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PLX51-DF1-MSG

DF1 Messenger

DF1 to EtherNet/IP™ Messenger

July 26, 2023

USER MANUAL

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PLX51-DF1-MSG User Manual
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July 26, 2023

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1 Preface

1.1 Introduction to the PLX51-DF1-MSG

This document describes the installation, operation, and diagnostics of the ProSoft Technology PLX51-DF1-MSG DF1 Messenger. The PLX51-DF1-MSG provides intelligent data routing between EtherNet/IP and DF1 which can help simplify the migration from PLC2, PLC3, PLC5, and SLC systems to ControlLogix or CompactLogix platforms, where a DF1 interface is required.

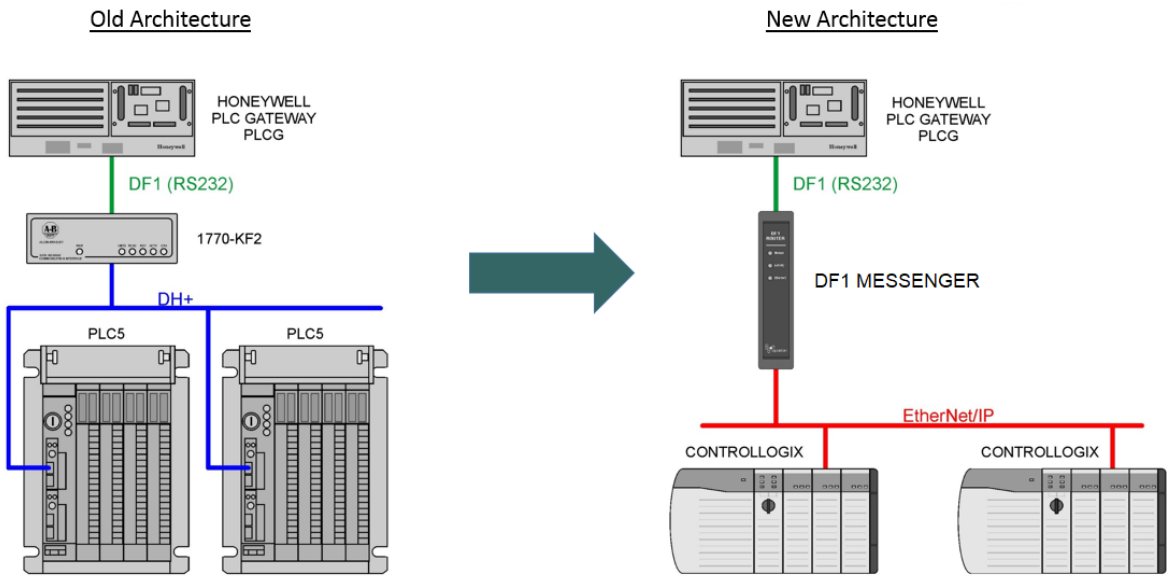


Figure 1.1 – Migration Path

1.2 Features

The PLX51-DF1-MSG can transfer data from a DF1 device to a maximum of eight Logix controllers. The module operates in one of three modes, simplifying the configuration for all applications.

Mode	Message Initiator	Description
DF1 Slave	Remote Device	The PLX51-DF1-MSG converts DF1 messages to Logix controller tag reads or tag writes. No Logix PLC Mapping configuration is required.
Scheduled Tag	PLX51-DF1-MSG	The PLX51-DF1-MSG transfers data between a DF1 device and Logix tags, using a preconfigured schedule. No Logix or remote device configuration is required.

Table 1.1 – Modes of Operation

The PLX51-DF1-MSG is configured using the ProSoft PLX50 Configuration Utility. This program can be downloaded from www.prosoft-technology.com free of charge. The PLX50 Configuration Utility offers various configuration methods, including a controller tag browser.

Hereafter the PLX51-DF1-MSG will be referred to as the **module**.

The module can operate in both a Logix "owned" and standalone mode. With a Logix connection, the input and output assemblies will provide additional diagnostics information which will be available in the Logix controller environment.

The module uses isolated RS232 for DF1 communication providing better noise immunity. The RS232 port also uses a terminal block for convenient installation. The module can also be used in systems with redundant DF1 pathways.

A built-in webserver provides detailed diagnostics of system configuration and operation, including the display of received DF1 communication packets, without the need for any additional software.

1.3 Architecture

The figure below provides an example of the typical network setup.

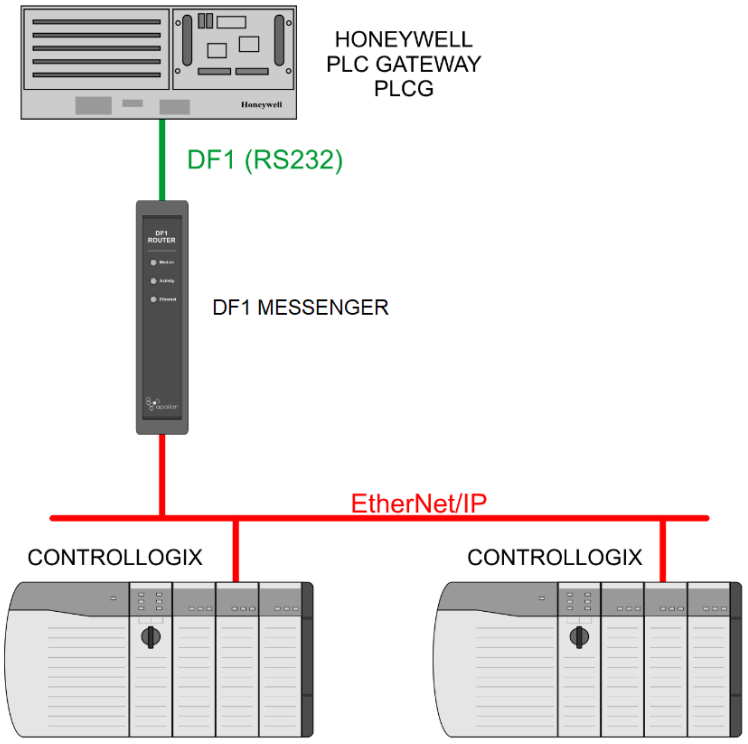


Figure 1.2 – Example of a typical network setup

By converting and redirecting serial DF1 messages from legacy devices to EtherNet/IP, the module provides an interface for data exchange to ControlLogix and CompactLogix platforms.

When connected to devices that provide more than one DF1 port, it is possible to implement DF1 communication redundancy with the use of two PLX51-DF1-MSG's. These can be configured in one of two modes; *Simultaneous* or *Active / Standby*.

In the *Simultaneous* mode, both modules route the same traffic to the same Logix controller. Effectively, the Logix controller will receive two of each message and process both of them.

Active / Standby mode requires both modes to be Logix "Owned". One of the modules has its routing capability disabled, achieved by setting the Inhibit Routing bit in the output assembly. Logic in the Logix controller can monitor the connection and performance of the Active module and, if necessary, inhibit the Active module and un-inhibit the Standby module.

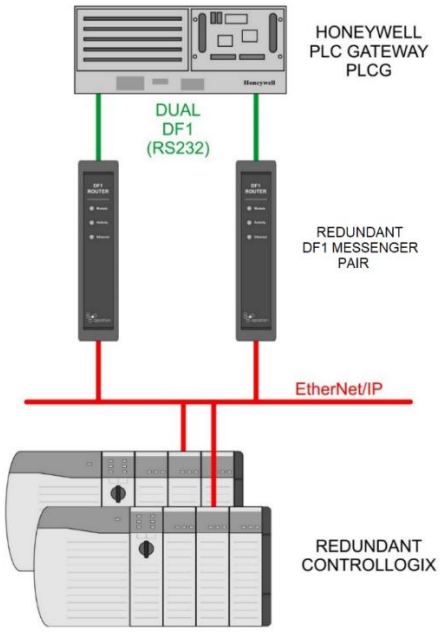


Figure 1.3 – Redundant Architecture

The PLX51-DF1-MSG can be used in redundant Logix controller systems.

Systems that rely on a central ControlLogix communicating to a number of remote DF1 devices, e.g. MicroLogix and SLC stations, may find the PLX51-DF1-MSG useful when upgrading to newer ControlLogix processors, which no longer have a serial port. These systems can easily be upgraded using the PLX51-DF1-MSG without affecting the existing and often costly wireless infrastructure.

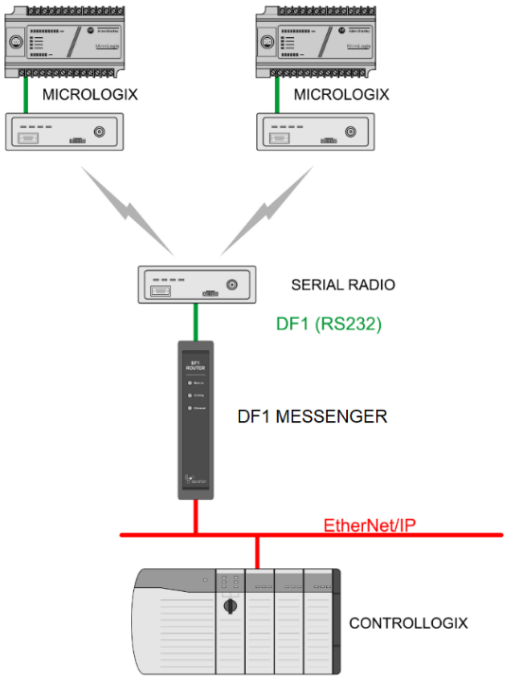


Figure 1.4 – Remote MicroLogix System

1.4 Additional Information

The following documents contain additional information that can assist you with the module installation and operation.

Information	Source
PLX50 Configuration Utility Software	www.prosoft-technology.com
PLX51-DF1-MSG User Manual	www.prosoft-technology.com
PLX51-DF1-MSG Datasheet	www.prosoft-technology.com
Example Code & UDTs	www.prosoft-technology.com
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html
CIP Routing	The CIP Networks Library, Volume 1, Appendix C: Data Management
Map PLC/SLC messages	• SLC to CompactLogix Migration Guide: Chapter 3 – Map PLC/SLC Messages (1769-ap001_-en-p.pdf) • EtherNet/IP Network Configuration: Chapter 5 – Mapping Tags (enet-um001_-en-p.pdf)

Table 1.2 – Additional Information

For users in the European Union:

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

2 Installation

2.1 Module Layout

The PLX51-DF1-MSG has three ports at the bottom of the enclosure. The ports are used for Ethernet, RS232 serial, and power.

The power port uses a three-way connector which is used for the DC power supply; positive and negative (or ground) voltage, as well as the earth connection.

The RS232 port uses a four-way connector. This provides connection for the communication transmit (TX), receive (RX), and ground (GND) conductors. The fourth connection is used for shielding the cable in high-noise environments.

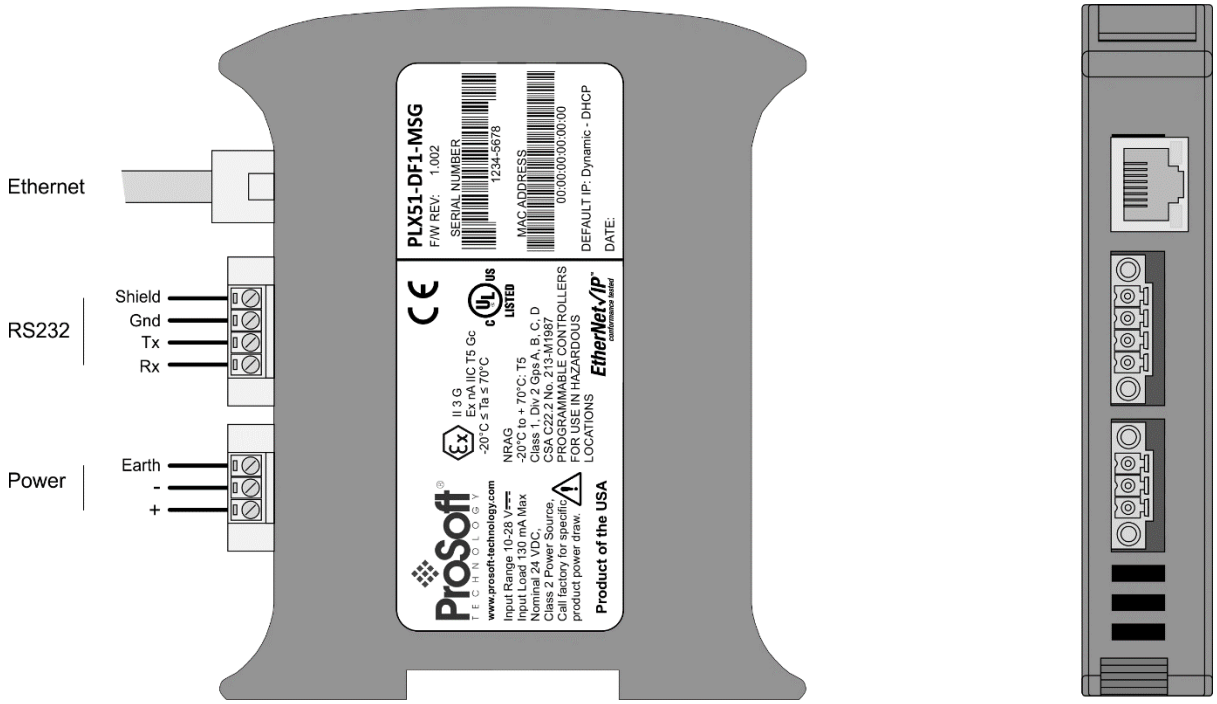


Figure 2.1 – PLX51-DF1-MSG side and bottom view

2.2 LEDs

The module provides three diagnostic LEDs that provide information regarding the module system operation, the Ethernet interface, and the auxiliary communication interface (RS232).

Figure 2.2 – PLX51-DF1-MSG front and top view

2.3 DIP Switches

The module provides four DIP switches at the top of the enclosure as shown in *Figure 2.2*.

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode”, the module will not load the application firmware and will wait for new firmware to be downloaded. This should only be used in the rare occasion when a firmware update was interrupted at a critical stage.
DIP Switch 2	This will force the module into DHCP mode which is useful when you have forgotten the IP address of the module.
DIP Switch 3	Used to lock the configuration from being overwritten by the PLX50 Configuration Utility. When set to ‘On’, the PLX50 Configuration Utility will not be able to download to the module.
DIP Switch 4	Upon bootup, the Ethernet IP address will be set to **192.168.1.100** and network mask **255.255.255.0**. The DIP switch can then be set to ‘Off’ to allow the assignment of a static IP address, if needed.

Table 2.1 – DIP Switch Settings

2.4 Module Mounting

The module provides a DIN rail clip to mount onto a 35mm DIN rail.

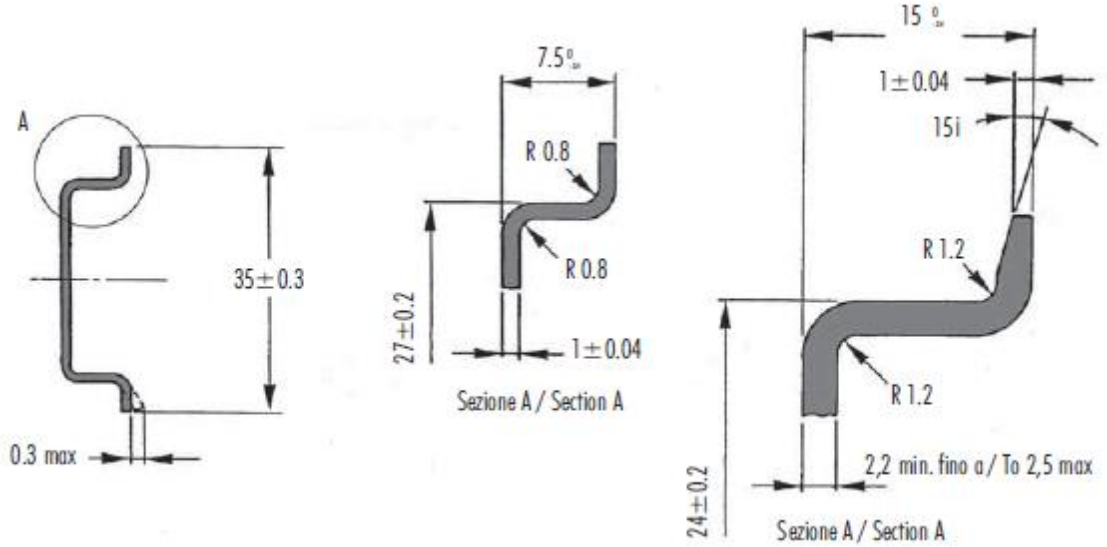


Figure 2.3 – DIN rail specification

The DIN rail clip is mounted on the bottom of the module, toward the back. Use a flat screwdriver to pull the clip downward. This will enable you to mount the module onto the DIN rail. Once the module is mounted onto the DIN rail, the clip must be pushed upward to lock the module onto the DIN rail.

Figure 2.4 – DIN rail mouting

2.5 Power

A three-way power connector is used to connect Power+, Power– (GND), and earth. The module requires an input voltage of 10 to 28 VDC. For more information on electrical requirements, please see page 60.

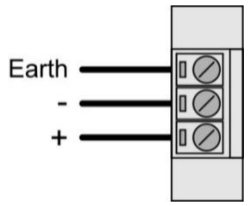


Figure 2.5 – Power connector

2.6 RS232 Port

The four-way RS232 connector is used to connect the transmit (TX), receive (RX), and GND conductors for serial communication. The shield terminal can be used for shielded cable in high noise environments.

Note: The shield of the RS232 port is internally connected to the power connector earth. Thus, when using a shield it is important to connect the Earth terminal on the power connector to a clean earth. Failing to do this can lower the signal quality of the RS232 communication.

Note: When using a shielded cable, it is important that only one end of the shield is connected to earth to avoid current loops. It is recommended to connect the shield to the PLX51-DF1-MSG module, and not to the other DF1 device.

