# MITSUBISHI

# TRANSISTORIZED INVERTER

## – INSTRUCTION MANUAL –

### Control & Communication Link

# FR-A5NC

**MITSUBISHI ELECTRIC**

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.<br>● Do not stand or rest heavy objects on the product.<br>● Check that the mounting orientation is correct.<br>● 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.<br>● 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

# 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 a plug-in option designed for use with the following inverters only. Check the inverter's type and serial number.

(1) Applicable inverters

| | |
|---|---|
| Mitsubishi transistorized inverters | FR-A500 series, FR-F500 series |
| Mitsubishi large-capacity inverters | FR-A500L series |

(2) Checking the serial number

This option unit may be used with only the products of the FR-A500 series manufactured in and after November, 1997.

Any of the products may be used with this option unit if its SERIAL number indicated on the rating plate and package has the following version or later.

(The SERIAL number on the package uses only the 3 most significant digits of the 6-digit control number.)

```
R        7        Y       ○○○○○○

Symbol   Year   Month    Control number
                 SERIAL number
```

## 1.2 Packing Confirmation

Make sure that the package includes the following accessories:

· Instruction manual..................................1
· Mounting screws M3 × 6........................2
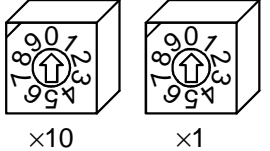
## 1.3  Instruction Manual Note

(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
(2) In this manual, Control & Communication Link is abbreviated to CC-Link.

## 1.4  Structure
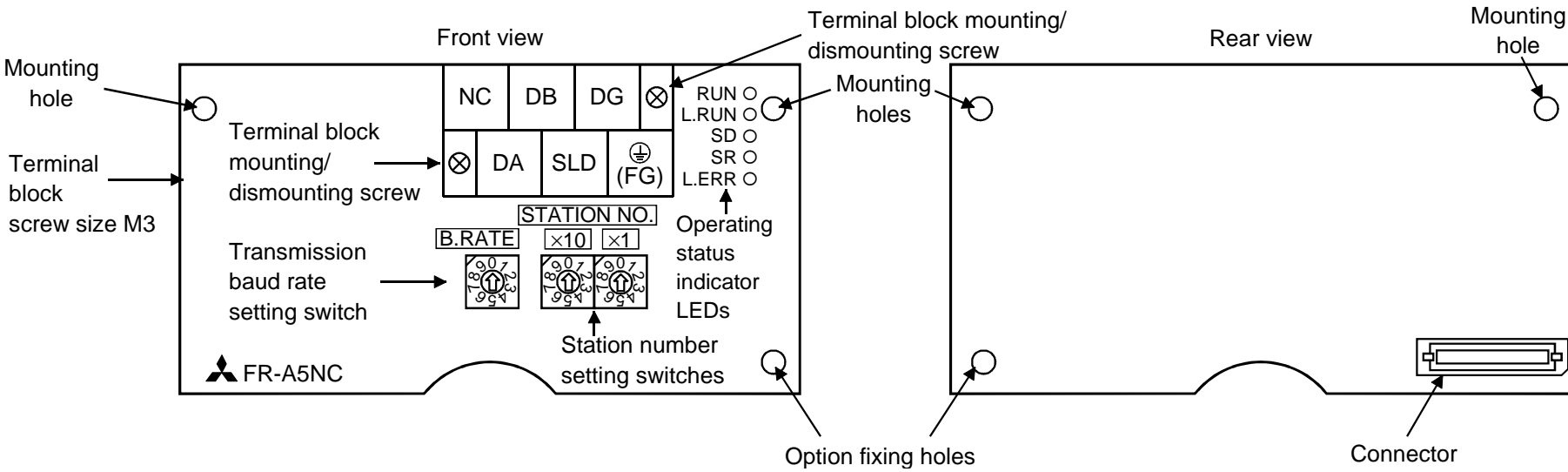
(1) Names and functions

| Name | Function |
|---|---|
| Station number setting switches |  ×10  ×1    Used to set the inverter station number between 1 and 64. For details, refer to page 8. |
| Transmission baud rate setting switch | Used to set the transmission speed. For details, refer to page 10. |
| Operating status indicator LEDs | RUN ......... Lit during normal operation (when internal 5V is normal). (Also lit when communication is not yet started.)<br>L.RUN ...... Lit to indicate that refresh data is received properly. Extinguished to indicate a break in data for a given period of time.<br>SD ............ Extinguished to indicate that send data is "0".<br>RD ............ Lit to indicate that the carrier of receive data is detected.<br>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. |

## 1.5 Inverter Option (FR-A5NC) 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 max. (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 |

Note:    When the CC-Link unit (FR-A5NC) is plugged in, the protective structure (JEM1030) is open type (IP00).

# 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

(1) Mount the option unit to slot 3.
   Remove the DATA PORT from the front cover and mount the front cover. (To remove the DATA PORT cover, push it from the back of the front cover.)

(2) Securely insert the connector of the option unit into the connector of slot 3 in the inverter. At this time, also fit the option fixing holes correctly. For the position of slot 3, refer to the next page.

(3) Securely fix both sides of the option unit to the inverter with the accessory mounting screws. If the screw holes do not match, the connector may not have been plugged correctly. Check for loose connection.

(4) Remove the terminal block mounting/dismounting screws to dismount the terminal block.

(5) Reinstall the front cover of the inverter. (Refer to the inverter manual.)

(6) Reinstall the terminal block securely.

| ⚠ **CAUTION** |
| :--- |
| ⚠ **When installing the inverter front cover, the cables to the inverter's control circuit terminals and option terminals should be routed properly in the wiring space to prevent them from being caught between the inverter and its cover.** |

## 2.3  Installation

Route the cables so that they do not take up a large space in the control circuit terminal block wiring area of the option unit.
Before wiring, mount the CC-Link unit (FR-A5NC) and fit the inverter front cover.
Note:    During wiring, do not leave wire off-cuts in the inverter. They may cause a fault, failure or malfunction.

Inverter
(Without cover)

Slot 1

Slot 2

Accessory screw (2 pcs.)

Inverter side
connector

DATA PORT

Slot 3

Inverter
(With cover)

CC-Link unit
(FR-A5NC)

Terminal block

Note: The mounting screws
do not release from terminal block.
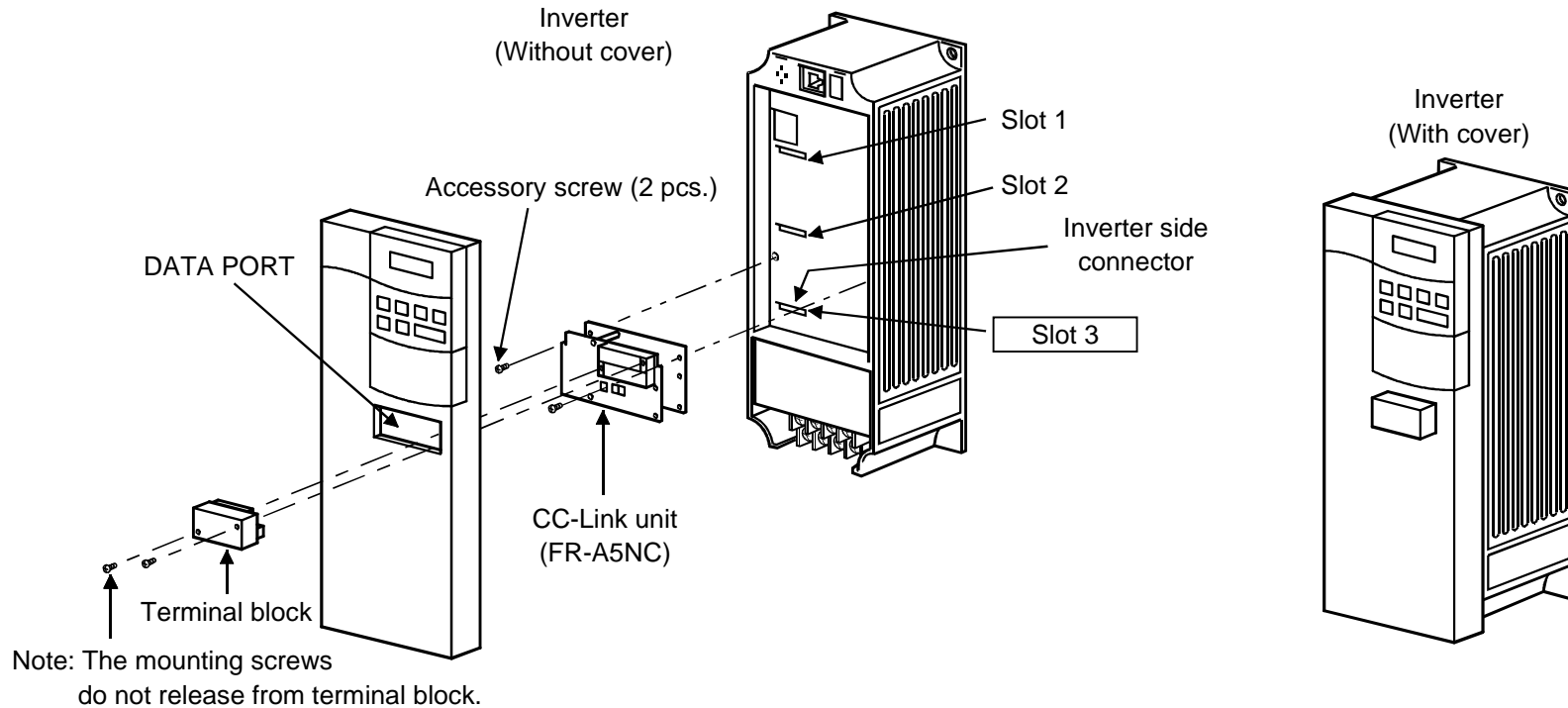
Note 1. Only one option of the same type may be used. When two or more options are mounted, priority is in order of slots 1, 2 and 3, and the options having lower priority are inoperative. (Only one communication option may be used.)

