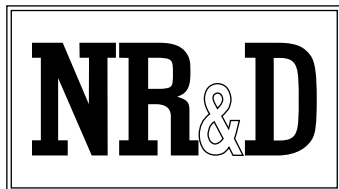


QUCM SMARTBOB

Installation and Programming Manual

This Manual describes the QUCM application for interfacing BinMaster[®] SmartBob II devices to a Modbus/TCP Ethernet system.

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Contents

1 Introduction	5
2 Installation	7
QUCM Installation	7
Software Installation	7
Serial Connections to the QUCM-OE	7
Port 1 (or Port 2) to DDC2I to 2-wire SmartBob Network	7
Port 1 (or Port 2) to BB85 to 2-wire SmartBob Network	8
Port 1 to the Personal Computer	8
Loading the Applications into the QUCM	9
Using ZAPREG32.EXE to set the IP Address	10
QLOAD QUCM Firmware Update	11
FWLOAD QUCM Firmware Update	12
QLOAD Applications 1 and 2	13
3 Modbus Operation	15
SmartBob Device Register List	15
Summary Slave Address 247	17
Global Setup Registers	23
4 Web Server	31
Navigation Bar	31
Home	31
Configuration Page	34
Password	34
Add Device	34
Serial Port Configuration	34
Edit Title Page	35
QUCM TCP/IP Configuration	35
Change Password	35
Store Configuration to FLASH	35
Statistics Pages	38
Help Pages	39

5 Examples	41
Example 1	41

Figures

Figure 2-1 DDC2I to SmartBob RS-485 2-wire cable	8
Figure 2-2 BB85 to SmartBob RS-485 2-wire cable	8
Figure 2-3 PC Connection to QUCM-OE serial port	9
Figure 2-4 QUCM-OE to RS-232 PC Port (9-pin) (MM1 Cable)	9
Figure 2-5 ZAPREG32 COM1:9600,E,8,1 255 -B	10
Figure 2-6 QLOAD of qucmtepl.qrc	12
Figure 2-7 FWOAD of qucmtepl.fwl	13
Figure 2-8 QLOAD of qucm_smartbob_app1.qcc	13
Figure 2-9 QLOAD of qucm_smartbob_app2.qcc	14
Figure 4-1 Main Page with two devices configured	32
Figure 4-2 Device Page	33
Figure 4-3 Configuration Page	36
Figure 4-4 Add Device Page	37
Figure 4-5 Statistics Web Page	38
Figure 4-6 Cable Help Web Page	39
Figure 5-1 Example 1 Layout	41
Figure 5-2 Config Web Page Screen	42

Tables

Table 2-1 DDC2I DIP Switch Settings for 2-wire	8
Table 3-1 SmartBob Register List	16
Table 3-2 Measurement Status List	17
Table 3-3 Address 247 Summary Register List (1)	18
Table 3-4 Address 247 Summary Register List (2 Measured Depth)	19
Table 3-5 Address 247 Summary Register List (3 Measured Depth)	20
Table 3-6 Address 247 Summary Register List (4 Pending Status)	21
Table 3-7 Address 247 Summary Register List (5 Pending Status)	22
Table 3-8 Global Register List (1 QUCM Setup)	23
Table 3-9 Global Register List (2 Modbus Slave Addresses)	24
Table 3-10 Global Register List (3 Modbus Slave Addresses)	25
Table 3-11 Global Register List (4 SmartBob Slave Addresses)	26
Table 3-12 Global Register List (5 SmartBob Slave Addresses)	27
Table 3-13 Global Register List (6 QUCM Port Number)	28
Table 3-14 Global Register List (7 QUCM Port Number)	29

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 data from up to two serial networks of BinMaster[®] SmartBob II Inventory Measurement System devices to be accessed by Modbus/TCP Ethernet or Modbus Serial.

Each SmartBob is continuously polled by the QUCM and the polled data is presented as a Modbus slave. A special summary Modbus slave address is provided to give access to all SmartBob data. A new measurement of all bobs may be triggered by a single Modbus write. Individual bobs may be triggered for new measurements as well.

A web server in the QUCM is used to configure the devices to be polled and set the serial port parameters. The data from each device may be viewed and new measurements may be triggered from the web server.

The Niobrara QXBP-001 single slot rack with built-in power supply is used for mounting the QUCM-OE. A two (or more) slot Quantum rack and appropriate Quantum power supply may also be used for mounting the QUCM-OE.

QUCM 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 QUCM_SMARTBOB_SETUP.EXE file. If not already installed, the QUCM_SETUP.EXE file should also be ran to properly install the FWLOAD, QLOAD, ZAPREG32, and QCOMPILE applications.

Serial Connections to the QUCM-OE

The Niobrara DDC2I is highly recommended for connecting networks of SmartBobs to the QUCM. The DDC2I provides optical isolation between the QUCM and the RS-485 network which helps to prevent ground loops and offers surge suppression.

Port 1 (or Port 2) to DDC2I to 2-wire SmartBob Network

The serial ports of the QUCM-OE must be switched to RS-232. The Niobrara cable MM0 is used to connect to the DDC2I. This cable is included with the DDC2I. The number of SmartBobs per QUCM port should be limited to 32 unless repeaters are used. The QUCM will provide the power for the DDC2I so the external supply is not required.

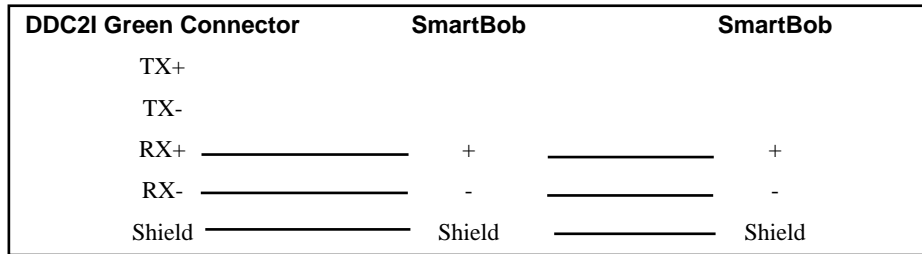


Figure 2-1 DDC2I to SmartBob RS-485 2-wire cable

The DDC2I DIP switches must be configured for 2-wire Slave with Termination and Bias.

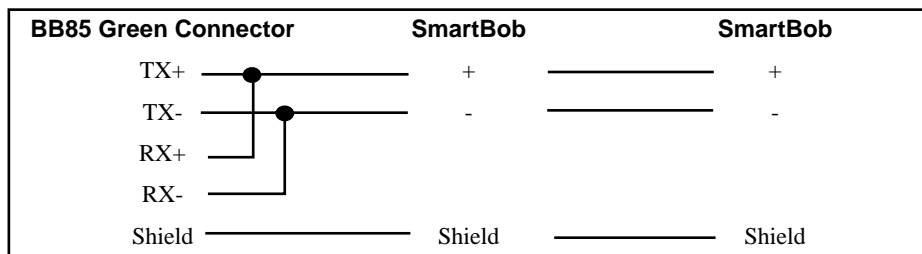
Table 2-1 DDC2I DIP Switch Settings for 2-wire

Switch	Description	Position
1	4/2 wire	ON
2	4/2 wire	ON
3	4/2 wire	ON
4	Master/Slave	ON
5	Termination	ON
6	Bias	ON

Port 1 (or Port 2) to BB85 to 2-wire SmartBob Network

The serial ports of the QUCM-OE must be switched to RS-485. Jumpers must be installed between the TX+ and RX+ on the BB85 as well as the TX- and RX-. The Niobrara cable MM0 is used to connect to the BB85. This cable is included with the BB85. The number of SmartBobs per QUCM port should be limited to 32 unless repeaters are used.

Figure 2-2 BB85 to SmartBob RS-485 2-wire cable



Port 1 to the Personal Computer

The initial configuration of the QUCM is easily done through an RS-232 serial connection from the PC to the QUCM. The Niobrara MM1 cable may be used for this connection. This cable pinout is shown in Figure 2-4.

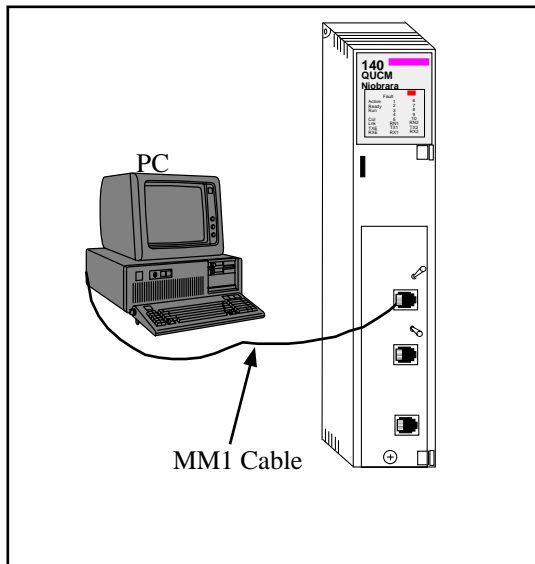


Figure 2-3 PC Connection to QUCM-OE serial port

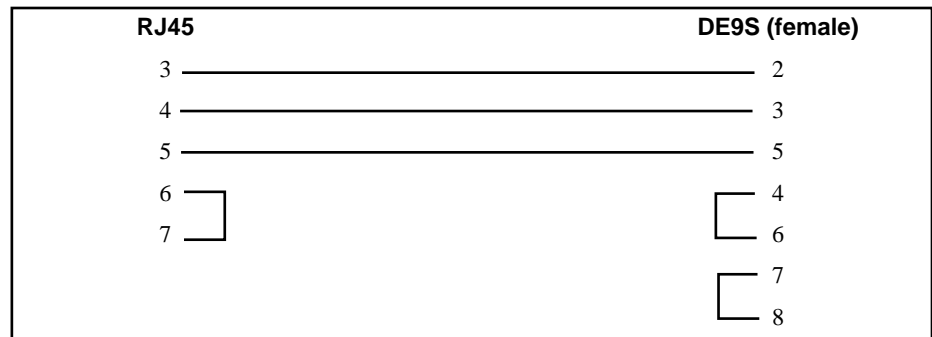


Figure 2-4 QUCM-OE to RS-232 PC Port (9-pin) (MM1 Cable)

