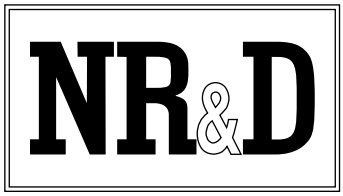
QUCM Elliott Flow Computer

Installation and Programming Manual

This Manual describes the QUCM application for interfacing an Elliott Flow Computer to a Modbus/TCP system.

Effective: 27 July, 2001



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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 protocols. This document covers an application that allows an Elliott Master/Prover Computer to be accessed as a Modbus/TCP compatible device. The QUCM emulates a Perkin Elmer Computer to have controlling access to the flow computer data.

Two applications are required to be loaded into the QUCM: app1.qcm is the Elliott Flow Computer serial driver and Modbus/TCP server, app2.qcm is the web server used for configuration and data display. Both of these applications must be running for the system to properly perform.

Port 1 of the QUCM is to be connected with an RS-232 cable to the Elliott Master/Prover Computer. The Elliott Flow Computer provides an ASCII serial interface to up to 15 flow computers. The data is accessed via Modbus/TCP by selecting the Destination Index 1.

Port 2 may be configured as a combination PNIM/Modbus RTU master to support a string of PowerLogic and/or Modbus RTU slaves. Up to 32 slaves may attached to the QUCM. They must be assigned unique drop numbers between 1 and 32. These devices are accessed by Modbus/TCP Destination Indices 101 through 132.

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

The QUCM-LE will support up to 6 simultaneous Modbus/TCP clients for access to the Elliott Flow Computer data and PowerLogic/Modbus data.

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 ELLIOTT.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 ELLIOTT.ZIP file is located at

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

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

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

Serial Connections to the QUCM-LE

Port 1 to Elliott Flow Computer

Port 1 of the QUCM-LE is set to RS-232 so a simple cable is required to connect to the Elliott Flow Computer. Use the Niobrara CS215 cable to connect the QUCM-LE to the Elliott Flow Computer (See Figure 2-1).

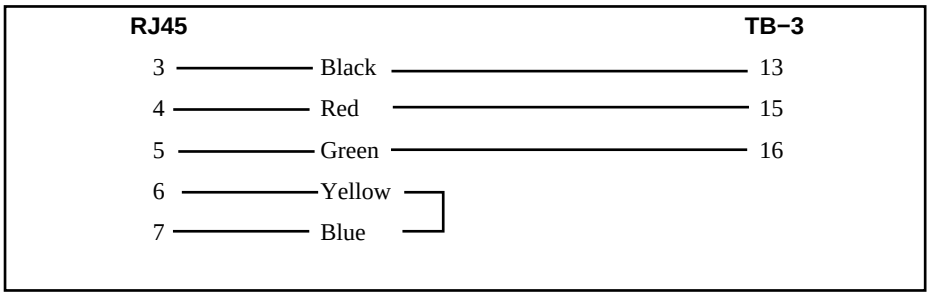

Figure 2-1 QUCM-LE to RS-232 Port (Screw Terminal) (CS215 Cable)

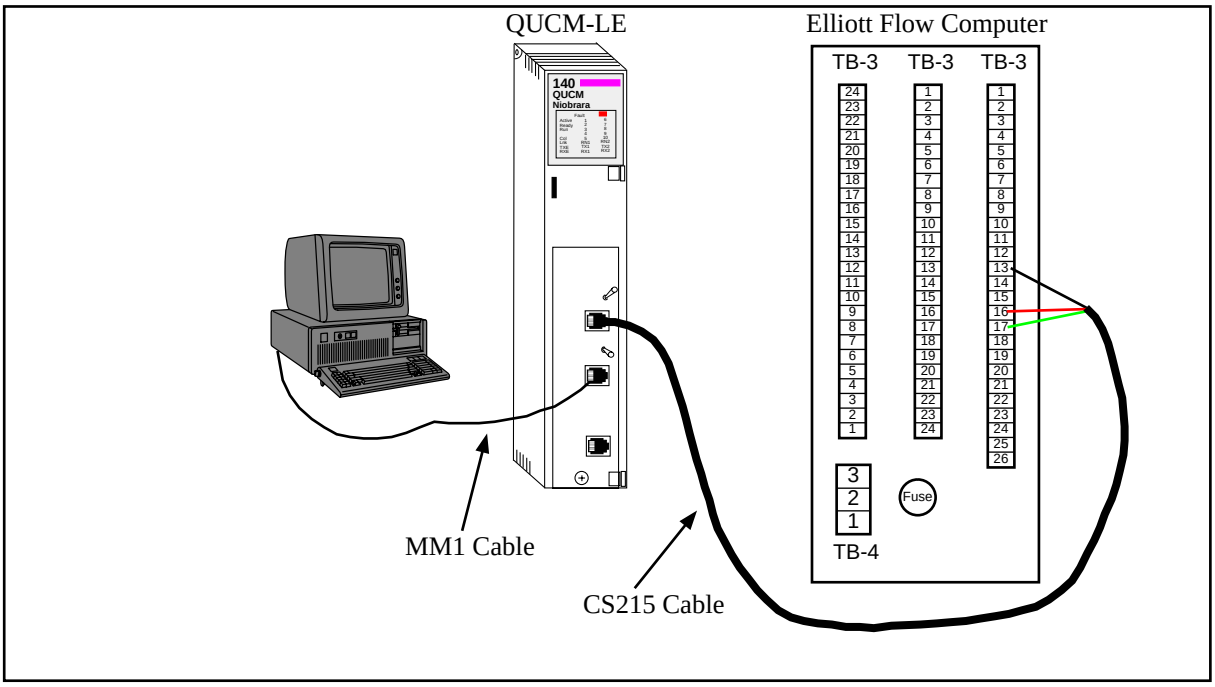

Figure 2-2 QUCM-LE Layout

Port 2 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-LE. The Niobrara MM1 cable may be used for this connection. This cable is shown in Figure 2-3.

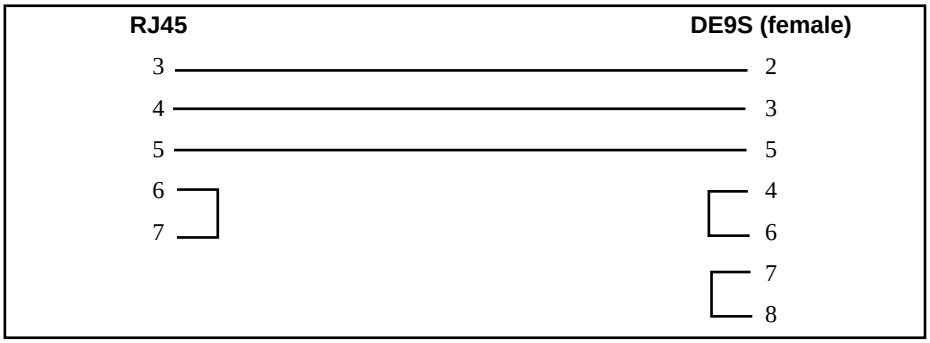

Figure 2-3 QUCM-LE to RS-232 PC DCE Port (9-pin) (MM1 Cable)

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 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 Load the APP2 file with qload.

```
> qload 2 app2 206.223.51.150:503 -a
```

Will load the file into application 2's flash and set the program to automatically start on power-up.

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

9 Place Switch 2 in RUN. The RN2 light should come on.

Configure the application by connecting a web broswer to the IP address of the QUCM-LE

3

Modbus/TCP Operation

Slave Address

The QUCM serves the Elliott data on Modbus Slave Address 1. The QUCM will always respond to slave address 1; even if it cannot communicate with the Elliott computer. The QUCM provides communication status registers that indicate the state of the flow computer.

