MITSUBISHI ELECTRIC

Changes for the Better

Open Field Network
CC-Link Compatible Product Development Reference Manual

CC-Link

CC-Link Remote Device Station Communication LSI MFP3N
(CC-Link Ver.2 Compatible)

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CONTENTS

Relevant Manuals

This manual does not describe the details on terms and functions of CC-Link system. For the details, please refer to the following manuals.

Manual name [manual number]	Description
MELSEC-Q CC-Link System Master/Local Module User's Manual [SH-080394E]	System configuration, performance specifications, functions, handling, wiring, and troubleshooting of the MELSEC Q series master/local module

Terms

Unless otherwise specified, this manual uses the following terms.

Term	Description
CC-Link Ver.1	CC-Link Ver.1, including CC-Link Ver.1.00 and CC-Link Ver.1.10, may be stated simply "Ver.1".
CC-Link Ver.2	CC-Link Ver.2 may be stated simply "Ver.2".
Cyclic transmission	A function by which data are periodically exchanged among stations on the same system using link devices (RX, RY, RWr, and RWw)
Disconnection	A process of stopping data link if a data link error occurs
End user	A purchaser and user of CC-Link family compatible products developed by users/vendors
Link scan (Link scan time)	Time required for all stations in a system to transmit data. The link scan time depends on data volume and the number of transient transmission requests.
Master station	A station that controls the entire system. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a system.
Remote device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station cannot perform transient transmission.
Remote input (RX)	Bit data input from a slave station to the master station
Remote output (RY)	Bit data output from the master station to a slave station
Remote register (RWr)	Word data input from a slave station to the master station
Remote register (RWw)	Word data output from the master station to a slave station
Return	A process of restarting data link when a station recovers from an error
Slave station	A generic term for a remote I/O station, remote device station, local station, intelligent device station, and standby master station
Transient transmission	A function of communication with another station, which is used when requested by a dedicated instruction or a programming tool
User	A manufacturer who develops and sells CC-Link family compatible products based on this manual. The term, vendor, is used as the same meaning.

Usage Precautions

The flowchart described in this manual is for the development of a remote device station for CC-Link using MFP3N. The flowchart indicates an example of use of the materials herein; its operation is not guaranteed by Mitsubishi Electric.

Address Notation

This manual uses byte addresses, unless otherwise specified.

Radix Notation

This manual uses the following radix notation, unless otherwise specified.

Radix	Description	Example
Binary	"b" is added at the end of the number to indicate bit.	0b
Decimal	Nothing is added at the end of the number.	0
Hexadecimal	"h" is added at the end of the number to indicate hexadecimal.	10BAh

(1) Specifications
The materials related to this manual include the specifications published by the CC-Link Partner Association below. For CC-Link details, refer to the "CC-Link Specification".

Document title	Document No.
CC-Link Specification (Overview/Protocol)	BAP-C2001ENG-001
CC-Link Specification (Implementation)	BAP-C2001ENG-002
CC-Link Specification (Profile)	BAP-C2001ENG-003
CC-Link IE TSN Installation Manual	BAP-C3007ENG-001

(2) Conformance test
When a product is developed based on the information in this manual, the product must undergo a conformance test implemented by the CC-Link Partner Association. For conformance test details, download and refer to the following document from the CC-Link Partner Association website.

Document title	Document No.
CC-Link Remote Device Station Conformance Test Specifications (Ver.1.1/Ver.2.0)	BAP-C0401ENG-012

(3) Creating a Control & Communication System Profile (CSP+)
The conformance test includes verification of CSP+. CSP+ files must be created in advance. For CSP+ details, download and refer to the following documents from the CC-Link Partner Association website.
From the same website, other relevant documents and tool that help users create CSP+ files can also be download.

Document title, related tool	Document No.
Control & Communication System Profile Specification	BAP-C2008ENG-001
Control & Communication System Profile Creation Guidelines	-
CSP+ profile creation support tool	-
Sample CSP+ Files	-
CSP+ Templates	-

(4) Inquiries
To request materials published by the CC-Link Partner Association and for conformance test details, please contact the following:

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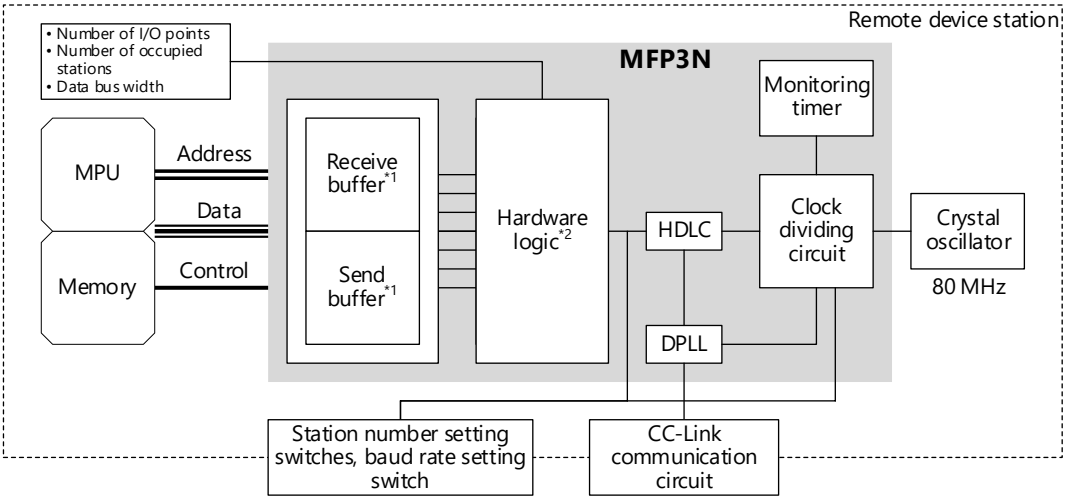
E-mail: info@cc-link.org
Web: http://www.cc-link.org/

1. OVERVIEW

This is the specification for developing a remote device station for CC-Link using "CC-Link remote device station communication LSI (MFP3N)" provided by Mitsubishi Electric.

1.1. Development Features

The remote device station to be developed comprises LSI (MFP3N) and a CC-Link communication circuit that incorporates peripheral circuits.



General block diagram

*1: SRAM equivalent

*2: This logic reads the bit data (RY) and word data (RWw) addressed to the own station from the receive data and stores the data in the receive buffer. The logic also reads the bit data (RX) and word data (RWr) addressed to the master station from the send data and sends the data to the master station.

(1) A remote device station can be developed easily by mounting an MPU (8 bits or 16 bits).

(2) The software to be developed can perform data communications by reading/writing data from/to the memory without the consideration of protocols.

(3) CC-Link Ver.1 can handle cyclic data of up to 128 bits for RX/RY and 16 words for RWr/RWw by selecting the number of occupied stations (between one and four).
CC-Link Ver.2 can handle data of up to 896 bits for RX/RY and 128 words for RWr/RWw by setting the extended cyclic setting parameter.

CC-Link Ver.1 Cyclic Data Capacity

Type	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
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

CC-Link Ver.2 Cyclic Data Capacity

Extended cyclic setting	Type	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
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

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

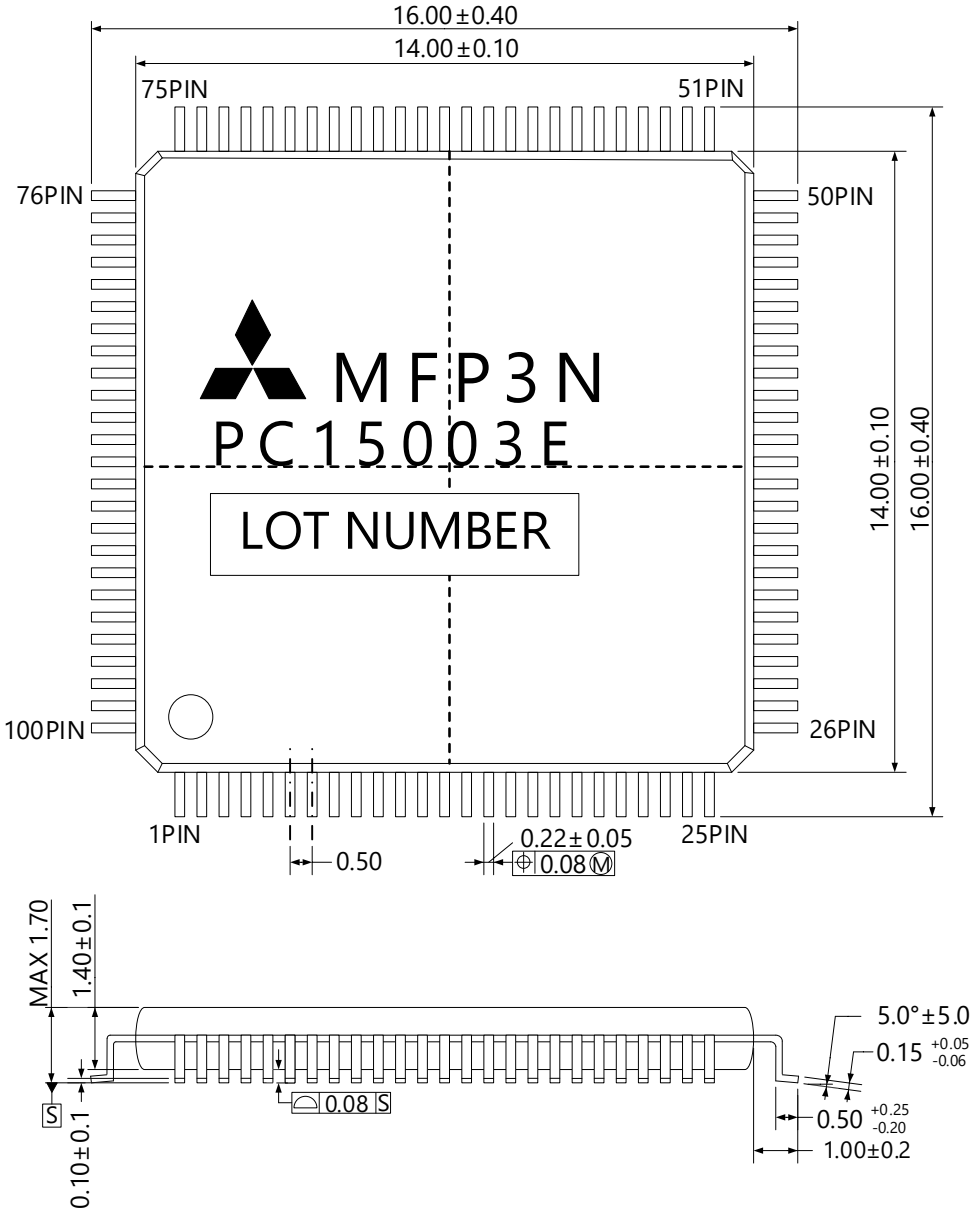
*: The cyclic data capacity when the extended cyclic setting parameter is set to "Single" is the same as the capacity of CC-Link Ver.1.

Function	Description
Number of occupied stations setting	Sets the number of occupied stations from 1 to 4 by the setting pins (SENYU0, SENYU1). For the cyclic data capacity for each number of occupied stations, refer to Section 1.1 "Development Features".
Timeout time setting	Determines the timeout time by the communication baud rate. Considering transmission inconsistencies at network start-up, two types of time settings are available: at software start-up (initial setting time) and after start-up (normal setting time).
Fuse blown detection function	Sends the fuse status to the master station when the fuse has blown (when a fuse is mounted to the module).
Frame send processing and independent write operation	Writes the send data to the send buffer (RX and RWr areas) at any desired timing using two buffers.
Frame receive processing and independent read operation	Reads the receive data from the receive buffer (RY and RWw areas) at any desired timing using two buffers.
Master station application status monitor function	Monitors the RUN/STOP status and the operating status (normal or error) of the master station application.
Network return function	Starts data link automatically when the module which has been disconnected from data link due to power-off is returned to the system.
Transmission status display function	Displays the transmission status using the transmission monitor section pins for LEDs. The SDLED on time can be adjusted by the software setting because the time is extremely short.
Baud rate setting function	Sets the baud rate, 10 Mbps, 5 Mbps, 2.5 Mbps, 625 Kbps, or 156 Kbps.
Baud rate/station number setting error detection function	Detects an error of the baud rate or station number setting by referencing the error information (STERR, BERR).
Baud rate/station number change detection function	Detects a change of the baud rate or station number setting from start-up by referencing the error information (SSERR, BSERR).

3. MFP3N SPECIFICATIONS

3.1. External Appearance

The following is the external appearance of MFP3N as of March 2022. For the previous external appearance, refer to Appendix 1 "MFP3N Previous Specifications".
Unit: mm



*: The position of dot may be different from the actual product.

Pin No.	Pin name	I/O	Pin No.	Pin name	I/O	Pin No.	Pin name	I/O	Pin No.	Pin name	I/O
1	VDD	-	26	GND	-	51	VDD	-	76	GND	-
2	MON3	O	27	MRDL	I	52	RSV52	O	77	RD	I
3	MON2	O	28	MWRL	I	53	RSV53	O	78	RSV78	I
4	MON1	O	29	CSL	I	54	RSV54	O	79	RSV79	-
5	MON0	O	30	A0	I	55	RSV55	O	80	RSV80	I
6	GND	-	31	A1	I	56	DCHANG	I	81	SD	O
7	MD0	I/O	32	A2	I	57	STBMSK	I	82	RSV82	I
8	MD1	I/O	33	A3	I	58	RSV58	O	83	RSV83	I
9	MD2	I/O	34	A4	I	59	SDLED	O	84	SDGATEON	O
10	MD3	I/O	35	A5	I	60	RDLED	O	85	RSV85	I
11	MD4	I/O	36	A6	I	61	ERRL	O	86	FUSEL	I
12	MD5	I/O	37	RSV37	I	62	RUN	O	87	IOTENSU	I
13	MD6	I/O	38	REH	I	63	SW80	I	88	SENYU0	I
14	MD7	I/O	39	RSV39	I	64	SW40	I	89	SENYU1	I
15	GND	-	40	REFSTB	O	65	SW20	I	90	DW8L	I
16	GND	-	41	WDTL	I	66	SW10	I	91	SCLK	O
17	MD8	I/O	42	RSV42	I	67	SW8	I	92	RDNRZ	O
18	MD9	I/O	43	RSV43	O	68	SW4	I	93	SDNRZ	O
19	MD10	I/O	44	RSV44	I	69	SW2	I	94	MON7	O
20	MD11	I/O	45	OUT5M	O	70	SW1	I	95	MON6	O
21	MD12	I/O	46	RSV46	I	71	BS8	I	96	MON5	O
22	MD13	I/O	47	OUT10M	O	72	BS4	I	97	MON4	O
23	MD14	I/O	48	RSV48	I	73	BS2	I	98	GND	-
24	MD15	I/O	49	OUT20M	O	74	BS1	I	99	CLK	I
25	VDD	-	50	GND	-	75	VDD	-	100	GND	-

3.3.1. Lists of pin functions

(1) Clock section

Pin No.	Pin name	I/O	Buffer type	Description
99	CLK	I	IBT	Clock input 80 MHz
49	OUT20M	O	OB1T_CCL	Clock output 20 MHz
47	OUT10M	O	OB1T_CCL	Clock output 10 MHz
45	OUT5M	O	OB1T_CCL	Clock output 5 MHz

(2) Reset section

Pin No.	Pin name	I/O	Buffer type	Description
38	REH	I	IBS_CCL	Reset input pin (Active "H")

(3) Transmission interface section

Pin No.	Pin name	I/O	Buffer type	Description
77	RD	I	IBS_CCL	Receive data
81	SD	O	OB1T_CCL	Send data
84	SDGATEON	O	OB3T_CCL	Transmission period signal "H": Data being sent

(4) Transmission setting section

Pin No.	Pin name	I/O	Buffer type	Description
87	IOTENSU	I	IBT	Sets the total number of I/O points of the own station. "H": Fixed to 32 bits. "L": Depends on the number of occupied stations. (Number of occupied stations × 32 bits)
88	SENYU0	I	IBT	Number of occupied stations setting
89	SENYU1	I	IBT	
63	SW80	I	IBCP1_CCL	Station number setting pins (tens place) (× 80)
64	SW40	I	IBCP1_CCL	(× 40)
65	SW20	I	IBCP1_CCL	(× 20)
66	SW10	I	IBCP1_CCL	(× 10)
67	SW8	I	IBCP1_CCL	Station number setting pins (ones place) (× 8)
68	SW4	I	IBCP1_CCL	(× 4)
69	SW2	I	IBCP1_CCL	(× 2)
70	SW1	I	IBCP1_CCL	(× 1)
71	BS8	I	IBCP1_CCL	Baud rate setting pins (× 8)
72	BS4	I	IBCP1_CCL	(× 4)
73	BS2	I	IBCP1_CCL	(× 2)
74	BS1	I	IBCP1_CCL	(× 1)

(5) Transmission monitor section

Pin No.	Pin name	I/O	Buffer type	Description
62	RUN	O	OB2BT_CCL	Communication status output "H": Normal (joined to the network) "L": Not joined to the network or a timeout
60	RDLED	O	OB2BT_CCL	Data receive status output "L": Data being received This pin is set to "L" when data (not necessarily normal data) is received.
59	SDLED	O	OB2BT_CCL	For turning on the send LED"L": Data being sent
61	ERRL	O	OB2BT_CCL	"L": CRC error The station number is set to 0 or 65 or higher (including the number of occupied stations). The baud rate is set to 5 or higher. Changing at intervals of 0.4 s: The station number or baud rate setting value has been changed from the value at start-up. (The station number and baud rate settings are latched after reset.)
91	SCLK	O	OB2BT_CCL	Internal synchronous clock output
92	RDNRZ	O	OB1T_CCL	Receive NRZ data
93	SDNRZ	O	OB1T_CCL	Send NRZ data
94	MON7	O	OB1T_CCL	Monitor output of receive frame information
95	MON6	O	OB1T_CCL	
96	MON5	O	OB1T_CCL	
97	MON4	O	OB1T_CCL	
2	MON3	O	OB1T_CCL	
3	MON2	O	OB1T_CCL	
4	MON1	O	OB1T_CCL	
5	MON0	O	OB1T_CCL	

(6) Status section

Pin No.	Pin name	I/O	Buffer type	Description
41	WDTL	I	IBT	Watchdog timer error input ("L": Error) The station continues the data link and stores the error information to the corresponding bits (SW0084 to SW0087) of the master station.
86	FUSEL	I	IBT	Fuse blown information input "L": Fuse blown For devices with no fuse, this bit is fixed to "H" (connected to VDD). The station continues the data link and stores the error information to the corresponding bits (SW0088 to SW008B) of the master station.

(7) MPU interface section

Pin No.	Pin name	I/O	Buffer type	Description
30	A0	I	IBT	Register (memory) address bus
31	A1	I	IBT	
32	A2	I	IBT	
33	A3	I	IBT	
34	A4	I	IBT	
35	A5	I	IBT	
36	A6	I	IBT	
24	MD15	I/O	BT1BT_CCL	Data bus When the data bus width is set to 8 bits, MD7 to MD0 are used (DW8L pin: "L"). In this case, MD15 to MD8 become input pins and must be treated as reserved pins.
23	MD14	I/O	BT1BT_CCL	
22	MD13	I/O	BT1BT_CCL	
21	MD12	I/O	BT1BT_CCL	
20	MD11	I/O	BT1BT_CCL	
19	MD10	I/O	BT1BT_CCL	
18	MD9	I/O	BT1BT_CCL	
17	MD8	I/O	BT1BT_CCL	
14	MD7	I/O	BT1BT_CCL	
13	MD6	I/O	BT1BT_CCL	
12	MD5	I/O	BT1BT_CCL	
11	MD4	I/O	BT1BT_CCL	
10	MD3	I/O	BT1BT_CCL	
9	MD2	I/O	BT1BT_CCL	
8	MD1	I/O	BT1BT_CCL	
7	MD0	I/O	BT1BT_CCL	
27	MRDL	I	IBT	Signal input for reading data from registers (memory) (active "L")
28	MWRL	I	IBT	Signal input for writing data to registers (memory) (active "L")
29	CSL	I	IBT	Chip select pin (active "L")
90	DW8L	I	IBT	Data bus width setting "H": 16-bit width "L": 8-bit width
40	REFSTB	O	OB1T_CCL	Refresh data receive completion signal This pin is set to "H" when the refresh data receive processing is completed and set to "L" when a refresh cycle end frame is received.

(8) Reserved pin section

Pin No.	Pin name	I/O	Buffer type	Description
37	RSV37	I	IBT	Fixed to "L". (Connect the pin to GND.)
39	RSV39	I	IBT	Fixed to "H". (Connect the pin to VDD.)
42	RSV42	I	IBH_CCL	Fixed to "L". (Connect the pin to GND.)
43	RSV43	O	OB1T_CCL	- (Open)
44	RSV44	I	IBH_CCL	Fixed to "L". (Connect the pin to GND.)
46	RSV46	I	IBH_CCL	
48	RSV48	I	IBH_CCL	
52	RSV52	O	OB1T_CCL	- (Open)
53	RSV53	O	OB1T_CCL	
54	RSV54	O	OB1T_CCL	
55	RSV55	O	OB1T_CCL	
56	DCHANG	I	IBT	Refer to Section 3.3.3 "Reserved pin handling".
57	STBMSK	I	IBT	
58	RSV58	O	OB2BT_CCL	- (Open)
78	RSV78	I	IBH_CCL	Fixed to "L". (Connect the pin to GND.)
79	RSV79	I	IBS_CCL	
80	RSV80	I	IBT	
82	RSV82	I	IBT	
83	RSV83	I	IBT	
85	RSV85	I	IBT	

(9) Power supply/GND section

Pin No.	Pin name	Description
1, 25, 51, 75	VDD	Power supply input
6, 15, 16, 26, 50, 76, 98, 100	GND	GND input

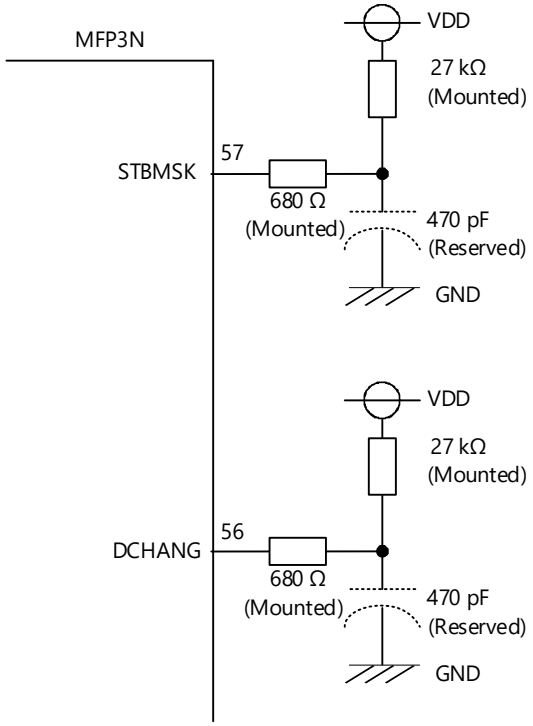
3.3.2. Buffer types

The following table lists the buffer types of each pin.

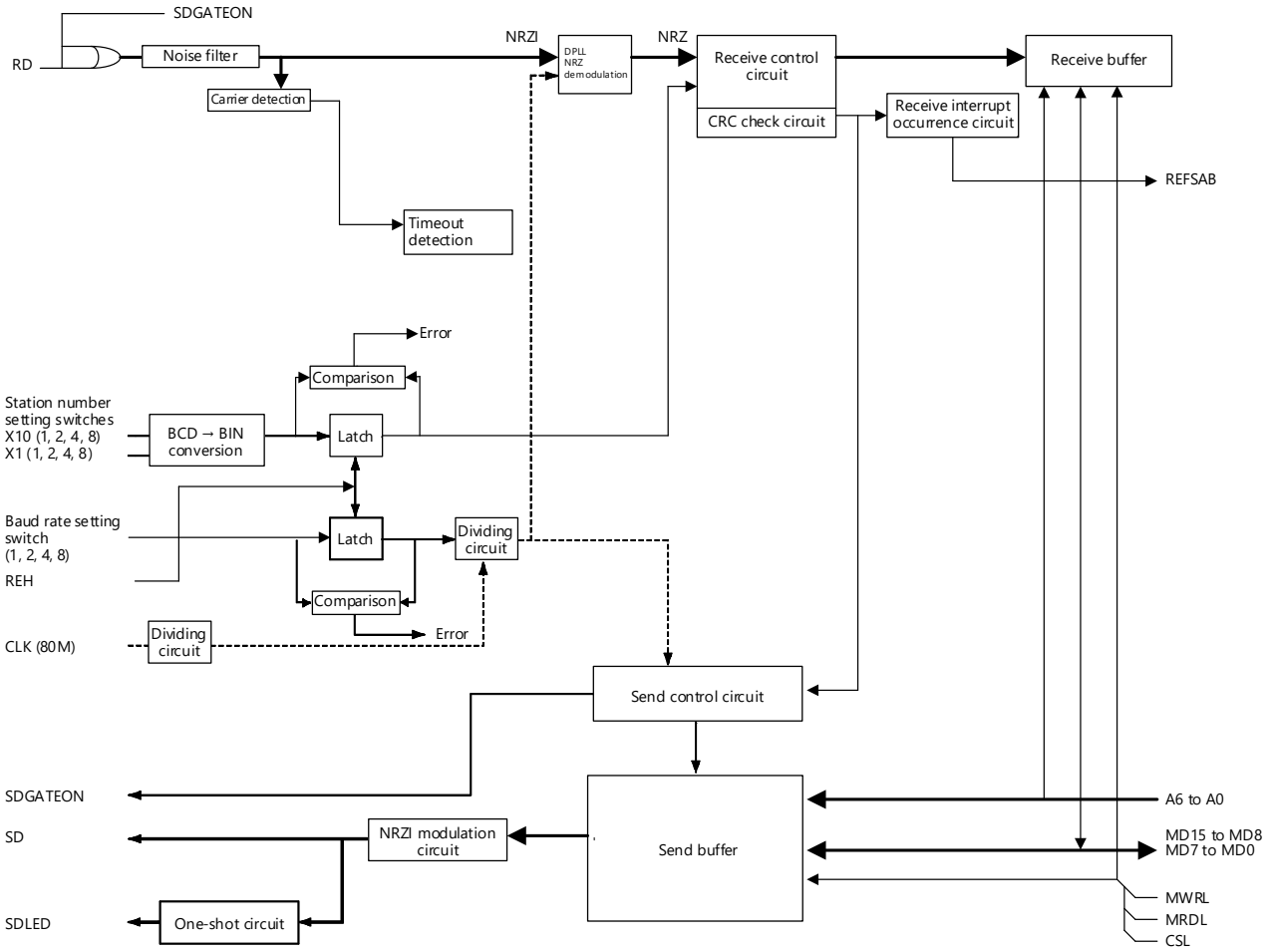
Buffer type	I/O	Function
BT1BT_CCL	I/O	I/O Buffer (TTL in: CMOS 3-state out: I_{OL} = 4 mA)
IBCP1_CCL	I	Input Buffer (CMOS in) with Pull-Up Resistor 5 kΩ
IBH_CCL	I	Input Buffer (CMOS Schmitt in)
IBT	I	Input Buffer (TTL Level in)
IBS_CCL	I	Input Buffer (TTL Schmitt in)
OB1T_CCL	O	Output Buffer (CMOS Level out: I_{OL} = 6 mA)
OB2BT_CCL	O	Output Buffer (CMOS Level out: I_{OL} = 9 mA)
OB3T_CCL	O	Output Buffer (CMOS Level out: I_{OL} = 12 mA)

3.3.3. Reserved pin handling

Design the circuit (pattern and pad) so that the components shown in the figure below can be implemented to the pin number 56 "DCHANG" and pin number 57 "STBMSK". (Dotted lines indicate the reserved components.)
Resistors: 1/10 W or more
Capacitors: 50 V or higher



3.4. Block Diagram



3.5.1. Absolute maximum ratings (Unless specified T_A = 25°C)

Symbol	Item	Condition	Rated value	Unit
V_{DD}	Power supply voltage	-	V_{SS} - 0.5 to + 7.0	V
V_I/V_O	I/O voltage	-	V_{SS} - 0.5 to +V_{DD} + 0.5	V
I_O	Output current	I_{OL} = 6 mA type	±30	mA
		I_{OL} = 9 mA type	±30	mA
		I_{OL} = 12 mA type	±30	mA
T_{opt}	Operating temperature	-	-40 to +110	°C
T_{stg}	Storage temperature	-	-65 to +150	°C
T_j	Junction temperature	-	135	°C

3.5.2. Recommended operating conditions

Symbol	Item	Condition*	Specification value			Unit
			Min.	Typ.	Max.	
V_{DD}	Power supply voltage	-	4.5	5.0	5.5	V
T_A	Ambient temperature	-	-40	25	110	°C
V_{IH}	"H" input voltage	CMOS type	3.15	-	V_{DD}	V
		TTL type	2.29	-	V_{DD}	V
V_{IL}	"L" input voltage	CMOS type	0	-	1.65	V
		TTL type	0	-	0.77	V
V_P	Positive trigger voltage	CMOS type	2.55	-	3.75	V
		TTL type	1.38	-	2.55	V
V_N	Negative trigger voltage	CMOS type	1.15	-	2.05	V
		TTL type	0.64	-	1.33	V
V_H	Hysteresis voltage	CMOS type	1.1	-	-	V
		TTL type	0.64	-	-	V
t_r	Input rising time	Schmitt input type	-	-	10	ms
		Other than the Schmitt input type	-	-	200	ns
t_f	Input falling time	Schmitt input type	-	-	10	ms
		Other than the Schmitt input type	-	-	200	ns
F	External clock input frequency	-	-	80	-	MHz
Θ_{jc}	Heat resistance	-	-	6	-	°C/W

3.5.3. DC characteristics (T_A = -40 to +110°C, V_{DD} = 5 V±10%)

Symbol	Item	Condition	Specification value[*3]			Unit
			Min.	Typ.	Max.	
I_{OZ}	Output leak current	V_O = V_{DD} or GND	-5	-	5	µA
V_{IC}	Input clamp voltage[*1]	V_I = -18 mA	-1.2	-	-	V
I_{OS}	Output short-circuit current[*2]	V_O = 0 V	-	-	-250	mA
I_I	Input leak current	V_I = V_{DD} or GND (Normal input)	-5	-	5	µA
		V_I = GND (Pull-up 5 kΩ)	-0.3489	-	-2.2	mA
R_{PU}	Pull-up resistance	V_I = GND	2.5	5.0	12.9	kΩ
I_{OL}	"L" output current	V_{OL} = 0.4 V (CMOS 6.0 mA type)	6.0	-	-	mA
		V_{OL} = 0.4 V (CMOS 9.0 mA type)	9.0	-	-	mA
		V_{OL} = 0.4 V (CMOS 12.0 mA type)	12.0	-	-	mA
I_{OH}	"H" output current	V_{OL} = V_{DD} - 0.4 V (CMOS 6.0 mA type)	-6.0	-	-	mA
		V_{OL} = V_{DD} - 0.4 V (CMOS 9.0 mA type)	-9.0	-	-	mA
		V_{OL} = V_{DD} - 0.4 V (CMOS 12.0 mA type)	-12.0	-	-	mA
V_{OL}	"L" output voltage	I_{OL} = 0 mA	-	-	V_{SS} + 0.4	V
V_{OH}	"H" output voltage	I_{OH} = 0 mA	V_{DD} - 0.4	-	-	V
I_{DDS}	Static supply current	V_I = V_{DD} or GND	-	-	240	µA

*1: Input clamp voltage (V_{IC}) is the voltage that is clamped when the input signal is negative voltage.

*2: Output short current (I_{OS}) only applies to one pin of LSI within one second.

*3: The + and - signs of the current values in the table indicate the direction of the current. Current flowing into a device is indicated by +, and current flowing out of a device is indicated by -.
The Min. and Max. columns show the comparison results with the absolute values.