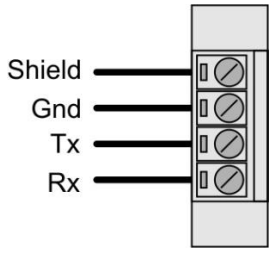


Figure 2.6 – RS232 connector

2.7 Ethernet Port

The Ethernet connector should be wired according to industry standards. Refer to the *Ethernet* section on page 60 for further details.

3 Setup

3.1 Install Configuration Software

The network setup and configuration of the PLX51-DF1-MSG is done in the ProSoft PLX50 Configuration Utility. This software can be downloaded from www.prosoft-technology.com.

Figure 3.1 – ProSoft PLX50 Configuration Utility Environment

3.2 Network Parameters

The module has DHCP (Dynamic Host Configuration Protocol) enabled as factory default. A DHCP server must be used to provide the module with the required network parameters (IP address, subnet mask, etc.). There are a number of DHCP utilities available, however it is recommended to use the DHCP server in the PLX50 Configuration Utility.

3.2.1 DHCP Server Configuration

Within the PLX50 Configuration Utility environment, the **DHCP SERVER** option can be found under the *Tools* menu.

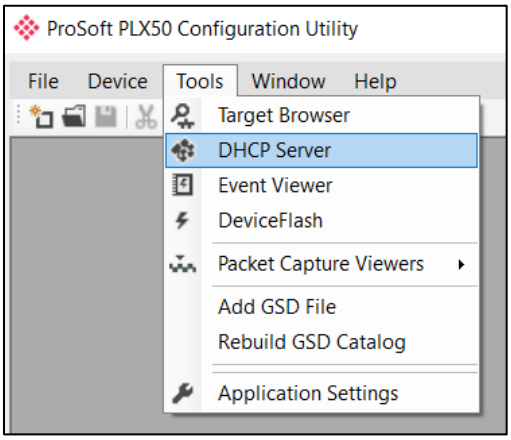


Figure 3.2 – Selecting DHCP Server

Once opened, the DHCP server will listen on all available network adapters for DHCP requests and display their corresponding MAC addresses.

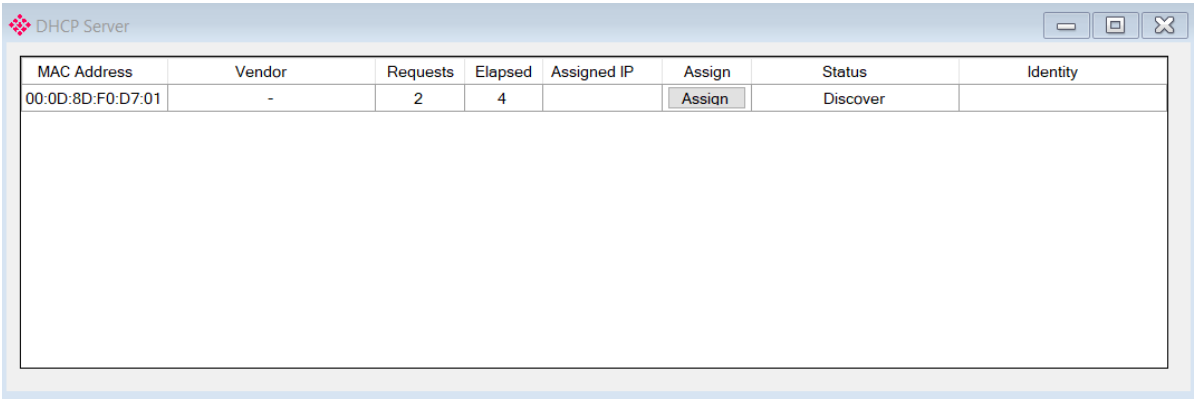


Figure 3.3 – DHCP Server

Note: If the DHCP requests are not displayed in the DHCP Server, it may be due to the local PC's firewall. During installation the necessary firewall rules are automatically created for the Windows firewall. Another possibility could be another DHCP Server is operational on the network and has assigned the IP address.

To assign an IP address, click on the corresponding **ASSIGN** button. The *Assign IP Address for MAC* dialog opens.

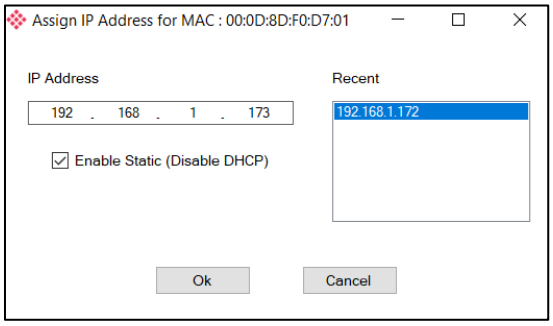


Figure 3.4 – Assigning IP Address

The required IP address can then be either entered, or a recently used IP address can be selected by clicking on an item in the *Recent List*.

If the **ENABLE STATIC** checkbox is checked, then the IP address will be set to static after the IP assignment, thereby disabling future DHCP requests.

Once complete, the DHCP server will automatically assign the IP address to the module and then read the Product name from the device.

The successful assignment of the IP address by the device is indicated by the green background of the associated row.

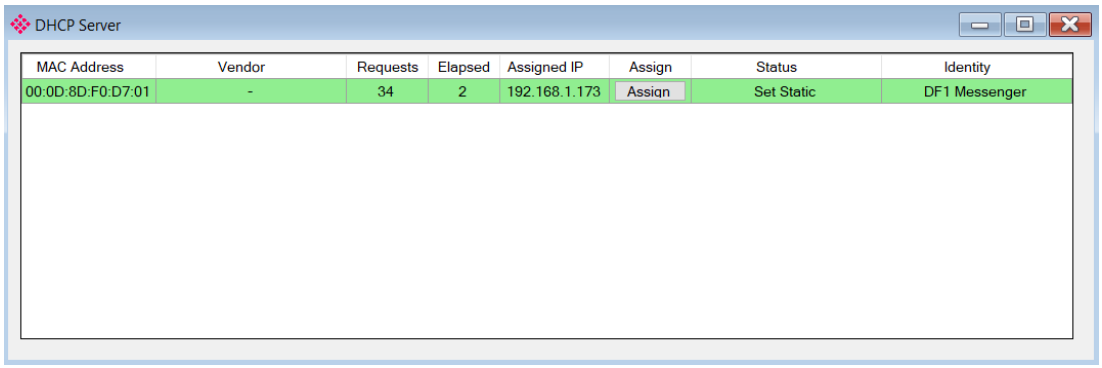


Figure 3.5 – Successful IP address assignment

It is possible to force the module back into DHCP mode by powering up the device with DIP switch 2 set to the **ON** position. A new IP address can then be assigned by repeating the previous steps.

Note: It is important to return DIP switch 2 back to **OFF** position to avoid the module returning to a DHCP mode after the power is cycled again.

In addition to the setting the IP address, other network parameters can be set during the DHCP process. These settings can be viewed and edited in the PLX50 Configuration Utility **APPLICATION SETTINGS**, in the *Tools* tab.

3.2.2 Ethernet Port Configuration

Once the DHCP process has been completed, the network settings can be set using the *Ethernet Port Configuration* via the **TARGET BROWSER** option.

The **TARGET BROWSER** can be accessed under the *Tools* menu.

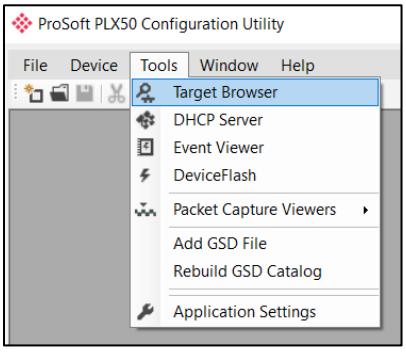


Figure 3.6 – Selecting the Target Browser

The *Target Browser* automatically scans the Ethernet network for EtherNet/IP devices.

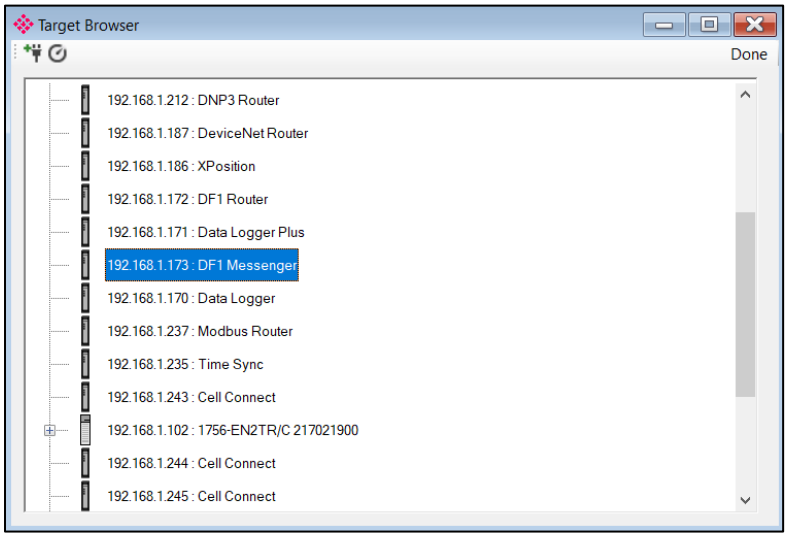


Figure 3.7 – Target Browser

Right-clicking on a device, reveals the context menu, including the **PORT CONFIGURATION** option.

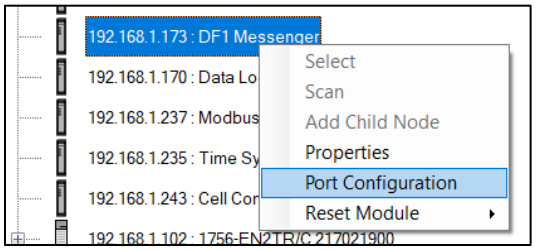


Figure 3.8 – Selecting Port Configuration

The Ethernet port configuration parameters can be modified using the *Ethernet Port Configuration* dialog.

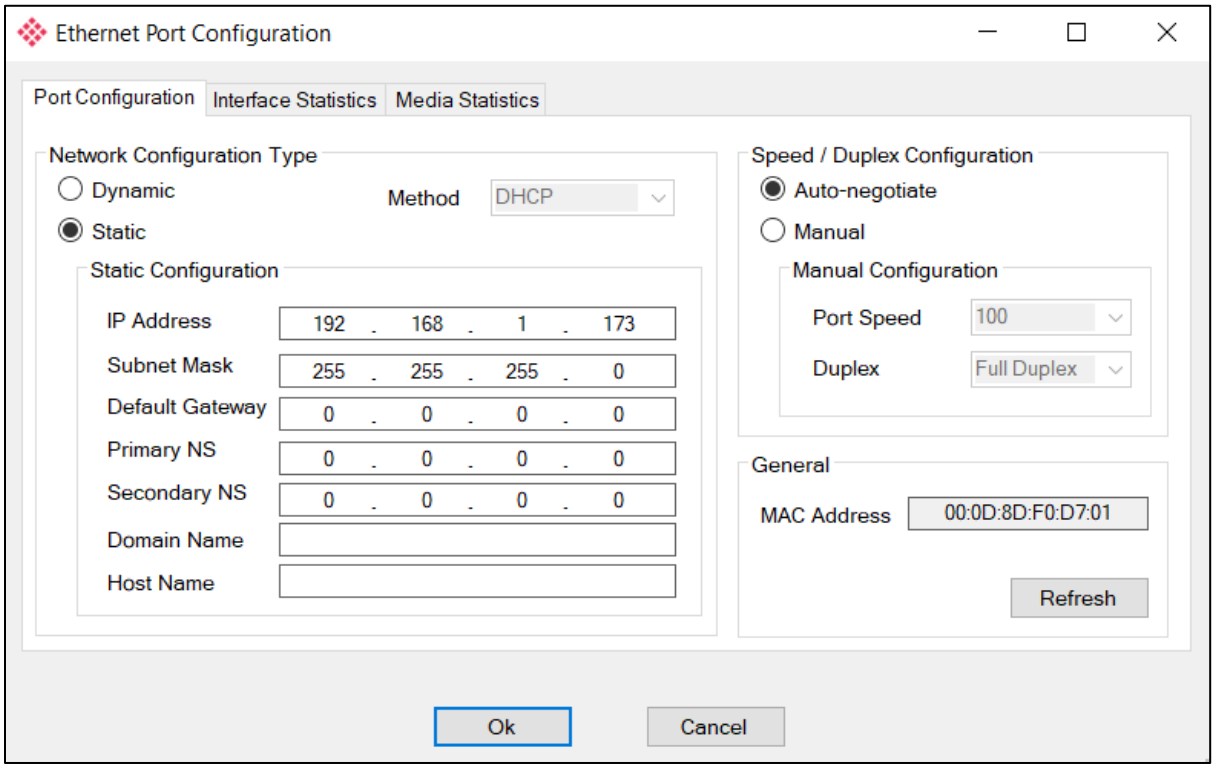


Figure 3.9 – Port Configuration

Alternatively, these parameters can be modified using RSLinx.

3.3 Creating a New Project

Before the module is configured, a new PLX50 Configuration Utility project must be created. Under the *File* menu, select **NEW**.

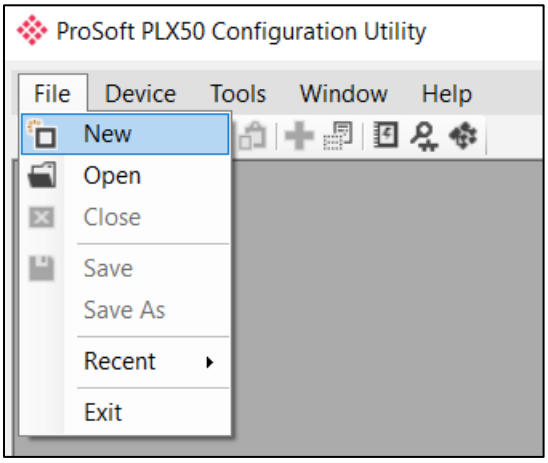


Figure 3.10 – Creating a new project

A PLX50 Configuration Utility project will be created, showing the *Project Explorer* tree view. To save the project use the **SAVE** option under the *File* menu.

Select **ADD** under the *Device* menu.

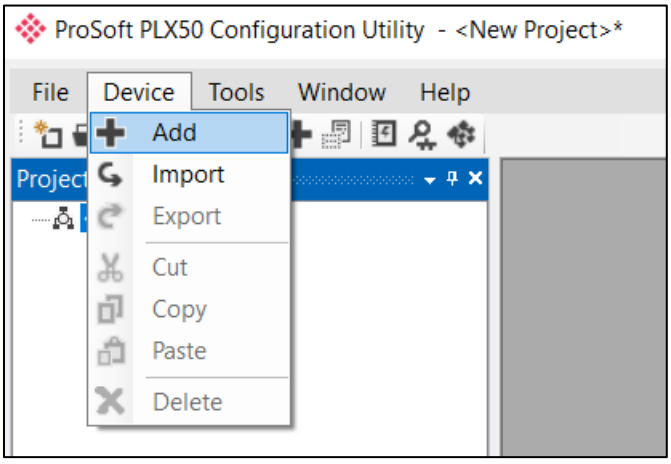


Figure 3.11 – Adding a new device

In the *Add New Device* dialog, select the PLX51-DF1-MSG, and click the **OK** button.

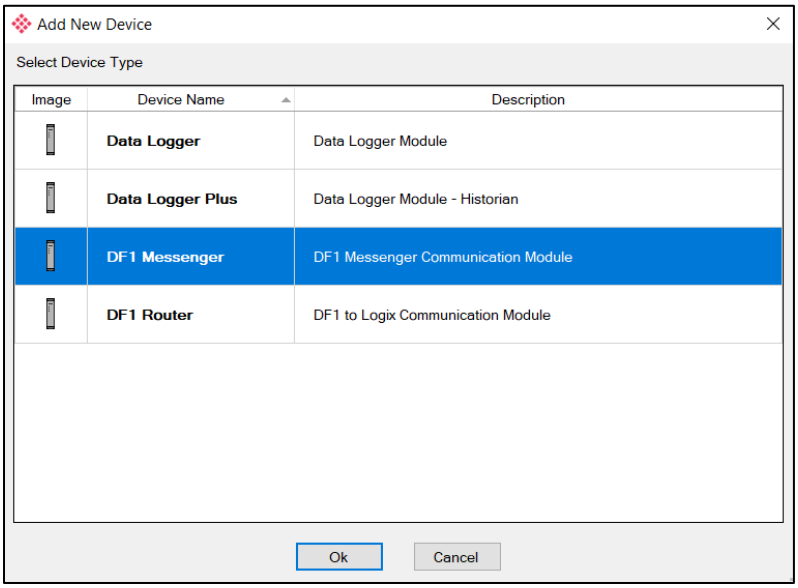


Figure 3.12 – Selecting a new PLX51-DF1-MSG

The device appears in the *Project Explorer* tree, with its configuration dialog opened.

The *DF1 Messenger – Configuration* dialog can be reopened by either double-clicking the module in the *Project Explorer* tree or right-clicking the module and selecting **CONFIGURATION**.