2. When the inverter cannot recognize that the option is mounted or when two or more communication option units are mounted, E.OPT error is displayed.
The errors shown differ with the mounting slots 1, 2, 3.

3. If the inverter front cover is installed with the terminal block mounted, the front cover may not be installed securely.

| Mounting Position | Error Display |
|---|---|
| Slot 1 | E.OP1 |
| Slot 2 | E.OP2 |
| Slot 3 | E.OP3 |

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## 2.4  System Configuration Example

(1) PLC side
   Load the "AJ61BT11", "A1SJ61BT11", "AJ61QBT11" or "A1SJ61QBT11" "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-A5NC)" on the inverter.

(3) Connect the PLC CC-Link unit master station and the FR-A5NC 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 L (NA) -74108143E.



Master station

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

Power supply module  CPU  AJ61 BT11

Termination resistor

Inverter

Inverter

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

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:
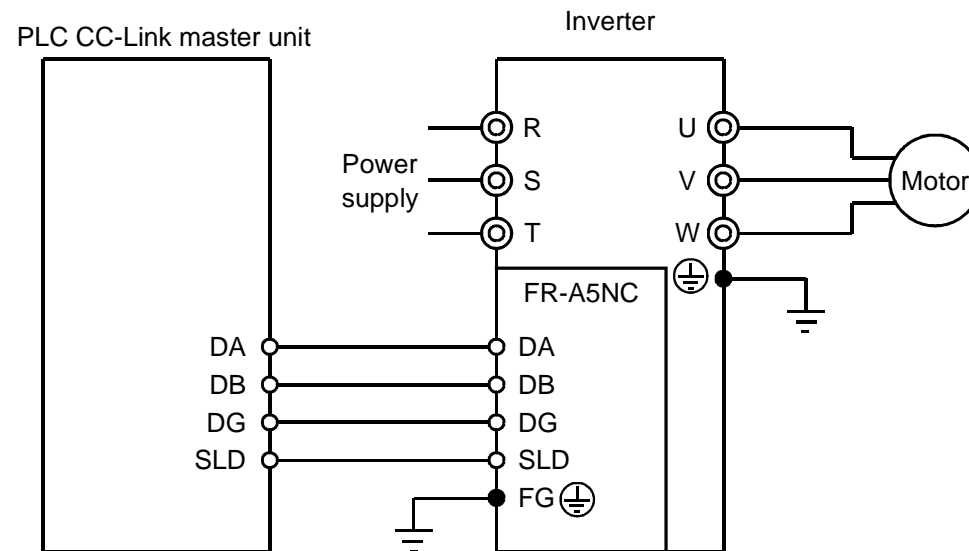
## 2.6  Connection of Several Inverters

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.
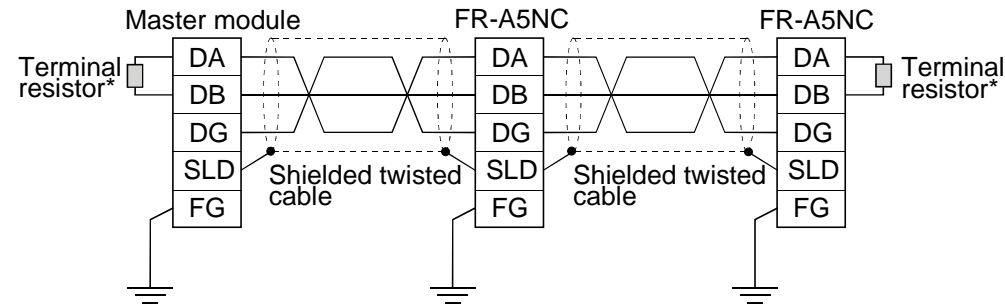


\*Use the termination resistors supplied with the PLC.

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

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

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# 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

● 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".

Station number setting switches



×10          ×1

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

● 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.
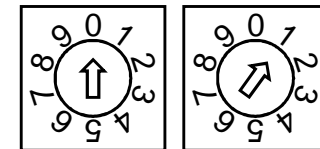
Good example   Bad example



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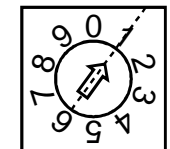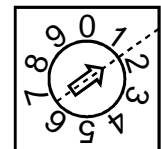
3) Connection example
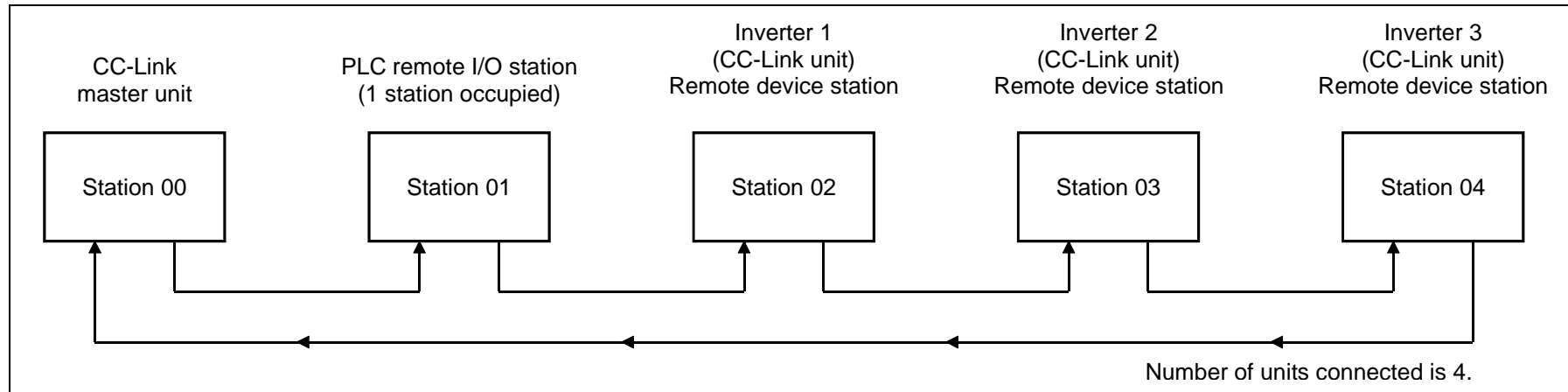


Note:   One inverter occupies one station (one remote device station)

## 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.) | |

## 3.2  Operation Modes of the Inverter

The inverter mounted with the CC-Link unit (FR-A5NC) has the following operation modes:

(1) PU operation mode ............... Controls the inverter from the keyboard of the operation panel (FR-DU04) 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-A5NC).

