A·B QUALITY
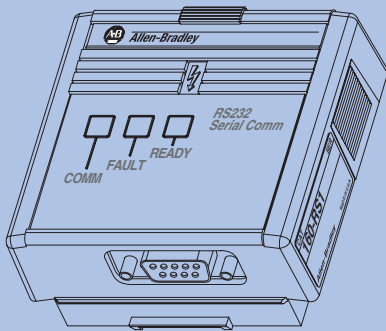
Allen-Bradley

160-RS1 Serial Communication Module

FRN 1.xx

User Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*" (Publication SGI-1.1) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of the Allen-Bradley Company is prohibited.

Throughout this manual we use notes to make you aware of safety considerations.

> ⚠ **ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:
- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

> **Shock Hazard** labels may be located on or inside the drive to alert people that dangerous voltage may be present.

Table of Contents

Using This Manual

The purpose of this manual is to provide you with the necessary information to apply the Bulletin 160-RS1 Communication Module. Described in this manual are methods for installing, configuring, and troubleshooting the RS1 Communication Module.

For information on specific drive features, refer to the *Bulletin 160 User Manual*.

Important: Read this manual in its entirety before installing, operating, servicing, or initializing the RS1 Module.

Who Should Use This Manual?

This manual is intended for qualified personnel. To make efficient use of the Communication Module, you must be able to program and operate serial communications devices, as well as have an understanding of the parameter settings and functions of the 160 Drive.

Conventions

In this manual we refer to the:

- 160 RS1 Communication Module as Communication Module, RS1 Module or Module.
- 160 SSC Adjustable Frequency AC Drive as the 160 Drive or drive.

In addition, parameter numbers and names (both 160 Drive and RS1 Module) are shown in bold typeface and follow the format PXX - [*] where P denotes parameter, XX denotes the two digit parameter number, and * represents the parameter name.
For example, **P01 - [Output Frequency]**.

RS1 Compatibility

The RS1 Module is compatible with all series of 160 Drives. When properly connected, the module communicates via RS-232 using the Allen-Bradley DF1 protocol.

Reference Manuals

The following documents contain additional information concerning Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley Sales Office or visit the "On-Line Publications" area of the Allen-Bradley home page on the World Wide Web at: **www.ab.com**.

For	Read This Document	Publication Number
Information about the DF1 protocol	DF1 Protocol and Command Set Reference Manual	1770-6.5.16
Additional information about networking and the SLC™ 500	SLC 500 Modular Hardware Style Manual	1747-6.2
Information about the AIC+	AIC+ Advanced Interface Converter User Manual	1761-6.4
Instruction set information for the SLC 500 and MicroLogix™ 1000	SLC 500 and MicroLogix 1000 Instruction Set Reference Manual	1747-6.15
For general MicroLogix 1000 information	MicroLogix 1000 User Manual	1761-6.3
For DriveExplorer™ information	DriveExplorer User Manual	9306-5.0
For 160 SSC Drive Information:	160 SSC User Manual Series A 160 SSC User Manual Series B 160 SSC User Manual Series C	0160-5.0 0160-5.9 0160-5.15
A complete listing of current Allen-Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1

Safety Precautions

ATTENTION: Only personnel familiar with 160 Drives, Communication Modules and associated machinery should plan or implement the installation, start-up, configuration and subsequent maintenance of this module. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: This module contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley Publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD protection handbook.

ATTENTION: The drive contains high voltage capacitors which take time to discharge after removal of AC line power. Before installing or removing the Communication Module, ensure isolation of mains supply from line inputs L1, L2, L3 (R, S, T). Wait the recommended amount of time for the capacitors to discharge to safe voltage levels (refer to the *160 User Manual* for recommended time). Failure to do so may result in personal injury or death.

ATTENTION: When a system is configured for the first time, the motor must be disconnected from the machine or process during initial system testing. Hazard of injury or equipment damage may occur due to unintended or incorrect machine motion.

Product Overview

This chapter contains the following information:

- The physical layout of the module.
- Location of configuration switches.
- Overview and components.

Module Description

The RS1 Module is an optional interface device designed to provide a direct, digital link between RS-232 devices and the 160 Drive. The module connects to the drive through the expansion/keypad port on the front of the drive. Refer to the figures 1.1 and 1.2 for general layout of the module and Chapters 4 or 9 for details on the LED indicators.

Figure 1.1
Module Front View

Module Installation Latch

Status LEDs
*Refer to Chapters 4 & 9
for Further Information*

*RS232
Serial Comm*

READY

FAULT

COMM

9 Pin, Female D-Shell Connector
Refer to Chapter 3 for Details

Nameplate
*Provides Firmware Version
and Series Letter*
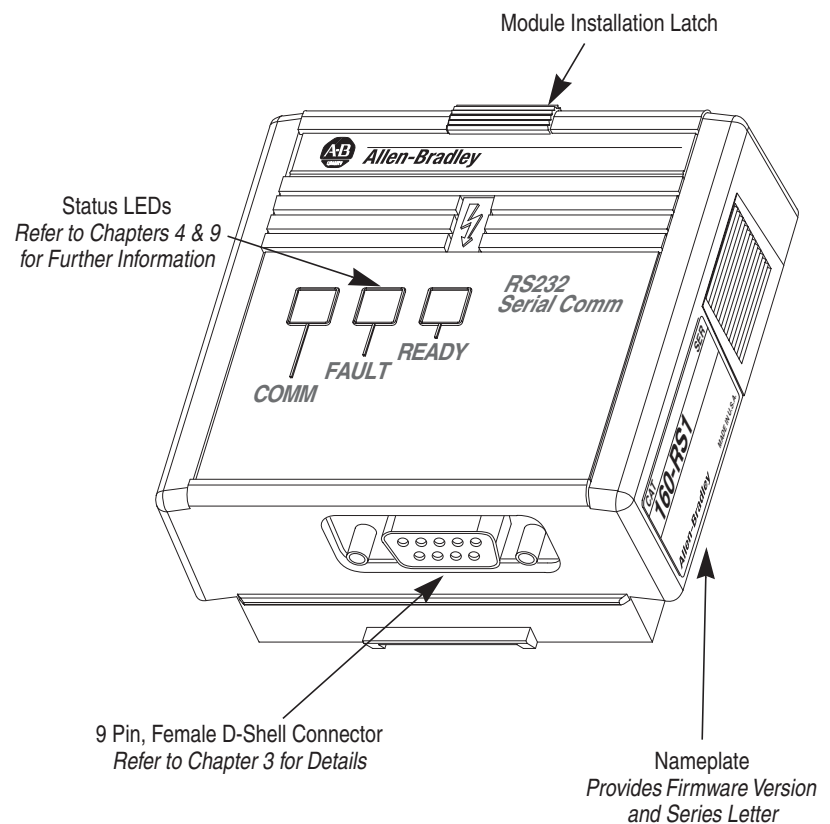
Configuration DIP Switches

The Communication Module has one four position DIP switch for setting the baud rate, protocol and checksum type. DIP switches are located on the rear of the module (see below) and are only accessible when the module is removed from the 160 Drive. Refer to Chapter 3 for switch configuration information.

Figure 1.2
Module Rear View

Module Latch

Expansion/Keypad Port
Connector

SW1 - SW4
DIP Switches

D-Shell Connector
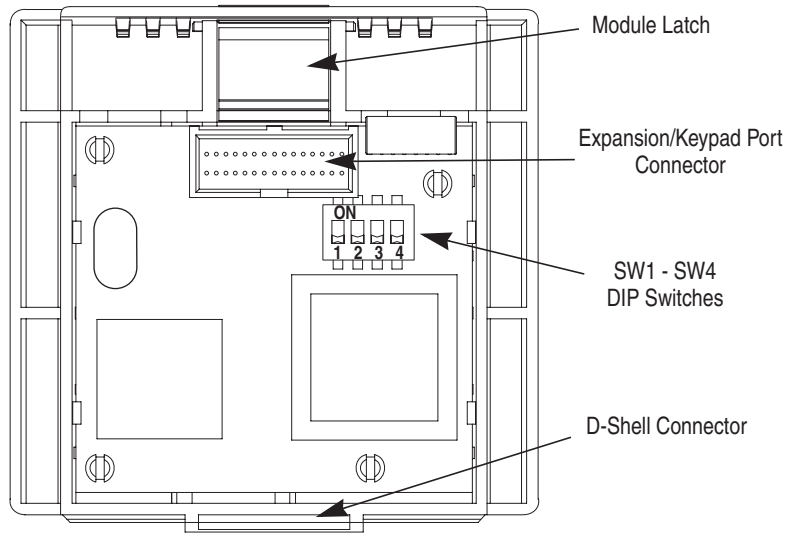
Quick Start for Experienced Users

This chapter can help you start using the RS1 Communication Module. If you have installed or configured a network previously and are familiar with Allen-Bradley communication modules and drives, this information can help reduce the time of installation. If you are uncertain, use the full installation/configuration information beginning in Chapter 3.

We base the procedures here on the assumption that you understand the basic concepts and know how to program the 160 Drive. In addition, you should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application.

Because it is a *start-up guide for experienced users*, this chapter *does not* contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters* and other recommended documentation before trying to apply the information.

This chapter contains the following information:
• What tools and equipment you need.
• When to address, configure and program the module.
• How to install and wire the Communication Module.
• System power-up procedures.

Required Tools and Equipment

Have the following tools and equipment ready:
• 1/8 in. (3.2 mm) flat blade screwdriver.
• Blunt, pointed instrument (not pen or pencil) for setting the DIP switches.

