MITSUBISHI

TRANSISTORIZED INVERTER

– INSTRUCTION MANUAL –

CC-*Link*

FR-E5NC

Thank you for choosing the Mitsubishi transistorized inverter option unit.

This instruction manual gives handling information and precautions for use of this product. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use it to its optimum.

Please forward this manual to the end user.

Safety Instructions

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.

In this manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⬦ WARNING	Denotes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Denotes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that even the CAUTION level may lead to a serious consequence under some circumstances. Please follow the instructions of both levels as they are important to personnel safety.

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

⚡ **WARNING**

- While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.
- If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a meter etc.
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Operate the switches with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.
- While power is on, do not move the station number and baud rate setting switches. Doing so can cause an electric shock.

2. Injury Prevention

⚠ **CAUTION**

- Apply only the voltage specified in the instruction manual to each terminal to prevent damage, etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, damage, etc. may occur.
- Always make sure that polarity is correct to prevent damage, etc.
- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

3. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

(1) Transportation and installation

⚠ CAUTION
● Do not install or operate the option unit if it is damaged or has parts missing. ● Do not stand or rest heavy objects on the product. ● Check that the mounting orientation is correct. ● Prevent screws, metal fragments, conductive bodies or oil, other flammable substance from entering the inverter.

(2) Test operation and adjustment

⚠ CAUTION
● Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

(3) Usage

◈ WARNING
● Do not modify the equipment.

> ⚠ **CAUTION**
>
> - When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation.
> - For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

(4) Maintenance, inspection and parts replacement

> ⚠ **CAUTION**
>
> - Do not test the equipment with a megger (measure insulation resistance).

(5) Disposal

> ⚠ **CAUTION**
>
> - Dispose of this product as general industrial waste.

(6) General instruction

> All illustrations given in this manual may have been drawn with covers or safety guards removed to provide in-depth description. Before starting operation of the product, always return the covers and guards into original positions as specified and operate the equipment in accordance with the manual.

CONTENTS

7 HOW TO CHECK FOR ERROR USING THE LEDS — 50

1 PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and Product Confirmation

Take the option unit out of the package, check the unit name, and confirm that the product is as you ordered and intact.
This product is an inboard option specifically used with the FR-E500 series (FR-E540-0.4K to 7.5K (-NA) (-EC) (-CH), FR-E520S-0.4K to 2.2K-EC (-CH)).

(1) Packing Confirmation
   Make sure that the package includes the following accessories:
   - · Instruction manual....................................1
   - · Mounting screws M3 $\times$ 6..........................2
   - · Operating status LED indication sticker ...1

(2) Instruction Manual Note
   1) Refer to the following manuals for full information on the CC-Link master station:
      AJ61BT11/A1SJ61BT11 Control & Communication Link system master/local module user's manual IB-66721
      AJ61QBT11/A1SJ61QBT11 Control & Communication Link system master/local module user's manual......IB-66722
      QJ61BT11 Control & Communication Link system master/local module user's manual SH-080016
   2) In this manual, Control & Communication Link is abbreviated to CC-Link.
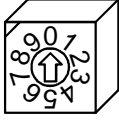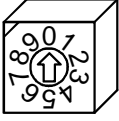
1.2 Structure
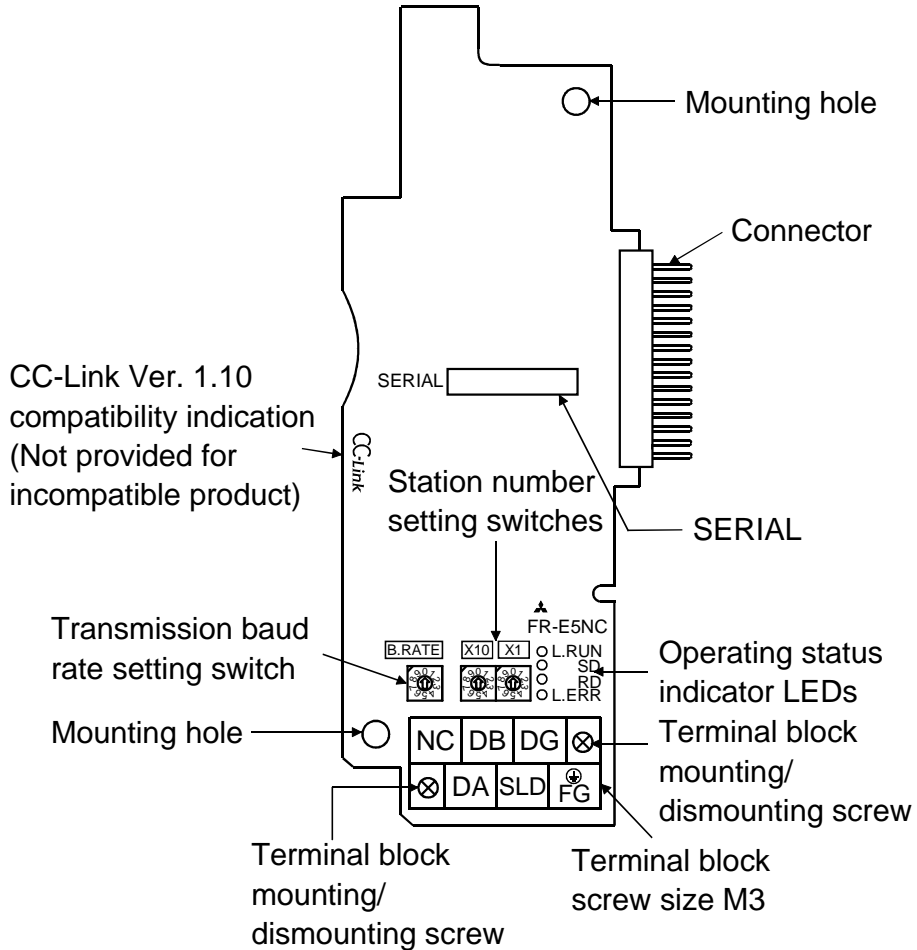
(1) Names and functions

Name	Function	
Station number setting switches	×10 ×1	Used to set the inverter station number between 1 and 64. For details, refer to page 11.
Transmission baud rate setting switch	Used to set the transmission speed. For details, refer to page 12.	
Operating status indicator LEDs	L.RUN ...... Lit to indicate that refresh data is received properly. Extinguished to indicate a break in data for a given period of time. SD .... Extinguished to indicate that send data is "0". RD .... Lit to indicate that the carrier of receive data is detected. L.ERR ...... Lit to indicate the communication error of the station itself. Flickers to indicate that the switch or other setting was changed while power is on.	

Mounting hole

Connector

CC-Link Ver. 1.10 compatibility indication (Not provided for incompatible product)

SERIAL

Station number setting switches

SERIAL

Transmission baud rate setting switch

Operating status indicator LEDs

Mounting hole

FR-E5NC

B.RATE   X10 X1   O L.RUN
                   O SD
                   O RD
                   O L.ERR

NC DB DG

DA SLD FG

Terminal block mounting/ dismounting screw

Terminal block mounting/ dismounting screw

Terminal block screw size M3

2

1.3 Inverter Option (FR-E5NC) Specifications

Type	Inverter inboard option fitted to the terminal block (can be mounted/dismounted to/from the inverter front face)
Power supply	5VDC supplied from the inverter
Number of units connected	42 units Maximum (1 station occupied by 1 unit). May be used with other equipment.
Terminal block	8-pin terminal block (M3 $\times$ 6 screws)
Cable size	0.75mm^2 to 2.00mm^2
Station type	Remote device station
Number of stations occupied	One inverter occupies one station.
Communication cable	CC-Link dedicated cable, CC-Link Version 1.10 compatible CC-Link dedicated cable

Note: When the CC-Link unit (FR-E5NC) is plugged in, the protective structure (JEM1030) is open type (IP00).

1.4 CC-Link Ver. 1.10

The conventional CC-Link products, whose inter-station cable lengths have equally been changed to 20cm (7.87 inch) or more to improve the inter-station cable length restriction, are defined as CC-Link Ver. 1.10. In comparison, the conventional products are defined as CC-Link Ver. 1.00.

Refer to the CC-Link Master Module Manual for the maximum overall cable lengths and inter-station cable lengths of CC-Link Ver. 1.00 and Ver. 1.10.

(1) CC-Link Ver. 1.10 compatibility conditions

    1) All modules that comprise a CC-Link system should be compatible with CC-Link Ver. 1.10.

    2) All data link cables should be CC-Link Ver. 1.10 compatible, CC-Link dedicated cables. (CC-Link Ver. 1.10 compatible cables have a CC-Link logo or Ver. 1.10 indication.)

Note: In a system that uses the CC-Link Ver. 1.00 and Ver. 1.10 modules and cables together, the maximum overall cable length and inter-station cable length are as specified for CC-Link Ver. 1.00.

(2) How to confirm the CC-Link Ver. 1.10 compatible products

    Only the FR-E5NC units manufactured in and after September 2001 are CC-Link Ver. 1.10 compatible.

    1) Product having SERIAL of "B19○○○○○○" or later on its board and shipping carton

      (The shipping carton has only three upper digits of the six-digit control number.)

<div align="center">

B   1   9   ○○○○○○

Symbol   Year   Month   Control number

SERIAL number

</div>
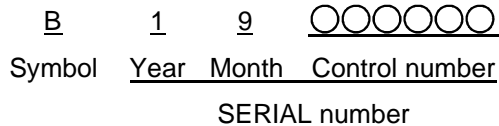
    2) Product having a CC-Link logo on its board

Refer to page 2 for the SERIAL and logo positions on the board.

2 INSTALLATION

2.1 Pre-Installation Instructions

(1) Make sure that the input power of the inverter is off.

⚠ **CAUTION**

⚠ **With input power on, do not install or remove the option unit. Otherwise, the inverter and option unit may be damaged.**

2.2 Installation Procedure

FR-E5NC plugged-in status

Connector for connection of inboad option

Accessory screw (2pcs.)

Inboad option mounting position

CC-Link unit (FR-E5NC)

Terminal block

Note: The mounting screws do not release from terminal block.

Wiring port cover for option

Apply the operating status LED indication sticker packed with the product.

5
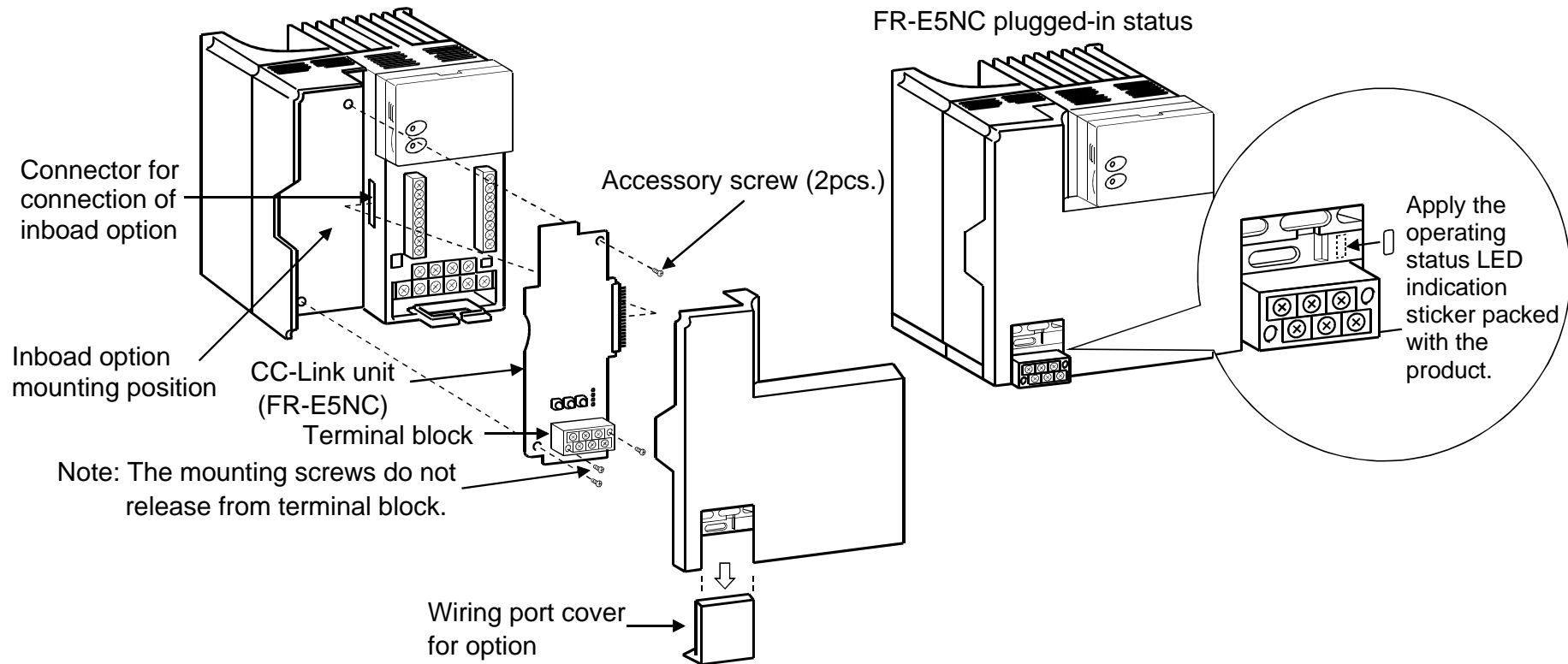
(1) Remove the front cover and option wiring port cover. (Refer to the inverter manual.)