3.5.4. AC characteristics (T_A = -40 to +110°C, V_{DD} = 5 V±10%)

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_r	Output rising time	C_L = 15 pF, I_{OL} = 4 mA	-	2.76	-	ns
t_f	Output falling time	C_L = 15 pF, I_{OH} = -2 mA	-	1.75	-	ns

3.5.5. I/O capacitance (T_A = +25°C, V_{DD} = 0 V)

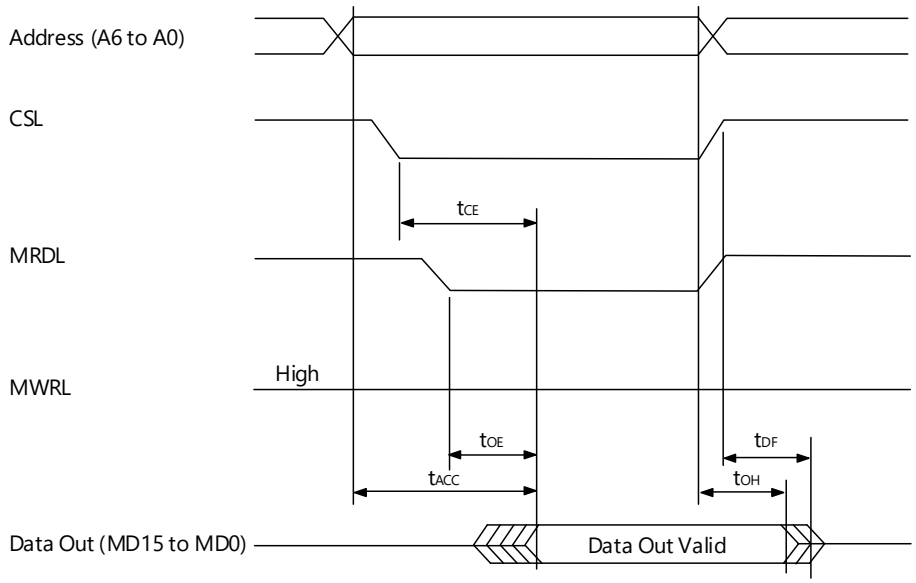
Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
C_{IN}	Input capacitance	f = 1 MHz 0 V at pins other than the measured pin	-	-	10	pF
C_{OUT}	Output capacitance		-	-	10	pF
$C_{I/O}$	I/O capacitance		-	-	10	pF

4. TIMING CHART (T_A = -40 TO +110°C, V_{DD} = 5 V±10%)

4.1. Read Cycle

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_{ACC}	Access time	CSL = MRDL = V_{IL}	-	-	24.19	ns
t_{CE}	CSL output delay time	MRDL = V_{IL}	-	-	19.34	ns
t_{OE}	MRDL output delay time	CSL = V_{IL}	-	-	19.35	ns
t_{DF}	Output disable delay time	CSL = V_{IL}	2.25	-	12.56	ns
t_{OH}	Output data hold time	CSL = MRDL = V_{IL}	2.25	-		ns

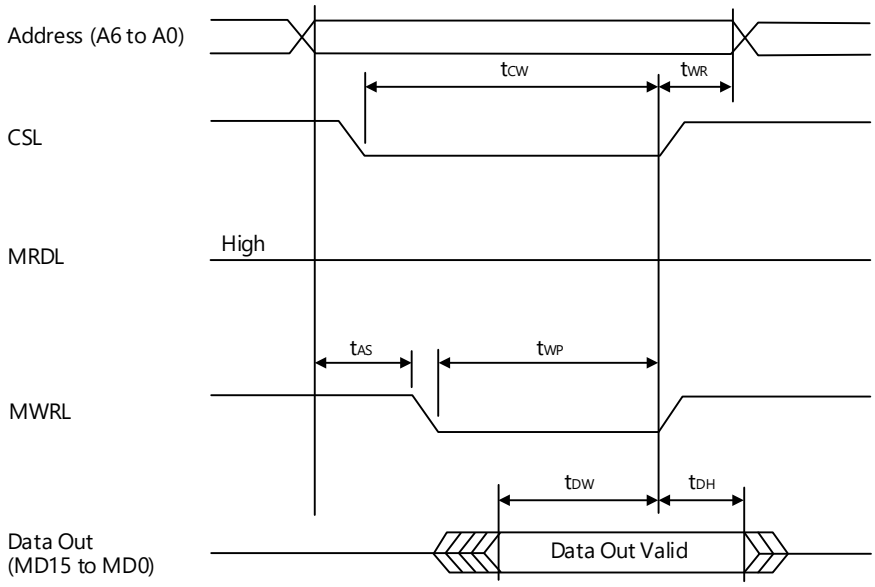
Read Timing Waveform



4.2. Write Cycle

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_{CW}	Chip selection time	-	6.3	-	-	ns
t_{AS}	Address setup time	-	0	-	-	ns
t_{WP}	Write pulse width	-	6.3	-	-	ns
t_{WR}	Address hold time	-	0	-	-	ns
t_{DW}	Input data setup time	-	12.35	-	-	ns
t_{DH}	Input data hold time	-	-3.14	-	-	ns

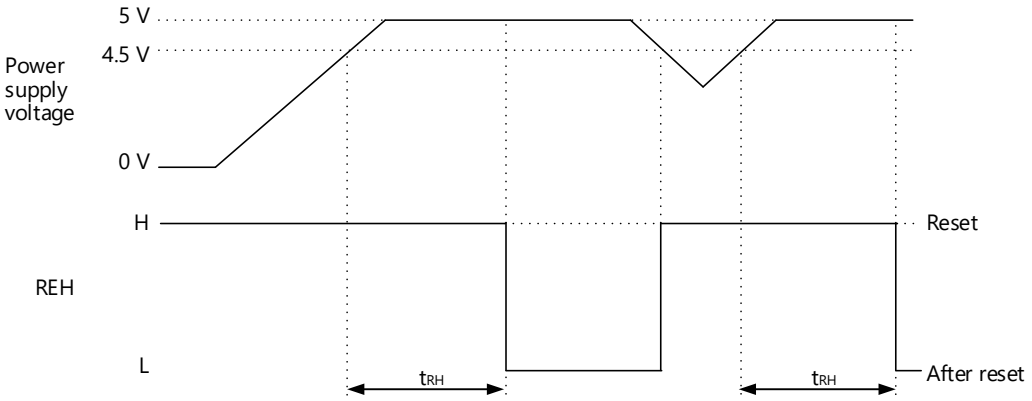
Write Timing Waveform



4.3. Reset Timing

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_{RH}	Reset pulse width	Clock normal	0.08	-	-	ms

Design the reset signal (REH) so that it satisfies the timing below.



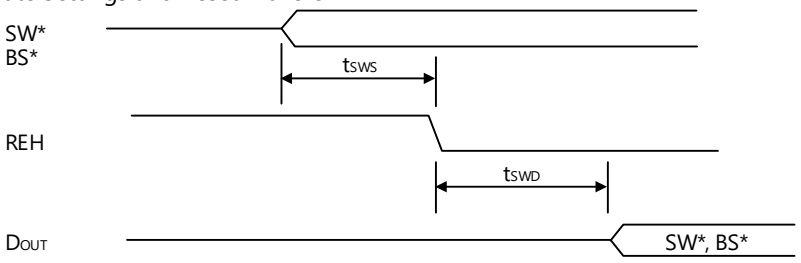
[Restrictions]
1) The reset signal (REH) must be held at "H" for 0.08 ms or longer after the power supply voltage reaches 4.5 V or higher.

4.4. Station Number/Baud Rate Settings and Reset Signal

The station number and baud rate settings are latched after reset. However, the station number and baud rate setting pins have filters internally. The following setup time is required.
In addition, when reading the station number and baud rate information, the following disable time is experienced.

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_{SWS}	Station number/baud rate settings setup time for REH↓	Clock normal	76.76	-	-	µs
t_{SWD}	Station number/baud rate information read disable time for REH↓	Clock normal	-	-	51.2	µs

Station Number/Baud Rate Settings and Reset Waveform



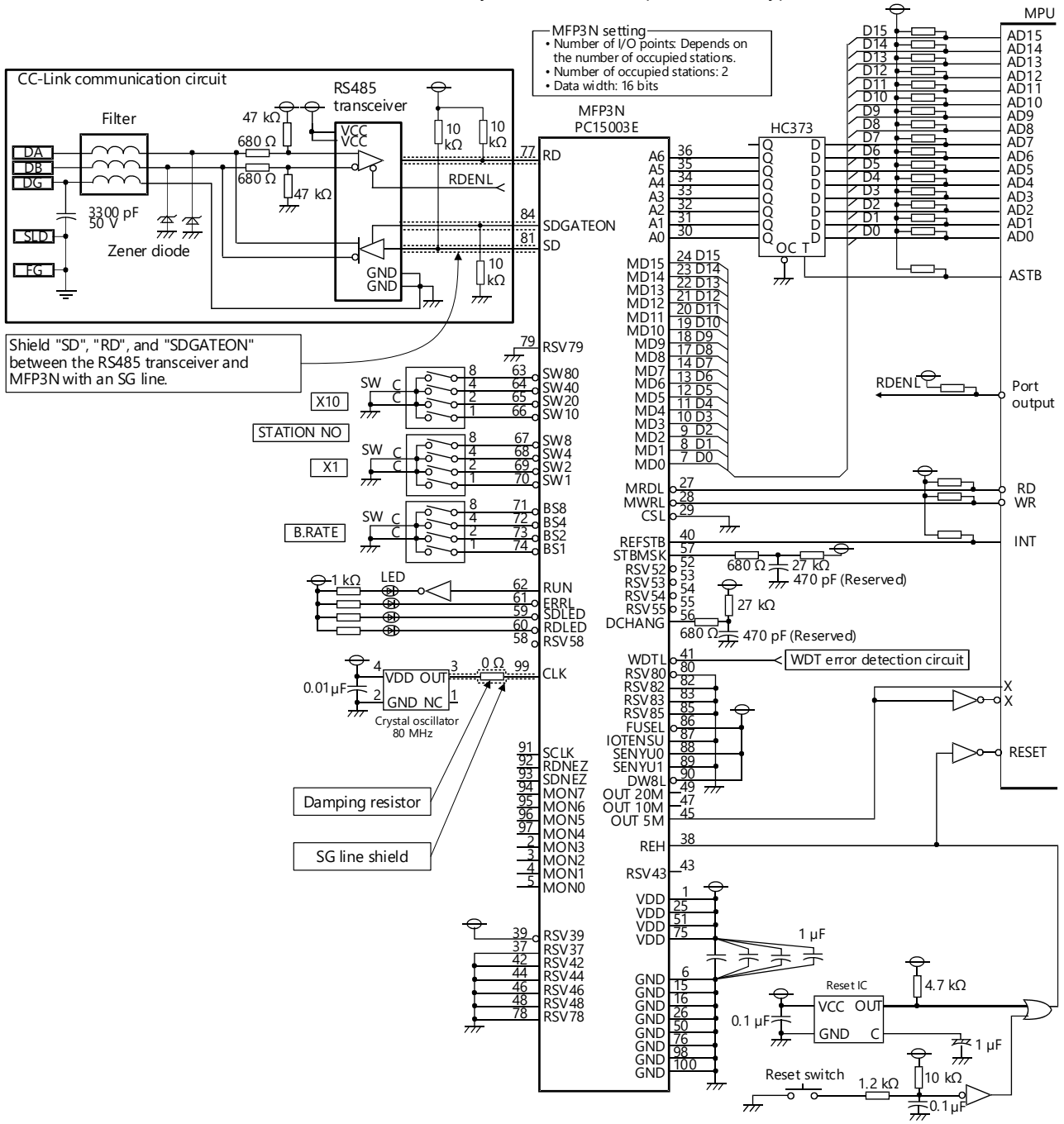
5. REMOTE DEVICE STATION CIRCUIT DIAGRAM EXAMPLES

This chapter provides remote device station circuit diagram examples of when the MPU data bus width is 16 bits and when it is 8 bits.
For measures to reduce noise, read the precautions described in Section 5.5 "Pattern Design Precautions".

5.1. Communication System Circuit Example (Non-Isolated Type) (When the Data Bus Width is 16 Bits)

By setting the DW8L pin to "H", the memory addresses of MFP3N are assigned in units of words (16 bits).
Connect AD0 to AD15 and MD0 to MD15.

In this example, the CC-Link communication circuit is non-isolated.
To improve the noise immunity, isolate the CC-Link communication circuit. (Recommended) For details, refer to Section 5.3 "CC-Link Communication Circuit (Communication System Circuit Example (Isolated Type))".



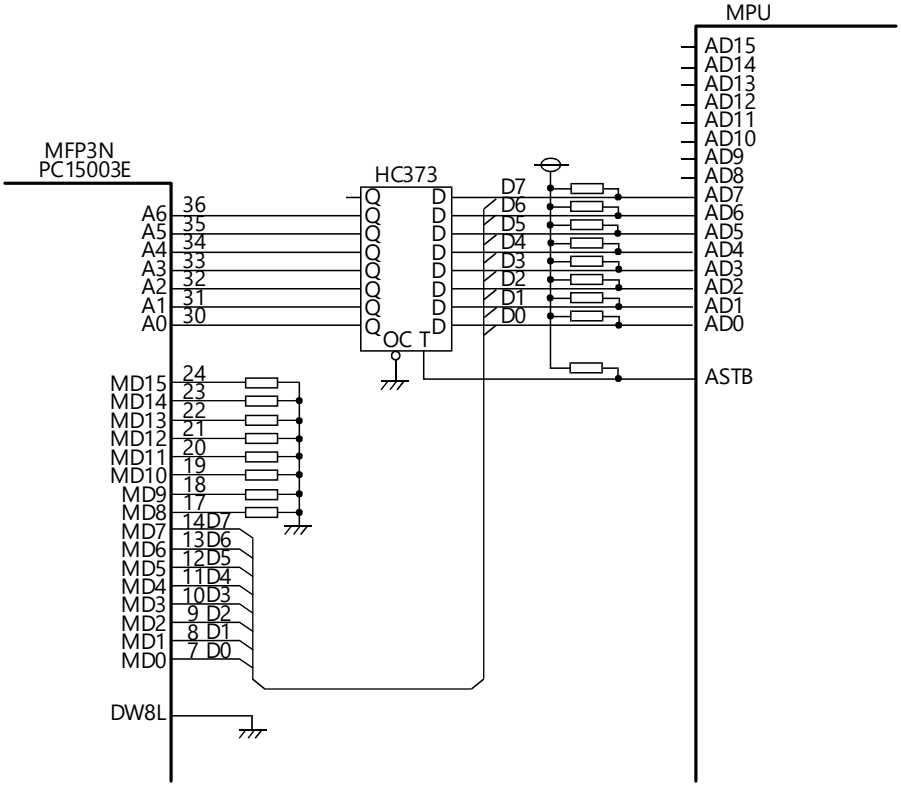
Point
When an MPU in which data bus width is 16 bits and memory addresses are specified in units of bytes (8 bits), even-numbered addresses must be specified on the MPU side. Connect the pins by shifting one place.

MFP3N pin	--- MPU pin	MFP3N pin	--- MPU pin
A6	--- AD7	A3	--- AD4
A5	--- AD6	A2	--- AD3
A4	--- AD5	A1	--- AD2

5.2. Communication System Circuit Example (Non-Isolated Type) (When the Data Bus Width is 8 Bits)

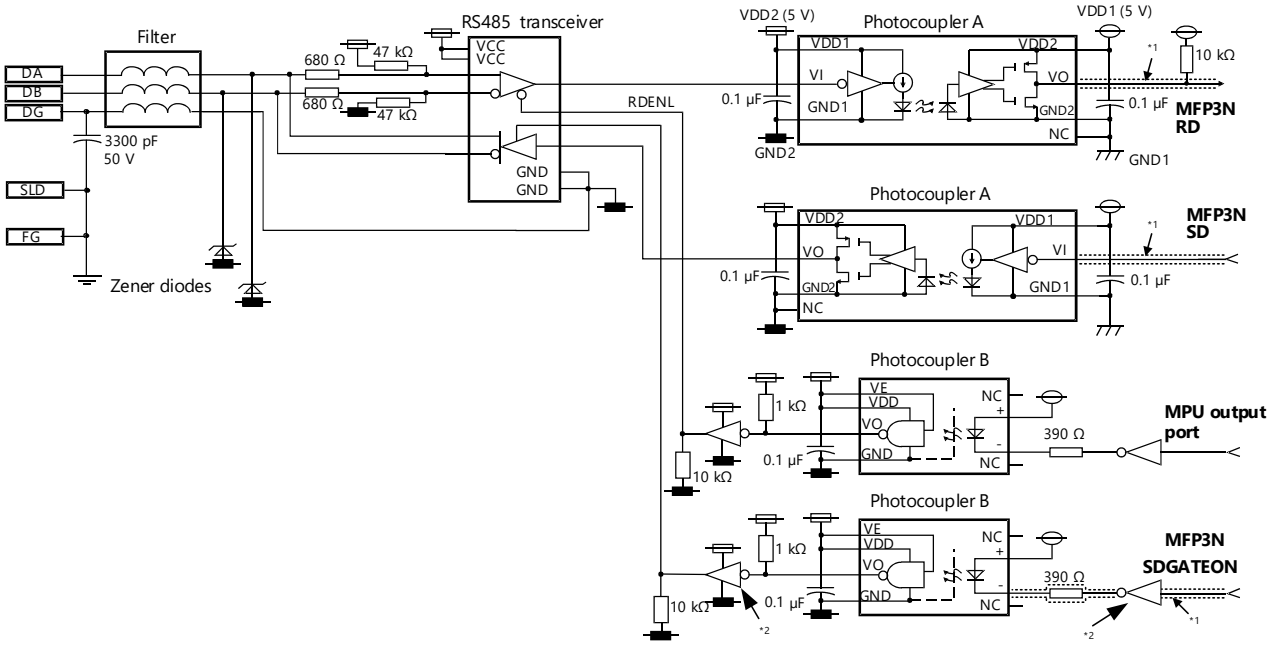
The following is the difference from the circuit example in Section 5.1 "Communication System Circuit Example (Non-Isolated Type) (When the Data Bus Width is 16 Bits)".

By setting the DW8L pin to "L", the memory addresses of MFP3N are assigned in units of bytes (8 bits).
Connect AD0 to AD7 and MD0 to MD7.



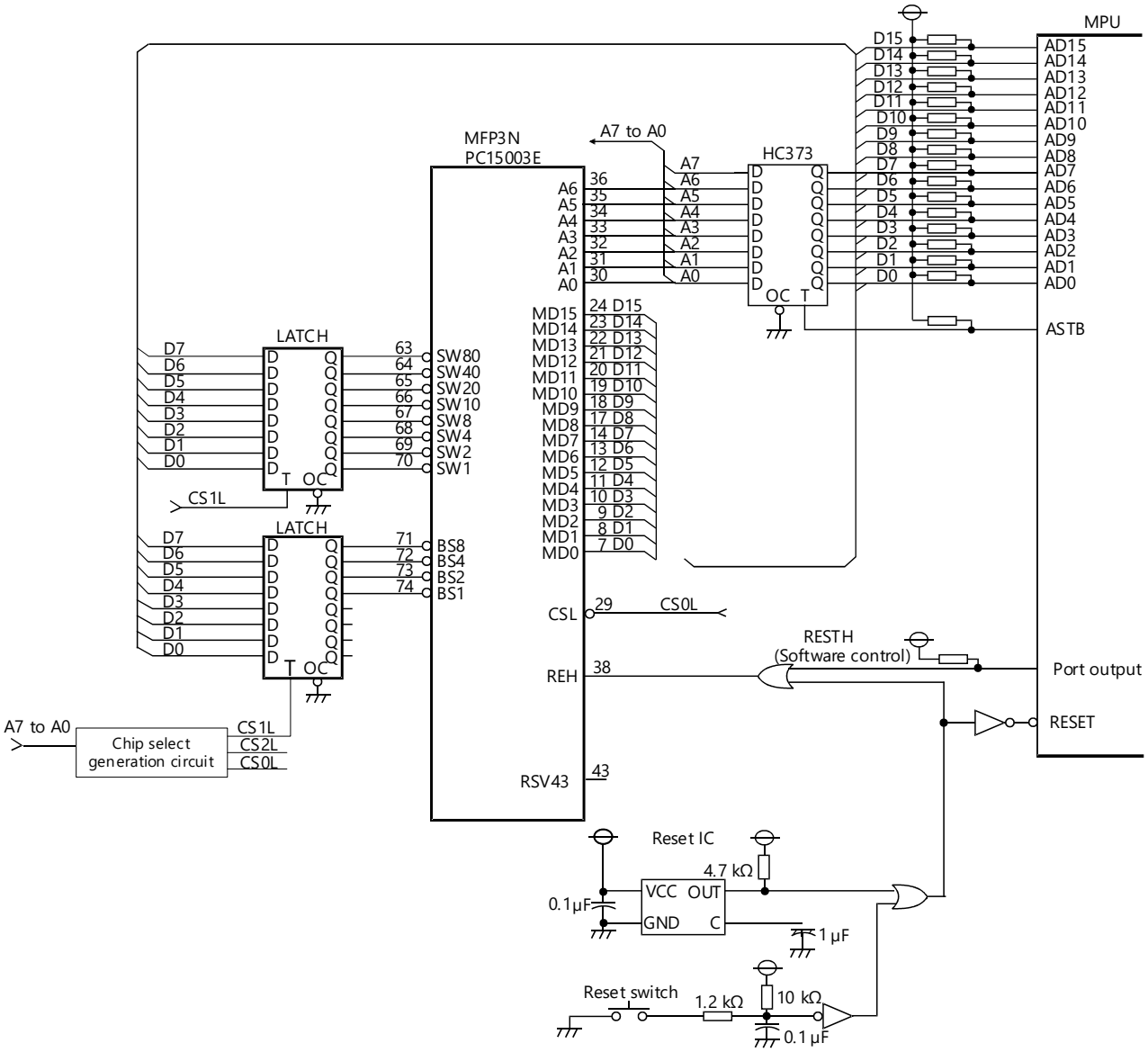
5.3. CC-Link Communication Circuit (Communication System Circuit Example (Isolated Type))

The following is an example of the isolated CC-Link communication circuit.
Components recommended by the CC-Link Partner Association are used in the circuit. For details, refer to the CC-Link Specification (Implementation).



*1: Make the traces between the "RD", "SD", and "SDGATEON" of MFP3N and the photocoupler as short as possible, and shield them with GND1 (signal ground).

*2: Place inverters (such as LV14A and LV04A) on both the primary and secondary sides of the photocoupler in the send gate control section of the RS485 transceiver.



Point
Reset MFP3N after the station number and baud rate settings are latched. For details, refer to Section 4.4 "Station Number/Baud Rate Settings and Reset Signal". For areas where not shown in this circuit example, refer to Section 5.1 "Communication System Circuit Example (Non-Isolated Type) (When the Data Bus Width is 16 Bits)" or Section 5.3 "CC-Link Communication Circuit (Communication System Circuit Example (Isolated Type))".

5.5. Pattern Design Precautions

(1) Make the traces between the crystal oscillator and MFP3N as short as possible so that a damping resistor can be surface mounted.
(2) Keep as much distance between the crystal oscillator trace and other signal traces.
(3) Design a ground plane for the crystal oscillator.
(4) Use a four-layered printed circuit board as the board for mounting MFP3N. (Recommended)
(5) Form wide traces for "SD", "RD", and "SDGATEON" between MFP3N and the RS485 transceiver.
(6) Shield "SD", "RD", and "SDGATEON" between MFP3N and the RS485 transceiver with an SG (signal ground) line.
(7) Note the following so that the stray capacitance (capacitor component) of the transmission path connection terminal block (between DA and DB) becomes 20 pF or less:
  • Shorten the trace between the transmission path connection terminal block and the RS485 transceiver, and eliminate any internal layer patterns in that area.
  • Keep as much distance between DA trace and DB trace, and position them far away from other traces.
  • Use a zener diode recommended by the CC-Link Partner Association for those used between DA and DG and between DB and DG.
(8) Implement the following as measures to reduce noise:
  • Connect SLD and FG near the external input/output terminal.
  • Wire the FG trace so that it does not intersect the input/output traces on the front/back of the printed circuit board.
  • Isolate the CC-Link communication circuit. (Recommended)
(9) Isolate power supply and device inputs and outputs. (Recommended)

6. SPECIFIED/RECOMMENDED COMPONENTS

This chapter describes the specified/recommended components of the remote device station circuit.

6.1. Mitsubishi Electric Specified Components

The following table lists the components specified by Mitsubishi Electric for using CC-Link remote device station communication LSI (MFP3N).
Use a crystal oscillator having a frequency deviation within ±100 ppm.

Component	Model name	Size (unit: mm)	Manufacturer
Crystal oscillator	DSO751SBM 80MHz	7.3 × 4.9	DAISHINKU CORP.
	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	7.0×5.0	KYOCERA Corporation
	KC3225K80.0000C56NDZ (The production will be discontinued from March 2022.)	3.2×2.5	
	DSO321SBN 80MHZ	3.2 × 2.5	DAISHINKU CORP.
	DSO321SBM 80MHZ		

Note
For the latest information of the specified components, check the technical bulletins. For the production status, contact each manufacturer.

6.2. CC-Link Partner Association Recommended Components

For the following components to be used in the CC-Link communication circuit, use CC-Link Partner Association recommended components.
For the model, manufacturer, and specifications of each component, refer to the CC-Link Specification (Implementation).

- Filter
- RS485 transceiver
- Zener diode
- Photocoupler A (for communication signals)
- Photocoupler B (for gate control)

6.3. MFP3N

MFP3N can be purchased from your Mitsubishi Electric dealer network. For prices, please ask your dealer. MFP3N is the lead-free/RoHS Directive compliant product.

Product	Model	Package unit	Manufacturer
MFP3N (PC15003E)	A6GA-CCMFP3NN60FN	60 pieces	Mitsubishi Electric Corporation
	A6GA-CCMFP3NN300FN	300 pieces	

7. SETTING DETAILS

7.1. Number of Occupied Stations Setting

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

Number of occupied stations / Pin	1	2	3	4
SENYU0	L	H	L	H
SENYU1	L	L	H	H

*: When the IOTENSU pin is set to "H", the number of I/O points is fixed to 32, regardless of the number of occupied stations setting.

7.2. Station Number and Baud Rate Settings

Station number setting value
• 1 to 64: Station number (normal)
• 0, 65 or higher: A station number switch setting error occurs. The L ERR. LED turns on.

Station number (tens place) / Pin	00	10	20	30	40	50	60	70*1	80*1	90*1
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 number (ones place) / Pin	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 setting value
• 0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps
• 5 to 9: A baud rate switch setting error occurs. The L ERR. LED turns on.

Baud rate / Pin	0 (156 Kbps)	1 (625 Kbps)	2 (2.5 Mbps)	3 (5 Mbps)	4 (10 Mbps)	5*1	6*1	7*1	8*1	9*1
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

*1: The settings result in an error.

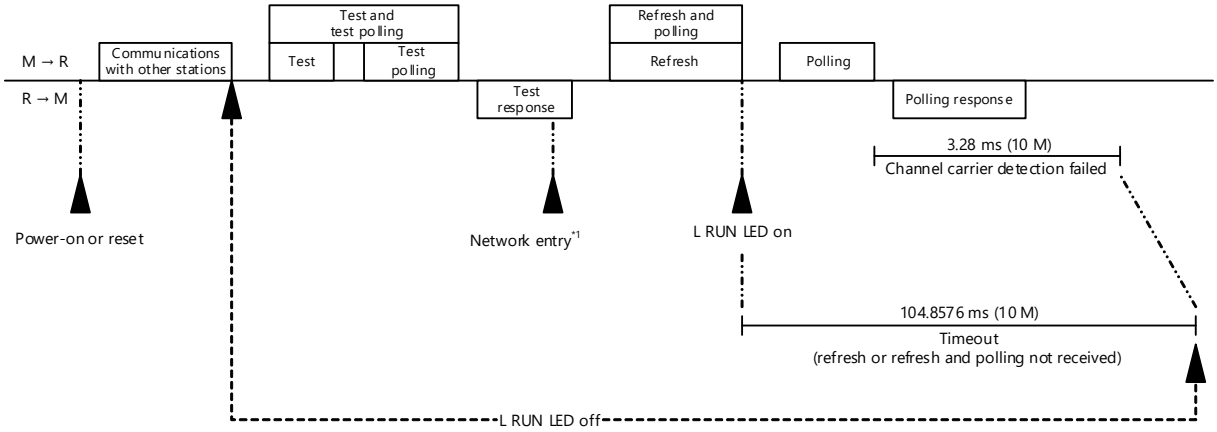
For the station number and baud rate setting timing, refer to Section 4.4 "Station Number/Baud Rate Settings and Reset Signal".

• On/off/flashing conditions of LEDs

The following table lists the on/off/flashing conditions of LEDs.

LED name	Status	Condition
L RUN (On: "H" output)	On	Refresh and polling data being received normally after network entry, or refresh data being received normally (Refer to *1 in the figure below.)
	Off	1. Before network entry (Refer to *1 in the figure below.) 2. Channel carrier detection failed 3. Timeout 4. Hardware reset
	Flashing	-
L ERR. (On: "L" output)	On	1. CRC error 2. Station number switch setting error after reset (0 or 65 or higher including the number of occupied stations is set.) 3. Baud rate switch setting error after reset (5 or higher is set.)
	Off	1. Normal communications 2. Hardware reset
	Flashing	The switch setting value has been changed from the value at start-up. (The LED flashes at intervals of 0.4 s.)
SD (On: "L" output)	On	Data being sent or +0.41 ms × $2^{(n-1)}$ after sending data (n = 1 to 8)
	Off	1. Other than the above 2. Hardware reset
	Flashing	-
RD (On: "L" output)	On	Channel carrier detection
	Off	1. Channel carrier detection failed 2. Hardware reset
	Flashing	-

On conditions of the L RUN LED



• Device operations indicated by LEDs

The following table lists the device operations indicated by LEDs. (○: On, ●: Off, ☼: Flashing)

L RUN	L ERR.	SD	RD	Operation
○	☼	☼	○	Data communications are performed normally, but a CRC error has often been detected due to noise.
○	☼	☼	○	The baud rate or station number setting value has been changed from the value at start-up. The L ERR. LED flashes at intervals of 0.4 s.*1
○	☼	☼	●	- (Impossible operating status)
○	☼	●	○	The station cannot respond because the receive data has a CRC error.
○	☼	●	●	- (Impossible operating status)
○	●	☼	○	Data communications are performed normally.
○	●	☼	●	- (Impossible operating status)
○	●	●	○	Data addressed to the own station cannot be received.
○	●	●	●	- (Impossible operating status)
●	☼	☼	○	Polling response is performed, but the refresh receive data has a CRC error.
●	☼	☼	●	- (Impossible operating status)
●	☼	●	○	Data addressed to the own station has a CRC error.
●	☼	●	●	- (Impossible operating status)
●	●	☼	○	Data link has not been started.
●	●	☼	●	- (Impossible operating status)
●	●	●	○	No data is addressed to the own station or data addressed to the own station cannot be received due to noise.
●	●	●	●	Data cannot be received due to disconnection. Power-off or hardware being set.
●	○	●	○	Baud rate or station number setting error

*1: Flashing of the L ERR. LED indicates a change in the baud rate or station number setting. The new setting will be reflected at the next reset.

Point
Implement the above LEDs to the device to be developed because they are useful for troubleshooting. (Recommended)

8. MONITOR OUTPUT OF RECEIVE FRAME INFORMATION

MON7, MON6: Monitor pins for internal signals. The signals to be monitored are not specified.
MON5: This pin is set to "H" when RWw information (bit data) for the own station is being received.
MON4: This pin is set to "H" when RY information (bit data) for the own station is being received.
MON3: This pin is set to "H" when a communication frame (bit data) other than a flag pattern is being received.
MON2 to MON0: These pins display the type of frame being received in accordance with the table below.

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

9.1. Memory Map List

(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
01	(Lower)	02	Station number switch information		Allowed	Not allowed
	(Upper)	03	Baud rate switch/number of occupied stations information		Allowed	Not allowed
02	(Lower)	04	Error information 1		Allowed	Not allowed
	(Upper)	05	Error information 2		Allowed	Not allowed
03	(Lower)	06	(Not used)		Not allowed	Not allowed
	(Upper)	07	(Not used)		Not allowed	Not allowed
04	(Lower)	08	Receive buffer	M → R ST1	Allowed	Not allowed
	(Upper)	09		M → R ST2	Allowed	Not allowed
05	(Lower)	0A		M → R RY00 to RY07	Allowed	Not allowed
	(Upper)	0B		M → R RY08 to RY0F	Allowed	Not allowed
06	(Lower)	0C		M → R RY10 to RY17	Allowed	Not allowed
	(Upper)	0D		M → R RY18 to RY1F	Allowed	Not allowed
07	(Lower)	0E		(Not used)	Not allowed	Not allowed
	(Upper)	0F		(Not used)	Not allowed	Not allowed
08	(Lower)	10		(Not used)	Not allowed	Not allowed
	(Upper)	11		(Not used)	Not allowed	Not allowed
09	(Lower)	12		(Not used)	Not allowed	Not allowed
	(Upper)	13		(Not used)	Not allowed	Not allowed
0A	(Lower)	14		(Not used)	Not allowed	Not allowed
	(Upper)	15		(Not used)	Not allowed	Not allowed
0B	(Lower)	16		(Not used)	Not allowed	Not allowed
	(Upper)	17		(Not used)	Not allowed	Not allowed
0C	(Lower)	18		(Not used)	Not allowed	Not allowed
	(Upper)	19		(Not used)	Not allowed	Not allowed
0D	(Lower)	1A		M → R RWw0 (L)	Allowed	Not allowed
	(Upper)	1B		M → R RWw0 (H)	Allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description		Read	Write
40	(Lower)	40	Send data write completed		Allowed	Allowed
	(Upper)	41	Receive data read request		Allowed	Allowed
41	(Lower)	42	Vendor code (Lower)		Allowed	Allowed
	(Upper)	43	Vendor code (Upper)		Allowed	Allowed
42	(Lower)	44	Model type		Allowed	Allowed
	(Upper)	45	Version		Allowed	Allowed
43	(Lower)	46	SDLED on time setting		Allowed	Allowed
	(Upper)	47	Timeout time setting		Allowed	Allowed
44	(Lower)	48	Send buffer	R → M ST1	Allowed	Allowed
	(Upper)	49		R → M ST2	Allowed	Allowed
45	(Lower)	4A		R → M RX00 to RX07	Allowed	Allowed
	(Upper)	4B		R → M RX08 to RX0F	Allowed	Allowed
46	(Lower)	4C		R → M RX10 to RX17	Allowed	Allowed
	(Upper)	4D		R → M RX18 to RX1F	Allowed	Allowed
47	(Lower)	4E		(Not used)	Not allowed	Not allowed
	(Upper)	4F		(Not used)	Not allowed	Not allowed
48	(Lower)	50		(Not used)	Not allowed	Not allowed
	(Upper)	51		(Not used)	Not allowed	Not allowed
49	(Lower)	52		(Not used)	Not allowed	Not allowed
	(Upper)	53		(Not used)	Not allowed	Not allowed
4A	(Lower)	54		(Not used)	Not allowed	Not allowed
	(Upper)	55		(Not used)	Not allowed	Not allowed
4B	(Lower)	56		(Not used)	Not allowed	Not allowed
	(Upper)	57		(Not used)	Not allowed	Not allowed
4C	(Lower)	58		(Not used)	Not allowed	Not allowed
	(Upper)	59		(Not used)	Not allowed	Not allowed
4D	(Lower)	5A		R → M RWr0 (L)	Allowed	Allowed
	(Upper)	5B		R → M RWr0 (H)	Allowed	Allowed
4E	(Lower)	5C		R → M RWr1 (L)	Allowed	Allowed
	(Upper)	5D		R → M RWr1 (H)	Allowed	Allowed
4F	(Lower)	5E		R → M RWr2 (L)	Allowed	Allowed
	(Upper)	5F		R → M RWr2 (H)	Allowed	Allowed
50	(Lower)	60		R → M RWr3 (L)	Allowed	Allowed
	(Upper)	61		R → M RWr3 (H)	Allowed	Allowed
51	(Lower)	62		(Not used)	Not allowed	Not allowed
	(Upper)	63		(Not used)	Not allowed	Not allowed
|		|		-	-	-
5C	(Lower)	78		(Not used)	Not allowed	Not allowed
	(Upper)	79		(Not used)	Not allowed	Not allowed

Address (hexadecimal)			Description		Read	Write
Data width						
16		8				
0E	(Lower)	1C	Receive buffer	M → R RWw1 (L)	Allowed	Not allowed
	(Upper)	1D		M → R RWw1 (H)	Allowed	Not allowed
0F	(Lower)	1E		M → R RWw2 (L)	Allowed	Not allowed
	(Upper)	1F		M → R RWw2 (H)	Allowed	Not allowed
10	(Lower)	20		M → R RWw3 (L)	Allowed	Not allowed
	(Upper)	21		M → R RWw3 (H)	Allowed	Not allowed
11	(Lower)	22		(Not used)	Not allowed	Not allowed
	(Upper)	23		(Not used)	Not allowed	Not allowed
|		|		-	-	-
1C	(Lower)	38		(Not used)	Not allowed	Not allowed
	(Upper)	39		(Not used)	Not allowed	Not allowed
1D | | | 3F		3A | | | 3F	(Not used)		Not allowed	Not allowed

Address (hexadecimal)			Description	Read	Write
Data width					
16		8			
5D	(Lower)	7A	HOLD/CLR information setting	Allowed	Allowed
	(Upper)	7B	(Not used)	Not allowed	Not allowed
5E | 5F		7C | 7F	(Not used)	Not allowed	Not allowed

