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1550 MBS

Modbus Protocol Interface

1550 Communications Interface for 1336
Adjustable Frequency AC Drive

User Manual

February 16, 2005

ProSoft
TECHNOLOGY

Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Allen Bradley Modbus Protocol Interface 1550 Communications Interface for 1336 Adjustable Frequency AC Drive hardware and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

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

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Important Notice: The 1550 card allows remote access to commands in the Allen Bradley drives and other SCANport compatible devices. The user is responsible for assuring that any applicable regulations concerning the remote operation of equipment are adhered to.

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Contents

1   Quick Start Guide

In This Chapter

In this section we have assembled a simple step-by-step procedure for installing and making the 1550 unit operational. This discussion presumes that the application decisions such as RS-232 versus RS-485, SCALper cable length, etc. have been addressed prior to this point.

1.1   Step-by-Step

The following steps will allow the 1550 to be setup in the shortest period of time (the following steps refer to the Allen Bradley drive implementation. Similar steps are followed when interfacing to other A-B Power Division products):

1   Set the dip switches. The 1550 dip switch positions are detailed in Section 3

2   Mount the 1550 either in the drive or on the DIN rail. If using an Open Style, plug the unit into the drive. If using the Enclosed Style, mount the unit with DIN rail. See Appendix C for mounting instructions.

3   Connect power to the 1550. If working with an Open Style unit, there are no power connection concerns. When working with the 120 VAC or the 24 VDC Enclosed Style units, please refer to Section 3

4   Setup the Drive hardware. Refer to the appropriate drive manual to connect control and power to the drive. This aspect of the drive installation is out of the scope of this manual.

5   Setup the Drive parameters. See Section 4 of the manual to setup the drive parameters

6   Install the SCANport cable between the drive and the 1550. When using the Enclosed Style, a cable connection between the 1550 and the drive must be made to connect the SCANports together. See Appendix D for instructions.

7   Connect the serial communication cable between the host system and the 1550. Section 6 details the cable connection diagrams for RS-232, RS-422 and RS-485 connections to the 1550 unit.

2 Product Specifications

In This Chapter

The ProSoft Technology, Inc. 1550-MBS card is a hardware product designed to be a communications front end for Allen Bradley SCANport compatible products (1336 Plus/Force/Vector and 1305, SMC Dialogue Plus, SMP3, etc.).

The product includes the following functionality:

2.1 Modbus Slave Specifications

- Protocol modes:

  RTU mode with CRC-16 error checking

- Supported Modbus Function codes:

  3 Read Multiple Data Registers

  4 Read Input Registers

  5 Force Single Coil

  6 Preset (Write) Single Data Register

  8 Loopback Test (Test 0 only)

  16 Preset Multiple Data Registers (1 word per write)

- Supports broadcast commands from host
- Pre-assigned Modbus memory map

2.1.1 Read/Write

- Command Control/Frequency
- Datalinks Out A to D
- Up to 575 drive parameter values

2.1.2 Read Only

- Status/Feedback
- Datalinks In A to D

2.2   General Specifications

- Configuration via dip switches

  Slave Address   1 to 63

  Baud Rate   300 to 19200 baud

  Parity   None, Odd and Even

  Physical Link   RS-232, RS-422 or RS-485

  Stop Bits   1 or 2

  Comm Configuration

          Modbus RTU Slave

          Modbus ASCII 7 or 8 bit Slave (future)

  SCANport Messaging

          Datalink A Enable (Type 4 Enable)

          Datalink B Enable (Type 5 Enable)

          Datalink C Enable (Type 6 Enable)

          Datalink D Enable (Type 7 Enable)

- Supplied in two forms:

  Open Style - Power supplied by drive

  Enclosed - Power supplied externally (120 VAC)

- Communication Port Connectors

  Modbus - 9 Pin Female

  SCANport - Regular A-B SCANport connection

- Status LED

  SCANport Status (bi-color)

  Serial Port Status (bi-color)

  Tx/Tx Activity Status (amber)

- Current Consumption : 60 ma DC

- Input Voltage

  Open   Supplied by drive

  Enclosed   85 to 264 VAC, 1 Phase

                    45 to 63 Hz

- Operating Temp   0 to 50 °C
- Storage Temp   -40 to 85 °C

3   Slave Port Functionality

In This Chapter

3.1   Modbus Communications

The 1550-MBS Modbus Slave card runs the RTU version of the Modbus protocol. This capability allows the module to communicate data from a A-B VFD to a Modbus Master host, and vice-versa. The module supports both point-to-point implementations as well as multi-drop implementations.