Loading the Applications into the QUCM

It is important to have the firmware in the QUCM match the compiled code of the SmartBob application so it may be necessary to upgrade the operating system of the QUCM. The QUCM-OE must use the `qucmtpl.fwl` or `qucmtpl.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_smartbob_app1.qcc and qucm_smartbob_app2.qcc into the QUCM. Set up the IP parameters of the module by the following method:

```

Command Prompt - zapreg32 com1: 255 -b
Niobrara R&D
SY/MAX Register Viewer
05Oct2004
QUCMTCPL 20JUN2005

REGSTR  HEX    UNSIGN  SIGNED  STAT
46  00CE    206    206    0000
47  00DF    223    223    0000
48  0033    51     51     0000
49  00A8    168    168    0000
50  00FF    255    255    0000
51  00FF    255    255    0000
52  00FF    255    255    0000
53  0000     0      0      0000
54  00CE    206    206    0000
55  00DF    223    223    0000
56  0033    51     51     0000
57  0001     1      1      0000
58  0037    55     55     0000
59  0000     0      0      0000
60  0514   1300   1300   0000
61  0000     0      0      0000
62  0064    100    100    0000
63  01F7    503    503    0000
64  0018    24     24     0000
65  0384    900    900    0000

Sy/Max Register Viewer
Up and Down arrows to select register,
Page Up and Page Down to change by 10,
Left and Right arrows to select mode,
0..9, A..F to enter new value,
Up/Down Arrow to build block write,
Enter to update without moving,
F10 to acknowledge error,
Escape to exit.
  
```

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 = 206.223.51.168 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	168
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 206.223.51.168
- 5 Verify a connection to the internal Modbus/TCP server with zapreg32.
> zapreg32 206.223.51.168:503 255
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\qucmtcp1.qrc. If not, click on the Browse button and select the file qucmtcp1.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_smartbob_app1.qcc and qucm_smartbob_app2.qcc.

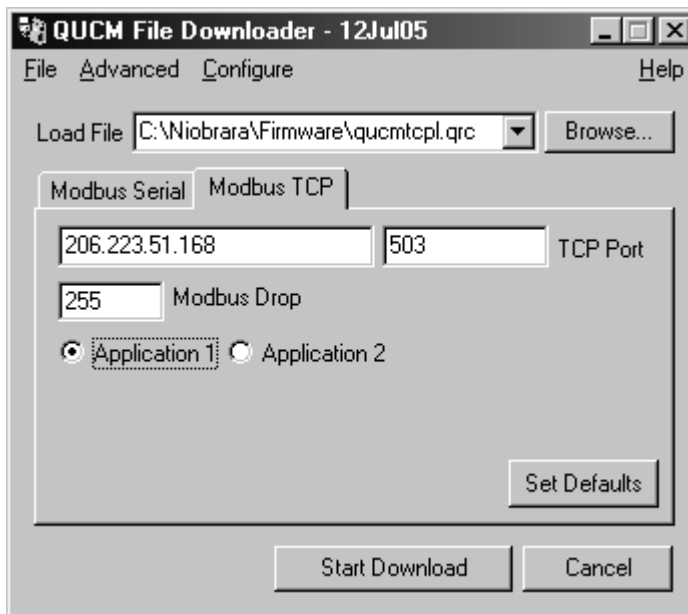


Figure 2-6 QLOAD of qucmtcppl.qrc

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\qucmtcppl.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.

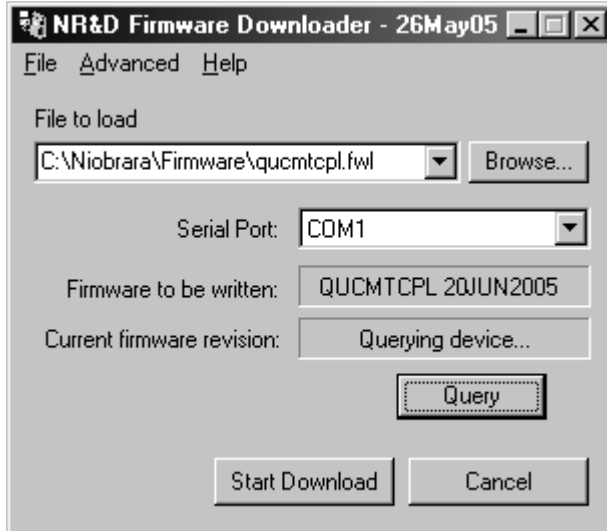


Figure 2-7 FWOAD of qucmtcp1.fwl

QLOAD Applications 1 and 2

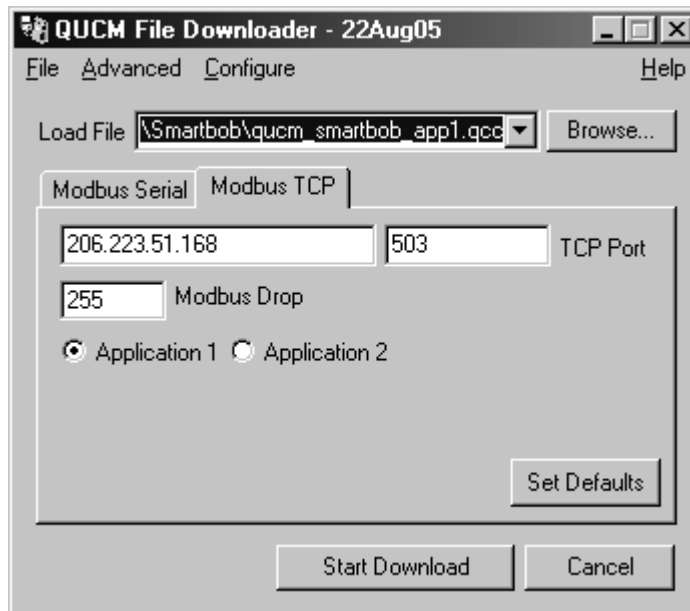


Figure 2-8 QLOAD of qucm_smartbob_app1.qcc

- 1 Application 1 and 2 Switches must be in RUN.
- 2 Start QLOAD by selecting "Start, Programs, Niobrara, QUCM, Apps, SmartBob, QLOAD SmartBob 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_smartbob_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.

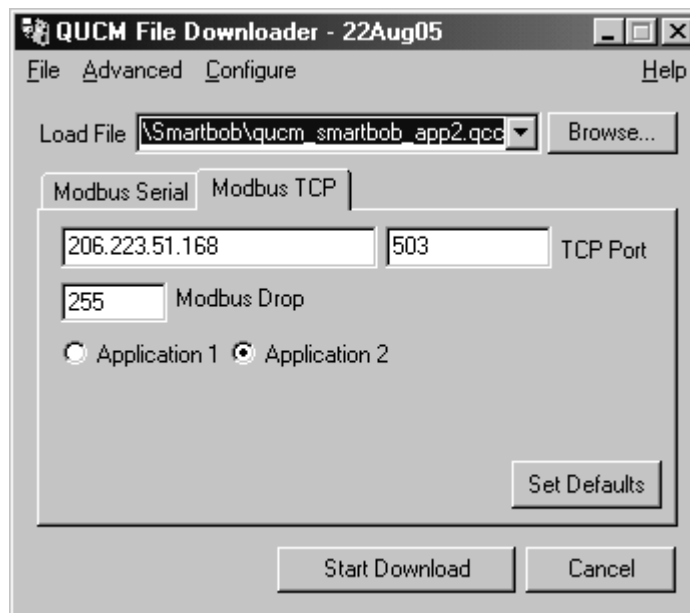


Figure 2-9 QLOAD of qucm_smartbob_app2.qcc

Modbus Operation

The SmartBob QUCM application provides an Ethernet Modbus/TCP server on TCP Port 502. The SmartBob data may be accessed directly by selecting the Modbus Slave address of the configured bob for the Modbus/TCP Destination Index. A summary slave index of address 247 (default) is also provided to allow the client to access all of the system data from a single slave device.

Either of the two QUCM serial ports may optionally be configured for Modbus RTU or ASCII Slave operation to also allow a serial Modbus Master to access the Smart-Bob data. The Modbus operation is the same for the serial ports as the Ethernet port.

SmartBob Device Register List

The data from a given SmartBob is presented as Holding Registers (4x). Register 1 is Read/Write and any value written to this register will cause the bob to take a new reading. Registers 2 through 66 are read only 16-bit unsigned integers that provide data on the bob. Several data points have an implied decimal place to give a greater precision for the reading. For example, register 6 indicates the depth of the product in feet times 10. A value of 599 indicates a depth of 59.9ft.

