MITSUBISHI

MITSUBISHI MELTRAC-A SERIES INVERTER

INSTRUCTION MANUAL FOR OPTION CARD T-OPT22

PROGRAMMABLE LOGIC CONTROLLER LINK CARD

T-OPT22

- PLG FEEDBACK CONTROL
- PROGRAMMABLE LOGIC CONTROLLER (MELSECNET/ MINI-S3) LINK

Your purchase of this Mitsubishi MELTRAC-A Inverter Option Card is greatly appreciated. This operation manual describes operating instructions and cautionary notes to use your MELTRAC-A Option Card correctly.
Incorrect operation or handling may cause unexpected problems. Be sure to read this operation manual thoroughly so that you will use your Option Card correctly.

PROGRAMMABLE LOGIC CONTROLLER LINK CARD (T-OPT22)
This is a multi-functional option card that is capable of interfacing with Mitsubishi Programmable Logic Controller MELSECNET/MINI-S3 and is designed to be used in constructing FA-compatible drive systems. The Option Card has the following functions.

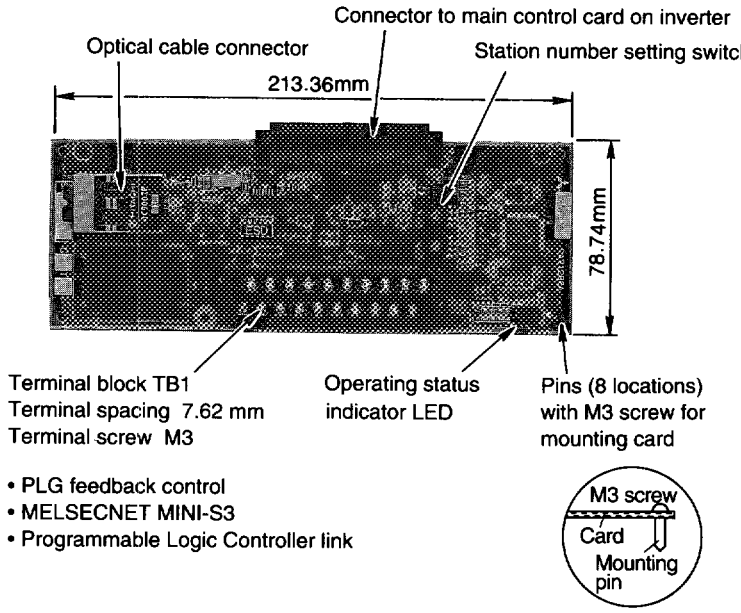
- PLG feedback control
- MELSECNET/MINI-S3 Programmable Logic Controller link

TABLE OF CONTENTS

NOTE: This multi-functional Option Card is initialized as shown in the table below. In order for each feature to be functional, refer to the corresponding pages in this manual to set the necessary parameters.

Function	Initial condition	Note
PLG feedback Back control function	Not functional	Pr. 105 is factory-set to [9999].
Programmable Logic Controller (MELSEC NET/MINI-S3) link	Not functional Monitor and parameter values can be read.	The operation mode is factory-set to the external operation mode. To make these functions operable, send data codes and data from the programmable Logic controller.

1. OUTLINE



- PLG feedback control
- MELSECNET MINI-S3
- Programmable Logic Controller link

Terminal Block TB1 pin layout

Terminal No.	Signal name	Description	Terminal No.	Signal name	Description
A1	Not used		B1	12V	External 12 V power source terminal
A2	Not used		B2	SG	External power ground terminal
A3	Not used		B3	Not used	
A4	Not used		B4	FG	Frame ground terminal
A5	Not used		B5	SG2	Frame ground
A6	Not used		B6	Not used	
A7	Not used		B7	PA1	Encoder phase A signal input terminal
A8	Not used		B8	PA2	Encoder phase A reverse signal input terminal
A9	Not used		B9	PB1	Encoder phase B signal input terminal
A10	Not used		B10	PB2	Encoder phase B reverse signal input terminal

2. INSTALLATION

Remove the front cover from the inverter. Mount the Option Card according to the following instruction.

2-1 PREPARATION

(1) Check that the inverter type and model number are correct.
This Option Card is exclusively for MELTRAC-A series products.

(2) Check that the main circuit power and the control circuit power of the inverter have been turned off.
Do not mount the Option Card with the power on otherwise the inverter will fail.

(3) If the PLG feedback control (optional) is to be used, prepare a PLG (or a motor with a PLG) and external power source.
See page 10 for details.

(4) Check that the following items are in the package.
- Operation manual × 1
- Option Card T-OPT22 × 1
- M3 screws for mounting Option Card × 8
- Pins for mounting Option Card × 8

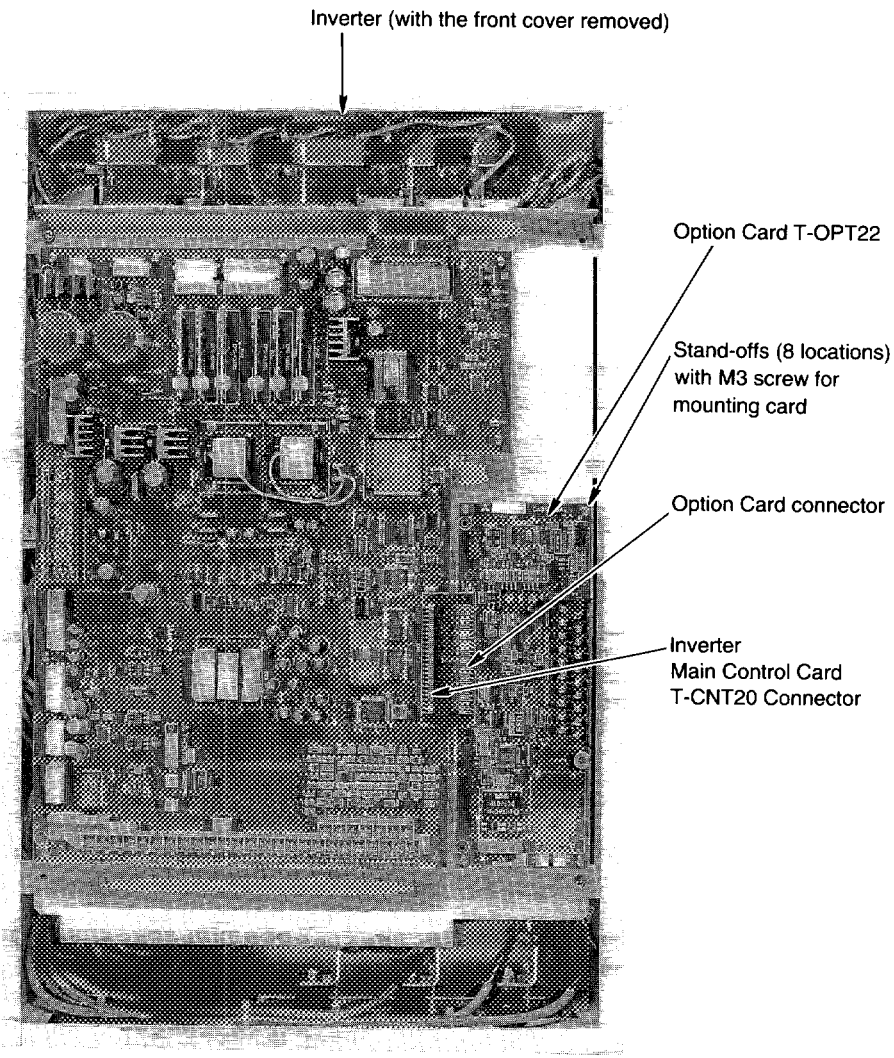
2-2 INSTALLATION PROCEDURE

(1) Insert the Option Card connector into the connector on the main control card of the inverter.
Be sure to insert it against the far end.

(2) Securely mount the Option Card on the inverter with the attached M3 screws and mounting pins (8 locations). The connector may be incorrectly coupled if the pins are not properly aligned with the inverter.

(3) See page 3 for mounting instruction.

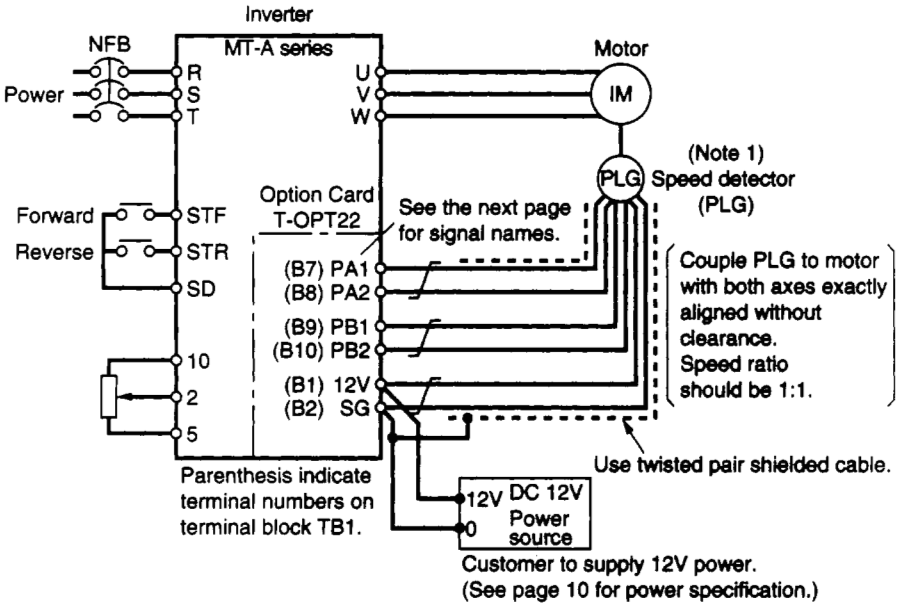
★ Open terminals are used within the option card.
NEVER use these open terminals as relay terminals.
Otherwise, the option card will be damaged.


Inverter (with the front cover removed)
Option Card T-OPT22
Stand-offs (8 locations) with M3 screw for mounting card
Option Card connector
Inverter Main Control Card T-CNT20 Connector

3. OPERATING INSTRUCTIONS FOR PLG FEEDBACK CONTROL FUNCTION

A speed detector (pulse encoder PLG) detects motor rotational speed. The speed is fed back to the inverter which controls the output frequency in order to maintain a constant motor speed regardless of load variation.

3-1 CONNECTION DIAGRAM

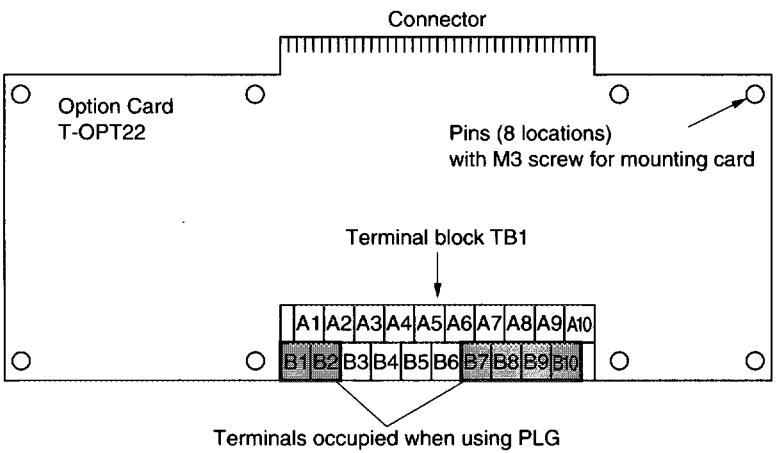


Note 1: The number of PLG pulses depends on the number of poles of the motor.
Number of PLG pulses = 150 pulses / number of poles
Example:
Install a 300 pulse-per-revolution encoder for a 2-pole motor or a 600 pulse-per-revolution encoder for a 4-pole motor.

Motor	Pulse number of PLG
2 Poles Motor	300 Pulses per revolution
4 Poles Motor	600 Pulses per revolution
6 Poles Motor	900 Pulses per revolution
8 Poles Motor	1200 Pulses per revolution

3.2 TERMINAL DESCRIPTION

Terminal No.	Signal name	Terminal name	Rating, etc.	Description
B7	PA1	PLG signal 1 (phase A +) input terminal	See page [i.e. Section 3.6] for details of pulse signals.	Receives phase A and phase B signals from encoder
B8	PA2	Common (PLG phase A –)		
B9	PB1	PLG signal 2 (phase B +) input terminal		
B10	PB2	Common (PLG phase B –)		
B1	12V	Positive power terminal	DC 11.4 to 12.6V (current consumption 200 mA)	Connect PLG power input. Connect 12 V + to terminal B8. Connect ground to terminal B2 (SG). Connect shielding line of shielded cable to terminal B2.
B2	SG	Power ground terminal		



3-3 CAUTIONARY NOTES ON WIRING

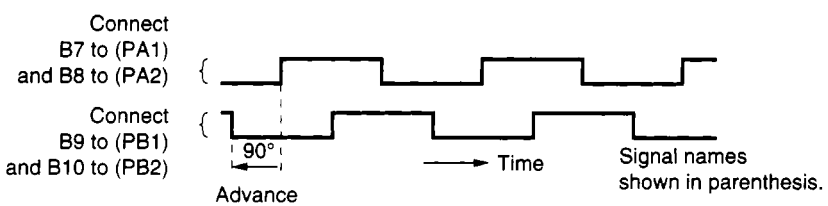
(1) WIRING TO SPEED DETECTOR (PLG)

Use a twisted pair shielded cable (not smaller than 16AWG (1.25 mm^2)) for wiring to the Option Card (T-OPT22).

The wiring to terminal B1 (12 V) and the wiring of the shield line of the twisted pair shielded cable to terminal B2 (SG) should be as follows depending on the length of the wiring.

Length of wiring	Increase in size
No longer than 100 m	No smaller than 16AWG (1.25 mm^2)
No longer than 200 m	No smaller than 14AWG (2.00 mm^2)

※ For the T-OPT terminals (B7, B8, B9 and B10), connect the feedback signals which has a phase angle that advances by 90° to terminals B7 and B8 when the motor rotates in the forward direction.



3-4 ADJUSTMENT

(1) PARAMETERS

Before operating the inverter, set the following parameters.

Table of parameters

Function No.	Function	Range of setting	Minimum setting	Ex-factory setting	Note
37	Number of motor poles	2 – 10* 11 – 9998	1	4	See page 7.
105	Range of speed feedback	0.01 – 400Hz 9999	0.01Hz	9999	Speed feedback does not occur if set to 0 or 9999.
106	Feedback gain	0 – 100	0.1	1	See page 8.

(2) SETTING NUMBER OF MOTOR POLES (Pr.37)

Set the number of poles of the motor used.

※ Option Error (E.OPT) occurs if the inverter is operated with this parameter set to 11 – 9998.

