User’s Manual

YHLS Master Module

Applicable Modules:

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Model Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3LH02-0N</td>
<td>YHLS Master Module</td>
</tr>
</tbody>
</table>

YOKOGAWA

Yokogawa Electric Corporation

IM 34M6H46-01E

1st Edition
Applicable Product:

- **Range-free Multi-controller FA-M3**
  
  - Model code: F3LH02-0N
  - Name: YLHS Master Module

The document number and document model code for this manual are given below. Refer to the document number in all communications; also refer to the document number or the document model code when purchasing additional copies of this manual.

- Document No.: IM 34M6H46-01E
- Document Model Code: DOCIM
Important

About This Manual

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

Safety Precautions when Using/Maintaining the Product

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

⚠️  Danger. This symbol on the product indicates that the operator must follow the instructions laid out in this instruction manual to avoid the risk of personnel injuries, fatalities, or damage to the instrument. Where indicated by this symbol, 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.

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

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

Alternating current. Indicates alternating current.

Direct current. Indicates direct current.
The following symbols are used only in the instruction 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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General Requirements for Using the FA-M3 Controller

- **Avoid installing the FA-M3 controller 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.

- **Use the correct types of wire for external wiring:**
  - 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 controller must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

- **Ground for low impedance:**
  - For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class D (earlier called Class 3) Ground*1. For compliance to CE Marking, use braided or other wires that can ensure low impedance even at high frequencies for grounding.

  *1 Japanese Industrial Standard (JIS) Class D Ground means grounding resistance of 100 Ω 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 to CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual” (IM34M6C11-01E).
Keep spare parts on hand:
- Stock up on maintenance parts including spare modules, in advance.

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

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

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

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

■ Overview of the Manual

This manual describes the specifications, operations, and communications protocol of the YHLS (Yokogawa High-speed Link System) master module F3LH02-0N.

■ Related Instruction Manuals

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

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

- **F3SP28, F3SP38, F3SP53, F3SP58, or F3SP59**
  
  For information on sequence CPU functions, refer to:
  - Sequence CPU Instruction Manual - Functions (for F3SP28-3N/3S, F3SP38-6N/6S, F3SP53-4H/4S, F3SP58-6H/6S, F3SP59-7S) (IM34M6P13-01E)
  
  For information on sequence CPU instructions, refer to:
  - Sequence CPU Instruction Manual - Instructions (IM34M6P12-03E)
  
  For information on creating ladder programs, refer to:
  - FA-M3 Programming Tool WideField2 (IM34M6Q15-01E)

- **F3SP21, F3SP25, F3SP35, F3SP05, or F3SP08**
  
  For information on sequence CPU functions, refer to:
  - Sequence CPU Instruction Manual – Functions (for F3SP21, F3SP25, and F3SP35) (IM34M6P12-02E)
  
  For information on sequence CPU instructions, refer to:
  - Sequence CPU Instruction Manual – Instructions (IM34M6P12-03E)
  
  For information on creating ladder programs, refer to:
  - FA-M3 Programming Tool WideField2 (IM34M6Q15-01E)

**All sequence CPU modules**

For the FA-M3 specifications and configurations \(^1\), installation and wiring, test run, maintenance, and module installation restrictions, refer to:

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

- Hardware Manual (IM34M6C11-01E)
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1. **Overview**

The Yokogawa High-speed Link System (YHLS) master module F3LH02-0N has two YHLS master interface ports for connecting slave units to perform remote I/O.

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Module Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3LH02-0N</td>
<td>YHLS Master Module</td>
</tr>
</tbody>
</table>

### 1.1 What is YHLS?

Yokogawa High-speed Link System (YHLS) is designed for implementing high-speed remote I/O in an FA-M3 system. A YHLS system consists of an FA-M3 master module connected to multiple distributed slave units through a communication cable to allow high-speed control of remote I/O units from a sequence CPU. It has the following merits:

- Reduced wiring through use of distributed I/O units within a system
- Simple mechanism for high-speed exchange of ON/OFF signals and numerical data with remote devices.
- Flexibility in building customized application systems using devices from different partner manufacturers.
- Support for user-built devices.

### 1.2 Features of YHLS

#### 1.2.1 Communications between Sequence CPU Module and Slave Units

The module relays actuator ON/OFF signals from the sequence CPU module to slave units, and relays switch ON/OFF signals from slave units to the sequence CPU module using its input/output memory areas as buffer.

#### 1.2.2 Withdrawal of Slave Unit

YHLS adopts a bus connection so when a slave unit is switched off or otherwise fails to communicate, the master module can continue communicating with other normal slave units.

#### 1.2.3 Automatic Slave Unit Participation

When a withdrawn slave unit is switched on and returns to normal condition, it automatically resumes communications with the master module.
1.2.4 **Constant Communication Cycle Time**
YHLS features a constant communication cycle time, not affected by automatic participation or withdrawal of slave units, thus delivering reliable communications with constant cycle time under all circumstances.

1.2.5 **Control of YHLS Output States when CPU Stops**
If the sequence CPU module switches to STOP mode, the YHLS master module also stops communications with the slave units. The YHLS master module can be used to configure the output control function of each slave unit to either reset or hold its outputs when the CPU stops.
2. Specifications

2.1 Standard Specifications

* Model and Suffix Codes

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3LH02</td>
<td>-0N</td>
<td>...</td>
<td>...</td>
<td>12 Mbps max., 2 YHLS ports</td>
</tr>
</tbody>
</table>

* Operating Environment

There is no restriction on the type of CPU module that can be used with the F3LH02-0N module. The F3LH02-0N module may be installed in the main unit but not in a sub-unit.

