QUCM Modbus Master

Installation and Programming Manual

This Manual describes the QUCM application for generating Modbus RTU, Modbus ASCII, SY/MAX®, and PNIM reads and writes from the Quantum PLC backplane.

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1
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 allows a Modicon Quantum PLC to generate read and write operations out the QUCM serial ports from I/O data on the backplane. Modbus opcodes 1, 2, 3, 4, 5, 6, 15, 16, 17, and 100 are supported. The QUCM may be mounted in the local CPU rack, RIO rack, or DIO rack.

Ports 1 and 2 of the QUCM may be independently configured for a variety of modes: PNIM, SY/MAX, Modbus RTU Master, and Modbus ASCII Master. Slave devices connected to the QUCM's serial ports may be directly accessed from the PLC by setting specific Holding Register values and the replies are posted in Input Registers. The QUCM can be configured to automatically dial a Hayes command modem to access remote locations before sending the Modbus or SY/MAX commands.

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

2
Installation

Module Installation

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 MASTER.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 MASTER.ZIP file is located at

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

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

http://www.niobrara.com/ftp/qucm/master/qmaster.pdf

Serial Connections to the QUCM-L

RS-232 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-L. The Niobrara MM1 cable may be used for this connection. This cable is shown in Figure 2-1.

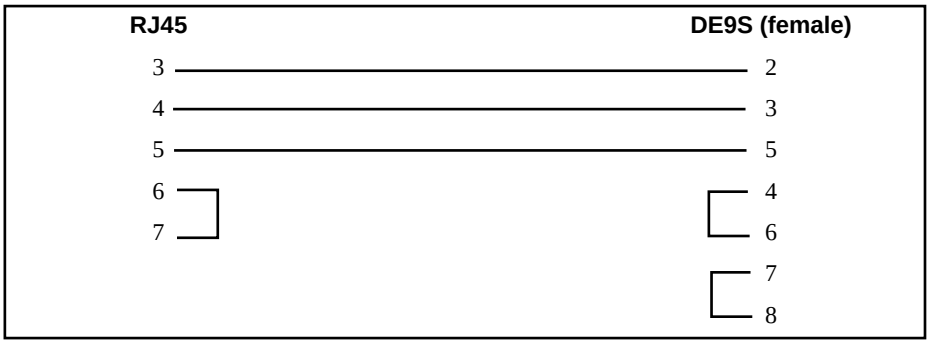

Figure 2-1 QUCM-L to RS-232 PC DCE Port (9-pin) (MM1 Cable)

RS-232 QUCM Port to a Modem

A special cable must be used to connect the QUCM to a modem for remote polling. The Niobrara MM9 cable may be used for this connection. This cable is slightly different than the normal MM4 modem cable. This cable is shown in Figure 2-2.

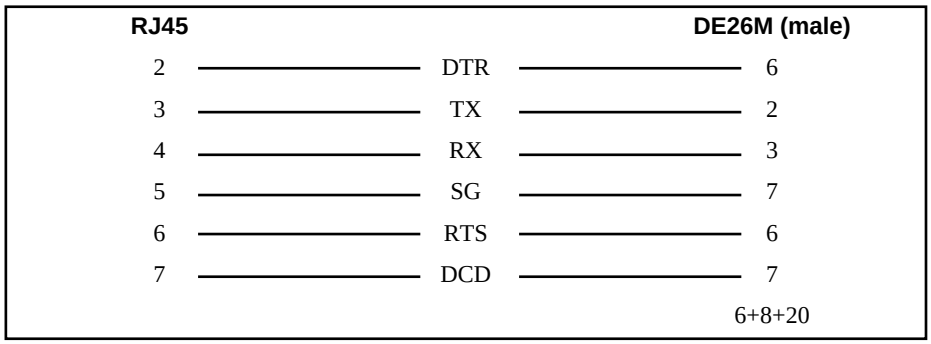

Figure 2-2 QUCM-L to RS-232 Modem DTE Port (25-pin) (MM9 Cable)

RS-485 QUCM Port to the POWERLOGIC Meters

The Niobrara BB85 cable is the most convenient method for connecting may be used for this connection. This cable is shown in Figure 2-1.

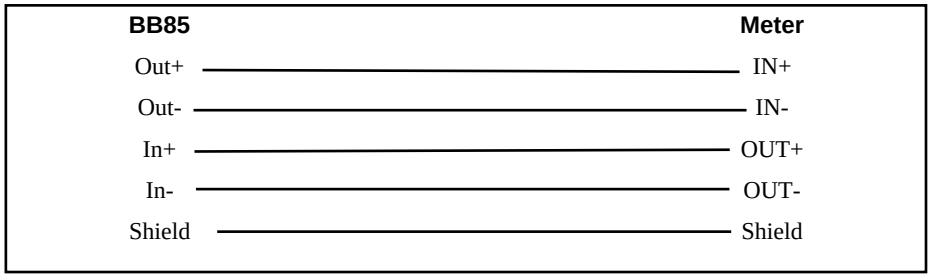

Figure 2-3 QUCM-LE to RS-485 to POWERLOGIC Meter

RS-485 QUCM Port to 2-wire Modbus Slaves

The Niobrara BB85 cable is the most convenient method for connecting may be used for this connection. This cable is shown in Figure 2-1.

