

APPLICATION NOTE

*Quick Reference Guide
for Setting Up
RF401-to-CR206 Communications*



CAMPBELL SCIENTIFIC, INC.[®]
WHEN MEASUREMENTS MATTER

Setting Up RF401-to-CR206 Communications

Certain CR206 settings must match the RF401 settings for communications between the datalogger and radio to be successful. The factory default settings of these devices do not match; therefore, they must be reconfigured before communications can take place. This document provides a quick reference for setting up the devices so that they work together. The terms "CR206" and "RF401" are used throughout this document but this information applies to the entire CR206 Series and the RF401 Series in general (much of this information applies as well to the earlier CR205 Series and RF400 Series).



You must change the default settings of the CR206 and RF401. The CR206 and RF401 will not communicate with each other using the default settings.

CR206 Setup Information

1. Apply 12 VDC power to the battery terminals on the CR206.
2. Connect the CR206 to a COM port on your computer using a standard 9-pin serial cable.
3. Run our Device Configuration Utility (DevConfig).
4. Under Device Type, click "CR200 Series".
5. Select the Serial Port matching the COM port on your computer.
6. Click the "Connect" button to establish communications with the datalogger. The Deployment panel in DevConfig will be displayed and the DevConfig parameters can now be entered (see Figure 1).

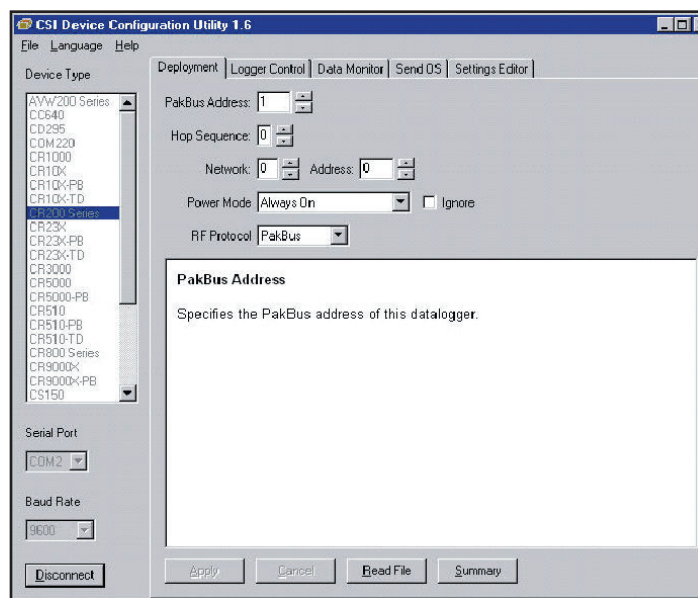


Figure 1. CR206 Setup Main Menu

7. Enter the datalogger "PakBus Address" that matches the communications software (LoggerNet, PC400, PC200W) setting for the CR206's PakBus Address. Valid settings are 1 - 4094.
8. Choose "PakBus" for the "RF Protocol", unless your network includes CR205 dataloggers or RF400 radios. The CR205 and RF400 were retired in 2005.
9. Enter the radio "Hop Sequence" that matches all of the RF401 radios and other CR206 dataloggers in the network. Valid entries are 0-6.
10. Enter the radio "Network" address that matches all of the RF401 radios and other CR206 dataloggers in the network. Valid entries are 0-3 for PakBus mode (0-63 for "Transparent" mode).
11. Enter 0 for the radio "Address" if the RF Protocol is PakBus. (For Transparent mode, enter a number from 0 to 1023 that matches the setting for the other dataloggers and radios in the network.)
12. Enter a radio "Power Mode" that works with the RF401's power mode (see Table 1 on page 5). Typically, the power mode setting should be "1 Sec with Long Header" or "8 Sec with Long Header". Although these power modes introduce 1 second or 8 seconds (respectively) of latency, they use less power than the "always on" modes. With settings other than "always on", the radio receivers turn on periodically for 100 milliseconds. It is therefore necessary for the transmitting radio to send a long header to assure that the duty cycling receiver on the other end hears it (see Figure 2).

