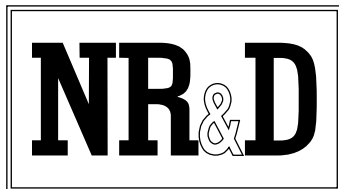# MUCM ModLon Gateway

Installation and Programming Manual

This Manual describes the MUCM application for interfacing the Cummins ModLon Gateway to a Modbus serial network.

Effective: 30 January, 2005

NR&D

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Introduction

The Niobrara MUCM is a Modicon Momentum® compatible module that is capable of running multiple applications for performing communication translations between serial protocols. This document covers an application that allows the Cummins Mod-Lon gateway to be used with a standard Modbus RTU RS-485 network.

The MUCM connects to the ModLon gateway through its RS-232 port. The MUCM automatically polls the ModLon gateway, observing its peculiar limitations on register starting address and count, as well as inter-character timing limitations and delays between messages. This data is then presented to the RS-485 port of the MUCM to connect to any standard Modbus RTU network.

The MUCM is configured through its RS-232 port with a standard terminal emulator such as Hyperterminal. This configuration consists of the setup for the ModLon gateway as well as the Modbus RTU slave port. The MUCM may be configured for the TP/XF-78 or FT-10 devices with full support for Options 1, 2, 3A, and 3B.

The RS-485 port of the MUCM connects to a standard Modbus RTU network in either 2-wire or 4-wire mode. The baud rate (default=9600), data bits (default=8), parity (default=NONE), and Modbus Slave Address (default = 1) may all be configured through a built-in terminal server on the RS-232 port.

This MUCM application does not support a Momentum communications tophat. It is advisable to cover the opening where a tophat would normally connect to protect the exposed circuit board. NR&D part number METH-001 is an inexpensive empty tophat case sold for this purpose.

Only one of the two application areas are used for this data concentrator application: mucm_modlon_app1.qcm is compiled and loaded into application area 1 of the MUCM.

The MUCM contains its own power supply and needs a source of 9 to 30 Volts, AC or DC. An ideal 12VAC transformer is available from NR&D as part number TR121-ST.

A complete kit may be ordered from Niobrara that includes the MUCM with this application pre-loaded, METH, MU1, MU3, and TR121-ST. The Niobrara part number for this kit is MCP-140.

2
Installation

Installation of the MUCM should go quickly, with the necessary materials. The following items are necessary:

- MUCM

- MU1 cable (or equivalent can be built; see Figure 2-2) for connecting to a PC for configuration and loading of the application and module firmware.

- MU3 cable (or equivalent can be built; see Figure) for connecting to the 9-pin RS-232 port of the ModLon gateway.

- Power source for MUCM (use NR&D part TR121-ST or available power)

- Cabling between MUCM and Modbus Master may be built or purchased

- PC with terminal emulator, or terminal with RS-232 port.

The following may be used:

- DIN rail for mounting

- Empty Momentum tophat plastic to close MUCM case (NR&D part METH-001)

Module Installation

1   Mount the MUCM on a DIN rail, or mount as desired using screws through the two holes provided. The DIN rail or mounting screws should be Earth-grounded for the MUCM serial ports' transient suppression.

2   Supply power to the MUCM; NR&D's TR121-ST may be used, or any available power source 9-30 Volts AC or DC.

Software Installation

The application files for the MUCM are included in the MUCM_MODLON_SETUP.EXE file. The latest version of this file is located at
http://www.niobrara.com

Follow the link for "Application Notes", select "MUCM", and "ModLon".

Serial Connections to the MUCM

Port 1 to Modlon Gateway

Port 1 of the MUCM is RS-232 so a simple 3-wire cable is required to connect to the Modlon Gateway. The Niobrara MU3 cable is used for this connection.

MUCM		DB9P (male)
Tx	————————————————	3
Rx	————————————————	2
SG	————————————————	5
RTS	————————————————	7
CTS	————————————————	8

Figure 2-1   MUCM to ModLon Gateway RS-232 (MU3 Cable)

Port 1 to PC

The Niobrara MU1 cable is used to connect the MUCM to a standard PC-style 9-pin RS-232 serial port. For other standard connections, see the MUCM manual, or contact NR&D's technical support.