* Performance Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission speed</td>
<td>3 Mbps, 6 Mbps or 12 Mbps$^1$</td>
</tr>
<tr>
<td>Maximum total transmission distance</td>
<td>300 m (at 3 Mbps), 200 m (at 6 Mbps) or 100 m (at 12 Mbps)$^1$</td>
</tr>
<tr>
<td>Number of slave units per module</td>
<td>126 slave units max.$^1$ (63 slave units per port)</td>
</tr>
<tr>
<td>Number of I/O points per module</td>
<td>2016 inputs (1008 inputs/port) 2016 outputs (1008 outputs/port)</td>
</tr>
<tr>
<td>Communications mode</td>
<td>4-wire full-duplex or 2-wire half-duplex$^1$</td>
</tr>
<tr>
<td>Synchronization mode</td>
<td>Bit synchronization</td>
</tr>
<tr>
<td>Signal coding</td>
<td>Manchester coding</td>
</tr>
<tr>
<td>Networking topology</td>
<td>Bus</td>
</tr>
<tr>
<td>Transmission format</td>
<td>YHLS proprietary format</td>
</tr>
<tr>
<td>Error detection</td>
<td>RZ check (all-bit check), CRC12</td>
</tr>
<tr>
<td>Connection cable</td>
<td>CAT5 or equivalent</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ45</td>
</tr>
<tr>
<td>RAS functions</td>
<td>- Withdrawal of slave unit</td>
</tr>
<tr>
<td></td>
<td>- Automatic slave unit participation</td>
</tr>
<tr>
<td></td>
<td>- Reset/hold outputs when CPU stops</td>
</tr>
<tr>
<td></td>
<td>- Network quality monitoring</td>
</tr>
<tr>
<td>Terminating resistor</td>
<td>Built-in resistor$^2$</td>
</tr>
<tr>
<td>Current consumption</td>
<td>440 mA max.</td>
</tr>
<tr>
<td>External dimensions</td>
<td>28.9 (W) x 100 (H) x 83.2 (D) mm$^3$</td>
</tr>
<tr>
<td>Weight</td>
<td>105 g</td>
</tr>
</tbody>
</table>

$^1$: Some slave devices may impose further restrictions. Check the specifications of slave units used.

$^2$: The YHLS master module has a built-in terminating resistor. It must be installed at the end of the remote I/O system.

$^3$: Excluding protrusions (see External Dimensions for details).
### Components and Functions

#### Front View

Status indicators
- **RDY**: Lit when the internal circuit is functioning normally.
- **YHLS communication ports**
  - **LNK**: Lit during communication with slave units.
  - **ALM**: Lit at communication failure.

#### LED Indicators

<table>
<thead>
<tr>
<th>Designation (color)</th>
<th>Description</th>
<th>When Lit</th>
<th>When Not Lit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDY (green)</td>
<td>Internal circuit status</td>
<td>Normal</td>
<td>Error</td>
</tr>
<tr>
<td>F/H (red)</td>
<td>Communications mode</td>
<td>F: full duplex; H: half duplex</td>
<td>Communications mode is undefined.</td>
</tr>
<tr>
<td>12/6/3 (red)</td>
<td>Transmission speed</td>
<td>12: 12 Mbps, 6: 6 Mbps, and 3: 3 Mbps</td>
<td>Transmission speed is undefined.</td>
</tr>
<tr>
<td>LNK (green)</td>
<td>Normal communications</td>
<td>Communicating with one or more slaves.</td>
<td>If the Communicating relay is on: No slave unit is available for communication. If the Communicating relay is off: No communication is in progress.</td>
</tr>
<tr>
<td>ALM (yellow)</td>
<td>Communications error</td>
<td>Communication failure has been detected at one or more slave units.</td>
<td>If the Communicating relay is on: No communication failure has been detected at any slave unit.</td>
</tr>
</tbody>
</table>

#### External Dimensions

(Unit: mm)
2.2 External Connection

Connection Topology

- YHLS master module
  - Port 1
    - Slave unit
    - Slave unit
    - Slave unit
    - Slave unit
  - Port 2
    - Slave unit
    - Slave unit
    - Slave unit
    - Slave unit

Each port supports a maximum of 63 slave units.
Maximum transmission speed: 12 Mbps (at 100 m distance)
Maximum transmission distance: 300 m (at 3 Mbps)

Connector Pin Assignment

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Full Duplex</th>
<th>Half Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal Symbol</td>
<td>Signal Flow</td>
</tr>
<tr>
<td>1</td>
<td>NC</td>
<td>Master</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>Slave</td>
</tr>
<tr>
<td>3</td>
<td>RXD+</td>
<td>←</td>
</tr>
<tr>
<td>4</td>
<td>RXD-</td>
<td>←</td>
</tr>
<tr>
<td>5</td>
<td>TXD+</td>
<td>→</td>
</tr>
<tr>
<td>6</td>
<td>TXD-</td>
<td>→</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>Master</td>
</tr>
<tr>
<td>8</td>
<td>SHIELD</td>
<td>←→</td>
</tr>
</tbody>
</table>
Cables

Prepare a plug-cable set that complies with the connector pin assignment described above. Use cables of the type described below.

