DUCM Crop-Protector™

Installation and Programming Manual

This manual describes the DUCM application for interfacing a Crop-Protector™ Temperature/Humidity Monitor to a Modbus RTU serial network.

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1 Introduction

The Niobrara DUCM is an Modicon Momentum® compatible module that is capable of running an application for performing communication translations between serial protocols. This document covers an application that allows a Modbus serial master to gather data from a Crop-Protector™ Master-Hub.

Crop-Protector™ data is presented as Modbus Holding Registers (4x). Temperature and humidity values are stored as 16bit integers. The Modbus Slave Address (default=1), baud rate (default=9600), data bits (default=8), and parity (default=NONE) may all be configured from the front panel.

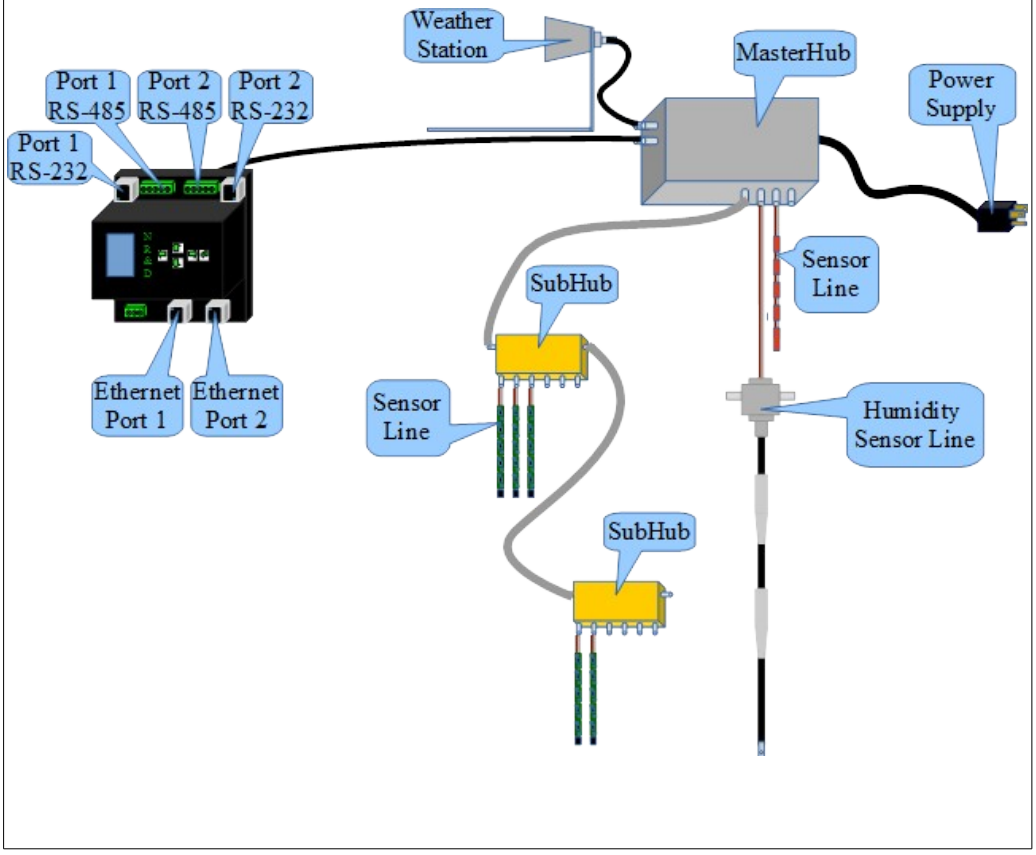
Serial ports 1 and 2 of the DUCM can be set to use a RS-485 driver and then connected to the Crop-Protector™ Master-Hub. The Niobrara SC912 cable is handy for testing the Modbus RS-485 connection from a PC. The ethernet ports on the DUCM can be used to connect to it to a network and accessed over that.

The DUCM requires 24 VDC power supply and needs a minimum 6W.

When ordered as the kit contains:

- DUCM - Preloaded with Crop-Protector™ application

Figure 1.1: Typical Configuration



2 Installation

Installation of the DUCM should go quickly, with the necessary materials. The following items are necessary:

- DUCM +302
- MU1 cable see Figure 2.1
- Power source for DUCM (use NR&D part TR121ST or available power)
- Cabling between DUCM and Modbus Master may be built or purchased
- Cabling between DUCM and Crop-Protector™ equipment may be built or purchased.

The following may be used:

- DIN rail for mounting

Module Installation

1. Mount the DUCM on a DIN rail. The DIN rail should be Earth-grounded for the DUCM serial ports' transient suppression.
2. Supply power to the DUCM; The supplied NR&D's TR121ST may be used, or any available power source of minimum 6W 9-30 Volts DC.

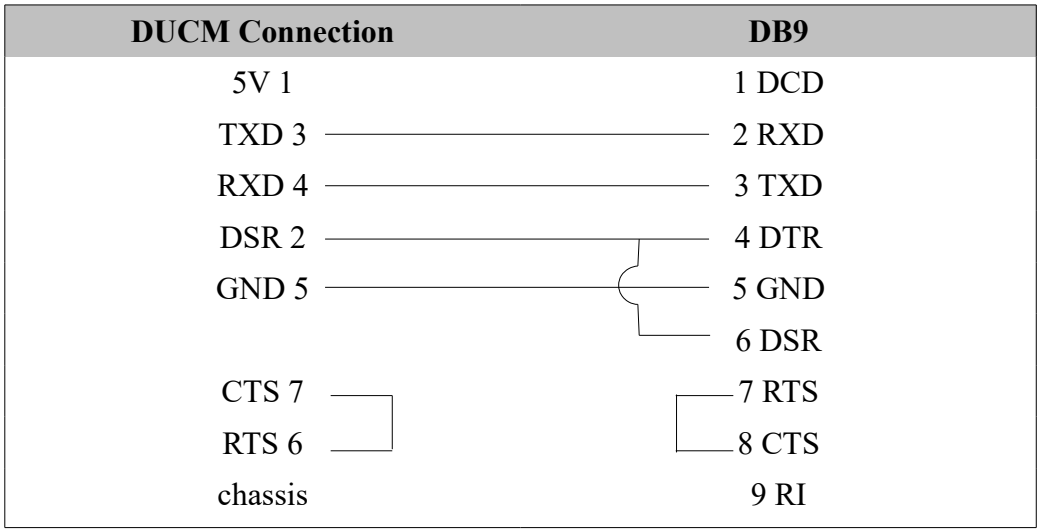
Serial Connections to the DUCM

Each DUCM port has jacks for both RS-232 and RS-485 connections, and which jack is being used is selected from the front panel by changing the port driver.

RS-232 Port to 9-pin UPS

A RS-232 connection off of a port of the DUCM requires an RJ45 jack to connect to a serial port off of a computer, thus the Niobrara MM1 cable may be used. For other standard connections, see the DUCM manual, or contact NR&D's technical support.

Figure 2.2.: DUCM to 9-pin RS-232 (MM1 Cable)



RS-485 Port to Master-Hub

2-Wire RS-485 Master-Hubs are supported by the DUCM by jumpering the TX+ and RX+ together to make the (+) connection and the Tx- and Rx- together for the (-) connection.

Figure 2.3.: DUCM to 2-wire Master-Hub

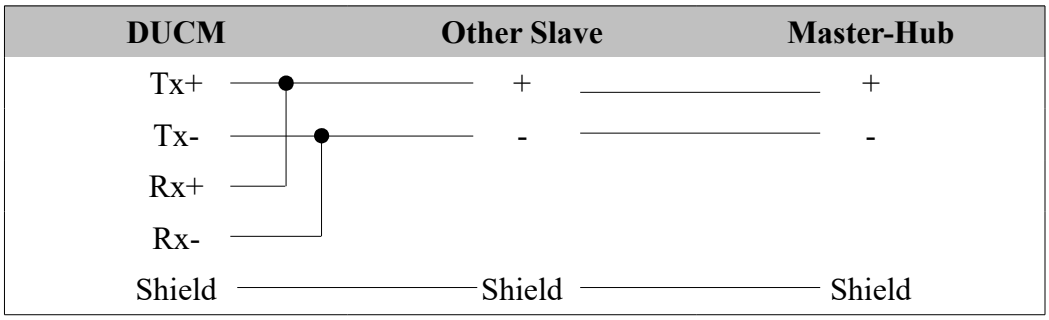
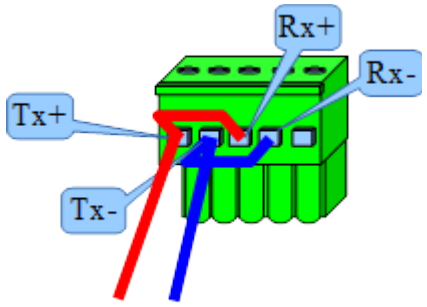


Figure 2.4:DUCM RS-485 2-wire Connector



DUCM Application Configuration

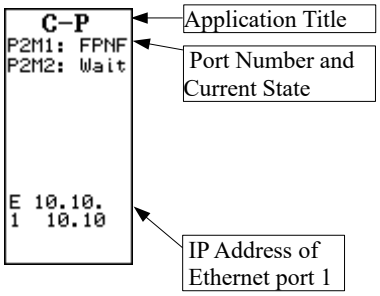
Connect the Crop-Protector™ Master-Hub to DUCM port. The default settings for the DUCM are shown in Table 2.1.

Table 2.1: DUCM Default Serial Port Settings

Setting	Port 1	Port 2
Protocol Mode	Modbus RTU	C-P
Baud Rate	9600	9600
Parity	None	None
Data Bits	8	8
Stop Bits	1	1
Modbus Slave Address	1	1
Driver	RS-232	RS-485
Number of Master-Hubs	N/A	1

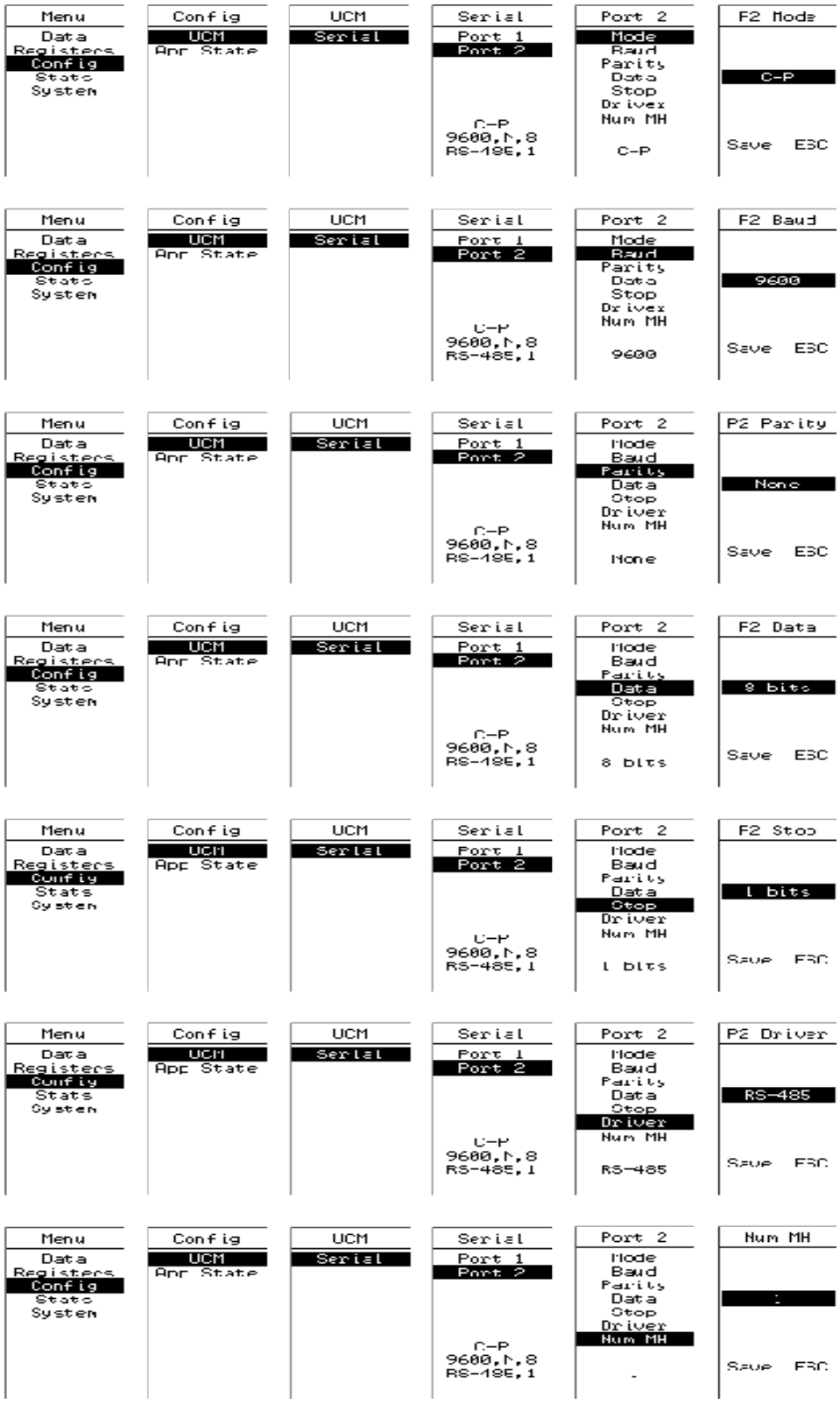
These settings may be modified by using the front panel and LCD screen on the DUCM. When the application starts it checks which ports are configured for Crop-Protector™ Master-Hubs. If the port responds to the queries Splash screen will look similar to Figure 2.5. This screen displays information about the status of the program state for the Master-Hub and DUCM on that port.

Figure 2.5: Splash screen



To set up port parameters use the up, down, right, and enter keys to select Menu, Config, UCM, Serial, Port # then select the Mode, Slave address, Baud rate, Parity, Data bits, and number of Master-Hubs off each port from the lists to match the settings of the Modbus master.

Figure 2.6: Serial Port Configuration Menus



The DUCM will attempt to communicate with the Master-Hub as long as the application is running. If the DUCM is not able to communicate with the Master-Hub then no data will be displayed and errors will be noted.

There can be a total of 8 Master-Hubs off of both the ports, and the addresses of the Master-Hubs need to start at one and increase sequentially. For example if there are 3 Master-Hubs off of port 1 the addresses need to be 1, 2, and 3. The application will not recognize or attempt to poll data from any Master-Hub with an address greater than 3. If there is a Master-Hub off of port 2 it will need to be address 1. When accessing the data polled from the devices, the slave addresses for this example will be 1 through 4 where the data from Master-Hub 1 off of port 1 will be accessed through slave address 1 and the data from Master-Hub 1 off of port 2 will be accessed through slave address 4.

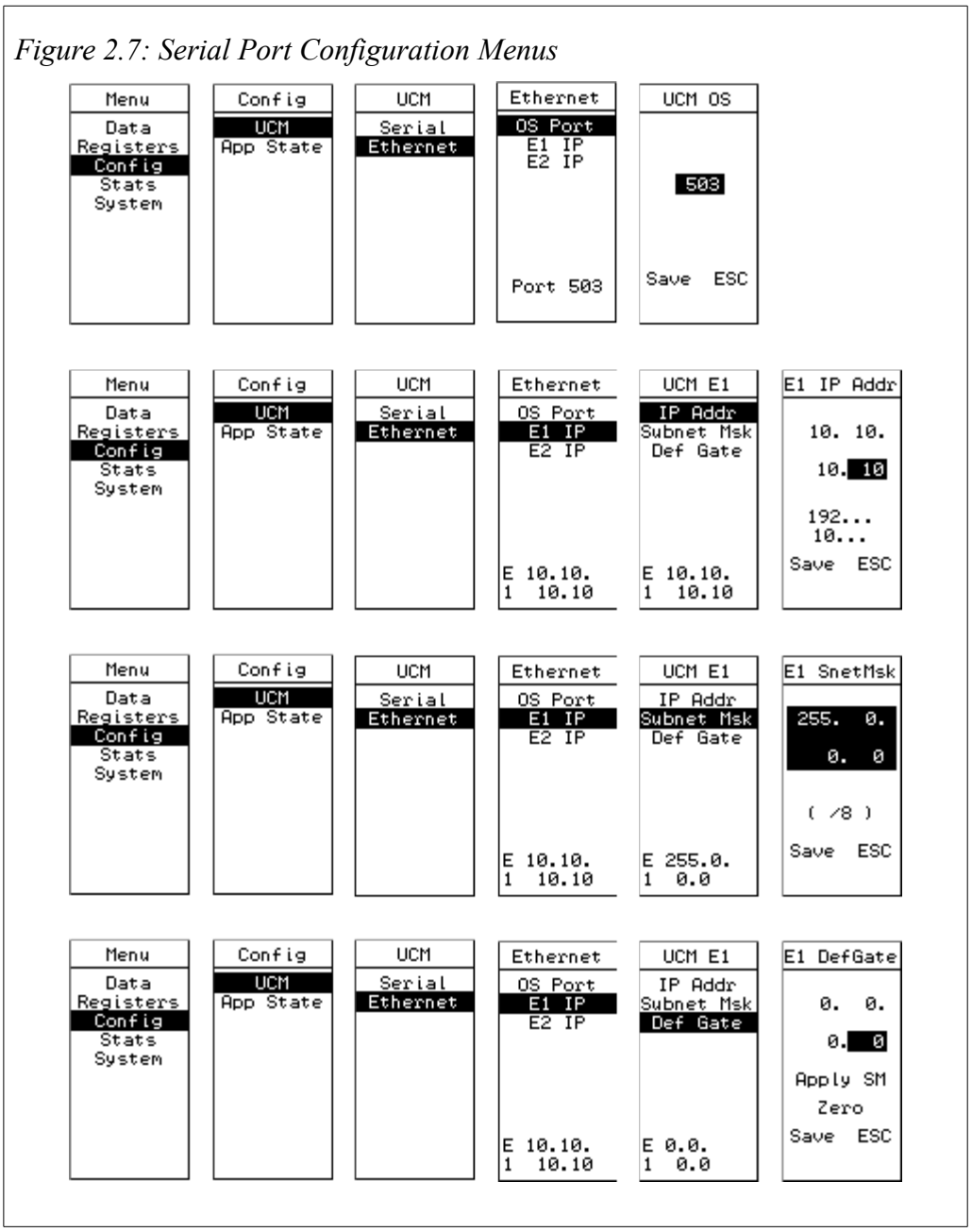
The DUCM also has ethernet ports in addition to the serial ports and the default settings are shown below.