The QUCM optionally supports a network of POWERLOGIC and/or Modbus RTU slaves on port 2. These devices are addressed as Modbus/TCP slaves 101 through 132. The QUCM subtracts 100 from the slave address before it transmits the message. Therefore, address the slaves as devices 1 through 32.

Register List

The data from the Elliott device is presented as Modbus Holding Registers (4x). Modbus function codes 03 and 100 for reading and opcodes 6 and 16 for writes.

Most data is presented as signed 16-bit integers. Values with two holding registers are 32-bit integers where the first register is bits 0-15 and the second register is bits 16-31. Many items have implied fixed decimal places and are indicated by notes of (times 1000) for example.

Unused registers are returned with the hex value x8000.

General Status Registers

The General Status registers are located in 4x registers 1, 2, and 3 and repeated at registers 997, 998, 999, and 1997, 1998, 1999, and 2997, 2998, 2999.

Table 3-1 General Status Register List

Modbus/TCP Register	Description	Notes
1, 997, 1997, 2997	General Poll Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
2, 998, 1998, 2998	Poll Count	Number of polled devices (1-15)
3, 999, 1999, 2999	Master Status	0 = Prover ready 1 = Prover busy with manual proof. 2 = Prover busy with automatic proof. 3 = Automatic proof complete.

Current Data

The Elliott device provides current data for all polled flow computers. There are two types of flow computers: Type ’A’ and Type ’B’. Type ’A’ and ’B’ computers have different data sets reported. The QUCM application maps the data from each possible device into 15 blocks of data starting at Holding Register 2001. Each block consists of 34 registers. The Type ’A’ mapping is shown in Table 3-2 while the Type ’B’ mapping is in Table 3-3. The mapping is determined by the value of the second register in each block. If the value is decimal 10 then the data is for a Type ’A’, 11 for ’B’.

Table 3-2 Type A Current Data (N=1 to 15)

Modbus/TCP Register	Description	Notes
1001 + ((N-1)*34)	Flow Computer ID	0-999
1002 + ((N-1)*34)	Flow Computer Type	10 = Type A, 11 = Type B
1003 + ((N-1)*34)	Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
1004 + ((N-1)*34)	Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
1005 + ((N-1)*34)	Fwd. Data Type	0 = Current Data, 1 = 12AM or Batch End Data
1006 + ((N-1)*34)	Fwd. Meter Run Temperature	Degrees F (times 10)
1007 + ((N-1)*34), 1008 + ((N-1)*34)	Fwd. Meter Run Pressure	PSIG (times 10)
1009 + ((N-1)*34), 1010 + ((N-1)*34)	Fwd. Meter Run Density	Gr/CC (times 1000)
1011 + ((N-1)*34)	Flowmeter #1 Fwd. ID	(0-999)
1012 + ((N-1)*34), 1013 + ((N-1)*34)	Flowmeter #1 Fwd. Brls	Brls (times 10)
1014 + ((N-1)*34)	Flowmeter #2 Fwd. ID	(0-999)
1015 + ((N-1)*34), 1016 + ((N-1)*34)	Flowmeter #2 Fwd. Brls	Brls (times 10)
1017 + ((N-1)*34)	Flowmeter #3 Fwd. ID	(0-999)
1018 + ((N-1)*34), 1019 + ((N-1)*34)	Flowmeter #3 Fwd. Brls	Brls (times 10)
1020 + ((N-1)*34)	Rev.. Data Type	0 = Current Data, 1 = 12AM or Batch End Data
1021 + ((N-1)*34)	Rev. Meter Run Temperature	Degrees F (times 10)
1022 + ((N-1)*34), 1023 + ((N-1)*34)	Rev. Meter Run Pressure	PSIG (times 10)
1024 + ((N-1)*34), 1025 + ((N-1)*34)	Rev. Meter Run Density	Gr/CC (times 1000)
1026 + ((N-1)*34)	Flowmeter #1 Rev. ID	(0-999)
1027 + ((N-1)*34), 1028 + ((N-1)*34)	Flowmeter #1 Rev. Brls	Brls (times 10)
1029 + ((N-1)*34)	Flowmeter #2 Rev. ID	(0-999)
1030 + ((N-1)*34), 1031 + ((N-1)*34)	Flowmeter #2 Rev Brls	Brls (times 10)
1032 + ((N-1)*34)	Flowmeter #3 Rev. ID	(0-999)
1033 + ((N-1)*34), 1034 + ((N-1)*34)	Flowmeter #3 Rev Brls	Brls (times 10)

Table 3-3 Type B Current Data (N=1 to 15)

Modbus/TCP Register	Description	Notes
1001 + ((N-1)*34)	Flow Computer ID	0-999
1002 + ((N-1)*34)	Flow Computer Type	10 = Type A
1003 + ((N-1)*34)	#1 Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
1004 + ((N-1)*34)	#1 Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
1005 + ((N-1)*34)	Data Type	0 = Current Data, 1 = 12AM or Batch End Data
1006 + ((N-1)*34)	Meter Run #1 Temperature	Degrees F (times 10)
1007 + ((N-1)*34), 1008 + ((N-1)*34)	Meter Run #1 Pressure	PSIG (times 10)
1009 + ((N-1)*34), 1010 + ((N-1)*34)	Meter Run #1 Density	Gr/CC (times 1000)
1011 + ((N-1)*34)	Flowmeter #1 ID	(0-999)
1012 + ((N-1)*34), 1013 + ((N-1)*34)	Flowmeter #1 Fwd. Brls	Brls (times 10)
1014 + ((N-1)*34)	Meter Run #2 Temperature	Degrees F (times 10)
1015 + ((N-1)*34), 1016 + ((N-1)*34)	Meter Run #2 Pressure	PSIG (times 10)
1017 + ((N-1)*34), 1018 + ((N-1)*34)	Meter Run #2 Density	Gr/CC (times 1000)
1019 + ((N-1)*34)	Flowmeter #2 ID	(0-999)
1020 + ((N-1)*34), 1021 + ((N-1)*34)	Flowmeter #2 Fwd. Brls	Brls (times 10)
1022 + ((N-1)*34) through 1034 + ((N-1)*34)	Forced to the value 0.	

12AM Data

The Elliott device provides 12AM data for all polled flow computers. There are two types of flow computers: Type ’A’ and Type ’B’. Type ’A’ and ’B’ computers have different data sets reported. The QUCM application maps the data from each possible device into 15 blocks of data starting at Holding Register 2001. Each block consists of 62 registers. The Type ’A’ mapping is shown in Table 3-4 while the Type ’B’ mapping is in Table 3-5. The mapping is determined by the value of the second register in each block. If the value is decimal 10 then the data is for a Type ’A’, 11 for ’B’.

Table 3-4 Type A 12AM Data (N=1 to 15)