Resetting: Set the number of motor poles to the correct value. Reset the inverter.

(3) SETTING SPEED FEEDBACK RANGE (Pr.105)

Set the range in which the feedback control takes place.

Set the upper and lower values based on the target value i.e. the frequency at which the user desires the motor to operate reliably.

Set this parameter by converting the slip (rpm) of the motor at its rated speed and load to a frequency.

(Example) Assume that the rated speed of a 4-pole motor is 1,740 rpm at 60 Hz.

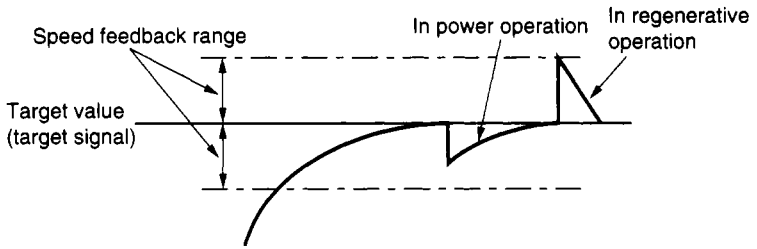
Slip Nsp = synchronous speed – rated speed

= 1,800 –1,770 = 30 (rpm)

Frequency fsp corresponding to the slip fsp

= (Nsp × number of poles)/120 = (30 × 4)/120 = 1 (Hz)

Poor response will result if the feedback range is too wide.



※ The speed feedback is set to 9999 (speed feedback not available) at the factory. Before starting operation, be sure to set this parameter to the proper value.

(4) SETTING FEEDBACK GAIN (Pr.106)
Set this parameter if the rotation is unstable or response is poor.
Setting greater than 1 ..... Response is improved. Unstable operation or over-current tends to occur.
Setting less than 1 ..... Response becomes slow. Stable operation results.

3-5 CAUTIONARY NOTES ON PLG FEEDBACK CONTROL

(1) Incorrect number of poles of the motor results in operation or control at incorrect speeds.

(2) The PLG should be coupled to the motor with its axis aligned exactly in line with the motor axis. The speed ratio should be 1:1.

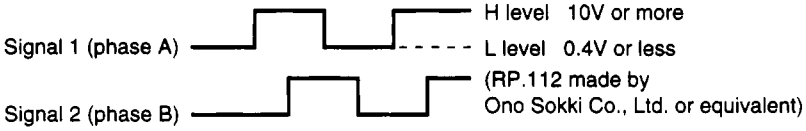
(3) To avoid instable phenomena such as hunting, feedback control does not take place during acceleration or deceleration.
Feedback control takes place once the output frequency reaches within (set speed) ± (speed feedback range).

(4) If any of the following situations occur during a speed feedback operation, the inverter will not stop operation or produce an alarm. The inverter produces a frequency of (set speed) ± (speed feedback range) and does not follow the motor speed.
- The pulse encoder stops generating pulse signals due to failure such as electrical discontinuity.
- Pulse signals cannot be detected correctly due to interference such as induction noise.
- The motor is forced to accelerate (regenerative operation) or decelerate (such as motor locking) due to a large external force.

3-6 SPECIFICATIONS

(1) Drive motor
Standard motor: 2-, 4-, 6-, or 8-pole
Constant torque motor: 2-, 4-, 6-, or 8-pole

(2) Speed detector (PLG)



PLG output signal terminal numbers (Ono Sokki RP.112)

Terminal No.	Description
1	Signal 1 (phase A)
2	Common
3	Singal 2 (phase B)
4	Common
6	Case (shield)
7	12V
8	0V

(3) Speed variation
Within ※ 0.1 % of the maximum speed (3600 rpm)
(Load variation* 0 – 100 % ..... 6 Hz or more)
※ 100% load means the maximum continuous operating torque with respect to the operating frequency that depends on the motor output characteris tics. See the catalog or technical data.

(4) Speed control range
The speed control range depends on the inverter.

(5) Setting
- Setting speed feedback range
- Setting feedback gain

(6) Power source
The PLG and Option Card need a DC 12 V power source.
The customer should prepare this power source as it is not within the system supplied.
Power source: DC 12 V No less than 200 mA current carrying capacity
For PLG–approximately 150 mA for normal operation
For Option Card–50 mA

3-7 CAUTIONARY NOTES ON USING PLG

The PLG consists of precision parts and components. Handle and operate the PLG with care. It may not function correctly if given a shock.

(1) INSTALLATION
- When installing the PLG do not subject it to shock by hammering it or exerting excessive force on the shaft.
- Use a coupling to connect the encoder shaft and the equipment shaft.
  Do not apply excessive forces when installing the coupling on the shaft.
  An improperly installed coupling may cause the shafts to receive a force larger than that allowed. Make sure that the shafts are correctly aligned and centered.
- Bearing life depends on conditions of use, especially on the shaft load. Note that longer bearing life can be expected under lower shaft loads.
- Do not disassemble the PLG, otherwise the oil sealing and drip proof capability may deteriorate.
  Although the PLG is drip proof, make sure that it is not exposed to water or oil for a long period.
  Wipe off water or oil if splashed.

(2) VIBRATION
- Vibration may cause the PLG to generate incorrect pulses. Make sure that the PLG is installed in a location free from the influence of vibration.
  The clearance between the slits of rotating slit disc is small for PLGs that generate many pulses per revolution. Such PLGs are sensitive to vibration. During low speed operation or when stopped vibration may cause the PLG to act as if the rotating slit disc had moved, making it generate incorrect pulses.

(3) ELECTRICAL WIRING AND CONNECTION

Make sure that the electrical wiring and connections are correct. Otherwise, the internal circuits will be damaged.

(4) COUNTER-MEASURES AGAINST NOISE

- Do not install the cables in parallel to power lines or in the same wiring duct.
- Do not use the PLG near discharge welding equipment or an electric furnace or similar equipment. In this case provide the cables with magnetic shield.
- Be sure to use shielded cables for extension wiring.
- Incorrect pulses may be generated when turning on or off the power. Wait a few seconds after turning on or off the power, before use.
- If malfunction due to noise caused by electrical potential between the PLG and control panel enclosures is possible, connect the two enclosures with wires no smaller than 2.0 mm^2 (14AWG).

4. OPERATING INSTRUCTION FOR PROGRAMMBLE LOGIC CONTROLLER LINK FUNCTIONS

This section of the operation manual describes the specifications, operating instruction and programming for the programmable logic controller (programmable logic controller) data link system (herein after referred to as "PLC (MINI)") for MELTRAC-A series inverters.
See the MELSECNET/MINI-S3 user's manual (master) for the specifications of the data link system master station.

4-1 GENERAL

4.1.1 FEATURES OF PLC (MINI)

The PLC (MINI) is a system that uses a data link system MELSECNET/MINI-S3 designed for Mitsubishi general- purpose programmable logic controllers MELSEC-A series to remotely and programmable logic control and/or monitor Mitsubishi MELTRAC-A series devices.

(1) As one of the remote I/O stations of the MELSECNET/MINI-S3 sharing the link system, the programmable logic link can easily make the inverter factory-automated (FA) by controlling and monitoring the system through the user's programmable logic control programs.

(2) The programmable logic controller can set and check various parameters such as acceleration and deceleration time for the motor.

(3) With programmable logic controller data link unit AJ71PT32-S3 as the master station, up to 16 inverters can be connected (when connecting inverters only).

(4) The PLC (MINI) Link is connected by optical fiber cables so that inverters are connected to the programmable logic controller without noise interference.

(5) Since the PLC (MINI) Link Unit is integrated in the inverter with a connector, it is easy to install and takes up no extra space.

(6) Optical fiber cables are easy to process. The optical fiber cables are plastic fiber cables.
With the attached, exclusive tool kit, the user can easily process the optical fiber cables.

4.1.2 SPECIMEN PLC LINK CONFIGURATION

(1) On the programmable logic controller side
An AJ71PT32-S3 is mounted in the base unit of the programmable logic controller CPU that serves as the master or in the add-on base unit.

(2) Inverter side
PLC Link Card T-OPT22 is installed in the inverter.

(3) The master station and the T-OPT22 are connected by optical fiber cables.

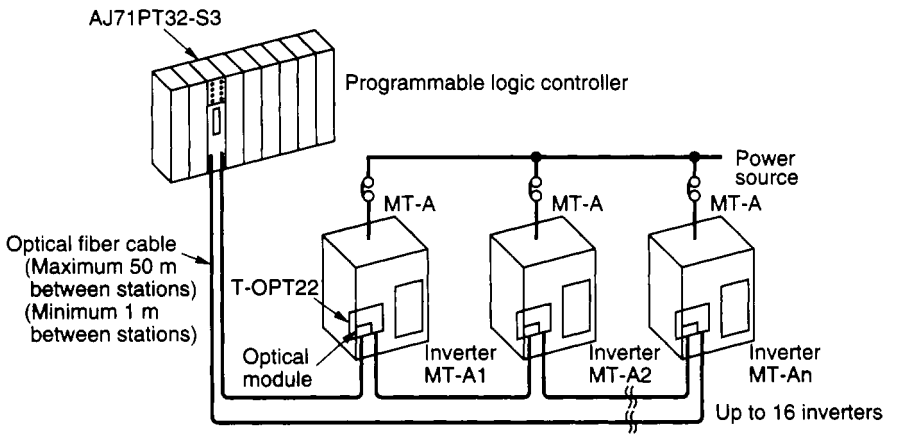


Figure 1.1 Configuration example

4.1.3 FUNCTIONAL BLOCK DIAGRAM

The functional block diagram shown in Figure 1.2 is used to illustrate the flow of input and output information in the PLC Link.

(1) I/O refreshing always takes place at a interval of 3.5 to 18 ms (512 points) between master station (AJ71PT32-S3) and the inverter.

(2) I/O refreshing and the execution of a programmble logic control program at the master station are asyn chronous.

(3) Data from the inverter is read from the buffer memory in the AJ71PT32-S3 through a FROM command.

(4) Data to the inverter is written to the buffer memory of the AJ71PT32-S3 through a TO command.

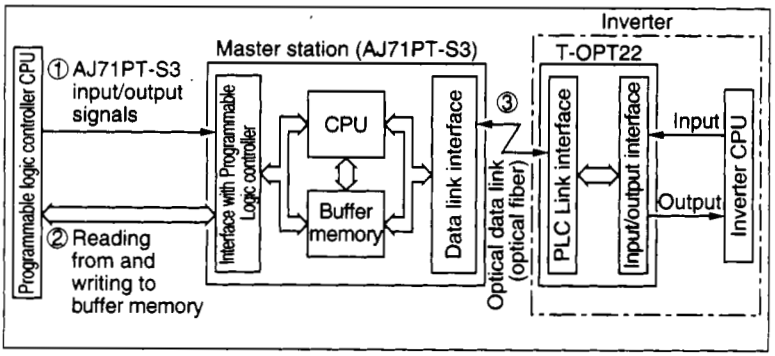


Figure 1.2 Functional block diagram

1) Input and output signals are allocated to the AJ71PT-S3. These signals are used for the communication between the programmable logic controller CPU and the AJ71PT32-S3.
2) Functions such as reading input/output information, writing output information, and identifying a PLC Link station failure are available. FROM and TO commands within a programmable logic control program initiate reading from and wiring to the buffer memory. See page 31 for details of the buffer memory.
3) The PLC Link is initiated through a programmable logic control program. After starting the PLC Link, I/O refreshing always takes place asynchronously with programmable logic control program execution.

4-2 SPECIFICATIONS

4.2.1 PERFORMANCE SPECIFICATIONS

Item			Specifications
PLC (MINI) Link system			MELSECNET/MINI S3 SYSTEM
On the programmable logic controller ※1	Applicable CPU card		1. A0J2CPU, A0J2HCPU (add-on space necessary) 2. A1CPU, A1NCPU 3. A2CPU, A2NCPU, A2ACPU, A2CCPU 4. A3CPU, A3HCPU, A3NCPU, A3HNCPU, A3ACPU, A3MCPU
	Master station	Profile	AJ71PT32-S3 optical link system
		Number of linked stations	Maximum 64 stations (8 points/station) Maximum 512 link points
		Refreshing time	3.5 to 18 msec. (with 64 stations connected)
Communication cable			Plastic optical fiber cable
Maximum distance between stations			Maximum 50 m
On the inverter	Applicable inverter		MT-A series inverter
	Profile		Optional type integrated in inverter, connector system
	Power source		DC 5 V supplied from inverter
	Number of inverters connected		Maximum 16 units (4 stations/unit occupied) Sharing with programmable logic controller possible (32 points/unit occupied)
	PLC (MINI) Link option model number		T-OPT22

※1 See the MELSECNET/MINI-S3 User's Manual for the specifications of the programmable logic controller. (PLC)
The MINI Link system, which is of one-loop construction, does not provide a loop-back function.

4.2.2 OPTICAL FIBER CABLE SPECIFICATIONS

Table 2.2 lists the specifications for the PLC link optical fiber cables.

Table 2.2 Optical fiber cable specifications

Item	Specification
Optical fiber cable used	Plastic fiber cable
Baud rate	1.5MBPS
Minimum optical transmissible level	−11.5dBm
Maximum transmissible level	−14.4dBm
Light wave length	660 nm (visible light)

4.2.3 INVERTER INPUT/OUTPUT TIME LAG

The following paragraphs describe the input and output time lag of the PLC (MINI).

(1) The following time lag factors are involved in the programmable logic controller CPU when reading out input signals from the inverter.
   (a) Inverter response time
   Time for the inverter to switch from ON to OFF or from OFF to ON is approximately 5 msec.
   (b) MINI Link I/O refreshing time
   See Section 4.2 of the AJ71PT-S3 User's Manual for detail.
   (c) Time for completing execution of a FROM command when reading input signals.
   e.g. When a FROM command is executed once per scan of the sequence program a maximum of 1 scan delay occurs.

(2) The following time lag factors are involved in the programmable logic controller CPU when sending out commands to the inverter.
   (a) Time for completing execution of TO command to send out signals to the inverter
   Assuming that one TO command is executed for every one scan of a programmable logic control program, for example, a maximum time lag for one scan will result.
   (b) MINI Link I/O refreshing time
   (c) Time for the inverter to switch from ON to OFF or from OFF to ON is approximately 5 msec.

NOTE

Inverter input and output time lag depends on the time for the inverter to execute FROM/TO commands as described in (1)-(c) and (2)-(a) above.

If input and output time lag is not of concern, the inverter executes one FROM/TO command for every scan.
To reduce the input and output time lag, establish programmable logic control programs considering the following.

(1) Immediately before using input signals by the programmable logic control program, execute the FROM command. This reduces the time lag for signal input.

(2) After computing the programmable logic control program, execute the TO command. This reduces the time lag for signal output.