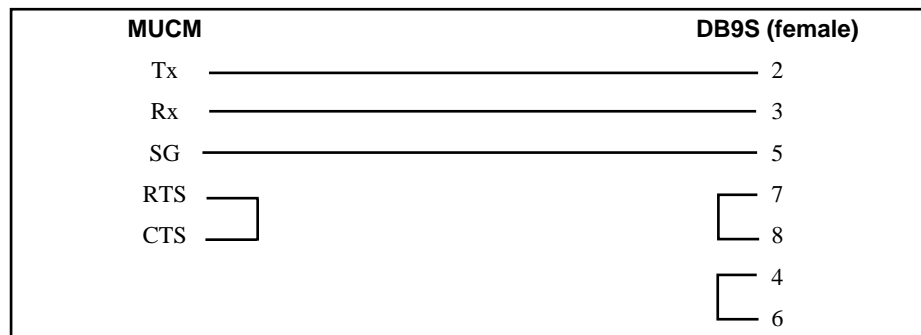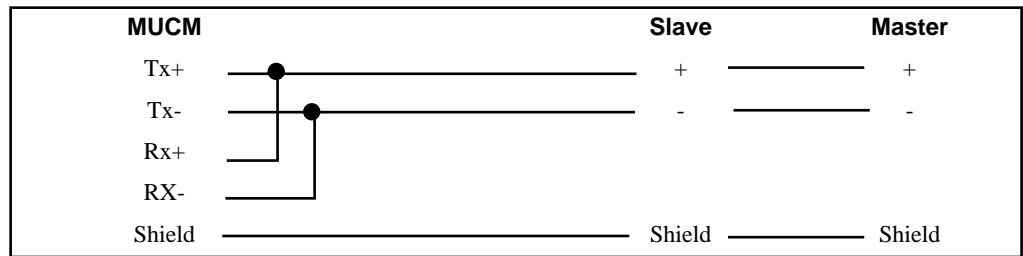| MUCM		DB9S (female)
Tx	————————————————	2
Rx	————————————————	3
SG	————————————————	5
RTS	⌐	7
CTS	⌐	8
		4
		6

Figure 2-2   MUCM to PC RS-232 (MU1 Cable)

Port 2 to Modbus RS-485 Network

Port 2 of the MUCM is RS-485 and supports a 4-wire or 2-wire cable network. Twisted pair cable should be used.
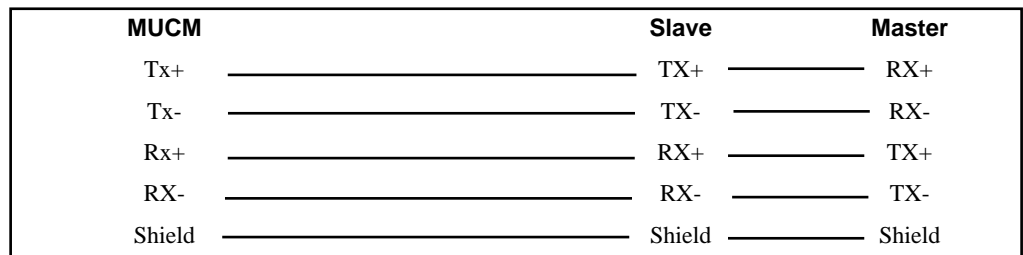
2-wire RS-485 slaves are supported by the MUCM by jumpering the TX+ and RX+ together to make the (+) connection and the TX- and RX- together for the (-) connection.

Figure 2-3   MUCM to 2-wire Modbus Network

4-wire RS-485 networks are directly supported by the MUCM. Connect the MUCM RX+ to the Master's TX+, RX- to TX-, TX+ to RX+, and finally TX- to RX-.

