ProSoft TECHNOLOGY

Where Automation Connects.

inRAx®

MVI69-FLN

CompactLogix Platform

FA Control Network Communication Module

11/3/2008

USER MANUAL

Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation CompactLogix hardware, the MVI69-FLN Module and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

This manual is provided to assist the user. Every attempt has been made to ensure that the information provided is accurate and a true reflection of the product's installation requirements. In order to ensure a complete understanding of the operation of the product, the user should read all applicable Rockwell Automation documentation on the operation of the Rockwell Automation hardware.

Under no conditions will ProSoft Technology be responsible or liable for indirect or consequential damages resulting from the use or application of the product.

Information in this manual is subject to change without notice and does not represent a commitment on the part of ProSoft Technology Improvements and/or changes in this manual or the product may be made at any time. These changes will be made periodically to correct technical inaccuracies or typographical errors.

Battery Life Advisory

All modules in the MVI series use a rechargeable Lithium Vanadium Pentoxide battery to backup the 512K SRAM memory, real-time clock, and CMOS. The battery should last for the life of the module.
The module must be powered for approximately twenty hours before it becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and configuration data, the real-time clock, and the 512K SRAM memory for approximately 21 days.
Before you remove a module from its power source, ensure that the battery within the module is fully charged. A fully charged battery will hold the BIOS settings (after being removed from its power source) for a limited number of days. When the battery is fully discharged, the module will revert to the default BIOS settings.

Note: The battery is not user replaceable.

Your Feedback Please

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about the product, documentation or support, please write or call us.

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MVI69-FLN User Manual
11/3/2008

ProSoft® Product Documentation

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed CD and are available at no charge from our web site: http://www.prosoft-technology.com
Printed documentation is available for purchase. Contact ProSoft Technology for pricing and availability.
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Guide to the MVI69-FLN User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	Start Here (page 9)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Sample Ladder	→	Sample Ladder Logic (page 20)	This section provides instructions on installing ProSoft's Sample Ladder Logic.
Node Configuration	→	FL-net Node Configuration (page 97)	This section contains instructions on setting up the module as a Node on the network. Provided are ControlLogix module definitions settings, FL-net Memory Map, Node Configuration.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 72, page 48) Diagnostics and Troubleshooting (page 71)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures
Reference Product Specs. Functional Overview Glossary	→	Reference (page 75) Functional Overview (page 77) Product Specifications (page 75)	These sections contain general references associated with this module, Product Specifications, and the Functional Overview.
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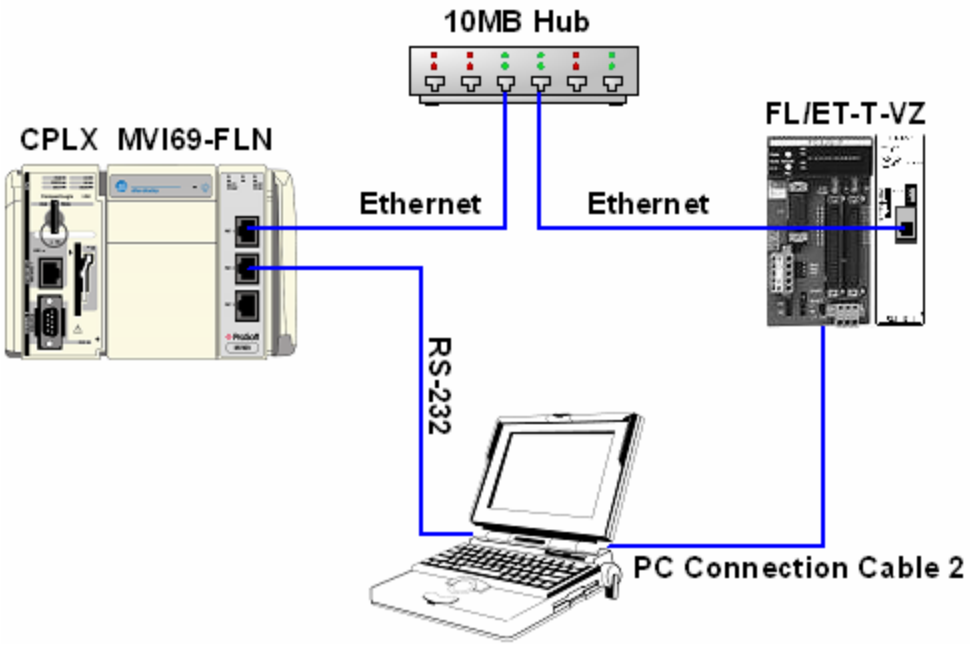
1 Start Here

In This Chapter

The purpose of this section of the User Manual is to show the MVI69-FLN functionality through a real application. For this application, the MVI69-FLN communicates with an FL/ET-T-V2 module (Toyoda) that transfers the data to the TOYODA PC3JG-P processor located on the same rack.

For this example, the MVI69-FLN node address is 40, and the FL/ET-T-V2 module node address is 10.



1.1 System Requirements

The MVI69-FLN module requires the following minimum hardware and software components:

- Rockwell Automation CompactLogix or MicroLogix processor, with compatible power supply and one free slot in the rack, for the MVI69-FLN module. The module requires 800mA of available power.

Important: The MVI69-FLN module has a power supply distance rating of 2 (L43 and L45 installations on first 2 slots of 1769 bus).
Important: For 1769-L23x processors, please make note of the following limitations.

- 1769-L23-QBFC1B = 800mA at 5Vdc (1 MVI69-FLN will use all 800mA of available power. No other modules can be used with an MVI69 module connected to this processor).
- 1769-L23E-QB1B = 1000mA at 5Vdc (1 MVI69-FLN will use 800mA of available power. One other module can be used on this rack provided it consumes less than 200mA at 5Vdc.
- 1769-L23E-QBFC1B = 450mA at 5Vdc (no MVI69 module can be used with this processor)

- Rockwell Automation RSLogix 5000 (CompactLogix) or RSLogix 500 (MicroLogix) programming software
- Rockwell Automation RSLinx communication software
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows XP Professional with Service Pack 1 or 2
  - 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)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive
- HyperTerminal or other terminal emulator program capable of file transfers using Ymodem protocol.

1.2 Package Contents

The following components are included with your MVI69-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	MVI69-FLN Module	MVI69-FLN	FA Control Network Communication Module
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection to the CFG Port
1	Cable	RJ45 to DB9 Male Adapter	For DB9 Connection to Module's Port
1	inRAx Solutions CD		Contains sample programs, utilities and documentation for the MVI69-FLN module.

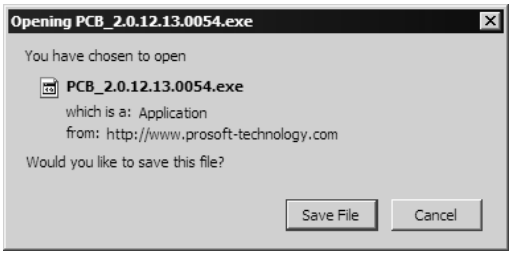
If any of these components are missing, please contact ProSoft Technology Support for replacement parts.

1.3 Install ProSoft Configuration Builder Software

You must install the ProSoft Configuration Builder (PCB) software in order to configure the MVI69-FLN module. You can always get the newest version of ProSoft Configuration Builder from the ProSoft Technology web site.

To install ProSoft Configuration Builder from the ProSoft Web Site

1. Open your web browser and navigate to http://www.prosoft-technology.com/pcb
2. Click the **Download Here** link to download the latest version of ProSoft Configuration Builder.
3. Choose "Save" or "Save File" when prompted. The following illustrations show the file download prompt for two of the most common web browsers.



4. Make a note of the location where you saved the file, for example "Desktop", or "My Documents", so you can start the installation program.
5. When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

If you do not have access to the Internet, you can install ProSoft Configuration Builder from the ProSoft Solutions CD-ROM, included in the package with your MVI69-FLN module.

To install ProSoft Configuration Builder from the CD-ROM

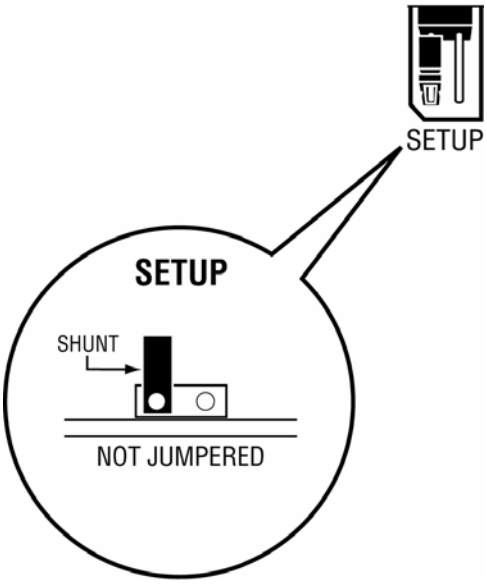
1. Insert the ProSoft Solutions CD-ROM into the CD drive of your PC. Wait for the startup screen to appear.
2. On the startup screen, click *Product Documentation*. This action opens an explorer window.

3 Click to open the *Utilities* folder. This folder contains all of the applications and files you will need to set up and configure your module.
4 Double-click the *ProSoft Configuration Builder Setup* program and follow the instructions on your screen to install the software on your PC.

Note: Many of the configuration and maintenance procedures use files and other utilities on the CD-ROM. You may wish to copy the files from the Utilities folder on the CD-ROM to a convenient location on your hard drive.

1.4 Setting Jumpers

Note: 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.



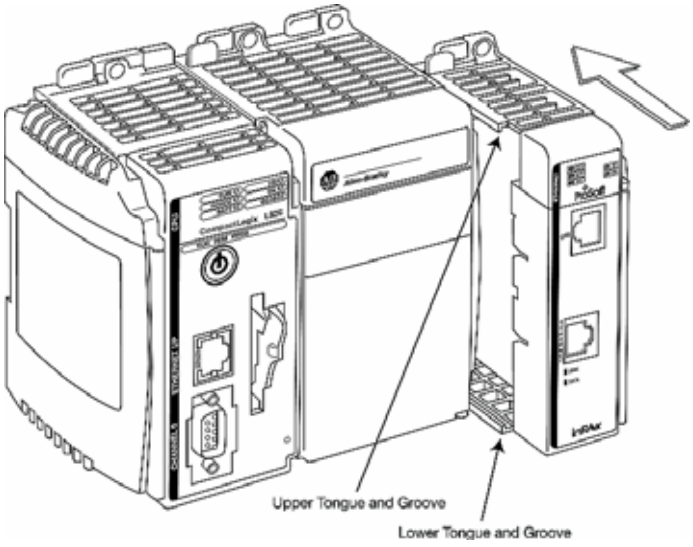
1.5 Install the Module in the Rack

This section describes how to install the module into a CompactLogix rack

Before you attempt to install the module, make sure that the bus lever of the adjacent module is in the unlocked (fully right) position.

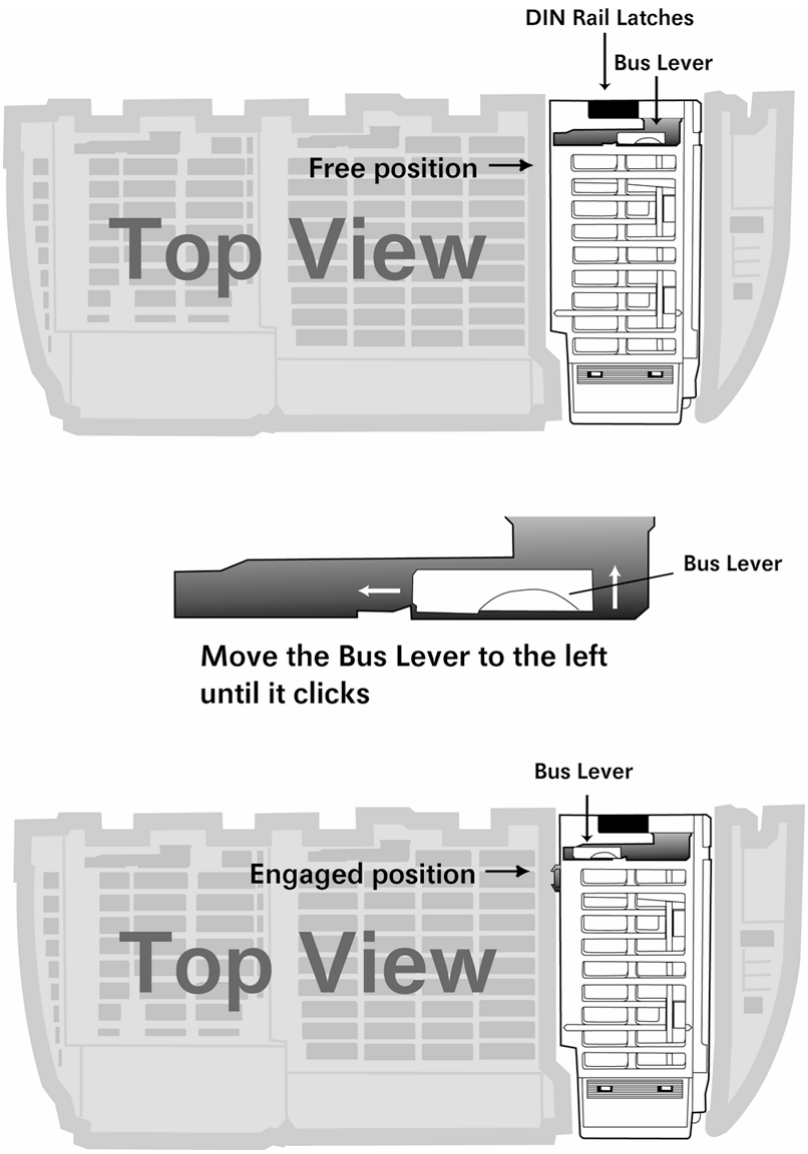
Warning: This module is not hot-swappable! Always remove power from the rack before inserting or removing this module, or damage may result to the module, the processor, or other connected devices.

1 Align the module using the upper and lower tongue-and-groove slots with the adjacent module and slide forward in the direction of the arrow.



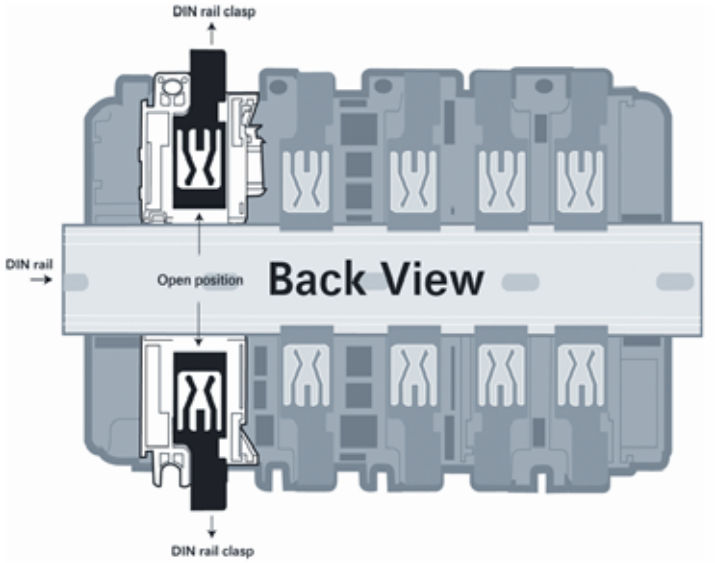
2 Move the module back along the tongue-and-groove slots until the bus connectors on the MVI69 module and the adjacent module line up with each other.

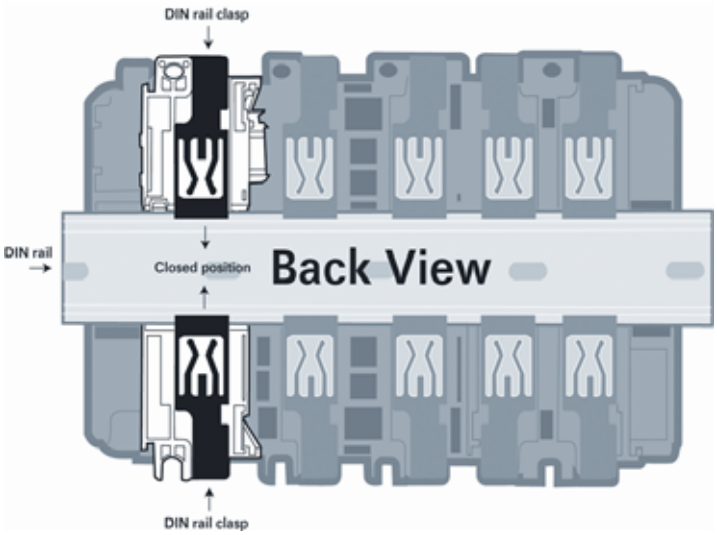
3 Push the module's bus lever back slightly to clear the positioning tab and move it firmly to the left until it clicks. Ensure that it is locked firmly in place.



4 Close all DIN rail latches.

5 Press the DIN rail mounting area of the controller against the DIN rail. The latches will momentarily open and lock into place.





1.6 Installing the Module with a CompactLogix Processor

If you are installing and configuring the module with a CompactLogix processor, follow these steps. If you are using a MicroLogix processor, refer to the next section.

Important: The MVI69-FLN module has a power supply distance rating of 2 (L43 and L45 installations on first 2 slots of 1769 bus)

This chapter describes how to install and configure the module to work with your application. The configuration process consists of the following steps.

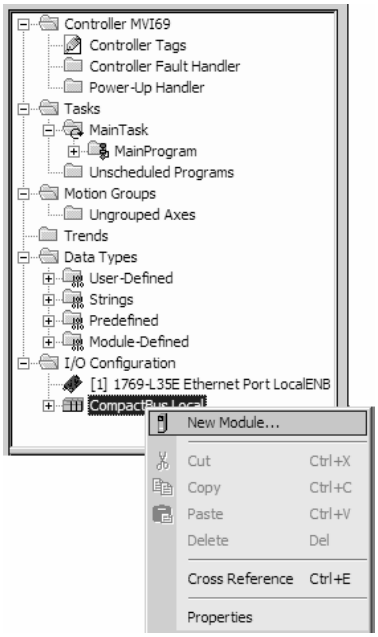
1 Use RSLogix to identify the module to the processor and add the module to a project.

Note: The RSLogix software must be in "offline" mode to add the module to a project.

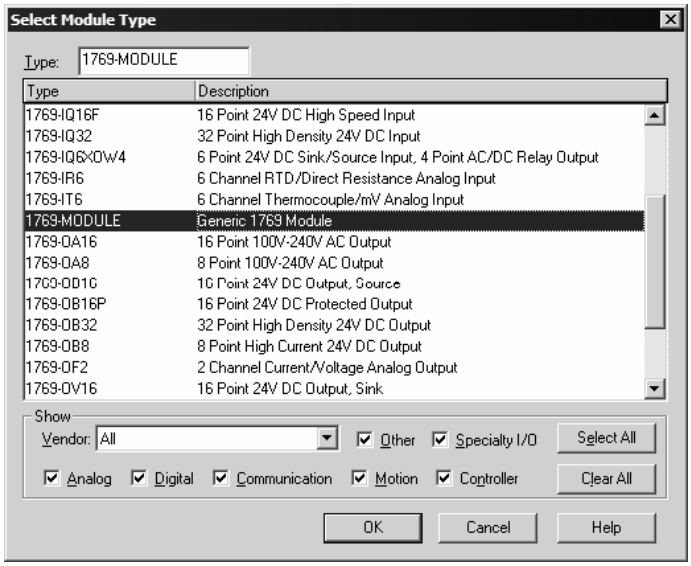
2 Modify the example ladder logic to meet the needs of your application, and copy the ladder logic to the processor. Example ladder logic files are provided on the CD-ROM.

Note: If you are installing this module in an existing application, you can copy the necessary elements from the example ladder logic into your application.
The rest of this chapter describes these steps in more detail.

First, define the module to the system. Right-click the mouse button on the I/O Configuration option in the Controller Organization window to display a pop-up menu. Select the New Module… option from the I/O Configuration menu.



This action opens the Select Module Type dialog box.



Select the 1769-Module (Generic 1769 Module) from the list and click OK.

You should configure the Connection Parameters according to the Block Transfer Size parameter in the configuration file as follows:

On the General page, fill in the values shown in the following tables, according to the Block Transfer Size parameter in the configuration file. You must select the **Comm Format** as **Data - INT**.

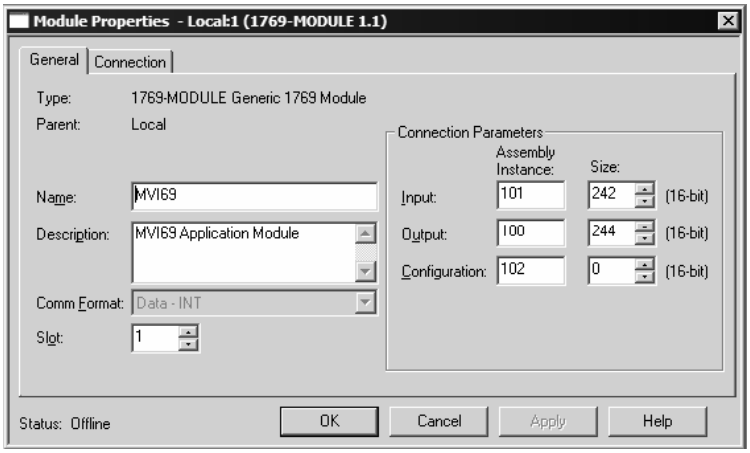
The configured Input Size and Output Size will depend on the block transfer size parameter defined in the configuration file. Use the values in the table corresponding with the block transfer size you configured.

Block Transfer Size = 240

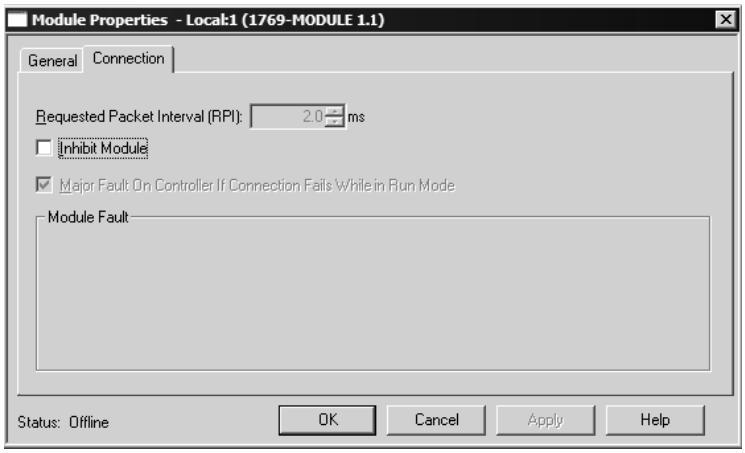
Field	Recommended Value
Type	1769-MODULE Generic 1769 Module
Parent	Local
Name	MVI69
Description	MVI69 Application Module
Comm Format	Data - INT
Slot	The slot number in the rack where the module is installed
Input Assembly Instance	101
Input Size	242
Output Assembly Instance	100
Output Size	244
Configuration Assembly Instance	102
Configuration Size	0

Important: If you set the **Assembly Instance** and **Size** values incorrectly, the module will not communicate over the backplane of the CompactLogix rack.

Click **Next** to continue.



Fill in the dialog boxes as shown, adjusting the Name, Description and Slot options for your application. You must select the **Comm Format** as **Data - INT** in the dialog box. Failure to set the **Assembly Instance** and **Size** values correctly will result in a module that will not communicate over the backplane of the CompactLogix rack. Click Next to open the next dialog box.



Select the Request Packet Interval value for scanning the I/O on the module. This value represents the minimum frequency the module will handle scheduled events. This value should not be set to less than 2 milliseconds.

1.6.1 Sample Ladder Logic

Important: You must download the sample ladder to the CompactLogix processor, otherwise the module will be unable to establish communication with the processor.
If you see the message
`"Waiting for connection to processor..."`
when you connect to the configuration/debug port on the MVI69-FLN module using HyperTerminal, connect to the processor with RSLogix and download the sample ladder logic to the processor before continuing.

Open the Sample Ladder Logic in RSLogix

The sample program for your MVI69-FLN module includes custom tags, data types and ladder logic for data I/O, status and 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.

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.

To open the sample program

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 Select File button.
6. Choose the sample program file, and then click the Select button.
7. RSLogix will load the sample program.

Next, configure the correct controller type and slot number for your application.

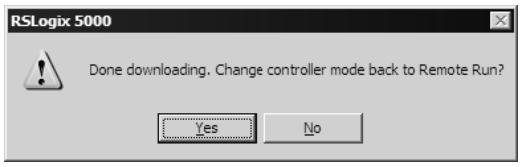
Download the Sample Program to the Processor

To download the sample program from RSLogix 5000 to the CompactLogix processor:

Note: The key switch on the front of the CompactLogix module must be in the REM position.

1. If you are not already online to the processor, open the Communications menu, and then choose Download. RSLogix will establish communication with the processor.
2. When communication is established, RSLogix will open a confirmation dialog box. Click the Download button to transfer the sample program to the processor.
3. RSLogix will compile the program and transfer it to the processor. This process may take a few minutes.

4 When the download is complete, RSLogix will open another confirmation dialog box. Click OK to switch the processor from Program mode to Run mode.



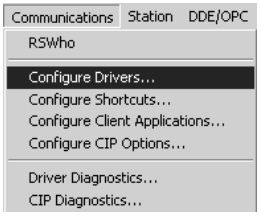
Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

5 To verify that the processor is communicating with the module, open the Main Program folder in the Controller Organization pane in RSLogix, and double-click MainRoutine. You will be able to see the numbers change in Rung 0 of the MainRoutine program.

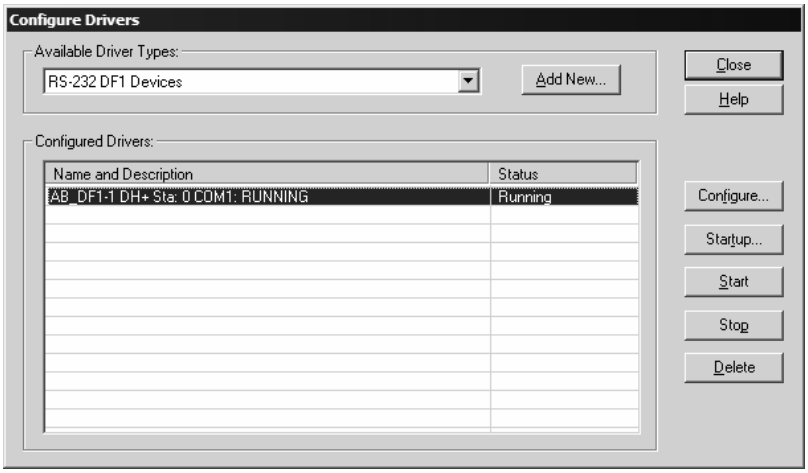
Configuring RSLinx

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 Allen-Bradley DF1 Communications Device 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.

1.7 Installing and Configuring the Module with a MicroLogix Processor

If you are installing and configuring the module with a MicroLogix processor, follow these steps. If you are using a CompactLogix processor, refer to the previous section.

This chapter describes how to install and configure the module to work with your application. The configuration process consists of the following steps.

1. Use RSLogix to identify the module to the processor and add the module to a project.

Note: The RSLogix software must be in "offline" mode to add the module to a project.

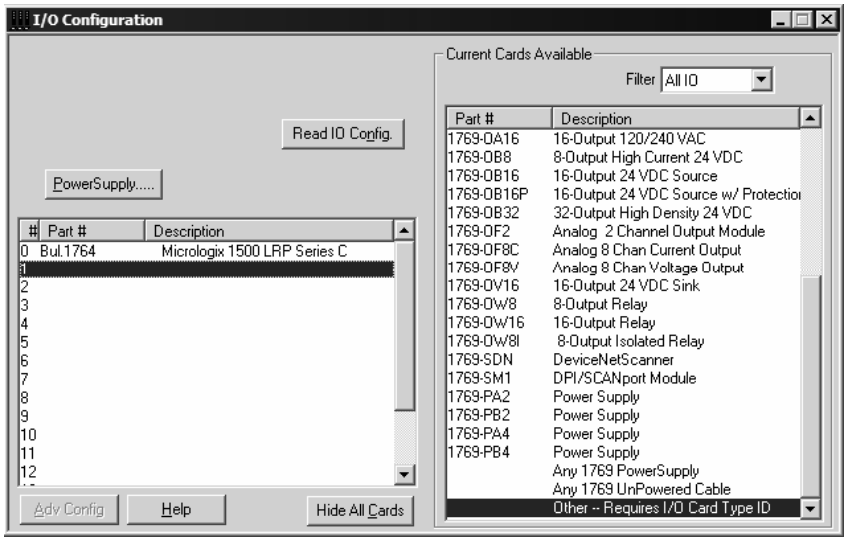
2. Modify the example ladder logic to meet the needs of your application, and copy the ladder logic to the processor. Example ladder logic files are provided on the CD-ROM.

Note: If you are installing this module in an existing application, you can copy the necessary elements from the example ladder logic into your application.

The rest of this chapter describes these steps in more detail.

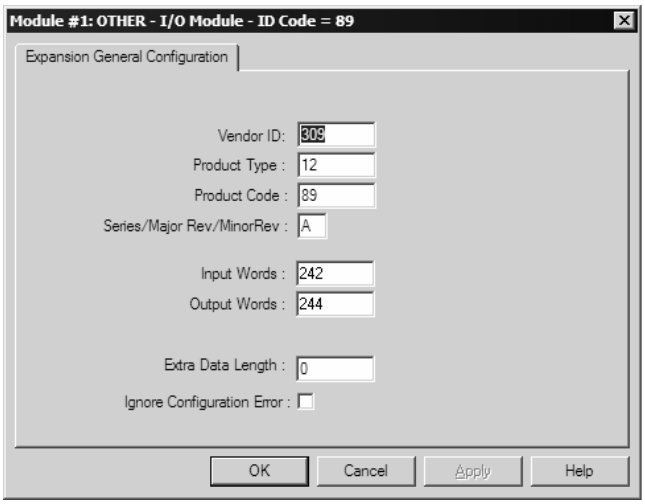
The first step in setting up the processor ladder file is to define the I/O type module to the system. Start RSLogix 500, and follow these steps:

1. In RSLogix, open your existing application, or start a new application, depending on your requirements.
2. Double-click the I/O Configuration icon located in the Controller folder in the project tree. This action opens the I/O Configuration dialog box.



