User's Manual

FA-M3V VITESSE™

FA Link H Module

Fiber-optic FA Link H Module
Model: F3LP02-0N, F3LP12-0N

IM 34M06 H43-01E

Applicable Modules:

Model Code	Model Name
F3LP02-0N	FA Link H Module
F3LP12-0N	Fiber-optic FA Link H Module

YOKOGAWA
Yokogawa Electric Corporation

IM 34M06 H43-01E
6th Edition

Blank Page

Applicable Product

- **Range-free Controller FA-M3**

  - Model : F3LP02-0N
  - Name : FA Link H Module

  - Model : F3LP12-0N
  - Name : Fiber-optic FA Link H Module

The document number for this manual is given below.

Refer to the document number in all communications, including when purchasing additional copies of this manual.

- Document No.: IM 34M06H43-01E

Precautions

■ About This Manual

- This Manual should be passed on to the end user.
- This manual is an essential part of the product; keep it in a safe place for future reference.
- This product is designed to be used by a person with specialized knowledge.
- Before using the product, read this manual thoroughly to have a clear understanding of the product.
- 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 Symbols

- **”Handle with care.”** 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.

- **Protective Conductor Terminal**

  This terminal is to prevent electric shock. Before using the instrument, connect to the Protective earth (Comply with the regulation of each country.), and route the line through the shortest path possible.

- **Functional Earth Terminal**

  This terminal is for stable operation. 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

- Draws attention to information essential to prevent electrical shock or other dangers that may result in injury or the loss of life.

CAUTION

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

NOTE

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

■ Safety Precautions when Using/Maintaining the Product

- 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, shipboard equipment, 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.
- To avoid electrical shock, turn off the power before wiring.
- This product is classified as Class A for use in industrial environments. If used in a residential environment, it may cause electromagnetic interference (EMI).

  In such situations, it is the user's responsibility to adopt the necessary measures against EMI.

■ 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 use 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 that contain the software in a safe place.
- Reverse engineering, such as decompiling of the software, is strictly prohibited.
- Under absolutely no circumstances may the software supplied by Yokogawa Electric be transferred, exchanged, or sublet or leased, in part or as a whole, for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3 / e-RT3 Controller

● Set the product in a location that fulfills the following requirements:

- INDOOR USE ONLY
- This product is an open equipment. The product must be installed in a metallic panel enclosure with an impact rating IK08 or more.
- Where the product will not be exposed to direct sunlight, and where the operating surrounding air temperature is from 0°C to 55°C (32°F to 131°F).

  There are modules that must be used in an environment where the operating surrounding air temperature is in a range smaller than 0°C to 55°C (32°F to 131°F). Refer to “Hardware Manual” (IM 34M06C11-01E) or the applicable user's manual. In case of attaching such a module, the entire system's operating surrounding air temperature is limited to the module's individual operating surrounding air temperature.
- Where the relative humidity is from 10 to 90%.

  In places where there is a chance of condensation, use a space heater or the like to constantly keep the product warm and prevent condensation.
- For use in Pollution Degree 2 Environment.
- Where there are no corrosive or flammable gases.
- Where the product will not be exposed to mechanical vibration or shock that exceed specifications.
- Where there is no chance the product may be exposed to radioactivity.

● Use the correct types of wire for external wiring:

- USE COPPER CONDUCTORS ONLY.
- Use conductors with temperature rating above 75°C.

● 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. Refer to the “Hardware Manual” (IM 34M06C11-01E) or the applicable user's manual for the appropriate tightening torque.

● 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 / e-RT3 controller 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).

● Ground for low impedance:

- For safety reasons, connect the [FG] grounding terminal to a protective earth (Comply with the regulation of each country.). 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 to CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual” (IM 34M06C11-01E).
  - The list of CE conforming models is available in Appendix A2. of “Hardware Manual”.

- **Keep spare parts on hand:**
  - We recommend that you stock up on maintenance parts, including spare modules, in advance.
  - Preventive maintenance (replacement of the module) is required for using the module beyond 10 years.

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

- **Wipe off dirt with a soft cloth:**
  - Gently wipe off dirt on the product's surfaces with a soft cloth.
  - If you soak the cloth in water or a neutral detergent, tightly wring it out before wiping the product. Letting water enter the module interior can cause malfunctions.
  - 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 /e-RT3 controller 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 surrounding air temperature should be from -20°C to 75°C).
  - There is a built-in lithium battery in a Sequence CPU 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.
- **Use the following power source:**
  - Use only F3PU□□-□□ as the power supply module.
  - If using this product as a UL-approved product, for the external power supply, use a limited voltage / current circuit power source or a Class 2 power source.
  - If using this product as a CE-complied product, for the external power supply, use a SELV and limited-energy circuit separated by reinforced insulation or double insulation from hazardous voltage.
- **Refer to the user's manual before connecting wires:**
  - Refer to the “Hardware Manual” (IM 34M06C11-01E) or the applicable user’s manual for the external wiring drawing.
  - Refer to “A3.6.5 Connecting Output Devices” in the “Hardware Manual” before connecting the wiring for the output signal.
  - Refer to “A3.5.4 Grounding Procedure” in the “Hardware Manual” for attaching the grounding wiring.
- **Authorized Representative:**
  - The Authorized Representative for this product in the EEA is:

    Yokogawa Europe B. V.

    Euroweg 2, 3825 HD Amersfoort, The Netherlands

■ General Requirements for Using the FA-M3 Slave Units (TAH Series)

● Connect YHLS cable to SHIELD terminal:

- Connect the DRAIN line of the YHLS cable to the SHIELD terminal of the YHLS master module securely. Failing to do so may affect the performance of the YHLS system.

● Do not touch components in the unit:

- Do not remove the back cover of the unit. Doing so may cause a failure.

■ Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive
(This directive is only valid in the EU.)

This product complies with the WEEE Directive marking requirement.
The 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, this product is classified as a “Monitoring and Control instruments”.

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

Do not dispose of this product in domestic household waste.

■ How to dispose the batteries

This is an explanation about the new EU Battery Directive. This directive is only valid in the EU.

Batteries are included in some modules of this product. The procedure is different when the user can remove or cannot remove.

①Batteries the user can remove

The battery of F3RP6☐ and F3RP7☐ can be removed by yourself.
When you remove the battery from F3RP6☐ and F3RP7☐ and dispose it, discard them in accordance with domestic law concerning disposal. See the User's Manual of F3RP6☐ and F3RP7☐ for the removal procedure. Take a right action on waste batteries, because the collection system in the EU on waste batteries are regulated. If you don't remove the battery from this product, please see ②.

②Batteries the user cannot remove

Dispose the battery together with this product.
When you dispose this product in the EU, contact your local Yokogawa Europe B.V.office.
Do not dispose them as domestic household waste.

Battery category: Lithium battery

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

Introduction

■ Overview of the Manual

FA Links are networks through which data are exchanged between FA-M3 systems. Data link is achieved through link relays and link registers on these FA links.

■ Other User's Manuals

The manual(s) to be read depends on the CPU module to be used. You should read the latest versions of the following manuals, as required.

F3SP71
F3SP76

● For 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)

● For ladder programming:

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

F3SP66
F3SP67

● For Functions:

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

● For ladder programming:

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

F3SP22
F3SP28
F3SP38

F3SP53
F3SP58
F3SP59

● For Functions:

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

● For ladder programming:

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

F3BP20
F3BP30

- **For Functions:**
  - BASIC CPU Modules and YM-BASIC/FA Programming Language (IM34M06Q22-01E)
- **For BASIC programming:**
  - BASIC Programming Tool M3 for Windows (IM 34M06Q22-02E)
- **Common for all sequence CPU modules**

  For the FA-M3 specifications and configurations*1, installation and wiring, test run, maintenance, and module installation limits for the whole system:

  *1: Refer to the relevant product manuals for specifications except for power supply modules, base modules, input/output modules, cables and terminal units.

  - Hardware Manual (IM 34M06C11-01E)

Copyrights and Trademarks

■ Copyrights

The copyright of the programs and online manuals contained in the software medium of the Software Product shall remain in YOKOGAWA.

You are allowed to print the required pages of the online manuals for the purposes of using or operating the Product; however, reprinting or reproducing the entire document is strictly prohibited by the Copyright Law.

Except as stated above, no part of the online manuals may be reproduced, transferred, sold, or distributed to a third party in any manner (either in electronic or written form including, without limitation, in the forms of paper documents, electronic media, and transmission via the network). Nor it may be registered or recorded in the media such as films without permission.

■ Trademarks

The trade names and company names referred to in this manual are either trademarks or registered trademarks of their respective companies.

FA Link H Module
Fiber-optic FA Link H Module

IM 34M06H43-01E 6th Edition

CONTENTS

Applicable Product i

Precautions ii

Introduction x

Copyrights and Trademarks xi

1. Overview 1-1

1.1 F3LP02-0N and F3LP12-0N Modules 1-1

1.2 Operation Mode 1-1

1.3 Link Device 1-1

1.4 System Configuration 1-2

1.4.1 Single-layer System 1-2

1.4.2 Multi-layer System 1-3

1.5 RAS Function 1-4

2. Specifications 2-1

2.1 Model Names and Specification Codes 2-1

2.2 Operating Environment 2-1

2.3 Performance Specifications 2-1

2.4 Cable Specifications 2-2

2.4.1 Specifications of Twisted Pair Cables 2-2

2.4.2 Specifications for Fiber Optic Cables 2-2

2.5 External Dimensions 2-8

■ F3LP02-0N 2-8

■ F3LP12-0N 2-8

3. Setup and Connection of Modules 3-1

3.1 Startup Procedures 3-1

3.2 Components and their Functions 3-2

■ F3LP02-0N 3-2

■ F3LP12-0N 3-3

3.3 Setting Station Numbers 3-4

3.4 Setting Parameters 3-5

■ F3LP02-0N 3-5

■ F3LP12-0N 3-5

■ Setting Operation Mode 3-5

3.5 Attaching and Detaching Modules 3-6
3.6 Wiring 3-8
■ F3LP02-0N 3-8
■ F3LP12-0N 3-9
3.7 Applying the Power 3-12
■ F3LP02-0N 3-12
■ F3LP12-0N 3-12
3.8 Checking Communication Status 3-13
3.8.1 FA Link Module Status 3-14
3.8.2 Displaying Status of Local Station 3-15
3.8.3 Displaying Status of Remote Stations 3-17
3.9 Configuration Setup of CPU Module 3-19
3.9.1 Setting Device Capacities 3-20
■ For High Speed Mode 3-21
■ For Normal Mode 3-23
3.9.2 Setting FA Link System Numbers 3-26
3.10 FA Link H Configuration 3-31
4. Link Data Configuration 4-1
4.1 Link Relays 4-1
4.2 Link Registers 4-2
4.3 Special Relays 4-3
4.4 Special Registers 4-6
5. Operation and Processing Time 5-1
5.1 Overview of Data Link Processing 5-1
5.1.1 Link Refresh 5-2
5.1.2 Link Refresh Range 5-4
5.1.3 Cyclic Transmission 5-5
5.2 Response Time 5-6
5.2.1 Response Time of a Single Layer System 5-6
6. Cautions on Using FA Link H Modules 6-1
■ Operation Mode 6-1
■ CPU Module Configuration Setup 6-1
■ Multi-CPU System 6-1
■ Programming Precautions 6-2
■ Checking Link Data Allocation 6-2
■ Precautions when Setting Station Numbers 6-2
■ Powering On 6-2
■ When a Slave Station Fails 6-3
■ When Connecting FA Link H module to FA500 or μFA20 6-3
■ When Intermixing Old and New Modules within the Same System 6-3

7. High-speed Mode 7-1

7.1 CPU Module Configuration 7-1

7.1.1 Setting Device Capacity 7-1

7.2 FA Link H Configuration 7-3

7.3 Link Data Configuration 7-4

7.3.1 Link Relays 7-4

7.3.2 Link Registers 7-5

7.4 Response Time 7-6

7.4.1 Response Time of Layered System 7-6

7.5 Restrictions on Mixing Modes (Normal and High-speed) in Link Systems 7-7

8. Troubleshooting 8-1

8.1 When "RDY" LED Is Off 8-2

8.2 When "ERR" LED is Lit 8-3

8.3 When Communication Cannot Proceed 8-4

8.4 Error Codes When Using WideField3 8-5

Index Index-1

Revision Information Rev-1

Blank Page

1. Overview

The FA Link H modules for interchanging data between FA-M3 CPUs allow the configuration of a high-speed data link over a long distance.

1.1 F3LP02-0N and F3LP12-0N Modules

- The F3LP02-0N FA Link H Modules use twisted-pair cables which allow easy installation and selection of four speeds -- 125 k, 250 k, 625 k and 1.25 Mbps. The maximum transmission distances are 1 km, 500 m, 200 m and 100m depending on the communication speed.
- The F3LP12-0N Fiber-optic FA Link H Modules use optical fiber cables with noise immunity, and the maximum distance between stations is 1 km with maximum total length of 10 km at a transmission speed of 1.25 Mbps.

Note

The term "FA Link H" is this manual refers to both the FA Link Modules and the Fiber-optic FA Link H modules, unless the model F3LP02-0N or F3LP12-0N is specifically mentioned otherwise.

1.2 Operation Mode

The FA Link H Module can operate in two modes: normal mode and high-speed mode.

In high-speed operation mode, the system can use up to 1024 link devices; internal processing is faster and the response time is shorter, when compared to normal mode. For more details on high-speed mode, see Chapter 7, "High Speed Mode".

In normal operation mode, the system supports up to 2048 link devices.

Select the appropriate operation mode to suit your system specifications.

1.3 Link Device

- Link relays (L) and link registers (W) which compose link devices of a connected FA Link H system are provided with a maximum of 2048 devices per system (per network) in normal mode.
- The maximum number of links that can be transmitted by one module in a link system depends on the number of links defined for that system. The number of links can be set arbitrarily for each station.
- The F3SP05, F3SP08 and F3SP21 sequence CPUs provide 2048 link devices; The F3SP25, F3SP35, F3SP28, F3SP53, F3SP66, and F3SP71-4S sequence CPUs provide 8192 link devices and the F3SP38, F3SP58, F3SP59, F3SP22, F3SP67, and F3SP76-7S sequence CPUs provide 16384 link devices.
- Multiple link modules can be connected to one CPU module, allowing the configuration of a multi-layer system. The table below shows the maximum number of link modules that can be connected to each CPU module for each operation mode of the link module.

	Operation Mode	
	Normal	High speed
F3SP05/08/21	1	2
F3SP25/35/28/53	4	8
F3SP38/58/59 F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S	8	8

1.4 System Configuration

This section shows the system configurations that can be constructed using the FA-Link H Modules.

1.4.1 Single-layer System

A single-layer system is a system with up to 32 modules connected through optical fiber cables or twisted-pair cables.

Be sure to install the FA Link H module in a main unit. There is no restriction on the installed position in the main unit.

The station numbers can be set to any number within the range of 1 to 32 provided that no station numbers are duplicated. Be sure to set station number 1 to a master station for network management requirements. The stations numbers need not be sequential.

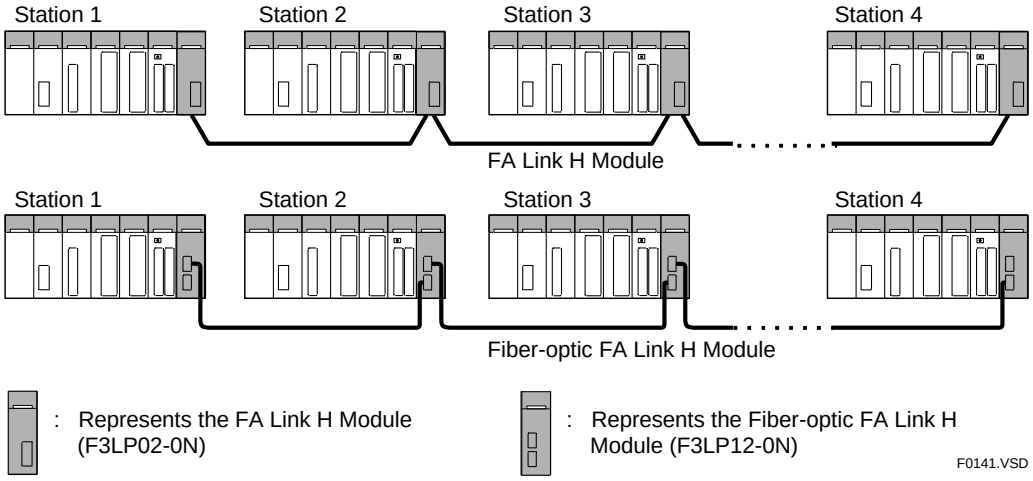


Figure 1.1 Single-layer System Configuration

CAUTION

F3LP32-0N modules cannot be connected to F3LP01-0N or F3LP02-0N modules. This means that those modules cannot be used together in the same communication bus (i.e., in the same system).

1.4.2 Multi-layer System

A multi-layer system refers to a system with multiple networks connected together.

To interconnect multiple networks, attach 2 FA Link H modules to one CPU module to configure a multi-layer system. A unit to which two FA Link H modules are attached is called a relay station. The same station number can be set to the two modules of a relay station. Similarly, in the case where multiple link modules are attached to one CPU module, the same number can be assigned to all these modules.

Be sure to attach the FA Link H modules to main units. There is no restriction on the installed position in the main unit.

The station numbers can be set to any number within the range of 1 to 32 provided that no station numbers are duplicated. Be sure to set station number 1 to a master station for network management requirements. The stations numbers need not be sequential.

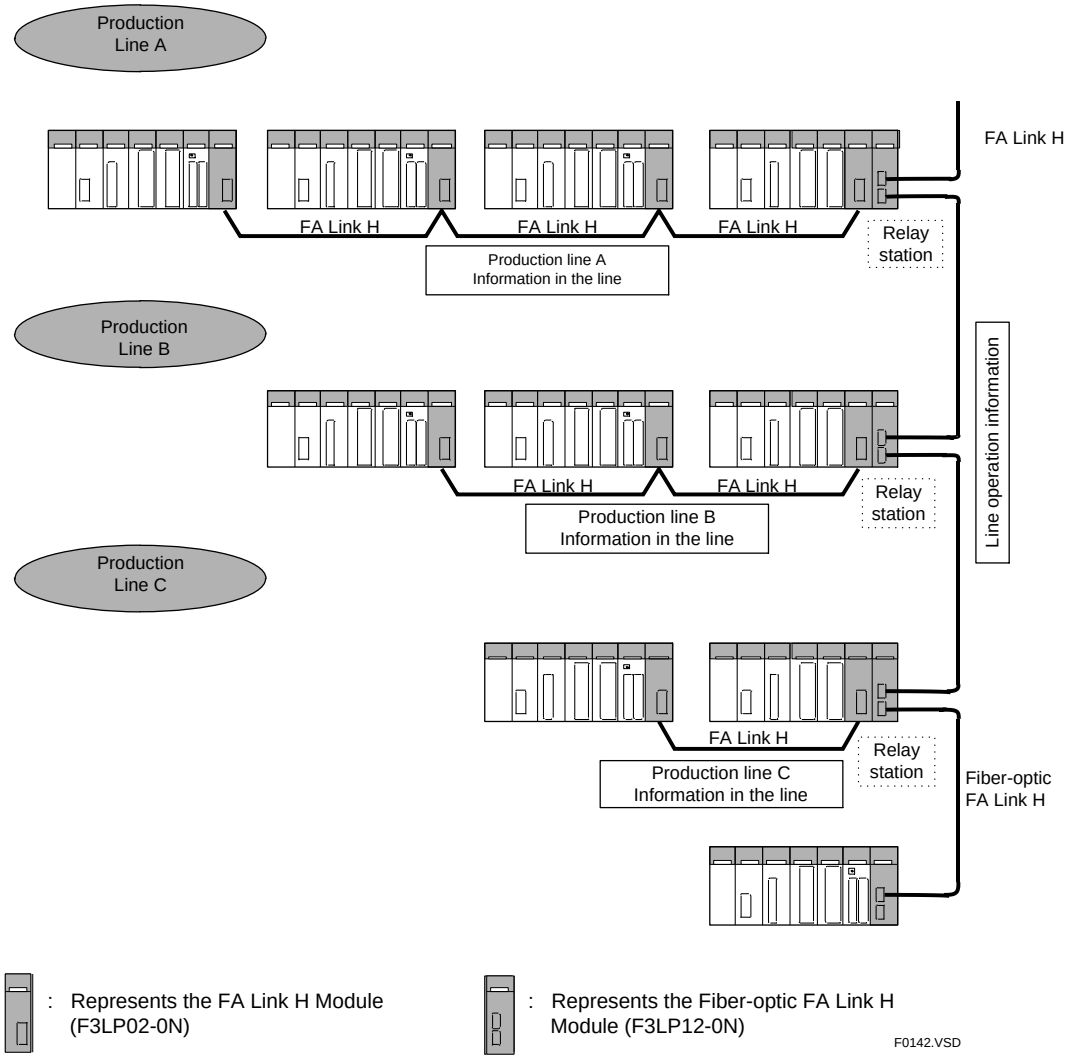


Figure 1.2 Example of Multi-layer System Configuration

CAUTION

F3LP32-0N modules cannot be connected to F3LP01-0N or F3LP02-0N modules. This means that those modules cannot be used together in the same communication bus (i.e., in the same system).

1.5 RAS Function

- The link status can be checked using special relays or registers.
- The F3LP02-0N module uses a bus-type communication configuration which allows all operating stations in a network to continue linking even in the event that a link module in the network, other than the master station, is down due to power failure or other reasons. In addition, a station, which becomes unlinked due to a power failure or a temporary communication failure, will revert to linked status automatically once its condition is restored to normal.
- The F3LP02-0N module provides local loop-back functions to monitor the network status.

Note

If any station in a network using F3LP12-0N modules is down due to power off or fiber-optic cable discontinuity, data linking of the entire network will fail.

2. Specifications

2.1 Model Names and Specification Codes

Model Name	Basic Specification Code	Style Code	Specification Code Suffix	Remarks
F3LP02	-0N	……	……	Up to 32 stations 125k/250k/625k/1.25Mbps 1km/500m/250m/100m
F3LP12	-0N	……	……	Up to 32 stations Maximum total length of 10km Maximum distance between stations of 1km 1.25Mbps

2.2 Operating Environment

The FA Link H module can be used with the following CPU models.

CPU Module	Style Number and Revision
F3SP05, F3SP08, F3SP21, F3SP25, F3SP35	S1 08 : XX or later
F3SP28, F3SP38, F3SP53, F3SP58, F3SP59 F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S	……

Note: Check the side of the product for the revision of the CPU Module.

2.3 Performance Specifications

Table 2.1 Performance Specifications

Item	FA Link H Module (F3LP02-0N)	Fiber-optic FA Link H Module (F3LP12-0N)
Number of connected stations	32 stations per system	
Link relays	16384 points*1 (Up to 2048 points per system)	
Link registers	16384 points*1 (Up to 2048 points per system)	
Maximum link points per station	2048 points	
Link relay/register assignments	Link relays: on 16-point basis, Link register: on 1-point basis	
Number of attached modules	F3SP05/08/21: 2 max. F3SP25/35/28/38/53/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S: 8 max. *1	
Communication speed	125k/250k/625k/1.25Mbps	1.25Mbps
Communication style	Single bus	Daisy chain
Maximum transmission distance	1km/500m/200m/100m (depending on transmission speed)	10km (1 km. Max between stations)
Communication mode	Token bus	
Synchronization mode	Frame synchronization	
Symbolization mode	NRZI mode	
Error control	CRC-CCITT	
RAS function	- Local loop-back function - Hardware self-diagnosis - Error detection by special relays and registers	- Hardware self-diagnosis - Error detection by special relays and registers
5V current consumption	470mA	495mA
Weight	120g	110g
Surrounding air temperature range	Operating : 0 to 55°C	
	Storage : -20°C to 75°C	
Surrounding humidity range	Operating : 10 to 90% RH (non-condensing)	
	Storage : 10 to 90% RH (non-condensing)	
Surrounding atmosphere	Must be free of corrosive gases, flammable gases or heavy dust.	

*1: See Section 1.3, "Link Device"

2.4 Cable Specifications

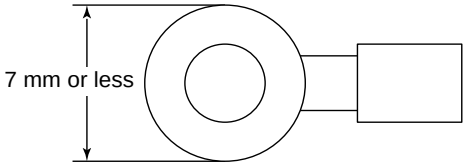
2.4.1 Specifications of Twisted Pair Cables

For wiring F3LP02-0N modules, use cables with the following specifications:

Cable type	Shielded twisted pair cable
Characteristic impedance	about 110Ω
Temperature rating	75ºC minimum
Connection Method	Solderless terminals

Use M3.5 self-tapping screws for the terminal screws.

The following solderless terminals are recommended for wiring.



F0241.VSD

Table 2.2 Recommended Solderless Terminals and Compatible Conductors

	Manufacturer	Model	Compatible Conductor
Solderless Terminals and Compatible Conductors	Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M3	AWG22 to 18 (0.33 to 0.82 mm^2) (Copper wire)
	Nippon Tanshi Co., Ltd.	RAV1.25-3.5	
	Japan Solderless Terminal Mfg Co., Ltd.	V1.25-M4	
	Japan Solderless Terminal Mfg Co., Ltd.	V2-M4	AWG16 to 14 (1.3 to 2.1 mm^2) (Copper wire)
Crimping Torque	0.8 N·m (7.1 lbf·in)		

2.4.2 Specifications for Fiber Optic Cables

To connect the F3LP12-0N module, use fiber optic cables supplied by Yokogawa Electric Corporation or the fiber optic cables listed in table 2.3 which have been tested for operation. Select cables according to the distance between the stations. For more details, contact the respective manufacturer.

■ Specifications for Optical Fiber

Specifications for Fiber-optic Cable Cores

Yokogawa Cable Model Number	KM60	KM60,KM61,KM62,KM65
Fiber-optic Cable Model No. (Size)	DK-HPF200/230	2×CCV-HC-20/07
Fiber-optic Cable type	SI type ※1	SI type※1
Vendor	SWCC Showa Cable System	Sumitomo Electric Industries
Core diameter	200±5μm	
Clad diameter	$230\pm^{0}_{10}$μm	
Transmission loss	7.0dB/km Max. (λ=0.85μm, Ta=25℃)	7dB/km Max. (λ=0.81μm, Ta=25℃)

※1：Step-index optical fiber

Specifications for Fiber-optic Cable Connectors

Yokogawa Cable Model Number	KM60	KM65	KM60,KM61,KM62
Optical connectors Model No.	KF-07	CF-2011 CF-2071	CF-2001H CF-2071H
Vendor	SWCC Showa Cable Systems	Sumitomo Electric Industries	Sumitomo Electric Industries
Specifications	Bi-directional, lever lock, bonding, polished	Bi-directional, lever lock, crimping, cut	Bi-directional, lever lock, bonding, polished

■ Fiber-optic Cords/Cables from Yokogawa Electric Corporation

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	—	—	Cord for system expansion inside panel enclosure; 0.6 m	2.60	F3LR01 F3LR02 F3LP12
	-001	—	—	Cord for system expansion inside panel enclosure; 1.0 m	2.60	
	-003	—	—	Cord for system expansion inside panel enclosure; 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 for indoor system expansion; 10 m	1.10	F3LR01 F3LR02 F3LP12
	-100	—	—	Cable for indoor system expansion; 100 m, a pulling eye on one end	1.10	
	-150	—	—	Cable for indoor system expansion; 150 m, a pulling eye on one end	1.55	
	-200	—	—	Cable for indoor system expansion; 200 m, a pulling eye on one end	1.96	

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 for indoor system expansion; 1 m	2.00	F3LR01 F3LR02 F3LP12
	-002	—	—	Cable for indoor system expansion; 2 m	2.00	
	-003	—	—	Cable for indoor system expansion; 3 m	2.00	
	-004	—	—	Cable for indoor system expansion; 4 m	2.00	
	-005	—	—	Cable for indoor system expansion; 5 m	2.00	
	-007	—	—	Cable for indoor system expansion; 7 m	2.00	
	-010	—	—	Cable for indoor system expansion; 10 m	2.00	
	-012	—	—	Cable for indoor system expansion; 12 m	2.00	
	-015	—	—	Cable for indoor system expansion; 15 m	2.00	
	-020	—	—	Cable for indoor system expansion; 20 m	2.00	
	-025	—	—	Cable for indoor system expansion; 25 m	2.00	
	-030	—	—	Cable for indoor system expansion; 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)

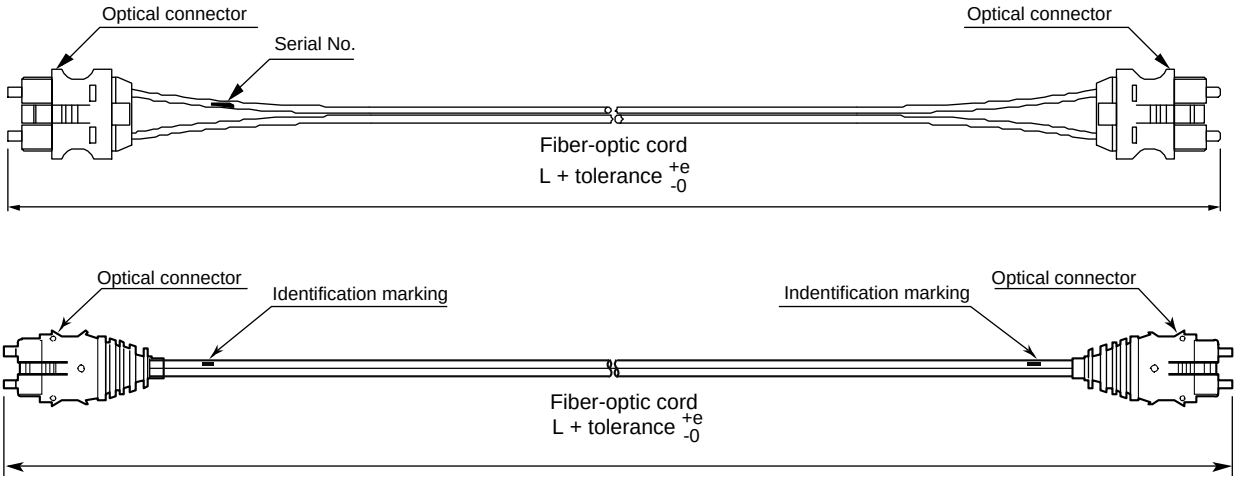
Model	Suffix Code	Style Code	Option Code	Description	Max. Transmission Loss (dB)	Applicable Module
KM62	-100	—	—	Cable for outdoor system expansion; 100 m, a pulling eye on one end	1.10	F3LR01 (Max.200 m) F3LR02 (Max.200 m) F3LP12 (Max.1000m)
	-200	—	—	Cable for outdoor system expansion; 200 m, a pulling eye on one end	1.96	
	-300	—	—	Cable for outdoor system expansion; 300 m, a pulling eye on one end	2.73	
	-400	—	—	Cable for outdoor system expansion; 400 m, a pulling eye on one end	3.44	
	-500	—	—	Cable for outdoor system expansion; 500 m, a pulling eye on one end	4.11	
	-600	—	—	Cable for outdoor system expansion; 600 m, a pulling eye on one end	4.74	
	-700	—	—	Cable for outdoor system expansion; 700 m, a pulling eye on one end	5.34	
	-800	—	—	Cable for outdoor system expansion; 800 m, a pulling eye on one end	5.92	
	-900	—	—	Cable for outdoor system expansion; 900 m, a pulling eye on one end	6.47	
	-L01	—	—	Cable for outdoor system expansion; 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.