4-3 FUNCTIONS

This section describes the operating functions of the PLC link (PLC Link) Link system using a PLC link Card T-OPT22.

4.3.1 OPERATION MODES

An inverter equipped with a T-OPT22 Option Card has the following operation modes. See Figure 3.1.

(1) PU OPERATION
The inverter can be operated through the keys on the parameter unit (herein after referred to as "PU") mounted on the inverter.

(2) EXTERNAL OPERATION
The inverter can be operated by turning on and off the external signal connected to the control circuit terminals of the inverter. This is a factory-set mode.

(3) PLC OPERATION
The inverter can be operated by a user's programmable logic control program through the Card T-OPT22.

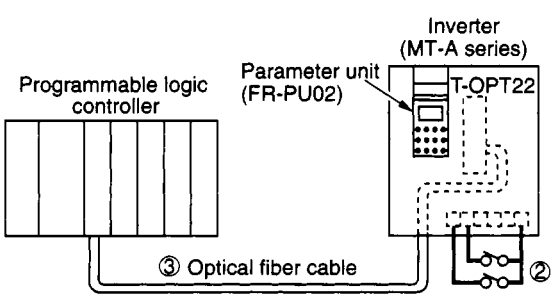


Figure 3.1 Operation mode

4.3.2 SWITCHING OPERATION MODES

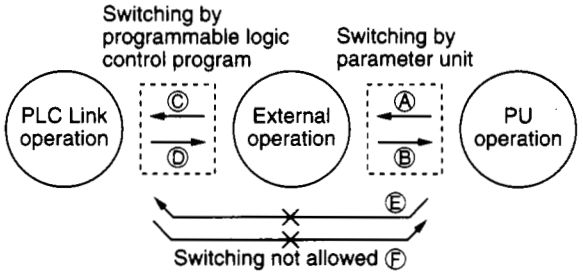
(1) PRECONDITIONS FOR SWITCHING OPERATION MODES

Check that the following preconditions are satisfied before switching operation modes.

1) The inverter is stopped.
2) Neither the forward nor the reverse signal is ON.
3) Parameter 79 has been set correctly.
   (Set this parameter through the parameter unit of the inverter.)

Setting	Operation mode selection	Switching PLC Link operation modes
0	PU or external operation	Not allowed if PU is selected. Allowed if external is selected.
1	PU operation only	Not allowed
2	External operation only	Allowed

(2) METHOD OF SWITCHING OPERATION MODES



Symbol	Type of switching	Switching method
A	PU operation→External operation	By operating external operation key pad on PU
B	External operation→PU operation	By operating PU operation key pad on PU
C	External operation→PLC operation	By user's program through programmable logic controller (see page 50)
D	PLC Link operation→External operation	By user's program through programmable logic controller (see page 50)
E	PU operation→PLC operation	This switching is not allowed. First switch to external operation by Ⓐ then switch to PLC Link operation by Ⓒ.
F	PLC operation→PU operation	This switching is not allowed. First switch to external operation by Ⓓ then switch to PU operation by Ⓑ.

(3) INDICATION OF OPERATING MODE

Operation modes are indicated on the PU.

1) PU operation ..... PU
2) External operation ..... EXT
3) PLC operation ..... NET

4.3.3 FUNCTIONS

The table below lists the operational functions in the sequencer link system through the programmable logic controller. (PLC)

Item	Operation mode		
	PLC operation	External operation	PU operation
Monitor	Available	Available	Available
Operation	Available	Not available	Not available
Parameter writing	Available※1	Not available	Not available
Parameter readout	Available	Available	Available
Inverter reset	Available※2	Not available	Not available

※1 Writing is not allowed while the inverter is in operation.

※2 When failure occurs in the PLC link, resetting through the programmable logic controller is no possible.

(1) MONITORING

The following variables can be monitored by the programmable logic controller.

1) Output frequency ..... Binary code minimum every 0.01 Hz
2) Output current ..... Binary code minimum every 0.1 A
3) Output voltage ..... Binary code minimum every 0.1 V
4) Failure indication (see page 51.)
5) Inverter status (see page 46.)
   - In operation (RUN)
   - In forward operation
   - In reverse operation
   - Frequency reached (SU)
   - Overload (OL)
   - Instantaneous halt (IPF)
   - Frequency detection (FU)
   - Failure

Note: For items 1) through 4), corresponding codes are read out from the buffer memory at every event. Item 5) can always be read out from the buffer memory.

(2) OPERATION COMMANDS (See page 47.)
The following data can always be sent to the inverter as operation commands from the programmable logic controller.

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

(3) OPERATING FREQUENCIES (See page 56.)
Every time this data is revised, the revised data is sent from the programmable logic controller to the inverter.
..... If changing the binary code minimum frequency increment of 0.01 Hz to stepless variation, be sure to write the data in the inverter RAM.

(4) PARAMETER WRITING (See page 57.)
Functions can be written from the programmable logic controller. However, if written while the inverter is in operation, a incompatible code error (writing mode error) is generated. See page 53.
The data codes of the parameters are according to the table in section 4-8, page 62.

(5) PARAMETER READOUT (See page 50.)
The programmable logic controller can retrieve functions.
The data codes of the parameters are according to the table in section 4-8, page 62.

4.3.4 FAILURE

The following paragraphs describe the countermeasures to be taken when failure occurs.

(1) FAILURE OCCURRENCE

The following operation will follow if failure occurs in each operation.

	Operation mode		
	PLC operation	External operation	PU operation
Inverter failure	Inverter halted Data communication continued	Inverter halted Data communication continued	Inverter halted Data communication continued
PLC Link failure	Inverter halted Data communication halted	Inverter operation continued Data communication halted	Inverter operation continued Data communication halted

(2) CHECKING FAILURE

Follow the instructions on page 51 to check failure.

1) Inverter failure
   See the inverter MELTRAC-A series Operation Manual to remedy problem.
2) Circuit failure, data communication halted
   Check the T-OPT22 Card to see if:

   - Has the optical cable connector been removed?
   - Is the optical cable disconnected?
   - Is the T-OPT22 Card properly joined to the connector?

   If these points are in order check the master station.
   See section 4-6 of the MELSECNET/MINI-S3 User's Manual (master).

(3) RESTORATION

When the cause of failure has been removed, reset the inverter.
Even if the main circuit of the inverter has been damaged, PLC operation is available for the other inverters within the same loop as long as control power is supplied.

(4) RESET

Resetting is according to the following table.

Reset method	Operation mode		
	PLC operation	External operation	PU operation
User's program through programmable logic controller (See page 44.)	Applicable ※1	No Applicable	No Applicable
Turn on between terminals RES and SD.	Applicable	Applicable	Applicable
Turn off inverter power.	Applicable	Applicable	Applicable

※1 The inverter cannot be reset through the programmable logic controller if circuit failure has occurred.

The operation mode after resetting depends on the setting in parameter 79 as follows.

Parameter 79 setting: 0 or 2 ..... External operation mode

Parameter 79 setting: 1 ..... Pu operation mode

Note: If the inverter is reset through the programmable logic controller in the PLC operation mode, external operation mode will follow. Switching to the PLC operation mode therefore is necessary. See page 55 for switching operation modes.

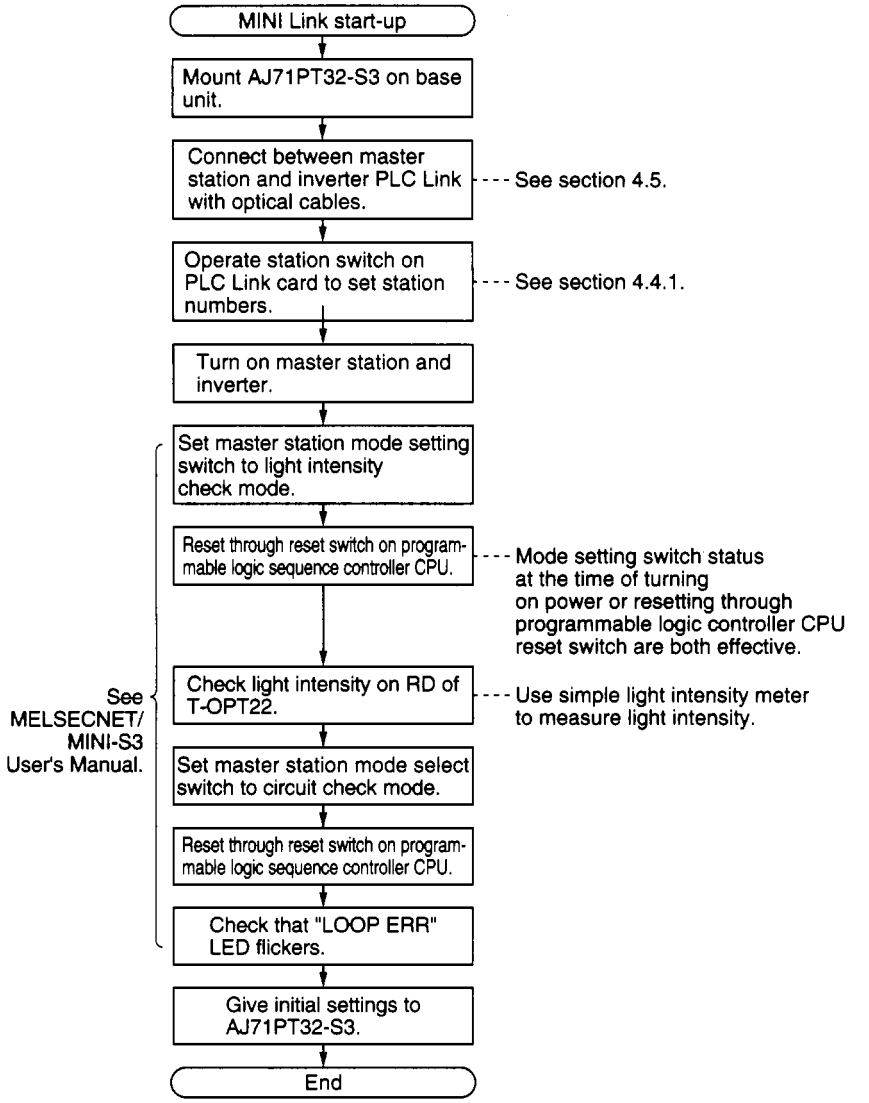
4-4 SETTING

4.4.1 FUNCTIONS

Item	
Optical cable connector	Connector to connect optical fiber cables. Be sure to connect with PLC (MINI) Link cables. See page 28. RD ..... Receiving side SD ..... Transmission side
Station number setting switch	 For setting inverter station numbers from 1through 61. See page 26 for details.
Operation status indicator LED	○ R D ..... ON during receiving data. Dimly lit for normal operation. ○ ERR ..... Receiving data error. Goes off when receiving normally. ○ S D ..... ON during receiving data. Dimly lit for normal operation. ● RUN ..... ON during normal data communication with master station. ※ Brightly lit for abnormal operation.

4.4.2 SETTING AND PROCEDURE BEFORE STARTING OPERATION

This section describes the setting and the outline of operation before starting the PLC (MINI) Link system.



4.4.3 SETTING STATION NUMBERS

Set the T-OPT22 station numbers while I/O refreshing is not being executed. Take the following information into account before setting the station numbers.

(1) Station numbers should be only odd numbers from 1 to 61.

(2) The T-OPT22 alone occupies addresses good for four stations (for the four programmable logic controller remote I/O stations). For example, setting the station number to 1 means that one inverter occupies stations 1 through 4. The other units therefore cannot use stations 1 through 4. See Figure 4.3.

(3) The range subjected to I/O refreshing depends on the total number of stations (address 0 in the buffer memory.)
The total number of stations is determined from the number of programmable logic controller remote I/O stations and the number of T-OPT22s connected within the same loop.
Assuming that the numbers of the remote I/O stations and inverter T-OPT22s are one and three respectively, the total number of stations is 13 ($1 + 3 \times 4$).

(4) The station numbers can be allocated independently of the order of connection. Figure 4.3 shows an example of allocating station numbers.

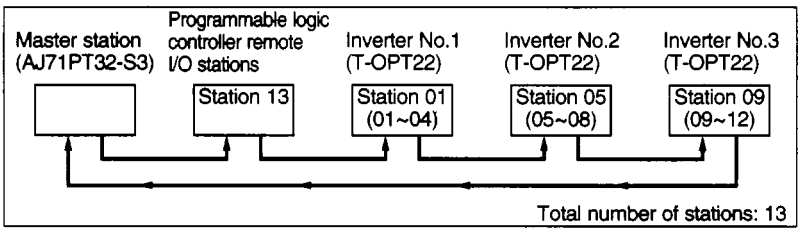


Figure 4.3 An example of allocating station numbers

4.4.4 OPTICAL FIBER CABLES

(1) CAUTIONARY NOTES ON HANDLING OPTICAL FIBER CABLES
Follow the instructions below to avoid damage to the optical fiber cables.

1) Avoid compressing the optical fiber cable sharp, rigid objects.
2) Do not twist the optical fiber cable excessively.
3) Do not pull on the optical fiber cable with a force exceeding the allowable tension.
4) Do not step on the optical fiber cable.
5) Do not put anything on the optical fiber cable.
6) Do damage the shielding on the optical fiber cable.

(2) CONNECTING OPTICAL FIBER CABLES
The following describes the connection, installation and removal of optical fiber cables.

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

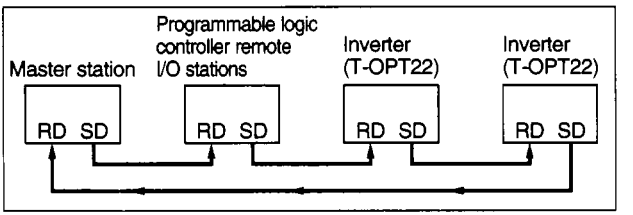
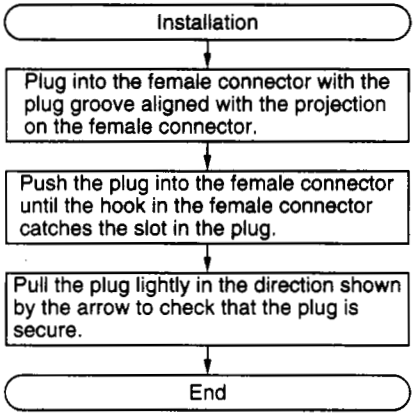


Figure 4.4 Connection of optical fiber cables

NOTE

Station numbers for the remote I/O station and T-OPT22 card can be allocated independent of the order of the PLC Link cable connection.
See section 4.4.3 for detail.

2) Install the optical fiber cables as shown in Figure 4.5.
(Remove the covers and keep them in a safe place.)



