

Access Multiplexer User's Guide

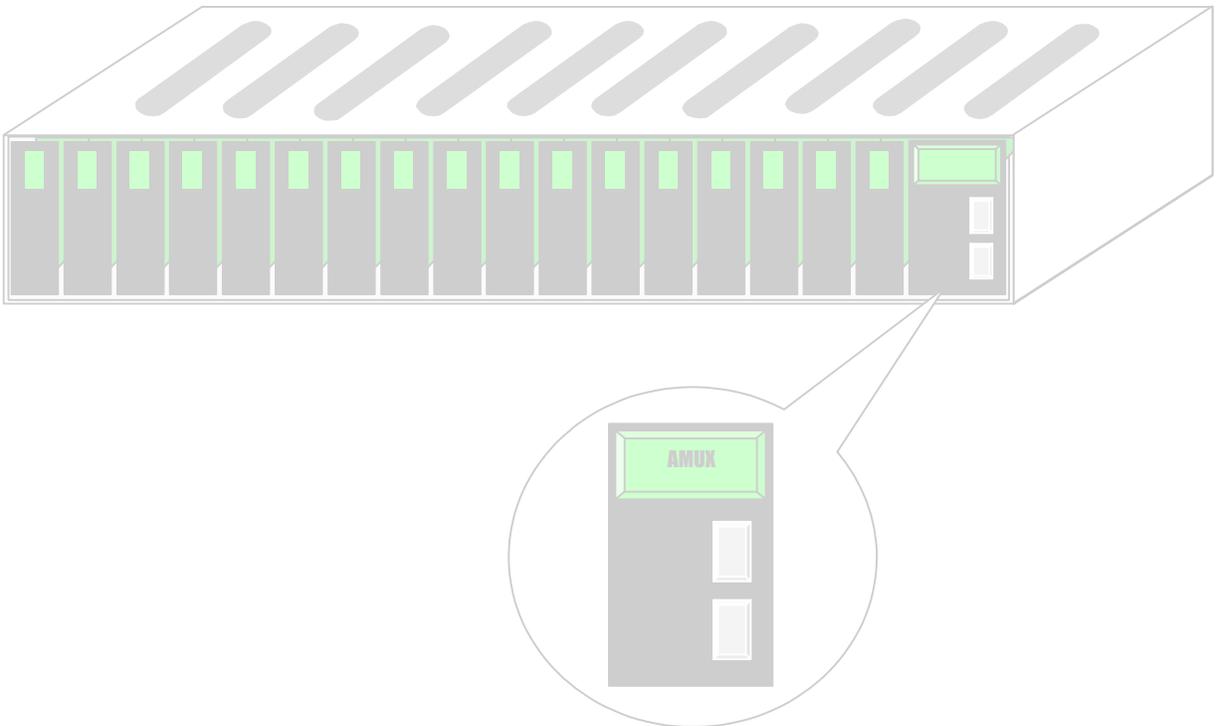


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1. Quick-Start Guide

A Quick-Start guide is included in Appendix A.

2. Introduction

The Access Multiplexer (or AMUX, for short) is a managed Ethernet switch that fits into a Charles Industries 300-mechanics HVDL shelf. The AMUX aggregates Ethernet data from up to 17 HVDL systems within the same shelf into a single 100 Mbps, full-duplex Ethernet connection. In addition, up to 3 AMUXs, from 3 separate card shelves, can be daisy-chained together, aggregating data from up to 51 HVDL systems into a single 100 Mbps Ethernet connection. The AMUX can be managed either – 1) on site, using a computer connected to the AMUX’s front panel serial port, or 2) remotely using the Telnet protocol.

3. What is Network Management?

Network management allows configuring the AMUX’s settings and/or viewing the AMUX’s performance. It also allows configuring and viewing any HVDL systems installed in the same shelf as the AMUX. Network management can be done on-site, that is, where the AMUX is actually installed. Network Management can also be done from a location other than where the AMUX is actually installed provided the remote location has an internet connection.

4. What can I Manage with Network Management?

Network Management of the AMUX allows viewing and/or changing the following:

- ✓ Access Accounts (Add/Delete access accounts and change passwords)
- ✓ The AMUX’s own network settings (IP address, subnet mask, DNS server, gateway address)
- ✓ The AMUX’s self diagnostics
- ✓ Configuration settings of HVDL COTs in the same shelf with the AMUX
- ✓ Monitor performance of HVDL COTs in the same shelf with the AMUX

5. What can I Manage using the Front Panel Pushbuttons?

The AMUX is also equipped with 3 pushbuttons on its front panel, which are used for management purposes. Two of these pushbuttons (Advance and Select) provide limited functionality for managing the AMUX, but allow anyone to view:

- ✓ The AMUX's factory-programmed serial number and MAC (Media Access Control) address.
- ✓ The AMUX's firmware revision level.
- ✓ The AMUX's settable IP address, subnet mask, and gateway address.

In addition, anyone can view and/or change:

- ✓ The Port Lock setting. Port Lock controls whether or not data from one HVDL system in the shelf can be "seen" by another HVDL in the same shelf, or by another HVDL system in one of the daisy-chained shelves.
- ✓ The network settings. Network settings, such as IP address, subnet mask, and default gateway can be set back to factory defaults using the front panel pushbuttons.

For a complete explanation of the AMUX's 2 management pushbuttons, please refer to the AMUX installation practice.

6. Connecting to the AMUX

There are 2 ways to connect to the AMUX to perform Network Management – 1) through the AMUX's front panel serial port, or 2) across the network using the Telnet protocol.

6.1. Serial Port

Connecting to the AMUX's front panel serial port requires a serial interface cable (Charles Industries part number 03-900953-0). To connect to the AMUX through its front panel serial port, plug the 8-pin DIN-style connector of the cable into the DIN-style connector on the front panel of the AMUX. Connect the 9-pin D-Sub connector at the other end of the cable into the serial port of a computer.

From the computer, launch a terminal emulator program, such as HyperTerminal, or some equivalent. The serial port must be set for 9600 bits-per-second, with 8 data bits, no parity, and 1 stop bit.

Press the **Enter** key to test the connection. If the connection is good and all settings are correct, the screen will display **login :** , prompting for a user name. See Section 8, *Logging In*, for information on logging in to the AMUX.

6.2. Telnet

Before connecting to the AMUX using Telnet, you must know the user-configured IP address of the AMUX.

From a computer connected to a network, launch the Telnet client. (There are many different Telnet clients available. Usually launching the Telnet client can be done from the computer's command prompt window by typing **Telnet** at the prompt.) Open a Telnet session using the AMUX's IP address and TCP port 10000 (ten-thousand). (The Telnet protocol typically uses TCP port 23. The AMUX has been designed to use port 10000 to enhance security.) Once a connection has been established, you should see **login :**, prompting for a user name. See Section 8, *Logging In*, for information on logging in to the AMUX.

7. Access Levels

The AMUX allows 2 different access levels– **user-level** access, and **administrator-level** access. Up to 10 access accounts can be set up in the AMUX, each with its own unique username, password, and an access level – either **user** or **administrator**.

The **user-level** is somewhat restrictive and is intended for those who should be permitted to view some information from the AMUX, and are only allowed to make limited changes to the AMUX’s settings.

The **administrator-level** allows full access to the AMUX, including access to all features prohibited to user-level access. The table below shows what features of the AMUX can be accessed at the **user** and **administrator** access levels.

Feature	User	Administrator
Account Manager		
View all users	√	√
Change own password	√	√
Change other’s password		√
Add user		√
Delete user		√
View/Change login settings		√
AMUX Diagnostics		
Monitor AMUX performance	√	√
Monitor HVDL data ports	√	√
Take AMUX “snapshot”	√	√
Reset AMUX		√
Card Slot Diagnostics		
View/Change COT configuration settings	√	√
Monitor COT performance	√	√
Reset COT	√	√
AMUX Management		
View network settings	√	√
Change network settings		√
View port security	√	√
Change port security		√
Enable/Disable Data ports		√
Upgrade internal firmware		√
AMUX ID		
View factory programmed serial number	√	√
View factory programmed MAC address	√	√
View software revision number	√	√

Table 1 - User permissions and management features

8. Logging In

If a successful connection has been made to the AMUX – whether using its front panel serial port, or a Telnet session – the AMUX will prompt for a login name. (See Figure 1 below.) This can be either a user-level name, or an administrator-level name. The AMUX will then prompt for a password. Each account, whether user-level or administrator-level, has its own unique password which is 4 to 8 characters long. Any combinations of alpha-numeric characters (a-z, A-Z, 0-9, and punctuation marks, except spaces), are allowed for user names and passwords. Usernames and passwords are not case-sensitive. That is, **CHARLES** and **charles** would be interpreted the same.

When shipped from the factory, the AMUX is configured with only one administrator-level account. Both the login name and password for this account are **admin**. This will allow first-time access to the AMUX so it can be configured to meet specific needs.

The AMUX allows only one management session at a time. However, if a User is logged in, an Administrator can still log in and supercede the User. This is referred to as “bumping”. So, for example, if a User is logged in (whether using the front panel serial port or via Telnet), an Administrator can attempt a login. The Administrator will then be shown the login name of the User, and will be given the option to abort or to continue logging in, thereby terminating the User’s session.

