8 EMBEDDED ETHERNET FUNCTION

This chapter describes the specifications of the embedded Ethernet function for Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*i*s/180*i*s/210*i*s–B.

8.1 EMBEDDED ETHERNET AND PCMCIA ETHERNET

The embedded Ethernet function can be used by selecting one of two types of devices: the embedded Ethernet port and PCMCIA Ethernet card.

The PCMCIA Ethernet card is to be inserted into the memory card slot to the left of the front LCD for temporary communication.

NOTE

1 Use the PCMCIA Ethernet card for temporary communication only. Do not use the PCMCIA Ethernet card for routine communication.
2 The PCMCIA Ethernet card is to be inserted into the memory card slot to the left of the LCD. This means that some part of the card is projected. When using the PCMCIA Ethernet card, be careful not to damage the card by hitting the card with an object.
  After using the PCMCIA Ethernet card, remove the card immediately to prevent the card from being damaged.
3 With FS21*i*–B, the embedded Ethernet port cannot be used.
4 This section assumes that the PCMCIA Ethernet card is inserted into the Series 16*i*/18*i*/21*i*–B CNC. When inserted into the Series 160*i*/180*i*/210*i*/160*is*/180*is*/210*is* CNC, the PCMCIA Ethernet card is not a embedded Ethernet card.

8.2 LIST OF FUNCTIONS

With the embedded Ethernet function, the following functions can be operated:

- FACTOLINK function
- FOCAS1/Ethernet function
- DNC1/Ethernet function
- FTP file transfer function

8.2.1 FACTOLINK Function

With the FACTOLINK function, data can be displayed on the CNC screen, and NC data can be transferred by operations on the NC.
For details, refer to “FANUC FACTOLINK Script Function OPERATOR’S MANUAL (B–75054EN)”.

NOTE
The FACTOLINK function is usable with the control software for the embedded Ethernet function series 656A edition 02 or later.

Screen display

Data created by a personal computer can be displayed on the NC screen by operations on the NC.

NC data transfer

The following NC data can be transferred by operations on the NC:

- NC program
- NC file data
  - Parameter
  - Ladder program
  - C languarge executor in executable form
  - Macro executor in executable form
  - NC system file
- PMC data
  - Addresses T, K, C, D

Logging

Machine state information can be automatically sent to the personal computer.

8.2.2 FOCAS1/Ethernet Function

The FOCAS1/Ethernet function allows a personal computer to remotely control and monitor the CNC. The FOCAS1/Ethernet function can transfer a wider range of NC data than the DNC1/Ethernet function. For details, refer to ”FANUC Open CNC FOCAS1/Ethernet CNC/PMC Data Window Library Description”.

NC data transfer

The following NC data can be transferred by operations on the personal computer:

- Data related to control axes/spindles

  - Absolute position
  - Relative position
  - Machine position
  - Remaining travel amount
  - Actual speed
- NC program
- Part program storage directory information
- NC data file
  - Parameter
  - Tool offset value
  - Custom macro variable
  - Workpiece origin offset
  - Setting data
  - P code macro variable
  - Pitch error compensation
- Tool life management data
- History data
  - Operation history data
  - Alarm history data
- Servo–/spindle–related data
- Data related to waveform diagnosis
- Modal data
- Diagnosis data
- A/D conversion data
- Alarm information
- NC system identification information
- PMC data
  - Addresses G, F, Y, X, A, R, T, K, C, D
  - Extended nonvolatile data

Remote operation

From the personal computer, the following operations can be performed:

- NC program selection
- NC program deletion
- External reset

NOTE
With the FOCAS1/Ethernet function of the embedded Ethernet function, DNC operation cannot be performed.

8.2.3 DNC1/Ethernet Function

The DNC1/Ethernet function allows a personal computer to remotely control and monitor the CNC. The DNC1/Ethernet function provides software libraries in a simpler function call format when compared with the FOCAS1/Ethernet function.
For details, refer to “FANUC Personal Computer FA System Windows NT Version OPERATOR’S MANUAL (B–75044EN)”.

NC data transfer

The following NC data can be transferred by operations on the personal computer:

- NC program
- Part program storage directory information
- NC file data
  - Parameter
  - Tool offset value
  - Custom macro variable
- Alarm information
- NC system identification information
- PMC data
  - Addresses G, F, Y, X, A, R, T, K, C, D

Remote operation

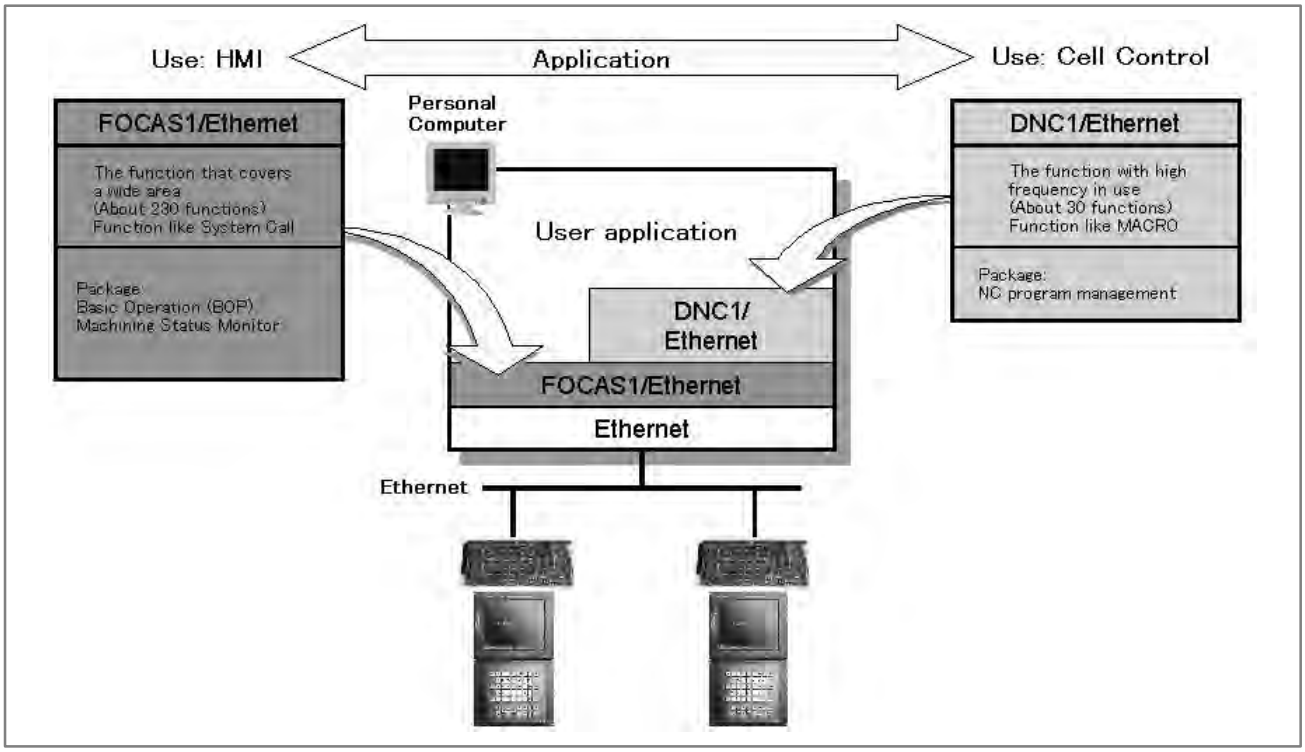
From the personal computer, the following operations can be performed:

- NC program selection
- NC program deletion
- External reset

NOTE
With the DNC1/Ethernet function of the embedded Ethernet function, DNC operation cannot be performed.

Differences between the FOCAS1/Ethernet function and DNC1/Ethernet function

Compared with the FOCAS1/Ethernet function, the DNC1/Ethernet function provides software libraries in a simpler function call format for frequently used functions.



8.2.4 FTP File Transfer Function

The FTP file transfer function transfers files with FTP. The function can read and punch NC programs and various types of NC data.

NOTE
The FTP file transfer function is usable with the control software for the embedded Ethernet function series 656A edition 02 or later.

NC data transfer [Personal computer ←→ Part program storage]

The following NC data can be transferred by operations on the NC:

- NC program
- NC file data
  - Parameter
  - Tool offset value
  - Workpiece origin offset value
  - Pitch error compensation
  - M code group (Series 16*i*/18*i*/160*i*/180*i*/160*is*/180*is*–B only)
- History data
  - Operation history data

8.2.5 Functional Differences between the Embedded Ethernet Function and the Ethernet Function Based on the Option Board

The table below indicates the differences between the embedded Ethernet function and the Ethernet function based on the option board.

