MITSUBISHI ELECTRIC
Changes for the Better

PLC
CC-Link (MELSEC iQ-R Series)

This course covers the steps from configuration to programming of the CC-Link system which is one of the FA field networks.

L(NA)00213ENG

Introduction Purpose of the course

This course provides training for users who will use CC-Link for the first time or actually configure CC-Link data link systems using a programmable controller (PLC).
The course includes the following:

- Basic knowledge
- Fundamental structure of the data link
- Basic parameter settings for each system configuration
- Programming method
- System start-up
- Operation check

As prerequisites for this course, you should have already completed the following courses or possess the equivalent knowledge.

- FA Equipment for Beginners (Industrial Network)

- MELSEC iQ-R Series Basic

- Programming Basics

The contents of this course are as follows.

Chapter 1 - Overview of CC-Link

Features and basic configuration of the CC-Link system

Chapter 2 - Specifications and settings

Basics of how to configure the CC-Link system, including specifications, basic terms, and basic command settings

Chapter 3 - Implementing the remote I/O system

Settings and operations necessary for implementing the remote I/O system

Chapter 4 - Expandability and Reliability of CC-Link

This chapter describes how to utilize operations other than remote I/O learned in this course. It also explains about the configuration for improving the reliability of the systems.

Final Test

Pass grade: 60% or higher

Introduction — How to use this e-Learning tool

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Move to the desired page	TOC	"Table of Contents" will be displayed, enabling you to navigate to the desired page.
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Introduction | Cautions for use

Safety precautions

When you learn based on using actual products, please carefully read the safety precautions in the corresponding manuals.

Precautions in this course

The displayed screens of the software version that you use may differ from those in this course.
This course uses the following software version:

- GX Works3 Version 1.038Q

Chapter 1 Overview of CC-Link

This course describes the basics of CC-Link, which is one of the field networks.

CC-Link specifications

The latest version as of October 2017 is Version 2, which is an enhanced version of Version 1.1.
This course provides explanation using CC-Link Version 1.1 for understanding the basics of CC-Link.
See the manual for the specifications of Version 2.

The role of CC-Link

CC-Link, an abbreviation of Control & Communication Link, realizes integration of system control and communications.
CC-Link is an open network. Its specifications have been disclosed widely to vendors of sensors and valves to be used in FA environments.
Systems best fit to applications can be configured by combining products of various participating vendors (partner manufacturers).

Background of why FA networks are required

Nowadays, large-scale and integrated systems are required in order to fulfill the demands for modern streamlined systems.
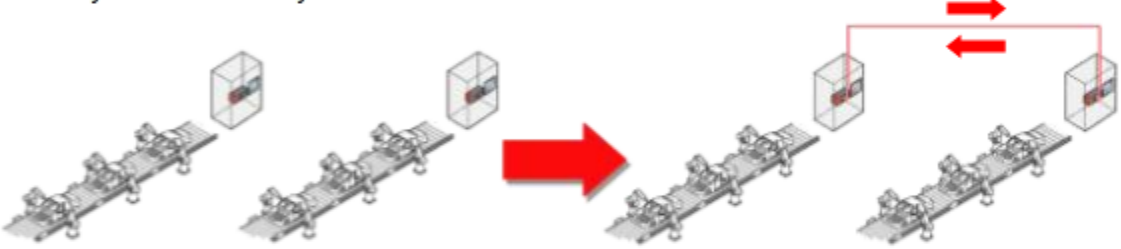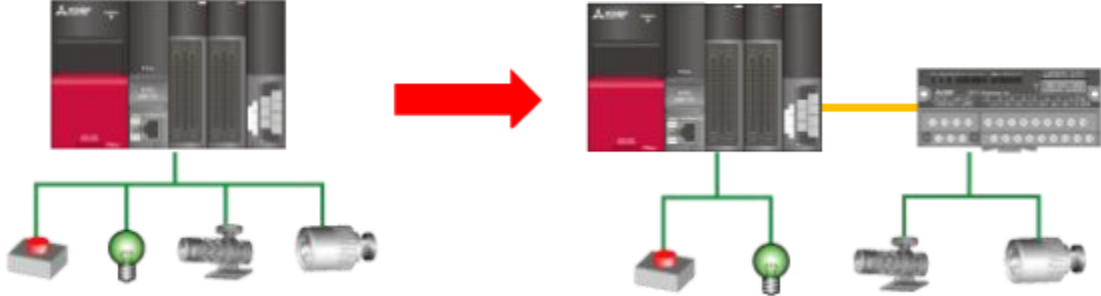Networking of various devices is a prerequisite for communicating and sharing information in such factory automation (FA) environments.

1.1 Necessity of FA networks

1.2 CC-Link family and position of CC-Link

1.3 Features of CC-Link

1.4 Two methods of data communication

1.5 Types of components

1.6 Configuration of CC-Link

1.7 Transmission between remote I/O and CPU module devices

1.1 Necessity of FA networks

Before getting into the main topic, let's review the purposes of FA networks.
FA networks are used in the following two applications.

Network application	Description
Information exchange (Cyclic transmission by the master station and local stations)	FA networks are used to exchange information between programmable controller systems. Connecting distributed equipment (controllers) via a network improves flexibility, expandability, and maintainability of automation systems.
Distribution of I/O (Cyclic transmission by the master station and remote stations)	Extending I/O cables without careful consideration can cause operational errors. In addition, bundling of many thick I/O cables becomes bulky. Instead of routing I/O cables, distributed I/O uses a network to exchange input/output states. By storing the control program in a single CPU module, failed sections can be found quickly and systems can be configured at a relatively low cost.

CC-Link supports both applications described above.
This course explains the most basic distributed I/O arrangement using CC-Link.

1.2 CC-Link family and position of CC-Link

The following table shows differences in each product in the CC-Link family.

Type	Features	Speed	Wiring
CC-Link IE Control Network	High speed and high reliability (resistant to noise and disturbance)	1 Gbps[1]	Optical fiber cable Ring topology
CC-Link IE Field Network	High speed and flexible wiring		Twisted pair cable Multiple topologies[2]
CC-Link	System configuration at a relatively low cost, extensively used, wide variety of connectable devices	156 kbps to 10 Mbps	Bus connection[3]

[1] 1 Gbps:
    Transfers 1×10^9 bits per second.

[2] Topology:
    Indicates how the wiring is configured. As the flexibility of the topology increases, more complicated wirings or system layouts can be configured.

[3] Bus connection:
    Connects all modules in a single signal line.

1.3 Features of CC-Link

The following shows main features of CC-Link.

- Long history and extensively used

- Remote I/O systems can be configured at a relatively low cost

- CC-Link-compatible I/O devices, sensors, valves, and actuators made by partner manufacturers[1] can be combined in the system

- Distributed control[2] through communications between controllers

- Deterministic[3] network communication

- Extensive RAS[4] functions

*1 Partner manufacturers:
   Vendor companies of sensors, actuators, or other equipment who participate in the CC-Link Partner Association (CLPA).

*2 Distributed control:
   Unlike the centralized control that performs all control by one CPU module, this control distributes CPU modules according to the purpose of each control.

*3 Deterministic:
   Responses are returned at predetermined interval.

*4 RAS:
   An abbreviation of Reliability, Availability, and Serviceability. It indicates an index for stable, secure, and reliable operation.

1.4   Two methods of data communication

There are following two methods of data communication used in the programmable controller network.

- Cyclic transmission
- Transient transmission

The following table lists the overview of each method.

Method	Overview	Send/receive program
Cyclic transmission	Communication method to cyclically and automatically send/receive data in the area predetermined by module parameters.[1]	Not required (Data is sent/received based on the setting of module parameters[1].)
Transient transmission	Communication method to send/receive data only when a communication request is issued between programmable controllers in the network during intervals between cyclic transmissions.	Required (Data is sent/received by the program through execution of dedicated instructions.)

CC-Link supports both cyclic and transient transmissions.

* Some modules do not support transient transmission.

This course provides explanation using cyclic transmission, which is the basic transmission method for the FA network.

[1] Network settings configured by module parameters:
Sets the configuration of devices to be connected, as well as the behavior of devices on the network and those on the CPU module side.

1.5 Types of components

The CC-Link system consists of the following four devices.
Location to be used and transmission method vary depending on the station type. Therefore, it is necessary to select suitable slave stations[1] according to applications.
Please remember station types, which will be used for module parameter setting in a later step.

Station type used in CC-Link

Station type		Description
Master station		Manages and controls the data link system. Possesses the network control information (module parameters). Each system must have one master station.
Slave station	Local station	Communicates with the master station or other local stations. The same type of module as the master station is used as the local station depending on the setting.
	Intelligent device station	Supports cyclic and transient transmissions. Local stations are also regarded as intelligent device stations.
	Remote station	Includes a remote I/O station (that handles bit data) and a remote device station (that handles bit data and word data). Supports cyclic transmission only. Transient transmission is not supported.