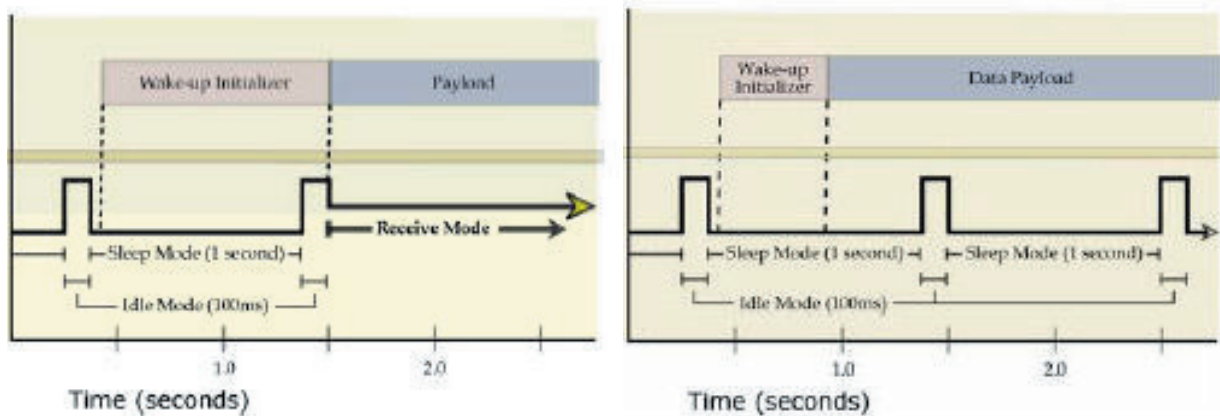


Figure 2. The graph on the left represents a transmitting radio that uses a long header and a receiving radio that is in a sleep cycle. The length of the wake-up initializer exceeds the time interval of cyclic sleep ensuring that the receiver detects the wake-up initializer and receives the payload (i.e., transmitted data). The graph on the right represents a radio that transmits a wake-up initializer that is shorter than the cyclic sleep of the receiving radio. The receiver does not detect the wake-up initializer and remains asleep—missing the data transmission.



1. Any radio that is transmitting to a sleeping radio must have a long header that spans the sleep duty cycle.
2. When a CR206 (or RF401) transmits to another CR206 (or RF401), the receiving radio knows when the originally transmitting radio is awake and not duty cycling. This allows the radio to only transmit a long header when it is needed.

Below is a description of all of the Power Mode options:

- **No Radio**—datalogger model has no radio (not used with this application).
- **Always ON**—radio always on; 25 mA continuous current drain; does not transmit wakeup header (alternatively you may check the "Ignore" box to disregard the Power Mode setting and keep the radio always on).
- **1 Sec**—radio wakes up every second for 100 msec to look for wakeup header; 2 mA current drain; does not transmit wakeup header. This option has the minimum latency but should not be used if the receiving radio has a sleep cycle.
- **1 Sec with Long Header**—radio wakes up every second for 100 msec to look for wakeup header; 2 mA current drain; transmits a 1.2 second wakeup header if needed.
- **8 Sec with Long Header**—radio wakes up every 8 seconds for 100 msec to look for wakeup header; 0.5 mA current drain; transmits a 8.2 second wakeup header if needed.
- **8 Sec**—radio wakes up every 8 seconds for 100 msec to look for wakeup header; 0.5 mA current drain; does not transmit wakeup header. This option should not be used if the receiving radio has a sleep cycle.
- **Pin Enabled**—radio is program controlled; does not transmit wakeup header.

13. Click the "Apply" button to send the entered settings to CR206.

RF401 Setup Information

1. Apply 12 VDC power to the "DC Pwr" jack of the RF401, or use an SC12 cable to connect to the datalogger's CS I/O port.
2. Use a standard 9-pin serial cable to connect the RF401's RS-232 port to a COM port on your PC.
3. Run DevConfig.
4. Click on "RF401" in DevConfig.
5. Click on the "Connect" button in DevConfig.
6. Press the "Program" button on the RF401, and DevConfig will display the Deployment panel—defaulting to the RF401/RF411/RF416 tab (see figure 3).
7. If desired, you can enter the "Serial Number" from the RF401 enclosure.
8. Select the "Active Interface." This should be set to Datalogger SDC if the RF401 will be connected to a CR206 or another PakBus datalogger. Select ME for the Active Interface if the RF401 is connected to a mixed-array datalogger. When the RF401 is connected to a PC, select either the "AutoSense" or "RS-232" mode; newer PCs may require a USB-to-RS232 serial adapter. The "AutoSense" mode senses whether or not a datalogger is connected to the RF401's CS I/O port, and accordingly routes network packets to its CS I/O port or RS-232 port. When the radio is connected to another RS-232 communication device, select the "RS-232" setting.
9. Select "SDC Address" if the RF401 is connected to a PakBus datalogger. Valid settings are 7, 8, 10, or 11.

