MITSUBISHI

# TRANSISTORIZED INVERTER

– INSTRUCTION MANUAL –

## MELSECNET/MINI-S3

# FR-A5NN

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 tester or the like.
- 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.

## 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, oil or 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

# 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.

Note: This product may be used with inverters manufactured during and after November, 1997.
The inverter may be used with this unit if its SERIAL number indicated on the rating plate and package plate has the following version or later. (The SERIAL number on the package plate uses the 3 most significant digits of the following 6-digit control number and is indicated in 6 digits including the version symbol.)

| Model | SERIAL Number |
|---|---|
| FR-A520-0.4K, 0.75K, 11K to 22K | R7Y○○○○○○ |
| FR-A520-1.5K to 7.5K | Q7Y○○○○○○ |
| FR-A520-30K to 55K | G7Y○○○○○○ |
| FR-A540-0.4K to 22K | G7Y○○○○○○ |

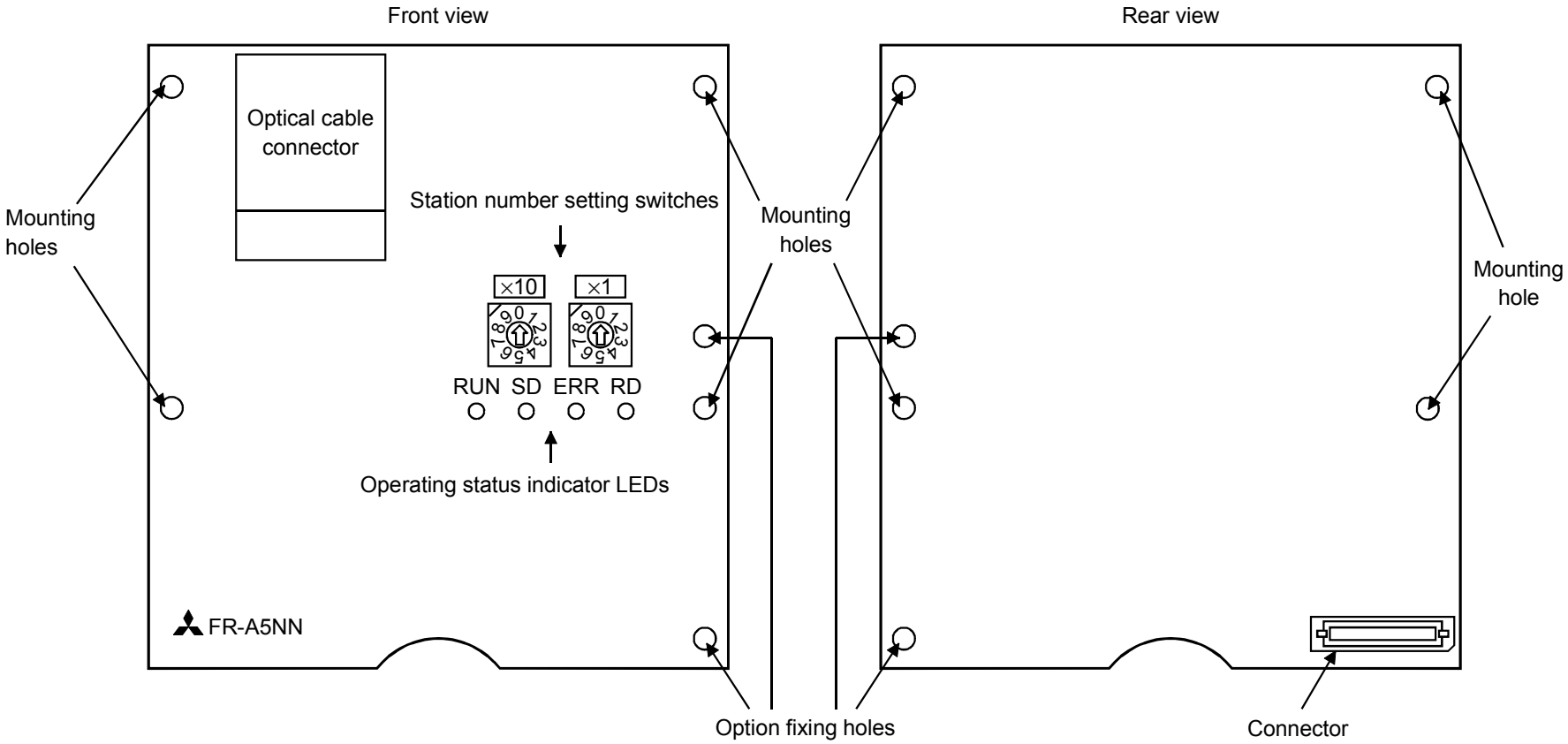
R 7 Y ○○○○○○
Symbol Year Month Control number
SERIAL number
SERIAL is made up of 1 version symbol and 8 numeric characters as shown above.

## 1.2 Packing Confirmation

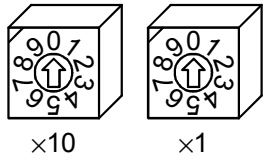
Make sure that the package includes the following accessories:

- Instruction manual ·····1
- Mounting screws M3 × 8 ·····4

## 1.3 Structure



(1) Nomeclature

| Name | Function |
|---|---|
| Optical cable connector | Used to connect optical cables.<br>Always connect the cables for MINI link.<br>RD · · · · · · · · · Receive cable<br>SD · · · · · · · · · Transmission cable |
| Station number setting switches |  Used to set the inverter station number between 1 and 61.<br>For details, refer to page 14. |
| Operating status indicator LEDs | RD · · · · · · · Lit during data receive. Dimly lit to indicate normal state.*<br>ERR · · · · · · · Lit to indicate receive data error. Extinguished to indicate normal communication.<br>SD · · · · · · · Lit during data transmission. Dimly lit to indicate normal state.*<br>RUN · · · · · · · Lit to indicate normal data transmission with the master station.<br>*: Extinguished to indicate alarm. |

## 1.4 Features

A programmable controller data link system (referred to as the "PC link") can be configured by connecting Mitsubishi transistorized inverters with the Mitsubishi MELSEC-A series general-purpose programmable controller data link system MELSECNET/MINI-3 (referred to as the "MINI link") using optical fiber cables.
PC link is a system designed to control and monitor the transistorized inverters from the programmable controller at a remote location.

(1) Factory Automation can be easily applied to inverters which are used as remote I/O stations in the MINI link system and are controlled and monitored by PC user programs.

(2) Various set values, such as motor acceleration/deceleration time, can be changed and checked from the PC.

(3) By using the AJ71PT32-S3 data link module as the master station, up to 16 inverters may be connected to the PC (if only inverters are connected).

(4) There is no need to worry about noise as optical cables are used to connect inverters in the PC link.

(5) The PC link unit is fitted to the connector in the inverter to ensure ease of installation and a saving of installation space.

(6) Plastic fiber cables are used as the optical fiber cables. Optical cable connectors can be machined easily by the user with a special-purpose tool kit.

## 1.5 Instruction

(1) In this manual, the link with the programmable controller is referred to as the "PC link".

# 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

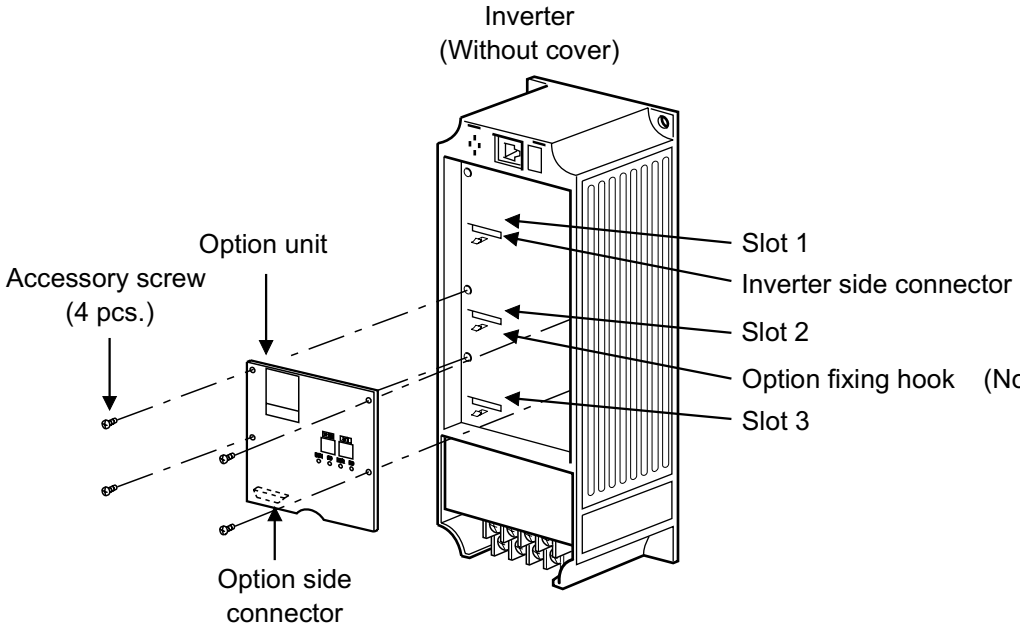
(1) Securely insert the connector of the option unit into the connector of slot 3 of the inverter. At this time, also fit the option fixing holes correctly. For the slot positions, refer to the next page.

(2) Securely fix 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 connections.

**⚠ CAUTION**

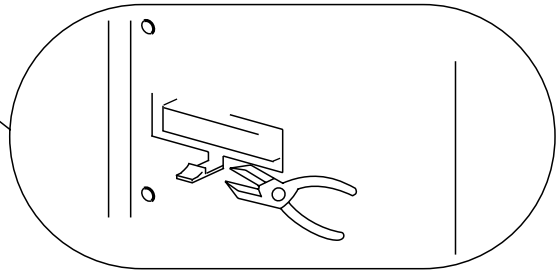
⚠ **When installing the inverter front cover, the cables to the inverter's control circuit terminals and the optical fiber cables should be routed properly in the wiring space to prevent them from being caught between the inverter and its cover.**

Note: This option unit uses two slots.
For routing the optical cables, use the space on the left-hand side of the control circuit terminal block.




(Note) When fitting an option unit, push it unitl it is fixed with the option fixing hook securely.
(The option fixing hooks are provided for inverters produced in and after August, 2000.)
Note that since this option unit (FR-A5NN) uses two slots, the fixing hook of slot 1 (slot 2) will interfere with the option unit fitted to slots 1, 2 (slots 2, 3). Using nippers etc., please cut off the hook that will interfere before fitting the option unit.

(Note)



Note 1. Only one option of the same type may be only 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. Remove the option unit carefully so that its connector is not damaged.

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

## 3.1 Wiring Example

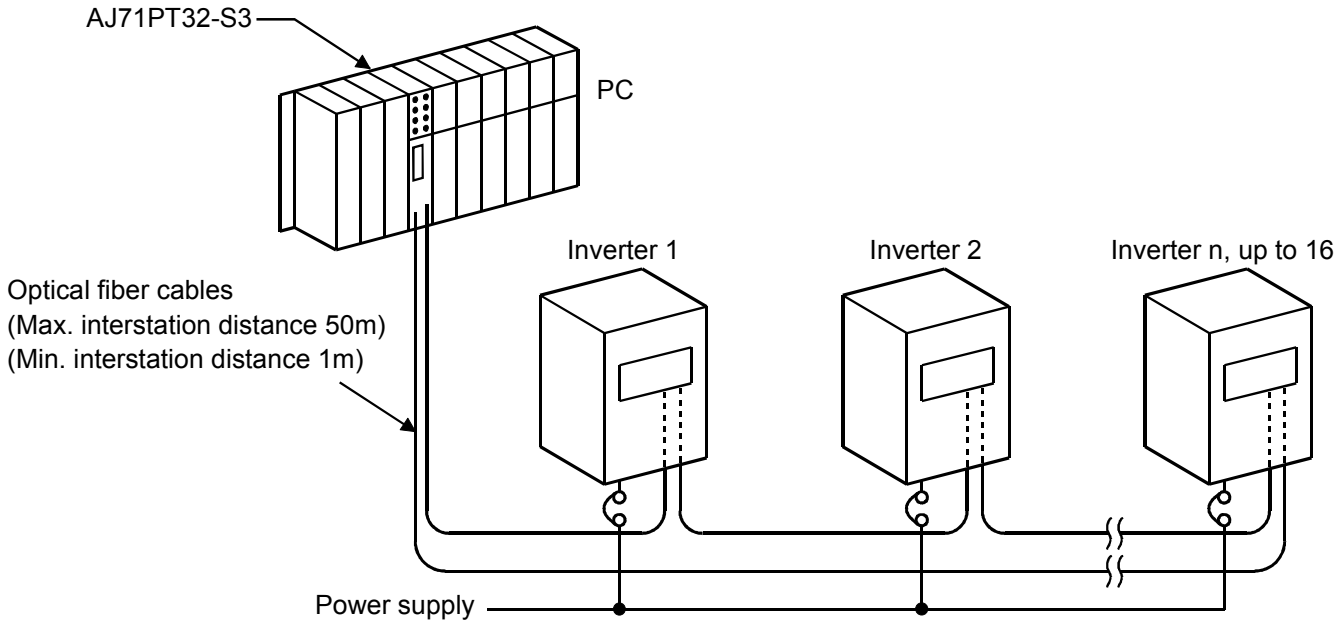
(1) PC side

Install the AJ71PT32-S3 to the main or extension base unit of the PC CPU used as the master station.

(2) Inverter side

Fit the MELSECNET/MINI-S3 unit (FR-A5NN) into the inverter.

(3) Connect the master station and the MELSECNET/MINI-S3 unit (FR-A5NN) with optical fiber cables.



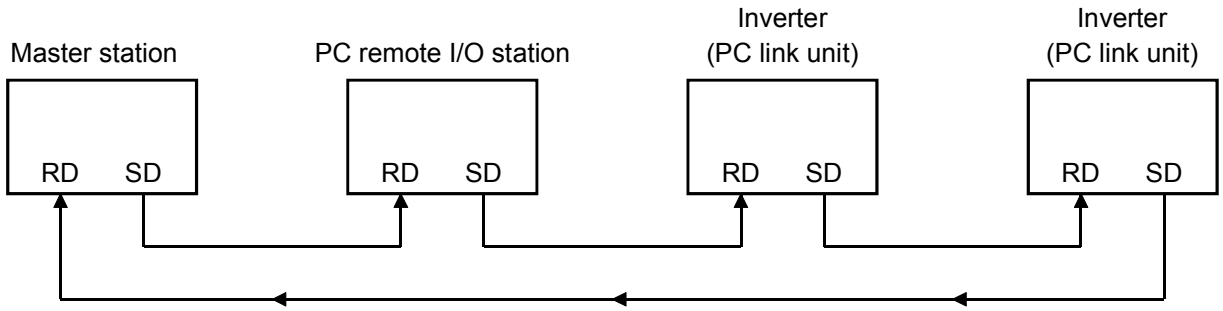
## 3.2 Optical Fiber Cables

### 3.2.1 Connection of optical fiber cables

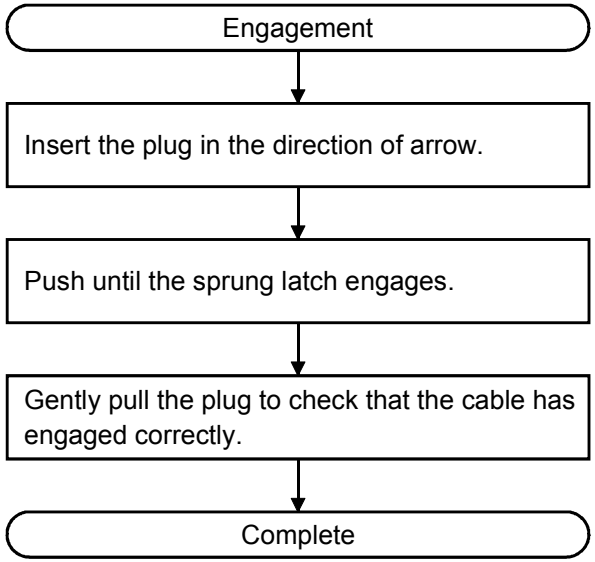
This section explains the connection, engagement and disengagement of optical fiber cables.

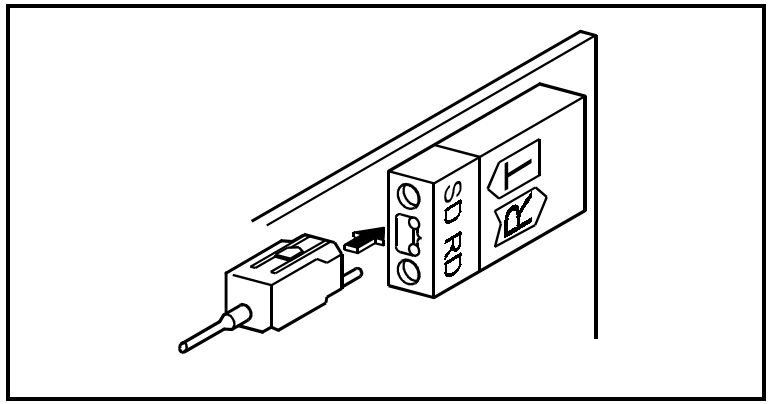
(1) Connection of PC and inverters

The station numbers of remote I/O station and PC link units may be set independently of the PC link cable connection sequence.

