User's Manual

Fiber-optic FA-bus Module
Fiber-optic FA-bus Type 2 Module
FA-bus Type 2 Module

IM 34M06H45-01E

Applicable Modules:

Model Code	Model Name
F3LR01-0N	Fiber-optic FA-bus Module
F3LR02-0N	Fiber-optic FA-bus Type 2 Module
F3LR02-1W	FA-bus Type 2 Module

YOKOGAWA
Yokogawa Electric Corporation

IM 34M06H45-01E
5th Edition

Blank Page

Applicable Product:

● Range-free Controller FA-M3

- Model : F3LR01-0N
- Model Name : Fiber-optic FA-bus Module

- Model : F3LR02-0N
- Model Name : Fiber-optic FA-bus Type 2 Module

- Model : F3LR02-1W
- Model Name : FA-bus Type 2 Module

The document number and document model code for this manual are given below.

Refer to the document number in all communications; also refer to the document number and the document model code when purchasing additional copies of this manual.

- Document No. : IM 34M06H45-01E
- Document Model Code : DOCIM

Media No. IM 34M06H45-01E (CD) 5th Edition : Jan. 2012（AR）

Important

■ About This Manual

- This Manual should be passed on to the end user.
- Before using the controller, read this manual thoroughly to have a clear understanding of the controller.
- This manual explains the functions of this product, but there is no guarantee that they will suit the particular purpose of the user.
- Under absolutely no circumstances may the contents of this manual be transcribed or copied, in part or in whole, without permission.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, should any errors or omissions come to the attention of the user, please contact the nearest Yokogawa Electric representative or sales office.

■ Safety Precautions when Using/Maintaining the Product

- The following safety symbols are used on the product as well as in this manual.

Danger. This symbol on the product indicates that the operator must follow the instructions laid out in this user's manual to avoid the risk of personnel injuries, fatalities, or damage to the instrument. The manual describes what special care the operator must exercise to prevent electrical shock or other dangers that may result in injury or the loss of life.

Protective Ground Terminal. Before using the instrument, be sure to ground this terminal.

Function Ground Terminal. Before using the instrument, be sure to ground this terminal.

Alternating current. Indicates alternating current.

Direct current. Indicates direct current.

The following symbols are used only in the user's manual.

WARNING

Indicates a "Warning".

Draws attention to information essential to prevent hardware damage, software damage or system failure.

CAUTION

Indicates a "Caution"

Draws attention to information essential to the understanding of operation and functions.

TIP

Indicates a "TIP"

Gives information that complements the present topic.

SEE ALSO

Indicates a "SEE ALSO" reference.

Identifies a source to which to refer.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function and safety of the product.
- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system as well as designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of processes and lines using the product and the system controlled by it, the user should implement it using devices and equipment, additional to this product.
- If component parts or consumable are to be replaced, be sure to use parts specified by the company.
- This product is not designed or manufactured to be used in critical applications which directly affect or threaten human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities or medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not attempt to modify the product.

■ Exemption from Responsibility

- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.
- Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the user or any unpredictable defect of the product.

■ Software Supplied by the Company

- Yokogawa Electric makes no other warranties expressed or implied except as provided in its warranty clause for software supplied by the company.
- Use the software with one computer only. You must purchase another copy of the software for use with each additional computer.
- Copying the software for any purposes other than backup is strictly prohibited.
- Store the original media, such as floppy disks, that contain the software in a safe place.
- Reverse engineering, such as decompiling of the software, is strictly prohibited.
- No portion of the software supplied by Yokogawa Electric may be transferred, exchanged, or sublet or leased for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3

● Avoid installing the FA-M3 in the following locations:

- Where the instrument will be exposed to direct sunlight, or where the operating temperature exceeds the range 0°C to 55°C (32°F to 131°F).
- Where the relative humidity is outside the range 10 to 90%, or where sudden temperature changes may occur and cause condensation.
- Where corrosive or flammable gases are present.
- Where the instrument will be exposed to direct mechanical vibration or shock.
- Where the instrument may be exposed to extreme levels of radioactivity.

● Select an appropriate field wiring material:

- USE COPPER CONDUCTORS ONLY.

  Use copper conductors having temperature rating of minimum 75°C for the field wiring.

● Securely tighten screws:

- Securely tighten module mounting screws and terminal screws to avoid problems such as faulty operation.
- Tighten terminal block screws with the correct tightening torque as given in this manual.

● Securely lock connecting cables:

- Securely lock the connectors of cables, and check them thoroughly before turning on the power.

● Interlock with emergency-stop circuitry using external relays:

- Equipment incorporating the FA-M3 must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

● Low impedance grounding:

- For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class D (earlier called Class 3) Ground. For compliance to CE Marking, use braided or other wires that can ensure low impedance even at high frequencies for grounding.

● Configure and route cables with noise control considerations:

- Perform installation and wiring that segregates system parts that may likely become noise sources and system parts that are susceptible to noise. Segregation can be achieved by measures such as segregating by distance, installing a filter or segregating the grounding system.

● Configure for CE Marking Conformance:

- For compliance with CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual” (IM34M06C11-01E).

- **Keep spare parts on hand:**
  - Stock up on maintenance parts including spare modules, in advance.
  - Preventive maintenance (replacement of the module or its battery) is required for using the module beyond 10 years. For enquiries on battery replacement service, contact your nearest Yokogawa Electric representative or sales office. (The module has a built-in lithium battery. Lithium batteries may exhibit voltage drop, and in rare cases, electrolyte leakage after ten years.)

- **Discharge static electricity before operating the system:**
  - Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

- **Never use solvents such as paint thinner for cleaning:**
  - Gently clean the surfaces of the FA-M3 with a cloth that has been soaked in water or a neutral detergent and wringed.
  - Do not use volatile solvents such as benzine or paint thinner or chemicals for cleaning, as they may cause deformity, discoloration, or malfunctioning.

- **Avoid storing the FA-M3 in places with high temperature or humidity:**
  - Since the CPU module has a built-in battery, avoid storage in places with high temperature or humidity.
  - Since the service life of the battery is drastically reduced by exposure to high temperatures, take special care (storage temperature should be from –20°C to 75°C).
  - There is a built-in lithium battery in a CPU module and temperature control module which serves as backup power supply for programs, device information and configuration information. The service life of this battery is more than 10 years in standby mode at room temperature. Take note that the service life of the battery may be shortened when installed or stored at locations of extreme low or high temperatures. Therefore, we recommend that modules with built-in batteries be stored at room temperature.

- **Always turn off the power before installing or removing modules:**
  - Failing to turn off the power supply when installing or removing modules, may result in damage.

- **Do not touch components in the module:**
  - In some modules you can remove the right-side cover and install ROM packs or change switch settings. While doing this, do not touch any components on the printed-circuit board, otherwise components may be damaged and modules may fail to work.

- **Do not use unused terminals:**
  - Do not connect wires to unused terminals on a terminal block or in a connector. Doing so may adversely affect the functions of the module.

■ Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC

(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement.

The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

■ How to Dispose of the Battery Used in This Product

The following description about the new Battery Directive 2006/66/EC is only valid in the EU.

This product uses an embedded battery, which cannot be removed by a customer and should be disposed of together with the product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

Battery category: Lithium battery

Note: With reference to Annex II of the new Battery Directive 2006/66/EC, the above symbol indicates obligatory separate collection.

Introduction

■ Overview of the Manual

This manual describes the specifications of the Fiber-optic FA-bus Module, Fiber-optic FA-bus Type 2 Module and FA-bus Type 2 Module, as well as how to send or receive data using these modules.

These modules are used to control distributed I/O subunits installed at remote locations (approximately 100 to 500 meters away).

For the Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module, the use of fiber-optic cables as communications lines provides noise immunity and allows high-speed communications.

■ Structure of the Manual

This manual consists of three parts as follows.

Part A: Fiber-optic FA-bus Module (F3LR01-0N),

Part B: Fiber-optic FA-bus Type 2 Module (F3LR02-0N), and

Part C: FA-bus Type 2 Module (F3LR02-1W).

■ Other User's Manuals

The manuals to be read depend on the CPU module to be used.

You should read the latest versions of the following user manuals, as required.

● F3SP71, F3SP76 functions

- Sequence CPU Instruction Manual – Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM34M06P15-01E)
- Sequence CPU – Network Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM34M06P15-02E)

● F3SP66, F3SP67 functions

- Sequence CPU – Functions (for F3SP66-4S, F3SP67-6S) (IM34M06P14-01E)
- Sequence CPU – Network Communication Functions (for F3SP66-4S, F3SP67-6S) (IM34M06P14-02E)

● F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, or F3SP59 functions

- Sequence CPU – Functions (for F3SP22-0S, F3SP28-3N/3S, F3SP38-6N/6S, F3SP53-4H/4S, F3SP58-6H/6S, F3SP59-7S) (IM34M06P13-01E)

● F3SP21, F3SP25, F3SP35, F3SP05, or F3SP08 functions

- Sequence CPU – Functions (for F3SP21, F3SP25, and F3SP35) (IM34M06P12-02E)

● Instructions

- Sequence CPU – Instructions (IM34M06P12-03E)

● Ladder programming

- FA-M3 Programming Tool WideField3 (IM34M06Q16-01E, -02E, -03E, -04E)
- FA-M3 Programming Tool WideField2 (IM34M06Q15-01E)

● All sequence CPU modules

For information on the specifications*, configuration*, installation, wiring, trial operation, maintenance and inspection of the FA-M3, or system-wide limitation of module installation, refer to:

- Hardware Manual (IM34M06C11-01E)

* : For information on the specifications of products other than power supply modules, base modules, I/O modules, cables and terminal block units, refer to their relevant user's manuals.

■ Documents on How to Lay Fiber-optic Cables

For details on laying of fiber-optic cables, read the following technical documents available from Sumitomo Electric Industries, Ltd.

Name of Document	Document No.
Cabling Instructions for Fiber-optic Cords/Cables for Use with the Sumi-Link DF Series	Technical Material No. 1769B
Fiber-optic Connector Assembling Tools Handling Instructions: CAK- 1020 (for CF- 2011) CAK- 0052 (for CF- 2071H)	Fiber-optic Technical Materials: No. 1100 (for CF- 2011) No. 1083 (for CF- 2071H)
Cabling Instructions for Fiber-optic Cables Fiber-optic Connector Assembling Tool CAK-1020 (for CF-2011) Fiber-optic Connector Assembling Tool CAK-0052 (for CF-2071H)	Technical Material No. 1769B Fiber-optic Technical Materials No. 1100 Fiber-optic Technical Materials No. 1083

Copyrights and Trademarks

■ Copyrights

■ Trademarks

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

IM 34M06H45-01E 5th Edition

CONTENTS

Blank Page

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part A: Fiber-optic FA-bus Module

IM 34M06H45-01E 5th Edition

Part A of the manual describes the Fiber-optic FA-bus Module (F3LR01-0N).

Blank Page

A1. Overview

The Model F3LR01-0N Fiber-optic FA-bus Module (hereinafter referred to as ‘the module’ or ‘this module’) is an interface module for configuring a distributed control system on a fiber-optic FA bus.

A user can configure an efficient remote I/O system by installing Fiber-optic FA-bus modules in the FA-M3 main unit and subunits and connecting them via a fiber-optic FA bus (fiber-optic cable). Modules in the subunits can then be handled like modules in the main unit.

A1.1 Features

A remote I/O system[*1] configured with Fiber-optic FA-bus modules has the following features.

- Users need not be concerned with I/O refresh time in ladder programming.
- Subunits can include contact input/output modules, as well as RS-232-C communications modules and other special modules (except for Ethernet Interface modules, NX Interface modules, FL-net Interface modules, FA Link H modules, Fiber-optic FA Link H modules, Hard Disk modules, PC Card modules and YHLS Master modules).
- Subunits connected with Fiber-optic FA-bus modules can be accessed like modules installed in a main unit.
- Optical transmission delivers high noise immunity.
- The maximum permissible total distance is 200 meters.

*1: I/O refers to contact input and output modules.
Remote I/O is located far away from the CPU module, but can be handled in the same way as contact input/output modules close to a CPU module.

A1.2 Application Example

In general, configuring a remote I/O system presents many challenges such as configuration (environment) setup, use of specific remote I/O instructions and long I/O refresh time.

Using fiber-optic FA-bus modules to configure a remote I/O system, however, totally eliminates such headaches.

The following figure shows a system configuration example.

An example of a conveyer control system

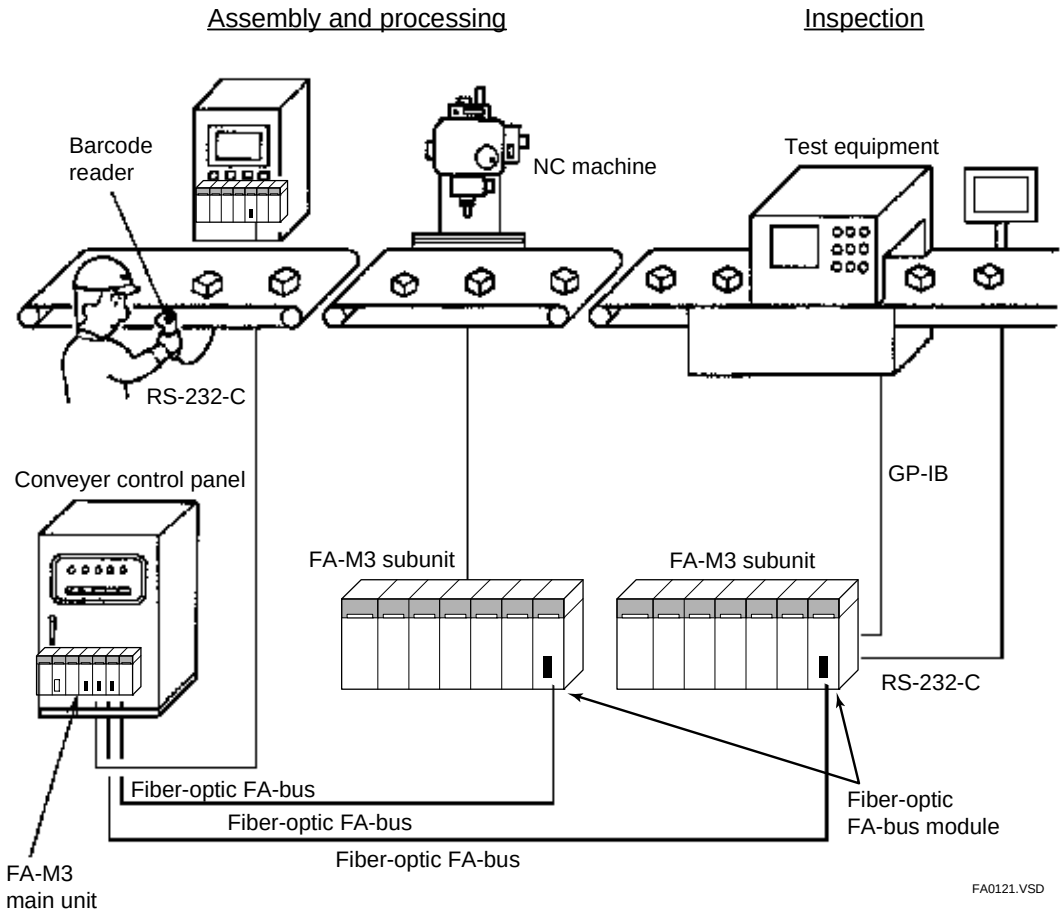


Figure A1.1 System Configuration Example

A2. Specifications

A2.1 Model and Suffix Codes

Table A2.1 Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Remarks
F3LR01	-0N	—	—	Maximum total distance: 200 m Maximum distance between units: 200 m

A2.2 Function Specifications

■ General Specifications

Table A2.2 General Specifications

Item	Specifications
Current consumption	220 mA (5 V DC)
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm
Weight	0.1 kg
Operating temperature range	0 to 55°C
Operating humidity range	10-90% RH (non-condensing)
Operating atmosphere	Free of corrosive gases and heavy dust
Storage temperature range	-20 to 75°C
Storage humidity range	10-90% RH (non-condensing)

The other specifications comply with the common specifications of the FA-M3.

■ Communications Specifications

Table A2.3 Communications Specifications

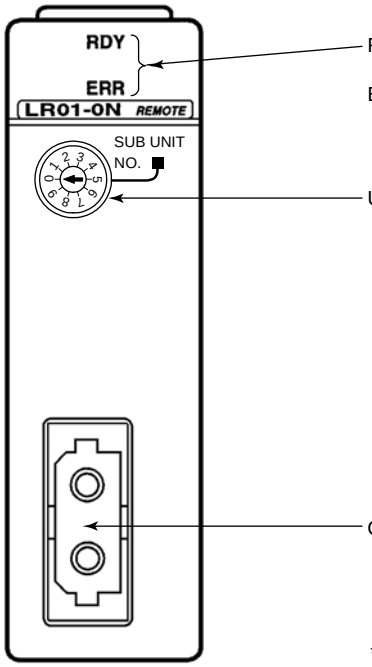
Item	Specifications
Transmission speed	10 Mbps
Transmission media	2-core fiber-optic cable (hard plastic clad quartz fiber-optic H-PCF)
Transmission distance	Maximum total distance: 200 m Maximum distance between stations: 200 m
Transmission channel configuration	Star configuration only
Maximum number of subunits	7 (or 6 if F3SP20 or F3SP30 is used)
RAS features	Shutdown I/O contact output on transmission channel error Reporting of transmission channel error location (ERR LED lit)

A2.3 Operating Environment

This module is compatible with all CPU modules. Logging of transmission channel error location to an error log is available with F3SP21/F3SP25/F3SP35 (Rev. 8 or later), F3SP05, F3SP08, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 and F3SP76, as well as WideField3, WideField2, WideField, and Ladder Diagram Support Program M3 (Rev. 1.08 or later).

A2.4 Components and Their Functions

■ Front View



RDY indicators:
Green when the internal circuitry is functioning normally.
ERR indicators:
Red when the module fails to detect an input signal from the fiber-optic connection port.

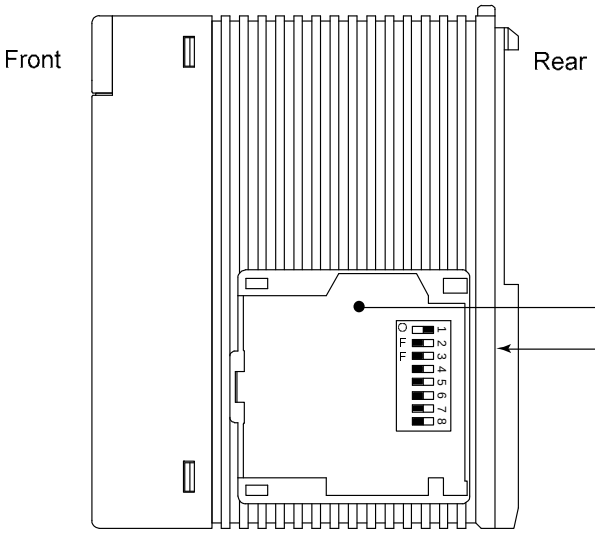
Unit Number Switch (Subunit number)
Specifies the unit number (0 to 7).
0: Unit number of main unit
1 to 7*: Unit number of subunits
8 to 9: Cannot be used

Optical connector port

*: 1 to 6 if F3SP20 or F3SP30 is used

FA0231.VSD

■ Right Side View



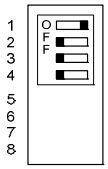
This figure is drawn with the panel cover moved.

Condition Switches (DIP switch)

Switch Number	ON	OFF	Factory setting
1	Shutdown output	Hold output	ON
2 to 8	OFF		

(Valid only for output module installed in a subunit.)

Some modules may use the following DIP switch instead:



FA0232.VSD

Figure A2.1 Components and Their Functions

A2.5 External Dimensions

■ External Dimensions

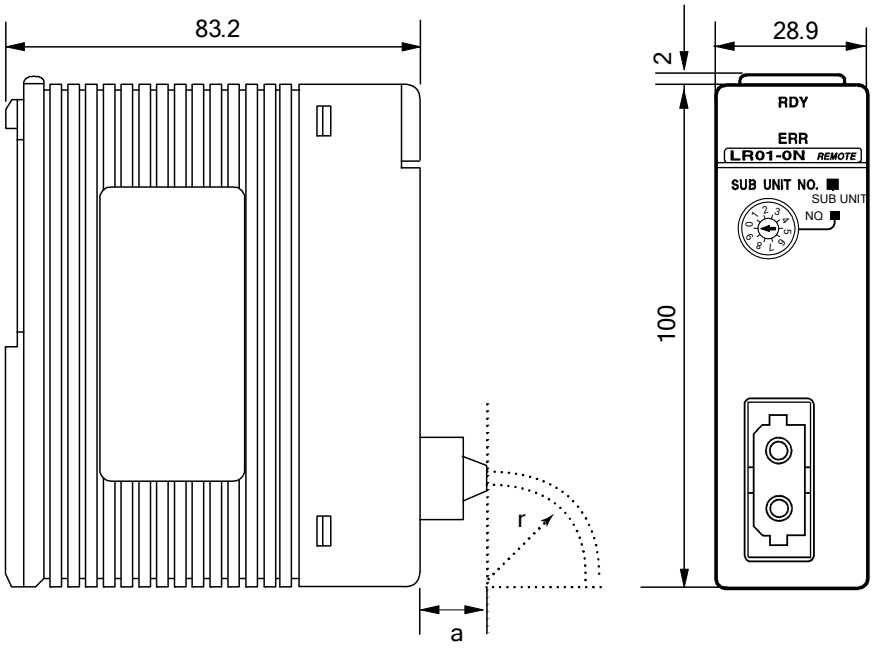


Figure A2.2 External Dimensions

■ Installation Depth

When installing the module, always take into consideration space required for bending of cords and cables.

Table A2.4 Bending Radius

	Bending Radius, r (mm)			
	KF-07 (a = 18.3)		CF-2071, CF-2071H (a = 35.0)	
	During installation (temporary)	When Secured	During installation (temporary)	When Secured
Fiber-optic cord	15 or larger	50 or larger	15 or larger	50 or larger
Fiber-optic cable	—	—	50 or larger	100 or larger

Blank Page

A3. System Configuration

A3.1 Fiber-optic FA-bus System Configuration

In a Fiber-optic FA-bus system configuration, FA-bus modules are installed in main unit and subunits, and then connected using fiber-optic cables.

Main unit : Unit with CPU module installed
Subunits : Units used for main unit system extension (with no CPU module installed)

A3.1.1 Restrictions on System Configuration

The following table lists some restrictions when configuring a Fiber-optic FA-bus system.

Table A3.1 Restrictions when Configuring a Fiber-optic FA-bus System

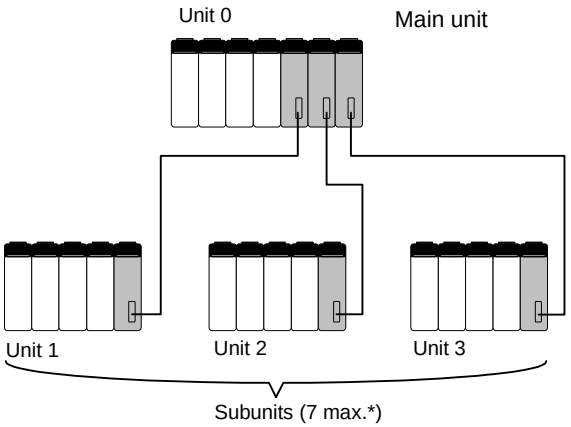
Item	Specifications
Maximum total distance per system	200 m
Number of connectable subunits	7 max.*
Number of Fiber-optic FA-bus modules installable in a main unit	7 max.*
Number of Fiber-optic FA-bus modules installable in a subunit	1 max
Modules installable in a subunit	All I/O modules and special modules except for - Ethernet interface modules, - NX Interface modules, - FL-net Interface modules, - FA Link modules, - FA Link H modules, - Fiber-optic FA Link H modules, - Hard Disk modules, - PC Card modules and - YHLS master modules.
Unit number setting (rotary switch located on the front of the module)	Main unit: 0 Subunits: 1 to 7* (no duplicates allowed)

*: Up to 6 subunits are allowed if F3SP20 or F3SP30 module is used.

A3.1.2 Connection Topology

Fiber-optic FA-bus modules can only be connected using a star topology.

■ Star Configuration



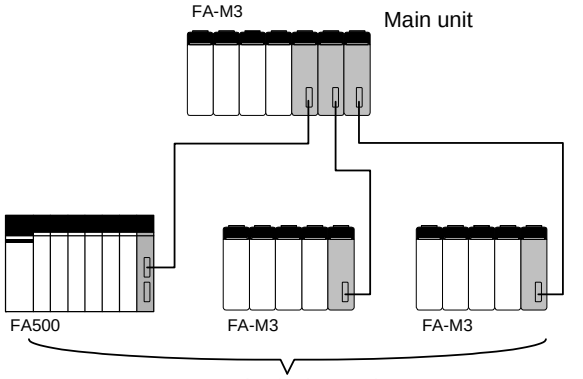
*: 6 max. when using F3SP20 or F3SP30

FA0311.VSD

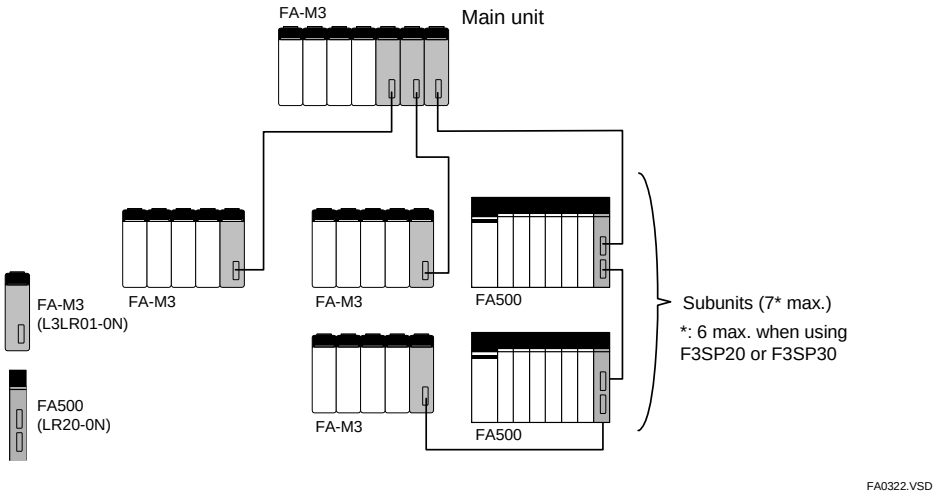
Tips

The following figures show example configurations when using both FA-M3 and FA500 modules.

- **Star Configuration**



- **Daisy-Chain + Star Configuration**



When using FA-M3 with FA500 modules, do not use a FA500 module as the main unit.

For the configuration examples shown above, the following modules cannot be installed in FA500 subunits:

- Expansion module (EU10-0N)
- SUMINET communications module (LS01-0N)
- Monitor module (LC01-N)
- Personal computer Link module (LC02-0N)

A4. Pre-operation Setup and Cable Connection

A4.1 Startup Procedure

The following figure shows the system startup procedure when using Fiber-optic FA-bus modules.

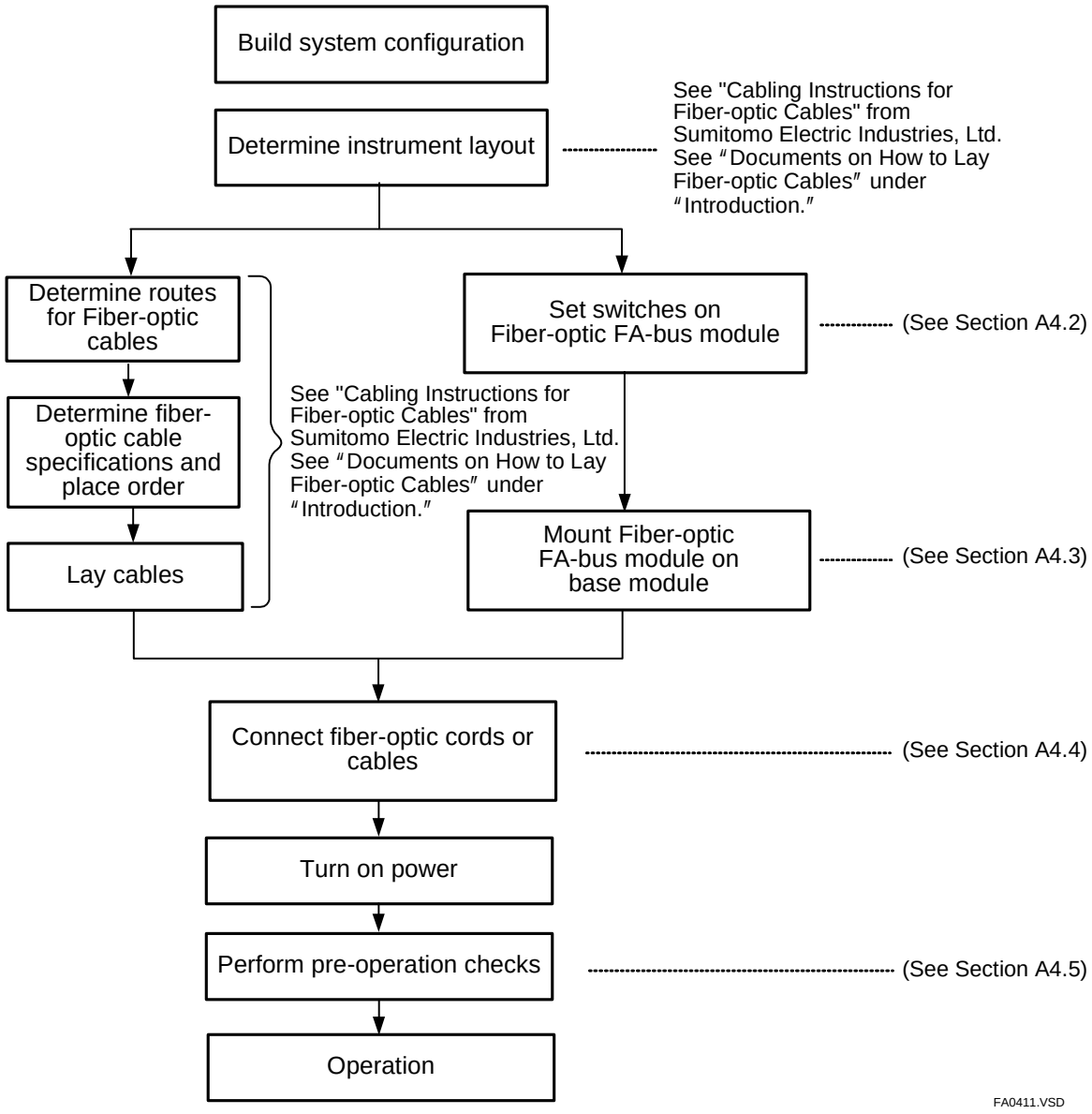


Figure A4.1 System Startup Workflow

A4.2 Setting Switches

A4.2.1 Setting Unit Number Switch

For a Fiber-optic FA-bus module, set its unit number decimal rotary switch located on the front face of the module to the number of the unit where it is installed.

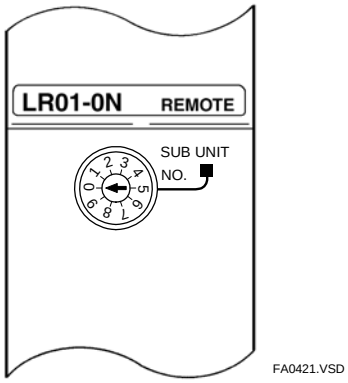


Figure A4.2 Unit Number Switch Located on Front Face of Module

The unit number ranges from 0 to 7*.

Do not duplicate unit numbers between Fiber-optic FA-bus modules.

For all modules installed in the main unit, set the unit number to 0.

Table A4.1 Unit Number Switch Settings

Switch Setting	Description
0	For modules installed in the main unit (Factory setting: 0)
1 to 7*	For modules installed in subunits
8 to 9	Not used (cannot be used)

* 1 to 6 when F3SP20 or F3SP30 is used

CAUTION

- The Fiber-optic FA-bus module will not operate normally if duplicate unit numbers exist. Furthermore, if the module is accessed using the WideField3 software when there are duplicate unit numbers, receiving will fail and the software will terminate.
- If a F3LR01 is set as a subunit (1 to 7) and yet installed along with the sequence CPU in the same base module, the sequence CPU may detect an error and clear its memory.

A4.2.2 Setting Condition Switches

Use the DIP switch (SW1 to SW4) located on the right side of the module to set up the following functions.

■ Enabling/Disabling Shutdown Output on Transmission Channel Error Function

Use SW1 for this setting.

This switch is valid only for subunits.

For the main unit, set the switch to OFF (factory setting is ON).

For details on the Shutdown Output function, see Section A7, “RAS Functions”

Table A4.2 Condition Switch Settings

Switch Number	Function	ON	OFF	Factory Setting
1	Shutdown output on transmission channel error	Shutdown output	Hold output	ON
2 to 4	Not Used	—	—	OFF

TIP

If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken fiber-optic cable or a powered-off substation in the transmission channel as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

CAUTION

Always set switch numbers 2, 3 and 4 to OFF.

Turning on these switches may affect normal module operation.

A4.3 Attaching and Detaching Modules

A4.3.1 Attaching the Module

Figure A4.3 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of this module towards the base module until the yellow anchor/release button (yellow button) clicks into place.

CAUTION

Always switch off the power before attaching or detaching a module.

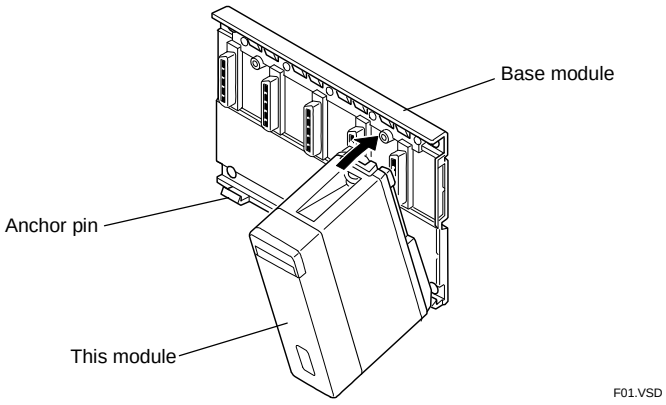


Figure A4.3 Attaching/Detaching the Module

CAUTION

DO NOT bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.

A4.3.2 Detaching the Module

To remove this module from the base module, reverse the above operation. Press the anchor/release button (yellow button) on the top of this module to unlock it and tilt the module away from the base module. Then lift the module off the anchor pin at the base.

A4.3.3 Attaching Modules in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw. Use screws of type listed in the table below. Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

Screw Required
M4-size binder screw 12 to 15 mm long (Or 14 to 15 mm if fitted with a washer)

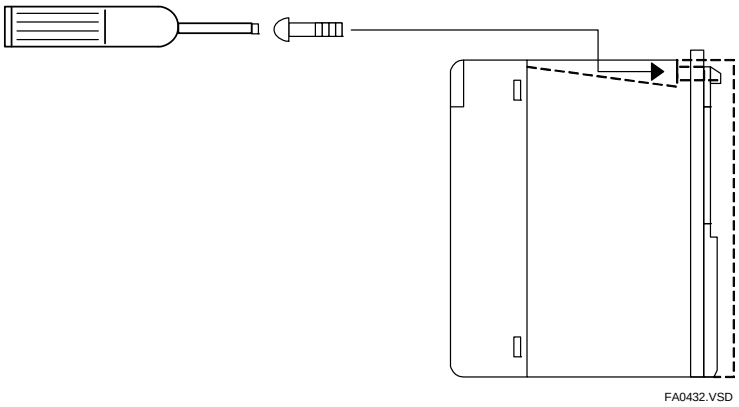
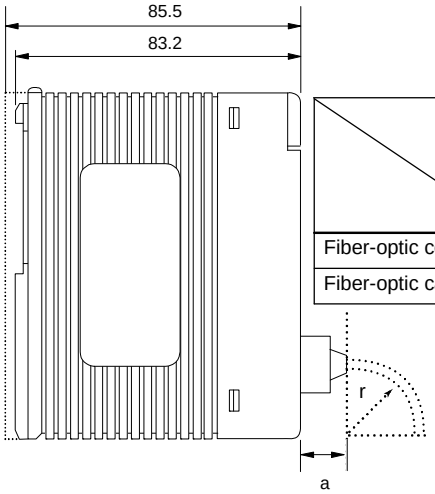


Figure A4.4 Securing Screws on Fiber-optic FA-bus Modules

A4.3.4 Installation Depth

The module's installation depth is 85.5 mm from the rear of the base module to the front of this module.

However, if cables with connectors are used, additional space should be provided to accommodate the connectors and the bending radius of the cables.



	Bending Radius, r (mm)			
	KF-07 (a=18.3)		CF-2071, CF-2071H (a=35.0)	
	During Installation (temporary)	When Secured	During Installation (temporary)	When Secured
Fiber-optic cord	15 or larger	50 or larger	15 or larger	50 or larger
Fiber-optic cable	—	—	50 or larger	100 or larger

Figure A4.5 Installation Depth

A4.4 Connecting Fiber-optic Cables

A4.4.1 Cable Preparation

Use the following fiber-optic cables for connecting Fiber-optic FA-bus modules.

■ Specifications for Fiber-optic Cable

Table A4.3 Specifications for Fiber-optic Cable Cores

Product name	DK-HPF200/230 (for KM60)	HC-20/07 (for KM60, KM61, KM62, KM65)
Vendor	SWCC Showa Cable Systems	Sumitomo Electric Industries
Core diameter	200±5 μm	
Clad diameter	230^{0}_{-10} μm	
Transmission loss	7 dB/km max. (λ =0.85 μm, Ta=25°C) *1	7 dB/km max. (λ =0.81 μm, Ta=25°C)

*1: The specifications of the fiber-optic cords and cables in the manual assume transmission loss of λ = 0.81 μm.

Table A4.4 Specifications for Fiber-optic Cable Connectors

Product name	KF-07 (for KM60)	CF-2001H, CF-2071H (for KM60, KM61, KM62)	CF-2011, CF-2071 (for KM65)
Vendor	SWCC Showa Cable Systems	Sumitomo Electric Industries	Sumitomo Electric Industries
Specifications	Bi-directional, lever lock, bonding, polished	Bi-directional, lever lock, bonding, polished	Bi-directional, lever lock, crimping, cut

■ List of Fiber-optic Cables

Fiber-optic Cords for Connections inside Panel (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM60	-S06	—	—	Cable length: 0.6 m	2.60	F3LR01, F3LR02, F3LP12
	-001	—	—	Cable length: 1.0 m	2.60	
	-003	—	—	Cable length: 3.0 m	2.60	

Fiber-optic Cables for Indoor Use with Tension Members (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM61	-010	—	—	Cable length: 10 m	1.10	F3LR01, F3LR02, F3LP12
	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	
	-150	—	—	Cable length: 150 m, a pulling eye on one end	1.54	
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	

Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual.
Note: The KM62 cable may be used in wet environments (but not in submerged environments).

Fiber-optic Cables for Indoor Use with Tension Members (with crimping and cutting treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM65	-001	—	—	Cable length: 1 m	2.00	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-002	—	—	Cable length: 2 m	2.00	
	-003	—	—	Cable length: 3 m	2.00	
	-004	—	—	Cable length: 4 m	2.00	
	-005	—	—	Cable length: 5 m	2.00	
	-007	—	—	Cable length: 7 m	2.00	
	-010	—	—	Cable length: 10 m	2.00	
	-012	—	—	Cable length: 12 m	2.00	
	-015	—	—	Cable length: 15 m	2.00	
	-020	—	—	Cable length: 20 m	2.00	
	-025	—	—	Cable length: 25 m	2.00	
	-030	—	—	Cable length: 30 m	2.00	

Note: The KM62 cable may be used in wet environments (but not submerged environments).
Note: KM65 cables are not supplied with pulling eyes. If pulling eye is required, use the KM61 or KM62 cables.

Fiber-optic Cables for Outdoor Use with Tension Members
(with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM62	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	
	-300	—	—	Cable length: 300 m, a pulling eye on one end	2.72	
	-400	—	—	Cable length: 400 m, a pulling eye on one end	3.43	
	-500	—	—	Cable length: 500 m, a pulling eye on one end	4.10	
	-600	—	—	Cable length: 600 m, a pulling eye on one end	4.73	
	-700	—	—	Cable length: 700 m, a pulling eye on one end	5.33	
	-800	—	—	Cable length: 800 m, a pulling eye on one end	5.91	
	-900	—	—	Cable length: 900 m, a pulling eye on one end	6.46	
	-L01	—	—	Cable length: 1000 m, a pulling eye on one end	7.00	

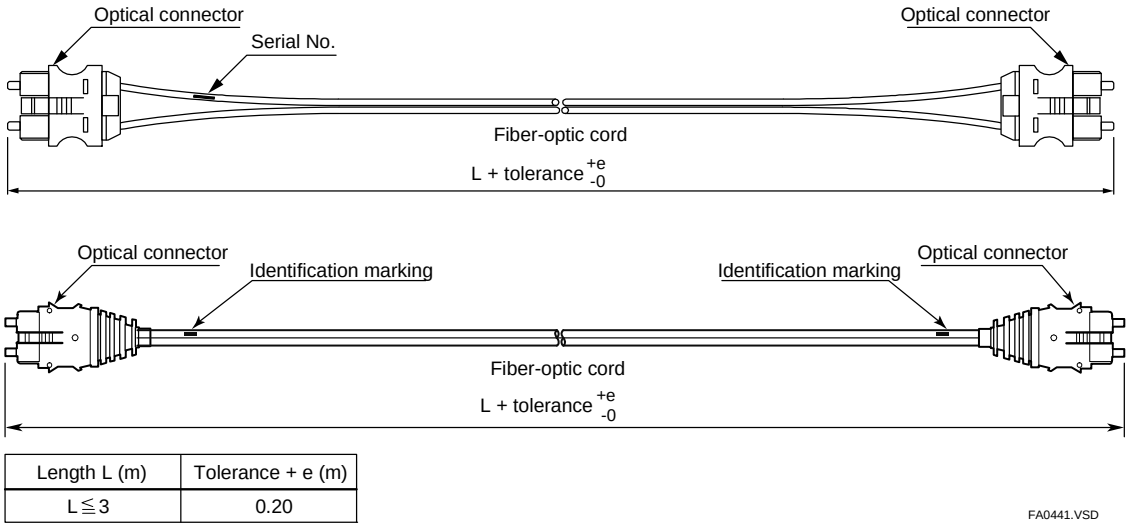
Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual.

CAUTION

KM6☐ cables cannot be used in submerged environments. Contact Yokogawa's sales office for alternative solutions.

■ External Diagram

●KM60

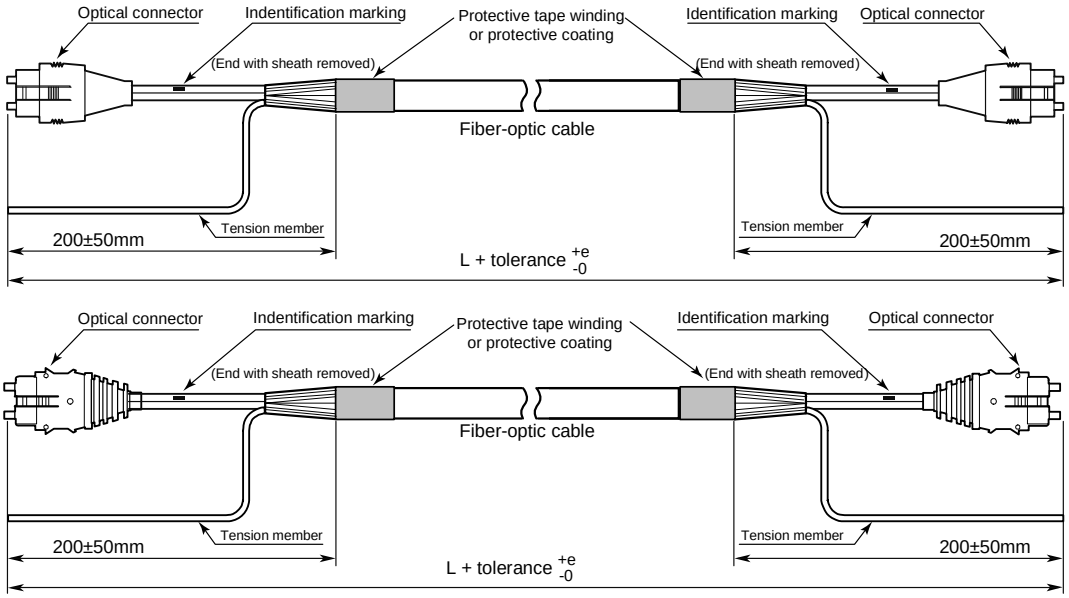


Length L (m)	Tolerance + e (m)
L≦3	0.20

FA0441.VSD

Note: Fiber-optic cord (KM60) is available in two types with optical connectors of different looks but customers cannot specify the connector type when placing an order.

●KM61, KM62

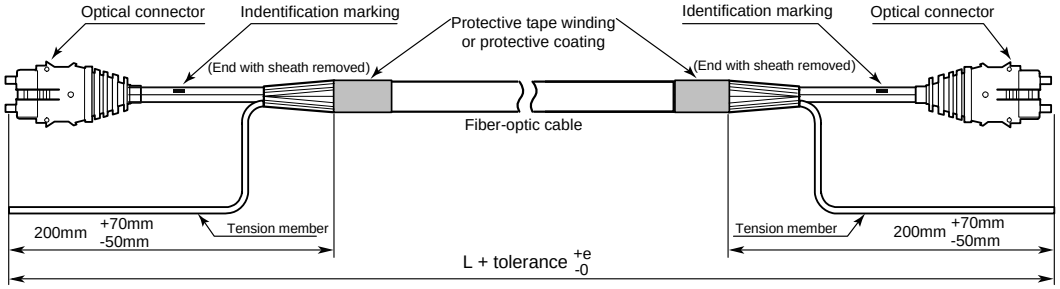


Length L (m)	Tolerance +e (m)
5<L ≦ 30	0.50
30<L	L x 0.03 (3%)

FA0442.VSD

Note: Fiber-optic cable (KM61, KM62) is available in two types with optical connectors of different looks but customers cannot specify the connector type when placing an order.

●KM65

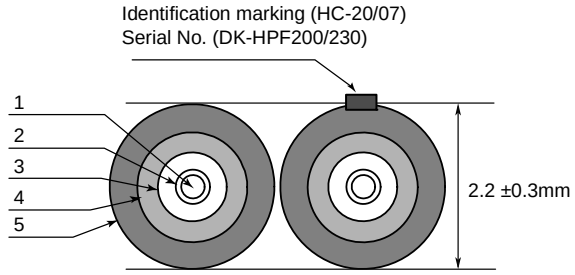


Length L (m)	Tolerance +e (m)
L ≦ 15	0.20
5<L ≦ 15	0.30
15<L ≦ 30	0.50

FA0442B.VSD

■ Cross-sectional view

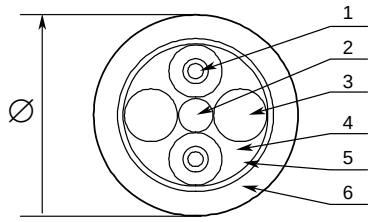
●KM60



1	Core (quartz glass)
2	Clad (fluorinated acrylate resin)
3	Cover (fluorine-based resin)
4	Reinforcer (aromatic high tensile fiber)
5	Outer cover (heat-resistant PVC black)

FA0443.VSD

●KM61, KM62, KM65



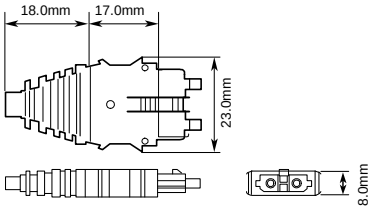
1	Fiber-optic single-core cord
2	Tension member (plastic-covered steel wire)
3	Lacing (plastic lacing)
4	Inclusion (plastic yarn or fiber)
5	Holding tape (plastic fiber)
6	Heat-resistant PVC sheath (KM61, 65), LAP sheath (KM62)

Model	Manufacturer Item code	External Dimensions(∅)
KM61 KM65	2-C-V	∅8.4mm ±1.0
KM62	2-C-LAP	∅10.0mm ±1.0

FA0444.VSD

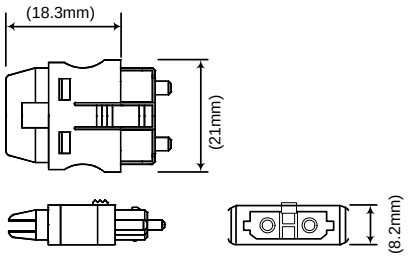
■ Connector (Top View)

● CF-2071H and CF-2071 (for cables KM60, KM61, KM62, and KM65)



FA0445.VSD

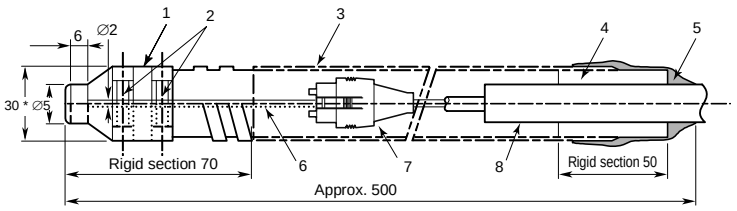
●KF-07 (for cable KM60)

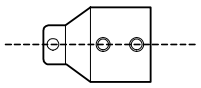


FB0245B.VSD

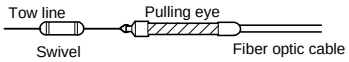
■ Fiber-optic Lead-in Cable Laying Pulling-Eye Assembly Diagram

Unit: mm





When performing lead-in work, connect the pulling eye to the tow line through a swivel which is attached to the head of the pulling eye as shown in the figure below.