Table 2.2: DUCM Default Ethernet Port Settings

Setting	Port 1	Port 2
IP Address	10.10.10.10	10.10.10.11
Subnet Mask	255.0.0.0	255.0.0.0
Default Gateway	0.0.0.0	0.0.0.0

To set up port parameters use the up, down, right, and enter keys to select Menu, Config, UCM, Ethernet, E# IP then select the IP Addr, Subnet Msk, Def Gate from the lists to match the desired settings. The default port number for the Operating System is 503, while the port number for the application itself is 502.

Figure 2.7: Serial Port Configuration Menus



3 Modbus Operation

The Crop-Protector™ DUCM application uses the ports for Modbus communication. Port 1 or 2 can be RS-485 and may be connected as a 4-wire multidrop slave or 2-wire multidrop slave. By default, Port 1 is set for Modbus RTU Slave, 9600 baud, 8 data bits, NONE parity, Slave Address 1, and RS-232. Port 2 is set for C-P, 9600 baud, 8 data bits, NONE parity, Slave Address 1, 1 Master-Hub off the port, and RS-485.

The DUCM will briefly light the yellow Rx LED on port 2 when any message is received on the RS-485 port. If the message is intended for the DUCM then the yellow Tx LED on port 2 light will come on as the DUCM replies if the Master-Hub is online.

Figure 3.1: Master-Hub on Port 2



Crop-Protector™ Master-Hub Register List

The data from the Master-Hub is presented as Holding Registers (4x). All registers are read as 16-bit signed integers that provide data on the Master-Hub System, Temperature and Humidity Sensors, Weather Station, and the currently running application. All temperature and humidity data points have an implied decimal place to give a greater precision for the reading. For example, any register containing a temperature or humidity value times 0.1 gives the actual reading. A value of 599 indicates a temperature of 59.9°(Fahrenheit or Celsius depending on the settings, default is Fahrenheit) or a humidity of 59.9%.

The mapping in the following tables provides data for the Master-Hub system. Master-Hub systems will have the unused values set to 10000, and not yet polled values set to 11111.

Table 3.1: Master-Hub Register List (Application Information)

Register	Measurement	Notes
4x0001	Current Application State	Integer Value 1 = System Scan then Poll Data 2 = Only Poll Data 3 = Reset Timer 4 = Wait for Timer Expire
4x0002	Max Wait Time for System Scan to Finish	Integer Value
4x0003	Master-Hub Address to Send Commands to	Integer Value
4x0004	Total Time Spent in Current State	Seconds
4x0005	Master-Hub Port for Current Command	Integer Value
4x0006	Sub-Hub Address for Current Command	Integer Value
4x0007	Sub-Hub Port for Current Command	Integer Value
4x0008	Current Command Op Code	ASCII Hex represented as Integer Value
4x0009	Whether Data is Stored in Fahrenheit or Celsius	Integer Value 0 = Fahrenheit 1 = Celsius
4x0011	Total Number of Bad Checksums	Integer Value
4x0012	Total Number of Bad Command Types Returned	Integer Value
4x0013	Total Number of Bad Replys	Integer Value
4x0014	Total Number of Bad Counts	Integer Value
4x0015	Total Number of System Scan Failures	Integer Value
4x0016	Total Number of Data Polls	Integer Value
4x0018	Total Current Number of Error Data Values	Integer Value

The Sensors of the Master-Hub system are mapped to registers. If the Master-Hub has a value for that sensor and the application has polled that data then it will be contained in the corresponding register location, otherwise that register location will contain the value 10000.

Table 3.2: Master-Hub Register List (Sensor Data Values)

Master-Hub Port	Sub-Hu Address	Sub-Hub Port	Register	Description	
			4x0999	Weather Station Temperature	
			4x1000	Weather Station Humidity	
1	1	1	4x1001-4x1020	1001 = Sensor 1 1020 = Sensor 20	NOTE: If the sensor line is a humidity line then the sensors 1-10 are for the temperature and sensors 11-20 are for the humidity
		2	4x1021-4x1040	1021 = Sensor 1 1040 = Sensor 20	
		3	4x1041-4x1060	1041 = Sensor 1 1060 = Sensor 20	
		4	4x1061-4x1080	1061 = Sensor 1 1080 = Sensor 20	
		5	4x1081-4x1100	1081 = Sensor 1 1100 = Sensor 20	
		6	4x1101-4x1120	1101 = Sensor 1 1120 = Sensor 20	
	2-16	1-6	4x1121-4x2920		
2	1-16	1-6	4x2921-4x4840		
3	1-16	1-6	4x4841-4x6760		
4	1-16	1-6	4x6761-4x8680		

Each sensor line in the Master-Hub system has 20 corresponding data registers. The address for the registers is calculated using the function:

RegisterAddress = ((MHPort-1)*1920)+((SHAddress-1)+120)+((SHPort-1)*20)
+1000+Sensor

Table 3.3: Sub-Hub Data Mapping (Master-Hub Port1; Sub-Hub Address 1)

Sensor Number	Sensor Line 1	Sensor Line 2	Sensor Line 3	Sensor Line 4	Sensor Line 5	Sensor Line 6
1	R1001	R1021	R1041	R1061	R1081	R1101
2	R1002	R1022	R1042	R1062	R1082	R1102
3	R1003	R1023	R1043	R1063	R1083	R1103
4	R1004	R1024	R1044	R1064	R1084	R1104
5	R1005	R1025	R1045	R1065	R1085	R1105
6	R1006	R1026	R1046	R1066	R1086	R1106
7	R1007	R1027	R1047	R1067	R1087	R1107
8	R1008	R1028	R1048	R1068	R1088	R1108
9	R1009	R1029	R1049	R1069	R1089	R1109
10	R1010	R1030	R1050	R1070	R1090	R1110
11	R1011	R1031	R1051	R1071	R1091	R1111
12	R1012	R1032	R1052	R1072	R1092	R1112
13	R1013	R1033	R1053	R1073	R1093	R1113
14	R1014	R1034	R1054	R1074	R1094	R1114
15	R1015	R1035	R1055	R1075	R1095	R1115
16	R1016	R1036	R1056	R1076	R1096	R1116
17	R1017	R1037	R1057	R1077	R1097	R1117
18	R1018	R1038	R1058	R1078	R1098	R1118
19	R1019	R1039	R1059	R1079	R1099	R1119
20	R1020	R1040	R1060	R1080	R1100	R1120

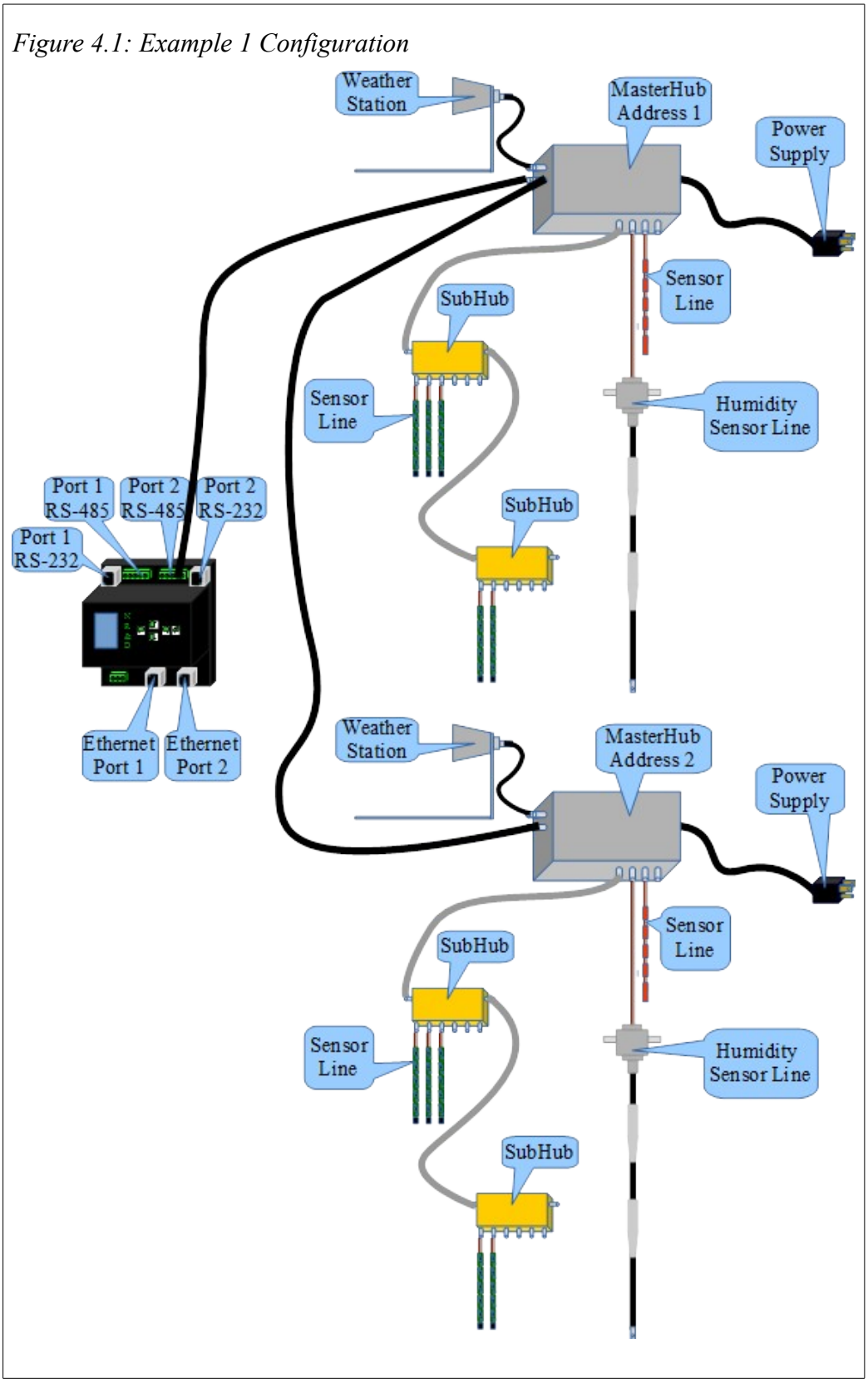
4 Examples

Table 4.1 shows system with two Master-Hub's connected to a DUCM, both Master-Hubs off of port 2. Any Master-Hubs connected to the DUCM must be connected to a RS-485 compatible port.

Table 4.1: Example 1 Settings

Parameter	DUCM	
	Port 1	Port 2
Protocol Mode	RTU_Slv	C-P
Baud Rate	9600	9600
Parity	NONE	NONE
Data Bits	8	8
Stop Bits	1	1
Driver	RS-232	RS-485
Number of Master-Hubs	N/A	2

Figure 4.1: Example 1 Configuration



Example System Information

Figure 4.1 is an example of a system consisting of two groups of:

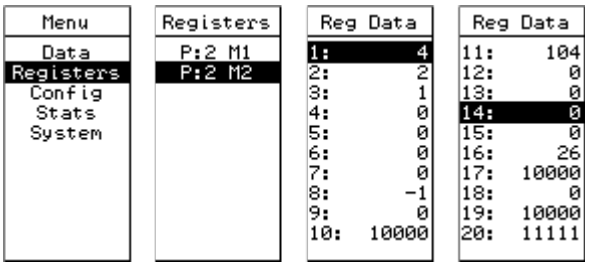
- One Master-Hub
  - 2 Sub-Hubs off Master-Hub Port 1
    - Sub-Hub 1 has 3 temperature sensor lines.
    - Sub-Hub 2 has 2 sensor lines.
  - 1 humidity sensor sine off of Master-Hub Port 2
  - 1 temperature sensor line off of Master-Hub Port 3
  - Weather Station

Each group is connected to port 2 of the DUCM using a 2-wire RS-485 cable and the data for each system can be accessed by selecting the corresponding port and Master-Hub address.

Register Data

The information regarding the current state of the application can be found within the first 20 registers as shown in Figure 4.2 by drilling into the Registers option in the menu screen, selecting the corresponding port and Master-Hub address and then scrolling the find the right registers.

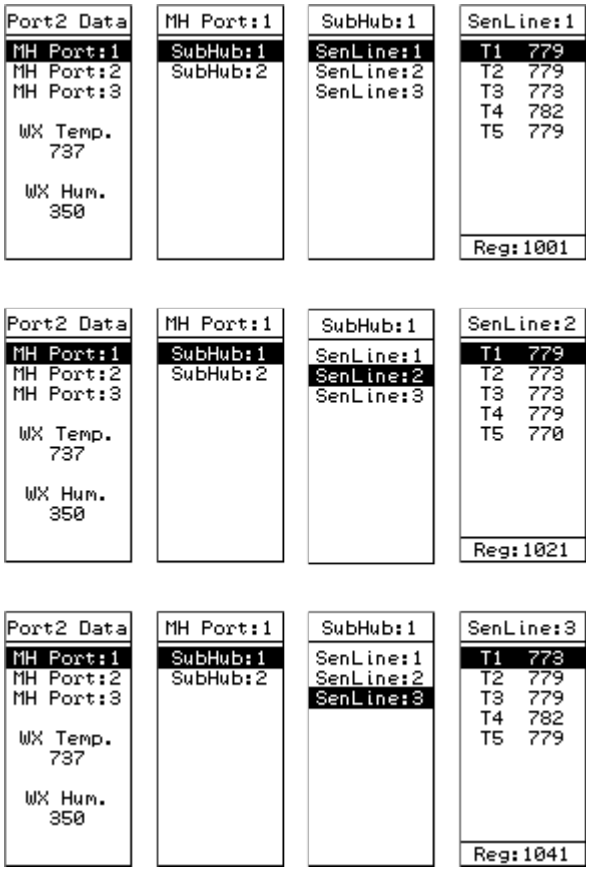
Figure 4.2: Example 1 App Data



Master-Hub Data

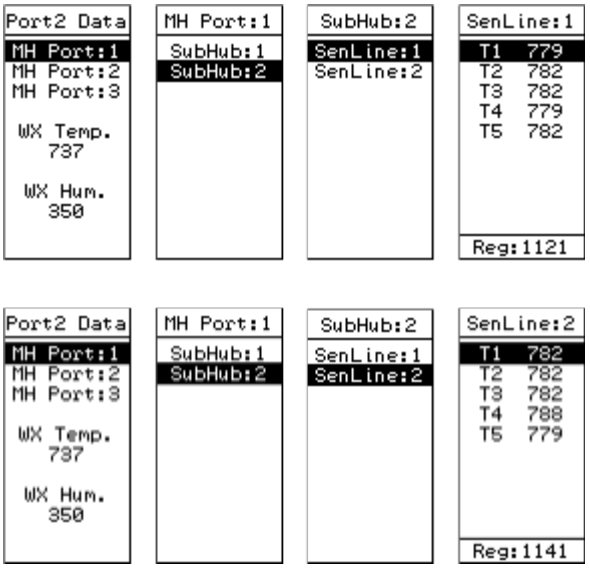
The first of the data which is polled from Master-Hub port 1, Sub-Hub 1, sensor lines 1 through 3 with 5 sensors on each line, and the Weather Station data is contained in data register range 1001 through 1060 as shown in Figure 4.3. The registers 999 and 1000 are for the Weather Station(WX) and are shown on the DUCM port screen.

