MITSUBISHI TRANSISTORIZED INVERTER

Instruction Manual

PROGRAMMABLE CONTROLLER LINK UNIT

TYPE FR-APC

- PLG Feedback Control
- MELSECNET/MINI-S3 Interface

Thank you for choosing the option unit for the Mitsubishi FREQROL transistorized frequency inverters. Please read this manual carefully to use the option unit to its optimum.

Programmable Controller Link Unit (FR-APC)

This option unit is a multi-function unit including a function to interface with the Mitsubishi MELSECNET/MINI-S3 programmable controller and designed to configure a Factory Automation-compatible drive system. Its functions are as follows:

- PLG feedback control
- MELSECNET/MINI-S3 programmable controller link

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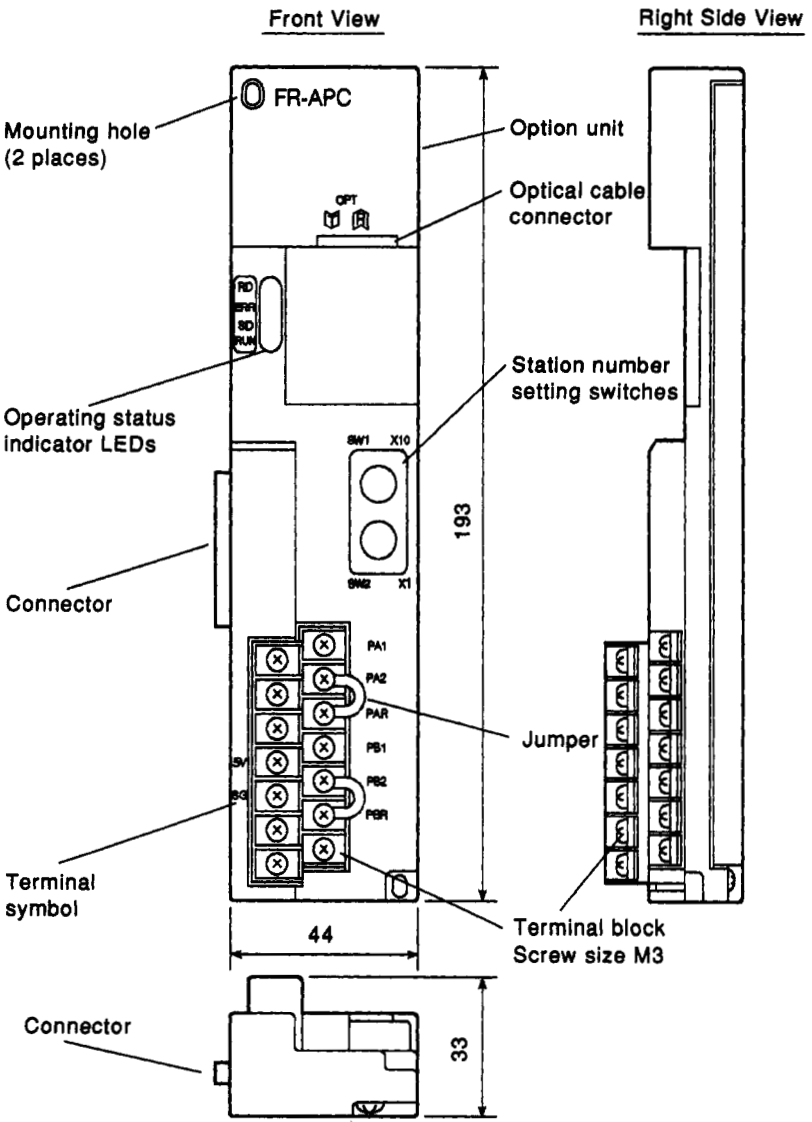
1. STRUCTURE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2. INSTALLATION

Remove the inverter cover and install the option unit in the following procedure:

2.1 Pre-Installation Checks

(1) Check the inverter type. This option unit may only be used with the FREQROL-A series inverters and must not be used with any other series (such as the Z and F series).

(2) Make sure that the inverter input power is off. The inverter may become faulty if the option unit is installed with the input power on.

(3) To carry out PLG feedback control, this option unit requires an encoder (or motor with encoder) and an external power supply. For more information, see page 9.

(4) Check that the following accessories are supplied with the option unit:

- 1 - Instruction manual
- 2 - Mounting screws M3 x 14
- 2 - Jumpers (installed to the terminal block)

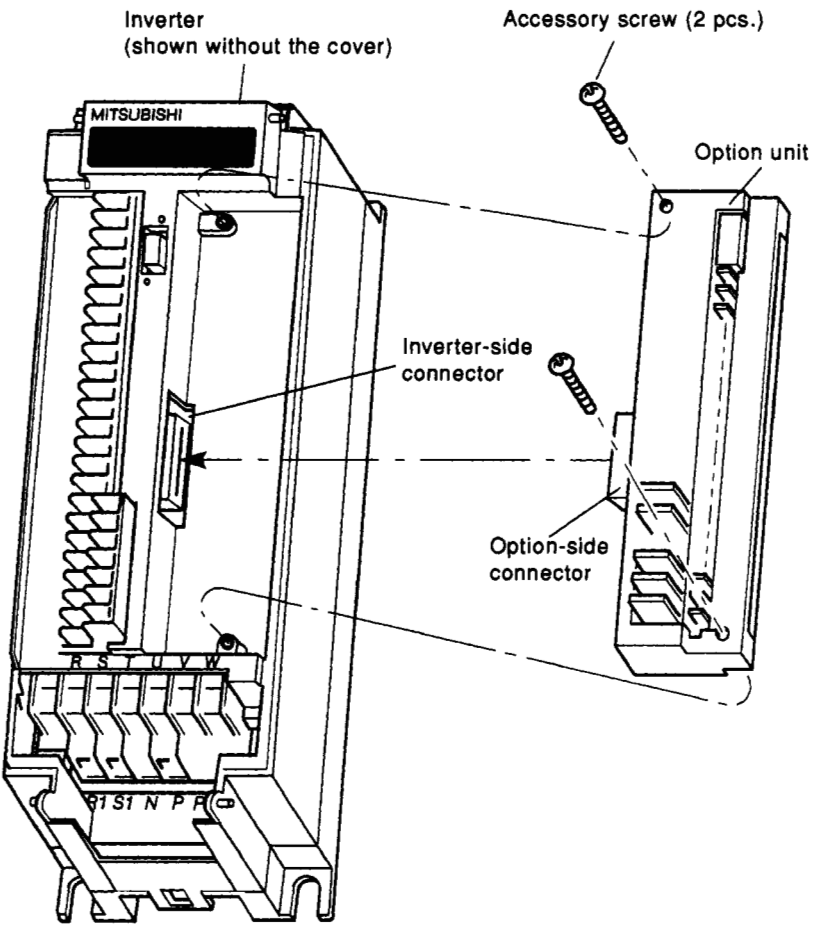
2.2 Installation Procedure

(1) Snugly insert the connector of the option unit far into the connector of the inverter.

(2) Securely fix the option unit to the inverter at the top and bottom with the accessory mounting screws. If the screw holes in the option unit do not match those in the inverter, check that the connectors have been fitted snugly.

(3) For the proper installation diagram, see page 3.

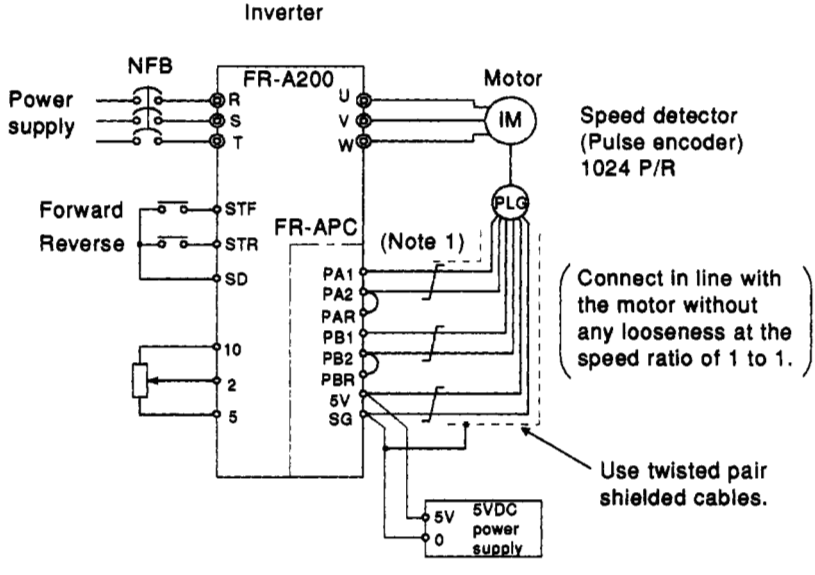
- The empty terminals, which are used inside the option, must not be used as relay terminals. Otherwise, the option may be damaged.


Inverter
(shown without the cover)
Accessory screw (2 pcs.)
MITSUBISHI
Option unit
Inverter-side
connector
Option-side
connector
R S T U V W
P1 S1 N P P1

3. PLG FEEDBACK CONTROL FUNCTION

This function is used with a speed detector (pulse encoder, PLG) to allow the motor speed to be detected by the speed detector and fed back to the inverter so that the output frequency of the inverter is controlled to keep the motor speed constant to load variations.

3.1 Wiring Example



The 5V power supply should be user-prepared.
(The power supply specifications are given on page 9.)

Note 1: Connect the accessory jumpers.
When this option unit shares the same pulse encoder with another unit (e.g. NC) which is fitted with terminal resistors, remove the accessory jumpers as they are not required.

3.2 Terminals

Symbol	Terminal	Rating	Description
PA1	Encoder phase A signal input terminal	For information on pulse signals, see page 9.	Phase A and B signals are input from the encoder.
PA2	Encoder phase A inverse signal input terminal		
PB1	Encoder phase B signal input terminal		
PB2	Encoder phase B inverse signal input terminal		
PAR	Phase A terminal resistor terminal		Connected with PA2 by the jumper before shipment from the factory. Remove the jumper when the terminal resistor is not required.
PBR	Phase B terminal resistor terminal		Connected with PB2 by the jumper before shipment from the factory. Remove the jumper when the terminal resistor is not required.
5V	DC power (positive) input terminal	4.75 to 6VDC (Current consumption 50mA)	Connect DC power and power terminals of encoder. Connect the positive cable to the 5V terminal and the ground (0V) cable to the SG terminal.also connect the shield of the shielded cable to SG.
SG	DC power ground terminal		

3.3 Wiring Instructions

(1) Connection with the position detector (pulse encoder)

Use twisted pair shielded cables (0.2mm^2 or larger) to connect the unit (FR-APC) and position detector. Cables to terminals 5V and SG must be connected in parallel or be larger in size according to the cable length as indicated below:

Cable Length	Number of Parallel Cables of 0.2mm^2	Larger-Size Cables
Within 10m	2 or more cables	0.4mm^2 or larger
Within 20m	4 or more cables	0.75mm^2 or larger
Within 30m	6 or more cables	1.25mm^2 or larger

3.4 Adjustments

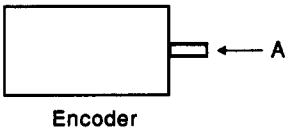
(1) Parameters

Before starting inverter operation, set the following parameters:

Parameter List

Function Number	Function	Setting Range	Minimum Increment	Initial Setting	Remarks
117	Encoder rotation direction	0,1	Integer	0	
37	Number of motor poles	0 2 to 8	Integer	0	See page 6.
105	Speed feedback range	0 0.01 to 400Hz 9999	0.01Hz	9999	Set 0 or 9999 to disable speed feedback control.
106	Feedback gain	0.1 to 100	0.1	1	See page 7.

(2) Setting the encoder rotation direction (Pr. 117)



Encoder

Pr. 117 = 0	Pr. 117 = 1
	
Forward rotation is clockwise when seen from A	Forward rotation is counterclockwise when seen from A

By installing this option unit, the encoder rotation direction is displayed on the rotation direction monitor screen of the parameter unit.

Set the rotation direction in Pr. 117 so that FWD is displayed for the STF command and REV is displayed for the STR command.

(3) Setting the number of motor poles (Pr. 37)

Set the number of poles of the motor driven.