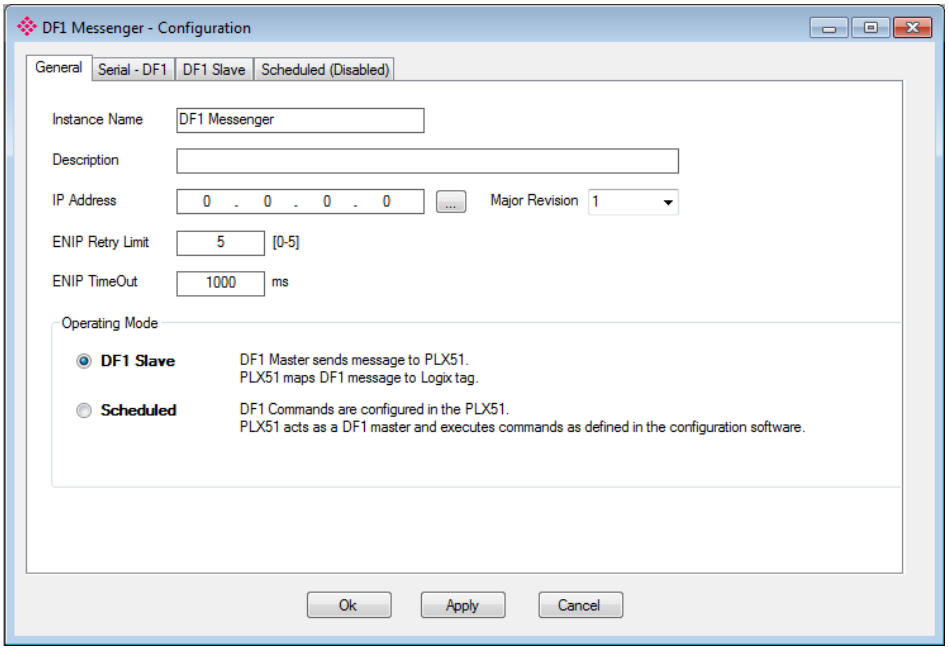


Figure 3.13 – PLX51-DF1-MSG configuration

3.4 DF1 Parameters

The DF1 parameters are configured by the PLX50 Configuration Utility. The *DF1 Messenger - Configuration* dialog consists of a general configuration as well as a serial configuration. The configuration is stored in non-volatile memory that persists when the module is powered down.

Note: When a firmware upgrade is performed, the module will clear all DF1 configuration and routing maps.

The *DF1 Messenger - Configuration* dialog is opened by either double-clicking on the module in the tree, or right-clicking the module and selecting **CONFIGURATION**.

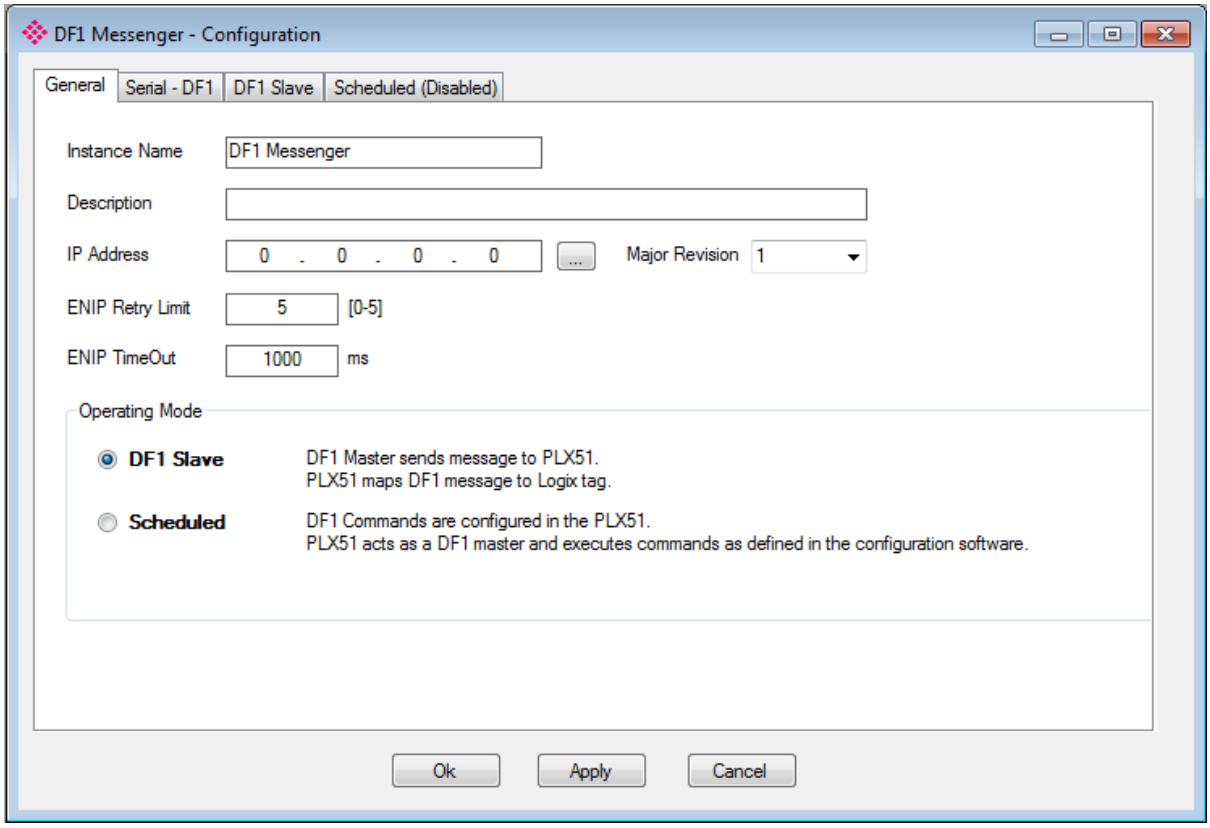


Figure 3.14 – General Configuration

The *General* tab configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various PLX51-DF1-MSG's.
Description	This parameter is used to provide a more detailed description of the application for the PLX51-DF1-MSG.
IP Address	The IP address of the PLX51-DF1-MSG.
Major Revision	The major revision of the PLX51-DF1-MSG.
ENIP Retry Limit	The amount of EtherNet/IP retries the module will make once no response was received from the Logix Controller.

ENIP TimeOut	The time, in milliseconds, after which a retry is sent. Once the first retry is sent, the next retry will be sent after the same amount of time. This will repeat until the *ENIP Retry Limit* is reached.
Operating Mode	The Operating Mode determines how the DF1 messages are routed. In **DF1 SLAVE** mode, the module automatically routes the DF1 message and function to the correct Logix tag. In this mode, the PLX51-DF1-MSG maps the DF1 request to the preconfigured tag. Communication in this mode is initiated by the remote DF1 device. In **SCHEDULED** mode, the PLX51-DF1-MSG initiates the exchange between the remote DF1 device and Logix. Either by reading data from a DF1 device and writing it into a preconfigured Logix tag, or vice versa. Communication in this mode is initiated by the PLX51-DF1-MSG. Refer to the Message Routing section on page 24 for an explanation of the routing operation.

Table 3.1 – General configuration parameters

The *Serial-DF1* configuration is shown in the figure below:

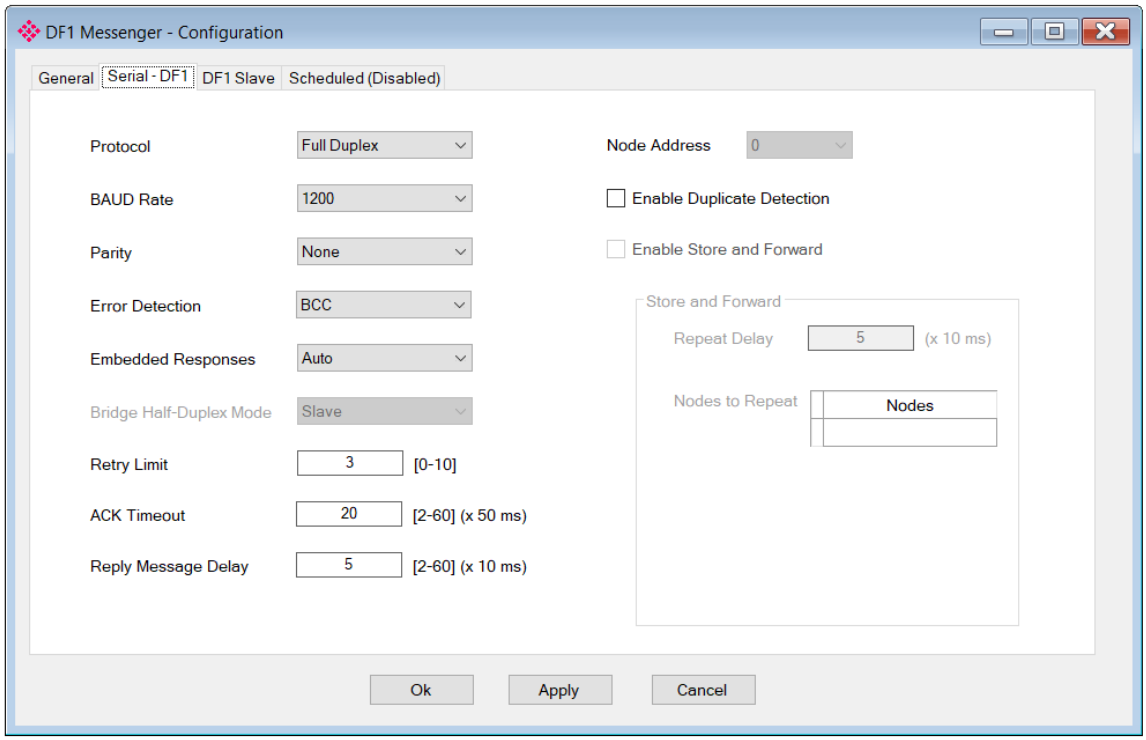


Figure 3.15 – Serial DF1 configuration

The *Serial – DF1* tab consists of the following parameters:

Parameter	Description
Protocol	The protocol parameter configures the module to operate in full duplex, half duplex, or Radio Modem mode on the DF1 network.
BAUD Rate	The BAUD rate configures at what speed the data is sent across the RS232 serial network. The module provides the following speeds: 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Parity	The parity parameter configures the parity of the module's RS232 serial port. The module allows for Even, Odd, or None parity setting.
Error Detection	The module can be configured to perform either BCC or CRC checksum validation on incoming and outgoing packets. CRC checksums is a much stronger validation method when compared to BCC but is more processor intensive to perform.
Embedded Response	This parameter configures the module to add the acknowledge responses in the data payload. You can configure the module to be **AUTO DETECT** or **ON**. This function is only available in Full Duplex mode.
Node Address	The node address is dynamically changed to suite the required mapping.
Retry Limit	The retry limit determines how many times the module must retry and message exchange before failing it.
ACK Timeout	The ACK timeout is used to determine the interval between retries when a message exchange has failed.
Reply Message Delay	This is the minimum delay before the DF1 reply is transmitted to the DF1 device.
Duplicate Detection	This parameter checks for duplicate packets and flagging them when they occur.
Enable Store and Forward	When using the Radio Modem protocol, the PLX51-DF1-MSG can be used to repeat messages from other nodes on the radio network (only relevant for DF1 Radio Modem protocol).
Repeat Delay	When repeating packets from other nodes on the Radio network, this setting determines the delay before repeating the packet (only relevant for DF1 Radio Modem protocol).
Nodes to Repeat	When Store and Forward has been enabled, the Nodes to Repeat list is all the nodes numbers of the devices from which the PLX51-DF1-MSG must repeat the messages (only relevant for DF1 Radio Modem protocol).

Table 3.2 – Serial DF1 configuration parameters

3.5 Message Routing

The module can be configured to route DF1 data in one of two modes:

- *DF1 Slave* mode
- *Scheduled* mode

3.5.1 DF1 Slave Mode

The *DF1 Slave* mode allows the mapping of virtual Data Files to Logix tags across multiple controllers. The mapping of data files to Logix tags is managed in the PLX51-DF1-MSG.

The routing of the Node address to Logix controller as well as DF1 File Number to a Logix tag is managed by the PLX51-DF1-MSG. In the *DF1 Slave* mode, the PLX51-DF1-MSG can operate independently from the Logix controller by directly reading and writing to Logix tags.

Note: The *DF1 Slave* mode only works with PLC5, SLC Typed Read and Write messages, as well as PLC2 Unprotected Read and Write messages.

1 Create a *Target Name* (CIP path to the destination Logix controller) to be used to link the DF1 File Number to the destination Logix tag.

Note: When using PLC2 messages, the Target will be linked to the DF1 Node Number. If the device sending out PLC2 requests wants to access multiple Target Tags, it will need to differentiate by using different Node Numbers.

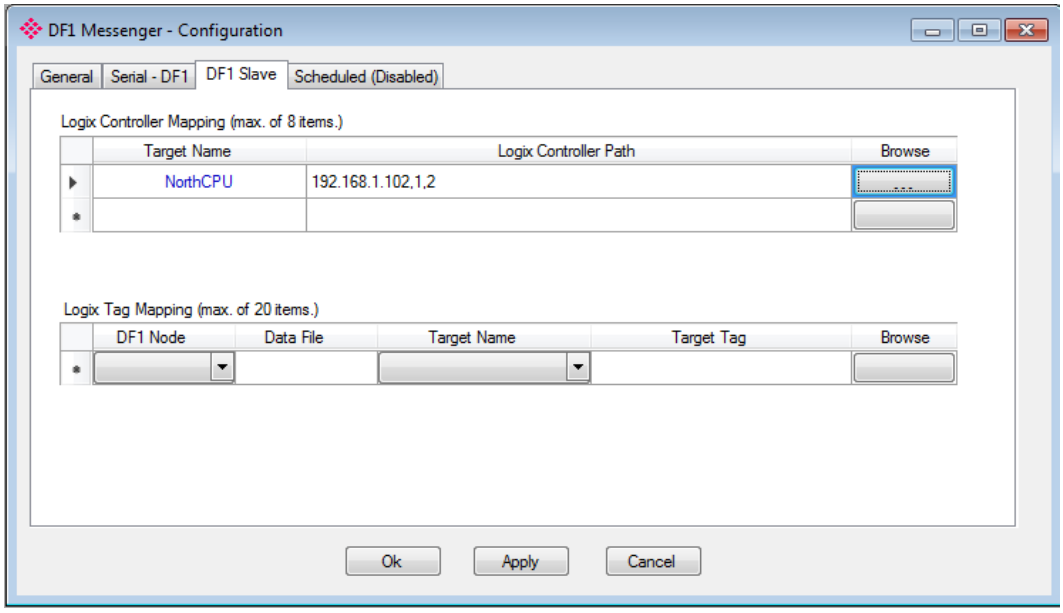


Figure 3.16 – DF1 Slave mode configuration

2 The *Logix Controller Path* can be entered manually, or browsed to by clicking the **BROWSE** button. The *Target Browser* will open and automatically scan for all available EtherNet/IP devices. If the EtherNet/IP module is a bridge module, it can be expanded by right-clicking on the module and selecting the **SCAN** option.

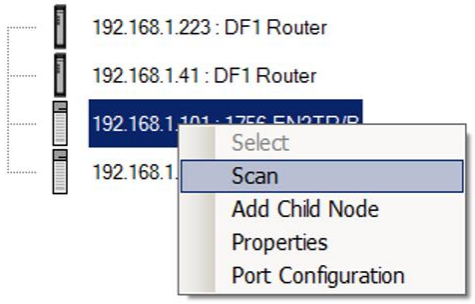


Figure 3.17 – Scanning node in the Target Browser

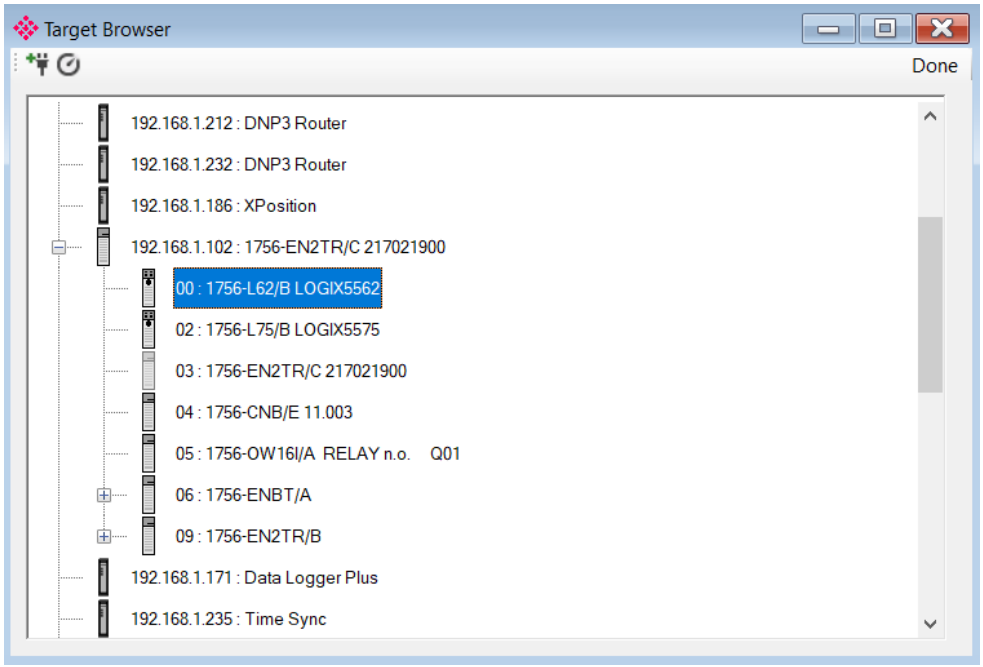


Figure 3.18 – Target Browser selection

Select the controller by either highlighting and clicking the **OK** button, or double-clicking on the controller icon.

A maximum number of 8 controller mapping entries can be added.

3 Next, configure the link between a *DF1 Node* and File Number combination to a Logix tag. This allows the DF1 message initiator to effectively write to, or read from, a Logix tag using traditional File Numbers (e.g. N7, F8, etc.).

