Controlling PowerFlex 4-Class Drives on RS-485 Modbus RTU using MicroLogix Controllers

Related Products and Documentation

This document will guide you through the basic steps needed to install, start up, and program PowerFlex 4-class drives for RS-485 Modbus RTU communications. **The information provided does not replace the user manual, and is intended for qualified personnel only.** All documentation can be found on the Internet at **www.theautomationbookstore.com** using either the public or private link.

Catalog Number	Document Title	Publication Number
22A Series	PowerFlex 4 Adjustable Frequency AC Drive User Manual	22A-UM001C(1)-EN-E
22B Series	PowerFlex 40 Adjustable Frequency AC Drive User Manual	22B-UM001A(1)-EN-E
1761-NET-AIC	MicroLogix AIC+ Advanced Interface Converter User Manual	1761-6.4
1764-L Series	MicroLogix 1500 Programmable Logic Controllers User Manual	1764-UM001B(1)-EN-P

(1) The letter represents document revision, and is subject to change.

Hardware That You Will Need

Many of the devices listed below may be or should be supplied with your system, however these devices have been listed to help in the understanding of the overall system application. You may **not** need all of the hardware listed. For more information regarding firmware and revision levels, refer to the table in **Step 2** entitled *Connecting the Hardware*.

Product Name	Catalog Number	Description
PowerFlex 4-Class Drive	22A-, or 22B-	Device used to control the speed of a motor.
MicroLogix AIC+ Advanced Interface Converter	1761-NET-AIC	Device used to interface a MicroLogix controller with an RS-485 network.
MicroLogix 1500 LRP Series C, Revision C, Firmware Version 9.0 Controller(2)	1764-LRP	Device also known as a Programmable Logic Controller.
MicroLogix Programming Cable	1761-CBL-PM02	Device used to program a MicroLogix controller.
Belden 9841 Cable	None; user-supplied	Device used to connect a 1761-NET-AIC converter to a PowerFlex 4-Class drive.

(2) It is recommended that you use this controller type since it offers an additional programming port.

What You Need To Do

- **Step 1:** Configure the hardware
- **Step 2:** Connect the hardware
- **Step 3:** Enter the Logic Status logic
- **Step 4:** Enter the Speed Feedback logic
- **Step 5:** Enter the Logic Command logic
- **Step 6:** Enter the Speed Reference logic

Supported Modbus Function Codes

Modbus Function Code	Command Description
03	Read Holding Registers
06	Preset (Write) Single Registers

Modbus devices can either be 0-based (registers are numbered starting at 0), or 1-based (registers are numbered starting at 1). Since MicroLogix controllers use 1-base technology, you will need to offset register addresses by +1.

For example, the *Logic Command* word may be register address **8192** for some master devices (e.g. ProSoft MVI56-MCM ControlLogix Modbus scanner) and **8193** for others (e.g. MicroLogix and PanelViews).

Important MicroLogix Controller Information

Even though you may configure Channel 0 and Channel 1 for Modbus RTU Master functionality, it is recommended that you dedicate Channel 0 for RSLogix 500 software programming and ControlFLASH firmware upgrading (based on customer statistics).

Channel 1 will **not**:

- allow you to flash upgrade controller firmware
- supply power to external devices (i.e. 1761-NET-AIC+)

While system setup is entirely up to the customer, using an external 24 VDC power supply isolates the controller from the 1761-NET-AIC+ converter for better noise immunity. Therefore, in this application example, Channel 1 has been dedicated as the Modbus RTU Master for drive control.