	Embedded Ethernet	Option board
FOCAS1/Ethernetfunction	Available	Available
CNC screen display function	Not available	Available
DNC operation	Not available	Available
Data Server function	Not available (Note 1)	Available
FACTOLINK function	Available	Available

NOTE

1 The embedded Ethernet function includes the FTP file transfer function.
This function is almost equivalent to the NC data transfer function in the FTP mode of the Data Server function of the option board.

2 Compared with the option board, the embedded Ethernet function allows a smaller number of FOCAS1/Ethernet clients to be connected simultaneously.

	Embedded Ethernet	**Ethernet board**	**Fast Ethernet board**
Number of clients that can be connected simultaneously	5 clients maximum	10 clients maximum	20 clients maximum
Number of personal computers that can be connected simultaneously	1 unit (recommended)	10 units maximum	20 units maximum

3 Communications using the embedded Ethernet function is processed by the CPU of the CNC. This means that the operation state of the CNC can affect the performance of communication based on the embedded Ethernet function, and communication based on the embedded Ethernet function can affect the processing of the CNC.
The embedded Ethernet function has lower priority than axis–by–axis processing such as automatic operation processing and manual operation. So, when automatic operation is being performed or many controlled axes are involved, communication may become slower.
On the contrary, the embedded Ethernet function has higher priority over CNC screen display processing, C language executor processing (excluding high–level tasks), and macro executor processing (excluding execution macros). So, communication based on the embedded Ethernet function can decrease the performance of such processing.

4 Note that when the embedded Ethernet function is connected to an intranet that handles large volumes of broadcast data, for example, the processing of broadcast data can take a longer time, resulting in a decrease in performance of processing such as CNC screen display processing.

8.3 SETTING THE EMBEDDED ETHERNET FUNCTION

This section describes the setting of the parameters for the embedded Ethernet function for the Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*is*/180*is*/210*is*–B.

8.3.1 Parameter Setting of the FACTOLINK Function

This subsection describes the settings required to operate the FACTOLINK function when the embedded Ethernet function for the Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*is*/180*is*/210*is*–B is used.

8.3.1.1 Notes on using the FACTOLINK function for the first time

CAUTION

When using the embedded Ethernet function for the first time, make various settings including IP address setting carefully and conduct a communication test sufficiently, consulting with your network manager.
Note that if an incorrect IP address is set, for example, the entire network may suffer from a communication error.

NOTE

1 When the FACTOLINK function is used, the optional function corresponding to a CNC used is required.

Series16*i*–TB	A02B–0281–S708
Series 16*i*–MB	A02B–0282–S708
Series 18*i*–TB	A02B–0283–S708
Series 18*i*–MB	A02B–0284–S708
Series 21*i*–TB	A02B–0285–S708
Series 21*i*–MB	A02B–0286–S708

2 With the FACTOLINK function, only one FACTOLINK server can be connected to one CNC.

8.3.1.2 FACTOLINK parameter setting screen

On the Ethernet parameter setting screen, set the parameters for operating the FACTOLINK function.

Display

Procedure

1 Place the CNC in the MDI mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

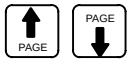
4 Press the [ETHPRM] soft key. The Ethernet parameter setting screen appears. The Ethernet functions currently available are displayed.

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

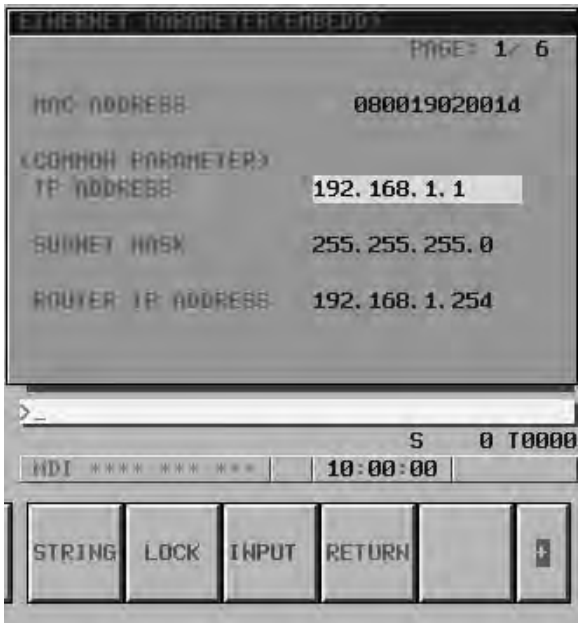
5 By pressing the [EMBEDD] soft key, the parameters for the embedded Ethernet port can be set.
By pressing the [PCMCIA] soft key, the parameters for the PCMCIA Ethernet card can be set.

NOTE
The parameters for the embedded Ethernet port and the parameters for the PCMCIA Ethernet card are independent of each other.

6 By using the MDI keys and soft keys, enter and update data.

7 Switch the screen display with the page keys  .

If data is already registered, the data is displayed.



Display item and setting items

Display item related to the embedded Ethernet function

The item related to the embedded Ethernet function is displayed.

Item	Description
MAC ADDRESS	Embedded Ethernet MAC address

Embedded Ethernet TCP/IP setting items

Set the TCP/IP–related items of the embedded Ethernet.

Item	Description
IP ADDRESS	Specify the IP address of the embedded Ethernet. (Example of specification format: ”192.168.1.1”)
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: ”255.255.255.0”)
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: ”192.168.1.254”)

FACTOLINK setting items

Set the items related to the host computer with which the FACTOLINK server operates.

Item	Description
IP ADDRESS	Specify the IP address of a personal computer to be accessed by the FACTOLINK function. (Example of specification format: ”192.168.1.100”)
PORT NUMBER	Specify a port number to be used with the FACTOLINK function. The valid input range is 5001 to 65535. A specified port number must match ”ocsnc” of the ”services” file of the personal computer. For details, refer to ” FANUC FACTOLINK Script Function OPERATOR’S MANUAL (B–75054EN)”.

8.3.1.3 Parameters

The NC parameters related to the FACTOLINK function are described below.

Parameters

0802	Communicationchannel

[Data type] Byte

[Valid data range] 21: Select the embedded Ethernet.

	#7	#6	#5	#4	#3	#2	#1	#0
0810			MONO	TIME				BGS

[Data type] Bit

BGS When the FACTOLINK screen is not displayed:
0 : Logging is performed in the background.
1 : Logging is not performed.

TIME Selects the time display format:
0 : ”97/11/12 00:00” format is used.
1 : ”Wed Nov 12 00:00:00” format is used.

MONO When the FACTOLINK screen is displayed:
0 : Two–tone monochrome display is used.
1 : Color display is used.

0811	Type of logging

[Data type] Byte

[Valid data range] 0, 1, 10, 20, 21
0 : D address area
1 : R address area
10 : Fixed data only
20 : D address area + fixed data
21 : R address area + fixed data

0812	PMC address for logging data

[Data type] Word

[Valid data range] 0 to 65535
Set a start PMC address for storing logging data.

0813	Data length of logging data

[Data type] Word

[Unit of data] Number of bytes

[Valid data range] 0 to 65535
Set the data length of logging data.

0814	Trigger PMC address for logging

[Data type] Word

[Valid data range] 0 to 65535

Set a PMC address that serves as a trigger for specifying logging data.

0815	Logging data transmission interval

[Data type] Double–word

[Unit of data] Seconds

[Valid data range] 0 to 4294967295

Set a time interval used for transmitting logging data (fixed data only). If 0 is set, logging data is transmitted at connection time only.

0820	Machine name posted to the host computer (1st byte)
0821	Machine name posted to the host computer (2nd byte)
0822	Machine name posted to the host computer (3rd byte)
0823	Machine name posted to the host computer (4th byte)
0824	Machine name posted to the host computer (5th byte)
0825	Machine name posted to the host computer (6th byte)
0826	Machine name posted to the host computer (7th byte)
0827	Machine name posted to the host computer (8th byte)
0828	Machine name posted to the host computer (9th byte)

[Data type] Byte

[Valid data range] 32 to 126

Set a machine name that is unique to each CNC and is required for the host computer to identify each CNC. Use ASCII codes in decimal for alphanumeric characters and blanks to set a machine name.