* If the inverter is operated after any of 10 and 11 to 9998 has been set in Pr. 37, alarm E.OPT (option error) is displayed and the inverter comes to a stop.

  Resetting method: After setting the correct number of motor poles, reset the inverter.

(4) Setting the speed feedback range (Pr. 105)

Set the feedback control range.

Define the upper and lower limits in reference to the set value (frequency at which the motor is rotated at stable speed). Normally set the frequency converted from the rated motor speed (rated load) slip (rpm).

Example: Rated speed of the 4P motor is 1740rpm/60Hz

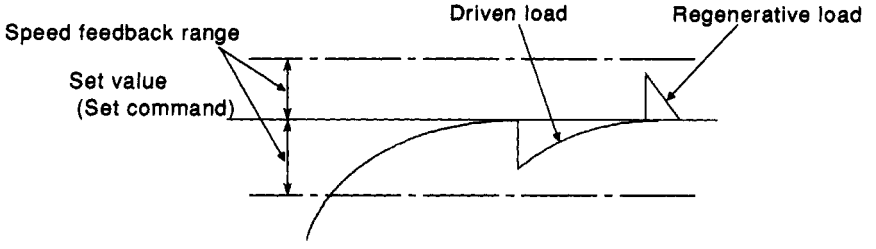
Slip Nsp = (synchronous speed) – (rated speed)

= 1800 – 1740 = 60 (rpm)

Frequency equivalent to slip fsp

$$fsp = \frac{Nsp \times (\text{number of poles})}{120} = \frac{60 \times 4}{120} = 2\ (Hz)$$

Response slows if the feedback range value is too large.



* The speed feedback range is factory-set to 9999 (speed feedback is not carried out). Before operation, an appropriate value must be set in Pr. 105.

(5) Setting the feedback gain (Pr. 106)

Set if rotation is instable or response is slow.

When the set value is greater than 1, response is faster but overcurrent or rotational instability is more liable to occur.

When the set value is less than 1, response is slower but rotation is more stable.

3.5 Instructions for Use of PLG Feedback Control

(1) The number of motor poles used must be checked before starting operation. The number of poles set must be correct to ensure proper control of the motor.

(2) The pulse encoder must be coupled in line with the motor shaft without any mechanical looseness at the speed ratio of 1 to 1.

(3) Check that the pulse encoder has been set to a correct rotation direction on the rotation direction display of the parameter unit. If the rotation direction is not correct, speed feedback control cannot be carried out (the inverter can be operated).

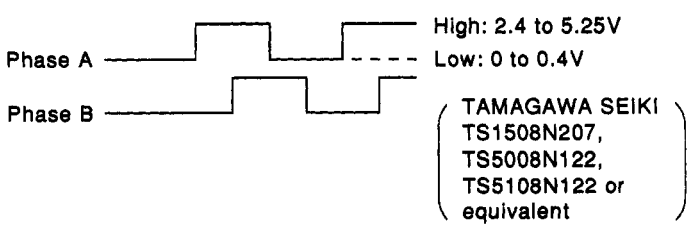
(4) During acceleration or deceleration, speed feedback control is not performed to prevent instability such as hunting.
Speed feedback control is started after the output frequency has once reached the (set speed) ± (speed feedback range).

(5) If any of the following states occurs during speed feedback control operation, the inverter is run at the output frequency of (set speed) ± (speed feedback range) without coming to an alarm stop and does not follow up the motor speed:
- The pulse signal from the pulse encoder is switched off due to an open cable, etc.;
- An accurate pulse signal cannot be detected due to induction noise, etc.; or
- The motor is forced to accelerate (regenerative operation) or decelerate (e.g. motor lock) by large external force.

3.6 Specifications

(1) Motor driven 2-, 4-, 6- or 8-pole standard motor
2-, 4-, 6- or 8-pole constant-torque motor

(2) Speed detector (Pulse encoder)
1024 pulses/revolution (P/R) line driver LED pulse encoder



Encoder Output Signal Pin Numbers
(TAMAGAWA SEIKI TS1508N207)

Pin Number	Signal
A	Phase A signal
N	Phase A inverse signal
C	Phase B signal
R	Phase B inverse signal
H	+ 5V power input
K	Power common
E	Case ground

(3) Speed variation ratio

Within ± 0.1% of the maximum speed (3600 rpm) (load variation 0 to 100%*...6Hz or more)
*: Load variation 100% indicates the maximum continuous operation torque value of the motor output characteristic (see the catalog and technical information) to the running frequency.

(4) Speed control range

Equivalent to the inverter.

(5) Functions

- Speed feedback range setting
- Feedback gain setting
- Encoder rotation direction setting

(6) DC power supply

A 5VDC power supply is required for the position detector (pulse encoder) and option unit.
This power supply should be user-prepared.

Power supply: 5VDC Current capacity 400mA or more (approx. 350mA for pulse encoder and 50mA for option unit)

Power supply example: NEMIC LAMBDA ES15-5 (5V, 3A)

4. PROGRAMMABLE CONTROLLER LINK FUNCTION

This manual gives specifications and handling and programming information on the programmable controller data link system (referred to as PC link) for use with the FR-A series transistorized inverters.
For the specifications of the master station in the data link system, see the MELSECNET/MINI-S3 User's Manual (Master Station).

4.1 Introduction

4.1.1 Features of PC link

PC link is a system designed to control and monitor the Mitsubishi FR-A200 series transistorized inverters from a programmable controller (PC) at a remote location using the MELSECNET/MINI-S3 data link system for the Mitsubishi MELSEC-A series general-purpose PCs (referred to as MINI link).

(1) Factory Automation can easily be applied to inverters which are used as remote I/O stations in the MINI link system and are controlled 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) Ease of machining optical cable connectors
Optical cable connectors can be machined easily by the user with the tool kit available from Mitsubishi.

4.1.2 PC link system configuration 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 FR-APC PC link unit into the inverter.
(3) Connect the master station and FR-APC with optical fiber cables.

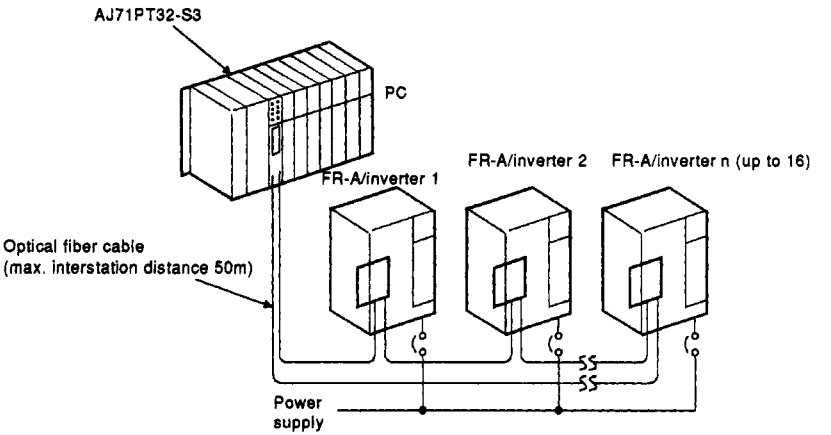


Fig. 1.1 Configuration Example

4.1.3 Function block diagram

Fig. 1.2 shows I/O data transfer in the PC link.

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

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

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

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

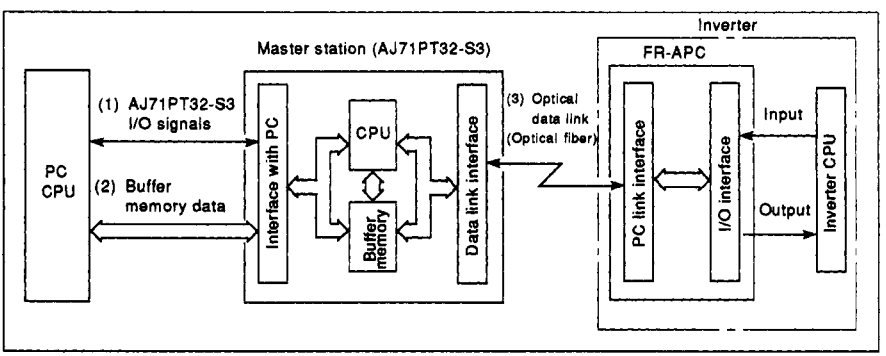


Fig. 1.2 Function Block Diagram

(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, see page 26.
(2) Allows input data to be read, output data to be written, and a PC link faulty station to be read, etc. Buffer memory data transfer is made by the FROM and TO instructions in the sequence program. For full information on the buffer memory, see page 29.
(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.

4.2 Specifications

4.2.1 Performance specifications

Table 2.1

Item			Specifications
PC link system			MELSECNET/MINI-S3 system
PC side*1	Applicable CPU card		1. A0J2CPU, A0J2HCPU (extension base required) 2. A1CPU, A1NCPU 3. A2CPU, A2NCPU, A2ACPU 4. A3CPU, A3HCPU, A3NCPU, A3HNCPU, A3ACPU, A3MCPU
	Master station	Type	AJ71PT32-S3 optical link module
		Number of link stations	64 stations max. (8 points/station), max. link points = 512
		Refresh time	3.5 to 18msec (when 64 stations are connected)
Communication cable			Plastic optical fiber cable
Interstation transmission distance			50m max.
Inverter side	Applicable inverter		FR-A200 inverter
	Type		Options are fitted to the connectors 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 PCs. (32 points occupied by one inverter)
	PC link option type		FR-APC

*1: For the PC specifications, see 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.

4.2.2 Optical fiber cable specifications

Table 2.2 Optical Fiber Cable Specifications

Item	Specifications
Optical cable used	Plastic fiber cable
Communication speed	1.5MBPS
Minimum optical transmission level	−11.6dBm
Maximum optical transmission level	−14.4dBm
Light wave length	660nm (visible light)

4.2.3 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. (Approx. 5msec)

(b) MINI link I/O refresh time
For full information, see 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.

(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.

(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. (Approx. 5msec)

POINT

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.

4.3. Operation Functions

4.3.1 Operation modes

The inverter fitted with the FR-APC option has the following operation modes (Fig. 3.1):

1) PU operation..... The inverter is operated from the keyboard of the parameter unit (PU) installed to the inverter.

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

3) PC link operation..... The inverter is operated under the control of the PC user program via the FR-APC PC link unit.

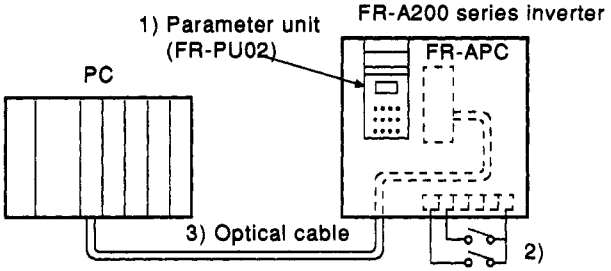


Fig. 3.1 Operation Modes

4.3.2 Operation mode switching

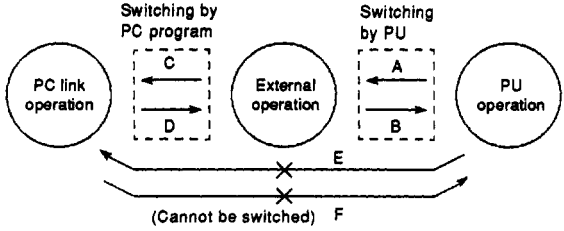
(1) Operation mode switching conditions

Before switching the operation mode, check that:

1) The inverter is at a stop;
2) The forward or reverse signal is not on; and
3) Parameter number 79 setting is correct.
(Set this parameter by the PU.)

Set Value	Operation Mode Selected	Switching to PC Link Operation Mode
0	PU or external operation	Disallowed in PU mode. Allowed in external mode.
1	PU operation only	Disallowed.
2	External operation only	Allowed.

(2) Operation mode switching method



Symbol	Switching	Description
A	PU to external operation	Press the EXT OP key on the PU.
B	External to PU operation	Press the PU OP key on the PU.
C	External to PC link operation	By user program from PC (see page 47).
D	PC link to external operation	By user program from PC (see page 47).
E	PU to PC link operation	Cannot be switched.Switch to external operation by A, then to PC link operation by C.
F	PC link to PU operation	Cannot be switched. Switch to external operation by D, then to PU operation by B.