(2) When the number of occupied stations is set to 2

Address (hexadecimal)			Description		Read	Write
Data width						
16		8				
00	(Lower)	00	Send data write enable information		Allowed	Not allowed
	(Upper)	01	Receive data update information		Allowed	Not allowed
01	(Lower)	02	Station number switch information		Allowed	Not allowed
	(Upper)	03	Baud rate switch/number of occupied stations information		Allowed	Not allowed
02	(Lower)	04	Error information 1		Allowed	Not allowed
	(Upper)	05	Error information 2		Allowed	Not allowed
03	(Lower)	06	(Not used)		Not allowed	Not allowed
	(Upper)	07	(Not used)		Not allowed	Not allowed
04	(Lower)	08	Receive buffer	M → R ST1	Allowed	Not allowed
	(Upper)	09		M → R ST2	Allowed	Not allowed
05	(Lower)	0A		M → R RY00 to RY07	Allowed	Not allowed
	(Upper)	0B		M → R RY08 to RY0F	Allowed	Not allowed
06	(Lower)	0C		M → R RY10 to RY17	Allowed	Not allowed
	(Upper)	0D		M → R RY18 to RY1F	Allowed	Not allowed
07	(Lower)	0E		M → R RY20 to RY27	Allowed	Not allowed
	(Upper)	0F		M → R RY28 to RY2F	Allowed	Not allowed
08	(Lower)	10		M → R RY30 to RY37	Allowed	Not allowed
	(Upper)	11		M → R RY38 to RY3F	Allowed	Not allowed
09	(Lower)	12		(Not used)	Not allowed	Not allowed
	(Upper)	13		(Not used)	Not allowed	Not allowed
0A	(Lower)	14		(Not used)	Not allowed	Not allowed
	(Upper)	15		(Not used)	Not allowed	Not allowed
0B	(Lower)	16		(Not used)	Not allowed	Not allowed
	(Upper)	17		(Not used)	Not allowed	Not allowed
0C	(Lower)	18		(Not used)	Not allowed	Not allowed
	(Upper)	19		(Not used)	Not allowed	Not allowed
0D	(Lower)	1A		M → R RWw0 (L)	Allowed	Not allowed
	(Upper)	1B		M → R RWw0 (H)	Allowed	Not allowed
0E	(Lower)	1C		M → R RWw1 (L)	Allowed	Not allowed
	(Upper)	1D		M → R RWw1 (H)	Allowed	Not allowed
0F	(Lower)	1E		M → R RWw2 (L)	Allowed	Not allowed
	(Upper)	1F		M → R RWw2 (H)	Allowed	Not allowed
10	(Lower)	20		M → R RWw3 (L)	Allowed	Not allowed
	(Upper)	21		M → R RWw3 (H)	Allowed	Not allowed
11	(Lower)	22		M → R RWw4 (L)	Allowed	Not allowed
	(Upper)	23		M → R RWw4 (H)	Allowed	Not allowed
12	(Lower)	24		M → R RWw5 (L)	Allowed	Not allowed
	(Upper)	25		M → R RWw5 (H)	Allowed	Not allowed
13	(Lower)	26		M → R RWw6 (L)	Allowed	Not allowed
	(Upper)	27		M → R RWw6 (H)	Allowed	Not allowed

Address (hexadecimal)			Description		Read	Write
Data width						
16		8				
40	(Lower)	40	Send data write completed		Allowed	Allowed
	(Upper)	41	Receive data read request		Allowed	Allowed
41	(Lower)	42	Vendor code (Lower)		Allowed	Allowed
	(Upper)	43	Vendor code (Upper)		Allowed	Allowed
42	(Lower)	44	Model type		Allowed	Allowed
	(Upper)	45	Version		Allowed	Allowed
43	(Lower)	46	SDLED on time setting		Allowed	Allowed
	(Upper)	47	Timeout time setting		Allowed	Allowed
44	(Lower)	48	Send buffer	R → M ST1	Allowed	Allowed
	(Upper)	49		R → M ST2	Allowed	Allowed
45	(Lower)	4A		R → M RX00 to RX07	Allowed	Allowed
	(Upper)	4B		R → M RX08 to RX0F	Allowed	Allowed
46	(Lower)	4C		R → M RX10 to RX17	Allowed	Allowed
	(Upper)	4D		R → M RX18 to RX1F	Allowed	Allowed
47	(Lower)	4E		R → M RX20 to RX27	Allowed	Allowed
	(Upper)	4F		R → M RX28 to RX2F	Allowed	Allowed
48	(Lower)	50		R → M RX30 to RX37	Allowed	Allowed
	(Upper)	51		R → M RX38 to RX3F	Allowed	Allowed
49	(Lower)	52		(Not used)	Not allowed	Not allowed
	(Upper)	53		(Not used)	Not allowed	Not allowed
4A	(Lower)	54		(Not used)	Not allowed	Not allowed
	(Upper)	55		(Not used)	Not allowed	Not allowed
4B	(Lower)	56		(Not used)	Not allowed	Not allowed
	(Upper)	57		(Not used)	Not allowed	Not allowed
4C	(Lower)	58		(Not used)	Not allowed	Not allowed
	(Upper)	59		(Not used)	Not allowed	Not allowed
4D	(Lower)	5A		R → M RWr0 (L)	Allowed	Allowed
	(Upper)	5B		R → M RWr0 (H)	Allowed	Allowed
4E	(Lower)	5C		R → M RWr1 (L)	Allowed	Allowed
	(Upper)	5D		R → M RWr1 (H)	Allowed	Allowed
4F	(Lower)	5E		R → M RWr2 (L)	Allowed	Allowed
	(Upper)	5F		R → M RWr2 (H)	Allowed	Allowed
50	(Lower)	60		R → M RWr3 (L)	Allowed	Allowed
	(Upper)	61		R → M RWr3 (H)	Allowed	Allowed
51	(Lower)	62		R → M RWr4 (L)	Allowed	Allowed
	(Upper)	63		R → M RWr4 (H)	Allowed	Allowed
52	(Lower)	64		R → M RWr5 (L)	Allowed	Allowed
	(Upper)	65		R → M RWr5 (H)	Allowed	Allowed
53	(Lower)	66		R → M RWr6 (L)	Allowed	Allowed
	(Upper)	67		R → M RWr6 (H)	Allowed	Allowed
54	(Lower)	68		R → M RWr7 (L)	Allowed	Allowed
	(Upper)	69		R → M RWr7 (H)	Allowed	Allowed
55	(Lower)	6A		(Not used)	Not allowed	Not allowed
	(Upper)	6B		(Not used)	Not allowed	Not allowed
56	(Lower)	6C		(Not used)	Not allowed	Not allowed
	(Upper)	6D		(Not used)	Not allowed	Not allowed
57	(Lower)	6E		(Not used)	Not allowed	Not allowed
	(Upper)	6F		(Not used)	Not allowed	Not allowed
58	(Lower)	70		(Not used)	Not allowed	Not allowed
	(Upper)	71		(Not used)	Not allowed	Not allowed
59	(Lower)	72		(Not used)	Not allowed	Not allowed
	(Upper)	73		(Not used)	Not allowed	Not allowed
5A	(Lower)	74		(Not used)	Not allowed	Not allowed
	(Upper)	75		(Not used)	Not allowed	Not allowed
5B	(Lower)	76		(Not used)	Not allowed	Not allowed
	(Upper)	77		(Not used)	Not allowed	Not allowed
5C	(Lower)	78		(Not used)	Not allowed	Not allowed
	(Upper)	79		(Not used)	Not allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description		Read	Write
14	(Lower)	28	Receive buffer	M → R RWw7 (L)	Allowed	Not allowed
	(Upper)	29		M → R RWw7 (H)	Allowed	Not allowed
15	(Lower)	2A		(Not used)	Not allowed	Not allowed
	(Upper)	2B		(Not used)	Not allowed	Not allowed
16	(Lower)	2C		(Not used)	Not allowed	Not allowed
	(Upper)	2D		(Not used)	Not allowed	Not allowed
17	(Lower)	2E		(Not used)	Not allowed	Not allowed
	(Upper)	2F		(Not used)	Not allowed	Not allowed
18	(Lower)	30		(Not used)	Not allowed	Not allowed
	(Upper)	31		(Not used)	Not allowed	Not allowed
19	(Lower)	32		(Not used)	Not allowed	Not allowed
	(Upper)	33		(Not used)	Not allowed	Not allowed
1A	(Lower)	34		(Not used)	Not allowed	Not allowed
	(Upper)	35		(Not used)	Not allowed	Not allowed
1B	(Lower)	36		(Not used)	Not allowed	Not allowed
	(Upper)	37		(Not used)	Not allowed	Not allowed
1C	(Lower)	38		(Not used)	Not allowed	Not allowed
	(Upper)	39		(Not used)	Not allowed	Not allowed
1D | | | 3F		3A | | | 3F	(Not used)		Not allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description	Read	Write
5D	(Lower)	7A	HOLD/CLR information setting	Allowed	Allowed
	(Upper)	7B	(Not used)	Not allowed	Not allowed
5E | 5F		7C | 7F	(Not used)	Not allowed	Not allowed

(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
01	(Lower)	02	Station number switch information		Allowed	Not allowed
	(Upper)	03	Baud rate switch/number of occupied stations information		Allowed	Not allowed
02	(Lower)	04	Error information 1		Allowed	Not allowed
	(Upper)	05	Error information 2		Allowed	Not allowed
03	(Lower)	06	(Not used)		Not allowed	Not allowed
	(Upper)	07	(Not used)		Not allowed	Not allowed
04	(Lower)	08	Receive buffer	M → R ST1	Allowed	Not allowed
	(Upper)	09		M → R ST2	Allowed	Not allowed
05	(Lower)	0A		M → R RY00 to RY07	Allowed	Not allowed
	(Upper)	0B		M → R RY08 to RY0F	Allowed	Not allowed
06	(Lower)	0C		M → R RY10 to RY17	Allowed	Not allowed
	(Upper)	0D		M → R RY18 to RY1F	Allowed	Not allowed
07	(Lower)	0E		M → R RY20 to RY27	Allowed	Not allowed
	(Upper)	0F		M → R RY28 to RY2F	Allowed	Not allowed
08	(Lower)	10		M → R RY30 to RY37	Allowed	Not allowed
	(Upper)	11		M → R RY38 to RY3F	Allowed	Not allowed
09	(Lower)	12		M → R RY40 to RY47	Allowed	Not allowed
	(Upper)	13		M → R RY48 to RY4F	Allowed	Not allowed
0A	(Lower)	14		M → R RY50 to RY57	Allowed	Not allowed
	(Upper)	15		M → R RY58 to RY5F	Allowed	Not allowed
0B	(Lower)	16		(Not used)	Not allowed	Not allowed
	(Upper)	17		(Not used)	Not allowed	Not allowed
0C	(Lower)	18		(Not used)	Not allowed	Not allowed
	(Upper)	19		(Not used)	Not allowed	Not allowed
0D	(Lower)	1A		M → R RWw0 (L)	Allowed	Not allowed
	(Upper)	1B		M → R RWw0 (H)	Allowed	Not allowed
0E	(Lower)	1C		M → R RWw1 (L)	Allowed	Not allowed
	(Upper)	1D		M → R RWw1 (H)	Allowed	Not allowed
0F	(Lower)	1E		M → R RWw2 (L)	Allowed	Not allowed
	(Upper)	1F		M → R RWw2 (H)	Allowed	Not allowed
10	(Lower)	20		M → R RWw3 (L)	Allowed	Not allowed
	(Upper)	21		M → R RWw3 (H)	Allowed	Not allowed
11	(Lower)	22		M → R RWw4 (L)	Allowed	Not allowed
	(Upper)	23		M → R RWw4 (H)	Allowed	Not allowed
12	(Lower)	24		M → R RWw5 (L)	Allowed	Not allowed
	(Upper)	25		M → R RWw5 (H)	Allowed	Not allowed
13	(Lower)	26		M → R RWw6 (L)	Allowed	Not allowed
	(Upper)	27		M → R RWw6 (H)	Allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description		Read	Write
40	(Lower)	40	Send data write completed		Allowed	Allowed
	(Upper)	41	Receive data read request		Allowed	Allowed
41	(Lower)	42	Vendor code (Lower)		Allowed	Allowed
	(Upper)	43	Vendor code (Upper)		Allowed	Allowed
42	(Lower)	44	Model type		Allowed	Allowed
	(Upper)	45	Version		Allowed	Allowed
43	(Lower)	46	SDLED on time setting		Allowed	Allowed
	(Upper)	47	Timeout time setting		Allowed	Allowed
44	(Lower)	48	Send buffer	R → M ST1	Allowed	Allowed
	(Upper)	49		R → M ST2	Allowed	Allowed
45	(Lower)	4A		R → M RX00 to RX07	Allowed	Allowed
	(Upper)	4B		R → M RX08 to RX0F	Allowed	Allowed
46	(Lower)	4C		R → M RX10 to RX17	Allowed	Allowed
	(Upper)	4D		R → M RX18 to RX1F	Allowed	Allowed
47	(Lower)	4E		R → M RX20 to RX27	Allowed	Allowed
	(Upper)	4F		R → M RX28 to RX2F	Allowed	Allowed
48	(Lower)	50		R → M RX30 to RX37	Allowed	Allowed
	(Upper)	51		R → M RX38 to RX3F	Allowed	Allowed
49	(Lower)	52		R → M RX40 to RX47	Allowed	Allowed
	(Upper)	53		R → M RX48 to RX4F	Allowed	Allowed
4A	(Lower)	54		R → M RX50 to RX57	Allowed	Allowed
	(Upper)	55		R → M RX58 to RX5F	Allowed	Allowed
4B	(Lower)	56		(Not used)	Not allowed	Not allowed
	(Upper)	57		(Not used)	Not allowed	Not allowed
4C	(Lower)	58		(Not used)	Not allowed	Not allowed
	(Upper)	59		(Not used)	Not allowed	Not allowed
4D	(Lower)	5A		R → M RWr0 (L)	Allowed	Allowed
	(Upper)	5B		R → M RWr0 (H)	Allowed	Allowed
4E	(Lower)	5C		R → M RWr1 (L)	Allowed	Allowed
	(Upper)	5D		R → M RWr1 (H)	Allowed	Allowed
4F	(Lower)	5E		R → M RWr2 (L)	Allowed	Allowed
	(Upper)	5F		R → M RWr2 (H)	Allowed	Allowed
50	(Lower)	60		R → M RWr3 (L)	Allowed	Allowed
	(Upper)	61		R → M RWr3 (H)	Allowed	Allowed
51	(Lower)	62		R → M RWr4 (L)	Allowed	Allowed
	(Upper)	63		R → M RWr4 (H)	Allowed	Allowed
52	(Lower)	64		R → M RWr5 (L)	Allowed	Allowed
	(Upper)	65		R → M RWr5 (H)	Allowed	Allowed
53	(Lower)	66		R → M RWr6 (L)	Allowed	Allowed
	(Upper)	67		R → M RWr6 (H)	Allowed	Allowed
54	(Lower)	68		R → M RWr7 (L)	Allowed	Allowed
	(Upper)	69		R → M RWr7 (H)	Allowed	Allowed
55	(Lower)	6A		R → M RWr8 (L)	Allowed	Allowed
	(Upper)	6B		R → M RWr8 (H)	Allowed	Allowed
56	(Lower)	6C		R → M RWr9 (L)	Allowed	Allowed
	(Upper)	6D		R → M RWr9 (H)	Allowed	Allowed
57	(Lower)	6E		R → M RWr10 (L)	Allowed	Allowed
	(Upper)	6F		R → M RWr10 (H)	Allowed	Allowed
58	(Lower)	70		R → M RWr11 (L)	Allowed	Allowed
	(Upper)	71		R → M RWr11 (H)	Allowed	Allowed
59	(Lower)	72		(Not used)	Not allowed	Not allowed
	(Upper)	73		(Not used)	Not allowed	Not allowed
5A	(Lower)	74		(Not used)	Not allowed	Not allowed
	(Upper)	75		(Not used)	Not allowed	Not allowed
5B	(Lower)	76		(Not used)	Not allowed	Not allowed
	(Upper)	77		(Not used)	Not allowed	Not allowed
5C	(Lower)	78		(Not used)	Not allowed	Not allowed
	(Upper)	79		(Not used)	Not allowed	Not allowed
5D	(Lower)	7A	HOLD/CLR information setting		Allowed	Allowed
	(Upper)	7B	(Not used)		Not allowed	Not allowed
5E | 5F		7C | 7F	(Not used)		Not allowed	Not allowed

Address (hexadecimal)		Description		Read	Write
Data width					
16	8				
14 (Lower)	28	Receive buffer	M → R RWw7 (L)	Allowed	Not allowed
14 (Upper)	29		M → R RWw7 (H)	Allowed	Not allowed
15 (Lower)	2A		M → R RWw8 (L)	Allowed	Not allowed
15 (Upper)	2B		M → R RWw8 (H)	Allowed	Not allowed
16 (Lower)	2C		M → R RWw9 (L)	Allowed	Not allowed
16 (Upper)	2D		M → R RWw9 (H)	Allowed	Not allowed
17 (Lower)	2E		M → R RWw10 (L)	Allowed	Not allowed
17 (Upper)	2F		M → R RWw10 (H)	Allowed	Not allowed
18 (Lower)	30		M → R RWw11 (L)	Allowed	Not allowed
18 (Upper)	31		M → R RWw11 (H)	Allowed	Not allowed
19 (Lower)	32		(Not used)	Not allowed	Not allowed
19 (Upper)	33		(Not used)	Not allowed	Not allowed
1A (Lower)	34		(Not used)	Not allowed	Not allowed
1A (Upper)	35		(Not used)	Not allowed	Not allowed
1B (Lower)	36		(Not used)	Not allowed	Not allowed
1B (Upper)	37		(Not used)	Not allowed	Not allowed
1C (Lower)	38		(Not used)	Not allowed	Not allowed
1C (Upper)	39		(Not used)	Not allowed	Not allowed
1D | | | 3F	3A | | | 3F	(Not used)		Not allowed	Not allowed

(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
01	(Lower)	02	Station number switch information		Allowed	Not allowed
	(Upper)	03	Baud rate switch/number of occupied stations information		Allowed	Not allowed
02	(Lower)	04	Error information 1		Allowed	Not allowed
	(Upper)	05	Error information 2		Allowed	Not allowed
03	(Lower)	06	(Not used)		Not allowed	Not allowed
	(Upper)	07	(Not used)		Not allowed	Not allowed
04	(Lower)	08	Receive buffer	M → R ST1	Allowed	Not allowed
	(Upper)	09		M → R ST2	Allowed	Not allowed
05	(Lower)	0A		M → R RY00 to RY07	Allowed	Not allowed
	(Upper)	0B		M → R RY08 to RY0F	Allowed	Not allowed
06	(Lower)	0C		M → R RY10 to RY17	Allowed	Not allowed
	(Upper)	0D		M → R RY18 to RY1F	Allowed	Not allowed
07	(Lower)	0E		M → R RY20 to RY27	Allowed	Not allowed
	(Upper)	0F		M → R RY28 to RY2F	Allowed	Not allowed
08	(Lower)	10		M → R RY30 to RY37	Allowed	Not allowed
	(Upper)	11		M → R RY38 to RY3F	Allowed	Not allowed
09	(Lower)	12		M → R RY40 to RY47	Allowed	Not allowed
	(Upper)	13		M → R RY48 to RY4F	Allowed	Not allowed
0A	(Lower)	14		M → R RY50 to RY57	Allowed	Not allowed
	(Upper)	15		M → R RY58 to RY5F	Allowed	Not allowed
0B	(Lower)	16		M → R RY60 to RY67	Allowed	Not allowed
	(Upper)	17		M → R RY68 to RY6F	Allowed	Not allowed
0C	(Lower)	18		M → R RY70 to RY77	Allowed	Not allowed
	(Upper)	19		M → R RY78 to RY7F	Allowed	Not allowed
0D	(Lower)	1A		M → R RWw0 (L)	Allowed	Not allowed
	(Upper)	1B		M → R RWw0 (H)	Allowed	Not allowed
0E	(Lower)	1C		M → R RWw1 (L)	Allowed	Not allowed
	(Upper)	1D		M → R RWw1 (H)	Allowed	Not allowed
0F	(Lower)	1E		M → R RWw2 (L)	Allowed	Not allowed
	(Upper)	1F		M → R RWw2 (H)	Allowed	Not allowed
10	(Lower)	20		M → R RWw3 (L)	Allowed	Not allowed
	(Upper)	21		M → R RWw3 (H)	Allowed	Not allowed
11	(Lower)	22		M → R RWw4 (L)	Allowed	Not allowed
	(Upper)	23		M → R RWw4 (H)	Allowed	Not allowed
12	(Lower)	24		M → R RWw5 (L)	Allowed	Not allowed
	(Upper)	25		M → R RWw5 (H)	Allowed	Not allowed
13	(Lower)	26		M → R RWw6 (L)	Allowed	Not allowed
	(Upper)	27		M → R RWw6 (H)	Allowed	Not allowed

Address (hexadecimal) Data width 16		8	Description		Read	Write
40	(Lower)	40	Send data write completed		Allowed	Allowed
	(Upper)	41	Receive data read request		Allowed	Allowed
41	(Lower)	42	Vendor code (Lower)		Allowed	Allowed
	(Upper)	43	Vendor code (Upper)		Allowed	Allowed
42	(Lower)	44	Model type		Allowed	Allowed
	(Upper)	45	Version		Allowed	Allowed
43	(Lower)	46	SDLED on time setting		Allowed	Allowed
	(Upper)	47	Timeout time setting		Allowed	Allowed
44	(Lower)	48	Send buffer	R → M ST1	Allowed	Allowed
	(Upper)	49		R → M ST2	Allowed	Allowed
45	(Lower)	4A		R → M RX00 to RX07	Allowed	Allowed
	(Upper)	4B		R → M RX08 to RX0F	Allowed	Allowed
46	(Lower)	4C		R → M RX10 to RX17	Allowed	Allowed
	(Upper)	4D		R → M RX18 to RX1F	Allowed	Allowed
47	(Lower)	4E		R → M RX20 to RX27	Allowed	Allowed
	(Upper)	4F		R → M RX28 to RX2F	Allowed	Allowed
48	(Lower)	50		R → M RX30 to RX37	Allowed	Allowed
	(Upper)	51		R → M RX38 to RX3F	Allowed	Allowed
49	(Lower)	52		R → M RX40 to RX47	Allowed	Allowed
	(Upper)	53		R → M RX48 to RX4F	Allowed	Allowed
4A	(Lower)	54		R → M RX50 to RX57	Allowed	Allowed
	(Upper)	55		R → M RX58 to RX5F	Allowed	Allowed
4B	(Lower)	56		R → M RX60 to RX67	Allowed	Allowed
	(Upper)	57		R → M RX68 to RX6F	Allowed	Allowed
4C	(Lower)	58		R → M RX70 to RX77	Allowed	Allowed
	(Upper)	59		R → M RX78 to RX7F	Allowed	Allowed
4D	(Lower)	5A		R → M RWr0 (L)	Allowed	Allowed
	(Upper)	5B		R → M RWr0 (H)	Allowed	Allowed
4E	(Lower)	5C		R → M RWr1 (L)	Allowed	Allowed
	(Upper)	5D		R → M RWr1 (H)	Allowed	Allowed
4F	(Lower)	5E		R → M RWr2 (L)	Allowed	Allowed
	(Upper)	5F		R → M RWr2 (H)	Allowed	Allowed
50	(Lower)	60		R → M RWr3 (L)	Allowed	Allowed
	(Upper)	61		R → M RWr3 (H)	Allowed	Allowed
51	(Lower)	62		R → M RWr4 (L)	Allowed	Allowed
	(Upper)	63		R → M RWr4 (H)	Allowed	Allowed
52	(Lower)	64		R → M RWr5 (L)	Allowed	Allowed
	(Upper)	65		R → M RWr5 (H)	Allowed	Allowed
53	(Lower)	66		R → M RWr6 (L)	Allowed	Allowed
	(Upper)	67		R → M RWr6 (H)	Allowed	Allowed
54	(Lower)	68		R → M RWr7 (L)	Allowed	Allowed
	(Upper)	69		R → M RWr7 (H)	Allowed	Allowed
55	(Lower)	6A		R → M RWr8 (L)	Allowed	Allowed
	(Upper)	6B		R → M RWr8 (H)	Allowed	Allowed
56	(Lower)	6C		R → M RWr9 (L)	Allowed	Allowed
	(Upper)	6D		R → M RWr9 (H)	Allowed	Allowed
57	(Lower)	6E		R → M RWr10 (L)	Allowed	Allowed
	(Upper)	6F		R → M RWr10 (H)	Allowed	Allowed
58	(Lower)	70		R → M RWr11 (L)	Allowed	Allowed
	(Upper)	71		R → M RWr11 (H)	Allowed	Allowed
59	(Lower)	72		R → M RWr12 (L)	Allowed	Allowed
	(Upper)	73		R → M RWr12 (H)	Allowed	Allowed
5A	(Lower)	74		R → M RWr13 (L)	Allowed	Allowed
	(Upper)	75		R → M RWr13 (H)	Allowed	Allowed
5B	(Lower)	76		R → M RWr14 (L)	Allowed	Allowed
	(Upper)	77		R → M RWr14 (H)	Allowed	Allowed
5C	(Lower)	78		R → M RWr15 (L)	Allowed	Allowed
	(Upper)	79		R → M RWr15 (H)	Allowed	Allowed
5D	(Lower)	7A	HOLD/CLR information setting		Allowed	Allowed
	(Upper)	7B	(Not used)		Not allowed	Not allowed
5E | 5F		7C | 7F	(Not used)		Not allowed	Not allowed

Address (hexadecimal)		Description		Read	Write
Data width					
16	8				
14 (Lower)	28	Receive buffer	M → R RWw7 (L)	Allowed	Not allowed
14 (Upper)	29		M → R RWw7 (H)	Allowed	Not allowed
15 (Lower)	2A		M → R RWw8 (L)	Allowed	Not allowed
15 (Upper)	2B		M → R RWw8 (H)	Allowed	Not allowed
16 (Lower)	2C		M → R RWw9 (L)	Allowed	Not allowed
16 (Upper)	2D		M → R RWw9 (H)	Allowed	Not allowed
17 (Lower)	2E		M → R RWw10 (L)	Allowed	Not allowed
17 (Upper)	2F		M → R RWw10 (H)	Allowed	Not allowed
18 (Lower)	30		M → R RWw11 (L)	Allowed	Not allowed
18 (Upper)	31		M → R RWw11 (H)	Allowed	Not allowed
19 (Lower)	32		M → R RWw12 (L)	Allowed	Not allowed
19 (Upper)	33		M → R RWw12 (H)	Allowed	Not allowed
1A (Lower)	34		M → R RWw13 (L)	Allowed	Not allowed
1A (Upper)	35		M → R RWw13 (H)	Allowed	Not allowed
1B (Lower)	36		M → R RWw14 (L)	Allowed	Not allowed
1B (Upper)	37		M → R RWw14 (H)	Allowed	Not allowed
1C (Lower)	38		M → R RWw15 (L)	Allowed	Not allowed
1C (Upper)	39		M → R RWw15 (H)	Allowed	Not allowed
1D | | | 3F	3A | | | 3F	(Not used)		Not allowed	Not allowed

(1) Send data write enable information

Byte address	Bit	Bit name	R/W	Description	After reset
00h	7 to 1	-	R	Reserved (Read: 0)	00h
	0	MWRENL	R	0: Enabled When this bit is set to "0", a user can write send data to the send buffer. 1: Disabled When this bit is set to "1", writing data to the send buffer is prohibited because MFP3N is reading the send data written by the user.	

When the Send data write completion flag (byte address 40h) is set to "1", MFP3N starts to read the data in the send buffer. Therefore, this bit is set to "1" (Disabled). When the read operation is completed, this bit is set to "0" (Enabled).

(2) Receive data update information

Byte address	Bit	Bit name	R/W	Description	After reset
01h	7 to 1	-	R	Reserved (Read: 0)	00h
	0	DCHANG	R	0: No update The data in the receive buffer is the same as the last read data.*1 1: Update Newly received data is stored in the receive buffer.*2	

For asynchronous reading, check that this bit is set to "1" before reading the receive data.
*1: New data is received during last reading, or the read interval is shorter than the refresh cycle.
*2: This bit is set to "1" when the data is updated to the same data as the last read data.

(3) Station number setting switch information

Byte address	Bit	Bit name	R/W	Description	After reset
02h	7 to 0	S7 to S0	R	The station number setting switch value is stored in binary code at power-on or reset. 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.	Undefined

(4) Baud rate switch/number of occupied stations information

Byte address	Bit	Bit name	R/W	Description		After reset
03h	7, 6	-	R	Reserved (Read: 0)		Undefined
	5	KYOKU1	R	SENYU1 pin (89) state	0: "L" 1: "H"	
	4	KYOKU0	R	SENYU0 pin (88) state		
	3	BSW8	R	BS8 pin (71) state	0: "H" 1: "L"	
	2	BSW4	R	BS4 pin (72) state		
	1	BSW2	R	BS2 pin (73) state		
	0	BSW1	R	BS1 pin (74) state		

*: The valid baud rate switch values are from 0 to 4.

Number of occupied stations information

Bit name	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
KYOKU1	0	0	1	1
KYOKU0	0	1	0	1

Baud rate switch information

Bit name	0 (156 Kbps)	1 (625 Kbps)	2 (2.5 Mbps)	3 (5 Mbps)	4 (10 Mbps)
BSW8	0	0	0	0	0
BSW4	0	0	0	0	1
BSW2	0	0	1	1	0
BSW1	0	1	0	1	0

(5) Error information 1 (switch status)

Byte address	Bit	Bit name	R/W	Description	After reset
04h	7, 6	-	R	Reserved (Read: 0)	00h
	5	BSERR	R	Baud rate switch change error information 0: Normal 1: Error (The setting has been changed from the setting at power-on.)	
	4	SSERR	R	Station number setting switch change error information 0: Normal 1: Error (The setting has been changed from the setting at power-on.)	
	3, 2	-	R	Reserved (Read: 0)	
	1	BERR	R	Baud rate switch setting error information 0: Normal 1: Setting error (A value other than 0 to 4 has been set.)	
	0	STERR	R	Station number switch setting error information 0: Normal 1: Setting error (A value 0, 65 or higher has been set.)	

*: An error will be cleared when the setting value returns to normal.

(6) Error information 2 (transmission status)

Byte address	Bit	Bit name	R/W	Description	After reset
05h	7 to 3	-	R	Reserved (Read: 0)	Undefined
	2	ERR22	R	Channel carrier detection status 0: Normal 1: Error*2	
	1	ERR21	R	Timeout error 0: Normal 1: Timeout error*1	
	0	ERR20	R	CRC error 0: Normal 1: CRC error*1	

*1: The error will be cleared when a normal frame is received.
*2: The error will be cleared when a channel carrier is detected.

(7) M → R status information (ST1)

Byte address	Bit	Bit name	R/W	Description	After reset
08h	7	MST17	R	0: Master station / 1: Standby master station	Undefined
	6, 5	MST16, MST15	R	Protocol version 00: Ver.1.**10: Ver.3.** (For future use) 01: Ver.2.**11: Ver.4.** (For future use)	
	4	MST14	R	Transient receive 0: Enabled / 1: Disabled	
	3	MST13	R	Transient 0: No / 1: Yes	
	2	MST12	R	Refresh 0: No / 1: Yes	
	1	MST11	R	Master station application 0: Normal / 1: Error	
	0	MST10	R	Master station application 0: STOP / 1: RUN	

(8) M → R status information (ST2)

Byte address	Bit	Bit name	R/W	Description	After reset
09h	7 to 4	MST27 to MST24	R	Number of RWw information send points (in units of words) 0000: 0 points 0011: 96 points 0110: 192 points 0001: 32 points 0100: 128 points 0111: 224 points 0010: 64 points 0101: 160 points 1000: 256 points	Undefined
	3 to 0	MST23 to MST20	R	Number of RY information send points (in units of bits) 0000: 0 points 0011: 768 points 0110: 1536 points 0001: 256 points 0100: 1024 points 0111: 1792 points 0010: 512 points 0101: 1280 points 1000: 2048 points	

(9) RY receive buffer

Byte address	Bit	Bit name	R/W	Description	After reset
0Ah	7 to 0	-	R	RY07 to RY00	Undefined
0Bh	7 to 0	-	R	RY0F to RY08	

*: The byte addresses 0Ch to 19h are the same as the byte addresses 0Ah to 0Bh.

(10) RWw receive buffer

Byte address	Bit	Bit name	R/W	Description	After reset
1Ah	7 to 0	-	R	RWw00 (lower bits, b7 to b0)	Undefined
1Bh	7 to 0	-	R	RWw00 (upper bits, bF to b8)	

*: The byte addresses 1Ch to 39h are the same as the byte addresses 1Ah to 1Bh.

(11) Send data write complete flag

Byte address	Bit	Bit name	R/W	Description	After reset
40H	7 to 1	-	R/W	Reserved (Write: 0 / Read: 0)	00h
	0	WPFLG	R/W	<Write> 0: - (Writing disabled) 1: A user has completed writing the send data. <Read> 0: MFP3N has completed reading the send data. 1: MFP3N has started reading the send data.	

Set this bit (WPFLG) to "1" when writing data to the send buffer is completed. MFP3N reads the send data written by the user, creates a frame, and sends it.
After MFP3N completes reading the send data, the bit (WPFLG) automatically returns to "0".

In the initial setting processing	Set the bit (WPFLG) to "1" when the initial value setting operation is completed. (The communications (send/receive) will not start unless the value "01H" is written.)
After the initial setting processing	Set the bit (WPFLG) to "1" when the send data write operation is completed.

(12) Receive data read request

Byte address	Bit	Bit name	R/W	Description	After reset
41H	7 to 1	-	R/W	Reserved (Write: 0 / Read: 0)	00h
	0	DRDREQ	R/W	<Write> 0: A user completed reading the receive data. 1: A user starts to read the receive data. <Read> The written data will be read.	

Set this bit to "1" when the receive data is read. Set this bit to "0" after the data has read.

(13) Vendor code (Lower)

Byte address	Bit	Bit name	R/W	Description	After reset
42H	7 to 0	-	R/W	<Write> Write the lower portion of the vendor code. <Read> The written data will be read.	00h

(14) Vendor code (Upper)

Byte address	Bit	Bit name	R/W	Description	After reset
43H	7 to 0	-	R/W	<Write> Write the upper portion of the vendor code. <Read> The written data will be read.	00h

Point	Vendor code

The vendor code is acquired from the ID number issued when a vendor joined 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]
When the ID number is 123-456-7890, the vendor code will be 5678.
Write the lower portion of the vendor code "78h" to the byte address 42h, and write the upper portion of the vendor code "56h" to the byte address 43h.

(15) Model type

Byte address	Bit	Bit name	R/W	Description	After reset
44h	7 to 0	-	R/W	<Write> Write the model type. <Read> The written data will be read.	00h

Point	Model type

Select the applicable device type from the types posted on the CC-Link Partner Association website.
If an applicable device type does not exist, consult with the CC-Link Partner Association.

