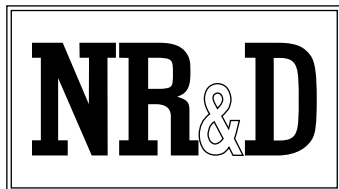# QUCM Landis+Gyr DGCOM

Installation and Programming Manual

This Manual describes the QUCM application for interfacing a Domino Printer to a Modicon Quantum PLC system.

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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 protocols. This document covers an application provides KWh data from Landis+Gyr AXS4 electric meters via the DGCOM protocol to a Modbus system. The Modbus data is provided via serial Modbus RTU or Modbus ASCII and Ethernet using Modbus/TCP.

The QUCM-OE is mounted stand-alone in the Niobrara QXBP-002 rack or other Modicon Quantum PLC rack. The DGCOM networks may be connected to QUCM port 1 and optionally port 2.

The QUCM provides the KWh values as a 32-bit unsigned integer using two Modbus Holding (4x) registers per meter. Up to 100 virtual Modbus slaves may be configured. Up to 7 meters may be configured for each Modbus slave address allowing up to 700 DGCOM meters to be concentrated within the QUCM.

The applications, "qucm_dgcom_app1.qcm" and "qucm_dgcom_app2.qcm" are compiled and loaded into Applications 1 and 2 of the QUCM-OE. These applications include multiple threads for simultaneously servicing the meters, Modbus/TCP, Modbus Serial, and a built-in Web Server.

2

Installation

QUCM Installation

Mount the QUCM in an available slot in the register rack or QXBP. Secure the screw at the bottom of the module. The QUCM is hot-swapable so it is not necessary to remove power from the rack before adding/removing the module.

Serial Connections to the QUCM-OE

Port 1 to Meters

The serial port of the QUCM-OE must be switched to RS-485 for a direct connection. Pin 1 of the RJ-45 port is the bottom pin on the QUCM-OE.

Table 2-1   QUCM RJ-45 RS-485 Pinout

Pin	Description
1	RX-
2	RX+
3	TX+
4	No Connection
5	GND
6	TX-
7	No Connection
8	Chassis

The S4 meter is offered in at least three different RS-485 interfaces. Part number 69866-2 is not terminated. Part number 70192-2 is terminated in a 6-position RJ-11 connector. Part number 69781 is terminated in an 8-position RJ-45 connector.

Table 2-2   70192 Pinout

Pin	Color	Description
1	Blue	Not Used
2	Yellow	RX-
3	Green	RX+
4	Red	TX+
5	Black	TX-
6	White	Gnd

Table 2-3   69866-2 Pinout

Pin	Color	Description
1	Red	Gnd
2	Orange	TX-
3	White	TX+
4	Blue	RX-
5	Black	RX+

Table 2-4   69781 Pinout

Pin	Color	Description
1	White	Gnd
2	Blue	Not Used
3	Green	RX+
4	Yellow	RX-
5	Red	TX+
6	Black	TX-
7	No Connection	Not Used
8	No Connection	Not Used

69781 Pinout

Pin 1 = White (GND)
Pin 2 = Blue (No Connection)
Pin 3 = Green (RX+)
Pin 4 = Yellow (RX-)
Pin 5 = Red (TX+)
Pin 6 = Black (TX-)
Pin 7 = No Connection
Pin 8 = No Connection
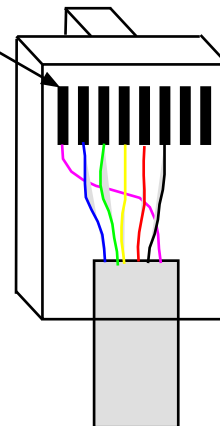
Figure 2-1   AXS4 69781 Assembly RJ-45 RS-485 Connector

QUCM RJ–45	Color	Meter RJ-45	Meter RJ–45
RX- (pin 1) ——————	Black ———	TX- (pin 6) ———	TX- (pin 6)
RX+ (pin 2) ——————	Red ———	TX + (pin 5) ———	TX + (pin 5)
TX- (pin 3) ——————	Yellow ———	RX- (pin 4) ———	RX- (pin 4)
(pin 4)			
(pin 5)			
TX+ (pin 6) ——————	Green ———	RX+ (Pin 3) ———	RX+ (Pin 3)
(pin 7)			
(pin 8)			

Figure 2-2 QUCM-OE RS-485 4-wire network to 69781 equipped meters

NOTE: The RS-485 network may be configured for 2-wire operation by jumpering the TX- to RX- to form the (-) connection and jumpering the TX+ to RX+ to form the (+) connection at each meter and the QUCM.