(2) Remove the sponge from the inboard option connector, align the option unit connector with the inboard option connector of the inverter, and securely insert it far enough into the inverter.

(3) Securely fix the top and bottom of the option unit to the inverter with the accessory mounting screws. If the screw holes do not match, check for insecure connector insertion. The connector may not have been inserted securely.

(4) Reinstall the front cover to the inverter. (Refer to the inverter manual.)

> Note: 1. While the inboard option is plugged in, store the option wiring port cover carefully.
> 2. When this option is plugged in, the protective structure of the inverter is the open type (IP00).
> 3. If the inverter cannot recognize the plugged-in option, the E.OPT error appears. (Refer to the inverter manual.)

2.3 Inverter Replacement

You can replace the inverter without removing the terminal block wiring.

Before replacement   New inverter

Terminal block

Note: The mounting screws
will not come off.

7
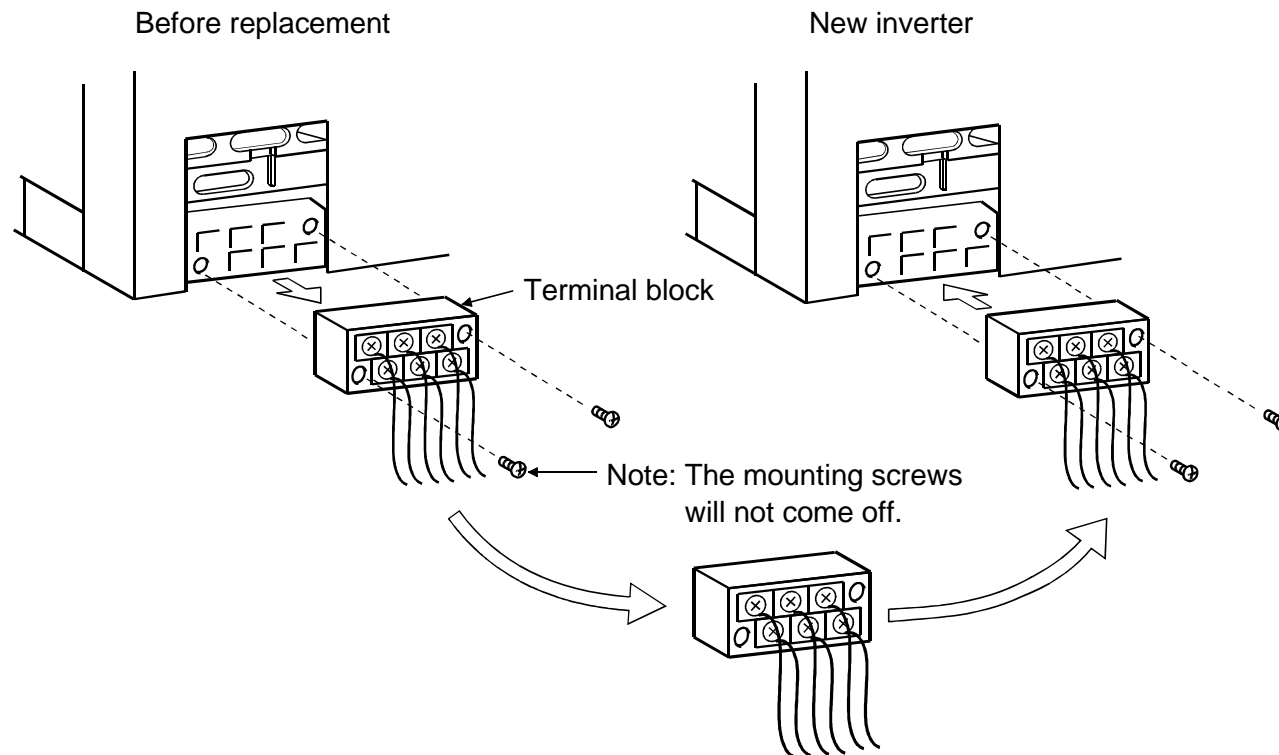
2.4 System Configuration Example

(1) PLC side
Load the "AJ61BT11", "A1SJ61BT11", "AJ61QBT11", "A1SJ61QBT11" or "QJ61BT11" "Control & Communication Link system master/local module" on the main or extension base unit having the PLC CPU used as the master station.

(2) Inverter side
Mount the "CC-Link unit (FR-E5NC)" on the inverter.

(3) Connect the PLC CC-Link unit master station and the FR-E5NC with the CC-Link dedicated cable.
If the cable used is other than the CC-Link dedicated cable, the performance of the CC-Link system is not guaranteed.
For the specifications and availability of the CC-Link dedicated cable, refer to the CC-Link catalog.

Masters for CC-Link master station

AJ61BT11/A1SJ61BT11 Control & Communication Link system master/local module user's manual
... IB-66721
AJ61QBT11/A1SJ61QBT11 Control & Communication Link system master/local module user's manual
... IB-66722
QJ61BT11 Control & Communication Link system master/local module user's manual
... SH-080016

Master station

Power supply module

CPU

AJ61 BT11

Termination resistor

Inverter

Up to 42 units may be connected (when only inverters are connected)

Inverter

Termination resistor

CC-Link dedicated cable

Power supply

Motor

Power supply

Motor

(4) When the CPU has automatic refresh function (example: QnA series CPU)

Through communication with the corresponding devices using sequence ladder logic, data is automatically transferred to the refresh buffer of the master station at the execution of the END instruction to perform communication with the remote devices.

(5) When the CPU does not have automatic refresh function (example: AnA series CPU)

Data is transferred to the refresh buffer of the master station directly by sequence ladder logic to perform communication with the remote devices.

2.5 Wiring Method

The following diagram shows how to wire the inverter and PLC CC-Link master unit:
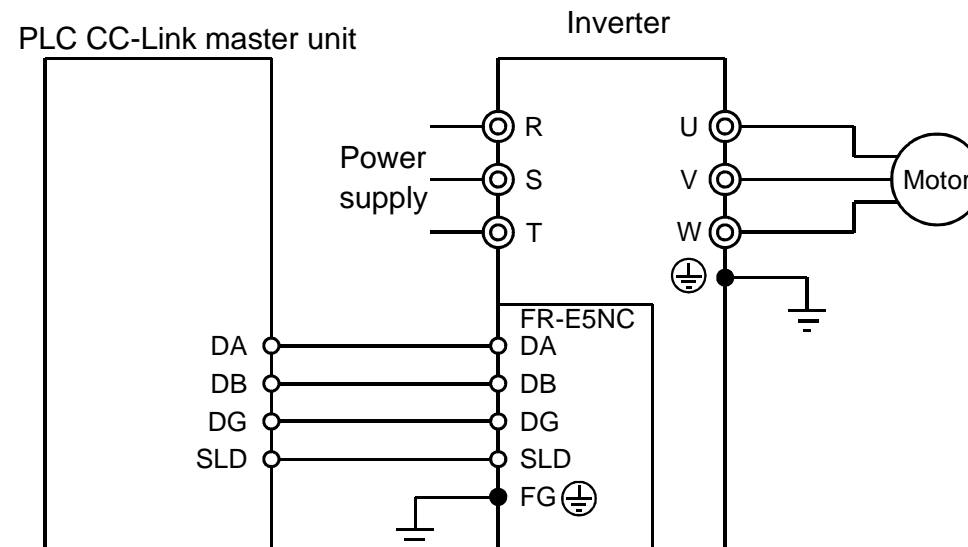
Note: Ensure that no wire offcuts can enter the inverter during wiring. They may cause a fault, failure or malfunction.

2.6 Connection of Several Inverters

Factory Automation can be applied to several inverters which share a link system as CC-Link remote device stations and are controlled and monitored by PLC user programs.
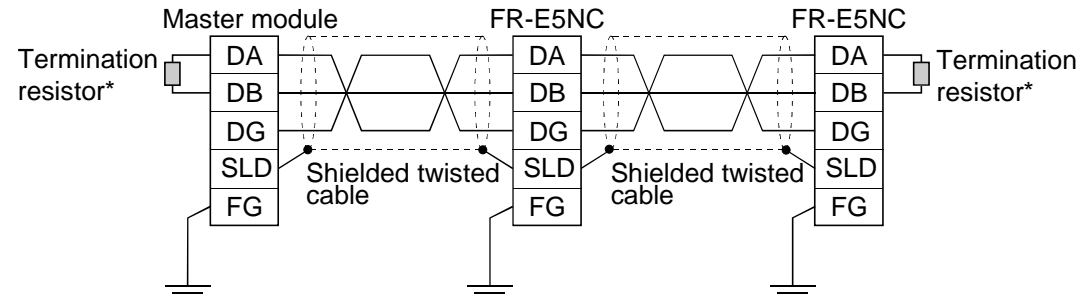
*Use the termination resistors supplied with the PLC.

1) Maximum number of units connected to one master station
    42 units (when only inverters are connected)
    If any other units are included, the number of stations
    occupied depends on the unit and therefore the following
    conditions must be satisfied:

    $\{(1 \times a) + (2 \times b) + (3 \times c) + (4 \times d)\} \leq 64$
    a: Number of units occupying 1 station
    b: Number of units occupying 2 stations
    c: Number of units occupying 3 stations
    d: Number of units occupying 4 stations

    $\{(16 \times A) + (54 \times B) + (88 \times C)\}$ $\quad \leq 2304$
    A: Number of remote I/O stations $\quad \leq 64$
    B: Number of remote device stations ≤ 42
    C: Number of local, standby master
        and intelligent device stations $\quad \leq 26$

3 INVERTER SETTING

3.1 Pre-Operation Setting

3.1.1 Inverter station number setting

Set the inverter station number before switching on the inverter and do not change the setting while power is on.

When setting the station number, the following points should be taken into consideration:

1) The station number may be set between 1 and 64.

Fully note that if the station number is changed during operation, data communication cannot be made with the new station number.

2) Setting method

Station number setting switches

×10   ×1

● Set the arrow (⇧) of the corresponding switch to the required numeral.

Example:

- For station number 1: Set (⇧) of ×10 to "0" and (⇧) of ×1 to "1".
- For station number 26: Set (⇧) ×10 to "2" and (⇧) ×1 to "6".

● Set station numbers consecutively in a connection sequence.

(The station numbers may also be set independently of the connection sequence.)

● Note that the same station number cannot be repeated.

(If the same station number is repeated, proper communication cannot be made.)

● Set each station number switch to the position of its numeral without error. If it is set to any position between numerals, normal data communication cannot be made.
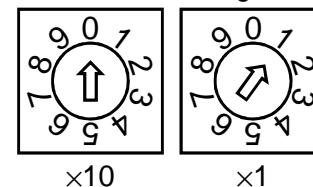
Good example   Bad example

11
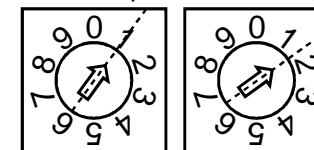
3) Connection example
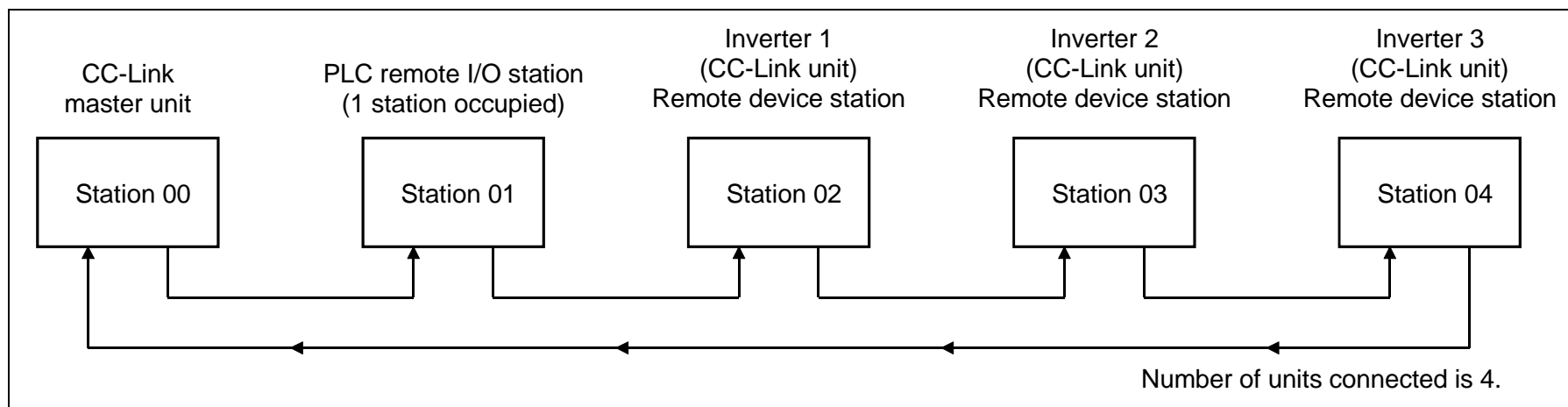
Note: One inverter occupies one station (one remote device station)

3.1.2 Setting of the transmission baud rate setting switch

Set the transmission speed.
(For details, refer to the CC-Link master unit manual.)