Procedures

Step	Action	For Further Information Refer to . . .
1.	**Review Attention statements in the Preface.**	
2.	**Ensure that power has been removed to the 160 Drive.**	**160 Drive User Manual**
3.	**Verify that the 160 Drive is correctly installed and wired. Stop Input (TB3-7, TB3-8) must be jumpered together to start drive.**	**160 Drive User Manual**
4.	**Remove Program Keypad Module or Ready/Fault Indicating Panel from the drive.**	**Chapter 3** (Installation)
5.	**Set the RS1 Module's baud rate, protocol and check-sum type DIP switches.**	**Chapter 3** (Installation)
6.	**Install the RS1 Module.**	**Chapter 3** (Installation)
7.	**Connect communication cable.**	**Chapter 3** (Installation)
8.	**Power up the drive and the network.**	**Chapter 3** (Installation)
9.	**Configure the 160 Drive for the RS1 Module so the drive can accept control logic and speed reference via the network.**	**Chapter 8** (Using the RS1 Module with a Programmable Controller) *or* **Chapter 7** (Using the RS1 Module with DriveExplorer Software)
	Set **P46 - [Input Mode]** to a value of "2." This will configure the drive to accept the logic commands from the network.	
	Set **P59 - [Frequency Select]** to "1." This will configure the drive to accept speed commands from the network.	
10.	**Configure the RS1 Module parameters for your application.** *For Example:* **P103 - [Fault Mode], P114 - [Application Timeout], etc.**	**Chapter 6** (Parameter Descriptions)
11.	**Check for proper operation.**	

Installation and Wiring

This chapter contains information needed to:

- Meet the requirements of the EMC and Low Voltage directives for CE compliance.
- Remove a pre-installed Program Keypad Module or Ready/Fault Indicating Panel.
- Configure and install the RS1 Module.
- Wire the communication cables.
- Remove the RS1 Module from the drive.

Read this chapter completely before you attempt to install or configure your module. Before applying power, review the Attention statements presented throughout this manual. Verify that all connections are secure and that all selections are correct.

> ⚠ **ATTENTION:** Unpredictable operation may occur if you fail to check connections and DIP switch settings for compatibility with your application. Unpredictable operation may result in personal injury, death, and equipment damage.

EMC Directive 89/336/EEC Compliance

This product complies with Electromagnetic Compatibility (EMC) Directive 89/336/EEC when conforming with the following installation requirements:

- The essential requirements for a conforming EMC installation for the Bulletin 160 SSC are employed. Refer to the *Bulletin 160 SSC User Manual*.

Low Voltage Directive 73/23/EEC Compliance

This product complies with Low Voltage Directive 73/23/EEC when conforming with the following installation requirements:

- The essential requirements for a conforming Low Voltage Directive installation for the Bulletin 160 SSC are employed. Refer to the *Bulletin 160 SSC User Manual*.
- Review the Attention statements in the Preface, and other areas throughout this manual prior to installation of the module.

Module Configuration Switches

The RS1 Module utilizes a four position DIP switch (see figure below) to configure the baud rate, protocol and checksum. These switches must be set to match the application settings. Refer to the paragraphs that follow for details.

Important: When you make changes to the switch settings, use a blunt, pointed instrument (not a pen or pencil).

Figure 3.1
DIP Switch Location (Back of Module)
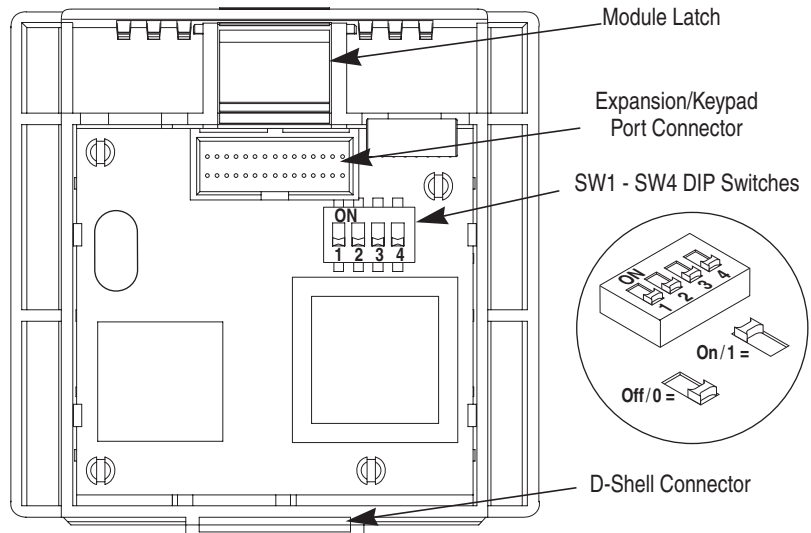
Setting the Baud Rate – SW1 & SW2

DIP switches SW1 and SW2 set the baud rate. Using the table below, configure the module for your application. Selection of the "EPROM Mode" (SW1 & SW2 are On) will cause the baud rate, protocol and checksum settings to be read from the RS1 parameters listed below. Note that these parameters must be programmed for correct operation.

Switches SW1 & SW2

	Switch Setting		
Baud Rate	**SW1**	**SW2**	**Special Notes**
9600 (Default)	Off	Off	
2400	On	Off	
1200	Off	On	
EPROM Mode	On	On	Baud Rate will be read from **P110 - [EPROM Baud]** Checksum will be read from **P109 - [EPROM Checksum]** Protocol will be read from **P108 - [EPROM Protocol]** **Important:** If an "AIC+" is being used and "EPROM Mode" is selected, SW3 must be set to "On" to enable software handshaking.

Setting the Protocol – SW3

As shown in the table below, SW3 sets the protocol being used (point-to-point or multi-drop). If EPROM Mode is active (SW1 & SW2 are On), the protocol will be read from **P108 - [EPROM Protocol]**.

Important: If an "AIC+" is being used and "EPROM Mode" is selected, SW3 must be set to "On."
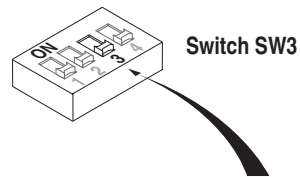
Switch SW3

Options	Switch Setting SW3	Special Notes
DF1 Point-to-Point (Default)	Off	Typically used for RS-232 applications between two devices.
DF1 Multi-Drop	On	Used for RS-232 applications between a number of devices. Additional module (i.e. AIC+) is required for RS-485 applications/networking.

Selecting the Checksum Mode – SW4

Switch SW4 sets the checksum mode. Configure this mode to be consistent with your communications and application. If EPROM Mode is active (SW1 & SW2 are On), the checksum mode will be read from **P109 - [EPROM Checksum]** (SW4 will have no effect).
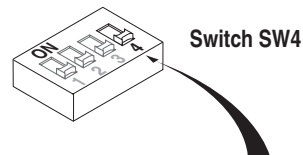
Switch SW4

Options	Switch Setting SW4	Special Notes
BCC (Default)	Off	Block checksum.
CRC	On	16 bit algorithm.

Module Installation/Removal

> ⚠️ **ATTENTION:** The drive contains high voltage capacitors which take time to discharge after removal of mains supply. Before installing or removing a keypad/module, ensure isolation of mains supply from line inputs L1, L2, L3 (R, S, T). Wait the recommended amount of time for the capacitors to discharge to safe voltage levels (refer to the *160 User Manual* for recommended time). Failure to do so may result in personal injury or death.

Keypad or Ready/Fault Panel Removal

Before installing the RS1 Module, it may be necessary to remove a previously installed Program Keypad Module or Ready/Fault panel.

1. Verify that all power to the drive is removed.

2. Insert a small screwdriver into slot, pry back and pivot module out. Avoid bending or twisting the contact pins located under the module.

Figure 3.2
Removing Program Keypad Module

Program Keypad Module
(or Ready/Fault Panel)
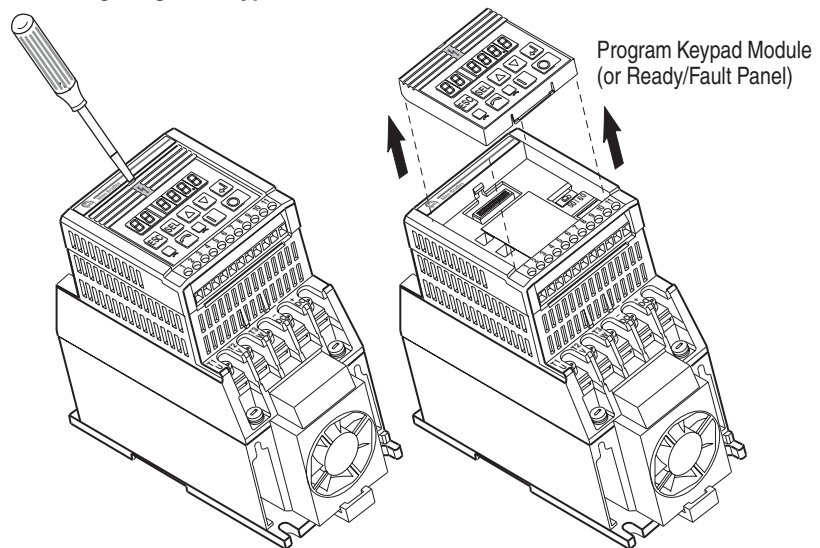
Installing the RS1 Module

After setting the DIP switches, install the RS1 Module in the drive by following these steps:

1. Verify that all power to the drive is removed.

2. Verify that the latch is up (see Figure 3.3). Insert the module, ensuring that the pins on the back of the module line up with the drive connector/expansion port.

3. Press the module down until it is fully seated (sides are flush with the top surface of the drive).

4. Press the latch down until it snaps into place.

Figure 3.3
Communication Module Installation

Latch must be in this position
before installation. Once installed,
push the latch down until it locks
into place.

Module should be flush
with top surface of drive
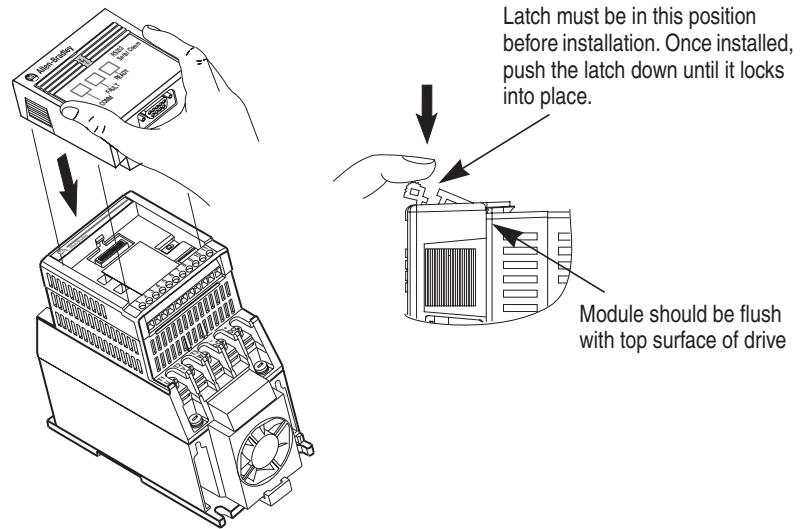
Removing the RS1 Module

If you need to reconfigure the RS1 Module DIP switches, you must
remove the module from the drive.

