



# DL6000

## User Manual



Revision 1.01 – June 12, 2007

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# 1 General Operation and Applications

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The DL6000 hardware platform was designed to be a gateway which interfaces your Ethernet Modbus TCP Networks to AB's Data Highway Plus (DH+), or DH-485 networks. Thus extending the life of existing Allen-Bradley PLC's and SLC's without Ethernet Interfaces. It comes in a DC powered Din-Rail Mountable compact cabinet for ease of portability and installation. The DL6000 combines the Lantronix XPORT\_MBTCP Ethernet Microprocessor with our proven A-B interface.

The DL6000 comes with a RJ-45 Connector for the 10/100 Base-T Ethernet link, and a 3 pin Phoenix plug for connection to A-B networks. Power is supplied via a 3 pin Phoenix type plug which allows for 9-27 Volts DC to be connected. Included is a RS232 DB9 and a USB Configuration Ports for access to the BIOS and Flash Burn Utilities.

Configuration of the operating parameters is done quickly and easily via the Ethernet Link by Telnet or the supplied Lantronix Device Installer software. Current releases of the software can be obtained from Lantronix's [Website](#).

Modbus TCP communication is handled by any generic Modbus TCP driver, tested ones include Citect, Parijat, and Kepware.

## 2 Hardware Specifications and Layout

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The DL6000 Hardware Platform has the following specifications.

### 2.1 Operating Specifications

Our DH+ versions A-B Channel allows Synchronous Transformer Coupled SDLC connection to Allen Bradley DH+. Speeds of 57.6K, 115.2K and 230.4K Baud are available.

Our DH-485 versions A-B Channel allows for Isolated DH-485 (RS485) connection to Allen Bradley DH-485 network. Speeds of 4800, 9600 and 19.2K (default) Baud are available.

Ethernet Channel allows 10/100 Base-T connections to TCP/IP and other Ethernet networks.

Currently Modbus TCP makes use of our proven Modbus to AB network interoperability.

Simple Parameter Configuration using menu driven Windows based Programs via Ethernet 10/100 Base-T.

Configuration and Reset Pushbuttons go into BIOS features and Flash Setup and do a full Hardware Reset.

Operating Parameters are stored in Non-Volatile Serial EEPROM.

The DL6000 uses FLASH upgradeable firmware from either the supplied EQ32 configuration program or once can use a HyperTerminal type program set to 19200,N,8,1 and XON/XOFF flow control.

Bi-Color (Green/Red) LED's for Ethernet and A-B Channels indicates activity and status. Green POWER LED indicates power on.

Bi-Color LED's for Ethernet Link and Tunneling Status, Diagnostic.

## 2.2 Physical Specifications

Dimensions: 1.2" H x 4.75" D x 3.2" W (30.4 x 120.7 x 81.3 mm) - Weight 0.56 Lbs (0.2 Kg)

Installation: Metal Enclosure; Desktop, # 8 Bolts, or Din Rail Mounting

Operating Environment: 32 to 122 °F (0 to 50 °C)

Storage: -40 to 185°F (-40 to 85°C)

Humidity: 5% to 95% non-condensing

Power: 9-27V DC – 3.0 Watts

## 2.3 Hardware Layout

This Section contains information of the physical position and purpose of the components of the DL6000.

The top row contains the following connectors. Going left to right.

- 3 pin Power Connector
- A-B Network 3 pin Screw terminal (Phoenix Type)

The LED's on the left side going from top to bottom.

- CHA A-B Network Status
- CHB Ethernet Activity (TX/RX).
- CHC DL6000 Operating Mode and Status.

The LED's on the RJ45 on the side.

- Ethernet Activity (Port TX/RX) On the right side of the RJ45
- 10/100 Base-T Ethernet Link Status On the left side of the RJ45

The RESET pushbutton is on the left side, the Configure pushbutton is on the right side.

The bottom side of the DL6000 has the following connectors: Going Left to Right.

- 9 Pin DB9 connector for MODBUS Configuration, the BIOS and Firmware.
- USB connector for MODBUS Configuration, the BIOS and Firmware
- RJ-45 connector for 10/100 Base-T Ethernet communications

## 3 Mode of Operation

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### 3.1 Online Mode of Operation

Online Mode is the normal operating Mode of the DL6000. In this mode the Channels are now configured as they are defined by the A-B Network and Configuration. The DL6000 is ready to interface your equipment.

The Reset pushbutton automatically puts the DL6000 into Online mode.

### 3.2 Offline Mode

Once the Configure Pushbutton is Pressed the Offline BIOS Manager is started. Using either the EQ32 configuration software and the “DL Offline Manager” option or a Windows Hyper Terminal type program with com port settings of 19200 Baud, 8,N,1 and Xon/Xoff flow control.

BIOS MANAGER for DL6000-1.00- Jun 16,06  
(c) Equustek Solutions Inc. 2006

MAIN MENU

- 1 - Restore EEPROM
- 2 - WRITE new Firmware
  
- 3 - Memory DUMP
- 4 - OFF-LINE Diagnostics
- 5 - DEBUG Mode
  
- 6 - FIRMWARE Version
- 7 - ONLINE
- 8 - CONFIGURE Model Parameters

MAKE SELECTION (1-8) -

#### 3.2.1 BIOS Manager Options

##### **Restore EEPROM to factory settings**

Once pressed you will be asked “Restore EEPROM to defaults (Y/N)?” If the answer is “Y”es then the Online parameters will be reset to defaults of Address 1, and settings of 9600,N,8,1 on the communication Channel to the COBOX.

##### **Write New Firmware**

Once pressed the message “This \*WILL\* overwrite DATALINK system code enter (Y/N) to proceed” will be displayed. Hit “Y” and the next message will appear telling you that it is alright to send the new firmware to the Flash;

ERASING FLASH, PLEASE WAIT...

SEND FIRMWARE TEXT FILE NOW...

Once the message to send the firmware appears then either click on the “Burn Flash System File” button to select the .txt file to send, or send the Text File under HyperTerminal.

Wait for an “\*A-OK\* BURN COMPLETE!” message to appear.

### **Memory Dump**

This is used to display the RAM memory of the DL6000. This should only be done after contacting Equustek Solutions to debug problems.

### **Off-Line Diagnostics**

Starts a series of tests to test the DL6000’s hardware and should only be done if instructed so by a trained person.

### **Debug Mode**

Starts up a DL6000 internal Debug mode that can be used by trained personnel to debug problems and check hardware configuration and operation.

### **Firmware Version**

Once selected the current DL6000 model and version numbers will be displayed. Can be used to check the correct firmware was burnt into the Flash or if the DL6000 has the most up to date firmware in the Flash.

### **Online**

Does a soft “software” reset of the unit to put it online. This will NOT reset the COBOX (Ethernet) hardware.



## 4 Switch and LED Indicator Functions

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### 4.1 Switch Functions

#### *Reset Pushbutton*

The Reset pushbutton will perform a complete hardware reset of the DL6000. It is identical to a complete power cycle and will cause the DL6000 to go through its LED start-up sequence as defined in Section 5.2.1. **A complete hardware reset is needed on changing any online operating parameters.**

#### *Configure Pushbutton*

The Configure pushbutton takes the DL6000 out of On-Line operation mode and puts it in the BIOS Manager mode. When this mode has been entered, CHA and CHC LEDs will be RED and CHB LED will be GREEN. To put the unit back On-line it is necessary to either press the Reset or cycle the DC power supplied to the DL6000.

### 4.2 Indicator Functions

#### 4.2.1 *Power-Up and Reset Sequence*

On Power-up or after the Reset button has been pressed the DL6000 executes a self diagnostic check-up of the ram and flash firmware. The correct LED indicator sequence to show the DL6000 is functioning properly is as follows: After all LEDs go out.

<b>LED</b>	<b>Status</b>
Power	Green Continuously
CHC LED (Status)	Green for 0.5 seconds
CHB LED (Ethernet)	Green for 0.5 seconds
CHA LED (A-B Network)	Green for 5 seconds
CHA LED	Green for An other 8 seconds
CHB LED	Red for

After this sequence the DL6000 goes into the On-line mode of Operation. The LED indicators will behave in the certain way defined by the DL6000 model used. Most likely the A-B Network will be solid or flashing depending on the A-B Network used.

## 4.2.2 Normal On-line Operation

The following is a description of the normal operation of the LED's on the DL6000.

<b>LEFT LED's</b>	<b>Description of Operation</b>
Power	Green Indicates Power is being supplied to the DL6000.
(Ethernet)	Flashes GREEN for 0.5 seconds when a character is Received or Transmitted. If Characters are being received or transmitted faster than this then it might appear the LED is on SOLID. Flashes RED for 0.5 seconds if a NAK is received or transmitted. Will also flash if all serial communication buffers are full.
A-B Network	<b>(DH+ )</b> On Hardware Reset will flash GREEN and RED until a valid DH+ network is detected. This is the AUTO BAUD Rate detection mode, the DL6000 will automatically connect at the DH+ speeds of 57.6K, 115.2K and 230.4K Baud. LED will switch to on solid once the DL6000 is on the DH+ network as a valid node address. LED will flash GREEN when the DH+ is set to a certain Baud rate but is not on network.  <b>(DH-485)</b> On Hardware reset the A-B Network will flash GREEN at a 1 second rate when the DH-485 is not on network. Once a valid network is running the LED will flash GREEN much more rapidly (approx. every 0.1 seconds), the rate depends on how busy the network is.
Status	Used for Determining Operating Mode and DL6000 Status

### **RJ45 LED's Description of Operation**

Activity LED	Blinks (amber 10BaseT) or (green 100BaseT) to indicate an Ethernet socket has been established and active.
Link LED	Lights Solid Amber or Green to indicate Ethernet Port is connected to the 10/100Base-T network.

### 4.2.3 On-Line, Power-Up and Reset Errors

The following table describes the meaning of LED patterns if the internal diagnostic tests detect an error on Reset/Power-Up.

<b>LED Pattern</b>	<b>Description of Problem</b>
Ethernet, A-B Network, and Status Flashing RED	The flash has not be burnt properly and the A-OK was not transmitted. Please reburn the flash with the correct text file. Contact Customer Support for help.
Ethernet, A-B Network, and Status Solid RED	The BIOS has been corrupted. A new Flash Chip has to be supplied by the factory. Please contact Customer support.
Start-up Sequence keeps repeating	The DL6000 EEPROM is corrupt.. Please Restore to Factory Settings (See Section 4.3) and then reconfigure the unit.
A-B Network Flashing RED	There is a duplicate node on the A-B network. The DL6000 has been assigned a node address that is already in use.