The following discusses the functional capabilities of the 1550-MBS card.

3.1.1   Command/Reply Cycle

Successful communications between the card and a host will always consist of the following two transactions:

Command: Message from master giving instruction to slave.

Reply: Response to command.

A slave station will respond to a master issued command in several ways.

- ▪   **Data Message:**   If the command was executed by the slave, the response message will include the data requested, or an acknowledgment that the command was executed.
- ▪   **Error Message:**   If the command could not be executed by the slave, for whatever reason, an error response message is transmitted to the master. The error response message consists of the original function code (or'd with 80hex) and an error code.
- ▪   **No Reply**: If the master does not detect a reply within its timeout period, the master should re-transmit the command, before a time out error is issued. If the Slave could not decode the message or an error occurred preventing the Slave from recognizing the message, no response will be issued.

3.1.2   Command Types

The 1550-MBS can respond to three types of commands from the master; read data, write data, and a diagnostic command. These are described below:

Read Data: The following types of data read commands are supported:

Command	Description
3	Read Multiple Registers
4	Read Input Registers

Write Data:The following data write command is supported:

Command	Description
5	Force Single Coil
6	Single Register Write
16	Write Multiple Registers

Diagnostics: The diagnostic command is supported:

Command	Description
8	Loopback Test - Code 0

3.1.3   Command Error Checking

When the 1550-MBS cannot execute a command, an error code is generated and returned to the master. Error codes generated at the slave will usually be indicative of an illegal function, an illegal address, bad data, or the inability to complete a transaction because of a network problem.

3.1.4   Data Integrity

As in all good protocols, there must exist a level of data integrity checking to verify, with some degree of assurance, the quality of the transmitted data. The Modbus protocol supports two types of error checking:

- RTU Mode : 16 bit cyclic redundancy check (CRC-16)
- One bit parity check

CRC-16: When the master generates a message, a 16 bit CRC value is added to the end of the transmitted packet. The CRC value is generated using a series of bit shifts and manipulations. The receiving station executes the same calculation on the data and verifies the transmitted CRC. Any discrepancy will cause the message to be disregarded.

Parity: Parity checking can be added as an additional level of data security. If parity checking is selected, even or odd parity can be implemented.

3.1.5   Modbus Register Map

A pre-defined register map has been provided for the 1550 unit. This map is detailed in Appendix A. The full memory map is dependent on the A-B device which is connected to the 1550 unit.

On power-up, the 1550 unit polls the remote device and determines the number of parameters that exist. If the number is greater than 575 the parameter list will be limited to 575.

4   Hardware Setup

In This Chapter

4.1   1550 Card Setup

4.1.1   Connecting Power to the 1550 Card - Enclosed Style

Connecting power to the Enclosed Style Communication Module (1552 model) requires a simple termination of the 120 VAC cable to the front of the module. The connection is shown in the following diagram:
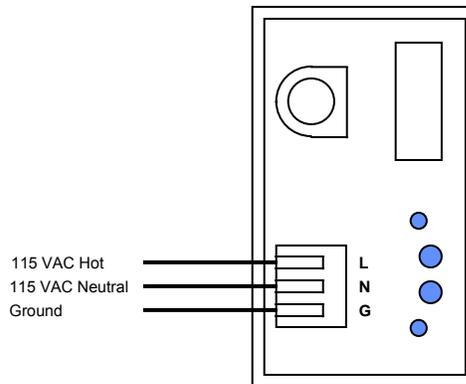
4.1.2   Dip Switch Configuration

Configuration of the 1550 is independent of whether the unit is an internally mounted (1551) card or an externally mounted unit (1552). In either case, configuration consists of setting up some dip switches. The dip switches are as follows:

Please note that dip switch configuration is read by the 1550 during the power up process. Power must be cycled if dip switches are changed under power.

Switch SW 1

Communication Physical Link	**SW1** 8 Hardware sel-H 7 | -L	**87** 00 = RS-232 01 = RS-422 10 = RS-485

Slave Address	**SW1**
	6 MSB dev addr -32
	5 | -16
	4 | -8
	3 | -4
	2 | -2
	1 LSB dev addr -1
		Valid Address are between 1 and 63
		Example:
		        654321
		        001100
		Represents address 12

