

Wireless DF1 Half-Duplex Setup with Serial Radios

Applies To

Rockwell Automation, Allen Bradley:

- MicroLogix 1000, 1100, 1200, 1400, 1500
- SLC 5/03, 5/04, 5/05

FreeWave Technologies:

- I2-C
- FGR2-C
- FGR09
- FGSR

Summary

This application note describes how to configure Allen Bradley MicroLogix and SLC programmable logic controllers (PLC) with DF1 capabilities and FreeWave Technologies' 900MHz and 2.4GHz serial radio modems to create a wireless DF1 Half-Duplex network. A MicroLogix 1100 is used as an example in this document; settings are common to all DF1-capable MicroLogix and SLC programmable logic controllers.

Point to Multipoint Master Settings

There is only one master radio in a point to multipoint network. The following steps provide an overview of the configuration procedure for the FGR2 and I2 serial radio modems configured as a point to multipoint master:

1. Connect one serial radio modem to a computer with the serial cable provided.
2. Power the serial radio modem with a power supply within the specific voltage range.
3. Press the button on the data cable so that all 3 lights turn green.
4. With the Tool Suite configuration software, change the radio modem settings:
 - i. Operation mode: Point to Multipoint Master
 - ii. Baud Rate:
 - i. Serial protocol: RS232
 - ii. Baud Rate: Must match DF1 device
 1. Should not be higher than 19,200 for use with MicroLogix PLCs.
 - iii. Parity: Must match DF1 device
 1. DF1 and radios default to "no parity."
 - iv. Stop Bits: Must match DF1 device
 1. DF1 and radios default to "1."
 - iii. Transmission Characteristics:
 - i. Frequency Key: Any entry from 0 through E
 1. Avoid using default value of 5.
 - ii. Transmit Power: Application dependant
 1. Select the lowest transmit power setting that provides a reliable wireless link. If unsure, use 10. For a bench test, setting transmit power to 0 should be sufficient. Increasing the transmit power increases the distance across which the radios remain linked at the expense of increased power consumption.
 - iv. MultiPoint Parameters:
 - i. Network ID: Any number between 1 and 4095, other than 255
 1. The simplest choice for the network ID is the last 4 digits of the master radio's serial number. However, if that number is greater than 4095 select a similar network ID that is 4095 or less.
 - ii. Repeaters: Off

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5. Press the write "All" button for settings to take effect.

Point to Multipoint Slave Settings

As many point to multipoint slave radios as needed can be connected to a point to multipoint master radio. The following steps provide an overview of the configuration procedure for the FGR2 and I2 serial radio modems configured as point to multipoint slave:

1. Repeat the configuration steps for the point to multipoint master with the following exceptions in step 3:
 - i. Operation Mode: Point to Multipoint Slave
 - ii. Transmission Characteristics:
 - i. Frequency Key: Must match master radio
 - ii. Slave security: Off
 - iii. MultiPoint Parameters:
 - i. Network ID: Must match master radio
2. Press the write "All" button for settings to take effect.

Once configuration of all radios is complete, connect an antenna to each radio and power all devices. Upon establishing a wireless link to the master radio, the slave radios will display a solid green Carrier-Detect (CD) LED and a solid red Clear-To-Send (CTS) LED. The master radio's CTS LED will come on only when a slave radio is sending data to the master radio.

For customized network configuration information please refer to the radio specific user manual or contact FreeWave Technologies customer support. Manipulating various settings allow users to avoid noisy radio frequency spectrum, adjust frequency hopping times, add repeaters for greater network coverage and enable over-the-air diagnostics, among other benefits.

PLC Settings

The following DF1 settings are for a MicroLogix 1100 PLC. However, all DF1-capable devices will have similar, if not identical, settings.

The following steps provide an overview of the configuration procedure for the DF1 Half-Duplex Master device:

1. Obtain the DF1 PLC that will be used to create the DF1 Half Duplex Master.
2. Power up the DF1 device 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 DF1 port. For this document, the connection method is via EtherNet I/P.
3. Configure the DF1 port as follows:
 - i. Driver: DF1 Half Duplex Master
 - ii. Baud: Must match FGR2
 - i. 19,200 preferred
 - iii. Parity: Must match radio
 - i. "None" preferred
 - iv. Node Address: 1
 - i. All node addresses in a DF1 Half Duplex network must be different. In some applications the addresses must be sequential, so it is recommended that the Master be address 0 or 1.
 - v. Protocol Control:
 - i. Control Line: No Handshaking
 - ii. Error Detection: Must match other DF1 Half Duplex device.
 1. CRC preferred

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- iii. Polling Mode: Any
 1. "Msg, Allow Slave to Initiate" preferred
- iv. Duplicated Packet Detected: Can be checked or unchecked
- v. Reply Msg, Timeout: 20 ms
- vi. ACK Timeout: 1000 ms
- vii. Message Retries: 3
- viii. Pre Transmit Delay: 0 ms
4. Select "OK" or "Apply".
5. For the remaining DF1 devices, follow steps 2 thru 4 with the following exception:
 - i. Driver: DF1 Half Duplex Slave
 - ii. Node addresses for each device must be sequential (2, 3, 4, etc...).
6. With each remote PLC's configured following the above steps, once connected to the Master PLC via the FGR2 radio modems, they will have a communications path back to the DF1 Half Duplex Master.
7. In the configuration example above, data will only move between the Master and Slaves or Slaves and Master when a message instruction in any given PLC is enabled. However in applications with a large number of slaves it is recommended that all of the messaging be done in the DF1 Full Duplex Master and that the port Polling Mode be set to "Msg. Don't allow Slave to Initiate". This will prevent a large number of multiple DF1 Slave PLC's from sending messages to the Master PLC at the same time.
8. If it is needed to set the Polling Mode to "Std. Xxx msgs. Per scan", once the PLC's are configured and connected to the FGR2 radio modems communications will start as the DF1 Half Duplex Master will start polling the Remote's in its polling list. However no data will be transferred unless a message instruction in the Master PLC is enabled.

Connecting the Serial Radio Modem to an Allen Bradley PLC

There are two basic types of physical DF1 ports. 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 an FGR2 (with an RS232 port) a standard straight through connection is required.
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.