Important RS-485 Wiring Information

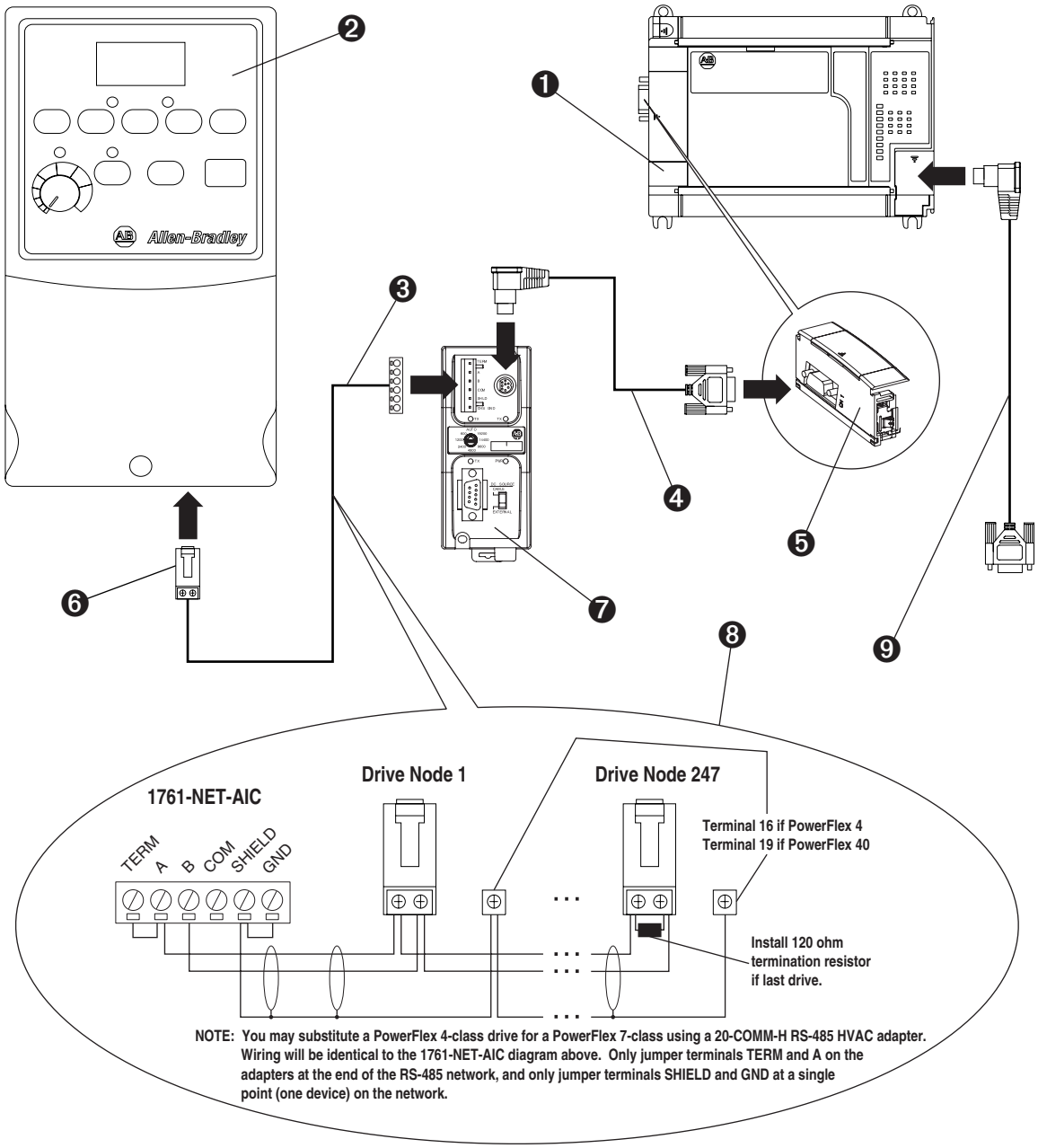
Standard RS-485 wiring practices apply. Termination resistors need to be installed at each end of the network cable to eliminate EMI noise induction and to strengthen data signal. Also, RS-485 repeaters may need to be used for long cable runs, or if greater than 32 nodes are needed on the network.

Step 1: Configuring the Hardware

This section will guide you through configuring a PowerFlex 4-class drive, 1761-NET-AIC converter, and MicroLogix 1500 LRP controller.