- **CAT5 shielded cable or equivalent**
  - Shielded twisted-pair cable
  - Impedance: 100 Ω
  - Conductor size: AWG24

⚠️ CAUTION

- If a different type of cable is recommended for a slave unit by its manufacturer, use that cable instead.
- Commercially available Ethernet cables cannot be used for this purpose because its connector pin assignment is different from that of the CAT5 cable.

Connector

Use plugs of the following type:

- RJ-45 shielded modular plug

Shield Treatment

The cable shield must be treated as follows:

- The cable drain must be connected to pin 8 of the RJ-45 modular plug.
- The cable shield must be connected to the shield of the RJ-45 modular plug.
2.3 Attaching/Detaching the Module

- Attaching the Module

Figure 2.2 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 the module toward the base module until the anchor/release button clicks into place.

**CAUTION**

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

- Detaching the Module

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

**CAUTION**

Do not bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend causing an error.
Attaching the Module 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>Required Screw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binding head machine screw M4 of 12 to 15 mm long</td>
</tr>
<tr>
<td>(washer screw of 14-15 mm long)</td>
</tr>
</tbody>
</table>

Figure 2.3  Securing Module Using Screws
3. Functions
This chapter describes the functions of the YHLS master module.

3.1 List of Functions

<table>
<thead>
<tr>
<th>Functions</th>
<th>Description</th>
<th>See Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication with slave units</td>
<td>I/O communication with slave units for ON/OFF control and monitoring.</td>
<td>3.2</td>
</tr>
<tr>
<td>Withdrawal of slave unit</td>
<td>A slave unit that failed to communicate due to power off or any other reason is withdrawn from the network and communication continues with the remaining normal slave units.</td>
<td>3.3</td>
</tr>
<tr>
<td>Automatic slave unit participation</td>
<td>When a slave unit that failed to communicate previously due to power off or any other reason returns to normal condition, it automatically resumes communications with the YHLS master module.</td>
<td>3.4</td>
</tr>
<tr>
<td>Stopping communications when CPU stops</td>
<td>If the sequence CPU module enters STOP mode, the YHLS master module suspends communications with slave units.</td>
<td>3.5</td>
</tr>
<tr>
<td>Monitoring slave units for error</td>
<td>Error notification may be selectively enabled for individual slave units.</td>
<td>3.6</td>
</tr>
</tbody>
</table>
3.2 Communication with Slave Units

3.2.1 Starting Communications
After setting the transmission speed, communications mode and the slave unit last address for the YHLS master module, turn on the Request to Communicate relay to start communication between YHLS master module and the slave units.

3.2.2 Input
Input statuses of slave units are transmitted to the YHLS master module and stored in its input area according to slave unit number during a communication cycle.
The sequence CPU module then issues a read command at its own timing to read the input status of a slave unit from the input area of the YHLS master module into its internal device.

3.2.3 Output
The sequence CPU module issues a write command to send and store the data of its internal device to the output area of the YHLS master module.
Data stored in data positions corresponding to each slave unit number within the output area of the YHLS master module is transmitted to the respective slave units during a communication cycle.
3.3 ** Withdrawal of Slave Unit **

A slave unit that is no longer available for communication due to power off or any other reason is withdrawn from the network and communication continues with the remaining normal slave units.

**TIP**

Withdrawal of an unavailable slave unit does not affect the remote scan time.

---

**CAUTION**

If a communication cable is broken, communication fails due to line instability caused by the loss of the terminating resistor.
3.4 Automatic Slave Unit Participation

When a slave unit that has been unavailable due to power off or any other reason returns to normal condition, it automatically resumes communication with the YHLS master module.

TIP

Automatic participation by a slave unit does not affect the remote scan time.

3.5 Stopping Communications when CPU Stops

If the sequence CPU module stops, the YHLS master module stops communication with slave units.

Before using this function, you should set the output at CPU failure to 'RESET' in the DIO setup for the slot installed with the F3LH02-0N master module in the configuration setup of the CPU module.

The output condition (reset or hold) of a slave unit when the YHLS master module suspends communication depends on the Reset/Hold setting for the slave unit.

SEE ALSO

For details on the sequence CPU module configuration, see:
- Sequence CPU Instruction Manual - Functions (IM 34M6P13-01E)
  Section 1.2.3, Configuration
  Chapter 8, RAS Features
- FA-M3 Programming Tool WideField2 (IM 34M6Q15-01E)
  Section B6.1.3, Configuration Setup

CAUTION

In the event of a moderate or fatal failure of the sequence CPU module, the YHLS master module stops communications with slave units. The output condition of a slave unit when the master module suspends communications can be specified using the Reset/Hold setting for the slave unit.

3.6 Monitoring Slave Units for Error

If a slave unit becomes unavailable for communications due to power off or any other reason, the master module may or may not report this condition as an error depending on the value of the bit corresponding to the slave unit in the Monitored Slave List setting (no error is reported if the bit is set to 0).
4. Response Time

This chapter describes the response time of a remote I/O system.

4.1 Remote Scan time (RST)

Remote scan time is the time required by the YHLS master module to update the I/O status of all slave units connected to each port. The remote scan time depends on communications mode (full- or half-duplex), transmission speed, and last address of slave units as shown below.