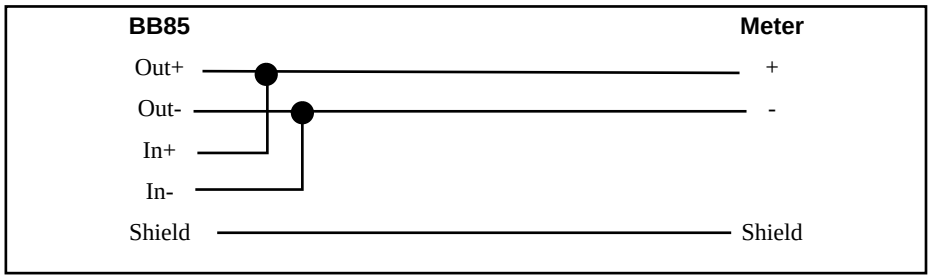

Figure 2-4 QUCM-LE to RS-485 to POWERLOGIC Meter

The DDC2I converter may be used to provide optical isolation between the QUCM and the RS-485 network.

Downloading 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:

Loading the Firmware

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

> fwload32 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.

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

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

Loading App1

1 Move switches 1 and 2 to HALT.

2 Connect the PC to QUCM Port 1 in RS232 mode with an MM1 cable.

3 Load the APP1 file with qload.

> qload 1 app1 com1: -a

Will load the file into application 1's flash and set the program to automatically start on power-up.

4 Place Switch 1 in RUN. The RN1 light should come on.

3
Operation

Holding Registers

The QUCM application uses Holding registers (4x) from the PLC to define the configuration of the serial ports, which port the message is to be transmitted from, and the type of message to be sent. The bit-mapped values are referenced as 984 bit ordering (msb 1-16 lsb).

Reading the QUCM Port Configuration

The operation to check the Port Configuration is as follows:

1 The PLC zeros 4x0001.

2 The PLC waits for 3x0005.16 to clear.

3 The PLC sets 4x0001.13

4 The PLC sets 4x0001.16 to trigger the read.

5 The PLC waits for 3x0005.16.

6 The PLC reads the following data:
3x00010 = Port 1 Mode
3x00011 = Port 2 Mode
3x00012 = Port 1 Baud Rate
3x00013 = Port 2 Baud Rate
3x00014 = Port 1 Parity
3x00015 = Port 2 Parity
3x00016 = Port 1 Data Bits
3x00017 = Port 2 Data Bits
3x00018 = Port 1 Stop Bits
3x00019 = Port 2 Stop Bits
3x00020 = Port 1 Timeout (mS)
3x00021 = Port 2 Timeout (mS)
3x00022 = Port 1 Modem Connection Timeout (mS)
3x00023 = Port 2 Modem Connection Timeout (mS)
3x00024 = Port 1 Modem Idle Disconnect Timeout (mS)
3x00025 = Port 2 Modem Idle Disconnect Timeout (mS)

7 The PLC inspects 3x0005.13 for errors. If set then inspect 3x0006 for the error code.

Loading the QUCM Port Configuration

The typical configuration operation technique is as follows:

1 The PLC zeros 4x0001.

2 The PLC waits for 3x0005.16 to clear.

3 The PLC sets 4x0001.12

4 The PLC loads the following data:
4x00010 = Port 1 Mode
4x00011 = Port 2 Mode
4x00012 = Port 1 Baud Rate
4x00013 = Port 2 Baud Rate
4x00014 = Port 1 Parity
4x00015 = Port 2 Parity
4x00016 = Port 1 Data Bits
4x00017 = Port 2 Data Bits
4x00018 = Port 1 Stop Bits
4x00019 = Port 2 Stop Bits
4x00020 = Port 1 Timeout (mS)
4x00021 = Port 2 Timeout (mS)
4x00022 = Port 1 Modem Connection Timeout (mS)
4x00023 = Port 2 Modem Connection Timeout (mS)
4x00024 = Port 1 Modem Idle Disconnect Timeout (mS)
4x00025 = Port 2 Modem Idle Disconnect Timeout (mS)

5 The PLC sets 4x0001.16 to trigger the store.

6 The PLC waits for 3x0005.16 to be set.

7 The PLC inspects 3x0005.13 for errors. If set then inspect 3x0006 for the error code.

Performing a Register Read

The following technique may be used to read register 4x01001 through 4x01010 from Slave device 5 connected to QUCM Port 2.

1 The PLC zeros 4x0001.

2 The PLC waits for 3x0005.16 to clear.

3 The PLC sets 4x0001.15 to indicate the message is to go out Port 2.

4 The PLC loads the following data:
4x00007 = 5 (Slave address)
4x00008 = 3 (Opcode 3 for Holding Register Read)
4x00009 = 10 (Register Count)
4x00010 = 1001 (Starting Register)

5 The PLC sets 4x0001.16 to trigger the read.

6 The PLC waits for 3x0005.16 to be set.

7 The PLC inspects 3x0005.13 for errors. If set then inspect 3x0006 for the error code.

8 The PLC reads the following data:
3x00010 = Slave Register 4x01001 Data
3x00011 = Slave Register 4x01002 Data
3x00012 = Slave Register 4x01003 Data
3x00013 = Slave Register 4x01004 Data
3x00014 = Slave Register 4x01005 Data
3x00015 = Slave Register 4x01006 Data
3x00016 = Slave Register 4x01007 Data
3x00017 = Slave Register 4x01008 Data
3x00018 = Slave Register 4x01009 Data
3x00019 = Slave Register 4x01010 Data

Performing a Register Write

The following technique may be used to write data to registers 4x0007 through 4x0011 from Slave device 25 connected to QUCM Port 1.