Table 3-1 SmartBob Register List

Register	Measurement	Notes
4x0001	Acquire New Reading	Write any value to this register to trigger a new reading.
4x0002	MUCM Port Number	Always 1 for RS-485 port
4x0003	SmartBob Slave Address	0-130
4x0004	Device Type	0=SmartBob
4x0005	Measurement Status	See Table 3-2
4x0006	Depth in feet	times 10 (123 = 12.3ft)
4x0007	Pulse Count	
4x0008	Reading Age in Minutes	0-65535
4x0009	Vessel ID	0-255
4x0010	Vessel Shape	ASCII "R"=Rectangle, "C"=Cylinder
4x0011	Vessel Height in feet	times 10
4x0012	Vessel Width in feet	times 10
4x0013	Vessel Length in feet	times 10
4x0014	Vessel Diameter in feet	times 10
4x0015	Volume Offset	cubic feet
4x0016	Density whole	
4x0017	Density fraction in .0001	
4x0018	Dimension Unit	0=ft, 1=yards, 2=meters
4x0019	Weight Unit	0=pounds, 1=kg, 2=tons, 3=metric tons, 4=slugs
4x0020	Volume Unit	0=cu ft, 1=cu yd, 2=gallons(dry), 3=gallons(liquid), 4=bushels, 5=cu meters, 6=liters, 7=barrels(dry), 8=barrels(oil), 9=barrels(liquid)
4x0021	Density Unit	0=pounds/cu ft., 1=pounds/cu yd, 2=pounds/gallon, 3=kg/cu meter, 4=kg/liter
4x0022	High Alarm Level in feet	times 10
4x0023	Low Alarm Level in feet	times 10
4x0024	Modbus Slave Address	1-239
4x0025	Length of packed ASCII Name	0-20
4x0026	Name bytes 0,1	Two characters per register.
4x0027	Name bytes 2,3	
4x0028	Name bytes 4,5	
4x0029	Name bytes 6,7	
4x0030	Name bytes 8,9	
4x0031	Name bytes 10,11	
4x0032	Name bytes 12,13	
4x0033	Name bytes 14,15	
4x0034	Name bytes 16,17	
4x0035	Name bytes 18,19	

Table 3-2 Measurement Status List

Status Value	Meaning
0	Retracted
1	Started Descending
2	Descending
3	Retracting (High Torque)
4	Retracting (Low Torque)
5	Manual Retracting (High Torque)
6	Manual Retracting (Low Torque)
7	Manual Cycle Started Descending
8	Manual Cycle Descending
9	Manual Cycle Retracting (High Torque)
10	Manual Cycle Retracting (Low Torque)
11	Retry Retract (High Torque)
12	Retry Retract (Low Torque)
13	Retract Failed
14	Manual Cycle Retract Failed
15	Bob Stuck At Top
16	Bob Stuck At Bottom
17	Motor Fault
18	Error (General or Communication)
19	Override jumper open (In Override)
98	No Bin Height (Used only internally on SBC)
99	Unknown
100	Measurement Pending
101	Measurement Pending

Summary Slave Address 247

A special slave address (destination index) of 247 is provided to allow the Modbus Master to gather data from all of the configured bobs with usually a single read message. Register 1 of slave 247 is writeable and any value below 240 (decimal) will trigger a new measurement of the Modbus Slave Address of that bob. For example, to trigger a new measurement of Modbus Slave 17 simply write the value 17 to register 1. Any value equal to or larger than 240 will trigger new measurements on all configured bobs. Thus it is possible to trigger new readings on all bobs with a single write.

Table 3-3 Address 247 Summary Register List (1)

Register	Measurement	Notes
4x0001	Acquire All New Measurements	Write the Modbus Slave Address of a single bob to trigger a drop. Write any value ≥ 240 to drop on all bobs.
4x0002	Online Status (dev 1-16) Bit 0 = bob 1, bit 15 = bob 16	Each bit represents a SmartBob. If the bit is on then the bob is online.
4x0003	Online Status (dev 17-32) Bit 0 = bob 17, bit 15 = bob 32	Each bit represents a SmartBob. If the bit is on then the bob is online.
4x0004	Online Status (dev 33-48) Bit 0 = bob 33, bit 15 = bob 48	Each bit represents a SmartBob. If the bit is on then the bob is online.
4x0005	Online Status (dev 49-64) Bit 0 = bob 49, bit 15 = bob 64	Each bit represents a SmartBob. If the bit is on then the bob is online.
4x0006	Valid Data Status (dev 1-16) Bit 0 = bob 1, bit 15 = bob 16	Each bit represents a SmartBob. If the bit is on then the depth data is valid.
4x0007	Valid Data Status (dev 17-32) Bit 0 = bob 17, bit 15 = bob 32	Each bit represents a SmartBob. If the bit is on then the depth data is valid.
4x0008	Valid Data Status (dev 33-48) Bit 0 = bob 33, bit 15 = bob 48	Each bit represents a SmartBob. If the bit is on then the depth data is valid.
4x0009	Valid Data Status (dev 49-64) Bit 0 = bob 49, bit 15 = bob 64	Each bit represents a SmartBob. If the bit is on then the depth data is valid.
4x0010	Reserved	

Table 3-4 Address 247 Summary Register List (2 Measured Depth)

Holding Register	Description	Notes
4x0011	Bob 1 Measured Data	feet times 10
4x0012	Bob 2 Measured Data	feet times 10
4x0013	Bob 3 Measured Data	feet times 10
4x0014	Bob 4 Measured Data	feet times 10
4x0015	Bob 5 Measured Data	feet times 10
4x0016	Bob 6 Measured Data	feet times 10
4x0017	Bob 7 Measured Data	feet times 10
4x0018	Bob 8 Measured Data	feet times 10
4x0019	Bob 9 Measured Data	feet times 10
4x0020	Bob 10 Measured Data	feet times 10
4x0021	Bob 11 Measured Data	feet times 10
4x0022	Bob 12 Measured Data	feet times 10
4x0023	Bob 13 Measured Data	feet times 10
4x0024	Bob 14 Measured Data	feet times 10
4x0025	Bob 15 Measured Data	feet times 10
4x0026	Bob 16 Measured Data	feet times 10
4x0027	Bob 17 Measured Data	feet times 10
4x0028	Bob 18 Measured Data	feet times 10
4x0029	Bob 19 Measured Data	feet times 10
4x0030	Bob 20 Measured Data	feet times 10
4x0031	Bob 21 Measured Data	feet times 10
4x0032	Bob 22 Measured Data	feet times 10
4x0033	Bob 23 Measured Data	feet times 10
4x0034	Bob 24 Measured Data	feet times 10
4x0035	Bob 25 Measured Data	feet times 10
4x0036	Bob 26 Measured Data	feet times 10
4x0037	Bob 27 Measured Data	feet times 10
4x0038	Bob 28 Measured Data	feet times 10
4x0039	Bob 29 Measured Data	feet times 10
4x0040	Bob 30 Measured Data	feet times 10
4x0041	Bob 31 Measured Data	feet times 10
4x0042	Bob 32 Measured Data	feet times 10

Table 3-5 Address 247 Summary Register List (3 Measured Depth)

Holding Register	Description	Notes
4x0043	Bob 33 Measured Data	feet times 10
4x0044	Bob 34 Measured Data	feet times 10
4x0045	Bob 35 Measured Data	feet times 10
4x0046	Bob 36 Measured Data	feet times 10
4x0047	Bob 37 Measured Data	feet times 10
4x0048	Bob 38 Measured Data	feet times 10
4x0049	Bob 39 Measured Data	feet times 10
4x0050	Bob 40 Measured Data	feet times 10
4x0051	Bob 41 Measured Data	feet times 10
4x0052	Bob 42 Measured Data	feet times 10
4x0053	Bob 43 Measured Data	feet times 10
4x0054	Bob 44 Measured Data	feet times 10
4x0055	Bob 45 Measured Data	feet times 10
4x0056	Bob 46 Measured Data	feet times 10
4x0057	Bob 47 Measured Data	feet times 10
4x0058	Bob 48 Measured Data	feet times 10
4x0059	Bob 49 Measured Data	feet times 10
4x0060	Bob 50 Measured Data	feet times 10
4x0061	Bob 51 Measured Data	feet times 10
4x0062	Bob 52 Measured Data	feet times 10
4x0063	Bob 53 Measured Data	feet times 10
4x0064	Bob 54 Measured Data	feet times 10
4x0065	Bob 55 Measured Data	feet times 10
4x0066	Bob 56 Measured Data	feet times 10
4x0067	Bob 57 Measured Data	feet times 10
4x0068	Bob 58 Measured Data	feet times 10
4x0069	Bob 59 Measured Data	feet times 10
4x0070	Bob 60 Measured Data	feet times 10
4x0071	Bob 61 Measured Data	feet times 10
4x0072	Bob 62 Measured Data	feet times 10
4x0073	Bob 63 Measured Data	feet times 10
4x0074	Bob 64 Measured Data	feet times 10

Table 3-6 Address 247 Summary Register List (4 Pending Status)

Holding Register	Description	Notes
4x0111	Bob 1 Measurement Pending Status	See Table 3-2
4x0112	Bob 2 Measurement Pending Status	
4x0113	Bob 3 Measurement Pending Status	
4x0114	Bob 4 Measurement Pending Status	
4x0115	Bob 5 Measurement Pending Status	
4x0116	Bob 6 Measurement Pending Status	
4x0117	Bob 7 Measurement Pending Status	
4x0118	Bob 8 Measurement Pending Status	
4x0119	Bob 9 Measurement Pending Status	
4x0120	Bob 10 Measurement Pending Status	
4x0121	Bob 11 Measurement Pending Status	
4x0122	Bob 12 Measurement Pending Status	
4x0123	Bob 13 Measurement Pending Status	
4x0124	Bob 14 Measurement Pending Status	
4x0125	Bob 15 Measurement Pending Status	
4x0126	Bob 16 Measurement Pending Status	
4x0127	Bob 17 Measurement Pending Status	
4x0128	Bob 18 Measurement Pending Status	
4x0129	Bob 19 Measurement Pending Status	
4x0130	Bob 20 Measurement Pending Status	
4x0131	Bob 21 Measurement Pending Status	
4x0132	Bob 22 Measurement Pending Status	
4x0133	Bob 23 Measurement Pending Status	
4x0134	Bob 24 Measurement Pending Status	
4x0135	Bob 25 Measurement Pending Status	
4x0136	Bob 26 Measurement Pending Status	
4x0137	Bob 27 Measurement Pending Status	
4x0138	Bob 28 Measurement Pending Status	
4x0139	Bob 29 Measurement Pending Status	
4x0140	Bob 30 Measurement Pending Status	
4x0141	Bob 31 Measurement Pending Status	
4x0142	Bob 32 Measurement Pending Status	

