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MVI56E-FLN

ControlLogix Platform

FA Control Network Ethernet Communication Module

February 7, 2023

USER MANUAL

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MVI56E-FLN User Manual
For Public Use.

February 7, 2023

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Important Safety Information

North America Warnings

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;

WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Class 2 Power

ATEX Warnings and Conditions of Safe Usage

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction

A Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
B Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
C These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.
D DO NOT OPEN WHEN ENERGIZED.

Agency Approvals & Certifications

Please visit our website: www.prosoft-technology.com

Contents

1 Start Here

To get the most benefit from this User Manual, you should have the following skills:

- **Rockwell Automation® RSLogix™ software:** launch the program, configure ladder logic, and transfer the ladder logic to the processor
- **Microsoft Windows:** install and launch programs, execute menu commands, navigate dialog boxes, and enter data
- **Hardware installation and wiring:** install the module, and safely connect FL-net and ControlLogix devices to a power source and to the MVI56E-FLN module's application port(s)

1.1 What's New?

MVI56E products are **backward compatible** with existing MVI56 products, ladder logic, and module configuration files already in use. Easily swap and upgrade products while benefiting from an array of new features designed to improve interoperability and enhance ease of use.

- **ProSoft Configuration Builder (PCB):** New Windows software for diagnostics, connecting via the module's Ethernet port to upload/download module configuration information and access troubleshooting features and functions.
- **ProSoft Discovery Service (PDS):** Utility software to find and display a list of MVI56E modules on the network and to temporarily change an IP address to connect with a module's webpage.
- **Personality Card:** An industrial compact flash memory card storing the module's complete configuration and Ethernet settings, allowing quick and easy replacement.
- **LED Scrolling Diagnostic Display:** 4-character, alphanumeric display, providing English messages for status and alarm data, and for processor and network communication status.

1.2 System Requirements

The MVI56E-FLN module requires the following minimum hardware and software components:

- Rockwell Automation ControlLogix® processor (firmware version 10 or higher), with compatible power supply, and one free slot in the rack for the MVI56E-FLN module. The module requires 800 mA of available 5 Vdc power
- Rockwell Automation RSLogix 5000 programming software
- Rockwell Automation RSLinx® communication software version 2.51 or higher
- ProSoft Configuration Builder (PCB) (included)
- ProSoft Discovery Service (PDS) (included in PCB)
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows 10
  - Microsoft Windows 7 Professional (32-or 64-bit)
  - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  - Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)

Note: The Hardware and Operating System requirements in this list are the minimum recommended to install and run software provided by ProSoft Technology®. Other third party applications may have different minimum requirements. Refer to the documentation for any third party applications for system requirements.

Note: You can install the module in a local or remote rack. For remote rack installation, the module requires EtherNet/IP or ControlNet communication with the processor.

1.3 Package Contents

The following components are included with your MVI56E-FLN module, and are all required for installation and configuration.

Important: Before beginning the installation, please verify that all of the following items are present.

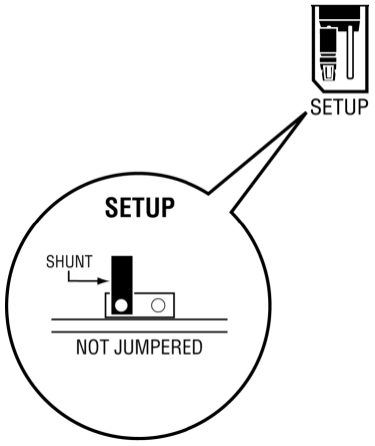
Qty.	Part Name	Part Number	Part Description
1	MVI56E-FLN Module	MVI56E-FLN	FA Control Network Communication Module

If any of these components is missing, please contact ProSoft Technology Support for replacement parts.

1.4 Setting Jumpers

The Setup Jumper acts as "write protection" for the module's flash memory. In "write protected" mode, the Setup pins are not connected, and the module's firmware cannot be overwritten. Do not jumper the Setup pins together unless you are directed to do so by ProSoft Technical Support.

The following illustration shows the MVI56E-FLN jumper configuration.



Note: If you are installing the module in a remote rack, you may prefer to leave the Setup pins jumpered. That way, you can update the module's firmware without requiring physical access to the module.

Security considerations:

Leaving the Setup pin jumpered leaves the module open to unexpected firmware updates.

You should consider segmenting the data flow for security reasons. Per IEC 62443-1-1, you should align with IEC 62443 and implement segmentation of the control system. Relevant capabilities are firewalls, unidirectional communication, DMZ. Oil and Gas customers should also see DNVGL-RP-G108 for guidance on partitioning.

You should practice security by design, per IEC 62443-4-1, including layers of security and detection. The module relies on overall network security design, as it is only one component of what should be a defined zone or subnet.

1.5 Installing the Module in the Rack

If you have not already installed and configured your ControlLogix processor and power supply, please do so before installing the MVI56E-FLN module. Refer to your Rockwell Automation product documentation for installation instructions.

Warning: You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify that suitable safety procedures are in place before installing or servicing the device.

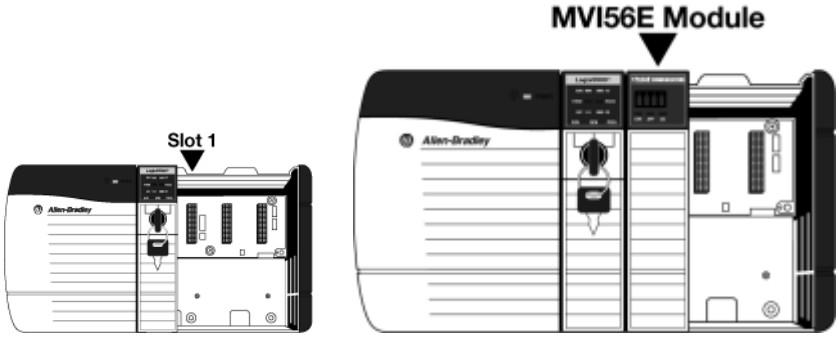
After you have checked the placement of the jumpers, insert the MVI56E-FLN into the ControlLogix chassis. Use the same technique recommended by Rockwell Automation to remove and install ControlLogix modules.

You can install or remove ControlLogix system components while chassis power is applied and the system is operating. However, please note the following warning.

Warning: When you insert or remove the module while backplane power is on, an electrical arc can occur. An electrical arc can cause personal injury or property damage by sending an erroneous signal to your system's actuators. This can cause unintended machine motion or loss of process control. Electrical arcs may also cause an explosion when they happen in a hazardous environment. Verify that power is removed or the area is non-hazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

1. Align the module with the top and bottom guides, and then slide it into the rack until the module is firmly against the backplane connector.



2. With a firm, steady push, snap the module into place.
3. Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
4. Make a note of the slot location. You must identify the slot in which the module is installed in order for the sample program to work correctly. Slot numbers are identified on the green circuit board (backplane) of the ControlLogix rack.
5. Turn power ON.

1.6 Installing ProSoft Configuration Builder

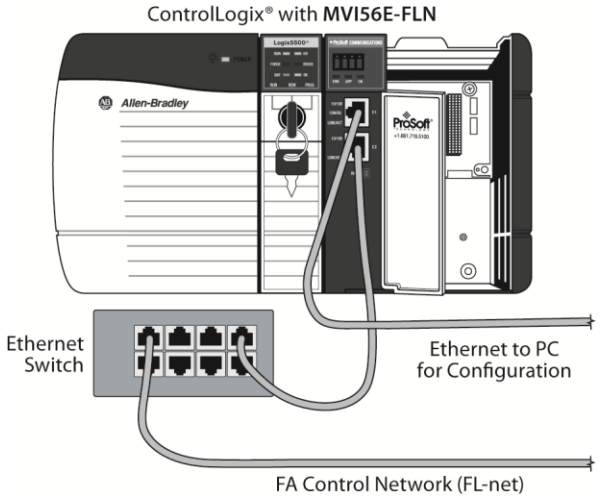
To install ProSoft Configuration Builder from the website

1. Download the latest version of PCB from www.prosoft-technology.com.
2. Run the install file. This action starts the installation wizard for *ProSoft Configuration Builder*.
3. Click **NEXT** on each page of the installation wizard. Click **FINISH** on the last page of the wizard.

1.7 Connecting Your PC to the Module

The *E1* port is for configuration only and cannot be used on the FL-net network. The *E2* port is for exclusive use on the *FL-net* network and cannot be used for configuration.

To configure the module, once it is securely mounted, connect one end of an Ethernet cable to the *Config (E1)* port and connect the other end to an Ethernet hub or switch which is accessible from the same network as your personal computer (PC). You can also connect directly from the Ethernet port on your PC to the *Config (E1)* port on the module by using an Ethernet crossover cable (not included).

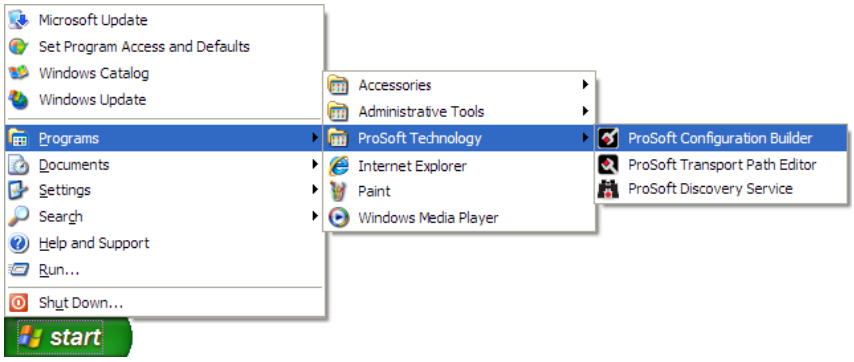


1.8 Setting Up a Temporary IP Address

Important: ProSoft Configuration Builder locates MVI56E-FLN modules through UDP broadcast messages. These messages may be blocked by routers or layer 3 switches. In that case, ProSoft Discovery Service will be unable to locate the modules.

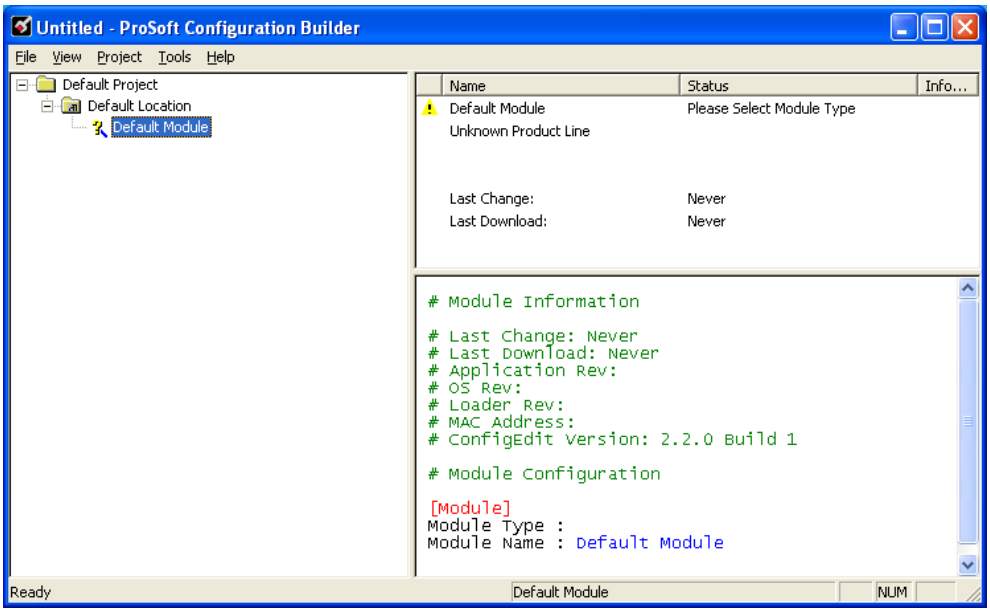
To use ProSoft Configuration Builder, arrange the Ethernet connection so that there is no router/layer 3 switch between the computer and the module OR reconfigure the router/layer 3 switch to allow the routing of the UDP broadcast messages.

1 Click the **START** button, and then navigate to **PROGRAMS / PROSOFT TECHNOLOGY**.



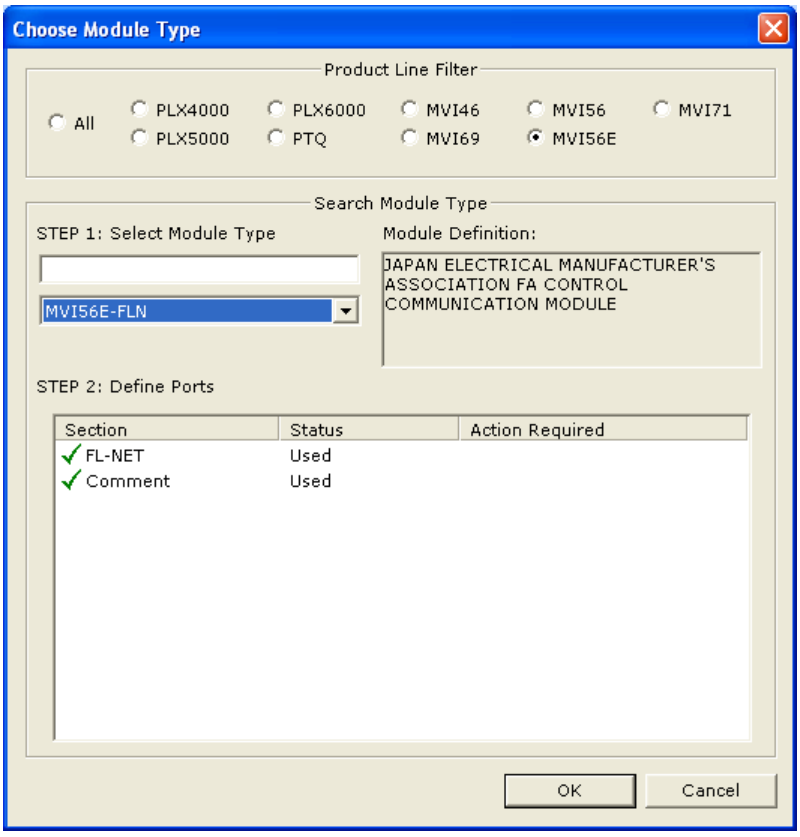
2 Click to start *ProSoft Configuration Builder*.

If you have used other Windows configuration tools before, you will find the screen layout familiar. PCB's window consists of a tree view on the left, and an information pane and a configuration pane on the right side of the window. When you first start *PCB*, the tree view consists of folders for **DEFAULT PROJECT** and **DEFAULT LOCATION**, with a **DEFAULT MODULE** in the Default Location folder. The following illustration shows the *PCB* window with a new project.



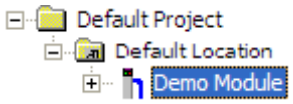
3 Use the mouse to select **DEFAULT MODULE** in the tree view, and then click the right mouse button to open a shortcut menu.

4 On the shortcut menu, select **CHOOSE MODULE TYPE**. This action opens the *Choose Module Type* dialog box.



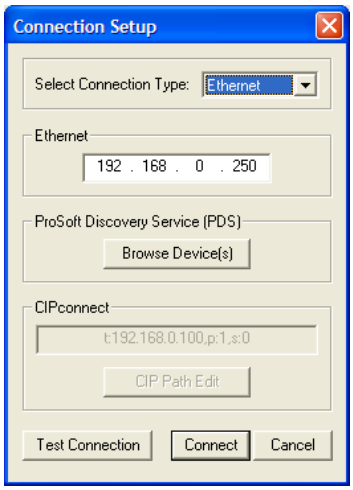
5 In the *Product Line Filter* area of the dialog box, select **MVI56E**. In the **SELECT MODULE TYPE** dropdown list, select **MVI56E-FLN**, and then click **OK** to save your settings and return to the *ProSoft Configuration Builder* window.

6 Right-click the module icon.



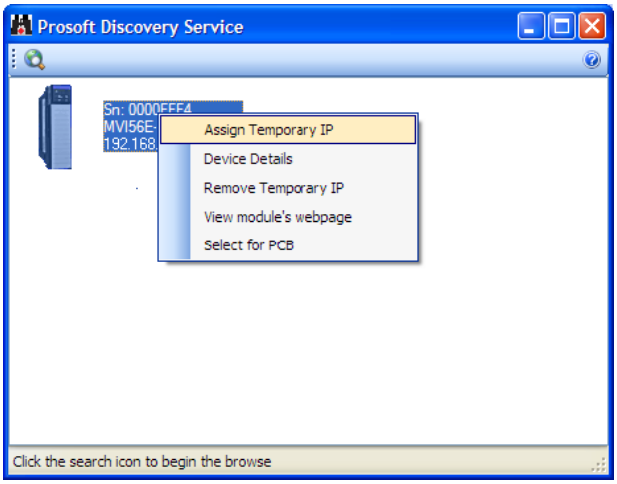
7 Click the **SET UP CONNECTION** button to browse for the module's IP address.

8 On the *Connection Setup* dialog box, click the **TEST CONNECTION** button to verify if the module is accessible with the current settings

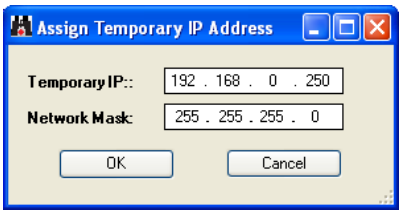


9 If PCB is still unable to connect to the module, click the **BROWSE DEVICE(S)** button to open the *ProSoft Discovery Service*.

10 Select the module, then right-click and choose **ASSIGN TEMPORARY IP**.

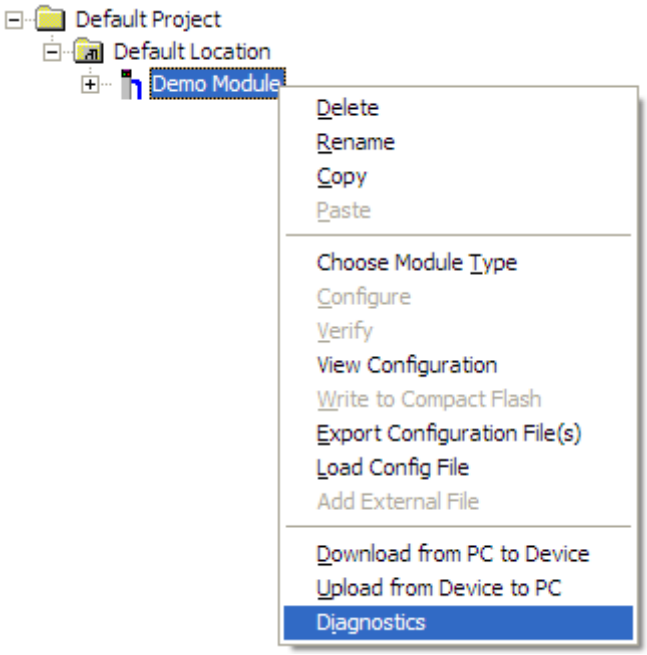


11 The module's default IP address is 192.168.0.250.

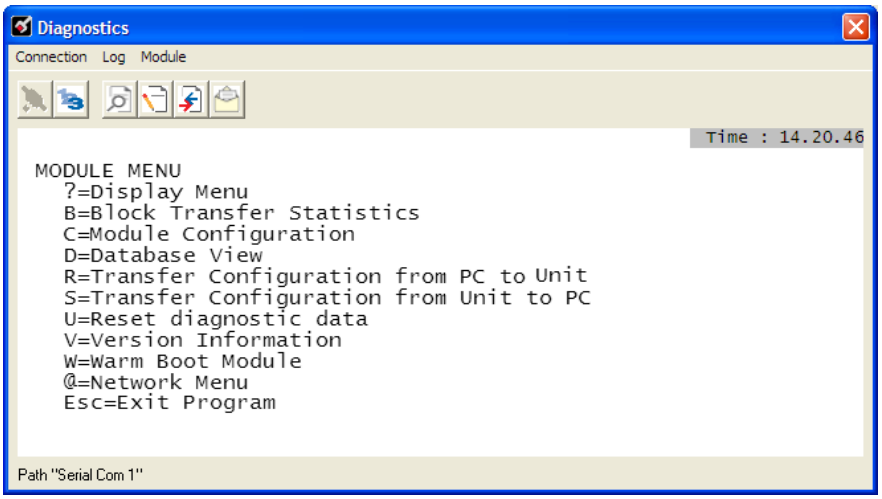


12 Choose an unused IP within your subnet, and then click **OK.**

13 On the shortcut menu, choose **DIAGNOSTICS**.

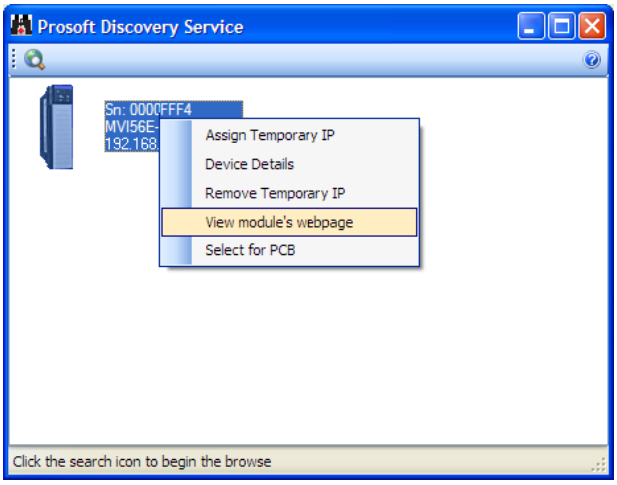


This action opens the *Diagnostics* dialog box.

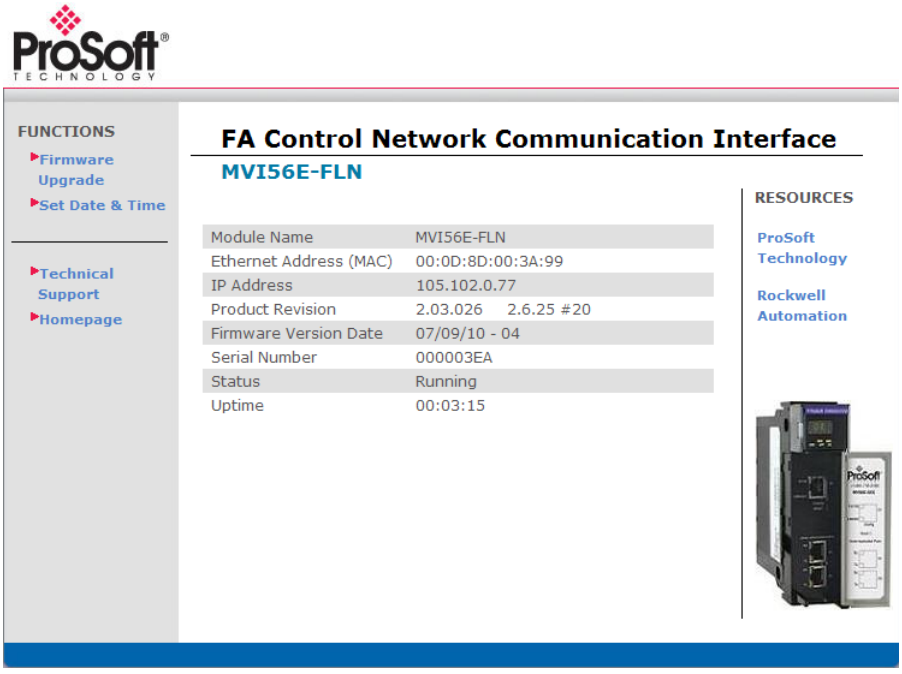


1.9 Connecting to the Module's Webpage

1. In *ProSoft Discovery Service*, select the MVI56E-FLN module, and then click the right mouse button to open a shortcut menu.
2. On the shortcut menu, choose **VIEW MODULE'S WEBPAGE**.



The webpage contains general product information, firmware download link, and links to ProSoft Technology's Website.



Important: The temporary IP address is only valid until the next time the module is initialized. Please refer to Setting Up a Temporary IP Address (page 12) in the MVI56E-FLN User Manual for information on how to set the module's permanent IP address.

1.10 Using the RSLogix 5000 Sample Project

1.10.1 Opening the Sample Ladder Logic

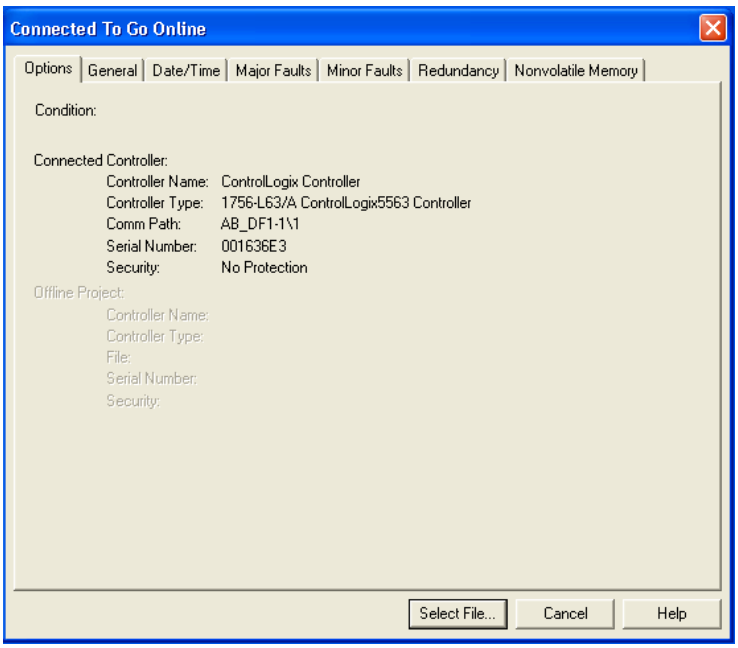
The sample program for your MVI56E-FLN module includes custom tags, data types and ladder logic for data I/O and status monitoring. For most applications, you can run the sample ladder program without modification, or, for advanced applications, you can incorporate the sample program into your existing application.

The version number appended to the file name corresponds with the firmware version number of your ControlLogix processor. The firmware version and sample program version must match.

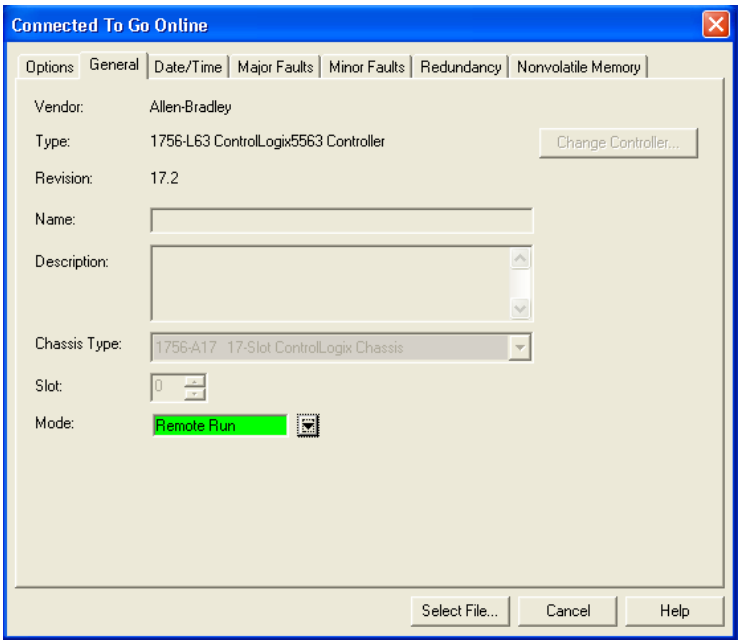
Determining the Firmware Version of Your Processor

Important: The RSLinx service must be installed and running on your computer in order for RSLogix to communicate with the processor. Refer to your RSLinx and RSLogix documentation for help configuring and troubleshooting these applications.

1. Connect an RS-232 serial cable from the COM (serial) port on your PC to the communication port on the front of the processor.
2. Start RSLogix 5000 and close any existing project that may be loaded.
3. Open the **COMMUNICATIONS** menu and choose **GO ONLINE**. RSLogix will establish communication with the processor. This may take a few moments.
4. When RSLogix has established communication with the processor, the *Connected To Go Online* dialog box will open.



5 On the *Connected To Go Online* dialog box, click the **GENERAL** tab. This tab shows information about the processor, including the *Revision* (firmware) version. In the following illustration, the firmware version is 17.2.

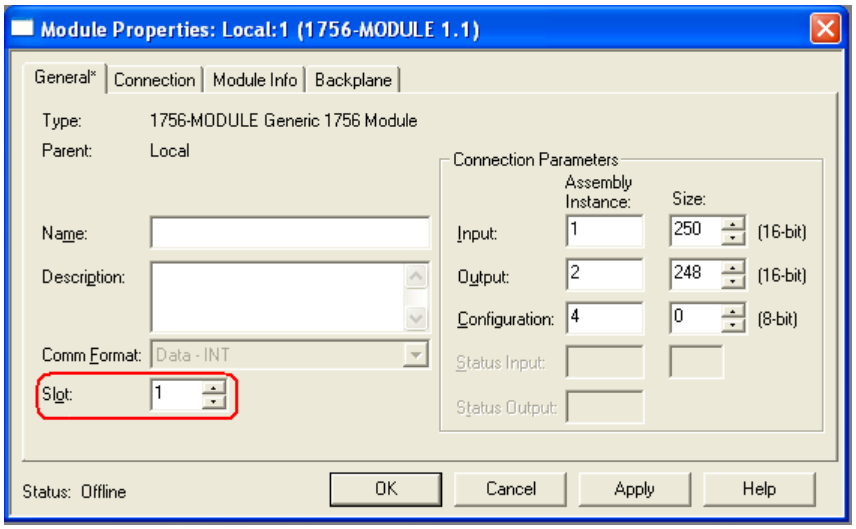


Selecting the Slot Number for the Module

This sample application is for a module installed in Slot 1 in a ControlLogix rack. The ladder logic uses the slot number to identify the module. If you are installing the module in a different slot, you must update the ladder logic so that program tags and variables are correct, and do not conflict with other modules in the rack.

Changing the slot number

1. In the *Controller Organization* list, select the module and then click the right mouse button to open a shortcut menu.
2. On the shortcut menu, choose **PROPERTIES**. This action opens the *Module Properties* dialog box.



3. In the *Slot* field, use the spinners on the right side of the field to select the slot number where the module will reside in the rack, and then click **OK**.

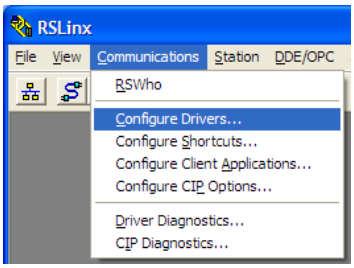
RSLogix will automatically apply the slot number change to all tags, variables and ladder logic rungs that use the MVI56E-FLN slot number for computation.

Configuring the RSLinx Driver for the PC COM Port

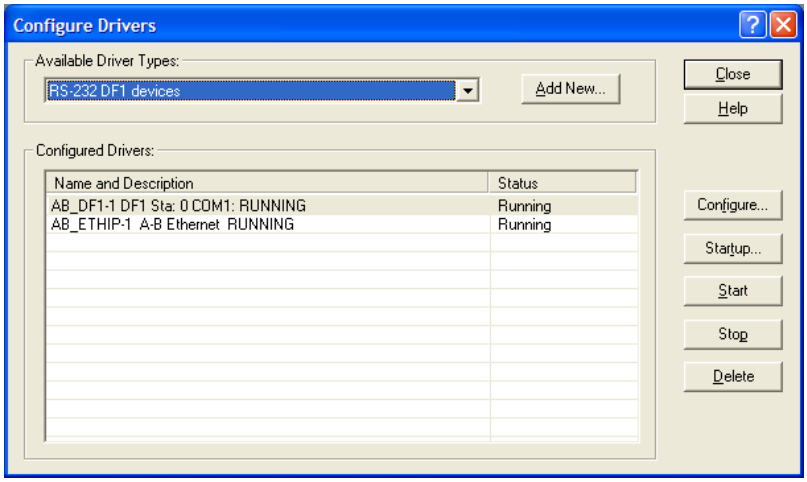
If RSLogix is unable to establish communication with the processor, follow these steps.

1 Open *RSLinx*.

2 Open the **COMMUNICATIONS** menu, and choose **CONFIGURE DRIVERS**.

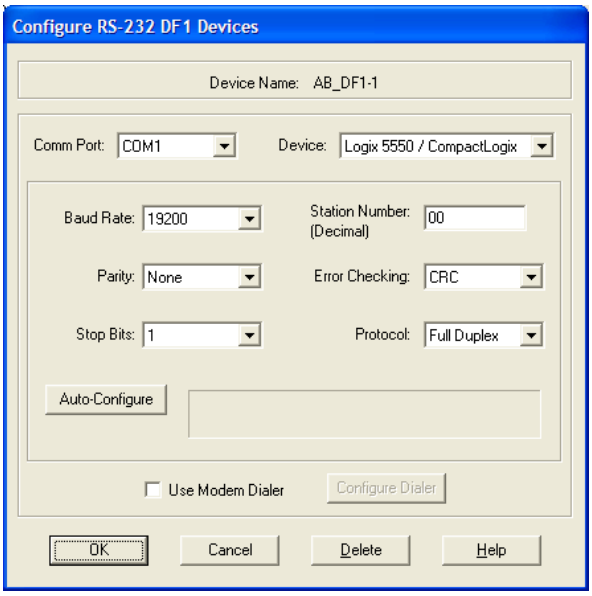


This action opens the *Configure Drivers* dialog box.



Note: If the list of configured drivers is blank, you must first choose and configure a driver from the Available Driver Types list. The recommended driver type to choose for serial communication with the processor is *RS-232 DF1 Devices*.

3 Click to select the driver, and then click **CONFIGURE**. This action opens the *Configure RS-232 DF1 Devices* dialog box.



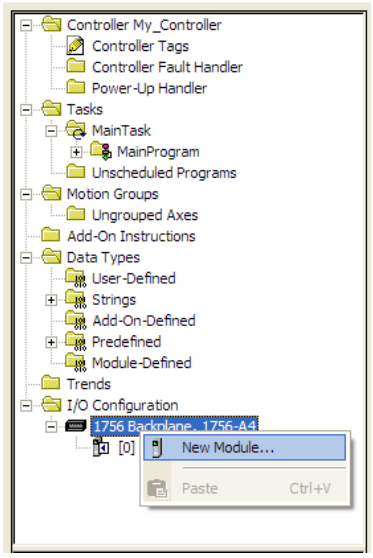
4 Click the **AUTO-CONFIGURE** button. *RSLinx* will attempt to configure your serial port to work with the selected driver.