(16) Software version/Protocol version

Byte address	Bit	Bit name	R/W	Description	After reset
45h	7, 6	-	R/W	CC-Link protocol version <Write> Write the protocol version. <Read> The written data will be read. 00: Ver.1.** 10: Ver.3.** (For future use) 01: Ver.2.** 11: Ver.4.** (For future use)	00h
	5 to 0	-	R/W	Device software version <Write> Write the software version. <Read> The written data will be read. Version: 01h, 02h, ..., 3Fh Initial setting: 00 0001b	

Point	Software version

For details on the software version, refer to "CC-Link Specification (Overview/Protocol)" published by the CC-Link Partner Association (CLPA). The management method of software versions must be determined by the user who develops the device.

(17) SDLED on time setting

Byte address	Bit	Bit name	R/W	Description	After reset
46h	7 to 4	SLED3 to SLED0	R/W	<Write> The setting value is written after "0" is written to b7 (SLED3). <Read> The written data will be read.	00h
	3 to 0	-	R/W	Reserved (Write: 0 / Read: 0)	

SLED3	SLED2	SLED1	SLED0	SDLED on time
0	-	-	-	Data being sent
1	0	0	0	0.05 to 0.1 ms
1	0	0	1	0.1 to 0.2 ms
1	0	1	0	0.4 to 0.8 ms
1	0	1	1	0.8 to 1.6 ms
1	1	0	0	3.3 to 6.6 ms
1	1	0	1	13.1 to 26.2 ms
1	1	1	0	52.4 to 104.8 ms
1	1	1	1	209.7 to 419.5 ms

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

(18) Timeout time setting

Byte address	Bit	Bit name	R/W	Description	After reset
47h	7 to 4	TIM3 to TIM0	R/W	The timeout time setting needs to be changed before and after the first receive completion*1. Write the setting value corresponding to the set baud rate.	00h
	3 to 0	-	R/W	Reserved (Write: 0 / Read: 0)	

*1: When the first time refresh data is received after power-on, reset, or recovery from timeout

<Initial setting time>
Setting value before the first data is received

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout time
10 Mbps	0→1→0	1	0	1	1677.7216 ms
5 Mbps	0→1→0	1	0	1	1677.7216 ms
2.5 Mbps	0→1→0	0	1	1	1677.7216 ms
625 Kbps	0→1→0	0	0	1	1677.7216 ms
156 Kbps	0→1→0	1	1	1	3355.4432 ms

<Normal setting time>
Setting value after the first data is received

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout time
10 Mbps	0→1→0	1	0	1	104.8576 ms
5 Mbps	0→1→0	1	0	1	104.8576 ms
2.5 Mbps	0→1→0	1	0	1	209.7152 ms
625 Kbps	0→1→0	1	0	1	838.8608 ms
156 Kbps	0→1→0	1	0	0	1677.7216 ms

Note

The timeout time is set with TIM0 to TIM2, and the set value is confirmed at the rising edge (0 → 1) of TIM3. After the setting is configured, change the value in TIM3 back to 0.
For details on the setting procedure, refer to Section 10.4 "Timeout Time Setting Change".

(19) Cyclic communication

Use this bit with CC-Link Ver.2 only. With CC-Link Ver.1, fix the bit to 0.

Byte address	Bit	Bit name	R/W	Description	After reset
48h	7, 6	-	R/W	Reserved (Write: 0 / Read: 0)	00h
	5	M3RMST1	R/W	<Write> 0: Cyclic communication enabled 1: Cyclic communication disabled <Read> The written data will be read.	
	4 to 0	-	R/W	Reserved (Write: 0 / Read: 0)	

For details, refer to Section 13.2 "Initial Setting INT_CCV20" and Section 13.5 "Send/Receive Processing Module (ICCV20)".

(20) Extended cyclic setting (setting of multiple)

Use this bit with CC-Link Ver.2 only. With CC-Link Ver.1, fix the bit to 0.

Byte address	Bit	Bit name	R/W	Description	After reset
49h	7, 6	-	R/W	<Write> 00b: Single 10b: Quadruple 01b: Double 11b: Octuple <Read> The written data will be read.	00h
	5 to 0	-	W	Reserved (Write: 0 / Read: 0)	

(21) RX send buffer

Byte address	Bit	R/W	Description	After reset
4Ah	7 to 0	W	RX07 to RX00	Undefined
4Bh	7 to 0	W	RX0F to RX08	

*: The byte addresses 4Ch to 59h are the same as the byte addresses 4Ah to 4Bh.

(22) RWr send buffer

Byte address	Bit	R/W	Description	After reset
5Ah	7 to 0	W	RWr00 (lower bits, b7 to b0)	Undefined
5Bh	7 to 0	W	RWr00 (upper bits, bF to b8)	

*: The byte addresses 5Ch to 79h are the same as the byte addresses 5Ah to 5Bh.

(23) HOLD/CLR information setting

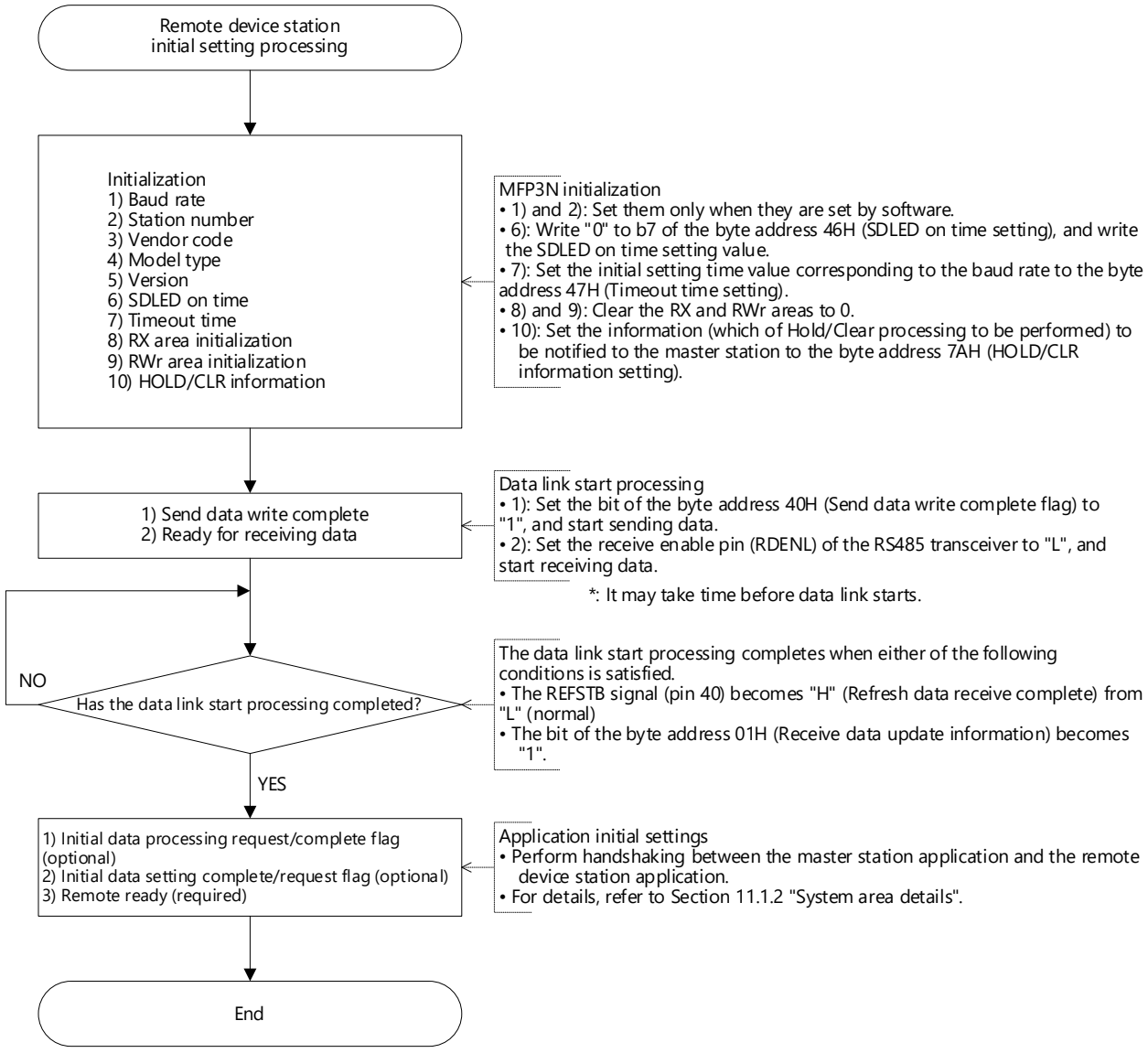
Byte address	Bit	Bit name	R/W	Description	After reset
7Ah	7 to 1	-	R/W	Reserved (Write: 0 / Read: 0)	00h
	0	HOLD/CLR	R/W	This processing notifies the master station about which of HOLD/CLR processing is to be performed. <Write> 0: CLR / 1: HOLD <Read> The written data will be read.	

Point	HOLD/CLR information setting
The Hold/Clear processing holds or clears data (RY/RWw) received from the master station when an error, STOP, or timeout occurs in the master station application (master station controller). Determine the output status (hold or clear) in accordance with the device specifications, and implement the processing to firmware.	

10. SAMPLE FLOWCHARTS

10.1. Initial Setting Processing

The following initial setting processing is required for the remote device station.
After the initial setting processing, perform the main processing (refer to Section 10.2 "Main processing").



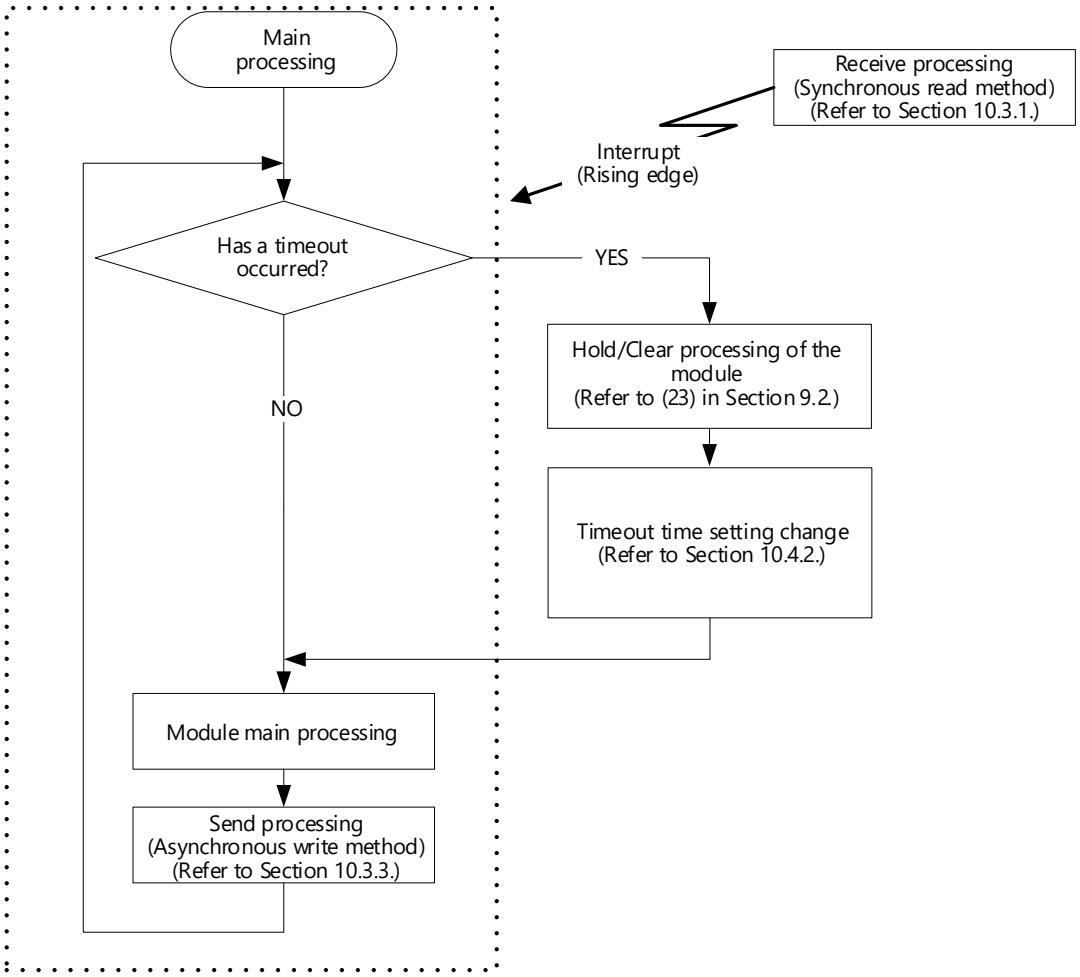
10.2. Main processing

When the receive processing is completed within 1 ms, perform the main processing using the synchronous read method / asynchronous write method (refer to Section 10.2.1 "Synchronous read method / Asynchronous write method"). When the receive processing is not completed within 1 ms, perform the main processing using the asynchronous read method / asynchronous write method (refer to Section 10.2.2 "Asynchronous read method / Asynchronous write method").
With CC-Link Ver.2, data must be read/written within 1 ms (refer to Section 13.4 "Send/receive processing").

10.2.1. Synchronous read method / Asynchronous write method

The following is an example of the main processing performed when the synchronous read method (refer to Section 10.3.1) is used for the receive processing and the asynchronous write method (refer to Section 10.3.3) is used for the send processing.

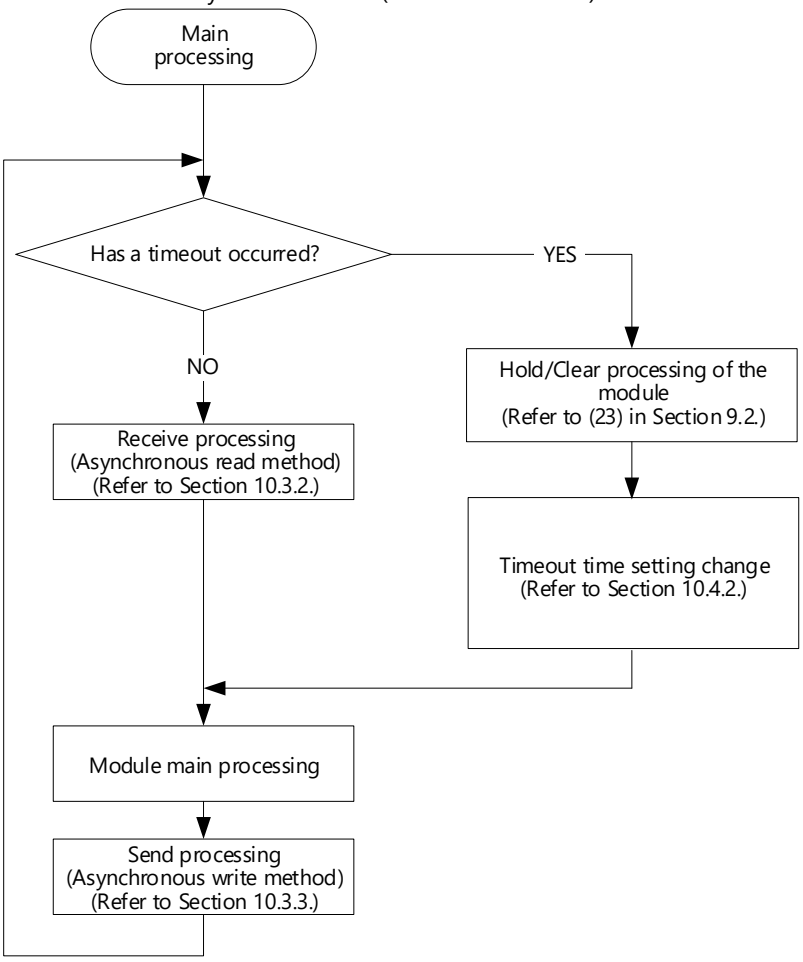
Perform the receive processing at the rising edge of the interrupt by connecting the REFSTB output of MFP3N to the interrupt input of the MPU.
Perform the send processing at any desired timing.
A timeout error can be checked with the byte address 05h (Error information 2).



10.2.2. Asynchronous read method / Asynchronous write method

The following is an example of the main processing performed when the asynchronous read method (refer to Section 10.3.2) is used for the receive processing and the asynchronous write method (refer to Section 10.3.3) is used for the send processing.

A timeout error can be checked with the byte address 05h (Error information 2).

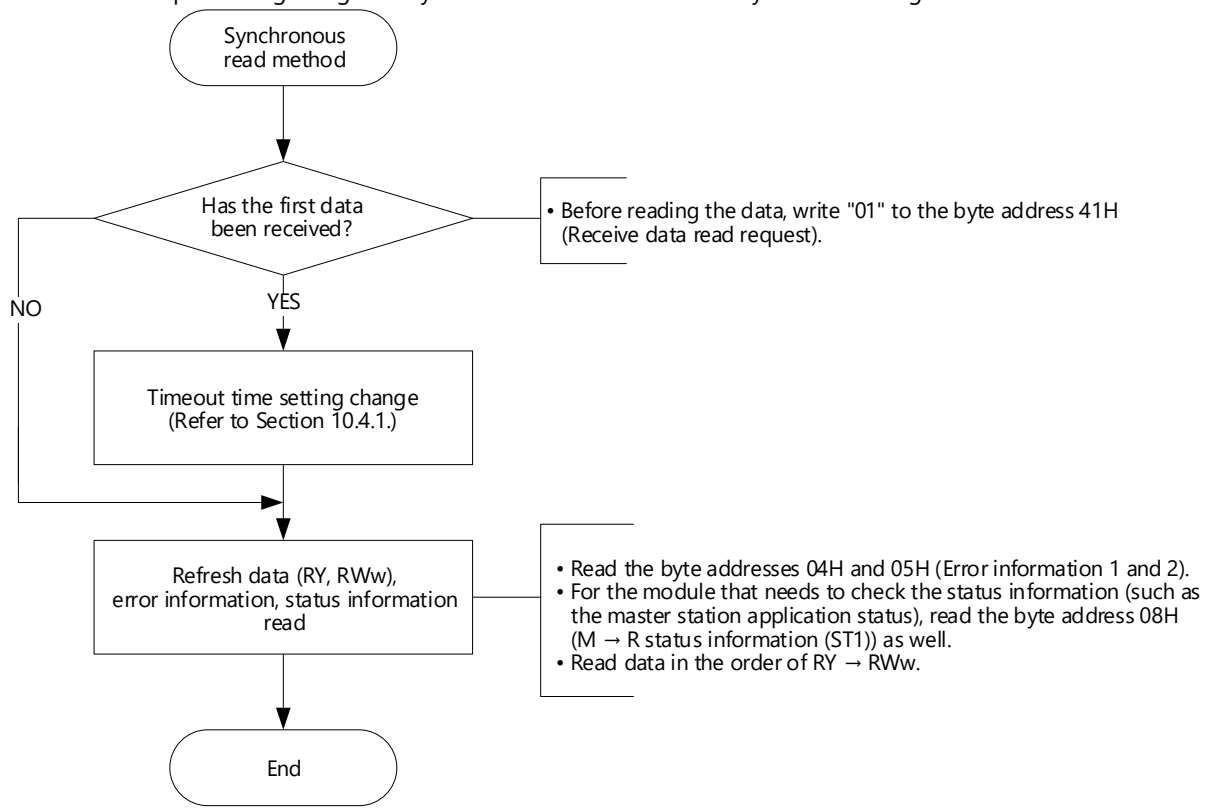


10.3. Receive Processing / Send Processing

When the read processing is completed within 1 ms, perform the processing using the synchronous read method (refer to Section 10.3.1 "Synchronous read method (interrupt processing)") and the asynchronous write method (refer to Section 10.3.3 "Asynchronous write method"). When the read processing is not completed within 1 ms, perform the processing using the asynchronous read method (refer to Section 10.3.2 "Asynchronous read method") and the asynchronous write method (refer to Section 10.3.3 "Asynchronous write method").

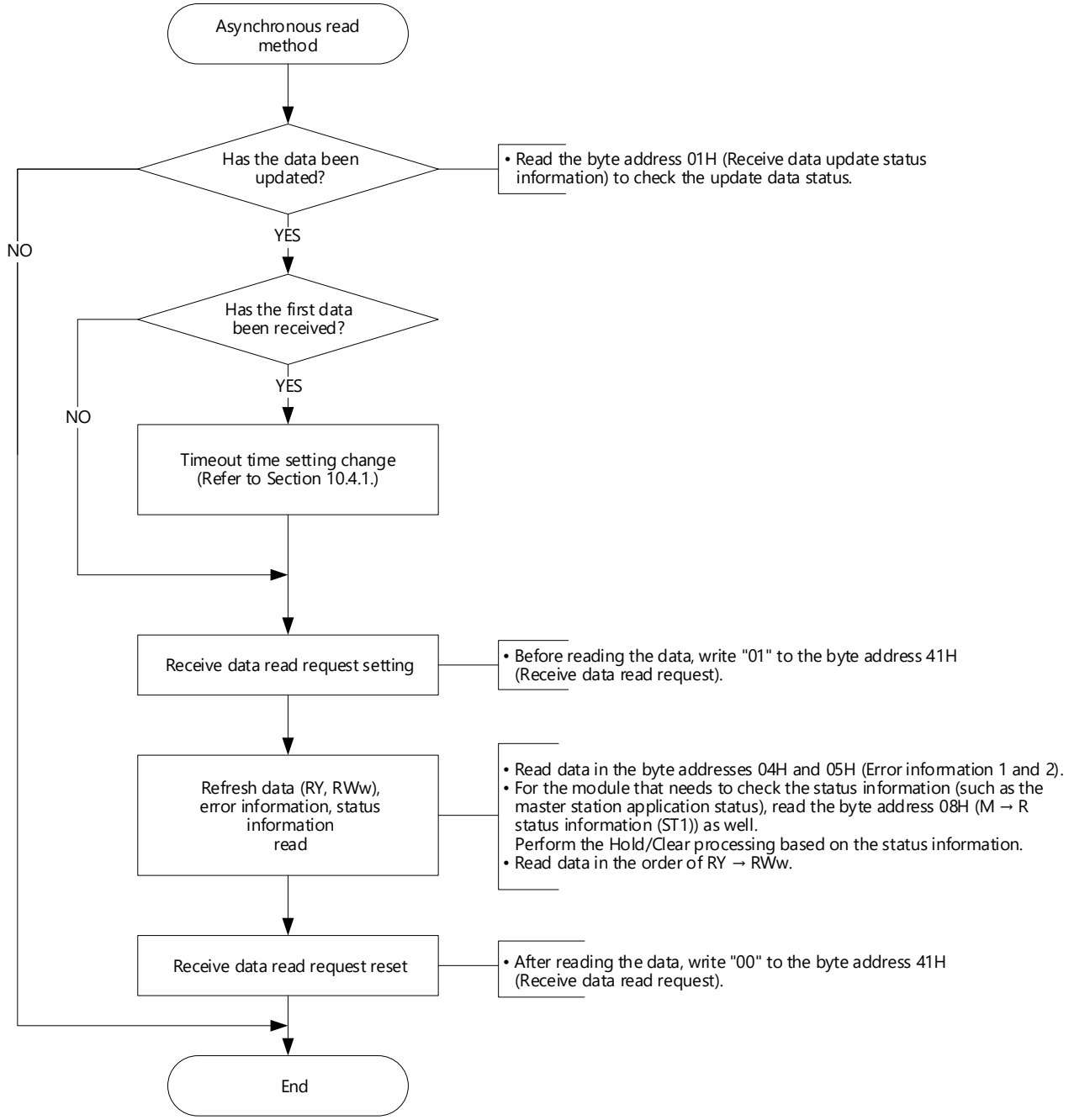
10.3.1. Synchronous read method (interrupt processing)

Perform the read processing at the rising edge of the interrupt by connecting the REFSTB output of MFP3N to the interrupt input of the MPU.
Perform the write processing using the asynchronous write method at any desired timing.



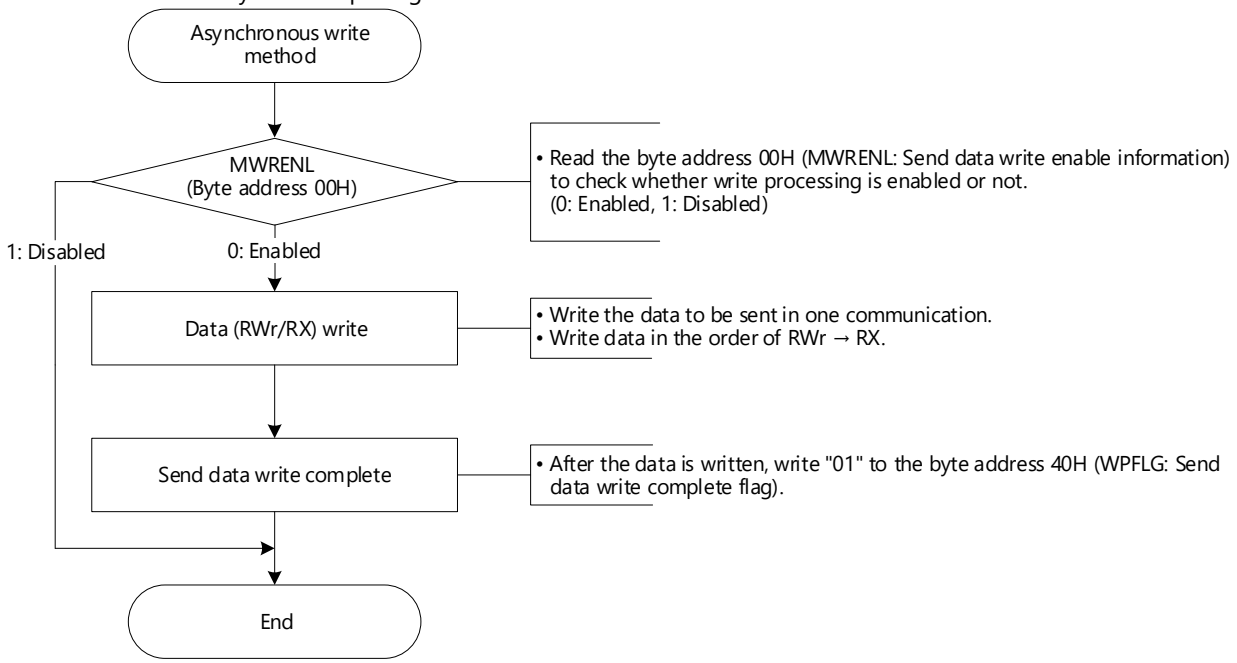
The processing (from "interrupt" to "completion") must be completed within 1 ms.
(If not, the next interrupt may be ignored.)

10.3.2. Asynchronous read method



10.3.3. Asynchronous write method

The written data is sent by the next polling from the master station.



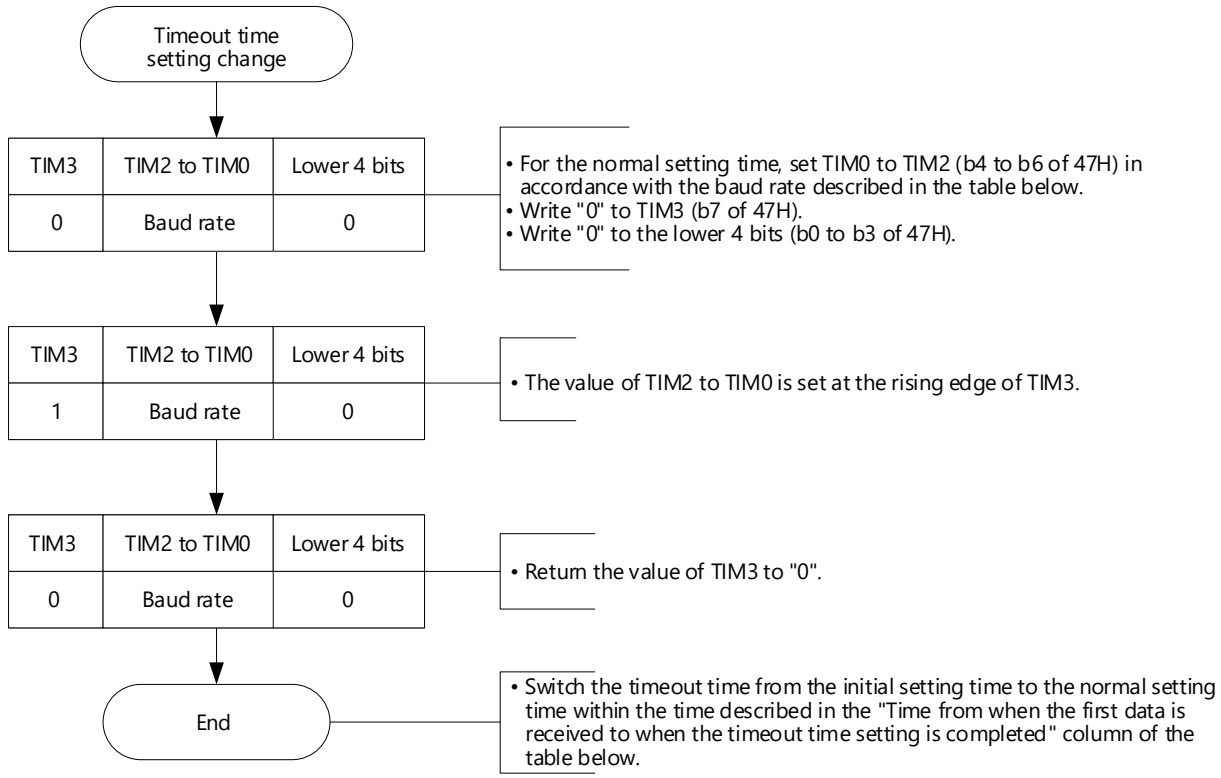
Point
When the baud rate is set to 156 Kbps, the send processing takes a maximum of 3.08 ms. During this period, the MWRENL bit (byte address 00h) does not become "0" (Enabled).

10.4.1. Initial setting time → Normal setting time

After the first data is received, 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 is received" (i.e., when the first time refresh data is received after power-on, reset, or recovery from timeout):

(Synchronous read)
• When the first receive complete interrupt occurs as a result of the REFSTB output of MFP3N

(Asynchronous read)
• When the bit of "Receive data update information" (byte address 01H) changes to "1" (Update) for the first time

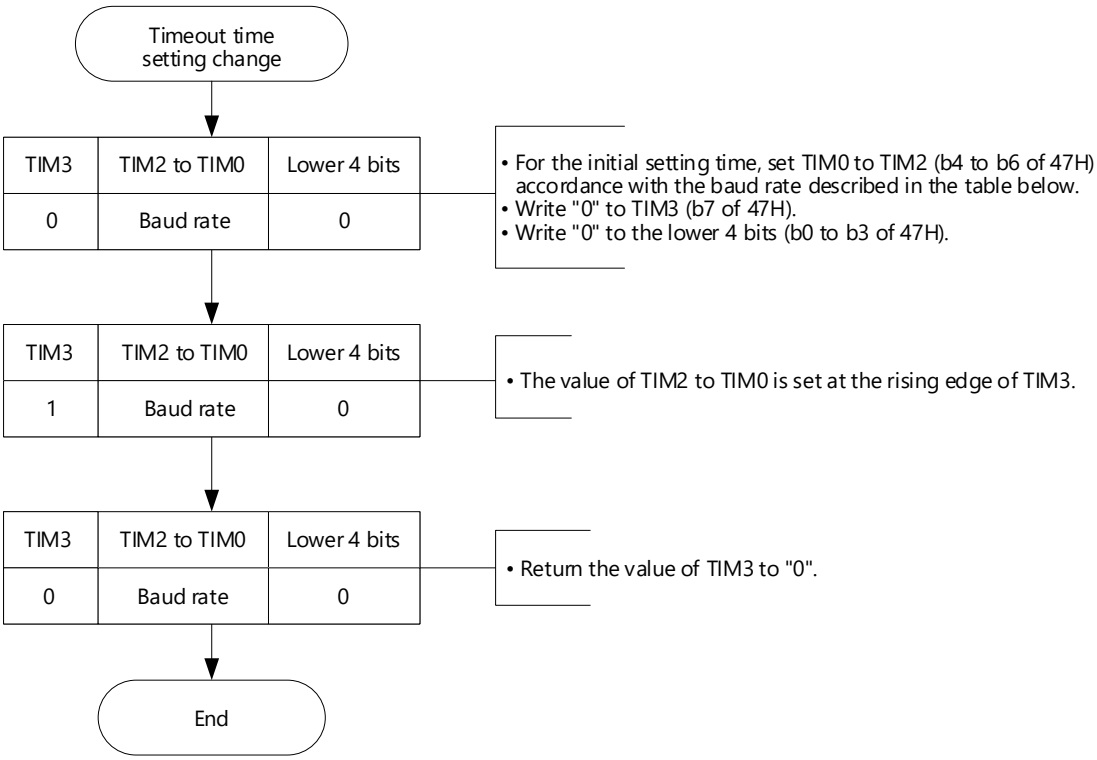


Normal setting time (Settings after the first data is received)

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout time	Time from when the first data is received to when the timeout time setting is completed
10 Mbps	0→1→0	1	1	0	104.8576 ms	51 ms or less
5 Mbps	0→1→0	1	0	1	104.8576 ms	103 ms or less
2.5 Mbps	0→1→0	1	0	1	209.7152 ms	49 ms or less
625 Kbps	0→1→0	1	0	1	838.8608 ms	39 ms or less
156 Kbps	0→1→0	1	0	0	1677.7216 ms	13000 ms or less

10.4.2. Normal setting time → Initial setting time

After a timeout occurs, change the timeout time setting from "normal setting time" to "initial setting time".
Set data corresponding to the transmission speed in the table below to TIM0 to TIM3.



Initial setting time (Settings after timeout)

Baud rate	TIM3	TIM2	TIM1	TIM0	Timeout time
10 Mbps	0→1→0	1	0	1	1677.7216 ms
5 Mbps	0→1→0	1	0	1	1677.7216 ms
2.5 Mbps	0→1→0	0	1	1	1677.7216 ms
625 Kbps	0→1→0	0	0	1	1677.7216 ms
156 Kbps	0→1→0	1	1	1	3355.4432 ms

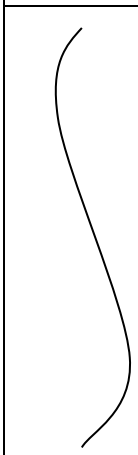
11. REMOTE DEVICE STATION COMMON SPECIFICATIONS

11.1. Cyclic Transmission Signals

11.1.1. Cyclic transmission signal definitions

There are two areas for input and output of a remote device station: user area and system area.
The last 16 bits of RX and RY are reserved as system areas.

