DUCM Lithonia

Installation and Programming Manual

This manual describes the DUCM application for interfacing Lithonia Emergency Lighting Inverters to a Modbus/TCP network.

Effective: January 27, 2017

NR&D

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1   Introduction

The Niobrara DUCM is a DIN rail mount device capable of running a custom application for performing communication translations between serial and/or Ethernet protocols. This document covers an application that allows a Modbus/TCP master to gather data from up to 20 Lithonia emergency lighting inverters.

Support is currently provided for Series "C", "CI", "CM", "IC3", "T", and "EAC". Inverter data is presented as Modbus Holding Registers (4x). The DUCM may be configured as a Modbus/TCP (default) or Modbus RTU slave. DUCM serial and Ethernet parameters, and the addition of all Lithonia inverters may all be configured from the front panel, or from a web interface.

Both serial ports of the DUCM may be configured as Lithonia master or Modbus slave. The Ethernet port will always be a Modbus/TCP slave.

The front panel may be used to configure the module. Pressing any key on the keypad will start the menu-driven configuration on the LCD. All ports and Lithonia slaves may be configured with this menu.

Figure 1.1: Typical Configuration
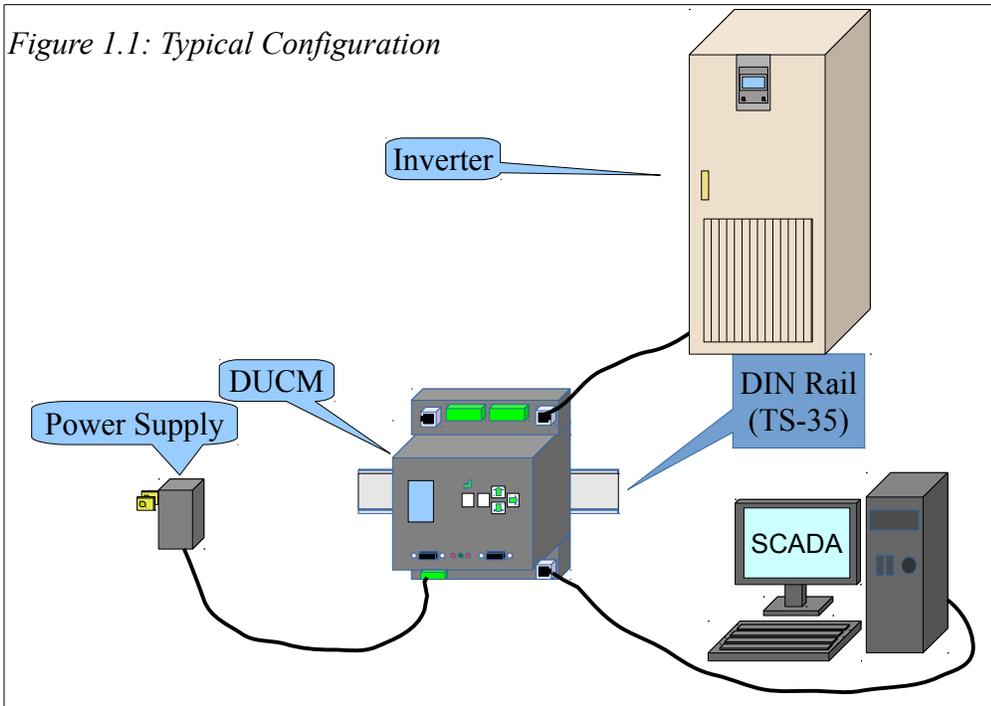
2   Installation

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

- DUCM
- Power source for DUCM (use NR&D part TR121ST or available power)
- Cabling between DUCM and Modbus/TCP Master is standard Ethernet cable
- Cabling between DUCM and inverter equipment may be built or purchased.
- DIN rail for mounting

Module Installation

1. Mount the DUCM on a DIN rail.
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

DUCM RS-232 Serial Port to 9-pin Inverter

The RJ45 ports of the DUCM are RS-232 so a simple 3-wire cable is required to connect to the inverter. In general, the device's Tx signal will connect to the DUCM's Rx, and the Rx signal will connect to the DUCM's Tx. Signal ground must run from the inverter to the DUCM, and each device will have its RTS and CTS handshaking pins shorted together.

The RS-232 port of the inverter uses a standard 9-pin RS-232 DCE serial port and thus the Niobrara MM3 cable may be used. For other standard connections, see the DUCM manual, or contact NR&D's technical support.

Figure 2.1.: DUCM to 9-pin DCE RS-232 (MM3 Cable)

DUCM RJ45	DB9S (female)
Tx 3	1
Rx 4	2
SG 5	3
RTS 6	4
CTS 7	5
	6
	7
	8
	9
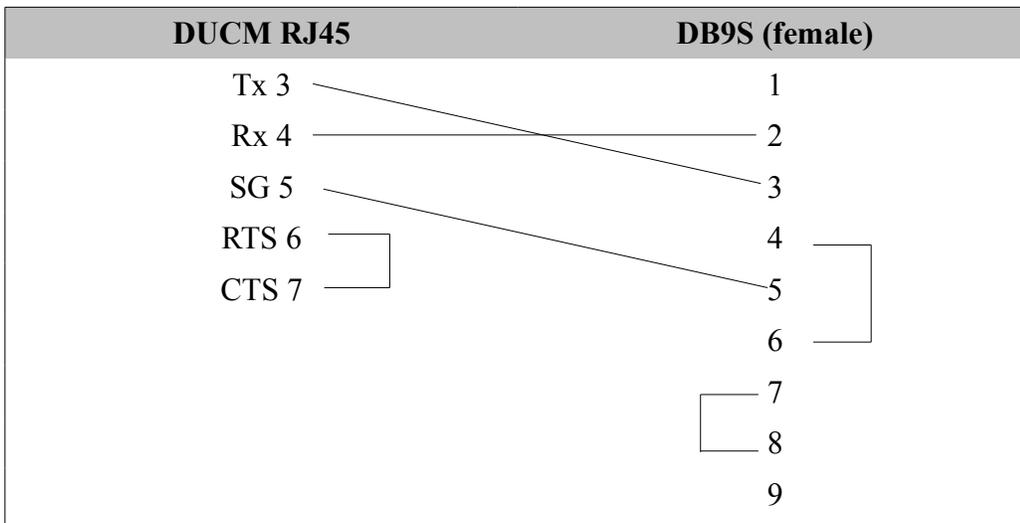
DUCM Application Configuration

Connect one or more inverters to DUCM serial port(s). Only one inverter may be connected to each port. In this example, connect an inverter to DUCM port 1 and the Modbus Master to DUCM Ethernet. The default settings for the DUCM are shown in Table 2.1.