Note

- Use the specified fiber-optic cables to avoid problems, malfunctions or under-performance.
- KM6☐ cables cannot be used in submerged environments. Contact Yokogawa's sales office for alternative solutions.

■ External Diagram of KM60

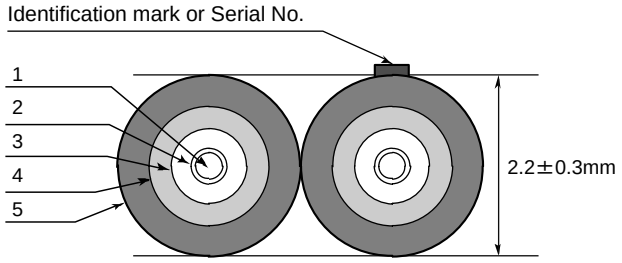


Length L (mm)	Tolerance +e (m)
L≦3	0.20

FB0242.VSD

Note: There are 2 types of fiber-optic cords (KM60) with optical connectors of different shapes but the cable type cannot be specified by the customer.

ex. Sumitomo Electric Industries



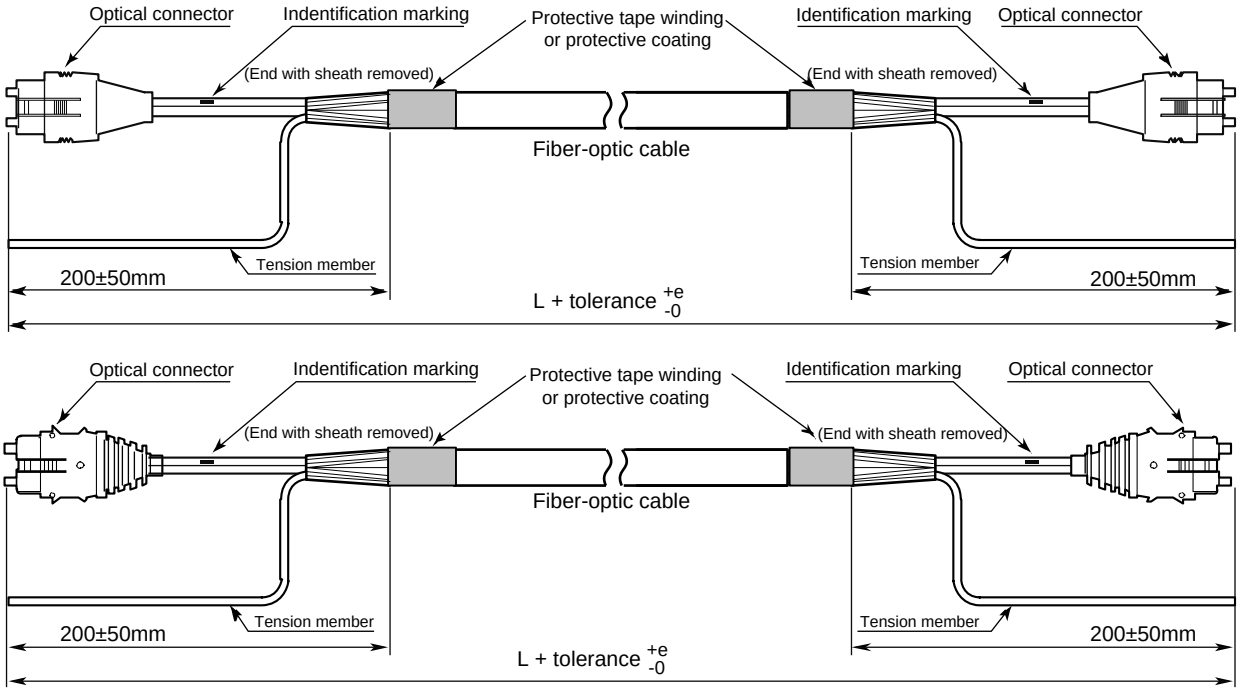
1	Core (quartz glass)
2	Clad (fluorinated acrylate resin)
3	Cover (fluorine-based resin)
4	Reinforcer (aromatic high tensile fiber)
5	Outer cover (heat-resistant PVC black)

FB0443.VSD

Note

Handle the fiber-optic cable with care since it may break readily if bent or tied like regular electrical cables. The cable is more likely to break at a point near the optical connector. For details on its installation, see the relevant instruction manual.

■ External Diagram of KM61, KM62

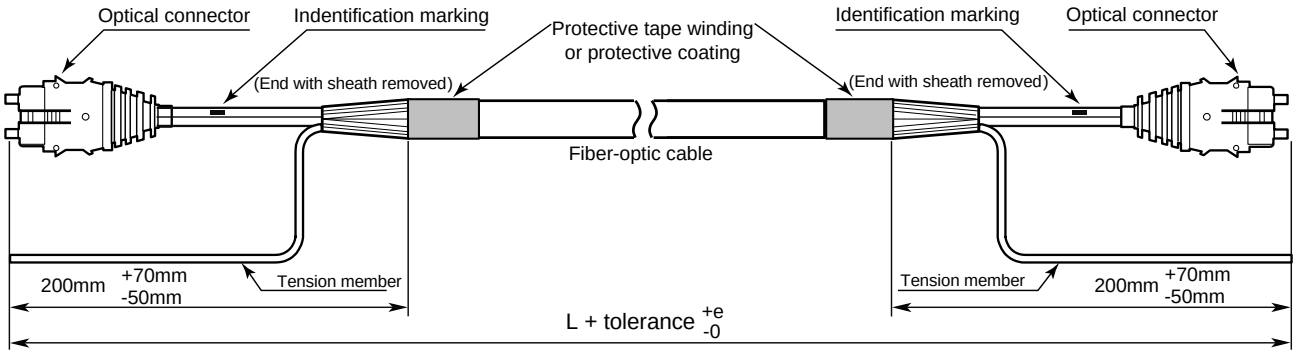


Length L (m)	Tolerance +e (m)
5<L ≦ 30	0.50
30<L	L x 0.03 (3%)

F0244.VSD

Note: There are 2 types of fiber-optic cable (KM61, KM62) with different shapes for the optical connectors but the cable type cannot be specified by the customer.

■ External Diagram of KM65

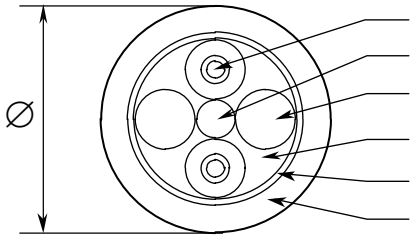


Length L (m)	Tolerance +e (m)
L ≦ 15	0.20
5<L ≦ 15	0.30
15<L ≦ 30	0.50

FB0244B.VSD

■ Cross-sectional View

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

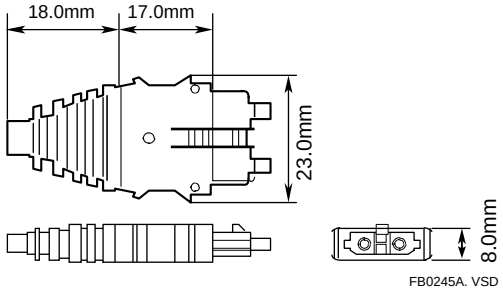
FB0444.VSD

Note: Near their fiber-optic connector where the sheath is removed, these cables have the same cross-section as KM60 cables.

■ Connector (Top View)

● CF-2071H and CF-2071

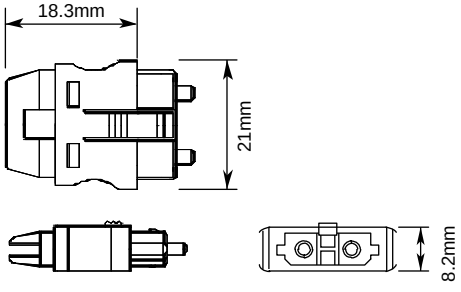
For cables KM60, KM61, KM62, and KM65



FB0245A. VSD

● KF-07

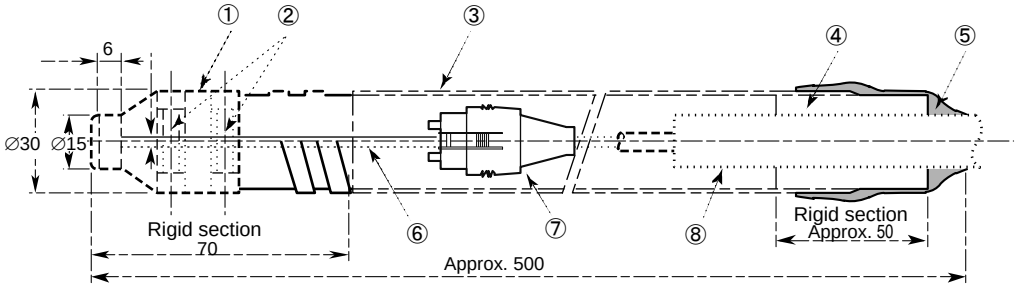
For cable KM60

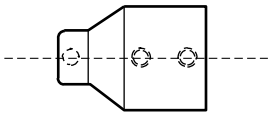


FB0245B.VSD

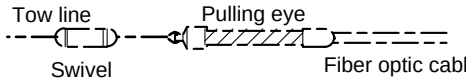
■ Fiber-optic Lead-in Cable Laying Pulling-Eye Assembly Diagram

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

Use the following products from Sumitomo Electric Industries, Ltd. when laying the fiber-optic cables.

Name		Model	
Optical connector	Adhesive grinding assembly	CF-2001	CF-2071H
	Crimp-on cutting assembly	CF-2011	CF-2071
Optical connector connecting tool	Crimp-on cutting assembly	CAK-1062	
Optical power tester (for checking optical connector connection)		CAT-2700	
Master fiber set (for checking optical connector connection)		CAT-2001H CAT-2001H(HG)	
Manual for Sumilink DF series	Procedure for laying fiber-optic cords and fiber-optic cables	Sumitomo Denki Ref. No. 1769	
	Optical connector connecting tool CAK-1020 instruction manual CAK-0057 instruction manual	Sumitomo Denki Ref. No. 1100 Sumitomo Denki Ref. No. 1083	

■ Tested Fiber-Optic Cables

Table 2.3 Tested Fiber-Optic Cables

Distance between stations	Manufacturer	Type		Remarks
Up to 1km	Sumitomo Electric Industries, Ltd. (Adhesive grinding method)	Type	2001H-MM-L	Cord
			2071H-MM-L	
		Size	DCV-HC-20/07	
		Type	2001H-MM-0.2/L-P	Cable
			2071H-MM-0.2/L-P	
		Size	2×CCV-HC-20/07	
	Toshiba Corporation	TOCP200Q-☐☐B		Cord
		TOCP200X-☐☐B		Cable
	Sumitomo Electric Industries, Ltd. (Crimp-on cutting method)	Type	2011-MM-L	Cord
			2071-MM-L	
		Size	DCV-HC-20/07	
		Type	2011-MM-0.2/L-P	Cable
			2071-MM-0.2/L-P	
		Size	2×CCV-HC-20/07	

2.5 External Dimensions

■ F3LP02-0N

Unit: mm

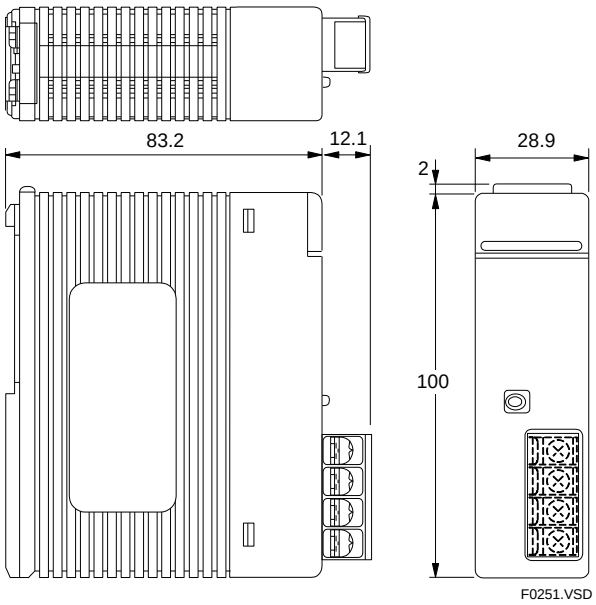


Figure 2.1 External Dimensions of the F3LP02-0N module

■ F3LP12-0N

Unit: mm

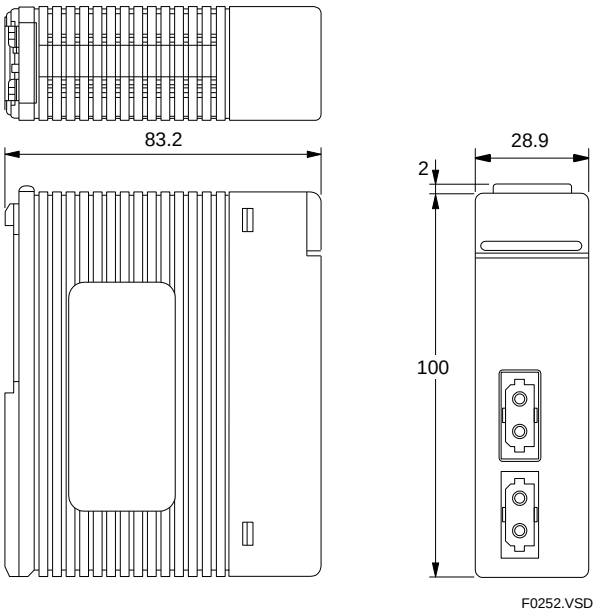
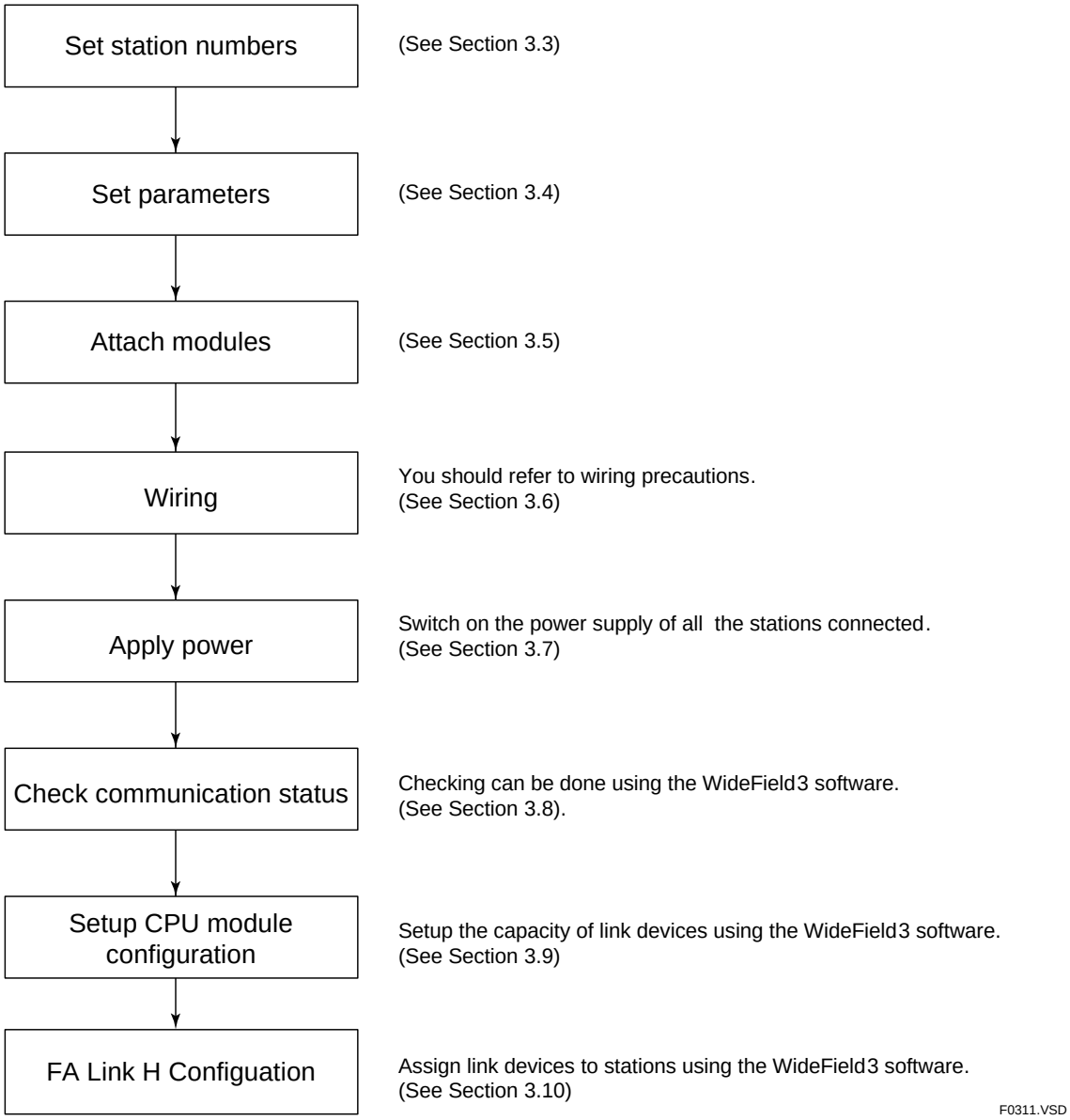


Figure 2.2 External Dimensions of the F3LP12-0N module

3. Setup and Connection of Modules

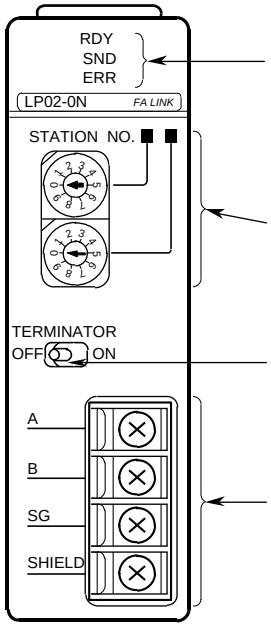
3.1 Startup Procedures



3.2 Components and their Functions

■ F3LP02-0N

● Front view



Indicators
RDY: Lit when the internal circuit is functioning mormally
SND: Lit when the transmission is functioning normally
ERR: Lit when errors occur.

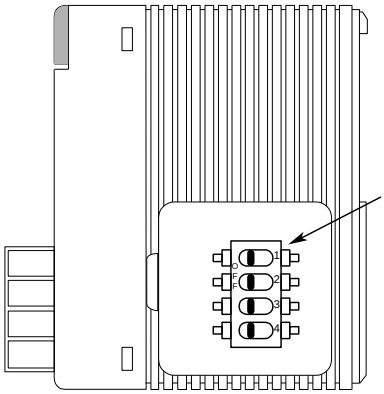
Station number setting switch:
Set station numbers from 1 to 32.
Value at shipment is 01

Terminator setting switch:
On: Set terminator.
Off: Not set terminator.
Setup at shipment is OFF

FA Link H connecting terminal board
(4 terminals, M3.5 screw)

F0321.VSD

● Right side view

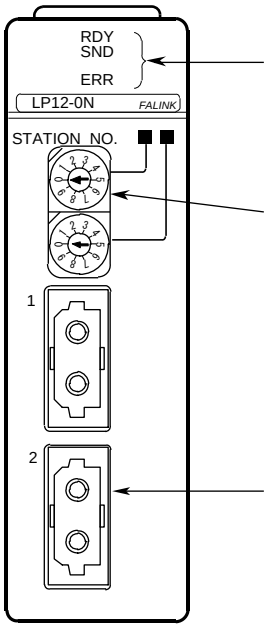


Parameter setting switch:
4-pole slide switch to set each parameter.

F0322.VSD

■ F3LP12-0N

● Front view



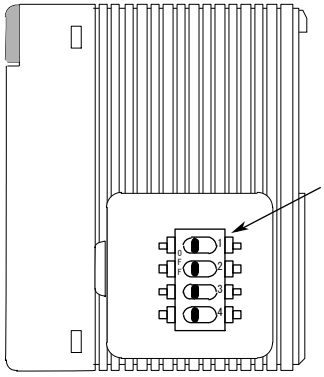
Indicators
RDY: Lit when the internal circuit is functioning mormally
SND: Lit when the transmission is functioning normally
ERR: Lit when errors occur.

Station number setting switch:
Set station numbers from 1 to 32.
Value at shipment is 01

Optical fiber connecting port.
*Attach a dust cap of accessories, is not using the port 2.

F0323.VSD

● Right side view



Parameter setting switch:
4-pole slide switch to set each parameter.

F0324.VSD

3.3 Setting Station Numbers

This sets the station number, which identifies a FA Link Module.

Set the station number of the FA link module using the two 10-position rotary switches on the front of the module (see Figure 3.1). Insert a flat-blade screwdriver into the slot of the arrow and change the direction of the arrow to perform setting.

Station numbers can be set to any arbitrary number in the range from 01 to 21 provided that station numbers are not duplicated. Do not set to 00 or 33 to 99. Otherwise, normal operation is not assured. A station with number 1 must be defined and will be the master station. Station numbers need not be sequential.

The default factory setting is 01.

Note

- If a station number is duplicated but falls within the range from 02 to 32, the error will not be detected nor indicated by the display LED or the special relay.

  (If station number 1 is duplicated or a duplicate station number falls within the range from 33 to 99, it will be detected and indicated by the display LED and special relay).
- Any duplicate station number falling within the range from 02 to 32 will prevent the link data of the entire system to be properly updated.

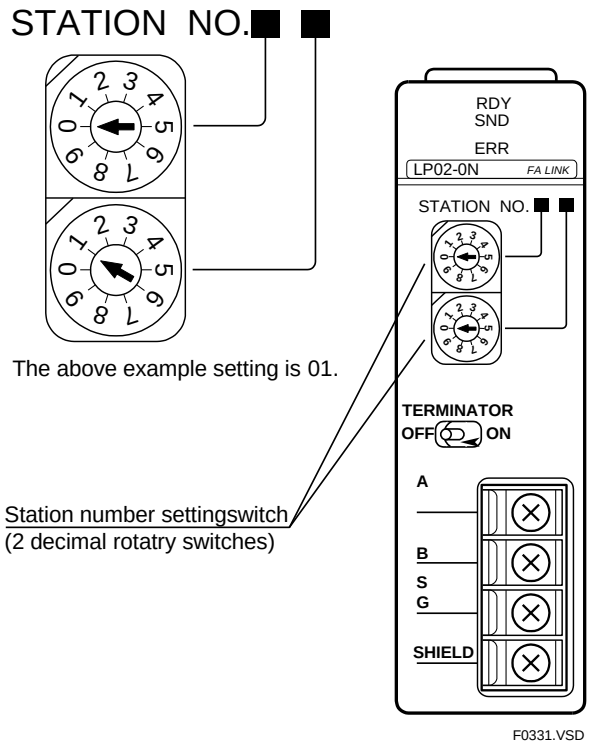


Figure 3.1 Station Number Setting Switch

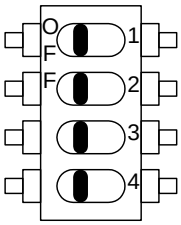
3.4 Setting Parameters

Remove the module right side cover to gain access to a 4-pole slide switch. Turn this switch on or off to set the parameters.

Turn off the power supply before performing this operation. If the switch is set with the power turned on, the setting will be invalid.

Leave unused switches “Always Off”.

■ F3LP02-0N

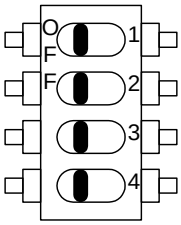


Number	Setting Item	OFF	ON	Factory Setting
1	Communication speed	Refer to the table below.		OFF
2				OFF
3	Operation mode	Normal	High-speed	OFF
4	Not used	~	~	OFF

Switch		Number 2	
		OFF	ON
Number 1	OFF	1.25Mbps	250kbps
	ON	625kbps	125kbps

F0341.VSD

■ F3LP12-0N



Number	Setting Item	OFF	ON	Factory Setting
1	Designation of intermediate station	Terminal station	Intermediate station	OFF
2	Not used	~	~	OFF
3	Operation mode	Normal	Normal	OFF
4	Not used	~	~	OFF

F0342.VSD

For a module to be terminal when interconnecting with other stations, set its terminal setting switch to off. Be sure to set the switches of non-terminal intermediate station modules to on.

A module to be used as a terminal station uses only one port. Any of the ports may be used. Be sure to attach a dust cap to an unused port, or an error may occur.

■ Setting Operation Mode

The FA Link H supports two operation modes: normal mode and high-speed mode.

In high-speed operation mode, the system can use up to 1024 link devices; internal processing is faster and the response time is shorter, when compared to normal mode. For more details on high-speed mode, see Chapter 7, "High Speed Mode".

In normal operation mode, the system supports up to 2048 link devices.

Select the appropriate operation mode to suit your system specifications.

3.5 Attaching and Detaching Modules

■ Attaching the Module

Figure 3.2 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.

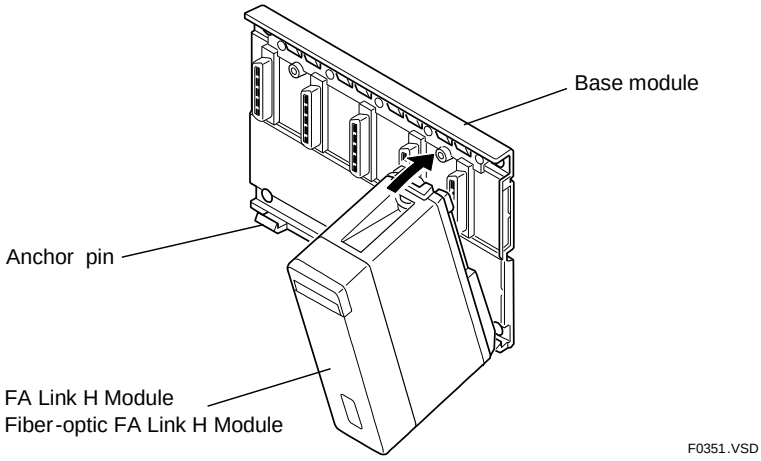


Figure 3.2 Attaching/Detaching the Module

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.