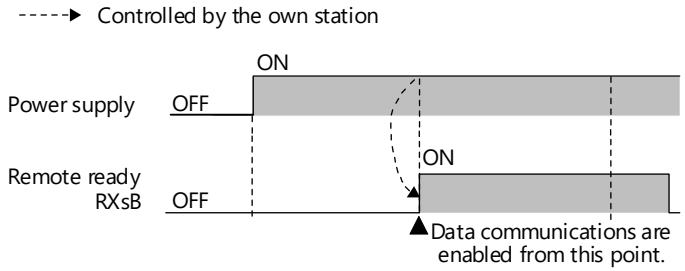
The number of user area points differs depending on the number of occupied stations.
1 station occupied: 16 bits
2 stations occupied: 48 bits
3 stations occupied: 80 bits
4 stations occupied: 112 bits

	Link input	Signal name	Link output	Signal name
User area	RXm0 	Defined by a user	RYm0 	Defined by a user
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 data processing complete flag
	RXs9	Initial data setting complete flag	RYs9	Initial data setting request flag
	RXsA	Error status flag	RYsA	Error reset request flag
	RXsB	Remote ready (required)	RYsB	Reserved
	RXsC	Reserved	RYsC	
	RXsD		RYsD	
	RXsE		RYsE	
	RXsF		RYsF	

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

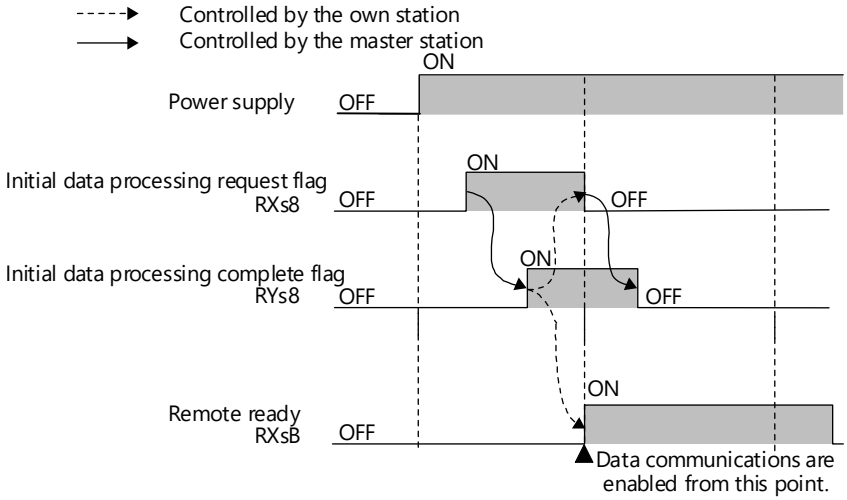
(1) RXsB (Remote ready)
This signal indicates that data can be sent and received between the application of the master station and the application of the remote device station.
Turn on this bit after power-on or hardware reset.
Be sure to implement this bit.

Note) Turn off this bit when data cannot be sent to or received from the application of the master station due to an error.



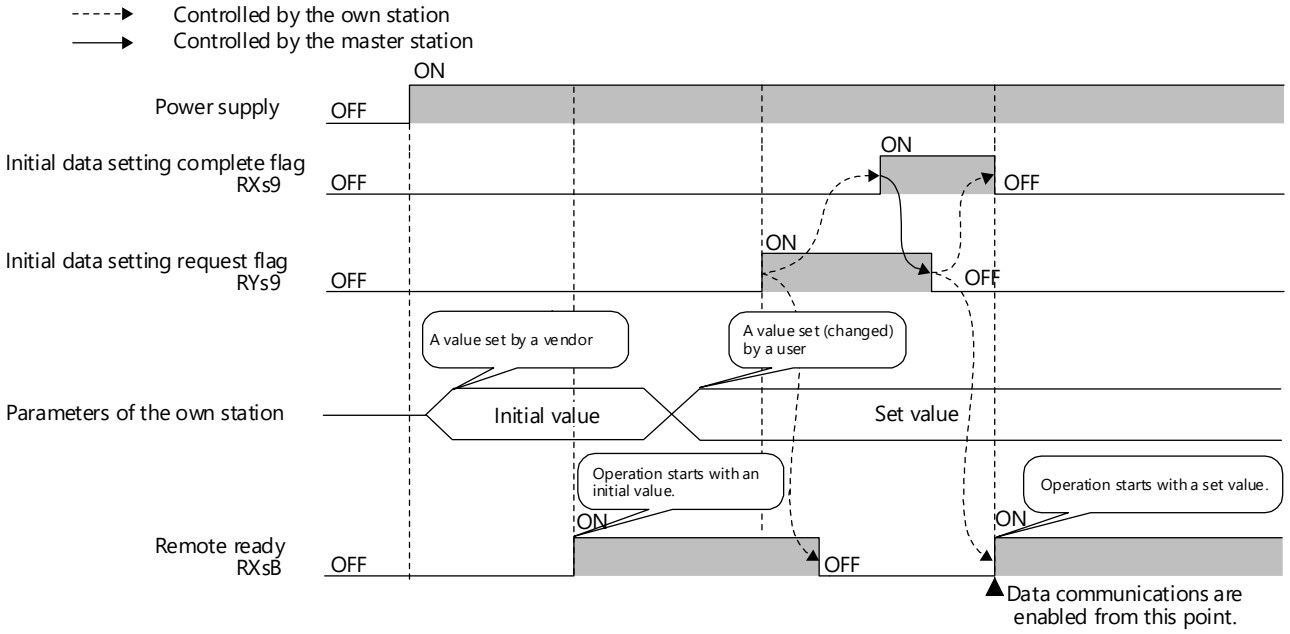
(2) RXs8/RYs8 (Initial data processing request/complete flag)
These signals are used when the remote device station requests the initial data processing (parameter settings for the application of the remote device station) to the application of the master station after power-on or hardware reset of the remote device station.

Note) Turn on RXsB (Remote ready) after the initial data processing is completed.

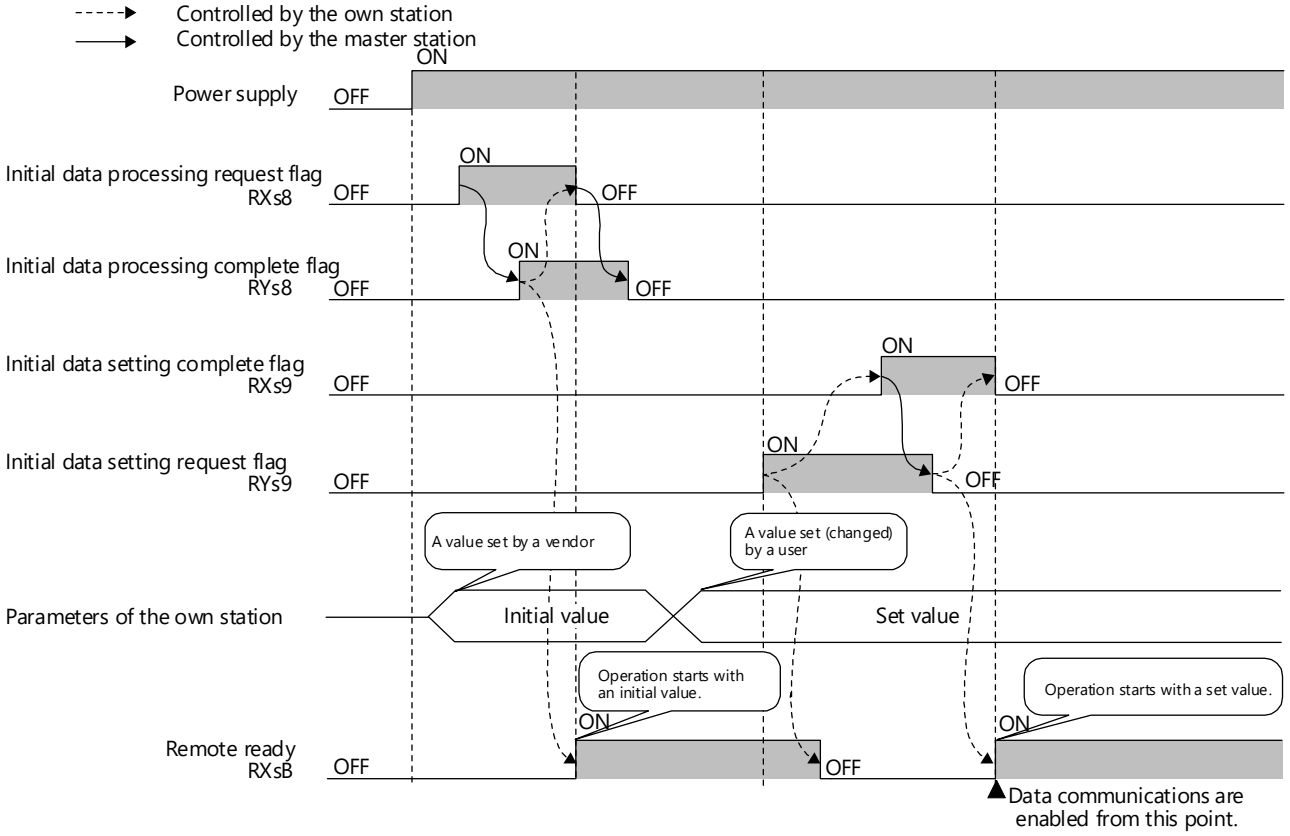


(3) RXs9/RYs9 (Initial data setting complete/request flag)
These signals are used when the application of the master station requests the initial data setting (parameter settings for the application of the remote device station) to the remote device station.

Note) Turn on RXsB (Remote ready) after the initial data setting is completed.

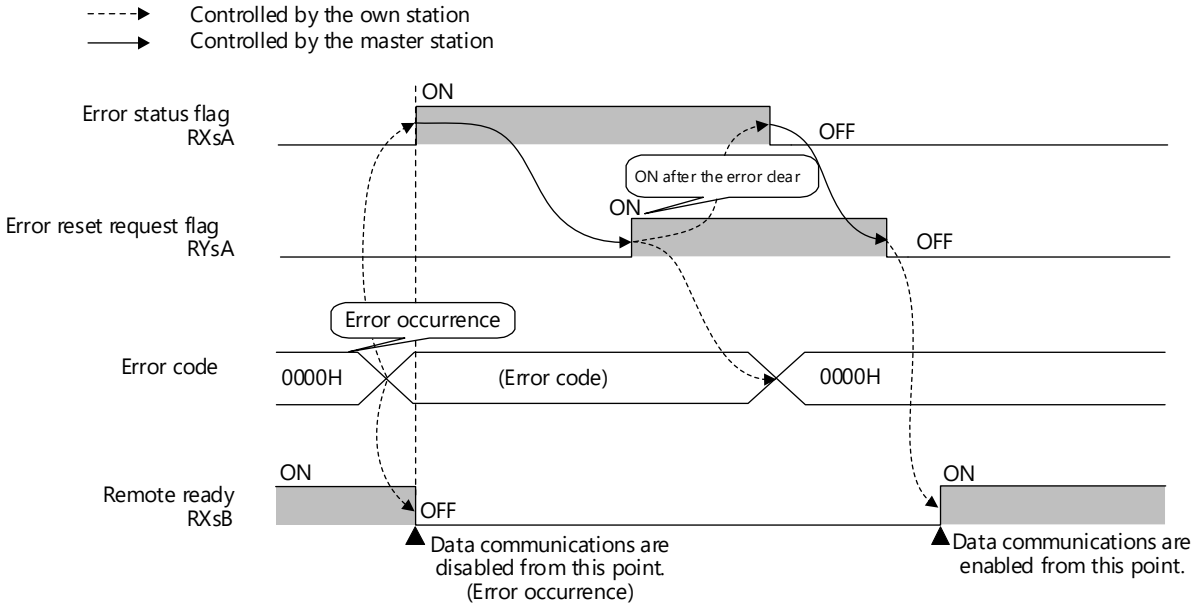


(4) When both RXs8/RYs8 and RXs9/RYs9 are implemented
Turn on RXsB (Remote ready) after both the initial data processing and the initial data setting are completed.



(5) RXsA/RYsA (Error status/Error reset request flag)
These signals are used for the remote device station to notify or clear an application error other than a watchdog timer error. RYsA (Error reset request flag) turns on after the error cause is eliminated.

Note) Clear the error and the error code storage area as well by turning on RYsA (Error reset request flag). Note, however, that the device number of the error code storage area must be defined as the specifications of the device (remote device station).
Turn off RXsB (Remote ready) from error occurrence to error reset.



11.1.3. Remote Registers

The all remote register areas of a remote device station are user-defined.
m: A register number assigned to each remote station

Link register	Signal name	Link register	Signal name
RWrm0	Defined by a user When 1 station is occupied	RWwm0	Defined by a user When 1 station is occupied
RWrm1		RWwm1	
RWrm2		RWwm2	
RWrm3		RWwm3	
RWrm4	When 2 stations are occupied	RWwm4	When 2 stations are occupied
RWrm5		RWwm5	
RWrm6		RWwm6	
RWrm7		RWwm7	
RWrm8	When 3 stations are occupied	RWwm8	When 3 stations are occupied
RWrm9		RWwm9	
RWrm10		RWwm10	
RWrm11		RWwm11	
RWrm12	When 4 stations are occupied	RWwm12	When 4 stations are occupied
RWrm13		RWwm13	
RWrm14		RWwm14	
RWrm15		RWwm15	

12. OVERVIEW OF CC-LINK VER.2

This chapter describes the specifications required to design a CC-Link remote device station compatible with CC-Link Ver.2.

This chapter describes only the contents related to CC-Link Ver.2 development. For detailed specifications of MFP3N, refer to other chapters.

[Hardware]
The hardware structure for CC-Link Ver.2 is basically the same as that for CC-Link Ver.1. This manual describes only the precautions for developing a CC-Link Ver.2-compatible remote device station.

[Software (Firmware)]
A protocol related to CC-Link Ver.2 must be implemented to software (firmware). This manual describes the precautions and sample flowcharts for developing a CC-Link Ver.2-compatible remote device station.

12.1. Features of CC-Link Ver.2

(1) Extended cyclic
The capacity of cyclic data per station can be increased by using extended cyclic.

		CC-Link Ver.2	CC-Link Ver.1
Maximum number of link points (Data volume)		RX/RY: 8192 bits each RWw/RWr: 2048 words each	RX/RY: 2048 bits each RWw/RWr: 256 words each
Number of link points per system (Data volume)	1 station occupied	RX/RY: 32 to 128 bits each RWw/RWr: 4 to 32 words each	RX/RY: 32 bits each RWw/RWr: 4 words each
	2 stations occupied	RX/RY: 64 to 384 bits each RWw/RWr: 8 to 64 words each	RX/RY: 64 bits each RWw/RWr: 8 words each
	3 stations occupied	RX/RY: 96 to 640 bits each RWw/RWr: 12 to 96 words each	RX/RY: 96 bits each RWw/RWr: 12 words each
	4 stations occupied	RX/RY: 128 to 896 bits each RWw/RWr: 16 to 128 words each	RX/RY: 128 bits each RWw/RWr: 16 words each
Number of occupied stations per system		1 to 4	1 to 4
Extended cyclic setting		Single, double, quadruple, octuple (single[*1])	None

*1: When "Single" is set in CC-Link Ver.2, the extended cyclic header information will not be added and the frame and data volume will be the same as those in CC-Link Ver.1.

Relationship between the number of occupied stations and the extended cyclic setting in CC-Link Ver.2

Number of occupied stations /	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
Single	RX/RY: 32 bits each RWw/RWr: 4 words each	RX/RY: 64 bits each RWw/RWr: 8 words each	RX/RY: 96 bits each RWw/RWr: 12 words each	RX/RY: 128 bits each RWw/RWr: 16 words each
Double	RX/RY: 32 bits each RWw/RWr: 8 words each	RX/RY: 96 bits each RWw/RWr: 16 words each	RX/RY: 160 bits each RWw/RWr: 24 words each	RX/RY: 224 bits each RWw/RWr: 32 words each
Quadruple	RX/RY: 64 bits each RWw/RWr: 16 words each	RX/RY: 192 bits each RWw/RWr: 32 words each	RX/RY: 320 bits each RWw/RWr: 48 words each	RX/RY: 448 bits each RWw/RWr: 64 words each
Octuple	RX/RY: 128 bits each RWw/RWr: 32 words each	RX/RY: 384 bits each RWw/RWr: 64 words each	RX/RY: 640 bits each RWw/RWr: 96 words each	RX/RY: 896 bits each RWw/RWr: 128 words each

(2) Less occupied stations

Relationship between the number of occupied stations and the number of connected modules

Number of occupied stations	1 station occupied	2 stations occupied	3 stations occupied	4 stations occupied
Number of connected modules per master station*1	42 modules	32 modules	21 modules	16 modules

*1: This is the case when remote device stations having the same number of occupied stations are connected.

Number of occupied stations and cyclic data volume of CC-Link Ver.1 and Ver.2

	Number of occupied stations	Cyclic data volume
CC-Link Ver.2	1 station occupied, quadruple setting	RX/RY: 64 bits each RWw/RWr: 16 words each
	1 station occupied, octuple setting	RX/RY: 128 bits each RWw/RWr: 32 words each
CC-Link Ver.1	4 stations occupied	RX/RY: 128 bits each RWw/RWr: 16 words each

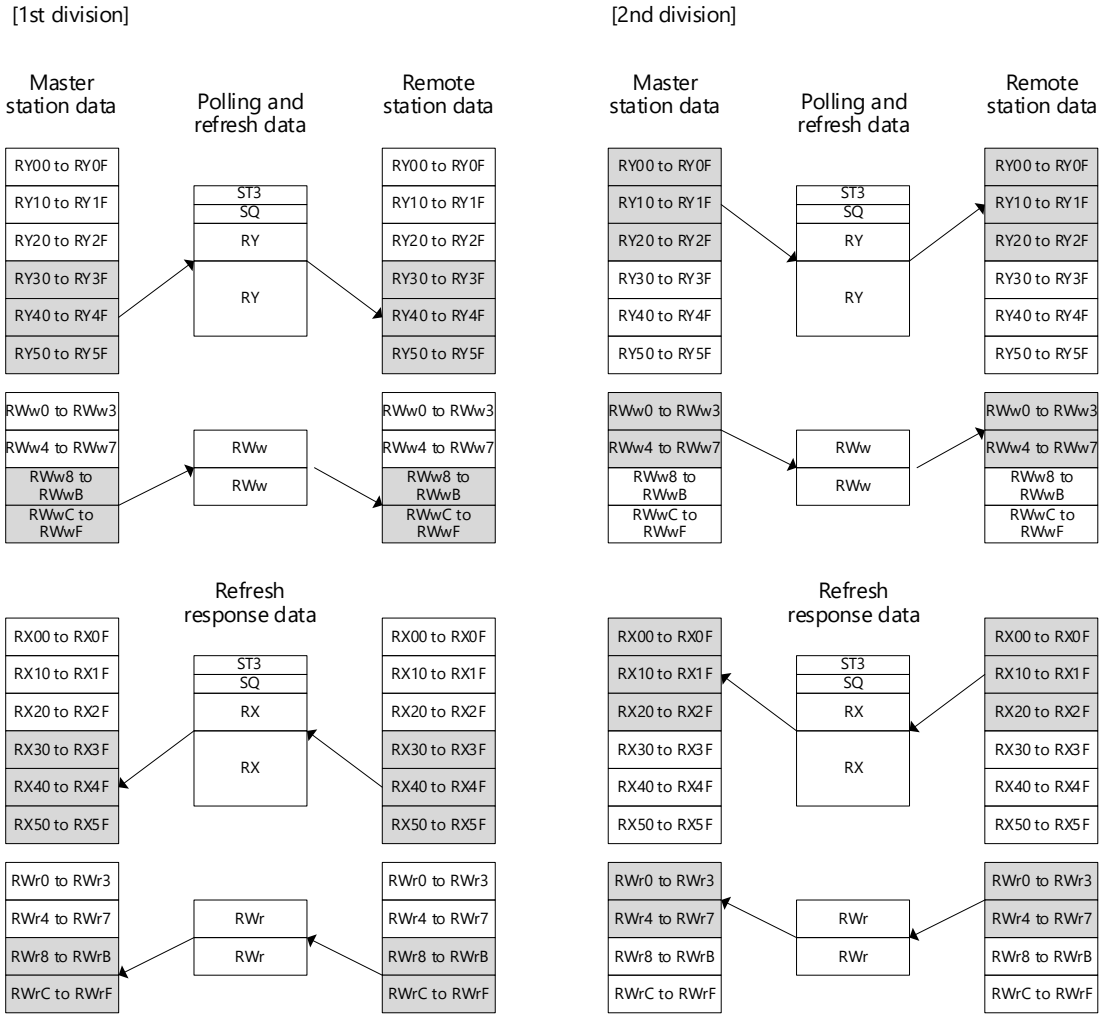
As shown in the table above, when 1 station is occupied and the extended cyclic setting is set to "Quadruple" in CC-Link Ver.2, the data volume of word data is the same as that when 4 stations are occupied in CC-Link Ver.1. When the extended cyclic setting is set to "Octuple" in CC-Link Ver.2, the data volume of bit data is the same as that when 4 stations are occupied in CC-Link Ver.1.

In CC-Link Ver.2, the same volume of data can be communicated with less number of occupied stations. Consequently, the number of remote stations controlled by a single master station can be increased.

12.2.1. Overview of extended cyclic communications

The extended cyclic, which is added in CC-Link Ver.2, performs data communications by dividing refresh data (RY, RWw) and response data (RX, RWr) into multiple link scans. The following figure shows an overview of the extended cyclic communications.

[When 2 stations are occupied and the extended cyclic is set to "Double"]



12.2.2. Sending the own station information

CC-Link Ver.2 sends the protocol version information (master station → slave station) and the extended cyclic setting information (slave station → master station) using unused bits of ST1 and ST2, which were set as a reserved area in CC-Link Ver.1.
In addition, CC-Link Ver.2 uses the highest 2 bits in the RV area for the protocol version information (slave station → master station) in the slave station test loopback data.

[Details of ST1 and ST2 in CC-Link Ver.2]

Basic Frame Format

ST1

Master station → Slave station

Different (modified) from CC-Link Ver.1 (b5 and b6)

Bit	Name	Description
0	Master station application	0: Stop 1: Run
1	Master station application	0: Normal 1: Error
2	Refresh	0: Stop 1: Start
3	Transient	0: Absent 1: Present
4	Transient receive	0: Disabled 1: Enabled
5 6	Protocol version	00: Ver.1 01: Ver.2 10: Ver.3 (For future use) 11: Ver.4 (For future use)
7	Data link executing station*1	0: Master station 1: Standby master station

*1: Valid only between the master station and the standby master station.

Slave station → Master station

Same as CC-Link Ver.1

Bit	Name	Description
0	Fuse blown	0: No error 1: Error
1	Module error or invalid points	0: No error 1: Error
2	Refresh data not received	0: Received 1: Not received
3	Parameter not received	0: Received 1: Not received
4	Switch change detection	0: Not changed 1: Changed
5	Cyclic communication	0: Enabled 1: Disabled*2
6	Reserved	-
7	WDT error	0: Not detected 1: Detected

*2: Set to "Disabled" when a version error occurs.

ST2

Same as CC-Link Ver.1

Bit	Name	Description
0 1 2 3	Number of RY information send points	0000: 0 bits 0001: 256 bits 0010: 512 bits ... 1000: 2048 bits 1001 to 1111: Reserved
4 5 6 7	Number of RWw information send points	0000: 0 bits 0001: 32 bits 0010: 64 bits ... 1000: 256 bits 1001 to 1111: Reserved

Different (modified) from CC-Link Ver.1 (b6 and b7)

Bit	Name	Description
0	Transient data	0: Absent 1: Present
1	Transient receive	0: Disabled 1: Enabled
2	Transient type	0: 1:n 1: n:n
3	Reserved	-
4	Transmission path status	0: No error 1: Error
5	Reserved	Fixed to 1
6 7	Extended cyclic setting (CC-Link Ver.2)	00: Single*3 01: Double 10: Quadruple 11: Octuple

*3: Setting of CC-Link Ver.1 (no extended cyclic setting)

[Details of RV in CC-Link Ver.2]

F	F	F	A1	A2	ST1	ST2	VD	TP	RV	Test loopback data (4 bytes)	CRC	F	F	F

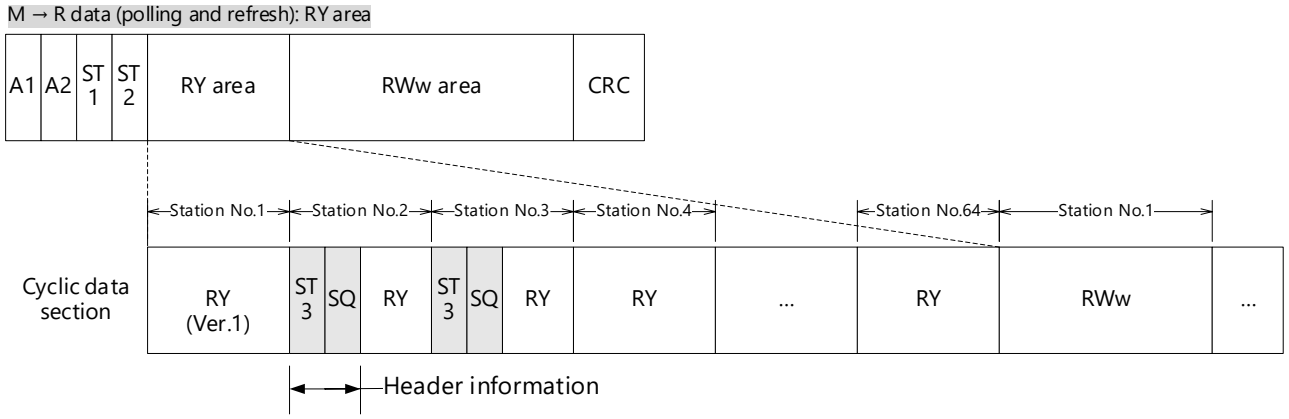
Slave Station Test Loopback Data

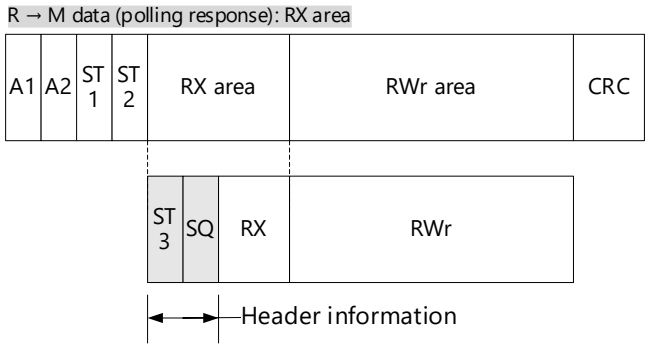
	Slave station → Master station
RV	Different (modified) from CC-Link Ver.1 (b6 and b7)

Bit	Name	Description
0 to 5	Software version	
6, 7	Protocol version	00: Ver.1 01: Ver.2 10: Ver.3 (For future use) 11: Ver.4 (For future use)

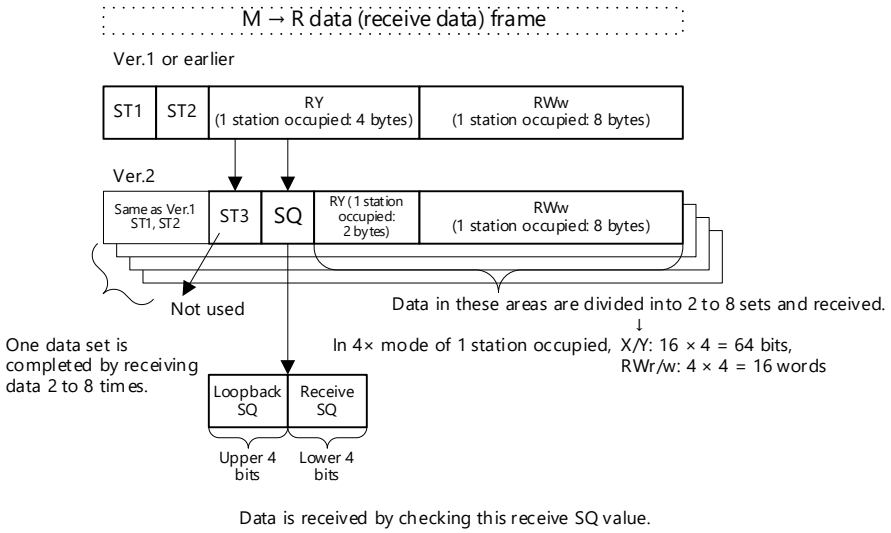
12.2.3. Extended cyclic header information

In CC-Link Ver.2, header information is added for the handshaking of the divided data between the master station and slave stations. The header information uses the first 16 bits of the CC-Link Ver.2-compatible slave station data area in the transmission frame. This area corresponds to the area in the frame used as RY00 to RY0F and RX00 to RX0F in CC-Link Ver.1. ST3 and SQ, each of which consists of 8 bits, can be used as the header information. However, ST3 is reserved for future expansion and not used in CC-Link Ver.2. Note that SQ does not exist when the extended cyclic setting is set to "Single". The transmission frame will be the same as that of CC-Link Ver.1.





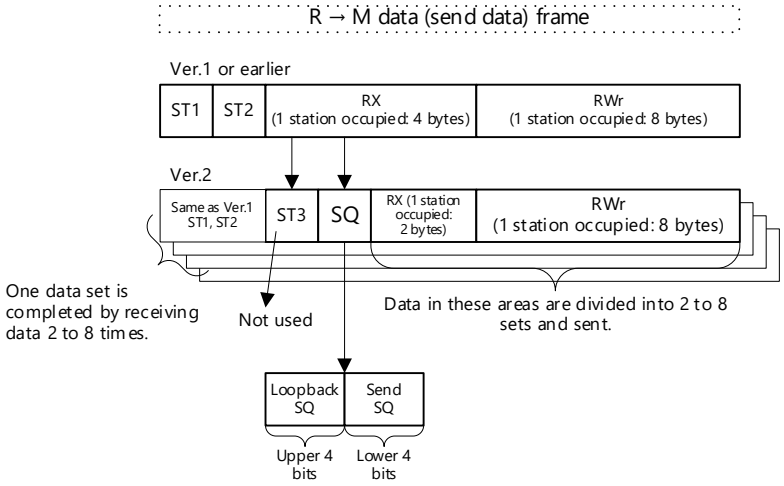
[Details of SQ value]
(1) M → R data
"Receive SQ": This indicates the order of data sent from the master station.
"Loopback SQ": This is the loopback value of the last SQ value sent from the remote station to the master station. The receive status of the master station can be monitored by checking the continuity of this data. If a receive error of the master station is detected, it is possible to resend the data from the first packet. (Resending of data is optional. Resend data when only required.)



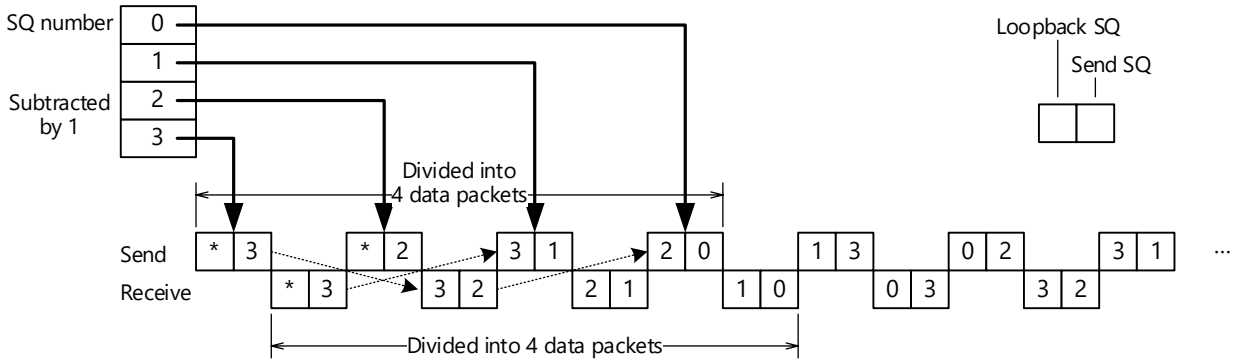
(2) R → M data

"Send SQ": This indicates the order of data sent to the master station.

"Loopback SQ": This is the loopback value of the last SQ value received by the remote station. The master station monitors this data as the receive status of the remote station. If the continuity of this value is lost, the master station determines that the remote station is not receiving data correctly and resends data starting from SQ (Number of divisions – 1). Since the master station checks loopback SQ values for data receive continuity of the remote station, the SQ loopback function is mandatory on the remote station.



- Sending divided data: Divided data is sent in the following send SQ number order: starting with "divisions – 1" and ending with "0".
  The loopback SQ number will contain the received and acknowledged send SQ number.
- Receiving divided data: The divided data is reassembled when the send SQ number "0" is received.
  Continuity of the SQ numbers is checked. (Data with the same SQ number are discarded.)



12.3. Relationship between SQ Values and RX/RY/RWr/RWw

The following table lists the relationship between SQ values and RX/RY/RWr/RWw.

[Example: When 2 stations are occupied and the extended cyclic setting is set to "Quadruple"]
The SQ values are sent and received in descending order. The send/receive messages (RX/RY/RWr/RWw) are also stored in descending order.

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

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

13. SAMPLE FLOWCHARTS FOR CC-LINK VER.2-COMPATIBLE REMOTE DEVICE STATIONS

13.1. Lists of Modules and Variables

(1) INT_CCV2: Initial processing

Variable name	Application
CC20_RECEIVE	Indicates that data has been received.
CC20R_DONE	Indicates that a set of data (all data packets) has been received.
CC20S_DONE	Indicates that a set of data (all data packets) has been sent.
R_ZEN_SQ	Last receive SQ value
R_NOW_SQ	Current receive SQ value
S_ORI_SQ	Loopback SQ value to be sent next
S_NOW_SQ	Next send SQ value
R_ZOR_SQ	Last received loopback SQ value

MFP3N register/port	Application
M3SDOK	MFP3N offset address 40h (Send data write complete flag)
RDENL	Receive ready flag

(2) REFSTB: Interrupt processing

Variable name	Application
CC20_RECEIVE	Indicates that data has been received.

MFP3N register/port	Application
M3SDOK	MFP3N offset address 40h (Send data write complete flag)

(3) ITIM: 1 ms interrupt processing

Variable name	Application
CC20_RECEIVE	Indicates that data has been received.