1. Verify that all power to the drive is removed. Review Attention
   statement on page 3–4.

2. Disconnect the cable/connector from the module (if present).

3. Press in on the module's latch and then push away and up.

4. Grasp the module and pull straight up. Avoid bending or twisting
   the contact pins located underneath the center portion of the
   module.

Figure 3.4
Removing the Communication Module
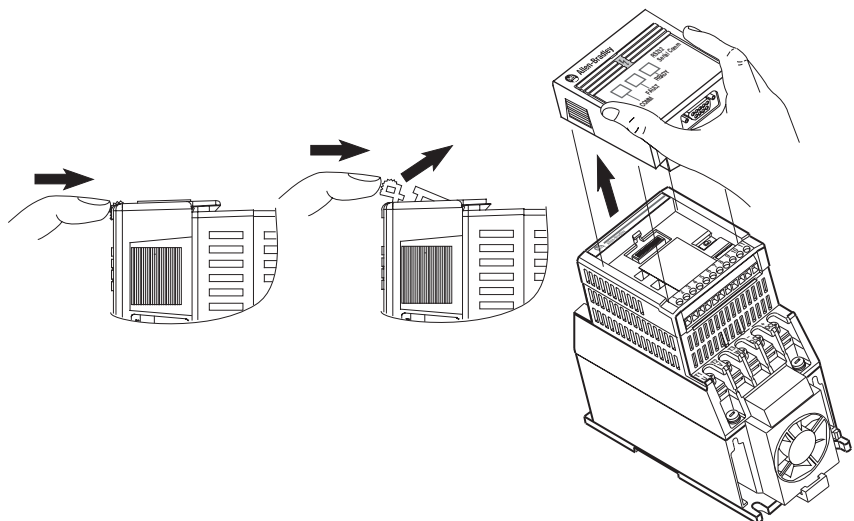
Wiring the Connector

The examples below can be used as a guide when wiring.

Important: Keep communication wiring away from high noise sources such as motor cables.

Figure 3.5
Wiring the RS1 Connector

Pin 1   Pin 9

9 Pin, Female D-Shell Connector
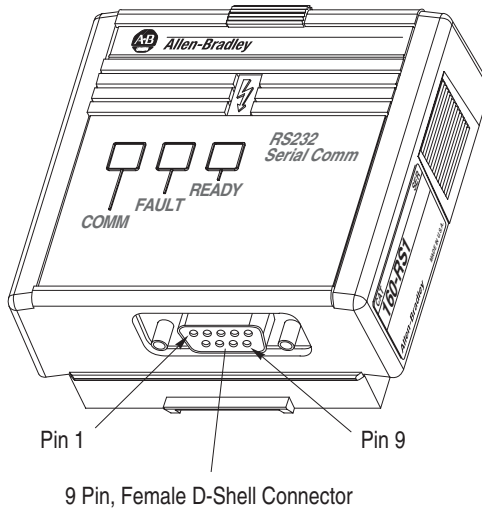
Personal Computer Serial Connections

RS1 Module
9 Pin, Male[1], D-Shell Connector

PC RS-232 Port
9 Pin, Female[1], D-Shell Connector

N.C.	COM	① ⑥
N.C.	TX	② ⑦
N.C.	RX	③ ⑧
N.C.	N.C.	④ ⑨
N.C.	COM	⑤

⑤ ⑨	COM	RI	
④ ⑧	DTR	CTS	
③ ⑦	TX	RTS	
② ⑥	RX	DSR	
①	DCD		
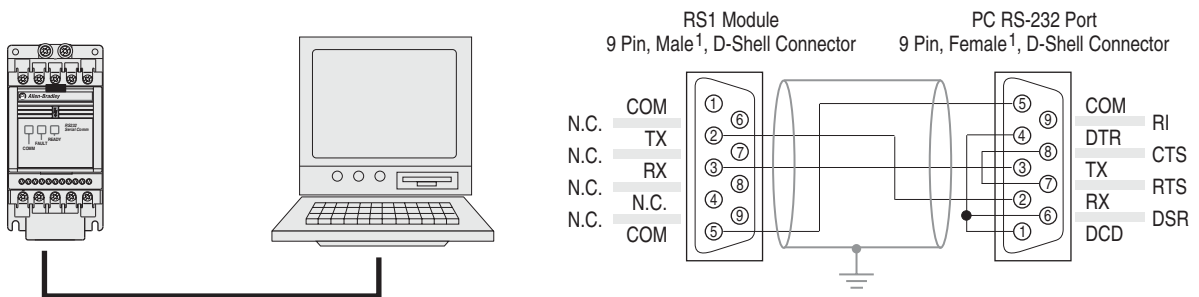
Adapter Cable to MicroLogix Serial Communications Cable

1761-CBL-PM02

Adapter Cable

RS1 Module
9 Pin, Male[1], D-Shell Connector

to A-B Cable 1761-CBL-PM02
9 Pin, Male[1], D-Shell Connector

N.C.	COM	① ⑥
N.C.	TX	② ⑦
N.C.	RX	③ ⑧
N.C.	N.C.	④ ⑨
N.C.	COM	⑤

① ⑥	N.C.	N.C.
② ⑦	TX	N.C.
③ ⑧	RX	N.C.
④ ⑨	N.C.	N.C.
⑤	COM	
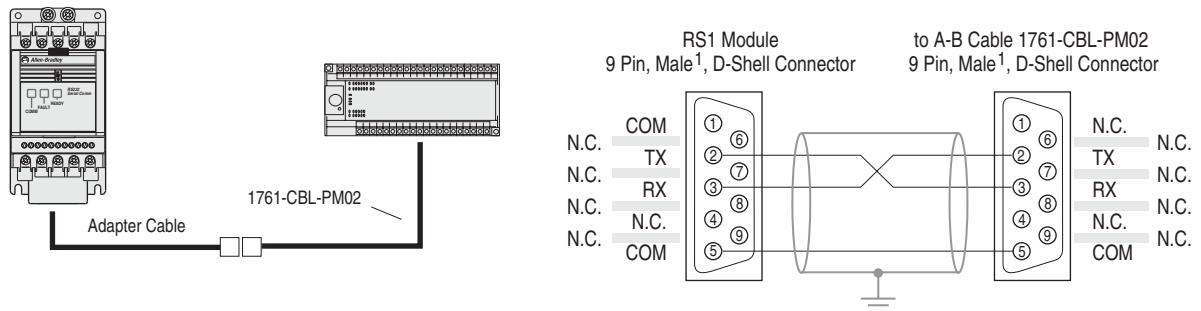
Refer to the MicroLogix 1000 User Manual,
publication 1761-6.3 for further details

[1] Gender specified refers to the cable connectors

Figure 3.5
Wiring the RS1 Connector - *continued*

SLC 500 Port 1 Serial Communications

RS1 Module
9 Pin, Male [1], D-Shell Connector

SLC RS-232 Port
9 Pin, Female [1], D-Shell Connector

RS1 Module		SLC RS-232 Port	
N.C.	COM ① ⑥	⑤ ⑨ COM	
N.C.	TX ② ⑦	④ ⑨ DTR	N.C.
N.C.	RX ③ ⑧	③ ⑧ TX	CTS
N.C.	N.C. ④ ⑨	② ⑦ RX	RTS
N.C.	COM ⑤	① ⑥ DCD	DSR
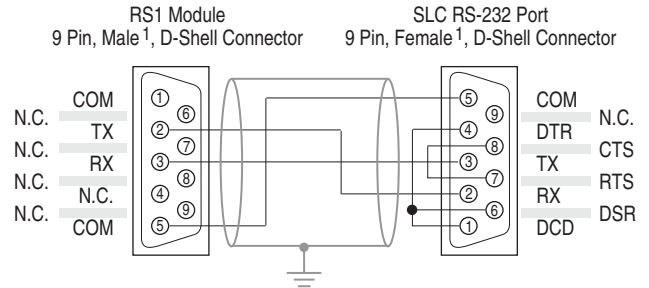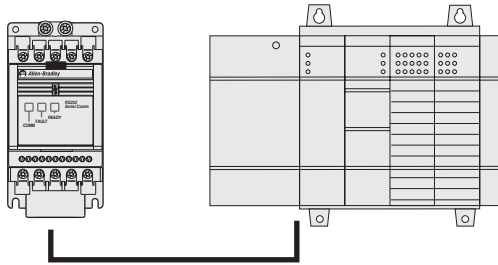
1761-NET-AIC+ Connections

