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Using the MultiTech CDMA Cellular Modem

Application Note #17

Overview

This Application Note provides information to setup and configure the MultiTech MultiModem CDMA Wireless (Cellular) Modem, model MTCBA-C-N3-NAM for Verizon service, as well as configuration information to setup and configure MultiLogger to communicate with a data acquisition system using this modem and a data acquisition unit equipped with a Campbell Scientific, Inc. CR10X Control Module (MCU).

A PC running MultiLogger will be used to communicate with the data acquisition unit connected to the MultiTech MultiModem via a standard dialup telephone modem.

More detailed information on the MultiTech MultiModem can be found in the User Guides on the CD included with the Modem. More detailed information on MultiLogger can be found in the **MultiLogger User's Guide**.

To complete the setup of the Modem, a service agreement will need to be obtained from Verizon. Verizon will need the ESN (Electronic Serial Number in Hex and Decimal) located on the back of the Modem, in order to provide service and a telephone number for the Modem. The command **AT+CGSN** is used to determine the ESN.

MultiTech MultiModem Configuration

Important Note: The current (as of May 2005) firmware version 2.05 does not allow the MultiTech MultiModem, that is being used with Verizon Wireless service, to receive calls. It must be returned to MultiTech to have the newer version 2.13 installed to enable this capability. The command **AT+CGMR** is be used to determine the firmware version. If necessary, call (800) 328-9717 to arrange the firmware upgrade.

The MultiTech MultiModem is configured using a communication program (**Hyperterminal**) and the DB15 x DB9 RS-232 cable supplied with the modem. Except for configuring the phone number, configuration can be accomplished with or without a service agreement. Set up **Hyperterminal** with Data Bits = 8, Parity = none, Stop Bits = 1, and Baud Rate = 115200 bps. These are the default settings for the MultiModem's serial port. Apply power (5 V to 32VDC) to the MultiModem and allow a few seconds for it to "boot" up.

There are 6 LED Indicators on the MultiModem as described below:

Light	Name	Description
TD	Transmit Data	Lit when modem is transmitting data.
RD	Receive Data	Lit when modem is receiving data.
CD	Carrier Detect	Lit when data connection has been established.
LS	Line Status	**Continuous "on" state** indicates that the wireless modem is not registered on the network. **Flashing state** indicates registration on network. **Off state**. Modem is off (not ready) or in download mode.
TR	Terminal Ready	Commonly called "Data Terminal Ready." This is a readiness signal from the PC.
PWR	Power	Indicates presence of DC power when lit.

With power and the RS-232 cable connected the PWR and CD LED's should be on steady. If there is CDMA signal available, the MultiModem should register (after a minute or two) with the network and the LS LED should be flashing.

Using the **Hyperterminal** program at the computer to which the Wireless MultiModem is connected via RS-232, it is now possible to issue AT commands to test and configure the MultiModem. Note when **Hyperterminal** makes the "call" the TR LED will now be on steady.

To check Signal Strength use the following:
AT+CSQ Signal Strength Verification
This will return the following values with the response syntax: +CSQ: <rssi>,<fer>
<rssi> is the Receive Signal Strength Indicator: This parameter represents the total RF received signal power from the base station(s) the mobile sees. A Signal strength of 10 – 31 is sufficient , 0 - 9 is weak or insufficient, and 99 is insufficient.
<fer> is the channel frame error rate. It is not used currently and always returns a value of 99.
This check can be done without a service contract with Verizon.

To check Network Registration Verification use the following:
AT+CREG Network Registration Verification
This will return one of the following values with the response syntax: +CREG: <0,stat>

- **0**: not registered, MS is not currently searching for a new operator.
- **1**: registered, home network.
- **2**: not registered, MS currently searching for a base station.
- **4**: unknown.
- **5**: registered, roaming

This check can be done without a service contract with Verizon.
If the modem does not register, perform the procedure for Verifying Signal Strength to determine the strength of the received signal.