MFP3N register/port	Application
M3SDOK	MFP3N offset address 40h (Send data write complete flag)
REFSTB	REFSTB signal of MFP3N

(4) ICCV20: Send/receive processing

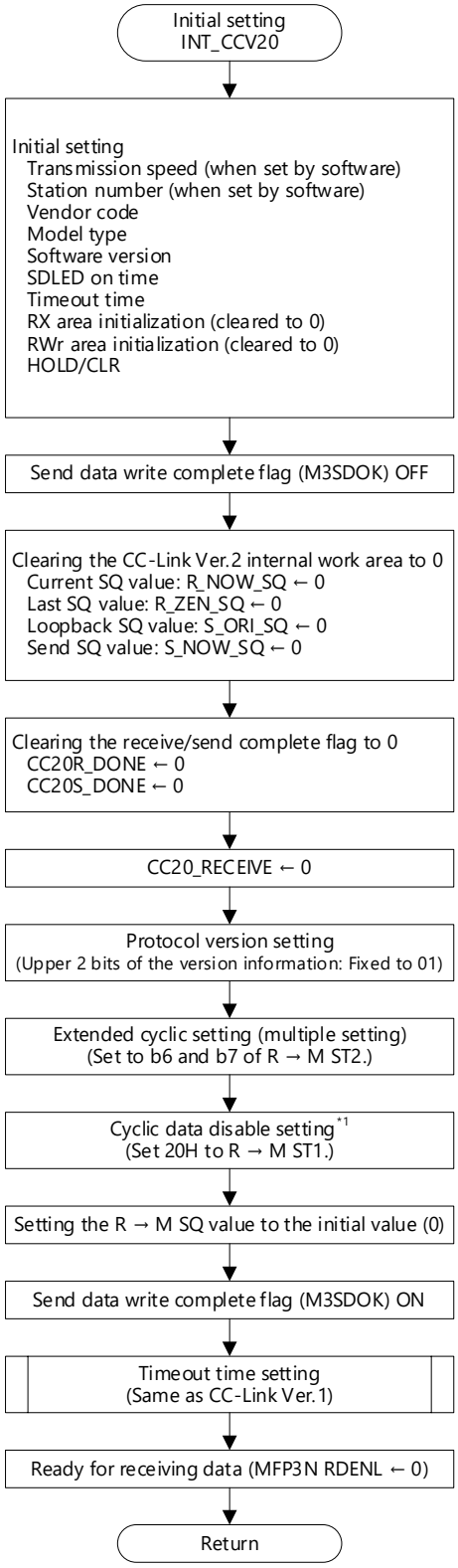
Variable name	Application
CC20_RECEIVE	Indicates that data has been received.
CC20R_DONE	Indicates that a set of data (all data packets) has been received.
CC20S_DONE	Indicates that a set of data (all data packets) has been sent.
R_ZEN_SQ	Last receive SQ value
R_NOW_SQ	Current receive SQ value
S_ORI_SQ	Loopback SQ value to be sent next
S_NOW_SQ	Next send SQ value
R_ZOR_SQ	Last received loopback SQ value

MFP3N register/port	Application
M3SDOK	MFP3N offset address 40h (Send data write complete flag)
M3MRST1	MFP3N offset address 08h (M → R ST1)
M3RM_SSQ	MFP3N offset address 4Bh (R → M SQ)
M3RDRQ	MFP3N offset address 41h (Receive data read request flag)
M3MR_SSQ	MFP3N offset address 0Bh (M → R SQ)
M3RCEX	MFP3N offset address 01h (Receive data update information)

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

Variable name	Application
CC20R_DONE	Indicates that a set of data (all data packets) has been received.
CC20S_DONE	Indicates that a set of data (all data packets) has been sent.

After the initial setting processing, perform the send/receive processing (refer to Section 13.4 "Send/receive processing").



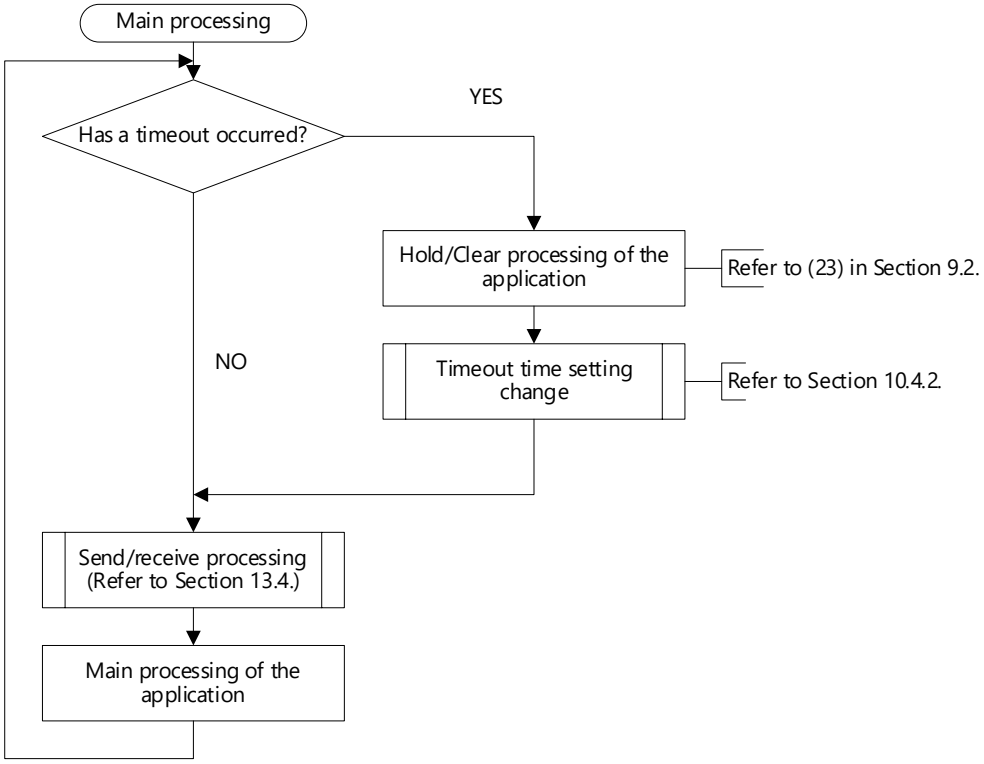
*1: The setting is disabled at the initial setting processing. The setting is enabled after the master station protocol version has been confirmed as Ver.2 by test polling from the master station.

13.3. CC-Link Ver.2 Main Processing

The following is an example of main processing for supporting CC-Link Ver.2.

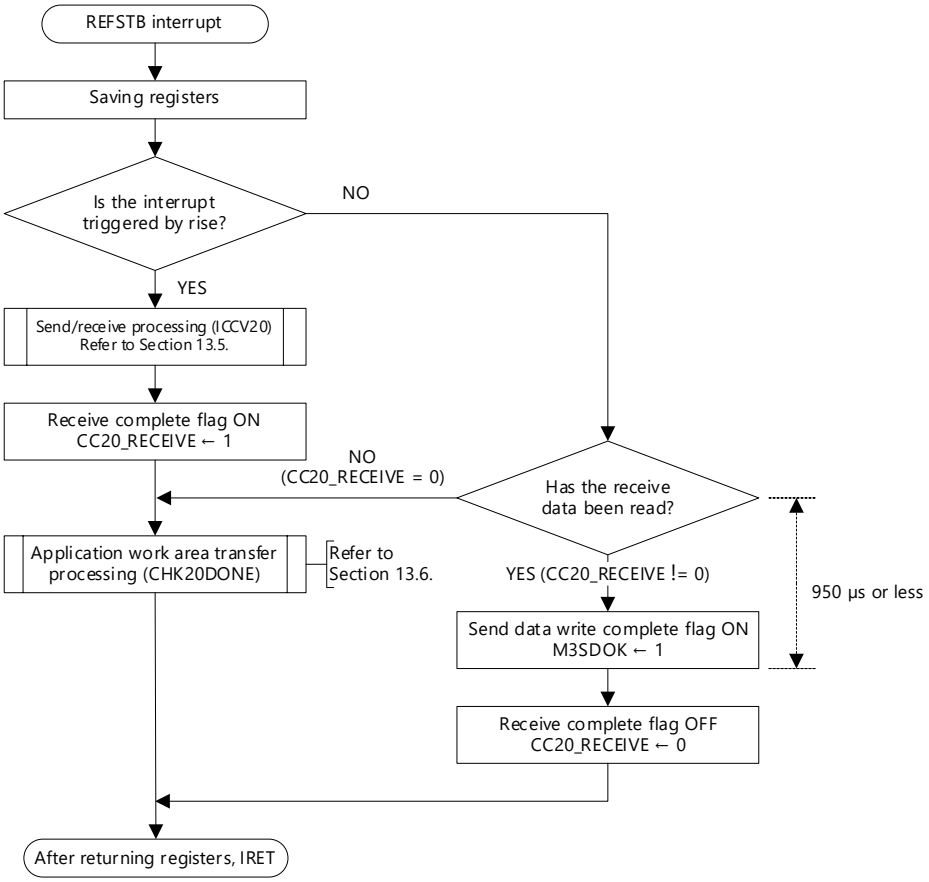
The following two methods are available to make the device compatible with CC-Link Ver.2.

- Send/receive processing using an interrupt (REFSTB signal) (Refer to Section 13.4.1.)
- Send/receive processing using polling (Refer to Section 13.4.2.)



13.4.1. Example using an interrupt (REFSTB signal)

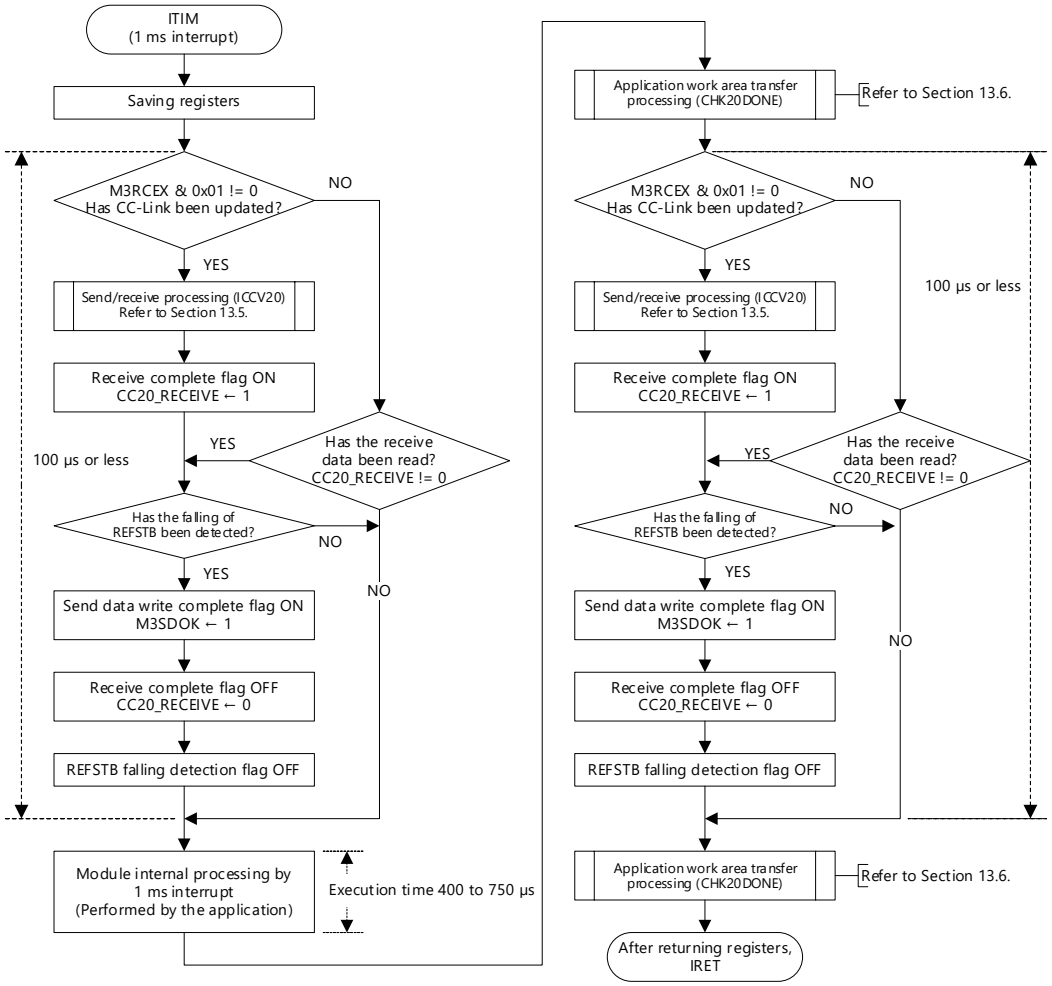
The following is an example of CC-Link Ver.2 send/receive processing using an interrupt at the rising/falling edge of the REFSTB signal of MFP3N.



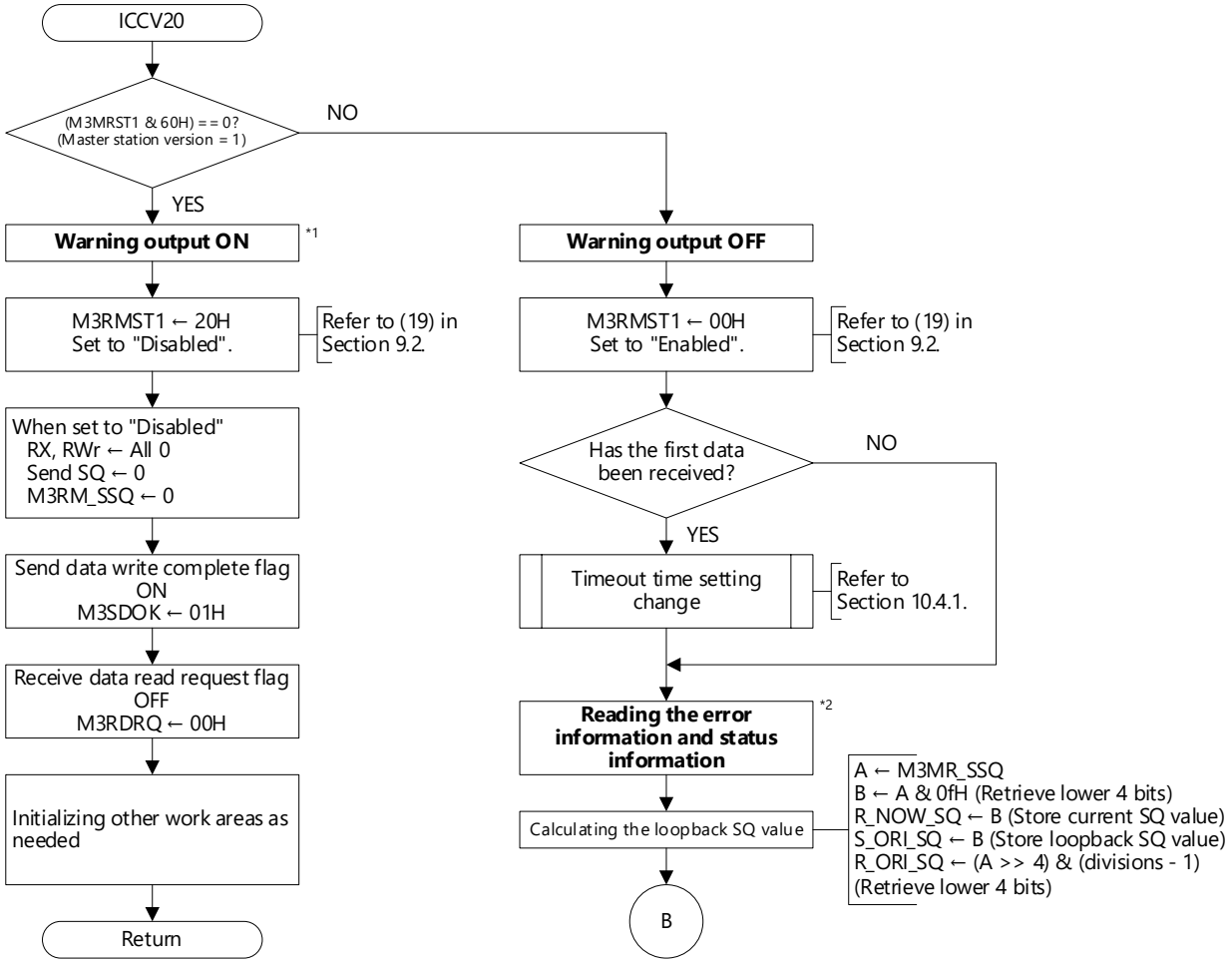
13.4.2. Example of polling

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

Polling condition:
When polling is used, perform 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 station occupied) to be connected to the master station (transmission speed 10 Mbps). Since the fastest link scan time at this point is approximately 1.1 ms, polling must be performed at intervals of 1 ms or less.



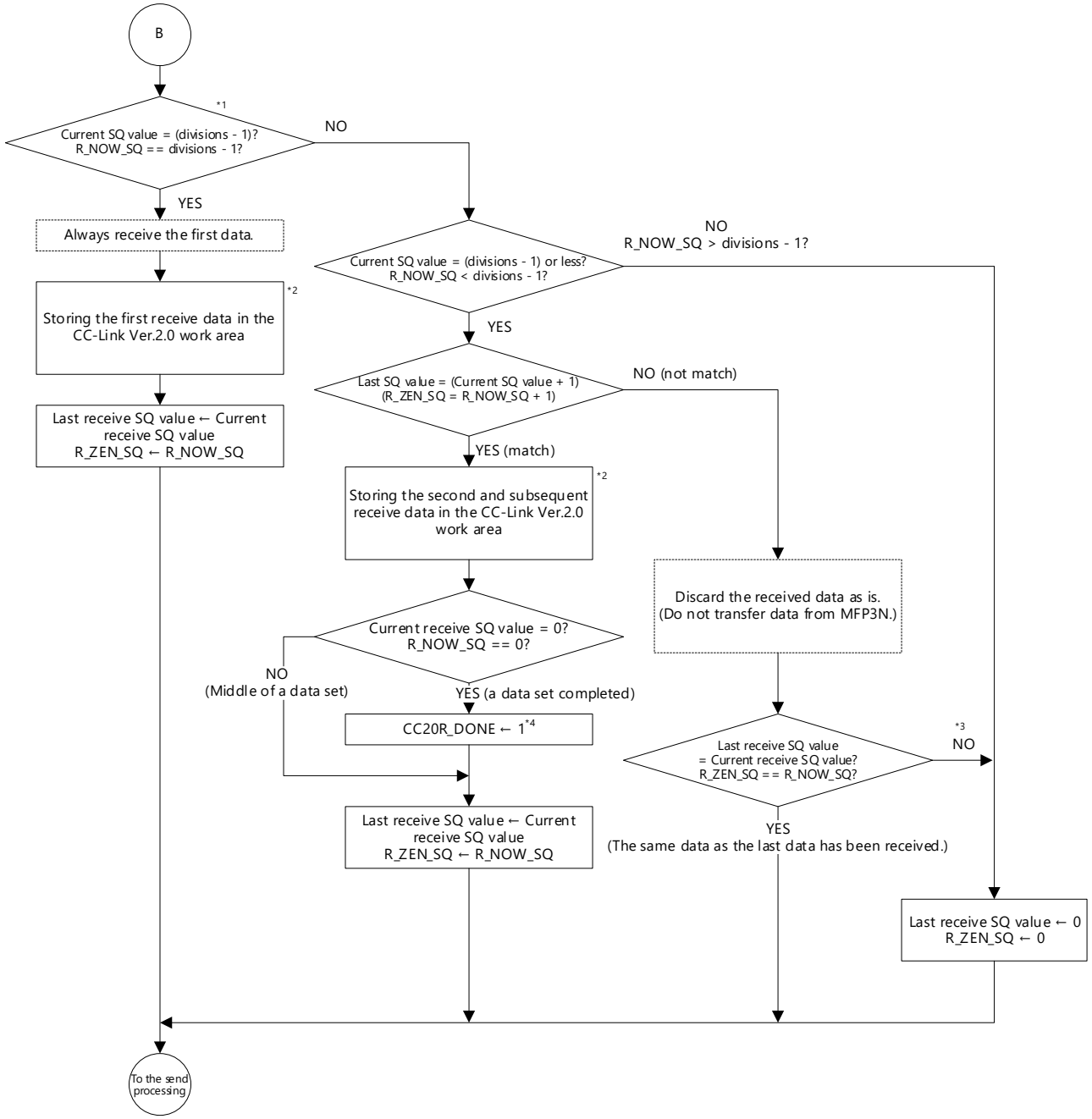
The following is an example of SQ value operation processing called during the interrupt or polling based send/receive processing.



*1: Output the version discrepancy as a warning on the application as needed.

*2: Read data in the byte addresses 04h and 05h (Error information 1 and 2).
For the device that needs to check the status information (such as the master station application status), read data in the byte address 08h (M → R status information (ST1)) as well. Then, perform the HOLD/CLR processing based on the status information.

Send/Receive Processing Module ICCV20 (Continued 1)



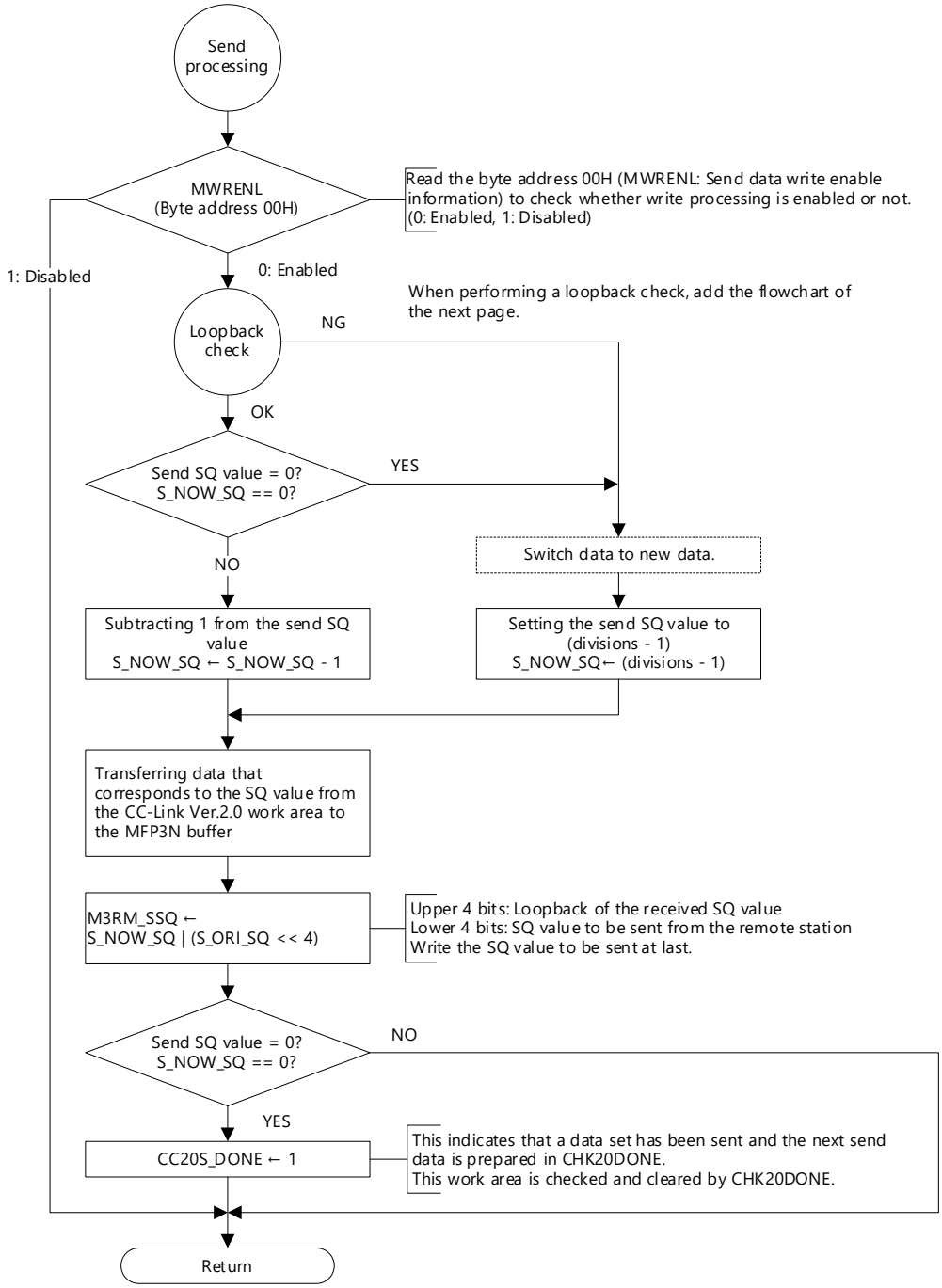
*1: Note that when an SQ value far greater than expected was received and if the value is not checked at this point, comparison against the last SQ value may set to the proper value due to subsequent processing.

*2: Although the master station sends the same ST1 and ST2 while the SQ value is 3 to 0, the remote station reads data constantly to ensure timeliness in case of an error.

*3: Reading data was skipped or the data was lost.
If the SQ value was skipped and the last SQ value was set, the fact that SQ value skipped may be lost if, for instance, SQ = 3 did not arrive and then same SQ is repeated, such as 2 → 2. In other words, 3 is lost and 2 → 2 → 1 → 0 or 3 and 2 are lost and 1 → 1 → 0 will both be perceived as correct values.

*4: The CC20R_DONE flag is checked and cleared with CHK20DONE (Application Work Area Transfer Processing Module CHK20DONE) (refer to Section 13.6).

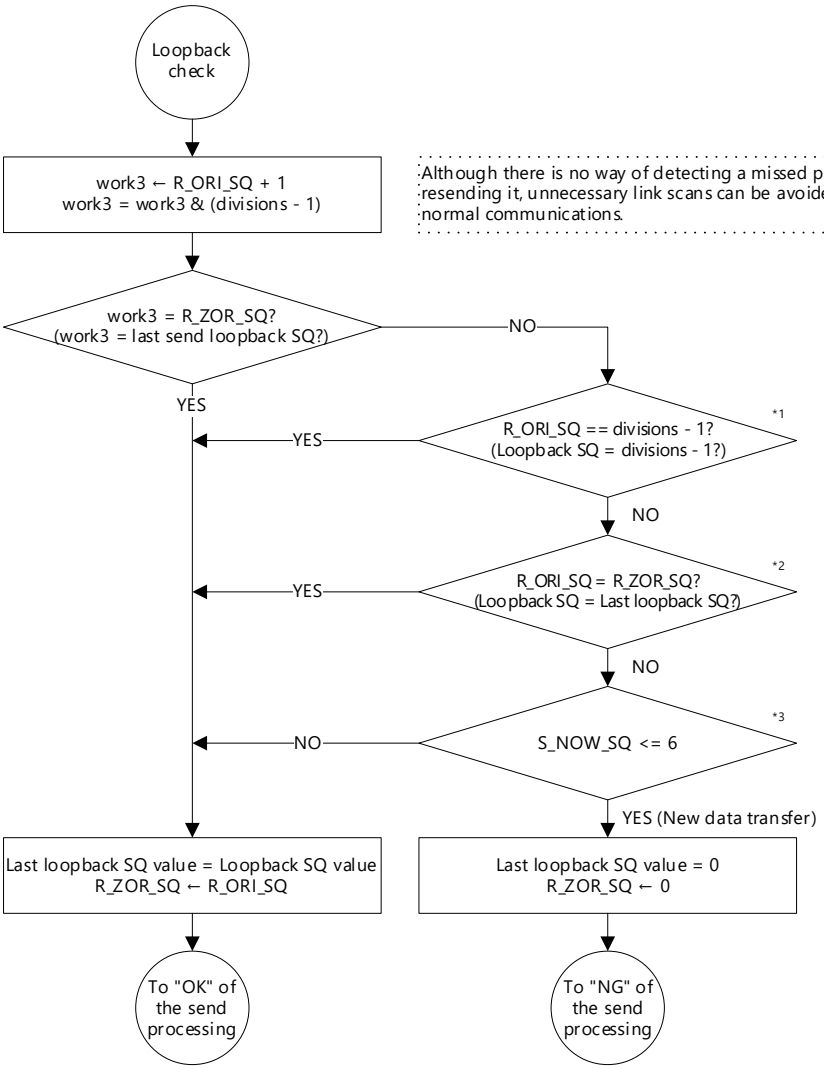
Send/Receive Processing Module ICCV20 (Continued 2)



Send/Receive Processing Module ICCV20 (Continued 3)

This processing checks the loopback SQ and determines whether the data is to be resent or not.

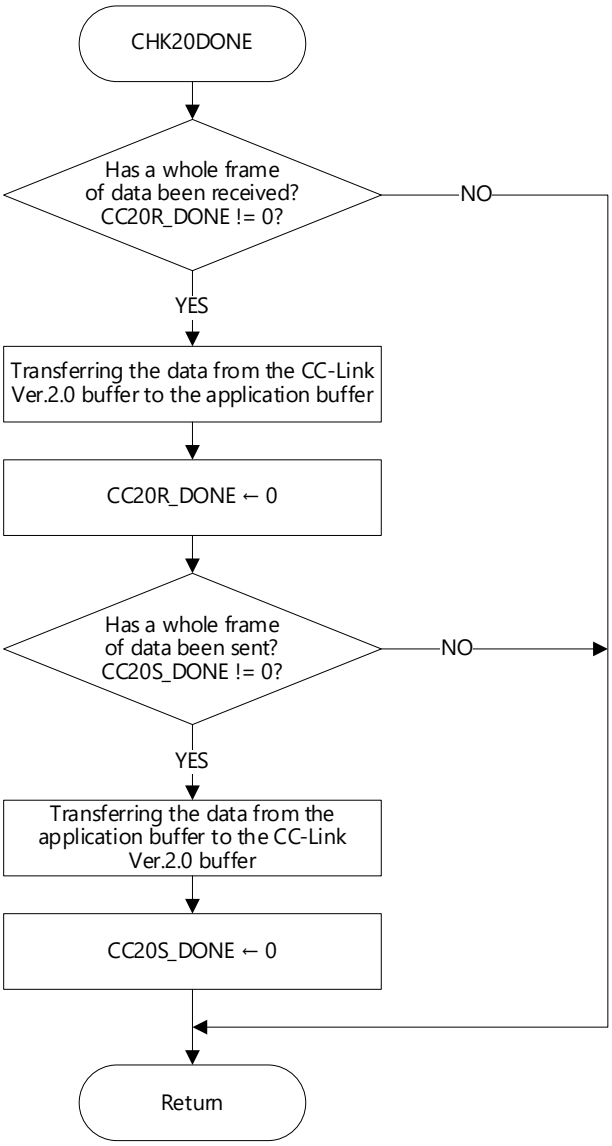
Point	Loopback check
Implement this processing when the extended cyclic setting is set to "Octuple". (The processing does not need to be implemented when the extended cyclic setting is set to "Single", "Double", or "Quadruple".)	



*1: In the case of "divisions - 1" (which is 7 in "Octuple" setting), this must always be accepted since data may be resent by the station itself.

*2: If the value is the same as the last loopback SQ value, there is a possibility that the processing on the counterpart side did not make it on time, which means the correct loopback may be received in the next communication. Therefore, this will be accepted.

*3: Missing data is detected only after 2 link scans; therefore, new data will not be sent at the first and second data transfer.


CHK20DONE
Has a whole frame of data been received? CC20R_DONE != 0?
NO
YES
Transferring the data from the CC-Link Ver.2.0 buffer to the application buffer
CC20R_DONE ← 0
Has a whole frame of data been sent? CC20S_DONE != 0?
NO
YES
Transferring the data from the application buffer to the CC-Link Ver.2.0 buffer
CC20S_DONE ← 0
Return

14. NOTES ON DEVELOPMENT WITH CC-LINK VER.2

14.1. Hardware

The hardware structure for CC-Link Ver.2 is basically the same as that for CC-Link Ver.1. However, note the following:

1) MFP3N
There is no MFP3N LSI dedicated for CC-Link Ver.2. The same MFP3N LSI is used in both CC-Link Ver.1 and CC-Link Ver.2.

2) CC-Link Ver.2 work area
In the extended cyclic setting (nx), data is sent/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 n packets of data can be read or written in a batch.

3) Toggle switch
If both CC-Link Ver.2 and CC-Link Ver.1 protocols are to be supported, a switch may be required in order to toggle between CC-Link Ver.2 and CC-Link Ver.1. The switch is unnecessary for CC-Link Ver.2-dedicated remote device stations.

4) Polling processing
To avoid missing a send SQ from the master station, polling processing must be performed at intervals of 1 ms or less. To achieve this, the REFSTB interrupt signal can be used, or an interrupt can be initiated by a timer, etc.
(For details, refer to Section 13.4 "Send/Receive Processing".)

5) Send processing
In CC-Link Ver.1, data could be written to MFP3N send buffer at any desired timing, but in CC-Link Ver.2, the timing of writing data to the send buffer is important. All of the polling processing described above needs processing to validate the data written after turning on the MFP3N send data write complete (offset address 0040h: M3SDOK) after triggered by the falling of the REFSTB signal.
Therefore, design the hardware so that it can positively detect the falling of the REFSTB signal. For example, use an MPU that can handle interrupt triggers or embed the falling of the REFSTB signal into an interrupt using external logic.
(For details, refer to Section 14.3 "Write Timing at Sending".)

14.2. Software (Firmware)

Since MFP3N does not include a protocol related to CC-Link Ver.2, such protocol must be implemented to the software (firmware). The following describes the items to be developed.

1) Master station version check processing
When data is received normally, check b5 and b6 (Protocol version) of the byte address 08h.
If the protocol version is CC-Link Ver.1, set b5 of the byte address 48h to "1" (Cyclic communication disabled).

2) Receive processing
The RY/RWw data read timing is the same as that of CC-Link Ver.1.
For example, when the extended cyclic setting is set to "Quadruple", the SQ values are received four times in order of 3 → 2 → 1 → 0.
The four packets of RY/RWw data are treated as one set of data.

3) Loopback check processing when receiving data (optional)
If the loopback SQ values are monitored and continuity is lost, new data is sent from the beginning. When the extended cyclic setting is set to "Octuple", sending new data from the remote station is less effective (transmission delay time actually becomes greater). Exercise caution during implementation.

4) Loopback processing when sending data
Loop back the SQ values received from the master station when sending data.
The master station checks the continuity of the loopback SQ values. If the continuity is lost, the master station determines that the data was not sent normally.
In this case, the master station suspends the current data sending and sends new data.
Unless the loopback SQ values are not sent, the master station will not send the correct data. Be sure to loop back all receive SQ values without fail.

14.3. Write Timing at Sending

Completing the processing (1) and (2) described below in a period of time between the rising of a REFSTB signal and the rising of a next REFSTB signal serves to maintain the continuity of the loopback SQ values.
If the continuity of the loopback SQ values cannot be maintained, the master station determines that the remote station is not receiving data correctly and sends data packets from the beginning again. Therefore, be sure to complete the processing (1) and (2) within the time between the rising of a REFSTB signal and the rising of a next REFSTB signal.

(1) After confirming the completion of receive processing by the rising of a REFSTB signal, set the receive SQ value from the master station as a loopback SQ, and write the send data (from (Number of divisions - 1) to 0) to the send buffer sequentially.
(The REFSTB signal should rise when refresh data is received during 1st station polling and refresh.)