RS1 Module
9 Pin, Male [1], D-Shell Connector

AIC+ RS-232 Port 1
9 Pin, Female [1], D-Shell Connector

RS1 Module		AIC+ RS-232 Port 1	
N.C.	COM ① ⑥	⑤ ⑨ COM	N.C.
N.C.	TX ② ⑦	④ ⑧ N.C.	N.C.
N.C.	RX ③ ⑧	③ ⑦ TX	N.C.
N.C.	N.C. ④ ⑨	② ⑥ RX	
N.C.	COM ⑤	① DCD	
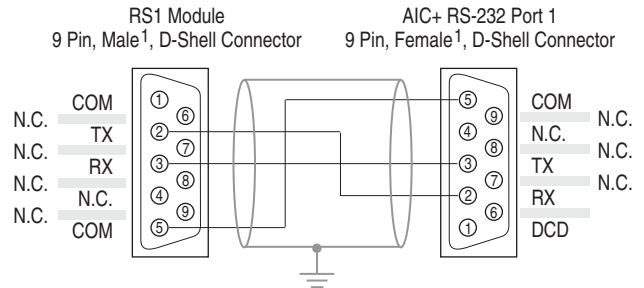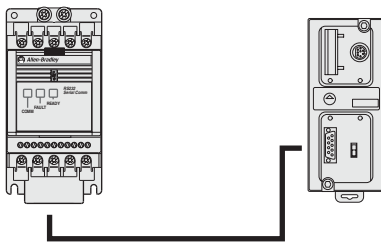
PLC-5® Channel 0 Serial Communications

to Channel 0

RS1 Module
9 Pin, Male [1], D-Shell Connector

PLC RS-232 Port
25 Pin, Male [1], D-Shell Connector

RS1 Module		PLC RS-232 Port	
N.C.	COM ① ⑥	① ⑭ C. GND	
N.C.	TX ② ⑦	② ⑮ TXD	N.C.
N.C.	RX ③ ⑧	③ ⑯ RXD	RES
N.C.	N.C. ④ ⑨	④ ⑰ RTS	N.C.
N.C.	COM ⑤	⑤ ⑱ CTS	RES
		⑥ ⑲ DER	RES
		⑦ ⑳ SG. GND	N.C.
		⑧ ㉑ DCD	DTR
		⑨ ㉒ RES	RES
		⑩ ㉓ N.C.	N.C.
		⑪ ㉔ RES	N.C.
		⑫ ㉕ RES	RES
		⑬ N.C.	RES
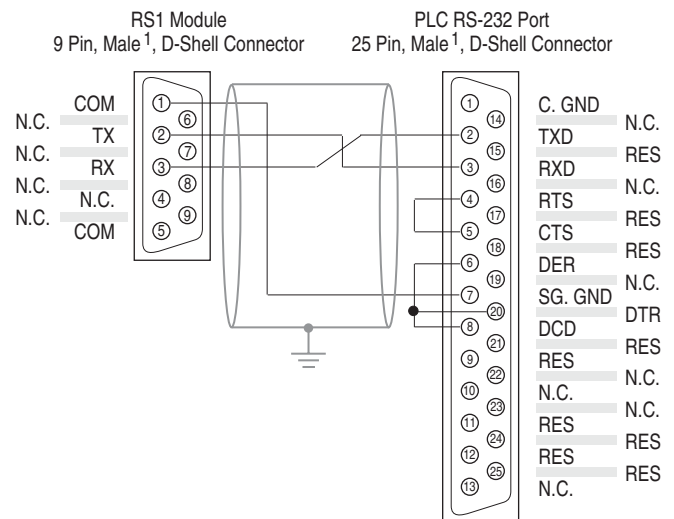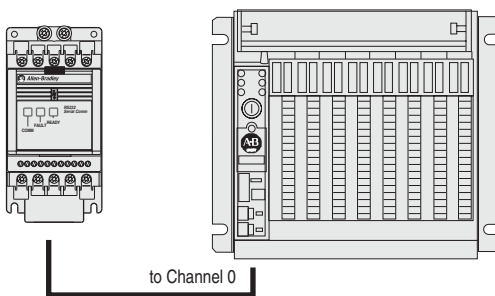
[1] Gender specified refers to the cable connectors

Connecting the Communication Cable to the Module

Follow these steps to connect your module.

1. Verify that the cable/connector is correctly wired (See Figure 3.5).

2. Locate the D-shell connector at the base of the RS1 Module.

3. Plug cable/connector into the RS1 D-shell connector and secure.

Modes of Operation

Chapter 4 contains the following information:
- Powering up the drive with the RS1 Module installed.
- The modes of operation and LED indications.

Powering Up the Drive

After you have installed the RS1 Module, apply power to the drive and to the connected device. The READY LED should illuminate. If it does not, refer to *Chapter 9, Troubleshooting*.

LED Indicators

The RS1 Module has three LEDs (see figure below) which provide module status.

READY LED

FAULT LED

COMM LED

Allen-Bradley

RS232
Serial Comm
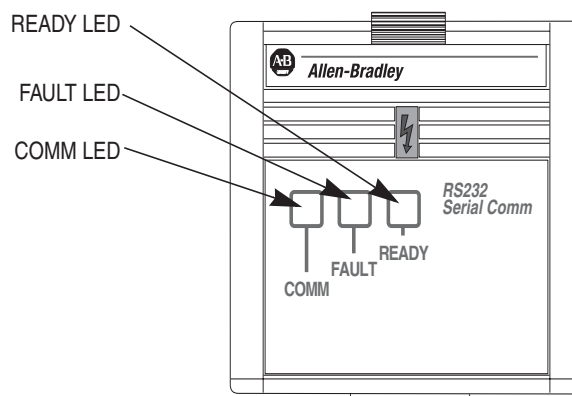
READY
FAULT
COMM

The LEDs are defined as follows:

- **COMM** – The COMM LED has four possible states:

Green (solid)	The cable is connected (both ends) and module is ready to communicate.
Green (flashing)	The module is on-line and communicating.
Red (solid)	Connection was lost or application timed out.
Red (flashing)	Device is transmitting & receiving data but application has timed out.

- **FAULT** – This LED tracks the fault status of the 160 Drive. When no faults are present, the LED will be off. The LED will illuminate (red) if a drive fault occurs.

- **READY** – The Ready LED will illuminate (green) whenever the module is connected to the drive and power is applied.

Modes of Operation

The RS1 Module has three modes of operation.

- Power-up mode
- Run mode
- Error mode

Power-up Mode

The following sequence of operation occurs:

1. During power-up, the READY LED illuminates.

2. The module reads and stores the DIP switch settings.

If the power-up sequence is successful, the module enters the run mode and the COMM LED flashes green or turns solid green.

If the power-up sequence fails, the COMM LED will go to solid red and the module will enter the Error Mode. See the Error Mode description in this section.

Run Mode

After a successful power-up, the RS1 Module enters the run mode and operates as a slave device to a master device. In run mode, the module:

- Accepts and responds to messages from the master on the network.
- Monitors cable integrity.

If an error is detected, the module enters error mode (see below).

Error Mode

If the module detects an error, the COMM LED flashes red or turns solid red. Refer to Chapter 9 for details on how to recover from an error.

RS1 Data Table Interface

This chapter provides you with the following information:

- Supported PCCC commands of the RS1 Module.
- RS1 Module Data Table Structure.

Supported PCCC Command List

The RS1 Module communicates over RS-232 using the Allen-Bradley DF1 protocol. The DF1 protocol uses PCCC (Programmable Controller Communication Commands) to determine the data format. PCCC describes the action of the message (set or get) and the location of the data involved. For further PCCC information, refer to *DF1 Protocol and Command Set Reference Manual*, publication 1770-6.5.16.

The RS1 Module responds to the PCCC types shown in the following table.

Table 5.A
PCCC Types

CMD Code	FNC Code	Command Name
0x06	0x03	Identify Host and some Status
0x0F	0x67	Typed Write (Logical ASCII Addressing only)
0x0F	0x68	Typed Read (Logical ASCII Addressing only)
0x0F	0xA2	Protected Type Logical Read with 3 Address Fields
0x0F	0xAA	Protected Type Logical Write with 3 Address Fields
0x0F	0xA1	Protected Type Logical Read with 2 Address Fields
0x0F	0xA9	Protected Type Logical Write with 2 Address Fields

Data Table Structure

The RS1 Module maintains a data table that allows DF1 devices (such as an SLC 500 or MicroLogix 1000) to set or request data using standard PCCC. The data table in the RS1 Module contains:

- Drive parameter information
- RS1 parameter information
- Logic command & status data
- Speed command & status data
- Communication status information.

The data table is formatted as integer files and follows the form shown on the next page.

Table 5.B
Data Table Format

Parameter Number	File Address	Description
None	N10:0	Total number of drive & RS1 parameters (R/W - values only).
Parameters 1-1xx	N10:1 - N10:1xx	Drive parameter value read or write. 160 drive parameters 1-99 and RS1 parameters 100-1xx.
None	N13:0	Total number of RS1 parameters (R/W - values only).
RS1 Parameters 1-xx	N13:1 - N13:xx	Read/write value for RS1 parameters 1-xx.
None	N30:0	Total number of drive parameters (Read Only - Full/ All information).
Parameters 1-1xx	N30:1 - N30:1xx	Read Full/All Info for drive parameters. 160 drive parameters 1-99 and RS1 parameters 100-1xx.
None	N33:0	Total number of RS1 parameters (Read Only - Full/ All information).
RS1 Parameters 1-xx	N33:1 - N33:xx	Read Full/All Info for RS1 parameters 1-xx.
None	N41:0	Logic Command/Status – Writing sends a logic command to drive. Reading supplies logic status.
None	N41:1	Reference/Feedback – Writing sends a speed command to drive. Reading supplies speed feedback from drive.
111	N42:0	Number of ENQs to transmit before retrying message.
112	N42:1	Number of NAKs received before message is canceled.
113	N42:2	Message timeout
114	N42:3	Application timeout.

The "File Address" section of the data table is divided into eight areas, each having a different purpose.

1. **Parameter Value Read or Write** (N10). Reading data from files in this area will cause the module to read parameter values from the device and send those values as the response to the read message. Writing data to files in this area will cause the module to write that data into device parameters.

2. **RS1 Parameter Value Read or Write** (N13). Reading data from files in this area will cause the module to read parameter values from the RS1 and send those values as the response to the read message. Writing to N13 will cause changes to RS1 parameters.

3. **Parameter Read Full** (N30). This area is read-only. When read, the data returned consists of 20 words of information about each parameter including scaling, parameter text, units text, minimum, maximum, and default values. When reading this area, set the number of elements to twenty times the number of parameters to be read.

Refer to table on next page.