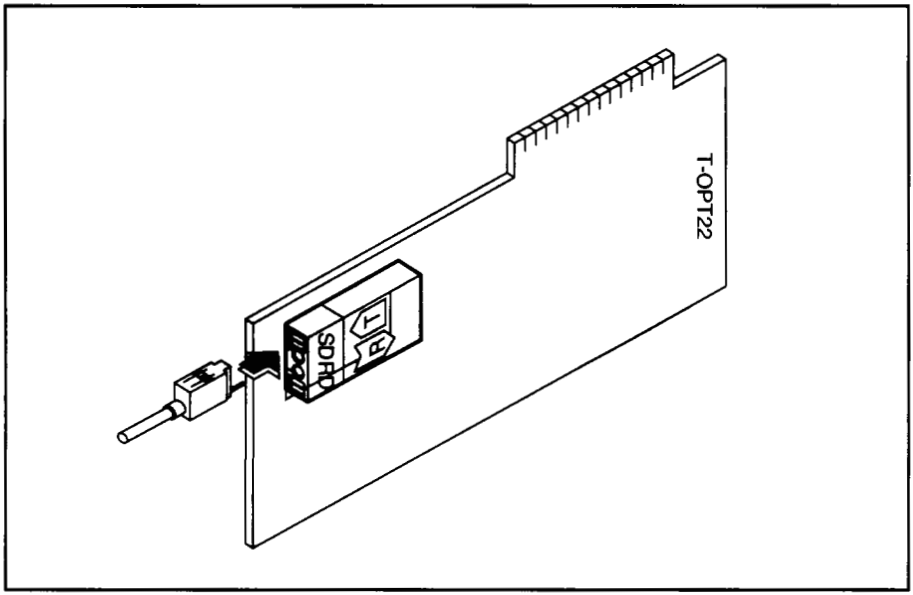
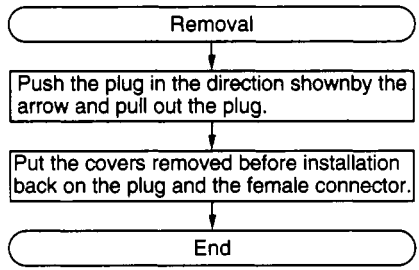


Figure 4.5 Installation of optical fiber cables

2) Remove the optical fiber cables as shown in Figure 4.6.



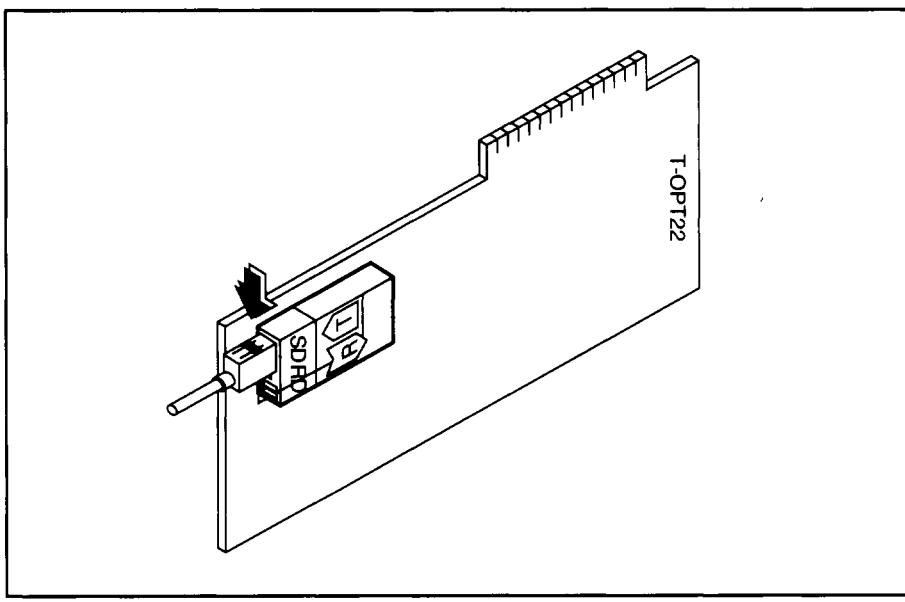
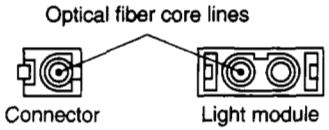


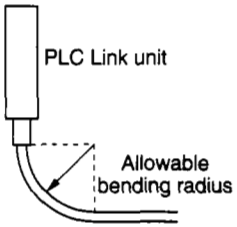
Figure 4.6 Removal of optical fiber cables

NOTE

(1) Do not touch the optical fiber core lines of the connectors or light modules with the fingers.
Keep them away from dust and other foreign objects.
Be sure to cover the optical fiber cables when storing them.
Dust and oil transferred from the hands and other foreign objects sticking on the optical fiber cables increases transmission loss and may cause problems in the data link system.



(2) When bending the optical fiber cable, make sure that the bending radius is larger than the allowable bending radius.
If bent to a smaller radius than the allowable bending radius, the core lines of the optical iber cable may break, making a correct data link impossible.
Allowable bending radius 40 mm



4-5 PROGRAMMING

This section describes the programming method using a PLC (MINI).

4.5.1 LIST OF INPUT AND OUTPUT TO AND FROM CPU PROGRAMMABLE LOGIC CONTROLLER (PLC)

The input and output signals of the AJ71P/T32 with respect to the programmable logic controller CPU are as follows.
The numbers accompanying X and Y are dependent on the number of the mounting position of this unit and the number of input and output points of other I/O units.
When a building block type CPU is installed in slot No.0 of the base unit, the input and output numbers will be as listed in the table below.

Table 5.1 List of input/output signals

Device No.	Signal name	Device No.	Signal name
X0	Hardware failure	Y0–Y17	Not available for use
X1	PLC (MINI) Link in communication		
X2	Not available for use		
X3		Y18	MINI Link communication start-up
X4		Y19	Not available for use
X5	Test mode	Y1A	Response command to FROM/TO commands
X6	PLC (MINI) Link failure detected	Y1B	Designating failed station data link
X7	PLC (MINI) communication failure	Y1C	Not available for use
X8~X1F	Not available for use	Y1D	Failure reset
		Y1E Y1F	Not available for use

DESCRIPTION OF INPUT/OUTPUT SIGNALS

The following paragraphs describe the ON/OFF timing and preconditions for input/output signals.
Numbers in parenthesis represent device numbers corresponding to Table 5.1.

(1) HARDWARE FAILURE (X0)

(a) This signal is turned on when the AJ71P/T32 mode switch is set to a value from 6 through 9 or when hardware failure occurs.

(b) Use this signal as an interlock for the FROM/TO commands with respect to AJ71P/T32.

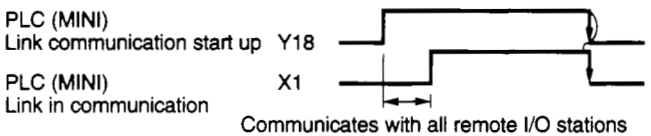
(2) PLC (MINI) LINK IN COMMUNICATION (X1)

(a) After turning on PLC (MINI) Link communication start-up (Y18), communication takes place between the master station (AJ71P/T32) and remote I/O stations, and the master station (AJ71P/T32) and the inverter.

(b) When turning off PLC (MINI) Link communication start-up (Y18), PLC (MINI) Link in communication (X1) is turned off.

(c) When a failure that stops data communication occurs, PLC Link in communication (X1) is turned off.

(d) Use this signal as an interlock signal to execute FROM/TO commands with respect to AJ71P/T32 when in PLC (MINI) Link communication.



(3) TEST MODE (X5)

This signal is turned on when the power is turned on with the mode setting switch set to a value from 3 through 5.

(4) PLC (MINI) Link failure detector (X6) ..... Communication continued

When the master station detects abnormality in the data received from the remote I/O stations or inverters, PLC (MINI) Link failure detector (X6) is turned on.

(a) PLC (MINI) Link failure detector (X6) will be as follows depending on the mode setting.

- With on-line auto double-row present:
  Although PLC (MINI) Link failure detector (X6) is turned on, PLC (MINI) Link failure detector (X6) is turned [off] if ata communication takes place normally.
- Without on-line double-row:
  Once PLC (MINI) Link failure detector (X6) is turned on, it remains on.

(b) When PLC (MINI) Link failure detector (X6) is turned on, failure detection code is stored in address 108 of the buffer memory.

Failure codes are latched.

See page 37 for detail.

(5) PLC (MINI) LINK COMMUNICATION FAILURE DETECTOR

..... Communication halted

When the master station becomes unable to communicate with the remote I/O stations and inverters, PLC (MINI) Link communication failure detector (X7) is turned on.

(a) Any of the following causes may be involved when PLC (MINI) Link failure detector (X7) is turned on.
- The power source for the remote I/O stations or inverters is turned off.
- The PLC Link cable is disconnected.
- With the mode set to abort communication in the event of on-line failure, and communication failure occurs.

(b) When PLC (MINI) Link communication failure detector (X7) is turned on, the communication failure code is stored in address 107 of the buffer memory.

(6) PLC (MINI) LINK COMMUNICATION START-UP (Y18)

(a) When PLC (MINI) Link communication start-up (Y18) is turned on, I/O refreshing is initiated.

(b) When communicating with all the remote stations normally, PLC (MINI) Link in communication (X1) is turned on.

(c) When PLC (MINI) Link communication start-up (Y18) is turned on or off, the FROM area (addresses 70 through 209) in the buffer memory are cleared.

(7) RESPONSE COMMAND TO FROM/TO COMMANDS (Y1A)

This signal determines the priority of AJ71PT32 for access to the buffer memory.

(a) When response command to FROM/TO commands (Y1A) is OFF, processing for AJ71PT32-S3 takes precedence.

(b) When response command to FROM/TO commands (Y1A) is ON, the FROM/TO command of the programmable logic controller CPU takes precedence.

(c) ON/OFF status of response command to FROM/TO commands (Y1A) affects the system operation as listed in the following table.

Item	Response command to FROM/TO commands (Y1A)	
	OFF	ON
Access to buffer memory	AJ71PT32-S3 takes precedence.	FROM/TO command of programmable logic controller CPU takes precedence.
Data read out from received data (input information) from plural stations through one FROM command	Data read out from received data is data that is I/O refreshed at the same timing.	Reads out receiving data at different refreshing timing depending on readout timing.
Processing time of FROM/TO commands	Up to 0.3 ms delay time results.	No delay time.

(8) FAILED STATION DATA CLEAR DESIGNATION (Y18)

This signal designates whether or not to clear data received by the remote I/O stations or inverters in which communication failure occurs.

(a) Turn on failed station data clear designation (Y18) if desired to clear (OFF) the data received by the station in which communication failure occurs.

(b) If failed station data clear designation (Y1B) is OFF, data received by the inverter in which communication failure occurs remains.

(c) Failed station data clear designation (Y1B) does not affect data transmitted by a station in which communication failure occurs.

Buffer memory of AJ71P/T32	Failed station data clear designation (Y1B)	
	OFF	ON
Data transmitted (addresses 10 through 41)	——	——
Data received (addresses 110 through 141)	Data immediately before communication failure remains	All points are OFF.

NOTE

When turning on failed station data clear designation, it is recommended that the mode setting switch be set to the mode without auto double-row.

(9) FAILURE RESET (Y1D)

This signal is for resetting failure after PLC (MINI) Link failure detected (X6) or PLC (MINI) Link communication failure (X7) occurs.

(a) With PLC (MINI) Link communication start-up (Y18) OFF, when failure reset (Y1D) is switched from OFF to ON, failure reset is operable.

(b) Communication failure code (address 107) and failure detection code (address 108) in the buffer memory are cleared.

(c) PLC (MINI) Link failure detected (X6) and PC (MINI) Link communication failure (X7) are turned off.

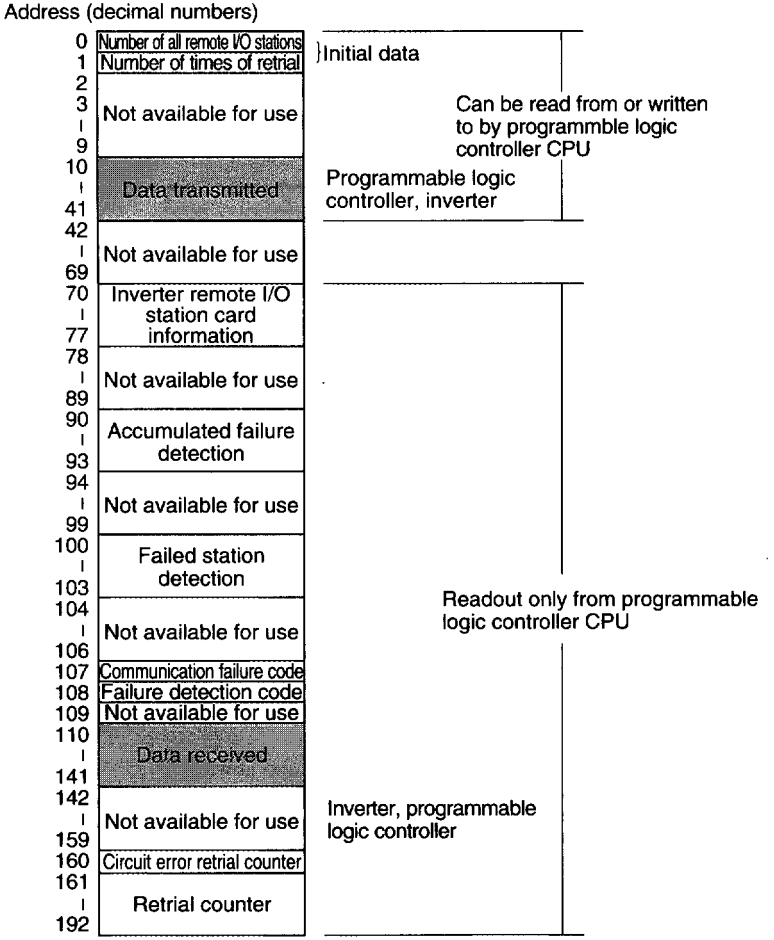
(d) RESETTING ERR.LED

LED No.4 that temporarily lights up upon circuit error and LED No.5 that lights up upon station failure are turned off.

4.5.2 BUFFER MEMORY

A buffer memory (without battery backup) for data communication with the programmable logic controller CPU is provided in the AJ71P-T32.
See section 4.6 for data readout and writing through programmable logic control programs.

(1) ALLOCATION OF BUFFER MEMORY
Address (decimal numbers)



NOTE

(1) All the buffer memory is cleared when the power is turned on or the programmable logic controller CPU is reset. However, "2" will be set in the number of times of retrial (address 1).

(2) Only addresses 0 and 1 and 10 through 41 can be written to from the programmable logic controller CPU. Do not write from programmable logic controller to other areas.

(3) The AJ71P/T32 uses the areas that are designated as "not available for use."
(4) Data in the read only area, including "not available for use," can be continuously read out. For example, one FROM command can read out the accumulated failure detection stations (addresses 90 through 93) and failed station detection (addresses 100 through 103).