■ 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.

■ 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)

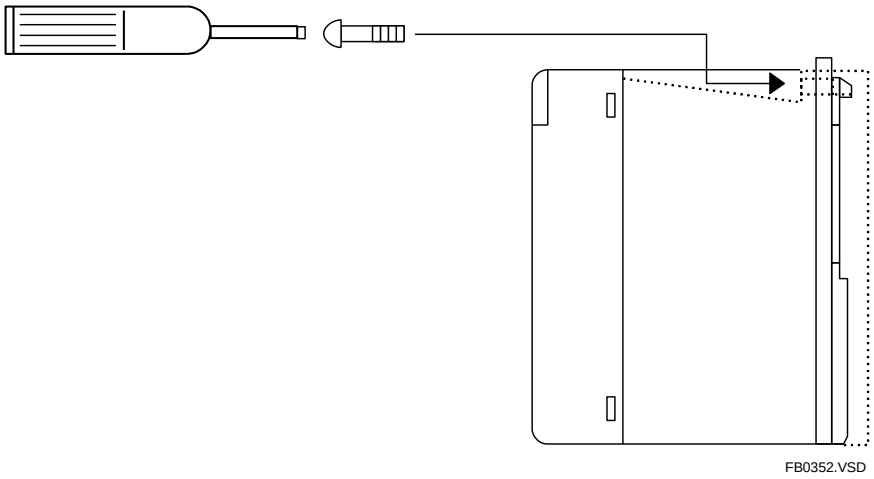


Figure 3.3 Tightening the Module

3.6 Wiring

This section describes the wiring of the FA Link H Modules.

■ F3LP02-0N

● Wiring

The F3LP02-0N module must be wired using a shielded cable consisting of two pairs of twisted wires. The wiring diagram is shown below.

Using a pair of twisted wires of a cable, connect all send/receive terminals A and B in parallel. For the other pair of twisted wires of the cable, connect both wires together at the signal ground terminal (SG) of each module. For better signal noise immunity, it is recommended to connect either end of the shield of a cable at the shield terminal (SHIELD) (both-end grounding method)*1. If many power machines are used near the modules and grounded locally, however, use the single-end grounding method to protect against noise from stray current.

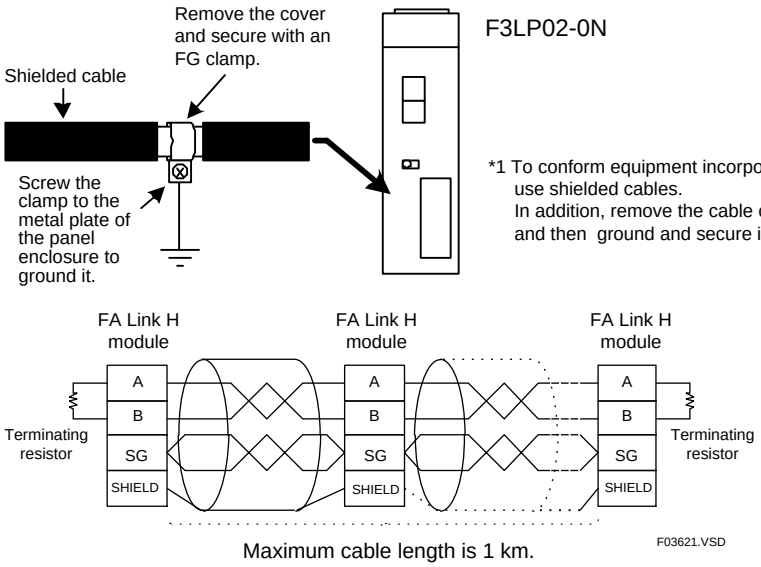


Figure 3.4 Wiring of F3LP02-0N Module

● Setting terminating resistors

F3LP02-0N has an in-built termination resistor (110Ω). FA Link Modules on both ends of the transmission path must have their Termination Resister ON/OFF switch set to ON (See Figure 3.5).

FA Link Modules not located at either end of the transmission path must have this switch set to OFF.

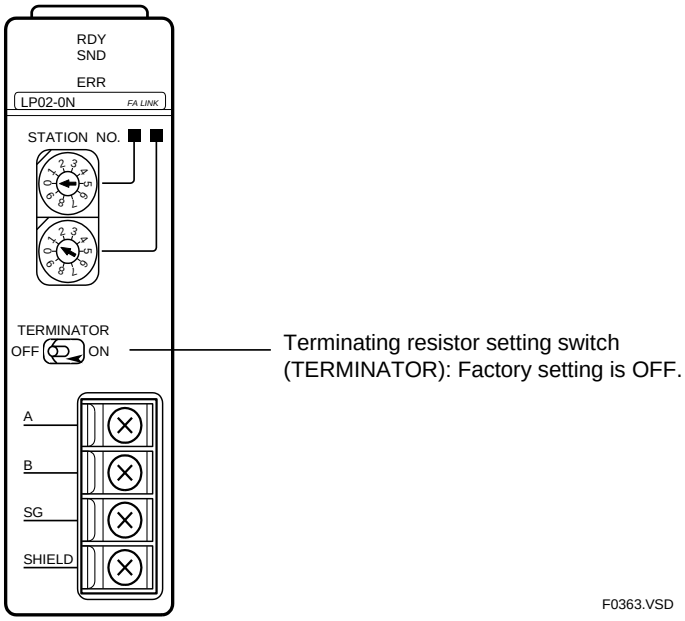


Figure 3.5 Terminating Resistor ON/OFF

■ F3LP12-0N

● Cautions for Connection

1. Measure the cable transmission loss before and after laying of the optical fiber cables to ensure that there is no difference in transmission loss.
   The following table shows the cable reference value for adhesive grinding method and crimp-on cutting method.

Optical Fiber Length [m]	Maximum Fiber Loss [dB]	
	Adhesive grinding	Crimp-on cutting
0	1.100	2.600
50	1.100	2.600
100	1.100	2.600
150	1.544	3.044
200	1.959	3.459
250	2.352	3.852
300	2.727	4.227
350	3.088	4.588
400	3.437	4.937
450	3.774	5.274
500	4.102	5.602
550	4.421	5.921
600	4.732	6.232
650	5.036	6.536
700	5.334	6.834
750	5.625	7.125
800	5.910	7.410
850	6.190	7.690
900	6.465	7.965
950	6.735	8.235
1000	7.000	8.500

The following table shows the allowable transmission loss for fiber-optic cables for

normal communications with the Fiber-optic FA Link H Module. Excessive stress, bending and pressure during the laying of fiber-optic cables may lead to breakage or cracks in the cable, causing a large transmission loss. We recommend that you engage professionals to lay fiber-optic cables, as well as measure the transmission loss of cables after work completion and check the results against the unit length transmission loss table and the allowable transmission loss table for the Fiber-optic FA Link H Module given below to ensure that it is within range and will not hamper normal communications.

Figure 3.1 Allowable Transmission Loss Table for Fiber-optic Cables for the Fiber-optic FA Link H Module

Cable length (m)	0.6 to 1000
Allowable transmission loss (dB)	9.0

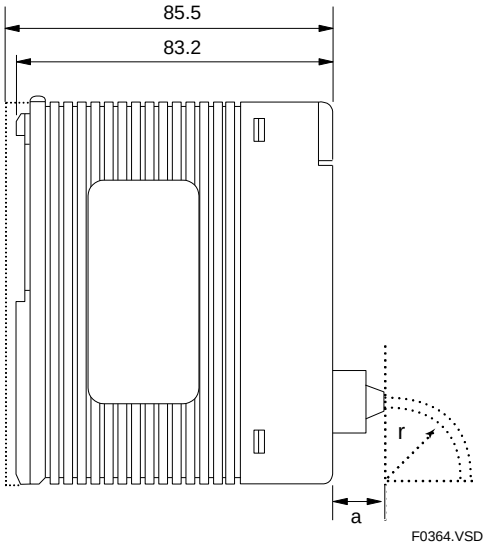
Notes:

- When fiber-optic connectors are processed and installed on site, or when cables are pulled and laid, measure the transmission loss after work completion and ensure that it is within allowable limits. Transmission loss exceeding allowable limits would result in abnormal communications.
- Measure transmission loss for fiber-optic cables regularly to check that it is within allowable limits. When stress is applied to fiber-optic cables, cracks may occur, causing an increase in transmission loss. Hence, we recommend that transmission loss for fiber-optic cables be measured regularly.

2. When connecting optical fiber cables, there are restrictions regarding the bending radius of the cable. See the reference values provided by the manufacturers in the table below. For more details, contact the manufacturers listed.

Distance among stations	Manufacturer	Type	Bending radius (mm)	Remarks
Up to 1km	Sumitomo Electric Industries, Ltd. (Adhesive grinding method)	2001H-MM-L	15	Cord
		2071H-MM-L		
		2001H-MM-0.2/L-P	45	Cable
		2071H-MM-0.2/L-P		
	Toshiba Corporation	TOCP200Q-☐☐B	15	Cord
		TOCP200X-☐☐B	25	Cable
	Sumitomo Electric Industries, Ltd. (Crimp-on cutting method)	2001-MM-L	15	Cord
		2071-MM-L		
		2001-MM-0.2/L-P	45	Cable
		2071-MM-0.2/L-P		

3. When calculating the installation depth, provide allowance for the connector and the bending radius of the optical fiber cord or cable. (The following figure shows the module installation depth when using optical fiber cord/cable manufactured by Yokogawa Electric Corporation. Contact the respective cable manufacturers when using cables from other sources.)



	Bending Radius, r (mm)			
	KF-07 (a = 18.3)		CF-2071, CF-2071H (a = 35.0)	
	During installation (temporary)	When installed	During installation (temporary)	When installed
Optical fiber cord	15 or more	50 or more	15 or more	50 or more
Optical fiber cable	-	-	50 or more	100 or more

4. While installing the fiber optic cables, do not touch the core at the cable ends and ensure that it is free from dust.
5. When inserting fiber optic cables into their connectors, do not reverse the direction of the cables. Each time the cables are attached or detached from the ports, hold the optical connector.
6. Attach dust caps to port, which are not in use.

Note

We recommend that you engage professionals to lay the optical fiber cables.

● Connecting method

Connect the optical fiber cables using port 1 and port 2 as shown in the figure below. Connection need not be carried out in sequential order of the station number. Be sure to attach dust caps to the unconnected ports at the terminal stations at two ends.

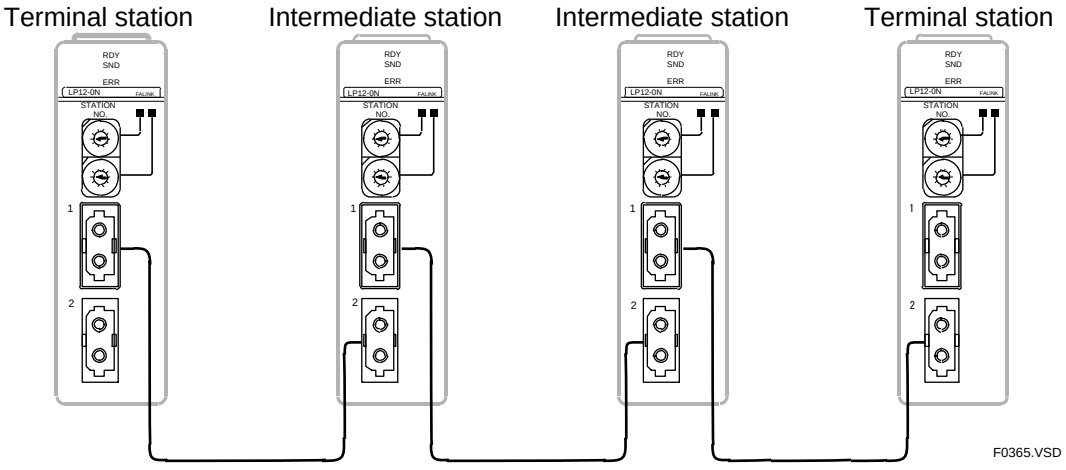


Figure 3.6 Connecting Cables to F3LP12-0N Modules

3.7 Applying the Power

■ F3LP02-0N

Power can be applied in any order, regardless of the master station and slave stations.

■ F3LP12-0N

First apply power to all the slave stations. Then apply power to the master station.

Note

If any of the stations in a network of F3LP12-0N modules are turned off, data link in the entire network cannot proceed. For a network of F3LP02-0N modules, even if some stations are turned off, data links continues among the stations, which are turned on, provided that the master station is turned on.

3.8 Checking Communication Status

The communication status of the FA Link H module can be checked using a personal computer and the WideField3 software package, which can be procured separately from Yokogawa.

Connect the personal computer to the programming port of the CPU module in any station using a special-purpose cable for the programming tool and start WideField3. You can check the communication status on the FA Link Status Monitor window.

This section explains how to operate the FA Link Status Monitor. For details on the WideField3 software, read the FA-M3 Programming Tool WideField3 User's Manuals (IM34M06Q16-01E, -02E, -03E, and -04E), which can be procured separately from Yokogawa.

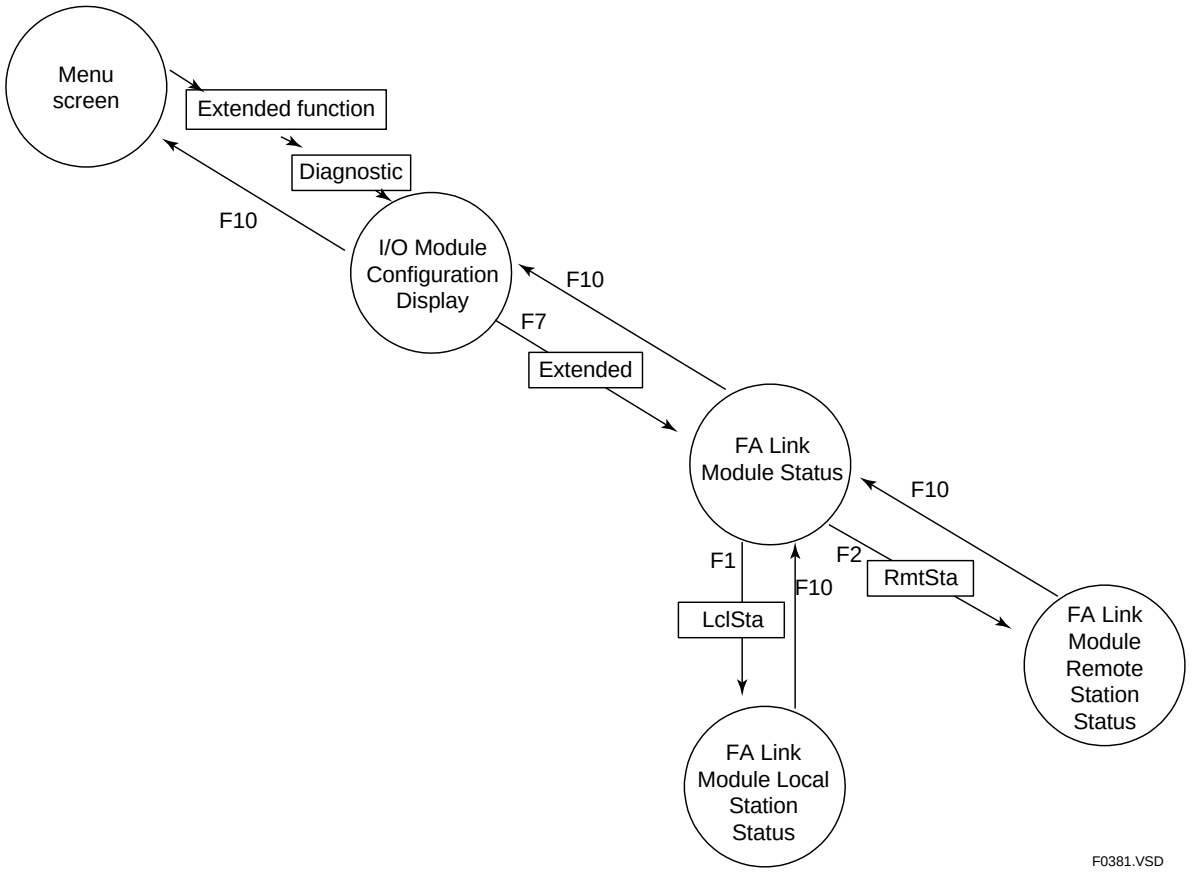
Note

If you are using WideField2, you may read "WideField3" as "WideField2" in this manual.

For details, read the FA-M3 Programming Tool WideField2 User's Manual (IM34M06Q15-01E), which can be procured separately from Yokogawa.

● Customers using the Ladder Diagram Support Program M3

Tasks relating to the FA Link Module status described in this book can also be carried out using the Ladder Diagram Support Program M3. Refer to the following window extensions.



When using the Ladder Diagram Support Program M3 for setting the communication specifications, the following condition must be satisfied.

Ladder Diagram Support Program M3	Rev. required
SF510-E3☐	Rev.1.08 or later

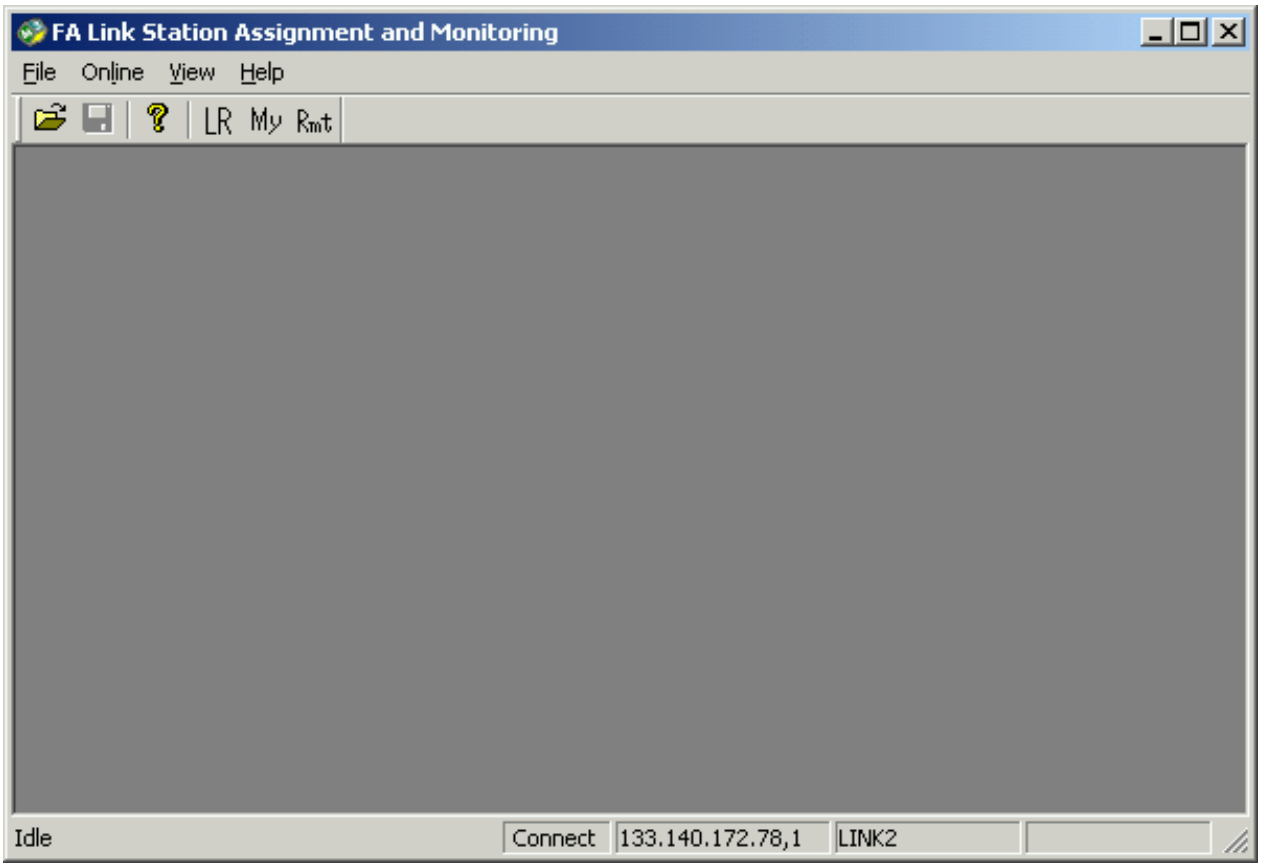
3.8.1 FA Link Module Status

Step 1 Start WideField3 and connect to the FA-M3.

Step 2 Select [Tools]—[Setup I/O Module]—[FA Link] from the menu to start the FA Link Tool. The FA Link Station Assignment and Monitoring window opens.

You can check two types of status on the FA Link Station Assignment and Monitoring window: FA Link local status and FA Link Remote Status.

To exit from the FA Link Station Assignment window, select [File]—[Exit] from this menu.



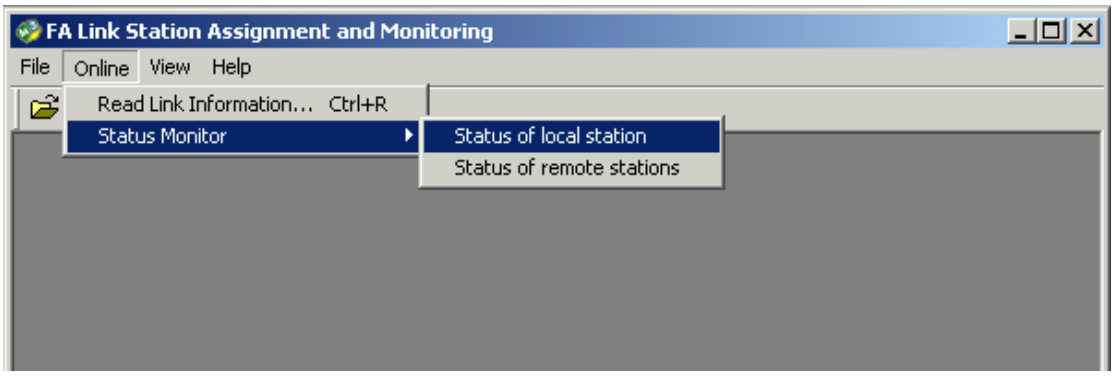
F0382.VSD

Figure 3.7 FA Link Station Assignment and Monitoring Window

3.8.2 Displaying Status of Local Station

This displays the status of the specified link module. The display is refreshed periodically.

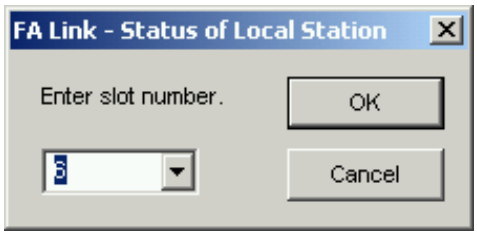
Step 1 Select [Online]—[Status Monitor]—[Status of Local Station] on the FA Link Station Assignment and Monitoring window.



F0383.VSD

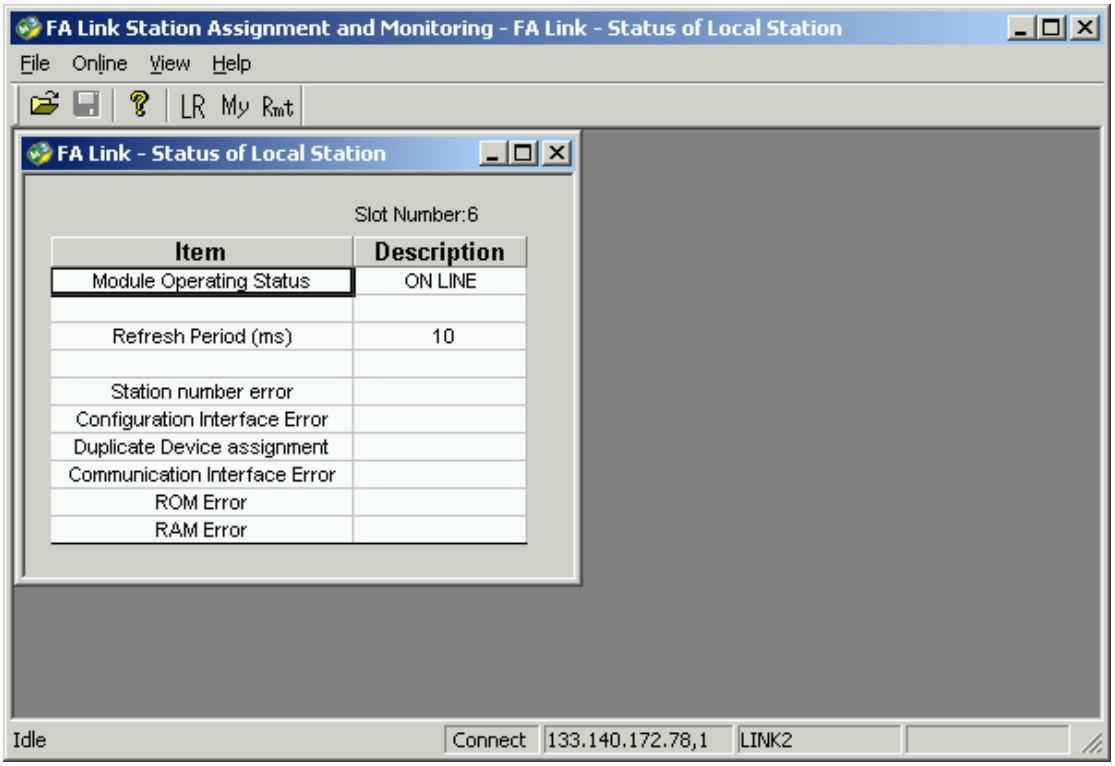
Figure 3.8 Step 1 to Display Status of Local Station

Step 2 To see the status of the local station, specify the slot number where the FA link module is installed and select [OK].



F0384.VSD

Figure 3.9 Selecting Slot Number to Display Status of Local Station



F0385.VSD

Figure 3.10 Status of Own Station Window

The descriptions of each status display or alarm display are as follows.

Other than the Module Operation Status item and the Refresh Period item, a "Yes" will be displayed only for items generating malfunctions.

Table 3.2 Status Display/Alarm Display Items and Description

Status Display/Alarm Display		Description
Module Operating Status	ON LINE	**Communication is normal.**
	OFF LINE	**No communication.**
Refresh Period (ms)		**The FA link H refresh period.**
Station number error		**Station number is incorrect. (duplicate, etc.)**
Configuration Interface Error		**Configuration information has not been set up.**
Duplicate Device assignment		**The allocation of link relays and link registers overlaps with another station.**
Communication Interface Error		**A communication interface error has been detected.**
ROM error		**A ROM checksum error has been detected.**
RAM error		**A RAM checksum error has been detected.**

Note

- Refresh Period

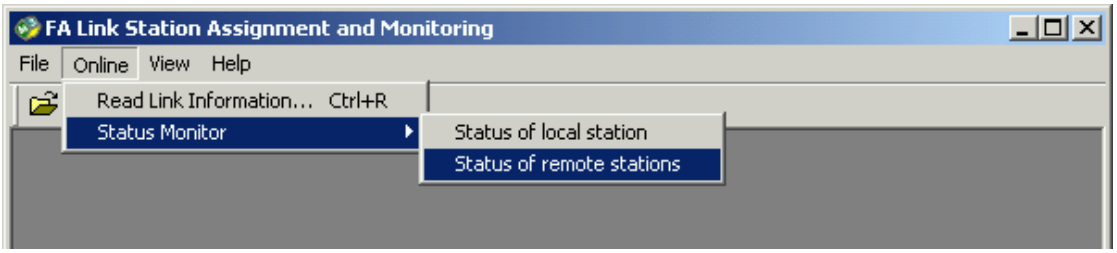
The Refresh Period refers to the cyclic sending period of a FA link.

3.8.3 Displaying Status of Remote Stations

This displays the FA link H module status of other remote stations on the network (32 stations) that includes the specified FA link module. The display is refreshed periodically.

To display remote station status, select [Online] - [Status Monitor] - [Status of remote stations].

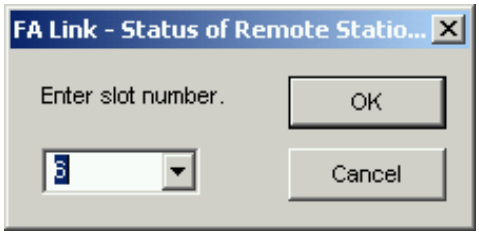
Step 1 Select [Online]—[Status Monitor]—[Status of remote stations] on the FA Link Station Assignment and Monitoring window.