1 The PLC zeros 4x0001.

2 The PLC waits for 3x0005.16 to clear.

3 The PLC clears 4x0001.15 to indicate the message is to go out Port 1.

4 The PLC loads the following data:

4x00007 = 5	(Slave address)
4x00008 = 16	(Opcode 16 for Holding Register Write)
4x00009 = 5	(Register Count)
4x00010 = 7	(Starting Register)
4x00012 = 123	(Data for register 4x0007)
4x00013 = 0	(Data for register 4x0008)
4x00014 = 789	(Data for register 4x0009)
4x00015 = 1	(Data for register 4x0010)
4x00016 = -5	(Data for register 4x0011)

5 The PLC sets 4x0001.16 to trigger the write.

6 The PLC waits for 3x0005.16 to be set.

7 The PLC inspects 3x0005.13 for errors. If set then inspect 3x0006 for the error code.

Table 3-1 Holding Register Map

PLC Register	Description	Values
4x00001	Command Bitmap	bit 16 - 0=reset, 1=submit command bits 14,15 - 00 = Send out Port 1 01 = Send out Port 2 10 = Send out Enet Port 11 = Reserved bit 13 = Read Port Configuration bit 12 = Write Port Configuration
4x0002	Number of dialing digits for modem	valid 0-16 Zero disables modem dialing.
4x0003	Reserved for IP Address 1 or modem dial	valid 0-254 Modem digits 1234 in hex
4x0004	Reserved for IP Address 2 or modem dial	valid 0-254 Modem digits 5678 in hex
4x0005	Reserved for IP Address 3 or modem dial	valid 0-254 Modem digits 9012 in hex
4x0006	Reserved for IP Address 4 or modem dial	valid 0-254 Modem digits 3456 in hex
4x0007	Slave Address	valid 0-254
4x0008	Modbus Opcode	1 = Read Coil (0x) 2 = Read Input Bits (1x) 3 = Read Holding Registers (4x) 4 = Read Input Registers (3x) 5 = Write Single Coil (0x) 6 = Write Singe Holding Register (4x) 15 = Write Multiple Coils (0x) 16 = Write Multiple Holding Registers (4x) 17 = Read Device ID 100 = Read Random Holding Registers (4x)
4x0009	Register Count	valid 1-20 for opcodes 3, 4, 16, and 100 valid 1-320 for opcodes 1, 2, and 15 Ignored on opcodes 5, 16, and 17.
4x0010	Starting Register	valid 1-65535
4x0011	Write Data 1 or Random Register 2	valid 1-65535
4x0012	Write Data 2 or Random Register 3	valid 1-65535
4x0013	Write Data 3 or Random Register 4	valid 1-65535
4x0014	Write Data 4 or Random Register 5	valid 1-65535
4x0015	Write Data 5 or Random Register 6	valid 1-65535
4x0016	Write Data 6 or Random Register 7	valid 1-65535
4x0017	Write Data 7 or Random Register 8	valid 1-65535
4x0018	Write Data 8 or Random Register 9	valid 1-65535
4x0019	Write Data 9 or Random Register 10	valid 1-65535
4x0020	Write Data 10 or Random Register 11	valid 1-65535
4x0021	Write Data 11 or Random Register 12	valid 1-65535
4x0022	Write Data 12 or Random Register 13	valid 1-65535
4x0023	Write Data 13 or Random Register 14	valid 1-65535
4x0024	Write Data 14 or Random Register 15	valid 1-65535
4x0025	Write Data 15 or Random Register 16	valid 1-65535
4x0026	Write Data 16 or Random Register 17	valid 1-65535
4x0027	Write Data 17 or Random Register 18	valid 1-65535
4x0028	Write Data 18 or Random Register 19	valid 1-65535
4x0029	Write Data 19 or Random Register 20	valid 1-65535
4x0030	Write Data 20	valid 1-65535

Table 3-2 Holding Register Map for Port Configuration

PLC Register	Description	Values	Default
4x00001	Status Bitmap	bit 16 - 0=reset, 1=submit command bit 13 = Read Port Configuration bit 12 = Write Port Configuration	
4x0010	Port 1 Mode	1 = Modbus RTU Master 2 = PNIM Master 3 = SY/MAX Master 4 = Modbus ASCII Master	1 = Modbus RTU
4x0011	Port 2 Mode	1 = Modbus RTU Master 2 = PNIM Master 3 = SY/MAX Master 4 = Modbus ASCII Master	1 = Modbus RTU
4x0012	Port 1 Baud Rate	2400, 4800, 9600, 19200	9600
4x0013	Port 2 Baud Rate	2400, 4800, 9600, 19200	9600
4x0014	Port 1 Parity	0 = NONE 1 = ODD 2 = EVEN	2 = EVEN
4x0015	Port 2 Parity	0 = NONE 1 = ODD 2 = EVEN	2 = EVEN
4x0016	Port 1 Data Bits	7 or 8 (7 only valid in ASCII)	8
4x0017	Port 2 Data Bits	7 or 8 (7 only valid in ASCII)	8
4x0018	Port 1 Stop Bits	1 or 2	1
4x0019	Port 2 Stop Bits	1 or 2	1
4x0020	Port 1 Timeout (mS)	must be > 50	2000
4x0021	Port 2 Timeout (mS)	must be > 50	2000
4x0022	Port 1 Modem Connection Timeout (mS)	must be > 5000	60000
4x0023	Port 2 Modem Connection Timeout (mS)	must be > 5000	60000
4x0024	Port 1 Modem Idle Disconnection Timeout (mS)	0 disables	60000
4x0025	Port 2 Modem Idle Disconnection Timeout (mS)	0 disables	60000