No.	Components	Qty.
1	Pulling eye	1
2	Stopper screw (M6)	4
3	Flexible pipe	1
4	Terminal spacer	1
5	Vinyl tape	–
6	Tension member	–
7	Optical connector	–
8	Fiber-optic cable	–

FA0446.VSD

■ Fiber-optic Cables from Sumitomo Electric Industries

Table A4.5 Cords and Cables without Connectors from Sumitomo Electric

Type		Specifications	Compatible Modules
Fiber-optic cord	H-PCF2 core cord	DCV-HC-20/07	F3LR01, F3LR02, F3LP12*1
Fiber-optic cable	2-C-V (for indoor use)	2×CCV-HC-20/07	F3LR01, F3LR02, F3LP12*1
	2-C-LAP (for outdoor use)	2×CCV-HC-20/07	F3LR01, F3LR02, F3LP12*1

Table A4.6 Cords and Cables with Connectors on Both Ends from Sumitomo Electric

Type	Model	Specifications	P:	L=length	Shape	Compatible Modules
Fiber-optic cord	2001H-MM-L 2071H-MM-L	DCV-HC-20/07		Up to 5m	φ2.2mm×2 core cord	F3LR01, F3LR02, F3LP12
2-C-V (cable for indoor use)	2001H-MM-0.2/L 2071H-MM-0.2/L	2×CCV-HC-20/07	-P*2	*1	φ8.4mm cable PVC sheath	F3LR01, F3LR02, F3LP12
2-C-LAP (cable for outdoor use)	2001H-MM-0.2/L 2071H-MM-0.2/L	2×CCV-HC-20/07	-P*2	*1	φ10mm cables PE sheath with metal tape	F3LR01, F3LR02, F3LP12

*1: Module, distance F3LR01, F3LR02 0 to 200 m
F3LP12 0 to 1000 m
*2: Pulling eye Recommended for cables longer than 50m

CAUTION

For product enquiries or order placement, contact an authorized sales agent of Sumitomo Electric Industries, quoting the manufacturer (Sumitomo Electric Industries), type, model and specifications information.

CAUTION

Do not use products other than those specified above. Doing so may result in hardware failure, incorrect operation or inability to achieve designed performance.

■ Products to be Used When Laying Cables

When laying fiber-optic cables, use the following products from Sumitomo Electric Industries.

Table A4.7 Products to be Used When Laying Cables

Name		Model	
Optical connector	Contact/polishing type	CF-2001H	CF-2071H
	Solderless/cut type	CF-2011	CF-2071
Optical connector connection tool	Solderless/cut type	CAK-1020	CAK-0057
Optical power tester (for testing work on optical connector)		CAT-2700	
Master fiber set (for testing work on optical connector)		CAT-2001H CAT-2001H (HG)	
Manuals for Sumi-Link DF series	Cabling Instructions for Fiber-optic Cords/Fiber-optic Cables	Technical Materials No. 1769B	
	Fiber-optic Connector Assembling Tool CAK-1020 (for CF-2011) (Fiber-optic Technical Materials No. 1100) Fiber-optic Connector Assembling Tool CAK-0052 (for CF-2071H) (Fiber-optic Technical Materials No. 1083)		

CAUTION

Do not use products other than those specified above. Doing so may result in hardware failure, incorrect operation or inability to achieve designed performance.

A4.4.2 Attaching and Detaching Connectors

■ Attaching Connectors

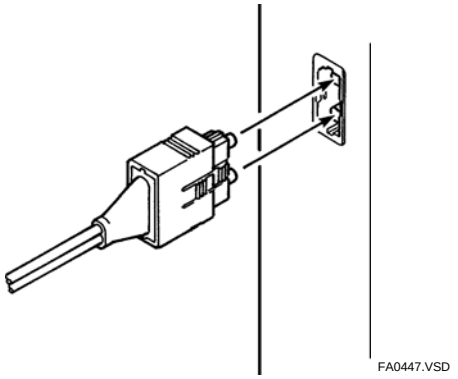


Figure A4.6 Attaching Connectors

When attaching a fiber-optic cable connector, always hold the connector (never the cable), and then insert it until it clicks into place.

Then, hold the connector and pull it lightly to make sure that it is correctly seated.

■ Detaching Connectors

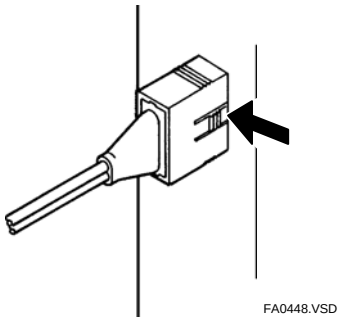


Figure A4.7 Detaching Connectors

Hold the center portion of the connector (indicated by the arrow in the figure) to unlock the connector, and then pull it toward you.

A4.4.3 Precautions When Connecting Fiber-optic Cables

Handle fiber-optic cables with care.

Before laying fiber-optic cables, read manuals available from Sumitomo Electric Industries. Engage a professional contractor specializing in laying fiber-optic cables. Read “Documents on How to Lay Fiber-optic Cables” under “Introduction” of this manual and the “Fiber-optic Cable Laying Instructions” (IM34M06C92-01E).

WARNING

- Always connect and disconnect fiber-optic cables when the system is offline. Connecting or disconnecting fiber-optic cables when the system is online may affect normal system operation.

CAUTION

Observe the following precautions when connecting fiber-optic cables.

- Never touch the core of optical connectors with your bare hands and protect them from dirt and dust.

  Dust, dirt and oil from hands may result in degraded transmission performance or even communications error.

  Attach the cover during storage.
- When laying fiber-optic cords or fiber-optic cables, keep the elongation within 0.7% of permissible elongation percentage. When the cable is secured, the elongation should be within 0.2% of permissible elongation percentage.

  Beyond these elongation limits, fiber-optic cables may break.

  For this purpose, refer to Table 4.8 and take care not to subject fiber-optic cables to excessive tensile impact, bending or twisting. Always pull an fiber-optic cable by its tension member.

Table A4.8 General Mechanical Characteristics for Fiber-optic Cords and Cables

	Tensile Strength (N)	Bending Radius (mm)	Lateral Pressure	Twisting
Fiber-optic Cord	During laying < 98 When secured = 0	During laying = 15 min. When secured = 50 min.	—	< 180°/2 m
Fiber-optic Cable	During laying < 735 When secured = 0	During laying = 50 min. When secured = 100 min.	980 N/50 mm (Should be temporary)	< 90°/2 m

You should strictly observe the restrictions on permissible tensile load specified in the catalog or technical specification of fiber-optic cables when laying cables.

When securing cables, do not subject connectors and cables to tensile force.

For on-site treatment, we recommend using crimp-on cutting type connectors.

A4.5 Pre-operation Checks

A4.5.1 Checking Transmission Loss

Measure the transmission loss of fiber-optic cables after laying. Exercise care during laying as excessive tension, bending and pressure during cable laying may cause cables to break or crack. The following table shows the transmission loss of fiber-optic cables and permissible transmission loss for the Fiber-optic FA-bus module.

Table A4.9 Transmission Loss Table for Fiber-optic Cables (up to 200 m)

Length of Fiber-optic Cable (HC-20/07)	Maximum Transmission Loss (dB)	
	(with bonding and polishing treatment on optical connector)	(with crimping and cutting treatment on optical connector)
10	1.10	2.60
20	1.10	2.60
30	1.10	2.60
40	1.10	2.60
50	1.10	2.60
60	1.10	2.60
70	1.10	2.60
80	1.10	2.60
90	1.10	2.60
100	1.10	2.60
110	1.19	2.69
120	1.28	2.78
130	1.37	2.87
140	1.45	2.95
150	1.54	3.04
160	1.62	3.12
170	1.71	3.21
180	1.79	3.29
190	1.87	3.37
200	1.95	3.45

Table A4.10 Allowable Transmission Loss for Fiber-optic FA-bus Modules

Cable Length (m)	0.6 to 200
Allowable Transmission Loss (dB)	4.0

CAUTION

- Engage a professional contractor to lay fiber-optic cables.
- Measure the transmission loss of fiber-optic cables after laying. Check that the measured value for the actual cable length is better than the transmission loss for the fiber-optic cable before laying.
- If the transmission loss exceeds the permissible transmission loss for the Fiber-optic FA-bus, normal communications will be affected. Replace the fiber-optic cable.
- Measure the transmission loss of fiber-optic cables regularly.

WARNING

Using a cable with transmission loss exceeding permissible transmission loss for a Fiber-optic FA-bus module may affect normal system operation.

A4.5.2 LED Checks

After installing modules and connecting fiber-optic cables, check that the modules are properly connected for communications. There should be no cable discontinuity or improper connection.

Apply power to the units and perform the following checks.

● The RDY (green) LED indicator must be lit

If this indicator is not lit, it may be because the Fiber-optic FA-bus module is not properly mounted to the base module. Turn off the power and attach the module to the base module correctly.

● The ERR LED indicator must be off

When this LED indicator is on, communications is not allowed.

If the power of the destination unit is off, turn on its power and check whether the ERR indicator turns off. If the ERR indicator is still on, it may be due to a transmission channel error, such as cable discontinuity.

For troubleshooting information, see Section A8.3, “Troubleshooting when the ERR LED is Lit.”

A4.6 Precautions When Applying Power

When turning on the power supply to the main unit and subunits, follow the sequence below.

First confirm that the main unit and all subunits are turned off. Then turn on the power supply to the main unit and the subunits simultaneously*, or turn on all subunits before turning on the main unit.

A program starts execution when the main unit is turned on, regardless of whether subunits are switched on. In situations where the powering sequence described above is not adhered to, you should write your application so that it checks the status of subunits using the special registers as listed on the next page. In this case, do not switch off and switch on the main unit, or restart the CPU module, while a subunit is switched on.

*: By “simultaneously”, we mean, for instance, a system whereby a single switch turns on the power to the entire system.

CAUTION

If you have switched off the main unit, ensure that all subunits are switched off before switching on the main unit. If you switch off and on the main unit while a subunit is switched on, some modules in the subunit may not be recognized correctly by the CPU module in the main unit.

Module Recognition special registers

When a module installed in a main unit or subunit is recognized as accessible, the bit corresponding to its slot position in the Module Recognition special registers is set to 1. If a module cannot be read or written due to I/O module failure, subunit power failure or some other reason, its corresponding bit in the Module Recognition special registers is cleared to 0.

Table A4.11 Module Recognition Special Registers

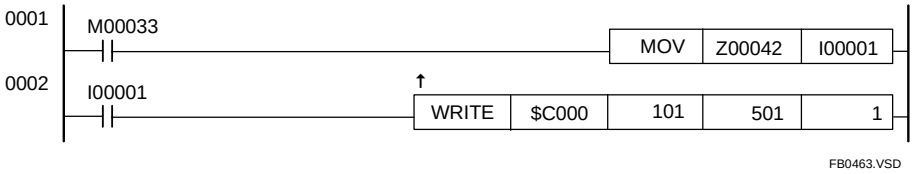
Cateogry	Module Recognition Special Registers	
Number	**Name**	**Description**
Z41	Main unit	Slot number 16 ··· 9 8 7 6 5 4 3 2 1 0 ··· 1 0 1 1 0 1 1 1 1 0: No module is mounted or mounted module does not allow read and write. 1: Module is recognized as accessible.
Z42	Subunit 1	
Z43	Subunit 2	
Z44	Subunit 3	
Z45	Subunit 4	
Z46	Subunit 5	
Z47	Subunit 6	
Z48	Subunit 7	

FB0462.VSD

In situations where some subunits are turned on after the main unit, by checking the Module Recognition special registers, a program can perform initialization setup of an advanced function module installed in a subunit without waiting for the entire system to be powered up.

Sample Program:

This sample program copies the Module Recognition special register for subunit 1 to an internal relay, and performs initialization of the module installed in slot 1 after it is recognized as accessible.



FB0463.VSD

Figure A4.8 Sample Program Illustrating the Use of the Module Recognition Special Registers

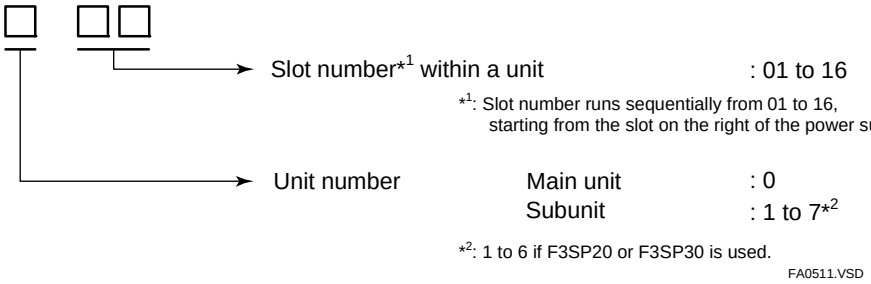
Blank Page

A5. Accessing Modules in a Subunit

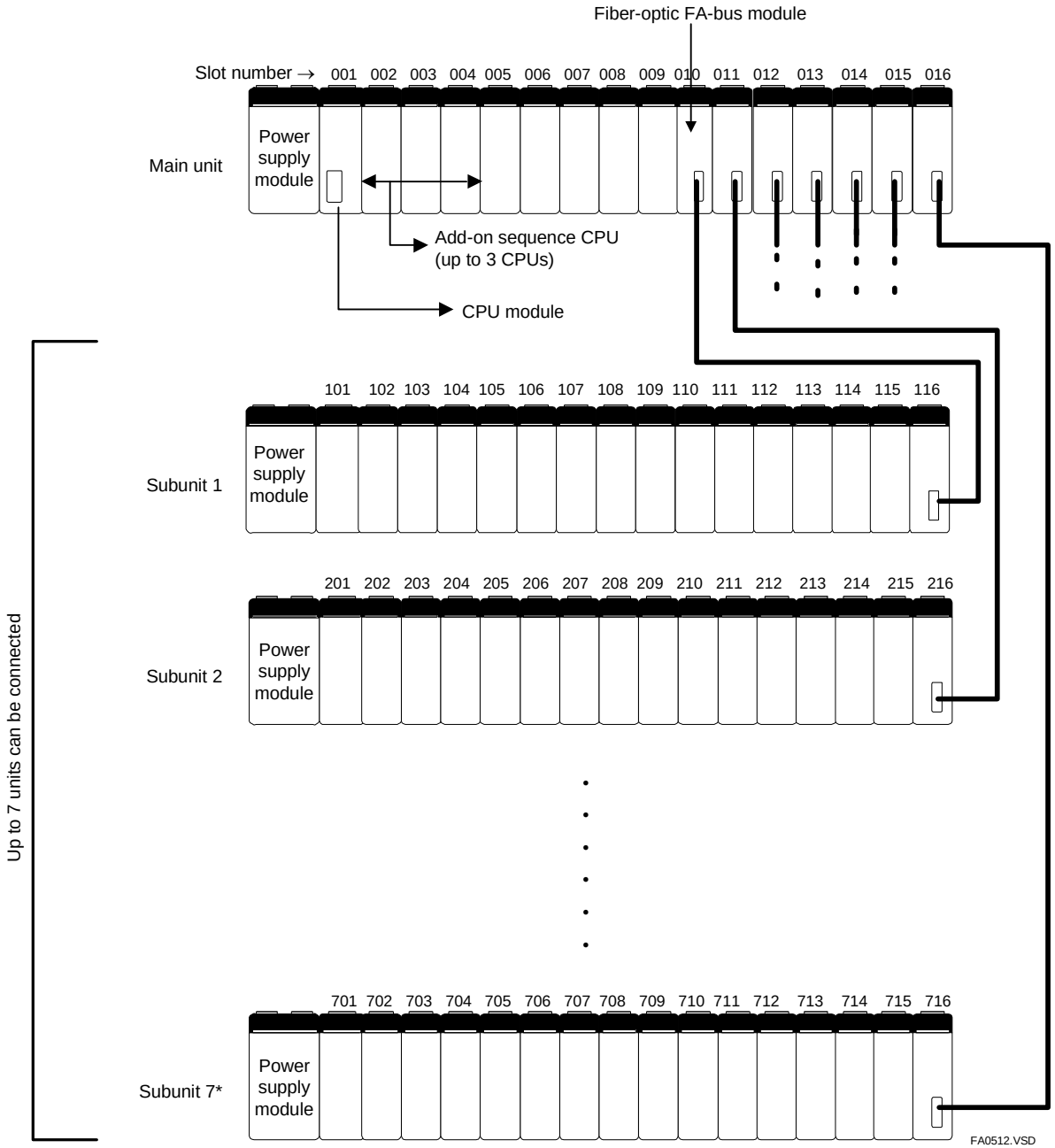
A5.1 Slot Number in FA-M3

In FA-M3, slot numbers are used for accessing various modules.

A slot number indicates the position of the slot where a module is mounted and is a 3-digit integer with the following structure.



A module installed in a subunit can be accessed using ladder or BASIC, in the same way as accessing a module mounted in the main unit.



*: Up to 6 units if F3SP20 or F3SP30 is used.

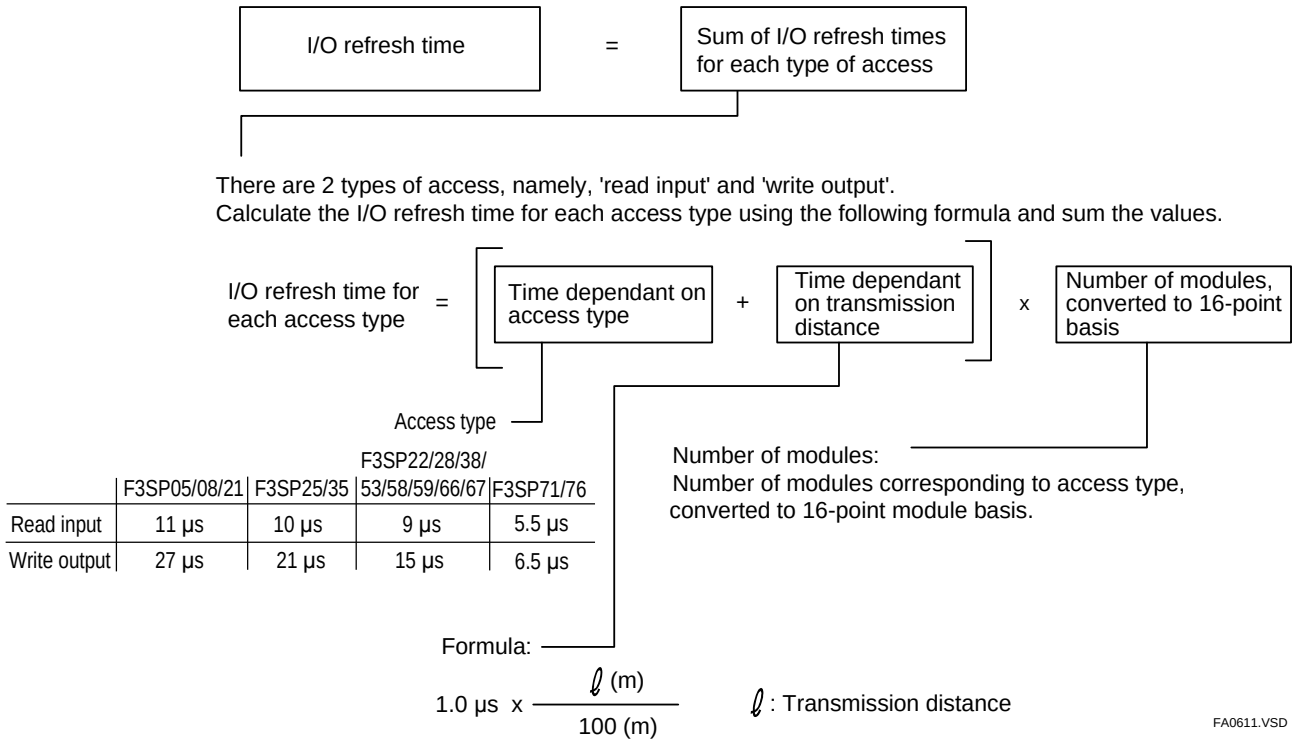
Figure A5.1 System Configuration and Slot Numbers

A6. I/O Refresh Time

A6.1 Estimating I/O Refresh Time

To estimate the I/O refresh time, calculate the I/O refresh time separately for each port of the main unit.

For details, refer to the following example.



	F3SP05/08/21	F3SP25/35	F3SP22/28/38/ 53/58/59/66/67	F3SP71/76
Read input	11 µs	10 µs	9 µs	5.5 µs
Write output	27 µs	21 µs	15 µs	6.5 µs

A6.2 An Example of I/O Refresh Time Calculation

This example calculates the I/O refresh time of the following system configuration.

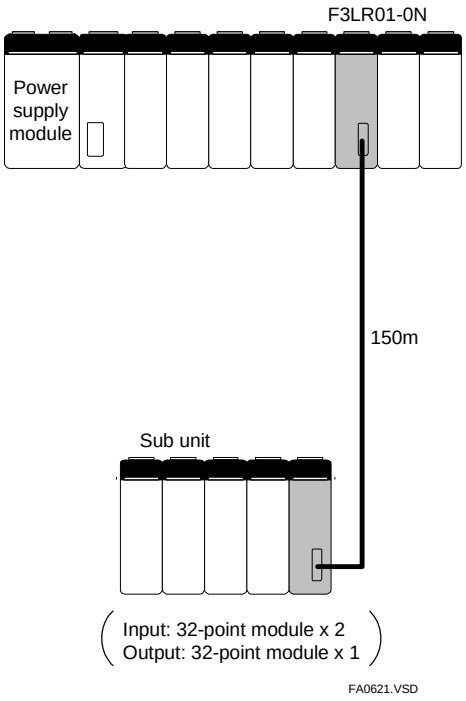


Figure 6.1 An Example of I/O Refresh Time Calculation (F3SP22, 28, 38, 53, 58, 59, 66 or 67)

Step 1: Calculate the 'time dependant on transmission distance'

$$- \quad 1.0\mu s \times \frac{150\ (m)}{100\ (m)} = 1.5\mu s$$

Step 2: Calculate the 'number of modules, converted to 16-point basis'

- Read Input = 32 points ×2 → 2×2 = 4
- Write Output = 32 points ×1 → 2×1 = 2

Step 3: Calculate the total time

Read input access = (9µs + 1.5µs) x 4 = 42.0µs
Write output access = (15µs + 1.5µs) x 2 = 33.0µs (+

I/O Refresh Time = 75.0µs

A7. RAS Functions

A7.1 Error Location Detection Function

A7.1.1 LED Display

When an error occurs in a Fiber-optic FA-bus module, or when a cable discontinuity occurs in a transmission channel, the error (ERR) LED or alarm (ALM) LED of the CPU module turns on to report the error.

The LED of the CPU module turns on even if an error is generated in a module other than the Fiber-optic FA Bus module.

To decide whether the cause of a lit LED lies in a Fiber-optic FA-bus module, check the status of the RDY and ERR LEDs of the Fiber-optic FA-bus modules mounted in each unit.

The following figure shows the relationship between fiber-optic cable discontinuity and the status of the LED of the Fiber-optic FA-bus module.

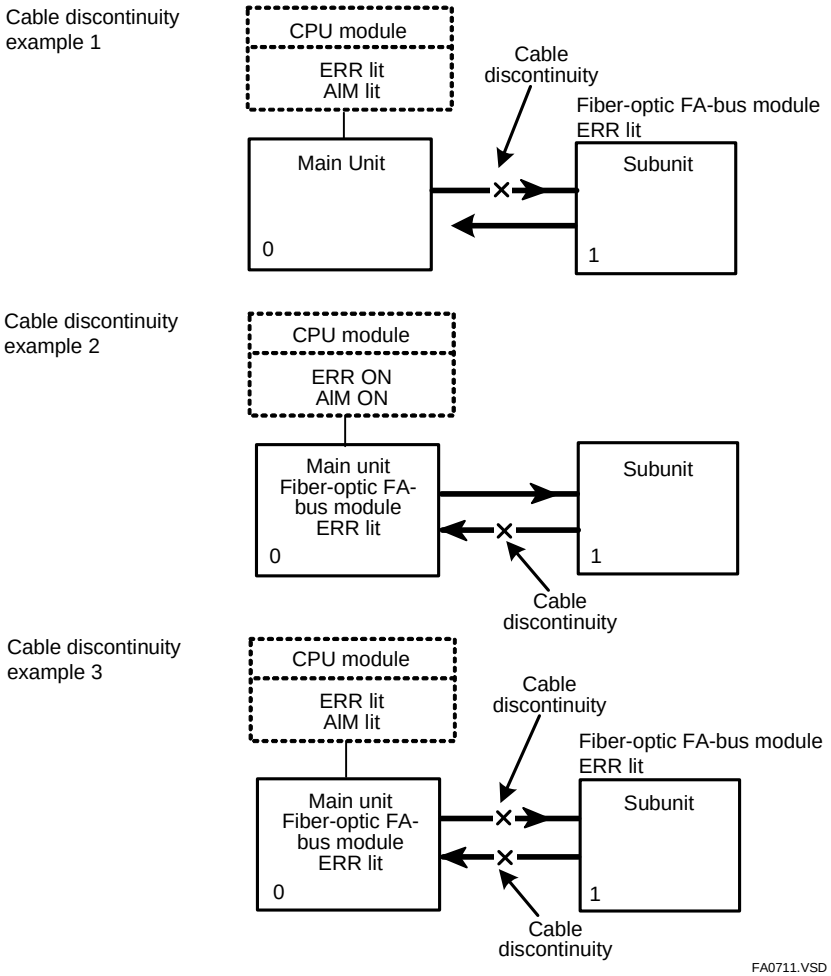


Figure A7.1 Relationship between Fiber-optic Cable Discontinuity and Status of LED in the Module

A7.2 Shutdown Output on Transmission Channel Error Function

A7.2.1 Overview of Shutdown Output Function

The Fiber-optic FA-bus module is equipped with a function, which forcefully shuts down the output of the I/O module when a communications error occurs.

This function prevents an error in a Fiber-optic FA-bus module from affecting the entire system or resulting in hazardous or unstable operation of the system.

For instance, when a cable discontinuity occurs in a transmission channel, the module detects a communications error and immediately turns ff the output signals of each I/O module to minimize risk.

The output shutdown on communications error function is available only for configurations with one main CPU (without add-on CPUs).

TIP

If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken fiber-optic cable or a powered-off substation in the transmission channel as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

A7.2.2 Shutdown Output of Subunit

CAUTION

- To configure the system to reset the output of output modules in the event of a power interruption on the main unit or a transmission channel error, turn on the Shutdown Output switch (SW1) of the F3LR01 and set the DIO Setup for the terminal to [Reset] in the CPU configuration.

  This setting can be used with F3YD64-1F, F3YD64-1P, F3WD64-3F and F3WD64-4F, but not with F3YD64-1A.*
- To configure the system to hold the output in the event of a power interruption on the main unit or a transmission channel error, turn off the Shutdown Output switch (SW1) of the F3LR01 and set the DIO Setup for the terminal to [Hold] in the CPU configuration.
- The Reset Output function cannot be used in a multi-CPU system (system with add-on CPUs). Always set to “Hold” in a multi-CPU system.

*: For F3YD64-1F and F3YD64-1P, the setting is available only when the modules are used with the F3SP28, 53, 58, 59, 66, 67, 71, or 76 CPU module.

The following table describes the operation of the module for various settings for your reference.

Shutdown Output switch (SW1) of F3LR01 module mounted in subunit	Configuration Setting of CPU module	FAIL Signal Contact Output Status		Operation of Output Module	
		FAIL1	FAIL2	Modules with 32 or less output points, F3YD64-1F, -1P, F3WD64-3F, -4F	Modules with 64 output points (including F3YD64-1A)
ON	Reset	Shorted	Open	Reset	Hold
	Hold	Shorted	Open	Hold	Hold
OFF	Reset	Open	Shorted	Hold	Hold
	Hold	Open	Shorted	Hold	Hold

A7.2.3 Procedure for Setting I/O Conditions

This section describes the procedure for using the Shutdown Output on Transmission Channel Error function.

A7.2.3.1 Setting Condition Switches

● Setting the condition switch on the right side of the module

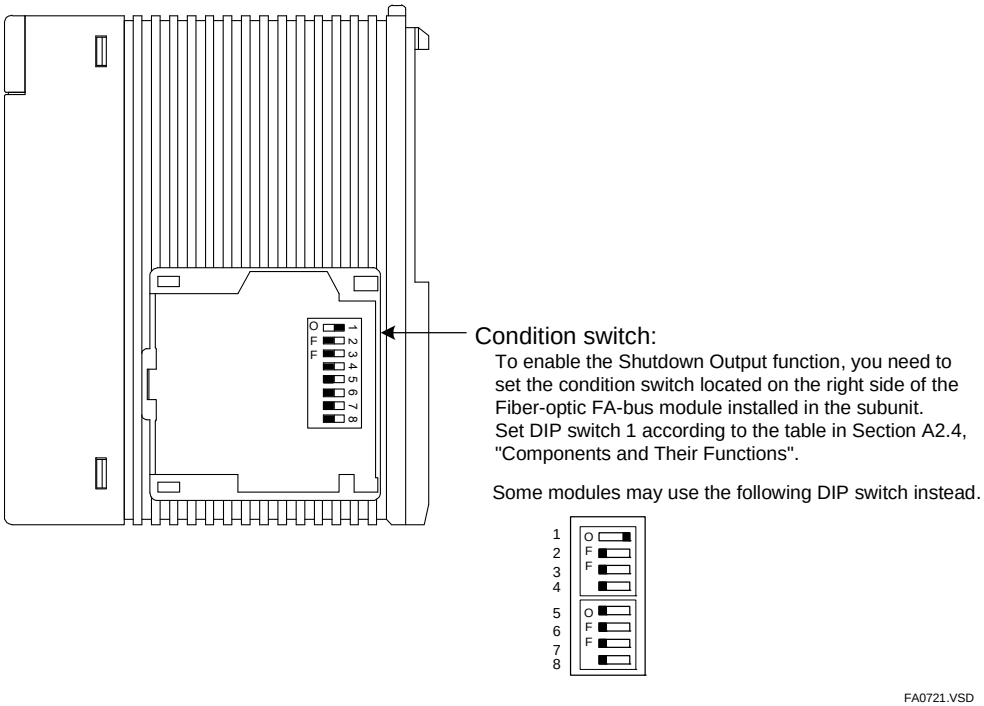


Figure A7.2 Condition Switches on Right Side of the Module

A7.2.3.2 DIO Setup in CPU Configuration

● How to Perform DIO Setup using WideField3

To perform DIO Setup using WideField3, use the following procedure.

1. Select [Project]–[Project Settings] from the WideField3 menu bar.
2. Select [Input/Output Setup] from the Configuration pane of the displayed Project Settings/Configuration window.
3. Click the cell for the slot installed with the module to be configured. Select the Output Setup tab under Detailed Information. Set the [Output when Stopped] field corresponding to the terminal number to [Reset (OFF)] or [Hold].

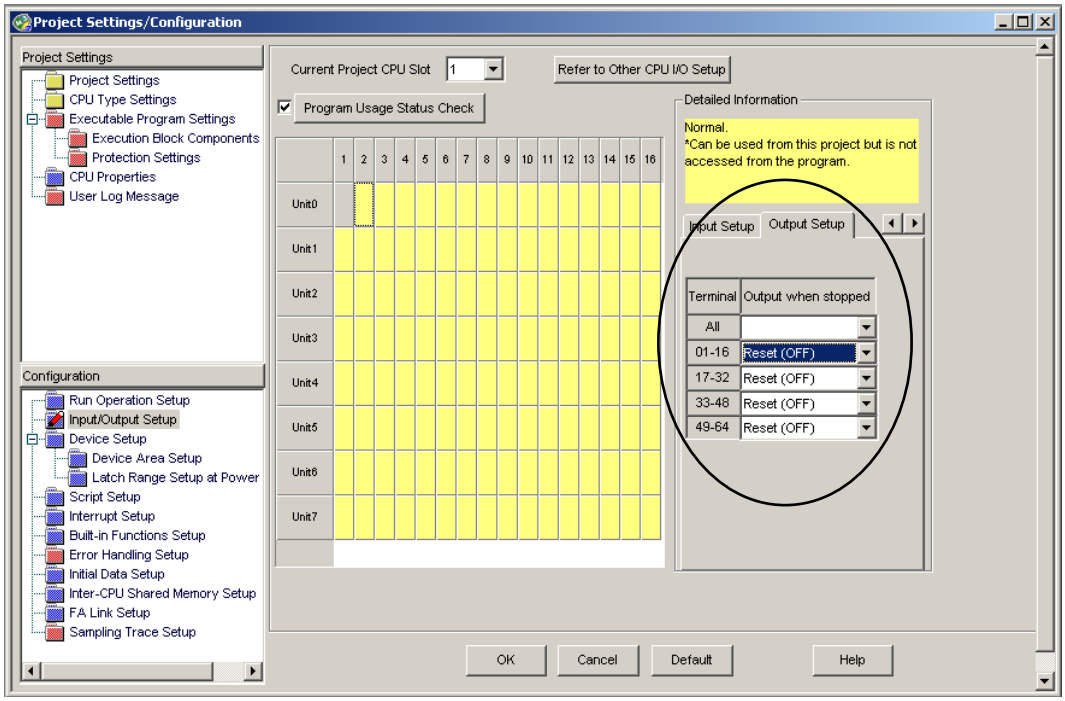


Figure A7.3 Setting I/O Conditions using WideField3

For details on WideField3 and its operation, see “FA-M3 Programming Tool WideField3 (Offline) User’s Manual” (IM34M06Q16-02E).

● How to Perform DIO Setup using BASIC (F3BP□□)

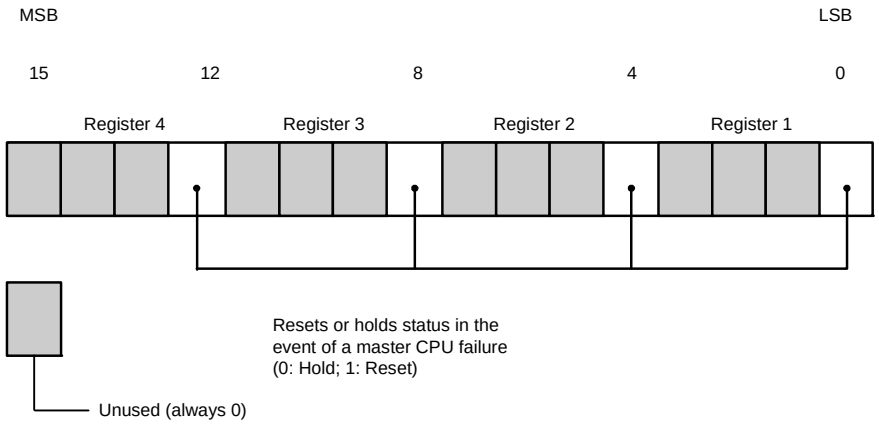
Use a CONTROL statement to select whether to reset or hold the output of output modules.

On 16-point and 32-point modules, the setup is made to the control registers in groups of 8 terminals.

The statement syntax is given below.

Syntax	CONTROL m, 1 ; I m : Slot number or numerical expression I : Data, integer or integer variable

Content of Control Register



Register 4 : terminals 25 to 32
Register 3 : terminals 17 to 24
Register 2 : terminals 9 to 16
Register 1 : terminals 1 to 8

- The control register is reset to all zeroes at startup.

Example	CONTROL 206, 1 ; $ 0010 : for the output module installed in slot 206, resets terminals 9 to 16 and holds the remaining terminals in the event of a master CPU failure.

FA0723.VSD

A7.2.3.3 Operation Control in CPU Configuration

● How to set up Operation Control using WideField3

To set up Operation Control using WideField3, use the following procedure.

1. Select [Project]–[Project Settings] from the WideField3 menu bar.
2. Select [Error Handling Setup] from the Configuration pane of the displayed Project Settings/Configuration window.
3. Select [Continue to run] or [Stop] for [I/O module Error] and [Subunit Communication Error] under Error-Time Action Setup.

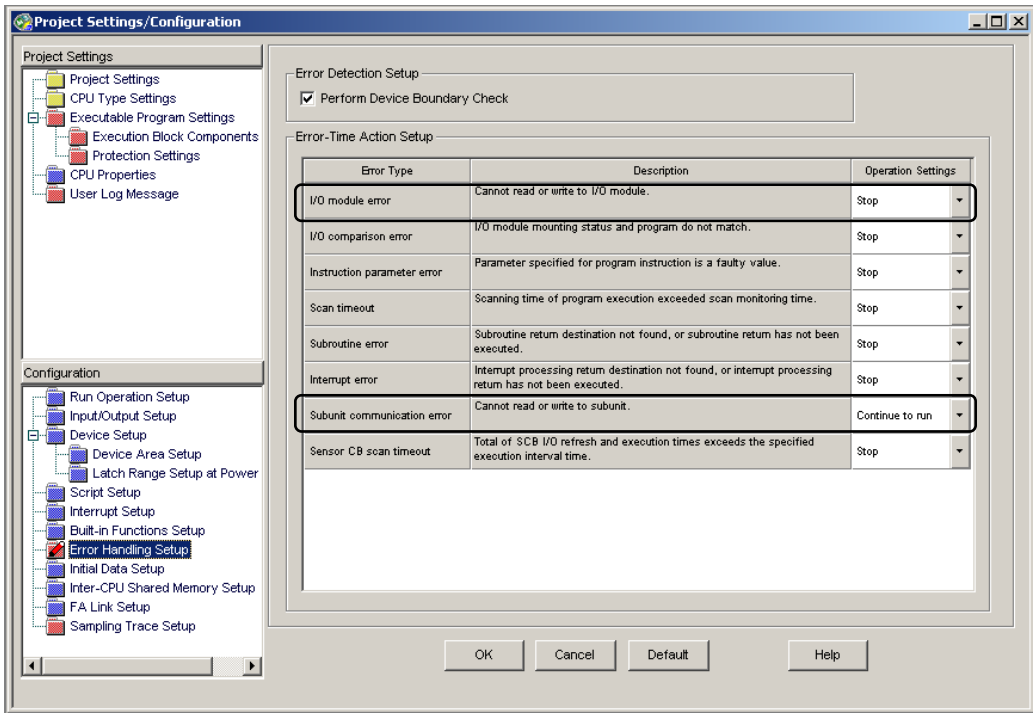


Figure A7.4 Setting Operation Control using WideField3

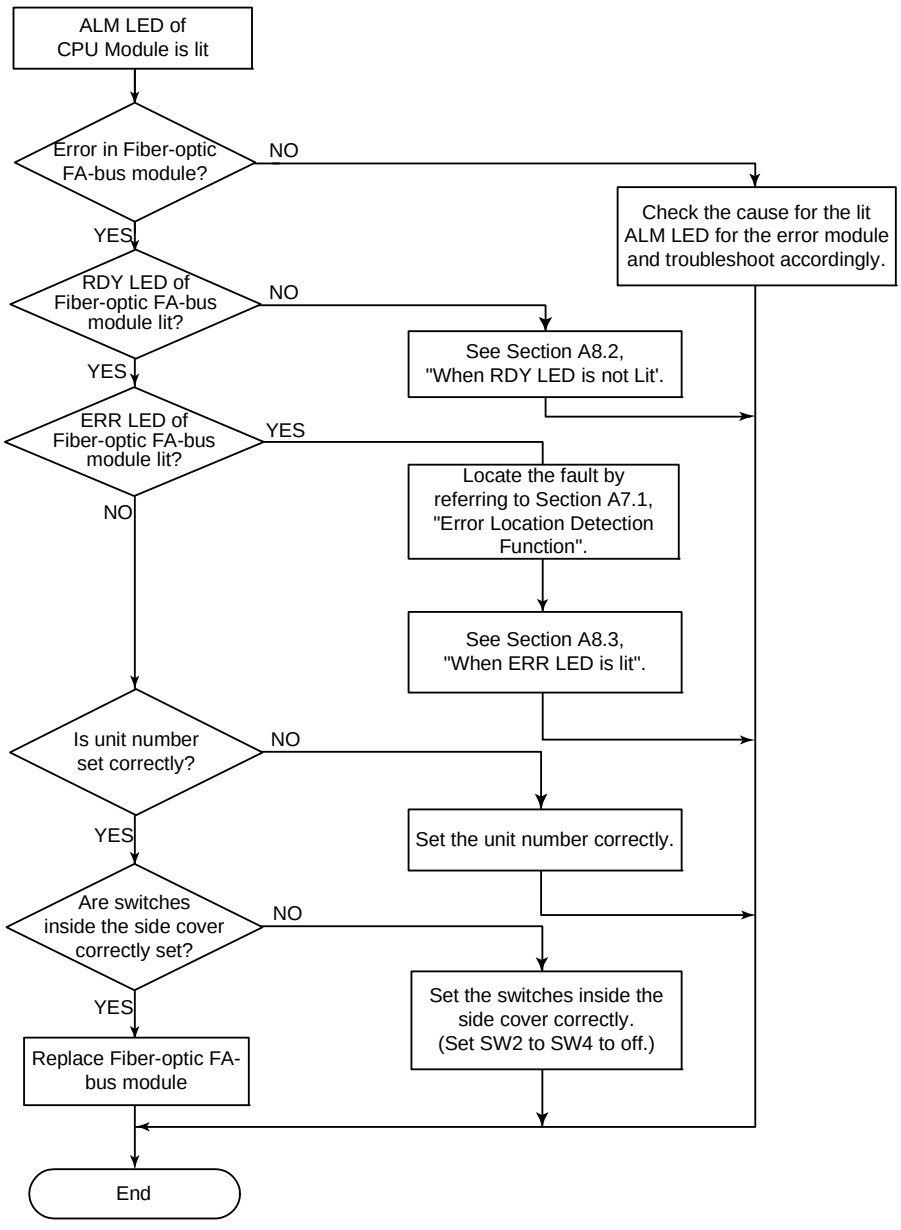
● How to set up Operation Control using BASIC (F3BP☐☐)

An I/O module error or subunit communications error generates an error in BASIC. Design your application program to handle such errors.

A8. Errors and Troubleshooting

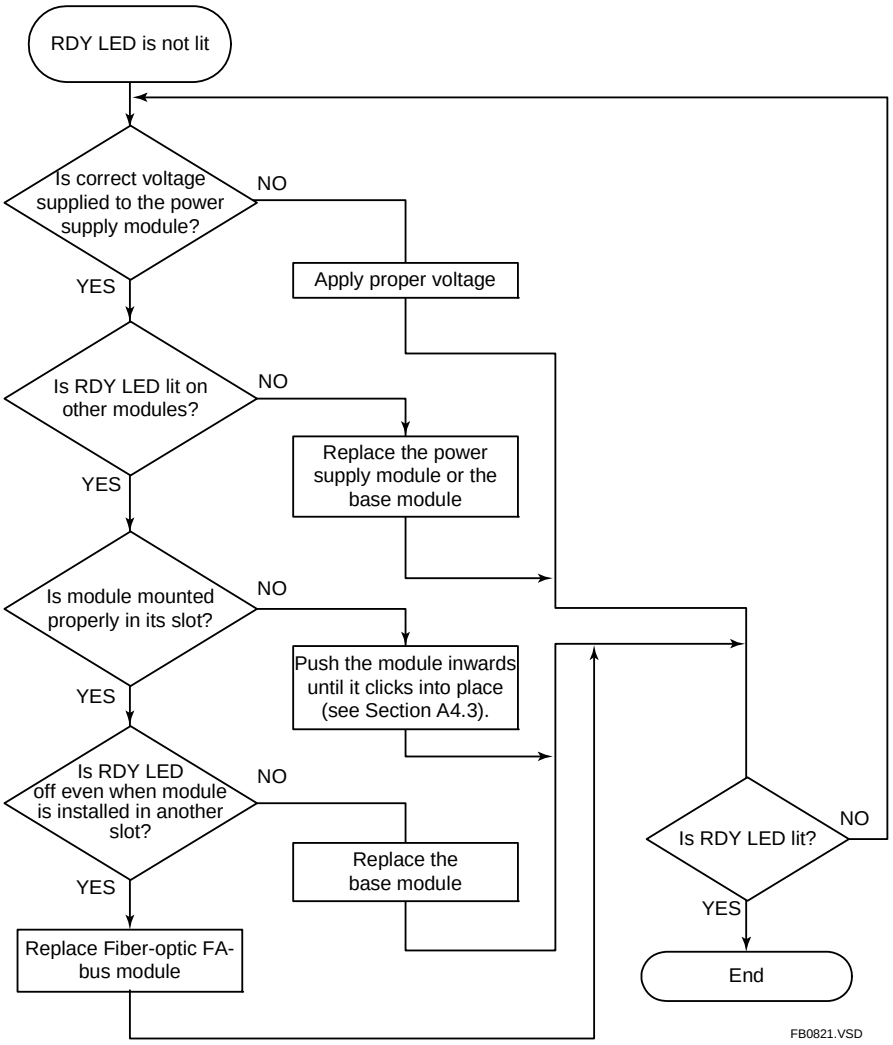
A8.1 Troubleshooting Flowcharts

This section shows flowcharts that can be used for troubleshooting problems that may occur with the Fiber-optic FA-bus module during operation.

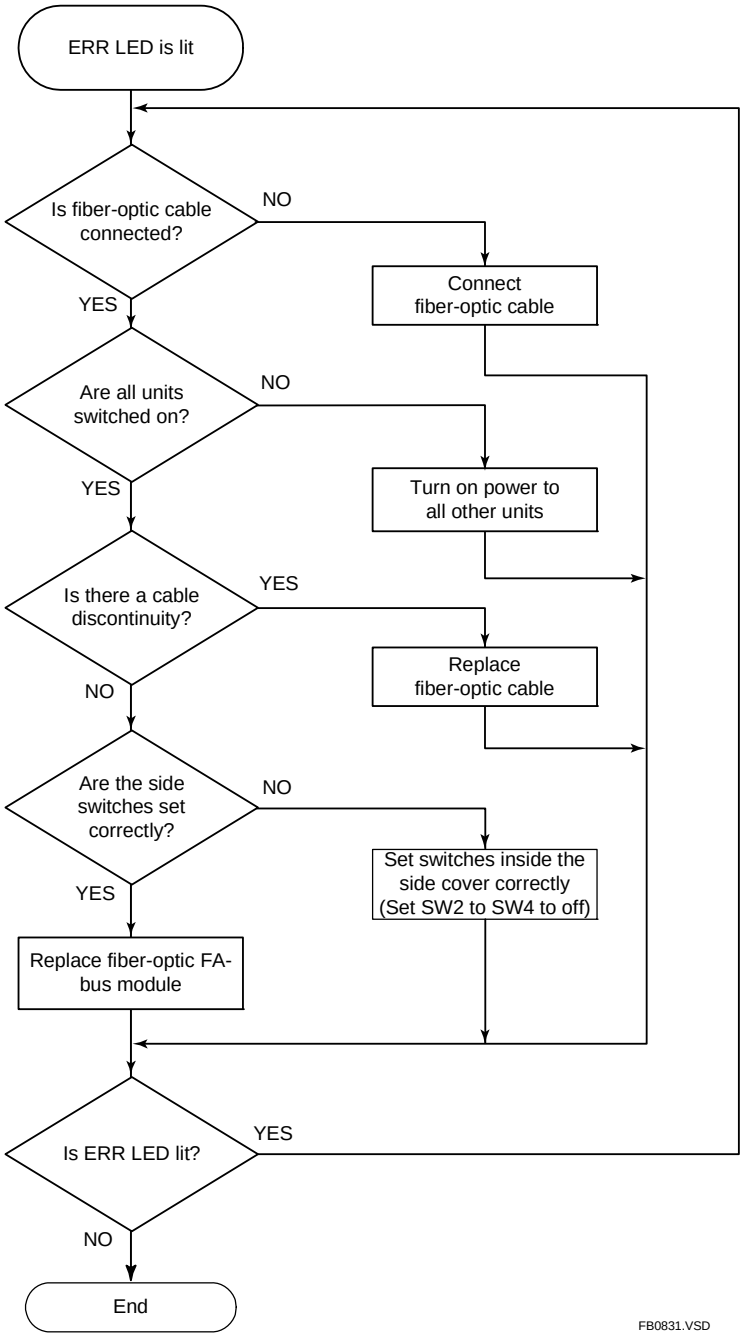


FB0811.VSD

A8.2 When RDY LED is Not Lit



A8.3 When ERR LED is Lit



Blank Page

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part A: Fiber-optic FA-bus Module

IM 34M06H45-01E 5th Edition

INDEX

Blank Page

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part B: Fiber-optic FA-bus Type 2 Module

IM 34M06H45-01E 5th Edition

Part B of the manual describes the Fiber-optic FA-bus Type 2 Module (F3LR02-0N).

Blank Page

B1. Overview

The Model F3LR02-0N Fiber-optic FA-bus Type 2 Module (hereinafter referred to as 'the module' or 'this module') is an interface module for configuring a distributed control system on a fiber-optic FA-bus type 2.

A user can configure an efficient remote I/O system by installing Fiber-optic FA-bus Type 2 modules in the FA-M3 main unit and subunits and connecting them using fiber-optic cables. Modules in the subunits can then be handled like modules in the main unit.

*1: I/O refers to contact input and output modules.

Fiber-optic FA-bus Type 2 module has two main uses:

- Distributed configuration of I/O modules
- System expansion

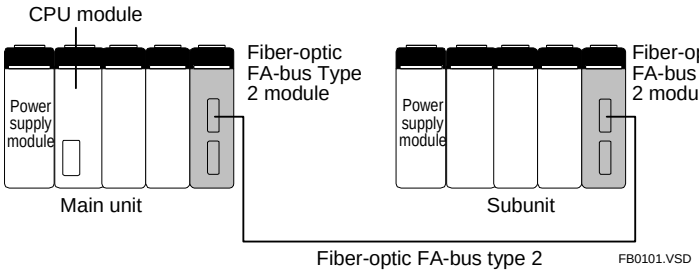


Figure B1.1 Remote I/O System

B1.1 Features

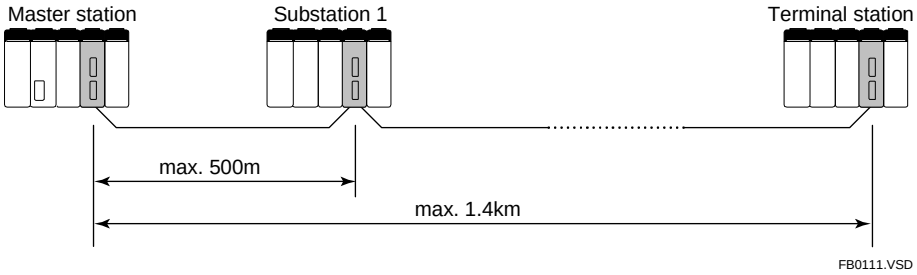
The Fiber-optic FA-bus Type 2 module has the following features.

