

Ethernet Communications Setting Guide

For FinsGateway and the PLC

Establishing communications between the computer and the PLC by Ethernet requires correct settings on both sides. Problems such as “Cannot communicate with the PLC” or “Cannot read/write data” are generally attributed to incorrect communications settings. Most of these can be avoided by understanding the necessary settings and their meanings.

The settings necessary for both the computer (FinsGateway) and the PLC are almost the same. Therefore, this setting guide explains the common settings required to connect the computer and the PLC by Ethernet. For the detailed settings of FinsGateway and the PLC, refer to the specific manuals.

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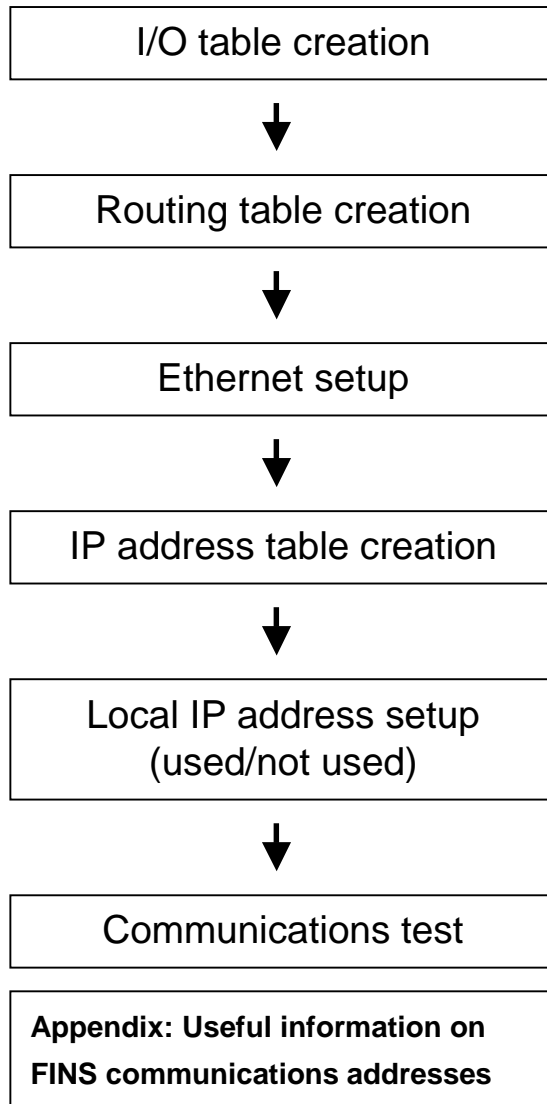
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Based on experience and FAQ, the IP address table setup is a major cause of customers' problems. Of course, there are other points also to note.

The basic procedures to establish Ethernet communications are as follows:



I/O Table Creation

The I/O table is one of the PLC system settings. It does not need to be set in FinsGateway. It is used for the PLC CPU to recognize what kinds of units are mounted to the PLC rack.

Create the I/O table in a PLC just after initial setup, or when any Unit is removed or added.

If there is any error in these settings, the PLC will not work properly.

If there is an error, the error LED of the PLC will light.

The I/O table can be created using either of the following tools:

1. PLC programming software.
2. PLC programming console.

For details, refer to the specific manuals.

Routing Table Creation

The next necessary setting is the routing table.

The routing table needs to be set in both the PLC and FinsGateway. If there is any error in the settings, the PLC may not be able to get to FinsGateway and vice versa.

The PLC and FinsGateway can be connected to multiple networks by using multiple Communication Units. In this case, each Unit is distinguished by a unique number. The routing table is used to set the network number to each Communication Unit. It also indicates the communication route for hopping networks. The routing table setup is necessary even for one, stand-alone network. If there is an error in the table, the error LED of the PLC will light.

All PLC Communication Units have a rotary switch on the front panel to set the unit number. (FinsGateway communication units have default unit numbers. For example, the ETN_UNIT unit number is 17.) This unit number and a FINS communications network number will be linked with the routing table.

This routing table is called the local network table. The network number in the table will be used as a network number to indicate a target PLC. The network number is necessary not only for Ethernet, but other networks, as well.