- Typically, select either "PakBus Aware" or "PakBus Node" for the "Protocol" setting (the CR206's "RF Protocol" should be PakBus). Radios set to "PakBus Aware" and radios set to "PakBus Node" can exist in the same network. The "Transparent" setting should only be chosen if the network contains CR205 dataloggers or RF400 radios. When the "Transparent" mode is used, all CR206 dataloggers and RF401 radios in the network must be set to "Transparent".

A datalogger attached to an RF401 operating in "PakBus Aware" or "PakBus Node" will only receive packets that are addressed to the datalogger (and any network broadcasts) lowering the average datalogger current drain. Also, Retries are used, which improve communication efficiency for radios using a "PakBus Aware" or "PakBus Node" protocol; retries are not available for the "Transparent" mode, except for point-to-point communications.

The "PakBus Aware" mode is the simplest mode and does not require a PakBus address. The "PakBus Node" protocol is useful when a stand-alone router is required, where the RF401 is assigned it's own PakBus Address. The "PakBus Node" protocol also allows our software to access the radio's RSSI (received signal strength indication).

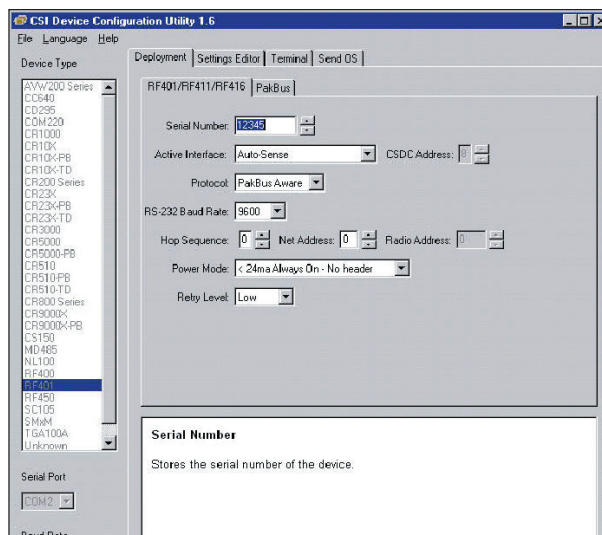


Figure 3. RF401 Setup

- If the Active Interface setting is "AutoSense" or "RS-232", enter the "RS-232 Baud Rate"—typically 9600. When the RF401 is connected to a PC, the baud rate selections in LoggerNet, PC400, or PC200W software must agree with the baud rate setting for the RF401. In the "AutoSense" mode, if you connect the RF401 to a datalogger's CS I/O port, the RS-232 Baud Rate is irrelevant since the RF401 communicates with the datalogger in the "SDC" mode.
- Select the "Hop Sequence" that matches all of the CR206 dataloggers and the other RF401 radios in the network. Valid entries are 0-6.
- Select the "Net Address" that matches all of the CR206 dataloggers and the other RF401 radios in the network. Valid entries are 0-3 for "PakBus Aware" or "PakBus Node" (0-63 for "Transparent" mode).
- Enter 0 for the "Radio Address" if the Protocol is "PakBus Aware" or "PakBus Node". (For "Transparent" mode, enter a number from 0 to 1023 that matches the setting for the other dataloggers and radios in the network.)

- Select a "Power Mode" from a pick list. The Power Modes of the CR206 and RF401 need to be configured to work together so that each can get the other's attention. With settings other than "Always On", the radio receivers turn on periodically for 100 milliseconds. It is therefore necessary for the transmitting radio to send a long header to assure that the duty cycling receiver on the other end hears it (see Figure 2 on page 2). Table 1 shows the CR206 Power Modes and the recommended corresponding RF401 Power Modes.

CR206 Power Mode	Recommended RF401 Power Mode
Always On	<24ma Always On - No header
Pin Enabled	<24ma Always On - No header
1 Sec	<24 ma Always On - 1 Sec Header
1 Sec with Long Header	< 2ma 1 Sec Header
8 Sec	<24ma Always On - 8 Sec Header
8 Sec with Long Header	<0.4ma 8 Sec Header

Table 1. CR206 Power Modes and the Recommended Corresponding RF401 Power Modes.

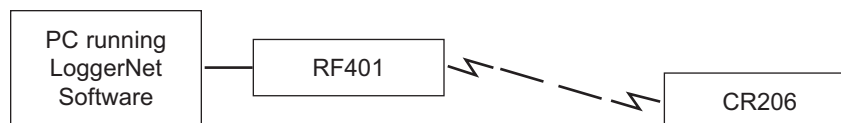
- Select the "Retry Level" desired. Retries are used with "PakBus Aware" and "PakBus Node". Attempting to use retries in the "Transparent" mode causes acknowledgement collision problems.