Table 2.1: DUCM Default Port Settings

Setting	Port 1	Port 2
Protocol Mode	Lithonia	Modbus RTU
Baud Rate	9600	9600
Parity	None	None
Data Bits	8	8
Stop Bits	1	1
Data Level	RS-232	RS-232

These settings may be modified by using the front panel and LCD screen on the DUCM. When the application starts it is ready to poll any configured inverter, and make that data available to the Modbus/TCP master. The DUCM Splash screen will look similar to Figure 2.2. This screen displays information about the DUCM's IP address.

Figure 2.2: Splash screen

LITHONIA

E 206.223. ← DUCM IP
1 51.154   Address
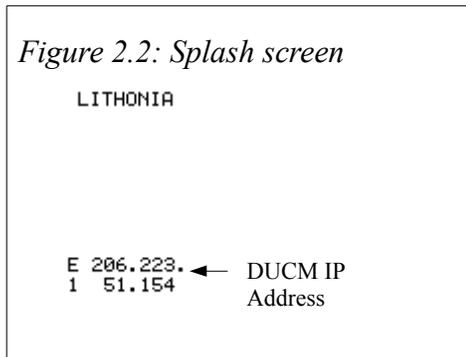
Pressing the Up, Down or right arrow key will bring up the Main Menu. Use the up, down, right, and enter keys to select Config, Slave to configure the slave(s) connected to the DUCM from the list.

Figure 2.3: Configure Slaves

Menu	Config	Unit Dev	Device
Data	Slave	0 N/A	MBSlv: 1
Config	UCM	1 N/A	Inverter
Stats		2 N/A	INV_01
System			Port: S1
		Not	DEL Enbld
		Configured	Save ESC
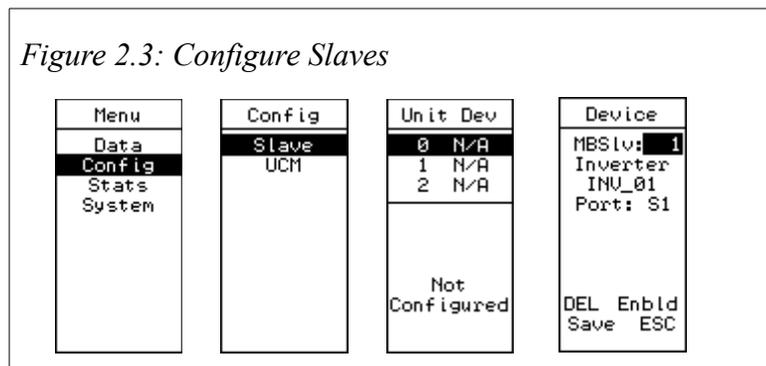
Use the left and right arrows to move between fields. Use the up and down arrows to change settings. Available settings are: MBSlv (the device address the Modbus/TCP master will poll), Slave Type, Inverter Name, Port (physical DUCM port slave is connected to), and if applicable, the IP address of the inverter. At the bottom of the screen, the user can delete the current configuration, enable or disable the ability to talk to the selected inverter, save the current configuration, or escape without making any changes to the current configuration.

To set up serial port parameters of the DUCM, use the up, down, right, and enter keys to select Menu, Config, Serial, Port 1 (or Port 2) then select the appropriate settings to match the settings of the connected device.

Figure 2.4: Configure Serial Ports

```
  Menu          Config          UCM           Serial          Port 1
 ────────      ────────       ────────       ────────       ────────
  Data          Slave          Serial         Port 1         Mode
  Config        UCM            Ethernet       Port 2         Baud
  Stats                                                      Parity
  System                                                     Data
                                                             Stop
                                                             Driver
                                              Lithonia       Timeout
                                              9600,N,8
                                              RS-232         Lithonia
                                              500 mS
```
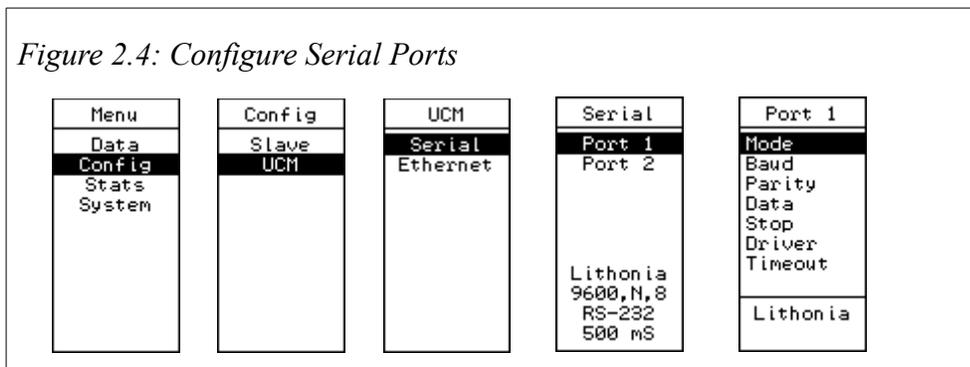
To change a setting, use the up or down arrows to navigate to the setting to be changed, then press the right or enter button. Once inside the setting, use the up or down arrows to change the setting, then left or right and enter to save that setting and return to the settings menu.

Available settings are:

- Mode – Selects the protocol for the serial port. Choices are Modbus RTU Master, Modbus RTU Slave, and Lithonia Master.

- Baud – Sets the port's baud rate. Choices are 2400, 4800, 9600, and 19200.

- Parity – Sets the port's parity. Choices are Even, Odd, and None.

- Data – Sets the data bits to be used. Choices are 7 or 8. As of the writing of this manual, all available protocols only use 8.

- Stop – Sets the port's stop bits to use. Choices are 1 or 2.

- Data – Sets the port's data level and hardware duplex. Choices are RS-232, 2wire 485, and 4wire 485

- Timeout – When the DUCM's port is a Lithonia or RTU master, this sets the timeout before the DUCM gives up on a reply from the slave. Choices are 500 mS, 1S, 2S, 3S, 4S, and 5S.

Once the inverters have been configured, the DUCM can display the polled data from the connected device. To access this, go to the main menu, and select Data. Use the up and down arrows to select which inverter to view, then press the right or enter button. Once inside, using the left and right arrows will change the radix of the data being displayed. This would be especially useful for the first two data points, as they are bitmaps.

Figure 2.5: Inverter Data Screen

```
   Menu          Unit Stat      Unit Stat
   Data          0 On           0 On
  Config         1   N/A        1   N/A
   Stats         2   N/A        2   N/A
   System
                 MBSlv:001      MBSlv:001
                 Inverter       Inverter
                 Target:001
                  INV_01         INV_01
                 Port: S1       Port: S1
```
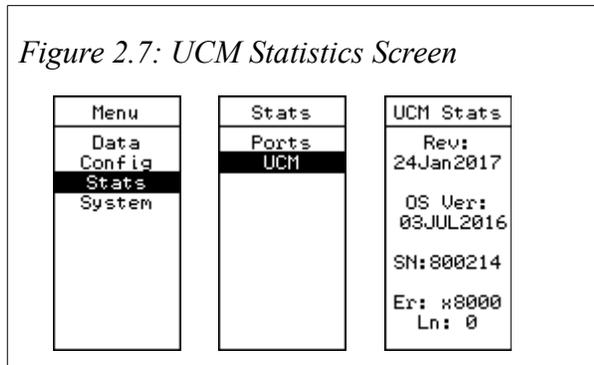
The DUCM can display useful statistics about its ports. Select this option by going to the main menu, and selecting stats. Then select ports. Using the left and right buttons will switch between port 1 and port 2. Statistics supplied by this screen are valid packets transmitted and received, invalid packets received, port framing errors, and bytes transmitted and received.