## 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 |
| 5 | Programmed operation | Disallowed |
| 6 | Switch-over | Allowed |
| 7 | External operation (PU operation interlock) | Allowed only in the external operation mode when the PU interlock signal (X12) 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:
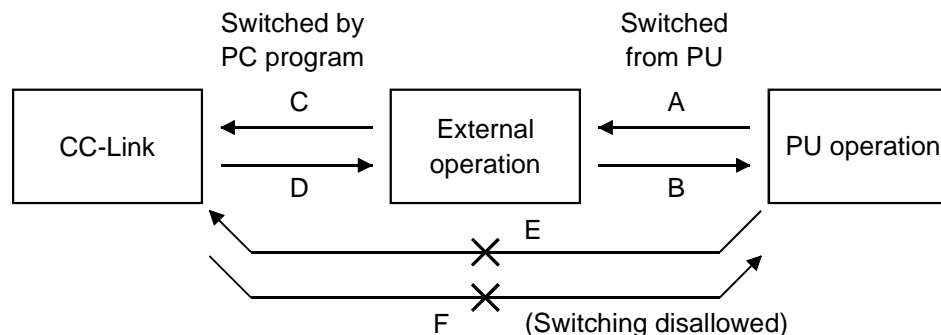


| Symbol | Switching Type | Switching Method |
|--------|----------------|------------------|
| A | PU operation → external operation | Operate the external operation key on the PU. |
| B | External operation → PU operation | Operate the PU operation key on the PU. |
| C | External operation → CC-Link 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.

(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 38 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. |
| | 5 | Programmed operation mode | Inverter is operated by the program. |
| | 6 | Switch-over mode | Operation mode is switched while running. |
| | 7 | External operation mode | X12 signal ON ........ Shift to the PU operation mode enabled (output stopped during external operation)<br>X12 signal OFF ...... Shift to the PU operation mode inhibited |
| | 8 | External/PU combined operation mode | X16 signal ON ........ Shift to external operation mode<br>X16 signal OFF ...... Shift to PU operation mode |
| 1 (2*) | | CC-Link operation | Inverter goes into the CC-Link operation mode. (Program need not be used for switching) |

1) The Pr. 340 value may be changed in any operation mode.

2) When Pr. 79 "operation mode selection" = "0, 2 or 6", "1" and "2" in Pr. 340 are made valid.

*The setting of "2" chooses the CC-Link operation mode, which is mainly used for computer link operation (when the FR-A5NR is connected).

## 3.3  Operation at Alarm Occurrence

| Fault Location | Description | | Operation Mode | | |
|---|---|---|---|---|---|
| | | | PU operation | External operation | CC-Link operation |
| Inverter alarm | Inverter operation | | Stop (inverter trip) | Stop (inverter trip) | Stop (inverter trip) |
| | Data communication | A5NC | Continued | Continued | Continued |
| Communication alarm (A5NC) | Inverter operation | | Continued | Continued | Stop (inverter trip) |
| | Data communication | A5NC | Stop | Stop | Stop |

(1) Inverter alarm

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

(2) Communication alarm

Check the LED states of the FR-A5NC and remove the cause of the alarm. (Refer to page 46)

Check the CC-Link master station.

(3) Communication error during CC-Link operation

When a communication error occurs, the error message "E.OP3" is displayed.

(4) Inverter reset (Note)

| Resetting Method | | Operation Mode | | |
|---|---|---|---|---|
| | | CC-Link operation | External operation | PU operation |
| PLC program | Inverter reset (*1) Instruction code | Allowed | Disallowed | Disallowed (*1) |
| | Error reset at inverter fault (RY1A) (*2) | Allowed | Allowed | Allowed (*1) |
| 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 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 13.)

## 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. 186 (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 | |
| | | | Start self-holding selection (STOP) | — | — | External | External | |
| | | | Output halt (MRS) | Both | Both | External | External | (Note 1) |
| | | | Reset (RES) | Both | Both | Both | Both | |
| | | | CC-Link operation frequency | PLC | — | PLC | — | |
| | | | 2 | — | External | — | External | |
| | | | 4 | — | External | — | External | |
| | | | 1 | Compensation | External | Compensation | External | |
| Selective functions | Pr. 180 to Pr. 186 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 | Jog operation selection (JOG) | — | — | External | External | |
| | | 6 | Automatic restart after instantaneous power failure selection (CS) | External | External | External | External | |
| | | 7 | External thermal relay input (OH) | External | External | External | External | |
| | | 8 | 15-speed selection (REX) | PLC | External | PLC | External | Pr. 59 = 0 |
| | | 9 | Third function (X9) | PLC | PLC | External | External | |
| | | 10 | FR-HC connection, inverter operation enable (X10) | External | External | External | External | |

| 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 | |
| Selective functions | Pr. 180 to Pr. 186 settings | 11 | FR-HC connection, instantaneous power failure detection (X11) | External | External | External | External | |
| | | 12 | PU operation external interlock (X12) | External | External | External | External | |
| | | 13 | External DC dynamic braking start (X13) | PLC | PLC | External | External | |
| | | 14 | PID control valid terminal (X14) | PLC | External | PLC | External | |
| | | 15 | Brake opening completion signal (BRI) | PLC | PLC | External | External | |
| | | 16 | PU operation-external operation switching (X16) | External | External | External | External | |
| | | 17 | Load pattern selection-forward/reverse rotation boost switching (X17) | PLC | PLC | External | External | |
| | | 18 | Magnetic flux-V/F switching (X18) | PLC | PLC | External | External | |
| | | 19 | Load torque high-speed frequency (X19) | PLC | PLC | External | External | |
| | | 20 | S-pattern acceleration/deceleration C selection terminal (X20)* | PLC | PLC | External | External | |
| | | 22 | Orientation command (X22)* | PLC | PLC | External | External | (Note 2) |
| | | 23 | Pre-excitation (LX)* | PLC | PLC | External | External | |
| RH, RM, RL, RT selection functions | | | Remote setting (RH, RM, RH) | PLC | External | PLC | External | Pr. 59 = 1, 2 |
| | | | Programmed operation group selection (RH, RM, RL) | — | — | — | — | Pr. 79 = 5 CC-Link operation disallowed |
| | | | Stop-on-contact selection 0 (RL) | PLC | External | PLC | External | Pr. 270 = 1, 3 |
| | | | Stop-on-contact selection 1 (RT) | PLC | PLC | External | External | |

*This setting is valid only when the FR-A5AP option is plugged in. (The FR-A5AP cannot be used with the FR-F500 series.)

[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.

 Compensation : Control by signal from external terminal is only valid if Pr. 28 (multi-speed input compensation) setting is 1.

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Note 1. If the FR-HC is connected, inverter operation enable signal (X10) is not assigned when the FR-HC is used (Pr. 30 = 2) or if the PU operation interlock signal (X12) is not assigned when the PU operation interlock function is set (Pr. 79 = 7), this function is also used by the MRS signal and therefore the MRS signal is only valid for the external terminals, independently of the Pr. 338 and Pr.339 settings.