### 4.2.4 Off-Line Modes

The following table describes the meaning of LED patterns in the different Off-Line modes of operation.

<b>LED Pattern</b>	<b>Description of Operation</b>
CHA and CHC Solid RED	BIOS MANAGER
CHA, CHB and CHC Solid Green	Offline Hardware Diagnostics Testing Mode OR Offline Debug Mode

# 5 Configuration

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The following sections describe how to setup and configure your DL6000 for the desired online operating parameters. To configure your DL6000, the following software will be needed.

## Configuration Software

- Device Installer - Used to assign IP address and update Lantronix daughter board firmware.
- ComPort Redirector - Creates a virtual COM port and redirects it to the PC's Ethernet port.
- EQ32 Configuration - Used to map Modicon registers/coils to Allan-Bradley data files with the DL6000-MEDH+ or MEDH-485.

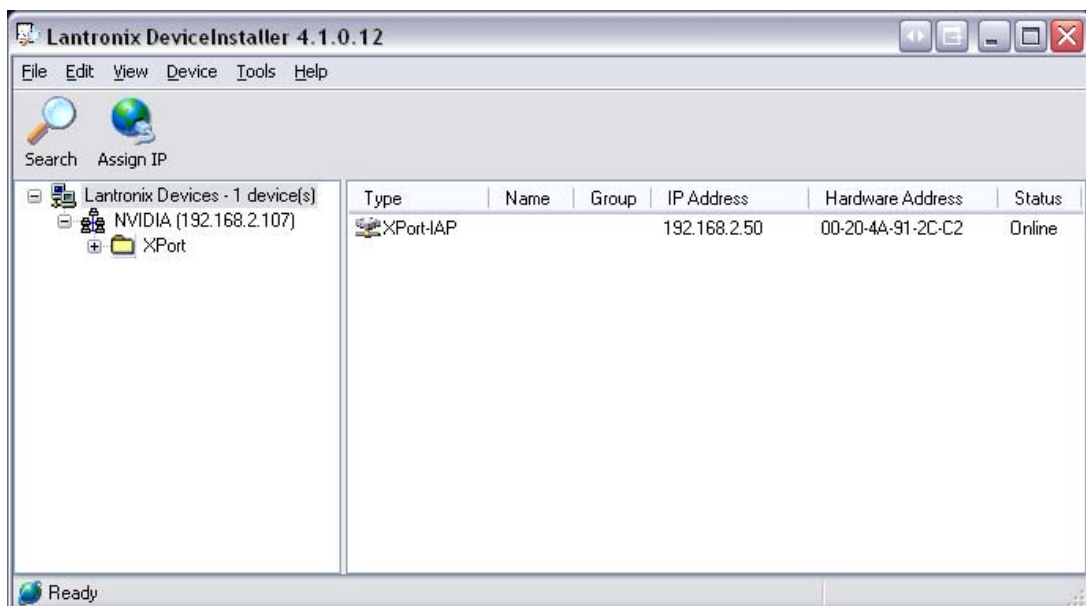
*After the IP address of the DL6000 is assigned, you must then telnet to the DL6000 to setup the internal communications between the Lantronix daughter board and the DL6000 motherboard. These settings are reset every time an IP address is assigned.*

## 5.1 Device Installer

The Device Installer is used to configure the IP address of the DL6000 as well as configure the internal communication settings between the Lantronix XPORT and the DL6000 mother board. The most recent version of Device Installer is *Device Installer 4.1*.

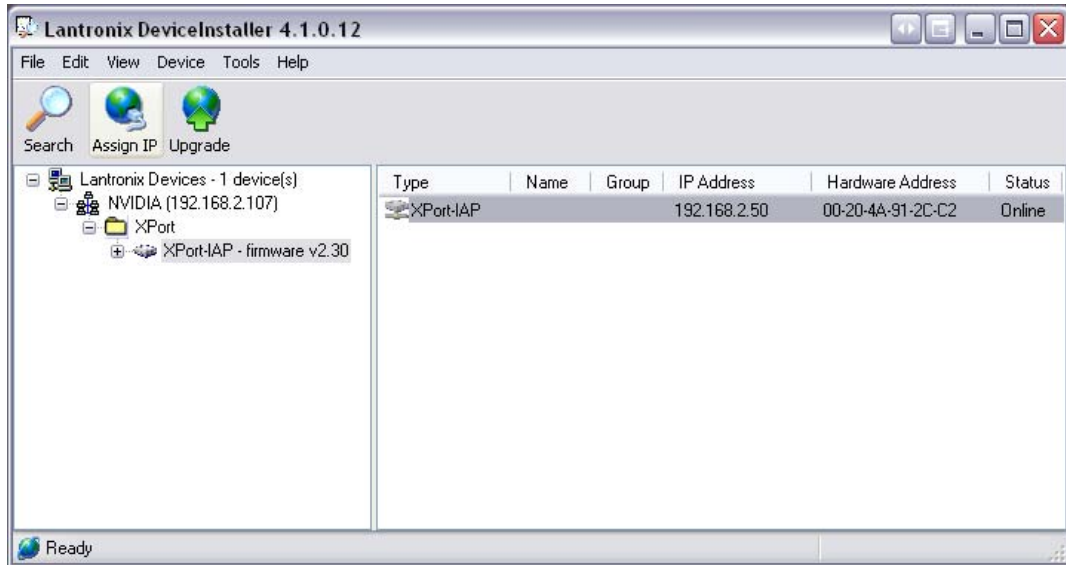
### 5.1.1 IP Address

To assign an IP address to the DL6000, open the Device Installer Software. You will see a screen as shown below.



The following steps are used to assign an IP address to the DL6000.

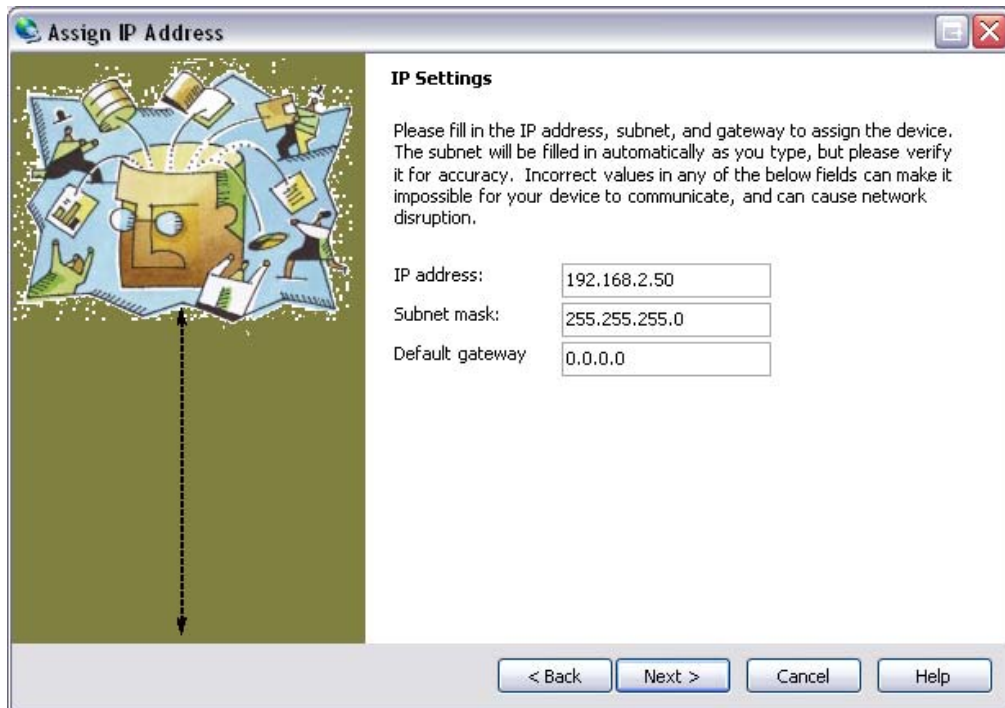
1. Click on the Search button to have the Device Installer find the DL6000. If the Device Installer finds the DL6000, the device should appear. If the device cannot be found then follow the instructions at the end of the *IP Address* section.



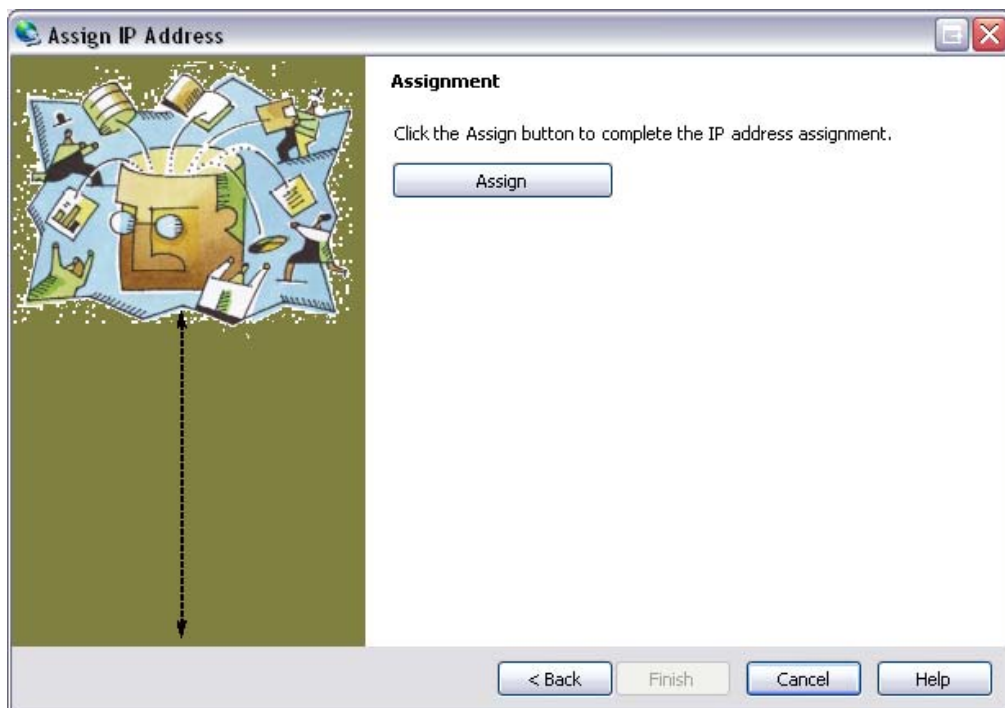
2. Highlight the device and click on the Assign IP button. Choose the “Assign a specific IP address” option and click Next. The following window will appear.



