User’s Manual

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

YOKOGAWA
Yokogawa Electric Corporation

IM 34M06H43-01E

4th Edition
Applicable Product:

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

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

The document number for this manual is given below.
Refer to the document number when purchasing additional copies of this manual or in any other inquiries.

- Document No. : IM 34M06H43-01E
Important

About This Manual

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

Safety Precautions when Using/Maintaining the Product

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

![Danger symbol]

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

![Protective Ground Terminal symbol]

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

![Function Ground Terminal symbol]

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

![Alternating current symbol]

**Alternating current.** Indicates alternating current.

![Direct current symbol]

**Direct current.** Indicates direct current.
The following symbols are used only in the user’s manual.

⚠️ **WARNING**
- Indicates a “Warning”.
- Draws attention to information essential to prevent hardware damage, software damage or system failure.

⚠️ **CAUTION**
- Indicates a “Caution”.
- Draws attention to information essential to the understanding of operation and functions.

**TIP**
- Indicates a “TIP”.
- Gives information that complements the present topic.

**SEE ALSO**
- Indicates a “SEE ALSO” reference.
- Identifies a source to which to refer.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function and safety of the product.

- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system as well as designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of processes and lines using the product and the system controlled by it, the user should implement it using devices and equipment, additional to this product.

- If component parts or consumable are to be replaced, be sure to use parts specified by the company.

- This product is not designed or manufactured to be used in critical applications which directly affect or threaten human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities or medical equipment. If so used, it is the user’s responsibility to include in the system additional equipment and devices that ensure personnel safety.

- Do not attempt to modify the product.

### Exemption from Responsibility
- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.

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- Store the original media, such as floppy disks, that contain the software in a safe place.
- Reverse engineering, such as decompiling of the software, is strictly prohibited.
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General Requirements for Using the FA-M3

Avoid installing the FA-M3 in the following locations:
- Where the instrument will be exposed to direct sunlight, or where the operating temperature exceeds the range 0°C to 55°C (32°F to 131°F).
- Where the relative humidity is outside the range 10 to 90%, or where sudden temperature changes may occur and cause condensation.
- Where corrosive or flammable gases are present.
- Where the instrument will be exposed to direct mechanical vibration or shock.
- Where the instrument may be exposed to extreme levels of radioactivity.

Select an appropriate field wiring material:
- USE COPPER CONDUCTORS ONLY
  Use copper wire with temperature ratings greater than 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.

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

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

Ground for low impedance:
- For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class 3 Ground. For compliance to CE Marking, use cables such as twisted cables which can ensure low impedance even at high frequencies for grounding.

  *1 Japanese Industrial Standard (JIS) Class D Ground means grounding resistance of 100Ω max.

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

Configure for CE Marking Conformance:
- For compliance with CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual” (IM34M06C11-01E).
Keep spare parts on hand:
- Stock up on maintenance parts including spare modules, in advance.
- Preventive maintenance (replacement of the module or its battery) is required for using the module beyond 10 years. For enquiries on battery replacement service, contact your nearest Yokogawa Electric representative or sales office. (The module has a built-in lithium battery. Lithium batteries may exhibit decreased voltage, and in rare cases, electrolyte leakage problems after ten years.)

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

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

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

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

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

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

Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC
(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement. The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category
With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.
Do not dispose in domestic household waste.
When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

How to Dispose of the Battery Used in This Product

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

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

Do not dispose in domestic household waste.
When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

Battery category: Lithium battery

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

■ Overview of the Manual

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.

■ How to Read this Manual

The FA Link H Module (F3LP02-0N) and Fiber-optic FA Link H Module (F3LP12-0N) can operate in normal mode or high speed mode. You should read different chapters for each mode.

To configure a system in normal mode, read Chapters 1 to 6 and Chapter 8.

To configure a system in high speed mode, in addition to Chapters 1 to 5 and Chapter 8, you should also read Chapter 7, "High Speed Mode". Chapter 7 discusses features of high speed mode, which differ from normal mode.

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

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

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

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*, installation and wiring, test run, maintenance, and module installation limits for the whole system:
* 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)
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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.

CAUTION

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 and F3SP53 sequence CPUs provide 8192 link devices and the F3SP38, F3SP58, F3SP59, F3SP22, F3SP66, F3SP67, F3SP71-4S 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.

<table>
<thead>
<tr>
<th>Operation Mode</th>
<th>Normal</th>
<th>High speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3SP05/08/21</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>F3SP25/35/28/53</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>F3SP38/58/59</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>
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.

![Diagram of Single-layer System Configuration]

Figure 1.1 Single-layer System Configuration
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**

- : Represents the FA Link H Module (F3LP02-0N)
- : Represents the Fiber-optic FA Link H Module (F3LP12-0N)

---
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.

