User's Manual

ASSP

R-IN32M3 Series

User's Manual (CC-Link Remote device station)

- R-IN32M3-EC
- R-IN32M3-CL

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Instructions for the use of product

In this section, the precautions are described for over whole of CMOS device.
Please refer to this manual about individual precaution.

When there is a mention unlike the text of this manual, a mention of the text takes first priority

1.1 Handling of Unused Pins

Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

-The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2.Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

-The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3.Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

-The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4.Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

-When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

How to use this manual

This manual is intended for users who wish to understand the functions of Industrial Ethernet network LSI "R-IN32M3-EC" (MC-10287F1-HN4-A) for designing application of it.

It is assumed that the reader of this manual has general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

Related Documents

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such. Please be understanding of this beforehand. In addition, because we make document at development, planning of each core, the related document may be the document for individual customers.

R-IN32M3に関する資料

資料名	資料番号
R-IN32M3 series Datasheet	R18DS0008EJ0100
R-IN32M3-EC User's Manual	R18UZ0002JJ0100
R-IN32M3-CL User's Manual	R18UZ0004JJ0100
R-IN32M3 series User's Manual Peripheral function	R18UZ0007EJ0300
R-IN32M3 Series Proguraming Manual (OS edition)	R18UZ0011EJ0200
R-IN32M3 Series Proguraming Manual (Driver edition)	R18UZ0009EJ0200
R-IN32M3 Series CC-Link device station	This manual

2. Notation of Numbers and Symbols

Weight in data notation: Left is high-order column, right is low-order column

Active low notation:

xxxZ (capital letter Z after pin name or signal name)

or xxx_N (capital letter _N after pin name or signal name)

or xxnx (pin name or signal name contains small letter n)

Note:

explanation of (Note) in the text

Caution:

Item deserving extra attention

Remark:

Supplementary explanation to the text

Numeric notation:

Binary ⋯ xxxx , xxxxB or n'bxxxx (n bits)

Decimal ⋯ xxxx

Hexadecimal ⋯ xxxxH or n'hxxxx (n bits)

Prefixes representing powers of 2 (address space, memory capacity):

K (kilo)⋯ $2^{10} = 1024$

M (mega)⋯ $2^{20} = 1024^2$

G (giga)⋯ $2^{30} = 1024^3$

Data Type:

Double word ⋯ 32 bits

Word ⋯ 16 bits

Byte ⋯ 8 bits

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1. Introduction

This document is the specification for developing CC-Link remote device stations using the R-IN32M3.
The function of CC-Link remote device stations is repsented as “CCS” in this document.

1.1 Related materials

The materials related to this product are indicated below. Refer to this table, and request any materials by contacting the CC-Link Partner Association as necessary. Please see the "CC-Link Specification" published by the CC-LinkPartner Association for a detailed description of CC-Link.

Reference materials

Reference Name	Reference Number
"CC-Link Specification (Overview, Protocol)"	Reference code: BAP-05026
"CC-Link Specification (Installation Specification)"	Reference code: BAP-05027
"CC-Link Specification (Profile)"	Reference code: BAP-05028

For document requests, contact:
CC-Link Partner Association (CLPA)
TEL: 052-919-1588
FAX: 052-916-8655
Email: info@cc-link.org

1.2 Generic Terms and Abbreviations

Unless otherwise stated, this manual uses the terms and abbreviations below to describe the CC-Link remote device station functions CCS.

Generic Terms and Abbreviations	Description
Ver.1	CC-Link Version 1, including CC-Link Version 1.00 and CC-Link Version 1.10, may be stated simply “Version 1.”
Ver.2	CC-Link Version 2 may be stated simply “Version 2.”

1.3 CC-Link Parter Association

The product developed based on this manual must pass a conformance test conducted by the CCLink Partner Association. For details of the conformance test, contact the CC-Link Partner Association. Home page address: http://www.cc-link.org/

1.4 Cyclic Data Capacity

The data amount of up to 128 bits for RX/RY and 16 words for RWr/RWw can be handled using Version 1 cyclic by selecting the number of occupied stations (between one and four). In addition, the data amount of up to 896 bits for RX/RY and 128 words for RWr/RWw can be handled by specifying the extended cyclic transmission setting in Version 2.

(1) Version 1 Cyclic Data Capacity

Table 1.1 Version 1 Cyclic Data Capacity

Type	No. of Occupied Stations			
	1 Occupied Station	2 Occupied Stations	3 Occupied Stations	4 Occupied Stations
RX/RY RWr/RWw	32 bits each 4 words each	64 bits each 8 words each	96 bits each 12 words each	128 bits each 16 words each

(2) Version 2 Cyclic Data Capacity

Table 1.2 Version 2 Cyclic Data Capacity

Extended Cyclic Setting	Type	No. of Occupied Stations			
		1 Occupied Station	2 Occupied Stations	3 Occupied Stations	4 Occupied Stations
Single	RX/RY RWr/RWw	32 bits each 4 words each	64 bits each 8 words each	96 bits each 12 words each	128 bits each 16 words each
Double	RX/RY RWr/RWw	32 bits each 8 words each	96 bits each 16 words each	160 bits each 24 words each	224 bits each 32 words each
Quadruple	RX/RY RWr/RWw	64 bits each 16 words each	192 bits each 32 words each	320 bits each 48 words each	448 bits each 64 words each
Octuple	RX/RY RWr/RWw	128 bits each 32 words each	384 bits each 64 words each	640 bits each 96 words each	896 bits each 128 words each

Remark1. The latter 16 bits of remote I/O (RX/RY) are reserved by the system.

2. The cyclic data capacity with an extended cyclic setting of “single” is the same as the cyclic data capacity of Version 1.

2. Function List

Table 2.1 Function list

Name	Description
Setting the number of occupied stations	Based on the terminal setting. For Version 1:No. of I/O points:32 to 128 bits Amount of data:4 to 16 words, setting possible For Version 2:No. of I/O points:32 to 896 bits Amount of data:4 to 128 words, setting possible
Setting timeout (transmission path switching) time	The timeout time is determined by the communication baud rate. Taking into consideration transmission inconsistencies at the time of network startup, two types of time settings are available: at software startup (initial setting time) and after startup (normal setting time).
Fuse blown detection function	When a device is equipped with a fuse, send the status of the fuse to the master station.
Send data separation prevention function	The data to be sent is written to the RX and RWr areas and then transferred all at once to the transmission buffer, thereby preventing send data separation.
Receive data separation prevention function	The received data are stored in the reception buffer and then transferred all at once to the RY and RWw areas, thereby preventing receive data separation.
Programmable controller CPU status monitoring function	Run/stop and normal/abnormal statuses of the programmable controller CPU can be monitored.
Network return function	This function automatically connects to the data link a module that has been disconnected from the data link due to an event such as power OFF after the module status has returned to normal.
Transmission status display function	The monitor terminal enables the LED display. Because an SDLED has a short lighting duration, adjustments can be made by software setting. (Refer to Chapter 8 for details.)
Baud rate setting function	10M / 5M / 2.5M / 625k / 156kbps settings available
Baud rate/station number setting error detection function	By referencing error flags, abnormal settings for baud rate and station number can be detected.
Baud rate/station number change detection function	If the communication baud rate or the station number setting value is changed to a value that is different from the value at startup, it can be detected by referencing the error flag.

3. Specified Parts and Recommended Parts

3.1 Recommended Parts

The following lists the parts recommended by the CC-Link Partner Association for use in the design of CC-Link interface circuits.

For detailed part specifications, direct your inquiries to the corresponding manufacturer.

Table 3.1 Recommended parts

Product name	Model name[note1]	Manufacturer
Filter	MCT7050-A401	Sinka Japan Co.,ltd.
RS485 transceiver	SN75ALS181NS	Texas Instruments Japan, Inc.
Zener diode	RD6.2Z	Renesas Electronics .

When the communication system is isolated

Product name	Model name[note1]	Manufacturer
Photocoupler A	HCPL-7720-500E[note2]	Avago Technologies, Inc.
	HCPL-0720-500E[note3]	
Photocoupler B	HCPL-2611-500E[note2]	Avago Technologies, Inc.
	HCPL-M611-500E[note3]	
	PS9117A	Renesas Electronics.

note1. For CC-Link interface circuit recommended parts and model names, direct your inquiries to the CC-Link Partner Association.

2. Specify option 060 when the insulation characteristics of V_{IORM} = 630V_{PEAK} are required.

3. Specify option 060 when the insulation characteristics of V_{IORM} = 560V_{PEAK} are required.

4. Setting Details

4.1 Setting the Number of Occupied Stations

Based on the combination listed below, the number of occupied stations can be set from 1 to 4.With one communication, 32 I/O bits and 4 words of data can be used per station.

Table 4.1 Occupied stations setting

Terminal \ Number of occupied stations	1	2	3	4
SENYU0	L	H	L	H
SENYU1	L	L	H	H

When the number of occupied stations is set to "2":
With one communication, 64 I/O bits and 8 words of data can be used.

Caution When the IOTENSU terminal is set to "H," the number of I/O points is fixed at 32, regardless of the Number of Occupied Stations setting.

4.2 Setting the Station Number and Baud Rate

Table 4.2 Setting the station number and baud rate

Station No. (Tens Place) / Terminal	00	10	20	30	40	50	60	70 (note1)	80 (note1)	90 (note1)
SW80	H	H	H	H	H	H	H	H	L	L
SW40	H	H	H	H	L	L	L	L	H	H
SW20	H	H	L	L	H	H	L	L	H	H
SW10	H	L	H	L	H	L	H	L	H	L

Station No. (Ones Place) / Terminal	0	1	2	3	4	5	6	7	8	9
SW8	H	H	H	H	H	H	H	H	L	L
SW4	H	H	H	H	L	L	L	L	H	H
SW2	H	H	L	L	H	H	L	L	H	H
SW1	H	L	H	L	H	L	H	L	H	L

Baud Rate / Terminal	0	1	2	3	4	5 (note2)	6 (note2)	7 (note2)	8 (note2)	9 (note2)
BS8	H	H	H	H	H	H	H	H	L	L
BS4	H	H	H	H	L	L	L	L	H	H
BS2	H	H	L	L	H	H	L	L	H	H
BS1	H	L	H	L	H	L	H	L	H	L

note1. The settings result in error.
Station number setting value 1 to 64: Station number (normal)
0 or 65 and over: Results in a station number switch setting error.
The L ERR. LED turns on.

2. Baud rate setting value: 0: 156kbps
1: 625kbps
2: 2.5Mbps
3: 5Mbps
4: 10Mbps
5 to 9: Results in a baud rate switch setting error. The L ERR. LED t urns on.

4.3 Transmission Monitor Section Terminals (for LED)

(1) Light ON/OFF/BLINK conditions

Table 4.2 Light ON/OFF/BLINK conditions

LED name	Status	Condition
L RUN （ON：「H」output）	ON	When the refresh signal or the refresh signal and polling signal are normally received after network entry. (*1: Refer to the figure below.)
	OFF	1. Before network entry (*1: Refer to the figure below.) 2. Channel carrier detection failed 3. Timeout 4. During hardware reset
	Blinking	—
L ERR. （ON：「L」output）	ON	1. CRC error 2. Station number switch setting error at reset release (0 or 65 stations or more including the number of occupied stations) 3. Baud rate switch setting error at reset release (a setting of 5 or higher)
	OFF	1. Normal communication 2. During hardware reset
	Blinking	The switch setting changed from the setting at reset release. (0.4s blinking)
SD （ON:「L」output）	ON	During transmission or +0.41ms × $2^{(n-1)}$ after transmission (n = 1 to 8)
	OFF	1. Other than the above 2. During hardware reset
	Blinking	—
RD （ON：「L」output）	ON	During channel carrier detection
	OFF	1. Channel carrier detection failed 2. During hardware reset
	Blinking	—

(2) Details of RUN light on

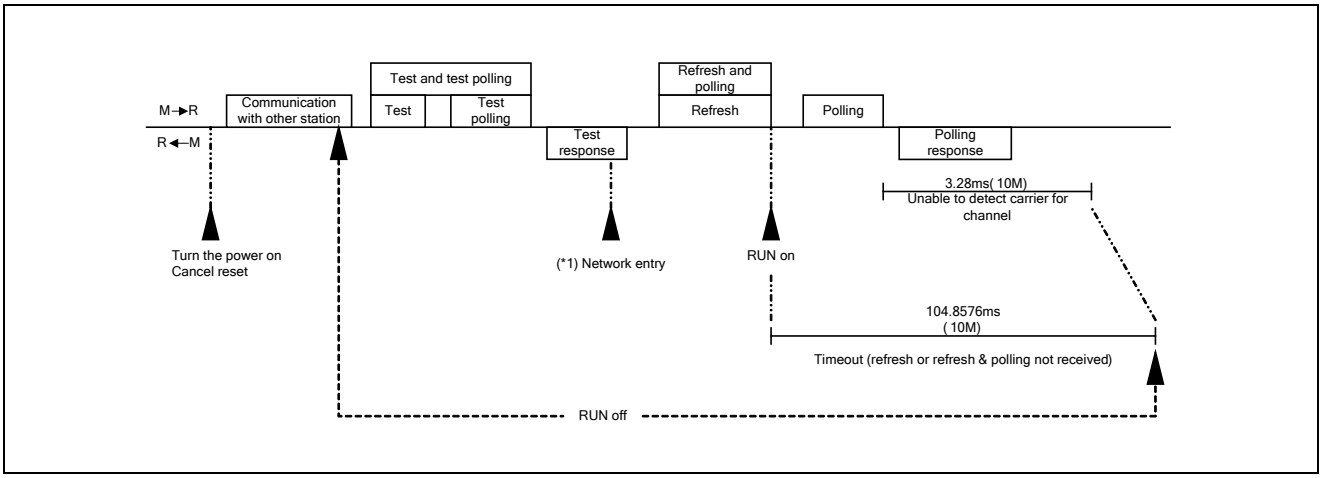


Figure 4.1 Condition of RUN light on

(3) Light ON/OFF/BLINK conditions

Table 4.3 Light ON/OFF/BLINK conditions

L RUN	L ERR.	SD	RD	Operation
○	☼	☼	○	Communicating normally, but CRC errors have often been detected due to noise.
○	☼	☼	○	The communication baud rate or the station number setting value has changed and is different from the value at startup L ERR. is lit at intervals of 0.4 s[*1].
○	☼	☼	●	- (Impossible operation status)
○	☼	●	○	Unable to respond because the received data caused a CRC error.
○	☼	●	●	- (Impossible operation status)
○	●	☼	○	Normal communication
○	●	☼	●	- (Impossible operation status)
○	●	●	○	No data for the own station
○	●	●	●	- (Impossible operation status)
●	☼	☼	○	Responds to polling signal, but the refresh reception caused a CRC error.
●	☼	☼	●	- (Impossible operation status)
●	☼	●	○	Data for the own station caused a CRC error.
●	☼	●	●	- (Impossible operation status)
●	●	☼	○	Link startup has not been conducted.
●	●	☼	●	- (Impossible operation status)
●	●	●	○	Either no data for the own station or unable to receive the data for own station due to noise.
●	●	●	●	Unable to receive data due to wire breakage, etc. Power off or hardware being set.
●	○	●	○	Baud rate and/or station number setting error

○ : ON ● : OFF ☼ : BLINK

Caution A blinking L ERR. light warns the operator that there has been a change in the baud rate or station number setting. The setting will be established at the next reset.

5. Monitor Outout of Reception Frame Information

MON7, 6 : Monitor terminals for internal signals. The signals to be monitored are not specified.
MON5 : Set to high when RWw information (bit data) of the own station is being received.
MON4 : Set to high when RY information (bit data) of the own station is being received.
MON3 : Set to high when a communication frame (bit data) other than a flag pattern is being received.
MON2 to 0 : Display the type of frame being received according to the table below.

Table 5.1 Monitor outout of reception frame information

MON2	MON1	MON0	Frame type
H	H	L	Receiving polling and refresh data
H	L	H	Receiving polling data
H	L	L	Receiving test polling and test data
L	H	H	Receiving test polling
L	H	L	Receiving refresh cycle complete
L	L	L	Initial state

6. Memory Map

Memory must be written in word unit in R-IN32M3.

6.1 Memory Map List

Table 6.1 When the number of occupied stations is set to 1

Address (hexadecimal) Data width 16		8		Description	Read	Write
00	(Lower)	00		Send data write enable information	Allowed	Not allowed
	(Upper)	01		Receive data update information	Allowed	Not allowed
02	(Lower)	02		Station number switch information	Allowed	Not allowed
	(Upper)	03		Baud rate switch/number of occupied stations information	Allowed	Not allowed
04	(Lower)	04		Error information 1	Allowed	Not allowed
	(Upper)	05		Error information 2	Allowed	Not allowed
06	(Lower)	06		(Not used)	Not allowed	Not allowed
	(Upper)	07		(Not used)	Not allowed	Not allowed
08	(Lower)	08	Reception buffer	M→R ST1	Allowed	Not allowed
	(Upper)	09		M→R ST2	Allowed	Not allowed
0A	(Lower)	0A		M→R RY00-07	Allowed	Not allowed
	(Upper)	0B		M→R RY08-0F	Allowed	Not allowed
0C	(Lower)	0C		M→R RY10-17	Allowed	Not allowed
	(Upper)	0D		M→R RY18-1F	Allowed	Not allowed
0E	(Lower)	0E		(Not used)	Not allowed	Not allowed
	(Upper)	0F		(Not used)	Not allowed	Not allowed
10	(Lower)	10		(Not used)	Not allowed	Not allowed
	(Upper)	11		(Not used)	Not allowed	Not allowed
12	(Lower)	12		(Not used)	Not allowed	Not allowed
	(Upper)	13		(Not used)	Not allowed	Not allowed
14	(Lower)	14		(Not used)	Not allowed	Not allowed
	(Upper)	15		(Not used)	Not allowed	Not allowed
16	(Lower)	16		(Not used)	Not allowed	Not allowed
	(Upper)	17		(Not used)	Not allowed	Not allowed
18	(Lower)	18		(Not used)	Not allowed	Not allowed
	(Upper)	19		(Not used)	Not allowed	Not allowed
1A	(Lower)	1A		M→R RWw0(L)	Allowed	Not allowed
	(Upper)	1B		M→R RWw0(H)	Allowed	Not allowed
1C	(Lower)	1C		M→R RWw1(L)	Allowed	Not allowed
	(Upper)	1D		M→R RWw1(H)	Allowed	Not allowed
1E	(Lower)	1E		M→R RWw2(L)	Allowed	Not allowed
	(Upper)	1F		M→R RWw2(H)	Allowed	Not allowed
20	(Lower)	20		M→R RWw3(L)	Allowed	Not allowed
	(Upper)	21		M→R RWw3(H)	Allowed	Not allowed
22	(Lower)	22		(Not used)	Not allowed	Not allowed
	(Upper)	23		(Not used)	Not allowed	Not allowed
				(Not used)	Not allowed	Not allowed
36	(Lower)	36		(Not used)	Not allowed	Not allowed
	(Upper)	37		(Not used)	Not allowed	Not allowed
38	(Lower)	38		(Not used)	Not allowed	Not allowed
	(Upper)	39		(Not used)	Not allowed	Not allowed
3A		3A		(Not used)	Not allowed	Not allowed
3E		3F				

Address (hexadecimal) Data width 16		8		Description	Read	Write
80	(Lower)	80		Send data write completed	Allowed	Allowed
	(Upper)	81		Receive data read request	Allowed	Allowed
82	(Lower)	82		Vendor code (Lower)	Allowed	Allowed
	(Upper)	83		Vendor code (Upper)	Allowed	Allowed
84	(Lower)	84		Model code	Allowed	Allowed
	(Upper)	85		Version	Allowed	Allowed
86	(Lower)	86		SDLED illumination time setting	Allowed	Allowed
	(Upper)	87		Timeout time setting	Allowed	Allowed
88	(Lower)	88	Update buffer	R→M ST1	Allowed	Allowed
	(Upper)	89		R→M ST2	Allowed	Allowed
8A	(Lower)	8A		R→M RX00-07	Allowed	Allowed
	(Upper)	8B		R→M RX08-0F	Allowed	Allowed
8C	(Lower)	8C		R→M RX10-17	Allowed	Allowed
	(Upper)	8D		R→M RX18-1F	Allowed	Allowed
8E	(Lower)	8E		(Not used)	Not allowed	Not allowed
	(Upper)	8F		(Not used)	Not allowed	Not allowed
90	(Lower)	90		(Not used)	Not allowed	Not allowed
	(Upper)	91		(Not used)	Not allowed	Not allowed
92	(Lower)	92		(Not used)	Not allowed	Not allowed
	(Upper)	93		(Not used)	Not allowed	Not allowed
94	(Lower)	94		(Not used)	Not allowed	Not allowed
	(Upper)	95		(Not used)	Not allowed	Not allowed
96	(Lower)	96		(Not used)	Not allowed	Not allowed
	(Upper)	97		(Not used)	Not allowed	Not allowed
98	(Lower)	98		(Not used)	Not allowed	Not allowed
	(Upper)	99		(Not used)	Not allowed	Not allowed
9A	(Lower)	9A		R→M RWr0(L)	Allowed	Allowed
	(Upper)	9B		R→M RWr0(H)	Allowed	Allowed
9C	(Lower)	9C		R→M RWr1(L)	Allowed	Allowed
	(Upper)	9D		R→M RWr1(H)	Allowed	Allowed
9E	(Lower)	9E		R→M RWr2(L)	Allowed	Allowed
	(Upper)	9F		R→M RWr2(H)	Allowed	Allowed
A0	(Lower)	A0		R→M RWr3(L)	Allowed	Allowed
	(Upper)	A1		R→M RWr3(H)	Allowed	Allowed
A2	(Lower)	A2		(Not used)	Not allowed	Not allowed
	(Upper)	A3		(Not used)	Not allowed	Not allowed
				(Not used)	Not allowed	Not allowed
B6	(Lower)	B6		(Not used)	Not allowed	Not allowed
	(Upper)	B7		(Not used)	Not allowed	Not allowed
B8	(Lower)	B8		(Not used)	Not allowed	Not allowed
	(Upper)	B9		(Not used)	Not allowed	Not allowed
BA	(Lower)	BA		Setting HOLD/CLR information	Allowed	Allowed
	(Upper)	BB		(Not used)	Not allowed	Not allowed
BC BE		BC BF		(Not used)	Not allowed	Not allowed

Table 6.2 When the number of occupied stations is set to 2

Address (hexadecimal) Data width 16		8		Description	Read	Write
00	(Lower)	00		Send data write enable information	Allowed	Not allowed
	(Upper)	01		Receive data update information	Allowed	Not allowed
02	(Lower)	02		Station number switch information	Allowed	Not allowed
	(Upper)	03		Baud rate switch/number of occupied stations information	Allowed	Not allowed
04	(Lower)	04		Error information 1	Allowed	Not allowed
	(Upper)	05		Error information 2	Allowed	Not allowed
06	(Lower)	06		(Not used)	Not allowed	Not allowed
	(Upper)	07		(Not used)	Not allowed	Not allowed
08	(Lower)	08	Reception buffer	M→R ST1	Allowed	Not allowed
	(Upper)	09		M→R ST2	Allowed	Not allowed
0A	(Lower)	0A		M→R RY00-07	Allowed	Not allowed
	(Upper)	0B		M→R RY08-0F	Allowed	Not allowed
0C	(Lower)	0C		M→R RY10-17	Allowed	Not allowed
	(Upper)	0D		M→R RY18-1F	Allowed	Not allowed
0E	(Lower)	0E		M→R RY20-27	Allowed	Not allowed
	(Upper)	0F		M→R RY28-2F	Allowed	Not allowed
10	(Lower)	10		M→R RY30-37	Allowed	Not allowed
	(Upper)	11		M→R RY38-3F	Allowed	Not allowed
12	(Lower)	12		(Not used)	Not allowed	Not allowed
	(Upper)	13		(Not used)	Not allowed	Not allowed
14	(Lower)	14		(Not used)	Not allowed	Not allowed
	(Upper)	15		(Not used)	Not allowed	Not allowed
16	(Lower)	16		(Not used)	Not allowed	Not allowed
	(Upper)	17		(Not used)	Not allowed	Not allowed
18	(Lower)	18		(Not used)	Not allowed	Not allowed
	(Upper)	19		(Not used)	Not allowed	Not allowed
1A	(Lower)	1A		M→R RWw0(L)	Allowed	Not allowed
	(Upper)	1B		M→R RWw0(H)	Allowed	Not allowed
1C	(Lower)	1C		M→R RWw1(L)	Allowed	Not allowed
	(Upper)	1D		M→R RWw1(H)	Allowed	Not allowed
1E	(Lower)	1E		M→R RWw2(L)	Allowed	Not allowed
	(Upper)	1F		M→R RWw2(H)	Allowed	Not allowed
20	(Lower)	20		M→R RWw3(L)	Allowed	Not allowed
	(Upper)	21		M→R RWw3(H)	Allowed	Not allowed
22	(Lower)	22		M→R RWw4(L)	Allowed	Not allowed
	(Upper)	23		M→R RWw4(H)	Allowed	Not allowed
24	(Lower)	24		M→R RWw5(L)	Allowed	Not allowed
	(Upper)	25		M→R RWw5(H)	Allowed	Not allowed
26	(Lower)	26		M→R RWw6(L)	Allowed	Not allowed
	(Upper)	27		M→R RWw6(H)	Allowed	Not allowed
28	(Lower)	28		M→R RWw7(L)	Allowed	Not allowed
	(Upper)	29		M→R RWw7(H)	Allowed	Not allowed
2A	(Lower)	2A		(Not used)	Not allowed	Not allowed
	(Upper)	2B		(Not used)	Not allowed	Not allowed
2C	(Lower)	2C		(Not used)	Not allowed	Not allowed
	(Upper)	2D		(Not used)	Not allowed	Not allowed
2E	(Lower)	2E		(Not used)	Not allowed	Not allowed
	(Upper)	2F		(Not used)	Not allowed	Not allowed
30	(Lower)	30		(Not used)	Not allowed	Not allowed
	(Upper)	31		(Not used)	Not allowed	Not allowed
32	(Lower)	32		(Not used)	Not allowed	Not allowed
	(Upper)	33		(Not used)	Not allowed	Not allowed
34	(Lower)	34		(Not used)	Not allowed	Not allowed
	(Upper)	35		(Not used)	Not allowed	Not allowed
36	(Lower)	36		(Not used)	Not allowed	Not allowed
	(Upper)	37		(Not used)	Not allowed	Not allowed
38	(Lower)	38		(Not used)	Not allowed	Not allowed
	(Upper)	39		(Not used)	Not allowed	Not allowed
3A		3A		(Not used)	Not allowed	Not allowed
3E		3F				