	#7	#6	#5	#4	#3	#2	#1	#0
3111	NPA							

[Data type] Bit

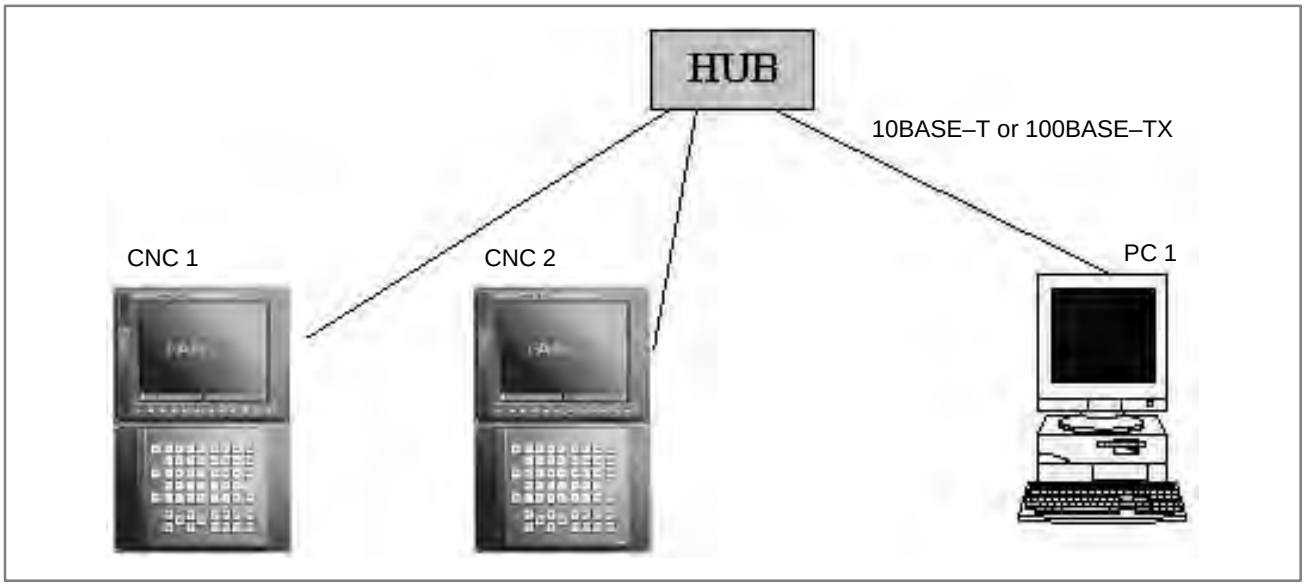
NPA When an alarm is issued while the FACTOLINK screen is displayed:

0 : The screen display does not switch to the alarm screen.
1 : The screen display switches to the alarm screen.

8.3.1.4 Using the FACTOLINK function on a small network

An example of minimum setting required to operate the FACTOLINK function on a small network is provided below.
In this example, one personal computer is connected to two CNCs through FACTOLINK.

- On Personal Computer 1, the server of the FACTOLINK function operates.
- On CNC 1 and CNC 2, the client of the FACTOLINK function operates.



	CNC 1	CNC 2
IP address	192.168.1.1	192.168.1.2
Subnet mask	255.255.255.0	255.255.255.0
Router IP address	None	None
IP address	192.168.1.100	192.168.1.100
Port number	9000	9000
NC parameter No. 802	21	21
NC parameter No. 820	67 'C'	67 'C'
NC parameter No. 821	78 'N'	78 'N'
NC parameter No. 822	67 'C'	67 'C'
NC parameter No. 823	49 '1'	50 '2'

→ The Ethernet parameter screen is used for setting.

→ The parameter screen is used for setting.

	PC 1
IP address	192.168.0.100
Subnet mask	255.255.255.0
Default gateway	None
ocsnc	9000/TCP
ocscomm	9001/TCP
ocsapplication	9002/TCP

→ "Microsoft TCP/IP property" of the personal computer (Windows NT) is used for setting.

→ Refer to "FANUC FACTOLINK Script Function OPERATOR'S MANUAL (B–75054EN)".

8.3.1.5 Configuring a large network

When configuring a large network or expanding an existing network, consult with your network manager to set an IP address, subnet mask, and router IP address.

8.3.2 Parameter Setting of the FOCAS1/Ethernet Function

This subsection describes the settings required to operate the FOCAS1/Ethernet function (or DNC1/Ethernet function) when the embedded Ethernet function for the Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*is*/180*is*/210*is*–B is used.

8.3.2.1 Notes on using the FOCAS1/Ethernet function for the first time

CAUTION

When using the embedded Ethernet function for the first time, make various settings including IP address setting carefully and conduct a communication test sufficiently, consulting with your network manager.
Note that if an incorrect IP address is set, for example, the entire network can suffer from a communication error.

NOTE

1 The FOCAS1/Ethernet function allows up to five FOCAS1/Ethernet clients to be connected to one CNC.
2 If multiple application software products or multiple personal computers access the CNC simultaneously, the communication load on the CNC can increase, resulting in decreased communication speed and degraded CNC screen display processing.

8.3.2.2 FOCAS1/Ethernet parameter setting screen

On the Ethernet parameter setting screen, set the parameters for operating the FOCAS1/Ethernet function.

Display

Procedure

1 Place the CNC in the MDI mode.

2 Press the function key [SYSTEM] .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [ETHPRM] soft key. The Ethernet parameter setting screen appears. The Ethernet functions currently available are displayed

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

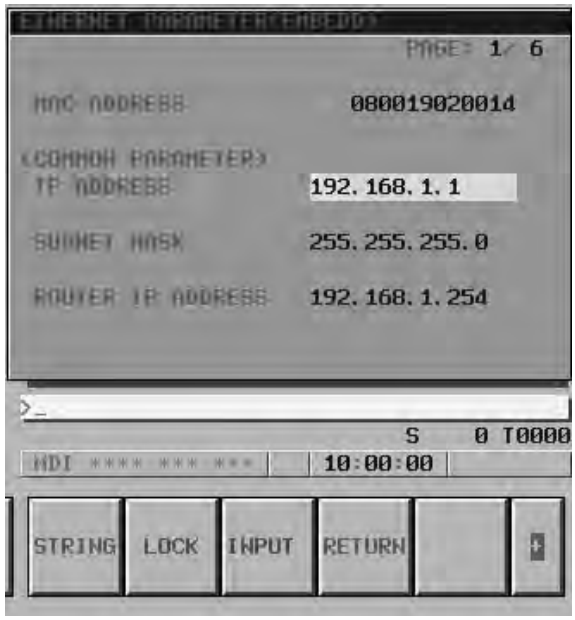
5 By pressing the [EMBEDD] soft key, the parameters for the embedded Ethernet port can be set.
By pressing the [PCMCIA] soft key, the parameters for the PCMCIA Ethernet card can be set.

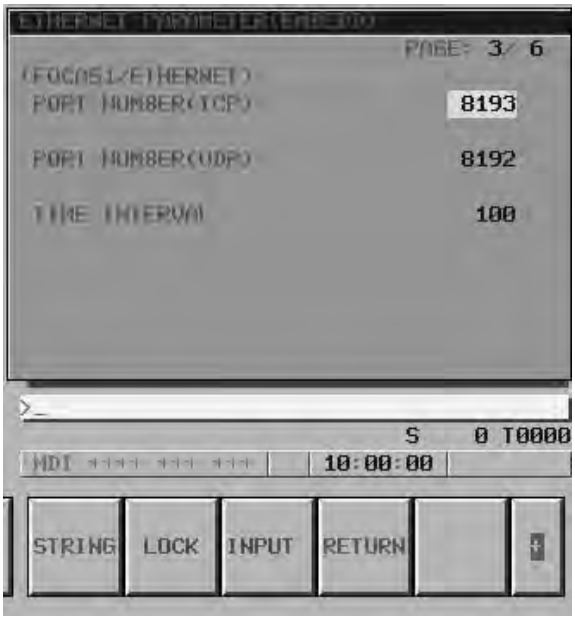
NOTE
The parameters for the embedded Ethernet port and the parameters for the PCMCIA Ethernet card are independent of each other.

6 By using the MDI keys and soft keys, enter and update data.

7 Switch the screen display with the page keys [PAGE] [PAGE] .

If data is already registered, the data is displayed.





Display item and setting items

Display item related to the embedded Ethernet function

The item related to the embedded Ethernet function is displayed.

Item	Description
MAC ADDRESS	Embedded Ethernet MAC address

Embedded Ethernet TCP/IP setting items

Set the TCP/IP–related items of the embedded Ethernet.

Item	Description
IP ADDRESS	Specify the IP address of the embedded Ethernet. (Example of specification format: ”192.168.1.1”)
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: ”255.255.255.0”)
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: ”192.168.1.254”)

FOCAS1/Ethernet setting items

Set the items related to the FOCAS1/Ethernet function.