5 When you see the message *Auto Configuration Successful*, click the **OK** button to dismiss the dialog box.

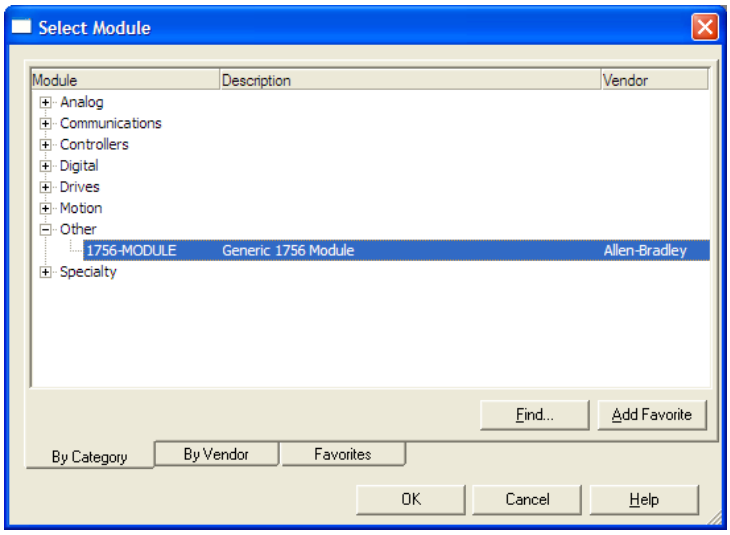
Note: If the auto-configuration procedure fails, verify that the cables are connected correctly between the processor and the serial port on your computer, and then try again. If you are still unable to auto-configure the port, refer to your *RSLinx* documentation for further troubleshooting steps.

1.10.2 Adding the Module to an Existing Project

1 Select the *I/O Configuration* folder in the *Controller Organization* window of RSLogix 5000, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **NEW MODULE**.



This action opens the *Select Module* dialog box:

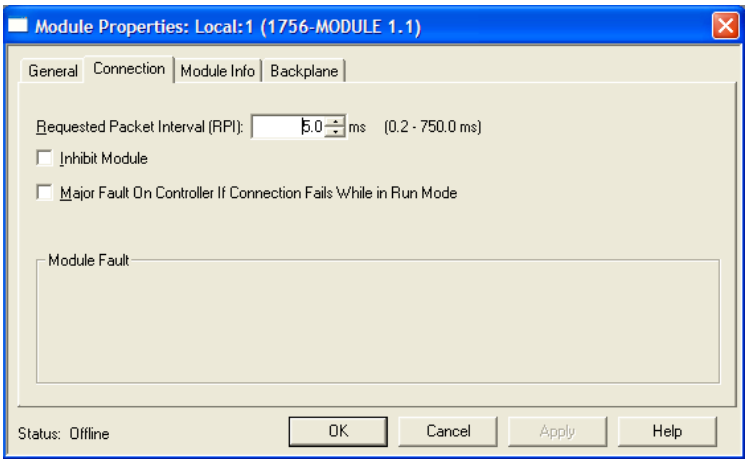


2 Select the **1756-MODULE (GENERIC 1756 MODULE)** from the list and click **OK**. This action opens the *New Module* dialog box.

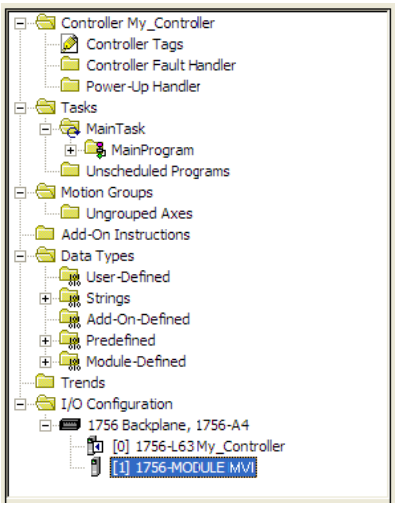
3 Enter the *Name, Description* and *Slot* options for your application. You must select the *Comm Format* as **DATA - INT** in the dialog box, otherwise the module will not communicate. Click **OK** to continue.

Parameter	Value
Name	Enter a module identification string. Example: **FLN_2**
Description	Enter a description for the module. Example: **FA CONTROL NETWORK COMMUNICATION MODULE**
Comm Format	Select **DATA-INT**.
Slot	Enter the slot number in the rack where the MVI56E-FLN module is located.
Input Assembly Instance	**1**
Input Size	**250**
Output Assembly Instance	**2**
Output Size	**248**
Configuration Assembly Instance	**4**
Configuration Size	**0**

4 Select the *Requested Packet Interval* value for scanning the I/O on the module. This value represents the minimum frequency that the module will handle scheduled events. This value should not be set to less than **1** millisecond. The default value is **5** milliseconds. Values between **1** and **10** milliseconds should work with most applications.



5 Save the module. Click **OK** to dismiss the dialog box. The *Controller Organization* window now displays the module's presence.

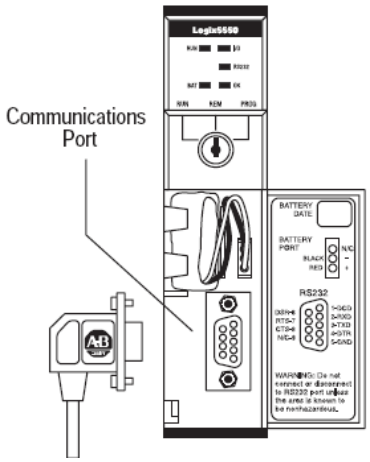


6 Copy the *User-Defined Data Types* from the sample program into your existing RSLogix 5000 project.
7 Copy the *Controller Tags* from the sample program into your project.
8 Copy the *Ladder Rungs* from the sample program into your project.

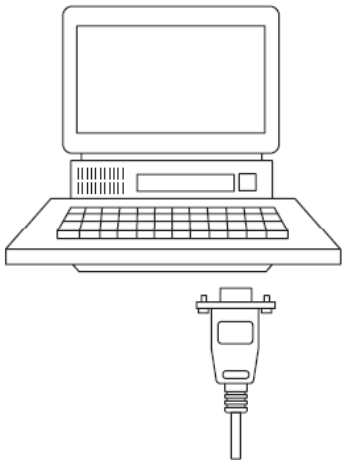
1.10.3 Connecting Your PC to the ControlLogix Processor

There are several ways to establish communication between your PC and the ControlLogix processor. The following steps show how to establish communication through the serial interface. It is not mandatory that you use the processor's serial interface. You may access the processor through whatever network interface is available on your system. Refer to your Rockwell Automation documentation for information on other connection methods.

1 Connect the right-angle connector end of the cable to your controller at the communications port.



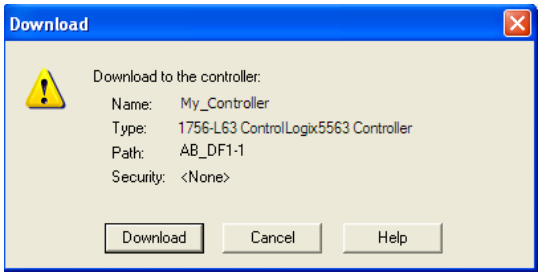
2 Connect the straight connector end of the cable to the serial port on your computer.



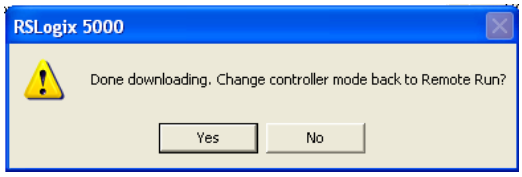
1.10.4 Downloading the Sample Program to the Processor

Note: The key switch on the front of the ControlLogix processor must be in the REM or PROG position.

1. If you are not already online with the processor, open the *Communications* menu, and then choose **DOWNLOAD**. RSLogix 5000 will establish communication with the processor. You do not have to download through the processor's serial port, as shown here. You may download through any available network connection.
2. When communication is established, RSLogix 5000 will open a confirmation dialog box. Click the **DOWNLOAD** button to transfer the sample program to the processor.



3. RSLogix 5000 will compile the program and transfer it to the processor. This process may take a few minutes.
4. When the download is complete, RSLogix 5000 will open another confirmation dialog box. If the key switch is in the REM position, click **OK** to switch the processor from PROGRAM mode to RUN mode.



Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

2 Configuring the MVI56E-FLN Module

The purpose of this section of the User Manual is to show the MVI56E-FLN functionality through a typical real-world application. For this example application, the MVI56E-FLN is shown communicating with a Toyoda FL/ET-T-V2 communication module that transfers the data to a TOYODA PC3JG-P processor located on the same rack.

For this example, the MVI56E-FLN node address is 40, and the FL/ET-T-V2 module node address is 10.

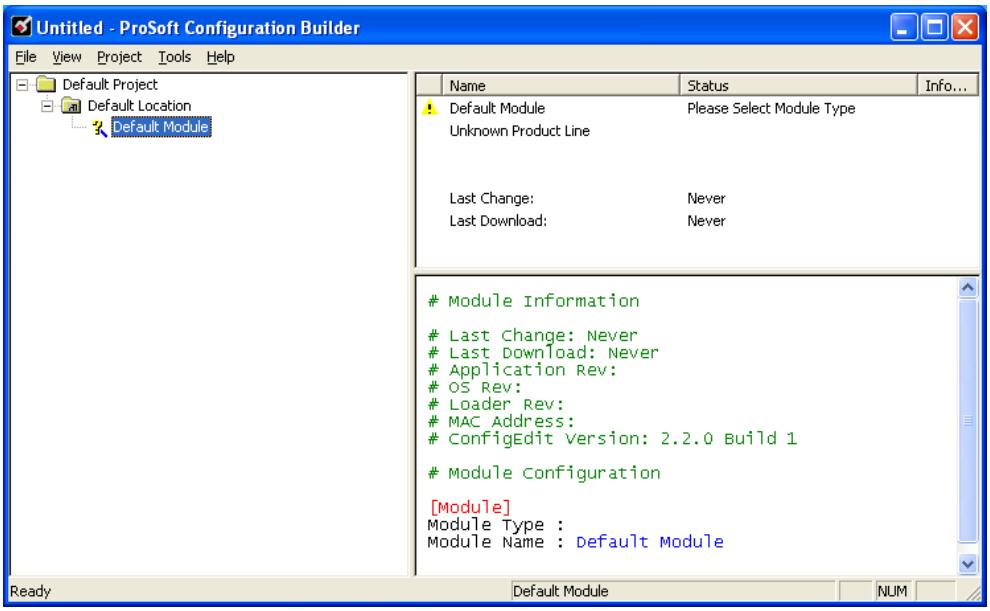
2.1 Using ProSoft Configuration Builder Software

ProSoft Configuration Builder (PCB) provides a quick and easy way to manage module configuration files customized to meet your application needs. *PCB* is not only a powerful solution for new configuration files, but also allows you to import information from previously installed (known working) configurations to new projects.

Note: During startup and initialization, the MVI56E-FLN module receives its protocol and backplane configuration information from the installed Personality Module (Compact Flash). Use *ProSoft Configuration Builder* to configure module settings and to download changes to the Personality Module.

2.1.1 Setting Module Parameters

Notice that the contents of the information pane and the configuration pane changed when you added the MVI56E-FLN module to the project.



At this time, you may wish to rename the *Default Project* and *Default Location* folders in the tree view.

Renaming an Object

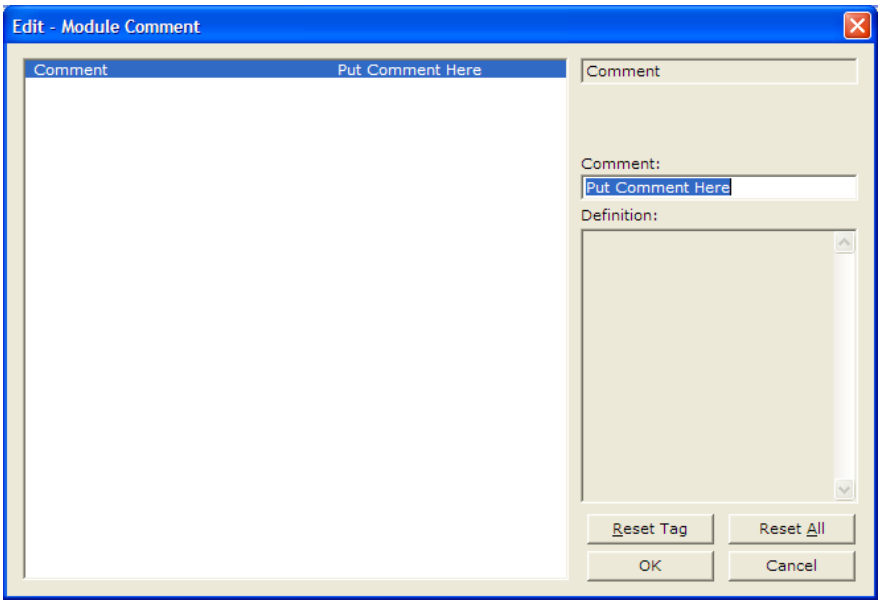
1. Select the object, and then click the right mouse button to open a shortcut menu. From the shortcut menu, choose **RENAME.**
2. Type the name to assign to the object.
3. Click away from the object to save the new name.

Configuring Module Parameters

1. Click on the **[+]** sign next to the module icon to expand module information.
2. Click on the **[+]** sign next to any icon to view module information and configuration options.
3. Double-click any icon to open an *Edit* dialog box.
4. To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
5. Click **OK** to save your changes.

Creating Optional Comment Entries

1 Click the **[+]** to the left of the Comment icon to expand the module comments.
2 Double-click the Module Comment icon. The *Edit - Module Comment* dialog box appears.



3 Enter your comment and click **OK** to save your changes.

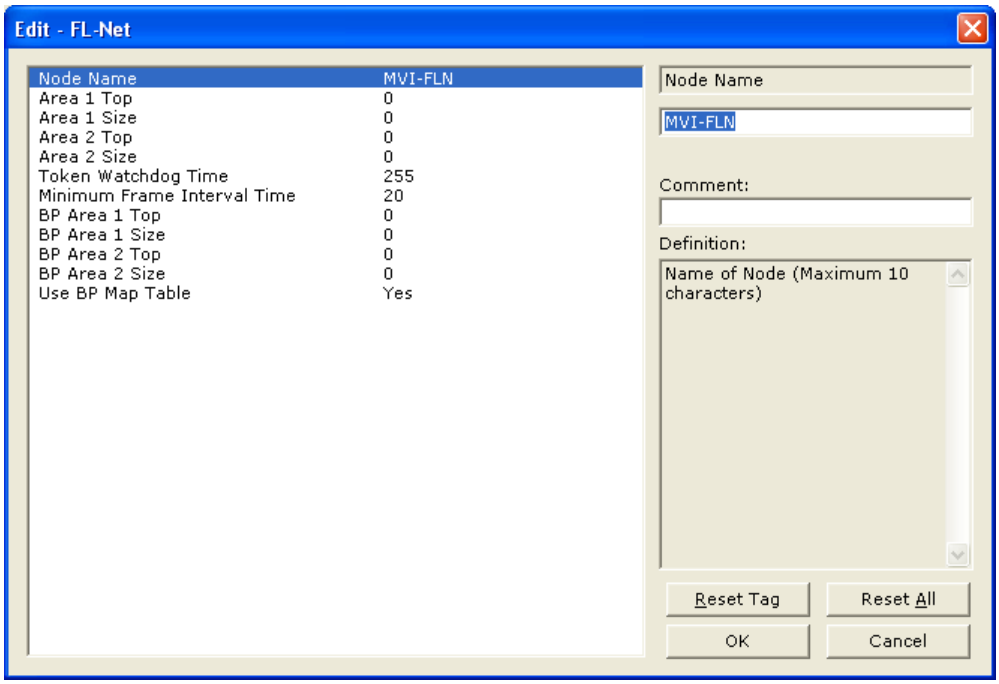
Printing a Configuration File

1 Select the module icon, and then click the right mouse button to open a shortcut menu.
2 On the shortcut menu, choose **VIEW CONFIGURATION.** This action opens the *View Configuration* window.
3 In the *View Configuration* window, open the **FILE** menu, and choose **PRINT.** This action opens the *Print* dialog box.
4 In the *Print* dialog box, choose the printer to use from the drop-down list, select printing options, and then click **OK.**

2.2 Module Configuration

2.2.1 FL-net

Configure the module to properly transfer data between the ControlLogix processor and the remote FL-net node (Toyoda PLC - TPLC).



Node Name

Up to 10 ASCII characters

This is a user-defined node identification.

It can be set from the upper layer or by a network parameter write message.

When it is set from the network by using message transmission, the node does not secede from the network if only the node name is changed, continuing communication.

Area Parameters

The ranges of the top addresses (starting addresses) and sizes of Common Memory Areas 1 and 2 are as follows.

	Parameter Range (Words)	
	Top Address	**Area Size**
Area 1	0 to 511	0 to 512
Area 2	0 to 8191	0 to 8192

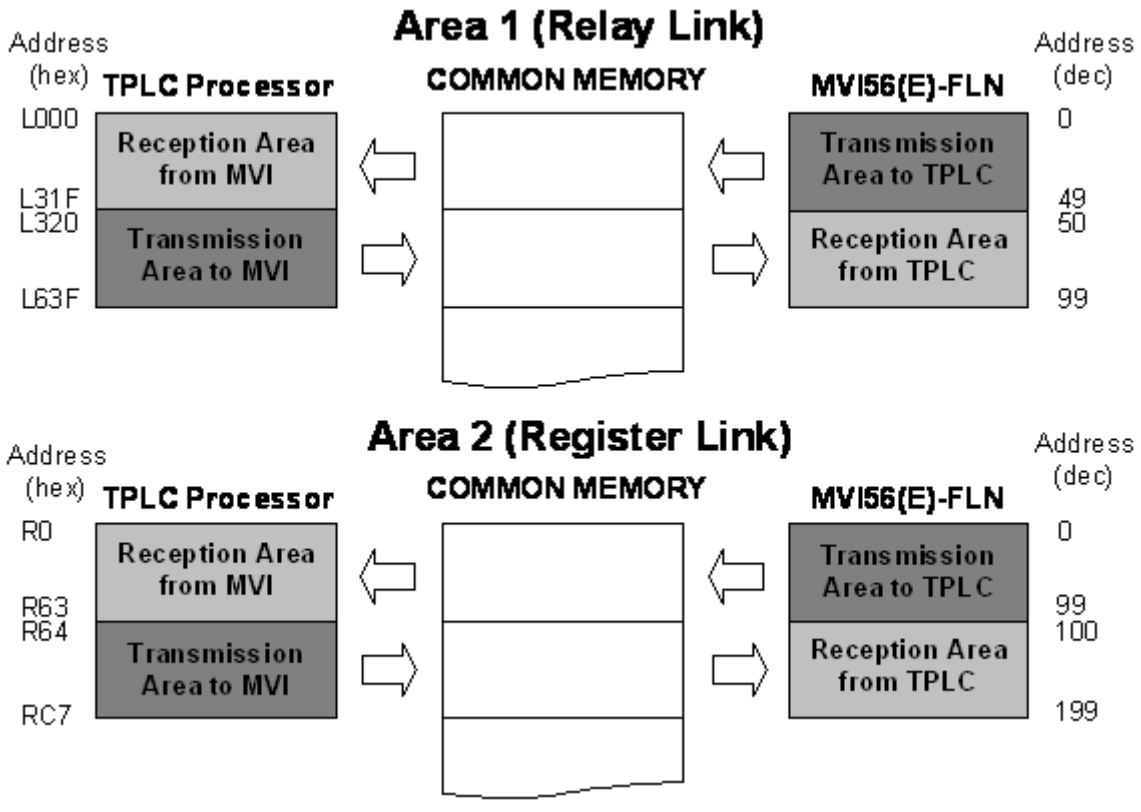
These parameters can be set from the upper layer or by a network parameter write message.

When nodes receive a network parameter write message for setting these parameters, the node secedes from the network and rejoins the network in the halfway participation status.

Unless they are set from the upper layer, the node is regarded as having no transmitting area. At this time, however, a token is exchanged.

Configuring Area 1 and Area 2

Each area is defined by its starting address (top address) and word length (size). The following illustration shows the starting addresses and word lengths used in the sample application:



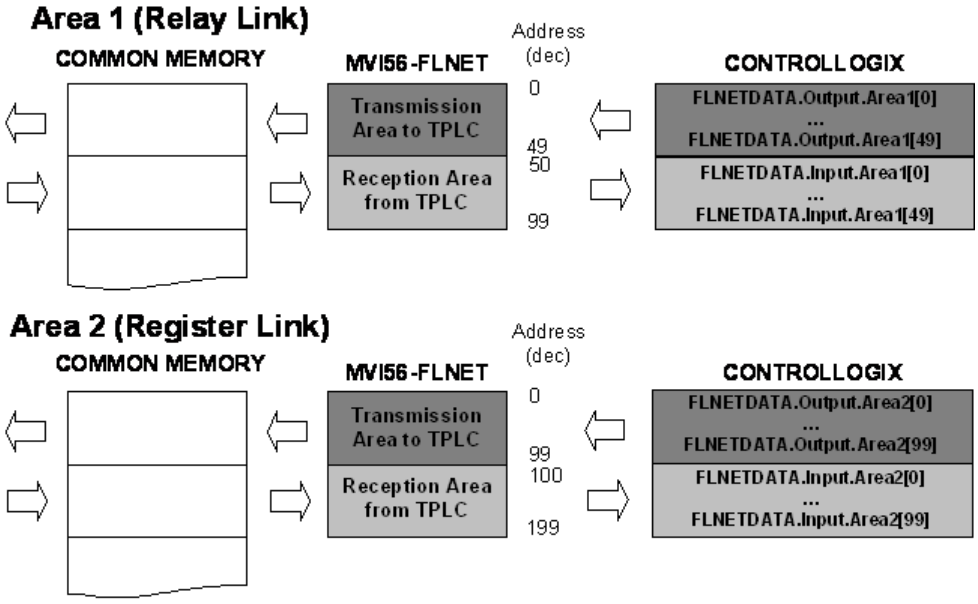
Use the following settings to configure the data to transfer from the module to the remote node. This data is transferred from the ControlLogix processor to the MVI56E-FLN module through the *FLNETDATA.Output.Area1* and *FLNETDATA.Output.Area2* controller tag arrays.

Area 1 Top : 0
Area 1 Size : 50
Area 2 Top : 0
Area 2 Size : 100

Use the following settings to configure the data to transfer from the Common Memory to the processor. This data is transferred from the MVI56E-FLN module to the ControlLogix processor through the *FLNETDATA.Input.Area1* and *FLNETDATA.Input.Area2* controller tag arrays.

BP Area 1 Top : 50
BP Area 1 Size : 50
BP Area 2 Top : 100
BP Area 2 Size : 100

The next illustration shows how the data is transferred through the module between Common Memory and the ControlLogix processor controller tags arrays:



Token Watchdog Time

1 to **255** milliseconds

The *Token Watchdog Time* (also known as Token Monitoring Time) value is unique for each node and is set from the FA link protocol upper layer as the initial value. If this value is not set, the node is inoperable.

The *Token Watchdog Time* is notified to all nodes as information on the frame header. Each node uses the value on the frame from each node as a value of the monitoring time until the token-holding node releases the token.

Minimum Frame Interval Time

0 to **50** (in units of 100 milliseconds)

This interval value is a unique for each node and is set from the FA link protocol upper layer as the initial value. If this value is not set, the node is inoperable.

The allowable minimum frame interval means

- The time interval between reception of a token by a node and and transmission of any frame from the node

or

- The time interval between frames transmitted (from the end of the previous frame until the beginning of the next frame) The allowable minimum frame interval of each node is notified to all nodes as information on the frame header. Each node obtains the maximum value from it and recognizes it as the allowable minimum frame interval to use.

Important Note: For this module to operate correctly on an FL-net network, the *Minimum Frame Interval Time* must be set to a value of **20** or more for all nodes on the network. If nodes on the network have values less than **20** for this parameter, the module may not be able to join the network.

2.2.2 Ethernet Configuration

Use this procedure to modify the temporary Ethernet settings you set for your module in the section on Setting Up a Temporary IP Address (page 12). Here you assign two sets of IP address, subnet mask, and gateway address values, one for each of the two Ethernet ports on the module. The IP address for module's *E1* port, which is used exclusively for configuring the module, is entered in the *my_ip* parameter set. The IP address for the module's *E2* port, which is used exclusively for the FL-net network data transfer application, is entered in the *my_ip1* parameter set.

1 Determine the network settings for the two ports on your module, with the help of your network administrator if necessary. You will need the following information:

For the configuration port *E1*:

- *my_ip* - IP address (fixed IP req.) _____ . _____ . _____ . _____
- *netmask* - Subnet mask _____ . _____ . _____ . _____
- *gateway* - Gateway address _____ . _____ . _____ . _____

For the FL-net application port *E2*:

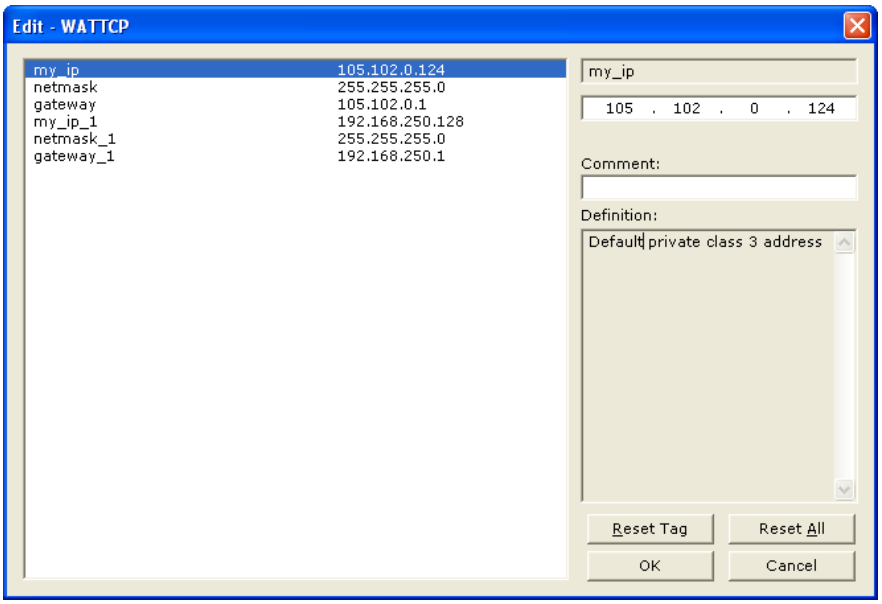
- *my_ip1* - IP address (fixed IP req.) _192_ . _168_ . _250_ . _XXX_
- *netmask* - Subnet mask _____ . _____ . _____ . _____
- *gateway* - Gateway address _____ . _____ . _____ . _____

Note: The gateway address is optional and is not required for networks that do not use a default gateway.

The last octet of the *my_ip1* address (XXX, above) will be the module's FL-net node address on the FA Control network.

Note: Both IP addresses must be configured for different networks. This module will not communicate if both IP addresses are located on the same network.

2 Double-click the **ETHERNET CONFIGURATION** icon. This action opens the *Edit* dialog box.



3 Edit the values.
4 When you are finished editing, click **OK** to save your changes and return to the *ProSoft Configuration Builder* main window.

Node Number

Node number	Applications
1 to 249	Used for standard FL-net (Version 2.00) devices.
250 to 254	Used for FL-net (Version 2.00) maintenance purposes.
255	Reserved for internal system use (used for broadcasting not available to users).
0	Reserved for internal system use.

A device's node number is the last octet of its IP address.

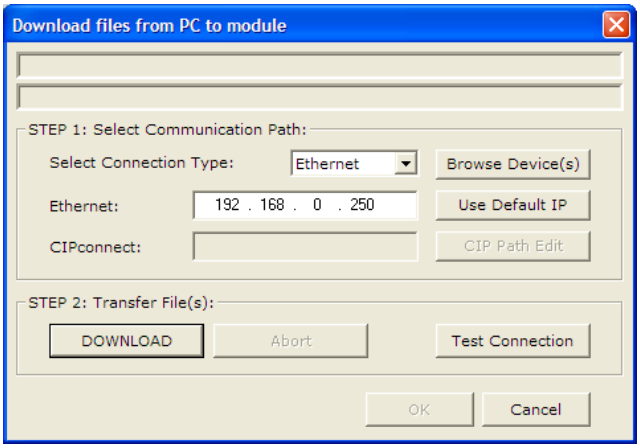
Without a node number, the node is inoperable. If, while joining a network, a node detects another node with an identical node number, it will not transmit any data on the network.

2.3 Downloading the Project to the Module

In order for the module to use the settings you configured, you must download (copy) the updated Project file from your PC to the module.

1. In the tree view in *ProSoft Configuration Builder*, click once to select the MVI56E-FLN module.
2. Open the **PROJECT** menu, and then choose **MODULE / DOWNLOAD.**

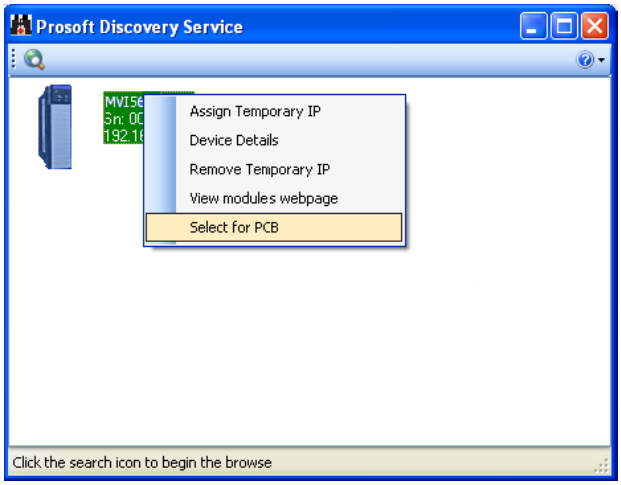
   This action opens the *Download* dialog box. Notice that the Ethernet address field contains the IP address you assigned in the previous step or the temporary IP you assigned in the previous chapter. *ProSoft Configuration Builder* will use this IP or temporary IP address to connect to the module.



   Click **TEST CONNECTION** to verify that the IP address is allows access to the module.
3. If the connection succeeds, click **DOWNLOAD** to transfer the Ethernet configuration to the module.

If the *Test Connection* procedure fails, you will see an error message. To correct the error, follow these steps.

1. Click **OK** to dismiss the error message.
2. On the *Download* dialog box, click **BROWSE DEVICES** to open *ProSoft Discovery Service*.



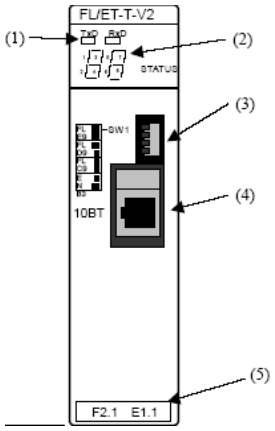
3. Select the module, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **SELECT FOR PCB**.
4. Close *ProSoft Discovery Service*.
5. Click **DOWNLOAD** to transfer the configuration to the module.

2.4 Configuring the FL-net Device

2.4.1 Setting Up the FL/ET-T-V2 Module

Setting Operation Mode Switch

Select the correct operation mode through the switch (item 3 below)



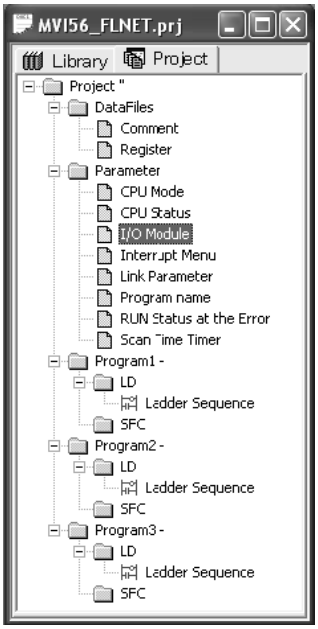
The following options are available. This procedure will consider the first option (ID Code = C9 - 8kbytes of Link Memory Capacity)

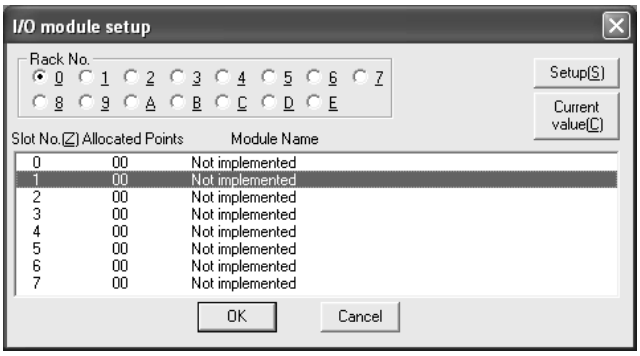
Switch Positions		I/O module ID Code	Link Memory Capacity	Data Link Capacity (maximum number of total words in reception and transmission areas)
4 3 2 1	1 & 2 off	C9	8 kbytes	Relay link: 2048 points (128 words) (*2) Register link: 2048 words (*1)
4 3 2 1	1 off, 2 on	D9	16 kbytes	Relay link: 2048 points (128 words) (*2) Register link: 6144 words (* 1)
4 3 2 1	1 & 2 on	E9	32 kbytes	Relay link: 2048 points (128 words) (*2) Register link: 8192 words (*1)
4 3 2 1	1 on, 2 off	B3	4 kbytes	The module is operated as Ethernet.

2.4.2 FL/ET-V2 Configuration with PCwin

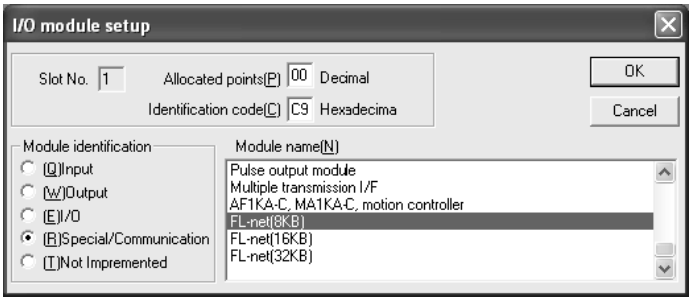
Specifying I/O Module ID Code

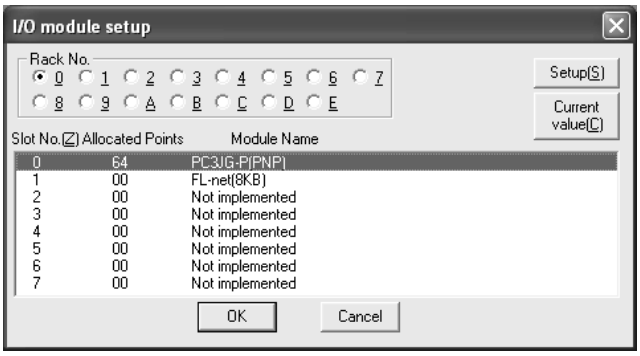
1 Expand the *Parameter* folder, and double-click **I/O MODULE**.