Figure 2.6: Port Statistics Screen

```
   Menu            Stats        P1 Stats
   Data            Ports       GdRx 54353
  Config           UCM         GdTx 54354
   Stats                       BdRx     0
   System                      FrEr     0
                               Txbt 42251
                               Rxbt  2829



                                  Zero⏎
```

The DUCM can also show some important stats about its own hardware and software. To access this, go to the main menu, select Stats, then UCM. The LCD will then display the version of the Lithonia application, the DUCM's firmware date, the DUCM's serial number, and the application's run/error state, along with a line number if the program has crashed.

Figure 2.7: UCM Statistics Screen

Menu	Stats	UCM Stats
Data	Ports	Rev:
Config	UCM	24Jan2017
Stats		
System		OS Ver:
		03JUL2016
		SN:800214
		Er: x8000
		Ln: 0

Finally, the DUCM has a System menu. To access this, go to the main menu, and select system. This menu has four options. "Factory" allows the user to reset the DUCM back to factory default settings. "Exit to OS" halts the Lithonia application, and returns control of the ports and LCD to the operating system. "MTCP Enable" gives the user the ability to turn on/off the Modbus/TCP server. "WEB Enable" give the user the ability to turn on/off the Web server.

Figure 2.8: System Menu

Menu	System
Data	Factory
Config	Exit to OS
Stats	MTCP Enble
System	WEB Enble
	Reset
	Settings
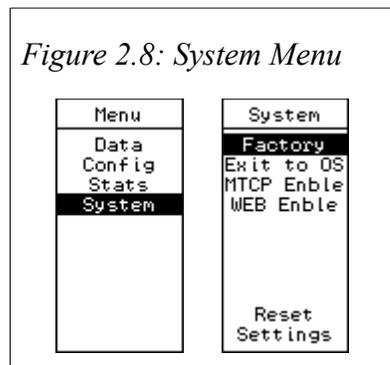
3　Operation

The DUCM Lithonia application automatically polls configured inverters, and stores the data in internal memory. Up to 20 inverters may be configured in the DUCM. When a Modbus/TCP master polls the DUCM, it should poll each inverter as a separate unit. The DUCM listens for queries for the inverter data, and delivers the data for the appropriate unit.

The DUCM will always answer Modbus messages directed to slave address 255 using its own registers.

If the inverter is not responding to the DUCM then the DUCM will not respond and inverter will be shown as offline on the LCD and the web page.

The following table shows the register list for the inverters:

Table 3.1: Lithonia Inverter Register List

Register	Measurement	Notes
4x0001	Alarm Status	Bit meaning: 0 = Overload Alarm 1 = Overload Shutdown Alarm 2 = High AC Voltage Alarm 3 = Low AC Voltage Alarm 4 = High Ambient Alarm 5 = Circuit Breaker Alarm 6 = Load Variation Alarm 7 = Near Low Battery Alarm 8 = Low Battery Alarm 9 = Inverter Failure Alarm 10 = Charge Failure Alarm 11 = Utility Failure Alarm 12 = Fan Failure Alarm 13 = Output Fault Alarm 14 = Spare 15 = Spare
4x0002	Indicator Status	Bit meaning: 0 = System Ready 1 = AC Present 2 = Battery Charging 3 = Battery Power 4 = Spare 5 = Spare 6 = Spare 7 = Phase (0=Single, 1=3-Phase)
4x0003	Input Voltage, Phase 1	Volts x10
4x0004	Input Voltage, Phase 2	Volts x10
4x0005	Input Voltage, Phase 3	Volts x10
4x0006	Output Voltage, Phase 1	Volts x10
4x0007	Output Voltage, Phase 2	Volts x10
4x0008	Output Voltage, Phase 3	Volts x10
4x0009	Output Current, Phase 1	Amps x10
4x0010	Output Current, Phase 2	Amps x10
4x0011	Output Current, Phase 3	Amps x10
4x0012	Battery Voltage	Volts x10
4x0013	Battery Current	Amps x10
4x0014	Temperature	Deg. x10
4x0015	Output Watts	Watts x10
4x0016	Output VA, Phase 1	VA x10
4x0017	Output VA, Phase 2	VA x10
4x0018	Output VA, Phase 3	VA x10
4x0019	Elapsed Time	Hours
4x0020	Inverter Run Time	Minutes

4   Web Pages

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 4.1. The home page shows the configuration of the serial ports and an overview of the inverters that are connected to the DUCM. From this page the user can follow links that allow for configuration of the DUCM's ports, configuration of connected slaves, and simple statistics about the DUCM. The user may also see the data from the connected slaves.

Figure 4.1: Web Server Home Page

Home

Configuration

Statistics

Help

NR&D's UCM
Lithonia Server

Status of Connected Devices
3 Devices Configured (20 max)
Port 1 Lithonia, 9600, None, 8, 1, RS-232, 500 msec timeout
Port 2 Lithonia, 9600, None, 8, 1, RS-232, 500 msec timeout

Dest. Index	QUCM Port	IP Address	Name	Device Type	Status
1	Port 1	206.223.51.0	INV_01	Inverter	Online
2	Port 2	206.223.51.0	INV_02	Inverter	Online
3	Enet 1	206.223.51.168	INV_03	Inverter	Online

UCM Configuration
UCM Statistics
Help

Configuration Page

The Configuration page contains links to the:

- *Add Device* page where the user may add all the connected inverters, as shown in Figure 4.3

- *Serial Port Configuration* page where the device's serial port settings can be viewed and changed as shown in Figure 4.4

- *Change UCM TCP/IP Address* page where the ethernet settings can be viewed and changed as shown in Figure 4.5

- *Change UCM Titles* where the user can change the titles displayed on the website as shown in Figure 4.6

- *Change Password* page where the password to access the configuration options can be changed as shown in Figure 4.7