Item	Description
PORT NUMBER (TCP)	Specify a port number to be used with the FOCAS1/Ethernet function. The valid input range is 5001 to 65535. When using a port number for the DNC1/Ethernet function, refer to ”FANUC Personal Computer FA System Windows NT Version OPERATOR’S MANUAL (B–75044EN)”.
PORT NUMBER (UDP)	Specify this item when using the DNC1/Ethernet function. Specify a UDP port number for transmitting UDP broadcast data. The valid input range is 5001 to 65535. For details, refer to ”FANUC Personal Computer FA System Windows NT Version OPERATOR’S MANUAL (B–75044EN)”. Set 0 when using the FOCAS1/Ethernet function or when transmitting no UDP broadcast data.
TIME INTERVAL (NOTE 1)	Specify this item when using the DNC1/Ethernet function. Specify a time interval at which UDP broadcast data specified above with a UDP port number is transmitted. The unit is 10 ms. The valid input range is 10 to 65535. This means that a value less than 100 ms cannot be specified. Set 0 when using the FOCAS1/Ethernet function or when transmitting no UDP broadcast data. Example) 100: Broadcast data is transmitted at intervals of one second [1000 ms] (= 100 × 10).

NOTE

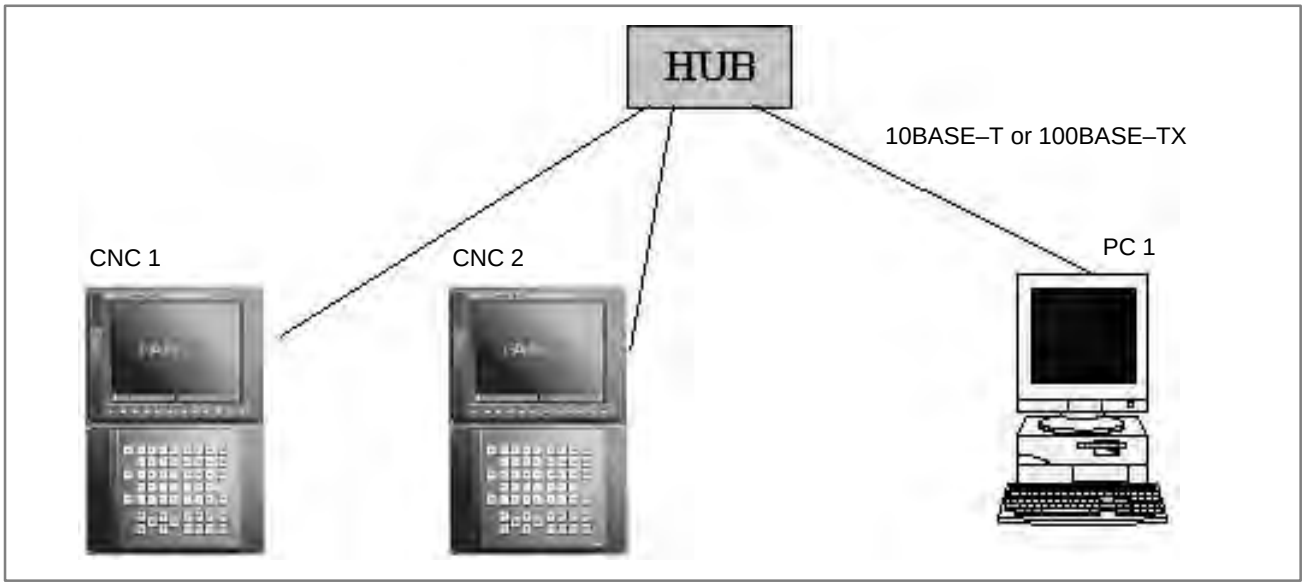
1 When a small value is set for the item of time interval, communication load increases, and the performance of the network can be adversely affected.
2 The parameters for the PCMCIA Ethernet card are set to the following default values before shipment:

IP address:	192.168.1.1
Subnet mask:	255.255.255.0
Router IP address:	None
TCP port number:	8193
UDP port number:	0
Time interval:	0

8.3.2.3 Using the FOCAS1/Ethernet function on a small network

An example of minimum setting required to operate the FOCAS1/Ethernet function on a small network is provided below.
In this example, one personal computer is connected to two CNCs through FOCAS1/Ethernet.

- On Personal Computer 1, the client of the FOCAS1/Ethernet function operates.
- On CNC 1 and CNC 2, the server of the FOCAS1/Ethernet function operates



	CNC 1	CNC 2
IP address	192.168.1.1	192.168.1.2
Subnet mask	255.255.255.0	255.255.255.0
Router IP address	None	None
TCP port number	8193	8193
UDP port number	0	0
Time interval	0	0

The Ethernet parameter screen is used for setting.

		PC 1
IP address		192.168.1.101
Subnet mask		255.255.255.0
Default gateway		None
CNC 1	NC IP address	192.168.1.1
	NC TCP port number	8193
CNC 2	NC IP address	192.168.1.2
	NC TCP port number	8193

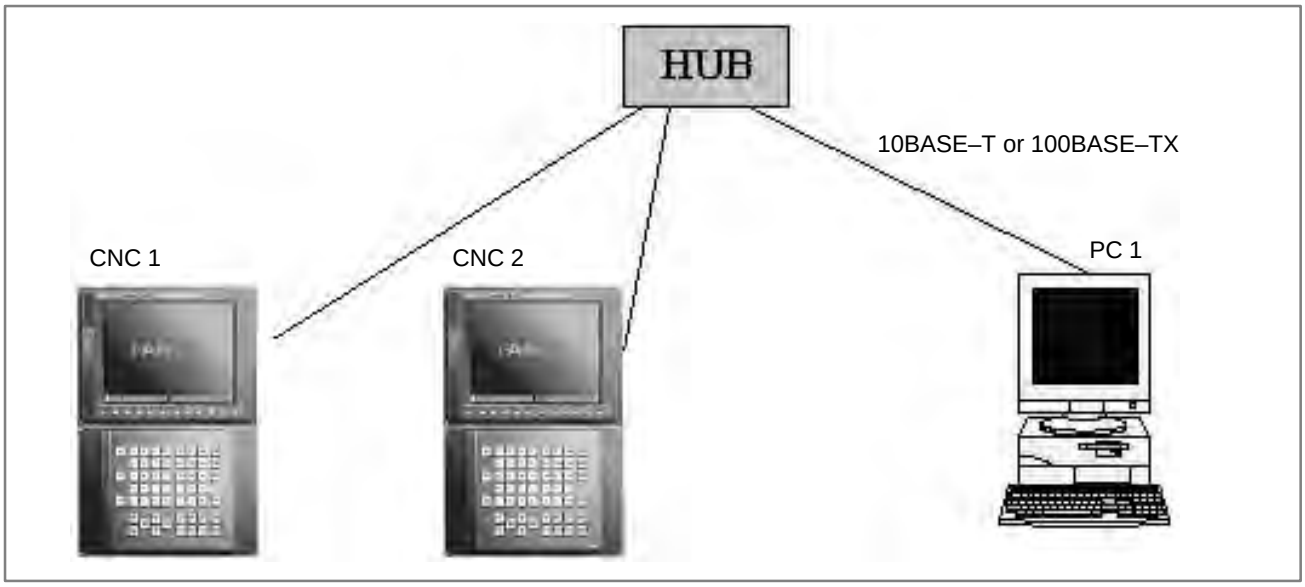
”Microsoft TCP/IP property” of the personal computer (Windows 95/98/NT/2000) is used for setting.

The arguments of the data window library function cnc_allclibhndl3 are used for setting.

8.3.2.4 Using the DNC1/Ethernet function on a small network

An example of minimum setting required to operate the DNC1/Ethernet function on a small network is provided below.
In this example, one personal computer is connected to two CNCs through DNC1/Ethernet.

- On Personal Computer 1, the client of the DNC1/Ethernet function operates.
- On CNC 1 and CNC 2, the server of the DNC1/Ethernet function operates.



	CNC 1	CNC 2
IP address	192.168.1.1	192.168.1.2
Subnet mask	255.255.255.0	255.255.255.0
Router IP address	None	None
TCP port number	8193	8193
UDP port number	8192	8192
Time interval	100	100

→ The Ethernet parameter screen is used for setting.

		PC 1
IP address		192.168.1.101
Subnet mask		255.255.255.0
Default gateway		None
FANUC_C4_SERVER		8192/udp
CNC 1		Machine No. 1
	NC IP address	192.168.1.1
	NC TCP port number	8193
CNC 2		Machine No. 2
	NC IP address	192.168.1.2
	NC TCP port number	8193

→ ”Microsoft TCP/IP property” of the personal computer (Windows NT) is used for setting.

→ Refer to ”FANUC Personal Computer FA System Windows NT Version OPERATOR’S MANUAL”.

8.3.2.5 Configuring a large network

When configuring a large network or expanding an existing network, consult with your network manager to set an IP address, subnet mask, and router IP address.

8.3.3 Parameter Setting of the FTP File Transfer Function

This subsection describes the settings required to operate the FTP file transfer function when the embedded Ethernet function for the Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*is*/180*is*/210*is*–B is used.

8.3.3.1 Notes on using the FTP file transfer function for the first time

CAUTION

When using the embedded Ethernet function for the first time, make various settings including IP address setting carefully and conduct a communication test sufficiently, consulting with your network manager.

