



Application Bulletin

August 8, 2007

Using 900 MHz Radio Communications

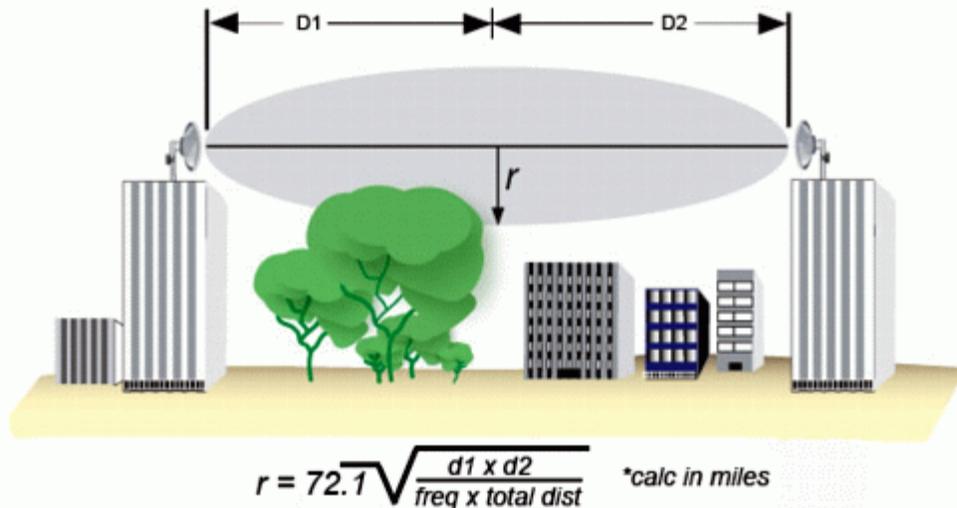
Application Note Using 900MHz Radio Communications

Overview:

900MHz radios provide a long-range radio solution where a 2.4GHz radio may just not cut it. 900MHz signals are more adept at going through walls and obstructions and can travel much longer distance obstructed or unobstructed... ~1500' indoor for 900MHz vs. ~600' indoor for 2.4GHz, ~20 miles outdoors with the proper antenna for 900MHz vs. ~10 miles outdoors with the proper antenna for 2.4GHz. However, unlicensed 900MHz signals are not acceptable in many parts of the world where 2.4GHz signals are accepted worldwide.

Using Horner APG WCM910 external serial radios and XRC9 XLe/XLt-mounted radio option cards, it is possible to talk between controllers or between a controller and a PC. This may be ideal if it is not desirable to run hundreds of feet of communications wire and may be the only option if distances exceed a wired network's maximum length.

For maximum radio performance, using the proper antennae and correct antenna placement is a must. While it may not matter so much if the radios are only 20 feet apart, getting the 20-mile range mentioned above requires very specific antennae types and placement. Think of an area between the two antennae that is shaped like a blimp or an elongated football (called the Fresnel zone) where the two points of the football will touch each antenna. The point exactly halfway between the two antennae will be the widest part of the football. At 1000 feet apart, the Fresnel (pronounced Freh-nel) zone is 16 feet in diameter. At 20 miles apart, it is 87 feet in diameter. Anything occupying the Fresnel zone will reduce the signal strength... the ground, buildings, vegetation, etc. Keeping the ground in mind, it can quickly require a raised antenna the further apart the two radios are. Antenna types will be determined by the direction the radio waves need to travel.



The Fresnel Zone

Setting Up the Hardware

XLe/XLt

1. If the XLe/XLt does not yet have a radio option installed, install an XRC9 option card.
2. Install the RadioSet software on your computer.
3. Open Cscope and load any XLe/XLt with the 'RadioSet to XRC' program.
4. Make sure the controller is in RUN mode, then press F1 on the controller to ready it for RadioSet communications.
5. Close Cscope and switch the programming cable over to MJ2.
6. Open the RadioSet software.
7. Select the correct COM port, then set the Baud/Flow Control/Data Bits/Parity/Stop Bits to 9600/NONE/8/NONE/1.
8. Click 'Test / Query'.
 - a. If a response comes back other than the radio model and firmware, power-cycle the unit and try again.
9. Once communications can be established, click the 'Modem Configuration' tab in the RadioSet software.
10. Click the 'Read' button under 'Modem Parameters and Firmware'.

A list of parameters will load from the modem and display on the screen. Since there may be many groups trying to talk via the radios at the same time, your radios will have to have their own channel to talk on to eliminate interference. The second parameter down is 'Hopping Channel'. The default is 0, which talks to everyone. Change this parameter to a number between 1 and 9 that is different than everyone else's. You will also use this number for your other radio.

Once this channel is set, click the 'Write' button under 'Modem Parameters and Firmware' and wait for the update to complete. Once complete, this modem is ready to go.