(3)Operation mode display

The current operation mode is displayed on the PU.

1) PU operation ..... PU
2) External operation ..... EXT
3) PC link operation ..... NET

4.3.3 Functions

The PC link system allows the following functions to be executed from the PC.

Item	Operation Mode		
	PC link operation	External operation	PU operation
Monitoring	Allowed	Allowed	Allowed
Run	Allowed	Disallowed	Disallowed
Parameter write	Allowed*1	Disallowed	Disallowed
Parameter read	Allowed	Allowed	Allowed
Inverter reset	Allowed*2	Disallowed	Disallowed

*1: Parameters cannot be written while the inverter is operating.

*2: The inverter cannot be reset from the PC when the PC link error has occurred.

(1) Monitoring

The following 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 (See page 44.)
5) Inverter status (See page 39.)
   - Running (RUN)
   - Forward running
   - Reverse running
   - Up to frequency (SU)
   - Overload (OL)
   - Instantaneous power failure (IPF)
   - Frequency detection (FU)
   - Alarm

   Note: Any of the above (1) to (4) should be read from the buffer memory by setting the predetermined code number. (5) may be read from the buffer memory any time.

(2) Operation commands (See page 40)

Any of the following operation commands may be output from the PC to the inverter any time.

1) Forward rotation (STF)
2) Reverse rotation (STR)
3) Low speed (RL)
4) Middle speed (RM)
5) High speed (RH)
6) Second acceleration/deceleration (RT)
7) Inverter output halt (MRS)

(3) Output frequency (See page 48)

Write the output frequency from the PC to the inverter every time it should be changed.....Binary in 0.01Hz increments

Data must be written to the inverter RAM if the frequency is changed continuously.

(4) Parameter write (See page 49)

The required function can be written from the PC. Write during inverter operation will result in code mismatch (write mode error). (See page 45.)

For the parameter data codes, see Section 4.8 (page 53).

(5) Parameter read (See page 43)

The required function can be read to the PC.

For the parameter data codes, see Section 4.8 (page 53).

4.3.4 Alarm

(1) Alarm occurrence

Alarm occurring during operation results in any of the following:

	Operation Mode		
	PC link operation	External operation	PU operation
Inverter fault	Inverter stopped. Data communication continued.	Inverter stopped. Data communication continued.	Inverter stopped. Data communication continued.
PC link error	Inverter stopped. Data communication stopped.	Inverter operation continued. Data communication stopped.	Inverter operation continued. Data communication stopped.

(2) Checking alarm definition

Check the alarm definition in the procedure given on page 44.

1) Inverter fault

Remove the cause of alarm in accordance with the FR-A200 series transistorized inverter instruction manual.

2) Line error, data communication stop

In the FR-APC unit, check that:

- The optical cable connectors are fitted snugly;
- The optical cables are not open; and
- The FR-APC unit fits snugly in the inverter connector.

When 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 alarm.

Even if the main circuitry of any 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 (See page 50)	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 reset, the inverter is set to either of the following operation modes depending on the setting of parameter number 79.

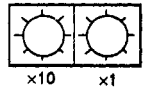
When parameter number 79 setting is 0 or 2....External operation mode

When parameter number 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, see page 47.)

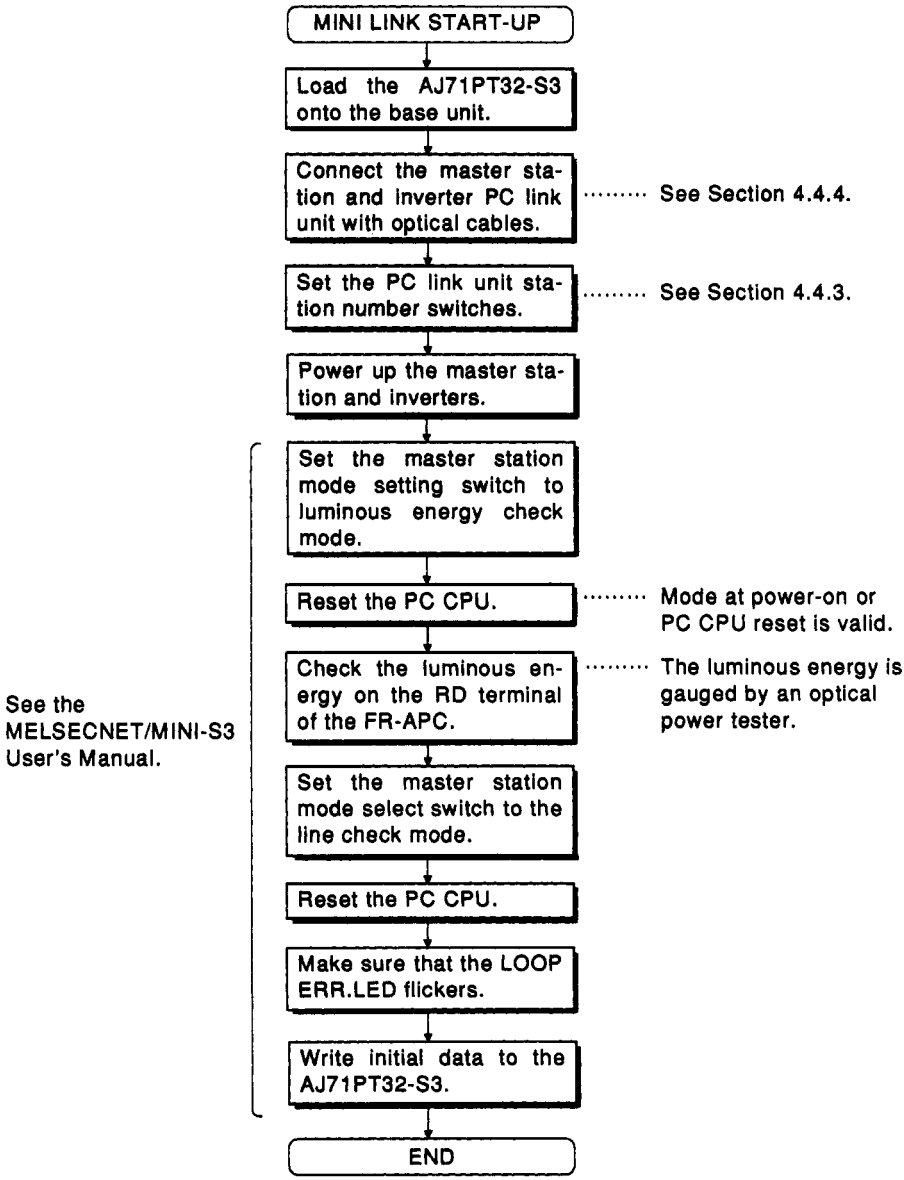
4.4. Settings

4.4.1 Nomenclature

Name	Description
Optical cable connector	To connect optical cables for the MINI link. (See page 24.) RD.....Receive cable SD.....Transmission cable
Station number setting switches	 To set the inverter station number between 1 and 61. For details, see Section 4.4.3.
Operation status indicator LEDs	○ RD ..... Lit during data receiving. Dimly lit to indicate normal state.* ○ ER ..... Lit to indicate receive data error. Off to indicate normal communication. ○ SD ..... Lit during data transmission. Dimly lit to indicate normal state.* ● RUN .... Lit to indicate normal data communication with the master station. *: Brightly lit to indicate alarm.

4.4.2 Pre-operation setting and procedure

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



4.4.3 Station number setting

The FR-APC station number should be set when I/O refresh is not being executed, noting the following:

(1) Odd station numbers may be set between 1 and 61.

(2) One FR-APC unit occupies four I/O stations (four PC remote I/O stations).
For example, the FR-APC defined as station 1 occupies stations 1 to 4. Hence, stations 1 to 4 cannot be used by the other units. (See Fig. 4.3.)

(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 FR-APC units connected in the same loop.
For example, if there are one remote I/O station and three inverters (FR-APCs), the number of stations is 13 (1 + 3 x 4).

(4) Station numbers may be specified independently of the connection sequence, e.g. as shown in Fig. 4.3.

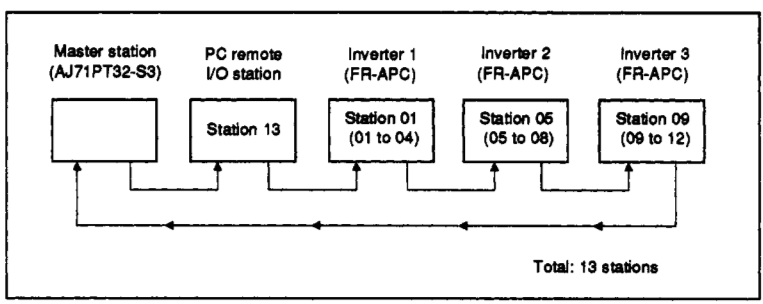


Fig.4.3 Station Number Setting Example

4.4.4 Optical fiber cables

(1) Handling instructions for optical fiber cables
Handle optical fiber cables with care.
1) Do not crush the cable.
2) Do not twist the cable.
3) Do not pull the cable by the connector.
4) Do not tension the cable.
5) Do not bend the cable to less than specified minimum bending radius.

(2) Connection of optical fiber cables

1) Connect the optical fiber cables as shown in Fig. 4.4.

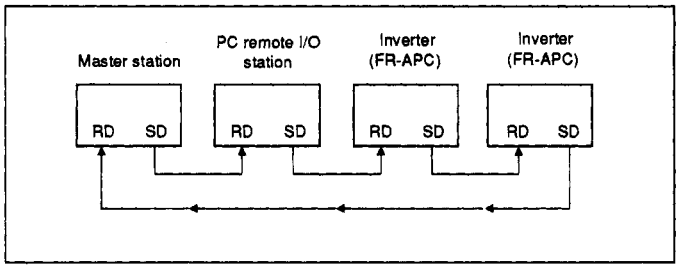
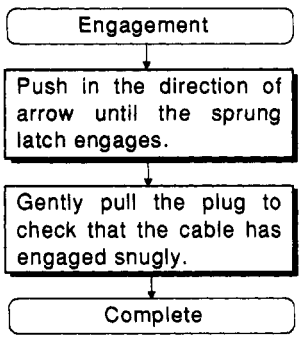


Fig. 4.4 Connection of Optical Fiber

POINT

Station numbers may be set independently of the PC link cable connection sequence. For details, see Section 4.4.3.

2) Optical fiber cable engagement



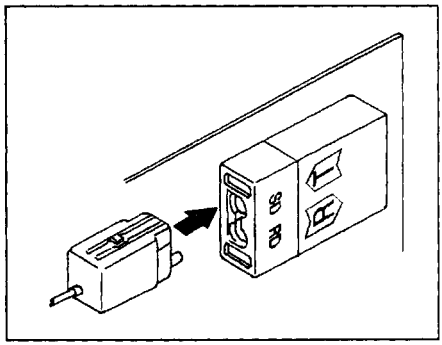
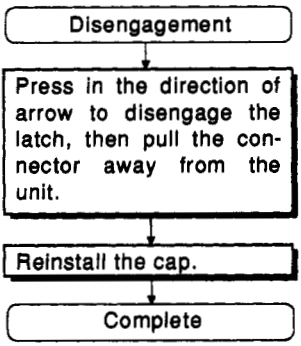


Fig. 4.5 Optical Fiber Cable Engagement

3) Optical fiber cable disengagement



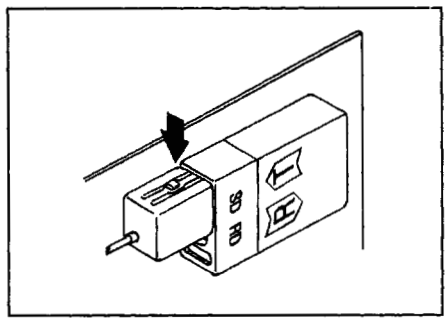
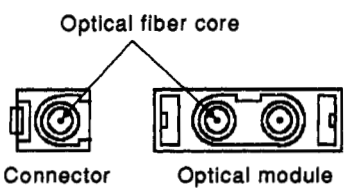


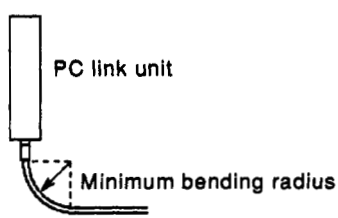
Fig. 4.6 Optical Fiber Cable Disengagement

POINT

(1) Do not touch the optical fiber cores in the connector or optical module and protect them from dirt and dust. Always fit the protective cap to the connector and optical module when not in use.