(2) DESCRIPTION AND CONFIGURATION OF BUFFER MEMORY
The description and configuration of each buffer memory item are as follows.

[1] NUMBER OF ALL REMOTE I/O STATIONS (address 0)

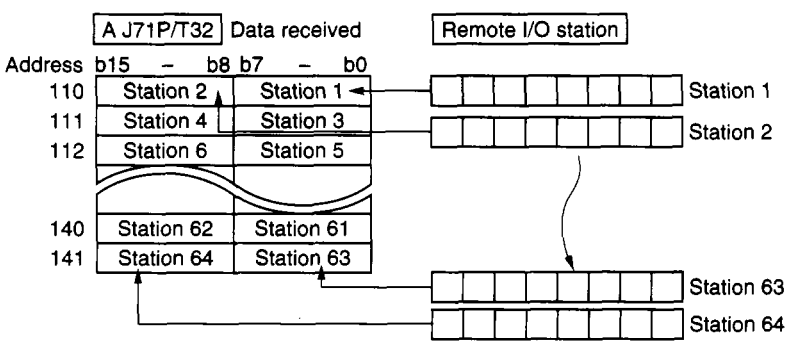
(a) This address is to set the range of remote I/O stations and inverters subject to I/O refreshing.
(b) I/O refreshing is carried out for the number of I/O stations or inverter stations which were set as the total number of remote I/O stations.
Assuming that "20" is set as the total number of remote I/O stations, I/O refreshing is carried out for the stations numbered from 1 through 20. I/O refreshing is not carried out for the I/O stations or inverter stations having a station number of 21 or above.
(c) Enter the last station number of the remote I/O stations or inverter stations connected to the master station (AJPT32-S3).
(d) It is set to "0" when the power is turned on.
(e) 1 through 64 can be set. If exceeding this range, the initial data error is generated when PLC (MINI) Link communication start-up (Y18) is switched from OFF to ON.
(f) Be sure to write the number of all I/O stations when PLC (MINI) Link communication start-up (Y18) is OFF. The number of all remote I/O stations in this address at the time when PLC (MINI) Link communication start-up (Y18) is switched from OFF to ON is valid.

2 NUMBER OF TIMES OF RETRIAL (address 1)

(a) This address is to set the number of times of retrial against a remote I/O station or inverter in which communication failure occurs.
(b) This is set to "5" when the power is turned on (default).
(c) The value can be from 0 through 32.
(d) Enter the number of times of retrial when PLC (MINI) Link communication start-up (Y18) is OFF. The number of times of retrial when PLC (MINI) Link communication start-up (Y18) is switched from OFF to ON is valid.
(e) When normal communication cannot be achieved after retrying the designated times, communication failure in that remote I/O station is recognized.

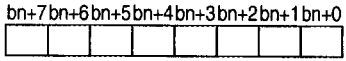
3 DATA TRANSMITTED (addresses 10 through 41)

(a) This is the data to be sent out to the output remote I/O station or inverter station.
(b) The buffer memory is zoned as shown below.



Note: One inverter occupies addresses good for four stations. See page 45.

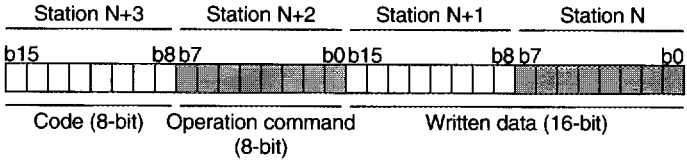
(c) Transmitted data is in 8 bits for each remote I/O station.
The data configuration is as follows.



※ "n" depends on remote I/O station numbers.
Odd numbered stations 1, 3 to 63 use b0 through b7.
Even numbered stations 2, 4 to 64 use b8 through b15.

1:ON 0:OFF

(d) 32 bits (good for four stations) are allocated for each inverter (T-OPT22).
The data configuration is as follows.
※N (odd number) depends on inverter station number.
(Note that odd number designation makes programming complicated.)



- Code ..... This represents data communication types such as reading, writing and parameters.
  See section 4-8 on page 62 for the table of codes.
- Operation command
  b0 ..... Not used (either 1 or 0)

1: ON 1:OFF

  b1 ..... Forward operation (STF)
  b2 ..... Reverse operation (STR)
  b3 ..... Low speed operation (RL)
  b4 ..... Medium speed operation (RM)
  b5 ..... High speed operation (RH)
  b6 ..... Secondary acceleration/deceleration (RT)
  b7 ..... Inverter output halted (MRS)
- Written data ..... This sets the data when writing parameters, operation frequency, etc.
  Read out monitor and parameters are ndependent of values set here.

4 REMOTE I/O STATION CARD INFORMATION (addresses 70 through 77)

(a) These addresses contain card information of the input/output units that are mounted on the remote I/O stations.

(b) Card information is as follows and is represented in 2 bits.
00: No remote I/O station, or station unable to communicate with initially.
01: Input remote I/O station, inverter
10: Output remote I/O station

(c) The data configuration is as follows.

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 information is processed only once when PLC (MINI) Link communication start-up (Y18) is switched from OFF to ON.

5 ACCUMULATED FAILURE DETECTION (addresses 90 through 93)

(a) These addresses are used to detect communication failure or set corresponding bits for remote I/O stations or inverter stations.

(b) Even if communication is achieved with a communication failure station, the corresponding bits are not reset.
Failed stations detected by failed station detection (addresses 100 through 103) are accumulated.

(c) When PLC (MINI) Link communication start-up (Y18) is turned on, "0" is stored in this address to reset the accumulated failed station detection.

(d) The data configuration is as follows.

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

6 FAILED STATION DETECTION (addresses 100 through 103)

(a) These addresses are used to detect communication failure or set corresponding bits for remote I/O stations or inverter stations.
(b) With auto double-row present, when the communication with the communication failure station is restored, the corresponding bits are reset.
Without auto double-row, this remains set.
When PLC (MINI) Link communication start-up is OFF, the data is saved.
(c) When PLC (MINI) Link communication start-up (Y18) is OFF, "0" is stored in this address to reset the accumulated failed station detection.
(d) The data configuration is as follows.

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

7 COMMUNICATION FAILURE CODE (address 107)

(a) When PLC (MINI) Link communication failure (X7) is turned on, the status of failed communication is stored.
(b) The following table lists the status stored in the communication failure code.

Stored code	Description	Cause
0	Normal	———
1	Initial data error	Number of all remote I/O stations or number of times of retrial setting is incorrect.
2	Circuit failure	Link cable is discontinued. Remote I/O station or inverter power is turned off.
3	Station failure	With system in mode to abort communication upon detection of failure, communication is aborted because station failure occurs.

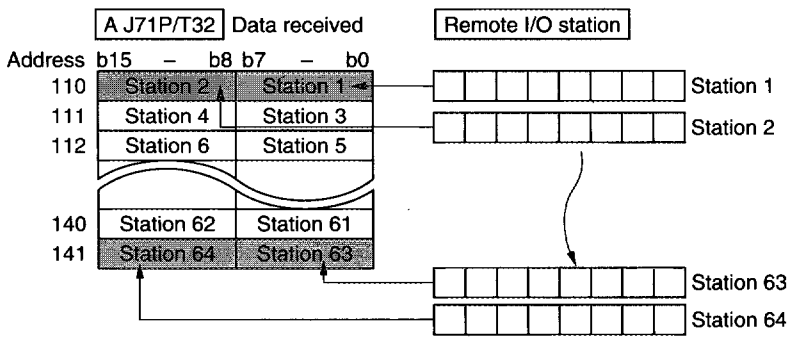
(c) When PLC (MINI) Link communication start-up (Y18) or failure reset (Y1D) is turned on, "0" is stored in this address to reset the communication failure.

8 FAILURE DETECTION CODE (address 108)

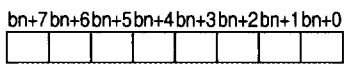
(a) Normally, "0" is stored in this address.
When PLC (MINI) Link failure detected (X6) is turned on, "1" is stored.
(b) With auto double-row present selected (mode setting switch:0), PLC (MINI) Link failure detector (X6) is turned off when normal communication is restored. However, failure detection code "1" remains in this address.
(c) When PLC (MINI) Link communication start-up (Y18) or failure reset (Y1D) is turned on, "0" is stored in this address to reset the failure detection code.

9 DATA RECEIVED (addresses 110 through 141)

(a) ON or OFF signal entered into the remote I/O stations and inverter stations is stored.
(b) The buffer memory are zoned as shown below.

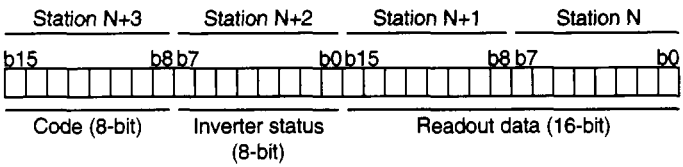


(c) Received data is in 8 bits for each remote I/O station.
The data configuration is as follows.



※ "n" depends on remote I/O station numbers.
Odd numbered stations 1, 3 to 63 use b0 through b7.
Even numbered stations 2, 4 to 64 use b8 through b15.

(d) 32 bits (good for four stations) are allocated for each inverter (T-OPT22).
The data configuration is as follows.
※ N depends on the inverter station numbers.



- Code ..... This represents data communication types such as reading, writing and parameters.
  See section 4-8 on page 62 for the list of codes.
- Inverter status
  b0 ..... In operation
  b1 ..... Forward operation
  b2 ..... Reverse operation
  b3 ..... Frequency arrive (SU)
  b4 ..... Overload (OL)
  b5 ..... Instantaneous halt (IPF)
  b6 ..... Frequency detection (FU)
  b7 ..... Failure

1:ON 0:OFF

- Readout data ..... Receives the data corresponding to the codes from the inverters and stores them.

10 CIRCUIT ERROR RETRIAL COUNTER (address 160)

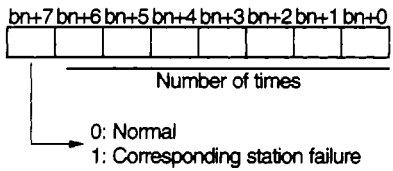
(a) When circuit failure occurs, the number of times of retrial is stored in this address.
(b) "0" is stored when communication takes place normally.
(c) When PLC (MINI) Link communication failure (X7) is turned on, the number of times of retrial (address 1) is stored.

11 RETRIAL COUNTER (addresses 161 through 192)

(a) The number of times of retrial attempted against the failed remote I/O stations or failed inverter stations is stored in these addresses.
(b) "0" is stored when communication takes place normally.
(c) The buffer memory are zoned as shown below.

	b15 – b8	b7 – 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 retrial counter consists of 8 bits for each station. The data configuration is as follows.



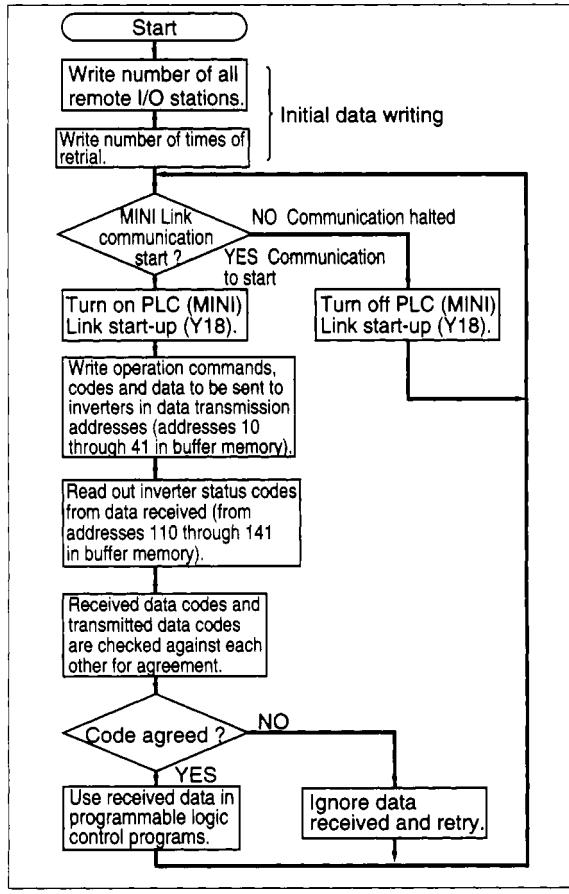
※ "n" depends on station numbers.
Odd numbered stations 1, 3 to 63 use b0 through b7.
Even numbered stations 2,4 to 64 use b8 through b15.

In the MINI Link system, I/O refreshing takes place. Therefore, initial data is written in the buffer memory of the master station (AJ71P/T32).

4.5.3 PROGRAMMING PROCEDURE

Be sure to write the initial data before turning on PLC (MINI) Link communication start-up. The initial data is the number of all remote I/O stations (address 0) and the number of times of retrial (address 1).

Example:



4-6 SAMPLE PROGRAMS

This section describes inverter operation, monitor, reading/writing parameters and other aspects of programming using sample programs.

4.6.1 WRITING INITIAL DATA

The following paragraphs deal with a program that writes MINI Link initial data on the buffer memory of the master station (AJ71P/T32).

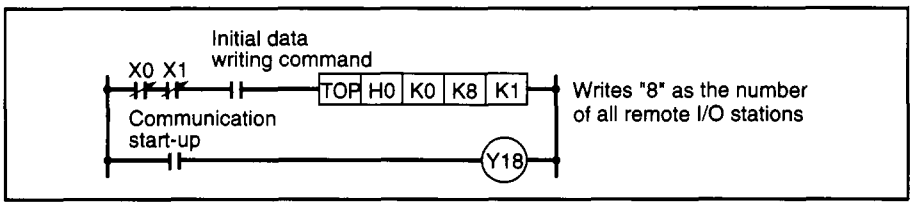
(1) The initial data is the number of all remote I/O stations (address 0) and number of times of retrial (address 1).

(2) The number of all I/O stations should be 1 through 64. The default value is 0.

(3) The number of times of retrial is 0 through 32. The default value is 2.

(4) Be sure to write the initial data while PLC (MINI) Link communication start-up (Y18) is OFF. If PLC (MINI) Link communication start-up (Y18) is ON, I/O refreshing conditions are not renewed even though the initial data is revised.

(5) Sample program
The following sample program assumes that the master station (AJ71P/T32) is mounted in slot 0 and two inverters are operated.