Table 3-7 Address 247 Summary Register List (5 Pending Status)

Holding Register	Description	Notes
4x0143	Bob 33 Measurement Pending Status	See Table 3-2
4x0144	Bob 34 Measurement Pending Status	
4x0145	Bob 35 Measurement Pending Status	
4x0146	Bob 36 Measuredment Pending Status	
4x0147	Bob 37 Measurement Pending Status	
4x0148	Bob 38 Measurement Pending Status	
4x0149	Bob 39 Measurement Pending Status	
4x0150	Bob 40 Measurement Pending Status	
4x0151	Bob 41 Measurement Pending Status	
4x0152	Bob 42 Measurement Pending Status	
4x0153	Bob 43 Measurement Pending Status	
4x0154	Bob 44 Measurement Pending Status	
4x0155	Bob 45 Measurement Pending Status	
4x0156	Bob 46 Measurement Pending Status	
4x0157	Bob 47 Measurement Pending Status	
4x0158	Bob 48 Measurement Pending Status	
4x0159	Bob 49 Measurement Pending Status	
4x0160	Bob 50 Measurement Pending Status	
4x0161	Bob 51 Measurement Pending Status	
4x0162	Bob 52 Measurement Pending Status	
4x0163	Bob 53 Measurement Pending Status	
4x0164	Bob 54 Measurement Pending Status	
4x0165	Bob 55 Measurement Pending Status	
4x0166	Bob 56 Measurement Pending Status	
4x0167	Bob 57 Measurement Pending Status	
4x0168	Bob 58 Measurement Pending Status	
4x0169	Bob 59 Measurement Pending Status	
4x0170	Bob 60 Measurement Pending Status	
4x0171	Bob 61 Measurement Pending Status	
4x0172	Bob 62 Measurement Pending Status	
4x0173	Bob 63 Measurement Pending Status	
4x0174	Bob 64 Measurement Pending Status	

Global Setup Registers

Holding Registers greater than 900 are global to the application and accessible either by the summary slave address of 247 or an individual bob slave address.

Table 3-8 Global Register List (1 QUCM Setup)

Holding Register	Description	Notes
4x0901	Summary Modbus Slave Address	240 - 254, default = 247
4x0902	Port 1 Mode	0 = Smartbob 5 = Modbus RTU Slave 6 = Modbus ASCII Slave
4x0903	Port 1 Baud Rate	2400, 4800, 9600, 19200
4x0904	Port 1 Parity	1 = EVEN, 0=None
4x0905	Port 1 Data Bits	7 or 8
4x0906	Port 2 Mode	0 = Smartbob 5 = Modbus RTU Slave 6 = Modbus ASCII Slave
4x0907	Port 2 Baud Rate	2400, 4800, 9600, 19200
4x0908	Port 2 Parity	1 = EVEN, 0=None
4x0909	Port 2 Data Bits	7 or 8
4x0910	Length of Revision Date string	0 - 20
4x0911	Rev. Date	bytes 0,1
4x0912	Rev. Date	bytes 2,3
4x0913	Rev. Date	bytes 4,5
4x0914	Rev. Date	bytes 6,7
4x0915	Rev. Date	bytes 8,9
4x0916	Rev. Date	bytes 10,11
4x0917	Rev. Date	bytes 12,13
4x0918	Rev. Date	bytes 14,15
4x0919	Rev. Date	bytes 16,17
4x0920	Rev. Date	bytes 18,19

Table 3-9 Global Register List (2 Modbus Slave Addresses)

Holding Register	Description	Notes
4x1001	Bob 1 Modbus Slave Address	1-239, 0=disabled
4x1002	Bob 2 Modbus Slave Address	
4x1003	Bob 3 Modbus Slave Address	
4x1004	Bob 4 Modbus Slave Address	
4x1005	Bob 5 Modbus Slave Address	
4x1006	Bob 6 Modbus Slave Address	
4x1007	Bob 7 Modbus Slave Address	
4x1008	Bob 8 Modbus Slave Address	
4x1009	Bob 9 Modbus Slave Address	
4x1010	Bob 10 Modbus Slave Address	
4x1011	Bob 11 Modbus Slave Address	
4x1012	Bob 12 Modbus Slave Address	
4x1013	Bob 13 Modbus Slave Address	
4x1014	Bob 14 Modbus Slave Address	
4x1015	Bob 15 Modbus Slave Address	
4x1016	Bob 16 Modbus Slave Address	
4x1017	Bob 17 Modbus Slave Address	
4x1018	Bob 18 Modbus Slave Address	
4x1019	Bob 19 Modbus Slave Address	
4x1020	Bob 20 Modbus Slave Address	
4x1021	Bob 21 Modbus Slave Address	
4x1022	Bob 22 Modbus Slave Address	
4x1023	Bob 23 Modbus Slave Address	
4x1024	Bob 24 Modbus Slave Address	
4x1025	Bob 25 Modbus Slave Address	
4x1026	Bob 26 Modbus Slave Address	
4x1027	Bob 27 Modbus Slave Address	
4x1028	Bob 28 Modbus Slave Address	
4x1029	Bob 29 Modbus Slave Address	
4x1030	Bob 30 Modbus Slave Address	
4x1031	Bob 31 Modbus Slave Address	
4x1032	Bob 32 Modbus Slave Address	

Table 3-10 Global Register List (3 Modbus Slave Addresses)

Holding Register	Description	Notes
4x1033	Bob 33 Modbus Slave Address	1-239, 0=disabled
4x1034	Bob 34 Modbus Slave Address	
4x1035	Bob 35 Modbus Slave Address	
4x1036	Bob 36 Modbus Slave Address	
4x1037	Bob 37 Modbus Slave Address	
4x1038	Bob 38 Modbus Slave Address	
4x1039	Bob 39 Modbus Slave Address	
4x1040	Bob 40 Modbus Slave Address	
4x1041	Bob 41 Modbus Slave Address	
4x1042	Bob 42 Modbus Slave Address	
4x1043	Bob 43 Modbus Slave Address	
4x1044	Bob 44 Modbus Slave Address	
4x1045	Bob 45 Modbus Slave Address	
4x1046	Bob 46 Modbus Slave Address	
4x1047	Bob 47 Modbus Slave Address	
4x1048	Bob 48 Modbus Slave Address	
4x1049	Bob 49 Modbus Slave Address	
4x1050	Bob 50 Modbus Slave Address	
4x1051	Bob 51 Modbus Slave Address	
4x1052	Bob 52 Modbus Slave Address	
4x1053	Bob 53 Modbus Slave Address	
4x1054	Bob 54 Modbus Slave Address	
4x1055	Bob 55 Modbus Slave Address	
4x1056	Bob 56 Modbus Slave Address	
4x1057	Bob 57 Modbus Slave Address	
4x1058	Bob 58 Modbus Slave Address	
4x1059	Bob 59 Modbus Slave Address	
4x1060	Bob 60 Modbus Slave Address	
4x1061	Bob 61 Modbus Slave Address	
4x1062	Bob 62 Modbus Slave Address	
4x1063	Bob 63 Modbus Slave Address	
4x1064	Bob 64 Modbus Slave Address	

Table 3-11 Global Register List (4 SmartBob Slave Addresses)

Holding Register	Description	Notes
4x1101	Device 1 SmartBob Slave Address	1-239, 0=disabled
4x1102	Device 2 SmartBob Slave Address	
4x1103	Device 3 SmartBob Slave Address	
4x1104	Device 4 SmartBob Slave Address	
4x1105	Device 5 SmartBob Slave Address	
4x1106	Device 6 SmartBob Slave Address	
4x1107	Device 7 SmartBob Slave Address	
4x1108	Device 8 SmartBob Slave Address	
4x1109	Device 9 SmartBob Slave Address	
4x1110	Device 10 SmartBob Slave Address	
4x1111	Device 11 SmartBob Slave Address	
4x1112	Device 12 SmartBob Slave Address	
4x1113	Device 13 SmartBob Slave Address	
4x1114	Device 14 SmartBob Slave Address	
4x1115	Device 15 SmartBob Slave Address	
4x1116	Device 16 SmartBob Slave Address	
4x1117	Device 17 SmartBob Slave Address	
4x1118	Device 18 SmartBob Slave Address	
4x1119	Device 19 SmartBob Slave Address	
4x1120	Device 20 SmartBob Slave Address	
4x1121	Device 21 SmartBob Slave Address	
4x1122	Device 22 SmartBob Slave Address	
4x1123	Device 23 SmartBob Slave Address	
4x1124	Device 24 SmartBob Slave Address	
4x1125	Device 25 SmartBob Slave Address	
4x1126	Device 26 SmartBob Slave Address	
4x1127	Device 27 SmartBob Slave Address	
4x1128	Device 28 SmartBob Slave Address	
4x1129	Device 29 SmartBob Slave Address	
4x1130	Device 30 SmartBob Slave Address	
4x1131	Device 31 SmartBob Slave Address	
4x1132	Device 32 SmartBob Slave Address	

Table 3-12 Global Register List (5 SmartBob Slave Addresses)