Figure 2-4   MUCM to 4-wire Modbus Network

Loading the Applications into the MUCM

NOTICE: *If the kit MCP-140 was ordered, then the ModLon application is already installed and this section may be skipped.*

The MUCM is rapidly evolving so be sure to upgrade the firmware in the module before loading the latest version of MUCM_MODLON_APP1.QCC. Most likely the QCOMPILE.EXE has been updated so be sure to use the newest version. The MUCM-001 and MUCM-002 use different firmware files: MUCM1.FWL (or MUCM1.QCC) is for the MUCM-001; MUCM.FWL (or MUCM.QCC) is for the MUCM-002. Firmware upload is as follows:

FWLOAD MUCM Firmware Update.

If the MUCM has corrupt firmware or completely non-responsive then new firmware may be loaded with the program FWLOAD.

Firmware upload is as follows:

1   Move the yellow RUN/LOAD switch near the power connector to LOAD.

2   Only the 3 light should be on.

3   Connect the PC to QUCM Port 1 with a MU1 cable.

4   Locate the and start the program FWLOAD.EXE. This program may be accessed by "Start, Programs, Niobrara, MUCM, Fwload MUCM Firmware".

5   If the above start menu link was followed, the proper MUCM.FWL file will be loaded. Otherwise, click on the Browse button and select c:\Niobrara\Firmware\mucm.fwl for an MUCM-002 or c:\Niobrara\Firmware\mucm1.fwl for an MUCM-001.

6   Select the PC's serial port (COM1).

7   Press START to begin the download process.   If difficulty is experienced in completing the download, try marking the Slow box and pressing start again.

8   When the download is completed, move the yellow LOAD/RUN switch back to RUN.

Figure 2-5   FWLOAD

QLOAD MUCM_MODLON_APP1
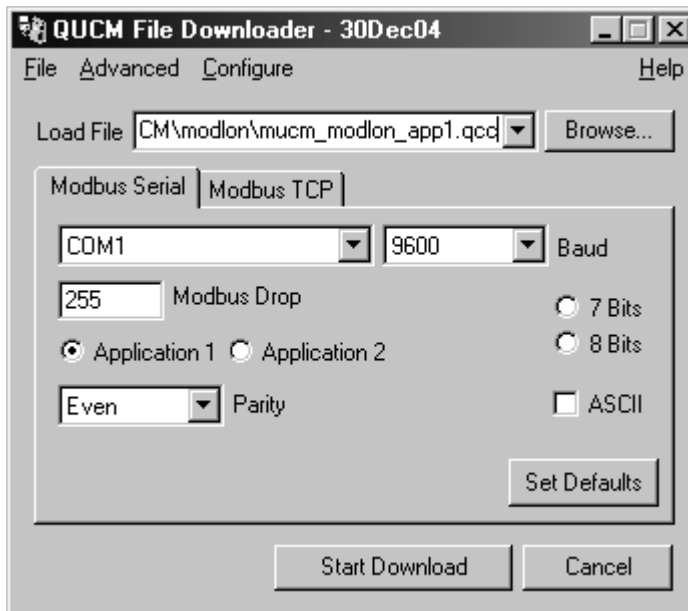
Figure 2-6   QLOAD of APP1

1   The RUN/LOAD switch must be in RUN.

2   Application Switches 1 (left) and 2 (right) must be in HALT.

3   Start QLOAD.EXE The Start Menu link is "Start, Programs, Niobrara, MUCM, Apps, ModLon, QLOAD ModLon Application 1".

4   Click on the Browse button and select the file MUCM_MODLON_APP1.QCC.

5   Select the Application 1 Radio Button.

6   Verify the following: The Modbus Serial tab is selected.

   (1)   The PC's com port is selected (COM1).

   (2)   The baud rate is set for 9600.

   (3)   The Modbus Drop is set to 255.

   (4)   The ASCII button is **NOT** checked.

   (5)   The 8 bits button is selected.

   (6)   The parity is set for EVEN.