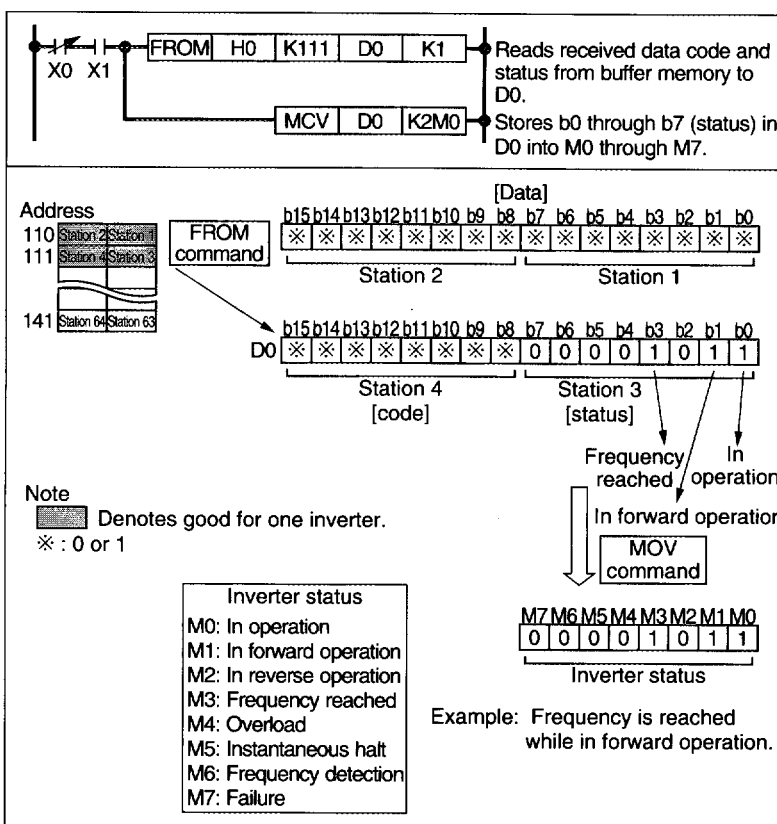
4.6.2 READING OUT INVERTER STATUS

The following paragraphs deal with a program that reads inverter status from the buffer memory in the master station.

(1) The inverter status is always stored in the received data addresses (addresses 111 through 141).

(2) Sample program.The following program reads the inverter status from station 1 to Mo through M7.

Example:

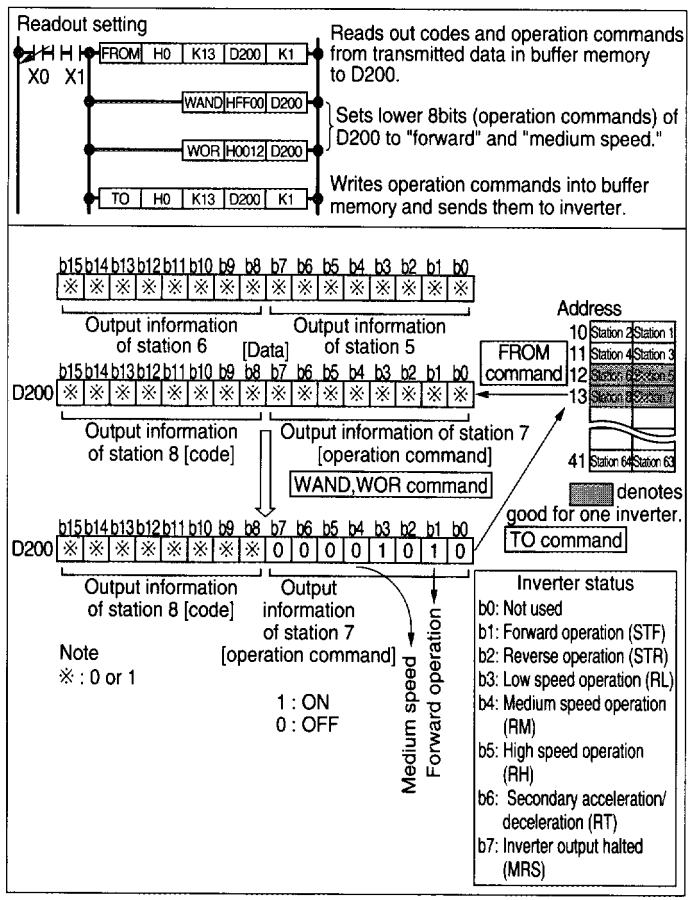


4.6.3 WRITING OPERATION COMMANDS

The following paragraphs deal with a program that writes operation commands to operate inverters in the buffer memory of the master station.

(1) Inverter operation commands are written in the transmitted data addresses (addresses 11 through 41).

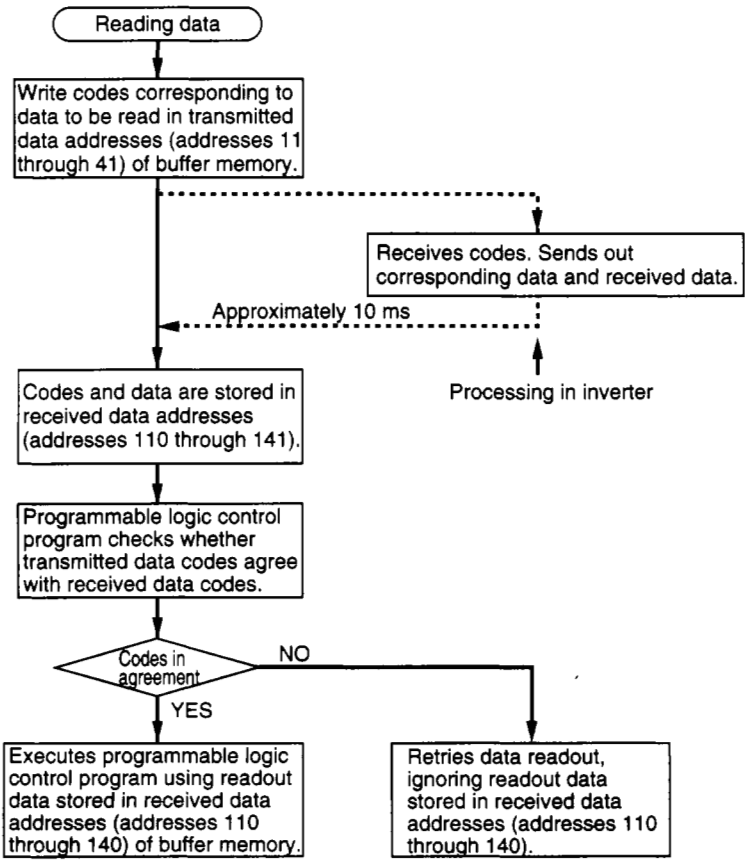
(2) Sample program.The following program commands the inverter at station 5 to run in the forward direction at medium speed.



4.6.4 READING OUT DATA

The following paragraphs deal with a program that reads out various inverter data.

(1) PROCEDURE



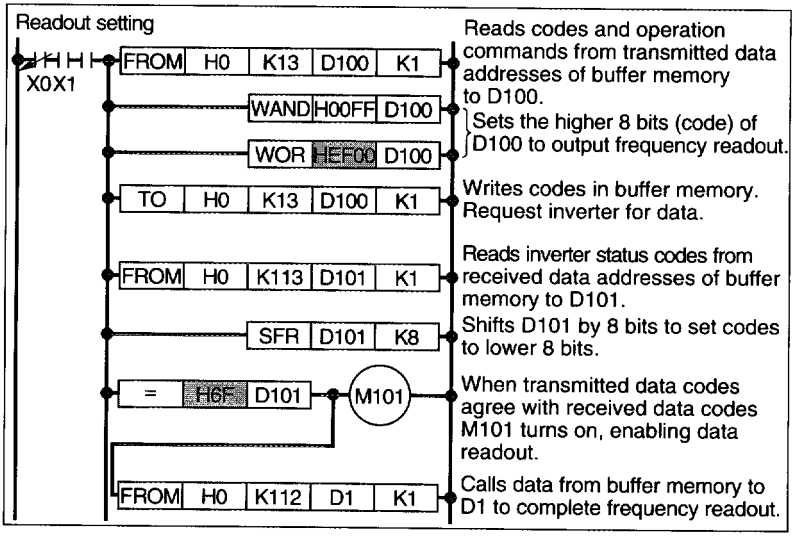
Note 1: When data is read immediately after completing data writing, the previous data could remain. Be sure to confirm that the received data codes agree with the transmitted data codes before reading the data.

Note 2: When codes do not agree after a certain times of retrial, refer to page 53 to check for disagreement. Then, take necessary measures.

(2) SAMPLE PROGRAM FOR MONITORING

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

Code for reading out output frequency: H6F (hexadecimal)



2) MONITOR CODES

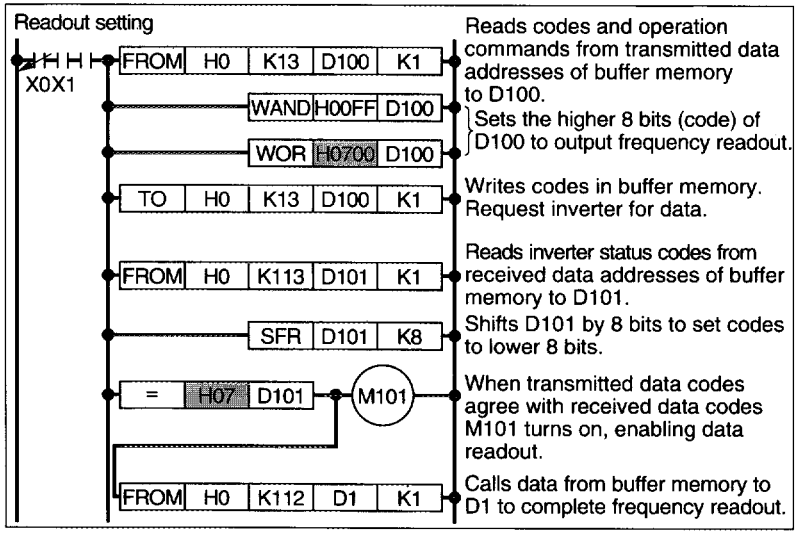
Item	Code	Data type	Data unit
Output frequency	H6F	Hexadecimal	0.01Hz
Output current	H70	Hexadecimal	0.1A
Output voltage	H71	Hexadecimal	0.1V

(Example) The data indication is H1770 (6000) when the output frequency is 60 Hz.

(3) SAMPLE PROGRAM FOR READING OUT PARAMETERS

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

Code for reading out acceleration time : H07 (hexadecimal)

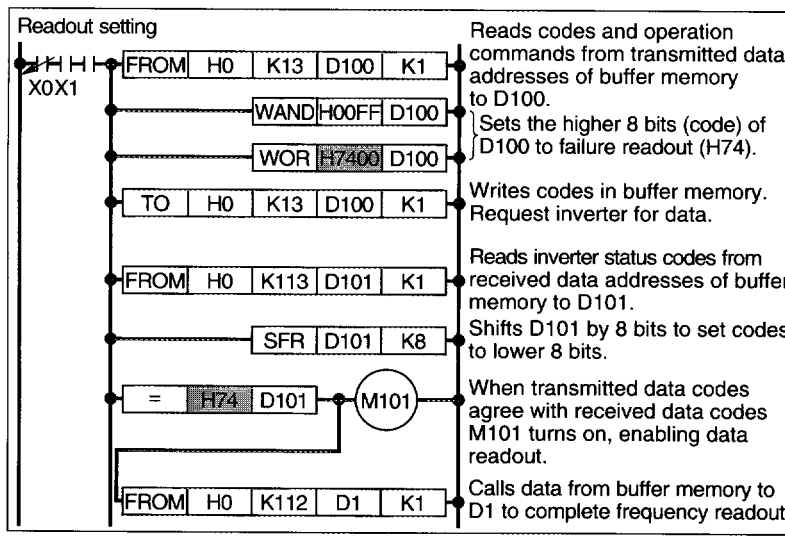


2) See the table of data codes in section 4-8 (page 62) for other parameters.

(4) SAMPLE PROGRAM FOR READING OUT FAILURE DESCRIPTION

1) The following program reads failure description of the inverter at station 5 to D1.

Code for reading out failure description : H74 (hexadecimal)

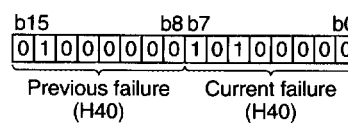


2) SAMPLE OF FAILURE DESCRIPTION

Readout data

(Example) H40A0 ..... Previous failure ..... FIN

Current failure ..... OPT



3) FAILURE DATA

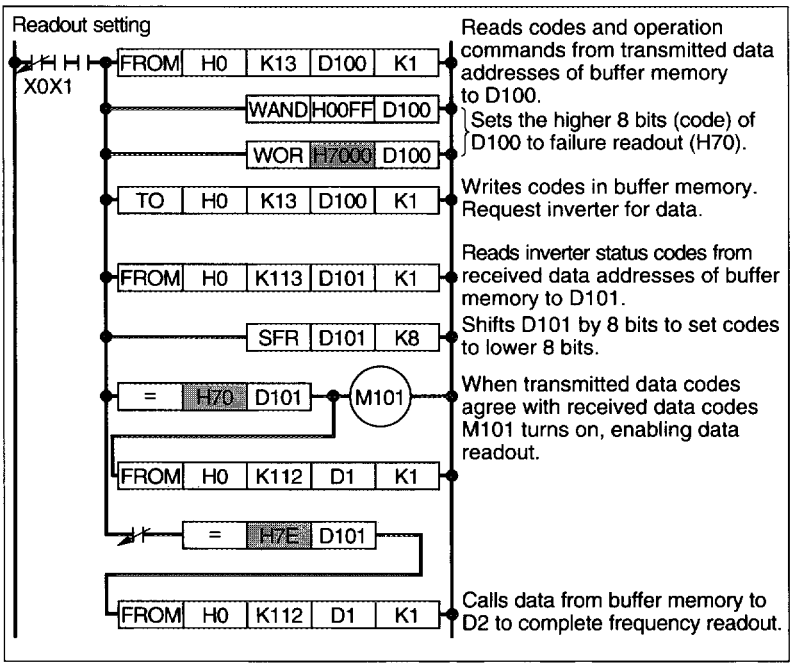
Refer to the inverter operation manual for the details of failure descriptions.

Data	Description	Data	Description
H00	Normal	H50	IPE
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) SAMPLE PROGRAM FOR READING STATUS OF DISAGREEMENT IN THE EVENT OF CODE DISAGREEMENT

1) The following sample program reads the status of disagreement when the data codes do not agree after a certain times of trial during an attempt to read out output currents of the inverter at station 5 .