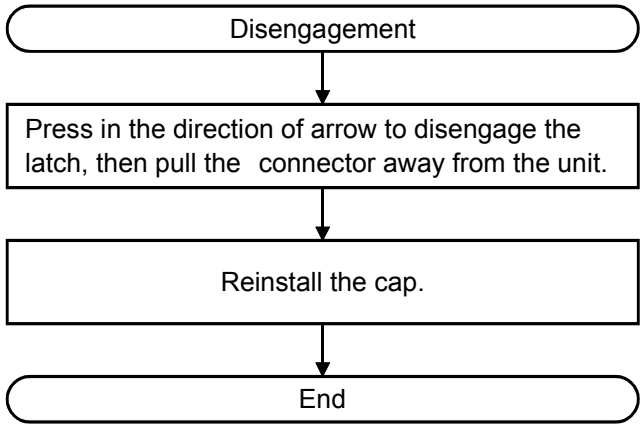


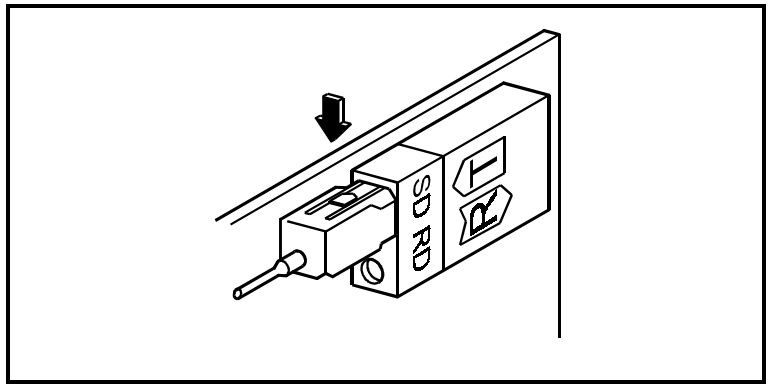

(2) Optical fiber cable engagement



(3) Optical fiber cable disengagement



(4) Optical fiber cables

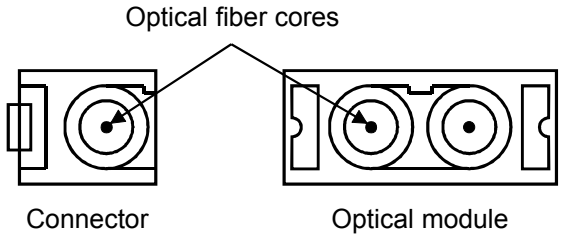
1) Optical fiber cable handling instructions

If optical fiber cables are handled roughly, they will be damaged. Therefore:

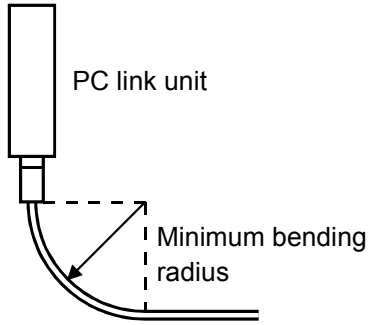
- Do not compress the cable with a sharp edge.
- Do not twist the cable roughly.
- Do not pull the cable roughly (more than permissible tension).
- Do not stamp on the cable.
- Do not put anything on the cable.
- Do not scratch the cable sheath.

**NOTE**

(1) Do not touch the optical fiber cores in the connector or optical module and protect them from dirt and dust.
When not in use, always fit the protective caps to the connector and optical module to prevent a data link fault that may occur due to transmission losses.




(2) Any optical fiber cable must not be bent within its minimum bending radius.




Handle the optical fiber cable with special care. If it is bent within its minimum bending radius, the optical fiber core may be broken, disabling the data link.
Minimum bending radius: 40mm

The following optical fiber cables conform to the required specifications and are available from Mitsubishi:

| Model Code | Cable Type | | Max. Interstation Distance |
|---|---|---|---|
| M-2P-☐M-A | PVC coated core cable (indoor standard type, UL Standard-compliant) | cable diameter 2.2mm | 50m |
| M-2P-☐M-B | Reinforced PVC coated core cable (indoor reinforced type) | cable diameter 5.0mm | |
| M-2P-☐M-C | PE coated core cable (indoor standard type) | cable diameter 2.2mm | |

☐ in the model code indicates the length of the optical fiber cable (unit: m).

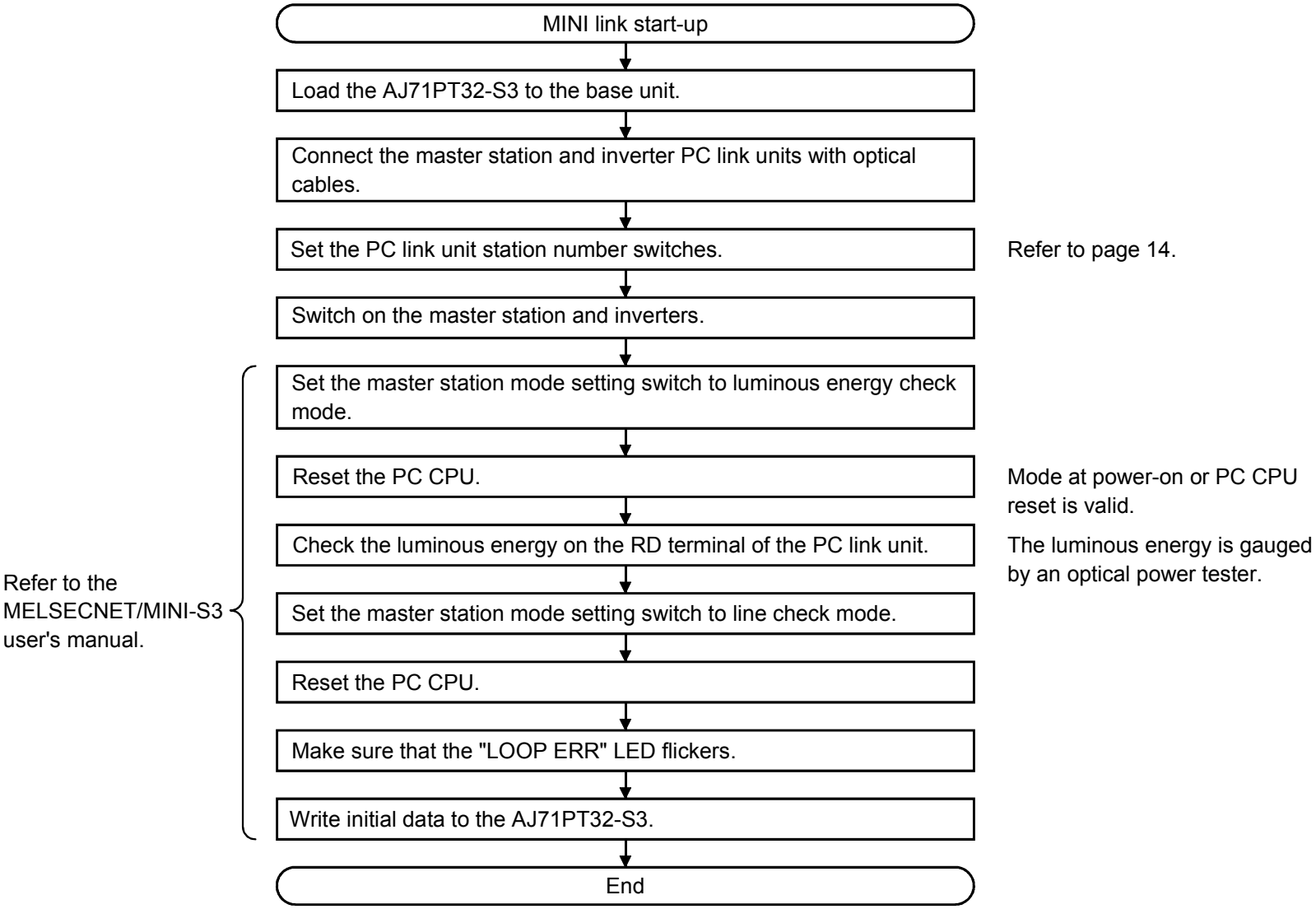
Example: PVC coated core cable of 40m
M-2P-40M-A

# 4. PRE-OPERATION PROCEDURE



## 4.1 Pre-Operation Settings and Procedures

Set the MINI link system in accordance with the following flowchart:



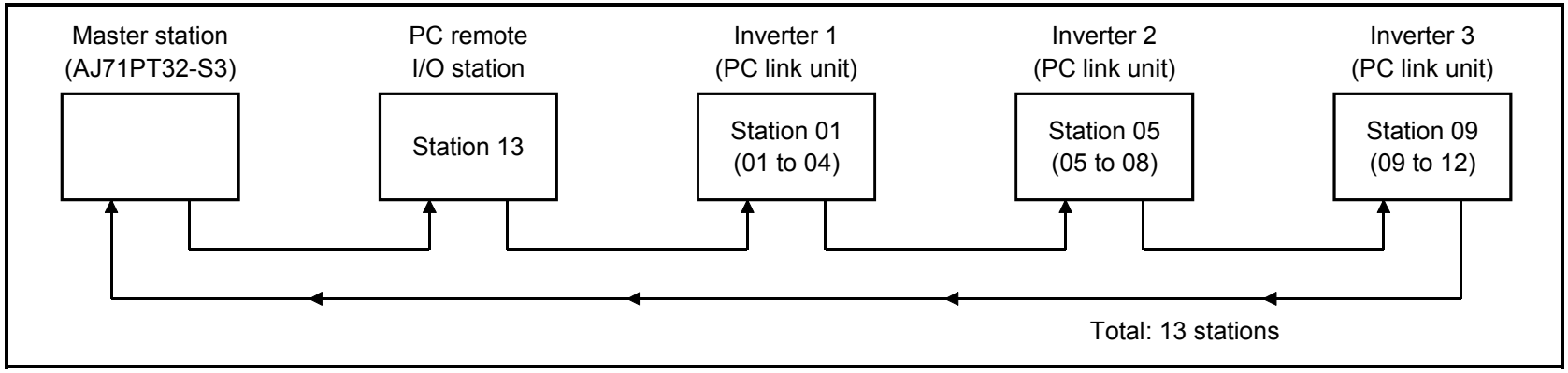
## 4.2 Instructions

1) During PC link operation, the inverter only accepts commands from the programmable controller 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 executed.
3) The inverter is brought to an alarm stop "E.OP2" or "E.OP3" if data communication stops, even instantaneously, due to a programmable controller fault, an open optical cable etc., during PC link operation.
4) If the communication start signal (Yn+18) of the master station is switched off during PC link operation, data communication stops and the inverter is brought to an alarm stop "E.OP2" or "E.OP3".
   To stop the PC link operation, switch the operation mode to the external operation once, then switch off the communication start signal (Yn+18).
5) When the power of any inverter is shut off, optical signals are cut off, data communication comes to a stop, and accordingly the other inverters within the same loop are also brought to an alarm stop.
   To continue the data communication of the other inverters, it is recommended to separate the control power supply of each inverter from the main power supply and connect it to the inverter terminals R1 and S1. Note that when the main power is restored, the corresponding inverter is reset and returned to the external operation mode. To resume the PC link operation, set the operation mode to the PC link operation using the programmable controller program.
   Note that setting "1" or "2" in Pr. 340 selects the PC link operation mode.
6) Do not set "1" in Pr. 77 "write inhibit selection" of the inverter. If the PC link mode is selected with this setting, all parameters will be write-inhibited. If this setting is made accidentally, switch power off once, remove the inboard option, then switch power on, and change the Pr. 77 setting to "0" or "2". Then, switch power off, mount the option, switch power on, and switch to the PC link mode.

## 4.3 Inverter Station Number Setting

Use the station number setting switches to set inverter station numbers. Set station numbers when I/O refresh is not being executed, noting the following:

1) Station numbers may be set between 1 and 61.
2) One inboard option occupies four stations. (four PC remote I/O stations).
   For example, one inverter defined as station 1 occupies stations 1 to 4. Hence, stations 1 to 4 cannot be used by the other units.
3) The I/O refresh range depends on the total number of stations (buffer memory address 0) which may be calculated from the number of PC remote I/O stations and PC link units connected in the same loop.
   For example, if there is one remote I/O station (there is one station as an example) and three inverters (PC link units), the total number of stations = 1 + (3 × 4) = 13.
4) Station numbers may be specified independently of the connection sequence, e.g. as shown below:



## 4.4 Operation Modes of the Inverter

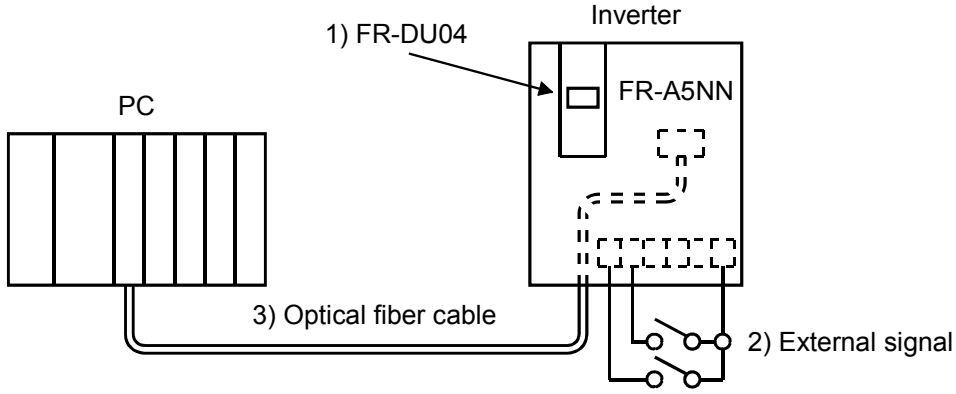
(1) Operation modes

The inverter mounted with the PC link unit has the following operation modes:

1) PU operation ····· Controls the inverter from the keyboard of the operation panel/parameter unit (FR-DU04/FR-PU04) (referred to as the "PU") installed to the inverter.

2) External operation····· Controls the inverter by switching on/off external signals to the control circuit terminals of the inverter. (The inverter is factory-set to this mode.)

3) PC link operation····· Controls the inverter in accordance with the PC user program via the MELSECNET/MINI-S3 unit (FR-A5NN).



(2) Operation mode switching

1) Operation mode switching conditions

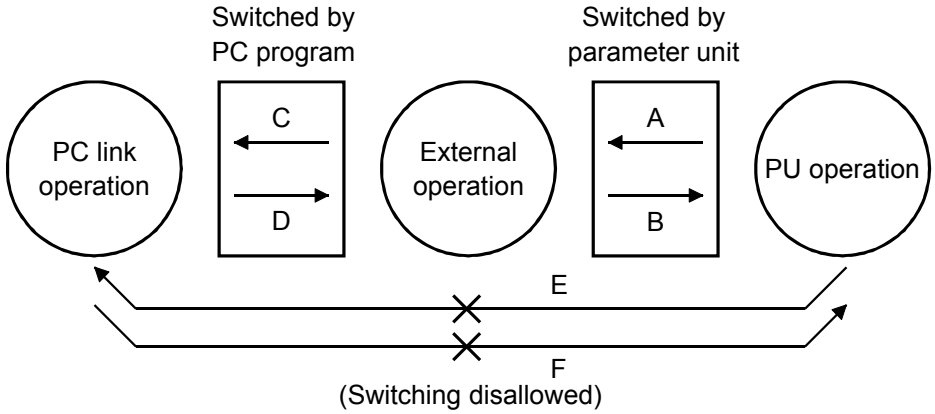
Before switching the operation mode, check that:

- The inverter is at a stop;
- Both the forward and reverse rotation signals are off; and
- The Pr. 79 "operation mode selection" setting is correct.
  (Use the parameter unit of the inverter for setting.)

| Setting | Operation Mode Selection | Switching to PC 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 only | Disallowed |
| 2 | External operation only | Allowed |
| 3 | External/PU combined operation | Disallowed |
| 4 | External/PU combined operation | Disallowed |
| 5 | Programmed operation | Disallowed (Parameter values write-enabled in the external operation mode may be changed) |
| 6 | Switch-over | Allowed |
| 7 | External operation (PU operation interlock) | Allowed only in the external operation mode when the PU interlock signal (X12) is on. |
| 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 sheet on the PU. |
| B | External operation → PU operation | Operate the PU operation key sheet on the PU. |
| C | External operation → PC link operation | By the user program of the PC (refer to page 52). |
| D | PC link operation → external operation | By the user program of the PC (refer to page 52). |
| E | PU operation → PC link operation | Switching disallowed/allowed if external operation is selected in A and PC link operation is then selected in C. (Note 2) |
| F | PC 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" or "2" is set in Pr. 340 "link start mode selection", the operation mode is computer link operation at power on or inverter reset.

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

3) Operation mode display

The operation mode is displayed on the PU as indicated below:

- PU operation ····· PU
- External operation ····· EXT
- PC link operation ····· NET

4) Operation mode at power on and instantaneous power failure

By setting the Pr. 340 "link start mode selection" value as appropriate, the operation mode at power on and at restoration from instantaneous power failure can be selected.

| Pr. 340 Setting | Operation Mode Name | | Mode at Power On or at Restoration from Instantaneous Power Failure |
|---|---|---|---|
| | Pr. 79 | | |
| 0 | 0 | PU or external operation | Inverter goes into the external operation mode. |
| | 1 | PU operation only | Inverter goes into the PU operation mode. |
| | 2 | External operation only | Inverter goes into the external operation mode. |
| | 3 | External/PU combined operation | 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 | 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 | Shift to the PU operation mode is controlled by ON/OFF of the X12 signal. |
| | 8 | External/PU combined operation mode | Operation mode is switched by ON/OFF of the X16 signal. |
| 1 | PC link operation | | Inverter goes into the PC link operation mode. (Program need not be used for switching) |
| 2 | PC link operation | | Inverter goes into the PC link operation mode. (Program need not be used for switching) For computer link operation. |

- The Pr. 340 value may be changed in any operation mode.
- When Pr. 79 "operation mode selection" = "0", "2", "6", "1" and "2" in Pr. 340 are made valid. When the other values are set, the Pr. 340 setting is made invalid.
- When performing MINI link operation, set "1" or "2" in Pr. 340.