Note that if an incorrect IP address is set, for example, the entire network can suffer from a communication error.

NOTE

With the FTP file transfer function, only one FTP session can be established with one CNC.

8.3.3.2 FTP file transfer parameter setting screen

On the Ethernet parameter setting screen, set the parameters for operating the FTP file transfer function.

Display

Procedure

1 Place the CNC in the MDI mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [ETHPRM] soft key. The Ethernet parameter setting screen appears. The Ethernet functions currently available are displayed.

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

5 By pressing the [EMBEDD] soft key, the parameters for the embedded Ethernet port can be set.
By pressing the [PCMCIA] soft key, the parameters for the PCMCIA Ethernet card can be set.

NOTE
The parameters for the embedded Ethernet port and the parameters for the PCMCIA Ethernet card are independent of each other.

6 By using the MDI keys and soft keys, enter and update data.

7 Switch the screen display with the page keys PAGE PAGE .

If data is already registered, the data is displayed.

Display item and setting items

Display item related to the embedded Ethernet function

The item related to the embedded Ethernet function is displayed.

Item	Description
MAC ADDRESS	Embedded Ethernet MAC address

Embedded Ethernet TCP/IP setting items

Set the TCP/IP–related items of the embedded Ethernet.

Item	Description
IP ADDRESS	Specify the IP address of the embedded Ethernet. (Example of specification format: ”192.168.1.1”)
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: ”255.255.255.0”)
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: ”192.168.1.254”)

FTP file transfer setting items

Make settings related to the FTP file transfer function.
Settings for up to three host computers can be made.

Item	Description
PORT NUMBER	Specify a port number to be used with the FTP file transfer function. An FTP session is used, so that ”21” is to be specified usually.
IP ADDRESS	Specify the IP address of the host computer. (Example of specification format: ”192.168.1.150”)
USERNAME	Specify a user name to be used for logging in to the host computer with FTP. (Up to 31 characters can be specified.)
PASSWORD	Specify a password for the user name specified above. Be sure to set a password. (Up to 31 characters can be specified.)
LOGIN DIR	Specify a work directory to be used when logging in to the host computer. (Up to 127 characters can be specified.)

8.3.3.3 Parameters

The NC parameters related to the FTP file transfer function are described below.

Parameters

0020	I/O CHANNEL: Input/output device selection

[Data type] Byte

[Valid data range] 9: Select the embedded Ethernet as the input/output device.

0931	Special character (No. 1)
0932	Special character (No. 2)
0933	Special character (No. 3)
0934	Special character (No. 4)
0935	Special character (No. 5)

[Data type] Byte

[Valid data range] 32 to 126

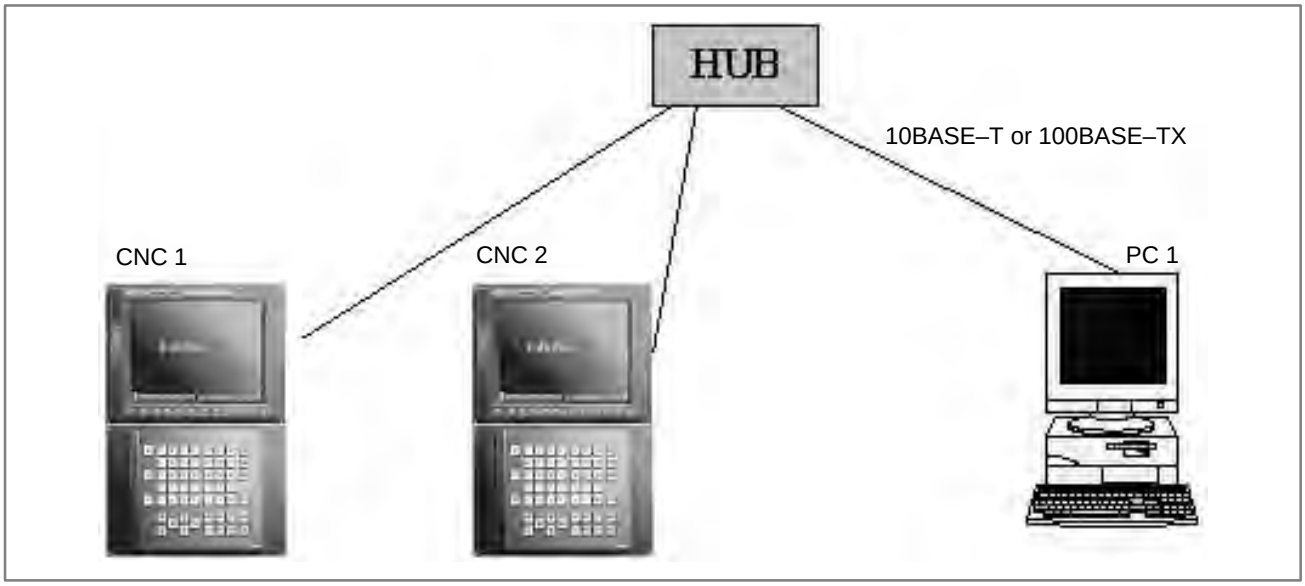
NC parameters No. 931 to No. 935 enable soft keys to substitute for characters unavailable with the MDI keys.
When a number other than 0 is set in each of these parameters, [CHAR–1] to [CHAR–5] are displayed in the input soft keys for special characters.

Example) When 33 is set in parameter No. 931, pressing the [CHAR–1] soft key enters ”!”.

8.3.3.4 Using the FTP file transfer function on a small network

An example of minimum setting required to operate the FTP file transfer function on a small network is provided below. (Windows NT 4.0 Workstation is used as the OS for the personal computer.)
In this example, one personal computer is connected to two CNCs through the FTP file transfer function.

- On Personal Computer 1, the FTP server function operates.
- On CNC 1 and CNC 2, the FTP client operates as the FTP file transfer function.



		CNC 1	CNC 2
IP address		192.168.1.1	192.168.1.2
Subnet mask		255.255.255.0	255.255.255.0
Router IP address		None	None
Connection host 1	Port number	21	21
	IP address	192.168.1.150	192.168.1.150
	User name	FANUC	FANUC
	Password	FANUC	FANUC
	Login DIR	None	None
NC parameter No. 20		9	9

The Ethernet parameter screen is used for setting.

The parameter screen is used for setting.

	PC 1
IP address	192.168.1.150
Subnet mask	255.255.255.0
Default gateway	None
User name	FANUC
Password	FANUC
Login DIR	Default

"Microsoft TCP/IP property" of the personal computer (Windows NT) is used for setting.

"User manager" of the personal computer (Windows NT) is used for setting.

"Internet service manager" of the personal computer (Windows NT) is used for setting.

8.3.3.5 Configuring a large network

When configuring a large network or expanding an existing network, consult with your network manager to set an IP address, subnet mask, and router IP address.

8.3.4 Communication Parameter Input Method

This subsection describes the method of parameter input when the embedded Ethernet function for the Series 16*i*/18*i*/21*i*/160*i*/180*i*/210*i*/160*is*/180*is*/210*is*–B is used.

Basic method of data input

The basic method of data input is described below, using an example of IP address input.

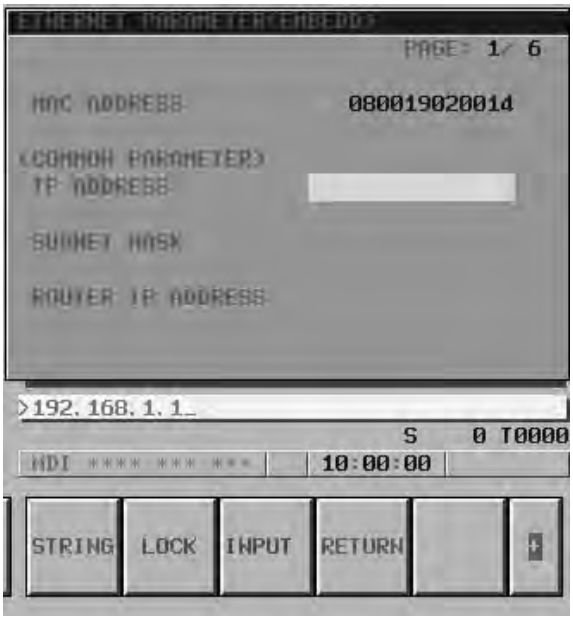
Procedure

1 Place the CNC in the MDI mode.
2 Display the Ethernet parameter screen.
3 Move the cursor to a desired input item with cursor keys.
4 Type data with MDI keys.
5 Press the [INPUT] soft key or the function key INPUT to enter the data.

NOTE
When deleting numeric data already set, enter 0. When deleting character data already set, enter SP (space).

Example) Setting 192.168.1.1 as IP address data
(a) Move the cursor to the item of IP address.