Upon successfully logging in, the AMUX will display the “banner” screen shown below.

```
login:      admin
password:   *****

*****
***** Charles Industries Ltd. Access Multiplexer *****
*****

Board Version:      0x1
FPGA Version:       0x3
Software Release:   5.0.4
Software Development Version: 5.0.4_management
Mac Address:        01-23-45-67-89-00
Serial Number:      9876543210

Charles Industries Access Multiplexer
                    Main Menu

1) Account Manager
2) AMUX Diagnostics
3) Slot Diagnostics
4) AMUX ID
5) AMUX Management
6) Current User Identification
7) Logoff
?) Help
```

Figure 1 - AMUX "Banner" screen



The banner screen shows AMUX-specific information, such as firmware (software) revision levels, MAC (media access control) address, and a factory-programmed serial number. After the “banner” displays, the Main Menu also appears.

After successfully logging into the AMUX, it is recommended that another administrator-level account be added, and the default **admin** account be deleted. (See Sections 9.1.3 and 9.1.4 on Adding and Deleting Accounts, respectively.)

9. Main Menu

Also shown in Figure 1 is the Main Menu. From the Main Menu the user can manage the AMUX and any HVDL systems that reside in the same shelf with the AMUX. To select a menu choice, type the number of the menu at the **Selection:** prompt and press the Enter key. Here’s a brief description of the menu choices shown in the main menu.

- | | |
|---------------------------------------|--|
| 1) Account Manager | Users with administrator-level access can list all user accounts, add user accounts, delete user accounts, change passwords.
Users with user-level access can list accounts and change their own password. |
| 2) AMUX Diagnostics | Monitor the AMUX’s performance statistics. This is helpful for troubleshooting network problems and/or customer outages that may occur. |
| 3) Slot Diagnostics | View and/or configure individual HVDL systems that reside in the same shelf as the AMUX. POTS lines can be turned on/off remotely. End customer’s data rate can be increased or decreased as provided through the HVDL system. |
| 4) AMUX ID | View the AMUX’s factory-assigned serial number, MAC (media access control) address, and firmware revision levels. |
| 5) AMUX Management | Configure and/or view the AMUX’s network settings, disabling selected data ports, and upgrading the AMUX’s internal firmware. |
| 6) Current User Identification | Shows the login name and access level for the current management session. |
| 7) Logoff | Terminate the current management session. |

Table 2 - Main Menu Summary

- ① There are more options available to Administrators than to Users. All menu screens shown throughout this document are for Administrators. Therefore, some options may not appear for clients with user-level access.

9.1. Account Manager

Figure 2 shows the Account Manager Menu screen.

```
Charles Industries Access Multiplexer
      Account Manager

1) List Accounts
2) Change Password(s)
3) Add Account
4) Delete Account
5) View/Change Login Parameters
m) Main Menu
?) Help

Selection: 1
```

Figure 2 - Account Manager Menu

9.1.1. List Accounts

This option allows viewing of all access accounts, both Administrators and Users, that have been set up for this system. The figure below shows an example of the accounts list.

```
Current Account List

Username      Access Level
-----
amy           Administrator
bill          User
chuck         User
derrick       Administrator
mark          Administrator
user          User
ad#346@!     Administrator
jack1234      User
$@|lboat     User
general       User

Press ENTER to continue.
```

Figure 3 - Current Account List

Up to ten (10) unique accounts can be set up in the AMUX.

Usernames and passwords are not case sensitive. Internally, both usernames and passwords are converted and stored as lower case. Therefore, *AMUX*, *Amux*, and *aMuX* are all equivalent.



9.1.2. Change Password(s)

Administrators can change passwords for any account – their own account, other Administrators, and Users. Users can change only their own passwords.

To change a password, an Administrator must choose the username of the account for which the password will be changed. Then the Administrator is double-prompted for the new password.

Since Users can change only their own password, they will not be prompted to enter a username. However, they will be double-prompted for their new password.

If the passwords are not entered and re-entered exactly the same way both times, the AMUX rejects the new password and leaves the old password for the account.

```
Change Password

Enter the username whose password you want to change (or ENTER to abort).
Username? Jack1234
Enter the new password (4-8 characters) (or ENTER to abort).
Password? *****
Re-enter the new password. (or ENTER to abort).
Password? *****
Password successfully changed.

Press ENTER to continue.
```

Figure 4 - Change Password screen, for administrators

9.1.3. Add Account

Only Administrators can add accounts to the AMUX.

There is a limit of ten (10) accounts. Once ten accounts have been set up, the AMUX will not allow any more accounts to be added.

Each account must have a unique username that distinguishes it from all other accounts. Usernames must be between 3 and 8 characters long. Passwords must be between 4 and 8 characters long. Any combination of letters, numbers, and punctuation marks can be used, with the exception of spaces.

Figure 5 shows the Add Account screen.

```
Add Account

Enter the new username you want to add (3-8 characters) (or ENTER to abort).
Username? peter
Enter the new password (4-8 characters) (or ENTER to abort).
Password? *****
Re-enter the new password. (or ENTER to abort).
Password? *****
Choose the new account's access level
1) Administrator
2) User
Selection: 1
Account successfully added.

Press ENTER to continue.
```

Figure 5 - Add Account

When adding an account to the AMUX, the Administrator enters the username, password, and an access level. Therefore, an Administrator can add either a User or another Administrator to the AMUX. There is a limit of ten accounts that can be set up. There can be any combination of Users and Administrators, but there must always be at least one Administrator.

9.1.4. Delete Account

Only Administrators can delete accounts from the AMUX.

```
Delete Account

Enter the username you want to delete (or ENTER to abort).
Username? jack1234
Are you sure you want to delete user jack1234 (y/n)? y
Account deleted

Press ENTER to continue.
```

Figure 6 - Delete Account screen

When deleting an account from the AMUX, the Administrator enters the username of the account that will be deleted. The administrator is then prompted for confirmation that the account should be deleted.

An Administrator cannot delete his/her own account. An Administrator can, however, delete other Administrators, provided that at least one Administrator account remains in the system.

For security purposes, it is recommended that the default **admin** account be deleted from the system. To do this, follow these steps:

1. Log in to the system using the **admin** login name and the **admin** password.
2. Add another Administrator-level account. The login name and password can be anything you choose.
3. Log off the system.
4. Log in again using the Administrator account created in step 2 above.
5. After successfully logging in, delete the default **admin** account.

9.1.5. View/Change Login Parameters

Only Administrators can change login parameters. This allows Administrators to control login parameters to enhance security of the AMUX.

The figure below shows the View/Change Login Parameters screen.

```
View/Change Login Parameters

Current      Change to...
1) Login block time (0-20 sec, 0=no delay)      20
2) Inactivity time (0-255 min, 0=disabled)      0
3) Use factory defaults
m) Main Menu
p) Previous Menu
?) Help

Selection: 1
```

Figure 7 - View/Change Login Parameters screen

Login block time

After every other unsuccessful login attempt, the AMUX “blocks”. This means the AMUX waits for a period of time before allowing another login attempt. This is designed to deter hacking into the system by trial and error.

Login block time sets how long, in seconds, the AMUX blocks.

In the figure above, the block time is set to 20 seconds. Therefore, if the first login attempt is unsuccessful, the AMUX will immediately respond with another login prompt. If, however, the second login attempt is also unsuccessful, then the AMUX will block for 20 seconds. After 20 seconds, the AMUX would allow another login attempt, and the cycle would repeat.

Inactivity time

The AMUX will automatically log off and terminate any session if <CR> (carriage return) is not pressed for a certain period of time. This is the Inactivity time. This setting determines how long the AMUX waits before terminating a session.

The higher the Inactivity time setting, the longer the AMUX will keep a session active with no keys being pressed.

The lower the Inactivity time setting, the shorter the AMUX will keep a session active with no keys being pressed.

The default setting is 0, which means the AMUX will never terminate a session, no matter how long between keystrokes.

Use factory defaults

Selecting **Use factory defaults** restores all the login parameters to the default values as described in the preceding sections.

9.1.6. Saving/Discarding Changes

When any settings have been changed, those changes are not put into effect immediately. Rather, a screen similar to the one shown below appears.

View/Change Login Parameters		
	Current	Change to...
1) Login block time (0-20 sec, 0=no delay)	10	20
2) Inactivity time (0-255 min, 0=disabled)	0	4
3) Use factory defaults		
s) Save 'Change to...' settings. Note: Returning to the Previous or Main Menu without Saving Changes will discard changes.		
m) Main Menu		
p) Previous Menu		
?) Help		
Selection: 2		

Figure 8 - View/Change Login Parameters, with changes

Notice the 2 columns near the end of each line. The middle column is the **Current** column. It shows what the settings are at the moment. The column on the right is the **Change to...** column. It shows whatever new settings have been chosen.

To accept the proposed changes and put them into effect, select **s**. This will put the changed settings into effect and refresh the View/Change Login Parameters screen. On the refreshed screen, the new changes will now appear in the Current column.