In this course, you will learn how to control remote I/O using the master and remote stations.
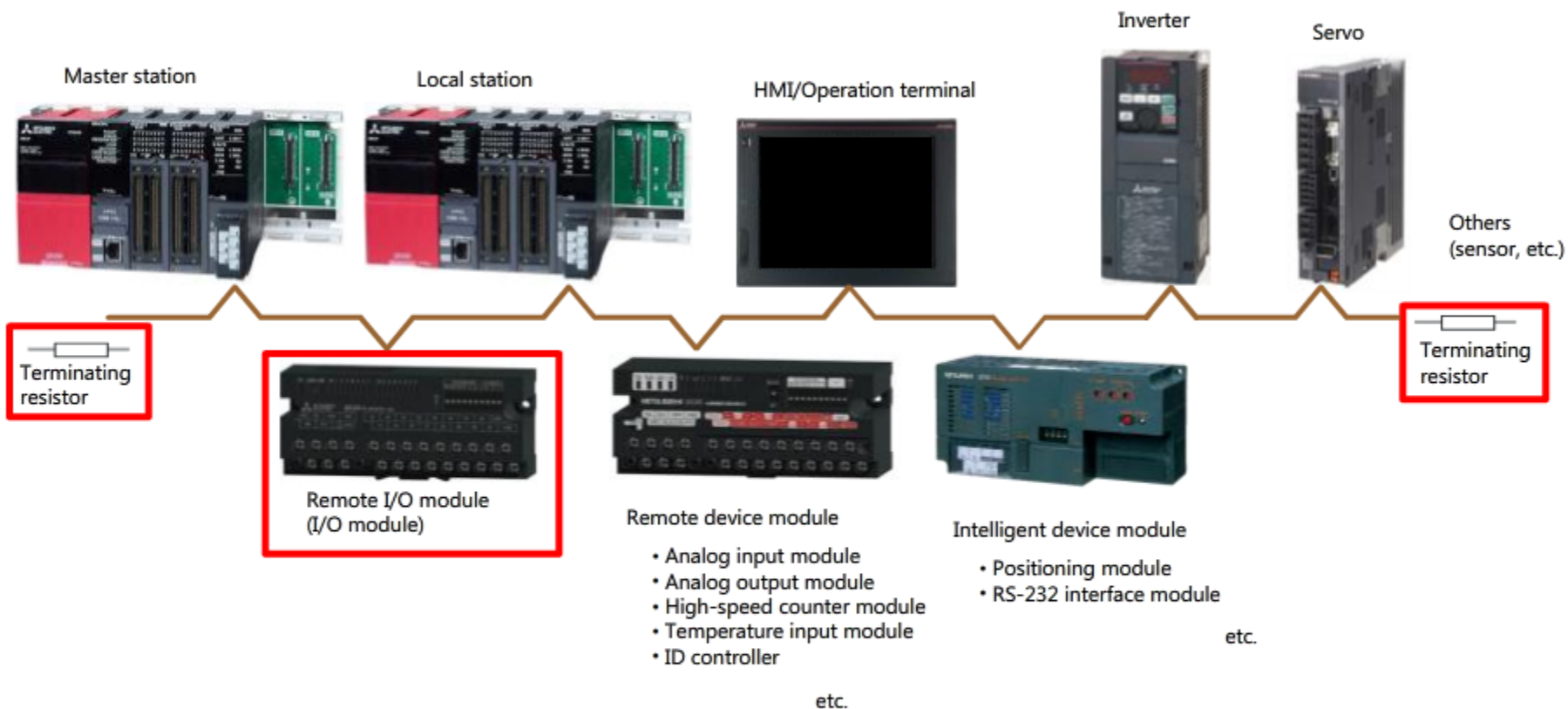
*1 Slave station:
   Stations other than the master station are referred to as slave stations.

1.6 Configuration of CC-Link

Configuration example of CC-Link system

Connect each device as shown below.
Terminating resistors are necessary on both ends of the wiring to stabilize the signals.

Inverter

Servo

Master station

Local station

HMI/Operation terminal

Others
(sensor, etc.)

Terminating
resistor

Remote I/O module
(I/O module)

Remote device module

- Analog input module
- Analog output module
- High-speed counter module
- Temperature input module
- ID controller

etc.

Intelligent device module

- Positioning module
- RS-232 interface module

etc.

Terminating
resistor

CC-Link allows various devices to be connected as shown in the above figure.
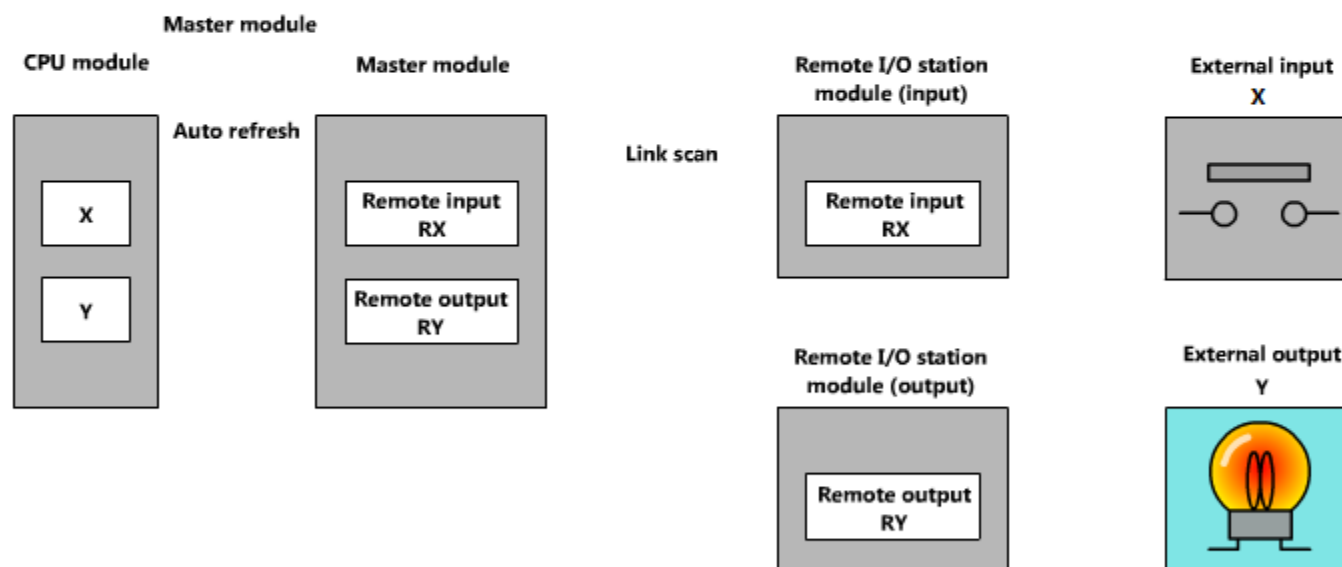This course describes the most basic control that uses remote I/O modules.

1.7 — Transmission between remote I/O devices and CPU module devices

Communications with remote I/O stations

- Bit information (ON/OFF) is transmitted using remote input devices (RX) and remote output devices (RY)
- It is not possible to directly describe remote I/O devices (RX/RY) in a control program
- Remote I/O and CPU module devices are updated automatically based on the assignment setting in the module parameters. This action is called auto refresh.

Auto refresh allows programming as if the remote I/O is accessing the modules installed on the base unit.

Click the play button to start the animation.

Master module

CPU module

Master module

Remote I/O station module (input)

External input
X

Auto refresh

Link scan

| X |
| Remote input RX |
| Remote input RX |

| Y |
| Remote output RY |

Remote I/O station module (output)

External output
Y

| Remote output RY |

Link scan:

An action of the master station that scans the status of the slave stations through the network (link). The data is sent from the master station and received by each slave station. In general, as the total number of connected devices decreases, the link scan time becomes shorter and the response of the remote I/O becomes better.

1.8 Summary of this chapter

In this chapter, you have learned:

- Overview of CC-Link
- Necessity of FA networks
- CC-Link family and position of CC-Link
- Features of CC-Link
- Two methods of data communication
- Types of components
- Configuration of CC-Link
- Transmission between remote I/O devices and CPU module devices

Important points

Station type	• There are four station types: Master stations, remote I/O stations, remote device stations, and intelligent device stations (including local stations) • Remote I/O stations and remote device stations are collectively named as remote stations
Data communication method	There are two transmission methods: Cyclic transmission (that communicates cyclically) and transient transmission (that communicates upon receipt of a request)
Auto refresh	Using module parameters, data in devices on the network will be transferred automatically to devices on the CPU module.

Chapter 2 Specifications and settings

This chapter describes the specifications and settings of CC-Link.

For more information, refer to the manuals for the modules to be used.

## 2.1 Number of occupied stations, station numbers, and number of modules

This section describes basic terms used for CC-Link systems.
Understanding of these terms is necessary to set the module parameters in a later step.

Number of occupied stations	The number of occupied stations is determined in advance according to the number of I/Os in the slave stations to be used.
Station number	Station number is a unique number assigned to a device to be connected. Station number "0" is fixed to the master station. Assignment of the station number starts from 1. The next station number to be assigned is the previous station number + the number of occupied stations of the previous station.

Example) The figure below explains about the station No. 3:

The station number of the own station (3)
= The first station number of the previous station (1) + Its number of occupied stations (2)
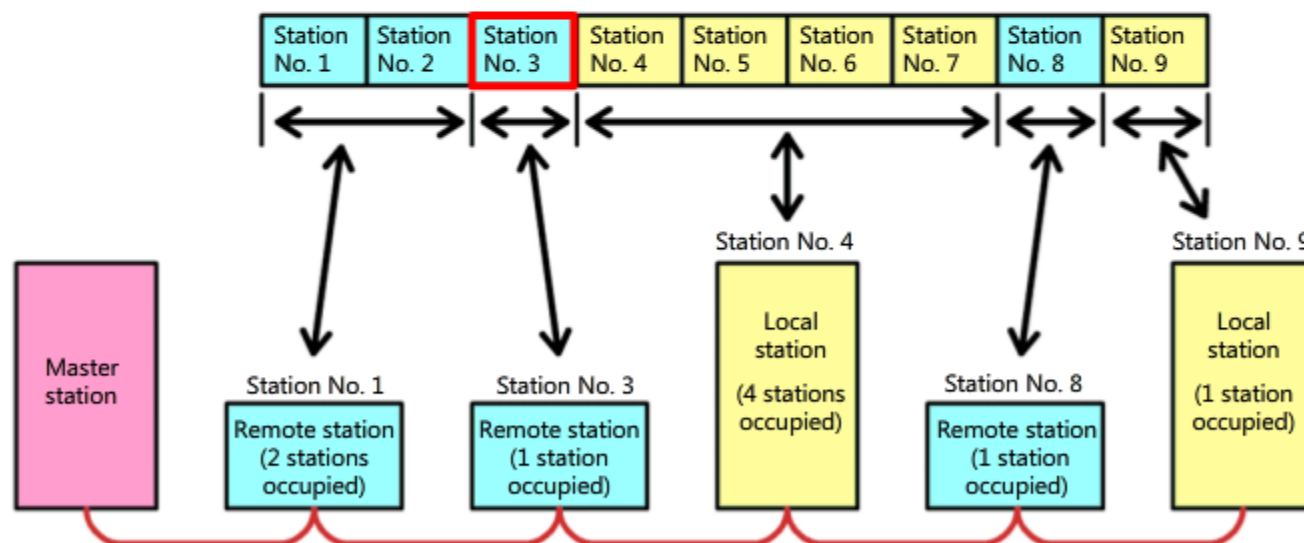
Modules are counted as 1, 2, etc. The number of modules shows how many of the modules are used.
A typical remote I/O station consists of one module.