Setting Switch	Transmission Speed
0	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps
5 or later should not be used. (If the switch is set to position 5 or later, the "L.ERR" LED is lit and a communication error occurs.)	

12

3.2 Operation Modes of the Inverter

The inverter mounted with the CC-Link unit (FR-E5NC) has the following operation modes:

(1) PU operation mode .... Controls the inverter from the keyboard of the operation panel (FR-PA02-02) or parameter unit (FR-PU04) installed to the inverter.

(2) External operation mode .... Controls the inverter by switching on/off external signals connected to the control circuit terminals of the inverter.

(3) CC-Link operation mode .... Controls the inverter in accordance with the PLC program via the CC-Link unit (FR-E5NC).

3.2.1 Operation mode switching

(1) Operation mode switching conditions

   Before switching the operation mode, check that:

   1) The inverter is at a stop;

   2) Both the forward and reverse rotation signals are off; and

   3) The Pr. 79 "operation mode" setting is correct.

   (For setting, use the inverter's operation panel or optional parameter unit.)

Pr. 79 Setting	Operation Mode Selection	Switching to CC-Link Operation Mode
0	PU or external operation	Disallowed when the PU mode is selected. Allowed when the external mode is selected.
1	PU operation mode	Disallowed
2	External operation mode	Allowed
3, 4	External/PU combined operation mode	Disallowed
6	Switch-over	Allowed
7	External operation (PU operation interlock)	Allowed only in the external operation mode when the output shut-off signal (MRS) is off.
8	PU or external (signal switching)	Allowed only in the external operation mode (X16 on).

(2) Operation mode switching method

Change the operation mode as described below:
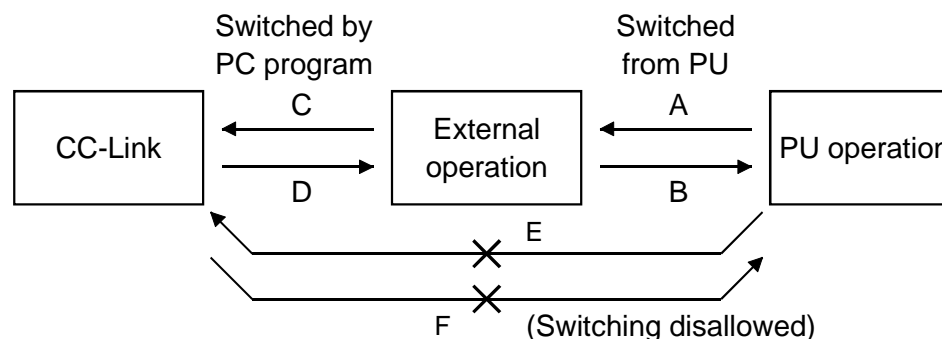
Symbol	Switching Type	Switching Method
A	PU operation → External operation	Operate the external operation key on the PU.
B	External operation → PU operation	Operate the PU operation key on the PU.
C	External operation → CC-Link operation	By the user program of the PLC.
D	CC-Link operation → External operation	By the user program of the PLC.
E	PU operation → CC-Link operation	Switching disallowed. Allowed if external operation is selected in A and CC-Link operation is then selected in C. (Note 2)
F	CC-Link operation → PU operation	Switching disallowed. Allowed if external operation is selected in D and PU operation is then selected in B. (Note 2)

When "1" is set in Pr. 340 "link start mode selection", the operation mode is CC-Link operation at power on or inverter reset.

Note: 1. When setting "1" in Pr. 340, the initial settings (station number setting, etc.) of the inverter must be made without fail.
2. In the switch-over mode (Pr. 79 = 6), switching in E and F is allowed.

14

(3) Link start mode

The operation mode at power on and at restoration from instantaneous power failure can be selected.

To choose the CC-Link operation mode, set "1" in Pr. 340.

After the link has started, parameter write is enabled with a program. (Refer to page 42 for a parameter write program example.)

Note: For Pr. 79 "operation mode", different inverters have different functions. For full information, refer to the inverter manual.

Pr. 340 Setting	Pr. 79	Operation Mode	Mode at Power On or at Restoration from Instantaneous Power Failure
0 (Factory Setting)	0	PU or external operation	Inverter goes into the external operation mode.
	1	PU operation	Inverter goes into the PU operation mode.
	2	External operation	Inverter goes into the external operation mode.
	3	External/PU combined operation mode	Running frequency is set in the PU operation mode and the start signal is set in the external operation mode.
	4	External/PU combined operation mode	Running frequency is set in the external operation mode and the start signal is set in the PU operation mode.
	6	Switch-over mode	Operation mode is switched while running.
	7	External operation mode	MRS signal ON....... Shift to the PU operation mode enabled (output stopped during external operation) MRS signal OFF..... Shift to the PU operation mode inhibited
	8	External/PU combined operation mode	X16 signal ON .... Shift to external operation mode X16 signal OFF ...... Shift to PU operation mode

Pr. 340 Setting	Pr. 79	Operation Mode	Mode at Power On or at Restoration from Instantaneous Power Failure
1	0	PU or CC-Link operation	Inverter goes into the CC-Link operation mode. (Program need not be used for switching)
	1	PU operation	Inverter goes into the PU operation mode.
	2	CC-Link operation	Inverter goes into the CC-Link operation mode. (Program need not be used for switching)
	3	CC-Link/PU combined operation mode	Running frequency is set in the PU operation mode and the start signal is set in the CC-Link operation mode.
	4	CC-Link/PU combined operation mode	Running frequency is set in the CC-Link operation mode and the start signal is set in the PU operation mode.
	6	Switch-over mode	Inverter goes into the CC-Link operation mode. Operation mode is switched while running.
	7	CC-Link operation mode	MRS signal ON....... Shift to the PU operation mode enabled (output stopped during CC-Link operation) MRS signal OFF..... Shift to the PU operation mode inhibited
	8	CC-Link/PU combined operation mode	X16 signal ON .... Shift to CC-Link operation mode X16 signal OFF ...... Shift to PU operation mode

Note: The Pr. 340 value may be changed in any operation mode.

3.3 Operation at Alarm Occurrence

Fault Location	Description		Operation Mode		
			PU operation	**External operation**	**CC-Link operation**
Inverter alarm	Inverter operation		Inverter trip	Inverter trip	Inverter trip
	Data communication		Continued	Continued	Continued
Communication line alarm	Inverter operation		Continued	Continued	Inverter trip
	Data communication		Stop	Stop	Stop
Built-in option alarm	Communication option connection fault	Inverter operation	Inverter trip	Inverter trip	Inverter trip
		Data communication	Continued	Continued	Continued
	FR-E5NC alarm	Inverter operation	Continued	Continued	Inverter trip
		Data communication	Stop	Stop	Stop

(1) Inverter alarm

   Refer to the inverter manual and remove the cause of the alarm.

(2) Communication line alarm

   Check the LED states of the FR-E5NC and remove the cause of the alarm. (Refer to page 50.)

   Check the CC-Link master station.

   The error message "E.OPT" is displayed .

(3) Built-in option alarm

   Check the connection between the inverter and FR-E5NC and remove the cause of the alarm.

   The error massage "E. 3" is displayed.

(4) Inverter reset (Note 1, 2)

(Refer to page 47 for an inverter reset program example.)

Resetting Method		Operation Mode		
		CC-Link operation	**External operation**	**PU operation**
PLC program	Inverter reset (*1) Instruction code	Allowed	Disallowed	Disallowed
	Error reset at inverter fault (RY1A) (*2)	Allowed	Allowed	Allowed
Connect terminals RES-SD		Allowed	Allowed	Allowed
Switch off inverter power		Allowed	Allowed	Allowed

(*1) Inverter reset can be made any time.

(*2) Reset can be made only when the protective function of the inverter is activated.

Note: 1. When a communication line fault has occurred, reset cannot be made from the PLC.
2. The inverter is set to the external operation mode if it has been reset in the CC-Link operation mode.
To resume the CC-Link operation, the inverter must be switched to the CC-Link operation again.
(When "1" is set in Pr. 340 "link start mode selection", switching is not needed. Refer to page 15.)

3.4 Operation and Speed Command Write

In the CC-Link operation mode, commands from the external terminals and sequence program are as listed below:
(For Pr. 180 to Pr. 183 (input terminal function selection), different inverters have different functions. For full information, refer to the inverter manual.)

Control location selection			Pr. 338 "operation command write"	0: PLC	0: PLC	1: External	1: External	Remarks
			Pr. 339 "speed command write"	0: PLC	1: External	0: PLC	1: External	
Fixed functions (Functions equivalent to terminals)			Forward rotation command (STF)	PLC	PLC	External	External	
			Reverse rotation command (STR)	PLC	PLC	External	External	
			Reset (RES)	Both	Both	Both	Both	
			CC-Link operation frequency	PLC	—	PLC	—	
			2	—	External	—	External	
			4	—	External	—	External	
Selective functions	Pr. 180 to Pr. 183 settings	0	Low-speed operation command (RL)	PLC	External	PLC	External	Pr. 59 = 0
		1	Middle-speed operation command (RM)	PLC	External	PLC	External	Pr. 59 = 0
		2	High-speed operation command (RH)	PLC	External	PLC	External	Pr. 59 = 0
		3	Second function selection (RT)	PLC	PLC	External	External	
		4	Current input selection (AU)	—	Both	—	Both	
		5	Start self-holding selection (STOP)	—	—	External	External	
		6	Output shut-off (MRS)	Both	Both	External	External	(Note)
		7	External thermal relay input (OH)	External	External	External	External	
		8	15-speed selection (REX)	PLC	External	PLC	External	Pr. 59 = 0
		16	PU operation-external operation switching (X16)	External	External	External	External	
		18	Magnetic flux-V/F switching (X18)	PLC	PLC	External	External	
RH, RM, RL selection functions			Remote setting (RH, RM, RL)	PLC	External	PLC	External	Pr. 59 = 1, 2

[Explanation of table]

External   : Control by signal from external terminal is only valid.

PLC   : Control from sequence program is only valid.

Both   : Control from both external terminal and PLC is valid.

—   : Control from both external terminal and PLC is invalid.

Note: When "7" (PU operation interlock function) is set in Pr. 79 "operation mode selection", only the external terminal is made valid independently of the Pr. 338 and Pr. 339 settings, since this function is also used by terminal MRS.