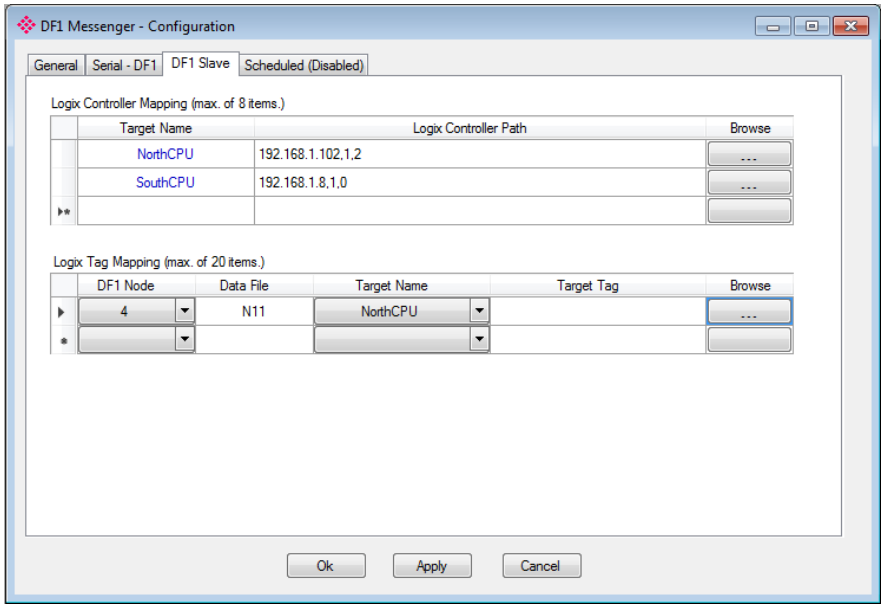


Figure 3.19 – DF1 Slave Mapping

Note: When using PLC-2 messages, enter **PLC2** in the *Data File* field as shown below. Only the *DF1 Node* address will be used to link the selected *Target Tag* to the incoming PLC2 DF1 message.

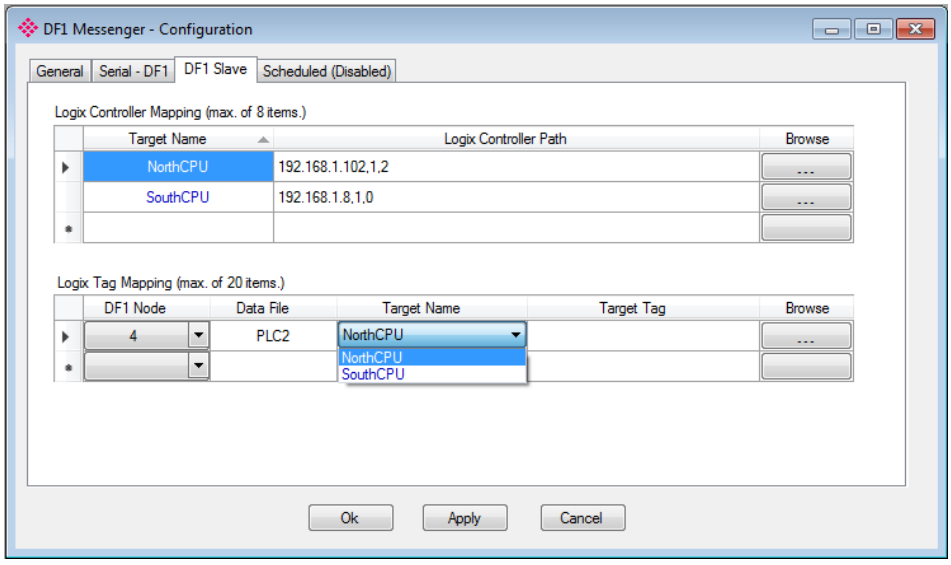


Figure 3.20 – DF1 Slave Mapping (PLC2 Messages)

Note: When using Unprotected Bit Write PLC-2 messages, only one byte worth of bits can be written at a time.

The module can emulate more than one destination DF1 Node Address and can route multiple messages to different Logix controllers. It is important to enter the correct associate DF1 Node address in each mapping record.

4 The next column is used to enter the DF1 *Data File*. It is important to enter only the file here (e.g. N11) and not a data word address (e.g. N11:0). The first element of the entered DF1 file (e.g. N11:0) will map to the first element of the Logix array and so on. When using PLC2 messages, enter **PLC2** into the *Data File* field.

3.5.1.1 Target Tag Selection

The Target Tag can be either entered manually or selected using the *Logix Tag Browser* dialog in the PLX50 Configuration Utility. The *Logix Tag Browser* requires the controller to be available on the network.

To browse to the tag, click on the **BROWSE** button. The *Logix Tag Browser* dialog opens and scans all the tags inside that controller. If the controller has been recently scanned in this session, then a cached version of the tags is displayed. A rescan of the tags can be triggered by selecting the **REFRESH** button in the *Logix Tag Browser*'s toolbar.

Note: When mapping PLC5 Boolean files (e.g. B3), it is recommended that the destination Logix tag be a SINT array.

Note: When mapping PLC2 messaging, only INT datatypes will be supported. The Target Tag must be an array of INTs.

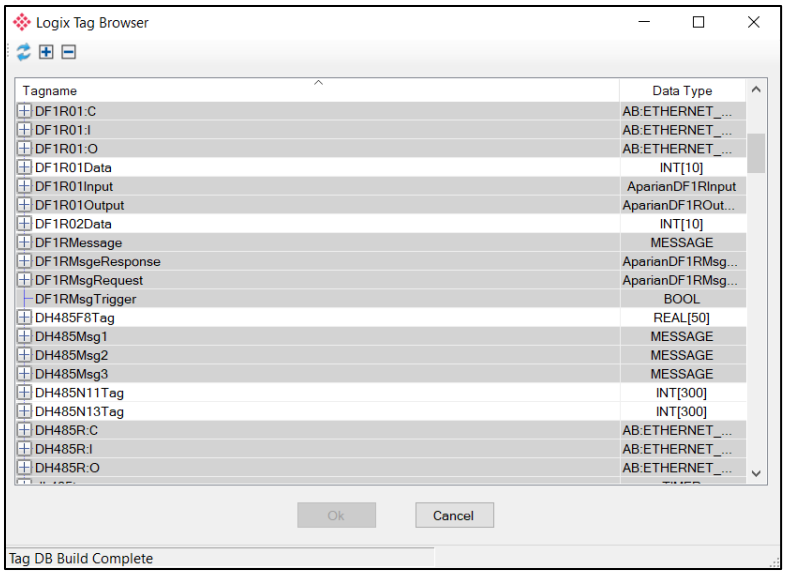


Figure 3.21 – Tag Browser tag selection

The following example shows how DF1 messages are routed to the Logix tags using the *DF1 Slave Map* mode.

Note: Ensure the Logix tag array datatype and size matches that of the DF1 File Number. Failing to do this can result in communication faults.

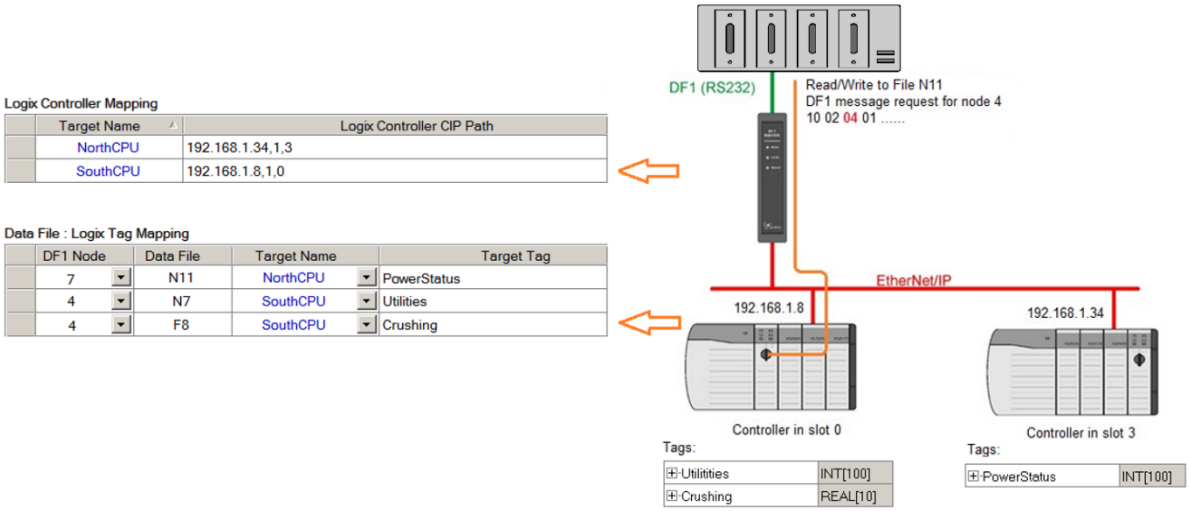


Figure 3.22 – DF1 Slave mode configuration in the PLX50 Configuration Utility

3.5.2 PLC2 Messaging

When receiving PLC2 messages, the Data File entered in the PLX50 Configuration Utility will be “PLC2” because there are no Data Files in PLC2 message structures. The DF1 Node address will be used to route the messages as shown below:

Note: Ensure the Logix tag array datatype and size matches that of the PLC2 DF1 request. Failing to do this can result in communication faults.

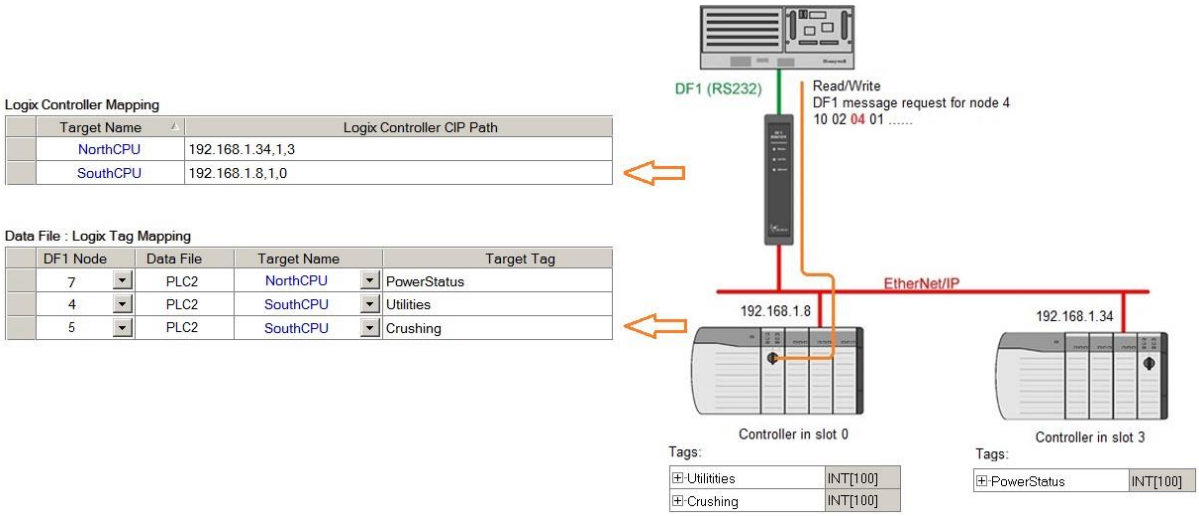


Figure 3.23 – DF1 Slave mode config in the PLX50 Configuration Utility (PLC2 messages)

3.5.3 Scheduled Mode

The *Scheduled* routing mode transfers data between a DF1 device and one or more Logix controllers (the PLX51-DF1-MSG initiates the messaging when in the *Scheduled* mode).

In this mode, the PLX51-DF1-MSG transfers data between a Logix controller and a DF1 device without any configuration or programming required in either the DF1 device or the Logix controller.

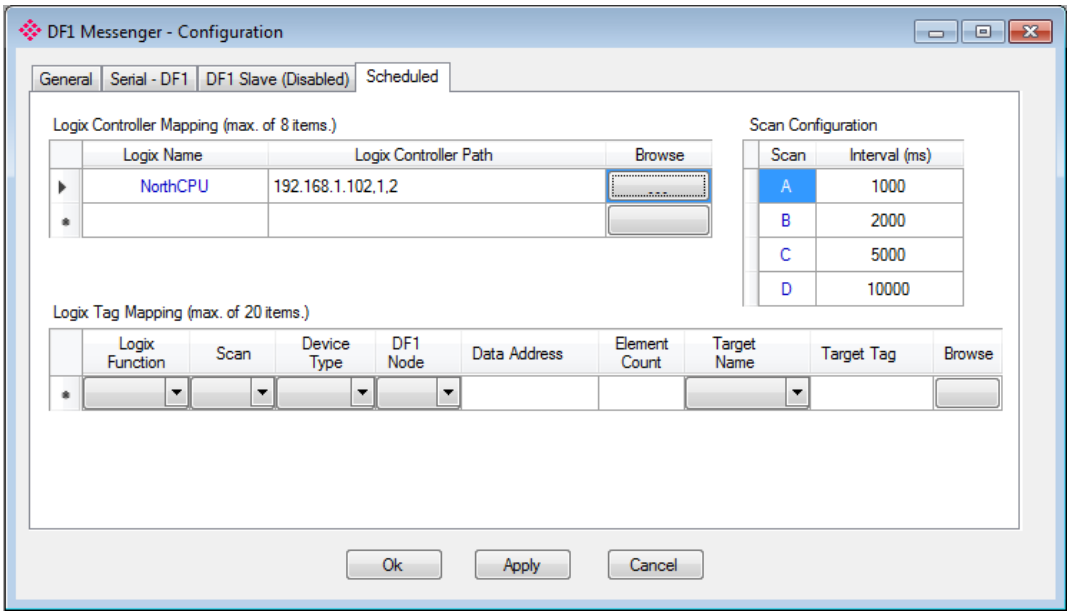


Figure 3.24 – Scheduled configuration

1. Create a *Target Name* (CIP path to the destination Logix controller) which will be used to link the DF1 File Number to the destination Logix tag.
2. The Logix controller paths can either be entered manually or can be browsed by clicking the **BROWSE** button. The *Target Browser* dialog opens and automatically scans for all available EtherNet/IP devices.

If the EtherNet/IP module is a bridge module, it can be expanded by right-clicking on the module and selecting the **SCAN** option.

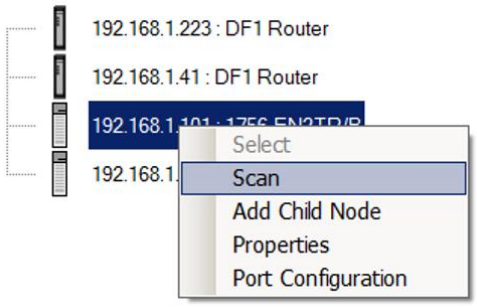


Figure 3.25 – Scanning node in the Target Browser

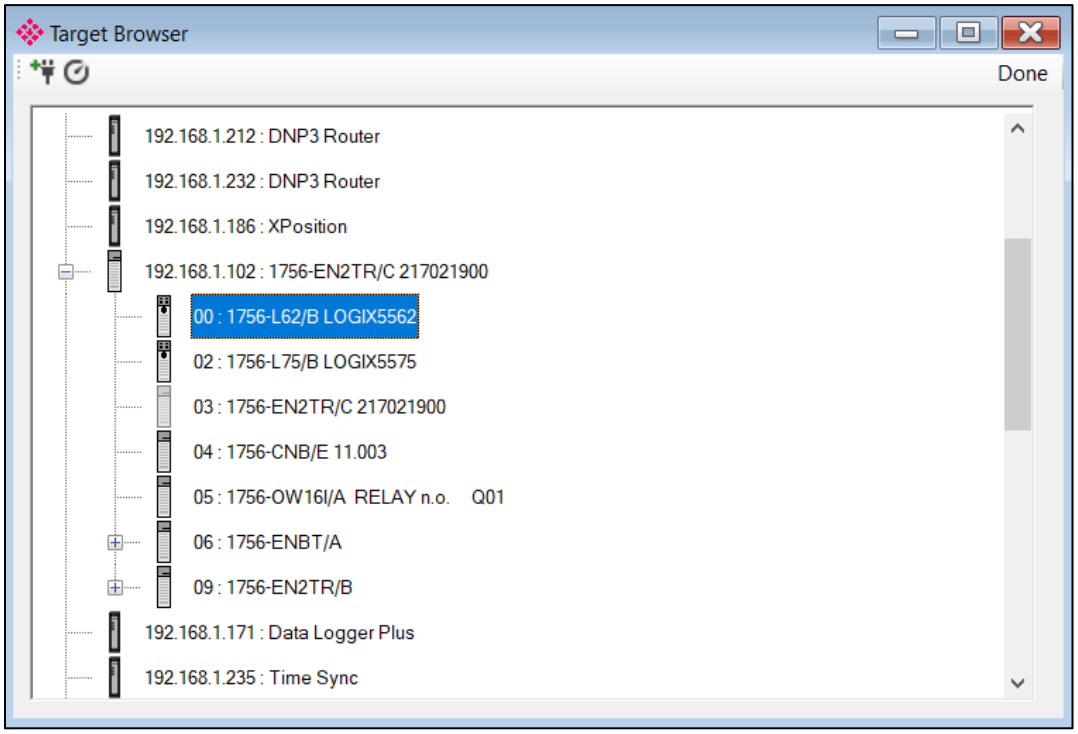


Figure 3.26 – Target Browser selection

The required Logix controller can be chosen by selecting it and clicking the **Ok** button, or by double-clicking on the controller module.

A maximum number of 8 controller mapping entries can be added.

3 Next, configure the scan intervals. The scan intervals allow different data items to be transferred at different rates. There are 4 scan classes: **A**, **B**, **C** and **D**. The intervals for each can be adjusted by entering the scan time in milliseconds. The interval must be between 200 milliseconds and 60 seconds.

4 Next, configure the link between a DF1 node and File Number to map to a Logix tag, and the associated action and scan required.