## ⚠ CAUTION

⚠ **If an instantaneous power failure occurs with "2" set in Pr. 340 "link start mode selection", the inverter continues operation in the status prior to the instantaneous power failure.**

## 4.5 Setting of Control Location for Inverters

In the PC link operation mode, operation can be performed by signals from external terminals in accordance with the settings of Pr. 338 "operation command write" and Pr. 339 "speed command write".

| Control location selection | | | Operation command write (Pr. 338) | 0: PC | 0: PC | 1: External | 1: External | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | Speed command write (Pr. 339) | 0: PC | 1: External | 0: PC | 1: External | |
| Fixed functions (Functions equivalent to terminals) | | | Forward rotation command (STF) | PC | PC | External | External | |
| | | | Reverse rotation command (STR) | PC | PC | External | External | |
| | | | Start self-holding selection (STOP) | — | — | External | External | |
| | | | Output halt (MRS) | Both | Both | External | External | (Note 1) |
| | | | Reset (RES) | Both | Both | Both | Both | |
| | | | PC link operation frequency | PC | — | PC | — | |
| | | | 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) | PC | External | PC | External | Pr. 59 = 0 |
| | | 1 | Middle-speed operation command (RM) | PC | External | PC | External | Pr. 59 = 0 |
| | | 2 | High-speed operation command (RH) | PC | External | PC | External | Pr. 59 = 0 |
| | | 3 | Second function selection (RT) | PC | PC | 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) | PC | External | PC | External | Pr. 59 = 0 |
| | | 9 | Third function (X9) | PC | PC | External | External | |
| | | 10 | FR-HC connection, inverter operation enable (X10) | External | External | External | External | |
| | | 11 | FR-HC connection, instantaneous power failure detection (X11) | External | External | External | External | |
| | | 12 | PU external interlock (X12) | External | External | External | External | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Selective functions | Pr. 180 to Pr. 186 settings | 13 | External DC dynamic braking start (X13) | PC | PC | External | External | |
| | | 14 | PID control valid terminal (X14) | PC | External | PC | External | |
| | | 15 | Brake opening completion signal (BRI) | PC | PC | External | External | |
| | | 16 | PU operation-external operation switching (X16) | External | External | External | External | |
| | | 17 | Load pattern selection-forward/reverse rotation boost switching (X17) | PC | PC | External | External | |
| | | 18 | Magnetic flux-V/F switching (X18) | PC | PC | External | External | |
| | | 19 | Load torque high-speed frequency (X19) | PC | PC | External | External | |
| | | 22 | Orientation command | PC | PC | External | External | (Note 2) |
| RH, RM, RL, RT selection functions | | | Remote setting (RH, RM, RL) | PC | External | PC | External | Pr. 59 = 1, 2 |
| | | | Programmed operation group selection (RH, RM, RL) | — | — | — | — | Pr. 79 = 5 PC link operation disallowed |
| | | | Stop-on-contact selection 0 (RL) | PC | External | PC | External | Pr. 270 = 1, 3 |
| | | | Stop-on-contact selection 1 (RT) | PC | PC | External | External | |

[Explanation of table]

External : Control by signal from external terminal is only valid.
PC : Control from sequence program is only valid.
Both : Control from both external terminal and PC is valid.
— : Control from both external terminal and PC is invalid.
Compensation : Control by signal from external terminal is only valid if Pr. 28 (multi-speed input compensation) setting is 1.

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.

# 5. FUNCTIONS



## 5.1 Function Block Diagram

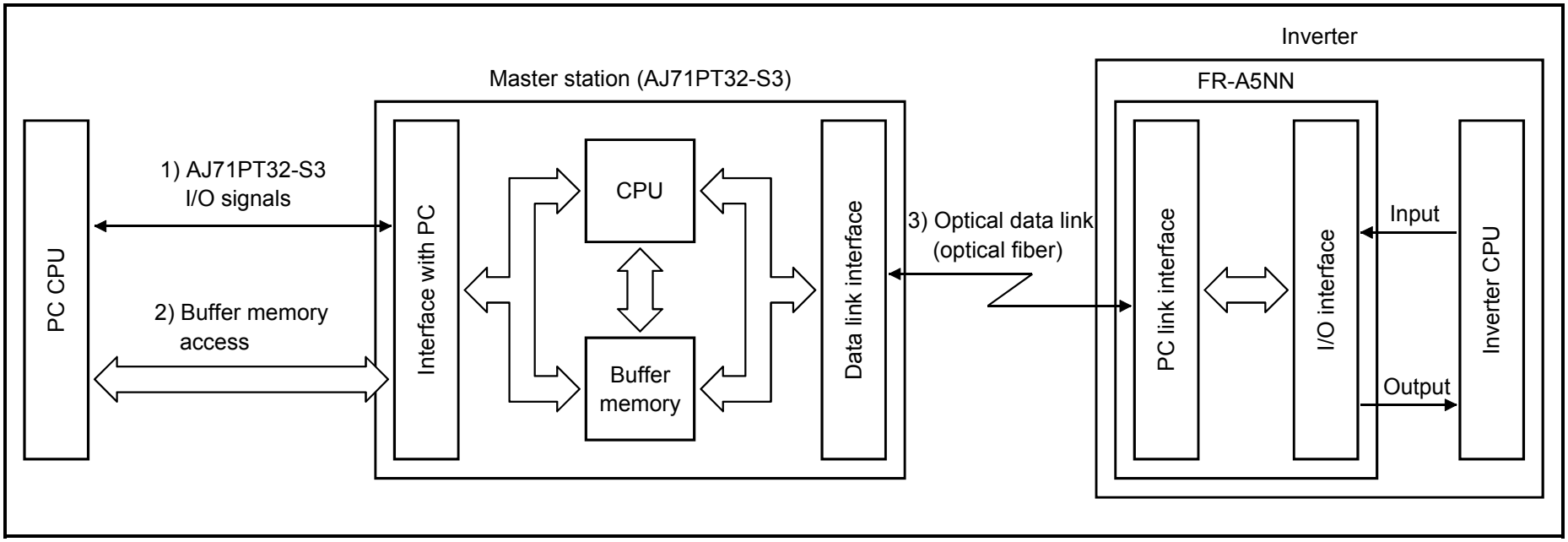
Using function blocks, this section explains I/O data transfer to/from an inverter in PC link operation mode:

(1) I/O refresh is continuously executed between the master station (AJ71PT32-S3) and inverter at intervals of 3.5ms to 18ms (512 points).

(2) I/O refresh and master station sequence program are executed asynchronously.

(3) Input data from the inverter is read from the AJ71PT32-S3 buffer memory by the FROM instruction.

(4) Output data to the inverter is written to the AJ71PT32-S3 buffer memory by the TO instruction.




1) I/O signals assigned to the AJ71PT32-S3. These signals are used for communication between the PC CPU and AJ71PT32-S3.
   For further details of the I/O signals, refer to page 27.
2) Allows input data to be read, output data to be written, and a PC link faulty station to be read, etc. Buffer memory is accessed by the FROM and TO instructions in the sequence program. For full information on the buffer memory, refer to page 30.
3) PC link start is directed from the sequence program. After PC link is initiated, I/O refresh is continually executed independently of the sequence program execution.

## 5.2 Functions

The following table lists the functions which can be executed from the PC in the PC link operation mode:

| Item | Operation Mode | | |
|---|---|---|---|
| | PC link operation | External operation | PU operation |
| Monitoring | Allowed | Allowed | Allowed |
| Operation | Allowed | Disallowed | Disallowed |
| Parameter write | Allowed (Note 1) | Disallowed | Disallowed |
| Parameter read | Allowed | Allowed | Allowed |
| Inverter reset | Allowed (Note 2) | Disallowed | Disallowed |

Note 1. Parameters cannot be written during inverter operation.
2. When a PC link fault occurs, the inverter cannot be reset from the PC.

(1) Monitoring

The following items can be monitored by the PC:

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 HF3
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 5) are read from the buffer memory by setting the corresponding code numbers when needed.
Item 6) can be read from the buffer memory at any time.

(2) Operation commands

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

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

The input signals marked *1 can be changed using Pr. 180 to Pr. 186 (input terminal function selection).

(3) Running frequency

The running frequency is written from the PC to the inverter when it is changed ····· Binary in 0.01Hz increments
When changing the frequency continuously, always write the data to the inverter RAM.
The number of $E^2$PROM registration times is limited to "10,000 times".

(4) Parameter write

Functions can be written from the PC. Note that write during inverter operation will result in code mismatch (write mode error).
For the parameter data code list, refer to the inverter manual.

(5) Parameter read

Functions can be read to the PC.
For the parameter data code list, refer to the inverter manual.

# 6. PROGRAMMING USING THE PC



## 6.1 Programming

This section describes the programming method for use of MINI link.

(1) I/O list for the PC CPU

The I/O signals of the AJ71PT32 transferred to/from the PC CPU are as indicated below. Numbers following X and Y depend on the head address of the slot being used for the AJ71PT32.

The following I/O numbers assume that the AJ71PT32 is loaded on slot 0 of the main base unit with a building block type CPU.

| Device No. | Signal |
|---|---|
| X0 | Hardware fault |
| X1 | MINI link communicating |
| X2 | Reserved |
| X3 | |
| X4 | |
| X5 | Test mode |
| X6 | MINI link error detection |
| X7 | MINI link communication error |
| X8 to X1F | Reserved |

| Device No. | Signal |
|---|---|
| Y0 to Y17 | Reserved |
| Y18 | MINI link communication start |
| Y19 | Reserved |
| Y1A | FROM/TO instruction response designation |
| Y1B | Faulty station data clear designation |
| Y1C | Reserved |
| Y1D | Error reset |
| Y1E<br>Y1F | Reserved |

(2) 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) 10ms to 30ms after data is written or read, confirmation data and code are written from an inverter to the buffer memory of the master station. At this time, a match check must be made. Otherwise, the previously requested code and data will be read.

3) To prevent a wrong request from being accepted, the inverter accepts a change request and returns change confirmation data and code some time (approx. 10ms) after a request code and data have been changed from the master station. Hence, if a request code and data are changed before the change of the confirmation data and code is completed by the match check, the inverter does not rely on the change request and accordingly does not accept the change request.
   When the change is not accepted, the previous confirmation data and code are returned, and data and code mismatch is repeated.
4) By preparing data, the operation commands and data write/read request can be written at the same time. Also, the inverter status, code and data can be read at the same time.

### 6.1.1 Explanation of I/O signals

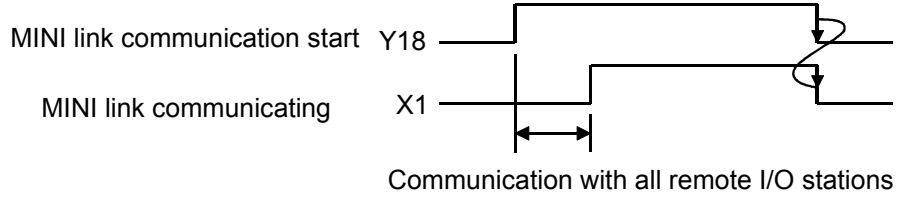
This section describes the ON/OFF timings, conditions, etc. of the I/O signals. Device numbers within parentheses correspond to those in the table on page 26.

(1) Hardware fault (X0)

1) On indicates that the AJ71PT32's mode setting switch has been set to any of "6 to 9" or a hardware fault has occurred.
2) Used as an interlock for the FROM/TO instruction to the AJ71PT32.

(2) MINI link communicating (X1)

1) On indicates that the master station (AJ71PT32) has communicated with the remote I/O stations and inverters after Y18 (MINI link communication start) is switched on.
2) Switched off when Y18 is switched off.
3) Off indicates that a data communication stop error has occurred.
4) Used as an interlock to execute the FROM/TO instruction for the AJ71PT32.



(3) Test mode (X5)

On indicates that power is switched on with the mode setting switch in any of "3 to 5".

(4) MINI link error detection (X6) · · · · · · · · · · · Communication continued

On indicates that the master station has detected an error in receive data from a remote I/O station or an inverter.

1) After X6 is switched on, its state depends on the mode setting as follows:
   · Automatic online return mode
     X6 is switched off after normal communication is restored.
   · No automatic online return mode
     X6 remains on.
2) The corresponding error code is stored to buffer memory address 108 when X6 is switched on.
   The error code is latched. For further details, refer to page 30.

(5) MINI link communication error (X7) · · · · · · Communication stopped

On indicates that the master station is unable to communicate with remote I/O stations and inverters.

1) X7 is switched on when:
   · Any remote I/O station or inverter is switched off;
   · Any PC link cable is broken; or
   · A communication error has occurred with the mode setting specified for communication stop at the time of online error detection.
2) The corresponding error code is stored to buffer memory address 107 when X7 is switched on.

(6) MINI link communication start (Y18)

1) Switch on to start I/O refresh.
2) X1 is switched on to indicate normal communication with all remote I/O stations.
3) The FROM area (buffer memory addresses 70 to 209) is cleared when Y18 is switched on.

(7) FROM/TO instruction response designation (Y1A)

Defines priority of access to the AJ71PT32 buffer memory.

1) Off indicates that the AJ71PT32-S3 processing has priority.

2) On indicates that the PC CPU's FROM/TO instruction has priority.

3) The ON/OFF status of Y1A defines the following:

| FROM/TO Instruction Response Designation (Y1A) / Item | OFF | ON |
|---|---|---|
| Access to buffer memory | Priority given to AJ71PT32-S3. | Priority given to PC CPU's FROM/TO instruction. |
| Receive (input) data read from several stations by one FROM instruction | The receive data refreshed at the same timing is read. | The receive data refreshed at different timings is read. |
| FROM/TO instruction processing time | There is a delay of 0.3ms max. | No delay. |

(8) Faulty station data clear designation (Y1B)

Specify whether the receive data from a faulty remote I/O station or inverter is cleared or not.

1) On indicates that the receive data from a faulty station is cleared.

2) Off indicates that the receive data from a faulty inverter is cleared.

3) Y1B is independent of the transmission data to a faulty station.

| Faulty Station Data Clear Designation (Y1B) / AJ71PT32 Buffer Memory | OFF | ON |
|---|---|---|
| Transmission data (addresses 10 to 41) | ——— | ——— |
| Receive data (addresses 110 to 141) | Data at occurrence of communication error is retained. | All points are switched off. |

**NOTE**

When switching on the faulty station data clear designation signal, it is recommended to set the mode setting switch to the no automatic return mode.

(9) Error reset (Y1D)

Used to reset an error when X6 or X7 is switched on.

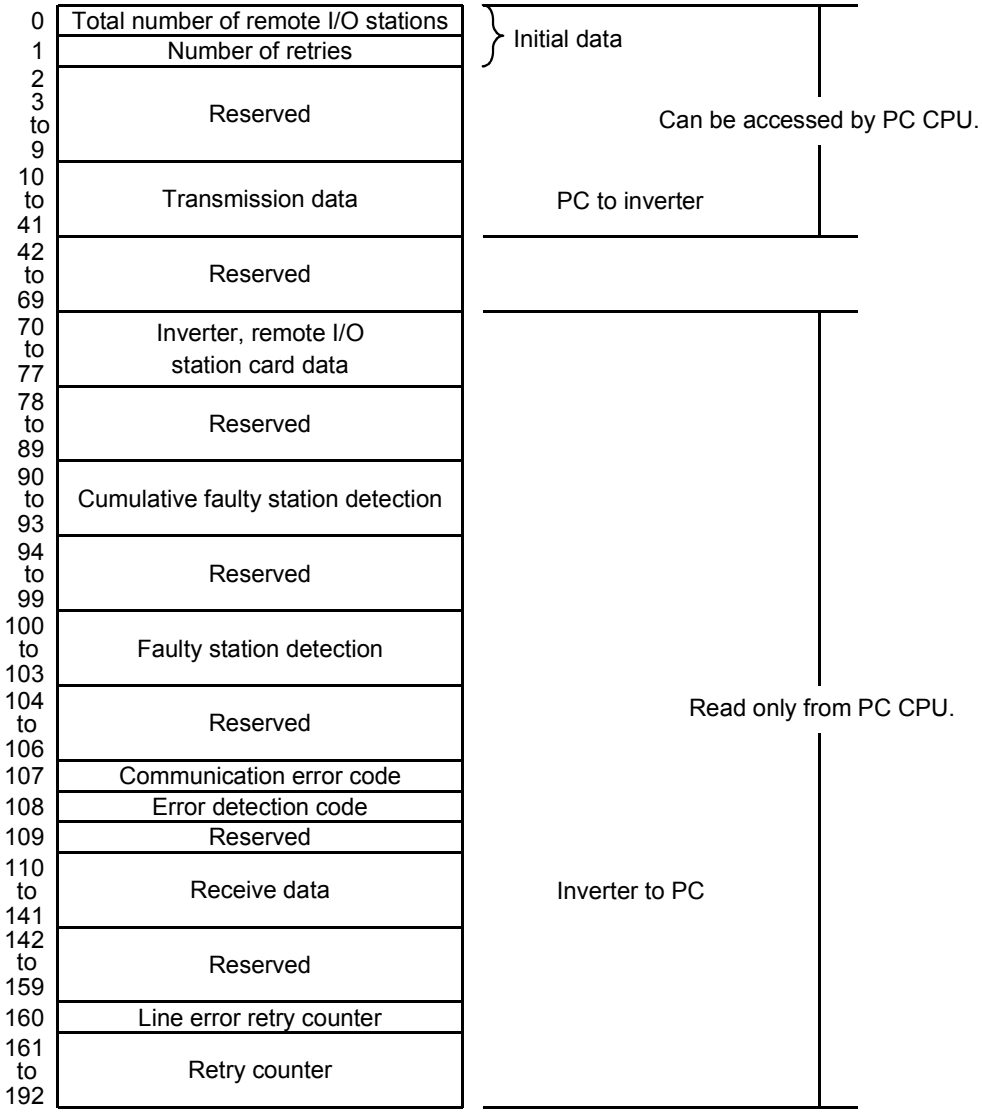
1) The error indicated by X6 or X7 can be reset by switching on Y1D when Y18 is off.
2) Clears the communication error code (buffer memory address 107) and error detection code (address 108).
3) Switches off the corresponding input signal (X6, X7).
4) ERR. LED reset
   Switches off the corresponding error indicator LED (line error LED 4, faulty station LED 5).

## 6.2 Buffer Memory

The AJ71PT32 has a buffer memory (not battery backed) for communication of data with the PC CPU.
For data transfer using the sequence program, refer to page 41.

