NACHI

AX CONTROLLER OPERATING MANUAL

ETHERNET FUNCTION

4th edition

	■ Before attempting to operate the robot, please read through this operating manual carefully, and comply with all the safety-related items and instructions in the text. ■ The installation, operation and maintenance of this robot should be undertaken only by those individuals who have attended one of our robot courses.
	■ This operating manual must be given without fail to the individuals who will actually be operating the robot.
	■ Please direct any inquiries about parts of this operating manual which may not be completely clear or any inquiries concerning the after-sale service of this robot to any of the service centers of Nachi Robotic Systems listed on the back cover.

NACHI-FUJIKOSHI CORP.

1107, TAXEN-066-004, 001

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Chapter 1 Outline

This chapter provides an outline of the Ethernet function of the AX controller. The Ethernet function enables file transfer between the AX controller and other nodes (such as a personal computer) on the network.

1.1 Outline of the Ethernet Function

1.1.1 Outline

The Ethernet function enables transference of various files using FTP (File Transfer Protocol) between the AX controller and other nodes (such as a personal computer) on the network. For the AX controller, all the constants, PLC programs, task programs, etc. are stored as files in the memory, so use this function for downloading or backing up (uploading) programs and other purposes.

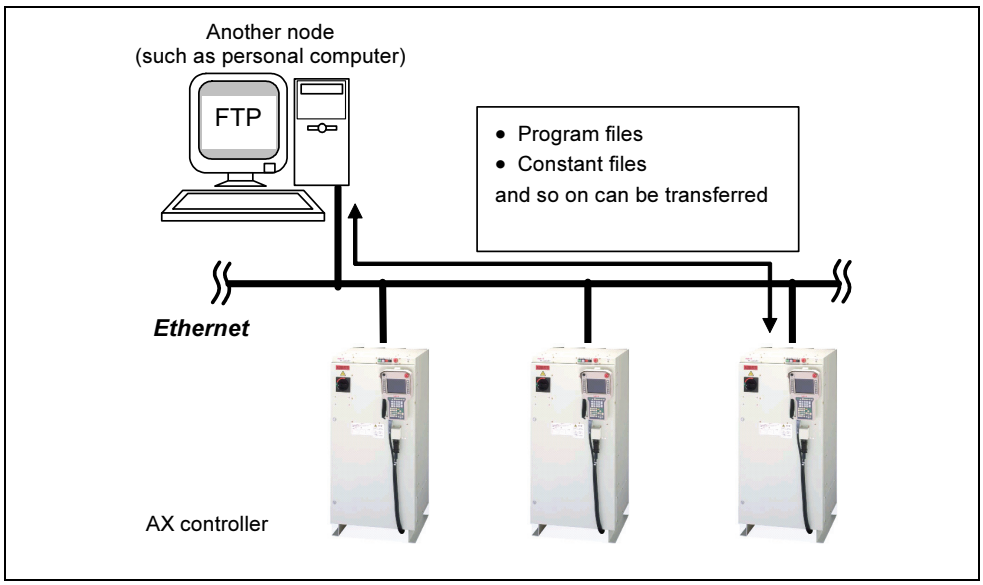


Fig. 1.1.1 Ethernet

File transfer can be performed either by operating the personal computer or by operating the AX controller.

POINT

Refer to commercially available technical books, if necessary, for technical terms such as "Ethernet," "DHCP," "IP address," "subnet mask," "default gateway," and "FTP."

Note that this manual describes the method of setting and operation for the AX controller. Software necessary for the personal computer is supposed to be prepared by the user side.

1.1.2 Network Settings

In order to enable the AX controller to communicate on the Ethernet, first the network configuration, including the AX controller, must be set. The following two methods are available.
Select the appropriate one according to the direction of the network administrator.

Table 1.1.1 Network configuration settings

Method	Details
Method that automatically performs the settings using DHCP	This is the method that automatically sets the network configuration, using DHCP (Dynamic Host Configure Protocol).
Method that manually inputs each setting value	This is the method that manually inputs each setting value, such as IP address and subnet mask, on the teach pendant screen. This method is used when DHCP cannot be used for some reason.

After the settings have been performed according to the setting procedure described in Chapter 2 and the AX controller has been recognized correctly on the network, files can be transferred on the network between a note and the AX controller.

1.1.3 Ethernet Cable Connections

Connecting method varies depending on the mounted CPU board. Confirm the CPU board to be connected to the AX/AXC control panel and refer to the description below.

[In case the CPU board is AXCPU10-10]
Remove the CPU board installed in the CPU rack of the AX/AXC controller, and attach the connector connection bracket (AX10-OP83-B) to the CPU board. Upon completion of attaching, insert the cable attached to the bracket into the RS45 connector on the CPU board.

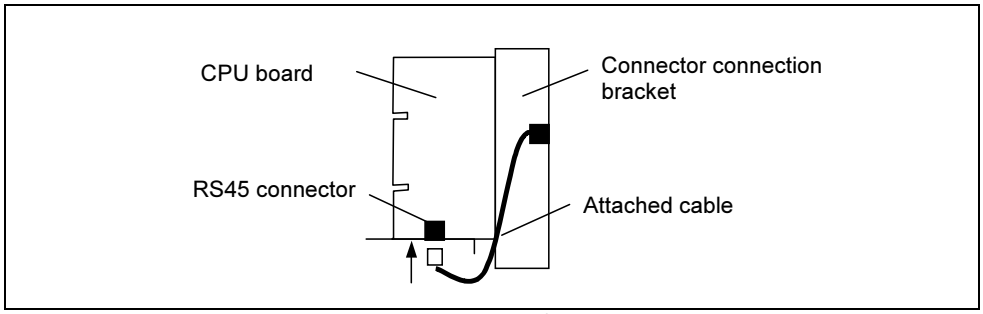


Fig. 1.1.2 Ethernet cable connection for the AX controller (1)

Fix the CPU board and connector connection bracket to the CPU rack, and insert the Ethernet cable to the RS45 connector installed on the front side of the bracket.