2.2 Settings for hardware and software

The following settings are necessary to be made to each module in order to operate CC-Link systems.

Hardware settings

- Station numbers and transmission speeds[1] of slave stations are set

Software settings

- Operation of the master station and slave station is configured with module parameters

[1] Transmission speed:
The transmission speed of CC-Link is variable in steps between 156 kbps and 10 Mbps. However, the transmission speed is inversely proportional to the transmission distance and the noise resistance. The higher the transmission speed, the shorter the transmission distance and the lower the noise resistance.
Therefore, you need to select the highest transmission speed that fulfills the overall cable distance calculated based on the installation layout of CC-Link.
If an actual operation seems to be affected by noise, take measures to reduce noise and then reduce the transmission speed further.

2.2 Settings for hardware and software

Hardware settings

To configure the hardware settings, follow the procedure below.

Connect each module with CC-Link dedicated cables.
(Terminating resistors must be connected to the modules at both ends of the system.)

⬇

Set the switches of the **remote module**.
- Station number setting switch
- Transmission speed setting switch

⬇

The hardware has been prepared.

2.2 Settings for hardware and software

Software settings

Using an engineering software, configure the settings of the CPU module that controls the master station.
Settings are configured in the module parameters.
The following items can be set with the module parameters.

- Station type, mode, station number, and transmission speed settings
- Number of retries[1] and network configuration settings[2], which are related to the basic operation of a network
- Link refresh settings for making a link between CPU module devices and CC-Link link devices[3]

[1] Number of retries:
CC-Link ensures data reliability by retrying (resending) data transmissions if data loss due to noise or other factor is detected.
The number of retries indicates how many times of consecutive detection of data losses in a particular station is allowed.
As the higher number of retries is set, the probability of continuing communications with the relevant station becomes higher. It can be thought, however, that the frequent occurrence of retries indicates that there may be a problem such as noise. In such a case, you should try to solve the problem.

[2]: Network configuration settings:
Settings for the attributes of a device (slave station) being connected with CC-Link. The attributes include the station type and the number of occupied stations described previously.

[3] Link device:
The generic term of RX/RY and RWr/RWw. RWr/RWw are the word devices to be used in the link.

2.3 Summary of this chapter

In this chapter, you have learned:

- The meaning of the number of occupied stations, station number, and the number of modules
- Settings necessary for operation, hardware and software settings

Important points

Number of occupied stations	• The number of occupied stations for remote I/O modules is generally 1 • Station numbers are affected by the number of occupied stations • The number of modules shows the number of slave stations
Transmission speed	• The transmission distance is inversely proportional to the transmission speed • Determine the transmission speed based on the required response speed and the operating environment

Chapter 3 Implementing the remote I/O system

This chapter describes how to implement the CC-Link system.
Module settings and operations are explained through configuration of the system.
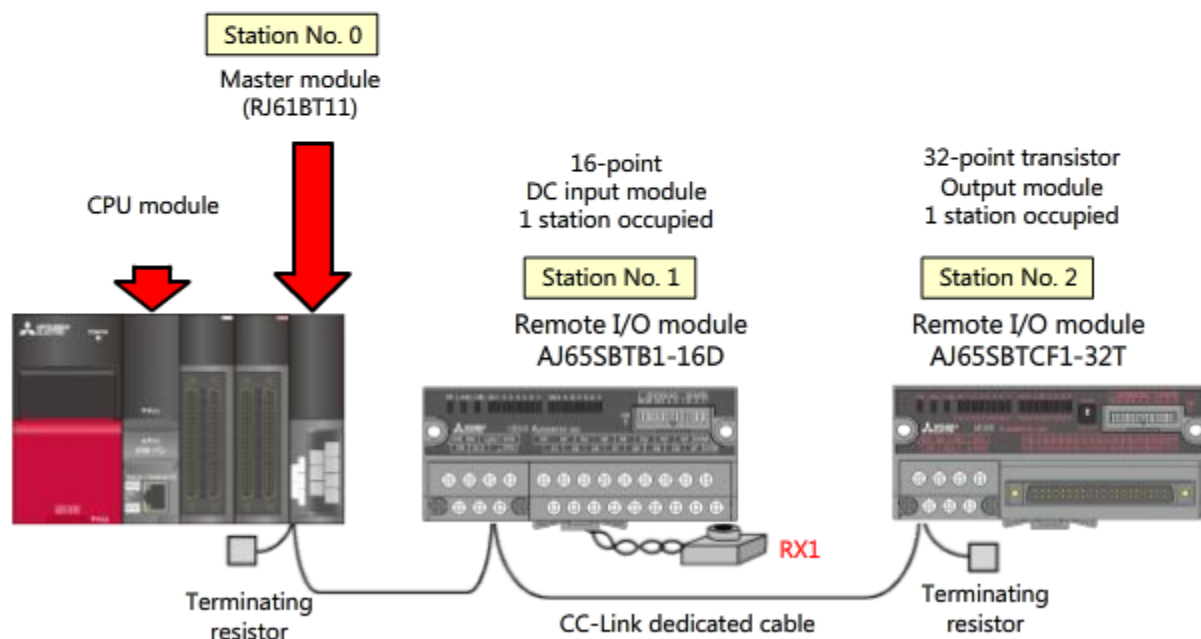
3.1 Overview of the system example

Operational overview of the system example

- Allow the RX1 status of the slave station (station No. 1) to be displayed on the output of the master station
- Turning on X2 of the master station causes RY2 of the slave station (station No. 2) to turn on
- Allow the communication status of the slave stations to be displayed on the output of the master station
- If an error occurs on the master module, no remote I/O is processed

Overall system configuration

The following shows the configuration of the system.

Station No. 0

Master module
(RJ61BT11)

CPU module

16-point
DC input module
1 station occupied

32-point transistor
Output module
1 station occupied

Station No. 1

Remote I/O module
AJ65SBTB1-16D

Station No. 2

Remote I/O module
AJ65SBTCF1-32T

RX1

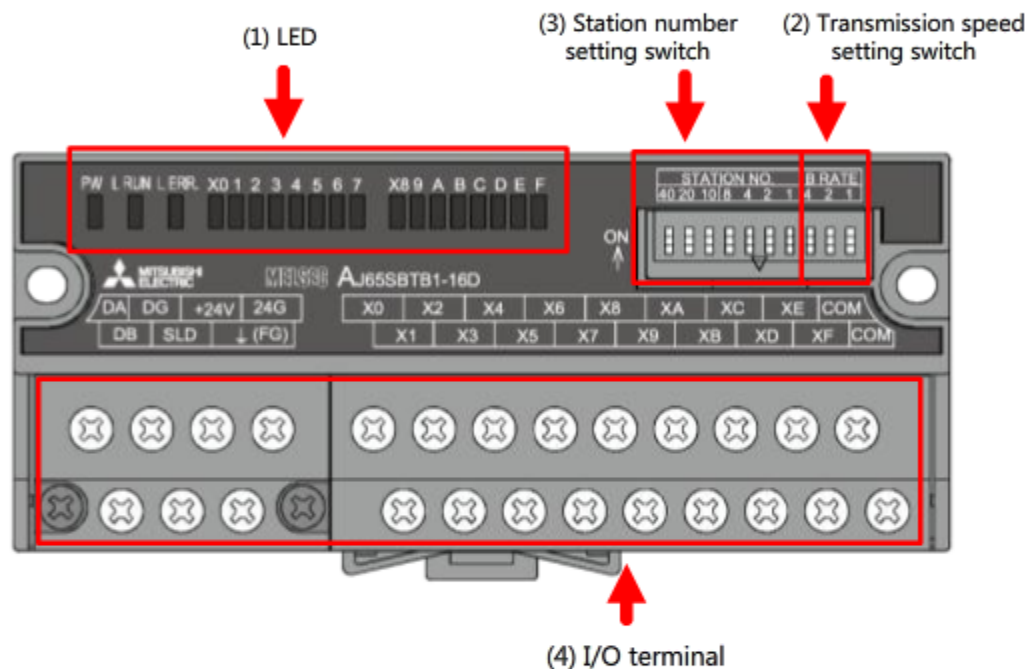Terminating
resistor

CC-Link dedicated cable

Terminating
resistor

3.2 Hardware settings for remote I/O modules

Input module

An input module is used as an example in this section.