Parameter Read Full Response Format

Data Word	Description	Character	
1	Parameter Value or Status Word		
2	Descriptor		
3	Multiply Value		
4	Divide Value		
5	Base Value		
6	Offset Value		
7	Parameter Text	2	1
8	Parameter Text	4	3
9	Parameter Text	6	5
10	Parameter Text	8	7
11	Parameter Text	10	9
12	Parameter Text	12	11
13	Parameter Text	14	13
14	Parameter Text	16	15
15	File, Group, Element		
16	Minimum Value		
17	Maximum Value		
18	Default Value		
19	Unit Text	2	1
20	Unit Text	4	3

4. **Logic Command** (N41:0). Writing sends a logic command to the drive. The format is:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Command	Description
															X	Stop	1 = Stop, 0 = Not Stop
														X		Start	1 = Start, 0 = Not Start
													X			N/A	Reserved
												X				Clear Faults	1 = Clear Faults, 0 = Not Clear Faults
										X	X					Direction	00 = No Command 10 = Reverse Command 01 = Forward Command 11 = Hold Direction Command.
								X	X							N/A	Reserved
				X	X	X	X									N/A	Reserved
	X	X	X													Reference Select [1]	000 = No Command 011 = Preset 3 110 = Preset 6 001 = TB3 Control 100 = Preset 4 111 = Preset 7 010 = Network Control 101 = Preset 5
X																N/A	Reserved

[1] Presets 0, 1 & 2 are not available when commanding over a network.
Presets 3, 6 & 7 are only available with Preset Speed drives that are commanded over a network.
Presets 4 & 5 are always available when commanding over a network.
Series A & B Analog Signal Follower drives have no presets.

5. **Logic Status** (N41:0). Reading supplies logic status. Data is formatted as follows:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Command	Description
															X	Enabled	1 = Enabled, 0 = Not Enabled
														X		Running	1 = Running, 0 = Not Running
													X			Command Direction	1 = Forward, 0 = Reverse
												X				Rotating Direction	1 = Forward, 0 = Reverse
											X					Accel	1 = Accelerating, 0 = Not Accelerating
										X						Decel	1 = Decelerating, 0 = Not Decelerating
									X							N/A	Reserved
								X								Fault	1 = Faulted, 0 = Not Faulted
							X									At Speed	1 = At Speed, 0 = Not At Speed
				X	X	X										Local	000 = TB3 Control, 001 = Network Control
X	X	X	X													Frequency Source	0000 = Preset 0 0100 = Preset 4 1000 = TB3 0001 = Preset 1 0101 = Preset 5 1001 = Network 0010 = Preset 2 0110 = Preset 6 1010 = Not Defined 0011 = Preset 3 0111 = Preset 7 1111 = Not Defined

6. **Reference Command** (N41:1) Writing sends a speed reference to the 160 drive. This is a scaled speed reference from 0 to 32767, where 0 = 0 Hz and 32767 = **P33 - [Maximum Frequency]**.

7. **Feedback Command** (N41:1) Reading supplies speed feedback from the drive. This is the actual drive speed scaled from 0 to 32767, where 0 = 0 Hz and 32767 = **P33 - [Maximum Frequency]**.

8. **RS1 Module Parameters** (N42). This area contains information about the communication configuration.

   • **Number of ENQ's** (N42:0). The number of ENQ's sent by the module before giving up on receiving ACK or NAK.

   • **Number of NAK's** (N42:1). The number of times the module will resend a message if the response is always NAK.

   • **Message Timeout** (N42:2). The number of milliseconds the module will wait before sending an ENQ.

   • **Application Timeout** (N42:3). The number of seconds the module will wait between messages before faulting the 160 drive.

Parameter Descriptions

This chapter provides a listing and description of the RS1 Parameters.

Important: Refer to your *160 User Manual* for drive parameter descriptions.

RS1 Parameters

The RS1 Module contains a set of parameters that are used to define how the module will interact with the network. These parameters may be used to set the module's baud rate, protocol, etc. Parameters may also be read to attain status from the module.

Parameter Number		Access	[Parameter Name] and Description	Min./Max. Values	Default
Drive (N10:, N30:)	**RS1** (N13:, N33:)				
101	1	Read/Write	**[Node Address]** Address that the RS1 Module will respond to. *Drive power must be cycled before changes will take affect.*	0 to 254	1
102	2	Read Only	**[DF1 Adapter Ver]** Firmware Version of the RS1 Module.	–	None
103	3	Read/Write	**[Fault Mode]** Enables forcing a drive fault for communication errors. 0 = Fault Drive Enabled 1 = Fault Drive Disabled	0 to 1	0
104	4	Read Only	**[Active Protocol]** The current communication protocol that the RS1 is using. 0 = DF1 Point-to-Point 1 = DF1 Multi-drop 2 = Used by Rockwell Automation Field Service Personnel	0 to 2	0
105	5	Read Only	**[DIP BAUD Rate]** Selected baud rate from DIP switches SW1-SW2. 0 = 9600 Baud 1 = 2400 Baud 2 = 1200 Baud 3 = EPROM Mode	0 to 3	0
106	6	Read Only	**[DIP Checksum]** Current checksum switch setting (selected by SW4). BCC = 0 (OFF) CRC = 1 (ON)	0 to 1	0
107	7	Read Only	**[DIP Protocol]** Current protocol selected by SW3. 0 = DF1 Point-to-Point 1 = DF1 Multi-drop	0 to 1	0
108	8	Read/Write	**[EPROM Protocol]** The communications protocol used when SW1 & SW2 are set to "On" (EPROM Mode). 0 = DF1 Point-to-Point 1 = DF1 Multi-drop *Drive power must be cycled before changes will take affect.*	0 to 1	0
109	9	Read/Write	**[EPROM Checksum]** The checksum mode used when SW1 & SW2 are set to "On" (EPROM Mode). 0 = BCC 1 = CRC *Drive power must be cycled before changes will take affect.*	0 to 1	0

Parameter Number		Access	[Parameter Name] and Description	Min./Max. Values	Default
Drive (N10:, N30:)	**RS1** (N13:, N33:)				
110	10	Read/Write	**[EPROM BAUD]** The baud rate used when SW1 & SW2 are set to "On" (EPROM Mode). 1 = 1200 Baud 2 = 2400 Baud 3 = 4800 Baud 4 = 9600 Baud *Drive power must be cycled before changes will take affect.*	1 to 4	9600 Baud
111	11	Read/Write	**[Max ENQs]** The number of ENQs sent while waiting for a ACK or NAK.	0 to 255	3
112	12	Read/Write	**[Max NAKs]** Number of times module resends a message if response is NAK.	0 to 255	3
113	13	Read/Write	**[Message Timeout]** Amount of time (milliseconds) RS1 Module waits before sending an ENQ.	100 to 65535	100 Milliseconds
114	14	Read/Write	**[Comm App Timeout]** When logic command/status and reference/feedback messaging is active, length of time in seconds from last DF1 message before faulting the drive.	0 to 65535	5 Seconds
115	15	Read	**[Packets Sent]** Number of DF1 packets sent.	0 to 65535	0
116	16	Read	**[Packets Received]** Number of DF1 packets received.	0 to 65535	0
117	17	Read	**[Undelivered Msgs]** Number of undelivered messages.	0 to 65535	0
118	18	Read	**[ENQs Sent]** Number of ENQs sent.	0 to 65535	0
119	19	Read	**[ENQs Received]** Number of ENQs received.	0 to 65535	0
120	20	Read	**[NAKs Received]** Number of NAKs received.	0 to 65535	0
121	21	Read	**[Bad Packets Rcvd]** Number of bad packets received (NAKed).	0 to 65535	0
122	22	Read	**[Duplicate Packet]** Number of duplicate packets received.	0 to 65535	0
123	23	Read	**[Out Memory NAKs]** Number of out of memory NAKs (messages coming faster than they can be processed).	0 to 65535	0
124	24	Read	**[AppTimeout Cnt]** Number of application timeouts.	0 to 65535	0
125	25	Read/Write	**[Overrun Errors]** Action of the RS1 Module on a data rx overrun. 0 = Ignore 1 = Clear UART buffer	0 to 1	0
126	26	Read Only	**[Overrun Err Cnt]** Data Overrun Count.	0 to 65535	0
127	27	Read/Write	**[Force Fault]** Setting this parameter will fault the drive. 0 = No Action 1 = Fault the Drive	0 to 1	0
128	28	Read/Write	**[Reset RS1]** Setting this parameter to 1 will only reset the RS1 Module parameters to factory settings. **Important:** Drive parameters can be reset using **P56 - [Reset Functions]**. 0 = No Action 1 = Resets RS1 parameters to defaults	0 to 1	0
129	29	Read/Write	**[Clr Comm Stats]** Setting this parameter to 1 will clear all diagnostic counters. 0 = No Action 1 = Clear all DF1 diagnostic counters (P115-124, 126)	0 to 1	0

| Parameter Number | | | | Min./Max. | |
Drive (N10:, N30:)	RS1 (N13:, N33:)	Access	[Parameter Name] and Description	Values	Default
130	30	Read	**[DIP Switches]** Displays the current DIP switch settings.	0 to 0xF 0 to 15	0000
131	31	Read	**[Actual Speed]** Returns speed feedback from the drive. This is the actual drive speed scaled from 0 to 32767, where 0 = 0 Hz and 32767 = **P33 - [Maximum Frequency]**.	0 to 32767	0
132	32	Read	**[Logic Status]** Returns logic status (N41:0). Refer to page 5–3 for data format.	0 to 65535	0
133	33	Read/Write	**[Logic Mask]** This parameter determines the source of the drive control logic. A value of "1" corresponds to terminal block control, and any drive input mode (**P46 - [Input Mode]**) value except "2" or "6." A value of "2" corresponds to RS1 Module logic control. The input mode value is "2" or "6." If the Logic Mask value is changed from "1" to "2," the terminal block logic control is masked out by the RS1 Module. The module does this by changing the Input Mode to the last previously active network mode, "2" or "6" (if a network mode has not been active since drive power was applied, it is set to "2"). If the Logic Mask value is changed from "2" to "1," the RS1 logic control is masked out by the RS1 Module. The module does this by changing the Input Mode to the last previously active non-network mode (if a non-network mode has not been active since drive power was applied, it is set to "0"). **IMPORTANT:** Power must be cycled or **P56-[Reset Functions]** must be set to "2" for this change to take affect.	1 to 2	1

Parameter 130 [DIP Switches] bit description table:

| | Bit | | | | | |
3	2	1	0	Description	Switch	
		0	0	9600 (Default)	SW1, SW2	
		0	1	2400		
		1	0	1200		
		1	1	EPROM Mode		
	0			DF1 Point-to-Point (Default)	SW3	
	1			DF1 Multi-Drop		
0				BCC (Default)	SW4	
1				CRC		

End of Chapter 6

Using the RS1 Module with DriveExplorer™ Software

The purpose of this chapter is to provide an overview of the steps needed to use the Bulletin 9306 DriveExplorer software program with the RS1 Module and 160 Drive. DriveExplorer is a Windows® 95/Windows NT®/Windows® CE based software program that allows you to upload/download parameter sets from a computer to the 160 Drive using the RS1 Module as an interface. For detailed DriveExplorer information, refer to the *DriveExplorer User Manual*, publication 9306-5.0.