Holding Register	Description	Notes
4x1133	Device 33 SmartBob Slave Address	1-239, 0=disabled
4x1134	Device 34 SmartBob Slave Address	
4x1135	Device 35 SmartBob Slave Address	
4x1136	Device 36 SmartBob Slave Address	
4x1137	Device 37 SmartBob Slave Address	
4x1138	Device 38 SmartBob Slave Address	
4x1139	Device 39 SmartBob Slave Address	
4x1140	Device 40 SmartBob Slave Address	
4x1141	Device 41 SmartBob Slave Address	
4x1142	Device 42 SmartBob Slave Address	
4x1143	Device 43 SmartBob Slave Address	
4x1144	Device 44 SmartBob Slave Address	
4x1145	Device 45 SmartBob Slave Address	
4x1146	Device 46 SmartBob Slave Address	
4x1147	Device 47 SmartBob Slave Address	
4x1148	Device 48 SmartBob Slave Address	
4x1149	Device 49 SmartBob Slave Address	
4x1150	Device 50 SmartBob Slave Address	
4x1151	Device 51 SmartBob Slave Address	
4x1152	Device 52 SmartBob Slave Address	
4x1153	Device 53 SmartBob Slave Address	
4x1154	Device 54 SmartBob Slave Address	
4x1155	Device 55 SmartBob Slave Address	
4x1156	Device 56 SmartBob Slave Address	
4x1157	Device 57 SmartBob Slave Address	
4x1158	Device 58 SmartBob Slave Address	
4x1159	Device 59 SmartBob Slave Address	
4x1160	Device 60 SmartBob Slave Address	
4x1161	Device 61 SmartBob Slave Address	
4x1162	Device 62 SmartBob Slave Address	
4x1163	Device 63 SmartBob Slave Address	
4x1164	Device 64 SmartBob Slave Address	

Table 3-13 Global Register List (6 QUCM Port Number)

Holding Register	Description	Notes
4x1201	Device 1 QUCM Port Number	1 or 2, 0=disabled
4x1202	Device 2 QUCM Port Number	
4x1203	Device 3 QUCM Port Number	
4x1204	Device 4 QUCM Port Number	
4x1205	Device 5 QUCM Port Number	
4x1206	Device 6 QUCM Port Number	
4x1207	Device 7 QUCM Port Number	
4x1208	Device 8 QUCM Port Number	
4x1209	Device 9 QUCM Port Number	
4x1210	Device 10 QUCM Port Number	
4x1211	Device 11 QUCM Port Number	
4x1212	Device 12 QUCM Port Number	
4x1213	Device 13 QUCM Port Number	
4x1214	Device 14 QUCM Port Number	
4x1215	Device 15 QUCM Port Number	
4x1216	Device 16 QUCM Port Number	
4x1217	Device 17 QUCM Port Number	
4x1218	Device 18 QUCM Port Number	
4x1219	Device 19 QUCM Port Number	
4x1220	Device 20 QUCM Port Number	
4x1221	Device 21 QUCM Port Number	
4x1222	Device 22 QUCM Port Number	
4x1223	Device 23 QUCM Port Number	
4x1224	Device 24 QUCM Port Number	
4x1225	Device 25 QUCM Port Number	
4x1226	Device 26 QUCM Port Number	
4x1227	Device 27 QUCM Port Number	
4x1228	Device 28 QUCM Port Number	
4x1229	Device 29 QUCM Port Number	
4x1230	Device 30 QUCM Port Number	
4x1231	Device 31 QUCM Port Number	
4x1232	Device 32 QUCM Port Number	

Table 3-14 Global Register List (7 QUCM Port Number)

Holding Register	Description	Notes
4x1233	Device 33 QUCM Port Number	1 or 2, 0=disabled
4x1234	Device 34 QUCM Port Number	
4x1235	Device 35 QUCM Port Number	
4x1236	Device 36 QUCM Port Number	
4x1237	Device 37 QUCM Port Number	
4x1238	Device 38 QUCM Port Number	
4x1239	Device 39 QUCM Port Number	
4x1240	Device 40 QUCM Port Number	
4x1241	Device 41 QUCM Port Number	
4x1242	Device 42 QUCM Port Number	
4x1243	Device 43 QUCM Port Number	
4x1244	Device 44 QUCM Port Number	
4x1245	Device 45 QUCM Port Number	
4x1246	Device 46 QUCM Port Number	
4x1247	Device 47 QUCM Port Number	
4x1248	Device 48 QUCM Port Number	
4x1249	Device 49 QUCM Port Number	
4x1250	Device 50 QUCM Port Number	
4x1251	Device 51 QUCM Port Number	
4x1252	Device 52 QUCM Port Number	
4x1253	Device 53 QUCM Port Number	
4x1254	Device 54 QUCM Port Number	
4x1255	Device 55 QUCM Port Number	
4x1256	Device 56 QUCM Port Number	
4x1257	Device 57 QUCM Port Number	
4x1258	Device 58 QUCM Port Number	
4x1259	Device 59 QUCM Port Number	
4x1260	Device 60 QUCM Port Number	
4x1261	Device 61 QUCM Port Number	
4x1262	Device 62 QUCM Port Number	
4x1263	Device 63 QUCM Port Number	
4x1264	Device 64 QUCM Port Number	

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 status of the polled SmartBobs. The table of devices shows the Modbus/TCP destination Index, QUCM port number, SmartBob Slave Address, Text Name, Measured Depth, Measurement Age, a link for the online status, and a link to acquire a new measurement. There is also a link to acquire a new measurement of all attached bobs.

Clicking on the online link in the Status will show a page for the readings and configuration setpoints of the chosen Bob. See figure 4-2. QUCM serial line statistics are also displayed for the device. Links are provided for a New Measurement as well as Next Device, Previous Device, and Home.