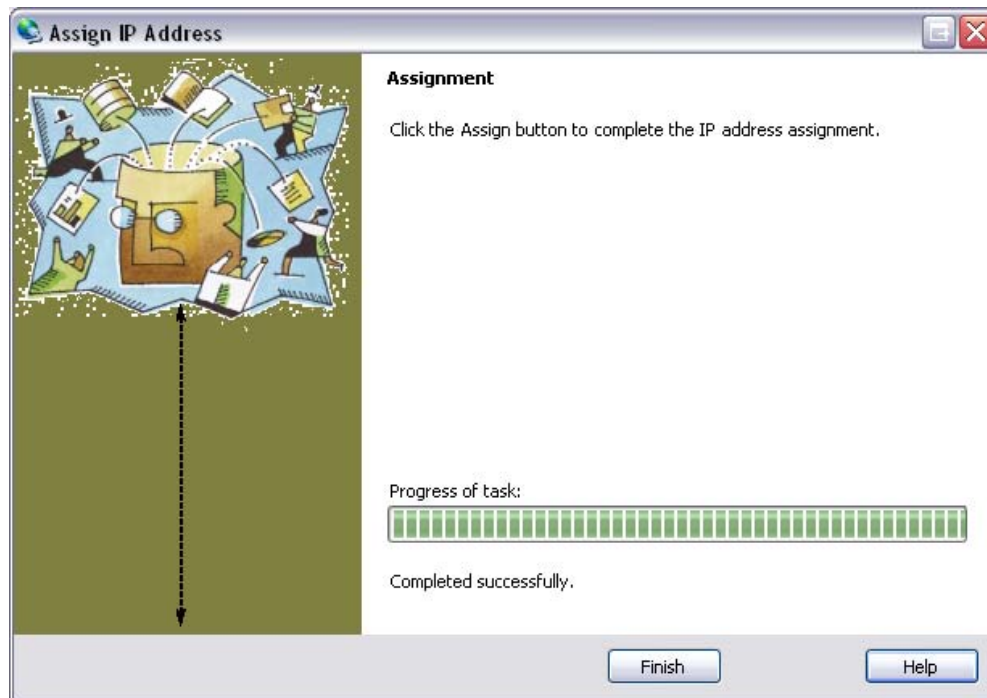
3. Enter the desired IP address, subnet mask, and default gateway (if required) and click Next.



4. To assign the chosen IP address to the DL6000, click the Assign button.



5. When the IP address is assigned, a message stating that the IP address was successfully assigned should appear. Click the Finish button to close the screen and go back to the main menu.



#### 5.1.1.1 Device Not Found

If for some reason the Device Installer cannot find the DL6000 on the Ethernet network, follow the steps below.

1. Click the Assign IP button and the following screen will appear.



2. Enter MAC address of the DL6000 and click Next. The MAC Address can be found on the bottom of the DL6000. The Device Installer should now find the device. Now follow the steps at the beginning of the *IP Address* section to assign an IP address. If for some reason the device still cannot be found, see section [9.1 Device Installer Cannot Find the DL6000](#).

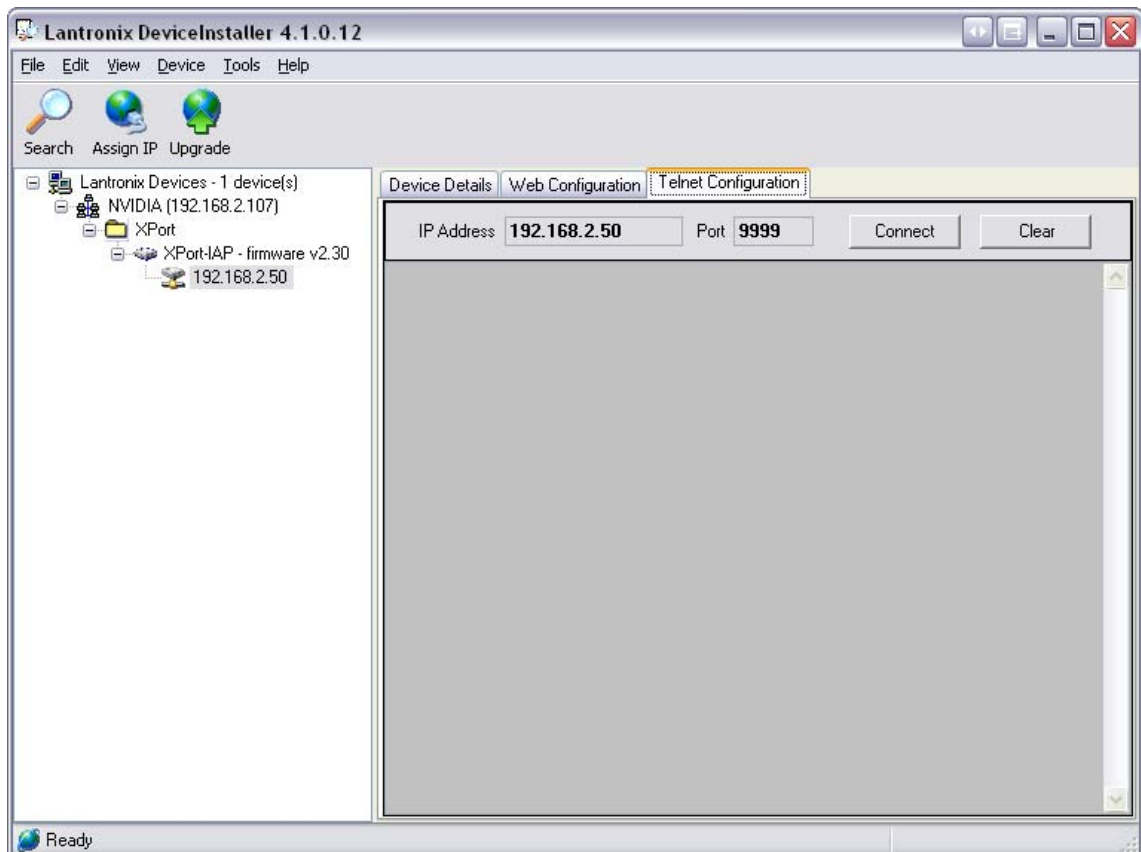
### 5.1.2 Telnet

After the IP address of the DL6000 is assigned, the internal communication parameters that the Lantronix XPORT uses to communicate with the DL6000 motherboard must be configured.

To start a telnet session, there are two ways that can be used. The first method uses the Device Installer while the second uses a DOS command prompt.

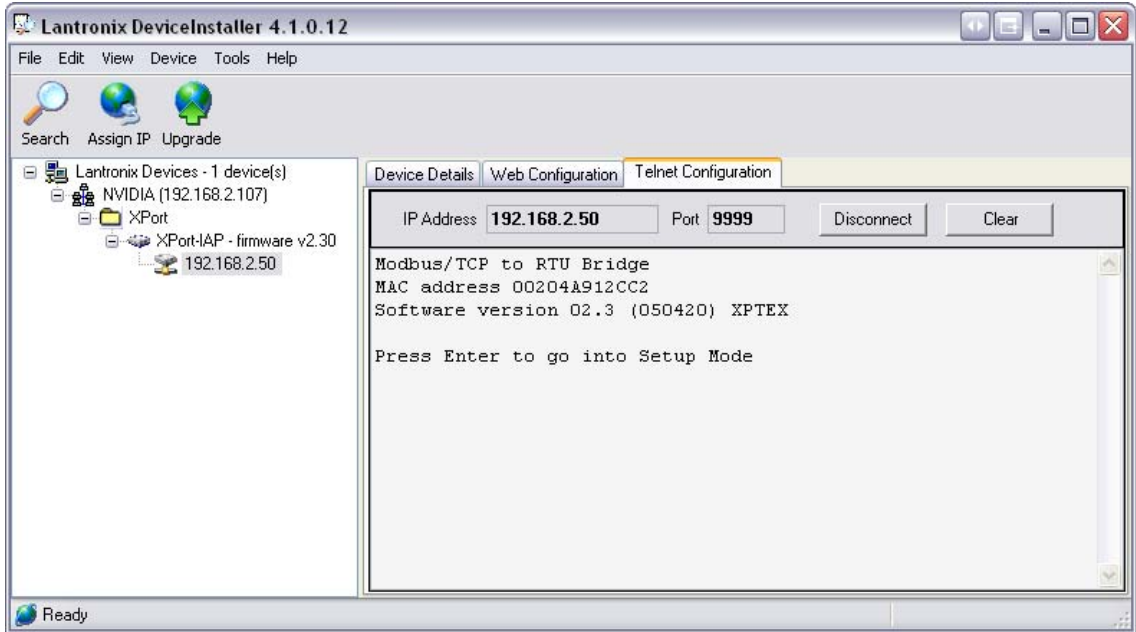
#### Telnet using Device Installer

Open Device Installer and click search to find the DL6000. Once the Device Installer has found the DL6000, double click on the device to bring up more options. Select the Telnet Configuration tab as shown below.