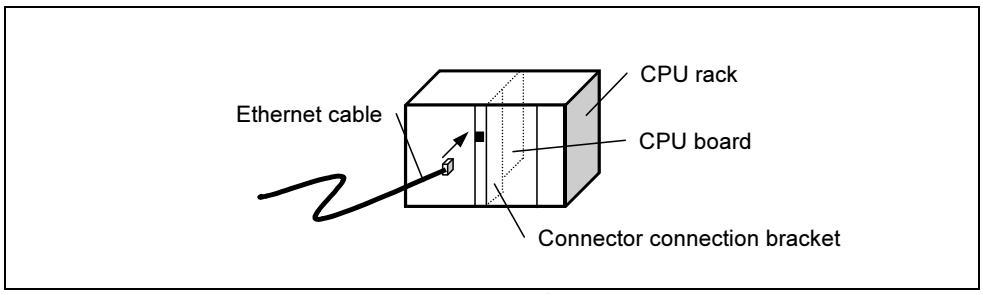


Fig. 1.1.3 Ethernet cable connection for the AX controller (2)

[In case the CPU board is AXCPU10-20/AXCPU10-50]
When this CPU board is mounted, there is no special part required. Connect the Ethernet cable to the CN12 connector in front of the CPU board.

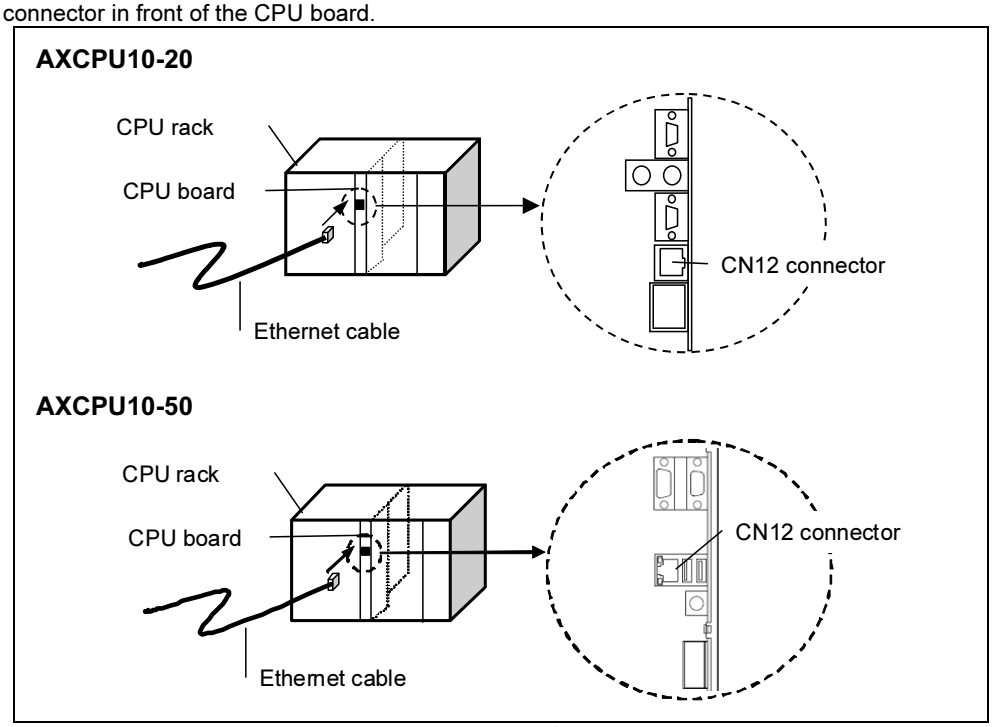


Fig. 1.1.4 Ethernet cable connection for the AX controller (3)

1.1.4 File Transfer Method

File transfer using FTP is transferring files between the FTP server and a FTP client. The operation is performed on the client side to copy a file from the remote computer to the local computer and vice versa. Two methods are provided for file transfer.

Table 1.1.2 Methods for file transfer

FTP server	FTP client	Details
Another node (such as personal computer)	AX controller	File transfer is performed using the operation menu of the AX controller. Here the AX controller serves as the FTP client (the node that starts requesting FTP).
AX controller	Another node (such as personal computer)	File transfer is performed using an FTP client software activated on another node. Here the AX controller serves as the FTP client (host).

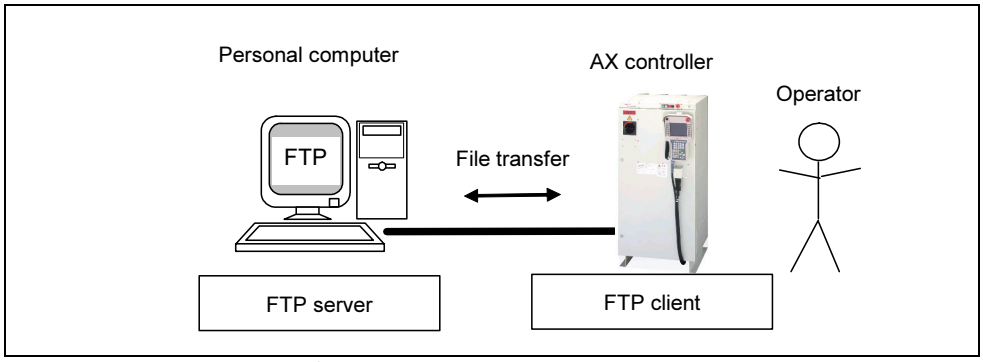


Fig. 1.1.5 File transfer with the AX controller serving as the FTP client

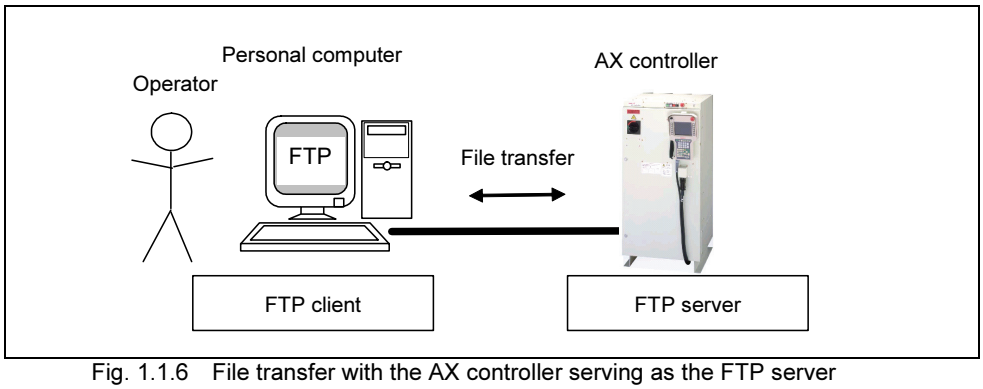


Fig. 1.1.6 File transfer with the AX controller serving as the FTP server

If file transfer is performed with the AX controller serving as the FTP server, the icon shown below is displayed when one or more FTP clients are connected to the FTP server of the AX controller to notify the connection. This icon disappears when the connection with the FTP server is lost.