Switch SW 2

Stop Bits	**SW2** 8 Stop Bits	0 = 1 Stop Bit 1 = 2 Stop Bits
Parity Modbus should select None	**SW2** 7 Parity - H 6 - L	**76** 00 = None 01 = Odd 10 = Even (Odd/Even parity is invalid at this time)
Not Assigned	**SW2** 5 Not assigned 4 Not assigned	
Baud Rate Select	**SW2** 3 Baud Select 2 1	**321** 000 = 300 001 = 600 010 = 1200 011 = 2400 100 = 4800 101 = 9600 110 = 19200 111 = 19200

Switch SW 3

SCANport Message	**SW3** 8 7 6 5	Datalink D Enable Datalink C Enable Datalink B Enable Datalink A Enable	Type 2(Control/Status and Reference/Feedback) is enabled by default. The datalinks will provide the fastest update times for values from the drives. Be aware that not all A-B SCANport devices support the data links (Verify when setting up A-B device and enable accordingly)
Communication Loss	**SW3** 4	Enable Fault on Loss of Comm	0 = No Fault 1 = Fault on Loss of Comm Enables/Disables a 10 second communication timeout timer. If timer times out, the device will be Serial Faulted. The timeout timer is reset upon receipt of <u>any</u> communications on the line, not just comm. for this slave. Note that the 1550-MBS may have to be power cycled after loss of comm to restart the SCANport communications. See Section 5 for values of the SCANport status register (40021)
Communication Configuration	**SW3** 3 2 1	Comm mode Comm mode Comm mode	<u>321</u> 000 = Modbus Slave RTU 001 = Modbus ASCII 7 bit (fut.) 010 = Modbus ASCII 8 bit (fut.)

5   Configuring Drive Parameters

In This Chapter

When the drive is first received, several parameters must be setup by the user in order for data transfer and control to be properly implemented.

5.1   Data Transfer

1   The 1550 units read and write data using three methods:

2   Control/Status Read and Write by default (Type 2 command)

3   Datalinks A to D selected by dip switch (Type 4,5,6,7 commands)

4   Client/Server Messaging by default (Up to 575 parameters)

When full datalinks (A to D) are enabled , a total of 10 words of data can be transferred each way. Two of these words are dedicated to specific functions, leaving eight words for User configuration.

In order to accomplish the transfer, the A-B Device's I/O ADAPTOR Data In and Data Out parameters must be configured. A discussion on the SCANport link communications is excerpted from the A-B documentation and included in Appendix D.

Please note that not all A-B Scanport devices support Datalinks. In particular, the SMC Dialogue Plus does not. To operate with the SMC Dialogue Plus do not enable the Datalink Messaging.

5.1.1   Controlling Drive Frequency

The primary configuration which must be performed is associated with enabling Frequency Control from the 1550.

In order to enable Frequency control from the 1550, the drive parameter FREQUENCY SELECT 2 must be configured for the appropriate Adapter ID representing the 1550 module. This will normally be Adaptor #2, unless a SCANport expander is being used (in which case this Adaptor number will be based on the port the 1550 is plugged into.

5.1.2   Setting up the Adaptor I/O - Data Out

Selects the parameter values which will be made available to the 1550 for reading into the register map. The Parameter Table can be found in Appendix A which details the placement of the values in the 1550.

Data Out Image	Suggested Parameter	Description
A1	54	Output Current
A2	1	Output Volts
B1	23	Output Power
B2	53	DC Bus Voltage
C1		
C2		
D1	19	Maximum Frequency
D2	4	Last Fault

5.1.3   Setting up the Adaptor I/O - Data In

Selects the parameters which will be made accessible for configuration/ writing from the 1550. As with the Data Out parameters, there are eight possible selections. These may be chosen as needed to meet the needs of the application.

6   Troubleshooting

In This Chapter

Several hardware diagnostics capabilities have been implemented using the LED indicator lights on the front of the 1550 card. The possible conditions as indicated by the lights are:

6.1   LED Locations

The location of the LEDs on the units are shown in the following diagrams:
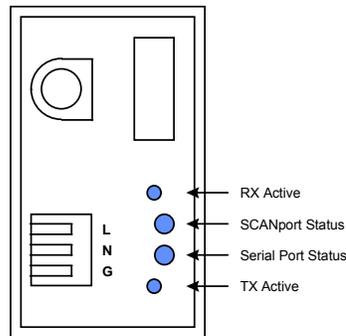
LED Locations for Enclosed Style unit
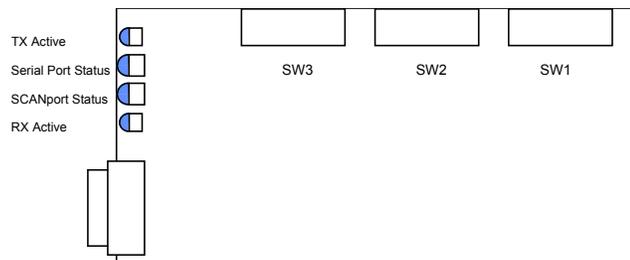
Front View Open Version

LED Locations for Open Style unit

6.2   LED Troubleshooting Table

The following table details the meaning of the LEDs in the 1550 unit.