- **RST for full-duplex communication**
  \[
  \text{RST} = 182 \times \text{FA} \times \text{Tbps} \text{ (seconds)}
  \]
  \[
  \begin{align*}
  \text{RST} & : \text{Remote scan time} \\
  182 & : \text{Constant} \\
  \text{FA} & : \text{Slave unit last address} \\
  \text{Tbps} & : 1/\text{transmission speed}
  \end{align*}
  \]

  Calculation example:
  Suppose that 8 slave units are connected to a port for communication at 12 Mbps.
  \[
  \begin{align*}
  \text{FA} & : \text{Slave unit last address} = 8 \\
  \text{Tbps} & : 1/\text{transmission speed} = 1/12 \text{ Mbps} = 0.083 \times 10^{-6}
  \end{align*}
  \]

  Thus, \[
  \text{RST} = 182 \times 8 \times 0.083 \times 10^{-6}
  \]
  \[
  = 121.3 \times 10^{-6} \text{ s}
  \]

- **RST for half-duplex communication**
  \[
  \text{RST} = 354 \times \text{FA} \times \text{Tbps} \text{ (s)}
  \]
  \[
  \begin{align*}
  \text{RST} & : \text{Remote scan time} \\
  354 & : \text{Constant} \\
  \text{FA} & : \text{Slave unit last address} \\
  \text{Tbps} & : 1/\text{transmission speed}
  \end{align*}
  \]
Calculation example:

Suppose that 16 slave units are connected to a port for communication at 6 Mbps.

FA : Slave unit last address = 16  
Tbps : 1/transmission speed = 1/6 Mbps = 0.167 x 10^-6  

Thus, \[ RST = 354 \times 16 \times 0.167 \times 10^{-6} \]  
\[ = 944 \times 10^{-6} \text{ (seconds)} \]  

**TIP**

Slave unit withdrawal or automatic slave unit participation does not affect the remote scan time.

---

![Remote scan time (full-duplex)](image-url)

**Fig. 4.1 Remote Scan time (for full-duplex communication)**
4.2 Response Time

The response time of a remote I/O system is the sum of the CPU scan time, remote scan time and slave unit internal processing time.

- **Response time for output from CPU module to slave unit**
  The output response time is the maximum time delay before an output of a slave unit turns on after the corresponding internal device of the sequence CPU module turns on.

  Output response time = SPST + RST + SUI
  
  SPST : Sequence CPU scan time
  RST : Remote scan time
  SUI : Internal processing time of slave unit

- **Response time for input from slave unit to CPU module**
  The input response time is the maximum time delay before an internal device of the sequence CPU module turns on after the corresponding input of a slave unit turns on.

  Input response time = SPST + RST + SUI
  
  SPST : Sequence CPU scan time
  RST : Remote scan time
  SUI : Internal processing time of slave unit

An example of response time calculation is given on the next page.
● Calculation example

Let us calculate the output response time from the CPU module to slave units under the following conditions:

- Number of slave units : 4
- Output processing time of slave unit : 1 ms max.
- Sequence CPU scan time : 1 ms
- Master module transmission speed and mode : 12 Mbps, full-duplex

Response time = SPST (maximum time for CPU to recognize input) + SPST (maximum time for CPU to compute and output according to input) + RST (remote scan time) + SUI (internal processing time of slave unit)

where 
RST = 182 x FA x Tbps = 182 x 4 x 1/12 x 10^6 = 61 x 10^6 (s)

Thus, response time = 1 x 10^-3 + 1 x 10^-3 + 61 x 10^-6 + 1 x 10^-3 (s)

= 3.061 ms
5. **Communication Preparation Flow**

The following flowchart shows how to prepare for communications.

Start

- Install the YHLS master module on the base module.  
  See Section 2.3, "Attaching/Detaching the Module."

- Connect slave units to the YHLS master module.  
  See Section 2.2, "External Connection."

- Set up the transmission speed.  
  See Section 7.3, "Parameter Setup Area."

- Set up the communications mode.  
  See Section 7.3, "Parameter Setup Area."

- Set up the slave unit last address.  
  See Section 7.3, "Parameter Setup Area."

- Turn on the Request to Communicate relay.  
  See Chapter 6, "List of I/O Relays.

Communicating relay turns on.

LINK relay turns on.

End
6. **List of I/O Relays**

The YHLS master module has 32 input and 32 output relays for interfacing with the sequence CPU module. Each of the input relays can be set to raise an interrupt.

6.1 **Output Relays**

<table>
<thead>
<tr>
<th>Output Relay Number</th>
<th>Output Relay Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y□□□33</td>
<td>Request to Communicate relay(^*1)</td>
<td>Turn on this relay to start communication. Once communication is started, input relay X□□□01 (Communicating relay) turns on. Turn off this relay to stop communication.</td>
</tr>
<tr>
<td>Y□□□34 to Y□□□40</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>Y□□□41</td>
<td>Request to Communicate relay(^*2)</td>
<td>Turn on this relay to start communication. Once communication is started, input relay X□□□09 (Communicating relay) turns on. Turn off this relay to stop communication.</td>
</tr>
<tr>
<td>Y□□□42 to Y□□□64</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>

\(^*1\) : For port 1  
\(^*2\) : For port 2  
□□□□ : Slot number
# 6.2 Input Relays