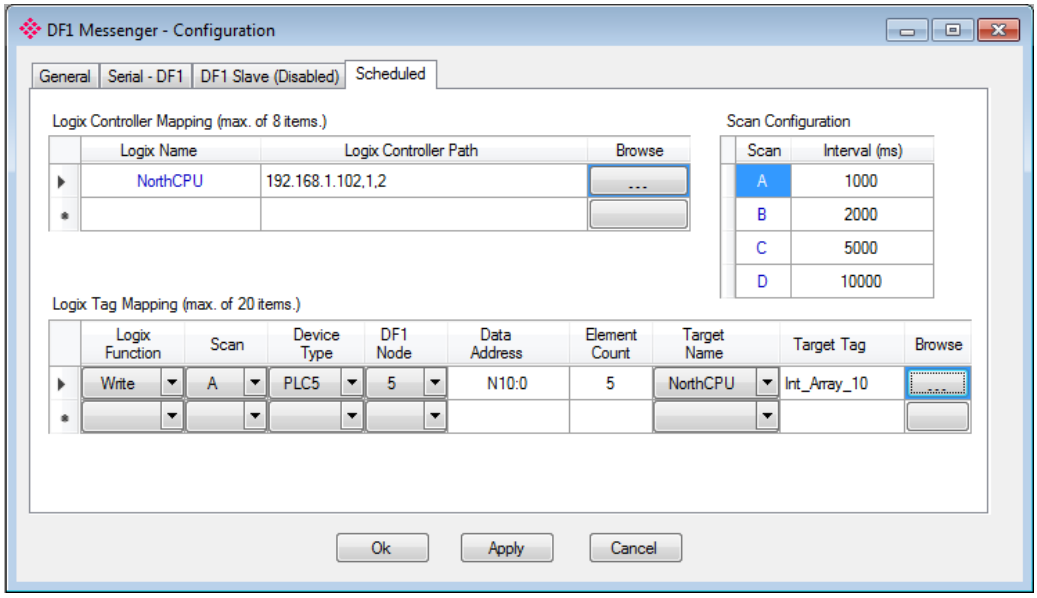


Figure 3.27 – Scheduled Tag Mapping

Parameter	Description
Logix Function	Specifies whether the transaction will result in a read or write function from the Logix controller's perspective.
Scan	Specifies the rate of transaction to be executed. Select a scan class letter that matches the required interval. Take into account the configured Baud rate and message size.
Device Type	Specifies the type of message that will be sent to the DF1 device. There are two options: **PLC5** and **SLC** (Use with a MicroLogix device)
DF1 Node	Specifies the remote device's node.
Data Address	Specifies the remote device's address - to the element level. For example, N10:0. (Note that this differs from the DF1 Slave configuration where only the file is specified)
Element Count	Specifies the number of items to be read or written. In the example above, with a Data Address of N10:0 and an Element Count of 5, then N10:0 through N10:4 will read from the DF1 device and written to Logix.
Target Name	Configured in the first step, it can be selected by means of the target Name combo box.
Target Tag	Either entered manually or selected using the *Tag Browser* in the PLX50 Configuration Utility. The *Tag Browser* requires the controller to be online.
Browse	When clicked, the *Tag Browser* dialog opens and scans all the tags inside that controller. If the controller has been recently scanned in this session, then a cached version of the tags will be displayed. A rescan of the tags can be triggered by selecting the **REFRESH** button in the *Tag Browser*'s toolbar. Only tags of a relevant type will be enabled, select a suitable tag.

Note: When mapping PLC5 Boolean files (e.g. B3), it is recommended that the destination Logix tag be a SINT array, rather than a Boolean array. Using the latter may result in unexpected results due to the packing format of Logix Boolean arrays.

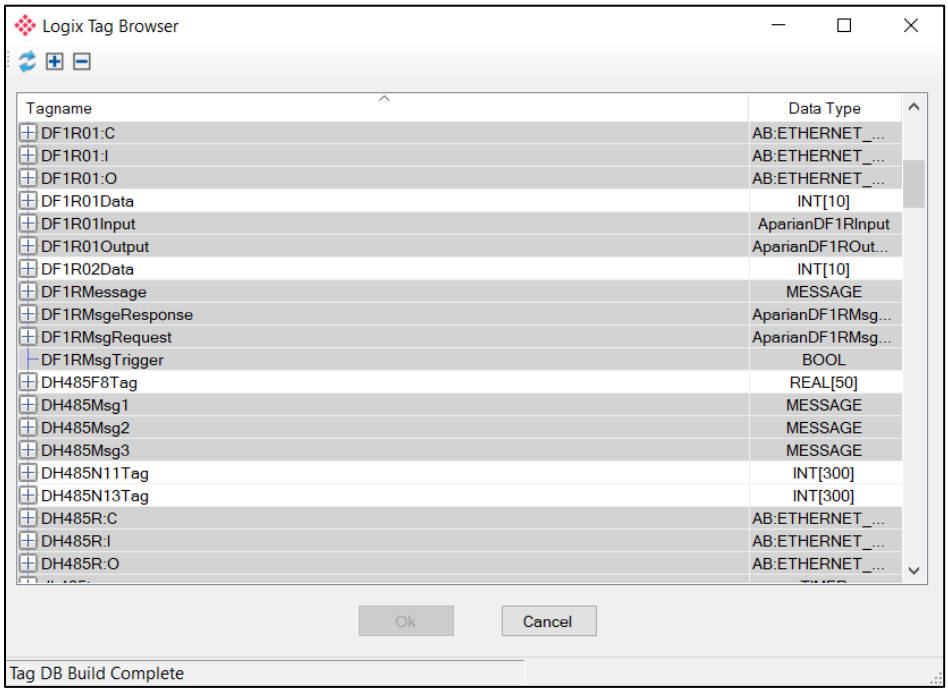


Figure 3.28 – Tag Browser tag selection

Note: Ensure the Logix tag array datatype and size matches that of the selected DF1 Data Address. Failing to do this can result in communication faults and unexpected results.

3.6 Module Download

Once the DF1 configuration has been completed, it must be downloaded to the module.

Before downloading, the Connection Path of the module must be set. This path will automatically default to the IP address of the module, as set in the module configuration. It can be modified if the PLX51-DF1-MSG is not on a local network.

The Connection Path can be set by right-clicking on the module and selecting the **CONNECTION PATH** option.

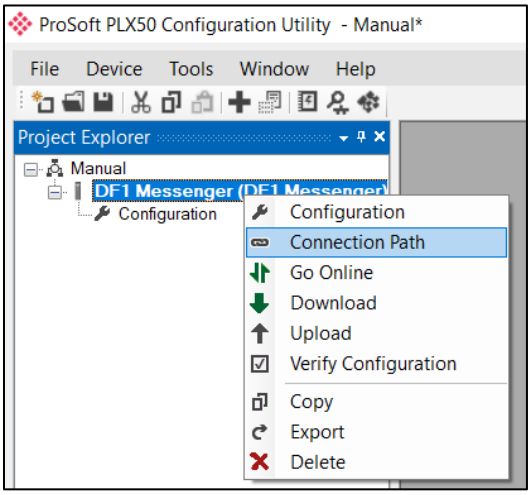


Figure 3.29 – Selecting Connection Path

The new connection path can then be either entered manually or selected by means of the Target Browser.

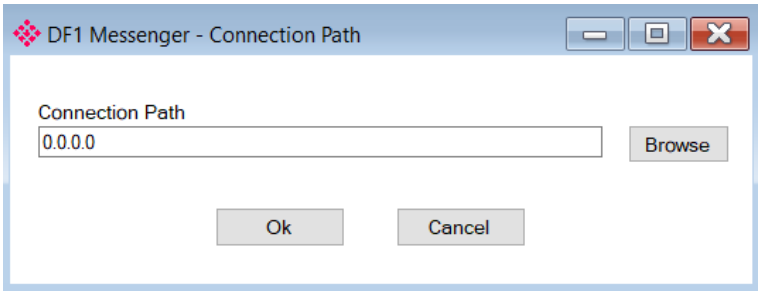


Figure 3.30 – Connection Path

To initiate the download, right-click on the module and select the **DOWNLOAD** option.

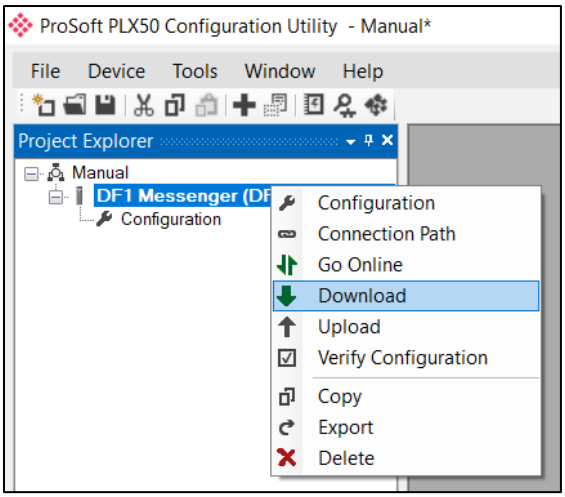


Figure 3.31 – Selecting Download

Once complete, a notification dialog indicates a successful download.

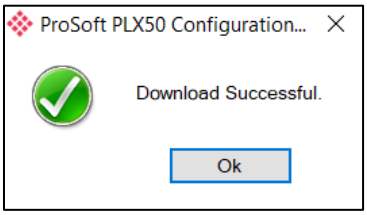


Figure 3.32 – Successful download

During the download process, the module's time will be compared to that of the PC's time. Should the difference be greater than 30 seconds, a prompt to set the module time to match the PC's time will appear. The module time is used only for the event log.

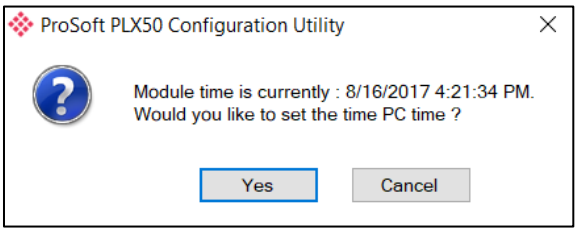


Figure 3.33 – Setting module time

Within the PLX50 Configuration Utility environment, the module will be in the **Online** state, indicated by the green circle around the module. The module is now configured and in operation.

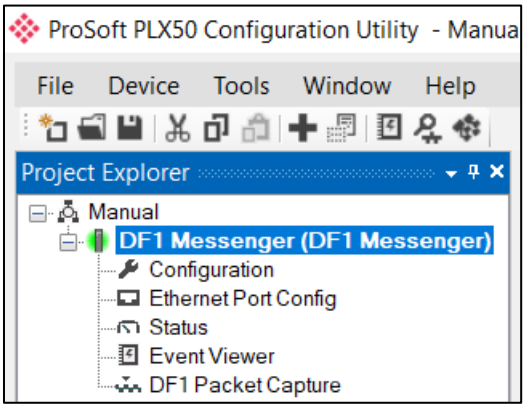


Figure 3.34 – Module online

3.7 RSLogix 5000 Configuration

The PLX51-DF1-MSG module can be easily integrated with Allen-Bradley Logix family of controllers.

For Logix versions 20 and newer, the module can be added using the EDS Add-On-Profile (AOP), as described on page 38.

For Logix versions 19 and older), the module must be added using a Generic Profile, as described on page 42.

3.7.1 Studio 5000 Configuration (Version 20+)

The Logix family in Studio 5000 uses the EDS AOP. Before the module can be added to the tree, the module's EDS file must be registered.

Using RSLinx, the EDS file can be uploaded from the device. The *EDS Hardware Installation Tool* is then invoked to complete the registration.

Alternatively, the EDS file can be downloaded from the product web page at www.prosoft-technology.com. It can be registered manually using the **EDS HARDWARE INSTALLATION TOOL** shortcut, under the *Tools* menu in Studio 5000.

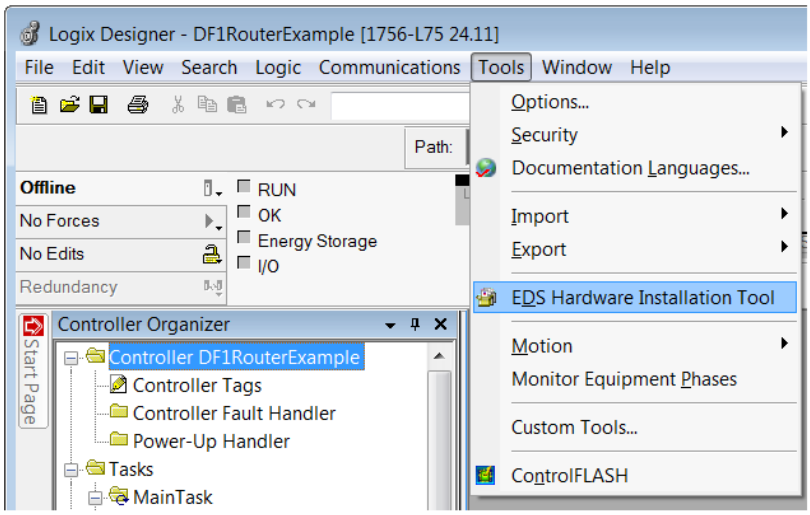


Figure 3.35 – EDS Hardware Installation Utility

Once the EDS file has been registered, the module can be added to the *I/O Configuration* tree.

1 Under an **ETHERNET** bridge module in the tree, select the *Ethernet* network, right-click and select the **NEW MODULE** option.

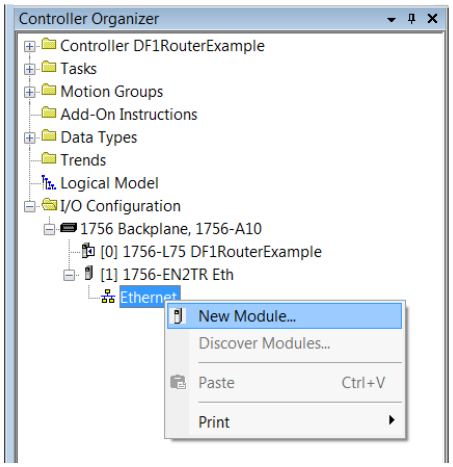


Figure 3.36 – Adding a module

2 The *Select Module Type* dialog opens. To find the module, use the *Vendor* filter to select the **PROSOFT TECHNOLOGY** modules as shown in the figure below.

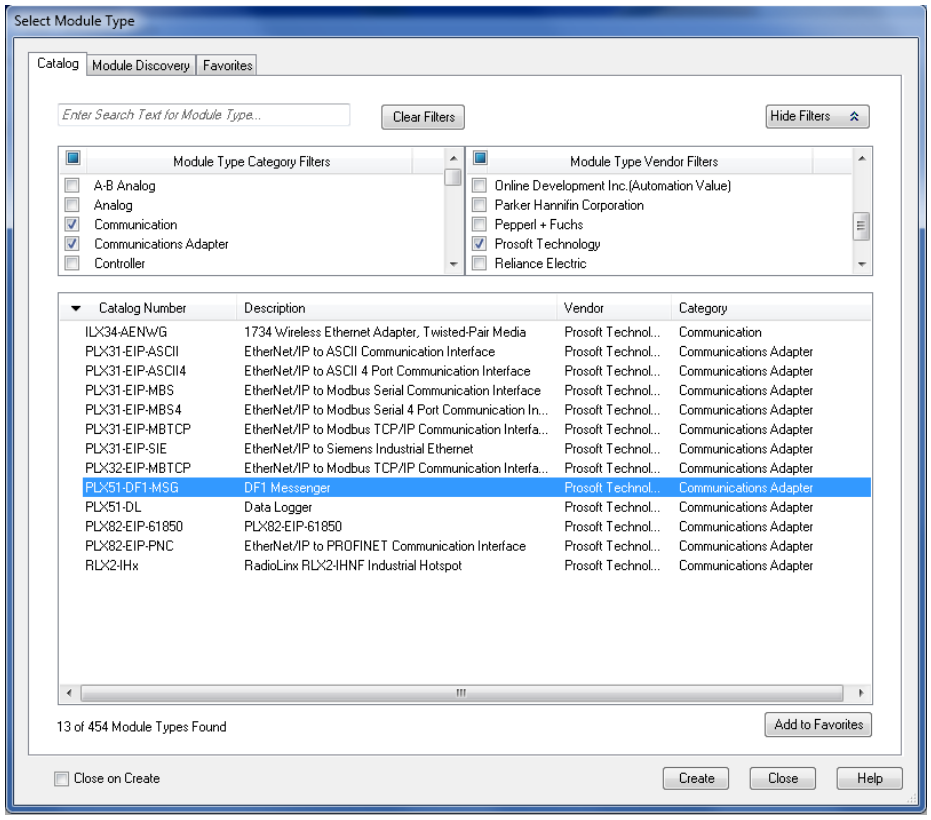


Figure 3.37 – Selecting the module

3 Locate and select the PLX51-DF1-MSG module, and select the **CREATE** option. In the *New Module* dialog, specify the *Name* and *IP Address* as a minimum to complete the instantiation.

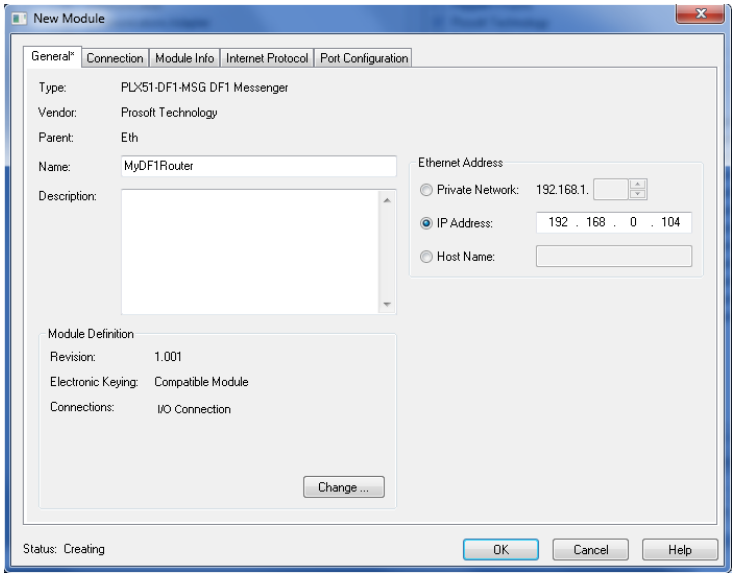


Figure 3.38 – Module instantiation

4 Once the instantiation is complete, the module appears in the Logix IO tree.

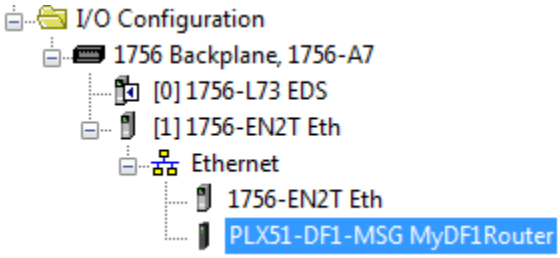


Figure 3.39 – Logix IO tree

5 The Module Defined Data Types are automatically created during the instantiation process. These data types provide meaningful structures to the module data. An excerpt of the Input Image is shown in the following figure.