NAME	Color	Status	Indication
Serial Port Status	Green	Blinking	The 1550 has successfully processed a command from the host and has generated a response.
	Red	Steady or Blinking	The 1550 unit has detected a serial communication error condition on the Serial port. This is normally due to a bad communication transmission from a host such as an invalid command or a request for an invalid point.
			This LED will also be steady if SW3-4 is enabled and there is no communication on the serial port.
SCANport Status	Green	Steady	SCANport connection if OK
	Green	Blinking	Check cable connections. Indicates that the 1550 unit is not able to link up with the drive's SCANport. Make sure that the A-B device supports Datalinks if the 1550 Datalinks are enabled.
	Red	Steady	The SCANport connection has faulted. Check configuration switch settings, SCANport cable connections, cycle power. Contact ProSoft factory support if problem persists.
RX Active	Amber or Green	Blinking	The 1550 Serial Port has detected some activity on the receive pins.
TX Active	Amber or Green	Blinking	The 1550 is sending out a response to the host.

7 Cable Diagrams

In This Chapter

The communication connections to the 1550 card are made via a DB-9 pin female connection on the front of the card. The physical terminations are shown in the following diagrams.

7.1 1550 Communication Port

RS-232 w/ No Hardware Handshaking **Port Connection with another communication port**	**1550** **DB-9 Pin Female**		**PC or Device**
	TxD	2	RxD
	RxD	3	TxD
	COM	5	GND

RS-422 4-wire Connection	**1550** **DB-9 Pin Female**		**RS-422** **Device**
	TxD+	9	RxD+
	TxD-	4	RxD-
	RxD+	6	TxD+
	RxD-	2	TxD-
	COM	5	COM (Optional)

RS-485 2-wire Connection	**1550** **DB-9 Pin Female**		**RS-485** **Device**
	TxRxD+	9	TxRxD+
	TxRxD-	4	TxRxD-
	COM	5	COM
	Shield	3	

Appendix A Modbus Register Map

	FC	FC	FC				
Type	5	4	3	Reg	Bit	Description	
R/W	1 to 16	30001	40001	0		Command Control Word	
R/W		30002	40002	1		Type 2 - Word 2	
R/W		30003	40003	2		Adaptor I/O - Out A1	Type 4 Command
R/W		30004	40004	3		Adaptor I/O - Out A2	Type 4 Command
R/W		30005	40005	4		Adaptor I/O - Out B1	Type 5 Command
R/W		30006	40006	5		Adaptor I/O - Out B2	Type 5 Command
R/W		30007	40007	6		Adaptor I/O - Out C1	Type 6 Command
R/W		30008	40008	7		Adaptor I/O - Out C2	Type 6 Command
R/W		30009	40009	8		Adaptor I/O - Out D1	Type 7 Command
R/W		30010	40010	9		Adaptor I/O - Out D2	Type 7 Command
R		30011	40011	10		Status Word	
R		30012	40012	11		Type 2 - Word 2	
R		30013	40013	12		Adaptor I/O - In A1	Type 4 Command
R		30014	40014	13		Adaptor I/O - In A2	Type 4 Command
R		30015	40015	14		Adaptor I/O - In B1	Type 5 Command
R		30016	40016	15		Adaptor I/O - In B2	Type 5 Command
R		30017	40017	16		Adaptor I/O - In C1	Type 6 Command
R		30018	40018	17		Adaptor I/O - In C2	Type 6 Command
R		30019	40019	18		Adaptor I/O - In D1	Type 7 Command
R		30020	40020	19		Adaptor I/O - In D2	Type 7 Command
R		30021	40021	20		ScanPort Comm Status	
						Device Parameter List	
R/W		30022	40022	21		1	
R/W		30023	40023	22		2	
R/W		30024	40024	23		3	
R/W		30025	40025	24		4	
R/W		30026	40026	25		5	
R/W						-	
R/W						FC 3 Modbus Address = Parameter Number + 40021	
R/W						-	
R/W		30xxx	40xxx			Up to Max Parameter in Device (Up to 575 max)	

All register values in the 1550-MBS are presented in unscaled units. Please refer to the drive User manual for any necessary scaling information

Appendix B Device Specific Hints

SMC Dialogue Plus

The SMC Dialogue Plus does not support Datalinks, therefore the configuration of SW3 should not include any of the Datalinks Enabled. If a Datalink is enabled, the SCANport Status LED will toggle, indicating an error in the SCANport communications.

