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ProLinx[®]
DFCM
ProLinx Gateway
DF1 Master/Slave

October 15, 2010

DRIVER MANUAL

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DFCM Driver Manual

October 15, 2010

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- A** WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;
- B** WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES
- C** WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
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Add **-WEB** to the standard ProLinx part number. For example, **5201-MNET-MCM-WEB**.

Markings

Electrical Specifications

Label Markings

CL I Div 2 GPs A, B, C, D

II 3 G

Ex nA nL IIC X

0°C ≤ Ta ≤ 60°C

II – Equipment intended for above ground use (not for use in mines).

3 – Category 3 equipment, investigated for normal operation only.

G – Equipment protected against explosive gasses.

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cULus	ISA 12.12.01 Class I, Div 2 Groups A, B, C, D
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1 Functional Overview

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The DF1 Master/Slave Protocol driver can exist in a single port (DFCM) or a multiple port (DFCM4) implementation. In either case, the driver can be configured on an individual port basis to operate as either a DF1 Master or a Slave. Each port is independently configured for communication on a DF1 network and interfaces with the internal database in the module.

1.1 Master/Slave Serial Port(s)

The ProLinx module supports the DF1 protocol as a Master or Slave on up to four ports. Each of the ports is individually configurable.

The relationship between the port labeling on the front of the ProLinx module and the application is as follows:

Port Label	Function
Debug	Debug/Configuration
Port 0	DF1 Port 0
Following ports only exist on multiple port units	
Port 1	DF1 Port 1
Port 2	DF1 Port 2
Port 3	DF1 Port 3

One or more DF1 protocol master ports can be configured on the module to continuously interface with DF1 slave devices over a serial communication interface (RS-232, RS-422 or RS-485). Each port is configured independently. Support for half-duplex (master-slave) and full-duplex (point-to-point) DF1 links are provided on the ports. User defined commands determine the commands to be issued on each port. Up to 100 commands can be defined for each port. Data read from the devices are placed in the virtual database. Any write requests for the DF1 slave devices are sourced with data from the virtual database.

The module can be configured to place slave devices that are not responding to commands from the master ports at a lower priority. If the module recognizes that a slave device has failed to respond to a message after the user defined retry count, it will mark the slave as "in communication failure" and set the error delay counter to the specified value. Each time the module encounters this slave in the command list, the counter will be decremented. When the value reaches zero, the slave will be placed in an active status. This facility can improve communication throughput on the network.

If the DF1 master port is configured to support the DF1 half-duplex protocol, the master port can be used to route messages between slaves. Peer-to-peer communication is accomplished by the master constantly polling all the slaves on the network and relaying the messages received. The slaves must contain ladder logic with MSG commands to generate and accept messages. This routing can be used in conjunction with the normal command processing discussed above.

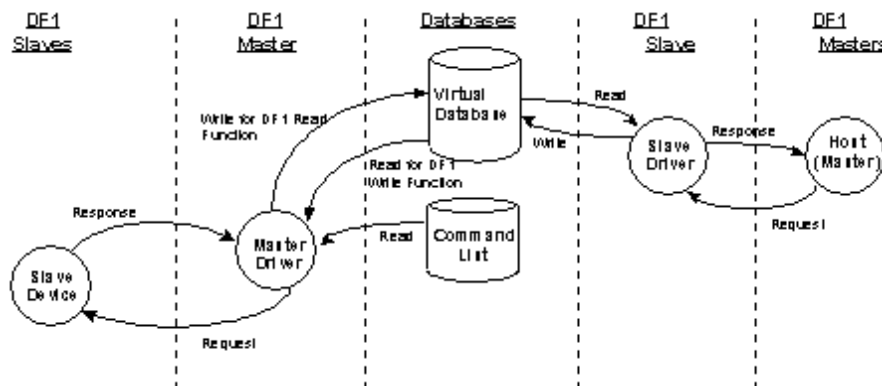
DF1 slave devices can be emulated on the module to interface with remote DF1 master devices. Each port is configured independently. Support for half-duplex (master-slave) and full-duplex (point-to-point) DF1 links are provided on the ports. Simulation of a selected set of functions from the basic, PLC5 and SLC command sets are supported. Virtual files are mapped to the internal database in the module to provide support of the PLC5 and SLC command sets.

1.2 Module Internal Database

The internal database is central to the functionality of the module. This database is shared between all the ports on the module and is used as a conduit to pass information from one device on one network to one or more devices on another network. This permits data from devices on one communication port to be viewed and controlled by devices on another port. In addition to data from the slave and master ports, status and error information generated by the module can also be mapped into the internal database.

1.2.1 DF1 Serial Port Driver Access to Database

The following diagram describes the flow of data between the serial port drivers and the internal database.



The Master driver uses the database in two ways:

- 1 A read command issued to a slave device by the master driver will return the slave data into the internal database
- 2 A write command issued to a slave device by the master driver uses the data in the internal database to write to the slave device

The slave driver accesses data from the internal database. External DF1 master devices can monitor and control data in this database through these slave port(s). Setup of the slave ports only requires the CFG file.

2 Protocol Functional Specifications

2.1 Functional Specifications - DF1 Master/Slave

The DF1 Master/Slave Protocol driver provides extensive support for both Master and Slave implementations of the protocol. The serial port on the module is user-configurable to support the DF1 protocol (Master or Slave, Error Checking, Baud rate, and so on).

DF1 General Specifications

Internal Database	10000 registers (words) available
Communication parameters	Local Station ID: 0 to 254 Ports 1 to 3 Baud Rate: 110 to 115K baud Stop Bits: 1 Data Bits: 8 Parity: None, Even, Odd RTS Timing delays: 0 to 65535 milliseconds
Error Checking	BCC and CRC
Miscellaneous	Full hardware handshaking control, providing radio, smart modem and multi-drop support Floating point data supported

DF1 Master

The ports on the module can be individually configured as Master ports. When configured in master mode, the DFCM module is capable of reading and writing data to remote DF1 devices.

DF1 Modes	Full-Duplex - Master (Module generates commands) Half-Duplex - Polling
Command List	Up to 100 commands per Master port, each fully-configurable for function, slave address, register to/from addressing and word/bit count
Polling of Command List	User-configurable polling of commands, including disabled, continuous, and on change of data (write only)
Configurable Parameters per Master port	Min Command Delay Number of Commands Response Timeout Retry Count Slave List Error Pointer

DF1 Slave

The ports on the module can be individually configured to support the Slave mode of the DF1 protocol. When in slave mode, the module can accept DF1 commands from a master to read/write data stored in the module's internal registers.

DF1 Modes	Full Duplex - Slave (not peer mode)
	Half Duplex - Polled
Configurable parameters per slave port	Data Table File Start (File N[x] 0 to 999)
	Data Table File Size (1 to 1000 words)
	Data Table location in database (0 to 3999)

2.2 Serial Port Specifications

Type	Specifications
Serial Ports	
Serial Port Cables (DB-9M Connector)	One DIN to DB-9M cable included per configurable serial port
Port 0	RS-232/422/485: jumper selectable DB-9M connector Hardware Handshaking: RTS,CTS,DTR,DSR,DCD
Port 1, 2, 3 Protocol Ports 1, 2, 3 (Only if product includes extra serial ports)	RS-232/422/485: Software configurable DB-9M connector Hardware Handshaking: RTS,CTS,DTR,DSR,DCD
Serial Port Isolation	2500V RMS port-to-port isolation per UL 1577. 3000V DC min. port to ground and port to logic power isolation.
Serial Port Protection	RS-485/422 port interface lines TVS diode protected at +/- 27V standoff voltage. RS-232 port interface lines fault protected to +/- 36V power on, +/- 40V power off.

3 DFCM Slave Driver Operation

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This section discusses several characteristics in the module's configuration and operation that are unique to the emulated DF1 slave ports. In order to support several types of DF1 devices, the slave ports require additional configuration parameters. If the basic command set is used, these features need not be considered. These features must be considered if the module has the potential of receiving a PLC5 or SLC command function.

3.1 File Simulation

The PLC5 and SLC command sets require the use of data files. These entities are simulated in the module and are configured by the user. Data in these processors are stored in files such as N10:, F20: and A25:. Each file has a defined element size and length. The module simulates these files by assigning each element to a word-size (two bytes) register in the module's database, and each file is set to a fixed, user-defined length. These files are mapped to the database under user control. A discussion of each parameter related to the file simulation is given below along with an example.

[SECTION]/Item	Range	Description
[DF1 PORT 0]		Configuration Header for Port 0
[DF1 PORT 1]		Configuration Header for Port 1
[DF1 PORT 2]		Configuration Header for Port 2
[DF1 PORT 3]		Configuration Header for Port 3
First File:		This parameter defines the first file number recognized by the module. If the value is set to 7, all requests for files less than 7 will be returned as an error message. Files greater than or equal to 7 will be processed as long as the elements referenced are valid for the database. If a request is received for an element beyond the last register in the database, the module will return an error message.
File Size:		This parameter defines a constant size for all files simulated by the module. If the parameter is set to 100, all files will contain 100 elements. If the First File parameter is set to 7 and the File Size parameter is set to 100, all files (N7:, N8:, N9...) will contain 100 elements.
File Offset:		This parameter defines the starting address in the module's internal database to be associated with the first element in the first file to be simulated. For example, if the First File parameter is set to 7 and the File Offset parameter is set to 1000, file element N7:0 will correspond to database register 1000 and N7:100 will correspond to register 1100.

3.2 Example Slave Port Application

The example given below assumes that both ports 0 and 1 are configured as slave ports using the following table of parameters:

Parameter	Port 0	Port1
First File	7	10
File Size	200	1000
File Offset	1000	2000

The following illustration shows the file simulation feature in the module using the configuration defined above:

Port 0		Database Register		Port 1
		0		
		200		
		400		
		600		
		800		
N7:0	→	1000		
N8:0	→	1200		
N9:0	→	1400		
N10:0	→	1600		
N11:0	→	1800		
N12:0	→	2000	←	N10:0
N13:0	→	2200	←	N10:200
N14:0	→	2400	←	N10:400
N15:0	→	2600	←	N10:600
N16:0	→	2800	←	N10:800
N17:0	→	3000	←	N11:0
N18:0	→	3200	←	N11:200
N19:0	→	3400	←	N11:400
N20:0	→	3600	←	N11:600
N21:0	→	3800	←	N11:800

3.3 Slave Port Command Support

The current version of the module will respond to the following list of DF1 commands. Future releases may support more functions as required by user applications.

4 Communication Port Cables

This section contains information on the cable and pin assignments for the ProLinux module's serial ports (RS-232/422/485). The ProLinux module will come with one to five serial ports, depending on the configuration purchased. In all cases, the protocol serial ports will have the same pinouts.