Name	Value	Force Mask	Style	Data Type
MyDF1Router:I	{...}	{...}		_0135:PLX51_DF1_MSG_50776D0E:...
MyDF1Router:I.ConnectionFaulted	0		Decimal	BOOL
MyDF1Router:I.InstanceNameLength	0		Decimal	DINT
MyDF1Router:I.Status	2#0000_0000...		Binary	DINT
MyDF1Router:I.Reserved	0		Decimal	BOOL
MyDF1Router:I.DF1SlaveMode	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagMode	0		Decimal	BOOL
MyDF1Router:I.Reserved0	0		Decimal	BOOL
MyDF1Router:I.ConfigurationValid	0		Decimal	BOOL
MyDF1Router:I.RoutingInhibited	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus0	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus1	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus2	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus3	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus4	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus5	0		Decimal	BOOL
...				
MyDF1Router:I.ScheduledTagStatus18	0		Decimal	BOOL
MyDF1Router:I.ScheduledTagStatus19	0		Decimal	BOOL
MyDF1Router:I.TransactionRate	0		Decimal	DINT
MyDF1Router:I.Temperature	0.0		Float	REAL
MyDF1Router:I.DF1RxPacketCount	0		Decimal	DINT
MyDF1Router:I.DF1TxPacketCount	0		Decimal	DINT
MyDF1Router:I.DF1ChecksumErrors	0		Decimal	DINT
MyDF1Router:I.PCCCRequests	0		Decimal	DINT
MyDF1Router:I.PCCCFailures	0		Decimal	DINT
MyDF1Router:I.TagReads	0		Decimal	DINT
MyDF1Router:I.TagWrites	0		Decimal	DINT
MyDF1Router:I.TagConnectionFailures	0		Decimal	DINT
MyDF1Router:I.TagErrors	0		Decimal	DINT

Figure 3.40 – Module Defined Data Type

3.7.2 RSLogix 5000 Configuration (Pre-Version 20)

3.7.2.1 Add Module to I/O Configuration

The module can operate in both a Logix "owned" and standalone mode. When operating in "owned" mode, the PLX51-DF1-MSG must be added to the RSLogix 5000 I/O tree as a *Generic Ethernet Module*.

1 Right-click on the **ETHERNET** bridge and select **NEW MODULE**. Select the **ETHERNET-MODULE** as shown in the figure below.

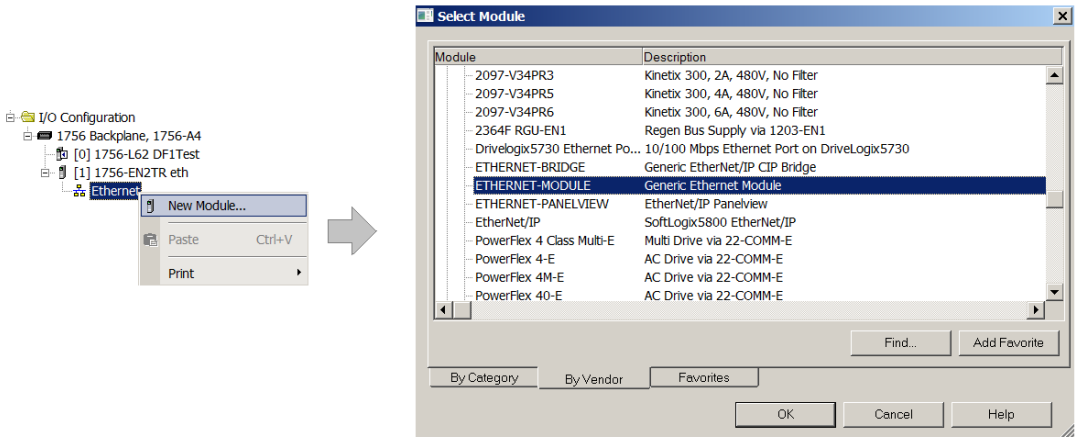


Figure 3.41 – Add a Generic Ethernet Module in RSLogix 5000

2 In the *Module Properties* dialog, enter the *Name*, *IP Address*, and *Connection Parameters*. Below are the required connection parameters.

Connection Parameter	Assembly Instance	Size
Input	100	34 (32-bit)
Output	101	1 (32-bit)
Configuration	102	0 (8-bit)

Table 3.3 – RSLogix class 1 connection parameters for the PLX51-DF1-MSG

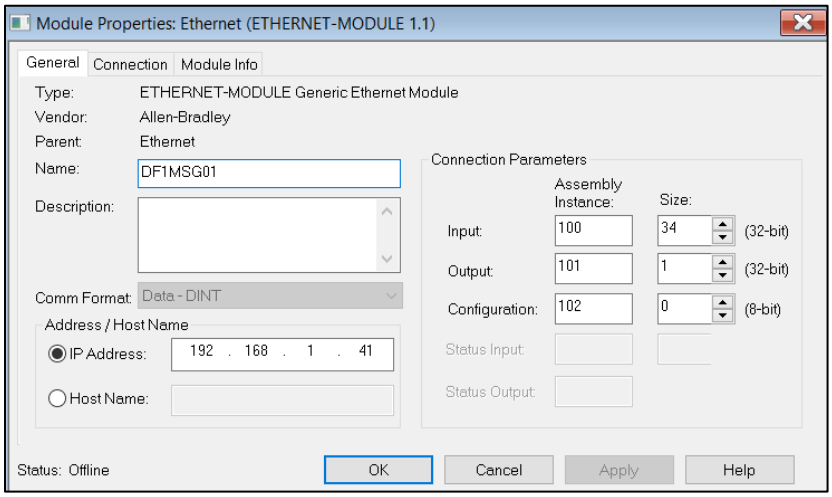


Figure 3.42 – RSLogix General module properties in RSLogix 5000

3 Enter the *Requested Packet Interval (RPI)*. This is the rate at which the input and output assemblies are exchanged. The recommended value is 500ms. Click **OK**.

Note: Although the module can run with an RPI of 10ms, it is recommended to set the RPI to 500ms to avoid unnecessary loading of the module processor.

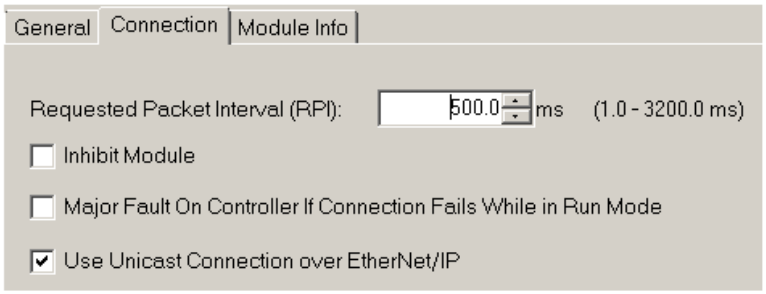


Figure 3.43 – Connection module properties in RSLogix 5000

4 Once the module has been added to the RSLogix 5000 I/O tree, assign the User Defined Types (UDTs) to the input and output assemblies.

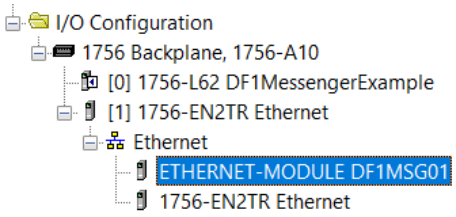


Figure 3.44 – RSLogix 5000 I/O module tree

5 Import the required UDTs by right-clicking on *User-Defined* sub-folder in the *Data Types* folder of the I/O tree, and selecting **IMPORT DATA TYPE**.

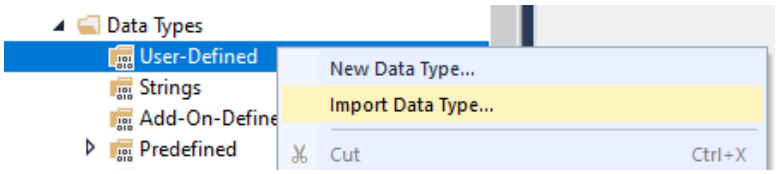


Figure 3.45 – Import Data Type

6 Select the data type file, the assemblies are then assigned to the UDTs with a ladder copy instruction (COP).

3.7.2.2 Importing UDTs and Mapping Routines

To simplify the mapping of the input image, an RSLogix 5000 Routine (.L5X) file is provided. This file can be imported by right-clicking on the required Program and selecting the **IMPORT ROUTINE** option.

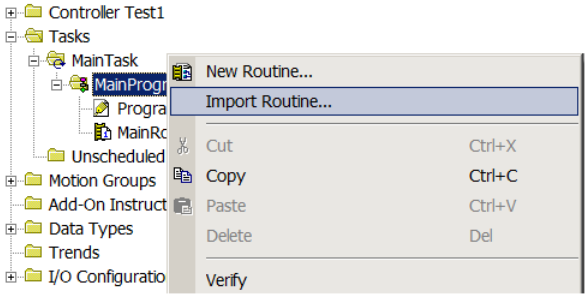


Figure 3.46 – RSLogix 5000 Importing DF1Messenger specific routine and UDTs

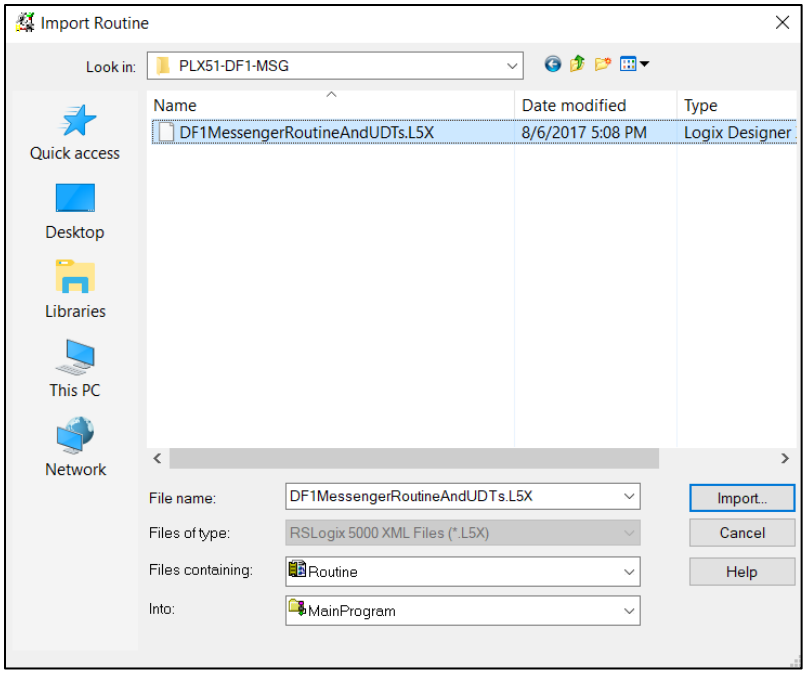


Figure 3.47 – Selecting partial import file

The import creates the following:

- The required UDTs (user defined data types)
- Two controller tags representing the Input and Output assemblies.
- A routine mapping the PLX51-DF1-MSG module to the aforementioned tags.

To change the routine to map to the correct PLX51-DF1-MSG module instance name, make sure the mapping routine is called by the Program's Main Routine.

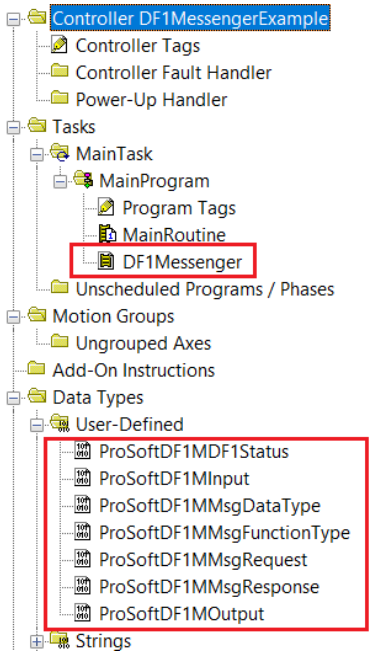


Figure 3.48 – Imported RSLogix 5000 objects

4 Operation

4.1 Message Routing

When the PLX51-DF1-MSG has been configured, the DF1 message initiator sends a read/write to a DF1 address, then routed to a Logix tag. There are various indicators to determine if the mapping has correctly routed the DF1 messages. Refer to the *Diagnostics* chapter on page 48 for a more information.

4.2 RSLogix 5000 Assemblies

When the module operates in a Logix “owned” mode, the Logix controller establishes a class 1 cyclic communication connection with the PLX51-DF1-MSG. An input and output assembly is exchanged at a fixed interval. The UDTs convert the input and output arrays into tag-based assemblies.

DF1M01Input	{...}	{...}		ProSoftDF1MInput
DF1M01Input.Instance	'South'	{...}		STRING
DF1M01Input.Status	{...}	{...}		ProSoftDF1MDF1Status
DF1M01Input.TransactionRate	31		Decimal	DINT
DF1M01Input.Temperature	46.3		Float	REAL
DF1M01Input.DF1RxPacketCount	34218		Decimal	DINT
DF1M01Input.DF1TxPacketCount	34217		Decimal	DINT
DF1M01Input.DF1ChecksumErrors	0		Decimal	DINT
DF1M01Input.PCCCRequests	0		Decimal	DINT
DF1M01Input.PCCCFailures	0		Decimal	DINT
DF1M01Input.TagReads	16522		Decimal	DINT
DF1M01Input.TagWrites	587		Decimal	DINT
DF1M01Input.TagConnectionFailures	0		Decimal	DINT
DF1M01Input.TagErrors	0		Decimal	DINT

Figure 4.1 – Input assembly UDT structure

4.2.1 Input Assembly

The following parameters are used in the input assembly of the module:

Parameter	Datatype	Description
Instance	STRING	The instance name of the module that was configured under the general DF1 configuration in the PLX50 Configuration Utility.
Status.Reserved	BOOL	Reserved
Status.ReactiveTagMode	BOOL	Set if the module is operating in DF1 Slave mode.
Status.ScheduledTagMode	BOOL	Set if the module is operating in Scheduled Tag mode.
Status.ConfigurationValid	BOOL	Set if a valid configuration is executing in the module.
Status.RoutingInhibited	BOOL	Set when the module's routing function has been inhibited. Routing can be inhibited by setting a bit in the output assembly of the module.
Status.ScheduledTagStatus0 to 19	BOOL[20]	Each bit represents the status of the last scheduled transaction for that specific map item. A true value indicates success.
TransactionRate	DINT	The transaction rate is the number of DF1 messages per second that the module is currently routing.
Temperature	REAL	The internal temperature of the module.
DF1RxPacketCount	DINT	The total number of DF1 packets received by the module.
DF1TxPacketCount	DINT	The number of DF1 packets sent by the module.
DF1ChecksumErrors	DINT	The number of corrupted DF1 packets received by the module.
PCCCRequests	DINT	The total number of DF1 message routing requests received by the module when operating in Bridge mode.
PCCCFailures	DINT	The total number of DF1 message routing requests that resulted in errors when operating in Bridge mode.
TagReads	DINT	The total number of tag reads executed by the module when operating in Tag Map mode.
TagWrites	DINT	The total number of tag writes executed by the module when operating in Tag Map mode.
TagConnectionFailures	DINT	The number of failed class 3 connection attempts when operating in Tag Map mode. Tag reading and writing requires the module to first establish a class 3 connection with the Logix Controller.
TagErrors	DINT	The number of failed tag access (read/write) requests when operating in tag Map mode. These may include privileged violations, non-existing tags, etc.

Table 4.1 – RSLogix 5000 input assembly parameters

4.2.2 Output Assembly

The following parameters are used in the output assembly of the module.

Parameter	Datatype	Description
RoutingInhibit	BOOL	This bit inhibits the module's routing capabilities. When set, no DF1 messages are routed. This may be required in applications running a redundant DF1 network where one of the PLX51-DF1-MSGs is to run in a hot-standby mode.

Table 4.2 – RSLogix 5000 output assembly parameters

5 Diagnostics

5.1 LEDs

The PLX51-DF1-MSG provides three LEDs for diagnostic purposes.

Figure 5.1 – PLX51-DF1-MSG front view

LED	Description
Ok	The Ok LED provides information regarding the system-level operation of the module. If the LED is red, the module is not operating correctly. For example, if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is green, then the module has booted and is running correctly.
Act	The Activity LED is used for the RS232 serial port. Every time a successful DF1 packet was received, the LED will toggle green. The LED toggles red if a corrupted packet was received (eg. failed checksum).
Eth	The Ethernet LED illuminates when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED flashes when traffic is detected.

Table 5.1 – Module LED operation

5.2 Module Status Monitoring

The PLX51-DF1-MSG provides statistics that can assist with module operation, maintenance, and diagnostics. The statistics can be accessed in full by the PLX50 Configuration Utility or using the web server in the module.

