QUCM ENRON Modbus

Installation and Programming Manual

This Manual describes the QUCM application for supporting the ENRON/DANIEL Modbus Extensions.

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Introduction

The Niobrara QUCM is a TSX Quantum® compatible module that is capable of running multiple applications for performing communication translations between serial and Ethernet protocols. This document covers an application that Modbus slaves that support the ENRON/DANIEL extensions of Modbus as well as other normal Modbus and Square D POWERLOGIC® meters.

Ports 1 and 2 of the QUCM may be independently configured for a variety of modes: PNIM, PLOGIC, Modbus RTU Master, Modbus RTU Slave, Modbus ASCII Master, and a combination of PNIM and Modbus RTU. Slave devices connected to the QUCM's serial ports may be directly accessed via Ethernet using Modbus/TCP or through the other serial port using Modbus RTU. Configuration of the serial ports is made through either a telnet session across the Ethernet or through a terminal connection to QUCM port 2.

A Modicon two (or more) slot Quantum rack and appropriate Quantum power supply is needed for mounting the QUCM.

2
Installation

Module Installation

1 Mount the QUCM in an available slot in the register rack. Secure the screw at the bottom of the module.

Software Installation

The application files for the QUCM are included in the ENRON.ZIP file. This file must be unzipped using PKUNZIP.EXE. A copy of PKUNZIP is included on the standard NR&D software disk and is also available at www.niobrara.com. The latest version of the ENRON.ZIP file is located at

http://www.niobrara.com/ftp/qucm/enron/enron.zip

The latest version of this document in pdf format is located at:

http://www.niobrara.com/ftp/qucm/enron/enron.pdf

Serial Connections to the QUCM-L

QUCM Port to Leased Line Modem

The Niobrara cable MM4 is ideal for this connection since it includes an RJ45 RS-232 connection for the QUCM-SE and a 25-pin male for the RS-232 modem. This cable pinout is described in Figure 2-1

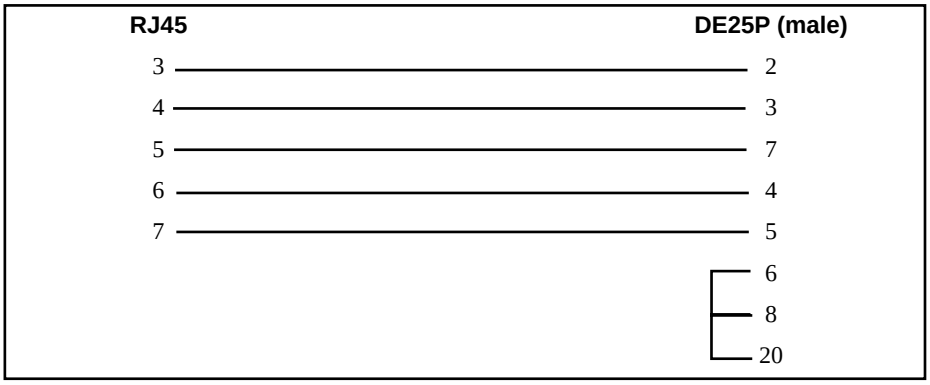

Figure 2-1 QUCM-S to RS-232 DTE Port (25-pin) (MM4 Cable)

QUCM Port to the Personal Computer

A physical connection must be made from the personal computer to the QUCM in order to download the applications. This link may be a serial connection from a COM port on the personal computer to the RS-232 port on the QUCM-S or QUCM-L with the port switched to RS-232. The Niobrara MM1 cable may be used for this connection. This cable is shown in Figure 2-2.

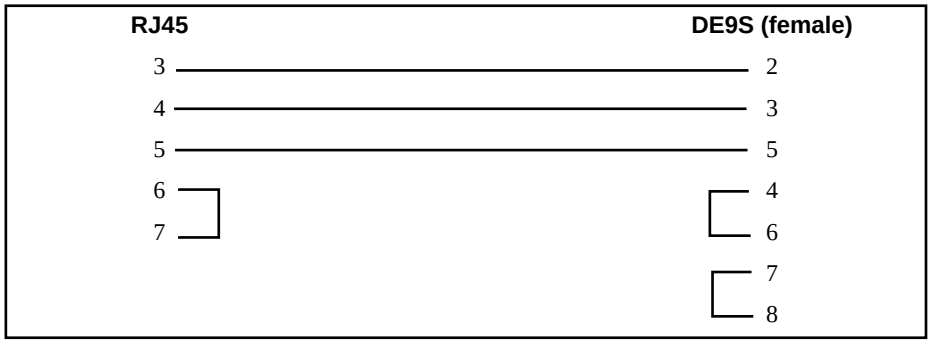

Figure 2-2 QUCM-SE to RS-232 PC DCE Port (9-pin) (MM1 Cable)