To discard the changes and continue operating with the current settings, select either **p**, to return to the previous menu, or **m** to return to the main menu.

9.2. AMUX Diagnostics

The AMUX Diagnostics option allows viewing and monitoring the performance of the AMUX or for monitoring data traffic on specific port(s). For Administrators, it also allows resetting the AMUX.

The figure below shows the AMUX Diagnostics menu.

```
Charles Industries Access Multiplexer
      AMUX Diagnostics

1) Monitor AMUX Performance
2) Reset AMUX
m) Main Menu
?) Help

Selection: 2
```

Figure 9 - AMUX Diagnostics menu

9.2.1. Monitor AMUX Performance

The Monitor AMUX Performance menu is shown below. This allows monitoring of various AMUX performance statistics. The statistics show how much user data traffic is being transmitted and received on all of the AMUX's 14 or 17 Ethernet ports (depending on whether a 19" or 23" shelf is being used), and how much data traffic is being transmitted and received on 2 of the AMUX's internal ports.

```
Monitor AMUX Performance

1) Frequency (10-14400 sec,0=off)          Current      Change to...
2) Ethernet Ports (slots) <Current:> none
   Ethernet Ports (slots) <Change to:>
3) Snapshot Now
4) Start Continuous Monitor
m) Main Menu
p) Previous Menu
?) Help

Selection: 1
Please set the frequency (10-14400,0=off): 10
```

Figure 10 - Monitor AMUX Performance menu

The performance statistics are useful when troubleshooting network problems. Analyzing the statistics from the AMUX can help determine the source of network outages, broadcast storms, and other networking anomalies.

Frequency

The AMUX can be configured to display its performance statistics periodically. The Frequency setting determines how often, in seconds, the AMUX displays to the management screen while in continuous monitoring mode. Possible values range from 10 seconds, to 14,400 seconds (4 hours). After the AMUX displays its performance statistics to the management screen, it resets all of its statistics counters. For example, if the AMUX was set to monitor every 300 seconds (5 minutes), then every 5 minutes it would send all of its performance statistics to the management screen. Then the AMUX would reset all of its internal counters to begin counting for the next 5 minute interval.

The default value for Frequency is 10, which means that during continuous monitoring mode, the AMUX displays a statistics screen every 10 seconds.

Ethernet Ports (slots)

This option allows monitoring of individual Ethernet ports of the AMUX. This can be helpful for troubleshooting network problems that seem to be isolated to a single HVDL system in the same shelf as the AMUX.

The Ethernet Ports screen is shown below. The screen shows all of the AMUX's 14 or 17 Ethernet ports and which ports, if any, are currently being monitored. If a port is not being monitored, an 'n' appears below the port number. If a port is being monitored, a 'y' appears below the port number.

```
Ethernet Ports
          <----- Slots ----->
          1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Monitor   y y n n y y y y n n y y y y y y y y
Change to...

Enter slot number to change...or...
y) Change all the slots to 'y'
n) Change all the slots to 'n'
?) Help
p) Previous Menu (save/discard changes made in this menu)
x) Cancel       (discards changes made in this menu)
```

Figure 11 - Ethernet Ports screen

To include performance statistics for port(s), type the port number at the **Selection:** prompt. As shown in Figure 12, a 'y' appears beneath the selected port in the **Change to...** row, indicating that this port will now be monitored.

```

Ethernet Ports

          <----- Slots ----->
          1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Monitor   y y n n y y y y n n y y y y y y y y
Change to...      y

Enter slot number to change...or...
y) Change all the slots to 'y'
n) Change all the slots to 'n'
?) Help
p) Previous Menu (save/discard changes made in this menu)
x) Cancel        (discards changes made in this menu)

```

Figure 12 - Ethernet Ports screen, with changes pending

To save the changes and put them into effect, press **p** to first navigate back up to the previous menu – the Monitor AMUX Performance screen. The Monitor AMUX Performance screen will show the changes but the changes have not yet been saved nor applied.

```

X Performance

          Current      Change to...
1) Frequency (10-14400 sec,0=off)          10          30
2) Ethernet Ports (slots) <Current:> 1-17
   Ethernet Ports (slots) <Change to:> 1-3,5-8,11-17
3) Snapshot Now
4) Start Continuous Monitor
s) Save 'Change to...' settings  Note: Returning to the Previous
   or Main Menu without Saving Changes will discard changes.
m) Main Menu
p) Previous Menu
?) Help

Selection:  s

```

Figure 13 - AMUX Diagnostics menu, with pending changes

Notice in Figure 13 above that the settings changes appear in the **Change to...** column. The settings changes for the Ethernet ports, however, appear in a separate row. In Figure 13, then, the settings changes will cause the AMUX to display its performance statistics every 30 seconds, and Ethernet ports 1-3, 5-8 and 11-17 will be monitored. Ports 4 and 9-10 have been excluded.

To save the changes and put them into effect, press **s**. To abandon the changes, leaving the AMUX with the settings in the **Current** column, press either **p** to navigate to the previous menu, or **m** to navigate to the main menu.

Snapshot Now

A snapshot is an immediate, one-time capture of the AMUX's performance statistics. Figure 14 shows a snapshot of the AMUX performance statistics. For each Ethernet port – all 14 or 17 HVDL Ethernet ports, in addition to 2 internal data traffic connections – the snapshot shows whether or not the port has link, and the number of Ethernet frames both received and transmitted. (The Uplink and Expansion ports do not display data traffic statistics.) The table below gives the abbreviations in the header row of the snapshot screen, along with their explanations.

```

a started at 240583
  Link Receive  Transmit Drop CR Ov Fr Jb Co LC RE Br  Mu
Slot01      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot02      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot03      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot05      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot06      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot07      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot08  L    00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot11  L    00000080 00000000 0000 00 00 00 00 00 00 00 0000 0002
Slot12      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot13      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot14      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot15      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot16      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
Slot17      00000000 00000080 0000 00 00 00 00 00 00 00 0000 0000
AmuxPr  L    00001089 000006C0 0000 00 00 00 00 00 00 00 0000 0000
SUplink  L    00000640 00001109 0000 00 00 00 00 00 00 00 0000 0000

Press ENTER to continue.

```

Figure 14 - Snapshot

Link	Link between the AMUX and the HVDL system or external device
Receive	Ethernet bytes received on this port
Transmit	Ethernet bytes transmitted on this port
Drop	Ethernet frames dropped on this port
CR	Ethernet frames with CRC errors
Ov	Overruns
Fr	Fragments
Jb	Jabbers
Co	Collisions
LC	Late collisions
RE	Receive errors
Br	Broadcast frames
Mu	Multi-cast frames

Table 3 - Snapshot header row definitions

Start Continuous Monitor

When Continuous Monitor mode is activated, the AMUX periodically displays all of its performance statistics to the management screen. Figure 15 below shows a sample output screen for continuous monitor mode. The statistics that are displayed are identical to those displayed in a snapshot. See the above table for explanations of the abbreviations in the header row.

Before starting continuous monitoring mode, change the Inactivity timer to 0 (zero). This will prevent the AMUX from terminating the management session due to inactivity while in continuous monitoring mode. Changing the inactivity timer can be done from the *Account Manager*, under the *View/Change login parameters* menu option.

To start continuous monitoring, choose option 4 from the Monitor AMUX Performance menu. The Frequency setting determines how often the performance statistics are displayed. For example, if Frequency has been set to 30 seconds, then once continuous monitor mode is started, the AMUX will display a statistics screen every 30 seconds. Typing the word **quit** will stop continuous monitor mode and return to the Monitor AMUX Performance menu.

```
a started at 240514
  Link Receive  Transmit Drop CR Ov Fr Jb Co LC RE Br  Mu
Slot01  L  000013A4 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot02  L  0000005C 000002B8 0000 00 00 00 00 00 00 00 0012 0000
Slot03          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot05          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot06          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot07  L  00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot08          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot11  L  000002B8 00000000 0000 00 00 00 00 00 00 00 0000 0006
Slot12          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot13          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot14          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot15          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot16          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
Slot17          00000000 000002B8 0000 00 00 00 00 00 00 00 0000 0000
AmuxPr  L  00000BAF 00000678 0000 00 00 00 00 00 00 00 0000 0000
SUpInk  L  00000380 00000E67 0000 00 00 00 00 00 00 00 0000 0000

Continuous monitoring mode
Type QUIT to terminate this mode:
```

Figure 15 - Continuous Monitoring output screen

Every statistics output screen displays the performance statistics since the previous output screen. So if, for example, Continuous Monitoring was set to display every 10 seconds, each output screen would show performance statistics for the last 10 seconds.

For Continuous Monitoring and for Snapshots, the first output screen may show large numbers for some statistics. This is because the statistics have been accumulated since the last time Continuous Monitoring or Snapshot was activated. To get a “fresher” set of statistics, either wait until the next Continuous Monitor output screen appears, or take another snapshot.