⚠️ CAUTION

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

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<tr>
<td>F3LP02</td>
<td>-0N</td>
<td>............</td>
<td>..........................</td>
<td>Up to 32 stations 125k/250k/625k/1.25Mbps 1km/500m/250m/100m</td>
</tr>
<tr>
<td>F3LP12</td>
<td>-0N</td>
<td>............</td>
<td>..........................</td>
<td>Up to 32 stations Maximum total length of 10km Maximum distance between stations of 1km 1.25Mbps</td>
</tr>
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</table>

2.2 Operating Environment

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

<table>
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<tr>
<th>CPU Module</th>
<th>Style Number and Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3SP05, F3SP08, F3SP21, F3SP25, F3SP35</td>
<td>S1 08 : XX or later</td>
</tr>
<tr>
<td>F3SP28, F3SP38, F3SP53, F3SP58, F3SP59</td>
<td>.............</td>
</tr>
<tr>
<td>F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S</td>
<td>.............</td>
</tr>
</tbody>
</table>

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

2.3 Performance Specifications

Table 2.1 Performance Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>FA Link H Module (F3LP02-0N)</th>
<th>Fiber-optic FA Link H Module (F3LP12-0N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of connected stations</td>
<td>32 stations per system</td>
<td></td>
</tr>
<tr>
<td>Link relays</td>
<td>16384 points*1 (Up to 2048 points per system)</td>
<td></td>
</tr>
<tr>
<td>Link registers</td>
<td>16384 points*1 (Up to 2048 points per system)</td>
<td></td>
</tr>
<tr>
<td>Maximum link points per station</td>
<td>2048 points</td>
<td></td>
</tr>
<tr>
<td>Link relay/register assignments</td>
<td>Link relays: on 16-point basis, Link register: on 1-point basis</td>
<td></td>
</tr>
<tr>
<td>Number of attached modules</td>
<td>F3SP05/08/21: 2 max. F3SP25/35/28/38/53/58/59, F3SP22, F3SP66/67, F3SP71-4S, F3SP76-7S: 8 max.*1</td>
<td></td>
</tr>
<tr>
<td>Communication speed</td>
<td>125k/250k/625k/1.25Mbps</td>
<td>1.25Mbps</td>
</tr>
<tr>
<td>Communication style</td>
<td>Single bus</td>
<td>Daisy chain</td>
</tr>
<tr>
<td>Maximum transmission distance</td>
<td>1km/500m/200m/100m (depending on transmission speed)</td>
<td>10km (1 km. Max between stations)</td>
</tr>
<tr>
<td>Communication mode</td>
<td>Token bus</td>
<td></td>
</tr>
<tr>
<td>Synchronization mode</td>
<td>Frame synchronization</td>
<td></td>
</tr>
<tr>
<td>Symbolization mode</td>
<td>NRZI mode</td>
<td></td>
</tr>
<tr>
<td>Error control</td>
<td>CRC-CCITT</td>
<td></td>
</tr>
<tr>
<td>RAS function</td>
<td>- Local loop-back function - Hardware self-diagnosis - Error detection by special relays and registers</td>
<td></td>
</tr>
<tr>
<td>5V current consumption</td>
<td>470mA</td>
<td>495mA</td>
</tr>
<tr>
<td>Weight</td>
<td>120g</td>
<td>110g</td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable type</td>
<td>Shielded twisted pair cable</td>
</tr>
<tr>
<td>Characteristic impedance</td>
<td>about 110Ω</td>
</tr>
<tr>
<td>Temperature rating</td>
<td>75°C minimum</td>
</tr>
<tr>
<td>Connection Method</td>
<td>Solderless terminals</td>
</tr>
</tbody>
</table>

Use M3.5 self-tapping screws for the terminal screws.
The following solderless terminals are recommended for wiring.

![Solderless Terminals Diagram]

Table 2.2 Recommended Solderless Terminals and Compatible Conductors

<table>
<thead>
<tr>
<th>Solderless Terminals and Compatible Conductors</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Compatible Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japan Solderless Terminal Mfg Co., Ltd.</td>
<td>V1.25-M3</td>
<td>AWG22 to 18 (0.33 to 0.82 mm² (Copper wire)</td>
</tr>
<tr>
<td></td>
<td>Nippon Tanshi Co., Ltd.</td>
<td>RAV1.25-3.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Japan Solderless Terminal Mfg Co., Ltd.</td>
<td>V1.25-M4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Japan Solderless Terminal Mfg Co., Ltd.</td>
<td>V2-M4</td>
<td>AWG16 to 14 (1.3 to 2.1 mm² (Copper wire)</td>
</tr>
</tbody>
</table>

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

**Fiber-optic Core Specifications**

<table>
<thead>
<tr>
<th>Fiber-optic Core</th>
<th>DK-HPF200/230 for KM60</th>
<th>HC-20/07 for KM60, KM61, KM62, or KM65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>SWCC Showa Cable Systems Co., Ltd.</td>
<td>Sumitomo Electric Industries, Ltd.</td>
</tr>
<tr>
<td>Core diameter</td>
<td>200±5 μm</td>
<td></td>
</tr>
<tr>
<td>Clad diameter</td>
<td>230±10 μm</td>
<td></td>
</tr>
<tr>
<td>Transmission loss</td>
<td>7.0 dB/km or less (λ = 0.85 μm, Ta = 25°C)*1</td>
<td>7.0 dB/km or less (λ = 0.81 μm, Ta = 25°C)</td>
</tr>
</tbody>
</table>