7   Press the Start Download button. QLOAD will open a progress window to show the status of the download.

8   After downloading the application, Move Switch 1 to RUN. The RN1 light should be on.

Table 2-1   MUCM Port Default Settings

Setting	Port 1 Value	Port 2 Value
Protocol Mode	FT-10 Option 1	Modbus RTU Slave
Baud Rate	9600	9600
Parity	NONE	NONE
Data Bits	8	8
Stop Bits	1	1
Modbus Slave Address	1	1

The MUCM will immediately start polling the gateway on the RS-232 port. If it is successful in communicating with the gateway then it will present the data to the RS-485 port. If the gateway is not responsive, then the MUCM will ignore Modbus RTU messages.

The MUCM will respond to queries directed to a special Modbus slave address of 255, even if it cannot communicate with the gateway.

Terminal Setup

The setup parameters may be inspected and modified by connecting a terminal or emulator such has Hyperterminal to MUCM port 1 with an MU1 cable.

1   Connect the PC to the MUCM port 1 with the MU1 cable.

2   Move switch 2 to MEM PROT on the MUCM. All four user lights will come on.

3   Start Hyperterminal. This program is usually in Start, Programs, Accessories, Communications, Hyperterminal. Make sure the connection is for the proper COM port at 9600, N, 8, 1 and VT100 emulation.

Pressing ESC or Enter on the keyboard should bring up a screen as shown in Figure 2-7. Pressing the "P" key will allow the two ports to be edited. Each entry to edit is adjusted by pressing the space bar or + and - keys. When the correct entry is selected then press the Enter key. Pressing the ESC will back out without changing the parameter. Pressing the "W" key will write the setup to FLASH. The keys are not case sensitive.
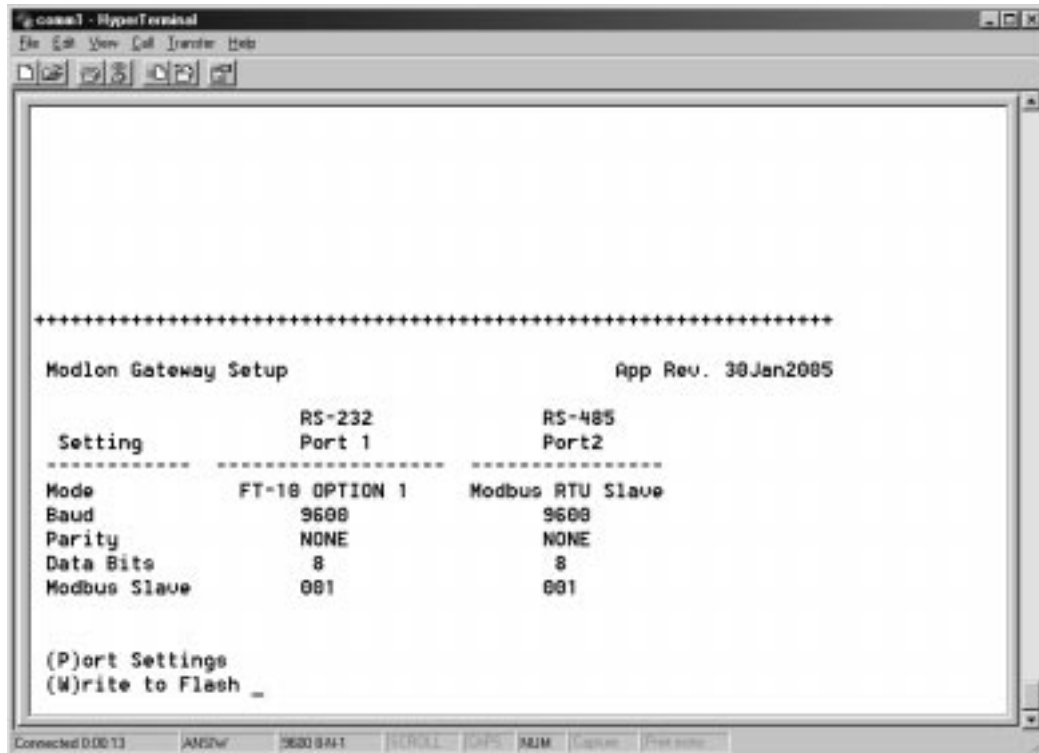
Figure 2-7   Hyperterminal Setup Main Screen

The following entries may be edited for the Modlon RS-232 port:

- Mode - The default is FT-10 Option 1. The MUCM also support FT-10 Option 2, FT-10 Option 3A, FT-10 Option 3B, and TP/XF-78.