None
Low (default)
Medium
High

- If using the "PakBus Node" protocol, select the PakBus tab and create a PakBus Address for the RF401.
- Click the "Apply" button to send the entered settings to the RF401.

Example Setup 1 - LoggerNet to CR206

The following is a typical setup for an RF401 connected to PC with a link to a CR206 (always a leaf node, never a router) in a PakBus network.



CR206 Setup for Example 1 (see Figure 4):

1. Enter PakBus Address 1.
2. Select PakBus for RF Protocol.
3. Select Hop Sequence 1.
4. Select Network (Address) 2.
5. The Radio Address is fixed at 0 when the RF Protocol is PakBus.
6. Select Power Mode 1 Sec with Long Header to economize station power.

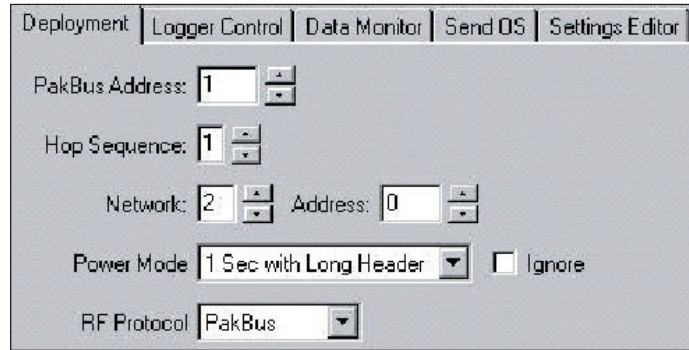


Figure 4. DevConfig Deployment panel showing the CR206 setup for Example 1.

RF401 Setup for Example 1 (see Figure 5):

1. Since the RF401 will connect to a PC, select AutoSense or RS-232 Active Interface.
2. Choose PakBus Aware for the Protocol.
3. Select 9600 or another RS-232 baud rate. It must match the baud rate setting in the LoggerNet, PC400, or PC200W Setup screen.
4. Select Hop Sequence 1, which matches the CR206's hop sequence.

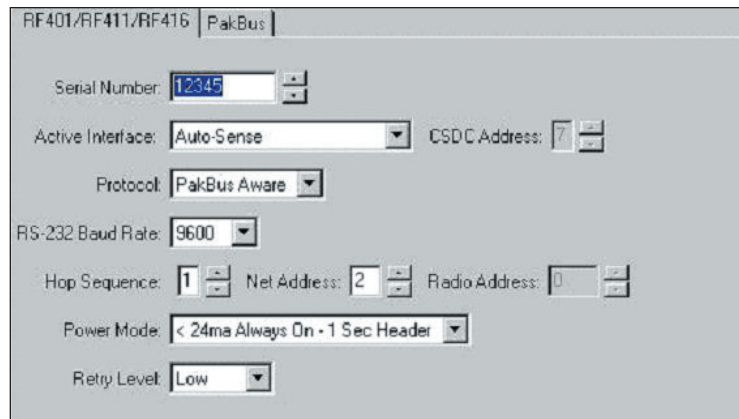
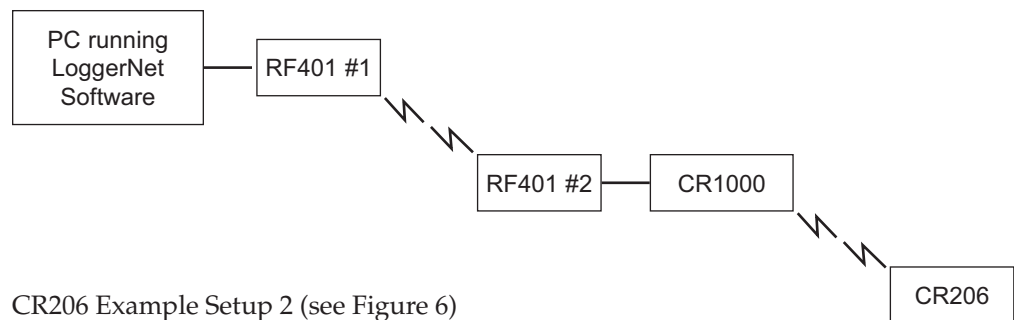


Figure 5. DevConfig Deployment panel showing the RF401 setup for Example 1.