(2) Any optical fiber cable must not be bent within its minimum bending radius.
Minimum bending radius: 40mm



4.5 Programming

4.5.1 I/O List for the PC CPU

The AJ71PT32-S3 I/O signals for 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 used with a building block type CPU.

Table 5.1 I/O Signal List

Device No.	Signal	Device No.	Signal
X0	Hardware fault	Y0 to Y17	Reserved
X1	MINI link communicating		
X2	Reserved		
X3		Y18	MINI link communication start
X4		Y19	Reserved
X5	Test mode	Y1A	FROM/TO instruction response designation
X6	MINI link error detection	Y1B	Faulty station data clear designation
X7	MINI link communication error	Y1C	Reserved
X8 to X1F	Reserved	Y1D	Error reset
		Y1E	Reserved
		Y1F	

Explanation for the I/O signals

(1) Hardware fault (X0)

(a) On indicates that the AJ71PT32 mode setting switch has been set to any of 6 to 9 or a hardware fault has occurred.

(b) Used as an interlock for the FROM/TO instruction to the AJ71PT32.

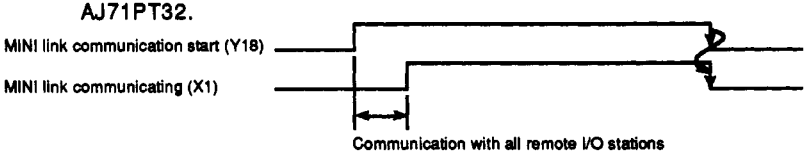
(2) MINI link communicating (X1)

(a) 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.

(b) Switched off when Y18 is switched off.

(c) Off indicates that a data communication stop error has occurred.

(d) Used as an interlock to execute the FROM/TO instruction for the AJ71PT32.



(3) Test mode (X5)

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

(a) 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.

(b) The corresponding error code is stored to buffer memory address 108 when X6 is switched on.

The error code is latched. For further details, see page 34.

(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.

(a) X7 is switched on when:

- Any remote I/O station or inverter is powered down;
- 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.

(b) The corresponding error code is stored to buffer memory address 107 when X7 is switched on.

(6) MINI link communication start (Y18)

(a) Switch on to start I/O refresh.

(b) X1 is switched on to indicate normal communication with all remote I/O stations.

(c) 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.

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

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

(c) 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 can be read.	The receive data refreshed at different timings may be 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.

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

(b) Off indicates that the receive data from a faulty inverter is retained.

(c) 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.

POINT

It is suggested to use no automatic return mode (mode setting switch 1) when Y1B is on.

(9) Error reset (Y1D)

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

(a) The error indicated by X6 or X7 can be reset by switching on Y1D when Y18 is off.

(b) Clears the communication error code (buffer memory address 107) and error detection code (address 108).

(c) Switches off the corresponding input device (X6, X7).

(d) ERR. LED reset

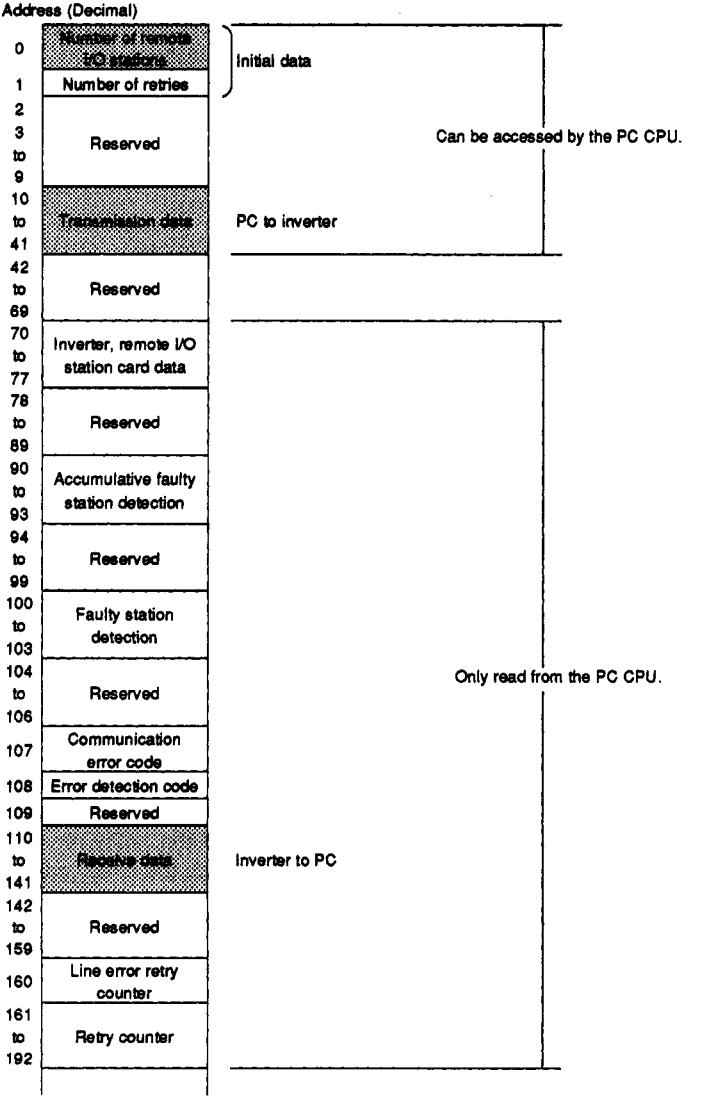
Switches off the corresponding error indicator LED (line error LED 4, faulty station LED 5).

4.5.2 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, see Section 4.6.

(1) Buffer memory assignment



POINTS

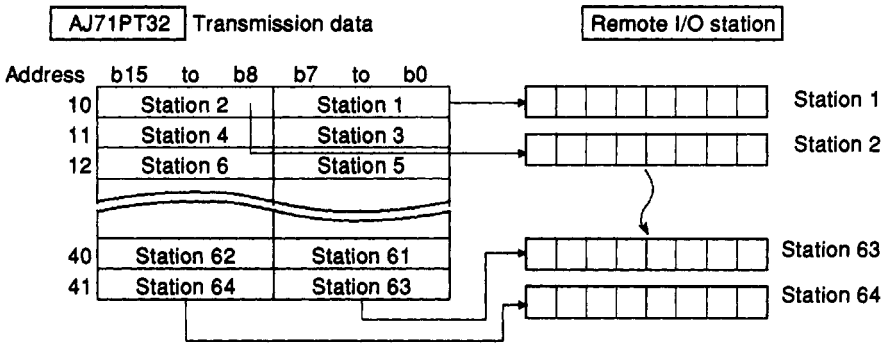
(1) The buffer memory is cleared and 2 written to address 1 (number of retries) when the PC CPU is powered up or reset.
(2) Any data must not be written to other than addresses 0, 1 and 10 to 41 from the PC CPU.
(3) The reserved areas are used by the AJ71PT32 system.
(4) Data in the read-only areas including the reserved areas can be read from the PC CPU sequentially, e.g. data can be read from the accumulative 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

1) 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 this range flags an initial data error when Y18 is switched on.
   (f) The 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.

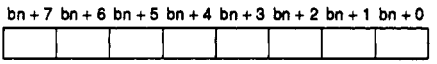
2) Number of retries (address 1)
   (a) Define the number of retries made to the faulty remote I/O station or inverter.
   (b) Defaults to 5.
   (c) Any value between 0 and 32 may be specified.
   (d) The number of retries should be written to address 1 when Y18 is off as the value on the leading edge 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 output remote I/O or inverter stations.
   (b) Buffer memory assignment is as follows:



Note: One inverter occupies the addresses of four stations. (See page 40.)

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

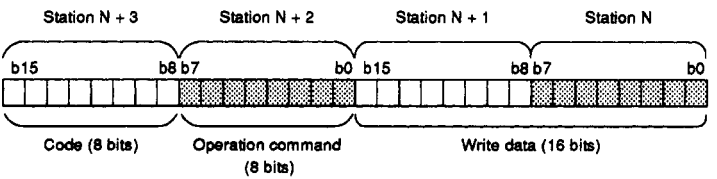


1: ON
0: OFF

*: 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 (FR-APC) 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 data communication type such as read, write and parameter number.
For the code list, see Section 4.8 (page 53).

• Operation command b0.....Not used (may either be 1 or 0)
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

• Write data..... Specify data such as parameter and output 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 is no remote I/O station 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:

Address	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 Y18 is switched on.

5) Accumulative 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 accumulative faulty stations indicated in the faulty station detection area (addresses 100 to 103).
(c) Reset to 0 when Y18 is switched on.

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

Address	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 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:

Address	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.

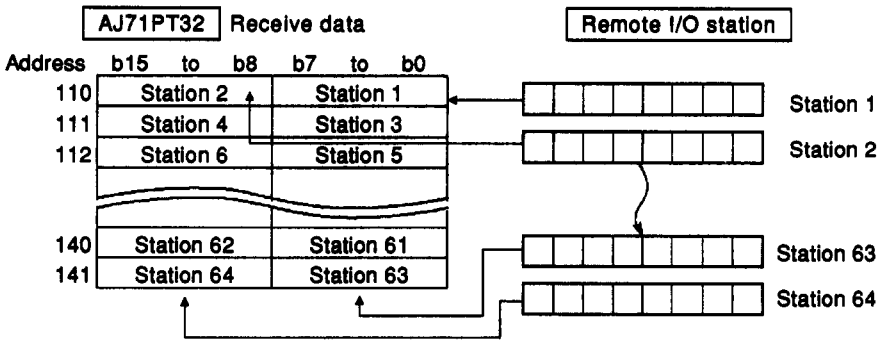
(b) Communication error codes are as follows:

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.

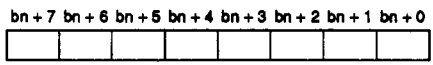
(c) The communication error code is reset to 0 when Y18 or Y1D is switched on.

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 ON/OFF data input to the remote I/O and inverter stations.
   (b) Buffer memory assignment is as indicated below:

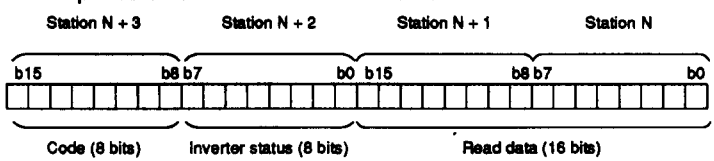


(c)Receive data is made up of 8 bits per remote I/O station as shown below.



*: 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 (FR-APC)] has 32 bit locations (four stations) as shown below.
*: N depends on the inverter station number.



- Code..... Represents a data communication type such as read, write and parameter number.
  For the code list, see Section 4.8 (page 53).
- Inverter status b0.....Running
  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

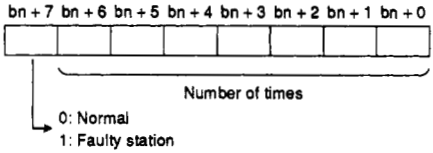
  1: ON
  0: OFF
- Read data..... Data corresponding to the code definition is received and stored from the inverter.