Port 2 to the Personal Computer

A physical connection must be made from the personal computer to the QUCM in order load the QUCM application program. This link may be a serial connection from a COM port on the personal computer to the RS-232 port on the QUCM-OE.   The Niobrara MM1 cable may be used for this connection. This cable pinout is shown in Figure 2-4.
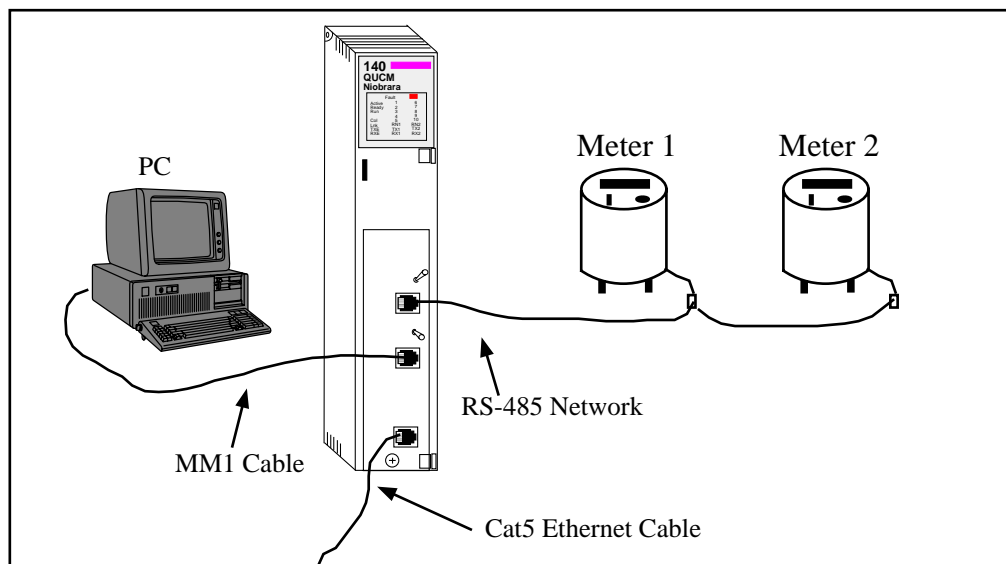
Figure 2-3   Connections to QUCM-OE serial ports

```
RJ45                                                      DE9S (female)
 3  ─────────────────────────────────────────────────  2
 4  ─────────────────────────────────────────────────  3
 5  ─────────────────────────────────────────────────  5
 6  ┐                                                ┌  4
 7  ┘                                                └  6
                                                     ┌  7
                                                     └  8
```
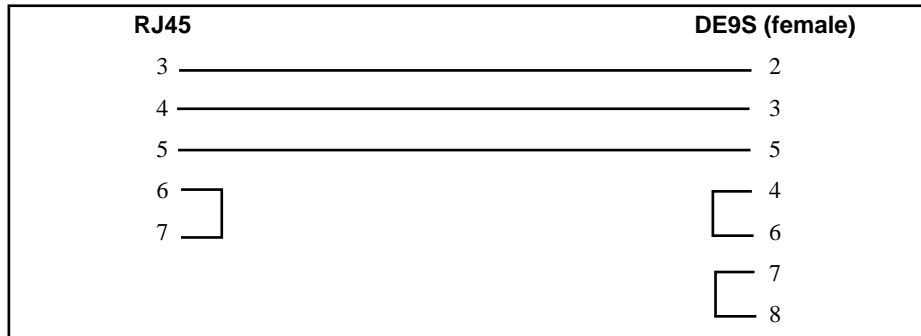
Figure 2-4 QUCM-OE to RS-232 PC Port (9-pin) (MM1 Cable)

Configure the Meter's DGCOM Slave Address

The meter will not communicate on its RS-485 port until it has been assigned a slave address through the optical port. The L+G AIP200 Optical Probe is required to perform this task.

1 Start the 1132Com software.

2 Select the <new meter> line in the meter information window.

3 Select "Connect". The protocol will be DGCOM. The connection type is Optical. The COM port will be the PC port assigned to the AIP200. Now press "Connect". The software should connect to the meter and add a new line for this serial number.

4 To enable/change the slave address choose "Modify Program, Modify Meter Program".

5 The Modify Meter Program Wizard starts. Press "Next".

6 Select "Addressability Enabled", enter the new slave address, and if necessary, check the "Set Address" field. Click "Next". The software will now program the meter and when it is complete click "Finished".

Loading the Applications into the QUCM

The QUCM-OE must use the qucmtcpl.fwl or qucmtcpl.qrc firmware included in the c:\Niobrara\Firmware folder after running the QUCM_SETUP.EXE file. There are two ways to upgrade the firmware of the QUCM-OE: QLOAD and FWLOAD.

Using ZAPREG32.EXE to set the IP Address

It is recommended to use the Ethernet capabilities of QLOAD to load the firmware, qucm_dgcom_app1.qcc and qucm_dgcom_app2.qcc into the QUCM. Set up the IP parameters of the module by the following method:

Figure 2-5   ZAPREG32 COM1:9600,E,8,1 255 -b

1   Move Switch 1 and Switch 2 to Halt.

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

3   From the command line enter
>zapreg32 com1: 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 = 206.223.51.169 subnet Mask = 255.255.255.0, Default Gate = 206.223.51.1, Modbus/TCP port number = 503:

Register	Description	Example (decimal)
46	IP MSByte	206
47	IP	223
48	IP	51
49	IP LSByte	169
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	(leave this alone)	

|	
59	(leave this alone)
60	(leave this alone)
61	(leave this alone)
62	(leave this alone)
63	Modbus Port 503 (this defaults to 502)

4   After entering the IP parameters, attempt to ping the module to verify the settings.
> ping 206.223.51.169

5   Verify a connection to the internal Modbus/TCP server with zapreg32.
> zapreg32 206.223.51.169:503 255
Should connect to the QUCM on port 503 with Destination index 255.