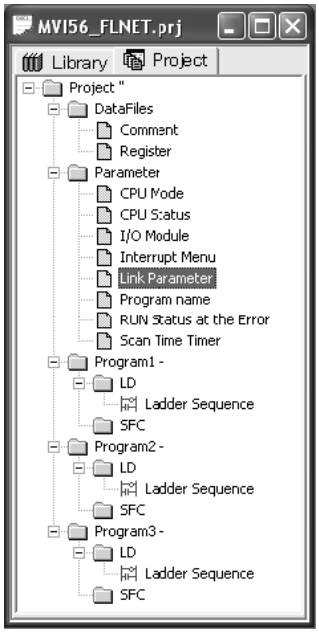
2 Select the FL-net module.



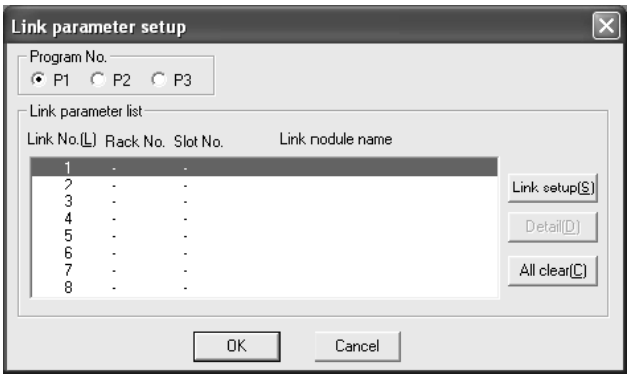


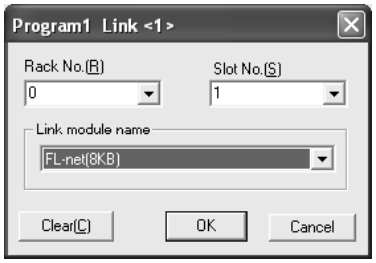
Setting Up the FL/ET-V2 Link Parameters

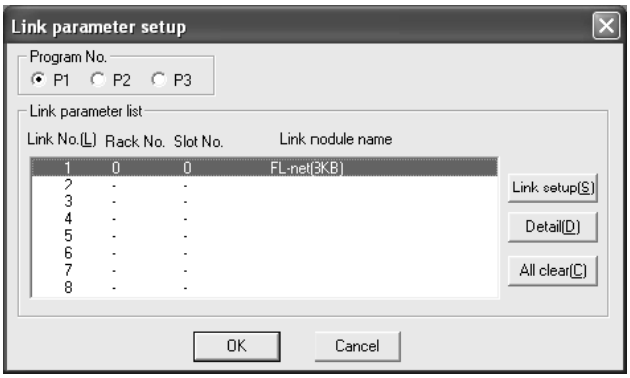
1 Double-click **LINK PARAMETER**.



2 Select the link number to assign to the FL/ET-T-V2 module. For this example, use Link No 1 for the FL/ET-T-V2 module. Double click the link row and configure the correct slot, rack and module for link 1 as shown in the following illustrations:

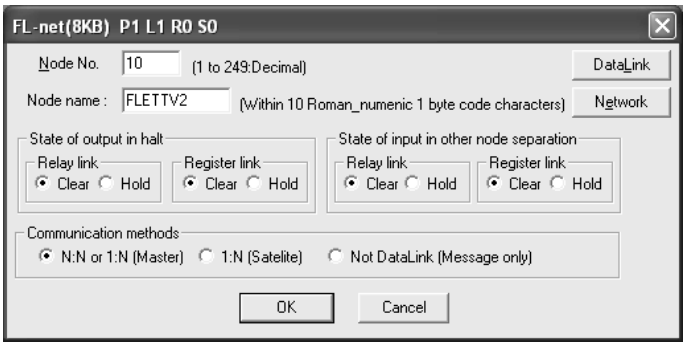




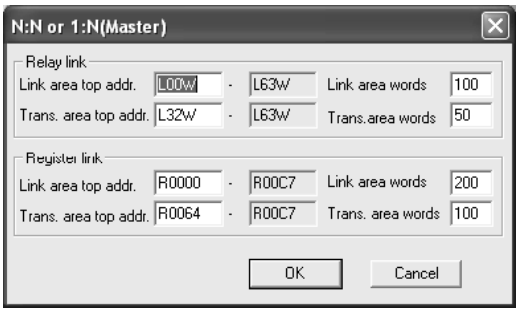


3 Click the **DETAIL** button to configure the following link parameters:

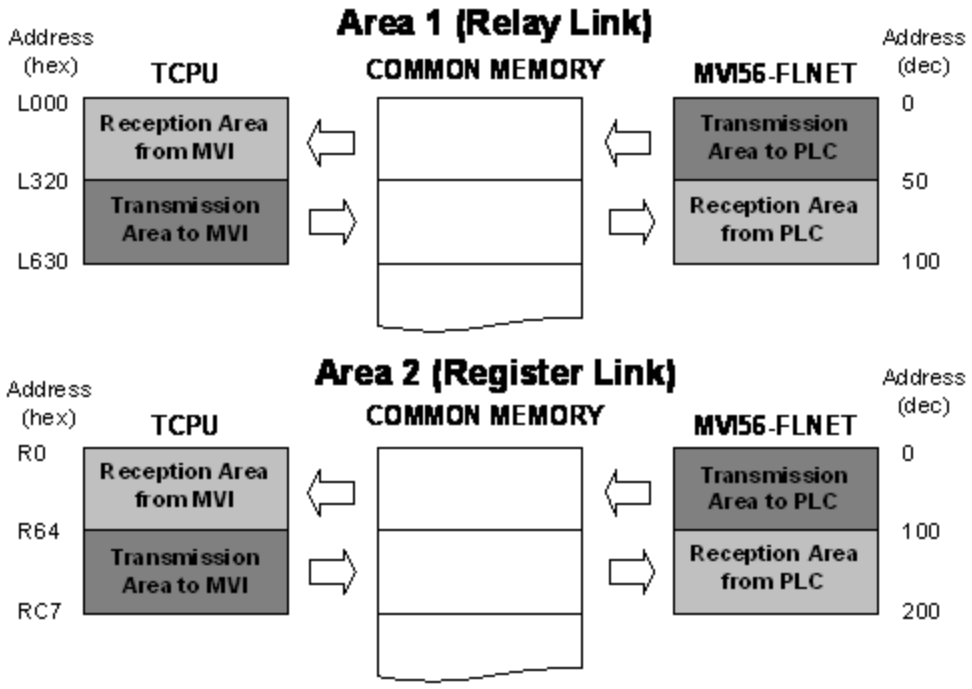
Node Number = 10
Communication Method = N:N or 1:N (Master)



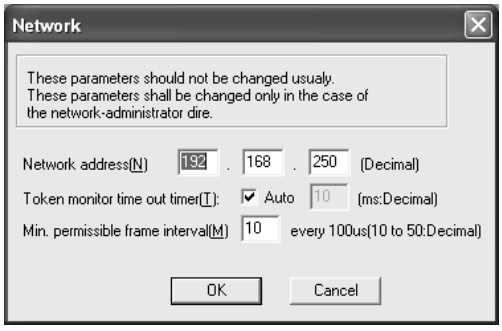
4 Click the **DATA LINK** button to configure the common memory that will be shared by all participating nodes in communication.



For this example, the data transfer takes place as described in the following illustration (the Transmit Area in the TOYODA PLC must be configured inside the Link Area):

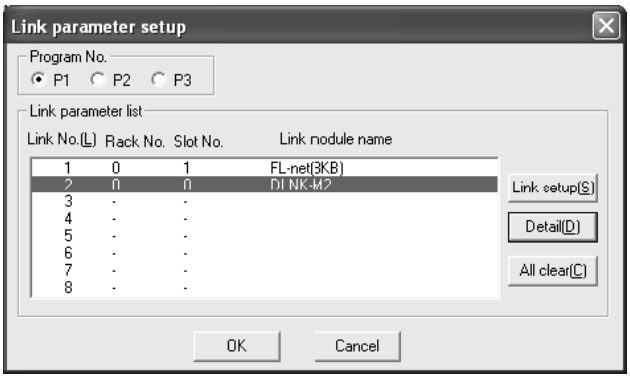


5 Click **OK** to close the *Data Link* window, and then click the **NETWORK** button. Configure the default parameters as shown in the following illustration:



Note: This configuration sets the node address of the FL/ET-T-V2 module to 192.168.250.10 (the node address was configured as 10).

For this example, the processor (rack 0 and slot 0) will be assigned as DLNK-M2. For more information about this topic, refer to the TOYODA PLC documentation.



2.4.3 Downloading the Project

Now save the project and download it to the TOYODA PLC.

2.4.4 Connecting the MVI56E-FLN Module to the FL/ET-T-V2

Use standard CA5 Ethernet cables to connect the Ethernet port on the MVI56E-FLN through a 10 Megabit Ethernet hub or switch to the Ethernet port on the FL/ET-T-V2 module.

Warning: The MVI56E-FLN module is NOT compatible with Power Over Ethernet (IEEE802.3af / IEEE802.3at) networks. Do NOT connect the module to Ethernet devices, hubs, switches or networks that supply AC or DC power over the Ethernet cable. Failure to observe this precaution may result in damage to hardware, or injury to personnel.

3 Diagnostics and Troubleshooting

The module provides information on diagnostics and troubleshooting in the following forms:

- LED status indicators on the front of the module provide information on the module's status.
- Status data contained in the module can be viewed in *ProSoft Configuration Builder* through the Ethernet port.
- Status data values are transferred from the module to the processor.

3.1 LED Status Indicators

3.1.1 Scrolling LED Status Indicators

The scrolling LED display indicates the module's operating status as follows:

Initialization Messages

Code	Message
Boot / DDOK	Module is initializing
Ladd	Module is waiting for required module configuration data from ladder logic to configure the application port(s)
Waiting for Processor Connection	Module did not connect to processor during initialization ▪ Sample ladder logic or AOI is not loaded on processor ▪ Module is located in a different slot than the one configured in the ladder logic/AOI ▪ Processor is not in RUN or REM RUN mode
Last config: <date>	Indicates the last date when the module changed its IP address. You can update the module date and time through the module's webpage, or with the optional MVI56E Advanced Add-On Instruction.

Code	Message
C0 (Client): CmdCnt: X MinDly : X CmdOffs: X RespTmout : X Retries : X ErrOffs : X ARPTmout : X ErrDelay : X FltFlag : X FltSt : X FltOffs : X SVR (server) : BIOffs: X WIOffs : X OutOffs : X HoldOffs : X FltFlag : X FltSt : X FltSt : X CommTmout : X	After power up and every reconfiguration, the module will display the configuration of the application port(s). The information consists of: **Client** ▪ CmdCnt : number of commands configured for the Client ▪ MinDly : Minimum Command Delay parameter ▪ CmdOffs : Command Error Pointer parameter ▪ RespTmout : Response Timeout parameter ▪ Retries : Retry Count parameter ▪ ErrOffs : Error/Status Offset parameter ▪ ARPTmout : ARP Timeout parameter ▪ ErrDelay: Command Error Delay parameter ▪ FltFlag: Float Flag parameter ▪ Flt St : Float Start parameter ▪ FltOffs : Float Offset parameter **Server** ▪ BIOffs: Bit Input Offset parameter ▪ WIOffs : Word Input Offset parameter ▪ OutOffs : Output offset parameter ▪ HoldOffs : Holding Register offset parameter ▪ FltFlag: Float Flag parameter ▪ FltSt : Float Start parameter ▪ FltOffs : Float Offset parameter

Operation Messages

After the initialization step, the following message pattern will be repeated.

<Backplane Status> <IP Address> <Backplane Status> <Port Status>

Code	Message
<Backplane Status>	OK: Module is communicating with processor ERR: Module is unable to communicate with processor. For this scenario, the <Port Status> message above is replaced with "Processor faulted or is in program mode".
<IP Address>	Module IP address
<C0>	OK: Port is communicating without error Communication Errors: port is having communication errors. Refer to Diagnostics and Troubleshooting (page 46) for further information about the error.

3.1.2 Ethernet LED Indicators

The Ethernet LEDs indicate the module's Ethernet port status as follows:

LED	State	Description
10/100	Off	No activity on the Ethernet port.
	Green Flash	The Ethernet port is actively transmitting or receiving data.
LINK/ACT	Off	No physical network connection is detected. No Ethernet communication is possible. Check wiring and cables.
	Green Solid	Physical network connection detected. This LED must be On solid for Ethernet communication to be possible.

3.1.3 Non-Scrolling LED Status Indicators

The non-scrolling LEDs indicate the module's operating status as follows:

LED Label	Color	Status	Indication
LER (FL-net Link Status LED)	Red or Green	OFF	The module is not receiving adequate power or is not securely plugged into the rack. May also be OFF during configuration download.
		GREEN	The MVI56E-FLN is 'in-ring' and working normally.
		RED	The most common cause is that the module has detected a communication error during operation of its application port. The following conditions may also cause a RED LED: ▪ The module is 'out-ring' or has a duplicate node number (Watchdog timeout error or Wait error may cause this) ▪ The module is rebooting due to a ColdBoot or WarmBoot request from the ladder logic or Debug Menu ▪ The firmware is initializing during startup ▪ The firmware detects an on-board hardware problem during startup ▪ Failure of application port hardware during startup ▪ The module is shutting down
OK	Red or Green	OFF	The module is not receiving adequate power or is not securely plugged into the rack.
		GREEN	The module is operating normally.
		RED	The module is initializing, has detected an internal error, or is re-booting. If the LED remains RED for over 10 seconds, the module is not working. Remove it from the rack and re-insert it to restart its internal program.

3.2 Troubleshooting

Use the following troubleshooting steps if you encounter problems when the module is powered up. If these steps do not resolve your problem, please contact ProSoft Technology Technical Support.

Processor Errors

Problem Description	Steps to take
Processor Fault	Verify that the module is plugged into the slot that has been configured for the module in the I/O Configuration of RSLogix. Verify that the slot location in the rack has been configured correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. A problem could exist between the processor and any installed I/O module, not just the MVI56E-FLN. Verify that all modules in the rack are correctly configured in the ladder logic.

Module Errors

Problem Description	Steps to take
MVI56E modules with scrolling LED display: *<Backplane Status>* condition reads ERR	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: ▪ The processor is in RUN or REM RUN mode. ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write data block transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is properly configured in the processor I/O configuration and ladder logic.
OK LED remains RED	The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert the card in the rack, and then restore power to the rack.

3.3 Clearing a Fault Condition

Typically, if the OK LED on the front of the module turns RED for more than ten seconds, a hardware problem has been detected in the module or the program has exited.

To clear the condition, follow these steps:

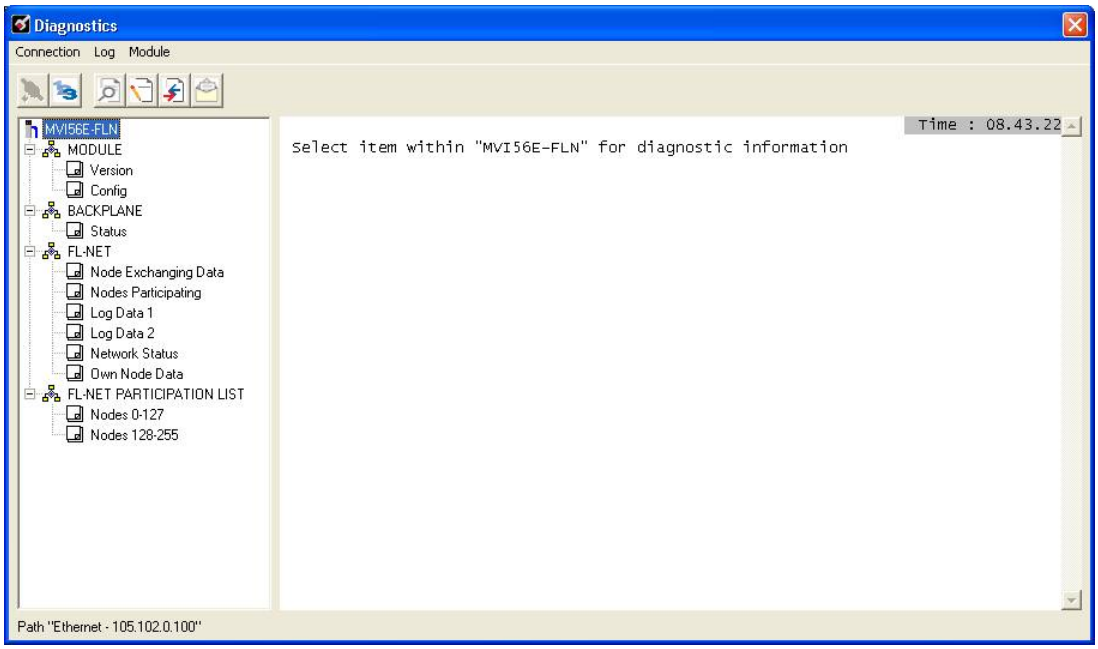
1. Turn off power to the rack.
2. Remove the card from the rack.
3. Verify that all jumpers are set correctly.
4. If the module requires a Compact Flash card, verify that the card is installed correctly.
5. Re-insert the card in the rack and turn the power back on.
6. Verify correct configuration data is being transferred to the module from the ControlLogix controller.

If the module's OK LED does not turn GREEN, verify that the module is inserted completely into the rack. If this does not cure the problem, contact ProSoft Technology Technical Support.

3.4 The Diagnostics Menu

The following sections describe several items in the *Diagnostics* menu useful for verifying communication in a newly set-up module. For information on the remaining menu items, see *Diagnostics Menu Items*.

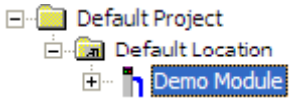
The *Diagnostics* menu for this module is arranged as a tree structure, with the *Main* menu at the top of the tree, and one or more submenus for each menu command. The first menu you see when you connect to the module is the *Main* menu.



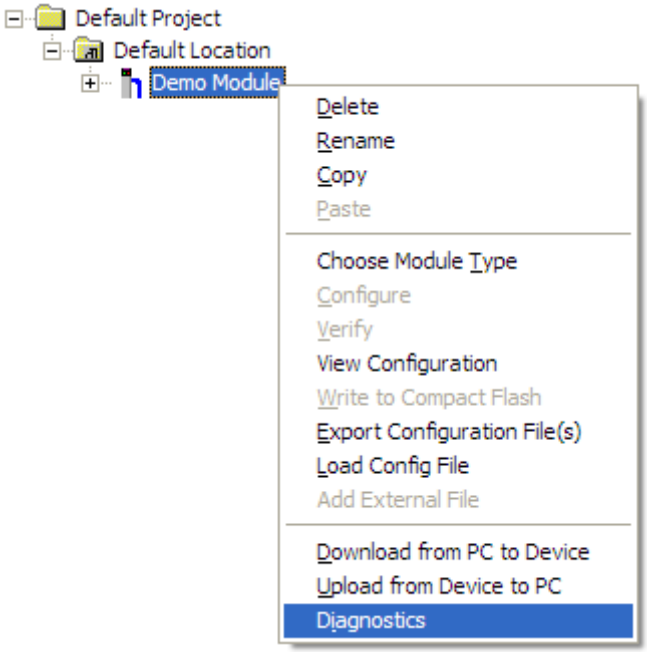
3.4.1 Connecting to the Diagnostics Menu in ProSoft Configuration Builder

To connect to the module's Configuration/Debug Ethernet port:

1 In *ProSoft Configuration Builder*, select the module, and then click the right mouse button to open a shortcut menu.

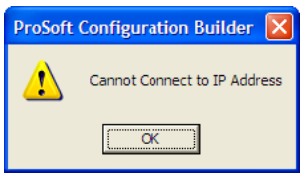


2 On the shortcut menu, choose **DIAGNOSTICS.**



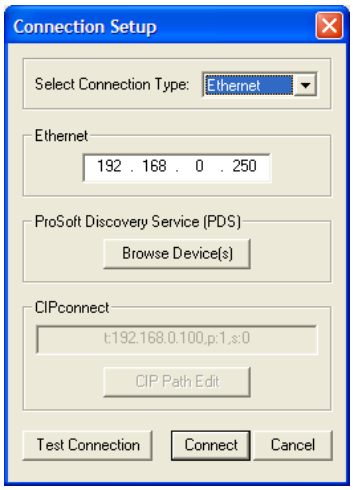
This action opens the *Diagnostics* dialog box.

If there is no response from the module:



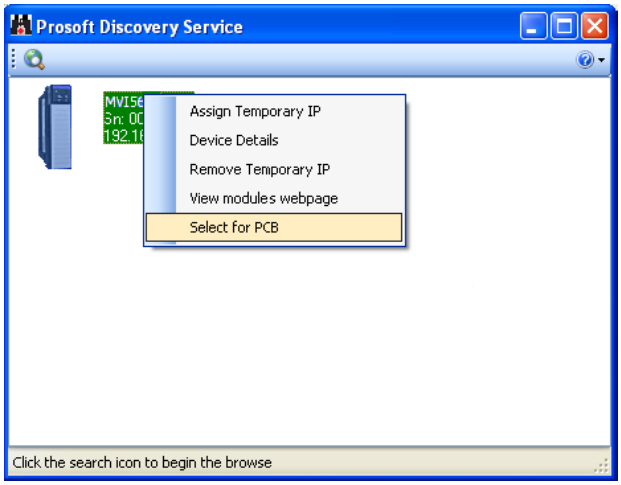
1 Click the **SET UP CONNECTION** button to browse for the module's IP address.

2 In the *Connection Setup* dialog box, click the **TEST CONNECTION** button to verify if the module is accessible with the current settings.



If *PCB* is still unable to connect to the module:

1 Click the **BROWSE DEVICE(S)** button to open the *ProSoft Discovery Service*. Select the module, then right-click and choose **SELECT FOR PCB**.



2 Close *ProSoft Discovery Service*, and click the **CONNECT** button again.

3 If all of these troubleshooting steps fail, verify that the Ethernet cable is connected properly between your computer and the module, either through a hub or switch (using a standard Ethernet cable) or directly between your computer and the module (using an Ethernet crossover-cable).

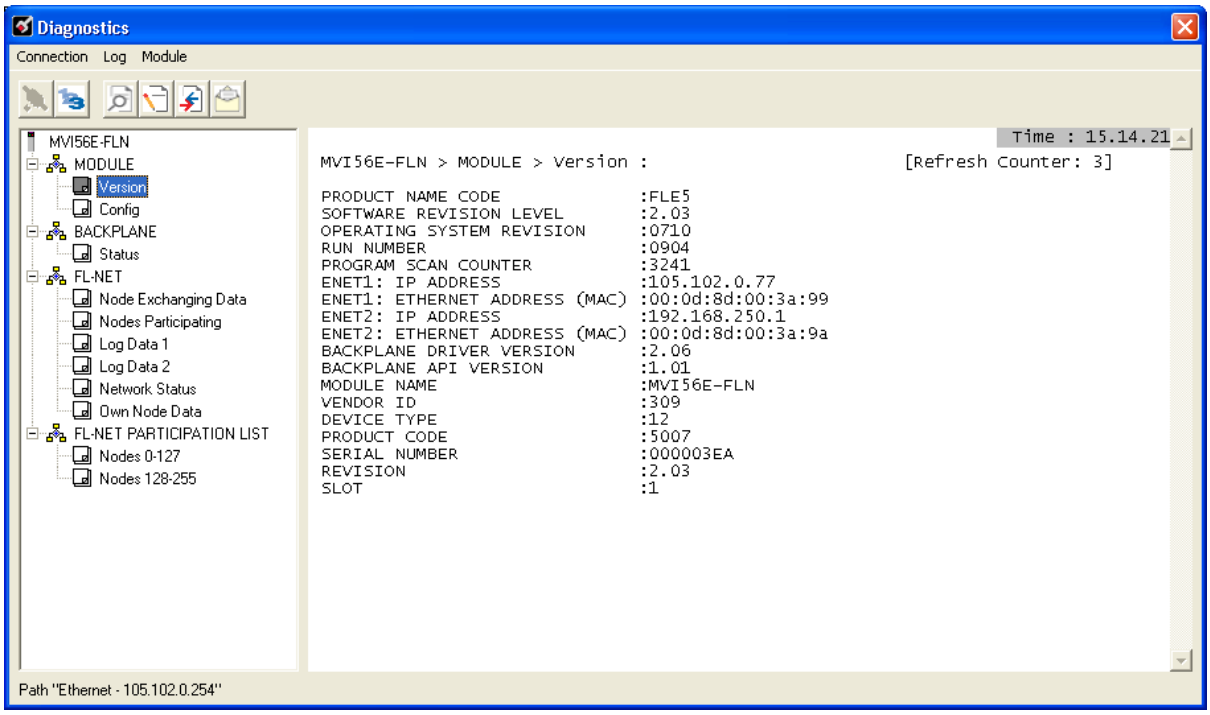
If you are still not able to establish a connection, contact ProSoft Technology for assistance.

3.4.2 Monitoring Module Information

Use the *MODULE* menu to view configuration and hardware information for the MVI56E-FLN module's backplane and Ethernet application port.

Viewing Version Information

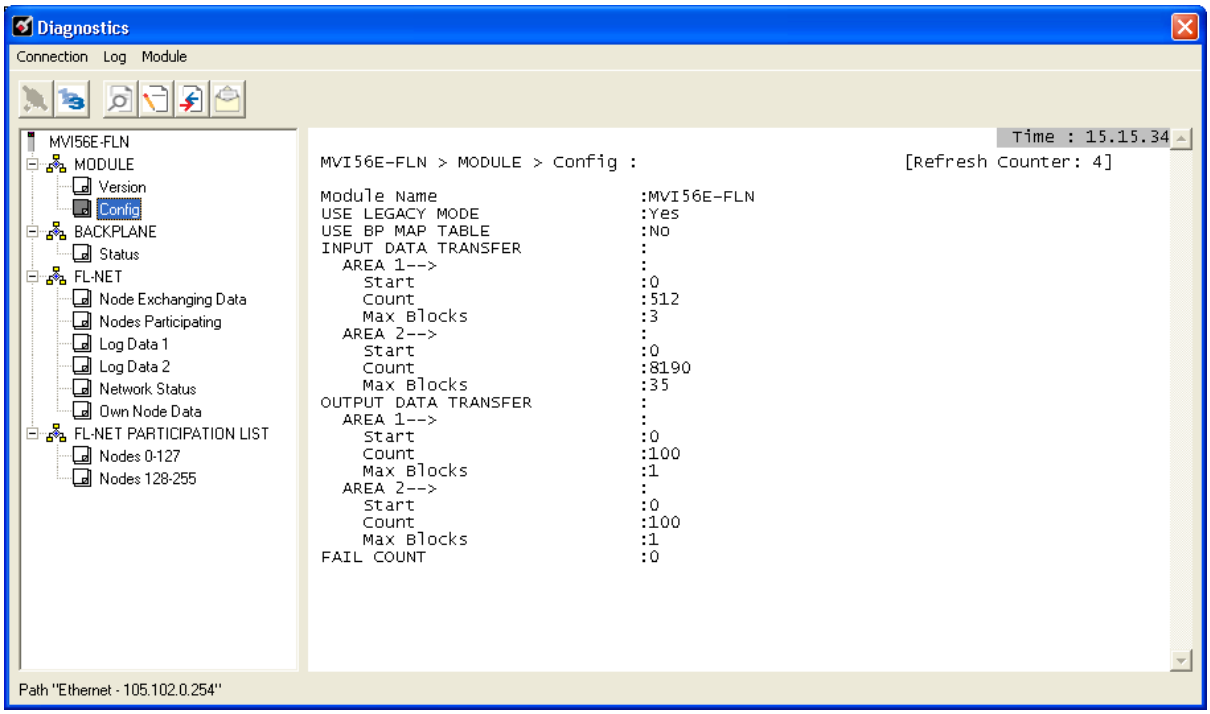
From the *MODULE* submenu select **VERSION** to view module hardware and firmware information.



The values on this menu correspond with the contents of the module's general product information registers.

Viewing Configuration Information

From the *MODULE* submenu select **CONFIG** to view backplane configuration settings for the MVI56E-FLN module.



This information corresponds with the **FL-NET** configuration settings in ProSoft Configuration Builder (page 31).

3.5 Verifying Communication

This section shows how to monitor the communication status of the configured FL-net network (assuming that both the FL/ET-T-V2 module and the MVI56E-FLN module were configured according to the previous sections).

3.5.1 Monitoring Backplane Information

Use the *BACKPLANE* menu to view the backplane status information for the MVI56E-FLN module.

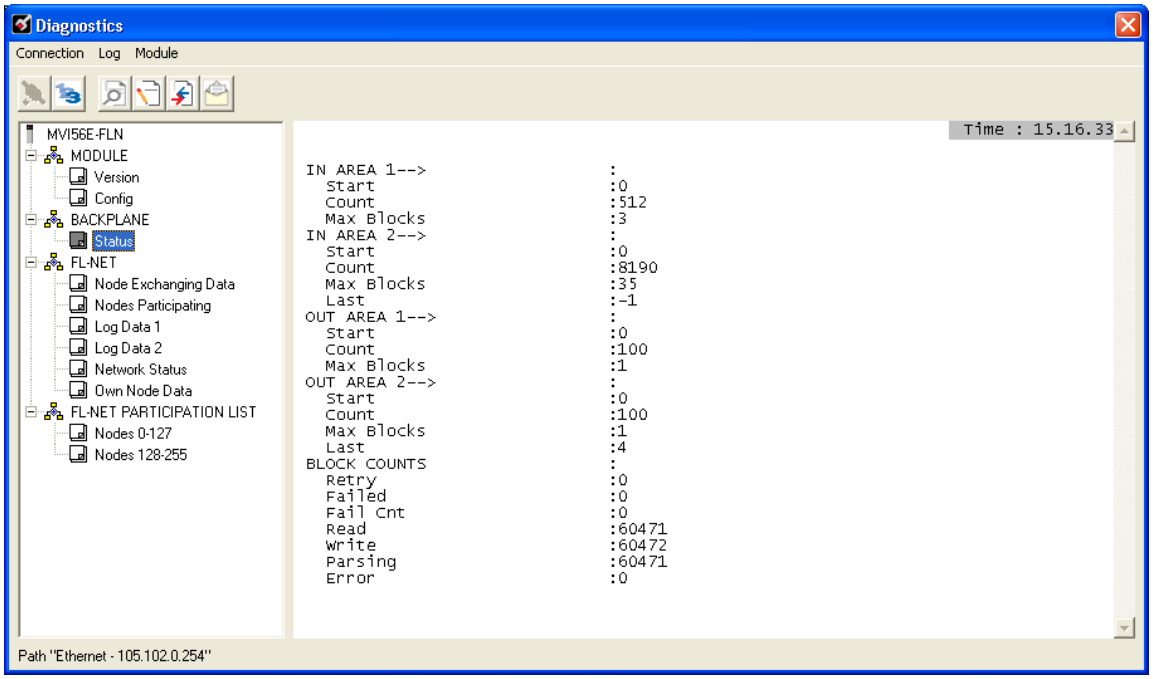
Viewing Backplane Status

From the *BACKPLANE* submenu select **STATUS** to view current backplane status, including

- Number of retries
- Backplane Status
- Fail Count
- Number of words read
- Number of words written
- Number of words parsed
- Error count
- Event count
- Command count

During normal operation, the Read, Write, and Parsing values should increment continuously, while the error value should not increment.

The status values on this menu correspond with the members of the MVI56E-FLN Status object.



Checking the Nodes Exchanging Data

From the *FL-NET* submenu select **NODE EXCHANGING DATA**. This screen contains a table which indicates all nodes that are exchanging data with the MVI56E-FLN module.

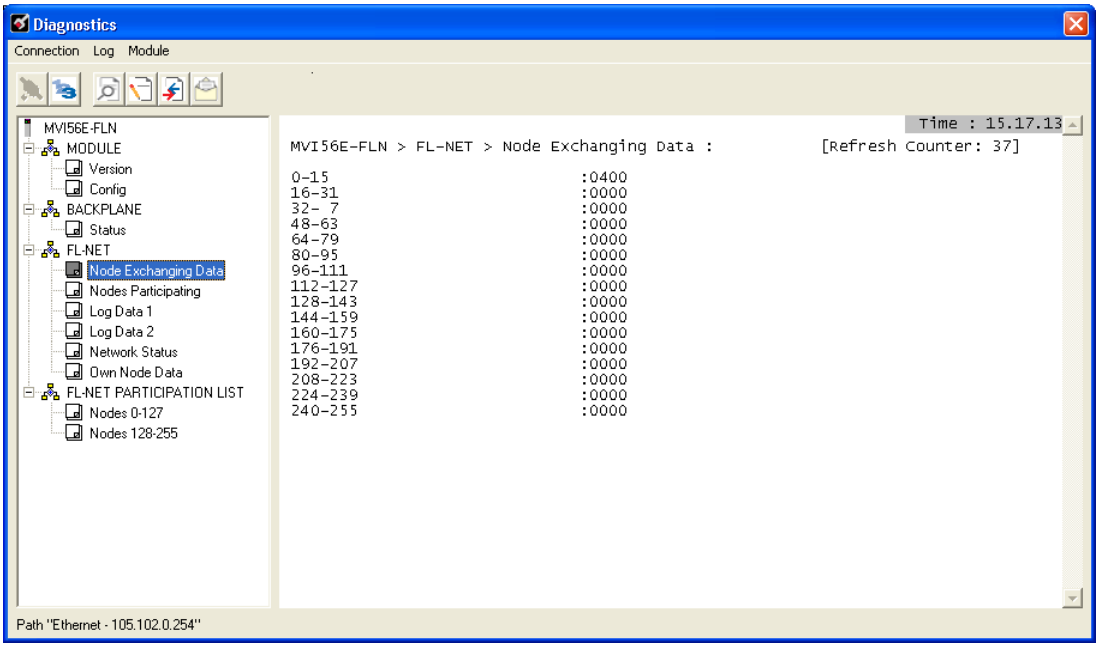
Each four-digit number in the table is a hexadecimal word (16 bits) which represents a bit sequence that corresponds to the status of each FL-net node. The following tables show the correlation between the bits and the nodes on the FL-net network for the first three words.

Word	**0**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Word	**1**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Word	**2**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

The following illustration shows that Node 10 is in data exchange mode. The value 0400 hex indicates that Bit 10 is set with a value of 1, and all other bits have a value of 0.



Checking the Participating Nodes

From the *FL-NET* submenu select **NODES PARTICIPATING**. This screen contains a table which indicates all participating nodes on the network.