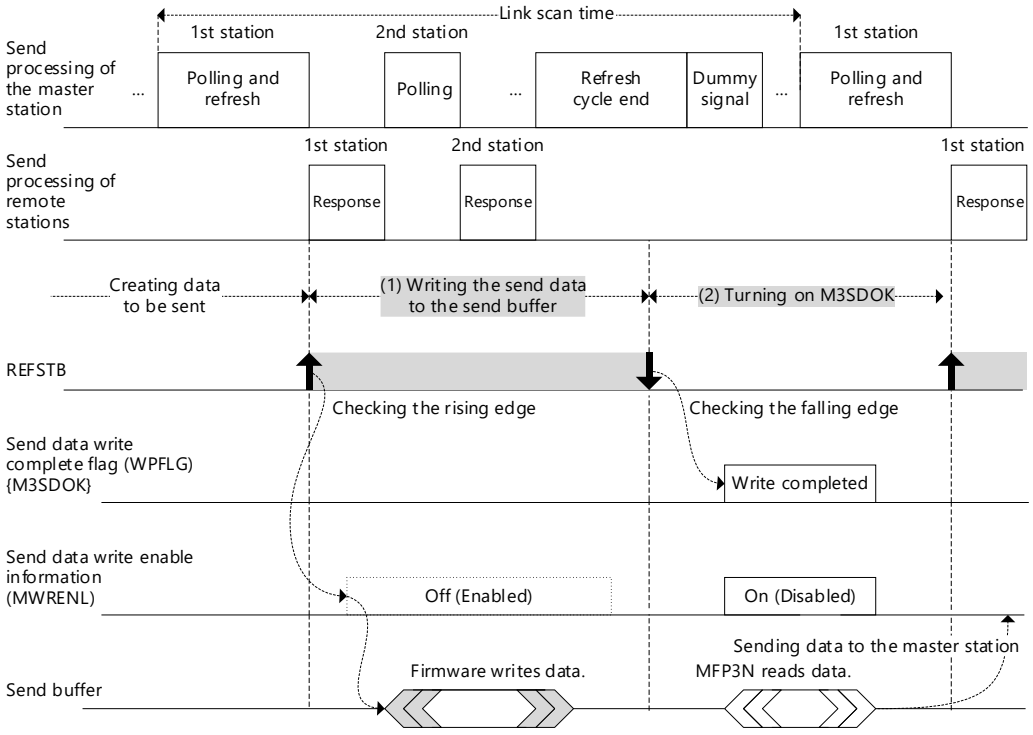
(2) After completing the processing (1), check the falling of a REFSTB signal, and turn on the send data write complete (offset address 0040h: M3SDOK).
(The REFSTB signal should fall after a refresh cycle has been completed).
With the processing (2) above, the data in the send buffer, which is written by the user, will be transferred to the send buffer to be used for sending and sent to the master station in the next polling.

The period of time between the rising of a REFSTB signal and the rising of a next REFSTB signal corresponds to a single link scan time. Therefore, the processing (1) and (2) need to be completed even for a system configuration[*1] with the shortest link scan time.
*1: System configuration with the shortest link scan time
- Transmission speed: 10 Mbps
- Slave station: A single remote device station (Number of occupied stations: 1)

(For the system configuration described above, the link scan time is approximately 1.1 ms).

In summary, the send processing of loopback SQ values should satisfy the following three conditions:
- Processing (1) + Processing (2) ≤ Shortest link scan time (approximately 1.1 ms)
- Processing (1) should take place after the rising of a REFSTB signal.
- Processing (2) should take place after the processing (1) has been completed and after the falling of the REFSTB signal.

[Link Scan Time and REFSTB Signal Change]



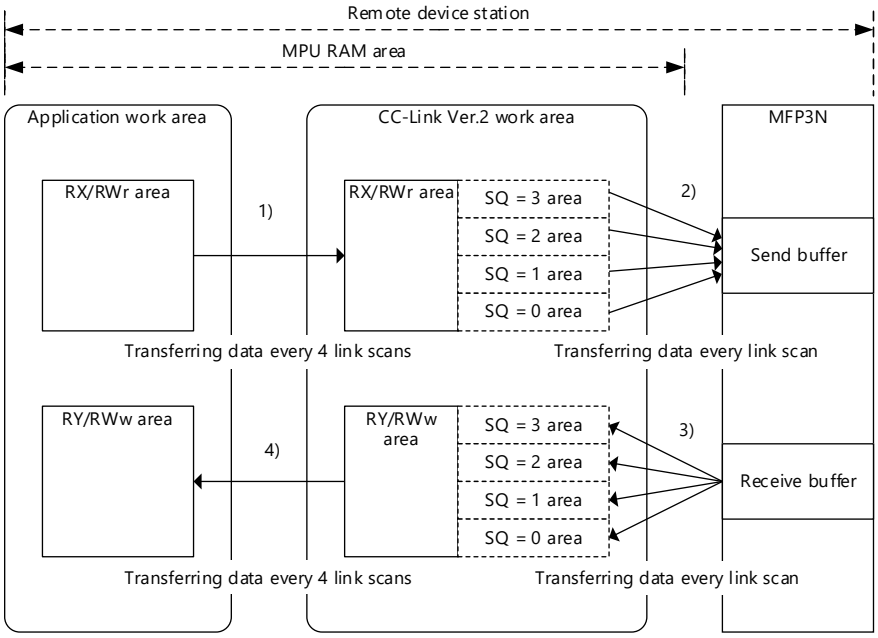
14.4. Handling of CC-Link Ver.2 Work Area

When the extended cyclic setting is the multiple n, ensure that data is sent and received between the CC-Link Ver.2 work area and MFP3N every link scan. The data communicated between MFP3N and the master station must be updated every link scan.

1) Write application work area data (RX/RWr) to be sent from the remote device station to the master station to the CC-Link Ver.2 work area in n packets.
2) When writing data from the CC-Link Ver.2 work area to MFP3N, divide the data and transfer them to MFP3N in n link scans.
3) When reading data (RY/RWw) to be received from MFP3N to the CC-Link Ver.2 work area or from the master station to the remote device station, divide the data and transfer them to MFP3N in n link scans.
4) When transferring data from the CC-Link Ver.2 work area to the application work area, hold the entire 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.)
The following is an example when the extended cyclic setting is set to "Quadruple".

[Example: When the extended cyclic setting is set to "Quadruple"]

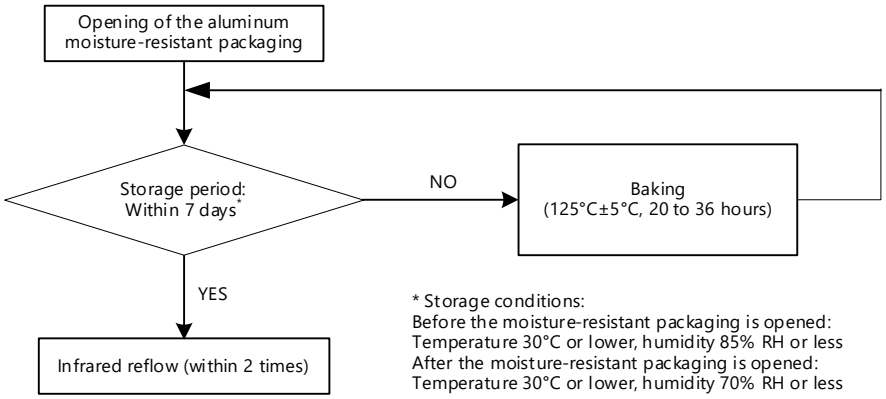


● Application work area
An area where the application can asynchronously read/write data. Exclusive control is necessary to avoid colliding with the transferring that takes place every 4 link scans.

● CC-Link Ver.2 work area
An area where only the CC-Link Ver.2 processing can access. For each link scan, corresponding SQ values are sent/received.

15.1. Recommended Infrared Reflow Soldering Conditions (Including Hot Air Reflow and Infrared + Hot Air Reflow)

The following shows the recommended infrared reflow soldering conditions (for the moisture absorption controlled product, management level: MSL3).

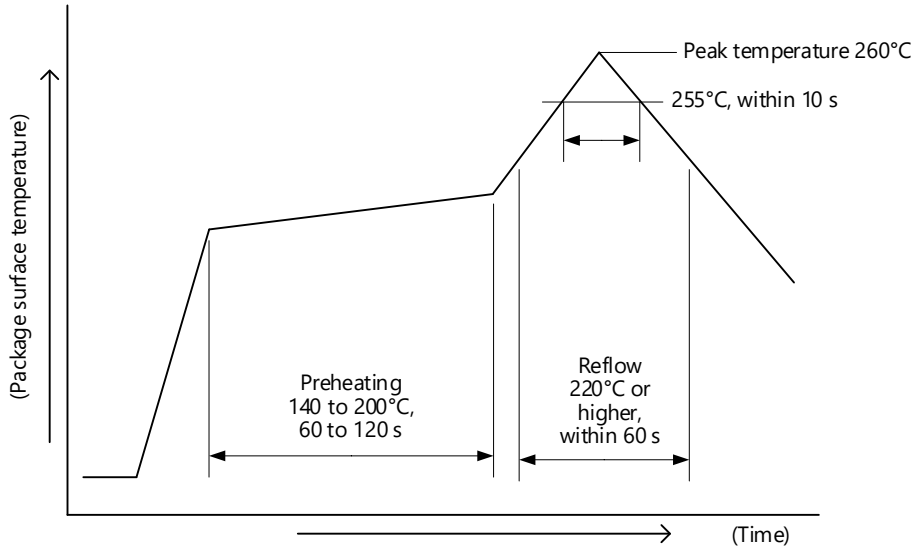


Mount the product by the infrared reflow method, hot air reflow method, or infrared + hot air reflow method.
Perform reflow within the above-indicated storage period. The maximum number of reflows is 2 times or less.
If the allowable storage period after opening of the moisture-resistant packaging is exceeded, dry the product under the above conditions before mounting.
The storage conditions from baking to mounting are the same as the conditions described above.
*: If the shipping form is tape and reel, put the product in a heatproof tray and perform drying.
*: When performing manual soldering, be careful that the soldering iron does not come in contact with anything other than the package leads.
<Conditions> Iron tip temperature: 350°C or less, Time: 5 s or less, Number of reflows: 2 times or less

<Recommended soldering conditions>

Peak temperature (package surface temperature)	260°C or lower
Duration at maximum temperature	Within 10 s
Duration at 220°C or higher	Within 60 s
Duration at preheat temperature (140 to 200°C)	60 to 120 s
Maximum number of reflows	2 times or less
Storage period after opening of the moisture-resistant packaging	Within 7 days

[Note]
When trays other than heatproof trays (such as magazine trays, taping trays, and non-heatproof trays) are used, the product must be unpacked for baking.



15.2. Precautions When Opening the Package

(1) Open the package immediately before soldering.
(2) Use the product within the moisture-resistant packaging storage period (within 12 months after sealing).
(3) This product requires moisture control. After opening, store the product in a moisture-proof environment (temperature: 30°C or lower, humidity: 70% RH or less), and mount the product within 7 days.
(4) If the product cannot be used within the periods stated in (2) and (3) above, put it in a heatproof tray and bake it for at least 20 hours at 125°C (Typ.) before mounting.

16. QUESTIONS & ANSWERS

Open System Center has received various questions from our partner manufacturers during the course of product development. These questions and our answers to the questions are listed in this section in a Questions & Answers format. Please use them as a reference for future product development.

16.1. Circuit Design in General

(1) Questions and answers related to specified parts

No.	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.
3	Can a HCPL7720#300 (gull-wing) be used instead of a HCPL7720#500?	Yes, it can be used. The HCPL7720#500 is a tape reel option; this product has the same gull-wing as the HCPL7720#300.
4	Pin 7 of the HCPL7720 is specified as N.C. Is it all right to design future products regarding pin 7 as N.C?	As long as you use a HCPL7720, it is all right to consider pin 7 as N.C. in your designs.

(2) Questions and answers related to capacitors

No.	Question	Answer
1	Can we change the capacity (3300 p/50 V) of the ground capacitor between FG and DG of the circuit example?	The FG-DG capacitor constant (3300 pF) cannot be changed, but (50 V) can be 50 V or higher.
2	We want to change the bypass capacitor to 0.1 µF. Are there any problems with this?	Any design will be fine (we think 1 µF is appropriate).
3	What is the type of capacitor used in the circuit? Is it all right to use IC capacitors?	We use chip-mounted multilayer ceramic capacitors, Tantalum capacitors, and aluminum electrolytic capacitors. We use chip-mounted multilayer ceramic capacitors at the four corners of MFP3N. For the sake of noise reduction, do not use IC capacitors in the communication part. It should be mounted as a separate device.

(3) Questions and answers related to resistors

No.	Question	Answer
1	Will you tell us the value of damping resistor for EMI measure, which is mounted for the output of the crystal oscillator?	Determine the damping resistance value in consideration of the EMI test results.
2	Is it mandatory to use a chip resistor for the 0 Ω resistor for EMI measure?	Please use a surface-mounted chip resistor (due to influence from the lead wire on EMI).
3	In the circuit example diagram, it is specified to use a "damping resistor (surface-mounted) of 0 Ω" between the crystal oscillator and the MFP3N. Is this resistor always necessary? (If it is not always necessary, we would like to short-circuit the pins of the resistor with a circuit pattern so that the resistor can be mounted after cutting the pattern when necessary.)	This resistor is provided as an EMI measure. Currently we do not consider the use of the resistor necessary, but it may become necessary in the future when we obtain an approval for the standards. To prepare for such occasions, a resistor of 0 Ω is mounted so that we can avoid pattern modification in the future. If your company considers that tasks such as cutting a circuit pattern can be performed later, then we see no harm in doing so.
4	How large is the minimum power drain (W) of the resistor?	We use 1/16 watts for the communication resistor.
5	In the circuit example, it is specified to use a resistor of 680 Ω between the filter and the RS485 transceiver. Does it pose a problem in the communication circuit if another value is used? [What is the minimum capacity (in watts) required?]	Please use a resistance value of 680 Ω (we use 1/16 watts).

(4) Questions and answers related to LEDs

No.	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	Three out of the four LEDs are operated directly by the MFP3N. Is it allowed to operate them with the HC series?	The LED display can be designed in any way you like.
3	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.
4	<Reference> says that the SDLED lighting time setting should be selected according to the LED used. What does this mean?	The response to an input signal varies depending on the LED used. Select and set the lighting time so that it is easy to check whether the LED in question is lit.
5	Lighting of the ERR lamp is currently controlled by an I/O signal. Will there be any changes to this?	There will be no changes. The ERROR signal is output via the I/O signals of the MPU.
6	Is it all right not to use the "FUSE" and "HOLD" LEDs?	It is all right not to use them if there is no need to output the setting status.
7	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.

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

No.	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	Is it necessary to use a flange (screw connecting two connectors) for reinforcing the connection of the 2-piece terminal block?	It is not mandatory to use a flange.
5	What precautions should we take when connecting or disconnecting a station with an online connector of a developed product during communication?	Turn off the power to the station to be connected or disconnected before inserting or removing the connector during communication. If the power supply is connected or disconnected at the same time, the internal circuit of the corresponding station may be damaged. In the case of a connector that connects or disconnects the power supply at the same time, make sure that the power is turned off before the communication line is disconnected and the power is turned on after the communication line is connected. In the case of a system, the temporary error invalid station or automatic return function can be used.
6	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.

(6) Questions and answers related to circuit pattern design

No.	Question	Answer
1	4-layer circuit boards may be desired but we want to use a double-sided circuit board. Will it make it difficult to pass the conformance test?	There is no specification for the number of layers that can be used on the circuit board. A double-sided circuit board can be used as far as appropriate measures are taken regarding power supply noise and floating capacitance issues.
2	Section 5.5 "Pattern Design Precautions" lists several points that require precautions. Are there any specific numerical values indicated?	There is no numerical data. Specific values cannot be obtained as they vary depending on the materials of the circuit board and chassis.
3	In the circuit diagram, the external SG and RS485 driver look as if they are connected at one point. Is it better to wire them in this way in the actual pattern as well?	There is no need to follow the wiring diagram. Take note of the points listed in Section 5.5 "Pattern Design Precautions" and design the circuit pattern accordingly.
4	Could you give us some information on points to note and prohibited matters when designing a circuit board? [1] Circuit pattern width, and clearance between patterns [2] Layout of parts [3] Places that require special treatments	Please refer to Section 5.5 "Pattern Design Precautions" in the circuit examples, although specific values are not listed. [1] Keep as much distance between an oscillator and other signal patterns as possible. If possible, place a solid GND pattern at the backside (soldered surface) of the oscillator. It is desired to use as wide patterns as possible for transmission signal lines "SD", "RD", "SDGATEON", and "RDENL", and to shield them with SG lines. [2] Make the circuit pattern path between the oscillator and the MFP3N as short as possible, so that a damping resistor (use a 0 Ω surface-mounted chip resistor) can be mounted. [3] There are no places that require special treatments.

(7) Questions and answers related to reset

No.	Question	Answer
1	We are planning to configure the circuit using an M51953B as a reset IC. Are there any problems such as MFP3N or MPU reset timing? (Since the output is reversed, it is necessary to use an inverting circuit on the MFP3N side.)	If an active low reset signal is used, there will be no problem if a signal inverting circuit is inserted before the REH input of the MFP3N. However, the difference between the actual operating voltages of the signal inverting circuit and the MFP3N may be a problem; please examine this issue thoroughly.
2	We want to employ an MM1095 (made by Mitsumi) or MB3771 (made by Fujitsu) instead of an M51954 in the reset circuit peripheral. Will it be all right?	Any design is allowed. Make sure, however, to use a reset pulse with the width described in the specifications.
3	It is possible to reset a user MPU with the RESET-OUT signal of the MFP3N. Conversely, is it also possible to change the design so that the MFP3N is reset via RESET-OUT of the user MPU?	Any design is allowed.
4	A reset switch is included in the circuit example. Is it mandatory?	If your product does not require resetting the hardware, it is not necessary to include a reset switch.
5	According to the circuit example, the power-on reset period is approximately 300 ms. Is such a long power-on reset necessary? With the circuit we are currently examining, it will be approximately 50 ms. Is this all right?	We set it longer than the time it takes before the power supply stabilizes. It can be shorter if it poses no problem with the power supply.

(8) Others

<table>
<tr><th>No.</th><th>Question</th><th>Answer</th></tr>
<tr><td>1</td><td>What is the typical current consumption value of MFP3N?</td><td>It is in the range from 30 mA to 40 mA (varies depending on the operating condition).</td></tr>
<tr><td>2</td><td>Is it possible to make a CC-Link remote device station work in a high ambient temperature environment (approximately 85°C)? (The master station is at room temperature.)</td><td>The rated operating ambient temperature is 0 to 55°C for our remote device stations, assuming that the same recommended/specified parts are used. It is designed so that some margin is maintained within the unit (ambient temperature of parts) at an ambient temperature of 55°C.
(Each manufacturer may have its own concept regarding the margin.)
Some kind of measures against heat may be required in the environment based on your question.
The following shows the operating ambient temperature of CC-Link Partner Association recommended parts and our specified parts, for reference.
<table>
<tr><th>Part name</th><th>Model name</th><th>Operating ambient temperature</th></tr>
<tr><td>Communication LSI</td><td>MFP3N</td><td>110°C</td></tr>
<tr><td rowspan="2">Filter</td><td>ZCYS51R5-M3PAT-01</td><td>85°C</td></tr>
<tr><td>MCT7050-A401</td><td>85°C</td></tr>
<tr><td>RS485 transceiver</td><td>SN75ALS181NS</td><td>70°C</td></tr>
<tr><td rowspan="3">Crystal oscillator</td><td>DSO751SBM</td><td>85°C</td></tr>
<tr><td>DSO751SB</td><td>70°C</td></tr>
<tr><td>KC7050B 80.0000C5ZBQZ</td><td>85°C</td></tr>
<tr><td rowspan="3">Photocoupler</td><td>HCPL-7720</td><td>100°C</td></tr>
<tr><td>HCPL-2611</td><td>85°C</td></tr>
<tr><td>PS9117</td><td>85°C</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>What type of lead plating does MFP3N employ?</td><td>The lead plating is Sn.</td></tr>
<tr><td>4</td><td>In the circuit example, the SLD and the FG are connected. In the case of general master modules and remote modules, however, are the SLD and the FG short-circuited?</td><td>The SLD and FG of our master modules are always short-circuited internally.</td></tr>
<tr><td>5</td><td>Regarding SLD and FG
In master modules and remote I/O modules, the SLD and FG terminals are independent.
For the module we are currently designing, we are planning to omit the FG terminal and short-circuit the SLD terminal and the FG line internally. Will it cause any problems?</td><td>We made the SLD and FG terminals independent in our modules because we consider it difficult to connect three solderless terminals to one terminal block. There will be no particular problems even if the FG terminal is omitted. It is, however, recommended to include both the SLD and FG terminals if possible, considering the mounting area.
Moreover, if the FG terminal is omitted, make sure to connect the SLD and the internal FG line so that they can be grounded from another part (a terminal block or chassis other than the CC-Link communication circuit board).</td></tr>
<tr><td>6</td><td>Are there any recommended 24 V-5 V DC-DC converters?</td><td>There are no specifically recommended converters.
There will be no problems as far as the current capacitance on the 5 V side satisfies the specification of your company.</td></tr>
<tr><td>7</td><td>There are two types of circuit example, a non-isolated communication system circuit and an isolated communication system circuit. We are considering a non-isolated communication system circuit. Could you tell us the advantages and disadvantages for each?
Which is used more often in partner products, isolated or non-isolated circuits?</td><td>A non-isolated communication system circuit does not require a photocoupler; it is possible to reduce the size and manufacturing cost of the interface.
In an isolated communication system circuit, the device and communication sides are separated from each other. In this case, it is possible to prevent noise generated by the device from affecting the communication side. Moreover, disturbances from the transmission path can only affect the communication system; it cannot affect the device.
In general, the communication system is often isolated from devices that may become noise sources, such as drive related devices (especially when a switch-mode regulator is included inside the device) and devices that must be protected against external disturbances, such as controllers. The communication system is usually not isolated for other devices.</td></tr>
<tr><td>8</td><td>The specifications indicate that insertion of the inverter device in the input/output stage of "HCPL2611" on the MFP3N output "SDGATEON" side is required in the communication system circuit example (isolated type). Why is this?</td><td>Inserting the inverter device on the "SDGATEON" side results in the same state as when output is enabled when the primary power supply is turned OFF, and thus the fear that some data will be continuously transmitted on the network from MFP3N. The inverter device is therefore inserted from a failsafe standpoint.</td></tr>
</table>

No.	Question	Answer
9	For CC-Link, does high voltage and high current have an electromagnetic noise effect? (What is the noise resistance guaranteed to users by CC-Link products?)	The noise resistance of CC-Link products is as follows. Device internal circuit common mode AC device: 1500 Vp-p, noise width: 1 μs, noise frequency: 25 to 60 Hz DC device: 500 Vp-p, noise width: 1 μs, noise frequency: 25 to 60 Hz
10	How can we prevent bundle noise errors?	It will be effective to treat the circuit from the RS485 transceiver (SN75ALS181NS) to the MFP3N (pins 77, 81, and 84) and the circuit from the crystal oscillator to the MFP3N (pin 99) with SG shield. Cut the circuit pattern between the transceiver and the MFP3N (pins 77, 81, and 84) and try connecting them with a jumper line instead. It can then be determined if each part is the cause of noise.
11	In the circuit example of the specification, the SD signal is not pulled up in the communication interface part of the isolated communication system circuit. Should it be pulled up?	It is not strictly necessary to pull it up.
12	Is the minimum thickness of cables that can be connected to a terminal block according to the CC-Link specification 0.5 mm^2?	The conductive material cross-section of the CC-Link dedicated cable is 0.5 mm^2. As far as this is supported, any terminal blocks may be used.
13	Are there any recommended connectors for connecting CC-Link cables? If so, could you provide us with the manufacturer names and types?	There are no specified parts for terminal blocks and connectors. It is all acceptable to use any terminal blocks or connectors by the manufacturer your company uses. At least five pins are required for the signal lines DA and DB, DG, SLD, and FG, however. It is also recommended to use 2-piece products where the base part soldered to the circuit board can be isolated from the main body to which cables are connected.
14	Could you tell us the specification of CC-Link terminal resistor? (CC-Link Version 1.10)	The CC-Link terminal resistor is 110 Ω, 1/2 W.

16.2. Hardware Design (MFP3N Peripheral)

(1) Questions and answers related to clock

No.	Question	Answer
1	Is it mandatory to use OUT-5M of the MFP3N?	The circuit example describes an example where the MPU uses a clock frequency of 5 MHz as a reference; but it is not mandatory.
2	Is the 5 MHz output of the MFP3N used in order to synchronize with the MPU?	It is not for synchronization purposes. We are simply suggesting to use it if a 5 MHz input is necessary for the MPU in question.
3	Is the clock output signal (OUT10M) output when the MFP3N is reset?	The clock output signal is output when the MFP3N is reset as well.
4	Is the duty cycle of the 20, 10, and 5 MHz CLKOUT signals 50%?	The duty cycles of all CLKOUT signals are 50%.

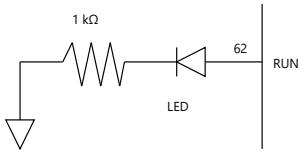
(2) Questions and answers related to address bus/data bus, and MFP3N access

No.	Question	Answer
1	The data bus width can be set via DW8L, pin 90 of the MFP3N. I want to switch between using an 8-bit bus and a 16-bit bus by controlling this signal. Is this possible?	It is possible to configure such circuit.
2	It is specified to treat the MD8 to 15 pins of the MFP3N as unconnected pins by grounding each of them via a 10 kΩ resistor. Is it possible to omit these resistors?	They cannot be omitted. This treatment is for protection, in case the MFP3N malfunctions and current is conducted out of the MFP3N via the MD8 to 15 pins. If the resistors are omitted and the pins are grounded directly, the circuit board and peripheral circuits may be damaged if the MFP3N malfunctions.
3	It is described that "if the data bus width is set to 8 bits, MD8 to 15 become input terminals and must be treated as unconnected pins". Is it acceptable to connect the terminals directly to ground in this case?	It is not allowed to connect the pins directly to ground without inserting resistors in between. Since the MD8 to 15 pins are I/O terminals, each of them must be connected to ground via a 10 kΩ resistor, as described in the circuit example. This is necessary for the protection against some unforeseen voltage being output at some point.
4	In the circuit example described in the specification, the pull-up resistors attached to pins 17 to 24 (MD8 to 15) of the MFP3N are specified to be 10 kΩ. Can they be changed to 22 kΩ (to use more commonly available parts)?	There is no problem in doing so.
5	Is the address bus of A0 to A6 active high?	Yes, it is active high.
6	Is the data bus of MD0 to MD15 active high?	Yes, it is active high.
7	We are examining the possibility of using a 16-bit data bus. Is it acceptable to connect only the MWRL signal among the WR signals, as in the 8-bit case? It will be connected to the data bus lines (0 to 15), the address bus lines (0 to 6), RD, WR (HWR and LWR), and CS of the MPU, respectively.	There will be no problem in doing so. Writing is controlled by MWRL and CSL and reading is controlled by MRDL and CSL even when a 16-bit data bus is used.
8	In TDH, how can we determine the input data retention time? Is it from the time CSL or MWRL is asserted, whichever comes first?	The input data retention time begins when CSL or MWRL is asserted, whichever comes first.
9	In TWR, how can we determine the address retention time? Is it from the time CSL or MWRL is asserted, whichever comes first?	The address retention time begins when CSL or MWRL is asserted, whichever comes first.
10	Is there any influence on the communication if the CSL terminal is set to H?	There will be no influence on the communication. Note, however, that the CSL terminal is active low; if it is set to H, it is not possible to write data from the MPU device to the MFP3N.
11	I do not understand the address relationship for an 8-bit specified value when the data width is 16-bits in the memory map list. Shouldn't the address 40h for a data width of 16 bits become 80h for a data width of 8 bits?	The memory map establishes memory space for the read area and write area in parallel. Thus, the write area start address is 40h for both a data width of 16 bits and a data width of 8 bits.

(3) Questions and answers related to the REFSTB signal

No.	Question	Answer
1	Does the REFSTB signal (pin 40) become H only when normal data is received? Or does it become H when any data is received?	It becomes H only when normal data is received.
2	Are there any restrictions for REFSTB interrupt, for instance that reading must be performed within a fixed period of time after an interrupt input is received?	When performing interrupt processing, the read operation must be completed within 1 ms. If the read operation cannot be completed within 1 ms, an asynchronous read method must be used.
3	How long does it take for the REFSTB signal to be output after the data reception? Also, how much can it vary?	There will be a delay time of approximately several ten nanoseconds after the completion of refresh data reception (receiving three flags after the transmission frame CRC). The REFSTB signal delay time varies by up to one SCLK cycle (same frequency as the baud rate).
4	The REFSTB signal (Pin 40), does not become H after the initialization. What can be the cause?	Check the following points: • Master station settings (station number, baud rate, parameters) • Cable wiring (terminal resistor, etc.) • Whether the circuit works if a remote device station made by Mitsubishi Electric is connected instead of the device being developed by your company • Whether the baud rate and station number of the remote station (monitored by addresses 02h and 03h) match with the settings of the master station • Is the RDENL signal set to L after the initialization? If so, add processing to set it to H at the start of the initialization and to L after the initialization. If it is not L, then check the circuit.
5	What is the normal state of the REFSTB signal (pin 40)?	The REFSTB signal (Pin 40) is usually set to L. It becomes H upon the completion of refresh data reception and is reset to L at the completion of the subsequent refresh cycle end frame reception.
6	When H is inputted to the REH signal and the status is reset, what is the state of the REFSTB signal (pin 40)? Is it H, L, or high impedance?	The state of the REFSTB signal (pin 40) is L.
7	In the circuit example, the REFSTB signal (pin 40) is pulled up. Since normally the setting is L, is there a possibility that the state will transition from H to L during the stage of power ON initialization?	The REFSTB signal (pin 40) never changes to a high impedance state. It will not, therefore, transition from H to L.

(4) Questions and answers related to LEDs

No.	Question	Answer
1	Is it possible to remove the inverter between the RUN terminal of pin 62 of the MFP3N and RUNLED, and turn the LED on by connecting it in reverse?	It is not possible to drive the LED directly, because the terminal cannot supply a current large enough to turn the LED on. Connect the LED as specified in the circuit example.
2	We want to change the lighting circuit of the RUN display LED as shown below.  I_{OL} = 8 mA, I_{OH} = -4 mA, L forward voltage (VF) = 1.7 Vtyp	The suggested circuit should work, but the driving current (I_{OH}) of -4 mA when the RUN terminal is H may not be enough. Use a high intensity LED and reduce the resistor value, or design the circuit as in the circuit example of the specification.
3	How large is the output current of the RUN terminal of pin 62 of the MFP3N?	The RUN terminal is a CMOS gate with I_{OH} = 8 mA.
4	At what frequency does the ERRL LED of pin 61 of the MFP3N flash?	ERRL LED Switch setting error: On Switch change error: Flash (0.4 seconds) CRC error: On. It turns off if the operation returns to normal by retry or return processing. The turn-on frequency thus is irregular.
5	It is specified that pin 60 of the MFP3N, RDLED, is "set to L at reception" and "turns on" during communication. Should it be "flashes" instead of "turns on"?	RDLED turns on whenever a carrier is detected. In normal communication, it thus looks as if it is flashing at high frequency. SDLED turns on during data transmission. With the default setting, it looks as if it is lit.

(5) Questions and answers related to WDT

No.	Question	Answer
1	Does the "WDT error detection circuit" of the circuit example detect MPU WDT errors?	The changes to L when an MPU WDT error occurs. If the circuit cannot be mounted, set pin 41 to H.
2	What will happen if L is input to pin 41 of the MFP3N, WDTL?	If L is input to WDTL, it is sent to the master station and the corresponding station bit of other stations' watchdog timer error status registers (SW0084 to SW0087) turns on. The operation of the MFP3N and the CC-Link communication are continued, however. If the link is in good condition upon recovery from WDT error, bits SW0084 to 0087 are cleared, as well.
3	At what interval is WDT cleared?	The interval is related to the MPU. Set the interval for WDT clearing so that a WDT error does not occur.
4	After WDT detection occurs, is the device reset without resetting MFP3N? If so, the WDT signal is recovered after the device is reset. Does this matter?	Do not reset only the MPU (device), rather reset both the MPU and MFP3N. It is not problematic that the WDT signal recovers as a result of reset. Assemble a circuit like the circuit example of the specification so that both the MFP3N and MPU reset by the reset switch.
5	What should be connected to pin 41 of the MFP3N (WDTL)? Is an MM1095 acceptable?	Connect a watchdog circuit that allows monitoring the MPU operation status, not an IC for monitoring the power supply voltage.

(6) Questions and answers related to reset

No.	Question	Answer
1	The reset switch is pressed in order to cancel a WDT error. Does it pose any problems if the reset switch is kept pressed? (In order to make a signal into a one-shot signal, etc.)	There is no problem in keeping the reset switch pressed. After the reset is cancelled (after REH falls), the required processing can be performed, for instance reading the station number and baud rate information and writing the SDLED lighting time and timeout time setting.
2	What will happen if H is input to pin 38 of the MFP3N, REH?	REH (pin 38) is a reset signal of the MFP3N. The MFP3N is reset if H is input for 0.08 ms or more.
3	Is it acceptable to connect a C-MOS IC (HC04) output to pin 38 of the MFP3N, REH?	The REH reset terminal is a TTL Schmitt input. It is possible to connect a C-MOS output directly to REH.

(7) Questions and answers related to setting inputs

No.	Question	Answer
1	Are the switch inputs for setting the baud rate and station number pulled up within the MFP3N? If so, what size of resistor is used to pull them up?	They are pulled up with 5 kΩ resistors. Please check the I/O type of each terminal of the MFP3N; it is listed in the type column in the table in the specifications.
2	If the baud rate setting is erroneous, what does the MFP3N do? Does it stop communicating at all or does it try to communicate with its own default setting?	It does not communicate.
3	Is it necessary to set IOTENSU and SENYU0/1 (pins 87 and 88/89) of the MFP3N before canceling the reset in the same way as for the baud rate setting?	It is necessary. They are normally set with switches or similar devices.
4	When changing the pin 87 (IOTENSU) setting from 'H' (Fixed to 32 bits) to 'L' (Depends on the number of occupied stations), what should I check with Version 2 (extended cyclic setting)? Does the change affect the operation?	The 'H' setting (Fixed to 32 bits) of pin 87 (IOTENSU) is used to fix the system area offset address (RX/RY) for receive/send buffer regardless of the number of occupied stations setting. When changing the pin setting from 'H' to 'L', conduct a test to check if the RX/RY system areas are normally operated with the extended cyclic setting of double/quadruple/octuple. Note that the same test must be conducted when the number of occupied stations setting is changed from 1 station occupied to 2 to 4 stations occupied.

(8) Others

No.	Question	Answer
1	How are the NRZ ports of pins 92 and 93 and the MON ports of pins 2 to 5 and 94 to 97 of the MFP3N normally supposed to be used?	These terminals are used for checking the operation of the MFP3N. SDNRZ: Transmission data before modulation RDNRZ: Reception data after modulation MON0 to 7: Reception address, data loading, DCLK, etc. Normally, partner manufacturers are not required to use them.
2	Can the SDGATEON signal of pin 84 of the MFP3N be placed in the floating status?	The SDGATEON signal must be H or L output.