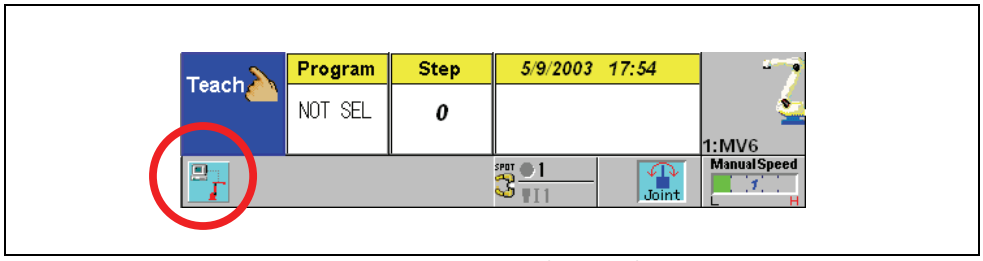


Fig. 1.1.7 Display during file transfer

Chapter 2 Settings

This chapter describes the method for setting IP address and other items by the AX controller in order to use the Ethernet function.

2.1 Ethernet Settings

The following functions are provided for the Ethernet menu, which can be set in the “Constant Setting” menu in the teach mode.
This setting is so much important that they are supposed to be made by the network administrator. With the AX controller, the qualifications class of ***Specialist*** or superior is required for this operation.
This operation is not necessary in case of CPU board AXCPU10-50.

Table 2.1.1 Constant settings menu for the Ethernet

Operation menu	Details
TCP/IP	This is for TCP/IP settings. Select whether to set it automatically using DHCP or to input setting values manually. When the settings are to be input manually, input IP address, subnet mask, etc.
FTP	This is for FTP settings. This menu enables the FTP server settings, which were set by the Microsoft Internet Information Server, to be changed.

(CAUTION) If the system software version is AXV06.36 to AXV06.38, it is necessary to disable the system memory protection function before changing the settings of “TCP/IP or FTP function”. For details, please see [2.3 System Memory Protection Function].

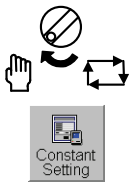
If the system memory protection function is “Enabled”, please follow the procedure given below to change the TCP/IP of FTP settings.

1. Disable the system memory protection function.
2. Perform the TCP/IP or FTP setting.
3. Enable the system memory protection function again.

Concerning the operation for enabling/disabling this function, please refer to [2.3 System Memory Protection Function].

The system memory protection function serves to safeguard the files of the operating system from damage by prohibiting the writing of data into those files.

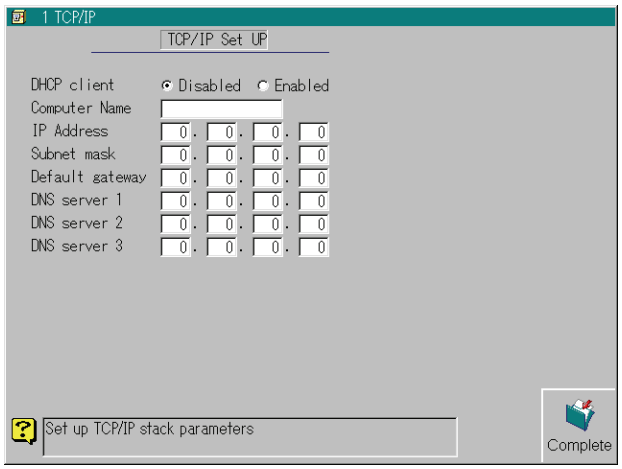
2.1.1 TCP/IP Settings



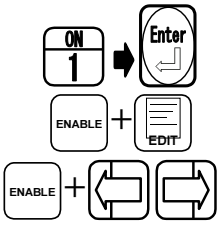
1 Select the teach mode.

2 **Select “8 Communication” from the “Constant Setting” menu and press [Enter].**
Select “2 Ethernet” from the “Communication” menu and press [Enter].
>> The “Ethernet” menu shown below appears.

3 **Align the cursor with “TCP/IP” and press [Enter].**
>> The TCP/IP setting screen shown below appears.



4 **Refer to Table 2.1.2 TCP/IP settings to set the required parameters.**



5 **For edit boxes, input a numerical value and press [Enter].**

For inputting character strings, press [ENABLE] and [EDIT] keys together to open the soft keyboard.

If one of the radio buttons (selection options arranged horizontally) is to be selected, press [ENABLE] and the [Left] or [Right] cursor key at the same time to make the selection.

6 **Upon completion of the settings, press <Complete> (f12).**

7 **Turn off the power of the controller and then turn it back on in order to enable the new settings.**

The following items are for the TCP/IP settings.

Table 2.1.2 TCP/IP settings

Parameter	Description of function
DHCP client	Select whether to use the [DHCP client function] of the AX controller. If it is enabled, the AX controller sends out a DHCP request to the network when it is turned on. When the DHCP host on the network responds, the IP address, the subnet mask, the default gateway, and up to 3 DNS IP addresses are automatically set. If there is no response for the DHCP request from the AX controller or the AX controller disables the DHCP, an appropriate value must be input manually. Note that DHCP request is sent out only when the power of the AX controller is turned on. In order to request DHCP again, the power of AX controller must be turned off and then turned back on.
IP address	Define a 32-bit IP address to identify the TCP/IP host (the AX controller) on the network. It consists of two parts. One is the [Network ID] that identifies the network where the AX controller exists; the other is the [Host ID] that identifies each host (the AX controller) on the network. Normally these IDs' length is variable, so the system needs to know where the border between these two is. For this purpose the [Subnet mask] is used. (Refer to Fig. 2.1.1 Defining IP address.)
Subnet mask	This is the data that defines the border (mask) for the IP addresses so that TCP/IP can distinguish the [Network ID] from the [Host ID]. It consists of 32 digits, each of which is 0 or 1. A "1" that appears in the subnet mask denotes that the corresponding bit is a part of the [Network ID], while a "0" denotes that the corresponding bit is a part of the [Host ID]. For instance, a subnet mask "255.255.255.0" is first translated in the binary form to "11111111.11111111.11111111.00000000". If it is applied to an IP address "192.168.0.1," the first 24 bits of this IP address (192.168.0) are recognized as the [Network ID], and the last 8 bits (1) as the [Host ID]. (Refer to Fig. 2.1.2 Relationship between IP address and subnet mask.)
Default gateway	Select the gateway address if communication with the host of another network is necessary. Normally it does not need to be set.
DNS server	Set the IP address of the DNS server.