Figure 4.3: Example 1 Master-Hub Data 1



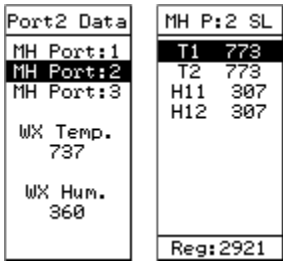
The next section of data which is polled from Master-Hub port 1, Sub-Hub 2, sensor lines 1 through 2 with 5 sensors on each line is contained in data register range 1121 through 1160 as shown in Figure 4.4

Figure 4.4: Example 1 Master-Hub Data 2



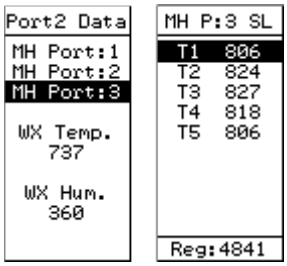
The next section of data which is polled from Master-Hub port 2 which is the humidity sensor line which contains 2 temperature sensors and 2 humidity sensors is contained in data register range 2921 through 2940 as shown in Figure 4.5. The temperatures are in registers 2921 and 2922, while the humidity readings are in registers 2931 and 2932.

Figure 4.5: Example 1 Master-Hub Data 3



The next section of data which is polled from Master-Hub port 3 which is a temperature sensor line which contains 5 temperature sensors is contained in data register range 4841 through 4860 as shown in Figure 4.6.

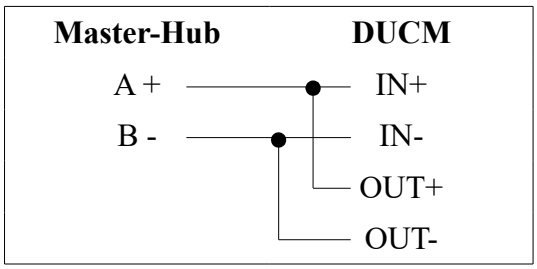
Figure 4.6: Example 1 Master-Hub Data 4



RS-485 2-Wire Connection

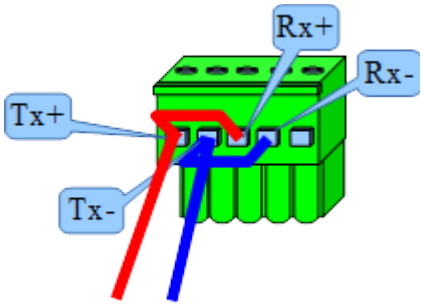
A 2-wire RS-485 port on the DUCM uses a single twisted pair cable and jumper the IN+ to OUT+ at each DUCM for the (A+) connection as well as jumper the IN- to OUT- for the (B-) connection on the Master-Hub device.

Figure 4.7:RS-485 2-wire Example



A graphical representation of this is shown below where the red wire goes to A+ RS-485 connection and the blue wire goes to the B- connection on the Master-Hub.

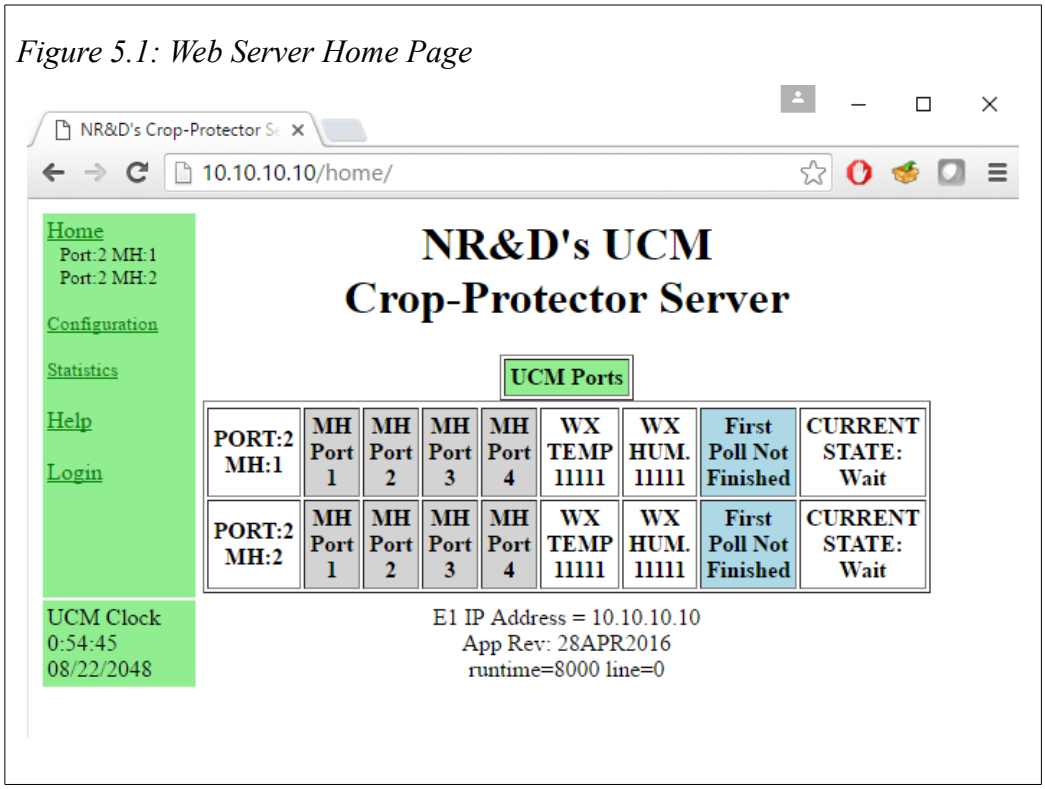
Figure 4.8:DUCM Port RS-485 2-wire Connector



5 Web Server

The DUCM contains a built in web server that can be accessed over an ethernet network using a web browser. By entering the IP Address of the device into the browser the home page of the server can be accessed as seen in Figure 5.1. The home page shows the ports that are connected to a Master-Hub and basic information on the current the application is in as well as the data collected from the Master-Hub.

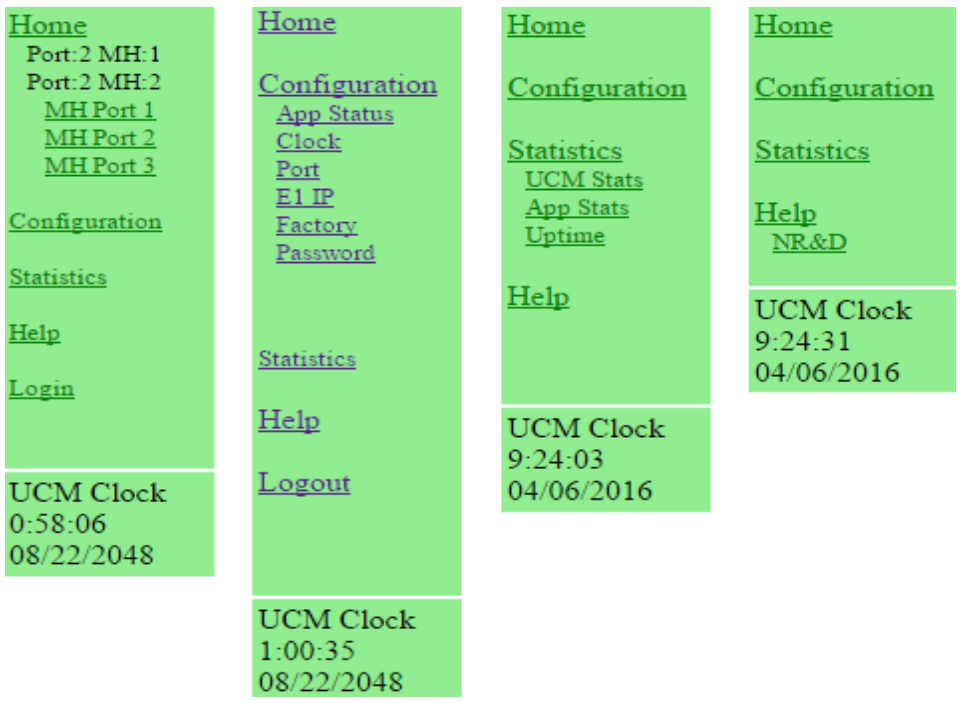
Figure 5.1: Web Server Home Page



Home Table

The home table is on the left side of every page and is green. It always contains links to the home page, configuration page, statistics page, and help page. Depending on the current page more links will be available.

Figure 5.2: Home Table States

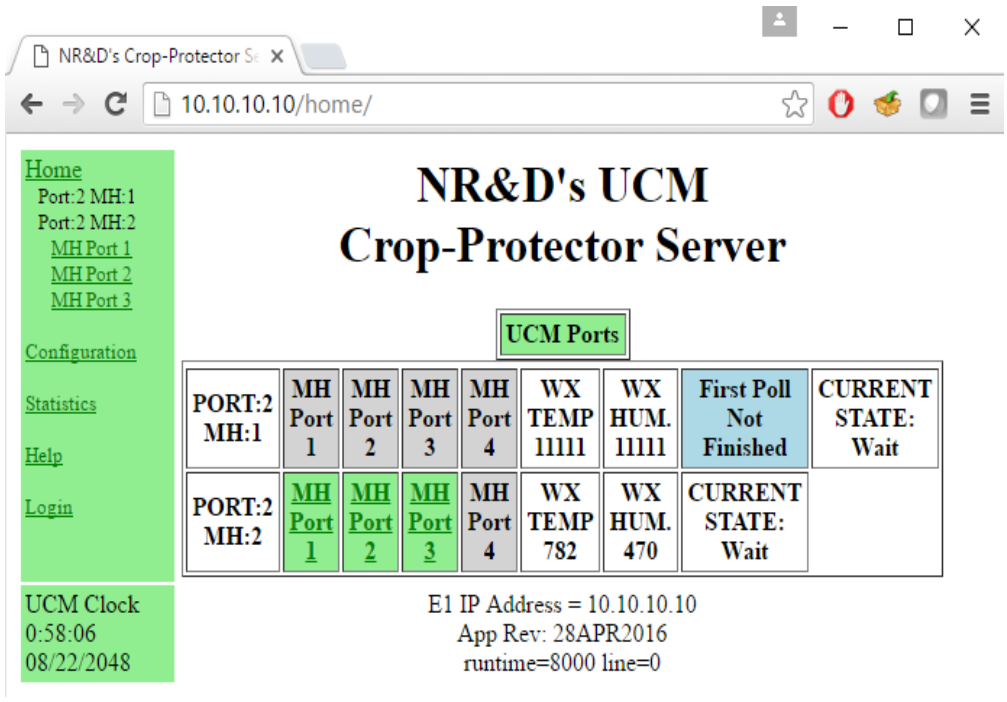


- Home
  - Under the Home link are links to the pages of each Master-Hub port that is connected to each DUCM port.
- Configuration
  - App Status, Clock, Port, E1 IP (Ethernet 1 port), Factory, and Password
- Statistics
  - UCM Stats, App Stats, Uptime
- Help
  - NR&D (contact information page)

Master-Hub System Data

The home page contains links to the data off of each Master-Hub port, the Weather Station data, as well as the current state of the application for that Master-Hub system.

Figure 5.3: Master-Hub Systems Data Page



Master-Hub Port Page

The Master-Hub port page either contains links to the data from the Sub-Hubs or the data from a sensor line with the corresponding registers directly connected to it. Figure 5.4 is an example of the first page while Figure 5.5 is an example of the second.

Figure 5.4: Master-Hub Port Page 1

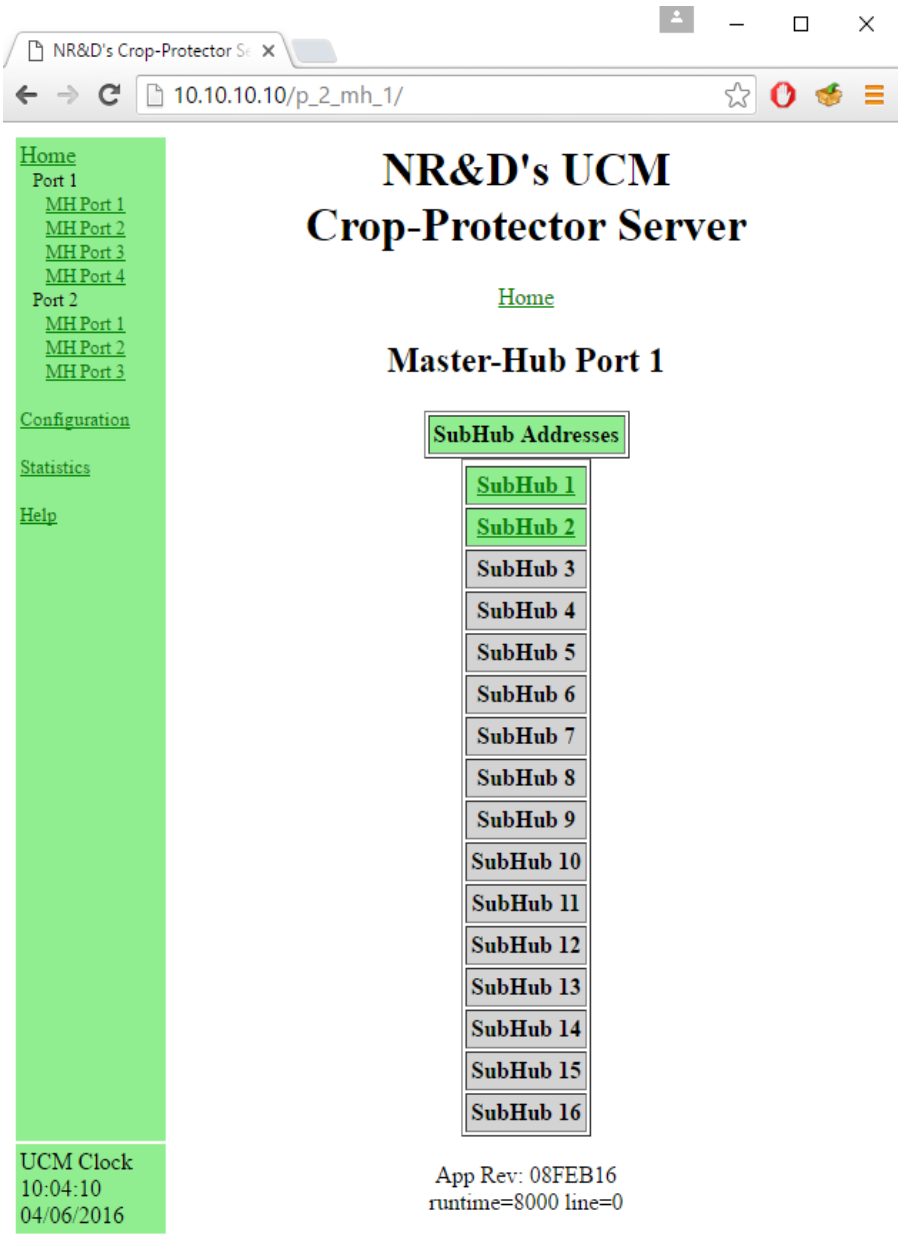
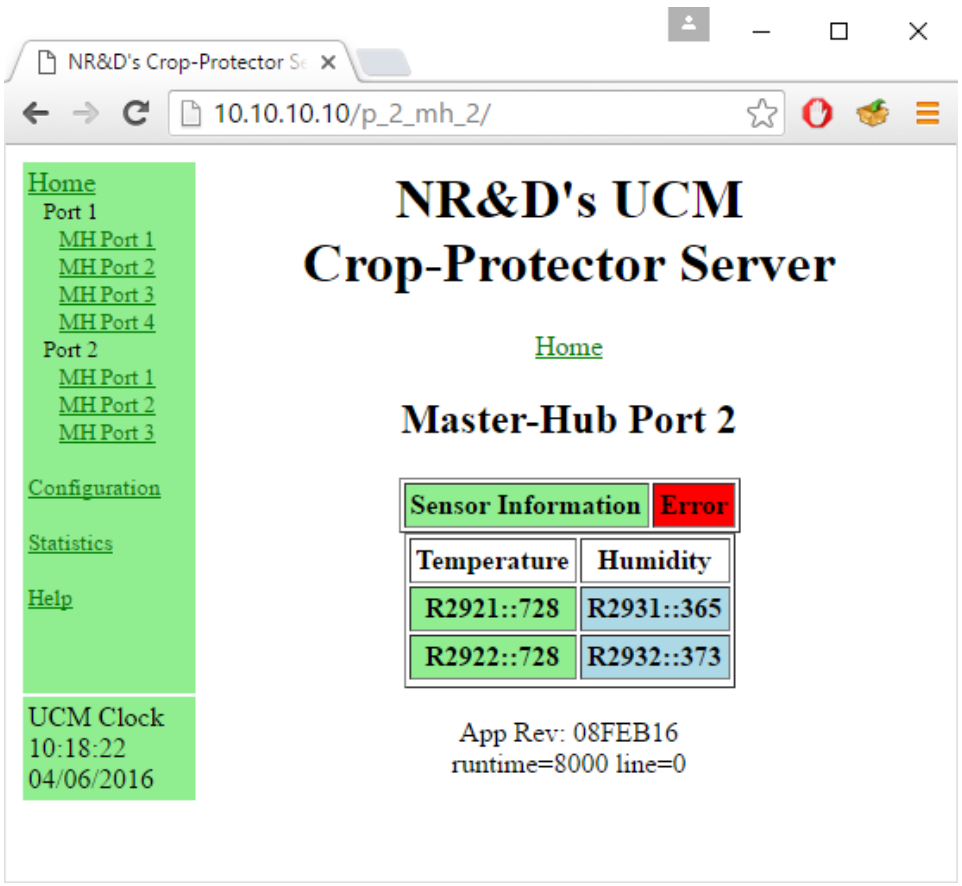