Example: The 5202-MNET-MCM4 module contains five serial communication ports; four configurable protocol application ports and one Configuration/ Debug port. The 5201-MNET-MCM module contains two serial communication ports; one configurable protocol application port and one Configuration/Debug port.

Each physical serial port has an eight-pin Mini-DIN jack connector. A six-inch Mini-DIN-8Male to DB-9Male adapter cable is provided for each serial port. The DB-9M provides connections for RS-232, wired as Data Terminal Equipment (DTE), RS-422 and RS-485. The diagrams in the following topics detail the pin assignments for several possible electrical interface connections.

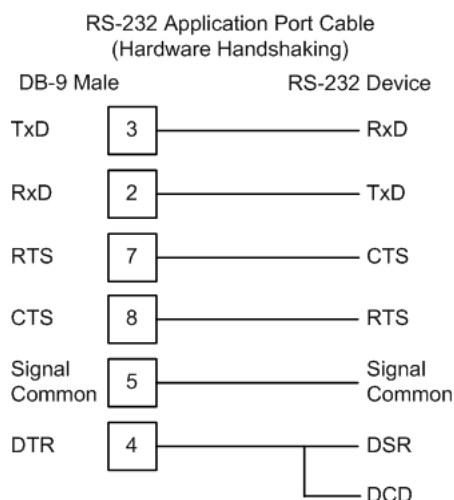
4.1 Serial Port Cable Connections: Multiple Port Units

The relationship between the port labeling on the front of the ProLinx module and the application is as follows:

The following ports only exist on units with more than one application serial port	
Port 1	Application Port 1 (RS-232, RS-422, or RS-485 Modes Available)
Port 2	Application Port 2 (RS-232, RS-422, or RS-485 Modes Available)
Port 3	Application Port 3 (RS-232, RS-422, or RS-485 Modes Available)

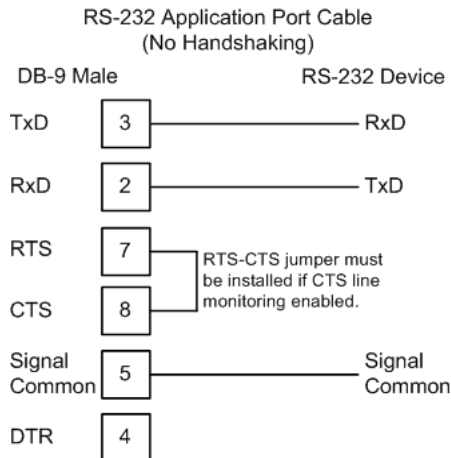
4.1.1 Port 0, 1, 2, 3: RS-232 - Null Modem (DTE with Hardware Handshaking)

This type of connection is used when the device connected to the module requires hardware handshaking (control and monitoring of modem signal lines; Use CTS (page 34) parameter set to **YES**).



4.1.2 Port 0, 1, 2, 3: RS-232 - Null Modem (DTE without Hardware Handshaking)

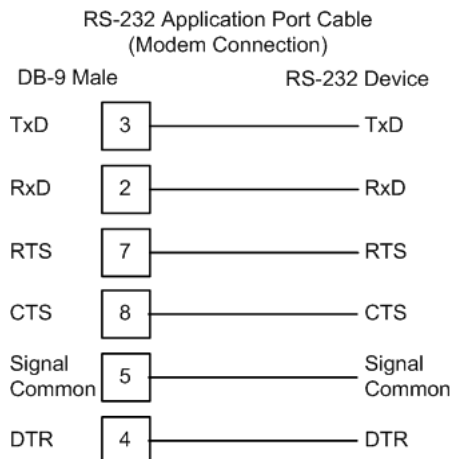
This type of connection can be used to connect the module to a computer or field device communication port.



Note: If the port is configured with the *Use CTS* (page 34) set to **YES**, then a jumper is required between the RTS and the CTS line on the module connection.

4.1.3 Port 0, 1, 2, 3: RS-232 - DTE to DCE Modem Connection

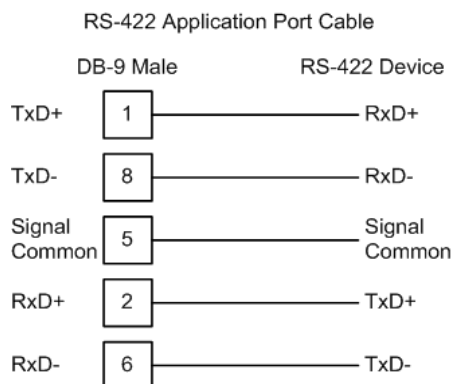
This type of connection is required between the module and a modem or other communication device.



The *Use CTS Line* (page 34) parameter for the port configuration should be set to **YES** for most modem applications.

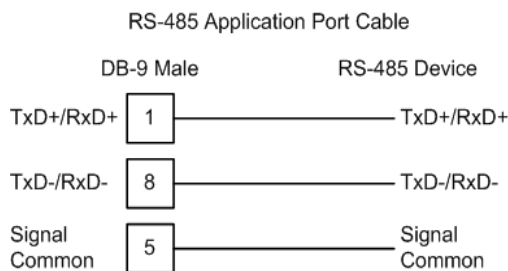
4.1.4 Port 0, 1, 2, 3: RS-422 Interface Connections

The following illustration applies when the RS-422 interface is selected.



4.1.5 Port 0, 1, 2, 3: RS-485 Interface Connections

The following illustration applies when the RS-485 interface is selected.



NOTE: This type of connection is commonly called a *RS-485 half-duplex, 2-wire* connection. If you have RS-485 4-wire, full-duplex devices, they can be connected to the module's serial ports by wiring together the TxD+ and RxD+ from the two pins of the full-duplex device to Pin 1 on the module and wiring together the TxD- and RxD- from the two pins of the full-duplex device to Pin 8 on the module. As an alternative, you could try setting the module to use the RS-422 interface and connect the full-duplex device according to the RS-422 wiring diagram (page 24). For additional assistance, please contact ProSoft Technical Support.

5 LED Indicators

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LED indicators provide a means of monitoring the operation of the unit and individual ports and are extremely useful for troubleshooting. In addition to port monitoring, system configuration errors, application errors, and fault indications are all monitored with LEDs providing alerts to possible problems. The *ProLinux Reference Guide* provides more information on LEDs and troubleshooting.

5.1 Base Module LEDs

LED	State	Description
Power	Off	Power is not connected to the power terminals or source is insufficient to properly power the module (minimum required is 800mA at 24 Vdc)
	Green Solid	Power is connected to the power terminals.
Fault	Off	Normal operation.
	Red Solid	A critical error has occurred. Program executable has failed or has been user-terminated and is no longer running. Press Reset p/b or cycle power to clear error. If not, use the Debug procedures described later in this manual.
Cfg	Off	Normal operation.
	Amber Solid	The unit is in configuration mode. The configuration file is currently being downloaded or, after power-up, is being read, the unit is implementing the configuration values, and initializing the hardware. This will occur during power cycle, or after pressing the reset button. It also occurs after a cold/warm boot command is received.
Err	Off	Normal operation.
	Flashing	An error condition has been detected and is occurring on one of the application ports. Check configuration and troubleshoot for communication errors.
	Solid Red	This error flag is cleared at the start of each command attempt (Master/Client) or on each receipt of data (slave/adaptor/server); so, if this condition exists, it indicates a large number of errors are occurring in the application (due to bad configuration) or on one or more ports (network communication failures).

5.2 LEDs for Serial DF1 Protocol Ports

Troubleshooting the operation of the serial DF1 protocol ports can be performed using several methods.

The first and quickest is to scan the LEDs on the module to determine the existence and possibly the cause of a problem. This section provides insight into the operation of the Serial Port status LEDs.

Some ProLinx modules will include three extra serial ports. Each of these serial ports has two LEDs indicating status.

LED	Color	Description
Port 0 - ACT	Off	No activity on the port.
Port 1 - ACT	Green	The port is either actively transmitting or receiving data
Port 2 - ACT	Flash	
Port 3 - ACT		
Port 0 - ERR	Off	Normal state. When off and Port Active led is indicating activity, there are no communication errors
Port 1 - ERR		
Port 2 - ERR	Amber	Activity on this led indicates some communication error was detected, either during transmit or receive. To determine the exact error, connect the Debug terminal to the Debug port.
Port 3 - ERR	On or Flashing	

Note that the meaning of the other LEDs on the unit can be found in the Product Manual for the specific module that is being debugged.

5.3 DFNT Pass-Through (Debug) Port LEDs

LED	State	Description
Fault	Off	Normal operation.
	Red Solid	If the CFG LED is on, the Debug/Configuration mode is active on the Debug port. If the CFG LED is off, a critical error has occurred. Program executable has failed or has been user-terminated and is no longer running. Press RESET p/b or cycle power to clear error. If not, use the Debug procedures described later in this manual.
CFG	Off	Normal operation.
	Amber Solid	If the Fault LED is on, the Debug/Configuration Mode is active on the Debug port. If the Fault LED is off, the unit is in the configuration mode. The configuration file is being read and the unit is implementing the configuration values and initializing the hardware. This will occur during power cycle, or after pressing RESET pushbutton. It also occurs after a cold/warm boot command is received.

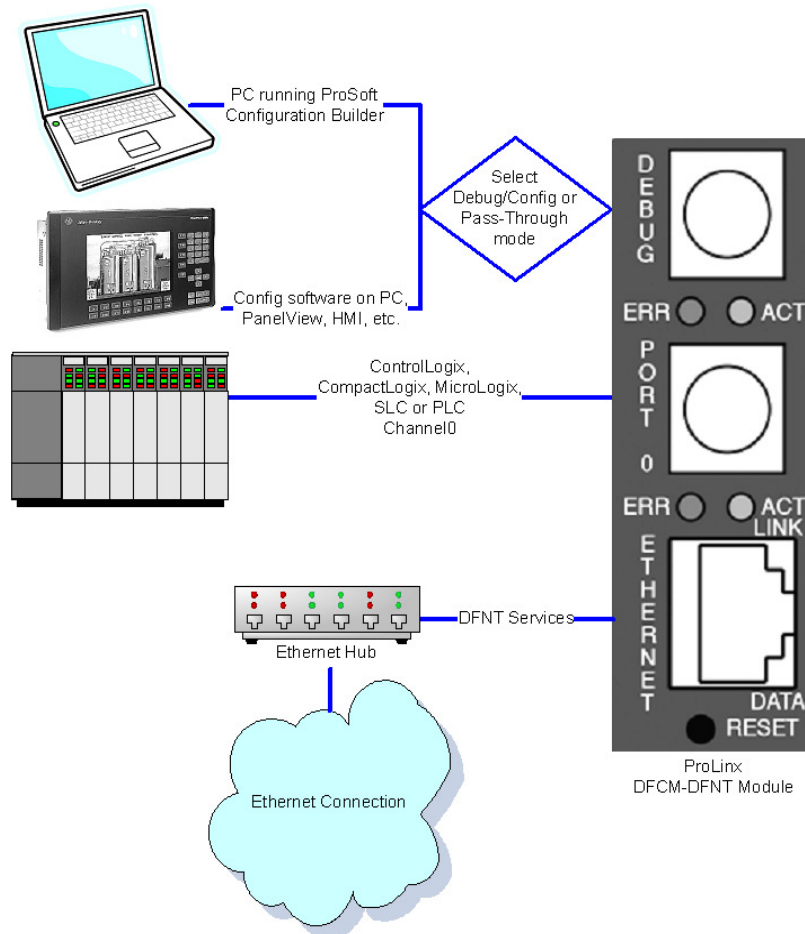
6 DFCM Protocol Configuration

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The following is excerpted from a full configuration file showing typical examples of the DF1 port configurations. In this example, one port has been setup as a master and the other as a slave. This example should serve only to give the programmer an idea of how a CFG file is structured. Complete configuration files are shipped on each unit and are available for download from the www.prosoft-technology.com web site for each of the products. These files can serve as an excellent starting point for any project.