Table 3-3 Input Register Map for Port Configuration

PLC Register	Description	Values	Default
3x00005	Command Bitmap	bit 16 - 0=reset, 1=submit command bit 13 = Read Port Configuration bit 12 = Write Port Configuration	
3x0006	Error Code	0 = No error 1- 12 Modbus Error Code (Table 3-5) 100- 106 Modem Error Code (Table 3-6) 1000 - 1018 QUCM Error Code (Table 3-7)	
3x0010	Port 1 Mode	1 = Modbus RTU Master 2 = PNIM Master 3 = SY/MAX Master 4 = Modbus ASCII Master	1 = Modbus RTU
3x0011	Port 2 Mode	1 = Modbus RTU Master 2 = PNIM Master 3 = SY/MAX Master 4 = Modbus ASCII Master	1 = Modbus RTU
3x0012	Port 1 Baud Rate	2400, 4800, 9600, 19200	9600
3x0013	Port 2 Baud Rate	2400, 4800, 9600, 19200	9600
3x0014	Port 1 Parity	0 = NONE 1 = ODD 2 = EVEN	2 = EVEN
3x0015	Port 2 Parity	0 = NONE 1 = ODD 2 = EVEN	2 = EVEN
3x0016	Port 1 Data Bits	7 or 8 (7 only valid in ASCII)	8
3x0017	Port 2 Data Bits	7 or 8 (7 only valid in ASCII)	8
3x0018	Port 1 Stop Bits	1 or 2	1
3x0019	Port 2 Stop Bits	1 or 2	1
3x0020	Port 1 Timeout (mS)	must be > 50	2000
3x0021	Port 2 Timeout (mS)	must be > 50	2000
3x0022	Port 1 Modem Connection Timeout (mS)	must be > 5000	60000
3x0023	Port 2 Modem Connection Timeout (mS)	must be > 5000	60000
3x0024	Port 1 Modem Idle Disconnection Timeout (mS)	0 disables	60000
3x0025	Port 2 Modem Idle Disconnection Timeout (mS)	0 disables	60000

Table 3-4 Input Register Map

PLC Register	Description	Values
3x0001	Application 1 Status	
3x0002	Application 1 Line Number	
3x0003	Application 2 Status	
3x0004	Application 2 Line Number	
3x0005	Status from QUCM Application bitmap	bit 16 - 0=reset, 1=Operation Complete bits 14,15 - 00 = Send out Port 1, 01 = Send out Port 2 10 = Send out Enet Port 11 = Reserved bit 13 0 = No Error, 1 = Error
3x0006	Error Code	0 = No error 1- 12 Modbus Error Code (Table 3-5) 100- 106 Modem Error Code (Table 3-6) 1000 - 1018 QUCM Error Code (Table 3-7)
3x0007	Slave Address	valid 0-255
3x0008	Modbus Opcode	1 = Read Coil (0x) 2 = Read Input Bits (1x) 3 = Read Holding Registers (4x) 4 = Read Input Registers (3x) 5 = Write Single Coil (0x) 6 = Write Singe Holding Register (4x) 15 = Write Multiple Coils (0x) 16 = Write Multiple Holding Registers (4x) 17 = Read Device ID 100 = Read Random Holding Registers (4x)
3x0009	Register Count	1-20 for opcodes 3, 4, 16, and 100 1-320 for opcodes 1, 2, and 15 Reports the number of bytes in Opcode 17 reply.
3x0010	Read Data 1	
3x0011	Read Data 2	
3x0012	Read Data 3	
3x0013	Read Data 4	
3x0014	Read Data 5	
3x0015	Read Data 6	
3x0016	Read Data 7	
3x0017	Read Data 8	
3x0018	Read Data 9	
3x0019	Read Data 10	
3x0020	Read Data 11	
3x0021	Read Data 12	
3x0022	Read Data 13	
3x0023	Read Data 14	
3x0024	Read Data 15	
3x0025	Read Data 16	
3x0026	Read Data 17	
3x0027	Read Data 18	
3x0028	Read Data 19	
3x0029	Read Data 20	

Table 3-5 Modbus Serial Error Codes

Error Code	Description
0	No error
1	Illegal Opcode
2	Illegal Data Address
3	Illegal Data Value
4	Slave Device Failure
5	Acknowledge
6	Slave Device Busy
7	Negative Acknowledge
8	Memory Parity Error
9	Reserved
10	Reserved
11	No Reply from Slave
12	CTS Error (possible cable unplugged from QUCM)

Table 3-6 Modem Error Codes

Error Code	Description
0	No error
100	Bad phone number digit count (>16)
101	Bad pone number dialing digit (must be hex 0-9, or C)
102	Modem not responding to AT commands.
103	No Dial Tone
104	Busy
105	No Carrier
106	Timeout waiting for answer.

Table 3-7 QUCM Configuration Error Codes

Error Code	Description
1000	Bad Command Bitmap
1001	Bad Port 1 Mode
1002	Bad Port 2 Mode
1003	Bad Port 1 Baud Rate
1004	Bad Port 2 Baud Rate
1005	Bad Port 1 Parity
1006	Bad Port 2 Parity
1007	Bad Port 1 Data Bits
1008	Bad Port 2 Data Bits
1009	Bad Port 1 Stop Bits
1010	Bad Port 2 Stop Bits
1011	Bad Port 1 Timeout
1012	Bad Port 2 Timeout
1013	Bad Slave Address
1014	Bad Opcode
1015	Bad Starting Register
1016	Bad Register Count
1017	Bad Random Register
1018	Bad TCP/IP Address

Opcode Detail

Opcode 01 - Coil Read

Opcode 01 allows reading of blocks of 0x coils from Modbus Slaves. This opcode should not be used on SY/MAX devices. The Register Count (4x0007) is actually a coil count for Opcode 01. The Staring Register value is actually the staring coil. The reply data is placed in 984 style registers starting in register 3x00010. Coil counts of up to 320 are permitted.