<table>
<thead>
<tr>
<th>Input Relay Number</th>
<th>Input Relay Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X001</td>
<td>Communicating(^1)</td>
<td>Turns on when communication is started by Y33. Turns off when Y33 is turned off.</td>
</tr>
<tr>
<td>X002</td>
<td>Link(^1)</td>
<td>Turns on when communication is started if one or more slave units are available for communication. Turns off when Y33 is turned off.</td>
</tr>
<tr>
<td>X003</td>
<td>Alarm(^1)</td>
<td>Turns on when one or more slave units that were previously available for communication are no longer available. Turns off when Y33 is turned off or when there is no failed slave unit.</td>
</tr>
<tr>
<td>X004 to X008</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>X009</td>
<td>Communicating(^2)</td>
<td>Turns on when communication is started by Y41. Turns off when Y41 is turned off.</td>
</tr>
<tr>
<td>X010</td>
<td>Link(^2)</td>
<td>Turns on when communication is started if one or more slave units are active. Turns off when Y41 is turned off.</td>
</tr>
<tr>
<td>X011</td>
<td>Alarm(^2)</td>
<td>Turns on when one or more slave units that were previously available for communication are no longer available. Turns off when Y41 is turned off or when there is no failed slave unit.</td>
</tr>
<tr>
<td>X012 to X032</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) : For port 1  
\(^2\) : For port 2  
\(\) : Slot number

---

**TIP**

The Link and Alarm relays are not mutually exclusive, and may turn on at the same time.

The Link relay turns on if at least one slave unit is available for communication.

The Alarm relay turns on when one or more slave units that were previously available for communication are no longer available.
7. **List of Registers**

The YHLS master module has registers for interfacing with the sequence CPU module. They are grouped into the following four areas:

- **Input data area**: For storing data read from slave units
- **Output data area**: For storing data to be written to slave units
- **Parameter setup area**: For YHLS parameter setup
- **Parameter monitoring area**: For YHLS parameter monitoring

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Input data area</strong></td>
</tr>
<tr>
<td>256</td>
<td><strong>Output data area</strong></td>
</tr>
<tr>
<td>257</td>
<td><strong>Reserved</strong></td>
</tr>
<tr>
<td>512</td>
<td><strong>Parameter setup area</strong></td>
</tr>
<tr>
<td>513</td>
<td><strong>Parameter monitoring area</strong></td>
</tr>
<tr>
<td>516</td>
<td></td>
</tr>
<tr>
<td>517</td>
<td></td>
</tr>
<tr>
<td>580</td>
<td></td>
</tr>
<tr>
<td>581</td>
<td></td>
</tr>
<tr>
<td>676</td>
<td></td>
</tr>
</tbody>
</table>
### 7.1 Input Data Area

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>Input data area for port 1</th>
<th>Input data area for port 2</th>
<th>For port 1</th>
<th>For port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slave 1</td>
<td>Slave 1</td>
<td>65</td>
<td>Slave 1</td>
</tr>
<tr>
<td>2</td>
<td>Slave 2</td>
<td>Slave 2</td>
<td>66</td>
<td>Slave 2</td>
</tr>
<tr>
<td>3</td>
<td>Slave 3</td>
<td>Slave 3</td>
<td>67</td>
<td>Slave 3</td>
</tr>
<tr>
<td>4</td>
<td>Slave 4</td>
<td>Slave 4</td>
<td>68</td>
<td>Slave 4</td>
</tr>
<tr>
<td>512</td>
<td>Input data area</td>
<td>Output data area</td>
<td>512</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Input data area</td>
<td>Output data area</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>128</td>
<td>Input data area</td>
<td>Output data area</td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>513</td>
<td>Input data area</td>
<td>Output data area</td>
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<td>516</td>
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<td>Output data area</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>256</td>
<td>Input data area</td>
<td>Output data area</td>
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<tr>
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<tr>
<td>192</td>
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<td>193</td>
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<tr>
<td>64</td>
<td>Input data area</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>580</td>
<td>Input data area</td>
<td>Output data area</td>
<td>580</td>
<td></td>
</tr>
<tr>
<td>581</td>
<td>Input data area</td>
<td>Output data area</td>
<td>581</td>
<td></td>
</tr>
<tr>
<td>676</td>
<td>Input data area</td>
<td>Output data area</td>
<td>676</td>
<td></td>
</tr>
</tbody>
</table>

- **Input data area**: Locations 1 to 511
- **Output data area**: Locations 512 to 675
- **Parameter setup area**: Locations 582 to 587
- **Parameter monitoring area**: Locations 588 to 593
- **Reserved**: Locations 60 to 63, 120 to 127

- **Slave**: Locations 65 to 67, 124 to 126

- **Input data area for port 1**: Locations 1 to 64
- **Output data area for port 1**: Locations 512 to 64
- **Input data area for port 2**: Locations 65 to 128
- **Output data area for port 2**: Locations 513 to 128
### 7.2 Output Data Area

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>Input data area</th>
<th>Output data area for port 1</th>
<th>Output data area for port 2</th>
<th>Reserved</th>
<th>Parameter setup area</th>
<th>Parameter monitoring area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>257</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>256</td>
<td></td>
<td>320</td>
<td>258</td>
<td>384</td>
<td>448</td>
<td>512</td>
</tr>
<tr>
<td>257</td>
<td></td>
<td>321</td>
<td>259</td>
<td>385</td>
<td>449</td>
<td>512</td>
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<tr>
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<td>320</td>
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<td>384</td>
<td>448</td>
<td>512</td>
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<tr>
<td>513</td>
<td></td>
<td>321</td>
<td>259</td>
<td>385</td>
<td>449</td>
<td>512</td>
</tr>
<tr>
<td>517</td>
<td></td>
<td>320</td>
<td>258</td>
<td>384</td>
<td>448</td>
<td>512</td>
</tr>
<tr>
<td>580</td>
<td></td>
<td>321</td>
<td>259</td>
<td>385</td>
<td>449</td>
<td>512</td>
</tr>
<tr>
<td>581</td>
<td></td>
<td>322</td>
<td>260</td>
<td>386</td>
<td>450</td>
<td>513</td>
</tr>
<tr>
<td>676</td>
<td></td>
<td>323</td>
<td>261</td>
<td>387</td>
<td>451</td>
<td>514</td>
</tr>
</tbody>
</table>