6.1 [DF1 Pass-Through Port]



This section describes the use and configuration of the pass-through mode on the Debug/Configuration port of DFCM based modules.

Port 0 can operate either as:

- Pass-Through from the Debug to Port 0
- Standard Debug/Configuration operation on the Debug Port.

To enable Pass-Through mode:

- 1 Port 0 on the module must be configured as a DF1 master port using the DF1 full-duplex protocol.
- 2 The Enabled parameter in the [Pass-Through Port] Section must be set to "Yes"

The communication parameters for the two ports need not match, as the module's program will convert the messages. The illustration above displays the use of the pass-through port and Debug/Configuration port.

6.1.1 Configuration Values

The module must be configured properly in order to use the pass-through mode. Port 0 must be configured as a DF1 master port using the full-duplex protocol. The termination type (BCC or CRC) set on Port 0 is used for the pass-through port. The module's configuration file must contain the **[Pass-Through Port]** section with the Enabled parameter set to "Yes".

[Section]/Item	Range	Description
[Pass-Through Port]		Start header for DF1 pass-through port definition.
Enabled:	Yes or No	This parameter specifies if the pass-through port is to be utilized in the application. Additionally, Port 0 must be configured correctly. Set the parameter to Yes to enable the feature and No to disable feature.
Local Station ID:	0 to 255	This parameter specifies the local station ID for all DF1 messages sent to this port. A value of 255 will cause the slave address to be ignored and the address issued in the master request packet to use as the slave ID. The application will only accept messages with this node address.
Protocol:	Full Duplex or Half Duplex	Full duplex, Half-duplex
Baud Rate:		This is the baud rate to be used on the port. Enter the baud rate as a value. For example, to select 19K baud, enter 19200.
Parity:	None, Odd, or Even	This is the Parity code to be used for the port. The coded values are as follows: None, Odd, Even.
Data Bits:	7 or 8	This parameter sets the number of data bits for each word used by the protocol.
Stop Bits:	1 or 2	This parameter sets the number of stop bits for each data value sent.
RTS On:	0 to 65535	This parameter sets the number of milliseconds to delay after RTS is asserted before the data will be transmitted.
RTS Off:	0 to 65535	This parameter sets the number of milliseconds to delay after the last byte of data is sent before the RTS modem signal will be set low.
Use CTS Line:	Yes or No	This parameter specifies if the CTS modem control line is to be used. If the parameter is set to N, the CTS line will not be monitored. If the parameter is set to Yes, the CTS line will be monitored and must be high before the module will send data. Normally, this parameter is required when half-duplex modems are used for communication (2-wire).
Request Timeout:	0 to 65535	This parameter specifies the number of milliseconds to wait for a complete request message. The timer is started after the DLE-STX character sequence is received for the full-duplex protocol or the DLE-SOH sequence for the half-duplex protocol. If the timer expires, the current request message will be aborted.

[Section]/Item	Range	Description
Busy Timeout:	0 to 65535	This parameter specifies the number of milliseconds to wait for the DF1 master port to become available. If the DF1 master port is processing a command list request, the busy flag will be set. The flag will remain busy until the communication transaction is complete. If the port does not become available before the busy timeout expires, the message will be aborted. If the master port becomes available before this timeout expires, the request will be routed to the master port.
ACK Timeout:	0 to 65535	This parameter specifies the number of milliseconds to wait for a DLE-ACK character sequence after a response is issued.
Retry Count:	0 to 65535	This parameter specifies the number of attempts for each response message. If a message fails, it will be retried up to the count specified.

6.1.2 Switching between Pass-Through and Debug/Configuration

When the module's program is initialized, it will be set with the Debug/Configuration port in pass-through mode. A DF1 master device (that is, PanelView or HMI) or programming device (that is, PC running RSLogix software) can be connected to the Debug/Configuration port with the messages routed through the port to Port 0 on the module. The module's command polling on Port 0 will be interrupted as messages from the pass-through port are handled.

To switch the module to Debug/Configuration mode on the port, follow these steps:

- 1 Connect the terminal device (personal computer running a terminal emulator) to the Debug/Configuration port.
- 2 Start the terminal emulator software.
- 3 Change the baud rate to match the pass-through configuration.
- 4 Press and hold the **[D]** key on the keyboard until the following message appears:
Change to 57.6 Kb Baud...
- 5 Change the baud rate on the terminal emulator software to 57.6 baud.
- 6 Press **[?]** key to display the module's Debug/Configuration main menu.

The Debug/Configuration is now available. Refer to the ProLinX Reference Guide for menu commands and other information).

To return the port to pass-through mode, press **[*]** (Shift-8) on the main menu. When the message **Exiting Debug Configuration Mode...** appears, disconnect the personal computer from the port and connect the DF1 master device to the port.

Debug Port LED Indications

The following table shows the status indicated by the module's LEDs. Note that in the pass-through mode, the FLT and CFG LEDs act normally, indicating fault and configuration problems.

Mode	FLT LED	CFG LED
Pass-Through Active	OFF	OFF
Debug Mode Active	ON	ON

6.2 [DF1 Port x]

The [DF1 PORT x] sections of the configuration file set the DF1 port type, communication parameters, define the protocol specifics and set the command list parameters. The parameters are the same for each port. Each DF1 Port also has its own Command List.

6.2.1 *Enabled*

This parameter specifies if the port will be used. If the parameter is set to No, the port is disabled. If the parameter is set to Yes, the port is enabled.

6.2.2 *Type*

Type : Master #M=Master, S=Slave

This parameter defines if the port will emulate a master or a slave device. Enter Master if the port is to emulate a master device or Slave if the port is to emulate a slave device.

6.2.3 *Local Station ID*

This parameter specifies the local station ID for all DF1 messages sent from this master port. A value of 255 is not permitted as this is the broadcast address. Enter a value in the range of 0 to 254.

6.2.4 *Protocol*

Protocol : Full #F=Full-Duplex, H=Half-Duplex

This parameter specifies the DF1 protocol to be used on the port. Enter Full for full-duplex communications or Half for half-duplex communications.

6.2.5 *Termination Type*

Termination Type : CRC #B=BCC, C=CRC

This parameter specifies error checking for all DF1 messages. Enter CRC or BCC.

6.2.6 *Baud Rate*

This is the baud rate to be used on the port. Enter the baud rate as a value. For example, to select 19K baud, enter 19200.

6.2.7 *Parity*

None, Odd, Even

Parity is a simple error checking algorithm used in serial communication. This parameter specifies the type of parity checking to use.

All devices communicating through this port must use the same parity setting.

6.2.8 Data Bits

7 or 8

This parameter sets the number of data bits for each word used by the protocol. All devices communicating through this port must use the same number of data bits.

6.2.9 Stop Bits

1 or 2

Stop bits signal the end of a character in the data stream. For most applications, use one stop bit. For slower devices that require more time to re-synchronize, use two stop bits.

All devices communicating through this port must use the same number of stop bits.

6.2.10 Minimum Response Delay

0 to 65535

This parameter is used only when the port is configured as a slave. It sets the number of milliseconds to wait before responding to a command received on the port from a remote Master. This delay is sometimes required to accommodate slower Master devices.

6.2.11 RTS On

0 to 65535 milliseconds

This parameter sets the number of milliseconds to delay after *Ready To Send* (RTS) is asserted before data will be transmitted.

6.2.12 RTS Off

0 to 65535 milliseconds

This parameter sets the number of milliseconds to delay after the last byte of data is sent before the RTS modem signal will be set low.

6.2.13 Use CTS Line

YES or NO

This parameter specifies if the Clear To Send (CTS) modem control line is to be used or not. If the parameter is set to **No**, the CTS line will not be monitored. If the parameter is set to **YES**, the CTS line will be monitored and must be high before the module will send data. Normally, this parameter is required when half-duplex modems are used for communication (2-wire). This procedure is commonly referred to as *hardware handshaking*.

6.2.14 Response Timeout

Number of milliseconds to wait for response to command. The value is set depending upon the communication network used and the expected response time of the slowest device on the network. Valid values are 0 to 5000 milliseconds.

6.2.15 Retry Count

0 to 10

This parameter specifies the number of times a command will be retried if it fails.

6.3 DF1 Master Configuration

The following parameters are required only if the port is to be configured as a Master.

6.3.1 ENQ Delay

ENQ Delay : 0 #0-65535 milliseconds before DLE-ENQ sent

This parameter specifies the number of milliseconds to wait after a DLE-ACK is received from a slave using half-duplex mode before the DLE-ENQ request is made for data. Enter a value in the range of 0 to 65535 milliseconds.

6.3.2 Minimum Command Delay

This parameter specifies the number of milliseconds to wait between issuing each command. This delay value is not applied to retries.

6.3.3 Error Delay Count

Error Delay Count : 100 #0-65535 Command cycle count if error

This parameter specifies the number of polls to be skipped on the slave before trying to re-establish communications. After the slave fails to respond, the master will skip commands to be sent to the slave the number of times entered in this parameter. Enter a value in the range of 0 to 65535.

6.3.4 Command Error Pointer

Command Error Pointer : 3000 #Cmd Error list data (-1=ignore)

This parameter sets the address in the internal database where the command error data will be placed. If the value is set to -1, the data will not be transferred to the database. Enter a value from 0 to 4999.

6.3.5 Slave List Pointer

Slave List Pointer : 3100 #Slave status list data (-1=ignore)

This parameter specifies the starting address in the virtual database where the 256 slave status values will be written. If the parameter is set to -1, the slave data will not be placed in the database. Enter a value in the range of -1 to 4743.

6.4 DF1 Slave Configuration

The following parameters are required only if the port is to be configured as a Slave.