WCM910

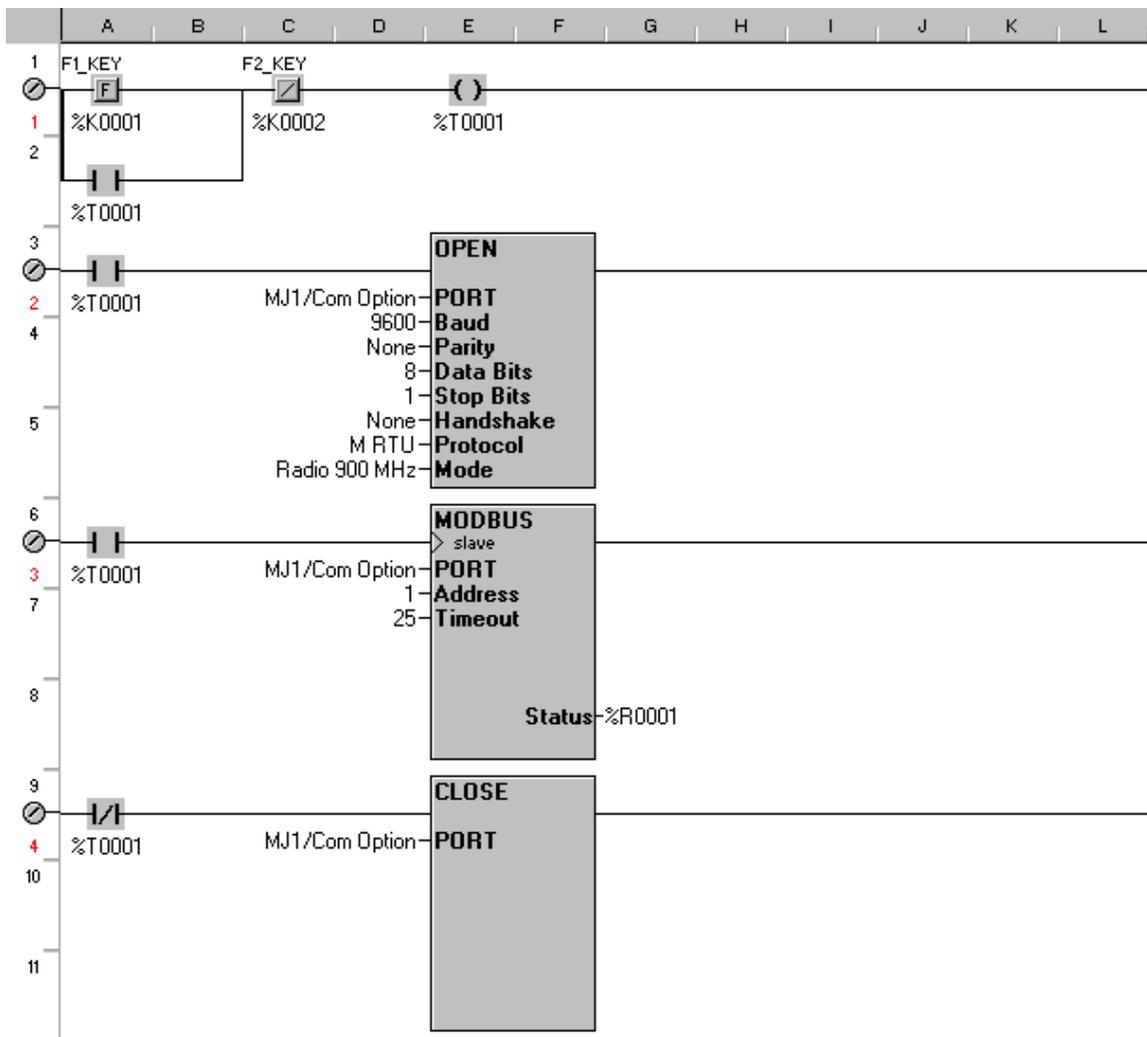
Set up for the WCM910 is mostly the same as for the XRC9.

1. Power up the WCM910 and connect a serial cable.
2. Continue from Step 6 above until you reach this section again, then continue below.

XL OCS to XL OCS

For this exercise, we can make a Modbus Master/Slave setup where one XL controller can read and write data to the other. We'll start with the Slave.

1. Open Cscope, start a new program, connect to the controller and auto-config the I/O (be sure the XRC9 modem is there!). OK the I/O Config.
2. Write a ladder program to open the 900MHz radio port, then specify it as a Modbus Slave. Here's one way to do it:



Note: You'll find the Port Open, Port Close and Modbus Slave functions under the 'Comm Operations' toolbar.

Create a few data fields on the screen... some for the Master to read (make them editable), some for the Master to write. Keep track of the registers you use...

let's say %R21 and %R22 will be registers the master will read, %R31 and %R32 will be registers the master will write.

Save and then download the program to the controller. Ensure RUN mode. Next, the Modbus Master. Open the 'Modbus Master Rotate' program in Cscape. Go into the I/O configuration and auto-config the I/O... make sure the XRC9 shows up. Next, find the "Port Open" function and change the parameters to 9600 baud, 900MHz mode.