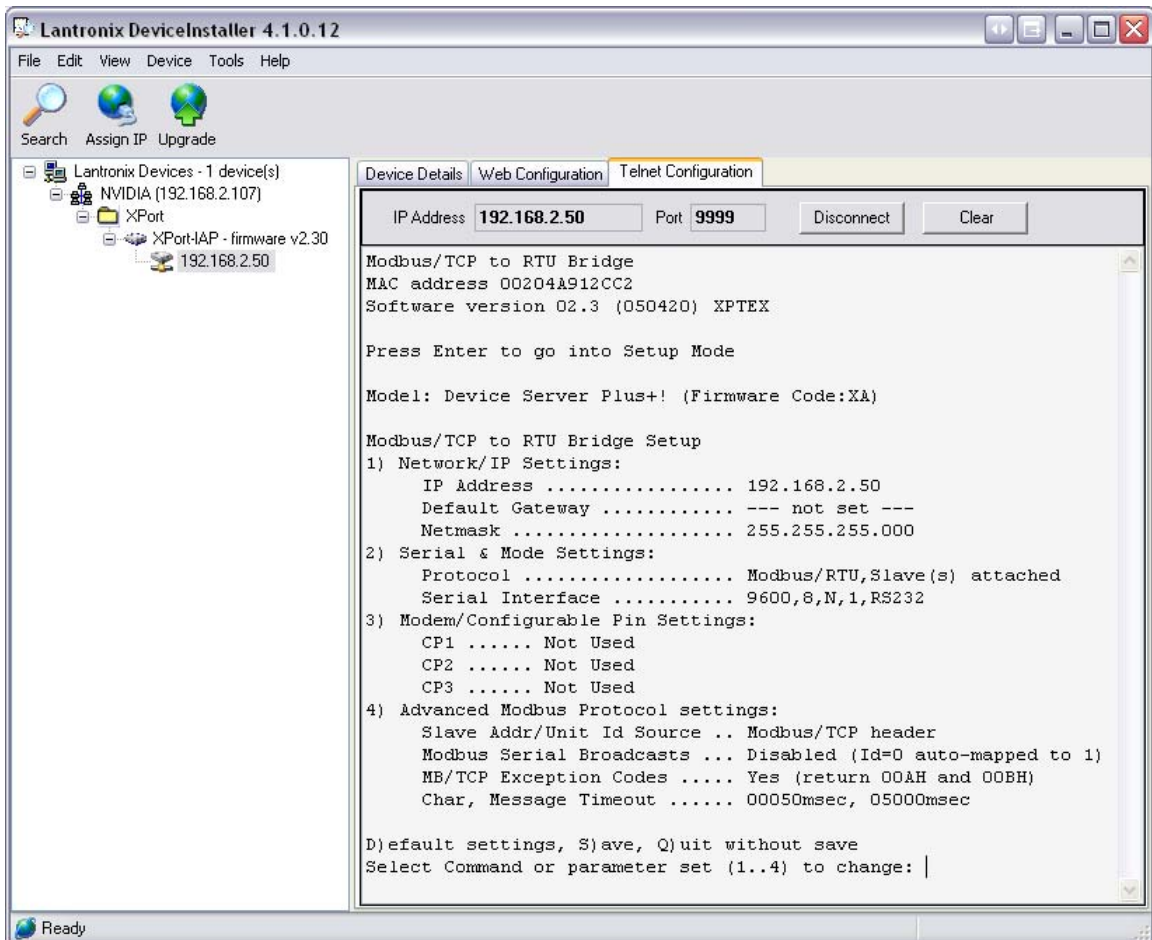




Press the *Connect* button and when prompted, press the *Enter* key with in 5 seconds to bring up the main menu.



After pressing *Enter*, you will get the following menu.



### Telnet using the DOS Command Prompt

Open a DOS command prompt window to begin. At the prompt, type *telnet* then a space, the IP address of the unit then a space, and then the port 9999. After this is entered, press Enter to begin a telnet session. The following is an example of how to begin a telnet session from the command prompt.

```
C:\>telnet 192.168.2.2 9999
```

Below are the Telnet settings for the different DL6000 models. After starting a telnet session, you must press the **Enter** key with in 5 seconds to bring up the main menu.

#### 5.1.3 Modbus TCP Telnet Settings

The following menu will appear after starting a telnet session.

```
Modbus/TCP to RTU Bridge Setup
1) Network/IP Settings:
   IP Address ..... 192.168.2.50
   Default Gateway ..... --- not set ---
   Netmask ..... 255.255.255.000
2) Serial & Mode Settings:
   Protocol ..... Modbus/RTU,Slave(s) attached
   Serial Interface ..... 9600,8,N,1,RS232,DB25
3) Modem Control Settings:
   DCD Output ..... Fixed High/Active
   CTS Output ..... Fixed High/Active
4) Advanced Modbus Protocol settings:
   Slave Addr/Unit Id Source .. Modbus/TCP header
   Modbus Serial Broadcasts ... Disabled (Id=0 auto-mapped to 1)
   MB/TCP Exception Codes ..... Yes (return 00AH and 00BH)
   Char, Message Timeout ..... 00050msec, 05000msec

D)efault settings, S)ave, Q)uit without save
Select Command or parameter set (1..4) to change:
```

The telnet setup is slightly different depending on whether the DL6000 is to be configured as a Modbus *Slave* or a Modbus *Master*. Follow the steps below for the configuration you wish to use.

##### 5.1.3.1 Modbus Slave Settings

To set the proper Telnet settings, follow the steps below:

1. Press D to restore Factory Defaults.
2. Press 2 to configure the *Serial and Mode Settings*. Input the values so that they match what is shown below. The values shown in the parentheses are the current settings. To keep the current settings, press Enter. The only value that needs to be changed is the baud rate.

```
Attached Device (1=Slave 2=Master) (1)
Serial Protocol (1=Modbus/RTU 2=Modbus/ASCII) (1)
Interface Type (1=RS232 2=RS422/RS485+4-wire 3=RS485+2-wire) (1)
Enter serial parameters (9600,8,N,1) 115200,8,n,1
```

The main menu should now show “Modbus/RTU Slave(s) attached” for the *Protocol* and “115200, 8, N, 1, RS232, DB25” for the *Serial Interface* under *Serial and Mode Settings*. **If your network is DH485 then your baud rate should be 19200 instead of 115200.**

3. Press S to save the new settings and end the telnet session.
4. Press the reset button on the DL6000 to put it online.

### 5.1.3.1 Modbus Master Settings

To set the proper Telnet settings, follow the steps below:

1. Press D to restore Factory Defaults.
2. Press 2 to configure the *Serial and Mode Settings*. Input the values so that they match what is shown below. The values shown in the parentheses are the current settings. To keep the current settings, press Enter.

```
Attached Device (1=Slave 2=Master) (1) 2
Serial Protocol (1=Modbus/RTU 2=Modbus/ASCII) (1)
Interface Type (1=RS232 2=RS422/RS485+4-wire 3=RS485+2-wire) (1)
Enter serial parameters (9600,8,N,1) 115200,8,n,1
```

The main menu should now show “Modbus/RTU Master attached” for the *Protocol* and “115200, 8, N, 1, RS232, DB25” for the *Serial Interface* under *Serial and Mode Settings*. **If your network is DH485 then your baud rate should be 19200 instead of 115200.**

After setting the *Serial and Mode Settings* and returning to the main menu you will see a 5<sup>th</sup> option, *Unit ID -> IP Address Table*, as shown below.

```
Modbus/TCP to RTU Bridge Setup
1) Network/IP Settings:
   IP Address ..... 192.168.2.50
   Default Gateway ..... --- not set ---
   Netmask ..... 255.255.255.000
2) Serial & Mode Settings:
   Protocol ..... Modbus/RTU,Master attached
   Serial Interface ..... 115200,8,N,1,RS232
3) Modem/Configurable Pin Settings:
   CP1 ..... Not Used
   CP2 ..... Not Used
   CP3 ..... Not Used
4) Advanced Modbus Protocol settings:
   MB/TCP Exception Codes ..... Yes (return 00AH and 00BH)
   Char, Message Timeout ..... 00050msec, 05000msec
5) Unit ID -> IP Address Table:
   Close Idle Sockets ..... 10sec
   Redundant Entry Retry ..... Feature Disabled
```

3. Press 5 to configure the Unit ID to IP Address mapping table. Here you will also configure the time to wait before closing an idle socket.

4. After pressing 5, choose the timeout period for idle TCP sockets. The default is 10 seconds.

Close Idle TCP sockets after (3-60 sec, 0=leave open) (10)

5. Leave the *Redundant entry retries* option disabled. This is the default setting.

Redundant entry retries after (15-60 sec, 0=disable feature) (0)

6. The last part is to setup the Unit ID to IP Address mapping table. To add a table entry, press **A**. You will now enter the range of unit ID's to map to an IP address. To map only one Unit ID to an IP Address, use the same Unit ID for both the beginning and ending values. After selecting the Unit ID range, enter the IP Address of the device to send the messages to. When finished, press **E** to exit back to the main menu. **You can enter up to a maximum of 8 separate table entries.**
7. From the main menu, press **S** to save the new settings and end the telnet session.
8. Press the reset button on the DL6000 to put it online.

## 5.3 EQ32 Configuration Software

The EQ32 software is required when configuring a DL6000-MEDH+ or a DL6000-MEDH-485. The EQ32 software is used to setup the address mapping between Modbus and Allan-Bradley networks.

### 5.3.1 Configuring Modbus Parameters

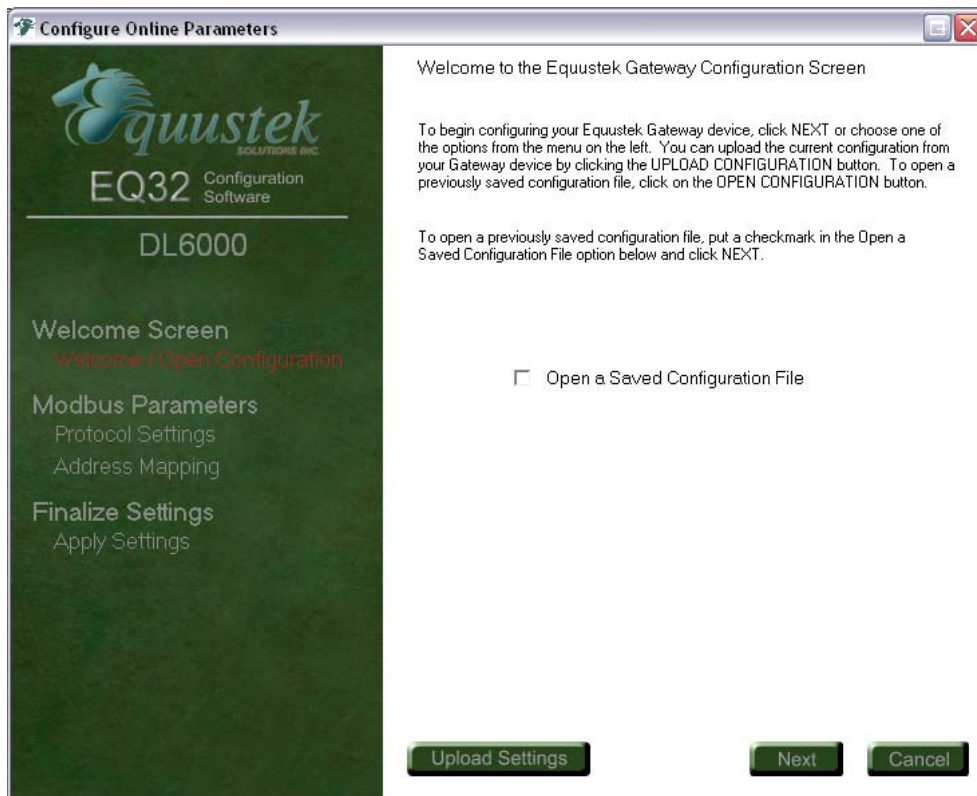
To configure your DL6000, open the EQ32 Configuration Software and follow the steps shown below. The following welcome screen will appear when the software is opened.