F0386.VSD

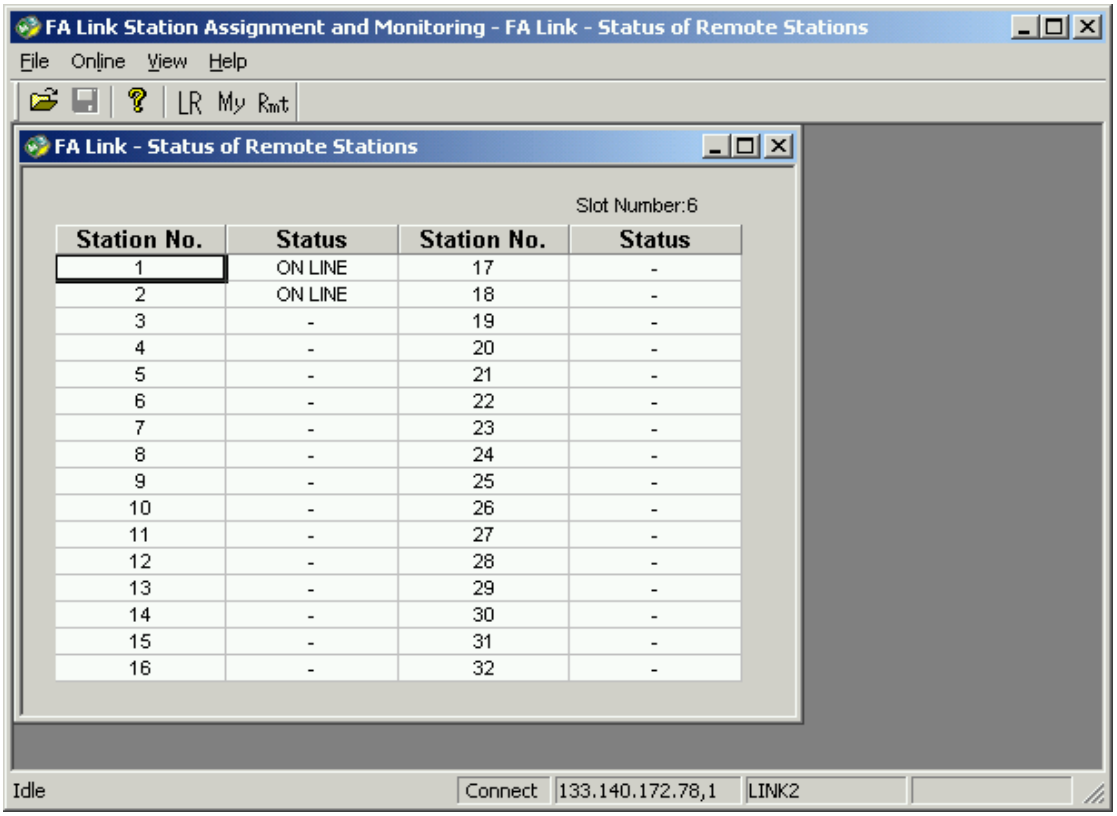
Figure 3.11 Step 1 to Display Status of Remote Station

Step 2 To see the status of the remote station, specify the slot number where the FA link module is installed and select [OK].



F0387.VSD

Figure 3.12 Selecting Slot Number to Display Status of Remote Station



F0388.VSD

Figure 3.13 Status of Remote Stations Window

The descriptions of the different statuses are as follows.

Table 3.3 Status Display and Description

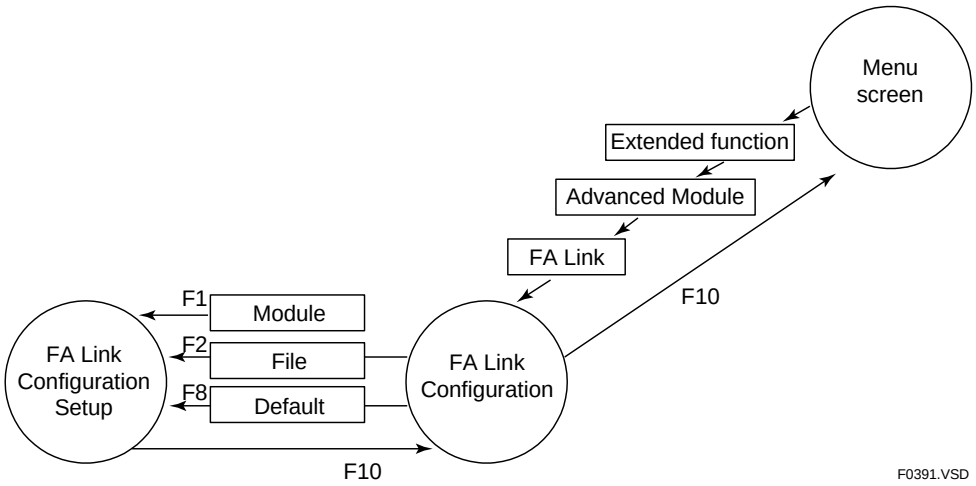
Status Display	Description
ON LINE	**Communication is normal.**
SEQ STOP	**The sequence program has stopped with error or is not operating.**
CPU NOT READY	**CPU is not operating normally.**
—	**Not set. Communication is not taking place normally, due to a setup error, etc.**

3.9 Configuration Setup of CPU Module

This section explains how to set up the configuration on the CPU module side when using a FA Link H module.

● Customers using the Ladder Diagram Support Program M3

Tasks relating to the FA link configuration described in this manual can also be carried out using the Ladder Diagram Support Program M3. Refer to the following window extensions.



When using the Ladder Diagram Support Program M3 for setting the communication specifications, the following condition must be satisfied.

Ladder Diagram Support Program M3	Rev. required
SF510-E3☐	Rev.1.08 or later

3.9.1 Setting Device Capacities

This setting is required when using an FA link H module.

Setting values depend on whether the FA Link H module is used in high-speed mode or normal mode.

Be sure to perform the setting according to the setting examples for the different CPU models shown in the following pages.

This setting is performed on the project Configuration window.

■ For High Speed Mode

For high speed mode, set the link device capacities as follows:

- Set the link device capacity of a FA link system in use to "1024".
- Set the [Link Type] of an unused FA link system to "Do not Use".

Sample setting for each CPU model is shown below. All the examples assume that the maximum allowable number of FA link modules is installed.

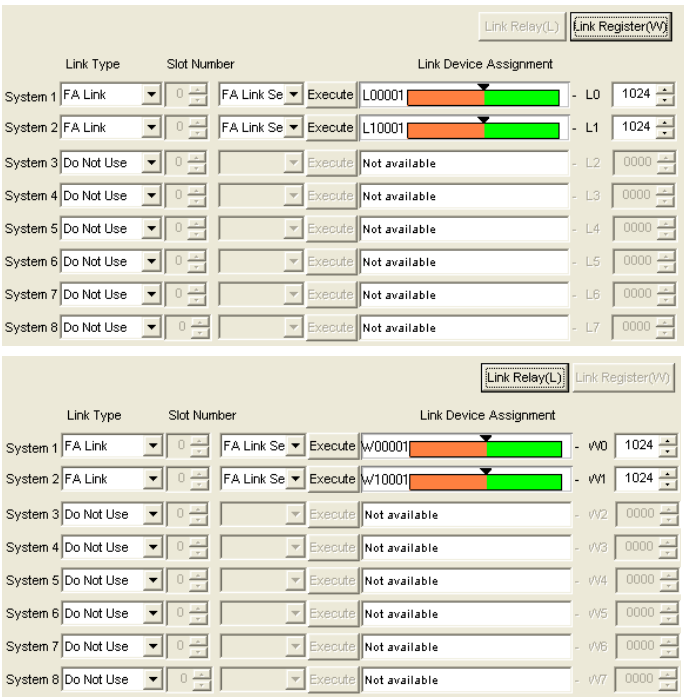


Figure 3.14 Sample Link Device Capacity Setting for F3SP05/08/21 (for High-speed Mode)

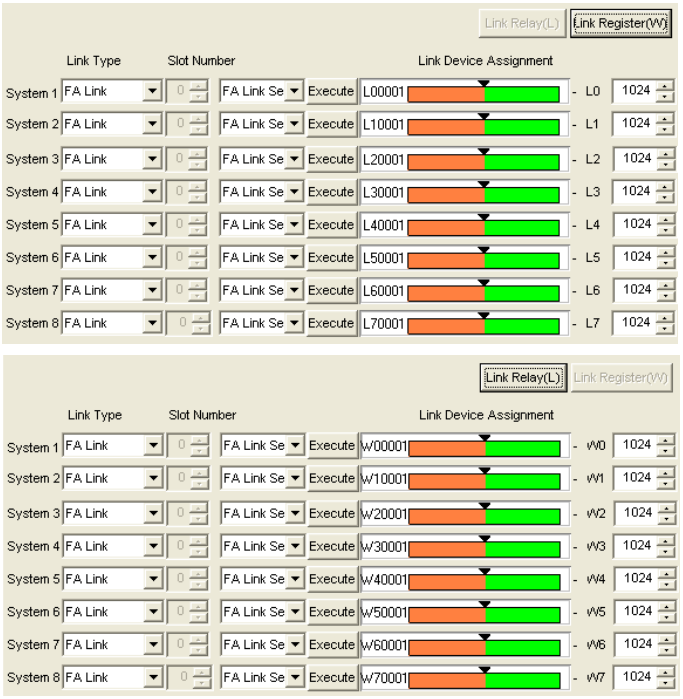


Figure 3.15 Sample Link Device Capacity Setting for F3SP25/35/28/53 (for High-speed Mode)

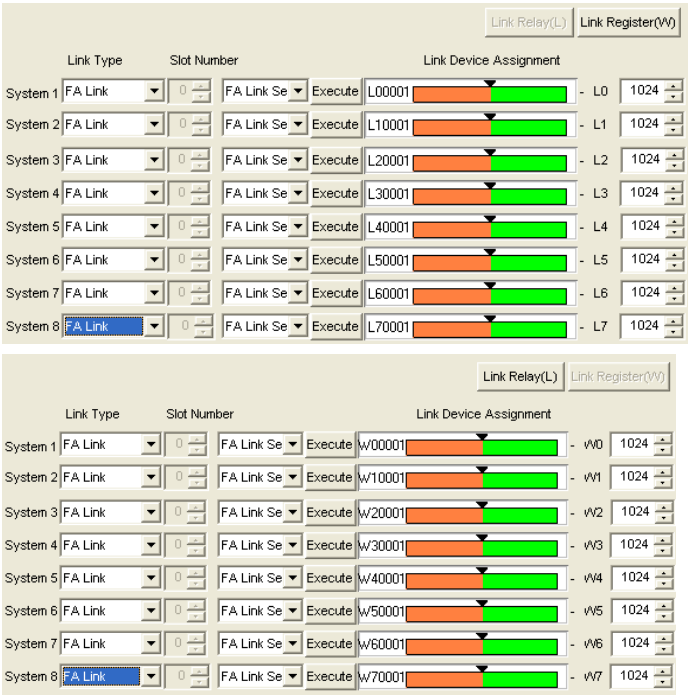


Figure 3.16 Sample Link Device Capacity Setting for F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S (for High-speed Mode)

■ For Normal Mode

For normal mode, set the link device capacities as follows:

- Set the link device capacity of a FA link system in use to "2048".
- Set the [Link Type] of an unused FA link system to "Do not Use".

Sample setting for each CPU model is shown below. All the examples assume that the maximum allowable number of FA link modules is installed.

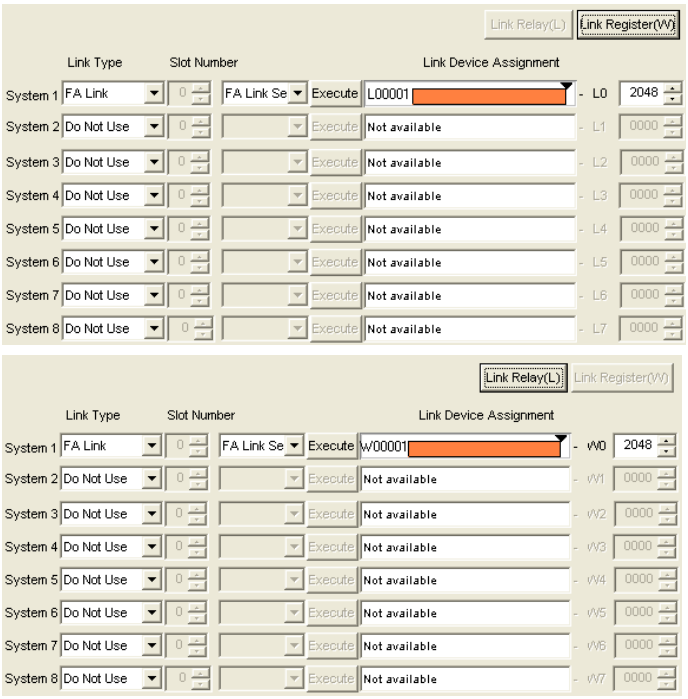


Figure 3.17 Sample Link Device Capacity Setting for F3SP05/08/21 (for Normal Mode)

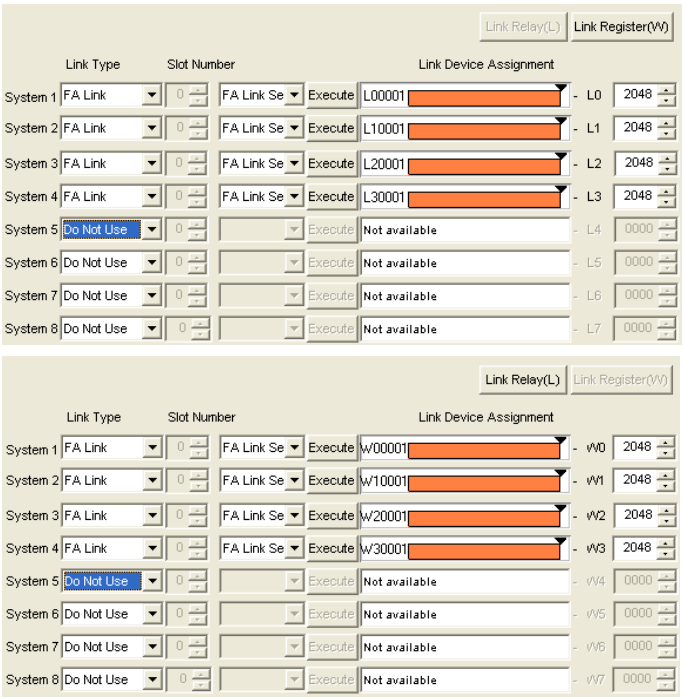


Figure 3.18 Sample Link Device Capacity Setting for F3SP25/35/28/53 (for Normal Mode)

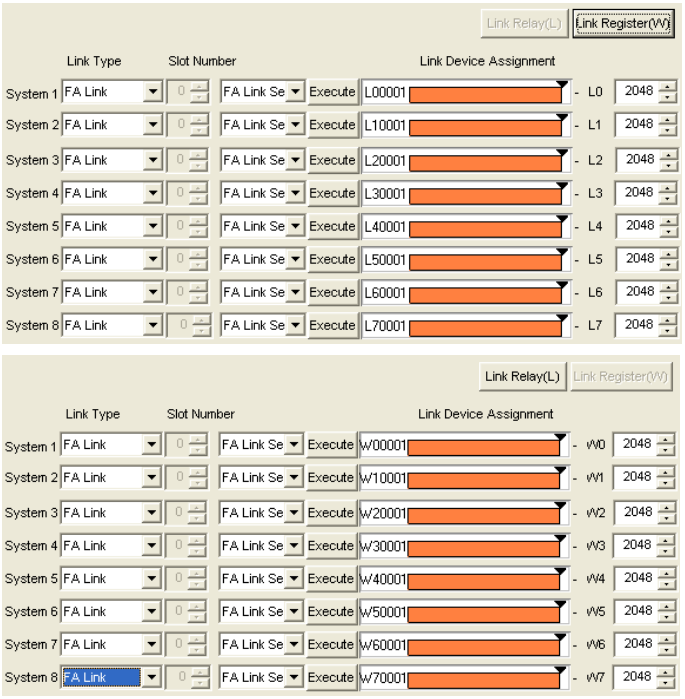


Figure 3.19 Sample Link Device Capacity Setting for F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S (for Normal Mode)

(1) Open the Configuration window

We describe here how to open the Configuration window for the project to set the link device capacities.

Step 1 Start WideField3 (or WideField2) and open the project.

Step 2 Select [Project]—[Project Settings] (for WideField2, select [Project]—[Configuration]) from the menu bar.
The Project Settings/Configuration window opens.

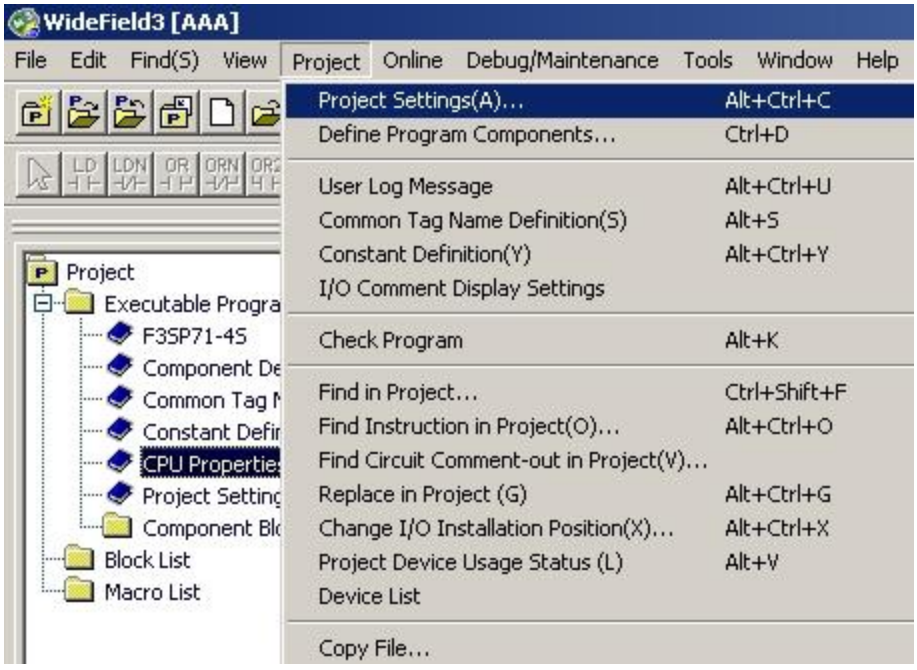


Figure 3.20 Opening the Configuration of a Project

Step 3 Click [FA Link Setup] on the Configuration tree pane.

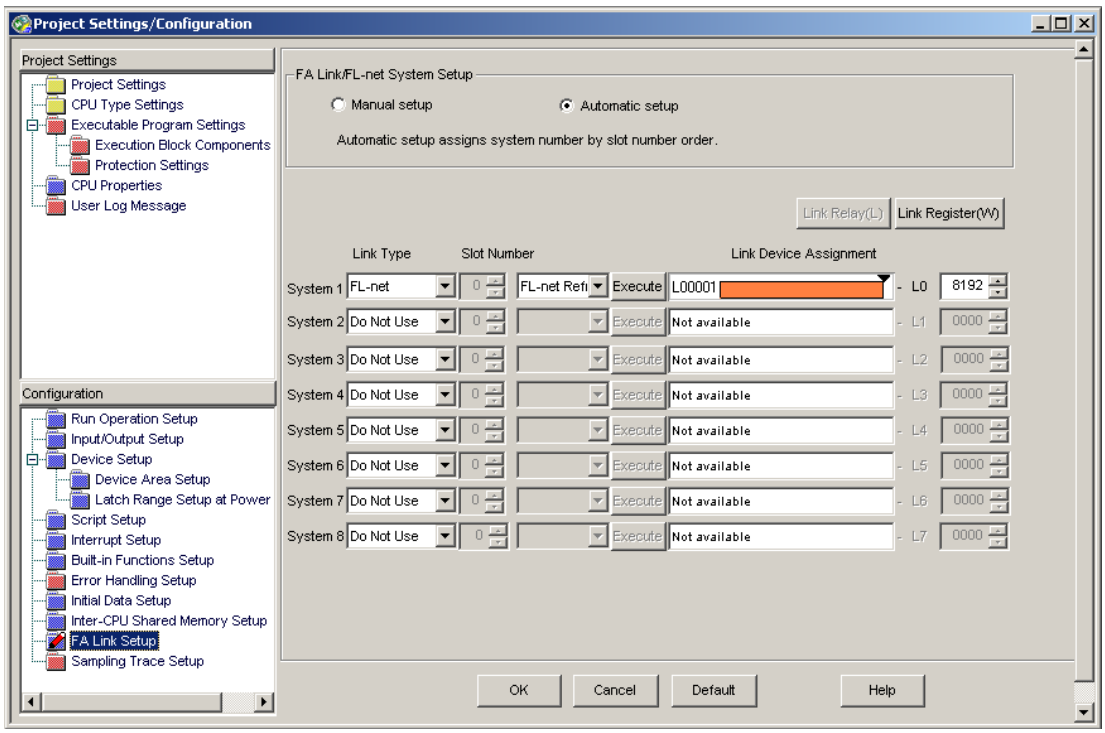


Figure 3.21 Project Settings/Configuration window

(2) Set the device capacities

Move the cursor using the TAB key and enter the number of devices.

(3) Update the configuration and exit

Step 1 Click the [OK] button.

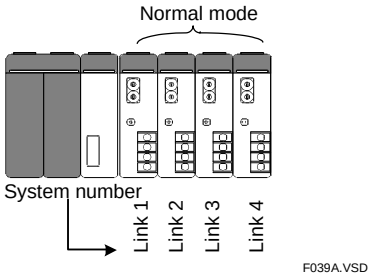
Note

- Update Configuration

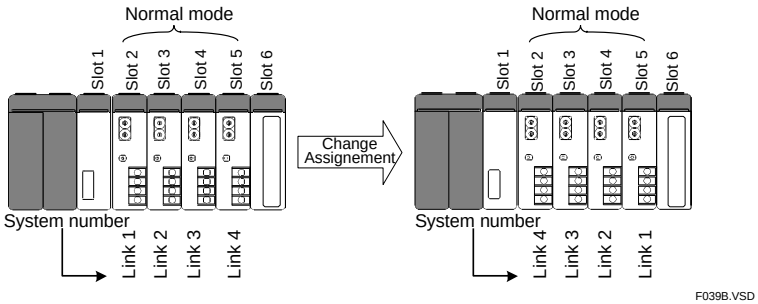
  Updating the configuration stores the current configuration settings in a configuration file, overwriting the old data in the configuration file.
  Exiting without updating the configuration discards the current configuration settings, leaving the configuration file unchanged with its previous data.

3.9.2 Setting FA Link System Numbers

If multiple FA Link H modules are installed, their system numbers are automatically assigned in ascending order of their slot numbers.



This setup is required only if you wish to re-assign the system numbers independent of the installed positions. The following example shows the setup required to replace the automatically assigned system numbers with a set of new values.



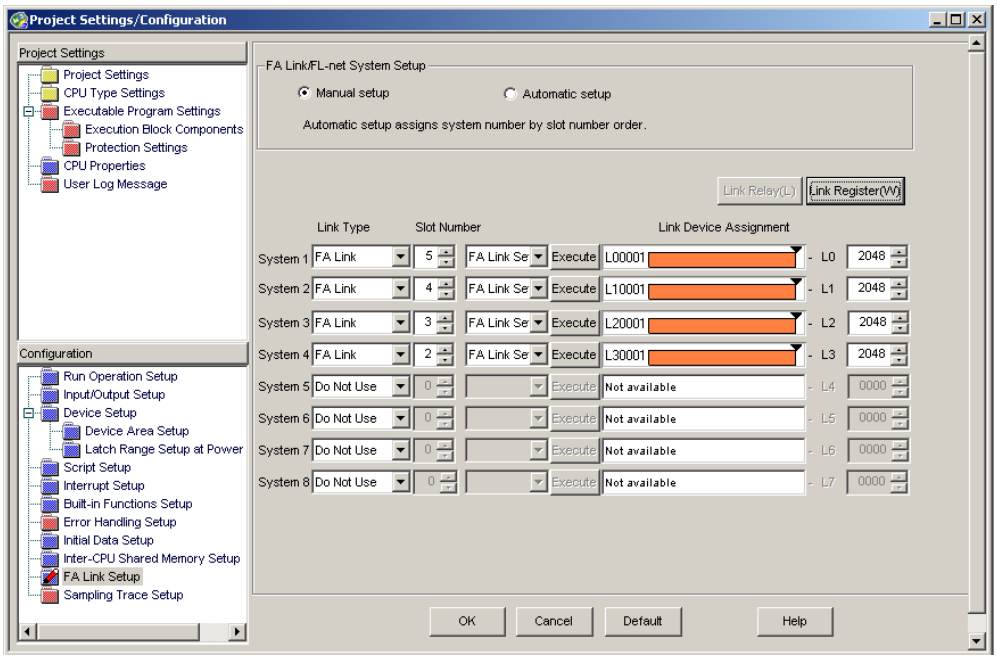


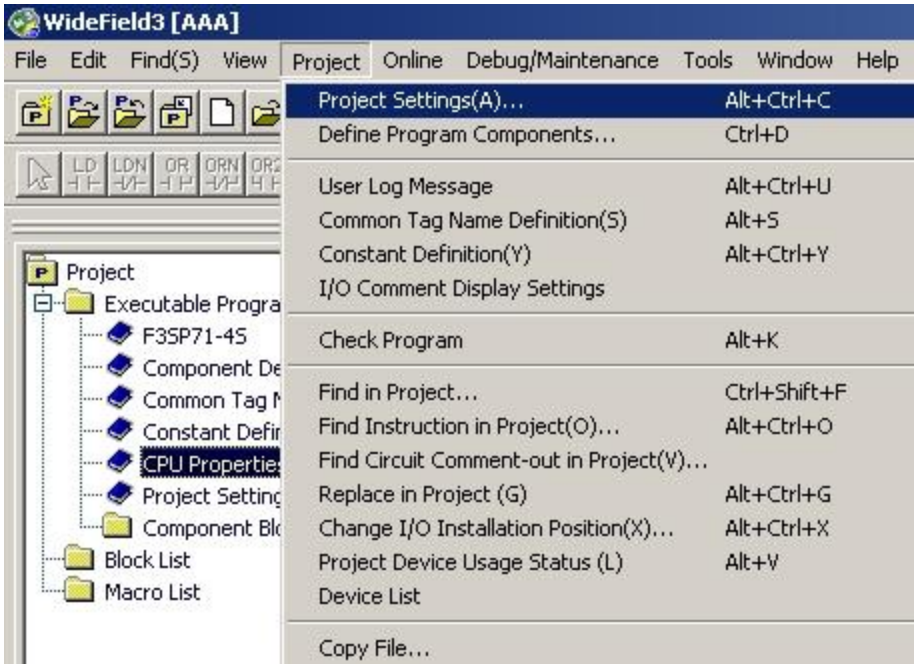
Figure 3.22 Example Setup for System Number Re-Assignment

(1) Open the Configuration window

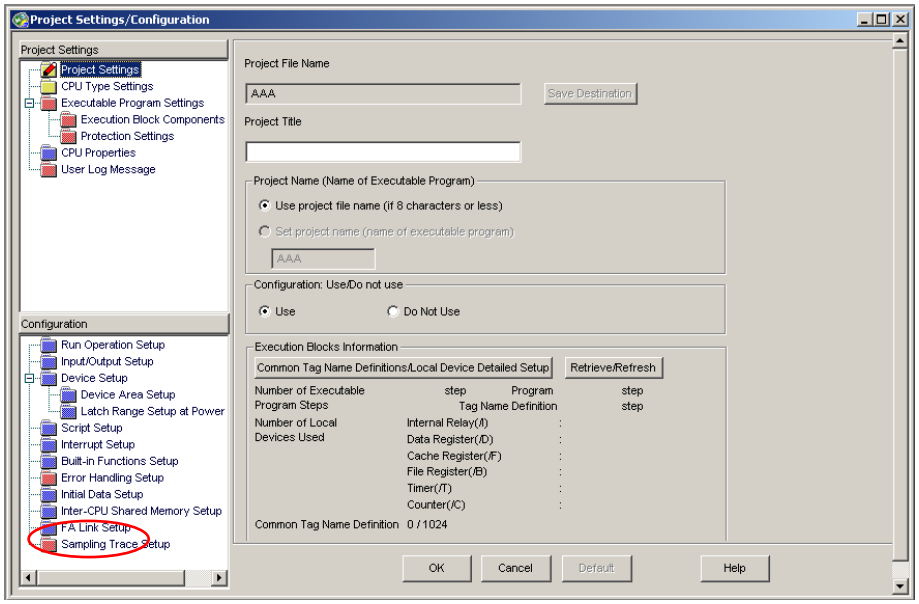
We explain the procedure to open the Configuration window of the project for setting the FA link system numbers.