(b) Type 192.168.1.1 with the MDI keys.



(c) Press the [INPUT] soft key or the function key INPUT to enter the data.

This stores the parameter in the nonvolatile memory of the CNC.

NOTE

Turn on the power again so that you should make a changed parameter effective.

Or, push soft key [RESET] on the maintenance screen of embedded Ethernet.

Method of lowercase character input

The method of entering lowercase characters when specifying a user name, password, and login DIR is described below.

Procedure

1 Place the CNC in the MDI mode.

2 Display the Ethernet parameter screen.

3 Move the cursor to a desired input item with cursor keys.

4 When the [UNLOCK] soft key is displayed, uppercase characters are actually entered through MDI keys. For lowercase character input, press the [UNLOCK] soft key. The soft key display changes from [UNLOCK] to [LOCK].

5 Then, press the MDI keys A through Z. All of these characters are entered as lowercase characters.

6 To enter uppercase characters, press the [LOCK] soft key.

Method of entering a long character string

The method of entering a character string longer than 32 characters for specifying a login DIR is described below.
As an example, the processing for setting the character string ”/NCDATA/NCPROGRAM/LINE001/GROUP002” is described.

Procedure

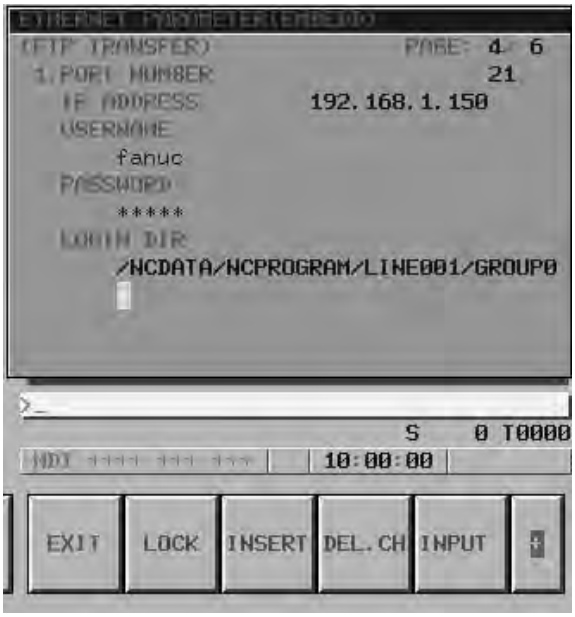
1 Place the CNC in the MDI mode.

2 Display the Ethernet parameter screen.

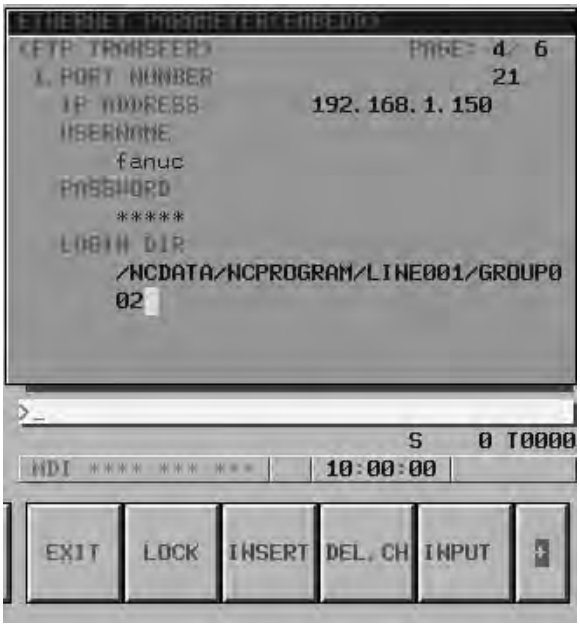
3 Move the cursor to LOGIN DIR with cursor keys.

4 Press the [STRING] soft key. The cursor position and soft key display change as shown below.

5 Type ”/NCDATA/NCPROGRAM/LINE001/GROUP0” with the MDI keys, then press the [INPUT] soft key.



6 Next, type the remaining character string ”02” with the MDI keys, then press the [INPUT] soft key.



[Tip]
For example, even if the character string is divided into ”/NCDATA/NCPROGRAM” and ”/LINE001/GROUP002” for two input operations the same result can be obtained.

7 To insert ”/FACTORY0010” between ”NCPROGRAM” and ”/LINE001”, move the cursor to ”/” prefixed to ”LINE001” then type ”/FACTORY0010” with the MDI keys. Finally, press the [INSERT] soft key.

8 To delete a character, move the cursor to the character to be deleted, then press the [DEL.CH] soft key. This operation deletes a character on which the cursor is placed one at a time.

9 To overwrite a character, move the cursor to the character to be overwritten, then type a desired character with the MDI key. Finally, press the [INPUT] soft key. This operation overwrites a character on which the cursor is placed.

10 Upon completion of character string input, press the [RETURN] soft key. This operation returns the cursor position and soft key display to the state of step 1, and stores the set data in the nonvolatile memory of the CNC.

Method of entering special characters

The method of entering special characters such as ”\” unavailable with the MDI keys is described below.
As an example, the procedure for setting the character string ”PROG$” is described.

Procedure

1 Place the CNC in the MDI mode.

2 Display the Ethernet parameter screen.

3 Move the cursor to LOGIN DIR with cursor keys.

4 Type ”PROG” with the MDI keys, then press the continuous menu key at the right end of the soft key display.

NOTE

Those characters unavailable with the MDI keys that are used frequently such as :, ¥, $, and _ can be entered using soft keys. To enter a character other than these characters, set the ASCII code of the character in a parameter from parameters No. 931 through No. 935.
For details, see Subsection 17.3.3.3, ”Parameters”.

5 Press the [$] soft key.

6 Press the [INPUT] soft key.

8.4 SWITCHING BETWEEN THE EMBEDDED ETHERNET DEVICES

There are two types of embedded Ethernet devices: the embedded Ethernet port and PCMCIA Ethernet card.

Screen operation is required to switch between these two types of devices.

Procedure

1 Place the CNC in the MDI mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [ETHPRM] soft key. The Ethernet parameter setting screen appears. The Ethernet functions currently available are displayed.

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

5 Press the [SWITCH] soft key. The screen for switching between the embedded Ethernet port and the PCMCIA Ethernet card appears.

6 Press the [PCMCIA] soft key. A confirmation message appears. Press the [EXEC] soft key to switch the device.

NOTE

Information about the switched device is stored in the nonvolatile memory.

So, when you turn on the power next time, the previously selected device can be used directly.

8.5 EMBEDDED ETHERNET OPERATIONS

This section describes the operation required of each embedded Ethernet function.

8.5.1 FACTOLINK Function

The operation of the FACTOLINK function is described below.

Display

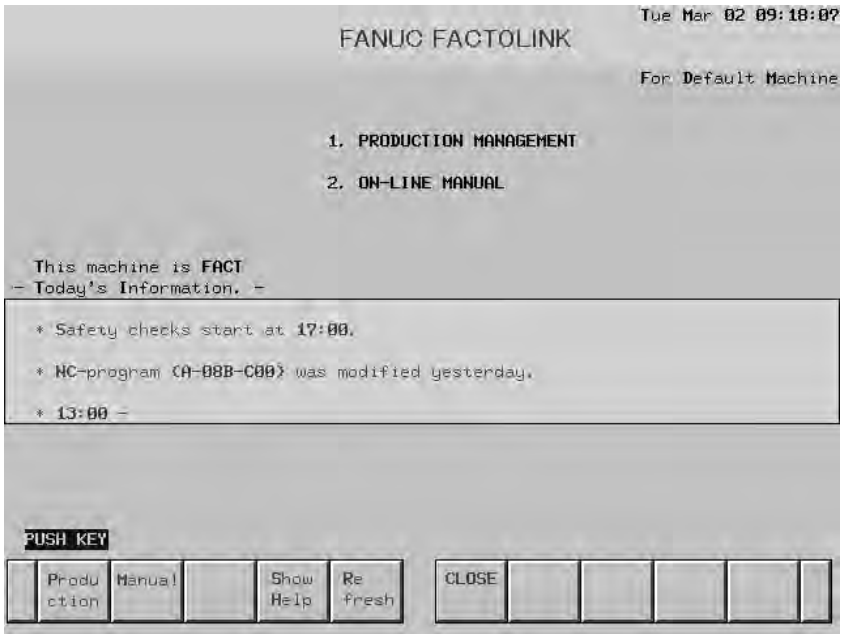
Procedure

1 Press the function key 

.

2 Press the continuous menu key at the right end of the soft key display.

3 Press the [FALINK] soft key. The FACTOLINK screen appears. The screen shown below is a sample FACTOLINK screen.



8.5.2 FTP File Transfer Function

The operation of the FTP file transfer function is described below.