1. From the Welcome screen, select the DL6000 model. The Main Menu should appear as shown below.



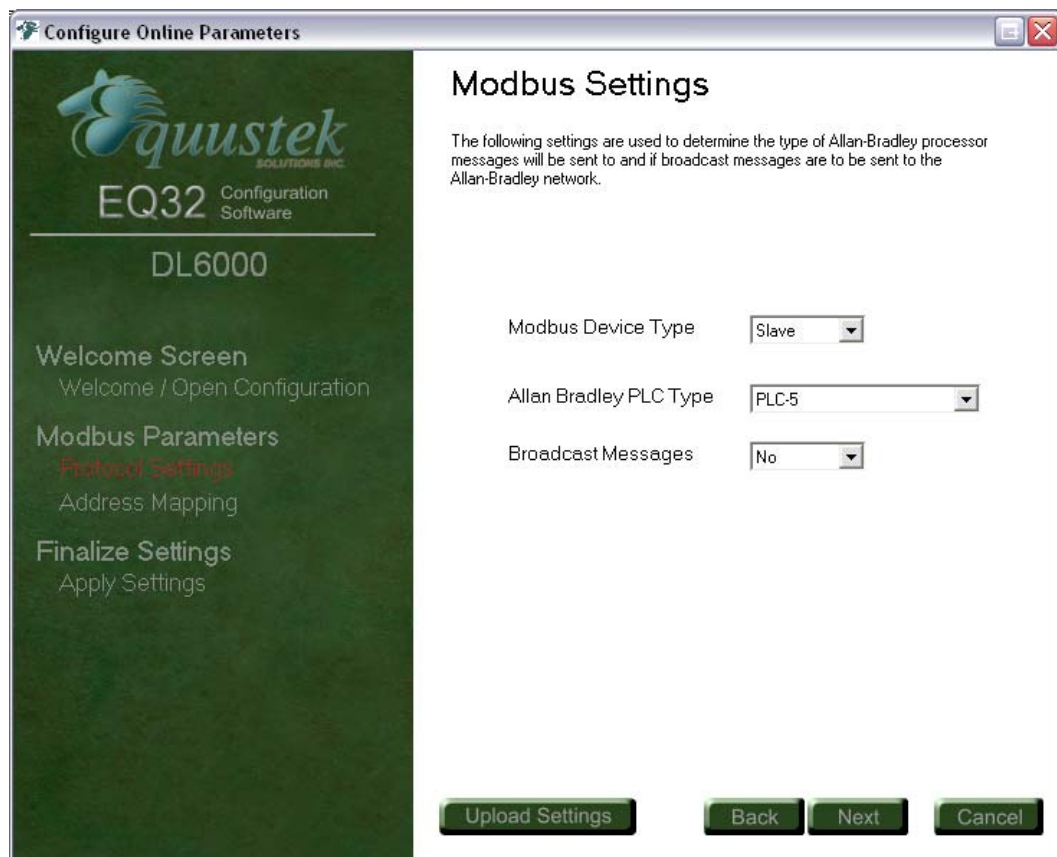
2. Select the COM port that you have connected to the DL6000 and Click on the *Configure* button. The Configuration Menu for the DL6000 will appear as shown below. Click *Next* to begin configuring you DL6000.



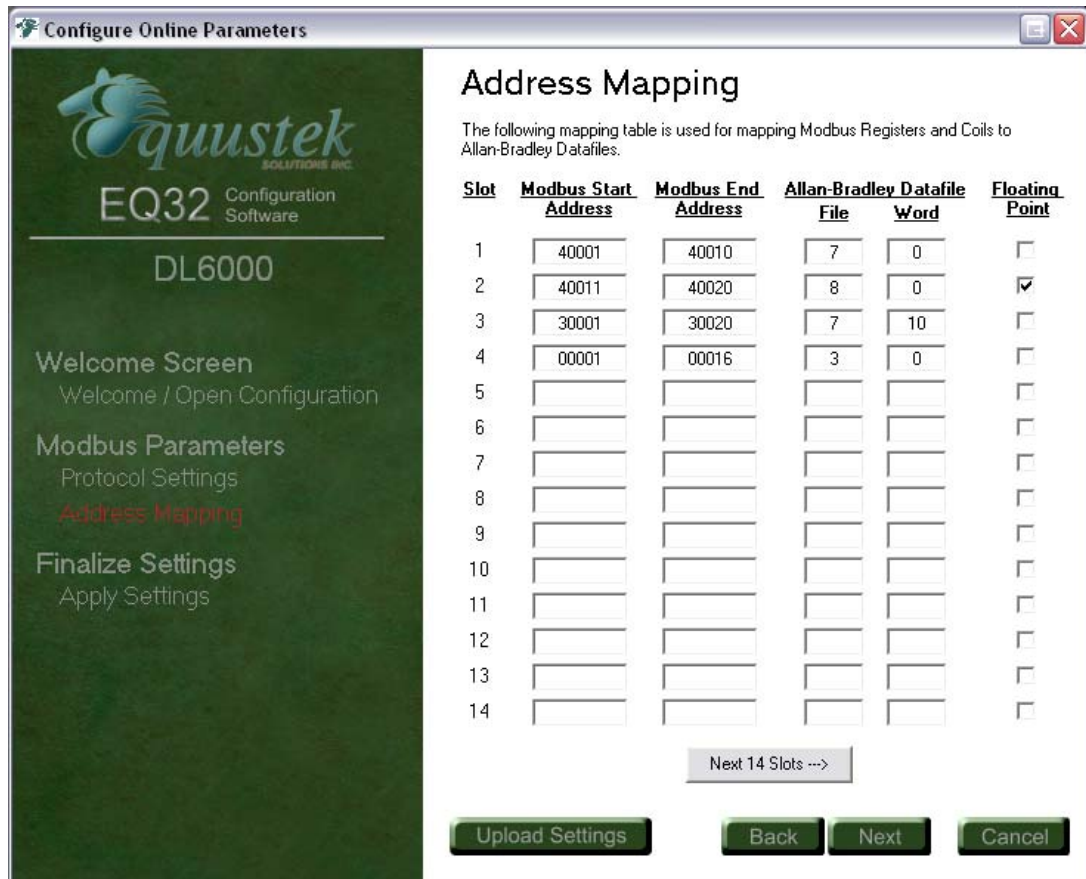
3. The configuration for the Modbus *Slave* is different than the Modbus *Master*. Follow the instructions for the mode that the DL6000 will be configured for.

### 5.3.1.1 Modbus Slave Parameters

4. For the *Modbus Device Type*, select *Slave* to bring up the configurable slave parameters.



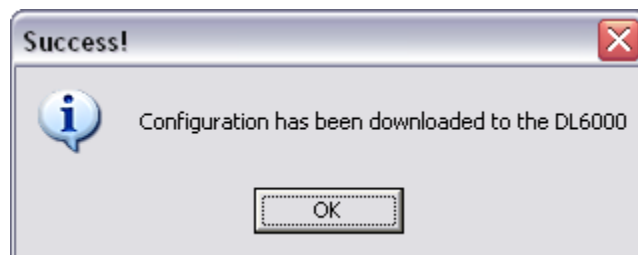
5. Select the Allan-Bradley PLC type. There are 3 choices available, PLC-5, PLC-3, and SLC/Micrologix/ControlLogix. Unless you need to communicate to a PLC-3, we suggest that you use the SLC/Micrologix/ControlLogix option as the PLC type.
6. Select whether broadcast messages are to be forwarded or not. The default option is to *not* forward broadcast messages. If broadcast messages are to be forwarded, you will then be prompted to select the address range of devices on the DH+ that will have the broadcast messages forwarded to them.
7. Click the *Next* button to setup the Modbus to Allan-Bradley mapping table. A new window will appear as shown below.



8. Fill in the table with the Modbus registers/coils that are to be mapped to AB data files. For more information about setting up the translation table, see the DL3500 application note “DL3500-DH+ Modbus Slave” which can be found on the CD that came with the DL6000 or downloaded from [www.equustek.com](http://www.equustek.com). The setup of the translation table is the same for both the DL3500 and the DL6000, to help with mapping you can use Equustek program called (Allan-Bradley to Modbus Mapping Program), it can be found on the CD and on our website as well.
  
9. After the Modbus parameters are set, click the *Next* to finalize and apply the configuration. On the last page you will have the option to download the configuration, save the configuration to file, or both.



