



Model 5100 Remote Administration Guide

The information in this document is current as of the following Hardware and Firmware revision levels. Some features may not be supported in earlier revisions. See www.ctc-control.com for the availability of firmware updates or contact CTC Technical Support.

Model Number	Hardware Revision	Firmware Revision
5101/5102/5103/5104	B, C, and E	4.05



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1.0 Introduction

This document introduces the remote administrative features of the 5100 controller. This includes both FTP and Telnet along with details on how to remotely re-flash any firmware within the controller. It is assumed that the user has read the *Model 5100 Script Language Guide (Document 951-510003)*, if not it is advised that this manual be kept handy since script commands are executed using Telnet. A general overview of the resident Flash Disk is also provided.

1.1 Remote Administration Features Overview

With the release of 5100 firmware revision 4.05 and above, a number of new features are available or have been enhanced. Most of these features are in the area of communications and remote administration. Those relevant to this manual are:

- **Flash Disk**
 - Structured support and storage for firmware flash updates
 - Quickstep program storage and dynamic loading.
 - Recipe storage
 - FTP and Telnet interface
 - Standard disk utilities
- **Script language**
 - Powerful commands to initialize registers, load datatables, programs, configure the system
 - Executable from within Quickstep
 - Executable from telnet and ftp command line
 - Executable at power up or reset
 - Executable from within other script files
- **Remote diagnostics and updates**
 - Remote firmware updates via ftp and telnet. All firmware field upgradeable.
 - Module firmware can be stored to flash disk for later updates.
 - Can determine contents of 5100 modules via telnet along with version info.
 - Low level logging and debug functions for CTC remote field support.

2.0 FTP and Telnet Connections

The 5100 controller supports remote connections for FTP and Telnet. These are both industry standard protocols available on most computer platforms. Dependent on firewall settings, these protocols can be used to access a 5100, virtually anywhere in the world.

2.1 FTP Interface

The File Transfer Protocol FTP is a significant Internet standard for file transfer. The current specification is contained in [RFC-959](#). The 5100 operates as an FTP Server,

implementing a sub-set of the standard for operation in a control environment, with a minimum file system. As detailed in Section 3.0, a flash disk is resident within the 5100. The primary means to transfer data to and from the 5100 is via FTP. You can download, delete, or transfer files to and from the controller and have the support of a directory architecture that resembles that found on typical computer systems.

2.1.1 Supported FTP Commands

The following FTP commands are supported by the 5100:

cd- Change to a different directory.

delete- Delete a file.

dir - Displays a directory and the amount of flash memory that is available, used up, or deleted.

get - Copies a file from the 5100 to a local directory on your computer.
Example: get filename.ext

ls - Lists files in the current directory. "ls -l" is equivalent to the "dir" command.

ls “!<cmd>” – Invoke a Script Language command.

mget - Copies multiple files from the 5100 to a local directory on your computer. Wild cards are limited to files with the same file extension. For example, “mget *.html” copies all .html files from the 5100’s directory to your local directory.

mkdir - Create a new directory inside the current 5100 directory.

mput - Copies multiple files to the 5100 from a local directory on your PC. Wild cards are limited to files with the same file extension. For example, mput*.html copies all .html files from your local directory to the 5100’s directory.

put - Copies a file from a local directory on your computer to the 5100.
Example: put filename.ext

pwd - Displays the current directory on the 5100.

quit - Quit the FTP session.

recv - This command functions the same as "get".

rmdir - Remove directory.

send - This command functions the same as "put" (only binary file transfers are supported).