This chapter will guide through . . .

- Configuring the communication port of the computer and connection to the RS1 Module.
- Downloading a parameter set to the 160 Drive.
- Uploading the 160 parameter set.
- Saving and retrieving parameter sets.

Before continuing with this chapter, you should have read the *DriveExplorer User Manual*. Understanding the concepts in this manual will be important in completing this chapter.

Required Items

The following items will be required:

- A personal computer with the DriveExplorer software installed.
- A 160 SSC Drive and RS1 Communication Module.
- A standard straight-thru serial cable

Example Network

The following setup is used in this chapter. Refer to *Chapter 3* for connection details.
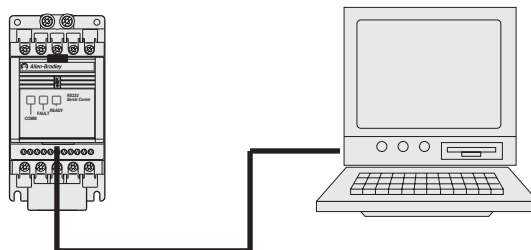
Setting Baud Rates and Configuring the Communications Port

1. Before proceeding, the RS1 Module baud rate should be set as desired and the module installed as explained in *Chapter 3*.

2. The PC serial port must now be configured using DriveExplorer.

   A. Start DriveExplorer.

   B. The Configure Comm Port window appears.
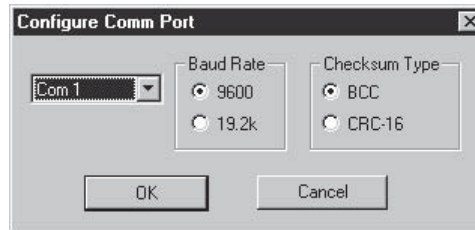
   C. Select the communications port that your computer is using. Next select the correct Baud Rate and Checksum Type – then choose **OK**.

   D. From the Explore menu, select **Connect -> Local**. A node will appear in the left pane of the main DriveExplorer window under "Devices."

Monitoring and Editing Parameters

Monitoring Parameters

To monitor parameters, double-click the drive in the left pane of the main DriveExplorer window – drive parameters appear on the right.

Editing Parameters

1. Double-click the parameter name to display the edit dialog box.
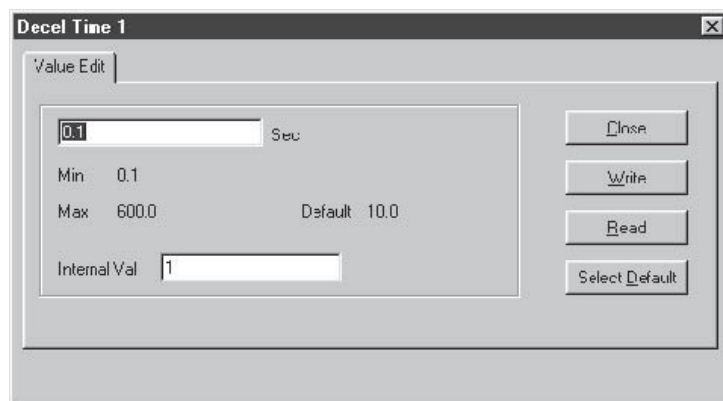
   Important: The edit dialog box will vary based on the type of value that you are editing.

2. Edit the parameter as necessary. To retrieve the current parameter value, select **Read**. To retrieve the factory default parameter value choose **Select Default**.

3. Selecting **Write** updates the parameter value. Choose **Close**.

   Important: In some cases the drive must be reset or power cycled before changes take effect. Refer to your user manual.

Uploading Editable Parameters

It is possible to upload editable parameters and their values (in internal units) from the drive and store them in a file. There are three upload options: upload all parameters, upload selected parameters, and upload links.

1. If you want to upload selected parameters, you must select them in the right pane of DriveExplorer.

2. Select **Actions -> Upload and Save** to display the Save Parameters dialog box.

3. Select **All Parameters** or **Selected Parameters**. Choose **OK** to upload the parameters and display the Save As dialog box.

4. In the Save in box, navigate to where you want to save the parameter file.

5. In the File Name box, type a name.

6. In the Save As type box, select DE Parameter Data Files **(*.dep)** for parameters.

7. Choose **Save** to save the file.

Downloading Parameters

To transfer values saved in a parameters **(*.dep)** file to the drive, you must download the file.

Important: Do not download a file uploaded from one drive (or device) to a different drive or device.

1. To download the file – select **Actions -> Download -> Archive File**. A prompt appears to warn you that setup values may change.

2. Select **Yes** to display the Open dialog box.

3. Select the desired file with a **.dep** extension.

4. Choose **Open** to download the values in the file.

End of Chapter 7

Using the RS1 Module with a Programmable Controller

This chapter provides an overview of the steps needed to use the RS1 Module with a MicroLogix 1000 (or other Allen-Bradley programmable controllers). The programmable controller can send control messages to the RS1 Module and receive status messages back. The device also allows a ladder logic program to configure and read parameters from the 160 Drive.

This chapter contains the following information:

• How to setup the RS1 Module with a programmable controller.
• A sample ladder logic program to control the 160 Drive.
• A description of reading parameters using the Message (MSG) Command.
• A sample ladder logic program to read parameters.

The MicroLogix 1000 Programmable Controller was used with RSLogix 500™ software for the examples shown in this chapter – the concepts demonstrated apply to other programmable controllers as well, including the SLC 500 and PLC-5.

Before continuing, the user should have read and understood:

• *MicroLogic 1000 Programmable Controller User Manual*, Publication 1761-6.3 (or appropriate controller User Manual).
• *SLC 500 and MicroLogix 1000 Instruction Set Reference Manual*, publication 1747-6.15.

Required Tools

The following tools will be needed to complete this chapter:

• 160 Drive equipped with an RS1 Communication Module.
• MicroLogix 1000 Programmable Controller.

Example Network

160 Drive with RS1

MicroLogix 1000
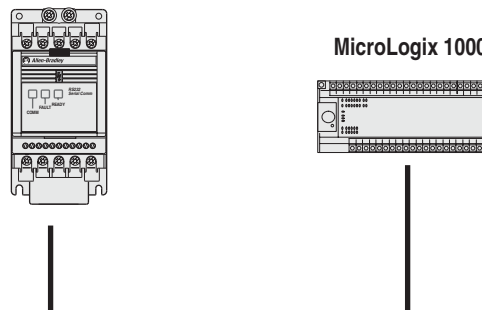
Setting the Drive to Enable Network Control

The 160 drive must be configured to accept logic and speed commands from the network. This can be done by configuring two of the 160 parameters:

1. Set **P46 - [Input Mode]** to a value of "2." This will configure the drive to accept the logic commands from the network.

2. Set **P59 - [Frequency Select]** to "1." This will configure the drive to accept speed commands from the network.

Changing the above parameters can be done with the 160 Keypad Module or configuration software such as the DriveExplorer.

Important: For a new Input Mode to take affect, drive power must be cycled.

Setting the Baud Rate and Checksum Mode

The baud rate and checksum mode on the RS1 Module should be configured to the desired setting for the network (and other devices). After configuration, install the RS1 Module into the 160 Drive as explained in Chapter 3. Note that the MicroLogix uses CRC as the checksum mode.

Connecting the Drive to the Programmable Controller

The RS1 Module is connected to the programmable controller through the 9-pin D-shell connector. Since each programmable controller may have different wiring requirements, Figure 3.5 should be referenced as a guide.

Important: The communication port of the programmable controller may also be used to program the controller, thus the user may have to disconnect the cable going to the RS1 Module before programming the controller.

Controlling the Drive

Controlling the 160 Drive from a programmable controller is accomplished using Message Commands to communicate through the RS1 Module to the drive. To send a Start or Stop command to the drive, the Message Command (MSG) is set up to write to N41:0. To read the drive status, the Message Command is set up to read from N41:0. Refer to Chapter 6 for the logic command and status format. Drive speed can be controlled or read in the same manner by accessing N41:1.

Program the Ladder

The example ladder program in Figure 8.2 demonstrates writing a Logic Command to the drive and reading the Logic Status from the drive.

In the following example ladder program, B3:0/0 is set every 2 seconds. This enables a Logic Command write to be done followed by the Logic Status read. The data for the Logic Command is stored in N7:8 of the MicroLogix and is written to location N41:0 of the RS1 Module. For the Logic Status, data from the RS1 Module at location N41:0 is read by the MicroLogix and stored in N7:9. This ladder program could be modified to read and write speed commands for the 160 Drive by changing the read and write location in the RS1 Module from N41:0 to N41:1.