5. Select Net Address 2, which matches the CR206's address.
6. The Radio Address is fixed at 0 when the Protocol is "PakBus Aware".
7. Select <2ma - 1 Sec Header for the Power Mode.
8. Select Retry Level Low.
9. Entry of a PakBus Address is disabled in DevConfig for the "PakBus Aware" protocol.

Example Setup 2 - Router to CR206

The following is a typical setup of an RF401 cabled to a router datalogger and linked to a CR206 in a PakBus network.



CR206 Example Setup 2 (see Figure 6)

1. Enter PakBus Address 1.
2. Select PakBus for RF Protocol.
3. Select Hop Sequence 1.
4. Select Network (Address) 2.
5. The Radio Address is fixed at 0 when the RF Protocol is PakBus.
6. Select Power Mode 1 Sec with Long Header to economize station power.

Deployment	Logger Control	Data Monitor	Send DS	Settings Editor
PakBus Address:	1			
Hop Sequence:	1			
Network:	2	Address:	0	
Power Mode:	1 Sec with Long Header	<input type="checkbox"/>	Ignore	
RF Protocol:	PakBus			

Figure 6: DevConfig Deployment panel for CR206 Example Setup 2

RF401 #1 Setup for Example 2 (see Figure 7)

1. Since RF401 #1 will connect to a PC, select AutoSense or RS-232 Active Interface.
2. Choose PakBus Aware for the Protocol.
3. Select 9600 or another RS-232 baud rate. It must match the baud rate setting in the LoggerNet, PC400, or PC200W Setup screen.
4. Select Hop Sequence 1, which matches the CR206's hop sequence.
5. Select Net Address 2, which matches the CR206's address.
6. The Radio Address is fixed at 0 when the Protocol is "PakBus Aware".
7. Select <2ma - 1 Sec Header for the Power Mode.
8. Select Retry Level Low.
9. Entry of a PakBus Address is disabled in DevConfig for the "PakBus Aware" protocol.

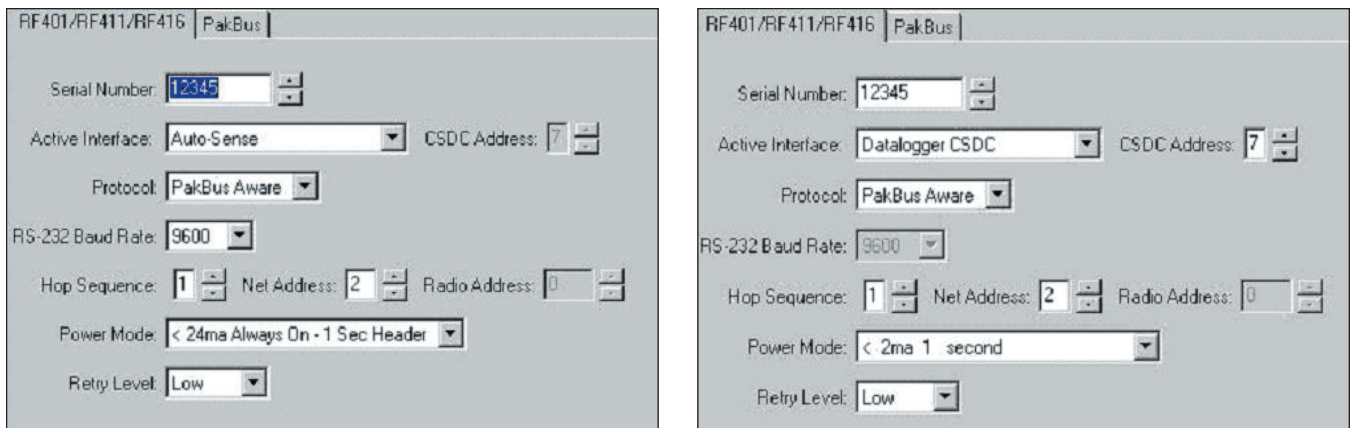


Figure 7. These DevConfig Deployment panels show the setup for the RF401 radios used in Example 2. The RF401 #1 radio's setup is on the left.

RF401 #2 Setup for Example 2 (see Figure 7)

1. For RF401 #2 , select Datalogger SDC 7 (or 8, 10, 11).
2. Set the RF401 Protocol to "PakBus Aware".
3. Select Hop Sequence 1, which matches the CR206's and RF401 #1's hop sequence.
4. Select Net Address 2, which matches the CR206's and RF401 #1's address.
5. The Radio Address is fixed at 0 in PakBus modes.
6. Select Power Mode < 2ma 1 second to work with the CR206.
7. Select Retry Level Low.
8. PakBus Address entry is disabled in DevConfig for the PakBus Aware protocol.