2. The orientation command needs the FR-A5AP and FR-A5AX options.

3. When the MRS signal is assigned to both PLC and External control, the output stop command is as listed below:

| PLC | External | Output Stop Command | |
|---|---|---|---|
| | | Pr. 17 = 0 | Pr. 17 = 2 |
| ON | ON | Output stopped | Output not stopped |
| ON | OFF | Output stopped | Output stopped |
| OFF | ON | Output stopped | Output stopped |
| OFF | OFF | Output not stopped | Output stopped |

# 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 (512 points).
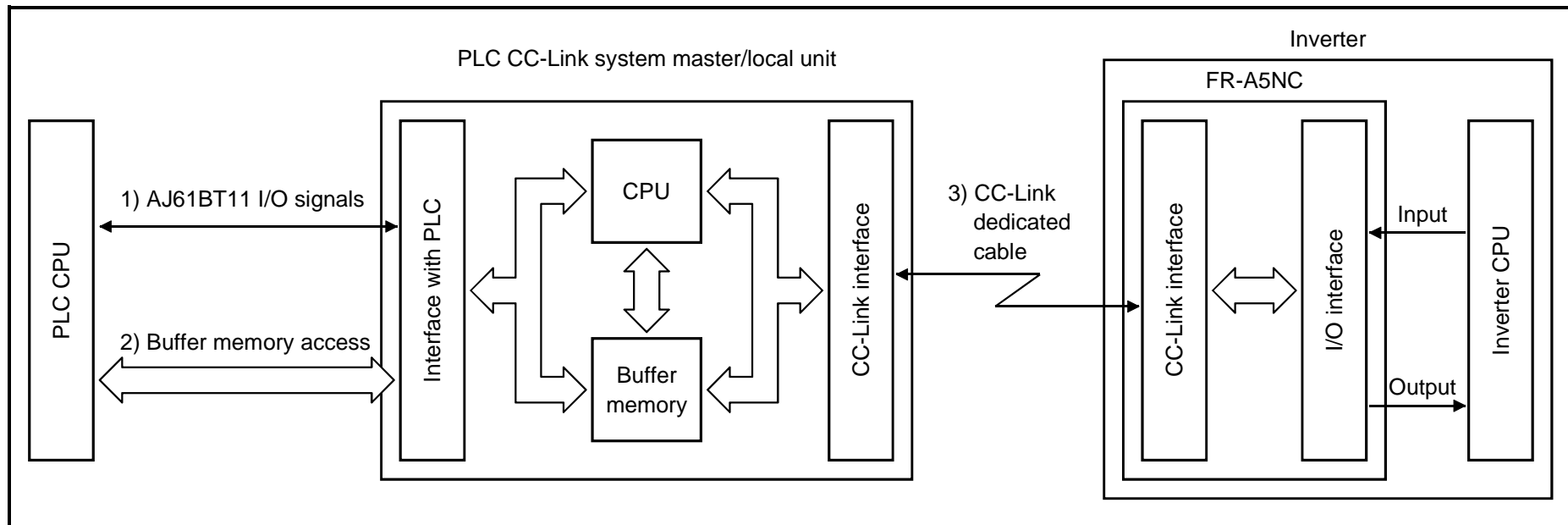


1) I/O signals assigned to the CC-Link system master/local unit.
   These signals are used for communication between the PLC CPU and CC-Link system master/local unit.
   For further details of the signals, refer to page 23.
2) Allows input data to be read, output data to be written, and a CC-Link faulty 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.

## 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 error, the inverter cannot be reset from the computer. (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 and Pr. 271 to Pr. 274 during operation.
  Different inverters have different functions. 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.

  2. In the programmed operation mode, parameters write-enabled in the external operation mode are write-enabled in CC-Link.

## 4.2.1  Monitoring function

(Refer to page 35.)

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 F3H
6) Inverter status

| | |
|---|---|
| · Forward running | · Overload (OL)* |
| · Reverse running | · Instantaneous power failure (IPF)* |
| · Running (RUN)* | · Frequency detection (FU)* |
| · Up to frequency (SU)* | · Alarm* |

The output signals marked * can be changed using Pr. 190 to Pr. 195 (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 34.)

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

| | |
|---|---|
| ・Forward rotation (STF) | ・Second acceleration/deceleration (RT)*1 |
| ・Reverse rotation (STR) | ・Inverter output halt (MRS) |
| ・Low speed (RL)*1 | ・AU terminal*1 |
| ・Middle speed (RM)*1 | ・JOG terminal*1 |
| ・High speed (RH)*1 | ・CS terminal*1 |

The input signals marked *1 can be changed using Pr. 180 to Pr. 186 (input terminal function selection). Depending on the setting, however, some signals do not accept the command from the PLC. For details, refer to page 16.

## 4.2.3  Running frequency

(Refer to page 39.)

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 $E^2$PROM or to RAM. When changing the frequency continuously, always write the data to the inverter RAM.

## 4.2.4  Parameter write

(Refer to page 38.)

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 37.)

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 devices No.s are those for station 1.

For stations 2 and later, the devices 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-A5NC))

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

| Device No. | Signal | Description |
|---|---|---|
| RY0 | Forward rotation command | OFF : Stop command<br>ON : Forward rotation start (Note 1) |
| RY1 | Reserve rotation command | OFF : Stop command<br>ON : Reserve rotation start (Note 1) |
| RY2 | RH terminal function (high speed) | Functions assigned to RH/RM/RL are selected.<br>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 | JOG terminal function | Function assigned to the JOG terminal is selected. (Note 2) |
| RY6 | RT terminal function | Function assigned to the RT terminal is selected. In the factory setting, the second function can be selected. (Note 2) |
| RY7 | AU terminal function | Function assigned to the AU terminal is selected. (Note 2) |
| RY8 | CS terminal function | Function assigned to the CS terminal is selected. (Note 2) |
| 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. 186 (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)<br>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.<br>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). |
| 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-A5NC) → 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) <br> ON  : Forward running |
| RX1 | Reverse running | OFF : Other than reverse running (during stop or forward rotation) <br> 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 ± Pr. 41. (Note) |
| RX4 | Overload (OL) | Switched on when stall prevention operation is performed, switched off when stall prevention is canceled. (Note) |
| RX5 | Instantaneous power failure (IPF) | Switched on when instantaneous power failure or undervoltage occurs. (Note) |
| RX6 | Frequency detection (FU) | Switched on when the output frequency reaches set frequency. (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 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$^2$PROM) | 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. |

Note:   With Pr. 190 to Pr. 195 (output terminal function selection), you can set the output signals of device No.s RX2 to RX7. For full information, refer to the inverter manual.

| Device No. | Signal | Description |
|---|---|---|
| RXF | Instruction code execution completion | Switched on on completion of the processing corresponding to the instruction code (RWW2) which is executed when the instruction code execution request (RYF) switches on. Switched off when the instruction code execution completion (RXF) is switched off. |
| 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 unit.) Switched off when an inverter error occurs (protective function is activated). |

## 5.2  Remote Register Assignment

### 5.2.1  Remote registers (master unit → inverter (FR-A5NC))

| Device No. | Signal | Description |
|---|---|---|
| RWW0 | Monitor code | Set the monitor code to be referenced. 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 28). 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. |

### 5.2.2  Remote registers (inverter (FR-A5NC) → 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. |

## 5.3  Instruction Codes

| Item | Code Number | Description |
|---|---|---|
| Operation mode read | 007BH | 0000H: CC-Link operation<br>0001H: External operation<br>0002H: PU operation |
| Operation mode write | 00FBH | 0000H: CC-Link operation<br>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 |
| Parameter write | 0080H to 00ECH | required. It should be noted that some parameters cannot be accessed. |
| 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.)<br>9966H: All clear<br>9669H: User 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 | 007F$_H$ | Changes the 0000$_H$ to 006C$_H$ and 0080$_H$ to 00EC$_H$ parameter values.<br>0000$_H$: Pr. 0 to Pr. 99<br>0001$_H$: Pr. 100 to Pr. 159, Pr. 200 to Pr. 231, Pr. 900 to Pr. 905<br>0002$_H$: Pr. 160 to Pr. 199, Pr. 232 to Pr. 285<br>0003$_H$: Pr. 300 to Pr. 399<br>0009$_H$: Pr. 990, Pr. 991 |
| | Write | 00FF$_H$ | |
| Second parameter changing | Read | 006C$_H$ | Pr. 201 to Pr. 230<br>0000$_H$: Running frequency<br>0001$_H$: Time<br>0002$_H$: Rotation direction |
| | Write | 00EC$_H$ | Pr. 902 to Pr. 905<br>0000$_H$: Offset/gain<br>0001$_H$: Analog<br>0002$_H$: Analog value of terminal |

# 6. PROGRAMMING EXAMPLES

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

System configuration for programming example
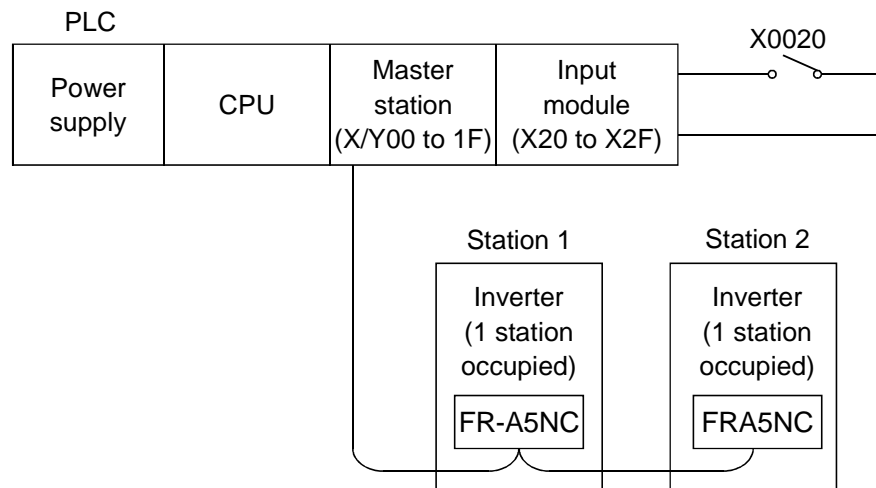
## 6.1  Reply Code Definitions

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 unit buffer memory:
The inverter status is always stored in remote inputs RX (addresses E0H to 15FH).
The following program reads the inverter status of station 1 to M0-M7:



X0000 X000F X0001

FROM 0000(H) 00E0(H) D0 K1 — Reads the remote input data of buffer memory to D0.