- ① Continuous Monitoring and Snapshots are intended for complicated debugging. Although this information may not seem useful for the User/Administrator, this information is very important to technical support should a problem occur with the system.
- ① The information in Snapshot and Continuous Monitoring is complicated and ever changing. There are no defined limits, but rather it provides a look at the entire system. For help interpreting these codes, contact Charles Industries Technical Support.

9.2.2. Reset AMUX

This option allows re-booting the AMUX.

```
Charles Industries Access Multiplexer
          AMUX Diagnostics

1) Monitor AMUX Performance
2) Reset AMUX
m) Main Menu
?) Help

Selection: 2

Confirmation of AMUX reset will:
* Preserve current AMUX configuration.
* Log you out.
* Restart the AMUX
  (Warning: The data system will stop for approx. 30 seconds.)
* Re-learn the configuration of each slot.

Reset the AMUX now (y/n)? y
AMUX in process shutting down and restarting.  Goodbye!
```

Figure 16 - Reset AMUX screen

As shown in Figure 16 , you must confirm that a reset of the AMUX is desired. Resetting the AMUX will stop all user data traffic while the AMUX re-boots, and it will terminate the management session. To continue managing the AMUX after confirming a reset, you must log in to the AMUX again. Any Telnet/serial communication sessions will be disconnected during the reset.

9.3. Slot Diagnostics

Slot Diagnostics provides a means to manage the HVDL systems that are in the same shelf as the AMUX. There are a number of configuration settings for an HVDL system, such as the data rate between COT and RT, and whether or not a particular HVDL system is configured to work with a repeater. (For a complete description of HVDL features and configuration settings, refer to the installation practice for HVDL, which can be obtained through Charles Industries Technical Support or Inside Sales departments.)

By default, the AMUX continually polls each COT within the same shelf. It gathers information from each COT about the COT's configuration settings. This information is stored in the memory of the AMUX. If a COT is reconfigured using its own front panel pushbuttons, then the AMUX will detect the new configuration settings and store them in its memory. In this way, the AMUX always has the latest configuration settings for all COTs within the same shelf. (Polling can be turned off on a per slot basis. This option is discussed later.)

If the configuration settings of an HVDL system are changed through the AMUX, then the AMUX will send those new settings *to* the HVDL system (as opposed to reading settings *from* the system).

If an HVDL COT must be replaced for any reason, the AMUX configures the new COT with the same settings as the COT that was previously in that slot. This makes COT replacement very simple – plug in the new COT and let the AMUX configure it.

Figure 17 shows the menu screen for Slot Diagnostics. The AMUX displays -- **Updating...Please Wait** – while it updates the alarm status of all slots.

```

Slot Diagnostics

-- Updating...Please Wait --

Slot Diagnostics

Slot  Type          Rate Bandwidth  Pots1   Pots2   Pots3   Link Status
----  -
 1  HVDL3.1          832 dynamic
 2  HVDL3.1          832 dynamic
 3  HVDL3.1          768 fixed
 4  HVDL3.1          384 fixed
 5  HVDL3.1          768 fixed      In Use   In Use
 6  HVDL3.1          512 fixed
 7  HVDL3.1          256 fixed
 8  HVDL3.1          768 dynamic
 9  unknown
10  HVDL3.1          512 fixed      In Use   xxx      xxx      Both In Sync
11  HVDL3.1           0 fixed
12  HVDL3.1          384 fixed
13  HVDL3.1          128 fixed
14  HVDL3.1          128 fixed
15  unknown
16  unknown
17  unknown
m) Main Menu          ?) Help
ENTER to Refresh     Enter slot number to view/change: 3

```

Figure 17 - Slot Diagnostics, main screen

Slot The **Slot** column lists all the slots in the shelf. 19” shelves have only 14 slots, while 23” shelves have 17. The Slot Diagnostics screen will show 14 slots if a 19” shelf is being used, but 17 slots if a 23” shelf is being used. The above example, therefore, is for a 23” shelf since 17 slots are shown.

Type The **Type** column lists what kind of COT card is in the corresponding slot. HVDL is the only Charles Industries COT that currently works with the AMUX’s network management, and therefore is the only card type shown. In the example screen above, slots 9, 15, 16, and 17 are listed as **unknown**. This could be because these slots are populated with other legacy COTs, such as Charles Industries’ Quad-POTS or DDL systems. It could also mean the slots are not populated at all. If polling of a particular slot has been disabled, then **Polling disabled...** would be displayed.

Rate The **Rate** column shows the data rate at which the HVDL system is operating. This is the data rate from the COT to RT given in kbps.



Bandwidth	<p>The Bandwidth column shows one of two modes – Fixed or Dynamic. In Dynamic mode an HVDL system uses bandwidth from idle POTS lines to provide additional bandwidth for high-speed data. In Fixed mode, the bandwidth of idle POTS lines is <i>not</i> used for high-speed data, but rather is left unused until a POTS call is set up. Generally, Fixed mode is recommended, especially for POTS lines that use on-hook transmission features. (Note: Caller ID will function in either Fixed or Dynamic mode.)</p>
Pots x	<p>The Pots1, Pots2, and Pots3 columns show the status of the POTS lines for each active slot. If a POTS line is idle then nothing appears on the screen. If a call is in progress, then the words In Use appear. If, however, a POTS line has been turned off, then xxx appears. In the example above, for slot 10, POTS line 1 is busy, while POTS lines 2 and 3 have been turned off. For slot 11, all 3 POTS lines are turned on, but they are idle.</p>
Link	<p>The Link column shows the state of the HVDL system’s 2 Ethernet links – the Ethernet link between the COT and the AMUX, and the Ethernet link between the RT and the end customer’s computer(s). The link between the COT and AMUX is referred to as the near-end link, and the link between the RT and the end user is referred to as the far-end link.</p> <p>If both links are active (indicating proper Ethernet connections at both the COT and the RT), then the word Both appears.</p> <p>If only the link between the COT and AMUX is active (such as would be the case if the end user’s computer was turned off), only the word Near appears.</p> <p>If only the link between the RT and the end user was active, the word Far would appear. In the example above, slots 1, 10, and 14 have active Ethernet links at both the COT and RT. All other slots (with the exception of slots 9, 15, 16, and 17) have active Ethernet links only between the COT and AMUX.</p>
Status	<p>The Status column shows the sync or alarm state of a slot. If a COT is not in an alarm state, this column will show the state of the system, such as Bypass, Training, or In Sync. If a COT is in an alarm state (such as a cable failure), the alarm state would be displayed. In the example above, slot 2 is currently in alarm due to an open circuit in the cable between the COT and RT.</p>

Table 4 - Slot Diagnostics, definitions

To manage a particular slot, enter the slot number at the **Enter slot number to view/change:** prompt. Pressing only the **Enter** key at the **Enter slot number to view/change:** prompt will simply refresh the screen. In Figure 17 above, slot 3 has been selected to manage individually. (Notice that **3** has been entered at the **Enter slot number to view/change:** prompt.)

```
View/Change Slot 3 Settings

Note: Changes on options with [*] will cause the card in the slot to reset.
During the reset operation, data and voice traffic will shutdown until the
reset operation is complete.

Current      Change to...
1) Pots 1    Enabled
2) Pots 2    Enabled      Disabled
3) Pots 3    Enabled      Disabled
4) DSL Rate (kbps) [*] 768          832
5) Dynamic Data Rate Fixed
6) Front Panel Enabled
7) EPREP/Repeater [*] Eprep
8) FTP/AutoStart [*] AutoStart
q) Slot polling Enabled
c) Enter single COT monitor mode
r) Manually reset this slot [*]

s) Save 'Change to...' settings will send the new data to the card. Returning
to the Previous or Main Menu without Saving Changes will discard changes.
m) Main Menu
p) Previous Menu
?) Help

Selection:
```

Figure 18 - Slot Diagnostics, individual slot management

Figure 18 above shows the Slot Diagnostics screen for an individual slot – in this case, slot 3. To change a setting, select the number of the setting at the **Selection:** prompt. When a configuration setting has been changed, the new choice appears in the **Change to...** column.

Note in Figure 18 that some configuration settings are marked with an asterisk (*). Changing any of these options will result in the HVDL system resetting. While the HVDL system is resetting it is unable to process any voice or data traffic. A complete reset can take anywhere from 30 seconds to approximately 2 minutes depending on the desired data rate and the number of repeaters in the system.

Selecting option **q** in Figure 18 enables or disables polling for this slot only. If polling is enabled (as shown in Figure 18) then selecting option **q** would disable it. Conversely, if polling was disabled, then selecting option **q** would enable polling once again.

With polling disabled the AMUX will not collect configuration settings from the COT to store in its memory. Nor will the AMUX configure a new card that is placed into the slot. This option is intended primarily as a troubleshooting tool.

Selecting option **r** in Figure 18 forces the particular HVDL system to perform a manual reset. As with changing any configuration settings marked with an asterisk (*) a reset temporarily disables an HVDL for a period of 30 seconds to 2 minutes.

Selecting option **c** in Figure 18 puts the AMUX into Single-COT mode. In this mode the Administrator or User can interface directly with a single COT via the AMUX. This allows the Administrator or User to view diagnostic information that is displayed by the COT, as well as send commands to the COT. While in this mode, the AMUX is not communicating slot information to/from the COTs. (The end user's data traffic is unaffected.) Therefore, to resume normal operations, you must exit Single COT mode.