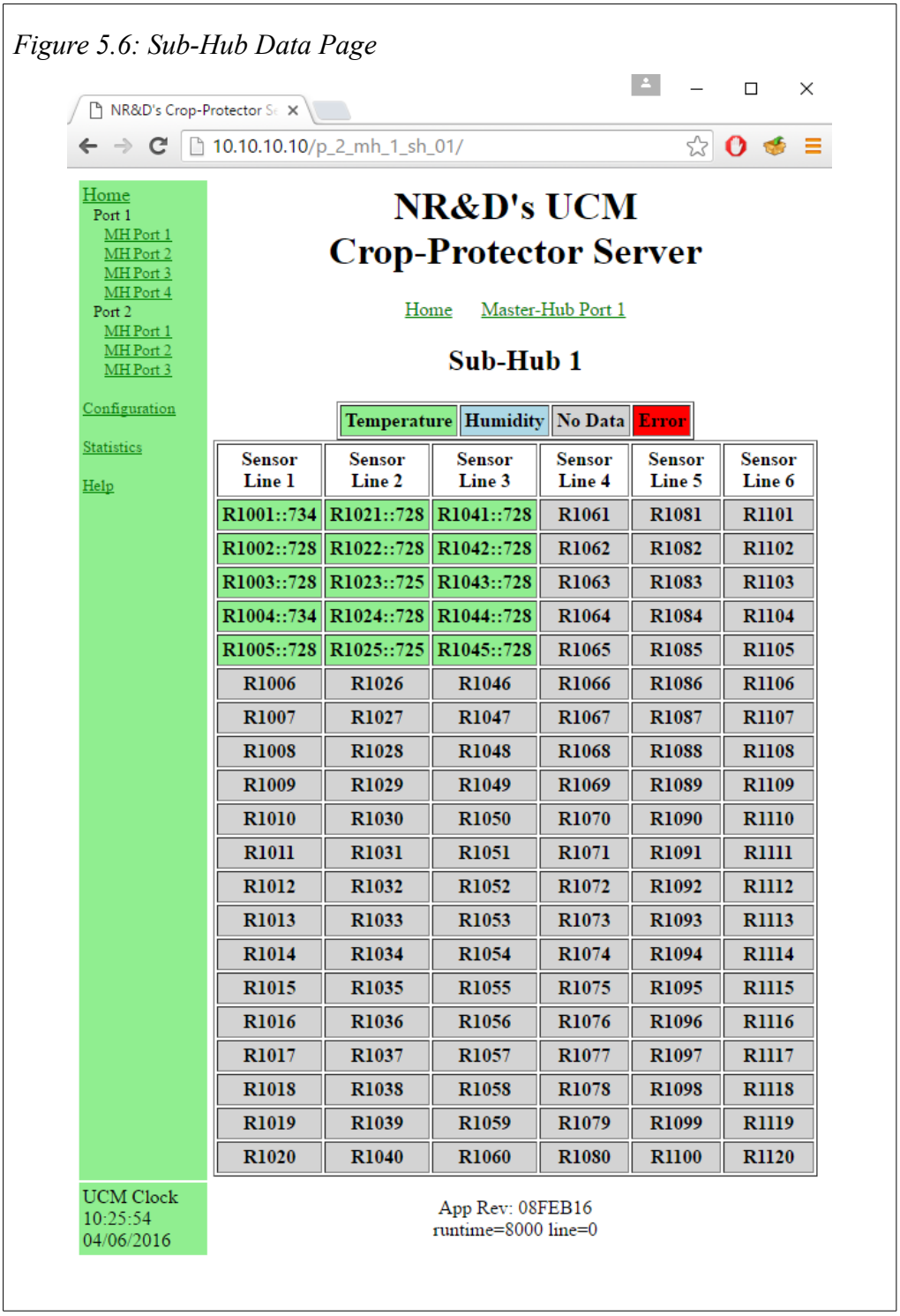
Figure 5.5: Master-Hub Port Page 2



Sub-Hub Data Page

The Sub-Hub data pages contain all the data for the sensor lines connected to that Sub-Hub as well as the register number that contains that data as shown in Figure 5.6.

Figure 5.6: Sub-Hub Data Page



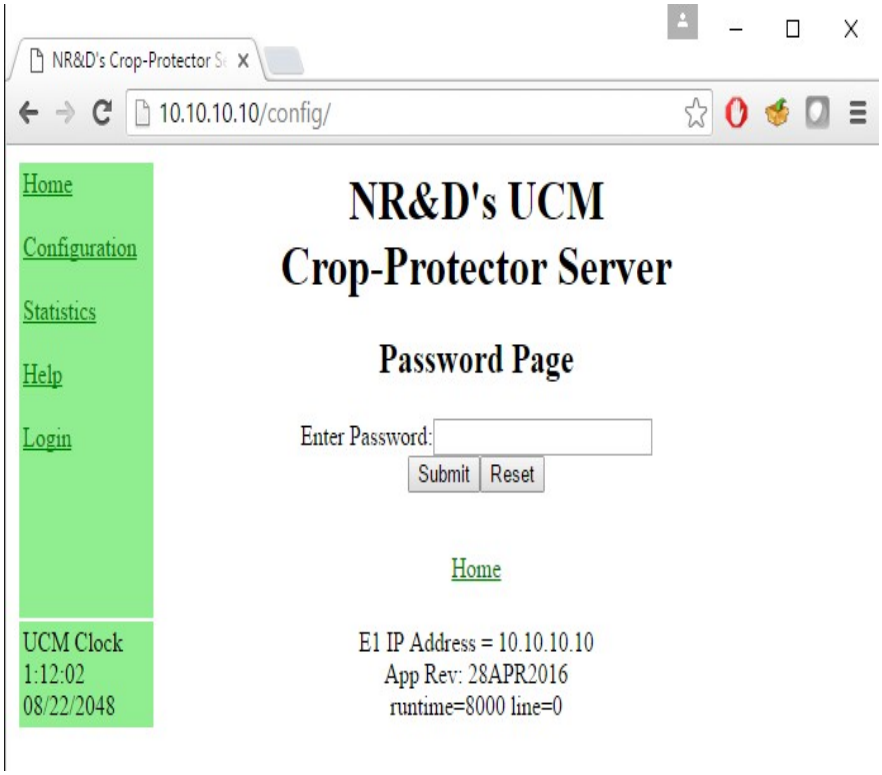
Configuration Page

The Configuration page contains links to the:

- *Application Status* page where information regarding each port for the application can be viewed and changed if required as shown in Figure 5.7
- *Set Clock* page where the devices internal clock can be changed as shown in Figure 5.8
- *Change Serial Port Settings* page where the device serial port's settings can be viewed and changed as shown in Figure 5.9
- *Change UCM E1 TCP/IP Address* page where the ethernet settings can be viewed and changed as shown in Figure 5.10
- *Factory Page* where the device can be reset to factory defaults
- *Change Password* page where the password to access the configuration options can be changed

All configuration options are locked behind a password. There is a 3 minute timeout period for the password as well given no activity. The default password is “master” and can be changed if required through the webpage.

Figure 5.7: Password Page



The *Application Status* page shows the Current State, Max SS(System Scan) Wait Time, and Temperature(F/C) for each Master-Hub off the DUCM.