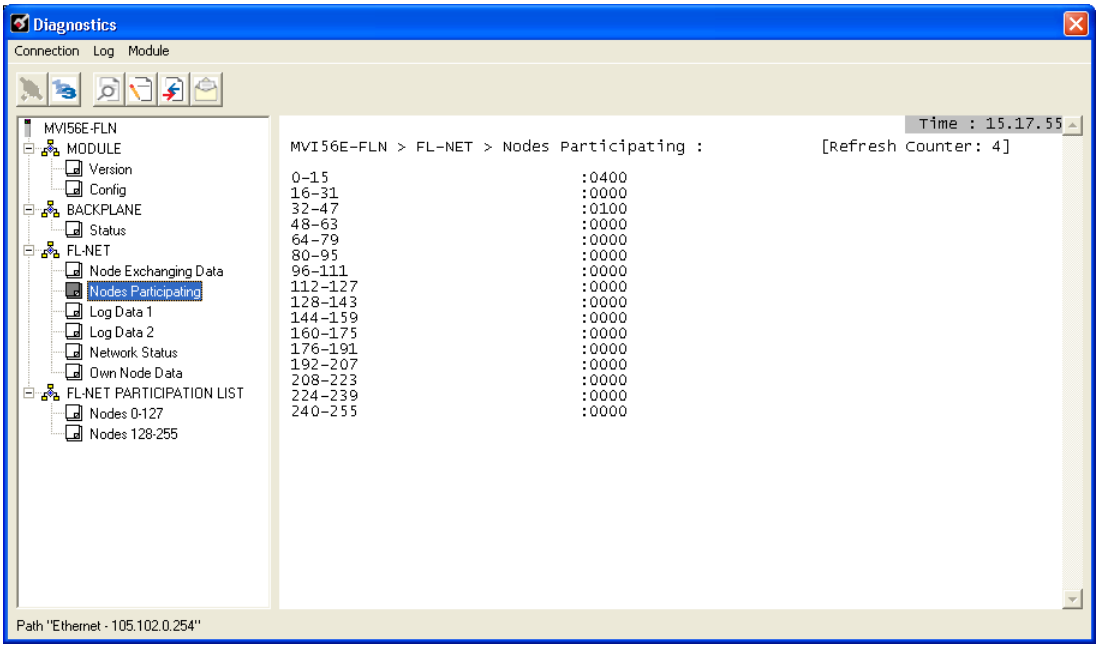
Each four-digit number in the table is a hexadecimal word (16 bits) which represents a bit sequence that corresponds to the status of each FL-net node. The following tables show the correlation between the bits and the nodes on the FL-net network for the first three words.

Word	**0**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Word	**1**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Word	**2**															
Bit #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Node #	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

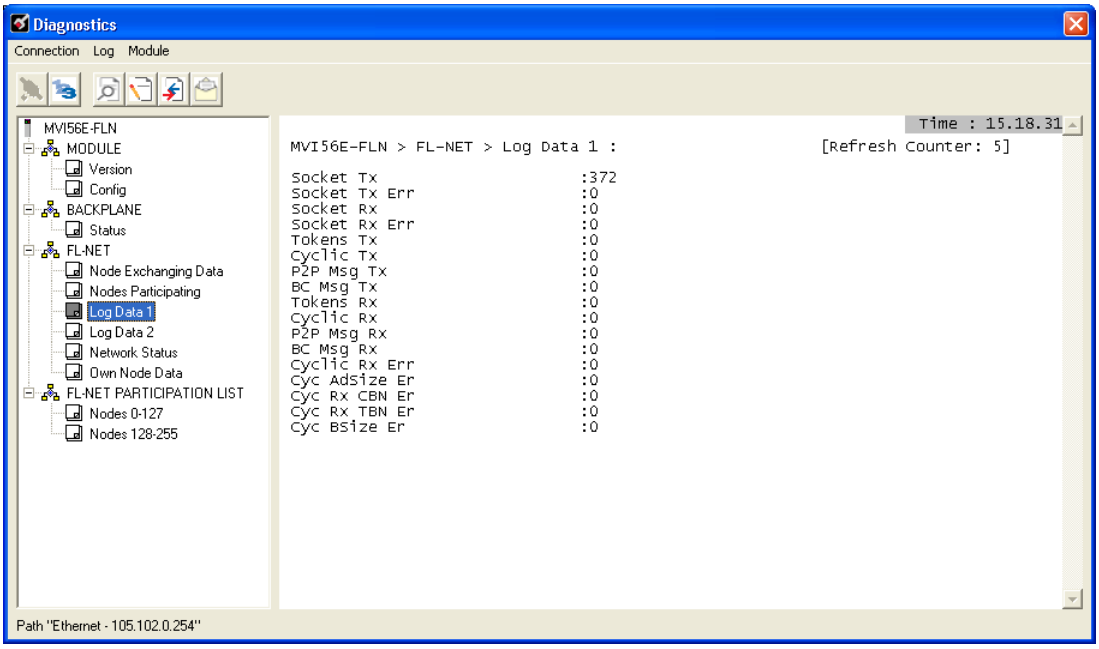
The following illustration shows that Nodes 10 and 40 are participating; a value of 0400 hex in Word 0 indicates that Bit 10 is set with a value of 1 and a value of 0100 hex in Word 2 indicates that Bit 40 is set with a value of 1.

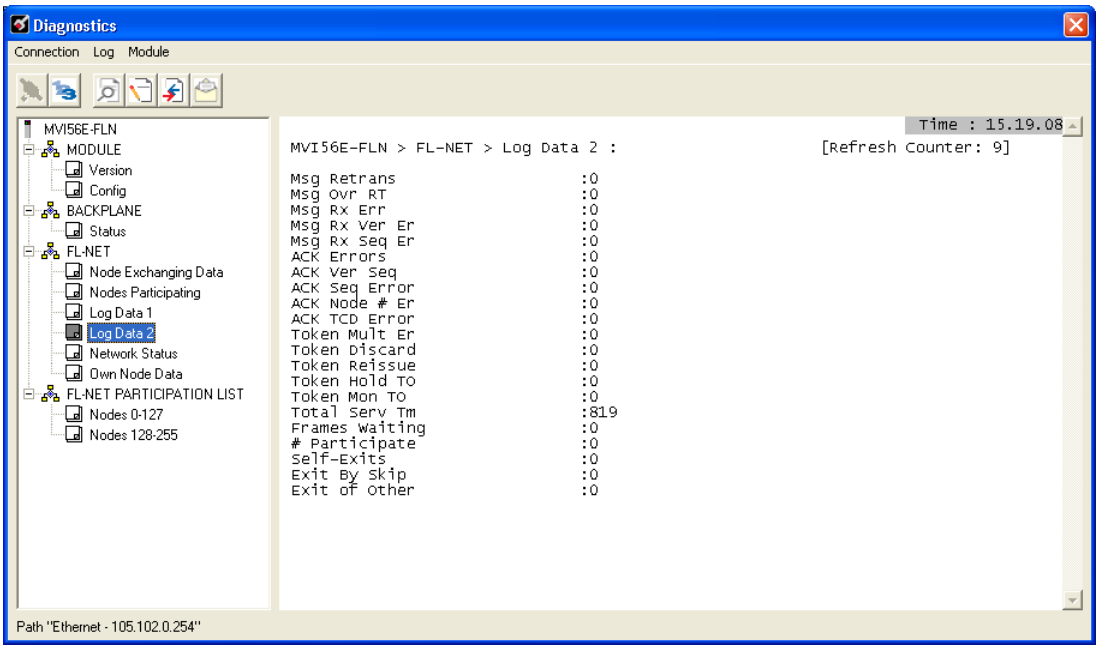


Checking the Log Data

From the *FL-NET* submenu select **LOG DATA 1** or **LOG DATA 2** to display information pertaining to:

- Transmission
- Reception
- Cyclic Transmission

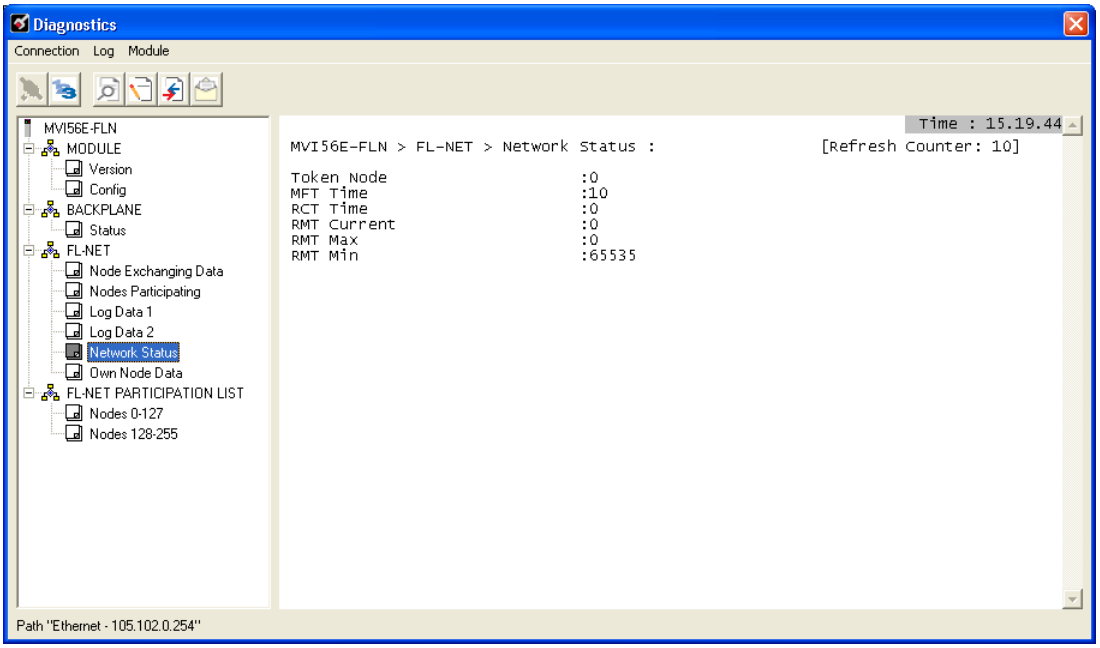




Checking the Network Status

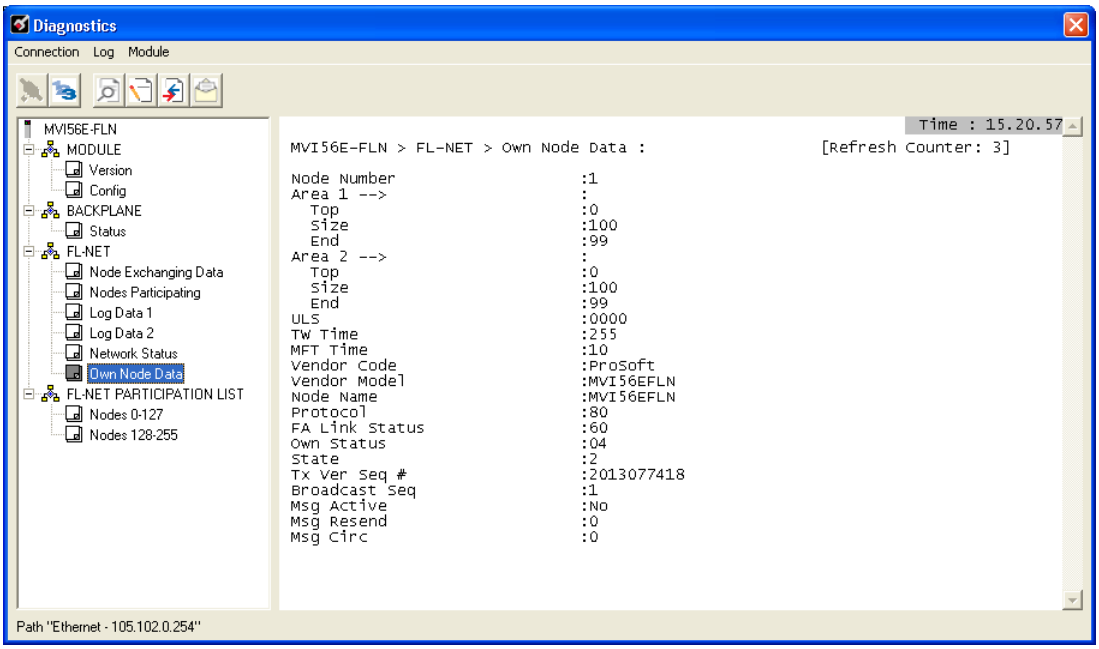
From the *FL-NET* submenu select **NETWORK STATUS** to display network information:

- Token-holding node number
- *Minimum Frame Interval Time*
- *Refresh Cycle Time*
- *Refresh Cycle Measurement Time*



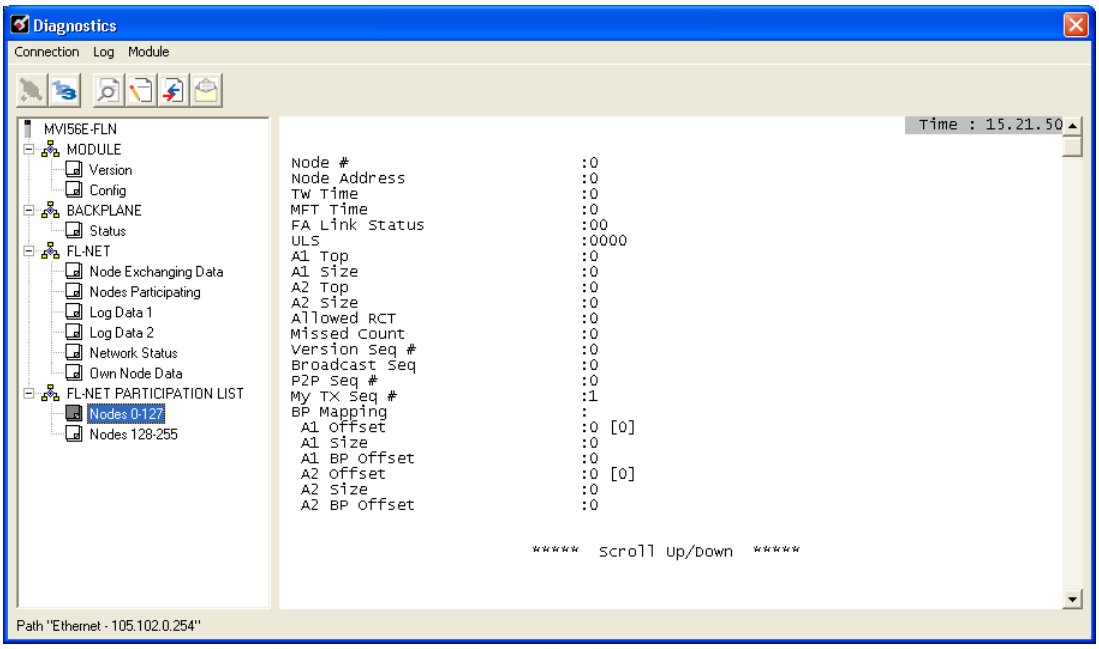
Checking the Own Node Data

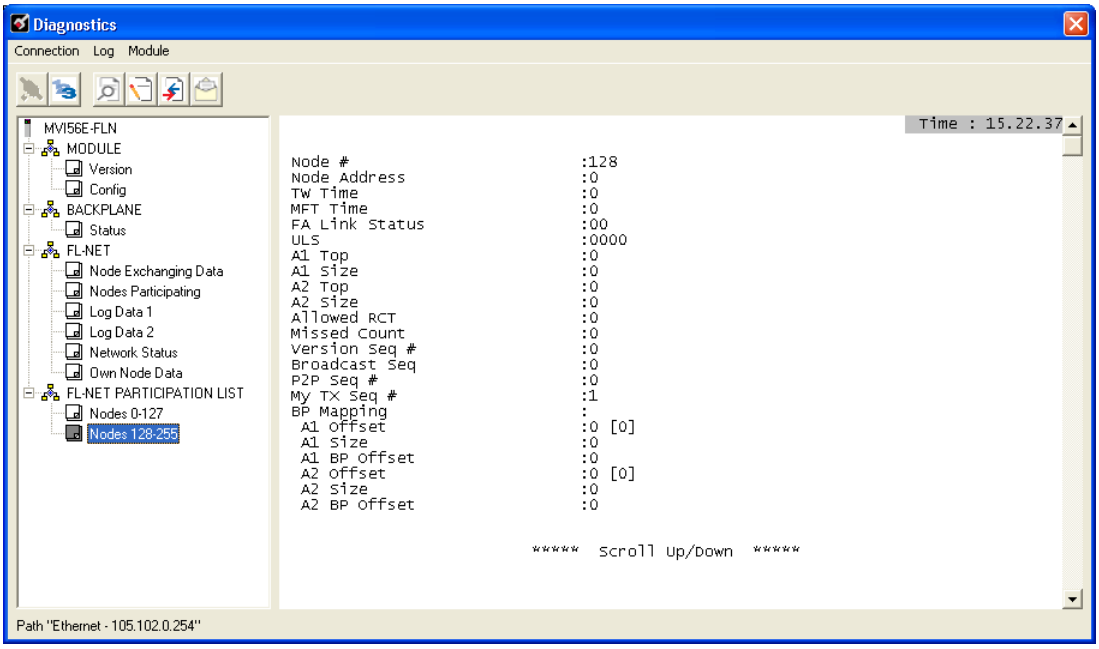
From the *FL-NET* submenu select **OWN NODE DATA** to view settings and status information for the MVI56E-FLN module.



Checking the Participating Node Status

From the *FLN-NET PARTICIPATION LIST* submenu select **NODES 0-127** and **NODES 128-255** to view settings and status information for each participating node on the network.





3.5.2 Checking Status through ControlLogix Controller Tags

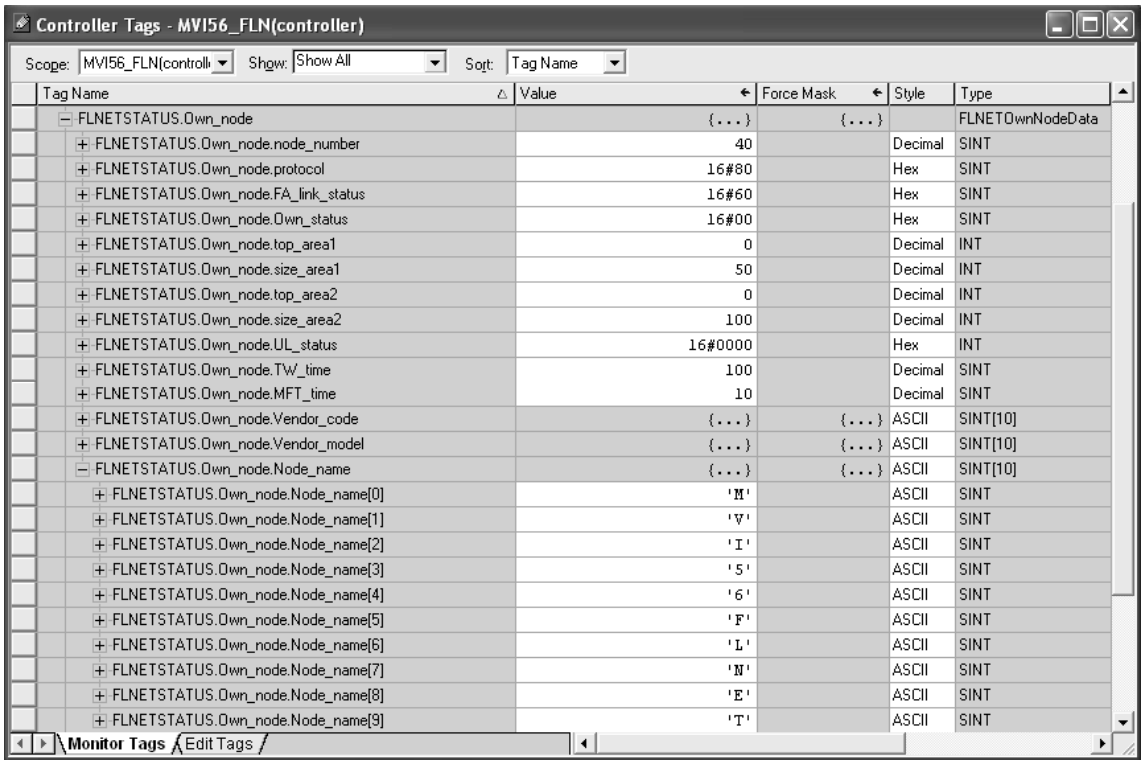
You can also monitor network status through the ControlLogix controller tags that are updated through the MVI56E-FLN sample ladder. Refer to the website at www.prosoft-technology.com for the sample ladder logic for the MVI56E-FLN module.

THE FLNETSTATUS controller tag contains status information that is copied from the module and the processor.

Checking the Own Node Status

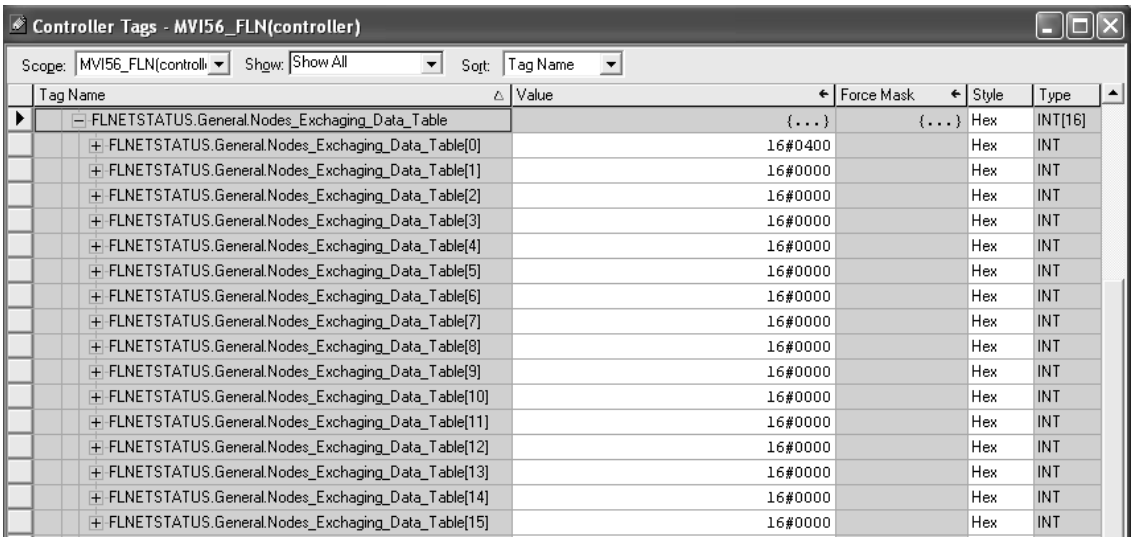
Monitor the FLNETSTATUS.Own_node controller tag for MVI56E-FLN status information. This tag includes the upper layer status (UL), allowable minimum frame interval time (MFT), token watchdog time (TW), protocol, Area 1 and Area 2 settings for the MVI56E-FLN.

The information in this tag is updated automatically from the module through status blocks 0 and -1.



Checking the Nodes Exchanging Data

Monitor the *FLNETSTATUS.General.Nodes_Exchanging_Data_Table[ ]* controller tag to see if each node is currently exchanging data. The following illustration shows that only node 10 is currently exchanging data with the MVI56E-FLN module: bit 10 of *FLNETSTATUS.General.Nodes_Exchanging_Data_Table[0]* word is set to 1 (hex value of 0400). The information in this tag is updated automatically from the module through status blocks 0 and -1.



Tag Name	Value	Force Mask	Style	Type
FLNETSTATUS.General.Nodes_Exchaging_Data_Table	{...}	{...}	Hex	INT[16]
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[0]	16#0400		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[1]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[2]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[3]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[4]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[5]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[6]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[7]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[8]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[9]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[10]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[11]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[12]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[13]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[14]	16#0000		Hex	INT
FLNETSTATUS.General.Nodes_Exchaging_Data_Table[15]	16#0000		Hex	INT

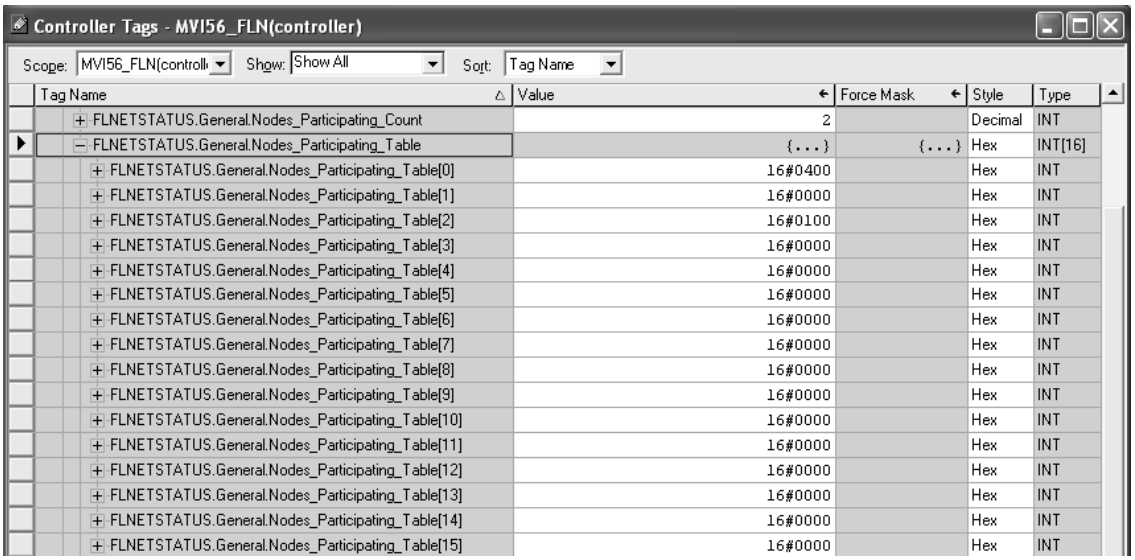
Checking the Participation Table

Monitor the *FLNETSTATUS.General.Nodes_Participating_Count* controller tag to see the number of nodes currently participating in the network. The information in this tag is updated automatically from the module through status blocks 0 and -1.

Monitor the *FLNETSTATUS.General.Nodes_Participating_Table[ ]* controller tag to check if each node is currently participating in the FL-net network. The following illustration shows that only nodes 10 and 40 are participating.

- Bit 10 of *FLNETSTATUS.General.Nodes_Exchanging_Data_Table[0]* word is set as 1 (hex value of 0400)
- Bit 8 of *FLNETSTATUS.General.Nodes_Exchanging_Data_Table[2]* word is set as 1 (hex value of 0100).
- Bit 8 of *FLNETSTATUS.General.Nodes_Exchanging_Data_Table[2]* corresponds with bit 40 for the entire participating table.

The following illustration shows that currently there are 2 nodes participating.



Tag Name	Value	Force Mask	Style	Type
+ FLNETSTATUS.General.Nodes_Participating_Count	2		Decimal	INT
– FLNETSTATUS.General.Nodes_Participating_Table	{...}	{...}	Hex	INT[16]
+ FLNETSTATUS.General.Nodes_Participating_Table[0]	16#0400		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[1]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[2]	16#0100		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[3]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[4]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[5]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[6]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[7]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[8]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[9]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[10]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[11]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[12]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[13]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[14]	16#0000		Hex	INT
+ FLNETSTATUS.General.Nodes_Participating_Table[15]	16#0000		Hex	INT

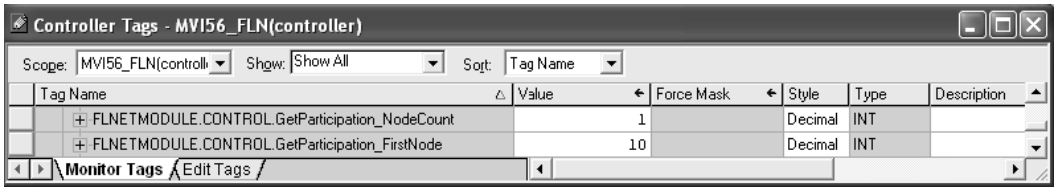
Checking the Participating Node Status

To retrieve the participation node status, the processor must request special block 2000 (Participation Table Request) from the module. This special block transfer request allows the processor to retrieve status information for each participating node. Status registers include:

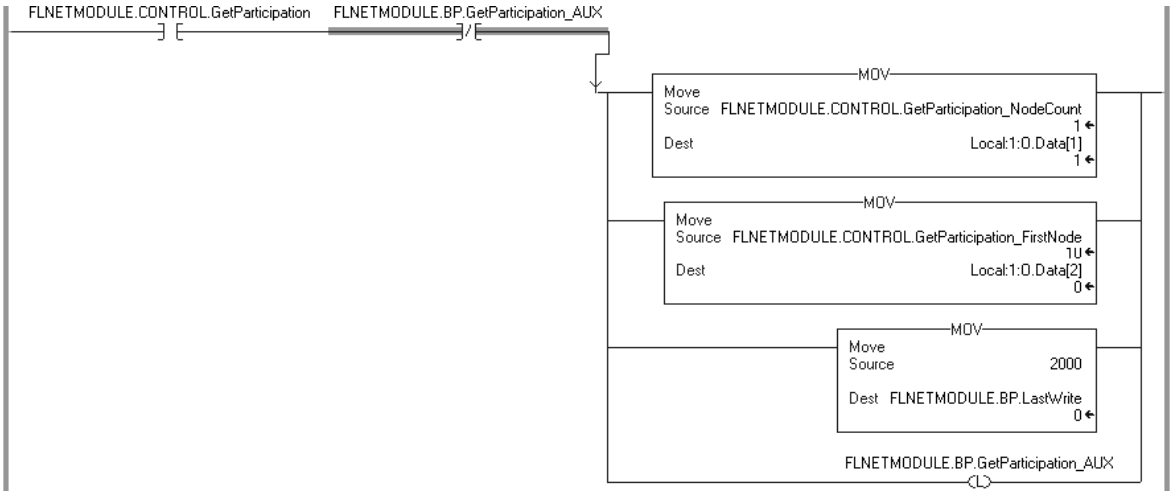
- upper layer status (ULS)
- allowable minimum frame interval time (MFT)
- allowable refresh cycle time (RCT)
- Area 1 (A1) and Area 2 (A2) settings
- token watchdog time (TW).

Each block can retrieve status for up to 10 participating nodes. The user application must initially select the number of nodes to retrieve (up to 10) and the first node address to retrieve.

For example, to retrieve the status for participating node address 10 (1 node only), set the controller tags as shown in the following illustrations:

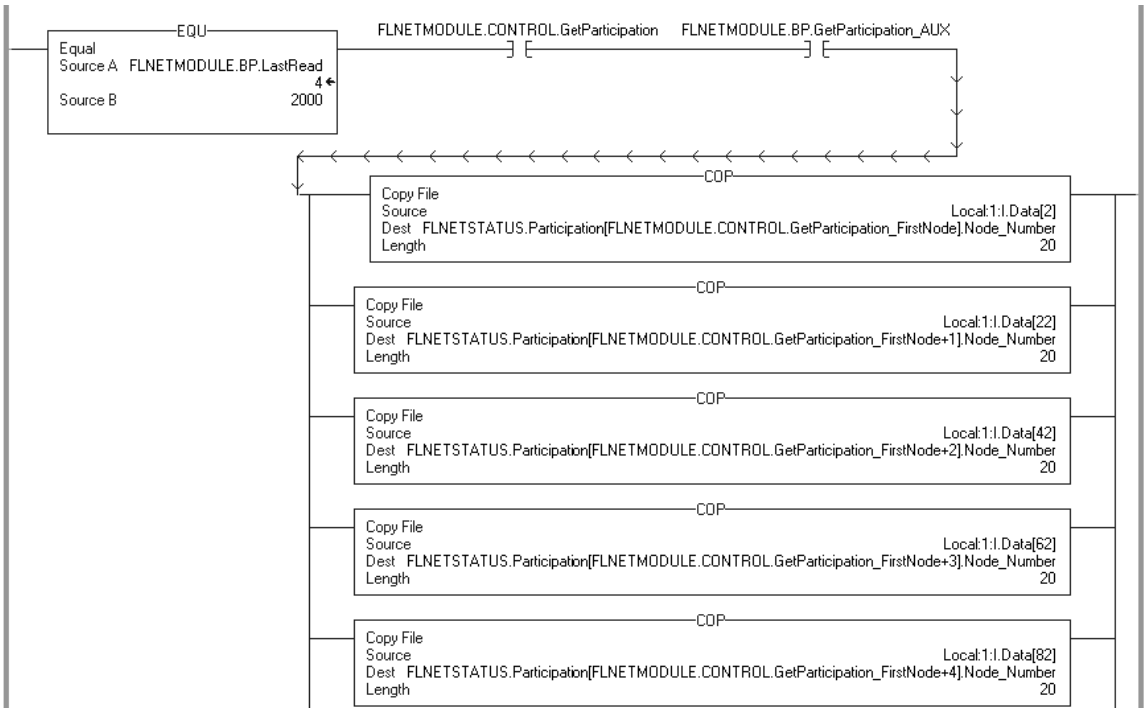


Next, trigger the Participation Table Request block (block 2000). To do this, set the *FLNETMODULE.CONTROL.GetParticipation* bit to 1. The following rung in the sample ladder WriteData routine performs the request to the module. The *FLNETMODULE.CONTROL.GetParticipation* bit is automatically cleared after the response is received from the module.

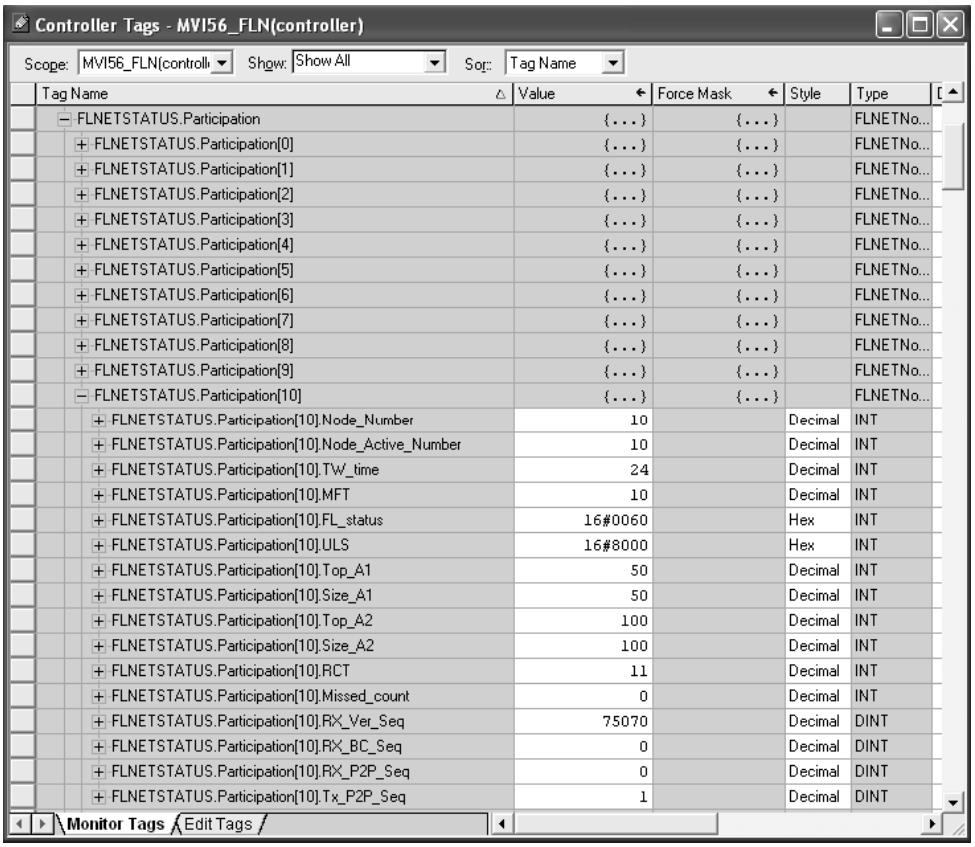


The following rung in the Read Data routine reads the module response containing the participating node status.