10) Line error retry counter (address 160)
  (a) Stores the number of retry times 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 has 8 bit locations per remote I/O station as shown below:

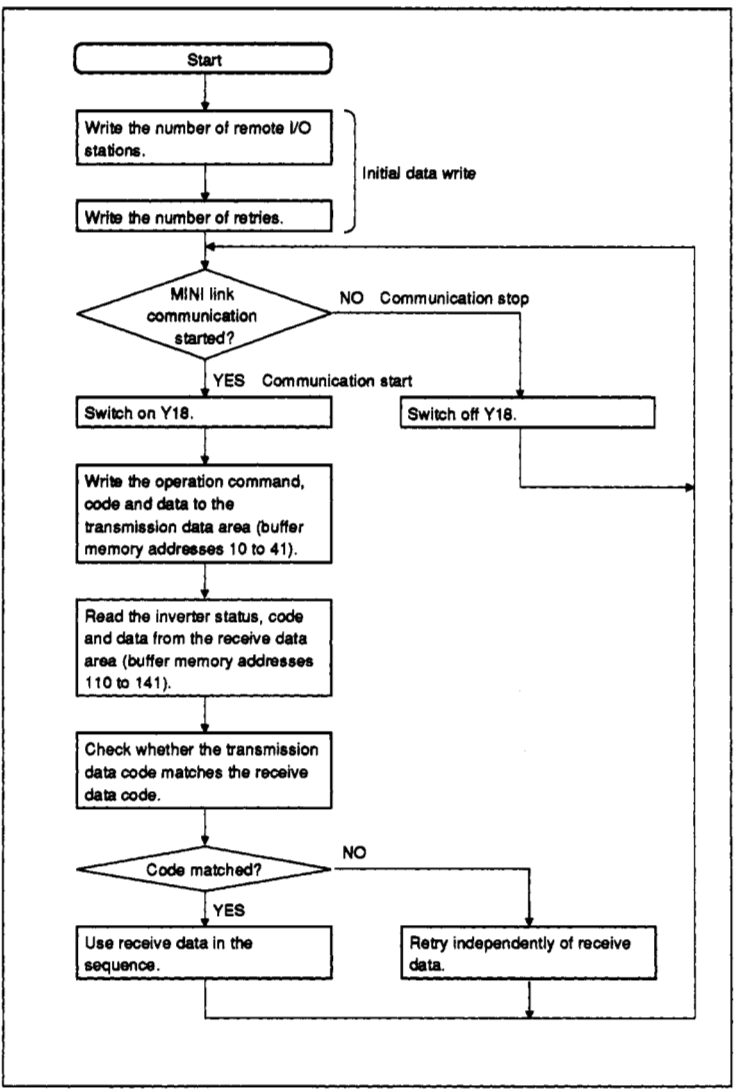


*: n depends on the station number.
b0 to b7 for odd-numbered stations 1, 3.....63
b8 to b15 for even-numbered stations 2, 4.....64

4.5.3 Programming procedure

In a MINI link system, write initial data (the 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



4.6 Programming Examples

4.6.1 Writing the initial data

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

(1) The initial data includes the number of remote I/O stations (address 0) and the number of retries (address 1).

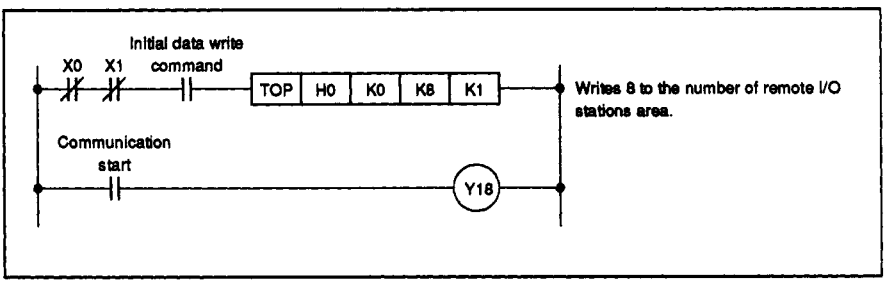
(2) The number of remote I/O stations may be set between 1 and 64, and defaults to 0.

(3) The number of retries may be set between 0 and 32, and defaults to 2.

(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.



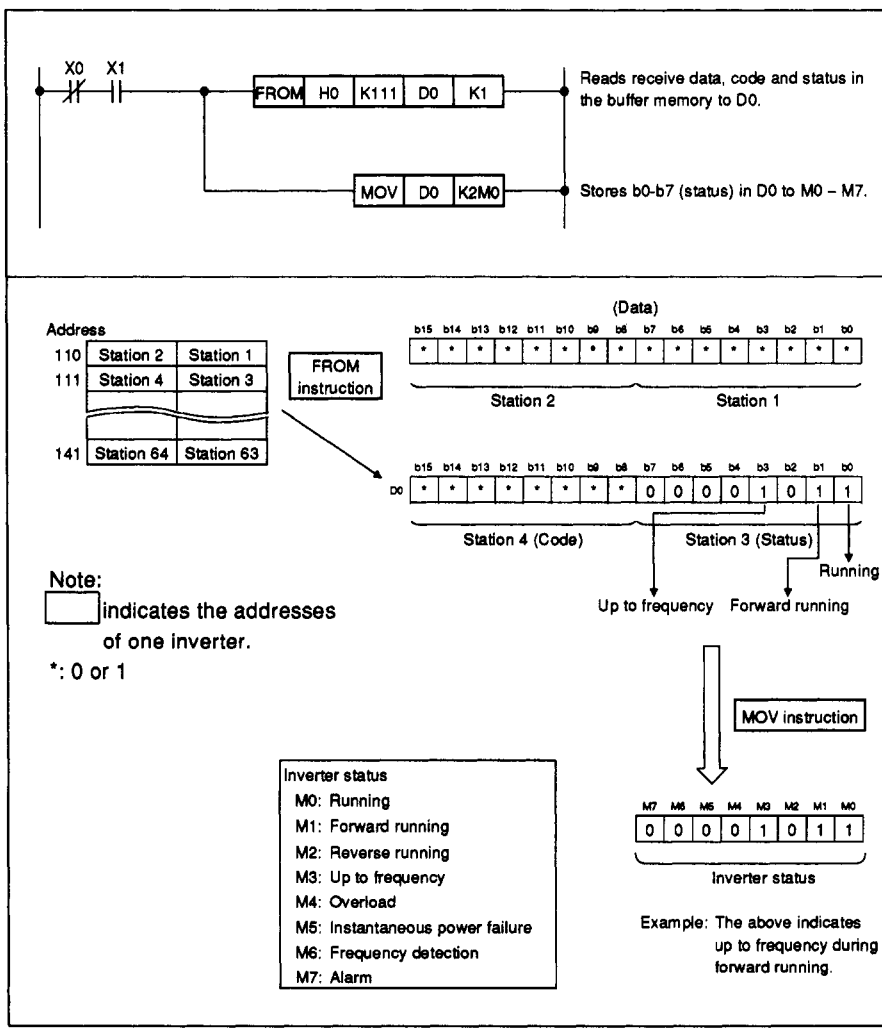
4.6.2 Reading the inverter status

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 110 to 141).

(2) Program example

The following program reads the inverter status of [station 1] to M0 – 7.



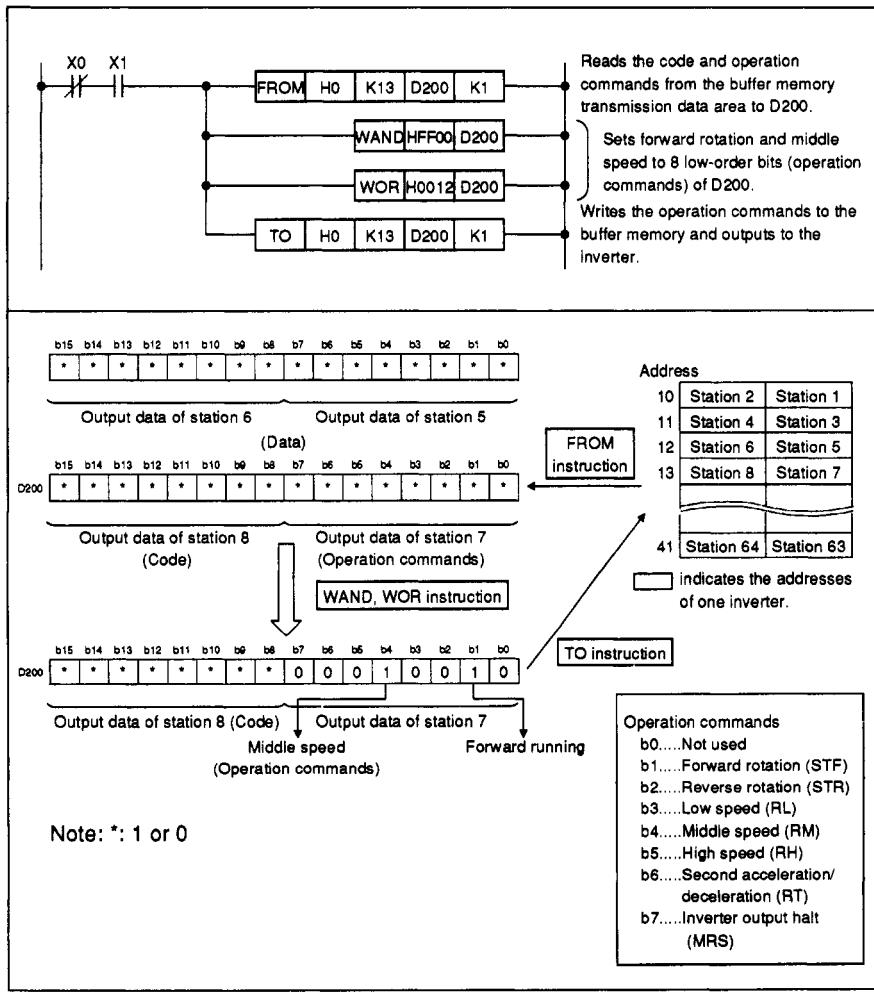
4.6.3 Writing the operation commands

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

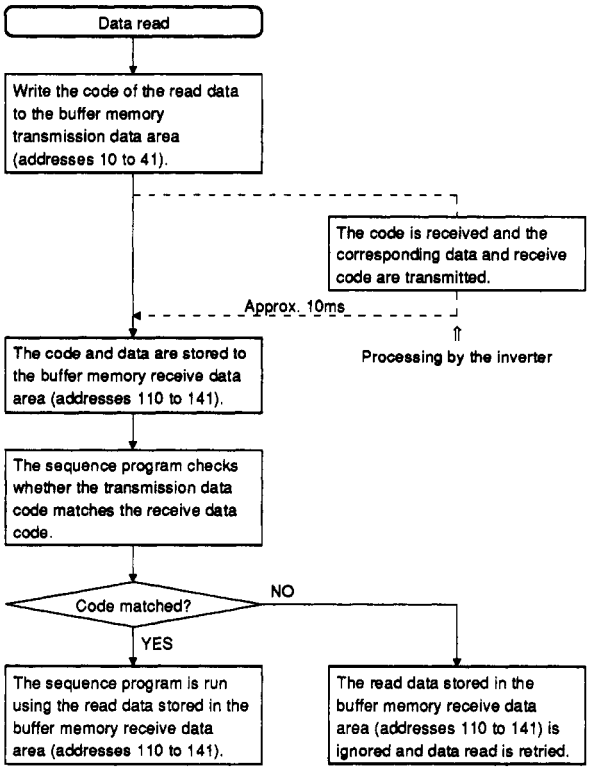
The following program outputs the forward rotation and middle speed signals to [station 5] inverter.



4.6.4 Reading data

Write programs as explained below to read various data of the inverters.

(1) Procedure.



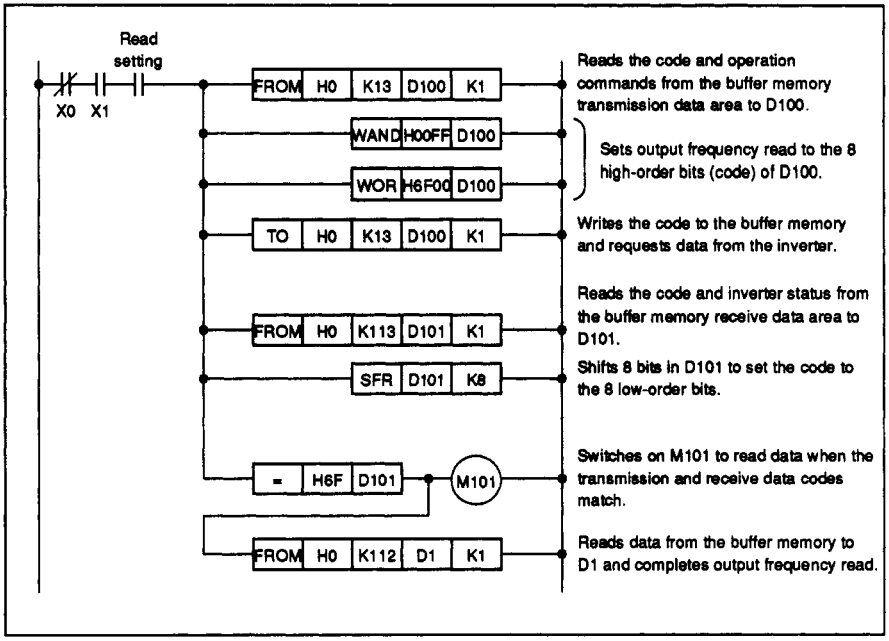
Note 1: The previous data may be read if the required data is read immediately after the code is written. Data should be read after the transmission data code has matched the receive data code.