Refer to the section titled *Single COT Mode* for more detailed information.

Once the desired changes have been made, select the **s** option at the **Selection:** prompt. This saves the changes and applies them to the HVDL system.

9.4. AMUX ID

The AMUX ID menu allows viewing of...

- ✓ the AMUX's factory-programmed unique serial number
- ✓ the MAC address
- ✓ the circuit board version
- ✓ the revision levels of the software/firmware in the AMUX.

```
Charles Industries Access Multiplexer
      AMUX ID

Serial Number:      1234567890
Mac Address:       01-23-45-67-89-AB
Board Version:     0x1
FPGA Version:     0x5
Firmware Version: 5.0.1

Press ENTER to continue.
```

Figure 19 - AMUX ID screen

9.5. AMUX Management

From the AMUX Management menu, Administrators can set and view configuration settings of the AMUX itself. Figure 20 below shows the AMUX Management menu.

```
Charles Industries Access Multiplexer
      AMUX Management

1) Network Settings
2) Port Security
3) Enable/Disable Ethernet Ports
4) Update AMUX Software
m) Main Menu
?) Help

Selection: 1
```

Figure 20 - AMUX Management menu

9.5.1. Network Settings

Network Settings		
	Current	Change to...
1) IP Address	172.16.139.2	
2) Subnet Mask	255.255.0.0	
3) Gateway Address	172.16.139.1	
4) DNS Server Address (optional)	172.16.139.181	
m) Main Menu		
p) Previous Menu		
?) Help		
Selection:		

Figure 21 - Network Settings menu

The Network Settings menu shows the IP Address, Subnet Mask, Gateway Address, and DNS Server Address for the AMUX. Administrator's can both view and change these settings. Users can view the settings only.

In order to manage the AMUX using Telnet, the AMUX must be configured with an IP address, a Gateway address, and optional DNS server, and the appropriate Subnet mask. All of this information must be provided by your network administrator. *Charles Industries does not know the configuration of your network and cannot supply you with this information.*

Configuring the AMUX with the address of a DNS (Domain Name System) server is optional. When AMUX software upgrades are desired, the AMUX is programmed to automatically look for a Charles Industries upgrade server by name. The AMUX uses a DNS server to help locate a Charles Industries software upgrade server. Once it has located the upgrade server, the AMUX downloads available upgrade files. The AMUX can still download software upgrades from a Charles Industries upgrade server without a using a DNS server, but the IP address of the Charles Industries upgrade server must be entered manually. (See section 9.5.4, *Update AMUX Software*, for more information.)

To change a setting, enter the setting number at the **Selection:** prompt. Any new settings appear in the **Change to...** column.

```
Network Settings

1) IP Address                Current      Change to...
2) Subnet Mask              172.16.139.2 192.168.12.2
3) Gateway Address         255.255.0.0
4) DNS Server Address (optional) 172.16.139.1
s) Save 'Change to...' settings (take effect upon next reset). Note: Returning
   to the Previous or Main Menu without Saving Changes will discard changes.
m) Main Menu
p) Previous Menu
?) Help

Selection:  s
```

Figure 22 - Network Settings, with changes

Any changes that are made are not saved until the **s** option is entered. Notice, however, that this only saves the changes in the AMUX's non-volatile memory. For the new IP Address, Subnet Mask, and/or Gateway Address settings to take effect, the AMUX must be reset. (The DNS Server Address setting, however, takes effect immediately.) This is because if the network managing is being done using Telnet, changing the IP address or any of the other network address settings could immediately terminate the management session. The AMUX can be reset by physically removing it from the shelf and re-inserting it, or from the AMUX Diagnostics menu. (See section 9.2 *AMUX Diagnostics*.)

9.5.2. Port Security

The AMUX has a total of 19 Ethernet ports – 17 ports for up to 17 HVDL systems that can reside in the same shelf, 1 **UPLINK** port for connecting to the Ethernet source and 1 **EXPANSION** port for daisy-chaining 3 AMUX's together. Port Security controls whether or not the Ethernet ports can “see” each other, that is, whether or not they can send/receive data to/from each other

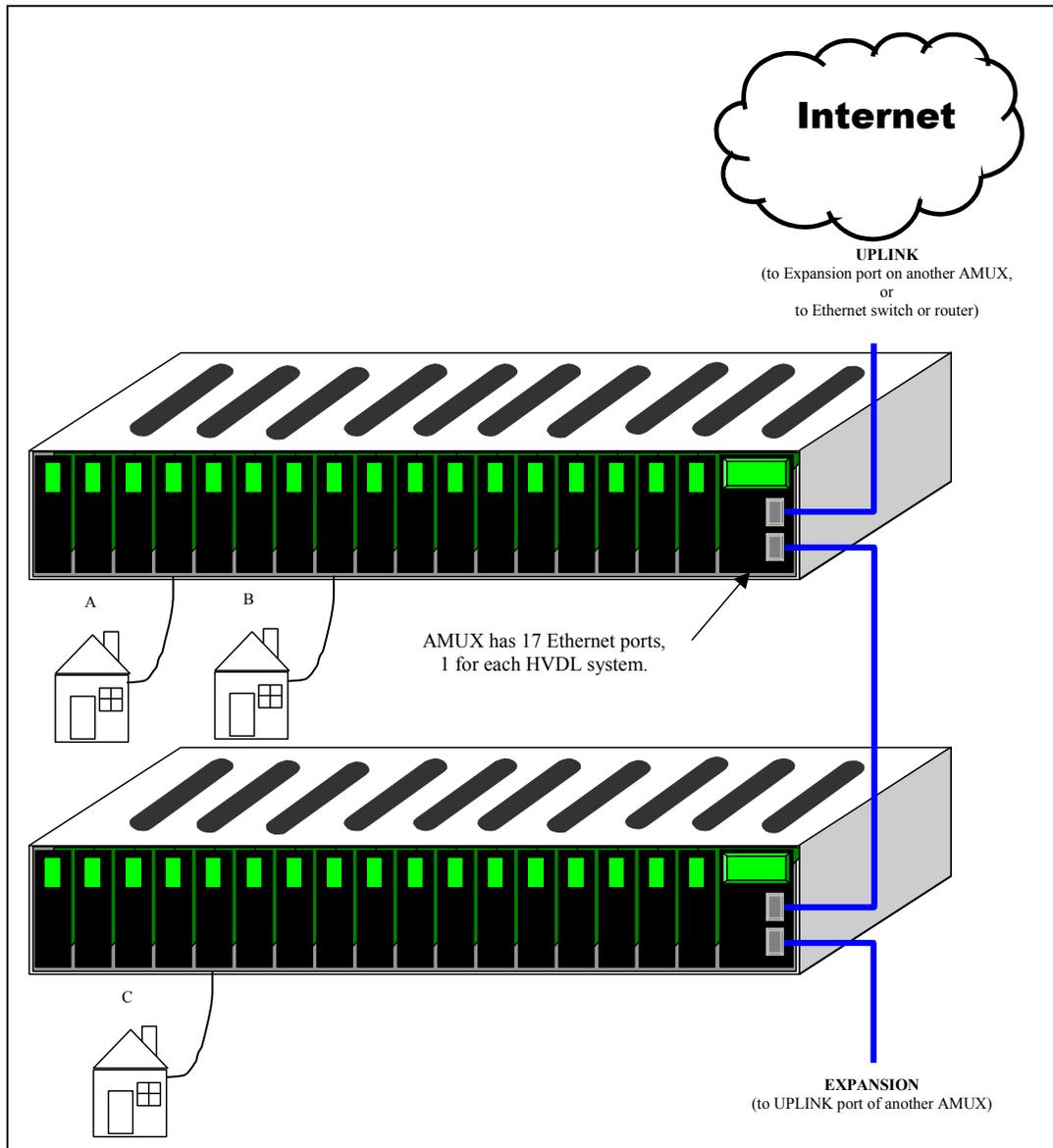


Figure 23 - Fully populated HVDL shelf

With Port Security ON, the 17 HVDL Ethernet ports cannot pass data traffic directly to/from one another. In addition, with Port Security ON, data traffic cannot pass from the HVDL Ethernet ports to the Expansion port. Traffic can, however, pass from the HVDL Ethernet ports to the Uplink port.

Referring to Figure 23 above, with Port Security ON, customer A could not access customer B's computer(s), and vice versa. Furthermore, since all HVDL Ethernet ports are prohibited from communicating with the Expansion port, customers A and B could not pass data to/from customer C, who is served by a 2nd AMUX in the daisy-chain. In the same way, customer C cannot pass data traffic to/from either customers A or B. Customer C's data traffic would go from the HVDL Ethernet port on the 2nd shelf, through the Uplink port of the 2nd shelf AMUX, to the Expansion port of the 1st shelf AMUX, to the Uplink port of the 1st shelf AMUX, then on to the rest of the network.