(1) Buffer memory assignment

Address (Decimal)



**NOTE**

(1) The buffer memory is cleared and 5 is written to address 1 (number of retries) when the PC CPU is switched on or reset.
(2) Data must not be written to addresses other than 0, 1 and 10 to 41 from the PC CPU.
(3) The reserved areas are used by the AJ71PT32 system.
(4) Data in the read-only areas including the reserved areas can be read from the PC CPU sequentially, e.g. data can be read from the cumulative faulty station detection (addresses 90 to 93) and faulty station detection (addresses 100 to 103) areas by using one FROM instruction.

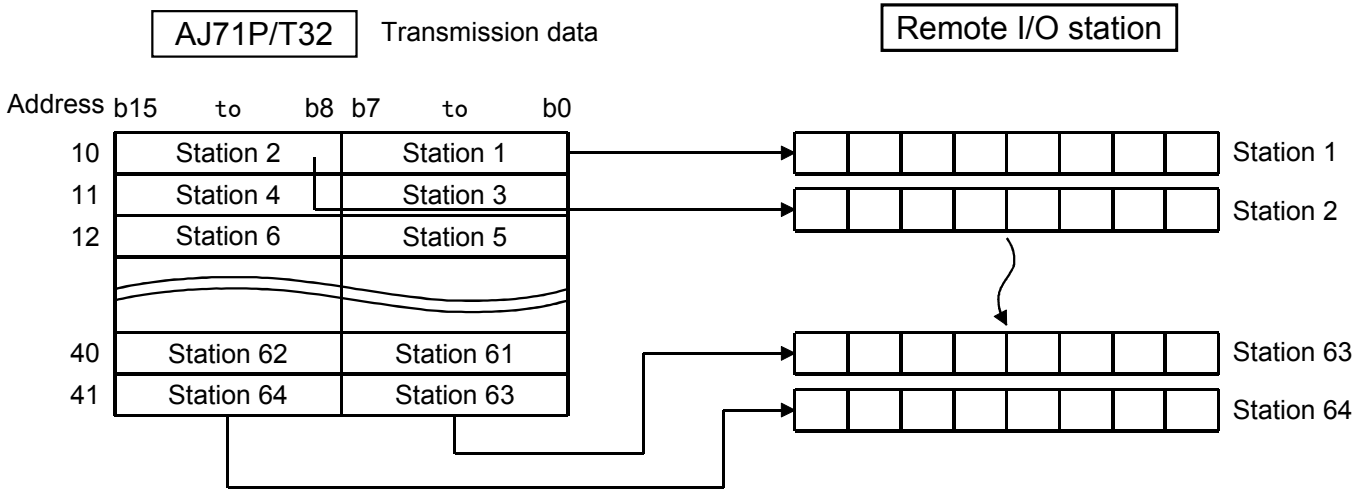
(2) Buffer memory and data location

Buffer memory and data location are described below:

1) Total number of remote I/O stations (address 0)
(a) Define the remote I/O and inverter station range for I/O refresh.
(b) I/O refresh is performed for up to the remote I/O stations and inverter stations specified in address 0.
For example, remote I/O stations 1 to 20 are refreshed when 20 is set to address 0.
(c) Specify the last remote I/O or inverter station number connected to the master station (AJ71PT32-S3).
(d) Defaults to 0.
(e) Any value between 1 and 64 may be specified. Any value set outside the range flags an initial data error when Y18 is switched from OFF to ON.
(f) The total number of remote I/O stations should be written to address 0 with Y18 off as the value on the leading edge of Y18 is valid.

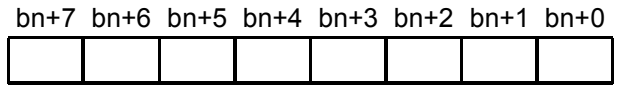
2) Number of retries (address 1)
   (a) Define the number of retries made to the faulty remote I/O station or inverter.
   (b) Defaults to 5.
   (c) Any value between 0 and 32 may be specified.
   (d) The number of retries should be written to address 1 when Y18 is off as the value on the leading edge of Y18 is valid.
   (e) A communication error occurs if the faulty remote I/O station cannot be restored after retry is made the specified number of times.

3) Transmission data (addresses 10 to 41)
   (a) Output to the remote I/O or inverter stations.
   (b) Buffer memory assignment is as follows:



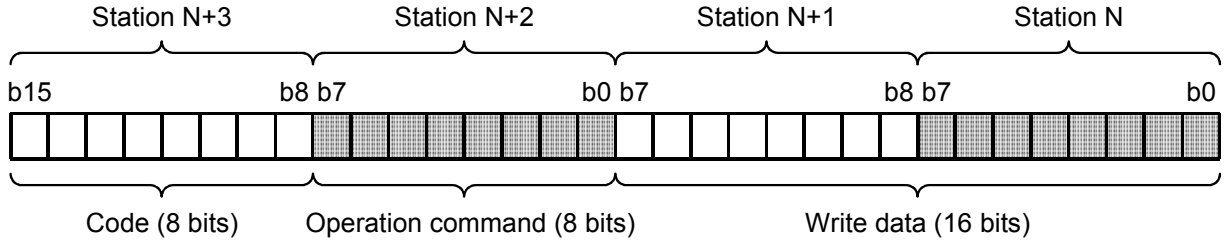

Note: One inverter occupies the addresses of four stations.

(c) Transmission data is made up of 8 bits per remote I/O station as shown below:




*: n depends on the remote I/O station number.
b0 to b7 for odd-numbered stations 1, 3, ····· 63
b8 to b15 for even-numbered stations 2, 4, ····· 64

(d) One inverter (PC link unit) has 32 bit locations (for four stations) as shown below:




*: N (odd number) depends on the inverter station number.
(If N is an even number, the program will be complicated.)

· Code ····· Represents a type of data communication such as read, write and parameter number. For the code list, refer to the inverter manual.

· Operation command b0: ····· AU*
b1 ····· Forward rotation (STF)
b2 ····· Reverse rotation (STR)
b3 ····· Low speed (RL)*
b4 ····· Middle speed (RM)*
b5 ····· High speed (RH)*
b6 ····· Second acceleration/deceleration (RT)*
b7 ····· Inverter output halt (MRS)

1: ON
0: OFF

The input signals marked * can be changed using Pr. 180 to Pr. 186 (input terminal function selection).

· Write data ····· Specific data such as parameter value or running frequency. Any value may be specified when monitoring, parameter read, etc. is executed.

4) Remote I/O station card data (addresses 70 to 77)
   (a) Stores the card data of the I/O units used as the remote I/O stations.
   (b) There are three types of card data which are expressed in two bits.
      00: Indicates that there are no remote I/O stations or the station could not make initial communication.
      01: Indicates an input remote I/O station or inverter.
      10: Indicates an output remote I/O station.
   (c) Data make-up is as indicated below:

| | b15 b14 | b13 b12 | b11 b10 | b9 b8 | b7 b6 | b5 b4 | b3 b2 | b1 b0 |
|---|---|---|---|---|---|---|---|---|
| 70 | Station 8 | Station 7 | Station 6 | Station 5 | Station 4 | Station 3 | Station 2 | Station 1 |
| 71 | Station 16 | Station 15 | Station 14 | Station 13 | Station 12 | Station 11 | Station 10 | Station 9 |
| 72 | Station 24 | Station 23 | Station 22 | Station 21 | Station 20 | Station 19 | Station 18 | Station 17 |
| | | | | | | | | |
| | | | | | | | | |
| 76 | Station 56 | Station 55 | Station 54 | Station 53 | Station 52 | Station 51 | Station 50 | Station 49 |
| 77 | Station 64 | Station 63 | Station 62 | Station 61 | Station 60 | Station 59 | Station 58 | Station 57 |

   (d) Remote I/O station card data is processed only once when Yn+18 is switched from OFF to ON.

5) Cumulative faulty station detection (addresses 90 to 93)
   (a) Sets 1 to the bit corresponding to the faulty remote I/O or inverter station.
   (b) The corresponding bit is not reset to 0 if the faulty station is restored.
      Addresses 90 to 93 indicate cumulative faulty stations indicated in the faulty station detection area (addresses 100 to 103).
   (c) Reset to 0 when Yn+18 is switched on.
   (d) Data make-up is as indicated below:

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | Station 16 | Station 15 | Station 14 | Station 13 | Station 12 | Station 11 | Station 10 | Station 9 | Station 8 | Station 7 | Station 6 | Station 5 | Station 4 | Station 3 | Station 2 | Station 1 |
| 91 | Station 32 | Station 31 | Station 30 | Station 29 | Station 28 | Station 27 | Station 26 | Station 25 | Station 24 | Station 23 | Station 22 | Station 21 | Station 20 | Station 19 | Station 18 | Station 17 |
| 92 | Station 48 | Station 47 | Station 46 | Station 45 | Station 44 | Station 43 | Station 42 | Station 41 | Station 40 | Station 39 | Station 38 | Station 37 | Station 36 | Station 35 | Station 34 | Station 33 |
| 93 | Station 64 | Station 63 | Station 62 | Station 61 | Station 60 | Station 59 | Station 58 | Station 57 | Station 56 | Station 55 | Station 54 | Station 53 | Station 52 | Station 51 | Station 50 | Station 49 |

1: Error
0: Normal

6) Faulty station detection (addresses 100 to 103)

(a) Sets 1 to the bit corresponding to the faulty remote I/O or inverter station.

(b) In automatic return mode, the corresponding bit is reset to 0 when the faulty station is restored. In no automatic return mode, the corresponding bit remains as 1. Data is held when Y18 is off.

(c) Any faulty station is detected when Y18 is on.

(d) Data make-up is as indicated below:

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Station 16 | Station 15 | Station 14 | Station 13 | Station 12 | Station 11 | Station 10 | Station 9 | Station 8 | Station 7 | Station 6 | Station 5 | Station 4 | Station 3 | Station 2 | Station 1 |
| 101 | Station 32 | Station 31 | Station 30 | Station 29 | Station 28 | Station 27 | Station 26 | Station 25 | Station 24 | Station 23 | Station 22 | Station 21 | Station 20 | Station 19 | Station 18 | Station 17 |
| 102 | Station 48 | Station 47 | Station 46 | Station 45 | Station 44 | Station 43 | Station 42 | Station 41 | Station 40 | Station 39 | Station 38 | Station 37 | Station 36 | Station 35 | Station 34 | Station 33 |
| 103 | Station 64 | Station 63 | Station 62 | Station 61 | Station 60 | Station 59 | Station 58 | Station 57 | Station 56 | Station 55 | Station 54 | Station 53 | Station 52 | Station 51 | Station 50 | Station 49 |

1: Error
0: Normal

7) Communication error code (address 107)

(a) Stores the corresponding error code when X7 is switched on.

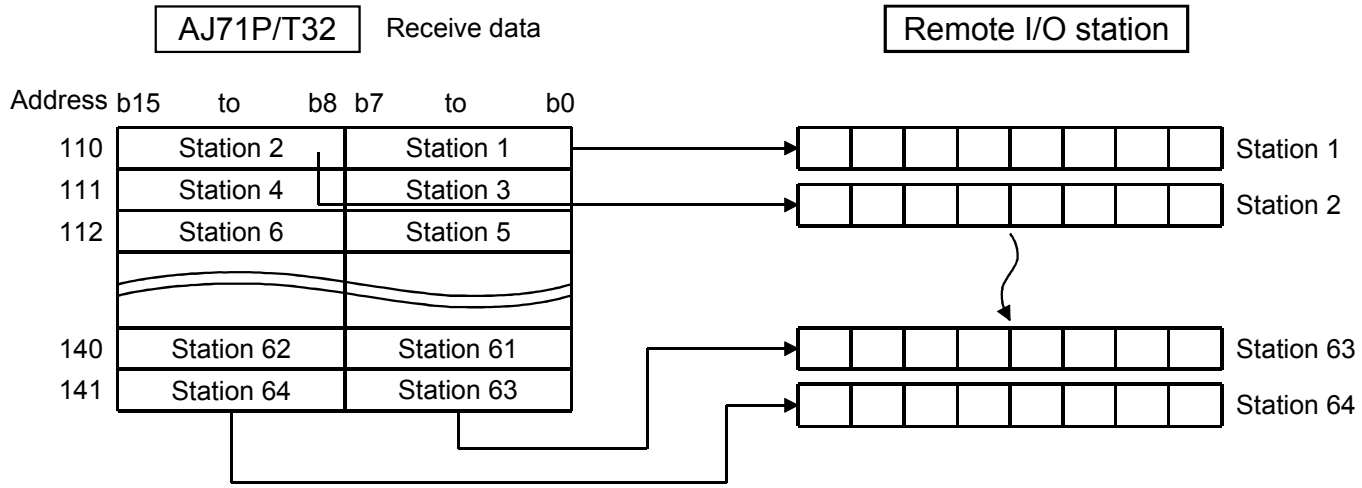
(b) Communication error codes are as follows:

| Code | Definition | Cause |
|---|---|---|
| 0 | No error | ——— |
| 1 | Initial data error | The number of remote I/O stations or retries is invalid. |
| 2 | Line error | A link cable is broken or a remote I/O or inverter station power is off. |
| 3 | Station fault | Communication has stopped due to a station fault with communication stop mode specified for fault detection. |

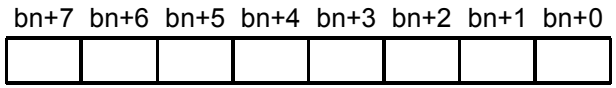
(c) The communication error code is reset to 0 when Y18 or Y1D is switched on.

8) Error detection code (address 108)
   (a) 1 indicates that X6 has been switched on. 0 indicates normal.
   (b) In automatic return mode (mode setting switch: 0), the error detection code remains 1 but X6 is switched off when communication is restored.
   (c) Reset to 0 when Y18 or Y1D is switched on.

9) Receive data (addresses 110 to 141)
   (a) Stores the ON/OFF data input to the remote I/O and inverter stations.
   (b) Buffer memory assignment is as indicated below:



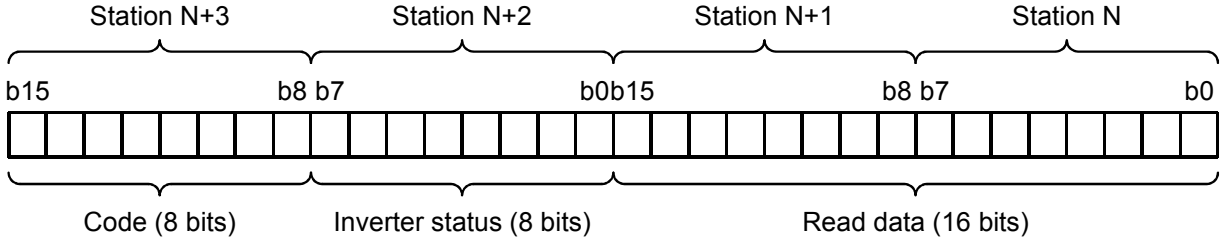

   (c) Receive data is made up of 8 bits per remote I/O station as shown below:




*: n depends on the remote I/O station number.
b0 to b7 for odd-numbered stations 1, 3, · · · · · · · · · 63
b8 to b15 for even-numbered stations 2, 4, · · · · · · · 64

(d) One inverter (PC link unit) has 32 bit locations (for four stations) as shown below:

*: N depends on the inverter station number.




· Code ····· Represents a type of data communication such as read, write and parameter number. For the code list, refer to the inverter manual.

· Inverter status

b0 ····· Running (RUN)*
b1 ····· Forward running
b2 ····· Reverse running
b3 ····· Up to frequency (SU)*
b4 ····· Overload (OL)*
b5 ····· Instantaneous power failure (IPF)*
b6 ····· Frequency detection (FU)*
b7 ····· Alarm*

1: ON
0: OFF

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

· Read data ····· Data corresponding to the code definition is received and stored from the inverter.

10) Line error retry counter (address 160)

(a) Stores the number of retries made after a line error has occurred.

(b) Reset to 0 when communication is restored.

(c) Stores the value from address 1 (number of retries) when X7 is switched on.

11) Retry counter (addresses 161 to 192)

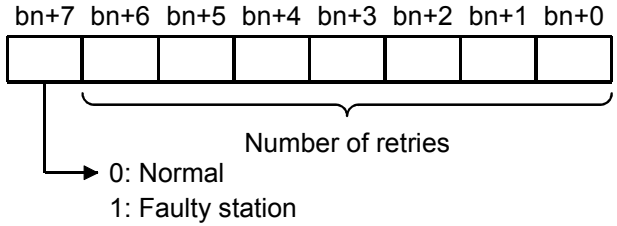
(a) Receives the number of retries made to the faulty remote I/O or inverter station.

(b) Reset to 0 when communication is restored.