Note: The sample ladder will copy the status for 10 nodes. Edit this logic according to the number of nodes to be read for your application.



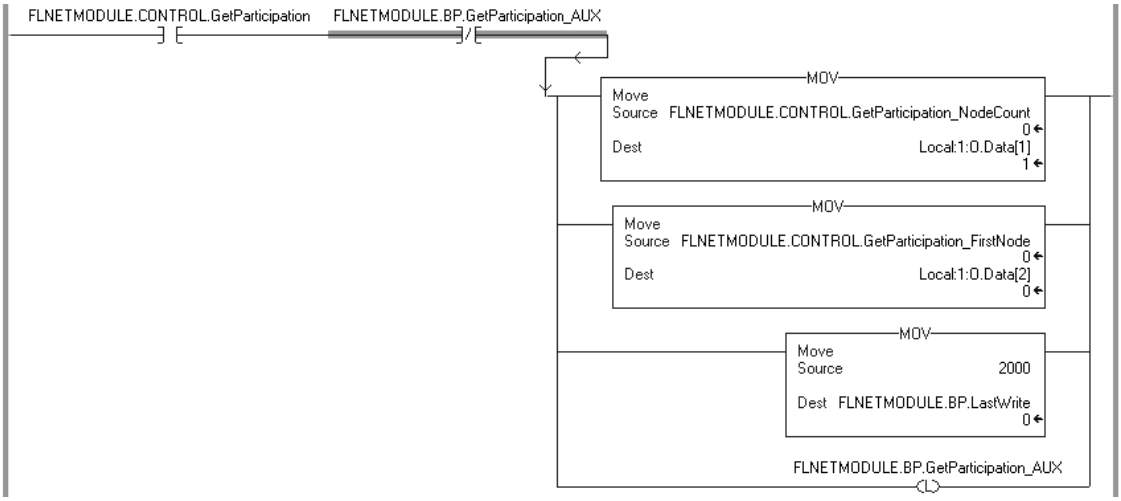
The participating node status is read to the *FLNETSTATUS.Participation[ ]* controller tag array. The status for node address 10 is available at *FLNETSTATUS.Participation[0]*.



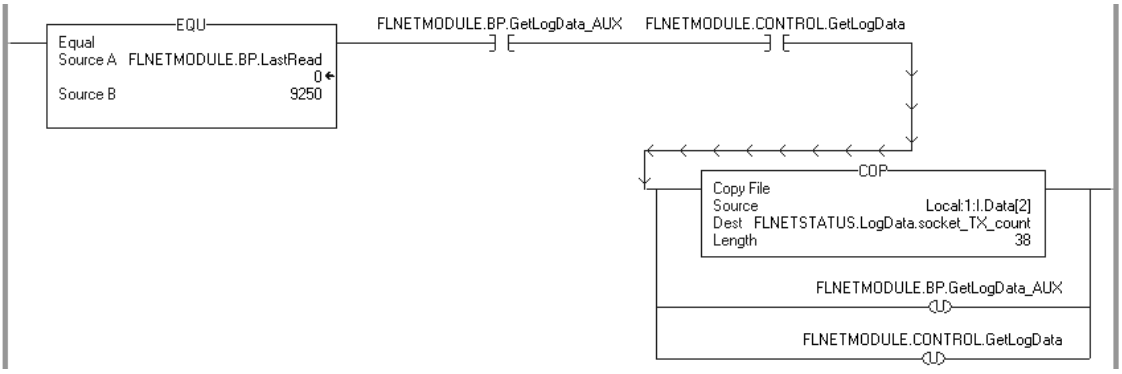
Checking the Log Data

To retrieve the Log Data, the processor must request special block 9250 (Log Data Block) from the module.

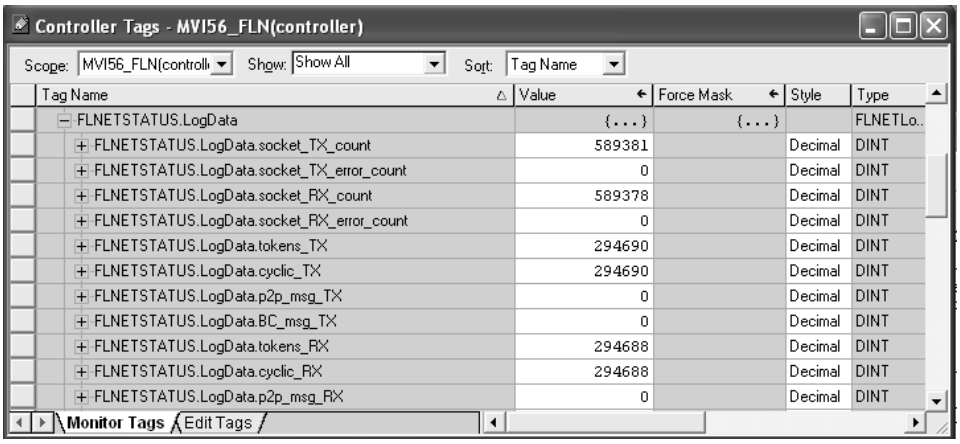
The following rung in the Write Data routine requests block 9250. To trigger this logic, set the *FLNETMODULE.CONTROL.GetParticipation* bit to 1.



The processor will eventually receive the block response from the module, and the following rung in the Write Data routine will automatically clear the *FLNETMODULE.CONTROL.GetParticipation* bit and read the block response to the correct tags.



You can view the Log Data read from the module in the *FLNETSTATUS.LogData* controller tag, as shown in the following illustration:

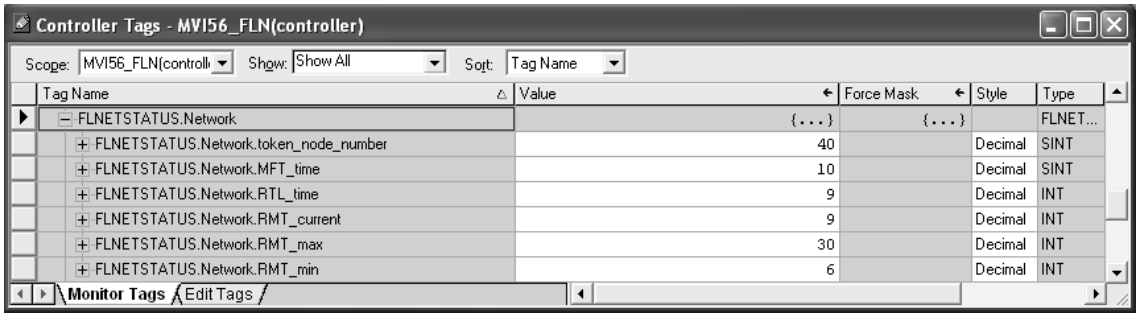


Checking the General Network Status

Monitor the *FLNETSTATUS.Network* for general FL-net network information:

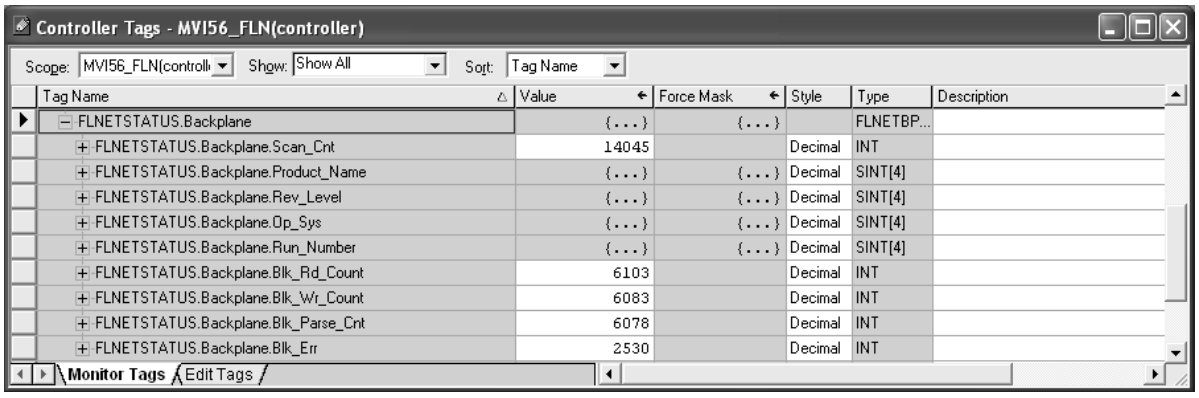
- the token node that is currently holding the token
- the refresh cycle measurement time (RMT) - minimum, maximum and current values
- allowable minimum frame interval time (MFT)
- allowable refresh cycle time (RCT).

This information is available in the *FLNETSTATUS.Network* controller tag.



Checking the Backplane status

Monitor the FLNETSTATUS.Backplane controller tag for information about backplane status.



3.5.3 Transferring Data

The sample ladder logic automatically updates the data with the *FLNETDATA.Output* and *FLNETDATA.Input* controller tags. The Area 1 data is divided into blocks 1 to 3. The Area 2 data is divided into blocks 4 to 35. Each block contains up to 240 words of data.

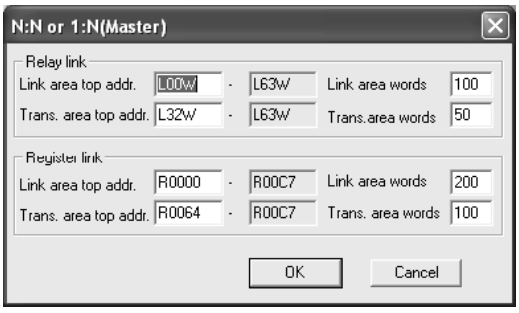
The data received from the remote FL-net node to the MVI56E-FLN module is automatically "reassembled" from the input blocks into the *FLNETDATA.Intput* controller tag (according to each block ID). Also, the data to transfer from the module to the remote FL-net node is copied from the *FLNETDATA.Output* controller tag into the output blocks according to its block ID. This logic is already handled by the sample ladder program supplied by ProSoft Technology.

For this example, use the following MVI56E-FLN Area1 and Area 2 settings in the configuration file:

```
Area 1 Top    :  0  #0...511 top address for area 1
Area 1 Size   :  50  #0...512 area 1 data size in words (0=not used)
Area 2 Top    :  0  #0...8191 top address for area 1
Area 2 Size   : 100  #0...8192 area 2 data size in words (0=not used)
BP Area 1 Top :  50  #0...511 top address for area 1
BP Area 1 Size:  50  #0...512 area 1 data size in words (0=none transferred)
BP Area 2 Top : 100  #0...8191 top address for area 1
BP Area 2 Size: 100  #0...8192 area 2 data size in words (0=none transferred)
```

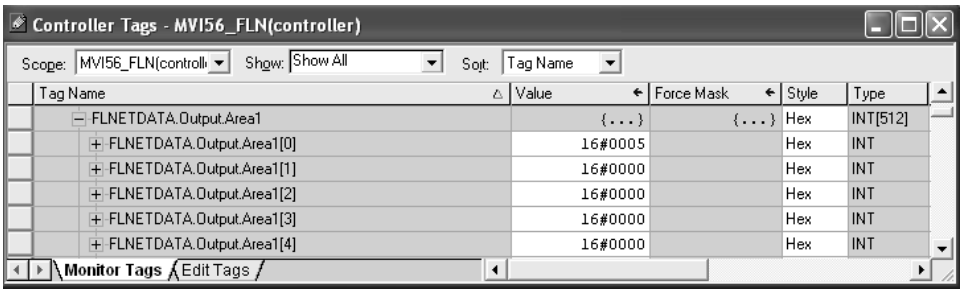
Important: The module only generates the blocks required to transfer the data you configured. For this example, only one Area 1 block and one Area 2 blocks are required, so only blocks 1 to 4 are used for data transfer. The larger the areas, the more blocks are required to transfer data (and the more time is required to update the whole block).

In this example, configure the FL/ET-T-V2 module with the values in the following illustration:

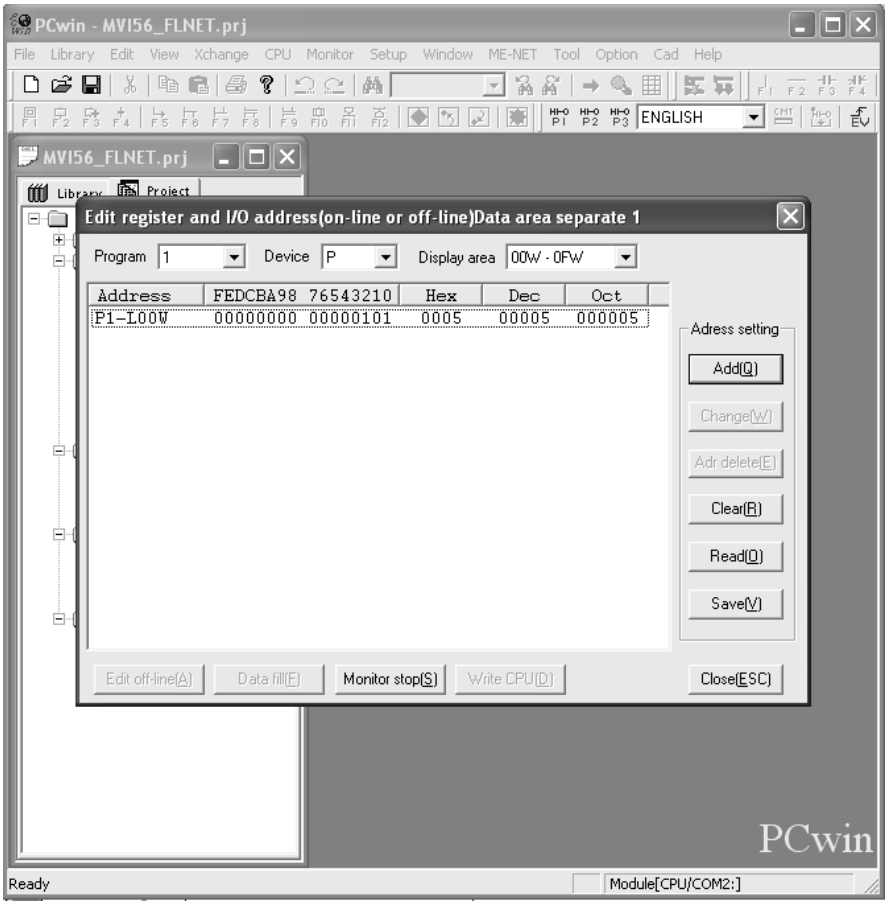


Transferring Data from MVI56E-FLN (Area 1) to FL/ET-T-V2 Module (Relay Area)

The *FLNETDATA.Output.Area1* controller tags transfer data from the module Area 1 to the remote FL-net node Relay link area. For this example, use the values in the following illustration:

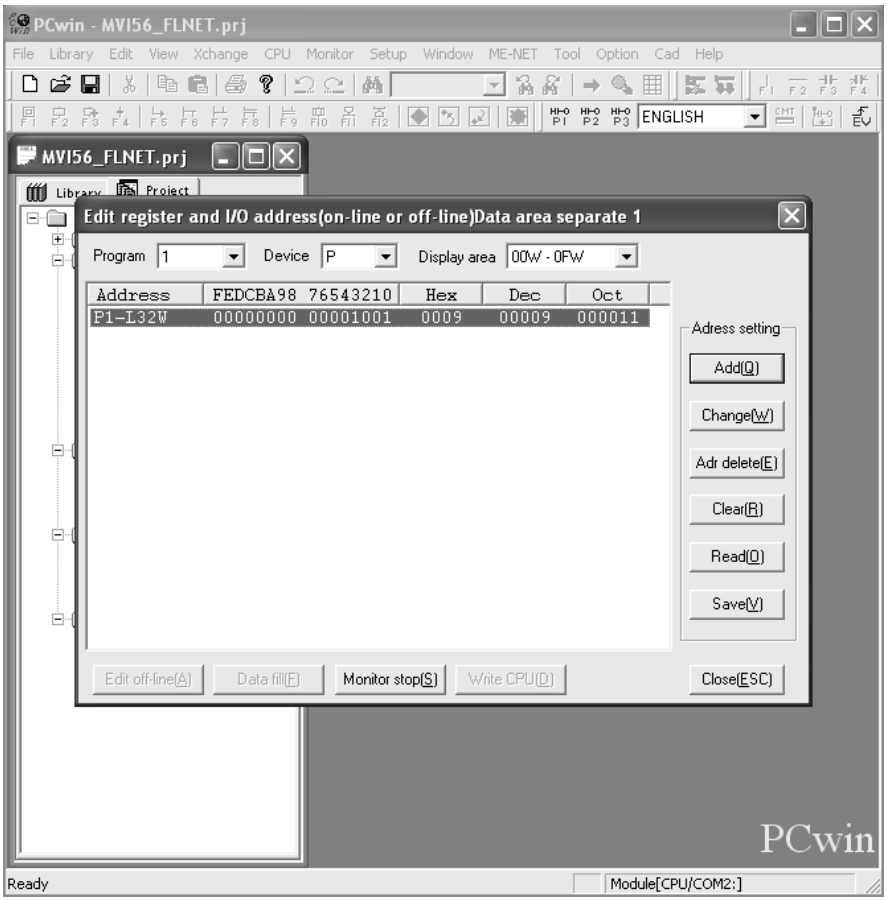


Use the PCWin Register Address Monitor to monitor the value set by the module (address L00W for our example).

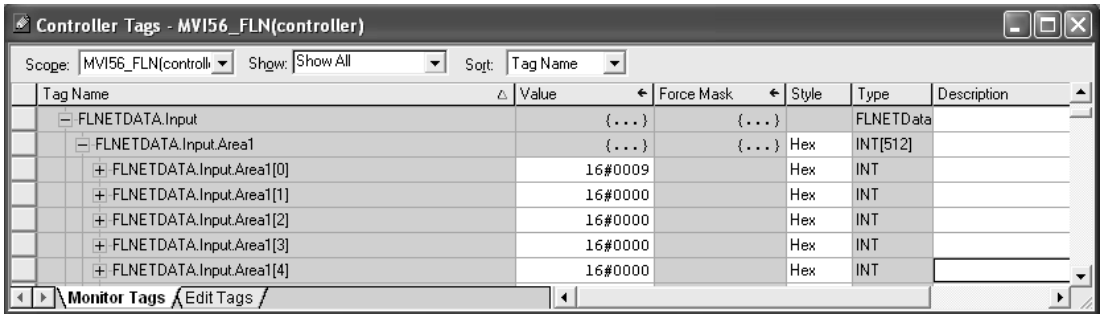


Transferring Data from FL/ET-T-V2 Link Area to MVI56E-FLN Area 1

Use the PCWin Register Address Monitor to set the value to transfer to the module (address L32W for this example).

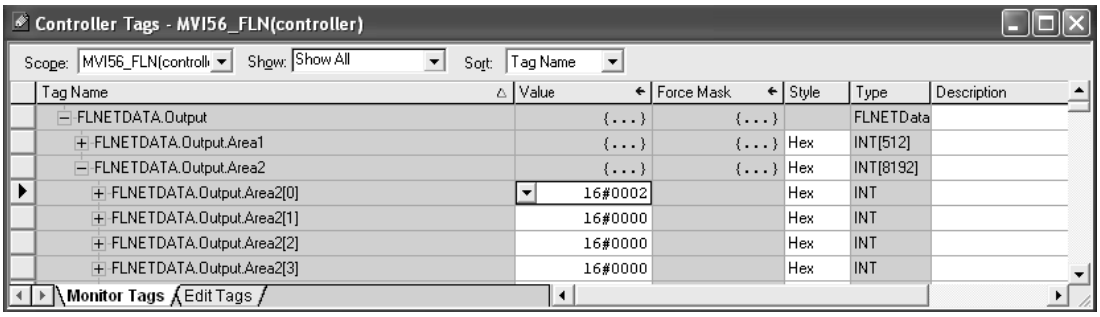


Use *FLNETDATA.Input.Area1* controller tags to monitor data received from the remote node to the MVI56E-FLN Area 1.

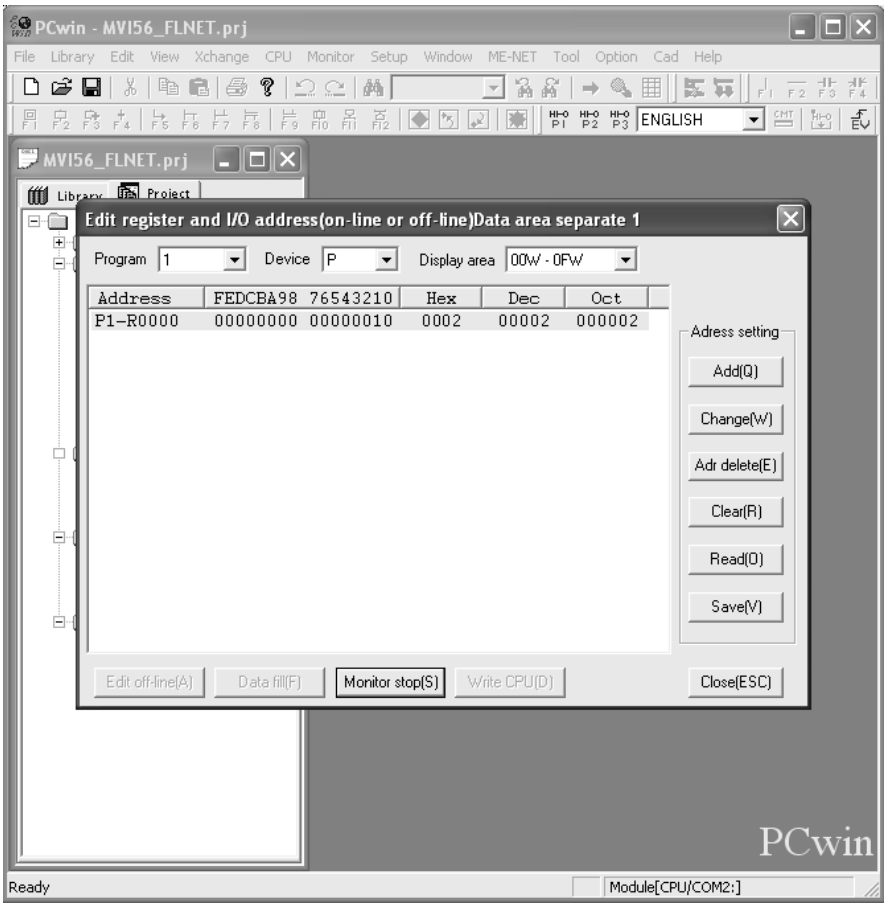


Transferring Data from MVI56E-FLN (Area 2) to FL/ET-T-V2 module (Register Area)

Use the *FLNETDATA.Output.Area2* controller tags to transfer data from the module Area 1 to the remote FL-net node Relay link area. For this example, use the values in the following illustration:

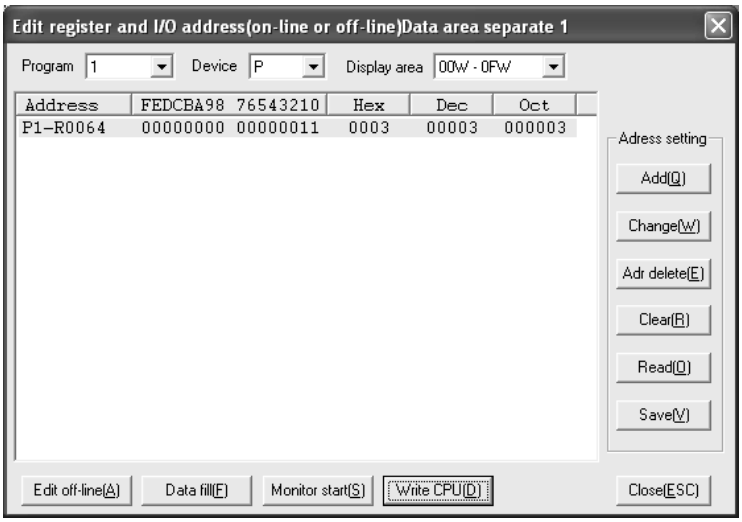


Use the PCWin Register Address Monitor to monitor the value set by the module (address R000 for our example).

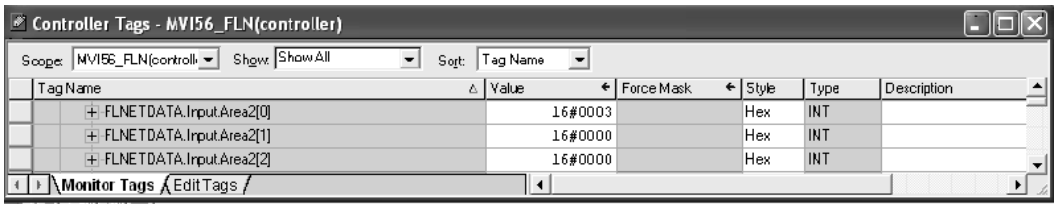


Transferring Data from FL/ET-T-V2 Register Area to MVI56E-FLN Area 2

Use the PCWin Register Address Monitor to set the value to transfer to the module (address R0064 for this example).



Use the *FLNETDATA.Input.Area2* controller tags to monitor data received from the remote node to the MVI56E-FLN Area 2.



3.6 Reading Status Data from the Module

The MVI56E-FLN module returns a block of status data in the input image that can be used to determine the module's operating status. This data is transferred from the module to the ControlLogix processor continuously. You can view this data in the *FLN.STATUS* controller tag in the ladder logic.

If the *Error/Status Pointer* is enabled, the status data can also be found in the Read Data area of the module's database at a location specified by the *Error/Status Pointer* configuration parameter.

The Configuration/Debug port provides the following functionality:

- Full view of the module's configuration data
- View of the module's status data
- Version Information
- Control over the module (warm boot, cold boot, transfer configuration)
- Facility to upload and download the module's configuration file

3.6.1 Own-Node Status information

The Own Node Status register (displayed on the Own Node Status menu) contains the following information:

Own Status Byte

Bit	Message	Description	Value
0	Node address duplicate (1 = Error)	Indicates the management information on node number conflicted to see whether any node having the same node number as the self node setting exists on the network or not.	0x0001
1	TW Error (1 = Error)	Token watchdog time error flag indicates that transmission processing fails to complete within the token watchdog time set in the own node	0x0002
2	Rx Wait Error (1 = Error)	Indicates that no frame has been received at network initialization, being a frame receive waiting status.	0x0004
3	Initialization Error (1 = Error)	Indicates an error is found in an initial setting or resetting parameter	0x0008
4	Reserved		0x0010
5	Reserved		0x0020
6	Reserved		0x0040
7			0x0080

Link Status Byte

The FA-Link Status register (displayed on the Own Node Status menu) contains the following information:

Bit	Message	Description	Value
0	*Node Status (1=Out-ring, 0=In-ring)	Indicates whether the node is in-ringed or out-ringed	0x0001
1	*Communication Invalid (1=Yes, 0=No)		0x0002
2	Always 0		0x0004
3	Always 0		0x0008
4	Upper Layer Error Signal (1=Error)	Indicates that the updating of the existence signal of the upper layer cannot be recognized	0x0010
5	Common Memory Valid (1=Valid)	Indicates the cycle data is valid	0x0020
6	Common Memory Set (1=Complete)	Indicates that the setting in the common memory of the node is completed	0x0040
7	Address Overlap (1=Error,0=No Error)	Indicates that there is a duplication in the common memory among the nodes connected to the network	0x0080

*Only reported to the processor and not network where these bits are always clear.

Upper Layer Status Word

The Upper Layer Status can be set by the ControlLogix processor to the module. Refer to Upper Layer Status Read Definition (page 100) for more information.

Bit	Message	Description		Value
0 to 11	Error Code (User Defined)			0x0001
12	reserved			0x1000
13	1=Warning, 0=No Warning	Bit 15 = 1	Bit 15 = 0	0x2000
		The upper layer program is running with an error but both cyclic data and message data are guaranteed.	The upper layer program is at a stop with an error but both cyclic data and message data are guaranteed.	
14	1=Alarm, 0=No Alarm	Both cyclic data and message data are not guaranteed.	Both cyclic data and message data are not guaranteed.	0x4000
15	1=Run, 0=Stop	Run	Stop	0x8000

4 Reference

4.1 Product Specifications

The MVI56E-FLN FA Control Network communication module is a single slot solution that allows Rockwell Automation ControlLogix compatible processors to easily interface with other FL-net protocol compatible devices. The module implements FL-net version 2.00 (OPCN-2) defined by JEMA (The Japan Electrical Manufacturers Association) for the standard FA control network. FL-net is a master-less system.

The MVI56E-FLN module acts as a gateway between the FL-net network and the ControlLogix backplane. The data transfer from the ControlLogix processor is asynchronous from the actions on the FL-net network. The module's internal database can be used to exchange Area 1 and Area 2 cyclic, network, and module status data between the processor and the FL-net network.

The MVI56E-FLN module accepts commands to control and monitor the data stored in the databases. This data is passed between the module and the ControlLogix processor over the backplane for use in user applications.

General features include:

- Master-less token control method
- FA link protocol on Ethernet UDP/IP
- Cyclic data transfer: Supports virtual memory Area 1 and Area 2. The cyclic data is mapped to the modules I/O area

4.1.1 Features

FL-net systems have the following features.

1 FL-net is an open system.
2 FL-net enables a multi-vendor network.
3 FL-net enables personal computers and FA controllers, such as programmable controllers (PLCs) or computerized numeric controllers (CNCs), by different manufacturers to be interconnected, controlled, and monitored.

- Master-less token control method.
- FA link protocol on Ethernet UDP / IP.
- Cyclic data transfer: Supports virtual memory Area 1 (512 words) and Area 2 (8192 words). The cyclic data is mapped to the modules I/O area.
- Message transfer:

  Server Functionality

  - Log data read service
  - Log data clear service
  - Network Parameter Read
  - Profile Read
  - Return Message
- Network Management Table: According to FL-net version 2.00 specification.
- Own-node Management Table: According to FL-net version 2.00 specification.

- Participating Node Management Table: According to FL-net version 2.00 specification.
- Network configurable via a text file or ProSoft Technology Configuration Builder Software
- Status and Error information

The MVI56E-FLN module provides highly configurable FL-net capabilities to the Allen-Bradley ControlLogix platform. FL-net (OPCN-2) is a controller-level network conforming to specification Japan Electrical manufacturers Association JEM1479. Developed by to focus on multi-vendor communications of programmable controllers, NC controllers, Robotic and other Motion Control systems.

4.1.2 General Specifications

- Backward compatible with previous MVI56-FLN versions
- Single-slot 1756 ControlLogix backplane compatible
- 10/100 Mbps auto crossover detection Ethernet configuration and application port
- User-definable module data memory mapping of up to 5000 16-bit registers
- ProSoft Configuration Builder (PCB) software supported, a Windows-based graphical user interface providing simple product and network configuration
- Sample ladder logic is used for data transfer between module and processor
- Internal web server provides access to product documentation, module status, diagnostics, and firmware updates
- 4-character, alpha-numeric, scrolling LED display of status and diagnostics data in plain English – no cryptic error or alarm codes to decipher
- ProSoft Discovery Service (PDS) software used to locate the module on the network and assign temporary IP address
- Personality Module - a non-volatile industrial-grade Compact Flash (CF) card used to store network and module configuration, allowing quick in-the-field product replacement by transferring the CF card

4.1.3 Hardware Specifications

Specification	Description
Backplane Current Load	800 mA @ 5 Vdc 3 mA @ 24 Vdc
Operating Temperature	0°C to 60°C (32°F to 140°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Shock	30 g operational 50 g non-operational Vibration: 5 g from 10 to 150 Hz
Relative Humidity	5% to 95% (without condensation)
LED Indicators	Battery Status (ERR) Application Status (APP) Module Status (OK)
4-Character, Scrolling, Alpha-Numeric LED Display	Shows Module, Version, IP, Application Port Setting, Port Status, and Error Information
Debug/Configuration Ethernet port (E1)	
Ethernet Port	10/100 Base-T, RJ45 Connector, for CAT5 cable Link and Activity LED indicators Auto-crossover cable detection
FL-net Application Ethernet port (E2)	
Ethernet Port	10 base-T, RJ45 Connector, for CAT5 cable Link and Activity LED indicators Auto-crossover cable detection
Shipped with Unit	Two, 5-foot Ethernet straight-through cables

4.1.4 Functional Specifications

The MVI56E-FLN module accepts commands to control and monitor the data stored in the databases. This data is passed between the module and the ControlLogix processor over the backplane for use in user applications.

Physical

- ControlLogix Form Factor - Single-Slot
- Connections:
  - 1 - RJ45, 10 BaseT, 10 Mbps connection to the FA Control Ethernet network (FL-net)
  - 1 - RJ45, 10/100 BaseT, 10 or 100 Mbps Ethernet connection for configuration

ControlLogix Interface

- Operation via simple ladder logic
- Complete set up and monitoring of module through ProSoft Configuration Builder (PCB) software
- ControlLogix backplane interface via I/O access
- All data is contained in a single controller tag array
- All status data is contained in a single controller tag array, with defined objects to simplify monitoring and communicating with the module

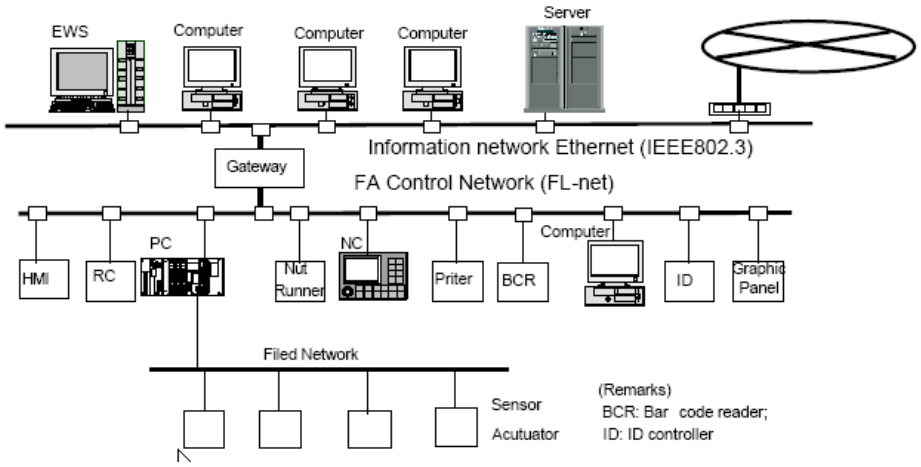
4.2 Functional Overview

4.2.1 About FL-net Protocol

FL-net is an open FA network that was standardized by the Japan FA Open Systems Promotion Group (JOP) of the Manufacturing Science and Technology Center (MSTC) under the Ministry of International Trade and Industry (MITI). It has been established in the Japan Electrical Manufacturers standards (JEM 1479) and is becoming very popular.