Example of setting of IP address and subnet mask

When there are 254 devices or less to be connected to one network, the setting can be as follows. Assign an IP address to each node (the AX controller, a personal computer, etc.) such as "192.168.0.2," "192.168.0.3," etc. In this case, up to 254 nodes can be connected to one network.

• IP address	192.168.0.1	(the 1st node)
	192.168.0.2	(the 2nd node)
	:	
	:	
	192.168.0.254	(the 254th node)
• Subnet mask	255.255.255.0	

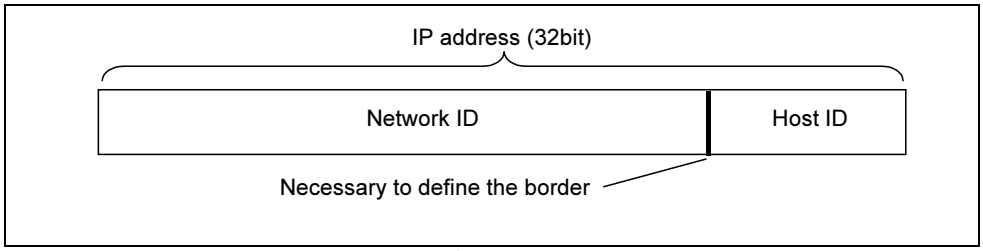


Fig. 2.1.1 Defining IP address

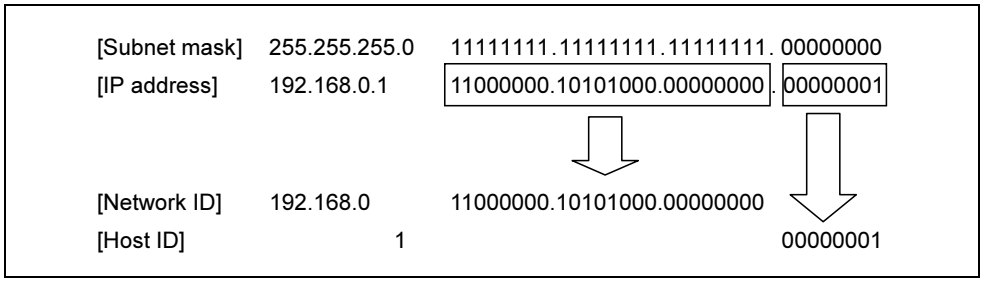


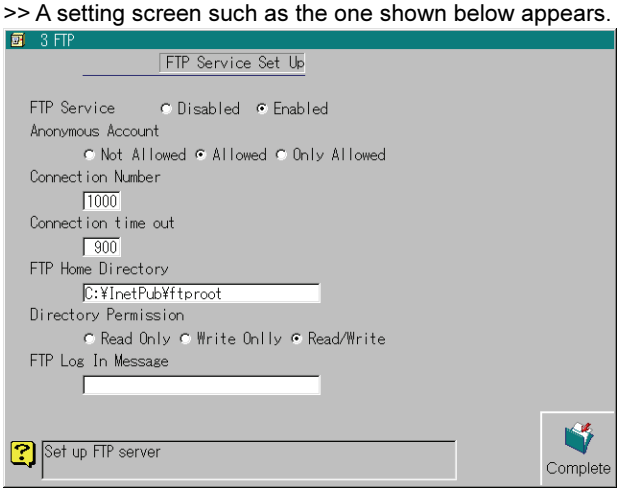
Fig. 2.1.2 Relationship between IP address and subnet mask

POINT

If the same IP address is assigned to two or more nodes, a communication failure occurs, so take care not to assign the same IP address to two or more nodes.
Inquire the network administrator beforehand how to assign an IP address to each device.

2.1.2 FTP Settings

1 **On the same menu as shown in the previous section, align the cursor with "FTP" and press the [Enter] key.**
>> A setting screen such as the one shown below appears.



2 **Refer to Table 2.1.3 FTP settings to set the required parameters.**

3 **Upon completion of the settings, press <Complete> (f12).**

4 **Turn off the power of the controller and then turn it back on in order to enable the new settings.**

The following items are for the FTP settings.

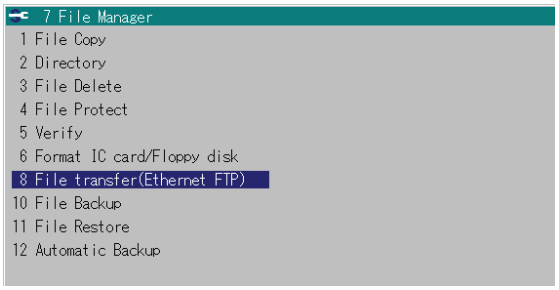
Table 2.1.3 FTP settings

Parameter	Description of function
FTP Service	Select whether to enable the [FTP service function] of the AX controller. If it is enabled, the AX controller starts the FTP service when the power is turned on. If it is disabled, the FTP service is stopped, and the FTP service from an FTP client to the AX controller is not available.
Anonymous Account	Set permission for anonymous connection. If [Only Allowed] is selected, any user cannot log on using the user name and the password. In addition, any access with the administrator account is disabled, and access is permitted only to those accounts specified as "anonymous access."
Connection Number	Set the maximum number of clients that can be connected simultaneously to the server. A number from 16 to 1000 can be set as the number of connections.
Connection time out	Set the time in seconds in which the server disconnects a non-active user. A value from 0 to 900 seconds can be set as the timeout time. This value enables all the connections to be closed when FTP fails to close connections.
FTP Home Directory	Set the path of the directory used for the FTP service. The default setting is C:¥InetPub¥ftproot, and the internal memory of the AX controller is C:¥AX¥NRA2001.
Directory Permission	Selecting "Write Only" or "Read/Write" enables the clients to write in the FTP server. This setting is supposed to be selected only for the directory used to receive files sent by the users.
FTP Log-in Message	It is displayed on the client that has made the first connection to the FTP server.