(c) Buffer memory assignment is as indicated below:

| | b15 to b8 | b7 to b0 |
|---|---|---|
| 161 | Station 2 | Station 1 |
| 162 | Station 4 | Station 3 |
| 163 | Station 6 | Station 5 |
| | | |
| | | |
| 191 | Station 62 | Station 61 |
| 192 | Station 64 | Station 63 |

(d) The retry counter is made up of 8 bits per remote I/O station as shown below:

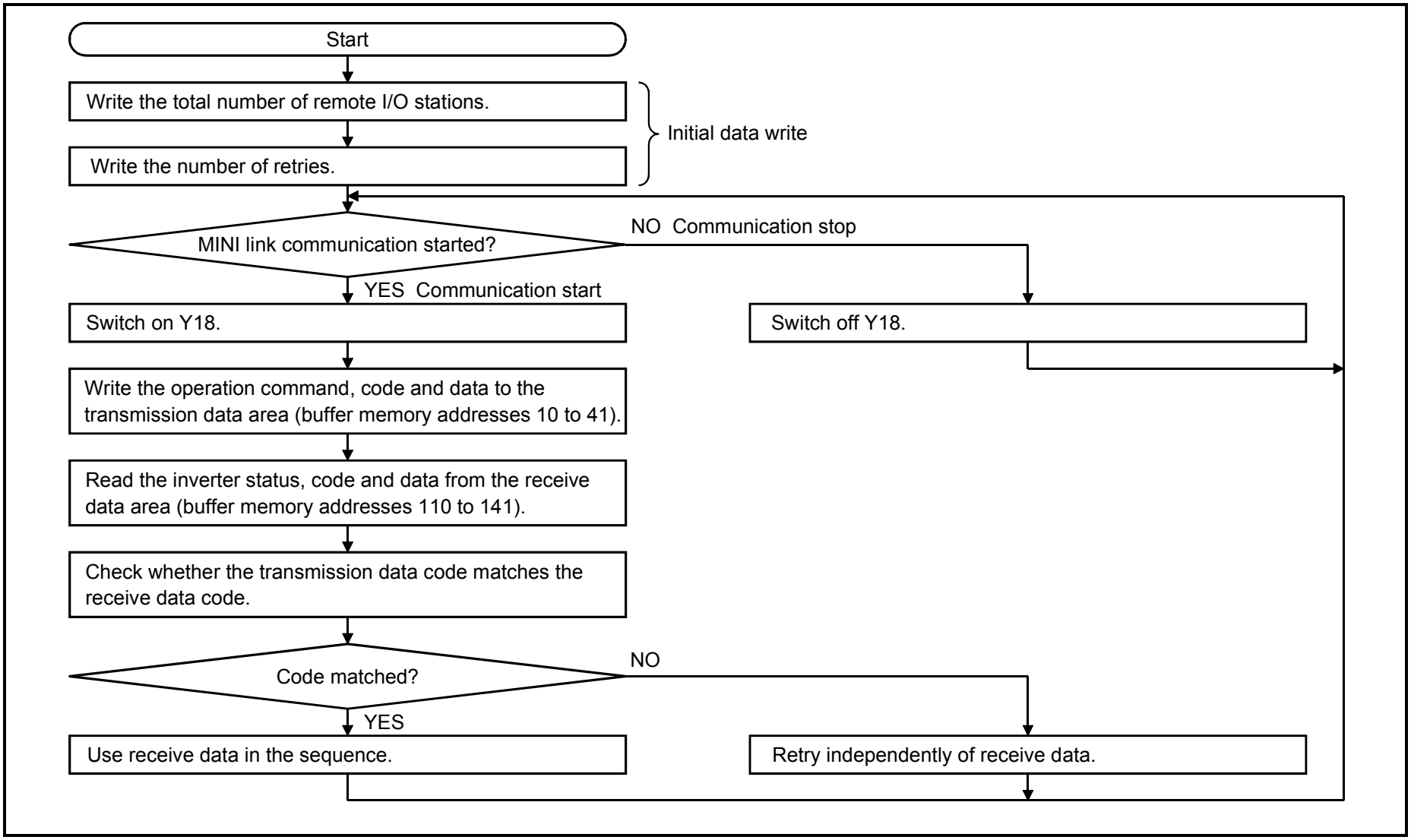



*: n depends on the station number.
b0 to b7 for odd-numbered stations 1, 3, · · · · · · · · · 63
b8 to b15 for even-numbered stations 2, 4, · · · · · · · 64

## 6.3 Programming Procedure

In MINI link, write initial data (the total number of remote I/O stations at address 0 and the number of retries at address 1) to the master station (AJ71PT32) buffer memory to perform I/O refresh.
The initial data must be written before Y18 is switched on.

Example


Start
Write the total number of remote I/O stations.
Write the number of retries.
Initial data write
MINI link communication started?
NO Communication stop
YES Communication start
Switch on Y18.
Switch off Y18.
Write the operation command, code and data to the transmission data area (buffer memory addresses 10 to 41).
Read the inverter status, code and data from the receive data area (buffer memory addresses 110 to 141).
Check whether the transmission data code matches the receive data code.
Code matched?
NO
YES
Use receive data in the sequence.
Retry independently of receive data.

## 6.4 Programming Examples

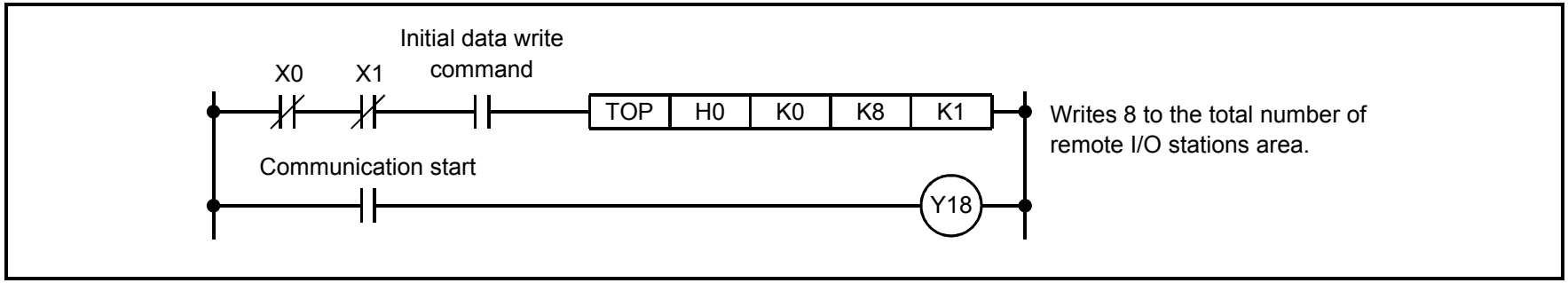
This section describes specific programming examples such as inverter operation, monitoring, and parameter read and write.

(1) Writing the initial data

Note the following when writing the initial data of MINI link to the master station (AJ71PT32) buffer memory.

1) The initial data includes the total number of remote I/O stations (address 0) and the number of retries (address 1).
2) The total number of remote I/O stations may be set between 1 and 64, and defaults to 0.
3) The number of retries may be set between 0 and 32, and defaults to 5.
4) The initial data should be written when Y18 is off. If the initial data is changed with Y18 on, the I/O refresh condition remains unchanged.
5) Program example

The following program operates only two inverters with the master station (AJ71PT32) loaded on slot 0:



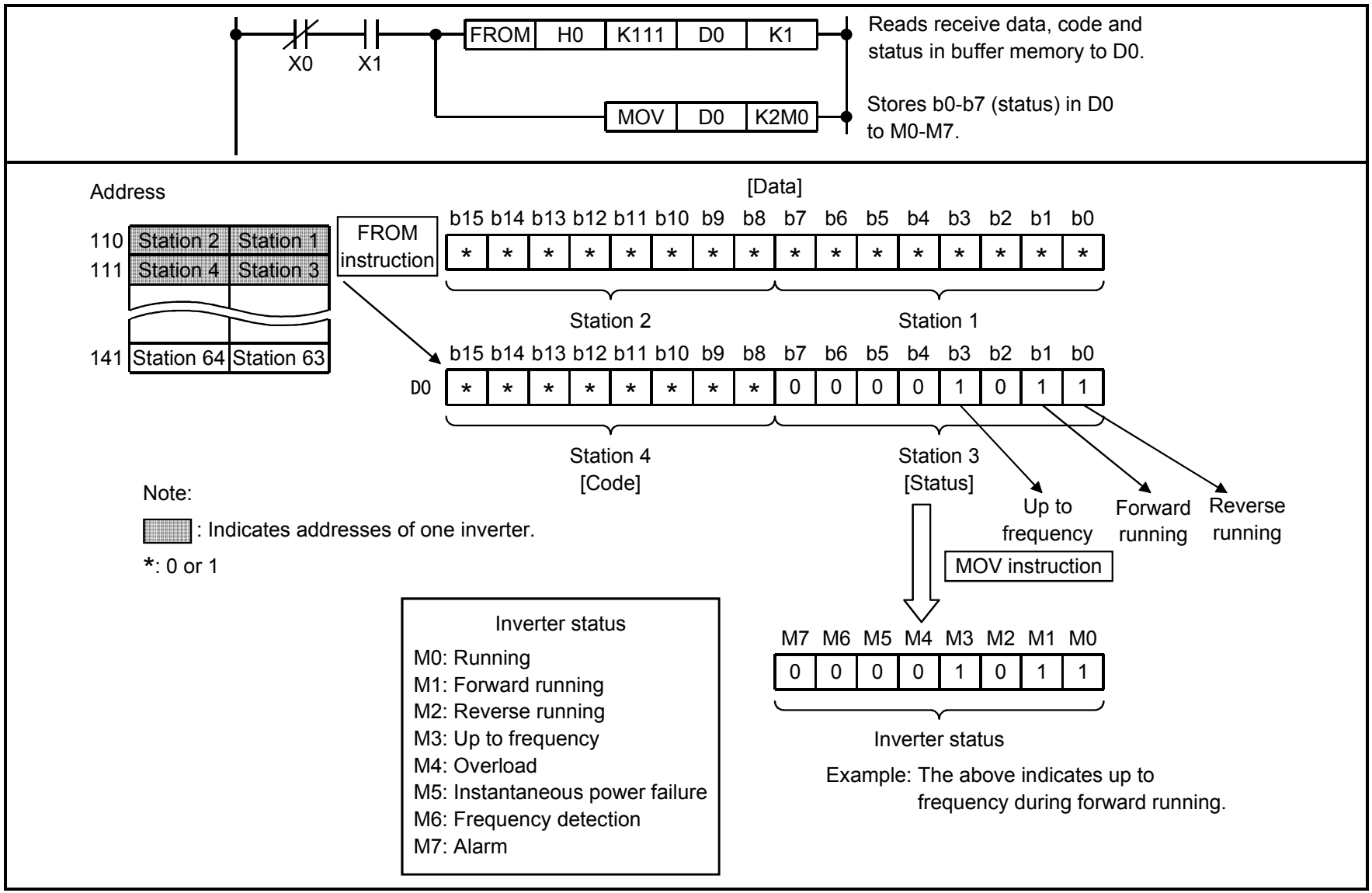

(2) Reading the inverter status

Write a program as explained below to read the inverter status from the master station buffer memory:

1) The inverter status exists in the receive data area (addresses 111 to 141).

2) Program example

The following program reads the inverter status of station 1 to M0-7:



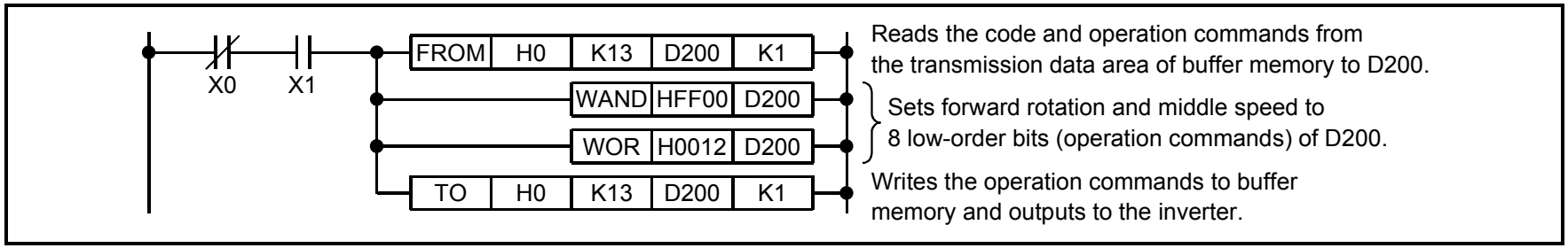
(3) Writing the operation commands

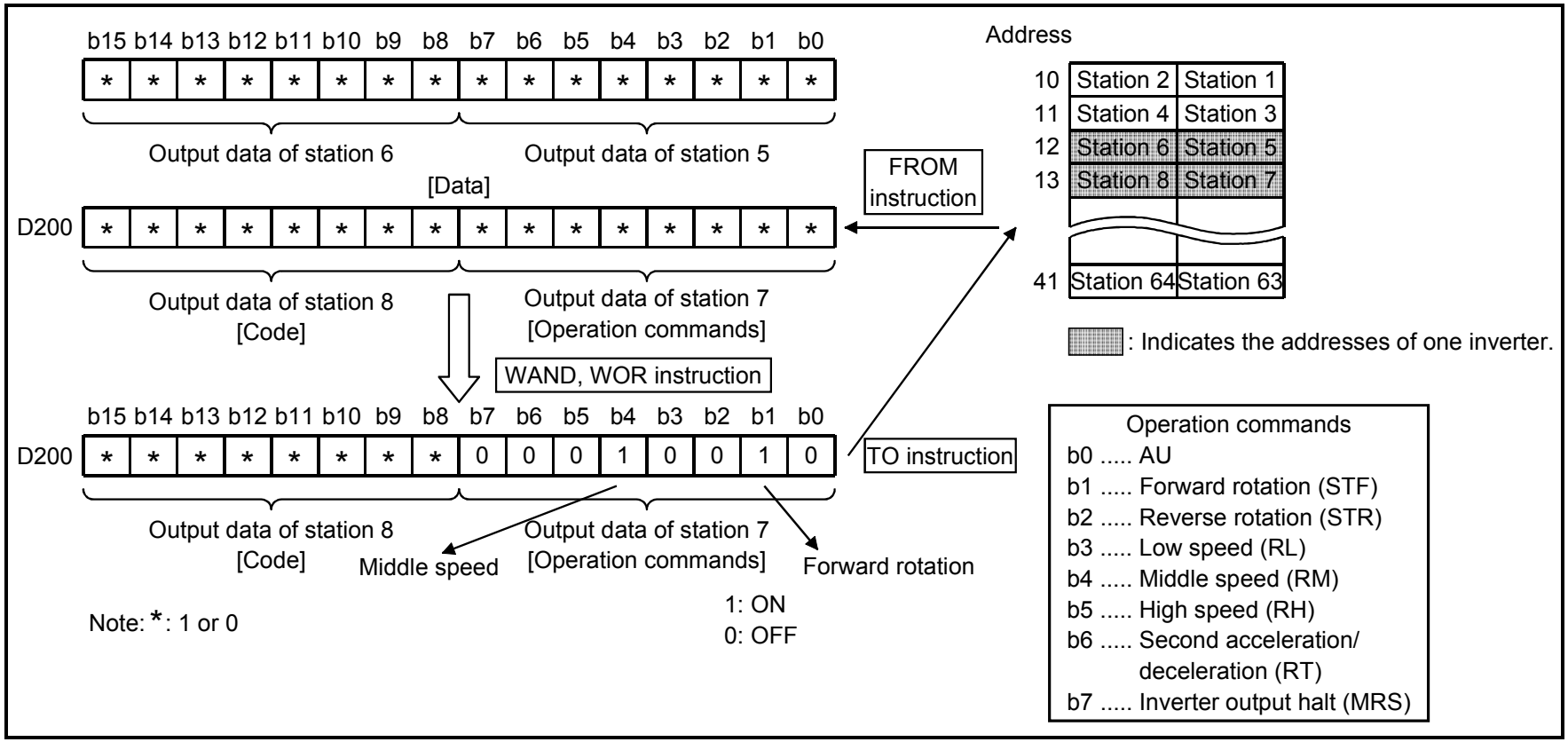
Write a program as explained below to write the inverter operation commands to the master station buffer memory:

1) The inverter is operated in accordance with the operation commands written to the transmission data area (addresses 10 to 41).

2) Program example

The following program outputs the commands of forward rotation and middle speed signals to station 5 inverter:

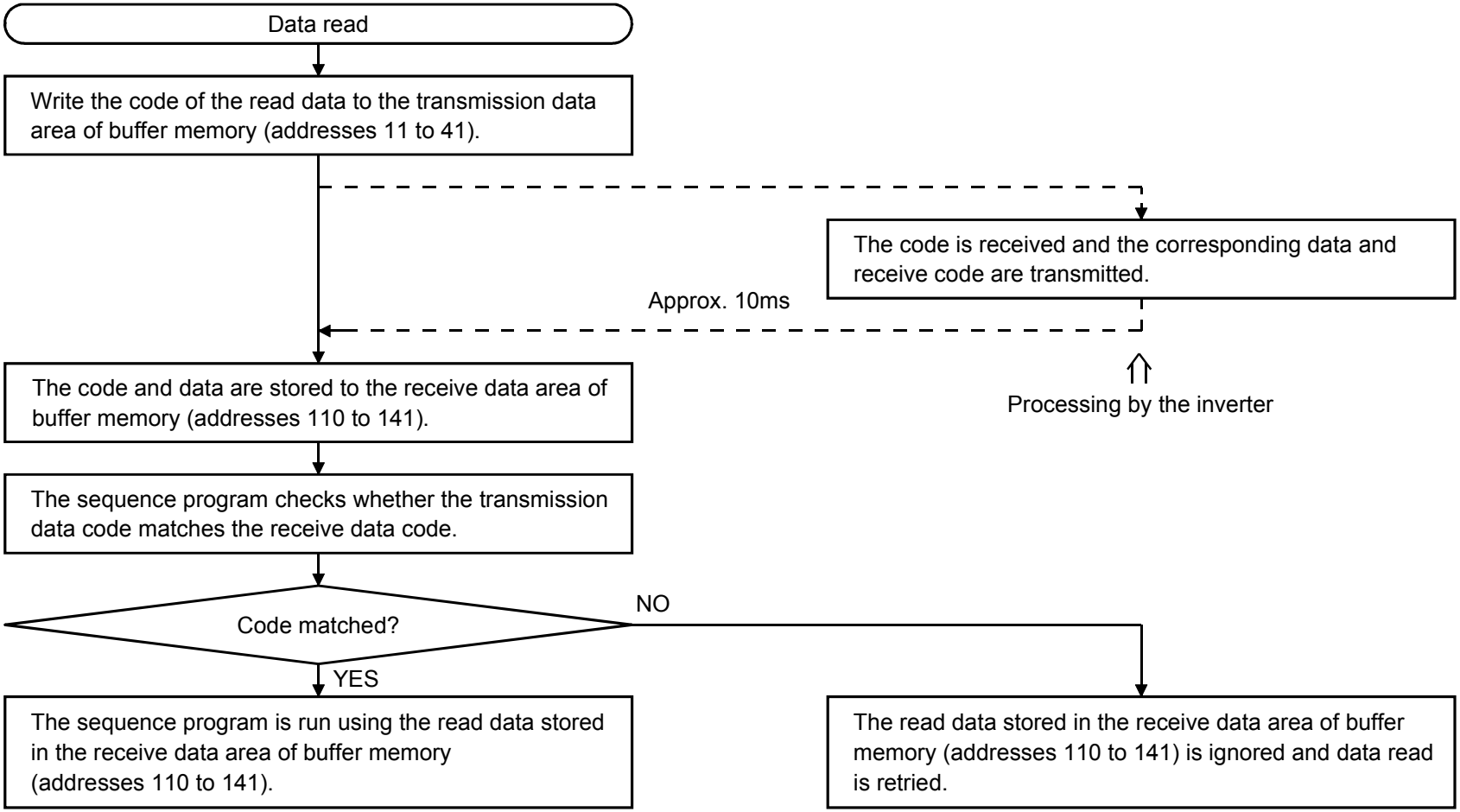



b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
* * * * * * * * * * * * * * * *
Output data of station 6
Output data of station 5
[Data]
D200
Output data of station 8
[Code]
Output data of station 7
[Operation commands]
WAND, WOR instruction
0 0 0 1 0 0 1 0
Middle speed
Forward rotation
Note: *: 1 or 0
1: ON
0: OFF
FROM instruction
TO instruction
Address
10 Station 2 Station 1
11 Station 4 Station 3
12 Station 6 Station 5
13 Station 8 Station 7
41 Station 64 Station 63
: Indicates the addresses of one inverter.
Operation commands
b0 ..... AU
b1 ..... Forward rotation (STF)
b2 ..... Reverse rotation (STR)
b3 ..... Low speed (RL)
b4 ..... Middle speed (RM)
b5 ..... High speed (RH)
b6 ..... Second acceleration/ deceleration (RT)
b7 ..... Inverter output halt (MRS)