All configuration options are locked behind a password. Once the password is entered, the user can do anything within the configuration of the DUCM for 3 minutes. The default password is "master" and can be changed if required through the webpage.
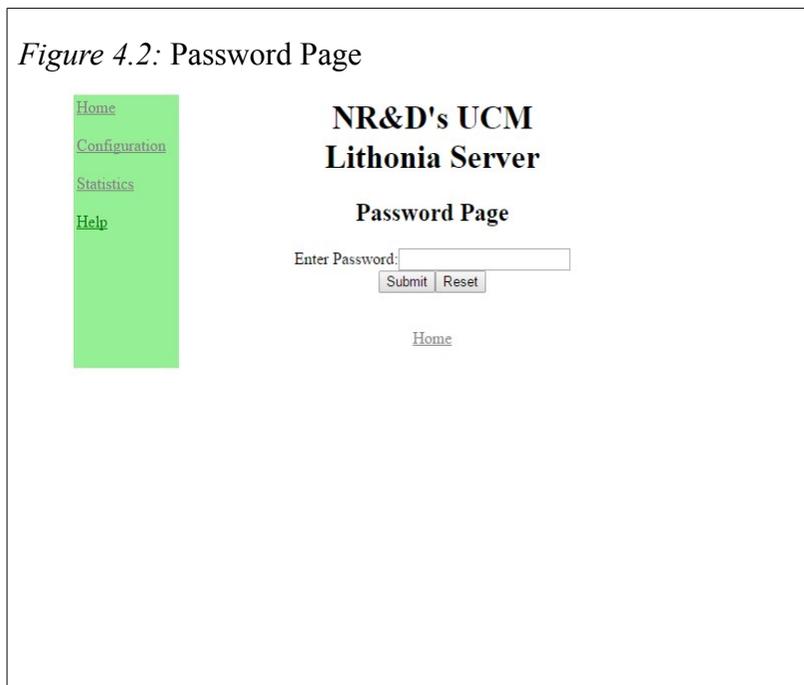
Figure 4.2: Password Page

DUCM Lithonia Manual

Figure 4.3: Add Device Page

Home

Configuration
Add Device
Serial Port
IP
Titles
Password
Save FLASH

Statistics

Help

NR&D's UCM
Lithonia Server

Device Add Page

Parameter	Value
Destination Index:	1 ▾
UCM Port Number	1 ▾
IP Address	206 223 51 0
Device Type	Inverter ▾
Name	INV_01
In Service	☑

Submit   Reset

Cancel Add Device

Home

Figure 4.4: Serial Port Configuration Page

NR&D's UCM
Lithonia Server

Serial Port Configuration

Home

Configuration
 Add Device
 Serial Port
 IP
 Titles
 Password
 Save FLASH

Statistics

Help

Parameter	Value
Port 1 Mode	Lithonia ▾
Port 1 Baud	9600 ▾
Port 1 Parity	None ▾
Port 1 Data Bits	8 ▾
Port 1 Stop Bits	1 ▾
Port 1 Driver	RS-232 ▾
Port 1 Timeout	500 ▾
Port 2 Mode	Lithonia ▾
Port 2 Baud	9600 ▾
Port 2 Parity	None ▾
Port 2 Data Bits	8 ▾
Port 2 Stop Bits	1 ▾
Port 2 Driver	RS-232 ▾
Port 2 Timeout	500 ▾

Submit   Reset

Cancel Port Configuration

Home

Figure 4.5: IP Address Configuration Page

Figure 4.6: Change Titles Page

Figure 4.7: Change Password Page
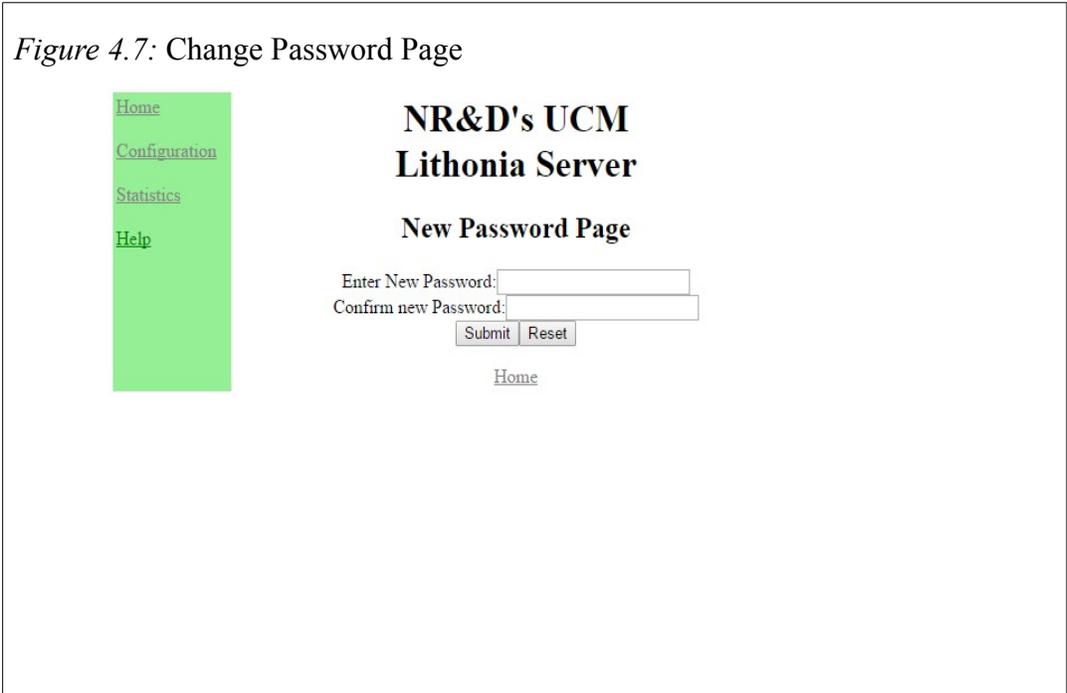
5   Example