Address (hexadecimal) Data width 16		8		Description	Read	Write
80	(Lower)	80		Send data write completed	Allowed	Allowed
	(Upper)	81		Receive data read request	Allowed	Allowed
82	(Lower)	82		Vendor code (Lower)	Allowed	Allowed
	(Upper)	83		Vendor code (Upper)	Allowed	Allowed
84	(Lower)	84		Model code	Allowed	Allowed
	(Upper)	85		Version	Allowed	Allowed
86	(Lower)	86		SDLED illumination time setting	Allowed	Allowed
	(Upper)	87		Timeout time setting	Allowed	Allowed
88	(Lower)	88	Update buffer	R→M ST1	Allowed	Allowed
	(Upper)	89		R→M ST2	Allowed	Allowed
8A	(Lower)	8A		R→M RX00-07	Allowed	Allowed
	(Upper)	8B		R→M RX08-0F	Allowed	Allowed
8C	(Lower)	8C		R→M RX10-17	Allowed	Allowed
	(Upper)	8D		R→M RX18-1F	Allowed	Allowed
8E	(Lower)	8E		R→M RX20-27	Allowed	Allowed
	(Upper)	8F		R→M RX28-2F	Allowed	Allowed
90	(Lower)	90		R→M RX30-37	Allowed	Allowed
	(Upper)	91		R→M RX38-3F	Allowed	Allowed
92	(Lower)	92		(Not used)	Not allowed	Not allowed
	(Upper)	93		(Not used)	Not allowed	Not allowed
94	(Lower)	94		(Not used)	Not allowed	Not allowed
	(Upper)	95		(Not used)	Not allowed	Not allowed
96	(Lower)	96		(Not used)	Not allowed	Not allowed
	(Upper)	97		(Not used)	Not allowed	Not allowed
98	(Lower)	98		(Not used)	Not allowed	Not allowed
	(Upper)	99		(Not used)	Not allowed	Not allowed
9A	(Lower)	9A		R→M RWr0(L)	Allowed	Allowed
	(Upper)	9B		R→M RWr0(H)	Allowed	Allowed
9C	(Lower)	9C		R→M RWr1(L)	Allowed	Allowed
	(Upper)	9D		R→M RWr1(H)	Allowed	Allowed
9E	(Lower)	9E		R→M RWr2(L)	Allowed	Allowed
	(Upper)	9F		R→M RWr2(H)	Allowed	Allowed
A0	(Lower)	A0		R→M RWr3(L)	Allowed	Allowed
	(Upper)	A1		R→M RWr3(H)	Allowed	Allowed
A2	(Lower)	A2		R→M RWr4(L)	Allowed	Allowed
	(Upper)	A3		R→M RWr4(H)	Allowed	Allowed
A4	(Lower)	A4		R→M RWr5(L)	Allowed	Allowed
	(Upper)	A5		R→M RWr5(H)	Allowed	Allowed
A6	(Lower)	A6		R→M RWr6(L)	Allowed	Allowed
	(Upper)	A7		R→M RWr6(H)	Allowed	Allowed
A8	(Lower)	A8		R→M RWr7(L)	Allowed	Allowed
	(Upper)	A9		R→M RWr7(H)	Allowed	Allowed
AA	(Lower)	AA		(Not used)	Not allowed	Not allowed
	(Upper)	AB		(Not used)	Not allowed	Not allowed
AC	(Lower)	AC		(Not used)	Not allowed	Not allowed
	(Upper)	AD		(Not used)	Not allowed	Not allowed
AE	(Lower)	AE		(Not used)	Not allowed	Not allowed
	(Upper)	AF		(Not used)	Not allowed	Not allowed
B0	(Lower)	B0		(Not used)	Not allowed	Not allowed
	(Upper)	B1		(Not used)	Not allowed	Not allowed
B2	(Lower)	B2		(Not used)	Not allowed	Not allowed
	(Upper)	B3		(Not used)	Not allowed	Not allowed
B4	(Lower)	B4		(Not used)	Not allowed	Not allowed
	(Upper)	B5		(Not used)	Not allowed	Not allowed
B6	(Lower)	B6		(Not used)	Not allowed	Not allowed
	(Upper)	B7		(Not used)	Not allowed	Not allowed
B8	(Lower)	B8		(Not used)	Not allowed	Not allowed
	(Upper)	B9		(Not used)	Not allowed	Not allowed
BA	(Lower)	BA		Setting HOLD/CLR information	Allowed	Allowed
	(Upper)	BB		(Not used)	Not allowed	Not allowed
BC		BC		(Not used)	Not allowed	Not allowed
BE		BF				

Table 6.3 When the number of occupied stations is set to 3

Address (hexadecimal) Data width 16		8	Description	Read	Write
00	(Lower)	00	Send data write enable information	Allowed	Not allowed
	(Upper)	01	Receive data update information	Allowed	Not allowed
02	(Lower)	02	Station number switch information	Allowed	Not allowed
	(Upper)	03	Baud rate switch/number of occupied stations information	Allowed	Not allowed
04	(Lower)	04	Error information 1	Allowed	Not allowed
	(Upper)	05	Error information 2	Allowed	Not allowed
06	(Lower)	06	(Not used)	Not allowed	Not allowed
	(Upper)	07	(Not used)	Not allowed	Not allowed
08	(Lower)	08	Reception buffer: M→R ST1	Allowed	Not allowed
	(Upper)	09	Reception buffer: M→R ST2	Allowed	Not allowed
0A	(Lower)	0A	Reception buffer: M→R RY00-07	Allowed	Not allowed
	(Upper)	0B	Reception buffer: M→R RY08-0F	Allowed	Not allowed
0C	(Lower)	0C	Reception buffer: M→R RY10-17	Allowed	Not allowed
	(Upper)	0D	Reception buffer: M→R RY18-1F	Allowed	Not allowed
0E	(Lower)	0E	Reception buffer: M→R RY20-27	Allowed	Not allowed
	(Upper)	0F	Reception buffer: M→R RY28-2F	Allowed	Not allowed
10	(Lower)	10	Reception buffer: M→R RY30-37	Allowed	Not allowed
	(Upper)	11	Reception buffer: M→R RY38-3F	Allowed	Not allowed
12	(Lower)	12	Reception buffer: M→R RY40-47	Allowed	Not allowed
	(Upper)	13	Reception buffer: M→R RY48-4F	Allowed	Not allowed
14	(Lower)	14	Reception buffer: M→R RY50-57	Allowed	Not allowed
	(Upper)	15	Reception buffer: M→R RY58-5F	Allowed	Not allowed
16	(Lower)	16	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	17	Reception buffer: (Not used)	Not allowed	Not allowed
18	(Lower)	18	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	19	Reception buffer: (Not used)	Not allowed	Not allowed
1A	(Lower)	1A	Reception buffer: M→R RWw0(L)	Allowed	Not allowed
	(Upper)	1B	Reception buffer: M→R RWw0(H)	Allowed	Not allowed
1C	(Lower)	1C	Reception buffer: M→R RWw1(L)	Allowed	Not allowed
	(Upper)	1D	Reception buffer: M→R RWw1(H)	Allowed	Not allowed
1E	(Lower)	1E	Reception buffer: M→R RWw2(L)	Allowed	Not allowed
	(Upper)	1F	Reception buffer: M→R RWw2(H)	Allowed	Not allowed
20	(Lower)	20	Reception buffer: M→R RWw3(L)	Allowed	Not allowed
	(Upper)	21	Reception buffer: M→R RWw3(H)	Allowed	Not allowed
22	(Lower)	22	Reception buffer: M→R RWw4(L)	Allowed	Not allowed
	(Upper)	23	Reception buffer: M→R RWw4(H)	Allowed	Not allowed
24	(Lower)	24	Reception buffer: M→R RWw5(L)	Allowed	Not allowed
	(Upper)	25	Reception buffer: M→R RWw5(H)	Allowed	Not allowed
26	(Lower)	26	Reception buffer: M→R RWw6(L)	Allowed	Not allowed
	(Upper)	27	Reception buffer: M→R RWw6(H)	Allowed	Not allowed
28	(Lower)	28	Reception buffer: M→R RWw7(L)	Allowed	Not allowed
	(Upper)	29	Reception buffer: M→R RWw7(H)	Allowed	Not allowed
2A	(Lower)	2A	Reception buffer: M→R RWw8(L)	Allowed	Not allowed
	(Upper)	2B	Reception buffer: M→R RWw8(H)	Allowed	Not allowed
2C	(Lower)	2C	Reception buffer: M→R RWw9(L)	Allowed	Not allowed
	(Upper)	2D	Reception buffer: M→R RWw9(H)	Allowed	Not allowed
2E	(Lower)	2E	Reception buffer: M→R RWw10(L)	Allowed	Not allowed
	(Upper)	2F	Reception buffer: M→R RWw10(H)	Allowed	Not allowed
30	(Lower)	30	Reception buffer: M→R RWw11(L)	Allowed	Not allowed
	(Upper)	31	Reception buffer: M→R RWw11(H)	Allowed	Not allowed
32	(Lower)	32	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	33	Reception buffer: (Not used)	Not allowed	Not allowed
34	(Lower)	34	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	35	Reception buffer: (Not used)	Not allowed	Not allowed
36	(Lower)	36	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	37	Reception buffer: (Not used)	Not allowed	Not allowed
38	(Lower)	38	Reception buffer: (Not used)	Not allowed	Not allowed
	(Upper)	39	Reception buffer: (Not used)	Not allowed	Not allowed
3A 3E		3A 3F	(Not used)	Not allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description	Read	Write
80	(Lower)	80	Send data write completed	Allowed	Allowed
	(Upper)	81	Receive data read request	Allowed	Allowed
82	(Lower)	82	Vendor code (Lower)	Allowed	Allowed
	(Upper)	83	Vendor code (Upper)	Allowed	Allowed
84	(Lower)	84	Model code	Allowed	Allowed
	(Upper)	85	Version	Allowed	Allowed
86	(Lower)	86	SDLED illumination time setting	Allowed	Allowed
	(Upper)	87	Timeout time setting	Allowed	Allowed
88	(Lower)	88	Update buffer: R→M ST1	Allowed	Allowed
	(Upper)	89	Update buffer: R→M ST2	Allowed	Allowed
8A	(Lower)	8A	Update buffer: R→M RX00-07	Allowed	Allowed
	(Upper)	8B	Update buffer: R→M RX08-0F	Allowed	Allowed
8C	(Lower)	8C	Update buffer: R→M RX10-17	Allowed	Allowed
	(Upper)	8D	Update buffer: R→M RX18-1F	Allowed	Allowed
8E	(Lower)	8E	Update buffer: R→M RX20-27	Allowed	Allowed
	(Upper)	8F	Update buffer: R→M RX28-2F	Allowed	Allowed
90	(Lower)	90	Update buffer: R→M RX30-37	Allowed	Allowed
	(Upper)	91	Update buffer: R→M RX38-3F	Allowed	Allowed
92	(Lower)	92	Update buffer: R→M RX40-47	Allowed	Allowed
	(Upper)	93	Update buffer: R→M RX48-4F	Allowed	Allowed
94	(Lower)	94	Update buffer: R→M RX50-57	Allowed	Allowed
	(Upper)	95	Update buffer: R→M RX58-5F	Allowed	Allowed
96	(Lower)	96	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	97	Update buffer: (Not used)	Not allowed	Not allowed
98	(Lower)	98	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	99	Update buffer: (Not used)	Not allowed	Not allowed
9A	(Lower)	9A	Update buffer: R→M RWr0(L)	Allowed	Allowed
	(Upper)	9B	Update buffer: R→M RWr0(H)	Allowed	Allowed
9C	(Lower)	9C	Update buffer: R→M RWr1(L)	Allowed	Allowed
	(Upper)	9D	Update buffer: R→M RWr1(H)	Allowed	Allowed
9E	(Lower)	9E	Update buffer: R→M RWr2(L)	Allowed	Allowed
	(Upper)	9F	Update buffer: R→M RWr2(H)	Allowed	Allowed
A0	(Lower)	A0	Update buffer: R→M RWr3(L)	Allowed	Allowed
	(Upper)	A1	Update buffer: R→M RWr3(H)	Allowed	Allowed
A2	(Lower)	A2	Update buffer: R→M RWr4(L)	Allowed	Allowed
	(Upper)	A3	Update buffer: R→M RWr4(H)	Allowed	Allowed
A4	(Lower)	A4	Update buffer: R→M RWr5(L)	Allowed	Allowed
	(Upper)	A5	Update buffer: R→M RWr5(H)	Allowed	Allowed
A6	(Lower)	A6	Update buffer: R→M RWr6(L)	Allowed	Allowed
	(Upper)	A7	Update buffer: R→M RWr6(H)	Allowed	Allowed
A8	(Lower)	A8	Update buffer: R→M RWr7(L)	Allowed	Allowed
	(Upper)	A9	Update buffer: R→M RWr7(H)	Allowed	Allowed
AA	(Lower)	AA	Update buffer: R→M RWr8(L)	Allowed	Allowed
	(Upper)	AB	Update buffer: R→M RWr8(H)	Allowed	Allowed
AC	(Lower)	AC	Update buffer: R→M RWr9(L)	Allowed	Allowed
	(Upper)	AD	Update buffer: R→M RWr9(H)	Allowed	Allowed
AE	(Lower)	AE	Update buffer: R→M RWr10(L)	Allowed	Allowed
	(Upper)	AF	Update buffer: R→M RWr10(H)	Allowed	Allowed
B0	(Lower)	B0	Update buffer: R→M RWr11(L)	Allowed	Allowed
	(Upper)	B1	Update buffer: R→M RWr11(H)	Allowed	Allowed
B2	(Lower)	B2	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	B3	Update buffer: (Not used)	Not allowed	Not allowed
B4	(Lower)	B4	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	B5	Update buffer: (Not used)	Not allowed	Not allowed
B6	(Lower)	B6	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	B7	Update buffer: (Not used)	Not allowed	Not allowed
B8	(Lower)	B8	Update buffer: (Not used)	Not allowed	Not allowed
	(Upper)	B9	Update buffer: (Not used)	Not allowed	Not allowed
BA	(Lower)	BA	Setting HOLD/CLR information	Allowed	Allowed
	(Upper)	BB	(Not used)	Not allowed	Not allowed
BC BE		BC BF	(Not used)	Not allowed	Not allowed

Table 6.4 When the number of occupied stations is set to 4

Address (hexadecimal) Data width 16		8		Description	Read	Write
00	(Lower)	00		Send data write enable information	Allowed	Not allowed
	(Upper)	01		Receive data update information	Allowed	Not allowed
02	(Lower)	02		Station number switch information	Allowed	Not allowed
	(Upper)	03		Baud rate switch/number of occupied stations information	Allowed	Not allowed
04	(Lower)	04		Error information 1	Allowed	Not allowed
	(Upper)	05		Error information 2	Allowed	Not allowed
06	(Lower)	06		(Not used)	Not allowed	Not allowed
	(Upper)	07		(Not used)	Not allowed	Not allowed
08	(Lower)	08	Reception buffer	M→R ST1	Allowed	Not allowed
	(Upper)	09		M→R ST2	Allowed	Not allowed
0A	(Lower)	0A		M→R RY00-07	Allowed	Not allowed
	(Upper)	0B		M→R RY08-0F	Allowed	Not allowed
0C	(Lower)	0C		M→R RY10-17	Allowed	Not allowed
	(Upper)	0D		M→R RY18-1F	Allowed	Not allowed
0E	(Lower)	0E		M→R RY20-27	Allowed	Not allowed
	(Upper)	0F		M→R RY28-2F	Allowed	Not allowed
A0	(Lower)	10		M→R RY30-37	Allowed	Not allowed
	(Upper)	11		M→R RY38-3F	Allowed	Not allowed
12	(Lower)	12		M→R RY40-47	Allowed	Not allowed
	(Upper)	13		M→R RY48-4F	Allowed	Not allowed
14	(Lower)	14		M→R RY50-57	Allowed	Not allowed
	(Upper)	15		M→R RY58-5F	Allowed	Not allowed
16	(Lower)	16		M→R RY60-67	Allowed	Not allowed
	(Upper)	17		M→R RY68-6F	Allowed	Not allowed
18	(Lower)	18		M→R RY70-77	Allowed	Not allowed
	(Upper)	19		M→R RY78-7F	Allowed	Not allowed
1A	(Lower)	1A		M→R RWw0(L)	Allowed	Not allowed
	(Upper)	1B		M→R RWw0(H)	Allowed	Not allowed
1C	(Lower)	1C		M→R RWw1(L)	Allowed	Not allowed
	(Upper)	1D		M→R RWw1(H)	Allowed	Not allowed
1E	(Lower)	1E		M→R RWw2(L)	Allowed	Not allowed
	(Upper)	1F		M→R RWw2(H)	Allowed	Not allowed
20	(Lower)	20		M→R RWw3(L)	Allowed	Not allowed
	(Upper)	21		M→R RWw3(H)	Allowed	Not allowed
22	(Lower)	22		M→R RWw4(L)	Allowed	Not allowed
	(Upper)	23		M→R RWw4(H)	Allowed	Not allowed
24	(Lower)	24		M→R RWw5(L)	Allowed	Not allowed
	(Upper)	25		M→R RWw5(H)	Allowed	Not allowed
26	(Lower)	26		M→R RWw6(L)	Allowed	Not allowed
	(Upper)	27		M→R RWw6(H)	Allowed	Not allowed
28	(Lower)	28		M→R RWw7(L)	Allowed	Not allowed
	(Upper)	29		M→R RWw7(H)	Allowed	Not allowed
2A	(Lower)	2A		M→R RWw8(L)	Allowed	Not allowed
	(Upper)	2B		M→R RWw8(H)	Allowed	Not allowed
2C	(Lower)	2C		M→R RWw9(L)	Allowed	Not allowed
	(Upper)	2D		M→R RWw9(H)	Allowed	Not allowed
2E	(Lower)	2E		M→R RWw10(L)	Allowed	Not allowed
	(Upper)	2F		M→R RWw10(H)	Allowed	Not allowed
30	(Lower)	30		M→R RWw11(L)	Allowed	Not allowed
	(Upper)	31		M→R RWw11(H)	Allowed	Not allowed
32	(Lower)	32		M→R RWw12(L)	Allowed	Not allowed
	(Upper)	33		M→R RWw12(H)	Allowed	Not allowed
34	(Lower)	34		M→R RWw13(L)	Allowed	Not allowed
	(Upper)	35		M→R RWw13(H)	Allowed	Not allowed
36	(Lower)	36		M→R RWw14(L)	Allowed	Not allowed
	(Upper)	37		M→R RWw14(H)	Allowed	Not allowed
38	(Lower)	38		M→R RWw15(L)	Allowed	Not allowed
	(Upper)	39		M→R RWw15(H)	Allowed	Not allowed
3A		3A		(Not used)	Not allowed	Not allowed
3E		3F				

Address (hexadecimal) Data width 16		8		Description	Read	Write
80	(Lower)	80		Send data write completed	Allowed	Allowed
	(Upper)	81		Receive data read request	Allowed	Allowed
82	(Lower)	82		Vendor code (Lower)	Allowed	Allowed
	(Upper)	83		Vendor code (Upper)	Allowed	Allowed
84	(Lower)	84		Model code	Allowed	Allowed
	(Upper)	85		Version	Allowed	Allowed
86	(Lower)	86		SDLED illumination time setting	Allowed	Allowed
	(Upper)	87		Timeout time setting	Allowed	Allowed
88	(Lower)	88	Update buffer	R→M ST1	Allowed	Allowed
	(Upper)	89		R→M ST2	Allowed	Allowed
8A	(Lower)	8A		R→M RX00-07	Allowed	Allowed
	(Upper)	8B		R→M RX08-0F	Allowed	Allowed
8C	(Lower)	8C		R→M RX10-17	Allowed	Allowed
	(Upper)	8D		R→M RX18-1F	Allowed	Allowed
8E	(Lower)	8E		R→M RX20-27	Allowed	Allowed
	(Upper)	8F		R→M RX28-2F	Allowed	Allowed
90	(Lower)	90		R→M RX30-37	Allowed	Allowed
	(Upper)	91		R→M RX38-3F	Allowed	Allowed
92	(Lower)	92		R→M RX40-47	Allowed	Allowed
	(Upper)	93		R→M RX48-4F	Allowed	Allowed
94	(Lower)	94		R→M RX50-57	Allowed	Allowed
	(Upper)	95		R→M RX58-5F	Allowed	Allowed
96	(Lower)	96		R→M RX60-67	Allowed	Allowed
	(Upper)	97		R→M RX68-6F	Allowed	Allowed
98	(Lower)	98		R→M RX70-77	Allowed	Allowed
	(Upper)	99		R→M RX78-7F	Allowed	Allowed
9A	(Lower)	9A		R→M RWr0(L)	Allowed	Allowed
	(Upper)	9B		R→M RWr0(H)	Allowed	Allowed
9C	(Lower)	9C		R→M RWr1(L)	Allowed	Allowed
	(Upper)	9D		R→M RWr1(H)	Allowed	Allowed
9E	(Lower)	9E		R→M RWr2(L)	Allowed	Allowed
	(Upper)	9F		R→M RWr2(H)	Allowed	Allowed
A0	(Lower)	A0		R→M RWr3(L)	Allowed	Allowed
	(Upper)	A1		R→M RWr3(H)	Allowed	Allowed
A2	(Lower)	A2		R→M RWr4(L)	Allowed	Allowed
	(Upper)	A3		R→M RWr4(H)	Allowed	Allowed
A4	(Lower)	A4		R→M RWr5(L)	Allowed	Allowed
	(Upper)	A5		R→M RWr5(H)	Allowed	Allowed
A6	(Lower)	A6		R→M RWr6(L)	Allowed	Allowed
	(Upper)	A7		R→M RWr6(H)	Allowed	Allowed
A8	(Lower)	A8		R→M RWr7(L)	Allowed	Allowed
	(Upper)	A9		R→M RWr7(H)	Allowed	Allowed
AA	(Lower)	AA		R→M RWr8(L)	Allowed	Allowed
	(Upper)	AB		R→M RWr8(H)	Allowed	Allowed
AC	(Lower)	AC		R→M RWr9(L)	Allowed	Allowed
	(Upper)	AD		R→M RWr9(H)	Allowed	Allowed
AE	(Lower)	AE		R→M RWr10(L)	Allowed	Allowed
	(Upper)	AF		R→M RWr10(H)	Allowed	Allowed
B0	(Lower)	B0		R→M RWr11(L)	Allowed	Allowed
	(Upper)	B1		R→M RWr11(H)	Allowed	Allowed
B2	(Lower)	B2		R→M RWr12(L)	Allowed	Allowed
	(Upper)	B3		R→M RWr12(H)	Allowed	Allowed
B4	(Lower)	B4		R→M RWr13(L)	Allowed	Allowed
	(Upper)	B5		R→M RWr13(H)	Allowed	Allowed
B6	(Lower)	B6		R→M RWr14(L)	Allowed	Allowed
	(Upper)	B7		R→M RWr14(H)	Allowed	Allowed
B8	(Lower)	B8		R→M RWr15(L)	Allowed	Allowed
	(Upper)	B9		R→M RWr15(H)	Allowed	Allowed
BA	(Lower)	BA		Setting HOLD/CLR information	Allowed	Allowed
	(Upper)	BB		(Not used)	Not allowed	Not allowed
BC		BC		(Not used)	Not allowed	Not allowed
BE		BF				

6.2 Memory Map Details

6.2.1 Send data write enable information(CCS_MWRENL_RCEX)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_MWRENL_RCEX	0	0	0	0	0	0	0	DCHANG	0	0	0	0	0	0	0	MWRENL	400F B000H	0000H
R/W	0	0	0	0	0	0	0	R	0	0	0	0	0	0	0	R		

Bit position	Bit name	Function
8	DCHANG	Receive data update information 0：No update Receive buffer (byte address 08h – 39h, word address 08h - 38h) contains the same data as the previously read data. (Received new data during the previous read, or the read interval is shorter than the refresh cycle.) 1：Update Newly received data is stored in the receive buffer. (Even if the updated data is the same as the previously read data, if the receive buffer has been updated this bit becomes "1.") For an asynchronous read, ensure that this bit is set to "1" before reading the receive data.
0	MWRENL	Send data write enable information 0：Enable Confirms that this bit is set to "0" and writes the send data into the update buffer. 1：Disable Writing to the update buffer is disabled when this bit is set to "1" because the data is being transferred from the update buffer to the send buffer. When the send data write completion flag (80h) is set to "1," the data transfer from the update buffer to the send buffer starts and the status is set to disable. When the transfer completes, the status is set to enable.