Figure 8.1
MSG Commands Setup – Logic Command/Status

Figure 8.2
Writing Logic Command and Reading Logic Status

LAD 3 - DF 1 LOGIC --- Total Rungs in File = 5
_____

This rung writes the Logic Command - Data in N7:8 is written to the Drive at N41:0
Enable for the Logic
command Write
B3:0

0000   ┤ ├   ┌── MSG ─────────────────────┐
         0   │ Read/Write Message   ├─⟨EN⟩
                                                         │ Read/Write   Write │
                                                         │ Target Device   500CPU ├─⟨DN⟩
                                                         │ Control Block   N7:0 │
                                                         │ Control Block Length   7 ├─⟨ER⟩
                                                         │   Setup Screen   │
                                                         └─────────────────────────────┘

Enable for the Logic   Done Bit - Logic   Enable for the Logic
command Write   Command Write   command Write
B3:0   N7:0   B3:0

0001   ┤ ├   ┌─┤ ├──────────────┐   ──⟨U⟩──
         0   │ 13   │   0

                              │ Error Bit - Logic│   Enable for Logic
                              │ Command Write   │   Command Read
                              │ N7:0   │   B3:0
                              └─┤ ├──────────────┘   ──⟨L⟩──
                                 12   1

This rung reads the Logic Status from the drive - Data from N41:0 is read and placed in N7:9
Enable for Logic
Command Read
B3:0

0002   ┤ ├   ┌── MSG ─────────────────────┐
         1   │ Read/Write Message   ├─⟨EN⟩
                                                         │ Read/Write   Read │
                                                         │ Target Device   500CPU ├─⟨DN⟩
                                                         │ Control Block   N7:10 │
                                                         │ Control Block Length   7 ├─⟨ER⟩
                                                         │   Setup Screen   │
                                                         └─────────────────────────────┘

Enable for Logic   Done Bit - Logic   Enable for Logic
Command Read   Command Read   Command Read
B3:0   N7:10   B3:0

0003   ┤ ├   ┌─┤ ├──────────────┐   ──⟨U⟩──
         1   │ 13   │   1

                              │ Error Bit - Logic│
                              │ Command Read   │
                              │ N7:10   │
                              └─┤ ├──────────────┘
                                 12

0004   ──⟨END⟩

Reading and Writing Parameters

Reading or writing parameters can be accomplished using message commands to communicate through the RS1 Module to the drive. The drive parameters are accessed at location N10:XX, with the XX being the parameter number to read or write (i.e. N10:30 accesses parameter **P30 - [Accel Time]**).

You can read or write RS1 Module parameters through location N10 or N13. For location N10, the RS1 parameters start at N10:101, thus accessing location N10:101 reads or writes RS1 parameter **P1 - [Node Address].** For location N13, the RS1 parameters start at N13:1 (N13:1 also accesses RS1 parameter **P1 - [Node Address]**).

Program the Ladder for Parameter Reads and Writes

The example ladder program in Figure 8.4 accomplishes reading and writing drive parameters.

In the following ladder program, B3:1/4 is set when requesting a parameter write. When no other Message Commands are enabled, B3:0/4 will be set, starting the parameter write. For the parameter write, data from N7:51 is written by the MicroLogix to location N10:30 (**P30 - [Accel Time])** of the RS1 Module. Bits B3:0/4 and B3:1/4 are cleared when the Message Command is completed.

B3:1/5 is set when requesting a read of a parameter. When no other Message Commands are enabled, B3:0/5 will be set, starting the parameter read. For the parameter read, location N10:30 (**P30 - [Accel Time])** of the RS1 Module is read by the MicroLogix and the data is placed in N7:52. Bits B3:0/5 and B3:1/5 are cleared when the Message Command is completed.

Figure 8.3
MSG Commands Setup – Parameter Read/Write

Figure 8.4
Reading and Writing Drive Parameters

LAD 5 - PARAMETER --- Total Rungs in File = 5

Parameter Write - when it's time to perform a parameter write B3:0.4 and B3:1.4 will be set. Data from N7:51 will written out Channel 0 to the 160 - RS1 module at location N10:30 (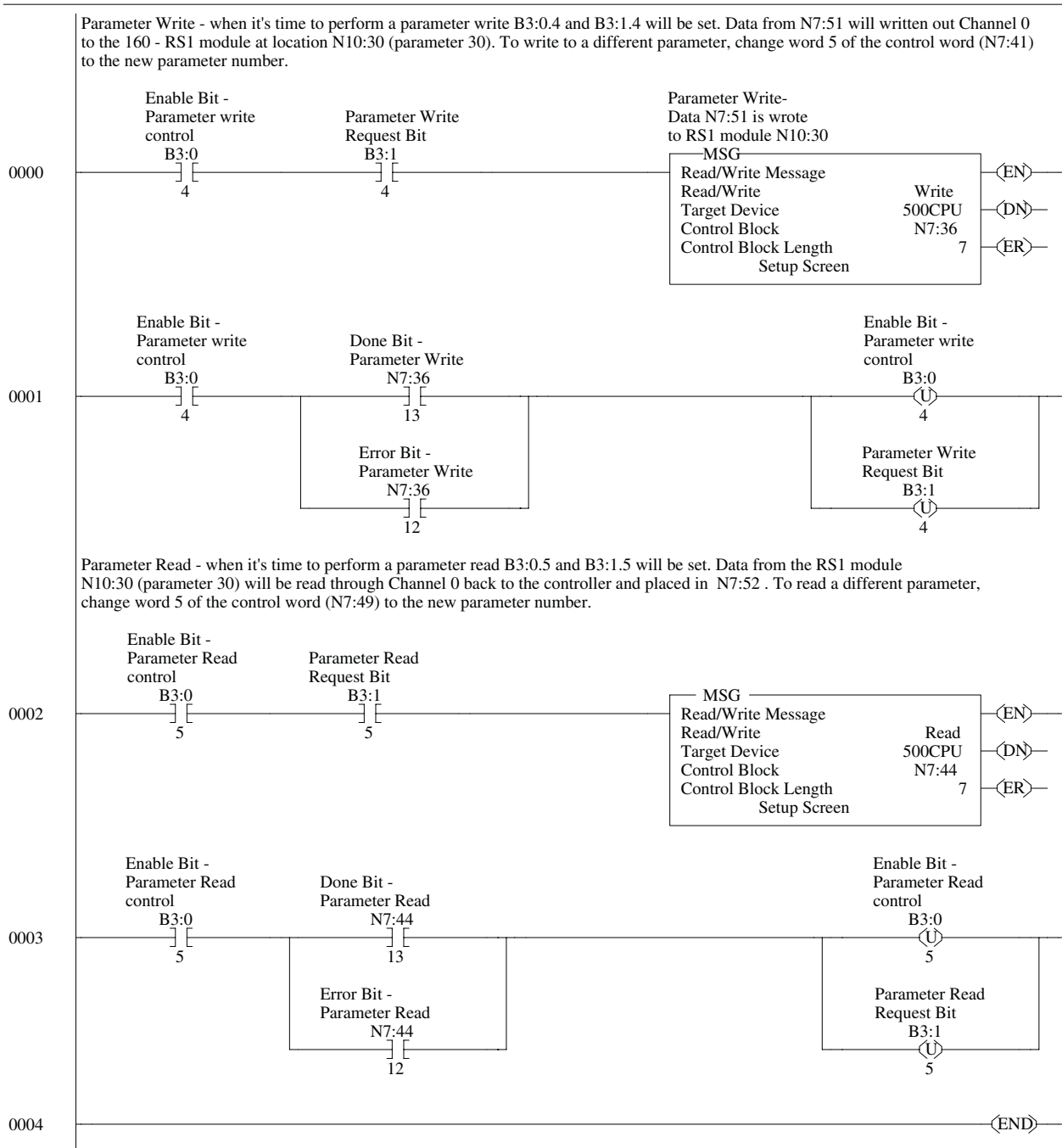parameter 30). To write to a different parameter, change word 5 of the control word (N7:41) to the new parameter number.

```
              Enable Bit -
              Parameter write       Parameter Write                       Parameter Write-
              control               Request Bit                           Data N7:51 is wrote
              B3:0                  B3:1                                   to RS1 module N10:30
                                                                   ┌─ MSG ──────────────────────────┐
0000            ] [                   ] [                          │ Read/Write Message            ⟨EN⟩
                                                                   │ Read/Write              Write   │
                 4                     4                           │ Target Device          500CPU  ⟨DN⟩
                                                                   │ Control Block            N7:36   │
                                                                   │ Control Block Length        7  ⟨ER⟩
                                                                   │         Setup Screen            │
                                                                   └─────────────────────────────────┘

              Enable Bit -
              Parameter write       Done Bit -                           Enable Bit -
              control               Parameter Write                      Parameter write
              B3:0                  N7:36                                 control
                                                                         B3:0
0001            ] [          ┌───────] [──────────┐                      ─(U)─
                 4           │        13           │                       4
                             │   Error Bit -       │                   Parameter Write
                             │   Parameter Write   │                   Request Bit
                             │   N7:36             │                   B3:1
                             └───────] [──────────┘                    ─(U)─
                                      12                                  4
```

Parameter Read - when it's time to perform a parameter read B3:0.5 and B3:1.5 will be set. Data from the RS1 module N10:30 (parameter 30) will be read through Channel 0 back to the controller and placed in N7:52 . To read a different parameter, change word 5 of the control word (N7:49) to the new parameter number.

```
              Enable Bit -
              Parameter Read        Parameter Read
              control               Request Bit
              B3:0                  B3:1                            ┌─ MSG ──────────────────────────┐
0002            ] [                   ] [                          │ Read/Write Message            ⟨EN⟩
                 5                     5                           │ Read/Write               Read   │
                                                                   │ Target Device          500CPU  ⟨DN⟩
                                                                   │ Control Block            N7:44   │
                                                                   │ Control Block Length        7  ⟨ER⟩
                                                                   │         Setup Screen            │
                                                                   └─────────────────────────────────┘

              Enable Bit -
              Parameter Read        Done Bit -                           Enable Bit -
              control               Parameter Read                       Parameter Read
              B3:0                  N7:44                                 control
                                                                         B3:0
0003            ] [          ┌───────] [──────────┐                      ─(U)─
                 5           │        13           │                       5
                             │   Error Bit -       │                   Parameter Read
                             │   Parameter Read    │                   Request Bit
                             │   N7:44             │                   B3:1
                             └───────] [──────────┘                    ─(U)─
                                      12                                  5

0004                                                                                            ⟨END⟩
```

Troubleshooting

The purpose of this chapter is to help you troubleshoot your RS1 Module.

⚠ **ATTENTION:** Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or un-intentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NPFA 70E, *Electrical Safety for Employee Workplaces*, when working on or near energized equipment. Do not work alone on energized equipment.

⚠ **ATTENTION:** Do not attempt to defeat or override fault circuits. The cause of a fault indication must be determined and corrected before attempting operation. Failure to correct a drive or system malfunction may result in personal injury and/or equipment damage due to uncontrolled machine system operation.