Settings

(1) LED

(3) Station number setting switch

(2) Transmission speed setting switch

(4) I/O terminal

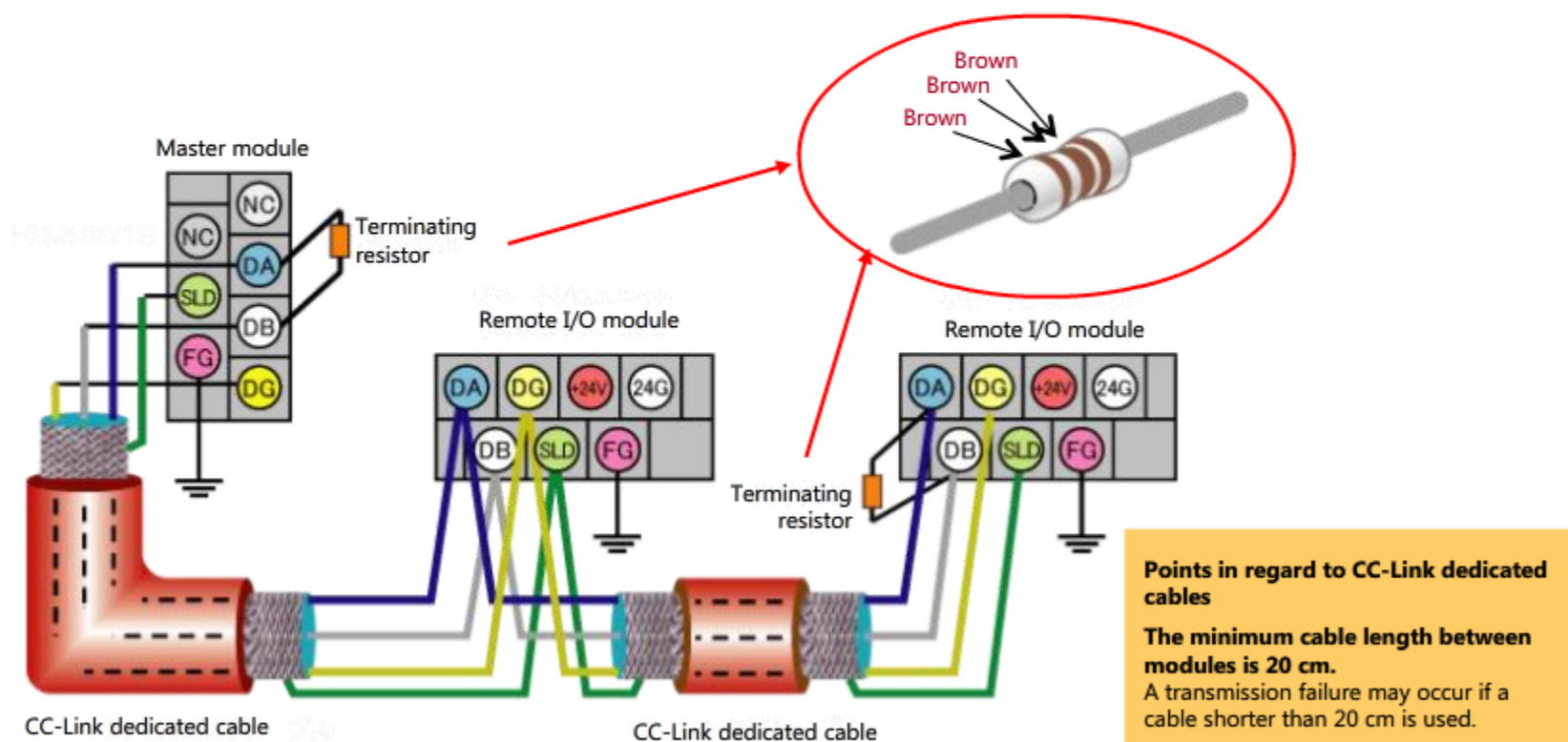|	Setting details
(1)	The area to display the operating status. Primary diagnostics can be performed in the event of an operating failure.
(2)	Set the transmission speed to 156 kbps (turn off all B RATE switches).
(3)	Set a unique station number.
(4)	Connect the CC-Link dedicated cable on the left. Terminals for connecting I/O devices are arranged on the right.

3.3 Wiring

Connect the wiring as shown below.

- Wiring to each module in CC-Link
  Modules can be connected in any order regardless of the station numbers.

- Connect terminating resistors (110 Ω, 1/2 W (color code: brown, brown, brown)) to the stations at both ends of the transmission line

- Supply a 24 V DC external power to the slave stations

Brown
Brown
Brown

Master module

NC
NC
DA   Terminating resistor
SLD
DB
FG
DG

Remote I/O module
DA DG +24V 24G
DB SLD FG

Remote I/O module
DA DG +24V 24G
DB SLD FG
Terminating resistor

CC-Link dedicated cable

CC-Link dedicated cable

Points in regard to CC-Link dedicated cables

The minimum cable length between modules is 20 cm.
A transmission failure may occur if a cable shorter than 20 cm is used.

3.4   Module parameter settings

After setting a station number for the remote I/O module, set the module parameters using MELSOFT GX Works3 engineering software.
While also the control program can be used to configure the settings, this section provides explanations in a visually understandable manner.

3.4.1   Operation settings of the master station

Set the station type of the CC-Link master module as well as the operation mode and the transmission speed of CC-Link.

From the Navigation window, select [Parameter], then [Module Information], and then [RJ61BT11] module parameters to open the setting window. Configure [Required Settings] as follows.

Item	Setting	
Station Type		Leave this setting as default ("Master Station").
Station Type	Master Station	
Mode		Leave this setting as default ("Remote NVer.1 Mode"). This is the most common mode.
Communication Mode	Remote Net Ver.1 Mode	
Station No.		*Change the mode in accordance with the system scale and requirements.
Station No.	0	
Transmission Speed		
Transmission Speed	156kbps	Leave this setting as default ("156kbps"). (Same transmission speed as that of slave stations)
Parameter Setting Method		
Setting Method of Basic/Application Settings	Parameter Editor	

3.4.2 Network configuration settings

Set up the configuration of stations to be connected in the network.

On the [Module Parameter Setting] window, select [Basic Settings], then [Network Configuration Settings], then [CC-Link Configuration Setting], and then [Detailed Setting] to open the [CC-Link Configuration] window.

Select the relevant modules from the module list shown on the right, and drag and drop them starting from the station No. 1 in order. The number of occupied stations is calculated and each station number is set automatically.

CC-Link Configuration Setting window

3.4.3 Link device assignment

CPU module devices and link devices must be assigned to determine the range of data transfer of link refresh.
On the [Module Parameter Setting] window, select [Basic Settings], then [Link Refresh Setting], and then [Detailed Setting].

Select the link devices.

Set the range of each link device.

Set the destination CPU module devices for transfer of the link device data.

Set the range of CPU module devices.

Link special relay (SB) and link special register (SW) are the areas for communicating information such as an operating status of the network modules. They are used for interlocks on the program or other purposes.

No.	Link Side					CPU Side				
	Device Name	Points	Start	End		Target	Device Name	Points	Start	End
–	SB	512	00000	001FF		Specify Devic	SB	512	00000	001FF
	SW	512	00000	001FF		Specify Devic	SW	512	00000	001FF
1	RX	64	00000	0003F		Specify Devic	X	64	01000	0103F
2	RY	64	00000	0003F		Specify Devic	Y	64	01000	0103F
3										
4										

Link Refresh Setting window

The remote station occupies 32 remote input and 32 remote output (RX and RY). Therefore, assign a total of 64 points (0 through 3F) for the target of auto refresh.

The CPU module does not use the I/O device area between 1000H and 2FFFH for modules installed on the base unit. Therefore, assign link devices from 1000H.
(Refer to 3.4.3-2 for more information.)

	Station No.	Model Name	Station Type	Version	# of STA Occupied	Expanded Cyclic Setting	Remote Station Points
	0/0	Host Station	Master Station				
	1/1	AJ65SBTB1-16D	Remote I/O Station	Ver.1	1 Occupied Station	Single	32 Points
	2/2	AJ65SBTCF1-32T	Remote I/O Station	Ver.1	1 Occupied Station	Single	32 Points

CC-Link Configuration Setting window

3.4.3   Link device assignment

When assigning the link devices to the CPU module devices, determine the assignment area based on the following CPU module specifications.

- Number of I/O points: Number of points that can be used by the module installed on the base unit
- Number of I/O points of user devices: Usable range of devices including CC-Link and other network devices

The following range is assigned for MELSEC iQ-R Series CPU modules.

- Number of I/O points: X/Y0000H to X/Y0FFFH
- Number of I/O points of user devices: X/Y0000H to 2FFFH

Thus, assign a part of the area between 1000H and 2FFFH for refresh of link devices, as it does not conflict with the area used for modules installed on the base unit.

A part of this area is used.

Number of I/O points	0000H to 0FFFH	
Number of I/O points of user devices	0000H to 0FFFH	1000H to 2FFFH
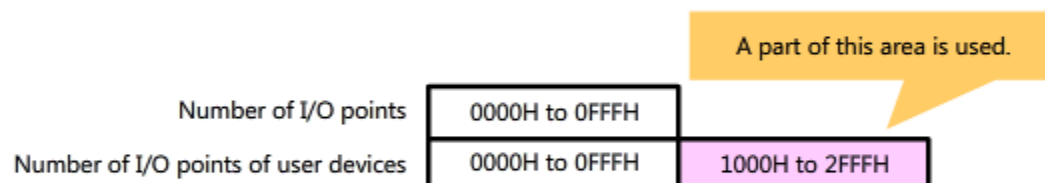
3.5 Specifications check

Before creating an actual program, check the following points.

Check of the station number setting status of slave stations

Check the station number setting of each slave station.

Station No. 1: Remote I/O station
(AJ65SBTB1-16D, 16-point DC input)

Turn on the pin **1** of the STATION NO. DIP switch

Station No. 2: Remote I/O station
(AJ65SBTCF1-32T, 32-point transistor output)

Turn on the pin **2** of the STATION NO. DIP switch

3.5 Specifications check

Check points (device compatibility)

Caution

For bit devices, 32 points are secured for one station. However, the station No. 1 does not use the area between X1010 and X101F, as this device is the remote input 16-point module.

Click the play button to start the animation.