3. On the I/O Configuration dialog box, select "Other - Requires I/O Card Type ID" at the bottom of the list in the right pane, and then double-click to open the Module dialog box.

4 Enter the values shown in the following illustration to define the module correctly for the MicroLogix processor, and then click OK to save your configuration.



5 Click **Next** to continue.

6 After completing the module setup, the I/O configuration dialog box will display the module's presence.

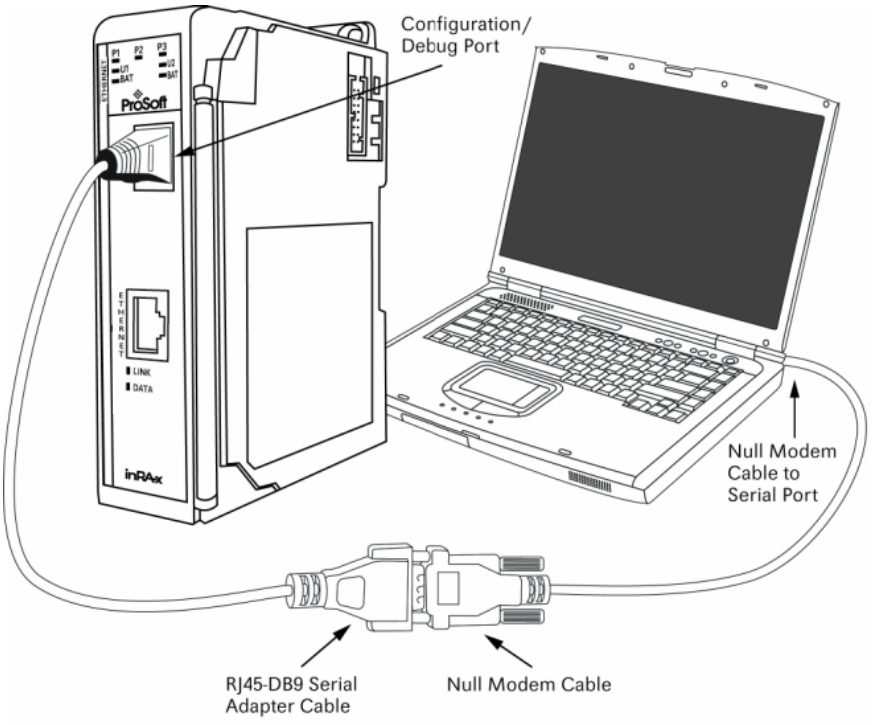
The last step is to add the ladder logic. If you are using the example ladder logic, adjust the ladder to fit your application. Refer to the example Ladder Logic section in this manual.

Download the new application to the controller and place the processor in run mode. If you encounter errors, refer to **Diagnostics and Troubleshooting** (page 71) for information on how to connect to the module's Config/Debug port to use its troubleshooting features.

1.8 Connect your PC to the Module

With the module securely mounted, connect your PC to the Configuration/Debug port using an RJ45-DB-9 Serial Adapter Cable and a Null Modem Cable.

1. Attach both cables as shown.
2. Insert the RJ45 cable connector into the Configuration/Debug port of the module.
3. Attach the other end to the serial port on your PC or laptop.

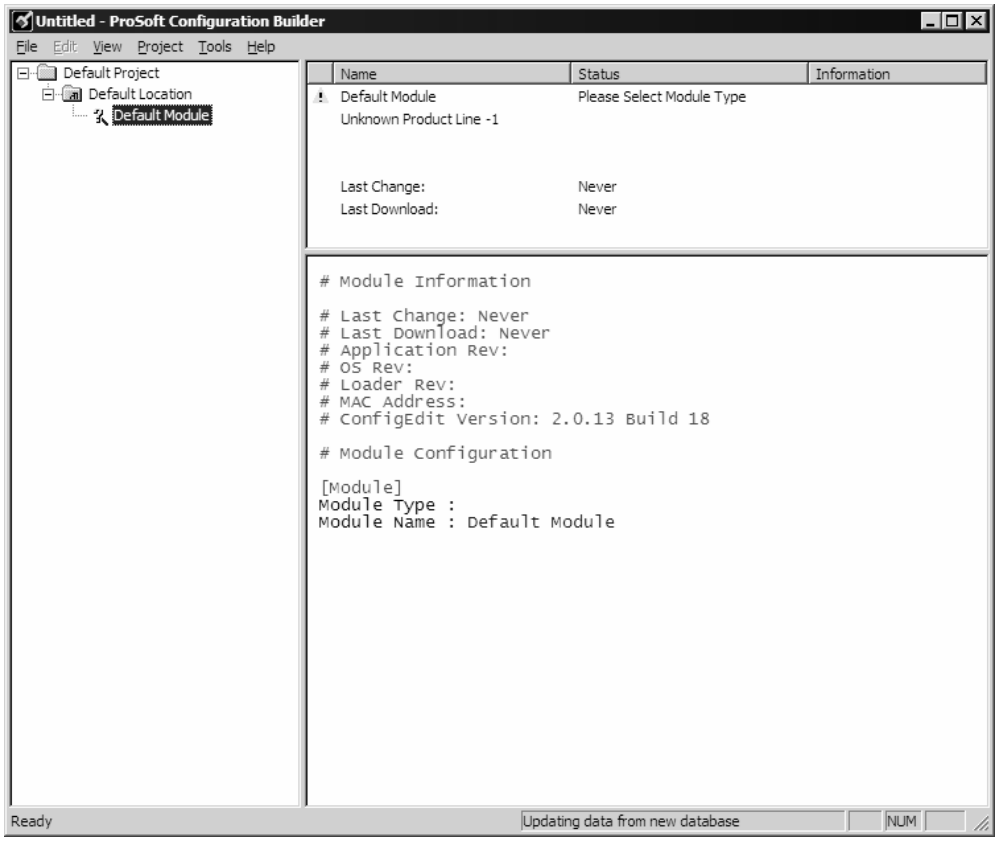


1.9 ProSoft Configuration Builder

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.

1.9.1 Set Up the Project

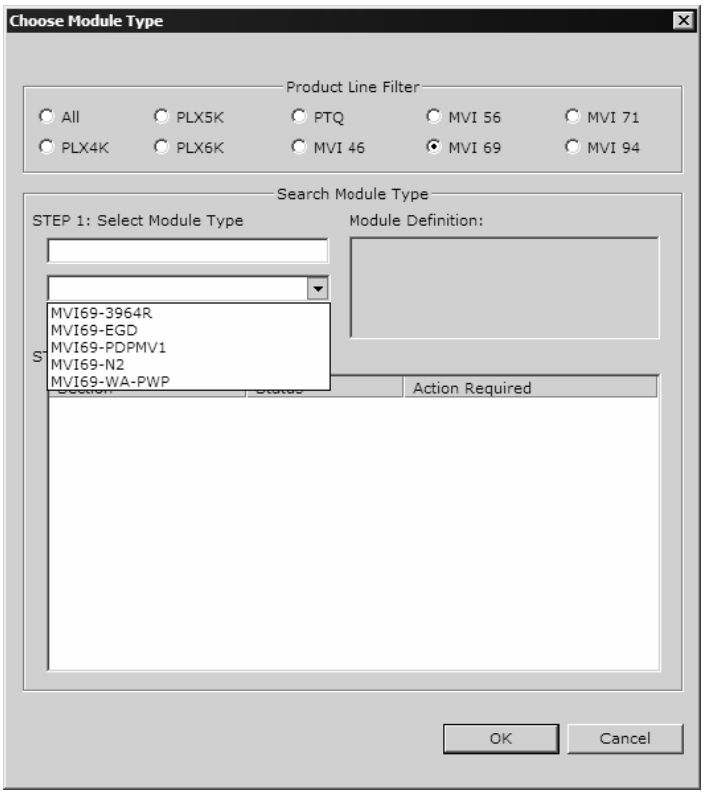
To begin, start ProSoft Configuration Builder. If you have used other Windows configuration tools before, you will find the screen layout familiar. ProSoft Configuration Builder's window consists of a tree view on the left, an information pane and a configuration pane on the right side of the window. When you first start ProSoft Configuration Builder, 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 ProSoft Configuration Builder window with a new project.



Your first task is to add the MVI69-FLN module to the project.

1 Use the mouse to select "Default Module" in the tree view, and then click the right mouse button to open a shortcut menu.

2 On the shortcut menu, choose "Choose Module Type". This action opens the Choose Module Type dialog box.



3 In the Product Line Filter area of the dialog box, select MVI69. In the Select Module Type dropdown list, select MVI69-FLN, and then click OK to save your settings and return to the ProSoft Configuration Builder window.

Adding a Project

To add a project to an existing project file:

1 Select the Default Project icon.
2 Choose Project from the Project menu, then choose Add Project. A new project folder appears.

Adding a Module

To add a module to your project:

1 Double-click the Default Module icon to open the Choose Module Type dialog box.
2 On the Choose Module Type dialog box, select the module type.

Or

1 Open the Project menu and choose Location.
2 On the Location menu, choose Add Module.

To add a module to a different location:

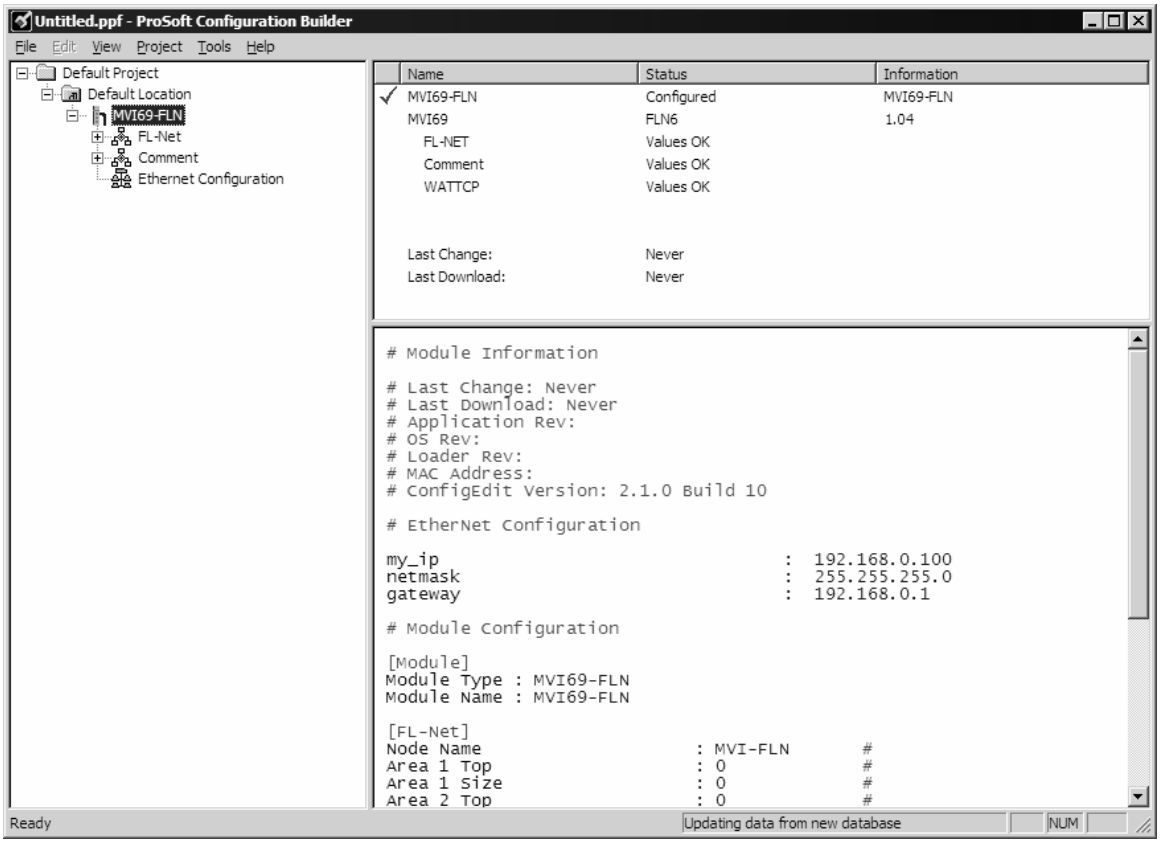
1 Right-click the Location folder and choose Add Module. A new module icon appears.

Or

1 Select the Location icon.
2 From the Project menu, select Location, then select Add Module.

1.9.2 Set Module Parameters

Notice that the contents of the information pane and the configuration pane changed when you added the MVI69-FLN module to the project.



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

To rename 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.

Module Entries

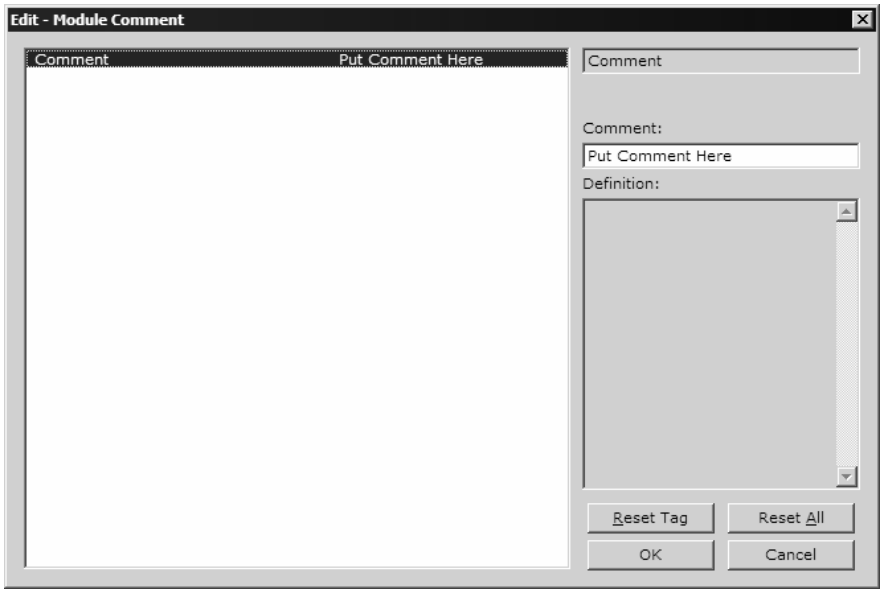
To configure module parameters

1. Click on the plus sign next to the icon Comment to expand module information.
2. Double-click the Module Comment icon to open the Edit dialog box.
3. To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
4. Click OK to save your changes.

Comment Entries

To add comments to your configuration file:

1. Click the plus sign to the left of the Comment icon to expand the Module Comments.
2. Double-click the Module Comment icon. The Edit - Module Comment dialog appears.



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

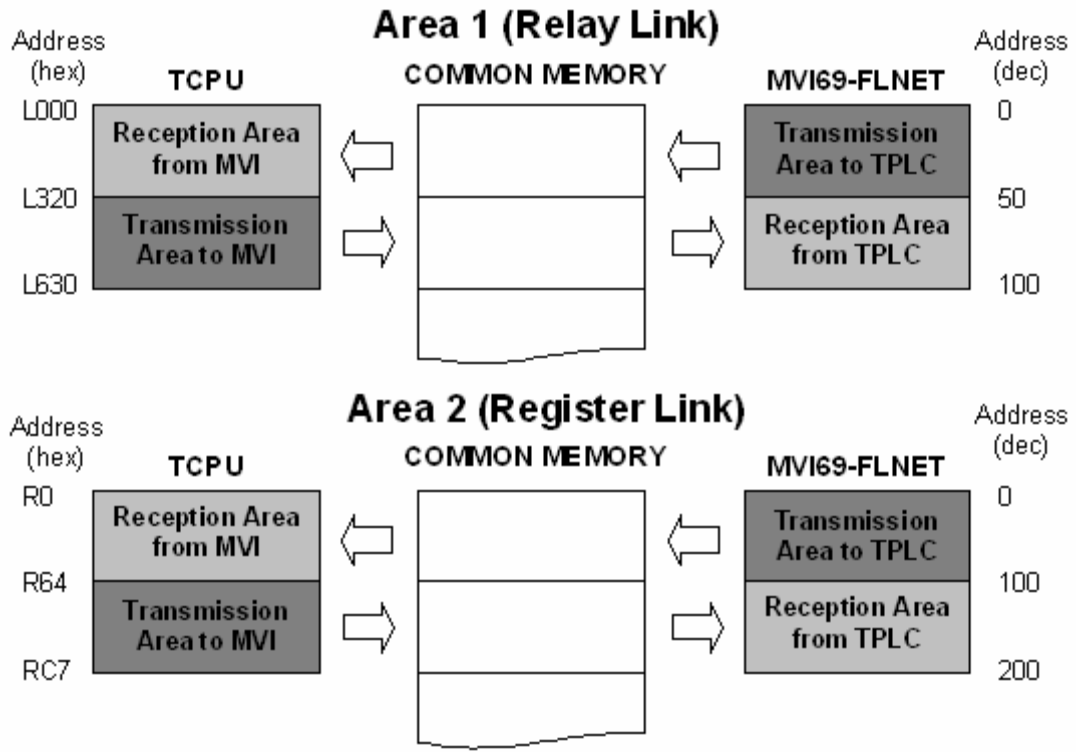
Printing a Configuration File

To print 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. On the View Configuration window, open the File menu, and choose Print. This action opens the Print dialog box.
4. On the Print dialog box, choose the printer to use from the dropdown list, select printing options, and then click OK.

1.10 Configure Area 1 and Area 2

Next, configure the module to properly transfer data between the CompactLogix processor and the remote FLNET node (Toyoda PLC - TPLC). Each area is defined by its start address (top address) and word length (size). The following illustration shows the start addresses and word lengths used in the sample application:



Refer to the MVI69-FLN configuration file (FLNET.CFG) to configure the module parameters for data transfer.

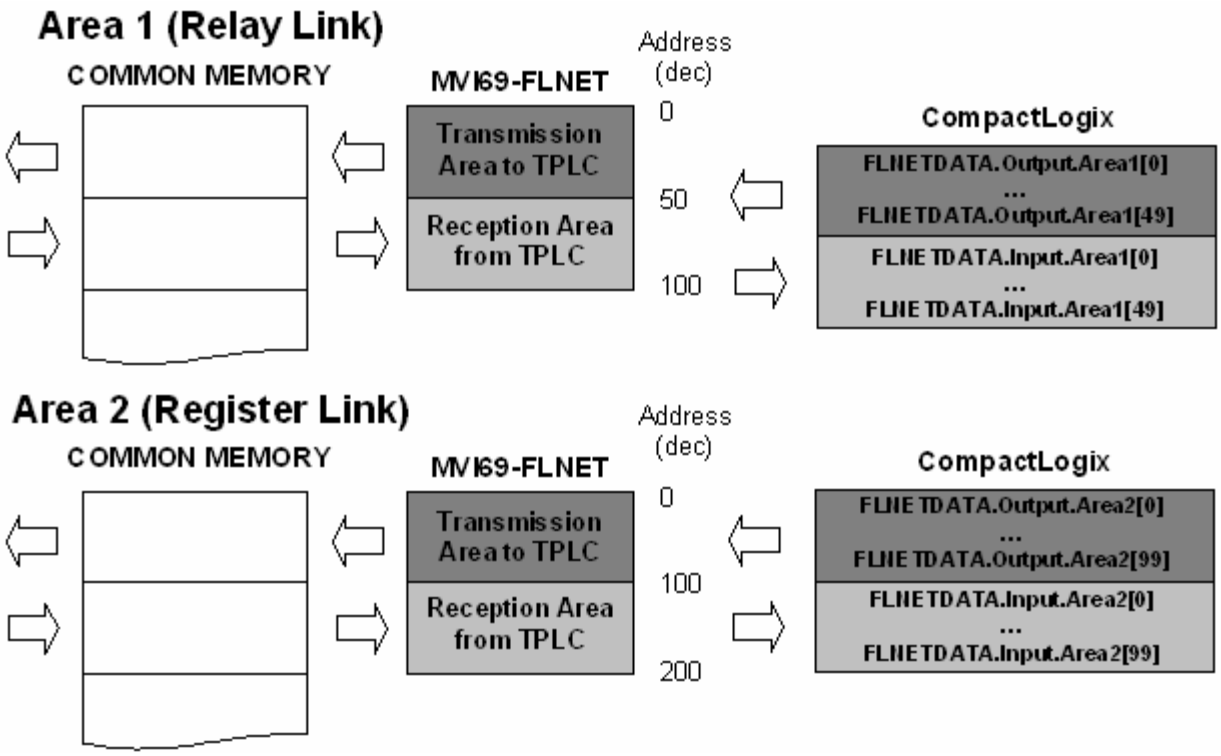
Use the following settings to configure the data to transfer from the module to the remote node. This data is transferred from the CompactLogix processor to the MVI69-FLN module through the *FLNETDATA.Output.Area1* and *FLNETDATA.Output.Area2* controller tag arrays.

```
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 MVI69-FLN module to the CompactLogix 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 following illustration shows how the data is transferred:



You can increase the area copied to the processor to also include the produced output data.

The following example shows how the data copied to the processor also includes the data produced by the module, which is available in the FLNET common memory.

This data is transferred from the MVI69-FLN module to the CompactLogix processor through the *FLNETDATA.Input.Area1* and *FLNETDATA.Input.Area2* controller tag arrays.

```
BP Area 1 Top  :   0
BP Area 1 Size : 100
BP Area 2 Top  :   0
BP Area 2 Size : 200
```

The data read from the remote FLNET starts at *FLNETDATA.Input.Area1[50]* (50 words) and *FLNETDATA.Input.Area2[100]* (50 words) controller tag arrays. The data produced by the module and available at the FLNET common memory starts at *FLNETDATA.Input.Area1[0]* (50 words) and *FLNETDATA.Input.Area2[0]* (50 words) controller tag arrays.

1.11 Configure the General Parameters

Configure the general parameters for your application. This example will consider the following parameters:

```
Node Name                 : MVI69FLNET #identifies the node in the FLNET
network
Token Watchdog Time       :        100 #token watchdog time (1..255) in ms
                                       #(default=255)
Minimum Frame Interval Time:        20 #allowable min frame interval
                                       #(20...50), #100 microsecond units
```

Note: Please refer to FL-net Node Configuration (page 97) for more information about these configuration parameters.

1.12 Data Mapping Functionality

Note: Data Mapping is supported for MVI69-FLN firmware version 1.04 and above only.

The data mapping feature allows the optimization of data transfer from the module to the ControlLogix processor.

1.12.1 Introduction

You can configure the sections of the A1 and A2 areas to be transferred to the processor through the following parameters:

```
BP Area 1 Top  :     0   #0...511 top address for area 1
BP Area 1 Size :   200   #0...512 area 1 data size in words
BP Area 2 Top  :     0   #0...8191 top address for area 2
BP Area 2 Size :  1440   #0...8192 area 2 data size in words
```

However, the data associated to the nodes is not necessarily in a contiguous order. Also, the application may require only specific data from each node that could be spread over the configured area to be transferred to the processor. This implementation may lead to the transfer of unused data to the processor, causing unnecessary delays to the overall module performance.

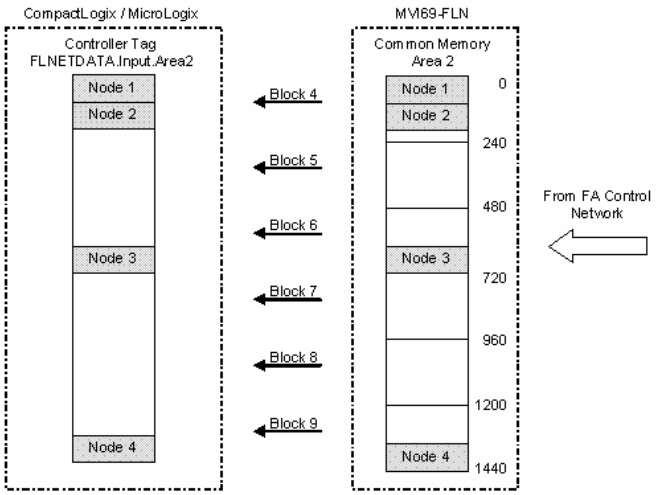
Example 1

In this example, the module receives data from four different nodes associated to the Area 2 common memory. Therefore, the module should be configured to transfer the first 1200 words of data to the processor as follows:

```
BP Area 2 Top  :     0   #0...8191 top address for area 2
BP Area 2 Size :  1440   #0...8192 area 2 data size in words
```

The module can only transfer a block of 240 words at a time. Therefore, for the following application, the module would have to transfer unused data in order to transfer the entire data associated to the four slaves to the processor. The result is that unused blocks would have to be transferred, resulting in unnecessary delay to the overall performance.

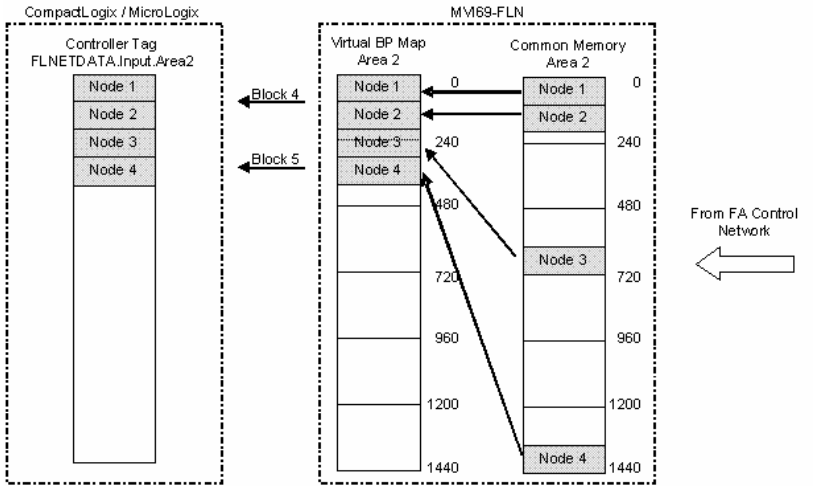
Without Map Feature



The data mapping feature allows you to select data sections associated to each slave, and select these to be mapped (in any order) into a virtual backplane map area. This virtual area will be copied to the processor (instead of the entire common memory area).

This feature allows the module to copy only specific data required for the application, as shown in the following illustration. Unused data blocks are not required to be copied:

With Map Feature



Instead of copying six blocks, the module only copies two blocks to send the data associated to all four nodes. You would also re-configure the portion of the Virtual BP Map area to be copied to the processor as follows:

```
BP Area 2 Top  :     0   #0...8191 top address for area 2
BP Area 2 Size :   480   #0...8192 area 2 data size in words
```

1.12.2 Setting the Mapping Parameters

To set mapping parameters

1 Enable the Use BP Map Table parameter with a value of Y as follows:

```
Use BP Map Table :    Y #Use BP mapping (Y=Use maps, N=Don't use maps
(default))
```

2 Setup the mapping for your application through the [FL-NET BACKPLANE MAPPING] section of the configuration file.

```
[FL-NET BACKPLANE MAPPING]
#Node    A1 Network  A1 Network  A1 Backplane  A2 Network  A2 Network  A2 Backplane
#             Start        Size         Start       Start        Size         Start
START
    1             0         150             0           0         150             0
    2           100          50           150         100          50           150
END
```

Where each parameter is defined as follows:

Parameter	Description
Node	Node number
A1 Network Start	Start word offset in the node area (within the network common memory) to be mapped into the virtual backplane map. This is not the absolute offset within the common memory. For example, if the node top address is 200 (size of 150 words), in order to remap the last 50 words of that node then enter a A1 Network Start value of 100 (not 300).
A1 Network Size	Total number of words (starting from A1 Network Start offset) to be mapped into the virtual backplane map.
A1 Network Backplane Start	Start absolute word offset in the virtual backplane map where the mapped A1 data will be copied to.
A2 Network Start	Start word offset in the node area (within the network common memory) to be mapped into the virtual backplane map. This is not the absolute offset within the common memory. For example, if the node top address is 200 (size of 150 words), in order to remap the last 50 words of that node then enter a A2 Network Start value of 100 (not 300).
A2 Network Size	Total number of words (starting from A2 Network Start offset) to be mapped into the virtual backplane map.
A2 Network Backplane Start	Start absolute word offset in the virtual backplane map where the mapped A2 data will be copied to.

3 Setup the portion of the virtual backplane map to be transferred to the processor.