6.2.2 Station number switch information, Number of occupied stations information and Baud rate switch information(CCS_M3STNO_BSW_KYOKU)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3STNO_BSW_KYOKU	0	0	KYOKU1	KYOKU0	BSW8	BSW4	BSW2	BSW1	S7	S6	S5	S4	S3	S2	S2	S0	400F B002H	Undefined
R/W	0	0	R	R	R	R	R	R	R	R	R	R	R	R	R	R		

Bit position	Bit name	Function
13-12		Number of occupied stations information
11-8		Baud rate switch information
7-0	S7-S0	Station number switch information The station number setting switch value will be stored as binary code upon power up or the completion of the reset cycle. Note that any value in the range from 0 to 99 (00h to 63h) is valid, because the hardware converts the 2-digit switch value from BCD to binary.

Number of occupied stations information

KYOKU1	KYOKU0	Number of occupied stations
0	0	1station
0	1	2 station
1	0	3 station
1	1	4 station

Baud rate switch information

BSW8	BSW4	BSW2	BSW1	Switch setting
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4

6.2.3 Error information（CCS_M3ERR1_ERR2）

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3ERR1_ERR2	0	0	0	0	1	ERR22	ERR21	ERR20	0	0	BSERR	SSERR	0	0	BERR	STERR	400F B004H	Undefined
R/W	0	0	0	0	1	R	R	R	0	0	R	R	0	0	R	R		

Bit position	Bit name	Function
10	ERR22	CRC error 0: Normal 1: CRC error
9	ERR21	Timeout error 0: Normal 1: Timeout error
8	ERR20	CRC error 0: Normal 1: CRC error
5	BSERR	Baud rate switch change error information 0: Normal 1: Error (The setting has been changed from the setting at power on.)
4	SSERR	Station number setting switch change error information 0: Normal 1: Error (The setting has been changed from the setting at power on.)
1	BERR	Baud rate switch setting error information 0: Normal 1: Setting error (Value other than 0 to 4 has been set)
0	STERR	Station number switch setting error information 0: Normal 1: Setting error (Value 0, 65 or greater has been set)

Remark The error is cancelled when it returns to its normal condition.

6.2.4 M → R status information（CCS_M3MRST1_ST2）

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3MRST1_ST2	MST27	MST26	MST25	MST24	MST23	MST22	MST21	MST20	MST17	0	MST15	MST14	MST13	MST12	MST11	MST10	400F B008H	Undefined
R/W	R	R	R	R	R	R	R	R	R	0	R	R	R	R	R	R		

Bit position	Bit name	Function
15-12	MST27-MST24	
11-8	MST23-MST20	
7	MST17	0: Main master station 1: Standby master station
5	MST15	Protocol Version 0: Ver.1.** 1: Ver.2.**
4	MST14	Transient reception 0: Enable 1: Disable

MST27	MST26	MST25	MST24	Number of RWw transmission words
0	0	0	0	0words
0	0	0	1	32 words (64bytes)
0	0	1	0	64 words (128 bytes)
0	0	1	1	96 words (192 bytes)
0	1	0	0	128 words (256 bytes)
0	1	0	1	160 words (320 bytes)
0	1	1	0	192 words (384 bytes)
0	1	1	1	224 words (448 bytes)
1	0	0	0	256 words (512 bytes)

MST23	MST22	MST21	MST20	Number of RY information transmission bits
0	0	0	0	0 ビット
0	0	0	1	256 ビット(32 bytes)
0	0	1	0	512 ビット(64 bytes)
0	0	1	1	768 ビット(96 bytes)
0	1	0	0	1024 ビット(128 bytes)
0	1	0	1	1280 ビット(160 bytes)
0	1	1	0	1536 ビット(192 bytes)
0	1	1	1	1792 ビット(224 bytes)
1	0	0	0	2048 ビット(256 bytes)

Bit position	Bit name	Function
3	MST13	Transient 0: No 1: Yes
2	MST12	Refresh 0: No 1: Yes
1	MST11	Master station program 0: Normal 1: Abnormal
0	MST10	Master station program 0: STOP 1: RUN

6.2.5 RY reception buffer(CCS_M3MRRY00_0F)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3MRRY00_0F	YnF	YnE	YnD	YnC	YnB	YnA	Yn9	Yn8	Yn7	Yn6	Yn5	Yn4	Yn3	Yn2	Yn1	Yn0	400F B00AH +2nH	Undefined
R/W	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		

Bit position	Bit name	Function
15-0	Yn15-Yn0	RY reception buffer

Remark n = 0-7

6.2.6 RWwn register(CCS_M3MRRWWn)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3MRRWWn	bnF	bnE	bnD	bnC	bnB	bnA	bn9	bn8	bn7	bn6	bn5	bn4	bn3	bn2	bn1	bn0	400F B01AH +2nH	Undefined
R/W	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		

Bit position	Bit name	Function
15-0	Bn15-bn0	RWw（RWwn15-RWwn0）

Remark n = 0-15

6.2.7 Send data write complete flag and Receive data read request (CCS_M3SDOK_RDRQ)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3SDOK_RDRQ	0	0	0	0	0	0	0	DRDREQ	0	0	0	0	0	0	0	WPFLG	400F B080H	00H
R/W	0	0	0	0	0	0	0	R/W	0	0	0	0	0	0	0	R/W		

Bit position	Bit name	Function
8	DRDREQ	<Write> Upon reading the receive data, set this bit to "1," and upon completing the read, set it to "0." <Read> The data written will be read. Initial setting：00H After initial setting： Writes 01h when starting to read reception data and writes 00h when reading is completed.
0	WPFLG	<Write> Set the flag to "write" after completing data write to the update buffer. (Write "01" as the data value.) When the flag becomes "write," the data transfer from the update buffer to the send buffer starts. (Caution 1) After writing all the data to be sent to the update buffer at one time, set the flag to "write." (Caution 2) Setting this flag to "write" starts sending and receiving. Ensure to set the flag to "write" after writing the initial data. <Read> The flag becomes "1" as the "write" operation begins. When the data transfer to the send buffer completes, the flag becomes "0." Initial setting： Writes 01h when initial data setting has been completed during initial processing. (The communication will not start unless this operation is performed.) After initial setting： Writes 01h after transmission data is written to the CCS during transmission processing.

6.2.8 Vendor code(CCS_M3VENDORCODE)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3VENDORCODE	VENDOR15	VENDOR14	VENDOR13	VENDOR12	VENDOR11	VENDOR10	VENDOR9	VENDOR8	VENDOR7	VENDOR6	VENDOR5	VENDOR4	VENDOR3	VENDOR2	VENDOR1	VENDOR0	400F B082H	0000H
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W		

Bit position	Bit name	Function
15-0	VENDOR15-0	Write the lower portion of the vendor code.

Caution The vendor code is obtained from the ID number issued when a vendor joins the CC-Link Partner Association (CLPA). The four digits consisting of the fifth to the eighth digits from the beginning of the ID number constitute the vendor code.

【Example】

If the ID number is 123-456-7890, the vendor code is 5678.

6.2.9 Model code and version(CCS_M3MODELCODE_VERSION)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3MODELCODE_VERSION	0	PROVER0	SFTVER5	SFTVER4	SFTVER3	SFTVER2	SFTVER1	SFTVER0	MCODE7	MCODE 6	MCODE 5	MCODE 4	MCODE 3	MCODE 2	MCODE 1	MCODE 0	400F B084H	0000H
R/W	0	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W		

Bit position	Bit name	Function
14	PROVER0	Protocol version 0: Ver.1.** 1: Ver.2.**
13-8	SFTVER5－ SFTVER0	Software version information Initial setting：00 0001B
7-0	MODE7- MODE0	Model code Initial setting：For each model code, contact the CC-Link Partner Association.

Caution The model code is defined by the CC-Link Partner Association (CLPA).

Write the model code specified in the “CC-Link Specification (Profile)”. If there is no corresponding code, contact the CC-Link Partner Association (CLPA).

6.2.10 SDLED illumination time setting and Timeout time setting (CCS_M3SDLED_TOVER)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3SDLED_TOVER	TIM3	TIM2	TIM1	TIM0	0	0	0	0	SLED3	SLED2	SLED1	SLED0	0	0	0	0	400F B086H	0000H
R/W	R/W	R/W	R/W	R/W	0	0	0	0	R/W	R/W	R/W	R/W	0	0	0	0		

Bit position	Bit name	Function
15-12	TIM3-TIM0	The time-over settings for the time up to first reception completion and the time after first reception completion need to be changed. 〈Initial setting time〉 Setting value until reception complete is set to ON for the first time after reset release or power ON

Baud rate	TIM3	TIM2	TIM1	TIM0	First time
10M	0→1→0	1	0	1	1677.7216ms
5M	0→1→0	1	0	1	1677.7216ms
2.5M	0→1→0	0	1	1	1677.7216ms
625k	0→1→0	0	0	1	1677.7216ms
156k	0→1→0	1	1	1	3355.4432ms

〈Normal setting time〉

This is the timeout time setting value after completion of the initial data reception

Baud rate	TIM3	TIM2	TIM1	TIM0	First time
10M	0→1→0	1	1	0	104.8576ms
5M	0→1→0	1	0	1	104.8576ms
2.5M	0→1→0	1	0	1	209.7152ms
625k	0→1→0	1	0	1	838.8608ms
156k	0→1→0	1	0	0	1677.7216ms

Initial setting : The default time setting value is set to a value corresponding to the baud rate.

Bit position	Bit name	Function
7-4	SLED3-SLED0	

SLED3	SLED2	SLED1	SLED0	SDLED Illumination time
0	–	–	–	During transmission period
1	0	0	0	0.05～0.1ms
1	0	0	1	0.1～0.2ms
1	0	1	0	0.4～0.8ms
1	0	1	1	0.8～1.6ms
1	1	0	0	3.3～6.6ms
1	1	0	1	13.1～26.2ms
1	1	1	0	52.4～104.8ms
1	1	1	1	209.7～419.5ms

Initial setting : 1111 (SDLED ON time: 209.7 to 419.5ms)

Caution1. In the above figure, the setting value is written after "0" is written to bit 7 (SLED3).

2. The timeout time is set using TIM0 to 2. The set value is confirmed at the TIM3 rising edge (0 □ 1). After the setting is set, change TIM3 back to 0. For setting procedure details, refer to Section 7.4 "Timeout Time Setting Change".

6.2.11 Cyclic Communication(CCS_M3RMST1_ST2)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3RMST1_ST2	M3RMST21	M3RMST20	0	0	0	0	0	0	0	0	M3RMST1	0	0	0	0	0	400F B088H	00H
R/W	R/W	R/W	0	0	0	0	0	0	0	0	R/W	0	0	0	0	0		

Bit position	Bit name	Function
15,14	M3RMST21, M3RMST20	Extended cyclic setting (setting of multiple) 00: 1x setting 01: 2x setting 10: 4x setting 11: 8x setting Initial setting：00H
5	M3RMST1	Cyclic Communication 0: Cyclic communication enable 1: Cyclic communication disable Initial setting：00H

Caution This bit is used in Version 2 only. For details of use, refer to Section 10.2 “Initial Setting INT_CCV20” and Section 10.4 “Transmission/Reception Processing Module (ICCV20).” With Version 1, set the setting to “Fixed to 0.”

6.2.12 RX update buffer(CCS_M3RMRXn0_nF)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3RMRXn0_nF	XnF	XnE	XnD	XnC	XnB	XnA	Xn9	Xn8	Xn7	Xn6	Xn5	Xn4	Xn3	Xn2	Xn1	Xn0	400F B08AH +2nH	Undefined
R/W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		

Bit position	Bit name	Function
15-0	Xn15-Xn0	RX update buffer

Remark n = 0-7

6.2.13 RWr register(CCS_M3RMRWRn)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3RMRWRn	XnF	XnE	XnD	XnC	XnB	XnA	Xn9	Xn8	Xn7	Xn6	Xn5	Xn4	Xn3	Xn2	Xn1	Xn0	400F B09AH +2nH	Undefined
R/W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W		

Bit position	Bit name	Function
15-0	Xn15-Xn0	RWr

Remark n = 0-15

6.2.14 RWr register(CCS_M3HOLDCLR)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Address	Initial Value
CCS_M3HOLDCLR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	HOLDCLR	400F B0BA	0000H
R/W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R/W		

Bit position	Bit name	Function
0	HOLDCLR	HOLD/CLR Information Setting This bit notifies the master station of the HOLD or CLR setting of the HOLD/CLR process performed by firmware. Set the information to be notified to the master station when an error, STOP, or time-over occurs on the master station application (master station controller), i.e., whether the device is to HOLD or CLR the data received from the master station. 1h: HOLD 0h: CLR

Caution The HOLD/CLR process holds or clears data received from the master station when an error, STOP, or timeout occurs on the master station application (master station controller). Determine the hold or clear process in accordance with device specifications, and execute the process using firmware.

7. Sample Flowchart for CC-Link Version 1

7.1 Initial Setting

After the initial setting process, execute Section 7.2 “Main Processing”

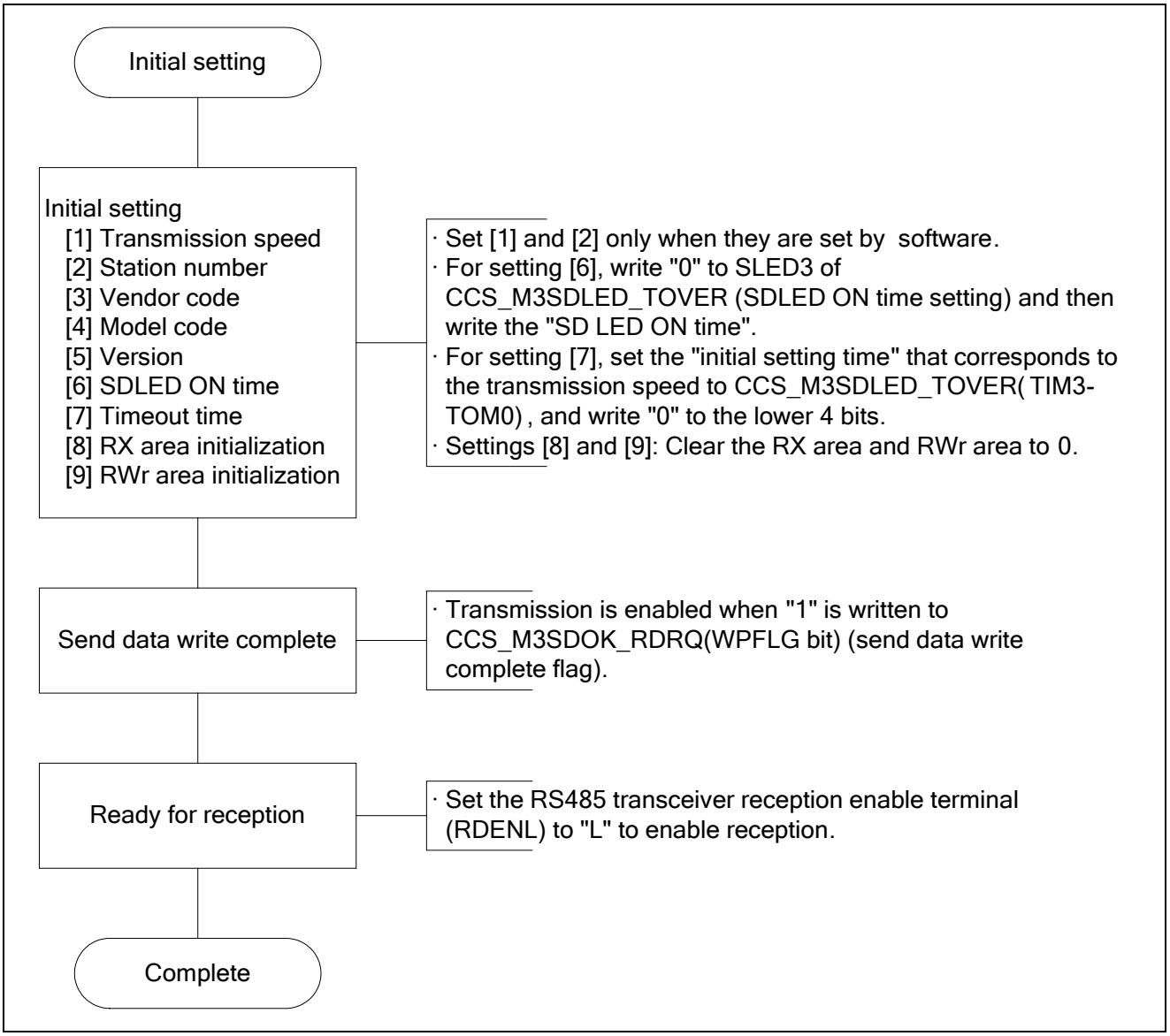


Figure 7.1 Initial Processing

7.2 Main Processing

When the reception processing is completed within 1 ms, execute the main processing as described in Section 7.2.1 “Synchronous Read Method / Asynchronous Write Method”. When the reception processing is not completed within 1 ms, execute the main processing as described in Section 7.2.2 “Asynchronous Read Method / Asynchronous Write Method”.

7.2.1 Synchronous Read Method / Asynchronous Write Method

The following indicates an example of the main processing performed when the synchronous read method (refer to Section7.3.1) is used during reception processing and the asynchronous write method (refer to Section7.3.3) is used during transmission processing.

Perform reception processing by connecting the CCS_REFSTB output of CCS to the interrupt input of the microcomputer and using a rising edge interrupt.

Perform transmission processing based on timing of your own discretion.

When a timeout occurs, assess conditions based on the timeout error of CCS_M3ERR1_ERR2. ERR21 (error information).

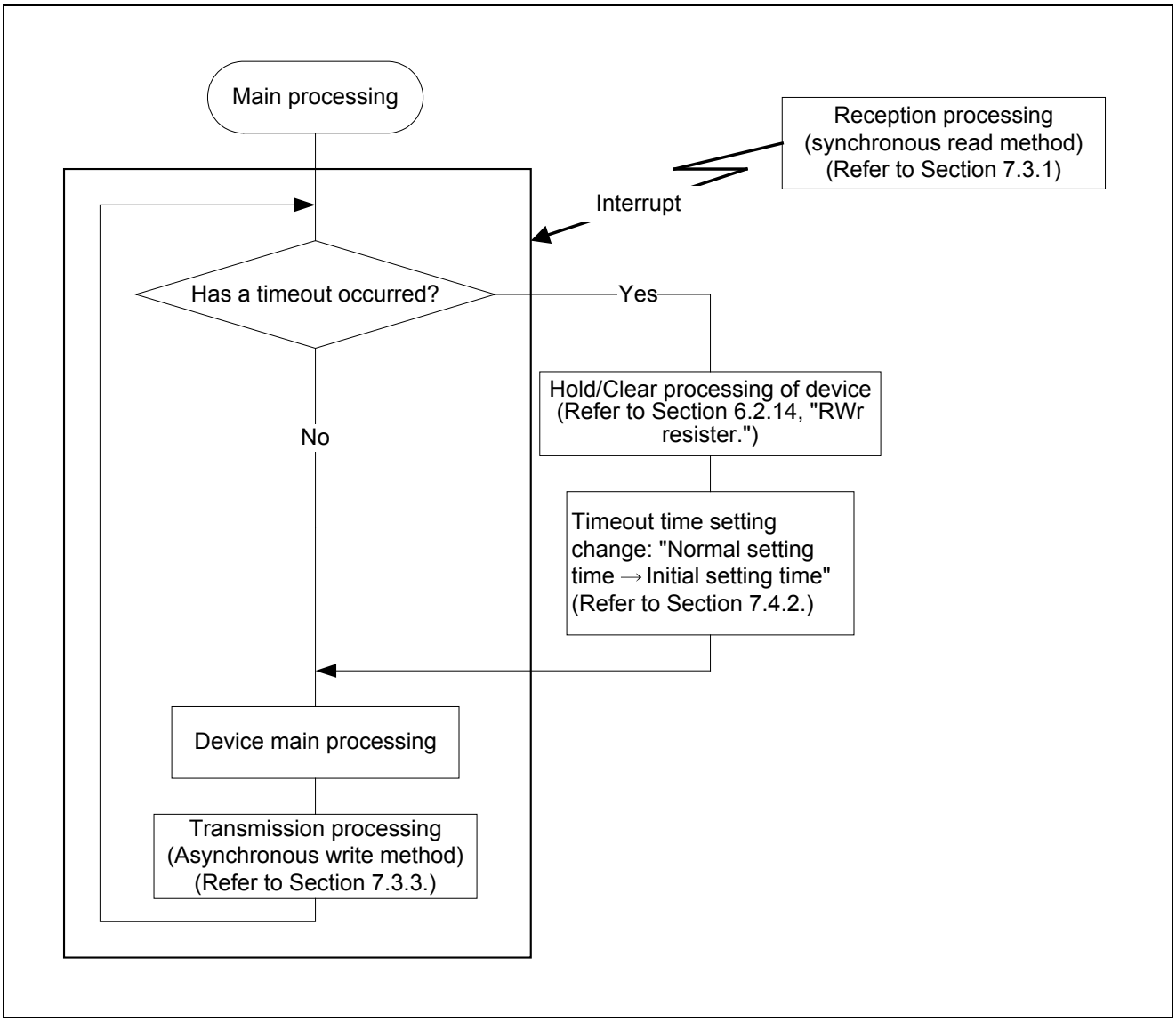


Figure 7.2 Synchronous Read Method / Asynchronous Write Method

7.2.2 Asynchronous Read Method / Asynchronous Write Method

The following indicates an example of the main processing performed when the asynchronous read method (refer to Section 7.3.2) is used during reception processing and the asynchronous write method (refer to Section 7.3.3) is used during transmission processing.

When a timeout occurs, assess conditions based on the timeout error of CCS_M3ERR1_ERR2.ERR21(error information).

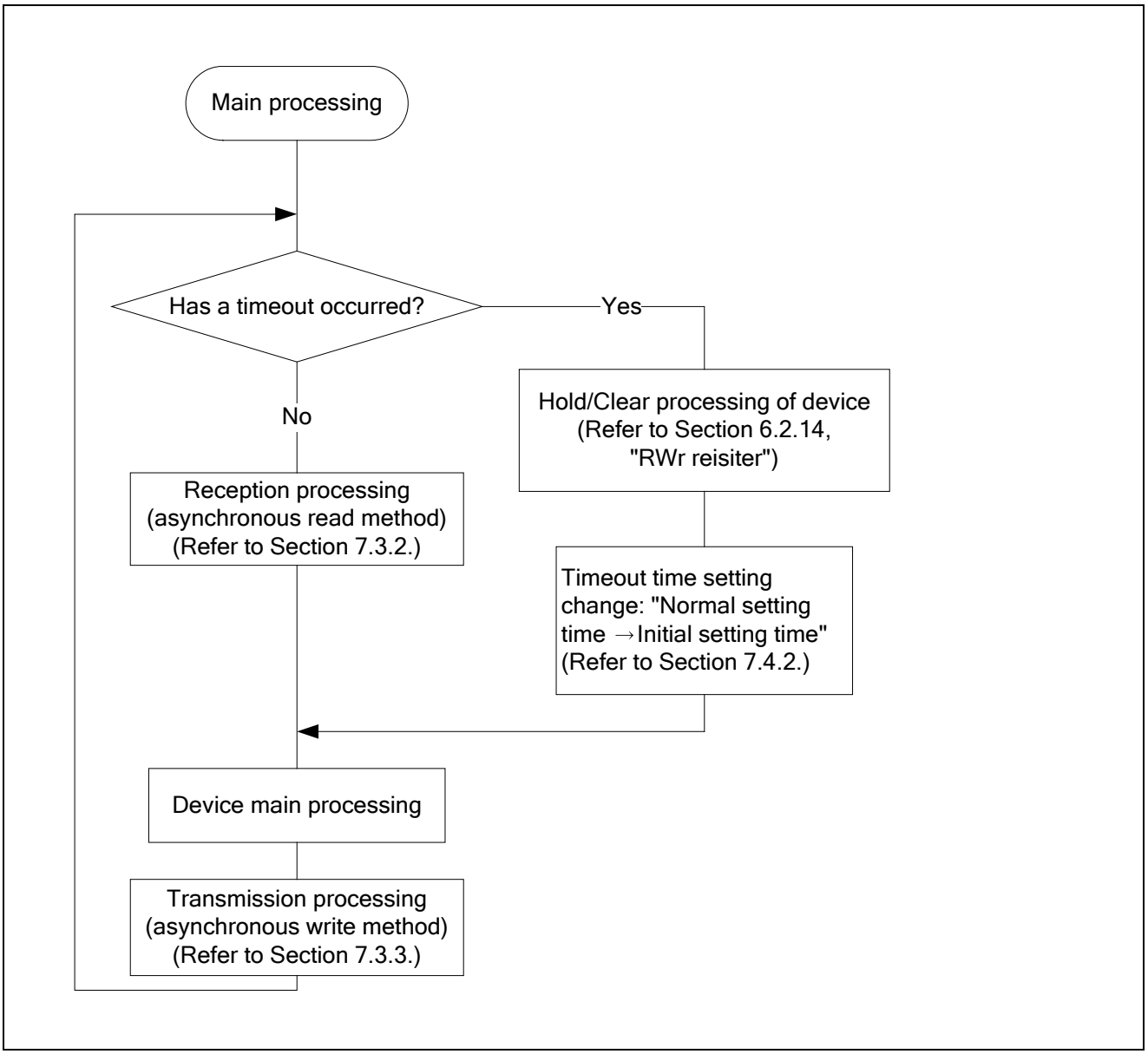


Figure 7.3 Asynchronous Read Method / Asynchronous Write Method

7.3 Reception and Transmission Processing

When the read process is to be completed within 1ms, use the methods described in Section 7.3.1 “Synchronous Read Method (Interrupt Processing)” and Section 7.3.3 “Asynchronous Write Method”. When the read process is not to be completed within 1ms, use the methods described in Section 7.3.2 “Asynchronous Read Method” and Section 7.3.3 “Asynchronous Write Method”.

