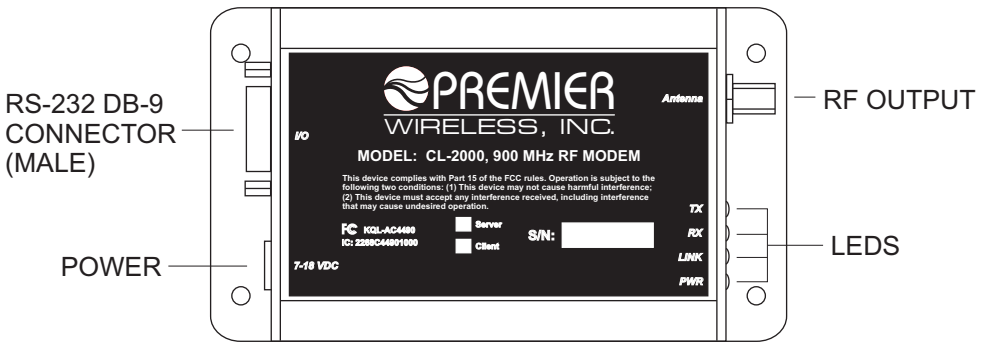
CL-2000 & CL-2400 CONTROL LINKS
(900 MHz & 2.4 GHz RF MODEMS)

1. INTRODUCTION

These modems can be used to replace the RS-232 or RS-422/485 data control cable in a closed circuit TV (CCTV) system to remotely control a pan, tilt and zoom (P/T/Z) camera. In a multiple camera installation and if the cameras can be addressed individually, a multi-point configuration can be deployed. In such system, there is only one modem (master) at the headend (control center) and one modem at each camera site. The master modem sends out data commands, embedding the address of the camera that is being controlled, to all the camera modems within the same RF channel at the same time, it is up to the camera with the correct address to respond to the data commands.

2. MODEM SET-UP

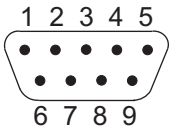


A minimum of two modems are required to relay data, they are setup as “Server” and “Client” modem. The one at the headend is usually the “Server” modem and those at the camera sites are “Client” modems. **These modems are set up with some default settings that may need changes in order to work in your system. The most common parameters that need to be changed are the “Client/Server”, “Channel”, “Baud Rate” settings. To change the settings, you need a computer loaded with the modem software (download the software from our website www.premierwirelessinc.com). Please follow the programming instructions in a later section.**
It is highly recommended to perform a bench test first prior to installation in the field. This is to get familiar with all the wiring connections and check out the modem settings that work with your CCTV system.

LED INDICATORS - There are four LEDs on the modem. The **PWR LED** indicates DC power. The **LINK LED** is constantly on when the modem is setup as “Server” and comes on only in the “Client” modem when it has established a successful communication with the “Server” modem. This is a useful indicator for checking the setup for the correct “Channel” and “sufficient signal” between the modems, but it has nothing to do with the “Baud Rate” though. The **TX** and **RX LEDs** come on when the modem is transmitting or receiving data. These LEDs flash briefly as they follow the burst of data flow. Use these LEDs to help setting up the system or to diagnose problem in the data link.

HOOKUP – Connect the DC power, antenna and RS-232 cable, or the CC-002 converter if RS-422/485 signal is used. Install the DB9 F-F adapter between the CC-002 converter and the modem if the modem is used outside the AirGuard NEMA enclosures or inside the enclosures manufactured before October 2005; newer enclosures use the ribbon DB9 F-F adapter instead. The CC-002 converter also requires DC power for it to operate, please refer to the document for the converter. The diagram on next page shows a typical hookup for a single camera system with 4-wire or 2-wire RS-422/485 interface, please pay attention to the polarity of the wires, some systems are reversed and the correct connection is such that when no data is being sent (idle state), the TX LED on the modem at the headend should be “OFF”. Some camera system’s controllers send out pulses continuously even when no command is transmitted, the headend modem of those systems will always be in the transmit mode and the TX LED will be on constantly.