● High-speed communications

The Fiber-optic FA-bus Type 2 module features 10 Mbps high-speed communications. Users no longer have to worry about I/O refresh time during ladder programming.

● Extended distance between stations

A master station can control remote stations[*1]. The maximum distance between two stations is 500 m[*2] and the maximum total distance is 1.4 km[*3].



● Flexible unit configuration

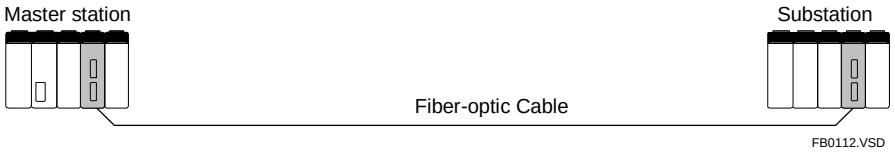
All I/O modules, with some exceptions[*4], can be installed in a substation. Modules installed in a substation can be accessed the same way as modules installed in the master station.

● Simple setup

No specific remote I/O configuration (environment setup) is required.

● Optical transmission

The use of fiber-optic cables for transmission delivers high noise immunity.



*1: Subunit installed with a Fiber-optic FA-bus Type 2 module
*2: GI-type H-PCF cables must be used for distance beyond 200m.
*3: 3 substations for daisy-chain configuration.
*4: Except for Ethernet Interface modules, NX Interface modules, FL-net Interface modules, FA Link modules, FA Link H modules, Fiber-optic FA Link H modules, Hard Disk modules, PC Card modules and YHLS Master modules.

● Flexible system configuration

2 communications ports are provided, thus allowing both daisy-chain configuration and loop configuration. Furthermore, multiple Fiber-optic FA-bus Type 2 modules can be installed in one master station to build a mixed configuration.

For details, see Section B3.5, “Connection Topology”.

● Support for multi-distributed systems

Supports multi-distributed systems, with up to 32 substations per system and up to 56 substations in total. Hence, it is suitable for many applications.

*: These figures apply in configurations where only F3BU04 modules are used.

● Early error location reporting (RAS *1 function)

The alarm monitor and error log functions facilitate identification of error locations such as a cable discontinuity. When an error is detected, the Error (ERR) LED on the fiber-optic FA-bus Type 2 module turns on, allowing on-site detection of the error.

For details of the RAS function, see Chapter B6, “RAS Functions of Fiber-optic FA-bus Type 2”.

*1: RAS (Reliability Availability Serviceability) indicates the overall usability of automated equipment.

Blank Page

B2. Specifications

B2.1 Model and Suffix Codes

Table B2.1 Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Remarks
F3LR02	-0N	—	—	Maximum total distance: 1.4 km Maximum distance between units: 500 m

B2.2 Function Specifications

■ General Specifications

Table B2.2 General Specifications

Item	Specifications
Current consumption	460 mA (5V DC)
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm
Weight	0.12 kg
Operating temperature range	0 to 55°C
Operating humidity range	10 to 90% RH (non-condensing)
Operating atmosphere	Free of corrosive gases and heavy dust
Storage temperature range	-20 to 75°C
Storage humidity range	10 to 90% RH (non-condensing)

The other specifications comply with the common specifications of the FA-M3.

■ Communications Specifications

Table B2.3 Communications Specifications

Item	Specifications
Transmission speed	10 Mbps
Transmission media	2-core fiber-optic cable (hard plastic clad quartz fiber-optic H-PCF)
Transmission distance	Maximum total distance: 1.4 km*1 Maximum distance between units: 500 m
Transmission channel configuration	Star, daisy-chain or loop configuration
Maximum number of substations	56 substations*2
RAS features	Shutdown output on transmission channel error function, error reporting function, loop switching
Signal encoding	Manchester encoding
Access method	Direct I/O access
Number of I/O ports	2 ports

*1: 3 substations in daisy-chain configuration. The maximum total distance decreases if more substations are used (see Table B3.2).
*2: Up to 32 substations are allowed per system if F3BU04 modules are used for all subunits.

B2.3 Operating Environment

- **Compatible CPU Modules:**

  F3SP21/F3SP25/F3SP35 (Rev. 8 or later), F3SP05, F3SP08, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71, F3SP76 and F3BP□□

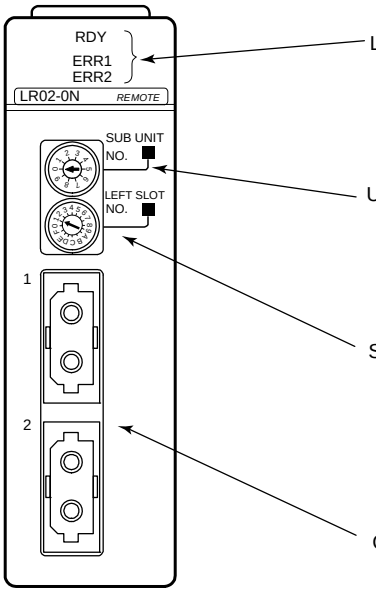
- **Base modules that support slot number setup: F3BU04, F3BU05 and F3BU06**
  *: Some base modules having the older type of nameplate do not support slot number setup. For details, see B3.8, “Precautions.”

- **Logging of transmission channel error location is available with:**
  F3SP21/F3SP25/F3SP35 (Rev. 8 or later), F3SP05, F3SP08, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71, F3SP76 and WideField3, WideField2, WideField, and Ladder Diagram Support Program M3 (Rev. 1.08 or later).

B2.4 Components and Their Functions

For details, see Section B4.2, “Setting Switches”.

■ Front View



LED indicators
RDY : Lit (green) when the internal circuit is functioning normally.
ERR1, ERR2 : Lit (red) when the module fails to detect an input signal in port 1 and port 2 respectively.

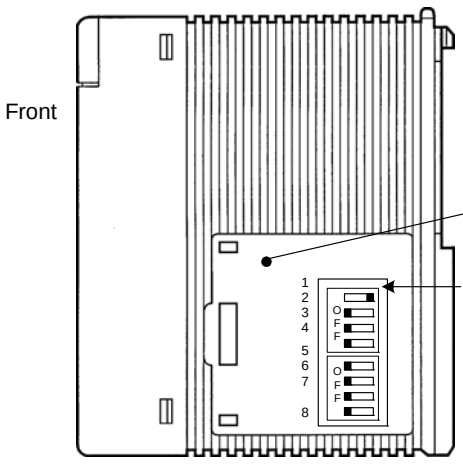
Unit number switch (subunit number):
Specifies a unit number (0 to 7)
0 : unit number of the main unit
1 to 7 : unit number of a subunit
8 to 9 : cannot be used
(factory setting is 0)

Slot number switch (left slot number):
Specifies the leftmost slot number of the base module where a Fiber-optic FA-bus Type 2 module is installed. (factory setting is 1)
1,3,5,7,9,B,D,F : valid values when using F3BU04
1,9 : valid values when using F3BU05 or F3BU06
1 : only valid value for other base modules (F3BU09, F3BU13, F3BU16,)

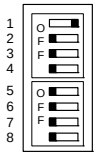
Optical connector port

FB0231.VSD

■ Right Side View



Some modules may use the following DIP switch instead.



Condition Switches

SW number	Description	OFF	ON	Factory setting
1*1	Shutdown output on transmission channel error	Hold*2	Shutdown	ON
2	Port used	Port 1	Both ports*3	OFF
3	Transmission channel configuration	Daisy-chain or star	Loop	OFF
4	Reserved	—	—	OFF

*1: Valid only for output modules installed in a sub-unit.
*2: Continues operation if transmission channel has been secured and system operation is continued.
*3: When using both port 1 and port 2.

SW number	Description	Distance Between Stations (Length of optical fiber) (m)							
5	Port 1 light intensity	OFF	0 to 200	ON	200 to 300	OFF	300 to 400	ON	400 to 500
6		OFF		OFF		ON		ON	
7	Port 2 light intensity	OFF	0 to 200	ON	200 to 300	OFF	300 to 400	ON	400 to 500
8		OFF		OFF		ON		ON	

FB0232.VSD

Figure B2.1 Components and Their Functions (F3LR02-0N)

B2.5 External Dimensions

■ External Dimensions

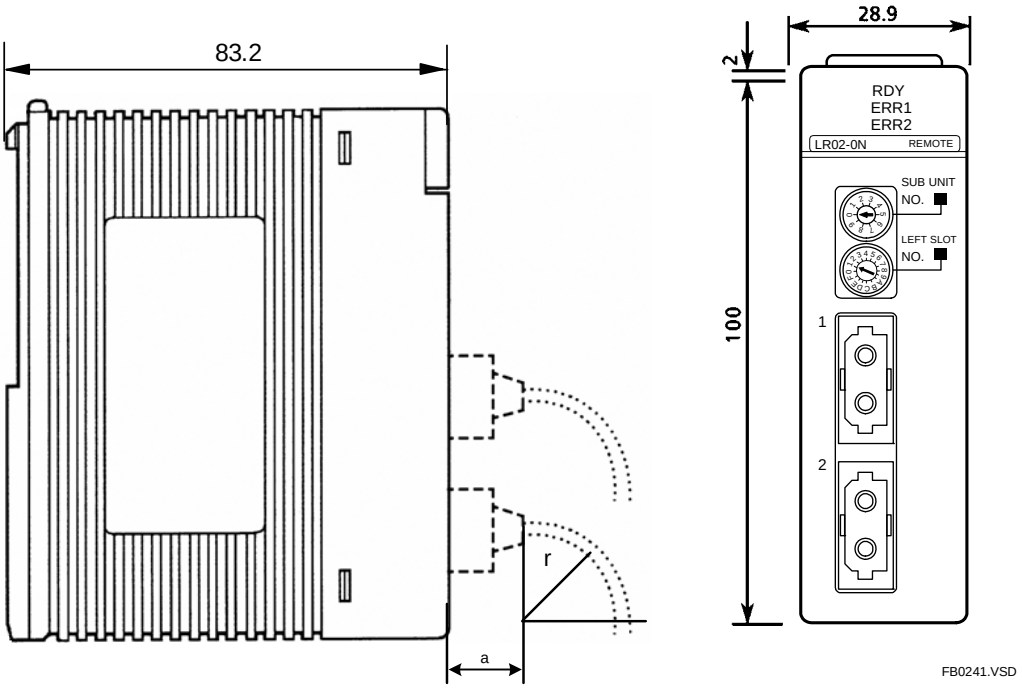


Figure B2.2 External Dimensions of F3LR02-0N

■ Installation Depth

When installing the module, always take into consideration space required for bending of fiber-optic cords and cables.

Table B2.4 Bending Radius

	Bending Radius, r (mm)			
	KF-07 (a=18.3)		CF-2071, CF-2071H (a=35.0)	
	During installation (temporary)	When secured	During installation (temporary)	When secured
Fiber-optic cord	15 or larger	50 or larger	15 or larger	50 or larger
Fiber-optic cable	—	—	50 or larger	100 or larger

Blank Page

B3. Fiber-optic FA-bus Type 2 System Configuration

B3.1 What Is a Substation?

A Fiber-optic FA-bus Type 2 system contains the following elements.

Element	Description
Station	A unit installed with a Fiber-optic FA-bus Type 2 module.
Main unit (master station)	A unit installed with a CPU module.
Subunit	Slots without a CPU module installed and are connected to a main unit via a Fiber-optic FA-bus Type 2 modules for system expansion. In a split-unit configuration, one subunit consists of multiple substations.
Substation	The smallest unit in a Fiber-optic FA-bus Type 2 system. Whether it is equivalent to a subunit depends on whether we have a split-unit configuration. In a split-unit configuration, a substation is a division of a subunit. Without splitting, a substation is equivalent to a subunit.

The following table lists some terminologies on system configuration used in this manual.

Terminology	Meaning
Terminal station	Substation at the end of a daisy chain.
Station address	General reference to a unit number and slot number assigned to a station
Master station module	Fiber-optic FA-bus Type 2 module installed in a master station
Substation module	Fiber-optic FA-bus Type 2 module installed in a substation
Terminal station module	Fiber-optic FA-bus Type 2 module installed in a terminal station

B3.2 Substation Configuration

In a Fiber-optic FA-bus Type 2 system, a user can split a subunit into multiple substations, as shown in Figure B3.1, “Substation Configuration Example”. Logically, a subunit consists of 16 slots. Up to 7 subunits are allowed in a system.

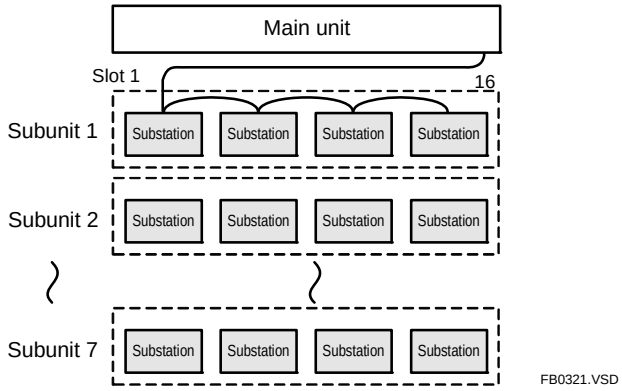


Figure B3.1 Substation Configuration Example

There are 6 patterns available for splitting subunits. Select an appropriate pattern to suit your application.

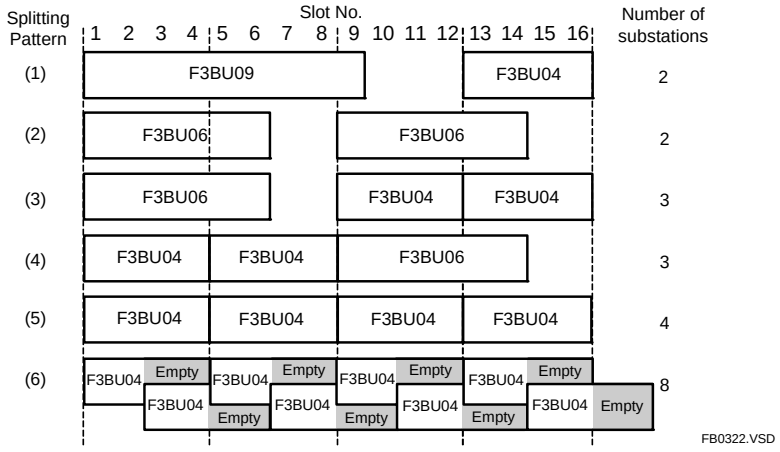


Figure B3.2 Patterns for Splitting Subunits

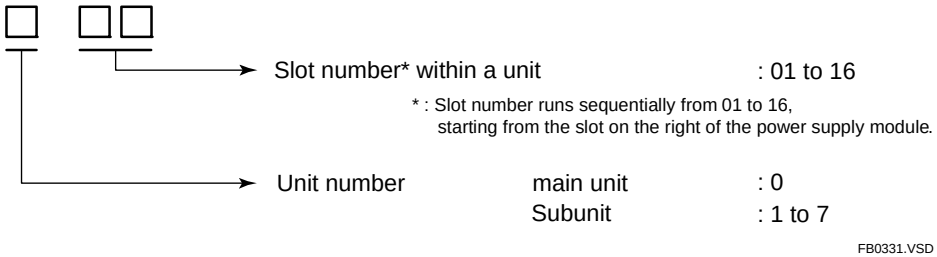
When pattern (3) is used, for example, up to 7 subunits can be connected, providing a maximum of 21 stations.

A 32-station system (maximum configurable system) can be configured by combining 6 sets of pattern (5) and 1 set of pattern (6). In pattern (6), only one module can be installed per substation.

B3.3 System Configuration and Slot Numbers

In FA-M3, slot numbers are used for accessing various modules.

A slot number indicates the position of the slot where a module is mounted and is a 3-digit integer with the following structure.



A module installed in a subunit can be accessed using ladder or BASIC, in the same way as accessing a module mounted in the main unit.

The following figure shows a system configuration example without split subunits, that is, one substation equates to one subunit.

Such a configuration can be used if the number of substations required in a system is no more than 7.

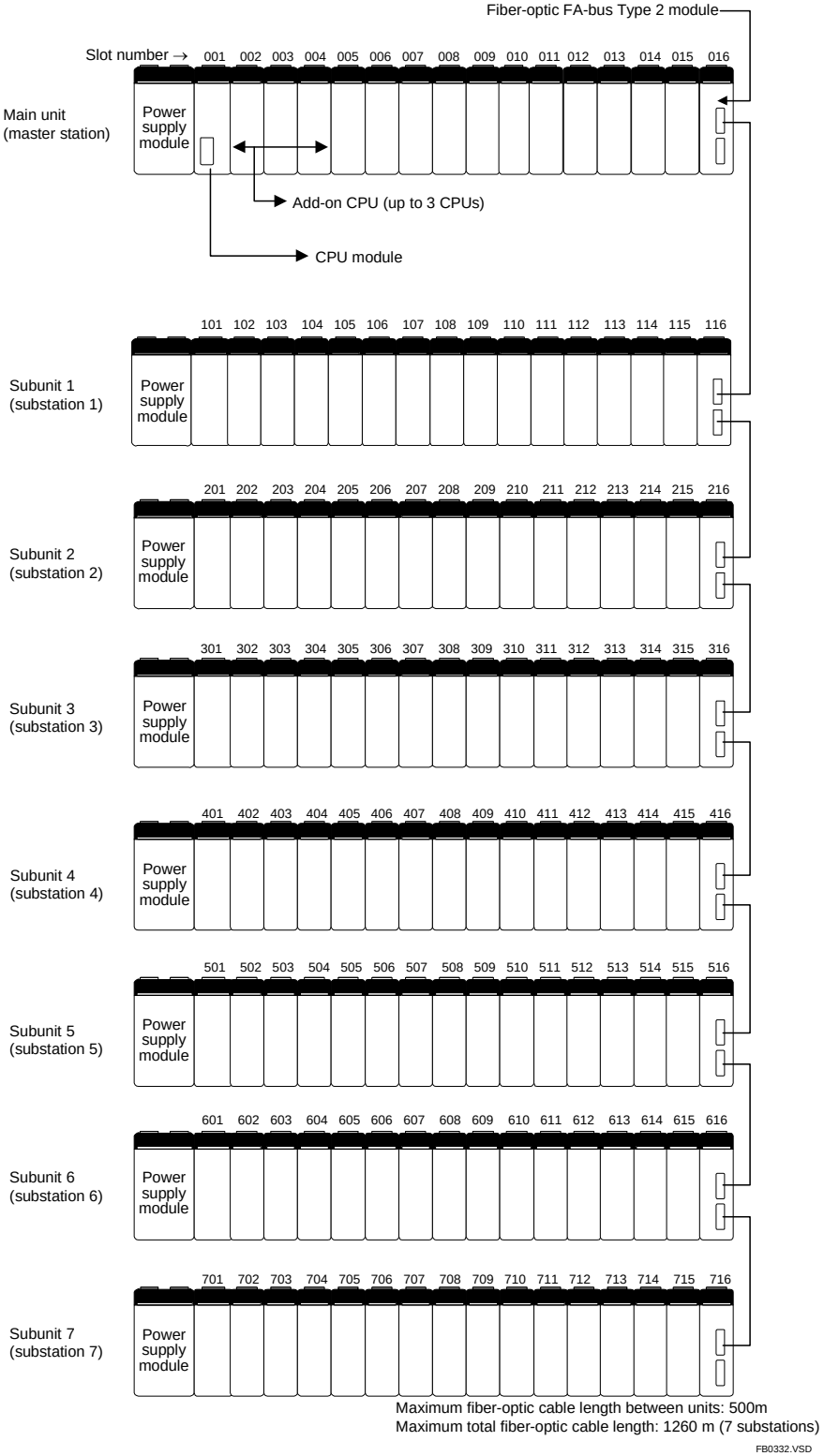


Figure B3.3 (a) System Configuration and Slot Numbers

If the number of substations required is more than 7, build a split-subunit configuration.

Figure B3.3 (b) System Configuration and Slot Numbers in a split-Subunit Configuration

B3.4 Restrictions on System Configuration

The following table lists some restrictions when configuring a Fiber-optic FA-bus Type 2 system.

Table B3.1 Restrictions when Configuring a Fiber-optic FA Bus System

Item	Specifications
Number of Fiber-optic FA-bus Type 2 modules installable in a master station	No restriction*
Number of Fiber-optic FA-bus Type 2 modules installable in a substation	1 max.
Modules installable in a substation	All I/O modules and special modules except for - Ethernet Interface modules, - NX Interface modules, - FL-net Interface modules, - FA Link modules, - FA Link H modules, - Fiber-optic FA Link H modules, - Hard Disk modules, - PC Card modules, and - YHLS Master modules.

* Provided the current capacity of the power supply module is not exceeded.

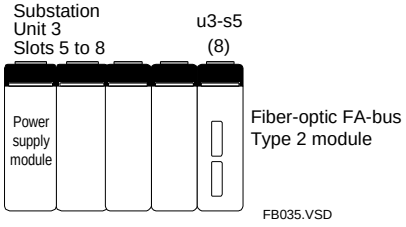
B3.5 Connection Topology

Fiber-optic FA-bus Type 2 modules can be connected using a loop, daisy chain or star configuration. The following pages show examples for each of the configurations. But first of all, you should understand the concept of “unit representation” described below.

● Unit Representation

This example shows the unit representation of a Fiber-optic FA-bus Type 2 module installed in a F3BU04, with the unit number switch (u) set to 3 and the slot number switch set to 5.

With this setup, the leftmost slot of the F3BU04 is changed to slot 5 and the location where the Fiber-optic FA-bus Type 2 module is installed is slot (8).



■ Loop Configuration

A loop configuration connects the empty port of a terminal station of a daisy chain to the master station to form a loop. In a loop configuration, if a cable discontinuity, substation failure or substation shutdown occurs, the built-in RAS function will operate to increase system reliability. Always form a loop with only one master station module.

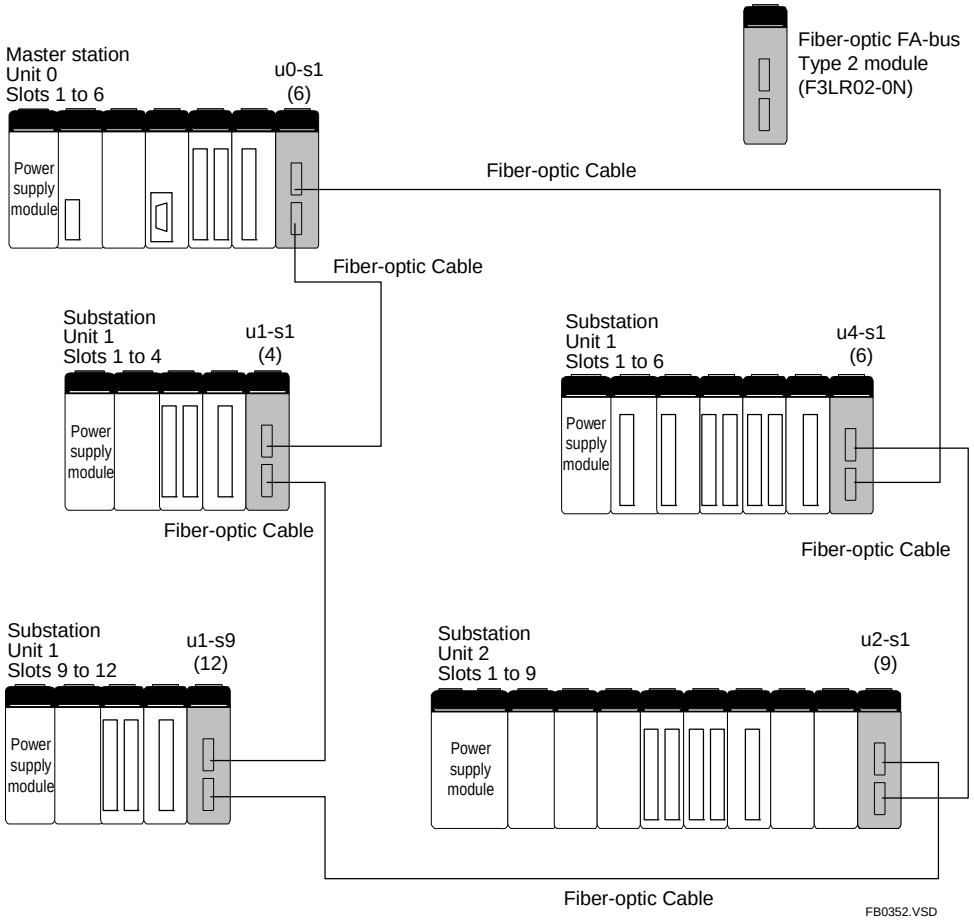


Figure B3.4 Loop Configuration

CAUTION

- Mixing Fiber-optic FA-bus modules (F3LR01-0N) with Fiber-optic FA-bus Type 2 modules (F3LR02-0N) in a loop configuration is not allowed.
- In a loop connection, port 2 of a station must be connected to port 1 of the other station. Otherwise, the system will not operate normally.

■ Daisy chain Configuration

A daisy chain configuration connects the master station to a substation, the substation to another substation and so on to access a remote substation.

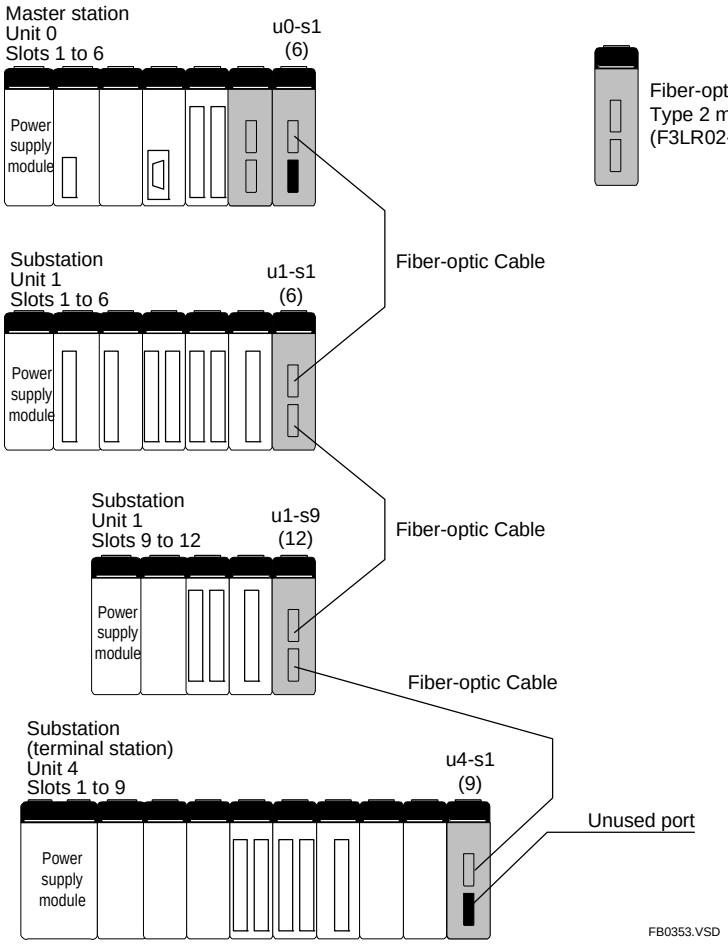


Figure B3.5 Daisy chain Configuration

CAUTION

- Mixing Fiber-optic FA-bus modules (F3LR01-0N) with Fiber-optic FA-bus Type 2 modules (F3LR02-0N) in a daisy chain is not allowed.
- In a daisy chain connection, port 1 or port 2 of the master station must be connected to port 1 of the substation. Port 2 of a substation must be connected to port 1 of another substation. Otherwise, the system will not operate normally.

■ Star Configuration

A star configuration consists of one-to-one connections between the master station and each substation. In this configuration, a cable discontinuity, substation failure or substation shutdown will not affect communications with other substations.

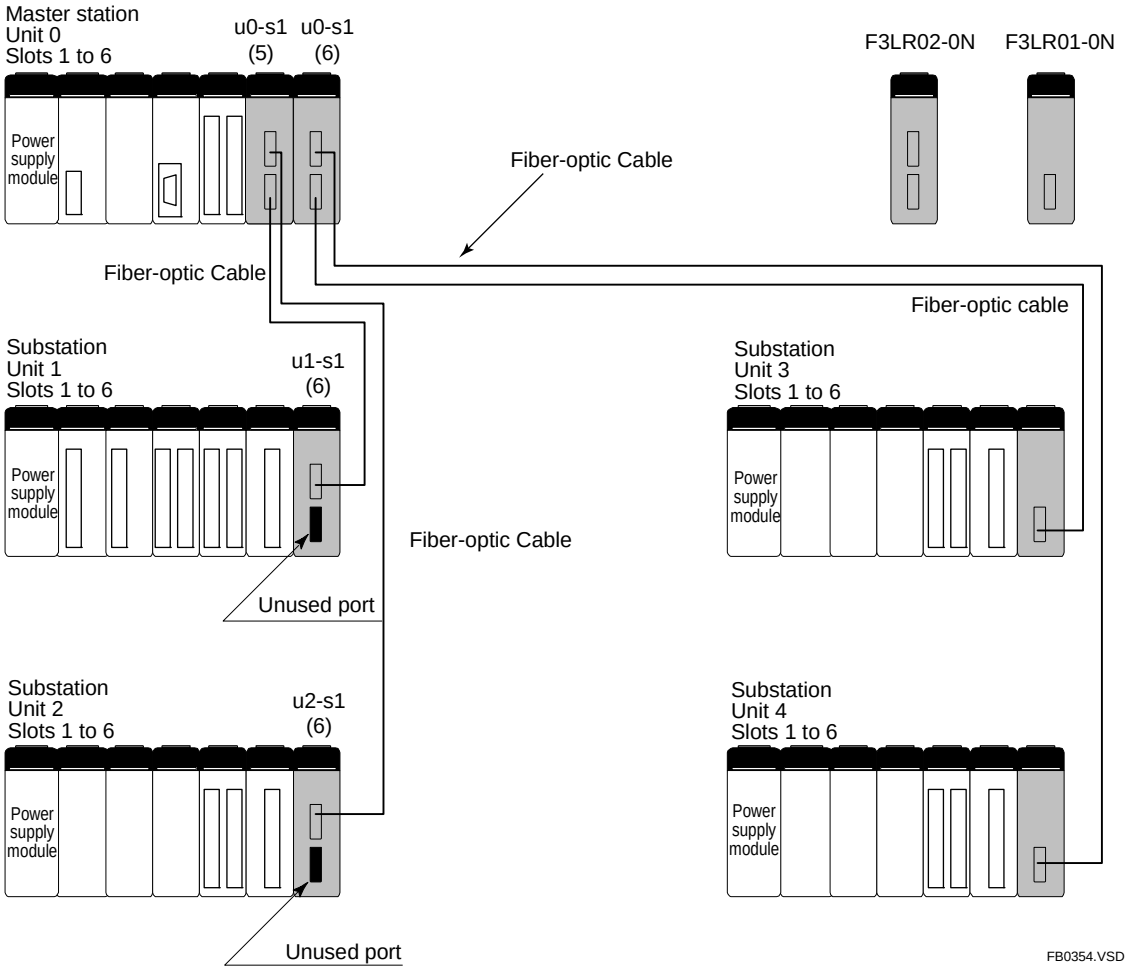


Figure B3.6 Star Configuration

CAUTION

- Using Fiber-optic FA-bus modules (F3LR01-0N) together with Fiber-optic FA-bus Type 2 modules (F3LR02-0N) is allowed in a star configuration.
- In a star connection, port 1 or port 2 of the master station must be connected to port 1 of the each substation. Otherwise, the system will not operate normally.

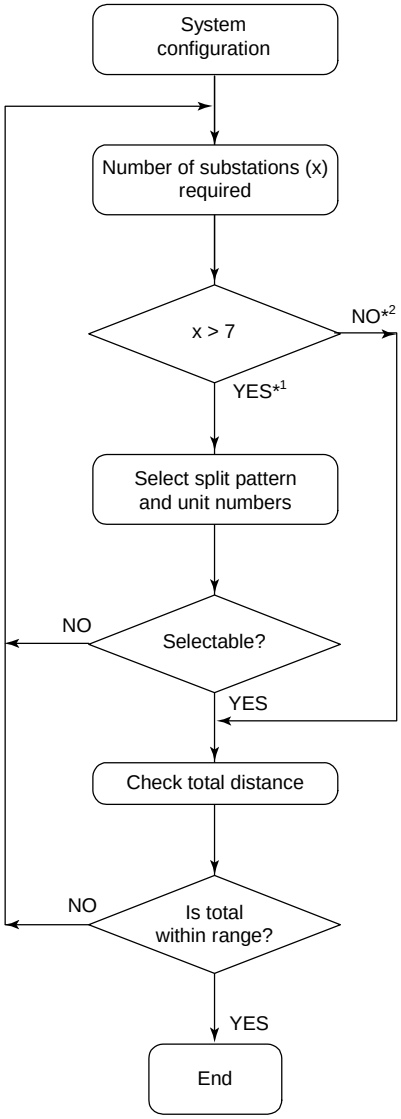
B3.6 System Configuration Design

■ Prerequisites

Before designing a system configuration, you must first confirm the following information.

- the number of substations (the number of distributed substations)
- the location of the substations

■ Design Flow



Whether to split subunits depends on whether the number of substations required in a system exceeds 7. This significantly changes the system configuration.

*1: See Figure 3.3 (b)
*2: See Figure 3.3 (a)

FB0361.VSD

Figure B3.7 Workflow for System Configuration Design

B3.7 Total Distance

The maximum total distance for a fiber-optic cable is determined by the number of substations. Table B3.2 shows the mapping between the number of substations and the maximum total distance.

Do not lay cables such that the actual fiber-optic cable length exceeds the maximum total distance, or the distance between two stations exceeds the maximum distance allowed between stations (500 m).

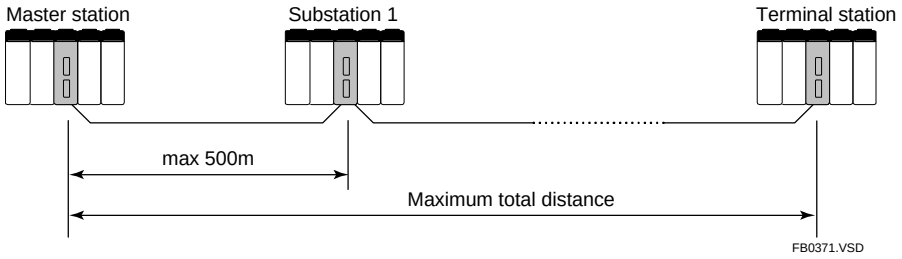
Table B3.2 Mapping Between Number of Substations and Maximum Total Fiber-optic Cable Extension

Number of Substations	Maximum Total Distance (m)	
	Daisy Chain	Loop
1	500	1000
2	1000	1500
3	1420	
4	1380	
5	1340	
6	1300	
7	1260	
8	1230	
9	1190	
10	1150	
11	1110	
12	1070	
13	1030	
14	1000	
15	960	
16	920	

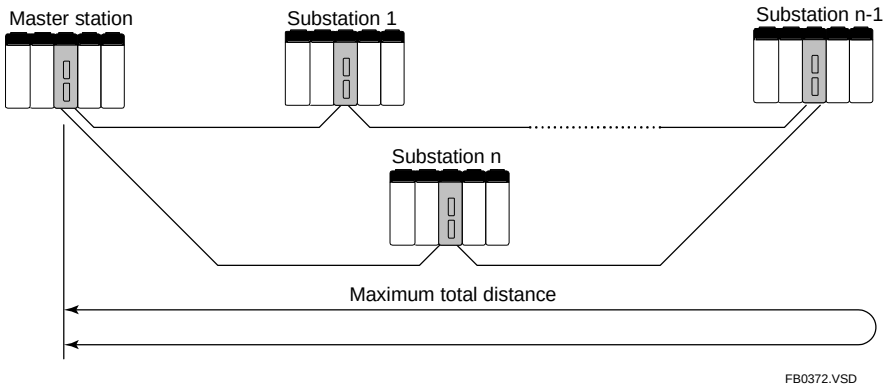
Number of Substations	Maximum Total Distance (m)
	Daisy Chain or Loop
17	880
18	840
19	800
20	760
21	730
22	690
23	650
24	610
25	570
26	530
27	500
28	460
29	420
30	380
31	340
32	300

The maximum total distance refers to the length of fiber-optic cable from the master station to the terminal station in a daisy chain configuration, or the length of fiber-optic cable in a complete loop of a loop configuration (see figure below). The maximum allowable distance between two stations is 500 m.

● Daisy chain Configuration



● Loop Configuration



B3.8 Precautions When Changing Slot Number

- Only the F3BU04, F3BU05 and F3BU06 base modules allow change of slot numbers[*1]. For other base modules, the slot number always start from 1.
- When setting addresses, do not duplicate unit/slot addresses within a system.
- Splitting of the unit is not allowed for the master station (unit number = 0). The slot number of the master station must be set to 1.
- F3LR01 modules may be used together with F3LR02 modules in a star configuration, but not in loop or daisy chain configurations.

*1: Older versions of the F3BU04 or F3BU06 base module do not allow slot number change. Check the nameplate of the base module for its version.
There are two types of nameplate: new and old. Base modules having the new type of nameplate always allow slot number change. A base modules having an old type of nameplate allows slot number change only if its nameplate is marked with "R01" but not otherwise.

- Slot number change allowed

[New nameplate type]

BASE	
MODEL	:F3BU06
SUFFIX	:-0N
STYLE	:S1
REV	:00:□□
SUPPLY	:-
INPUT	:-
OUTPUT	:-
DATE	:
NO.	:

[Old nameplate type]

BASE			
MODEL			
SUFFIX			
STYLE	S1	ROM REV	–
SUPPLY			
INPUT			
OUTPUT			
			R01
NO.			

- Slot number change not allowed

[Old nameplate type]

BASE			
MODEL	F3BU06		
SUFFIX			
STYLE	S1	ROM REV	–
SUPPLY			
INPUT			
OUTPUT			
NO.			

B4. Pre-operation Setup and Cable Connection

B4.1 Startup Procedure

The following figure shows the system startup procedure when using Fiber-optic FA-bus Type 2 modules.

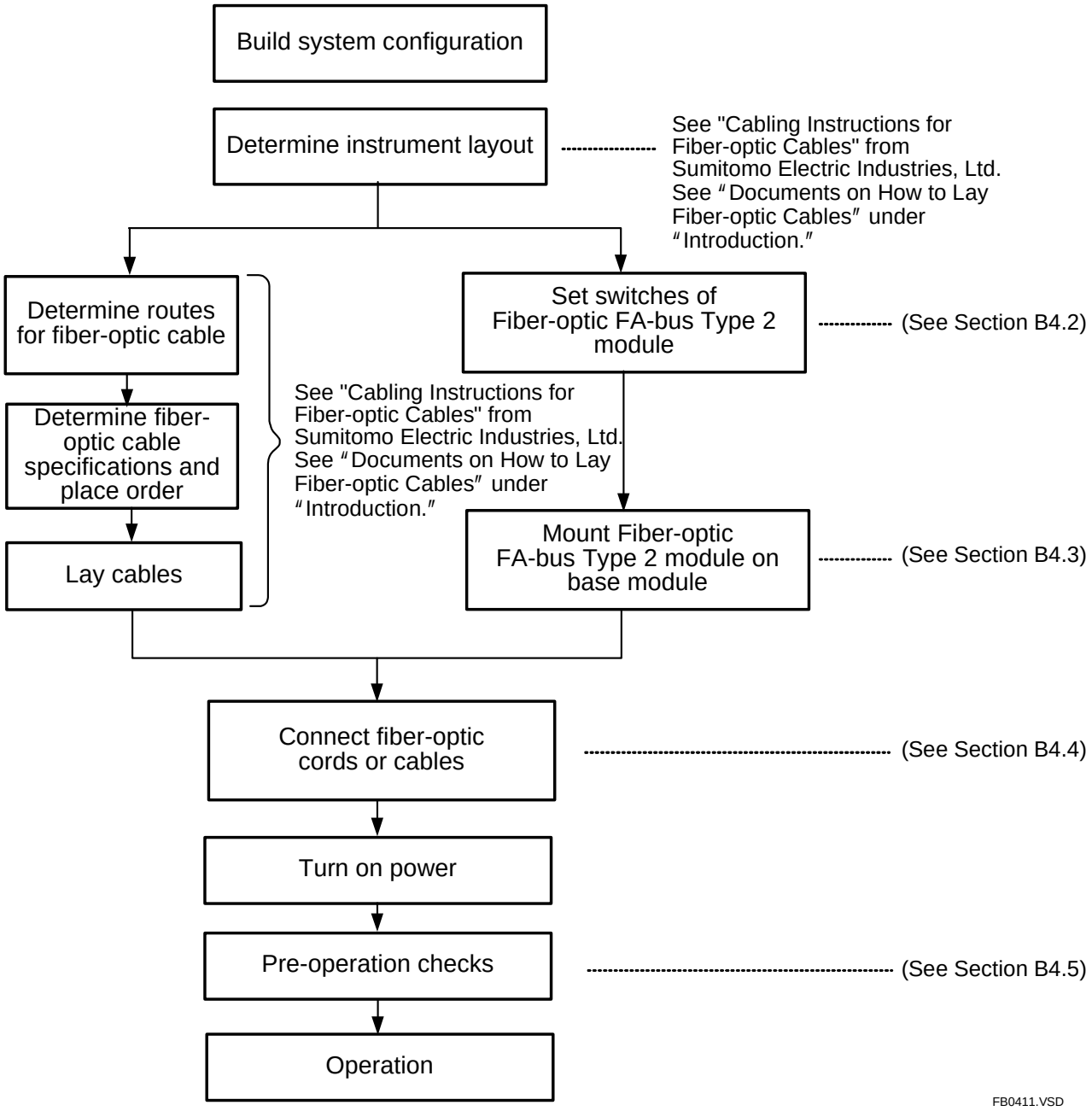


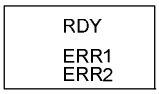
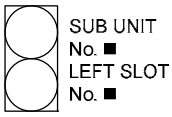
Figure B4.1 Startup Workflow

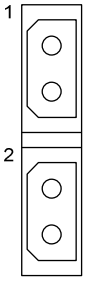
B4.2 Setting Switches

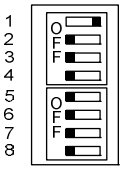
Before using this module, set its switches according to its installed location, transmission channel configuration, etc.

Table B4.1 gives an overview of the module components and settings. Subsequent subsections describe the setup of individual switches. For details on the location of switches, see Section B2.4, “Components and Their Functions.”

Table B4.1 Components and Settings

<table>
<tr><th>Name</th><th colspan="11">Description</th></tr>
<tr><td>LED
  </td><td colspan="11"><table>
<tr><th>Name</th><th>Status</th><th>Description</th></tr>
<tr><td>RDY (green)</td><td>lit</td><td>Internal circuit is functioning normally.</td></tr>
<tr><td></td><td>off</td><td>Internal circuitry is not functioning normally. No power supply.</td></tr>
<tr><td>ERR1 (red)</td><td>lit</td><td>Error: No signal in port 1. Cable discontinuity possible.*1</td></tr>
<tr><td></td><td>off</td><td>Normal: Input signal detected in port 1.</td></tr>
<tr><td>ERR2 (red)</td><td>lit</td><td>Error: No signal in port 2. Cable discontinuity possible.*1</td></tr>
<tr><td></td><td>off</td><td>Normal: Input signal detected in port 2.
Number of ports is set to 1.</td></tr>
</table></td></tr>
<tr><td>Unit number swtitch
Slot number switch
  </td><td colspan="11">Unit address number setting (factory setting: 0)
Setting range:
0 : unit number when installed in main unit
1 to 7 : unit number of subunit when installed in subunit
8, 9 : cannot be used

Used to set first number of its base module address (factory setting: 1)
Setting range:
1,3,5,7,9,B,D,F : valid values when using F3BU04
1,9 : valid values when using F3BU05 or F3BU06
1 : valid value when using other base modules (F3BU09, F3BU13, F3BU16)</td></tr>
<tr><td>Connector (port)
  </td><td colspan="11">Connector for fiber-optic cable.

Remarks:
Always use port 1.
If port 2 is not used, cover it with the connector.</td></tr>
<tr><td>Condition switches
(located on side of module)
  </td><td colspan="11"><table>
<tr><th>No.</th><th>Name</th><th colspan="7">State</th><th>Description</th></tr>
<tr><td>1</td><td>Shutdown output on transmission channel error*2</td><td colspan="7">OFF</td><td>Hold*3</td></tr>
<tr><td></td><td></td><td colspan="7">ON</td><td>Shutdown</td></tr>
<tr><td>2</td><td>Number of ports</td><td colspan="7">OFF</td><td>Use port 1 only</td></tr>
<tr><td></td><td></td><td colspan="7">ON</td><td>Use both ports 1 and 2</td></tr>
<tr><td>3</td><td>Transmission channel configuration</td><td colspan="7">OFF</td><td>Star or daisy-chain</td></tr>
<tr><td></td><td></td><td colspan="7">ON</td><td>Loop</td></tr>
<tr><td>4</td><td>Not used</td><td colspan="7">OFF</td><td>Always off</td></tr>
<tr><td>5</td><td rowspan="2">Distance between stations for port 1 (Factory setting: all off)</td><td>OFF</td><td rowspan="2">0 to 200 m</td><td>ON</td><td rowspan="2">200 to 300 m</td><td>OFF</td><td rowspan="2">300 to 400 m</td><td>ON</td><td rowspan="2">400 to 500 m</td></tr>
<tr><td>6</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>7</td><td rowspan="2">Distance between stations for port 2 (Factory setting: all off)</td><td>OFF</td><td rowspan="2">0 to 200 m</td><td>ON</td><td rowspan="2">200 to 300 m</td><td>OFF</td><td rowspan="2">300 to 400 m</td><td>ON</td><td rowspan="2">400 to 500 m</td></tr>
<tr><td>8</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
</table></td></tr>
</table>

FB0421.VSD

*1: For details on investigation of cable discontinuity, see Section B6.1, “Error Location Detection.”
*2: This setting is not valid for a master station.
*3: For a substation with secured transmission channel to the master station, continues operation if the [Subunit Communication Error] in the [Error-time Action] group on the Operation Control tab of the Configuration dialog is set to [Run].

B4.2.1 Setting Unit Number

Set the unit number using the unit number switch. This unit number will be used as an address in programs. The following table lists the valid preset values.

Table B4.2 Unit Number Switch Settings

Switch Setting	Description
0	For modules installed in the main unit (Factory setting: 0)
1 to 7	For modules installed in subunits
8 to 9	Not used (cannot be used)

CAUTION

- Always set the unit number of the Fiber-optic FA-bus Type 2 module installed in the main unit to 0. With any other value, the memory of the CPU module may be cleared.
- The unit number for a substation can be set to any integer from 1 to 7 (inclusive).
- Modules within the same system should not be given the same station address.

B4.2.2 Setting Slot Number

This switch setting changes the slot number of the base module. Changing the starting slot number of a base module allows multiple stations to share the same unit number. Always set the slot number of the master station to 1.

● F3BU04

Left Slot Number	Slot Number				
1	—	1	2	3	4
3	—	3	4	—	—
5	—	5	6	7	8
7	—	7	8	—	—
9	—	9	10	11	12
B (11)	—	11	12	—	—
D (13)	—	13	14	15	16
F (15)	—	15	16	—	—
	Power supply module				

FB0422.VSD

● F3BU05

Left Slot Number	Slot Number					
1	—	1	2	3	4	5
9	—	9	10	11	12	13
	Power Supply Module					

FB04231.VSD

● F3BU06

Left Slot Number	Slot Number						
1		1	2	3	4	5	6
9		9	10	11	12	13	14
	Power Supply Module						

FB0423.VSD

CAUTION

- The unit number of a substation can be set to any valid value but if possible, start with the smallest number.
- Modules within the same system should not have the same station address.

B4.2.3 Enabling/Disabling Shutdown Output on Transmission Channel Error Function

This switch is used to specify whether to shutdown the output of the I/O modules in a subunit in the event of a transmission channel error (cable discontinuity, subunit power off, etc.). Set operations for individual I/O modules to Hold or Reset using WideField3 or CONTROL statements in BASIC programs.

For details on the Shutdown Output function, see Section B6, “RAS Functions of Fiber-optic FA-bus Type 2”.

Setting	Description
OFF	Hold output in the event of a transmission channel error (Continue operation if a transmission channel is secured and system operation is continued).
ON	Shutdown output in the event of a transmission channel error

The Shutdown Output on Transmission Channel Error function is valid only for configurations with one CPU module (i.e. not a multi-CPU configuration).

TIP

If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken fiber-optic cable or a powered-off intermediate substation as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

CAUTION

- The Shutdown Output on Transmission Channel Error is invalid for a main unit and should be turned off for the main unit.
- Turn off this function for a loop configuration. If it is on, output will be shutdown in the event of a cable discontinuity even if loop switching is activated to maintain transmission.
- When using F3SP05, F3SP08, F3SP21, F3SP25 and F3SP35 CPU modules (Rev. 8 or later), this function is only available for output modules with 32 outputs or less.
- When using CPU modules F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76, this function is available for output modules with 32 outputs or less, as well as F3YD64-1F, F3WD64-3F, F3WD64-4F, and F3YD64-1P.

B4.2.4 Setting the Number of Ports

This switch is used to specify the ports to be used on a Fiber-optic FA-bus Type 2 module.

Value	Ports Used
OFF	Port 1
ON	Port 1 and Port 2

CAUTION

- When the number of ports is set to 1, use port 1.
- If a port is not used, cover it with the connector cover.
- Turn on this setting when using a loop configuration.

B4.2.5 Setting Transmission Channel Configuration

This switch sets the communication behavior of the Fiber-optic FA-bus Type 2 module to support various transmission channel configurations.

Value	Used Ports
OFF	Star configuration or daisy-chain configuration
ON	Loop configuration

CAUTION

- All Fiber-optic FA-bus Type 2 modules (master station and substations) in the same system should have the same transmission channel configuration setting.
- In a loop configuration, complete one system loop with only one master station.

B4.2.6 Setting Light Intensity

Depending on the length of the fiber-optic cable to be used, you may need to change the optical port setting. Before performing this setup, confirm the length of fiber-optic cables.