4. FUNCTION OVERVIEW

4.1 Function Block Diagram

Using function blocks, this section explains I/O data transfer to/from an inverter in CC-Link:
• Link refresh is continuously executed between the master station and inverter in the CC-Link system at intervals of 1.1ms to 141ms (per station).
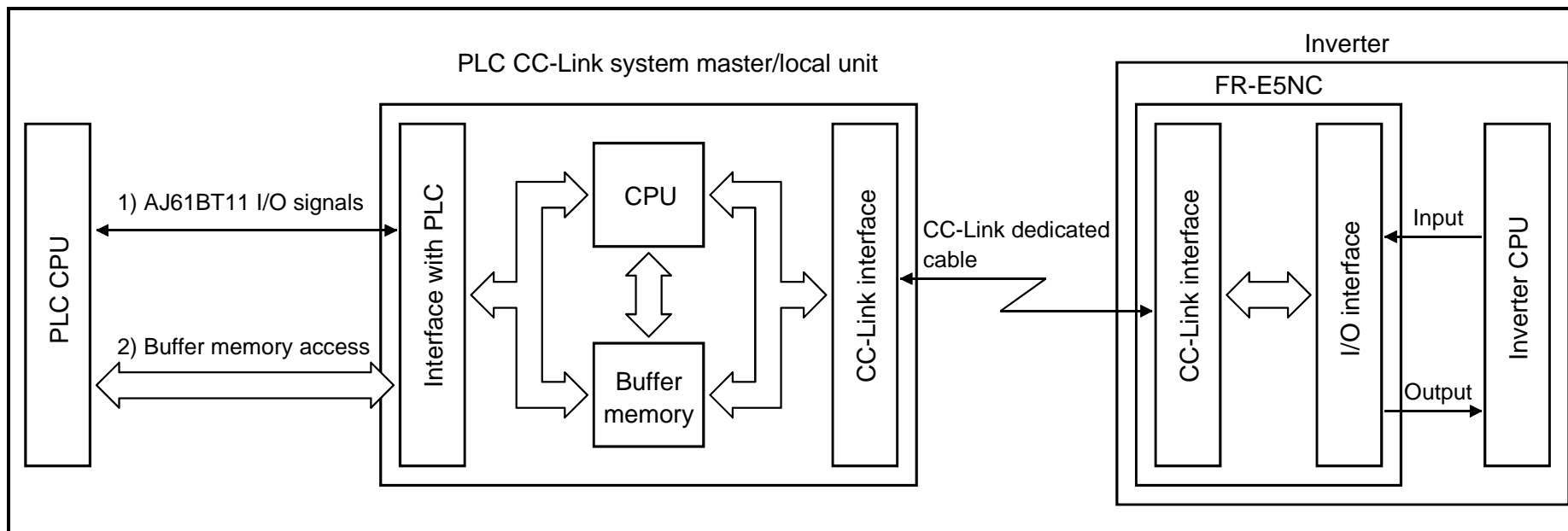
1) I/O signals assigned to the CC-Link system master/local unit.
   These signals are used for communication between the PLC CPU and CC-Link system master/local unit.
   For further details of the signals, refer to page 25.
2) Allows input data to be read, output data to be written, and a CC-Link faulty station to be read, etc. (The FROM/TO instruction is not needed when the automatic refresh function is used.)
   Buffer memory is accessed by the FROM and TO instructions in the sequence program. For full information on the buffer memory, refer to the CC-Link system master/local unit manual.
3) CC-Link start is dictated by the sequence program. After CC-Link is initiated, I/O refresh is continually executed independently of (or in synchronization with) the sequence program execution.
   For details, refer to the CC-Link system master/local unit manual.

21

4.2 Setting the Running Frequecy

The following table lists the functions which can be executed from the programmable logic controller in the CC-Link system:

Control Location	Item	Operation Mode		
		PU operation	External operation	CC-Link operation
User program	Operation command	Disallowed	Disallowed	Allowed
	Running frequency setting	Disallowed	Disallowed	Allowed
	Monitoring	Allowed	Allowed	Allowed
	Parameter write	Disallowed (*3)	Disallowed (*3)	Allowed (*3)
	Parameter read	Allowed	Allowed	Allowed
	Inverter reset	Disallowed	Disallowed	Allowed (*1)
	Error reset at inverter fault (RY1A)	Allowed (*1)	Allowed (*1)	Allowed (*1)
	Stop command (*2)	Disallowed	Disallowed	Allowed
Control circuit terminal	Inverter reset terminal	Allowed	Allowed	Allowed
	Operation command	Disallowed	Allowed	Allowed (*4)
	Frequency setting	Disallowed	Allowed	Allowed (*4)

(*1) At occurrence of a communication line fault, the inverter cannot be reset from the PLC. (For inverter reset, refer to the inverter manual.)

(*2) As set in Pr. 75.

(*3) As set in Pr. 77.

Values can be written to Pr. 4 to Pr. 6, Pr. 22, Pr. 24 to Pr. 27, Pr. 52 to Pr. 56, Pr. 72, Pr. 232 to Pr. 239 during operation.

(For full information, refer to the inverter manual.)

(*4) As set in Pr. 338 and Pr. 339

Note 1. The inverter goes into the external operation mode if it is reset from the PLC in the CC-Link operation mode. The setting of "1" in Pr. 340 (link start mode) selects CC-Link operation mode.

4.2.1 Monitoring function

(Refer to page 39.)

The following items can be monitored by the PLC:

    1) Output frequency .... Binary in 0.01Hz increments

    2) Output current................... Binary in 0.01A increments

    3) Output voltage .... Binary in 0.1V increments

    4) Alarm definition

    5) Special monitoring .... Monitored data selected by instruction code F3$_H$

    6) Inverter status

・Forward running	・Overload (OL)
・Reverse running	・Frequency detection (FU)＊
・Running (RUN)＊	・Alarm＊
・Up to frequency (SU)	

    The output signals marked ＊ can be changed using Pr. 190 to Pr. 192 (output terminal function selection).

Note: Items 1) to 4) are read from the buffer memory by setting the corresponding code numbers when needed. Item 6) can be read from the buffer memory any time.

4.2.2 Operation commands

(Refer to page 38.)

Any of the following commands can be output from the PLC to the inverter as an operation command any time:

- ・Forward rotation (STF)
- ・Reverse rotation (STR)
- ・Low speed (RL)*1
- ・Middle speed (RM)*1
- ・High speed (RH)*1
- ・Inverter output halt (MRS)*1

The input signals marked *1 can be changed using Pr. 180 to Pr. 183 (input terminal function selection). Depending on the setting, however, some signals do not accept the command from the PLC. For details, refer to page 19.

4.2.3 Running frequency

(Refer to page 43.)

The running frequency is written from the PLC to the inverter when it is changed.........Binary in 0.01Hz increments

The running frequency may either be written to E^2PROM or to RAM. When changing the frequency continuously, always write the data to the inverter RAM.

4.2.4 Parameter write

(Refer to page 42.)

Functions can be written from the PLC. Note that write during inverter operation will result in a write error.

For the parameter data code list, refer to the inverter manual.

4.2.5 Parameter read

(Refer to page 41.)

Functions can be read to the PLC.

For the parameter data code list, refer to the inverter manual.

5. COMMUNICATION SPECIFICATIONS

5.1 I/O Signal List

The following device No.s are those for station 1.
For stations 2 and later, the device No.s are different. (For the device No. correspondence list, refer to the master unit manual.)

5.1.1 Output signals (master unit → inverter (FR-E5NC))

The output signals from the master unit are indicated. (Input signals to inverter)

Device No.	Signal	Description
RY0	Forward rotation command	OFF : Stop command ON : Forward rotation start (Note 1)
RY1	Reserve rotation command	OFF : Stop command ON : Reserve rotation start (Note 1)
RY2	RH terminal function (high speed)	Functions assigned to RH/RM/RL are selected. In the factory setting, multi-speed selection can be made by the combination of RH, RM and RL. (Note 2)
RY3	RM terminal function (middle speed)	
RY4	RL terminal function (low speed)	
RY5	Reserved (Note 5)	Reserved for the system.
RY6		
RY7		
RY8		
RY9	Output halt (MRS)	When the MRS signal switches on, the inverter output stops.

Note: 1. Switching on RY0 and RY1 at the same time gives a stop command.
2. With Pr. 180 to Pr. 183 (input terminal function selection), you can set the input signals of device No.s RY2 to RY8. For full information, refer to the inverter manual.

Device No.	Signal	Description
RYA	Reserved (Note 5)	Reserved for the system.
RYB		
RYC	Monitor command	When the monitor command (RYC) is switched on, the monitored value is set to remote register RWr0 and monitoring (RXC) switches on. While the monitor command (RYC) is on, the monitored value is always updated.
RYD (Note 4)	Frequency setting command (RAM)	When the frequency setting command (RYD) is switched on, the set frequency (RWw1) is written to the inverter. (Note 3) On completion of write, frequency setting completion (RXD) switches on.
RYE (Note 4)	Frequency setting command (E^{2}PROM)	When the frequency setting command (RYE) is switched on, the set frequency (RWw1) is written to the inverter. On completion of write, frequency setting completion (RXE) switches on.
RYF (Note 4)	Instruction code execution request	When the instruction code execution request (RYF) is switched on, processing corresponding to the instruction code set to RWw2 is executed. After completion of instruction code execution, instruction code execution completion (RXF) switches on. When an instruction code execution error occurs, a value other than 0 is set to the reply code (RWr2).

Device No.	Signal	Description
RY10	Reserved (Note 5)	Reserved for the system.
RY11		
RY12		
RY13		
RY14		
RY15		
RY16		
RY17		
RY18		
RY19		
RY1A	Error reset request flag	If the error reset request flag (RY1A) is switched on only when an inverter fault occurs, the inverter is reset and the error status flag (RX1A) switches off.

Note: 3. While the set frequency designation (RYD) is on, the set frequency (RWw1) value is always returned.

4. If these commands are switched on simultaneously, only one of these is executed.

5. The reserved input signal should be off. (Enter 0)

5.1.2 Input signals (inverter (FR-E5NC) → master unit)

The input signals to the master unit are indicated. (Output signals from inverter)

Device No.	Signal	Description
RX0	Forward running	OFF : Other than forward running (during stop or reverse rotation) ON : Forward running
RX1	Reverse running	OFF : Other than reverse running (during stop or forward rotation) ON : Reverse running
RX2	Running (RUN)	On while the inverter is running. (Note)
RX3	Up to frequency (SU)	Switched on when the output frequency reaches the set frequency $\pm$ Pr. 41.
RX4	Overload (OL)	Switched on when stall prevention is activated and switched off when stall prevention is deactivated.
RX5	Reserved	Reserved for the system.
RX6	Frequency detection (FU)	Switched on when the output frequency reaches the frequency set in Pr. 42. (Note)
RX7	Alarm (A, B, C)	Switched on when the inverter's protective function is activated to stop the output. (Note)
RX8	Reserved	Reserved for the system.
RX9		
RXA		
RXB		
RXC	Monitoring	Switched on when the monitored value is set to RW_{r0} by the monitor command (RYC) switching on. Switched off when the monitor command (RYC) is switched off.
RXD	Frequency setting command (RAM)	Switched on when the set frequency is written to the inverter by the frequency setting command (RYD) switching on. Switched off when the frequency setting command (RYD) is switched off.
RXE	Frequency setting command (E^2PROM)	Switched on when the set frequency is written to the inverter by the frequency setting command (RYE) switching on. Switched off when the frequency setting command (RYE) is switched off.
RXF	Instruction code execution completion	Switched on on completion of the processing corresponding to the instruction code (RW_{W2}) which is executed when the instruction code execution request (RYF) switches on. Switched off when the instruction code execution completion (RXF) is switched off.

Device No.	Signal	Description
RX10	Reserved	Reserved for the system.
RX11		
RX12		
RX13		
RX14		
RX15		
RX16		
RX17		
RX18		
RX19		
RX1A	Error status flag	Switched on when an inverter error occurs (protective function is activated).
RX1B	Remote station ready	Switched on when the inverter goes into the ready status on completion of initial setting after power-on or hardware reset. (Used as an interlock for read/write from/to the master station.) Switched off when an inverter error occurs (protective function is activated).

Note: With Pr. 190 to Pr. 192 (output terminal function selection), you can set the output signals of device No.s RX2, RX6, RX7. For full information, refer to the inverter manual.

5.2 Remote Register Assignment

5.2.1 Remote registers (master unit → inverter (FR-E5NC))

Device No.	Signal	Description
RWw0	Monitor code	Set the monitor code to be referenced. (Refer to page 40) By switching on the RYC signal after setting, the specified monitored data is set to RWr0.
RWw1	Set frequency	Specify the set frequency. At this time, whether it is written to RAM or E^{2}PROM is differentiated by the RYD and RYE signals. After setting the frequency to this register, switch on the above RYD or RYE to write the frequency. On completion of frequency write, RXD or RXE switches on in response to the input command.
RWw2	Instruction code	Set the instruction code for execution of operation mode rewrite, Pr. read/write, error reference, error clear, etc. (refer to page 32). The corresponding instruction is executed by switching on RYF after completion of register setting. RXF switches on on completion of instruction execution.
RWw3	Write data	Set the data specified by the above instruction code. (When required) Switch RYF on after setting the above instruction code and this register. Set zero when the write code is not required.