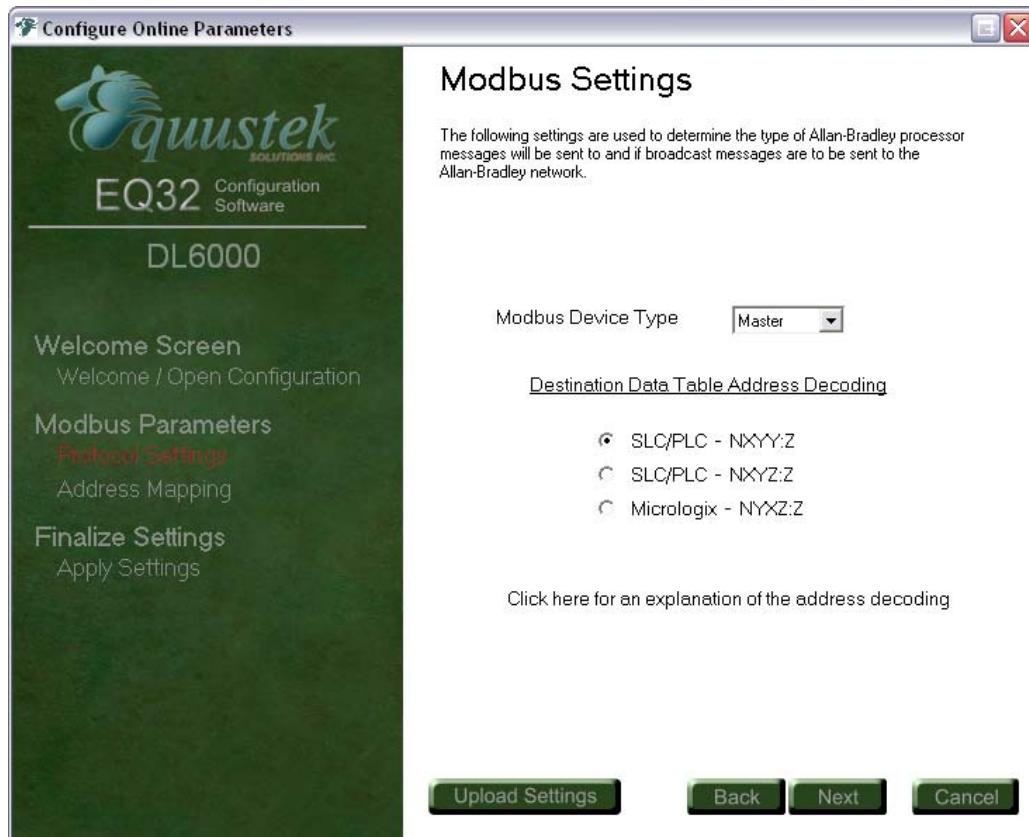
10. After selecting one of the three options, click *Finish* to perform the selected action. If you have chosen to download the configuration, make sure you received message shown below before pressing reset to put the DL6000 online.



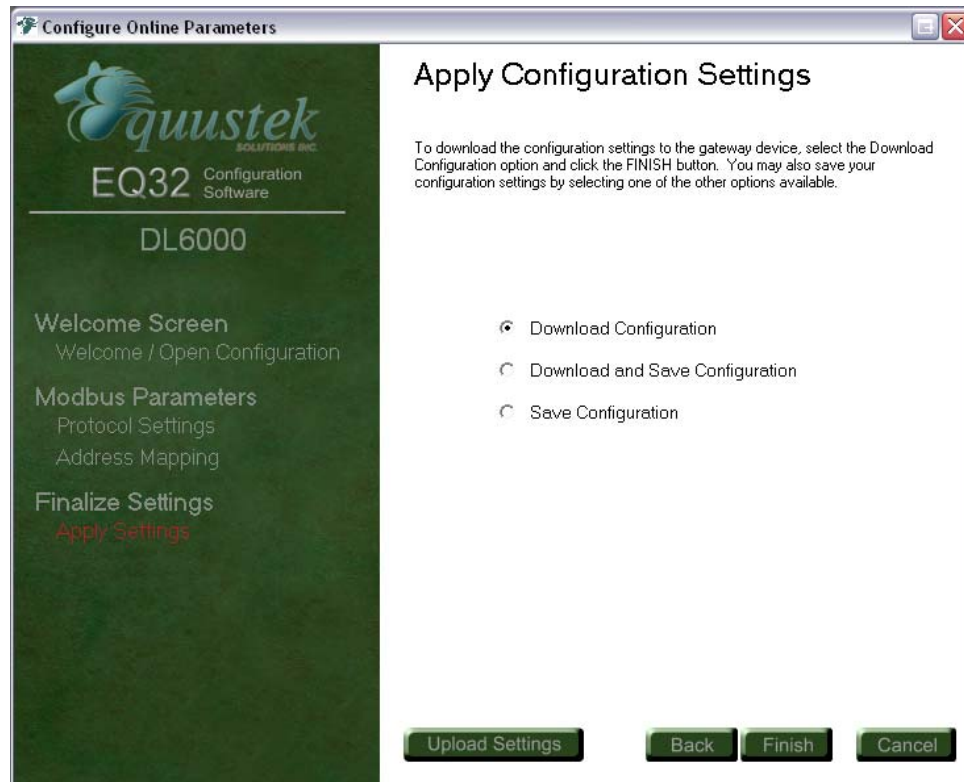


### 5.3.1.2 Modbus Master Parameters

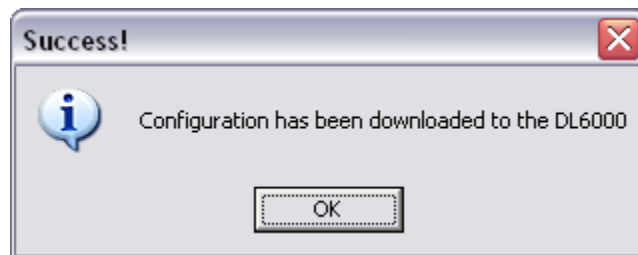
11. For the *Modbus Device Type*, select *Master* to bring up the configurable master parameters.



12. Select one of the three *Destination Data Table Address Decoding* methods to use for determining how the data table address for the target device will be decoded. For more information about the decoding methods, click on the link below the three options. For a more detailed explanation with examples, see the DL3500 application note "*DL3500-DH+ Modbus Master*" which can be found on the CD that came with the DL6000 or downloaded from [www.equustek.com](http://www.equustek.com). The decoding method used by the DL6000 is the same as the DL3500.
13. After the Modbus parameters are set, click the *Next* to finalize and apply the configuration. On the last page you will have the option to download the configuration, save the configuration to file, or both.



14. After selecting one of the three options, click *Finish* to perform the selected action. If you have chosen to download the configuration, make sure you received message shown below before pressing reset to put the DL6000 online.



### 5.3.2 *Configuring Modbus Parameters using the DL Offline Manager*

The DL Offline Manager can also be used to setup the Modbus Slave parameters for the DL6000. There is currently no ability to configure the Modbus Master settings. If you are using the DL6000 as a Modbus Master, you will need to use the method described above.

To use the DL Offline Manager, open the EQ32 Configuration software and choose the DL6000 models. From the Main Menu, select the COM port that is connected to the DL6000 and Click the *DL Offline Manager* button. After this is done, follow the steps

below to configure the DL6000-MEDH+. A new window should appear with the following menu in the text box.

BIOS MANAGER for DL6000-1.00- Jun 16,06  
(c) Equustek Solutions Inc. 2006

MAIN MENU

- 1 - Restore EEPROM
- 2 - WRITE new Firmware
  
- 3 - Memory DUMP
- 4 - OFF-LINE Diagnostics
- 5 - DEBUG Mode
  
- 6 - FIRMWARE Version
- 7 - ONLINE
- 8 - CONFIGURE Model Parameters

MAKE SELECTION (1-8) -

1. Press 8 to configure the Modbus Parameters. The following will appear.

Enter Modbus Translation table parameters for Modicon to AB mapping.  
AT Any time hit <ENTER> To Keep existing parameter value  
Hit <ENTER> To continue, <ESC> to exit

2. Press Enter to continue. You will then be asked to select a PLC type that the DL6000 will be communicating to.

Select A-B PLC TYPE: SLC/Micrologix  
Enter 0 for PLC5, 1 for PLC3 or 2 for SLC or Micrologix or <ENTER> to keep:

3. After selecting the PLC type you will then be asked to enter the values for the translation table. Leading zeros need to be entered when using the DL Offline Manager to configure the DL6000. After entering the translation parameters, press Enter to proceed to the end of the table.

Program Modbus/A-B Translation Parameters  
Hit <ENTER> to keep existing value or Type in New Value  
Need to enter Leading Zeros. IE. file 7 = 007  
Hit <ENTER> to Proceed any other key to exit now.

REC No	Modbus Start Add.	Modbus End Add.	A-B Start Address	Floating Point
	xxxxx	xxxxx	(File:Word) xxx:xxx	Yes/No
00	40001	40010	007:000	N
01	30001	30010	008:000	N
02	00001	00016	003:000	N
03	00000	00000	000:000	N
04	00000	00000	000:000	N
05	00000	00000	000:000	N
06	00000	00000	000:000	N
07	00000	00000	000:000	N

08	00000	00000	000:000	N
09	00000	00000	000:000	N
10	00000	00000	000:000	N
11	00000	00000	000:000	N
12	00000	00000	000:000	N
13	00000	00000	000:000	N
14	00000	00000	000:000	N
15	00000	00000	000:000	N
16	00000	00000	000:000	N
17	00000	00000	000:000	N
18	00000	00000	000:000	N
19	00000	00000	000:000	N
20	00000	00000	000:000	N
21	00000	00000	000:000	N
22	00000	00000	000:000	N
23	00000	00000	000:000	N
24	00000	00000	000:000	N
25	00000	00000	000:000	N
26	00000	00000	000:000	N
27	00000	00000	000:000	N
28	00000	00000	000:000	N
29	00000	00000	000:000	N
30	00000	00000	000:000	N
31	00000	00000	000:000	N
32	00000	00000	000:000	N
33	00000	00000	000:000	N
34	00000	00000	000:000	N
35	00000	00000	000:000	N
36	00000	00000	000:000	N
37	00000	00000	000:000	N
38	00000	00000	000:000	N
39	00000	00000	000:000	N

4. After all the parameters are entered you will be prompted to save the configuration. Press Y to accept the current parameters, or N to discard the current parameters.
  
5. After this is done, close the EQ32 Configuration software and press Reset on the DL6000 to put it online.

## 5.4 Allan-Bradley Network Configuration

The DH+ or DH-485 requires that every station on the network has its own node address. This section describes the configuration of the DL6000 for the desired A-B network.

### 5.4.1 DH+ Node Address

The DH+ network allows up to 64 nodes on a network with addresses ranging from 0 to 63 decimal. The DL6000 DH+ node address is determined from the last octet of the IP address assigned to the unit. The following table shows how the DH+ node address is determined from the last octet of the IP address.

Node Address	Last Octet of IP address
0-63	0-63
0-63	64-127
0-63	128-191
0-63	192-255

If the last octet of the IP address is larger than 63, subtract 64 from the value until it falls within the range of 0 to 63. This will be the DH+ node address in decimal. Since DH+ uses octal notation, a conversion decimal to octal will be needed.