- Baud Rate - The baud rate is fixed at 9600.

- Parity - The value is fixed at NONE for the FT-10 and EVEN for the TP/XF-78.

- Data Bits - The value is fixed at 8 for the FT-10 and 7 for the TP/XF-78.

- Modbus Slave - This is the Modbus Slave address for the ModLon Gateway and should be left at 1.

The following entries may be edited for the Modbus RTU RS-485 port:

- Mode - The only mode is Modbus RTU Slave.

- Baud Rate - The default baud rate is 9600. Other possibilities are 2400, 4800, and 19200.

- Parity - The default value is NONE but may also be set to EVEN.

- Data Bits - The value is fixed at 8.

- Modbus Slave address defaults to 1 but may be set within the range of 1-254. This is the slave address that the MUCM responds to when queried by the Modbus master. This value is independent of the slave address of the ModLon gateway.

NOTE: When finished, press the "w" key to write the new settings to flash. Otherwise the new settings will be lost on the next power cycle of the MUCM.

3

Modbus Operation

This MUCM application uses Port 2 for Modbus communication. By default, Port 2 is set for Modbus RTU Slave, 9600 baud, 8 data bits, 1 stop bit, NONE parity.

Device Register List

The data from the gateway is presented as Holding Registers (4x). Refer to Cummins document C621b for specific register details.

FT-10 Option 1

The FT-10 GENSET data is in registers 1-49, 101-149, 201-249, 301-349, and 401-449 for the CCM-G. Pass-through writes are allowed for registers 50-51, 150-151, 250-251, 350-351, and 450-451. (See Table 9 of Cummins document C621b for more details.)

The FT-10 Transfer Switch data is in registers 1001-1068, 1101-1168, 1201-1268, 1301-1368, and 1401-1468 for the CCM-T. Pass-through writes are allowed for registers 1069-1070, 1169-1170, 1269-1270, 1369-1370, and 1469-1470. (See Table 10 of Cummins document C621b for more details.)

The FT-10 Digital I/O Module data is in registers 1501-15024 and 1601-1624 for the DIM. Pass-through writes are allowed for registers 1525 and 1625. (See Table 11 of Cummins document C621b for more details.)

FT-10 Option 2

The FT-10 GENSET data is in registers 1-65, 101-165, 201-265, 301-365, and 401-465 for the CCM-G. Pass-through writes are allowed for registers 66-67, 166-167, 266-267, 366-367, and 466-467. (See Table 12 of Cummins document C621b for more details.)

The FT-10 Transfer Switch data is in registers 1001-1034, 1101-1134, 1201-1234, 1301-1334, and 1401-1434 for the CCM-T. Pass-through writes are allowed for registers 1035-1036, 1135-1136, 1235-1236, 1335-1336, and 1435-1436. (See Table 13 of Cummins document C621b for more details.)

The FT-10 Digital I/O Module data is in registers 1501-15024 and 1601-1624 for the DIM. Pass-through writes are allowed for registers 1525 and 1625. (See Table 11 of Cummins document C621b for more details.)

FT-10 Option 3A

The FT-10 GENSET data is in registers 1-65, 101-165, 201-265, 301-365, 401-465, 501-565, 601-665, 701-765, 801-865, and 901-965 for the CCM-G. Pass-through writes are allowed for registers 66-67, 166-167, 266-267, 366-367, 466-467, 566-567, 666-667, 766-767, 866-867, and 966-967. (See Table 15 of Cummins document C621b for more details.)