Code for reading output current : H70 (hexadecimal)
Code for reading disagreement description : H7E (hexadecimal)



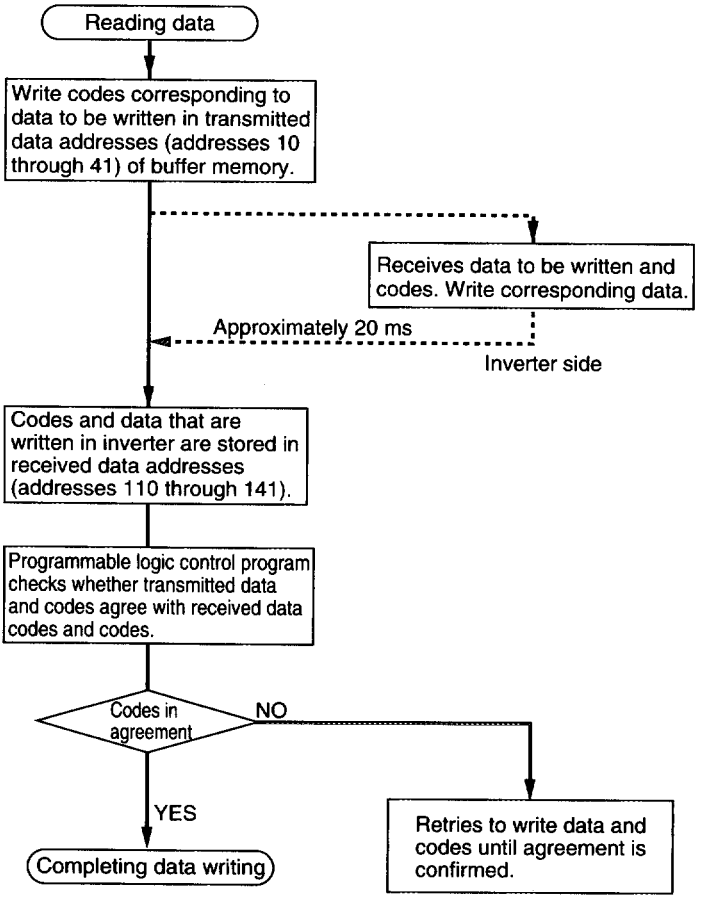
2) DESCRIPTION OF CODE DISAGREEMENT

Data	Item	Failure description
H0000	Code being recognized	Agreement on inverter being checked.
H0001	Write mode error	Parameter writing is attempted when PLC operation mode is not in "halt."
H0002	Parameter selection error	Unregistered code is set.
H0003	Setting range error	Data exceeds allowable range.
H0004	Inverter communication error	Communication between option unit and inverter is inoperative.

4.6.6 WRITING DATA

The following paragraphs deal with a sample program that writes various data in the inverters.

(1) PROCEDURE

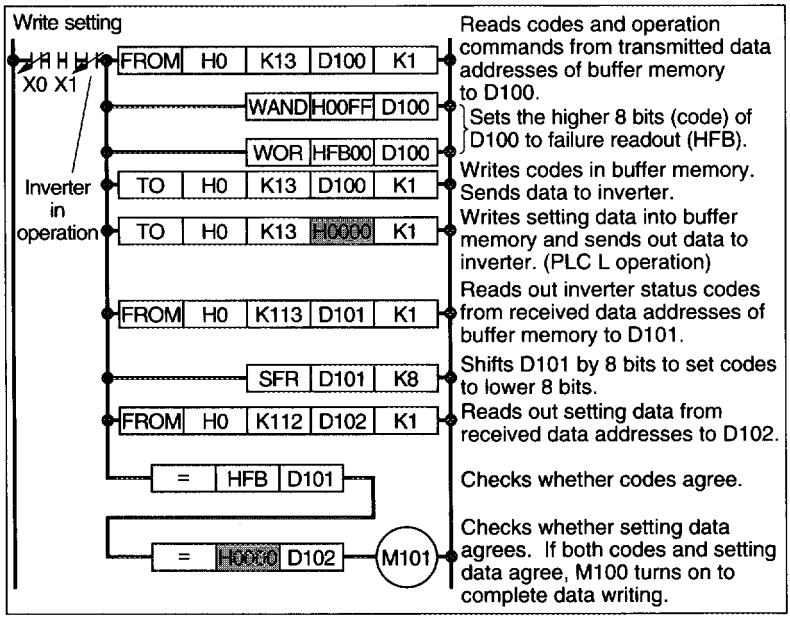


Note: When writing data, be sure to check that the code and data agree with each other. If so, the data and codes have been correctly written.
When codes and data do not agree after a certain times of retrial, refer to page 53 to check for disagreement. Then, take necessary measures.

(2) SAMPLE PROGRAM FOR SWITCHING OPERATION MODES

1) The following sample program switches the operation mode of the inverter at station 5 to the PLC Link operation.

Code for operation mode setting : HFB (hexadecimal)
Data setting for PLC Link operation : H0000 (hexadecimal)



2) OPERATION MODE SETTING

Code: HFB

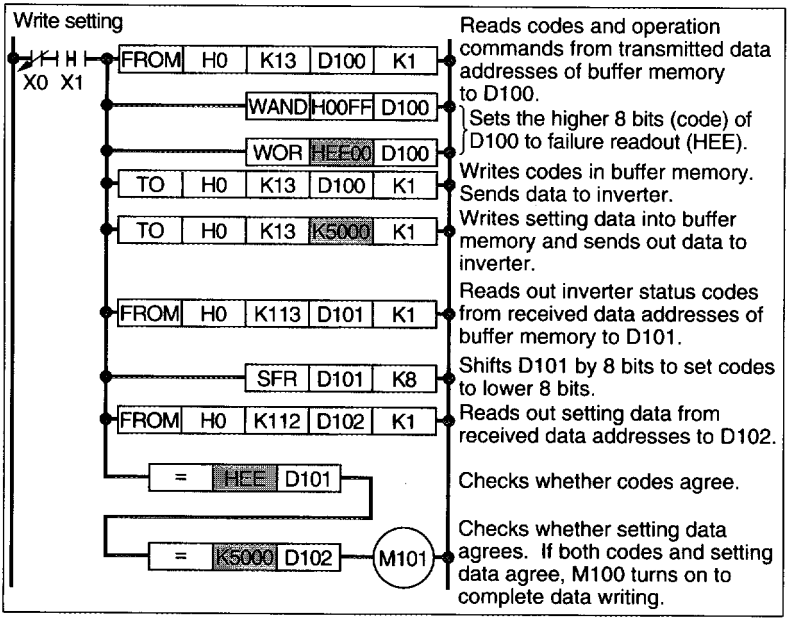
Setting data ..... 0000: PLC operation
0001: External operation
(0002: PU operation)

Note: The programmable logic controller cannot set the operation mode to PU operation.
See page 20.

(3) SAMPLE PROGRAM FOR SETTING OPERATING FREQUENCY

1) The following sample program revises the operating frequency of the inverter at station 5 to 50.00 Hz.

Code for operating frequency setting : HEE (hexadecimal)
Set frequency: K5000 (hexadecimal)



2) When changing operating frequencies consecutively:

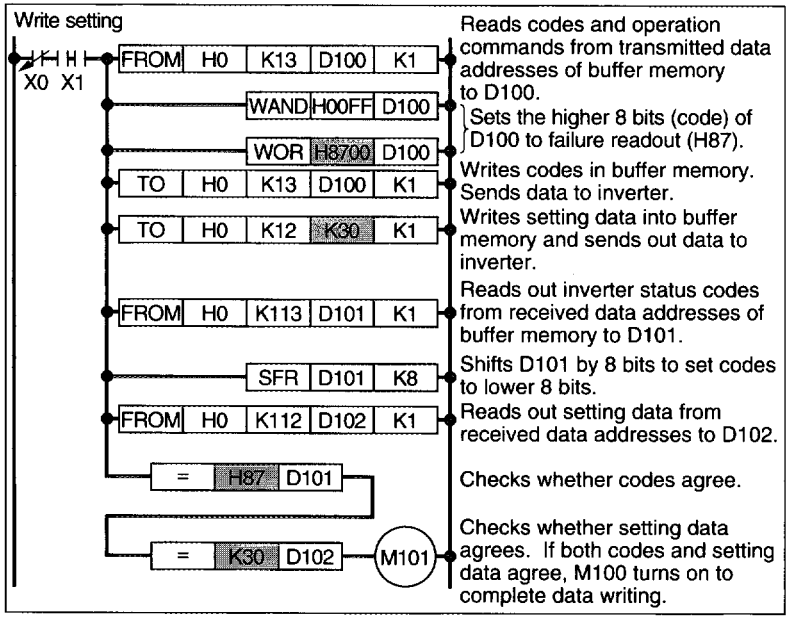
- Setting data agreement need not be checked. However, codes should be checked for agreement. The sample program above writes the frequency setting data into the E2PROM on the inverter. The E2PROM has restriction to the number of times of data writing. When changing frequencies consecutively, the program should be such that the data is written in the inverter RAM.

A SAMPLE PROGRAM WRITING OPERATING FREQUENCY INTO RAM
Change the program above as follows.
Replace code HEE with HED.

(4) SAMPLE PROGRAM FOR WRITING PARAMETERS

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

Code for writing acceleration time : H87 (hexadecimal)
Acceleration time setting data : K30 (hexadecimal)

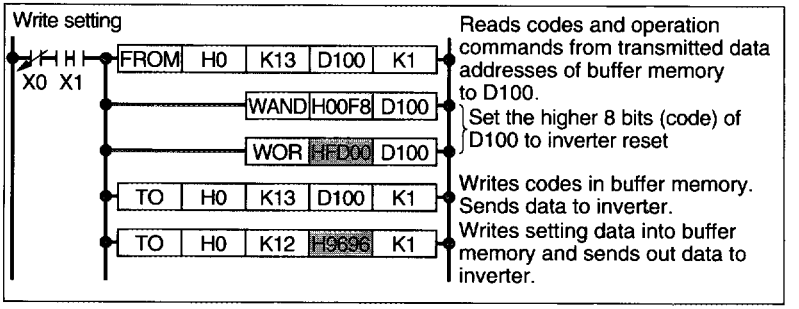


2) See the table of data codes in section 4-8 (page 62) for other parameters.

(5) SAMPLE PROGRAM FOR RESETTING INVERTERS

1) The following sample program resets the inverter at station 5 .

Code for resetting inverter: HFD (hexadecimal)
Inverter resetting data: H9696 (hexadecimal)



2) OTHER SAMPLE PROGRAMS

Replace code HFD in the program above to obtain the functions listed in the table below.

Function	Code
Parameter all clear	HFC
Failure description all clear	HF4

4-7 CAUTIONARY NOTES

(1) CAUTIONARY NOTES ON PROGRAMMING

1) Data in the buffer memory at the master station is always renewed by communicating with the inverters (I/0 refreshing). When writing or reading data, it is not necessary to execute a TO command for every scan. However, executing a TO command for every scan does not have adverse effects.

2) When writing or reading data, the data from the inverter for confirmation purpose is written at a 10 to 30 msec time lag in the buffer memory of the master station. Be sure to check for data agreement. Otherwise, the previous code might be read.

3) In order to prevent the inverter from receiving incorrect requests, the following measures are taken.
When the master station revises codes and data, the inverter does not immediately accept the codes and data. It accepts the revision when the codes and data persist for a certain period (approximately 10 msec). The inverter then returns the confirmation data and codes.
If the requested codes and data have been changed before completing the code and data change through the agreement check, the inverter will not recognize the change, and therefore will not accept the request.
If the request is not accepted, the previous confirmation codes and data are returned repeatedly.
Thus, the codes and data will not agree.

4) When the data is prepared according to the data format described on page 34, operation commands, data and readout request can be written simultaneously. Inverter status, codes and data can also be read simultaneously.

(2) CAUTIONARY NOTES ON OPERATION AND HANDLING

1) Only the commands from the programmable logic controller are accepted when in PLC operation.
Operation commands from the external devices or the parameter unit are ignored.

2) If more than one inverter has the same station number, incorrect data is communicated, making normal data communication impossible.

3) During PLC operation, when data communication is halted even for a moment due to failure in the programmable logic controller, discontinuity in the optical cable, or other incidents, the inverter stops while generating the "E.OPT" alarm.

4) During the PLC operation, when the communication start-up signal (Yn + 18) of the master station is turned off, data communication is halted. The inverter stops while generating the "E.OPT" alarm.
To end the PLC operation, first switch the operation mode to the external operation. Then, turn off the communication start-up signal (Yn + 18).

5) When the power to an inverter is turned off, optical signals are also turned off, ending data communication. This causes other inverters within the same loop to stop operation while generating an alarm.
It is recommended that each inverter should have its own power source independent of the main power supply, connected to terminals R1 and S1 so that failure in one inverter will not interrupt operation of the others.
Once the power has been turned off, the inverter in that circuit stops operation. When the power is restored, the inverter is reset into the external operation mode. To resume the PLC operation, switch to the PLC operation mode through the programmable logic control program.

6) With inverter parameter Pr.77 = 1 (write inhibit) selected, do not switch to the PLC Link mode.
Otherwise, all parameter writing would be inhibited. If such switching is made, first turn off the power. Remove Option Card T-OPT22. Turn on the power again. Set parameter Pr.77 to "0" or "2." Turn off the power. Put the Option Card back. Turn on the power. Then, switch to the PLC Link mode.

(3) TROUBLESHOOTING

1) The operation mode cannot be switched to the PLC operation mode.
Check if:
- The Option Card T-OPT22 and optical cables are mounted correctly. Check for poor contact, discontinuity, incorrect polarity, etc.,
- The station switches are correctly set. Check if settings agree with the program. Check if more than one station has the same station number,
- The inverter is in the external operation mode,

- The RUN indicator LED is on,
- The operation mode switching program has been executed,
- Operation mode switching is correctly programmed.

2) The inverter will not start up even in the PLC Link mode.
   Check if:
   - The operation mode has been switched to the PLC Link mode,
   - The program that starts the inverter is correctly programmed,
   - The program that starts the inverter has been executed,
   - Signals are sent out from the inverter,
   - The RUN indicator LED is on,
   - The operation mode switching program has been executed,
   - The operation mode switching is correctly programmed.

3) Communication halts in the middle of operation.
   Check if:
   - The Option Card T-OPT22 and optical cables are mounted correctly. Check for poor contact, discontinuity, etc.,
   - The programmable logic control program is being executed correctly, The programmable logic controller CPU is not stopped,
   - Data communication has been interrupted due to instantaneous power failure,
   - Communication start-up signal Y(n + 18) has not been turned off.