6.4.1 First File

First File : 7 #First file number for SLC simulation

This parameter is used when a request for a file is received on the communication port. This field is required when responding to PLC5 and SLC DF1 commands. Use this parameter to define the virtual file(s) to be simulated on the module. Enter a value in the range of 0 to 100.

6.4.2 File Size

Range 1 to 1000

This parameter specifies the size of each file to be simulated on the module. All files simulated are defined to have the same assigned size.

6.4.3 File Offset

This parameter sets the database register location of the first element in the first file simulated in the module. All offsets in the first file and subsequent files will be computed using the address specified. Enter a value in the range of 0 to 4999.

6.5 [DF1 PORT x COMMANDS]

The [DF1 PORT 0 COMMANDS], [DF1 PORT 1 COMMANDS], [DF1 PORT 2 COMMANDS] and [DF1 PORT 3 COMMANDS] sections of the CFG file set the serial master port command lists. These lists poll slave devices attached to the master ports. The module supports numerous commands.

The command list is formatted differently than the other sections of the configuration file. Commands are present in a block between the labels **START** and **END**. These labels inform the program where the list resides. The module's program will parse all commands after the **START** label until it reaches the **END** label.

6.5.1 Command List Overview

In order to interface the ProLinx module with slave devices, you must construct a command list. The commands in the list specify the slave device to be addressed, the function to be performed (read or write), the data area in the device to interface with and the registers in the internal database to be associated with the device data. There is a separate command list for each master port, with up to 100 commands allowed per master port. The command list is processed from top (command #0) to bottom. A poll interval parameter is associated with each command to specify a minimum delay time in seconds between the issuance of a command. If the user specifies a value of 10 for the parameter, the command will be executed no more frequently than every 10 seconds.

Write commands have a special feature, as they can be set to execute only if the data in the write command changes. If the register data values in the command have not changed since the command was last issued, the command will not be executed. If the data in the command has changed since the command was last issued, the command will be executed. Use of this feature can lighten the load on the DF1 network. In order to implement this feature; set the enable code for the command to a value of 2.

If the module is configured for the DF1 half-duplex protocol, the module can act as a master device routing messages between attached slave devices. This peer-to-peer communication is defined in the DF1 protocol specification. The master polls each DF1 slave device until no more data is available from the device. Response messages from the slaves that have a destination address that do not match the module are routed with a request message header back out onto the network. This facility offers communication between the slave devices for control and data monitoring. This feature is not available if the module is configured for DF1 full-duplex mode (point-to-point).

The module supports numerous commands. This permits the module to interface with a wide variety of DF1 protocol devices. This includes PLC2, PLC5, SLC-500 series, MicroLogix and ControlLogix processors. Additionally, other devices supplied by that use the DF1 protocol are supported.

7 Commands Supported by the Module

The format of each command in the list depends on the function being executed. To simplify command construction, the module uses its own set of function codes to associate a command with a DF1 command/function type. The tables below list the functions supported by the module:

Basic Command Set Functions

Function Code	Command	Function	Definition	PLC5	SLC500 & MicroLogix	Power-monitor II	ControlLogix
1	0x00	N/A	Protected Write	X			X
2	0x01	N/A	Unprotected Read	X	X		X
3	0x02	N/A	Protected Bit Write	X			X
4	0x05	N/A	Unprotected Bit Write	X			X
5	0x08	N/A	Unprotected Write	X	X		X

PLC-5 Command Set Functions

Function Code	Command	Function	Definition	PLC5	SLC500 & MicroLogix	Power-monitor II	ControlLogix
100	0x0F	0x00	Word Range Write (Binary Address)	X			X
101	0x0F	0x01	Word Range Read (Binary Address)	X			X
102	0x0F	0x26	Read-Modify-Write (Binary Address)	X			X
150	0x0F	0x00	Word Range Write (ASCII Address)	X			X
151	0x0F	0x01	Word Range Read (ASCII Address)	X			X
152	0x0F	0x26	Read-Modify-Write (ASCII Address)	X			X

SLC-500 Command Set Functions

Function Code	Command	Function	Definition	PLC5	SLC500 & MicroLogix	Power-monitor II	ControlLogix
501	0x0F	0xA1	Protected Typed Logical Read With Two Address Fields		X		X
502	0x0F	0xA2	Protected Typed Logical Read With Three Address Fields		X	X	X
509	0x0F	0xA9	Protected Typed Logical Write With Two Address Fields		X		X
510	0x0F	0xAA	Protected Typed Logical Write With Three Address Fields		X	X	X
511	0x0F	0xAB	Protected Typed Logical Write With Mask (Three Address Fields)		X		X

Each command list record has the same general format. The first part of the record contains the information relating to the communication module and the second part contains information required to interface to the DF1 slave device.

The PLC-5 and SLC-500 command set require the use of files. These files are emulated in the module. The module defines these files each as containing 200-word registers that overlay the internal database. The following table shows the relationship of the files to the user data area of the internal database:

File	→	Database Register
N7:0	→	0
N8:0	→	200
N9:0	→	400
N10:0	→	600
N11:0	→	800
N12:0	→	1000
N13:0	→	1200
N14:0	→	1400
N15:0	→	1600
N16:0	→	1800
N17:0	→	2000
N18:0	→	2200
N18:0	→	2400
N20:0	→	2600
N21:0	→	2800
N22:0	→	3000
N23:0	→	3200
N24:0	→	3400
N25:0	→	3600
N26:0	→	3800
N27:0	→	4000
N28:0	→	4200
N29:0	→	4400
N30:0	→	4600
N31:0	→	4800
N32:0	→	5000

Note: The way these files are emulated depends of the *First File* and *File Size* parameters. The previous example shows using the *First File* parameter set to 7 and the *File Size* parameter set to 200.

In order to retrieve data from the modules database register 200, the remote master would issue a command using the address N8:0. In order to interface with database base register 405, the remote master would use the address N9:5. The following table outlines the complete file emulation for the module:

Register Range	File Start	File End	Content	Size
0 to 4999	N7:0	N31:199	User Data	5000
5000 to 5009	N32:0	N32:9	Backplane Configuration	10
5010 to 5039	N32:10	N32:39	Port 1 Setup	30
5040 to 5069	N32:40	N32:69	Port 2 Setup	30
5070 to 5199	N32:70	N32:199	Reserved	130
5200 to 6399	N33:0	N38:199	Port 1 Commands	1200
6400 to 7599	N39:0	N44:199	Port 2 Commands	1200
7600 to 7700	N45:0	N45:199	Misc. Status Data	200
7800 to 7999	N46:0	N46:199	Command Control	200
8000 to 9999	N47:0	N56:199	Reserved	2000

All the data in the module is available to a remote host. This permits the host device to remotely configure the module and view the status data.

7.1.1 Command Entry Formats

Note: The format of each command in the list depends on the function being executed. Refer to the Reference chapter for a complete discussion of the DF1 commands supported by the module and of the structure and content of each command.

The following table shows the structure of the configuration data necessary for each of the supported commands.

Module Information Data ← → Device Information Data

DF1 COMMAND STRUCTURE

Column #	1	2	3	4	5	6	7	8	9	10	11
Function Code	Enable Code	Internal Address	Poll Interval Time	Count	Swap Code	Node Address	Function Code	Function Parameters			
FC 1	Code	Register	Seconds	Count	Code	Node	1	Word Address			
FC 2	Code	Register	Seconds	Count	Code	Node	2	Word Address			
FC 3	Code	Register	Seconds	Count	0	Node	3	Word Address			
FC 4	Code	Register	Seconds	Count	0	Node	4	Word Address			
FC 5	Code	Register	Seconds	Count	Code	Node	5	Word Address			
FC 100	Code	Register	Seconds	Count	Code	Node	100	File Number	Element	Sub-Element	
FC 101	Code	Register	Seconds	Count	Code	Node	101	File Number	Element	Sub-Element	
FC 102	Code	Register	Seconds	Count	0	Node	102	File Number	Element	Sub-Element	
FC 150	Code	Register	Seconds	Count	Code	Node	150	File String			
FC 151	Code	Register	Seconds	Count	Code	Node	151	File String			
FC 152	Code	Register	Seconds	Count	0	Node	152	File String			
FC 501	Code	Register	Seconds	Count	Code	Node	501	File Type	File Number	Element	
FC 502	Code	Register	Seconds	Count	Code	Node	502	File Type	File Number	Element	Sub-Element
FC 509	Code	Register	Seconds	Count	Code	Node	509	File Type	File Number	Element	
FC 510	Code	Register	Seconds	Count	Code	Node	510	File Type	File Number	Element	Sub-Element
FC 511	Code	Register	Seconds	Count	0	Node	511	File Type	File Number	Element	Sub-Element

Node Address = Destination Address for Message

The first part of the record is the module Information, which relates to the ProLinX module and the second part contains information required to interface to the slave device. Refer to the slave device documentation for a full discussion of each function.

Command list example:

```
[DF1 Port 1 Commands]
# The file contains examples for a SLC 5/03 processor.
#
START
#      1      2      3      4      5      6      7      8      9      10     11
#      Internal Poll      Swap      Node Func File File Elm Sub
# Enable Address Interval Count Code Address Code Type # # Elm
      1      1510      0      5      0      3      501      N      10      10
      0      1515      0      2      0      3      509      N      10      0
      1      1500      0      10     0      3      502      N      10      0      0
END
```

Parameter	Range	Description	
Enable	0, 1, 2, 999	This field defines whether the command is to be executed and under what conditions.	
		Value	Description
		0	The command is disabled and will not be executed in the normal polling sequence.
		1	The command is executed each scan of the command list if the Poll Interval Time is set to zero. If the Poll Interval time is set, the command will be executed, when the interval timer expires.
		2	The command will execute only if the internal data associated with the command changes. This value is valid only for write commands.
999	Issues a poll request to indicated slaves. This command can be used to implement a slave-to-slave network or an RBE based network		
Internal Address	0 to 3999	This field specifies the internal database register to be associated with the command. For Read functions, the data read from the slave device will be placed starting at the register value entered in this field. For write functions, the data written to the slave device will be sourced from the address specified.	
Poll Interval	0 to 65535	This parameter specifies the minimum interval to execute continuous commands (Enable code of 1). The parameter is entered in units of seconds. Therefore, if a value of 10 is entered for a command, the command will execute no more frequently than every 10 seconds.	
Count	Message dependent	This parameter specifies the number of registers or digital points to be associated with the command. Functions 5 and 6 ignore this field as they only apply to a single data point. For Binary data functions, this parameter sets the number of digital points (inputs or coils) to be associated with the command. For word or register functions, this parameter sets the number of registers to be associated with the command.	