Ex. DL6000 with IP Address 192.168.2.170

#### Solution

Take the last octet and subtract and keep subtracting 64 until the value falls within the range of 0 to 63.

$$170 - 64 - 64 = 42$$

The DH+ node address is 42 decimal or 52 octal.

### 5.4.2 DH+ Baud Rate

The DH+ Baud rate on the DL6000 is auto detecting; whatever the existing network is set to the DL6000 will use that baud rate. Valid rates of 57.6K, 115.2K and 230.4K Baud are supported.

On Hardware Reset the A-B Network (CHA) LED will flash GREEN and RED until a valid DH+ network is detected. This is the AUTO BAUD Rate detection Mode and the DL6000 will stay in this mode until a valid network is connected to the A-B Network Connector. The A-B Network LED will then switch to on solid once the DL6000 is on the DH+ network as a valid node address.

### 5.4.3 DH-485 Node Address

The DH-485 network allows up to 32 nodes on a network with addresses ranging from 0 to 31 decimal. The DL6000 DH-485 node address is determined from the last octet of the IP address assigned to the unit. The following table shows how the DH-485 node address is determined from the last octet of the IP address.

Node Address	Last Octet of IP address
0-31	0-31
0-31	32-63
0-31	64-95
0-31	96-127
0-31	128-159
0-31	160-191
0-31	192-223
0-31	224-255

If the last octet of the IP address is larger than 31, subtract 32 from the value until it falls within the range of 0 to 31. This will be the DH-485 node address in decimal.

Ex. DL6000 with IP Address 192.168.2.170

#### Solution

Take the last octet and subtract and keep subtracting 32 until the value falls within the range of 0 to 31.

$$170 - 32 - 32 - 32 - 32 - 32 = 10$$

The DH-485 node address is 10 decimal.

### 5.4.4 DH-485 Baud Rate

The DH-485 Baud rate will set itself to 19.2K if the Serial Interface was set to 19200 or Higher. Otherwise it will use 9600 for a 9600 baud and 4800 for 4800 baud.

Serial Interface Speed	DH-485 Speed
19200-115200 Baud	19.2K Baud
9600 Baud	9600 Baud
4800 Baud	4800 Baud

## 6 Firmware Upgrade

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There may be times when the firmware in the DL6000 needs to be upgraded. To upgrade the firmware in the DL6000, follow the procedure outlined below.

### 6.1 EQ32 Configuration Software

The EQ32 Configuration Software is used to upgrade the firmware on the DL6000 motherboard. This firmware is responsible for the DH+ and DH-485 networks.

In order to upgrade the DL6000 firmware, follow the procedure below.

1. Open the EQ32 Configuration and select *DL6000 Models*. You will see the following screen.



2. Select the COM port attached to the DL6000 and click the *DL Offline Manager* button. You will be prompted to press the configure button on the DL6000. The following menu will be shown in a new window.

MAIN MENU

- 1 - Restore EEPROM
- 2 - WRITE new Firmware
  
- 3 - Memory DUMP
- 4 - OFF-LINE Diagnostics
- 5 - DEBUG Mode
  
- 6 - FIRMWARE Version
- 7 - ONLINE
- 8 - CONFIGURE Model Parameters

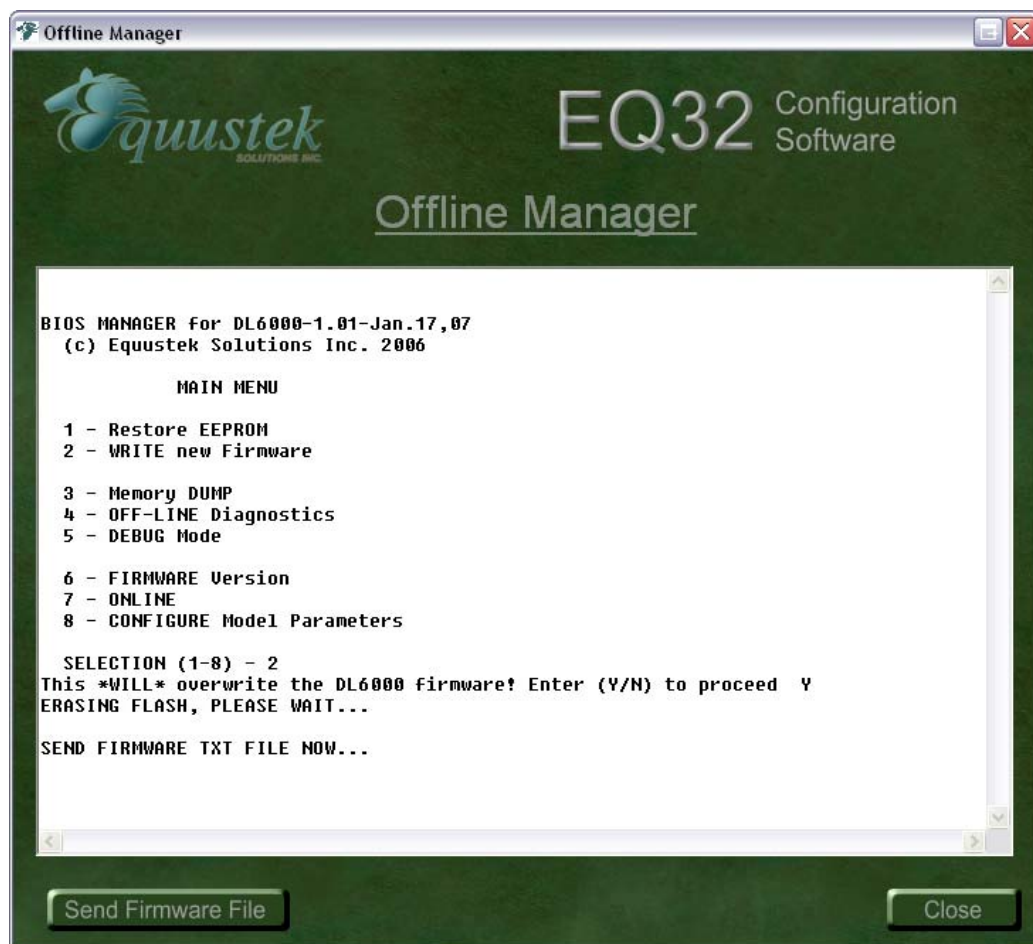
MAKE SELECTION (1-8) -

3. Press 2 to upgrade the firmware. A message will appear notifying that this will overwrite the existing system code. Press Y to continue.

This \*WILL\* overwrite DATALINK system code enter (Y/N) to proceed Y  
ERASING FLASH, PLEASE WAIT...

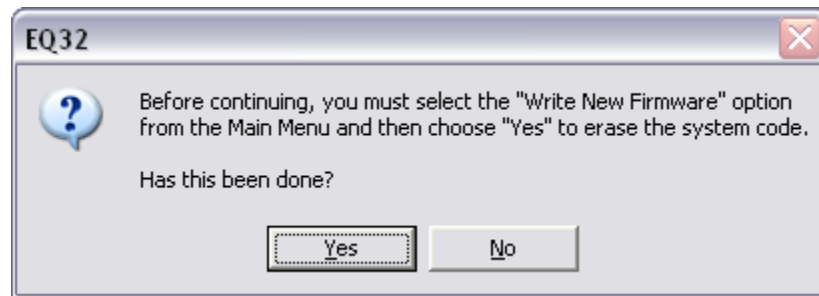
SEND FIRMWARE TEXT FILE NOW...

4. After the message *Send firmware text file now...* appears, press the button *Select Flash System File* button located in the bottom left corner of the window.





5. When the *Send Flash System File* button is pressed, a message box will appear asking if the *WRITE new Firmware* option was selected. Click *Yes* to continue.



6. Select the desired firmware file and the DL6000 will begin upgrading the firmware. Upon a successful install, the following text will appear.

\*A-OK\* BURN COMPLETE!

7. The EQ32 Configuration Software can now be closed. Press the Reset button on the DL6000 to put it online.

## 7 Wiring Diagrams

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This section contains the information required for connecting your DL6000 to Allan Bradley's DH+ and DH-485 networks. It also contains wiring diagrams for building an RS-232 null modem cable which is used to connect serially to the DL6000.

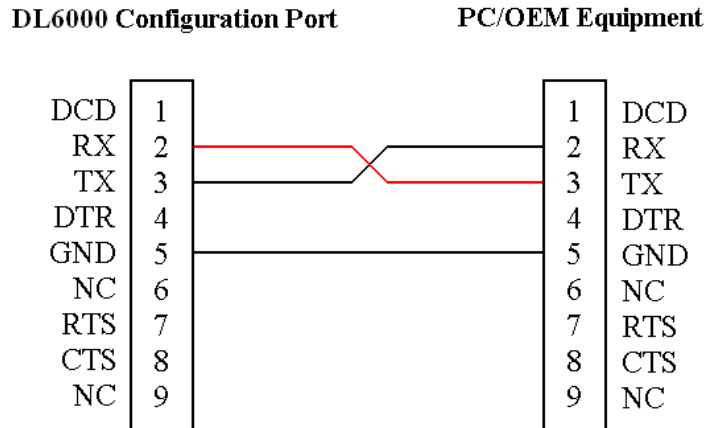
### 7.1 DL6000 Pinout Diagram

Below is an image of the DL6000 that shows the numbering of the DH+/DH-485 connector. Pin 1 is located closest to the power connector.



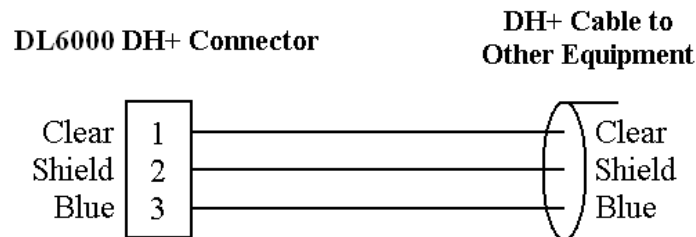
## 7.2 RS-232 Null Modem Cable

The RS-232 null modem cable is used to serially connect to the DL6000 in order to use the *DL Offline Manager* or configure the device using the EQ32 Configuration Software.