CPU module	Master module	Remote I/O station (Station No.1) AJ65SBTB1-16D
X1000–X100F	Remote input (RX) storage area	
X1010–X101F	Station No. 1 { (Reserved)	RX00–RX0F
	Input refresh operation / Input signal transfer (link scan)	

Remote input (RX) storage area
- Station No. 1
- Station No. 2

Remote output (RY) storage area
- Station No. 1 { (Reserved) / (Reserved)
- Station No. 2

		Remote I/O station (Station No.2) AJ65SBTCF1-32T
Y1020–Y102F	Output refresh operation / Output signal transfer (link scan)	RY00–RY0F
Y1030–Y103F		RY10–RY1F

3.5 Specifications check

Check of the compatibility between devices

In the system example, the refresh device of the remote input starts from X1000, and the refresh device of the remote output starts from Y1000.

The compatibility between RX/RY of the remote I/O stations and the devices of the CPU module is as follows.

Assignment of remote input RX

Remote station			Master station	
			Master module	CPU module
Station No.	Module name	Remote input (RX)	Remote input (RX)	Device (X)
1	AJ65SBTB1-16D (16-point input)	RX00 to RX0F	RX00 to RX0F	X1000 to X100F
		Not used	Not used	X1010 to X101F

Assignment of remote output RY

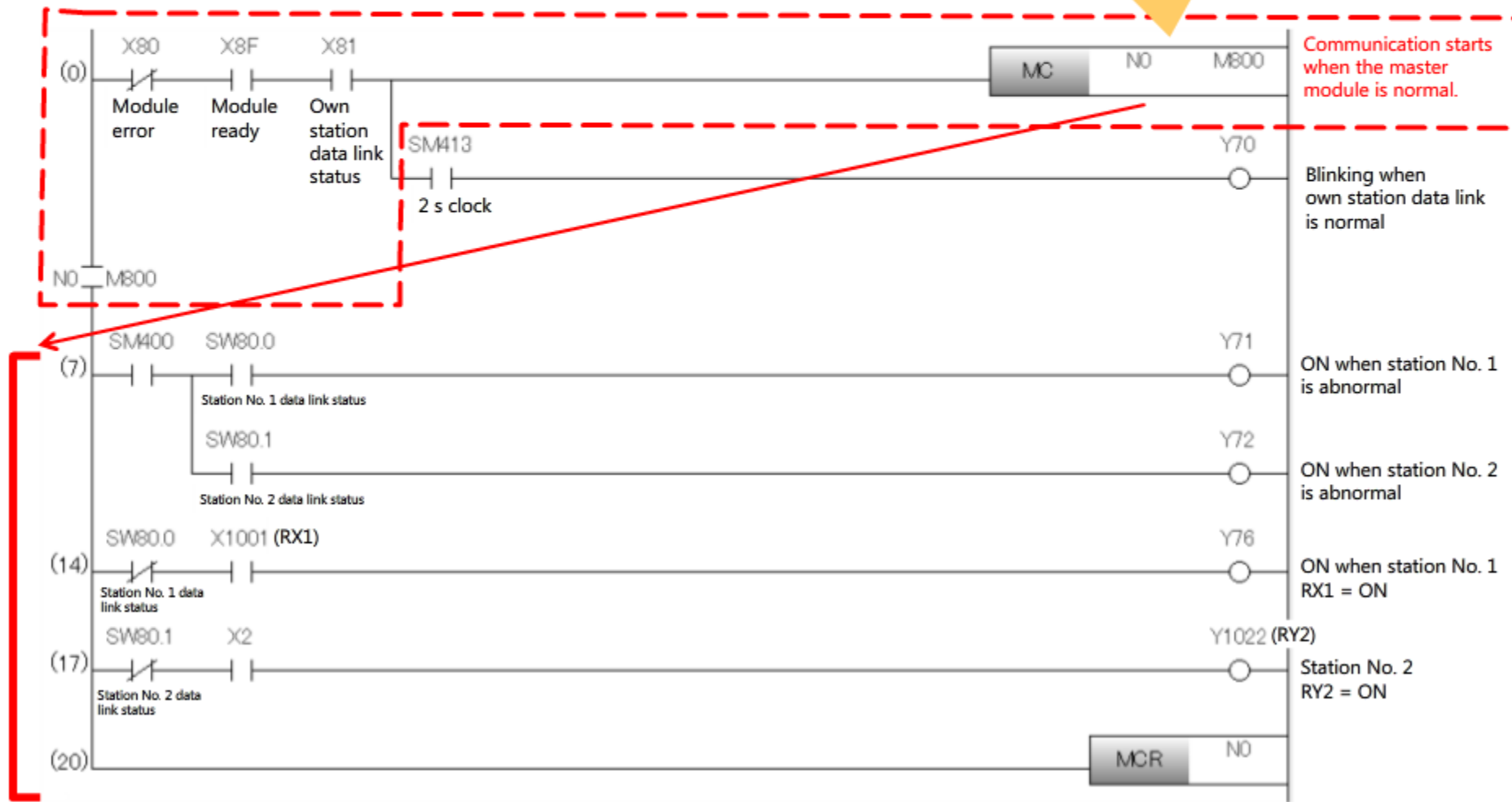| Remote station			Master station	
			Master module	CPU module
Station No.	Module name	Remote output (RY)	Remote output (RY)	Device (Y)
2	AJ65SBTCF1-32T (32-point output)	RY00 to RY1F	RY20 to RY3F	Y1020 to Y103F

3.6 Creating a control program

Control program example

A control program for the system example is shown below.

Steps 0 to 6:
The program has been created so that the subsequent processes take place when the status of the master module is read and the conditions for operating the master module are met.

[Master control]

When M800 becomes active, the range between N0 M800 and MCR N0 is activated.

Ladder diagram:

(0) X80 Module error | X8F Module ready | X81 Own station data link status — MC | N0 | M800
Communication starts when the master module is normal.

SM413 2 s clock — Y70
Blinking when own station data link is normal

N0 M800

(7) SM400 | SW80.0 Station No. 1 data link status — Y71
ON when station No. 1 is abnormal

SW80.1 Station No. 2 data link status — Y72
ON when station No. 2 is abnormal

(14) SW80.0 Station No. 1 data link status | X1001 (RX1) — Y76
ON when station No. 1 RX1 = ON

(17) SW80.1 Station No. 2 data link status | X2 — Y1022 (RY2)
Station No. 2 RY2 = ON

(20) MCR | N0

3.6 Creating a control program

Control program example (continued)

Steps 7 to 13:
The status of each station is read.
Either or both of the master module output devices (Y71, Y72) is/are output according to the failed station.
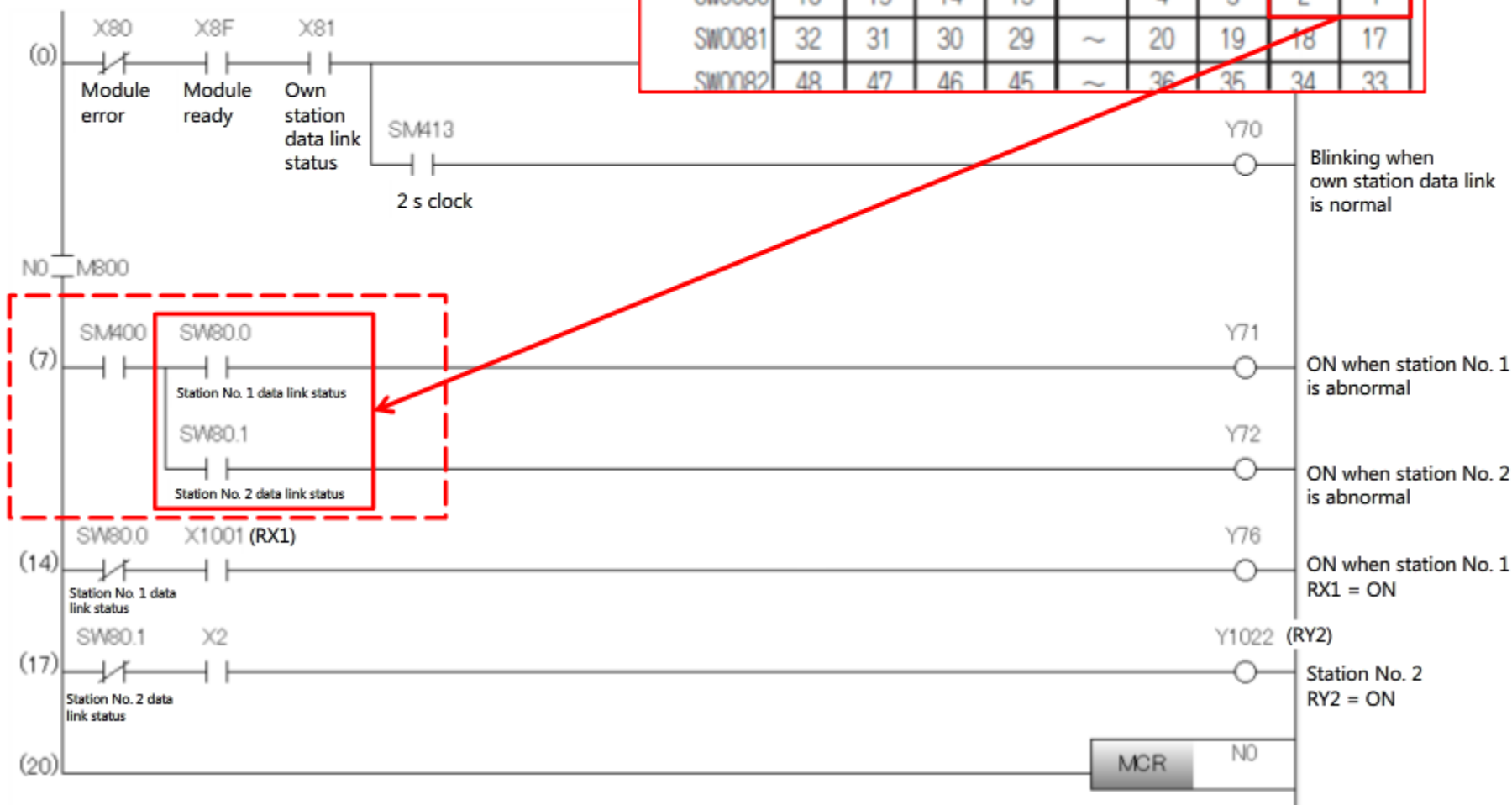
The data link status of each station is stored.
0: Normal
1: A data link error is issued.