```
BP Area 1 Top  :     0   #0...511 top address for area 1
BP Area 1 Size :   200   #0...512 area 1 data size in words
BP Area 2 Top  :     0   #0...8191 top address for area 2
BP Area 2 Size :   200   #0...8192 area 2 data size in words
```

The following example shows how to use the map feature by configuring the module parameters.

Example 2

This example application requires the MVI69-FLN module to communicate with two nodes configured as follows:

```
Node 1
Area 1 Top :    0
Area 1 Size:  150
Area 2 Top :    0
Area 2 Size:  150

Node 2
Area 1 Top :  240
Area 1 Size:  150
Area 2 Top :  240
Area 2 Size:  150
```

The MVI69-FLN must transfer the following data to the processor:

- Entire node 1 data
- Last 50 words of node 2 data

Without Data Mapping

In order to disable the data mapping, set the Use BP Map Table parameter as N:

```
Use BP Map Table       :    N #Use BP mapping (Y=Use maps, N=Don't use maps
(default))
```

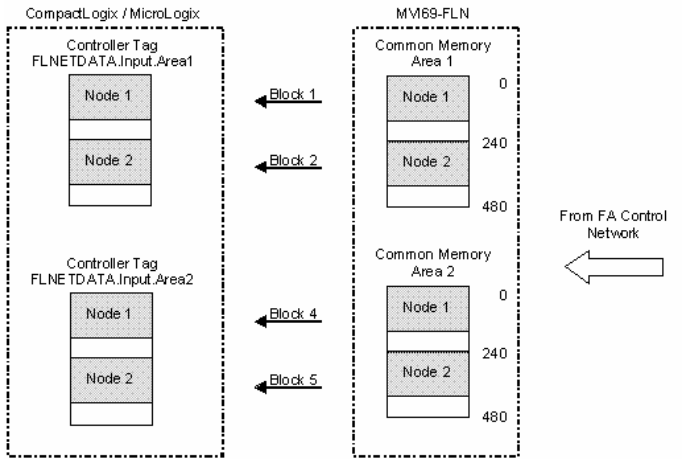
Because the goal is to transfer the entire Node 1 data and the last 50 words for Node 2 data, the backplane transfer to the processor should be set as follows:

```
BP Area 1 Top  :     0   #0...511 top address for area 1
BP Area 1 Size :   390   #0...512 area 1 data size in words
BP Area 2 Top  :     0   #0...8191 top address for area 2
BP Area 2 Size :   390   #0...8192 area 2 data size in words
```

Therefore, two blocks per each area will be required to transfer the data as follows:

Read Block ID	Area	Start Area Offset	Last Area Offset
1	1	0	239
2	1	240	389
4	2	0	239
5	2	240	389

The following illustration demonstrates this application:



Note: This application only requires the last 50 words from Node 2, but it must transfer the entire data because the transferred data must be organized.

With Data Mapping

In order to enable the mapping feature set the Use BP Map Table parameter as Y:

```
Use BP Map Table  :    Y #Use BP mapping (Y=Use maps, N=Don't use maps
(default))
```

Now configure the mapping settings through the [FL-NET BACKPLANE MAPPING] section in the configuration file. The goal is to remap only the areas to be transferred to the application in a contiguous order to provide optimal performance.

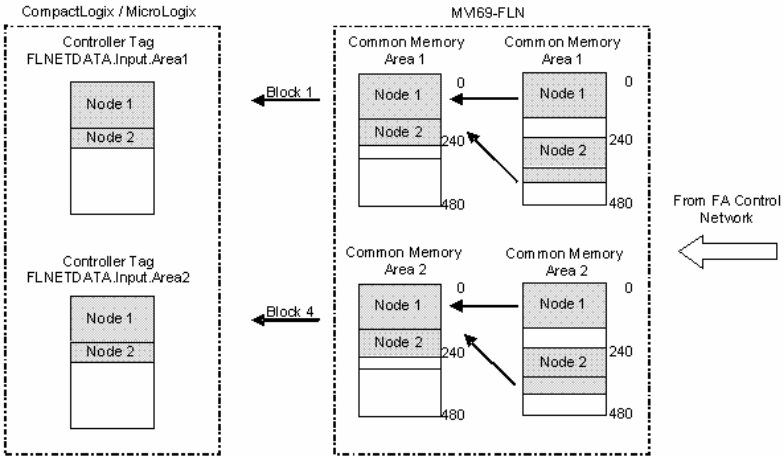
For this example the application requires only the following areas to me transferred to the processor (same offsets for both Area 1 and Area 2):

- Node 1 = Common Memory Data Offset from 0 to 149
- Node 2 = Common Memory Data Offset from 340 to 389

The following illustration shows how to configure this section for this example:

```
# Node  A1 Network  A1 Network  A1 Backplane   A2 Network   A2 Network  A2 Backplane
#            Start        Size         Start        Start         Size         Start
START
     1          0         150             0            0          150             0
     2        100          50           150          100           50           150
END
```

The following illustration shows how the data transfer would occur for this example:



Important: A1 Network Start and A2 Network Start parameters refer to the start offset within each node's area. So for this example node 2 mapping was configured as:

```
A1 Network Start = A2 Network Start = 100
```

Therefore, the A1/A2 Network Start offsets do not indicate the absolute Common Memory offset (340 for this example). It indicates the starting offset within that specific node's area (100 for this example).

1.13 Configure the Node Number

Configure the MVI69-FLN module with a node number of 40. The last digit of the IP address is used to denote the node number of the module.

Refer to the configuration file WATTCP.CFG and configure both parameters as follows:

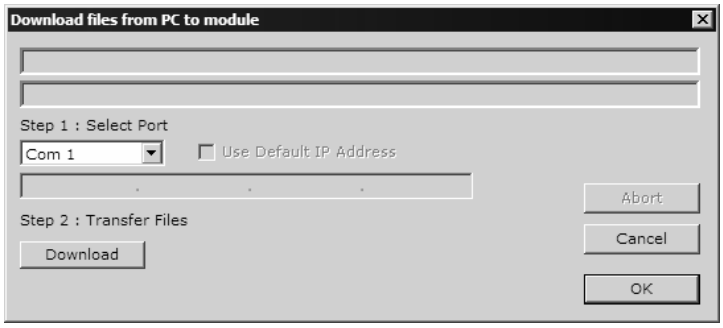
```
my_ip=192.168.250.40
netmask=255.255.255.0
```

1.14 Download 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.

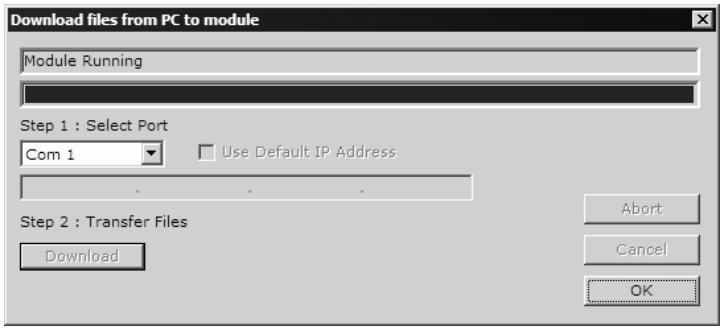
To Download the Project File

1. In the tree view in ProSoft Configuration Builder, click once to select the MVI69-FLN module.
2. Open the **Project menu,** and then choose **Module / Download**. The program will scan your PC for a valid com port (this may take a few seconds). When PCB has found a valid com port, the following dialog box will open.



3. Choose the com port to use from the dropdown list, and then click the Download button.

   The module will perform a platform check to read and load its new settings. When the platform check is complete, the status bar in ProSoft Configuration Builder will be updated with the message *"Module Running*".



1.15 Cable Connections

The MVI69-FLN module has the following communication connections on the module:

- One Ethernet port (RJ45 connector)
- One RS-232 Configuration/Debug port (RJ45 connector)

1.15.1 Ethernet Connection

The MVI69-FLN module has an RJ45 port located on the front of the module labeled "Ethernet", for use with the TCP/IP network. The module is connected to the Ethernet network using an Ethernet cable between the module's Ethernet port and an Ethernet switch or hub.

Note: Depending on hardware configuration, you may see more than one RJ45 port on the module. The Ethernet port is labeled "Ethernet".
Warning: The MVI69-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 is used to denote the node number of the module.

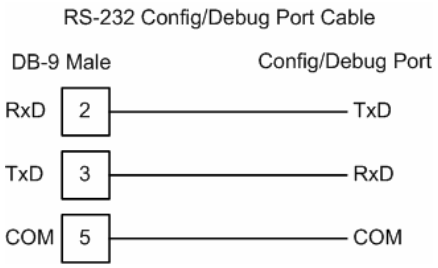
Ethernet Port Configuration - wattcp.cfg

The wattcp.cfg file must be set up properly in order to use a TCP/IP network connection. You can view the current network configuration using an ASCII terminal by selecting "@" (Network Menu) and "V" (View) options when connected to the Debug port.

```
# WATTCP.CFG FILE:
# ProSoft Technology.
  my_ip=192.168.0.40
# Default class 3 network mask
  netmask=255.255.255.0
# The gateway I wish to use
  gateway=192.168.0.1
```

1.15.2 RS-232 Configuration/Debug Port

This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC based terminal emulation program to view configuration and status data in the module and to control the module. The cable for communications on this port is shown in the following diagram:

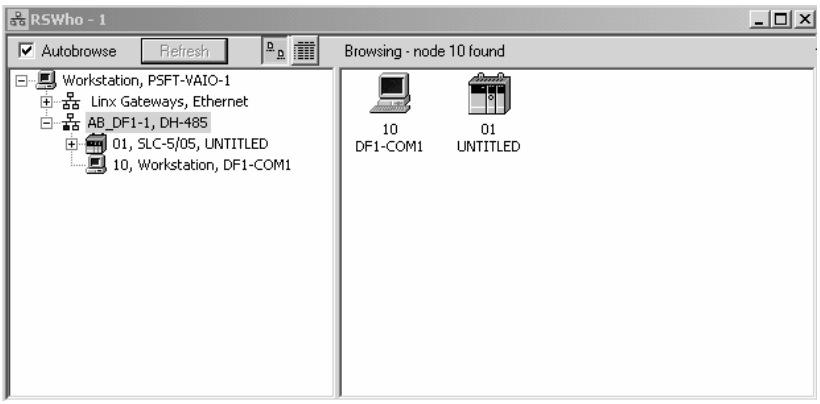


Disabling the RSLinx Driver for the Com Port on the PC

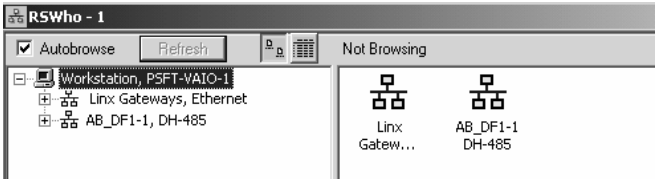
The communication port driver in RSLinx can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using ProSoft Configuration Builder (PCB), HyperTerminal or another terminal emulator, follow these steps to disable the RSLinx Driver.

1 Open RSLinx and go to Communications>RSWho

2 Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network:



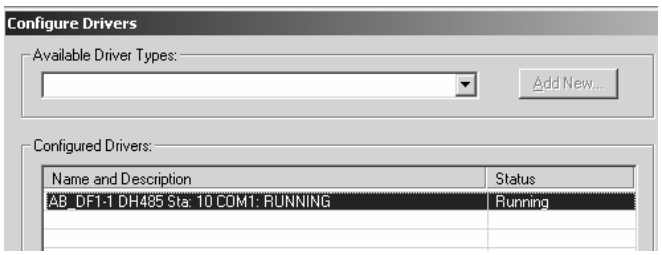
3 Notice how the DF1 driver is opened, and the driver is looking for a processor on node 1. If the network is being browsed, then you will not be able to stop this driver. To stop the driver your RSWho screen should look like this:



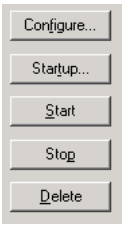
Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.

4 When you have verified that the driver is not being browsed, go to

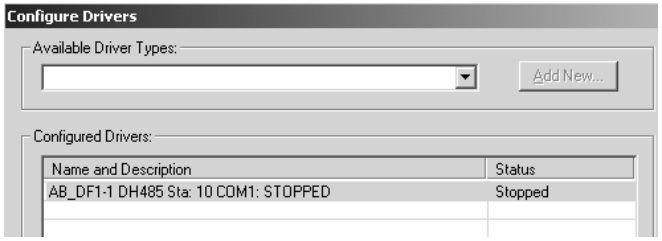
Communications>Configure Drivers
You may see something like this:



If you see the status as running, you will not be able to use this com port for anything other than communication to the processor. To stop the driver press the "Stop" on the side of the window:



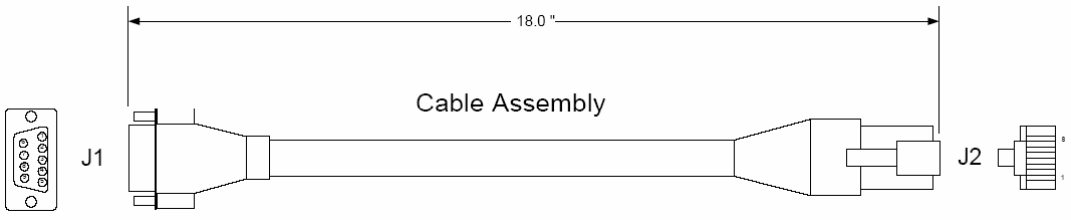
5 After you have stopped the driver you will see the following:

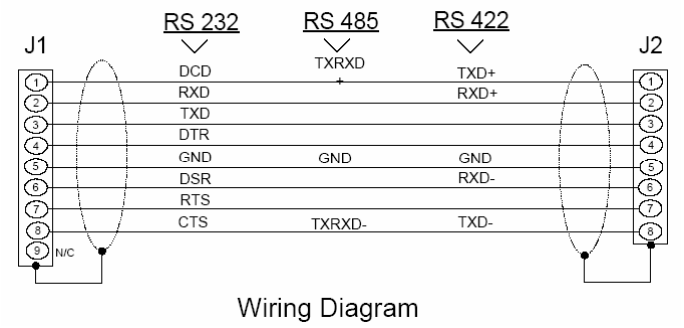


6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

Note: You may need to shut down and restart your PC before it will allow you to stop the driver (usually only on Windows NT machines). If you have followed all of the above steps, and it will not stop the driver, then make sure you do not have RSLogix open. If RSLogix is not open, and you still cannot stop the driver, then reboot your PC.

1.15.3 DB9 to RJ45 Adaptor (Cable 14)



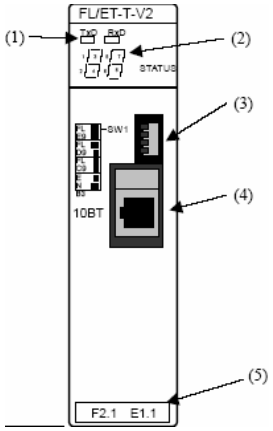


Wiring Diagram

1.16 Setup the FL/ET-T-V2 Module

1.16.1 Set Operation Mode Switch

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



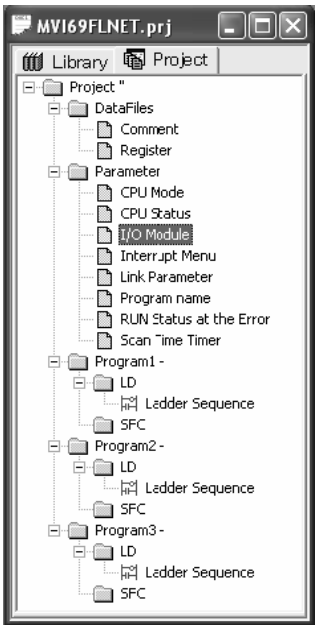
The following options are available. This procedure will consider the first option (ID Code = C9 - 8kbytes of Link Memory Capacity)

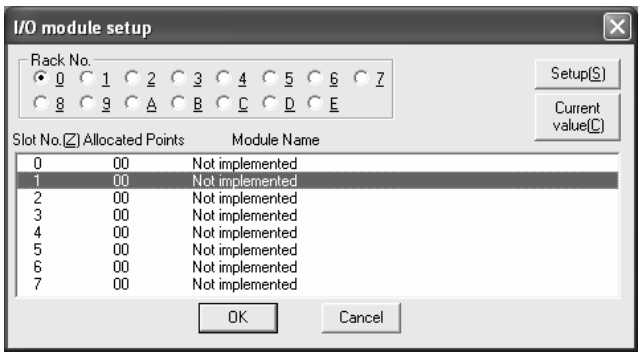
Switch Positions		I/O module ID Code	Link Memory Capacity	Data Link Capacity (maximum number of total words in reception and transmission areas)
	1 & 2 off	C9	8 kbytes	Relay link: 2048 points (128 words) (*2) Register link: 2048 words (*1)
	1 off, 2 on	D9	16 kbytes	Relay link: 2048 points (128 words)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

1.17 FL/ET-V2 Configuration with PCwin

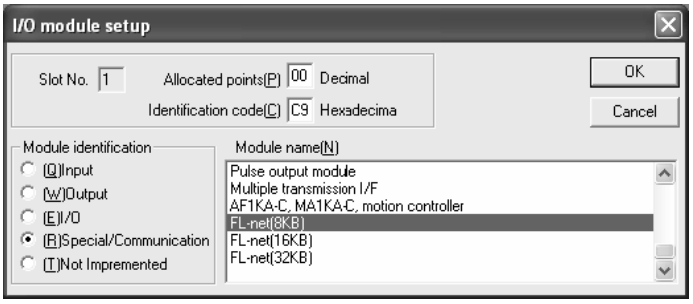
1.17.1 Specify I/O Module ID Code

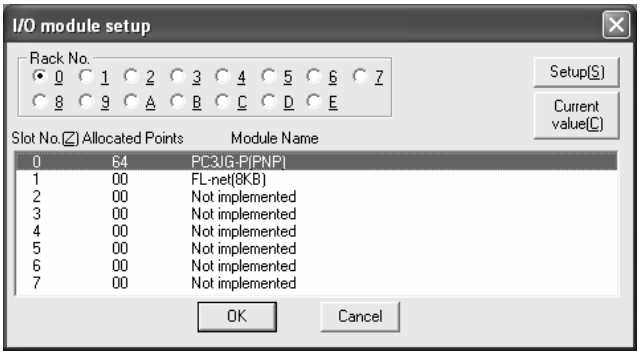
Expand the *Parameter* folder, and double-click *I/O Module*





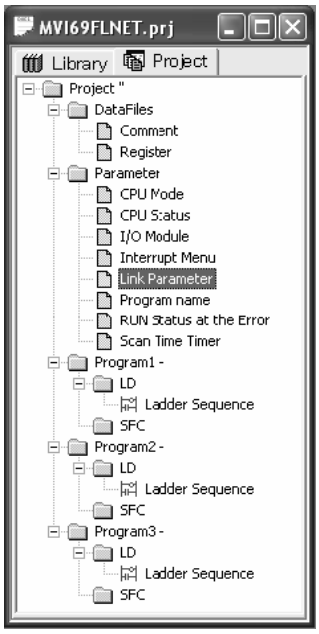
Select the FL-net module



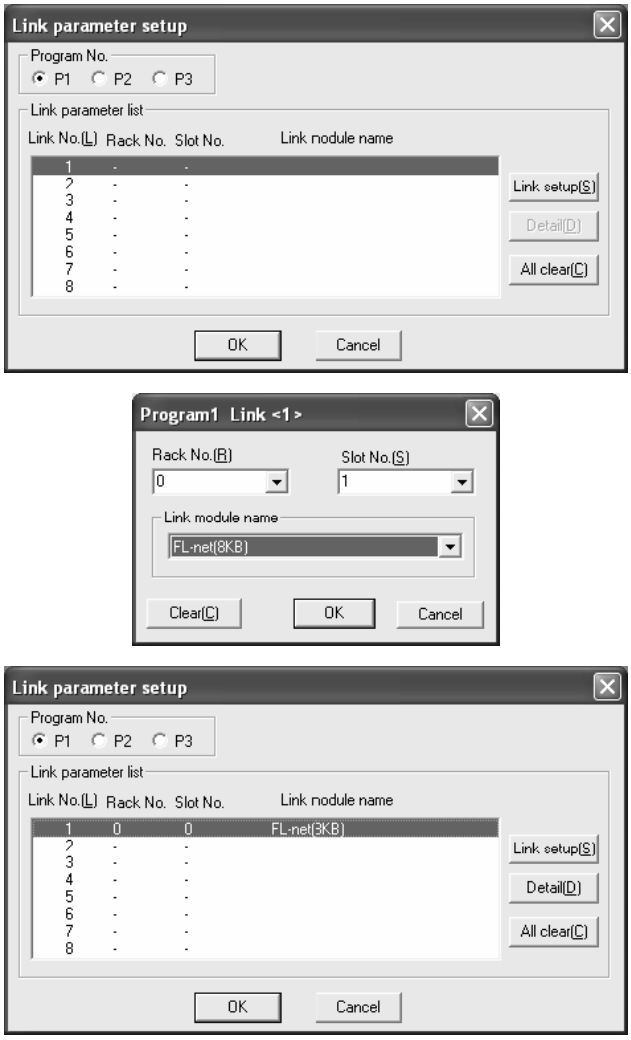


1.17.2 Setup the FL/ET-V2 Link Parameters

Double-click Link Parameter

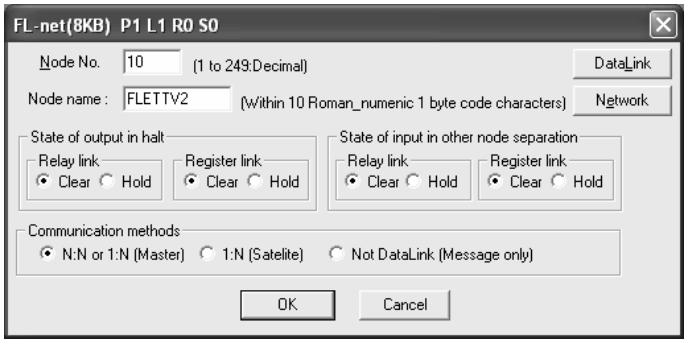


Select the link number to assign to the FL/ET-T-V2 module. For this example, use Link No 1 for the FL/ET-T-V2 module. Double click the link row and configure the correct slot, rack and module for link 1 as shown in the following illustrations:

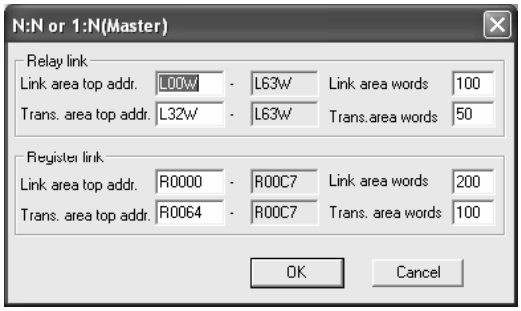


Now click the Detail button to configure the following link parameters:

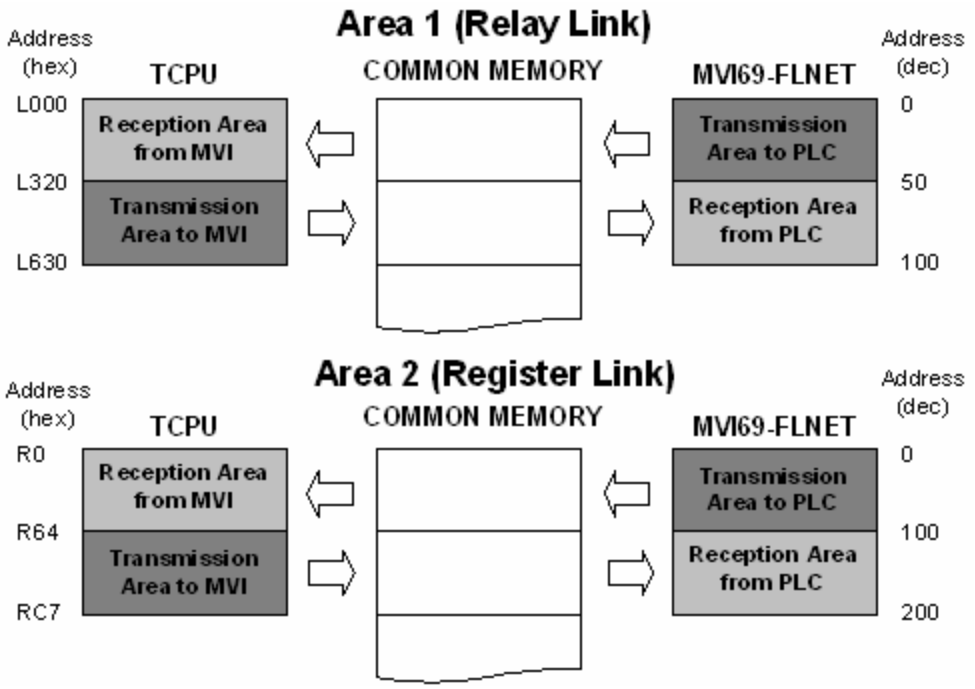
- Node Number = 10
- Communication Method = N:N or 1:N (Master)



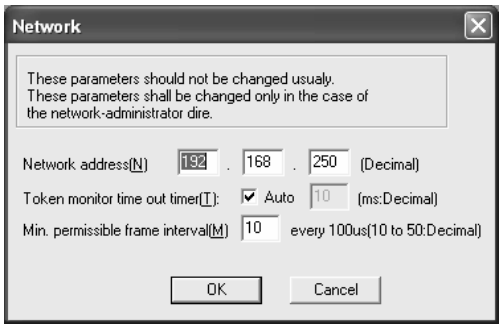
Click the Data Link button to configure the common memory that will be shared by all participating nodes in communication.



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):

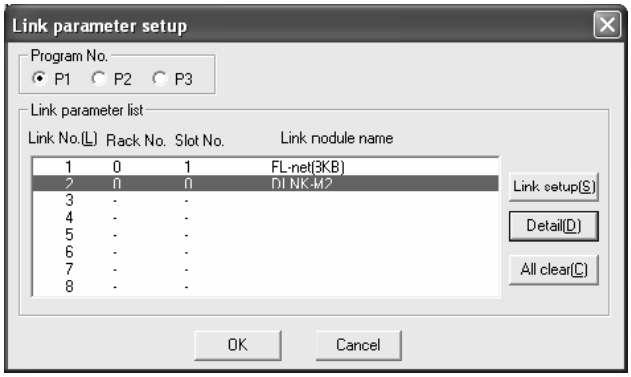


Click OK to close the Data Link window, and then click the Network button. Configure the default parameters as shown in the following illustration:



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.



1.18 Download the Project

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

1.19 Connect the MVI69-FLN Module to the FL/ET-T-V2

Use standard CA5 Ethernet cables to connect the Ethernet port on the MVI69-FLN through a 10 Megabit Ethernet hub or switch to the Ethernet port on the FL/ET-T-V2 module.

Warning: The MVI69-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.

1.20 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 MVI69-FLN module were configured according to the previous sections).

1.20.1 Required Hardware

You can connect directly from your computer's serial port to the serial port on the module to view configuration information, perform maintenance, and send (upload) or receive (download) configuration files.

ProSoft Technology recommends the following minimum hardware to connect your computer to the module:

- 80486 based processor (Pentium preferred)
- 1 megabyte of memory
- At least one UART hardware-based serial communications port available. USB-based virtual UART systems (USB to serial port adapters) often do not function reliably, especially during binary file transfers, such as when uploading/downloading configuration files or module firmware upgrades.
- A null modem serial cable.

1.20.2 The Configuration/Debug Menu

The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

Because this is a text-based menu system, you enter commands by typing the command letter from your computer keyboard in the terminal application (for example, HyperTerminal). The module does not respond to mouse movements or clicks. The command executes as soon as you press the command letter — you do not need to press **[Enter]**. When you type a command letter, a new screen will be displayed in your terminal application.

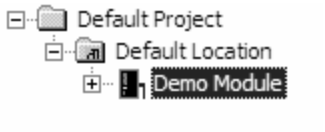
Important: You must download the sample ladder to the CompactLogix processor, otherwise the module will be unable to establish communication with the processor.

If you see the message
`"Waiting for connection to processor..."`
when you connect to the configuration/debug port on the MVI69-FLN module using HyperTerminal, connect to the processor with RSLogix and download the sample ladder logic to the processor before continuing.

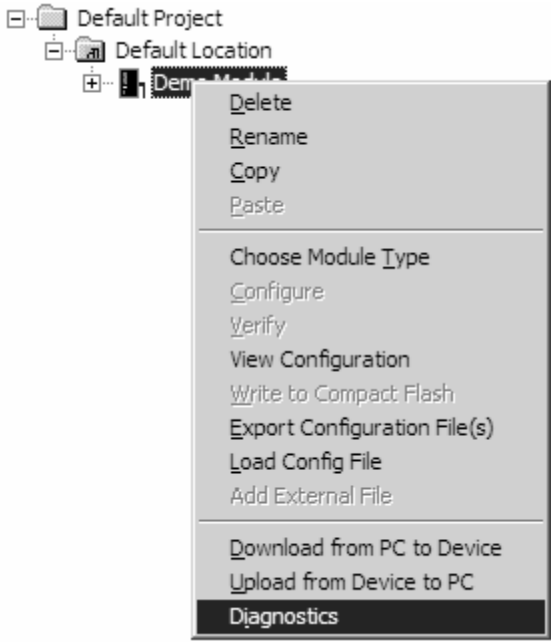
Using the Diagnostic Window in ProSoft Configuration Builder

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

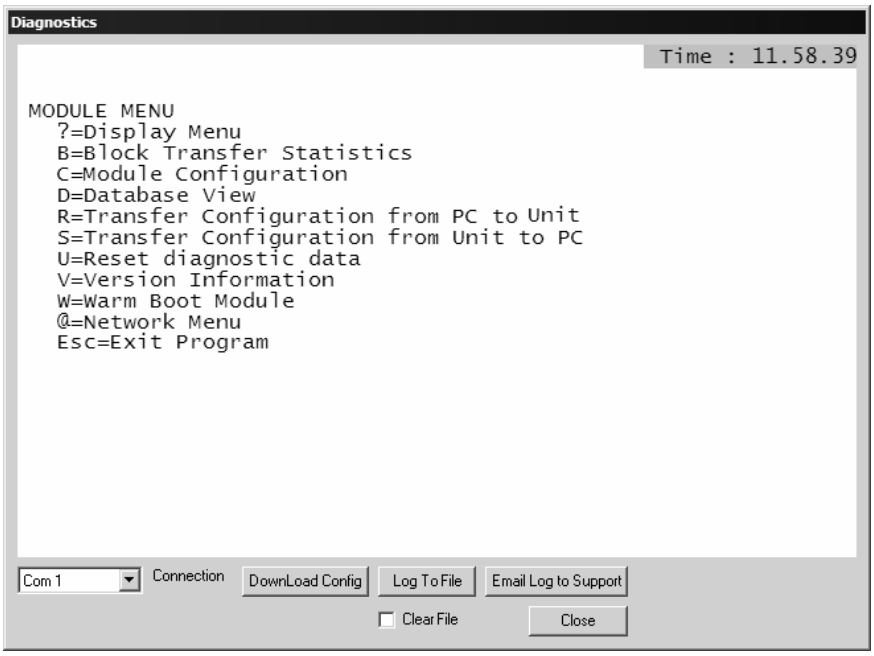
1 Start PCB program with the application file to be tested. Right click over the module icon.



2 On the shortcut menu, choose Diagnostics.



3 This action opens the Diagnostics dialog box. Press "?" to display the Main Menu.



Important: The illustrations of configuration/debug menus in this section are intended as a general guide, and may not exactly match the configuration/debug menus in your own module.

If there is no response from the module, follow these steps:

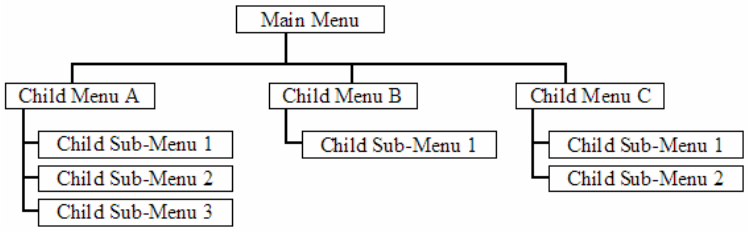
1 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
2 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.

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

Navigation

All of the sub-menus for this module contain commands to redisplay the menu or return to the previous menu. You can always return from a sub-menu to the next higher menu by pressing **[M]** on your keyboard.

The organization of the menu structure is represented in simplified form in the following illustration:



The remainder of this section shows you the menus available for this module, and briefly discusses the commands available to you.

Keystrokes

The keyboard commands on these menus are almost always non-case sensitive. You can enter most commands in lower case or capital letters.

The menus use a few special characters (**[?]**, **[-]**, **[+]**, **[@]**) that must be entered exactly as shown. Some of these characters will require you to use the **[Shift]**, **[Ctrl]** or **[Alt]** keys to enter them correctly. For example, on US English keyboards, enter the **[?]** command as **[Shift][/]**.

Also, take care to distinguish capital letter **[I]** from lower case letter **[l]** (L) and number **[1]**; likewise for capital letter **[O]** and number **[0]**. Although these characters look nearly the same on the screen, they perform different actions on the module.

1.20.3 Using the Module Debug Menu

Checking the Nodes Exchanging Data

From the Main Menu select:

FL-net Menu (F) → Node Data Exchange (D)

This menu contains a table that indicates all nodes that are exchanging data with the MVI69-FLN module. In the following table, each group of four digits corresponds to a word (16-bits) displayed in hexadecimal format. This table describes a sequence of bits that correspond to each FL-net node.

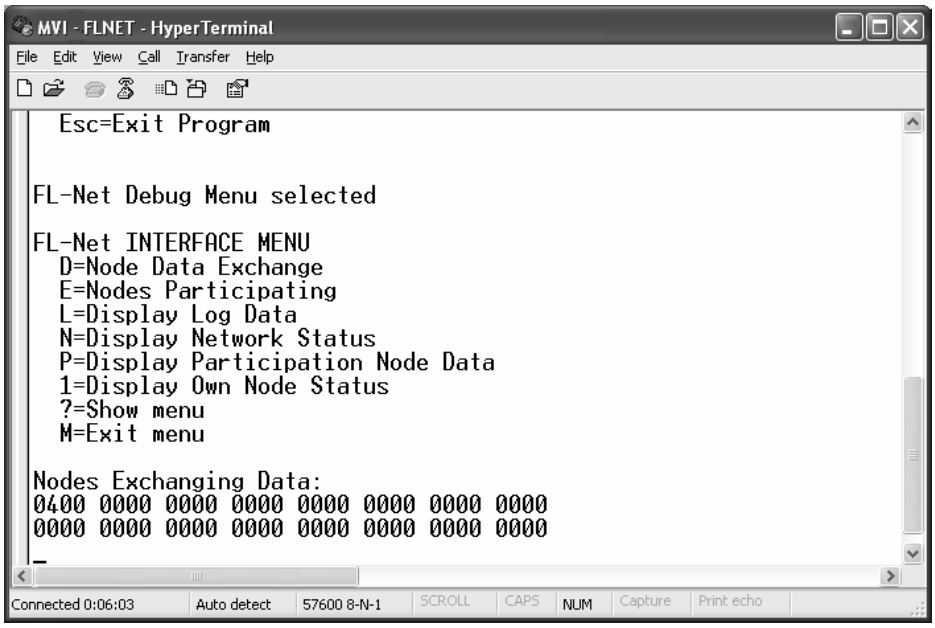
The following tables show the correlation between the bits and the nodes on the FL-net network for the first three words:

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 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 Main Menu select:

FL-net Menu (F)→ Nodes Participating (E)

In the following tables, each group of four digits corresponds to a word (16-bits) displayed in hexadecimal format. This table describes a sequence of bits that correspond to each FL-net node.

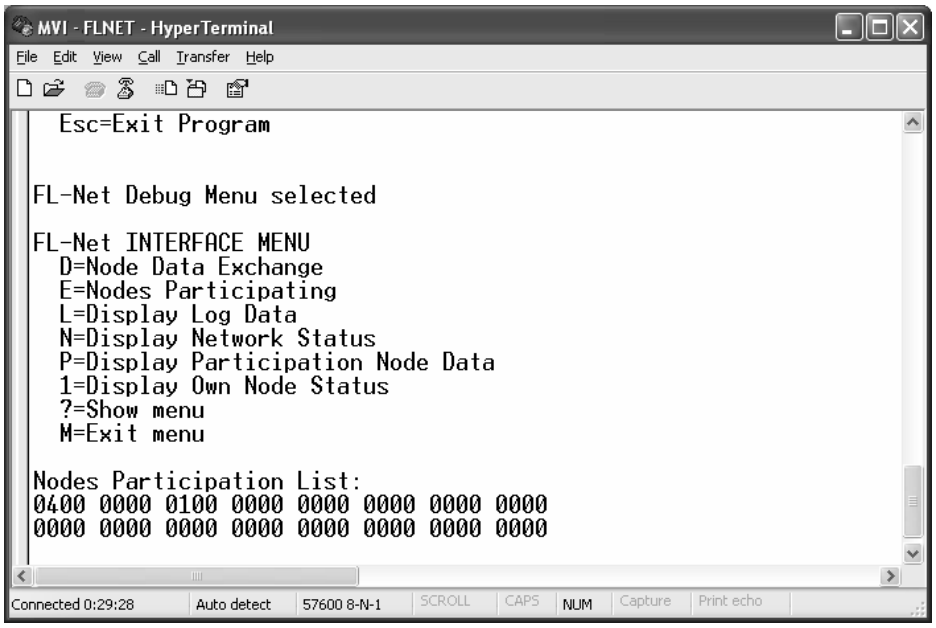
The following tables show the correlation between the bits and the nodes on the FL-net network for the first three words:

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.



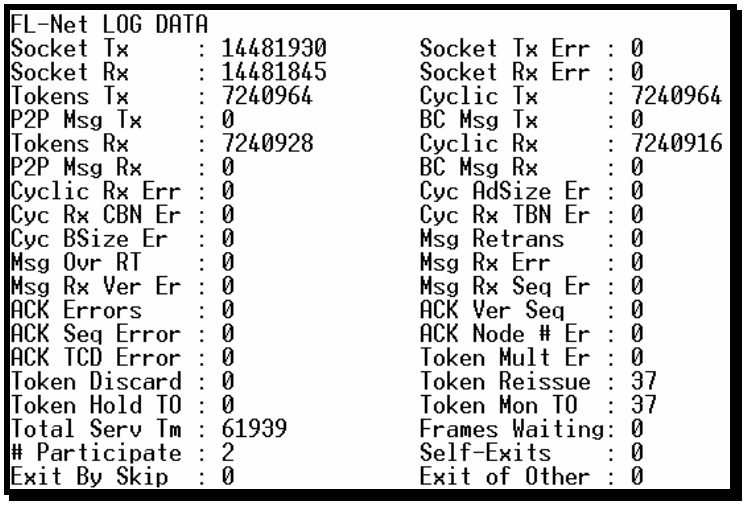
Checking the Log Data

From the Main Menu select:

FL-net Menu (F)→ Display Log Data (L)

The log data menu displays information pertaining to:

- Transmission
- Reception
- Cyclic Transmission



Checking the Participating Node Status

From the Main Menu select:

FL-net Menu (F)→ Display Log Data (P)

Use the navigation keys to navigate between nodes (next, previous, skip forward, skip backward).