Modbus/TCP Register	Description	Notes
2001 + ((N-1)*62)	Flow Computer ID	0-999
2002 + ((N-1)*62)	Flow Computer Type	10 = Type A, 11 = Type B
2003 + ((N-1)*62)	Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
2004 + ((N-1)*62)	Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
2005 + ((N-1)*62), 2006 + ((N-1)*62)	Gross Inventory Brls	(times 10)
2007 + ((N-1)*62), 2008 + ((N-1)*62)	Inventory Mass KLBs	(times 100)
2009 + ((N-1)*62)	Fwd. Meter Run FWA Temperature	Degrees F (times 10)
2010 + ((N-1)*62), 2011 + ((N-1)*62)	Fwd. Meter Run FWA Pressure	PSIG (times 10)
2012 + ((N-1)*62), 2013 + ((N-1)*62)	Fwd. Meter Run FWA Density	Gr/CC (times 1000)
2014 + ((N-1)*62)	Fwd. FWA Densitometer Temperature	Degrees F (times 10)
2015 + ((N-1)*62)	Flowmeter #1 Fwd. ID	(0-999)
2016 + ((N-1)*62), 2017 + ((N-1)*62)	Flowmeter #1 Fwd. M.F.	(times 100000)
2018 + ((N-1)*62), 2019 + ((N-1)*62)	Flowmeter #1 Fwd. Brls	(times 10)
2020 + ((N-1)*62), 2021 + ((N-1)*62)	Flowmeter #1 Fwd. KLBs	(times 100)
2022 + ((N-1)*62)	Flowmeter #2 Fwd. ID	(0-999)
2023 + ((N-1)*62), 2024 + ((N-1)*62)	Flowmeter #2 Fwd. M.F.	(times 100000)
2025 + ((N-1)*62), 2026 + ((N-1)*62)	Flowmeter #2 Fwd. Brls	Brls (times 10)
2027 + ((N-1)*62), 2028 + ((N-1)*62)	Flowmeter #2 Fwd. KLBs	(times 100)
2029 + ((N-1)*62)	Flowmeter #3 Fwd. ID	(0-999)
2030 + ((N-1)*62), 2031 + ((N-1)*62)	Flowmeter #3 Fwd. M.F.	(times 100000)
2032 + ((N-1)*62), 2033 + ((N-1)*62)	Flowmeter #3 Fwd. Brls	(times 10)
2034 + ((N-1)*62), 2035 + ((N-1)*62)	Flowmeter #3 Fwd. KLBs	(times 100)
2036 + ((N-1)*62)	Rev. Meter Run FWA Temperature	Degrees F (times 10)
2037 + ((N-1)*62), 2038 + ((N-1)*62)	Rev. Meter Run FWA Pressure	PSIG (times 10)
2039 + ((N-1)*62), 2040 + ((N-1)*62)	Rev. Meter Run FWA Density	Gr/CC (times 1000)
2041 + ((N-1)*62)	Rev. FWA Densitometer Temperature	Degrees F (times 10)
2042 + ((N-1)*62)	Flowmeter #1 Rev. ID	(0-999)
2043 + ((N-1)*62), 2044 + ((N-1)*62)	Flowmeter #1 Rev. M.F.	(times 100000)
2045 + ((N-1)*62), 2046 + ((N-1)*62	Flowmeter #1 Rev. Brls	(times 10)
2047 + ((N-1)*62), 2048 + ((N-1)*62)	Flowmeter #1 Rev. KLBs	(times 100)

2049 + ((N-1)*62)	Flowmeter #2 Rev. ID	(0-999)
2050 + ((N-1)*62), 2051 + ((N-1)*62)	Flowmeter #2 Rev. M.F.	(times 100000)
2052 + ((N-1)*62), 2053 + ((N-1)*62)	Flowmeter #2 Rev Brls	Brls (times 10)
2054 + ((N-1)*62), 2055 + ((N-1)*62)	Flowmeter #2 Rev. KLBs	(times 100)
2056 + ((N-1)*62)	Flowmeter #3 Rev. ID	(0-999)
2057 + ((N-1)*62), 2058 + ((N-1)*62)	Flowmeter #3 Rev. M.F.	(times 100000)
2059 + ((N-1)*62), 2060 + ((N-1)*62)	Flowmeter #3 Rev Brls	(times 10)
2061 + ((N-1)*62), 2062 + ((N-1)*62)	Flowmeter #3 Rev. KLBs	(times 100)

Table 3-5 Type B 12AM Data Block (N=1 through 15)

Modbus/TCP Register	Description	Notes
2001 + ((N-1)*62)	Flow Computer ID	0-999
2002 + ((N-1)*62)	Flow Computer Type	11 = Type B
2003 + ((N-1)*62)	#1 Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
2004 + ((N-1)*62)	#1 Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
2005 + ((N-1)*62)	Meter Run #1 FWA Temperature	Degrees F (times 10)
2006 + ((N-1)*62), 2007 + ((N-1)*62)	Meter Run #1 FWA Pressure	PSIG (times 10)
2008 + ((N-1)*62), 2009 + ((N-1)*62)	Meter Run #1 FWA Density	Gr/CC (times 1000)
2010 + ((N-1)*62)	Densitometer Meter Run #1 FWA Temperature	Degrees F (times 10)
2011 + ((N-1)*62)	Flowmeter #1 Fwd. ID	(0-999)
2012 + ((N-1)*62), 2013 + ((N-1)*62)	Flowmeter #1 Fwd. M.F.	Brls (times 10000)
2014 + ((N-1)*62), 2015 + ((N-1)*62)	Flowmeter #1 Fwd. Brls	Brls (times 10)
2016 + ((N-1)*62), 2017 + ((N-1)*62)	Flowmeter #1 Fwd. KLBS	KLBS (times 100)
2018 + ((N-1)*62)	#2 Alarm Status	Same as above
2019 + ((N-1)*62)	#2 Transducer Fail Status	Same as above
2020 + ((N-1)*62)	Meter Run #2 FWA Temperature	Degrees F (times 10)
2021 + ((N-1)*62), 2022 + ((N-1)*62)	Meter Run #2 FWA Pressure	PSIG (times 10)
2023 + ((N-1)*62), 2024 + ((N-1)*62)	Meter Run #2 FWA Density	Gr/CC (times 1000)
2025 + ((N-1)*62)	Densitometer Meter Run #2 FWA Temperature	Degrees F (times 10)
2026 + ((N-1)*62)	Flowmeter #2 Fwd. ID	(0-999)
2027 + ((N-1)*62), 2028 + ((N-1)*62)	Flowmeter #2 Fwd. M.F.	(times 10000)
2029 + ((N-1)*62), 2030 + ((N-1)*62)	Flowmeter #2 Fwd. Brls	Brls (times 10)
2031 + ((N-1)*62), 2032 + ((N-1)*62)	Flowmeter #2 Fwd. KLBS	KLBS (times 100)
2033 + ((N-1)*62) through 2062 + ((N-1)*62)	Forced to the value 0.	

Latest Proof Data

The Elliott device provides latest proof data for five runs. The QUCM application maps the data starting at Holding Register 3001.

Table 3-6 Latest Proof Data

Modbus/TCP Register	Description	Notes
3001	Prover Type	0 = compact, 1 = pipe
3002	Flow Computer ID	
3003	Flowmeter ID	
3004, 3005	Base 60 Deg. Volume Brls	(times 100000)

Table 3-7 Latest Proof Data (Runs 1 through 5)

Modbus/TCP Register	Description	Notes
3006, 3007	Prove 1 Flowrate	Brls/Hr (times 10)
3008, 3009	Prove 1 Flowmeter Counts	(times 1000)
3010	Prove 1 Flowmeter FWA Temperature	Degrees F (times 10)
3011, 3012	Prove 1 Flowmeter FWA Pressure	PSIG (times 10)
3013	Prove 1 Prover FWA Temperature	(times 10)
3014, 3015	Prove 1 Prover FWA Pressure	PSIG (times 10)
3016	Prove 1 Prover Invar Rod FWA Temperature	Degrees F (times 10)
3017, 3018	Prove 2 Flowrate	Brls/Hr (times 10)
3019, 3020	Prove 2 Flowmeter Counts	(times 1000)
3021	Prove 2 Flowmeter FWA Temperature	Degrees F (times 10)
3022, 3023	Prove 2 Flowmeter FWA Pressure	PSIG (times 10)
3024	Prove 2 Prover FWA Temperature	(times 10)
3025, 3026	Prove 2 Prover FWA Pressure	PSIG (times 10)
3027	Prove 2 Prover Invar Rod FWA Temperature	Degrees F (times 10)
3028, 3029	Prove 3 Flowrate	Brls/Hr (times 10)
3030, 3031	Prove 3 Flowmeter Counts	(times 1000)
3032	Prove 3 Flowmeter FWA Temperature	Degrees F (times 10)
3033, 3034	Prove 3 Flowmeter FWA Pressure	PSIG (times 10)
3035	Prove 3 Prover FWA Temperature	(times 10)
3036, 3037	Prove 3 Prover FWA Pressure	PSIG (times 10)
3038	Prove 3 Prover Invar Rod FWA Temperature	Degrees F (times 10)
3039, 3040	Prove 4 Flowrate	Brls/Hr (times 10)
3041, 3042	Prove 4 Flowmeter Counts	(times 1000)
3043	Prove 4 Flowmeter FWA Temperature	Degrees F (times 10)
3044, 3045	Prove 4 Flowmeter FWA Pressure	PSIG (times 10)
3046	Prove 4 Prover FWA Temperature	(times 10)
3047, 3048	Prove 4 Prover FWA Pressure	PSIG (times 10)
3049	Prove 4 Prover Invar Rod FWA Temperature	Degrees F (times 10)
3050, 3051	Prove 4 Flowrate	Brls/Hr (times 10)
3052, 3053	Prove 5 Flowmeter Counts	(times 1000)
3054	Prove 5 Flowmeter FWA Temperature	Degrees F (times 10)
3055, 3056	Prove 5 Flowmeter FWA Pressure	PSIG (times 10)
3057	Prove 5 Prover FWA Temperature	(times 10)
3058, 3059	Prove 5 Prover FWA Pressure	PSIG (times 10)
3060	Prove 5 Prover Invar Rod FWA Temperature	Degrees F (times 10)