Step 1 Start WideField3 (or WideField2) and open the project.

Step 2 Select [Project]—[Project Settings] (for WideField2, select [Project]—[Configuration]) from the menu bar.



Step 3 Select [FA Link Setup] in the Configuration tree pane.



The window for FA link setup appears.

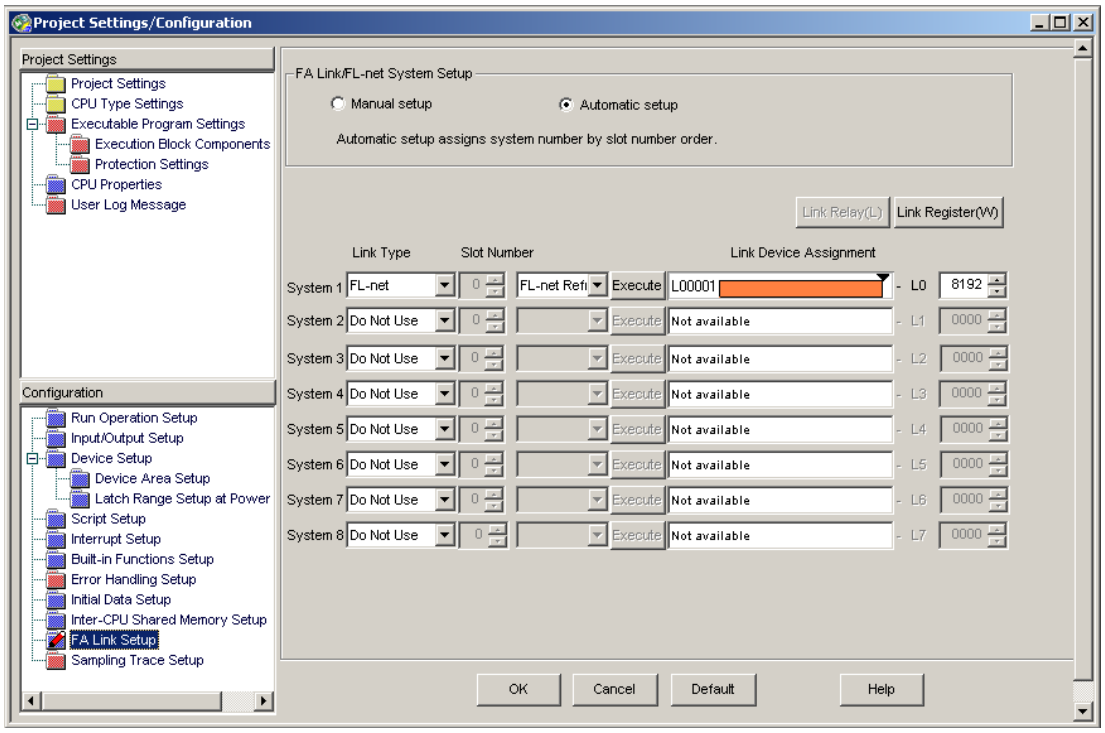
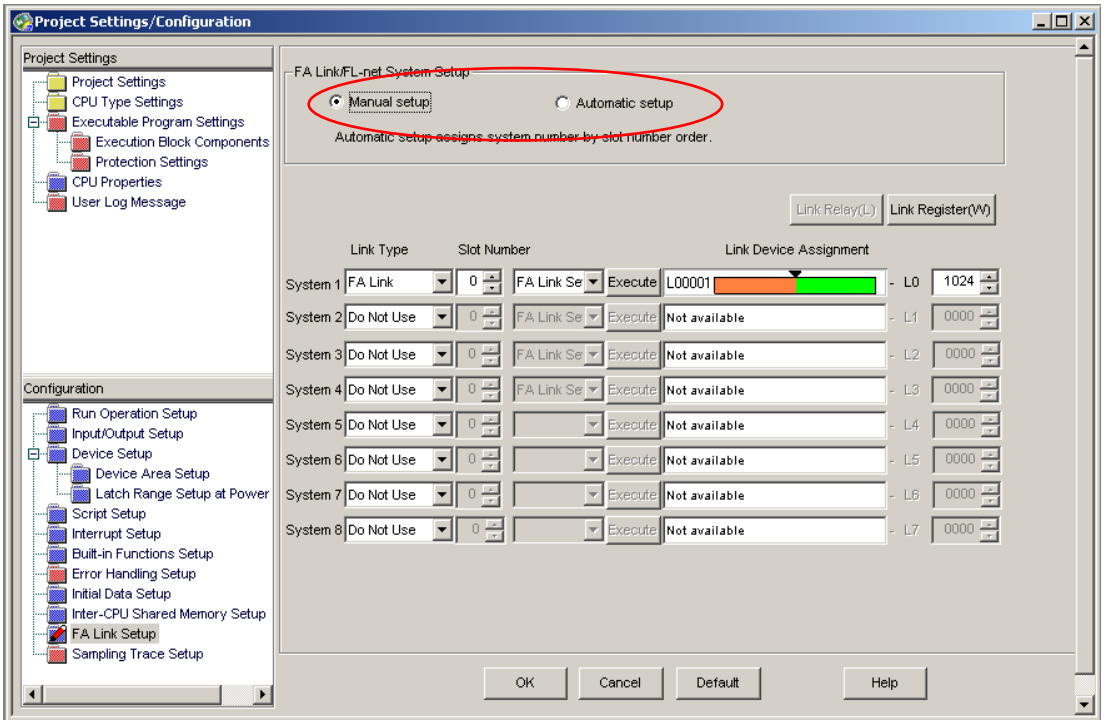


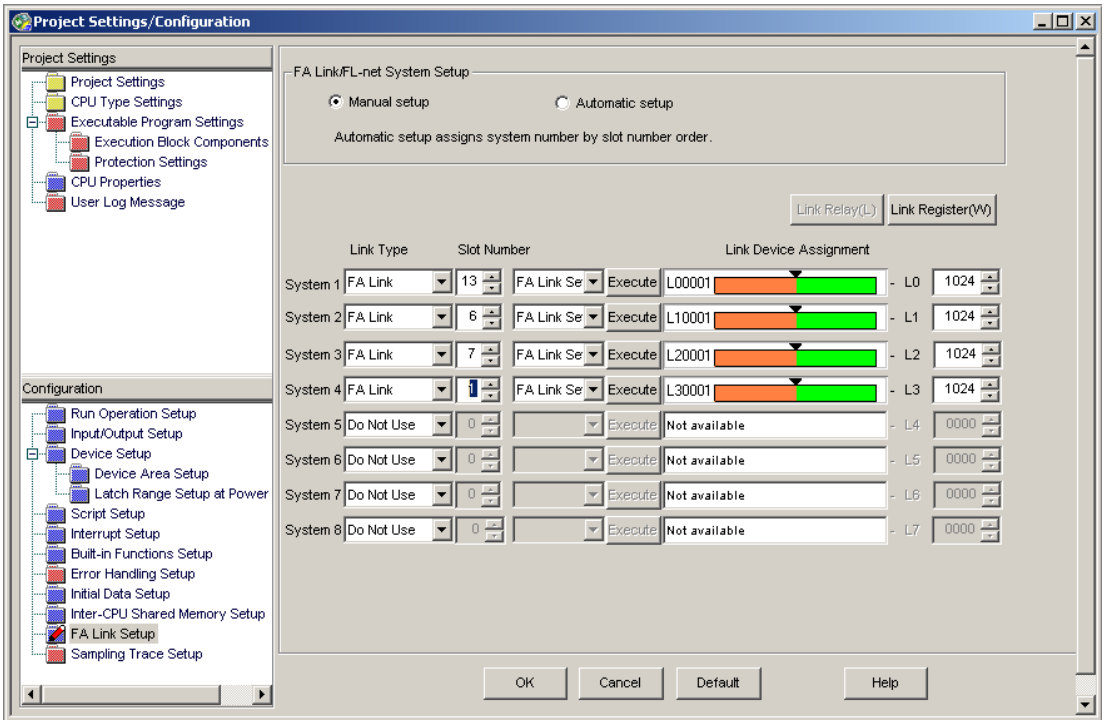
Figure 3.23 Window for FA Link Setup

(2) FA Link Setup

Step 1 Select “Manual Setup” or “Automatic Setup” under FA Link/FL-net System Setup, (For WideField2, select "Setup" or "Not Setup" under Setup FA Link System).



Step 2 Specify the slot number where the FA Link module is installed for each FA Link system.



(3) Update the configuration and exit

Step 1 Click the [OK] button.

Note

- Update Configuration

  Updating the configuration stores the current configuration settings in a configuration file, over-writing the old data in the configuration file.
  Exiting without updating the configuration discards the current configuration settings, leaving the configuration file unchanged with its previous data.

3.10 FA Link H Configuration

In order to establish data links using the FA Link H, the following configuration setup is required. Configuration setup here involves the allocation of link devices for each link system to each station.

The configuration is carried out on the FA Link Station Assignment and Monitoring window of the WideField3 software.

This setup is stored in the non-volatile memory of each link module and therefore, once set, does not need to be set again unless a link module is replaced.

The conditions for the setup values depend on the operation mode of the link module as shown in the table below.

Note

Each link module stores only the link device allocation data of its own (local) station, but not the data of the other remote stations. Always perform the FA link configuration again when a FA link module is replaced or added.

Figure 3.4 Maximum Number of Link Devices

	Normal Mode		High Speed Mode	
	Link Relay	**Link Register**	**Link Relay**	**Link Register**
Maximum number of devices*1	2048	2048	1024	1024
Allocation	On 16-device basis*2	On 1-device basis	On 16-device basis*2	On 1-device basis

*1 The maximum total number of devices allocated to each station in the system.
The allocation of the devices to each station should be such that the total does not exceed this value.

*2 16m (where m is an integer from 0 to 64) except that the F3LP02 may be allocated with up to 2048 link relays per station in normal mode.

We describe below how to setup the FA Link H configuration using the WideField3 software. For more details on the WideField3 software, read the FA-M3 Programming Tool WideField3 User's Manuals (IM34M06Q16-01E, -02E, -03E, and -04E), which can be procured separately from Yokogawa Electric Corporation.

Note

If you are using WideField2, you may read "WideField3" as "WideField2" in this manual.

For details, read the FA-M3 Programming Tool WideField2 User's Manual (IM34M06Q15-01E), which can be procured separately from Yokogawa.

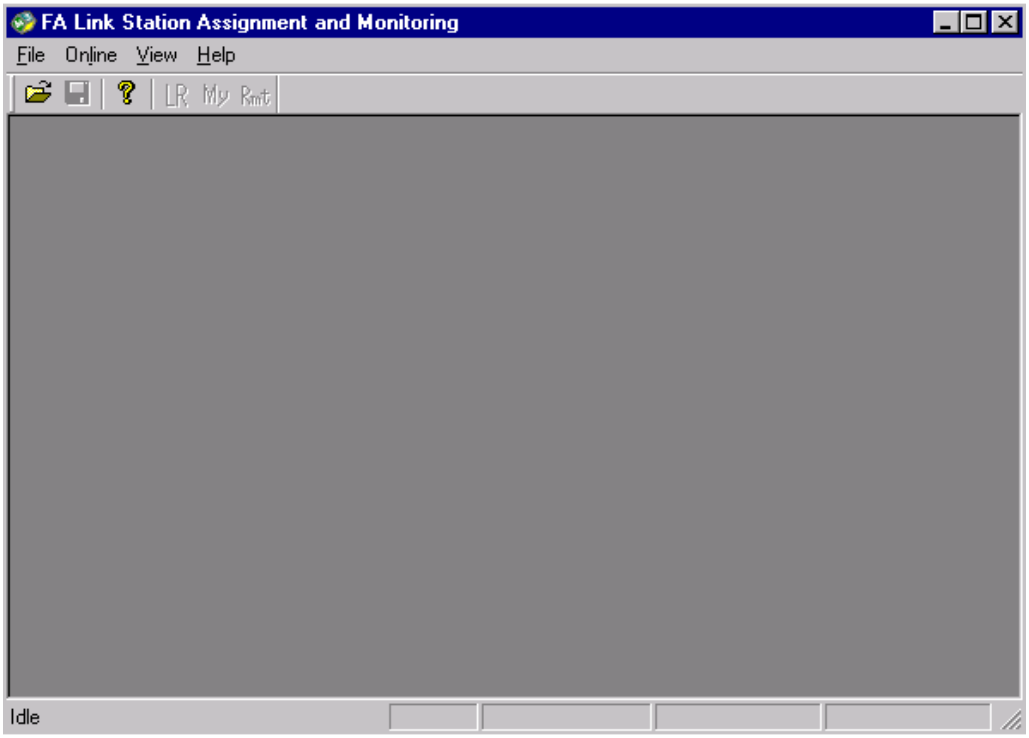
■ FA Link Configuration

Step 1 Start WideField3 and select [Tools]—[Setup I/O Module]—[FA Link] from the menu. The FA Link Station Assignment and Monitoring window opens.

- To read link information from the module or to register link information to the module, you must first connect to the FA-M3 before performing the above step.

You can perform the following tasks related to station allocation on this window.

- Read link information from a file
- Read link information from a module
- Save link information to a file
- Register link information to a module



F03A1.VSD

Figure 3.24 FA Link Station Assignment and Monitoring window

Note

- Link Information

  This refers to the information regarding the allocation of the link relays and link registers to the various stations on a network on the FA link.

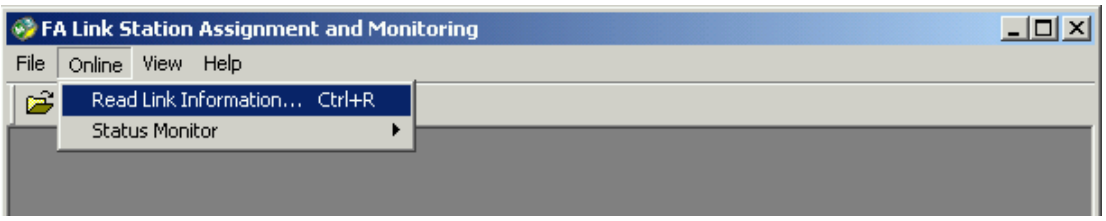
Note

Setting the link device points using FA link configuration cannot be performed with a standalone module. Make sure that the module is in “connected” state before performing the setup.

■ Reading Link Information from the Module

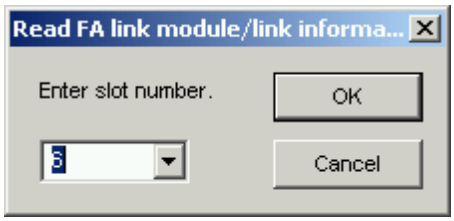
This reads the current link information setup from the link module installed in the FA-M3.

Step 1 Select [Online]—[Read Link Information] from the menu.

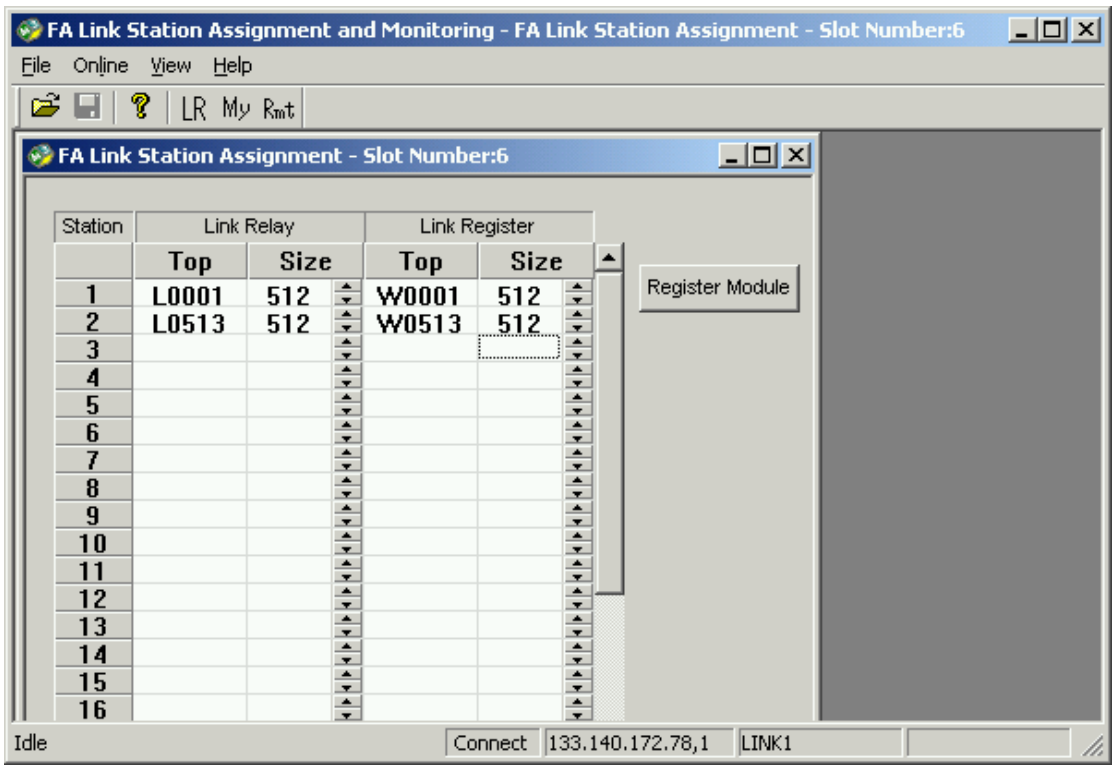


F03A2.VSD

Step 2 Specify the slot number where the FA link module to be read is stored and Click the [OK] button. The FA Link Station Assignment window opens.



FB03A3.VSD



F03A4.VSD

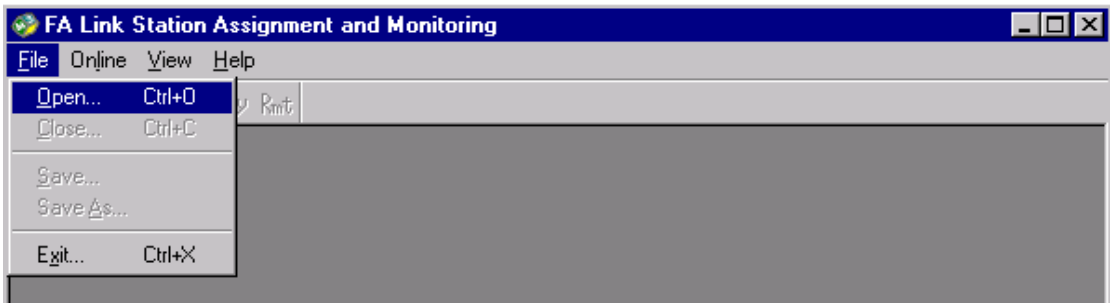
Note

To perform L allocation of the link relays and link registers after reading the link information,
see "■ Allocating Link Relays and Link Registers]", which will be described later.

■ Reading Link Information from a File

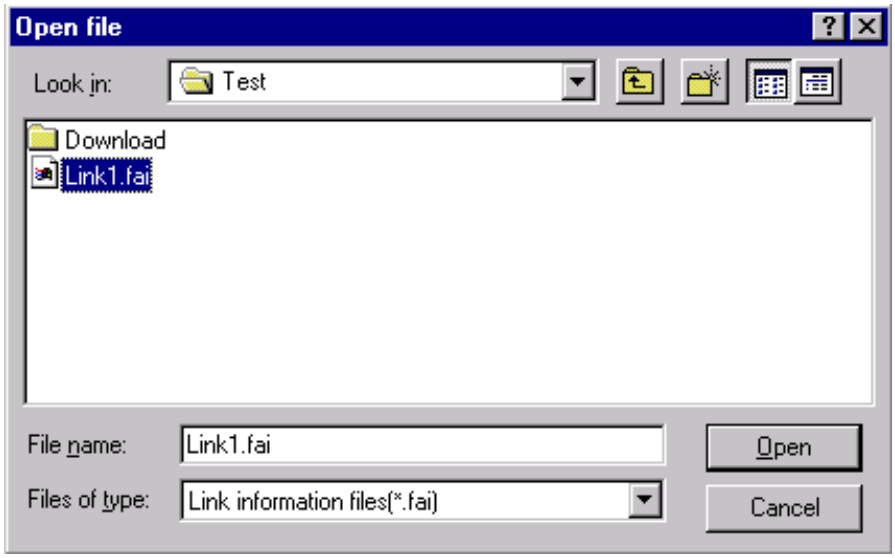
This reads link information from the link information file.
If a link information file exists, you can read link information from the file.

Step 1 Select [File]—[Open] from the menu.



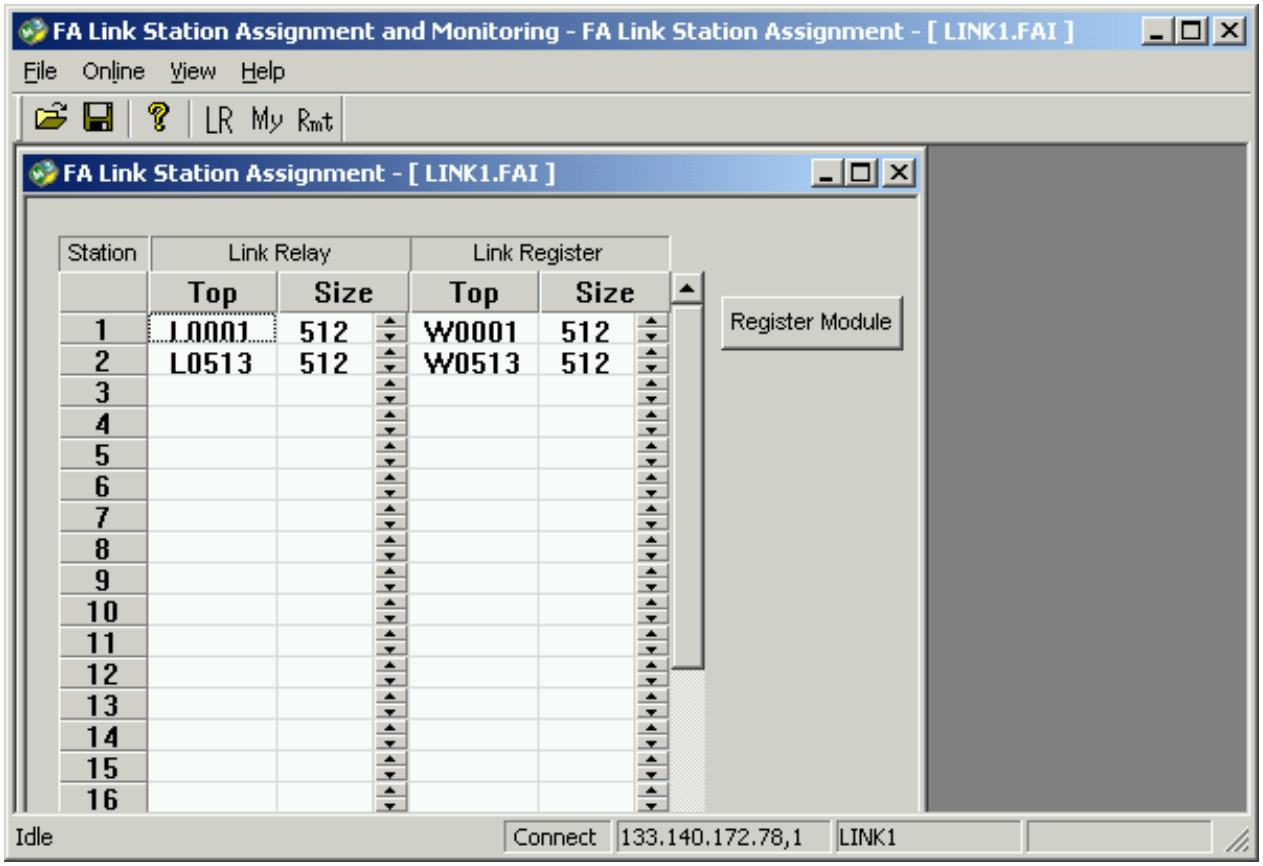
F03A5.VSD

Step 2 Specify the directory, select the link information file and click [Open].



F03A6.VSD

The FA Link Station Assignment window opens.



F03A7.VSD

Note

To perform L allocation of the link relays and link registers after reading the link information,
see “■ Allocating Link Relays and Link Registers]”, which will be described later.

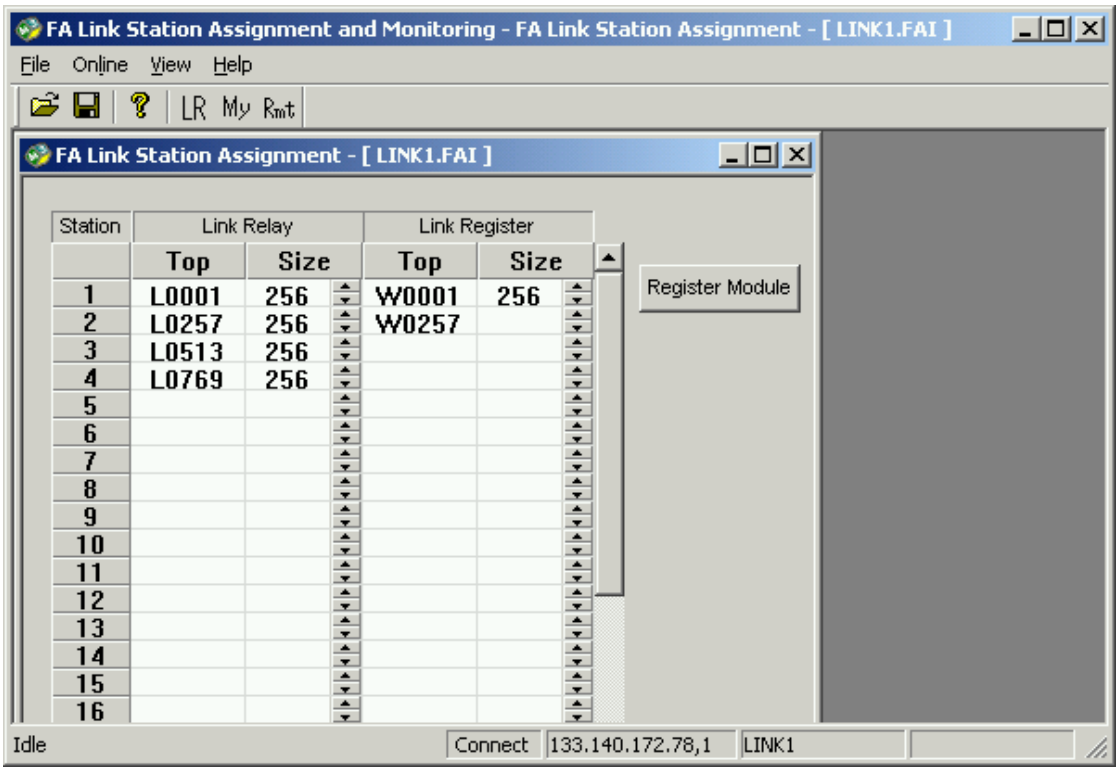
■ Allocating Link Relays and Link Registers

You can change (setup) link information, write (register) it to a link module and save it to a file.

● Setup

This changes the link information displayed on the window. The items to be set are the starting address and the size of each link relay and link register.

Step 1 Move the cursor to the item you wish to set (the starting address or size of a link relay, or the starting address or size of a link register) using the [↑], [↓], [←], [→] arrow keys or the mouse.



F03A8.VSD

Figure 3.25 FA Link Station Assignment Window

Step 2 Enter the starting device number or the number of points and press the Enter key.

Prefix the device number with the letter “L” (respectively the letter “W”) when setting the starting device number of a link relay (respectively of a link register). Enter a numeric value for the size. The table below shows the restrictions on the setting values.

Table 3.5 Restrictions on Setup Values

	Normal Mode		High Speed Mode	
	Link Relay	Link Register	Link Relay	Link Register
Starting Address	L0001 to L2033 On 16-point basis *1	W0001 to W2048 On 1-point basis	L0001 to L1009 On 16-point basis *1	W0001 to W1024 On 1-point basis
Size	0 to 2048 points On 16-point basis *2	0 to 2048 points On 1-point basis	0 to 1024 points On 16-point basis *2	0 to 1024 points On 1-point basis

*1 16m+1 (where m is an integer from 0 to 63)
*2 16m (where m is an integer from 0 to 64) except that the F3LP02 may be allocated with up to 2048 link relays per station in normal mode.