Note 2: If the codes do not match after retry is repeated, take an appropriate action after checking the mismatch definition on page 45.

(2) Monitoring program example

1) The following program reads the output frequency of station 5 inverter to D1.

Output frequency reading code number: H6F (hexadecimal)



2) Monitoring codes

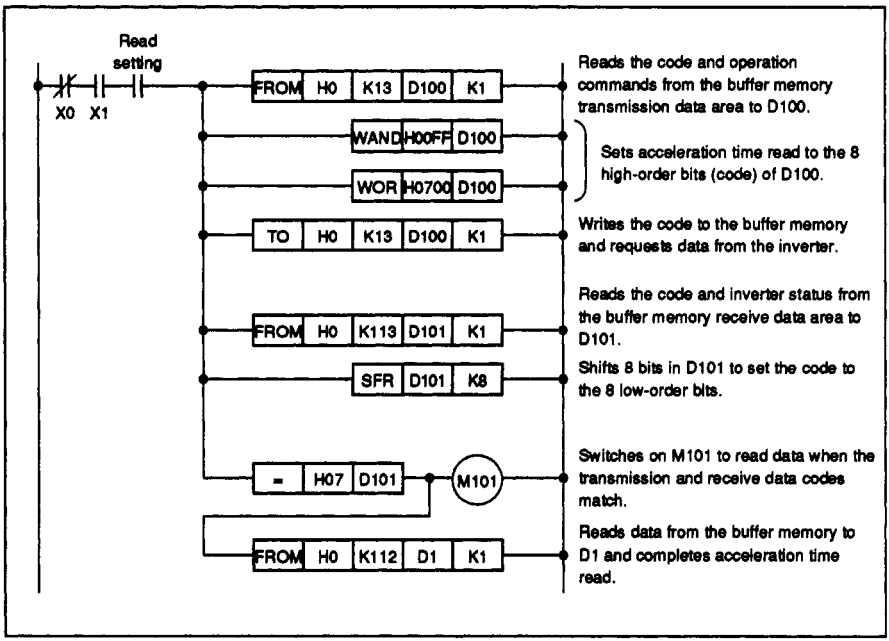
Item	Code	Data Type	Data Unit
Output frequency	H6F	Hexadecimal	0.01Hz
Output current	H70	Hexadecimal	0.01A
Output voltage	H71	Hexadecimal	0.1V

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

(3) Parameter reading program example

1) The following program reads the acceleration time set value of station 5 inverter to D1.

Acceleration time reading code number: H07 (hexadecimal)

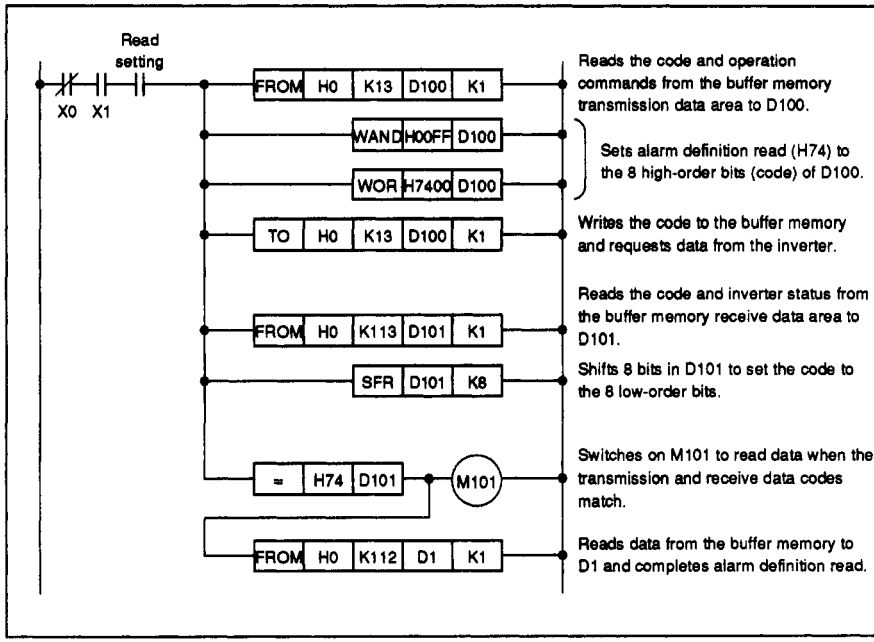


2) For other parameters, see the data code list in Section 4.8 (page 53).

(4) Alarm definition reading program example

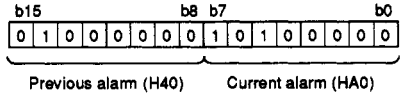
1) The following program reads the alarm definition of station 5 inverter to D1.

Alarm definition reading code number: H74 (hexadecimal)



2) Alarm definition display example

Example: Read data is H40A0 ——— Previous alarm.....FIN
Current alarm.....OPT



3) Alarm data

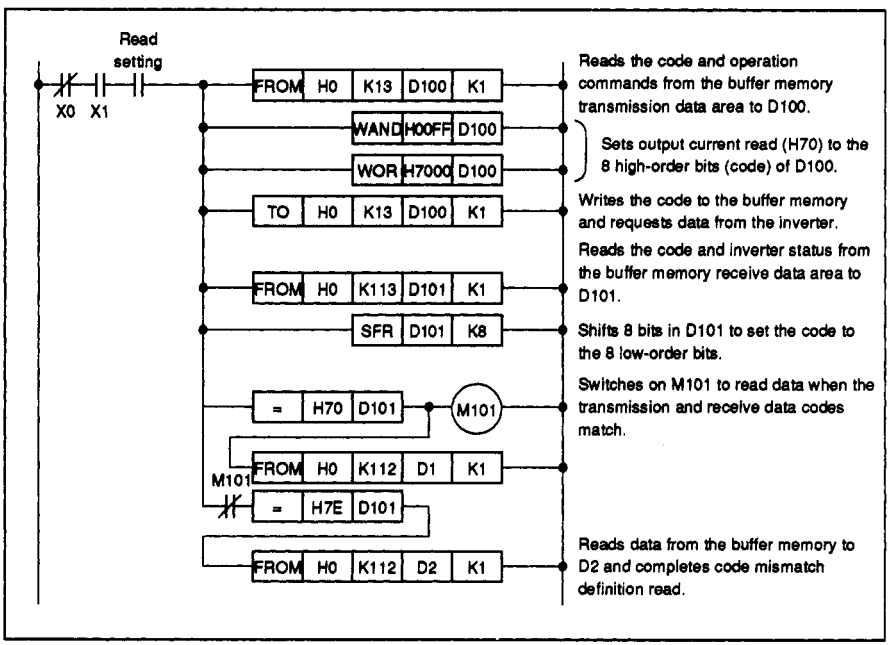
For full information on alarm definition, see the inverter instruction manual.

Data	Definition	Data	Definition
H00	No alarm	H50	IPF
H10	OC1	H51	UVT
H11	OC2	H60	OLT
H12	OC3	H70	BE
H20	OV1	H80	GF
H21	OV2	H90	OHT
H22	OV3	HA0	OPT
H30	THT	HB0	PE
H31	THM	HB1	PUE
H40	FIN	HB2	RET
H41	FAN	HC0	CPU

(5) Code mismatch definition reading program example

1) The following program reads the code mismatch definition of station 5 inverter to D2 when code mismatch is repeated during output current read.

Output current reading code number: H70 (hexadecimal)
Code mismatch definition reading code number: H7E (hexadecimal)



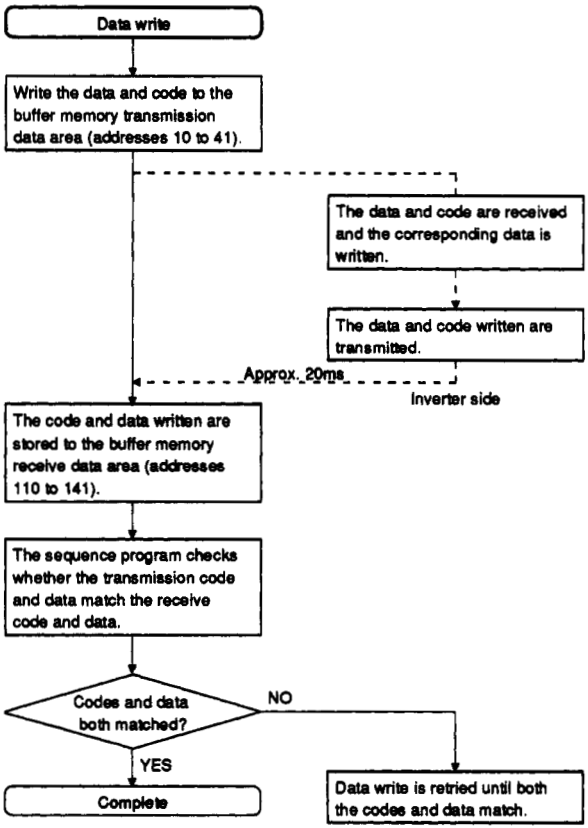
2) Code mismatch definition

Data	Item	Alarm Definition
H0000	Code recognition	Match check is being performed in the inverter.
H0001	Write mode error	Parameter has been written during other than stop in PC link operation mode.
H0002	Parameter select error	Invalid code number has been set.
H0003	Setting range error	Data set is outside the allowed range.
H0004	Inverter communication error	Communication between option unit and inverter has been disabled.

4.6.5 Writing data

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

(1) Procedure

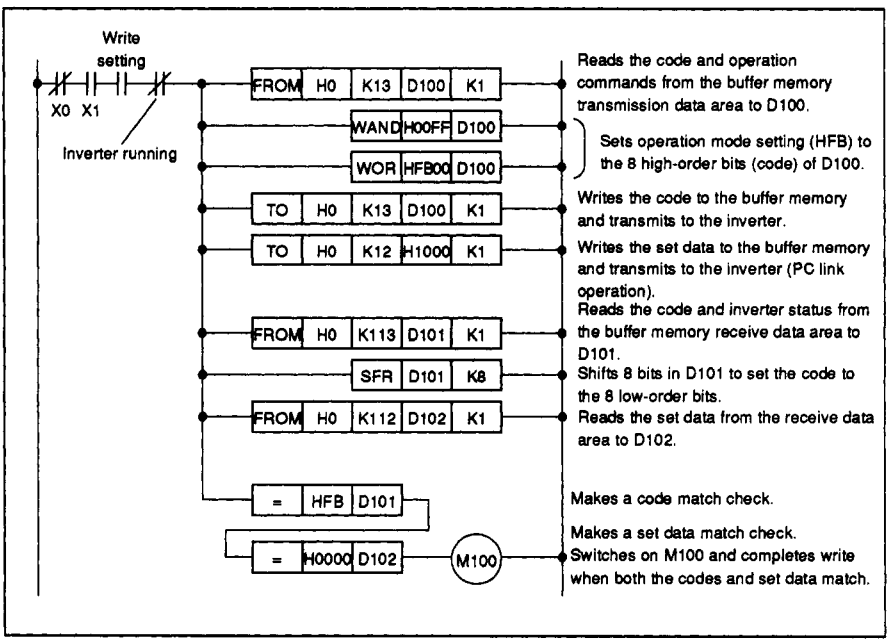


Note: Both the codes and data must be checked to ensure that they are correct.
If code and data mismatch is repeated, check the mismatch definition on page 45.