Clock Set

The clock in the Elliott device may be set through the QUCM. The QUCM application maps the time to set starting at Holding Register 4000. To set the time, load the current seconds, minutes, hour, day, month, and year into the appropriate register and then set bit 0 of the command register. It may take on the order of 1 minute from the time that the command bit is set before the QUCM is ready to set the time in the Elliott device. The QUCM application runs a software TOD clock to keep the time current while waiting for the update. The command bit 0 will be cleared by the QUCM after the command is sent. The error status will be updated when the command bit is zeroed.

Table 3-8 Clock Set

Modbus/TCP Register	Description	Notes
4000	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
4001	Seconds	0-59
4002	Minutes	0-59
4003	Hours	0-23
4004	Day	1-31
4005	Month	1-12
4006	Year	1900+
4007	Command	Set bit 0 ON to set the clock. QUCM clears this bit when command sent.

Request Batch End

The currently running batch may be canceled by requesting a batch end. The QUCM application maps the time to set starting at Holding Register 5000. To request the batch end, set the flow computer type, flow computer ID, and flowmeter IDs. Unused IDs must be set to zero. Set bit 0 of the command register to send the request. It may take on the order of 1 minute from the time that the command bit is set before the QUCM is able to send the request. The command bit 0 will be cleared by the QUCM after the command is sent. The error status will be updated when the command bit is zeroed.

Table 3-9 Request Batch End

Modbus/TCP Register	Description	Notes
5000	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
5001	Flow Computer Type	10 = ’A’, 11 = ’B’
5002	Flow Computer ID	
5003	Flowmeter ’A’ ID	
5004	Flowmeter ’B’ ID	Set to 0 if not used.
5005	Flowmeter ’C’ ID	Set to 0 if not used.
5006	Command	Set bit 0 ON to end the batch. QUCM clears this bit when command sent.

Prove a Specific Flowmeter

The currently running batch may be canceled by requesting a batch end. The QUCM application maps the setup starting at Holding Register 5000. To request the batch end, set the flow computer type, flow computer ID, and flowmeter IDs. Unused IDs must be set to zero. Set bit 0 of the command register to send the request. It may take on the order of 1 minute from the time that the command bit is set before the QUCM is able to send the request. The command bit 0 will be cleared by the QUCM after the command is sent. The error status will be updated when the command bit is zeroed.

Table 3-10 Prove A Specific Flowmeter

Modbus/TCP Register	Description	Notes
6000	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
6001	Flow Computer Type	10 = 'A', 11 = 'B'
6002	Flow Computer ID	
6003	Flowmeter ID	
6004	Command	Set bit 0 ON to Prove a specific flowmeter. QUCM clears this bit when command sent.

Abort Prove in Progress

The currently running prove may be canceled. The QUCM application maps the setup starting at Holding Register 6000. To request the abort, set bit 0 of the command register to send the request. It may take on the order of 1 minute from the time that the command bit is set before the QUCM is able to send the request. The command bit 0 will be cleared by the QUCM after the command is sent. The error status will be updated when the command bit is zeroed.

Table 3-11 Abort Prove in Progress

Modbus/TCP Register	Description	Notes
6009	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
6010	Command	Set bit 0 ON to abort the prove. QUCM clears this bit when command sent.

Initialize All Flags

The QUCM application maps the setup starting at Holding Register 6011. To request the flag initialization, set bit 0 of the command register to send the request. It may take on the order of 1 minute from the time that the command bit is set before the QUCM is able to send the request. The command bit 0 will be cleared by the QUCM after the command is sent. The error status will be updated when the command bit is zeroed.

Table 3-12 Initialize All Flags

Modbus/TCP Register	Description	Notes
6011	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
6012	Command	Set bit 0 ON to initialize all Flags. QUCM clears this bit when command sent.

Last Batch End Data

The data for the last batch end may be requested. The data returned is in the same structure as 12AM data so the QUCM stores it a device 16 in registers 2931 through 2992.

Table 3-13 Request Last Batch End Data

Modbus/TCP Register	Description	Notes
6000	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
6001	Flow Computer Type	10 = ’A’, 11 = ’B’
6002	Flow Computer ID	
6003	Flowmeter ’A’ ID	
6004	Flowmeter ’B’ ID	Set to 0 if not used.
6005	Flowmeter ’C’ ID	Set to 0 if not used.
6006	Command	Set bit 0 ON to end the batch. QUCM clears this bit when command sent.

Table 3-14 Type A Last Batch Data

Modbus/TCP Register	Description	Notes
2931	Flow Computer ID	0-999
2932	Flow Computer Type	10 = Type A, 11 = Type B
2933	Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
2934	Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
2935, 2936	Gross Inventory Brls	(times 10)
2937, 2938	Inventory Mass KLBs	(times 100)
2939	Fwd. Meter Run FWA Temperature	Degrees F (times 10)
2940, 2941	Fwd. Meter Run FWA Pressure	PSIG (times 10)
2942, 2943	Fwd. Meter Run FWA Density	Gr/CC (times 1000)
2944	Fwd. FWA Densitometer Temperature	Degrees F (times 10)
2945	Flowmeter #1 Fwd. ID	(0-999)
2946, 2947	Flowmeter #1 Fwd. M.F.	(times 100000)
2948, 2949	Flowmeter #1 Fwd. Brls	(times 10)
2050, 2951	Flowmeter #1 Fwd. KLBs	(times 100)
2952	Flowmeter #2 Fwd. ID	(0-999)
2953, 2954	Flowmeter #2 Fwd. M.F.	(times 100000)
2955, 2956	Flowmeter #2 Fwd. Brls	Brls (times 10)
2957, 2958	Flowmeter #2 Fwd. KLBs	(times 100)
2959	Flowmeter #3 Fwd. ID	(0-999)
2960, 2961	Flowmeter #3 Fwd. M.F.	(times 100000)
2962, 2963	Flowmeter #3 Fwd. Brls	(times 10)
2964, 2965	Flowmeter #3 Fwd. KLBs	(times 100)