4-8 TABLE OF DATA CODES

(1) STANDARD PARAMETERS
(With data code FF = 0)

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
0	Torque boost	00	80	0 – 30%	0.1%	1%
1	Upper limit frequency	01	81	0 – 60Hz	0.01Hz	60Hz
2	Lower limit frequency	02	82	0 – 120Hz	0.01Hz	0Hz
3	Basic frequency	03	83	0 – 400Hz	0.01Hz	60Hz
4	Multi-step speed setting (high speed)	04	84	0 – 400Hz	0.01Hz	60Hz
5	Multi-step speed setting (medium speed)	05	85	0 – 400Hz	0.01Hz	30Hz
6	Multi-step speed setting (low speed)	06	86	0 – 400Hz	0.01Hz	10Hz
7	Acceleration time	07	87	0 - 3600 seconds 0 - 360 seconds	0.1/0.01 seconds	15 seconds
8	Deceleration time	08	88	0 - 3600 seconds 0 - 360 seconds	0.1/0.01 seconds	15 seconds
9	Electronic thermal current	09	89	0 – 3600A	0.1A	Rating
10	DC braking operation frequency	0A	8A	0 – 120Hz	0.01Hz	0Hz
11	DC braking operation time	0B	8B	0 – 10 seconds	0.1 seconds	0.5 seconds
12	DC braking operation voltage	0C	8C	0 – 30%	0.1%	1%
13	Start-up frequency	0D	8D	0 – 60Hz	0.01Hz	0.5Hz
14	Applicable load selection	0E	8E	0, 1, 2, 3	1	0
15	JOG frequency	0F	8F	0 – 400Hz	0.01Hz	5Hz
16	JOG acceleration/deceleration time	10	90	0 - 3600 seconds 0 - 360 seconds	0.1/0.01 seconds	15 seconds
17	External thermal input	11	91	0, 1, 2, 3	1	0

Parameter No	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
18	Upper limit frequency in high speed	12	92	0 – 400Hz	0.01Hz	60Hz
19	Voltage at basic frequency	13	93	0 – 1000V 9999	0.1V	9999
20	Reference frequency for acceleration/deceleration	14	94	0 – 400Hz	0.01Hz	60Hz
21	Acceleration/deceleration time unit	15	95	0, 1	1	0
22	Operation level for preventing stall	16	96	0 – 120%	0.1%	120%
23	Operation level 2 for preventing stall	17	97	0/120% 9999	0.1%	9999
24	Multi-step speed setting (4th speed)	18	98	0 – 400Hz 9999	0.01Hz	9999
25	Multi-step speed setting (5th speed)	19	99	0 – 400Hz 9999	0.01Hz	9999
26	Multi-step speed setting (6th speed)	1A	9A	0 – 400Hz 9999	0.01Hz	9999
27	Multi-step speed setting (7th speed)	1B	9B	0 – 400Hz 9999	0.01Hz	9999
28	Multi-step speed input compensation	1C	9C	0, 1	1	0
29	Acceleration/deceleration pattern	1D	9D	0, 1, 2, 3	1	0
30	Regenerative brake selected	1E	9E	0, 1	1	0
31	Frequency jump 1A	1F	9F	0 – 400Hz 9999	0.01Hz	9999
32	Frequency jump 1B	20	A0	0 – 400Hz 9999	0.01Hz	9999
33	Frequency jump 2A	21	A1	0 – 400Hz 9999	0.01Hz	9999
34	Frequency jump 2B	22	A2	0 – 400Hz 9999	0.01Hz	9999
35	Frequency jump 3A	23	A3	0 – 400Hz 9999	0.01Hz	9999

NOTE: "9999" in factory setting should be set to be "65535 (HFFFF)".

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
36	Frequency jump 3B	24	A4	0 – 400Hz 9999	0.01Hz	9999
37	Rotating device indication	25	A5	2 – 10 11 – 9998	1	4
38	Automatic torque boost	26	A6	0 – 200%	0.1%	0
39	Automatic torque boost start-up current	27	A7	0 – 3600A	0.01A	0
40	Output terminal allocation	28	A8	0 – 9999	1	1234
41	Band width for frequency reached	29	A9	0 – 100%	0.1%	10%
42	Output frequency detection	2A	AA	0 – 400Hz	0.01Hz	6Hz
43	Output frequency detection when reversed	2B	AB	0 – 400Hz 9999	0.01Hz	9999
44	Secondary acceleration/ deceleration time	2C	AC	0 - 3600 seconds 0 - 360 seconds	0.1/0.01 seconds	15 seconds
45	Secondary deceleration time	2D	AD	0 - 3600 seconds 0 - 360 seconds	0.1/0.01 seconds	9999
46	Secondary torque boost	2E	AE	0 – 30% 9999	0.1%	9999
47	Secondary V/F (basic frequency)	2F	AF	0 – 400Hz 9999	0.01Hz	9999
48*	Operation level (current) for preventing secondary stall	30	80	0 – 120%	0.1%	150%
49	Operation level (frequency) for preventing secondary stall	31	81	0 – 400Hz	0.01Hz	0
50	Secondary frequency detection	32	82	0 – 400Hz	0.01Hz	30Hz
51	LED indication data selection	33	83	1 – 14, 17, 18	1	1
52	PU main indication data selection	34	84	0, 17 – 20	1	0
53	PU level indication data selection	35	85	0 – 3, 5 – 14, 17, 18	1	1

* 0 to 150 % for MT-A200 series

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
54	FM terminal function selection	36	86	1 - 3, 5 - 14, 17, 18, 21, 101 – 103, 105 – 114, 117, 118, 121	1	1
55	Reference frequency setting	37	87	0 – 400Hz	0.01Hz	60Hz
56	Current monitor reference	38	88	0 – 3600A	0.01A	Rating
57	Re-start free line time	39	89	0 - 30 seconds 9999	0.1 seconds	9999
58	Re-start transient time	3A	BA	0 – 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 – 5	1	0
61	Reference current	3D	BD	0 – 3600A 9999	0.01A	9999
62	Acceleration reference time	3E	BE	0 – 120% 9999	0.1%	9999
63	Deceleration reference time	3F	BF	0 – 120% 9999	0.1%	9999
64	Lift mode starting frequency	40	C0	0 – 10Hz 9999	0.01Hz	9999
65	Hold time during start-up	41	C1 E1	0 – 10 seconds	0.1 seconds	0
66	Stall restriction, frequency for starting reduction	42	C2	0 – 400Hz	0.01Hz	60Hz
67	Number of times of retrial in case of alarm	43	C3	0 – 10 (101 – 110)	1	0
68	Time for waiting for retrial	44	C4	0 - 10 seconds 9999	0.1 seconds	9999
69	Indication of number of times of retrial	45	C5	0	1	0

Parameter No.	Name		Data code		Setting range	Minimum setting unit	Factory setting
			Reading	Writing			
70	Duty for regenerative brake		46	C6	0 – 100%	0.1%	0%
71	Applicable motor		47	C7	0, 1, 2	1	0
72	PWM mode selection		48	C8	0, 1, 2		0
73	0 - 5 V, 0 - 10 V selection		49	C9	0 – 5, 10 – 15	1	1
74	Input filter constant		4A	CA	0 – 8	1	1
75	Reset selection		4B	CB	0, 1, 2, 3	1	0
76	Alarm code output selection		4C	CC	00 – 54	1	00
77	Parameter write inhibit selection		–	–	0, 1, 2	1	0 Setting impossible
78	Anti-reversal selection		4E	CE	0, 1, 2	1	0
79	Operation mode selection		–	–	0 – 5	1	0 Setting impossible
80	Motor capacity		50	D0	0.4 – 3600kW 9999	0.01kW	9999
81	Number of poles		51	D1	2 - 6, 12 - 16 9999	1	9999
	Second parameter switching		6C	EC	00, 01, 02	1	00
	Frequency setting	Operation frequency (RAM)	6D	ED	0 – 400Hz	0.01Hz	0Hz
		Operation frequency (E^2PROM)	6E	EE	0 – 400Hz	0.01Hz	0Hz
	Monitor	Frequency monitor	6F	–	0 – 400Hz	0.01Hz	
		Output current monitor	70	–	0 – 3600A	0.1A	
		Output voltage monitor	71	–	0 – 1000V	0.1V	
		Special monitor	72	–			

Parameter No.	Name		Data code		Setting range	Minimum setting unit	Factory setting
			Reading	Writing			
	Monitor	Special monitor selection No.	73	F3	0 – 14		
	Failure indication	Last No.1, No.2 failure indication clear	74	F4	9696H		
		Last No.3, No.4	75	–			
		Last No.5, No.6	76	–			
		Last No.7, No.8	77	–			
	————————		–	–			
	Operation mode achieved		7B	FB	0, 1, 2		00
	Parameter all clear		–	FC	9696H		
	Inverter reset			FD	9696H		
	Data code disagreed		7E	–			
	Link parameter extension setting		7F	FF	0:Pr0 – 99 1:Pr100 – 905		

(2) SPECIFICATION PARAMETERS
(With data code FF = 1)

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
100	BCD input (offset)	–	–	0 – 400Hz	0.01Hz	0
101	BCD input (gain)	–	–	0 – 400Hz 9999	0.01Hz	60Hz
102	Binary input (offset)	–	–	0 – 400Hz	0.01Hz	0
103	Binary input (gain)	–	–	0 – 400Hz 9999	0.01Hz	60Hz
104	BCD/binary selection	–	–	0, 1, 2, 3 9999	1	0
105	Speed feedback range	05	85	0 – 400Hz 9999	0.01Hz	9999
106	Feedback gain	06	86	0 – 100	0.1	1.0
107	V/F1 (1st frequency)	–	–	0 – 400Hz, 9999	0.01Hz	9999
108	V/F1 (1st frequency voltage)	–	–	0 – 1000V	0.1V	0
109	V/F2 (2nd frequency)	–	–	0 – 400Hz, 9999	0.01Hz	9999
110	V/F2 (2nd frequency voltage)	–	–	0 – 1000V	0.1V	0
111	V/F3 (3rd frequency)	–	–	0 – 400Hz, 9999	0.01Hz	9999
112	V/F3 (3rd frequency voltage)	–	–	0 – 1000V	0.1V	0
113	V/F4 (4th frequency)	–	–	0 – 400Hz, 9999	0.01Hz	9999
114	V/F4 (4th frequency voltage)	–	–	0 – 1000V	0.1V	0
115	V/F5 (5th frequency)	–	–	0 – 400Hz, 9999	0.01Hz	9999
116	V/F5 (5th frequency voltage)	–	–	0 – 1000V	0.1V	0
117	Number of times of averaging for speed detection			1 – 20	1	4
118	Baud rate	–	–	3 – 96	1	96

NOTE: "9999" in factory setting should be set to be "65535 (HFFFF)".

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
119	Stop bit length	–	–	0, 1	1	1
120	Parity check provision	–	–	0, 1, 2	1	2
121	Number of times of communication retrial	–	–	0 – 10	1	1
122	Time interval for checking communication	–	–	0 – 999.8 seconds 9999	0.1%	0
123	Operation command location	–		0, 1	1	0
124	Speed command location	–	–	0, 1	1	0
125	Computer link start-up mode selection	–	–	0, 1, 2	1	0
126	Selection for provision of CR, LF	–	–	0, 1, 2	1	1
127	Provision of PLC Link. computer link E^2PROM writing	1B	9B	0, 1	1	0
128	PI operation selection	–	–	0, 1, 9999	1	9999
129	Proportional range of PI	–	–	0.1 – 3600%, 9999	0.1%	4%
130	PI integrating time	–	–	0.1 – 360 seconds 9999	0.1 seconds	150 seconds
131	Upper limit	–	–	0 – 200% 9999	0.1%	9999
132	Lower limit	–	–	0 – 200% 9999	0.1%	9999
133	PLC Link. PU PI target value	–	–	0 – 100%	0.1%	0%
134	Relay output selection	–	–	0 – 9999	1	12
135	Analog meter output selection	–	–	1 – 21	1	17
136	Analog meter offset	–	–	0 – 100%	0.1%	0
137	Analog meter gain	–	–	0 – 100%	0.1%	100%
138	Re-start lead-in upper limit frequency	–	–	0 – 400Hz	0.01Hz	60Hz

NOTE: "9999" in factory setting should be set to be "65535 (HFFFF)".

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
139	Upper limit for deceleration rate during e-start	–	–	0 – 60.0 seconds	0.1 seconds	30 seconds
140	Torque load square reduction rate	–	–	1 – 5	0.01	1.75
141	Current limiter time lag	–	–	0 – 60 seconds	0.1 seconds	30 seconds
142	Instantaneous power failure time	–	–	0 – 5 seconds	0.1 seconds	0 seconds
143	Rated voltage	–	–	0 – 1000V	0.1V	Depending on inverter capacity
144	Rated current	–	–	0 – 3600A	0.1A	Depending on inverter capacity
145	Type selection	–	–			
146	Analog input voltage/current switching	–	–	0, 1	1	0
147	(Not used)	–	–			
148	(Not used)	–	–			
149	(Not used)	–	–			
150	(Not used)	–	–			
151	(Not used)	–	–			
152	(Not used)	–	–			
153	(Not used)	–	–			
154	(Not used)	–	–			
155	(Not used)	–	–			
156	(Not used)	–	–			
157	(Not used)	–	–			
158	————	–	–			
159	————	–	–			
200	Program minute/second selection	–	–	0, 1	1	0
201	Program set 1	–	–			

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
202	Program set 2	–	–			
203	Program set 3	–	–			
204	Program set 4	–	–	For direction of rotation		
205	Program set 5	–	–	0 – 2	1	0
206	Program set 6	–	–			
207	Program set 7	–	–			
208	Program set 8	–	–	For frequency		
209	Program set 9	–	–	0 – 400.0Hz 9999	0.1Hz	9999
210	Program set 10	–	–			
211	Program set 11	–	–			
212	Program set 12	–	–	For time		
213	Program set 13	–	–	0 – 99.59	0.01	0
214	Program set 14	–	–			
215	Program set 15	–	–			
216	Program set 16	–	–			
217	Program set 17	–	–			
218	Program set 18	–	–			
219	Program set 19	–	–			
220	Program set 20	–	–			
221	Program set 21	–	–			
222	Program set 22	–	–			
223	Program set 23	–	–			
224	Program set 24	–	–			
225	Program set 25	–	–			
226	Program set 26	–	–			
227	Program set 27	–	–			

Parameter No.	Name	Data code		Setting range	Minimum setting unit	Factory setting
		Reading	Writing			
228	Program set 28	–	–			
229	Program set 29	–	–			
230	Program set 30	–	–			
231	Time set	–	–	0 – 99.59	0.01	0
900	FM terminal calibration	–	–		1	1444
901	AM terminal calibration	–	–	606	1	3521
902	Frequency setting voltage bias	5E	DE	0 – 60Hz (0 – 4095)	0.1Hz	0
903	Frequency setting voltage gain	5F	DF	0 – 400.00Hz (0 – 4095)	0.1Hz	60Hz
904	Frequency setting current bias	60	E0	0 – 60Hz (0 – 4095)	0.1Hz	0
905	Frequency setting current gain	61	E1	1 – 400.00Hz (0 – 4095)	0.1Hz	60Hz
	Link parameter extension setting	7F	7F	0: Pr0 – 99 1: Pr100 – 905		