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

**Fiber-optic Connector Specification**

<table>
<thead>
<tr>
<th>Connectors</th>
<th>KF-07 for KM60</th>
<th>CF-2001H and CF-2071H for KM60, KM61, or KM62</th>
<th>CF-2011 and CF-2071 for KM65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>SWCC Showa Cable Systems Co., Ltd.</td>
<td>Sumitomo Electric Industries, Ltd.</td>
<td>Sumitomo Electric Industries, Ltd.</td>
</tr>
<tr>
<td>Specifications</td>
<td>Full-duplex, lever lock, bonding, polishing treatment</td>
<td>Full-duplex, lever lock, bonding, polishing treatment</td>
<td>Full-duplex, lever lock, crimping, cutting treatment</td>
</tr>
</tbody>
</table>
### Fiber-optic Cables from Yokogawa Electric Corporation

#### Fiber-Optic Cable For Connections inside Panel
(with bonding and polishing treatment on optical connector)

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
<th>Max. Transmission Loss (dB)</th>
<th>Applicable Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM60</td>
<td>-S05</td>
<td></td>
<td></td>
<td>Cable length: 0.6 m</td>
<td>2.60</td>
<td>F3LR01, F3LR02, and F3LP12</td>
</tr>
<tr>
<td></td>
<td>-001</td>
<td></td>
<td></td>
<td>Cable length: 1.0 m</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-003</td>
<td></td>
<td></td>
<td>Cable length: 3.0 m</td>
<td>2.60</td>
<td></td>
</tr>
</tbody>
</table>

#### Fiber-Optic Cable For Indoor Use with Tension Members
(with bonding and polishing treatment on optical connector)

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
<th>Max. Transmission Loss (dB)</th>
<th>Applicable Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM61</td>
<td>-010</td>
<td></td>
<td></td>
<td>Cable length: 10 m</td>
<td>1.10</td>
<td>F3LR01, F3LR02, and F3LP12</td>
</tr>
<tr>
<td></td>
<td>-100</td>
<td></td>
<td></td>
<td>Cable length: 100 m, a pulling eye on one end</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-150</td>
<td></td>
<td></td>
<td>Cable length: 150 m, a pulling eye on one end</td>
<td>1.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-200</td>
<td></td>
<td></td>
<td>Cable length: 200 m, a pulling eye on one end</td>
<td>1.95</td>
<td></td>
</tr>
</tbody>
</table>

Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual. *FA500

Note: Use the KM62 cable in wet environments (but not submerged environments).

#### Fiber-Optic Cable For Indoor Use with Tension Members
(with crimping and cutting treatment on optical connector)

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
<th>Max. Transmission Loss (dB)</th>
<th>Applicable Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM65</td>
<td>-001</td>
<td></td>
<td></td>
<td>Cable length: 1 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-002</td>
<td></td>
<td></td>
<td>Cable length: 2 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-003</td>
<td></td>
<td></td>
<td>Cable length: 3 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-004</td>
<td></td>
<td></td>
<td>Cable length: 4 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-005</td>
<td></td>
<td></td>
<td>Cable length: 5 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-007</td>
<td></td>
<td></td>
<td>Cable length: 7 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-010</td>
<td></td>
<td></td>
<td>Cable length: 10 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-012</td>
<td></td>
<td></td>
<td>Cable length: 12 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-015</td>
<td></td>
<td></td>
<td>Cable length: 15 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-020</td>
<td></td>
<td></td>
<td>Cable length: 20 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-025</td>
<td></td>
<td></td>
<td>Cable length: 25 m</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-030</td>
<td></td>
<td></td>
<td>Cable length: 30 m</td>
<td>2.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: Use the KM62 cable in wet environments (but not submerged environments). KM65 cables are not supplied with pulling eyes. If pulling eye is required, use the KM61 or KM62 cables. *FA500

#### Fiber-Optic Cable For Outdoor Use With Tension Members
(with bonding and polishing treatment on optical connector)

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
<th>Max. Transmission Loss (dB)</th>
<th>Applicable Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM62</td>
<td>-100</td>
<td></td>
<td></td>
<td>Cable length: 100 m, a pulling eye on one end</td>
<td>1.10</td>
<td>F3LR01 (Max. 200 m)</td>
</tr>
<tr>
<td></td>
<td>-200</td>
<td></td>
<td></td>
<td>Cable length: 200 m, a pulling eye on one end</td>
<td>1.95</td>
<td>F3LR02 (Max. 200 m)</td>
</tr>
<tr>
<td></td>
<td>-300</td>
<td></td>
<td></td>
<td>Cable length: 300 m, a pulling eye on one end</td>
<td>2.72</td>
<td>F3LP12 (Max. 1000m)</td>
</tr>
<tr>
<td></td>
<td>-400</td>
<td></td>
<td></td>
<td>Cable length: 400 m, a pulling eye on one end</td>
<td>3.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-500</td>
<td></td>
<td></td>
<td>Cable length: 500 m, a pulling eye on one end</td>
<td>4.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-600</td>
<td></td>
<td></td>
<td>Cable length: 600 m, a pulling eye on one end</td>
<td>4.73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-700</td>
<td></td>
<td></td>
<td>Cable length: 700 m, a pulling eye on one end</td>
<td>5.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-800</td>
<td></td>
<td></td>
<td>Cable length: 800 m, a pulling eye on one end</td>
<td>5.91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-900</td>
<td></td>
<td></td>
<td>Cable length: 900 m, a pulling eye on one end</td>
<td>6.46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-101</td>
<td></td>
<td></td>
<td>Cable length: 1000 m, a pulling eye on one end</td>
<td>7.06</td>
<td></td>
</tr>
</tbody>
</table>

Note: For information on pulling eyes, see the fiber-optic lead-in cable laying pulling-eye assembly diagram in this manual. *FA500

---

**CAUTION**

- 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

<table>
<thead>
<tr>
<th>Length L (mm)</th>
<th>Tolerance ±e (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 5</td>
<td>±0.20</td>
</tr>
</tbody>
</table>

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.