7.3.1 Synchronous Read Method (Interrupt Processing)

Connect the CCS_REFSTB output of CCS to the microcomputer interrupt input, and execute the read process using a rising-edge interrupt.

The write process can be executed in asynchronous write mode based on arbitrary timing.

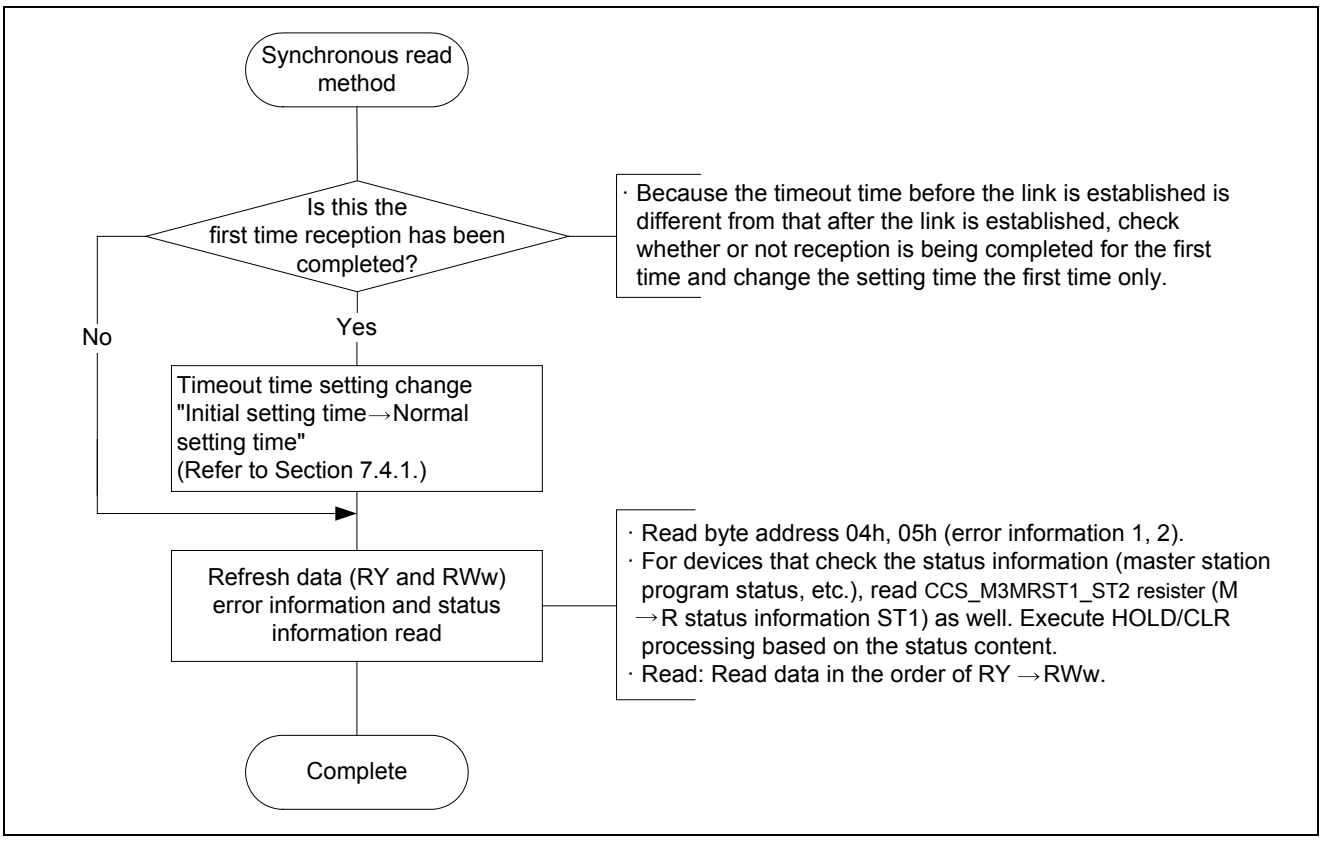


Figure 7.4 Synchronous Read Method

The processing of an "interrupt" to "completion" has to be done within 1 ms.
(The next interrupt might be ignored if processing does not finish within 1 ms.)

7.3.2 Asynchronous Read Method

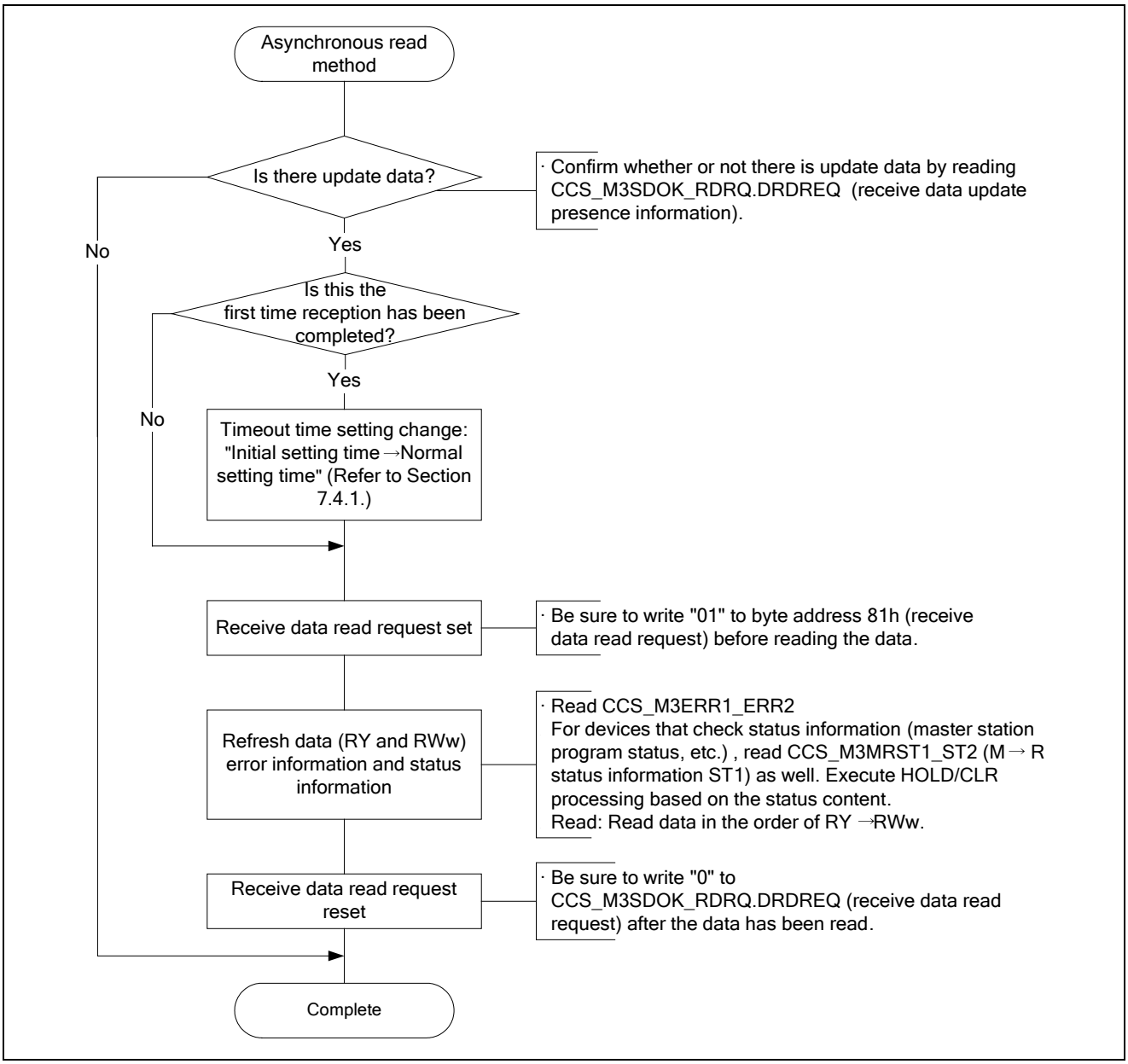


Figure 7.5 Asynchronous Read Method

7.3.3 Asynchronous Write Method

The written data is transmitted by the next polling from the master.

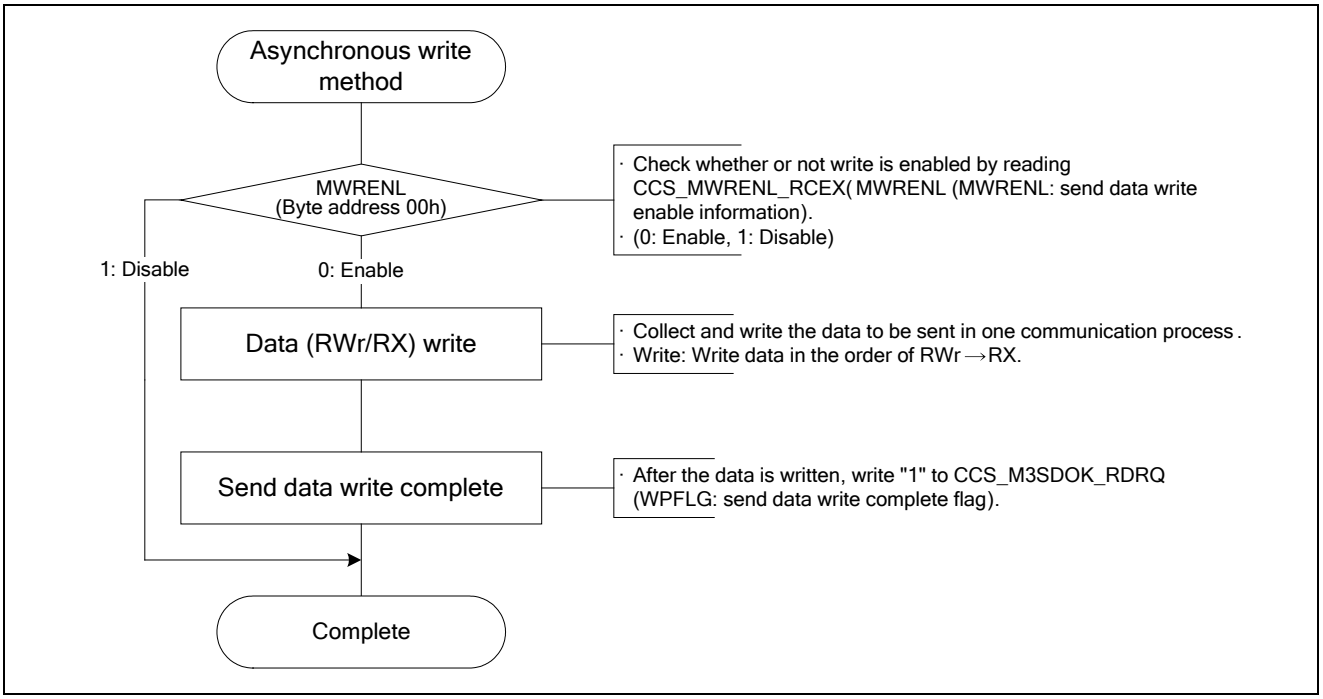


Figure 7.6 Asynchronous Write Method

Caution When the baud rate is 156Kbps, a maximum of 3.08ms is required for send processing. During this period, CCS_MWRENL_RCEX.MWRENL does not become enabled.

7.4 Timeout Time Setting Change

7.4.1 Initial Setting Time Normal Setting Time

After the first data reception has been completed, change the timeout time setting from “initial setting time” to “normal setting time” following the procedure below.

The following cases apply to “the first data reception” (i.e., the first time refresh data is received after power ON, reset or timeout recovery):

(Synchronous read)

-When the first reception complete interrupt occurs as a result of CCS_REFSTB output

(Asynchronous read)

-When “receive data update presence information” changes to “present” for the first time

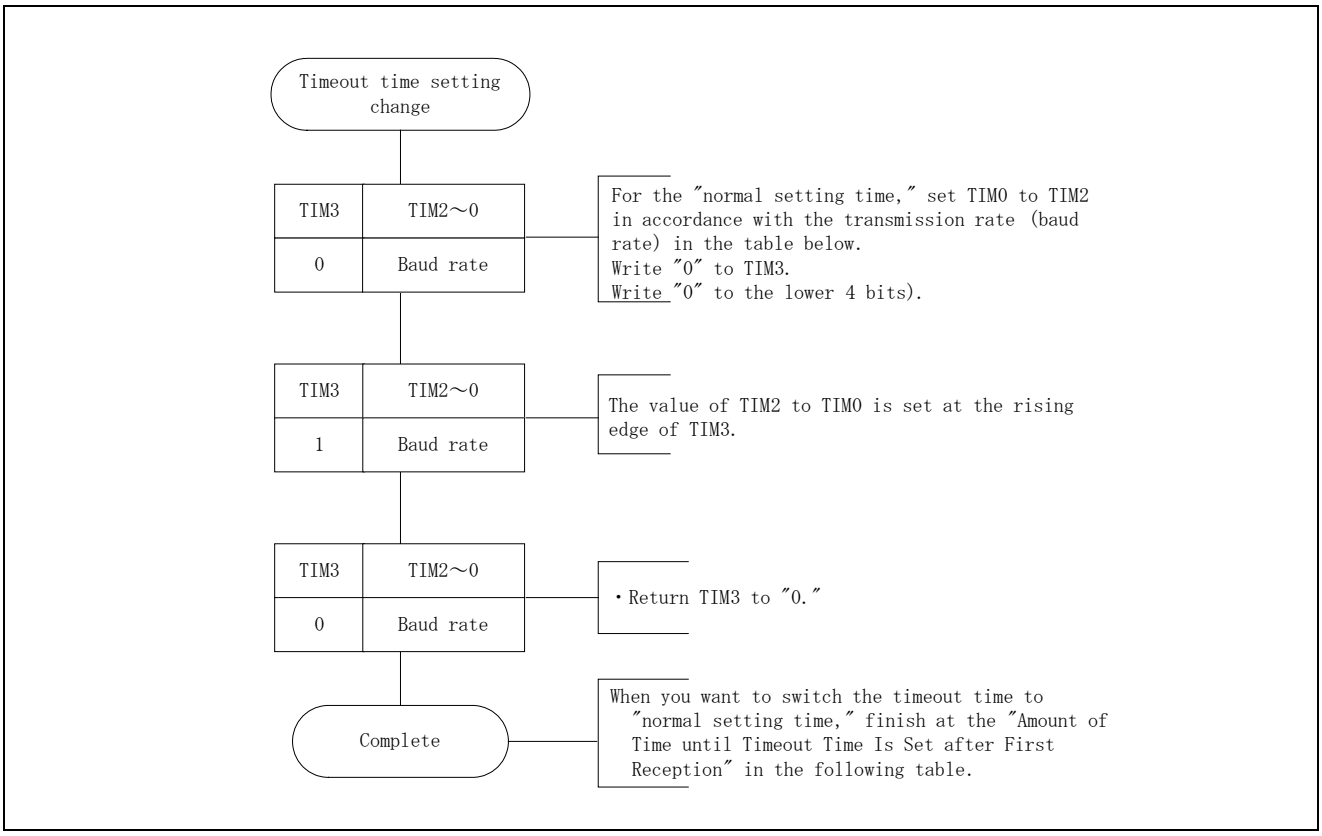


Figure 7.7 Initial Setting Time → Normal Setting Time

Table 7.1 Normal setting time (setting after first reception completion)

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout Time	Amount of Time until Timeout Time Is Set after First Reception
10M	0→1→0	1	1	0	104.8576ms	51ms or less
5M	0→1→0	1	0	1	104.8576ms	103ms or less
2.5M	0→1→0	1	0	1	209.7152ms	49ms or less
625k	0→1→0	1	0	1	838.8608ms	39ms or less
156k	0→1→0	1	0	0	1677.7216ms	13,000ms or less

7.4.2 Normal Setting Time → Initial Setting Time

After a timeout occurs, change the setting from “normal setting time” to “initial setting time.” Set TIM0 to TIM3 to the data (TIM3 = 1) corresponding to the transmission speed in the table below.

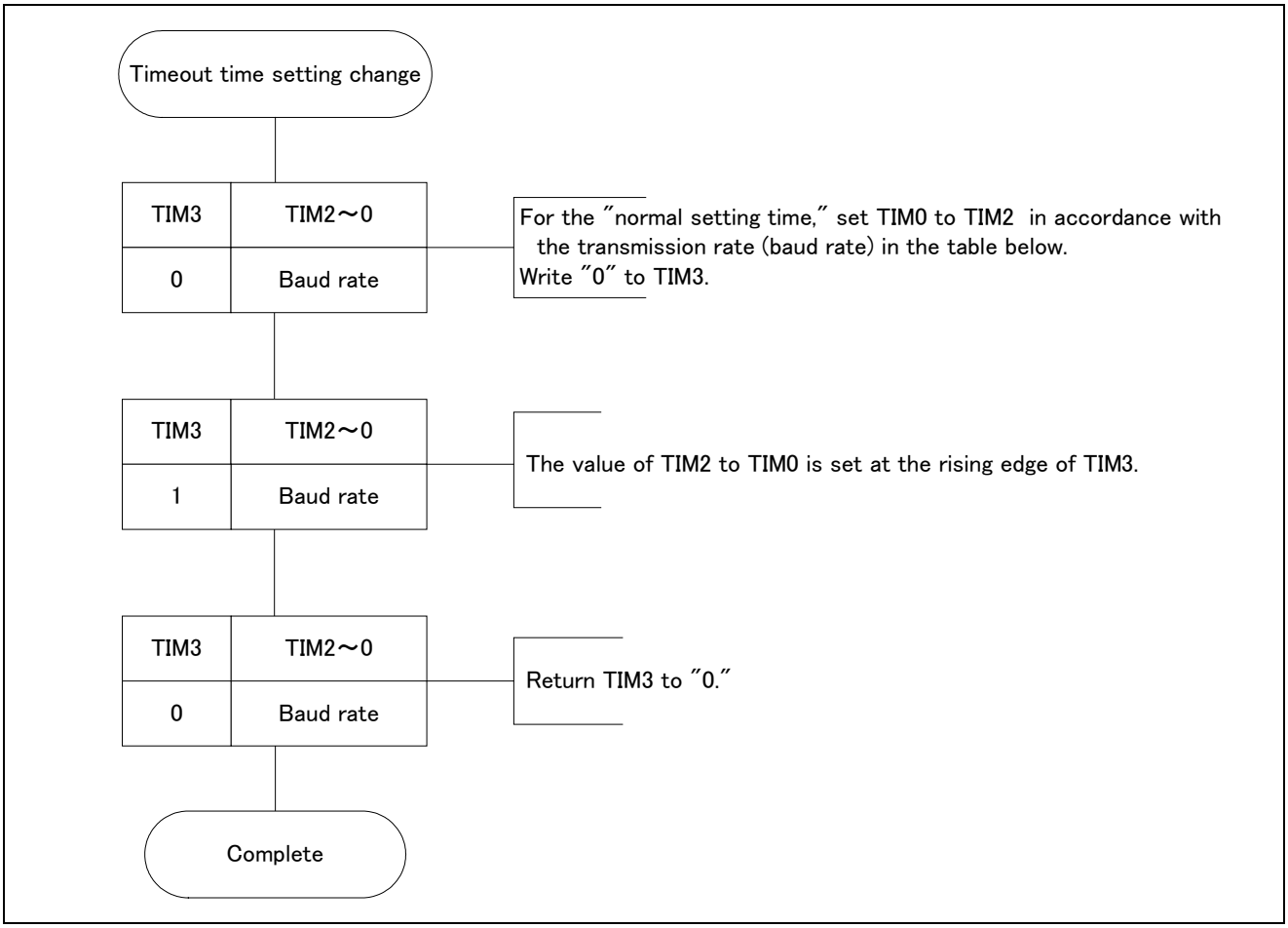


Figure7.8 Normal Setting Time → Initial Setting Time

Table 7.2 Initial setting time (Setting after timeout)

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout Time
10M	0→1→0	1	0	1	1677.7216ms
5M	0→1→0	1	0	1	1677.7216ms
2.5M	0→1→0	0	1	1	1677.7216ms
625k	0→1→0	0	0	1	1677.7216ms
156k	0→1→0	1	1	1	3355.4432ms

8. Remote Device Station Common Specification

8.1 Cyclic Transmission Signals

8.1.1 Cyclic Transmission Signal Definitions

The I/O points of the remote device station are divided into a user area and a system area.
The final 16 bits of RX and RY are reserved as system areas.

The following lists the number of user area points according to the number of occupied stations.

1 occupied station: 16 bits
2 occupied stations: 48 bits
3 occupied stations: 80 bits
4 occupied stations: 112 bits

	Link input	Signal name	Link output	Signal name
User area	RXm0	User area	RYm0	User area
System area	RXs0	Reserved	RYs0	Reserved
	RXs1		RYs1	
	RXs2		RYs2	
	RXs3		RYs3	
	RXs4		RYs4	
	RXs5		RYs5	
	RXs6		RYs6	
	RXs7		RYs7	
	RXs8	Initial data processing request flag	RYs8	Initial processing complete flag
	RXs9	Initial data setting complete flag	RYs9	Initial setting request flag
	RXsA	Error status flag	RYsA	Error set request flag
	RXsB	Remote ready (required)	RYsB	Reserved
	RXsC	Reserved	RYsC	
	RXsD		RYsD	
	RXsE		RYsE	
	RXsF		RYsF	

Remark m : A number derived from the station number setting.
s: Indicates the RX/RY system area occupied by the slave station.

8.1.2 System Area Details

(1) RXsB(remote Ready)

Indicates that data transmission/reception is possible between the master station and user program of the remote device station.

Turn this signal ON after power ON or hardware reset.

Be sure to implement this signal.

Caution This signal turns OFF when master station data transmission/reception with the user program is not possible due to an error.

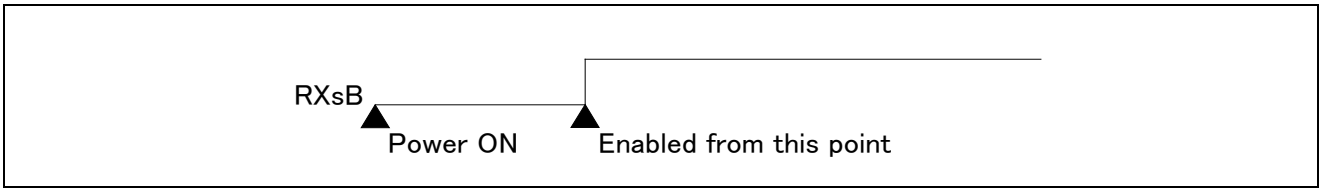


Figure 8.1 RXsB(Remote Ready)

(2) RXs8/RYs8（initial data processing request / processing complete flag）

Used when the remote device station requests the user program to execute initial data processing after remote device power ON or hardware reset.

Caution Remote ready (RXsB) is turned ON after initial data processing is completed.

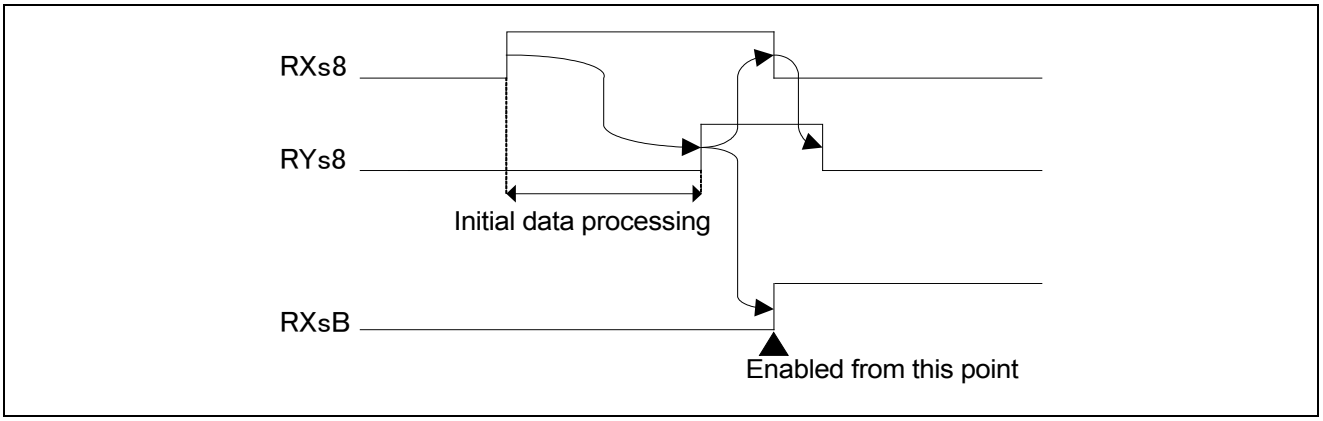


Figure 8.2 RXs9/RYs9 (initial data setting complete / setting request flag)

(3) RXs9/RYs9(initial data setting complete / setting request flag)

Used when the master station user program requests the remote device station to execute initial data setting.