Example of a routing table (local network table)

Network number	Unit number	
1	1	ControllerLink Unit
2	3	Ethernet Unit
3	5	SYSMAC LINK Unit

Note: Each network number and unit number combination must be unique within the table. In the above example, the network number for Ethernet is 2. By creating the routing table, network number 2 can now be used as a target node address for FINS communications.

The routing tables are set using the following tools:

1. PLC: PLC programming software
2. FinsGateway: Ethernet properties of FinsGateway FINS Network Navigator

For details, refer to the manuals.

If there is an error in the routing table, one of the following will occur.

1. A reply to a command sent to a PLC Communication Unit is returned. However, no reply is returned from the CPU. (Data read/write is impossible.)
2. Routing error is returned.

Ethernet Setup

Perform the basic settings necessary for Ethernet communications, such as IP address setup.

IP Address

In Ethernet communications, an IP address must be set to all the nodes, including PLCs.

The PLC does not have an IP address auto-acquisition with DHCP function.

For CV-series PLCs, an IP address is written to the PLC as a software switch with the programming software.

For CS1-series PLCs, an IP address needs to be set manually with the rotary switch on the back of the PLC.

Sub-net Mask

Set the same value as the one used in the Ethernet environment.

(a) Broadcast setting

Set the same value as the one used in the Ethernet environment.

(b) IP router table

Set an IP router table if communicating with other network segments through an IP router.

FINS UDP Port Number

Leave the value set to the default (9600), except when necessary to change it.

The Ethernet settings are performed using the following tools:

1. PLC: PLC programming software
2. FinsGateway: Ethernet board or Network setup functions included in the OS, and the Ethernet properties of FinsGateway FINS Network Navigator.

For details, refer to the manuals.

IP Address Table Creation

In Ethernet communications with OMRON PLCs, there is a setting to specify the IP address table creation method for registering the target IP address.

Incorrect settings may cause communications failures.

The IP address table is used to link the IP address and the FINS node number. There are two methods to create the IP address table as follows:

- | |
|---|
| (a) IP address table method |
| (b) Automatic address generation method |

If you are not familiar with these methods, use method (a).

(a) IP Address Table Method

In OMRON FINS communications, the network, node and unit numbers are used to specify the target node, while in Ethernet communications protocol (UDP/IP), an IP address is used. Therefore, the FINS node number and Ethernet IP address must be associated with each other.

If using this method, an IP address table must be registered to perform Ethernet communications.

An IP address table must be set in both the PLC and the computer. Registering all the communication targets enables correct data exchange.

Example of IP address table:

Node number	IP address
3	10.100.200.5
5	10.100.200.12
10	10.100.200.24

If there is an error in the IP address table, the following will occur.

A reply to a command sent to a PLC Communication Unit is returned. However, no reply is returned from the CPU. (Data read/write is impossible.)

(b) Automatic Address Generation Method

Note: If you are not familiar with the content of this method, use method (a).

This method, unlike the IP address table method, does not require table registration. It uses the specified target node number as the value of the fourth byte of the IP address.

Example:

If the local node IP address is 10.100.200.1, and 2.3.0 is specified as the target node, then the target node IP address will automatically become 10.100.200.3, and the command will be sent. This means that the first three bytes of the target node IP address are same as those of the local node, and the node number is set to the fourth byte.

The following advantages are gained by this method:

- The maximum number of nodes that can be registered in the table for the IP address table method is 32. To communicate with more than 32 targets, the automatic generation method is required.
- Using this method reduces the setup time since there is no need to set an IP address table.

However, the following disadvantages are also incurred:

- This method is difficult to understand, since the target nodes are not explicitly registered like the IP address table method.
- The value of the fourth byte of the target node IP address must be the same as the node number. (The node numbers and IP addresses cannot be set independently)
- The communication range is limited to the same segment, because the first three bytes of the target node IP address must be same as those of the local node (i.e., the same Ethernet net ID).

The IP address table settings are performed using the following tools:

1. PLC: PLC programming software
2. FinsGateway: the Ethernet properties of FinsGateway FINS Network Navigator

For details, refer to the manuals.

Local IP Address Setup (Used/Not Used)

This setting is only for CV-series PLCs.

If you are not familiar with the following explanation, select Node number rotary switch not used.