Daniel 2500 to Leased Line Modem

A custom cable must be made to connect the screw terminal serial port of the Daniel meter to a 25-pin male for the RS-232 modem. The Daniel Port 2 is normally used for this connection. This cable pinout is described in Figure 2-3

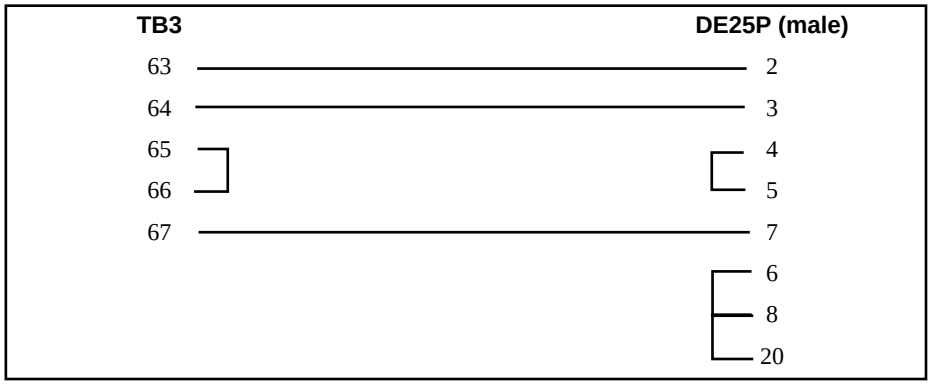

Figure 2-3 DANIEL 2500 to RS-232 DTE Port (25-pin)

Loading the Applications into the QUCM

The QUCM is rapidly evolving so be sure to upgrade the firmware in the module before loading the latest version of APP1.QCC. Most likely the QCOMPILE.EXE has been updated so be sure to use the newest version. Firmware upload is as follows:

1 Remove the module form the rack.

2 Move the RUN/LOAD switch on the back of the module to LOAD.

3 Replace the module in the rack and apply power.

4 Only the 3 light should be on. (The Link and RX E-net lights may be on if the E-net port is connected and there is traffic.)

5 Connect the PC to QUCM Port 1 with a MM1 cable.

6 From the command line enter

> fwload qucmtcps.fwl com1:

or > fwload qucmtcpl.fwl com1:

Be sure to have the colon after the PC's com port name. The download will only take a few minutes and will inform when finished.

7 Remove the module from the rack and change the switch back to RUN.

8 It is a good idea to press the RESET button after a firmware change.

It is recommended to use the Ethernet capabilities of QLOAD to load APP1.QCC and APP2.QCC into the QUCM. Set up the IP parameters of the module by the following method:

1 Move Switch 1 to Halt.

2 Connect the PC to QUCM Port 1 with a MM1 cable.

3 From the command line enter

>zapreg32 com1:9600,e,8,1 255 -b

This will start zapreg32 in Modbus RTU mode to slave address 255. Use the arrow and Page Up/Down keys to move to register 46. The IP parameters are shown below for a unit with the IP = 206.223.51.150 subnet Mask = 255.255.255.0, Default Gate = 206.223.51.1, Modbus/TCP port number = 503, Telnet Port number = 24:

Register	Description	Example (decimal)
46	IP MSByte	206
47	IP	223
48	IP	51
49	IP LSByte	150
50	SN Mask	255
51	SN Mask	255
52	SN Mask	255
53	SN Mask	0
54	Def. Gate	206
55	Def. Gate	223
56	Def. Gate	51
57	Def. Gate	1
58	TCP Control	7 (leave this at 7)
59	Reserved	0
60	Reserved	0
61	Reserved	0
62	TCP backstep	100 (leave this at 100)
63	Modbus Port	503 (this defaults to 502)
64	Telnet Port	24 (this defaults to 23)

65 Quiet Timer 900 (leave this at 900)
66 Clients -1 (leave this at -1)

4 After entering the IP parameters, attempt to ping the module to verify the settings.
> ping 206.223.51.150

5 Verify a connection to the internal Modbus/TCP server with zapreg32.
> zapreg32 206.223.51.150:503 255
Should connect to the QUCM on port 503 with Destination index 255.