CAUTION

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

<table>
<thead>
<tr>
<th>Length L (m)</th>
<th>Tolerance +e (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&lt;L ≤ 30</td>
<td>0.50</td>
</tr>
<tr>
<td>30&lt;L</td>
<td>L x 0.03 (3%)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Length L (m)</th>
<th>Tolerance +e (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 15</td>
<td>0.20</td>
</tr>
<tr>
<td>5&lt;L ≤ 15</td>
<td>0.30</td>
</tr>
<tr>
<td>15&lt;L ≤ 30</td>
<td>0.50</td>
</tr>
</tbody>
</table>
## Cross-sectional View

**KM61, KM62, KM65**

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

### Connector (Top View)

- **CF-2071H and CF-2071**
  For cables KM60, KM61, KM62, and KM65

- **KF-07**
  For cable KM60
Fiber-optic Lead-in Cable Laying Pulling-Eye Assembly Diagram

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.

Tow line
Swivel
Pulling eye
Fiber optic cable

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

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

Tested Fiber-Optic Cables

<table>
<thead>
<tr>
<th>Distance between stations</th>
<th>Manufacturer</th>
<th>Type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1km</td>
<td>Sumitomo Electric Industries, Ltd. (Adhesive grinding method)</td>
<td>Type 2001H-MM-L 2071H-MM-L</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size DCV-HC-20/07 Type 2001H-MM-0.2/L-P 2071H-MM-0.2/L-P</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size 2×CCV-HC-20/07 Type 2001H-MM-L 2071H-MM-L</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td>Toshiba Corporation</td>
<td>TOCP200Q-DB</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOCP200X-DB</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td>Sumitomo Electric Industries, Ltd. (Crimp-on cutting method)</td>
<td>Type 2011-MM-L 2071-MM-L</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size DCV-HC-20/07 Type 2011-MM-0.2/L-P 2071-MM-0.2/L-P</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size 2×CCV-HC-20/07 Type 2011-MM-L 2071-MM-L</td>
<td>Cord</td>
</tr>
</tbody>
</table>
2.5 External Dimensions

- **F3LP02-0N**

![Diagram of F3LP02-0N module dimensions](image1)

*Figure 2.1  External Dimensions of the F3LP02-0N module*

- **F3LP12-0N**

![Diagram of F3LP12-0N module dimensions](image2)

*Figure 2.2  External Dimensions of the F3LP12-0N module*
3. Setup and Connection of Modules

3.1 Startup Procedures

- Set station numbers
  (See Section 3.3)
- Set parameters
  (See Section 3.4)
- Attach modules
  (See Section 3.5)
- Wiring
  You should refer to wiring precautions.
  (See Section 3.6)
- Apply power
  Switch on the power supply of all the stations connected.
  (See Section 3.7)
- Check communication status
  Checking can be done using the WideField3 software.
  (See Section 3.8)
- Setup CPU module configuration
  Setup the capacity of link devices using the WideField3 software.
  (See Section 3.9)
- FA Link H Configuration
  Assign link devices to stations using the WideField3 software.
  (See Section 3.10)
3.2 Components and their Functions

F3LP02-0N

Front view

- **Indicators**
  - RDY: Lit when the internal circuit is functioning normally
  - 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)

Right side view

- **Parameter setting switch**
  - 4-pole slide switch to set each parameter.
### Front view

- **Indicators**
  - **RDY**: Lit when the internal circuit is functioning normally
  - **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.**

### Right side view

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

**CAUTION**

- 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.

![Station Number Setting Switch](image)

The above example setting is 01.

Station number setting switch (2 decimal rotary switches)

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**

<table>
<thead>
<tr>
<th>Number</th>
<th>Setting Item</th>
<th>OFF</th>
<th>ON</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication speed</td>
<td>Refer to the table below.</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Operation mode</td>
<td>Normal</td>
<td>High-speed</td>
<td>OFF</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>~</td>
<td>~</td>
<td>OFF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switch</th>
<th>Number 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Number 1</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
</tbody>
</table>

**F3LP12-0N**

<table>
<thead>
<tr>
<th>Number</th>
<th>Setting Item</th>
<th>OFF</th>
<th>ON</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Designation of intermediate station</td>
<td>Terminal station</td>
<td>Intermediate station</td>
<td>OFF</td>
</tr>
<tr>
<td>2</td>
<td>Not used</td>
<td>~</td>
<td>~</td>
<td>OFF</td>
</tr>
<tr>
<td>3</td>
<td>Operation mode</td>
<td>Normal</td>
<td>Normal</td>
<td>OFF</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>~</td>
<td>~</td>
<td>OFF</td>
</tr>
</tbody>
</table>

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 protective 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](image)

⚠️ **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.