With Port Security OFF, data traffic *can* pass from one HVDL system directly to another HVDL system in the same shelf. Data traffic *can* also pass from an HVDL Ethernet port to the Expansion port. Data can always pass from the HVDL Ethernet ports to the Uplink port.

Referring to Figure 23 above then, with Port Security OFF, customers A and B could send/receive data to/from one another directly. Also with Port Security OFF, customers A and B could pass data traffic to the Expansion port of the 1st shelf AMUX. This data traffic could then pass to the AMUX of the 2nd shelf and then on to customer C.

There are advantages and disadvantages to having Port Security On or Off. With Port Security OFF each HVDL customer can see every other HVDL customer in the same shelf. This may not be desirable since the customer must provide his/her own security (such as a firewall) to prevent outside users from accessing his/her computer(s). On the other hand, with Port Security ON each HVDL system is blocked from passing data to other HVDL systems. While this does provide additional security between customers, this may not be desired either. Some game programs which allow multiple players to play simultaneously over the Internet rely on the users being able to pass traffic to/from one another directly. This cannot be done with Port Security ON.

The default setting for Port Security is ON, which means each HVDL Ethernet port is blocked from passing data traffic directly to another HVDL Ethernet port or to the Expansion port.

- ① The AMUX cannot be managed via Telnet from the Expansion port if Port Security is ON. Changing Port Security from OFF to ON while using Telnet from the Expansion Port will therefore terminate the management session. Changing Port Security while managing the AMUX via the front panel serial port will **not** cause the management session to terminate.

The Port Security setting screen is shown in Figure 24 below. As shown, Port Security is ON. To change the Port Security setting, select option **1**. There are only 2 choices for Port Security, and so selecting option **1** simply toggles between the 2 options. The Port Security setting takes effect immediately.

```

Port Security

1) Port Security is ON
m) Main Menu
p) Previous Menu
?) Help

Selection:

```

Figure 24 - Port Security menu

9.5.3. Enable/Disable Ethernet Ports

The HVDL Ethernet ports of the AMUX can be enabled or disabled individually. This feature is an easy method of disabling subscriber data service in the event the subscriber doesn't pay their bill. Figure 25 shows the Enable/Disable Ethernet Ports menu. An **E** appears beneath each HVDL Ethernet port that is currently enabled, and a **D** appears beneath each HVDL Ethernet port that is currently disabled.

```

Enable/Disable Ethernet Ports

          1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
Current   E  E  E  E  E  E  E  E  E  E  E  E  E  D  D  D  D
Change to...

Enter Port number to toggle Enable/Disable
e) Enable all ports
d) Disable all ports
m) Main Menu
p) Previous Menu
?) Help

```

Figure 25 - Enable/Disable Ethernet Ports

To change the enabled/disabled state of a particular port, enter the port number at the **Selection:** prompt. When the state of a port is changed, its new state appears in the **Change to** row on the screen. The changes do not take effect until they are saved. Changes are saved by entering **s** at the **Selection:** prompt.

```
Enable/Disable Ethernet Ports

          1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
Current   E  E  E  E  E  E  E  E  E  E  E  E  E  D  D  D  D
Change to... D

Enter Port number to toggle Enable/Disable
e) Enable all ports
d) Disable all ports
s) Save 'Change to...' settings Note: Returning to the Previous or Main Menu
   without Saving Changes will discard changes.
m) Main Menu
p) Previous Menu
?) Help

Selection:  1
```

Figure 26 - Enable/Disable Ethernet Ports (2)

9.5.4. Update AMUX Software

The AMUX's internal software can be updated remotely. Occasional software updates may be made available by Charles Industries. When prompted by an Administrator, the AMUX can locate software updates in 1 of 2 ways:

1. If the AMUX has been configured with the IP address of a DNS server, then it will automatically locate a Charles Industries FTP site and find software updates for itself,
or...
2. The Administrator can manually enter the IP address of a Charles Industries FTP server into the AMUX. Contact Charles Industries technical support to get this IP address.

```
Charles Industries Access Multiplexer
AMUX Management

1) Network Settings
2) Port Security
3) Enable/Disable Ethernet Ports
4) Near Link Reset
5) Update AMUX Software
m) Main Menu
?) Help

Selection: 5
AMUX Firmware Upgrade      Technical Services: 800-607-8500
Serial Number of the AMUX: 5555555555

** Describing the Process **
CAUTION: You have entered the AMUX Firmware Upgrade Area.

Upgrading firmware will require rebooting of this unit which will temporarily
disable all data traffic as the firmware is installed. Consider upgrading the
firmware during periods of low data traffic.

To proceed, you will need to have the following:

a) Either have entered a valid DNS server address in Network Settings
   or
   Have a valid IP address to the Charles Industries upgrade server.
b) The name of the company at which this unit is installed.
c) the Zip code of the location at which this unit is installed.

1) Continue
?) Help
A) Abort Upgrade

Selection: 1
```

Figure 27 - Update AMUX Software, entry screen

This is the entry screen for updating the AMUX software. Aborting the update process can be done by selecting **A** at the **Selection:** prompt. After reading the entry screen, to proceed with the software update, select **1** and the **Selection:** prompt.

Figure 28 below shows the information entry screen. If necessary, an IP address for the Charles Industries FTP server must be entered. Charles Industries technical support can provide this IP address.

```
AMUX Firmware Upgrade      Technical Services: 800-607-8500
Serial Number of the AMUX: 5555555555

** Locating the Charles Industries upgrade server **

Please wait: *****
*****
ERROR: The Charles Industries Upgrade server was not found

1) Change the DNS Server Address if incorrect (will abort upgrade and
   proceed to Network Management screen.)
2) Enter an IP Address for the Charles Industries upgrade server
   (available from Technical Services)
?) Help
A) Abort Upgrade

Selection: 2

AMUX Firmware Upgrade      Technical Services: 800-607-8500
Serial Number of the AMUX: 5555555555

** Enter the IP Address of the Charles Industries upgrade server **

Enter the IP Address of the Charles Industries upgrade server.
(Contact Technical Services if this address is unknown)

IP Address: 123.123.123.1

You are now connected to the AMUX Upgrade server
```

Figure 28 - Update AMUX Software, enter info. screen

A company name and zip code must also be entered. Company name is limited to 25 characters and the zip code is limited to 5 digits. Once this information is entered, the AMUX will automatically locate the Charles Industries server and download the latest software updates. The AMUX displays a progress indicator as it looks for the server.



Charles Industries requests your company name and zip code to assist us with technical support if necessary.

Charles Industries requests your company name and zip code to assist us with technical support if necessary.

Company Name (25 characters max.): hometown_telco

Company Zip Code (1st 5 digits only): 12345

Progress Indicator: *****

AMUX Firmware Upgrade Technical Services: 800-607-8500

Serial Number of the AMUX: 5555555555

** Contacting Charles Industries upgrade server to determine which upgrades are available...please wait **

The following files are available for download:

1. 5_0_18.dat (Latest Version)
2. 5_0_17.dat
3. 5_0_13c.dat

?) Help

A) Abort Upgrade

Selection: 1

Figure 29 - Update AMUX Software, File List

Once the AMUX locates the server, it displays the 3 most recent software versions. This allows the Administrator to download the latest software version or an older software version. In Figure 29 above, since **1** was entered at the **Selection:** prompt, file **5_0_18.dat** has been chosen to download.

Once a software file has been chosen, the AMUX downloads the file. However, it downloads the file into volatile memory, meaning the AMUX is still functioning using the old software version, not the one that was downloaded. To put the downloaded software into use, it must be transferred from volatile memory into the AMUX's flash memory.



IT IS CRUCIAL THAT THE AMUX NOT LOSE POWER WHILE TRANSFERRING THE FILE INTO ITS FLASH MEMORY. IF THE AMUX LOSES POWER DURING THIS TIME IT WILL RENDER THE AMUX INOPERATIVE!

It takes approximately 20 seconds for the AMUX to transfer the new software into its flash memory. To abort the software update procedure, select **A** at the Selection: prompt. This will immediately abort the update process and leave the AMUX's software unchanged.

To begin operating with the new software the AMUX must be re-booted. Press ENTER to reboot the system.

Note: All data traffic will stop during the reboot.

10. Getting Help

The AMUX's network management software includes access to Help for each management screen. To access Help from any AMUX management screen, press the ? key.

Help displays information related to the screen from which Help was activated. For example, if the *Add Account* screen was up and Help was activated (by pressing the ? key) then information about adding accounts would be displayed.

Help displays information one screen at a time. The table below shows the keys used to navigate through the Help text, and to leave Help as well.

Help keys	Function
?	Activates Help from anywhere within the network management software.
U	Up. View the previous page of text.
D	Down. View the next page of text.
Q	View the previous half of a page of text.
A	View the next half of a page of text.
Enter key	Leave Help. Return to the last network management screen.

Table 5 - Help keys

11. Security Tips

The remote network management capabilities of the AMUX make it a powerful addition to the HVDL family and any high-speed internet access network. The AMUX was designed with security in mind. However, like any other piece of equipment on the internet, it is subject to “hacking” and malicious tampering. Therefore, it is important to practice network security to assure that the AMUX operates consistently, meeting your networking needs, without being compromised.