```
FL-Net PARTICIPATION NODE DATA MENU
  F=Go to node 0
  N=Go to next node
  P=Go to previous node
  +=Skip forward 5 nodes
  -=Skip backward 5 nodes
  >=Skip forward 10 nodes
  <=Skip backward 10 nodes
  S=Display Current Node Status
  ?=Show menu
  M=Exit menu
```

The following illustration shows the status for node 10. If the Node Address register indicates a value equal than zero it means that the node is not participating in the network.

```
FL-Net PARTICIPATION NODE 10 DATA:
Node Address  : 10 (0=not participating in network)
TW Time       : 24 (milliseconds)
MFT Time      : 10  100usec units
FA Link Status: 60 (hex)
ULS           : 8000 (hex)
Area 1 --> Top: 50       Size : 50
Area 2 --> Top: 100      Size : 100
Allowed RCT   : 10
Missed Count  : 0
Version Seq # : 28470
Broadcast Seq : 0
P2P Seq #     : 0
My TX Seq #   : 1
```

The Participation Node Data page shows Area 1 and Area 2 settings, FA Link, Upper Layer Status (ULS) and other values for each participating node.

Checking the Own Node Status

From the Main Menu select:

FL-net Menu (F)→ Display Own Node Status (1)

```
FL-Net OWN NODE DATA
Node Number   : 40
Area 1 --> Top: 0        Size : 50       End : 49
Area 2 --> Top: 0        Size : 100      End : 99
ULS           : 0000 (hex)
TW Time       : 100 milliseconds
MFT Time      : 10  (100usec units)
Vendor Code   : ProSoft
Vendor Model  : MVI56-FLN
Node Name     : MVI56FLNET
Protocol      : 80 (hex)
FA Link Status: 60 (hex)
Own Status    : 00 (hex)
State         : 7
Tx Ver Seq #  : 2024438129
Broadcast Seq : 1
Msg Active    : No    Msg Resend : 0    Msg Circ : 0
```

The Own Node Data page shows MVI69-FLN status in the FL-net network, including upper layer status, allowable minimum frame interval time (MFT), Area 1 and Area 2 settings, and other values.

1.20.4 Checking Status through CompactLogix Controller Tags

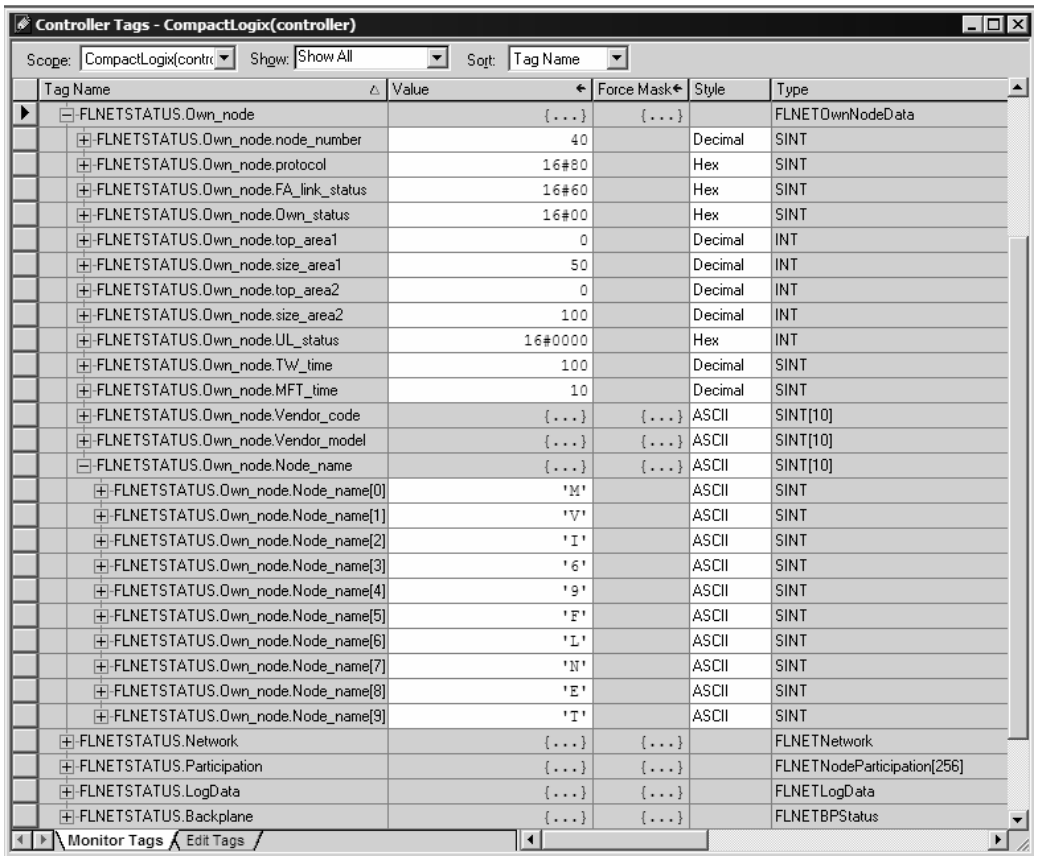
You can also monitor network status through the CompactLogix controller tags that are updated through the MVI69-FLN sample ladder. Refer to the ProSoft Solutions CD-ROM or the ProSoft web site at http://www.prosoft-technology.com (http://www.prosoft-technology.com) for the sample ladder logic for the MVI69-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 MVI69-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 MVI69-FLN.

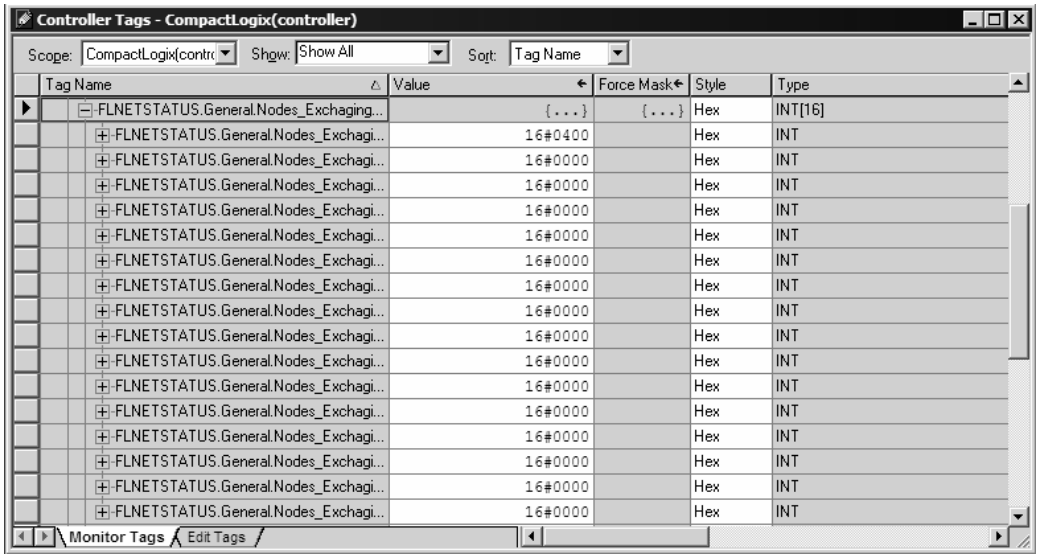
The information in this tag is updated automatically from the module through status blocks 0 and -1.



Tag Name	Value	Force Mask	Style	Type
FLNETSTATUS.Own_node	{...}	{...}		FLNETOwnNodeData
FLNETSTATUS.Own_node.node_number	40		Decimal	SINT
FLNETSTATUS.Own_node.protocol	16#80		Hex	SINT
FLNETSTATUS.Own_node.FA_link_status	16#60		Hex	SINT
FLNETSTATUS.Own_node.Own_status	16#00		Hex	SINT
FLNETSTATUS.Own_node.top_area1	0		Decimal	INT
FLNETSTATUS.Own_node.size_area1	50		Decimal	INT
FLNETSTATUS.Own_node.top_area2	0		Decimal	INT
FLNETSTATUS.Own_node.size_area2	100		Decimal	INT
FLNETSTATUS.Own_node.UL_status	16#0000		Hex	INT
FLNETSTATUS.Own_node.TW_time	100		Decimal	SINT
FLNETSTATUS.Own_node.MFT_time	10		Decimal	SINT
FLNETSTATUS.Own_node.Vendor_code	{...}	{...}	ASCII	SINT[10]
FLNETSTATUS.Own_node.Vendor_model	{...}	{...}	ASCII	SINT[10]
FLNETSTATUS.Own_node.Node_name	{...}	{...}	ASCII	SINT[10]
FLNETSTATUS.Own_node.Node_name[0]	'M'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[1]	'V'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[2]	'I'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[3]	'6'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[4]	'9'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[5]	'F'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[6]	'L'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[7]	'N'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[8]	'E'		ASCII	SINT
FLNETSTATUS.Own_node.Node_name[9]	'T'		ASCII	SINT
FLNETSTATUS.Network	{...}	{...}		FLNETNetwork
FLNETSTATUS.Participation	{...}	{...}		FLNETNodeParticipation[256]
FLNETSTATUS.LogData	{...}	{...}		FLNETLogData
FLNETSTATUS.Backplane	{...}	{...}		FLNETBPStatus

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 MVI69-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.



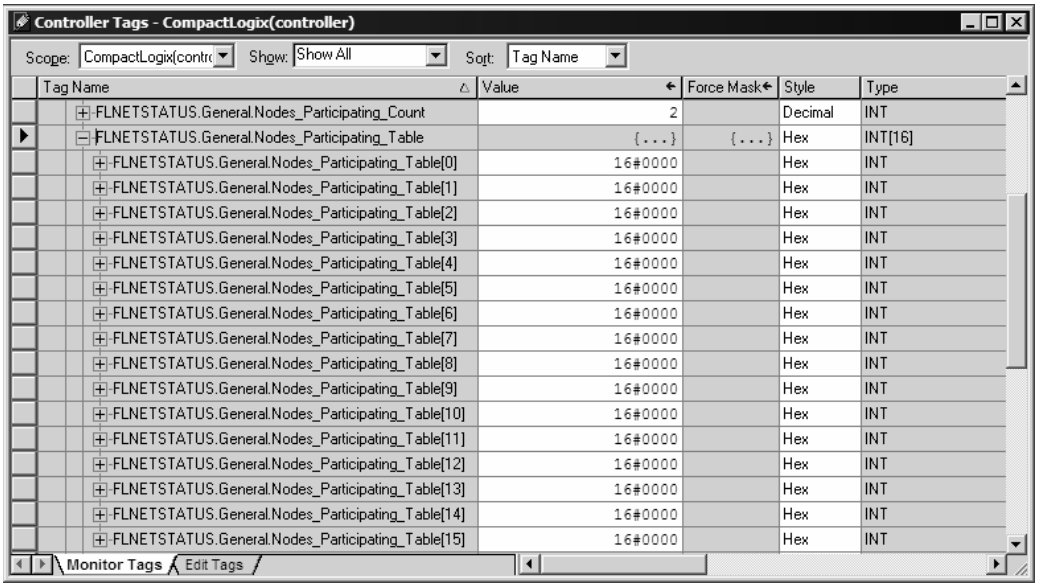
Checking the Participation Table

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.



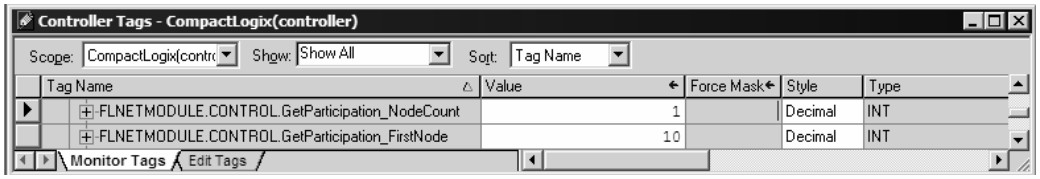
Checking the Participating Node Status

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:

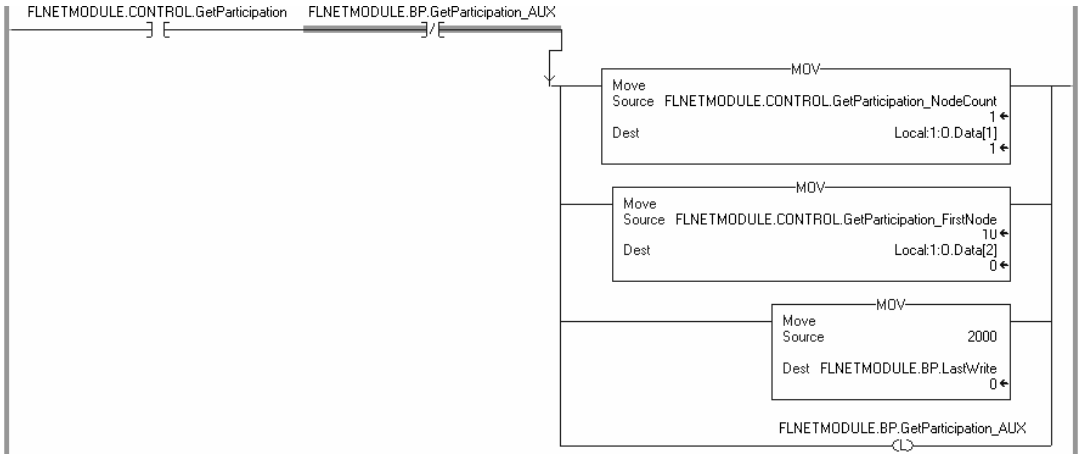
- upper layer status (ULS)
- allowable minimum frame interval time (MFT)
- allowable refresh cycle time (RCT)
- Area 1 (A1) and Area 2 (A2) settings
- token watchdog time (TW).

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:

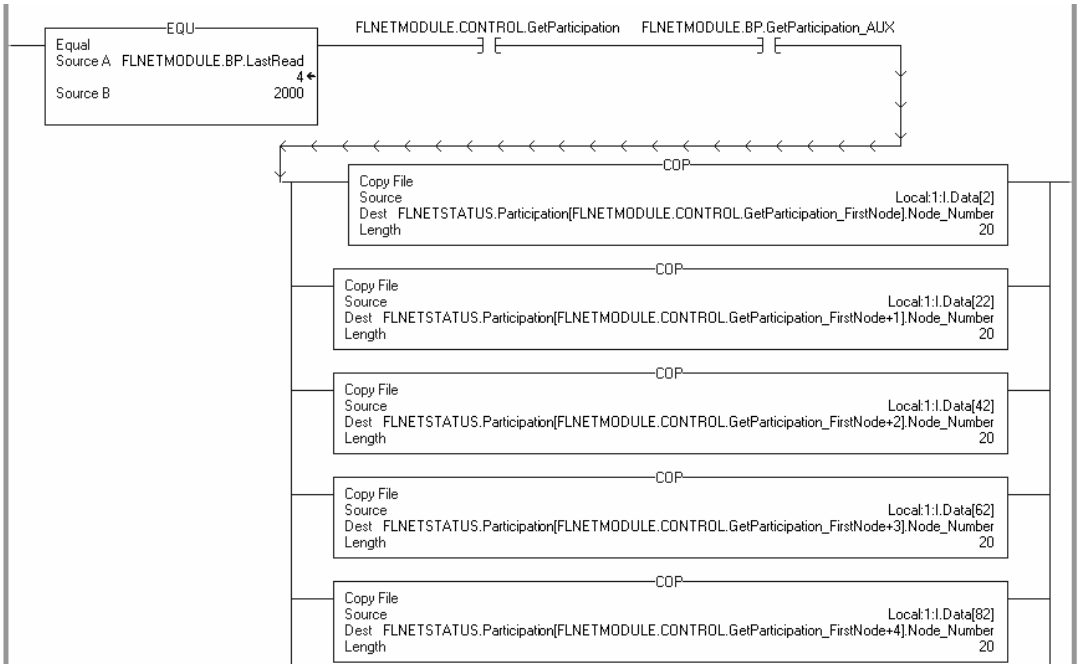


Next, trigger the Participation Table Request block (block 2000). To do this, set the *FLNETMODULE.CONTROL.GetParticipation* bit to 1. The following rung in the sample ladder WriteData routine performs the request to the module. The *FLNETMODULE.CONTROL.GetParticipation* bit is automatically cleared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

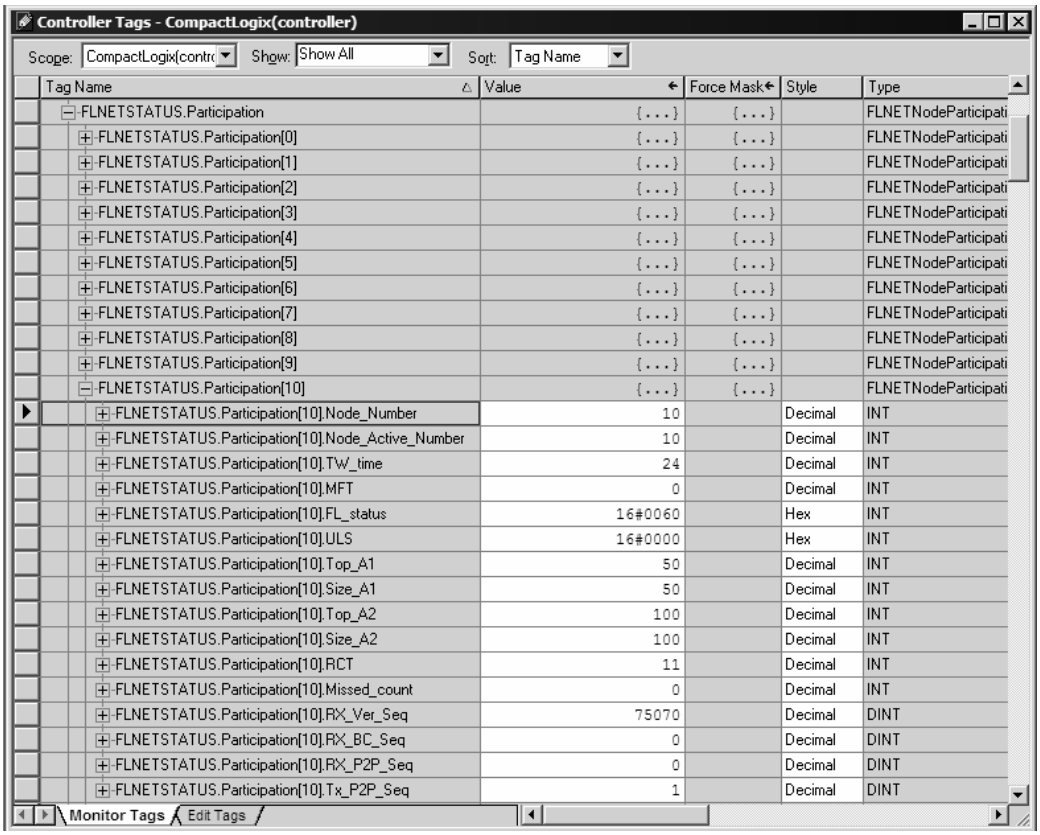


The following rung in the Read Data routine reads the module response containing the participating node status.

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.



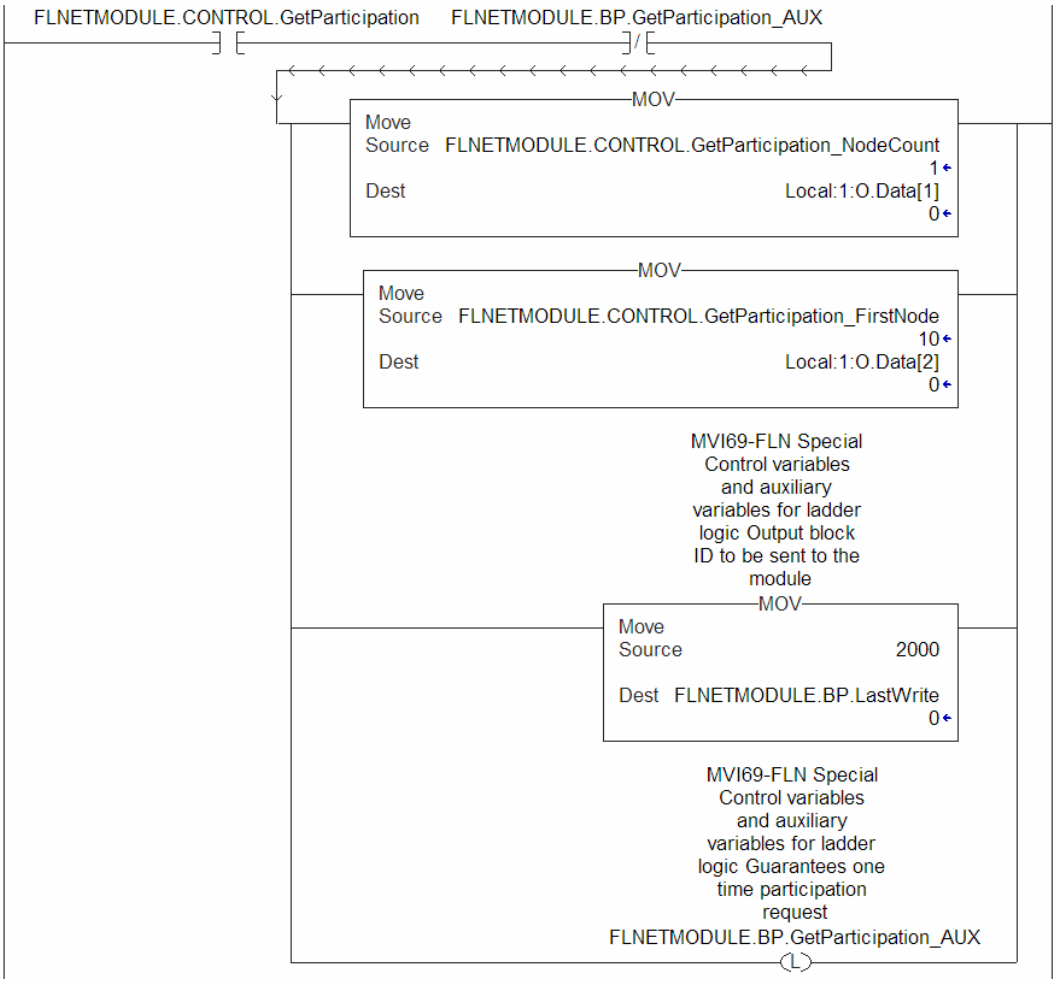
The participating node status is read to the *FLNETSTATUS.Participation[ ]* controller tag array. The status for node address 10 is available at *FLNETSTATUS.Participation[0]*.



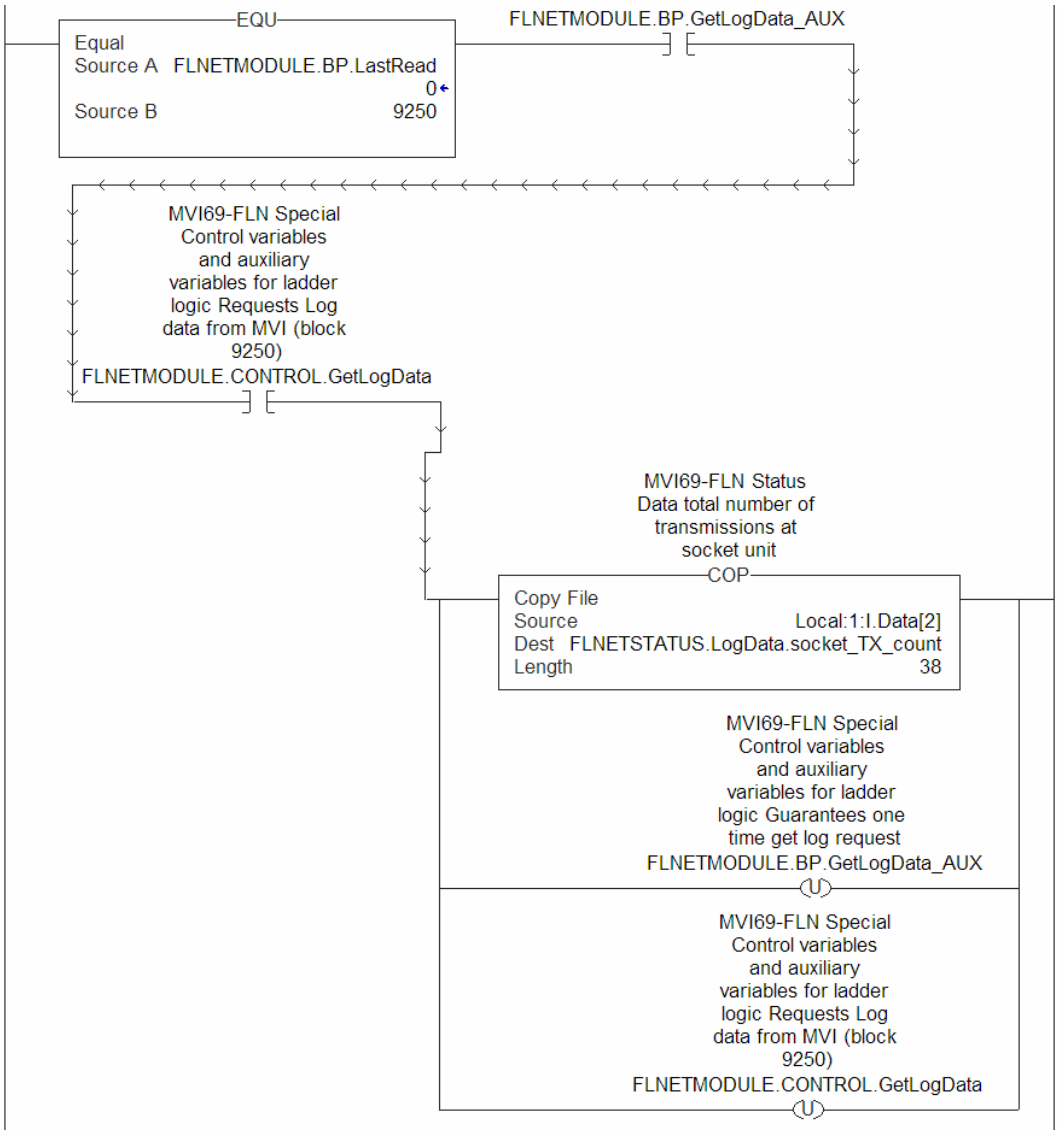
Checking the Log Data

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

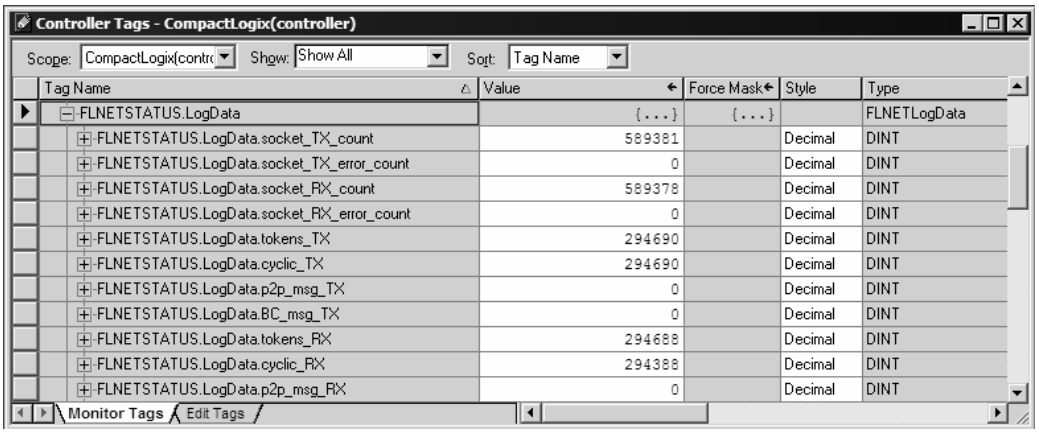
The following rung in the Write Data routine requests block 9250. To trigger this logic, set the *FLNETMODULE.CONTROL.GetParticipation* bit to 1.



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:

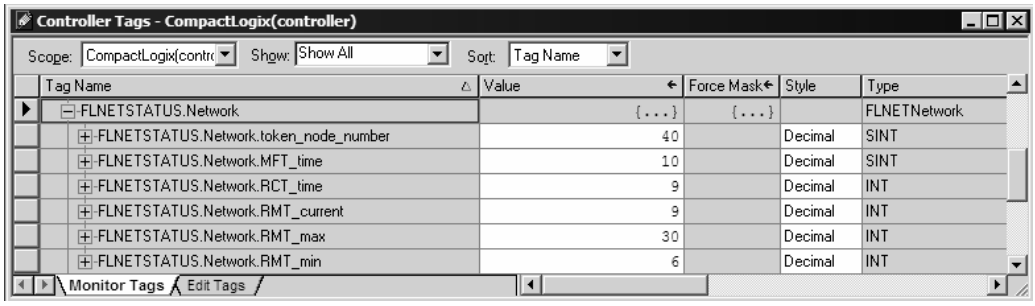


Checking the General Network Status

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

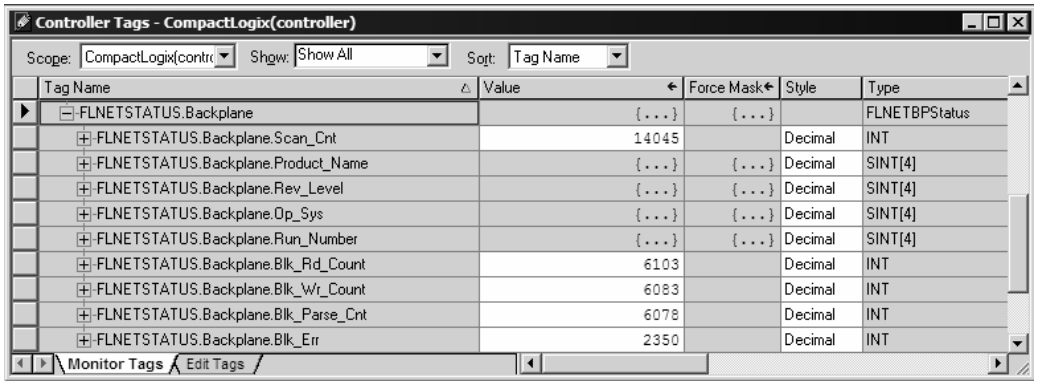
- the token node that is currently holding the token
- the refresh cycle measurement time (RMT) - minimum, maximum and current values
- allowable minimum frame interval time (MFT)
- allowable refresh cycle time (RCT).

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



Checking the Backplane status

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



1.20.5 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.

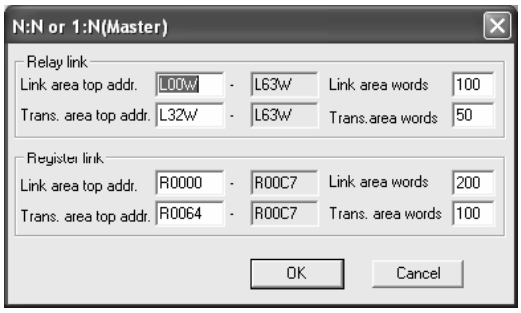
The data received from the remote FL-net node to the MVI69-FLN module is automatically "reassembled" from the input blocks into the *FLNETDATA.Intput* controller tag (according to each block ID). Also, the data to transfer from the module to the remote FL-net node is copied from the *FLNETDATA.Output* controller tag into the output blocks according to its block ID. This logic is already handled by the sample ladder program supplied by ProSoft.

For this example, use the following MVI69-FLN Area1 and Area 2 settings in the FLNET.CFG 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)
```