Device	Steps
PowerFlex 4 and 40 Drives	1. Set Parameters: P036 [Start Source] to **5** "Comm Port" P038 [Speed Reference] to **5** "Comm Port" A103 [Comm Data Rate] to **4** "19.2K" A104 [Comm Node Addr] to **1**, or a unique node address A107 [Comm Format] to **0** "RTU 8-N-1" To Configure: You may use the LCD HIM, DriveExplorer software version 3.01 or greater, or DriveExecutive software version 2.01 or greater.
MicroLogix AIC+ Advanced Interface Converter, 1761-NET-AIC	1. Set rotary switch to **AUTO** position.
MicroLogix 1500 LRP Series C, Revision C, Firmware Version 9.0 Controller	1. Run RSLogix 500 programming software. 2. Create a project, or open an existing project. 3. In the left-hand project window, double-click the "Channel Configuration" folder. 4. Click the "Channel 1" tab and set: • Driver to **Modbus RTU Master** • Baud to **19.2K** • Parity to **NONE** • Control Line to **No Handshaking** • InterChar. Timeout (x1 ms) to **0** • Pre Transmit Delay (x1 ms) to **0** 5. Leave all other settings at default. To Configure: You may only use RSLogix 500 software version 6.10.00 or greater. To verify software revision level, click **Help** then **About RSLogix 500** from the top menu bar.