Parameter	Range	Description										
Swap Code	0, 1, 2, 3	This parameter defines if the data received from the slave is to be ordered differently than received from the slave device. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in slave devices. This parameter can be set to order the register data received in an order useful by other applications. The following table defines the values and their associated operations: <table><tr><th>Swap Code</th><th>Description</th></tr><tr><td>0</td><td>None: No Change is made in the byte ordering (1234 = 1234)</td></tr><tr><td>1</td><td>Words: The words are swapped (1234=3412)</td></tr><tr><td>2</td><td>Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)</td></tr><tr><td>3</td><td>Bytes: The bytes in each word are swapped (1234=2143)</td></tr></table>	Swap Code	Description	0	None: No Change is made in the byte ordering (1234 = 1234)	1	Words: The words are swapped (1234=3412)	2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)	3	Bytes: The bytes in each word are swapped (1234=2143)
Swap Code	Description											
0	None: No Change is made in the byte ordering (1234 = 1234)											
1	Words: The words are swapped (1234=3412)											
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)											
3	Bytes: The bytes in each word are swapped (1234=2143)											
Node Address	1 to 255 (255 = broadcast)	This parameter specifies the slave node address on the network to be considered. Values of 1 to 255 are permitted. If the value is set to 255, the command will be a broadcast message on the network. The DF1 protocol permits broadcast commands for write operations. Do not use this node address for read operations.										
Function Code	See Reference section	These parameters specify the function to be executed by the command. The Reference chapter in this Manual describes the meaning of these values for each of the available supported commands. Following is a complete list of the command supported by the Master driver.										
File Type		ProLinx Function Code Listing Basic Command Set Protected Write Unprotected Read Protected Bit Write Unprotected Bit Write Unprotected Write										
File Number												
Elem #		PLC-5 Command Set Word Range Write (Binary Address) Word Range Read (Binary Address) Read-Modify-Write (Binary Address) Word Range Write (ASCII Address) Word Range Read (ASCII Address) Read-Modify-Write (ASCII Address) SLC Command Set Prot Typed Read with 2 addr fields Prot Typed Read with 3 addr fields Prot Typed Write with 2 addr fields Prot Typed Write with 3 addr fields Prot Typed Write with Mask 3 addr fields										
Sub Elem #												

8 Reference

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8.1 Serial Port Protocol Error/Status Data

The second and most thorough troubleshooting method for debugging the operation of the DFCM driver (and the module in general) is the powerful Debug port on the module which provides much more complete access to the internal operation and status of the module. Accessing the Debug capabilities of the module is accomplished easily by connecting a PC to the Debug port and loading a terminal program such as ProSoft Configuration Builder or HyperTerminal.

8.1.1 Viewing Error and Status Data

The following topics describe the register addresses that contain protocol error and status data. Viewing the contents of each register is accomplished using the Database View option. The use of this option and its associated features are described in detail in the ProLinux Reference Guide.

8.1.2 DF1 Error and Status Data Area Addresses

DF1 error and status data are stored in registers based on the DF1 port configuration. Starting register addresses are shown in the following table.

DF1 Port	Starting Address
0	6300
1	6700
2	7100
3	7500

Note: None of the addresses are available in the DF1 address range. In order to view them, the data must be moved using the Data Map section of the configuration file. Refer to Moving Data (page 70) for an example of how to move data to the DF1 address range.

8.1.3 DF1 Ports - Error/Status Data

The serial port (DF1 Master/Slave) Error and Status Data areas are discussed in this section. The Error Status Pointer value is configured in the CFG file within each of the individual [DF1 PORT X] sections.

The data area is initialized with zeros whenever the module is initialized. This occurs during a cold-start (power-on), reset (reset push-button pressed) or a warm-boot operation (commanded or loading of new configuration).

Example Internal Database Address	Offset	Description
6300	0	Number of Command Requests
6301	1	Number of Command Responses
6302	2	Number of Command Errors
6303	3	Number of Requests
6304	4	Number of Responses
6305	5	Number of Errors Sent
6306	6	Number of Errors Received
6307	7	Configuration Error Word
6308	8	Current Error Code
6309	9	Last Error Code

Refer to the following Error Codes section to interpret the status/error codes present in the data area.

8.1.4 Master Port: Command Errors

The individual command errors for each master port are returned to the address locations specified in the following table.

DF1 Port	Address Range
0	6310 to 6409
1	6710 to 6809
2	7110 to 7209
3	7510 to 7609

The first word in the register location defined contains the status/error code for the first command in the port's command list. Each successive word in the command error list is associated with the next command in the list.

Refer to Error Codes to interpret the status/error codes present in the data area.

Example DF1 Port 1 Command List Errors

Internal Database Address (Example)	Offset	Description
6310	0	Command #0 Error Status
6311	1	Command #1 Error Status
6312	2	Command #2 Error Status
6313	3	Command #3 Error Status
6314	4	Command #4 Error Status
	.	.
	.	.
	.	.
6407	97	Command #97 Error Status
6408	98	Command #98 Error Status
6409	99	Command #99 Error Status

Note that the values in the Command List Error Status tables are initialized to zero (0) at power-up, cold boot and during warm boot.

8.1.5 Master Port: DF1 Slave List Status

Each slave polled in the command list on the DF1 master ports has a reserved word value for a status code. This status data list can be read using the Configuration/Debug Port and can be placed in the module's internal database. The first word in the register location defined contains the status code for the DF1 slave node address 0. Each successive word in the list is associated with the next node up to slave node 255.

Slaves attached to the master port can have one of the following states:

0	The slave is inactive and not defined in the command list for the master port.
1	The slave is actively being polled or controlled by the master port and communication is successful.
2	The master port has failed to communicate with the slave device. Communication with the slave is suspended for a user defined period based on the scanning of the command list.

Slaves are defined to the system when the module initializes the master command list. Each slave defined will be set to a state value of 1 in this initial step. If the master port fails to communicate with a slave device (retry count expired on a command), the master will set the state of the slave to a value of 2 in the status table. This suspends communication with the slave device for a user specified scan count (**Error Delay Counter** value in the configuration). Each time a command in the list is scanned that has the address of a suspended slave, the delay counter value will be decremented. When the value reaches zero, the slave state will be set to 1. This will enable polling of the slave.

The individual Slave List Status errors for each DF1 port are returned to the address locations specified in the following table.

DF1 Port	Address Range
0	6410 to 6665
1	6810 to 7065
2	7210 to 7465
3	7610 to 7865

Example DF1 Port 1 Slave List Status Example

Internal Database Address (Example)	Offset	Description
6410	0	Slave #0 Status
6411	1	Slave #1 Status
6412	2	Slave #2 Status
6413	3	Slave #3 Status
6414	4	Slave #4 Status
	.	.
	.	.
	.	.
6663	253	Slave #253 Status
6664	254	Slave #254 Status
6665	255	Slave #255 Status

The example addresses shown above assumes DF1 Port 1. Note that each master port will have one of these status data blocks available in the internal database, each individually located with a separate address.

Note that the values in the Slave List Status tables are initialized to zero (0) at power-up, cold boot and during warm boot.

8.2 Error Codes

The module error codes are listed in this section. Error codes returned from the command list process are stored in the command list error memory region. A word is allocated for each command in the memory area. The error codes are formatted in the word as follows: The least-significant byte of the word contains the extended status code and the most-significant byte contains the status code.

Use the error codes returned for each command in the list to determine the success or failure of the command. If the command fails, use the error code to determine the cause of failure.

Note: The Module Specific error codes (not DF1 compliant) are returned from within the module and never returned from an attached DF1 slave device. These are error codes that are part of the DF1 protocol or are extended codes unique to this module. The standard DF1 error codes can be found in the DF1 Protocol and Command Set Reference Manual (Publication 1770-6.5.16) from Rockwell Automation. The most common errors for the DF1 protocol are shown in the following tables:

8.2.1 Local STS Error Codes

Code (Int)	Code (Hex)	Description
0	0x0000	Success, no error
256	0x0100	DST node is out of buffer space
512	0x0200	Cannot guarantee delivery (Link Layer)
768	0x0300	Duplicate token holder detected
1024	0x0400	Local port is disconnected
1280	0x0500	Application layer timed out waiting for response
1536	0x0600	Duplicate node detected
1792	0x0700	Station is offline
2048	0x0800	Hardware fault

8.2.2 Remote STS Error Codes

Code (Int)	Code (Hex)	Description
0	0x0000	Success, no error
4096	0x1000	Illegal command or format
8192	0x2000	Host has a problem and will not communicate
12288	0x3000	Remote node host is missing, disconnected or shut down
16384	0x4000	Host could not complete function due to hardware fault
20480	0x5000	Addressing problem or memory protect rungs
24576	0x6000	Function not allowed due to command protection selection
26872	0x7000	Processor is in Program mode
-32768	0x8000	Compatibility mode file missing or communication zone problem
-28672	0x9000	Remote node cannot buffer command
-24576	0xA000	Wait ACK (1775-KA buffer full)
-20480	0xB000	Remote node problem due to download
-16384	0xC000	Wait ACK (1775-KA buffer full)

Code (Int)	Code (Hex)	Description
-12288	0xD000	Not used
-8192	0xE000	Not used
	0xF0nn	Error code in the EXT STS byte (nn contains EXT error code)

8.2.3 Errors When EXT STS Is Present

Code (Int)	Code (Hex)	Description
-4096	0xF000	Not used
-4095	0xF001	A field has an illegal value
-4094	0xF002	Less levels specified in address than minimum for any address
-4093	0xF003	More levels specified in address than system supports
-4092	0xF004	Symbol not found
-4091	0xF005	Symbol is of improper format
-4090	0xF006	Address does not point to something usable
-4089	0xF007	File is wrong size
-4088	0xF008	Cannot complete request
-4087	0xF009	Data or file is too large
-4086	0xF00A	Transaction size plus word address is too large
-4085	0xF00B	Access denied, improper privilege
-4084	0xF00C	Condition cannot be generated - resource is not available
-4083	0xF00D	Condition already exists - resource is already available
-4082	0xF00E	Command cannot be executed
-4081	0xF00F	Histogram overflow
-4080	0xF010	No access
-4079	0xF011	Illegal data type
-4078	0xF012	Invalid parameter or invalid data
-4077	0xF013	Address reference exists to deleted area
-4076	0xF014	Command execution failure for unknown reason
-4075	0xF015	Data conversion error
-4074	0xF016	Scanner not able to communicate with 1771 rack adapter
-4073	0xF017	Type mismatch
-4072	0xF018	1771 module response was not valid
-4071	0xF019	Duplicate label
-4070	0xF01A	File is open; another node owns it
-4069	0xF01B	Another node is the program owner
-4068	0xF01C	Reserved
-4067	0xF01D	Reserved
-4066	0xF01E	Data table element protection violation
-4065	0xF01F	Temporary internal problem

8.2.4 Module Specific Error (not DFCM Compliant)

Code (Int)	Code (Hex)	Description
-1	0xFFFF	CTS modem control line not set before transmit
-2	0xFFFE	Timeout while transmitting message
-10	0xFFFF6	Timeout waiting for DLE-ACK after request
-11	0xFFFF5	Timeout waiting for response after request
-12	0xFFFF4	Reply data does not match requested byte count
-20	0xFFEC	DLE-NAK received after request
-21	0xFFEB	DLE-NAK sent after response
-200	0xFF38	DLE-NAK received after request

8.3 DF1 Configuration Error Word

DF1 Configuration Error Word errors are stored in protocol-specific registers. The following table lists the Port/Register Address configuration.