FT-10 Option 3B

The FT-10 Transfer Switch data is in registers 1-68, 101-168, 201-268, 301-368, 401-468, 501-568, 601-668, 701-778, 801-868, and 901-968 for the CCM-T. Pass-through writes are allowed for registers 69-70, 169-170, 269-270, 369-370, 469-470, 568-570, 669-670, 769-770, 869-870, and 969-970. (See Table 16 of Cummins document C621b for more details.)

TP/XF-78

The TP/XF-78 GENSET data is in registers 1001-39, 1101-1039, 1201-1239, 1301-1339, and 1401-1439. Pass-through writes are allowed for registers 1040-1042, 1140-1142, 1240-1242, 1340-1342, and 1440-1442. (See Table 6 of Cummins document C621b for more details.)

The FT-10 CCM data is in registers 1-26, 101-126, 201-226, 301-326, and 401-426. Pass-through writes are allowed for registers 27-28, 127-128, 227-228, 327-328, and 427-428. (See Table 8 of Cummins document C621b for more details.)

The FT-10 Digital I/O Module data is in registers 2001-2010 and 2101-2110 for the DIM. Pass-through writes are allowed for registers 2011 and 2111. (See Table 7 of Cummins document C621b for more details.)

Example 1

Figure 4-1 shows system with a Modbus Master a Modbus Slave (Address = 1), a second Modbus Slave (Address = 2), an MUCM, and a ModLon Gateway with two Gensets. The Modbus RTU Master has an RS-485 port and is configured for 19200 baud, 8 data bits, 1 stop bit and NONE parity. The ModLon gateway is configured for FT-10 Option 1 and the generators are 0 and 1.
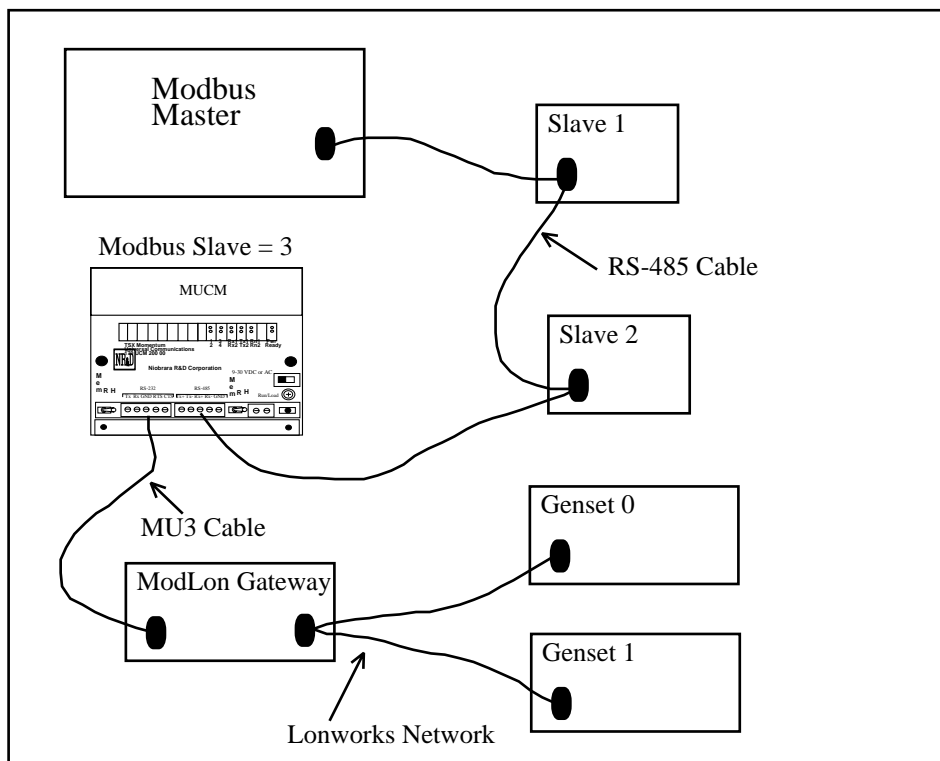