Table B4.3 Light Intensity Switches

SW Number	Description	Distance Between Stations (Length of Fiber-optic Cable) (m)							
5	Light intensity for port 1	OFF	0 to 200	ON	200 to 300	OFF	300 to 400	ON	400 to 500
6		OFF		OFF		ON		ON	
7	Light intensity for port 2	OFF	0 to 200	ON	200 to 300	OFF	300 to 400	ON	400 to 500
8		OFF		OFF		ON		ON	

CAUTION

- When laying fiber-optic cables, we recommend that you record the lengths of the cables.
- Each port is associated with a pair of switches.
- A mismatch between fiber-optic cable length and light intensity may cause data to be incorrectly received by the remote Fiber-optic FA-bus Type 2 module, thus causing an error.
- Always use KM67 fiber-optic cables with Fiber-optic FA-bus Type 2 modules (F3LR02) if the cable length exceeds 200 m. Using KM62 cables beyond 200 m will affect normal operation.

B4.3 Attaching and Detaching Modules

B4.3.1 Attaching the Module

Figure B4.2 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of this module towards the base module until the yellow anchor/release button clicks into place.

CAUTION

Always switch off the power before attaching or detaching a module.

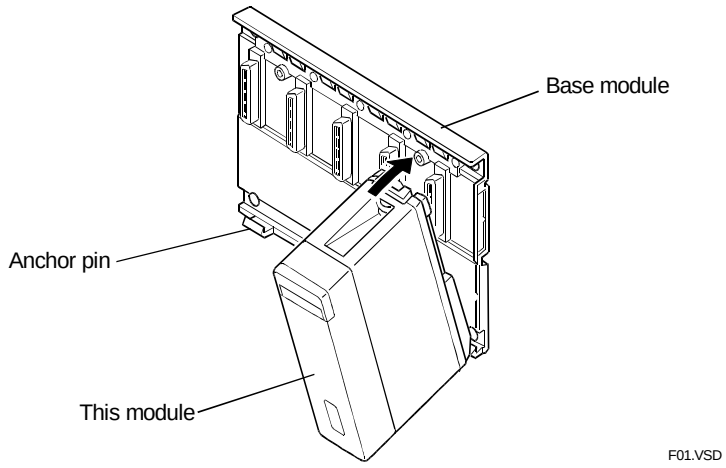


Figure B4.2 Attaching/Detaching the Module

CAUTION

DO NOT bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.

B4.3.2 Detaching the Module

To remove this module from the base module, reverse the above operation. Press the yellow anchor/release button on the top of this module to unlock it and tilt the module away from the base module. Then lift the module off the anchor pin at the base.

B4.3.3 Attaching Modules in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw. Use screws of type listed in the table below. Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

Screw Required
M4-size binder screw 12 to 15 mm long (Or 14 to 15 mm if fitted with a washer)

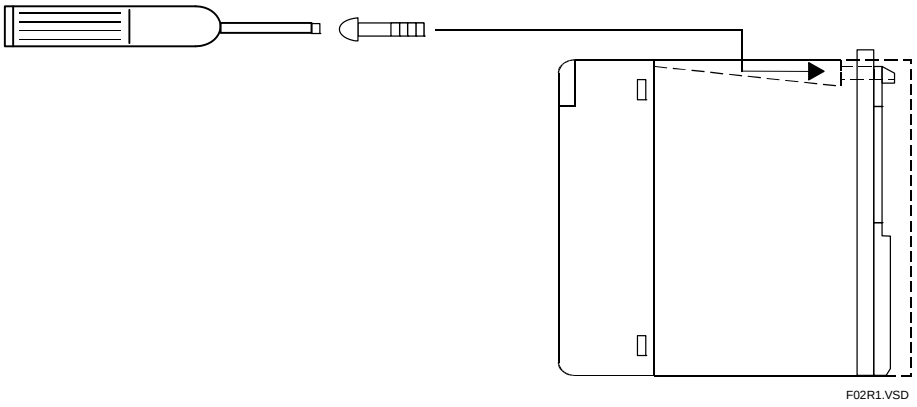
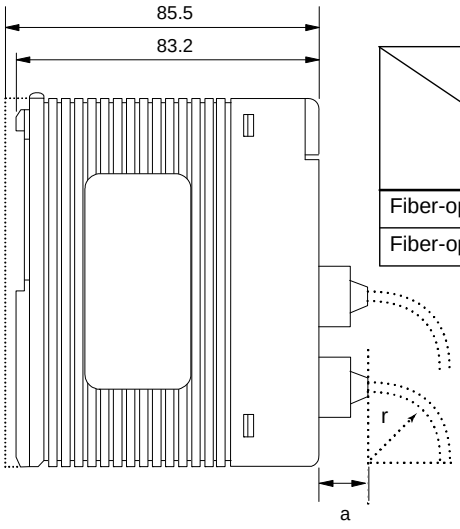


Figure B4.3 Securing Screws on Fiber-Optic FA-bus Type 2 Module

B4.3.4 Installation Depth

The module's installation depth is 85.5 mm from the rear of the base module to the front of this module.

However, if cables with connectors are used, additional space should be provided to accommodate the connectors and the bending radius of the cables.



	Bending Radius, r (mm)			
	KF-07 (a=18.3)		CF-2071, CF-2071H (a=35.0)	
	During Installation (temporary)	When Secured	During Installation (temporary)	When Secured
Fiber-optic cord	15 or larger	50 or larger	15 or larger	50 or larger
Fiber-optic cable	—	—	50 or larger	100 or larger

Figure B4.4 Installation Depth

B4.4 Connecting Fiber-optic Cables

B4.4.1 Cable Preparation

Use the following fiber-optic cables to connect Fiber-optic FA-bus Type 2 modules.

■ Specifications for Fiber-optic Cables to be Used

Table B4.4 Specifications for Fiber-optic Cable Cores

Product name	DK-HPF200/230 (for KM60)	HC-20/07 (for KM60, KM61, KM62, KM65)	HC-20/08 (for KM67)
Vendor	SWCC Showa Cable Systems	Sumitomo Electric Industries	
Core diameter	200±5 μm		
Clad diameter	230$^{0}_{\pm 10}$ μm		
Transmission loss	7 dB/km max. (λ =0.85 μm, Ta=25°C) *1	7 dB/km max. (λ =0.81 μm, Ta=25°C)	8 dB/km max. (λ =0.81 μm, Ta=25°C)

*1: The specifications of the fiber-optic cords and cables in the manual assume transmission loss of λ = 0.81 μm.

Table B4.5 Specifications for Fiber-optic Cable Connectors

Product name	KF-07 (for KM60)	CF-2001H, CF-2071H (for KM60, KM61, KM62, KM67)	CF-2011, CF-2071 (for KM65)
Vendor	SWCC Showa Cable Systems	Sumitomo Electric Industries	Sumitomo Electric Industries
Specifications	Bi-directional, lever lock, bonding, polished	Bi-directional, lever lock, bonding, polished	Bi-directional, lever lock, crimping, cut

■ List of Fiber-optic Cables

Fiber-optic Cords for Connections inside Panel (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM60	-S06	—	—	Cable length: 0.6 m	2.60	F3LR01, F3LR02, F3LP12
	-001	—	—	Cable length: 1.0 m	2.60	
	-003	—	—	Cable length: 3.0 m	2.60	

Fiber-optic Cables for Indoor Use with Tension Members (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM61	-010	—	—	Cable length: 10 m	1.10	F3LR01, F3LR02, F3LP12
	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	
	-150	—	—	Cable length: 150 m, a pulling eye on one end	1.54	
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	

Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual.
Note: The KM62 cable may be used in wet environments (but not in submerged environments).

Fiber-optic Cables for Indoor Use with Tension Members (with crimping and cutting treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM65	-001	—	—	Cable length: 1 m	2.00	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-002	—	—	Cable length: 2 m	2.00	
	-003	—	—	Cable length: 3 m	2.00	
	-004	—	—	Cable length: 4 m	2.00	
	-005	—	—	Cable length: 5 m	2.00	
	-007	—	—	Cable length: 7 m	2.00	
	-010	—	—	Cable length: 10 m	2.00	
	-012	—	—	Cable length: 12 m	2.00	
	-015	—	—	Cable length: 15 m	2.00	
	-020	—	—	Cable length: 20 m	2.00	
	-025	—	—	Cable length: 25 m	2.00	
	-030	—	—	Cable length: 30 m	2.00	

Note: The KM62 cable may be used in wet environments (but not in submerged environments).
Note: KM65 cables are not supplied with pulling eyes. If pulling eye is required, use the KM61 or KM62 cables.

Fiber-optic Cables for Outdoor Use with Tension Members (with bonding and polishing treatment on optical connector)

Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM62	-100	—	—	Cable length: 100 m, a pulling eye on one end	1.10	F3LR01 (Max. 200 m) F3LR02 (Max. 200 m) F3LP12 (Max. 1000m)
	-200	—	—	Cable length: 200 m, a pulling eye on one end	1.95	
	-300	—	—	Cable length: 300 m, a pulling eye on one end	2.72	
	-400	—	—	Cable length: 400 m, a pulling eye on one end	3.43	
	-500	—	—	Cable length: 500 m, a pulling eye on one end	4.10	
	-600	—	—	Cable length: 600 m, a pulling eye on one end	4.73	
	-700	—	—	Cable length: 700 m, a pulling eye on one end	5.33	
	-800	—	—	Cable length: 800 m, a pulling eye on one end	5.91	
	-900	—	—	Cable length: 900 m, a pulling eye on one end	6.46	
	-L01	—	—	Cable length: 1000 m, a pulling eye on one end	7.00	
KM67	-300	—	—	Cable length: 300 m, a pulling eye on one end	3.34	F3LR02 (200 to 500m)
	-400	—	—	Cable length: 400 m, a pulling eye on one end	4.15	
	-500	—	—	Cable length: 500 m, a pulling eye on one end	4.90	

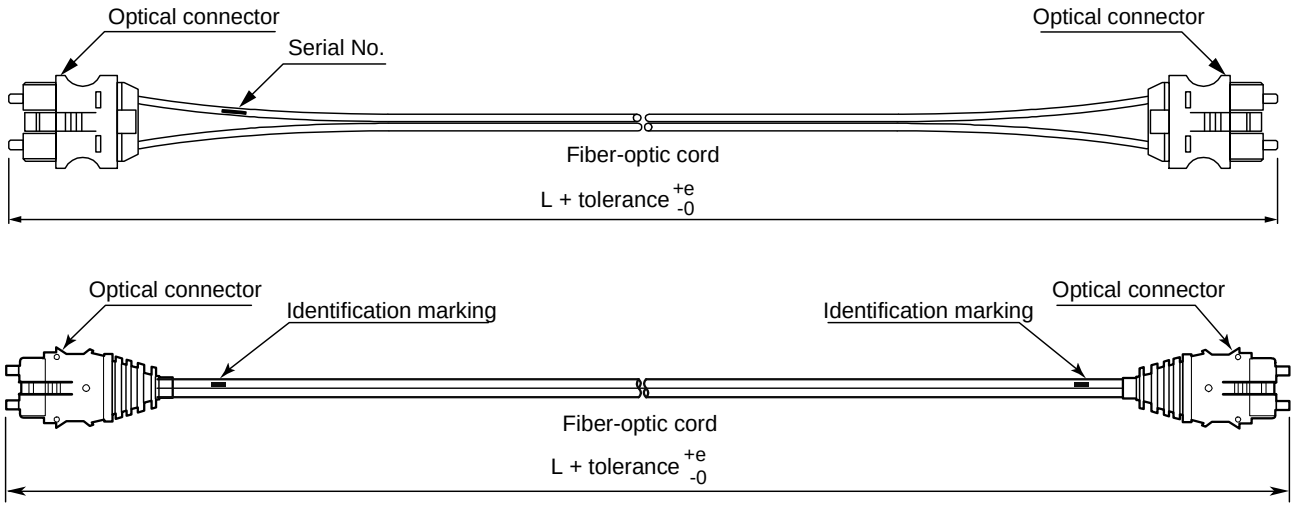
Note: - For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual.
- Always use KM67 fiber-optic cables with F3LR02 modules if the cable length exceeds 200 m. Using KM62 cables beyond 200 m will result in incorrect operation.

CAUTION

KM6☐ cables cannot be used in submerged environments. Contact Yokogawa's sales office for alternative solutions.

■ External Diagram

●KM60

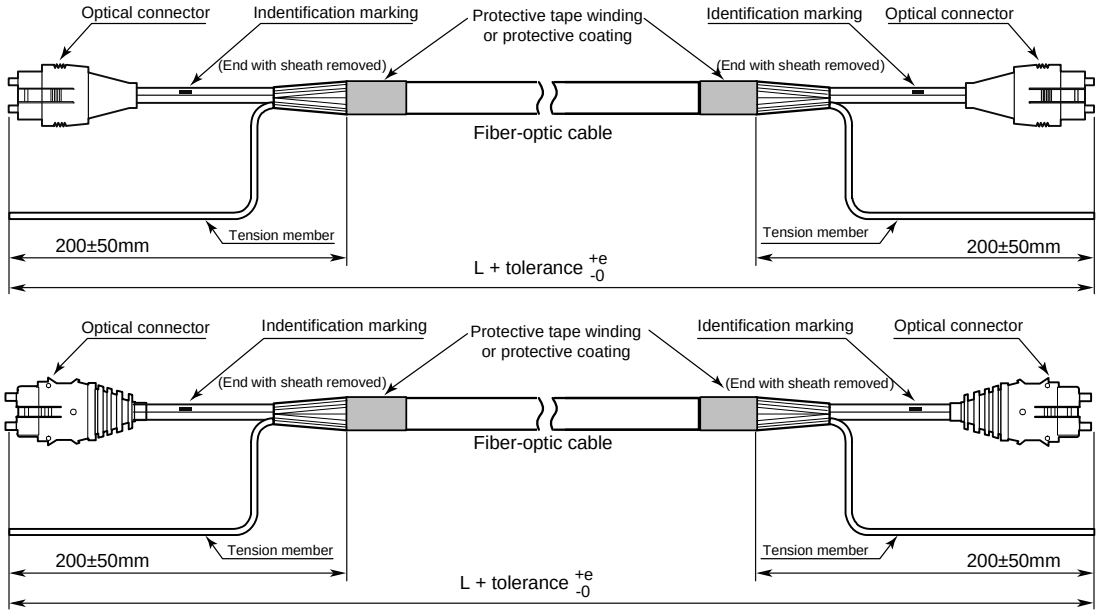


Length L (m)	Tolerance + e (m)
L≦3	0.20
3≦L≦5	0.50

FA0242.VSD

Note: Fiber-optic cord (KM60) is available in two types with optical connectors of different looks but customers cannot specify the connector type when placing an order.

●KM61, KM62, KM67

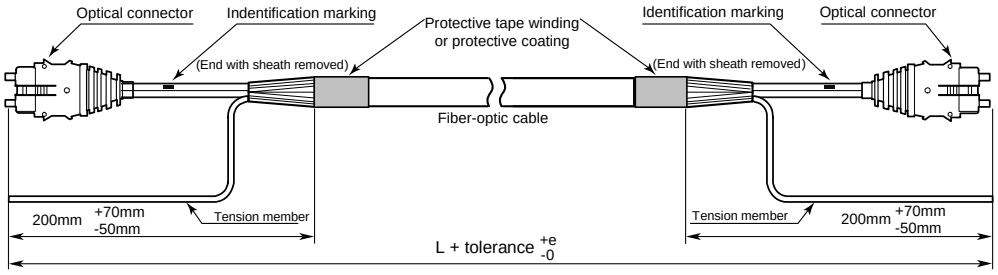


Length L (m)	Tolerance +e (m)
5<L≦30	0.50
30<L	L x 0.03 (3%)

FB0442.VSD

Note: Fiber-optic cable (KM61, KM62, KM67) is available in two types with optical connectors of different looks but customers cannot specify the connector type when placing an order.

●KM65

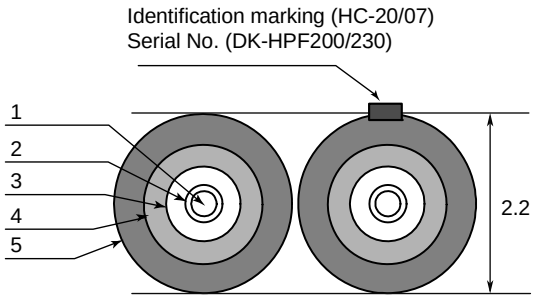


Length L (m)	Tolerance +e (m)
L≦15	0.20
5<L≦15	0.30
15<L≦30	0.50

FB0442B.VSD

■ Cross-sectional view

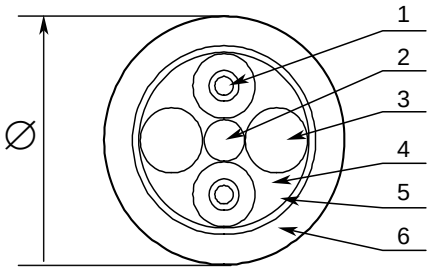
●KM60



1	Core (quartz glass)
2	Clad (fluorinated acrylate resin)
3	Cover (fluorine-based resin)
4	Reinforcer (aromatic high tensile fiber)
5	Outer cover (heat-resistant PVC black)

FB0443.VSD

●KM61, KM62, KM65, KM67



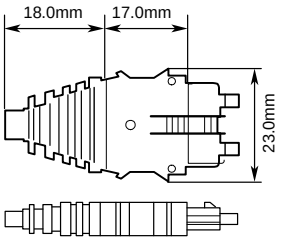
1	Fiber-optic single-core cord
2	Tension member (plastic-covered steel wire)
3	Lacing (plastic lacing)
4	Inclusion (plastic yarn or fiber)
5	Holding tape (plastic fiber)
6	Heat-resistant PVC sheath (KM61, KM65), LAP sheath (KM62, KM67)

Model	Manufacturer Item code	External Dimensions(∅)
KM61 KM65	2-C-V	∅8.4mm ±1.0
KM62 KM67	2-C-LAP	∅10.0mm ±1.0

FB0444.VSD

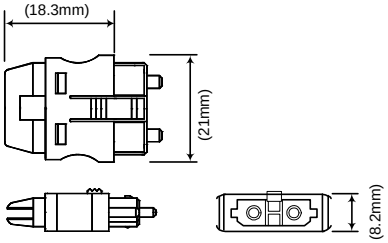
■ Connector (Top View)

● CF-2071H and CF-2071
(for cables KM60, KM61, KM62, KM65, and KM67)



FB0445.VSD

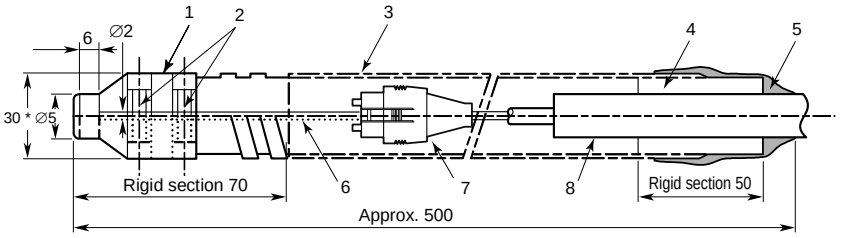
● KF-07
(for cable KM60)

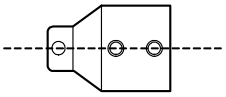


FB0245B.VSD

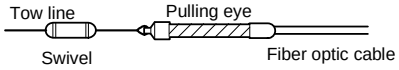
■ Fiber-optic Lead-in Cable Laying Pulling-Eye Assembly Diagram

Unit: mm





When performing lead-in work, connect the pulling eye to the tow line through a swivel which is attached to the head of the pulling eye as shown in the figure below.



No.	Components	Qty.
1	Pulling eye	1
2	Stopper screw (M6)	4
3	Flexible pipe	1
4	Terminal spacer	1
5	Vinyl tape	–
6	Tension member	–
7	Optical connector	–
8	Fiber-optic cable	–

FB0446.VSD

■ Fiber-optic Cables from Sumitomo Electric Industries

Table B4.6 Cords and Cables without Connectors from Sumitomo Electric

Type		Specifications	Compatible Modules
Fiber-optic cord	H-PCF2 core cord	DCV-HC-20/07	F3LR01, F3LR02, F3LP12*1
Fiber-optic cable	2-C-V (for indoor use)	2×CCV-HC-20/07	F3LR01, F3LR02, F3LP12*1
	2-C-LAP (for outdoor use)	2×CCV-HC-20/07	F3LR01, F3LR02, F3LP12*1
	2-C-V (for indoor use)	2×CCV-HG-20/08	F3LR02*2
	2-C-LAP (for outdoor use)	2×CCV-HG-20/08	F3LR02*2

Table B4.7 Cords and Cables with Connectors on Both Ends from Sumitomo Electric

Type	Model	Specifications	P:	L=length	Shape	Compatible Modules
Fiber-optic cord	2001H-MM-L 2071H-MM-L	DCV-HC-20/07		Up to 5m	φ2.2mm×2 core cord	F3LR01, F3LR02, F3LP12
2-C-V (cable for indoor use)	2001H-MM-0.2/L 2071H-MM-0.2/L	2×CCV-HC-20/07	-P*3	*1	φ8.4mm cable PVC sheath	F3LR01, F3LR02, F3LP12
		2×CCV-HG-20/08	-P*3	*2		F3LR02
2-C-LAP (cable for outdoor use)	2001H-MM-0.2/L 2071H-MM-0.2/L	2×CCV-HC-20/07	-P*3	*1	φ10mm cables PE sheath with metal tape	F3LR01, F3LR02, F3LP12
		2×CCV-HG-20/08	-P*3	*2		F3LR02

*1: Module, distance F3LR01, F3LR02 0 to 200 m
F3LP12 0 to 1000 m
*2: Module, distance F3LR02 200 to 500 m
*3: Pulling eye Recommended for cables longer than 50 m.

CAUTION

For product enquiries or order placement, contact an authorized sales agent of Sumitomo Electric Industries, quoting the manufacturer (Sumitomo Electric Industries), type, model and specifications information.

CAUTION

Do not use products other than those specified above. Doing so may result in hardware failure, incorrect operation or inability to achieve designed performance.

■ Products to be Used When Laying Cables

When laying fiber-optic cables, use the following products from Sumitomo Electric Industries.

Table B4.8 Products to be Used When Laying Cables

Name		Model	
Optical connector	Contact/polishing type	CF-2001H	CF-2071H
	Solderless/cut type	CF-2011	CF-2071
Optical connector connection tool	Solderless/cut type	CAK-1020	CAK-0057
Optical power tester (for testing work on optical connector)		CAT-2700	
Master fiber set (for testing work on optical connector)		CAT-2001H CAT-2001H (HG)	
Manuals for Sumi-Link DF series	Cabling Instructions for Fiber-optic Cords/Fiber-optic Cables	Technical Materials No. 1769B	
	Fiber-optic Connector Assembling Tool CAK-1020 (for CF-2011) (Fiber-optic Technical Materials No. 1100) Fiber-optic Connector Assembling Tool CAK-0052 (for CF-2071H) (Fiber-optic Technical Materials No. 1083)		

CAUTION

Do not use products other than those specified above. Doing so may result in hardware failure, incorrect operation or inability to achieve designed performance.

B4.4.2 Attaching and Detaching Connectors

■ Attaching Connectors

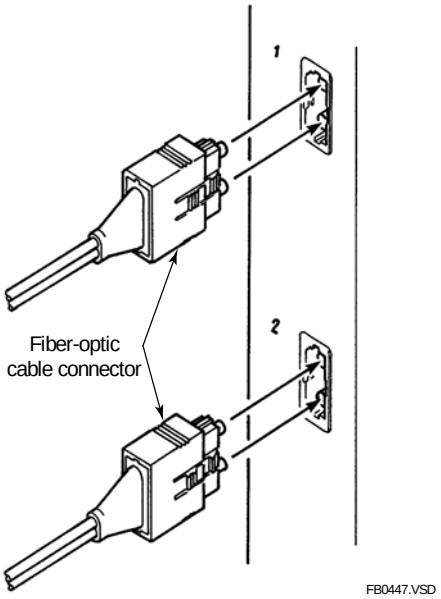


Figure B4.5 Attaching Connectors

When attaching a fiber-optic cable connector, always hold the connector (never the cable), and then insert it until it clicks into place.

Then, hold the connector and pull it lightly to make sure that it is correctly seated.

■ Detaching Connectors

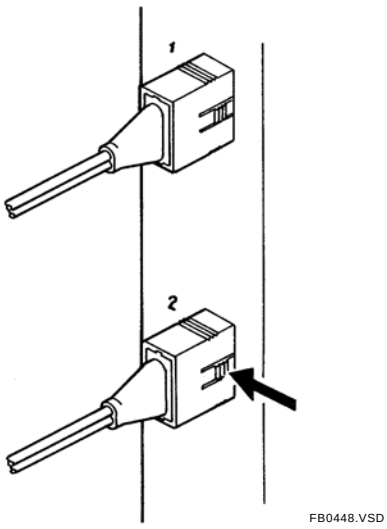


Figure B4.6 Detaching Connectors

Hold the center portion of the connector (indicated by the arrow in the figure) to unlock the connector, and then pull it toward you.

B4.4.3 Precautions When Connecting Fiber-optic Cables

Handle fiber-optic cables with care.

Before laying fiber-optic cables, read manuals available from Sumitomo Electric Industries. Engage a professional contractor specializing in laying fiber-optic cables. Read “Documents on How to Lay Fiber-optic Cables” under “Introduction” of this manual and the “Fiber-optic Cable Laying Instructions” (IM34M06C92-01E).

WARNING

Always connect and disconnect fiber-optic cables when the system is offline. Connecting or disconnecting fiber-optic cables when the system is online may affect normal system operation.

CAUTION

- Never touch the core of optical connectors with your bare hands and protect them from dirt and dust.

  Dust, dirt and oil from hands may result in degraded transmission performance or even communications error.

  Attach the cover during storage.

- When laying fiber-optic cords or fiber-optic cables, keep the elongation within 0.7% of permissible elongation percentage. When the cable is secured, the elongation should be within 0.2% of permissible elongation percentage.

  Beyond these elongation limits, fiber-optic cables may break.

  For this purpose, refer to Table 4.9 and take care not to subject fiber-optic cables to excessive tensile impact, bending or twisting. Always pull a fiber-optic cable by its tension member.

Table B4.9 General Mechanical Characteristics for Fiber-optic Cords and Cables

Type	Tensile Strength (N)	Bending Radius (mm)	Lateral Pressure	Twisting
Fiber-optic Cord	During laying < 98 When secured = 0	During laying = 15 min. When secured = 50 min.	—	< 180°/2 m
Fiber-optic Cable	During laying < 735 When secured = 0	During laying = 50 min. When secured = 100 min.	980 N/50 mm (Should be temporary)	< 90°/2 m

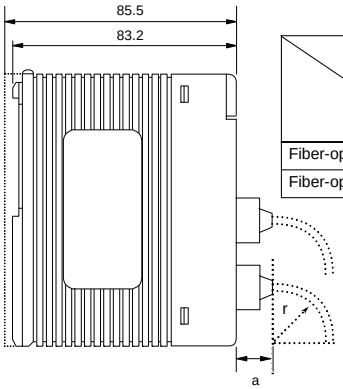
You should strictly observe the restrictions on permissible tensile load specified in the catalog or technical specification of fiber-optic cables when laying cables.

When securing cables, do not subject connectors and cables to tensile force.

For on-site treatment, we recommend using crimp-on cutting type connectors.

- Bending radius limits for fiber-optic cables

  When connecting fiber-optic cables, you must secure tension members and strictly observe allowable bending radius limits.



	Bending Radius, r (mm)			
	KF-07 (a=18.3)		CF-2071, CF-2071H (a=35.0)	
	During Installation (temporary)	When Secured	During Installation (temporary)	When Secured
Fiber-optic cord	15 or larger	50 or larger	15 or larger	50 or larger
Fiber-optic cable	—	—	50 or larger	100 or larger

B4.4.4 Connecting Fiber-optic Cables

When connecting modules using fiber-optic cables, there are no restrictions on the sequence of unit numbers and slot numbers. The connection sequence is independent of station addresses. How the modules are connected, however, depends on the transmission channel configuration.

SEE ALSO

For details on unit representation for the system configuration examples given in this section, see the text on “Unit Representation” in Section B3.5, “Connection Topology”.

● Example of Daisy-chain Configuration

In this configuration, port 2 of the terminal station is not used.

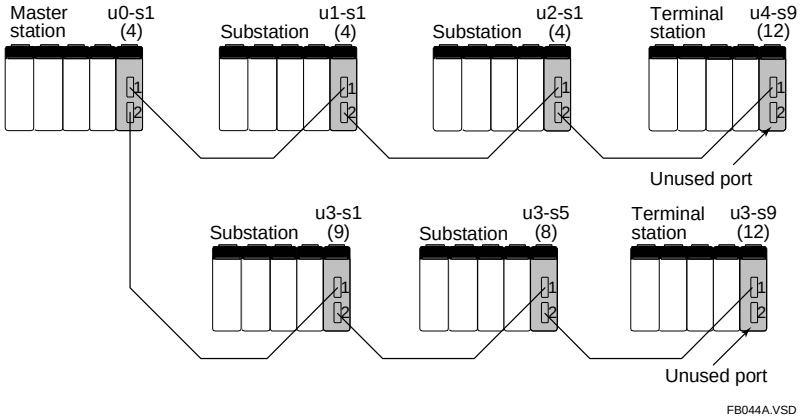


Figure B4.7 Daisy-chain (Star) Configuration

● Example of Loop Configuration

In a loop configuration, form a loop with one master station.

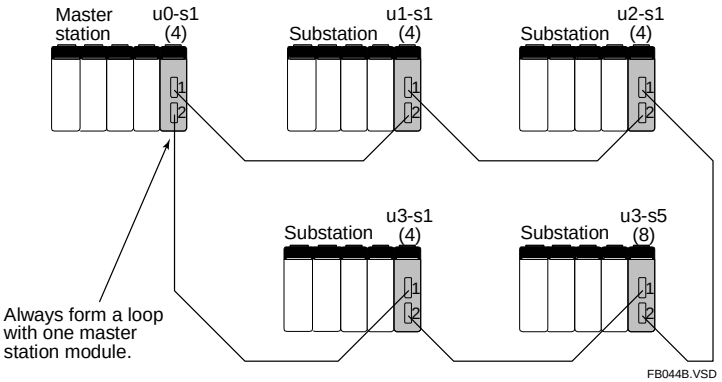


Figure B4.8 Loop Configuration

CAUTION

(1) When configuring a daisy-chain (including star configuration)

- When connecting a master station and a substation

  Connect port 1 or port 2 of the master station module to port 1 of the substation module.

- When connecting two substations

  Connect port 2 of one substation module to port 1 of the other substation module.

(2) When configuring a loop

Connect port 2 of a station module to port 1 of the next station module in the loop.

B4.5 Pre-operation Checks

B4.5.1 Checking Transmission Loss

Measure the transmission loss of fiber-optic cables after laying. Exercise care during laying as excessive tension, bending and pressure during cable laying may cause cables to break or crack. The following table shows the transmission loss of fiber-optic cables and permissible transmission loss for the Fiber-optic FA-bus Type 2 module.

Table B4.10 Transmission Loss Table for Fiber-optic Cables (up to 200 m)

Length of Fiber-optic Cable (HC-20/07)	Maximum Transmission Loss (dB)		Length of Fiber-optic Cable (HC-20/07)	Maximum Transmission Loss (dB)	
	(with bonding and polishing treatment on optical connector)	(with crimping and cutting treatment on optical connector)		(with bonding and polishing treatment on optical connector)	(with crimping and cutting treatment on optical connector)
10	1.10	2.60	110	1.19	2.69
20	1.10	2.60	120	1.28	2.78
30	1.10	2.60	130	1.37	2.87
40	1.10	2.60	140	1.45	2.95
50	1.10	2.60	150	1.54	3.04
60	1.10	2.60	160	1.62	3.12
70	1.10	2.60	170	1.71	3.21
80	1.10	2.60	180	1.79	3.29
90	1.10	2.60	190	1.87	3.37
100	1.10	2.60	200	1.95	3.45

Table B4.11 Transmission Loss Table for Fiber-optic Cables (200 m to 500 m)

Length of Fiber-optic Cable (HG-20/08)	Maximum Transmission Loss (dB)	Length of Fiber-optic Cable (HG-20/08)	Maximum Transmission Loss (dB)
	(with bonding and polishing treatment on optical connector)		(with bonding and polishing treatment on optical connector)
200	2.43	360	3.83
220	2.62	380	3.99
240	2.81	400	4.15
260	2.99	420	4.30
280	3.16	440	4.46
300	3.34	460	4.61
320	3.51	480	4.75
340	3.67	500	4.90

Table B4.12 Permissible Transmission Loss for Fiber-optic FA-bus Type 2

Cable Length (m)	0.6 to 200	200 to 300	300 to 400	400 to 500
Permissible Transmission Loss (dB)	4.0	5.5	6.5	7.5

WARNING

Using a cable with transmission loss exceeding permissible transmission loss for Fiber-optic FA-bus Type 2 may affect normal system operation.

CAUTION

- Engage a professional contractor to lay fiber-optic cables.
- Measure the transmission loss of fiber-optic cables after laying. Check that the measured value for the actual cable length is better than the transmission loss for the fiber-optic cable before laying.
- If the transmission loss exceeds the permissible transmission loss for the Fiber-optic FA-bus Type 2, normal communications will be affected. Replace the fiber-optic cable.
- Measure the transmission loss of fiber-optic cables regularly.

B4.5.2 LED Checks

After installing modules and connecting fiber-optic cables, check that the modules are properly connected for communications. There should be no cable discontinuity or improper connection.

Apply power to the units and perform the following checks:

(1) The RDY (green) LED indicator must be lit
If this indicator is not lit, it may be because the Fiber-optic FA-bus Type 2 module is not properly mounted to the base module. Turn off the power and attach the module to the base module correctly.

(2) The ERR1 and ERR2 LED indicators must be off
When the ERR indicators are on (red), communications is not allowed.

If the power of the adjacent unit is off, turn on its power and check whether the ERR indicator turns off. If the ERR indicator is still on, it may be due to a transmission channel error, such as cable discontinuity.

See Section B7.3, “When ERR1 LED or ERR2 LED is Lit” and troubleshoot accordingly. If an unused port is lit, check the setting of the function switch located on the side of the module.

(3) The transmission channel configuration (star, daisy-chain or loop configuration) must match the setting of the switch located on the side of the module.

(4) The cable must be connected according to the selected transmission channel configuration.

(5) An unused port must be an empty port 2. In this case, switch SW2 located on the side of the module must be set to off, and the unused port must be covered with a connector cover.

(6) No unit number, slot number must be duplicated.

(7) Fiber-optic cable length must match the optical port setting. G1-type H-PCF (KM67) cables must be used for optic fiber lengths exceeding 200 m.

B4.6 Precautions When Applying Power

When turning on the power supply to the main unit and subunits, follow the sequence below.

First confirm that the main unit and all subunits are turned off. Then turn on the power supply to the main unit and the subunits simultaneously*, or turn on all subunits before turning on the main unit.

A program starts execution when the main unit is turned on, regardless of whether subunits are switched on. In situations where the powering sequence described above is not adhered to, you should write your application so that it checks the status of subunits using the Module Recognition special registers. In this case, do not switch off and switch on the main unit, or restart the CPU module, while a subunit is switched on.

*: By “simultaneously”, we mean, for instance, a system whereby a single switch turns on the power to the entire system.

CAUTION

If you have switched off the main unit, ensure that all subunits are switched off before switching on the main unit. If you switch off and on the main unit while a subunit is switched on, some modules in the subunit may not be recognized correctly by the CPU module in the main unit.

● Module Recognition special registers

When a module installed in a main unit or subunit is recognized as accessible, the bit corresponding to its slot position in the Module Recognition special registers is set to 1. If a module cannot be read or written due to I/O module failure, subunit power failure or some other reason, its corresponding bit in the Module Recognition special registers is cleared to 0.

Table B4.13 Module Recognition Special Registers

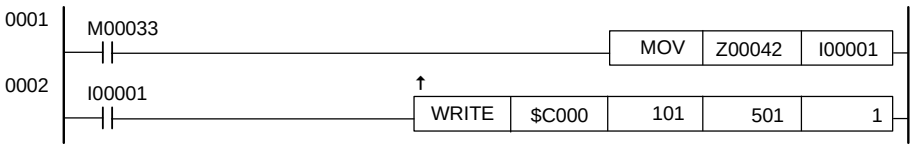
Cateogry	Module Recognition Special Registers	
Number	**Name**	**Description**
Z41	Main unit	Slot number 16 ··· 9 8 7 6 5 4 3 2 1 0 ··· 1 0 1 1 0 1 1 1 1 0: No module is mounted or mounted module does not allow read and write. 1: Module is recognized as accessible.
Z42	Subunit 1	
Z43	Subunit 2	
Z44	Subunit 3	
Z45	Subunit 4	
Z46	Subunit 5	
Z47	Subunit 6	
Z48	Subunit 7	

FB0462.VSD

In situations where some subunits are turned on after the main unit, by checking the Module Recognition special registers, a program can perform initialization setup of an advanced function module installed in a subunit without waiting for the entire system to be powered up.

Sample Program:

This sample program copies the Module Recognition special register for subunit 1 to an internal relay, and performs initialization of the module installed in slot 1 after it is recognized as accessible.



FB0463.VSD

Figure B4.9 Sample Program Illustrating the Use of the Module Recognition Special Registers

B5. I/O Refresh Time

B5.1 Estimating I/O Refresh Time

Calculate the I/O refresh time separately for each port of the main unit.
For details, refer to the following example.

I/O refresh time = Sum of I/O refresh times for each type of access

There are 2 types of access, namely, 'read input' and 'write output'.
Calculate the I/O refresh time for each access type using the following formula and sum the values.

I/O refresh time for each access type = [Time dependant on access type + Time dependant on transmission distance] x Number of modules, converted to 16-point basis

Access type

	F3SP05/08/21	F3SP25/35	F3SP22/28/38/ 53/58/59/66/67	F3SP71/76
Read input	11 µs	10 µs	9 µs	5.5 µs
Write output	27 µs	21 µs	15 µs	4.5 µs

Number of modules:
Number of modules corresponding to access type, converted to 16-point module basis.

Formula:

$$1.0\ \mu s \times \frac{\ell\ (m)}{100\ (m)}$$

ℓ : Transmission distance

FB0511.VSD

B5.2 Example of I/O Refresh Time Calculation

This example calculates the I/O refresh time for the following system configuration.

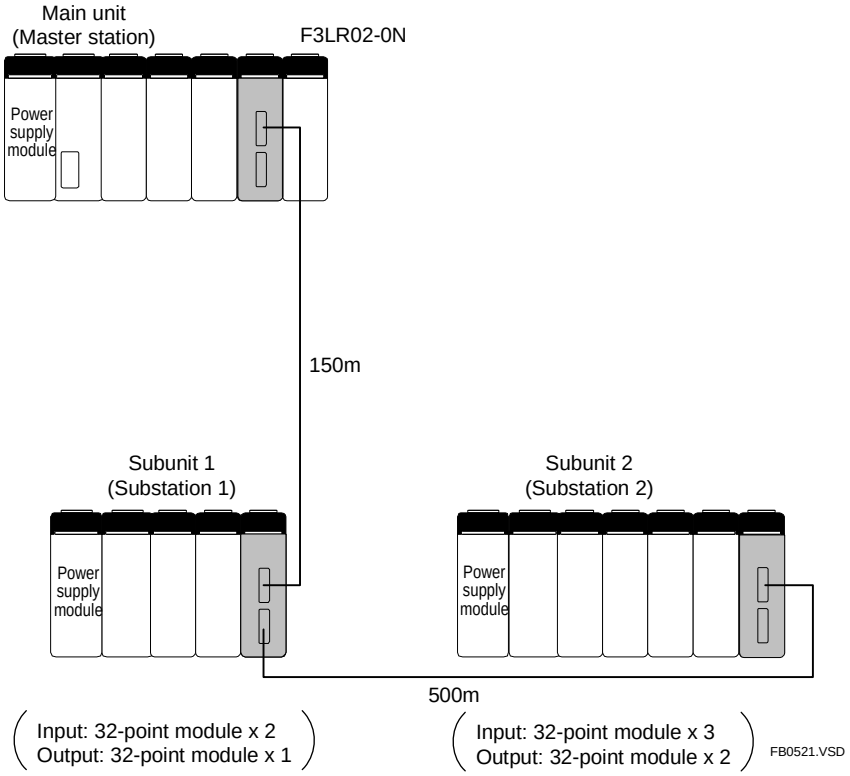


Figure B5.1 An Example of I/O Refresh Time Calculation (for F3SP22/28/38/53/58/59/66/67)

Step 1 Calculate the 'time dependant on transmission distance'

$$- \quad 1.0\mu s \times \frac{(150 + 500)\ (m)}{100\ (m)} = 6.5\mu s$$

Step 2 Calculate the 'number of modules, converted to 16-point basis'

- Read Input = 32 points × 5 → 2×5 = 10
- Write Output = 32 points × 3 → 2×3 = 6

Step 3 Calculate the total time

Read input access = (9µs + 6.5µs) x 10 = 155µs
Write output access = (15µs + 6.5µs) x 6 = 129µs (+

I/O Refresh Time = 284µs

B6. RAS Functions of Fiber-optic FA-bus Type 2

B6.1 System Operation with Transmission Channel Error

B6.1.1 Run or Stop System

You can set the module to either stop the system or continue operation when a transmission channel error occurs in a Fiber-optic FA-bus Type 2 system.

B6.1.2 Causes of Transmission Channel Errors

A transmission channel error of a Fiber-optic FA-bus Type 2 system may be due to the following two reasons:

(1) Fiber-optic cable fault

(2) Power interruption of substation (after recognition by the system earlier)

B6.1.3 Defining System Operation (Run or Stop) in the Event of a Transmission Channel Error

System operation in the event of a transmission channel error is determined by the Run/Stop settings for I/O Module Error and Subunit Communication Error in Operation Control of the CPU module's configuration.

System Behavior	Operation Control in the CPU Module's Configuration	
	I/O Module Error	Subunit Communication Error
System operation continues	Run	Run (default)
System stops	Stop (default)	Stop
See Also	B6.3.3	B6.3.3

B6.1.4 Loop Switching

In a loop configuration, when an error is detected in a transmission channel, the system can automatically change the transmission channel configuration so as to allow normal system operation to continue. This function is known as loop switching. To enable this function, setup the module to continue operation in the event of a communication error and turn off the Shutdown Output function.

A loop configuration secures two transmission loops: a primary loop and a secondary (standby) loop. The primary loop is normally used for communications. However, the system switches transmission loops as shown below to secure a transmission channel if any of the following 2 events occur. (1) Cable discontinuity in the primary loop (or secondary loop) (i.e. one of the two loops is normal); or (2) Cable discontinuity in both the primary and secondary loops (including power interruption to a subunit).

(1) Cable discontinuity in the primary loop (or secondary loop)

In the event of cable discontinuity in either the primary loop or the secondary loop, the system automatically switches to the loop with no cable discontinuity to secure a transmission channel with no loss of data.[*1]

(2) Cable discontinuity in both primary and secondary loops

In the event of cable discontinuity in both the primary and secondary loops, the system automatically switches from a loop configuration to two daisy-chains to secure a transmission channel.[*2]

*1: When using F3SP05/08/21/25/35 Rev.8 or later, or F3SP28, F3SP38, F3SP53, F3SP58 F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76.

*2: (1) Migration from a loop configuration to a daisy-chain configuration involves data loss. In situations where the system continues operation, check the Subunit Line Switchover special register and handle any loss of data accordingly.

(2) System operation after switching depends on the setting of switch SW1 located on the side of the module and the configuration setup.

To enable loop switching, perform the following setup.

	Operation Control in the CPU Module's Configuration		Condition Switches of F3LR02 Module	
	I/O Module Error	Subunit Communication Error	SW1	SW3
	Run	Run (default)	OFF	ON
See Also	B6.3.3	B6.3.3	B4.2.3	B4.2.5

TIP

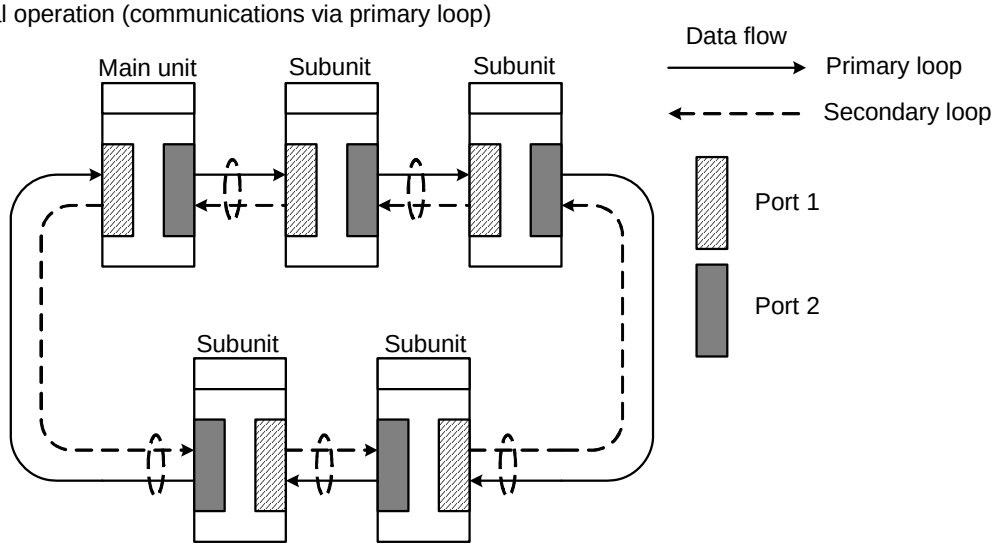
If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken fiber-optic cable or a powered-off substation in the transmission channel as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

CAUTION

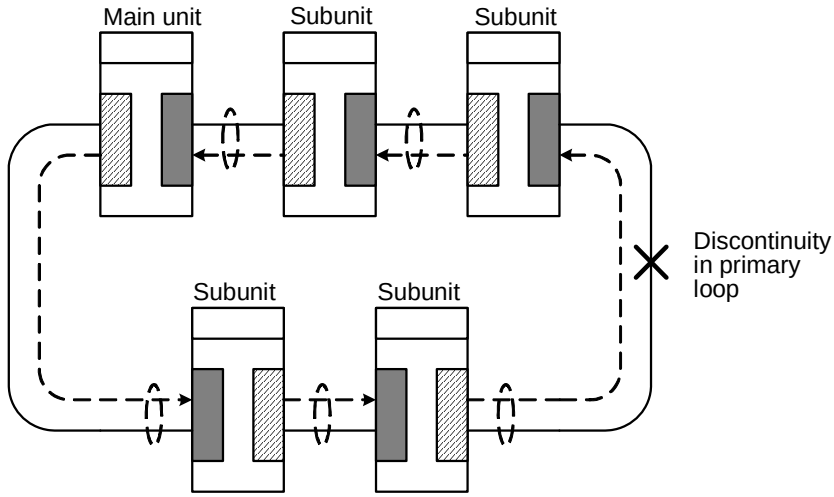
- For F3BP□□, when the system switches to the secondary loop in the event of a cable discontinuity in the primary loop, and when the system switches to 2 daisy-chains in the event of cable discontinuity in both the primary and secondary loops, accessing the substation may cause an error. In such situations, you should include program codes for retry processing.
- When the system switches from a loop configuration to two daisy chains due to cable discontinuity or substation power interruption, take note of the following phenomena.
  - Replacing a cable or switching on the substation again in online mode may cause an I/O error. Hence, always do so in offline mode (i.e., when the master station and all substations are switched off).
  - If cable discontinuity happens again, the transmission loop switching function may not work. Furthermore, output states (reset or hold) are not assured.

The figure below shows an example of channel migration when an error occurs.

Normal operation (communications via primary loop)

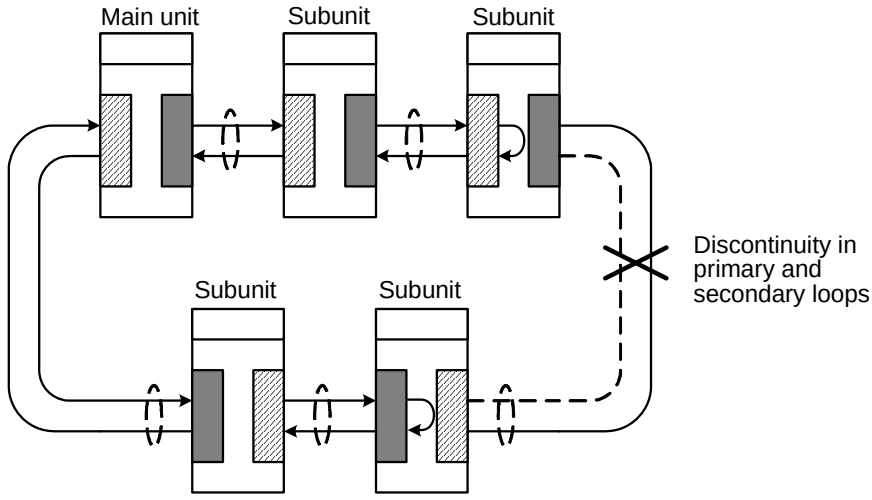


Error (Discontinuity in primary loop)



(1) Discontinuity in primary loop; migrating to secondary loop

Error (Discontinuity in both primary and secondary loops)



(2) Discontinuity in primary and secondary loops; migrating to daisy-chain

FB0611.VSD

Figure B6.1 Loop Switching

B6.1.5 Transmission Channel Loop-back Function

When a transmission channel error occurs in a daisy-chain configuration, the channel loop-back function automatically isolates the inaccessible substation and continues system operation. To enable this function, setup the system to continue operation in the event of a transmission channel error. Alternatively, you can setup to stop system operation in the event of a transmission channel error.

When a transmission channel error occurs in a daisy-chain configuration, the loop-back function automatically cuts off the unreachable stations so that the station immediately preceding the point of discontinuity now becomes the terminal station and communications can continue. For this function to work properly, the cables must be correctly connected.