6 Load the APP1 file with qload.
> qload 1 app1 206.223.51.150:503 -a
Will load the file into application 1's flash and set the program to automatically start on power-up.

7 Place Switch 1 in RUN. The RN1 light should come on and light 1 will probably blink rapidly.

8 Place Switch 2 in HALT. The RN2 light should stay off.

Configure the application by connecting a telnet client to the IP address of the QUCM.

Slave Addressing

The slave address on Modbus messages arriving at the QUCM determines which port the message leave the QUCM, the target device, and possible ENRON translations of slave data. If an incoming Modbus query has a slave address of 1 through 50, then it will leave Port 1, use ENRON translations and be directed to Modbus slave 1 through 50. If the incoming address is within the range 51 through 100 then the message will leave Port 2, use ENRON translations, and the slave address will have 50 subtracted to direct it to Modbus slave 1 through 50. The ranges 101 through 200 do not use ENRON translations but direct the messages to ports 1 and 2 with the target slave subtracted from 100, and 150 respectively.

Table 2-1 Slave Address Mapping

Modbus Slave (INDEX)	QUCM Port	Serial Slave Address	ENRON Translation
1 through 50	1	1 through 50	YES
51 through 100	2	1 through 50	YES
101 through 150	1	1 through 50	NO
151 through 200	2	1 through 50	NO

ENRON Translations

The ENRON system uses special versions of Modbus messages to access 32-bit integers and floating point numbers. ENRON Holding registers (4x) 5001 through 5999 are long integers while registers 7001 through 7999 are floating point.. This QUCM application provides a general purpose mapping of the ENRON registers to standard Modbus registers. Each ENRON 32-bit register is mapped to two Modbus registers within a range using the following formula:
Long Modbus Starting Register =(((ENRON register - 5000) * 2) -1)+5000
Float Modbus Starting Register =(((ENRON register - 7000) * 2) -1)+7000

Table 2-2 ENRON Register Mapping

ENRON Register	Modbus Register
5001	5001, 5002
5002	5003, 5004
5003	5005, 5006
5004	5007, 5008
5005	5009, 5010
5006	5011, 5012
...	...
5999	6997, 6998
7001	7001, 7002
7002	7003, 7004
7003	7005, 7006
7004	7007, 7008
7005	7009, 7010
7006	7011, 7012
....	...
7999	8997, 8998

Only Modbus function codes 03 (Read Holding Registers) and 16 (Write Holding registers) are supported to the ENRON translation registers. Reads and Writes must include an even number of registers and must start on odd boundaries. Error replies will be returned for illegal register accesses.
For example, a Modbus read of registers 5001 with a count of 4 will return the data from ENRON registers 5001 and 5002. A Modbus read of registers 5001 with a count of 3 will return an error which indicates an illegal message because 1/2 of a long integer is not valid.

Daniel Software Setup

The 2500 meter must be configured to use port 2 in MODBUS ASCII mode. Set the parity to EVEN and the baud to 9600. The delay time may be set to 0.

Multitech Modem Setup

The Multitech modem must be confgured for leased line operation. The easiest method is to set the dip switches to the factory default settings as shown in Table 2-3. After setting the switches to the factor defaults, connect the QUCM port 1 to the modem with the MM4 cable and connect with the TELNET server via the Ethernet.. Select Modem configuration from the menu and follow the instructions. The QUCM will configure the modem for the proper settings. One modem must have switch 5 UP and the other DOWN after the complete configuration.

To configure the modem by hand, send the commands at 9600 buad, 7 data bits, EVEN parity, 1 stop bit.

AT&F0<CR>

Then,

AT$SB9600$BA0&W0<CR>

After the software configuration, change the DIP switches to those shown in Table 2-4.

This setup is the same as the one shown on section 8.5 (page 102) of the Multitech manual.