Figure 4-1   Example 1 Layout

The Modbus Master would access the MUCM at Modbus Slave address 3 and read registers 4001 through 4049 to get the data from generator 0. Registers 40101 through 40149 contain the data for generator 1.
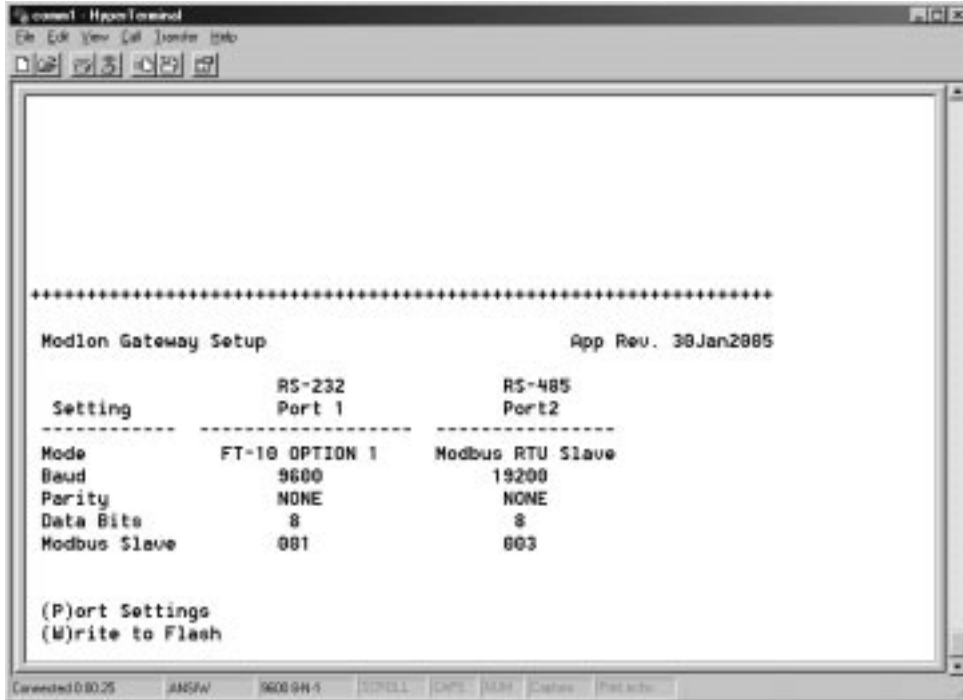

Figure 4-2   Hyperterminal Setup Main Screen
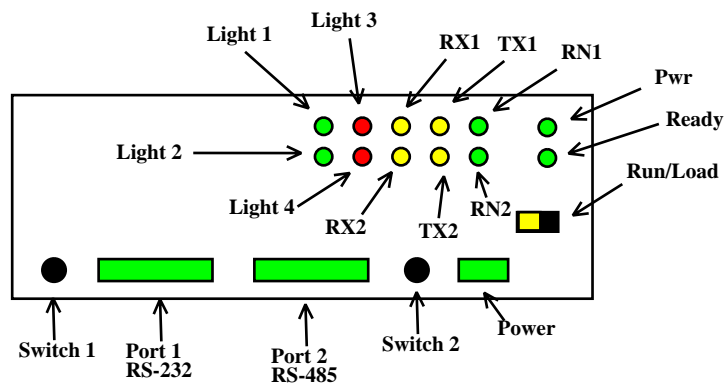
Testing and Troubleshooting

Figure 5-1   MUCM Lights and Switches

Switches

- Switch 1 controls the running of the Modlon application.

    — Mem Prot - Not used.

    — Run - The middle position is the normal running setting for this switch. The RN1 light should be on and other lights may be on or flashing to indicate operation.

    — Halt - The right position of this switch halts the application. Move to this position when loading new versions of the application with qload.

- Switch 2 turns on the terminal server for setup.

    — Mem Prot - The far left position forces the unit to enable the configuration terminal server on the RS-232 port. The RN1 light will be on and lights 1, 2, 3, and 4 will all be on to indicate the terminal server is enabled. Connect an MU1 cable to the RS-232 port to a PC and run a terminal emulator (Hyperterminal) at 9600,N,8,1, with VT100 emulation.