LED Indicators and Troubleshooting

The RS1 Status LEDs can help you troubleshoot the module in the event that problems occur. Refer to the paragraphs that follow for details.

Status LEDs
Refer to Chapter 4 for detailed LED descriptions

Allen-Bradley

RS232
Serial Comm
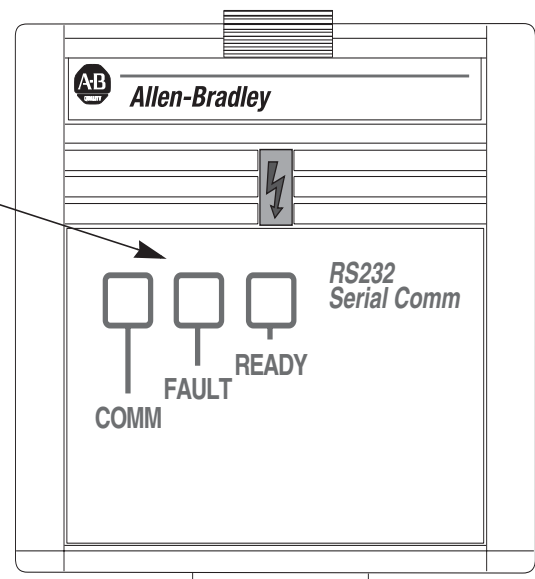
READY
FAULT
COMM

READY LED

The green READY LED will illuminate whenever the RS1 Module is connected to the drive and power is applied.

COMM LED

The COMM LED provides status information on module operations. Table 9.A shows how to use the LED to detect and correct common operating problems.

Table 9.A
COMM LED Indications

Color	State	What It Means:	What To Do:
Red	Solid	Cable disconnected or bad connection.	Connect cable/check connections.
		Application timed out.	Application did not access N41:0 before parameter 114 expired – verify parameter 114 setting.
Green	Solid	Cable is connected and module is ready.	No action required.
	Flashing	Device is on-line and communicating.	No action required.

FAULT LED

When the FAULT LED is Red, a drive fault is present. Drive fault codes can be read by accessing drive parameter **P07 - [Last Fault]**. Refer to Tables 9.B and 9.C for fault descriptions/actions.

Table 9.B
160 Drive[1] Fault Codes

Fault Code	Fault Indication	Description	Corrective Action
00	No Fault	The drive is currently not faulted.	No action required.
03	Power Loss Fault	DC Bus voltage remains below 85% nominal on power up for longer than 5 seconds.	Monitor incoming AC line for low voltage or line power interruption.
04	Undervoltage Fault	DC Bus voltage fell below the minimum value while the motor was running.	Monitor incoming AC line for low voltage or line power interruption.
05	Overvoltage Fault	DC Bus maximum voltage exceeded.	Bus overvoltage caused by motor regeneration. Extend the decel time, or install dynamic brake option or external capacitor module.
06	Motor Stall Fault	Motor has stalled. Motor load is excessive.	Longer accel time or reduced load required.
07	Motor Overload Fault	Internal electronic overload trip. Excessive motor load exists.	Reduce motor load.
08	Overtemperature Fault	Excessive heat detected.	Clear blocked or dirty heat sink fins. Check ambient temperature. Check for blocked or non-operating fan.
12	Overcurrent Fault	Overcurrent detected in hardware trip circuit.	Check short circuit at the drive output or excessive load conditions at the motor.
20	Drive Overload Fault	An internal electronic overload trip has occurred. The drive is overheating.	Clear blocked or dirty heat sink fins. Check ambient temperature. Check for blocked or non-operating fan.
22	Drive Reset	Stop input not present.	Check stop input at TB3 terminal 8.
32	EPROM Fault	EPROM has invalid data.	Reset EPROM using **P56 - [Reset RS1]**.
33	Max Retries Fault	Drive did not reset fault within the max retries specified.	Repair system fault.
38	Phase U Fault	Phase to ground fault detected between drive and motor phase U.	Check wiring between drive and motor. Check motor for grounded phase.
39	Phase V Fault	Phase to ground fault detected between drive and motor phase V.	Check wiring between drive and motor. Check motor for grounded phase.

[1] Refer to the *160 User Manual* for the most current fault code information.

Table 9.B (continued)
160 Drive[1] Fault Codes

Fault Code	Fault Indication	Description	Corrective Action
40	Phase W Fault	Phase to ground fault detected between drive and motor phase W.	Check wiring between drive and motor. Check motor for grounded phase.
41	UV Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
42	UW Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
43	VW Short Fault	Excessive current has been detected between these two drive output terminals.	Check the motor and external wiring to the drive output terminals for a shorted condition.
48	Reprogramming Fault	Occurs when reset defaults is performed.	Clear fault.
49	Zero Overload Fault	Occurs when load requires excessive current at zero hertz.	Reduce motor load and/or motor dwell time at zero hertz.

[1] Refer to the *160 User Manual* for the most current fault code information.

Table 9.C
RS1 Fault Codes

Fault Code	Fault Indication	Description	Corrective Action
51	RS1 Module EPROM Fault	Module EPROM has invalid data.	Reset to factory defaults **P128 - [Reset RS1].**
52	RS1 Lost I/O Connection	Application timed out.	Check master for correct operation (i.e., powered up, run mode, etc.).
55	Force Fault	**P127 - [Force Fault]** was set to "1."	Clear fault.

RS1/DF1 Error Codes

The following error codes could be returned over DF1 (with the Message Command) when accessing the RS1 Module.

Table 9.D
Error Codes

Message	STS	EXT STS	Problem	Problem
All Messages	10h	N/A	Illegal command or format.	The RS1 does not support this command.
	F0h	06h	Address does not point to anything usable.	The address does not exist, or does not point to anything usable by this command.
	F0h	0Ah	Transaction size plus word address is too large.	Trying to read/write multiple parameters with one command. Writing one parameter at a time or reading past end of last parameter is only supported.
	F0h	12h	Invalid parameter or data.	Data out of range.
	F0h	1Eh	Data table element protection violation.	Write to Read Only parameter.
	F0h	1Fh	Temporary internal problem.	Unable to execute due to temporary internal conditions – Parameter Read Only when drive is running.

End of Chapter 9

Specifications

Electrical

|	
Supply Voltage	Supplied by Drive
Power Consumption	1.25 Watts maximum

Environmental

Ambient Temperature	
Operating	0 to 50° C (32 to 122° F)
Storage	–40 to 85° C (–40 to 185° F)
Relative Humidity	0 to 95% non-condensing
Vibration	1.0 G Operational
	2.5 G Non-operational
Shock	15.0 G Operational
	30.0 G Non-operational
Altitude	1,000 m (3,300 ft.) without derating

Communications

Baud Rates	1200, 2400, 4800, 9600 BPS
Checksum	BCC or CRC
Protocol	DF1 Point-to-Point
	DF1 Multi-Drop

Mechanical

Dimensions are in Millimeters and (inches)
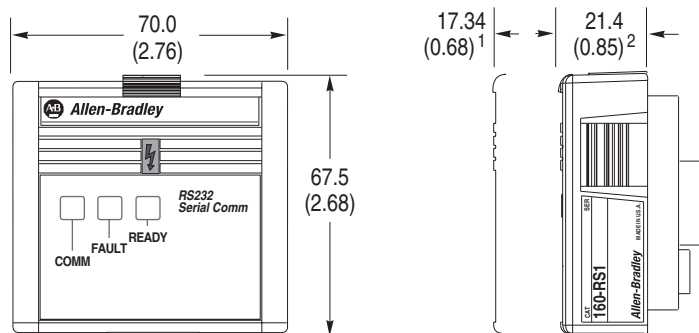
[1] Required for module removal.

[2] Module adds this dimension to the overall drive depth.

End of Appendix A

RS1 Module Compatibility

The 160-RS1 Module has been tested and found to be compatible with the following Allen-Bradley products:

- MicroLogix 1000

Protocol	Point-to-Point
PCCC Command	0xA1 Protected Type Logical Read with 2 Address Fields
	0xA9 Protected Type Logical Write with 2 Address Fields
Hand Shaking	None
Cable	*See Chapter 3 for details*
Versions	Series D, FRN 1.0 or later

- SLC 500

Protocol	Point-to-Point/Multi-Drop Master
PCCC Command	0xA2 Protected Type Logical Read with 3 Address Fields
	0xAA Protected Type Logical Write with 3 Address Fields
Hand Shaking	None
Cable	9 Pin - 9 Pin (*see Chapter 3 for details*)
Versions	Series B, FRN 7 (OS 4.01) or later

- 1761-NET-AIC+

Protocol	Multi-Drop
PCCC Command	All *(see Chapter 5 for details)*
Hand Shaking	None
Cable	9 Pin - 9 Pin
Versions	Series A

- PLC-5 Enhanced

Protocol	Point-to-Point/Multi-Drop Master
PCCC Command	0x67 Typed Write (Logical ASCII Addressing only)
	0x68 Typed Read (Logical ASCII Addressing only)
Hand Shaking	None
Cable	9 Pin - 25 Pin (*see Chapter 3 for details*)
Versions	Series C, FRN E or later

- RSLinx™

Protocol	Point-to-Point/Multi-Drop
PCCC Command	0xA1 Protected Type Logical Read with 2 Address Fields
	0xA9 Protected Type Logical Write with 2 Address Fields
Hand Shaking	None
Cable	PC Cable (*see Chapter 3 for details*)
Versions	1.7.62.00 or later

- DriveExplorer

Protocol	Point-to-Point
PCCC Command	0x67 Typed Write (Logical ASCII Addressing only)
	0x68 Typed Read (Logical ASCII Addressing only)
Hand Shaking	None
Cable	PC Cable (*see Chapter 3 for details*)
Versions	1.01.10 or later

- DriveTools32™

Protocol	Point-to-Point
PCCC Command	0x67 Typed Write (Logical ASCII Addressing only)
	0x68 Typed Read (Logical ASCII Addressing only)
Hand Shaking	None
Cable	PC Cable (*see Chapter 3 for details*)
Versions	2.01 or later

End of Appendix B

Notes

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