3. RS-232 CONNECTOR

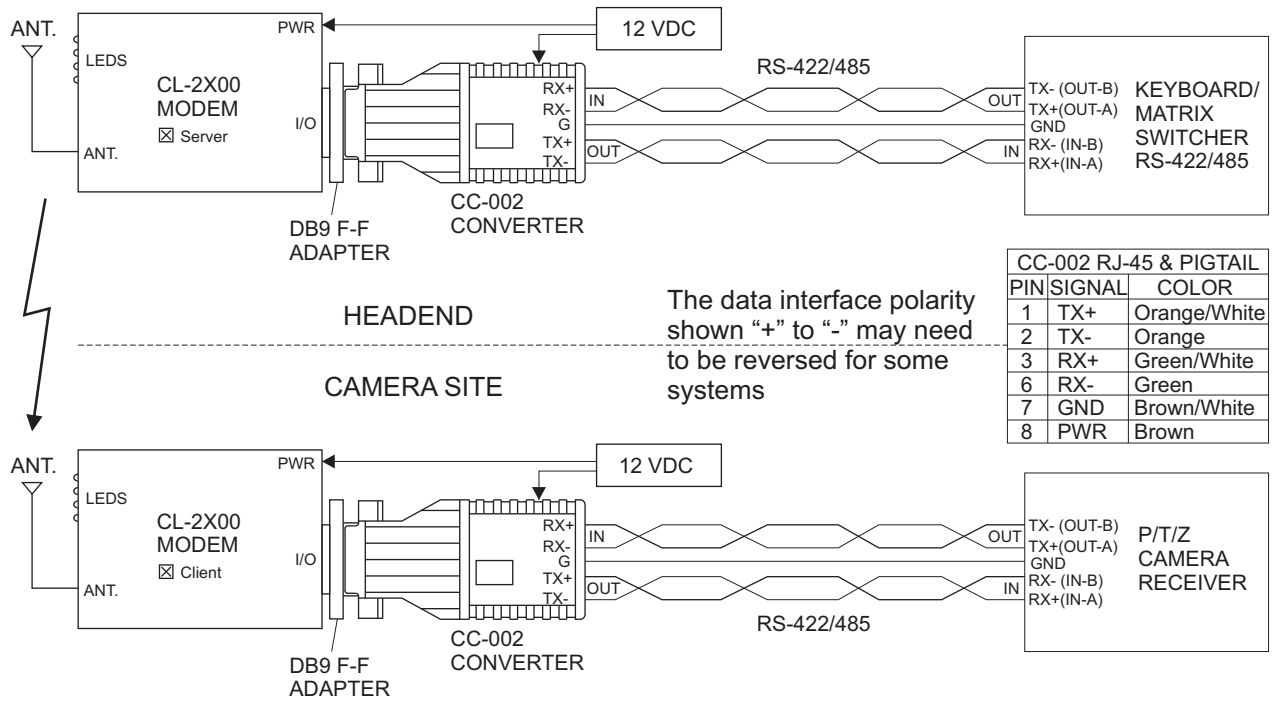


DB9 MALE CONNECTOR ON THE MODEM (MIRROR THE PIN NUMBER IF LOOKING AT THE DB9 FEMALE ADAPTER)

PIN	SIGNAL
1	DCD (Output)
2	RxD (Output)
3	TxD (Input)
4	DTR (Input)
5	GROUND
6	DSR (Output)
7	RTS (Input)
8	CTS (Output)
9	RI (Output)

The table shows all the RS-232 signals that are available at the DB9 connector on the modem and some have to be enabled with the software before they can be used. When the CC-002 converter is used to convert the RS-232 to RS-422/485 format, only the RxD, TxD and GND signals are used and no enabling is necessary.

4. HOOKUP DIAGRAM



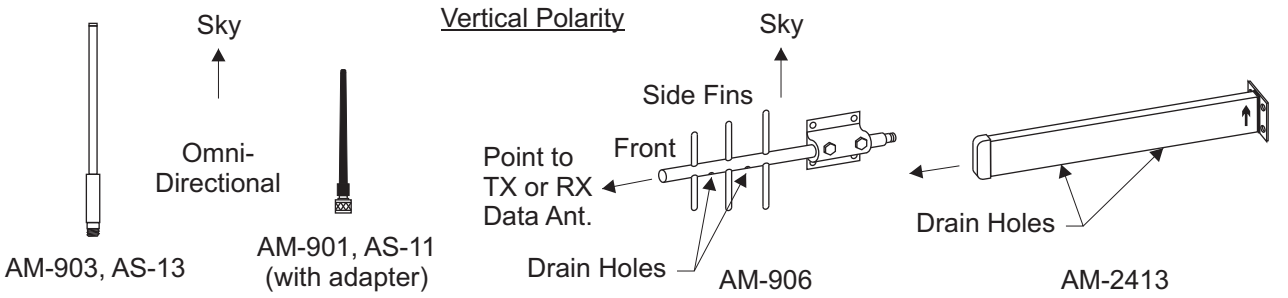
The data interface polarity shown "+" to "-" may need to be reversed for some systems