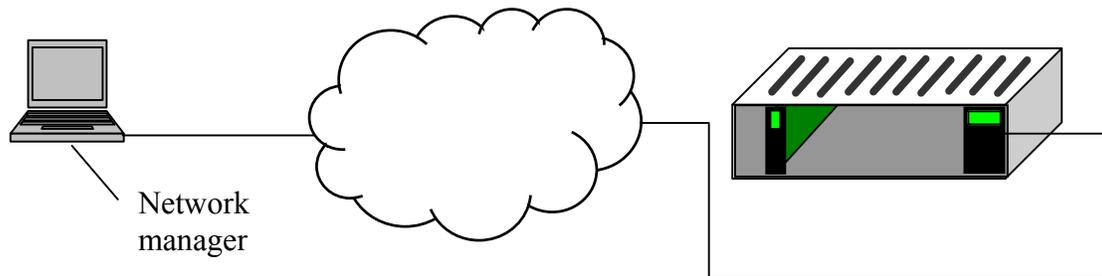
Here are some network security tips on how to take full advantage of the AMUX’s security features.

- ✓ Limit the number of access accounts to only those individuals who need to configure and/or monitor the AMUX on a regular basis. Especially limit the number of Administrator accounts, since Administrators are much more powerful than Users.
- ✓ Avoid passwords that are easy to “crack”, such as your first or last name, your spouse’s name, etc. Instead, choose passwords that mix letters, numbers, and punctuation marks. For example, instead of **MIKE** as a password, choose **M!K3**. (Use an exclamation point ! instead of an **I** and a **3** instead of an **E**.) The latter password will be much harder to “crack”.
- ✓ Change your password from time to time.
- ✓ Don’t let others know your password, especially if you are an Administrator. Remember, Administrators can delete accounts, even the accounts of other Administrators!
- ✓ Change the IP address of the AMUX from time to time.

In the event that all Administrator accounts become inoperative, Charles Industries Technical Support can remotely access any AMUX that has been assigned a valid IP address and create a working Administrator account. This account will restore access to the AMUX. Once access has been restored, Administrator accounts can be re-created and the account created by Charles Industries Technical Support can be deleted.

12. Single COT Mode

Single COT Mode allows a User/Administrator to manage a single HVDL system **through** the AMUX. In Single COT Mode, the Administrator/User is communicating exclusively with a single HVDL COT. The COT sends diagnostic output to the AMUX, which in turn, displays it to the Administrator/User, whether via the front panel serial port or a Telnet session. And, the Administrator/User can send commands to the COT through the AMUX as well.



The network manager can interface with a single COT

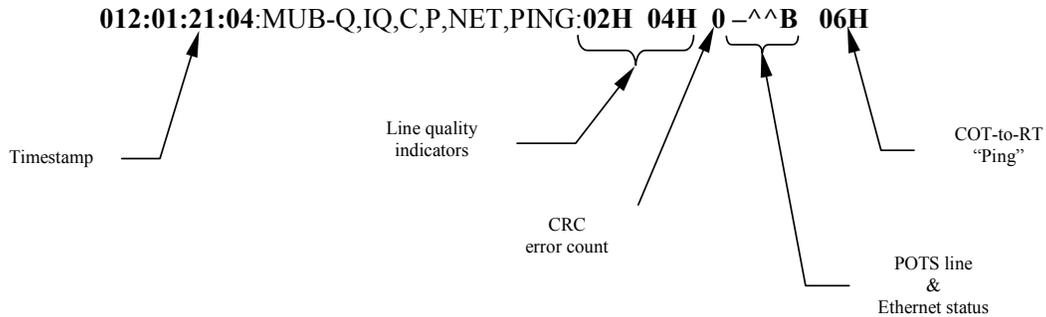
Figure 30 - Single COT Mode

To enter Single COT Mode select *Slot Diagnostics* from the Main Menu. Then choose the shelf slot number of the HVDL COT to communicate with. At the **Enter slot number to view/change:** prompt select **c** for Single COT Mode. Now the network manager is communicating with the selected COT through the AMUX.

12.1. Diagnostics Output

Repeating lines of diagnostic information will appear if the HVDL COT and RT are synchronized (“in sync”). The COT displays 1 line of diagnostic information about once every second. At this point anything typed by the Administrator/User is sent to the COT. (COT commands will be discussed later.)

Here’s just one line of diagnostic information from the COT.



The fields in boldface convey performance information about the COT. Here’s what the different fields mean:

Timestamp

The line begins with a timestamp indicating how long the system has been in sync. The format is given as *days:hours:minutes:seconds*. In the example above, this system has been in sync for 12 days, 1 hour, 21 minutes, and 4 seconds.

Line quality indicators

The 2 line quality indicators give some indication about the quality of DSL signal between the HVDL COT and RT. The higher these numbers are, the stronger the DSL signal is. The maximum value is **25H** and the minimum is **00H**.

CRC error count

HVDL COTs and RTs calculate CRCs (cyclic redundancy checks) on the data that passes between them. The CRC error count is used as a means of detecting bit errors. Ideally this number should be 0, indicating no CRC errors. On a poor quality line this number may not always be 0. If the number of CRCs is exceptionally high – about 15 or higher – a repeater may need to be added to this HVDL system.

POTS Line status

The 3 characters to the right of the CRC count are the POTS line status indicators. These 3 characters show the state of HVDL’s 3 POTS lines.

A dash (–) shows an idle POTS line.

A carat (^) shows an off-hook POTS line. (The carat is used to represent a lifted telephone handset.)

An **R** indicates a ringing POTS line.



An **x** indicates a POTS lines that has been turned OFF.
In the example above, POTS line 1 is idle (as shown by the dash, -)while POTS lines 2 and 3 are in use (as shown by 2 carats, ^^).

Ethernet links status

A single letters appears immediately to the right of the POTS line status indicators. This letter shows the state of the HVDL system's 2 Ethernet links – the Ethernet link from the AMUX to the COT through the backplane of the HVDL shelf, and the Ethernet link from the RT to the end customer's computer(s).

An **N** indicates that only the near-end link (the link from the AMUX to the COT) is active.

An **F** indicates that only the far-end link (the link from the RT to the end customer's computer(s)) is active.

A **B** indicates that both the far-end and near-end links are active.

In the example above, both Ethernet links are active, as indicated by the **B** after the POTS line status indicator characters.

COT-to-RT “Ping”

The last number on the line is a ping indicator. This is not a true network ping. Rather this is simply a number that is exchanged between the COT and RT while they are in sync. This number should decrease with each line of output as long as the COT and RT are in sync. When the number decreases all the way to 00H, it will automatically “roll over” to 3FH and continue to decrease from there.

Approximately every 40 seconds, the COT displays a line such as:

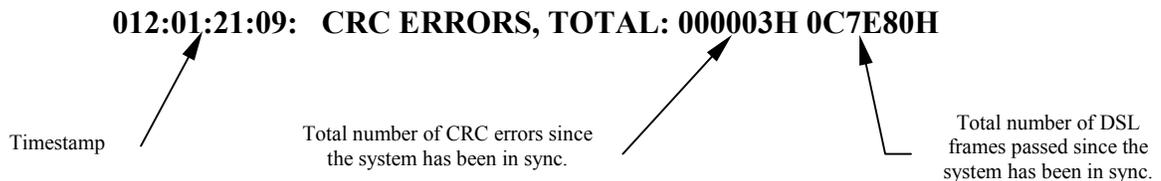


Figure 31 - Single COT Mode, CRC error line

This line shows how many CRC errors have been detected by the COT since it synchronized with the RT. It also shows the total number of DSL frames that have been exchanged between the COT and RT since the system synchronized. Ideally the number of CRC errors should be all zeroes – 000000H. The higher the CRC error count, the poorer the signal quality on the DSL line between the COT and RT.

Figure 32 - Single COT Mode, Single Node status line

Every 20 seconds or so the COT displays a line such as this.

006:13:57:21: * NODE, QUAL, CRC s: UP 1 0 0 *

Timestamp Node and link side indicator

This line shows the status of the HVDL system's nodes, such as repeaters and/or RTs. Each node in the HVDL system is numbered, with node 1 being closest to the COT. Furthermore, each node has an upstream side (the part of the DSL connection toward the COT) and a downstream side (the part of the DSL connection toward the RT).

The line above would be displayed for a single node HVDL system, such as the one shown in the figure below. The text "UP 1" refers to the upstream side of node 1. Since this HVDL system has only an RT and no repeaters, the RT is considered node 1.

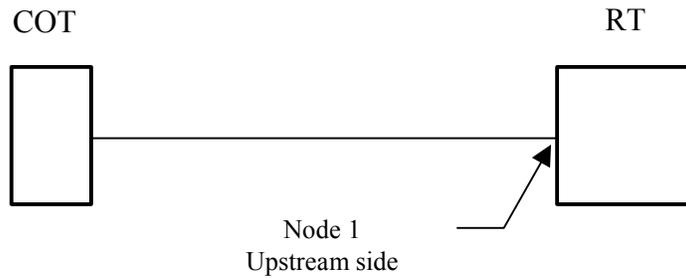


Figure 33 - 1 Node, RT only

In an HVDL system with a single repeater, as shown in Figure 33, the COT would display 3 lines similar to the 3 lines shown in Figure 34. The lines show **UP 1**, **DOWN 1**, and **UP 2**. This refers to the upstream side of node 1 (the repeater), the downstream side of node 1, and the upstream side of node 2 (the RT), respectively.