Note

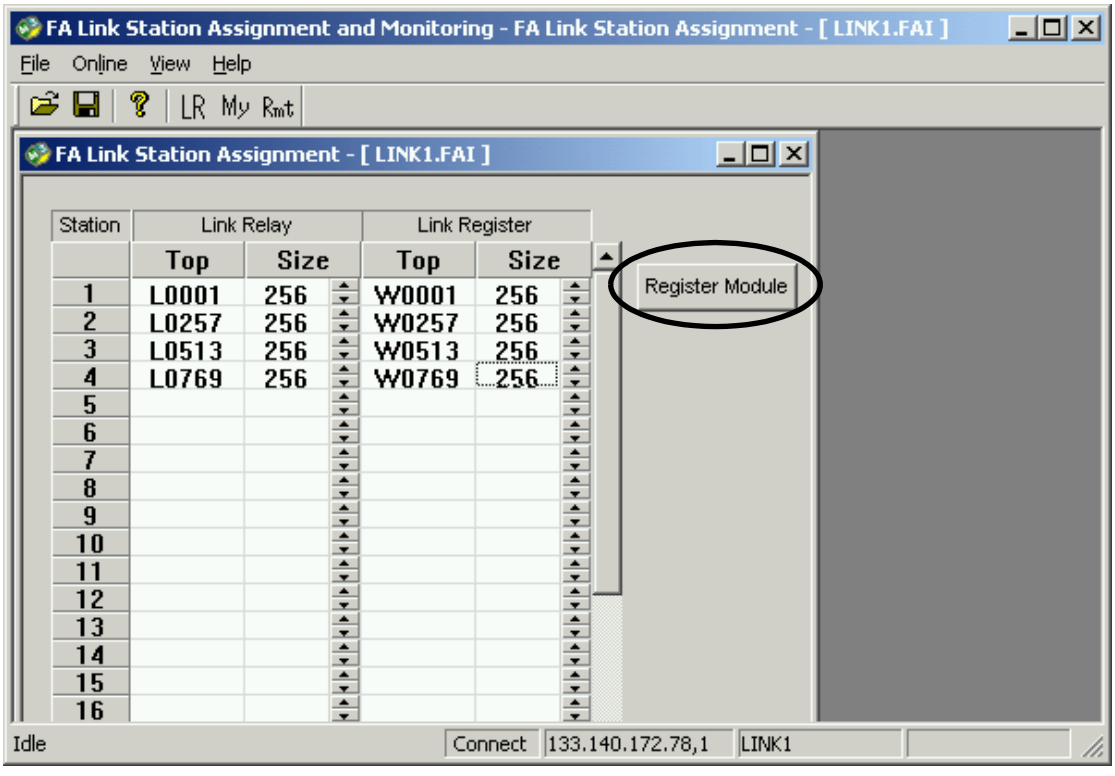
Link data cannot be written to a station whose starting address field is set to spaces or whose size field is set to spaces or zero. These stations become read-only stations.

Always perform registration after setup is completed.

● Batch registration (of all 32 stations)

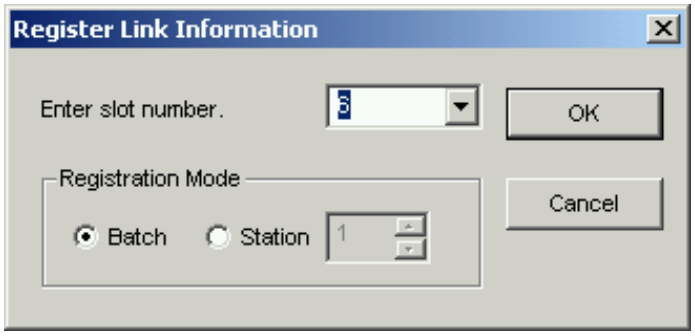
This registers the FA link H configuration information defined for all the 32 stations of the link module.

Step 1 Click [Register Module] on the window displaying the link information read from a module or from a file.



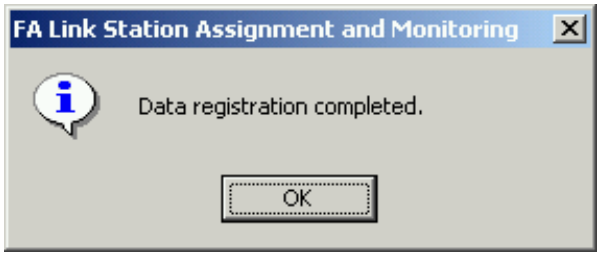
F03A9.VSD

Step 2 Specify the slot number where the FA link module to which you wish to register is mounted and click [OK].



F03AA.VSD

Step 3 When registration completes, the following message is displayed. Click [OK] to exit.

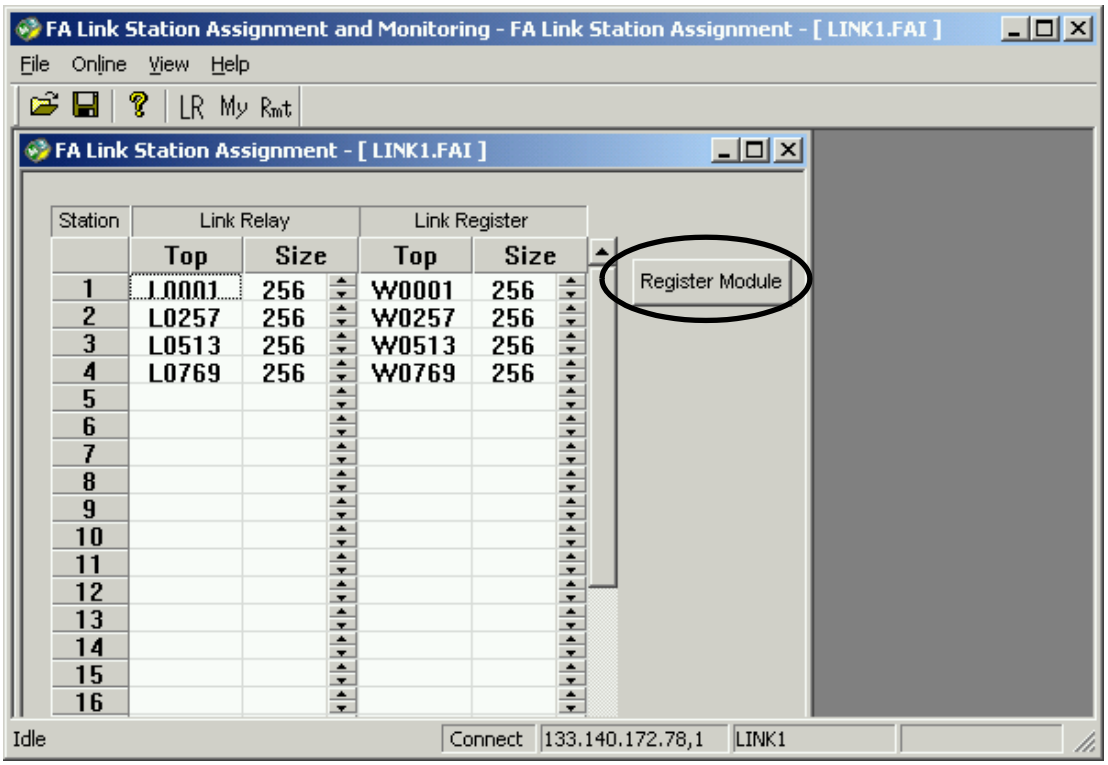


F03AB.VSD

● Station registration (on per station basis)

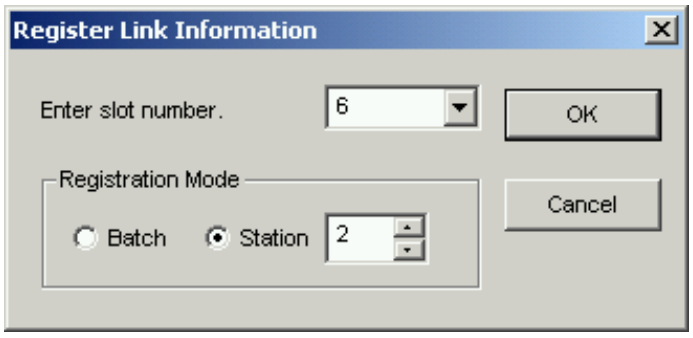
This registers the FA link H configuration information setting to the link module for one station.

Step 1 Click [Register Module] on the window displaying the link information read from a module or from a file.



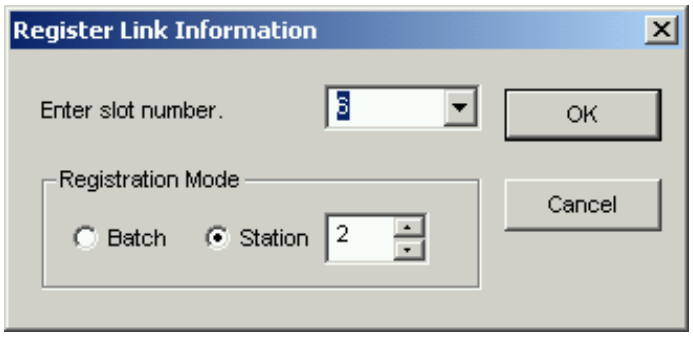
F03AC.VSD

Step 2 Select [Station] in the Registration Mode frame. Then specify the station number which you wish to resister



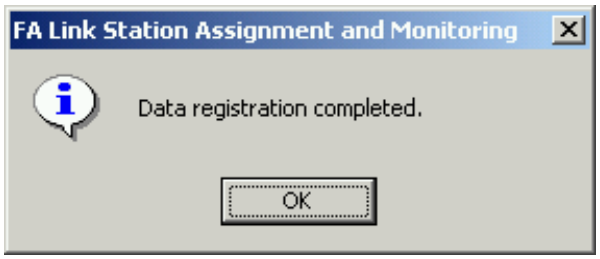
F03AD.VSD

Step 3 Specify the slot number where the FA link module to which you wish to register is mounted and click [OK].



F03AE.VSD

Step 4 When registration completes, the following message is displayed. Click [OK] to exit.



F03AF.VSD

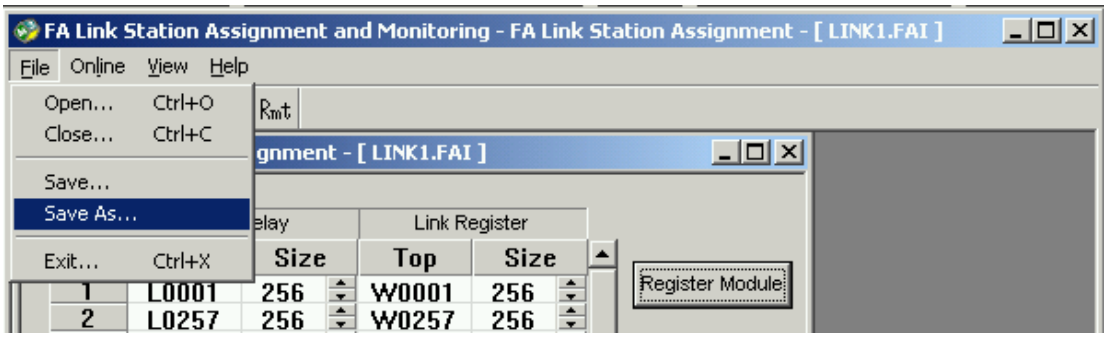
● Save

This saves the FA link H configuration information in a link information file.

A file extension of ".FAI" is automatically appended to the file name.

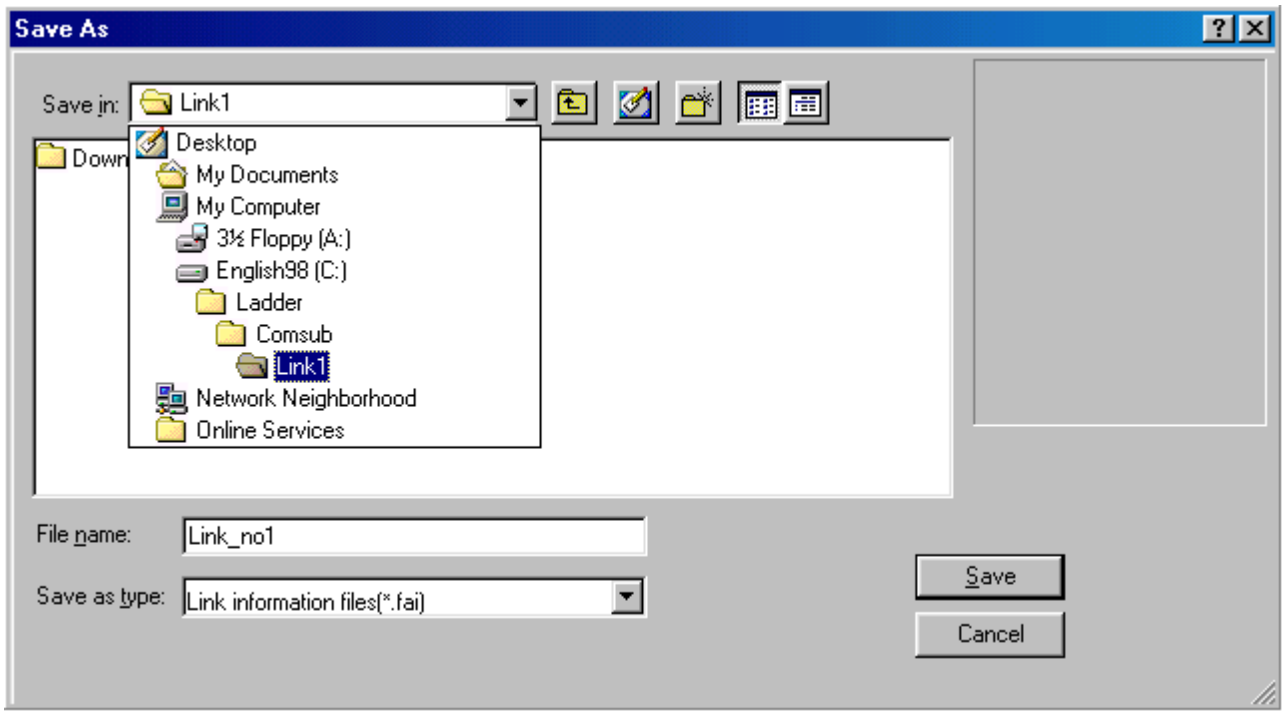
Step 1 Open the window displaying link information read from a module or the window displaying link information read from a file.

Step 2 Select [File]—[Save As] from the menu bar.



F03AG.VSD

Step 3 Specify the directory where you wish to save the link information file and enter the file name.



F03AH.VSD

Step 4 Click [Save]. The file specification screen disappears.

You can also save to the file currently open from the screen displaying link information read from a file. In step 2 above, select [File]—[Save] from the menu instead.

Note

When creating 2 or more files, save the files in different directories.

Blank Page

4. Link Data Configuration

This chapter describes the link relays and registers used in the FA Link H Module.

4.1 Link Relays

Link Relays are data-linked relays in the connected FA Link H system. In normal mode, one system incorporates a maximum of 2048 points. A maximum of 2048, 8192 and 16384 points of link relays are available for the F3S05/08/21, F3SP25/35/28/53, F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S CPU modules respectively. This allows multiple link modules to be installed but note that the device numbers are not contiguous across systems.

System Number	Normal Mode
1	L00001 to L02048
2	L10001 to L12048
3	L20001 to L22048
4	L30001 to L32048
5	L40001 to L42048
6	L50001 to L52048
7	L60001 to L62048
8	L70001 to L72048

Link relays are non-latched, which means they reset when all power is turned off. Unlike I/O relays, these relays cannot receive signals directly from external equipment, nor provide output to external equipment. The link relays of the local station are read and write enabled, but the link relays of the other stations are read-only.

Link relays are accessed on a 16-bit basis, so they are allocated to individual stations on a 16×n (where n is an integer between 0 to 64, inclusive) point basis. They are allocated during FA link configuration. 16 or 32 points of link relays can be handled at a time.

4.2 Link Registers

Link registers are data-linked registers in the connected FA Link H system. In normal mode, one system incorporates a maximum of 2048 points. A maximum of 2048, 8192 and 16384 points of link registers are available for the F3SP05/08/21, F3SP25/35/28/53 and F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S CPU modules respectively. This allows multiple link modules to be installed but note that the device numbers are not contiguous across systems.

System Number	Normal Mode
1	W00001 to W02048
2	W10001 to W12048
3	W20001 to W22048
4	W30001 to W32048
5	W40001 to W42048
6	W50001 to W52048
7	W60001 to W62048
8	W70001 to W72048

Link registers are non-latched, which means they reset when all power is turned off. The link registers of the local station are read and write enabled, but the link registers of the other stations are read-only.

When data is treated as 2 words (32 bits), two devices are used. In a two-word instruction, the low-order word corresponds to the specified link device number and the high-order word corresponds to the specified link device number +1.

4.3 Special Relays

Special relays with special functions are used only as contacts. They provide information on the various stations in the data link system.

Relays Number for FA Link 1	Turns on when…	Cause /Explanation	LED Display		Remarks	Status of FA Link Module*2
			CPU	FA Link		
M0257 *1 *3	Station number error occurs	- A number other than 1-32 is specified as the station number. - Station number 1 is duplicated.	RDY (green) RUN (green) ALM (yellow) ERR (off)	RDY (green) SND (off) ERR (red lit)	- The ERR LED on the front of the FA Link H module lights up. (It turns off when the cause of the error is eliminated). - The ALM LED of the sequence CPU using the link data also lights up. (The LED turns off when the alarm is acknowledged using WideField3 after the cause of the error had been eliminated. The special relay turns off simultaneously.)	OFF-LINE
M0258*4	Configuration data error occurs.	There is a checksum error in the configuration information stored in a FA Link H Module.	RDY (green) RUN (green) ALM (off) ERR (off)	RDY (off) SND (off) ERR (red)	The RDY LED on the front of the FA Link H module turns off and the ERR LED lights up.	OFF-LINE
M0259*5	Duplicate allocation of device occurs.	A link relay or link register is doubly allocated.	RDY (green) RUN (green) ALM (off) ERR (off)	RDY (green) SND (off) ERR (red)	The "ERR" LED on the front of the FA Link H module lights up.	OFF-LINE
M0260*6	FA Link H module restarts	An FA Link H Module has restarted due to a hardware failure or the like.	RDY (green) RUN (green) ALM (off) ERR (off)	RDY (green) SND (off) ERR (off)		OFF-LINE

*1: If any station number between 2 to 32, inclusive is duplicated, the error is not detected. However, link data of the entire system incorporating that station cannot be updated normally.

*2: When a station is off-line, its link data is not updated. However, the link data of the remaining stations in the FA link system is updated.

Relays Numbers for FA Link 1	Turns On When…	Cause /Explanation	Remarks
M0273*7 to M0304	Turns on for station numbers 1 to 32 if the relevant station is not connected or if it is unable to communication due to an error.	These relays are read-only and indicate the communication status.	Mnnnn+15 Mnnnn 16 15 ---------- 3 2 1 32 31 ---------- 19 18 17 Mnnnn+31 Mnnnn+16 The communication status, CPU operating status, and sequence operating status for stations 1 to 32 are each allocated two words (6 words in total per station) in the configuration shown above.
M0305*8 to M0336	If the CPU module or add-on CPU module of a station is the Not Ready state, the corresponding relay turns on.	These relays are read-only and indicate the operating status of a CPU. A Not Ready state means that initialization is being requested or that the CPU is down.	
M0337*9 to M0368	If no sequence program is running at a station, the corresponding relay turns on.	These relays are read-only and indicate the status of sequencing. If the CPU is in the Not Ready state, the sequencing also stops (the relay is on.)	

The relay numbers of FA Link 2 to 8 are given below.

	Relay Numbers of FA Link 2	Relay Numbers of FA Link 3	Relay Numbers of FA Link 4	Relay Numbers of FA Link 5	Relay Numbers of FA Link 6	Relay Numbers of FA Link 7	Relay Numbers of FA Link 8
*3	M0369	M8321	M8433	M8545	M8657	M8769	M8881
*4	M0370	M8322	M8434	M8546	M8658	M8770	M8882
*5	M0371	M8323	M8435	M8547	M8659	M8771	M8883
*6	M0372	M8324	M8436	M8548	M8660	M8772	M8884
*7	M0385 to M0416	M8337 to M8368	M8449 to M8480	M8561 to M8592	M8673 to M8704	M8785 to M8816	M8897 to M8928
*8	M0417 to M0448	M8369 to M8400	M8481 to M8512	M8593 to M8624	M8705 to M8736	M8817 to M8848	M8929 to M8960
*9	M0449 to M0480	M8401 to M8432	M8513 to M8544	M8625 to M8656	M8737 to M8768	M8849 to M8880	M8961 to M8992

Note

For details on how to use the special relays, see the notes on creating a program in Chapter 6, “Cautions on Using FA Link H Modules”.

Note

If any station in a network incorporating the F3LP12-0N module has its power turned off or its fiber optic cable disconnected, data link in the entire network cannot proceed. In addition, the special relays (M0273 through M0368 and the corresponding relays) are not data linked and do not reflect their status. Whether the network is normal can be determined by checking whether the local station status of the special registers (Z0065 and the corresponding link registers) is online.

The following data is logged in the error log of the CPU module when an error is detected in the setup or module.

Message string	System Log Detailed Code	Alarm Display Code	**Description**	**Corrective Action**
FA LINK 1 error*1	15-0n*2	09-0000	Error in FA Link Module configuration	Correct the configuration setting.
FA LINK 2 error*1	16-0n*2	0A-0000		
FA LINK 3 error*1	19-0n*2	0B-0000		
FA LINK 4 error*1	1A-0n*2	0C-0000		
FA LINK 5 error*1	1B-0n*2	0D-0000		
FA LINK 6 error*1	1C-0n*2	0E-0000		
FA LINK 7 error*1	1D-0n*2	0F-0000		
FA LINK 8 error*1	1E-0n*2	10-0000		

*1: When only one FA Link module is installed on the FA-M3, only FA Link 1 is displayed. When multiple FA Link H modules are installed on the FA-M3, the module with the smallest slot number is displayed as FA Link 1, the module with the next larger slot number is displayed as FA Link 2, etc. FA Link system numbers can be defined during configuration.

*2: n is a number indicating the error type as follows:
1: Station number error
2: Configuration error
3: Duplicate device allocation

4.4 Special Registers

Special registers with special functions provide information on the status, cyclic transmission time intervals of the local station on the data link system.

Register Numbers of FA Link 1	Description	Remarks
Z0065*1	This register indicates the status of the local station. 0: Initialization in progress 1: Offline (data communications disabled due to error, etc.) 2: Online (operating normally)	Read-only
Z0066*2	This register indicates the cyclic transmission time. It indicates the refresh period of all link data in the communication buffer in an FA Link Module in milliseconds. The maximum value is 408 ms.	Read-only

Note: The transmission period may be prolonged when communications fails due to noise, cable discontinuity, etc.

The register numbers of FA Link 2 to 8 are shown below.

	Register number of FA Link 2	Register number of FA Link 3	Register number of FA Link 4	Register number of FA Link 5	Register number of FA Link 6	Register number of FA Link 7	Register number of FA Link 8
*1	Z070	Z257	Z262	Z267	Z272	Z277	Z282
*2	Z071	Z258	Z263	Z268	Z273	Z278	Z283

Note

For details on how to use the special registers, see the notes on creating a program in Chapter 6, “Cautions on Using FA Link H Modules”.

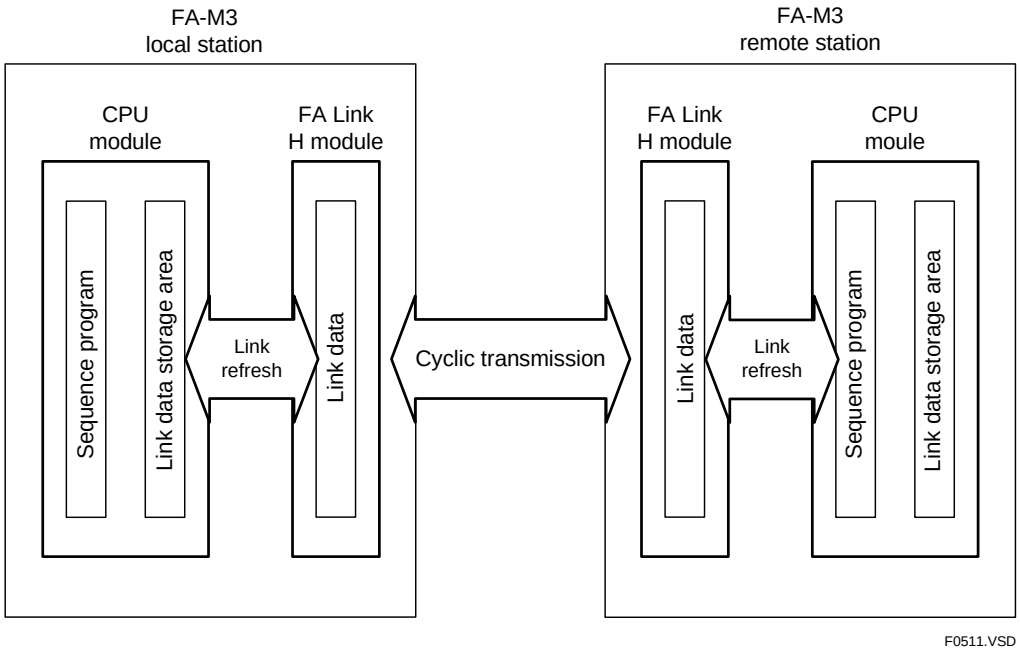
5. Operation and Processing Time

The following section describes sending and receiving of link data and its processing time in the FA-M3 FA Link H system.

5.1 Overview of Data Link Processing

In the FA Link H, each station and link device data are linked by the link device allocated by the FA Link configuration. The following description outlines the processing starting from the writing of the link device allocated to a local station until the same data is read by a remote station.

Two processes are involved until the local station data is read in the remote station, namely, link refreshing and cyclic transmission.



5.1.1 Link Refresh

Link refresh refers to the reading and writing between the link relays and link registers in the sequence CPU module and the link data in the FA link module attached to a local unit to synchronize the link data in the sequence CPU's data storage area with that in the FA Link Module.

The sequence CPU reads data from the FA Link Module automatically so that data communications is transparent.

Link refresh executes concurrently with instruction processing and does not affect the scan time.

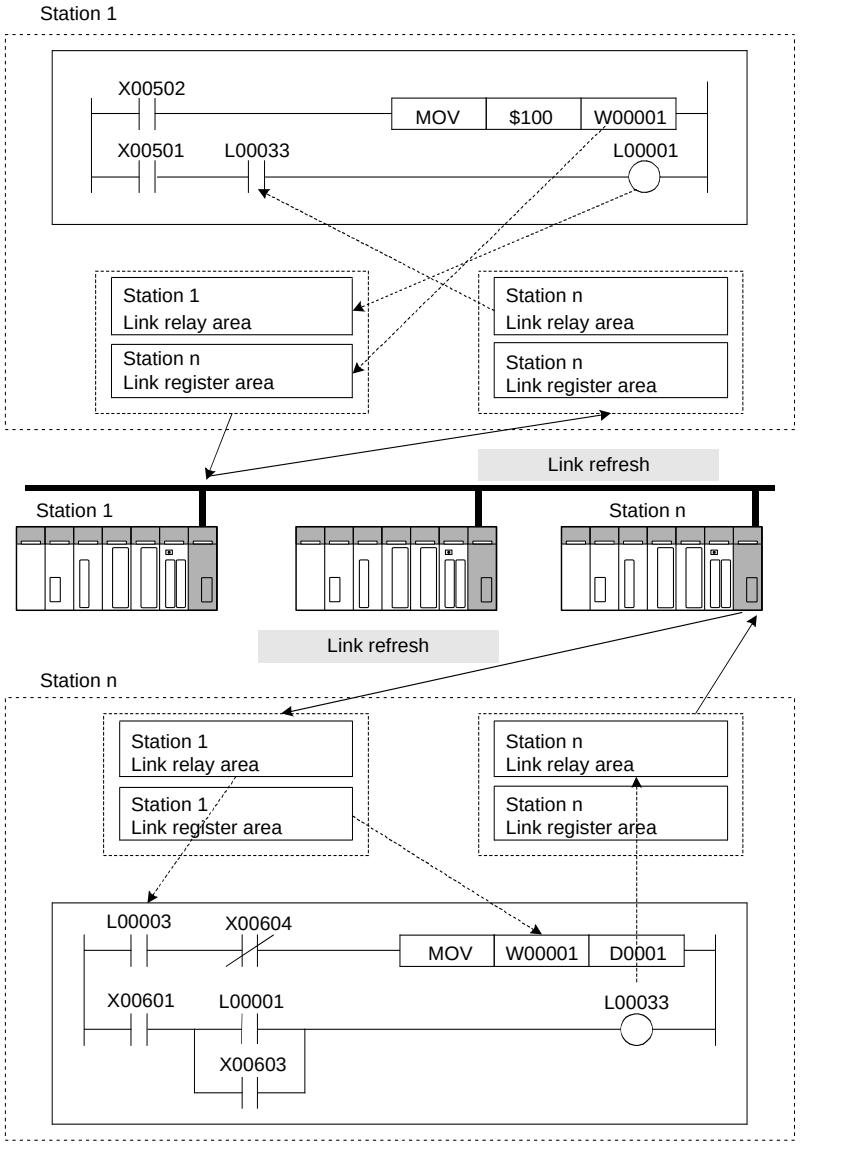


Figure 5.1 Link Refresh

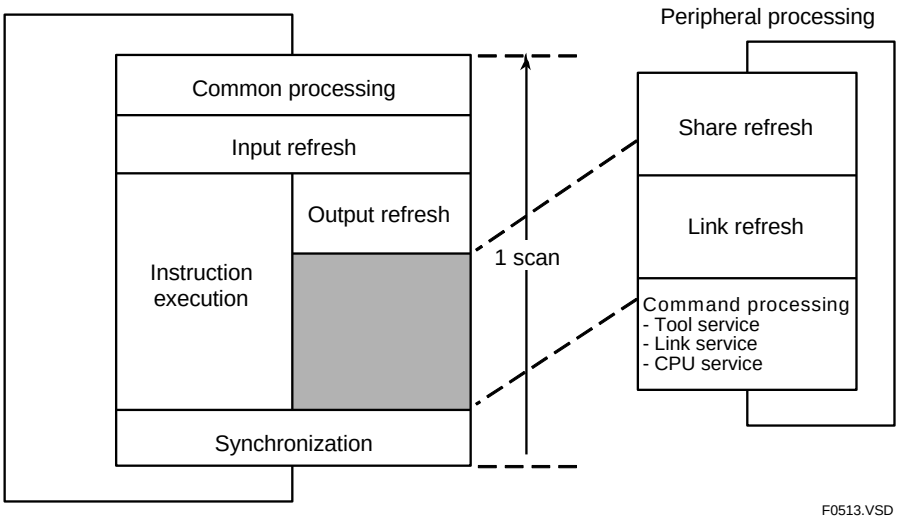


Figure 5.2 Peripheral Processing Operation

Note

Link refresh takes place for the link relays and registers of FA Link 1, FA Link 2, ... and FA Link 8 each time peripheral processing is performed.