MOV D0 M0(K2) — Stores b0-b7 (status) in D0 to M0-M7.

Address of master unit buffer memory / Remote Input

| | |
|---|---|
| E0H | RXF to RX0 |
| E1H | RX1F to RX10 |
| E2H | RX2F to RX20 |
| E3H | RX3F to RX30 |
| 15EH | RX7EF to RX7E0 |
| 15FH | RX7FF to RX7F0 |

Station 1: E0H, E1H
Station 2: E2H, E3H
Station 64: 15EH, 15FH

FROM instruction

D0: b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 = 0 0 0 0 * * * * 0 0 * 0 1 1 0 1

[RXF to RX8]    [Inverter Status]

Up to frequency    Running    Forward running

MOV instruction

M7 M6 M5 M4 M3 M2 M1 M0 = 0 0 * 0 1 1 0 1

Inverter status

Example: The above indicates up to frequency during forward running.

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: Instantaneous power failure (IPF)
M6: Frequency detection (FU)
M7: Alarm

## 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 28.)

   The reply code at the time of instruction code execution is set to D2. (Refer to page 31.)



| | |
|---|---|
| M9036 ... FROM H0000 H00E2 K4 M200 K2 (line 26) | Reads the remote input (RX20 to RX3F) data of buffer memory to M200-M231. |
| X0000 X000F X0001 X0020 M202 ... PLS M302 (line 36) Write setting / Inverter running | |
| M302 ... SET M303 (line 44) | |
| M303 ... MOV H00FB D100 / MOV H0000 D101 / TO H0000 H01E6 D100 K2 (line 46) | Writes operation mode writing code (FBH) to RWw6 and set data (0000H) to RWw7. |
| ... SET M115 | Switches on the instruction code execution request (RY2F). |
| M215 ... FROM H0000 H02E6 D2 K1 (line 67) | 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 | |
| M9036 ... TO H0000 H0162 M100 K2 (line 88) | Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory. |

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## 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 (E²PROM)
M115 ..... Instruction code execution request

Operation commands
M100 ..... Forward rotation command
M101 ..... Reverse rotation command
M102 ..... High speed (RH)
M103 ..... Middle speed (RM)
M104 ..... Low speed (RL)
M105 ..... JOG
M106 ..... Second acceleration/deceleration (RT)
M107 ..... Current input selection
M108 ..... Automatic restart after instantaneous power failure (CS)
M109 ..... MRS

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## 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).



35
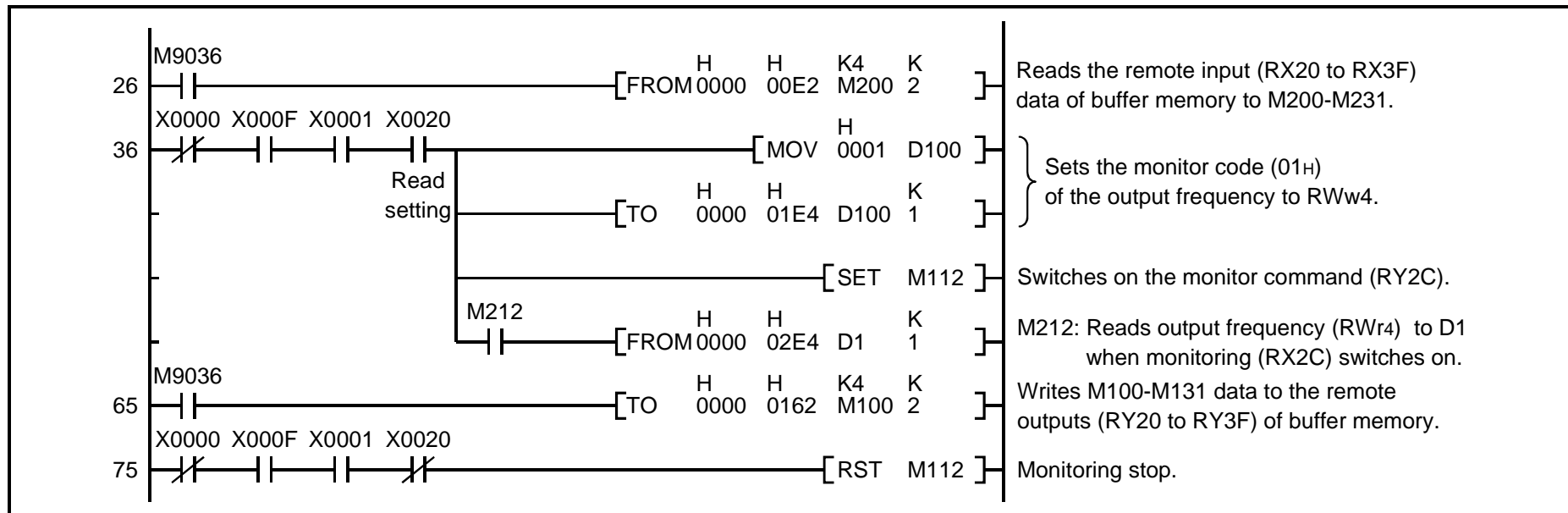
## 6.5.1  Monitor codes

| Code Number | Description | Increments | |
|---|---|---|---|
| 0000H | No monitoring (monitored value fixed to 0) | —— | |
| 0001H | Output frequency | 0.01Hz | |
| 0002H | Output current | 0.01A | |
| 0003H | Output voltage | 0.1V | |
| 0004H | No monitoring (monitored value fixed to 0) | —— | |
| 0005H | Frequency setting | 0.01Hz | |
| 0006H | Running speed | 1r/min | |
| 0007H | Motor torque | 0.1% | |
| 0008H | Converter output voltage | 0.1V | |
| 0009H | Regenerative brake duty factor | 0.1% | |
| 000AH | Electronic overcurrent protection load factor | 0.1% | |
| 000BH | Output current peak | 0.01A | |
| 000CH | Converter output voltage peak | 0.1V | |
| 000DH | Input power | 0.01kW | |
| 000EH | Output power | 0.01kW | |
| 000FH | Input terminal status | —— | |
| 0010H | Output terminal status | —— | |
| 0011H | Load meter | 0.1% | |
| 0012H | Motor exciting current | 0.01A | |
| 0013H | Position pulse | 1pulse | * |
| 0014H | Cumulative energization time | 1hr | |
| 0015H | No monitoring (monitored value fixed to 0) | —— | |
| 0016H | Orientation status | —— | * |
| 0017H | Actual operation time | 1hr | |
| 0018H | Motor load factor | 0.1% | |
| 0019H | Cumulative power | 1kWh | |

*: Valid only when the FR-A5AP options are mounted.