QLOAD QUCM Firmware Update

QLOAD is a convenient method for upgrading the firmware of a QUCM, especially if the QUCM already has an IP Address. A direct serial connection to the module is not required, the module does not need to be powered down, and the entire process may be done remotely across the Ethernet.

1   Application 1 Switch will usually be in RUN unless this is the first time to run QLOAD to load the firmware. If this is the case then place switch 1 in Halt before loading the file. After loading the file, switch Switch 1 to run to allow the update to complete.

2   Start QLOAD.EXE by selecting "Start, Programs, Niobrara, QUCM, QLOAD QUCM Firmware".

3   The file to load should be c:\Niobrara\Firmware\qucmtcpl.qrc. If not, click on the Browse button and select the file qucmtcpl.qrc.

4   Verify the following:

a. The Application 1 Radio Button is selected.

b. The Modbus/TCP tab is selected.

(1) The IP Address of the QUCM is entered correctly.

(2) The TCP Port number is set to 503.

(3) The Modbus Drop is set to 255.

5   Press the Start Download button. QLOAD will open a progress window to show the status of the download. If Switch 1 is in Halt then move it to Run, otherwise, wait approximately 20 seconds for the upgrade to finish after the download is complete. The unit should be ready to received the new versions of qucm_dgcom_app1.qcc and qucm_dgcom_app2.qcc.
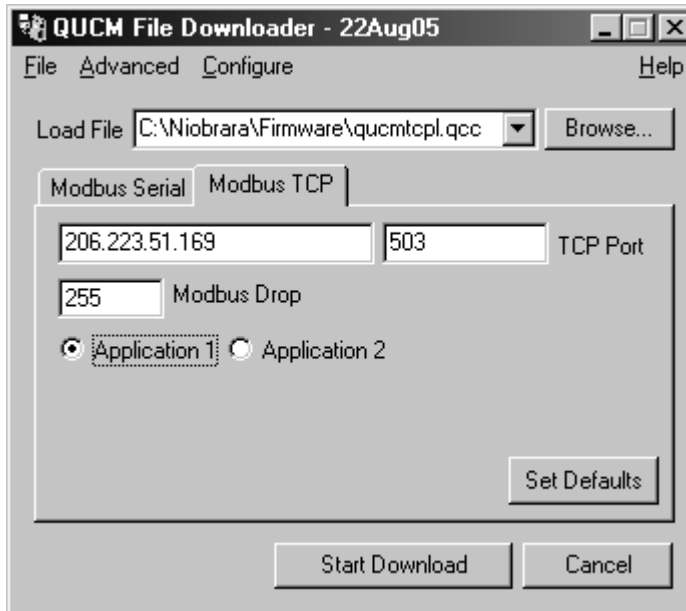
Figure 2-6   QLOAD of qucmtcpl.qrc

FWLOAD QUCM Firmware Update.

If the QUCM has corrupt firmware or completely non-responsive then the old method of using FWLOAD may be required.

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. Make sure that Port 1 is set to RS-232 mode with the slide switch below the port.

6   Start FWLOAD by selecting "Start, Programs, Niobrara, QUCM, FWLOAD QUCM Firmware.

7   Verify the following:

   a. The file to load is c:\Niobrara\Firmware\qucmtcpl.fwl.

   b. The proper PC serial port is selected.

8   Press the "Query" button to verify that the firmware to be loaded is newer than the firmware in the module.

9   Press the "Start Download" button to update the firmware. The download should take a couple of minutes to complete.

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

Figure 2-7　FWOAD of qucmtcpl.fwl

QLOAD Applications 1 and 2
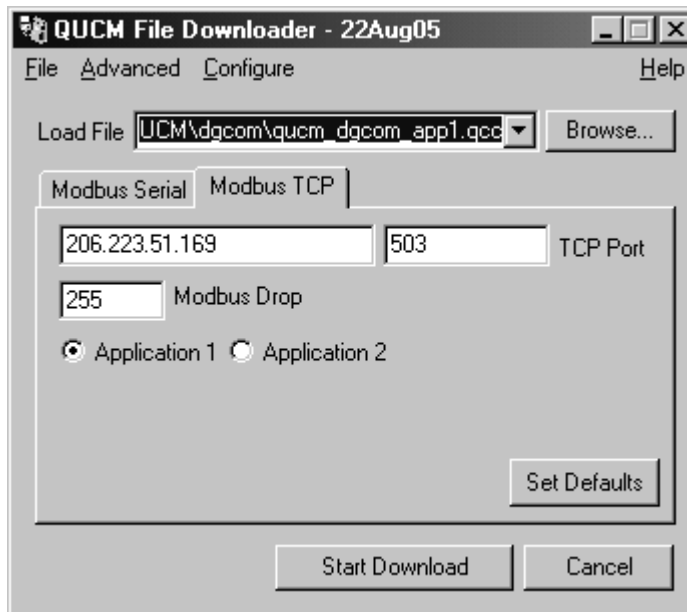
Figure 2-8　QLOAD of qucm_dgcom_app1.qcc

1　Application 1 and 2 Switches must be in RUN.

2　Start QLOAD by selecting "Start, Programs, Niobrara, QUCM, Apps, DGCOM, QLOAD DGCOM Application 1.

3　Verify the following:

　　a.　Application 1 radio button is selected.

       b. The Modbus/TCP tab is selected.