(4) Reading data

Write programs as explained below to read various data from the inverters:

1) Procedure

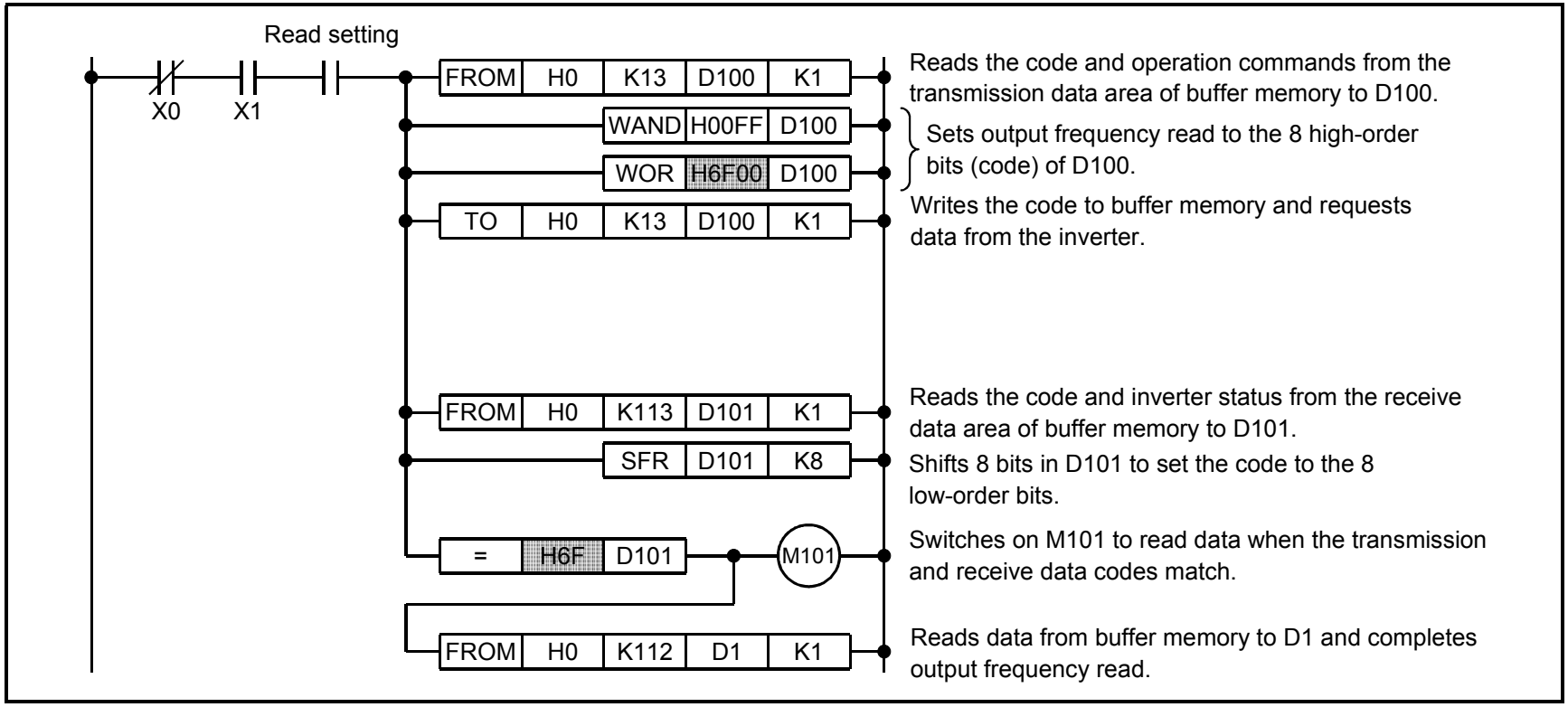



Note 1. The previous data may be read if the required data is read immediately after the code is written. Data should be read after the transmission data code has matched the receive data code.

Note 2. If the codes do not match after retry is repeated, take appropriate action after checking the mismatch definition on page 50.

2) Monitoring program example

- The following program reads the output frequency of station 5 inverter to D1.
  Output frequency reading code number: H6F (hexadecimal)



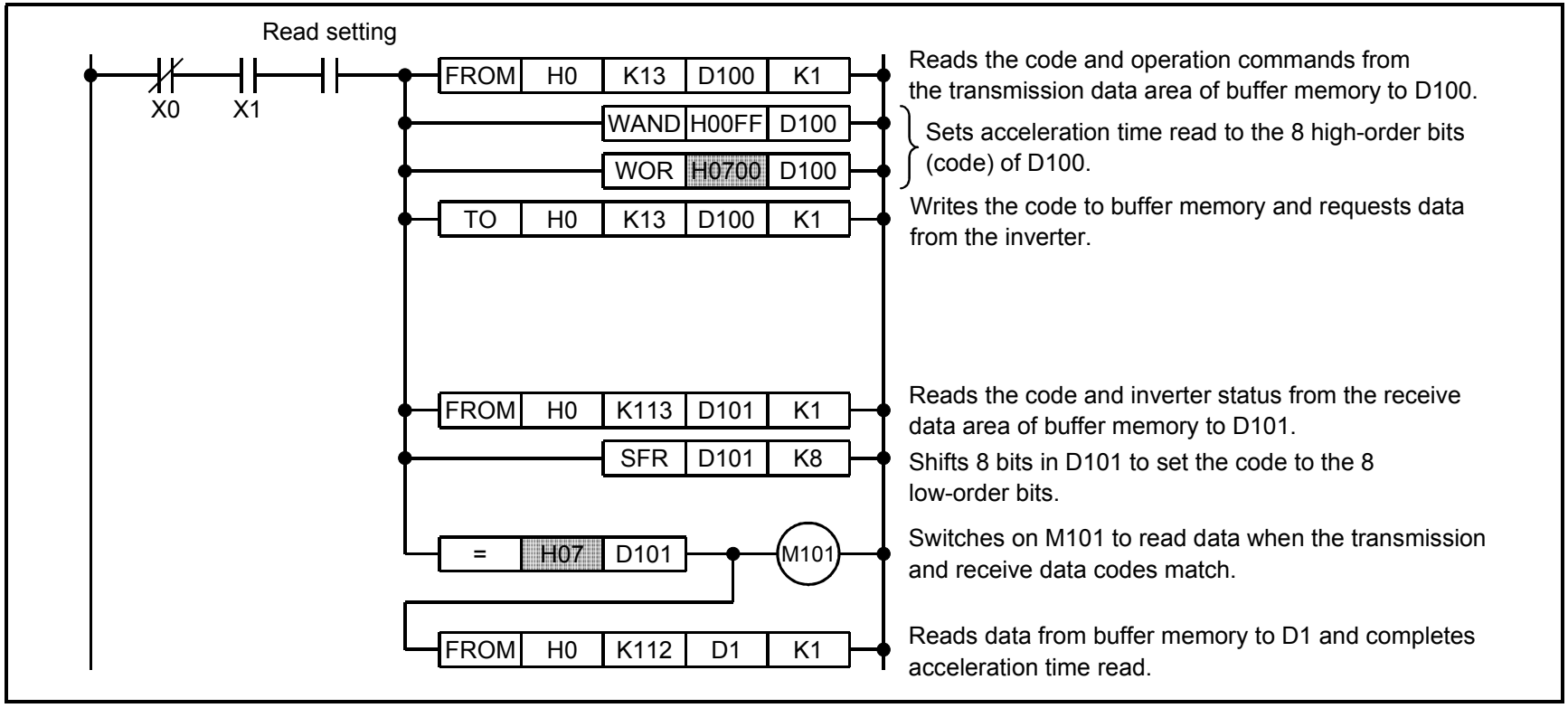

- Monitoring codes

| Item | Code | Data Type | Data Unit |
|---|---|---|---|
| Output frequency | H6F | Hexadecimal | 0.01Hz |
| Output current | H70 | Hexadecimal | 0.01A |
| Output voltage | H71 | Hexadecimal | 0.1V |

Example: The output frequency of 60Hz is indicated H1770 (6000).

3) Parameter reading program example

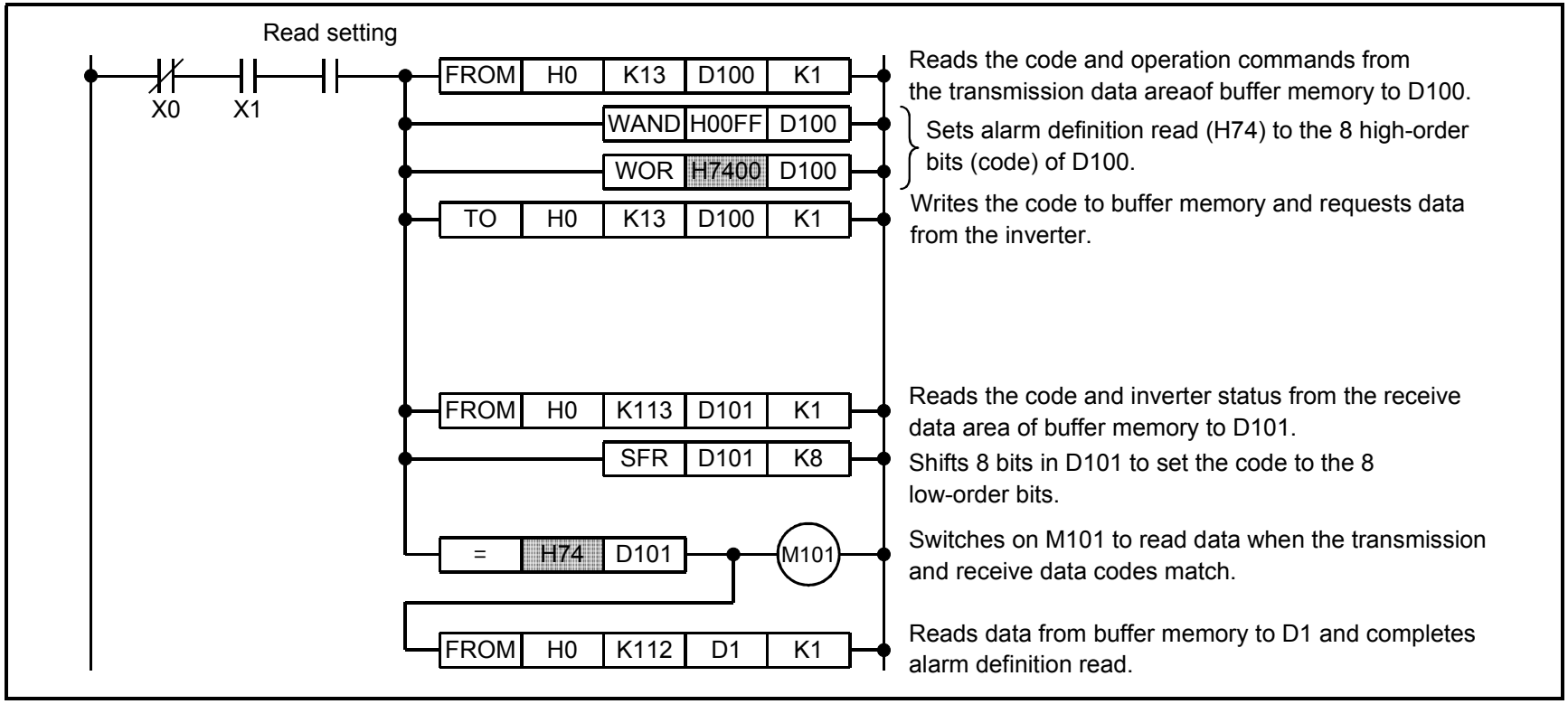
- The following program reads the acceleration time setting of station 5 inverter to D1.
  Acceleration time reading code number: H07 (hexadecimal)



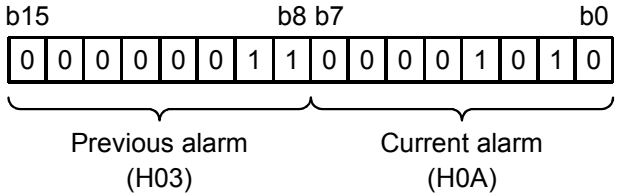

For other parameters, refer to the "data code list" in the inverter manual.

4) Alarm definition reading program example

- The following program reads the alarm definition of station 5 inverter to D1.
  Alarm definition reading code number: H74 (hexadecimal)




- Alarm definition display example
  Example: Read data is H030A ——— Previous alarm ··· THT
  Current alarm····· OPT



- Alarm data

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

| Data | Definition | Data | Definition | Data | Definition |
|---|---|---|---|---|---|
| H00 | No alarm | H05 | IPF | H0B | PE |
| H01 | OC1 | H15 | UVT | H1B | PUE |
| H11 | OC2 | H06 | OLT | H2B | RET |
| H21 | OC3 | H07 | BE | H0C | CPU |
| H02 | OV1 | H08 | GF | H1C | CTE |
| H12 | OV2 | H81 | LF | H2C | P24 |
| H22 | OV3 | H09 | OHT | H5D | MB1 |
| H03 | THT | H0A | OPT | H6D | MB2 |
| H13 | THM | H1A | OP1 | H7D | MB3 |
| H04 | FIN | H2A | OP2 | H8D | MB4 |
| H14 | —— | H3A | OP3 | H9D | MB5 |
| | | | | HAD | MB6 |
| | | | | HBD | MB7 |

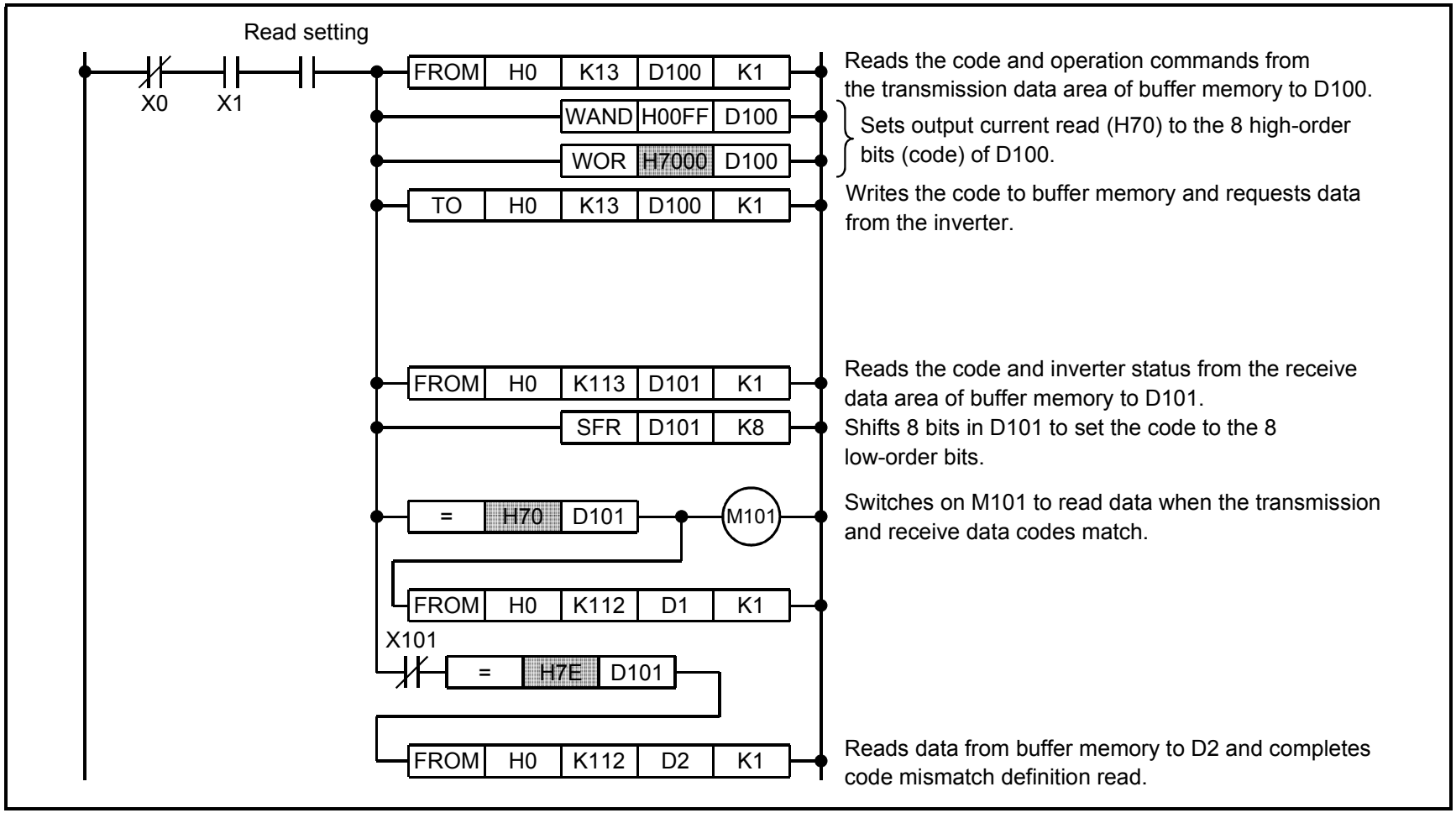
5) Code mismatch definition reading program example

- The following program reads the code mismatch definition of station 5 inverter when code mismatch is repeated during output current read.