For port 1:
- Slave 1
- Slave 2
- Slave 3
- Slave 4
- Slave 60
- Slave 61
- Slave 62
- Slave 63

For port 2:
- Slave 1
- Slave 2
- Slave 3
- Slave 4
- Slave 60
- Slave 61
- Slave 62
- Slave 63
### 7.3 Parameter Setup Area

#### Data Position No.

<table>
<thead>
<tr>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>517</td>
<td>533</td>
</tr>
<tr>
<td>518</td>
<td>534</td>
</tr>
<tr>
<td>519</td>
<td>535</td>
</tr>
<tr>
<td>520</td>
<td>536</td>
</tr>
<tr>
<td>521 to</td>
<td>537 to</td>
</tr>
<tr>
<td>524</td>
<td>537 to</td>
</tr>
<tr>
<td>532</td>
<td>541 to</td>
</tr>
<tr>
<td>534</td>
<td>542</td>
</tr>
<tr>
<td>535</td>
<td>543</td>
</tr>
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<td>536</td>
<td>544</td>
</tr>
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<td>538</td>
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<td>539</td>
<td>547</td>
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<tr>
<td>540</td>
<td>548</td>
</tr>
</tbody>
</table>

#### Description

<table>
<thead>
<tr>
<th>Data Position No.</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port 1 : Port 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>517</td>
<td>Last address</td>
<td>Between 1 and 63</td>
</tr>
<tr>
<td>518</td>
<td>Transmission speed</td>
<td>0 : 12 Mbps 1 : 6 Mbps 2 : 3 Mbps</td>
</tr>
<tr>
<td>519</td>
<td>Communications mode</td>
<td>0 : Full-duplex 1 : Half-duplex</td>
</tr>
<tr>
<td>520</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>521</td>
<td>Monitored slave list</td>
<td>0 : Not monitored 1 : Monitored (monitored)</td>
</tr>
<tr>
<td>525</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>
7.3.1 Last Address
The Last Address parameter specifies the maximum slave unit address value that can be specified for communication. It must be between 1 and 63. If the specified last address is beyond this range, it is assumed to be 63.

**CAUTION**
- A slave unit whose address is larger than the specified last address cannot be specified for communication with the master module and, therefore, its input/output data, alive list or error monitoring information is not updated.
- Beware that setting the last address to a number larger than the number of slave units actually used lengthens remote scan time unnecessarily.
- Full-duplex transmission is not available if the last address is set to 1. In this case, specify half-duplex transmission instead.
- The last address setting is enabled when the Request to Communicate relay is turned on.

7.3.2 Transmission Speed
There are three transmission speed options:
0: 12 Mbps
1: 6 Mbps
2: 3 Mbps
The default is 0 (=12 Mbps). If a number other than 0, 1 or 2 is specified, 0 (=12 Mbps) is assumed.

**CAUTION**
The transmission speed setting is enabled when the Request to Communicate relay is turned on.
Total transmission distance and remote scan time depend on the transmission speed setting: the total transmission distance is 100 m at 12 Mbps, 200 m at 6 Mbps, or 300 m at 3 Mbps. For details on remote scan time, see Chapter 4, “Response Time.”

7.3.3 Communications mode
There are two communications mode options:
0: Full-duplex
1: Half-duplex
The default is 0 (= full-duplex). If a number other than 0 or 1 is specified, 0 (= full-duplex) is assumed.

**CAUTION**
- Full-duplex and half-duplex communications modes have the following differences:
  - Remote scan time is shorter for full-duplex mode.
  - Full-duplex mode uses a 4-wire (2-pair) communication cable, while half-duplex mode uses a 2-wire (1-pair) communication cable.
  - Only half-duplex mode is available if the slave unit last address is set to 1.
- The communications mode setting is enabled when the Request to Communicate relay is turned on.
### 7.3.4 Monitored Slave List

You can specify which slave units are to be monitored for communication error. To monitor error for a specific slave unit, set its corresponding bit to 1. Bit values for slave units beyond the Last Address setting are ignored. When a communication error with a monitored slave unit is detected, the ALM LED lights up and the ALARM relay turns on.

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>521</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
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<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>522</td>
<td>32</td>
<td>31</td>
<td>30</td>
<td>29</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>22</td>
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<td>18</td>
</tr>
<tr>
<td>523</td>
<td>48</td>
<td>47</td>
<td>46</td>
<td>45</td>
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<td>52</td>
<td>51</td>
<td>50</td>
<td>49</td>
</tr>
</tbody>
</table>

Note: The data positions shown in the table are for port 1.
## 7.4 Parameter Monitoring Area