Table 3-15 Type A Last Batch Reverse Data

Modbus/TCP Register	Description	Notes
2966	Rev. Meter Run FWA Temperature	Degrees F (times 10)
2967, 2968	Rev. Meter Run FWA Pressure	PSIG (times 10)
2969, 2970	Rev. Meter Run FWA Density	Gr/CC (times 1000)
2971	Rev. FWA Densitometer Temperature	Degrees F (times 10)
2972	Flowmeter #1 Rev. ID	(0-999)
2973, 2974	Flowmeter #1 Rev. M.F.	(times 100000)
2975, 2976	Flowmeter #1 Rev. Brls	(times 10)
2977, 2978	Flowmeter #1 Rev. KLBs	(times 100)
2979	Flowmeter #2 Rev. ID	(0-999)
2980, 2981	Flowmeter #2 Rev. M.F.	(times 100000)
2982, 2983	Flowmeter #2 Rev Brls	Brls (times 10)
2984, 2985	Flowmeter #2 Rev. KLBs	(times 100)
2986	Flowmeter #3 Rev. ID	(0-999)
2987, 2988	Flowmeter #3 Rev. M.F.	(times 100000)
2989, 2990	Flowmeter #3 Rev Brls	(times 10)
2991, 2992	Flowmeter #3 Rev. KLBs	(times 100)

Table 3-16 Type B Last Batch End Data Block

Modbus/TCP Register	Description	Notes
2931	Flow Computer ID	0-999
2932	Flow Computer Type	11 = Type B
2933	#1 Alarm Status	B0 = Low Alarm Pressure B1 = Low Alarm Temperature B2 = Low Alarm Density B3 = Low Alarm Density, Temp. B4 = Low Alarm Flow Rate B5,B6,B7 = Low Alarm Reserved B8 = High Alarm Pressure B9 = High Alarm Temperature B10 = High Alarm Density B11 = High Alarm Density, Temp. B12 = High Alarm Flow Rate B13,B14,B15 = High Alarm Reserved
2934	#1 Transducer Fail Status	B0 = Pressure Transducer Failure B1 = Temp. Transducer Failure B2 = Dens. Transducer Failure B3 = Dens. Temp. Transducer Failure B4 = Flow Rate Transducer Failure B5, B6 = Reserved B7 = Communication Failure
2935	Meter Run #1 FWA Temperature	Degrees F (times 10)
2936, 2937	Meter Run #1 FWA Pressure	PSIG (times 10)
2938, 2939	Meter Run #1 FWA Density	Gr/CC (times 1000)
2940	Densitometer Meter Run #1 FWA Temperature	Degrees F (times 10)
2941	Flowmeter #1 Fwd. ID	(0-999)
2942, 2943	Flowmeter #1 Fwd. M.F.	Brls (times 10000)
2944, 2945	Flowmeter #1 Fwd. Brls	Brls (times 10)
2946, 2947	Flowmeter #1 Fwd. KLBS	KLBS (times 100)
2948	#2 Alarm Status	
2949	#2 Transducer Fail Status	
2950	Meter Run #2 FWA Temperature	Degrees F (times 10)
2951, 2952	Meter Run #2 FWA Pressure	PSIG (times 10)
2953, 2954	Meter Run #2 FWA Density	Gr/CC (times 1000)
2955	Densitometer Meter Run #2 FWA Temperature	Degrees F (times 10)
2956	Flowmeter #2 Fwd. ID	(0-999)
2957, 2958	Flowmeter #2 Fwd. M.F.	(times 10000)
2959, 2960	Flowmeter #2 Fwd. Brls	Brls (times 10)
2961, 2962	Flowmeter #2 Fwd. KLBS	KLBS (times 100)
2963 through 2992	Forced to the value 0.	

Download Meter Factor

A new meter factor may be loaded to a given flowmeter. Load the Flow Computer type, Flow Computer ID, Flowmeter ID, and the new meter factor into the 4x7000 registers. Set bit 0 of the command register to load the new factor. Register 7000 will display the error status after the QUCM clears bit 0 of the command register.

Table 3-17 Download Meter Factor

Modbus/TCP Register	Description	Notes
7000	Error Status	1 = No Errors, good communication 2 = Receiving ACK for ENQ and Commands but no reply. 3 = Not receiving ACK for ENQ 20 = No errors encountered. 21 = Invalid Master/Prover ID 22 = Invalid Flow Computer ID 23 = Invalid Flowmeter ID 24 = Invalid Flow Computer Type 25 = End Batch requested before data from a previous batch had been requested. 26 = Prove a Flowmeter requested while the prover was busy. 27 = Invalid Function Code. 28 = No communication with the Flow Computer.
7001	Flow Computer Type	10 = 'A', 11 = 'B'
7002	Flow Computer ID	
7003	Flowmeter ID	
7004, 7005	Meter Factor	32 bit long integer (times 100000)
7006	Command	Set bit 0 ON to end the batch. QUCM clears this bit when command sent.

4

Web Server

Main Page

The Main page displays a summary of the configured flowmeter devices. The table will display the poll entry, Flow computer ID, Flow Computer Type, High Alarm Status, Low Alarm Status, Transducer Fail Status, links to the Current Data and 12AM data.

Figure 4-1 shows an example page with the Elliott polling 15 devices.

At the bottom of the Main page are links to the Latest Prove data, Control for the Elliott, Statistics on this QUCM, and a page for configuring this QUCM.

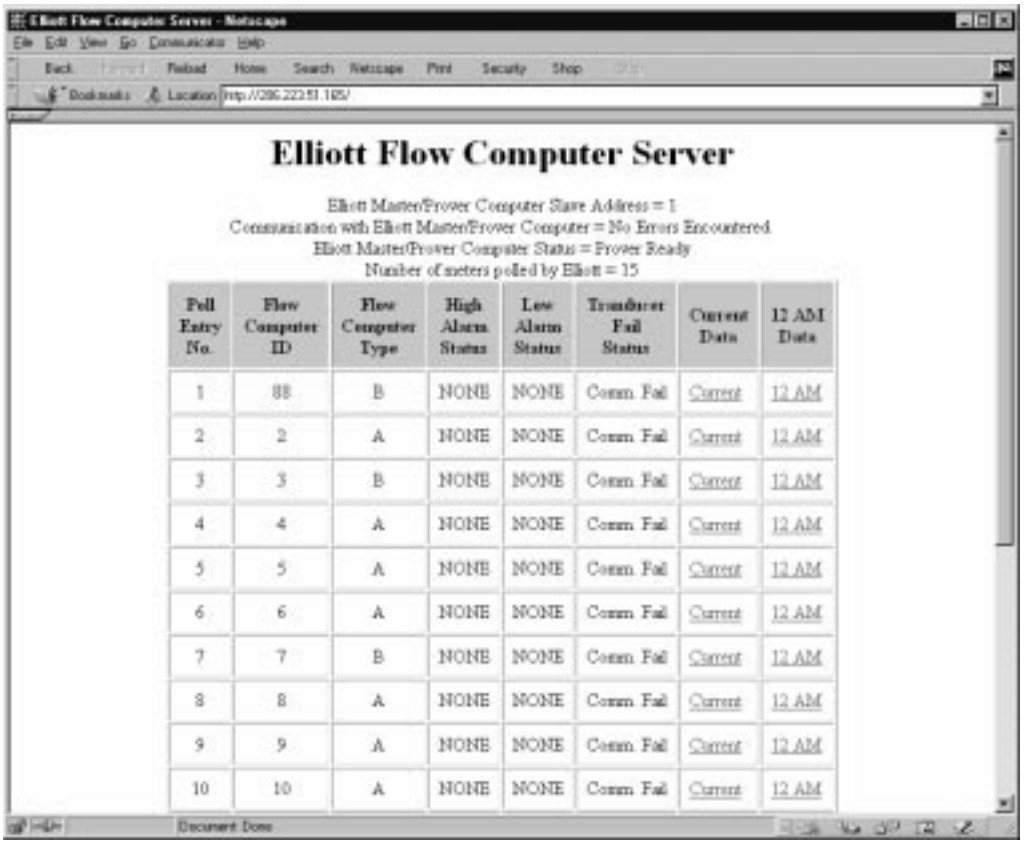

Figure 4-1 Main Web Page

Current Data Page

Following one of the "Current" links will display a table of the data for the particular Elliott Flow Computer device. Figure 4-2 shows a table for a Type B meter. The bottom of the page has links for the next and previous units as well as a direct link to the 12AM data.