## 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 31.)



| Step | 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 —\|\|— Read setting [SET M303] | |
| 45 | M303 —\|\|— [MOV 0007(H) D100] / [TO 0000(H) 01E6(H) D100 1(K)] | Writes Pr. 7 reading code (07H) to RWw6. |
| | [SET M115] | Switches on the instruction code execution request (RY2F). |
| 61 | M215 —\|\|— [FROM 0000(H) 02E7(H) D1 1(K)] / [FROM 0000(H) 02E6(H) D2 1(K)] | M215: "Reads acceleration time (RWr7) and reply code (RWr6) to D1 and D2" when the instruction code execution completion (RX2F) switches on. |
| | [RST M115] | Switches off the instruction code execution request (RY2F). |
| | [RST M303] | |
| 82 | M9036 —\|\|— [TO 0000(H) 0162(H) M100(K4) 2(K)] | Writes M100-M131 data to the remote outputs (RY20 to RY2F) of buffer memory. |

Note:   For parameters having numbers 100 and later, change their link parameter extension settings (set them to other than 0000H).

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## 6.7  Parameter Writing Program Example

1) Program example which changes the Pr. 7 "acceleration time" setting of station 2 inverter to 3.0 seconds
   Acceleration time writing code number: 87H (hexadecimal)
   Acceleration time set data: K30 (decimal)
   For the parameter code numbers, refer to the inverter manual.

| Ladder | Description |
|---|---|
| **26** M9036 ⊢⊢ ──[FROM H 0000  H 00E2  K4 M200  K 2] | 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 H 0087  D100] ──[MOV K 0030  D101] ──[TO H 0000  H 01E6  D100  K 2] | Writes Pr. 7 write (87H) to RWw6 and acceleration time setting data (K30) to RWw7. |
| ──[SET  M115] | Switches on the instruction code execution request (RY2F). |
| ──[FROM H 0000  H 02E6  D2  K 1] | 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 H 0000  H 0162  K4 M100  K 2] | 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).
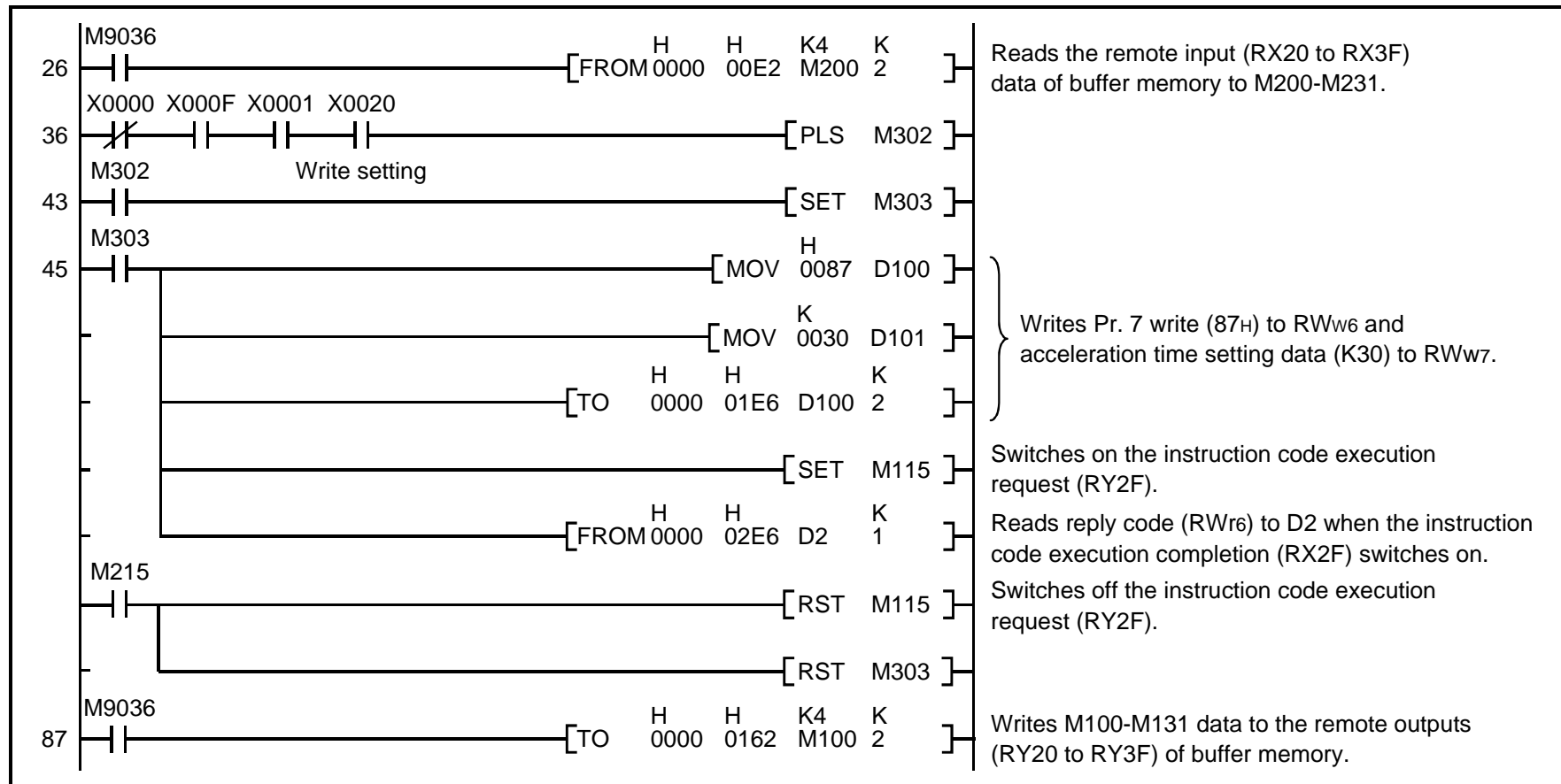   2. For other functions, refer to the instruction codes (page 28).

## 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 31.)



| Rung | Ladder | Comment |
|------|--------|---------|
| 26 | M9036 —[FROM H 0000 H 00E2 K4 M200 K 2] | 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 K 5000 D100] —[TO H 0000 H 01E5 D100 K 1] | Writes set frequecy to RWw5. |
| | —[SET M113] | Switches on the frequency setting command RAM (RY2D). |
| 66 | M213 —[FROM H 0000 H 02E6 D2 K 1] | Reads reply code (RWr6) to D2 when the frequency setting completion (RX2D) switches on. |
| | —[RST M113] | Switches off the frequency setting command (RY2D). |
| | —[RST M303] | |
| 82 | M9036 —[TO H 0000 H 0162 K4 M100 K 2] | Writes M100-M131 data to the remote outputs (RY20 to RY3F) of buffer memory. |

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$^2$PROM

Modify the above program as follows:

Change the frequency setting command from RY2D to RY2E.

Frequency setting completion RX2D → RX2E
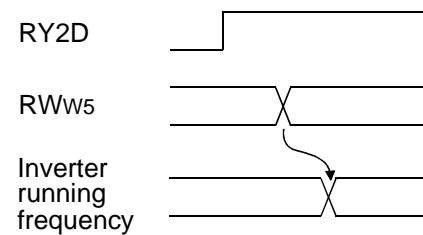
&lt;Timing chart for write to RAM&gt;                    &lt;Timing chart for write to E$^2$PROM&gt;

RY2D

RWW5

Inverter
running
frequency

RY2E

(Note 2)

RWw5

(Note1)

Inverter
running
frequency
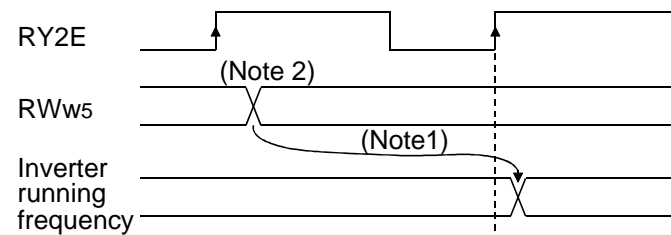
Reflected on inverter
at the point when RY2E
switches on