The number in each grid shows the station number.

	b15	b14	b13	b12	~	b3	b2	b1	b0
SW0080	16	15	14	13	~	4	3	2	1
SW0081	32	31	30	29	~	20	19	18	17
SW0082	48	47	46	45	~	36	35	34	33

(0) X80 Module error — X8F Module ready — X81 Own station data link status

SM413 — 2 s clock

Y70 — Blinking when own station data link is normal

N0 — M800

(7) SM400 — SW80.0 Station No. 1 data link status — Y71 — ON when station No. 1 is abnormal

SW80.1 Station No. 2 data link status — Y72 — ON when station No. 2 is abnormal

(14) SW80.0 Station No. 1 data link status — X1001 (RX1) — Y76 — ON when station No. 1 RX1 = ON

(17) SW80.1 Station No. 2 data link status — X2 — Y1022 (RY2) — Station No. 2 RY2 = ON
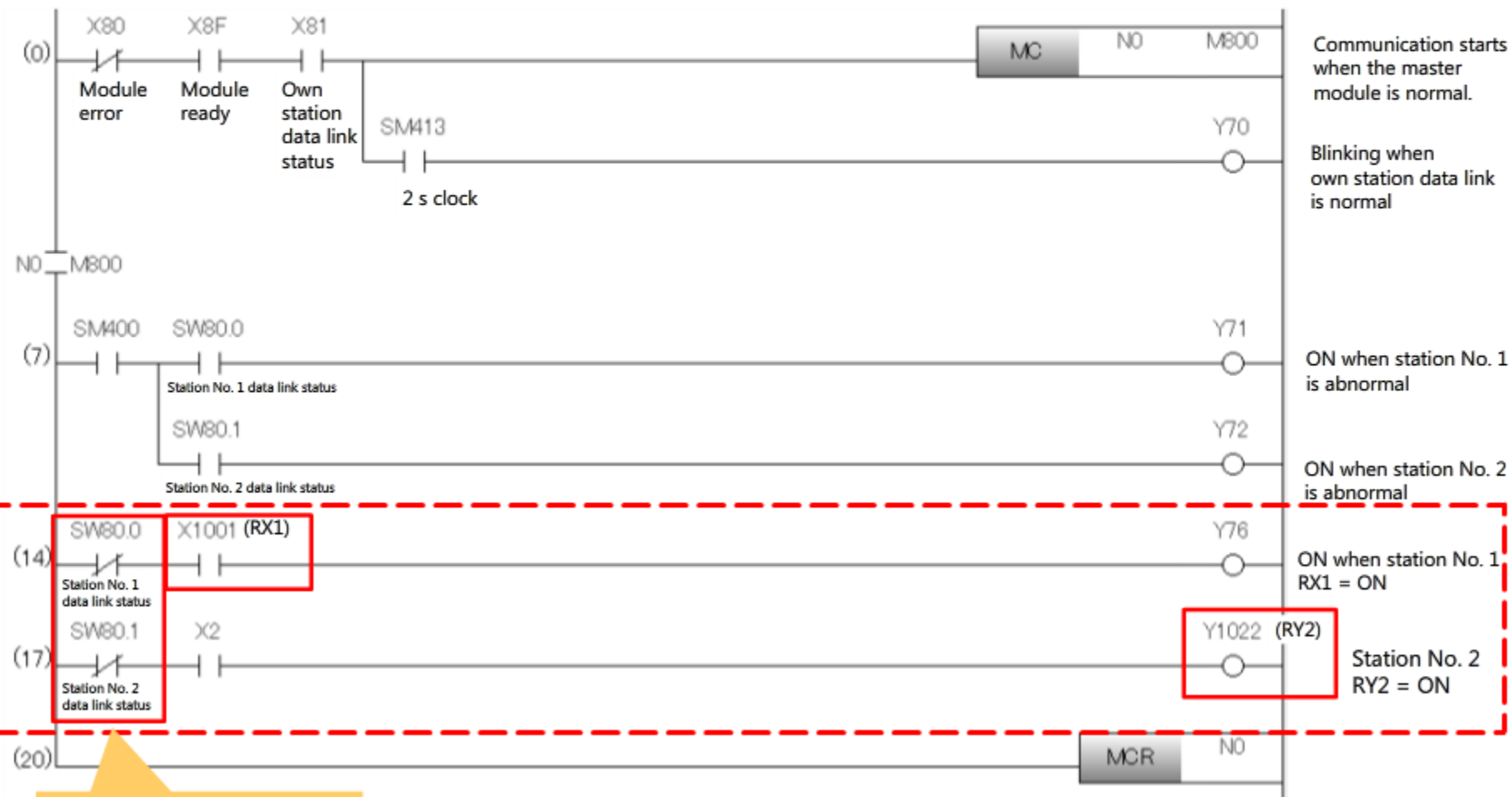
(20) — MCR N0

3.6   Creating a control program

Control program example (continued)

Steps 14 to 19: Signals are input/output to/from the slave stations of CC-Link.

X1001: Corresponds to the input module RX1 of the station No. 1.
Y1022: Corresponds to the output module RY2 of the station No. 2.

Communication starts when the master module is normal.

Blinking when own station data link is normal

ON when station No. 1 is abnormal

ON when station No. 2 is abnormal

ON when station No. 1 RX1 = ON

Station No. 2 RY2 = ON

Sends/receives signals when each slave station is normal.

3.7 Operation check

This section describes the operation check of the system.

Details of operation

1. When the data link status is normal, LED Y70 of the master station RY42NT2P flashes.

2. When the switch RX1 of AJ65SBTB1-16D is turned on, LED Y76 of the master station RY42NT2P turns on.

3. When X2 is forcibly turned on by changing the current value with GX Works3, LED Y2 of the station No. 2 AJ65SBTB1-32T turns on.

3.8 Primary diagnostics
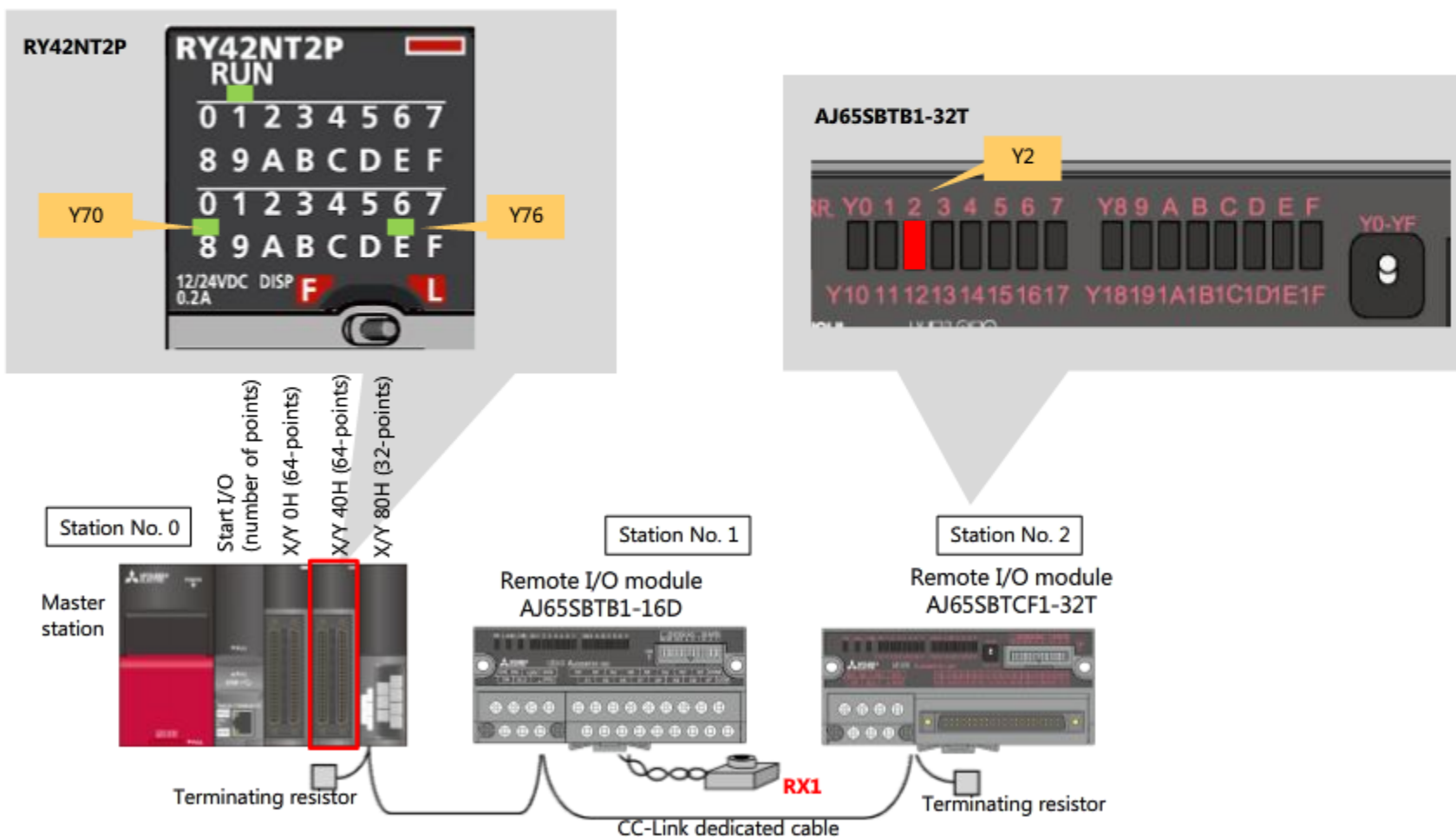
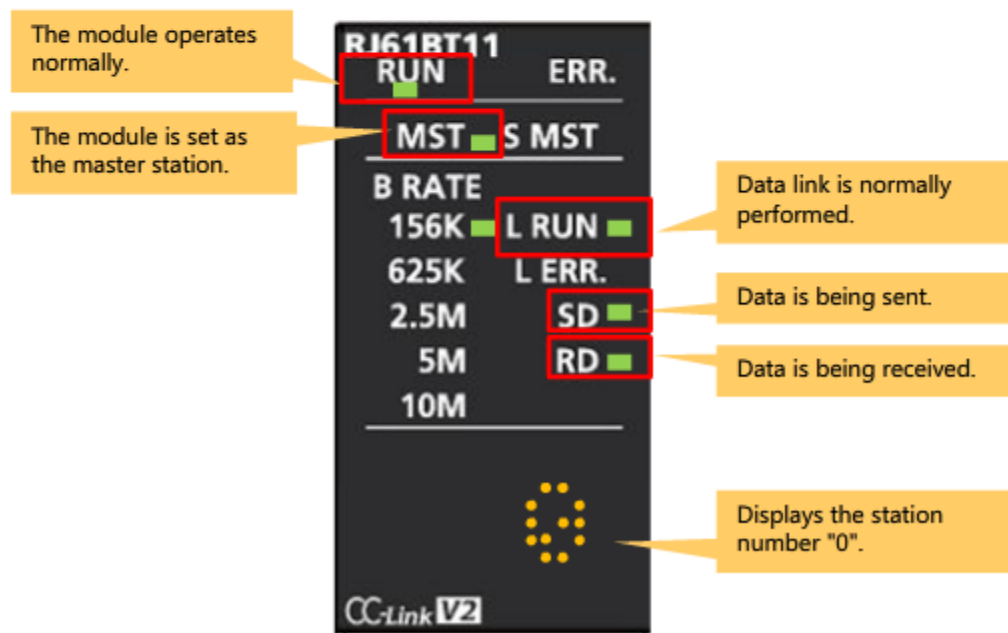## Primary diagnostics of operation through LED indications