Table 5.1 shows a system with one inverter connected to each serial port of the DUCM, as well as one on Ethernet. The inverters are connected on the serial ports via the Niobrara MM3. The 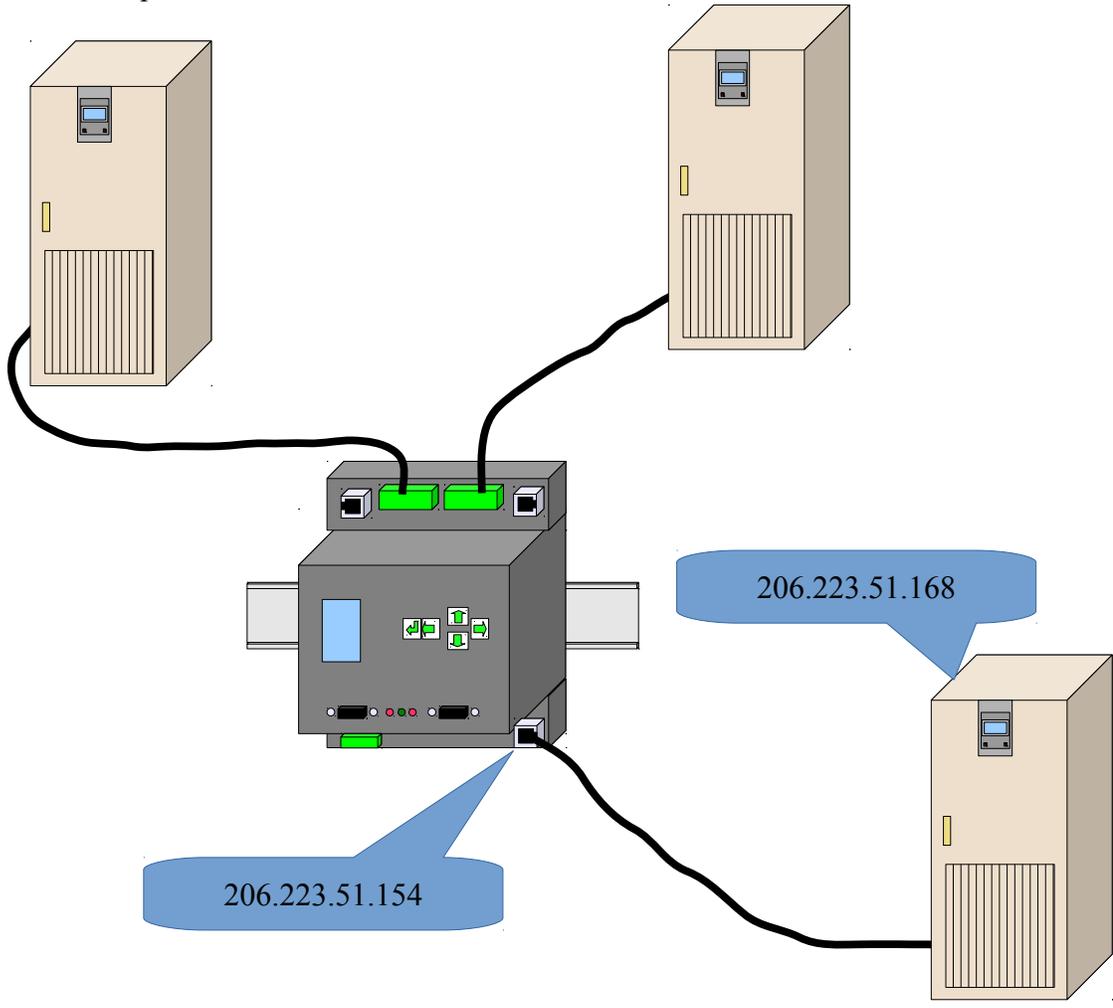serial ports are configured for 9600 baud, 8 data bits, 1 stop bit and No parity. The DUCM is configured as shown in Table 5.1.

Table 5.1: Example 1 Settings

Parameter	DUCM	
	Port 1	Port 2
Protocol Mode	Lithonia	Lithonia
Baud Rate	9600	9600
Parity	None	None
Data Bits	8	8
Stop Bits	1	1
Driver	RS-232	RS-232
Timeout	500 mS	500 mS

Figure 5.1: Example Hardware

206.223.51.168

206.223.51.154

The first two inverters are on the serial ports of the DUCM. The third inverter is on the Ethernet network at an IP address of 206.223.51.168. The DUCM is configured as shown in Figure 5.2.

Figure 5.2: Example Configuration

NR&D's UCM
Lithonia Server

Status of Connected Devices
3 Devices Configured (20 max)
Port 1 Lithonia, 9600, None, 8, 1, RS-232, 500 msec timeout
Port 2 Lithonia, 9600, None, 8, 1, RS-232, 500 msec timeout

Dest. Index	QUCM Port	IP Address	Name	Device Type	Status
1	Port 1	206.223.51.0	INV_01	Inverter	Online
2	Port 2	206.223.51.0	INV_02	Inverter	Online
3	Enet 1	206.223.51.168	INV_03	Inverter	Online

UCM Configuration
UCM Statistics
Help

The DUCM will begin to poll the configured devices. If the inverters respond, the DUCM will mark the devices "Online" on the main page of the website, as shown in Figure 5.2. Clicking on the word "Online" will show the data for that inverter, as shown in Figure 5.3.

Figure 5.3: Inverter Data Page

Home

Configuration

Statistics

Help

NR&D's UCM
Lithonia Server

Modbus/TCP Index Number = 1
Device Type = Inverter
INV_01

Variable	Value
Alarm Status	0000h
Indicator Status	0007h
Input Voltage, Phase 1	119.7 V
Input Voltage, Phase 2	119.8 V
Input Voltage, Phase 3	119.9 V
Output Voltage, Phase 1	120.1 V
Output Voltage, Phase 2	120.2 V
Output Voltage, Phase 3	120.3 V
Output Current, Phase 1	12.3 A
Output Current, Phase 2	12.4 A
Output Current, Phase 3	12.5 A

6   Testing and Troubleshooting

DUCM Lights

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

- The yellow **Tx** light on each serial port indicates that the DUCM port is transmitting data. This light should quickly flash when the DUCM has a message to transmit to the connected device.

- The green **Rx** light on each serial port indicates that the DUCM port is receiving data. This light should quickly flash when the DUCM receives a message from the connected device.

- The yellow Link/Activity light indicates that the Ethernet port of the DUCM has a link, and is transmitting or receiving packets. This light should blink periodically any time an Ethernet cable is connected.

- The yellow 100 light indicates that the DUCM has a 100 Mbit connection.

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 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.
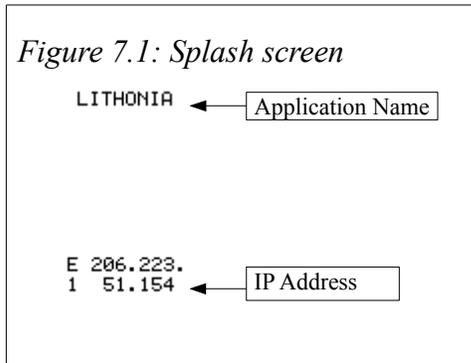
Backlight

The LCD backlight will illuminate on any button press. The timeout for the backlight is set for 30 seconds.

Operating Screens

Splash Screen

The main page shows the application name, and optionally, IP address.

Figure 7.1: Splash screen

LITHONIA ← Application Name

E 206.223.
1 51.154 ← IP Address

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

Menu
Data
Config
Stats
System ← Selection box
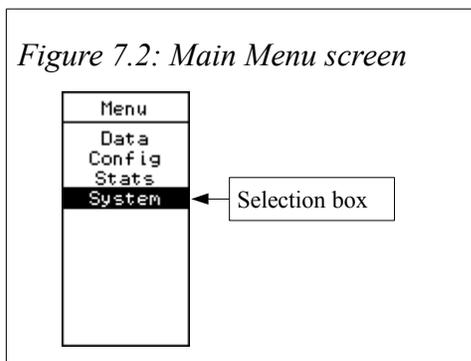
Config Menu

The Config menu is used to configure the application for the correct slave types, serial port parameters, and optionally the IP address.