CC-002 RJ-45 & PIGTAIL		
PIN	SIGNAL	COLOR
1	TX+	Orange/White
2	TX-	Orange
3	RX+	Green/White
6	RX-	Green
7	GND	Brown/White
8	PWR	Brown

NOTES:
(1) The 4-wire connection shown is applicable to 4-wire full duplex and 2-wire simplex (omit the TX pair at the headend and the RX pair at the camera site, referenced to the converter). Set S1 to S4 switches on the converter to "OFF", S5 & S6 to "ON".
(2) The pair of signals labeled "TX+ & TX-" is output while the other pair labeled "RX+ & RX-" is input.
(3) When the CC-002 is set at the 2 Wire Mode (half duplex), use the TX+ & TX- pair for In/Out signals at both ends. Set S1 to "2 WIRE", S3, S4 & S5 to "ON" on the converter.
(4) Use the RJ-45 Pigtail that is supplied with the converter to hookup to the signal source. Observe the color code on the wires to identify the correct one to use.
(5) Please observe the "Server" and "Client" settings on the modems. For point to point system, meaning one modem talking to one other modem only, the location of the server or client modem is not important. But in a point to multi-point system, meaning multiple cameras, the modem at the headend has to be the "Server" and all the modems at the camera sites have to be set as "Client".
(6) The diagram shows a typical system using RS-422/485 interface between the camera system and the modems. The CC-002 RS-232 to RS-422/485 converters are used. For other systems that use the RS-232 interface signal, the CC-002s are not required. Some other camera systems using other interface signal format, e.g. Coaxitron, Sensornet, etc., will require a special converter to convert the signal to RS-422/485 (or RS-232) in order to work with these modems.

5. OUTDOOR ANTENNA MOUNTING

The polarities of the antennas on both sides have to be identical for good reception, either vertical or horizontal polarity can be used. Omni-directional antennas are usually mounted vertically giving vertical polarity. They can be used with other directional antennas when the directional antennas are oriented to the same polarity. Here are some examples of antennas with vertical polarity:



Notes:
(1) When mounting the AM-906 in the vertical orientation (vertical polarity), point the side fins to the sky and drain holes to ground. Aim the front end towards the other side of the transmission.
(2) When mounting any omni-directional antenna on a pole or against a wall, unless it is mounted on the very top end of these structures with ample clearance on the back side, the pole or wall will act as a reflecting surface and modify the forward gain pattern. The forward gain can change from a maximum to a null depending on the distance of the antenna from the reflecting surface. To reestablish maximum forward gain, the distance has to be adjusted by a few inches forward or backward (up to 3.25“ or odd multiples of 3.25“; 3.25” is a quarter of a wavelength at 900MHz). To avoid this back plane problem, use directional antennas such as AM-906.
(3) Horizontal Polarity – In some installation, horizontal polarity may be needed to reduce adjacent channel interference or to reduce pickup of other signals. Omni-directional antennas are usually vertically polarized due to the way they are mounted and can not be used usually to provide horizontal polarity transmission. On the other hand, Yagi antennas can provide horizontal polarity simply by rotating the antenna along the axis so that the side fins are parallel to the ground.

6. TROUBLE SHOOTING

If after hooking up the wiring and antennas, there is no response from the P/T/Z camera, check the LEDs on the modems to ensure DC power is present and then perform the following steps below to solve the problems.