If a device does not operate as intended, for example, no signal is output from the remote I/O station, the primary diagnostics can be performed through observing LED indications on the module.

Master station

The following figure shows the LED indication status on the master station when the data link is normally performed.

If the data link is not performed normally, check the following.

- If either or both of SD/RD do(es) not turn on, check the wiring of the CC-Link dedicated cables including that for terminating resistors.

- If L RUN does not turn on, there may be a problem in the setting.

- If MST does not turn on, check the module parameters, as the module may not be set as the master station.

- If RUN does not turn on, the module may not operate normally.

The module operates normally. → RUN

The module is set as the master station. → MST

Data link is normally performed. → L RUN

Data is being sent. → SD

Data is being received. → RD

Displays the station number "0".

RJ61BT11
RUN   ERR.
MST   S MST
B RATE
156K L RUN
625K L ERR.
2.5M SD
5M   RD
10M

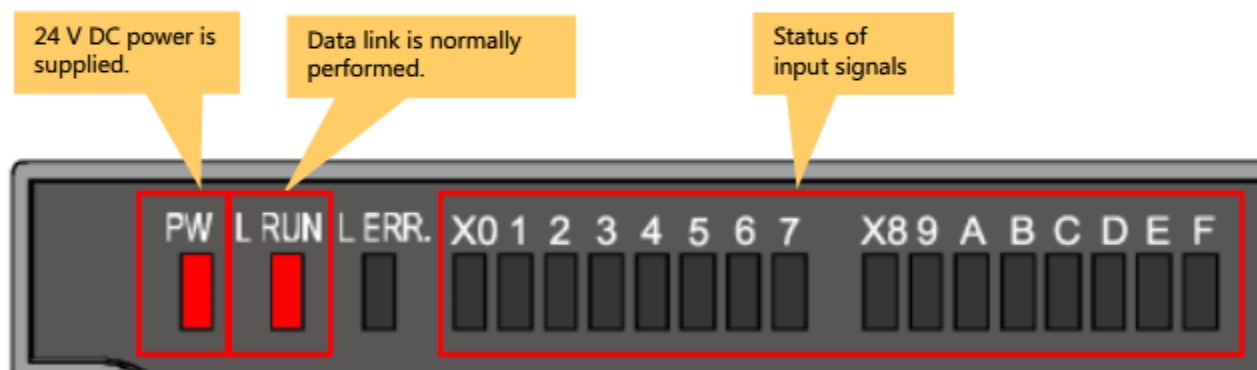CC-Link V2

3.8 Primary diagnostics

Primary diagnostics of operation through LED indications

Remote I/O station

The status of the remote I/O station is indicated with LEDs when the data link is performed normally.

If it is not performed normally, check that the LEDs are indicated as shown below.

- If L RUN does not turn on, there may be a problem in the setting.
- If PW does not turn on, power may not be supplied to the module.

24 V DC power is supplied.

Data link is normally performed.

Status of input signals

PW L RUN L ERR. X0 1 2 3 4 5 6 7 X8 9 A B C D E F

3.9 Detailed diagnostics

Diagnostics using an engineering software

If the problem persists even after the primary diagnostics using LEDs is conducted, conduct more detailed inspection using the diagnostic function of GX Works3 engineering software.

The following shows the CC-Link Diagnostics windows.

Normal

Error

Warning that appears when the station number or transmission speed switch is changed while the data link is established

CC-Link Diagnostics window

CC-Link Diagnostics window

3.10 Summary of this chapter

In this chapter, you have learned:

- Remote I/O module settings
- Wiring
- Module parameter settings
- Specifications check
- Programming

- Operation check
- Primary diagnostics

Important points

Transmission speed	Set the same setting (as that of the master station) to all the transmission speed settings in the system.
Station number	Assign a unique station number in numerical order from 1.
Connection of terminating resistors	Be sure to connect terminating resistors to both ends of the transmission line.

Chapter 4 Expandability and reliability of CC-Link

You have learned so far about the simple procedure from implementing a remote I/O device to diagnosing it.
In addition to the communication of bit data you have learned in this course, the following functions may be necessary for the manufacturing site.

- Communication of analog data
- Data communication between CPU modules
- Operation and status display on HMI
- Extending the distance

CC-Link also supports these functions.

In an actual system, the lines and systems should not be affected by CC-Link disconnection.
To maintain this requirement, CC-Link is equipped with the following functions which helps to enhance network reliability.

- Standby master station
- Slave station cut-off
- Automatic return

These functions are described in detail on the following pages.

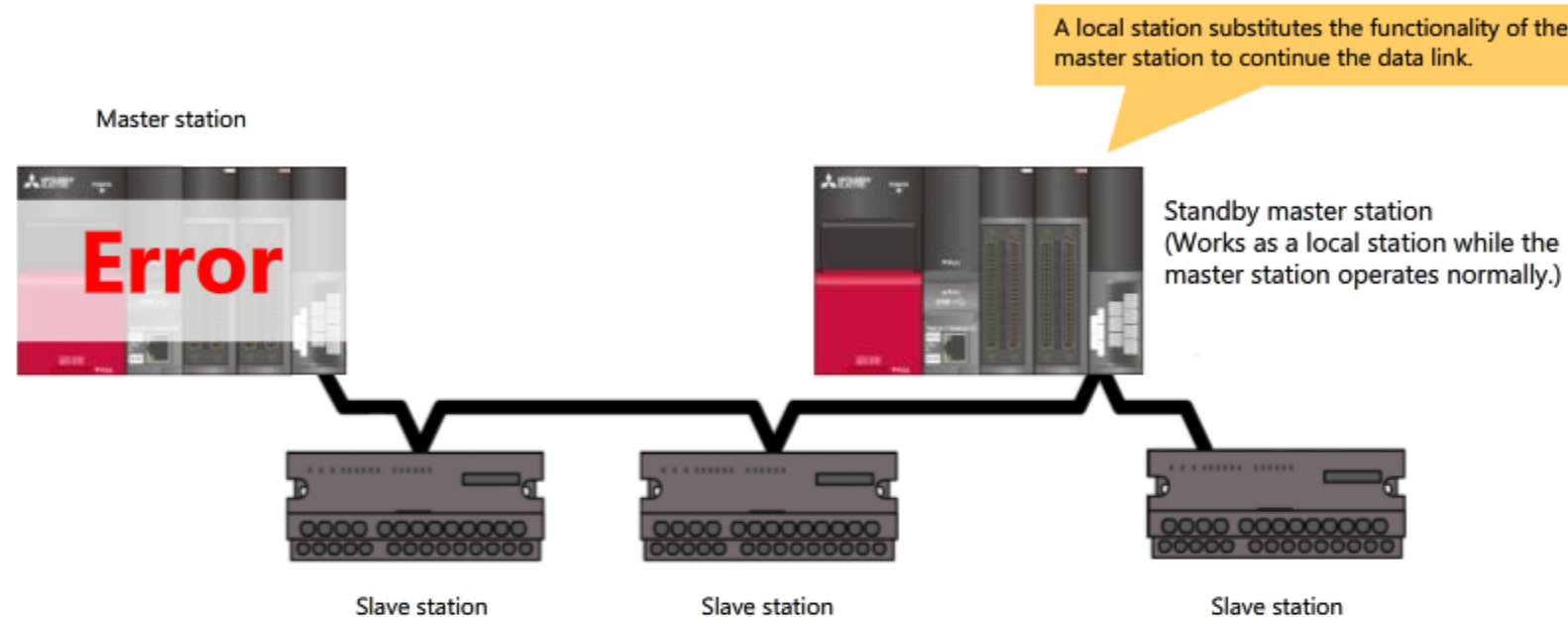4.1 Standby master station

4.2 Slave station cut-off

4.3 Automatic return

4.1 Standby master station

As the master station takes a crucial role in communications, the data link stops if the master station stops abnormally.