DF1 Port	Configuration Error Word Register
0	6307
1	6707
2	7107
3	7507

A register containing a code indicates a problem with the configuration. The following table lists the codes, a description of the problem, and parameters to correct the error condition within the configuration file.

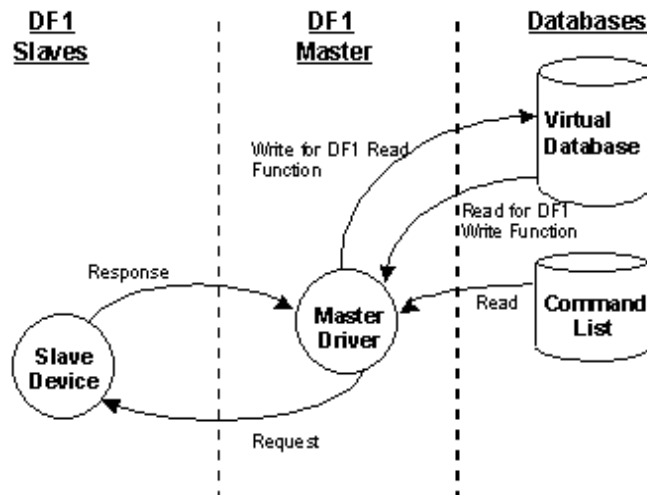
Bit	Code	Description
0	0x0001	Invalid Enabled parameter (Yes or No)
1	0x0002	Invalid RS-Interface parameter (0 to 2)
2	0x0004	Invalid Type (Master or Slave)
3	0x0008	Invalid Protocol (RTU or ASCII)
4	0x0010	Invalid Baud Rate
5	0x0020	Invalid Parity (None, Odd, Even)
6	0x0040	Invalid Data Bits (7 or 8 bits)
7	0x0080	Invalid Stop Bits (1 or 2)
8	0x0100	Invalid Use CTS Line (Yes or No)
9	0x0200	Retry Count Invalid (0 to 10)
10	0x0400	Invalid Floating Point Data: Float Flag not Yes or No Float Start less than 0 or Float Offset is Invalid
11	0x0800	Invalid Internal Slave ID (1 to 255) (Slave Only)
12	0x1000	Invalid Entry for Register Offset Data (Slave Only)
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved

8.4 DF1 Command Set For ProSoft Technology Communication Modules

8.4.1 Introduction

This document contains a complete description of the command set required to communicate with DF1 protocol devices using a ProSoft communication module. ProSoft communication modules that contain a virtual DF1 master device use this command set to control and monitor data in DF1 protocol devices. These include PLC, SLC, MicroLogix and ControlLogix controllers and field devices supporting the DF1 protocol. ProSoft supports the DF1 protocol on both the serial and network interface. The network interface requires the use of the port service address 0xAF12 as specified in the ControlNet Specification. supports this feature in the ControlLogix, PLC5 xx/E and SLC 5/05 processors.

The ProSoft modules contain a virtual database that is defined by the user. This database is used as the source for write commands and the destination for read commands issued on the virtual DF1 master devices. The module interfaces data contained in remote DF1 slave devices to the virtual database using the DF1 master. User commands are issued out of the DF1 master from a command list. These commands gather or control data in the DF1 slave devices. The following illustration shows the relationships discussed above:



Each command issued from the DF1 master contains a field that indicates the location in the virtual database to be associated with the command. Care must be taken when designing a system to be sure the read and write data regions for the database do not overlap for a single device. The read area of one device can overlap the write section of another device to transfer the data from one slave device to another.

8.4.2 Command Function Codes

This section describes DFCM commands to be configured by the user.

Module Information Data					←	→	Device Information Data				
1	2	3	4	5		6	7	8	9	10	11
Enable Code	Internal Address	Poll Interval Time	Count	Swap Code		Node Address	Function Code	Function Parameters			

Function Code #1 - Protected Write (Basic Command Set)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 1	Protected Write Function	
8	Word Address	Word address where to start the write operation.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function writes one or more words of data into a limited area of the slave device. This function should work on the following devices: 1774-PLC, PLC-2, PLC-3, PLC-5 and PLC-5/250.

Function Code #2 - Unprotected Read (Basic Command Set)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled and 1=Continuous.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 2	Unprotected Read Function	
8	Word Address	Word address where to start the read operation.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function reads one or more words of data from the PLC memory. This function should work on the following devices: 1774-PLC, PLC-2, PLC-3, PLC-5, SLC 500, SLC 5/03, SLC 5/04 and MicroLogix 1000.

Function Code #3 - Protected Bit Write (Basic Command Set)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
	Virtual Database Address	This parameter defines the database address for the data to be associated with the command. The address defined represents a register address and not a bit address. This function will update one or more words of data as defined by the count parameter.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: Always zero (0).	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 3	Protected Bit Write Function	
8	Word Address	Word address where to start the write operation.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function sets or resets individual bits within a limited area of the PLC data table. This function should work on the following devices: 1774-PLC, PLC-2, PLC-3, PLC-5 and PLC-5/250.

Function Code #4 - Unprotected Bit Write (Basic Command Set)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address for the data to be associated with the command. The address defined represents a register address and not a bit address. This function will update one or more words of data as defined by the count parameter.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: Always zero (0).	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 4	Unprotected Bit Write Function	
8	Word Address	Word address where to start the write operation.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function sets or resets individual bits within a limited area of the PLC data table. This function should work on the following devices: 1774-PLC, PLC-2, PLC-3 and PLC-5.

Function Code #5 - Unprotected Write (Basic Command Set)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 5	Unprotected Write Function	
8	Word Address	Word address where to start the write operation.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function writes one or more words of data to the PLC memory. This function should work on the following devices: 1774-PLC, PLC-2, PLC-3, PLC-5, SLC 500, SLC 5/03, SLC 5/04 and MicroLogix 1000.

Function Code #100 - Word Range Write (PLC-5 Command) (Binary Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 100	Word Range Write Command.	
8	File Number	PLC-5 file number to be associated with the command. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default file will be used.	P1
9	Element Number	The parameter defines the element in the file where write operation will start. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default element will be used.	P2
10	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub- element codes. If the value is set to -1, the default sub-element number will be used.	P3
11	Not Used	This field is not used by the command. Values entered in this column will be ignored.	P4

This function writes one or more words of data to a PLC data table. This function should work on the following devices: PLC-5.

Function Code #101 - Word Range Read (PLC-5 Command) (Binary Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled and 1=Continuous.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 101	Word Range Write Command.	
8	File Number	PLC-5 file number to be associated with the command. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default file will be used.	P1
9	Element Number	The parameter defines the element in the file where write operation will start. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default element will be used.	P2
10	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub- element codes. If the value is set to -1, the default sub-element number will be used.	P3
11	Not Used	This field is not used by the command. Values entered in this column will be ignored.	P4

This function reads one or more words of data from a PLC data table. This function should work on the following devices: PLC-5.

Function Code #102 - Read-Modify-Write (PLC-5 Command) (Binary Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address for the data to be associated with the command.	
3	Poll Interval	Minimum number of seconds to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: Always zero (0).	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 102	Read-Modify-Write Command.	
8	File Number	PLC-5 file number to be associated with the command. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default file will be used.	P1
9	Element Number	The parameter defines the element in the file where write operation will start. If a value of -1 is entered for the parameter, the field will not be used in the command, and the default element will be used.	P2
10	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub-element codes. If the value is set to -1, the default sub-element number will be used.	P3
11	Not Used	This field is not used by the command. Values entered in this column will be ignored.	P4

This function writes one or more words of data to a PLC data table. This function should work on the following devices: PLC-5. The command constructed contains an AND mask and an OR mask. Values in the AND mask have the following definitions: 0=Reset and 1=Leave the Same. Values in the OR mask have the following definitions: 0=Leave the Same and 1=Set. The module is responsible for setting the mask values to correctly construct the message from the virtual database values.

Function Code #150 - Word Range Write (PLC-5 Command) (ASCII Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 150	Word Range Write Command.	
8	File String	PLC-5 address as specified as an ASCII string. For example, N10:300.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function writes one or more words of data to a PLC data table. This function should work on the following devices: PLC-5.

Function Code #151 - Word Range Read (PLC-5 Command) (ASCII Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled and 1=Continuous.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 151	Word Range Read Command.	
8	File String	PLC-5 address as specified as an ASCII string. For example, N10:300.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function reads one or more words of data from a PLC data table. This function should work on the following devices: PLC-5.

Function Code #152 - Read-Modify-Write (PLC-5 Command) (ASCII Address)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address for the data to be associated with the command. The first database register is used as the AND mask for the command, and the second is used for the OR mask. Values in the AND mask have the following definitions: 0=Reset and 1=Leave the Same. Values in the OR mask have the following definitions: 0=Leave the Same and 1=Set.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: Always zero (0).	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 152	Read-Modify-Write Command.	
8	File String	PLC-5 address as specified as an ASCII string. For example, N10:300.	P1
9 to 11	Not Used	These fields are not used by the command. Values entered in these columns will be ignored.	P2 to P4

This function writes one or more words of data to a PLC data table. This function should work on the following devices: PLC-5. The command constructed contains an AND mask and an OR mask. Values in the AND mask have the following definitions: 0=Reset and 1=Leave the Same. Values in the OR mask have the following definitions: 0=Leave the Same and 1=Set. The module is responsible for setting the mask values to correctly construct the message from the virtual database values.

Function Code #501 - Protected Typed Logical Read (Two Address Fields)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled and 1=Continuous.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum number of seconds to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 501	Logical Read Command	
8	File Type	SLC file type letter as used in file name string. Valid values for the system are N, S, F, A,	P1
9	File Number	SLC file number to be associated with the command.	P2
10	Element Number	The parameter defines the element in the file where write operation will start.	P3
11	Not Used	This field is not used by the command. Values entered in this column will be ignored.	P4

This function reads one or more words of data from a PLC data table.

Function Code #502 - Protected Typed Logical Read (Three Address Fields)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled and 1=Continuous.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum number of seconds to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 502	Logical Read Command	
8	File Type	SLC file type letter as used in file name string. Valid values for the system are N, S, F, A,	P1
9	File Number	SLC file number to be associated with the command.	P2
10	Element Number	The parameter defines the element in the file where write operation will start.	P3
11	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub-element codes.	P4

This function reads one or more words of data from a PLC data table. This function should work on the following devices: SLC 500, SLC 5/03 and SLC 5/04.