Addresses		Remote Registers	Addresses		Remote Registers	Addresses		Remote Registers	Addresses		Remote Registers
1 station	1E0H	RWw0	3 station	1E8H	RWw8	5 station	1F0H	RWw10			
	1E1H	RWw1		1E9H	RWw9		1F1H	RWw11			
	1E2H	RWw2		1EAH	RWwA		1F2H	RWw12			
	1E3H	RWw3		1EBH	RWwB		1F3H	RWw13			
2 station	1E4H	RWw4	4 station	1ECH	RWwC	6 station	1F4H	RWw14	64 station	2DCH	RWwFC
	1E5H	RWw5		1EDH	RWwD		1F5H	RWw15		2DDH	RWwFD
	1E6H	RWw6		1EEH	RWwE		1F6H	RWw16		2DEH	RWwFE
	1E7H	RWw7		1EFH	RWwF		1F7H	RWw17		2DFH	RWwFF

5.2.2 Remote registers (inverter (FR-E5NC) → master unit)

RWr0	Monitored value	The monitored value specified by RWW0 (monitor code) is set.
RWr1	Output frequency	The present output frequency is always set.
RWr2	Reply code	The reply code corresponding to RWW2 (instruction code) is set. 0 is set for a normal reply and a value other than 0 is set for a data error.
RWr3	Read data	For a normal reply, the reply data to the instruction specified by the instruction code is set.

Addresses		Remote Registers	Addresses		Remote Registers	Addresses		Remote Registers	Addresses		Remote Registers
1 station	2E0H	RWr0	3 station	2E8H	RWr8	5 station	2F0H	RWr10			
	2E1H	RWr1		2E9H	RWr9		2F1H	RWr11			
	2E2H	RWr2		2EAH	RWrA		2F2H	RWr12			
	2E3H	RWr3		2EBH	RWrB		2F3H	RWr13			
2 station	2E4H	RWr4	4 station	2ECH	RWrC	6 station	2F4H	RWr14	64 station	3DCH	RWrFC
	2E5H	RWr5		2EDH	RWrD		2F5H	RWr15		3DDH	RWrFD
	2E6H	RWr6		2EEH	RWrE		2F6H	RWr16		3DEH	RWrFE
	2E7H	RWr7		2EFH	RWrF		2F7H	RWr17		3DFH	RWrFF

31

5.3 Instruction Codes

Item	Code Number	Description
Operation mode read	007BH	0000H: CC-Link operation 0001H: External operation 0002H: PU operation
Operation mode write	00FBH	0000H: CC-Link operation 0001H: External operation
Alarm history No. 1, No. 2 read	0074H	Reads the most recent No. 1 and 2 alarms.
Alarm history No. 3, No. 4 read	0075H	Reads the most recent No. 3 and 4 alarms.
Alarm history No. 5, No. 6 read	0076H	Reads the most recent No. 5 and 6 alarms.
Alarm history No. 7, No. 8 read	0077H	Reads the most recent No. 7 and 8 alarms.
Set frequency (RAM) read	006DH	Reads the set frequency (RAM). (Note)
Set frequency (E^{2}PROM) read	006EH	Reads the set frequency (E^{2}PROM). (Note)
Set frequency (RAM) write	00EDH	Writes the set frequency to RAM. (Note)
Set frequency (E^{2}PROM) write	00EEH	Writes the set frequency to E^{2}PROM. (Note)
Parameter read	0000H to 006CH	Refer to the data code list in the inverter manual, and perform read/write as required. It should be noted that some parameters cannot be accessed.
Parameter write	0080H to 00ECH	
Batch alarm definition clear	00F4H	9696H: Batch-clears the alarm history.
Parameter clear	00FCH	9696H: Parameter clear (parameters values other than calibrated values are reset to factory settings.) 9966H: All clear
Inverter reset	00FDH	9696H: Resets the inverter.

Note: Setting can be made from the remote register.

Item		Code Number	Description
Link parameter expansion setting	Read	007FH	Changes the 0000H to 006CH and 0080H to 00ECH parameter values. 0000H: Pr. 0 to Pr. 96 0001H: Pr. 100 to Pr. 156, Pr. 900 to Pr. 905
	Write	00FFH	0002H: Pr. 160 to Pr. 192, Pr. 232 to Pr. 251 0003H: Pr. 338 to Pr. 342 0009H: Pr. 990, Pr. 991
Second parameter changing	Read	006CH	Pr. 902 to Pr. 905 0000H: Offset/gain
	Write	00ECH	0001H: Analog 0002H: Analog value of terminal

6. PROGRAMMING EXAMPLES

This chapter provides programming examples which control the inverter with sequence programs.

System configuration for programming example
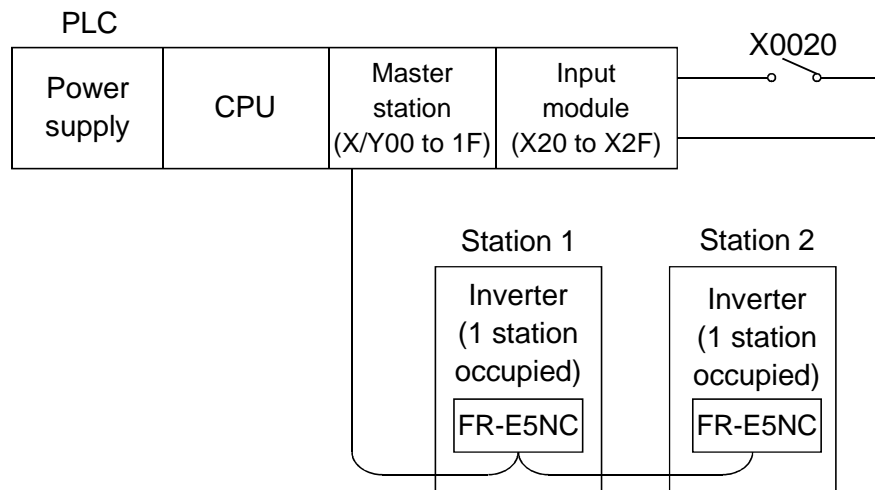
6.1 Reply Code Definitions

When executing the frequency setting (RYD, RYE) or instruction code execution (RYF), check the reply code (RWr2) in the remote register after execution.

Date	Item	Alarm Definition
0000H	Normal	Normal completion of instruction code execution
0001H	Write error	Parameter write was attempted during operation other than a stop in the CC-Link operation mode.
0002H	Parameter selection error	Unregistered code number was set.
0003H	Setting range error	Set data is outside the permissible data range.

6.2 Program Example for Reading the Inverter Status

Write a program as explained below to read the inverter status from the master station buffer memory:
The following program reads the inverter status of station 1 to M0-M7:

Note:

▓ : Indicates addresses of one inverter.

* : 0 or 1 because of reserved bits

Inverter status

M0: Forward running
M1: Reverse running
M2: Running (RUN)
M3: Up to frequency (SU)
M4: Overload (OL)
M5: ——
M6: Frequency detection (FU)
M7: Alarm

Example: The above indicates up to frequency during forward running.
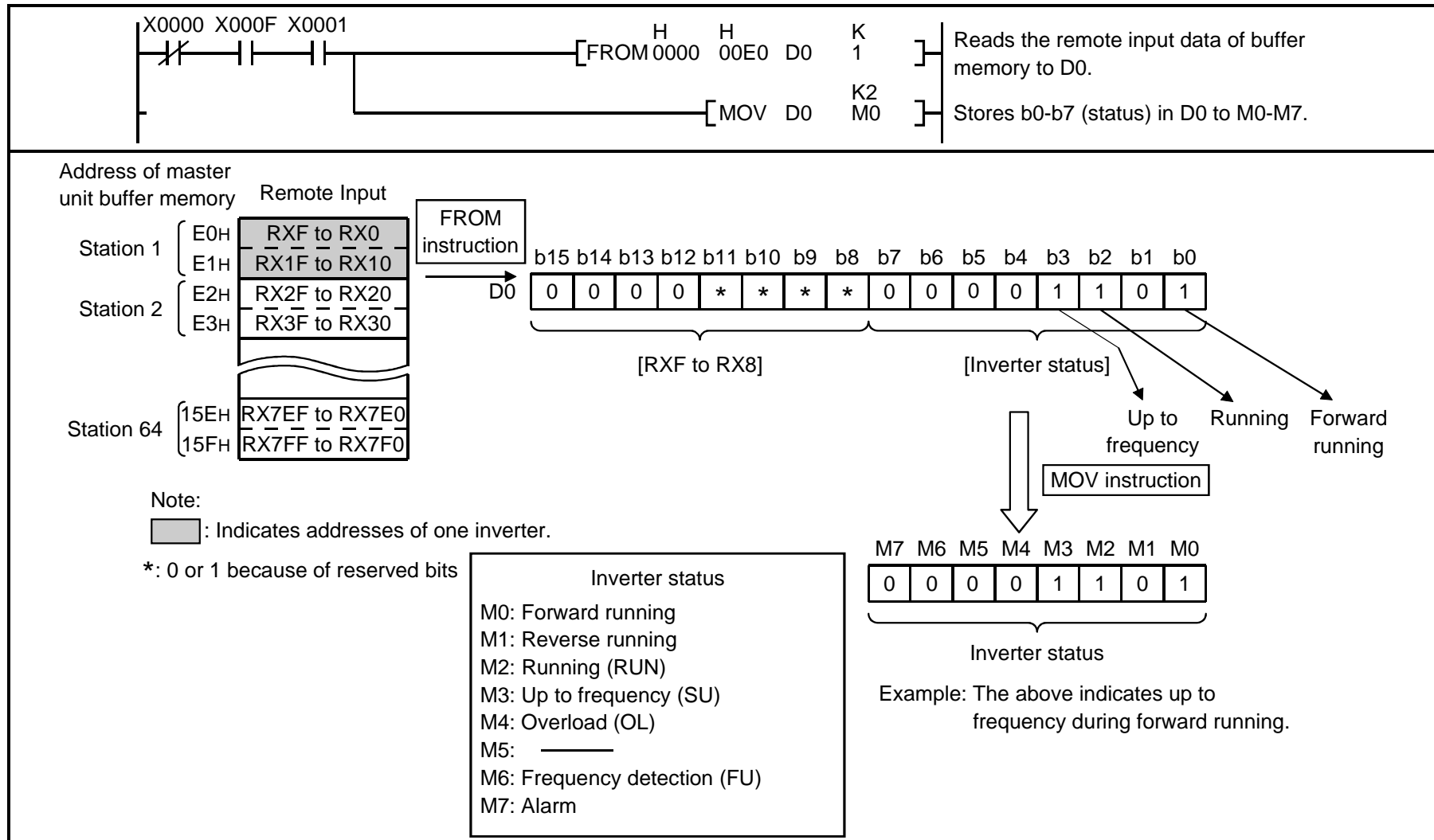
6.3 Program Example for Setting the Operation Mode

Write programs as explained below to write various data to the inverters:

1) The following program changes the operation mode of station 2 inverter to CC-Link operation.
   Operation mode writing code number: FBH (hexadecimal)
   CC-Link operation set data: 0000H (hexadecimal) (Refer to page 32.)
   The reply code at the time of instruction code execution is set to D2. (Refer to page 35.)

Rung	Ladder	Description
26	M9036 —[FROM 0000(H) 00E2(H) M200(K4) 2(K)]	Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231.
36	X0000 X000F X0001 X0020 M202 —[PLS M302] (Write setting / Inverter running)	
44	M302 —[SET M303]	
46	M303 —[MOV 00FB(H) D100]	Writes operation mode writing code (FBH) to RWw6 and set data (0000H) to RWw7.
	—[MOV 0000(H) D101]	
	—[TO 0000(H) 01E6(H) D100 2(K)]	
	—[SET M115]	Switches on the instruction code execution request (RY2F).
67	M215 —[FROM 0000(H) 02E6(H) D2 1(K)]	Reads reply code (RWr6) to D2 when the instruction code execution completion (RX2F) switches on.
	—[RST M115]	Switches off the instruction code execution request (RY2F).
	—[RST M303]	
88	M9036 —[TO 0000(H) 0162(H) M100(K4) 2(K)]	Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory.

37

6.4 Program Example for Setting the Operation Commands

Write a program as explained below to write the inverter operation commands to the master station buffer memory:
The inverter is operated in accordance with the operation commands written to the remote outputs (addresses 160H to 1DFH).
The following program outputs the commands of forward rotation and middle speed signals to the inverter of station 2:

RY2F to RY2A
M110 ..... ————
M111 ..... ————
M112 ..... Monitor command
M113 ..... Frequency setting command (RAM)
M114 ..... Frequency setting command (E^{2}PROM)
M115 ..... Instruction code execution request

Operation commands
M100 ..... Forward rotation command   M105 ..... ————
M101 ..... Reverse rotation command   M106 ..... ————
M102 ..... High speed (RH) *1   M107 ..... ————
M103 ..... Middle speed (RM) *1   M108 ..... ————
M104 ..... Low speed (RL) *1   M109 ..... MRS

The input signals marked *1 can be changed using Pr. 180 to Pr. 183 (input terminal function selection). Depending on the setting, however, some signals do not accept a command from the PLC. Refer to page 19 for details.