Figure 7.3: Inverter Configuration Screen
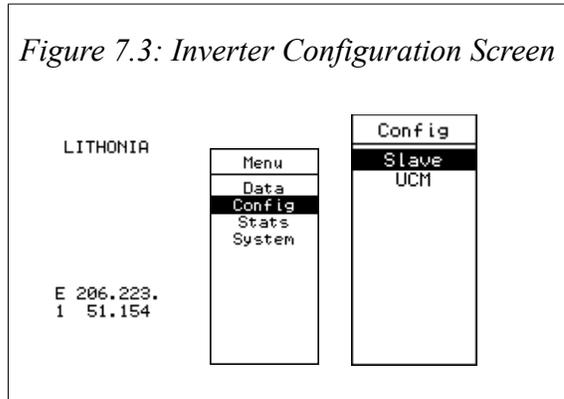
Slave

Menu used to configure the available slaves. The user can configure the Modbus device address, slave type, PLC address, PLC name, attached DUCM port, File Type, and File Number desired for the slave. Use the left and right arrows to navigate between fields, up and down arrows to changed the parameters, and the enter key to activate the fields at the bottom of the screen.

Figure 7.4: Slave Configuration Screen
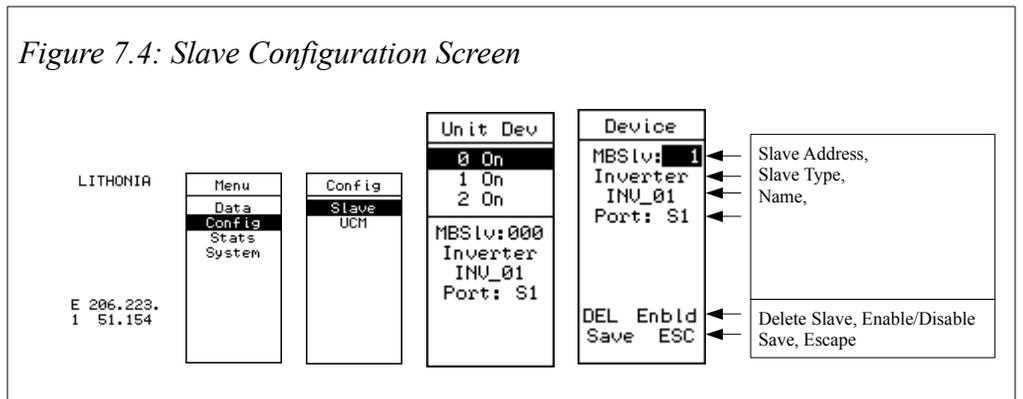
Serial Config Menu

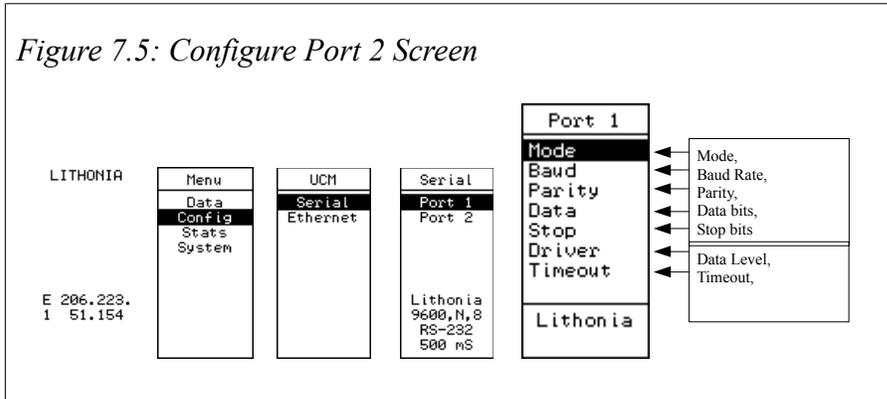The serial configuration menu is used to set the operating parameters of both serial ports. Select the Mode, Baud rate, Parity, Data bits, Stop bits, Data Level, and Timeout.
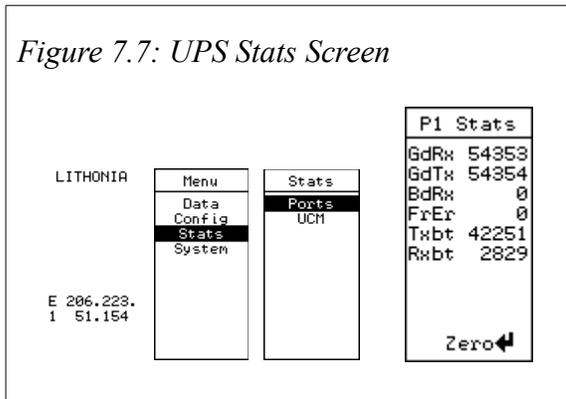

Figure 7.5: Configure Port 2 Screen

Stats Menu

The Stats Menu shows communication statistics for the UPS and Modbus port. Pressing the Enter key will reset the counts displayed in these screens.
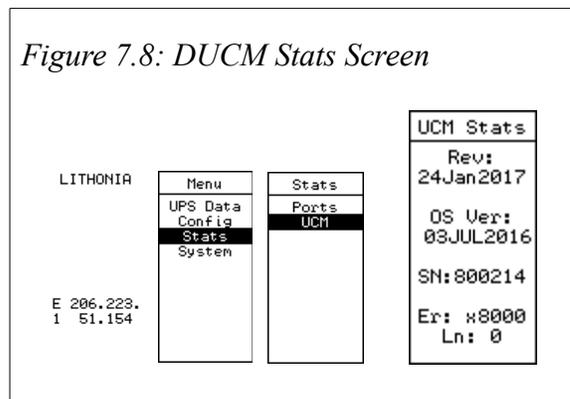

Figure 7.6: Stats Screen
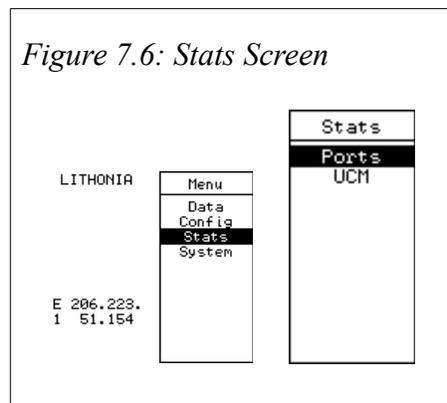
Port Statistics Screen

Shows statistics on the serial communications.

Figure 7.7: UPS Stats Screen

```
                                     ┌─P1 Stats─┐
                                     │GdRx 54353│
          ┌──Menu──┐ ┌──Stats──┐     │GdTx 54354│
LITHONIA  │  Data  │ │  Ports  │     │BdRx     0│
          │ Config │ │   UCM   │     │FrEr     0│
          │  Stats │ │         │     │Txbt 42251│
          │ System │ │         │     │Rxbt  2829│
          │        │ │         │     │          │
E 206.223.│        │ │         │     │          │
1  51.154 │        │ │         │     │    Zero◄┘│
          └────────┘ └─────────┘     └──────────┘
```

UCM Statistics Screen

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

Figure 7.8: DUCM Stats Screen

```
                                     ┌─UCM Stats─┐
                                     │   Rev:    │
          ┌──Menu──┐ ┌──Stats──┐     │ 24Jan2017 │
LITHONIA  │ UPS Data│ │  Ports │     │           │
          │ Config │ │   UCM   │     │  OS Ver:  │
          │  Stats │ │         │     │ 03JUL2016 │
          │ System │ │         │     │           │
          │        │ │         │     │ SN:800214 │
E 206.223.│        │ │         │     │           │
1  51.154 │        │ │         │     │ Er: x8000 │
          │        │ │         │     │   Ln: 0   │
          └────────┘ └─────────┘     └───────────┘
```

System Menu

The System Menu provides access to the OS, reset settings to factory defaults, and the ability to turn on and off the Modbus/TCP servers and Web interface.