Caution RXs9/RYs9 (initial data setting complete / setting request flag)

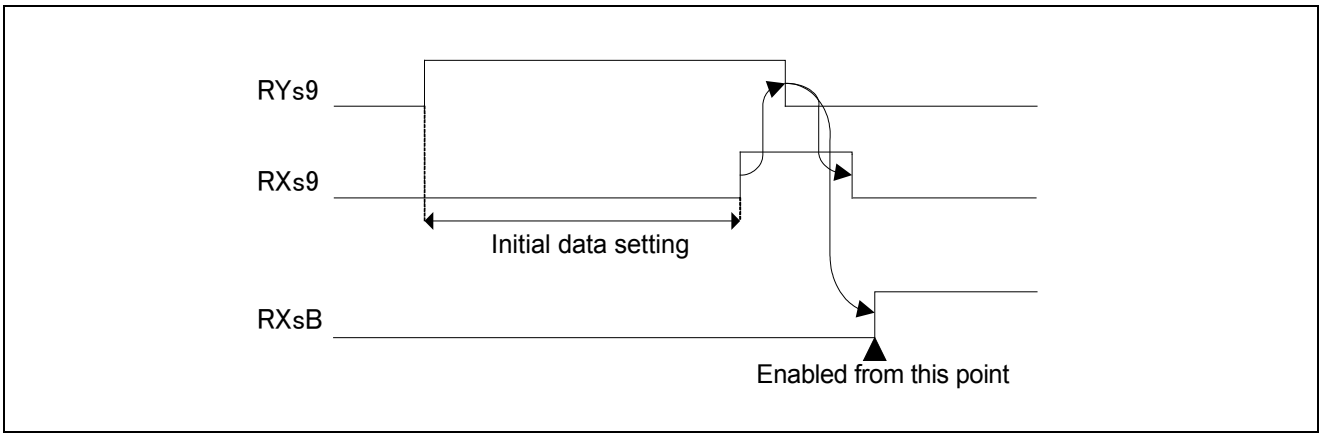


Figure 8.3 RXs9/RYs9 (initial data setting complete / setting request flag)

(4) When both RXs8/RYs8 and RXs9/RYs9 are implemented

When both RXs8/RYs8 and RXs9/RYs9 are implemented, turn RYsB (remote ready) ON after both initial data processing and initial data setting are completed.

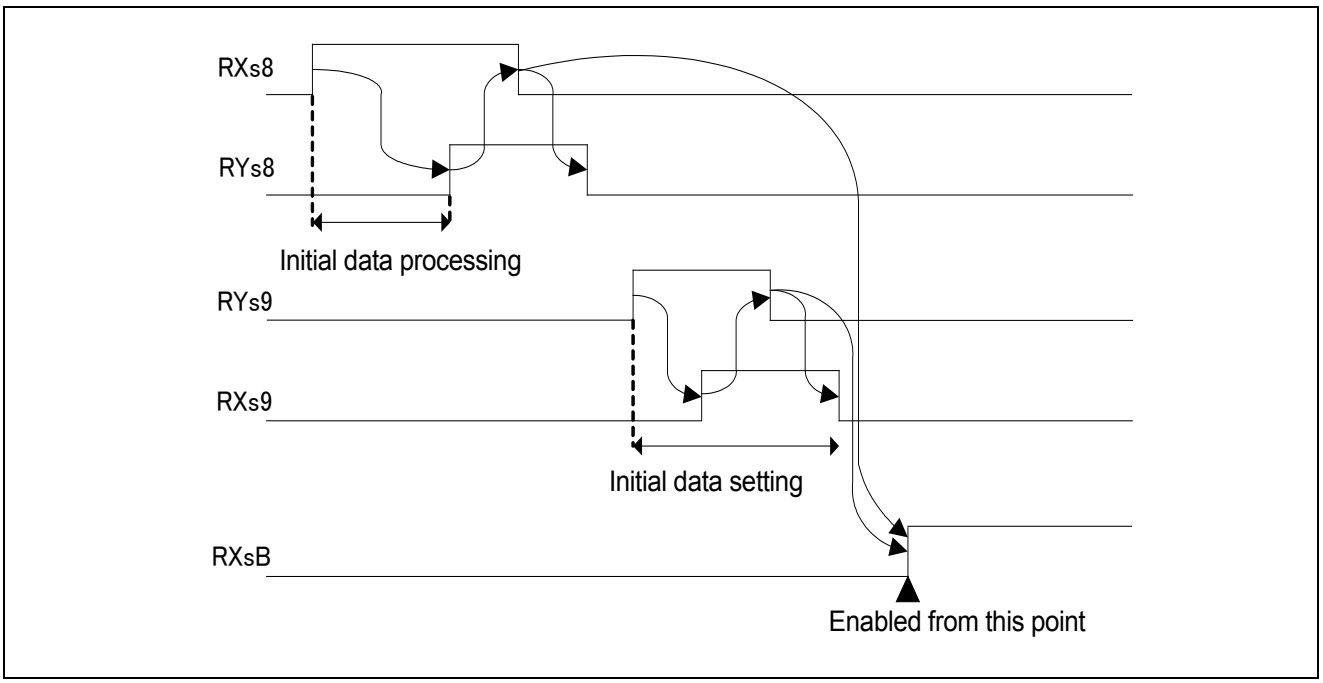


Figure 8.4 When both RXs8/RYs8 and RXs9/RYs9 are implemented

(5) RXsA/RYsA (error status / reset request flag)

Used for error notification/clearing when an error other than a watch dog timer error occurs in the remote device station.

Caution An error reset request clears the error as well as the error code storage area. Note, however, that the device number of the error code storage area is controlled by the remote device. Remote ready (RXsB) is turned OFF from error occurrence to error reset.

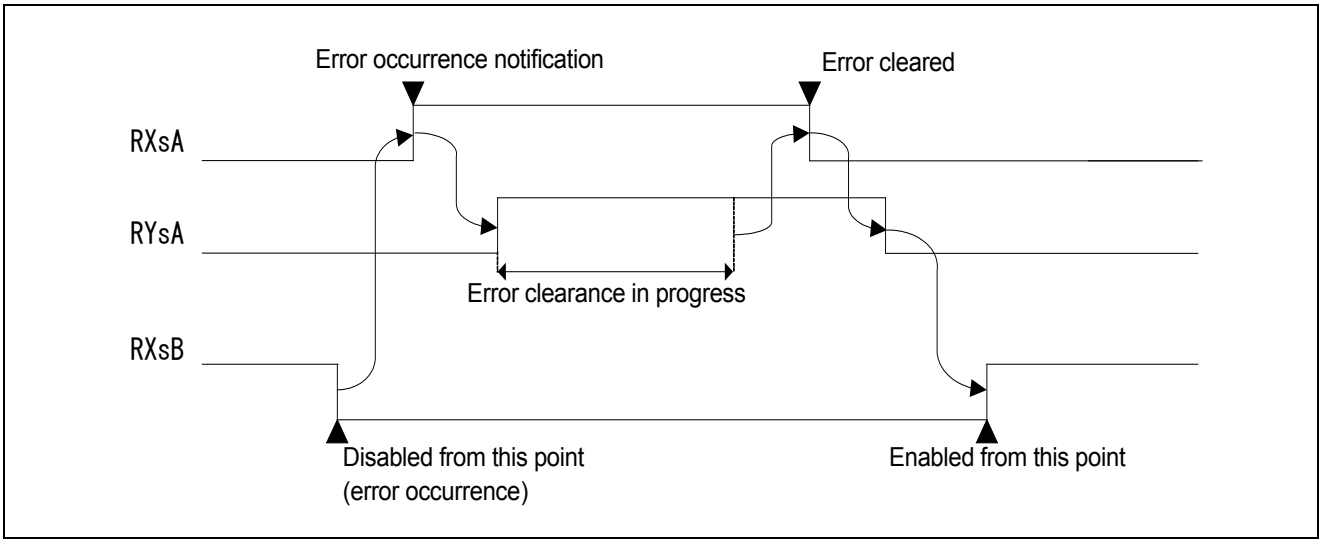


Figure 8.5 RXsA/RYsA (error status / reset request flag)

8.2 Remote register

The all areas of the remote registers of a remote device station are user-defined areas.

Note that m is a register number assigned to each remote station.

Table 8.1 Remote Registers

Link register	Signal name	Link register	Signal name
RWrm0	User-defined area	RWwm0	User-defined area
RWrm1		RWwm1	
RWrm2		RWwm2	
RWrm3	1 station occupied	RWwm3	1 station occupied
RWrm4		RWwm4	
RWrm5		RWwm5	
RWrm6		RWwm6	
RWrm7	2 stations occupied	RWwm7	2 stations occupied
RWrm8		RWwm8	
RWrm9		RWwm9	
RWrm10		RWwm10	
RWrm11	3 stations occupied	RWwm11	3 stations occupied
RWrm12		RWwm12	
RWrm13		RWwm13	
RWrm14		RWwm14	
RWrm15	4 stations occupied	RWwm15	4 stations occupied

9. Overview of CC-Link Ver. 2

This chapter explains the specifications necessary to design CC-Link remote device stations compatible with CC-Link Version 2.

This chapter describes only the contents related to Version 2 development. For detailed specifications regarding the CCS, see the other chapters.

【Hardware】

Since the hardware structure for CC-Link Version 2 is basically identical to that of Version 1, this document contains only the notes for development of CC-Link Version 2-compatible remote device stations.

【Software (Firmware)】

Protocol related to CC-Link Version 2 must be constructed in software (firmware). This document contains notes as well as sample flowcharts for developing CC-Link Version 2-compatible remote device stations.

9.1 Characteristics of CC-Link Ver. 2

9.1.1 Extended Cyclic

The capacity of cyclic data per station can be increased by using extended cyclic.

Table 9.1 Extended Cyclic

		Version 2	Version 1
Maximum number of links (Data volume)		RX/RY: 8192 bits RWw/RWr: 2048 words	RX/RY: 2048 bits RWw/RWr: 256 words
Number of links per machine (Data volume)	1 station occupied	RX/RY: 32 to 128 bits RWw/RWr: 8 to 32 words	RX/RY: 32 bits RWw/RWr: 4 words
	2 stations occupied	RX/RY: 96 to 384 bits RWw/RWr: 16 to 64 words	RX/RY: 64 bits RWw/RWr: 8 words
	3 stations occupied	RX/RY: 160 to 640 bits RWw/RWr: 24 to 96 words	RX/RY: 96 bits RWw/RWr: 12 words
	4 stations occupied	RX/RY: 224 to 896 bits RWw/RWr: 32 to 128 words	RX/RY: 128 bits RWw/RWr: 16 words
Number of occupied stations per machine		1 to 4	1 to 4
Extended cyclic setting		1×, 2×, 4×, 8× (1×[*1])	None

Caution When 1 setting is set in Version 2, the header information for extended cyclic does not exist, and frame and data amount are identical to Version 1.
Then, don't use 1 setting of Ver.2, use Ver.1 communication mode.

Table 9.2 Relationship between the number of occupied stations and extended cyclic setting in CC-Link Version 2

Stations	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
1× Setting	RX/RY: 32 bits RWw/RWr: 4 words	RX/RY: 64 bits RWw/RWr: 8 words	RX/RY: 96 bits RWw/RWr: 12 words	RX/RY: 128 bits RWw/RWr: 16 words
2× Setting	RX/RY: 32 bits RWw/RWr: 8 words	RX/RY: 96 bits RWw/RWr: 16 words	RX/RY: 160 bits RWw/RWr: 24 words	RX/RY:224 bits RWw/RWr: 32 words
4× Setting	RX/RY: 64 bits RWw/RWr: 16 words	RX/RY: 192 bits RWw/RWr: 32 words	RX/RY: 320 bits RWw/RWr: 48 words	RX/RY:448 bits RWw/RWr: 64 words
8× Setting	RX/RY: 128 bits RWw/RWr: 32 words	RX/RY: 384 bits RWw/RWr: 64 words	RX/RY: 640 bits RWw/RWr: 96 words	RX/RY: 896 bits RWw/RWr: 128 words

9.1.2 Less Occupied Stations

Table 9.3 Relationship between number of occupied stations and number of connected modules

No. of Occupied Stations	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
No. of connected modules of remote device station per master (note)	42 modules	32 modules	21 modules	16 modules

note. When the number of remote device stations connected is the same as the number of occupied stations.

Table 9.4 Version 1 and Version 2 No. of Occupied Stations / Amt. of Cyclic Data

	No. of Occupied Stations	Amt. of Cyclic Data
CC-Link Version 2	1 occupied station, quadruple setting	RX/RY: 64 bits RWw/RWr: 16 words
	1 occupied station, octuple setting	RX/RY: 128 bits RWw/RWr: 32 words
CC-Link Version 1	4 occupied stations	RX/RY: 128 bits RWw/RWr: 16 words

When the extended cyclic setting of a Version 2 system with 1 occupied station is “quadruple,” the number of bit data points handled is the same as that of a CC-Link Version 1 system with four occupied stations. When the setting is “octuple,” the amount of word data handled is the same as that of a CC-Link Version 1 system with four occupied stations.

It is therefore possible to realize the same amount of data using a lesser number of occupied stations and, consequently, increase the number of remote stations controlled by a single master station.

9.2 Overview of Protocol

9.2.1 Overview of Extended Cyclic Communication

"Extended Cyclic" to be added in Version 2 splits refresh data (RY, RWw) and response data (RX, RWr) into multiple link scans, and sends/receives data. The following shows a general description of the communication.

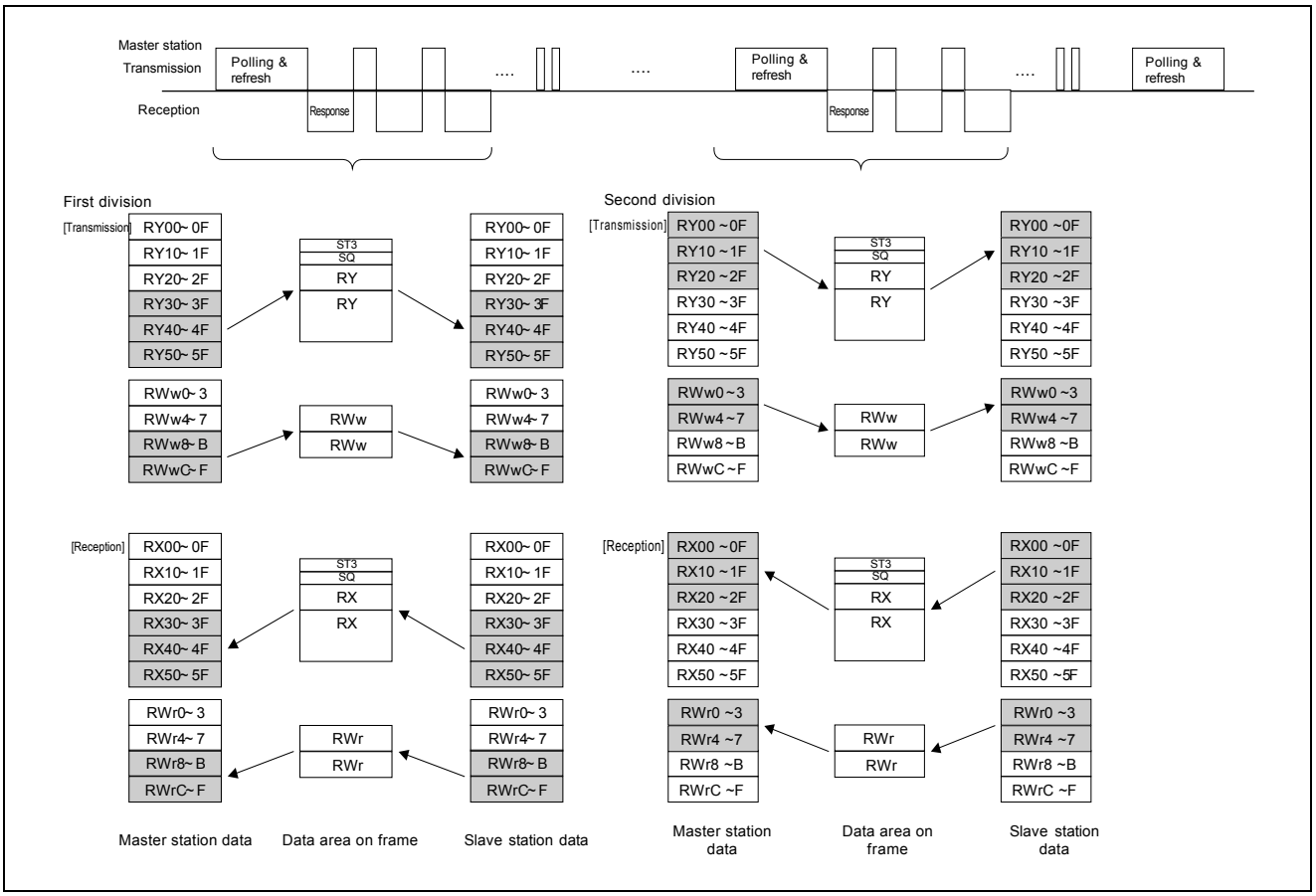


Figure 9.1 With 2 occupied stations and extended cyclic 2 × setting

9.2.2 Transmission of Own Station Information

CC-Link Version 2 uses bits ST1 and ST2 in the transmission frame, which were reserved in Version 1, to transmit protocol version information (master station→ slave station) and extended cyclic setting information (slave station→ master station).

Also, in the slave station test loopback data, highest 2 bits in the RV area are used for protocol version information (slave station→master station).

Table 9.5 Details of ST1 and ST2 in Version 2

Basic Frame Format

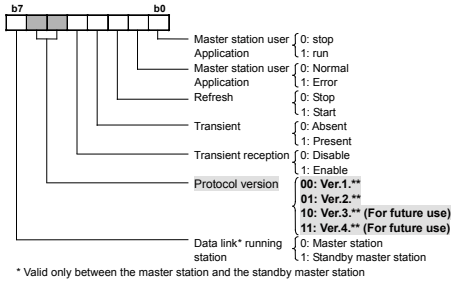
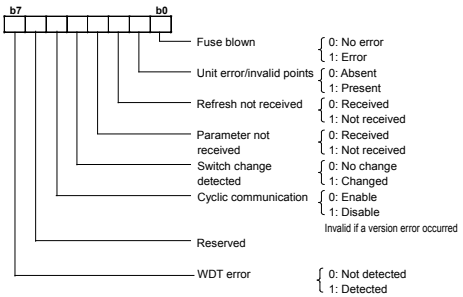
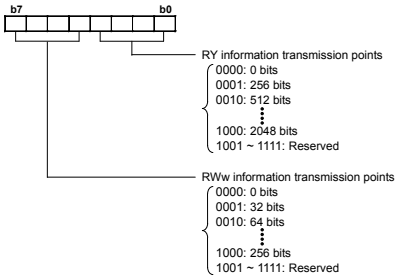
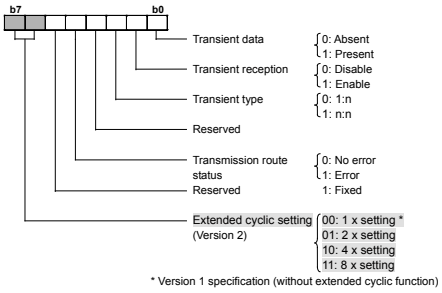
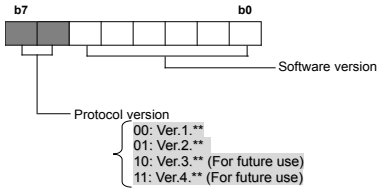
	Master station→Slave station	Slave station→Master station
ST1		 No changes since Version 1
ST2	 No changes since Version 1	

Table 9.6 Details of RV in Version 2

Slave station test loopback data

	Slave station→Master station
RV	

9.2.3 Extended Cyclic Header Information

In Version 2, header information provides for the handshaking between the master and slave stations for the divided data. The header information uses the first 16 bits of the data area in the transmission frame. This corresponds to the section in the frame used as RY00-0F and RX00-0F in Version 1. This frame section is now referred to as header information in Version 2, containing “ST3” and “SQ,” each of which consists of 8 bits. ST3 is reserved for future expansion and is not used in Version 2.

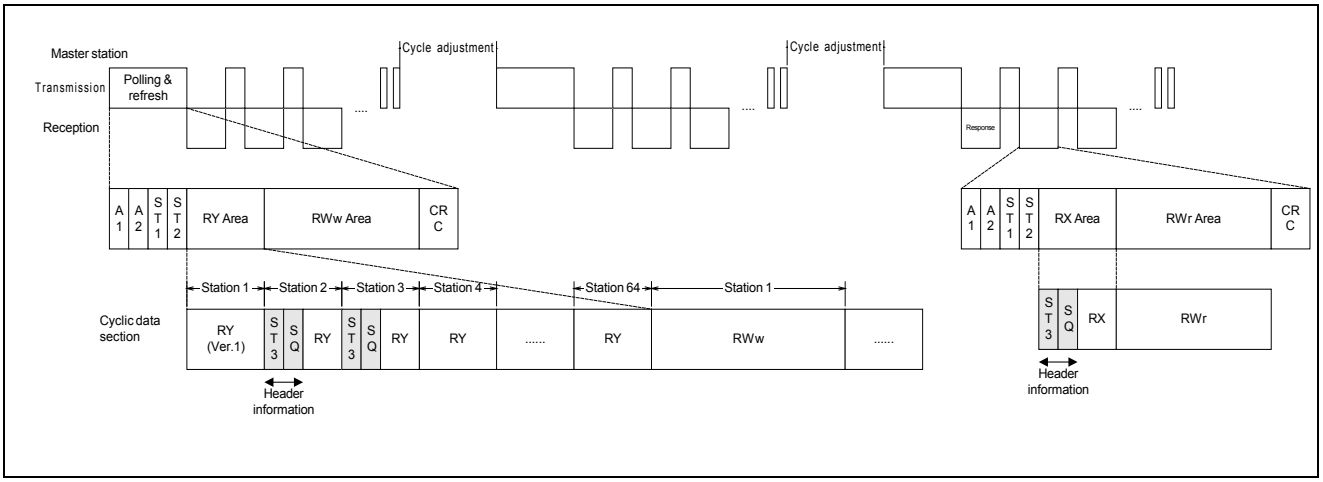


Figure 9.2 Extended Cyclic Header Information

(1) Details of SQ value

(a) M→R DATA

"Reception SQ": This indicates the order of data transmitted from the master station.

"Loopback SQ": This is loopback information containing the SQ value transmitted in the previous Remote station to Master station transmission. The reception status of the master station can be monitored by checking the continuity of this data.

If a reception error by the master station is detected, it is possible to resend the data again from the first packet. (The resending of data from the first packet function is optional and is not required.)

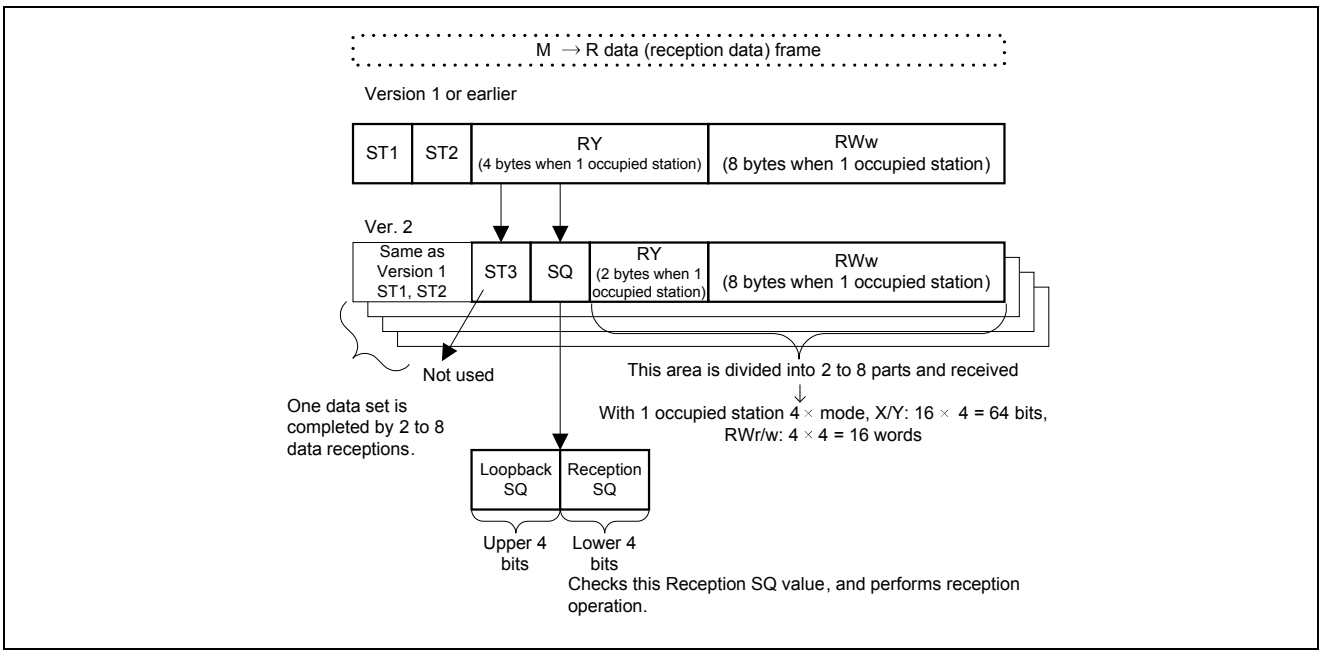


Figure 9.3 Details of SQ value (M→R data)

(b) R→M DATA

"Transmission SQ": This indicates the order of data transmitted to the master station.

"Loopback SQ": This is loopback information containing the SQ value received in the previous Master station to Remote station transmission. The master station monitors this data as the remote station's reception status. If the continuity of this loopback SQ value is lost, the master station decides that the remote station is not receiving data correctly, and retransmits data starting from SQ (Number of divisions – 1).. Since the master station checks the loopback SQ value for remote station reception continuity, this SQ loopback function is mandatory on remote stations.