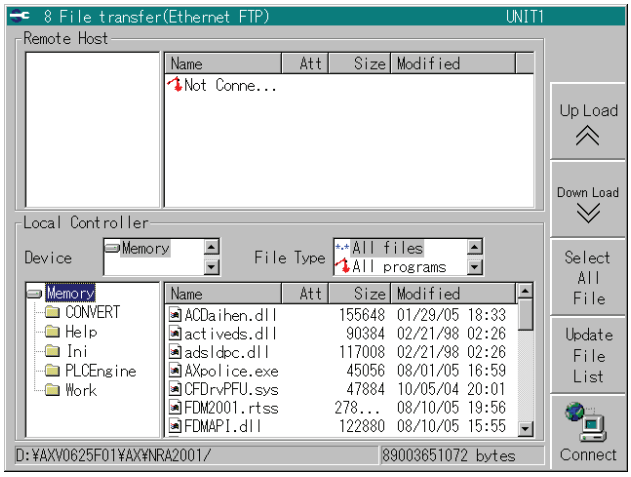
2.2 Setting the FTP Client

Before using the FTP client function, it is necessary to set a host, which will be the FTP sever for connection, according to the following steps.
Up to 2 FTP servers can be connected to the AX controller.
This is an important setting and must be made by the network controller of the user. To operate the AX controller, operator qualification as the ***specialist*** is necessary.

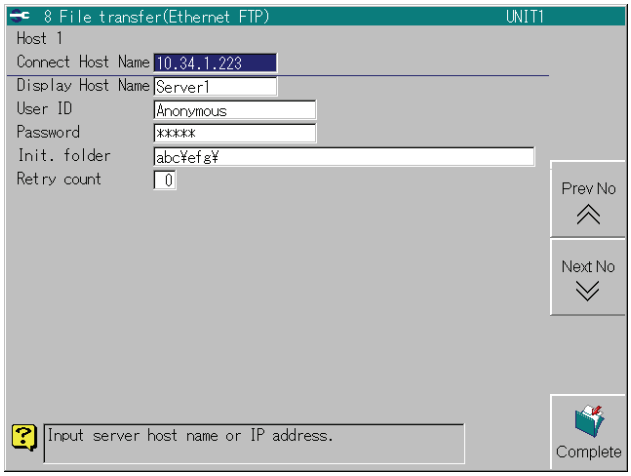
1 **In the teach mode or playback mode, press <File> (f4).**
When soft keys are not provided, service menu can be used for entry. In this case, select "7. File Manager" from the service menu and press the [Enter] key
>> File manager menu such as the following is opened.



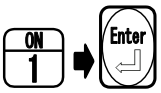
2 **Position the cursor on the "File Transfer (Ethernet FTP)" and press the [Enter] key.**
>> A screen such as the following is displayed.



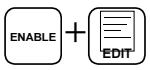
3 Press <Setting of Host > (f7).
>> Host setting screen such as the following is displayed.



4 **Refer to Table 2.2.1 Host setting and set necessary parameters.**



5 **When the edit box is available, enter numerical values and press the [Enter] key.**



For entering character strings, soft keyboard can be used by pressing the [ENABLE] key and the [EDIT] key simultaneously

6 **When the host has been set, press <Complete> (f12).**

Items for host setting are as follows:

Table 2.2.1 Host setting

Parameters	Functions
Connect Host Name	Used to set the name of host for connection on the network. IP address can also be set directly. Up to a maximum of 15 characters can be entered.
Display Host Name	Used to set the host name for display on the FTP client menu. Up to a maximum of 15 characters can be entered.
User ID	Used to set the user name for logging it into the host. Up to a maximum of 20 characters can be entered.
Password	Used to set the password for logging in with the above user ID. Up to a maximum of 128 characters can be entered.
Init. folder	Used to set the folder pass to refer to when the connection to the host is completed. Enter the relative pass from the home directory of the host. '¥' is used to delimit the folder. Up to a maximum of 260 characters can be entered.
Retry count	When data logging into the host is failed, set the repeating number of data logging.

Host setting is also used for automatic backup function. When the backup device is set to "Host 1" or "Host 2", host is connected with this setting during backup operation. In this case, a backup folder is created on the initial folder of the set host for connection.

2.3 System Memory Protection Function

The system memory protection function serves to safeguard the files of the operating system from damage by prohibiting the writing of data into those files. The following settings are not allowed when the system memory protection function is “Enabled”.

- Optional software setting
- TCP/IP setting
- FTP service setting
- Restore operation of the backup files and the optional software

Therefore, the setting operation must be performed following the procedure given below.

1. Disable the system memory protection function.
2. Perform the each setting. (See the respective manuals)
3. Enable the system memory protection function again.

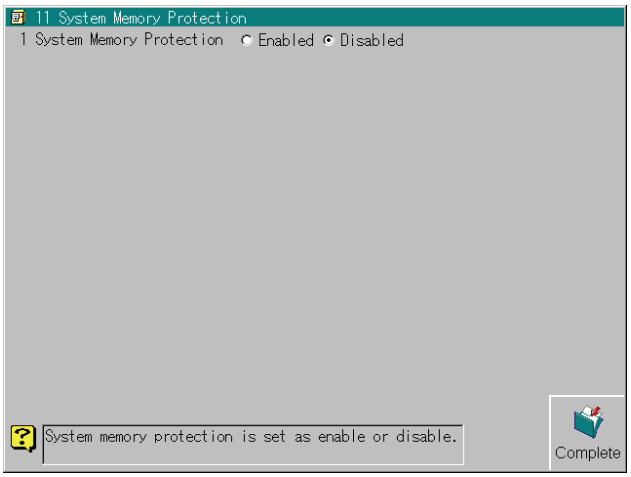
Checking the setting status of the system memory protection function

In order to check the setting status of the system memory protection function, the operator must have the qualification of ***Expert*** or above.

1 **Press f5 <Constant Setting>.**
On the [Constants] menu, select [1. Control Constants] and then [11. System Memory Protection].

>> The [System Memory Protection] screen now appears.

Whether the system memory protection has been set to “enabled” or “disabled” is indicated by the radio button on this screen.