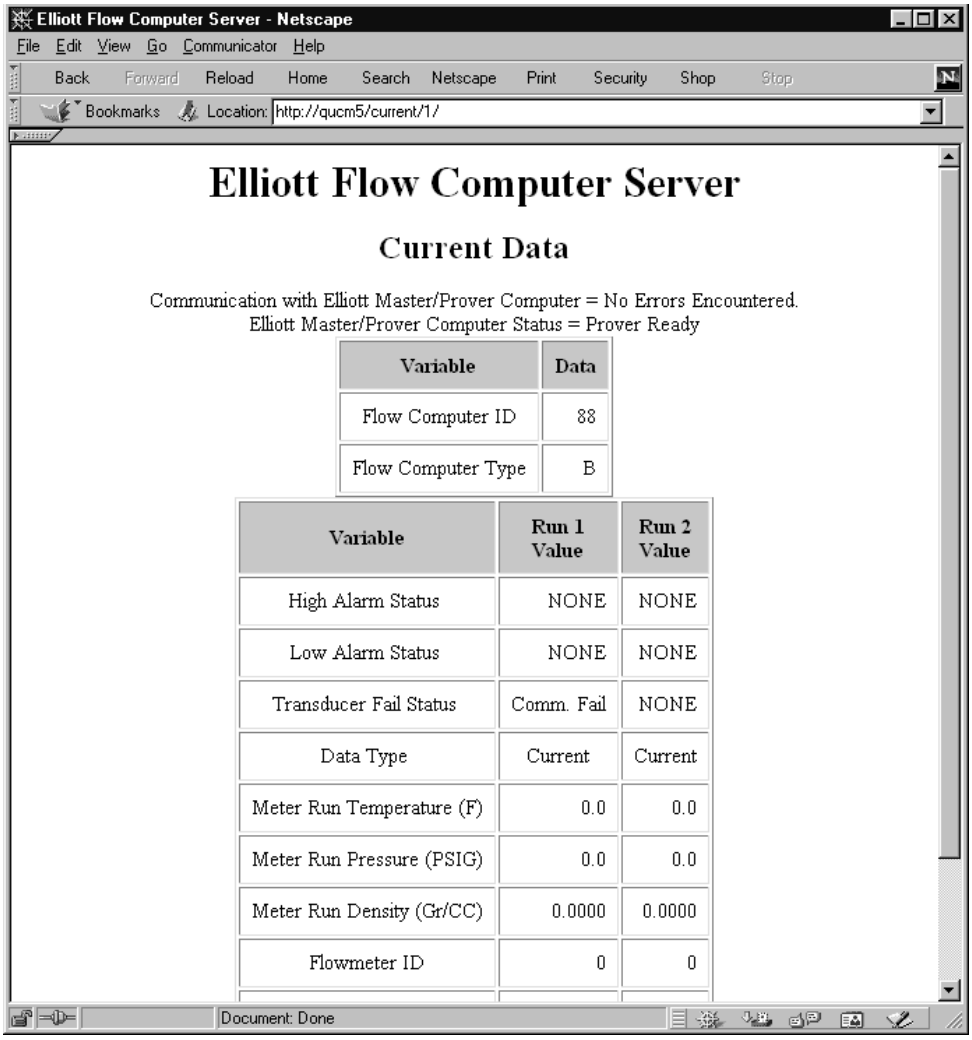

Figure 4-2 Web Server Current Data Page

12AM Data Page

Following one of the "12AM" links will display a table of the data for the particular Elliott Flow Computer device. Figure shows a table 4-3 for a Type B meter. The bottom of the page has links for the next and previous units as well as a direct link to the 12AM data.

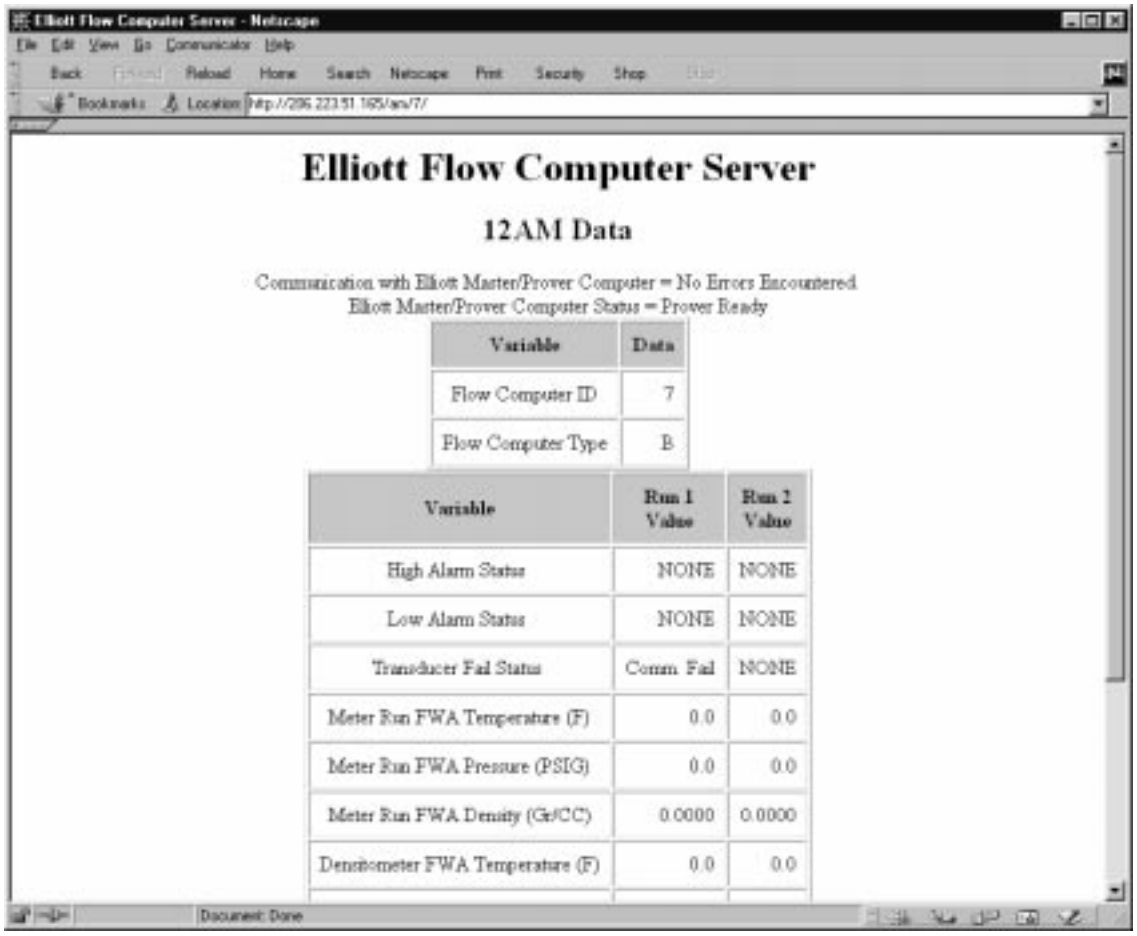

Figure 4-3 Web Server 12AM Data Page

Configure QUCM

At the bottom of the Main page is a link to configure the QUCM. The password may need to be entered before access to this page is granted. The default password is "master" and is case sensitive. Light 9 will come on while the password timer is active.

A link is provided for altering the password. The current password must be verified before the new password is edited. The new password must be entered twice for verification. If it has been longer than three minutes since a password protected setting has been altered then the user will be prompted to enter the password.

NOTE: This password protection is not very secure and is only intended to prevent accidental modification to the QUCM configuration. The user should implement other more stringent protection such as firewalls and isolated networks to ensure the safety of the metered system.

NOTE: Once a password has been accepted by the QUCM, any new user connection will be prompted for the password before allowed to modify settings.