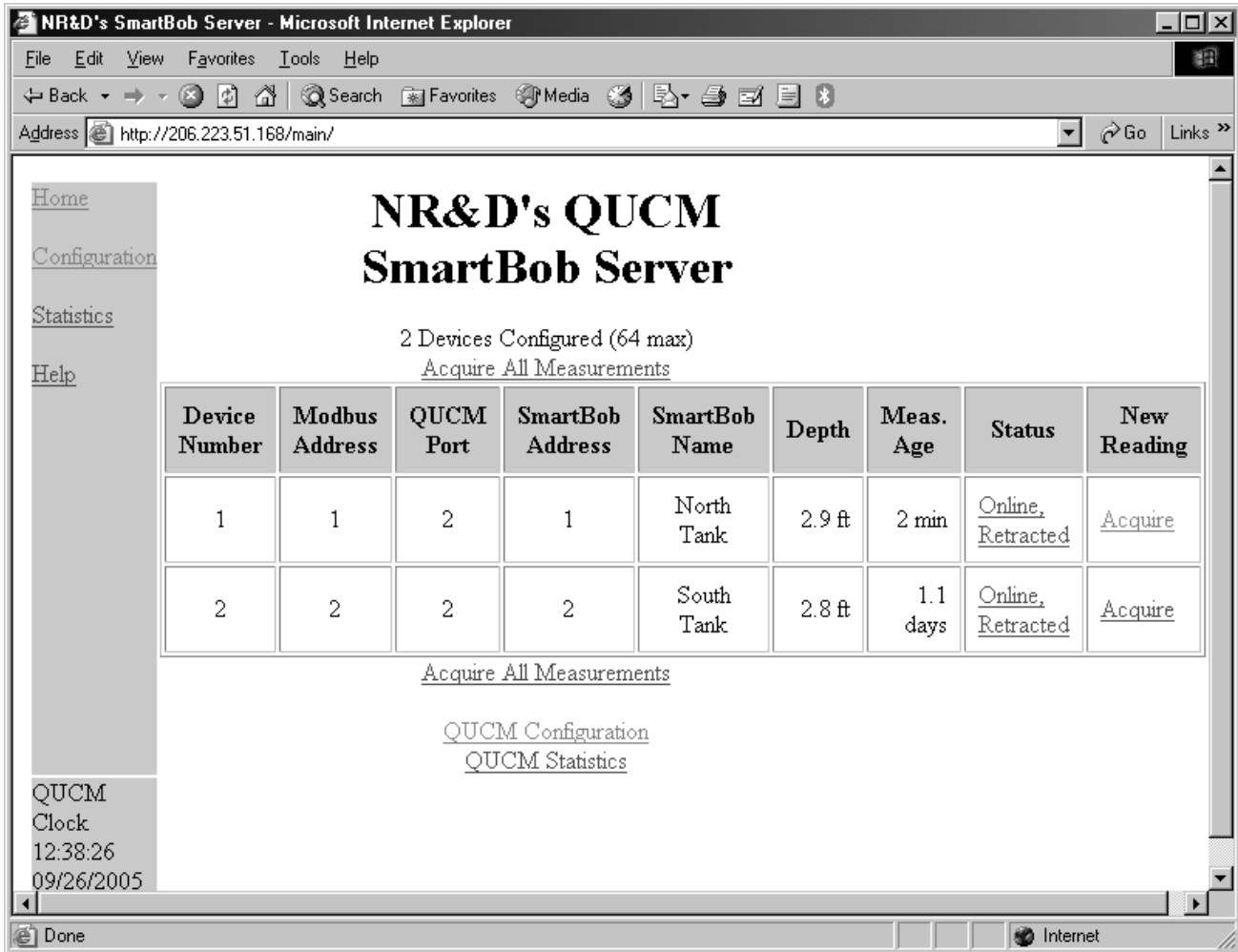


Figure 4-1 Main Page with two devices configured

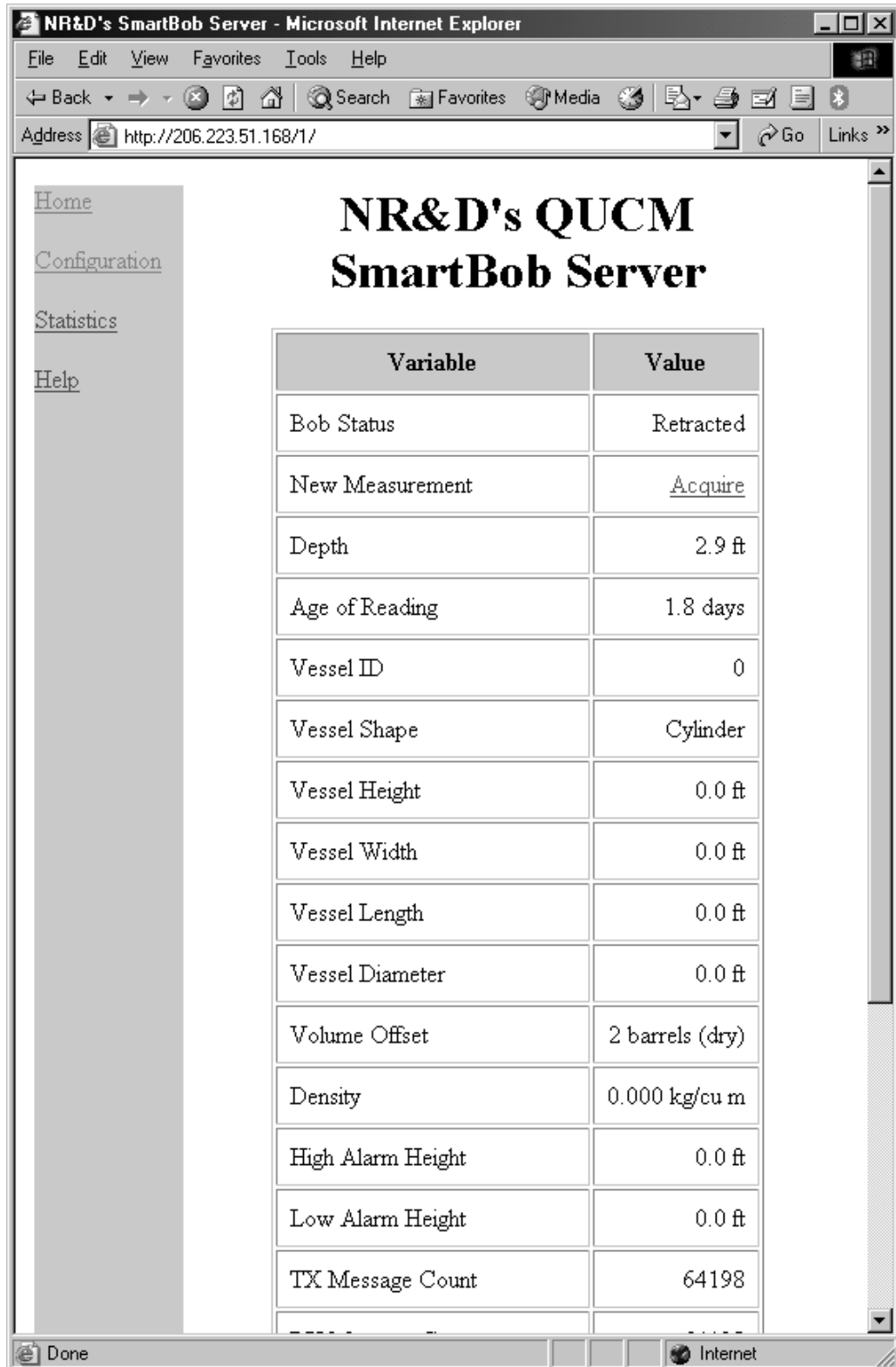


Figure 4-2 Device Page

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 4-3.

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 Smartbob devices to be polled. Each device allows the selection of the Modbus/TCP Address, QUCM Port number, text Name, Smartbob Slave Address, and In Service check box.

The "**Modbus Address**" is the Modbus/TCP or Modbus Serial slave address used to access the collected data in the QUCM for testing and debugging. Valid entries are 1 to 240.

The "**QUCM Port**" is the port that the message will be transmitted from. Possible values are Port 1 and Port 2. The QUCM Port must be set for Smartbob mode to be valid.

The "**Slave Name**" is a text description for the remote slave. This description is shown in most QUCM tables. The maximum length is 20 characters.

The "**Slave Address**" is the Smartbob slave address of the meter. Possible values are 1-240.

The "**In Service**" check box is used to temporarily disable a device.

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:

- **SmartBob** - This mode is used when a network of SmartBobs is directly connected to the QUCM port. When the port is in SmartBob mode, the baud rate becomes fixed at 2400, parity is fixed at NONE, and data bits is fixed at 8.
- **Modbus RTU Slave** - This mode is for access to the SmartBob data for from a Modbus RTU serial master. The data bits are fixed at 8 when the port is in Modbus RTU Slave.
- **Modbus ASCII Slave** - This mode is for access to the SmartBob data for from a Modbus ASCII serial master. The data bits may be set to either 7 or 8 while in ASCII mode.

The Baud Rate settings allow the chosen serial port to be set at 1200, 2400, 9600, and 19200 baud.

The Parity setting allow the port to be set to NONE or EVEN. The default value is EVEN.

The Data Bits should be at 8 unless Modbus ASCII requires 7.

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.