Disabling the system memory protection function

In the case of CPU board is AXCPU10-10/AXCPU10-20

1 With the power off, connect the keyboard (PS2 connector type) to the CPU circuit board, and then turn on the control power.

>> The screen shown below appears.

```
OS Loader V4.01
...
Press spacebar NOW to invoke Hardware Profile/Last Known Good menu
```

2 On the screen in 1, press the [Space] key on the keyboard.

>> When the [Space] key is pressed, the screen shown below appears.

```
     Hardware Profile/Configuration Recovery Menu

This menu allows you to select a hardware profile
to be used when Windows NT is started.

If your system is not starting correctly, then you may switch to a
previous
system configuration, which may overcome startup problems.
IMPORTANT: System configuration changes made since the last
successful
startup will be discarded.



Use the up and down arrow keys to move the highlight
to the selection to you want. Then press ENTER.
To switch to the Last Known Good configuration, press 'L'
To Exit this menu and restart your computer, press F3.
```

3 Press the [L] key on the keyboard.

>> The screen shown below appears.

```
     Hardware Profile/Configuration Recovery Menu

This menu allows you to select a hardware profile
to be used when Windows NT is started.

If your system is not starting correctly, then you may switch to a
previous
system configuration, which may overcome startup problems.
IMPORTANT: System configuration changes made since the last
successful
startup will be discarded.



Use the up and down arrow keys to move the highlight
to the selection to you want. Then press ENTER.
To switch to the default configuration, press 'D'
To Exit this menu and restart your computer, press F3.
```

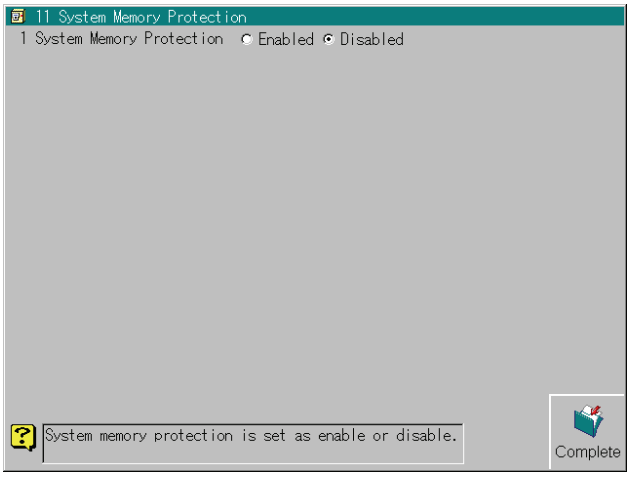
* What is displayed at the bottom of the screen differs from what is shown on the screen in 2.

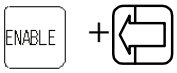
4 **Press the [Return (Enter)] key on the keyboard.**
>> Windows startup is resumed, and the AX software then starts up. Once the AX software starts up, the system memory protection function is set to "disabled."

Enabling the system memory protection function

In order to set the system memory protection function, the operator must have the qualification of ***Specialist*** or above.

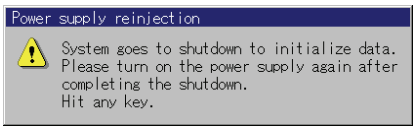
1 **Press f5 <Constant Setting>.**
On the [Constants] menu, select [1. Control Constants] and then [11. System Memory Protection].
>> The [System Memory Protection] screen now appears.





2 **Press the [ENABLE] key and [←] key at the same time to select "Enabled."**

3 **Upon completion of the settings, press f12 <Complete>.**
>> A message prompting the user to turn the power back on now appears.



4 **Press any key, wait until "Restart" is displayed, and then turn the control power back on.**

Chapter 3 File Transfer

This chapter describes how to use the FTP (File Transfer Protocol).

3.1 File Transfer (FTP Client)

File transfer can be performed using the operation menu of the AX controller. Here the AX controller serves as the FTP client (the node that starts requesting FTP). The Ethernet settings, such as TCP/IP and FTP, must be set before using the FTP client functions. For details, refer to Chapter 2.

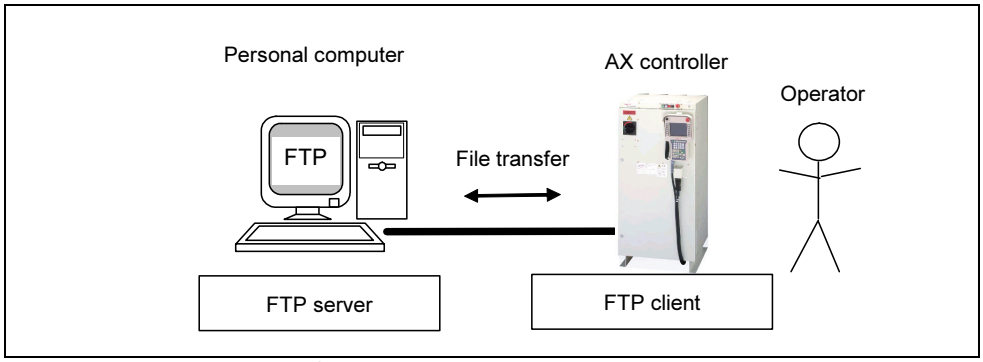
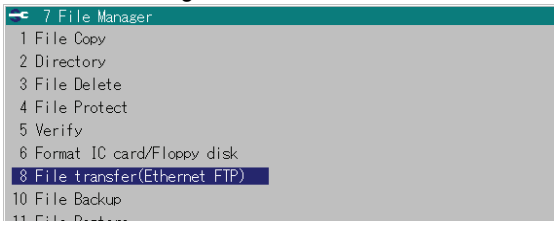


Fig. 3.1.1 File transfer with the AX controller serving as the FTP client

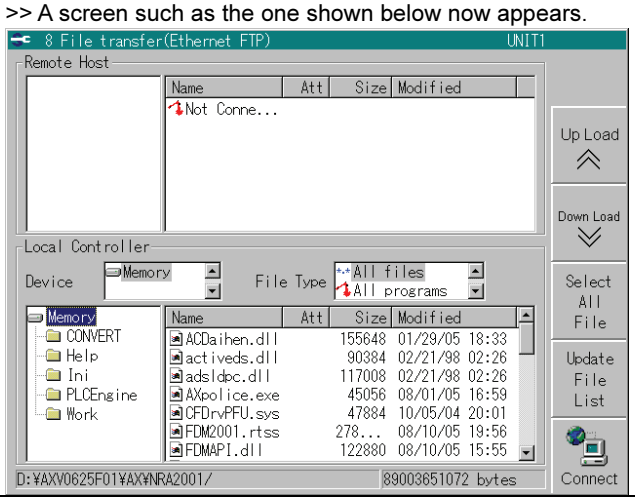
3.1.1 Downloading Files

Described here is how to copy a remote file to a local computer (AX controller).
This operation must be performed by an operator with the qualifications class of *Expert* or superior.