Figure 5.8: Application Status Page

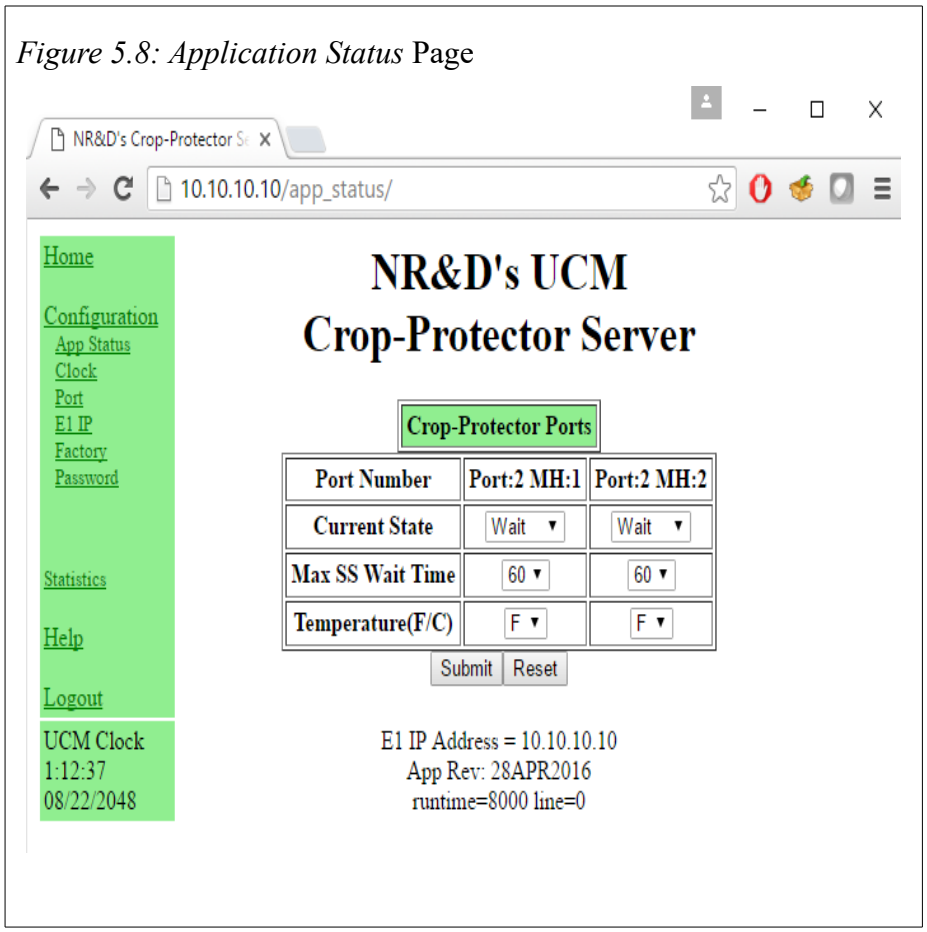


Figure 5.9: Set Clock Page

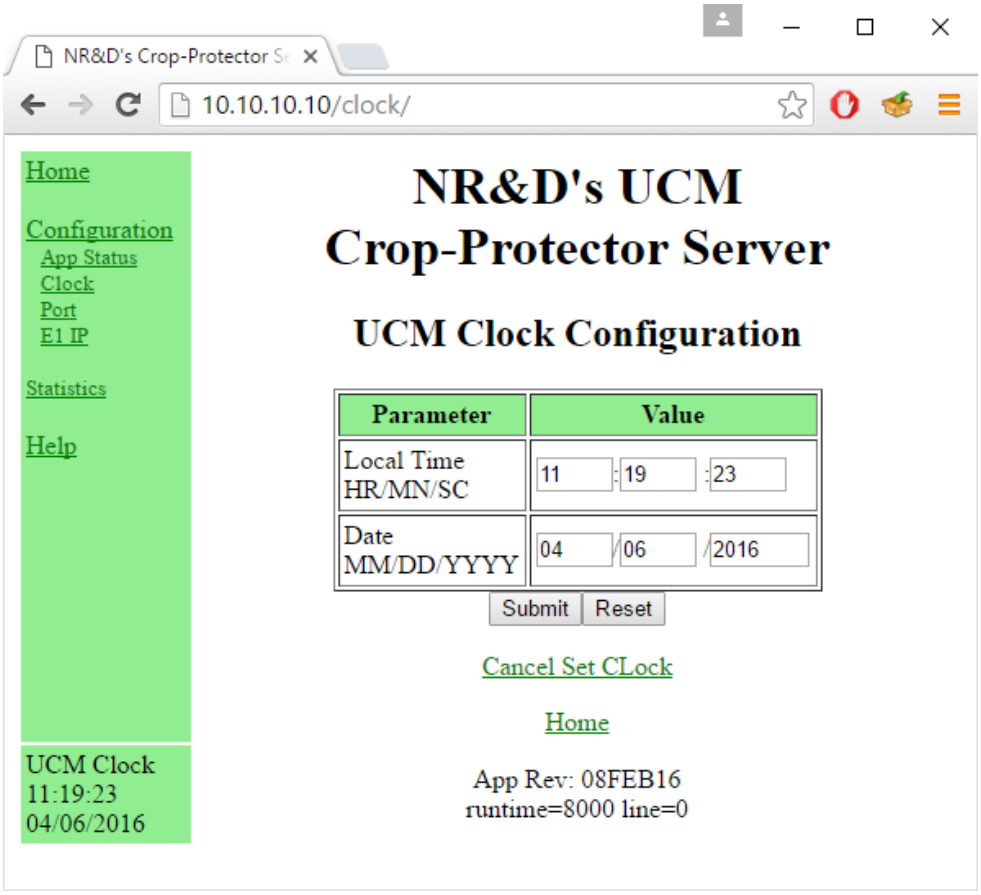


Figure 5.10: Change Serial Port Settings Page

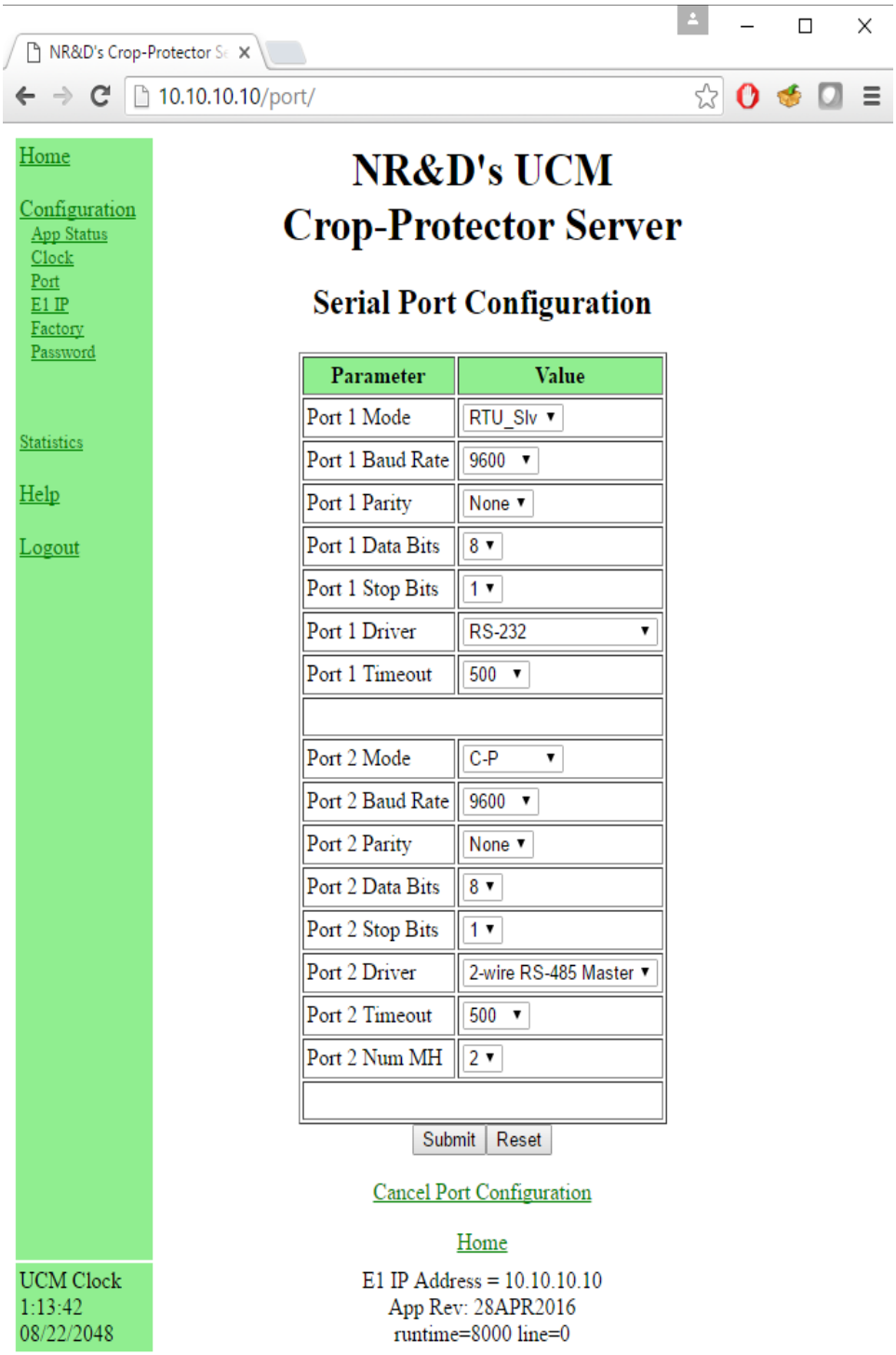


Figure 5.11: Change UCM E1 TCP/IP Address Page

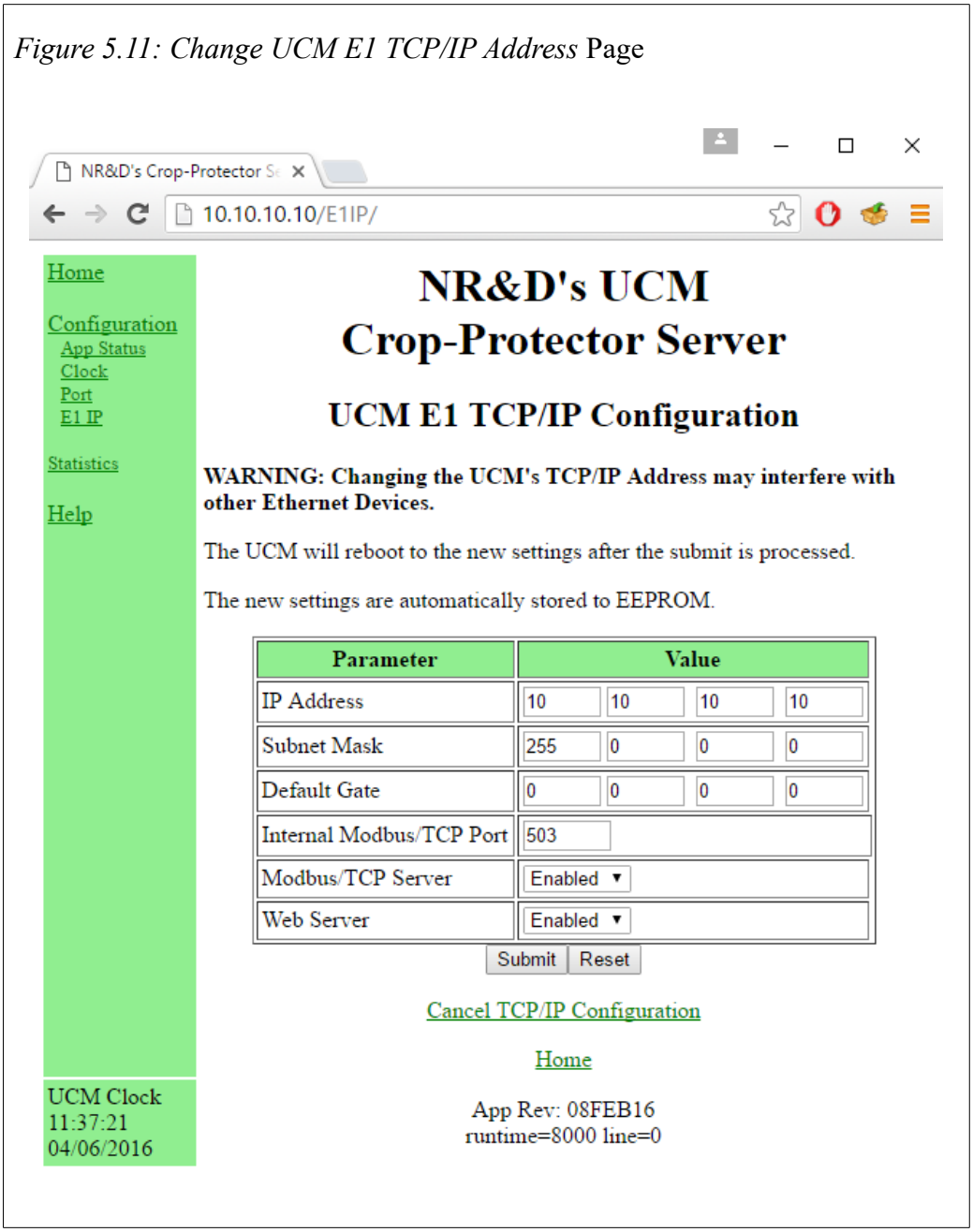


Figure 5.12: Factory Defaults Page

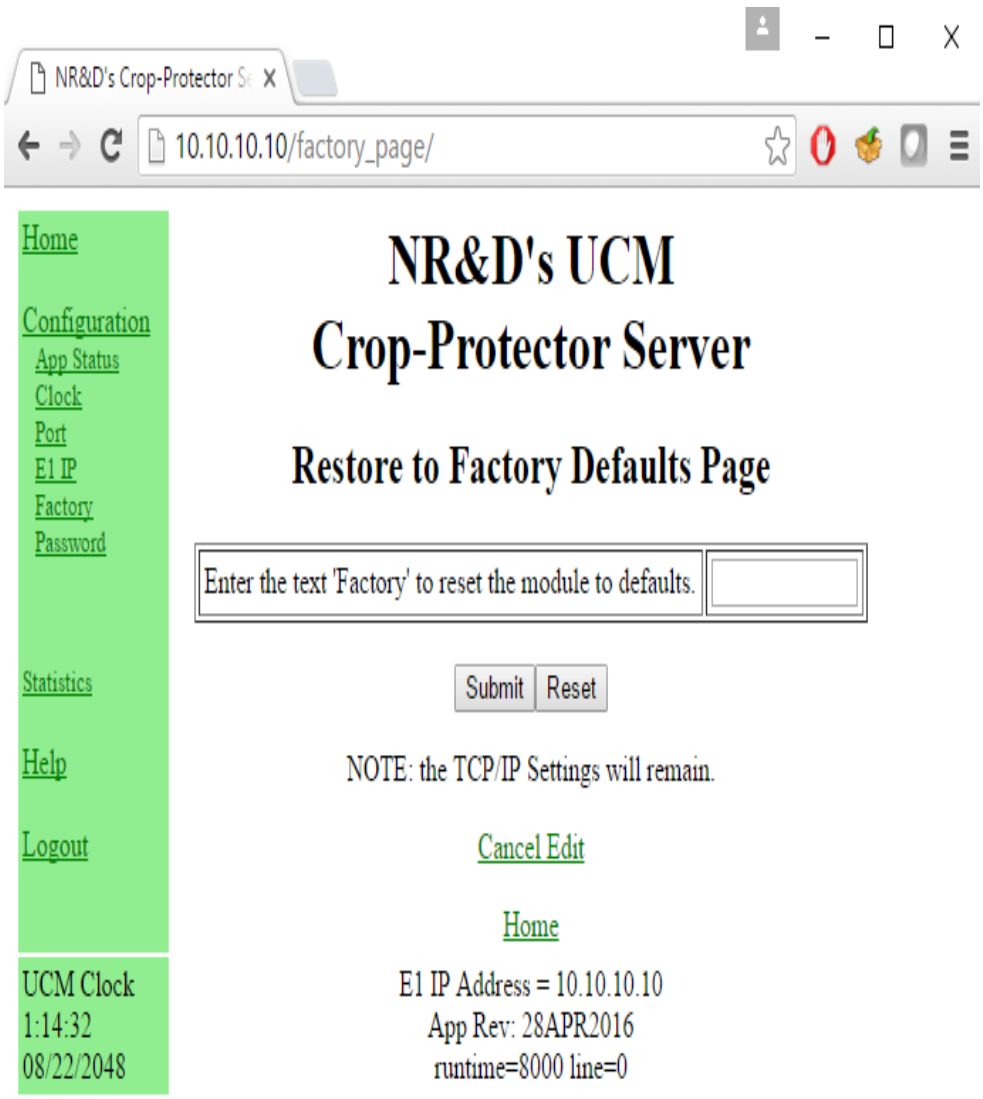
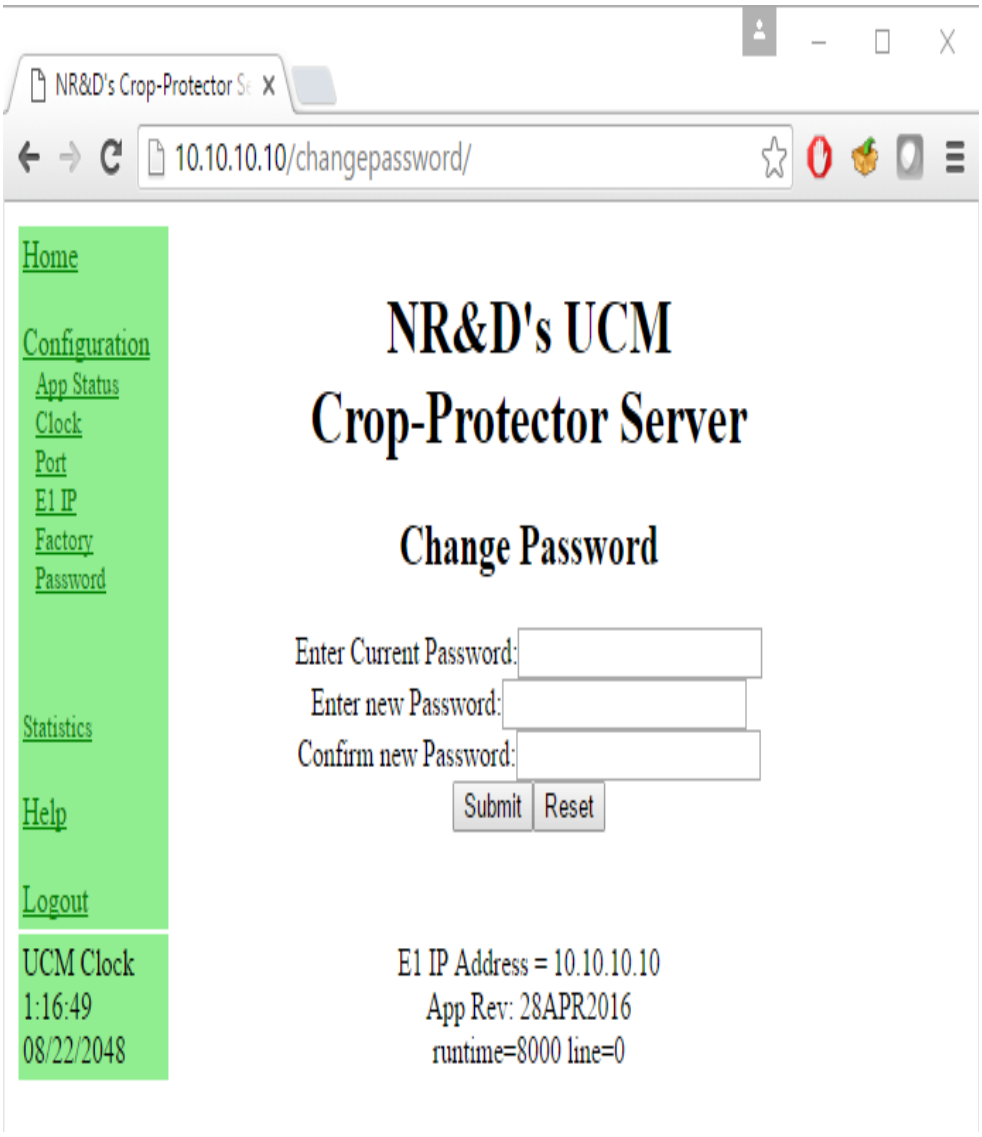


Figure 5.13: Change Password Page



Statistics Page

The Statistics page contains links to the:

- *UCM Stats* page where information regarding the UCM device is given as shown in Figure 5.11
- *App Stats* page where the devices internal clock can be changed as shown in Figure 5.12
- *Uptime* page where the device serial port's settings can be viewed and changed as shown in Figure 5.13