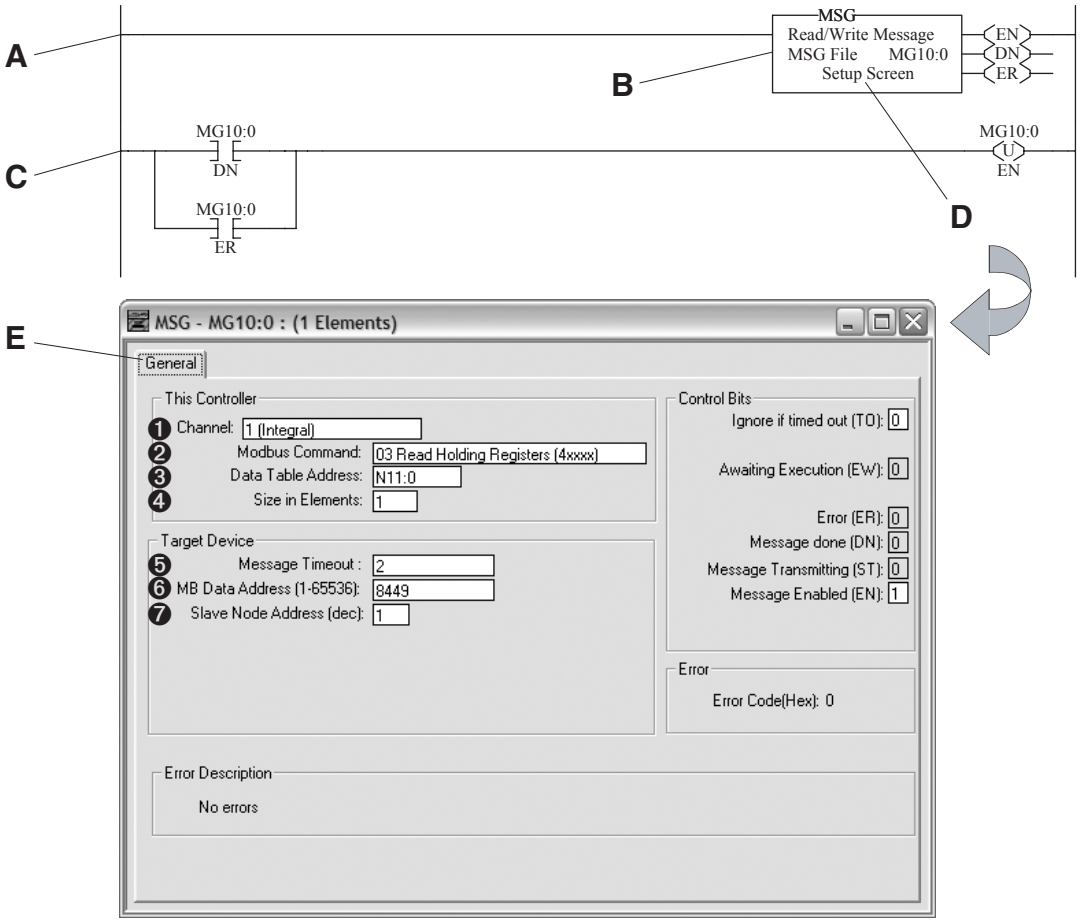
Step 2: Connecting the Hardware



No.	Description
❶	MicroLogix 1500 LRP Series C, Revision C, Firmware Version 9.0 Controller
❷	PowerFlex 4-Class Drive Frn 1.xxx and greater
❸	Belden #3105A or equivalent cable
❹	1761-CBL-PM02 MicroLogix Programming Cable. If this cable is not available, you may use a 1761-CB2-AC00 cable instead.
❺	Channel 1 9-pin Female Serial Connector on MicroLogix 1500 LRP Controller (left side)
❻	AK-U0-RJ45-TB2P Terminal Block Connector
❼	1761-NET-AIC MicroLogix AIC+ Advanced Interface Converter Frn 1.xxx. You will need to supply converter with external 24 VDC power.
❽	RS-485 Network Wiring Diagram
❾	Second 1761-CBL-PM02 MicroLogix Programming Cable (for uploading/downloading programs to controller)

Step 3: Entering the Logic Status Logic

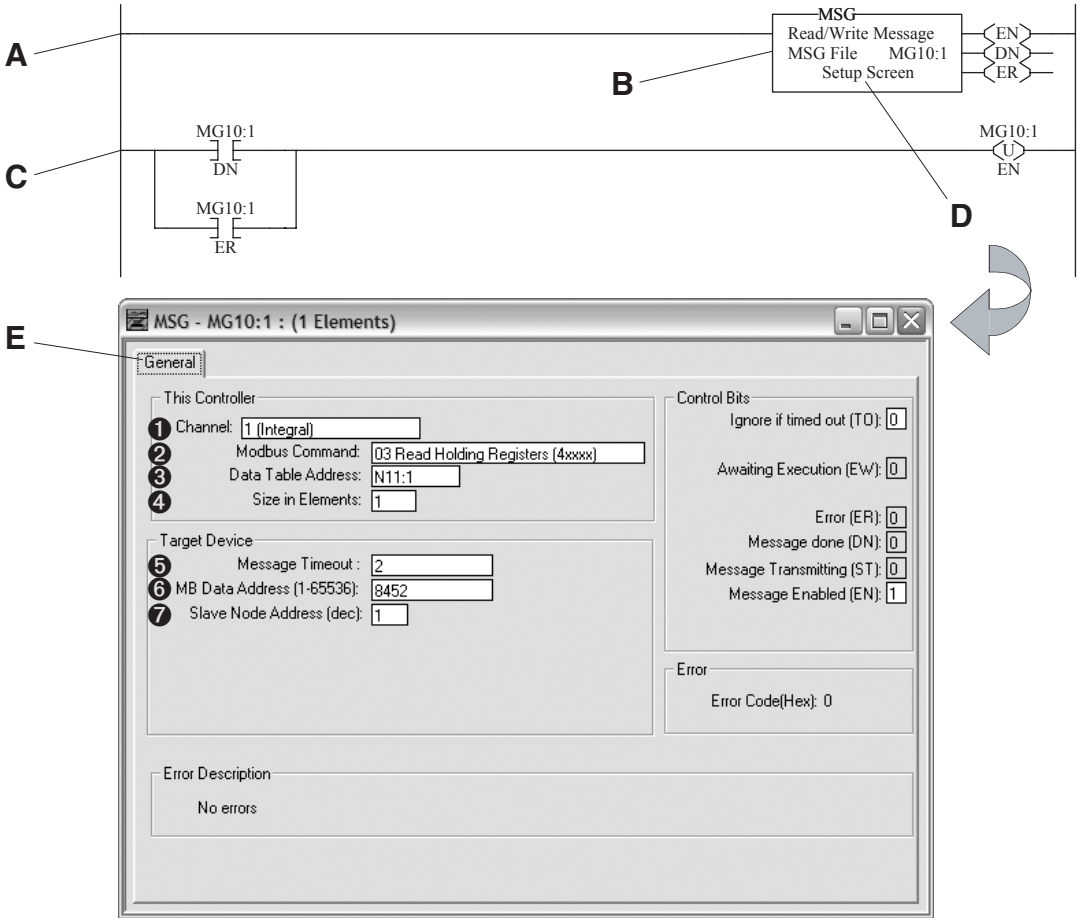
Task	Description
A	Double-click the LAD 2 [MAIN] program folder and insert a ladder rung.
B	Double-click on the rung, and then copy-and-paste the following logic into the address bar: **MSG MG10:0 3 LOCAL 1 1 N11:0 8449 1 2 132 SLOT:0**
C	In a separate rung, double-click on the rung, and then copy-and-paste the following logic into the address bar: **BST XIC MG10:0/DN NXB XIC MG10:0/ER BND OTU MG10:0/EN**
D	Click on **Setup Screen** to launch the message configuration window.
E	Configure the **General** tab by entering the information shown in the table below.