<table>
<thead>
<tr>
<th>Screw Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4-size binder screw 12 to 15 mm long</td>
</tr>
<tr>
<td>(Or 14 to 15 mm if fitted with a washer)</td>
</tr>
</tbody>
</table>

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.

  ![Wiring Diagram](image)

  *1 To conform equipment incorporating this module to CE marking, use shielded cables. In addition, remove the cable covering to expose the wire, and then ground and secure it using an FG clamp.

  **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.

Terminating resistor setting switch (TERMINATOR): Factory setting is 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.

<table>
<thead>
<tr>
<th>Optical Fiber Length [m]</th>
<th>Maximum Fiber Loss [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adhesive grinding</td>
</tr>
<tr>
<td></td>
<td>Crimp-on cutting</td>
</tr>
<tr>
<td>0</td>
<td>1.100</td>
</tr>
<tr>
<td>50</td>
<td>1.100</td>
</tr>
<tr>
<td>100</td>
<td>1.100</td>
</tr>
<tr>
<td>150</td>
<td>1.544</td>
</tr>
<tr>
<td>200</td>
<td>1.959</td>
</tr>
<tr>
<td>250</td>
<td>2.352</td>
</tr>
<tr>
<td>300</td>
<td>2.727</td>
</tr>
<tr>
<td>350</td>
<td>3.088</td>
</tr>
<tr>
<td>400</td>
<td>3.437</td>
</tr>
<tr>
<td>450</td>
<td>3.774</td>
</tr>
<tr>
<td>500</td>
<td>4.102</td>
</tr>
<tr>
<td>550</td>
<td>4.421</td>
</tr>
<tr>
<td>600</td>
<td>4.732</td>
</tr>
<tr>
<td>650</td>
<td>5.036</td>
</tr>
<tr>
<td>700</td>
<td>5.334</td>
</tr>
<tr>
<td>750</td>
<td>5.625</td>
</tr>
<tr>
<td>800</td>
<td>5.910</td>
</tr>
<tr>
<td>850</td>
<td>6.190</td>
</tr>
<tr>
<td>900</td>
<td>6.465</td>
</tr>
<tr>
<td>950</td>
<td>6.735</td>
</tr>
<tr>
<td>1000</td>
<td>7.000</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>Cable length (m)</th>
<th>0.6 to 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable transmission loss (dB)</td>
<td>9.0</td>
</tr>
</tbody>
</table>

**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 if 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.

<table>
<thead>
<tr>
<th>Distance among stations</th>
<th>Manufacturer</th>
<th>Type</th>
<th>Bending radius (mm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1km</td>
<td>Sumitomo Electric Industries, Ltd.</td>
<td>2001H-MM-L</td>
<td>15</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2071H-MM-L</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001H-MM-0.2/L-P</td>
<td>45</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2071H-MM-0.2/L-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toshiba Corporation</td>
<td>TOCP2000Q-□□B</td>
<td>15</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOCP2000X-□□B</td>
<td>25</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td>Sumitomo Electric Industries, Ltd.</td>
<td>2001-MM-L</td>
<td>15</td>
<td>Cord</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2071-MM-L</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001-MM-0.2/L-P</td>
<td>45</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2071-MM-0.2/L-P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.)

---

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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 protective caps to ports, which are not in use.

⚠️ CAUTION

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 protective caps to the unconnected ports at the terminal stations at two ends.

![Connecting Cables to F3LP12-0N Modules](image)

Figure 3.6 Connecting Cables to F3LP12-0N Modules

<table>
<thead>
<tr>
<th>Bending Radius, r (mm)</th>
<th>KF-07 (a = 18.3)</th>
<th>CF-2071, CF-2071H (a = 35.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During installation (temporary)</strong></td>
<td><strong>When installed</strong></td>
<td><strong>During installation (temporary)</strong></td>
</tr>
<tr>
<td>Optical fiber cord</td>
<td>15 or more</td>
<td>50 or more</td>
</tr>
<tr>
<td>Optical fiber cable</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
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.

---

**CAUTION**

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.

TIP

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.

<table>
<thead>
<tr>
<th>Ladder Diagram Support Program M3</th>
<th>Rev. required</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF510-E3□</td>
<td>Rev.1.08 or later</td>
</tr>
</tbody>
</table>
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.

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.

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].

Figure 3.9  Selecting Slot Number to Display Status of Local Station
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

<table>
<thead>
<tr>
<th>Status Display/Alarm Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Operating Status</td>
<td>ON LINE</td>
</tr>
<tr>
<td>Refresh Period (ms)</td>
<td>10</td>
</tr>
<tr>
<td>Station number error</td>
<td></td>
</tr>
<tr>
<td>Configuration Interface Error</td>
<td></td>
</tr>
<tr>
<td>Duplicate Device assignment</td>
<td></td>
</tr>
<tr>
<td>Communication Interface Error</td>
<td></td>
</tr>
<tr>
<td>ROM error</td>
<td></td>
</tr>
<tr>
<td>RAM error</td>
<td></td>
</tr>
</tbody>
</table>

[Keyword]
- 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.

