

Wired IO Expansion Setup with Modbus RTU, Universal Expansion Modules and Serial Base

Applies To

Rockwell Automation, Allen Bradley:

- MicroLogix 1100, 1200, 1400, 1500

FreeWave Technologies:

- IOE-X-4422PC
- IOE-X-4422P

Summary

This application note describes how to configure Allen Bradley MicroLogix programmable logic controllers (PLC) with Modbus RTU capability and FreeWave Technologies' Serial Base with Expansion Modules. A MicroLogix 1100 is used as an example in this document; settings are common to all MicroLogix PLC's with Modbus RTU.

Serial Base and Expansion Module Settings

Up to 15 Expansion Modules can be stacked on a Serial Base. The following steps provide an overview of the configuration procedure for the Serial Base with stacked Expansion Modules:

1. Stack as many Expansion Modules (IOE-X-4422P) on the Serial Base (IOE-X-4422PC) as necessary for the application.
2. Connect the expansion stack to a computer with the data cable provided.
3. Power the expansion stack with a power supply within the specific voltage range.
4. Press and hold the button on the data cable until the "P" light flashes green.
5. With the Tool Suite configuration software, change the following settings in the Serial Base:
 - i. Universal Channels: Select desired functionality for each channel
 - ii. Input Channels: Select desired functionality for each channel
 - iii. Isolated Digital Inputs: Select desired functionality for each channel
 - iv. Isolated Digital Outputs: Select desired functionality for each channel
 - i. In each of the separate channel tabs, additional configuration settings will appear once specific channel functionality is selected. Configure each channel as the appropriate for the application.
 - v. Stack Settings:
 - i. Serial Protocol: RS-232
 - ii. Port Speed: Must match PLC port speed.
 1. 19,200 preferred.
 - iii. Parity: Must match MicroLogix.
 1. "None" is default and preferred.
 - iv. Stop Bits: Must match MicroLogix.
 1. 1 Bit is default and preferred.
 - v. Modbus ID: Any number.
 1. 1 preferred
6. Press the write "All" button for settings on the Serial Base to take effect.
7. For each of the stacked Expansion Modules, select that device in the device tree and configure the following settings:
 - i. Universal Channels: Select desired functionality for each channel
 - ii. Input Channels: Select desired functionality for each channel
 - iii. Isolated Digital Inputs: Select desired functionality for each channel
 - iv. Isolated Digital Outputs: Select desired functionality for each channel

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- i. In each of the separate channel tabs, additional configuration settings will appear once specific channel functionality is selected. Configure each channel as the appropriate for the application.
- v. Press the write "All" button for settings on that module to take effect.

PLC Settings

The following steps provide an overview of the configuration procedure for the Modbus RTU devices.

1. Obtain the MicroLogix devices that will be used to create the Modbus RTU network
2. Power up the MicroLogix and establish a connection to a PC running RSLinx and RSLogix 500.
 - i. Depending on the PLC, there are several different methods to connect to RSLinx. Best practice is to use a method that does not tie up the serial port. For this document, the connection method is via EtherNet I/P.
3. Configure the MicroLogix channel 0 port as follows:
 - i. Driver: Modbus RTU Master
 - ii. Baud: Must match IOE-X-4422PC. 19,200 preferred
 - iii. Parity: Must match IOE-X-4422PC. "None" preferred
 - iv. Protocol Control:
 - i. Control Line: No Handshaking
 - ii. InterChar. Timeout: 0
 - iii. Pre Transmit Delay: 0
4. Select "OK" or "Apply".
5. With the PLC, IOE-X-4422PC and IOE-X-4422P devices configured, you will now be able to create a message instruction in the MicroLogix to either read or write to and from the IOE-X-4422PC and/or IOE-X-4422P.

Configuring the Message Instruction in the PLC

With a the MicroLogix's serial port configured as a Modbus RTU Master, any message instruction configured to use channel 0 will automatically become a Modbus RTU message instruction. In order to read or write data to and from the IOE-X-4422PC set the following parameters in the message instruction.

1. This Controller (MicroLogix):
 - i. Modbus Command: Dependant on data type
 - i. 1: Read Coils
 - ii. 2: Read Discrete Inputs
 - iii. 3: Read Holding Registers
 - iv. 4: Read Input Registers
 - v. 5: Write Single Coil
 - vi. 6: Write Single Register
 - vii. 15: Write Multiple Coils
 - 1. The FGR2-IO-IOE does not support command 15.
 - viii. 16: Write Multiple Registers
 - 1. The FGR2-IO-IOE does not support command 16.
 - ii. Data Table Address: Select the data table where you want the data that is to be written to or be read from in the MicroLogix PLC
 - iii. Size in Elements: This is the number of elements to be transferred.
2. Target Device (FGR2-IO-IOE):
 - i. Message Timeout: 2
 - ii. MB Data Address: Refer to the FGRIO Modbus and Expansion Module register maps in their respective user manuals for data addresses.
 - i. Add 200 to the register address of stacked modules.

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- iii. Slave Node Address: Use the address configured in the IOE-X-4422PC device that data is being read from or written to.

Connecting the Expansion Modules to the PLC

There are two basic types of physical DF1 ports on Allen Bradley devices. In both of the following connector types, only the Transmit, Receive and Ground lines are needed to establish a connection between the FGR2 radio and DF1 Full Duplex port:

1. The first DF1 port type uses a DB9 male connector (DTE type port). To connect this type of port to Expansion Modules a standard straight through connection is required with a FreeWave data cable.
2. The second DF1 port type uses a proprietary mini din connector. It requires an Allen Bradley PM02 cable with a DB9 female connector (DCE type port). With this cable a Null connection is required.