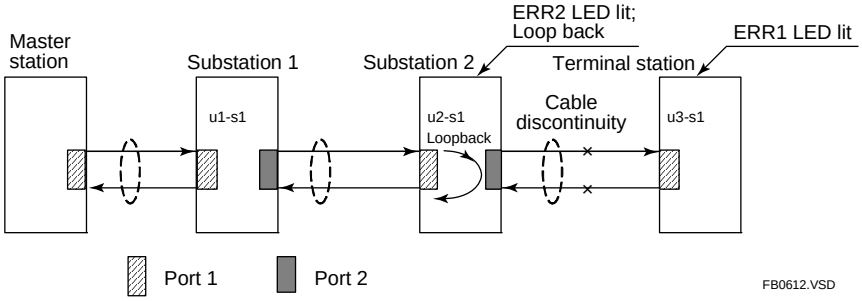


Figure B6.2 Transmission Channel Loop-back Function

To enable the transmission channel loop-back function, perform the following setup.

	Operation Control in the CPU Module's Configuration		Condition Switches of the F3LR02	
	I/O Module Error	**Subunit Communication Error**	**SW1**	**SW3**
	Run	Run (default)	OFF	OFF (default)
See Also	B6.3.3	B6.3.3	B4.2.3	B4.2.5

B6.2 Shutdown Output on Transmission Channel Error Function

B6.2.1 Overview of Shutdown Output Function

The Fiber-optic FA-bus Type 2 module is equipped with a function, which shuts down the output of the I/O module of a substation when a transmission channel error occurs.

This function prevents an error in the Fiber-optic FA-bus type 2 from affecting the entire system or resulting in hazardous or unstable system operation.

For instance, when a cable discontinuity occurs, the module detects a transmission channel error and immediately turns off the output signals of each I/O module to minimize risks.

A transmission channel error that occurs in one location can be propagated to other units to shut down the I/O modules of substations connected to the channel.

The shutdown output on transmission channel error function is available only for configurations with one CPU module (not a multi-CPU system).

CAUTION

- This function is not available in a multi-CPU configuration.
- When using F3SP05, F3SP08, F3SP21, F3SP25 and F3SP35 CPU modules (Rev. 8 or later), this function is only available for output modules with 32 outputs or less.
- When using CPU modules F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76, this function is available for output modules with 32 outputs or less, as well as F3YD64-1F, F3WD64-3F, F3WD64-4F, and F3YD64-1P.
- Do not enable the Shutdown Output function in a loop configuration.

B6.2.2 Shutdown Output Function Setup

	SW1 Condition Switch of F3LR02	**[Output When Stopped] setting in DIO Setup of CPU Module's Configuration**
To shutdown output	ON (Shutdown) (default)	Reset (default)
To hold output[*1]	OFF (Hold)	Hold
See Also	B4.2.3	B6.3.2

*1: Continues operation if a transmission channel is secured and system operation is to be continued.

Table B6.1 shows the operation of the output module and FAIL signal contact for different setup configurations and transmission channel error locations. In the table, substation A and substation B are defined as follows.

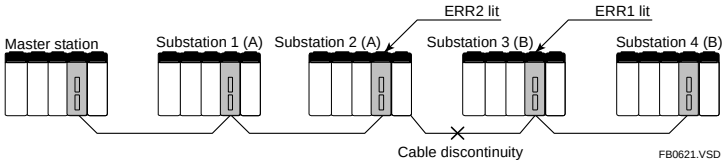
Substation A: A substation that is nearer to the master station than the location of a channel error so that a transmission channel is still established between the substation and master station

Substation B: A substation that is further from the master station than the location of a channel error so that a transmission channel is no longer established between the substation and master station

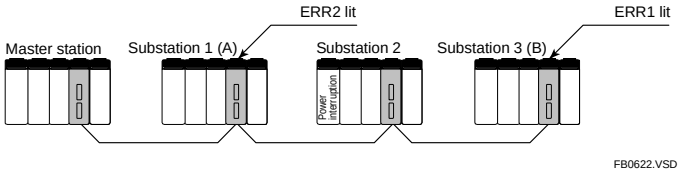
Table B6.1 Operation of the Output Module and FAIL Signal Contact for Different Setup Configurations and Channel Error Locations

Station	Condition Switches of F3LR02	Configuration Setup		Operation of Output Module	Operation of FAIL Signal Contact	
	Shutdown Output on Communication Error Switch	[Output When Stopped] of DIO Setup	Run/Stop Setting for Subunit Communication Error in Operation Control		FAIL1	FAIL2
Master station	OFF (Hold)	Reset	Stop	Shutdown	Shorted	Open
			Run	Continue operation	Open	Shorted
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Open	Shorted
Substation A	ON (Shutdown)	Reset	Stop	Shutdown	Shorted	Open
			Run	Shutdown	Shorted	Open
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Shorted	Open
	OFF (Hold)	Reset	Stop	Shutdown	Shorted	Open
			Run	Continue operation	Open	Shorted
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Open	Shorted
Substation B	ON (Shutdown)	Reset	Stop	Shutdown	Shorted	Open
			Run	Shutdown	Shorted	Open
		Hold	Stop	Hold	Shorted	Open
			Run	Hold	Shorted	Open
	OFF (Hold)	Reset	Stop	Hold	Open	Shorted
			Run	Hold	Open	Shorted
		Hold	Stop	Hold	Open	Shorted
			Run	Hold	Open	Shorted

Example 1:



Example 2:



Example 3:

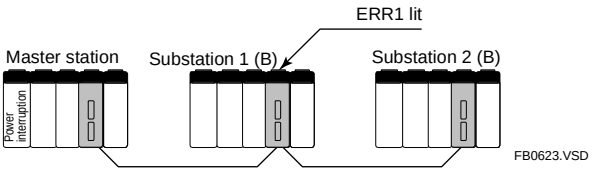


Figure B6.3 Operation of Output Module for Various Transmission Channel Error Locations

B6.3 Procedure for Setting Condition Switches

To enable the Shutdown Output on Transmission Channel Error function, use the following procedure.

B6.3.1 Setting Condition Switches

● Setting the Condition Switches Located on the Right Side of the Module

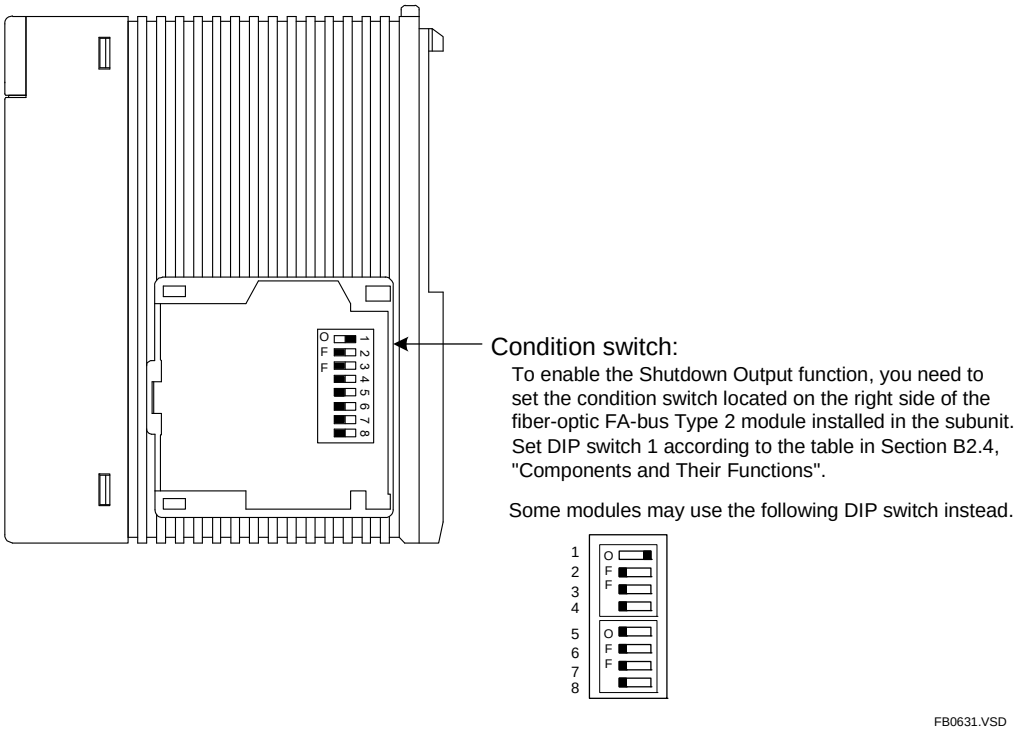


Figure B6.4 Condition Switches Located on the Right Side of the Module

B6.3.2 DIO Setup in CPU Configuration

● How to Perform DIO Setup using WideField3

To perform DIO Setup using WideField3, use the following procedure.

1. Select [Project]–[Project Settings] from the WideField3 menu bar.
2. Select [Input/Output Setup] from the Configuration pane of the displayed Project Settings/Configuration window.
3. Click the cell for the slot installed with the module to be configured. Select the Output Setup tab under Detailed Information. Set the [Output when Stopped] field corresponding to the terminal number to [Reset (OFF)] or [Hold].

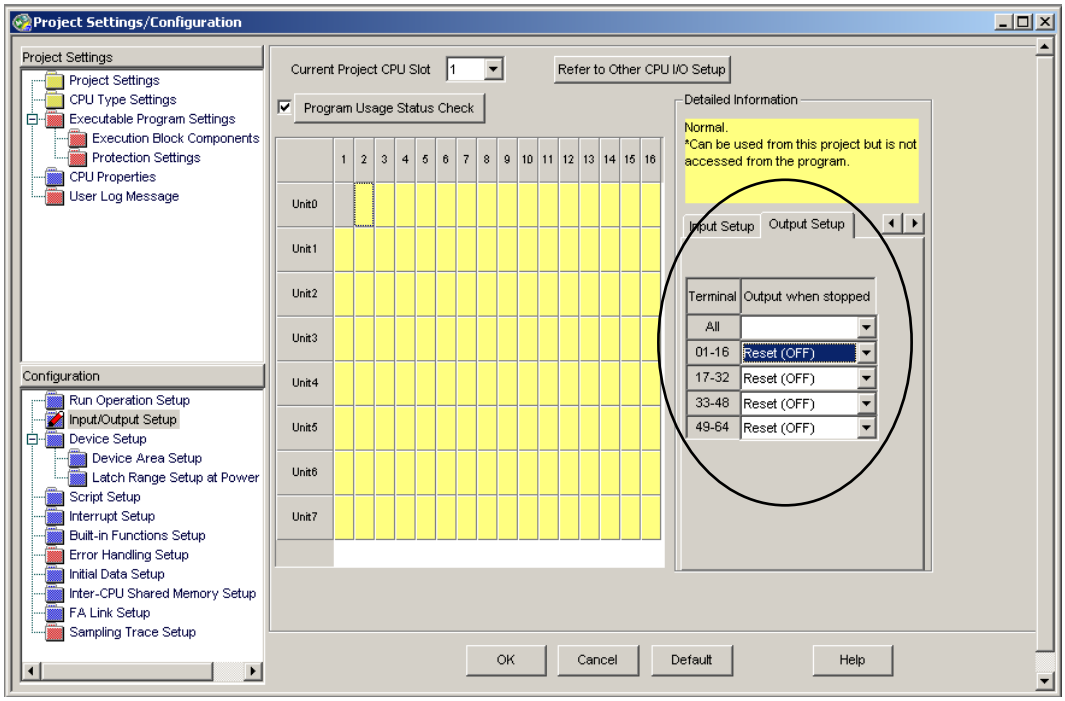


Figure B6.5 Setting I/O Conditions using WideField3

For details on WideField3 and its operation, see “FA-M3 Programming Tool WideField3 (Offline) User’s Manual” (IM34M06Q16-02E).

● How to Perform DIO Setup using BASIC (F3BP□□)

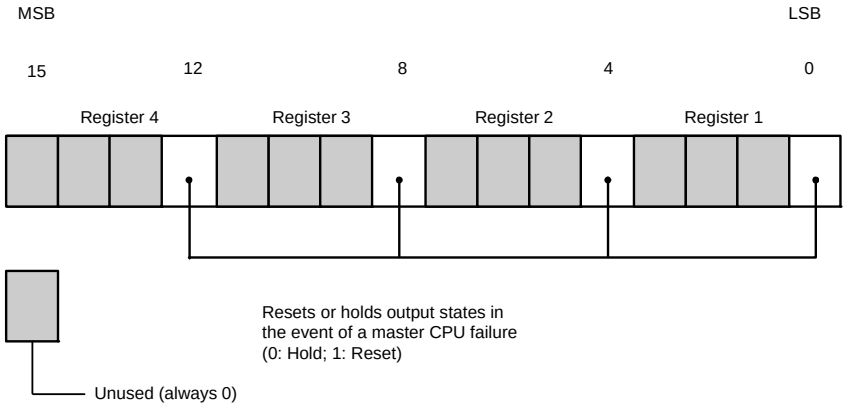
Use a CONTROL statement to select whether to reset or hold the output of an output module.

On 16-point and 32-point modules, the setup is made to the control registers in groups of 8 terminals.

The statement syntax is given below.

Syntax	CONTROL m, 1 ; I m : SIot number or numerical expression I : Data, integer or integer variable

Content of Control Register



Register 4 : terminals 25 to 32
Register 3 : terminals 17 to 24
Register 2 : terminals 9 to 16
Register 1 : terminals 1 to 8

- The control register is reset to all zeroes at startup.

Example	CONTROL 206, 1 ; $ 0010 : for the output module installed in slot 206, resets the states of terminals 9 to 16 and holds the states of the remaining terminals in the event of a master CPU failure.

FB0633.VSD

B6.3.3 Operation Control in CPU Configuration

● How to set up operation control using WideField3

To set up operation control using WideField3, use the following procedure.

1. Select [Project]–[Project Settings] from the WideField3 menu bar.
2. Select [Error Handling Setup] from the Configuration pane of the displayed Project Settings/Configuration window.
3. Select [Continue to run] or [Stop] for [I/O module Error] and [Subunit Communication Error] under Error-Time Action Setup.

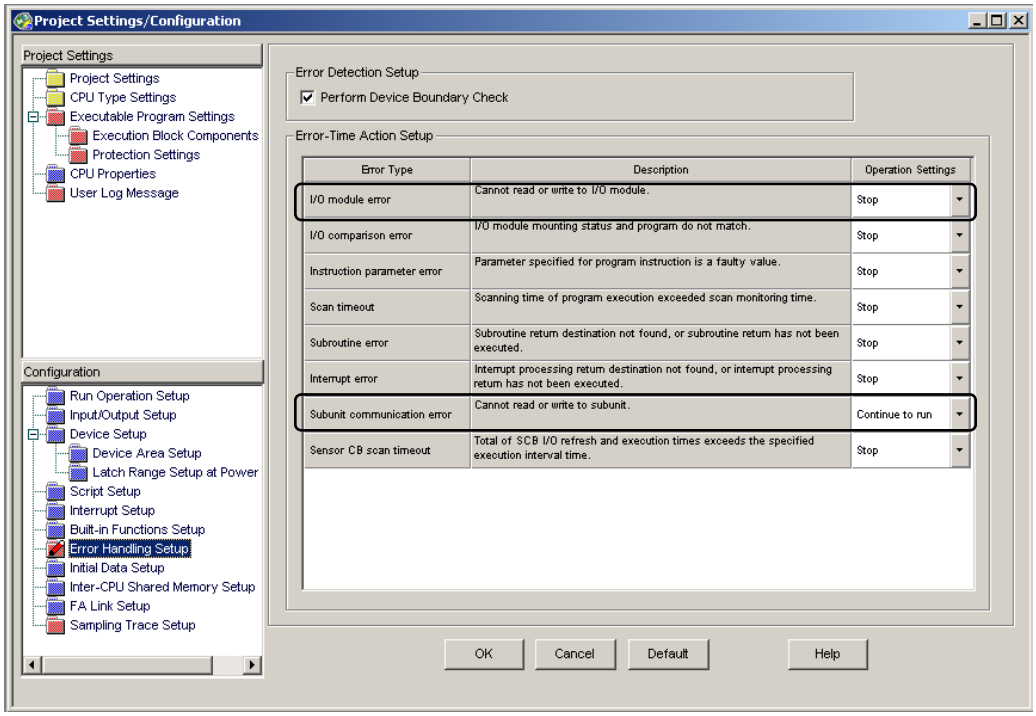


Figure B6.6 Setting Operation Control using WideField3

● How to set up Operation Control using BASIC (F3BP☐☐)

An I/O module error or subunit communications error generates an error in BASIC. Design your application program to handle such errors.

B6.4 Error Location Detection Function

B6.4.1 LED Display

When an error occurs with the Fiber-optic FA-bus type 2 module, or when a cable discontinuity occurs in a transmission channel, the error (ERR) LED or alarm (ALM) LED of the CPU module turns on to report the error.

Table B6.2 Status of CPU's LEDs

Status of CPU's LED	Condition Setting in Configuration		
	I/O Module Error	Conditional Operator	Subunit Communication Error
ALM lit	Run	AND	Run
ERR lit	Stop	OR	Stop

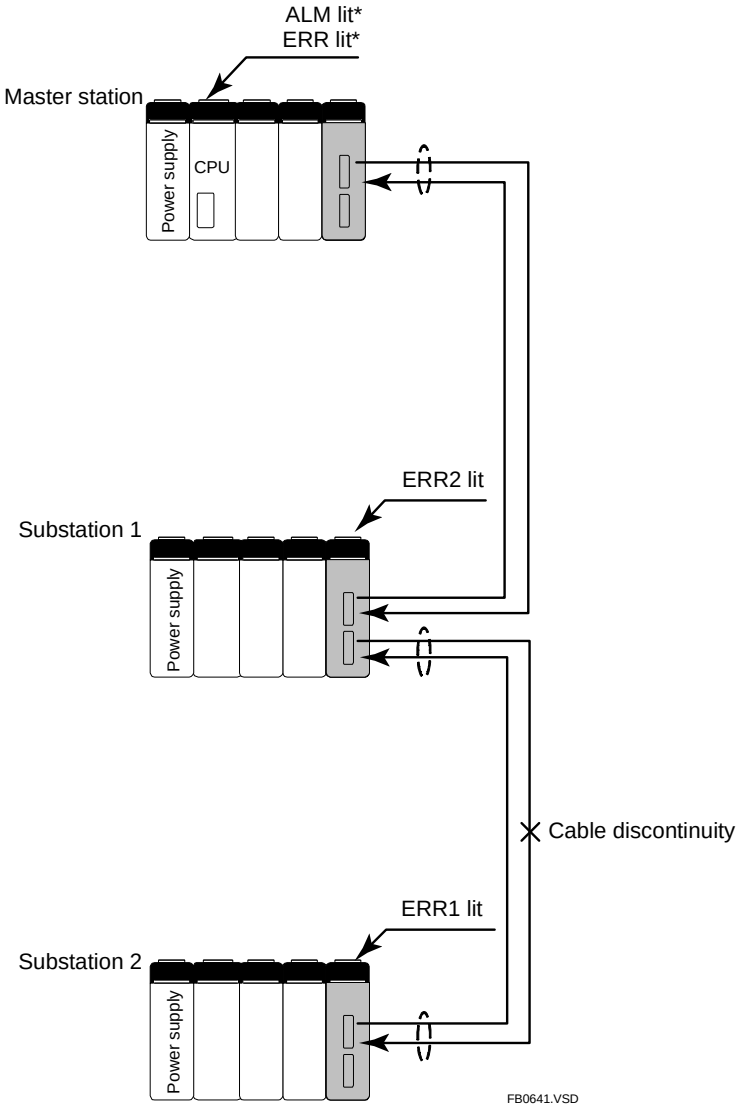
The LEDs of the CPU module turn on even if an error is generated in a module other than the Fiber-optic FA-bus type 2 module.

To decide whether the cause of a lit LED lies in a Fiber-optic FA-bus type 2 module, check the status of the RDY, ERR1 (port 1) and ERR2 (port 2) LEDs of the Fiber-optic FA-bus type 2 module mounted in each unit.

The following pages show the relationship between a fiber-optic cable discontinuity and the status of the LEDs of a Fiber-optic FA-bus type 2 module.

In the loop configuration, a "subunit line switchover" message is logged by the system if transmission is automatically switched from the primary loop to the secondary loop due to a fiber-optic cable discontinuity in the primary loop. In this case, the ALM LED is lit but the ERR LED is not lit and operation continues.

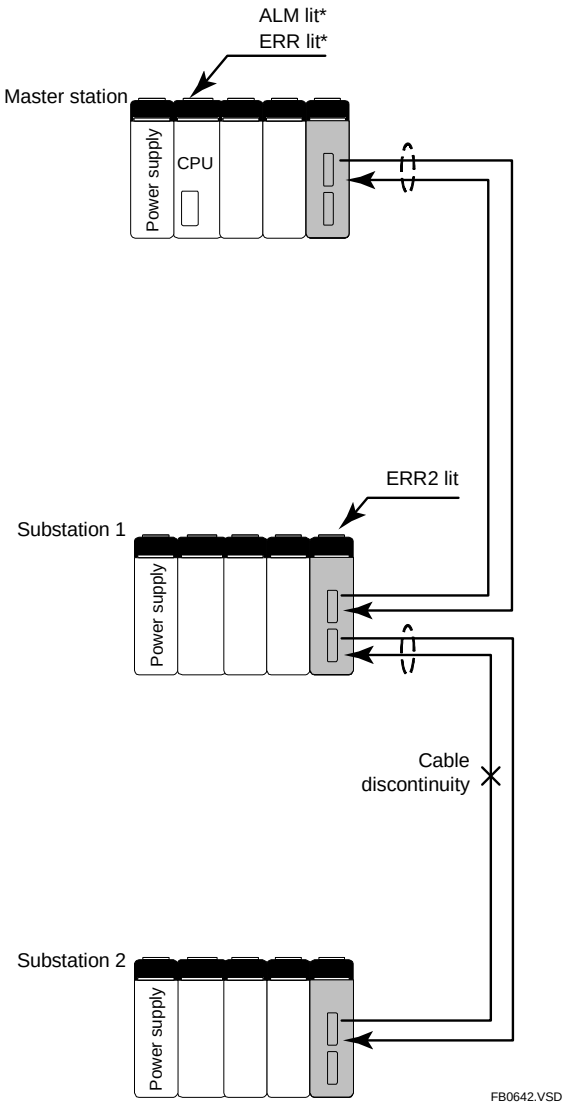
● Daisy-chain Configuration (Cable discontinuity example 1)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table B6.2, “Status of CPU’s LEDs”.

Figure B6.6 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (1)

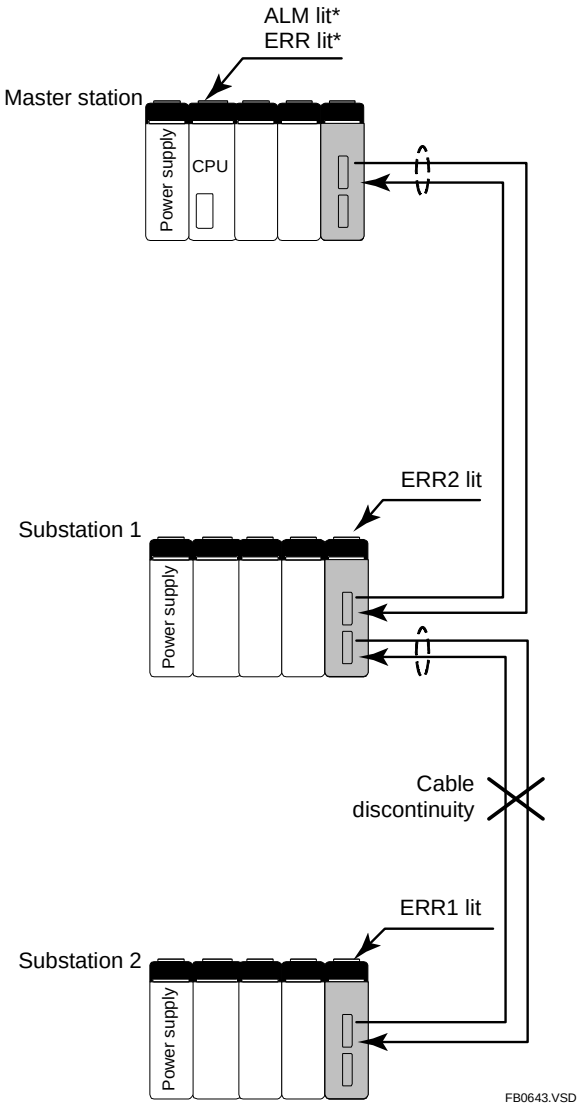
● Daisy-chain Configuration (Cable discontinuity example 2)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table B6.2, “Status of CPU’s LEDs”.

Figure B6.7 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (2)

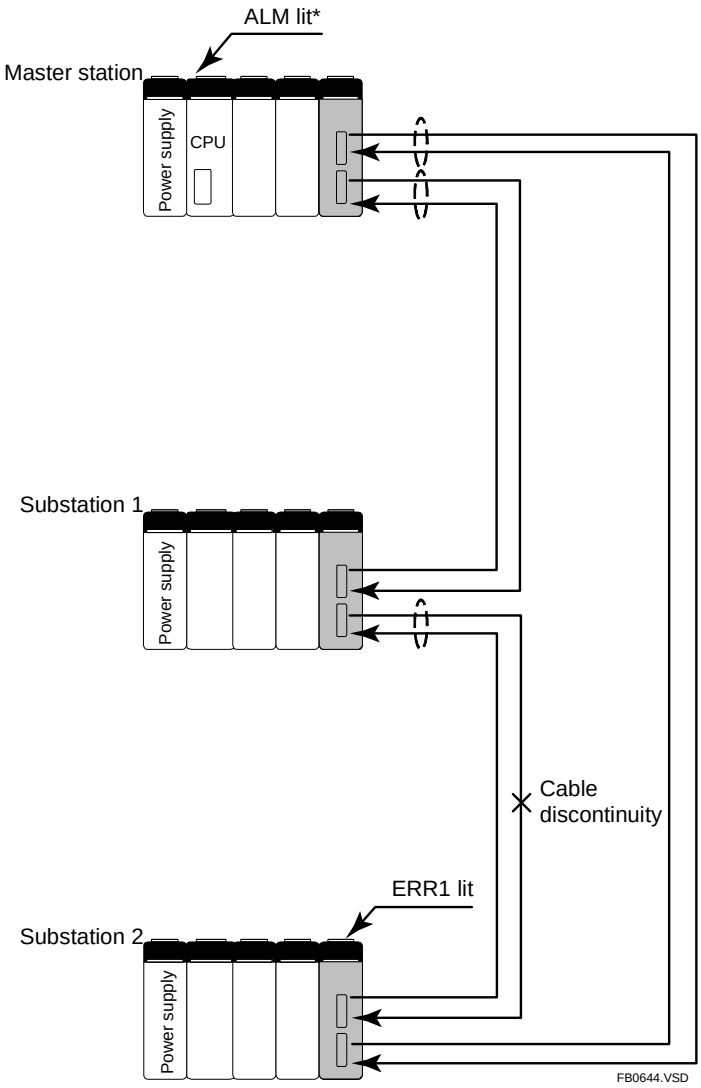
● Daisy-chain Configuration (Cable discontinuity example 3)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table B6.2, “Status of CPU’s LEDs”.

Figure B6.8 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (3)

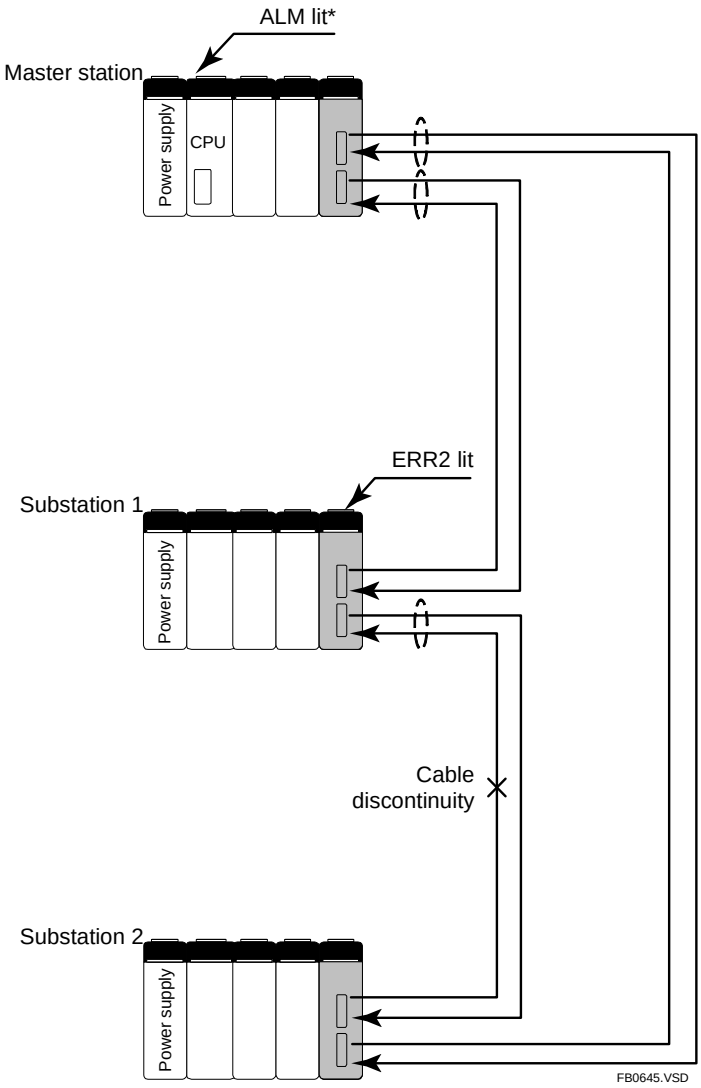
● Loop Configuration (Cable discontinuity example 1)



* A “subunit line switchover” alarm is output. The ALM LED is lit but the ERR LED is not lit and operation continues.

Figure B6.9 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (4)

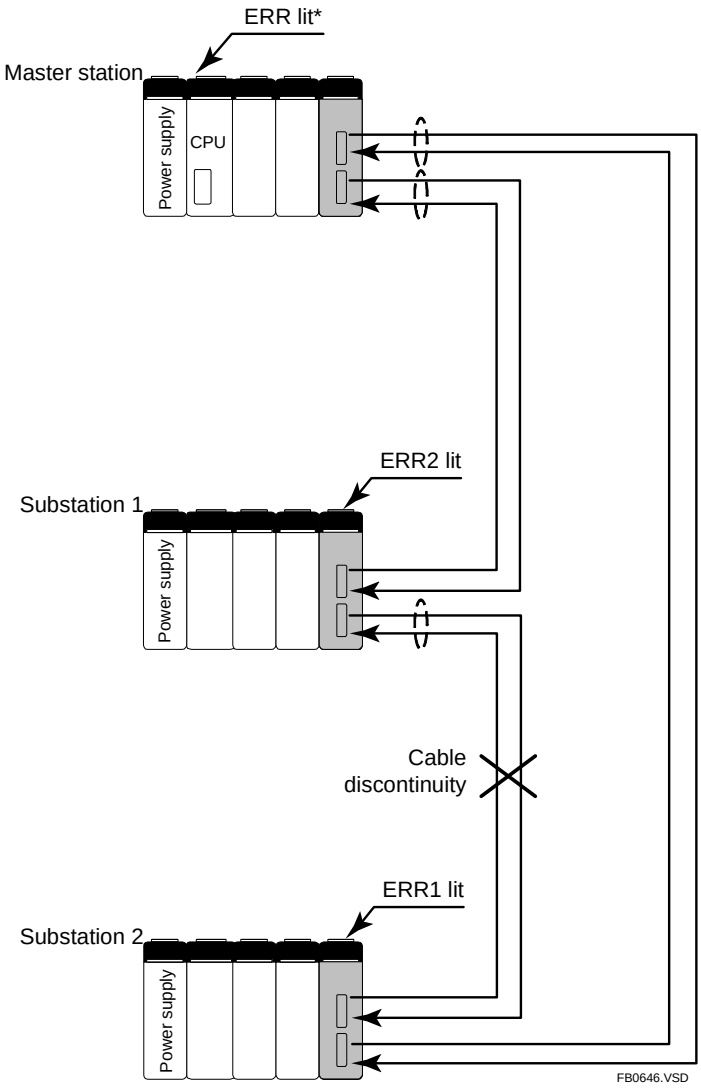
● Loop Configuration (Cable discontinuity example 2)



* A “subunit line switchover” alarm is output. The ALM LED is lit but the ERR LED is not lit and operation continues.

Figure B6.10 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (5)

● Loop Configuration (Cable discontinuity example 3)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table B6.2, “Status of CPU’s LEDs”.

Figure B6.11 Relationship between Fiber-optic Cable Discontinuity Location and Status of LEDs (6)

B6.4.2 Logging of Transmission Channel Error Location*1

When an error occurs in a transmission channel, an error is logged and a fiber-optic FA-bus transmission channel error location notification is generated. There are two types of notification, namely, subunit communication error and subunit line switchover.

(1) Subunit communication error

This is an error caused by a transmission channel error or power interruption to a substation (module installed in a subunit). Some or all substations become inaccessible for reading and writing.

(2) Subunit line switchover

This is a state whereby communications has switched from the primary loop to the secondary loop due to discontinuity in one wire pair of a two-pair (4-wire) fiber-optic cable. The substations remain accessible. The program continues execution with the ALM LED lit.

*1: Can be used with F3SP05/08/21/25/35 (Rev. 8 or later), F3SP28/38/53/58/59/66/67/71/76 and WideField3.

In this manual, when we say “a transmission channel error has occurred,” we mean either a “subunit communication error” or a “subunit line switchover”, as described above, has occurred.

● Special relays

The following special relays indicate the communication status of a subunit.

Category Number	Usage	
	Name	**Description**
M66	Subunit transmission line normal	ON : Normal OFF : Channel not established*1 Channel error
M210	Subunit communication error	ON : Error*2 OFF : Channel not established*1 Channel normal
M211	Subunit line switchover	ON : Error*2 OFF : Channel not established*1 Channel normal

*1: Indicates that the channel has never been normal since powering on.

*2: Indicates that the channel was once normal but an error was encountered later.

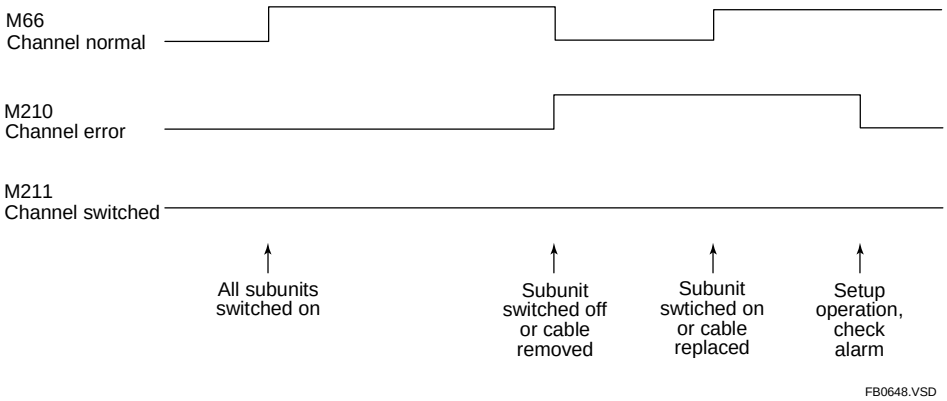
● Special Registers

When a transmission channel error or alarm is detected by a Fiber-optic FA-bus Type 2 module, these special registers indicate the slot where the module is installed.

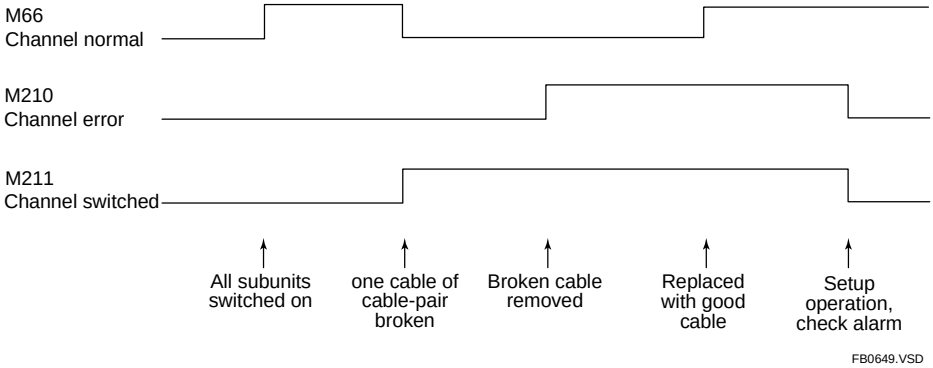
Category Number	Subunit Communication Error Special Register	
	Name	**Description**
Z89	Main unit	Slot number 16 … 9 8 7 6 5 4 3 2 1 0 … 0 0 0 1 0 0 0 0 0 Fiber-optic FA-bus Type 2 module 0: Transmission channel normal Transmission channel not yet established 1: Transmission channel error
Z90	Subunit 1	
Z91	Subunit 2	
Z92	Subunit 3	
Z93	Subunit 4	
Z94	Subunit 5	
Z95	Subunit 6	
Z96	Subunit 7	

FB0647.VSD

● On/Off timing of special relays when the power supply of a subunit is interrupted (cable is disconnected)



● On/Off timing of special relays in the event of cable discontinuity in one of two cables in a cable pair



CAUTION

The above timing diagrams show the statuses of the special relays over time. In practice, cables should be disconnected and connected only when the system is offline. By offline, we mean the master station and all substations are switched off.

Example 1: System Log Display

A system log contains an entry only for the first transmission channel error detected after the program starts execution or after alarms are checked.

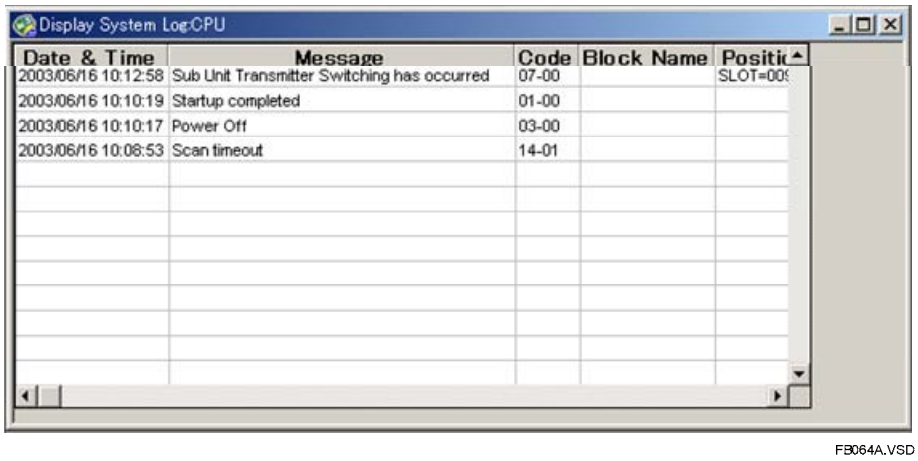


Figure B6.12 System Log Display

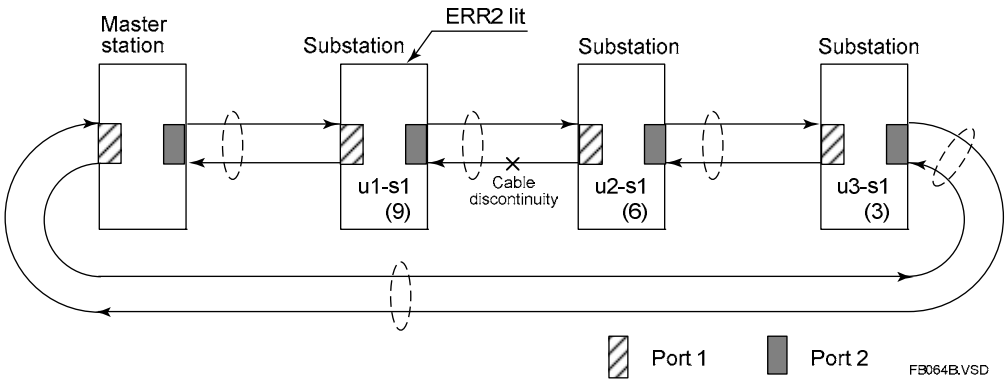


Figure B6.13 Example of Cable Discontinuity

CAUTION

A slot number displayed on the system log screen indicates the slot where a Fiber-optic FA-bus Type 2 module is installed.

It does not indicate the switch settings (unit number, slot number).

Example 2: Alarm Display

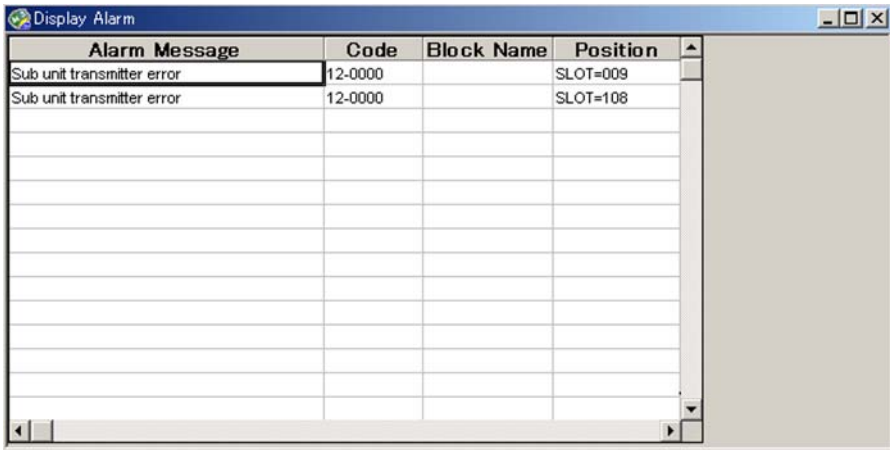


Figure B6.14 Alarm Display

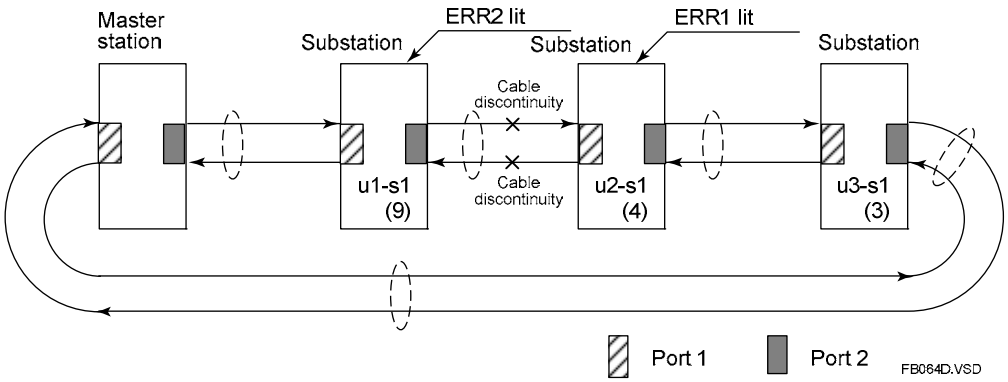


Figure B6.15 Example of Cable Discontinuity

CAUTION

A slot number displayed on the alarm display screen indicates the slot where a Fiber-optic FA-bus Type 2 module is installed.

It does not indicate the switch settings (unit number, slot number).

Example 3: System Log Display

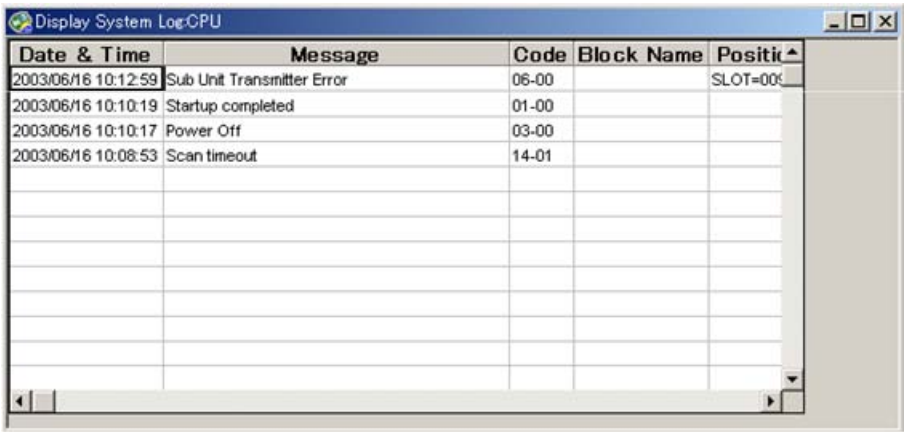
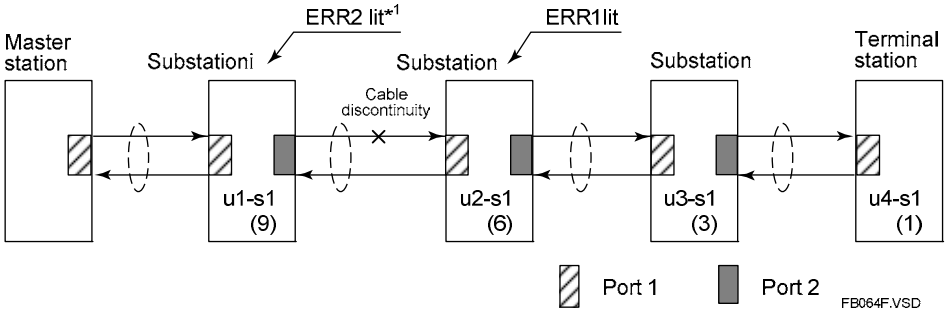


Figure B6.16 System Log Display



*1: ERR is lit when U2-S1 stops the output.

Figure B6.17 Example of Cable Discontinuity

CAUTION

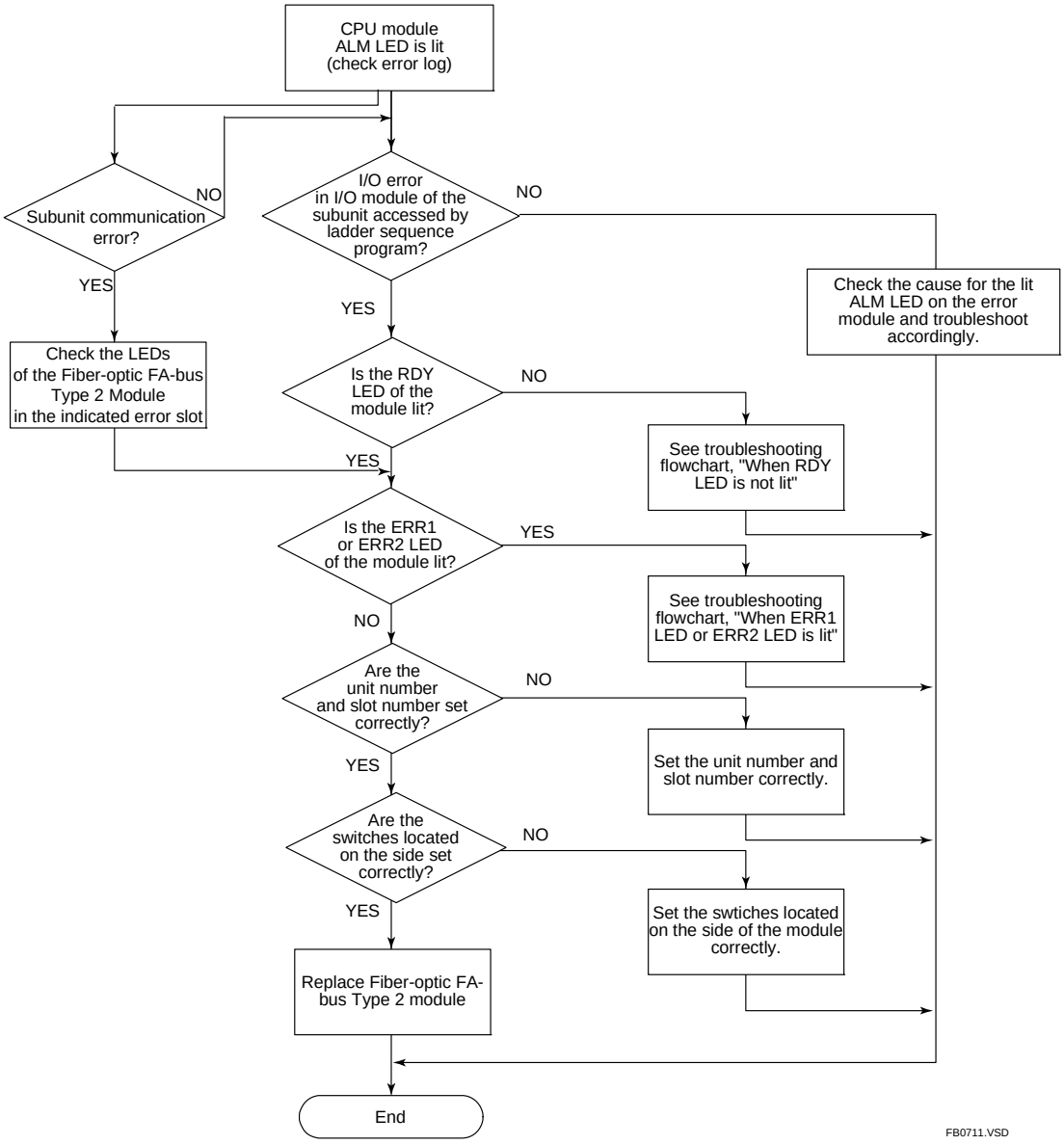
A slot number displayed on the system log screen indicates the slot where a Fiber-optic FA-bus Type 2 module is installed.

It does not indicate the switch settings (unit number, slot number).