![Figure 3.11 Step 1 to Display Status of Remote Station](image)

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

![Figure 3.12 Selecting Slot Number to Display Status of Remote Station](image)
The descriptions of the different statuses are as follows.

<table>
<thead>
<tr>
<th>Status Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON LINE</td>
<td>Communication is normal.</td>
</tr>
<tr>
<td>SEQ STOP</td>
<td>The sequence program has stopped with error or is not operating.</td>
</tr>
<tr>
<td>CPU NOT READY</td>
<td>CPU is not operating normally.</td>
</tr>
<tr>
<td>—</td>
<td>Not set. Communication is not taking place normally, due to a setup error, etc.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Ladder Diagram Support Program M3</th>
<th>Rev. required</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF510-E3</td>
<td>Rev.1.08 or later</td>
</tr>
</tbody>
</table>
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, 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 3.16 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.
(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.
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.

[Keyword]
- 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.

[Keyword]

- 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.

---

### Figure 3.4 Maximum Number of Link Devices

<table>
<thead>
<tr>
<th></th>
<th>Normal Mode</th>
<th></th>
<th>High Speed Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Link Relay</td>
<td>Link Register</td>
<td>Link Relay</td>
</tr>
<tr>
<td>Maximum number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of devices*1</td>
<td>2048</td>
<td>2048</td>
<td>1024</td>
</tr>
<tr>
<td>Allocation</td>
<td>On 16-device basis*2</td>
<td>On 1-device basis</td>
<td>On 16-device basis*2</td>
</tr>
</tbody>
</table>

*1 The maximum total number of devices allocated to each station in the system.

*2 The allocation of the devices to each station should be such that the total does not exceed this value.

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.

---

### TIP

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

![FA Link Station Assignment and Monitoring window](image)

Figure 3.24 FA Link Station Assignment and Monitoring window

[Keyword]

- 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.

---

**CAUTION**

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.

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.

See Also
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.

Step 2   Specify the directory, select the link information file and click [Open].
The FA Link Station Assignment window opens.

<table>
<thead>
<tr>
<th>Station</th>
<th>Link Relay</th>
<th>Link Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L0001</td>
<td>W0001</td>
</tr>
<tr>
<td>2</td>
<td>L0513</td>
<td>W0513</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**See Also**

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 \[^\] (up), \[^\] (down), \[^\] (left), \[^\] (right) arrow keys or the mouse.

![FA Link Station Assignment Window](image)

*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

<table>
<thead>
<tr>
<th></th>
<th>Normal Mode</th>
<th>High Speed Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Link Relay</td>
<td>Link Register</td>
</tr>
<tr>
<td>Starting Address</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L0001 to L2033</td>
<td>W0001 to W2048</td>
</tr>
<tr>
<td>Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 2048 points</td>
<td>On 1-point basis</td>
</tr>
<tr>
<td></td>
<td>0 to 1024 points On 16-point basis</td>
<td>0 to 1024 points On 1-point basis</td>
</tr>
</tbody>
</table>

*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.

**CAUTION**

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

![Register Link Information]

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

![FA Link Station Assignment and Monitoring]
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.

Step 2  Select [Station] in the Registration Mode frame. Then specify the station number which you wish to register.
Step 3  Specify the slot number where the FA link module to which you wish to register is mounted and click [OK].

![Register Link Information](image1)

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

![FA Link Station Assignment and Monitoring](image2)

- **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.

![FA Link Station Assignment and Monitoring](image3)
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.

<table>
<thead>
<tr>
<th>System Number</th>
<th>Normal Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L00001 to L02048</td>
</tr>
<tr>
<td>2</td>
<td>L10001 to L12048</td>
</tr>
<tr>
<td>3</td>
<td>L20001 to L22048</td>
</tr>
<tr>
<td>4</td>
<td>L30001 to L32048</td>
</tr>
<tr>
<td>5</td>
<td>L40001 to L42048</td>
</tr>
<tr>
<td>6</td>
<td>L50001 to L52048</td>
</tr>
<tr>
<td>7</td>
<td>L60001 to L62048</td>
</tr>
<tr>
<td>8</td>
<td>L70001 to L72048</td>
</tr>
</tbody>
</table>

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 $16 \times n$ (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.