Local IP address setup (used/not used) specifies whether or not to enable the local node number, which is set with the node address rotary switch on the front of the Communication Unit. If it is used, it sets the fourth byte of the IP address.

Note: The IP address table method is used to specify the target node IP address. However, this is used to change the local node IP address.

Example:

If the local node IP address is set to 10.100.200.242, and the bit for the local IP address setup is set to 0 (which means Node number setting rotary switch used) and the node number is set to 10, then the IP address will be automatically changed to 10.100.200.10. The value of the fourth byte of the local node IP address is automatically replaced with the node number set with the rotary switch.

The following case can be assumed for this method:

If a CV-series PLC local IP address needs to be changed frequently, it is troublesome to change it with programming software or a programming console. However, the node number can easily be changed with the rotary switch on the front of the unit. Changing the node number changes the IP address (the fourth byte), which can consequently reduce the time for system changes.

However, since the PLC will have a different IP address from the one set with the programming software, address management may be confusing. Understand this function fully before using it.

Communications Test

Now it is time to test communications. If there are errors, data read/write may not work.

If there are errors, it is necessary to troubleshoot step by step, by performing gradual communications tests

Basic policy: Begin communications tests with the closest node!!

Use the following procedure to perform the communications tests:

(a) Confirm IP level communications with the Ping command

Select "Run..." from the Windows Start menu. Enter the following command:

ping [target IP address]

Example: ping 123.100.10.12

If "Reply from ..." is displayed, the Ethernet settings on the computer and the communications route are working correctly. If "Request timeout" is displayed, there is something wrong with the settings.

(b) Start the CPU_UNIT and ETN_UNIT services of FinsGateway, and the FINS Network Tester.

Use the FINS Network Tester (FinsendW.exe) included with FinsGateway.

(c) Send the "Controller Data Read" command to the local node CPU_UNIT.

Send "0501" to "0.0.0". If the controller data is read, the FinsGateway CPU_UNIT is working correctly.

(d) Send the "Controller Data Read" command to the local node ETN_UNIT.

Send "0501" to "0.0.17". If the ETN_UNIT unit number is changed from 17, then use the new number. If the controller data is read, the FinsGateway ETN_UNIT is working correctly.

(e) Send the "Controller Data Read" command to the local node ETN_UNIT with the network number.

Send "0501" to "x.0.17". If the ETN_UNIT unit number is changed from 17, then use the new number. Set the network number to the value set for Ethernet in the routing table. Set "0" to the node number. If the controller data is read, the FinsGateway routing table is correctly set.

(f) Send the “Controller Data Read” to the closest node ETN_UNIT.

Send “0501” to “x.x.254”. Set the values indicating the target node to the network number and the node number. Set “254” to the unit number. This number is a special number for specifying the target node Communication Unit. If the controller data is read, communication with the target node Ethernet Unit is working correctly. In this case, the command was sent directly to the Ethernet Unit. Therefore, no data can be read or written.

(g) Send the “Controller Data Read” to the closest node CPU_UNIT.

Send “0501” to “x.x.0”. Set the values indicating the target node to the network number and the node number. Set “0” to the unit number. This number is a reserved number for specifying the target node CPU. If the CPU type is read, communication with the target node is working correctly.

(h) Send “Memory Area Read” to the closest node CPU_UNIT.

Send “010182000000000a” to “x.x.0”. Set the values indicating the target node to the network number and the node number. Set “0” to the unit number. If 10 words of data from DM0 are read, FinsGateway and the PLC are communicating successfully.

If this communications confirmation test was not successful, refer to the Troubleshooting section.

Troubleshooting

If an error occurs in (a)

The target node IP address is wrong. Reconfirm it. Or there are wrong settings in the computer Ethernet settings, or the board settings. Reconfirm them. Or there is something wrong in the Ethernet cable. Reconfirm it. (Maybe the connector is removed or the cable is damaged.)

If an error occurs in (b)

FinsGateway is not successfully installed. Reinstall it. If ETN_UNIT service is not started, there is something wrong with the computer Ethernet board settings. Check the error details with the Event Viewer and correct the OS network settings.

If an error occurs in (c)

The FinsGateway CPU_UNIT service is not started. Start it.

If an error occurs in (d)

The FinsGateway ETN_UNIT service is not started. Start it.