The version of SMC which we tested (Rev 1.05) had 88 parameters. Each parameter was accessible in the Modbus register listing shown in Appendix A. Note that if one of the 88 parameters is to be changed from a host that the host must enable the EEPROM Storage function by writing a 2 into the Parameter Management parameter (17 - Modbus address 40038).

SMP 3

The SMP3 does not support Datalinks, therefore the configuration of SW3 should not include any of the Datalinks Enabled. If a Datalink is enabled, the SCANport Status LED will toggle, indicating an error in the SCANport communications.

The 1550 is able to read all of the parameters out of the SMP3 unit.

Appendix C: Mounting Instructions

Open and Enclosed Style Units

In This Chapter

Mounting the Communications Module

The Communications Module can be provided in three mounting configurations

- Open style board, factory installed in a drive (not available for all drives)]
- Open style board as a separate kit
- Enclosed style for panel mount or DIN rail mount

This section provides mounting information for the Enclosed style and the Open style kit.

Figure C-1

Open Style Communications Module Mounting Location

(1336 PLUS 7.5-500HP)
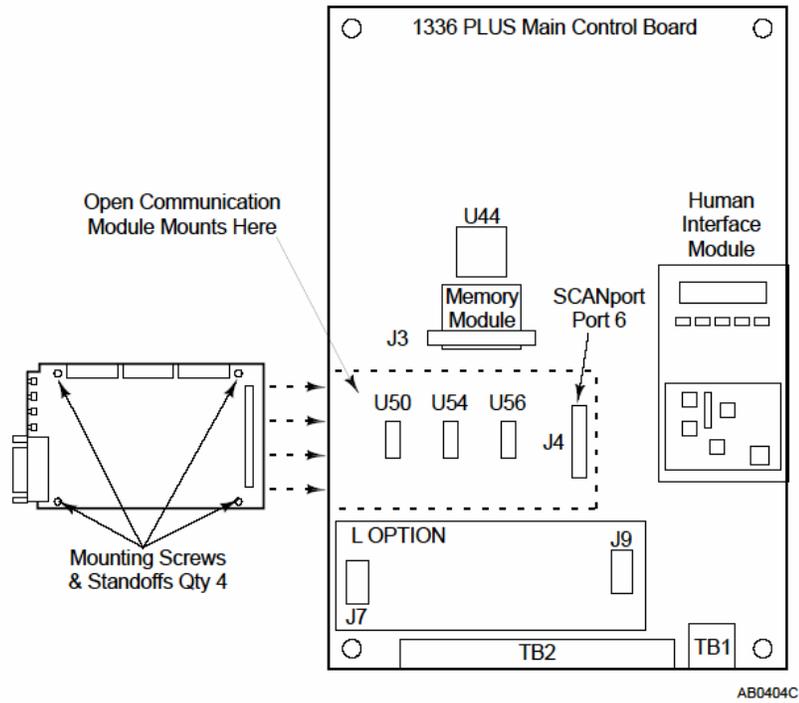
Enclosed Style Communications

Module Dimensions

Figure C-2

Enclosed Style Communications Module Dimensions
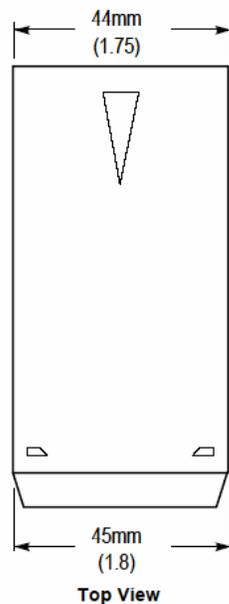
45mm
(1.8)

25mm
(1)

76mm
(3.0)

DINN
Rail

25mm
(1)

Front View

123mm
(4.8)