Table 2-3 Default Switches

Switch	Position
1	UP
2	UP
3	DOWN
4	UP
5	UP
6	UP
7	DOWN
8	DOWN
9	DOWN
10	UP
11	DOWN
12	DOWN
13	DOWN
14	DOWN
15	UP
16	DOWN

Table 2-4 Leased Line Opertating Switches

Switch	Position
1	DOWN
2	UP
3	UP
4	UP
5	UP for one, DOWN for the other
6	UP
7	DOWN
8	DOWN
9	DOWN
10	DOWN
11	UP
12	DOWN
13	DOWN
14	DOWN
15	DOWN
16	UP

3

Port Configuration

Telnet Server

If the QUCM has an Ethernet port, then the serial ports may be configured through a Telnet connection. The QUCM application listens on TCP port 23 for Telnet. A password is required for Telnet access. The default password is "master" and is case sensitive. This password may be changed by the user.

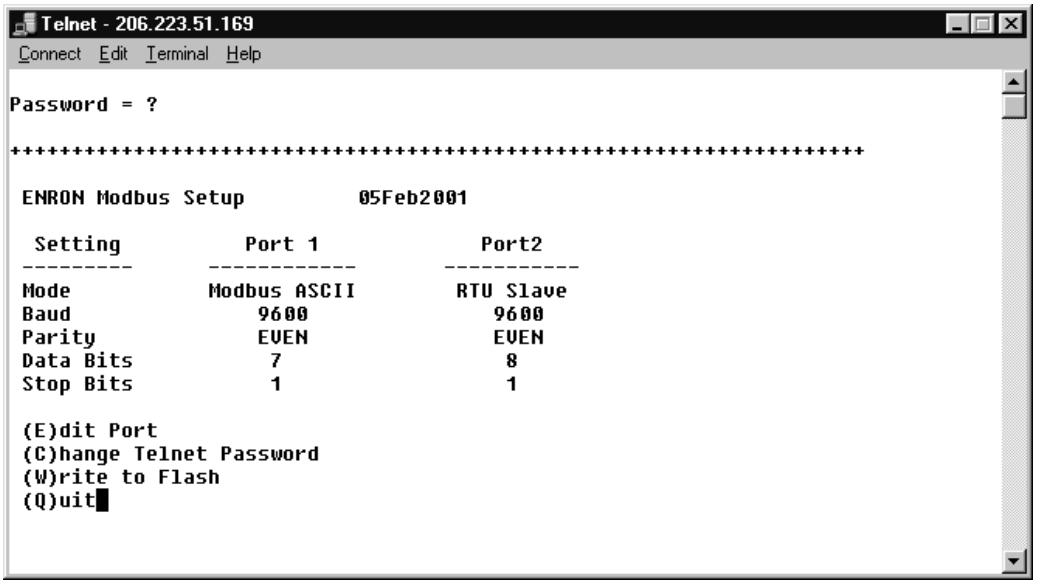

Figure 3-1 Main Configuration Page

Figure 3-1 shows a Telnet screen with Port 1 set to Modbus ASCII Master mode at 9600 baud, EVEN parity, 7 data bits, and 1 stop bit. Port 2 is set for Modbus RTU Slave mode at 9600 baud, EVEN parity, 8 data bits, and 1 stop bit.

To change a ports configuration, press the "e" or "E" key on the keyboard. A prompt for the port number to edit will be presented. Use the "space bar" or "+" or "-" keys to scroll through the options. Press the "Enter" key to accept the changes on each option. Pressing the "Esc" key will abort the edit. The options list is shown in Table 3-1.

Table 3-1 Port Setting Options

Setting	Options	Description
Edit Port	1	QUCM Port 1
	2	QUCM Port 2
Mode	PNIM/RTU	Combination PNIM and Modbus RTU Master
	PNIM	PNIM Master only
	Modbus RTU	Modbus RTU Master only
	PLOGIC	PLOGIC Master only (Use with Powerlink or CM100)
	RTU Slave	Modbus RTU Slave only
	Modbus ASCII	Modbus ASCII Master only
Baud Rate	2400	
	4800	
	9600	
	19200	
Parity	EVEN	
	NONE	
Data Bits	8	8 bits must be set for RTU, PNIM, or PLOGIC, optional on ASCII
	7	7 bits valid for Modbus ASCII only
Stop Bits	1	
	2	

When the modifications to the settings are finished they must be written to FLASH by pressing the "w" or "W" key. The QUCM loads its settings from FLASH memory on every power-up and if modifications are not written to flash, they will be lost on the next power cycle.