38

6.5 Program Example for Monitoring the Output Frequency

Write programs as explained below to monitor the data of the inverters:

The following program reads the output frequency of station 2 inverter to D1.
Output frequency reading code number: 0001H (hexadecimal)
Example: The output frequency of 60Hz is indicated 1770H (6000).

26 ⊢⊢ M9036 ─── [FROM 0000(H) 00E2(H) M200(K4) 2(K)]	Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231.
36 X0000 X000F X0001 X0020 ─── [MOV 0001(H) D100]	Sets the monitor code (01H) of the output frequency to RWw4.
Read setting ─── [TO 0000(H) 01E4(H) D100 1(K)]	
─── [SET M112]	Switches on the monitor command (RY2C).
M212 ─── [FROM 0000(H) 02E4(H) D1 1(K)]	M212: Reads output frequency (RWr4) to D1 when monitoring (RX2C) switches on.
65 M9036 ─── [TO 0000(H) 0162(H) M100(K4) 2(K)]	Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory.
75 X0000 X000F X0001 X0020 ─── [RST M112]	Monitoring stop.

6.5.1 Monitor codes

Code Number	Description	Increments
0000H	No monitoring (monitored value fixed to 0)	——
0001H	Output frequency (Note)	0.01Hz
0002H	Output current	0.01A
0003H	Output voltage	0.1V

Note: About the speed display

When Pr. 37≠0, output frequency monitoring changes to speed monitoring.

Unit for speed display: 1r/min

*Note that the speed display of higher than 65535 (FFFFH) is 65535 (FFFFH).

6.6 Parameter Reading Program Example

1) The following program reads Pr. 7 "the acceleration time" of station 2 inverter to D1.

   Pr. 7 "Acceleration time" reading code number: 07H (hexadecimal)

   For the parameter code numbers, refer to the inverter manual.

   The reply code at the time of instruction code execution is set to D2. (Refer to page 35.)
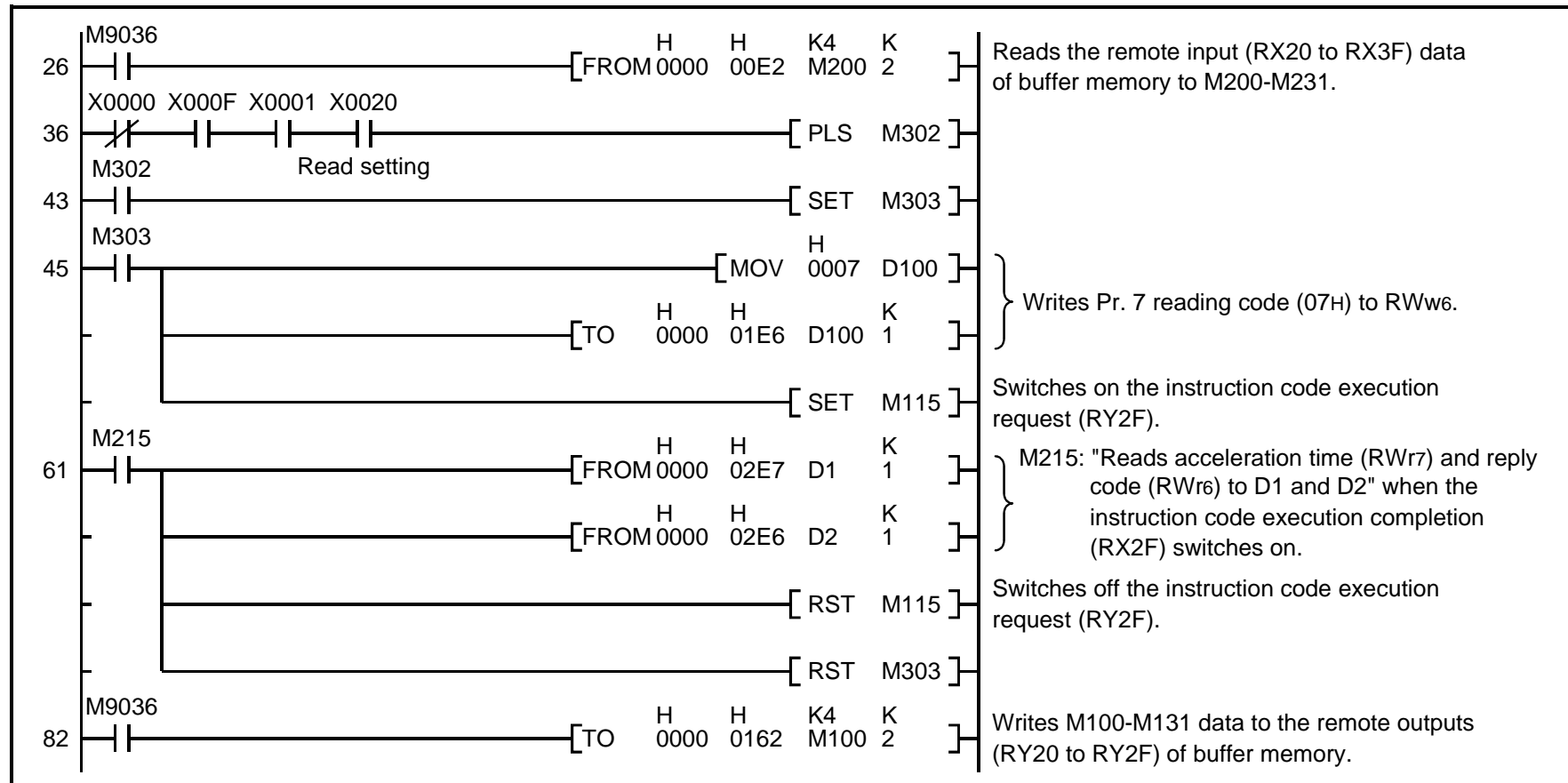
Note: For parameters having numbers 100 and later, change their link parameter extension settings (set them to other than 0000H).
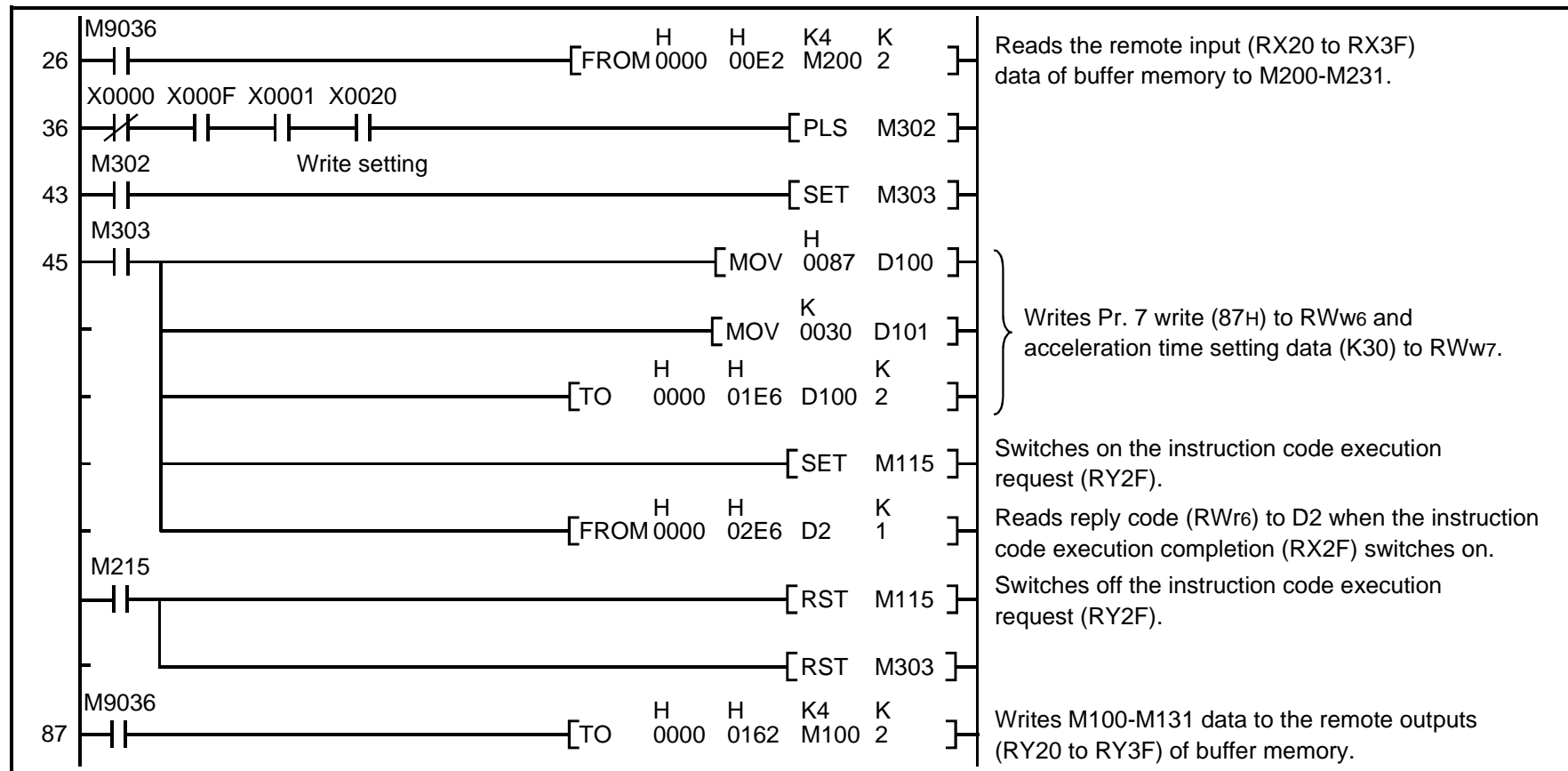
6.7 Parameter Writing Program Example

1) Program example which changes the Pr. 7 "acceleration time" setting of station 2 inverter to 3.0s
   Acceleration time writing code number: 87H (hexadecimal)
   Acceleration time set data: K30 (decimal)
   For the parameter code numbers, refer to the inverter manual.
   The reply code at the time of instruction code execution is set to D2. (Refer to page 35)

Ladder	Description
26 — M9036 —[FROM 0000(H) 00E2(H) M200(K4) 2(K)]	Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231.
36 — X0000 X000F X0001 X0020 —[PLS M302]	
43 — M302 Write setting —[SET M303]	
45 — M303 —[MOV 0087(H) D100]	Writes Pr. 7 write (87H) to RWw6 and acceleration time setting data (K30) to RWw7.
—[MOV 0030(K) D101]	
—[TO 0000(H) 01E6(H) D100 2(K)]	
—[SET M115]	Switches on the instruction code execution request (RY2F).
—[FROM 0000(H) 02E6(H) D2 1(K)]	Reads reply code (RWr6) to D2 when the instruction code execution completion (RX2F) switches on.
M215 —[RST M115]	Switches off the instruction code execution request (RY2F).
—[RST M303]	
87 — M9036 —[TO 0000(H) 0162(H) M100(K4) 2(K)]	Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory.