DIN
Rail

Side View
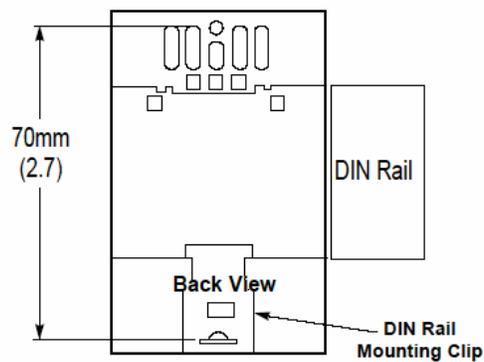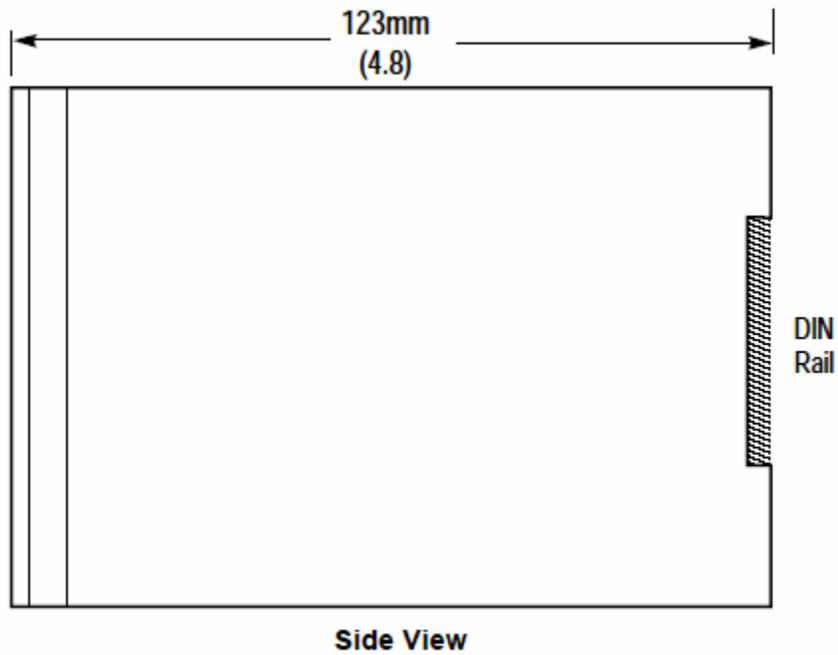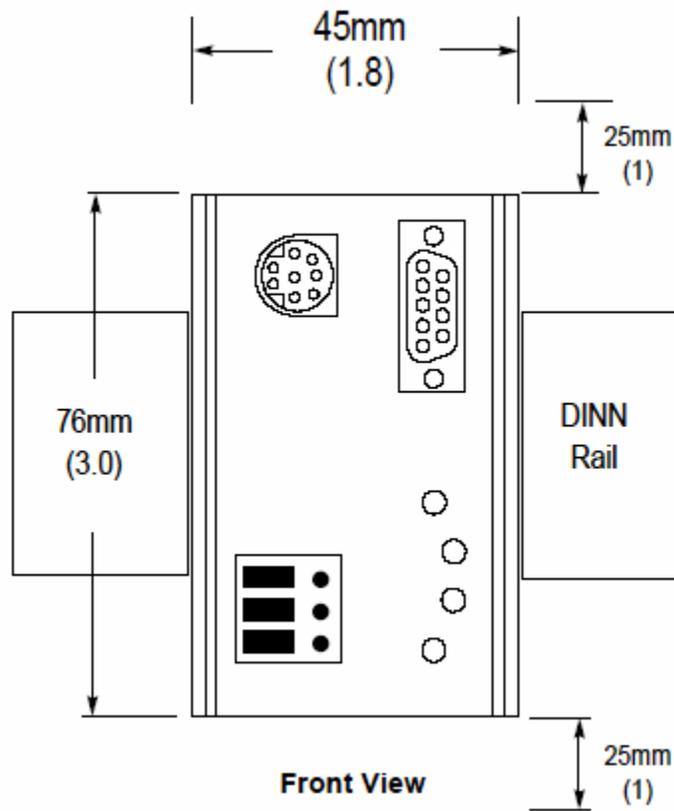
Figure C-3