(2) Operation mode switching program example

1) 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)



2) Operation mode setting

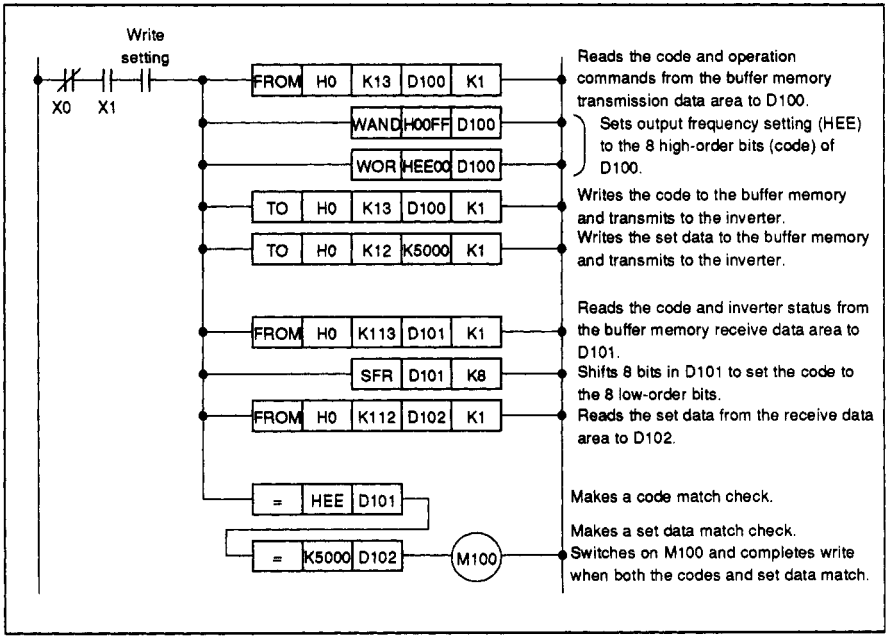
Code number: HFB Set data.....0000: PC link operation
0001: External operation
(0002: PU operation)

Note: PU operation cannot be set from the PC. (See page 17.)

(3) Output frequency setting program example

1) The following program changes the output frequency of station 5 inverter to 50.00Hz.

Running frequency setting code number : HEE (hexadecimal)
Set frequency : K5000 (hexadecimal)



2) To continuously change the output frequency from PC

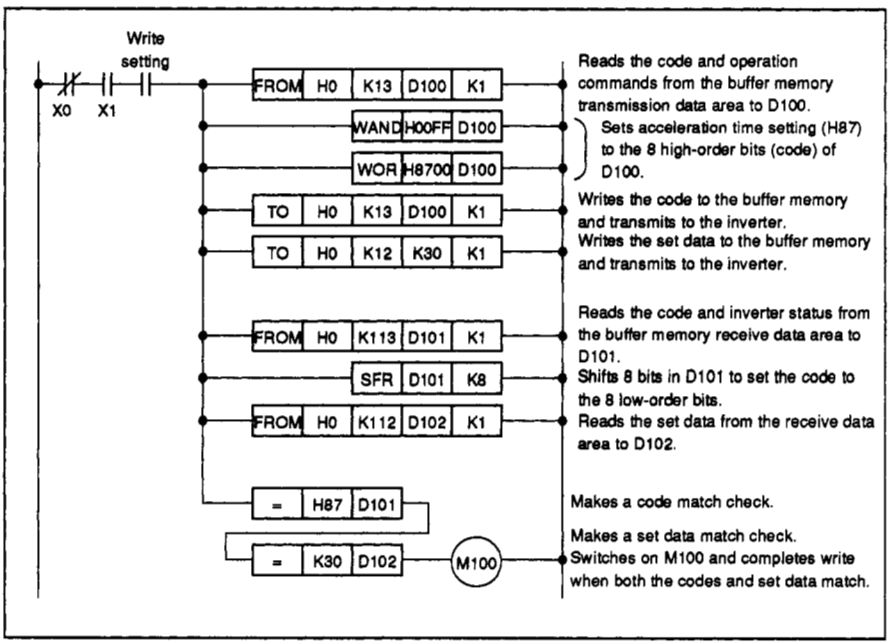
The set data match check is not required but the code match check should be made. The above program writes the frequency set data to E^2ROM of the inverter. When the output frequency is changed continuously, output frequencies should be written to the inverter RAM as the number of write times to E^2ROM is limited.

Program for writing to RAM
Modify the above program as follows:
Change the output frequency setting code number from HEE to HED.

(4) Parameter writing program example

1) The following program changes the acceleration time set value of station 5 inverter to 3.0 seconds.

Acceleration time writing code number : H87 (hexadecimal)
Acceleration time set data : K30 (hexadecimal)



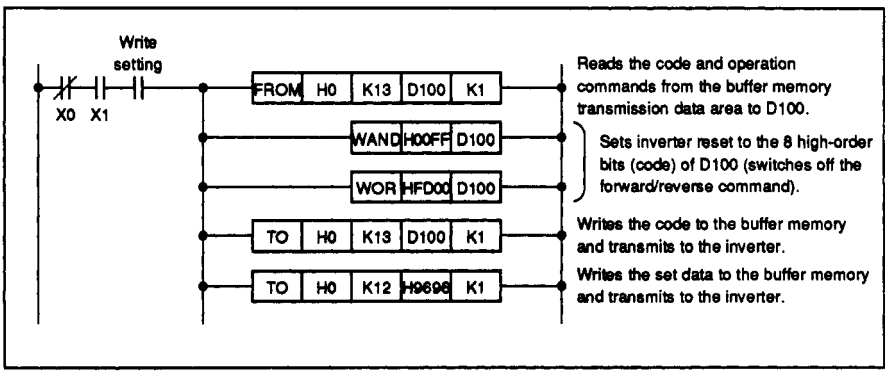
2) For other parameters, see the data code list in Section 4.8 (page 53).

(5) Inverter resetting program example

1) The following program resets the inverter of station 5.

Inverter resetting code number : HFD (hexadecimal)

Inverter resetting set data : H9696 (hexadecimal)



2) Other program example

Change the code number HFD of the above program as follows:

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

4.7 Instructions

(1) Programming instructions

1) Since the buffer memory data of the master station is kept transferred (refreshed) to and 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) 10 to 30msec 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. 10msec) after a request code and data have been changed from the master station once. 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 writing data as in the data format on page 31, 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(p.35).

(2) Operating 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 made.

3) The inverter is brought to an alarm stop E.OPT if data communication stops, even instantaneously, due to a programmable controller fault, an open optical cable or the like 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.OPT. 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 main circuit power of any inverter is shut off, optical signals are cut off, data communication come 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 to return to the external operation mode. To resume the PC link operation, therefore, set the operation mode to the PC link operation using the programmable controller program.

(3) Troubleshooting

1) Operation mode unswitched to PC link
- Check that the FR-APC 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 and the station numbers are not repeated.)
- 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 FR-APC unit and optical cables are fitted properly. (Check for contact fault, open cable, etc.)
- Check that the programmable controller program is executed reliably.
- Check that data communication is not stopped due to an instantaneous power failure, etc.
- Check that the communication start signal (Yn + 18) of the master station is on.

4.8 Data Code List

(1) Standard parameters (Data code FF = 0)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
0	Torque boost	00	80	0 to 30%	0.1%	6/3%
1	Max. frequency limit	01	81	0 to 120Hz	0.01Hz	120Hz
2	Min. frequency limit	02	82	0 to 120Hz	0.01Hz	0Hz
3	Base frequency	03	83	0 to 400Hz	0.01Hz	60Hz
4	Multi-speed setting (high speed)	04	84	0 to 400Hz	0.01Hz	60Hz
5	Multi-speed setting (middle speed)	05	85	0 to 400Hz	0.01Hz	30Hz
6	Multi-speed setting (low speed)	06	86	0 to 400Hz	0.01Hz	10Hz
7	Acceleration time	07	87	0 to 3600 seconds/ 0 to 360 seconds	0.1/0.01 seconds	5/15 seconds
8	Deceleration time	08	88	0 to 3600 seconds/ 0 to 360 seconds	0.1/0.01 seconds	5/15 seconds
9	Electronic thermal relay	09	89	0 to 500A	0.01A	Rated value
10	DC dynamic brake frequency	0A	8A	0 to 120Hz	0.01Hz	3Hz
11	DC dynamic brake time	0B	8B	0 to 10 seconds (9999)	0.1 seconds	0.5 seconds
12	DC dynamic brake voltage	0C	8C	0 to 30%	0.1%	6/3%
13	Starting frequency	0D	8D	0 to 60Hz	0.01Hz	0.5Hz
14	Load pattern selection	0E	8E	0, 1, 2, 3 (4, 5)	1	0
15	Jog frequency	0F	8F	0 to 400Hz	0.01Hz	5Hz
16	Jog acceleration/deceleration time	10	90	0 to 3600 seconds/ 0 to 360 seconds	0.1/0.01 seconds	0.5 seconds
17	External thermal relay signal input	11	91	0, 1, 2, 3	1	0
18	High-speed maximum frequency limit	12	92	120 to 400Hz	0.01Hz	120Hz
19	Base frequency voltage	13	93	0 to 1000V, 9999	0.1V	9999
20	Acceleration/deceleration reference frequency	14	94	1 to 400Hz	0.01Hz	60Hz
21	Acceleration/deceleration time unit	15	95	0, 1	1	0
22	Stall prevention level	16	96	0 to 200%	0.1%	150%
23	Stall prevention level 2	17	97	0 to 200%, 9999	0.1%	9999
24	Multi-speed setting (4th)	18	98	0 to 400Hz, 9999	0.01Hz	9999
25	Multi-speed setting (5th)	19	99	0 to 400Hz, 9999	0.01Hz	9999
26	Multi-speed setting (6th)	1A	9A	0 to 400Hz, 9999	0.01Hz	9999
27	Multi-speed setting (7th)	1B	9B	0 to 400Hz, 9999	0.01Hz	9999
28	Multi-speed input correction	1C	9C	0, 1	1	0
29	Acceleration/deceleration pattern	1D	9D	0, 1, 2 (3)	1	0
30	Regenerative brake duty selection	1E	9E	0, 1	1	0
31	Frequency jump 1A	1F	9F	0 to 400Hz, 9999	0.01Hz	9999
32	Frequency jump 1B	20	A0	0 to 400Hz, 9999	0.01Hz	9999
33	Frequency jump 2A	21	A1	0 to 400Hz, 9999	0.01Hz	9999
34	Frequency jump 2B	22	A2	0 to 400Hz, 9999	0.01Hz	9999
35	Frequency jump 3A	23	A3	0 to 400Hz, 9999	0.01Hz	9999

(Data code FF = 0)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
36	Frequency jump 3B	24	A4	0 to 400Hz, 9999	0.01Hz	9999
37	Speed display	25	A5	2 to 10, 11 to 9998	1	4
38	Automatic torque boost	26	A6	0 to 200%	0.1%	0
39	Automatic torque boost starting current	27	A7	0 to 215A	0.01A	0
40	Output terminal assignment	28	A8	0 to 9999	1	1234
41	Up to frequency sensitivity	29	A9	0 to 100%	0.1%	10%
42	Output frequency detection	2A	AA	0 to 400Hz	0.01Hz	6Hz
43	Output frequency detection during reverse operation	2B	AB	0 to 400Hz, 9999	0.01Hz	9999
44	Second acceleration/deceleration time	2C	AC	0 to 3600 seconds/ 0 to 360 seconds	0.1/0.01 seconds	5 seconds
45	Second deceleration time	2D	AD	0 to 3600 seconds/ 0 to 360 seconds, 9999	0.1/0.01 seconds	9999
46	Second torque boost	2E	AE	0 to 30%, 9999	0.1%	9999
47	Second V/F (base frequency)	2F	AF	0 to 400Hz, 9999	0.01Hz	9999
48	Second stall prevention level (current)	30	B0	0 to 200%	0.1%	150%
49	Second stall prevention level (frequency)	31	B1	0 to 400Hz	0.01Hz	0
50	Second output frequency detection	32	B2	0 to 400Hz	0.01Hz	30Hz
51	LED display data selection	33	B3	1 to 18	1	1
52	PU main display data selection	34	B4	0, 17 to 20	1	0
53	PU level display data selection	35	B5	0 to 18	1	2
54	FM terminal function selection	36	B6	1 to 21 (101 to 121, AM terminal)	1	1
55	Frequency reference setting	37	B7	0 to 400Hz	0.01Hz	60Hz
56	Current monitoring reference	38	B8	0 to 215A	0.01A	Rated value
57	Coasting time for automatic restart	39	B9	0 to 5 seconds, 9999	0.1 seconds	9999
58	Automatic restart time	3A	BA	0 to 5 seconds	0.1 seconds	0.5 seconds
59	Remote setting function	3B	BB	0, 1, 2	1	0
60	Intelligent mode selection	3C	BC	0 to 6	1	0
61	Reference current	3D	BD	0 to 500A, 9999	0.01A	9999
62	Acceleration time reference value	3E	BE	0 to 200%, 9999	0.1%	9999
63	Deceleration time reference value	3F	BF	0 to 200%, 9999	0.1%	9999
64	Optimum value write selection	40	C0	0, 1, 9999	1	9999
65	(Not yet defined)	41	C1	–	–	–
66	Stall limit, reduction starting frequency	42	C2	0 to 400Hz	0.01Hz	60Hz
67	Number of retries at alarm occurrence	43	C3	0 to 10 (101 to 110)	1	0