  Example

  Output current reading code number: H70 (hexadecimal)

  Code mismatch definition reading code number: H7E (hexadecimal)



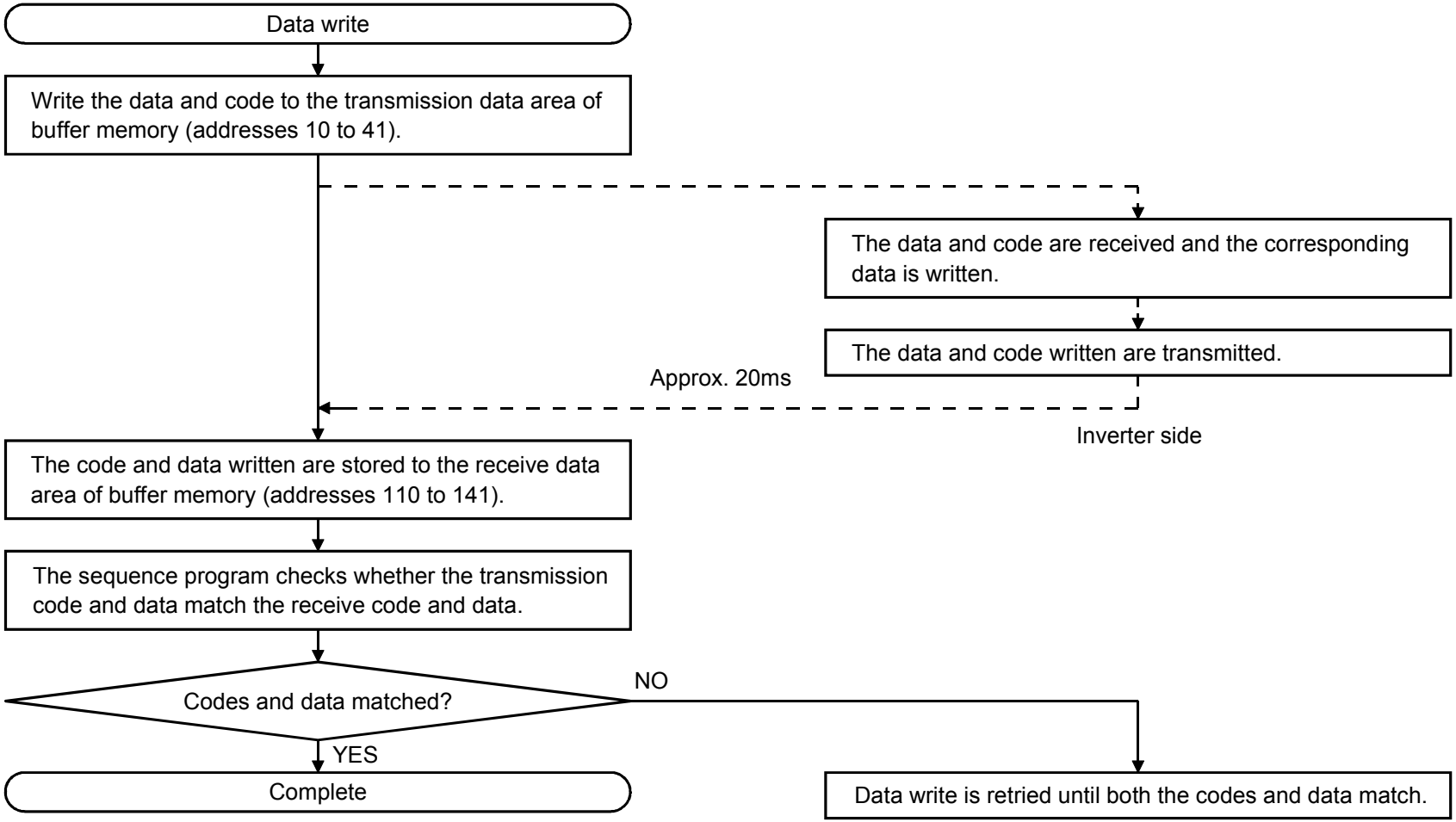

● Code mismatch definition

| Data | Item | Alarm Definition |
|---|---|---|
| H0000 | Code under recognition | Match check is being performed in the inverter. |
| H0001 | Write mode error | Parameter write was attempted during other than stop in PC link operation mode. |
| H0002 | Parameter select error | Invalid code number has been set. |
| H0003 | Setting range error | Set data is outside the permissible range. |

(6) Writing data

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

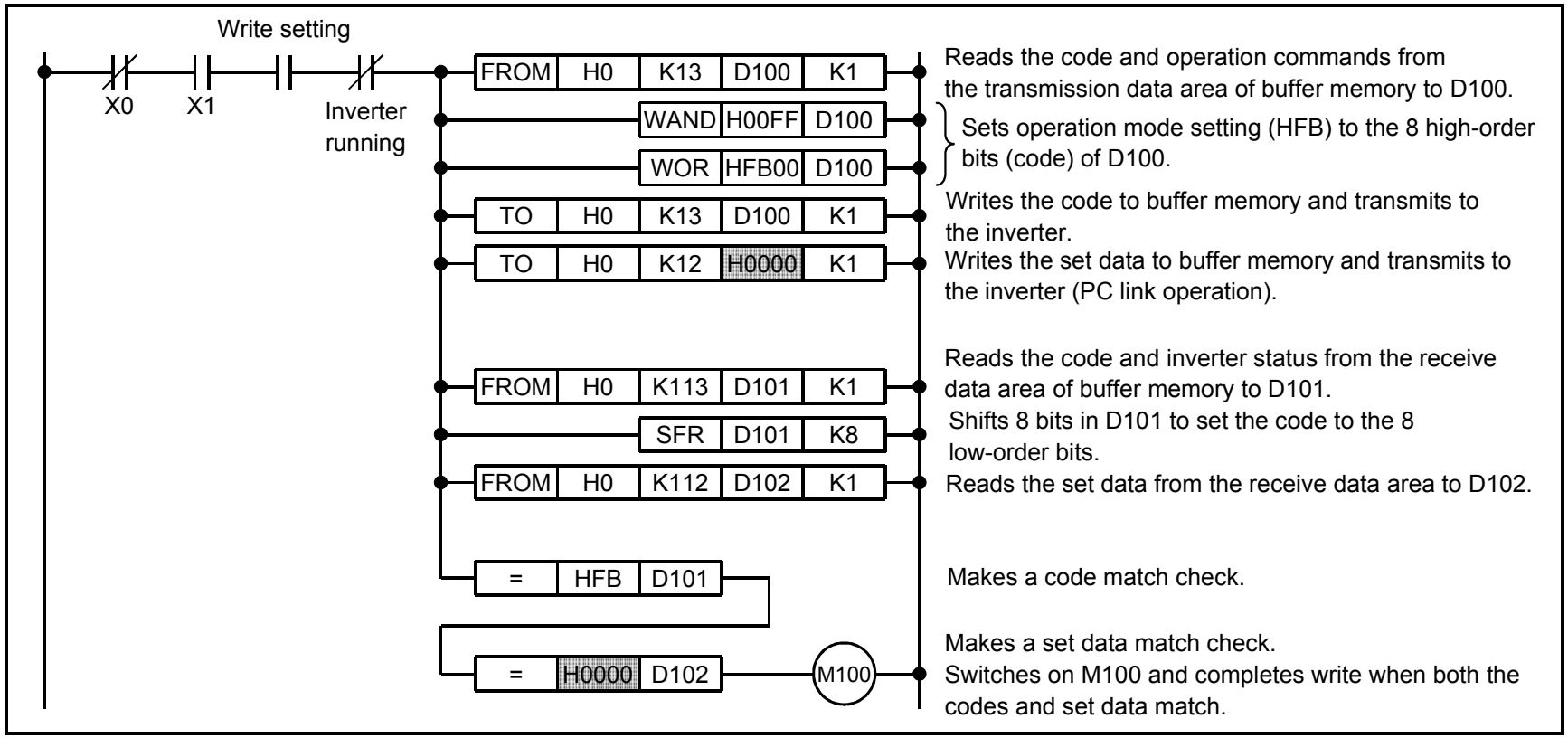
1) Procedure




Note: Both the codes and data must be checked to ensure that they are correct. If code and data mismatch is repeated, check the mismatch definition on page 49.

2) Operation mode switching program example

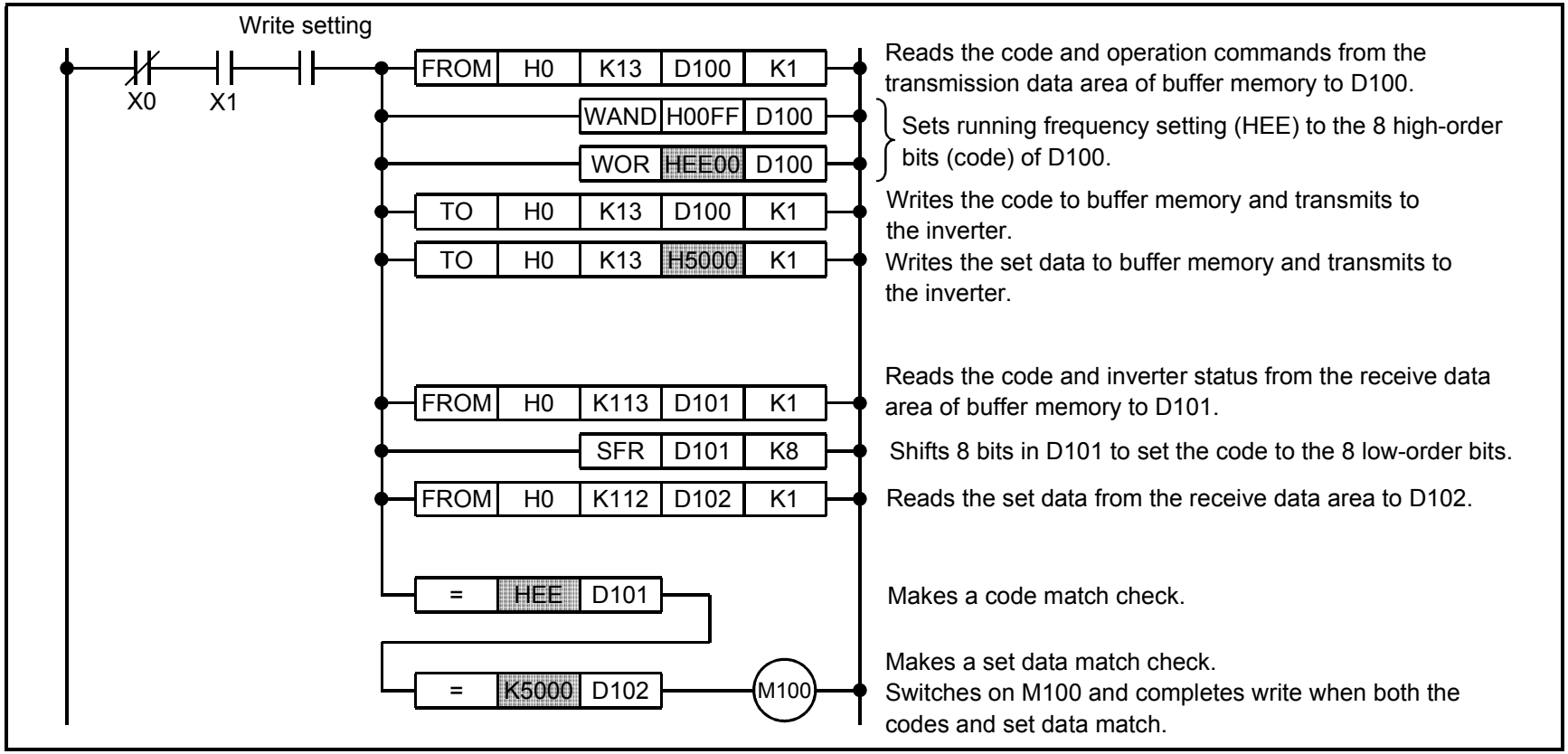
● The following program changes the operation mode of station 5 inverter to PC link operation.
Operation mode setting code number: HFB (hexadecimal)
PC link operation set data: H0000 (hexadecimal)




● Operation mode setting
Code number: HFB
Set data ·····0000: PC link operation
0001: External operation
(0002: PU operation)
Note: PU operation cannot be set from the PC.

3) Running frequency setting program example

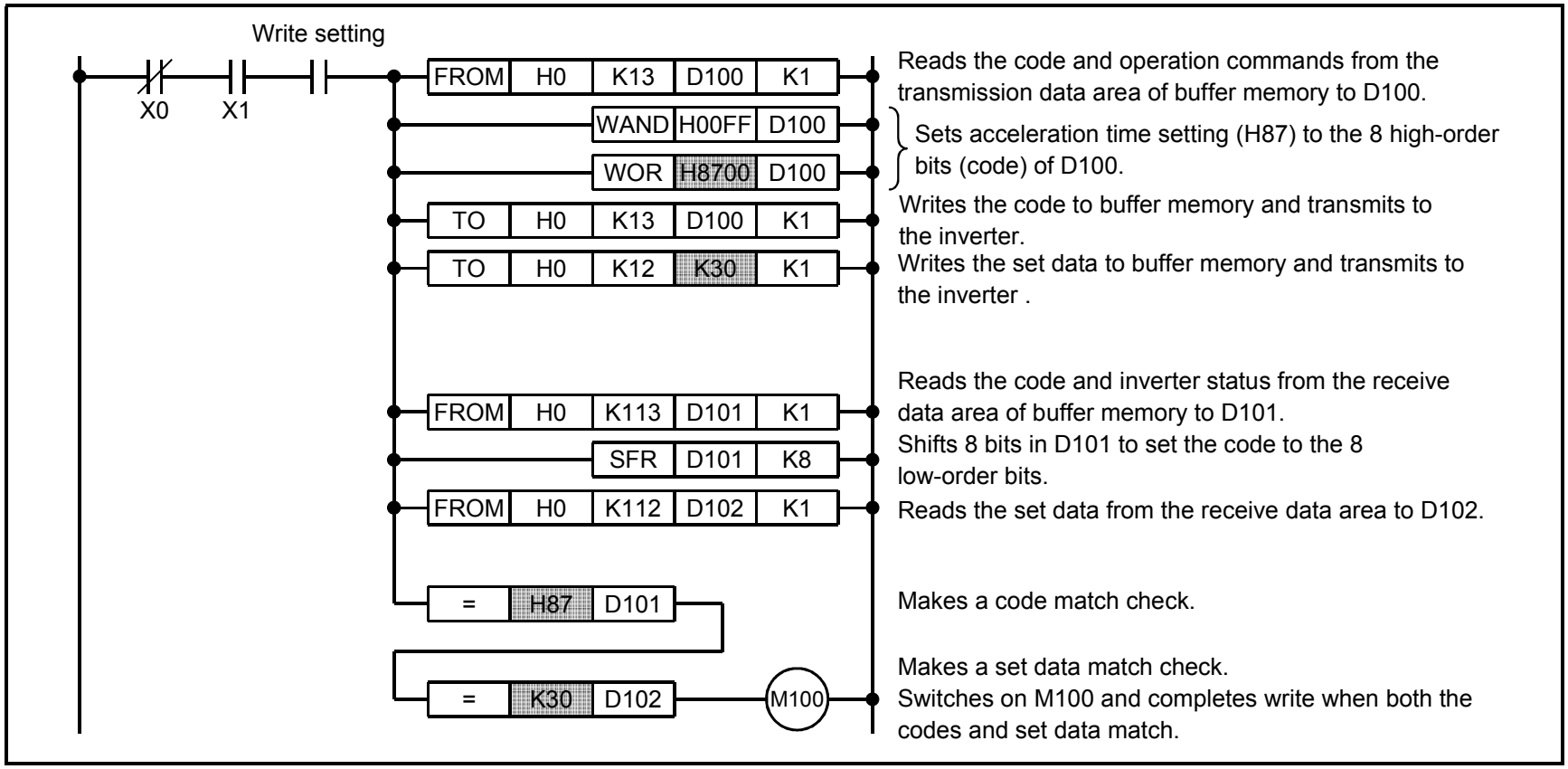
- The following program changes the running frequency of station 5 inverter to 50.00Hz.
  Running frequency setting code number: HEE (hexadecimal)
  Set frequency: K5000 (decimal)




- To continuously change the running frequency from PC
  The set data match check is not required but the code match check should be made. The above program writes the frequency set data to $E^2$ROM of the inverter. When the output frequency is changed continuously, running frequencies should be written to the inverter RAM as the number of write times to $E^2$ROM is limited.
  Program example for writing to RAM
  Modify the above program as follows:
  Change the running frequency setting code number from HEE to HED.