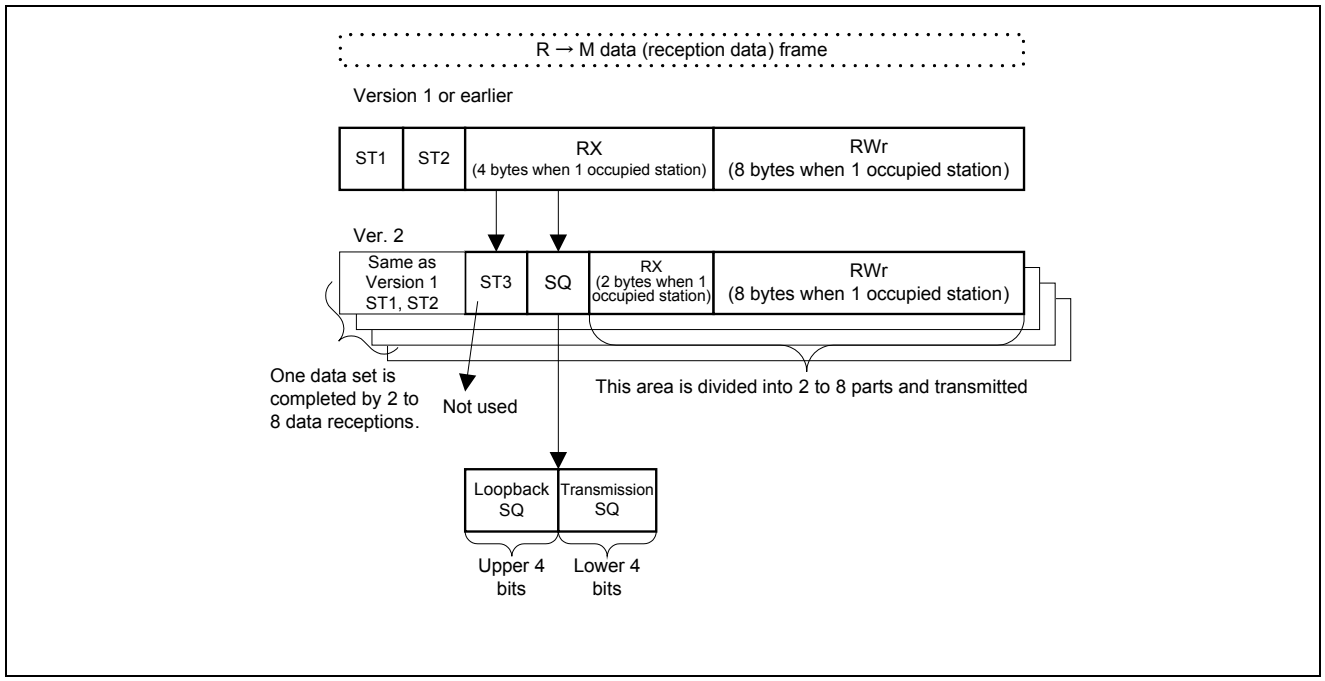


Figure 9.4 Details of SQ value (R→M data)

Split transmission:Transmission starts with the [(Transmission SQ number of Divisions) –1], and is decremented until it becomes 0. This indicates the end of split transmission. The loopback SQ number will contain the received and acknowledged Transmission SQ number.

Split reception:The split reception data is recombined when the transmission SQ number equals zero. Continuity of the SQ numbers is checked. (Redundant receptions are discarded.)

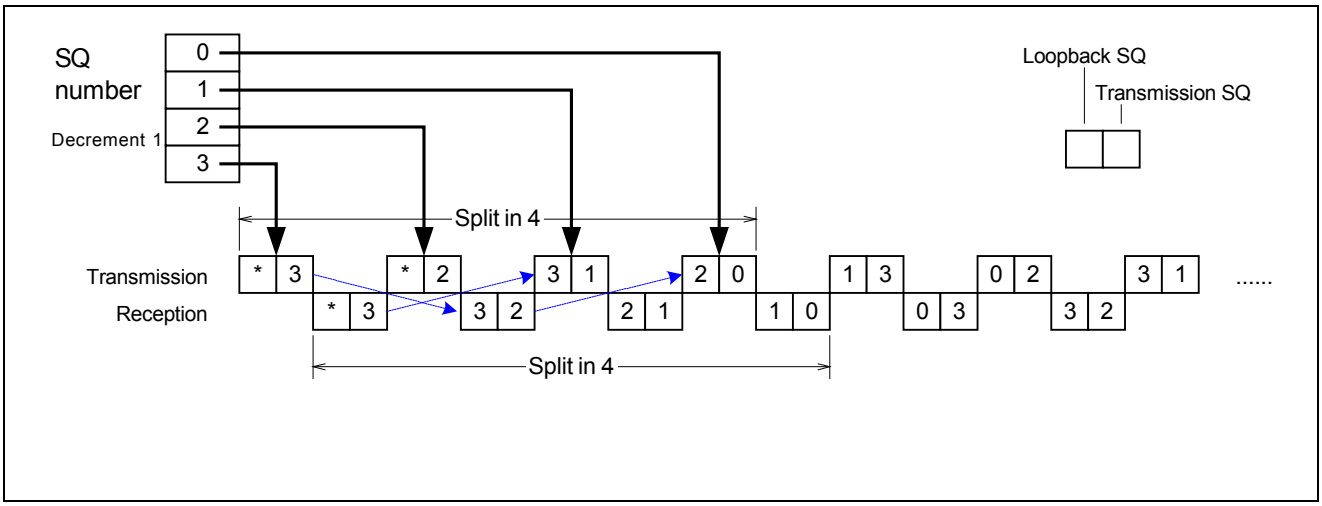


Figure 9.5 Details of SQ value(loopback)

9.3 Relationship between SQ Values and RX/RY, RWr/RWw

The relationship between SQ values and RX/RY or RWr/RWw is shown below.

【Example with 2 occupied stations at 4× setting】

The SQ values are transmitted and received in the descending order. Furthermore, the transmitted/received message content (RX/RY and RWr/RWw) is stored in the descending order.

Table 9.7 Relationship between SQ Values and RX/RY, RWr/RWw

Reception SQ=3	RY90 ～ RYBF	RWw+18
		RWw+19
		RWw+1A
		RWw+1B
		RWw+1C
		RWw+1D
		RWw+1E
		RWw+1F
Reception SQ=2	RY60 ～ RY8F	RWw+10
		RWw+11
		RWw+12
		RWw+13
		RWw+14
		RWw+15
		RWw+16
		RWw+17
Reception SQ=1	RY30 ～ RY5F	RWw+8
		RWw+9
		RWw+A
		RWw+B
		RWw+C
		RWw+D
		RWw+E
		RWw+F
Reception SQ=0	RY0 ～ RY2F	RWw+0
		RWw+1
		RWw+2
		RWw+3
		RWw+4
		RWw+5
		RWw+6
		RWw+7

Transmission SQ=3	RX90 ～ RXBF	RWr+18
		RWr+19
		RWr+1A
		RWr+1B
		RWr+1C
		RWr+1D
		RWr+1E
		RWr+1F
Transmission SQ=2	RX60 ～ RX8F	RWr+10
		RWr+11
		RWr+12
		RWr+13
		RWr+14
		RWr+15
		RWr+16
		RWr+17
Transmission SQ=1	RX30 ～ RX5F	RWr+8
		RWr+9
		RWr+A
		RWr+B
		RWr+C
		RWr+D
		RWr+E
		RWr+F
Transmission SQ=0	RX0 ～ RX2F	RWr+0
		RWr+1
		RWr+2
		RWr+3
		RWr+4
		RWr+5
		RWr+6
		RWr+7

10. Sample Flowchart for CC-Link Version 2

10.1 List of Modules and Variables

(1) INT_CCV2: Initial processing

Variable Name	Application
CC20_RECEIVE	Indicates that reception is complete
CC20R_DONE	Indicates that a single data reception is complete
CC20S_DONE	Indicates that a single data transmission is complete
R_ZEN_SQ	Previously received Reception SQ value
R_NOW_SQ	Currently received Reception SQ value
S_ORI_SQ	Loopback SQ value to be transmitted next
S_NOW_SQ	Transmission SQ value to be transmitted next
R_ZOR_SQ	Previously received loopback SQ value

CCS Register/Port	Application
CCS_M3SDOK_RDRQ	CCS offset address 80h (Send data write complete flag)
RDENL	Reception ready flag

(2) CCS_REFSTB: Interrupt processing

Variable Name	Application
CC20_RECEIVE	Indicates that reception is complete

CCS Register/Port	Application
CCS_M3SDOK_RDRQ	Send data write complete flag（400F B080H）

(3) ITIM:1ms Interrupt processing

Variable Name	Application
CC20_RECEIVE	Indicates that reception is complete

CCS Register/Port	Application
CCS_M3SDOK_RDRQ	end data write complete flag（400F B080H）
CCS_REFSTB	CCS_REFSTB signal for the CCS

(4) ICCV20: Transmission/reception processing

Variable Name	Application
CC20_RECEIVE	Indicates that reception is complete
CC20R_DONE	Indicates that a single data reception is complete
CC20S_DONE	Indicates that a single data transmission is complete
R_ZEN_SQ	Previously received Reception SQ value
R_NOW_SQ	Currently received Reception SQ value
S_ORI_SQ	Loopback SQ value to be transmitted next
S_NOW_SQ	Transmission SQ value to be transmitted next
R_ZOR_SQ	Previously received loopback SQ value

CCS Register/Port	Application
CCS_M3SDOK_RDRQ	Send data write complete flag（400F B080H）
CCS_M3MRST1_ST2	M→R status information（400F B008H）
M3RM_SSQ	CCS offset address 8Bh（R→M SQ）（400F B08BH）
M3MR_SSQ	CCS offset address 0Bh（M→R SQ）（400F B00BH）
CCS_MWRENL_RCEX	Receive data update information（400F B000H）

(5) CHK20DONE:（Application work area transfer processing module）

Variable Name	Application
CC20R_DONE	Indicates that a single data reception is complete
CC20S_DONE	Indicates that a single data transmission is complete

10.2 Initial Setting INT_CCV20

After initial setting completion, execute Section 10.3“Transmission/Reception Processing.”

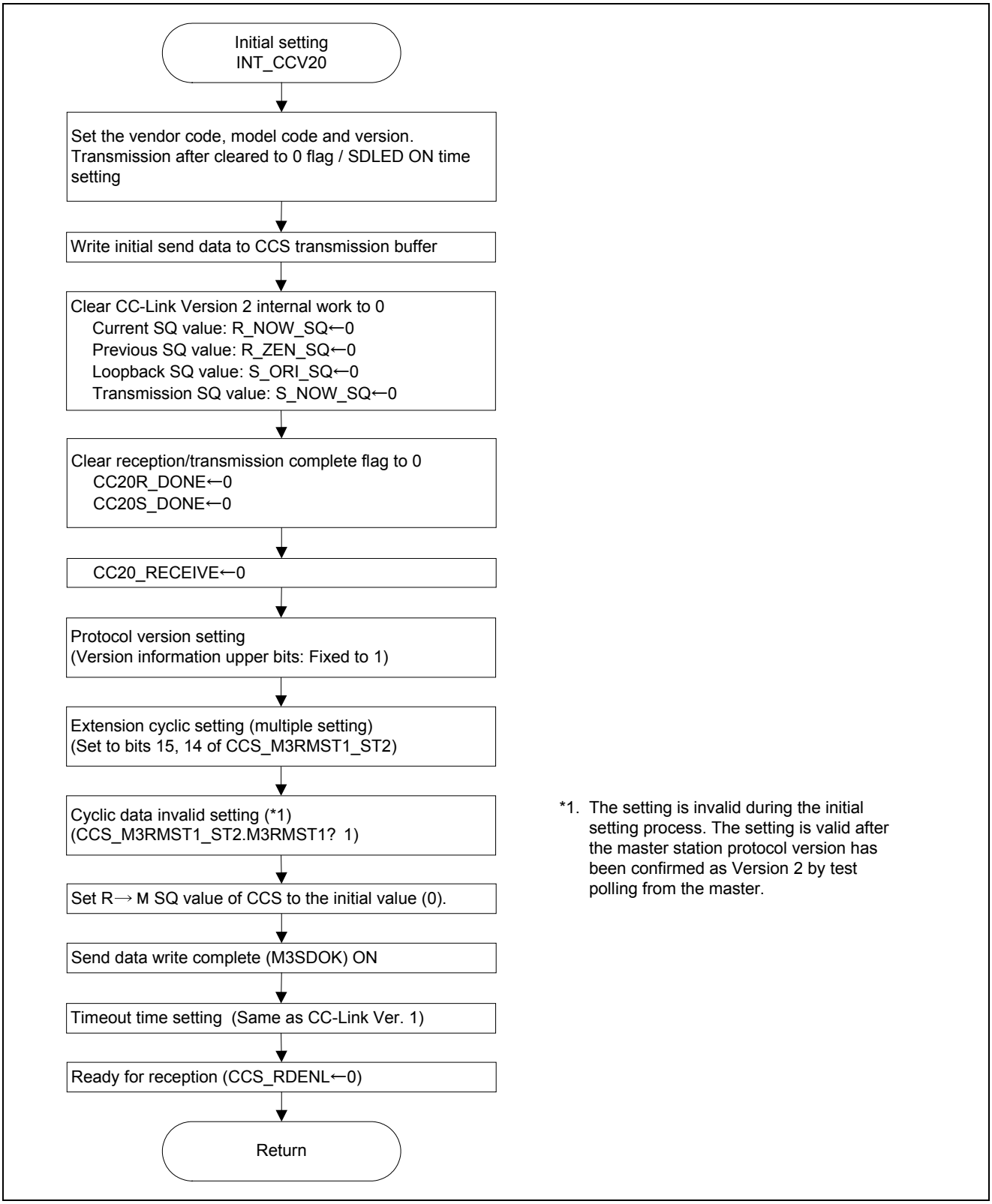


Figure 10.1Initial Setting INT_CCV20

10.3 Transmission/Reception Processing

10.3.1 Example Using an Interrupt (CCS_REFSTB Signal)

The following shows an example of transmission/reception processing in CC-Link Version 2 that utilizes an interrupt at the rising/falling of the CCS_REFSTB signal of the CCS.

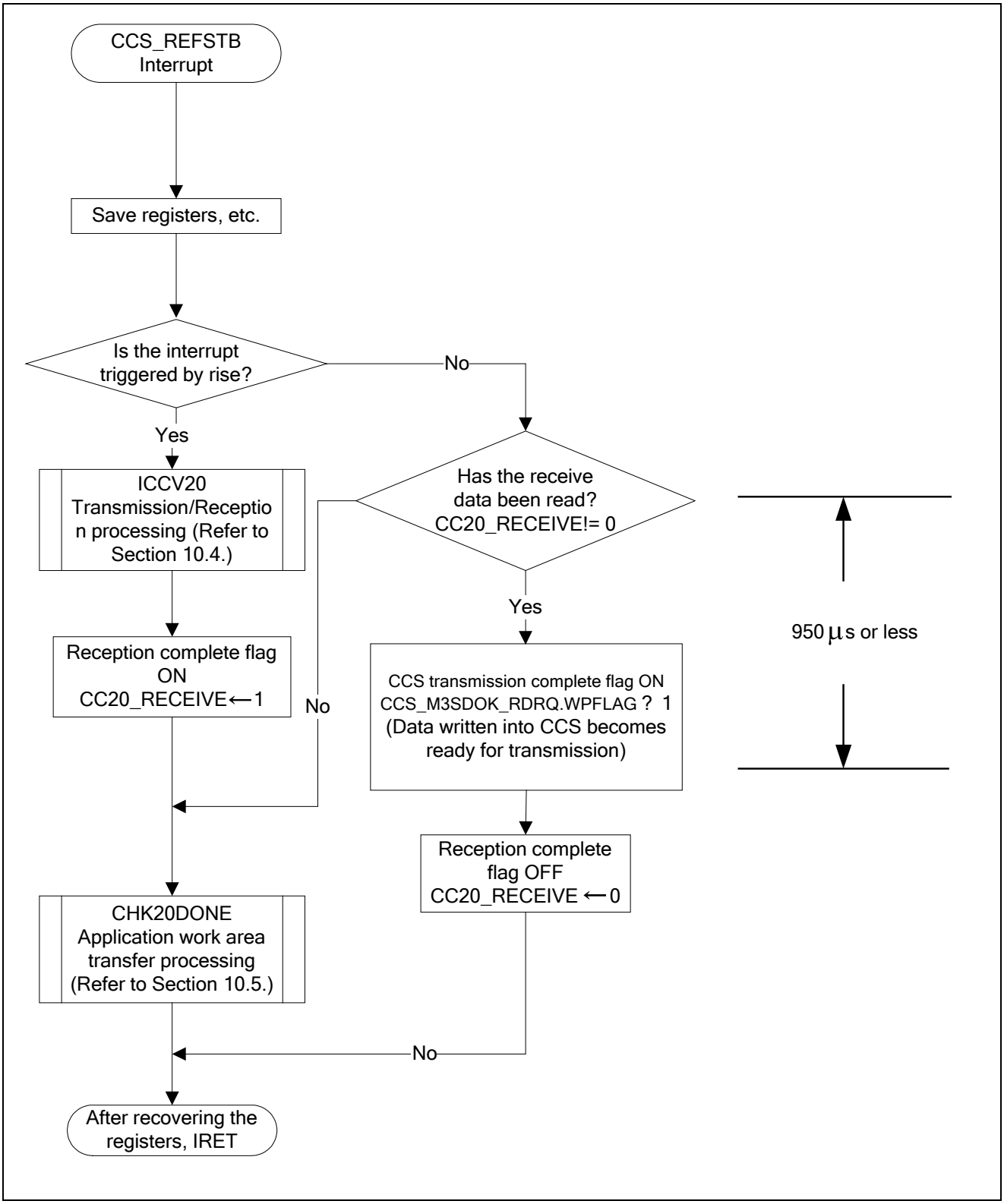


Figure 10.2Transmission/Reception Processing Using Interrupt (CCS_REFSTB signal)

10.3.2 Example of Polling

The following shows an example of transmission/reception processing in CC-Link Version 2 that performs polling processing at an interval of 1ms or less using a timer. The processing in the two areas enclosed by dotted lines are identical. In this example, "transmission SQ" and "loopback SQ" can be transmitted/received without fail by polling before and after the polling interval, assuming that the processing time within the unit is constant.

Polling condition: When using polling, execute the processing so that incompletion does not occur even with the shortest link scan time.
The shortest link scan time is the time required for one remote device station (1 occupied station) to be connected to the master station (transmission speed 10Mbps). Since the fastest link scan time at this point is approx. 1.1ms, polling must be done at intervals of 1ms or less.

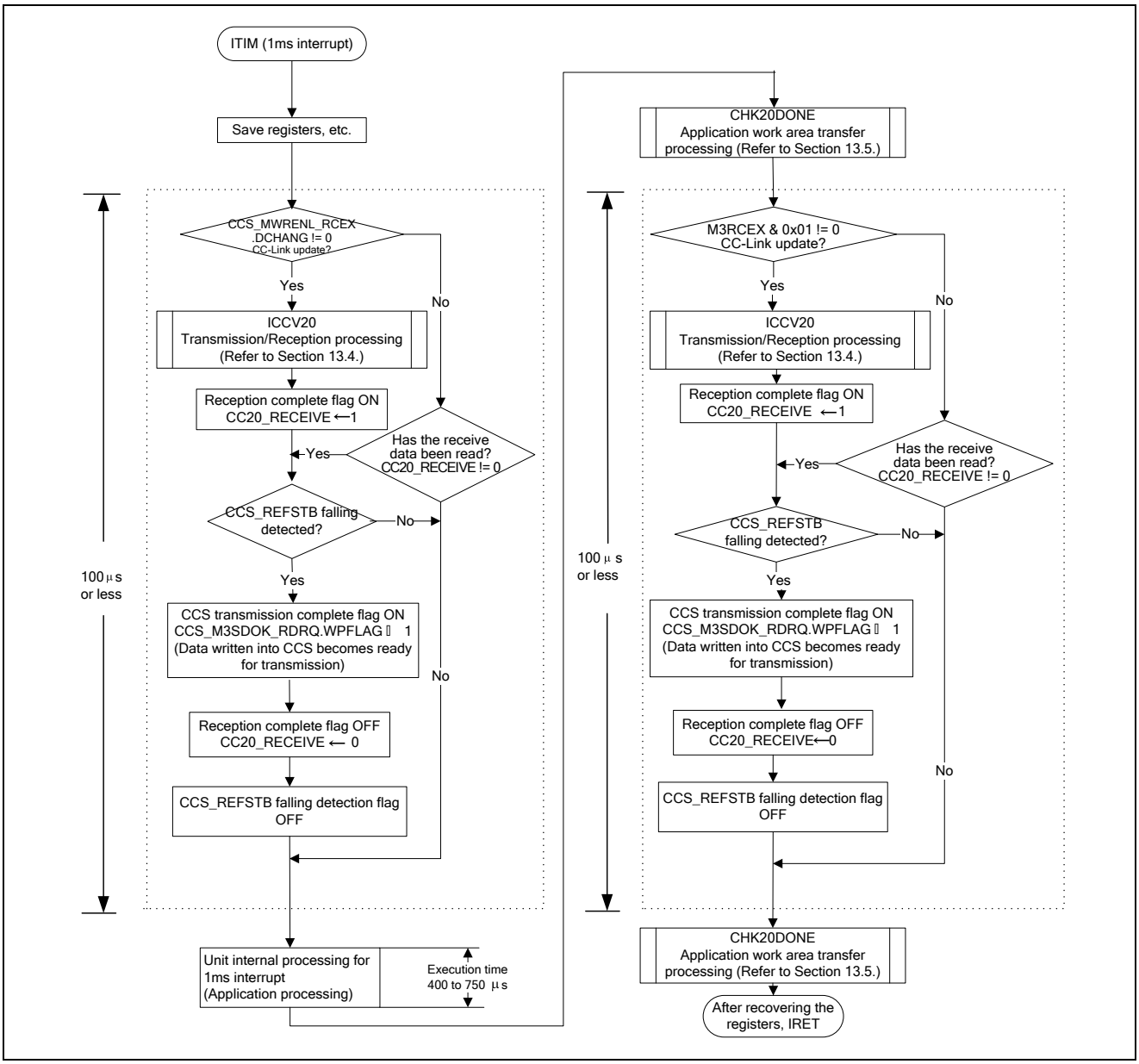


Figure 10.3Transmission/Reception Using Polling

10.4 Transmission/Reception Processing Module (ICCV20)

The following indicates the processing called during interrupt or polling based transmission/reception processing.