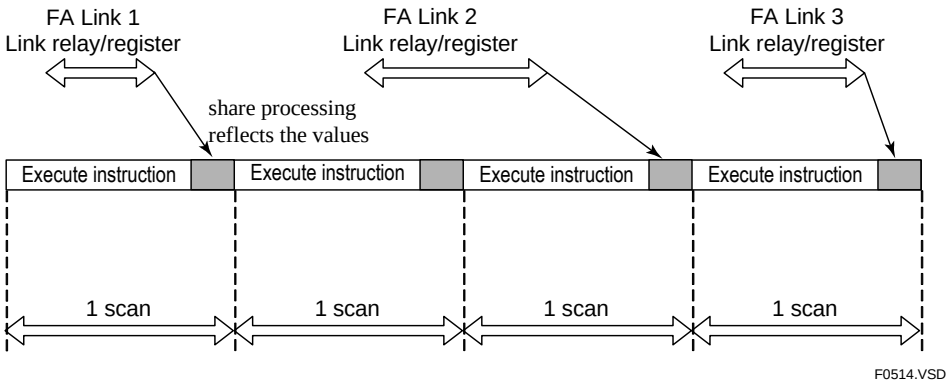


Figure 5.3 Link Refresh Operation

5.1.2 Link Refresh Range

Link refresh applies only to those link relays and link registers used in the instructions in a program.

● Link relay (L)

- If a link relay (L) is directly represented, the word that includes the link relay will be refreshed.
- If the link relay (L) is indexed, the word that includes the link relay with the index register set to 0 will be refreshed.

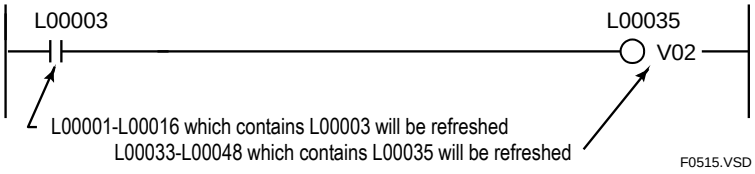


Figure 5.4 Link Relay Refresh Range

● Link register (W)

- For an instruction which handles word data, the link register (W) specified by the instruction will be refreshed.
- For an instruction which handles long word data or IEEE single-precision floating point data, the link register (W) specified by the instruction and the next higher link register (W) will be refreshed.
- For an instruction which handles double-long word data or IEEE double-precision floating point data, the link register (W) specified by the instruction and the next three higher link registers (W) will be refreshed.
- For an instruction involving multiple words, the number of words in the calculation range will be refreshed if the calculation range is specified with a constant. However, only the first word in the calculation range will be refreshed if the calculation range is specified with a register.

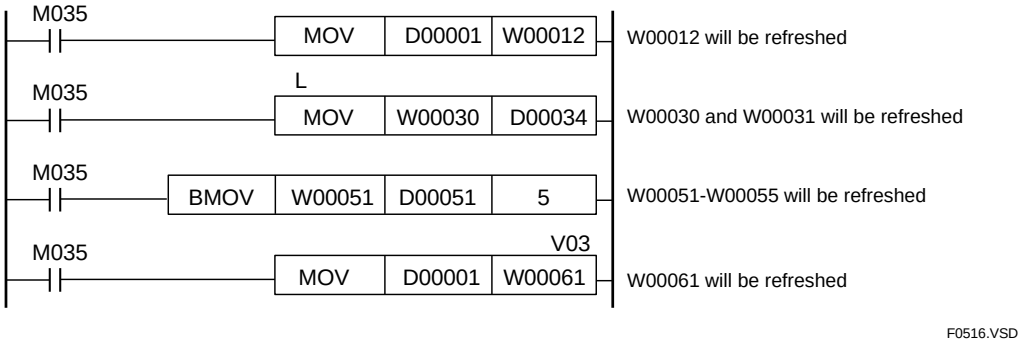


Figure 5.5 Link Register Refresh Range

Note

Any link register specified in the program will be refreshed regardless of whether the instruction using the register is actually executed eventually.

To refresh all link relays and link registers, write the following program:

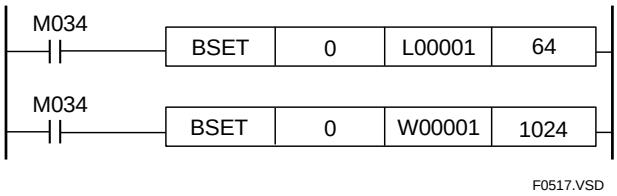


Figure 5.6 Refreshing L00001-L01024, W00001-W01024

When using indexed link relays (L) or link registers (W), set the index range as follows to ensure refreshing.

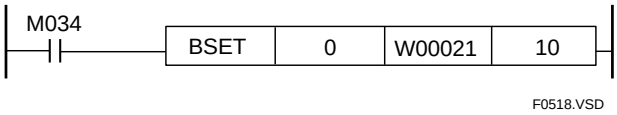


Figure 5.7 Using W00021 - W00030 with Index Modification

Note

(1) Index modification/indirect specification

Index modification or indirect specification is available only within the same link system. Do not use it across different systems.

(2) Block transfer or calculation for multiple devices

Block transfer or calculation involving multiple devices is available only within the same link system. Do not use it across different systems. Beware especially when specifying the number of words to be transferred or computed using a device.

5.1.3 Cyclic Transmission

Cyclic transmission refers to updating of the link device data between the local and remote stations.

Each link module transmits (broadcasts) the link device allocated in the configuration to the remote station with its own station transmission timing; Each of the other FA Link Modules stores the data in the corresponding area in the link module when it receives such data. Link data is sent out cyclically with the link data in each local station updated at each cycle.

Cyclic transmission runs asynchronously to the execution of the sequence program in the CPU module.

5.2 Response Time

5.2.1 Response Time of a Single Layer System

Use the equations below to obtain the following components of the response time:

- Scan time of the sequence program in the transmitting and receiving stations
- Link refresh processing time in the transmitting and receiving stations
- Cyclic transmission processing time

(1) Maximum response time of a single layer system (T_{LD})

$T_{LD} = ST_S + LR_S \times 2 + CT \times 3 + (ST_R \times 2) + (LR_R \times 2) + IM$ (unit: ms)

where, ST_S = Sequence program scan time of transmitting station
LR_S = Link refresh time of transmitting station
CT = Cyclic transmission time
ST_R = Sequence program scan time of transmitting station
LR_R = Link refresh time of receiving station
IM = Internal processing time (constant: 50 ms)

(2) Link Refresh Time (LR)

$LR = (RL_L/16+RG_L) \times 0.012 \times 1.2$ (unit: ms)

where, RL_L = Number of link relays used in the station
RG_L = Number of link registers used in the station

(3) Cyclic Transmission Time (CT)

For F3LP02-0N:

$CT = (RL_A + RG_A \times 16 + 200 \times S) \times BT + 1.3 \times S + 8$ (unit: ms)

For F3LP12-0N:

$CT = (RL_A + RG_A \times 16 + 1100 \times S) \times BT + 1.3 \times S + 8$ (unit: ms)

where RL_A = Total number of link relays used in all stations
RG_A = Total number of link registers used in all stations
BT = Transmission time per bit
BT = 0.0008 (1.25Mbps)
BT = 0.0016 (625Kbps)
BT = 0.004 (250Kbps)
BT = 0.008 (125Kbps)
S = Total number of connected stations

6. Cautions on Using FA Link H Modules

■ Operation Mode

Make sure that the operation modes of all link modules in a system are the same. If not, operation will not be normal.

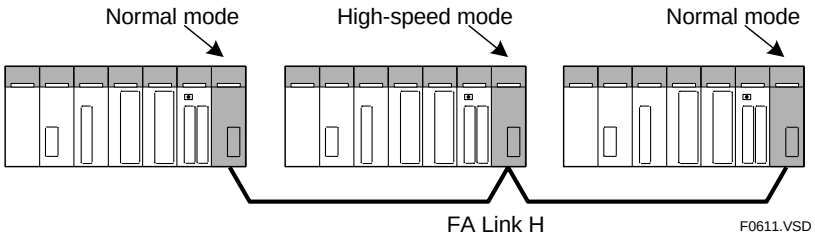


Figure 6.1 Example of Improper Setup

Do not mix different modes in the configuration as shown in the figure above.

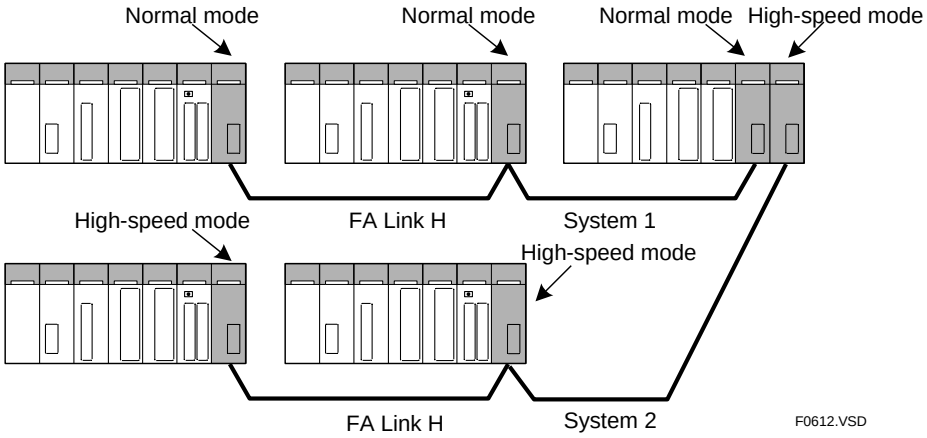


Figure 6.2 Example of Proper Setup

The above figure shows a valid configuration with multiple systems of different operation modes, but with the same operation mode maintained within each system. However, take note of restrictions on system allocation (see Section 7.5).

■ CPU Module Configuration Setup

The operation mode of a link module is factory set to normal. Therefore, be sure to set the link device capacity to “2048” during configuration setup. Otherwise, the link device capacity of the CPU module will remain at its default value of “1024” and the module will work only in this range (see Section 3.9.1).

■ Multi-CPU System

The FA-M3 controller supports configuration of multi-CPU systems. However, the FA Link H modules must be used by only one sequence CPU module. The link devices of a link module may not be shared by multiple sequence CPU modules. For a sequence CPU that does not use the FA Link H module, select [FA Link Setup] from the Configuration tree pane, and then select “Manual Setup” and set the “Link Type” to “Do Not Use” in WideField3 (for WideField2, select the “Setup FA Link System” tab window, and then select “Setup” and set the “Slot Number” to any slot with no FA Link H module installed).

■ Programming Precautions

- If a transmitting station fails, the contents of the data of that station are not assured. To check whether the data of a station is valid, verify the status of the station and the execution status of the sequence program of the said station using special relays. If these states are normal, the data is correctly updated.
- The special relays associated with the status of the remote stations of the FA Link are valid only when the local station is connected on the network (normal communications). To verify that the local station is connected on the network, check that the local station status (as indicated by a special register) is online.

Note

If any station in a network incorporating the F3LP12-0N module has its power turned off or its fiber optic cable disconnected, data link in the entire network cannot proceed. In addition, the special relays (M0273 through M0368 and the corresponding relays) are not data linked and do not reflect their status. Whether the network is normal can be determined by checking whether the local station status of the special registers (Z0065 and the corresponding link registers) is online.

■ Checking Link Data Allocation

The link data allocation is checked each time allocation (FA Link H configuration) is made or power supply is applied. If duplicate allocation is present, error occurs (ERR LED of the module lights up) at all the stations with duplication. However, if duplication is with the master station (station with station number “01”), error occurs in all slave stations (all stations excluding the master station).

■ Precautions when Setting Station Numbers

- Note that no error will be detected and indicated by the display LED or special relay if any station number within the range 02–32 is duplicated.
- Note that link data on the entire FA Link system will not be correctly updated if any station number within the range 02–32 is duplicated.

■ Powering On

- For the F3LP02-0N module, power supply may be applied to the master and slave stations in any order.
- For the F3LP12-0N module, apply power to all the slave stations first before applying power to the master station.

Note

For the F3LP12-0N module, data link continues among the stations that are powered on provided the master station is turned on.

■ When a Slave Station Fails

For the F3LP12-0N module, when a communication error occurs due to a slave station power failure or for other reasons, communication is interrupted for several hundred milliseconds for each station.

Note

If any of the stations in a network of F3LP12-0N modules are turned off, data link in the entire network cannot proceed.

■ When Connecting FA Link H module to FA500 or μFA20

When connecting the FA Link H Module to the FA500 Programmable Logic Controller or the μFA20 Small Programmable Controller, note the following points.

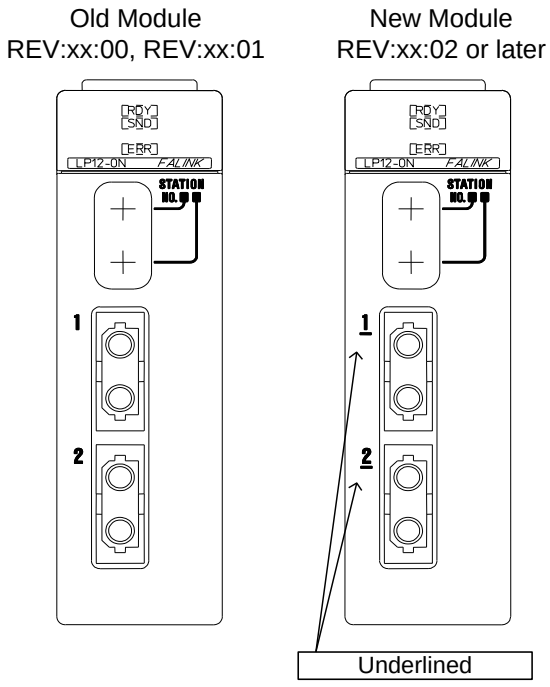
- Set the communication speed of the FA Link H Module (F3LP02-0N) to 250 kbps.
- Calculate the response time using the equations for the FA Link system (F3LP01-0N).

■ When Intermixing Old and New Modules within the Same System

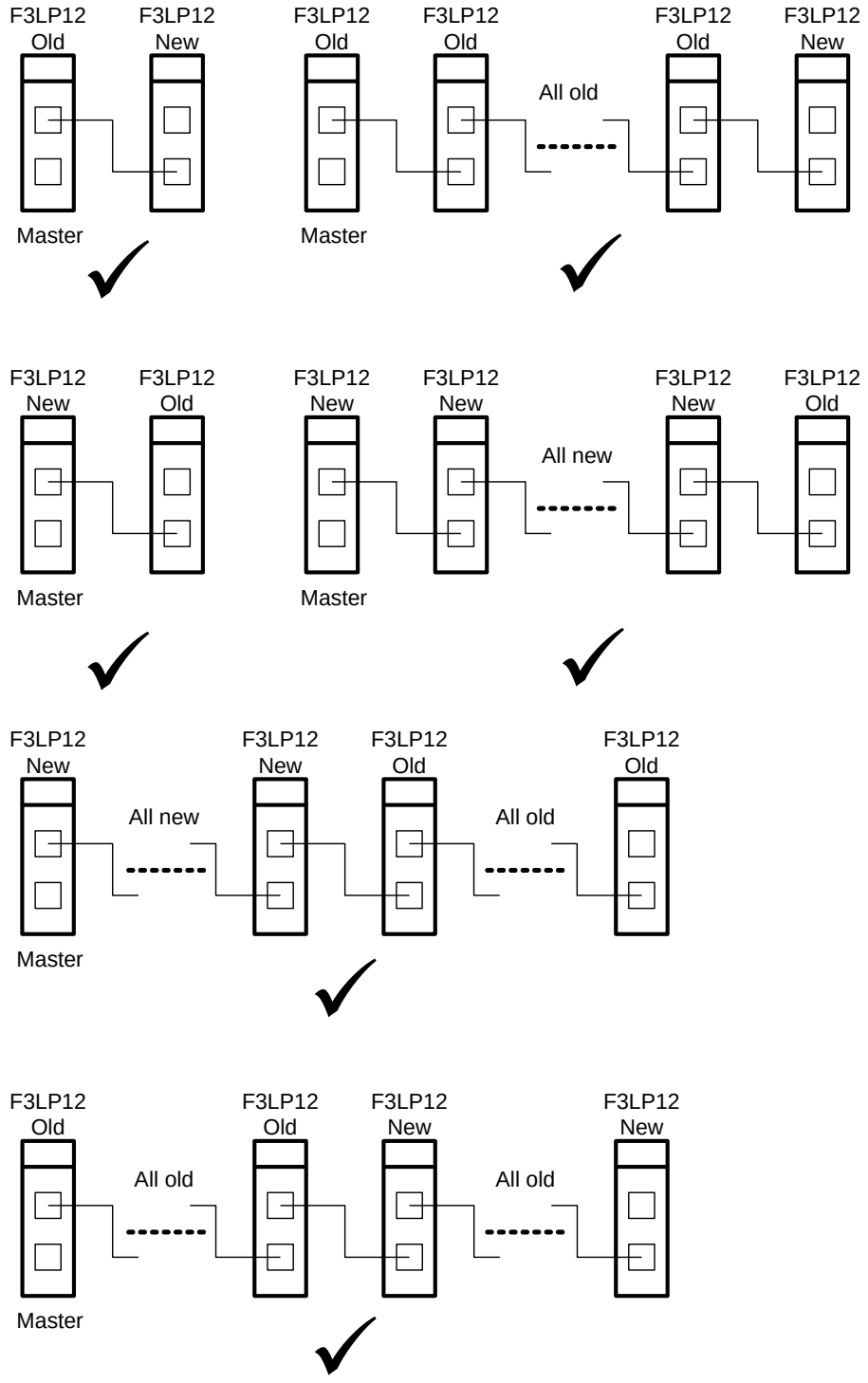
When connecting old modules (REV:xx:00 or REV:xx:01) and new modules (REV:xx:02 or later) in a cascade manner to configure a system, ensure that old modules and new modules are grouped separately so that there is only one point of interface between old and new modules throughout the system.

The following pages show examples of valid connections (indicated by '✓') and invalid connections (indicated by 'X').

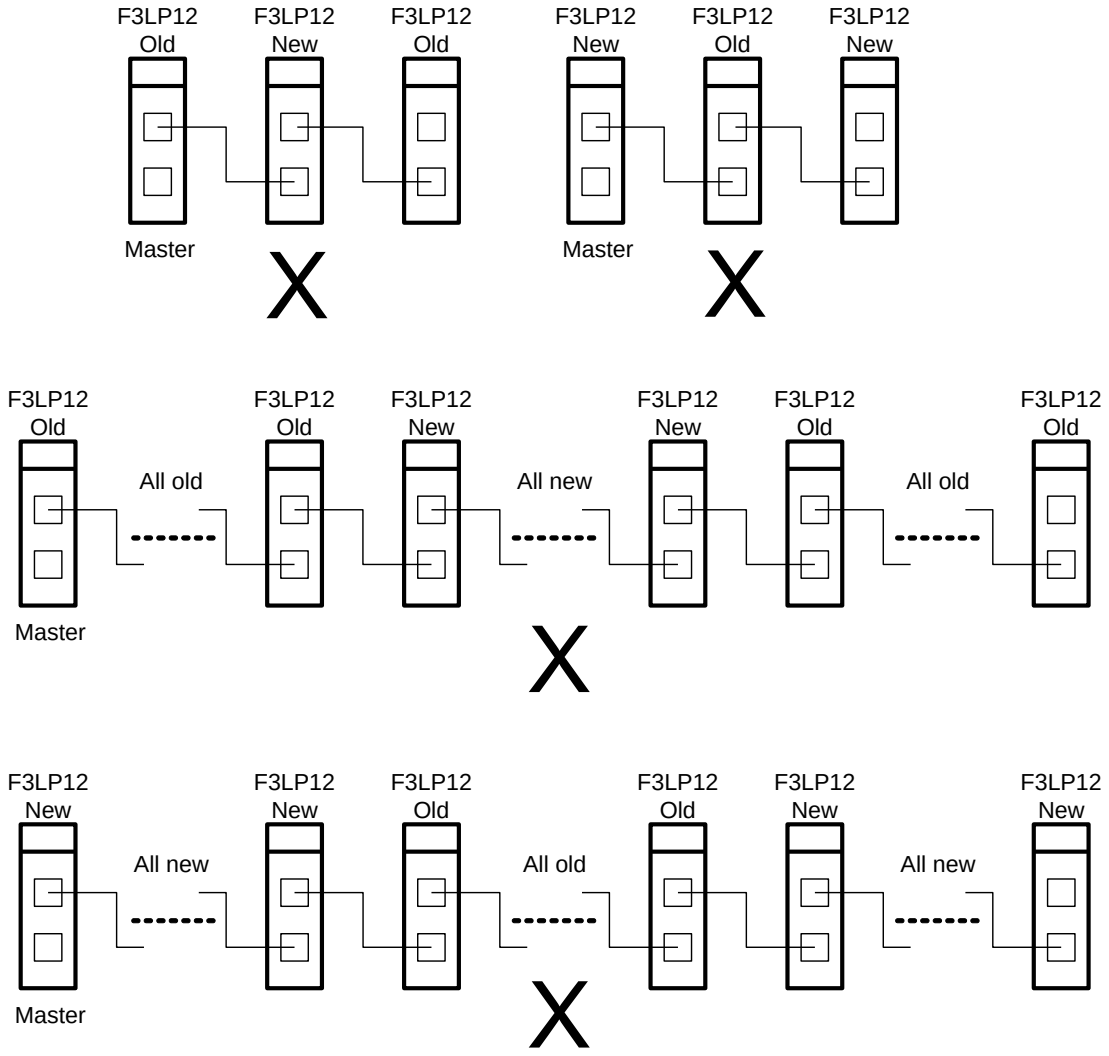
You can distinguish between old and new modules by checking the revision number given on the nameplate located on the module side, or by looking at the module front (new modules have underlined port numbers 1 and 2 as shown in the figure below).



■ Examples of Valid Connections



■ Examples of Invalid Connections



Blank Page

7. High-speed Mode

The FA Link H supports high-speed mode for the link module operation. As compared to normal mode, high-speed mode:

- Reduces the response time
- Allows up to 1024 points of link devices per link system (maximum number of modules that can be installed is 8).

7.1 CPU Module Configuration

The section describes the configuration setup on the CPU module side for using the FA Link H high-speed mode.

7.1.1 Setting Device Capacity

In high speed mode, set the link device capacities as follows:

- Set the link device capacity of a FA link system in use to "1024".
- Set the link type of an unused FA link system to "Do Not Use".

Sample setting for each CPU model is shown below. All the examples assume that the maximum allowable number of FA link modules is installed.

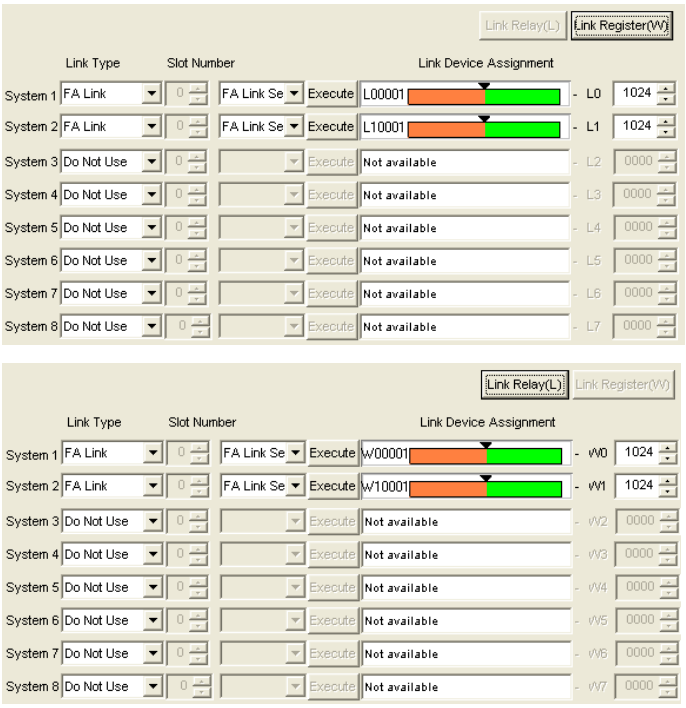


Figure 7.1 Sample Link Device Capacity Setting for F3SP05/08/21 (for High speed Mode)

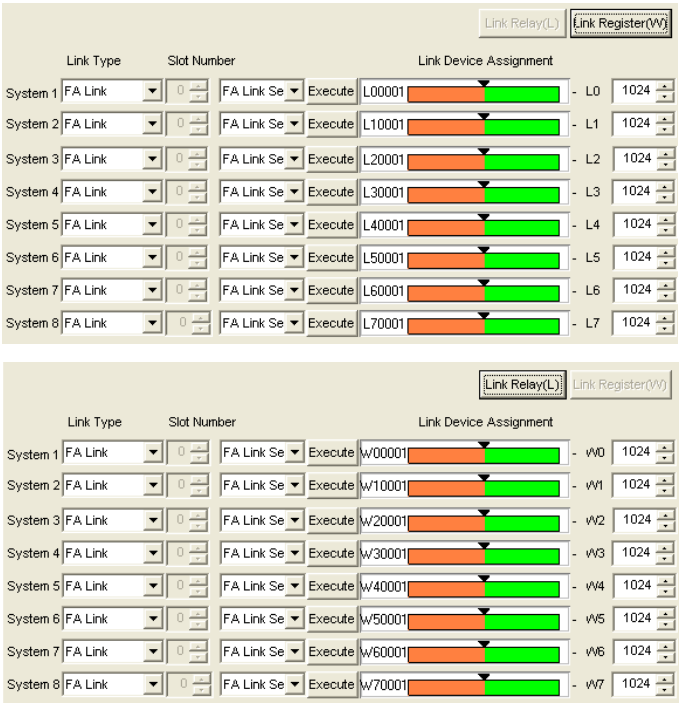


Figure 7.2 Sample Link Device Capacity Setting for F3SP25/35/28/53 (for High-speed Mode)

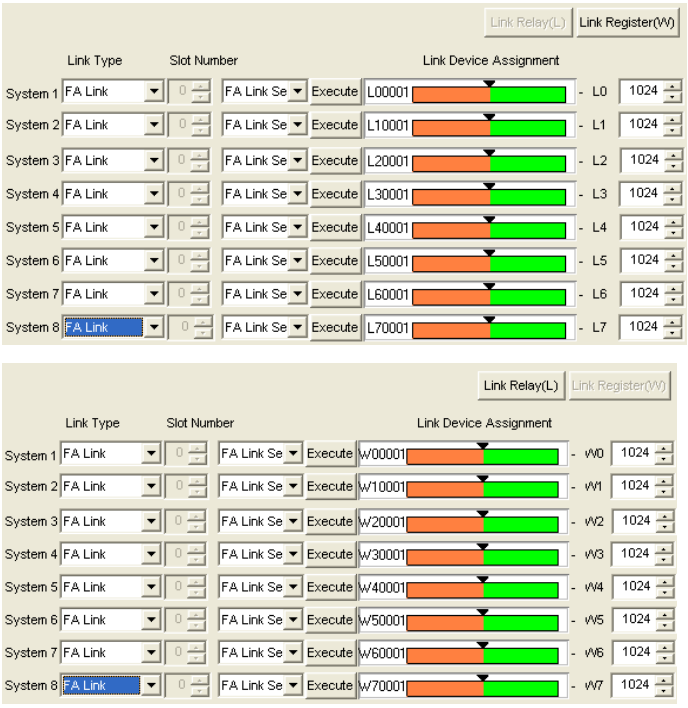


Figure 7.3 Sample Link Device Capacity Setting for F3SP38/58/59, F3SP22, F3SP66/67/71, F3SP71-4S, F3SP76-7S (for High-Speed Mode)

For details on how to set up the device capacities using the configuration function of the WideField3 software, see Section 3.9.1.