16.3. Software

(1) Questions and answers related to initial processing

No.	Question	Answer
1	We have a question about the initial setting in the sample flowchart. Should the RS485 reception enable signal be set to H only at initialization?	Set it to H at initialization, and keep it to L afterwards.
2	We perform the following software processing for the initial processing. Byte address [1] 41h = 0x0119 [4] 43h = 0xf2f0 [2] 42h = 0x0120 [5] 40h = 0x0101 [3] 43h = 0xf200 However, in step 5 above, SDLED is not lit even though the WPFLG bit is set to 1 (there is no output from the SD terminal of the MFP3N, either. It maintains the H level). If byte address 40h 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 WPFLG bit is set to 1, data is transferred between the double buffers for transmission. During the transfer, the MWRENL send data write enable information of byte address 00h is set to 1. WPFLG and MWRENL are set to 0 when the transfer between the double buffers for transmission is completed. No data is transmitted from the MFP3N (causing SDLED to be lit) unless polling data from the master station is received. If data was read after the WPFLG bit was set to "1" and the bit is changed to "0", the data transfer between the double buffers for transmission 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

No.	Question	Answer
1	What does reception enable mean? Are there any operations necessary for the MFP3N?	Reception enable means allowing RS485 to receive data. There are no operations necessary for the MFP3N.
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

No.	Question	Answer
1	Which version should be written to byte address 45h of the MFP3N? Is it the version on the user side?	Byte address 45h 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	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 MFP3N. It is only the data of the 3rd byte that your company must specify.

(4) Questions and answers related to SDLED

No.	Question	Answer
1	Doesn't SDLED turn on unless the SDLED lighting time is written to byte address 46h? 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 46h SDLED lighting time setting using 16 bits, however, the data in byte address 47h timeout time setting) 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

No.	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 byte address 04h of the MFP3N 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 byte address 04h?	It is not necessary to generate device errors when BSERR (baud rate switch change error information) and SSERR (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 byte address 05h 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 byte address 05h?	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 (3.28 ms for 10 Mbps), an error occurs. The status changes to normal when either a carrier is detected on the transmission path or MFP3N 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

No.	Question	Answer
1	When reading data, do we just need to set 01 in byte address 41h (write 01 to byte address 41h)? Must we set it back to 0 after reading the data?	Byte address 41h, 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 byte address 41h 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 MFP3N is prevented when it is set to 1.
3	Is it necessary to turn on DRDREQ (reception data read request) of byte address 41h 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 byte address 01h 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 DRDREQ 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 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 byte address 01h (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 byte address 01h 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 REFSTB.	We do not intend to limit the usage, but it is not necessary to check DCHANG at a synchronous read using REFSTB, i.e., pin 40 of the MFP3N. It is acceptable to check DCHANG at a REFSTB interrupt, but make sure to keep the processing time within 1 ms.
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) Questions and answers related to the timeout processing

No.	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

No.	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 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?	The latest data is always transmitted.
3	Does the MFP3N 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	What is the upper limit of data to be written to the send buffer when setting the WPFLG bit of the byte address 40h to "1"? Also, does writing to the send 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 42h to 47h (vendor code, model type, version, etc.) and 7Ah (HOLD/CLR information setting) at the initial processing and byte addresses 48h to 59h (RX) and 5Ah to 79h (RWr) during normal operation. 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 mandatory to use hardware reset (operating the RESET terminal of the MPU directly regardless of the operation status at that time)? Considering the fact that data save processing is performed at reset, we want to execute a software reset after completing specific processing. Is it allowed?	Both reset methods are possible. However, make sure to design the circuit so that deadlock will not occur when resetting by software.
7	Is it possible to obtain the status equivalent to the "RUN" signal of pin 62 of the MFP3N?	There are no signals that are completely synchronized.
8	In the sample application flowchart, data is read within the interrupt handler via pin 40 of the MFP3N, 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.
9	Is it true that ST1 and ST2 of byte addresses 48h and 49h are identical to those of byte addresses 08h and 09h?	They are different. ST1 and ST2 of 48h and 49h represent the status of remote stations, and data is stored in them by the MFP3N. ST1 and ST2 of 08h and 09h represent the status of the master station. It is possible to read from them but not to write to them.
10	Can you explain about byte address 08h of the MFP3N?	MST10 indicates the RUN/STOP status of the master station application, MST11 indicates the normal/abnormal status of the master station 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.

16.4. Protocol and Others

(1) Questions and answers related to errors

No.	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 ready RX(m+n)B to ON using the error reset request flag 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.
9	What is the relationship between the RX(m+n)A error status flag and the various MFP3N errors? In an MFP3N 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 MFP3N 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 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)

No.	Question	Answer
1	Is it mandatory to set the following flags? RX(m+n)8: Initial data processing request flag RY(m+n)8: Initial data processing complete flag RY(m+n)9: Initial data setting request flag RX(m+n)9: Initial data setting complete flag	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.

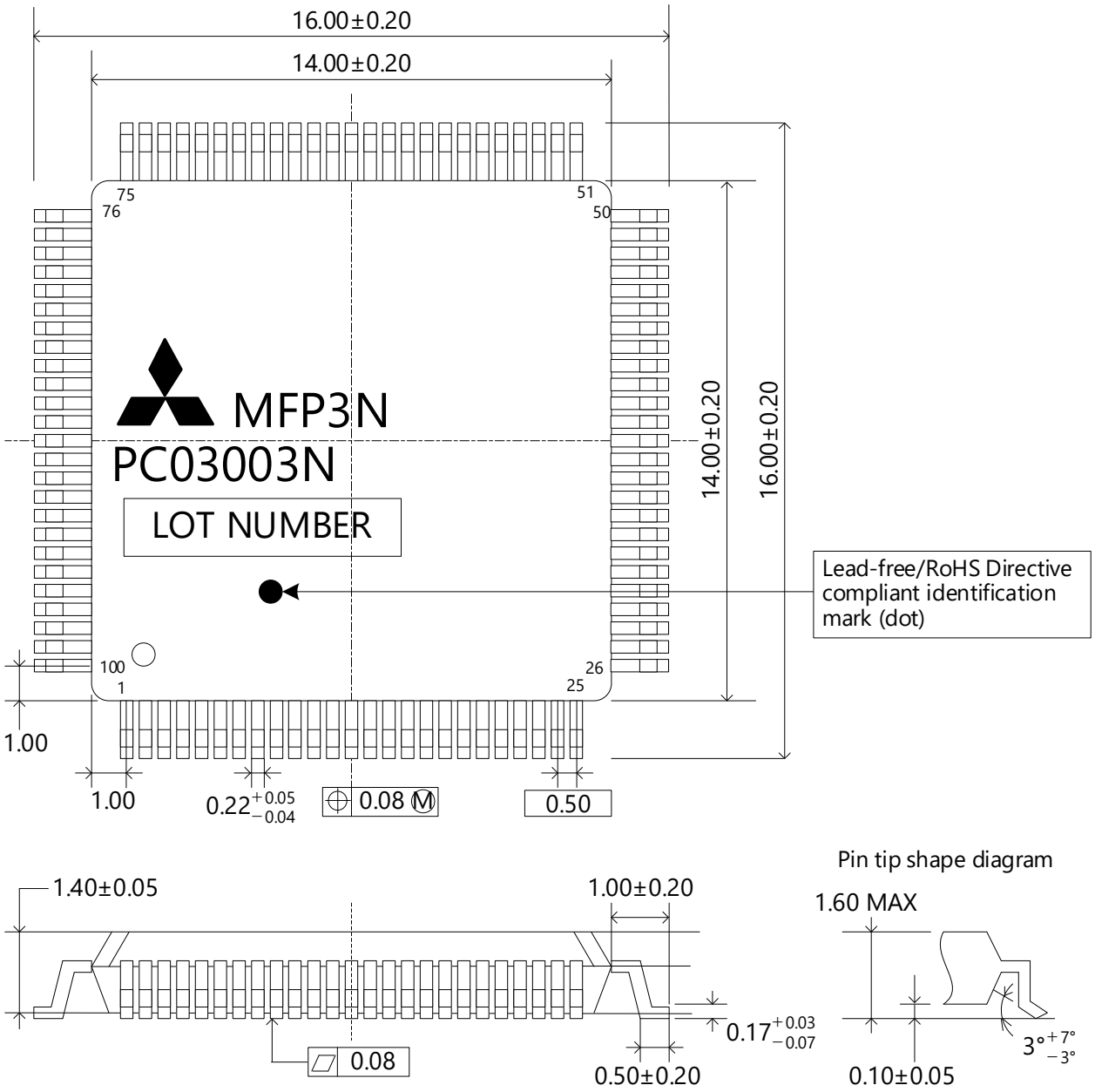
(3) Others

No.	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 MFP3N 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 MFP3N; 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 byte addresses 02h and 03h. 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).

Appendix 1 MFP3N Previous Specifications

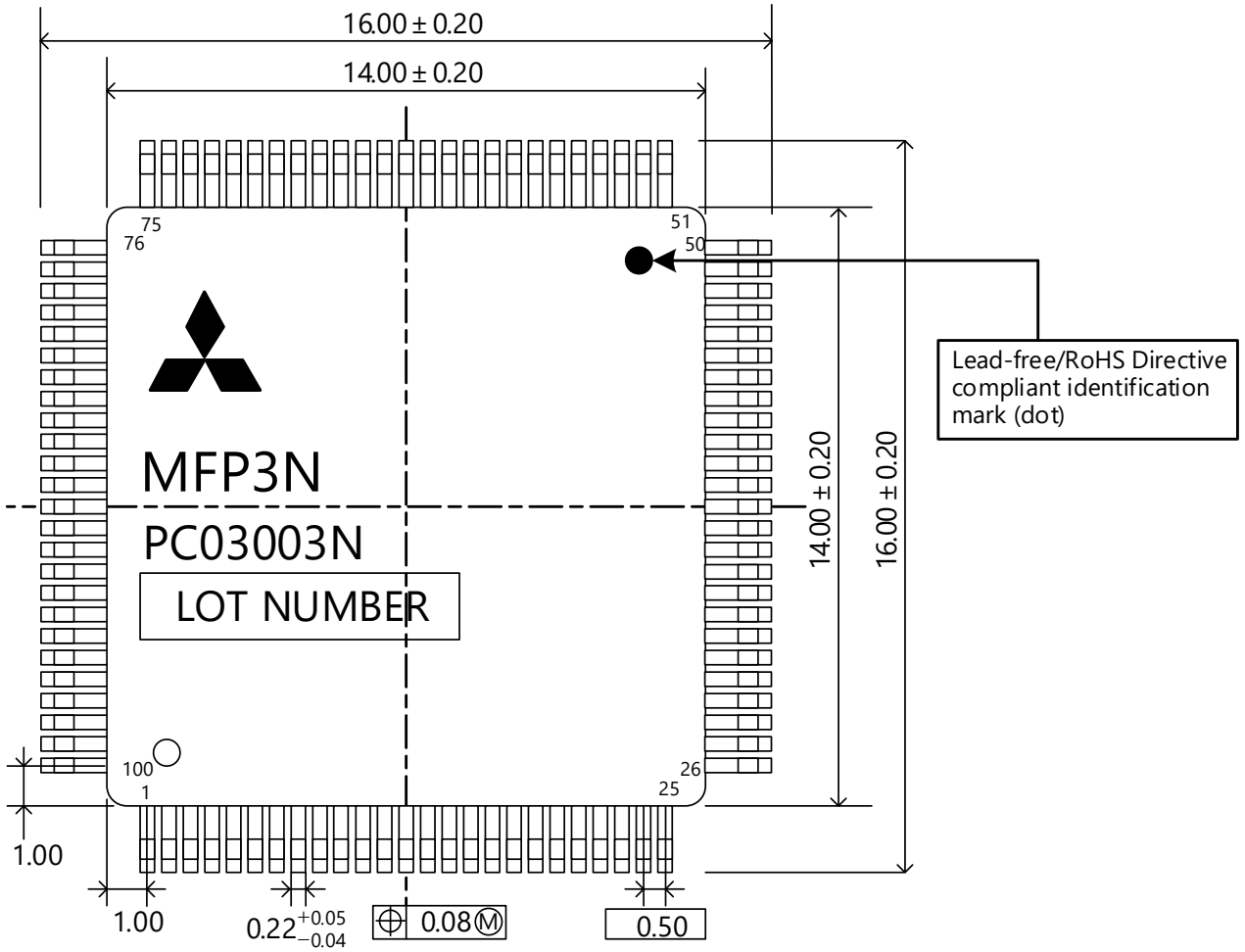
Appendix 1.1 External appearance (before March 2020)

The following is the external appearance of MFP3N before March 2020.
Unit: mm

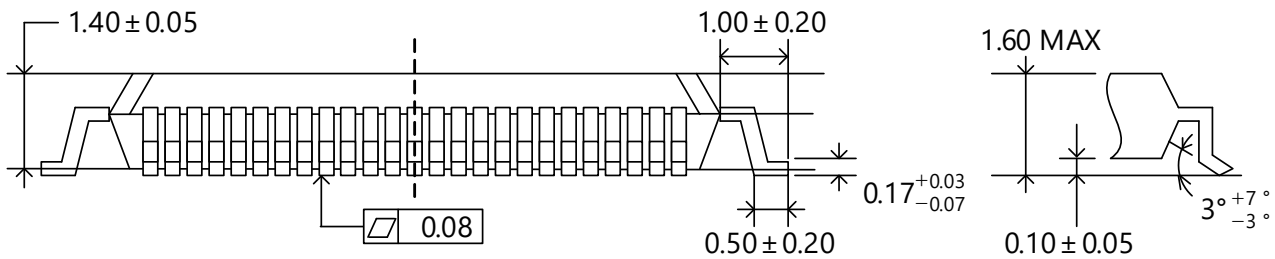


*: The position of dot may be different from the actual product.

The following is the external appearance of MFP3N before September 2014.
Unit: mm



Pin tip shape diagram



*: The position of dot may be different from the actual product.

Appendix 2 Differences between PC03003N and PC15003E

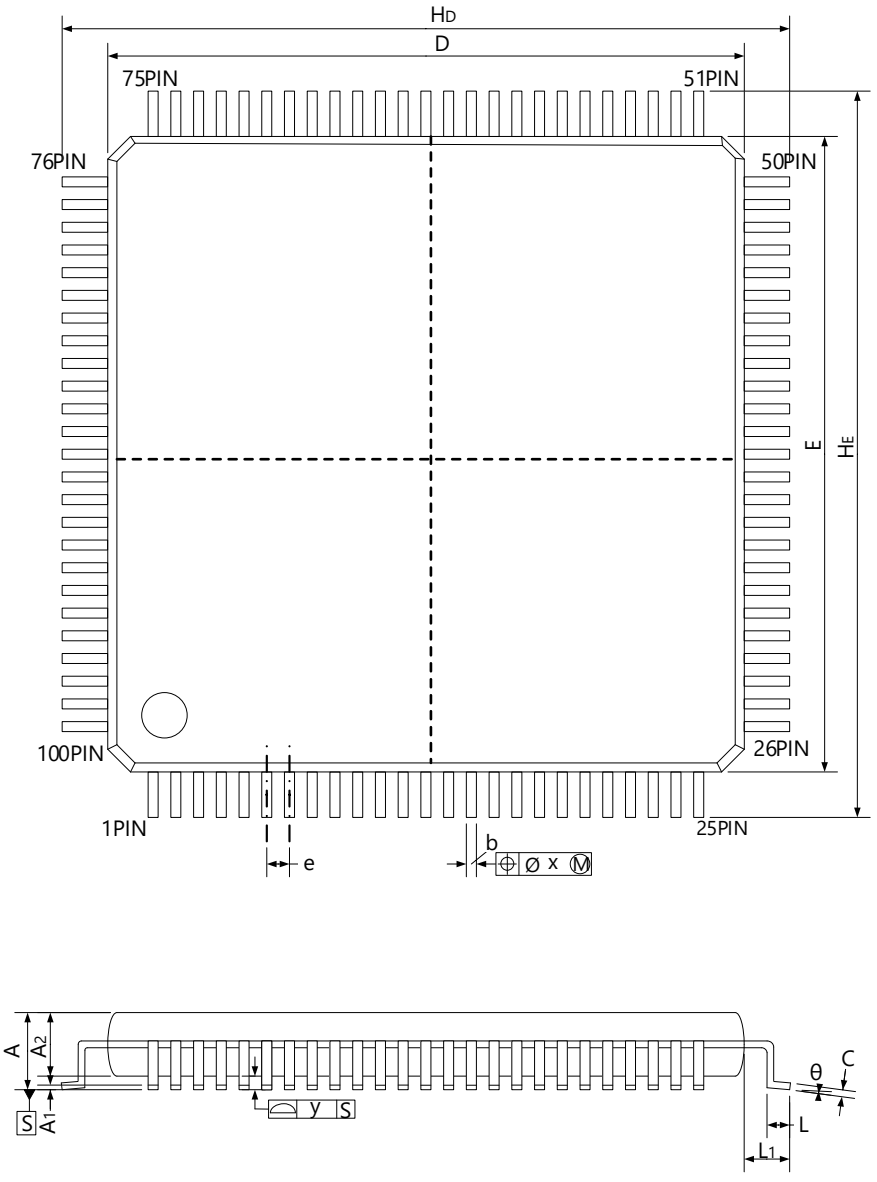
This section describes the differences between PC03003N and PC15003E.
Some specifications of PC15003E, such as electrical characteristics, have changed from the specifications of PC03003N.
Refer to this section when considering replacement.

Appendix 2.1 Model names

Item	Discontinued model	Alternative model
Product	PC03003N	PC15003E
Model (package unit: 60 pieces)	A6GA-CCMFP3NN60F	A6GA-CCMFP3NN60FN
Model (package unit: 300 pieces)	A6GA-CCMFP3NN300F	A6GA-CCMFP3NN300FN
Manufacturer	Mitsubishi Electric Corporation	Mitsubishi Electric Corporation

Appendix 2.2 External appearance

Appendix 2.2.1 Package dimensions



Detailed package dimensions
[Unit: mm unless otherwise specified]

Symbol	PC03003N			PC15003E		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.6	-	-	1.7
A1	0.05	0.1	0.15	0	0.1	0.2
A2	1.35	1.4	1.45	1.3	1.4	1.5
C	0.1	0.17	0.2	0.09	0.15	0.2
D	13.8	14	14.2	13.9	14	14.1
E	13.8	14	14.2	13.9	14	14.1
HD	15.8	16	16.2	15.6	16	16.4
HE	15.8	16	16.2	15.6	16	16.4
L	0.3	0.5	0.7	0.3	0.5	0.75
L1	0.8	1	1.2	0.8	1	1.2
b	0.18	0.22	0.27	0.17	0.22	0.27
e	-	0.5	-	-	0.5	-
x	-	-	0.08	-	-	0.08
y	-	-	0.08	-	-	0.08
Θ	0°	3°	10°	0°	5°	10°

Appendix 2.2.2 Print position specifications

For the print position of PC15003E, refer to Section 3.1 "External Appearance".
For the print position of PC03003N, refer to Appendix 2.2 "External appearance".

Appendix 2.3.1 Buffer types

I/O	Buffer type	PC03003N	PC15003E
I/O	I/O Buffer (TTL in: CMOS 3-state out: I_{OL} = 4 mA)	BO04	BT1BT_CCL
I	Input Buffer (CMOS in) with Pull-Up Resistor 5 kΩ	FIW1	IBCP1_CCL
I	Input Buffer (CMOS Schmitt in)	OFI7	IBH_CCL
I	Input Buffer (TTL Level in)	FI02	IBT
I	Input Buffer (TTL Schmitt in)	FIS2	IBS_CCL
O	Output Buffer (CMOS Level out: I_{OL} = 6 mA)	FO01	OB1T_CCL
O	Output Buffer (CMOS Level out: I_{OL} = 9 mA)	FO02	OB2BT_CCL
O	Output Buffer (CMOS Level out: I_{OL} = 12 mA)	FO03	OB3T_CCL

Appendix 2.3.2 Absolute maximum ratings

Item		PC03003N			PC15003E			Unit
		Symbol	Rated value		Symbol	Rated value		
			Min.	Max.		Min.	Max.	
Power supply voltage		V_{DD}	-0.5	6.0	V_{DD}	V_{SS} - 0.5	7.0	V
Input voltage		V_I	-0.5	6.0	V_I	V_{SS} - 0.5	V_{DD} + 0.5	V
Output voltage		V_O	-0.5	6.0	V_O	V_{SS} - 0.5	V_{DD} + 0.5	V
Output current	I_{OL} = 4 mA type ↓ I_{OL} = 6 mA type	I_{OUT}	-	12	I_{OUT}	±30		mA
	I_{OL} = 8 mA type ↓ I_{OL} = 9 mA type		-	24				mA
	I_{OL} = 12 mA type		-	30				mA
Storage temperature		T_{stg}	-65	150	T_{stg}	-65	150	°C

Appendix 2.3.3 Recommended operating conditions

Item		PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Power supply voltage		V_{DD}	4.5	-	5.5	V_{DD}	4.5	5.0	5.5	V
Operating temperature		T_A	-40	-	85	T_A	-40	25	110	°C
Input rising time	Normal	t_{ri}	0	-	200	t_{ri}	-	-	200	ns
	Schmitt	t_{fa}	0	-	10	t_{fa}	-	-	10	ms
Input falling time	Normal	t_{ri}	0	-	200	t_{ri}	-	-	200	ns
	Schmitt	t_{fa}	0	-	10	t_{fa}	-	-	10	ms
External clock input frequency		F	-	80	-	f	-	80	-	MHz

Item		PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
"H" Input voltage	CMOS	V_{IH1}	$0.7V_{DD}$	-	V_{DD}	V_{IH1}	3.15	-	V_{DD}	V
	TTL	V_{IH2}	2.29	-	V_{DD}	V_{IH2}	2.29	-	V_{DD}	V
"L" Input voltage	CMOS	V_{IL1}	0	-	$0.3\ V_{DD}$	V_{IL1}	0	-	1.65	V
	TTL	V_{IL2}	0	-	0.77	V_{IL2}	0	-	0.77	V
Positive trigger voltage	CMOS	V_{T1+}	2.85	-	3.75	V_{T1+}	2.55	-	3.75	V
	TTL	V_{T2+}	1.68	-	2.55	V_{T2+}	1.38	-	2.55	V
Negative trigger voltage	CMOS	V_{T1-}	1.15	-	1.75	V_{T1-}	1.15	-	2.05	V
	TTL	V_{T2-}	0.64	-	1.33	V_{T2-}	0.64	-	1.33	V
Hysteresis voltage	CMOS	ΔV	1.3	-	2.07	V_{H1}	1.1	-	-	V
	TTL	V_{H2}	0.83	-	1.44	V_{H2}	0.64	-	-	V
Output leak current		I_{OZ}	-	-	10	I_{OZ}	-5	-	5	μA
Input clamp voltage		V_{IC}	-1.2	-	-	V_{IC}	-1.2	-	-	V
Output short-circuit current		I_{OS}	-	-	-250	I_{OS}	-	-	-250	mA
Input leak current $V_I = V_{DD}$ or GND		I_I	-	$\pm10^{-5}$	±10	I_I	-5	-	5	μA
Pull-up resistance		R_{PU}	2.5	5.0	12.9	R_{PU}	2.5	5.0	12.9	kΩ
"L" Output current	I_{OL} = 4 mA type ↓ I_{OL} = 6 mA type	I_{OL}	4.0	-	-	I_{OL}	6.0	-	-	mA
	I_{OL} = 8 mA type ↓ I_{OL} = 9 mA type		8.0	-	-		9.0	-	-	mA
	I_{OL} = 12 mA type		12.0	-	-		12.0	-	-	mA
"H" Output current	I_{OL} = 4 mA type ↓ I_{OL} = 6 mA type	I_{OH}	-2.0	-	-	I_{OH}	-6.0	-	-	mA
	I_{OL} = 8 mA type ↓ I_{OL} = 9 mA type		-4.0	-	-		-9.0	-	-	mA
	I_{OL} = 12 mA type		-6.0	-	-		-12.0	-	-	mA
"L" output voltage		V_{OL}	-	-	0.1	V_{OL}	-	-	0.4	V
"H" output voltage		V_{OH}	V_{DD} - 0.1	-	-	V_{OH}	V_{DD} - 0.4	-	-	V
Static supply current		I_{DDS}	-	-	100	I_{DDS}	-	-	240	μA

Appendix 2.3.5 CMOS Schmitt buffer characteristics

Item		PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Positive trigger voltage	CMOS	V_{T1+}	2.85	-	3.75	V_{T1+}	2.55	-	3.75	V
Negative trigger voltage	CMOS	V_{T1-}	1.15	-	1.75	V_{T1-}	1.15	-	2.05	V
Hysteresis voltage	CMOS	ΔV	1.3	-	2.07	V_{H1}	1.1	-	-	V

Appendix 2.3.6 TTL Schmitt buffer characteristics

Item		PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Positive trigger voltage	TTL	V_{T2+}	1.68	-	2.55	V_{T2+}	1.38	-	2.55	V
Negative trigger voltage	TTL	V_{T2-}	0.64	-	1.33	V_{T2-}	0.64	-	1.33	V
Hysteresis voltage	TTL	V_{H2}	0.83	-	1.44	V_{H2}	0.64	-	-	V

Appendix 2.3.7 AC characteristics

Item	PC03003N				PC15003E				Unit
	Symbol	Rated value			Symbol	Rated value			
		Min.	Typ.	Max.		Min.	Typ.	Max.	
Output rising time	t_r	-	1.23	-	t_r	-	2.76	-	ns
Output falling time	t_f	-	1.62	-	t_f	-	1.75	-	ns

Appendix 2.3.8 I/O capacitance

Item	Condition	PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Input capacitance	f = 1 MHz, V_{DD} = 0 V	C_I	-	10	20	C_I	-	-	10	pF
Output capacitance		C_O	-	10	20	C_O	-	-	10	pF
I/O capacitance		C_{IO}	-	10	20	C_{IO}	-	-	10	pF

Appendix 2.4 Operation timing

Appendix 2.4.1 Read cycle

Item	Condition	PC03003N				PC15003E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Access time	CSL = MRDL = V_{IL}	t_{ACC}	-	-	24.19	t_{ACC}	-	-	24.19	ns
CSL output delay time	MRDL = V_{IL}	t_{CE}	-	-	19.34	t_{CE}	-	-	19.34	ns
MRDL output delay time	CSL = V_{IL}	t_{OE}	-	-	19.35	t_{OE}	-	-	19.35	ns
Output disable delay time	CSL = V_{IL}	t_{DF}	2.25	-	12.56	t_{DF}	2.25	-	12.56	ns
Output data hold time	CSL = MRDL = V_{IL}	t_{OH}	2.1	-	-	t_{OH}	2.25	-	-	ns

Appendix 2.4.2 Write cycle

Item	PC03003N				PC15003E				Unit
	Symbol	Rated value			Symbol	Rated value			
		Min.	Typ.	Max.		Min.	Typ.	Max.	
Chip selection time	t_{CW}	2.5	-	-	t_{CW}	6.3	-	-	ns
Address setup time	t_{AS}	0	-	-	t_{AS}	0	-	-	ns
Write pulse width	t_{WP}	2.5	-	-	t_{WP}	6.3	-	-	ns
Address hold time	t_{WR}	0	-	-	t_{WR}	0	-	-	ns
Input data setup time	t_{DW}	12.35	-	-	t_{DW}	12.35	-	-	ns
Input data hold time	t_{DH}	-3.14	-	-	t_{DH}	-3.14	-	-	ns

Appendix 2.5 Specified components (crystal oscillator)

Use a crystal oscillator having a frequency deviation within ±100 ppm.

PC03003N			PC15003E		
Size (unit: mm)	Model	Manufacturer	Size (unit: mm)	Model	Manufacturer
7.3 × 4.9	DSO751SBM 80MHz	DAISHINKU CORP.	7.3 × 4.9	DSO751SBM 80MHz	DAISHINKU CORP.
	DSO751SB 80MHz (discontinued product)			-	
7.0 × 5.0	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	KYOCERA Corporation	7.0 × 5.0	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	KYOCERA Corporation
	KC7050B80.0000C5ZBQZ (discontinued product) (FXO-37FNB 80MHz)			-	
3.2 × 2.5	KC3225K80.0000C56NDZ (The production will be discontinued from March 2022.)	KYOCERA Corporation	3.2 × 2.5	KC3225K80.0000C56NDZ (The production will be discontinued from March 2022.)	KYOCERA Corporation
	DSO321SBN 80MHZ	DAISHINKU CORP.		DSO321SBN 80MHZ	DAISHINKU CORP.
	DSO321SBM 80MHZ			DSO321SBM 80MHZ	

Note

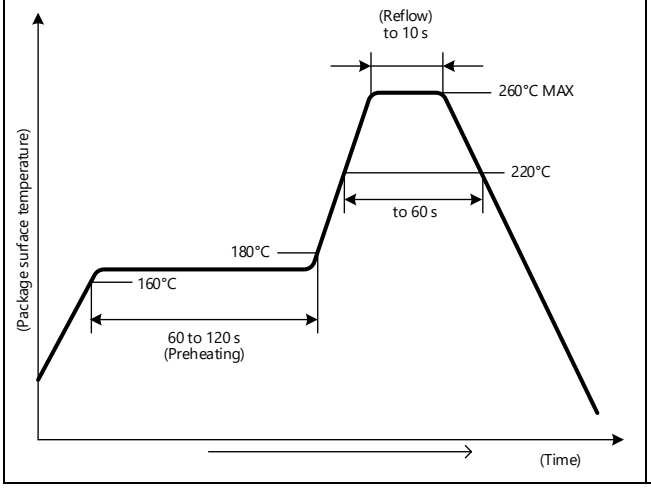
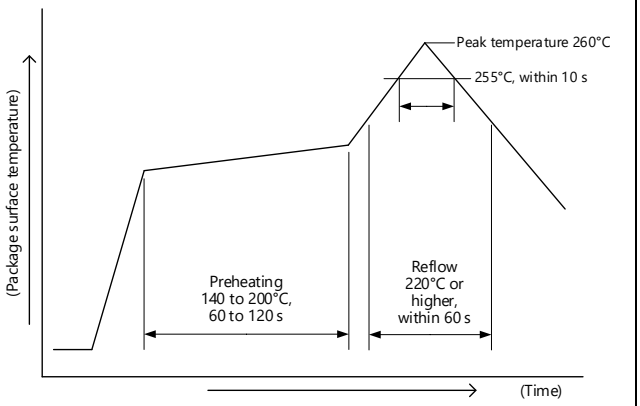
For the latest information of the specified components, check the technical bulletins.
For the production status, contact each manufacturer.

Appendix 2.6 Handling precautions

Appendix 2.6.1 Recommended conditions

Item	PC03003N	PC15003E
After package opening	Within 7 days	Within 7 days
Baking	125°C, 10 to 72 hours	125°C, 20 to 36 hours
Maximum temperature (package surface temperature)	260°C or lower	260°C or lower
Preheating time	60 to 120 s	60 to 120 s
Reflow time	220°C, within 60 s	220°C, within 60 s
Maximum number of reflows	3 times or less	2 times or less

Appendix 2.6.2 Allowable temperature profile conditions

PC03003N	PC15003E
	

Revisions

* The manual number is given on the bottom left of the back cover.

Print date	*Manual number	Revision
December 2005	SH(NA)-080624ENG-A	First edition
November 2006	SH(NA)-080624ENG-B	Modified Revisions associated with lead-free/RoHS Directive compliancy
November 2006	SH(NA)-080624ENG-C	Modified Sections 3.5.3, 5.1, 5.2, 6.1, Chapter 16
October 2010	SH(NA)-080624ENG-D	Modified Reference materials, Section 1.1, Section 3.2, Chapter 5, Chapter 6, Chapter 7, Chapter 9, Section 10.1, Section 10.2.1, Section 10.2.2, Section 10.3.1, Section 10.3.2, Section 10.3.3, Section 10.4.1, Section 10.4.2, Chapter 11, Section 12.1, Section 12.2.2, Section 13.1, Section 13.4, Section 14.1, Section 14.4, Section 16.1, Section 16.2, Section 16.3
January 2012	SH(NA)-080624ENG-E	Modified Section 1.1, Chapter 2, Section 3.1, Section 3.3.1, Section 3.3.2, Section 3.5.3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 9, Chapter 10, Section 11.1.1, Chapter 12, Section 12.1, Section 12.2.1, Section 12.2.2, Section 12.2.3, Section 13.1, Section 13.2, Section 13.3.1, Section 13.3.2, Section 13.4, Section 14.1, Section 14.2, Section 14.3, Chapter 15, Chapter 16, Appendix, Guarantee Added Requests Concerning Safe Design, Precautions for Using This Document, Section 5.4, Section 7.1, Section 7.3
October 2017	SH(NA)-080624ENG-F	Modified Notice for Safe Designs, INTRODUCTION, Chapter 1, Section 1.1, Section 3.1, Section 3.2, Section 3.3, Section 3.5.3, Chapter 5, Section 6.1, Section 6.2, Section 7.3, Section 9.2, Section 10.1, Section 10.2, Section 10.2.1, Section 10.2.2, Section 11.1.2, Section 12.1, Section 12.2.3, Section 13.2, Section 13.5, Section 14.4, Section 16.2, Section 16.3 Added CC-Link Partner Association (CLPA), Trademarks, Section 13.3, APPENDIX Deleted RELATED MATERIALS
February 2021	SH(NA)-080624ENG-G	Modified Section 6.1, Section 6.2
March 2022	SH(NA)-080624ENG-H	Modified Notes Regarding This Manual, Relevant Manuals, CC-Link Partner Association, Section 1.1, Section 3.1, Section 3.2, Section 3.5.2, Section 5.1, Section 5.3, Section 5.5, Section 6.1 to 6.3, Section 7.2, Section 9.1, Section 10.1, Section 11.1.2, Section 14.3, Section 15.1, Section 16.1, Section 16.3, Trademarks Added Conditions of Use for the Product, Usage Precautions, Terms, Address Notation, Radix Notation, Appendix 2 Deleted INTRODUCTION, Generic Terms and Abbreviations

Warranty

Please confirm the following product warranty details before using the dedicated LSI.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be replaced at no cost via the sales representative or Mitsubishi Service Company.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, a replacement fee shall be applied in the following cases.

- [1] Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
- [2] Failure caused by unapproved modifications, etc., to the product by the user.
- [3] When the Mitsubishi product is assembled into a user's device, failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
- [4] Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
- [5] Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
- [6] Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Handling after discontinuation of production

(1) Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Customer service

(1) When the cause of failure requires an investigation, Mitsubishi shall conduct the investigation using the dedicated LSI unit only. Please bring the dedicated LSI removed from the product to which it was incorporated to Mitsubishi. Mitsubishi will not conduct business travel in connection with the investigation.

(2) Overseas, replacements shall be provided by Mitsubishi's local FA Centers. Note that the conditions under which replacements are provided by each FA Center differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals, and technical documents are subject to change without prior notice.

Trademarks

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies. In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

Open Field Network
CC-Link Compatible Product Development Reference Manual

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