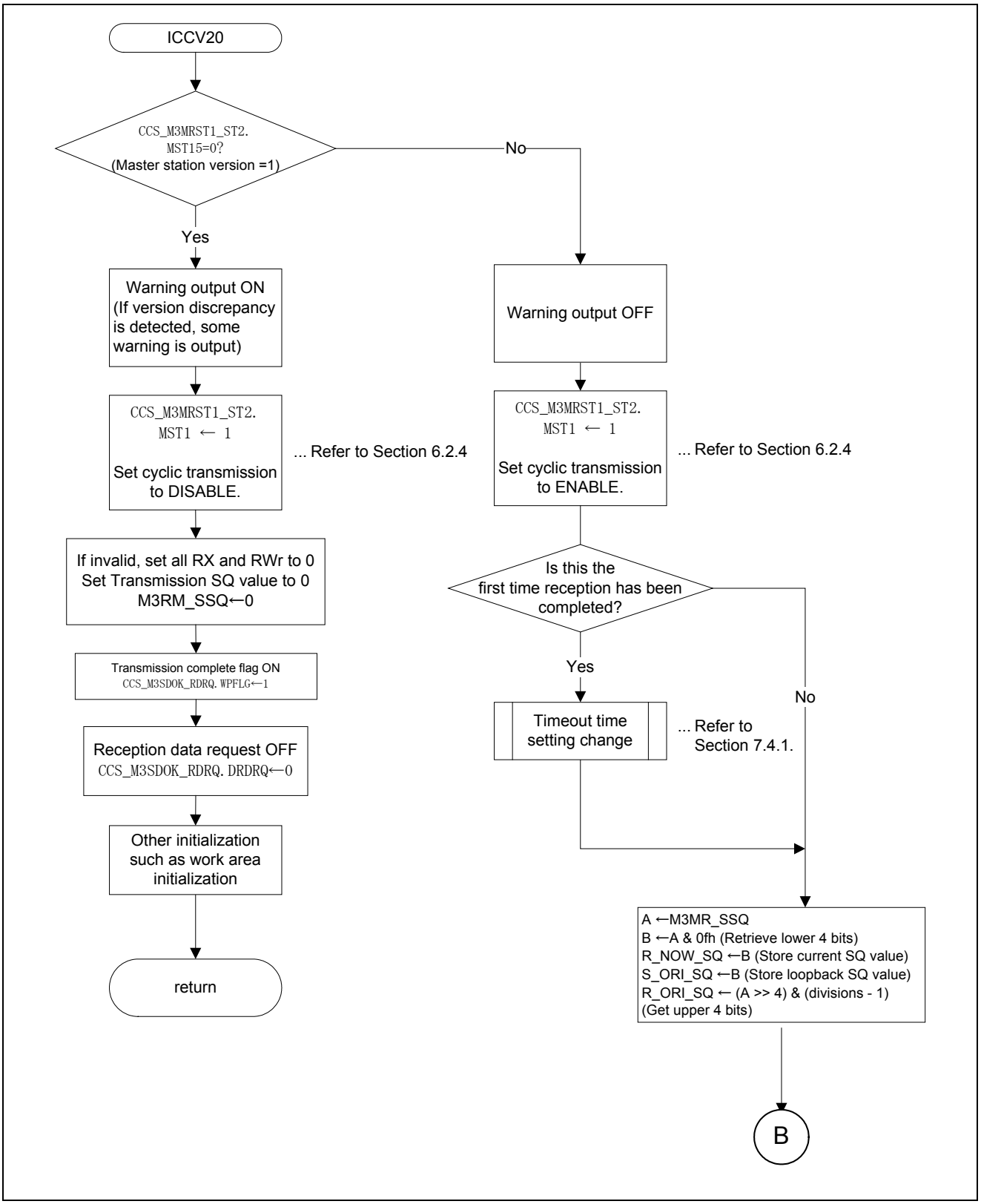


Figure 10.4Transmission/Reception Processing Module (ICCV20)

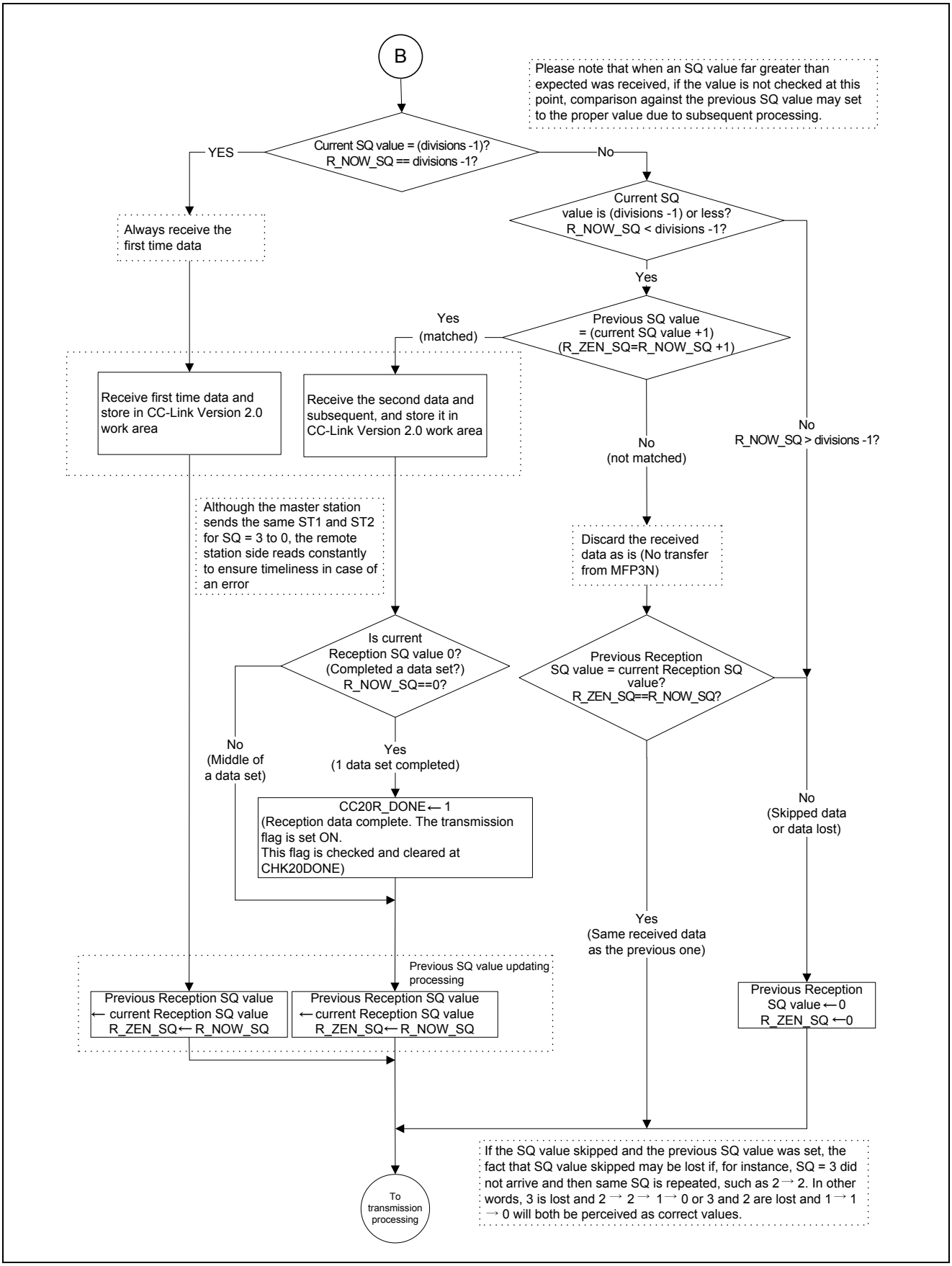


Figure 10.5Transmission/Reception Processing Module ICCV20 (Continued 1)

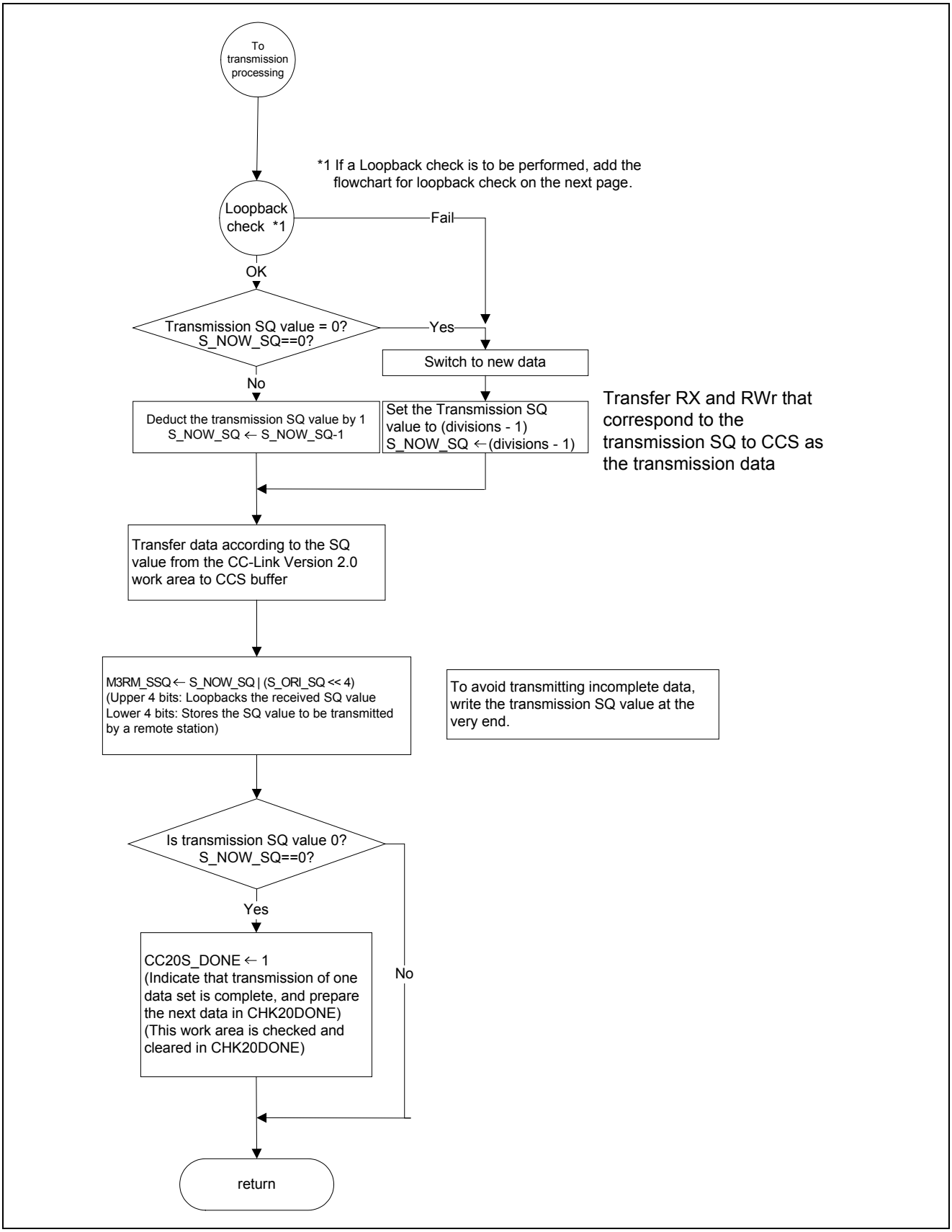


Figure 10.6Transmission/Reception Processing Module ICCV20 (Continued 2)

Transmission/Reception Processing Module ICCV20 (Continued 3)

This processing checks the loopback SQ and decides whether or not retransmission is to be performed.

Point	[Loopback check]
Implement this processing in the 8x expanded cyclic setting mode. □(The process does not need to be implemented when the expanded cyclic setting is 4x or less.)	

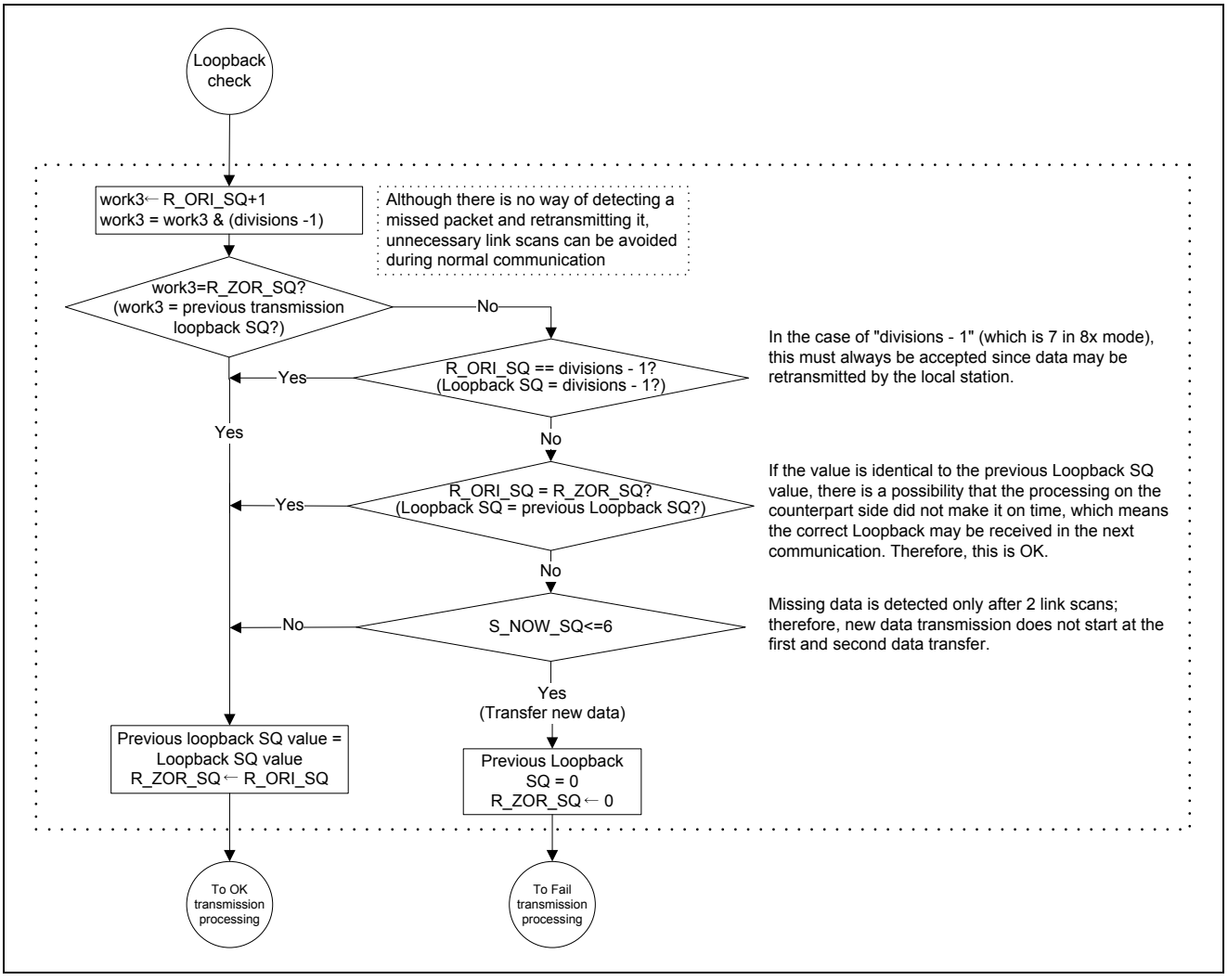


Figure 10.7Transmission/Reception Processing Module ICCV20 (Continued 3)

10.5 Application Work Area Transfer Processing Module CHK20DONE

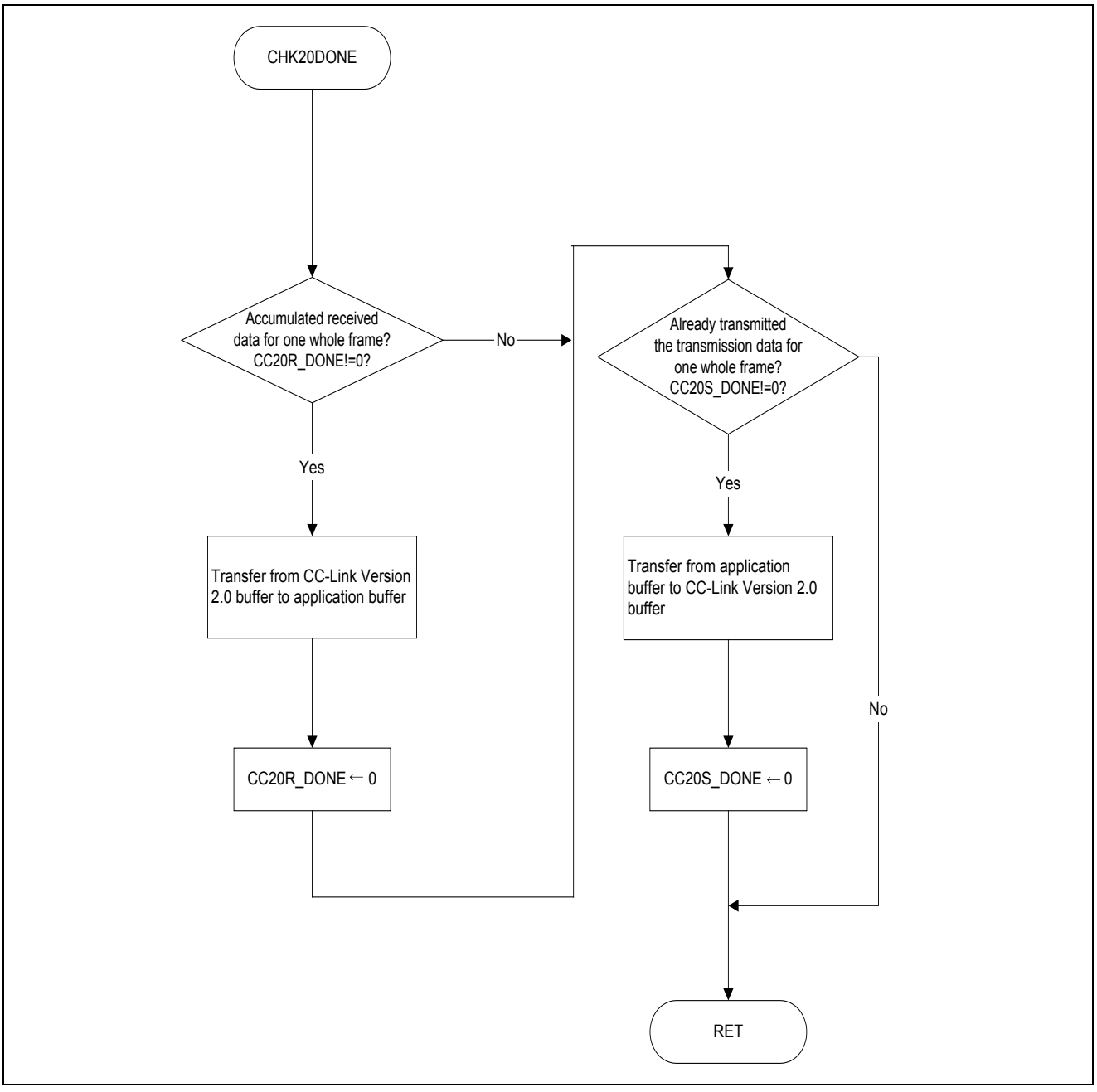


Figure 10.8Application Work Area Transfer Processing Module CHK20DONE

11. Notes on Developing with CC-Link Version 2

11.1 Hardware

Basically, hardware structures for Versions 2 and 1 are the same. Nonetheless, please note on the following points.

(1) Version 2 work area

When in the Extended Cyclic setting (nx), data is transmitted/received by dividing it into n packets. Therefore, it is necessary to store the data for n packets in a memory buffer and read/write all the data together. To avoid losing part or all of the data, design the buffer in a way that all data packets for n transmissions/receptions can be read or written in one operation.

(2) Switching

Though this is unnecessary for Version 2-dedicated remote device stations, if both Version 2 and Version 1 protocols are to be supported, a switch may be required in order to toggle between Version 2 and Version 1.

(3) Polling processing

To avoid missing a Transmission SQ from the master station, polling processing must be performed at an interval less than 1ms. To achieve this, the CCS_REFSTB interrupt signal can be used, or an interrupt can be initiated by a timer, etc.

→ For details, see Section 10.3 “Transmission/Reception Processing.”

(4) Transmission processing

In Version 1, writing to CCS transmission buffer could be done at any time, but in Version 2, the timing of writing to the transmission buffer is critical. All of the polling processing described above needs processing to validate the data written after turning ON the CCS transmission data write complete (offset address 0080h: M3SDOK) after triggered by the falling of the CCS_REFSTB signal. Therefore, design the hardware so that it can positively detect the falling of the CCS_REFSTB signal. For example, use an MPU that can handle interrupt triggers or embed the falling of the CCS_REFSTB signal into an interrupt using external logic.

→For details, see Section 11.3 "Write Timing at Transmission."

11.2 Software (Firmware)

Since the CCS does not include any protocol related to Version 2, such protocol must be written into the software (firmware). The following describes the items to be developed.

(1) Master station version checking

At the time of normal reception, check bits 5, 6 "Protocol Version" of CCS_M3MRST1_ST2 register.

If the protocol version is Version 1, set M3RMST1 bit "Cyclic communication" of CCS_M3RMST1_ST2 register to disable.

(2) Reception processing

The timing of RY/RWw data read is the same as that of Version 1.

For example, when the extended cyclic setting is quadruple, the SQ values are received four times in the order of 3→2→1→0.

The four segments of RY/RWw data are treated as one set of data.

(3) Loopback checking at reception (optional)

If the loopback SQ values are monitored and continuity is broken, new data is transmitted from the beginning. Except for 8× setting, transmitting new data from the remote side is less effective (transmission delay time actually becomes greater), so exercise caution during implementation.

(4) Loopback processing at transmission

Loop back the SQ values received from the master station at the time of transmission.

The master station checks the continuity of the looped back SQ values, and if the continuity is broken, assesses that the data was not transmitted normally, aborts the current data transmission and sends new data.

At the time of transmission, normal data will not be sent from the master station unless the SQ values have been processed. Be sure to loop back all reception SQ values without fail.

11.3 Write Timing at Transmission

Completing the processes (1) and (2) described below in a period of time between the rising of a CCS_REFSTB signal and the rising of a next CCS_REFSTB signal serves to maintain the continuity of the looped back SQ values.

If the continuity of the looped back SQ values is broken, the master station will assess that the slave station has not correctly received the data and then send data in packets from the beginning again. Therefore, be sure to complete the processes (1) and (2) within the time between the rising of a CCS_REFSTB signal and the rising of a next CCS_REFSTB signal.

(1) After confirming the completion of reception processing by the rise of a CCS_REFSTB signal, set the received SQ from the master station as a loopback SQ and then writes the send data (from [fraction number – 1] to 0) to the update buffer sequentially.
(The CCS_REFSTB signals should rise when refresh data is received during refresh & single station polling.)

(2) After completing the process (1), check the falling of a CCS_REFSTB signal and then turn ON the send data write complete (CCS_M3SDOK_RDRQ).
(CCS_REFSTB signals should fall after a refresh cycle has been completed).
With the process (2) above, what is stored in the CCS update buffer will be transferred to the send buffer to be used for transmission and then sent to the master station in the next polling.

The period of time between the rising of a CCS_REFSTB signal and the rising of a next CCS_REFSTB signal corresponds to a single link scan time. Therefore, the processes (1) and (2) need to be completed even for a system configuration with the shortest link scan time (note).

note. System configuration with the shortest link scan time
・Transmission rate: 10 Mbps
・Slave station: A single remote device station (the number of stations occupied: 1)
(For the system configuration described above, the link scan time is about 1.1 ms).

In summary, the transmission rate of looped back SQ values should satisfy the following three conditions:

- Process (1) + Process (2) ≦ Shortest link scan time (about 1.1 ms)
- Process (1) should take place after the rising of a CCS_REFSTB signal.
- Process (2) should take place after Process (1) has been completed and after the falling of the CCS_REFSTB signal.

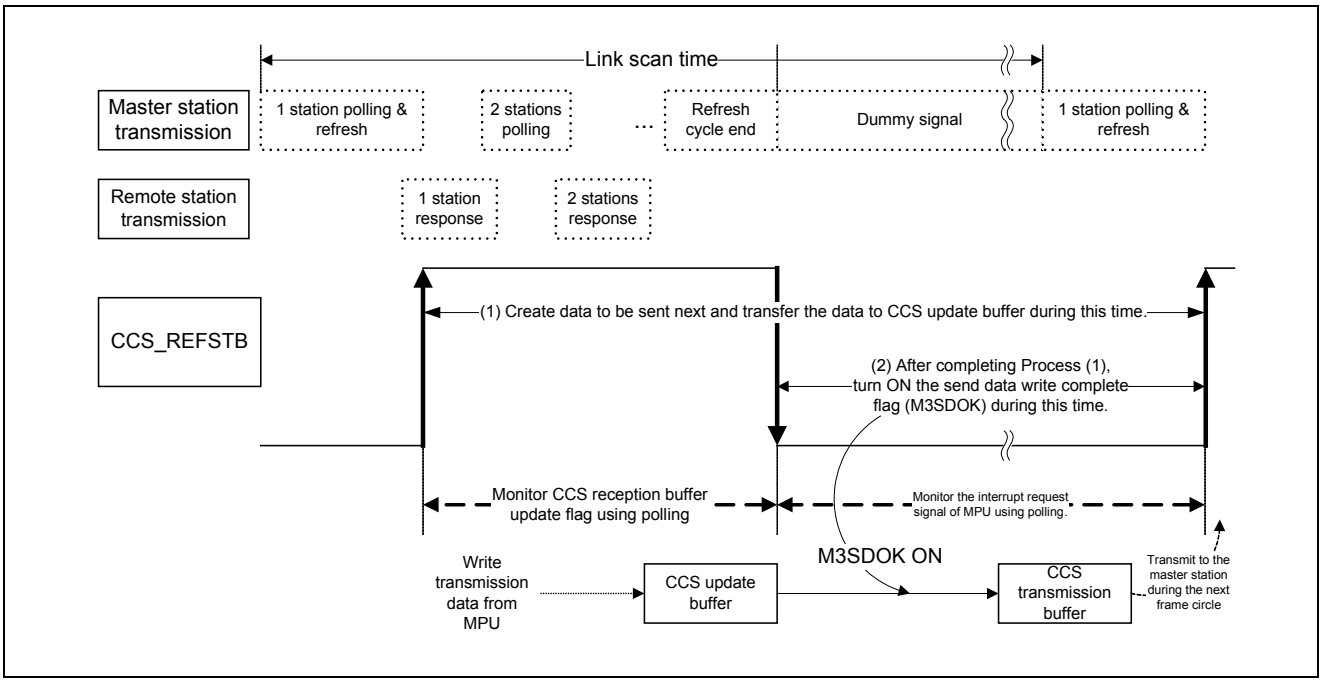


Figure 11.1Link Scan Time and CCS_REFSTB Signal Change

11.4 Handling CC-Link Version 2 Work Area

When the extended cyclic setting is the multiple n, ensure that data is transmitted and received between the Version 2 work area and CCS every link scan. The data communicated between CCS and the master station must be updated every link scan.

[1] Write application work area data (RX/RWr) to be transmitted from the remote device station to the master station to the Version 2 work area in n segments.
[2] When writing data from the Version 2 work area to CCS, be sure to divide and transfer the data to CCS every n link scans.
[3] When reading the data (RY/RWw) to be received from CCS to the Version 2 work area, from the master station to the remote device station, be sure to divide and transfer the data to CCS every n link scans.
[4] When transferring data from the Version 2 work area to the application work area, hold the data of the n link scans.

To guarantee data integrity between the master station and remote device stations, make sure the hardware design follows the structure below. (A memory size that supports the multiple n extension is required.)