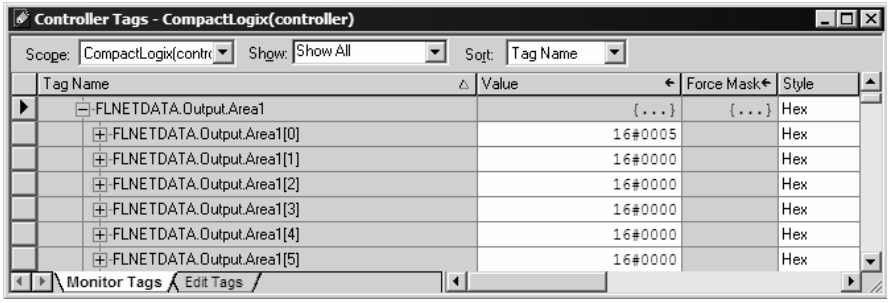
Important: The module only generates the blocks required to transfer the data you configured. For this example only one Area 1 block and one Area 2 blocks are required, so only blocks 1 to 4 are used for data transfer. The larger the areas, the more blocks are required to transfer data (and the more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

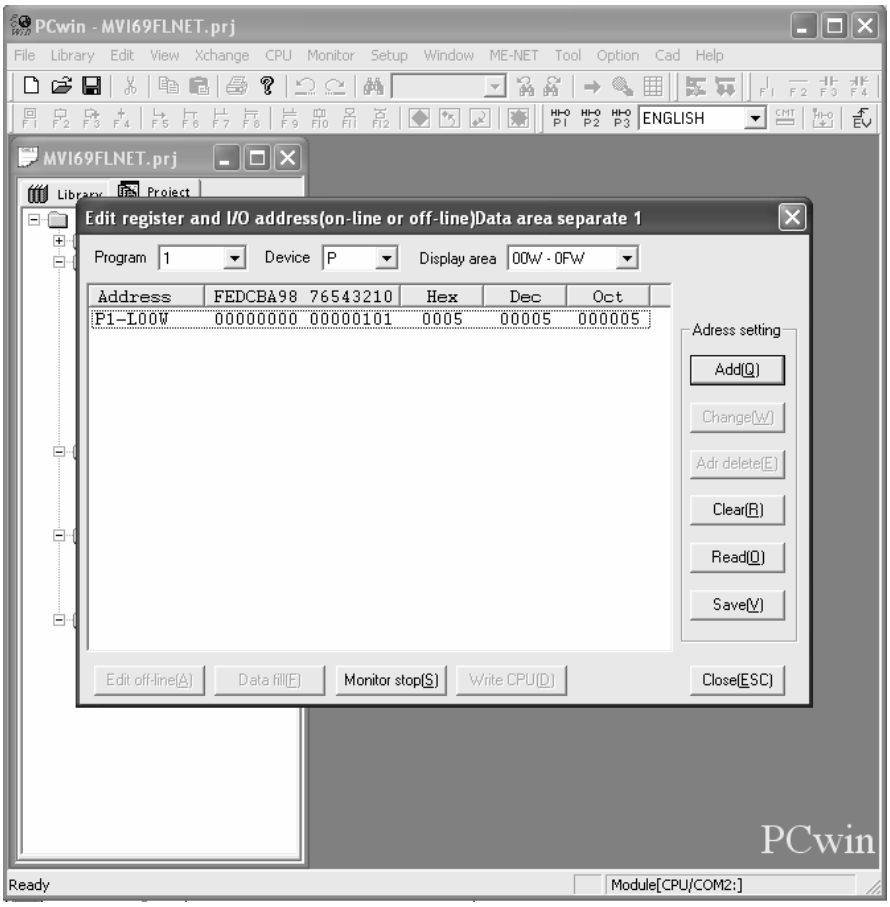


Transferring Data from MVI69-FLN (Area 1) to FL/ET-T-V2 module (Relay Area)

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:

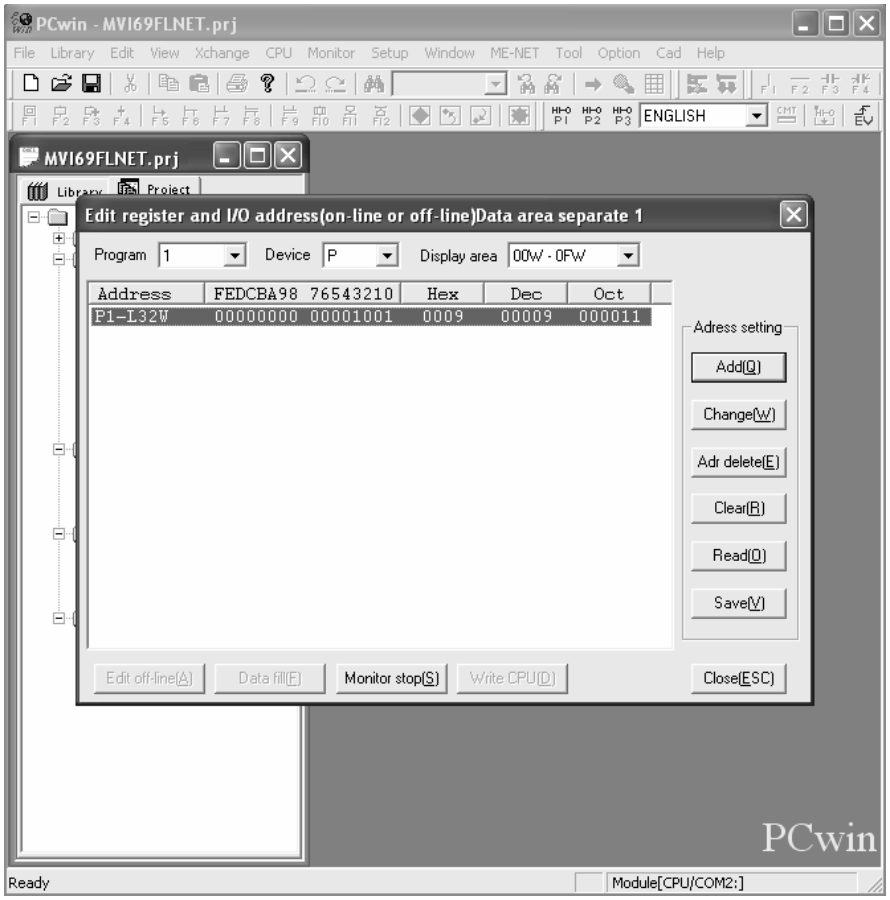


Use the PCWin Register Address Monitor to monitor the value set by the module (address L00W for our example).

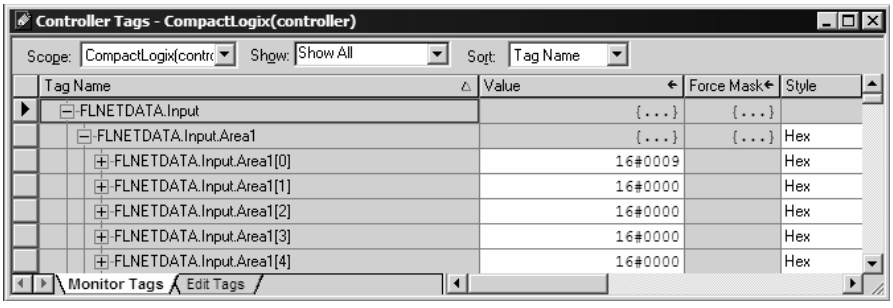


Transferring Data from FL/ET-T-V2 Link Area to MVI69-FLN Area 1

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

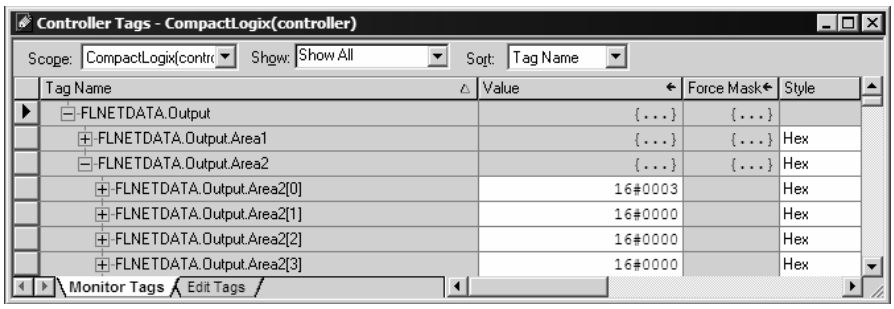


Use *FLNETDATA.Input.Area1* controller tags to monitor data received from the remote node to the MVI69-FLN Area 1.

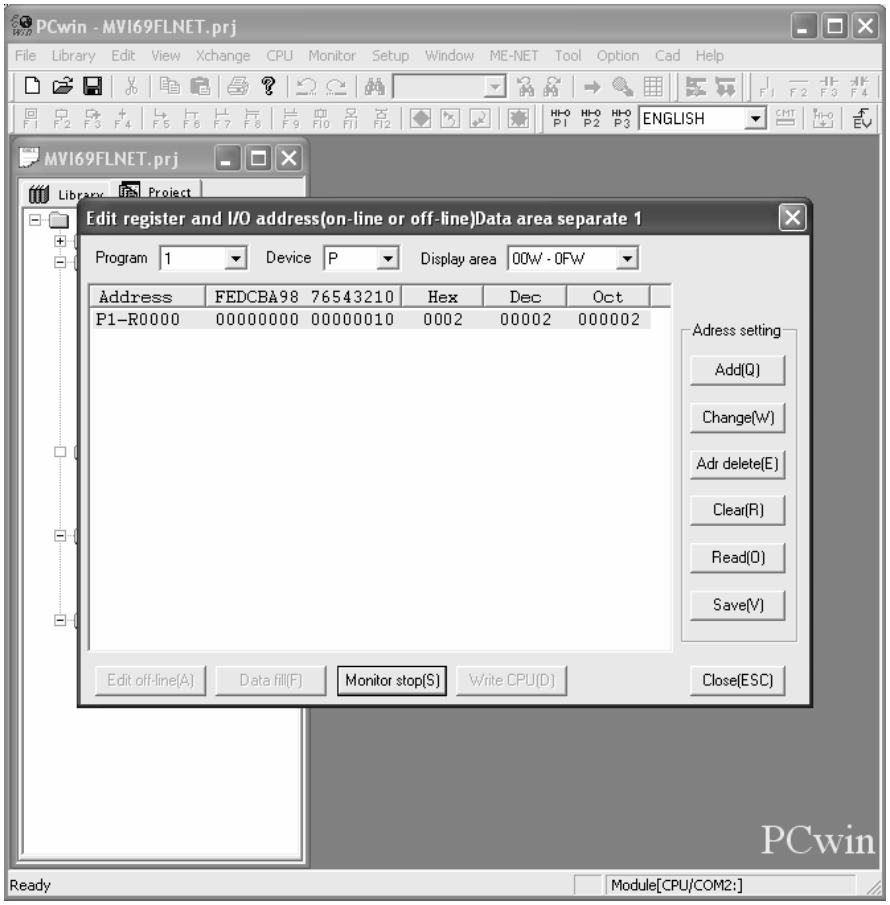


Transferring Data from MVI69-FLN (Area 2) to FL/ET-T-V2 module (Register Area)

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:

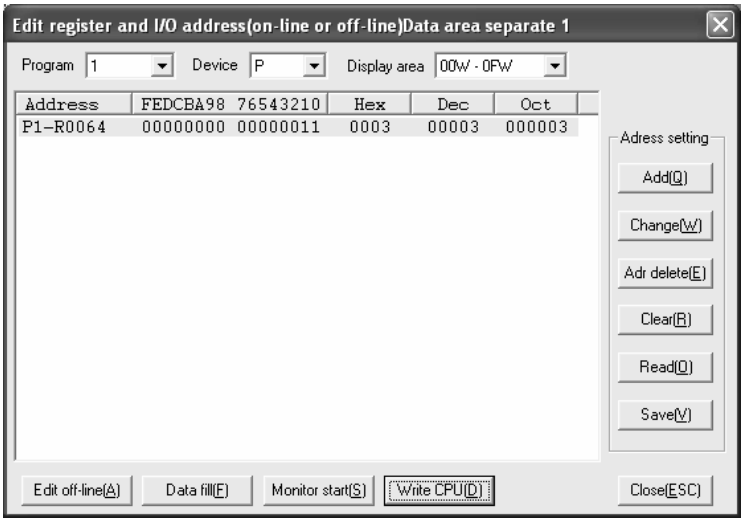


Use the PCWin Register Address Monitor to monitor the value set by the module (address R000 for our example).

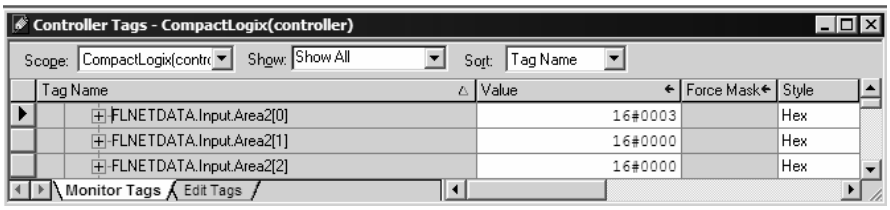


Transferring Data from FL/ET-T-V2 Register Area to MVI69-FLN Area 2

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 MVI69-FLN Area 2.



2 Diagnostics and Troubleshooting

In This Chapter

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

- Status data values are transferred from the module to the processor.
- Data contained in the module can be viewed through the Configuration/Debug port attached to a terminal emulator.
- LED status indicators on the front of the module provide information on the module's status.

2.1 Basic Ethernet

The Ethernet Unit is provided with a variety of troubleshooting functions for prompt recovery in case of errors.

- Self-diagnostic function at startup
- PING command for checking other nodes
- Inter-nodal tests for checking other nodes
- Error log for recording error history data

2.2 LED Status Indicators

LED	Description
COM	Indicates Rx/Tx activity on the Ethernet interface.
LER/LE	Communication Error and FA Link present. This LED will be illuminated when any of the following conditions exist: Bad frame recognized on FA Link Error recognized on FA Link Own Status Errors: ▪ Watchdog timeout error ▪ Receive wait error Link Status Errors: ▪ Out-ringed ▪ Communication invalidity bit set
ERR/ER	This LED indicates several conditions. If the LED illuminates solid green, there are no error conditions recognized. If the LED illuminates solid red, there is a major problem with the module and it may need to be replaced. If the LED blinks red and green, there is a parameter error present. The conditions which cause a parameter error are as follows: Own Status Errors: ▪ Node duplication address detected ▪ Initialization error Link Status Errors: ▪ Address overlap error
BP ACT	This LED indicates backplane activity. The LED should flash very quickly when backplane activity is present.
BATT	This LED indicates if the battery on the module is low or failed.
LINK	This LED on the Ethernet card indicates that the module recognizes the connection to the hub or switch.

2.3 Ethernet LED Indicators

LED	State	Description
Data	Off	No activity on the port.
	Green Flash	The port is either actively transmitting or receiving data.
Link	Off	No connection to hub or network is detected.
	Green Solid	Connected to hub or network correctly. This is the normal operating state.

2.4 Troubleshooting

2.4.1 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 CompactLogix processor o the module. Refer to Upper Layer Status Read Definition (page 92) 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

3 Reference

In This Chapter

3.1 Product Specifications

The PC56-FLN FA Control Network communication module is a single slot solution that allows CompactLogix I/O 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 PC56-FLN module acts as a gateway between the FL-net network and the Allen-Bradley backplane. The data transfer from the CompactLogix 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.

3.1.1 General Specifications

- Single Slot - 1769 backplane compatible
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module
- Ladder Logic is used for data transfer between module and processor. Sample ladder file included.
- Configuration data obtained from configuration text file downloaded to module. Sample configuration file included.
- Supports all CompactLogix processors: L20/L23/L30/L31/L32/L35, L43 and L45 (L43 and L45 supported with RSLogix 5000 v16.03 or later)
- Also supports MicroLogix 1500 LRP

3.1.2 Hardware Specifications

Specification	Description
Dimensions	Standard 1769 Single-slot module
Current Load	800 mA max@ 5 VDC Power supply distance rating of 2 (L43 and L45 installations on first 2 slots of 1769 bus)
Operating Temp.	0 to 60°C (32 to 140°F)
Storage Temp.	-40 to 85°C (-40 to 185°F)
Relative Humidity	5 to 95% (non-condensing)
LED Indicators	Power and Module Status Application Status CFG Port Activity Ethernet Port Activity Error Status
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only No hardware handshaking
App Port (Ethernet modules)	10/100 Base-T Ethernet compatible interface Electrical Isolation 1500 V rms at 50 Hz to 60 Hz for 60 s, applied as specified in section 5.3.2 of IEC 60950: 1991 Ethernet Broadcast Storm Resiliency = less than or equal to 5000 [ARP] frames-per-second and less than or equal to 5 minutes duration
Shipped with Unit	RJ45 to DB-9M cables for each port 6-foot RS-232 configuration Cable

3.1.3 Functional Specifications

- Message transfer:

  Server Functionality

  - Log data read service
  - Log data clear service
  - Network Parameter Read
  - Return Message
  - Profile Read
- 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
- Status and Error information

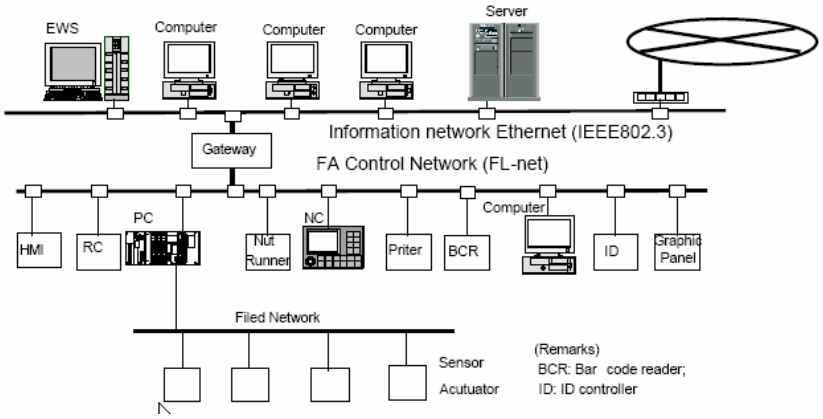
3.2 Functional Overview

3.2.1 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)

User-defined Specifications

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

2 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.

3 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.

4 Large-capacity Common Memory

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

5 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 a 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).

Data Communication Between Nodes

Types of Data Communication

The FL-net protocol supports 2 types of data communication.

1 Cyclic transmission for cyclic data transmission
2 Message transmission for non-cyclic data transmission

Cyclic transmission

The common memory size is 8k bits + 8k words = 8.5k words in a whole network.

Available amount of transmission data in one node is 8.5k words at maximum.

One word consists of 2 bytes.

Message transmission

Maximum data length of one message frame is 1024 bytes (excluding header).

Cyclic Transmission Function

Cyclic transmission means a function that supports cyclic data exchange between nodes.

Basic functions

1 The cyclic transmission implements common memory interface.
2 Each node sends its whole data while it holds the token.
3 Nodes having no cyclic data are acceptable.

Common memory

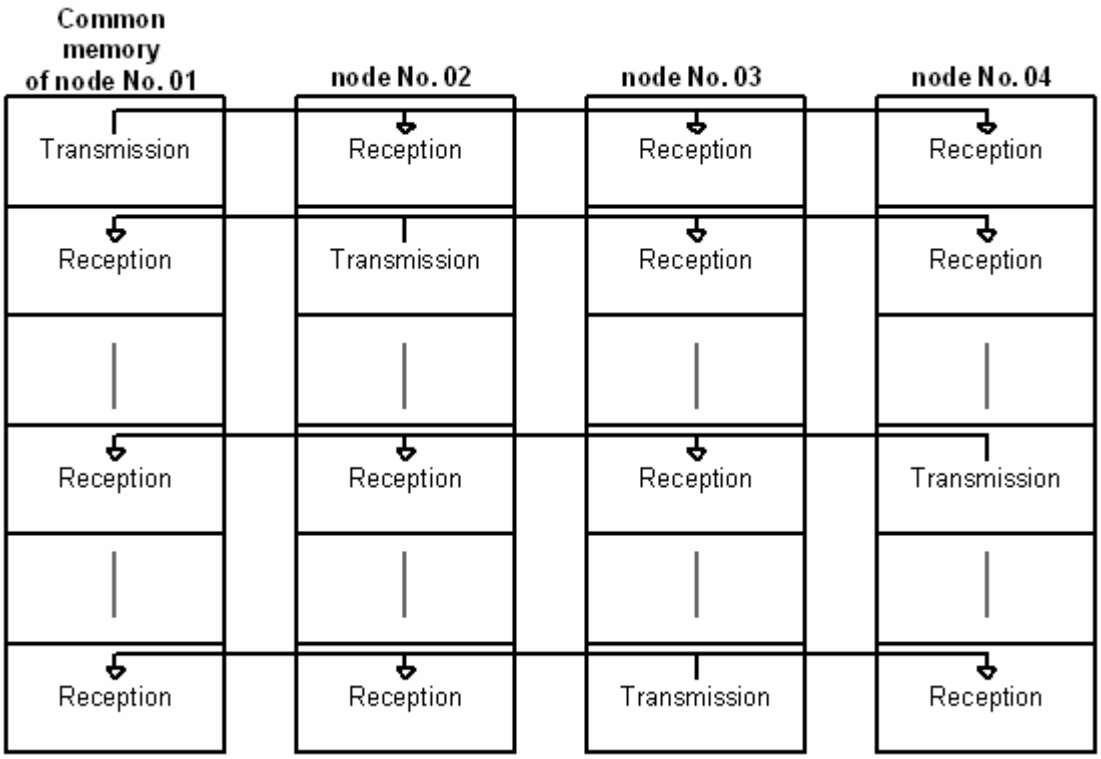
1 The common memory interface provides nodes with a service that can be regarded as a memory shared among them.
2 Two area types (Area 1 and Area 2) may be assigned for a node.
3 Multiple frames may be used if the transmitting area size of a node exceeds the transmission size of one frame, that is, 1024 bytes.
4 The common memory will not update itself with receiving data until all frames from a node are successfully received in case of the item (3).Thus time coherency of data from a node is guaranteed.
5 Communication unit of each node shall provide fixed area of 8k bits + 8k words = 8.5k words as the common memory.
6 Both Area 1 and Area 2 can be set at any size within the maximum.