No.	Field	Action	Recommended Setting
❶	Channel:	Select communication port	1
❷	Modbus Command:	Select message function	03 Read Holding Registers (4xxxx)
❸	Data Table Address:	Select an unused data file	N11:0 (user defined)
❹	Size in Elements:	Element size = INT	1
❺	Message Timeout:	Select control timeout in “seconds”	2
❻	MB Data Address (1-65536):	Select data register in drive	8449 (drive defined)
❼	Slave Node Address (dec):	Select node address of drive	1

Step 4: Entering the Speed Feedback Logic

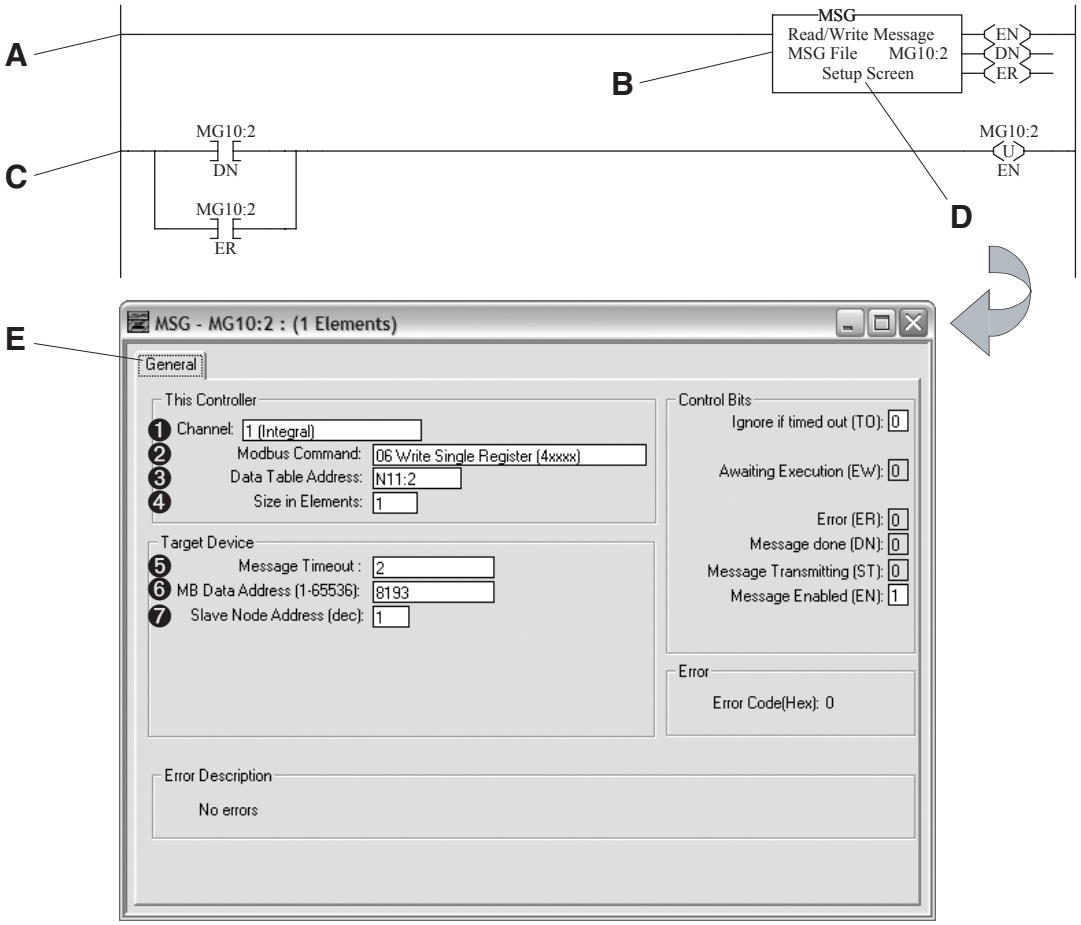
Task	Description
A	Double-click the LAD 2 [MAIN] program folder and insert a ladder rung.
B	Double-click on the rung, and then copy-and-paste the following logic into the address bar: **MSG MG10:1 3 LOCAL 1 1 N11:1 8452 1 2 128 SLOT:0**
C	In a separate rung, double-click on the rung, and then copy-and-paste the following logic into the address bar: **BST XIC MG10:1/DN NXB XIC MG10:1/ER BND OTU MG10:1/EN**
D	Click on **Setup Screen** to launch the message configuration window.
E	Configure the **General** tab by entering the information shown in the table below.