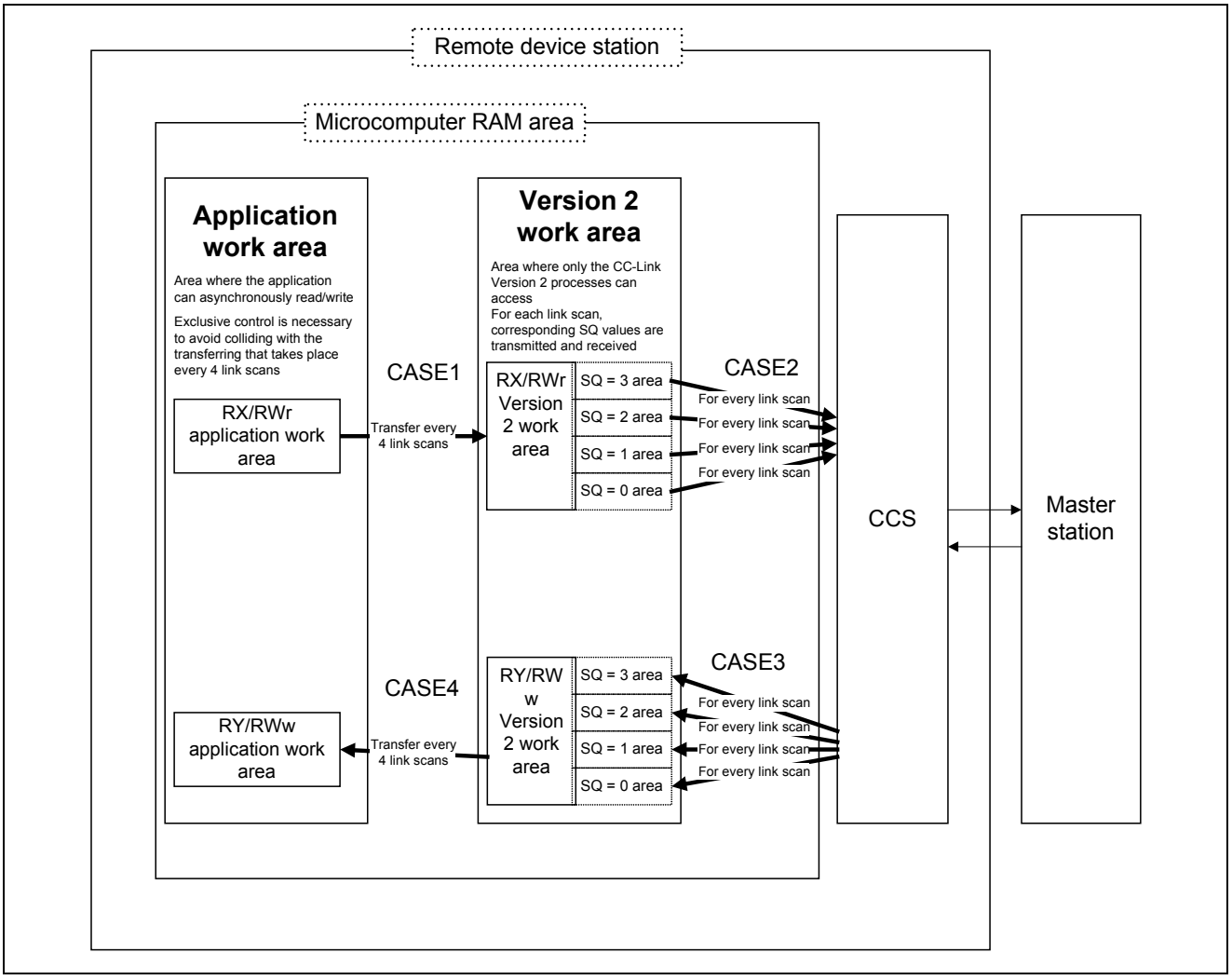


Figure 11.2Example of 4x setting

12. Questions & Answers

12.1 Circuit Design in General

(1) Questions and answers related to specified parts

	Question	Answer
1	Is it mandatory to use CC-Link specified parts? Can they be substituted with other parts with the same specifications?	The specified parts are essential to maintaining the performance of CC-Link; please use the specified parts.
2	While it is specified to use the RD6.2Z-T2B Zener diodes, can we use -T1B rather than -T2B?	The RD6.2Z-T1B can also be used. The RD6.2Z-T2B and -T1B Zener diodes are, in fact, the same Zener diode products; the only difference is the direction of the device taping of the mold packaging. There is thus no problem in using RD6.2Z-T1B.

(2) Questions and answers related to LEDs

	Question	Answer
1	Are any colors specified (or recommended) for the transmission monitor LEDs?	There is no special specification. We use red LEDs for our units. With the products by other manufacturers, the most frequently used colors seem to be red for the ERR LED only and green for other LEDs.
2	In the circuit example, four LEDs (RUN, ERRL, SDLED, and RDLED) are used for displaying the status. Is it all right to use only two LEDs (RUN and ERRL)?	It is recommended to use four LEDs whenever possible to monitor the link status. However, if this is not possible due to the mounting conditions, etc., it is all right not to use them.
3	Are there any limitations on the size of characters printed on LED displays and panels?	There are no limitations on the size of characters printed on the LED displays and panels.

(3) Questions and answers related to switches, connectors, and terminal blocks

	Question	Answer
1	Does it pose any problems if we place the switches for setting the station number and the baud rate (rotary switch) in a place other than on the panel surface? We are planning to place the station number setting switch on the rear surface (installation surface) and the baud rate setting switch on the bottom surface of the station.	There are no restrictions on the switch layout. If it is difficult to place a group of the setting switches at one place, place them in different locations.
2	Regarding the setting of the station number We are planning to fix the station number instead of using a rotary switch. Does this specification pose any problems?	Station number setting is mandatory. This is because if the customer cannot set the station number freely, it may not be possible to configure a system. It is, however, all right to use dip switches or software processing instead of a rotary switch.
3	We want to install a communication connector (RS485) on the bottom surface of the station. Does this pose any problems? (We will make it possible to insert and remove the connector.)	It is all right to layout the connector as you like.
4	There is no specification for the external form. Can we decide the following as we like? [1] The shape, layout, color, and size of the LEDs [2] The type of connectors (we are considering the use of Conbicon connectors made by Phoenix.) [3] The size and type of rotary and dip switches (we are considering the use of S-3011A switches made by Copal.)	There is no specification for parts except the specified parts. [1] Any design can be used for the LEDs. [2] Use 2-piece connectors. If 2-piece connectors cannot be used, please specify in your manual that this product cannot be replaced in the link operation status (without shutting down the entire link). (Online connection and disconnection are not possible.) [3] Any design can be used for the switches.

12.2 Software

(1) Questions and answers related to initial processing

	質　問	回　答
1	We have a question about the initial setting in the sample flowchart (Note 3). Should the RS485 reception enable signal be set to H only at initialization?	Set it to H at initialization, and keep it high afterwards.
2	We perform the following software processing for the initial processing. Word address ①CCS_M3VENDORCODE＝0x0119 ②CCS_M3MODELCODE_VERSION ＝0x0120 ③CCS_M3SDLED_TOVER＝0xf200 ④CCS_M3SDLED_TOVER＝0xf2f0 ⑤CCS_M3SDOK_RDRQ＝0x0101 However, in step 5 above, SDLED is not lit even though the WRFLG bit is set to 1 (there is no output from the SD terminal of the CCS, either. It maintains the H level). If CCS_M3SDOK_RDRQ register is read after this, the value 0x0100 has been stored. This means that the transfer to the send buffer must have been completed. (Are we correct in thinking so?)	When the CCS_M3SDOK_RDRQ.WPFLG bit is set to 1, data is transferred between the double buffers for transmission (send buffer and update buffer). During the transfer, the MWRENL send data write enable information ofCCS_MWRENL_RCEX.MWRENL is set to 1. CCS_M3SDOK_RDRQ.WRFLG and CCS_MWRENL_RCEX.MWRENL are set to 0 when the transfer from the send buffer to the update buffer is completed. No data is transmitted from the CCS (causing SDLED to be lit) unless polling data from the master station is received. If data was read after the CCS_M3SDOK_RDRQ.WRFLG bit was set to "1" and the bit is changed to "0," the data transfer from the send buffer to the update buffer has been completed.
3	Which takes priority, an initial processing request or error status request? (Assuming a request is generated while another request is being processed)	As a general rule, priority should be given to error status requests. However, this rule does not apply if it would cause deadlock in the operation of the developed device. Please specify the operation in the operation manual in such cases.
4	The specifications indicate that initialization of initial settings occurs in the order of RX information followed by RWr information. In the asynchronous write method flowchart, however, the specifications indicate that the settings are to be written in the order of RWr → RX.　Can initialization be performed in the order of RWr → RX as well?	During initialization, RX and RWr information may be initialized in either order.
5	Do we need to verify the transmission data enable signal of RX and RWr information initial settings during initialization?	The data link is not established during RX and RWr information initialization; there is no need to verify the signal.

(2) Questions and answers related to reception enable

	Question	Answer
1	What does reception enable mean? Are there any operations necessary for the CCS?	Reception enable means allowing RS485 to receive data. There are no operations necessary for the CCS.
2	The specifications describe a precaution on RS485 transceiver reception as "the receive enable pin of the RS485 transceiver is controlled." Are there any particular points to note, such as timing?	Enable the transceiver reception after enabling transmission during the initial settings. It can be kept enabled afterwards.
3	In the circuit example in the specifications, the MPU port output is connected to the RDENL line connected to the RS485 transceiver. Under what circumstances might the communication input be disconnected? If it is not necessary to disconnect it, we would like to connect the MPU port output to GND.	Data reception from the master station should be disabled until the initial processing is completed (the communication input is disconnected). The reception should then be enabled after the initial processing is completed. After that, it is not necessary to disable the reception. Since it is necessary to disable the reception before the initial processing is performed, make sure to use the MPU port output; do not connect the MPU port output to GND.

(3) Questions and answers related to version and model code

	Question	Answer
1	Which version should be written to byte address 85h of the CCS? Is it the version on the user side?	CCS_M3MODELCODE_VERSION is an area where the version information of your product (i.e., the CC-Link product you develop) should be written. Write 01h for version "A" and 02h for version "B," and update the contents every time you upgrade the product. Note that your company must take care of the version control.
2	Regarding the model code at initialization processing Does the model code consist of the following three bytes? 1st byte: Station information 2nd byte: Unit information 3rd byte: Model type	The 3-byte model data is transmitted via the transmission path. However, the data of the 1st and 2nd bytes are supplied by the CCS. It is only the data of the 3rd byte that your company must specify.

(4) Questions and answers related to SD LED

	Question	Answer
1	Doesn't SDLED turn on unless the SDLED lighting time is written to byte address 86h? Does it turn on even if the period remains 00h after resetting?	If 00h is stored after resetting, the SDLED turns on only during the "transmission period." With this setting, the SDLED can scarcely be seen to light up in practice. By default, SLED0 to SLED3 are set to "1111" in our products.
2	The specifications indicate that 0 must be written to the 7th bit, and the SDLED lighting time must then be written in order to set the SDLED lighting time. If data is written to byte address 86h SDLED lighting time setting using 16 bits, however, the data in byte address 87h initial setting time must also be rewritten. Does this pose any problems?	Rewriting does not pose any problems.
3	The specifications indicate that the SDLED time setting is to be set after writing "0" to bit 7, but is a wait time required?	The time setting can be written immediately after writing "0" to bit 7. A wait time is not particularly required.
4	If there is no change in the SDLED time setting from the initial value (Fh), does the process of writing "1111" after writing "0" need to be performed?	If there has been no change from the initial value, the process of writing "1111" after writing "0" is not required.

(5) Questions and answers related to errors

	Question	Answer
1	Are there any processing flowcharts that can be used as a reference when handling errors? Are there any standard charts?	Errors must be handled for each device as required. It is not possible to determine standard processing; please handle errors according to the specification and communication status of your products.
2	The explanation of the BSERR bit of CCS_M3ERR1_ERR2 of the CCS states that "the error is canceled when it returns to normal." Does this mean that only the BSERR bit is canceled? Are other bits also canceled?	The STERR and BERR must be restarted after setting the station number and baud rate within the valid range. The SSERR and BSERR become normal by returning their settings to the original settings when the power was turned on.
3	Should errors also be generated in SSERR and STERR of CCS_M3ERR1_ERR2?	It is not necessary to generate device errors when SSERR (baud rate switch change error information) and STERR (station number setting switch change error information) are turned on. In the case of SSERR and BSERR, it is not necessary to generate errors as data is linked normally with the status before change. (The ERR LED flashes on remote stations only.) Moreover, in the case of STERR (station number switch setting error) and BERR (baud rate switch setting error), data cannot be linked normally; thus, the error information cannot be communicated to the master station.
4	What does the ERR21 timeout error of CCS_M3ERR1_ERR2 mean?	It turns on if refresh data cannot be received within the timeout time specified by the baud rate when the line is disconnected or the master station is shut down.
5	What is the meaning of ERR22 channel carrier detection of CCS_M3ERR1_ERR2?	A carrier refers to a change in signal level on a transmission path of CC-Link communication. The carrier is used to detect whether or not communication has been normally performed between the master station and remote device station. When a carrier is not detected on the transmission path within the carrier monitoring time (3.28ms for 10Mbps), an error occurs. The status changes to normal when either a carrier is detected on the transmission path or CCS is reset.
6	Can timeout errors occur if the power to the master station is not turned on?	Timeout is checked for the period from the time polling data is received to the time the next polling data is received. This means that polling data has not been received at all if the master station is not started, so timeout errors will not occur.

(6) Questions and answers related to reception data read processing

	Question	Answer
1	When reading data, do we just need to set 01 in CCS_M3SDOK_RDRQ (write 01 to CCS_M3SDOK_RDRQ)? Must we set it back to 0 after reading the data?	CCS_M3SDOK_RDRQ, reception data read request, is used to secure data consistency by preventing the link data from being overwritten by the master station while reading the receive buffer. As described in the flowchart in the specifications, the value 1 should be written to this address before reading data, and 0 should be written after reading is completed.
2	The specification indicates, upon reading the reception data, that the DRDREQ bit of CCS_M3SDOK_RDRQ should be set to 1; and upon completing the read operation, it should be reset to 0. Is this operation necessary when reading one byte (word)? Is it possible to read multiple bytes (words)?	The number of data points read can be any number of bytes. The DRDREQ bit is a flag used in the reception data separation prevention processing. Data transfer between the double receive buffers within the CCS is prevented when it is set to 1.
3	Is it necessary to turn on DRDREQ (reception data read request) of byte address 81h at synchronous read?	It is not necessary. Synchronous reading, however, must be completed within 1 ms.
4	Is it correct that the DCHANG bit of CCS_MWRENL_RCEX notifies that data has been updated? Currently the software on the device side is halted, the programmable controller CPU is in the STOP status, the RD and RUN LEDs are lit, and the SD LED flashes. In this status, DCHANG is set to 1. At this point, we set DRDEQ to 1 (at this point DCHANG changes to 0) in order to read the receive buffer and return DCHANG to 0. Then DCHANG immediately changes to 1. Why does this happen, even though the programmable controller CPU is in the STOP status? Is DCHANG updated regardless of the operation of the programmable controller CPU (in the same ways as CCS_REFSTB)?	The DCHANG signal receives new refresh data and notifies that it is stored in the receive buffer by being set to "1" (it is also set to "1" when the same data is refreshed). Normally, refresh data is received successively while the link is active. Therefore, "1" is continuously written to bit 0 of CCS_MWRENL_RCEX (the DCHANG signal) as well. The CC-Link master station continues to perform the link refresh operation when the link is started even if the programmable controller CPU is in the STOP status (RY, however, becomes 0).
5	The explanation of the DCHANG bit of CCS_MWRENL_RCEX says "for an asynchronous read, ensure that this bit is set to '1' before reading the receive data." We think reading should be performed upon checking that the DCHANG register is set to 1 even when an interrupt is received via CCS_REFSTB.	We do not intend to limit the usage, but it is not necessary to check DCHANG at a synchronous read using CCS_REFSTB, i.e., pin 40 of the CCS. It is acceptable to check DCHANG at a CCS_REFSTB interrupt, but make sure to keep the processing time within 1 ms.

	Question	Answer
6	When a link is established after the initial processing is completed, the reception data update information is always set to on, even when the programmable controller CPU is in the STOP status. Since interrupts are always received as well, it is not possible to perform normal processing. How can we know that data writing is completed?	The reception data update information indicates that data is written to the buffer and turns on at every link scan. It has nothing to do with whether or not the actual data has changed. Perform handshaking with the master station using a separate remote input/output (RX and RY). In the case of devices that do no require reading programmable controller's data all the time, you should not use interrupts, but use the asynchronous read method instead.

(7) Timeout processing

	Question	Answer
1	The timeout time setting switches based on whether it is (the first time), but: (1) Please clarify the definition of (the first time). (2) Is (the first time) when recovery occurs after communication was attempted but regarded as not possible due to some type of failure?	(1) The first time is when initialization processing is performed after power ON or reset cancel or after recovery from communication discontinuity. (2) The first time is as described above; it does not occur in a case where a failure other than communication discontinuity, such as a data packet error, occurs.
2	Why is the processing in which the software writes to TIM0-3 with reference to the baud rate switches BS1-8 during timeout time setup performed for (initialization write operation) → (first time reception) → (normal setup time)?	The reason is as follows: Until normal reception occurs for the first time, a longer time than usual is required. If the timeout time is set to a short time, "timeout" will always occur the first time. Conversely, if the timeout time is remains long, timeout may not always be detectable during normal periods.
3	The specifications indicate that the timeout time setting should be set in accordance with the baud rate when the initialization time is set. Specifically, what is this process?	When setting the initialization time of timeout time settings, read the value of the baud rate switch of the byte address 03H after power ON or reset, and set the timeout time in accordance with that baud rate.
4	Do we always need to monitor the value of the baud rate switch for the timeout time setting? Should we always update the timeout time setting in accordance with the baud rate if the switch is changed?	You do not need to always monitor the baud rate switch value for the timeout time setting. If the baud rate switch is changed during Link-Run, the setting is assessed for the first time at the rise after reset or power OFF/ON. Change the timeout time setting at that time.

(8) Others

	Question	Answer
1	Could you tell us the processing flow of existing products (i.e., software processing procedure)?	The basic processing is as described in the sample flowchart. In the event that the master station user application stops, generates an error, or pauses to refresh, the HOLD/CLR output processing is performed in each device.
2	Is the latest data always transmitted if the data update period is shorter than the response period during an asynchronous write operation? Or does it depend on the timing at which data written to the update buffer is transferred to the send buffer?	The latest data is always transmitted.
3	Does the CCS send a remote station refresh response data frame asynchronously with the refresh data update interval on the remote station side?	Yes, it is asynchronous.
4	Are there any restrictions on continuous access to the same port and register?	There are no special restrictions.
5	There is a description regarding CCS_M3SDOK_RDRQ of the CCS, stating to write a collection of data to be sent simultaneously in a single communication to the update buffer and then write the data. What is the upper limit of the transmission amount? Also, does writing to the update buffer mean writing data to any address (wherever you want to store the data)? (Is any other processing necessary?)	Data must be written to byte addresses 82h to 87h (vendor code, model code, version, etc.) and BAh (HOLD/CLR information setting) at the initial processing and CCS_M3RMRXn0_nF (RX) and CCS_M3RMRWRn (RWr) at normal data transmission. Data is written to the areas above as necessary at data transmission. The range varies depending on the number of occupied stations (the upper limit is the occupied data).
6	Is it possible to obtain the status equivalent to the "RUN" signal of pin 62 of the CCS ? For example, is it possible to obtain the same status for the "SQSTOPL" signal on the memory map?	There are no signals that are completely synchronized. If a link is started at normal operation, DCHANG of CCS_M3SDOK_RDRQ turns on at each link scan; please substitute with this.
7	In the sample application flowchart, data is read within the interrupt handler via pin 40 of the CCS_REFSTB. Are there any problems in using it to read data outside the interrupt handler?	There will be no problems as far as data is read within 1 ms.
8	Is it true that ST1 and ST2 of CCS_M3RMST1_ST2 are identical to those of CCS_M3MRST1_ST2?	They are different. CCS_M3RMST1_ST2 represent the status of the master station. CCS_M3MRST1_ST2 represent the status of remote stations, and data is stored in them by the CCS. It is possible to read from them but not to write to them.

	Question	Answer
9	Can you explain about CCS_M3MRST1_ST2 of the CCS?	MST10 indicates the RUN/STOP status of the master station user application, MST11 indicates the normal/abnormal status of the master station user application, and MST12 indicates the information of the link refresh status. Perform the HOLD/CLR processing of outputs on the device side according to this information. MST13 and MST14 contain information about the transient transmission. MST15 and MST16 contain the protocol version of the master station. MST17 contains information about the standby master station; use is not necessary

12.3 Protocol and Others

(1) Questions and answers related to errors

	Question	Answer
1	What is the exact definition of “disconnection”?	It means that a data link error occurs and a station is disconnected from the data link. Automatic return means that the data link is restarted automatically when problems are solved.
2	On what should we base our assessment of a “disconnection” state?	A timeout error.
3	We know that there are timeout errors, but what is the definition of the timeout error?	It occurs when the time from the completion of refresh normal reception to the time of normal reception of the next refresh exceeds the specified value.
4	What is the definition of "temporary error invalid stations"?	By specifying some of the link status special relays (SB) and link special registers (SW) of the master station as temporary error invalid stations, it is possible to exclude the stations specified as temporary error invalid stations from being detected as stations in the error status, even if they are down. By using this function, it is possible to replace modules without causing link errors (the power to the modules to be replaced must be turned off). The specification of temporary error invalid stations does not require parameters; it can be changed online. If any temporary error invalid stations are down (the power is turned off), the outputs from the master station are turned off while the inputs are maintained; it is possible to replace them while displaying the information before the shutdown.
5	Is the log of each station saved when a communication error occurs? How about the number of retries?	The information log of each station is not saved when a communication error occurs. The real time information of each station is written to the link special register (SW), but it simply indicates the bit status and is cleared when the error is canceled and the station recovers and returns to the system. To leave the information in the log, it is necessary to save it with a program on the master station side every time the status changes. The number of retries is saved for the entire network but there is no information for each station.
6	Is it possible to receive the next request (command) when the error status flag RX(m+n)A is ON?	Yes, it is possible. Execute the request (command).
7	What happens if the error reset request flag RY(m+n)A is turned on when an error state continuously occurs?	The error reset request flag is always executable. When executed in such a state, the error status flag turns OFF, but then turns ON again since the request (command) to generate an error continues.
8	When an error state continues or multiple errors occur, can we set remote station READY RX(m+n)B to ON using the error reset request RY(m+n)A?	Turn remote station Ready ON after clearing all error conditions (states), unless a deadlock is to occur for the operation convenience of the developed device. Clearly describe the operation at this time in the user's manual.

	Question	Answer
9	What is the relationship between the RX(m+n)A error status flag and the various CCS errors? In an CCS error state, is it OK if we do not set RX(m+n)A to “1”?	Set RX(m+n)A to “1” when the device itself is in an error state. When there is an CCS error (switch setting error, transmission status error), data cannot be transmitted and, thus, RX transmission is not possible.
10	When an error occurs, must remote station Ready RX(m+n)B be set to OFF until reset is requested, regardless of the error contents?	Yes, it is determined so by CC-Link specifications. However, if an error exists that makes it inconvenient to set remote ready to OFF, it is acceptable to not set remote ready to OFF, as clearly indicated in the manual.
11	The master station and slave station L RUN light will not turn on, and a data link cannot be established. What should I check?	Check the following items: · Is the initial processing completed? · Is “REH” still set to "H"? · Is the CC-Link cable disconnected, or is there a wiring error? · Is the CC-Link cable disconnected? · Is the terminating resistor disconnected?

(2) Questions and answers related to initial processing (specifications common to remote devices)

	Question	Answer
1	The initial data processing request flags are as follows: RX(m+n)8: Initial processing complete flag RY(m+n)8: Initial setting request flag RY(m+n)9: Initial data setting complete flag Is it mandatory to set RX(m+n)9?	It is not mandatory to use these signals if this processing is not necessary. Note, however, that these signals cannot be used for other purposes.
2	The CC-Link master module is initialized with a programmable controller program according to the following procedure: (a) Initialize other circuit boards (will take several seconds) (b) Initialize the CC-Link In this case, what kinds of data are output from the master module to the slaves and programmable controller during step (a)?	The master module outputs test polling data to the slaves, as described in the specifications. This data is repeatedly output until the completion of the initial communication. The master module outputs I/O signals (either Xn0: unit error or XnF: unit ready) to the programmable controller CPU, after the power to both the programmable controller and the master module is turned on.

(3) Others

	Question	Answer
1	If both the master station and the device station start sending data at the same time, will the data be in conflict with each other?	The device station does not start transmission unless it receives polling data from the master station; thus, data will never be in conflict.
2	When we cancel reset on the device side, initialize and enable reception (software is halted), and then turn on the power to the programmable controller (stop status), the LED displays become as follows: RUN:Off ERR:Off RD:On SD: Flashes (at approximately 1 second intervals) This status is described as “impossible” in the CCS specifications. Could you give us more information? At this time, update can be performed normally by making the programmable controller run.	If any Mitsubishi programmable controller is used as the master station, the link to the CC-Link master station is not started if the power is turned on while the programmable controller CPU is in the STOP status; test scans will be repeated. This means that SD and RD should flash and RUN and ERR should be turned off.
3	In what way is "No data for the own station" different from "Unable to receive the data for the own station," precisely?	"No data for the own station" is a status in which data is not refreshed and a timeout error has occurred. "Unable to receive the data for the own station" is a status in which data is refreshed but polling data addressed to the own station is not received.
4	Is the FE (polling frame) data in the polling data expressed in hexadecimal?	Yes, the FE data is expressed in hexadecimal. Note, however, that the corresponding address information and related information is automatically set by the CCS; the software of your device does not need to know them.
5	Are there any methods to conduct hardware tests for the baud rate switch and the station number switch in a simple manner?	Monitor the switches with CCS_M3STNO_BSW_KYOKU. Please note that it is necessary to turn the power on again every time the switch is changed.
6	Regarding the CC-Link bit rate, are we correct to interpret the value 156k in specifications to be, more precisely, 156.25k (625k/4)?	Yes, the value is more precisely 156.25k (625k/4).

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CC-Link Remote device station

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