Figure 4-4 Enter Password Page

Links are given to change the Master/Prover slave address, change the QUCM titles, change the password, alter the serial port configuration, and save the configuration to FLASH.

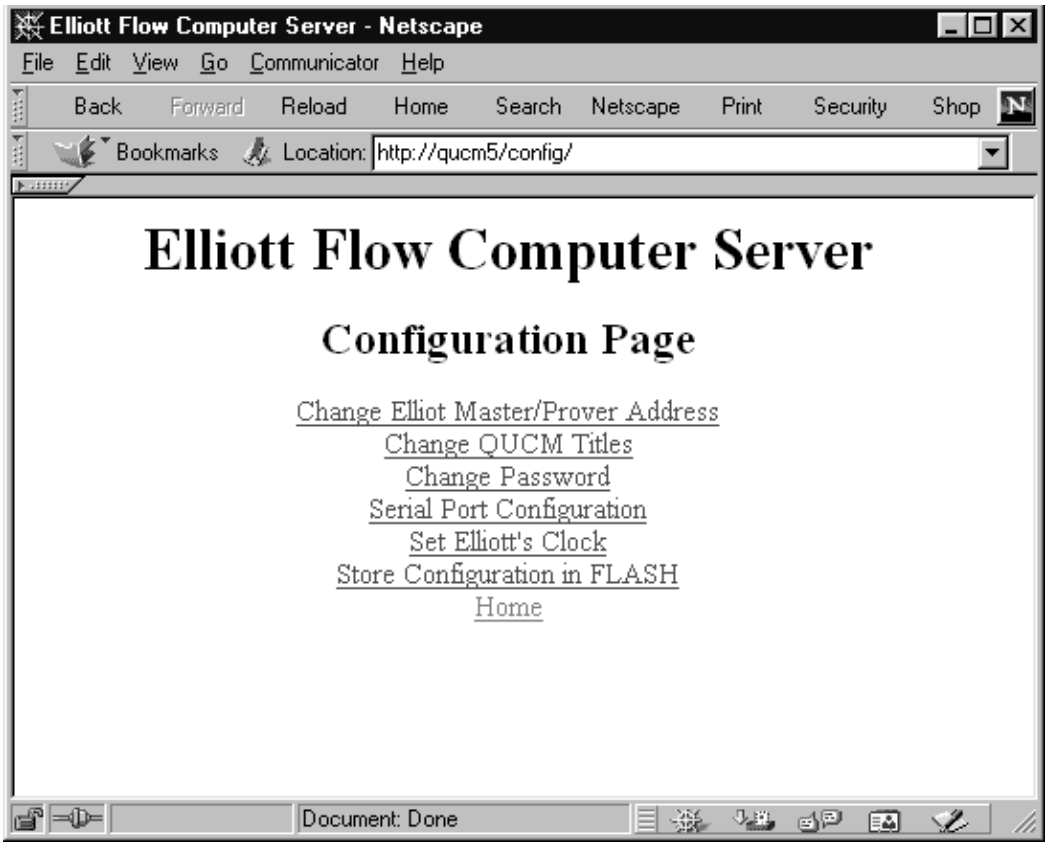

Figure 4-5 Configuration Page

Change Elliott Master/Prover Address

This link edits the slave address of the Elliott to which the QUCM is connected. A screen like Figure 4-6 is displayed. There is a text field for the slave address of the Master/Prover. The field will display the currently assigned number.

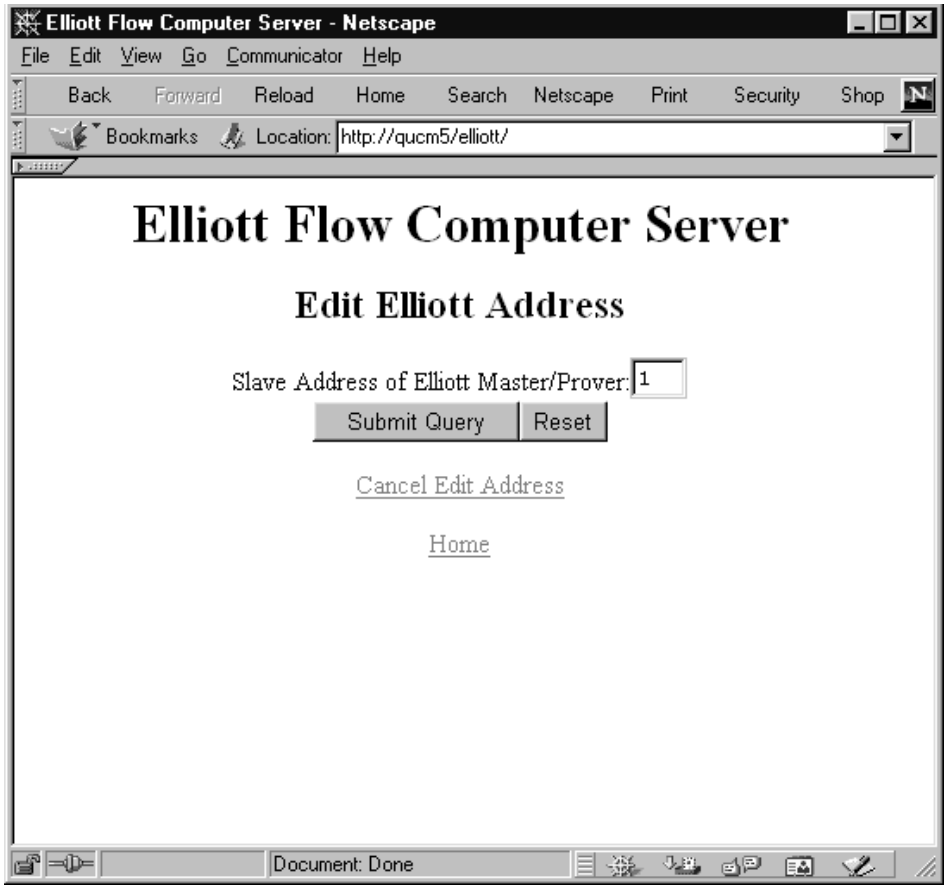

Figure 4-6 Elliott Slave Address

Serial Port Configuration

The Serial Port Configuration page allows the altering of the baud rates of QUCM Port 2, the Protocol of Port 2, and the Parity of Port 2.

Port 1 is fixed as an Perkin-Elmer Master. Its parity is fixed at EVEN and the baud rate is fixed at 2400.

Port 2 may be set to PNIM/RTU Master, PNIM Master, Modbus RTU Master, PLOGIC Master, and RTU Slave. Its parity may be set to EVEN or NONE and its baud rate may be set to 1200, 2400, 4800, 9600, or 19200

When Port 2 is in PNIM/RTU, RTU Master, or PLOGIC, it accepts Modbus/TCP queries to Destination Idices 101 through 132 and passes the messages out to either PNIM or Modbus RTU slaves 1 through 32. The QUCM will automatically determine the proper protocol for the each of the possible 32 slaves.