— Run - Not Used.

— Halt - Not Used.

- The Run/Load switch is used for loading firmware into the MUCM with FWLOAD. Normally, this switch is in RUN but is moved to LOAD before starting the download. Light 3 is ON when the switch is in LOAD.

MUCM Lights

The MUCM has several lights to give indication of activity of the application and serial ports.

- The **Pwr** light is green and indicates that the MUCM is powered and booted.

- The **Ready** light is green and indicates that the MUCM is communicating with a tophat adapter. This light will not be on because the a tophat is not used.

- The green **RN1** light indicates that the application is running. This lights should be on when the switch 1 is in RUN or MEM PROT. If the switch is in a run position but the RN1 light is off then qload the application.

- The green **RN2** light indicates that an application 2 is running. This light should always be off in the ModLon application.

- The yellow **Tx1** light indicates that the MUCM RS-232 port is transmitting data. This light should be occasionally flashing as the MUCM polls the ModLon gateway.

- The yellow **Rx1** light indicates that the MUCM RS-232 port is receiving data. This light should be occasionally flashing as the Modlon Gateway replies to the MUCM.

- The yellow **Tx2** light indicates that the MUCM RS-485 port is transmitting data. This light should be occasionally flashing as the MUCM responds to queries from the Modbus Master.

- The yellow **Rx2** light indicates that the MUCM RS-485 port is receiving data. This light should be occasionally flashing as the Modbus Master polls slaves on the RS-485 network.

- **Light 1** is a green light controlled by the application. Light 1 ON as long as the MUCM is receiving good replies from the ModLon gateway. This light indicates that the gateway is "ONLINE". If lights 1, 2, 3 are all on then the unit is in the configuration terminal server mode.

- **Light 2** is a green light controlled by the application. Light 2 will flash when any good Modbus message is received on the RS-485 port (even if the message is not directed at the MUCM). If the message is intended for the MUCM then the flash will be slightly longer and the TX2 light will also flash. If lights 1, 2, 3 are all on then the unit is in the configuration terminal server mode.

- **Light 3** is a red light controlled by the application. If light 3 is normally off but comes on briefly to indicate that the MUCM did not receive a reply from the Mod-

Lon Gateway. If lights 1, 2, and 3 are all on then the unit is in the configuration terminal server mode.

- **Light 4** is a red light controlled by the application. Light 4 indicates an error in the Modbus Message. It will come on briefly if an attempt is made to read the MUCM if the ModLon gateway is offline or if there is a problem with the Modbus query. This light may indicate a parity or framing error in the configuration of the RS-485 port. Light 4 is normally off. If lights 1, 2, 3, and 4 are all on then the unit is in the configuration terminal server mode.

Testing the Modbus Connection

The program ZAPREG32.EXE may be used to quickly test the Modbus settings on the MUCM.

1 Connect the Niobrara SC912 (or some other RS-232<>RS-485 converter) cable to the MUCM port 2 and the serial port of the PC.

2 Open a Command Prompt. On most Windows systems do a Start, Programs, Accessories, Command Prompt.

3 From the command line enter the following:
>zapreg32 com1:9600,n,8,1 255 -b
where com1: is the PC's com port, 9600,n,8,1 are the settings of the MUCM's RS-485 port, 255 is a special drop number that the MUCM will respond to whether it is talking to the gateway or not, and the -b tells zapreg to use Modbus RTU.

A screen like Figure 5-2 should appear. The left column is the Holding Register number, the data is shown in the HEX, SIGNED, and UNSIGNED columns. The arrow keys and Page UP/Down may be used to move around. Values may be entered directly and the change occurs when the Enter key is pressed.

When finished verifying that the communication is good, press ESC and the program will exit.

To verify that the ModLon data is present, substitute the Modbus Slave address (default=1) for the 255 in the command line above. If the MUCM is talking to the gateway then the data will be displayed. If the MUCM is not talking to the gateway then "Read Reply Timeout" will be displayed on zapreg.

Figure 5-2   ZAPREG32 Screen