At the top of this program are 4 'Message Control Blocks' (MCBs). The first 2 are Writes (command 16), the second 2 are Reads (command 3). Delete the second 2 functions so that there are only 2 left. To the remaining two:

1. Change them to the correct Slave ID (first parameter).
2. Change the second MCBs command code to 3, leave the first MCBs command code at 16 (second parameter).
3. Change the offset in the first MCB to match what you are writing in your slave. OCS %R registers have an offset starting at 3000... 3000 = %R1, 3001 = %R2, etc. Therefore, %R21 = 3020 (third parameter)
4. Change the offset in the second MCB to match what you are reading in your slave. %R31 = 3030 (third parameter)
5. Change the number of registers in each MCB to reflect how many of each you want to read... make it at least 2. (fourth parameter)
6. The fifth parameter is the register type... %R registers = 8.
7. The last parameter is which of those types to use... %R51 = 50. For the first MCB, this is where you will get the data to write to the slave. For the second MCB, this is where you will store the data you read from the slave.

Next, find the Multi-Rotate function at the bottom. Change its length from 24 to 12.

Create data fields on the screen to be able to edit data going to your slave and view data coming from your slave.

This completes the changes needed to the Modbus Master program. Save the program, then download it to the Master controller.

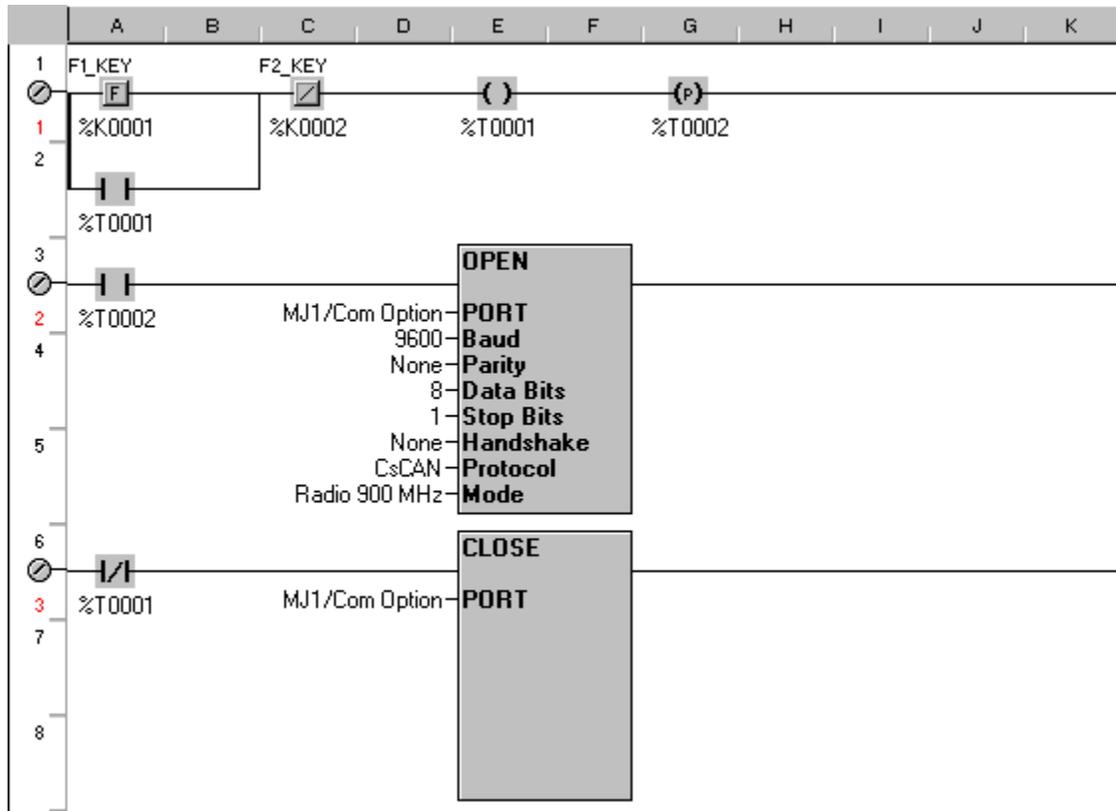
Confirm your wireless Modbus network works. Press the F1 key on the slave to open its radio for communications. Press the F1 key on the master to open its radio for communications and start the Modbus process.

PC to XL Controller

For this exercise, we will monitor the XL Controller with Cscope or HMI software via a radio connection.

1. Open Cscope, start a new program and auto-config the I/O... make sure that XRC9 is there.
2. For ladder logic, open the 900MHz port in CsCAN mode.

NOTE!!!! When opening for CsCAN mode, the 'Open Port' function **cannot** be held on as with Modbus or other port functions... it must be "one-shotted".



You can add other ladder logic that does something for you to monitor or add this code into an existing ladder program. Once finished, download this program to the XL controller and make sure it is in RUN mode.

Next, power up and connect a serial port to a WCM910 external radio modem. Make sure the radio has been configured as previously noted. Also, make sure the radio is at least 5 feet away from the XRC9... they cannot be too close!

With the serial port connected and Cscope running, you may be able to see the middle, green TX light flicker. Press F1 on the controller to open the port for radio communications. You should see the 3 green lights on the WCM910 light up. Check for communications in Cscope at the bottom right. You should now be able to run DataWatch or Debug over the radio connection. You can also run the HMI software if available.