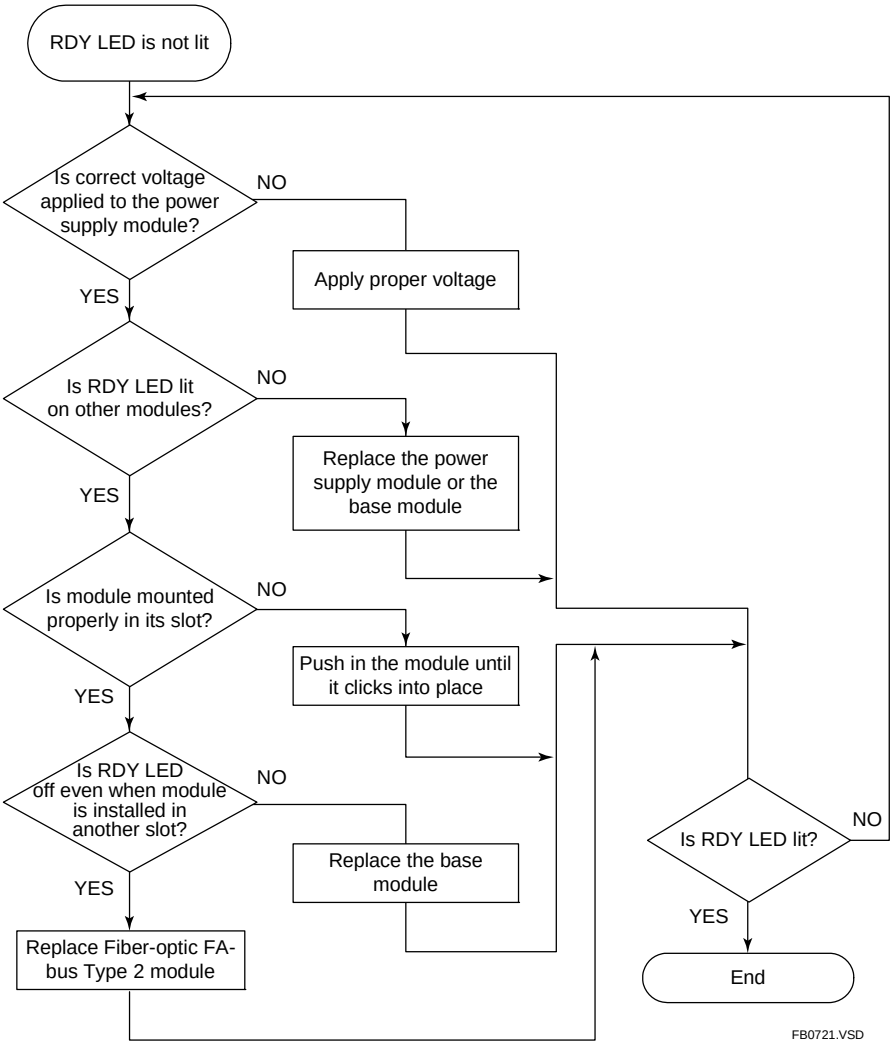
B7. Errors and Troubleshooting

B7.1 Troubleshooting Flowcharts

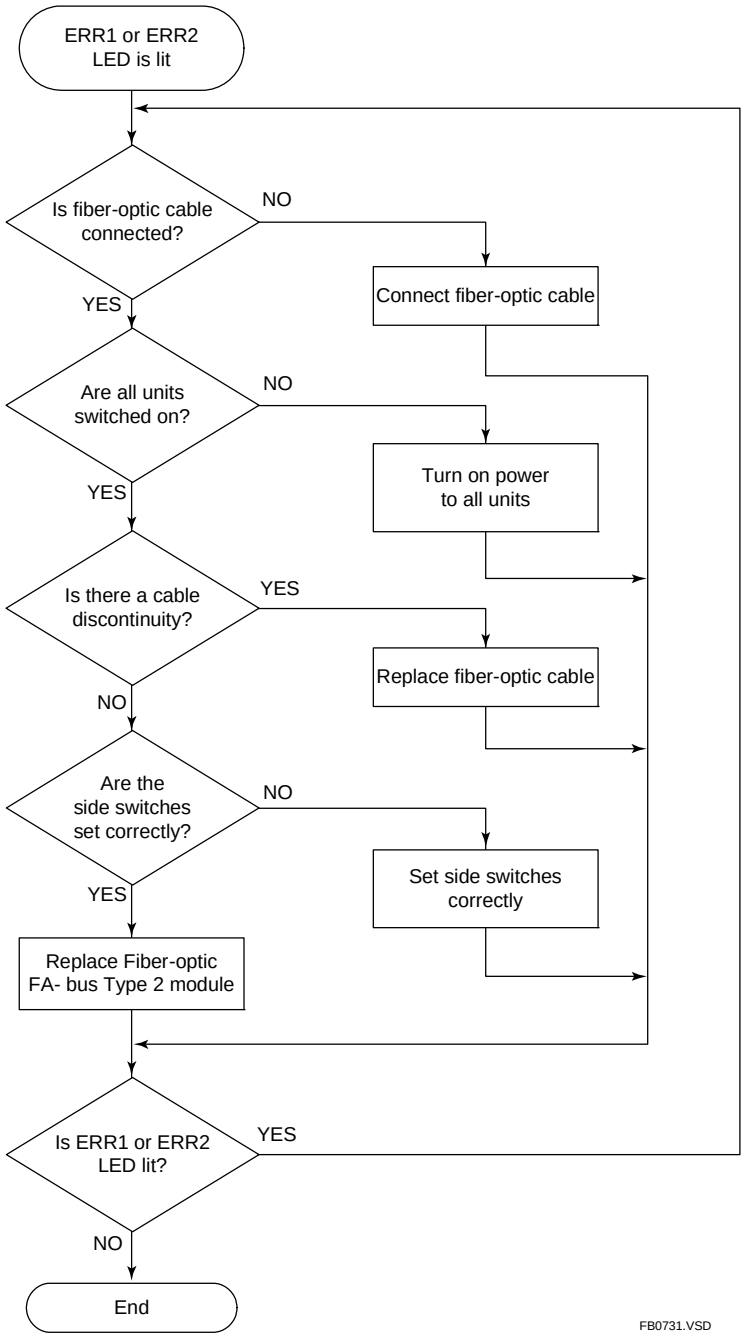
This section shows flowcharts that can be used for troubleshooting problems that may occur with the Fiber-optic FA-bus Type 2 module during operation.



B7.2 When RDY LED is Not Lit



B7.3 When ERR1 LED or ERR2 LED is Lit



Blank Page

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part B: Fiber-optic FA-bus Type 2 Module

IM 34M06H45-01E 5th Edition

INDEX

Blank Page

FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part C: FA-bus Type 2 Module

IM 34M06H45-01E 5th Edition

Part C of the manual describes the FA-bus Type 2 Module (F3LR02-1W).

Blank Page

C1. Overview

The Model F3LR02-1W FA-bus Type 2 Module (hereinafter referred to as ‘the module’ or ‘this module’) is an interface module for configuring a distributed control system on an FA-bus type 2.

A user can configure an efficient remote I/O system by installing FA-bus Type 2 modules in the FA-M3 main unit and subunits and connecting them to each other. Modules in the subunits can then be handled like modules in the main unit.

*1: I/O refers to contact input and output modules.

FA-bus Type 2 module has two main uses:

- Distributed configuration of I/O modules
- System expansion

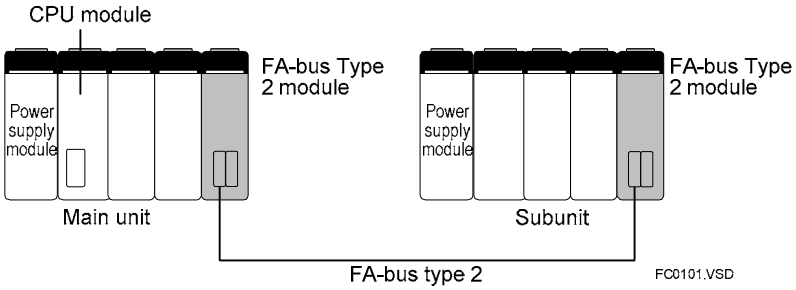


Figure C1.1 Remote I/O System

C1.1 Features

The FA-bus Type 2 module has the following features.

● High-speed communications

The FA-bus Type 2 module features 10 Mbps high-speed communications. Users no longer have to worry about I/O refresh time during ladder programming.

● Simple Wiring

FA-bus Type 2 modules can be easily connected using a two-pair (4 wire) shielded twisted cable.

● Distance between stations

A main unit can control remote subunits[*1]. The maximum distance between two stations is 10 m and the maximum total distance is 80 m (for loop connection).

*1: Subunit installed with an FA-bus Type 2 module

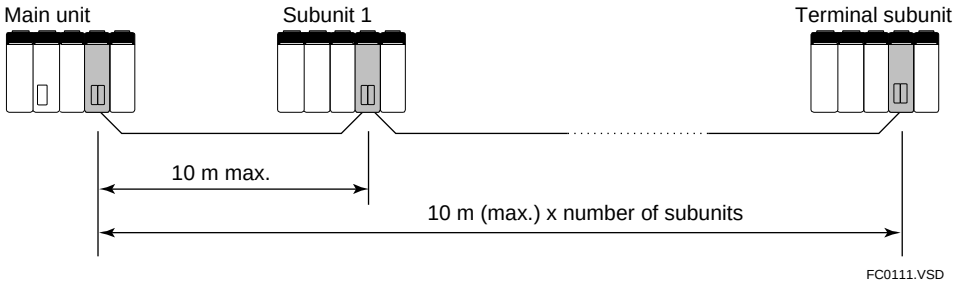


Figure C1.2 Distance between Stations

● Flexible unit configuration

Specials modules, with some exceptions,[*2] and all I/O modules can be installed in a subunit. Modules installed in a subunit can be accessed the same way as modules installed in the main unit.

*2: Except for Ethernet Interface modules, NX Interface modules, FL-net Interface modules, FA Link modules, FA Link H modules, Fiber-optic FA Link H modules, Hard Disk modules, PC Card modules, and YHLS Master modules F3LH0□-0N.

● Simple setup

No specific remote I/O configuration (environment setup) is required.

● Flexible system configuration

Two communications ports are provided, thus allowing both daisy-chain configuration and loop configuration. Furthermore, multiple FA-bus Type 2 modules can be installed in one main unit to build a mixed configuration.

For details, see Section C3.4, “Connection Topology”.

● Early error location reporting (RAS function [*3])

The alarm monitor and error log functions facilitate identification of error locations such as a cable discontinuity. When an error is detected, the Error (ERR) LED on the FA-bus Type 2 module turns on, allowing on-site detection of the error.

For details of the RAS function, see Chapter C6, “RAS Functions of FA-bus Type 2”.

*3: RAS (Reliability Availability Serviceability) indicates the overall usability of automated equipment.

C2. Specifications

C2.1 Model and Suffix Codes

Table C2.1 Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Remarks
F3LR02	-1W	—	—	Maximum number of subunits: 7 Maximum distance between stations: 10 m Maximum total distance: 70 m for daisy chain or 80 m for loop configuration Uses twisted-pair cable

C2.2 Function Specifications

■ General Specifications

Table C2.2 General Specifications

Item	Specifications
Current consumption	320 mA (5V DC)
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm
Weight	105 g
Operating temperature range	0 to 55°C
Operating humidity range	10 to 90% RH (non-condensing)
Operating atmosphere	Free of corrosive gases and heavy dust
Storage temperature range	-20 to 75°C
Storage humidity range	10 to 90% RH (non-condensing)

The other specifications comply with the common specifications of the FA-M3.

■ Communications Specifications

Table C2.3 Communications Specifications

Item	Specifications
Transmission speed	10 Mbps
Transmission media	Two-pair (4-wire) shielded cable (impedance: 100 Ω)
Transmission distance	Maximum distance between stations: 10 m Maximum total distance: 70 m for daisy chain or 80 m for loop configuration
Transmission configuration	Star, daisy-chain or loop configuration
Maximum number of subunits	7
RAS features	Shutdown output on transmission channel error function, error reporting function, loop switching
Installation location	Must be installed inside panel enclosure
Signal encoding	Manchester encoding
Access method	Direct I/O access
Number of I/O ports	2 ports

C2.3 Operating Environment

- **Compatible CPU Modules:**

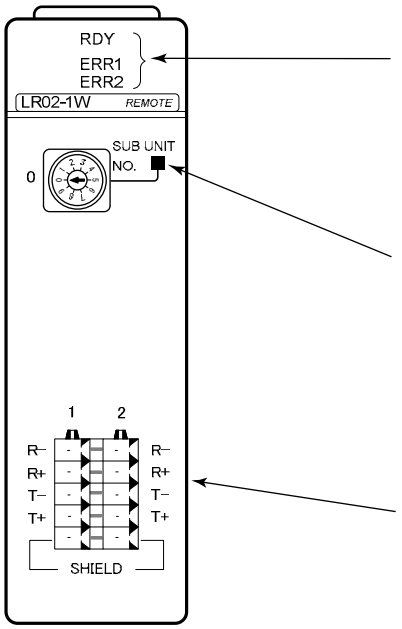
  F3SP21/F3SP25/F3SP35 (Rev. 8 or later), F3SP05, F3SP08, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71, F3SP76 and F3BP□□.

- **Logging of transmission channel error location is available with:**
  F3SP21/F3SP25/F3SP35 (Rev. 8 or later), F3SP05, F3SP08, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71, F3SP76 and WideField3, WideField2, WideField, and Ladder Diagram Support Program M3 (Rev. 1.08 or later).

C2.4 Components and Their Functions

For details, see Section C4.2, “Setting Switches”.

■ Front View



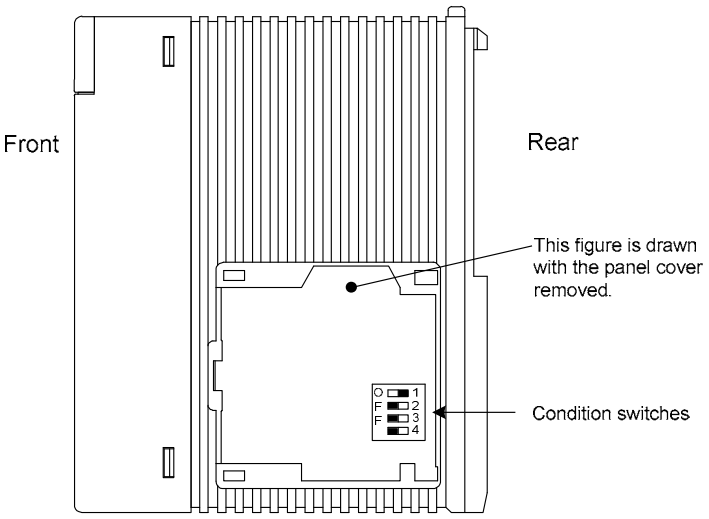
LED indicators
RDY : Lit (green) when the internal circuit is functioning normally.
ERR1, ERR2 : Lit (red) when the module fails to detect an input signal from port 1 and port 2 respectively.

Unit number switch (subunit number):
Specifies a unit number (0 to 7)
0 : unit number of the main unit
1 to 7 : unit number of a subunit
8 to 9 : cannot be used
(factory setting is 0)

Communication ports

FC0231.VSD

■ Right Side View



Condition Switches

SW number	Description	OFF	ON	Factory setting
1*1	Shutdown output on transmission channel error	Hold*2	Shutdown	ON
2	Port used	Port 1	Both ports*3	OFF
3	Transmission channel configuration	Daisy-chain or star	Loop	OFF
4	Reserved	—	—	OFF

*1: Valid only for output modules installed in a sub-unit.
*2: Continues operation if transmission channel has been secured and system operation is continued.
*3: When using both port 1 and port 2.

FC0232.VSD

Figure C2.1 Components and Their Functions (F3LR02-1W)

C2.5 External Dimensions

■ External Dimensions

unit: mm

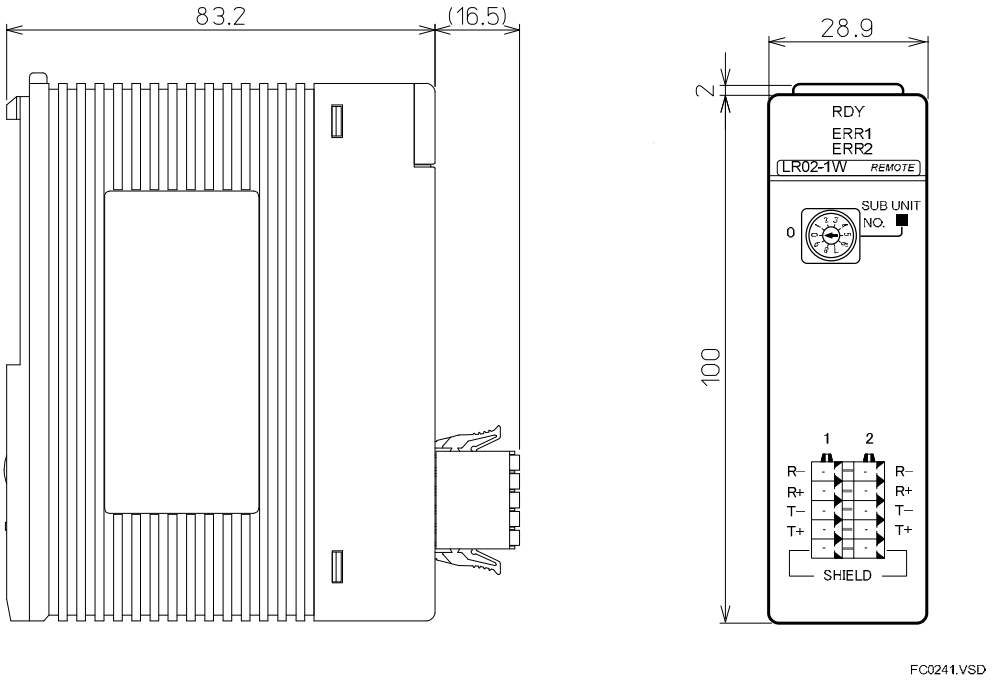


Figure C2.2 External Dimensions of F3LR02-1W

Blank Page

C3. FA-bus Type 2 System Configuration

C3.1 System Elements and Terminology

The FA-bus Type 2 system contains the following elements.

Table C3.1 System Elements

Element	Description
Main unit	The unit installed with a CPU module.
Subunit	The unit with no CPU module, which is connected to the main unit for system expansion through FA-bus Type 2 modules.

The following table lists some system configuration terms used in this manual.

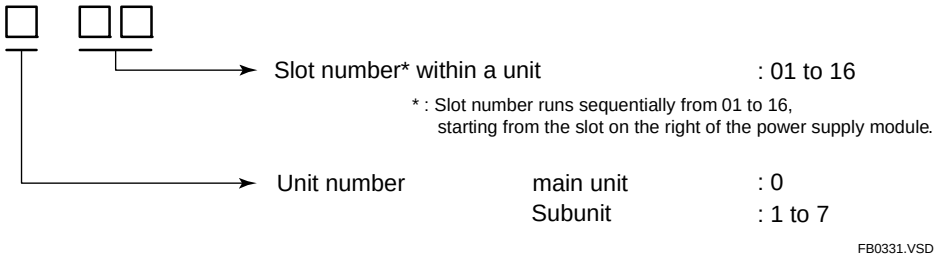
Table C3.2 Terminology

Term	Meaning
Station	The unit with FA-bus Type 2 module (i.e., main unit or subunit)
Own station	The unit
The other station	The unit connected to the own station
Intermediate station	The subunit between the main unit and the terminal station in the daisy-chain configuration
Terminal station	The subunit in the star configuration or the subunit farthest from the main unit in the daisy-chain configuration

C3.2 System Configuration and Slot Numbers

In FA-M3, slot numbers are used for accessing various modules.

A slot number indicates the position of the slot where a module is mounted and is a 3-digit integer with the following structure.



A module installed in a subunit can be accessed using ladder or BASIC, in the same way as accessing a module mounted in the main unit.

■ System configuration example:

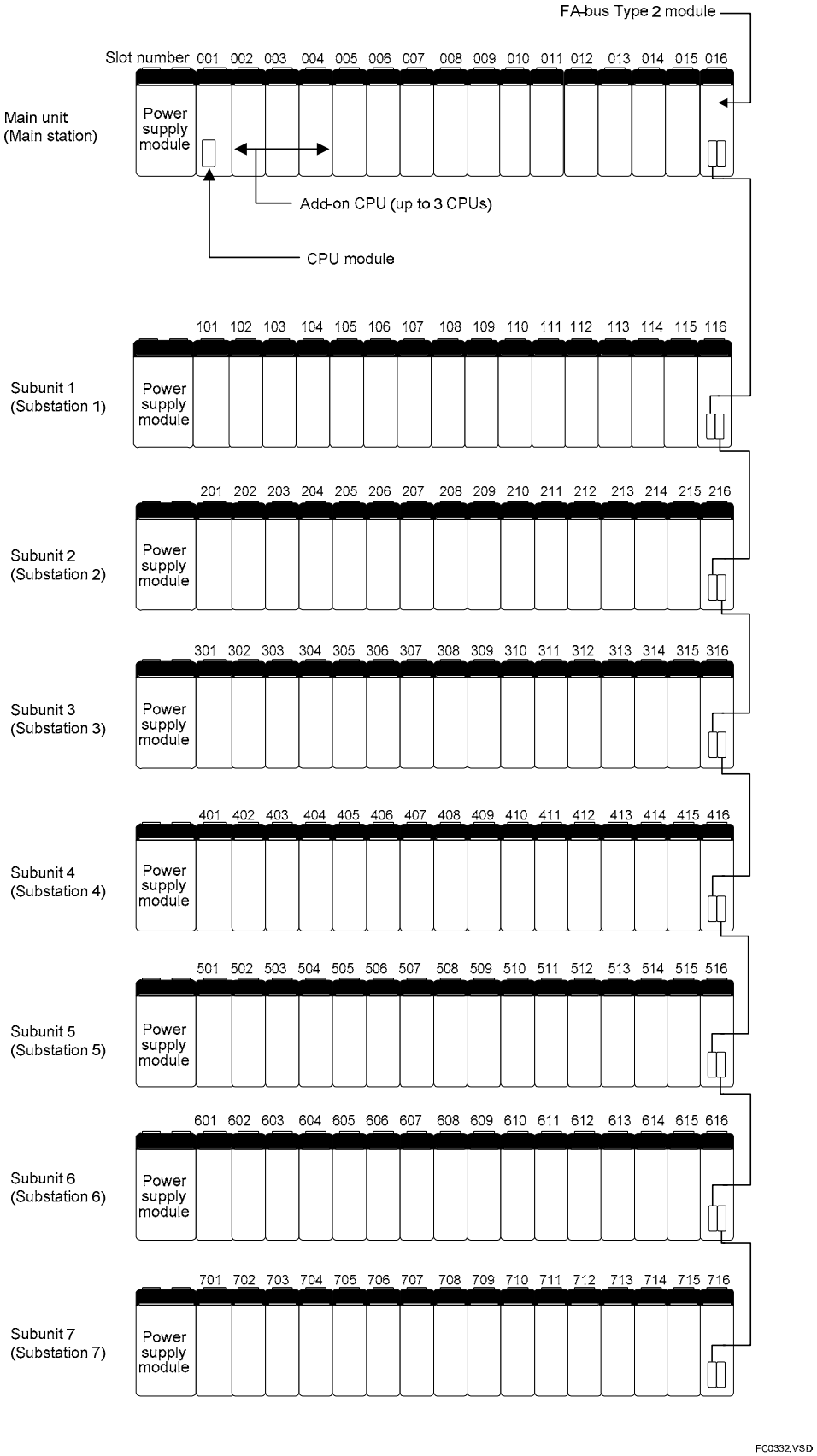


Figure C3.1 System Configuration and Slot Numbers

C3.3 Restrictions on System Configuration

The following table lists some restrictions when configuring an FA-bus Type 2 system.

Table C3.3 Restrictions when Configuring an FA-bus Type 2 System

Item	Specifications
Number of FA-bus Type 2 modules installable in a main unit	7
Number of FA-bus Type 2 modules installable in a subunit	1 max.
Modules installable in a subunit	All I/O modules and special modules except for - Ethernet Interface modules, - NX Interface modules, - FL-net Interface modules, - FA Link modules, - FA Link H modules, - Fiber-optic FA Link H modules, - Hard Disk modules, - PC Card modules, and - YHLS Master modules F3LH0□-0N.

C3.4 Connection Topology

FA-bus Type 2 modules can be connected using a loop, daisy chain or star configuration. The following pages show examples for each of the configurations.

■ Loop Configuration

One main unit and multiple subunits are connected together in a loop. Port 2 of the own station must be connected to port 1 of the other station. Always form a loop using only one FA-bus Type 2 module in the main unit. In a loop configuration, if a cable discontinuity or subunit down occurs, the built-in RAS function will operate to increase system reliability.

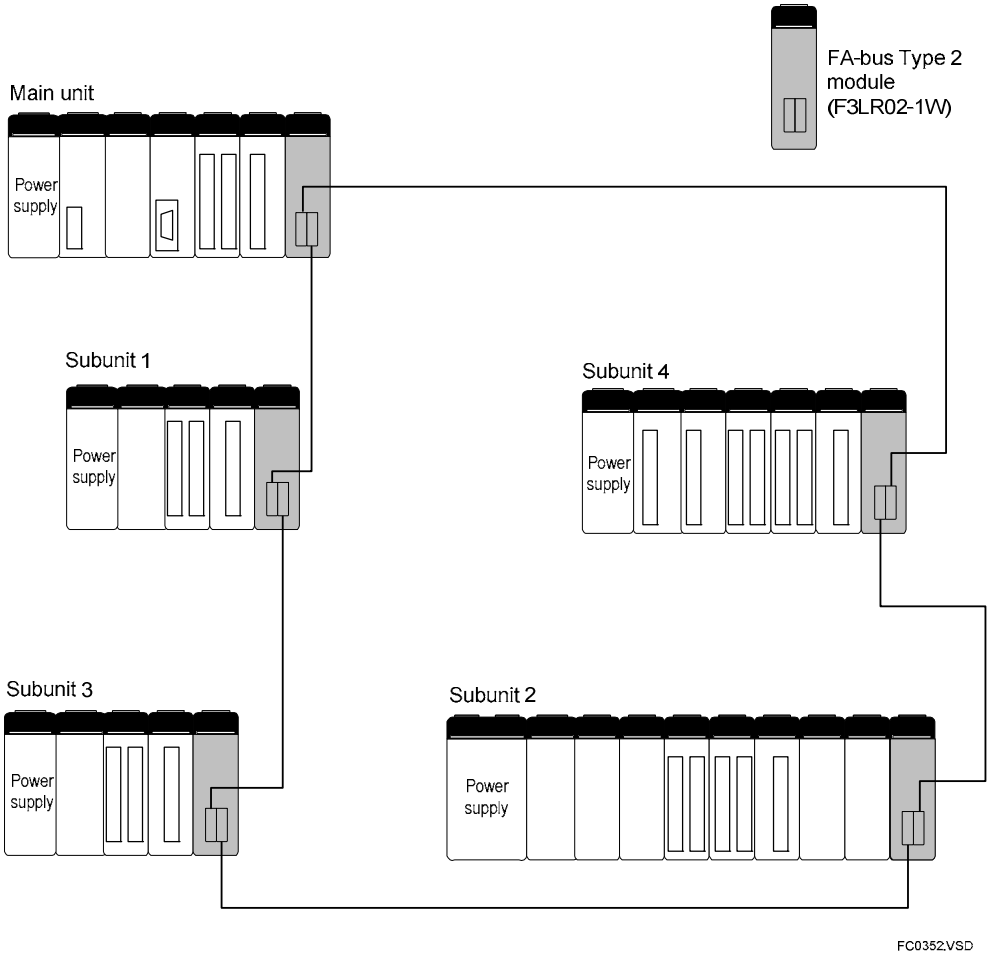


Figure C3.2 Loop Configuration

CAUTION

- In a loop connection, port 2 of the own station must be connected to port 1 of the other station. Otherwise, the system will not operate normally.

■ Daisy-chain Configuration

One main unit and multiple subunits are connected to form a line. Port 1 or port 2 of the FA-bus Type 2 module in the main unit must be connected to port 1 of the FA-bus Type 2 module in a subunit. Port 2 of the FA-bus Type 2 module in a subunit must be connected to port 1 of the FA-bus Type 2 module in another subunit.

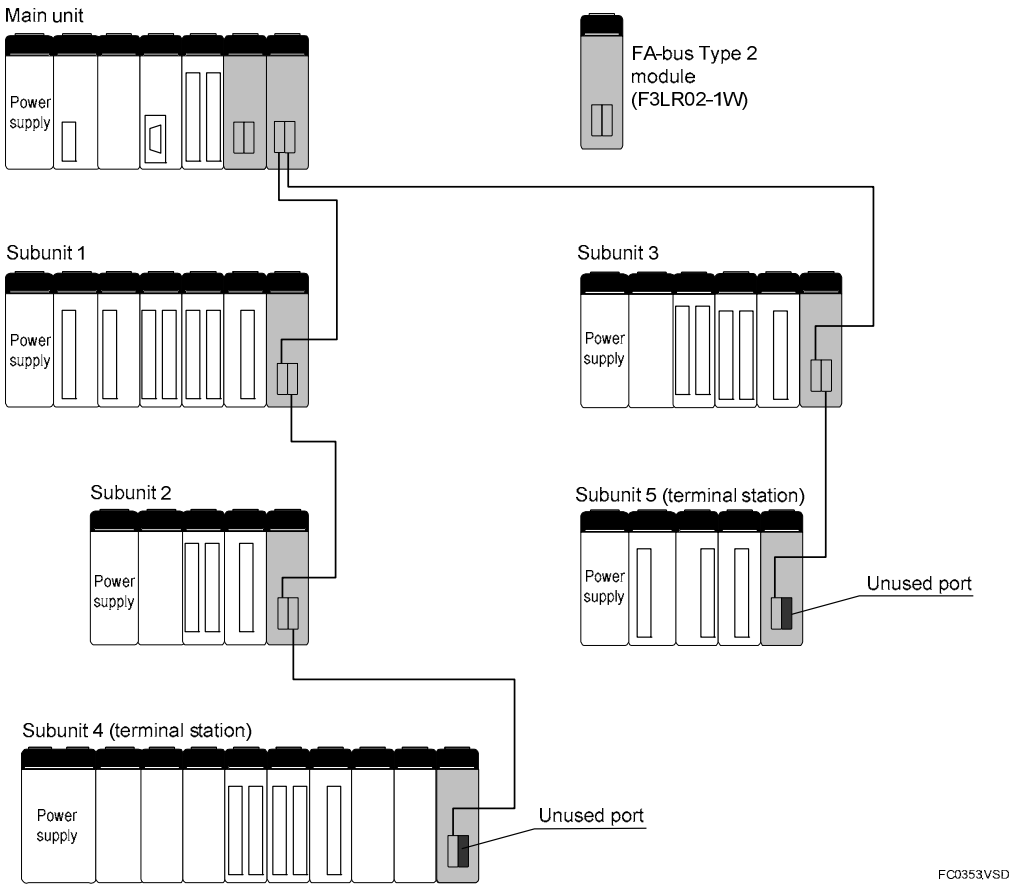


Figure C3.3 Daisy-chain Configuration

CAUTION

- In a daisy chain connection, port 1 or port 2 of the FA-bus Type 2 module in the main unit must be connected to port 1 of the FA-bus Type 2 module in a subunit. Port 2 of the FA-bus Type 2 module in a subunit must be connected to port 1 of the FA-bus Type 2 module in another subunit. Otherwise, the system will not operate normally.

■ Star Configuration

A star configuration consists of one-to-one connections between the main unit and each subunit. Port 1 or port 2 of the FA-bus Type 2 module in the main unit must be connected to port 1 of the FA-bus Type 2 module in a subunit. In this configuration, a cable discontinuity or subunit shutdown will not affect the communication between the main unit and the other subunits.

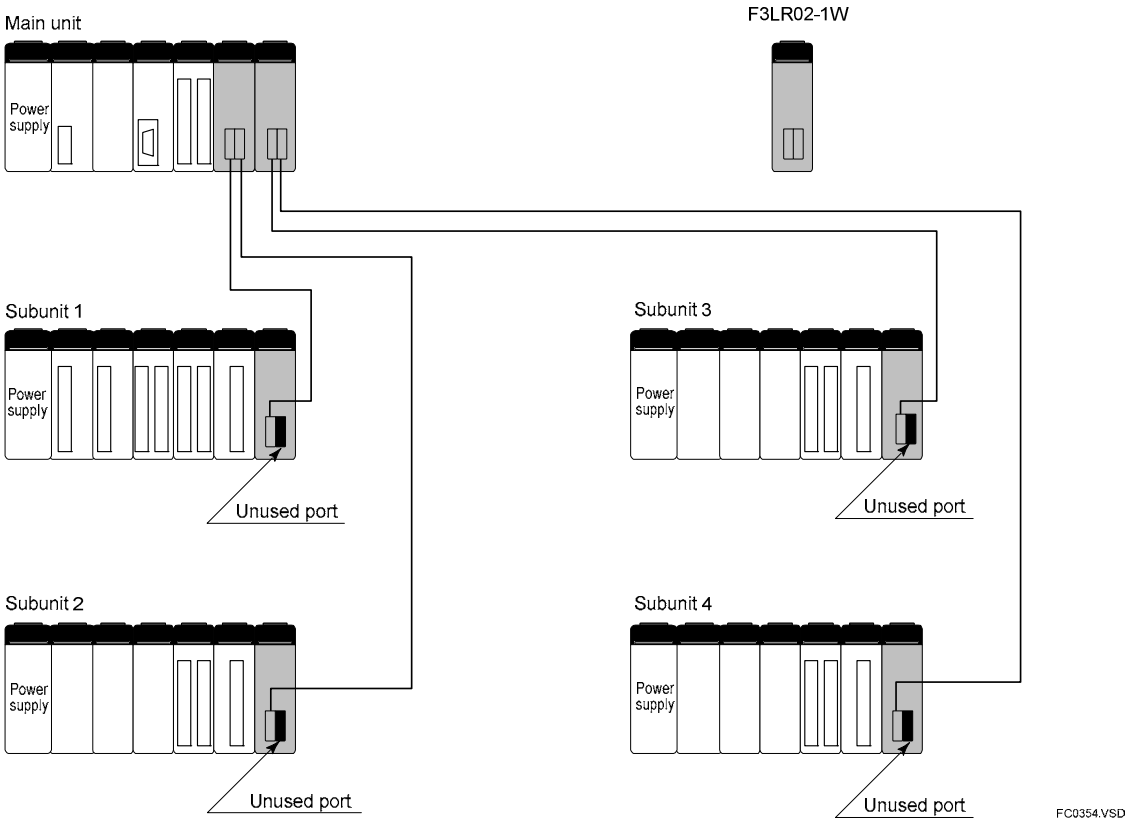


Figure C3.4 Star Configuration

CAUTION

- In a star connection, port 1 or port 2 of the FA-bus Type 2 module in the main unit must be connected to port 1 of the FA-bus Type 2 module in a subunit. Otherwise, the system will not operate normally.

Blank Page

C4. Pre-operation Setup and Cable Connection

C4.1 Startup Procedure

The following figure shows the system startup procedure when using FA-bus Type 2 modules.

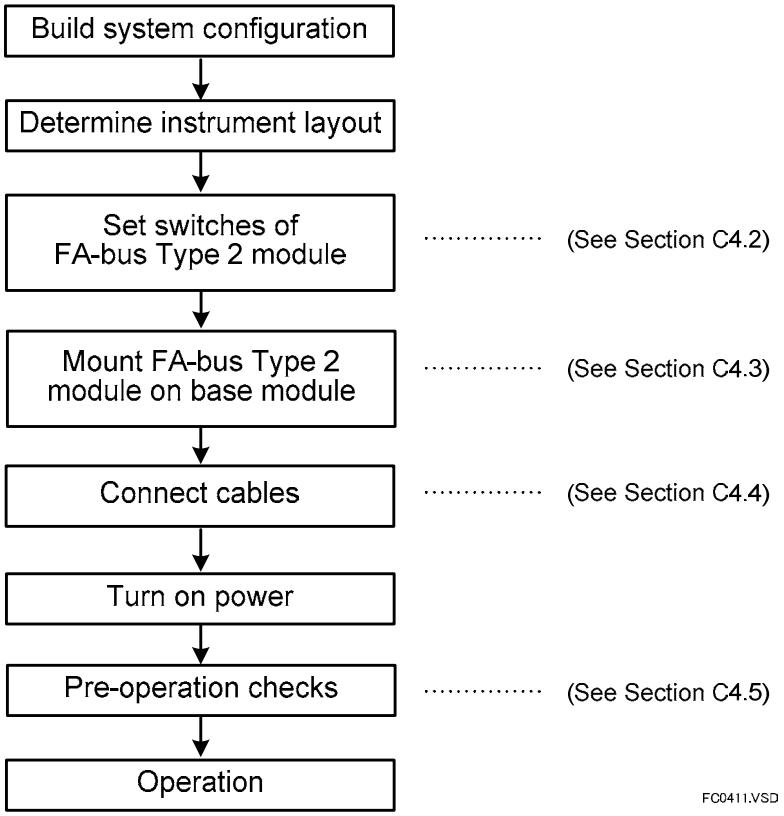


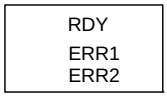
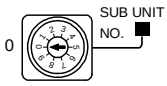
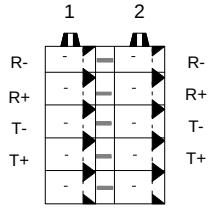
Figure C4.1 Startup Workflow

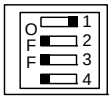
C4.2 Setting Switches

Before using this module, set its switches according to its installed location, transmission channel configuration, etc.

Table C4.1 gives an overview of the module components and settings. Subsequent subsections describe the setup of individual switches. For details on the location of switches, see Section C2.4, “Components and Their Functions.”

Table C4.1 Components and Settings

<table>
<tr><th>Name</th><th colspan="4">Description</th></tr>
<tr><td>LED
 
</td><td>Name</td><td>Status</td><td colspan="2">Description</td></tr>
<tr><td></td><td>RDY (green)</td><td>lit</td><td colspan="2">Internal circuit is functioning normally.</td></tr>
<tr><td></td><td></td><td>off</td><td colspan="2">Internal circuitry is not functioning normally. No power supply.</td></tr>
<tr><td></td><td>ERR1 (red)</td><td>lit</td><td colspan="2">Error: No signal in port 1. Cable discontinuity possible.*1</td></tr>
<tr><td></td><td></td><td>off</td><td colspan="2">Normal: Input signal detected in port 1.</td></tr>
<tr><td></td><td>ERR2 (red)</td><td>lit</td><td colspan="2">Error: No signal in port 2. Cable discontinuity possible.*1</td></tr>
<tr><td></td><td></td><td>off</td><td colspan="2">Normal: Input signal detected in port 2.
Number of ports is set to OFF (for using port 1 only).</td></tr>
<tr><td>Unit number switch
 
</td><td colspan="4">Unit address number setting (factory setting: 0)
Setting range:
0 : unit number of main unit
1 to 7 : unit number of subunit
8, 9 : cannot be used</td></tr>
<tr><td>Connector (port)
 
</td><td colspan="4">Connector for cable.

Remarks:
Always use port 1.
If port 2 is not used, cover it with the connector.</td></tr>
<tr><td>Condition switches
(located on side of module)
 
</td><td>No.</td><td>Name</td><td>State</td><td>Description</td></tr>
<tr><td></td><td>1</td><td>Shutdown output on transmission channel error*2</td><td>OFF</td><td>Hold*3</td></tr>
<tr><td></td><td></td><td></td><td>ON</td><td>Shutdown</td></tr>
<tr><td></td><td>2</td><td>Number of ports</td><td>OFF</td><td>Use port 1 only</td></tr>
<tr><td></td><td></td><td></td><td>ON</td><td>Use both ports 1 and 2</td></tr>
<tr><td></td><td>3</td><td>Transmission channel configuration</td><td>OFF</td><td>Star or daisy-chain</td></tr>
<tr><td></td><td></td><td></td><td>ON</td><td>Loop</td></tr>
<tr><td></td><td>4</td><td>Not used</td><td>OFF</td><td>Always off</td></tr>
</table>

FC0421.VSD

*1: For details on investigation of cable discontinuity, see Section C6.4, “Error Location Detection.”
*2: This setting is not valid on a main unit.
*3: On a subunit with secured transmission channel to the main unit, continues operation if the [Subunit Communication Error] in the [Error-time Action] group on the Operation Control tab of the Configuration dialog is set to [Run].

C4.2.1 Setting Unit Number

Set the unit number using the unit number switch. This unit number will be used as an address in programs. The following table lists the valid preset values.

Table C4.2 Unit Number Switch Settings

Switch Setting	Description
0	For modules installed in the main unit (Factory setting: 0)
1 to 7	For modules installed in subunits
8 to 9	Not used (cannot be used)

CAUTION

- Always set the unit number of the FA-bus Type 2 module installed in the main unit to 0. With any other value, the memory of the CPU module may be cleared.
- The unit number of a subunit can be set to any integer from 1 to 7 (inclusive).
- Modules within the same system should not be given the same unit number.

C4.2.2 Enabling/Disabling Shutdown Output on Transmission Channel Error

This switch is used to specify whether to shutdown the output of the I/O modules in a subunit in the event of a transmission channel error (cable discontinuity, subunit power off, etc.). Set operations for individual I/O modules to Hold or Reset using WideField3 or CONTROL statements in BASIC programs.

For details on the Shutdown Output function, see Section C6, “RAS Functions of FA-bus Type 2”.

Table C4.3 Shutdown Output on Transmission Channel Error

Setting	Description
OFF	Hold output in the event of a transmission channel error (Continue operation if a transmission channel is secured and system operation is continued).
ON	Shutdown output in the event of a transmission channel error.

The Shutdown Output on Transmission Channel Error function is valid only for configurations with one CPU module (i.e. not a multi-CPU configuration).

TIP

If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken cable or a powered-off intermediate station as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

CAUTION

- The Shutdown Output on Transmission Channel Error is invalid for a main unit and should be turned off for the main unit.
- Turn off this function for a loop configuration. If it is on, output will be shutdown in the event of a cable discontinuity even if loop switching is activated to maintain transmission.
- When using F3SP05, F3SP08, F3SP21, F3SP25 and F3SP35 CPU modules (Rev. 8 or later), this function is only available for output modules with 32 outputs or less.
- When using CPU modules F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76, this function is available for output modules with 32 outputs or less, as well as F3YD64-1F, F3WD64-3F, F3WD64-4F, and F3YD64-1P.

C4.2.3 Setting the Number of Ports

This switch is used to specify the ports of the FA-bus Type 2 module to be used.

Table C4.4 Number of Ports Used

Value	Ports Used
OFF	Port 1
ON	Port 1 and Port 2

CAUTION

- When the switch is set to off, use port 1 only.
- Turn on this switch when using the loop configuration.

C4.2.4 Setting Transmission Channel Configuration

This switch sets the communication behavior of the FA-bus Type 2 module to support various transmission channel configurations.

Table C4.5 Transmission Channel Configuration

Value	Used Ports
OFF	Star configuration or daisy-chain configuration
ON	Loop configuration

CAUTION

- All FA-bus Type 2 modules (on main unit and subunits) in the same system should have the same transmission channel configuration setting.
- In a loop configuration, complete one system loop with only one main unit.

C4.3 Attaching and Detaching Modules

C4.3.1 Attaching the Module

Figure C4.2 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of this module towards the base module until the yellow anchor/release button clicks into place.

CAUTION

Always switch off the power before attaching or detaching a module.

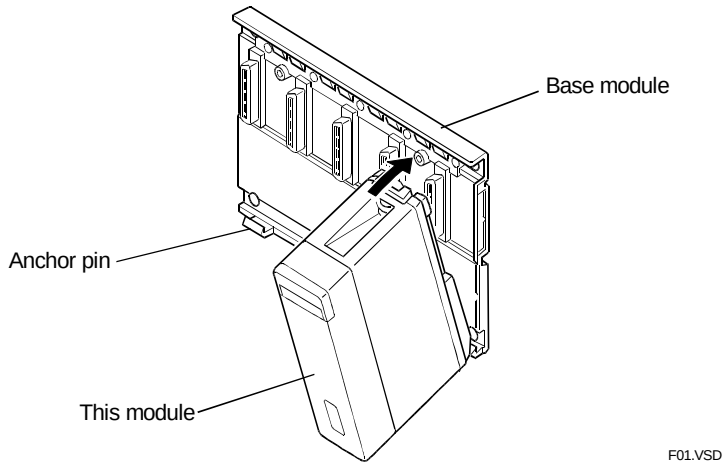


Figure C4.2 Attaching/Detaching the Module

CAUTION

DO NOT bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.

C4.3.2 Detaching the Module

To remove this module from the base module, reverse the above operation. Press the yellow anchor/release button on the top of this module to unlock it and tilt the module away from the base module. Then lift the module off the anchor pin at the base.

C4.3.3 Attaching Modules in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw. Use screws of type listed in the table below. Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

Screw Required
M4-size binder screw 12 to 15 mm long (Or 14 to 15 mm if fitted with a washer)

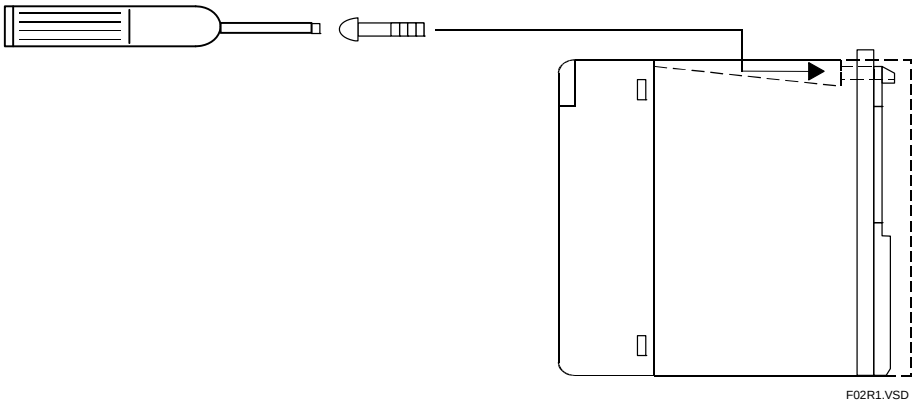


Figure C4.3 Securing Screws on FA-bus Type 2 Module

C4.4 Connecting Transmission Cables

C4.4.1 Cable Preparation

Use the cable given below to connect FA-bus Type 2 modules.

	Specification
Transmission cable between FA-bus Type 2 modules	Two pair (4 wire) shielded cable (impedance: 100 Ω).

C4.4.2 Recommended Cables

Yokogawa supplies both fixed and flexible two-pair (4-wire) shielded cables.

■ Model and Suffix Codes

Table C4.6 Model and Suffix Codes

	Model	Suffix Code	Style Code	Option Code	Description
Fixed cable	KM80	-010	···	···	Cable length: 10 m
Flexible cable	KM81	-010	···	···	Cable length: 10 m

■ Cable Specifications

Table C4.7 Cable Specifications

	Fixed Cable	Flexible Cable
Model	**KM80**	**KM81**
Conductors	2 pairs of 23AWG wires (tin-plated soft-copper braids)	2 pairs of 21AWG wires (soft-copper braids)
Insulation	Polyethylene	
Shields	Aluminum-mylar tape, tin-plated soft-copper braided shield	
Drain wire size	23AWG	22AWG
Outer diameter	Approx. 8.0 mm	Approx. 11.0 mm
Conductor resistance @ 20°C	65.7 Ω/km max.	37.8 Ω/km max.
Dielectric strength (through air)	Withstanding 2000 V AC for one minute	
Insulation resistance	2500 MΩ km min.	
Characteristic impedance @ 1 MHz	100 ± 15 Ω	
Flame retardancy	VW-1 (tested according to UL Subject 758)	
Applicable standards	UL (E107262), AWM 2464	
Application	Fixed transmission cable for FA-bus type 2 communication	Flexible transmission cable for FA-bus type 2 communication

■ Cross-sectional View

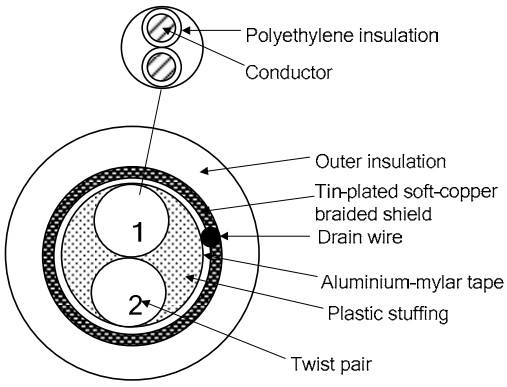


Figure C4.4 Cross-section of KM80 (fixed cable)

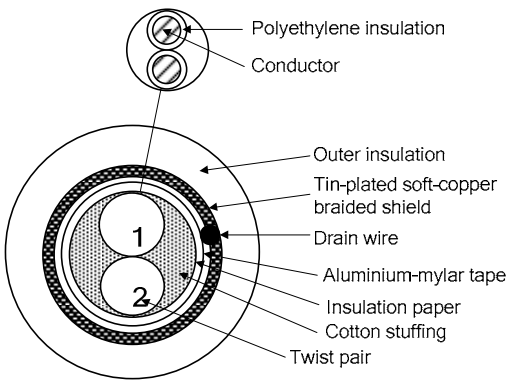


Figure C4.5 Cross-section of KM81 (flexible cable)

■ Cable Flexibility Performance (for KM81 only)

Table C4.8 Cable Flexibility Performance

Test	Test Conditions	Performance
U-bend test simulating the movement of a cable bearer	- Cable bearer bending radius (R) is 50 mm. - Cable bearer stroke is 800 mm. - The cable bearer is moved 28 cycles per minute where one back-and-forth movement is counted as one movement cycle.	Withstanding more than 4 million times of flexing
90-degree bending in both directions	- Mandrel radius (R) is 100 mm. - A load of 1 kg is attached to the lower end of the cable. - The cable is bent 60 times per minute where one time of bending consists of bending and straightening the cable in one direction and then in the opposite direction.	Withstanding more than 10 million times of bending

Note: The above test results are obtained under the specified test conditions, and should not be interpreted as guaranteed values for actual usage in real applications.

C4.4.3 Wiring of Recommended Cables

Table C4.9 Wire Color and Signal Name of KM80 or KM81

		Wire Color (F3LR02-1W)	Wire Color (F3LR0-1W at the other station)
5	R-	Green	Blue
4	R+	Yellow	White
3	T-	Blue	Green
2	T+	White	Yellow
1	SHIELD	Drain wire	Drain wire

It is recommended to terminate the cable wires with pin terminals for insertion into a connector. Pin terminals do not come with the cables (see below for suppliers).

- Pin terminals

Manufacturer: Phoenix Contact

Model: AI 0,34 - 8 TQ (for fixed cable)

AI 0,5 - 10 WH (for flexible cable)

C4.4.4 Usage Precautions for Fixed Cable (KM80)

CAUTION

- **Minimum bending radius**
  Do not bend the cable beyond the minimum bending radius (see the table below). Otherwise, the cable wires may break or be disconnected from the connector.