SERVER LED			CLIENT LED			PROBLEM	SOLUTION
LINK	TX	RX	LINK	TX	RX		
Off	X	X	X	X	X	Server modem is not programmed correctly	(1) Reprogram modem to “Server”
On	X	X	Off	X	X	No or unsuccessful communication between modems	(1) Check antennas & RF cables on both sides (2) Move within range and no obstruction (3) Set modems at same channel (4) Set modems at same system ID
On	Off	X	On	X	X	No data reaching Server modem	(1) Check keyboard controller and cables, etc. (2) Check CC-002 converter if used
On	On	X	On	X	X	Incorrect wiring polarity when no data is sent (not applicable to continuous TX systems)	(1) Reverse the RX wires of the Server modem; will check continuous TX system below
On	Flash	X	On	X	Off	Data is sent but no data out from client modem	(1) Verify Client modem is not set as “Server” (2) If the Server modem’s “System Config” was changed from point-to-multipoint to point-to-point, the MAC address of the Client modem has to be programmed in the Server setup.
On	Flash	X	On	X	Flash	Both modems are working and the RF signal path is good, the problems are in the polarity of the interface signal, baud rate matching, encryption setting, etc. of the system.	(1) Match baud rate of both modems and has to match source and receive equipment (2) Verify “Encryption Key” of both modems if enabled to match each other (3) Check CC-002 converter and its cable at the Client modem if used (4) Reverse the TX wires on the Client modem and check operation (5) Regular and continuous transmission systems alike, try both polarities of the TX wires on the Client modem, then reverse the RX wires of the Server modem and check operation with both polarities of the TX wires on the Client modem again.
Notes: (1) X = Irrelevant (2) “Flash” = “On” for continuous transmission system. (3) For simplicity, this table shows how to deal with one way signal. When 4-wire bi-directional signals are used, the other pair of wires should be connected in a similar way and the remaining RX or TX LED will flash.							

7. MODEM PROGRAMMING

To program the modem and change its settings, please download the modem software from our website www.premierwirelessinc.com. The software is a PC Windows program. Install the downloaded software on a computer running Windows operating system. Remove the CC-002 converter if connected. Use a straight through DB9 cable, such as a 9 pin serial port extension cable, to connect the modem to the computer, use the DB9 F-F adapter if needed. Start the modem configuration program. The initial screen shows the commonly used parameters of the modem and the advanced settings are grayed out until they are enabled by clicking on the “Enable Advance Options” button. In most cases, these advanced settings do not need to be changed and incorrect entry may create problem. In such case, click on the button named “Set Advanced to Defaults” to reset only the advanced settings back to their default values.

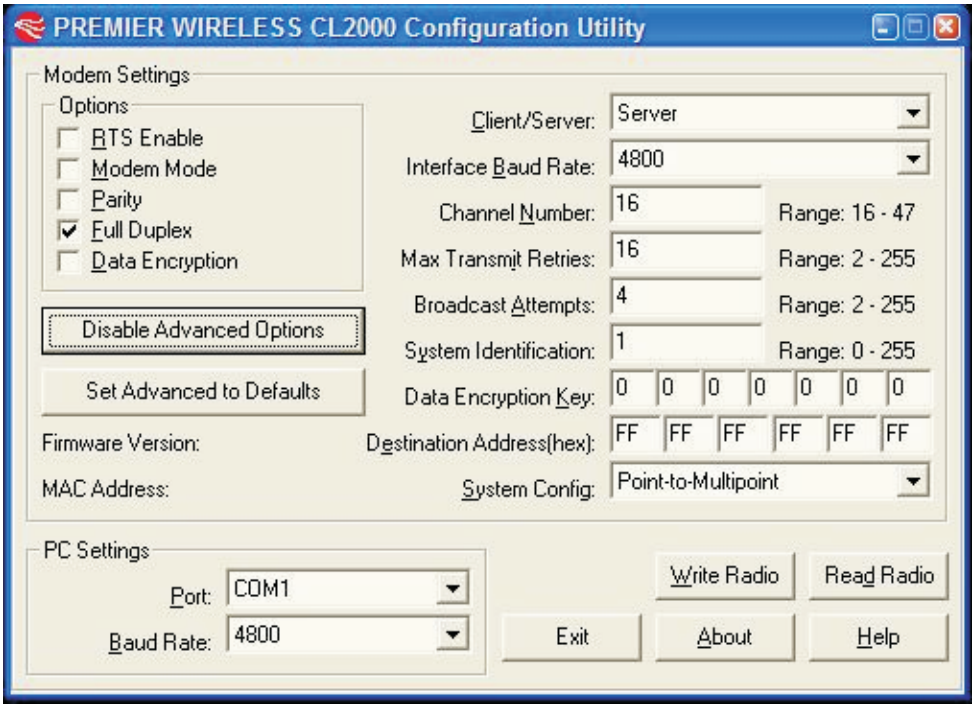
To start communication with the modem, check these settings on the modem configuration program:--

“PC Settings – Port”: COM1, COM2, etc.(The serial port the modem is connected to)

“Baud Rate”: 4800 (This is the default factory setting for the modem. It has to match the Baud rate the modem was last set to, or communication will fail).