Note: 1. For E$^2$PROM, 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 31.)

```
        M9036                                    H    H    K4   K
  26    ┤├                              ┤FROM 0000 00E2 M200 2 ]   Reads the remote input (RX20 to RX3F)
                                                                    data of buffer memory to M200-M231.
        X0000 X000F X0001 X0030
  36    ┤/├──┤├──┤├──┤├                        ┤PLS    M302 ]

        M302          Read setting
  43    ┤├                                     ┤SET    M303 ]

        M303                                        H
  45    ┤├                               ┤MOV   0074 D100 ]
                                                                    Writes alarm history No. 1, No. 2 reading
                                              H    H    K            code (74H) to RWw6.
                                    ┤TO    0000 01E6 D100 1 ]

                                              ┤SET    M115 ]        Switches on the instruction code execution
                                                                    request (RY2F).
        M215                               H    H    K
  61    ┤├                         ┤FROM 0000 02E7 D1   1 ]         Reads alarm data (RWr7) and reply code
                                              H    H    K           (RWr6) to D1 and D2 when the instruction
                                   ┤FROM 0000 02E6 D2   1 ]         code execution completion (RX2F) switches on.

                                              ┤RST    M115 ]        Switches off the instruction code execution
                                                                    request (RY2F).
                                              ┤RST    M303 ]

        M9036                              H    H    K4   K
  82    ┤├                          ┤TO    0000 0162 M100 2 ]       Writes M100-M131 data to the remote outputs
                                                                    (RY20 to RY3F) of buffer memory.
```
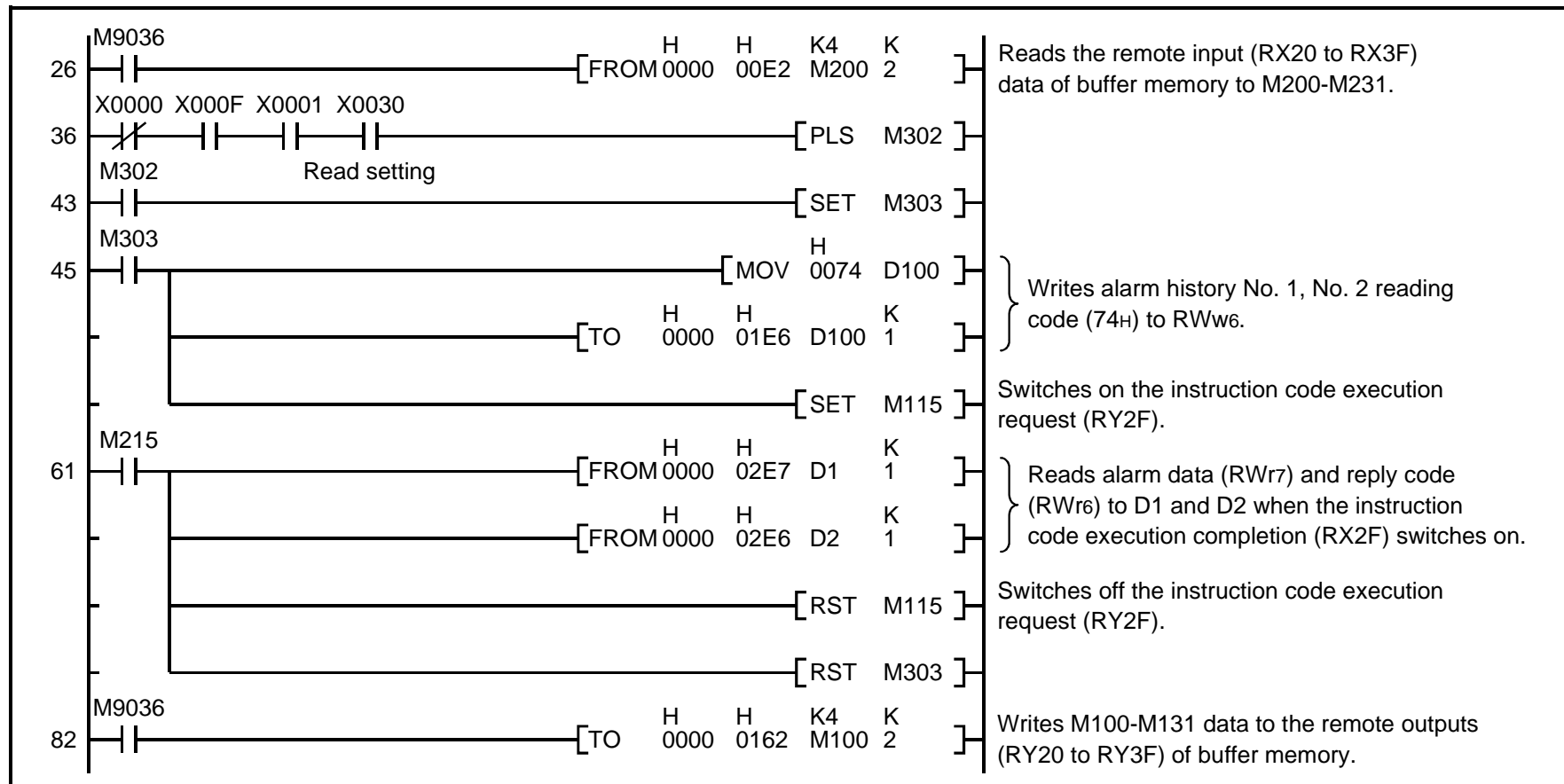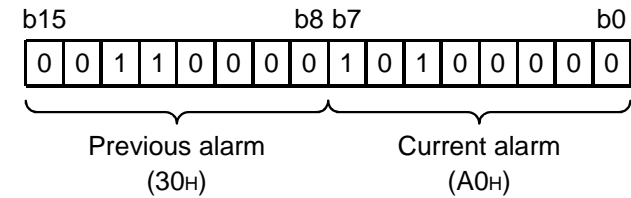
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2) Alarm definition display example

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.

Different inverters have different alarm definitions.

| Data | Definition | Data | Definition | Data | Definition |
|---|---|---|---|---|---|
| 00H | No alarm | 51H | E. UVT | B2H | E. RET |
| 10H | E. OC1 | 60H | E. OLT | C1H | E. CTE |
| 11H | E. OC2 | 70H | E. BE | C2H | E. P24 |
| 12H | E. OC3 | 80H | E. GF | D5H | E. MB1 |
| 20H | E. OV1 | 81H | E. LF | D6H | E. MB2 |
| 21H | E. OV2 | 90H | E. OHT | D7H | E. MB3 |
| 22H | E. OV3 | A0H | E. OPT | D8H | E. MB4 |
| 30H | E. THT | A1H | E. OP1 | D9H | E. MB5 |
| 31H | E. THM | A2H | E. OP2 | DAH | E. MB6 |
| 40H | E. FIN | A3H | E. OP3 | DBH | E. MB7 |
| 41H | —— | B0H | E. PE | F6H | E. 6 |
| 50H | E. IPF | B1H | E. PUE | F7H | E. 7 |

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## 6.10 Program Example for Resetting the Inverter at Inverter Error

1) The following program resets the inverter of station 2.

   The reply code at the time of instruction code execution is set to D2. (Refer to page 31.)

   For the program example, refer to page 33.
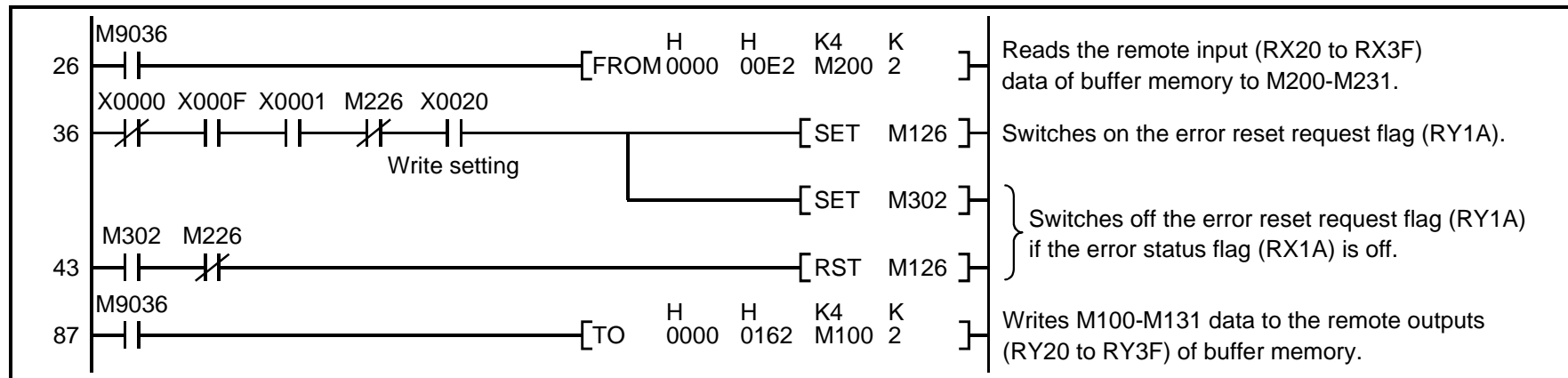