<table>
<thead>
<tr>
<th>System Number</th>
<th>Normal Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W00001 to W02048</td>
</tr>
<tr>
<td>2</td>
<td>W10001 to W12048</td>
</tr>
<tr>
<td>3</td>
<td>W20001 to W22048</td>
</tr>
<tr>
<td>4</td>
<td>W30001 to W32048</td>
</tr>
<tr>
<td>5</td>
<td>W40001 to W42048</td>
</tr>
<tr>
<td>6</td>
<td>W50001 to W52048</td>
</tr>
<tr>
<td>7</td>
<td>W60001 to W62048</td>
</tr>
<tr>
<td>8</td>
<td>W70001 to W72048</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Relays Number for FA Link 1</th>
<th>Turns on when...</th>
<th>Cause /Explanation</th>
<th>LED Display</th>
<th>Remarks</th>
<th>Status of FA Link Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0257 *3</td>
<td>Station number error occurs</td>
<td>- A number other than 1-32 is specified as the station number. - Station number 1 is duplicated.</td>
<td>CPU: RDY (green) RUN (green) ALM (yellow) ERR (off)</td>
<td>- 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.)</td>
<td>OFF-LINE</td>
</tr>
<tr>
<td>M0258*4</td>
<td>Configuration error occurs.</td>
<td>There is a checksum error in the configuration information stored in a FA Link H Module.</td>
<td>CPU: RDY (green) RUN (green) ALM (off) ERR (off)</td>
<td>- The RDY LED on the front of the FA Link H module turns off and the ERR LED lights up.</td>
<td>OFF-LINE</td>
</tr>
<tr>
<td>M0259*5</td>
<td>Duplicate allocation of device occurs.</td>
<td>A link relay or link register is doubly allocated.</td>
<td>CPU: RDY (green) RUN (green) ALM (off) ERR (off)</td>
<td>The &quot;ERR&quot; LED on the front of the FA Link H module lights up.</td>
<td>OFF-LINE</td>
</tr>
<tr>
<td>M0260*6</td>
<td>FA Link H module restarts</td>
<td>An FA Link H Module has restarted due to a hardware failure or the like.</td>
<td>CPU: RDY (green) RUN (green) ALM (off) ERR (off)</td>
<td>OFF-LINE</td>
<td></td>
</tr>
</tbody>
</table>

*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.

<table>
<thead>
<tr>
<th>Relays Numbers for FA Link 1</th>
<th>Turns On When...</th>
<th>Cause /Explanation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0273 to M0304</td>
<td>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.</td>
<td>These relays are read-only and indicate the communication status.</td>
<td>Mnnnn+15 Mnnnn</td>
</tr>
<tr>
<td>M0305 to M0336</td>
<td>If the CPU module or add-on CPU module of a station is the Not Ready state, the corresponding relay turns on.</td>
<td>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.</td>
<td>Mnnnn+31 Mnnnn+16</td>
</tr>
<tr>
<td>M0337 to M0368</td>
<td>If no sequence program is running at a station, the corresponding relay turns on.</td>
<td>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.)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Relay Numbers of FA Link 2</th>
<th>Relay Numbers of FA Link 3</th>
<th>Relay Numbers of FA Link 4</th>
<th>Relay Numbers of FA Link 5</th>
<th>Relay Numbers of FA Link 6</th>
<th>Relay Numbers of FA Link 7</th>
<th>Relay Numbers of FA Link 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;3&quot; M0369</td>
<td>M8321</td>
<td>M8433</td>
<td>M8545</td>
<td>M8657</td>
<td>M8769</td>
<td>M8881</td>
</tr>
<tr>
<td>&quot;4&quot; M0370</td>
<td>M8322</td>
<td>M8434</td>
<td>M8546</td>
<td>M8658</td>
<td>M8770</td>
<td>M8882</td>
</tr>
<tr>
<td>&quot;5&quot; M0371</td>
<td>M8323</td>
<td>M8435</td>
<td>M8547</td>
<td>M8659</td>
<td>M8771</td>
<td>M8883</td>
</tr>
<tr>
<td>&quot;6&quot; M0372</td>
<td>M8324</td>
<td>M8436</td>
<td>M8548</td>
<td>M8660</td>
<td>M8772</td>
<td>M8884</td>
</tr>
<tr>
<td>&quot;7&quot; M0385 to M0416</td>
<td>M8337 to M8368</td>
<td>M8449 to M8460</td>
<td>M8561 to M8592</td>
<td>M8673 to M8704</td>
<td>M8785 to M8816</td>
<td>M8897 to M8928</td>
</tr>
<tr>
<td>&quot;8&quot; M0417 to M0448</td>
<td>M8369 to M8400</td>
<td>M8481 to M8512</td>
<td>M8593 to M8624</td>
<td>M8705 to M8736</td>
<td>M8817 to M8848</td>
<td>M8929 to M8960</td>
</tr>
<tr>
<td>&quot;9&quot; M0449 to M0480</td>
<td>M8401 to M8432</td>
<td>M8513 to M8544</td>
<td>M8625 to M8656</td>
<td>M8737 to M8768</td>
<td>M8849 to M8880</td>
<td>M8961 to M8992</td>
</tr>
</tbody>
</table>

**CAUTION**

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".

**CAUTION**

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.

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

*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.

<table>
<thead>
<tr>
<th>Register Numbers of FA Link 1</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z0065*1</td>
<td>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)</td>
<td>Read-only</td>
</tr>
</tbody>
</table>

| 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.

<table>
<thead>
<tr>
<th>Register number of FA Link 2</th>
<th>Register number of FA Link 3</th>
<th>Register number of FA Link 4</th>
<th>Register number of FA Link 5</th>
<th>Register number of FA Link 6</th>
<th>Register number of FA Link 7</th>
<th>Register number of FA Link 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>*1 Z070</td>
<td>Z257</td>
<td>Z262</td>
<td>Z267</td>
<td>Z272</td>
<td>Z277</td>
<td>Z282</td>
</tr>
<tr>
<td>*2 Z071</td>
<td>Z258</td>
<td>Z263</td>
<td>Z268</td>
<td>Z273</td>
<td>Z278</td>
<td>Z283</td>
</tr>
</tbody>
</table>

**CAUTION**

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.

![Diagram of Data Link Processing](F0511.VSD)
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
**TIP**

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 5.2 Peripheral Processing Operation**

**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.

- **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.