Enclosed Style Communications Module Mounting Location

(1336 FORCE Drive with Standard Adapter Board)
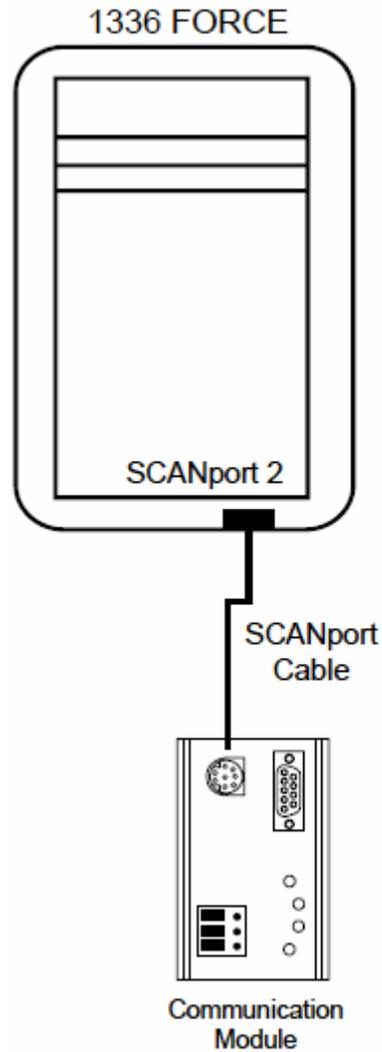
Appendix D: Cable Requirements

In This Chapter

SCANport cables are available in either Male to Male or Male to Female configuration. Cables of up to 10 meters (33 feet) can be connected from the master to the SCANport device (A in Figure D-1). If a Port Expander is used as shown in Figure D-1, the overall cable length from master to port expander to SCANport device must not exceed 10 meters (B1 + C = max 10 meters).

1305 Drive

An Allen Bradley SCANport link cable is used to make the connection between the Communications Module and the drive (Figure D-1).

Figure D-1

SCANport Connection on Communications Module
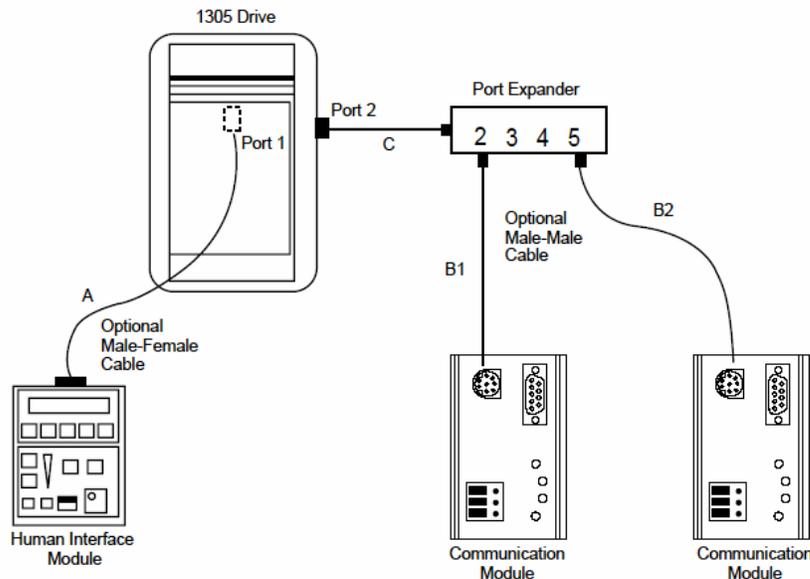
> **Important:** The length of cable used between any two devices must not exceed 10 meters (33 feet).
>
> For example: A + B1 +C < 10 meters
>
> A + B2 +C < 10 meters
>
> B1 + B2 < 10 meters

1336 PLUS (7.5-500HP) and 1336 FORCE

Refer to the product manual for correction information. On larger horsepower 1336 PLUS and FORCE drives with an open Communications Module mounted in the drive, no separate SCANport cable connection is required.

SMP 3

An Allen Bradley SCANport cable is used to make the connection between the Communications Module and an SMP3.

Figure D-2

SCANport Connection on Communications Module
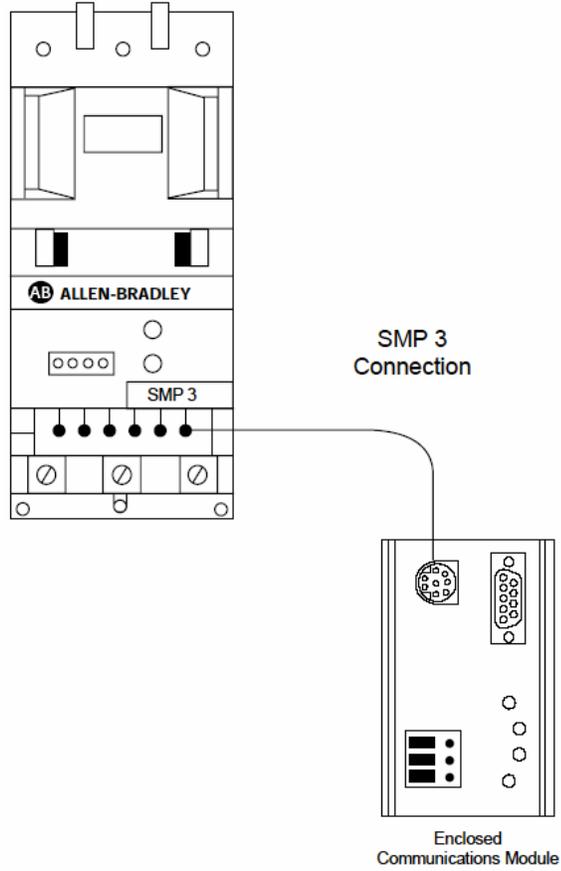
Appendix E: SCANport Datalink Operation