          (1) The IP Address of the QUCM is entered correctly.

          (2) The TCP Port number is set to 503.

          (3) The Modbus Drop is set to 255.

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

5   Click on the Browse button and select the file qucm_dgcom_app2.qcc.

6   Select the Application 2 Radio Button.

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

After downloading both applications, the RN1 and RN2 lights should be on. Open a web browser and point it to the IP Address of the QUCM for configuration.
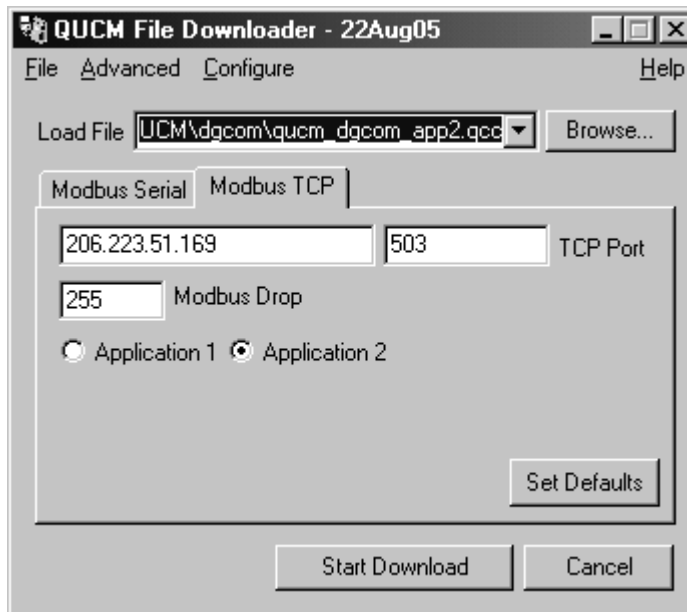
Figure 2-9   QLOAD of qucm_dgcom_app2.qcc

3
Modbus Data

Modbus Servers

Modbus/TCP Server

The QUCM application supports up to six Modbus/TCP connections. The server listens on the standard TCP port 502.

Modbus RTU Server

Port 2 of the QUCM may be configured for Modbus RTU Slave operation. 2-wire or 4-wire modes are both supported.

Slave Registers

Each Virtual Modbus Slave supports up to six meters. The first register provides a bit-map of the configured meters as well as online/offline status for each meter.

NOTE: Bit 0 is the least significant bit.

NOTE: All Modbus registers are read-only.

For example: Register 1 shows a value of 1F0E (hex) = 7950 (dec). In binary this is 0001 1111 0000 1110. Bits 8 through 12 are ON indicating that meters 0 through 4 are being polled.   Bits 1, 2, and 3 are ON indicating that meter 1, 2, and 3 are responding and that their data is valid.

The Wh values for each meter are stored as a 32-bit integer across two Modbus Holding (4x) registers. The Most Significant Word is in the lower numbered register pair while the Least Significant Word is stored in the higher numbered register. For example if the Wh value for meter 3 is 1234567 Watts then registers 400009 and 400010 will have the values in Table 3-1.

Table 3-1   Long Integer Example Values

Register	Value (hex)	Value (unsigned)	Value (Signed)
9	0012	18	18
10	D687	54919	-10617

The value 1234567 = 0012D687(hex). To calculate this value take the unsigned value of register 9 and multiply it by 65536 and then add the unsigned value from register 10. (18 * 65536) + 54919 = 1234567.

Table 3-2   Modbus Slave Holding Register Map

Register	Meaning	Notes
1	Bitmap of Meters	bits 0-6 are ON if the meter is replying to queries. bits 8-14 are ON if the meter is configured to be polled by the QUCM
2	Reserved	Always 0
3	Meter 0 WH	MSW
4	Meter 0 WH	LSW
5	Meter 1 WH	MSW
6	Meter 1 WH	LSW
7	Meter 2 WH	MSW
8	Meter 2 WH	LSW
9	Meter 3 WH	MSW
10	Meter 3 WH	LSW
11	Meter 4 WH	MSW
12	Meter 4 WH	LSW
13	Meter 5 WH	MSW
14	Meter 5 WH	LSW
15	Meter 6 WH	MSW
16	Meter 6 WH	LSW

Table 3-3 lists the statistical counter registers for each meter. These registers count up from 0 to 65536 and then roll over. These registers may be cleared from the web server.

Table 3-3   Statistical Counter Registers

Meaning	Meter 0	Meter 1	Meter 2	Meter 3	Meter 4	Meter 5	Meter 6
Max Retry Count	70	71	72	73	74	75	76
Transmit Attempts	80	81	82	83	84	85	86
Timeout Counts	90	91	92	93	94	95	96

Table 3-4   Additional Meter Data

Meaning	Meter 0	Meter 1	Meter 2	Meter 3	Meter 4	Meter 5	Meter 6
QUCM Port Number (1 or 2)	100	110	120	130	140	150	160
Meter DGCOM Slave Address (0-65536)	101	111	121	131	141	151	161
K-Factor (times 100)	102	112	122	132	142	152	162
KWh Pulse Count (long)	103,104	113,114	123,124	133,134	143,144	153,154	164,164
Meter Serial Number (BCD)	105,106	115,116	125,126	135,136	145,146	155,156	165,166
KWH Pulse Count (BCD)	107-109	117-119	127-129	137-139	147-149	157-159	167-169

Navigation Bar

The left side of each page includes a set of navigation links. This list changes dynamically based on the current page displayed. The root links are Home, Configuration, Statistics, and Help.