FL-net enables personal computers and FA controllers, such as programmable controllers (PLCs) or computerized numeric controllers (CNCs), by different manufacturers to be interconnected, controlled, and monitored, as shown in the following illustration.

The following illustration shows the positioning of the FL-net.

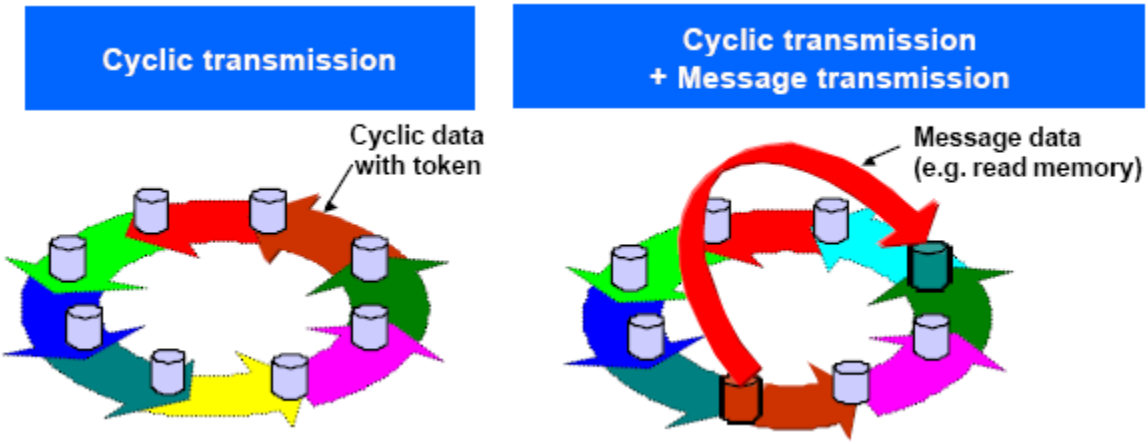


FL-net (Version 2.00) Unit specifications have been designed to conform to Japan Electrical Manufacturers standards (JEM 1479: 2001). It cannot be connected to communications devices based on the previous standards (JEM 1479: 2000).

The most recent FL-net specifications can be downloaded from the home page of the Japan Electrical Manufacturers Association (http://www.jema-net.or.jp/Japanese/hyojun/opcn_e/opcn07.htm (http://www.jema-net.or.jp/japanese/hyojun/opcn_e/opcn07.htm)

Data Communication Between Nodes

FL-net supports data communications by cyclic transmission and message transmission.

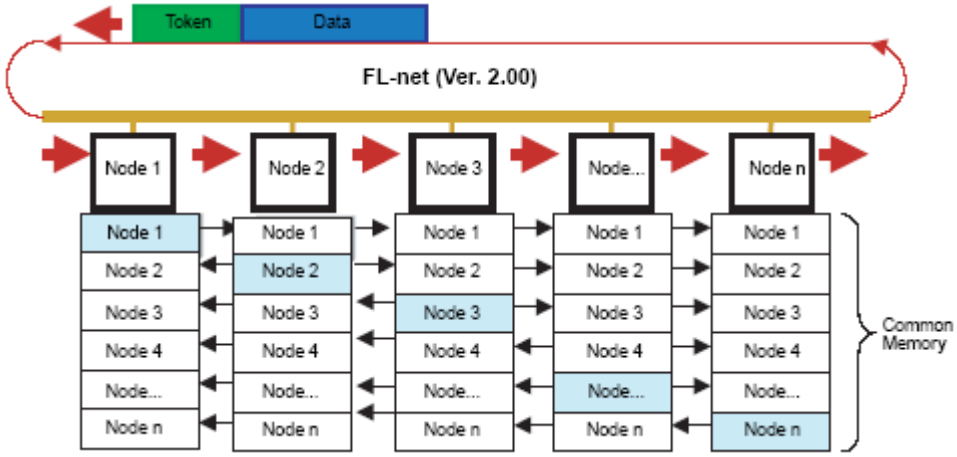


Multi-access data exchange between controllers

Peer to peer messaging (read / write memory or parameters)

Cyclic Transmission

Cyclic transmission is used to exchange data between nodes. The data is shared by each node through the Common Memory (shared memory) function.



Basic functions:

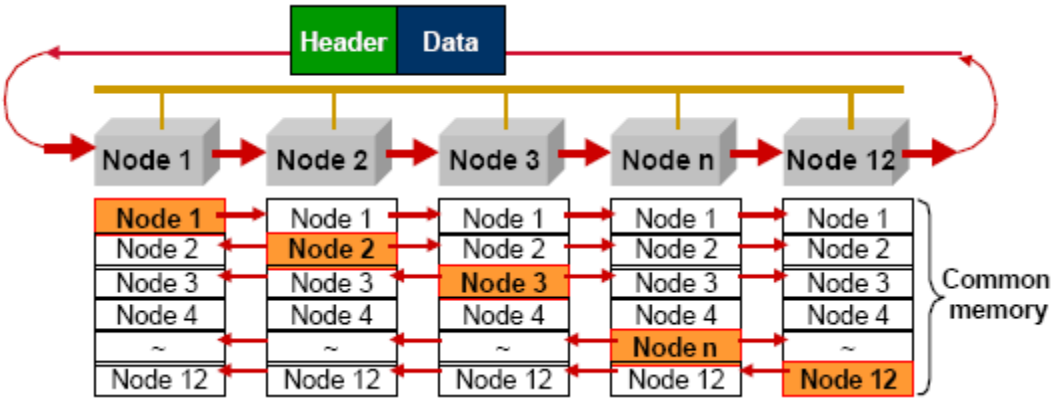
- Cyclic transmission implements Common Memory interface.
- Each node transmits its entire memory content while it holds the token.
- Nodes having no cyclic data are acceptable.

With cyclic communications, the Common Memory is refreshed on a fixed cycle time. Message communications are controlled so that the Common Memory refresh time does not exceed the allowable refresh cycle time.

Each node constantly monitors the message communications frames that travel through the network from the time it receives one local-node-directed token until it receives the next local-node-directed token. When no message communications frame travels through the network in a single cycle, 120% of the cycle time value becomes the allowable refresh cycle time. In this way the allowable refresh cycle time is actively determined according to the number of nodes in the network.

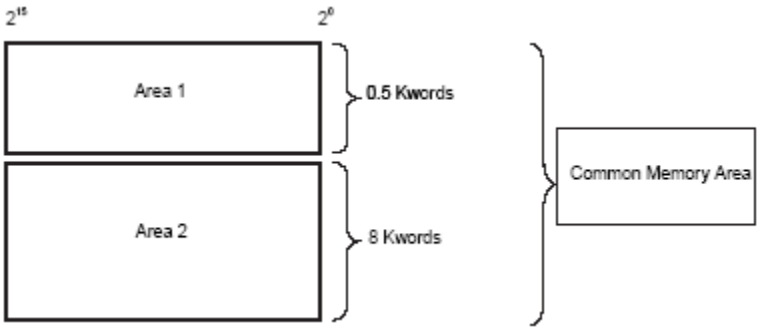
Common Memory

- The Common Memory interface provides nodes with a service that can be regarded as a memory shared among them.
- Data on the Common Memory is refreshed cyclically as each node updates and broadcasts its memory contents.
- Each node broadcasts its data in a fixed cycle and all the nodes in a network share the same data on the Common Memory.
- A user can use the Common Memory as global area in the node.
- The Common Memory size is 8k bits + 8k words = 8.5k words in a whole network.



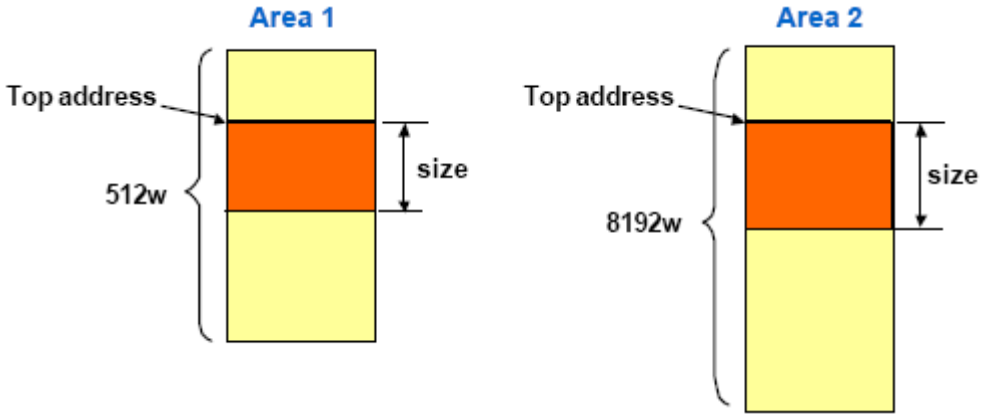
Area 1 and Area 2

- The Common Memory is divided into two areas.
- Area 1 has 512 words and Area 2 has 8192 words (1 word = 2 bytes = 16 bits)
- The maximum quantity of data that can be transmitted by a single node is 8.5k words.



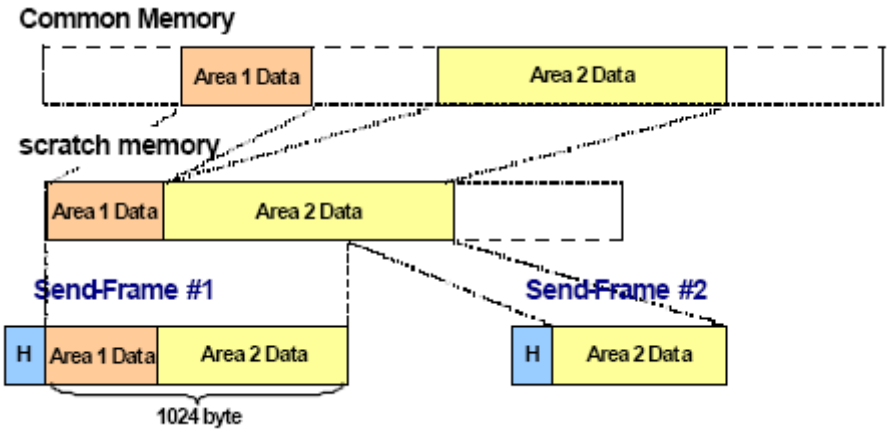
Node Data Area Assignment

- Each node on a FL-net has a specific transmission area in the Common Memory that does not overlap with others.
- A transmission area assigned to one node must be a receiving area for other nodes.
- Two data areas can be assigned to a node within Area 1 and Area 2 of the Common Memory.
- Both areas can be assigned at any word-size within the maximum.
- A node's memory assignment within a Common Memory area is defined by the top address (starting address) and size of its data area.

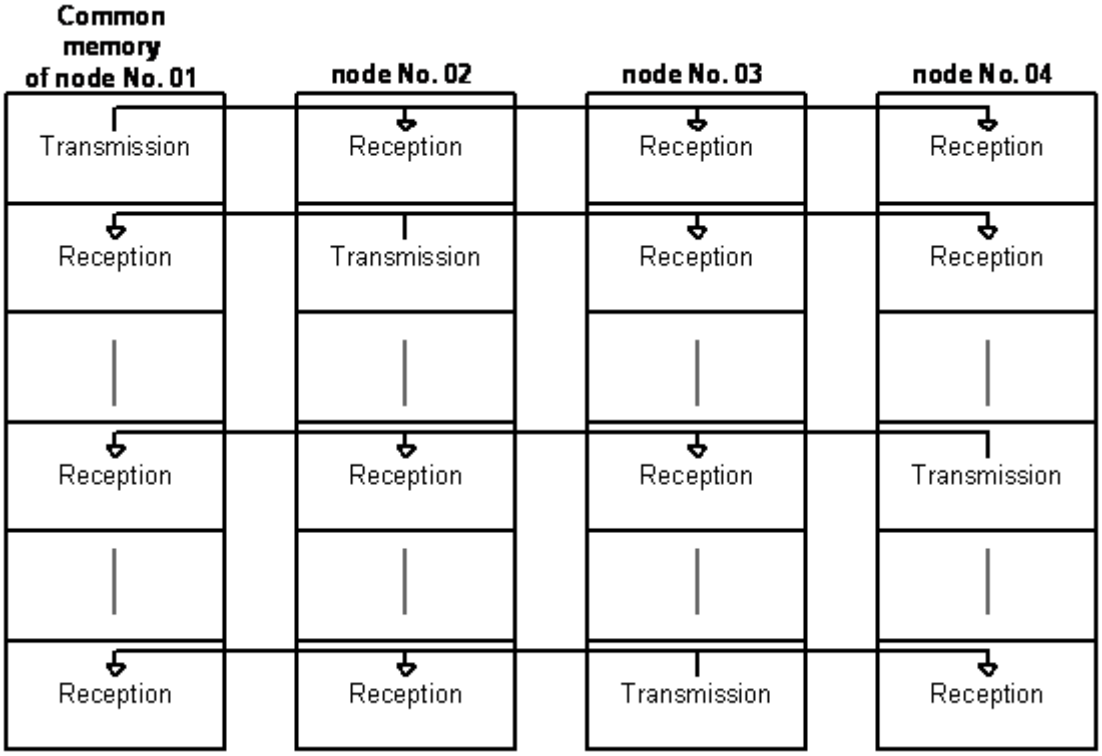


Frame Transmission

- Maximum data length of one message frame is 1024 bytes (excluding header).
- Multiple frames may be used if the transmitting area size exceeds the maximum frame data size.
- A node receiving multiple frames will update the area only after successfully receiving all frames from the sending node. Thus time coherency of data from a node is guaranteed.

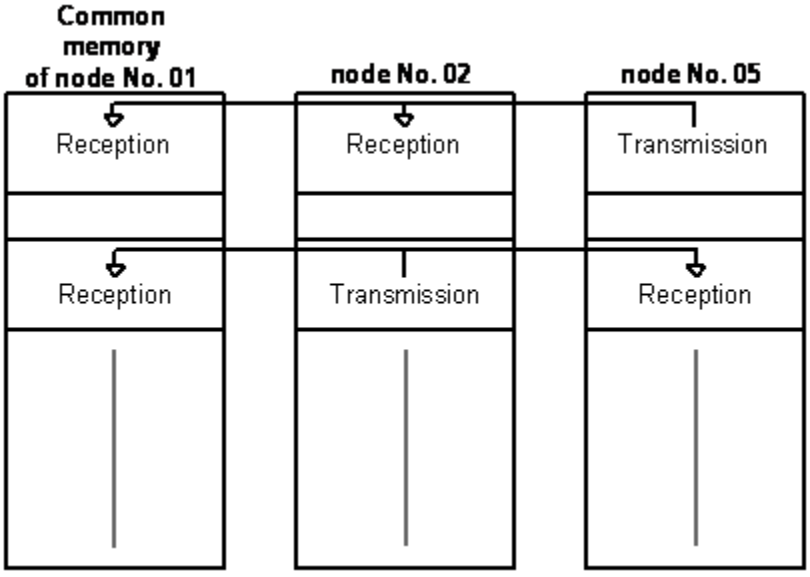


Common Memory Function



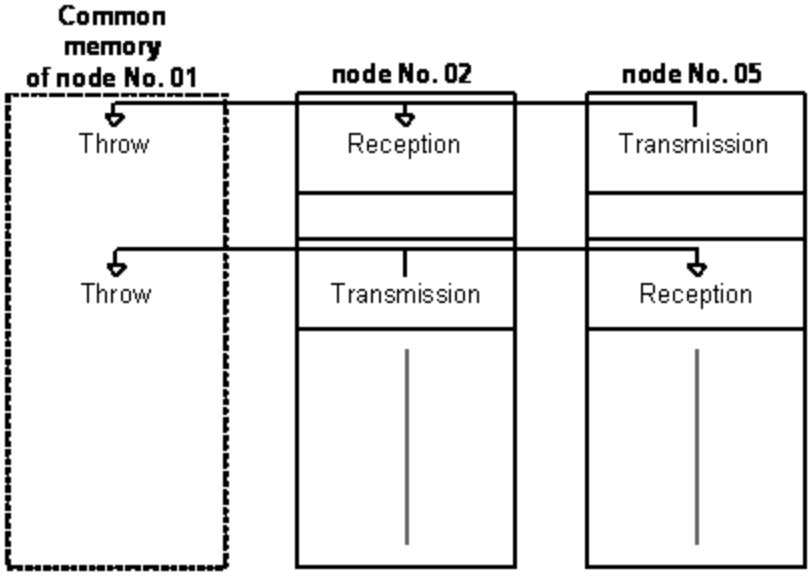
A node can use the whole Common Memory as receiving area.

Node for Reception Only



Nodes can be set up to only receive data.

Node Having No Common Memory



The FA link protocol allows for the existence of nodes that do not have Common Memory because they only participate in message transmission, and do not transmit and receive cyclic data.

User-Defined Specifications

User-defined specifications allow the following range of features that are required for FA systems.

1 Large-scale network

Up to 254 devices (nodes) can be connected in the physical layer of the network. "1 through 254" shall be used as node number. However, numbers "250 through 254" are reserved for maintenance purposes. Number "0" shall not be used. Number "255" shall be used as the global address for broadcasting.

2 Dual communications functions to suit application

The Common Memory function uses cyclic transmission so that each node can always share the same data with other nodes on the network. FL-net also supports message communications for use when handling only essential data is required.

3 Large-capacity Common Memory

The Common Memory is provided with a large capacity of 8K bits (Area 1) and 8K words (Area 2).

4 High-speed response

High-speed response time of 50 milliseconds / 32 nodes (for 2K bits and 2K words) is provided. The absence of a Master in the FL-net network enables nodes to be added or removed readily without affecting any other nodes. This allows any node to be turned ON or OFF easily and facilitates maintenance.

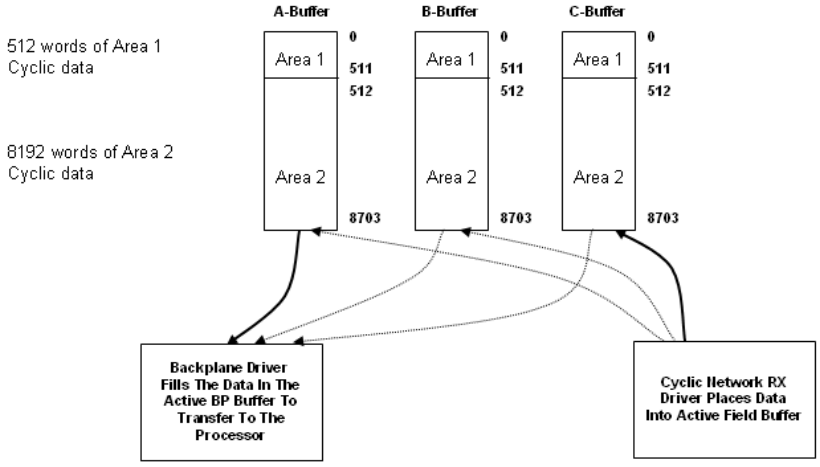
The FL-net protocol is characterized by the following items:

1 Transmission control using masterless token system avoids collision.
2 Refresh cycle time can be specified since the system circulates a token in a fixed time.
3 The token is transmitted together with cyclic data.
4 The node with a smallest node number among those who participate the network at start-up time shall start to send the token.
5 If no token is transmitted for a specified period, next node in the token circulation ring shall send a new token.
6 The masterless token system (characterized by the above two items) will keep the network from stopping in case of failure of some nodes.
7 The protocol provides information management tables for useful information to refer operation status of other nodes such as operation mode (RUN / STOP) and hardware malfunction (ALARM).

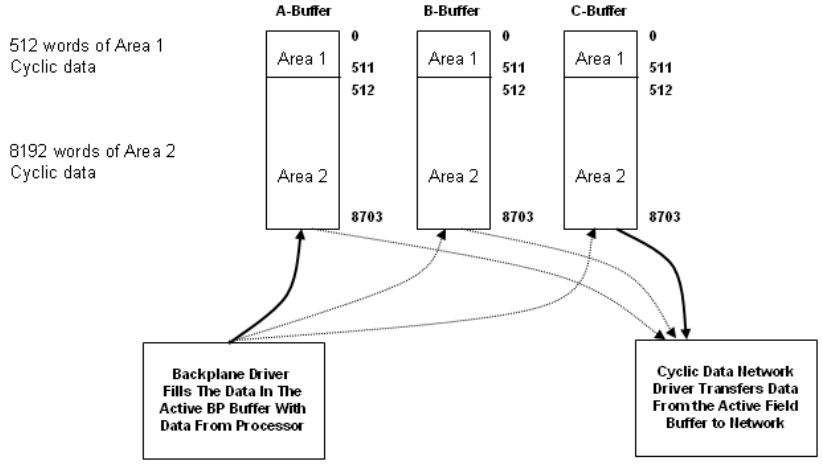
4.2.2 Data Flow between Module and Processor

The following discussion outlines the flow of data between the two pieces of hardware (ControlLogix processor and MVI56E-FLN module) and other nodes on the TCP/IP network.

Module's Cyclic Input Data



Module's Cyclic Output Data



4.2.3 Backplane Data Transfer

Block Assignments

In order to exchange data with the processor, the MVI56E-FLN module supports the following block. The block range refers to the Block ID used to identify each block.

Input Data

Block Range	Descriptions
0 & -1	Status Data
1 to 3	Area 1 Data From Common Memory
4 to 35	Area 2 Data From Common Memory
1000 to 1004	Message Request ACK Blocks (future)
1100 to 1104	Message Response Blocks (future)
2000	Participation Table Response
9250	Log Data Block

Output Data

Block Range	Descriptions
0 & -1	Empty Data Blocks
1 to 3	Area 1 Data To Common Memory
4 to 35	Area 2 Data To Common Memory
1000 to 1004	Message Request Blocks (future)
2000	Participation Table Request
9250	Log Data Block Request
9998	Warm-boot control block
9999	Cold-boot control block

Read Block

Area 1 Input (Read) Data Block

Offset	Description	Length
0	Write Block ID Requested (1 to 3)	1
1 to 240	Area 1 data from field	240
241	Reserved	1
242	Reserved	1
243	Reserved	1
244	Reserved	1
245	Reserved	1
246	Reserved	1
247	Reserved	1
248	Reserved	1
249	Read Block ID (1 to 3)	1

Area 2 Input (Read) Data Block

Offset	Description	Length
0	Write Block ID Requested (4 to 35)	1
1 to 240	Area 2 data from field	240
241	Reserved	1
242	Reserved	1
243	Reserved	1
244	Reserved	1
245	Reserved	1
246	Reserved	1
247	Reserved	1
248	Reserved	1
249	Read Block ID (4 to 38)	1

Write Block

Empty Output (Write) Data Block

Offset	Description	Length
0	Write Block ID (-1 or 0)	1
1 to 240	Reserved	240
241	Reserved	1
242	Reserved	1
243	Reserved	1
244	Reserved	1
245	Reserved	1
246	Command Byte	1
247	Upper Layer Status for Module	1

Area 1 Output (Write) Data Block

Offset	Description	Length
0	Write Block ID (1 to 3)	1
1 to 240	Area 1 Data to field	240
241	Reserved	1
242	Reserved	1
243	Reserved	1
244	Reserved	1
245	Reserved	1
246	Command Byte	1
247	Upper Layer Status for Module	1

Area 2 Output (Write) Data Block

Offset	Description	Length
0	Write Block ID (4 to 38)	1
1 to 240	Area 1 Data to field	240
241	Reserved	1
242	Reserved	1
243	Reserved	1
244	Reserved	1
245	Reserved	1
246	Command Byte	1
247	Upper Layer Status for Module	1

Special Blocks

Participation Table Request (Write Block) Output Data

Offset	Description	Length
0	2000	1
1	Number of nodes to report (1 to 10)	1
2	Index of first node (0 to 255)	1
3 to 247	Spare	245

Participation Table Response (Read Block) Input Data

Offset	Description	Length
0	Write Block ID Requested	1
1	Number of nodes to reported (0 to 10)	1
2 to 21	Participation Data first node	20
22 to 41	Participation Data second node	20
42 to 61	Participation Data third node	20
62 to 81	Participation Data fourth node	20
82 to 101	Participation Data fifth node	20
102 to 121	Participation Data sixth node	20
122 to 141	Participation Data seventh node	20
142 to 161	Participation Data eighth node	20
162 to 181	Participation Data ninth node	20
182 to 201	Participation Data tenth node	20
202 to 248	Spare	47
249	2000	1

Participation Data Structure (20 words)

Offset	Description	Words
0	Node Number	1
1	Node Number (0 if not participating)	1
2	Token watchdog time	1
3	Allowable minimum frame interval	1
4	FL Link status	1
5	Upper layer status	1
6	Top Area 1	1
7	Size Area 1	1
8	Top Area 2	1
9	Size Area 2	1
10	Allowable refresh cycle time	1
11	Missed count	1
12 to 13	Rx Version sequence number	2
14 to 15	Rx Broadcast sequence number	2
16 to 17	Rx Peer-to-peer sequence number	2
18 to 19	Tx Peer-to-peer sequence number	2

Log Data Request (Write Block) Output Data

Offset	Description	Length
0	9250	1
1 to 247	Spare	247

Log Data Request (Read Block) Input Data

Offset	Description	Length
0	Write Block ID Requested	1
1	Spare	1
2 to 3	Socket Tx count	2
4 to 5	Socket Tx error count	2
6 to 7	Socket Rx count	2
8 to 9	Socket Rx error count	2
10 to 11	Tokens Tx	2
12 to 13	Cyclic Tx	2
14 to 15	Peer-to-peer message Tx	2
16 to 17	Broadcast message Tx	2
18 to 19	Tokens Rx	2
20 to 21	Cyclic Rx	2
22 to 23	Peer-to-peer message Rx	2
24 to 25	Broadcast message Rx	2
26 to 27	Cyclic Rx errors	2
28 to 29	Cyclic Rx address size errors	2
30 to 31	Cyclic Rx CBN errors	2
32 to 33	Cyclic Rx TBN errors	2
34 to 35	Cyclic Rx BSIZE errors	2
36 to 37	Message retrans	2
38 to 39	Message over retrans	2
40 to 41	Message Rx errors	2
42 to 43	Message Rx version sequence errors	2
44 to 45	Message sequence retrans errors	2
46 to 47	ACK errors	2
48 to 49	ACK version sequence errors	2
50 to 51	ACK sequence errors	2
52 to 53	ACK node number errors	2
54 to 55	ACK TCD errors	2
56 to 57	Token multiple errors	2
58 to 59	Token discards	2
60 to 61	Token reissued	2
62 to 63	Token holding timeouts	2
64 to 65	Token monitoring timeouts	2
66 to 67	Total service time (seconds)	2
68 to 69	Frames waiting	2
70 to 71	Number of nodes participating	2
72 to 73	Self-exits	2
74 to 75	Exits by skipping	2
76 to 77	Exits of other nodes	2
78 to 79	Spare	2

Offset	Description	Length
80	Node holding token	1
81	Network allowable minimum frame interval	1
82	Network allowable refresh cycle time	1
83	Current measured refresh cycle time	1
84	Maximum refresh cycle time	1
85	Minimum refresh cycle time	1
86 to 248	Spare	163
249	9250	1

4.3 Implementation of FL-net

The following two classes are defined considering differences among necessities of FL-net transmission functions for various devices.

Class	Class Cyclic transmission		Message transmission	
	Sending	Receiving	Client function	Server function
1	Mandatory	Mandatory	Optional	Optional
2	Not applicable	Optional	Optional	Optional

Notes:

1 "Sending "of "cyclic transmission" indicates a function that the node allocates common memory and that it transmits data in the common memory of the own node to other nodes cyclically.

2 "Receiving "of "cyclic transmission" indicates a function that the system receives data from the common memory of other nodes cyclically.

3 The "client function" of "message transmission" indicates a function that the node transmits request messages and that it receives response messages.

4 The "server function" of "message transmission" indicates that the node processes request messages and that it returns response messages.

4.3.1 Information Tables

Types of Management Tables

Node status management is divided into the own-node management table, the participating node management table, and the network management table.

1 The self-node management table manages the local node settings.
2 The participating node management table manages the information of the nodes of in-ring the network.
3 The network management table manages the common network information.

The MVI56E-FLN module conforms to the mandatory items in the following tables. *For more information refer to Status Data (page 119).*

Table name	Information	Conforming level
Own-node management Table	Node number	*Mandatory*
	Area 1 data top address	Optional (Supported)
	Area 1 data size	Optional (Supported)
	Area 2 data top address	Optional (Supported)
	Area 2 data size	Optional (Supported)
	Upper layer status	*Mandatory*
	Token watchdog time	Optional (Supported)
	Allowable minimum frame interval time	Optional (Supported)
	Vendor code	Optional
	Manufacturer model name	Optional (Supported: Vendor Model)
	Node name	Optional (Supported)
	Protocol type	Optional (Supported)
	FA link status	*Mandatory* (Supported)
	Own-node status	*Mandatory* (Supported)
Participating node management table	Node number	*Mandatory* (Supported)
	Upper layer status	*Mandatory*
	Area 1 data top address	*Mandatory*
	Area 1 data size	*Mandatory*
	Area 2 data top address	*Mandatory*
	Area 2 data size	*Mandatory*
	Allowable refresh cycle time	Optional (Supported)
	Token monitoring time	Optional (Not Supported)
	Allowable minimum frame interval time	Optional (Supported)
	FA link status	*Mandatory*
Network management table	Token holding node number	Optional (Supported)
	Allowable minimum frame interval time	*Mandatory*
	Allowable refresh cycle time	Optional (Supported)
	Refresh cycle measurement time (Current value)	*Mandatory*
	Refresh cycle measurement time (Maximum value)	Optional (Supported)
	Refresh cycle measurement time (Minimum value)	Optional (Supported)

Own-Node Management Table

This table manages the local node settings.

1 The table is used to network parameter read and participation request frames.
2 Management data is set from the FA link protocol upper layer at the node startup time.
3 The node names and the top addresses and size of the transmitting area in the Common Memory can be set from the network.

Table name	Size	Description
Node number	1 byte	1 to 249 (addresses 0 and 250-255 are special function)
Common Memory Area 1 first word	2 bytes	Word address (0 to 1FF**H**)
Common Memory Area 1 data size	2 bytes	Size (0 to 200**H**)
Common Memory Area 2 first word	2 bytes	Word address (0 to 1FFF**H**)
Common Memory Area 2 data size	2 bytes	Size (0 to 2000**H**)
Upper layer status	2 bytes	RUN / STOP / ALARM / WARNING / NORMAL See status block (page 119) for additional information
Token watchdog time	1 byte	1 to 255 ms
Minimum frame interval time	1 byte	10 to 50 (in units of 100 ms)
Vendor code	10 bytes	Vendor code
Manufacturer model	10 bytes	Manufacture model, device name
Node name (equipment name)	10 bytes	User-defined node name
Protocol version	1 byte	80h (fixed)
FA link status	1 byte	In-ring / out-ring, and so on.
Own status	1 byte	Duplicate node number detection, and so on.

Participating Node Management Table

This table manages information on the nodes in the network.

The node status of each node joining in the network is monitored by the management table held by each node. Regarding the nodes joining the network, this table handles the data to be managed for each node.

1. At a start, participating node management table and the network management table is created in accordance with the received token frame.
2. Upon receipt of each token frame, each node updates the participating node management table.
3. Upon receipt of the participation request frame for new joining, the joining node management table is updated.
4. When non-reception of a token frame of each node or a timeout is detected 3 times running, the corresponding node is deleted from the table.

Table name	Size	Description
Node number	1 byte	1 to 249 if participating (a zero in this field for a node indicates the node is not participating on the network)
Upper layer status	2 bytes	RUN / STOP / ALARM / WARNING / NORMAL See status block for additional information
Common Memory Area 1 data first word	2 bytes	Word address (0 to 1FF**H**)
Common Memory Area 1 data size	2 bytes	Size (0 to 200**H**)
Common Memory Area 2 data first word	2 bytes	Word address (0 to 1FFF**H**)
Common Memory Area 2 data size	2 bytes	Size (0 to 2000**H**)
Allowable refresh cycle time	2 bytes	1 ms. (unit)
Token watchdog time	1 byte	1 to 255 ms
Minimum frame interval time	1 byte	1 to 50 (in units of 100 ms)
FA link status	1 byte	In-ring / out-ring information, and so on.

Network Management Table

This table manages information that is shared by all nodes on the network.

Table name	Size	Description
Token-holding node number	1 byte	Node currently holding the token
Minimum frame interval time	1 byte	1 to 50 (in units of 100 ms)
Allowable refresh cycle time	2 bytes	1 ms. (unit)
Refresh cycle measurement time (current)	2 bytes	0 to 65535 ms
Refresh cycle measurement time (maximum)	2 bytes	1 ms. (unit)
Refresh cycle measurement time (minimum)	2 bytes	1 ms. (unit)

4.3.2 Upper Layer Status Read Definition

The node status is divided into two types: FA link protocol upper layer status (referred to as the upper layer status) and FA link protocol status (referred to as the FA link status).

Upper Layer Status

The upper layer status is divided into upper layer operation information and upper layer error information.

Upper layer operation information

- RUN: Indicates that the upper layer program is running.
- STOP: Indicates that the upper layer program is at a stop.

Upper layer error information

- NORMAL: Indicates that the upper layer is normal and both cyclic data and message data are guaranteed.
- WARNING: Indicates that there occurs an error that permits continuing operation in the upper layer but both cyclic data and message data are guaranteed.
- ALARM: Indicates that there occurs an error that does not permit continuing operation in the upper layer and both cyclic data and message data are not guaranteed.

Contents of error in the upper layer: Indicates the contents of an error in the upper layer program.

The upper layer program means those that have an interface with the FA link protocol upper layer, which for the MVI-FLN module is the ControlLogix processor.

Upper Layer Status Table

Operation Information

Error information	Run	Stop
NORMAL	The upper layer program is running and both cyclic data and message data are guaranteed.	The upper layer program is at a stop but both cyclic data and message data are guaranteed.
WARNING	The upper layer program is running with an error but both cyclic data and message data are guaranteed.	The upper layer program is at a stop with an error but both cyclic data and message data are guaranteed.
ALARM	Both cyclic data and message data are not guaranteed.	Both cyclic data and message data are not guaranteed.