2.1.2 Establishing FTP Connections

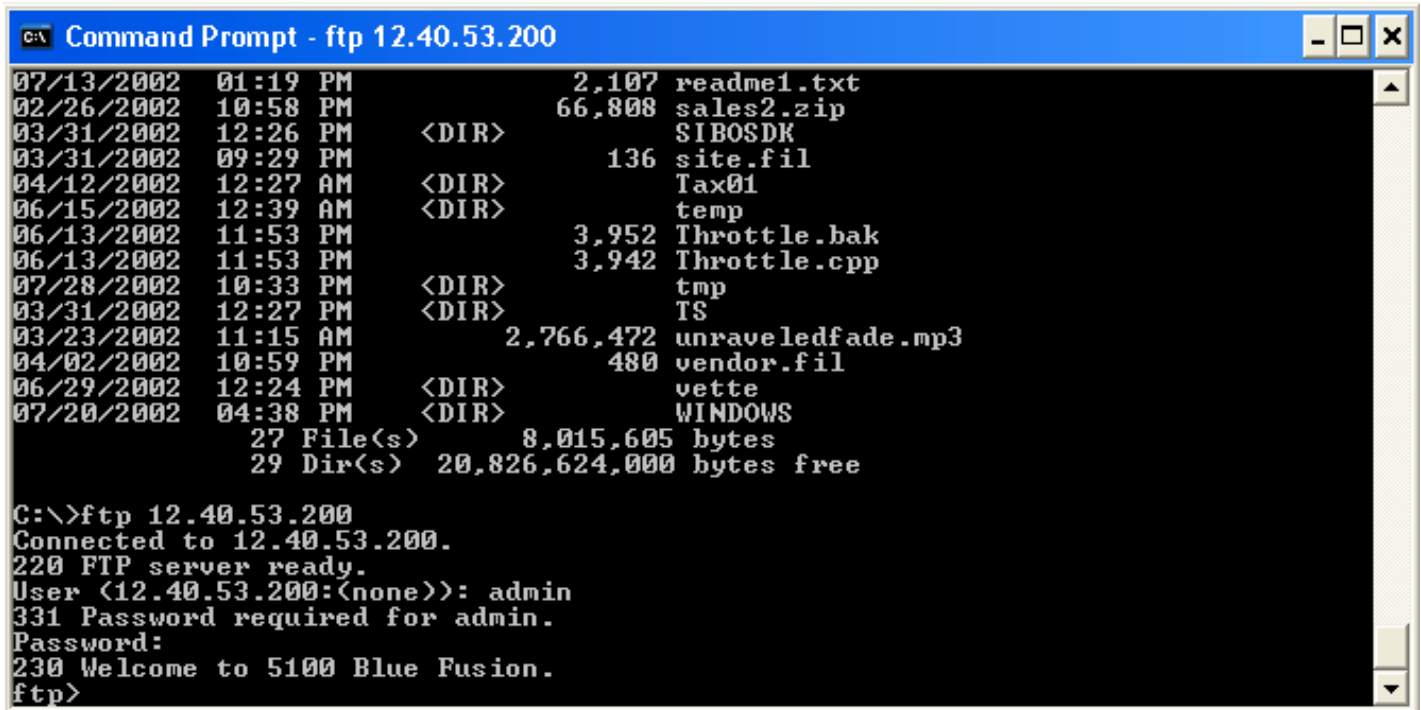
FTP is shipped standard with UNIX, Windows 2000 and XP products. On Windows systems it is typically invoked from the command line, although graphical interfaces are also available, including Internet Explorer. When invoked from the command line the user will be prompted for a user ID and a password. To start an FTP connection from the command line, simply type the following substituting the desired controller IP address for the sample given:

```
ftp 192.168.254.1
```

The user will then be prompted for a Username and Password. The default shipping ID/Password is admin/BlueFusion, as shown below (Script Language 'set password' command allows the changing of the password):

```
User: admin
Password: BlueFusion
```