Home

The Home link displays a page similar to figure 4-1. It gives a brief summary of the number of virtual Modbus devices configured, the settings on the two QUCM serial ports, and the status of the polled meters. The table of devices shows the Modbus Slave, Meter number, Meter DGCOM Address, QUCM port number, Meter Serial Number, KWh, and the online/offline status.
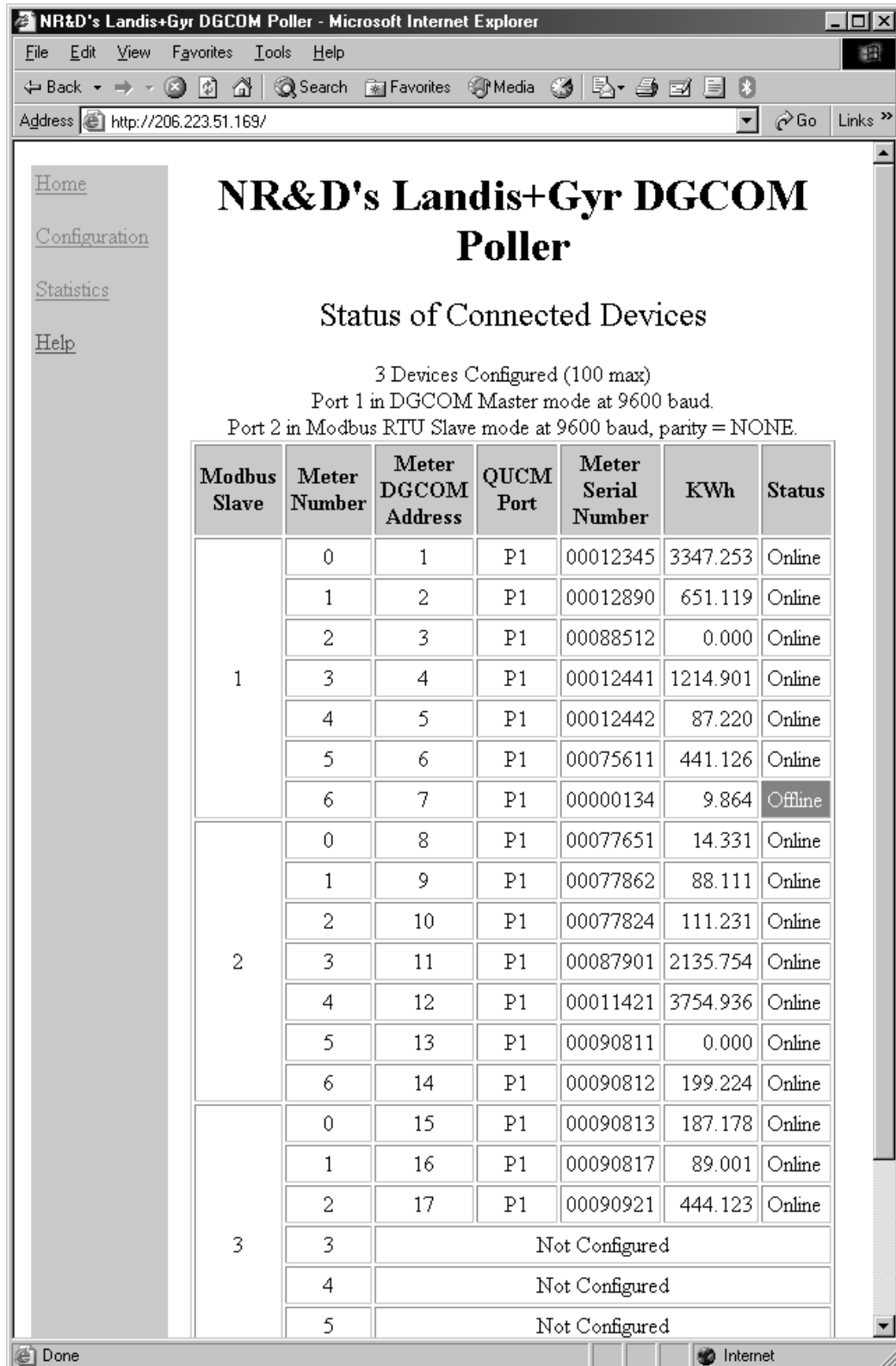
NR&D's Landis+Gyr DGCOM Poller

Status of Connected Devices

3 Devices Configured (100 max)
Port 1 in DGCOM Master mode at 9600 baud.
Port 2 in Modbus RTU Slave mode at 9600 baud, parity = NONE.