(Data code FF = 0)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
68	Retry waiting time	44	C4	0 to 10 seconds, 9999	0.1 seconds	9999
69	Retry count display	45	C5	0	1	0
70	(Regenerative brake duty change)	46	C6	(0 to 15%, 0 to 30%)	(0.1%)	0
71	Motor driven	47	C7	0, 1	1	0
72	PWM carrier frequency selection	48	C8	2 to 14.5 (115 to 120) KHz	0.1	14.5KHz
73	0-5V, 0-10V selection	49	C9	0 to 5, 10 to 15	1	1
74	Input filter constant	4A	CA	0 to 8	1	1
75	Reset selection	4B	CB	0, 1	1	0
76	Alarm code output selection	4C	CC	0, 1, 2 (3)	1	0
77	Parameter write prohibition	4D	CD	0, 1, 2 (801)	1	0. Must not be set.
78	Reverse prevention	4E	CE	0, 1, 2	1	0
79	Operation mode selection	4F	CF	0 to 5	1	0. Must not be set.
80	Motor capacity	50	D0	0.4 to 55kW, 9999	0.01kW	9999
81	Number of poles	51	D1	2 to 6, 9999	1	9999
82	Exciting current setting	52	D2	0 to 500.0A, 9999	0.01A	(9999)
83	Exciting current at double speed	53	D3	0 to 500.0A, 9999	0.01A	(9999)
84	Exciting current flexing point 1	54	D4	0 to 400.00Hz, 9999	0.01Hz	(9999)
85	Exciting current flexing point 2	55	D5	0 to 400.00Hz, 9999	0.01Hz	30.00Hz
86	Exciting current low-speed ratio	56	D6	0 to 1000.0%	0.1%	150.0%
87	d axis control gain	57	D7	0.0 to 100.00%, 9999	0.1%	(9999)
88	q axis control gain	58	D8	0.0 to 1000.00%	0.1%	100.0%
89	Speed control gain	59	D9	0.0 to 1000.00%	0.1%	100.0%
90	Motor constant R1	5A	DA	0 to 1000.0Ω, 9999	0.001Ω	9999
91	Motor constant R2	5B	DB	0 to 1000.0Ω, 9999	0.001Ω	(9999)
92	Motor constant L1	5C	DC	0 to 1000.0mH, 9999	0.1mH	9999
93	Motor constant L2	5D	DD	0 to 1000.0mH, 9999	0.1mH	(9999)
94	Motor constant δ	5E	DE	0 to 100.00%, 9999	0.1%	(9999)
95	Coasting detection current gain	5F	DF	0 to 300.0%, 9999	0.1%	(9999)

(Data code FF = 0)

Parameter No.	Function		Data Code		Setting Range	Minimum Increment	Initial Setting
			Read	Write			
96	(Not yet defined)		60	E0	–	–	–
97	(Td correction value)		61	E1	0 to 200%	1%	72%
98	(Carrier switching)		62	E2	0 to 400.00Hz, 9999	0.01Hz	10.00Hz
99	(Under carrier frequency)		63	E3	0 to 20KHz	0.1KHz	9.0KHz
–	Second parameter switching		6C	EC	00, 01, 02	1	00
–	Frequency setting	Output frequency setting (RAM)	6D	ED	0 to 400Hz	0.01Hz	0Hz
–	Frequency setting	Output frequency setting (E^2ROM)	6E	EE	0 to 400Hz	0.01Hz	0Hz
–	Monitor	Frequency monitor	6F	–	0 to 400Hz	0.01Hz	
–	Monitor	Output current monitor	70	–	0 to 500A	0.01A	
–	Monitor	Output voltage monitor	71	–	0 to 1000V	0.1V	
–	Monitor	Special monitor	72	–			
–	Monitor	Special monitor selection No.	73	F3	1 to 14		
–	Alarm display	Most recent No. 1, No. 2/ alarm display clear	74	F4			
–	Alarm display	Most recent No. 3, No. 4	75	–			
–	Alarm display	Most recent No. 5, No. 6	76	–			
–	Alarm display	Most recent No. 7, No. 8	77	–			
–	Inverter status monitor/ operation command		7A	FA			
–	Operation mode acquisition		7B	FB	0, 1, 2		
–	Parameter all clear		–	FC			
–	Inverter reset		–	FD			
–	Data code mismatch		7E	–			
–	Link parameter expansion setting		7F	FF	0: Pr. 0 to 99, 1: Pr. 100 to 915		

(2) Special parameters (Data code FF = 1)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
100	BCD input (offset)	00	80	0 to 400Hz	0.01Hz	0
101	BCD input (gain)	01	81	0 to 400Hz, 9999	0.01Hz	60Hz
102	Binary input (offset)	02	82	0 to 400Hz	0.01Hz	0
103	Binary input (gain)	03	83	0 to 400Hz, 9999	0.01Hz	60Hz
104	BCD/binary selection	04	84	0, 1, 2, 3, 9999	1	0
105	Speed feedback range	05	85	0 to 400Hz, 9999	0.01Hz	9999
106	Feedback gain	06	86	0.1 to 100	0.1	1.0
107	Stop position command selection	07	87	0 to 120, 9999	1	9999
108	Orientation speed	08	88	0 to 30Hz	0.01Hz	2Hz
109	Creep speed	09	89	0 to 10Hz	0.01Hz	0.5Hz
110	Creep select position	0A	8A	0 to 4095	1	511
111	Position loop select position	0B	8B	0 to 2047	1	96
112	DC dynamic braking start position	0C	8C	0 to 31	1	5
113	Internal stop position command	0D	8D	0 to 4095	1	0
114	In-position zone	0E	8E	0 to 31	1	5
115	Servo torque selection	0F	8F	0, 1	1	1
116	Number of retries	10	90	0, 1, 2, 3	1	2
117	Encoder rotation direction	11	91	0, 1	1	0
118	Communication speed	12	92	3 to 96	1	96
119	Stop bit length	13	93	0, 1, 2	1	2
120	Parity check	14	94	0, 1, 2	1	2
121	Number of communication retries	15	95	0 to 10	1	1
122	Communication check time interval	16	96	0 to 999.8 seconds, 9999	0.1 seconds	0
123	Operation command place	17	97	0, 1	1	0
124	Speed command place	18	98	0, 1	1	0
125	Computer link start-up mode selection	19	99	0, 1	1	0
126	CR, LF code selection	1A	9A	0, 1, 2	1	1
127	Setting of E^2ROM write by PC link/computer link	1B	9B	0, 1	1	0
128	PI action selection	1C	9C	0, 1, 9999	1	9999
129	PI proportional band	1D	9D	0.1 to 1000%, 9999	0.1%	100%
130	PI integral time	1E	9E	0.1 to 3600 seconds, 9999	0.1 seconds	1 second
131	Maximum limit	1F	9F	0 to 100%, 9999	0.1%	9999
132	Minimum limit	20	A0	0 to 100%, 9999	0.1%	9999
133	PC link/PU PI set value	21	A1	0 to 100%	0.1%	0%
134	Relay output selection	22	A2	0 to 999	1	12
135	Analog meter output selection	23	A3	0 to 18	1	17
136	Analog meter offset	24	A4	0 to 100%	0.1%	0
137	Analog meter gain	25	A5	0 to 100%	0.1%	100%
138	(Not yet defined)	26	A6			
139	(Not yet defined)	27	A7			

(Data code FF = 1)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
140	(Not yet defined)	28	A8			
141	(Not yet defined)	29	A9			
142	(Not yet defined)	2A	AA			
143	(Not yet defined)	2B	AB			
144	(Not yet defined)	2C	AC			
145	(Not yet defined)	2D	AD			
146	(Not yet defined)	2E	AE			
147	(Not yet defined)	2F	AF			
148	(Not yet defined)	30	B0			
149	(Not yet defined)	31	B1			
150	(Not yet defined)	32	B2			
151	(Not yet defined)	33	B3			
152	(Not yet defined)	34	B4			
153	(Not yet defined)	35	B5			
154	(Not yet defined)	36	B6			
155	(Not yet defined)	37	B7			
156	(Not yet defined)	38	B8			
157	(Not yet defined)	39	B9			
158	Debugging address	3A	BA			
159	Debugging data	3B	BB			
200	Program minute/second selection	3C	BC	0, 1	1	0
201	Program setting 1	3D	BD			
202	Program setting 2	3E	BE			
203	Program setting 3	3F	BF			
204	Program setting 4	40	C0			
205	Program setting 5	41	C1	0 to 2 for rotation direction	1	0
206	Program setting 6	42	C2			
207	Program setting 7	43	C3			
208	Program setting 8	44	C4	0 to 400.0Hz, 9999 for frequency	0.1Hz	9999
209	Program setting 9	45	C5			
210	Program setting 10	46	C6			
211	Program setting 11	47	C7	0 to 99.59 for time	0.01	0
212	Program setting 12	48	C8			
213	Program setting 13	49	C9			
214	Program setting 14	4A	CA			
215	Program setting 15	4B	CB			
216	Program setting 16	4C	CC			
217	Program setting 17	4D	CD			
218	Program setting 18	4E	CE			
219	Program setting 19	4F	CF			
220	Program setting 20	50	D0			

(Data code FF = 1)

Parameter No.	Function	Data Code		Setting Range	Minimum Increment	Initial Setting
		Read	Write			
221	Program setting 21	51	D1	0 to 2 for rotation direction	1	0
222	Program setting 22	52	D2			
223	Program setting 23	53	D3	0 to 400.0Hz, 9999 for frequency	0.1Hz	9999
224	Program setting 24	54	D4			
225	Program setting 25	55	D5			
226	Program setting 26	56	D6			
227	Program setting 27	57	D7	0 to 99.59 for time	0.01	0
228	Program setting 28	58	D8			
229	Program setting 29	59	D9			
230	Program setting 30	5A	DA			
231	Time of day setting	5B	DB	0 to 99.59	0.01	0
900	FM terminal calibration	5C	DC	0 to 4096	1	Not defined
901	AM terminal calibration	5D	DD	0 to 4096	1	255
902	Frequency setting voltage bias	5E	DE	0 to 60.00Hz (0 to 4096)	0.01Hz	0
903	Frequency setting voltage gain	5F	DF	0 to 400.00Hz (0 to 4096)	0.01Hz	60Hz
904	Frequency setting current bias	60	E0	0 to 60.00Hz (0 to 4096)	0.01Hz	0
905	Frequency setting current gain	61	E1	0 to 400.00Hz (0 to 4096)	0.01Hz	60Hz
906	Voltage calibration bias	62	E2	0 to 1000.0V (0 to 4096)	0.1V	215/400V
907	Voltage calibration gain	63	E3	0 to 1000.0V (0 to 4096)	0.1V	400/600V
908	None	64	E4			
909	Rated current	65	E5	0 to 300A		
910	None	66	E6	0 to 400Hz, 9999		
911	None	67	E7	0 to 3600 seconds/0 to 360 seconds		
912	None	68	E8			
913	None	69	E9			
914	Terminal 1 0V calibration	6A	EA	0 (0 to 4096)		
915	Communication without parameter number	6B	EB			

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