The Upper Layer Status word is structured as follows:

Upper Layer Status Word

Bit	Description	Value
0 to 11	Error Code (User Defined)	0x0001
12	reserved	0x1000
13	1=Warning, 0=No Warning	0x2000
14	1=Alarm, 0=No Alarm	0x4000
15	1=Run, 0=Stop	0x8000

The output blocks that transfer Area 1 and Area 2 data from the ControlLogix to the MVI56E-FLN module (blocks 1 to 38) update the Upper Layer Status through word offset 247. The sample ladder logic uses the FLNETMODULE.CONTROL.UpperLayerStatus controller tag to update the upper layer status.

For example, to set a warning condition, set this controller tag as shown in the following illustration:

You can monitor the Upper Layer Status from Own Node Data screen (page 61) in the *PCB Diagnostics* menu.

FA Link Status

The information on link status is divided into two types: information shared on the network and information to be managed by each node.

In-ring and out-ring of each node are managed in units of node. All information except the above is shared on the network.

Message	Description
Address overlapping detection	Indicates that there is any overlapping setting in the common memory of a node connected to the network.
Common memory setting completion	Indicates that the setting in the common area of a node is completed.
Common memory data validity	Indicates that cyclic data is effective.
Upper layer operation signal error	Indicates that updating of the existence signal of the upper layer cannot be recognized.
Node in-ring / out-ring	Indicates the information managed to see whether each node joins the network or secedes from it.

The MVI56E-FLN module allows the processor to dynamically set the module to out-ring and then again to in-ring state. The output blocks that transfer Area 1 and Area 2 data from the ControlLogix to the MVI56E-FLN module (blocks 1 to 38) updates word offset 246 which is reserved for this purpose (in-ring and out-ring command).

The sample ladder logic uses the *FLNETMODULE.CONTROL.In_Out_ RingCommand* controller tag to update this register. Setting a value of 0 will not interfere on the module regular functionality (it will go in-ring once finds other nodes in the network as defined in the protocol specification)

In order to monitor the in-ring and out-ring state the user can refer to the FA Link status which according to the protocol specification is defined as follows:

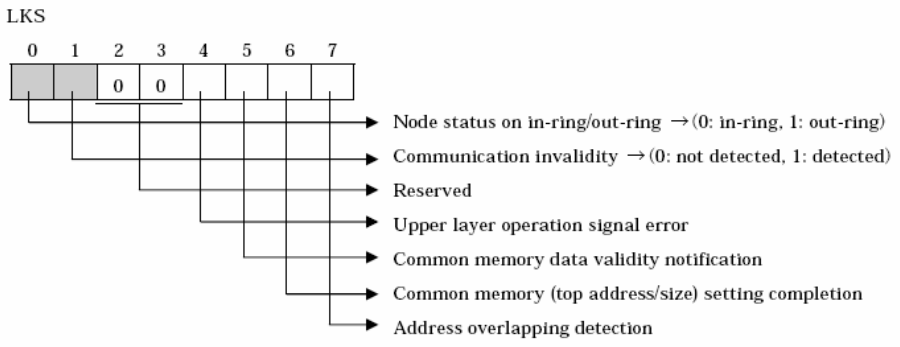


Figure 4 LKS Data

You can monitor the FA Link Status through the FLNETSTATUS.Own_node.FA_link_status. For this example bit 0 is currently set as 0 (MVI56E-FLN is in-ring)

Setting a value of 1 to *FLNETMODULE.CONTROL.In_Out_RingCommand* controller tag will set the MVI56E-FLN module as out-ring:

- **Firmware Version 1.04 or higher:** The out-ring state can be checked by the FA Link status which now indicates that all bits are set to 0 (out-ring).
- **Older Versions :** The out-ring state can be checked by the FA Link status which now indicates that bit 0 is set to 1 (out-ring).

You can observe that the LER/LE LED will be asserted to indicate that the module was set out-ring.

Setting a value of 2 to *FLNETMODULE.CONTROL.In_Out_RingCommand* controller tag will set the MVI56E-FLN module again to in-ring:

- **Firmware Version 1.04 or higher**: The in-ring state can be checked by the FA Link status which now indicates that bit 0 is set to 1 (in-ring)
- **Older Versions**: The in-ring state can be checked by the FA Link status which now indicates that bit 0 is set to 0 (in-ring)

Self-Node Status

This is the information on self-node status to be given to the upper layer.

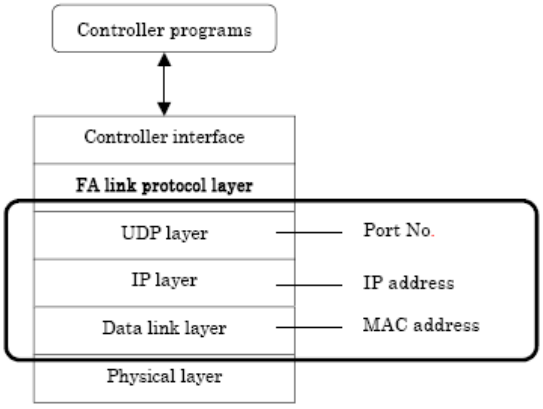
Message	Description
Self-node number conflict	Indicates the management information on node number conflicted to see whether any node having the same node number as the self-node setting exists on the network or not.
Token monitoring time error	Indicates the error notice information that transmit processing has not been completed within the token monitoring time set in the self-node.
Receive waiting status	Indicates that no frame has been received at network initialization, being a frame receive waiting status.
Initialize error	Indicates an error is found in an initial setting or resetting parameter.

Timer Types

Message	Description
Token monitoring time	Set from the upper layer (in units of 1 ms).
Allowable refresh cycle time	Calculated from the refresh time only for cyclic transmission.
Refresh cycle measurement time	Measurement value in a circulation of a token: Present value. The maximum value and the minimum value from the start time are held (in units of 1 ms).
Allowable minimum frame interval time	Set from the upper layer. The maximum value on the network is effective (in units of 100 microseconds).
Joining token detection time	Fixed value (3 seconds)
Participation request frame transmission waiting time	Fixed value (self-node number □□4 ms□
Three-circulation waiting time	Fixed value (3 seconds)
Token holding timeout time	Within this time after receipt of a token directed to the self-node, a token must be transmitted to the next node.
Trigger frame transmission waiting time	Fixed value ((self-node number mod 8) □□4 ms)

4.3.3 Lower Layer Protocol

Address Setting



IP Address

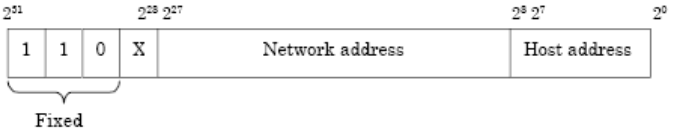
The IP address is set from the upper layer of the FA link protocol.

The sub-network mask is also set from the upper layer of the FA link protocol.

The default value of the transmission source is specified as 192.168.250.N (N = node No.: 1 to 125).

The default value of the transmission destination is specified as 192.168.250.255.

Remarks: For the IP address, it is recommended that class C is used and that the lower host address is matched with the FA link protocol node No



MAC Address

As the MAC address, the default set in the unit is used.

Port Number

For reception

- Cyclic transmission port number (for system: 55000 fixed)
- Message transmission port number (for system: 55001 fixed)
- Participation request frame port number (for system: 55002 fixed)

  For transmission
- Transmission port number (for system: 55003 fixed)

4.4 FL-net Protocol and Network

4.4.1 Understanding the Basics of FL-net

The MVI56E-FLN module is equipped to be used with 10Base-T FL-net (Version 2.00) Systems.

The basic configuration of a 10Base-T FL-net System consists of one hub to which nodes are attached in star form through twisted-pair cable.

4.4.2 Data Frame ID of FL-net

When review the network with an analyzer such as Ethereal the user can examine the protocol frames and use the following table to determine the transaction type.

Data Frame ID: Transaction Code

Transaction Code	Application
0 to 59999	Transparent mode message frame
60000 to 64999	Reserved
65000	Cyclic frame (with token)
65001	Cyclic frame (without token)
65002	Participation request frame
65003	Byte block read frame (request)
65004	Byte block write frame (request)
65005	Word block read frame (request)
65006	Word block write frame (request)
65007	Network parameter read frame (request)
65008	Network parameter write frame (request)
65009	Stop command frame (request)
65010	Start command frame (request)
65011	Profile read frame (request)
65012	Trigger frame
65013	Log data read frame (request)
65014	Log data clear frame (request)
65015	Echo back message frame (request)
65016 to 65202	Reserved (for future expansion)
65203	Byte block read frame (response)
65204	Byte block write frame (response)
65205	Word block read frame (response)
65206	Word block write frame (response)
65207	Network parameter read frame (response)
65208	Network parameter write frame (response)
65209	Stop command frame (response)
65210	Start command (response)
65211	Profile read frame (response)
65212	Reserved
65213	Log data read frame (response)
65214	Log data clear frame (response)
65215	Echo back message frame (response)
65216 to 65399	Reserved (for future expansion)
65400 to 65535	Reserved

4.4.3 Allowable Refresh Cycle Time

Each node always monitors the message frames in the network in the period from receipt of a token until receipt of the next token to the node. If there is no message frame in the network in this 1 cycle, this cycle time × 1.2 is specified as the allowable refresh cycle time.

When the network is started, the allowable refresh cycle time is set to "0". When a token directed to the node is received 3 times at the start-up, a refresh cycle measurement will be started. Accordingly, the network does not perform message transmission before a token is circulated once.

A node that joins in the halfway participation status, starts measuring the refresh cycle time after the third token reception to the node.

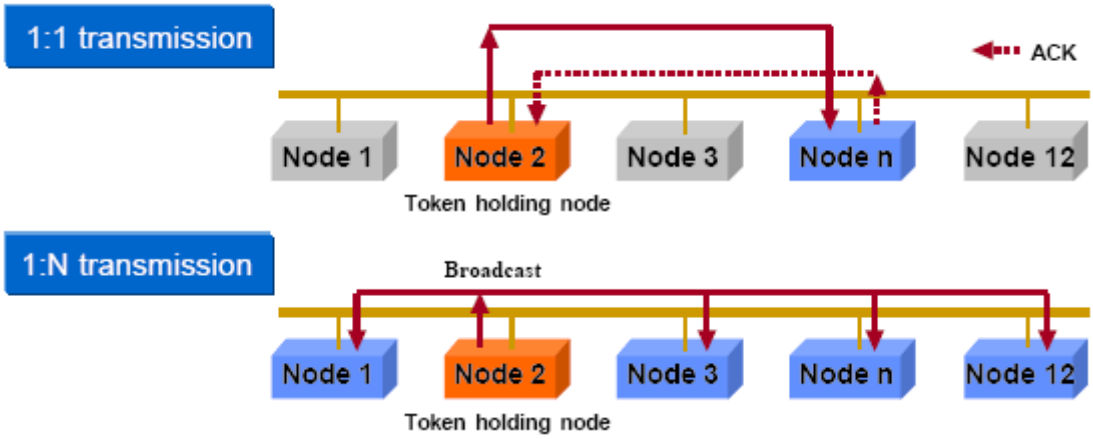
The allowable refresh cycle time is dynamically determined depending on the number of nodes joining the network.

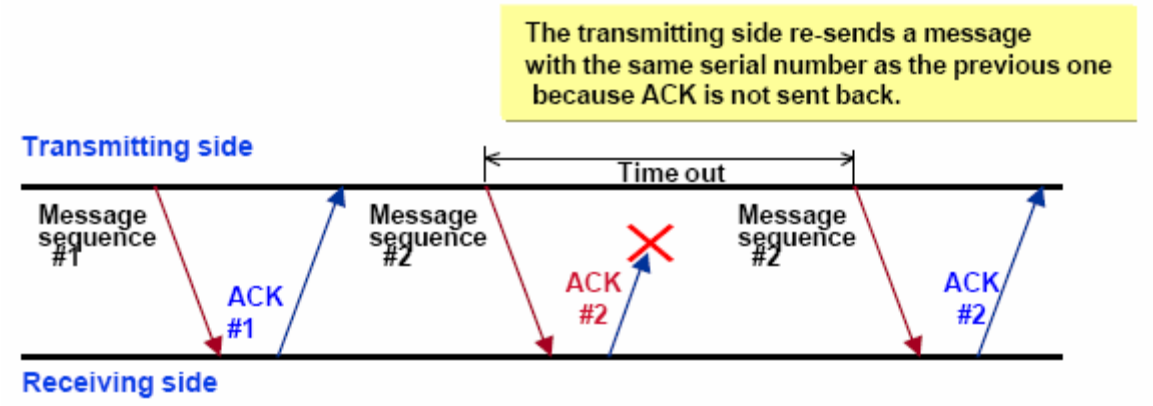
4.4.4 Memory Resources

The module provides 8700 words for shared Area 1 and Area 2 Common Memory.

4.4.5 Message Transmissions

- A token-holding node can send up to one message frame.
- 1:1 transmission and 1:N transmission are provided.
- Message acknowledges is available for 1:1 transmission.





Type of message	ACK response	Re-send	Sequence No. control
1:1 message transmission	Yes	Yes	Yes
1:N message transmission	No	No	Yes

Message Transmission Services

Type of Message Service	Remarks
Read byte block data	Not supported
Write byte block data	Not supported
Read word block data	Not supported
Write word block data	Not supported
Read network parameter	Supported
Write network parameter	Not supported
Start operation	Not supported
Stop operation	Not supported
Read profile	Supported
Read log data	Supported
Clear log data	Supported
Transparent mode message	Not Supported
Echo back message	Supported

4.4.6 Message Transmission Function

Message transmission is a function that supports non-cyclic data exchange between nodes. The MVI56E-FLN module does not support the optional messaging functions except in response to Log Data request messages as follows:

Log data read: Function reads the log data on a specified node.

- (Request) No data division.
- (Normal response) 512 bytes
- (Error response) The data division includes an error code.

Log data clear: Function clears the log related to a specified node.

- (Request) No data division.
- (Normal response) No data division.
- (Error response) The data division includes an error code.

Items provided for "Log Data Read" service

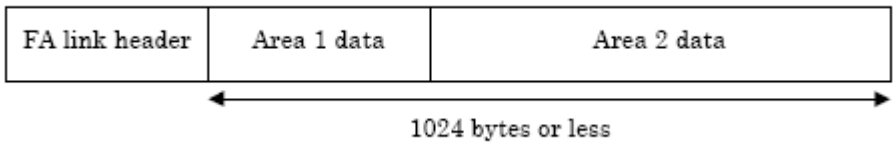
Major items	Minor items	Implemented (Y) or not(N)
Transmission / reception	Total number of transmission at socket unit *	Y
	Total number of transmission errors at socket unit *	Y
	Number of Ethernet transmission errors	N
	Total number of receptions *	Y
	Total number of reception errors *	Y
Frame types	Number of Ethernet reception errors	N
	Number of tokens transmitted	Y
	Number of cyclic frames transmitted	Y
	Number of peer-to-peer messages transmissions	Y
	Number of broadcast messages transmissions	Y
	Number of tokens received	Y
Cyclic transmission	Number of cyclic frames received	Y
	Number of peer-to-peer messages received	Y
	Number of broadcast messages received	Y
	Number of cyclic reception errors *	Y
	Number of cyclic address size errors	Y
	Number of cyclic CBN errors	Y
Message transmission	Number of cyclic TBN errors	Y
	Number of cyclic BSIZE errors	Y
	Number of message retransmissions *	Y
	Number of message over-retransmissions *	Y
	Number of message reception errors *	Y
	Number of message version-of-sequence number errors	Y
	Number of message sequence number retransmissions recognized	Y
ACK-related	Number of ACK errors *	Y
	Number of ACK version-of-sequence number errors	Y

Major items	Minor items	Implemented (Y) or not(N)
	Number of ACK sequence number errors	Y
	Number of ACK node number errors	Y
	Number of ACK TCD errors	Y
Token-related	Number of token multiplications recognized *	Y
	Number of tokens discarded *	Y
	Number of tokens re-issued *	Y
	Number of token holding timeouts	Y
	Number of token monitoring timeouts	Y
Total service time	Number of frame waiting states *	Y
	Number of participations *	Y
	Number of self-exits *	Y
	Number of exits by skipping *	Y
Status 1	Number of exits of other nodes recognized *	Y
Status 2	List of participation recognized nodes	Y
Vendor definable area	Self-exits	Y
	Exits by skipping	Y
	Exits of other nodes	Y
	Spare	Y
	Node holding token	Y
	Network allowable minimum frame interval	Y
	Network allowable refresh cycle time	Y
	Current measured refresh cycle time	Y
	Maximum refresh cycle time	Y
	Minimum refresh cycle time	Y

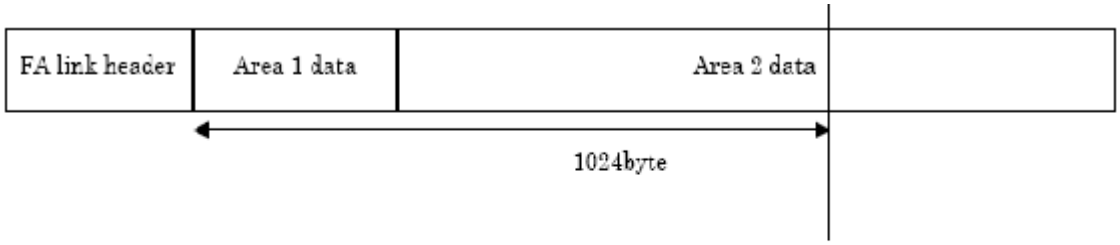
4.4.7 Data Volume and Number of Frames

The frame structure for cyclic transmission depends on the data volume consisting of Area 1 and Area 2.

1 When the data volume is 1024 bytes or less: This data is transmitted by one frame.
Figure when the transit data volume is 1024 bytes or less

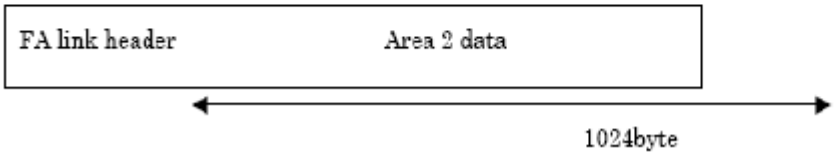


2 When the data volume exceeds 1024 bytes: This data is transmitted by 2 frames of more in divided form.



(a) 1st transmit data

(b) 2nd and subsequent transmit data



When the transmit data volume exceeds 1024 bytes, two or more divided frames are continuously sent in the token held state.

4.4.8 Network Management

- Nodes can be added while the FL-net system is running.
- The system will continue to run even if any node fails.
- Each node knows the state of all the other nodes.

  Each node manages In-ring and Out-ring of nodes
- One token is circulated between all nodes in the FL-net and the token is monitored by the time of each node. If a node does not send the token, the next node will reissue it after a fixed time interval.
- Out-ring management

  If a node does not send the token, every node will recognize the node failure.
- In-ring management

  New node sends a participation request frame and every node monitors it.
- Node state management

  Network status and upper layer status are attached in the cyclic frame.

4.4.9 Masterless Transmission Management

Token

1 A node can transmit data only while holding a token, with the following two exceptions:

- Reissue of token due to failure of a node to send a token within the token monitoring time
- Transmission of participation request frame when the node has not joined in the network

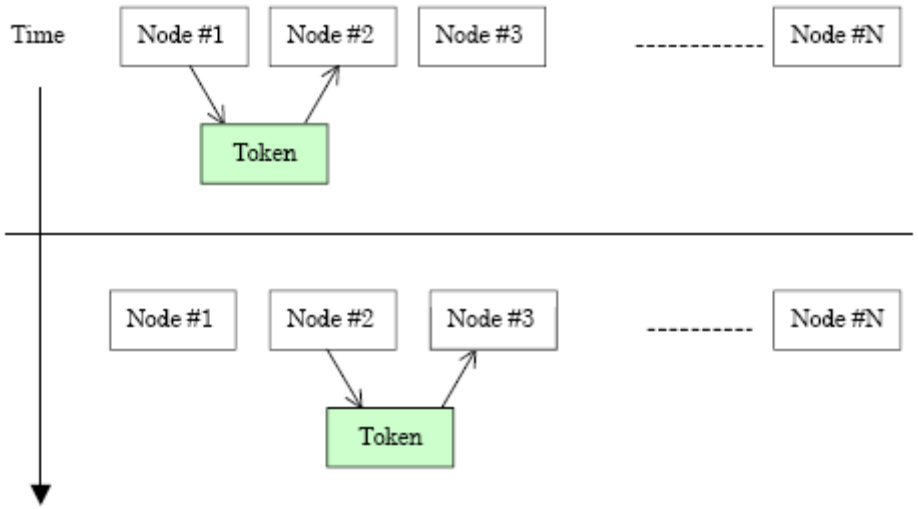
1 A single token is circulated among nodes. A node receiving a token holds the transmission right until it releases the token to the next node.
2 The token is circulated between all the nodes joining the FL-net.
3 The token can be transmitted along with cyclic data.
4 The token can also be circulated without any data.
5 The token is monitored by each node's timer. If the token is not released by a node within a fixed time, the token is automatically reissued.
6 If there are two tokens in the network, they are combined into one.

Token Flow

Only one token exists in the network.

A frame including a token (token frame) is provided with a destination node number and node number of token transmitting side. Each node becomes a token holding node when a match is found with the destination node number of the received token frame.

The token rotation order is determined in the ascending order of node number. The node with the largest node number releases a token to the node with the smallest node number.

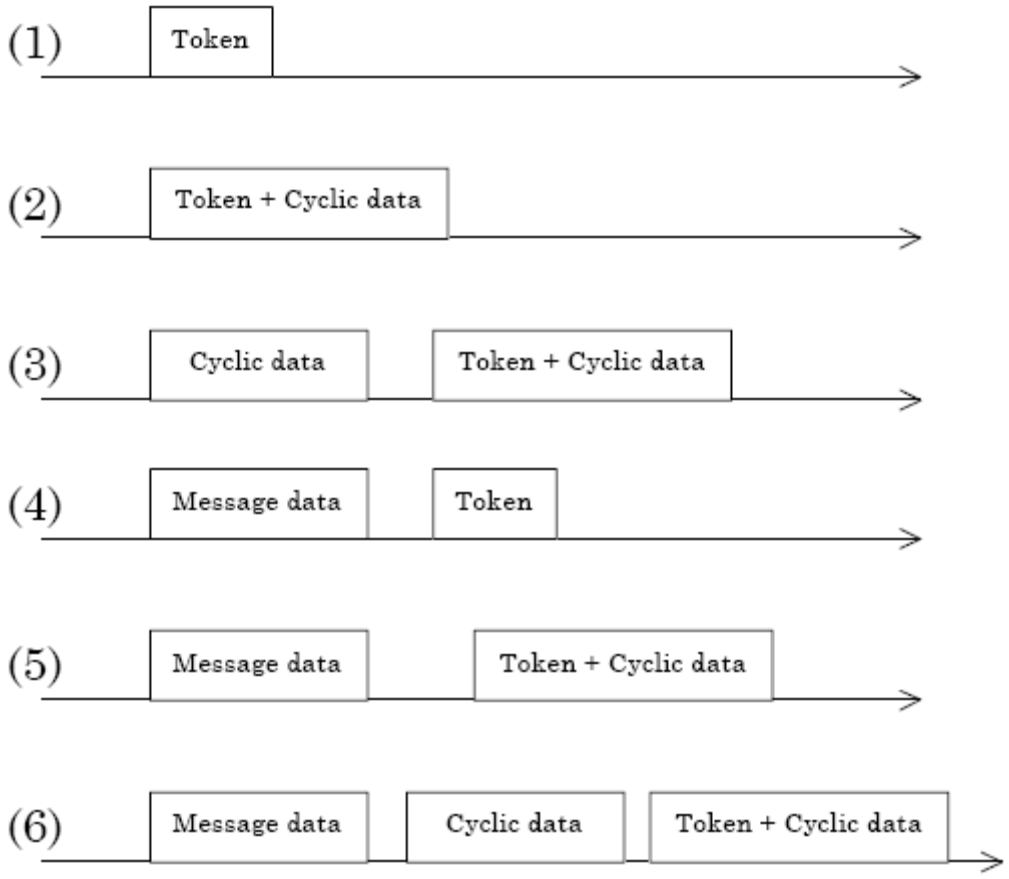


Token and Frames

There are six types of frames sent with a token.

1 When there is no cyclic data to be sent, only a token is transmitted.
2 When there is only cyclic data, a token is transmitted together with cyclic data.
3 When there is only cyclic data and this cyclic data is sent in divided form, only the cyclic frames are transmitted and a token is attached to the last cyclic frame.
4 When there is only message data, the message frame is transmitted, followed by a token.
5 When there is cyclic data and message data, the message frame is transmitted and then the cyclic frame is transmitted together with a token.

6 When there is cyclic data and message data and the cyclic data is sent in divided form: The message frame is transmitted and then only the cyclic frames are transmitted and a token is attached to the last frame.



4.4.10 FA Link Protocol

In-Ring and Out-Ring Management

In-ring and out-ring of other nodes

At network initialization, each node monitors the line until the joining token detection time is up. If the node monitors token flow, the node considers it as a halfway participation state and performs the processing of (1) below. In the other case, if the node does not monitor any token, the node considers itself as a network start-up state and performs the processing of (2) below.

1 When monitoring a token flow (halfway participation state)

When monitoring a token flow within the joining token detection time, it is recognized that a link is already established.
At this time, the node waits for transmission of a participation request frame until the token is circulated 3 times. In this period, a node number conflict check and an address overlapping check of common memory are made by the received frames and the participating node management table is updated. If any address overlapping is detected, the node set the common memory top address and data size of areas 1 and 2 to 0 and shall not transmit cyclic data. At the same time, the node sets the address overlapping flag, and resets the common memory data validity flag.
When no error is found in node number, the node will send out a participation request frame after the participation request frame transmission waiting time is up. The participation request frame is transmitted regardless of token holding.
A node that has recognized a node number conflict does not transmit a participation request frame and does not join the network. The node number conflict error shall be notified to the upper layer.
When a token for the self-node is not received after the third circulation though the node joined the network by the participation request frame, this node transmits a participation request frame again. Token monitoring is performed for the joining token detection time. When a token is received, the node is put into a halfway participation status. When no token is received, it is put into a network startup status that will be described later.

2 When receiving no token (network startup status)

When no token is monitored during the joining token detection time, the node transmits a trigger frame after the remainder of (node number / 8) x 4 milliseconds. If a trigger frame is received before the node transmits its trigger frame, the node shall transmit no trigger frame.
When the participation request frame transmission waiting time (node number x 4 milliseconds) is up after a first trigger frame reception, each node transmits its participation request frame.
During the participation request frame reception waiting time (1200 milliseconds) after a first trigger frame reception, a conflict check of node number and an address overlapping check are made and the participating node management table is updated, thus each node shall wait for all nodes to transmit participation request frames.

A node that recognized address overlapping by the participation request frame reception from other nodes sets the common memory top address and common memory size of areas 1 and 2 to 0 and does not transmit cyclic data. At the same time, the node set the address overlapping and reset the common memory data validity flag.
The node having the smallest node number transmits a token first according to the participating node management table after the participation request frame reception waiting time is up.
A node that recognized conflict of node number does not transmit and receive data at all. A joining error in the network shall be notified to the upper layer.
A conflict of node number / address overlapping check are made when the node does not yet join the network. At the initial startup status, a conflict of node number / address overlapping check are made for both nodes that transmitted a participation request frame and nodes that did not transmit it. If overlapping is detected, the corresponding processing is performed.
When a node does not receive even one frame during the participation request frame reception waiting time, the node executes the start up sequence from monitoring the token for the joining token detection time. If the existence of other nodes is not recognized in the period from transmission of the third participation request frame until the participation request frame reception waiting time is up, the node sets a frame waiting flag. The node continues to resend a participation request frame until the network is established.
In case other nodes have fallen off and only one node remains during token circulation with the result that the node waits for a trigger frame or a token frame, the above is also applicable.

4.5 Error and Status Data

4.5.1 Status Data

Status Input (Read) Data Block

Offset	Description	Length
0	Write Block ID Requested (0 &-1)	1
1	FA_link status & Own status	1
2	Number of Nodes Active	1
3 to 18	Participation List	16
19 to 34	Nodes With Active Data	16
35	Token Node & MFT	1
36	Allowable refresh cycle time	1
37	Current refresh cycle time	1
38	Maximum refresh cycle time	1
39	Minimum refresh cycle time	1
40	Frames waiting to send	1
41	Node Number & protocol	1
42	FL-Status & Own Status	1
43	Top Area 1	1
44	Size Area 1	1
45	Top Area 2	1
46	Size Area 2	1
47	Upper Layer Status	1
48	Watchdog Timeout & MFT	1
49 to 53	Vendor Code (10 bytes)	5
54 to 58	Vendor Model (10 bytes)	5
59 to 63	Node Name (10 bytes)	5
64	Network Token Node & MFT	1
65	Network Allowable refresh cycle time	1
66	Network current refresh cycle time	1
67	Network maximum refresh cycle time	1
68	Network minimum refresh cycle time	1
69 to 99	Reserved for future use	31
100	Program scan counter	1
101 to 102	Product Code	2
103 to 104	Revision	2
105 to 106	Operating system revision	2
107 to 108	Run number	2
109	Block read count	1
110	Block write count	1
111	Block parse count	1
112	Block error count	1
113 to 248	Reserved for future use	136
249	Read Block ID (-1 or 0)	1

4.6 FL-net Device Profile for MVI56E-FLN Module

4.6.1 Text Notation of Profile

Name of Parameter	Characters used [Printable String type], (length), (characters)	Data type [Type]	Text Notation (Length), (content)
Version of device profile common specification	6, "COMVER"	INTEGER	1, 1
System parameter ID	2, "ID"	Printable String	7, "SYSPARA"
System parameter revision number	3, "REV"	INTEGER	1, 0
System parameter revision date	7, "REVDATE"	[INTEGER], 2, (0001 to 9999), [INTEGER], 1, (01 to 12), [INTEGER], 1, (01 to 31)	2, 2006 1, 5 1, 30
Device type	10, "DVCATEGORY"	Printable String	5, "OTHER"
Vendor name	6, "VENDOR"	Printable String	24, "PROSOFT TECHNOLOGY, INC."
Product name	7, "DVMODEL"	Printable String	9, "MVI56E-FLN"

Abstract Syntax of Profile

1) Type Definition

OtherRecord: :=	SEQUENCE	
	{	
	syspara	SysparaType
	}	
SysparaType: :=	SEQUENCE	
	{	
	nameCOMVER	NameType
	paraCOMVER	INTEGER
	nameID	NameType
	paraID	NameType
	nameREV	NameType
	paraREV	INTEGER
	nameREVDATE	NameType
	paraREVDATE	DateType
	nameDVCATEGORY	NameType
	paraDVCATEGORY	NameType
	nameVENDOR	NameType
	paraVENDOR	NameType
	nameDVMODEL	NameType
	paraDVMODEL	NameType
	}	

2) Value Definition

{			
syspara	{		
	nameCOMVER	"COMVER",	
	paraCOMVER	1,	
	nameID	"ID",	
	paraID	"SYSPARA",	
	nameREV	"REV",	
	paraREV	0,	
	nameREVDATE	"REVDATE",	
	paraREVDATE	{	
		year	2006,
		month	5,
		day	30
		},	
	nameDVCATEGORY	"DVCATEGORY",	
	paraDVCATEGORY	"OTHER",	
	nameVENDOR	"VENDOR",	
	paraVENDOR	"PROSOFT TECHNOLOGY, INC.",	
	nameDVMODEL	"DVMODEL",	
	paraDVMODEL	"MVI56E-FLN"	
	}		
}			

MVI56E-FLN Transfer Syntax Data Array (Coding)

Identifier	Length						
30	8180	**Identifier**	**Length**				
		30	7E	**Identifier**	**Length**	**Content**	
				13	06	"COMVER"	
				02	01	1	
				13	02	"ID"	
				13	07	"SYSPARA"	
				13	03	"REV"	
				02	01	0	
				13	07	"REVDATE"	
				Identifier	**Length**	**Content**	
				30	0A	**Identifier**	**Length**	**Content**
						02	02	07D6
						02	01	05
						02	01	1E
				Identifier	**Length**	**Content**	
				13	0A	"DVCATEGORY"	
				13	05	"OTHER"	
				13	06	"VENDOR"	
				13	18	"PROSOFT TECHNOLOGY, INC."	
				13	07	"DVMODEL"	
				13	09	"MVI56E-FLN"	

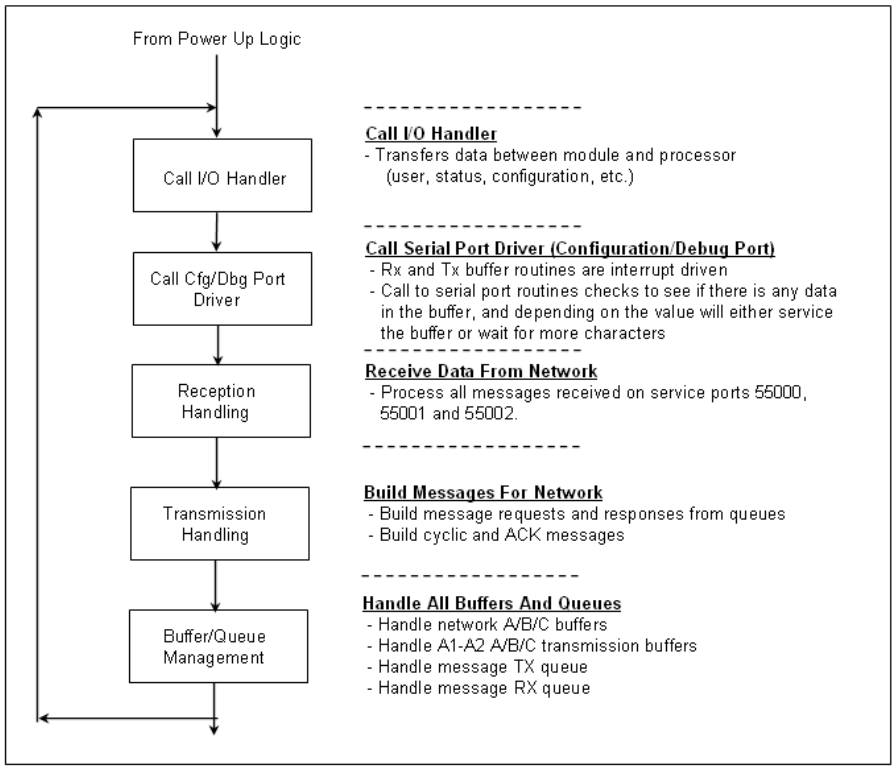
MVI56E-FLN Profile Data Array

Relative Address

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
00	30	81	80	30	7E	13	06	"C"	"O"	"M"	"V"	"E"	"R"	02	01	1
10	13	02	"I"	"D"	13	07	"S"	"Y"	"S"	"P"	"A"	"R"	"A"	13	03	"R"
20	"E"	"V"	02	01	00	13	07	"R"	"E"	"V"	"D"	"A"	"T"	"E"	30	0A
30	02	02	07	D6	02	01	05	02	01	1E	13	0A	"D"	"V"	"C"	"A"
40	"T"	"E"	"G"	"O"	"R"	"Y"	13	05	"O"	"T"	"H"	"E"	"R"	13	06	"V"
50	"E"	"N"	"D"	"O"	"R"	13	18	"P"	"R"	"O"	"S"	"O"	"F"	"T"	" "	"T"
60	"E"	"C"	"H"	"N"	"O"	"L"	"O"	"G"	"Y"	","	" "	"I"	"N"	"C"	"."	13
70	07	"D"	"V"	"M"	"O"	"D"	"E"	"L"	13	09	"M"	"V"	"I"	"5"	"6"	"-"
80	"F"	"L"	"N"													

4.7 Module Power Up

4.7.1 Main Logic Loop



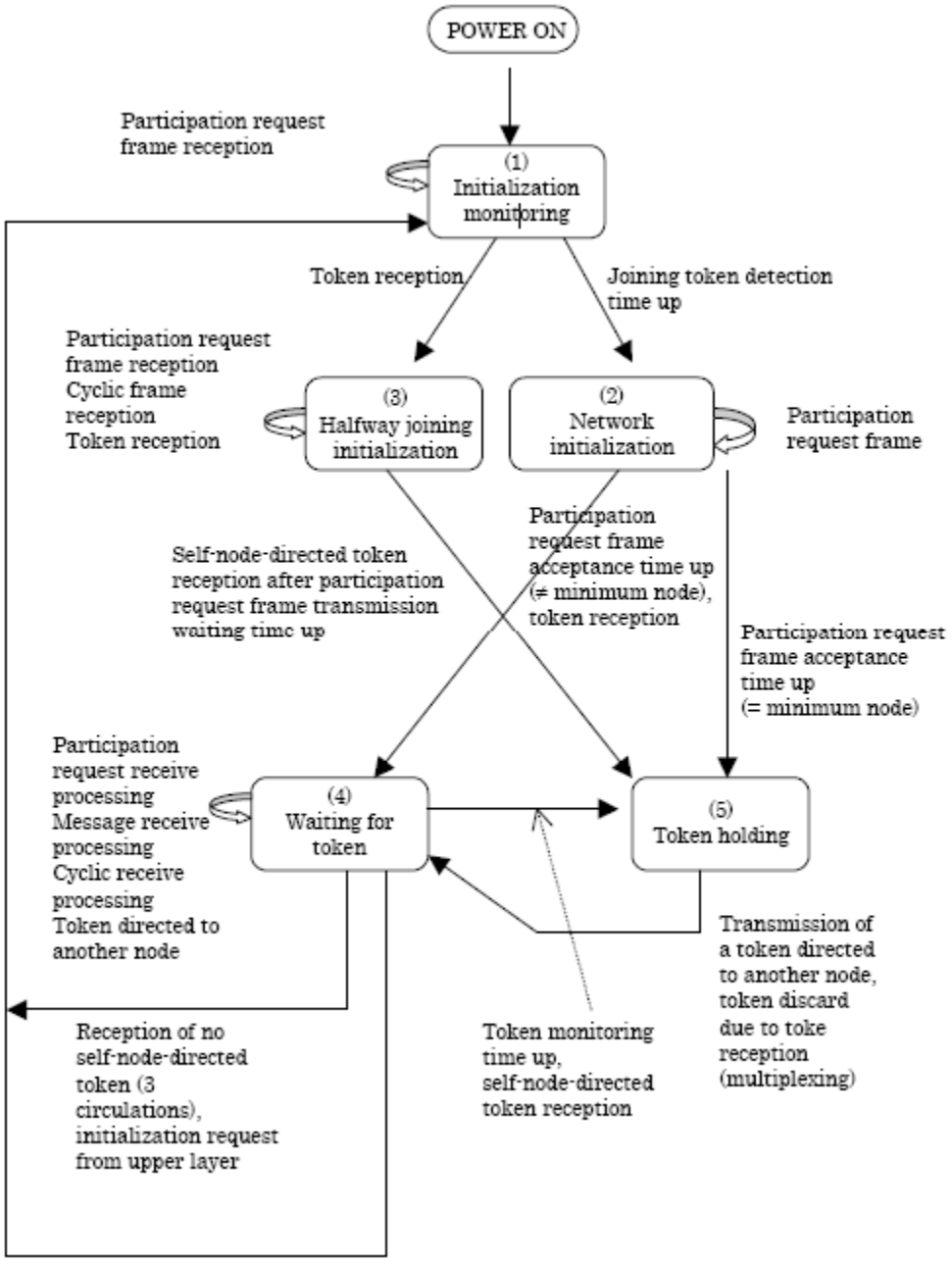
4.8 State Transition Diagram

This section describes the state transition.