Opcode 02 - Input Bit Read

Opcode 02 allows reading of blocks of 1x bits from Modbus Slaves. This opcode should not be used on SY/MAX devices. The Register Count (4x0007) is actually a coil count for Opcode 02. The Staring Register value is actually the staring coil. The reply data is placed in 984 style registers starting in register 3x00010. Coil counts of up to 320 are permitted.

Opcode 03 - Holding Register Read

Opcode 03 allows reading of blocks of 4x registers from Modbus Slaves. This opcode may be used on SY/MAX devices. Register counts of up to 20 are permitted. The Starting Register determines the start of the read block from the slave.

Opcode 04 - Input Register Read

Opcode 04 allows reading of blocks of 3x registers from Modbus Slaves. This opcode may be used on SY/MAX devices but will provide exactly the same data as opcode

03. Register counts of up to 20 are permitted. The Starting Register determines the start of the read block from the slave.

Opcode 05 - Single Coil Write

Opcode 05 allows writing of a single 0x coil in a Modbus Slave. This opcode should not be used on SY/MAX devices. The Register count is ignored. The Starting Register determines the target coil in the slave. The bit to be written should be placed in register 4x00011 bit 1 (MSB).

Opcode 06 - Single Holding Register Write

Opcode 06 allows writing of a single 4x register in a Modbus Slave. This opcode may be used on SY/MAX devices. The Register count is ignored. The Starting Register determines the target register in the slave. The data to be written should be placed in register 4x00011.

Opcode 15 - Multiple Coil Write

Opcode 15 allows writing of multiple 0x coils in a Modbus Slave. This opcode should not be used on SY/MAX devices. The Register count determines the number of coils to be written. The Starting Register determines the target starting coil in the slave. The bits to be written should be placed starting in register 4x00011 bit 1 (MSB).

Opcode 16 - Multiple Holding Register Write

Opcode 16 allows writing of a block of 4x registers in a Modbus Slave. This opcode may be used on SY/MAX devices. The Register count determines the number of words to write (max 20). The Starting Register determines the target register in the slave. The data to be written should be placed in registers 4x00011 through 4x00030.

Opcode 17 - Device ID Read

Opcode 17 allows reading of the device ID from Modbus Slaves. This opcode should not be used on SY/MAX devices. The Register count in the command is ignored. The Register Count in the reply indicates the number of bytes of data in the reply. The Starting Register is ignored.

Opcode 100 - Random Holding Register Read

Opcode 100 allows reading of random 4x registers from Powerlogic Modbus Slaves. This opcode may be used on SY/MAX devices. Register counts of up to 20 are permitted. The Starting Register determines the first register from the slave. Register 4x00011 determines the next register to read; through register 2x00029.

Modem Operation

A standard Hayes command compatible modem may be connected to the QUCM with an MM9 cable to allow the QUCM to dial-up remote slaves. The QUCM looks at the phone number on each read/write operation. If necessary, it will dial the remote location, perform the command and report the reply data. If successive operations use the same phone number, the QUCM will not disconnect between operations unless there has been no messages for more than the Idle Disconnect Timeout.

Notice: If Modbus RTU, RNIM, or SY/MAX protocols are used through a modem, extensive configuration of the modem sets will likely be required to enable the full 8-

bit data to pass. Usually this involves disabling all hardware and software flow control, data compression, and error correction in the modems. Depending upon the target device, it may also be necessary to use 11-bit modem to ensure 8 data bits and EVEN parity.

Phone Number Storage

The telephone number for the remote location is stored in holding registers 2, 3, 4, 5, and 6. Register 2 contains the number of digits in the number. A value of 0 disables modem dialing. The maximum value is 16 digits. The numbers are packed into register 3, 4, 5, and 6 in hexadecimal characters, 4 characters per register from the most significant to the least significant. Valid characters are hex numbers 0-9 and C. The C value is used to signify a comma which is normally a 2 second pause in the dialing string. Table 3-8 gives an example for dialing "9,14176248918".

Table 3-8 Example for Dialing 9,14176248918

Register	Value (hex)	Value (decimal)	Description
2	000D	13	13 digits in dial string
3	9C14	39956	dial "9,14"
4	1762	5986	dial "1762"
5	4891	18577	dial "4891"
6	8000	32768	dial "8"

4
Examples

Example 1

Figure 4-1 displays two POWERLOGIC CM2350 meters connected to Port 1 of the QUCM-L through a BB85 terminal block. These meters do not communicate using Modbus so Port 1 will be set for PNIM mode at 9600,E,8,1.

Port 2 of the QUCM is connected to a pair of Gas Monitors through a DDC2I to provide optical isolation. The Gas Monitors use Modbus ASCII protocol at 19200,N,8,1.

The QUCM port configuration is shown in Table 4-1.