Function Code #509 - Protected Typed Logical Write (Two Address Fields)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 509	Logical Write Command	
8	File Type	SLC file type letter as used in file name string. Valid values for the system are N, S, F, A,	P1
9	File Number	SLC file number to be associated with the command.	P2
10	Element Number	The parameter defines the element in the file where write operation will start.	P3
11	Not Used	This field is not used by the command. Values entered in this column will be ignored.	P4

This function writes one or more words of data to a PLC data table.

Function Code #510 - Protected Typed Logical Write (Three Address Fields)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the first data point to be associated with the command.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: 0=None, 1=Swap words, 2=Swap words & bytes and 3=swap bytes in each word.	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 510	Logical Write Command	
8	File Type	SLC file type letter as used in file name string. Valid values for the system are N, S, F, A,	P1
9	File Number	SLC file number to be associated with the command.	P2
10	Element Number	The parameter defines the element in the file where write operation will start.	P3
11	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub-element codes.	P4

This function writes one or more words of data to a PLC data table. This function should work on the following devices: SLC 500, SLC 5/03 and SLC 5/04.

Function Code #511 - Protected Typed Logical Write with Mask (Three Address Fields)

Column	Parameter	Description	Parameter
1	Enable/Type Word	0=Disabled, 1=Continuous and 2=Conditional.	
2	Virtual Database Address	This parameter defines the database address of the data to be associated with the command. The first word of data contains the bit mask and the second word contains the data.	
3	Poll Interval	Minimum time in tenths of a second to wait before polling with this command.	
4	Count	Number of data word values to be considered by the function.	
5	Swap Type Code	Swap type code for command: Always zero (0).	
6	Node Address	Address of unit to reach on the data highway.	
7	Function Code = 511	Logical Write with mask	
8	File Type	SLC file type letter as used in file name string. Valid values for the system are N, S, F, A,	P1
9	File Number	SLC file number to be associated with the command.	P2
10	Element Number	The parameter defines the element in the file where write operation will start.	P3
11	Sub-Element Number	This parameter defines the sub-element for the command. Refer to the AB documentation for a list of valid sub-element codes.	P4

This function writes one or more words of data from a PLC data table controlling individual bits in the table. The bit mask used for the command is 0xFFFF. This provides direct manipulation of the data in the device with the internal data of the module. The function requires that all data associated with the command use the same mask.

8.4.3 PLC-5 Processor Specifics

This section contains information specific to the PLC-5 processor with relation to the DF1 command set. The commands specific to the PLC-5 processor contain a sub-element code field. This field selects a sub-element field in a complex data table. For example, to obtain the current accumulated value for a counter or timer, the sub-element field should be set to 2. The tables below show the sub-element codes for PLC-5 complex data tables.

PLC-5 Sub-Element Codes

Timer / Counter

Code	Description
0	Control
1	Preset
2	Accumulated

Control

Code	Description
0	Control
1	Length
2	Position

PD*

Code	Description
0	Control
2	SP
4	Kp
6	Ki
8	Kd
26	PV

*All PD values are floating point values, so they are two words long.

BT

Code	Description
0	Control
1	RLEN
2	DLEN
3	Data file #
4	Element #
5	Rack/Grp/Slot

MG

Code	Description
0	Control
1	Error
2	RLEN
3	DLEN

8.4.4 SLC Processor Specifics

This section contains information specific to the SLC processor based family when used with the DF1 command set. The SLC processor commands support a file type field entered as a single character to denote the data table to interface with in the command. The following table defines the relationship of the file types accepted by the module and the SLC file types:

SLC File Types

File Type	File Type Command Code	Description
S	83	Status
B	66	Bit
T	84	Timer
C	67	Counter
R	82	Control
N	78	Integer
F	70	Floating-point
Z	90	String
A	65	ASCII

The File Type Command Code is the ASCII character code value of the File Type letter. This is the value to enter into the "File Type" parameter of the DF1 Command configurations in the data tables in the ladder logic.

Additionally, the SLC specific functions (502, 510 and 511) support a sub-element field. This field selects a sub-element field in a complex data table. For example, to obtain the current accumulated value for a counter or timer, the sub-element field should be set to 2.

8.4.5 MicroLogix Processor Specifics

This section contains information specific to the MicroLogix processor based family when used with the DF1 command set. The MicroLogix processor commands support a file type field entered as a single character to denote the data table to interface with in the command. This field is the same as that used for a SLC processor. The following table defines the relationship of the file types accepted by the module and the SLC file types:

SLC File Types

File Type	File Type Command Code	Description
S	83	Status
B	66	Bit
T	84	Timer
C	67	Counter
R	82	Control
N	78	Integer
F	70	Floating-point
Z	90	String
A	65	ASCII

The File Type Command Code is the ASCII character code value of the File Type letter. This is the value to enter into the "File Type" parameter of the DF1 Command configurations in the data tables in the ladder logic.

Additionally, the SLC specific functions (502, 510 and 511) support a sub-element field. This field selects a sub-element field in a complex data table. For example, to obtain the current accumulated value for a counter or timer, the sub-element field should be set to 2.

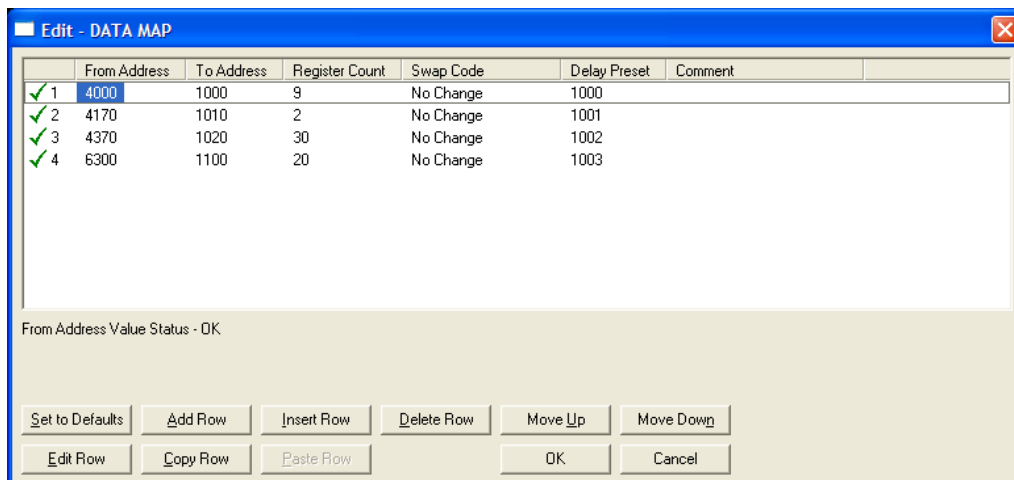
8.4.6 ControlLogix Processor Specifics

This section contains information specific to the ControlLogix processor when used with the DF1 command set. The current implementation of the DF1 command set does not use functions that can directly interface with the ControlLogix Tag Database. In order to interface with this database, the table-mapping feature provided by RSLogix 5000 must be used. The software permits the assignment of ControlLogix Tag Arrays to virtual PLC 5 data tables. The ProSoft module using the PLC 5 command set defined in this document can then reach this controller data.

[illegible]

8.6 Moving Data

The following illustration shows an example Data Map. The Data Map allows you to move data to different addresses within the module database in order to create simpler data requests and control.



8.7 5102-DFS3-DFM Configuration Information

The following example shows the configuration file for the 4102-DFS3-DFM only.
If you do not have this module, ignore this topic.

```
# DF1R.CFG
#
# This file contains the configuration for the DF1 slave communication
# module.
#
# LOCATION      : ProSoft Technology
# DATE          :
#
# This section defines the configuration for the DF1 master device
# simulated on Port 0.
#

[Module]
Module Name: x102-DFS3-DFM

[DF1 Master Port]
Local Station ID      : 1      #Source ID used in DF1 requests
Termination Type      : CRC    #B=BCC, C=CRC
Baud Rate             : 192    #Baud rate for port 110-115200
Parity                : None   #N=None, O=Odd, E=Even, M=Mark, S=Space
Data Bits             : 8      #5, 6, 7 or 8
Stop Bits             : 1      #1 or 2
RTS On                : 0      #0-65536 mSec before message
RTS Off               : 0      #0-65536 mSec after message
Use CTS Line          : No     #Use CTS modem control line (Y/N)
Response Timeout      : 5000   #Response message timeout (0-65535
milliseconds)
ACK Timeout           : 100    #DLE-ACK timeout (0-65535 milliseconds)
Retry Count           : 3      #Response failure retry count

[DF1 Slave Port 0]
Enabled               : Yes    #Y=Use port, N=Do not use port
RS Interface          : 0      #0=RS-232, 1=RS-485, 2=RS-422
Protocol              : Full   #F=Full-Duplex, H=Half-Duplex
Baud Rate             : 9600   #Baud rate for port 110-115200
Parity                : None   #N=None, O=Odd, E=Even, M=Mark, S=Space
Data Bits             : 8      #5, 6, 7 or 8
Stop Bits             : 1      #1 or 2
RTS On                : 0      #0-65536 mSec before message
RTS Off               : 0      #0-65536 mSec after message
Use CTS Line          : No     #Use CTS modem control line (Y/N)
Request Timeout       : 1000   #Request message timeout (0-65535 milliseconds)
Busy Timeout          : 550    #Port Busy timeout (0-65535 milliseconds)
ACK Timeout           : 500    #DLE-ACK timeout (0-65535 milliseconds)
Retry Count           : 0      #Response failure retry count

[DF1 Slave Port 1]
Enabled               : Yes    #Y=Use port, N=Do not use port
RS Interface          : 0      #0=RS-232, 1=RS-485, 2=RS-422
Protocol              : Full   #F=Full-Duplex, H=Half-Duplex
Baud Rate             : 9600   #Baud rate for port 110-115200
Parity                : No     #N=None, O=Odd, E=Even
```

```
Data Bits          : 8      #5, 6, 7 or 8
Stop Bits          : 1      #1 or 2
RTS On             : 0      #0-65536 mSec before message
RTS Off            : 0      #0-65536 mSec after message
Use CTS Line       : No     #Use CTS modem control line (Y/N)
Request Timeout    : 1000   #Request message timeout (0-65535 milliseconds)
Busy Timeout       : 500    #Port Busy timeout (0-65535 milliseconds)
ACK Timeout        : 1000   #DLE-ACK timeout (0-65535 milliseconds)
Retry Count        : 0      #Response failure retry count
```