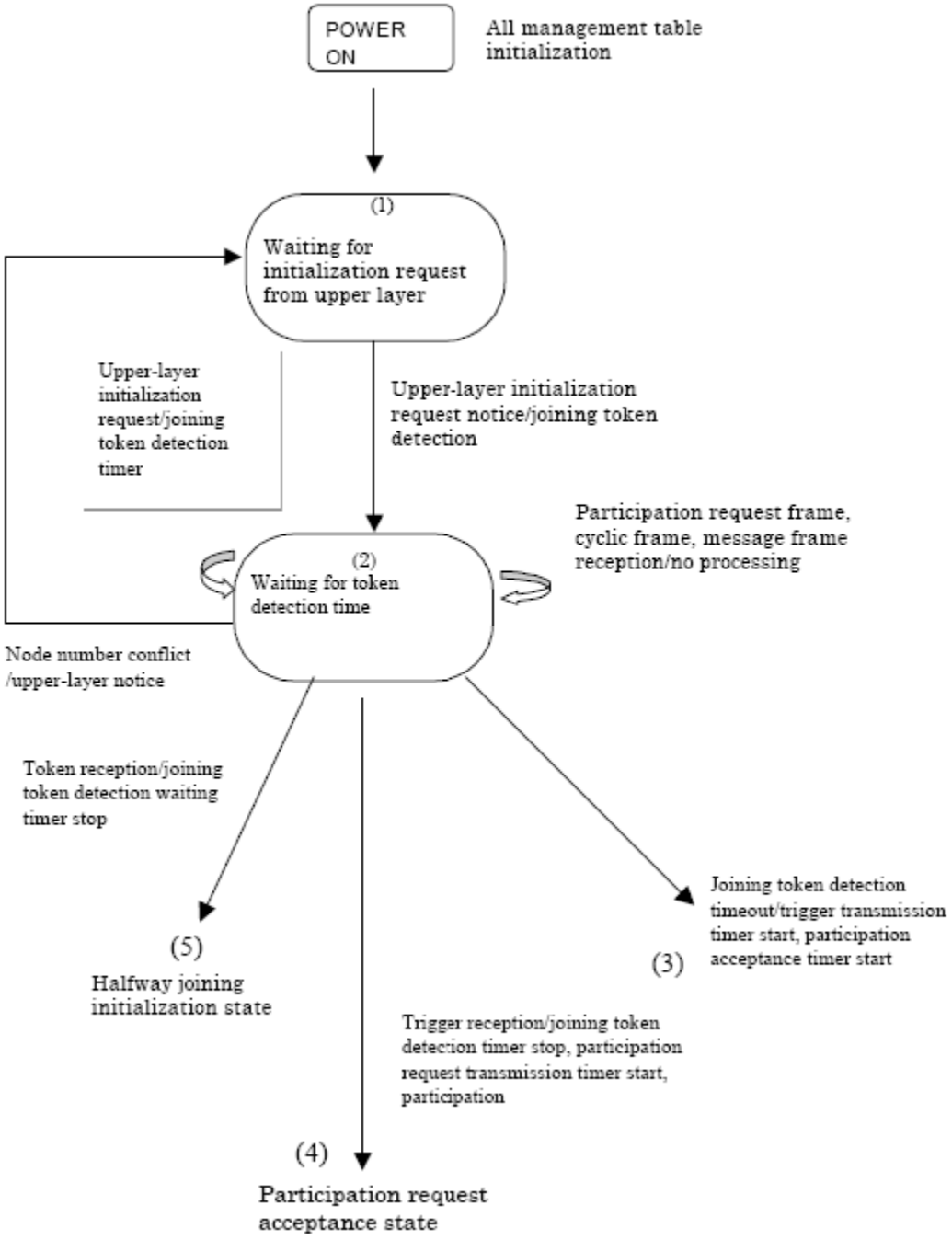
4.8.1 A. State Definitions

1 Initialization monitoring state: Waits for an initialization request from the upper layer and judges if the network link is established
2 Network initialization state: Link establishment state from a link non-establishment state.
3 Halfway joining initialization state: Up to the time when the self-node joins the network in the link establishment state.
4 Token waiting state: State where a token is not held in the link joining state.

5 Token holding state: State where a token is held in the link joining state.



4.8.2 B. Initialization Monitoring



State

Waiting for initialization request from upper layer.

Because necessary information for joining the network such as self-node No. is not set, a joining operation cannot be started.

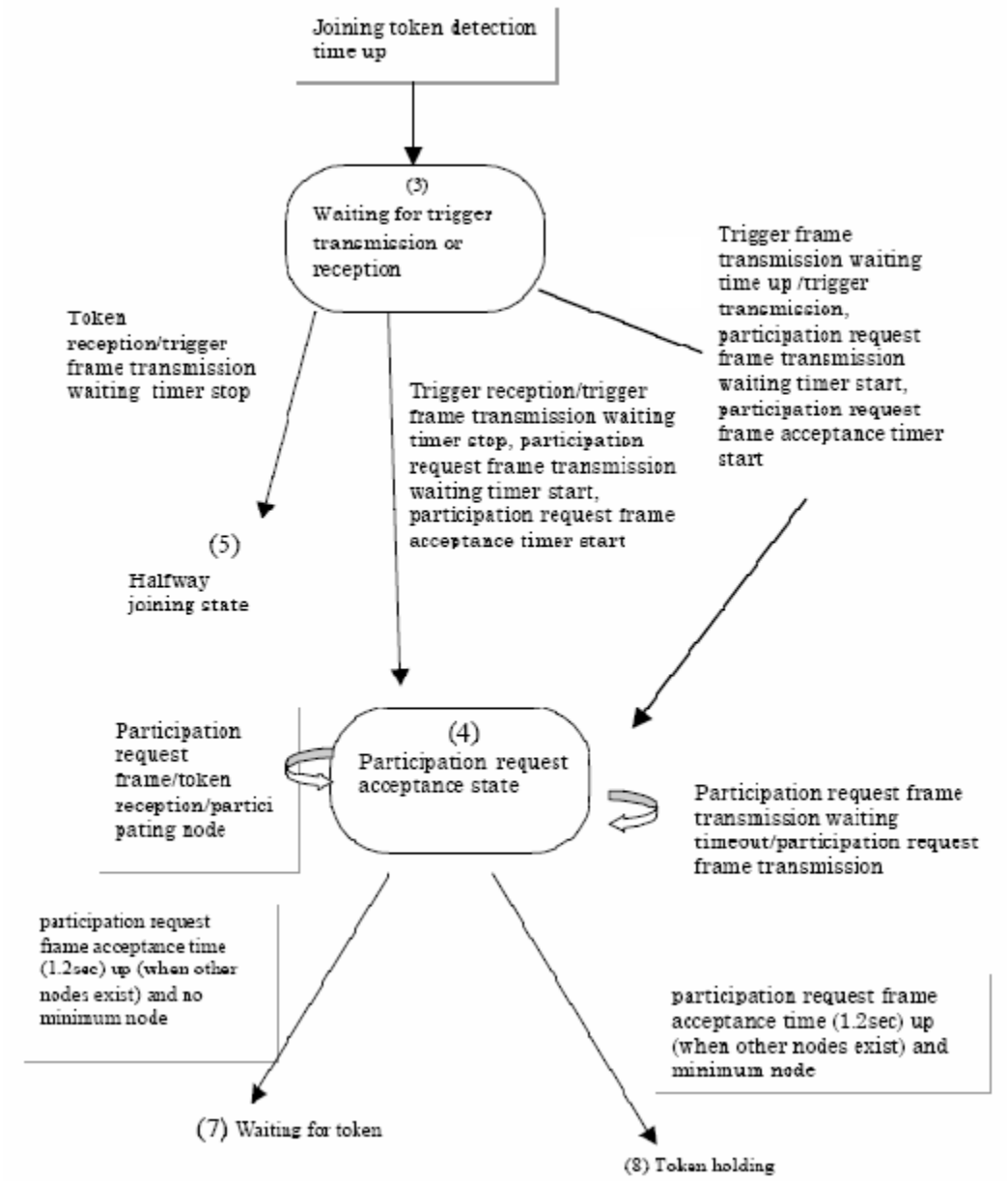
The node waits until the parameters that permit joining the network are set by the upper layer.

Waiting for joining token detection timeout Time for judging the current network status. The time starts after an initialization request from the upper layer is accepted. The monitoring time shall be 3 sec.

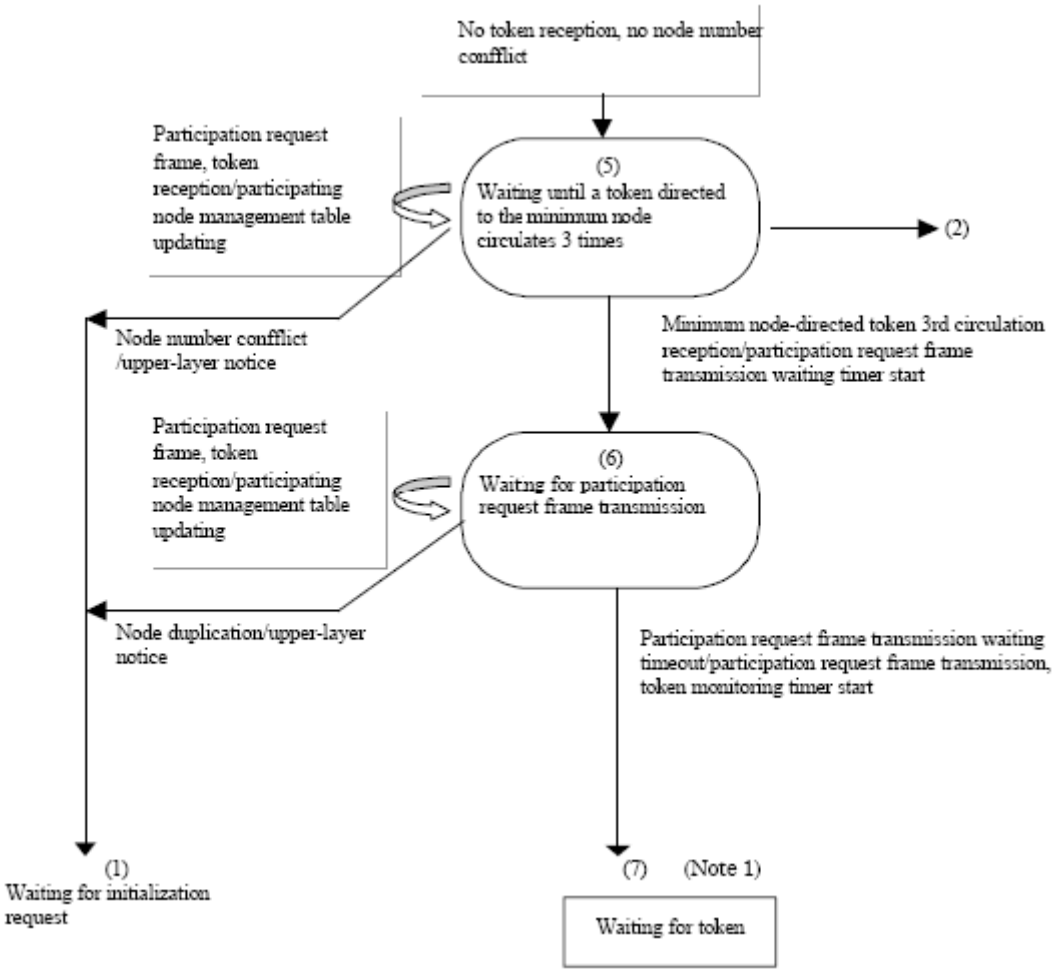
If even a token is received within this monitoring time, the network is judged as an operating status. When the network is in the operating status, the self-node in the network is put into the halfway joining initialization state.

When the network is not in the operating status, the self-node will join the network at network initialization.

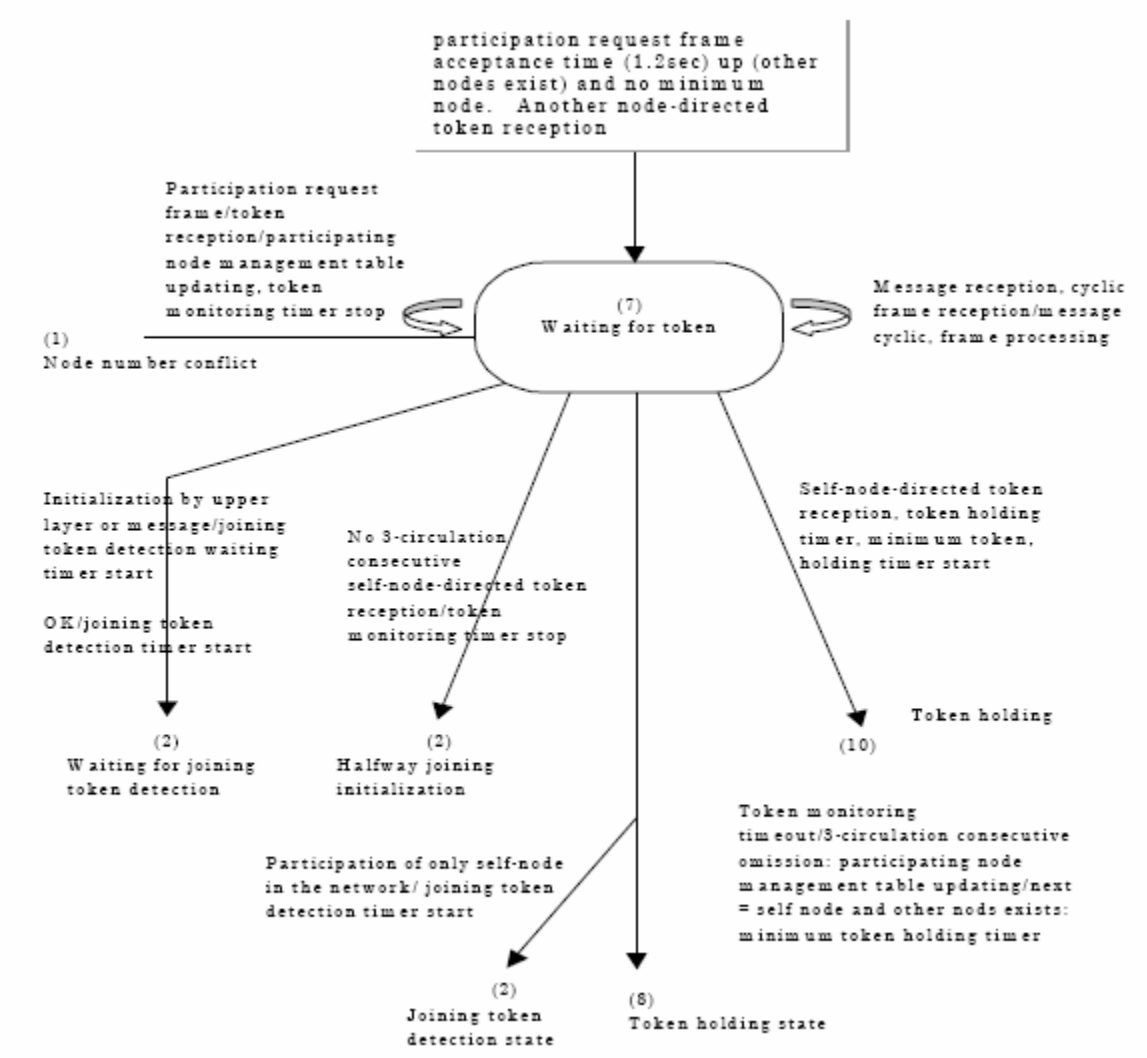
4.8.3 C. Network Initialization



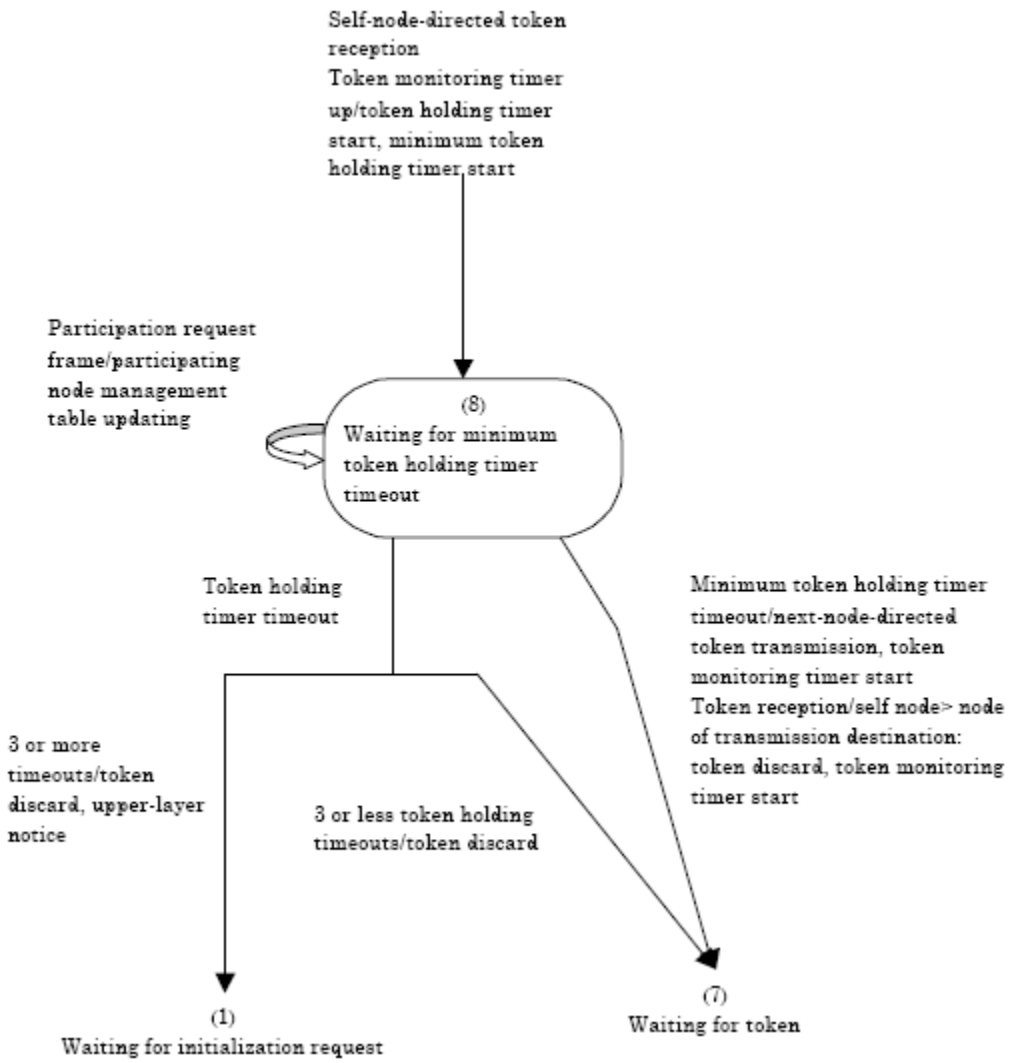
4.8.4 D. Halfway Joining Initialization



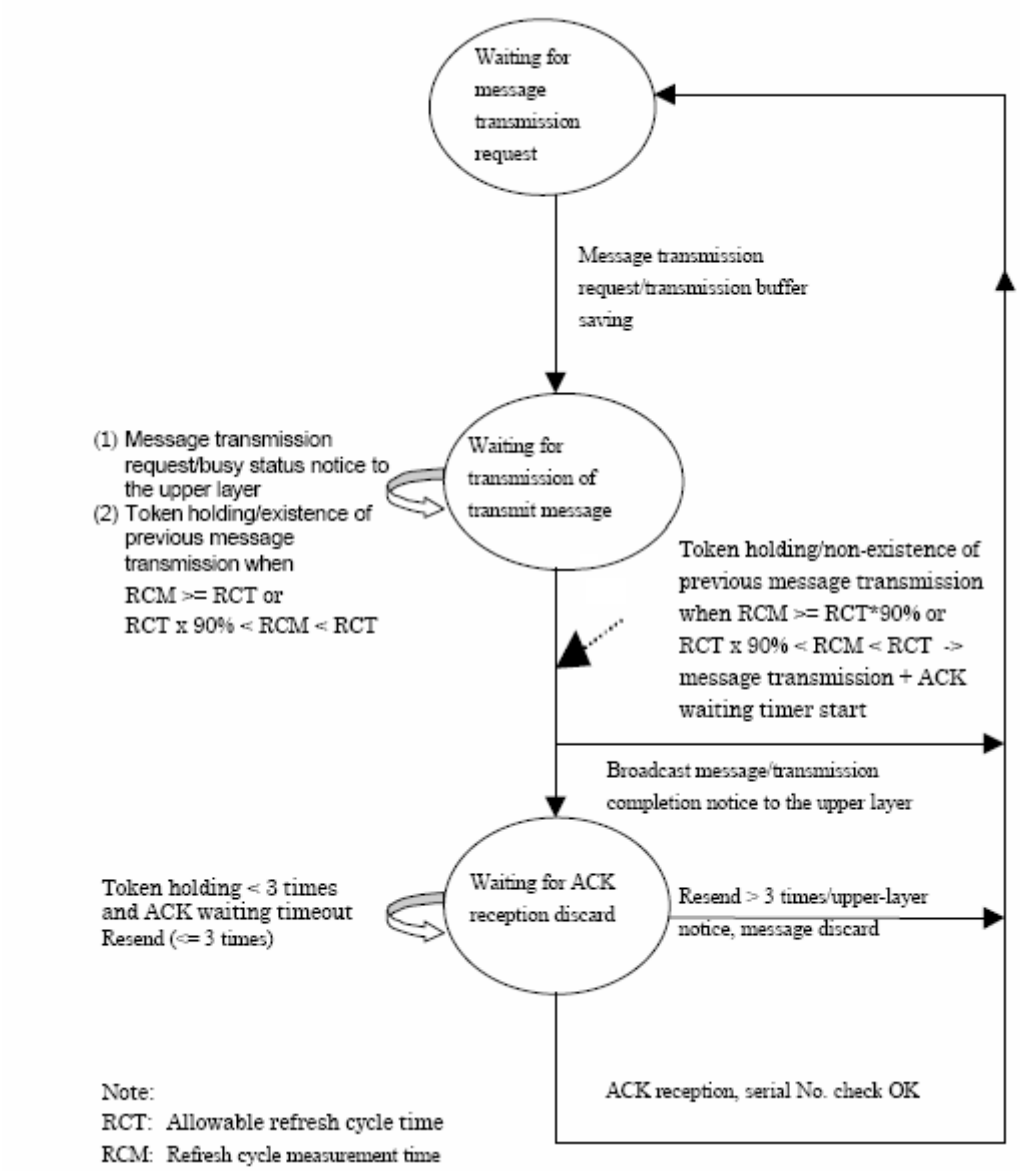
4.8.5 E. Waiting for Token



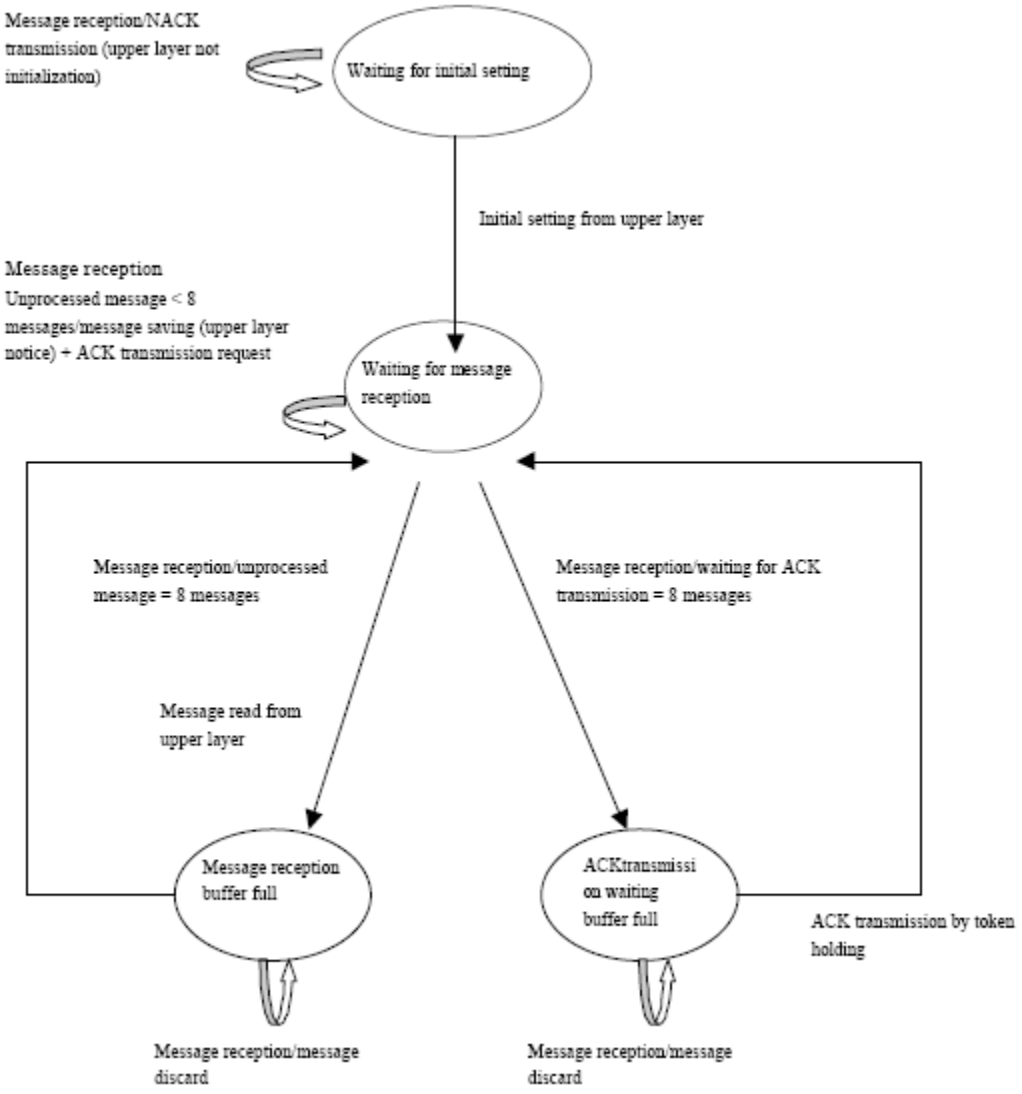
4.8.6 F. Token Holding



4.8.7 G. Message Transmission State Transition



4.8.8 H. Message Reception State Transition



4.9 Cable Connections - MVI56E-FLN

The MVI56E-FLN module has the following functional communication connections installed:

- One 10/100 Mbps Ethernet port (RJ45 connector, labeled E1) for configuration and troubleshooting only
- One 10/100 Mbps Ethernet port (RJ45 connector, labeled E2) for FL-net application data transfer only

4.9.1 Ethernet Connection

The MVI56E-FLN module has two RJ45 ports located on the front of the module labeled "E1", to be used only for configuration and troubleshooting, and "E2", to be used only for connection to the FL-net FA Control Network.

Warning: The MVI56E-FLN module is NOT compatible with Power Over Ethernet (IEEE802.3af / IEEE802.3at) networks. Do NOT connect the module to Ethernet devices, hubs, switches or networks that supply AC or DC power over the Ethernet cable. Failure to observe this precaution may result in damage to hardware or injury to personnel.

Important: The module requires a static (fixed) IP address that is not shared with any other device on the Ethernet network. Obtain a list of suitable IP addresses from your network administrator BEFORE configuring the Ethernet port on this module. The last digit of the IP address for port *E2* is the FL-net node number of the module on the FA Control network.

4.9.2 Ethernet Cable Specifications

The recommended cable is Category 5 or better. A Category 5 cable has four twisted pairs of wires, which are color-coded and cannot be swapped. The module uses only two of the four pairs.

The Ethernet ports on the module are Auto-Sensing. You can use either a standard Ethernet straight-through cable or a crossover cable when connecting the module to an Ethernet hub, a 10/100 Base-T Ethernet switch, or directly to a PC. The module will detect the cable type and use the appropriate pins to send and receive Ethernet signals.

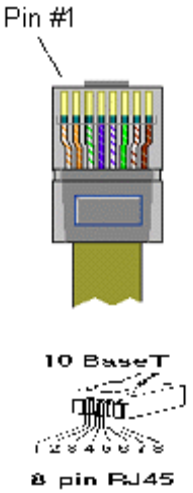
Ethernet cabling is like U.S. telephone cables, except that it has eight conductors. Some hubs have one input that can accept either a straight-through or crossover cable, depending on a switch position. In this case, you must ensure that the switch position and cable type agree.

Refer to Ethernet cable configuration (page 134) for a diagram of how to configure Ethernet cable.

Ethernet Cable Configuration

Note: The standard connector view shown is color-coded for a straight-through cable.

Crossover cable	
RJ-45 PIN	**RJ-45 PIN**
1 Rx+	3 Tx+
2 Rx-	6 Tx-
3 Tx+	1 Rx+
6 Tx-	2 Rx-



Straight- through cable	
RJ-45 PIN	**RJ-45 PIN**
1 Rx+	1 Tx+
2 Rx-	2 Tx-
3 Tx+	3 Rx+
6 Tx-	6 Rx-

5 Support, Service & Warranty

5.1 Contacting Technical Support

ProSoft Technology, Inc. is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

1. Product Version Number
2. System architecture
3. Network details

If the issue is hardware related, we will also need information regarding:

1. Module configuration and associated ladder files, if any
2. Module operation and any unusual behavior
3. Configuration/Debug status information
4. LED patterns
5. Details about the interfaced serial, Ethernet or Fieldbus devices

Note: For technical support calls within the United States, ProSoft Technology's 24/7 after-hours phone support is available for urgent plant-down issues.

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For additional ProSoft Technology contacts in your area, please visit:
www.prosoft-technology.com/About-Us/Contact-Us.

5.2 Warranty Information

For complete details regarding ProSoft Technology's TERMS & CONDITIONS OF SALE, WARRANTY, SUPPORT, SERVICE AND RETURN MATERIAL AUTHORIZATION INSTRUCTIONS, please see the documents at:
www.prosoft-technology/legal