Note: 1. For parameters having numbers 100 and later, change their link parameter extension settings (set them to other than 0000H).
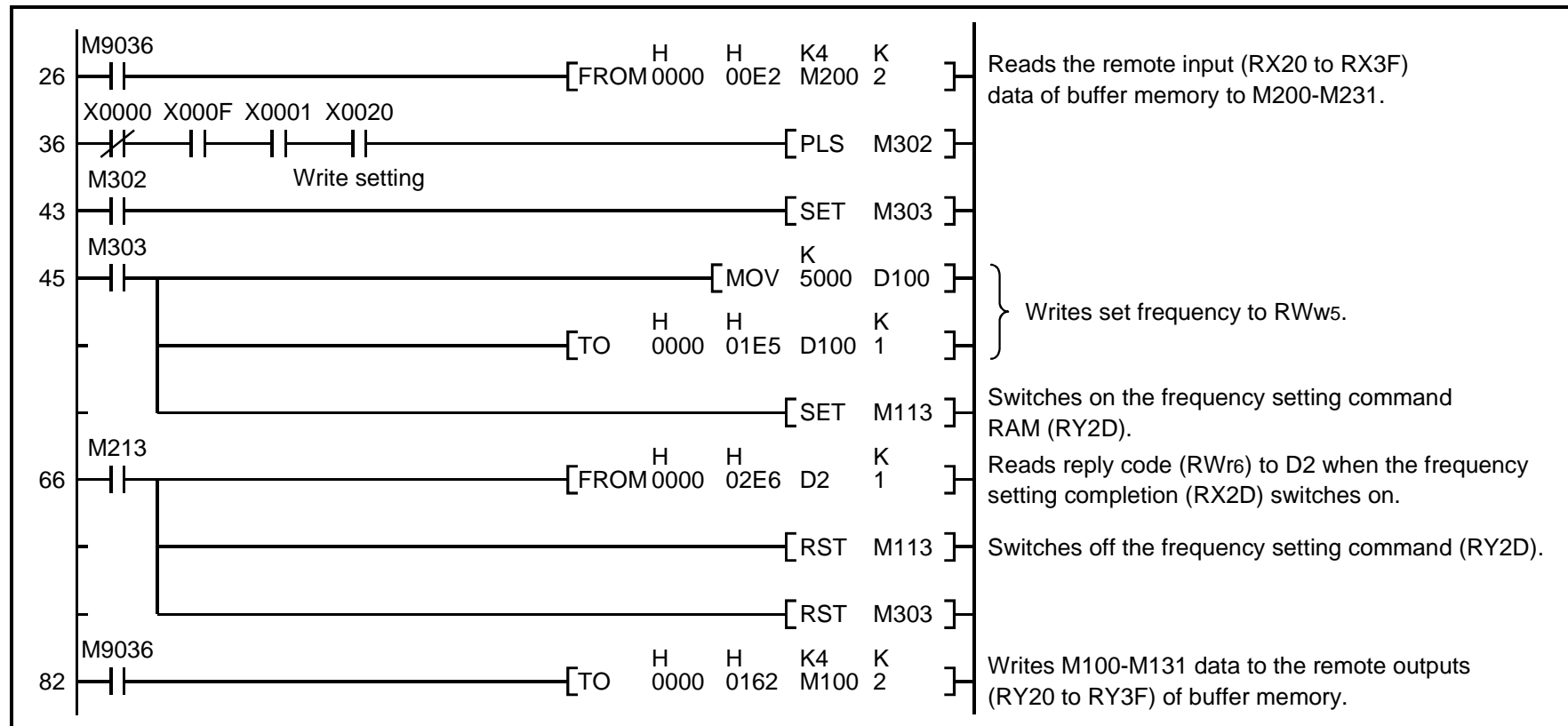   2. For other functions, refer to the instruction codes (page 32).

6.8 Running Frequency Setting Program Example

1) The following program changes the running frequency of station 2 inverter to 50.00Hz.

Set frequency: K5000 (decimal)

The reply code at the time of instruction code execution is set to D2. (Refer to page 35.)

26 — M9036 —[FROM H0000 H00E2 K4 M200 K2]	Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231.
36 — X0000 X000F X0001 X0020 —[PLS M302]	
43 — M302 (Write setting) —[SET M303]	
45 — M303 —[MOV K5000 D100] —[TO H0000 H01E5 D100 K1] —[SET M113]	Writes set frequency to RWw5. / Switches on the frequency setting command RAM (RY2D).
66 — M213 —[FROM H0000 H02E6 D2 K1] —[RST M113] —[RST M303]	Reads reply code (RWr6) to D2 when the frequency setting completion (RX2D) switches on. / Switches off the frequency setting command (RY2D).
82 — M9036 —[TO H0000 H0162 K4 M100 K2]	Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory.

43

2) To continuously change the running frequency from PLC

When the frequency setting completion (example: RX2D) switches on, make sure that the reply code in the remote register is 0000H and change the set data (example: RWw5) continuously.
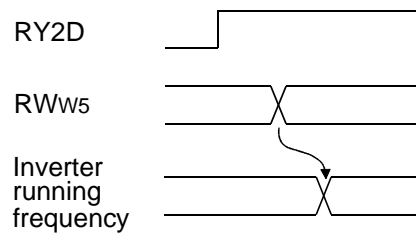
3) Program example for writing data to E^2PROM
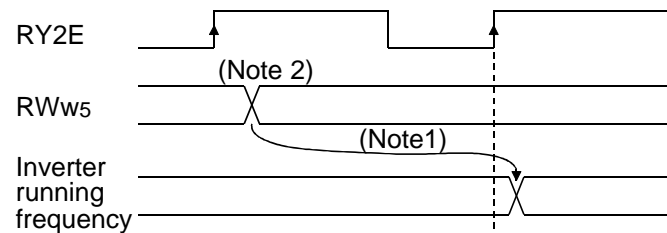
Modify the above program as follows:

Change the frequency setting command from RY2D to RY2E.

Frequency setting completion   RX2D → RX2E

<Timing chart for write to RAM>   <Timing chart for write to E^2PROM>

RY2D

RWw5

Inverter running frequency

RY2E

(Note 2)

RWw5

(Note1)

Inverter running frequency

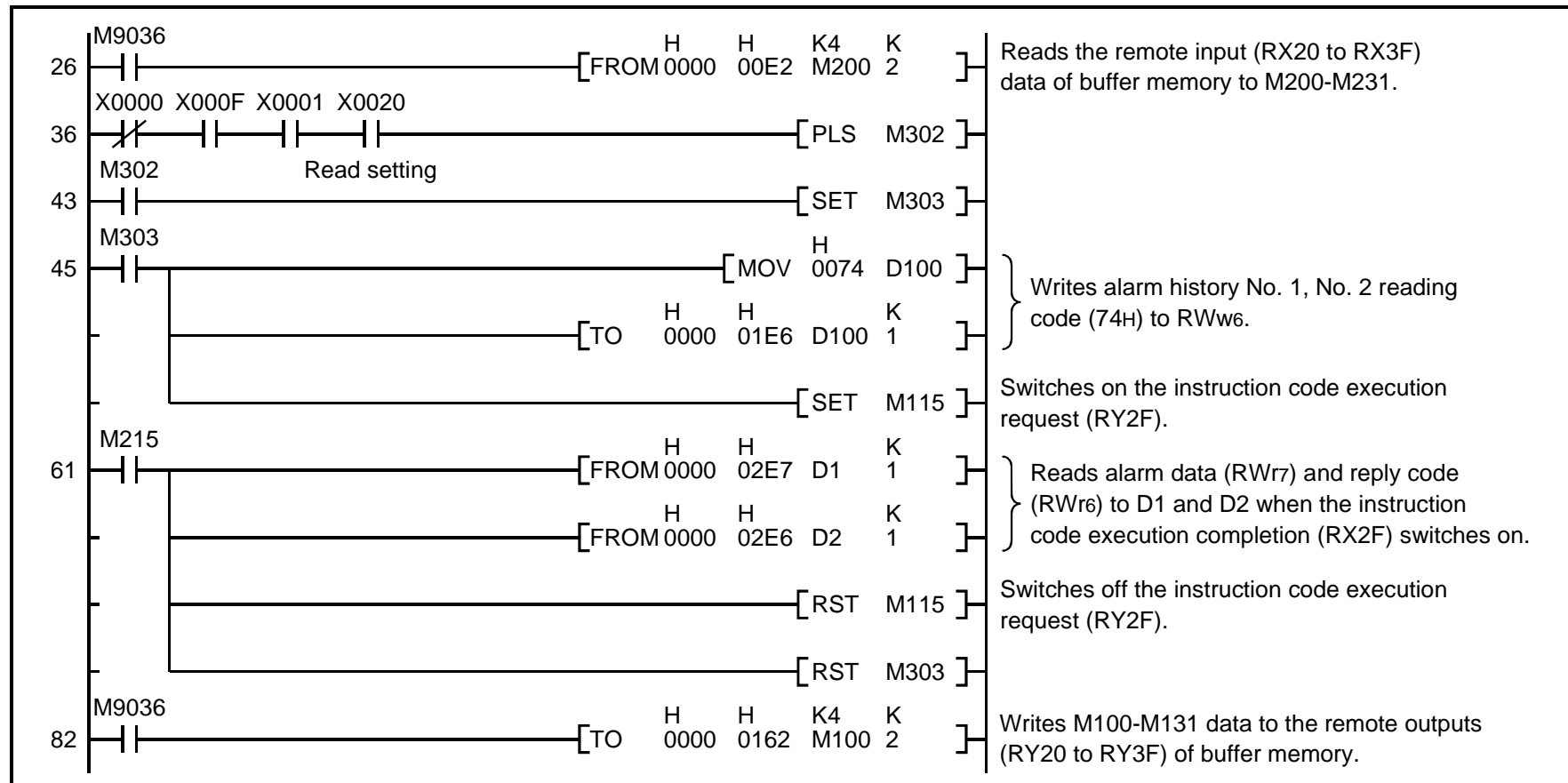Reflected on inverter at the point when RY2E switches on

Note: 1. For E^2PROM, write is made only once when RY2E is switched on.
    2. If the set data is changed with RY2E on, it is not returned on the inverter.

6.9 Alarm Definition Reading Program Example

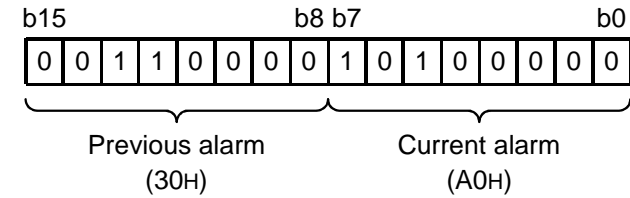1) The following program reads the alarm definition of station 2 inverter to D1.

   Alarm (error) history No. 1, No. 2 reading code number: 74H (hexadecimal)

   The reply code at the time of instruction code execution is set to D2. (Refer to page 35.)

Rung	Ladder	Comment
26	M9036 —[FROM H0000 H00E2 K4M200 K2]	Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231.
36	X0000 X000F X0001 X0020 —[PLS M302]	
43	M302 Read setting —[SET M303]	
45	M303 —[MOV H0074 D100]	Writes alarm history No. 1, No. 2 reading code (74H) to RWw6.
	—[TO H0000 H01E6 D100 K1]	
	—[SET M115]	Switches on the instruction code execution request (RY2F).
61	M215 —[FROM H0000 H02E7 D1 K1]	Reads alarm data (RWr7) and reply code (RWr6) to D1 and D2 when the instruction code execution completion (RX2F) switches on.
	—[FROM H0000 H02E6 D2 K1]	
	—[RST M115]	Switches off the instruction code execution request (RY2F).
	—[RST M303]	
82	M9036 —[TO H0000 H0162 K4M100 K2]	Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory.

2) Alarm definition display example

Example: Read data is 30A0H ————— Previous alarm........ THT
Current alarm.......... OPT

b15   b8 b7   b0

| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

Previous alarm (30H)   Current alarm (A0H)

3) Alarm data

For full information on alarm definition, refer to the inverter manual.

Data	Definition	Data	Definition
00H	No alarm	60H	E. OLT
10H	E. OC1	70H	E. BE
11H	E. OC2	80H	E. GF
12H	E. OC3	81H	E. LF
20H	E. OV1	90H	E. OHT
21H	E. OV2	A0H	E. OPT
22H	E. OV3	B0H	E. PE
30H	E. THT	B1H	E. PUE
31H	E. THM	B2H	E. RET
40H	E. FIN	F3H	E. 3

6.10 Program Example for Resetting the Inverter at Inverter Error

1) The following program resets the inverter of station 2.
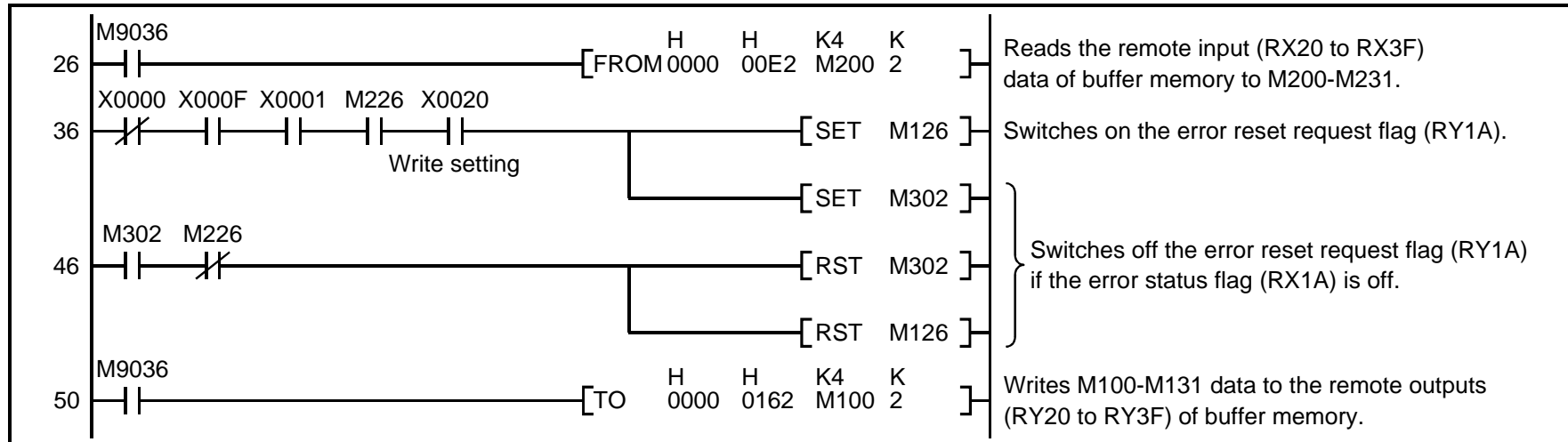
Note: 1. The above inverter reset using RY1A may be made only when an inverter error occurs.
Also, inverter reset can be made independently of the operation mode.
2. When using the instruction code execution request (RYF) with the instruction code (FDH) and data (9696H) to reset the inverter, set "1" in Pr. 340 "link start mode" (refer to page 15) or change the operation mode to the CC-Link operation mode. (For the program example, refer to page 37.)

