GE Power Management - Control System

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GE Power Management Control System

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Technical Note #15

Radio Frequency Modems

Subject: Radio Modem basics and their use for Device Communications.

Applies To: PMCS Modbus Systems with or considering radio modems.

Radio frequency modems modulate the communications on top of a carrier frequency and then transmit th resulting signal through the air. The modulation methods are radio dependent and can severely impact the system.

NOTE: The radio modem used must be compatible with the MODBUS RTU protocol. This protocol has timing restraints requiring each byte be sent without delays. A delay greater than 1.5 characters betwee bytes will be interpreted as an error. Since radio modems typically packet data together, this timing constraint is easily violated and therefore causes a high percentage of communication errors. A radio modem must be able to packet 256 bytes of data to work reliably by transmitting the entire message at once.

RF modems typically connect RS-232 to the air waves. A converter is required to convert the RS-232 sign to RS-485 and vice versa. A typical configuration for a single point-to-point network is shown in figure 1.
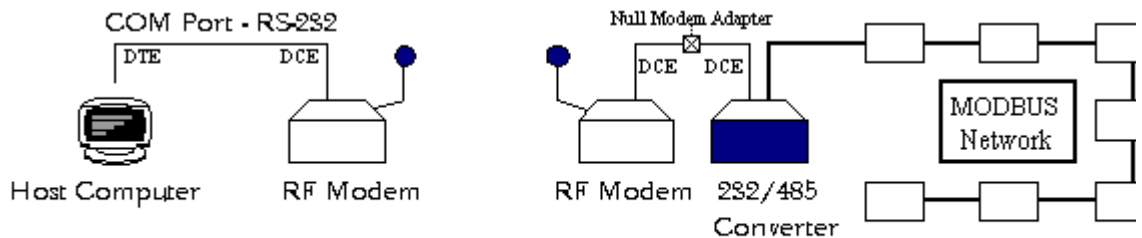

Figure 1 - Point to Point with Remote Devices

If multiple remote sites are required in point-to-point networks, then the above configuration must be duplicated for each site.

A configuration used to extend a current MODBUS network is shown in figure 2.
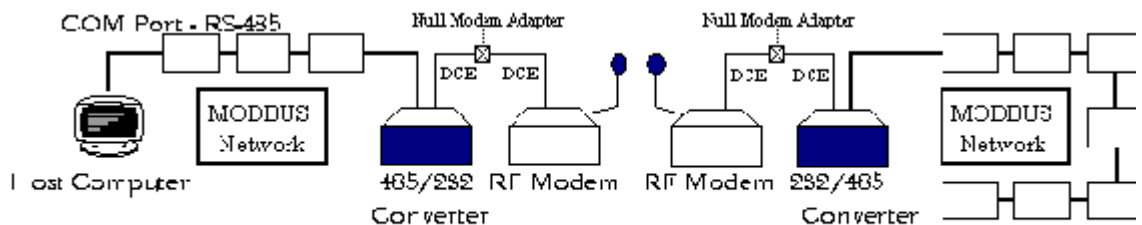

Figure 2 - Point to Point with Local and Remote Devices

Remember that all devices, including the modems, must be configured to run at the same baud rate. Although the figures 1 and 2 only represent point to point communications, many RF modems support poi to multipoint systems. Typically, RF multipoint systems utilize a central host and several remote sites whi all utilize the same frequency and to the system looks like a single wired network. It is important to not duplicate addresses in these situations.

NOTE: For most applications, the RS-232 cable between the computer (DTE) and the modem (DCE) will be a standard straight-through cable while the cable between a modem (DCE) and converter (DCE)will be crossover or null-modem cable. For more information regarding RS-232 cables, see Application Note 17.

NOTE: If the modem is MODBUS RTU compatible, then the communications when configured correctly should be successful with few errors. Since the success of using radio modems is often linked to the capability of getting the signal to and from the remote sites it is important to obtain accurate information regarding anything which might interfere with the radio signal. Important parameters include the distance, hills, mountains, power lines, and antennae chosen for the application. Talk with the radio manufacturer regarding the site layout. It may be beneficial to obtain an official site survey with recommendations for power settings, repeaters, and antennae.

Radio frequency modems are available in two basic types, licensed and unlicensed spread spectrum.

Licensed Radio Frequency Modems

Licensed radio modems operate in standard frequencies where FCC site licenses are required to ensure the is no conflicting use of the air waves.

Make sure the RF modem chosen contains both the radio and modem required for communications.

A licensed radio frequency modem should have the following features:

1. MODBUS RTU compatible / Packet up to 256 bytes
2. Baud rate sufficient to handle application (up to 9600 baud typical)
3. Power and antenna necessary to transmit required distance
4. Frequency available for licensing purposes.

A licensed radio frequency modem GE has tested with the PMCS 5.0 system is:

Advanced Digital Systems Smart Packet Modem - P/N SPM-9600 520-798-1181

ADS Wireless Data Transceiver - P/N DH2000

Both units listed above are required at each site. Each modem should be initialized before being placed at the remote sites to ensure proper communications. This may be accomplished by using the Terminal program provided with Windows NT Accessories Group. Make sure the correct communications options are set under the SETTINGS - COMMUNICATIONS tab. These options include the COM port, the baud rate, 8 data bits, 1 stop bit, no parity, and no flow control. Once the settings are correct, the modem may b initialized through the program.
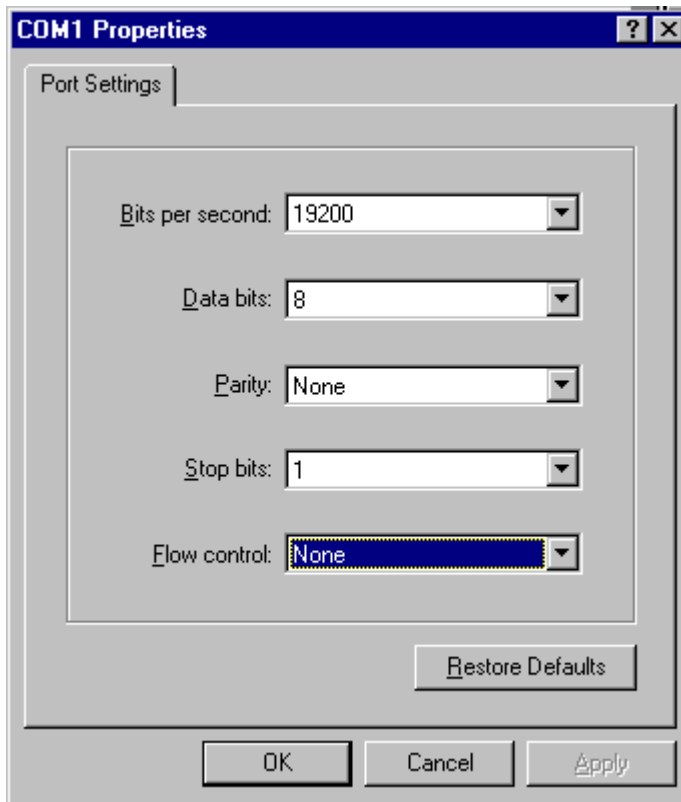
<u>Figure 3 - Windows NT Hyper Terminal Settings Dialog Box</u>

Power up the modem and press <CTRL> C three times to obtain a prompt. If no prompt appears, try different baud rate settings. Once the prompt appears, the following commands should be entered:

RPSP 9600<enter> - sets radio speed to 9600 baud

SP 19200<enter> - sets serial port speed to 19200 baud

TO -2<enter> - sets for global addressing

CHARTM 20<enter> - sets character timeout

FLOW 1<enter> - disables flow control

BUFSZ 256<enter> - sets maximum buffer size

The modem automatically stores the settings. Simply type RESET or cycle power to begin communication with the new parameters. Be sure each modem has a unique ID and is operating on the same frequency.

Unlicensed Spread Spectrum Radio Frequency Modem<u>s</u>

Unlicensed spread spectrum radios operate in the 902 - 928 MHz or 2.4 GHz radio band and therefore do not require an FCC site license. The power usage is kept low to stop stray signals from interfering elsewhere. However, proper antennae can provide the distance required for most applications.

An unlicensed spread spectrum radio frequency modem should have the following features:

1. MODBUS RTU compatible / Packet up to 256 bytes
2. Baud rate sufficient to handle application (19.2k normally available)
3. Power and antenna necessary to transmit required distance

A spread spectrum radio frequency modem GE has tested with the PMCS 5.0 system is:

Aerotron-Repco Systems, ARS - P/N NLR-900M 407-856-1953

As with licensed modems, initialization is necessary before installation through the use of the Terminal program. Once the Terminal is setup (factory default is 9600 baud), turn the modem on. A message requesting "ARS" should be seen. If characters are seen but are not readable, then try a different baud rate and cycle power on the modem. Continue until the message is seen. Type "ARS" to reach the setup mode. Once in this mode, the following commands should be sent:

COMBAUD=192,0,1,8<enter> - for 19200 baud

CONMODE=2<enter> - for permanent transparent mode

HARDWARE FLOW=0<enter>q - disable flow control

PACSIZE=256<enter> - set max packet size to 256 bytes

PACWAIT=1,10<enter> - set timeout to 20ms

RFBAUD=128<enter> - set RF baud rate to 128 kbaud

Once the modem is setup, type 'QUIT' or simply cycle power to leave the setup mode. Make sure all modems on the same network are configured to the same frequency. As long as there are no duplicate device addresses, a point to multipoint system is easily obtained by matching all frequencies. The host wil transmit a message, and only one device will respond. It is important that no radio acknowledgments are turned on to avoid collisions.

Another spread spectrum radio frequency modem GE has tested with the PMCS 5.0 system is:

Utilicom LongRanger 2000 - P/N ISM900-1HD 805-964-5848

As with licensed modems, initialization is necessary before installation through the use of the Terminal program. Once the Terminal is setup (factory default is 9600 baud), turn the power on to the modem, and, no prompt appears, type <control> V three times. If a prompt still does not appear, then try a different bau rate and repeat the sequence until a prompt appears. Once the prompt is achieved, then enter the following command:

ATS52=128 S53=255 S55=255 S96=x&w z d<enter>

where,

S52=128 - No error detection or addressing plus power up in data mode

S53=255 - Fill buffer before transmitting (requires timeout to transmit)

S55=255 - Maximum number of data allowed in packet

S96=x - baud rate where x = 2 - 2400 baud

3 - 4800 baud

4 - 9600 baud

5 - 19200 baud

&w - store configuration

z - update baud rate without power cycling

d - place in data mode.

Once the commands are entered, the modem is all set for communications. Make sure all modems on the same network are configured to the same frequency. As long as there are no duplicate device addresses, a

point to multipoint system is easily obtained by matching all frequencies. The host will transmit a message and only one device will respond. It is important that no radio acknowledgments are turned on to avoid collisions.

Keywords

Radio; Radio Frequency; Spread Spectrum; RF; Radio Modems

Related Notes

[Application Note 17: RS-232 Cables for Modem Support](#)

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