---

**TIP**

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:

```
M034
   BSET 0 L00001 64
M034
   BSET 0 W00001 1024
```

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.

```
M034
   BSET 0 W00021 10
```

Figure 5.7 Using W00021 - W00030 with Index Modification

---

**CAUTION**

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 \((T_{LD})\)

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

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 \((LR)\)

\[
LR = (RL_L/16+RG_L) \times 0.012\times1.2 \text{ (unit: ms)}
\]

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:

\[
CT = (RL_A + RG_A \times 16 + 200 \times S) \times BT + 1.3 \times S + 8 \text{ (unit: ms)}
\]

For F3LP12-0N:

\[
CT = (RL_A + RG_A \times 16 + 1100 \times S) \times BT + 1.3 \times S + 8 \text{ (unit: ms)}
\]

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](image1)

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

![Figure 6.2 Example of Proper Setup](image2)

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.

### CAUTION

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.

### CAUTION

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.

⚠️ CAUTION

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
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.
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

<table>
<thead>
<tr>
<th>Maximum Number of Link Device Points Per Module</th>
<th>High-speed mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link Relay</td>
<td>Link Register</td>
</tr>
<tr>
<td>Starting Address</td>
<td></td>
</tr>
<tr>
<td>Ln0001-Ln1009</td>
<td>Wn0001-Wn1009</td>
</tr>
<tr>
<td>On 16-point basis*1</td>
<td>On 1-point basis</td>
</tr>
<tr>
<td>Size</td>
<td></td>
</tr>
<tr>
<td>0-1024 (points)</td>
<td>0-1024 (numbers)</td>
</tr>
<tr>
<td>On 16-point basis*2</td>
<td>On 1-point basis</td>
</tr>
</tbody>
</table>

*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: \(n = \text{system number} - 1\) (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.

<table>
<thead>
<tr>
<th>System Number</th>
<th>High-speed Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L00001 to L01024</td>
</tr>
<tr>
<td>2</td>
<td>L10001 to L11024</td>
</tr>
<tr>
<td>3</td>
<td>L20001 to L21024</td>
</tr>
<tr>
<td>4</td>
<td>L30001 to L31024</td>
</tr>
<tr>
<td>5</td>
<td>L40001 to L41024</td>
</tr>
<tr>
<td>6</td>
<td>L50001 to L51024</td>
</tr>
<tr>
<td>7</td>
<td>L60001 to L61024</td>
</tr>
<tr>
<td>8</td>
<td>L70001 to L71024</td>
</tr>
</tbody>
</table>

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 $16 \times n$ (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.

<table>
<thead>
<tr>
<th>System Number</th>
<th>High-speed Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W00001 to W01024</td>
</tr>
<tr>
<td>2</td>
<td>W10001 to W11024</td>
</tr>
<tr>
<td>3</td>
<td>W20001 to W21024</td>
</tr>
<tr>
<td>4</td>
<td>W30001 to W31024</td>
</tr>
<tr>
<td>5</td>
<td>W40001 to W41024</td>
</tr>
<tr>
<td>6</td>
<td>W50001 to W51024</td>
</tr>
<tr>
<td>7</td>
<td>W60001 to W61024</td>
</tr>
<tr>
<td>8</td>
<td>W70001 to W71024</td>
</tr>
</tbody>
</table>

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 \( (T_{LD}) \)

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

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)

\[
LR = (RL_L/16+RG_L) \times 0.012 \times 1.2 \text{ (unit: ms)}
\]

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:

\[
CT = (RL_A + RG_A \times 16 + 200 \times S) \times BT + 1.3 \times S + 8 \text{ (unit: ms)}
\]

For F3LP12-0N:

\[
CT = (RL_A + RG_A \times 16 + 1100 \times S) \times BT + 1.3 \times S + 8 \text{ (unit: ms)}
\]

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.

![Diagram showing restrictions on mixing modes in link systems](change1.png)

![Diagram showing change in system number assignment](change2.png)
Set the link device capacities in the CPU module configuration for the above example as shown below.

<table>
<thead>
<tr>
<th>Link Type</th>
<th>Slot Number</th>
<th>Link Device Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>System 1</td>
<td>FA Link</td>
<td>Execute</td>
</tr>
<tr>
<td>System 2</td>
<td>FA Link</td>
<td>Execute</td>
</tr>
<tr>
<td>System 3</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
<tr>
<td>System 4</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
<tr>
<td>System 5</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
<tr>
<td>System 6</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
<tr>
<td>System 7</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
<tr>
<td>System 8</td>
<td>Do Not Use</td>
<td>Execute</td>
</tr>
</tbody>
</table>
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

*ERR* LED is lit

Display local station status using WideField3

Correct station number

Turn FA-M3 power off and then on

Correct FA link configuration information

Re-assign devices to remove duplication

Use module in specified environments

Is station number invalid?

YES

NO

Is configuration information invalid?

YES

NO

Device doubly assigned?

YES

NO

Communication I/F error?

YES

NO

Is module used under harsh environments (such as noise)?

YES

NO

Is module used under harsh environments (such as noise)?

YES

NO

Replace module

Is “ERR” LED off?

YES

END

NO

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

Access Errors and Error Codes

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