If an error occurs in (e)

There is something set wrong in the FinsGateway routing table. Correct the settings (i.e., network number, etc.) with the FINS Network Navigator.

If an error occurs in (f)

The target node is not registered in the FinsGateway IP address table. Register the target node number and IP address with the FINS Network Navigator (in the case of the IP address table method).

If an error occurs in (g)

The local node is not registered in the target node IP address table. The IP address table needs to be set in the target node, too. Both nodes need to have all nodes registered to the IP address table (in the case of the IP address table method). Or there is something wrong with the mode settings (i.e., the IP address table method). Set the same mode as FinsGateway.

If an error occurs in (h)

The FINS command sent was incorrect. The FINS command to read 10 words from DM0 is "01018200000000a". Or there is something wrong with the target node. Check the node.

Appendix: Important Points about FINS Communications Addresses

FINS Communications Addresses

Specify a target node such as "1.2.0" in the FINS Network Tester. This is a FINS communications address. A FINS communications address consists of a network number, a node number, and a unit number.

Network number	A number assigned to a network such as Ethernet or ControllerLink. Specify the value set in the routing table.
Node number	A number indicating a device such as a target PLC or computer in a network. Set it with the rotary switch on the PLC or the FinsGateway FINS Network Navigator. The Node number must be unique within that network.
Unit number	A number indicating a target unit on the PLC or computer. The unit number for the CPU unit is reserved as 0. Always specify 0 for communications with the CPU, such as data read/write.

Reserved Number (0)

The network number 0 is a special number indicating the local network. If a PLC is only connected to one network, even if the network number is set, 0 can be used as the target network number. However, if the PLC is connected to multiple networks, specifying 0 as the network number will generate a routing error.

For example, suppose a computer has both the FinsGateway SerialUnit and ETN_UNIT running. If attempting to communicate with a PLC connected to the Serial port by specifying "0.240.0", a **Routing table error** will occur. This is because there are two local networks. In this case, the network numbers must be set to both the SerialUnit and the ETN_UNIT, with the FINS Network Navigator. Then, use the correct network number to specify the target network.

The node number 0 is also a special number indicating the local node. This number will be used for special occasions such as communications within the local node or inter-process communications. The unit number 0 is also a reserved number indicating the CPU.

When setting 0.0.0 to a FINS communication target, the memory within the local node will be accessed.

Example: If 2 is the local network number and 10 is the local node number, the following target addresses are all the same:

"2.10.0", "2.0.0", "0.10.0", "0.0.0"

PLC Unit Number Specification (Adding 16)

In general, the CPU (unit number 0) is specified as the target unit number in order to read/write data to/from a PLC. However, in some cases, a Communication Unit itself, not the CPU, is specified as the target. For example, this is done when executing Data Link Start to a ControllerLink Unit or Controller Data Read to an Ethernet Unit. In such cases, the unit number needs to be specified. (Example: 2.3.19)

If the target is a Unit of the PLC, be careful when specifying the unit number. **It is necessary to add 16 to specify the target unit number.**

For example, if the unit number of the target PLC Ethernet Unit is 3, then 2.3.19 must be specified (3+16=19).

This rule is based on the following:

The unit number can be set with the rotary switch on the front of the PLC. 0 can be set as the unit number. However, in FINS communications, the unit number 0 is a reserved number indicating the CPU. (Refer to the Reserved Number (0) section.) Therefore, in order to distinguish the CPU from the Communication Unit in the FINS communication address, add 16 (hex: 10) to the unit number to specify the Communication Unit.

However, when attempting to communicate with a FinsGateway communication unit, 16 does not need to be added. The FinsGateway communication unit number can be specified as is.

Special Unit Number (254)

In (f) of the Communications Test section, "x.x.254" is specified as the target. This unit number 254 is a special number indicating the Communication Unit receiving the command.

Therefore, in case of (f), the Ethernet Unit which received the communications test command replied, so that the controller data of the Unit could be read. In this case, the reply process is performed within the Communication Unit so that the target CPU does not get involved in the communication. This unit number: 254 behaves in the same way in other networks, such as ControllerLink. Due to this specification, communications with a Communication Unit is possible by using 254 even if the unit number of the target Communication Unit is unknown.