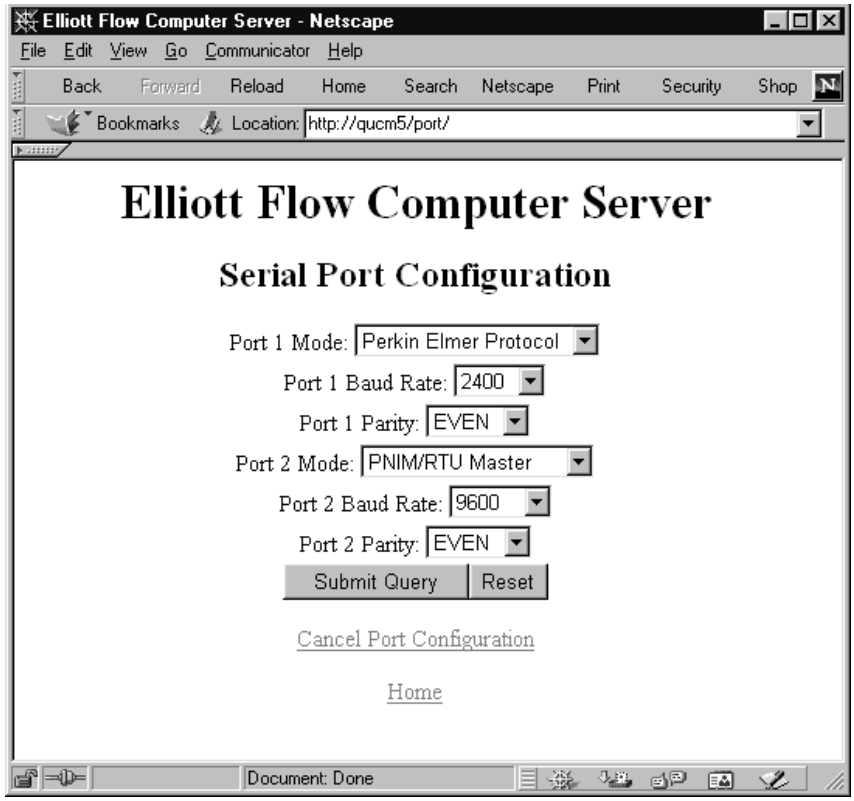

Figure 4-7 Serial Port Page

Save Settings to FLASH

After completion of the configuration, be sure to save the settings to flash. Otherwise the modifications will be lost on the next power cycle of the QUCM. Once the settings are saved to flash, the QUCM's configuration, including its IP settings, will be safe indefinitely.

Elliott Control

The link at the bottom of the main page for Elliott Control allows complete control of all the Flow Computer functions from the Web interface. The user may set the Elliott clock, request a batch end, prove a specific flowmeter, abort a prove in progress, initialize all flags, download a new meter factor, request and view last batch end data for a specific flowmeter.

A password is required before entering any of these pages. The password is the same as the configuration password.

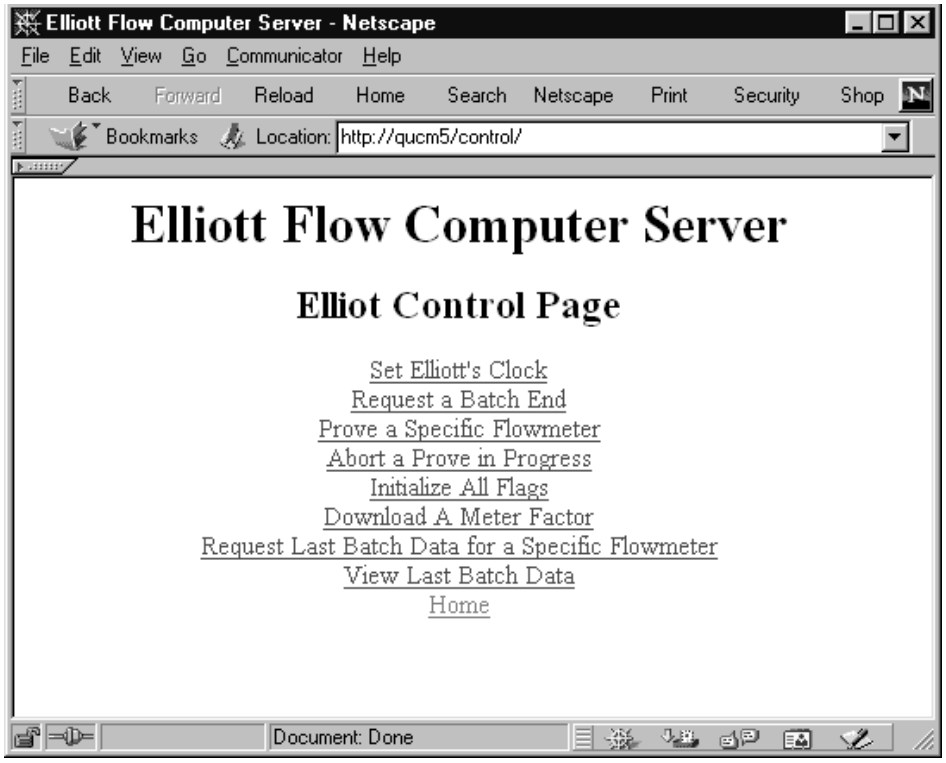

Figure 4-8 Elliott Control Page

Statistics Page

At the bottom of the Main page is a link to some statistical information about this QUCM. (See Figure 4-9)

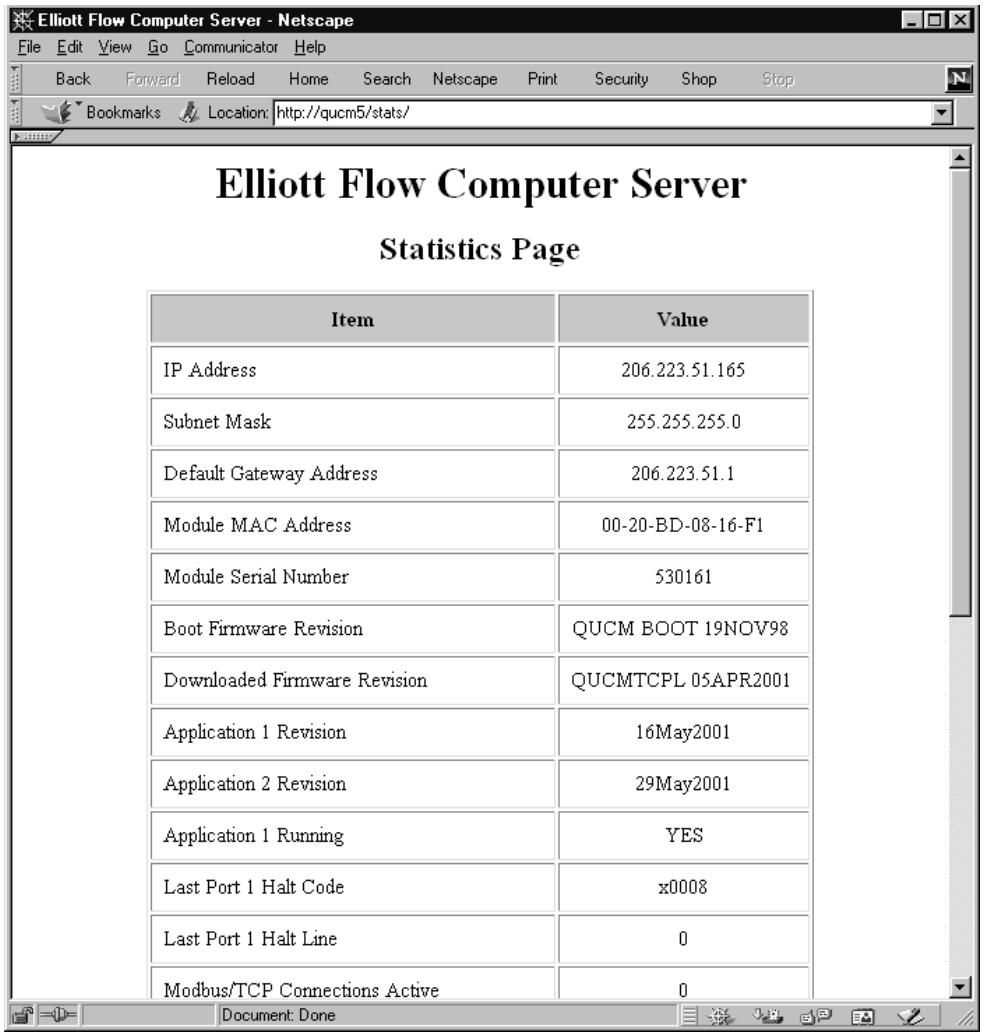

Figure 4-9 Statistics Web Page