Pressing the "c" or "C" key will allow the modification of the Telnet password.

Pressing the "q" or "Q" key will close the Telnet session. The Telnet session will also automatically close after 3 minutes of inactivity.

Terminal Server

This application may be loaded into a non-Ethernet QUCM. Serial port 2 may be used for the configuration of the serial ports instead of a Telnet session by setting the Application Switch 2 in "Memory Protect" and connecting a terminal emulator (such as Hyperterm) to Port 2. While the Application Switch 2 is in "Memory Protect", Port 2 is set for 9600 baud, Parity = NONE, data bits = 8, and stop bits = 1.

A password is not required for serial configuration through Port 2.

The settings are altered through the same command interface described in the Telnet Server on the previous pages.

NOTE: If loaded into a QUCM-L or QUCM-S, it is required that the QUCM-TCPL.FWL or QUCMTCPS.FWL firmware be loaded into the module instead of the QUCML.FWL or QUCMS.FWL files.

4
Examples

Example 1

Figure 4-1 displays an example system of a QUCM-LE with a Daniel Flow Computer connected to Port 1 and a Daniel Gas Analyzer connected to Port 2. Both ports are configured for Modbus ASCII, 1200, Even, 7, 1. Leased-line modems are used to connect the flow meters to the QUCM. An MM4 cable is used to connect the 25-pin RS-232 port on the modem to the QUCM. Both port on the QUCM are set to RS232.

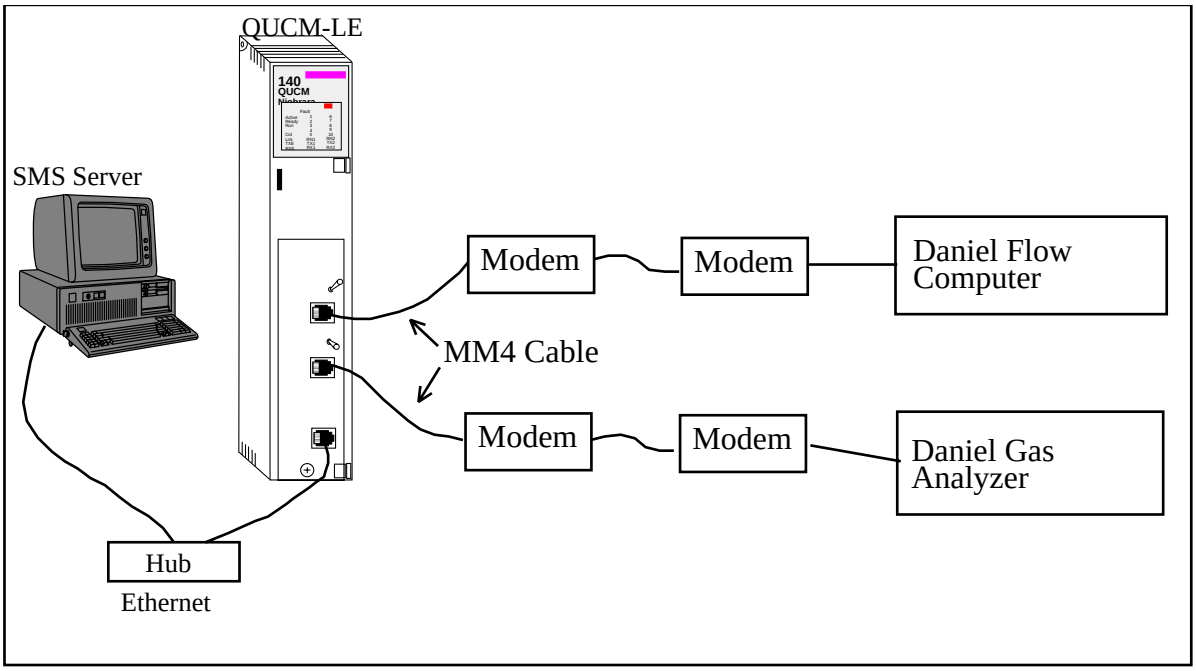

Figure 4-1 Ethernet Network Example

Each Daniel device is configured for Modbus ASCII protocol at 1200, E, 7, 1 and set to slave address 1.