A datalink is a type of pointer used by some SCANport devices to transfer information to the drive. Datalinks allow parameter values to be written when the Logic Command and Reference are sent to the drive. Datalinks also allow parameter values to be read whenever the Logic Status and Feedback are read.

SCANport devices that support this function have a group of parameters for Datalink configuration. These parameters are identified as "Datalink In" and "Datalink Out" parameters. The Datalink functions are enabled by setting the correct switch to "Enable" on SW3 of the Communications Module and configuring the "Datalink In" and "Datalink Out" parameters in the SCANport device.

Each Datalink consists of two 16-bit words of input and two 16-bit words of output. Each of the two input words can be configured to write to a different destination parameter inside the SCANport device by setting the two "Datalink In" parameters for that Datalink to the desired destination parameters. Similarly, each of the two output words is configured by setting the two "Datalink Out" parameters for that Datalink.

Each Datalink switch on SW3 can enable or disable one Datalink. If a Datalink is enabled the value of the parameters set in the "Datalink Out" parameters will be transferred to the Communications Module and the data sent by the Communications Module for the Datalink will be transferred into the parameters set in the "Datalink In" parameters. If a Datalink is not enabled the data transferred to the SCANport device for that Datalink will be zero and any data sent by the SCANport device will be ignored by the Communications Module.

If no "Datalink In" parameter is configured for an input word that word will be ignored. If no "Datalink Out" parameter is configured for an output word the output word will be undefined (usually set to zero).

Support, Service & Warranty

ProSoft Technology, Inc. survives on its ability to provide meaningful support to its customers. Should any questions or problems arise, please feel free to contact us at:

Internet	Web Site: http://www.prosoft-technology.com/support
	E-mail address: support@prosoft-technology.com
Phone	(661) 716-5100
	(661) 716-5101 (Fax)
Postal Mail	ProSoft Technology, Inc.
	1675 Chester Avenue, Second Floor
	Bakersfield, CA 93301

Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information (you may wish to fax it to us prior to calling):

Support, Service and Warranty

1 Product Serial and Version Number

2 1550 Configuration Information

   o Dip Switches

   o Communication cabling

An after-hours answering system (on the Bakersfield number) allows pager access to one of our qualified technical and/or application support engineers at any time to answer the questions that are important to you.

Module Service and Repair

The 1550 MBS device is an electronic product, designed and manufactured to function under somewhat adverse conditions. As with any product, through age, misapplication, or any one of many possible problems the device may require repair.

When purchased from ProSoft Technology, Inc., the device has a 1 year parts and labor warranty according to the limits specified in the warranty. Replacement and/or returns should be directed to the distributor from whom the product was purchased. If you need to return the device for repair, obtain an RMA (Returned Material Authorization) number from ProSoft Technology, Inc.. Please call the

factory for this number, and print the number prominently on the outside of the shipping carton used to return the device.

General Warranty Policy

ProSoft Technology, Inc. (Hereinafter referred to as ProSoft) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at ProSoft's election, of defective or non-conforming Product, and ProSoft shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misapplication or misuse of the Product; (b) failure of Customer to adhere to any of ProSoft's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by ProSoft.

Limited warranty service may be obtained by delivering the Product to ProSoft and providing proof of purchase or receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to ProSoft, and to use the original shipping container or equivalent. Contact ProSoft Customer Service for further information.

Limitation of Liability

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Where directed by State Law, some of the above exclusions or limitations may not be applicable in some states. This warranty provides specific legal rights; other rights that vary from state to state may also exist. This warranty shall not be

applicable to the extent that any provisions of this warranty are prohibited by any Federal, State or Municipal Law that cannot be preempted.

Hardware Product Warranty Details

Warranty Period: ProSoft warranties hardware Product for a period of 1 year.

Warranty Procedure: Upon return of the hardware Product ProSoft will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using current ProSoft standard rates for parts and labor, and return the Product freight collect.

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