Clicking on the “Read Radio” button will bring in the settings from the modem and a pop up message ‘Read successful” will appear. If the message states that “Unable to read modem .....”, the PC and modem baud rates are not matched. Change the “PC Settings - Baud Rate” to match the modem’s rate if known and “Read Radio” again. If the modem’s setting is unknown, there are only a few values of the “PC Settings – Baud Rate” to choose from, try all of them to find the one that works with the modem.

CL-2000 MODEM CONFIGURATION UTILITY SHOWN, UTILITY FOR CL-2400 IS SIMILAR



7.1 ADVANCED OPTIONS

RTS Enable: Enable the Request to Send control line. (RS-232 interface mode)

Modem Mode: Enables DCD, DTR, DSR and Ring Indicator (RI) control lines. (RS-232 interface mode)

Parity: Needs to be enabled if host requires even or odd parity data setting. (RS-232 interface mode)

Full Duplex: Default mode for the modem; half duplex if unchecked. (Full dup[lex for CL-2400)

Data Encryption: When enabled, an encryption key of 56 bits is used to encrypt the data packet to increase data security. Modems in the same network must be either all enabled or all disabled. (Not used in CL-2400)

7.2 PARAMETER DEFINITIONS

Client/Server: There must be only one Server in the system, must be at the headend for multiple camera system. (Basic Option)

Interface Baud Rate: The baud rate of the modem. Default setting is 4800. Setting must match that of the host device to communicate. (Basic Option)

Channel Number: This is equivalent to the RF channel the modem was set to, all the modems in the system must be set to the same channel. Default value for singe network is 16. (Basic Option)

Max Transmit Retries: The maximum number of times a particular data packet can be sent by the modem. Default value is 16. (Advanced Option)

Broadcast Attempts: For Point-to-Multipoint networks, the number of times a data packet will be sent by the Server. Default value is 4. (Advanced Option)

System Identification: This provide added security in addition to the Channel Number and serves as a RF password to maintain secure transfers of data. All modems within the same RF channel must have the same system ID. Default value for single network system is 1. (Advanced Option)

Data Encryption Key (CL-2000 only): An encryption key of 56 bits is used to encrypt the data packet to increase security further. All modems within the same RF channel must use the same key if enabled. Default value is all zeros. Do not leave blank entry even if encryption is not enabled. (Advanced Option)

Interface Timeout (CL-2400 only): This specifies the time between bytes the modem will wait before transmitting the data packet. Default is 6 for 4800 baud rate. (Advanced Option)

Packet Length (CL-2400 only): The number of characters in a packet. Default is 512. (Advanced Option)

Destination Address(hex): The MAC address of the opposite modem in a Point-to-Point setup which uses RF acknowledgement to optimize data transfers. Not required in a Point-to-Multipoint setup. Default value is all “FF”. Do not leave blank entry even if it is not required. (Advanced Option)

System Config: Configure the type of network – Point-to-Point (one Server and one Client) or Point-to-Multipoint (one Server and multiple Clients). Default setting is Point-to-Multipoint. Recommend that Point-to-Multipoint be used even with 2 modem system. This is a Server modem setting, not applicable to Client modems. (Advanced Option)

Firmware Version: Display the modem’s firmware version. (Modem Information)

MAC Address: The MAC address of the modem being read. (Modem Information)

7.3 CHANGE MODEM SETTINGS

After reading the modem successfully to display its settings, click on the parameters that require changes. Please note the range of the value to enter. Pay attention to the “Interface Baud Rate” setting and make note of it. To program the modem with the new values, click on the “Write Radio” button. A message will pop up to confirm successful operation. **Cycle the modem power to load its new settings**. To read from the modem again, the “PC Settings – Baud Rate” field may need to be changed in order to match the new baud rate of the modem.