No.	Field	Action	Recommended Setting
❶	Channel:	Select communication port	1
❷	Modbus Command:	Select message function	03 Read Holding Registers (4xxxx)
❸	Data Table Address:	Select an unused data file	N11:1 (user defined)
❹	Size in Elements:	Element size = INT	1
❺	Message Timeout:	Select control timeout in “seconds”	2
❻	MB Data Address (1-65536):	Select data register in drive	8452 (drive defined)
❼	Slave Node Address (dec):	Select node address of drive	1

Step 5: Entering the Logic Command Logic

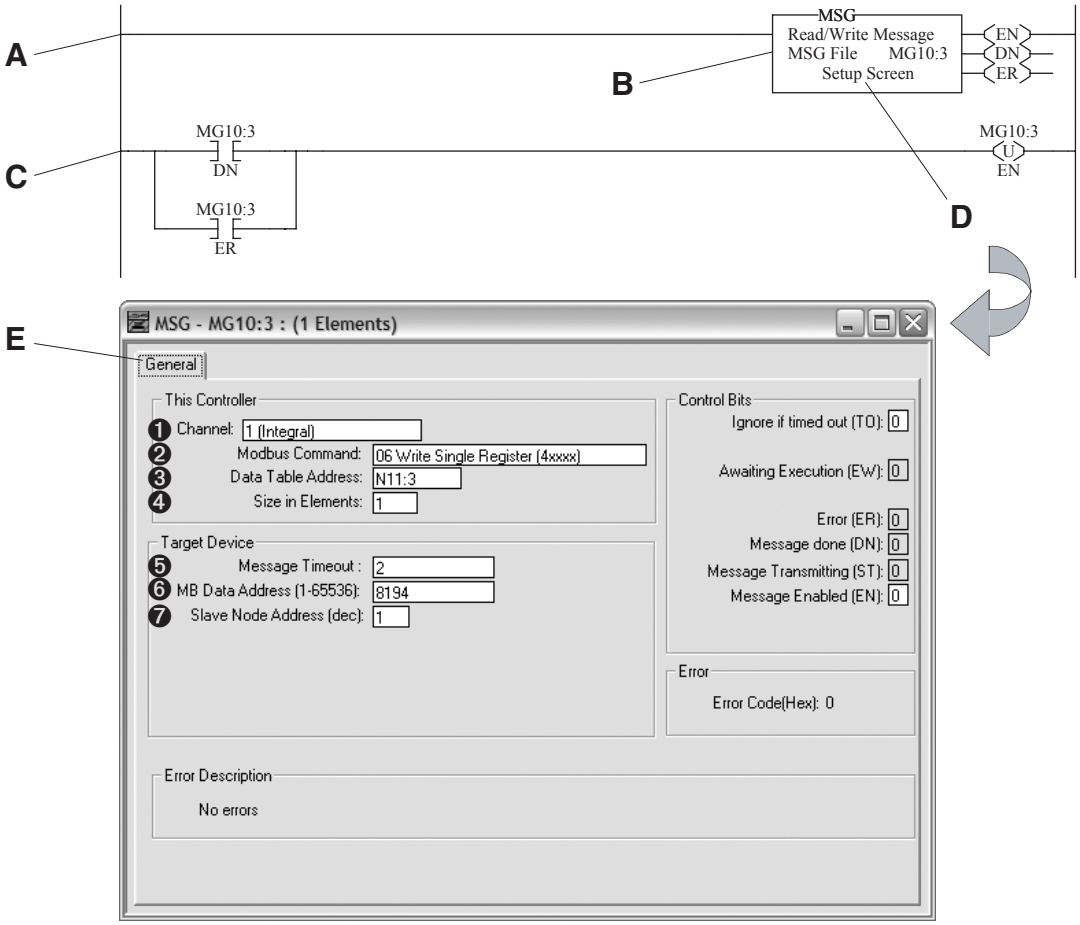
Task	Description
A	Double-click the LAD 2 [MAIN] program folder and insert a ladder rung.
B	Double-click on the rung, and then copy-and-paste the following logic into the address bar: **MSG MG10:2 6 LOCAL 1 1 N11:2 8193 1 2 128 SLOT:0**
C	In a separate rung, double-click on the rung, and then copy-and-paste the following logic into the address bar: **BST XIC MG10:2/DN NXB XIC MG10:2/ER BND OTU MG10:2/EN**
D	Click on **Setup Screen** to launch the message configuration window.
E	Configure the **General** tab by entering the information shown in the table below.