To activate the MultiModem with Verizon Account information:
Once a Verizon Wireless account has been obtained (see below for information on obtaining an account), the MultiModem will need to activated by entering the phone number using the following three AT commands:
AT+WSPC=1,000000<cr> ;enter the programming code; response from modem should be OK
AT+WMDN=nnnnnnnnnn<cr> ;"nnnnnnnnnn" is your phone number (your MDN);
response from modem should be OK
AT+WCMT=1<cr> ;commit the changes to memory; response from modem should be OK

MultiModem Configuration for use with Campbell MCU Data Acquisition:
Five parameters that must be configured in the MultiModem in order for it to work with a CR10X based datalogger system are:

1) The RS-232 port's baud rate referred to as the "Fixed DTE Rate"
2) The RS-232 port's flow control referred to as the "DTE-DCE Local Flow Control"
3) Auto Answer
4) The type of incoming calls to expect, referred to as "Incoming Call Bearer"
5) The Save Configuration Command

To Set Fixed DTE Rate:
The RS-232 port's baud rate is set to the required **9600** baud using the command **AT+IPR=9600**. **NOTE: After this command is issued, it is necessary to change the baud rate in Hyperterminal to 9600 in order to continue to communicate with the MultiModem.** To check the baud rate parameter use the command **AT+IPR?.**

To Set DTE-DCE Local Flow Control:
The RS-232 port's flow control is set to the required **None** using the command **AT+IFC=0,0** where the first 0 sets the TX flow control to none and the second 0 sets the RX flow control to none**.** To check the flow control parameter use the command **AT+IFC?.**

To Set Auto-Answer:
Auto Answer is set by changing the S0 Register from 0 (Auto Answer Disabled) to the number of rings desired for the MultiModem to answer on. To auto answer on the second ring use the command **ATS0=2**. To check the value use the command **ATS0?**.

To Set Incoming Call Bearer:
To set the type of incoming calls to the required **Data type** use the command **AT+CICB=0**. To check this value use the command **AT+CICB?**.

To Save Configuration:
Most of the values set above will not survive a power cycling of the MultiModem and must, therefore, be saved to NV Ram using the command **AT&W**.

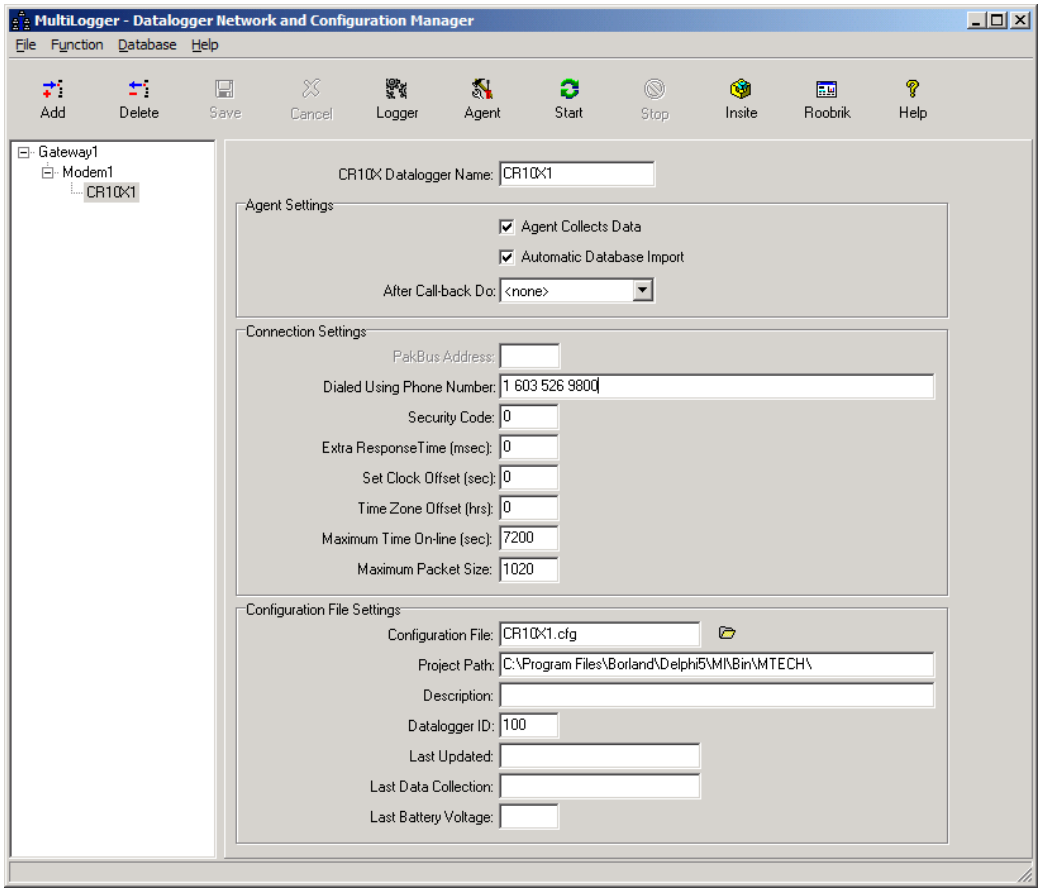
A complete listing of the AT commands is detailed in the MultiModem Users Manual.