6.11 Instructions

(1) Programming instructions

  1) Since the buffer memory data of the master station is kept transferred (refreshed) to/from the inverters, the TO instruction need not be executed every scan in response to data write or read requests.
  The execution of the TO instruction every scan does not pose any problem.

  2) If the FROM/TO instruction is executed frequently, data may not be written reliably.
  When transferring data between the inverter and sequence program via the buffer memory, perform the handshake to confirm that data has been written without error.
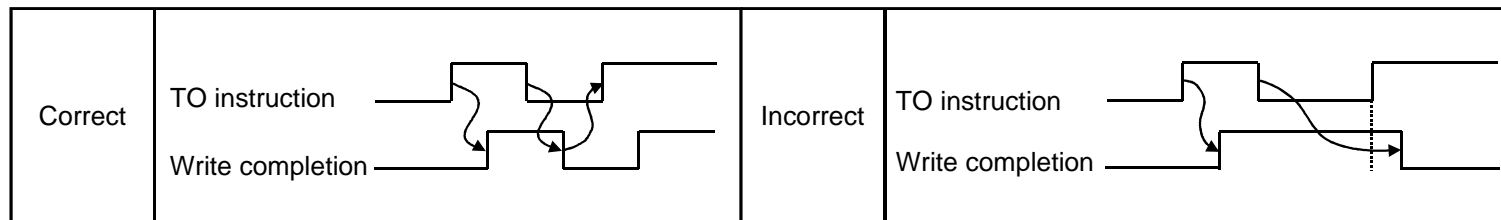
(2) Operating and handling instructions

  1) During CC-Link operation, the inverter only accepts commands from the PLC and ignores any external operation command and any operation command from the parameter unit.

  2) If the same station number is set to different inverters, wrong data will be transferred and normal communication cannot be made.

  3) The inverter is brought to any of the alarm stops "E.OPT" if data communication stops, due to a PLC fault, an open CC-Link dedicated cable etc. during CC-Link operation.

  4) If the PLC (master station) is reset during CC-Link operation or if the PLC is powered off, data communication stops and the inverter is brought to any of the alarm stops "E.OPT".
  To reset the PLC (master station), switch the operation mode to the external operation once, then reset the PLC.

5) When the main power of any inverter is restored, that inverter is reset to return to the external operation mode. To resume the CC-Link operation, therefore, set the operation mode to the CC-Link operation using the PLC program. Note that setting "1" in Pr. 340 (link start mode) selects the CC-Link operation mode.

(3) Troubleshooting

1) Operation mode does not switch to CC-Link
・Check that the CC-Link units (FR-E5NC) and CC-Link dedicated cables are fitted properly.
(Check for contact fault, open cable, etc.)
・Check that the station number setting switches are set to the correct positions. (Check that the station number matches the program, the station numbers are not repeated, and the station number is not outside the range.)
・Check that the inverter is in the external operation mode.
・Check that the operation mode switching program is running.
・Check that the operation mode switching program has been written correctly.

2) Inverter does not start in CC-Link operation mode
・Check that the inverter starting program has been written correctly.
・Check that the inverter starting program is running.
・Check that the inverter is providing output.

7. HOW TO CHECK FOR ERROR USING THE LEDS

7.1 When One Inverter Is Connected

The following example indicates the causes of faults which may be judged from the LED states of the CC-Link unit (FR-E5NC) of the inverter under the condition that the SW, M/S and PRM LEDs of the master unit are off (the master unit setting is correct) in a system configuration where one inverter is connected:
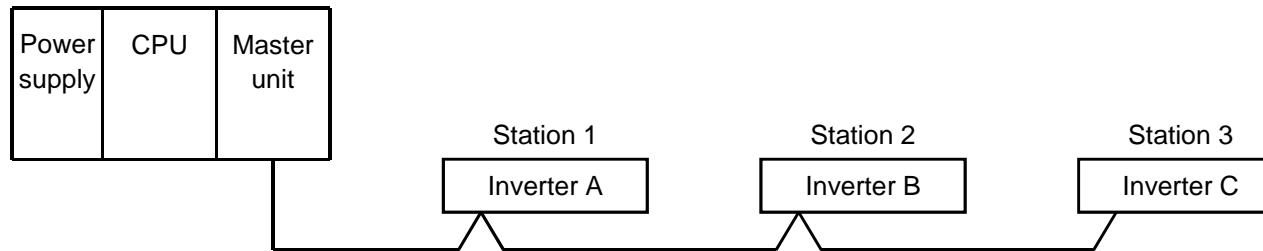
Power supply	CPU	Master unit

Station 1

Inverter
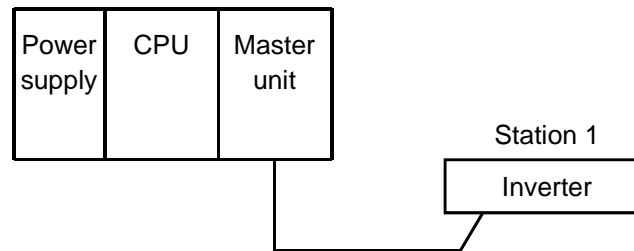
LED Status				Cause
L. RUN	**SD**	**RD**	**L. ERR**	
●	⊙	⊙	⊙	Normal communication is made but CRC error has occurred due to noise.
●	⊙	⊙	○	Normal communication
●	⊙	○	⊙	Hardware fault
●	⊙	○	○	Hardware fault
●	○	⊙	⊙	Cannot answer due to CRC error of receive data.
●	○	⊙	○	Data sent to the host station does not reach destination.
●	○	○	⊙	Hardware fault
●	○	○	○	Hardware fault
○	⊙	⊙	⊙	Polling response is made but refresh receive is in CRC error.
○	⊙	⊙	○	Hardware fault
○	⊙	○	⊙	Hardware fault
○	⊙	○	○	Hardware fault
○	○	⊙	⊙	Data sent to the host station is in CRC error.
○	○	⊙	○	There is no data sent to the host station, or data sent to the host station cannot be received due to noise.
○	○	○	⊙	Hardware fault
○	○	○	○	Cannot receive data due to open cable, etc.
○	○	⊙ ○	●	Invalid baud rate or station number setting
●	⊙	⊙	⊙	Baud rate or station number changed during operation.
○	○	○	●	WDT error occurrence (hardware fault), power off, power supply failure

●: On, ○: Off, ⊙: Flicker

7.2 When Two or More Inverters Are Connected

The following example indicates the causes and corrective actions for faults which may be judged from the LED states of the CC-Link units (FR-E5NCs) of the inverters under the condition that the SW, M/S and PRM LEDs of the master unit are off (the master unit setting is proper) in the system configuration shown below:

Power supply	CPU	Master unit

Station 1 — Inverter A
Station 2 — Inverter B
Station 3 — Inverter C

LED States				Cause	Corrective Action
Master unit	Inverters (FR-E5NC)				
	Station 1	Station 2	Station 3		
TIME ○ LINE ○ or TIME ● LINE ○	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ○	Normal	————
	L. RUN ○ SD ○ RD ○ L. ERR ○	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ○	Poor contact of the FR-E5NC with the inverter	Plug the FR-E5NC securely. Check the connector.

LED States			Cause	Corrective Action
Master unit	**Inverters (FR-E5NC)**			
	Station 1	**Station 2**	**Station 3**	
TIME ○ LINE ○ or TIME ● LINE ○	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ○ SD * RD * L. ERR ○	L. RUN ○ SD * RD * L. ERR ○	Since the L.RUN LEDs of the FR-E5NCs on station 2 and later are off, the transmission cable between the remote I/O units A and B is open or disconnected from the terminal block.	Referring to the LED "on" condition, search for an open point and repair.
	L. RUN ○ SD * RD * L. ERR ○	L. RUN ○ SD * RD * L. ERR ○	L. RUN ○ SD * RD * L. ERR ○	The transmission cable is shorted.	Among the three wires of the transmission cable, search for the shorted wire and repair.
	L. RUN ○ SD * RD * L. ERR *	L. RUN ○ SD * RD * L. ERR *	L. RUN ○ SD * RD * L. ERR *	The transmission cable is wired improperly.	Check the wiring on the inverter terminal block and correct the improper wiring point.

●: On, ○: Off, ⊙: Flicker, *: Any of on, flicker or off

7.3 Communication Stops During Operation

・Check that the CC-Link unit (FR-E5NC) and CC-Link dedicated cables are fitted properly. (Check for contact fault, open cable, etc.)

・Check that the programmable controller program is executing properly.

・Check that data communication has not stopped due to an instantaneous power failure, etc.

LED States				Cause	Corrective Action
Master unit	Inverters (FR-E5NC)				
	Station 1	Station 2	Station 3		
TIME ○ LINE ○ or TIME ● LINE ○	L. RUN ○ SD　　* RD　　● L. ERR ○	L. RUN ● SD　　● RD　　● L. ERR ○	L. RUN ○ SD　　* RD　　● L. ERR ○	Since the L.RUN LEDs of the FR-E5NC on station 1 and the FR-E5NC on station 3 are off, the station numbers of the inverters set as stations 1 and 3 are the same.	After correcting the repeated station numbers of the inverters, switch power on again.
	L. RUN ● SD　　● RD　　● L. ERR ○	L. RUN ○ SD　　○ RD　　● L. ERR ○	L. RUN ● SD　　● RD　　● L. ERR ○	Since the L.RUN and SD LEDs of the FR-E5NC on station 2 are off, the transmission speed setting of the FR-E5NC on station 2 is wrong within the setting range (0 to 4).	After correcting the transmission speed setting, switch power on again.
	L. RUN ● SD　　● RD　　● L. ERR ○	L. RUN ● SD　　● RD　　● L. ERR ○	L. RUN ● SD　　● RD　　● L. ERR ⊙	Since the L.ERR LED of the FR-E5NC on station 3 flickers, the setting switch of the FR-E5NC on station 3 was moved during normal operation.	After returning the setting switch of the FR-E5NC to the original position, power on the inverter again.
	L. RUN ○ SD　　○ RD　　● L. ERR ●	L. RUN ● SD　　● RD　　● L. ERR ○	L. RUN ● SD　　● RD　　● L. ERR ○	Since the L.RUN and SD LEDs of the FR-E5NC on station 1 are off and its L.ERR LED is on, the setting switch setting of the FR-E5NC on station 1 is outside the range (transmission speed: 5 to 9, station number: 65 or more).	After correcting the setting switch position of the FR-E5NC, switch power on again.

LED States				Cause	Corrective Action
Master unit	Inverters (FR-E5NC)				
	Station 1	Station 2	Station 3		
TIME ● LINE ● or TIME ○ LINE ●	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ●	L. RUN ● SD ● RD ● L. ERR ○	Since the L.ERR LED of the FR-E5NC on station 2 is on, the FR-E5NC itself on station 2 is affected by noise. (L.RUN may go off.)	Securely connect FG of each inverter and master unit to ground.
	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ●	L. RUN ● SD ● RD ● L. ERR ●	Since the L.ERR LEDs of the FR-E5NCs on station 2 and later are on, the transmission cable between the inverters of stations 2 and 3 is affected by noise. (L.RUN may go off.)	Check that the transmission cable is connected to SLD. Also run it as far away as possible from the power lines. (100mm or more)
	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ○	L. RUN ● SD ● RD ● L. ERR ●	Terminal resistors are left unconnected. (L.RUN may go off.)	Check that the terminal resistors are connected.

●: On, ○: Off, ⊙: Flicker, ∗: Any of on, flicker or off

REVISIONS

Print Date	*Manual Number	Revision
Jul., 1999	IB(NA)-0600003-A	First edition
Aug., 2001	IB(NA)-0600003-B	Partial changes • Program examples Additions • CC-Link Ver. 1.10 specifications • Applicable Control & Communication Link system master/local modules