8.5.2.1 Host file list display

A list of the files held on the hard disk embedded to the host computer is displayed.

Procedure

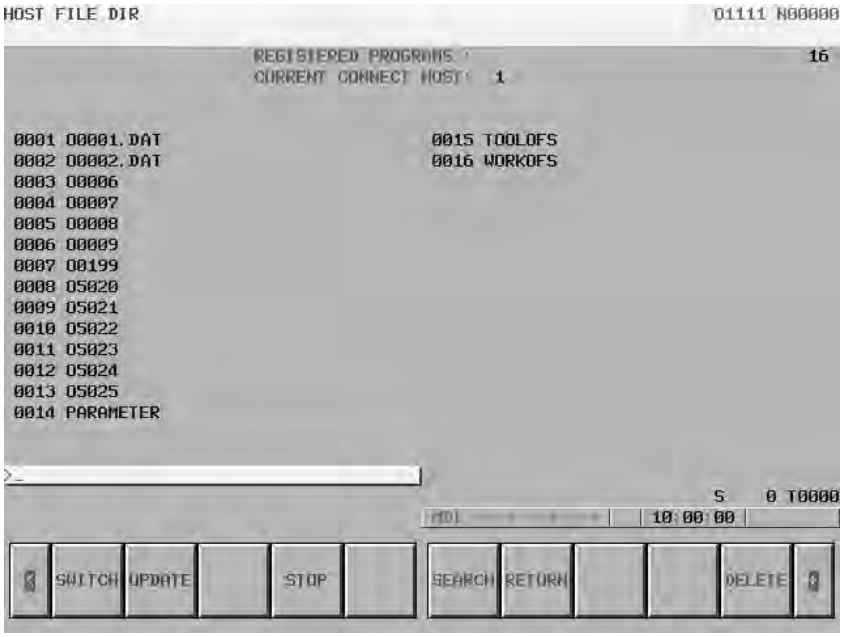
1 Press the function key PROG .

2 Press the continuous menu key at the right end of the soft key display.

3 Press the [HOST] soft key. The host file list screen appears. The Ethernet functions currently available are displayed.

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

4 When you press the [EMBEDD] soft key, a list of the files held on the host computer specified with the embedded Ethernet port is displayed. If the usable embedded Ethernet function device is the PCMCIA card, the [PCMCIA] soft key is displayed instead of the [EMBEDD] soft key. When you press the [PCMCIA] soft key, a list of the files held on the host computer specified with the PCMCIA Ethernet card is displayed.



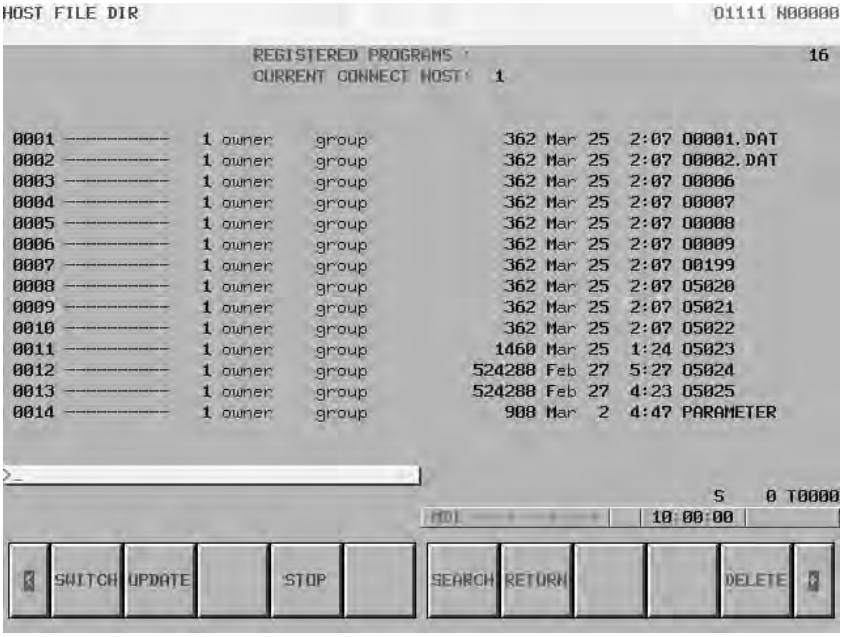
NOTE

Depending on the FTP server software, the number of displayed programs may differ between the host file list screen above and the host file list (detail) screen described below.

5 When a list of files is larger than one page, the screen display can be switched using the page keys PAGE PAGE .

6 Press the [UPDATE] soft key to update the screen display.

7 Press the [SWITCH] soft key. The host file list (detail) screen appears.



NOTE
The host file list (detail) screen shown above is an example of screen display, and information displayed may vary according to the specification of the FTP server used with the host computer.

Display items

- **Number of registered program files** — The number of files registered in the directory (folder) of the host computer currently connected is displayed.
- **Currently connected host** — The number of the host currently connected is displayed.

List of operations

- **SWITCH** — This operation switches between normal display and detail display.
- **UPDATE** — This operation updates information displayed.
- **STOP** — This operation stops [SEARCH] operation.
- **SEARCH** — This operation updates screen information so that a file specified by its file number is placed at the start of the list.
- **DELETE** — This operation deletes a file held on the hard disk embedded to the host computer.
- **READ** — This operation reads a file held on the hard disk embedded to the host computer to the CNC part program storage. This soft key is displayed only when 9 is set as the input/output device number of the CNC, and the CNC is placed in the EDIT mode.
- **PUNCH** — This operation outputs a file held in the CNC part program storage to the hard disk embedded to the host computer. This soft key is displayed only when 9 is set as the input/output device number of the CNC, and the CNC is placed in the EDIT mode.

8.5.2.2 Host file search

When a list of the files held on the hard disk embedded to the host computer is displayed, a file can be placed at the start of the list by specifying its file number.

Procedure

1 Display the host file list screen.
2 Press the [SEARCH] soft key.
3 Type the file number of a file to be displayed at the start of the list with the MDI keys.
[Input format]
<file–number>
4 Press the [EXEC] soft key.
5 During search, ”SEARCH” blinks in the lower–right corner of the screen.

8.5.2.3 Host file deletion

A file held on the hard disk embedded to the host computer can be deleted.

Procedure

1 Display the host file list screen.
2 Press the [DELETE] soft key.
3 Type the file number or file name of a file to be deleted, with the MDI keys.
[Input format]
<file–number>
or
<file–name>
4 Press the [EXEC] soft key.
5 During deletion, ”DELETE” blinks in the lower–right corner of the screen.

NOTE
1 When a file number is used for deletion, only a file displayed on the host file list screen can be deleted.
2 The information displayed at the right end of the host file list (detail) screen is recognized as a file name. So, when deleting a host file from the host file list (detail) screen by specifying its file number, check that a file name is displayed at the right end of the screen, before specifying the file number.

8.5.2.4 NC program input

A file (NC program) on the host computer can be read to the CNC memory.

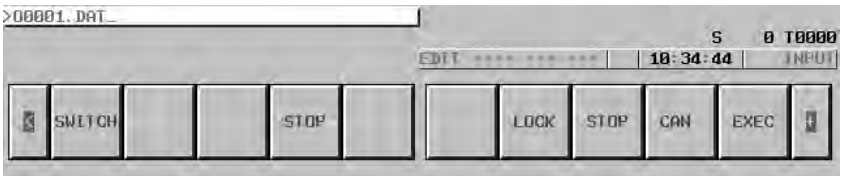
For the host file list screen

Procedure

1 Place the CNC in the EDIT mode.
2 Display the host file list screen.
3 Press the [READ] soft key.
4 Type the file number or file name of an NC program to be input, with the MDI keys.
[Input format]
<file–number>
or
<file–name>
5 Press the [EXEC] soft key.
6 During input, ”INPUT” blinks in the lower–right corner of the screen.

CAUTION
1 If the CNC memory holds an NC program that has the same O number as that of an NC program to be input, the NC program in the CNC memory is overwritten when bit 2 of parameter No. 3201 is set to 1.
2 If an NC program is input when bit 0 of parameter No. 3201 is set to 1, all NC programs in the CNC memory are automatically deleted before NC program input.

[Example of use]
When a file with the file name O0001.DAT held on the hard disk embedded to the host computer is to be input to the CNC memory, enter O001.DAT. Note, however, that the O number input to the CNC memory depends on the O number described in the file named O0001.DAT.



NOTE
When a file is input from this screen to the CNC memory, the O number described in the file is input.

For the program screen

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key PROG .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [PRGRM] soft key. The program screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [READ] soft key.