Data Share Function

Each node on a FL-net has specific transmission area in the common memory that does not overlap with others. A transmission area assigned to one node must be receiving area for other nodes.

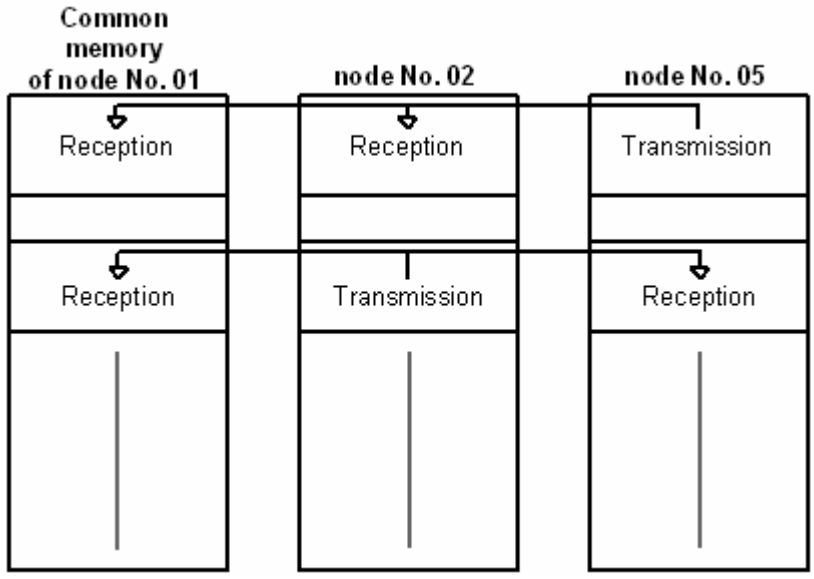
Each node broadcasts its data in a fixed cycle and all the nodes in a network share the same data on the common memory.

Common Memory Function



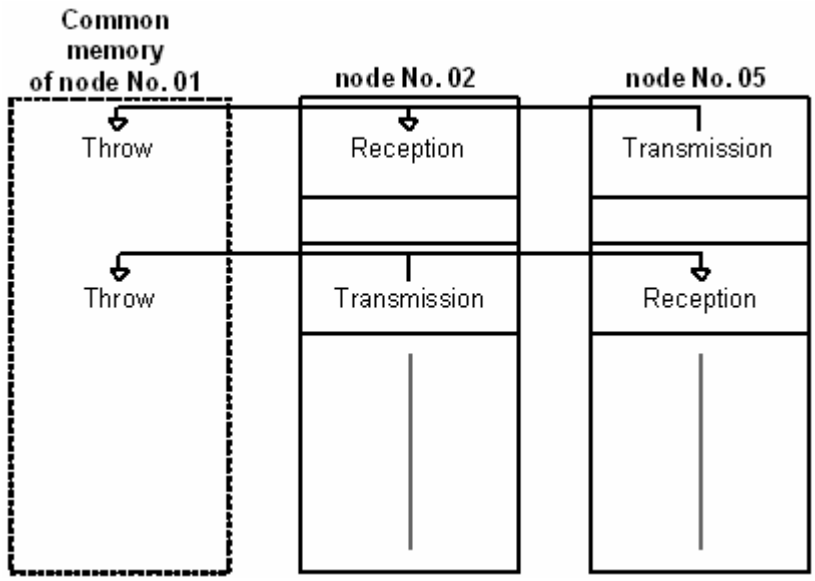
A node can use the whole common memory as receiving area.

Node for Reception Only



The FA link protocol allows the existence of nodes which do not have common memory because there is no transmission and reception data of cyclic but message transmission only.

Node Having No Common Memory



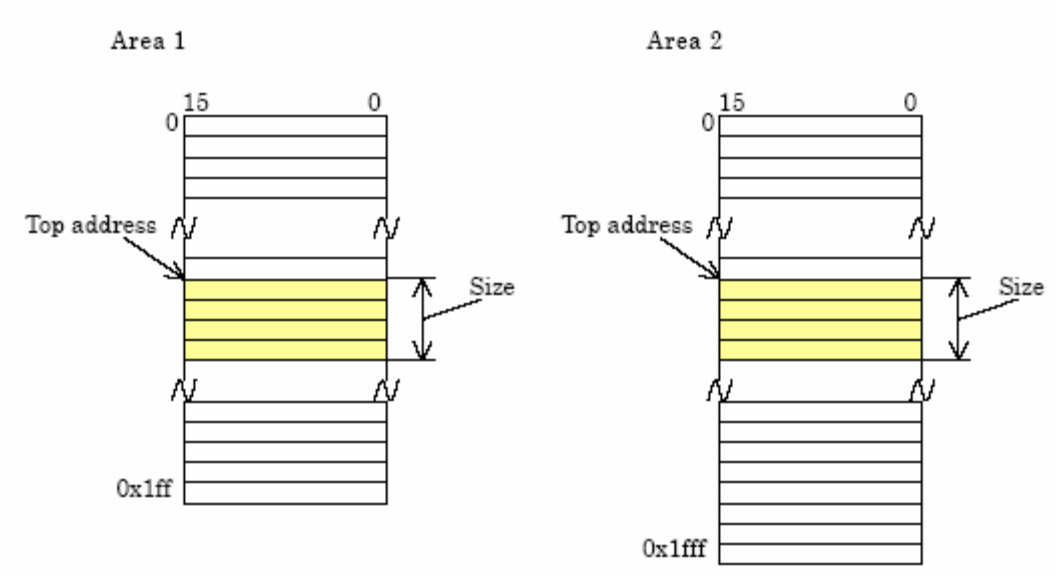
Area 1 and area 2

A node shall be assigned two data areas, area 1 and area 2, as the transmitting areas in its common memory.

A transmitting area is defined by the top address and size of the area.

Access to the area is made by word address. Area 1 consists of 0.5k word and area 2 consists of 8k words.

Assignment of Area 1 and Area 2



Common memory area size that one node should have

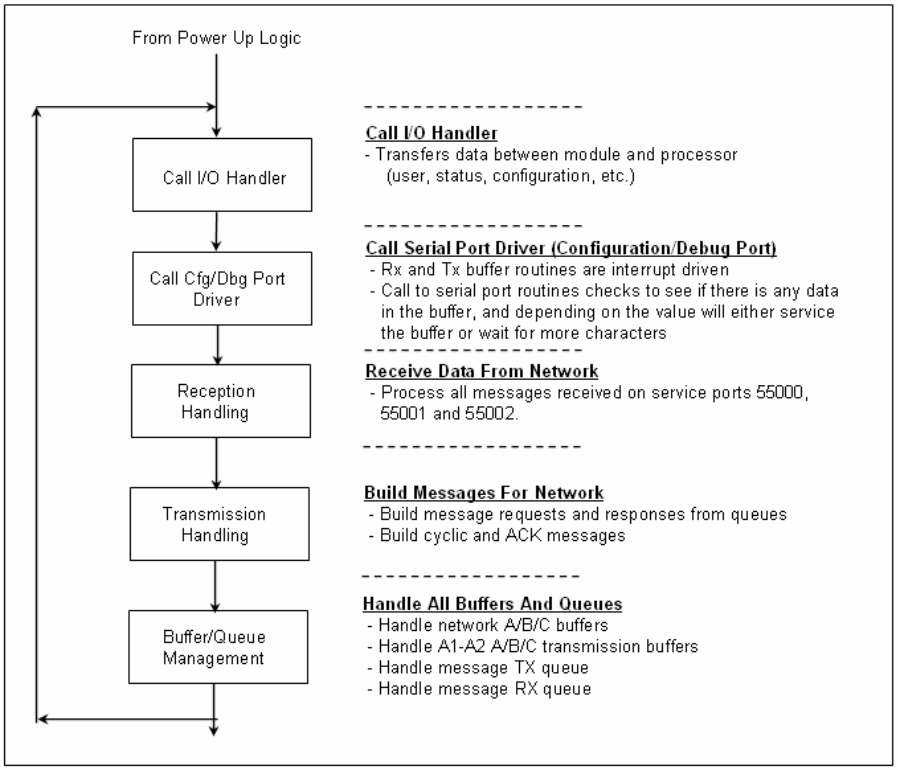
A node that is intended to perform cyclic transmission must have a common memory area size of 8.5k words.

A node that is not intended to perform cyclic transmission does not need to have any common memory area.

For more information about FL-net please refer the FL-net Protocol Specifications Version 1.0: MSTC / JOP-1012

3.2.2 Module Power Up

Main Logic Loop



3.2.3 Backplane Data Transfer

MVI69-FLN Block Assignments Summary

In order to exchange data with the processor, the MVI69-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
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
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	Read Block ID (1 to 3)	1
1	Write Block ID Requested	1
2 to 241	Area 1 data from field	240

Area 2 Input (Read) Data Block

Offset	Description	Length
0	Read Block ID (4 to 38)	1
1	Write Block ID Requested	1
2 to 241	Area 2 data from field	240

Write Block

Empty Output (Write) Data Block

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

Participation Table Response (Read Block) Input Data

Offset	Description	Length
0	2000	1
1	Write Block ID Requested	1
2	Number of nodes to reported (0 to 10)	1
3 to 22	Participation Data first node	20
23 to 42	Participation Data second node	20
43 to 62	Participation Data third node	20
63 to 82	Participation Data fourth node	20
83 to 102	Participation Data fifth node	20
103 to 122	Participation Data sixth node	20
123 to 142	Participation Data seventh node	20
143 to 162	Participation Data eighth node	20
162 to 182	Participation Data ninth node	20
183 to 202	Participation Data tenth node	20
203 to 241	Spare	39

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

Offset	Description	Words
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 243	Spare	243

Log Data Request (Write Block) Output Data

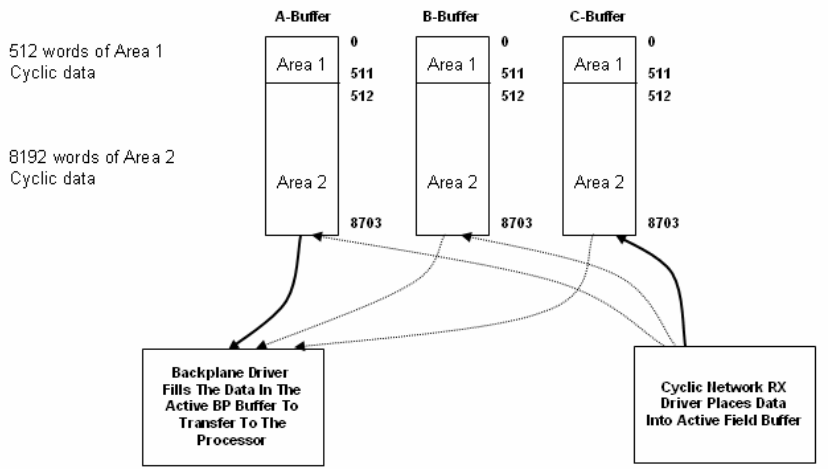
Offset	Description	Length
0	9250	1
1	Write Block ID Requested	1
2 to 3	Socket Tx count	2
4 to 5	Socket Tx error count	2
6 to 7	Socket Rx count	2
8 to 9	Socket Rx error count	2
10 to 11	Tokens Tx	2
12 to 13	Cyclic Tx	2
14 to 15	Peer-to-peer message Tx	2
16 to 17'	Broadcast message Tx	2
18 to 19	Tokens 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

Offset	Description	Length
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
80	Node holding token	1
81	Network allowable min 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 241	Spare	156

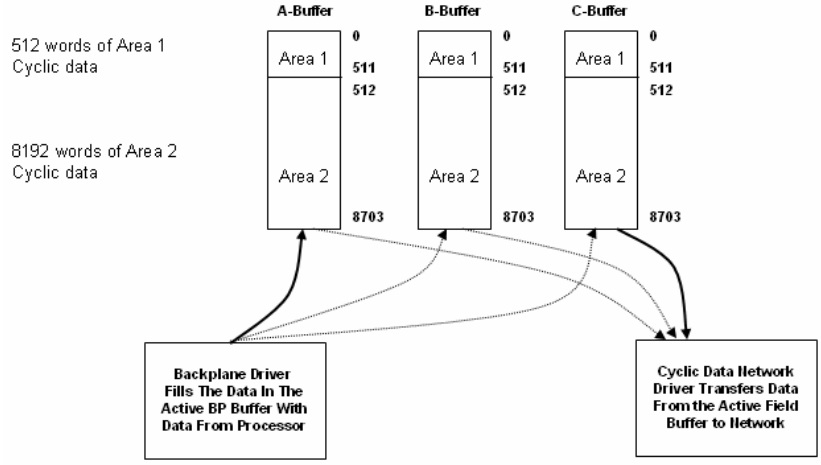
3.2.4 Data Flow between Module and Processor

The following discussion outlines the flow of data between the two pieces of hardware (CompactLogix processor and MVI69-FLN module) and other nodes on the TCP/IP network.

Module's Cyclic Input Data



Module's Cyclic Output Data



3.3 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.

3.3.1 Information Tables

Types of management table

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

1 The self-node management table manages the settings of the self-node.
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 MVI69-FLN module conforms to the mandatory items in the following tables. *For more information refer to Status Data.*

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)

Table name	Information	Conforming level
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 data on the settings of the self-node.

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.

Own node management table

Table name	Size	Description
(1) Node number	(1 byte)	1 to 254
(2) Area 1 data top address in common memory	(2 bytes)	Word address (0 to 0x1ff)
(3) Area 1 data size in common memory	(2 bytes)	Size (0 to 0x1ff)
(4) Area 2 data top address in common memory	(2 bytes)	Word address (0 to 0x1fff)
(5) Area 2 data size in common memory	(2 bytes)	Size (0 to 0x1fff)
(6) Upper layer status	(2 bytes)	RUN / STOP / ALARM / WARNING / NORMAL See status block for additional information
(7) Token watchdog time	(1 byte)	1 to 255 (1 ms. Units)
(8) Allowable minimum frame interval	(1 byte)	10 to 50 (in units of 100ms.)
(9) Vender code	(10 byte)	Vender code

Table name	Size	Description
(10) Manufacture Model name	(10 bytes)	Manufacture Model name , device name
(11) Node name (equipment name)	(10 bytes)	Node name set by user
(12) Protocol version	(1 byte)	0x80 (fixed)
(13) FA link status	(1 byte)	in-ring / out-ring, etc.
(14) Self-node status	(1 byte)	Node number conflict detection, etc.

Participating Node Management Table

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
(1) Node number	(1 byte)	1 to 254
(2) Upper layer status	(2 bytes)	RUN / STOP / ALARM / WARNING / NORMAL See status block for additional information
(3) Area 1 data top address in common memory	(2 bytes)	Word address (0 to 0x1ff)
(4) Area 1 data size in common memory	(2 bytes)	Size (0 to 0x1ff)
(5) Area 2 data top address in common memory	(2 bytes)	Word address (0 to 0x1fff)
(6) Area 2 data size in common memory	(2 bytes)	Size (0 to 0x1fff)
(7) Allowable refresh cycle time	(2 bytes)	1 ms. (unit)
(8) Token watchdog time	(1 byte)	1 to 255 (1 ms. Units)
(9) Allowable minimum frame interval	(1 byte)	1 to 50 (in units of 100ms.)
(10) Link status	(1 byte)	in-ring / out-ring information, etc.

Network management table

This table manages the parameters related to the network status.

Table name	Size	Description
(1) Token holding node number	(1 byte)	Node currently holding a token
(2) Allowable minimum frame interval	(1 byte)	1 to 50 (in units of 100ms.)
(3) Allowable refresh cycle time	(2 byte)	1 ms. (unit)

Table name	Size	Description
(4) Refresh cycle measurement time (present value)	(2 byte)	0 to 65535 (in 1 ms(unit)
(5) Refresh cycle measurement time (maximum value)	(2 byte)	1 ms. (unit)
(6) Refresh cycle measurement value (minimum value)	(2 byte)	1 ms. (unit)

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 he CompactLogix 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:

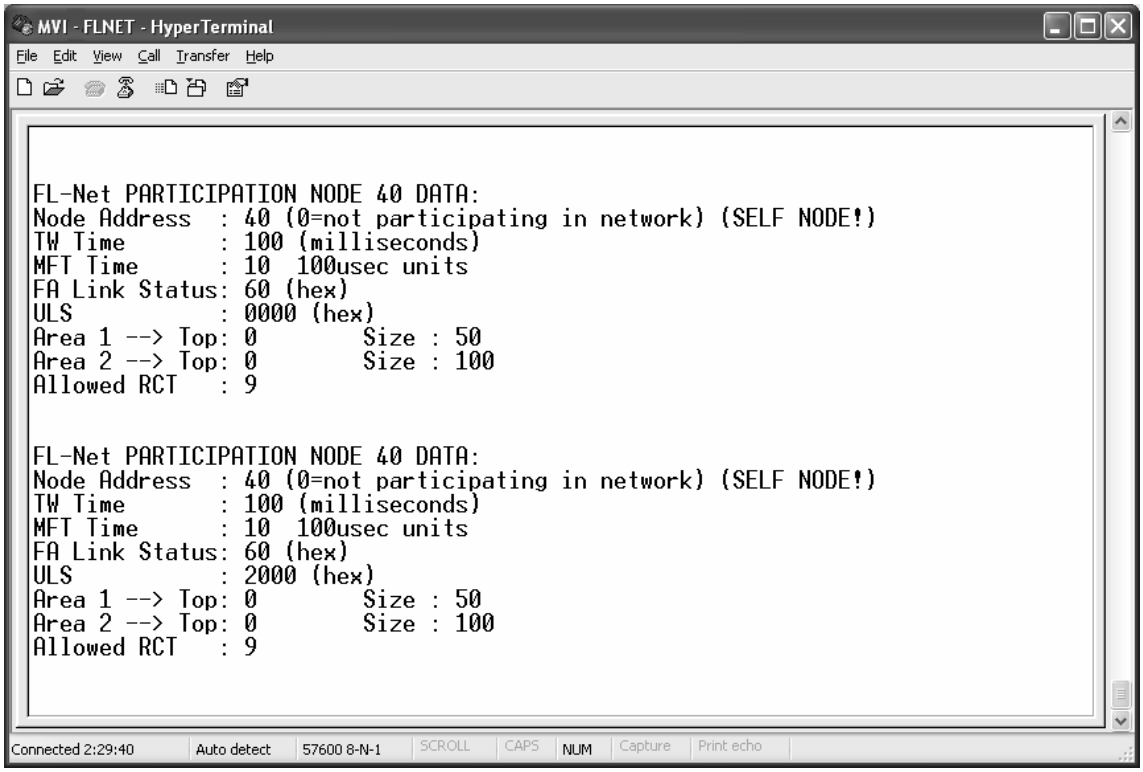
Upper Layer Status Word

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 CompactLogix to the MVI69-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 the Display Own Node Status command in the Configuration/Debug 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 MVI69-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 CompactLogix to the MVI69-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:

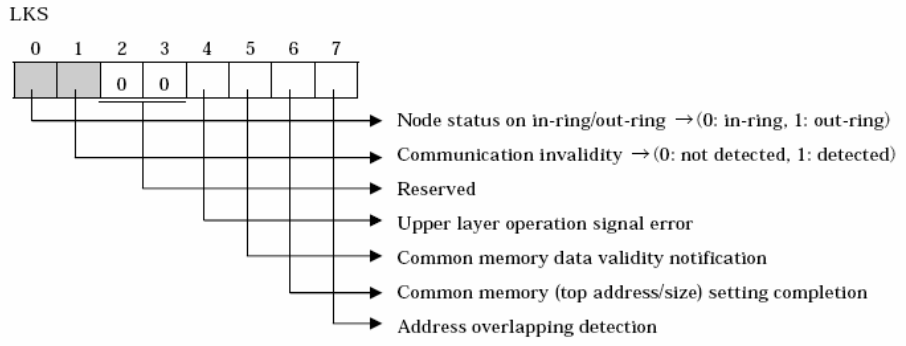


Figure 4 LKS Data

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 (MVI69-FLN is in-ring)

Setting a value of 1 to *FLNETMODULE.CONTROL.In_Out_RingCommand* controller tag will set the MVI69-FLN module as out-ring:

The out-ring state can be checked by the FA Link status which now indicates that all bits are set to 0 (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 MVI69-FLN module again to in-ring:

The in-ring state can be checked by the FA Link status which now indicates that bit 0 is set to 1 (in-ring)

You can observe that the LED display will have an "I" and the word "OK".

Self-node status

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

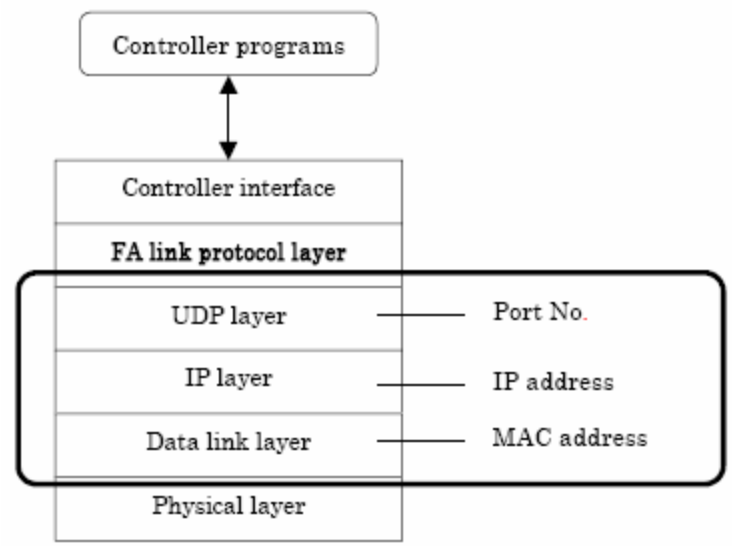
Message	Description
Self-node number conflict	Indicates the management information on node number conflicted to see whether any node having the same node number as the self-node setting exists on the network or not.
Token monitoring time error	Indicates the error notice information that transmit processing 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)

3.3.2 Lower Layer Protocol

Address Setting



IP address

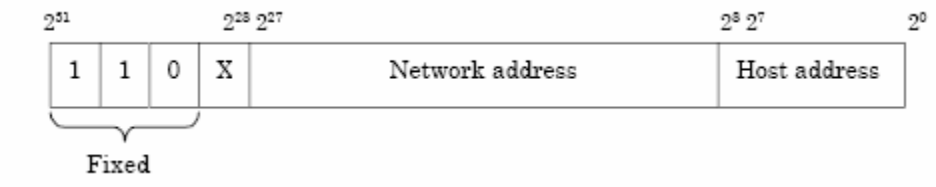
The IP address is set from the upper layer of the FA link protocol.

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)

3.4 FL-net Node Configuration Parameters

3.4.1 Node Number

Node number is set by software configuration file (FLNET.CFG) using HyperTerminal. As the initial value, a node number is set from the FA link protocol upper layer. Without a node number, the node is inoperable. When a node number conflict is detected before joining the network, it does not transmit any frame. The range of the node address is 1 to 254.

3.4.2 Top address and data size of common memory transmitting area

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 this 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.

The range of top address and size of areas 1 and 2 of common memory are as follows:

1 Top address of common memory area 1: (0…16#1FF)
2 Data size of common memory area 1: (0…16#200)
3 Top address of common memory area 2: (0…16#1FFF)
4 Data size of common memory area 2: (0…16#2000)

3.4.3 Node name (equipment name)

This 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. The node name is set in ASCII character set up to 10 characters.

3.4.4 Token monitoring time

This time value is peculiar to each node. This time value 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 monitoring 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 token holding node releasing the token.

The watchdog time is set as 1 to 255 in the unit of 1 millisecond.

3.4.5 Allowable minimum frame interval

This interval value is a peculiar to each node. This value 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 is set to 0 to 50 (in units of 100 milliseconds).

The allowable minimum frame interval means the following 2 contents:

- Time from receiving a token directed to the node until transmitting any frame from the node.
- Time of transmitting frame interval. (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, this parameter 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.

3.4.6 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.

3.4.7 Memory Resources

The module provides 8700 words for shared Area1 and Area2 common memory.

3.5 FL-net Protocol and network

3.5.1 Understanding the Basics of FL-net

The MVI69-FLN module is equipped to use 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.

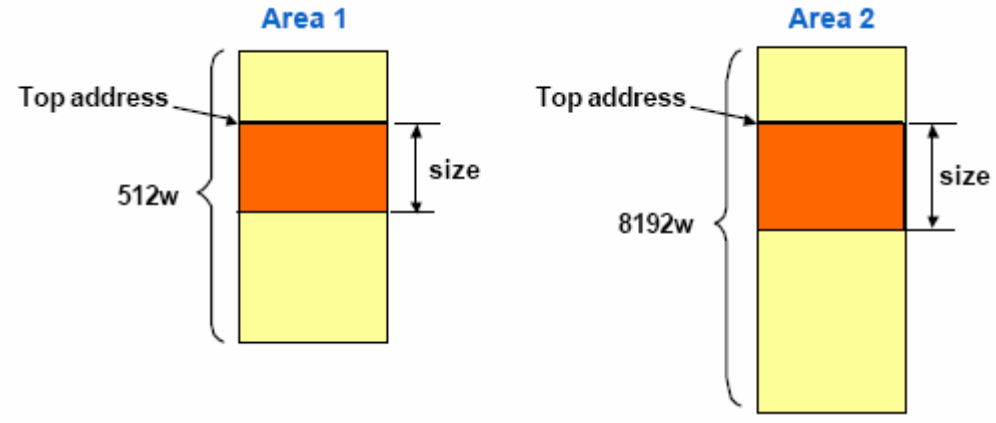
Number of Connectable Nodes and Node Numbers

Up to 254 nodes can be connected to an FL-net network. Each node is assigned a node number from 1 to 254.

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.

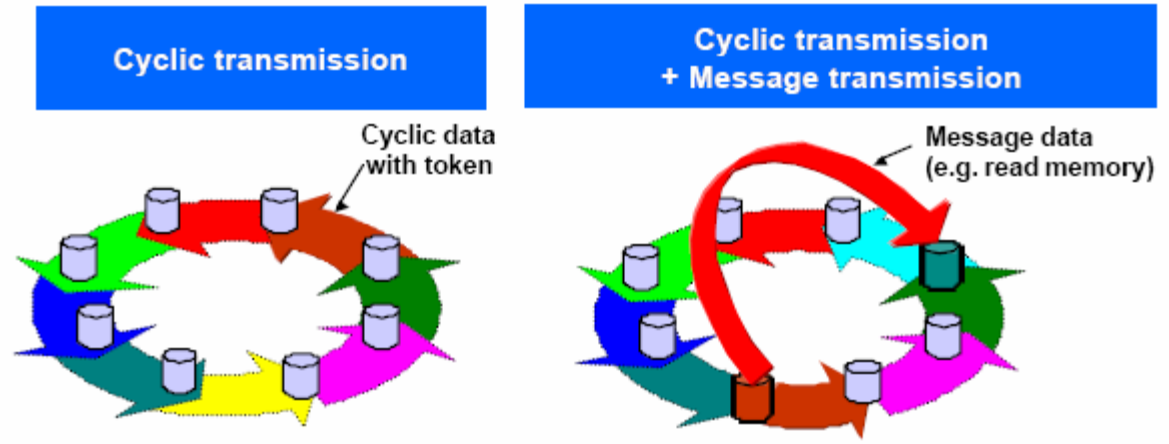
Assignment of common memory

- Two data areas "area1 and area2" can be assigned for a node.
- Area 1 has 512w and area 2 has 8192w. (1w=16bits)
- Both areas can be assigned at any word-size within the maximum.
- Both areas are defined by the top address and size of the area.



Data Communications

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)

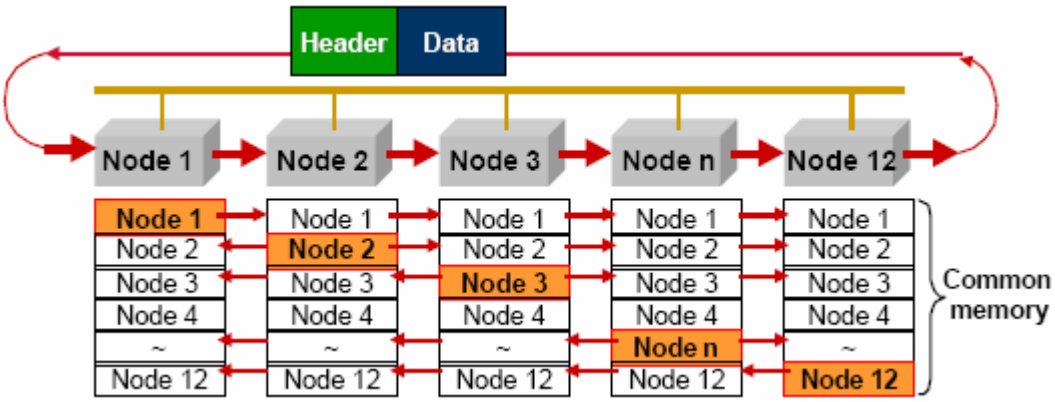
Transmission Cycle

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.

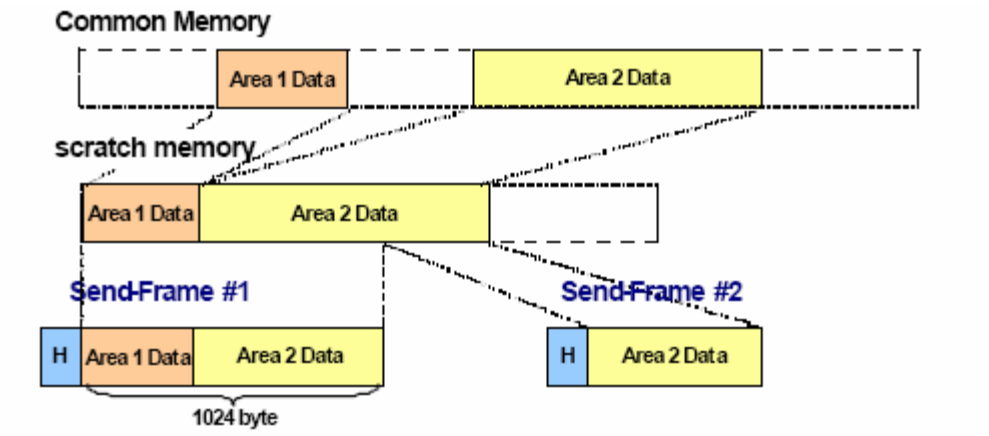
Common memory is divided by each node not to be overlapped.