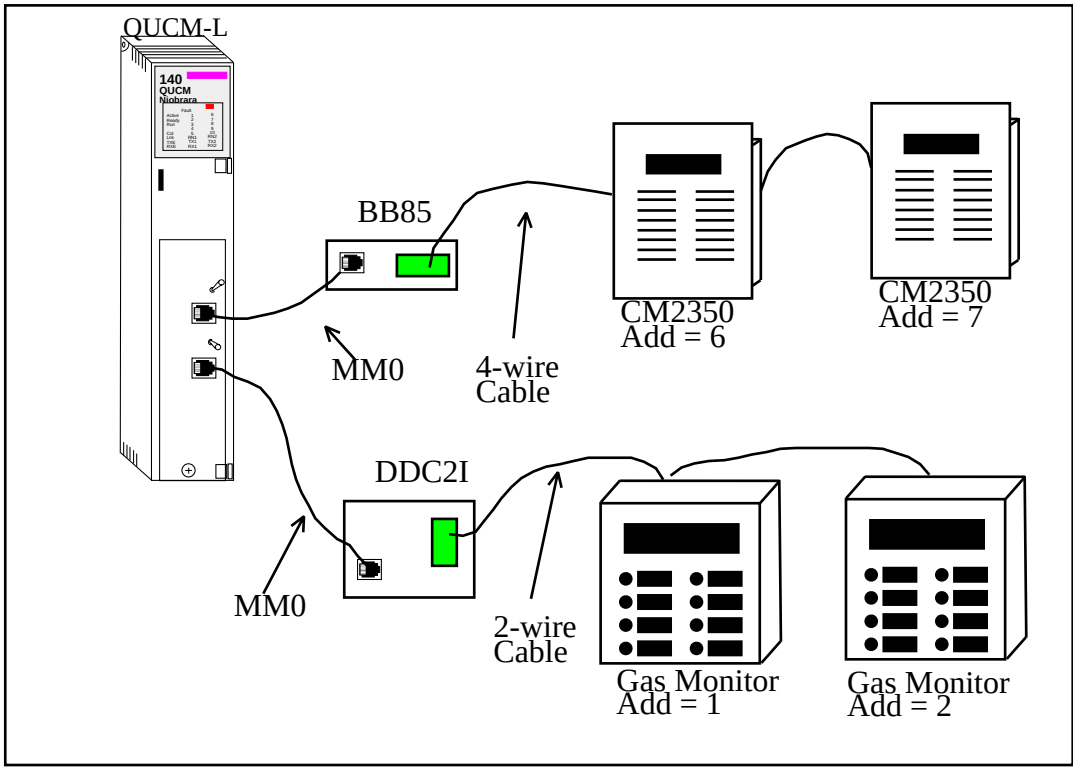

Figure 4-1 Example

Table 4-1 Input Register Map for Port Configuration

PLC Register	Description	Values
3x00005	Status Bitmap	9 (bits 16 and bit 13)
3x0006	Error Code	0 = No error
3x0010	Port 1 Mode	2 = PNIM Master
3x0011	Port 2 Mode	4 = Modbus ASCII Master
3x0012	Port 1 Baud Rate	9600
3x0013	Port 2 Baud Rate	19200
3x0014	Port 1 Parity	2 = EVEN
3x0015	Port 2 Parity	0 = NONE
3x0016	Port 1 Data Bits	8
3x0017	Port 2 Data Bits	8
3x0018	Port 1 Stop Bits	1
3x0019	Port 2 Stop Bits	1
3x0020	Port 1 Timeout (mS)	1000
3x0021	Port 2 Timeout (mS)	1000

The CM2350 units support the Opcode 100 Random Read so it may be used to gather a wide variety of data in a single message. Tables 4-2 and 4-3 show a sample random read to gather frequency, average voltage, current, power, and energy values from meter 6. The same setup could be used to read meter 7 by changing 4x00007 from 6 to 7 and then toggle bit 4x00001.16.

The Gas Monitor uses Analog Input Registers (3x) for its data. A Tables 4-4 and 4-5 show a sample Opcode 4 read to gather five registers of data form monitor 2. The same data may be polled from unit 1 by changing the slave address in 4x0007 to 1 and toggle bit 16 or register 1.

Table 4-2 Holding Register Map for CM2350 # 6

PLC Register	Description	Values
4x00001	Command Bitmap	1 (Bit 16 only)
4x0002	Reserved	0
4x0003	Reserved for IP Address 1	0
4x0004	Reserved for IP Address 2	0
4x0005	Reserved for IP Address 3	0
4x0006	Reserved for IP Address 4	0
4x0007	Slave Address	6.
4x0008	Modbus Opcode	100 = Read Random Holding Registers (4x)
4x0009	Register Count	20
4x0010	Random Register 1	1001 (frequency)
4x0011	Random Register 2	1008 (Current 3-Phase Avg)
4x0012	Random Register 3	1017 (Voltage L-L 3-Phase Avg)
4x0013	Random Register 4	1021 (Voltage L-N 3-Phase Avg)
4x0014	Random Register 5	1034 (True Power Factor 3-Phase Total)
4x0015	Random Register 6	1042 (Real Power 3-Phase Total)
4x0016	Random Register 7	1046 (Reactive Power 3-Phase Total)
4x0017	Random Register 8	1050 (Apparent Power 3-Phase Total)
4x0018	Random Register 9	1621 (Real Energy Total 1)
4x0019	Random Register 10	1622 (Real Energy Total 2)
4x0020	Random Register 11	1623 (Real Energy Total 3)
4x0021	Random Register 12	1624 (Real Energy Total 4)
4x0022	Random Register 13	1625 (Reactive Energy Total 1)
4x0023	Random Register 14	1626 (Reactive Energy Total 2)
4x0024	Random Register 15	1627 (Reactive Energy Total 3)
4x0025	Random Register 16	1628 (Reactive Energy Total 4)
4x0026	Random Register 17	1617 (Apparent Energy Total 1)
4x0027	Random Register 18	1618 (Apparent Energy Total 2)
4x0028	Random Register 19	1619 (Apparent Energy Total 3)
4x0029	Random Register 20	1620 (Apparent Energy Total 4)