Table C4.10 Minimum Bending Radius (for KM80)

Model	Item	Outer Diameter	Minimum Bending Radius	
KM80	Cable	8.0 mm	10 D min. during cable laying	> 80 mm
			4 D min. after installation	> 32 mm
	Signal wire	1.4 mm	10 D min. during cable laying	> 14 mm
			4 D min. after installation	> 5.5 mm

D = Outer diameter of cable or wire.

During cable laying: This minimum bending radius must be observed throughout cable laying.
After installation: This minimum bending radius must be observed even after cable laying to ensure lifetime performance of the cable.

- **Maximum allowable tension**
  No tensile force exceeding the maximum allowable tensile load should be applied during cable laying to prevent excessive conductor elongation, loose connector, loose wire, open circuit, or performance degradation.

  During cable laying: Never tension the cable beyond its maximum allowable tension during cable laying.
  After installation: Pay attention to cable length and cable securing method and ensure that the cable is not tensioned.

  Maximum allowable tension (N)
  = 7 (kg/mm^2)* x 4 (No. of cable wires) x 0.3 (cross-sectional area of conductor in mm^2) x 9.8
  = 82 (N)
  * Maximum allowable tension of copper conductor = 7 kg/mm^2

- **Exposure to direct sunlight or ultraviolet rays**
  Polyethylene insulation may deteriorate or even crack, thus leading to insulation breakdown, if exposed to direct sunlight or fluorescent light over an extended period of time. If the cable is to be used in such environments, protect the polyethylene insulation with UV-resistant tube or tape (such as black adhesive polyethylene insulation tape).

C4.4.5 Usage Precautions for Flexible Cable (KM81)

CAUTION

- **Minimum bending radius**
  Do not bend the cable beyond the minimum bending radius (see the table below). Otherwise, the cable wires may break or be disconnected from the connector.

Table C4.11 Minimum Bending Radius (for KM81)

Model	Item	Outer Diameter	Minimum Bending Radius	
KM81	Cable	11.0 mm	10 D min. during cable laying	> 110 mm
			4 D min. after installation	> 44 mm
	Signal wire	2.1 mm	10 D min. during cable laying	> 21 mm
			4 D min. after installation	> 8 mm

D = Outer diameter of cable or wire.

During cable laying: This minimum bending radius must be observed throughout cable laying.
After installation: This minimum bending radius must be observed even after cable laying to ensure lifetime performance of the cable.

- **Maximum allowable tension**
  No tensile force exceeding the maximum allowable tensile load should be applied during cable laying to prevent excessive conductor elongation, loose connector, loose wire, open circuit, or performance degradation.

  During cable laying: Never tension the cable beyond its maximum allowable tension during cable laying.
  After installation: Pay attention to cable length and cable securing method and ensure that the cable is not tensioned.

  Maximum allowable tension (N)
  = 7 (kg/mm^2)* x 4 (No. of cable wires) x 0.5 (cross-sectional area of conductor in mm^2) x 9.8
  = 137 (N)
  * Maximum allowable tension of copper conductor = 7 kg/mm^2

- **Wiring the cable to moving parts**
  Observe the following precautions when wiring the cable to moving parts:
  (1) If the cable is laid on a cable bearer, secure the cable to the cable bearer only at two points: the entry and exit points. Do not tie cables together using banding bands inside the cable bearer. The cable should occupy as little space as possible within the bearer, preferably less than 30%.
  (2) To reduce interference between multiple cables, separate cables using separators and do not stack cables.
  (3) The bending radius of the cable bearer must be at least 10 times the outer diameter of the cable as shown below:

Table C4.12 Bending Radius of Cable Bearer (for KM81)

Cable Model	Outer Diameter	Recommended Bending Radius for Cable Bearer
KM81	11.0 mm	> 110 mm

  (4) If the cable is laid on a cable bearer together with air hoses or other flexible cables, arrange them such that interference is minimized. Do not bind the cable and hoses or other cables together using banding bands.
  (5) Ensure that the cable is not scratched, twisted, stretched or sagging.
  (6) Similar precautions must also be observed if the cable is wired to moving parts not using a cable bearer. In particular, do not bind the cable and other cables together using banding bands.

- **Exposure to direct sunlight or ultraviolet rays**
  Polyethylene insulation may deteriorate or even crack, thus leading to insulation breakdown, if exposed to direct sunlight or fluorescent light over an extended period of time. If the cable is to be used in such environments, protect the polyethylene insulation with UV-resistant tube or tape (such as black adhesive polyethylene insulation tape).

C4.4.6 Provided Connectors

■ Connector Pin Assignment

The FA-bus Type 2 modules are connected together with a transmission cable cross-connected between them.

The FA-bus Type 2 module comes with connectors for cable connection. If more connectors are needed, you can purchase the following connector:

- Model: FMC1,5/5-ST3,5-RF (from Phoenix Contact)

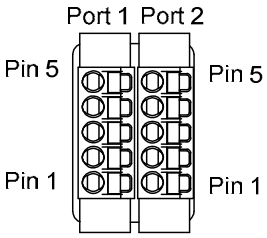


Figure C4.6 Connectors Installed on the Module (front view)

Table C4.13 Connector Pin Assignment

Connector	Pin No.	Signal Name	Printed label on F3LR02-1W
Port 1 connector	5	RxD-	R-
	4	RxD+	R+
	3	TxD-	T-
	2	TxD+	T+
	1	SHIELD	SHIELD
Port 2 connector	5	RxD-	R-
	4	RxD+	R+
	3	TxD-	T-
	2	TxD+	T+
	1	SHIELD	SHIELD

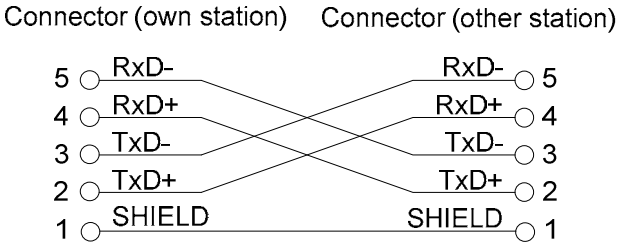


Figure C4.7 Cable-connector Set Internal Wiring

C4.5 Pre-operation Checks

C4.5.1 LED Checks

After installing modules and connecting transmission cables, check that the modules are properly connected for communication. There should be no cable discontinuity or improper connection.

Apply power to the units and perform the following checks:

(1) The RDY (green) LED indicator must be lit
If this indicator is not lit, it may be because the FA-bus Type 2 module is not properly mounted to the base module. Turn off the power and attach the module to the base module correctly.

(2) The ERR1 and ERR2 LED indicators must be off
When the ERR indicators are on (red), communication is not allowed.

If the power of the adjacent station is off, turn on its power and check whether the ERR indicator turns off. If the ERR indicator is still on, it may be due to a transmission channel error, such as cable discontinuity.

See Section C7.3, “When the ERR1 LED or ERR2 LED is Lit” and troubleshoot accordingly. If the ERR LED for an unused port is lit, check the setting of the function switch located on the side of the module.

(3) The transmission channel configuration (star, daisy-chain or loop configuration) must match the setting of the switch located on the side of the module.

(4) The cable must be connected according to the selected transmission channel configuration.

(5) An unused port must be port 2. In this case, switch SW2 located on the side of the module must be set to off, and the unused port must be covered with a connector cover.

(6) No unit number must be duplicated.

C4.6 Precautions When Applying Power

When turning on the power supply to the main unit and subunits, follow the sequence below.

First confirm that the main unit and all subunits are turned off. Then turn on the power supply to the main unit and the subunits simultaneously*, or turn on all subunits before turning on the main unit.

A program starts execution when the main unit is turned on, regardless of whether subunits are switched on. In situations where the powering sequence described above is not adhered to, you should write your application so that it checks the status of subunits using the Module Recognition special registers. In this case, do not switch off and switch on the main unit, or restart the CPU module, while a subunit is switched on.

*: By “simultaneously”, we mean, for instance, a system whereby a single switch turns on the power to the entire system.

CAUTION

If you have switched off the main unit, ensure that all subunits are switched off before switching on the main unit. If you switch off and on the main unit while a subunit is switched on, some modules in the subunit may not be recognized correctly by the CPU module in the main unit.

Module Recognition special registers

When a module installed in a main unit or subunit is recognized as accessible, the bit corresponding to its slot position in the Module Recognition special registers is set to 1. If a module cannot be read or written due to I/O module failure, subunit power failure or some other reason, its corresponding bit in the Module Recognition special registers is cleared to 0.

Table C4.14 Module Recognition Special Registers

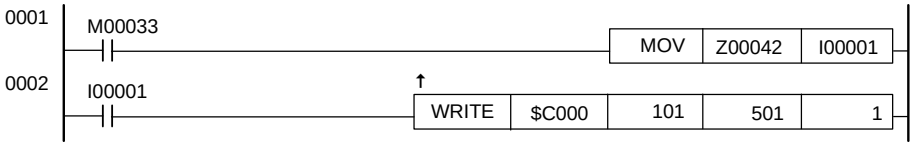
Cateogry	Module Recognition Special Registers	
Number	**Name**	**Description**
Z41	Main unit	Slot number 16 ··· 9 8 7 6 5 4 3 2 1 0 ··· 1 0 1 1 0 1 1 1 1 0: No module is mounted or mounted module does not allow read and write. 1: Module is recognized as accessible.
Z42	Subunit 1	
Z43	Subunit 2	
Z44	Subunit 3	
Z45	Subunit 4	
Z46	Subunit 5	
Z47	Subunit 6	
Z48	Subunit 7	

FB0462.VSD

In situations where some subunits are turned on after the main unit, by checking the Module Recognition special registers, a program can perform initialization setup of an advanced function module installed in a subunit without waiting for the entire system to be powered up.

Sample Program:

This sample program copies the Module Recognition special register for subunit 1 to an internal relay, and performs initialization of the module installed in slot 1 after it is recognized as accessible.



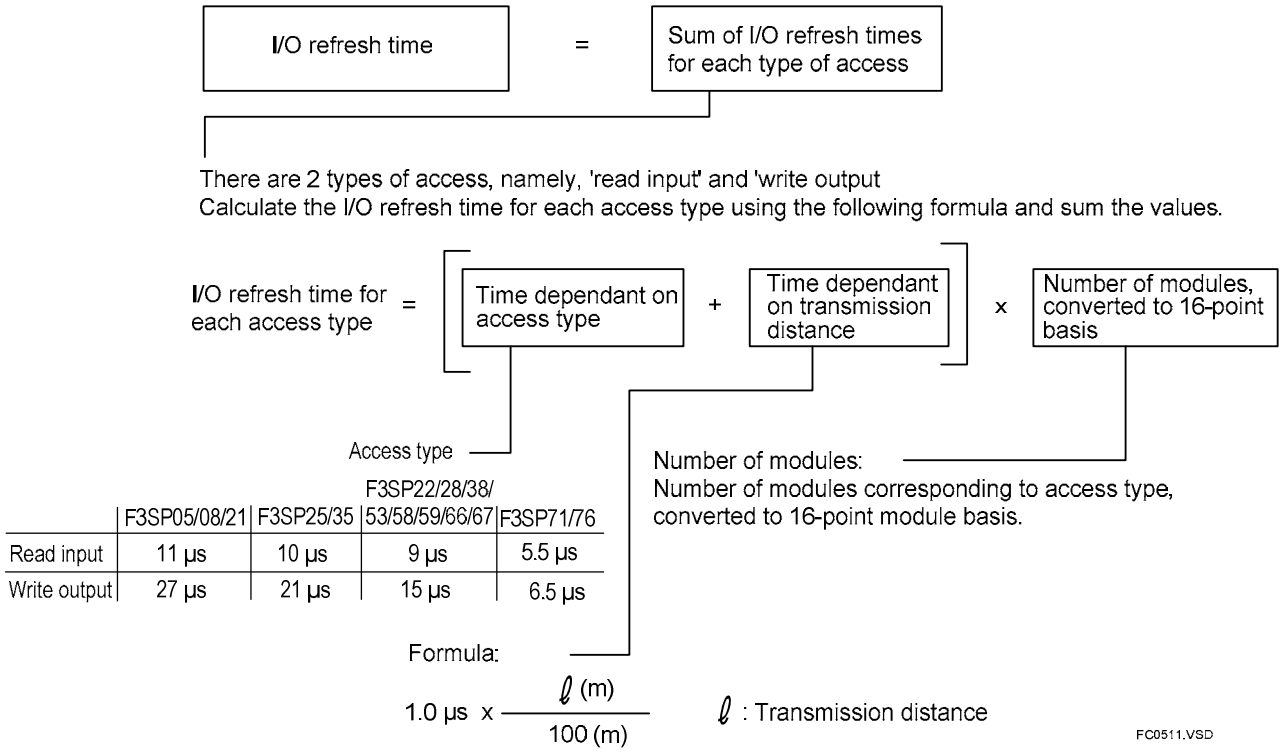
FB0463.VSD

Figure C4.8 Sample Program Illustrating the Use of the Module Recognition Special Registers

C5. I/O Refresh Time

C5.1 Estimating I/O Refresh Time

Calculate the I/O refresh time separately for each port of the main unit.
For details, refer to the following example.



	F3SP05/08/21	F3SP25/35	F3SP22/28/38/ 53/58/59/66/67	F3SP71/76
Read input	11 µs	10 µs	9 µs	5.5 µs
Write output	27 µs	21 µs	15 µs	6.5 µs

C5.2 Example of I/O Refresh Time Calculation

This example calculates the I/O refresh time for the following system configuration.

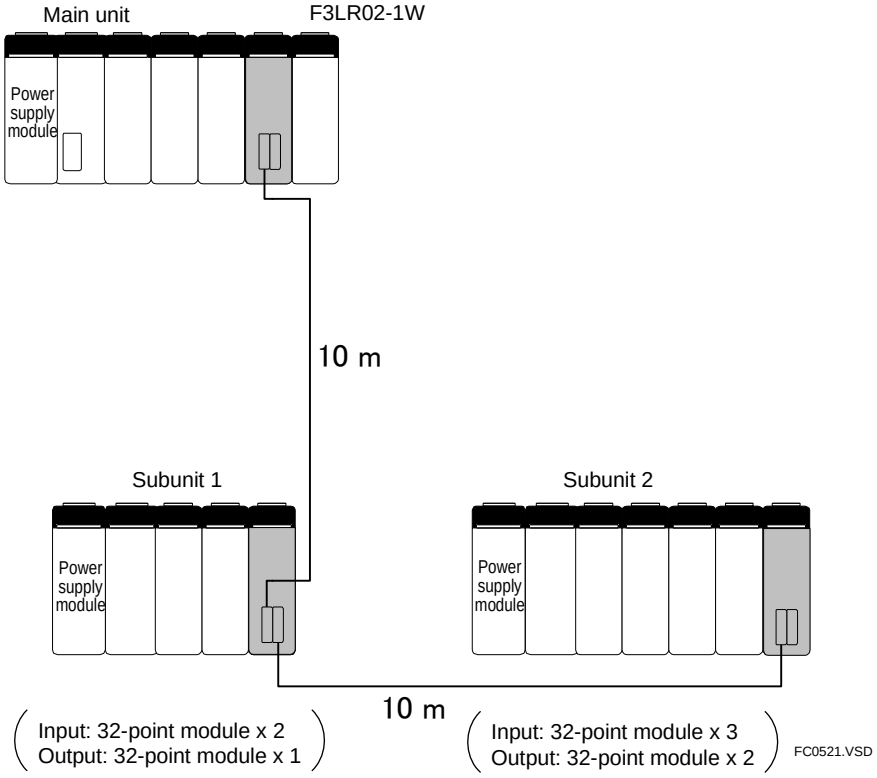


Figure C5.1 An Example of I/O Refresh Time Calculation (for F3SP22/28/38/53/58/59/66/67)

Step 1 Calculate the 'time dependant on transmission distance'

$$\cdot 1.0\,\mu s \times \frac{(10+10)\ (m)}{100\ (m)} = 0.2\,\mu s$$

Step 2 Calculate the 'number of modules, converted to 16-point basis'

- Read Input = 32 points × 5 → 2×5 = 10
- Write Output = 32 points × 3 → 2×3 = 6

Step 3 Calculate the total time

$$\text{Read input access} = (9\,\mu s + 0.2\,\mu s) \times 10 = 92\,\mu s$$

$$\text{Write output access} = (15\,\mu s + 0.2\,\mu s) \times 6 = 91.2\,\mu s \quad (+$$

$$\text{I/O Refresh Time} = 183.2\,\mu s$$

C6. RAS Functions of FA-bus Type 2

C6.1 System Operation with Transmission Channel Error

C6.1.1 Run or Stop System

You can set the module to either stop the system or continue operation when a transmission channel error occurs in an FA-bus Type 2 system.

C6.1.2 Causes of Transmission Channel Errors

A transmission channel error of an FA-bus Type 2 system may be due to the following two reasons:
(1) Transmission cable fault
(2) Power interruption of subunit (after recognition by the system earlier)

C6.1.3 Defining System Operation (Run or Stop) in the Event of a Transmission Channel Error

System operation in the event of a transmission channel error is determined by the [I/O Module Error] setting and the [Subunit Communication Error] setting under Operation Control in the CPU module's configuration.

Table C6.1 System Behavior Setup

System Behavior	Operation Control in the CPU Module's Configuration	
	I/O Module Error	Subunit Communication Error
System operation continues	Run	Run (default)
System stops	Stop (default)	Stop
See Also	C6.3.3	C6.3.3

C6.1.4 Loop Switching

In a loop configuration, when an error is detected in a transmission channel, the system can automatically change the transmission channel configuration so as to allow normal system operation to continue. This function is known as loop switching. To enable this function, setup the module to continue operation in the event of a communication error and turn off the Shutdown Output function.

A loop configuration secures two transmission loops: a primary loop and a secondary (standby) loop. The primary loop is normally used for communications. However, the system switches transmission loops as shown below to secure a transmission channel if any of the following 2 events occur. (1) Cable discontinuity in the primary loop (or secondary loop) (i.e. one of the two loops is normal); or (2) Cable discontinuity in both the primary and secondary loops (including power interruption to a subunit).

(1) Cable discontinuity in the primary loop (or secondary loop)

In the event of cable discontinuity in either the primary loop or the secondary loop, the system automatically switches to the loop with no cable discontinuity to secure a transmission channel with no loss of data.*1

(2) Cable discontinuity in both primary and secondary loops

In the event of cable discontinuity in both the primary and secondary loops, the system automatically switches from a loop configuration to two daisy-chains to secure a transmission channel.*2

*1: When using F3SP05/08/21/25/35 Rev.8 or later, or F3SP28, F3SP38, F3SP53, F3SP58 F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76.

*2: (1) Migration from a loop configuration to a daisy-chain configuration involves data loss.
In situations where the system continues operation, check the Subunit Line Switchover special register and handle any loss of data accordingly.
(2) System operation after switching depends on the setting of switch SW1 located on the side of the module and the configuration setup.

To enable loop switching, perform the following setup.

Table C6.2 Loop Switching

	Operation Control in the CPU Module's Configuration Setup		Condition Switches of F3LR02 Module	
	I/O Module Error	**Subunit Communication Error**	**SW1**	**SW3**
	Run	Run (default)	OFF	ON
See Also	C6.3.3	C6.3.3	C4.2.2	C4.2.4

CAUTION

- For F3BP□□, when the system switches to the secondary loop in the event of a cable discontinuity in the primary loop, and when the system switches to 2 daisy-chains in the event of cable discontinuity in both the primary and secondary loops, accessing the subunit may cause an error. In such situations, you should include program codes for retry processing.
- When the system switches from a loop configuration to two daisy chains due to cable discontinuity or subunit power interruption, take note of the following phenomena.
  - Replacing a cable or switching on the subunit again in online mode may cause an I/O error. Hence, always do so in offline mode (i.e., when the main unit and all subunits are switched off).
  - If cable discontinuity happens again, the transmission loop switching function may not work. Furthermore, output states (reset or hold) are not assured.

The figure below shows an example of channel migration when an error occurs. The bold line indicate the active line after migration.

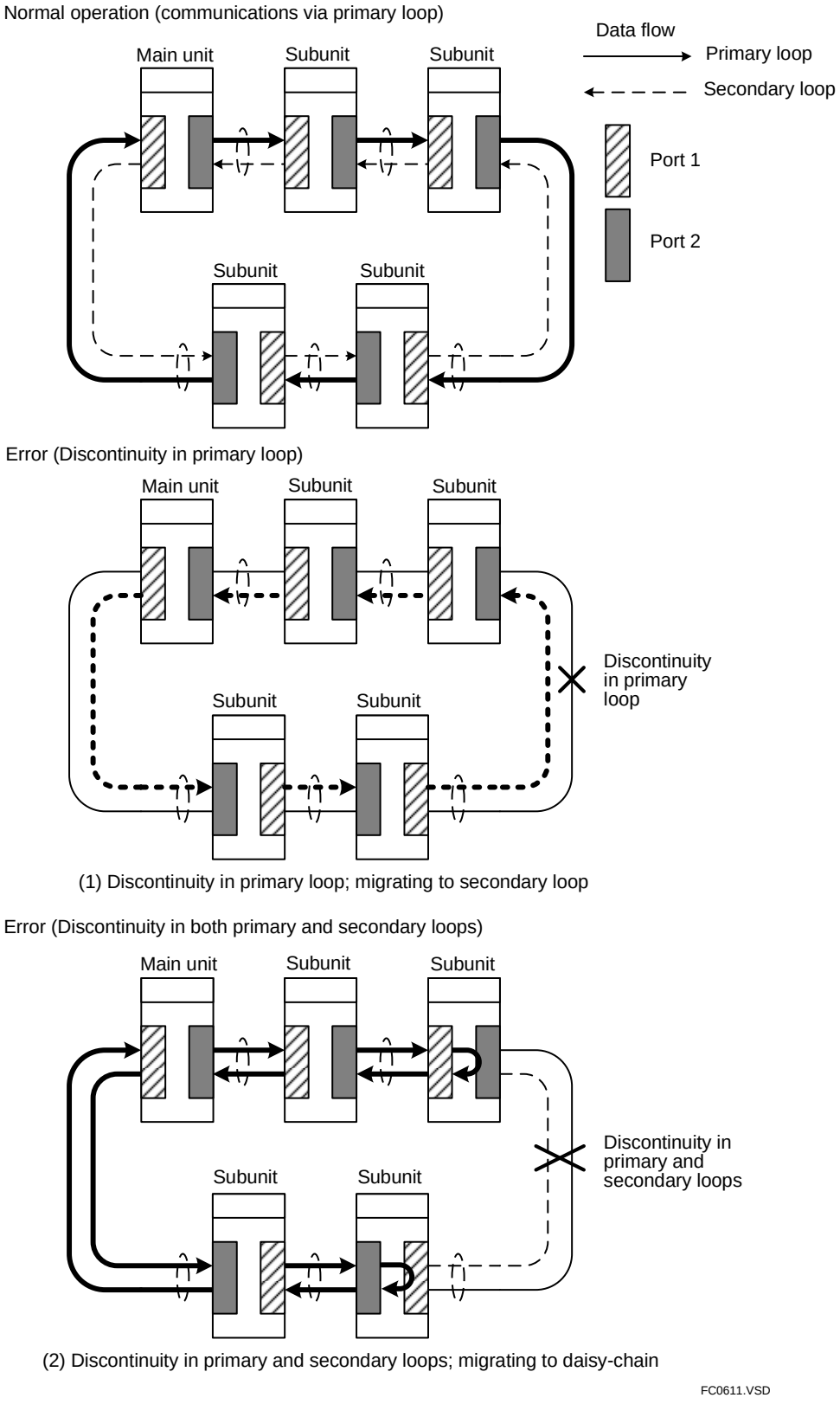


Figure C6.1 Loop Switching

C6.1.5 Transmission Channel Loop-back Function

When a transmission channel error occurs in a daisy-chain configuration, the channel loop-back function automatically isolates the inaccessible subunit and continues system operation. To enable this function, setup the system to continue operation in the event of a transmission channel error. Alternatively, you can setup to stop system operation in the event of a transmission channel error.

When a transmission channel error occurs in a daisy-chain configuration, the loop-back function automatically cuts off the unreachable stations so that the station immediately preceding the point of discontinuity now becomes the terminal station and communications can continue. For this function to work properly, the cables must be correctly connected.

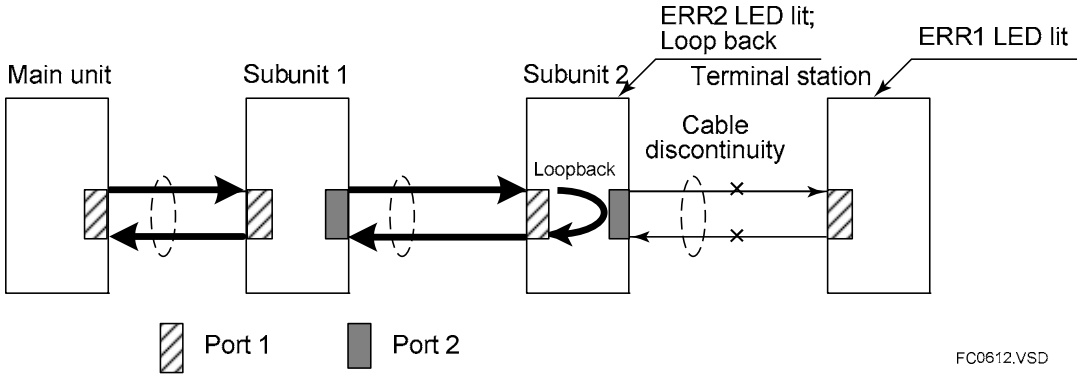


Figure C6.2 Transmission Channel Loop-back Function

To enable the transmission channel loop-back function, perform the following setup.

Table C6.3 Transmission Channel Loop-back Setup

	Operation Control in the CPU Module's Configuration		Condition Switches of the F3LR02	
	I/O Module Error	**Subunit Communication Error**	**SW1**	**SW3**
	Run	Run (default)	OFF	OFF (default)
See Also	C6.3.3	C6.3.3	C4.2.2	C4.2.4

C6.2 Shutdown Output on Transmission Channel Error Function

C6.2.1 Overview of Shutdown Output Function

The FA-bus Type 2 module is equipped with a function, which shuts down the output of the I/O module of a subunit when a transmission channel error occurs.

This function prevents an error in the FA-bus type 2 from affecting the entire system or resulting in hazardous or unstable system operation.

For instance, when a cable discontinuity occurs, the module detects a transmission channel error and immediately turns off the output signals of each I/O module on the subunit to minimize risks.

A transmission channel error that occurs at a subunit can be propagated to other subunits to shut down their I/O modules connected to the channel.

The shutdown output on transmission channel error function is available only for configurations with one CPU module (not a multi-CPU system).

CAUTION

- This function is not available in a multi-CPU configuration.
- When using F3SP05, F3SP08, F3SP21, F3SP25 and F3SP35 CPU modules (Rev. 8 or later), this function is only available for output modules with 32 outputs or less.
- When using CPU modules F3SP28, F3SP38, F3SP53, F3SP58, F3SP59, F3SP66, F3SP67, F3SP71 or F3SP76, this function is available for output modules with 32 outputs or less, as well as F3YD64-1F, F3WD64-3F, F3WD64-4F, and F3YD64-1P.
- Do not enable the Shutdown Output function in a loop configuration.

C6.2.2 Shutdown Output Function Setup

Table C6.4 Shutdown Output Setup

	SW1 Condition Switch of F3LR02	**[Output When Stopped] setting in DIO Setup of CPU Module's Configuration**
To shutdown output	ON (Shutdown) (default)	Reset (default)
To hold output[*1]	OFF (Hold)	Hold
See Also	C4.2.2	C6.3.3

*1: Continues operation if a transmission channel is secured and system operation is to be continued.

TIP

If the module has its Shutdown Output function (Condition Switch No. 1) set to ON, it treats a transmission channel error due to, say, a broken cable or a powered-off intermediate station as a major failure of the sequence CPU module. Thus, if a transmission channel error occurs with Condition Switch No. 1 set to ON, the output is either shut down or held according to the DIO Setup ("Reset" or "Hold") of the CPU configuration.

Table C6.5 shows the operation of the output modules and FAIL signal contact for different setup configurations and transmission channel error locations. In the table, subunit A, subunit B, and subunit C are defined as follows:

Subunit A: A subunit that is nearer to the main unit than the location of a channel error so that sending to and receiving from the main unit are still available through the transmission channel between the subunit and main unit

Subunit B: A subunit that is further from the main unit than the location of a channel error where receiving from the main unit is still available through the transmission channel between the subunit and main unit

Subunit C: A subunit that is further from the main unit than the location of a channel error where only sending to the main unit is available or neither sending to nor receiving from the main unit is available through the transmission channel between the subunit and main unit

Table C6.5 Operation of the Output Modules and FAIL Signal Contact for Different Setup Configurations and Channel Error Locations

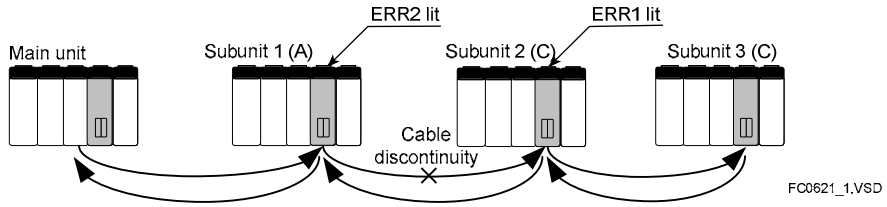
(Condition: [I/O Module Error] in Operation Control of the configuration setup is set to Run.)

Station	Condition Switches of F3LR02	Configuration Setup		Operation of Output Module	Operation of FAIL Signal Contact	
	Shutdown Output on Communication Error Switch	[Output When Stopped] of DIO Setup	Run/Stop Setting for [Subunit Communication Error] in Operation Control		FAIL1	FAIL2
Main unit	OFF	Reset	Stop	Shutdown	Shorted	Open
			Run	Continue operation	Open	Shorted
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Open	Shorted
Subunit A	ON (Shutdown)	Reset	Stop	Shutdown	Shorted	Open
			Run	Shutdown	Shorted	Open
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Shorted	Open
	OFF (Hold)	Reset	Stop	Shutdown	Shorted	Open
			Run	Continue operation	Open	Shorted
		Hold	Stop	Hold	Shorted*1	Open*1
			Run	Continue operation	Open	Shorted
Subunit B	ON (Shutdown)	Reset	Stop	Shutdown	Shorted	Open
			Run	Shutdown	Shorted	Open
		Hold	Stop	Hold	Shorted	Open
			Run	Continue operation	Shorted	Open
	OFF (Hold)	Reset	Stop	Shutdown	Shorted	Open
			Run	Continue operation	Open	Shorted
		Hold	Stop	Hold	Shorted*1	Open*1
			Run	Continue operation	Open	Shorted
Subunit C	ON (Shutdown)	Reset	Stop	Shutdown	Shorted	Open
			Run	Shutdown	Shorted	Open
		Hold	Stop	Hold	Shorted	Open
			Run	Hold	Shorted	Open
	OFF (Hold)	Reset	Stop	Hold	Open	Shorted
			Run	Hold	Open	Shorted
		Hold	Stop	Hold	Open*1	Shorted*1
			Run	Hold	Open	Shorted

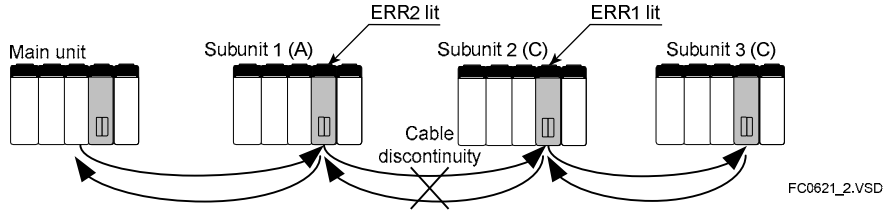
CAUTION

- When the Shutdown Output on Communication Error switch is set to OFF (hold), the operation of the FAIL signal contacts of a subunit depends on its location (either subunit A, B or C) relative to the location of a transmission channel error (as indicated by *1 in Table C6.5).
- If the FAIL signal contact of the power supply module is used to protect against program stop, always use the FAIL signal contact of the power supply module of the main unit. Measures to safeguard the system against program stop must be taken by hardware outside the PLC.

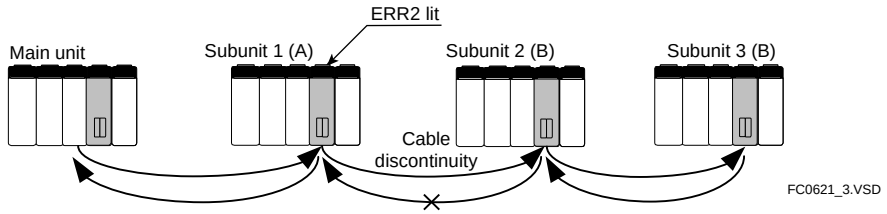
Example 1:



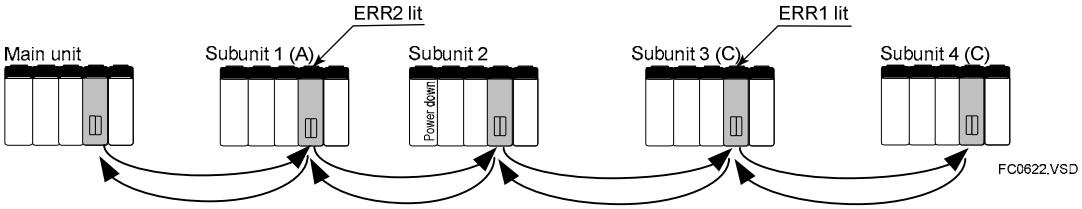
Example 2:



Example 3:



Example 4:



Example 5:

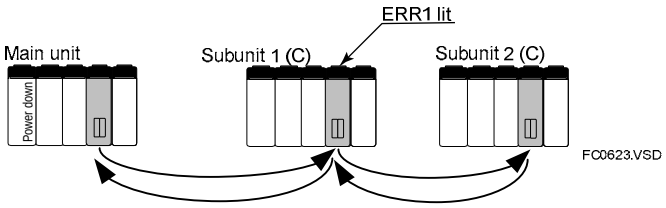


Figure C6.3 Operation of Output Module for Various Transmission Channel Error Locations

C6.3 Procedure for Setting Condition Switches

To enable the Shutdown Output on Transmission Channel Error function, use the following procedure.

C6.3.1 Setting Condition Switches

● Setting the Condition Switches Located on the Right Side of the Module

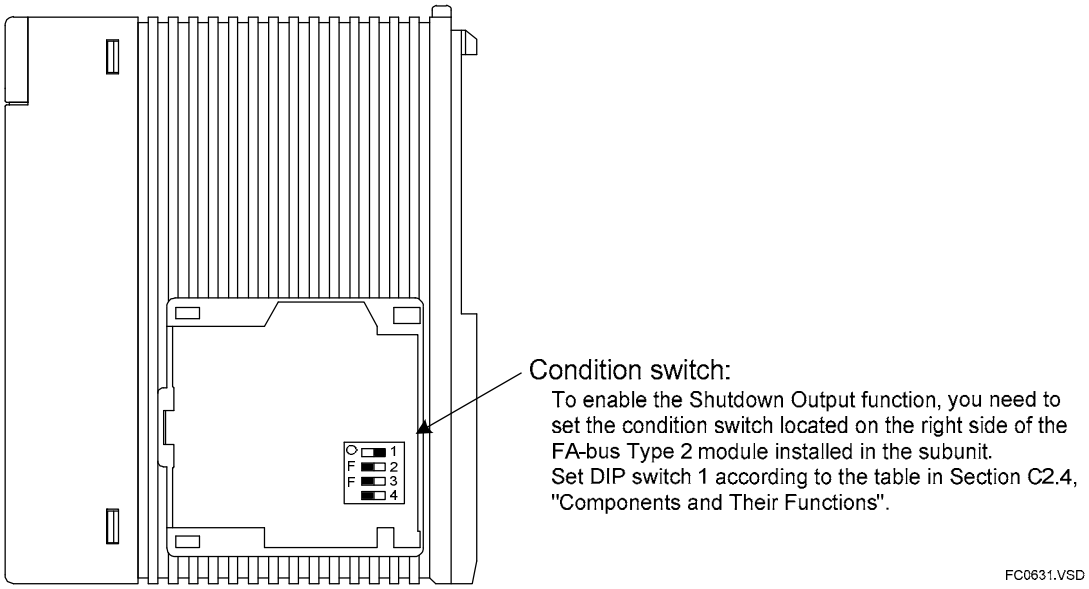


Figure C6.4 Condition Switches Located on the Right Side of the Module

C6.3.2 DIO Setup in CPU Configuration

● How to Perform DIO Setup using WideField3

To perform DIO Setup using WideField3, use the following procedure.

1. Select [Project]–[Configuration] from the WideField3 menu.
2. Select the DIO Setup tab from the Configuration dialog box.
3. Double-click the field for the slot for which you wish to perform setup in the DIO Setup window. The DIO Setup window for the slot opens. Set the [Output when Stopped] field corresponding to the terminal number to [Reset] or [Hold].

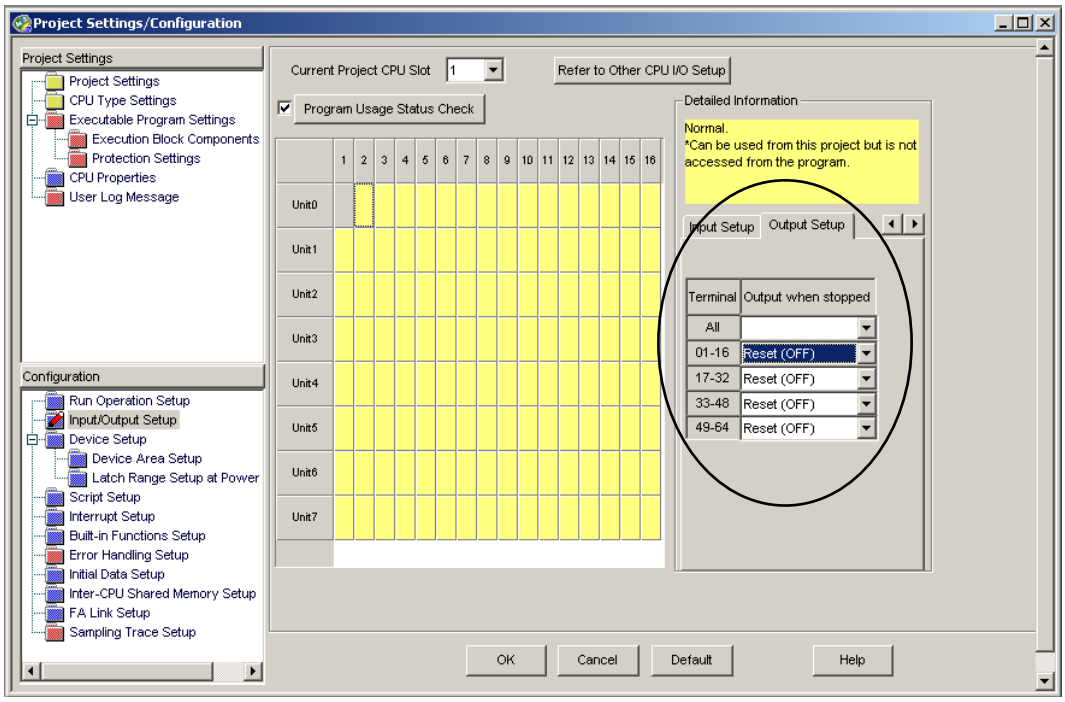


Figure C6.5 Setting I/O Conditions using WideField3

For details on WideField2 and its operation, see “FA-M3 Programming Tool WideField2 User’s Manual” (IM34M06Q15-01E).

● How to Perform DIO Setup using BASIC (F3BP□□)

Use a CONTROL statement to select whether to reset or hold the output of an output module.

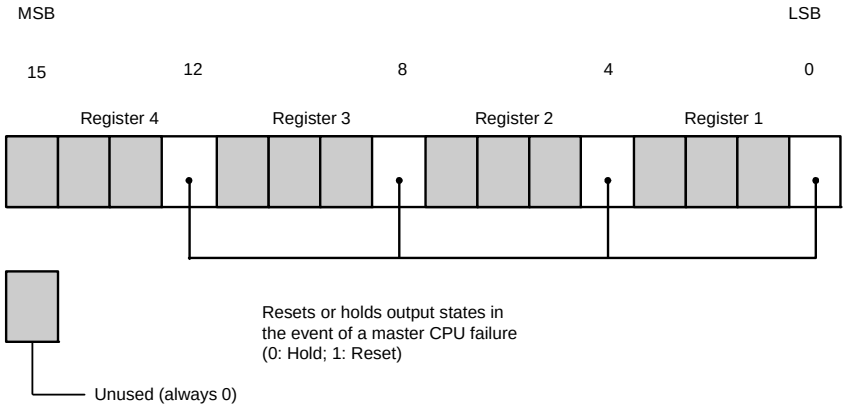
On 16-point and 32-point modules, the setup is made to the control registers in groups of 8 terminals.

The statement syntax is given below.

Table C6.6 CONTROL Statement Syntax

Syntax	CONTROL m, 1 ; I m : Slot number or numerical expression I : Data, integer or integer variable

Content of Control Register



Register 4 : terminals 25 to 32
Register 3 : terminals 17 to 24
Register 2 : terminals 9 to 16
Register 1 : terminals 1 to 8

- The control register is reset to all zeroes at startup.

Example	CONTROL 206, 1 ; $ 0010 : for the output module installed in slot 206, resets the states of terminals 9 to 16 and holds the states of the remaining terminals in the event of a master CPU failure.

FB0633.VSD

C6.3.3 Operation Control in CPU Configuration

● How to set up Operation Control using WideField3

To setup Operation Control using WideField3, use the following procedure.

1. Select [Project]–[Configuration] from the WideField3 menu.
2. Select the Operation Control tab from the Configuration dialog box.
3. On the Operation Control window, select [Run] or [Stop] for [I/O Module Error] and [Subunit Communication Error] in the [Error-Time Action] group.

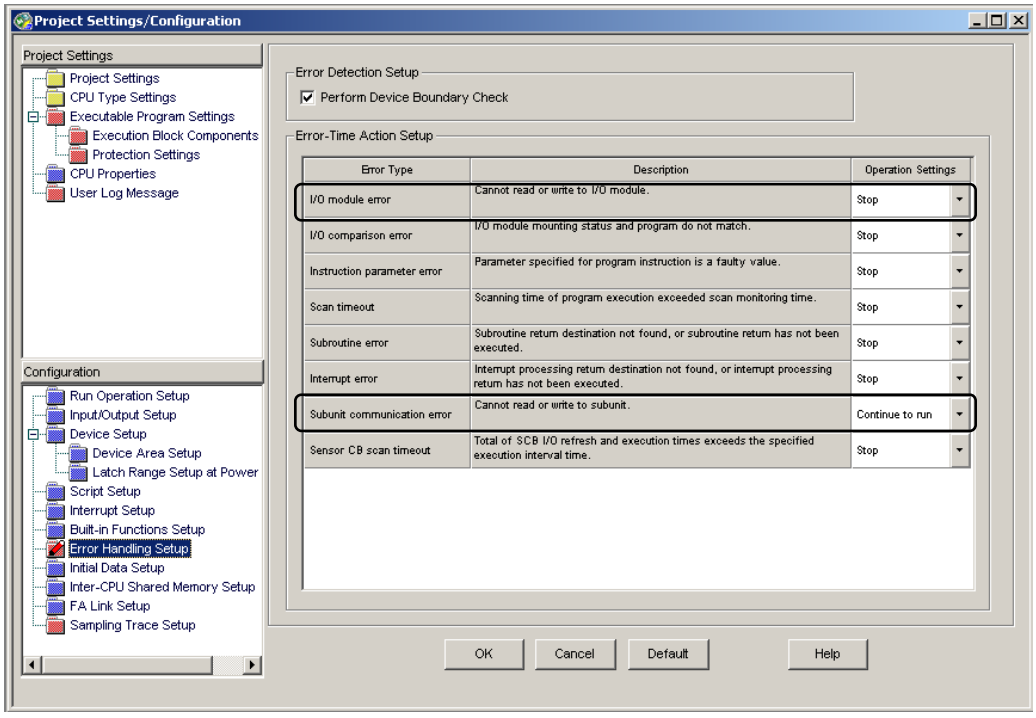


Figure C6.6 Operation Control Setup Using WideFied3

● How to set up Operation Control using BASIC (F3BP□□)

An I/O module error or subunit communications error generates an error in BASIC. Design your application program to handle such errors.

C6.4 Error Location Detection Function

C6.4.1 LED Display

When an error occurs with the FA-bus Type 2 module, or when a cable discontinuity occurs in a transmission channel, the error (ERR) LED or alarm (ALM) LED of the CPU module turns on to report the error.

Table C6.7 Status of CPU's LEDs

Status of CPU's LED	Condition Setting in Configuration		
	I/O Module Error	Conditional Operator	Subunit Communication Error
ALM lit	Run	AND	Run
ERR lit	Stop	OR	Stop

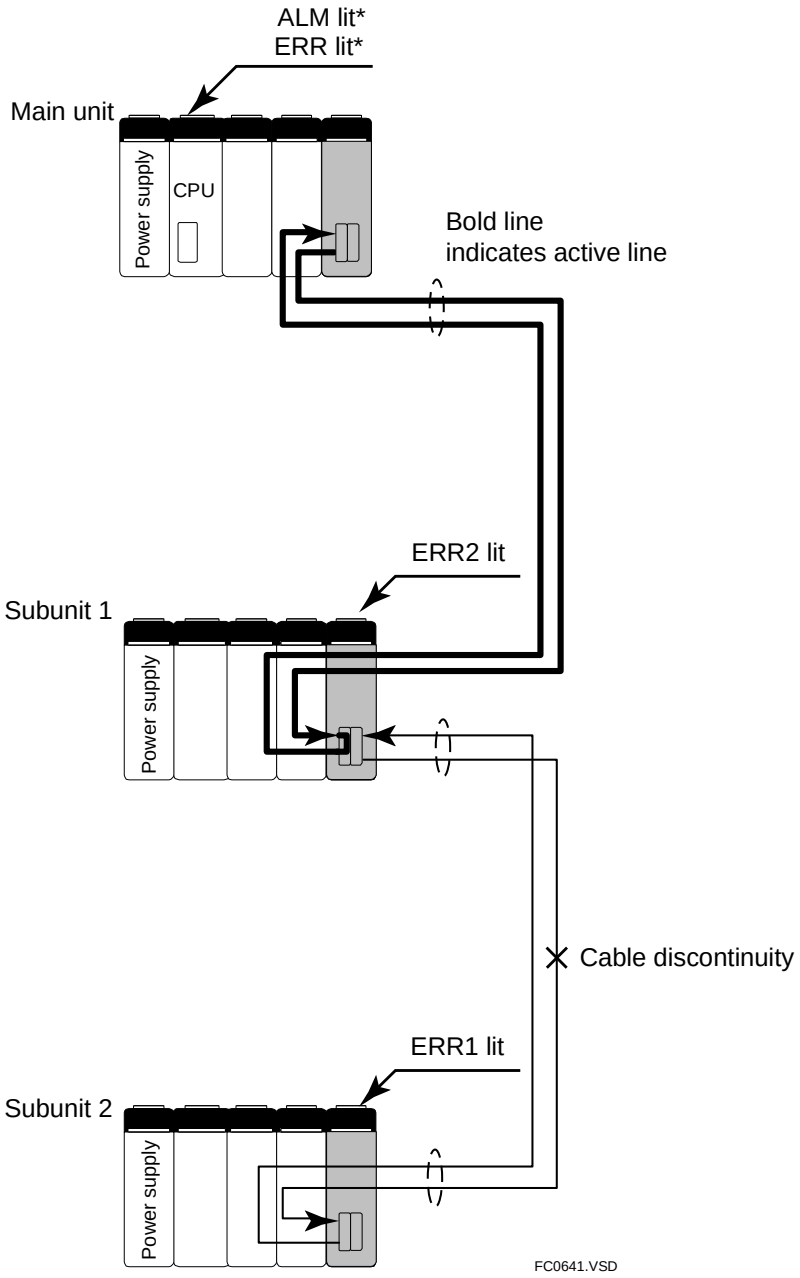
The LEDs of the CPU module turn on even if an error is generated in a module other than the FA-bus Type 2 module.

To decide whether the cause of a lit LED lies in the FA-bus Type 2 module, check the status of the RDY, ERR1 (port 1) and ERR2 (port 2) LEDs of the FA-bus Type 2 module mounted in each unit.

The following pages show the relationship between a transmission cable discontinuity and the status of the LEDs of the FA-bus Type 2 module. Bold lines in the figures indicate active lines.

In the loop configuration, a "subunit line switchover" message is logged by the system if transmission is automatically switched from the primary loop to the secondary loop due to a transmission cable discontinuity in the primary loop. In this case, the ALM LED is lit but the ERR LED is not lit and operation continues.