Figure 5.14: UCM Stats Page

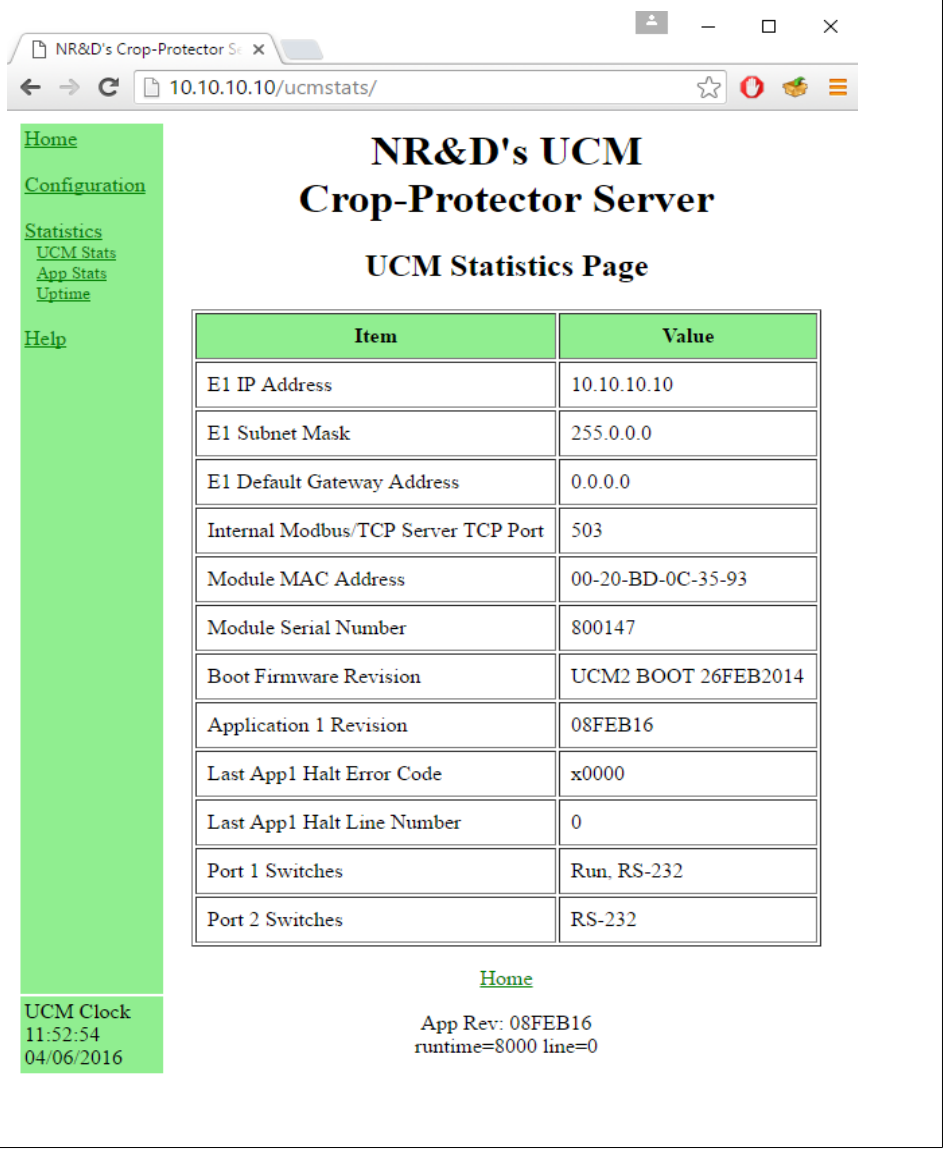


Figure 5.15: App Stats Page

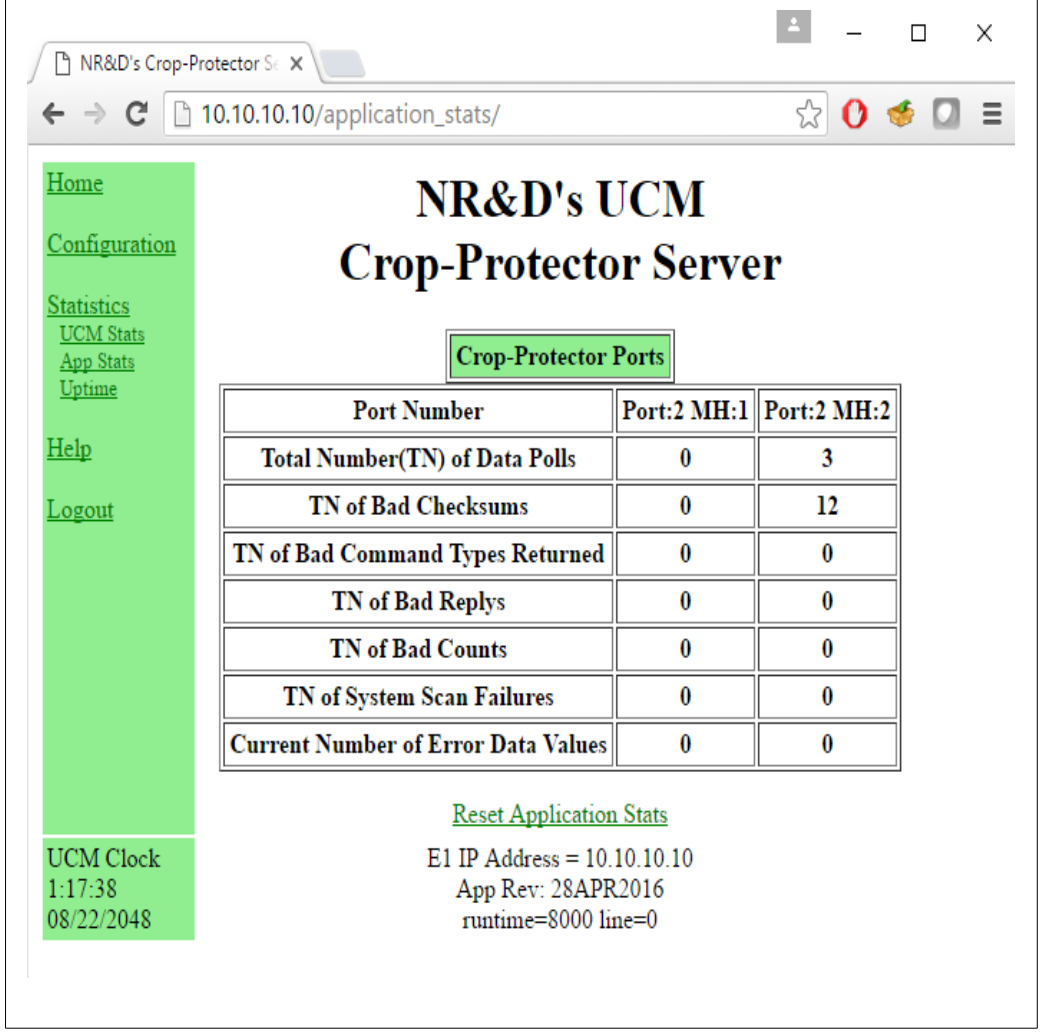
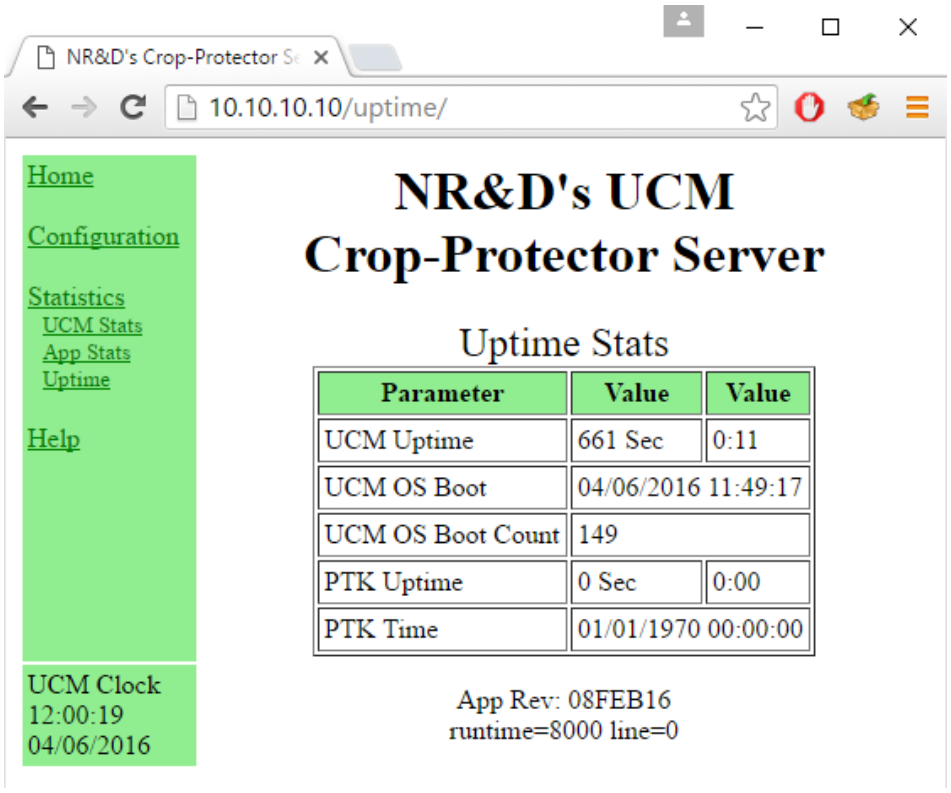


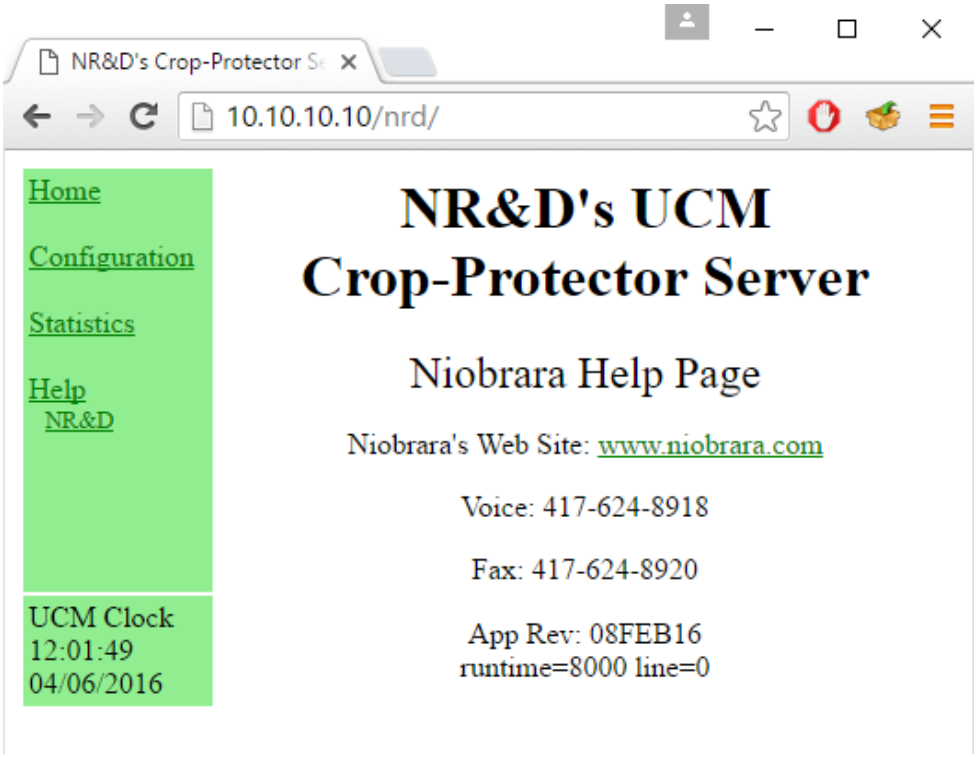
Figure 5.16: Uptime Page



Help Page

The *Help* page contains a link to Niobrara's website as well as other contact information as shown in Figure 5.14

Figure 5.17: Help Page



6 Testing and Troubleshooting

DUCM Lights

The DUCM has several lights to give indication of activity of the application and serial ports.

- The **Pwr** light is green and indicates that the DUCM is powered.
- The yellow **Tx1** light indicates that the DUCM RS-232 port is transmitting data. This light should normally be quickly flashing when the port is in use.
- The yellow **Rx1** light indicates that the DUCM RS-232 port is receiving data. This light should normally be quickly flashing when the port is in use.
- The yellow **Tx2** light indicates that the DUCM RS-485 port is transmitting data. This light should normally be occasionally flashing as the DUCM polls the Master-Hub.
- The yellow **Rx2** light indicates that the DUCM RS-485 port is receiving data. This light should normally be occasionally flashing as the DUCM polls the Master-Hub.
- The yellow **Ethernet** light indicates that the DUCM ethernet port is operating as a 100Mbps connection. When this light is off and the green light is on the port is operating as a 10Mbps connection.
- The green **Ethernet** light indicates that the DUCM ethernet port is connected to a network. This light should normally be occasionally flashing as the DUCM communicates over the network.
- **Light 1** is a red light placed behind the LCD screen and is controlled by the application. If light 1 is on a warning or error message will appear on the LCD.
- **Light 2** is a red light placed behind the LCD screen and is controlled by the application. If light 1 is on a warning or error message will appear on the LCD.

Testing the Master-Hub Connection

When the DUCM port is connected to the Master-Hub(s) and the correct Crop-Protector™ mode from the configuration menu is selected. Changing the App State to SysSc in the DUCM will begin requesting the Master-Hub system information. Looking at the DUCM you should see the Tx1 light quickly flash closely followed by the Rx1 light quickly flash. If the DUCM is communicating with the Master-Hub the LCD screen will display OK. If the Master-Hub is not responding the Rx1 light will not blink.

When the program runs there will be a list of the Master-Hubs that should be on the port in the format P#M# where P stands for the device port and M for the Master-Hub address. Next to that will be a code concerning the state of the app.

- FPNF – First poll not finished
- FPF – First poll failed

Figure 6.1: Master-Hub Polling Properly



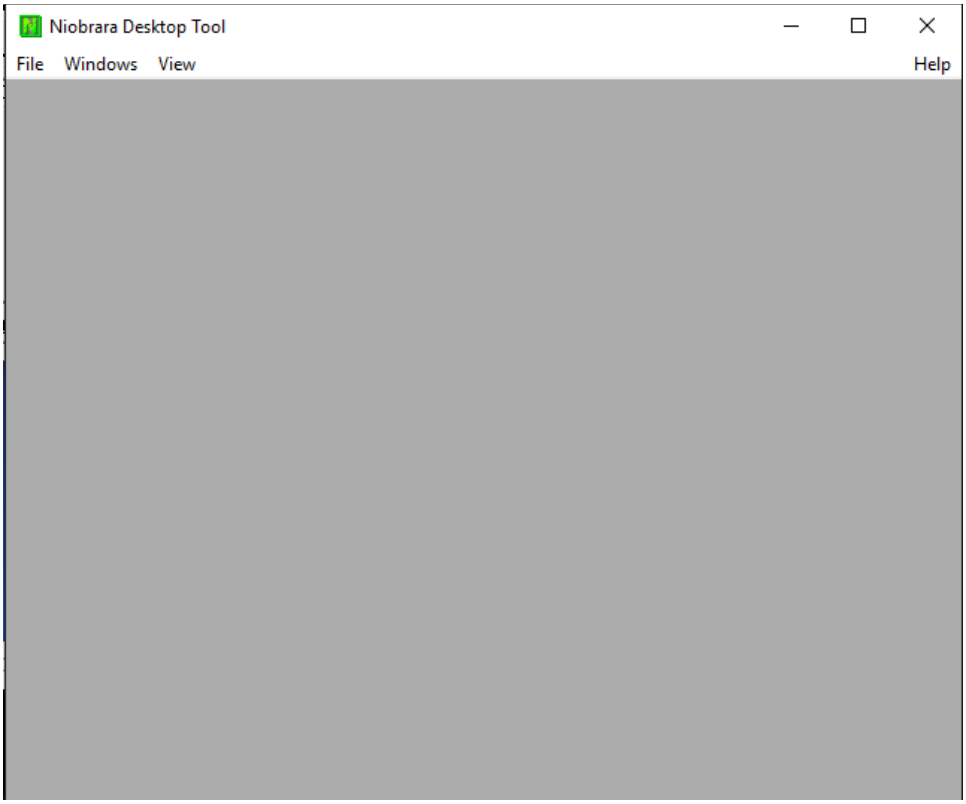
Testing the Modbus Connection

The program NRDTOOL.EXE may be used to quickly test the Modbus settings on the DUCM. NRDTOOL.EXE is a register editor contained in DUCM_SETUP.EXE.

1. Download and install DUCM_SETUP.EXE from www.niobrara.com. On the Web site go to Products, Modicon Products, Momentum, DUCM, Software. This will download the DUCM_SETUP.EXE.
2. Connect the DUCM ethernet port to the computer, or the network connected to the computer through an ethernet cable.

3. Start NRDTOOL.EXE. On most Windows systems do a Start, All Programs, Niobrara, NrdTool. See Figure 6.2.

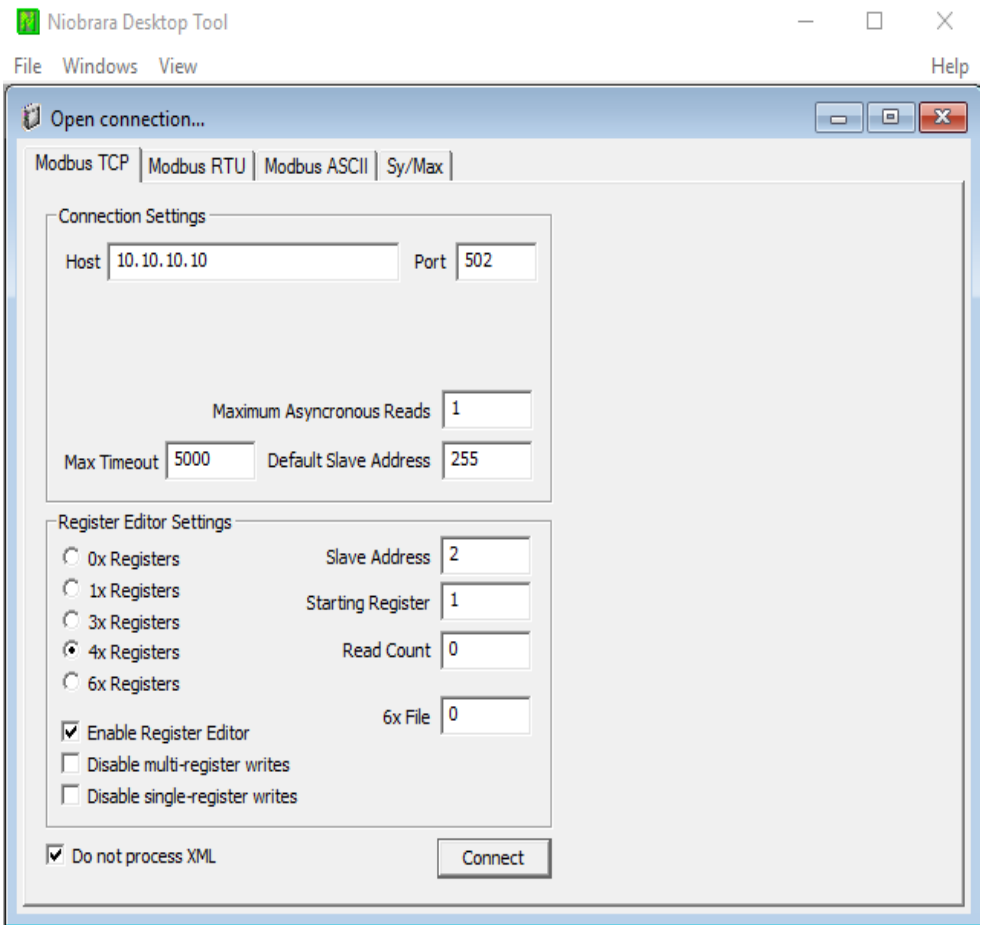
Figure 6.2: NRDTOOL.EXE



5. Select the Modbus TCP tab
6. Check that the Connection settings match the DUCM ethernet port 1 or 2 settings. The Default Slave Address leave at 255, and set the port to 502. See Figure 6.3