Modbus Slave	Meter Number	Meter DGCOM Address	QUCM Port	Meter Serial Number	KWh	Status
1	0	1	P1	00012345	3347.253	Online
	1	2	P1	00012890	651.119	Online
	2	3	P1	00088512	0.000	Online
	3	4	P1	00012441	1214.901	Online
	4	5	P1	00012442	87.220	Online
	5	6	P1	00075611	441.126	Online
	6	7	P1	00000134	9.864	Offline
2	0	8	P1	00077651	14.331	Online
	1	9	P1	00077862	88.111	Online
	2	10	P1	00077824	111.231	Online
	3	11	P1	00087901	2135.754	Online
	4	12	P1	00011421	3754.936	Online
	5	13	P1	00090811	0.000	Online
	6	14	P1	00090812	199.224	Online
3	0	15	P1	00090813	187.178	Online
	1	16	P1	00090817	89.001	Online
	2	17	P1	00090921	444.123	Online
	3			Not Configured		
	4			Not Configured		
	5			Not Configured		

Sidebar navigation: Home, Configuration, Statistics, Help

Figure 4-1   Main Page with 17 meters configured as 3 Modbus Slaves

Configuration Page

The Configuration Page link will enter a set of pages for configuring the QUCM. A table is shown with the currently configured devices with links to Edit or Remove each device. Additional links are provided to Add Device, Serial Port Configuration, Change QUCM Titles, Change QUCM TCP/IP Address, Change Password, Store Configuration in Flash, and Home. See Figure 4-2.

Password

These pages are password protected based on a 3 minute activity timer. If the password timer has expired the user will be prompted to enter the password. Some configuration parameters require the password to be entered before the action is taken.

The default password is "master" and it is case sensitive.

Add Device

The Add Device link is used to add new virtual Modbus Slaves. Each slave device allows the selection of the Modbus Slave Address, and the seven DGCOM meters with their DGCOM Slave Addresses.

The "**Modbus Slave**" is the Modbus RTU or Modbus/TCP slave address used to access the collected data in the QUCM for testing and debugging. Valid entries are 1 to 100.

The "**QUCM Port**" is the serial port of the QUCM to which the DGCOM meters are attached.

The "**QUCM Port**" is the port that the message will be transmitted from. Possible values are Port 1, Port 2, and Ethernet Socket 1. QUCM Port 1 may not be a valid choice if Port 1 is in an INCOM mode.

The "**Meter DGCOM Slave Address**" is the slave address configured within the meter. The QUCM limits this slave address to be within the range of 0-65536.

Serial Port Configuration

The Serial Port Configuration page is used to set up the parameters for the QUCM's serial ports.

The "**Port Mode**" allows the setting of Port 1 or Port 2 operation. The following settings are allowed:

- DGCOM Master - The L+G meters are connected to a port in this mode. Port 1 is fixed in DGCOM Master mode.

- Modbus RTU Slave - This mode is for access to the Modbus data from a Modbus Master. Port 2 may optionally be set for Modbus Slave mode.

The Baud Rate settings allow the chosen serial port to be set at 1200, 2400, 9600, and 19200 baud. DGCOM Master ports must be set to either 1200 or 9600.

The Parity setting allow the port to be set to NONE or EVEN. The default value is NONE. DGCOM Master ports are overridden to NONE parity.

Edit Title Page

The Edit Title page allows the setting of the HTML Title and Head values. The Title is displayed at the top of most browsers and it also the text displayed when book-marked. The Head is the text displayed in bold at the top of every QUCM web page.

QUCM TCP/IP Configuration

The QUCM TCP/IP page allows the changing of the IP Address, Subnet Mask, and Default Get of the QUCM. The new settings are not automatically stored to flash so they must be stored after the change.

Change Password

This page allows the user to change the default password for the configuration of the QUCM.