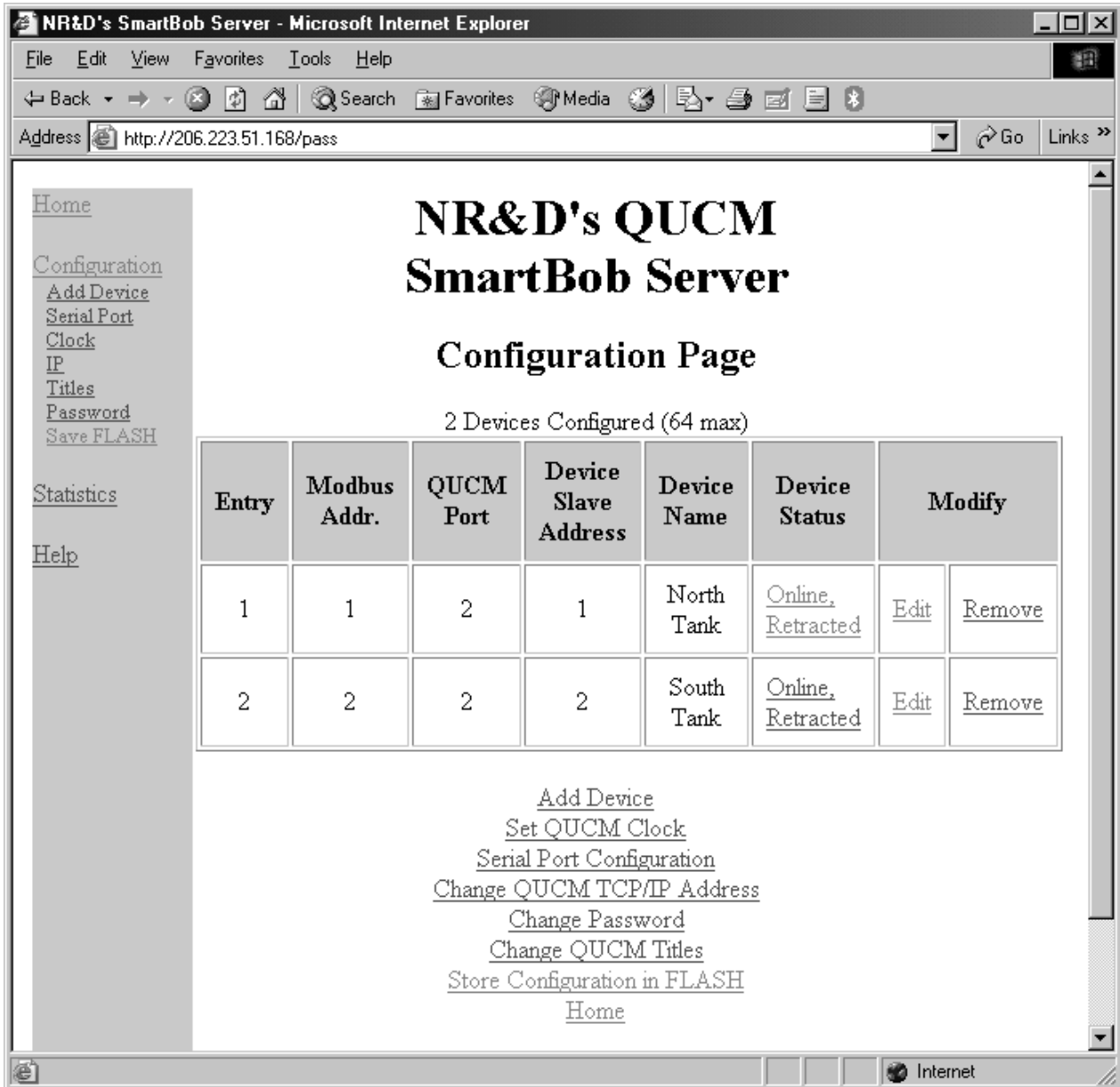


Figure 4-3 Configuration Page

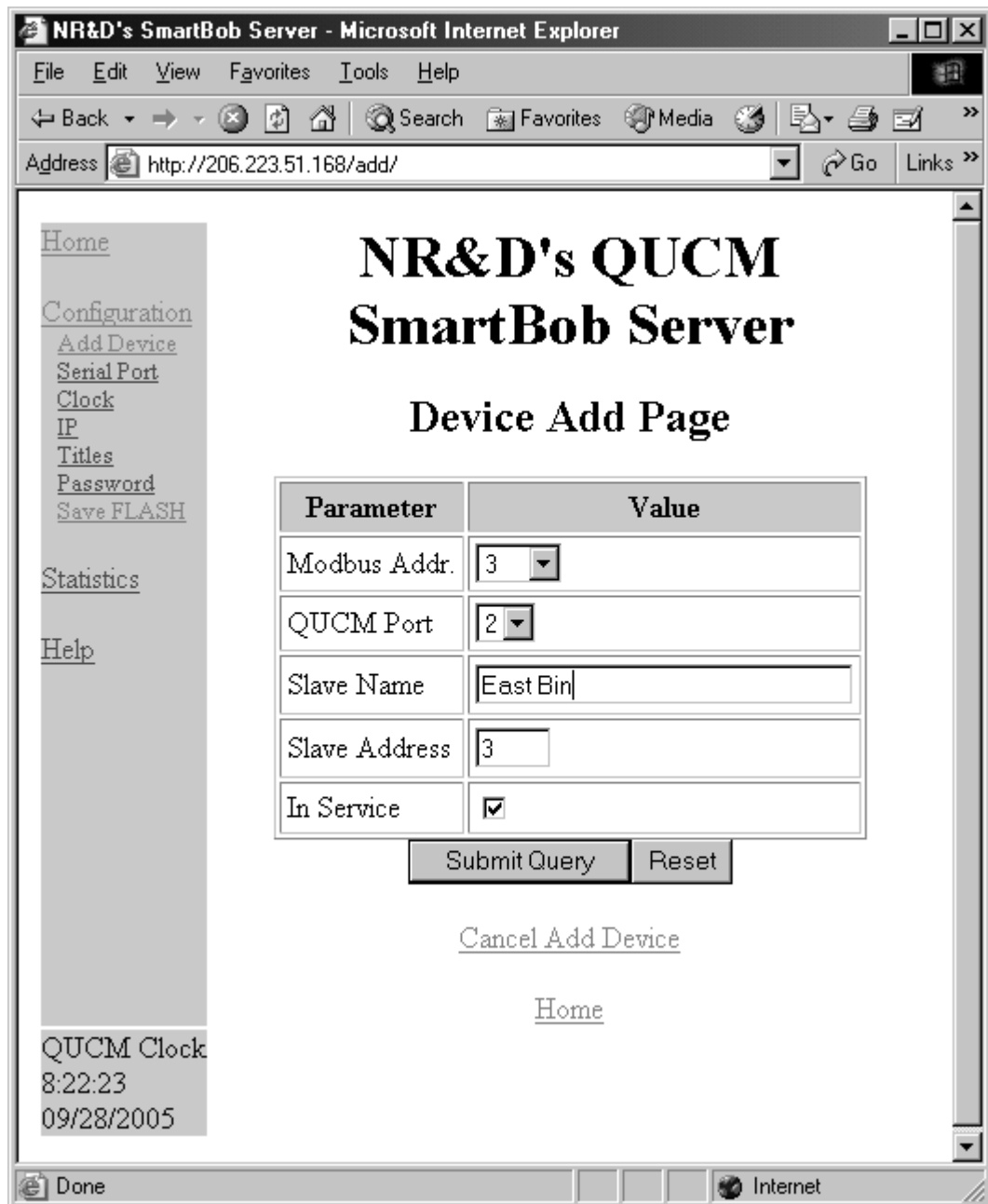
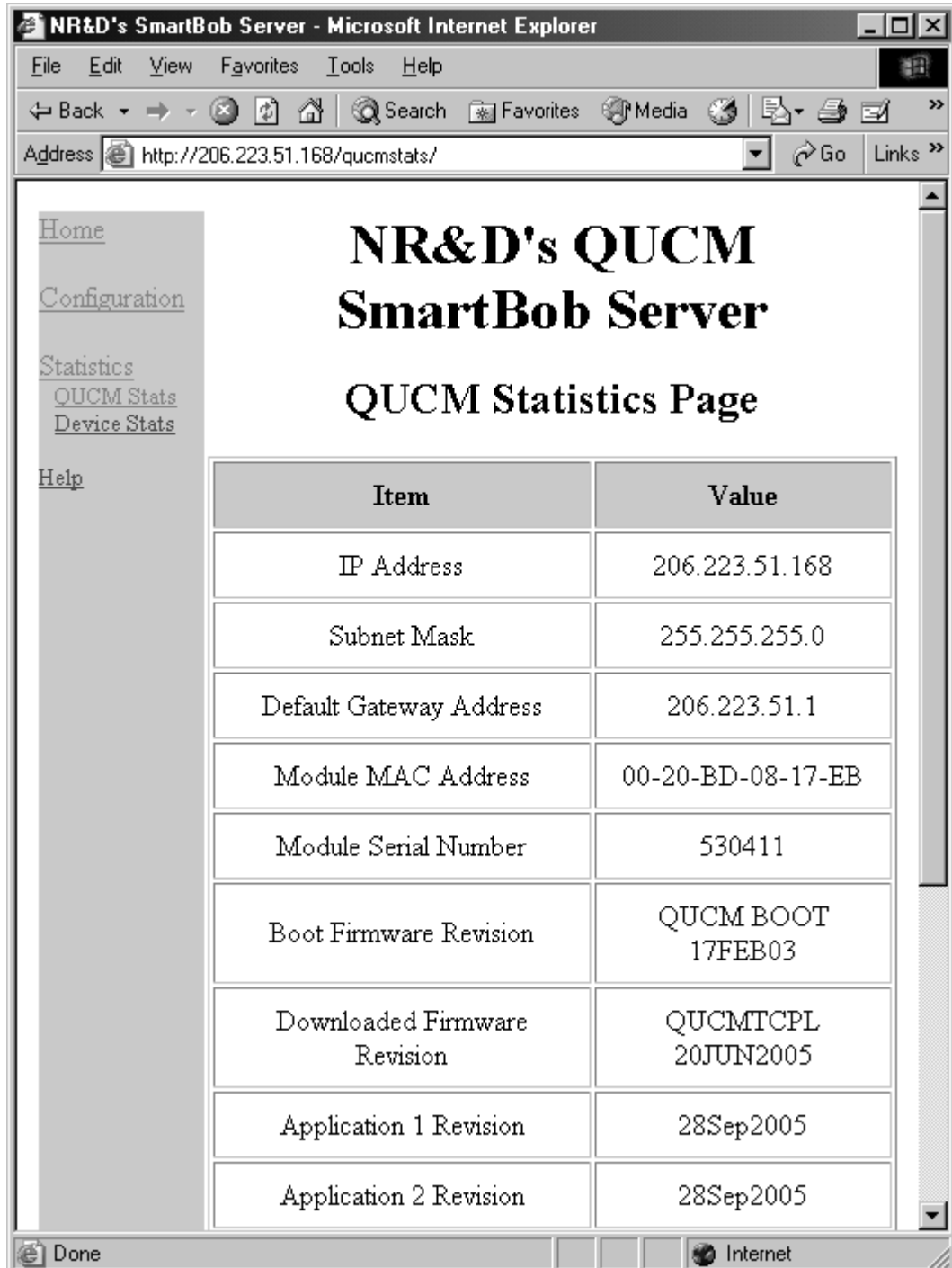


Figure 4-4 Add Device Page

Statistics Pages

There are two links for statistics: QUCM and Device stats. (See Figure 4-5 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.



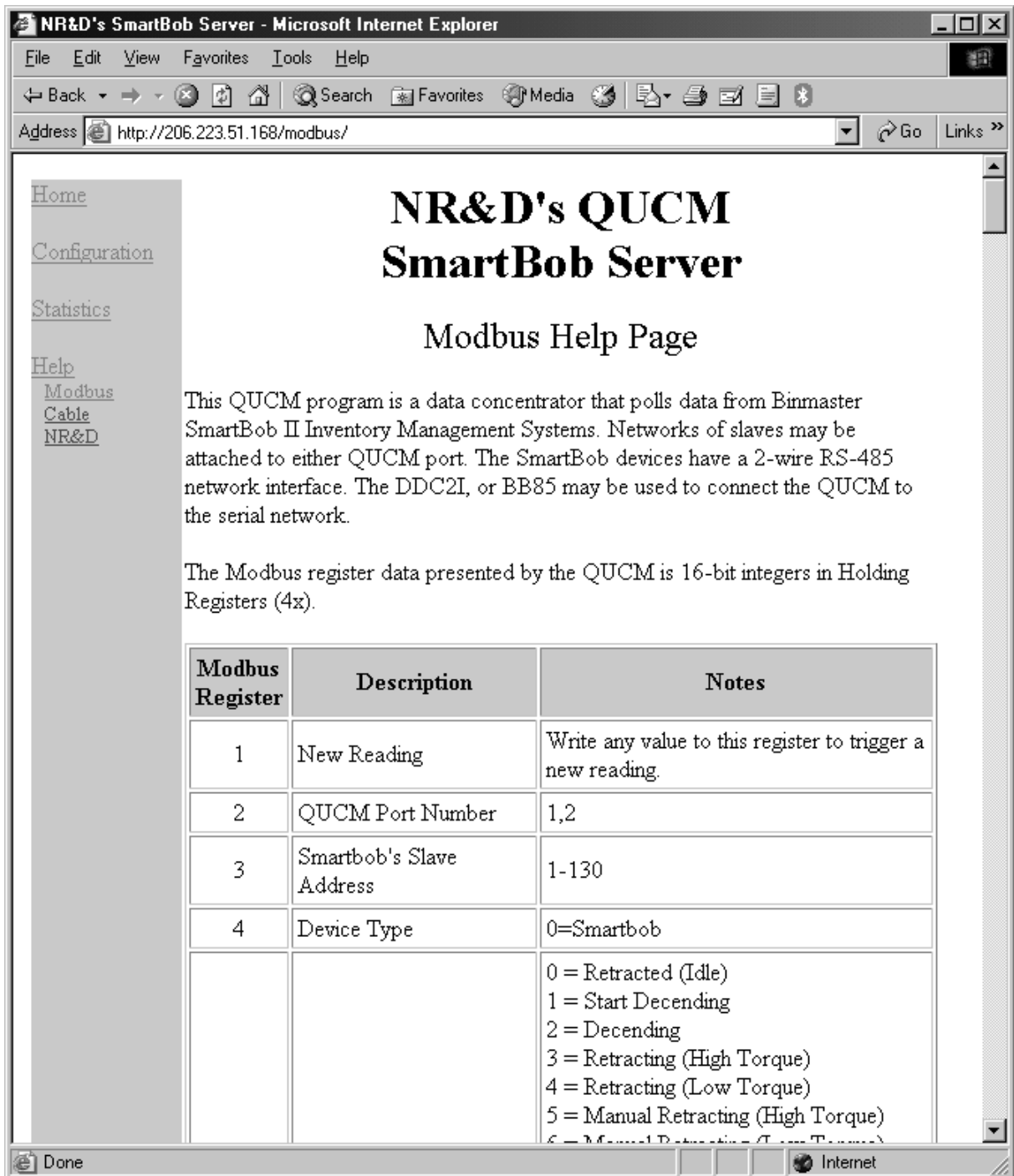
The screenshot shows a Microsoft Internet Explorer browser window titled "NR&D's SmartBob Server - Microsoft Internet Explorer". The address bar shows "http://206.223.51.168/qucmstats/". The page content includes a navigation menu on the left with links for Home, Configuration, Statistics (with sub-links for QUCM Stats and Device Stats), and Help. The main content area features the heading "NR&D's QUCM SmartBob Server" and "QUCM Statistics Page". Below this is a table with the following data:

Item	Value
IP Address	206.223.51.168
Subnet Mask	255.255.255.0
Default Gateway Address	206.223.51.1
Module MAC Address	00-20-BD-08-17-EB
Module Serial Number	530411
Boot Firmware Revision	QUCM BOOT 17FEB03
Downloaded Firmware Revision	QUCMTCPL 20JUN2005
Application 1 Revision	28Sep2005
Application 2 Revision	28Sep2005

Figure 4-5 Statistics Web Page

Help Pages

There are a number of help pages to assist in building the serial cables and an abridged listing of the Modbus registers. Figure <help page> shows the help page for the DDC2I.



The screenshot shows a Microsoft Internet Explorer window titled "NR&D's SmartBob Server - Microsoft Internet Explorer". The address bar shows "http://206.223.51.168/modbus/". The page content includes a navigation menu on the left with links for Home, Configuration, Statistics, Help, Modbus, Cable, and NR&D. The main heading is "NR&D's QUCM SmartBob Server Modbus Help Page". The text describes the QUCM program as a data concentrator that polls data from Binmaster SmartBob II Inventory Management Systems. It mentions that networks of slaves may be attached to either QUCM port and that SmartBob devices have a 2-wire RS-485 network interface. It also states that the DDC2I or BB85 may be used to connect the QUCM to the serial network. A paragraph below states that the Modbus register data presented by the QUCM is 16-bit integers in Holding Registers (4x). A table follows, listing Modbus registers with their descriptions and notes.

Modbus Register	Description	Notes
1	New Reading	Write any value to this register to trigger a new reading.
2	QUCM Port Number	1,2
3	Smartbob's Slave Address	1-130
4	Device Type	0=Smartbob
		0 = Retracted (Idle) 1 = Start Decending 2 = Decending 3 = Retracting (High Torque) 4 = Retracting (Low Torque) 5 = Manual Retracting (High Torque) 6 = Manual Retracting (Low Torque)

Figure 4-6 Cable Help Web Page

Example 1

Figure 5-1 shows system with a Modbus/TCP Client, a QUCM, and two SmartBobs on tanks. The PC is connected via Ethernet to the QUCM through a switch. The SmartBob RS-485 network is connected to a DDC2I connected to QUCM port 2. The SmartBobs are set for slave addresses 1 and 2 and these are mapped to Modbus Slave Addresses 1 and 2 respectively.

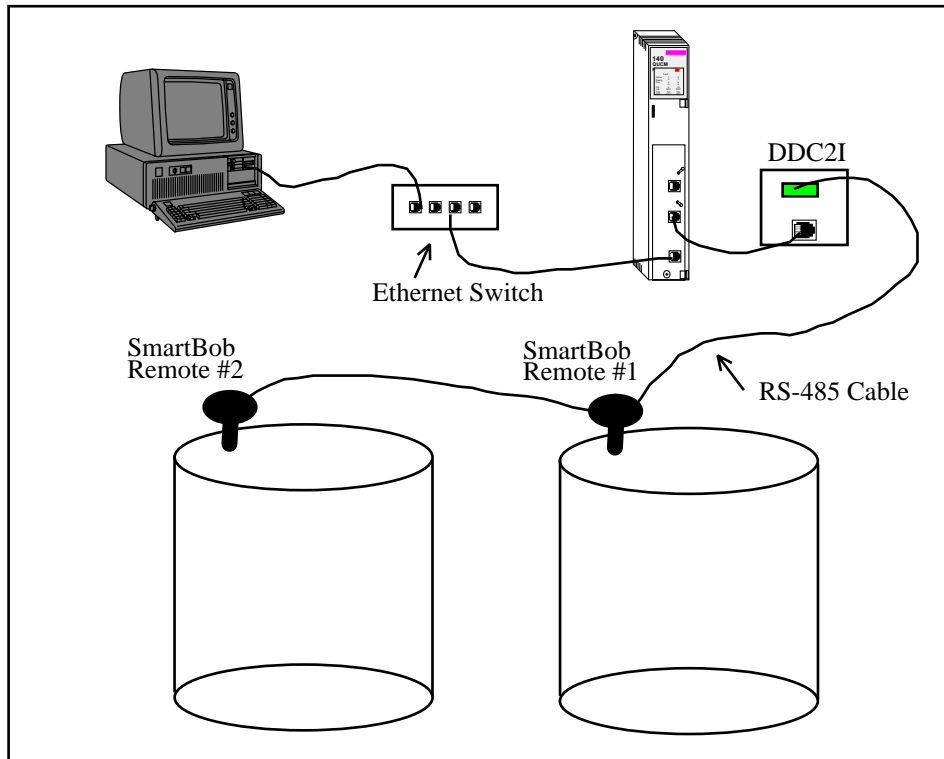


Figure 5-1 Example 1 Layout

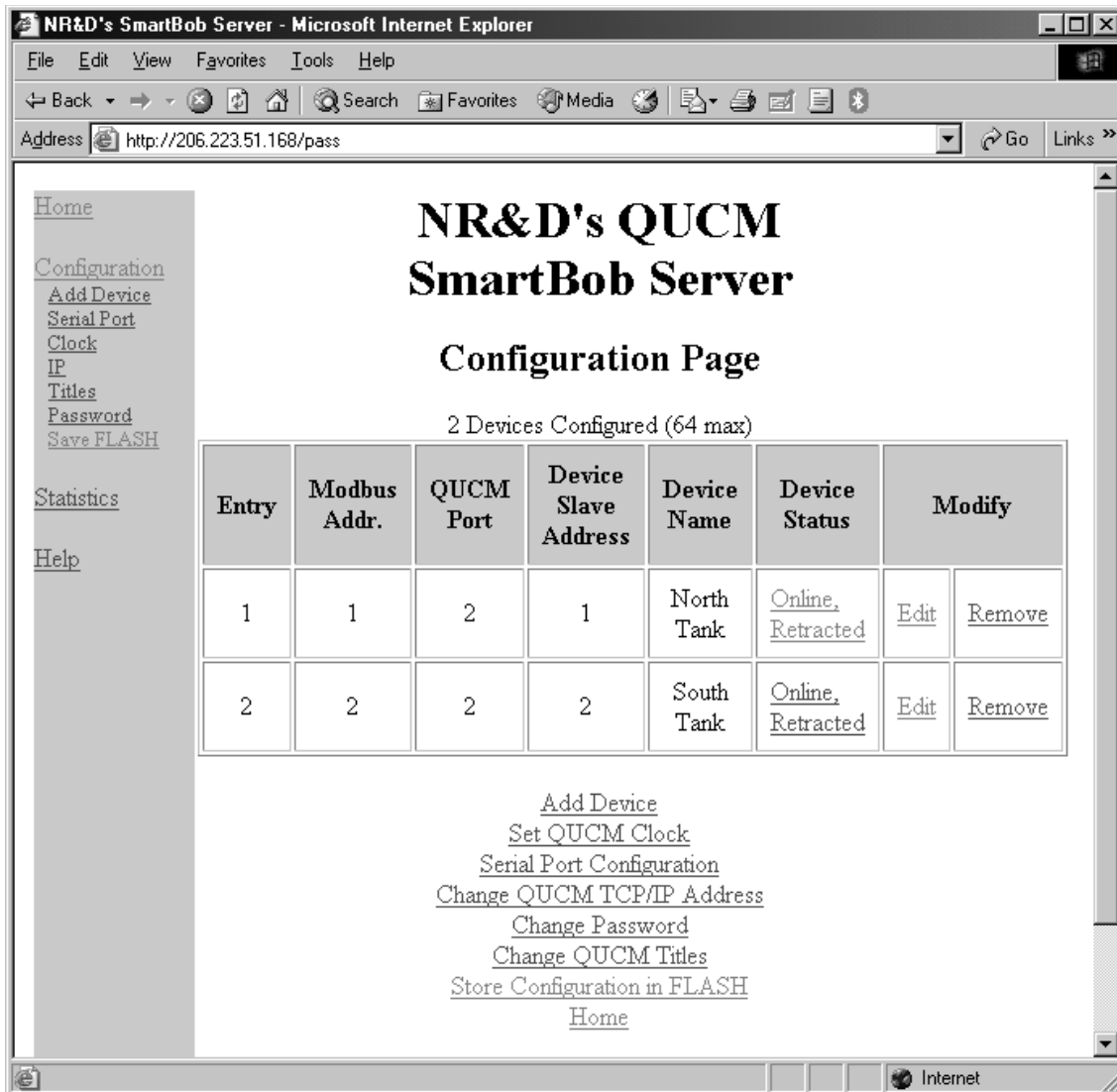


Figure 5-2 Config Web Page Screen