- Share the same data in a system by each node's data broadcasting.
- Data on the common memory is refreshed cyclically.
- User can use the common memory as global area in the node.



Multiple frames of cyclic data

- Multiple frames may be used if the transmitting area size exceeds the frame data size that is 1024 byte.
- A node receiving multiple frames, the node shall update the area after receiving all frames from sending node.



3.5.2 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.

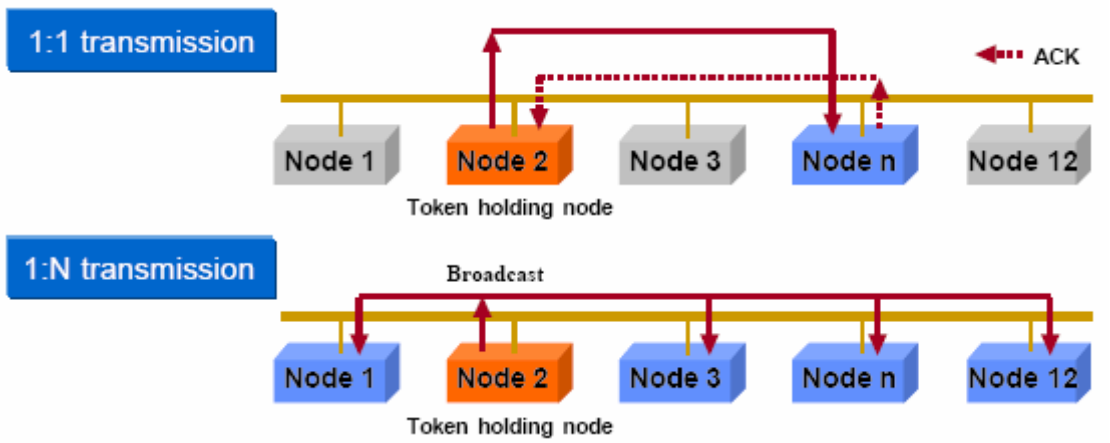
Data Frame ID: Transaction Code

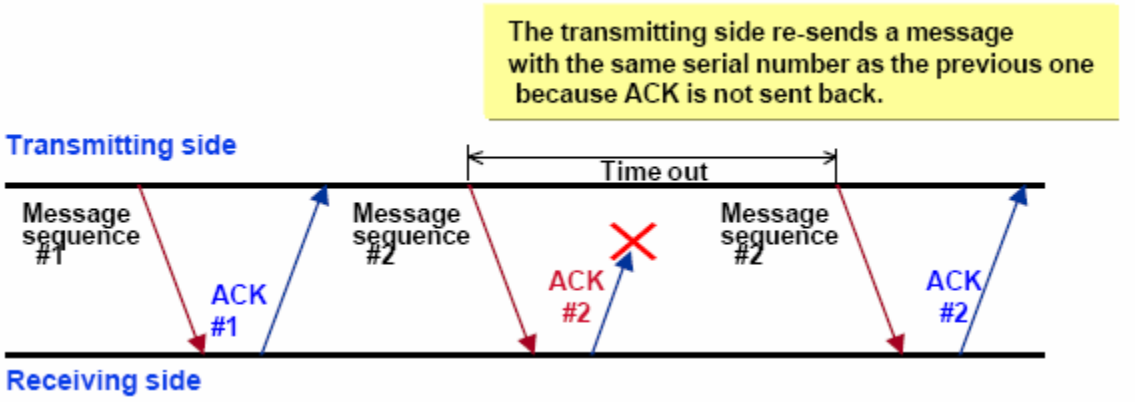
Transaction Code	Application
0 to 59999	Transparent mode message frame
60000 to 64999	Reserved
65000	Cyclic frame (with token)
65001	Cyclic frame (without token)
65002	Participation request frame
65003	Byte block read frame (request)
65004	Byte block write frame (request)
65005	Word block read frame (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)

Transaction Code	Application
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

3.5.3 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

3.5.4 Message Transmission Function

Message transmission is a function that supports non-cyclic data exchange between nodes. *The* MVI69-FLN *module does not support the optional messaging functions except in response to Log Data request messages as follow:*

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
	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

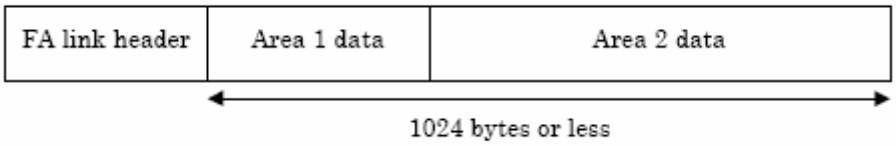
Major items	Minor items	Implemented (Y) or not(N)
	Number of tokens discarded *	Y
	Number of tokens re-issued *	Y
	Number of token holding timeouts	Y
	Number of token monitoring timeouts	Y
Total service time	Number of frame waiting states *	Y
	Number of participations *	Y
	Number of self-exits *	Y
	Number 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 min 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

3.5.5 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.

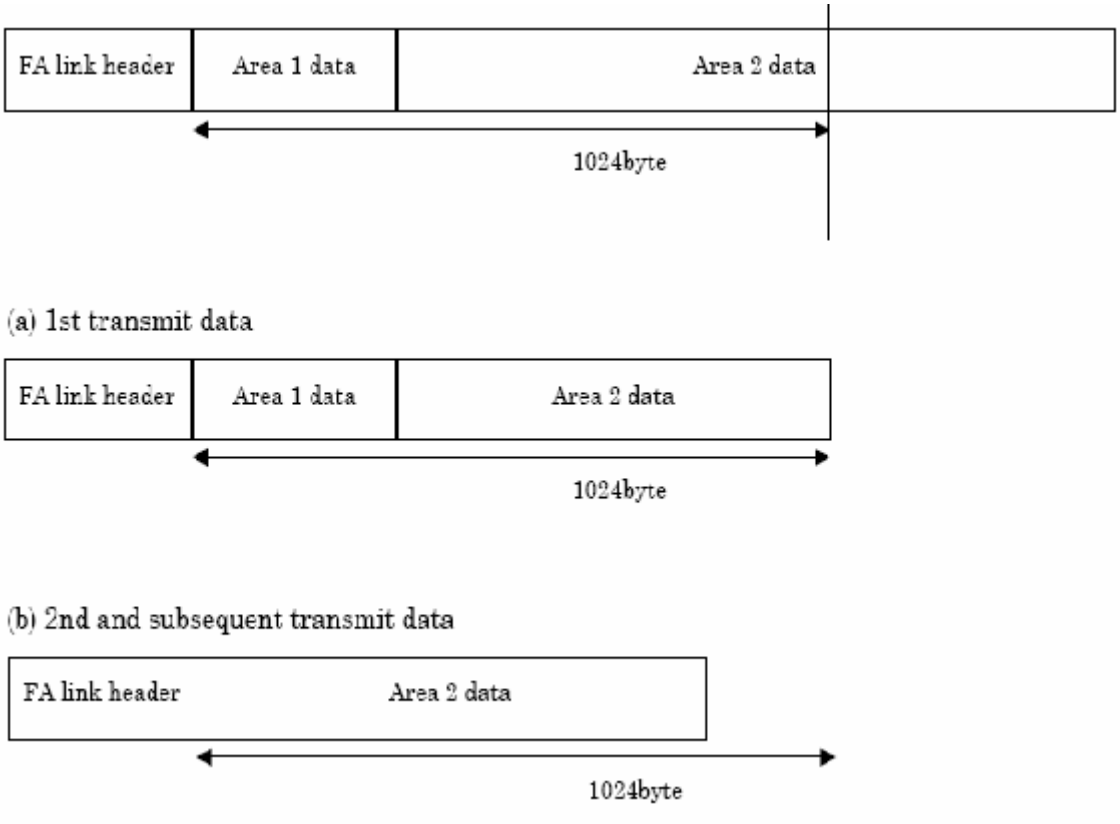


Figure when the transmit data volume exceeds 1024 bytes

Two or more divided frames are continuously sent in the token held state.

3.5.6 Network Management

- Node addition can be done while FL-net system is running.
- System is running even if any node will be failure.
- Every node knows state all other nodes.

  Every node manages In-ring and Out-ring of nodes
- One token is circulated among all nodes in the FL-net and

  Token is monitored by the time of each node.
  If a node does not send the token, next node will reissue it in a fixed time.
- 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.

3.5.7 Masterless Transmission Management

Token

Basically, while a node holds a token, the node can transmit data.

In the following two cases, however, transmission is enabled without a token. That is, one is reissue of token due to a token monitoring time is up and the other is a transmission of participation request frame when the node has not joined in the network.

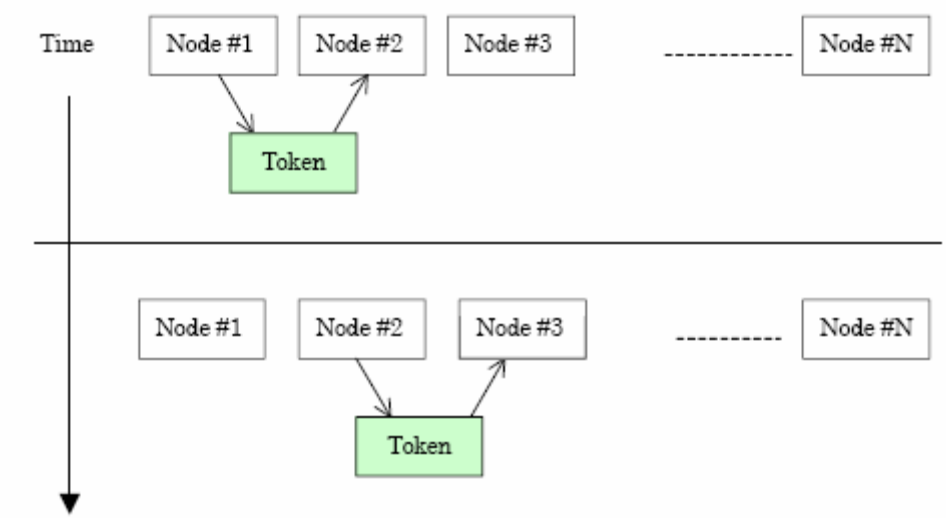
1 In the FL-net, a single token is circulated among nodes. A node receiving a token, this node will hold the transmission right until it releases the token to the next node.
2 The token is circulated among all the nodes joining in the FL-net.
3 The token can be transmitted together with cyclic data.
4 The token can also be circulated without any data.
5 The token is monitored by the timer of each node. If the token is not sent in the network for a fixed time, another token will be reissued automatically.
6 If there are two tokens in the network, they are unified into one.

Token flow

Only one token exists in the network.

A frame including a token (token frame) is provided with a node number of destination 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.

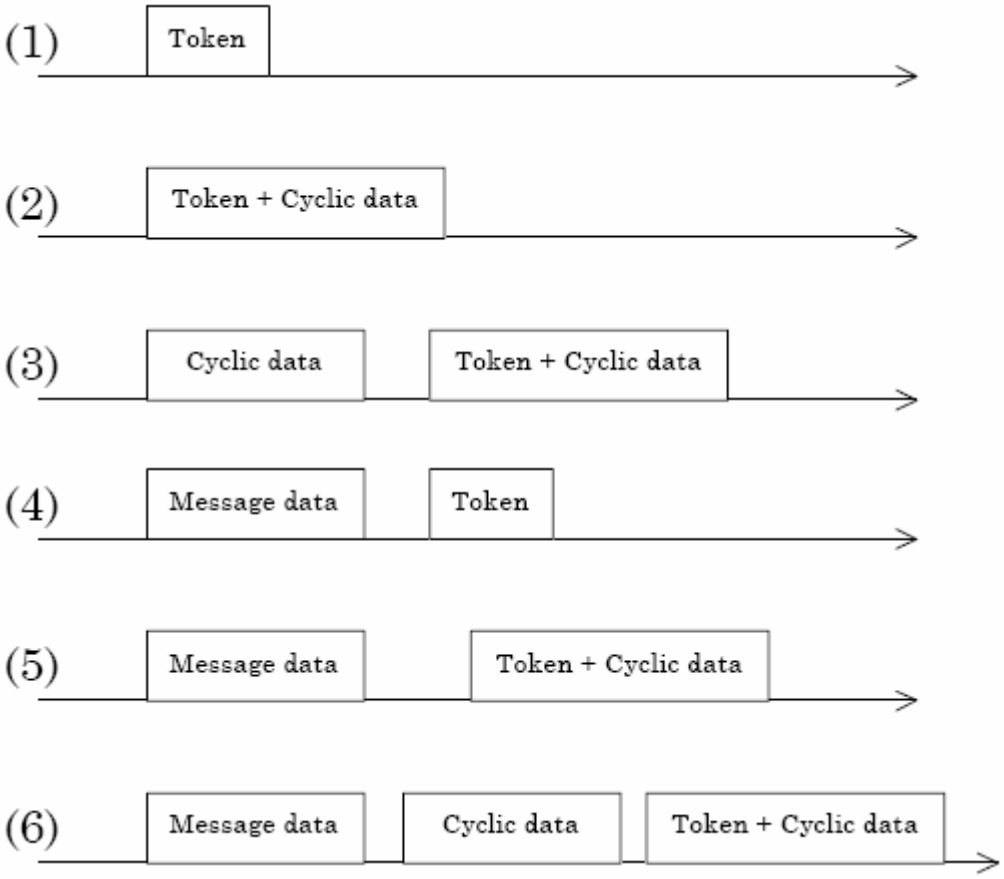
The token rotation order is determined in the ascending order of node number. The node with the largest node number releases a token to the node with the smallest node number.



Token and frames

As patterns of the frames to be sent with a token, the following 6 types are available.

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 frame.
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 and then a token is transmitted.
5 When there are cyclic data and message data: The message frame is transmitted and then the cyclic frame is transmitted together with a token.
6 When there are 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.



3.5.8 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.

3.6 Error and Status Data

3.6.1 Status Data

Own Status Byte

Bit	Description	Value
0	Node address duplicate (1=Error)	0x0001
1	TW Error (1=Error)	0x0002
2	Rx Wait Error (1=Error)	0x0004
3	Initialization Error (1=Error)	0x0008
4		0x0010
5		0x0020
6		0x0040
7		0x0080

Link Status Byte

Bit	Description	Value
0	*Node Status (1=Out-ring, 0=In-ring)	0x0001
1	*Communication Invalid (1=Yes, 0=No)	0x0002
2	Always 0	0x0004

Bit	Description	Value
3	Always 0	0x0008
4	Upper Layer Error Signal (1=Error)	0x0010
5	Common Memory Valid (1=Valid)	0x0020
6	Common Memory Set (1=Complete)	0x0040
7	Address Overlap (1=Error,0=No Error)	0x0080
	*Only reported to the processor and not network where these bits are always clear.	

Upper Layer Status Word

Bit	Description	Value
0-11	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

3.7 FL-net Device Profile for MVI69-FLN Module

3.7.1 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, "MVI69-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	"MVI69-FLN"	
	}		
}			

MVI69-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	"MVI69-FLN"

MVI69-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"	"6"	"9"	"-"
80	"F"	"L"	"N"													

3.8 Communications Management Tables

Node status is managed using three types of management tables: Own node management tables, participating node management tables, and network management

3.8.1 Own Node Management Table

The own node management table manages the local node settings.

Item	Bytes	Contents (data range)
Node number	1 byte	1 to 249
Common Memory Area 1 first word	2 bytes	Word address (0 to 0xff)
Common Memory Area 1 data size	2 bytes	Size (0 to 0x200)
Common Memory Area 2 first word	2 bytes	Word address (0 to 0x2000)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x200)
Upper layer status	2 bytes	RUN / STOP / ALARM / WARNING / NORMAL
Token monitoring time	1 byte	Unit: 1 ms
Minimum allowable frame interval	1 byte	Unit: 100 _s
Vendor code	10 bytes	Vendor code
Manufacturer model	10 bytes	Manufacturer model, device name
Node name (equipment name)	10 bytes	User-defined node name
Protocol version	1 byte	0x80 (fixed)
FA link status	1 byte	Participating, not participating, etc.
Local node status	1 byte	Duplicate node number detection, etc.

3.8.2 Participating Node Management Table

The participating node management table manages information on the nodes in the network.

Item	Bytes	Contents (data range)
Node number	1 byte	1 to 254 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
Common Memory Area 1 data first word	2 bytes	Word address (0 to 0x1ff)
Common Memory Area 1 data size	2 bytes	Size (0 to 0x200)
Common Memory Area 2 data first word	2 bytes	Word address (0 to 0x1fff)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x2000)
Minimum allowable refresh cycle time	2 bytes	Unit: 1 ms
Token monitoring time	1 byte	Unit: 1 ms
Minimum allowable frame interval	1 byte	Unit: 100 ms
Link status	1 byte	Participating, not participating, etc.

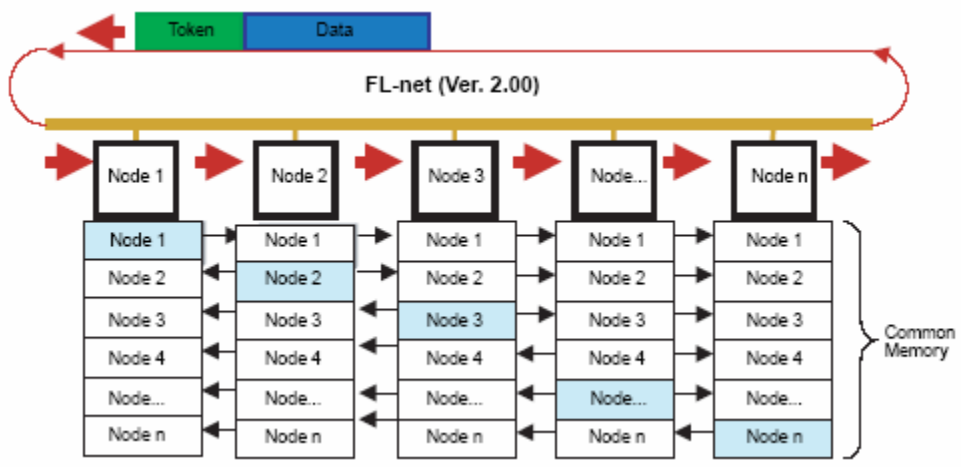
3.8.3 Network Management Table

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

Item	Bytes	Contents (data range)
Token holding node number	1 byte	Node currently holding the token
Minimum allowable frame interval	1 byte	Unit: 100 _s
Allowable refresh cycle time	2 bytes	Unit: 1 ms
Refresh cycle measurement value (current)	2 bytes	Unit: 1 ms
Refresh cycle measurement value (maximum)	2 bytes	Unit: 1 ms
Refresh cycle measurement value (minimum)	2 bytes	Unit: 1 ms

3.8.4 Cyclic Transmission

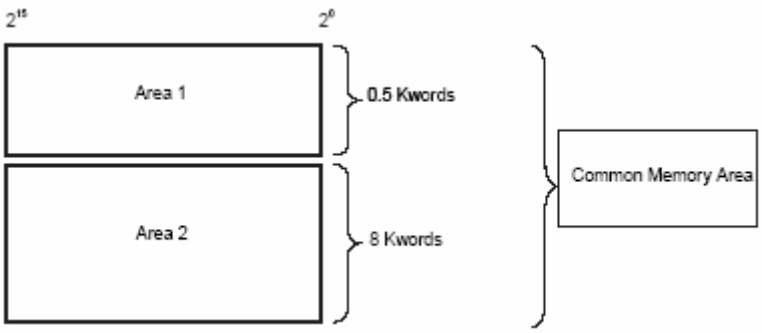
Cyclic transmission is used to transmit cyclic data. The data is shared by each node through the Common Memory (shared memory) function.



3.8.5 Volume of Transmission Data

An area of 0.5Kwords + 8Kwords = 8.5Kwords is provided for the whole network.

The maximum quantity of data that can be transmitted by a single node is 8.5Kwords. One word is equal to two bytes.

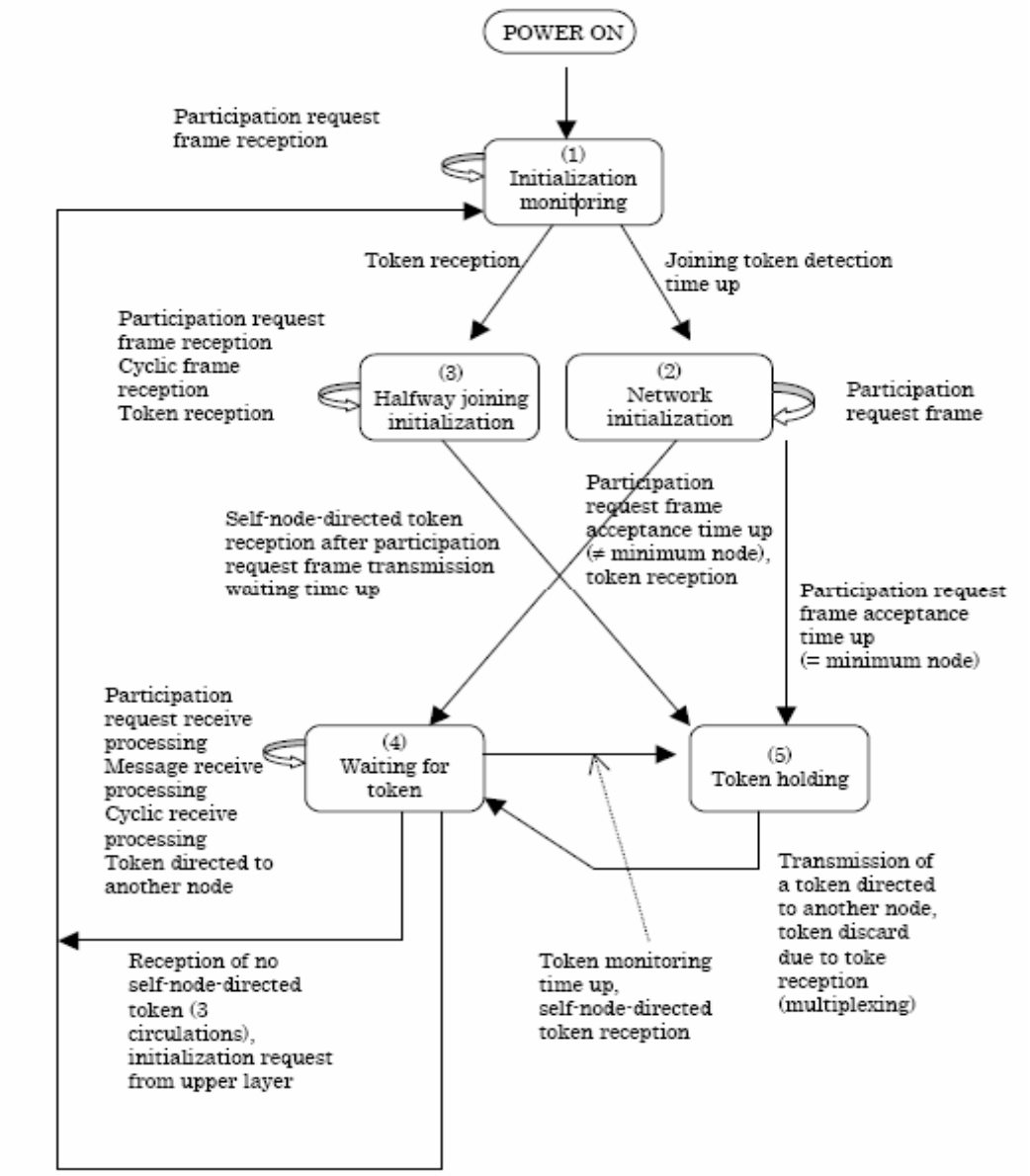


3.9 State Transition Diagram

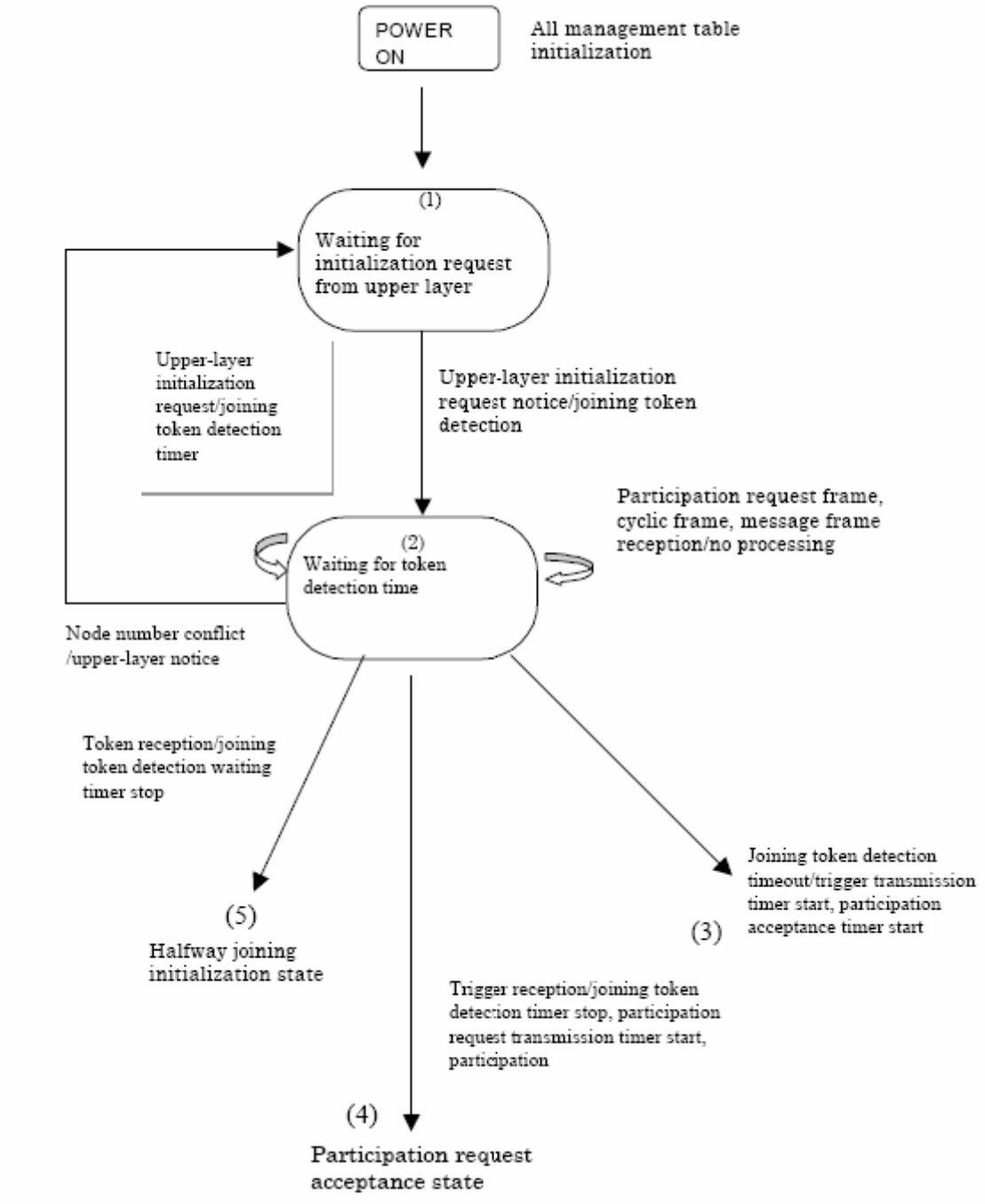
This chapter describes the state transition.

3.9.1 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.



3.9.2 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.

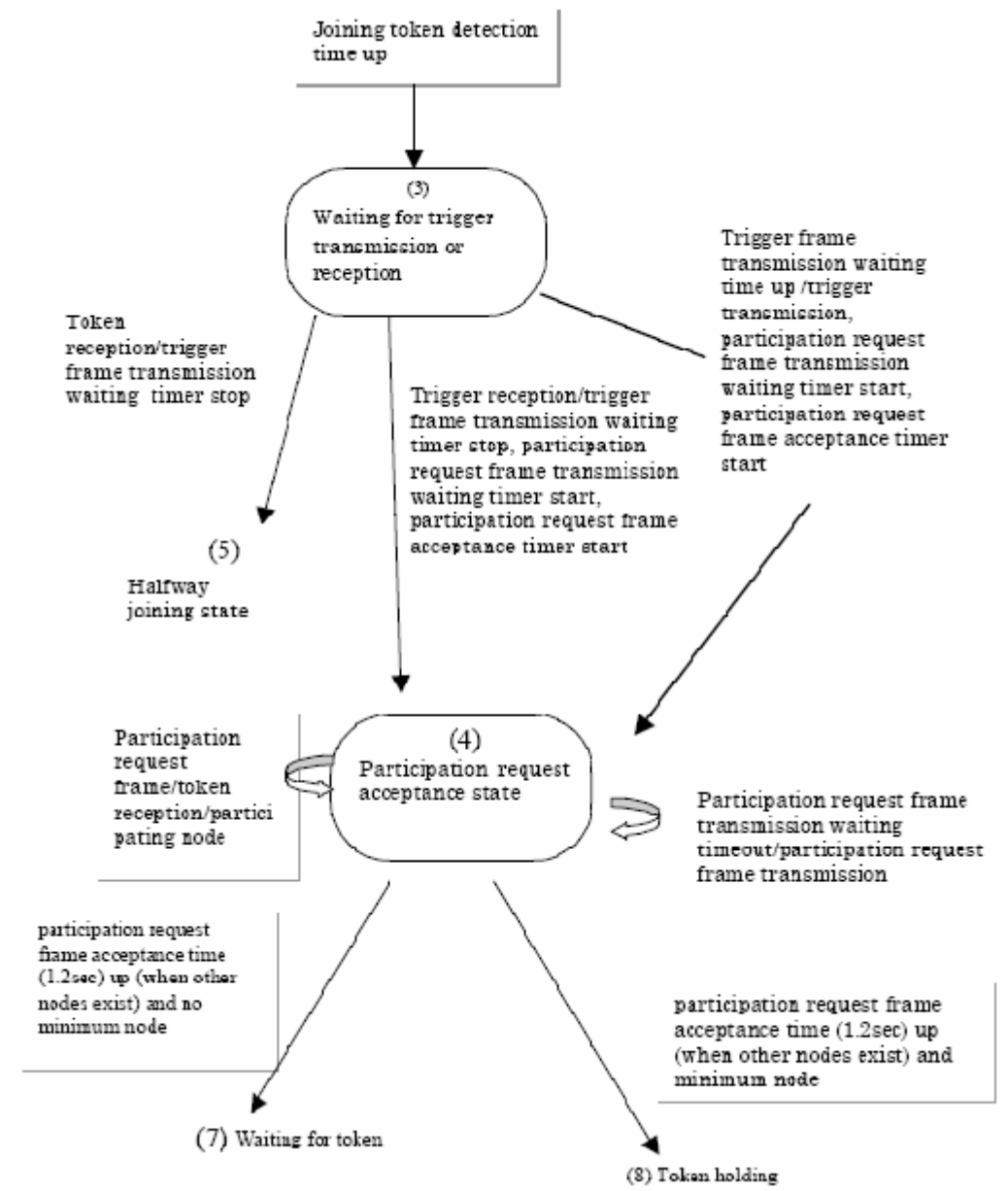
The node waits until the parameters that permit joining the network are set by the upper layer.