<table>
<thead>
<tr>
<th>Data Position No.</th>
<th>Description</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>581 - 605</td>
<td>Last address</td>
<td>Between 1 and 63</td>
<td></td>
</tr>
<tr>
<td>582 - 606</td>
<td>Transmission speed</td>
<td>0 : 12 Mbps</td>
<td>1 : 6 Mbps</td>
</tr>
<tr>
<td>583 - 607</td>
<td>Communications mode</td>
<td>0 : Full-duplex</td>
<td>1 : Half-duplex</td>
</tr>
<tr>
<td>584 - 608</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>585 to 588</td>
<td>Alive slave list</td>
<td>0 : Error</td>
<td>1 : Normal</td>
</tr>
<tr>
<td>589 to 592</td>
<td>Failed slave list (non-latched)</td>
<td>0 : Normal</td>
<td>1 : Error</td>
</tr>
<tr>
<td>593 to 596</td>
<td>Failed slave list (latched)</td>
<td>0 : Normal</td>
<td>1 : Error</td>
</tr>
<tr>
<td>597 to 600</td>
<td>Monitored slave list</td>
<td>0 : Not monitored</td>
<td>1 : Monitored</td>
</tr>
<tr>
<td>601 to 604</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Diagram

The diagram illustrates the data position numbers and their corresponding descriptions in the parameter monitoring area. The table provides a detailed overview of the data positions and their respective descriptions, including last address, transmission speed, communications mode, and various lists for slave monitoring and status.
7.4.1 Last Address
This parameter monitors the last address setting for the current communication cycle.

7.4.2 Transmission Speed
This parameter monitors the transmission speed setting for the current communication cycle.

7.4.3 Communications mode
This parameter monitors the communications mode setting for the current communication cycle.

7.4.4 Alive Slave List
This parameter monitors the statuses of connected slave units. A slave unit is considered alive if it is powered on and available for communication. The bit corresponding to an alive slave unit is set to 1.

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
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</thead>
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<tr>
<td>585</td>
<td>16</td>
<td>15</td>
<td>14</td>
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<tr>
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<td>31</td>
<td>30</td>
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<td>587</td>
<td>48</td>
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<td>53</td>
<td>52</td>
<td>51</td>
<td>50</td>
<td>49</td>
</tr>
</tbody>
</table>

Note: The data positions shown in the table are for port 1.

7.4.5 Failed Slave List (non-latched)
If an error is detected during communication with a slave unit specified for error monitoring, its corresponding bit in the Failed Slave List (non-latched) is set to 1. When the error condition is removed, the bit is automatically reset to 0. If the bit of any slave unit is set to 1, the ALM LED lights up and the ALARM relay turns on.

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
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<tbody>
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<td>53</td>
<td>52</td>
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<td>50</td>
<td>49</td>
</tr>
</tbody>
</table>

Note: The data positions shown in the table are for port 1.
7.4.6  Failed Slave List (latched)

If an error is detected during communication with a slave unit specified for error monitoring, its corresponding bit in the Failed Slave List (latched) is set to 1. Once turned on, a bit is not reset to 0 even when the error condition is removed. To reset a bit, you must overwrite the bit with 0 using a program.

Note: The data positions shown in the table are for port 1.

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
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<th>1</th>
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</thead>
<tbody>
<tr>
<td>593</td>
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<td>15</td>
<td>14</td>
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<td>11</td>
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<td>53</td>
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<td>50</td>
<td>49</td>
</tr>
</tbody>
</table>

7.4.7  Monitored Slave List

This parameter indicates which slave units are currently monitored for error. Bits corresponding to slave units that are currently monitored for error are set to 1.

Note: The data positions shown in the table are for port 1.

<table>
<thead>
<tr>
<th>Data position No.</th>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
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</tr>
</thead>
<tbody>
<tr>
<td>597</td>
<td>16</td>
<td>15</td>
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<td>13</td>
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<td>11</td>
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<td>51</td>
<td>50</td>
<td>49</td>
</tr>
</tbody>
</table>
8. Troubleshooting

This chapter describes how to troubleshoot communication failure and other problems.

8.1 Hardware or Setup Error?

Check for the following setup errors before proceeding with troubleshooting:

- Are the modules installed correctly?
- Are the conditions set correctly?
- Is the communication cable correct?
- Is the YHLS master module configured correctly?
- Are the settings on slave units correct?
- Are the power supplies of slave units correct?
8.2 Troubleshooting Common Problems

This section shows troubleshooting flowcharts for various error scenarios that may occur when using the YHLS master module.

![Troubleshooting Flowchart]

- **Error**
  - Is sequence CPU module in error?
    - Yes → Remove the cause of the error of the sequence CPU module.
    - No → Is RDY LED lit?
      - Yes → See Subsection 8.2.1, "RDY LED is not Lit."
      - No → See Subsection 8.2.2, "LNK LED is not Lit."
  - Is LNK LED lit?
    - Yes → See Subsection 8.2.3, "ALM LED is Lit."
    - No → Is ALM LED lit?
      - Yes → See Subsection 8.2.4, "No Output to Slave Units."
      - No → Is output to slave units normal?
        - Yes → See Subsection 8.2.5, "No Input from Slave Units."
        - No
8.2.1 RDY LED is not Lit

RDY LED is not lit.

- Is power supply module supplied with proper voltage?
  - No: Apply proper voltage.
  - Yes: Is RDY LED on power supply module lit?
    - No: Replace the power supply module.
    - Yes: Is RDY LED on other modules lit?
      - No: Check total current consumption. If it is within the specification, replace the base module.
      - Yes: Is the module properly mounted in its slot?
        - No: Push the module until it locks in place.
        - Yes: Does RDY LED light up if installed in another slot?
          - Yes: Replace the base module.
          - No: Replace the YHLS master module.
8.2.2 LNK LED is not Lit

- LNK LED is not lit.
  - Is Request to Communicate relay on?
    - Yes
      - Turn on the Request to Communicate relay.
    - No
      - Is Communicating relay on?
        - Yes
          - Replace the YHLS master module.
        - No
          - Is LINK relay on?
            - Yes
              - Replace the YHLS master module.
            - No
              - Check power supply and cable connection of slave units.