Figure 7.9: System Menu Screen
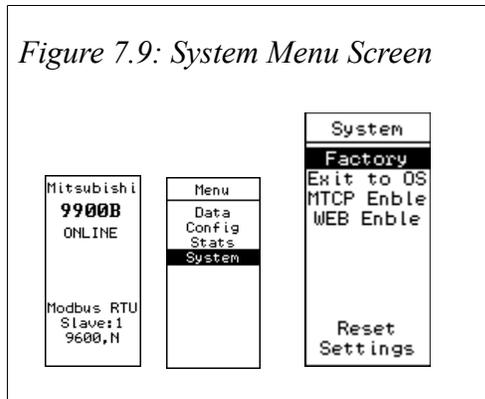
8   Software Installation

Software Installation

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

The program DUCM_SETUP.EXE is also required to be run before the Lithonia 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 DUCM_Lithonia 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
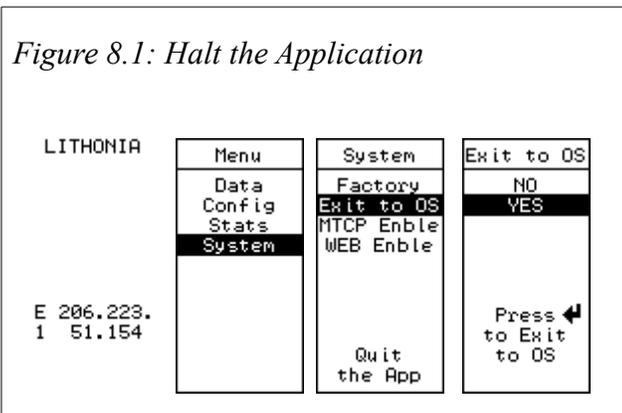
3. Connect an Ethernet cable from the module to the PC.

4. Start QLOAD.EXE. The Windows Start Menu link is "Start, Programs, Niobrara, DUCM, Apps, Lithonia, QLOAD_Lithonia" See Figure 8.2
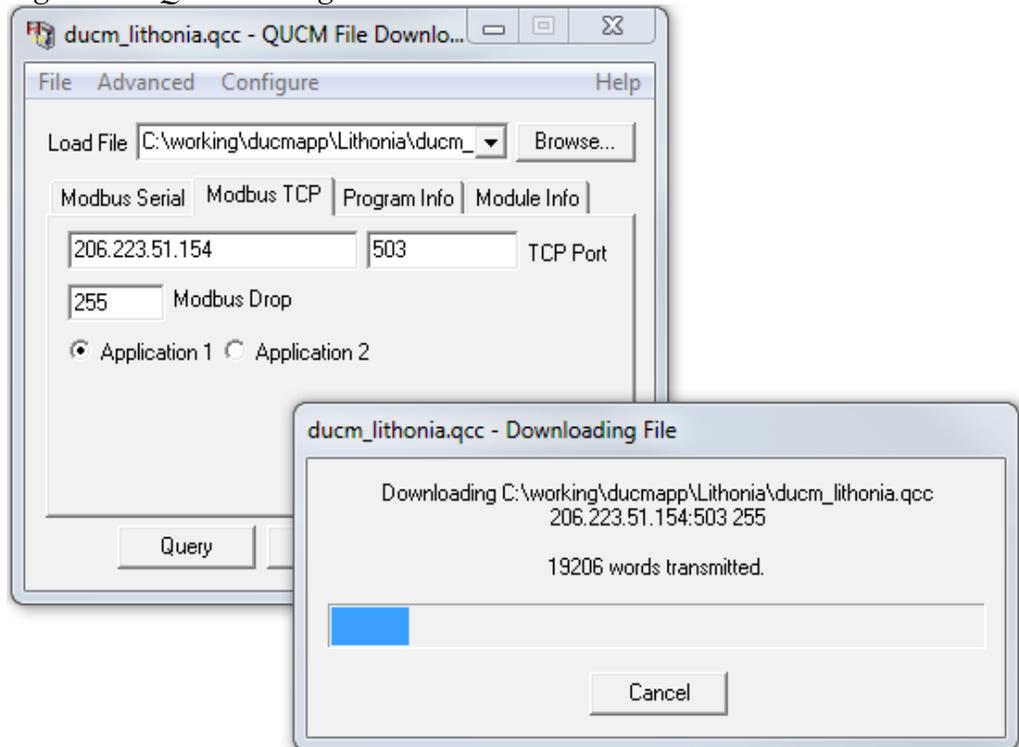
Figure 8.2: QLOAD Application
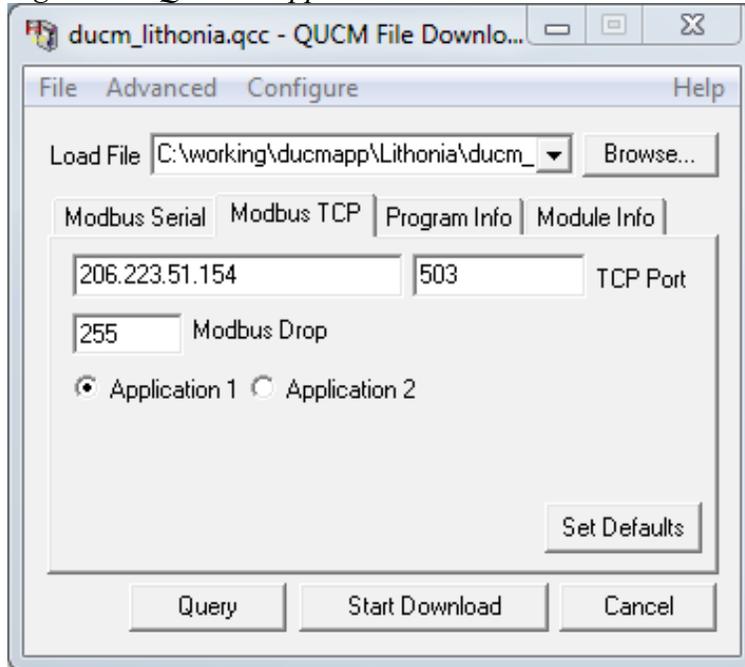
5. If necessary, Click on the Browse button and select ducm_lithonia.qcc.