No.	Field	Action	Recommended Setting
❶	Channel:	Select communication port	1
❷	Modbus Command:	Select message function	06 Write Single Registers (4xxxx)
❸	Data Table Address:	Select an unused data file	N11:2 (user defined)
❹	Size in Elements:	Element size = INT	1
❺	Message Timeout:	Select control timeout in “seconds”	2
❻	MB Data Address (1-65536):	Select data register in drive	8193 (drive defined)
❼	Slave Node Address (dec):	Select node address of drive	1

Step 6: Entering the Speed Reference Logic

Task	Description
A	Double-click the LAD 2 [MAIN] program folder and insert a ladder rung.
B	Double-click on the rung, and then copy-and-paste the following logic into the address bar: **MSG MG10:3 6 LOCAL 1 1 N11:3 8194 1 2 0 SLOT:0**
C	In a separate rung, double-click on the rung, and then copy-and-paste the following logic into the address bar: **BST XIC MG10:3/DN NXB XIC MG10:3/ER BND OTU MG10:3/EN**
D	Click on **Setup Screen** to launch the message configuration window.
E	Configure the **General** tab by entering the information shown in the table below.



No.	Field	Action	Recommended Setting
❶	Channel:	Select communication port	1
❷	Modbus Command:	Select message function	06 Write Single Registers (4xxxx)
❸	Data Table Address:	Select an unused data file	N11:3 (user defined)
❹	Size in Elements:	Element size = INT	1
❺	Message Timeout:	Select control timeout in “seconds”	2
❻	MB Data Address (1-65536):	Select data register in drive	8194 (drive defined)
❼	Slave Node Address (dec):	Select node address of drive	1

Understanding the I/O

The following table identifies drive I/O. In RSLogix 500 software, you will need to know the data table address(es), and logic bit definiton(s) in order to effectively control your drive. They are:

Data Table Address	Description
N11:0	**Logic Status Word**; for bit definitons, please refer to Appendix C-4 of the drive's user manual.
N11:1	**Speed Feedback**; for bit definitons, please refer to Appendix C-4 of the drive's user manual.
N11:2	**Logic Command Word**; for bit definitons, please refer to Appendix C-3 of the drive's user manual.
N11:3	**Speed Reference Word**; for bit definitons, please refer to Appendix C-3 of the drive's user manual.

Other Supported Controllers

Allen-Bradley offers additional MicroLogix controllers with Modbus RTU Master capabilities. They are:

Controller Type	Catalog Number
MicroLogix 1200 Series C, Revision C, Firmware Version 8.0	1762-L24, -L40
MicroLogix 1500 LSP Series C, Revision C, Firmware Version 9.0	1764-LSP

Rockwell Automation Support

Before you contact Rockwell Automation for technical assistance, we suggest that you please review the troubleshooting information contained in the supporting product publications.

If the problem persists, call your local Allen-Bradley distributor or contact Rockwell Automation in one of the following ways:

Phone	United States / Canada	• 1.262.512.8176 (7 AM - 6 PM CST) • 1.440.646.5800 (24 hour support)
	Outside United States / Canada	You can access the phone number for your country via the Internet: 1. Go to **http://www.ab.com** 2. Click on **Support** (http://support.rockwellautomation.com) 3. Under **Contact Customer Support**, click on **Phone Support**
Internet	⇨	Go to **http://www.ab.com/support/abdrives**
Email	⇨	support@drives.ra.rockwell.com

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