To view the module's status in the ProSoft PLX50 Configuration Utility, the module must be online. Right-click on the module and select the **GO ONLINE** option.

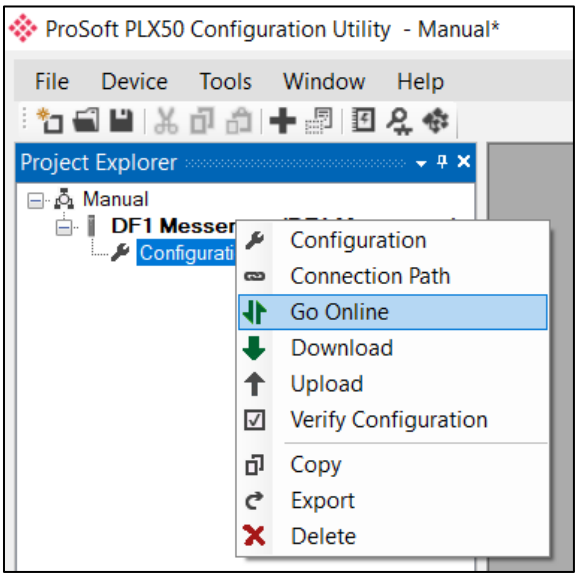


Figure 5.2 – Selecting to Go Online

The **Online** mode is indicated by the green circle behind the module icon in the Project Explorer tree.

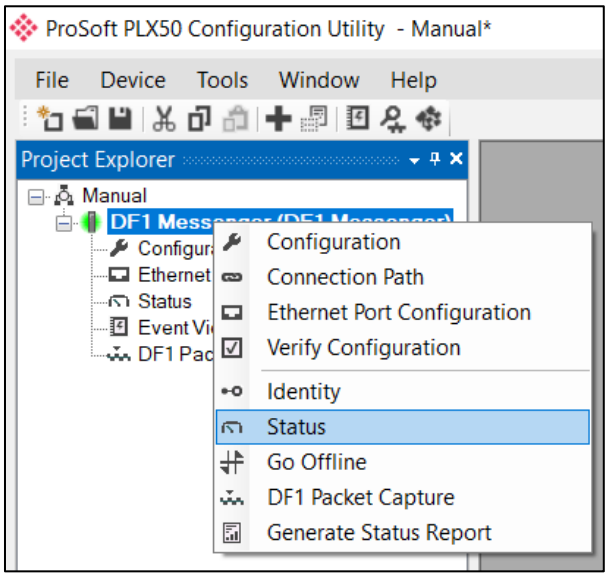


Figure 5.3 – Selecting online Status

The *Status* dialog can be opened by either double-clicking on the **STATUS** item in the Project Explorer tree, or by right-clicking on the module and selecting **STATUS**.

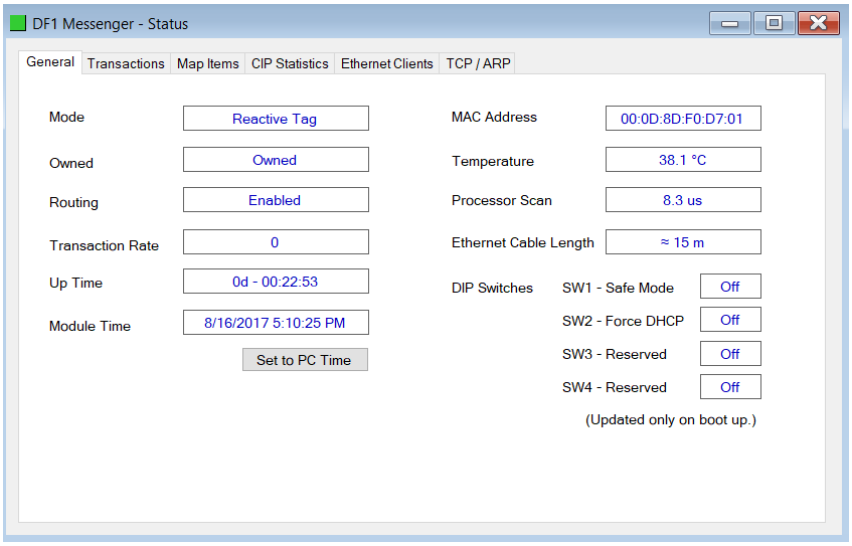


Figure 5.4 – Status monitoring - General

5.2.1 General Tab

The *General* tab displays the following general parameters. It can also be used to set the module time to the PC time:

Parameter	Description
Mode	Indicates the current operating mode: • DF1 Slave • Scheduled Tag
Owned	Indicates whether or not the module is currently owned (Class 1) by a Logix controller.
Routing	Indicates whether the routing of the module is enabled or inhibited. The routing operation can be inhibited in the output assembly of the module.
Transaction Rate	The number of DF1 messages per second that the module is currently routing.
Up Time	Indicates the elapsed time since the module was powered-up.
Module Time	Indicates the module's internal time. The module time is stored in UTC (Universal Coordinate Time) but displayed on this page according to the local PC Time Zone settings.
MAC Address	Displays the module's unique Ethernet MAC address.
Temperature	The internal temperature of the module.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
DIP Switches - Position	The status of the DIP switches when the module booted. Note that this status will not change if the DIP switches are altered when the module is running.

Table 5.2 – Parameters displayed in the Status Monitoring – General Tab

5.2.2 Transactions Tab

The *Transactions* tab displays the following statistics for:

- DF1 messages
- Bridge messages (Not relevant for the DF1 Messenger)
- Logix Tag Mapping (DF1 Slave and Scheduled Tag Mode)

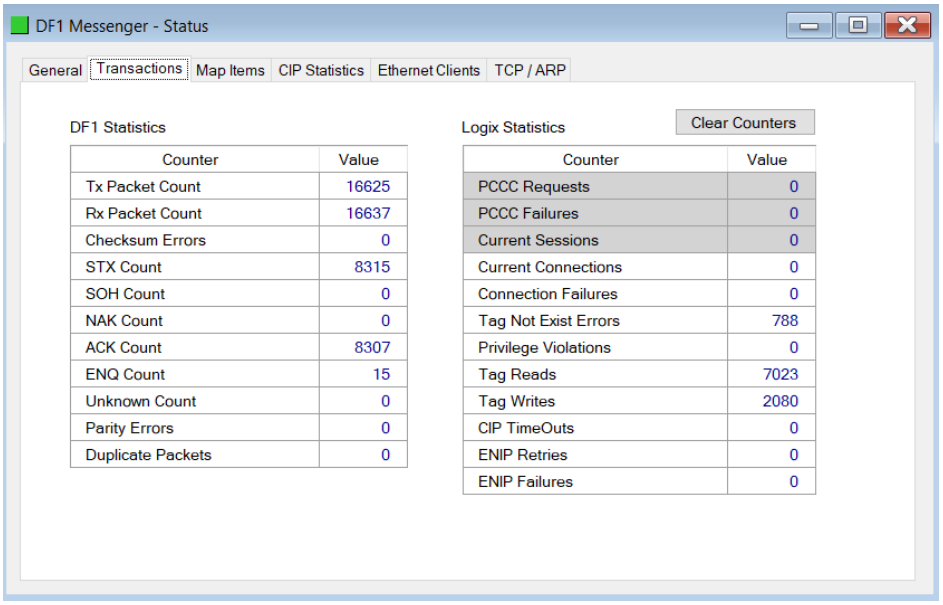


Figure 5.5 – Status monitoring - Transactions

Statistic	Description
Tx Packet Count	The number of DF1 packets sent by the module.
Rx Packet Count	The number of DF1 packets received by the module.
Checksum Errors	The number of corrupted DF1 packets received by the module.
STX Count	The number of DF1 STX (Start of Text) delimiters received by the module.
SOH Count	The number of DF1 SOH (Start of Header) delimiters received by the module.
NAK Count	The number of NAK (Negative Acknowledge) DF1 packets received by the module.
ACK Count	The number of ACK (Acknowledge) DF1 packets received by the module.
ENQ Count	The number of ENQ (Enquiry) DF1 packets received by the module.
Unknown Count	The number of unknown packets received by the module.
Parity Errors	The number of bytes with parity errors received by the module.
Duplicate Packets	The number of duplicate packets received by the module.

Table 5.3 – DF1 statistics

The following PCCC statistics are not relevant for the PLX51-DF1-MSG.

Statistic	Description
PCCC Requests	The number of EtherNet/IP PCCC requests that have been sent to a Logix controller.
PCCC Failures	The number of failed EtherNet/IP PCCC responses that have been received by the PLX51-DF1-MSG from a Logix controller.
Current Sessions	The current number of open EtherNet/IP PCCC sessions.

Table 5.4 – PCCC statistics

The following Tag Mapping statistics are only relevant when the module is running in either DF1 Slave or Scheduled Tag mode.

Statistic	Description
Current Connections	The number of current open class 3 connections.
Connection Failures	The number of failed attempts at establishing a class 3 connection with a Logix controller.
Tag Not Exist Errors	The number of tag read and tag write transactions that failed due to the destination tag not existing.
Privilege Violation Errors	The number of tag read and tag write transactions that failed due to a privilege violation error. This may be caused by the External Access property of the Logix tag being set to either None or Read Only.
Tag Reads	The number of tag read transactions executed by the PLX51-DF1-MSG module.
Tag Writes	The number of tag write transactions executed by the PLX51-DF1-MSG module.
CIP Timeout	This count increases when no response was received for the Tag Read/Write.
ENIP Retries	This count increases when no response was received from the Logix Controller by the time the ENIP timeout is reached.
ENIP Failures	This count increases when the ENIP Retry Limit is reached and no response has been received from the Logix Controller.

Table 5.5 – Tag Mapping statistics

5.2.3 Map Items Tab

The *Map Items* tab displays the successful packet counts processed by each mapping item. If an item count changes, the *Success Count* field will be displayed with a green background for approximately 3 seconds. This provides quick visual feedback of the currently active items.

The fields in the *Map Items* tab adjust to suit the appropriate mode.

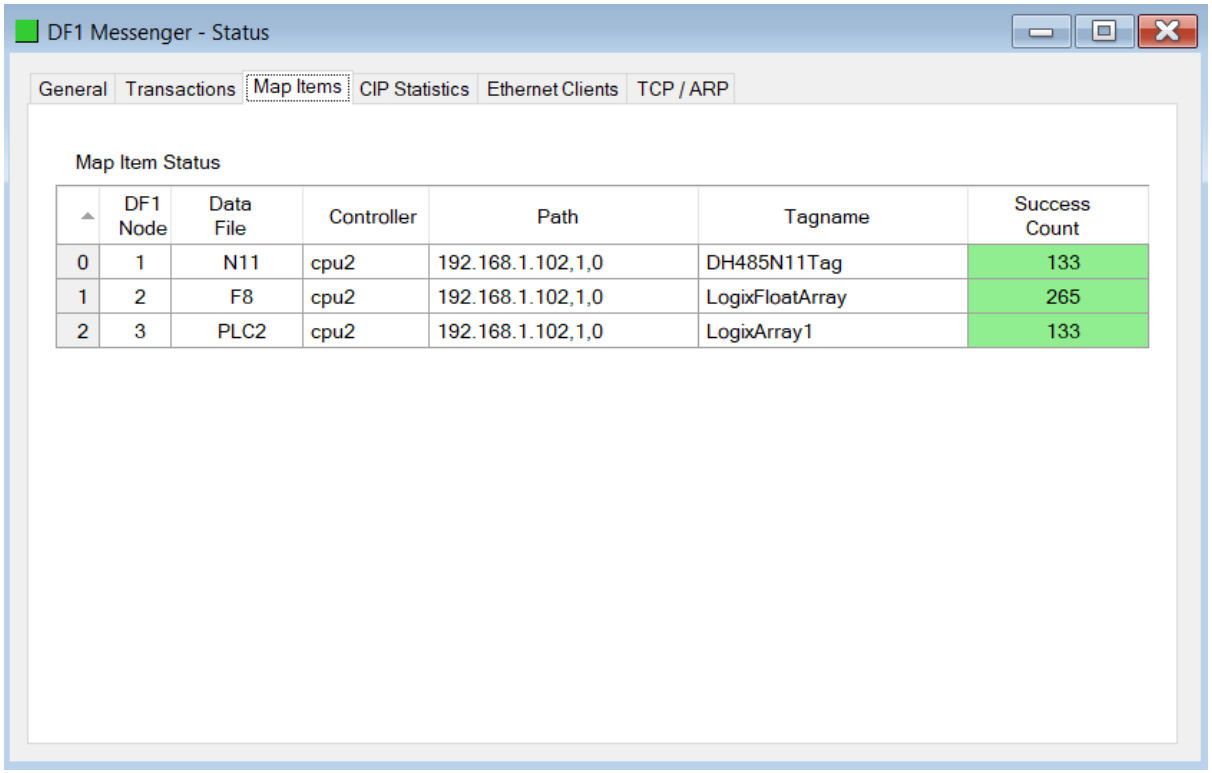


Figure 5.6 – Map Item status

5.3 DF1 Packet Capture

The module provides the ability to capture the DF1 traffic for analysis.

To invoke the capture, double-click on the **DF1 PACKET CAPTURE** selection in the Project Explorer tree.

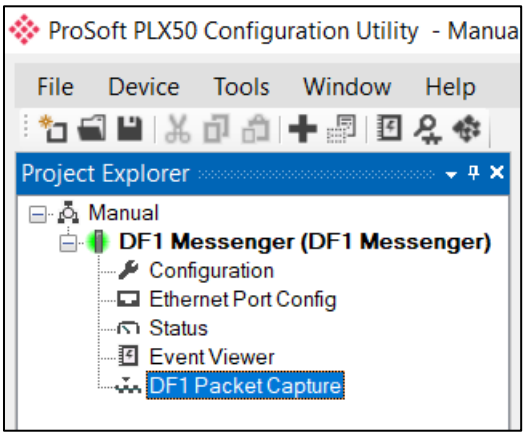


Figure 5.7 – Selecting DF1 Packet Capture

The *DF1 Packet Capture* dialog opens and automatically starts capturing all DF1 packets.

Note: The module keeps a circular buffer of the last 20 DF1 packets, there may be up to 20 packets in the capture that were received / sent before the capture was initiated.

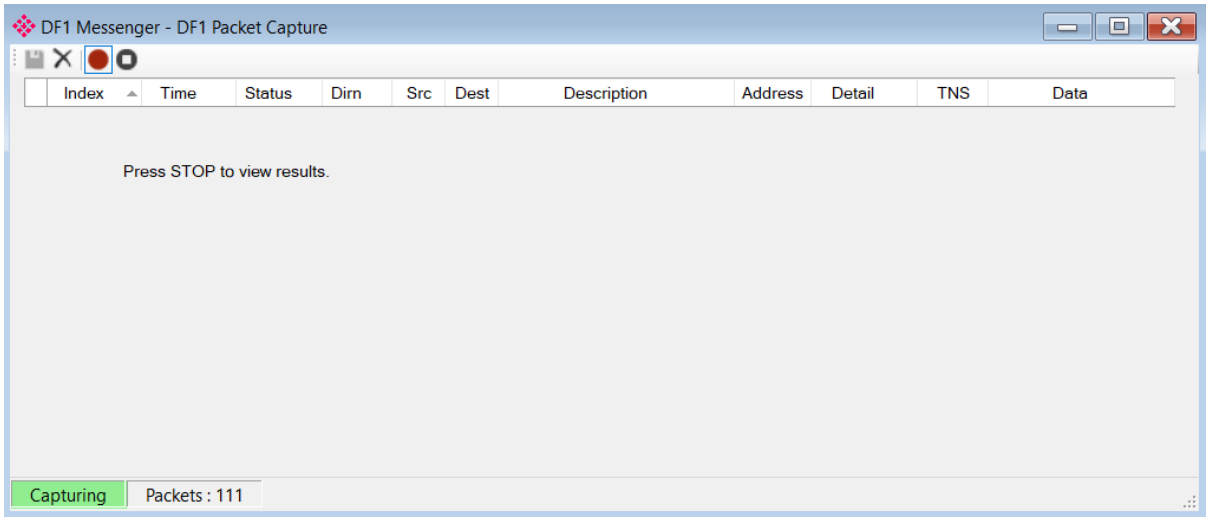
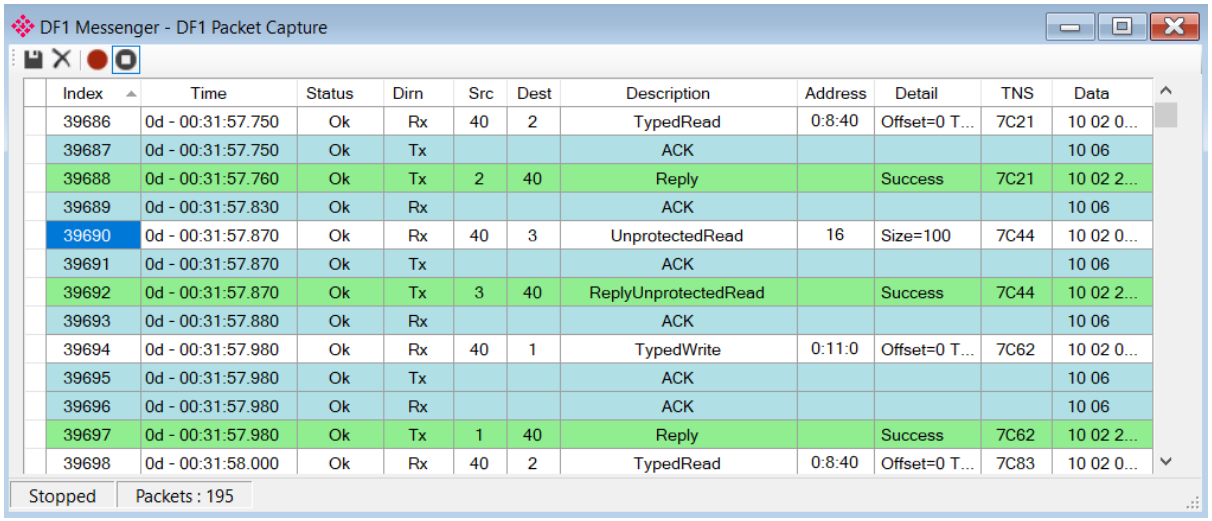


Figure 5.8 – DF1 packet capture

To display the captured DF1 packets, the capture process must first be stopped by pressing the **STOP** button.