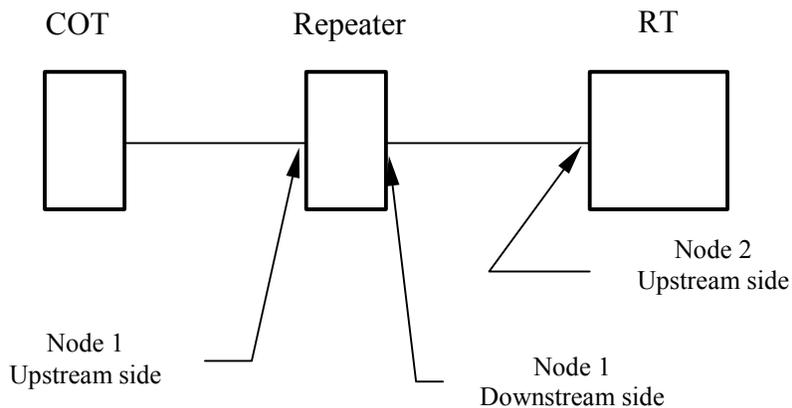


Figure 34 - 2 Nodes - 1 Repeater & 1 RT

```
006:13:57:21: * NODE, QUAL, CRC s: UP 1 0 0
006:13:57:22: * NODE, QUAL, CRC s: DOWN 1 0 0
006:13:57:23: * NODE, QUAL, CRC s: UP 2 0 0
```

Figure 35 - Single COT Mode, Multi Node status lines

12.2. Single COT Mode Menu Commands

The commands that are available when in Single COT Mode are shown in the table below.

HELP	Displays a list of available commands.
NO RESET	This is intended for factory diagnostics only. Use of this command is not recommended.
CRC COUNT [ON/OFF]	The COT displays a running total to CRC errors approximately every 40 seconds. This command turns the periodic display ON or OFF. For example, typing CRC COUNT OFF turns off the display of CRC errors. Typing CRC COUNT ON would resume displaying CRC errors.
QUAL STATUS [ON/OFF]	The COT displays status information approximately every second. This command turns the periodic display ON or OFF. For example, typing QUAL STATUS OFF turns off the display of the status lines that print approximately every second. Typing QUAL STATUS ON would resume displaying the status lines.
QUAL LED [ON/OFF]	This is intended for factory diagnostics only. Use of this command is not recommended.
QUAL LED AUTO	This is intended for factory diagnostics only. Use of this command is not recommended.
SYNC LED [ON/OFF]	This is intended for factory diagnostics only. Use of this command is not recommended.
INJECT CRC ERROR	This is intended for factory diagnostics only. Use of this command is not recommended.
DATA RATE	Display the current data rate at which the COT and RT are synchronized.
LAST ERROR	Display error codes for the last 3 times the COT lost synchronization with the RT.
VERSION	Display firmware revision levels for the COT.
BEGIN TEST	This is intended for factory diagnostics only. Use of this command is not recommended.

Table 6 - Single COT Mode Commands

12.3. Exiting Single COT Mode

To exit Single COT Mode, type **quit**. This ends Single COT Mode and resumes the management session. The Administrator or User is no longer communicating the a single COT, but is now communicating with the AMUX again.

The AMUX will also resume polling all COTs in the shelf as described in Section 8.3, *Slot Diagnostics*.

13. Glossary

AMUX	Access Multiplexer. A managed Ethernet switch designed to fit into a Charles Industries 300-mechanics HVDL shelf. The Access Multiplexer aggregates data from up to 17 HVDL systems into a single 100 Mbps Ethernet connection.
COT	Central Office Terminal A circuit pack installed at a central office or a remote office that multiplexes numerous POTS and/or data circuits onto a single copper pair. COTs can be placed in the same 300-mechanics shelf as an AMUX.
DDL	Digital Dual Line DDL is a pair-gain type system that provides 2 POTS lines to a customer premises using only a single copper pair. DDL consists of a Central Office Terminal (COT) and a Remote Terminal (RT).
Far-end link	The Far-end link is the Ethernet connection from an HVDL RT to the end customer's computer(s) or other piece of Ethernet capable equipment. (See also <i>Near-end link</i>)
HVDL	High-speed Voice & Data Line TM HVDL is a pair-gain type system that provides 3 POTS lines and (1) 10 Mbps Ethernet circuit to a customer premises using only a single copper pair. HVDL consists of a Central Office Terminal (COT), a Remote Terminal (RT), and optional repeaters.
kbps	kilobits per second A measure of bandwidth or data "speed".
MAC address	Media Access Control address A unique 6 octet (48 byte) address used by devices when communicating using Ethernet. The AMUX has a MAC address which is programmed at the factory.
Near-end link	The Near-end link is the Ethernet connection from an HVDL COT to the one of the HVDL Ethernet ports of the AMUX. (See also <i>Far-end link</i>)
NID	Network Interface Device A weather-proof enclosure, usually plastic, that houses electronics and is typically located at the customer premises. Some NIDs can be pole-mounted, while others are designed to be wall-mounted, as on the outside wall of a building.

POTS	Plain Old Telephone Service. Also commonly referred to as “dial tone”, this is an ordinary telephone line connection.
QuadPOTS	QuadPOTS is a pair-gain type system that provides 4 POTS lines to a customer premises using only a single copper pair. QuadPOTS consists of a Central Office Terminal (COT), a Remote Terminal (RT) at the customer premises, and an optional repeater.
RT	Remote Terminal A circuit pack housed in a NID that works in conjunction with a COT. The RT de-multiplexes multiple POTS and/or data circuits from a single copper pair. The RT is located at the customer premises.
Single COT Mode	A mode in which the network manager can interface directly with an individual COT. The AMUX acts as a “go-between”, passing messages from the network manager to the COT and vice versa.

14. Quick-Start Guide

This Quick-Start Guide is intended to assist in setting up the AMUX when it is first received from the factory.

Before the AMUX software will allow remote management via Telnet, the AMUX's network settings must be configured. These settings include an IP address, a Gateway address, and an appropriate subnet mask. These settings are dependent on the particular network configuration and should be provided by a network administrator. *Charles Industries cannot supply these network settings. They depend on the network in which the AMUX is installed.*

The network settings described above will not be needed if the AMUX will be managed via its front panel serial port.

Users of the Quick-Start Guide are assumed to have a working knowledge of Microsoft Windows™, the PC, and Ethernet.

Things you will need:

- ✓ AMUX card with serial cable (part number 03-900953-0)
- ✓ Charles Industries 300-mechanics HVDL Shelf (19" or 23")
- ✓ PC
- ✓ IP address for the AMUX, Subnet Mask, and Gateway Address (available from your network administrator), if the AMUX will be managed via Telnet.

Prior Set Up: If not already completed, install the shelf as recommended in the practice. Power up the PC and locate it near the shelf.

Quick-Start Procedure:

- ✓ **Unpack the AMUX:** Locate the serial cable. Connect the serial cable from the front of the AMUX to an empty serial port connector on the PC.
- ✓ **Establish Serial communications:** Using Hyperterminal (included in Windows: Start → Programs → Accessories → Communications → Hyperterminal) or another serial communication software, set the port to 9600 bits-per-second, 8 data bits, No Parity, 1 stop bit, and No Flow Control. Most computers use COM1, although any other available serial communications ports may be used as well. Proceed to communicate with the AMUX by pressing ENTER until the login prompt appears.
- ✓ **Login into the AMUX:** Login: admin Password: admin

The following steps show how to configure the AMUX's network settings. If the AMUX will be managed via its front panel serial port, and not via Telnet, then the network settings are not needed. To log out now, select option 7 (Log off).

- ✓ **Locate the Network Setting Screen:** Select option 5 (AMUX Management) and then option 1 (Network Settings)
- ✓ **Change the IP Address:** Select option 1 (IP Address) and enter the IP address of the AMUX.
- ✓ **Change the Subnet Mask:** Select option 2 (Subnet Mask) and enter the new Subnet Mask.
- ✓ **Change the Gateway Address:** Select option 3 (Gateway Address) and enter the new Gateway Address
- ✓ **Save the changes:** Select 's' and save the changes. All new addresses/subnet masks should be in the left column once the save is complete. Return to the main menu by selecting 'm'. Until the system is rebooted, the new settings are not available.
- ✓ **Reboot the AMUX:** Select option 2 (AMUX Diagnostics) and then option 2 (Reset AMUX). Answer 'y' (yes) to reset the AMUX.

The AMUX is now ready to work on your system. You may Telnet into AMUX (refer to the Telnet section) or continue work with the serial cable.

IMPORTANT: For security reasons, you should change the default passwords on the system immediately. Refer to the section on changing passwords.