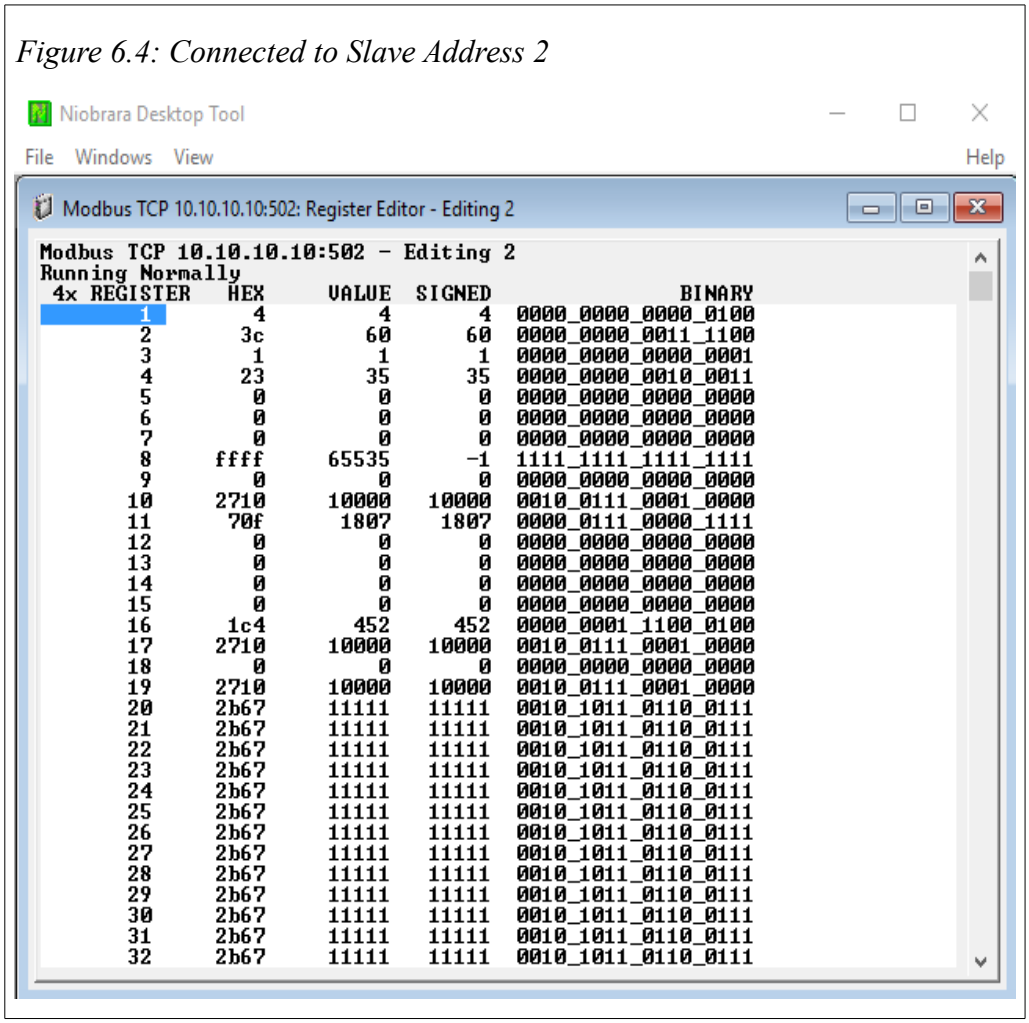
7. Under Register Editor Settings check that 4x registers is selected, set slave address to 1 for the first Master-Hub or 2 for the second Master-Hub off the DUCM serial ports the Master-Hubs are connected to, Starting Register to 1, Read Count to 0, Enable Register Editor is checked, and Do Not Process XML is check. See Figure 6.3

Figure 6.3: Open Connection



8. Click Connect. Slave address 2 is the drop number that the DUCM will respond to for the second Master-Hub connected the DUCM, use a slave address of 1 to for the first Master-Hub connected the DUCM.
9. A screen like Figure 6.4 should appear. The left column is the Holding Register number, the data is shown in the HEX, UNSIGNED, SIGNED, and BINARY columns. The arrow keys and Page UP/Down may be used to move around. Values may be entered directly and the change occurs when the Enter key is pressed. When finished verifying that the communication is good, Close NRDTOOL.EXE.

Figure 6.4: Connected to Slave Address 2



4x REGISTER	HEX	VALUE	SIGNED	BINARY
1	4	4	4	0000_0000_0000_0100
2	3c	60	60	0000_0000_0011_1100
3	1	1	1	0000_0000_0000_0001
4	23	35	35	0000_0000_0010_0011
5	0	0	0	0000_0000_0000_0000
6	0	0	0	0000_0000_0000_0000
7	0	0	0	0000_0000_0000_0000
8	ffff	65535	-1	1111_1111_1111_1111
9	0	0	0	0000_0000_0000_0000
10	2710	10000	10000	0010_0111_0001_0000
11	70f	1807	1807	0000_0111_0000_1111
12	0	0	0	0000_0000_0000_0000
13	0	0	0	0000_0000_0000_0000
14	0	0	0	0000_0000_0000_0000
15	0	0	0	0000_0000_0000_0000
16	1c4	452	452	0000_0001_1100_0100
17	2710	10000	10000	0010_0111_0001_0000
18	0	0	0	0000_0000_0000_0000
19	2710	10000	10000	0010_0111_0001_0000
20	2b67	11111	11111	0010_1011_0110_0111
21	2b67	11111	11111	0010_1011_0110_0111
22	2b67	11111	11111	0010_1011_0110_0111
23	2b67	11111	11111	0010_1011_0110_0111
24	2b67	11111	11111	0010_1011_0110_0111
25	2b67	11111	11111	0010_1011_0110_0111
26	2b67	11111	11111	0010_1011_0110_0111
27	2b67	11111	11111	0010_1011_0110_0111
28	2b67	11111	11111	0010_1011_0110_0111
29	2b67	11111	11111	0010_1011_0110_0111
30	2b67	11111	11111	0010_1011_0110_0111
31	2b67	11111	11111	0010_1011_0110_0111
32	2b67	11111	11111	0010_1011_0110_0111

To verify that the Master-Hub data is present, substitute the Modbus Slave address (default = 255) for the port number the Master-Hub is connected to in the Slave Address. If the DUCM is talking to the Master-Hub then the data retrieved will be displayed.

7 Front Panel Operation

Keypad Buttons

The front panel includes five push buttons.

- The RIGHT arrow advances to the next screen or field. In many cases, it has the same behavior as the ENTER key.
- The LEFT arrow escapes to the previous screen or field. Changes are saved when the left arrow is pressed.
- The UP arrow moves up in a list or increments a selection.
- The DOWN arrow moves down in a list or decrements a selection.
- The ENTER key accepts the values on a screen and exits to a previous screen.

LCD Screen

The DUCM includes a high resolution LCD screen main screen to assist the user in configuring and troubleshooting the device. Serial port parameters may be observed and modified. Statistical information is also provided through the front panel interface.

Backlight

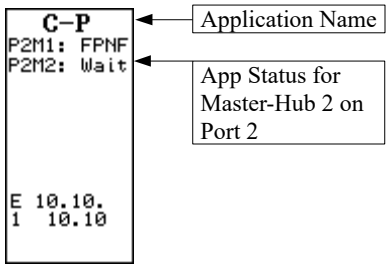
The LCD backlight will illuminate on any button press. The timeout for the backlight is set for 5 minutes.

Operating Screens

Splash Screen

The main page shows the application name, and application status information concerning any ports connected to a Master-Hub, such as the current command for each port and if there are any errors for that command.

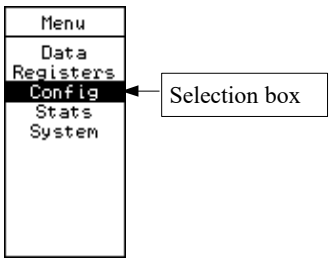
Figure 7.1: Splash screen



Main Menu Screen

Pressing a key while the splash screen is displayed will move to the Main menu page. A selection box indicates the sub-menu to be chosen. Pressing the UP or DOWN arrows will move the selection box to the next choice. Pressing the RIGHT arrow or ENTER buttons will select the sub-menu. Pressing the LEFT arrow will return to the splash screen page.

Figure 7.2: Main Menu screen



Master-Hub Data

The Data screen shows a series of screens containing data from the Master-Hub. The screens displayed are dependent on the physical configuration of the Crop-Protector™ System. After selecting the corresponding DUCM port, Master-Hub data can be viewed through selecting the Master-Hub port, Sub-Hub address, then Sensor Line number to view the data polled for that sensor line.

Figure 7.3: Master-Hub Data Sensor Line

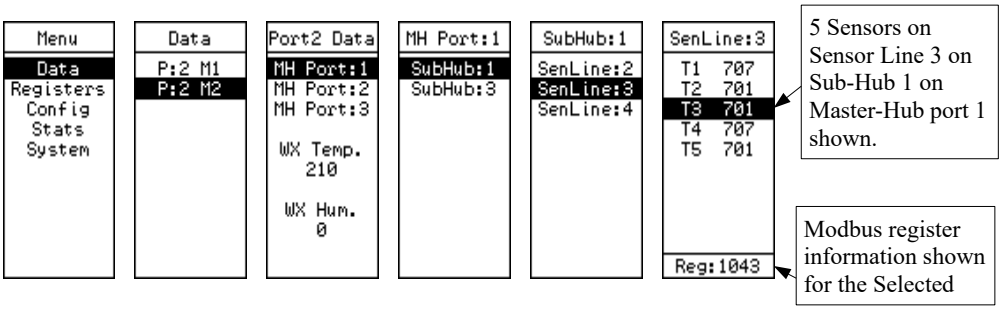
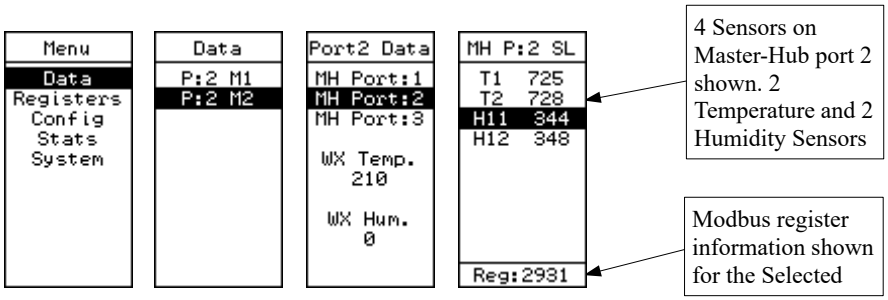
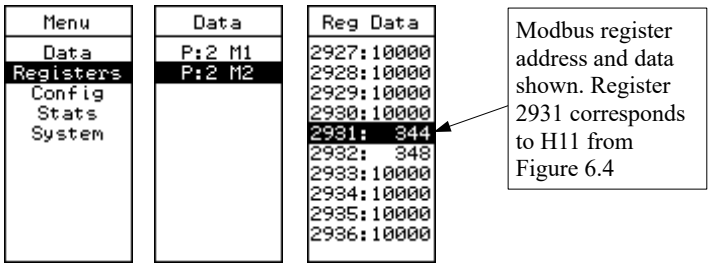


Figure 7.4: Master-Hub Data Sensor Line



The registers that hold the data can also be view by selecting Register, the corresponding port, then scrolling to the register address you wish to view.

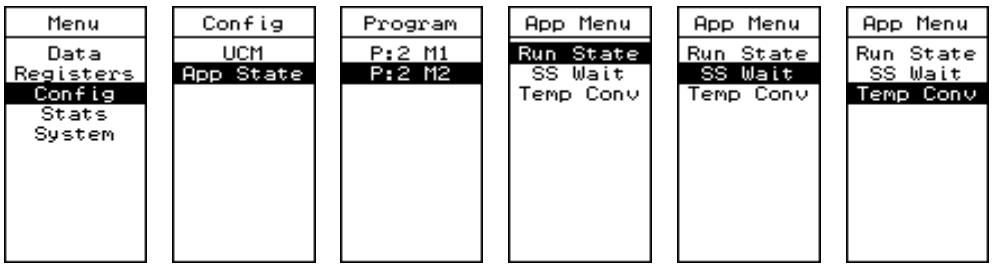
Figure 7.5: Master-Hub Register Data



App State Menu

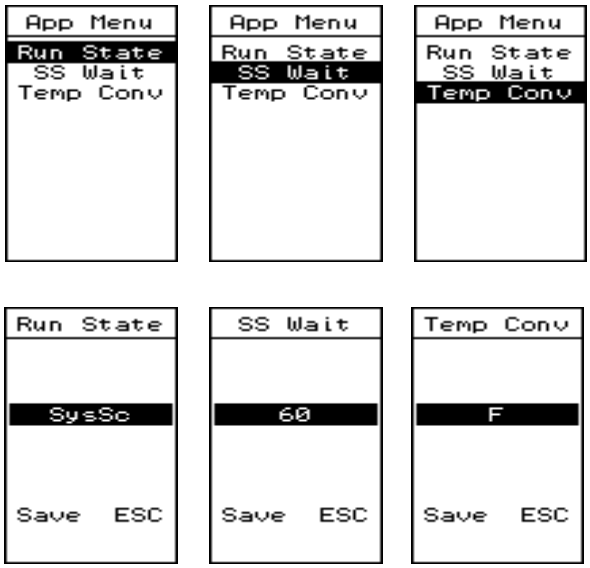
The App State menu located under the Config option is used to configure the current state of the application for the Master-Hub System. After selecting the port, select which attribute of the state to be changed.

Figure 7.6: Master-Hub App State Screen



- The *Run State* selection can be used to change the state to:
  - *SysSc* (System Scan, the application will reset it's modbus data for that port, run a System Scan of the Master-Hub's system, build the physical system into memory, poll for the sensor data of the system, and finally set the timer and enter the Wait state)
  - Poll (run a System Scan of the Master-Hub's system, poll for the sensor data of the system, and finally set the timer and enter the Wait state)
  - Reset (resets the timer of the Wait state)
  - Wait (waits until the timer is expired then enters the Poll state).
- SS Wait is used to change the maximum time to spend waiting (in minutes) for the System Scan on the Master-Hub to finish. It defaults to 60 minutes and can be changed according to the size of the system.
- Temp Conv is used to change how the temperature polled from the Master-Hub is stored, whether it is in Fahrenheit(F) or Celsius(C). Default is Fahrenheit. All temperatures previously stored will be converted to the correct degree representation.

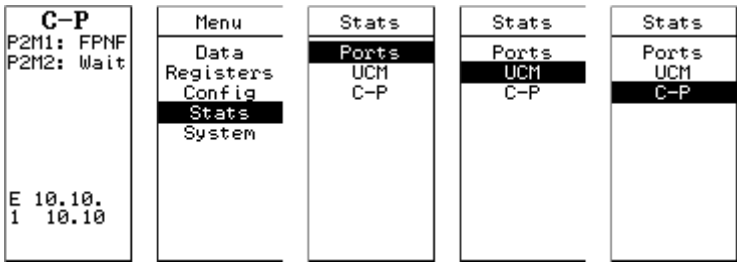
Figure 7.7: App State Menu Item Screens



Stats Menu

The Stats Menu shows communication statistics for the ports on the DUCM, information on the DUCM device itself, as well as statistics from the Crop-Protector™ application as well. Pressing the Enter key will reset the counts displayed in these screens.

Figure 7.8: Stats Screen



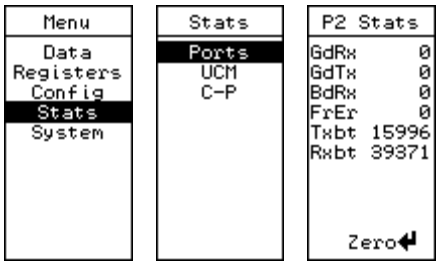
Port Statistics Screen

The names for the statistics displayed on this screen are abbreviated. A less abbreviated name is displayed at the bottom of the screen for the selected statistic.

The statistics displayed on this screen are:

- GdRx – Good read
- GdTx – Good write
- BdRx – Bad read
- FrEr – Framing Error
- Txbt – Transmitted bytes
- Rxbt – Received bytes

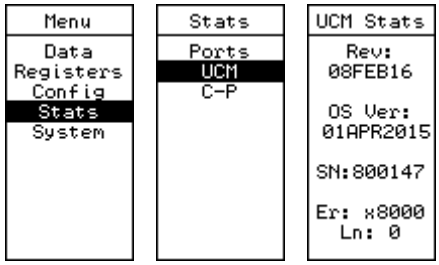
Figure 7.9: Port Stats Screen



DUCM Statistics Screen

The DUCM Stats screen shows hardware revision, OS Version, Module serial number, and application error code and line number.

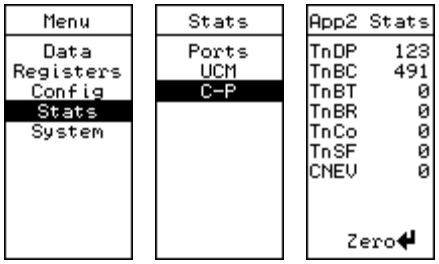
Figure 7.10: DUCM Stats Screen



Crop-Protector™(C-P) Statistics Screen

The C-P Stats screen shows information regarding the application that is running off of the ports connected to a Master-Hub.

Figure 7.11: DUCM Stats Screen



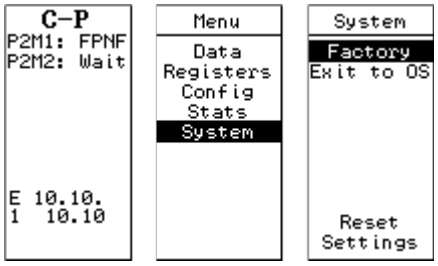
The statistics displayed on this screen are:

- TnDP – Total number of times data has been polled from the Master-Hub
- TnBC – Total number of bad checksum errors
- TnBT – Total number of bad command type errors
- TnBR – Total number of bad reply errors
- TnCo – Total number of bad count errors
- TnSF – Total number of system scan failures
- CNEV – Current number of errors data values

System Menu

The System Menu provides access to the OS, and reset settings to factory defaults.

Figure 7.12: System Menu Screen



8 Software Installation

Software Installation

NOTICE: If the DUCM was ordered from Garner Industries or from Niobrara with the part number MCP-104 then the latest Crop-Protector™ application and firmware is already loaded.

The application files for the DUCM are included in the DUCM_CROP_PROTECTOR_SETUP.EXE file. The latest version of this file is located at www.niobrara.com. Follow the link for "Application Notes", select "DUCM", and "CROP_PROTECTOR".