Note: 1. The above inverter reset using RY1A may be made only when an inverter error occurs.
      Also, inverter reset can be made independently of the operation mode.
   2. When using the instruction code execution request (RYF) with the instruction code (FD$_H$) and data (9696$_H$)
      to reset the inverter, set "1" in Pr. 341 "link start mode" (refer to page 13) or change the operation mode to
      the CC-Link operation mode. (For the program example, refer to page 33.)
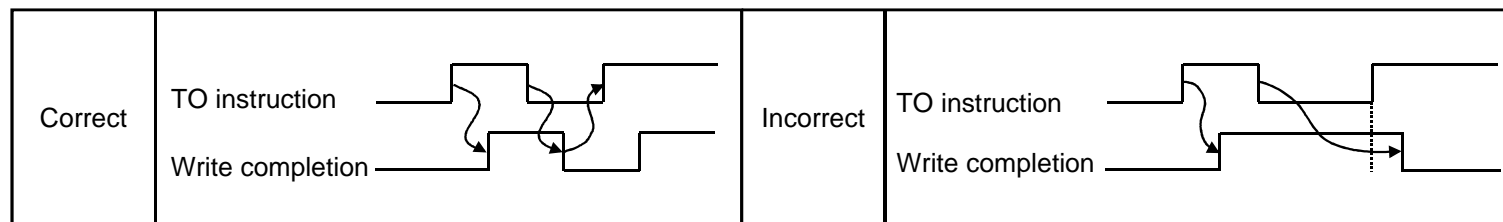
## 6.11  Instructions

(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.OP1 to E.OP3" if data communication stops, even instantaneously, 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.OP1 to E.OP3".
    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-A5NC) 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.
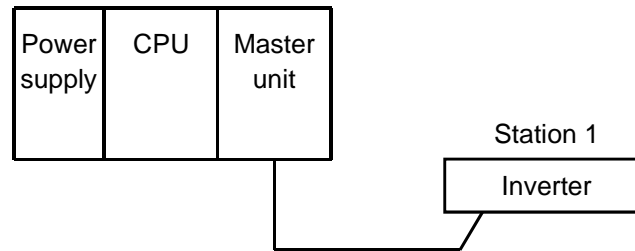
  2) Inverter does not start in CC-Link operation mode
    ・Check that the inverter is in the CC-Link operation mode.
    ・Check that the inverter starting program has been written correctly.
    ・Check that the inverter starting program is running.
    ・Check that the inverter is providing output.

# 7. HOW TO CHECK FOR ERROR USING THE LEDS

## 7.1 When One Inverter Is Connected

1) The following example indicates the causes of faults which may be judged from the LED states of the CC-Link unit (FR-A5NC) 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 the system configuration where one inverter is connected:
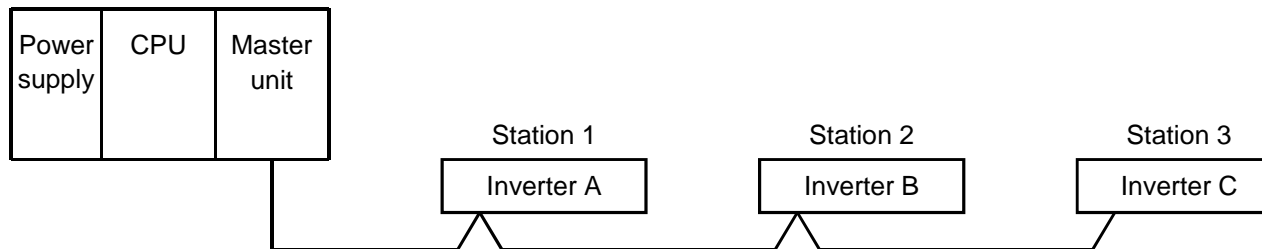
```
┌──────┬─────┬────────┐
│Power │ CPU │ Master │
│supply│     │  unit  │
│      │     │        │          Station 1
│      │     │        │      ┌──────────────┐
│      │     │        │──┐   │   Inverter   │
└──────┴─────┴────────┘  └───┴──────────────┘
```

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| LED Status | | | | | Cause |
|---|---|---|---|---|---|
| **RUN** | **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-A5NCs) 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 | Remote I/O unit | | | | |
| | Station 1 | Station 2 | Station 3 | | |
| TIME ○ LINE ○ or TIME ● LINE ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | Normal | ———— |
| | RUN ○ L. RUN ○ SD ○ RD ○ L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | Poor contact of the FR-A5NC with the inverter | Plug the FR-A5NC securely. Check the connector. |

| LED States | | | | Cause | Corrective Action |
|---|---|---|---|---|---|
| **Master unit** | **Remote I/O unit** | | | | |
| | **Station 1** | **Station 2** | **Station 3** | | |
| TIME ○ LINE ○ or TIME ● LINE ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ○ SD * RD * L. ERR ○ | RUN ● L. RUN ○ SD * RD * L. ERR ○ | Since the L.RUN LEDs of the FR-A5NCs 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. |
| | RUN ● L. RUN ○ SD * RD * L. ERR ○ | RUN ● L. RUN ○ SD * RD * L. ERR ○ | RUN ● 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. |
| | RUN ● L. RUN ○ SD * RD * L. ERR * | RUN ● L. RUN ○ SD * RD * L. ERR * | RUN ● 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

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## 7.3  Communication Stops During Operation

・Check that the CC-Link units and optical cables are fitted properly. (Check for contact fault, open cable, etc.)

・Check that the programmable controller program is executing reliably and that the PLC CPU is running.

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

| LED States | | | | Cause | Corrective Action |
|---|---|---|---|---|---|
| **Master unit** | **Inverters (FR-A5NC)** | | | | |
| | **Station 1** | **Station 2** | **Station 3** | | |
| TIME ○ LINE ○ or TIME ● LINE ○ | RUN ● <br> L. RUN ○ <br> SD * <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ○ <br> SD * <br> RD ● <br> L. ERR ○ | Since the L.RUN LEDs of the FR-A5NC on station 1 and the FR-A5NC 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. |
| | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ○ <br> SD ○ <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | Since the L.RUN and SD LEDs of the FR-A5NC on station 2 are off, the transmission speed setting of the FR-A5NC on station 2 is wrong within the setting range (0 to 4). | After correcting the transmission speed setting, switch power on again. |
| | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ⊙ | Since the L.ERR LED of the FR-A5NC on station 3 flickers, the setting switch of the FR-A5NC on station 3 was moved during normal operation. | After returning the setting switch of the FR-A5NC to the original position, power on the inverter again. |
| | RUN ● <br> L. RUN ○ <br> SD ○ <br> RD ● <br> L. ERR ● | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | RUN ● <br> L. RUN ● <br> SD ● <br> RD ● <br> L. ERR ○ | Since the L.RUN and SD LEDs of the FR-A5NC on station 1 are off and its L.ERR LED is on, the setting switch setting of the FR-A5NC 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-A5NC, switch power on again. |

| LED States | | | | Cause | Corrective Action |
|---|---|---|---|---|---|
| **Master unit** | **Inverters (FR-A5NC)** | | | | |
| | **Station 1** | **Station 2** | **Station 3** | | |
| TIME ● LINE ● or TIME ○ LINE ● | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ● | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | Since the L.ERR LED of the FR-A5NC on station 2 is on, the FR-A5NC itself on station 2 is affected by noise. (L.RUN may go off.) | Securely connect FG of each inverter and master unit to ground. |
| | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ● | RUN ● L. RUN ● SD ● RD ● L. ERR ● | Since the L.ERR LEDs of the FR-A5NCs 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) |
| | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● L. RUN ● SD ● RD ● L. ERR ○ | RUN ● 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

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**REVISIONS**

| Print Date | *Manual Number | Revision |
|---|---|---|
| Oct, 1997 | IB(NA)-66836-A | First edition |
| Jul, 1999 | IB(NA)-66836-B | Partial changes<br>• Terminal block arrangement<br>• Program examples<br><br>Additions<br>• Adaptable inverters |
|  |  |  |