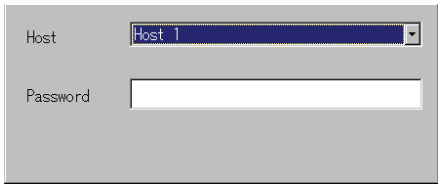
1 **In teach or playback mode, press <File Manager> (f4).**
If this soft key is not provided, the menu can be opened from the "Service Utilities" menu. In such cases, select "7 File Manager" from the "Service Utilities" menu and press [Enter].
>> The file manager menu such as the one shown below is now opened.



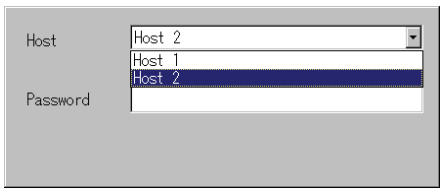
2 **Align the cursor with "File transfer (Ethernet FTP)" and press [Enter].**
>> A screen such as the one shown below now appears.

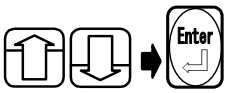


3 **Press <Connect> (f12) to connect to the FTP server.**
>> A log-in screen such as the one shown below appears.



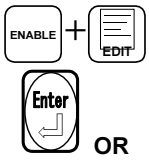
4 **Position the cursor on the host selection column and press the [Enter] key.**
>>Two host names are displayed in the pull-down menu as shown.



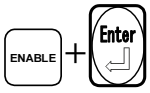


5 **Select the host for connection with [Up] or[Down] keys and press the [Enter] key.**

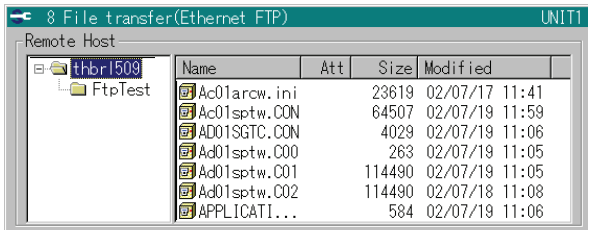
6 **Input the password for logging in to the FTP server in the "Password" field.**
If the user ID is set to "Anonymous," leave this field blank.
For inputting character strings, press [ENABLE] and [EDIT] keys together to open the soft keyboard.

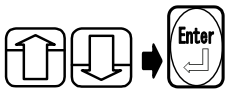


7 **When the cursor is in the password column, press the [Enter] key. When the cursor is in the host column, press the [ENABLE] key and the [Enter] key.**
The host is connected to the specified FTP server.
Login screen is closed automatically.

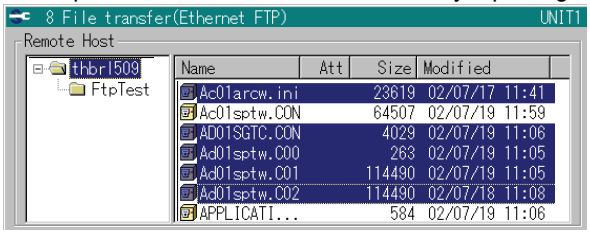


8 **When host is connected properly, the file in the initial folder is displayed. The initial folder is set by the host setting mode. (Refer to 2.2 Setting the FTP Client). When the initial folder is not set or when the directory set in the initial folder does not exist under the home directory, internal home directory is displayed.**
In this case, the beginning of the folder list is displayed by the name set in the host name for display.
>> The file list of the FTP server is displayed. The following is an example.





9 **Select a file in the FTP server to be transferred.**
Select a file using the [Up] or [Down] key, and press [Enter]. The selected file is highlighted in blue.
A multiple number of files can be selected by repeating these steps.



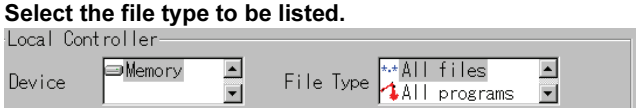
To release the selected status, select the file to be released, and press [BS].

To select all files, press the <Select All File> (f10).

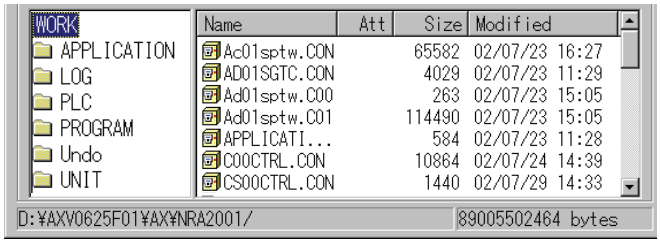
When the all file selection mode is reset, press the <Release All File> (ENABLE + f10).

10 **Move to the "Device" selection field in the "Local controller" (AX controller) section, and select a device.**

11 **Select the file type to be listed.**



12 **Select the folder of the local controller (AX controller) to which the files are to be transferred.**



13 **Press <Down Load> (f9) after selection.**
>> File transfer (downloading) now starts.

14 **Upon completion of all the File transfer needed, press the <RESET> key to close the menu.**

IMPORTANT

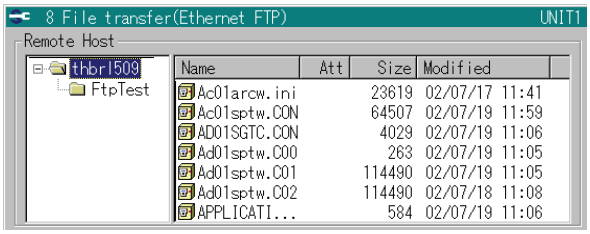
Constant files and initial value files cannot be downloaded during a playback operation since they may affect the robot operations.

3.1.2 Uploading Files

Described here is how to copy a local file to the remote computer.
This operation must be performed by an operator with the qualifications class of ***Expert*** or superior.