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.

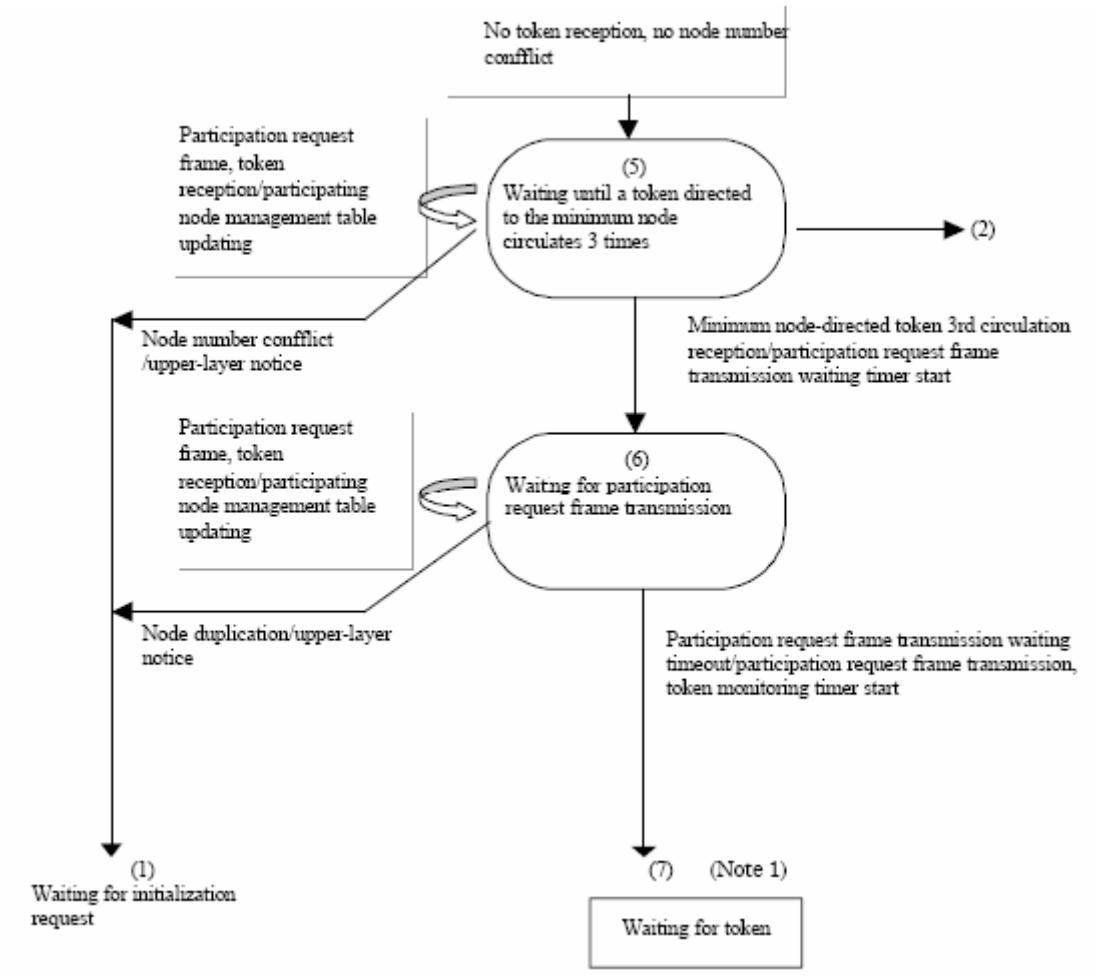
If even a token is received within this monitoring time, the network is judged as an operating status. When the network is in the operating status, the self-node in the network is put into the halfway joining initialization state.

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

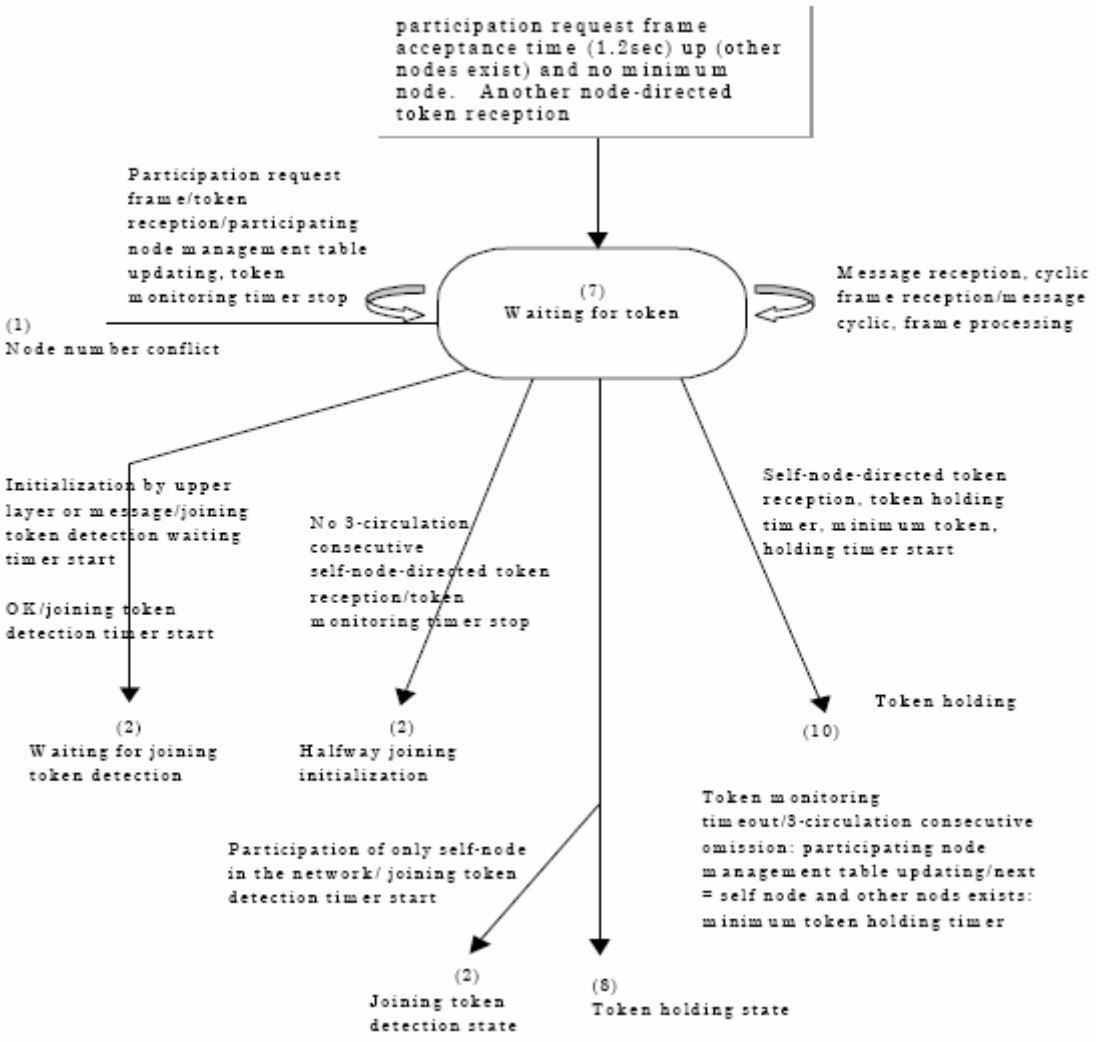
3.9.3 C. Network initialization



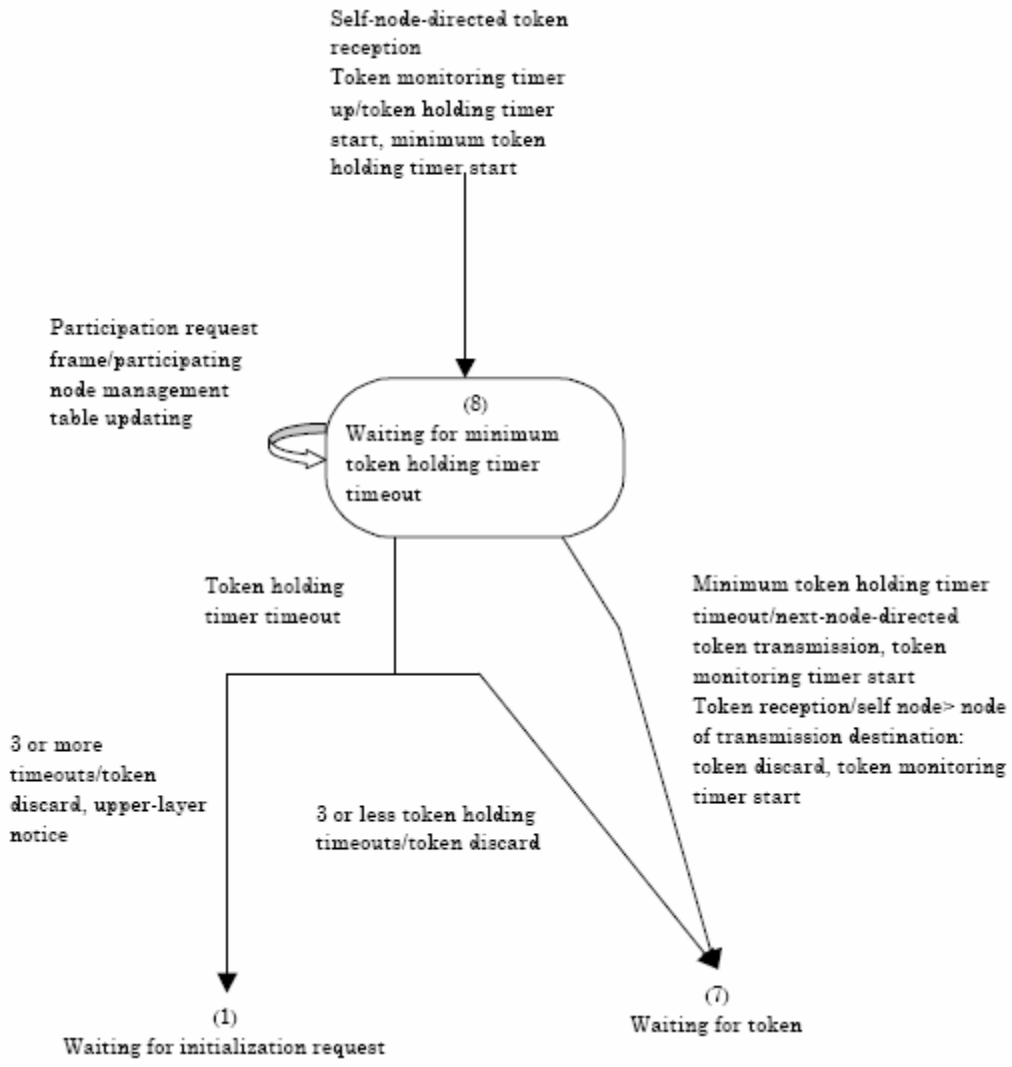
3.9.4 D. Halfway joining initialization



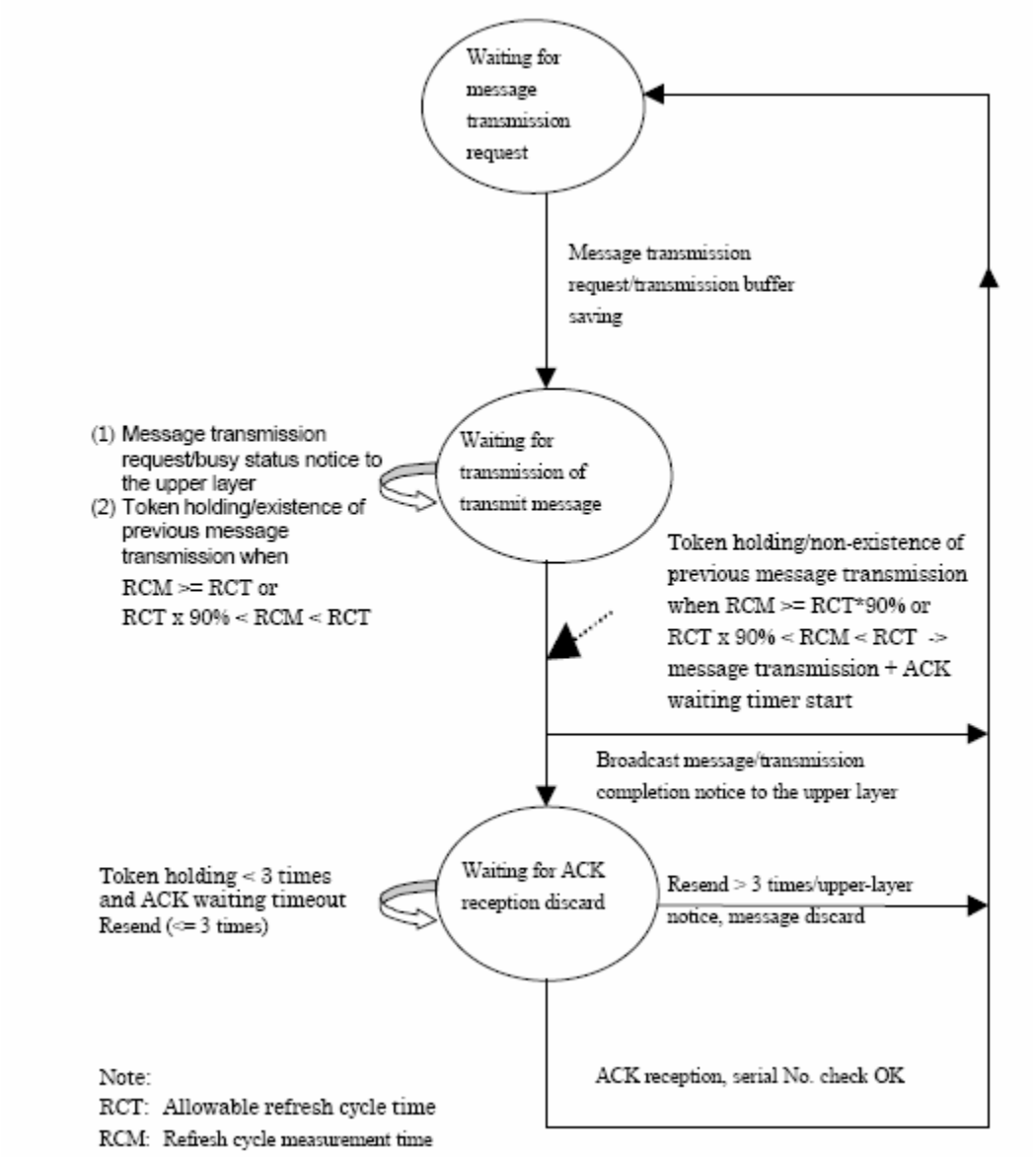
3.9.5 E. Waiting for token



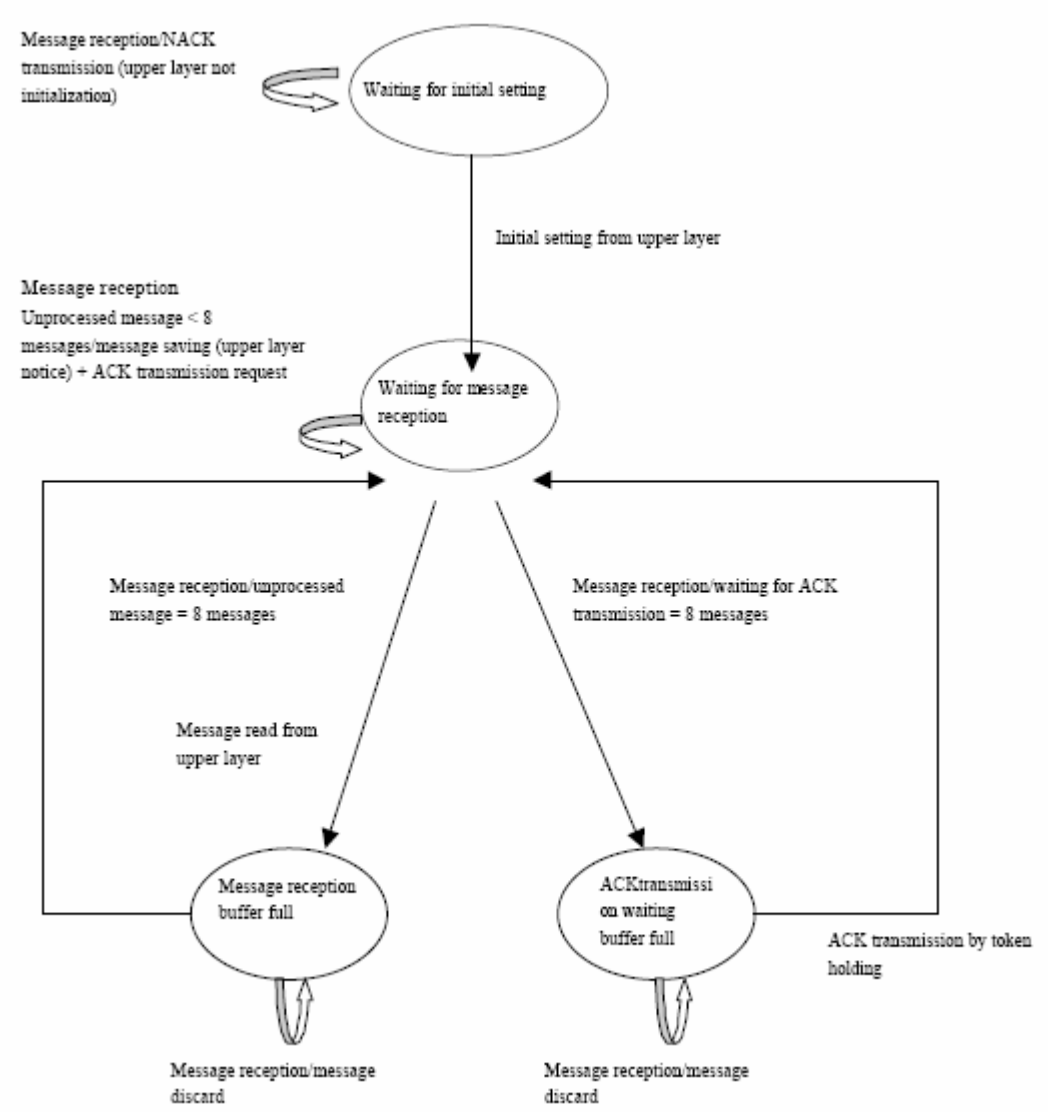
3.9.6 F. Token holding



3.9.7 G. Message transmission state transition



3.9.8 H. Message reception state transition



3.10 Glossary

Term	Definition
ACK	At communication by message transmission, the data receiving side notifies the transmitting side that the data has been received. This is used only for 1:1 message transmission.
Allowable minimum frame interval	This is the minimum value of frame interval that allows a node to receive a frame.
Allowable refresh cycle time	This time is used for a node to judge whether message transmission should be performed or not.
Bit area	This means a 1K-byte area in the common memory.
Common memory	A function that permits using a memory in common between nodes under cyclic transmission is provided.
Cyclic transmission	This function supports cyclic data exchange that occurs between nodes.
Ethernet	The physical layer and data link layer of the FA link protocol are specified.
FA network	This is an abbreviation of the FA control network.
Joining token detection time	This is the time to judge whether the network is in operation or not when joining the network. If a token is detected within this time, the network is regarded as being in operation.
Message transmission	This function supports non-cyclic data exchange that occurs between nodes.
Network management table	This table manages the common parameters on the network.
Participating node management table	This table manages the status of each node participating in the network.
Resend function	If ACK is not sent back from the receiving side at 1:1 message transmission, this function permits the transmitting side to resend a message.
Self-node management table	This table manages the information on the self-node.
Sequence number	This number is used to identify a message as a unique one at message transmission.
Version number	This number is used for message transmission. The version number is initialized by random number when a node is started.
Token monitoring time	This means the timeout period in which each node holds a token.
Word area	This means a 16K-byte area in the common memory.

4 Support, Service & Warranty

In This Chapter

ProSoft Technology, Inc. (ProSoft) 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 contents of file
   - Module Operation
   - Configuration/Debug status information
   - LED patterns
2. Information about the processor and user data files as viewed through and LED patterns on the processor.
3. Details about the serial devices interfaced, if any.

4.1 How to Contact Us: Technical Support

Internet	Web Site: http://www.prosoft-technology.com/support (http://www.prosoft-technology.com/support) E-mail address: support@prosoft-technology.com (mailto:support@prosoft-technology.com)

Asia Pacific

+603.7724.2080, support.asia@prosoft-technology.com (mailto:support.asia@prosoft-technology.com)

Languages spoken include: Chinese, English

Europe (location in Toulouse, France)

+33 (0) 5.34.36.87.20, support.EMEA@prosoft-technology.com (mailto:support.emea@prosoft-technology.com)

Languages spoken include: French, English

North America/Latin America (excluding Brasil) (location in California)

+1.661.716.5100, support@prosoft-technology.com (mailto:support@prosoft-technology.com)

Languages spoken include: English, Spanish

For technical support calls within the United States, an after-hours *answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer your questions.*

Brasil (location in Sao Paulo)

+55-11-5084-5178 , eduardo@prosoft-technology.com (mailto:eduardo@prosoft-technology.com)

Languages spoken include: Portuguese, English

4.2 Return Material Authorization (RMA) Policies and Conditions

The following RMA Policies and Conditions (collectively, "RMA Policies") apply to any returned Product. These RMA Policies are subject to change by ProSoft without notice. For warranty information, see "Limited Warranty". In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

4.2.1 All Product Returns:

a) In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.
b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 127). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft using a shipment method other than that specified by ProSoft or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
d) A 10% restocking fee applies to all warranty credit returns whereby a Customer has an application change, ordered too many, does not need, etc.

4.2.2 Procedures for Return of Units Under Warranty:

A Technical Support Engineer must approve the return of Product under ProSoft's Warranty:

a) A replacement module will be shipped and invoiced. A purchase order will be required.
b) Credit for a product under warranty will be issued upon receipt of authorized product by ProSoft at designated location referenced on the Return Material Authorization.

4.2.3 Procedures for Return of Units Out of Warranty:

a) Customer sends unit in for evaluation
b) If no defect is found, Customer will be charged the equivalent of $100 USD, plus freight charges, duties and taxes as applicable. A new purchase order will be required.
c) If unit is repaired, charge to Customer will be 30% of current list price (USD) plus freight charges, duties and taxes as applicable. A new purchase order will be required or authorization to use the purchase order submitted for evaluation fee.

The following is a list of non-repairable units:

- 3150 - All
- 3750
- 3600 - All
- 3700
- 3170 - All
- 3250
- 1560 - Can be repaired, only if defect is the power supply
- 1550 - Can be repaired, only if defect is the power supply
- 3350
- 3300
- 1500 - All

4.2.4 Purchasing Warranty Extension:

a) ProSoft's standard warranty period is three (3) years from the date of shipment as detailed in "Limited Warranty (page 130)". The Warranty Period may be extended at the time of equipment purchase for an additional charge, as follows:

- Additional 1 year = 10% of list price
- Additional 2 years = 20% of list price
- Additional 3 years = 30% of list price

4.3 LIMITED WARRANTY

This Limited Warranty ("Warranty") governs all sales of hardware, software and other products (collectively, "Product") manufactured and/or offered for sale by ProSoft, and all related services provided by ProSoft, including maintenance, repair, warranty exchange, and service programs (collectively, "Services"). By purchasing or using the Product or Services, the individual or entity purchasing or using the Product or Services ("Customer") agrees to all of the terms and provisions (collectively, the "Terms") of this Limited Warranty. All sales of software or other intellectual property are, in addition, subject to any license agreement accompanying such software or other intellectual property.

4.3.1 What Is Covered By This Warranty

a) *Warranty On New Products*: ProSoft warrants, to the original purchaser, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires three years from the date of shipment (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 39 months. Within a reasonable time after notification, ProSoft will correct any failure of the Product to conform to specifications or any defect in material or workmanship of the Product, with either new or used replacement parts. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft.
b) *Warranty On Services*: Materials and labor performed by ProSoft to repair a verified malfunction or defect are warranteed in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

4.3.2 What Is Not Covered By This Warranty

a) ProSoft makes no representation or warranty, expressed or implied, that the operation of software purchased from ProSoft will be uninterrupted or error free or that the functions contained in the software will meet or satisfy the purchaser's intended use or requirements; the Customer assumes complete responsibility for decisions made or actions taken based on information obtained using ProSoft software.

b) This Warranty does not cover the failure of the Product to perform specified functions, or any other non-conformance, defects, losses or damages caused by or attributable to any of the following: (i) shipping; (ii) improper installation or other failure of Customer to adhere to ProSoft's specifications or instructions; (iii) unauthorized repair or maintenance; (iv) attachments, equipment, options, parts, software, or user-created programming (including, but not limited to, programs developed with any IEC 61131-3, "C" or any variant of "C" programming languages) not furnished by ProSoft; (v) use of the Product for purposes other than those for which it was designed; (vi) any other abuse, misapplication, neglect or misuse by the Customer; (vii) accident, improper testing or causes external to the Product such as, but not limited to, exposure to extremes of temperature or humidity, power failure or power surges; or (viii) disasters such as fire, flood, earthquake, wind and lightning.
c) The information in this Agreement is subject to change without notice. ProSoft shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. The user guide included with your original product purchase from ProSoft contains information protected by copyright. No part of the guide may be duplicated or reproduced in any form without prior written consent from ProSoft.

4.3.3 Disclaimer Regarding High Risk Activities

Product manufactured or supplied by ProSoft is not fault tolerant and is not designed, manufactured or intended for use in hazardous environments requiring fail-safe performance including and without limitation: the operation of nuclear facilities, aircraft navigation of communication systems, air traffic control, direct life support machines or weapons systems in which the failure of the product could lead directly or indirectly to death, personal injury or severe physical or environmental damage (collectively, "high risk activities"). ProSoft specifically disclaims any express or implied warranty of fitness for high risk activities.

4.3.4 Intellectual Property Indemnity

Buyer shall indemnify and hold harmless ProSoft and its employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not ProSoft is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless ProSoft and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party. ProSoft makes no warranty that the product is or will be delivered free of any person's claiming of patent, trademark, or similar infringement. The Buyer assumes all risks (including the risk of suit) that the product or any use of the product will infringe existing or subsequently issued patents, trademarks, or copyrights.

a) Any documentation included with Product purchased from ProSoft is protected by copyright and may not be duplicated or reproduced in any form without prior written consent from ProSoft.
b) ProSoft's technical specifications and documentation that are included with the Product are subject to editing and modification without notice.
c) Transfer of title shall not operate to convey to Customer any right to make, or have made, any Product supplied by ProSoft.
d) Customer is granted no right or license to use any software or other intellectual property in any manner or for any purpose not expressly permitted by any license agreement accompanying such software or other intellectual property.
e) Customer agrees that it shall not, and shall not authorize others to, copy software provided by ProSoft (except as expressly permitted in any license agreement accompanying such software); transfer software to a third party separately from the Product; modify, alter, translate, decode, decompile, disassemble, reverse-engineer or otherwise attempt to derive the source code of the software or create derivative works based on the software; export the software or underlying technology in contravention of applicable US and international export laws and regulations; or use the software other than as authorized in connection with use of Product.
f) **Additional Restrictions Relating To Software And Other Intellectual Property**

   In addition to compliance with the Terms of this Warranty, Customers purchasing software or other intellectual property shall comply with any license agreement accompanying such software or other intellectual property. Failure to do so may void this Warranty with respect to such software and/or other intellectual property.

4.3.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 130) are in lieu of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

*4.3.6 Limitation of Remedies ***

In no event will ProSoft or its Dealer be liable for any special, incidental or consequential damages based on breach of warranty, breach of contract, negligence, strict tort or any other legal theory. Damages that ProSoft or its Dealer will not be responsible for included, but are not limited to: Loss of profits; loss of savings or revenue; loss of use of the product or any associated equipment; loss of data; cost of capital; cost of any substitute equipment, facilities, or services; downtime; the claims of third parties including, customers of the Purchaser; and, injury to property.

** Some areas do not allow time limitations on an implied warranty, or allow the exclusion or limitation of incidental or consequential damages. In such areas, the above limitations may not apply. This Warranty gives you specific legal rights, and you may also have other rights which vary from place to place.

4.3.7 Time Limit for Bringing Suit

Any action for breach of warranty must be commenced within 39 months following shipment of the Product.

4.3.8 No Other Warranties

Unless modified in writing and signed by both parties, this Warranty is understood to be the complete and exclusive agreement between the parties, suspending all oral or written prior agreements and all other communications between the parties relating to the subject matter of this Warranty, including statements made by salesperson. No employee of ProSoft or any other party is authorized to make any warranty in addition to those made in this Warranty. The Customer is warned, therefore, to check this Warranty carefully to see that it correctly reflects those terms that are important to the Customer.

4.3.9 Allocation of Risks

This Warranty allocates the risk of product failure between ProSoft and the Customer. This allocation is recognized by both parties and is reflected in the price of the goods. The Customer acknowledges that it has read this Warranty, understands it, and is bound by its Terms.

4.3.10 Controlling Law and Severability

This Warranty shall be governed by and construed in accordance with the laws of the United States and the domestic laws of the State of California, without reference to its conflicts of law provisions. If for any reason a court of competent jurisdiction finds any provisions of this Warranty, or a portion thereof, to be unenforceable, that provision shall be enforced to the maximum extent permissible and the remainder of this Warranty shall remain in full force and effect. Any cause of action with respect to the Product or Services must be instituted in a court of competent jurisdiction in the State of California.

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