By setting a standby master station in advance, the data link can be used continuously in the event of an error occurring in the master station.

Master station

Error

A local station substitutes the functionality of the master station to continue the data link.

Standby master station
(Works as a local station while the master station operates normally.)

Slave station

Slave station

Slave station

4.2 Slave station cut-off

If an error has occurred in a slave station and the data link becomes deactivated during the data link, the faulty slave station is cut-off and the data link continues with the normal stations only.

The faulty station is separated and the data link continues with the normal stations only.

Master station

Error

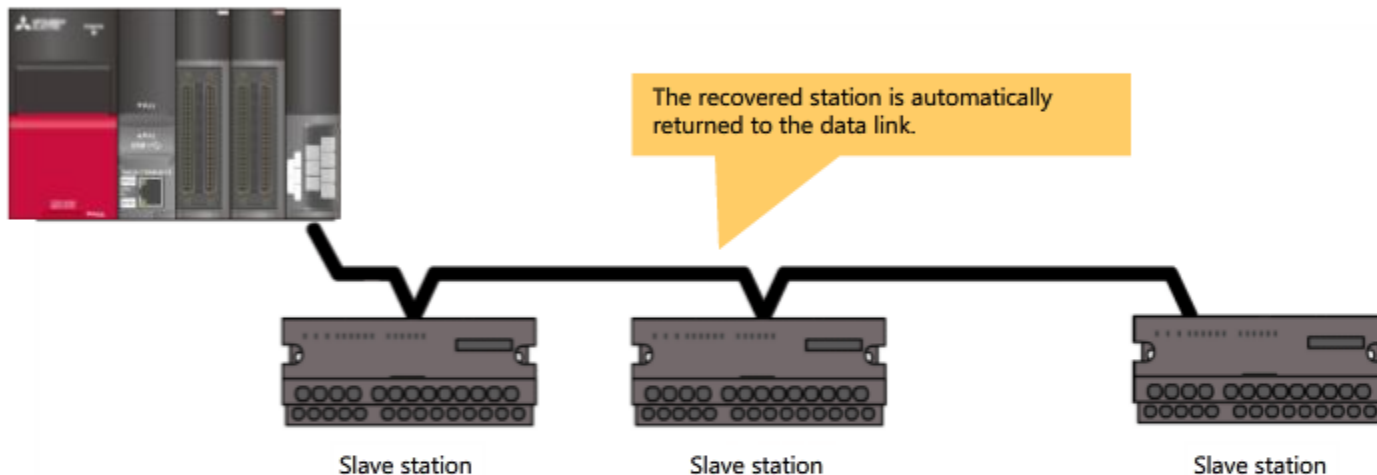Slave station   Slave station   Slave station
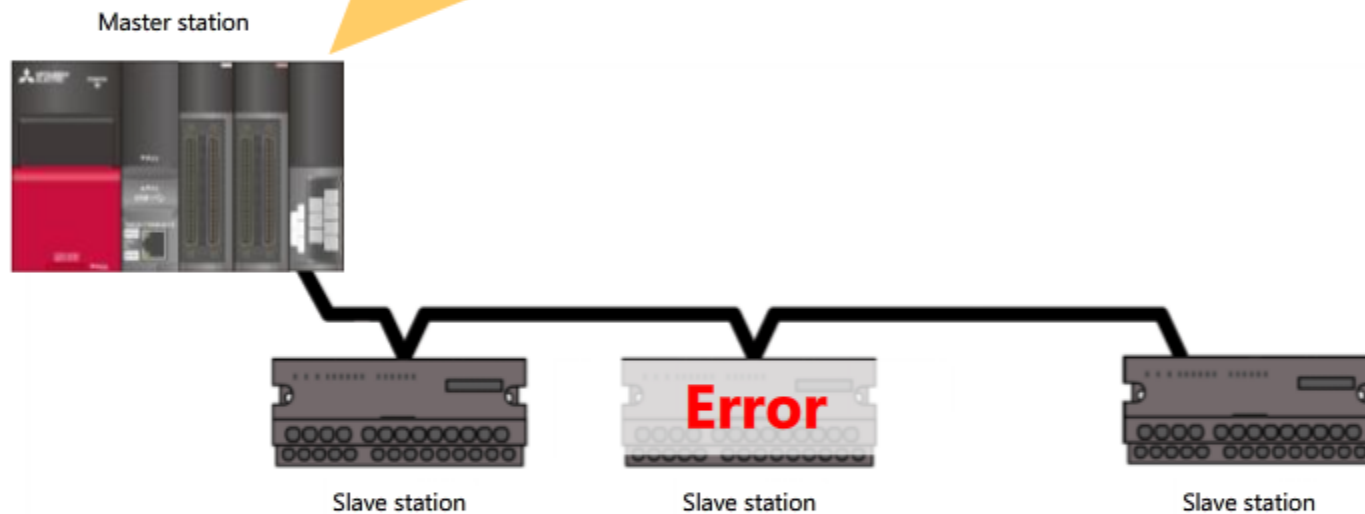
4.3 Automatic return

When the faulty station that was separated from the data link resumes normal operation, it is automatically returned to the data link.

This action is called "Automatic return". For recovery, restarting of the entire system is not required.

Master station

The recovered station is automatically returned to the data link.

Slave station   Slave station   Slave station

Error ➡ **Recovered**

4.4   Summary of this chapter

In this chapter, you have learned:

- Expandability of CC-Link
- Reliability of CC-Link

Important points

Expandability of CC-Link	• In addition to remote I/O devices described in this course, other equipment such as analog devices, high speed counters, positioning devices, and HMIs can be connected. Also, CC-Link is equipped with necessary functionality for FA networks, which allows various operations such as communication between programmable controllers. • The distance can be extended according to system requirements.
Standby master station	By specifying a local station as the standby master station, it substitutes the functionality of the master station if an error has occurred in the master station.
Slave station cut-off	Cuts-off the faulty slave station from the link.
Automatic return	Allows the faulty station to automatically return to the link when it recovers from an error.

Test   Final Test

Now that you have completed all of the lessons of the CC-Link (MELSEC iQ-R Series) course, you are ready to take the final test. If you are unclear on any of the topics covered, please take this opportunity to review those topics.
There are a total of 6 questions (6 items) in this Final Test.
You can take the final test as many times as you like.

How to score the test
After selecting the answer, make sure to click the **Answer** button. Your answer will be lost if you proceed without clicking the Answer button. (Regarded as unanswered question.)

Score results
The number of correct answers, the number of questions, the percentage of correct answers, and the pass/fail result will appear on the score page.

Correct answers :   **6**

Total questions :   **6**

To pass the test, you have to answer **60%** of the questions correct.

Percentage :   **100%**

[Proceed]   [Review]

- Click the **Proceed** button to exit the test.
- Click the **Review** button to review the test. (Correct answer check)
- Click the **Retry** button to retake the test again.

Test | Final Test 1

✅ Select the item that most appropriately represents the feature of CC-Link. (Select only one item.)

- ○ CC-Link only allows the connection of products manufactured by Mitsubishi.
- ○ The functionality available in CC-Link is limited to remote I/O.
- ✅ ● Specifications of CC-Link are open to the public and can be combined with various products to allow a wide range of desired systems.

<<   >>

Test | Final Test 2

✅ **Select the item that most appropriately represents the feature of CC-Link. (Select only one item.)**

- ○ X1010
- ☑ ● X1020
- ○ X1030
- ○ M1000

Remote station			CPU module
Station No.	Module model name	Remote input (RX)	Device
1	AJ65SBTB1-16D (16-point input)	RX00–RX0F	X1000–X100F
		(Reserved)	X1010–X101F
2	AJ65SBTB1-32D (32-point input)	RX00–RX0F	???
		RX10–RX1F	???

[<<] [>>]

☑ Select the item that most appropriately represents the feature of CC-Link. (Select only one item.)

○ Cyclic transmission only

○ Transient transmission only

☑ ● Cyclic transmission and transient transmission

<<   >>

Test — Final Test 4

Select the stations that require the connection of terminating resistors. (Select two items.)

- ☐ Station No. 0
- ☑ Station No. 1
- ☐ Station No. 2
- ☐ Station No. 3
- ☑ Station No. 4

Station No. 1   Station No. 0   Station No. 2   Station No. 3   Station No. 4

<<　　>>

☑ Select a correct method to assign station numbers. (Select only one item.)

○ The station number for the master station can be set freely.

☑ ◉ The station number for the remote I/O module is set with the station number setting switch.

○ Modules have to be wired in the order of the station number.

○ The initial station number of slave stations can be set with module parameters.

<<   >>

✅ Select an item that is not included in the module parameters for CC-Link. (Select only one item.)

- ⭘ Network configuration
- ⭘ Transmission speed
- ⭘ Number of connected modules
- ✅ ⦿ Connecting position of terminating resistors
- ⭘ Number of retries

<<   >>

Test

Test Score

You have completed the Final Test. You results area as follows.
To end the Final Test, proceed to the next page.

Correct answers: **6**

Total questions: **6**

Percentage: **100%**

Proceed	Review

Congratulations. You passed the test.

You have completed the CC-Link (MELSEC iQ-R Series) course.

Thank you for taking this course.

We hope you enjoyed the lessons and the information you acquired in this course will be useful in the future.

You can review the course as many times as you want.

Review   Close