Table 4-3 Input Register Map for CM2350 # 6

PLC Register	Description	Values
3x00005	Status Bitmap	1 (bit 16 only)
3x0006	Error	0
3x0007	Slave Address	6
3x0008	Modbus Opcode	100 = Read Random Holding Registers (4x)
3x0009	Register Count	20
3x0010	Random Register 1001	6001 (frequency)
3x0011	Random Register 1008	89 (Current 3-Phase Avg)
3x0012	Random Register 1017	0 (Voltage L-L 3-Phase Avg)
3x0013	Random Register 1021	119 (Voltage L-N 3-Phase Avg)
3x0014	Random Register 1034	525 (True Power Factor 3-Phase Total)
3x0015	Random Register 1042	17 (Real Power 3-Phase Total)
3x0016	Random Register 1046	27 (Reactive Power 3-Phase Total)
3x0017	Random Register 1050	32 (Apparent Power 3-Phase Total)
3x0018	Random Register 1621	9423 (Real Energy Total 1)
3x0019	Random Register 1622	4127 (Real Energy Total 2)
3x0020	Random Register 1623	9666 (Real Energy Total 3)
3x0021	Random Register 1624	0 (Real Energy Total 4)
3x0022	Random Register 1625	2305 (Reactive Energy Total 1)
3x0023	Random Register 1626	7235 (Reactive Energy Total 2)
3x0024	Random Register 1627	1144 (Reactive Energy Total 3)
3x0025	Random Register 1628	0 (Reactive Energy Total 4)
3x0026	Random Register 1617	5553 (Apparent Energy Total 1)
3x0027	Random Register 1618	3590 (Apparent Energy Total 2)
3x0028	Random Register 1619	7636 (Apparent Energy Total 3)
3x0029	Random Register 1620	1 (Apparent Energy Total 4)

Table 4-4 Holding Register Map for Gas Monitor #2

PLC Register	Description	Values
4x00001	Command Bitmap	3 (bit 16 and bit 15)
4x0002	Reserved	0
4x0003	Reserved for IP Address 1	0
4x0004	Reserved for IP Address 2	0
4x0005	Reserved for IP Address 3	0
4x0006	Reserved for IP Address 4	0
4x0007	Slave Address	2
4x0008	Modbus Opcode	4 = Read Input Registers (3x)
4x0009	Register Count	19
4x0010	Starting Register	1

Table 4-5 Input Register Map for Gas Monitor # 2

PLC Register	Description	Values
3x00005	Status Bitmap	3 (bits 16 and 15)
3x0006	Error	0
3x0007	Slave Address	2
3x0008	Modbus Opcode	4 = Read Analog Input Registers (3x)
3x0009	Register Count	19
3x0010	Register 1 Data	
3x0011	Register 2 Data	
3x0012	Register 3 Data	
3x0013	Register 4 Data	
3x0014	Register 5 Data	
3x0015	Register 6 Data	
3x0016	Register 7 Data	
3x0017	Register 8 Data	
3x0018	Register 9 Data	
3x0019	Register 10 Data	
3x0020	Register 11 Data	
3x0021	Register 12 Data	
3x0022	Register 13 Data	
3x0023	Register 14 Data	
3x0024	Register 15 Data	
3x0025	Register 16 Data	
3x0026	Register 17 Data	
3x0027	Register 18 Data	
3x0028	Register 19 Data	

Example 2

Figure displays two SQUARE D Model 400 PLCs connected to remote 11-bit modems and Port 1 of the QUCM-L connected to its own 11-bit modem through an MM9 cable. These PLCs do not communicate using Modbus so Port 1 will be set for SY/MAX mode at 9600,E,8,1.

The remote location at 624-8921 has a Niobrara RM14K modem in the SY/MAX rack. The RM14K is configured for SY/MAX PSTN Auto-Answer operation with the PORT set for 9600,EVEN,BCC and the LINE for 9600,EVEN,BCC. The Model 400 has a standard DC1 (CC-100) cable connecting its RS-422 port to the RS-422 port on the RM14K.

The remote location at 624-8923 has an external 11-bit modem connected to the PLC through a Niobrara SC606 cable. The SC606 provides the RS232<>RS422 conversion between the 25-pin port on the modem to the RS422 port on the PLC.

The QUCM port configuration is shown in Table 4-6.