7.2 FA Link H Configuration

Refer to the following table for the conditions of the configuration setup values in high-speed mode.

Table 7.1 Link Device Setting

	Maximum Number of Link Device Points Per Module	
	High-speed mode	
	Link Relay	Link Register
Starting Address	Ln0001-Ln1009 On 16-point basis*1	Wn0001-Wn1009 On 1-point basis
Size	0-1024 (points) On 16-point basis*2	0-1024 (numbers) On 1-point basis

*1: 16m+1 (where m is an integer from 0 to 63, inclusive)
*2: 16m (where m is an integer from 0 to 64, inclusive)
Note: n = system number – 1 (for details on the setup of system number, see section 3.9.2 “Setting FA Link System Numbers”.)

7.3 Link Data Configuration

This section describes the link relays and registers used in the FA Link H module.

7.3.1 Link Relays

Link Relays are data-linked relays in the connected FA Link H system. In normal mode, one system incorporates a maximum of 2048 points. A maximum of 2048, 8192 and 16384 points of link relays are available for the F3SP05/08/21, F3SP25/35/28/53, and F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S CPU modules respectively. This allows multiple link modules to be installed but note that the device numbers are non-contiguous across systems.

System Number	High-speed Mode
1	L00001 to L01024
2	L10001 to L11024
3	L20001 to L21024
4	L30001 to L31024
5	L40001 to L41024
6	L50001 to L51024
7	L60001 to L61024
8	L70001 to L71024

Link relays are non-latched, which means they reset when all power is turned off. Unlike I/O relays, these relays cannot receive signals directly from external equipment, nor provide output to external equipment. The link relays of the local station are read or write enabled, but the link relays of the other stations are read-only.

Link relays are accessed on a 16-bit basis, so they are allocated to individual stations on a 16×n (where n is an integer between 0 to 64, inclusive) point basis. They are allocated during FA link configuration. 16 or 32 points of link relays can be handled at a time.

7.3.2 Link Registers

Link registers are data-linked registers in the connected FA Link H system. In normal mode, one system incorporates a maximum of 2048 points. A maximum of 2048, 8192 and 16384 points of link registers are available for the F3SP05/08/21, F3SP25/35/28/53 and F3SP38/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S CPU modules respectively. This allows multiple link modules to be installed but note that the device numbers are non-contiguous across systems.

System Number	High-speed Mode
1	W00001 to W01024
2	W10001 to W11024
3	W20001 to W21024
4	W30001 to W31024
5	W40001 to W41024
6	W50001 to W51024
7	W60001 to W61024
8	W70001 to W71024

Link registers are non-latched, which means they reset when all power is turned off. The link registers of the local station are read and write enabled, but the link registers of the other stations are read-only.

When data is treated as two words (32 bits), two devices are used. In a two-word instruction, the low-order word corresponds to the specified link device number and the high-order word corresponds to the specified link device number +1.

7.4 Response Time

This section describes the calculation of the response time in high-speed mode. The basic processing is the same as that for normal mode.

7.4.1 Response Time of Layered System

Use the equations below to obtain the following components of the response time:

- Scan time of the sequence program in the transmitting and receiving stations
- Link refresh processing time in the transmitting and receiving stations
- Cyclic transmission processing time

(1) Maximum response time of a single layer system (T_{LD})

$T_{LD} = ST_S + LR_S \times 2 + CT \times 3 + (ST_R \times 2) + (LR_R \times 2) + IM$ (unit: ms)

where, ST_S = Sequence program scan time of transmitting station

LR_S = Link refresh time of receiving station

CT = Cyclic transmission time

ST_R = Sequence program scan time of receiving station

LR_R = Link refresh time of receiving station

IM = Internal processing time (constant: 30 ms)

Note: The internal processing time differs from that of normal mode (see Section 5.2.1 “Response Time of Single Layer System”)

(2) Link Refresh Time (LR)

$LR = (RL_L/16+RG_L) \times 0.012 \times 1.2$ (unit: ms)

where, RL_L = Number of link relays used in the station

RG_L = Number of link registers used in the station

(3) Cyclic Transmission Time (CT)

For F3LP02-0N:

$CT = (RL_A + RG_A \times 16 + 200 \times S) \times BT + 1.3 \times S + 8$ (unit: ms)

For F3LP12-0N:

$CT = (RL_A + RG_A \times 16 + 1100 \times S) \times BT + 1.3 \times S + 8$ (unit: ms)

where RL_A = Total number of link relays used in all stations

RG_A = Total number of link registers used in all stations

BT = Transmission time per bit

BT = 0.0008 (1.25Mbps)

BT = 0.0016 (625Kbps)

BT = 0.004 (250Kbps)

BT = 0.008 (125Kbps)

S = Total number of connected stations

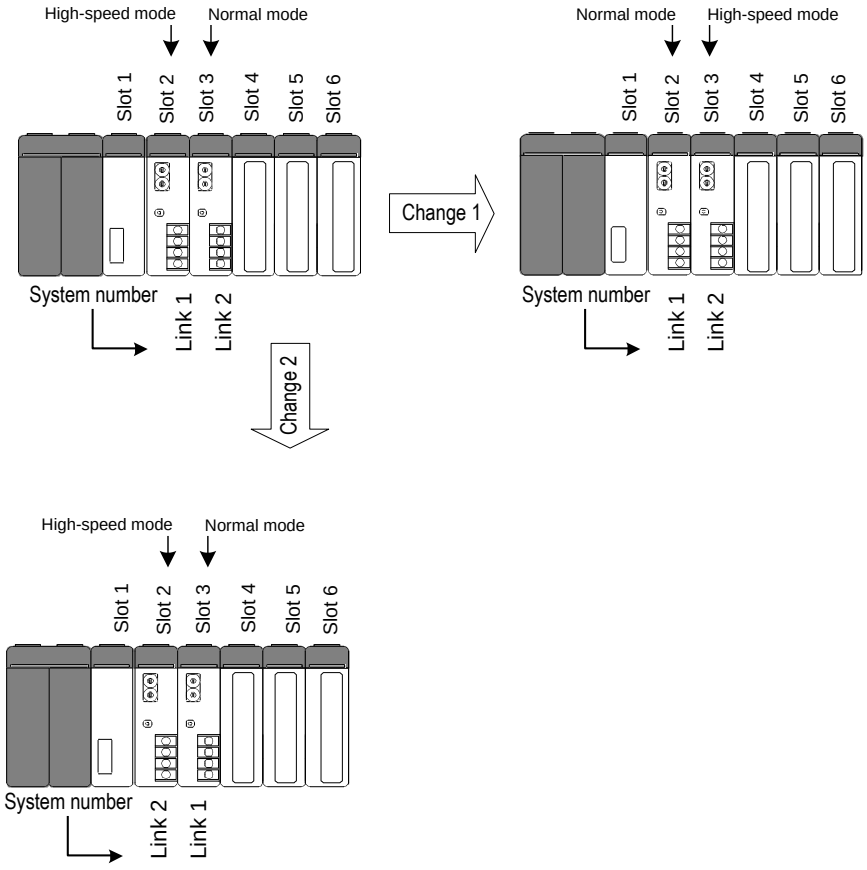
7.5 Restrictions on Mixing Modes (Normal and High-speed) in Link Systems

If both normal and high-speed modes are used within a link system as shown in the figure below, some precautions must be observed when installing a link module or during configuration setup of the CPU module. When using two different modes in a system, always install or assign (for details, see Section 3.9.2 “Setting FA Link System Numbers”) normal mode to link 1.

Provided that normal mode is assigned to link 1, there are no restrictions on the remaining links.

In the figure below, high-speed mode may not be assigned to link 1*; Either reinstall the link module with normal mode in a slot number smaller than that of the high-speed module (as in Change 1) or reassign the system numbers in the CPU module configuration FA link setup (as in Change 2).

* Normally, FA link modules are automatically assigned with sequential system numbers in ascending order of their slot numbers.



Set the link device capacities in the CPU module configuration for the above example as shown below.

8. Troubleshooting

This chapter shows flowcharts which can be used for troubleshooting when a problem occurs with the FA Link H Module or Fiber-optic FA Link H Module. Separate flowcharts are used to explain different error scenarios.

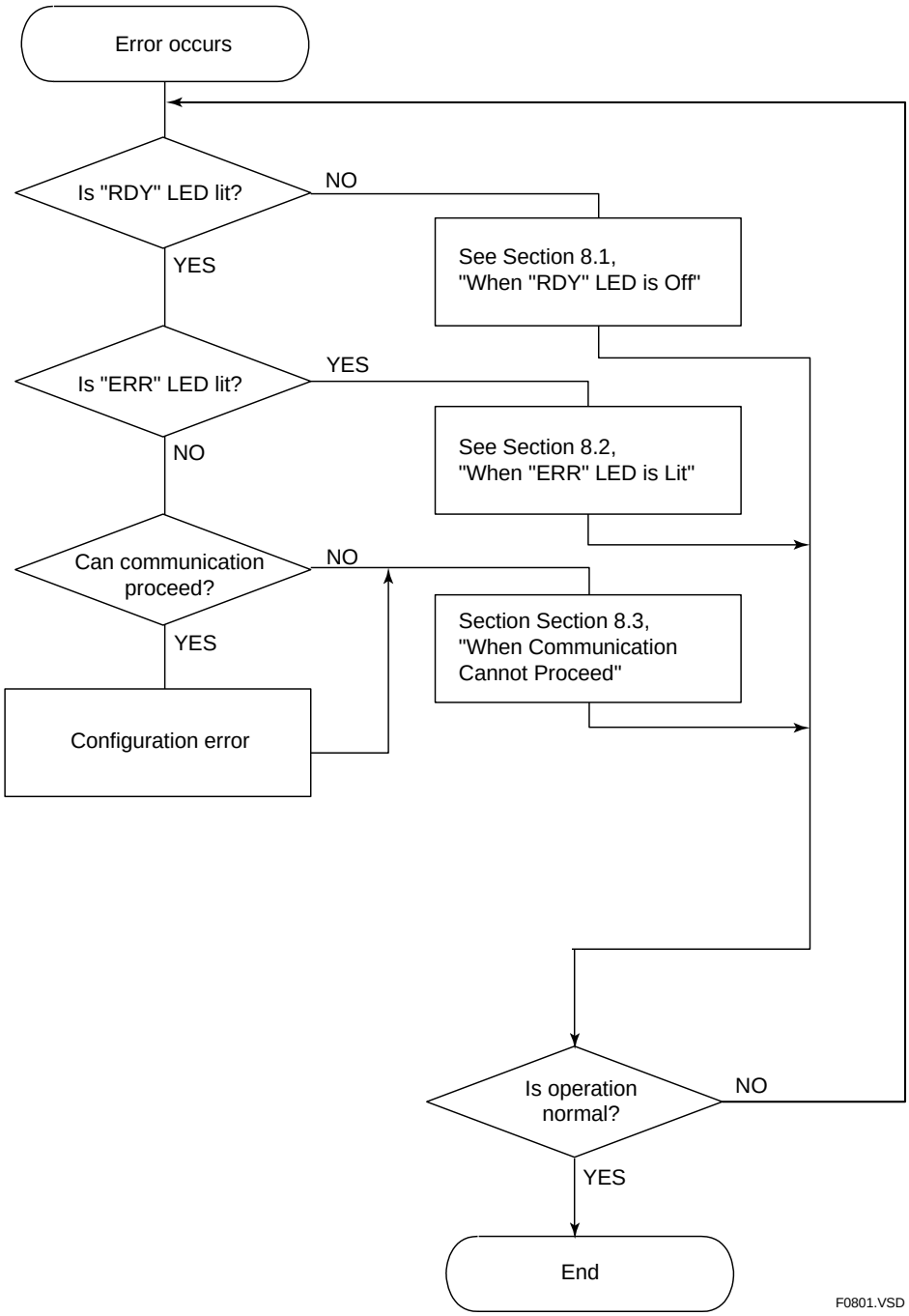


Figure 8.1 Troubleshooting Flowchart

8.1 When “RDY” LED Is Off

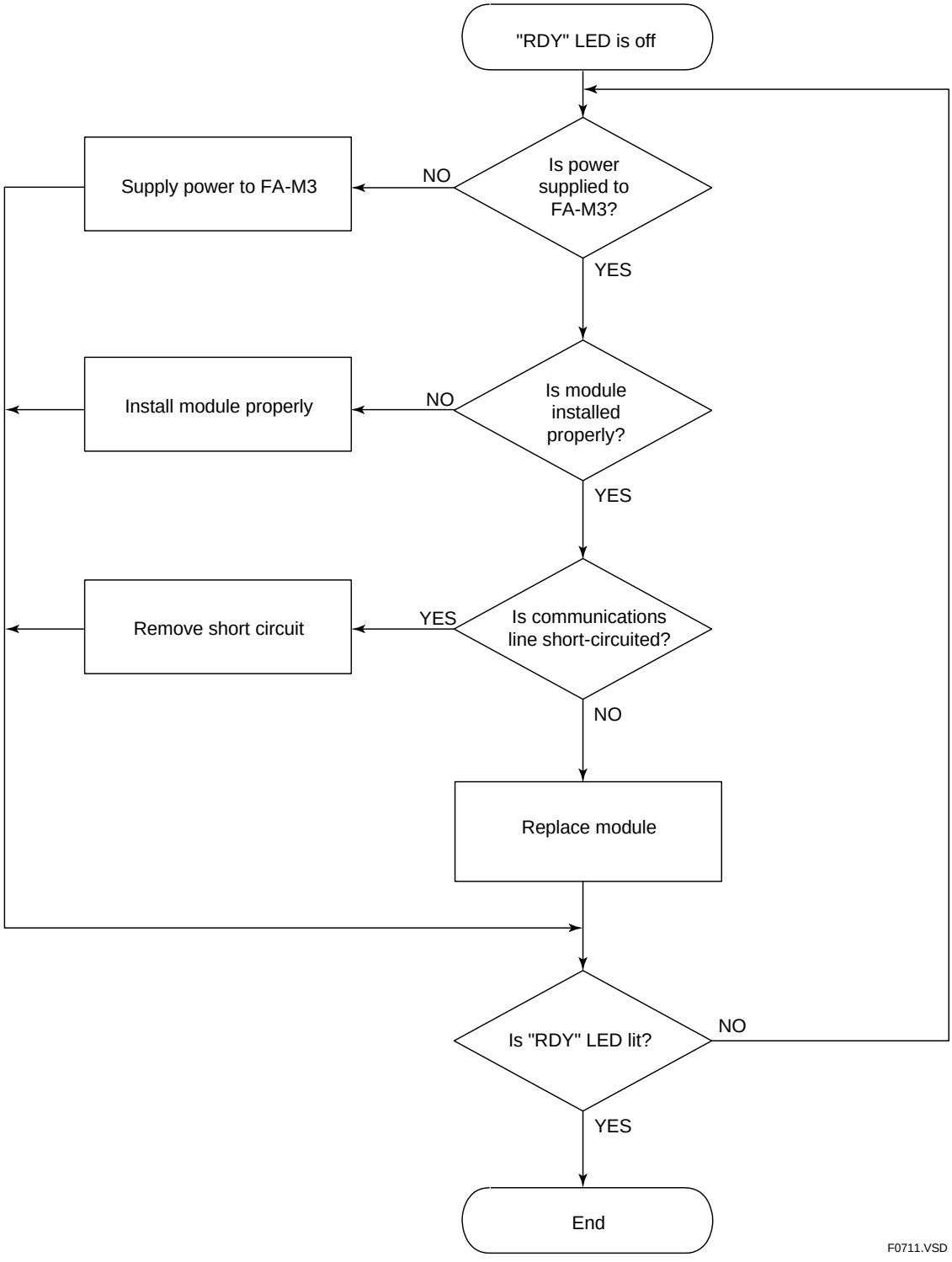


Figure 8.2 Flowchart To Be Used When “RDY” LED is Off

8.2 When “ERR” LED is Lit

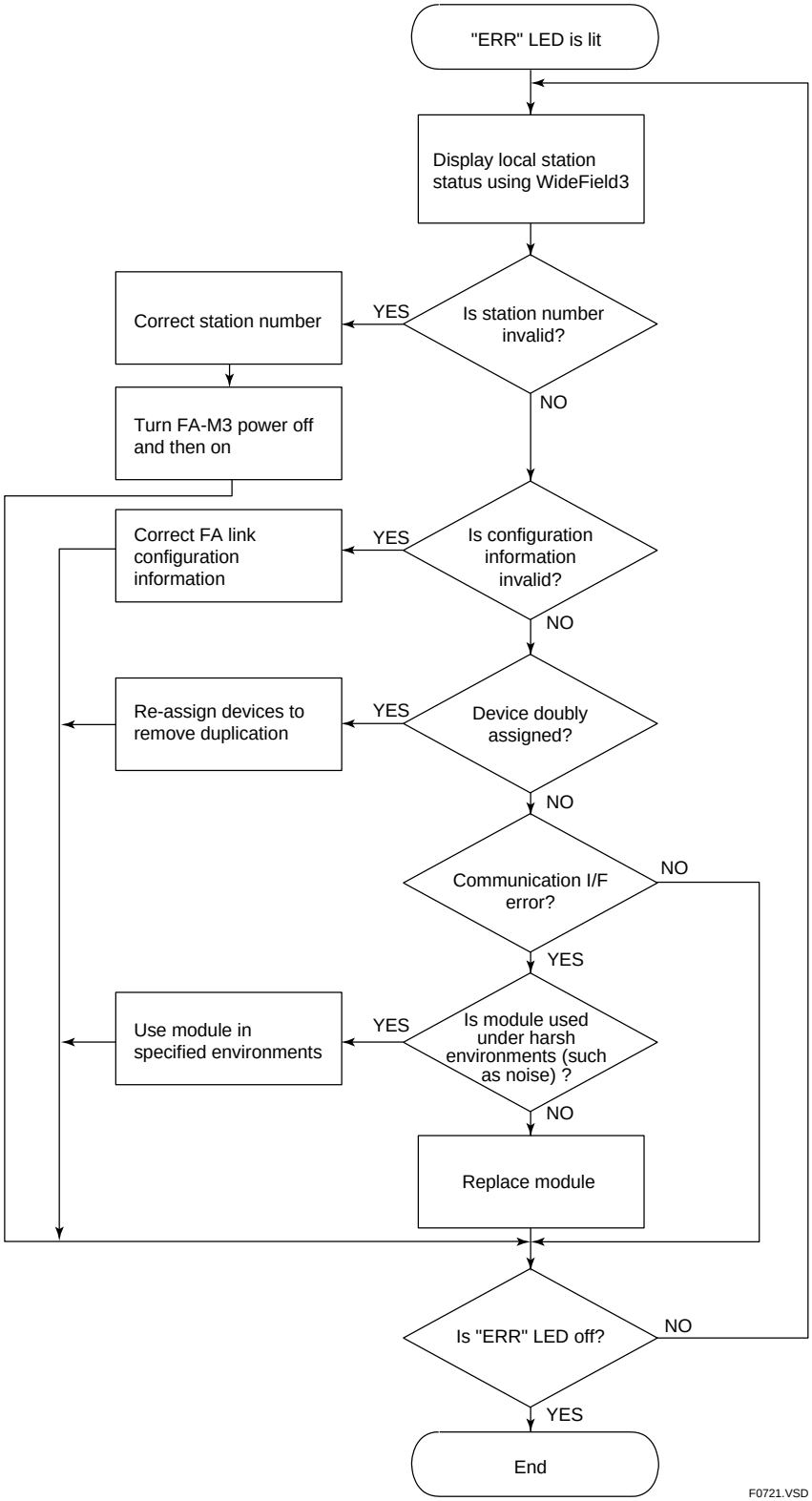


Figure 8.3 Flowchart To Be Used When “ERR” LED is Lit

8.3 When Communication Cannot Proceed

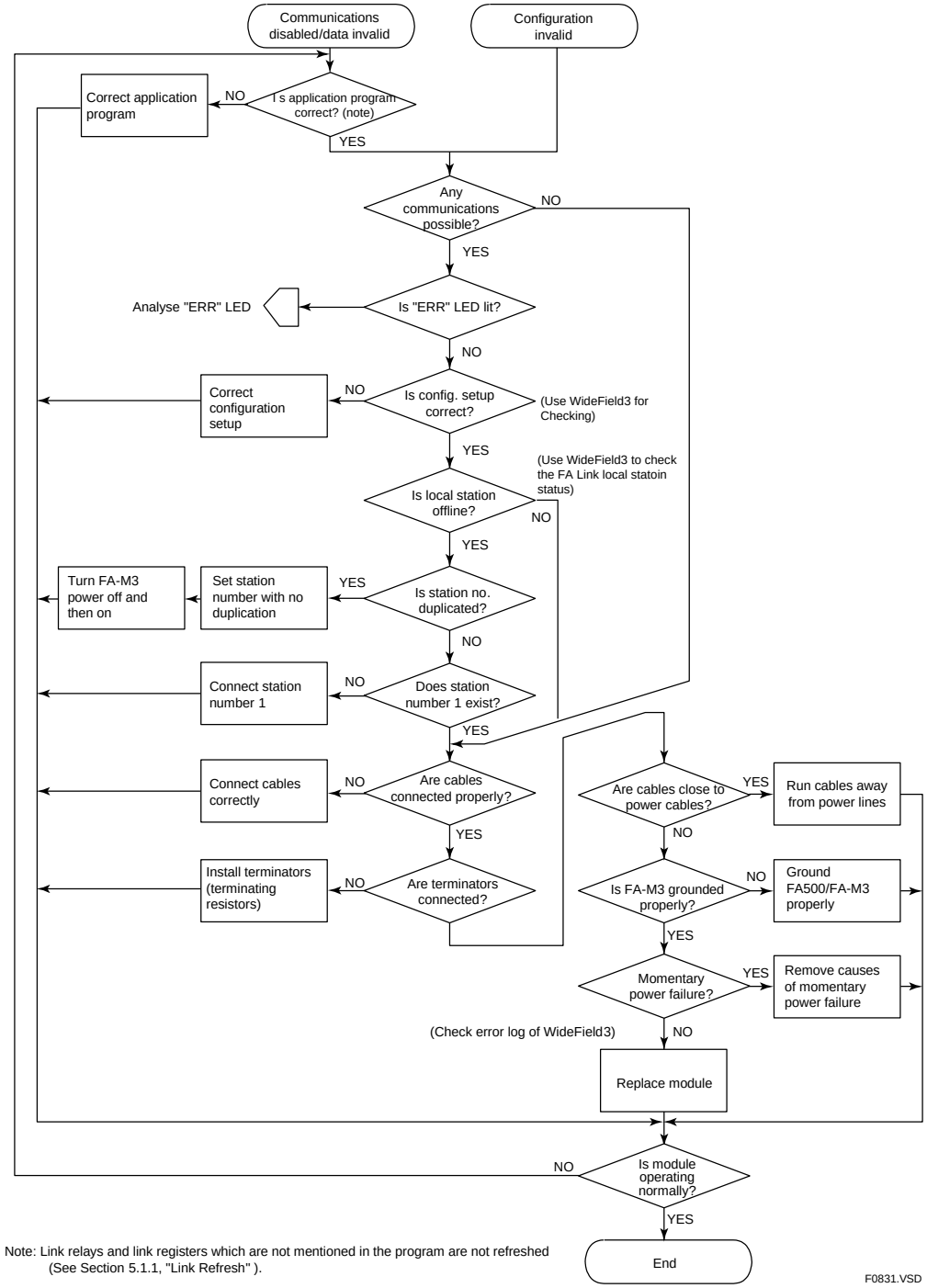


Figure 8.4 Flowchart To Be Used When Communications Cannot Proceed

8.4 Error Codes When Using WideField3

This section lists error messages that may appear when starting the FA Link Configuration or FA Link Module Status. It also lists probable causes and corrective actions.

■ Error Messages

Table 8.1 Error Messages

Message	Probable Cause	Corrective Action
Communication error	An error has occurred while communicating with the CPU.	– Replace PC cables. – Remove PC option port. – Set PC clock correctly. – Replace PC. – Replace main CPU module.
Device not found	No floppy disk is inserted. Invalid device specification.	– Specify a correct device. – Insert a floppy disk.
Directory not found	Invalid directory specification.	Specify a correct directory.
Unable to create file	Disk space not available.	– Free disk space. – Replace device (write error).
Module not found	FA Link Module is not mounted.	Mount FA Link Module and re-execute.
Error in the specified range	The specified value is outside the link relay/link register range.	Specify within a correct range.
Data size exceeds range	The total number of data exceeds the range.	Set a correct range.
Duplicate data	Link relay/link register data has duplication.	Set data without duplication.
Error in slot number	Incorrect slot number of FA Link Module specified.	Specify a correct slot number.
Extended display not found in the specified module	Extended display program is not found in the specified module	Include extended display program XLP01X.COM
Access error Error code = XX	Error occurred while accessing FA Link Module.	For details, see Error Codes hereafter.

Access Errors and Error Codes

Table 8.2 Access Errors and Error Codes

Error Code	Probable Cause	Corrective Action
26	Off-line error: Attempt to allocate for an off-line station or local station is offline.	– Allocate for an online station – Connect wires correctly.
83	Parameter error: The allocated address and/or size is not correct	Allocate with correct address and/or size.
E2 D5 C1 BF	Communication error: noise, hardware problem etc.	– Eliminate noise – Replace modules

Blank Page

FA-M3

FA Link H Module,
Fiber-optic FA Link H Module Manual

IM 34M06H43-01E 6th Edition

Index

C

cautions on using FA Link H modules....6-1
caution when a slave station fails....6-3
communication status, checking....3-13
configuration setup....3-19, 6-1, 7-1
cyclic transmission....5-5

D

data link processing....5-1
device capacity, setting....3-20, 7-1

E

error codes....8-5

F

FA Link H configuration....3-31, 7-3
FA Link Module status....3-14
FA Link system number, setting....3-26
fiber-optic cables....2-2

H

high-speed mode....7-1

L

link data allocation, checking....6-2
link data configuration....4-1, 7-4
link device....1-1
link refresh....5-2
link refresh range....5-4
link register....4-2, 7-4
link relay....4-1, 7-3

M

module, setup and connection....3-1
multi-CPU system....6-1

N

normal mode and high-speed mode, mixing....7-7

O

operation mode....1-1, 3-5, 6-1

P

parameters, setting....3-5

R

response time....5-6, 7-6

S

special registers....4-6
special relays....4-3
startup procedure....3-1
station number, setting....3-4
status of local station, displaying....3-15
status of remote station, displaying....3-17

T

troubleshooting....8-1
troubleshooting flowchart, when "ERR" LED is lit....8-3
troubleshooting flowchart, when "RDY" LED is off....8-2
troubleshooting flowchart, when communication cannot proceed....8-4

Blank Page

Revision Information

Title : FA Link H Module, Fiber-optic FA Link H Module
Document No. : IM 34M06H43-01E

Aug.2019 / 6th Edition
Addition of modules.

Oct.2014 / 5th Edition
Incorporation of addendum contents; Correction of errors.

Jan.2012 / 4th Edition
Addition of information on F3SP22, F3SP66, F3SP67, F3SP71-4S and F3SP76-7S; Addition of information on WideField3; Incorporation of addendum.

Apr.2003 / 3rd Edition
Addition of modules; Addition of Fiber-optic cable KM65; Modification for WideField2 support; Correction of errors.

Sep.2001 / 2nd Edition
Addition of explanations on support of CE Mark; Correction of typographical errors.

Feb.1999 / 1st Edition
New Publication

■For Questions and More Information
If you have any questions, you can send an E-mail to the following address.
E-mail: plc_message@cs.jp.yokogawa.com
■Written by
Yokogawa Electric Corporation
■Published by
Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750, JAPAN

Blank Page