The SMS Server will be configured to add the QUCM's IP Address as a Network Connection. The Daniel devices will be added as type Modbus and the Flow Computer will be set for slave address 1 while the Gas Analyzer is slave address 51.

A few of the common registers of interest are shown in the following table.

Table 4-1 Flow Computer Sample Registers

Modbus Registers	ENRON Register	Description
7001, 7002	7001	Mole % - Component #1
7003, 7004	7002	Mole % - Component #2
7005, 7006	7003	Mole % - Component #3
7033, 7034	7017	GPM or Weight % - Component #1
7035, 7036	7018	GPM or Weight % - Component #2
7065, 7066	7033	BTU - Dry
7067, 7068	7034	BTU - Saturated
7069, 7070	7035	Specific Gravity
7077, 7078	7039	Total GPM

Example 2

Figure displays an example of a system with a QUCM-L, a Daniel Flow Computer connected to Port 1 through leased-line modems and a computer running SMS connected to Port 2. Port 1 is set for 1200 baud, Even parity, 7 data bits, and 1 stop bit in Mode Modbus ASCII. Port 2 is set for 9600 baud, EVEN parity, 8 data bits, and 1 stop bit in Modbus RTU Slave mode. The Flow computer is configured to Modbus Slave address 1.

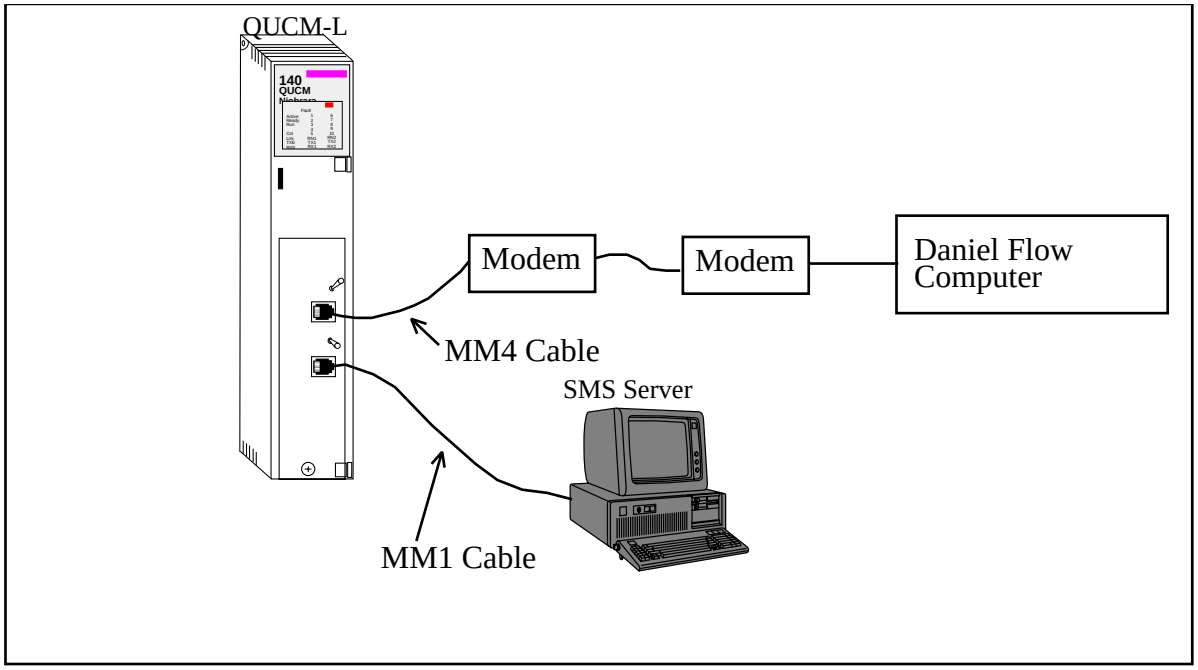

Figure 4-2 Serial Network Example

The SMS computer is configured to use its serial port as a Modbus RTU connection. The Flow computer will be added as a Modbus type devices at Slave Address 01.