Index	Time	Status	Dirn	Src	Dest	Description	Address	Detail	TNS	Data
39686	0d - 00:31:57.750	Ok	Rx	40	2	TypedRead	0:8:40	Offset=0 T...	7C21	10 02 0...
39687	0d - 00:31:57.750	Ok	Tx			ACK				10 06
39688	0d - 00:31:57.760	Ok	Tx	2	40	Reply		Success	7C21	10 02 2...
39689	0d - 00:31:57.830	Ok	Rx			ACK				10 06
39690	0d - 00:31:57.870	Ok	Rx	40	3	UnprotectedRead	16	Size=100	7C44	10 02 0...
39691	0d - 00:31:57.870	Ok	Tx			ACK				10 06
39692	0d - 00:31:57.870	Ok	Tx	3	40	ReplyUnprotectedRead		Success	7C44	10 02 2...
39693	0d - 00:31:57.880	Ok	Rx			ACK				10 06
39694	0d - 00:31:57.980	Ok	Rx	40	1	TypedWrite	0:11:0	Offset=0 T...	7C62	10 02 0...
39695	0d - 00:31:57.980	Ok	Tx			ACK				10 06
39696	0d - 00:31:57.980	Ok	Rx			ACK				10 06
39697	0d - 00:31:57.980	Ok	Tx	1	40	Reply		Success	7C62	10 02 2...
39698	0d - 00:31:58.000	Ok	Rx	40	2	TypedRead	0:8:40	Offset=0 T...	7C83	10 02 0...

Figure 5.9 – DF1 Packet Capture complete

The captured DF1 packets are tabulated as follows:

Statistic	Description
Index	The packet index, incremented for each packet sent or received.
Time	The elapsed time since the module powered up.
Status	The status of the packet. Received packets are checked for valid DF1 constructs and valid checksums.
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
Src	DF1 node address of the message source.
Dest	DF1 node address of the message destination.
Description	Brief description of the packet, usually the command.
Address	The string representing a PLC data address, where applicable.
Detail	Additional details associated with command.
TNS	Transaction number used to match the request and reply messages.
Data	The packet's raw data displayed in space delimited hex.

Table 5.6 – DF1 Packet Capture fields

The packet capture can be saved to a file for further analysis by selecting the **SAVE** button on the toolbar. Previously saved DF1 Packet Capture files can be viewed by selecting the **DF1 PACKET CAPTURE VIEWER** option in the *Tools* menu.

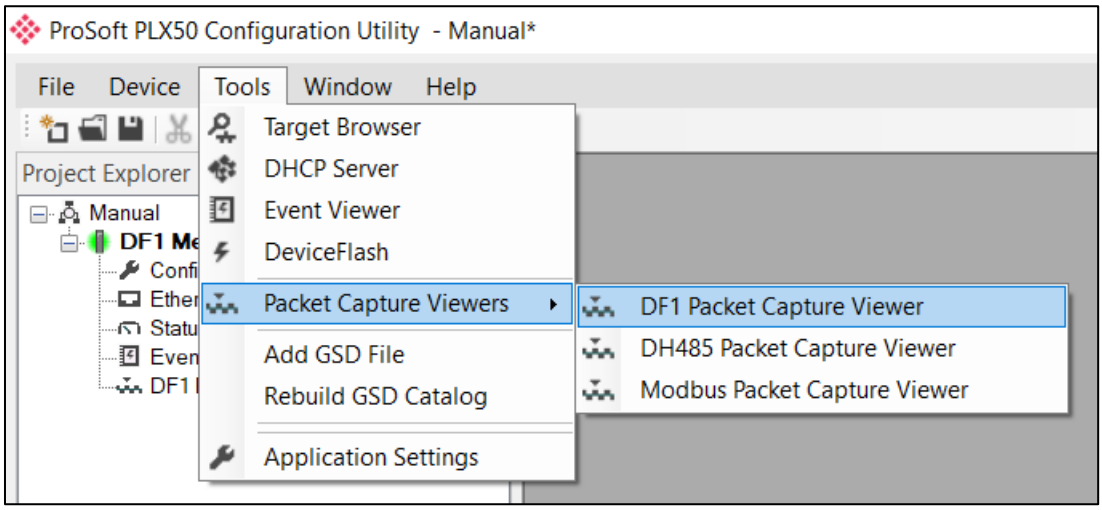


Figure 5.10 – Selecting the DF1 Packet Capture Viewer

5.4 Module Event Log

The PLX51-DF1-MSG module logs various diagnostic records to an internal event log. These logs are stored in non-volatile memory and can be displayed using the PLX50 Configuration Utility or via the web interface. To view the logs in the PLX50 Configuration Utility, select the **EVENT VIEWER** option in the Project Explorer tree.

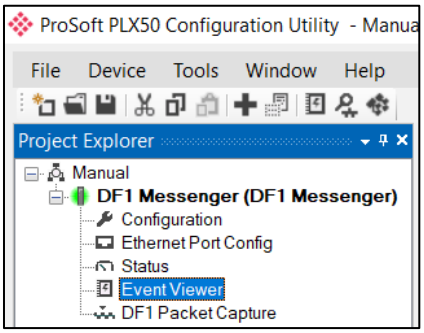
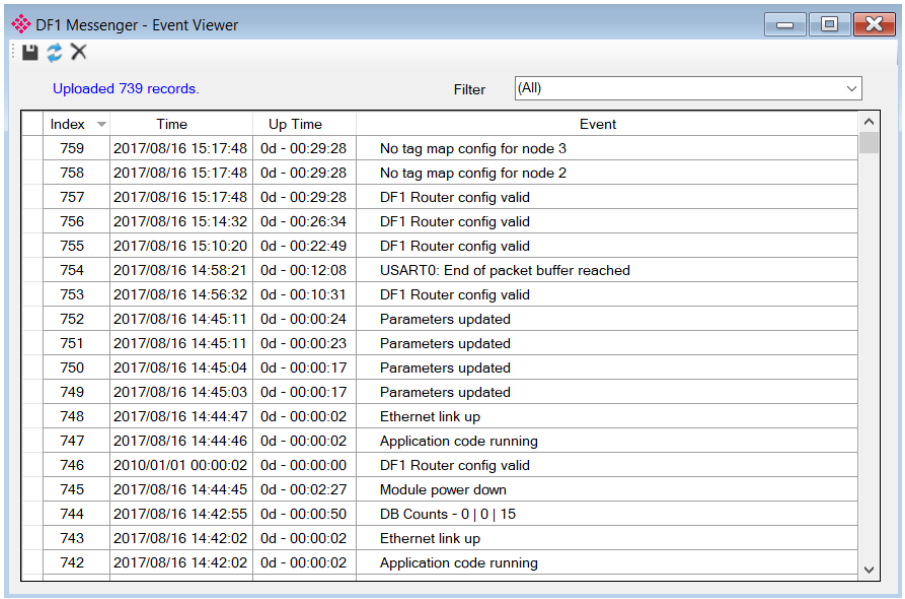


Figure 5.11 – Selecting the module Event Log

The *Event Viewer* dialog opens and automatically reads all the events from the module.

The log entries are displayed with the latest record at the top. Custom sorting is achieved by double-clicking on the column headings.



Index	Time	Up Time	Event
759	2017/08/16 15:17:48	0d - 00:29:28	No tag map config for node 3
758	2017/08/16 15:17:48	0d - 00:29:28	No tag map config for node 2
757	2017/08/16 15:17:48	0d - 00:29:28	DF1 Router config valid
756	2017/08/16 15:14:32	0d - 00:26:34	DF1 Router config valid
755	2017/08/16 15:10:20	0d - 00:22:49	DF1 Router config valid
754	2017/08/16 14:58:21	0d - 00:12:08	USART0: End of packet buffer reached
753	2017/08/16 14:56:32	0d - 00:10:31	DF1 Router config valid
752	2017/08/16 14:45:11	0d - 00:00:24	Parameters updated
751	2017/08/16 14:45:11	0d - 00:00:23	Parameters updated
750	2017/08/16 14:45:04	0d - 00:00:17	Parameters updated
749	2017/08/16 14:45:03	0d - 00:00:17	Parameters updated
748	2017/08/16 14:44:47	0d - 00:00:02	Ethernet link up
747	2017/08/16 14:44:46	0d - 00:00:02	Application code running
746	2010/01/01 00:00:02	0d - 00:00:00	DF1 Router config valid
745	2017/08/16 14:44:45	0d - 00:02:27	Module power down
744	2017/08/16 14:42:55	0d - 00:00:50	DB Counts - 0 | 0 | 15
743	2017/08/16 14:42:02	0d - 00:00:02	Ethernet link up
742	2017/08/16 14:42:02	0d - 00:00:02	Application code running

Figure 5.12 – Module Event Log

The log can also be stored to a file for future analysis, by selecting the **SAVE** button in the tool menu.

To view previously saved files, use the **EVENT LOG VIEWER** option under the *Tools* menu.

5.5 Web Server

The PLX51-DF1-MSG provides a web server allowing a user without the PLX50 Configuration Utility or RSLogix 5000 to view various diagnostics of the module. This includes Ethernet parameters, system event log, advanced diagnostics, and application diagnostics (DF1 diagnostics).

Note: The web server is read-only and thus no parameters or configuration can be altered from the web interface.

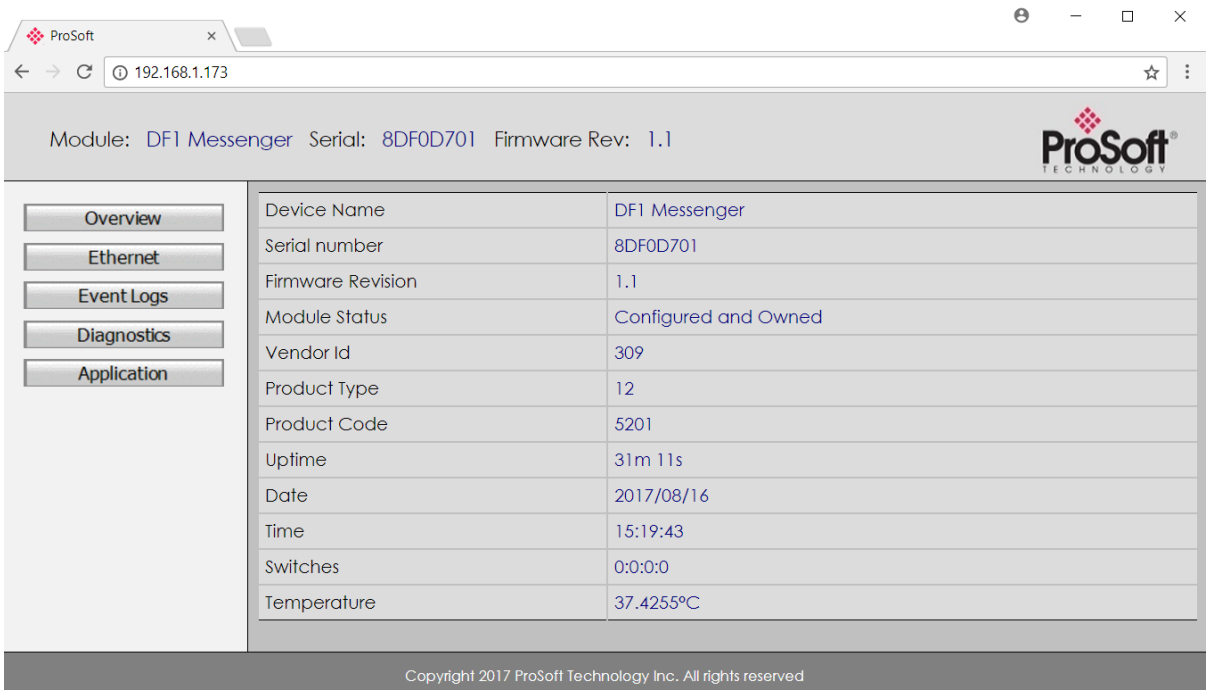


Figure 5.13 – Web interface

6 Technical Specifications

6.1 Dimensions

Below are the enclosure dimensions as well as the required DIN rail dimensions. All dimensions are in millimeters.

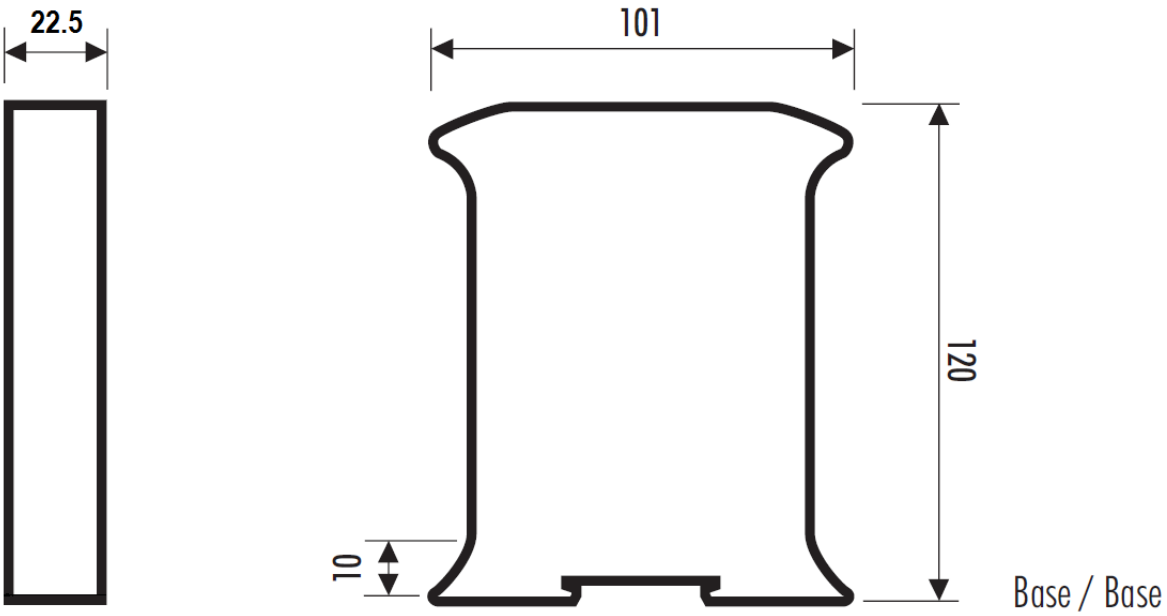


Figure 6.1 – PLX51-DF1-MSG enclosure dimensions

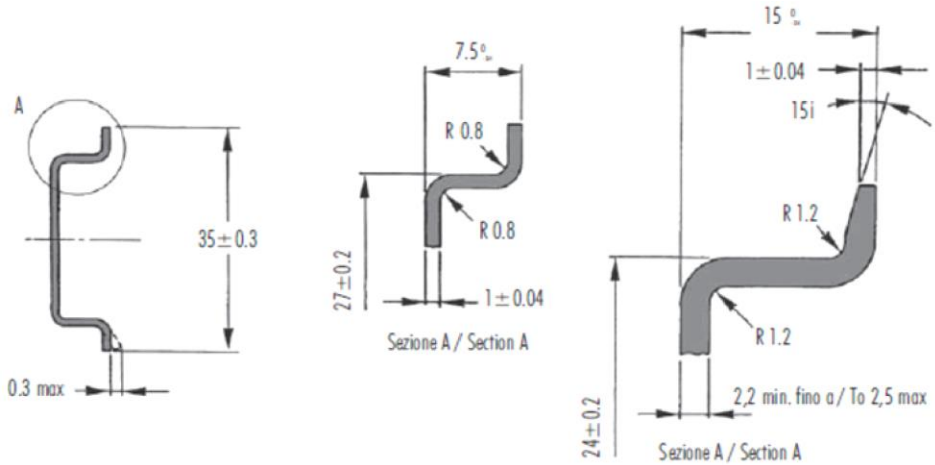


Figure 6.2 – Required DIN dimensions

6.2 Electrical

Specification	Rating
Power requirements	Input: 10 to 28V DC, (70 mA @ 24 VDC / 130 mA @ 10 VDC)
Power consumption	1.7 W
Connector	3-way terminal
Conductors	24 to 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20°C to 70°C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 6.1 – Electrical specification

6.3 Ethernet

Specification	Description
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 20
TCP connections	Max 20
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes

Table 6.2 – Ethernet specification

6.4 DF1

Specification	Rating
Connector	4-way terminal
Conductor	24 to 18 AWG
Isolation voltage	2.5 kV
Protocol	DF1 Full Duplex, DF1 Half Duplex, DF1 Radio Modem
BAUD	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	None, Even, Odd
Data bits	8
Stop bits	1
Error detection	CRC, BCC
Embedded response	Auto, On
DF1 Slave mode	Max 20 mapping items
Scheduled Tag mode	Max 20 mapping items
DF1 Slave Mode Message Support	PLC-5 Typed Read, PLC-5 Typed Write, SLC Typed Read, SLC Typed Write, PLC-2 Unprotected Read, PLC-2 Unprotected Write, PLC-2 Unprotected Bit Write
Scheduled Tag Mode Message Support	PLC-5 Typed Read, PLC-5 Typed Write, SLC Typed Read, SLC Typed Write

Table 6.3 – DF1 specification

6.5 Agency Approvals and Certifications

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

7 Support, Service & Warranty

7.1 Contacting Technical Support

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

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

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

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

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

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

7.2 Warranty Information

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