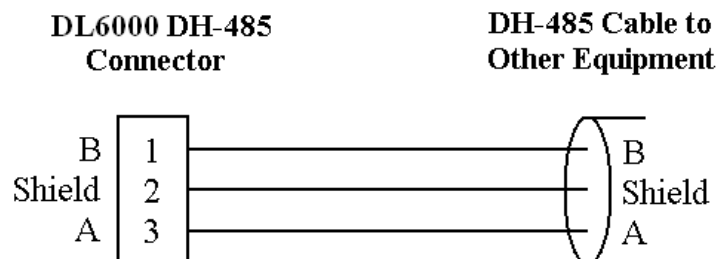
## 7.3 DH+ Cable

Below is a diagram of the DL6000 DH+ connector. Pin 1 is the pin closest to the power connector.



## 7.4 DH-485 Cable

Below is a diagram of the DL6000 DH-485 connector. Pin 1 is the pin closest to the power connector. *Note that Shield cannot be replaced by Common.*



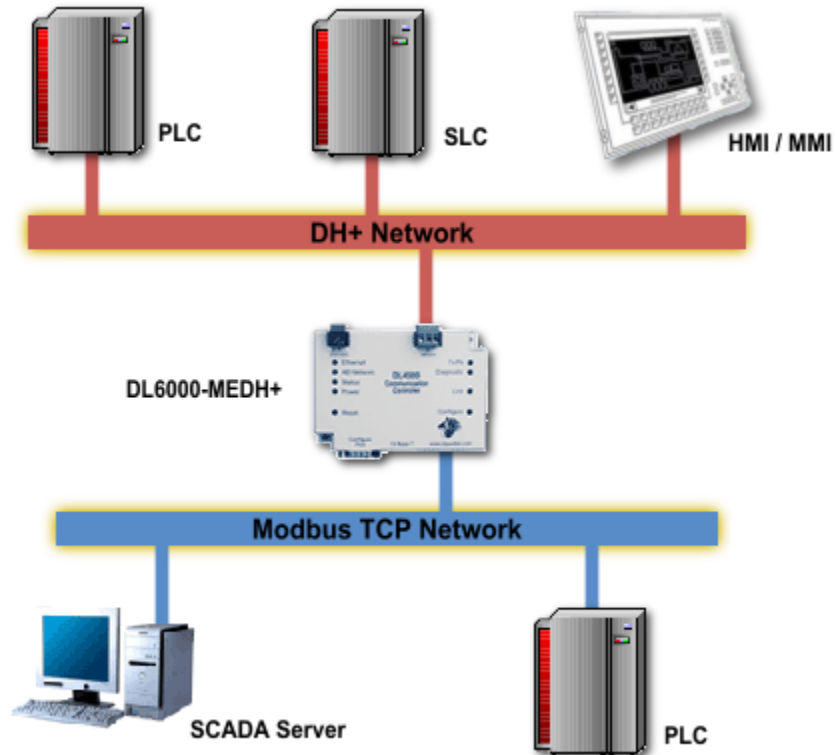
## 8 DL6000 Typical Applications

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The DL6000 is designed to be used in applications using Ethernet to communicate with devices on a DH+ or DH-485 network. Some of the typical applications that use the DL6000 are shown in this section.

### 8.1 DL6000-MEDH+

The following example shows a SCADA server using a DL6000 to acquire data from PLC's and devices on the DH+ network.



## 9 Frequently Encountered Problems

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This section outlines some of the most frequently encountered problems when trying to configure the DL6000. If the problem you are having is not located in this section, please contact [technical support](#).

### 9.1 Device Installer cannot find the DL6000

If for some reason the Device Installer software cannot find the DL6000 on the Ethernet network, it can possibly be because one of the following problems:

1. Another device on the Ethernet network has the same IP address that is currently assigned to the DL6000.
2. The DL6000 may have an IP address in which the network ID portion of the address does not match the network ID that is being used by the Ethernet network.

In order to assign an IP address to the DL6000, the address resolution protocol (ARP) will be used. Using the ARP command will only temporarily change the IP address in the device. To configure the unit so that it keeps the IP address, you must telnet to the unit and change its IP address from the configuration menu. In order for the ARP command to work in Windows 95, the ARP table on the PC must have at least one IP address defined other than its own. To use the ARP command to assign a temporary IP address, follow the steps below.

1. Open an MS DOS command prompt window.
2. At the command prompt, type the following to view the ARP table.

```
arp -a
```

To add another value to the ARP table, ping another device on the current network.

3. Use the following ARP command to add the DL6000 to the ARP table.

```
arp -s xxx.xxx.xxx.xxx aa-bb-cc-dd-ee-ff
```

The first entry after the arp -s is the IP address that you wish to temporarily assign to the DL6000 (denoted by xxx.xxx.xxx.xxx). The next entry is the MAC address of the DL6000 which can be located on the bottom of the unit (denoted by aa-bb-cc-dd-ee-ff).

4. Open a telnet session to the DL6000 using port 1. This is done by typing the following at the command prompt.

```
telnet xxx.xxx.xxx.xxx 1
```

The connection will fail when this is done, but will temporarily change the IP address of the DL6000 to xxx.xxx.xxx.xxx.

5. Finally open another telnet session but this time to port 9999 as follows.

```
telnet xxx.xxx.xxx.xxx 9999
```

6. Set the IP address of the DL6000 by changing the *Network* or *Server* settings from the main menu of the telnet session. The IP address assigned here will become the permanent IP address of the DL6000.

## **9.2 Cannot communicate to DH+ node 0 using the DL6000-MEDH+**

Any Modbus client that is trying to read or write data to a PLC or device on the DH+ or DH-485 at node 0 will not work. The reason for this is because the Modbus protocol uses slave ID 0 as the broadcast address. All Modbus slaves recognize the broadcast address but do not send a response when a broadcast message has been received.

# Appendix A: TCP/IP Tutorial

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This section is design to guide you to gain a brief understanding to TCP/IP addressing mechanism and the meaning behind the DL6000 IP configurations. TCP/IP suite is the most commonly used Ethernet communication protocol in both industrial and commercial networking applications. The protocol implements a two-level addressing mechanism in order to assign a computer or other Ethernet device (1) its Node Address (Host ID), and (2) its Network Address (Network ID). With the node address, the Ethernet device can identify itself on a network; with the network address, the Ethernet device can identify the network in which it belongs to, and facilitate communication among computers across different networks.

## Analogy

The node address is analogous to the suite number in an apartment, and the network address is equivalent to the residential number of the entire apartment building. When my friends want to visit me, I must give them both my suite number and the residential number of the apartment in which I live in, else they wouldn't be able to find my place.

## A.1 IP Address

TCP/IP uses a four-segmented number set to store the node address and the network address; the number in every segment varies from 0 to 255, and segments are separated by decimal points. This segmented number set is called the IP Address, and has the appearance of XXX.XXX.XXX.XXX.

Ex. Here are some valid IP addresses:

192.168.2.1	(reserved for Local Area Network applications)
68.142.197.85	(www.yahoo.com)
64.233.187.99	(www.google.ca)
127.0.0.1	(Networking Interface Card Loopback IP)

## A.2 Subnet Mask

At this point, one may start to wonder how to identify the node address and the network address from the four number segments. Sadly, with only the IP address, no one can meaningfully separate the node address from the network address, not even computers. What is needed in addition to IP address is the Address Delimiter – The Subnet Mask. A Subnet Mask has the same format as the IP address (XXX.XXX.XXX.XXX); however, the segments are usually filled with either 255 or 0.

Ex. Here are some valid subnet masks:

255.255.255.0	(Class C Subnet Mask)
255.255.0.0	(Class B Subnet Mask)

## A.3 IP Address and Subnet Mask Couple

When combining IP address with Subnet Masks, the node address can be separated from the network address in this way: (1) the node address is the IP address segment that maps to the Subnet Mask segment(s) that is/are filled with 0; (2) the network address is the IP address segment that maps to the Subnet Mask segment(s) that is/are filled with 255.

Ex. Illustration of IP address / Subnet Mask mapping rule:

IP address	192.168.2.3
Subnet Mask	255.255.255.0

### Solution

This IP address couple gives you:

Node Address	3
Network Address	192.168.2

**Note:** The IP address/Subnet Mask mapping rule introduced above is generally true for most of the TCP/IP networking applications; in some specialized networks, network administrators can enter numbers other than 255 or 0 in the Subnet Mask segments for network customizations. However, this advance TCP/IP application is beyond the scope of this tutorial.



## A.4 Valid IP Addresses

Although the IP address / Subnet Masks couple gives a phenomenally large number of possible combinations of node/network address, only certain combinations are “valid”. Here are some general classifications of valid IP addresses:

### Local Area Network

#### **192.168.x.x**

This set of IP addresses is reserved for addressing in Local Area Network (the network that is not connected directly to the internet, but through routers or gateways).

#### **127.0.0.1**

This IP address points to the Node itself. (Loopback Address)

#### **0.0.0.0**

This IP points to current network.

#### **Node Address of 255**

This IP address points to every nodes on the network. (Broadcast Address)

#### **Node Address of 0**

This IP address points to the entire network with the network address described in the IP address.

### Wide Area Network / Internet

When connected to the internet, network nodes must use the IP Addresses from the following Categories:

#### **Class A IP Address**

IP addresses with the first segment ranging from 1 to 127, and subnet mask 255.0.0.0.

#### **Class B IP Address**

IP addresses with the first segment ranging from 128 to 191, and subnet mask 255.255.0.0.

#### **Class C IP Address**

IP addresses with the first segment ranging from 192 to 223, and subnet mask 255.255.255.0.

### **Class D IP Address (Multicast)**

IP addresses with the first segment ranging from 224 to 239.

### **Class E IP Addresses (Reserved)**

IP addresses from 240 and above in the first segment.

- Note:**
1. These IP address regulations are weakly enforced; users are allowed to violate these rules. In Local Area Network applications, IP rule violation will not cause problems on network connectivity. However, when connected to the internet, users are expected to strictly conform to the IP regulations to ensure valid connectivity. For more in-depth information on IP address regulation, please consult your networking administrator.
  2. Since 1993, the “Classful” IP address regulation has no longer been the only IP rules implemented on the internet. Many inter service providers (ISPs) adopted class-less IP address regulations, in which the IP address / Subnet Mask couple is interpreted differently than in classful IP address. Detail information on class-less IP address regulations is out of the scope of this tutorial.