[DF1 Slave Port 2]

```
Enabled            : Yes    #Y=Use port, N=Do not use port
RS Interface       : 0      #0=RS-232, 1=RS-485, 2=RS-422
Protocol           : Full   #F=Full-Duplex, H=Half-Duplex
Baud Rate          : 192    #Baud rate for port 110-115200
Parity             : None   #N=None, O=Odd, E=Even
Data Bits          : 8      #5, 6, 7 or 8
Stop Bits          : 1      #1 or 2
RTS On             : 0      #0-65536 mSec before message
RTS Off            : 0      #0-65536 mSec after message
Use CTS Line       : No     #Use CTS modem control line (Y/N)
Request Timeout    : 1000   #Request message timeout (0-65535 milliseconds)
Busy Timeout       : 500    #Port Busy timeout (0-65535 milliseconds)
ACK Timeout        : 1000   #DLE-ACK timeout (0-65535 milliseconds)
Retry Count        : 0      #Response failure retry count
```

8.7.1 Parameter Descriptions

[SECTION]/Item	Range	Description																																
[DF1 Master Port]		Configuration Header for DF1 Master Port																																
Local Station ID:	0 to 255	This parameter specifies the local station ID for all DF1 messages sent from this master port. A value of 255 will cause the slave address to be ignored and the address issued in the master request packet to be used as the slave ID.																																
Termination Type:	BCC or CRC	This parameter specifies the error checking for all DF1 messages. BCC or CRC																																
Baud Rate:		This is the baud rate to be used on the port. Enter the baud rate as a value. For example, to select 19K baud, enter 19200. Ports 0, 1, 2 and 3 <table><tr><th>Baud Rate</th><th>Parameter Value</th></tr><tr><td>110</td><td>110</td></tr><tr><td>150</td><td>150</td></tr><tr><td>300</td><td>300</td></tr><tr><td>600</td><td>600</td></tr><tr><td>1200</td><td>12 or 1200</td></tr><tr><td>2400</td><td>24 or 2400</td></tr><tr><td>4800</td><td>48 or 4800</td></tr><tr><td>9600</td><td>96 or 9600</td></tr><tr><td>14,400</td><td>14, 114 or 14400</td></tr><tr><td>19,200</td><td>19, 192 or 19200</td></tr><tr><td>28,800</td><td>28, 288 or 28800</td></tr><tr><td>38,400</td><td>38, 384 or 38400</td></tr></table> Ports 1, 2 and 3 only <table><tr><th>Baud Rate</th><th>Parameter Value</th></tr><tr><td>57,600</td><td>57 or 576</td></tr><tr><td>115,200</td><td>115 or 1152</td></tr></table>	Baud Rate	Parameter Value	110	110	150	150	300	300	600	600	1200	12 or 1200	2400	24 or 2400	4800	48 or 4800	9600	96 or 9600	14,400	14, 114 or 14400	19,200	19, 192 or 19200	28,800	28, 288 or 28800	38,400	38, 384 or 38400	Baud Rate	Parameter Value	57,600	57 or 576	115,200	115 or 1152
Baud Rate	Parameter Value																																	
110	110																																	
150	150																																	
300	300																																	
600	600																																	
1200	12 or 1200																																	
2400	24 or 2400																																	
4800	48 or 4800																																	
9600	96 or 9600																																	
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19,200	19, 192 or 19200																																	
28,800	28, 288 or 28800																																	
38,400	38, 384 or 38400																																	
Baud Rate	Parameter Value																																	
57,600	57 or 576																																	
115,200	115 or 1152																																	
Parity:	None, Odd, or Even	This is the Parity code to be used for the port. The values are as follows: None, Odd, Even.																																
Data Bits:	7 or 8	This parameter sets the number of data bits for each word used by the protocol.																																
Stop Bits:	1 or 2	This parameter sets the number of stop bits to be used with each data value sent.																																
RTS On:	0 to 65535	This parameter sets the number of milliseconds to delay after RTS is asserted before the data will be transmitted.																																
RTS Off:	0 to 65535	This parameter sets the number of milliseconds to delay after the last byte of data is sent before the RTS modem signal will be set low.																																

[SECTION]/Item	Range	Description
Use CTS Line:	Yes or No	This parameter specifies if the CTS modem control line is to be used. If the parameter is set to No, the CTS line will not be monitored. If the parameter is set to Yes, the CTS line will be monitored and must be high before the module will send data. Normally, this parameter is required when half-duplex modems are used for communication (2-wire).
Response Timeout:	0 to 65535	This parameter represents the message response timeout period in 1-ms increments. This is the time that a port configured as a master will wait before re-transmitting a command if no response is received from the addressed slave. The value is set depending upon the communication network used and the expected response time of the slowest device on the network.
ACK Timeout	0 to 65535	DLE-ACK timeout in milliseconds.
Retry Count:	0 to 10	This parameter specifies the number of times a command will be retried if it fails.
[DF1 Slave Port 0] [DF1 Slave Port 1] [DF1 Slave Port 2]		
Enabled:	Yes or No	This flag specifies if the port on the module will be utilized. If the parameter is set to No, the port will not be used. If the parameter is set to Yes, the port will be used supporting the DF1 protocol.
RS Interface	0, 1, or 2	0=RS-232, 1=RS-485, 2=RS-422
Protocol:	Full or Half	This parameter specifies the DF1 protocol to be used on the port. Full Duplex or Half-Duplex

[SECTION]/Item	Range	Description																																
Baud Rate:		This is the baud rate to be used on the port. Enter the baud rate as a value. For example, to select 19K baud, enter 19200. Ports 0, 1, 2 and 3 <table><tr><th>Baud Rate</th><th>Parameter Value</th></tr><tr><td>110</td><td>110</td></tr><tr><td>150</td><td>150</td></tr><tr><td>300</td><td>300</td></tr><tr><td>600</td><td>600</td></tr><tr><td>1200</td><td>12 or 1200</td></tr><tr><td>2400</td><td>24 or 2400</td></tr><tr><td>4800</td><td>48 or 4800</td></tr><tr><td>9600</td><td>96 or 9600</td></tr><tr><td>14,400</td><td>14, 114 or 14400</td></tr><tr><td>19,200</td><td>19, 192 or 19200</td></tr><tr><td>28,800</td><td>28, 288 or 28800</td></tr><tr><td>38,400</td><td>38, 384 or 38400</td></tr></table> Ports 1, 2 and 3 only <table><tr><th>Baud Rate</th><th>Parameter Value</th></tr><tr><td>57,600</td><td>57 or 576</td></tr><tr><td>115,200</td><td>115 or 1152</td></tr></table>	Baud Rate	Parameter Value	110	110	150	150	300	300	600	600	1200	12 or 1200	2400	24 or 2400	4800	48 or 4800	9600	96 or 9600	14,400	14, 114 or 14400	19,200	19, 192 or 19200	28,800	28, 288 or 28800	38,400	38, 384 or 38400	Baud Rate	Parameter Value	57,600	57 or 576	115,200	115 or 1152
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Use CTS Line:	Yes or No	This parameter specifies if the CTS modem control line is to be used. If the parameter is set to No, the CTS line will not be monitored. If the parameter is set to Yes, the CTS line will be monitored and must be high before the module will send data. Normally, this parameter is required when half-duplex modems are used for communication (2-wire).																																
Request Timeout	1000	Request message timeout in milliseconds. Use default value.																																
Busy Timeout	550	Port Busy Timeout in milliseconds. Use default value.																																
ACK Timeout	0 to 65535	DLE-ACK timeout in milliseconds.																																
Retry Count:	0 to 10	This parameter specifies the number of times a command will be retried if it fails.																																

9 Support, Service & Warranty

In This Chapter

- ❖ Contacting Technical Support 77
- ❖ Return Material Authorization (RMA) Policies and Conditions..... 79
- ❖ LIMITED WARRANTY 81

Contacting Technical Support

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

Note: For technical support calls within the United States, an after-hours answering system allows 24-hour/7-days-a-week pager access to one of our qualified Technical and/or Application Support Engineers.

Internet	Web Site: www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Asia Pacific (location in Malaysia)	Tel: +603.7724.2080, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Asia Pacific (location in China)	Tel: +86.21.5187.7337 x888, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Europe (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: support.EMEA@prosoft-technology.com Languages spoken include: French, English
Europe (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: mea@prosoft-technology.com Languages spoken include: English, Hindi
North America (location in California)	Tel: +1.661.716.5100, E-mail: support@prosoft-technology.com Languages spoken include: English, Spanish
Latin America (Oficina Regional)	Tel: +1-281-2989109, E-Mail: latinam@prosoft-technology.com Languages spoken include: Spanish, English
Latin America (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: soporte@prosoft-technology.com Languages spoken include: Spanish
Brasil (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: brasil@prosoft-technology.com Languages spoken include: Portuguese, English

9.1 Return Material Authorization (RMA) Policies and Conditions

The following Return Material Authorization (RMA) Policies and Conditions (collectively, "RMA Policies") apply to any returned product. These RMA Policies are subject to change by ProSoft Technology, Inc., without notice. For warranty information, see Limited Warranty (page 81). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

9.1.1 Returning Any Product

- a) In order to return a Product for repair, exchange, or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft Technology and comply with ProSoft Technology 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 77). 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 Technology, 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 Technology using a shipment method other than that specified by ProSoft Technology, 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. Returns for credit require that all accessory parts included in the original box (i.e.; antennas, cables) be returned. Failure to return these items will result in a deduction from the total credit due for each missing item.

9.1.2 Returning Units Under Warranty

A Technical Support Engineer must approve the return of Product under ProSoft Technology'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 Technology at designated location referenced on the Return Material Authorization
 - i. If a defect is found and is determined to be customer generated, or if the defect is otherwise not covered by ProSoft Technology's warranty, there will be no credit given. Customer will be contacted and can request module be returned at their expense;
 - ii. If defect is customer generated and is repairable, customer can authorize ProSoft Technology to repair the unit by providing a purchase order for 30% of the current list price plus freight charges, duties and taxes as applicable.

9.1.3 Returning Units Out of Warranty

- a) Customer sends unit in for evaluation to location specified by ProSoft Technology, freight prepaid.
- 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

9.2 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 Technology, Incorporated (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.

9.2.1 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 (3) years from the date of shipment for Product purchased **on or after** January 1st, 2008, or one (1) year from the date of shipment for Product purchased **before** January 1st, 2008 (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 from date of original shipment. 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 remanufactured replacement parts. ProSoft reserves the right, and at its sole discretion, may replace unrepairable units with new or remanufactured equipment. All replacement units will be covered under warranty for the 3 year period commencing from the date of original equipment purchase, not the date of shipment of the replacement unit. 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 warranted 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.

9.2.2 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.

9.2.3 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 or 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.

9.2.4 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.

9.2.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 81) 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.

9.2.6 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 include, 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.

9.2.7 Time Limit for Bringing Suit

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

9.2.8 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.

9.2.9 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.

9.2.10 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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