Store Configuration to FLASH

The Store Configuration to FLASH link must be used to save the current settings to non-volatile memory. All changes will be lost on power cycle if the store to flash is not used.
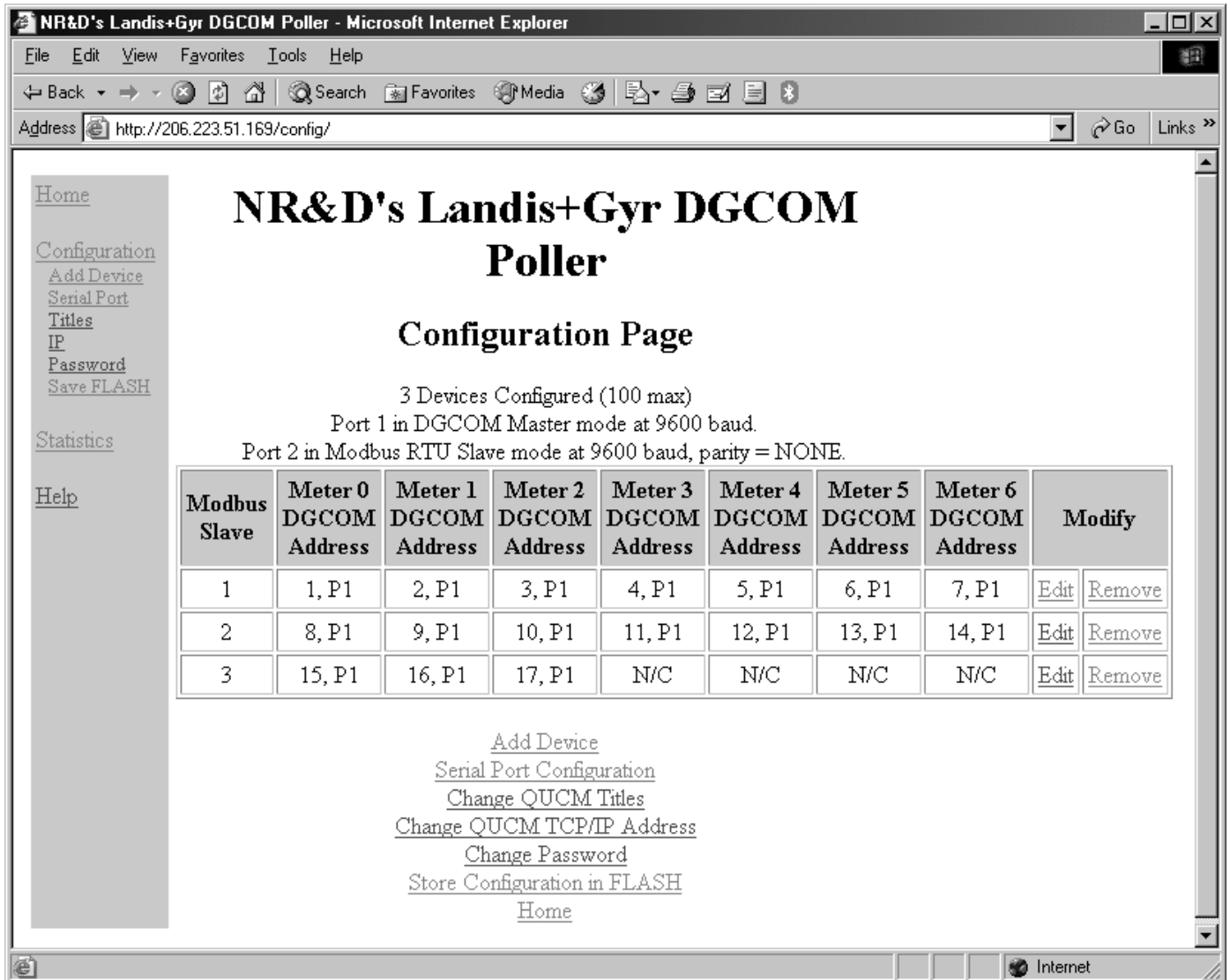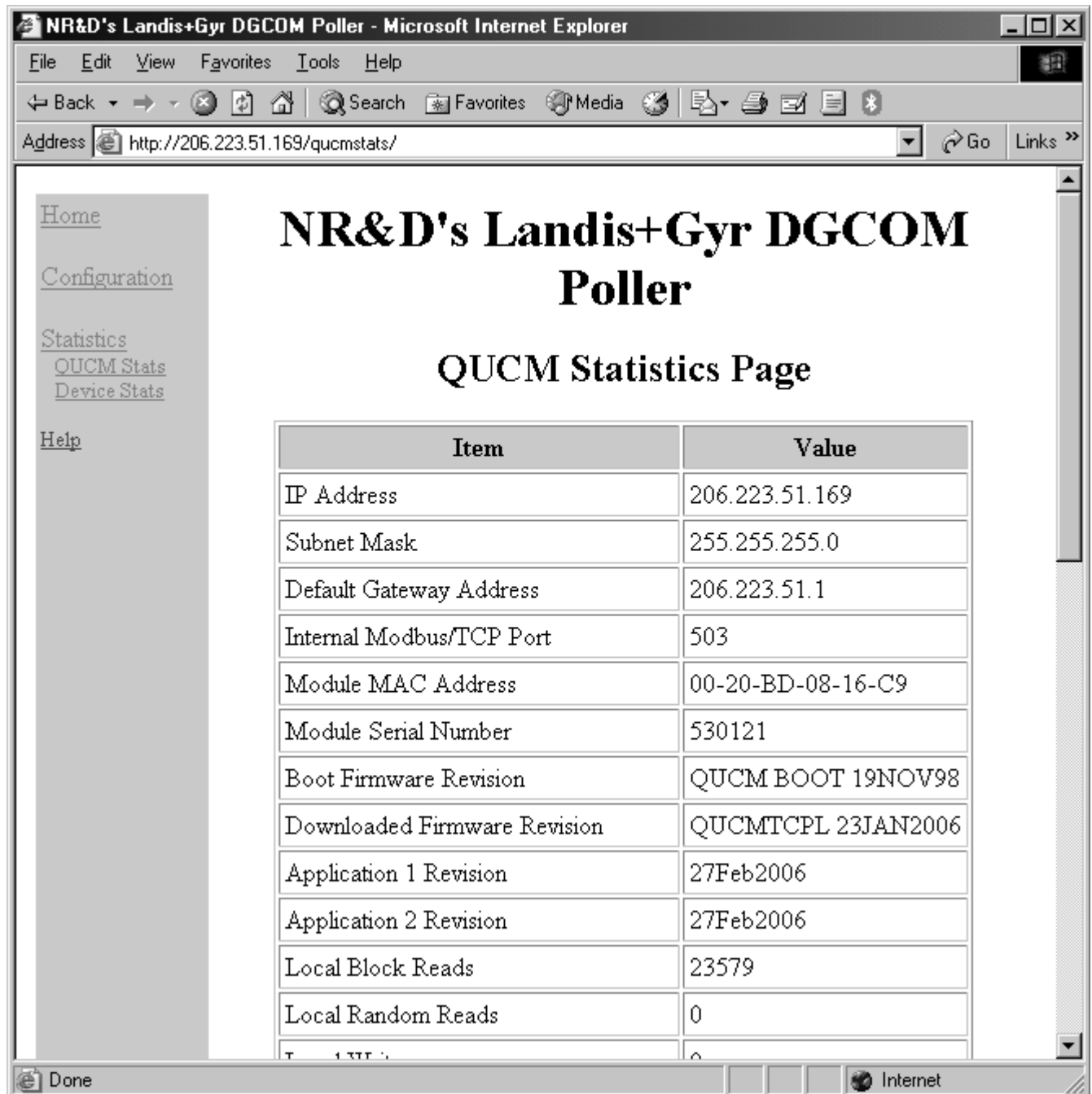
Figure 4-2 Configuration Page
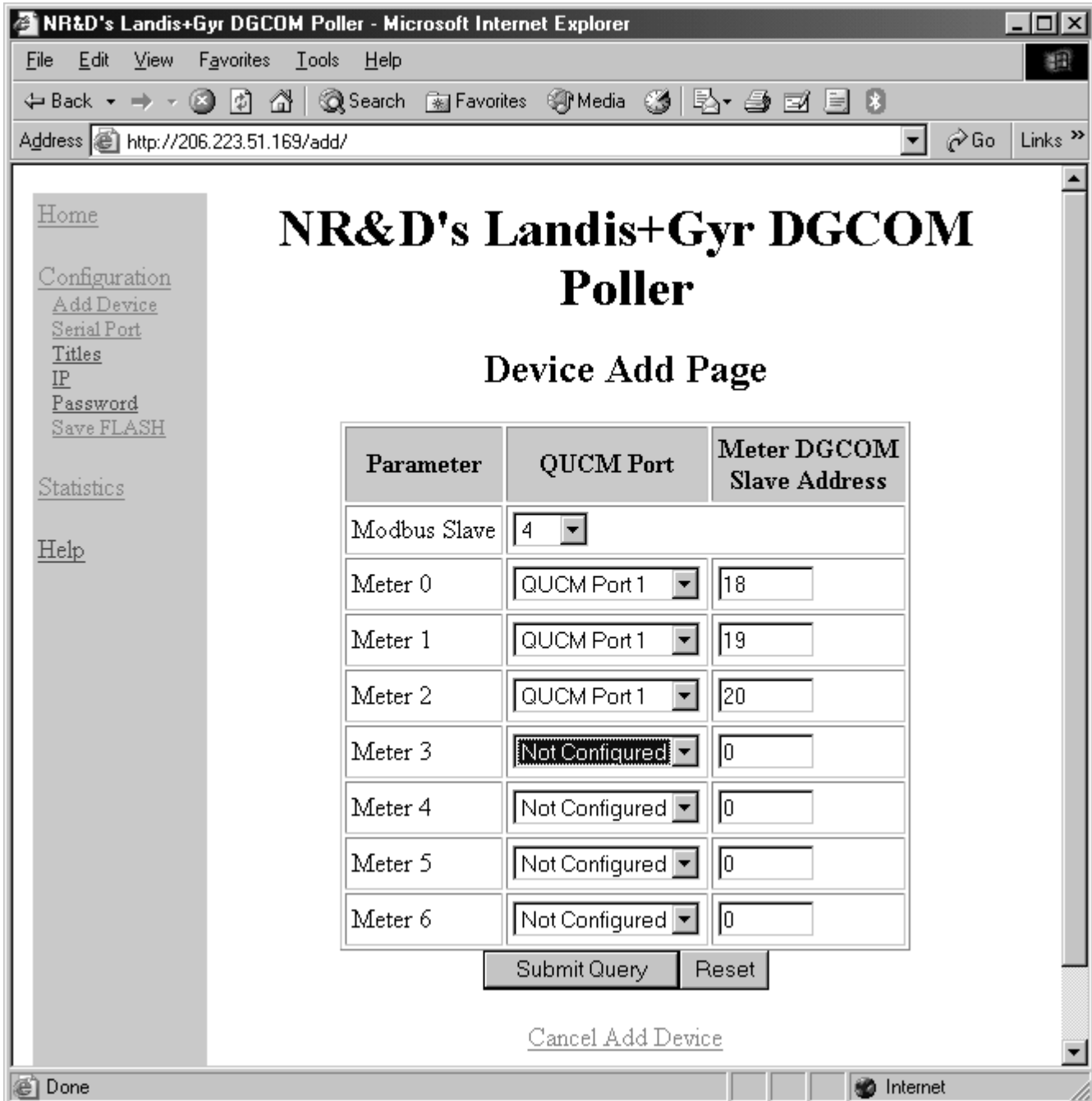
Figure 4-3 Add Device Page

QUCM Landis+Gyr DGCOM Application Manual

Statistics Pages

There are two links for statistics: QUCM and Device stats. (See Figure 4-4 for the QUCM stats sample page) The QUCM stats page shows a variety of information about the QUCM itself including the MAC address, IP settings, firmware revisions and downloaded application revisions. The Device Stats page shows a summary of the communication counters for each device.

Figure 4-4   Statistics Web Page

Help Pages

There are a number of help pages to assist in building the serial cables.