Caution: Commercially available Ethernet cables must not be used because of different pin assignments.

8.2.3 ALM LED is Lit

- ALM LED is lit.
  - Is LINK relay on?
    - Yes
      - Check the Alive Slave List for error slave units.
    - No
      - Check cables.
        - Check the power supply of slave units.

Note: If the LINK relay is off, it means that no slave unit is available for communication.

- Is terminator set correctly?
  - Yes
    - Enable the terminating resistor of the slave unit at the end of the bus.
  - No
    - Check the Alive Slave List for error slave units.

For each error slave unit, check for:
- duplicate address
- cable problems
- power supply problems
8.2.4 No Output to Slave Unit

No output to a slave unit.

- Is LINK relay on?
  - No: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions. Note: If the LINK relay is off, it means that no slave unit is available for communication.
  - Yes: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions.

- Is corresponding bit in Alive Slave List on?
  - No: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions.
  - Yes: Check the slave unit number. Check the program code that writes data to the output data area.

- Does slave unit no. and position no. for writing match?
  - No: Check the slave unit number. Check the program code that writes data to the output data area.
  - Yes: Replace the YHLS master module.

8.2.5 No Input from Slave Unit

No input from a slave unit.

- Is LINK relay on?
  - No: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions. Note: If the LINK relay is off, it means that no slave unit is available for communication.
  - Yes: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions.

- Is corresponding bit in Alive Slave List on?
  - No: Check the cable from the YHLS master module. Check the power supply of the slave unit. Check the communication conditions.
  - Yes: Check the slave unit number. Check the program code that reads data from the input data area.

- Does slave unit no. and data position no. for reading match?
  - No: Check the slave unit number. Check the program code that reads data from the input data area.
  - Yes: Replace the YHLS master module.
9. Sample Program

Assuming 8 slave units with 16 inputs or outputs are connected

The sample program below assumes that the F3LH02-0N YHLS master module is installed in slot 3 of the main unit, and four slave units (having addresses 1 to 4) with 16 outputs and four slave units (having addresses 5 to 8) with 16 inputs are connected to port 1 of the master module.

The sample program sends output data stored in registers D00001 to D00004 to the master module for output by the four 16-output slave units, as well as reads input data from the four 16-input slave units into registers D00005 to D00008 via the master module.

Continued on the next page
To check for live slave units, the program reads the live/dead status of slave units 1-63 into /I00001 to /I00063. To check for slave units currently not communicating, the program reads the non-latched error status of slave units 1-63 into /I00101 to /I00163. To check for slave units that were not communicating at some point in time, the program reads the latched error status of slave units 1-63 into /I00201 to /I00263. To clear the latched error status of the slave units, the program writes value 0 to the corresponding bits at communication startup.
Appendix  Preparing a Plug-cable Set

(1) Modular plug, material and tool

The following types of modular plug, material and tool are recommended for use:

- RJ-45 shielded-modular plug
  Example:
  Manufacturer: Tyco Electronics AMP K.K.
  Model: 5-569550-3
  Note: The constructions of some products may differ from the example shown here.

- Conductive tape
  Example:
  Beaten copper tape

- RJ-45 modular-plug crimping tool
  Example:
  Manufacturer: Tyco Electronics AMP K.K.
  Model: 1-231666-4 (1-853400-0)
  Note: Check for compatibility with the modular plug.

(2) Cable

CAT5 shielded twisted-pair cable is recommended.

The cable shown below uses aluminum tape as its shield.
(3) How to prepare a plug-cable set

a. Peel off 25-mm length of outer insulation from the cable. Take care not to damage the tape shield underneath.
Check whether the tape shield has its outer surface insulation-coated.

b. If insulation-coated:
Fold the exposed part of the tape shield backwards over the outer insulation so that the inner conductive surface of the tape shield is exposed.
Note: Cut the folded part of the tape shield to about 10 mm long.

If not insulation-coated:
Cut the exposed part of the tape shield so that it extends 5 mm from the outer insulation.

c. Cut the exposed inner insulation at the end of the tape shield. Take care not to damage the wires underneath.
To reinforce the tape shield, wind about one turn of conductive tape around it. Beware of over-winding.

d. Select two pairs of wires to be used and cut off the remaining wires. Untwist the two pairs of wires and straighten the wires so that they can be inserted into the guide smoothly.
Note: Never strip the wires of their insulation.
e. Lead the wires and the drain into the guide and trim to about 12 mm long.

Pin 1: Not used
Pin 2: Not used
Pin 3: Twisted pair
Pin 4: Twisted pair
Pin 5: Twisted pair
Pin 6: 
Pin 7: Not used
Pin 8: Drain

Note: The two modular plugs to be installed on the cable must have the same pin assignments.

f. Lead the wires and the drain together with the guide into the modular plug.

Flattening the conductive tape part of the cable slightly using pliers will ease its insertion into the plug.

Push the wires and the drain all the way into the modular plug. Verify this visually.

Also verify that the conductive tape part of the cable is about 6 mm into the plug.
g. Crimp the plug with a modular-plug crimping tool, all the while taking care that the wires and the drain are properly positioned.

h. The cable is now provided with a plug. Check the prepared plug-cable set for wrong connection, shorted circuit or open circuit using an ohmmeter or some other appropriate instrument.
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