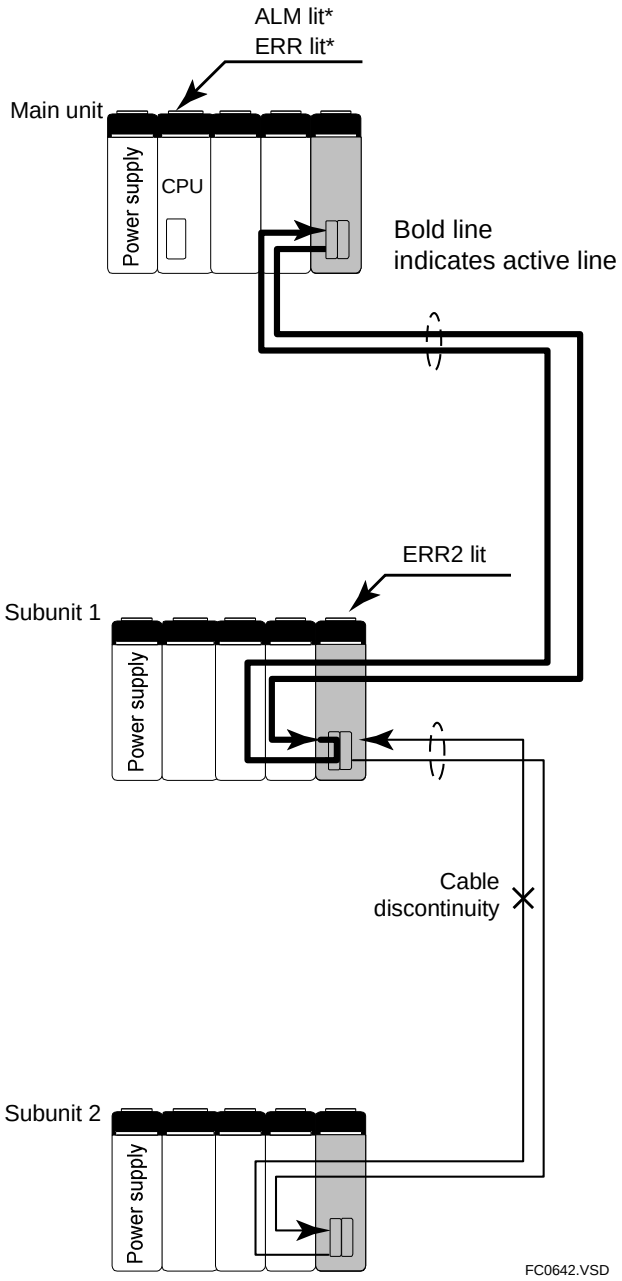
● Daisy-chain Configuration (Cable discontinuity example 1)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table C6.7, “Status of CPU’s LEDs”.

Figure C6.7 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (1)

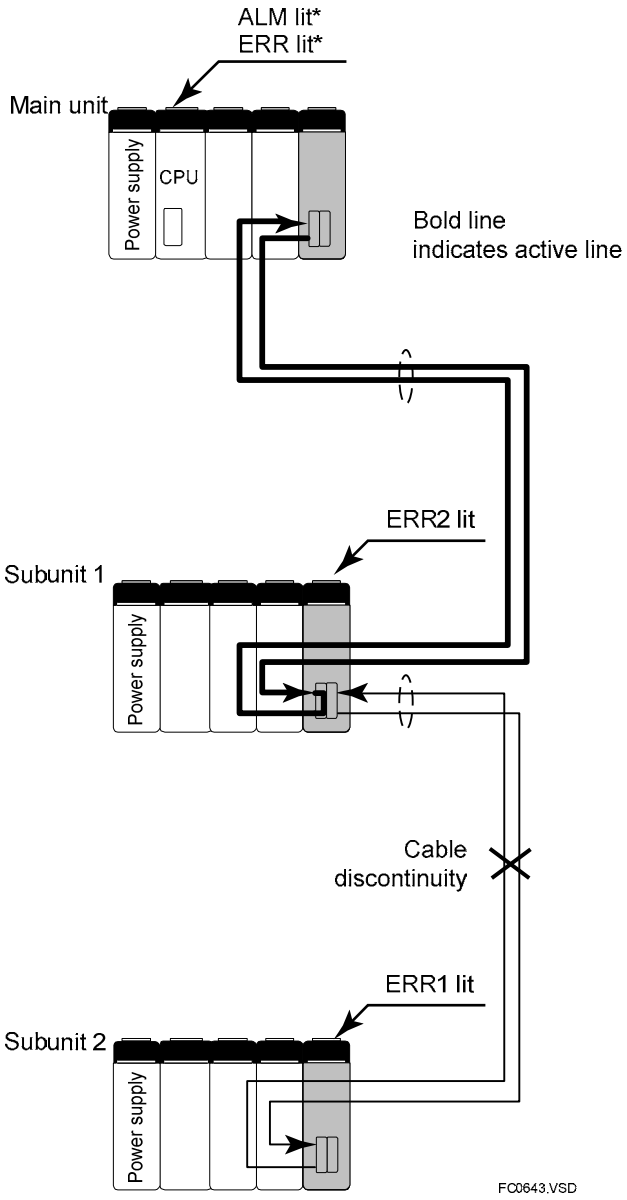
● Daisy-chain Configuration (Cable discontinuity example 2)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table C6.7, “Status of CPU’s LEDs”.

Figure C6.8 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (2)

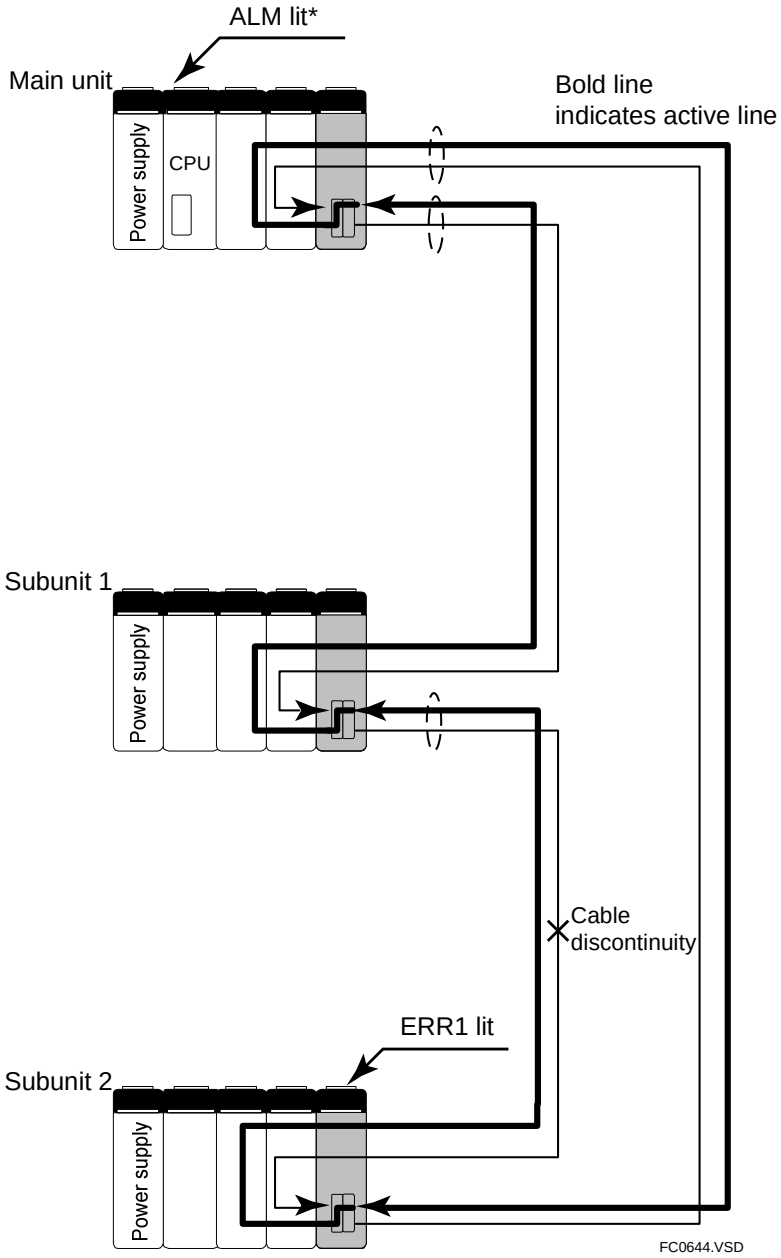
● Daisy-chain Configuration (Cable discontinuity example 3)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table C6.7, “Status of CPU’s LEDs”.

Figure C6.9 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (3)

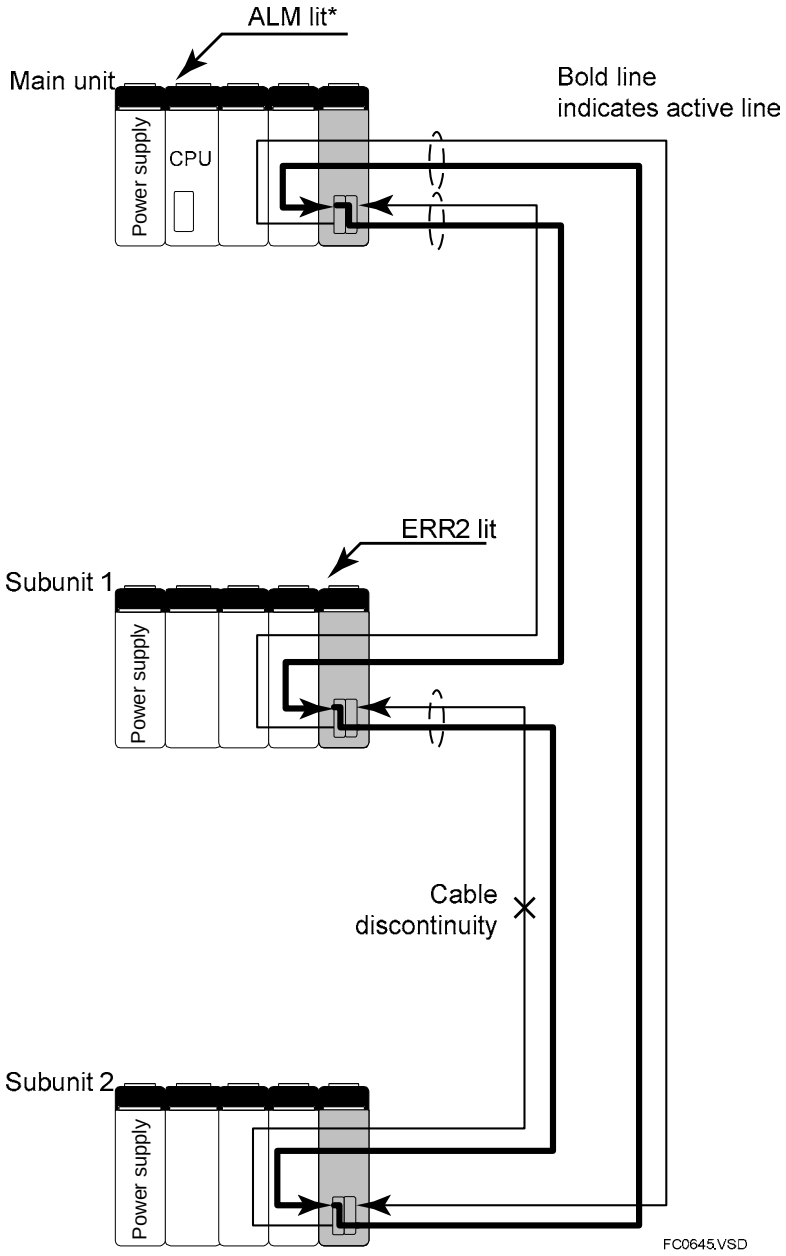
● Loop Configuration (Cable discontinuity example 1)



* A “subunit line switchover” alarm is output. The ALM LED is lit but the ERR LED is not lit and operation continues.

Figure C6.10 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (4)

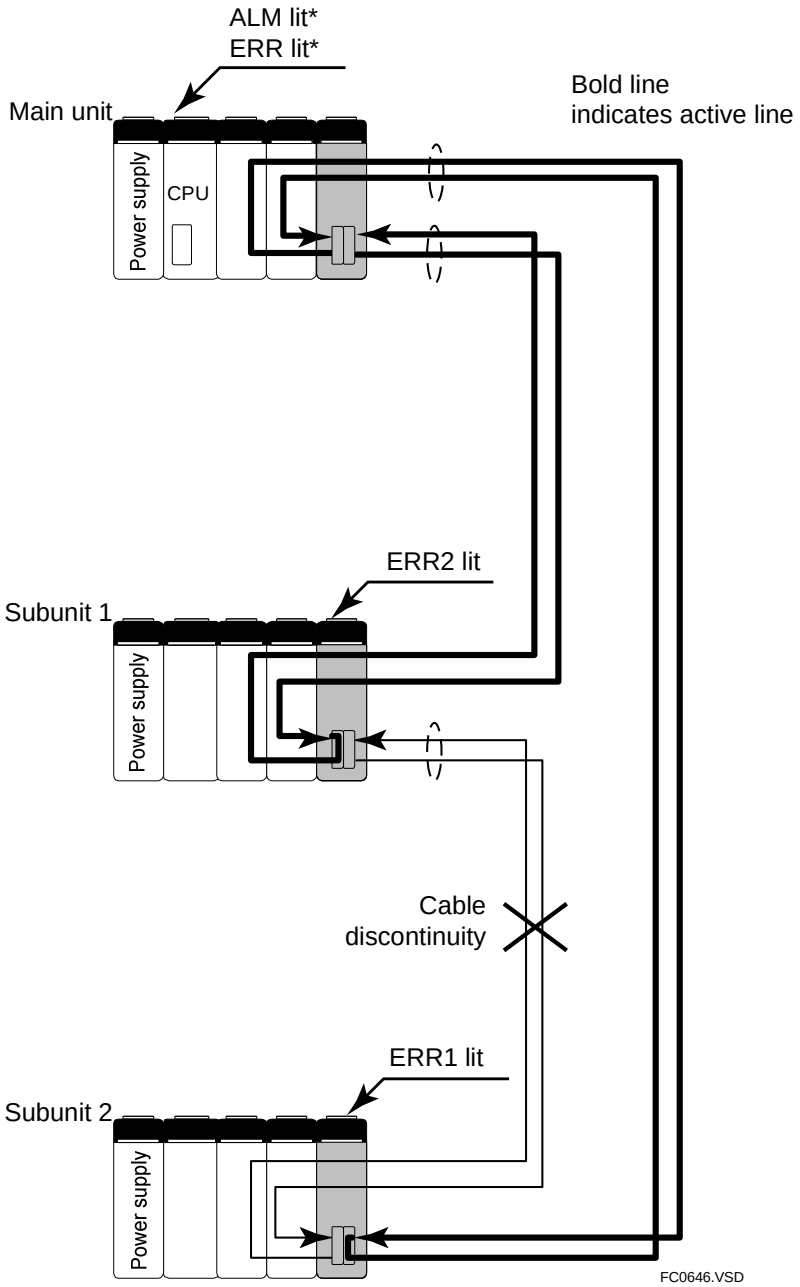
● Loop Configuration (Cable discontinuity example 2)



* A “subunit line switchover” alarm is output. The ALM LED is lit but the ERR LED is not lit and operation continues.

Figure C6.11 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (5)

● Loop Configuration (Cable discontinuity example 3)



* The statuses of the ERR and ALM LEDs depend on the configuration setup as shown in Table C6.7, “Status of CPU’s LEDs”.

Figure C6.12 Relationship between Transmission Cable Discontinuity Location and Status of LEDs (6)

C6.4.2 Logging of Transmission Channel Error Location*1

When an error occurs in a transmission channel, an error is logged and the FA-bus transmission channel error location notification is generated. There are two types of notification, namely, subunit communication error and subunit line switchover.

(1) Subunit communication error

This is an error caused by a transmission channel error or power interruption to a subunit. Some or all subunits become inaccessible for reading and writing.

(2) Subunit line switchover

This is a state whereby communications has switched from the primary loop to the secondary loop due to discontinuity in one of the two wires of a transmission cable. The subunits remain accessible. The program continues execution with the ALM LED lit.

*1: Can be used with F3SP05/08/21/25/35 (Rev. 8 or later), F3SP28/38/53/58/59/66/67/71/76 and WideField3.

In this manual, when we say “a transmission channel error has occurred,” we mean either a “subunit communication error” or a “subunit line switchover”, as described above, has occurred.

● Special relays

The following special relays indicate the communication status of a subunit.

Table C6.8 Special Relays

Category	Usage	
Number	**Name**	**Description**
M66	Subunit transmission line normal	ON : Normal OFF : Channel not established*1 Channel error
M210	Subunit communication error	ON : Error*2 OFF : Channel not established*1 Channel normal
M211	Subunit line switchover	ON : Error*2 OFF : Channel not established*1 Channel normal

*1: Indicates that the channel has never been normal since powering on.

*2: Indicates that the channel was once normal but an error was encountered later.

● Special Registers

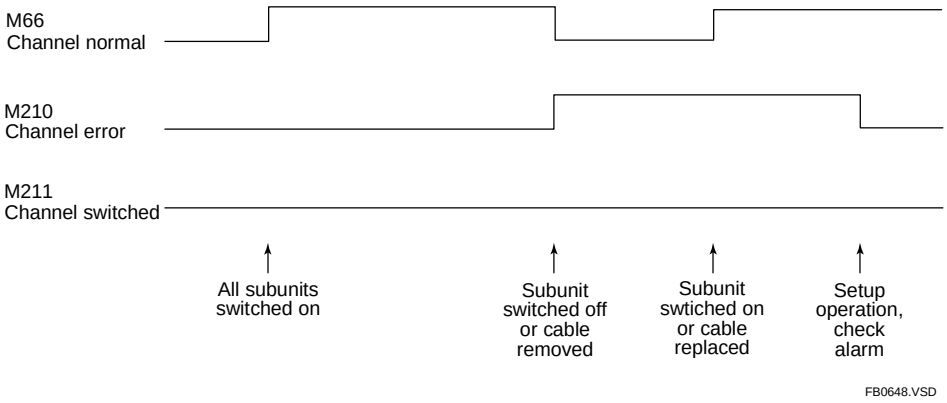
When a transmission channel error or alarm is detected by the FA-bus Type 2 module, these special registers indicate the slot where the module is installed.

Table C6.9 Special Registers

Category	Subunit Communication Error Special Register	
Number	**Name**	**Description**
Z89	Main unit	Slot number 16 ⋯ 9 8 7 6 5 4 3 2 1 0 ⋯ 0 0 0 1 0 0 0 0 0 FA-bus Type 2 module 0: Transmission channel normal Transmission channel not yet established 1: Transmission channel error
Z90	Subunit 1	
Z91	Subunit 2	
Z92	Subunit 3	
Z93	Subunit 4	
Z94	Subunit 5	
Z95	Subunit 6	
Z96	Subunit 7	

FC0647.VSD

On/Off timing of special relays when the power supply of a subunit is interrupted (cable is disconnected)



On/Off timing of special relays in the event of cable discontinuity in one of two cables in a cable pair

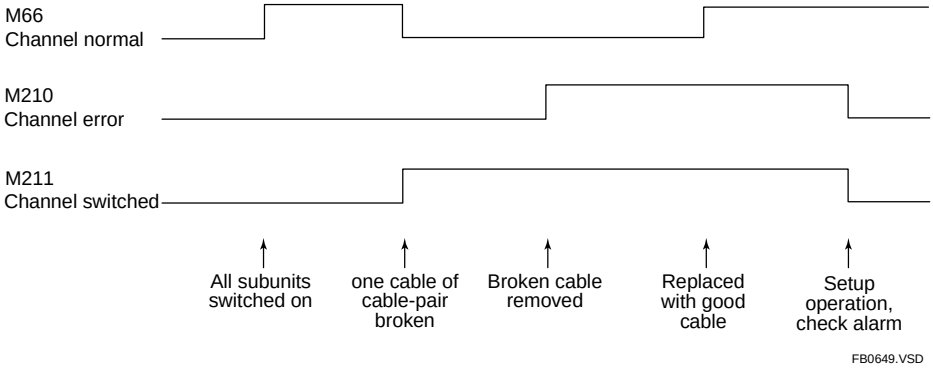


Figure C6.13 On/Off Timing of Special Relays

CAUTION

The above timing diagrams show the statuses of the special relays over time. In practice, cables should be disconnected and connected only when the system is offline. By offline, we mean the main unit and all subunits are switched off.

Example 1: System Log Display

A system log contains an entry only for the first transmission channel error detected after the program starts execution or after alarms are checked.

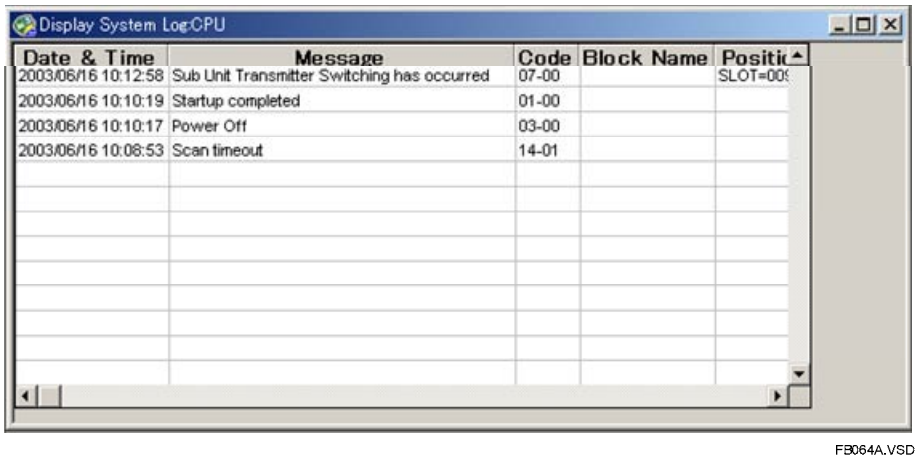


Figure C6.14 System Log Display

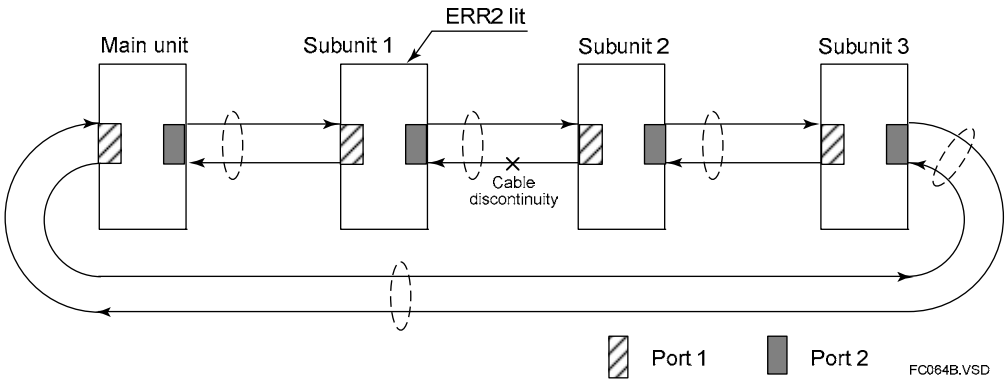


Figure C6.15 Example of Cable Discontinuity

CAUTION

A slot number displayed on the system log screen indicates the slot where the FA-bus Type 2 module is installed.

Example 2: Alarm Display

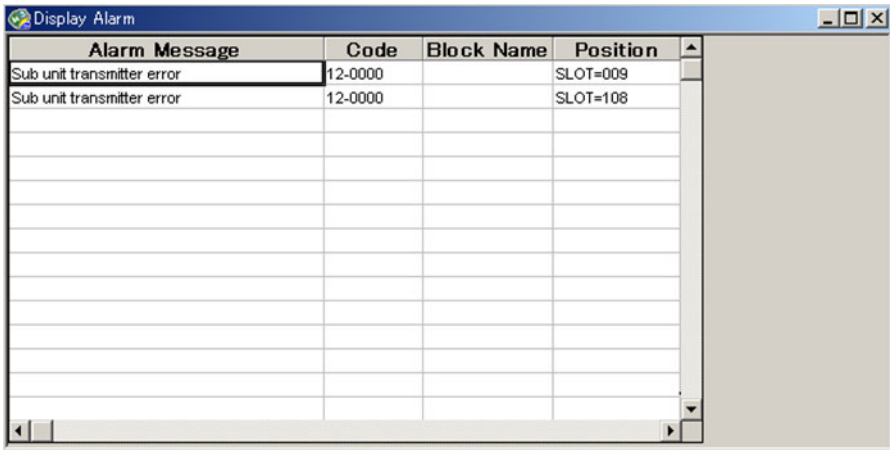


Figure C6.16 Alarm Display

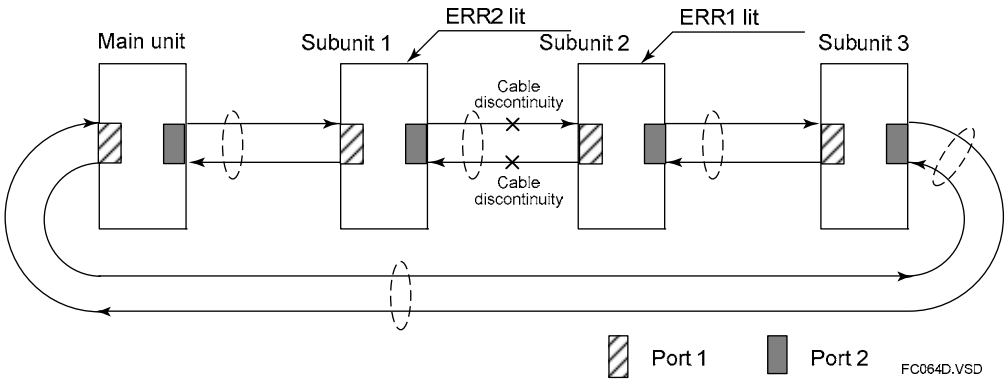


Figure C6.17 Example of Cable Discontinuity

CAUTION

A slot number displayed on the alarm display screen indicates the slot where the FA-bus Type 2 module is installed.

Example 3: System Log Display

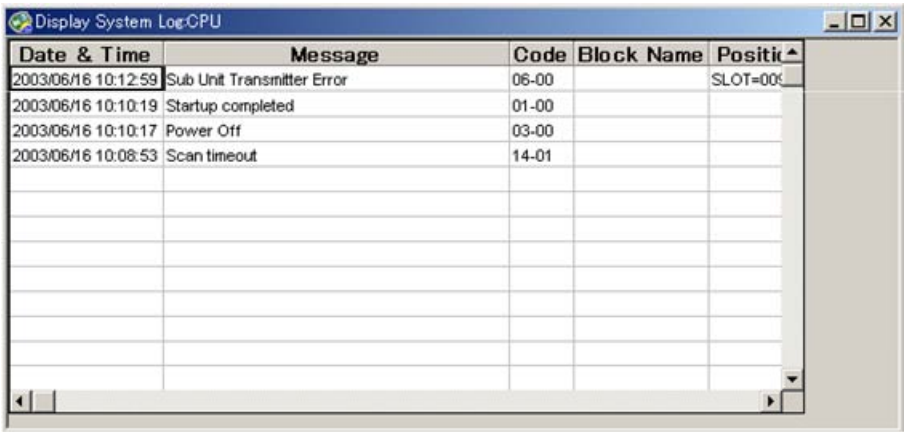
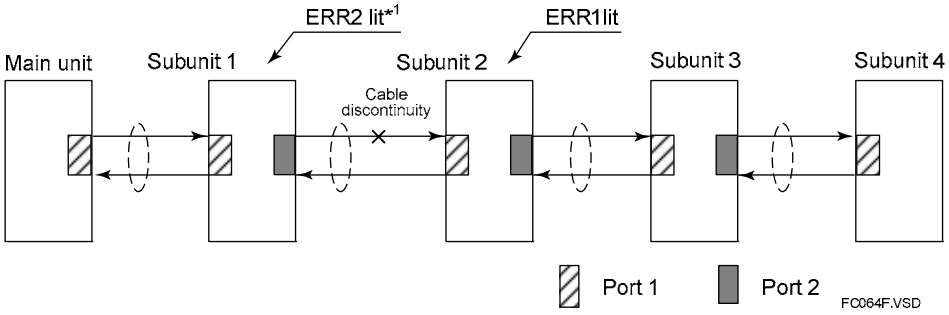


Figure C6.18 System Log Display



*1: ERR2 is lit when FA-bus Type 2 module of subunit 2 stops its output.

Figure C6.19 Example of Cable Discontinuity

CAUTION

A slot number displayed on the system log screen indicates the slot where the FA-bus Type 2 module is installed.

Blank Page

C7. Errors and Troubleshooting

C7.1 Troubleshooting Flowcharts

This section shows flowcharts that can be used for troubleshooting problems that may occur with the FA-bus Type 2 module during operation.

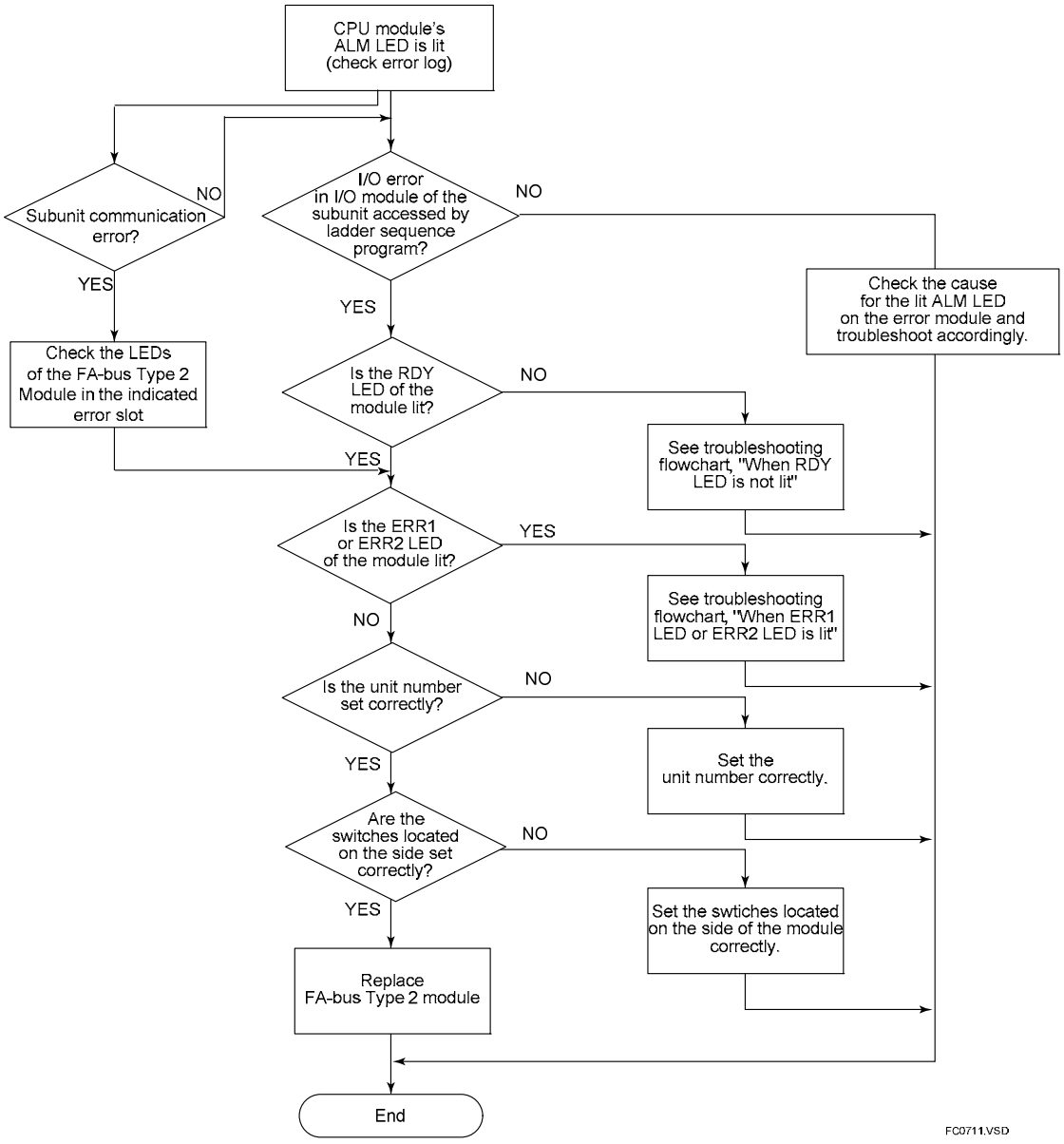


Figure C7.1 Troubleshooting Flowchart

C7.2 When RDY LED is Not Lit

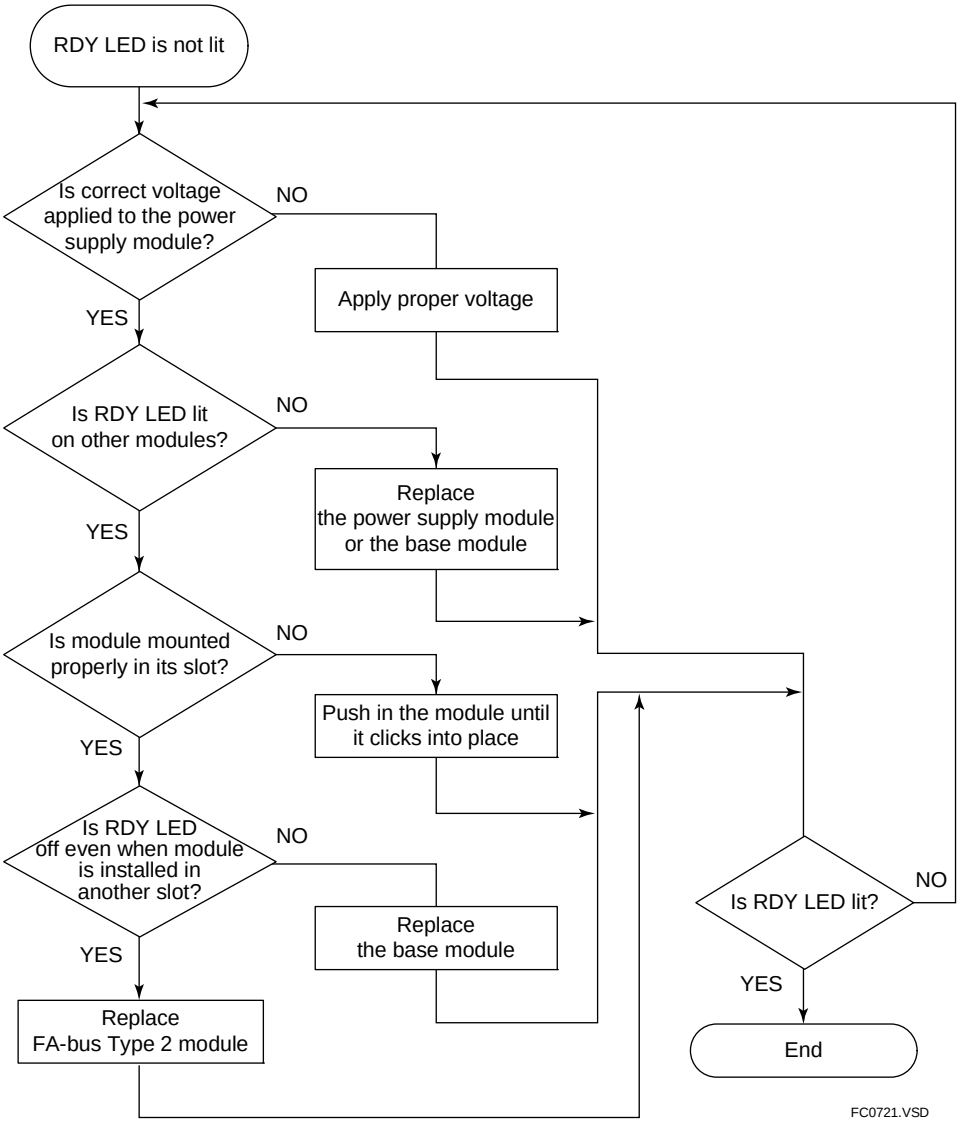


Figure C7.2 When RDY LED is Not Lit

C7.3 When ERR1 LED or ERR2 LED is Lit

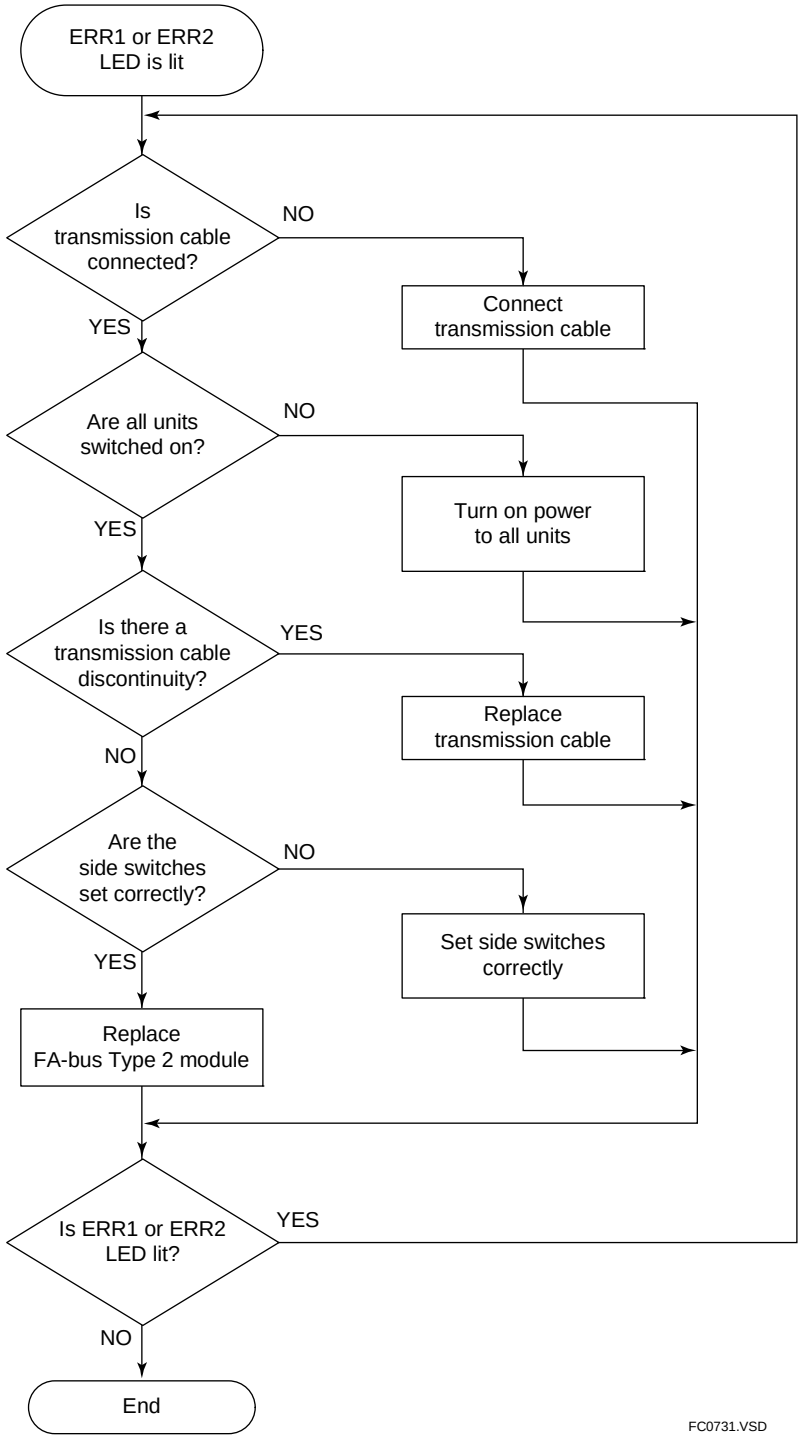


Figure C7.3 When ERR1 LED or ERR2 LED is Lit

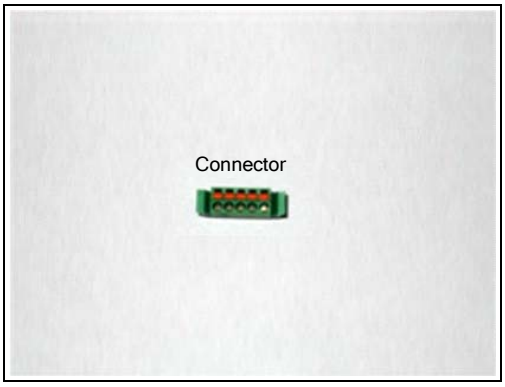
Blank Page

Appendix C: KM8☐ Cable Preparation

(1) Components and tools

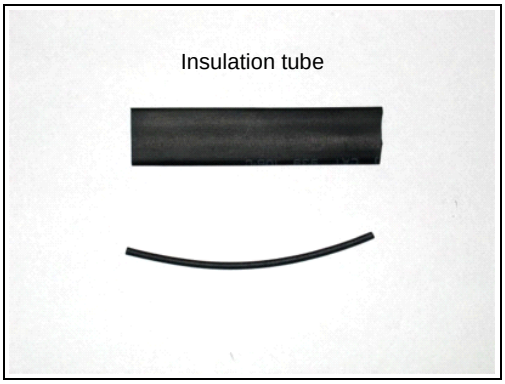
- Connector

Example:
Manufacturer: Phoenix Contact
Model: FMC 1,5/5-ST-3,5-RF
Applicable wire size: AGW16-24



- Insulation tube

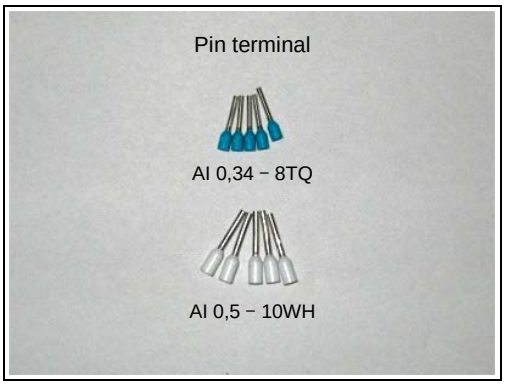
For cable insulation and drain insulation (example):
Approx. 8 mm diameter for fixed cable with 22 AWG drain, or
Approx. 11 mm diameter for flexible cable with 22 AWG drain



- Pin terminal

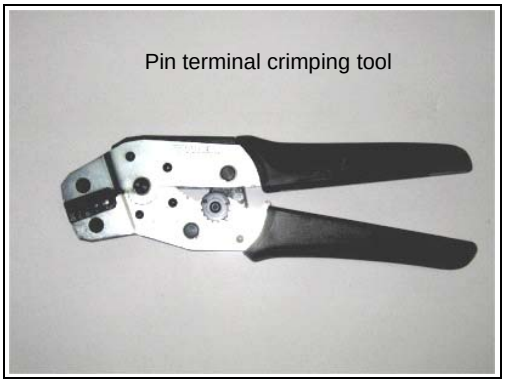
For fixed cable (example):
Manufacturer: Phoenix Contact
Model: AI 0,34 – 8 TQ

For flexible cable (example):
Manufacturer: Phoenix Contact
Model: AI 0,5 – 10 WH



- Pin terminal crimping tool

(Example)
Manufacturer: Phoenix Contact
Model: CRIMPFOX ZA3



- Wire stripper

(Example 1)
Manufacturer: Hozan Tool Industrial
Model: P-90-A (with green handle)

(Example 2)
Manufacturer: Vessel Co., Inc.
Model: 3000A or 3000C

Note: The picture shows wire stripper model P-911 with black handle from Hozan Tool Industrial. Model P-90-A has a green handle instead.

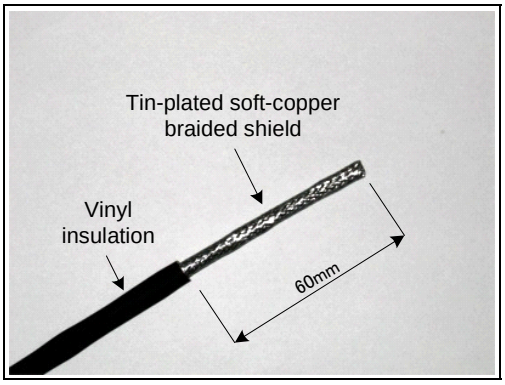
Wire stripper

CAUTION

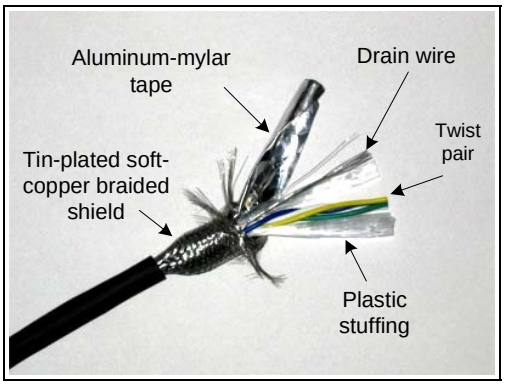
Always use a recommended wire stripper for the KM81 flexible cable. As its wires are fine copper strands, a significant number (or even half) of these strands may be inadvertently cut off during a stripping operation if a non-recommended wire stripper is used.

(2) Preparing a cable-connector set

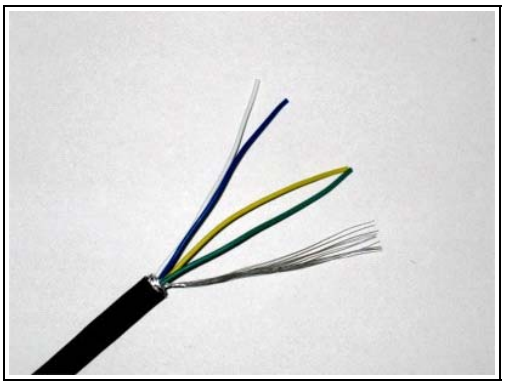
(1) Peel off about 60-mm length of outer vinyl insulation from the cable.



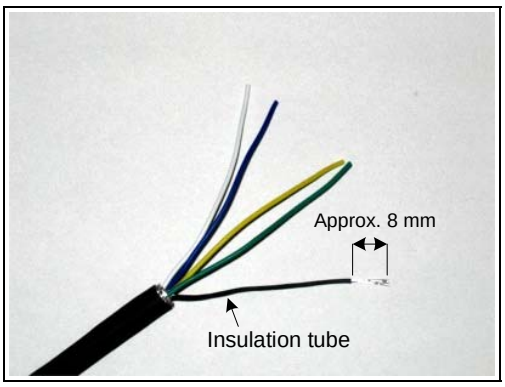
(2) Remove the exposed tin-plated soft-copper braided shield, aluminum-mylar tape, and plastic stuffing. Take care not to damage the exposed drain wire.



(3) Straighten the exposed twisted wires.

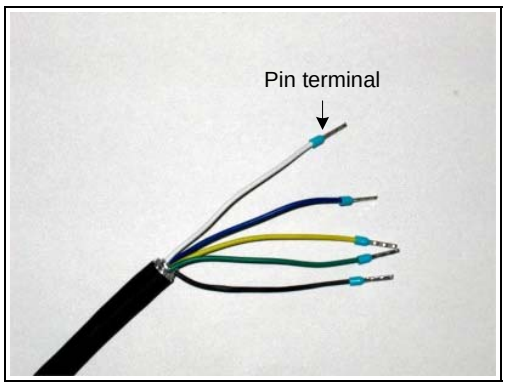


(4) Apply an insulation tube onto the drain wire and shrink the tube with a heat gun.

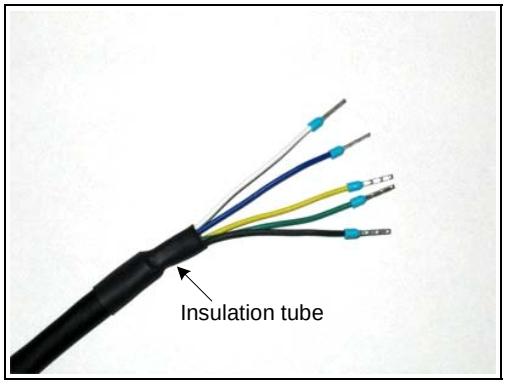


(5) Strip off a sufficient length of the insulation of each wire to allow good electrical contact with a pin terminal. Then put and crimp a pin terminal onto each wire using a crimping tool.

Check that the pin terminal size is compatible with the wire size. Check that each pin terminal is securely crimped to a wire.



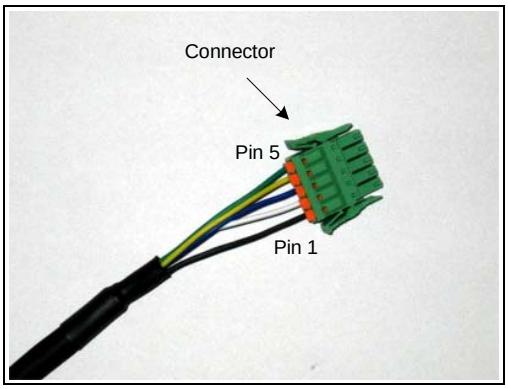
(6) Apply an insulation tube to the cable such that it partially covers both the cable insulation and the exposed wires. Then shrink the tube with a heat gun.



(7) Fully insert each pin terminal into the connector.
Ensure that each pin terminal is securely inserted in the connector.

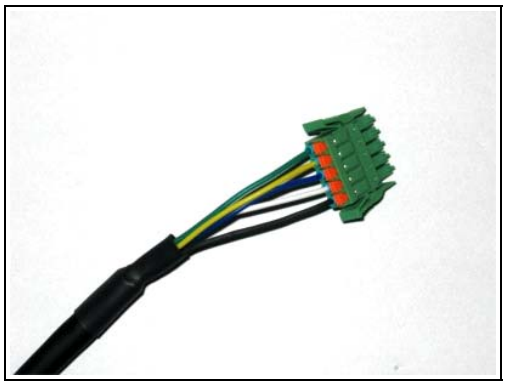
Pin No.	Signal Name (own station)	Wire Color (KM8□)	Signal Name (other station)	Pin No.
5	RxD−	Green	TxD−	3
4	RxD+	Yellow	TxD+	2
3	TxD−	Blue	RxD−	5
2	TxD+	White	RxD+	4
1	SHIELD	Drain	SHIELD	1

Note: The cable-connector set must become a cross-connection type.



(8) A connector-cable set is completed.

Note: Check the completed connector-cable set for any wrong connection, shorted circuit or open circuit using an ohmmeter or other appropriate instrument.



FA-M3

Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules

Part C: FA-bus Type 2 Module

IM 34M06H45-01E 5th Edition

INDEX

Blank Page

Revision Information

Document Name : Fiber-optic FA-bus, Fiber-optic FA-bus Type 2, FA-bus Type 2 Modules User's Manual
Document No. : IM 34M06H45-01E

Edition	Date	Revised Item
1st	Feb. 1999	New publication
2nd	July. 2003	Added text for new modules, KM65 fiber-optic cable WideField2 support; editorial corrections
3rd	Jan. 2008	F3SP66 and F3SP67 included in applicable CPU modules; data and editorial corrections
4th	June 2008	Added FA-bus Type 2 Module (F3LR02-1W).
5th	Jan. 2012	Added information for F3SP22, F3SP71 and F3SP76 CPU modules and WideField3; data and editorial corrections

Written by PLC Solution Department
IA Systems Business Headquarters
Yokogawa Electric Corporation
Published by Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750, JAPAN
Printed by Kohoku Publishing & Printing Inc.

Blank Page