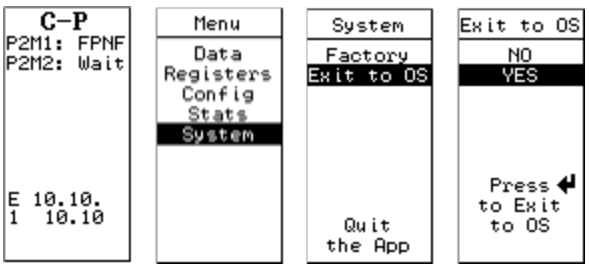
The program DUCM_SETUP.EXE is also required to be run before the Crop-Protector™ program may be loaded into the DUCM. The DUCM_SETUP program installs the QLOAD program and the FWLOAD program.

Updating the Application in the DUCM

The QLOAD program is used to install the Crop-Protector™ program.

1. The module must be powered.
2. The application must be halted. To accomplish this, use the arrow keys on the module to navigate to the Main menu. Use the Enter or Right arrow button to select the System option. Select the Exit to OS option in the System menu. Use the Enter or Right arrow button to select the YES option. See Figure 8.1

Figure 8.1: Halt the Application



3. When the application halts the operation of the arrow keys and the LCD screen is handled by the DUCM OS. The OS does not continuously paint the LCD screen so the last screen displayed when the application halted will remain on the screen until a key is pressed. Press the Up, Down, or Left arrow keys will bring up the OS Main Menu. See Figure 8.2

Figure 8.2: Halted Application

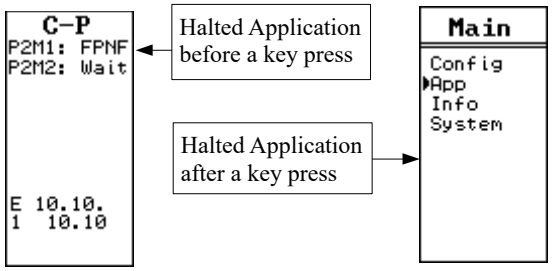
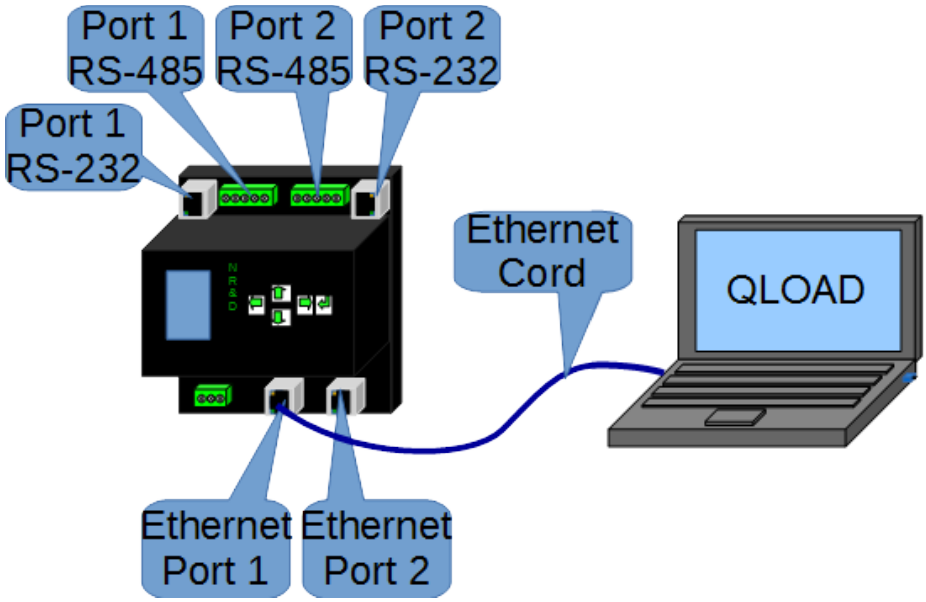
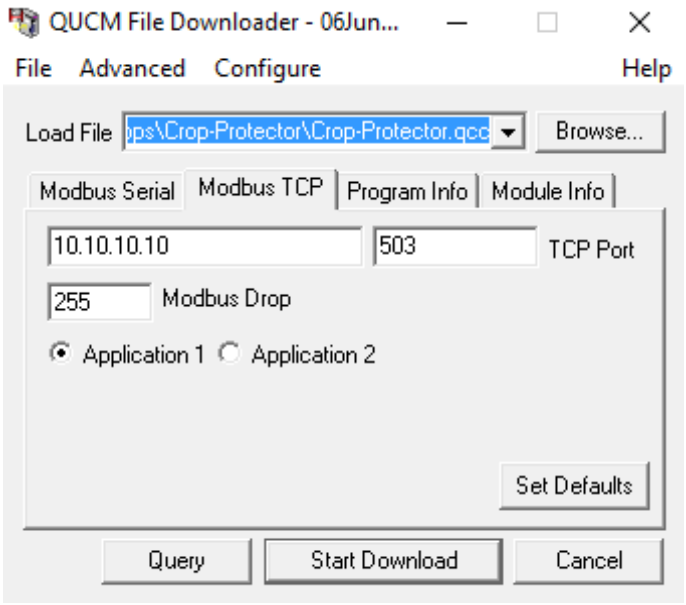


Figure 8.3: Connect DUCM Module to PC



5. Start QLOAD.EXE. The Windows Start Menu link is “Start, Programs, Niobrara, DUCM, Apps, Crop-Protector, QLOAD_Crop-Protector” See Figure 8.4

Figure 8.4: QLOAD Application



7. Click on the “Modbus TCP” tab and verify the following:
    1. The proper IP Address is selected (10.10.10.10 default).
    2. The TCP Port matches the OS Port of the device(default is 503).
    3. The Modbus Drop is 255.
    4. The Application 1 radio button is selected.

8. Press the “Start Download” button. QLOAD will open a progress bar to show the status of the download see Figure 8.5.

Figure 8.5: QLOAD Progress

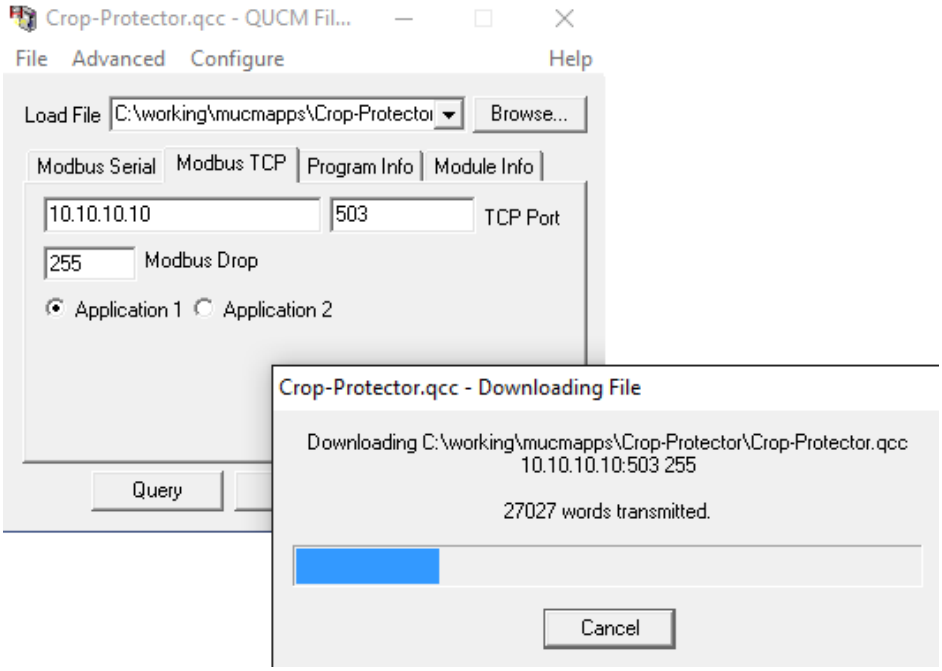
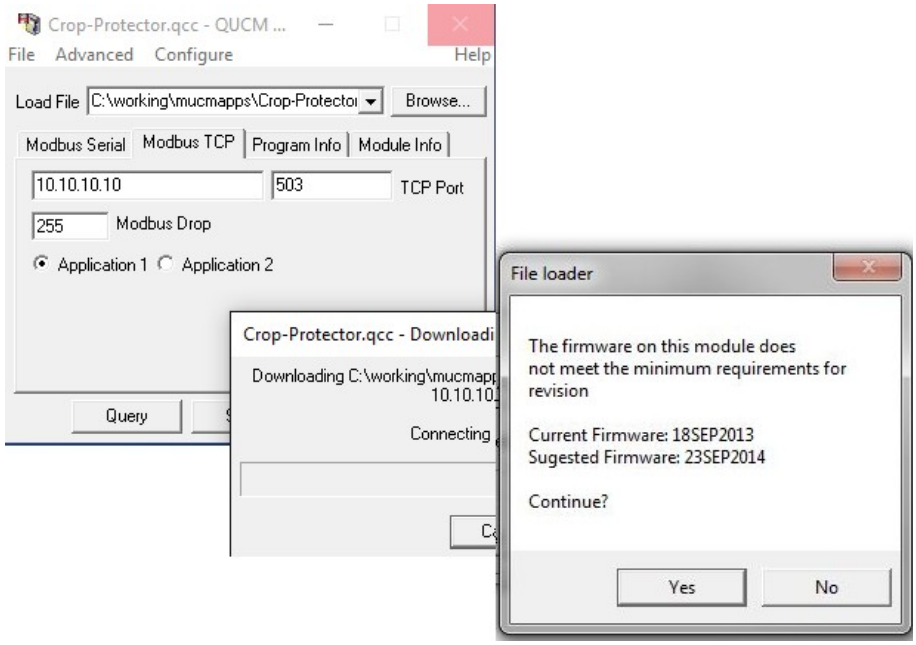


Figure 8.6: QLOAD Firmware Warning Dialog



9. The application Switch must be in Run for the application to be executed:

   To accomplish this, use the arrow keys on the module to navigate to the App option in the Main menu. Use the Enter or Right arrow button to select the option. Select the Switch option in the Apps menu. Use the Up or Down arrow to select the Run option. Use the Enter or Left arrow to accept the choice. See Figure 8.7

Figure 8.7: Change Application Switch to Halt

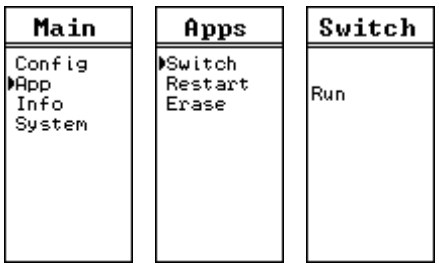
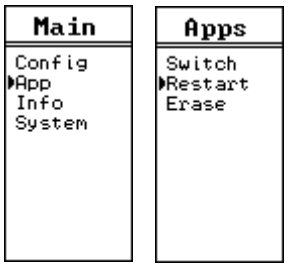


Figure 8.8: Restart the Application



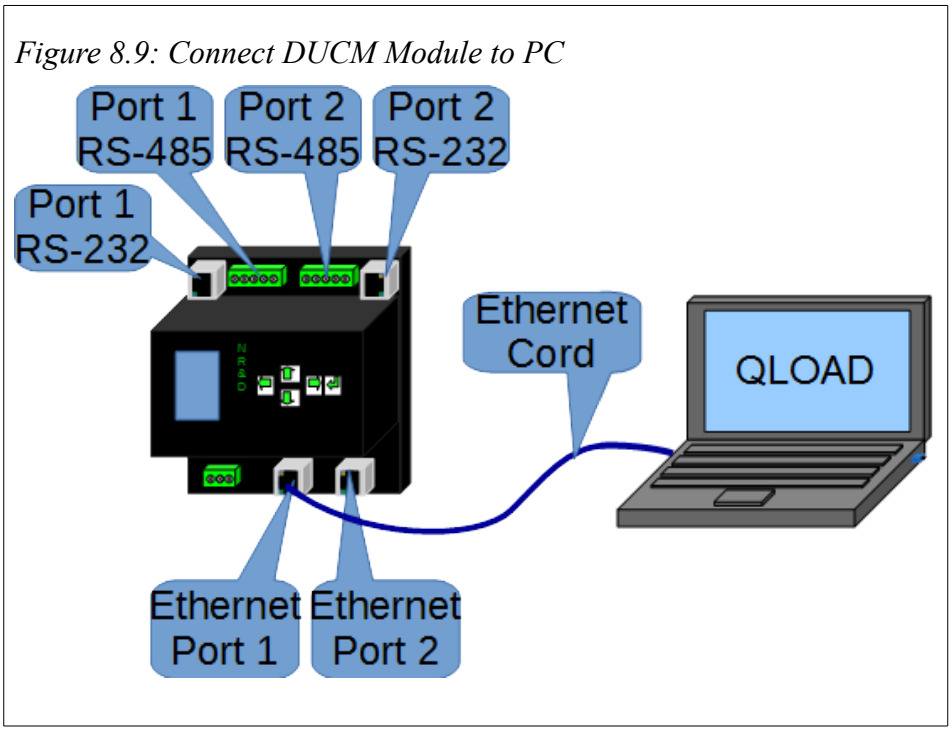
Updating the DUCM Firmware

The QLOAD program may be used to install the module firmware through a Serial port connection using Modbus RTU.

Start QLOAD.EXE from Windows Start Menu:

1. Make sure the DUCM is powered and connected to the PC

Figure 8.9: Connect DUCM Module to PC



3. Click on the "Modbus TCP" tab and verify the following:

   See Figure 8.10

   a) The proper IP Address is selected (10.10.10.10 default).
   b) The TCP Port matches the OS Port of the device(default is 503).
   c) The Modbus Drop is 255.
   d) The Application 1 radio button is selected.

Figure 8.10: Using QLOAD to update firmware

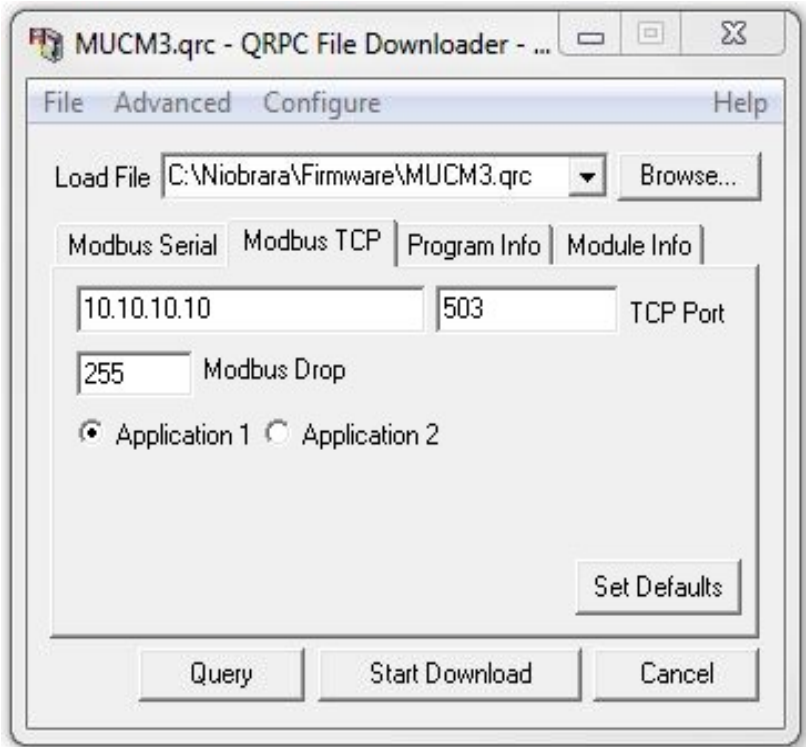
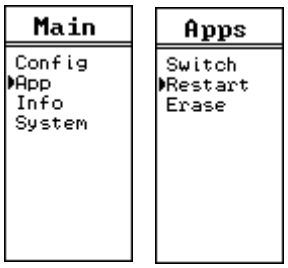


Figure 8.11: Restart the Application



Appendix A Purchasing Options

The part numbering scheme for the Crop-Protector™ kit:

DCP-1501-X

X: One digit code for DUCM part number

- No Number - DUCM+102
- 2 – DUCM+202

Example part numbers:

DCP-1501 - DUCM+102 preloaded with Crop-Protector™ application

DCP-1501-2 - DUCM+202 preloaded with Crop-Protector™ application

MCP-1501-X

X: One digit code for MUCM part number

- No Number - MUCM+302
- 3 – MUCM+303

Example part numbers:

MCP-1501 - MUCM+302 preloaded with Crop-Protector™ application, METH-001, wall transformer for MUCM (no connector), MU1 cable

MCP-1501-3 - MUCM+303 preloaded with Crop-Protector™ application, METH-001, wall transformer for MUCM (no connector), MU1 cable

TR121ST - wall transformer for DUCM