4) Parameter writing program example

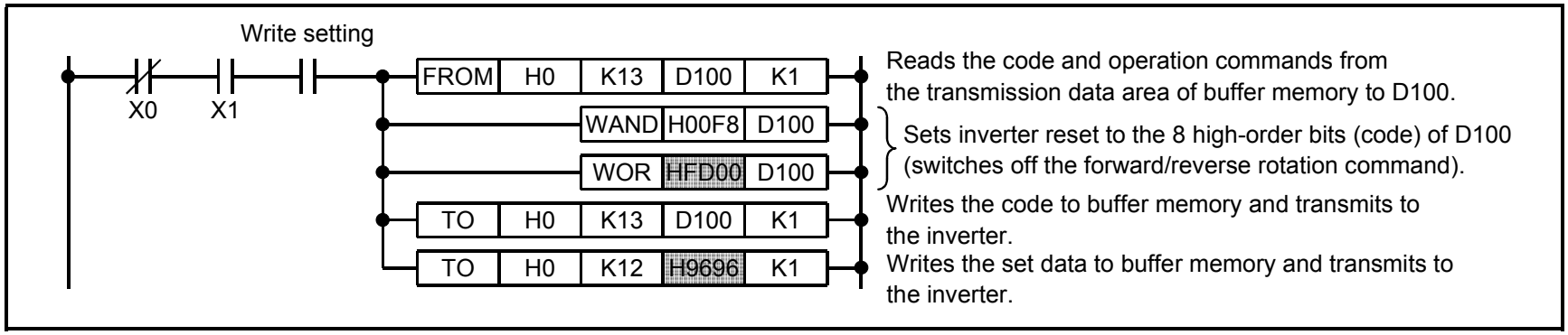
- The following program changes the acceleration time setting of station 5 inverter to 3.0 seconds.
  Acceleration time writing code number: H87 (hexadecimal)
  Acceleration time set data: K30 (decimal)




- For other parameters, refer to the "data code list" in the inverter manual.

5) Inverter resetting program example

- The following program resets the inverter of station 5.
  Inverter resetting code number: HFD (hexadecimal)
  Inverter resetting set data: H9696 (hexadecimal)




- Other program examples
  Change the code number HFD of the above program as follows:

| Function | Code Number |
|---|---|
| All parameter clear | HFC |
| Alarm definition batch clear | HF4 |

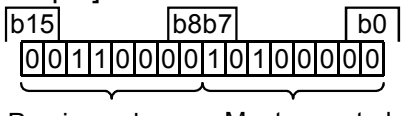
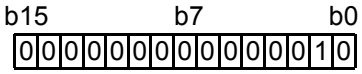
Note: All clear function
In code number HFC, note that the execution differs with the set data as described below:

| Data | Execution |
|---|---|
| H9669 | Clears user-set parameters. |
| H9696 | Returns parameters to the factory settings (initial values) with the exception of some parameters (calibration values・・・・・ Pr. 900 to Pr.905). |
| H9966 | Returns all parameters to the factory settings (initial values). |

## 6.5 Setting Items and Set Data

After completion of parameter setting, set the instruction codes and data as indicated below and start communication from the computer to allow various types of operation control and monitoring.

<table>
<tr><th>No.</th><th colspan="3">Item</th><th colspan="2">Instruction Code</th><th>Description</th></tr>
<tr><td rowspan="2">1</td><td colspan="2" rowspan="2">Operation mode</td><td>Read</td><td colspan="2">H7B</td><td>H0001: External operation<br>H0002: Communication operation</td></tr>
<tr><td>Write</td><td colspan="2">HFB</td><td>H0001: External operation<br>H0002: Communication operation</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Monitoring</td><td colspan="2">Output frequency [speed]</td><td colspan="2">H6F</td><td>H0000 to HFFFF: Output frequency (hexadecimal) in 0.01Hz increments<br>[Speed (hexadecimal) in 1r/min increments if Pr. 37 = 1 to 9998 or Pr. 144 = 2 to 10, 102 to 110.]</td></tr>
<tr><td colspan="2">Output current</td><td colspan="2">H70</td><td>H0000 to HFFFF: Output current (hexadecimal) in 0.01A increments</td></tr>
<tr><td colspan="2">Output voltage</td><td colspan="2">H71</td><td>H0000 to HFFFF: Output voltage (hexadecimal) in 0.1V increments</td></tr>
<tr><td colspan="2">Special monitor</td><td colspan="2">H72</td><td>H0000 to HFFFF: Monitored data selected by instruction code HF3</td></tr>
<tr><td colspan="2" rowspan="2">Special monitor selection No.</td><td>Read</td><td>H73</td><td rowspan="2">H0001 to H000E: Monitor selection data<br>
<table>
<tr><th>Data</th><th>Description</th><th>Increments</th><th>Data</th><th>Description</th><th>Increments</th></tr>
<tr><td>H0001</td><td>Output frequency</td><td>0.01Hz</td><td rowspan="2">H000A</td><td rowspan="2">Electronic overcurrent protection load factor</td><td rowspan="2">0.1%</td></tr>
<tr><td>H0002</td><td>Output current</td><td>0.01A</td></tr>
<tr><td>H0003</td><td>Output voltage</td><td>0.1V</td><td rowspan="2">H000B</td><td rowspan="2">Output current peak value</td><td rowspan="2">0.01A</td></tr>
<tr><td>H0005</td><td>Frequency setting</td><td>0.01Hz</td></tr>
<tr><td>H0006</td><td>Running speed</td><td>1r/min</td><td rowspan="2">H000C</td><td rowspan="2">Converter output peak value</td><td rowspan="2">0.1V</td></tr>
<tr><td>H0007</td><td>Motor torque</td><td>0.1%</td></tr>
<tr><td>H0009</td><td>Regenerative brake</td><td>0.1%</td><td>H000D</td><td>Input power</td><td>0.01kW</td></tr>
<tr><td></td><td></td><td></td><td>H000E</td><td>Output power</td><td>0.01kW</td></tr>
</table></td></tr>
<tr><td>Write</td><td>HF3</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Instruction Code</th><th>Description</th></tr>
<tr><td>2</td><td>Monitoring</td><td>Alarm definition</td><td>H74 to H77</td><td>H0000 to HFFFF: Two most recent alarm definitions<br>Alarm definition display example (instruction code H74)<br>Read data: [Example] H30A0<br>(Previous alarm ····· THT)<br>(Most recent alarm ···· OPT)<br>  <br><br>Alarm data
<table>
<tr><th>Data</th><th>Description</th><th>Data</th><th>Description</th><th>Data</th><th>Description</th></tr>
<tr><td>H00</td><td>No alarm</td><td>H05</td><td>IPF</td><td>H1C</td><td>CTE</td></tr>
<tr><td>H01</td><td>OC1</td><td>H15</td><td>UVT</td><td>H2C</td><td>P24</td></tr>
<tr><td>H11</td><td>OC2</td><td>H06</td><td>OLT</td><td>H5D</td><td>MB1</td></tr>
<tr><td>H21</td><td>OC3</td><td>H07</td><td>BE</td><td>H6D</td><td>MB2</td></tr>
<tr><td>H02</td><td>OV1</td><td>H08</td><td>GF</td><td>H7D</td><td>MB3</td></tr>
<tr><td>H12</td><td>OV2</td><td>H18</td><td>LF</td><td>H8D</td><td>MB4</td></tr>
<tr><td>H22</td><td>OV3</td><td>H09</td><td>OHT</td><td>H9D</td><td>MB5</td></tr>
<tr><td>H03</td><td>THT</td><td>H0A</td><td>OPT</td><td>HAD</td><td>MB6</td></tr>
<tr><td>H13</td><td>THM</td><td>H0B</td><td>PE</td><td>HBD</td><td>MB7</td></tr>
<tr><td>H04</td><td>FIN</td><td>H1B</td><td>PUE</td><td>H1A</td><td>OP1</td></tr>
<tr><td>H14</td><td>—</td><td>H2B</td><td>RET</td><td>H2A</td><td>OP2</td></tr>
<tr><td></td><td></td><td>H0C</td><td>CPU</td><td>H3A</td><td>OP3</td></tr>
</table>
</td></tr>
<tr><td>3</td><td colspan="2">Operation command</td><td>HFA</td><td>H00 to HFF: Operation command<br>  <br><br>(For example 1)<br>[Example 1] H02 ··· Forward rotation<br>[Example 2] H00 ··· Stop<br>b0: AU*<br>b1: Forward rotation (STF)<br>b2: Reverse rotation (STR)<br>b3: RL*<br>b4: RM*<br>b5: RH*<br>b6: RT*<br>b7: MRS<br>The input signals marked * change with the settings of Pr. 180 to Pr. 186 (input terminal function selection).</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Instruction Code</th><th>Description</th></tr>
<tr><td>4</td><td>Inverter status monitor</td><td>H7A</td><td>H00 to HFF: Inverter status monitor<br>b7 b0<br>0 0 0 0 0 0 1 0<br>(For example 1)<br>[Example 1] H02 ··· Forward running<br>[Example 2] H00 ··· Stop due to alarm occurrence<br>b0: Inverter running (RUN)*<br>b1: Forward running (STF)<br>b2: Reverse running (STR)<br>b3: Up to frequency (SU)*<br>b4: Overload (OL)*<br>b5: Instantaneous power failure (IPF)*<br>b6: Frequency detection (FU)*<br>b7: Alarm occurrence*<br>*: Outputs change with the settings of Pr. 190 to Pr. 195 (output terminal function selection).</td></tr>
<tr><td>5</td><td>Running frequency write ($E^2$ROM)</td><td>HEE</td><td>H0000 to H9C40: 0.01Hz increments (hexadecimal)<br>(0 to 400.00Hz)<br>To change the running frequency consecutively, write data to the inverter RAM.<br>(Instruction code: HED)</td></tr>
<tr><td>6</td><td>Inverter reset</td><td>HFD</td><td>H9696: Resets the inverter.<br>As the inverter is reset on start of communication by the computer, the inverter cannot send reply data back to the computer.</td></tr>
<tr><td>7</td><td>All clear</td><td>HFC</td><td>All parameters return to the factory settings.<br>Any of four different clear operations is performed according to the data.
<table>
<tr><th>Parameter / Data</th><th>Communication Pr.</th><th>Calibration Pr.</th><th>Other Pr.</th><th>HEC<br>HF3<br>HFF</th></tr>
<tr><td>H9696</td><td>○</td><td>×</td><td>○</td><td>○</td></tr>
<tr><td>H9966</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
</table>
When all clear is executed with H9696 or H9966, RS-485 communication-related parameter settings also return to the factory settings. When using RS-485 communication, make parameter settings again.</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Instruction Code</th><th>Description</th></tr>
<tr><td>8</td><td colspan="2">User clear</td><td>HFC</td><td>H9669: User clear is made.
<table>
<tr><th>Communication Pr.</th><th>Calibration Pr.</th><th>Other Pr.</th><th>HEC HF3 HFF</th></tr>
<tr><td>○</td><td>×</td><td>○</td><td>○</td></tr>
</table></td></tr>
<tr><td>9</td><td colspan="2">Parameter write</td><td>H80 to HE3</td><td rowspan="2">Write and/or read parameter values as required.<br>Note that some parameters may not be accessible.</td></tr>
<tr><td>10</td><td colspan="2">Parameter read</td><td>H00 to H63</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Link parameter expansion setting</td><td>Read</td><td>H7F</td><td rowspan="2">H00 to H6C and H80 to HEC parameter values are changed.<br>H00: Pr. 0 to Pr. 99 values are accessible.<br>H01: Pr. 100 to Pr. 159, Pr. 200 to Pr. 231 and Pr. 900 to Pr. 905 values are accessible.<br>H02: Pr. 160 to Pr. 199 and Pr. 232 to Pr. 285 values are accessible.<br>H09: Pr. 990 value is accessible.</td></tr>
<tr><td>Write</td><td>HFF</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">Second parameter changing<br>(Code FF=1)</td><td>Read</td><td>H6C</td><td>H3D to H5A<br>HBD to HAD (Code FF = 1)<br>H00: Running frequency<br>H01: Time<br>H02: Rotation direction</td></tr>
<tr><td>Write</td><td>HEC</td><td>H5E to H6A<br>HDE to HED (Code FF = 1)<br>H00: Offset/gain<br>H01: Analog<br>H02: Analog value of terminal</td></tr>
</table>

# 7. ALARM



## 7.1 Alarm

This section explains the corrective action and restoration method after an alarm has occurred.

(1) Alarm occurrence

Alarms occurring in each operation mode results in the following:

| | Operation Mode | | |
|---|---|---|---|
| | **PC link operation** | **External operation** | **PU operation** |
| Inverter fault | Inverter stopped.<br>Data communication continued. | Inverter stopped.<br>Data communication continued. | Inverter stopped.<br>Data communication continued. |
| PC link error | Inverter stopped.<br>Data communication stopped. | Inverter operation continued.<br>Data communication stopped. | Inverter operation continued.<br>Data communication stopped. |

(2) Checking alarm definition

Check the alarm definition in the procedure given on page 48.

1) Inverter fault

Remove the cause of alarm in accordance with the inverter manual.

2) Line error, data communication stop

In the inboard option unit, check that:

· The optical cable connectors are fitted correctly;

· The optical cables are not open; and

· The inboard option unit is fitted correctly in the inverter connector.

If the above faults are not found, check the master station in accordance with Section 4.6 of the MELSECNET/MINI-S3 user's manual (master station).

(3) Restoration

Reset the inverter after removing the cause of the alarm.

Even if the main circuitry of an inverter has been damaged, the other inverters in the same loop can perform PC link operation when the control power is live.

(4) Resetting method

Reset is allowed or disallowed as indicated below:

| Resetting Method | Operation Mode | | |
|---|---|---|---|
| | PC link operation | External operation | PU operation |
| PC user program (refer to page 55) | Allowed*1 | Disallowed | Disallowed |
| Connect terminals RES-SD | Allowed | Allowed | Allowed |
| Switch off inverter power | Allowed | Allowed | Allowed |

*1. The inverter cannot be reset from the PC if a line error has occurred.
After resetting, the inverter is set to either of the following operation modes depending on the setting of Pr. 79:
When Pr. 79 setting is "0" or "2"・・・・ External operation mode
When Pr. 79 setting is "1"・・・・・・・・・ PU operation mode

Note: The inverter is set to the external operation mode if it has been reset from the PC in the PC link operation mode. To resume the PC link operation, therefore, the inverter must be switched to the PC link operation mode. (For the operation mode switching, refer to page 16.)

(5) Troubleshooting

1) Operation mode does not switch to PC link

· Check that the PC link unit and optical cables are fitted properly.
(Check for contact fault, open cable, wrong polarity, 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 RUN indicator LED is on.
· Check that the operation mode switching program is run.
· Check that the operation mode switching program has been written correctly.

2) Inverter unstarted in PC link mode
- · Check that the inverter is in the PC link operation mode.
- · Check that the inverter starting program has been written correctly.
- · Check that the inverter starting program is run.
- · Check that the inverter is providing output.

3) Communication stops during operation
- · Check that the PC link unit and optical cables are fitted properly.
  (Check for contact fault, open cable, etc.)
- · Check that the programmable controller program is executed reliably and that the PC CPU is running.
- · Check that data communication has not stopped due to an instantaneous power failure, etc.
- · Check that the communication start signal (Yn+18) of the master station is on.

# 8. SPECIFICATIONS



## 8.1 Performance Specifications

| Item | | | Specifications |
|---|---|---|---|
| PC link system | | | MELSECNET/MINI-S3 system |
| PC side*1 | Applicable CPU card | | 1. A0J2CPU, A0J2HCPU (extension base required)<br>2. A1SJCPU-S3, A1SJHCPU, A1SCPU, A1SHCPU<br>3. A2SCPU, A2SHCPU, A2USCPU(-S1), A2USHCPU-S1<br>4. AnN, AnA, AnUCPU |
| | Master station | Type | AJ71PT32-S3 optical link module (remote I/O mode, remote terminal mode possible), A1SJ71PT32-S3 |
| | | Number of link stations | 64 stations max. (8 points/station), max. link points = 512 |
| | | Refresh time | 3.5ms to 18ms (when 64 stations are connected) |
| Communication cable | | | Plastic optical fiber cable |
| Max. interstation transmission distance | | | 50m |
| Inverter side | Type | | Inboard options fitted to the connector in the inverter |
| | Power supply | | 5VDC supplied from the inverter |
| | Number of inverters connected | | 16 inverters max. (4 stations occupied by 1 inverter). May be used with other equipment. |

*1. For the PC specifications, refer to the MELSECNET/MINI-S3 user's manual. The MINI link system does not have a loopback function as it has only one loop of PC link cables.

## 8.2 Optical Fiber Cable Specifications

The following table lists the specifications for the optical fiber cable for PC link:

| Item | Specifications |
|---|---|
| Optical cable used | Plastic fiber cable |
| Communication speed | 1.5MBPS |
| Minimum optical transmission level | -15dBm |
| Maximum optical transmission level | -31dBm |
| Light wavelength | 660nm (visible light) |
| Optical fiber OD | 1mm |
| Connector | 1-core connector |
| Cable transmission loss | 260dB/km max. |

## 8.3 Inverter I/O Delay Time

The following I/O signal delays may occur in the MINI link:

1) The following delays may occur until the PC CPU reads an input signal from the inverter:

(a) Inverter response time

Indicates a period of time required for the inverter to be switched from ON to OFF or from OFF to ON. (FR-A5NN: Approx. 10ms to 30ms)

(b) MINI link I/O refresh time

For full information, refer to Section 4.2 in the AJ71PT32-S3 user's manual.

(c) FROM instruction processing time

There is a maximum of one scan delay if the FROM instruction is executed once during a scan of the sequence program, for example.

2) The following delays may occur until the PC CPU outputs a command to the inverter:

(a) TO instruction processing time

There is a maximum of one scan delay if the TO instruction is executed once during a scan of the sequence program, for example.

(b) MINI link I/O refresh time

(c) Inverter response time

Indicates a period of time required for the inverter to be switched from ON to OFF or from OFF to ON.
(FR-A5NN: Approx. 10ms to 30ms)

**NOTE**

The I/O delay time of the inverter depends on the FROM/TO instruction processing time ( 1 )-(c) or 2)-(a) ).
Where the I/O delay time does not pose any problem, the FROM/TO instruction is executed once during a scan.
The I/O delay time can be reduced by writing the program as described below:

1) To reduce the input delay time, execute the FROM instruction immediately before the input signal is used in the sequence program.
2) To reduce the output delay time, execute the TO instruction after the sequence program operation is performed.

**REVISIONS**

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

| Print Date | *Manual Number | Revision |
|---|---|---|
| Oct, 1997 | IB(NA)-66834-A | First edition |
| | | |