8 Type the O number of an NC program to be input, with the MDI keys.
[Input format]
<O–number>

9 Press the [EXEC] soft key.

10 During input, ”INPUT” blinks in the lower–right corner of the screen.

CAUTION
1 If the CNC memory holds an NC program that has the same O number as that of an NC program to be input, the NC program in the CNC memory is overwritten when bit 2 of parameter No. 3201 is set to 1.
2 If an NC program is input when bit 0 of parameter No. 3201 is set to 1, all NC programs in the CNC memory are automatically deleted before NC program input.

NOTE
The valid O number of a file to be input to the CNC memory is Oxxxx (with xxxx representing a number) only.

8.5.2.5 NC program output

A file (NC program) in the CNC memory can be output to the host computer.

For the host file list screen

Procedure

1 Place the CNC in the EDIT mode.

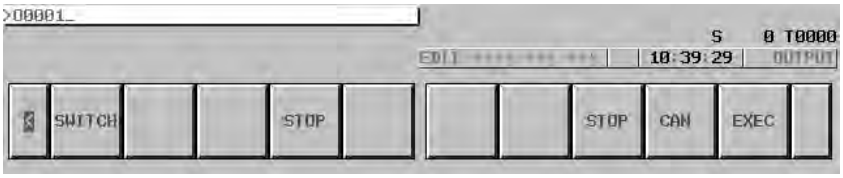
2 Display the host file list screen.

3 Press the [PUNCH] soft key.

4 Type the O number of an NC program to be output, with the MDI keys.
[Input format]
<O–number>

5 Press the [EXEC] soft key.
6 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

[Example of use]
When an NC program (O0001) in the CNC memory is to be output to the hard disk embedded to the host computer, enter O0001.



NOTE
An outputted file name is Oxxxx.

For the program screen

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key PROG .
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [PRGRM] soft key. The program screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [PUNCH] soft key.
8 Type the O number of an NC program to be output, with the MDI keys.
[Input format]
<O–number>
9 Press the [EXEC] soft key.
10 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

NOTE
An outputted file name is Oxxxx.

8.5.2.6 Input/output of various types of data

With the FTP file transfer function, the types of data listed below can be input/output. This subsection describes the input/output method.

A) NC parameter
B) Tool offset value
C) Custom macro variable
D) Workpiece offset offset value
E) Pitch error compensation data
F) M code group
G) Operation history data

Parameter input

The file (NC parameter) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key SYSTEM .
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [PARAM] soft key. The parameter screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [READ] soft key.
8 Press the [EXEC] soft key.
9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name PRAMETER is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Parameter output

The file (NC parameter) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key SYSTEM .
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [PARAM] soft key. The parameter screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [PUNCH] soft key.

8 Press the [EXEC] soft key.
9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name PRAMETER is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Tool offset value input

The file (tool offset value) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key 

.
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [OFFSET] soft key. The tool compensation screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [READ] soft key.
8 Press the [EXEC] soft key.
9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name TOOLOFS is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Tool offset value output

The file (tool offset value) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key 

.
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [OFFSET] soft key. The tool compensation screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [PUNCH] soft key.
8 Press the [EXEC] soft key.
9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name The fixed file name TOOLOFS is used.

File format, restrictions Refer to the operator’s manual of each CNC.

Workpiece origin offset value input

The file (workpiece origin offset value) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key 

.

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [WORK] soft key. The workpiece coordinate system setting screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [READ] soft key.

8 Press the [EXEC] soft key.

9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name The fixed file name WORKOFS is used.

File format, restrictions Refer to the operator’s manual of each CNC.

Workpiece origin offset value output

The file (workpiece origin offset value) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key 

.

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [WROK] soft key. The workpiece coordinate system setting screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [PUNCH] soft key.

8 Press the [EXEC] soft key.

9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name The fixed file name WORKOFS is used.

File format, restrictions Refer to the operator’s manual of each CNC.

Pitch error compensation input

The file (pitch error compensation) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key SYSTEM .
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [PITCH] soft key. The pitch error setting screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [READ] soft key.
8 Press the [EXEC] soft key.
9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name PITCH is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Pitch error compensation output

The file (pitch error compensation) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.
2 Press the function key SYSTEM .
3 Press the continuous menu key at the right end of the soft key display.
4 Press the [PITCH] soft key. The pitch error setting screen appears.
5 Press the [(OPRT)] soft key.
6 Press the continuous menu key at the right end of the soft key display.
7 Press the [PUNCH] soft key.
8 Press the [EXEC] soft key.
9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name PITCH is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

M code group input

The file (M code group) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [M–CODE] soft key. The M code group setting screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [READ] soft key.

8 Press the [EXEC] soft key.

9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name M–CODE is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

M code group output

The file (M code group) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [M–CODE] soft key. The M code group setting screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [PUNCH] soft key.

8 Press the [EXEC] soft key.

9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name M–CODE is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Operation history data input

The file (operation history data) on the host computer can be input to the CNC memory.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [OPEHIS] soft key. The operation history screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [READ] soft key.

8 Press the [EXEC] soft key.

9 During input, ”INPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name HISTORY is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

Operation history data output

The file (operation history data) in the CNC memory can be output to the host computer.

Procedure

1 Place the CNC in the EDIT mode.

2 Press the function key SYSTEM .

3 Press the continuous menu key at the right end of the soft key display.

4 Press the [OPEHIS] soft key. The operation history screen appears.

5 Press the [(OPRT)] soft key.

6 Press the continuous menu key at the right end of the soft key display.

7 Press the [PUNCH] soft key.

8 Press the [EXEC] soft key.

9 During output, ”OUTPUT” blinks in the lower–right corner of the screen.

File name

The fixed file name HISTORY is used.

File format, restrictions

Refer to the operator’s manual of each CNC.

8.5.2.7 Checking and changing of the connection host

Procedure

The host computer to which the FTP file transfer function attempts to make a connection as the current communication destination can be checked.

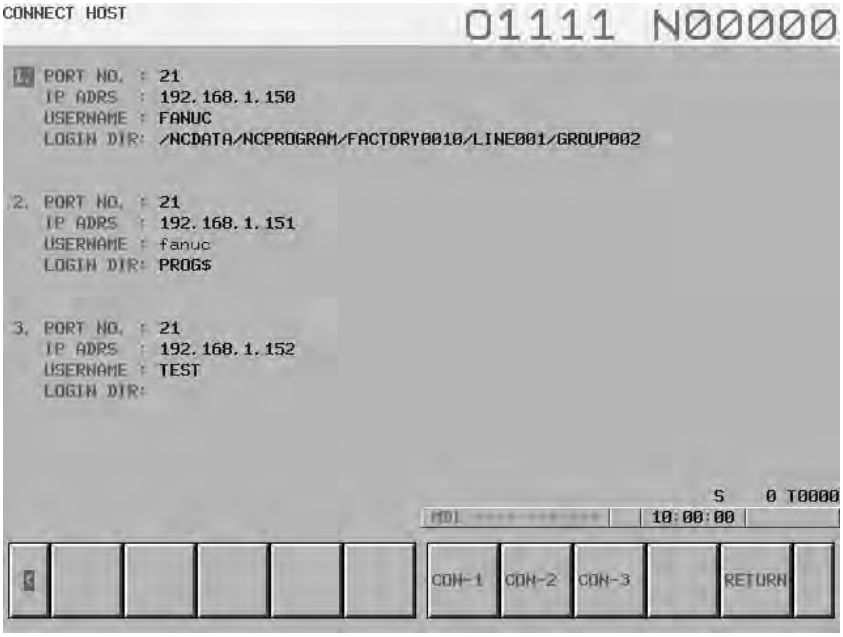
1 Press the function key PROG .

2 Press the continuous menu key at the right end of the soft key display.

3 Press the [CONECT] soft key. The connection host change screen appears. The Ethernet functions currently available are displayed.

The upper row displays the usable embedded Ethernet function device.
The embedded port or PCMCIA card is displayed.
The lower row displays the usable Ethernet option boards. When no option board is installed, no information is displayed.

4 When you press the [EMBEDD] soft key, a list of the connection host computers specified with the embedded Ethernet port is displayed.
If the usable embedded Ethernet function device is the PCMCIA card, the [PCMCIA] soft key is displayed instead of the [EMBEDD] soft key. When you press the [PCMCIA] soft key, a list of the connection host computers specified with the PCMCIA Ethernet card is displayed.



NOTE
The title of the host computer that is the current communication destination of the embedded Ethernet is displayed in reverse video.

5 The connected host can be changed by pressing the [CON–1], [CON–2], or [CON–3] soft key.

Display items

- **Port number, IP address, user name, login DIR** — Those values that are set on the Ethernet parameter setting screen are displayed.

List of operations

- **CON–1** — This operation changes the connected host to host 1.
- **CON–2** — This operation changes the connected host to host 2.
- **CON–3** — This operation changes the connected host to host 3.