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

    1. The proper IP address is entered.

    2. The proper Modbus/TCP port for the DUCM is entered. 502 is default, but 503 is recommended.

    3. The Modbus Drop is 255.

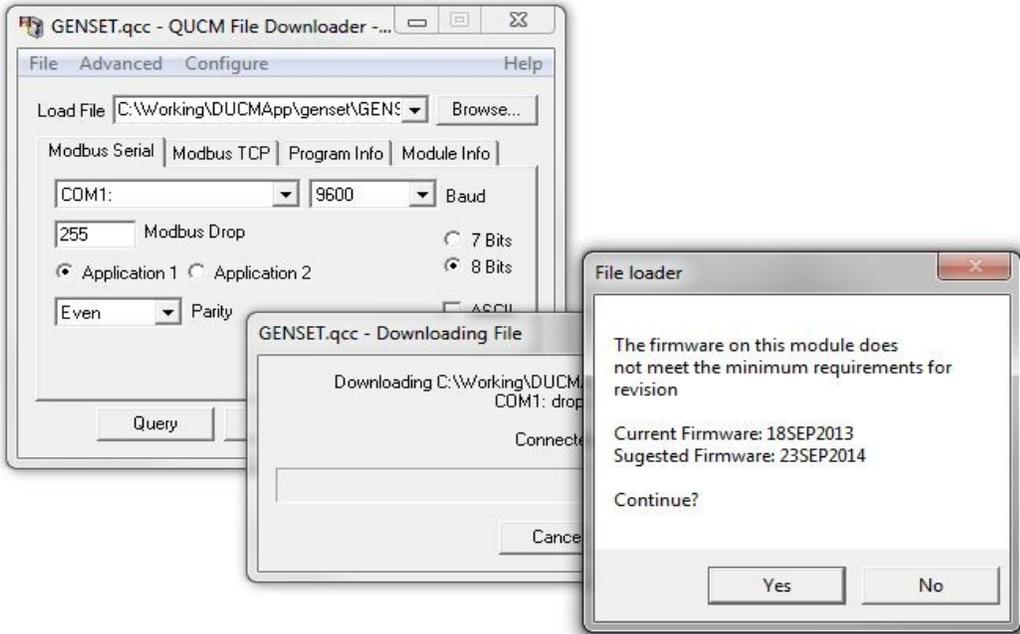   4. The Application 1 radio button is selected.

7. Press the "Start Download" button. QLOAD will open a progress bar to show the status of the download see Figure 8.3.
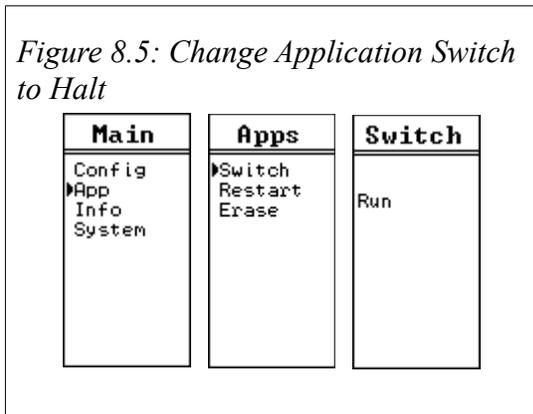
Figure 8.3: QLOAD Progress

If the Firmware Warning dialog appears click "No" and refer to the Updating the DUCM Firmware section of this manual see Figure 8.4.

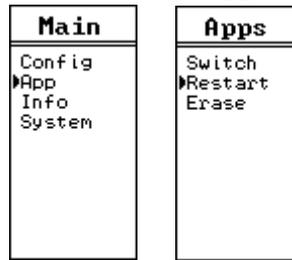*Figure 8.4: QLOAD Firmware Warning Dialog*

8. 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 8.5

Figure 8.5: Change Application Switch to Halt

or Restart the application. Use the arrow keys on the module to navigate to the App option in the Main menu. Select the Restart option in the Apps menu. See Figure 8.6

Figure 8.6: Restart the Application

```
┌─────────────┐  ┌─────────────┐
│    Main     │  │    Apps     │
├─────────────┤  ├─────────────┤
│ Config      │  │ Switch      │
│▶App         │  │▶Restart     │
│ Info        │  │ Erase       │
│ System      │  │             │
│             │  │             │
│             │  │             │
└─────────────┘  └─────────────┘
```

Updating the DUCM Firmware

The QLOAD program may be used to install the module firmware through the Ethernet port.

Start QLOAD.EXE from Windows Start Menu:

1. Make sure the DUCM is powered and connected to the PC or the same network as the PC.

2. Start QLOADEXE.   The Windows Start Menu Link is "Start, All Programs, Niobrara, DUCM, QLOAD DUCM Firmware"

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

    See Figure 8.7

    a) The proper IP address is entered.

    b) The DUCM's Modbus/TCP port is entered.

    c) The Modbus Drop is 255.

    d) Application 1 is selected.

Figure 8.7: Using QLOAD to update firmware
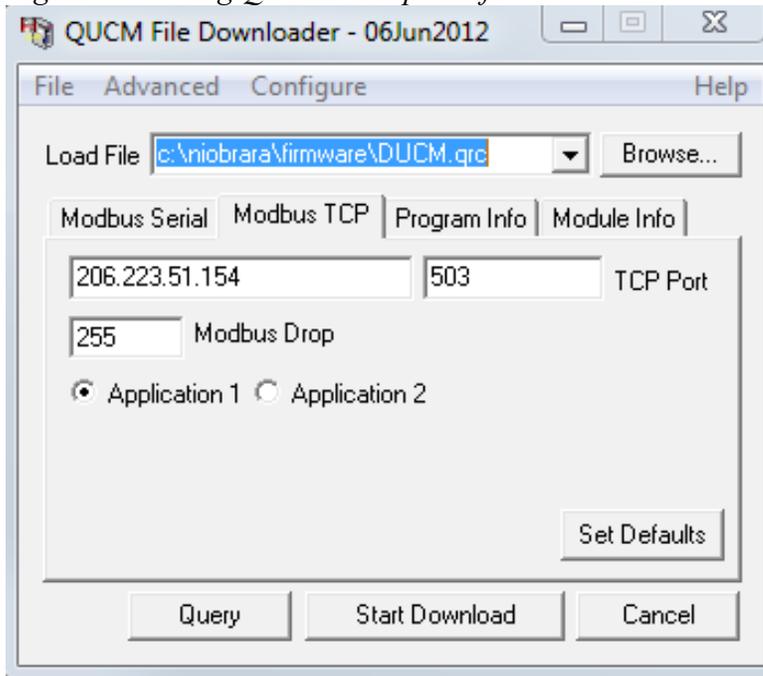
4. Press the "Start Download" button. QLOAD will open a progress bar to show the status of the download. When the download is complete the application may have to be restarted. To accomplish this, use the arrow keys on the module to navigate to the App option in the Main menu. Use the Enter or Right arrow button to select the option. Then select the

Restart option in the Apps menu. See Figure 8.8

Figure 8.8: Restart the Application