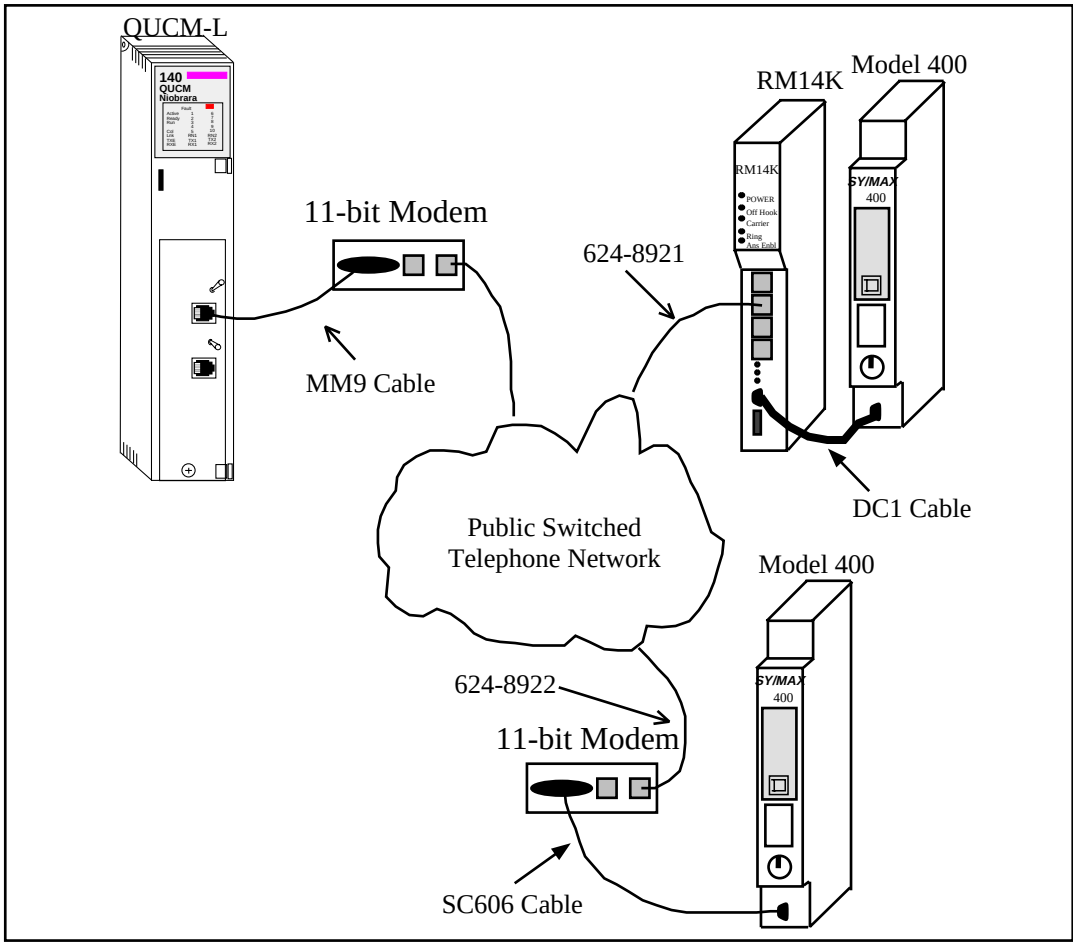

Figure 4-2 Example

Table 4-6 Input Register Map for Port Configuration

PLC Register	Description	Values
3x00005	Status Bitmap	9 (bits 16 and bit 13)
3x0006	Error Code	0 = No error
3x0010	Port 1 Mode	3 = SY/MAX Master
3x0011	Port 2 Mode	3 = SY/MAX Master
3x0012	Port 1 Baud Rate	9600
3x0013	Port 2 Baud Rate	9600
3x0014	Port 1 Parity	2 = EVEN
3x0015	Port 2 Parity	2 = EVEN
3x0016	Port 1 Data Bits	8
3x0017	Port 2 Data Bits	8
3x0018	Port 1 Stop Bits	1
3x0019	Port 2 Stop Bits	1
3x0020	Port 1 Timeout (mS)	2000
3x0021	Port 2 Timeout (mS)	2000

The Model 400 units support the Opcode 100 Random Read so it may be used to gather a wide variety of data in a single message. Opcodes 3 and 16 are also used with the SY/MAX devices for performing block reads and writes. Table <example 2 setup 1> shows the QUCM Holding registers for dialing the PLC at 624-8921 and sending a 10 register read from remote register 3020. Table 4-8 shows the QUCM Holding registers for dialing the PLC at 624-8922 and sending a single register write to remote register 205.

Table 4-7 Holding Registers for PLC 1 Write

PLC Register	Description	Values
4x00001	Command Bitmap	3 (bit 16 and bit 15)
4x0002	Dialing Digit Count	7
4x0003	Digits 1234	6248 (hex)
4x0004	Digits 5678	9210 (hex)
4x0005	Digits 9012	0000 (hex)
4x0006	Digits 3456	0000 (hex)
4x0007	Slave Address	0
4x0008	Modbus Opcode	3 = Read Registers (4x)
4x0009	Register Count	10
4x0010	Starting Register	3020

Table 4-8 Holding Map for PLC 2 Read

PLC Register	Description	Values
4x00001	Command Bitmap	3 (bit 16 and bit 15)
4x0002	Dialing Digit Count	7
4x0003	Digits 1234	6248 (hex)
4x0004	Digits 5678	9220 (hex)
4x0005	Digits 9012	0000 (hex)
4x0006	Digits 3456	0000 (hex)
4x0007	Slave Address	0
4x0008	Modbus Opcode	16 = Write Registers (4x)
4x0009	Register Count	1
4x0010	Starting Register	205
4x0011	Write Data	xxxx

5
Troubleshooting

Module Lights

The QUCM has several lights that indicate the status of the module. Table 5-1 shows the meanings of these lights.

Table 5-1 Module Lights

Light	Meaning
Fault	The module has a catastrophic fault.. Call the factory.
Active	This light will be on if the module is in a traffic-copped slot in a Quantum PLC system and the PLC is in RUN.
Ready	This light should always be on (as long as it isn't in firmware load).
Run	This light will be on if the module is in a traffic-copped slot in a Quantum PLC system and the PLC is in RUN.
Col	Comes on when an Ethernet collision occurs.
Lnk	Is on when LINK is established on the 10BaseT port.
TXE	Comes on when the module is transmitting on the Ethernet port.
RXE	Comes on when the module is receiving on the Ethernet port.
RN1	This light should be on to indicate app1 is running.
TX1	Comes on when the module is transmitting on serial port 1.
RX2	Comes on when the module is receiving on serial port 1.
RN2	This light should not come on since there is no app2 loaded.
TX1	Comes on when the module is transmitting on serial port 1.
RX2	Comes on when the module is receiving on serial port 1.

User Lights

The QUCM-SE has 10 application driven lights numbered 1-10. The meaning of these lights while the APP1 program is running is shown in Table 5-2.

Table 5-2 User Light Definitions

Light	Meaning
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	