MultiTech MultiModem Interface Configuration

The MultiTech MultiModem is a DCE device. Typically a Campbell Scientific SC932A (CS I/O to RS232 DCE) is used to interface between the CR10X and the MultiModem. When connected in this manner to a powered CR10X logger, the TR LED will be on steady. If callback thru the CS I/O port using the "print instruction" to the MultiModem is needed, then pin 6 (PE/SDE) in the SC12 cable must be removed as this signal is pulsed high and disables the SC932A.

MultiLogger Configuration

Configuration of MultiLogger is straightforward, the Network Configuration needs to include a **Gateway, Phone Modem** and the **Control Module**. An example of the setup is shown below.



Enter the phone number of the MulitModem in the edit **Dialed Using Phone Number**, shown in the **Connection Settings** group. It should not be necessary to modify the **Extra Response Time** parameter.

To access the Logger functions simply left double-click on the Control Module, CR10X1, in the Network Configuration. The Logger functions, **Start/Update**, **Collect**, **Monitor**, etc. are activated by clicking the toolbar button on the Logger form.

The datalogger may be equipped to dial out on an alarm condition. Please review the MultiLogger Application Note #14, **How to Configure the Alarm Action Outgoing Cell Call**, available from the support area of our website at www.canarysystems.com

Note: Due to some improvements in the communications functions when using cellular modems and changes in the firmware of the Campbell MCU's it is strongly advised to use the latest version of MultiLogger. This can be downloaded from the the support area of our website at www.canarysystems.com

Troubleshooting

If the connection is not functional you will see timeout errors. To check if the MultiTech MultiModem is answering the call, simply call the number programmed into it using a standard telephone. You should hear about three ring tones (with the modem set to answer on 2 rings) after which the modem should answer. You should then hear the high-pitched carrier detect tone followed by warbling tones indicating data communication. No ring tones generally means that Verizon Wireless has not set up the service correctly. No answer generally means the MultiModem has not been configured properly, or correctly connected to the MCU.

If the modem is answering but MultiLogger is unable to connect then use Hyperterminal to connect directly. Configure Hyperterminal to use the installed modem of the computer for it's connection, then enter the phone number in the Dialing Properties, after dialing and connecting you should be able to press <ENTER> several times and receive * responses from the MCU. If you cannot receive these responses then the quality of the connection may be too low to support the communication required or there may be a problem with the control module in the datalogger. An example of correct response is shown below.