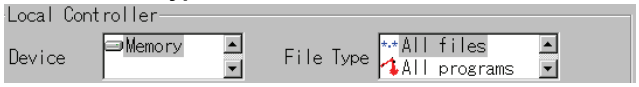
2 **Steps 1 to 8 are the same as those for downloading.**

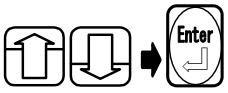
9 **Select the folder of the remote host to which files are to be transferred.**



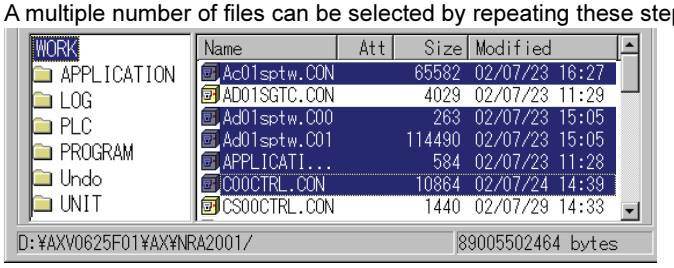
10 **Move to the "Device" selection field in the "Local controller" section, and select a device.**

11 **Select the file type to be listed.**





12 **Select a file in the local controller to be transferred.**
Select a file using the [Up] or [Down] key, and press [Enter]. The selected file is highlighted in blue.
A multiple number of files can be selected by repeating these steps.



To release the selected status, select the file to be released, and press [BS].

To select all files, press the <Select All File> (f10).

When the all file selection mode is reset, press the <Release All File> (ENABLE + f10).

13 **Press <Up Load> (f8) after selection.**
>> The File transfer (uploading) now starts.

14 **Upon completion of all the File transfer needed, press the <RESET> key to close the menu.**

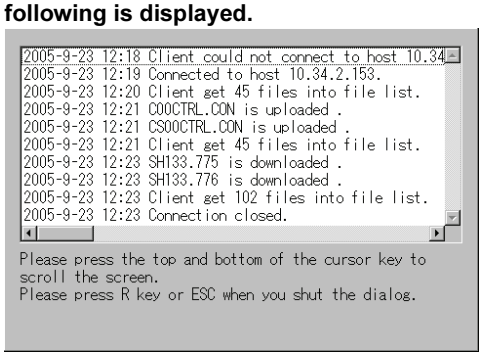
3.1.3 Referent Log

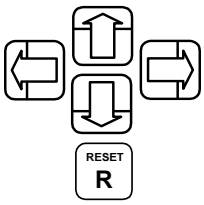
Record of communication with the FTP server is referenced.
This operation should be carried out by the qualified operator of the ***Specialist*** level or above.

2 **Operations are the same as those of down load operation from 1 to 2.**

Referent Log

3 **Press the <Referent Log> (ENABLE + f8) key and the log list such as the following is displayed.**





4 **To display the list, press [Up] or [Down] keys for vertical list scrolling and press [Right] or [Left] keys for lateral list scrolling.**

5 **Pressing the [Rest] key ends the log list screen.**

Contents of the log list displayed are as follows:

Table 3.1.1 Host Setting

Status	Log display
Sever connection succeeded	Host: Server was connected to the [Host name].
Server connection failed	Host: Server could not be connected to the [Host name].
Server connection shutoff	Server connection was shut off.
Folder list Acquisition succeeded	[File number] file was acquired in the file list.
Folder list Acquisition failed	File could not be acquired in the file list.
1 file Upload execution	[File name] was uploaded.
Write inhibit file Upload	[File name] is protected and could not be uploaded.
Upload when writing of the same name file is inhibited	[File name] could not be uploaded due to “Do not overwrite” operation.
Upload when the capacity is insufficient	[File name] could not be uploaded because of insufficient storage capacity.
Upload failed due to unknown cause	[File name] could not be uploaded
Upload suspended	Uploading was suspended.
1 file Download execution	[File name] was downloaded.

Status	Log display
Changing in playback mode not allowed File Download	[File name] could not be downloaded due to playback mode.
Write inhibit file Download	[File name] is protected and could not be downloaded.
Download when writing of the same name file is inhibited	[File name] could not be downloaded due to “Do not overwrite” operation.
Download when the capacity is insufficient	[File name] could not be downloaded because of insufficient storage capacity.
Download failed due to unknown cause	[File name] could not be downloaded.
Download suspended	Download was suspended.

3.2 File Transfer (FTP Server)

Files can be transferred from an FTP client working on another node. Here the AX controller serves as the FTP server (host).
No special operation of the AX controller is required. File transfer can be performed even during a playback operation. Note that the Ethernet settings, such as TCP/IP and FTP, must be set before using the FTP server functions. For details, refer to Chapter 2.

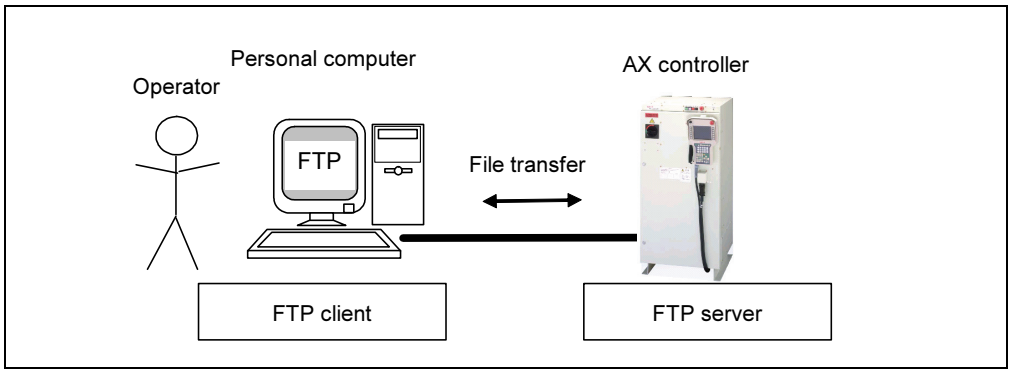


Fig. 3.2.1 File transfer with the AX controller serving as the FTP server

IMPORTANT

Care must be taken when files are to be transferred to the AX controller during a playback operation.
In particular, never try to transfer constant files or initial value files, since they directly affect the robot operations. Sufficient care must be taken when the FTP server functions are used, since no restriction is imposed inside the AX controller when File transfer is performed.

Note

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