Note that in most systems the password will not be echoed to the screen for security reasons. Failure to enter the proper User ID and Password will result in disconnection.



```

C:\>ftp 12.40.53.200
Connected to 12.40.53.200.
220 FTP server ready.
User (12.40.53.200:(none)): admin
331 Password required for admin.
Password:
230 Welcome to 5100 Blue Fusion.
ftp>
07/13/2002 01:19 PM      2,107  readme1.txt
02/26/2002 10:58 PM    66,808  sales2.zip
03/31/2002 12:26 PM      <DIR>    SIBOSDK
03/31/2002 09:29 PM      136     site.fil
04/12/2002 12:27 AM      <DIR>    Tax01
06/15/2002 12:39 AM      <DIR>    temp
06/13/2002 11:53 PM    3,952  Throttle.bak
06/13/2002 11:53 PM    3,942  Throttle.cpp
07/28/2002 10:33 PM      <DIR>    tmp
03/31/2002 12:27 PM      <DIR>    TS
03/23/2002 11:15 AM    2,766,472 unraveledfade.mp3
04/02/2002 10:59 PM      480     vendor.fil
06/29/2002 12:24 PM      <DIR>    vette
07/20/2002 04:38 PM      <DIR>    WINDOWS
      27 File(s)      8,015,605 bytes
      29 Dir(s)      20,826,624,000 bytes free

C:\>ftp 12.40.53.200
Connected to 12.40.53.200.
220 FTP server ready.
User (12.40.53.200:(none)): admin
331 Password required for admin.
Password:
230 Welcome to 5100 Blue Fusion.
ftp>

```

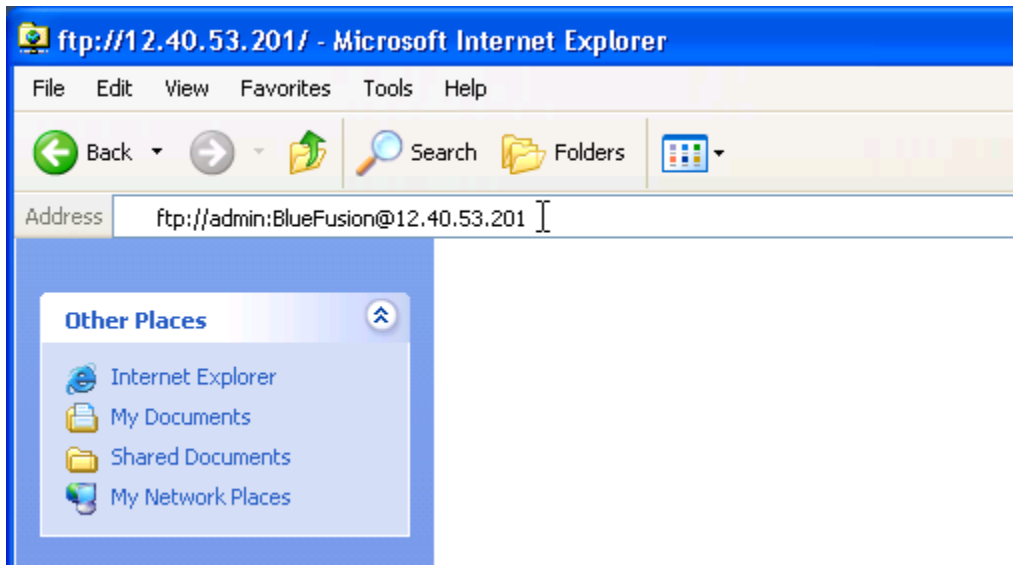
Figure 2.0: Typical FTP Windows command line session

FTP can also be run through Microsoft Internet Explorer. The url for an FTP connection to a Blue Fusion controller would be:

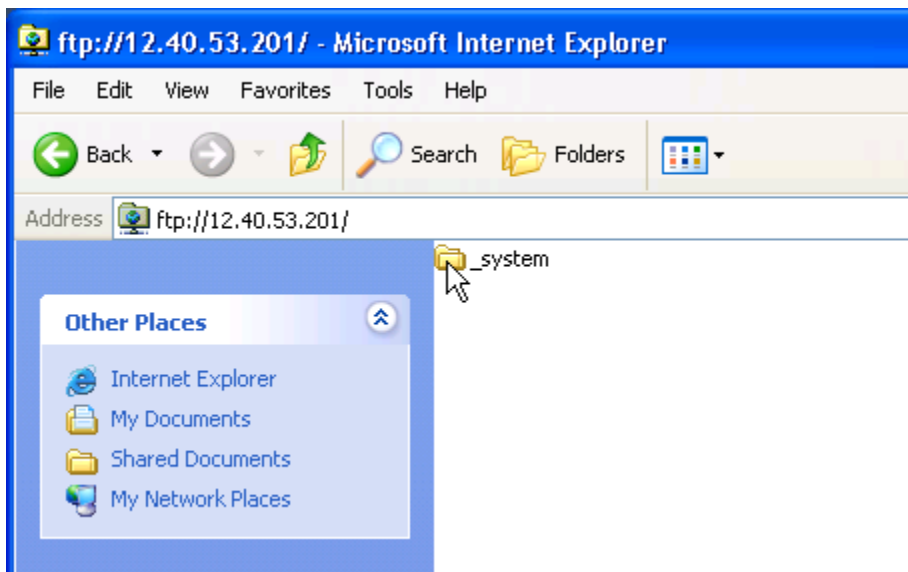
<ftp://userid:password@ipAddress>

Or as an example:

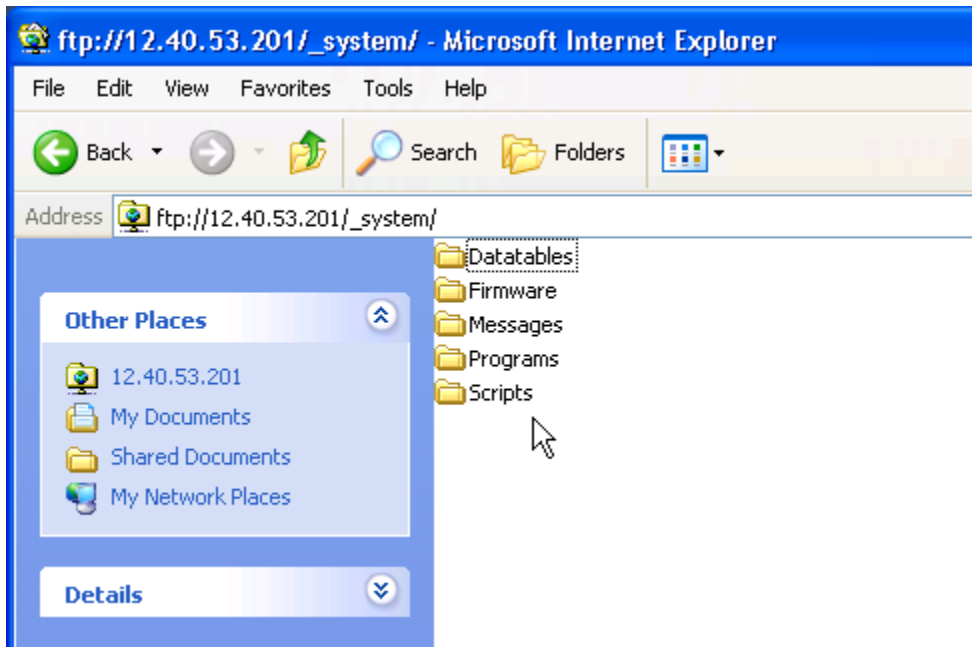
<ftp://admin:BlueFusion@12.40.53.201>



Hitting the Enter key would cause FTP access to the 5100:



Double clicking the _system folder would display the lower level folders:

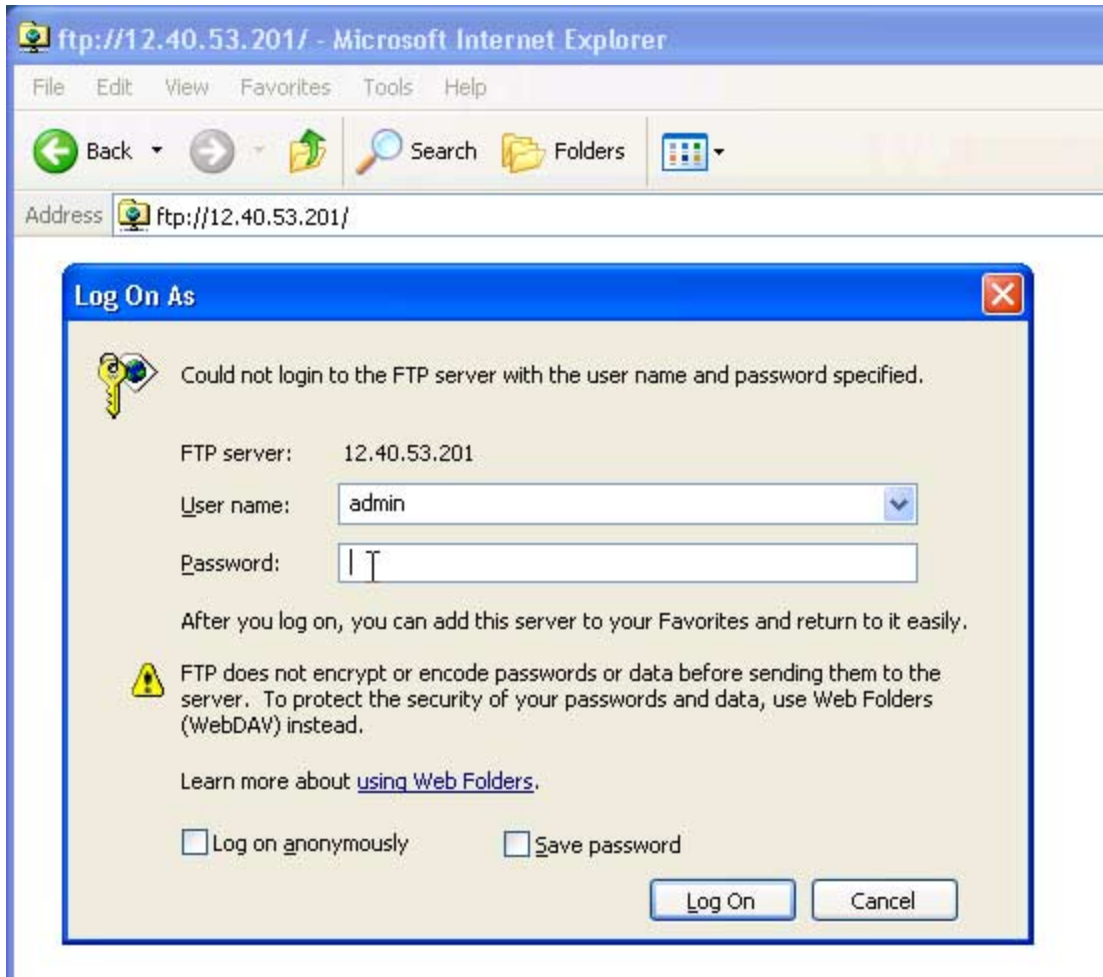


To protect your password, it may be best to only enter the user ID as the URL within Microsoft Internet Explorer. Anonymous logons are not accepted. An example using Windows XP appears below.

<ftp://userid@ipAddress>

or as an example:

<ftp://admin@12.40.53.201>



Once connected in Explorer, you can move through the controller's file system the same way as you can your local computer. To copy files from the PC to the controller or controller to the PC, simply drag and drop the file to the target folder. Note that if you drag and drop on top of a folder it goes into that folder. When directed to drag and drop things to the root directory that means on the white space beneath any listed directories, not on top of the _system directory.

2.2 Telnet Interface

The 5100 supports a full Telnet administrative interface. Telnet is a standard internet remote login application protocol (RFC-854) which is available on most computer platforms. A number of standard interfaces exist, both graphical and command line. Microsoft Windows products ship with a command line interface which can be invoked by typing telnet at a Command Prompt. Available commands may be displayed by typing help. Once invoked:

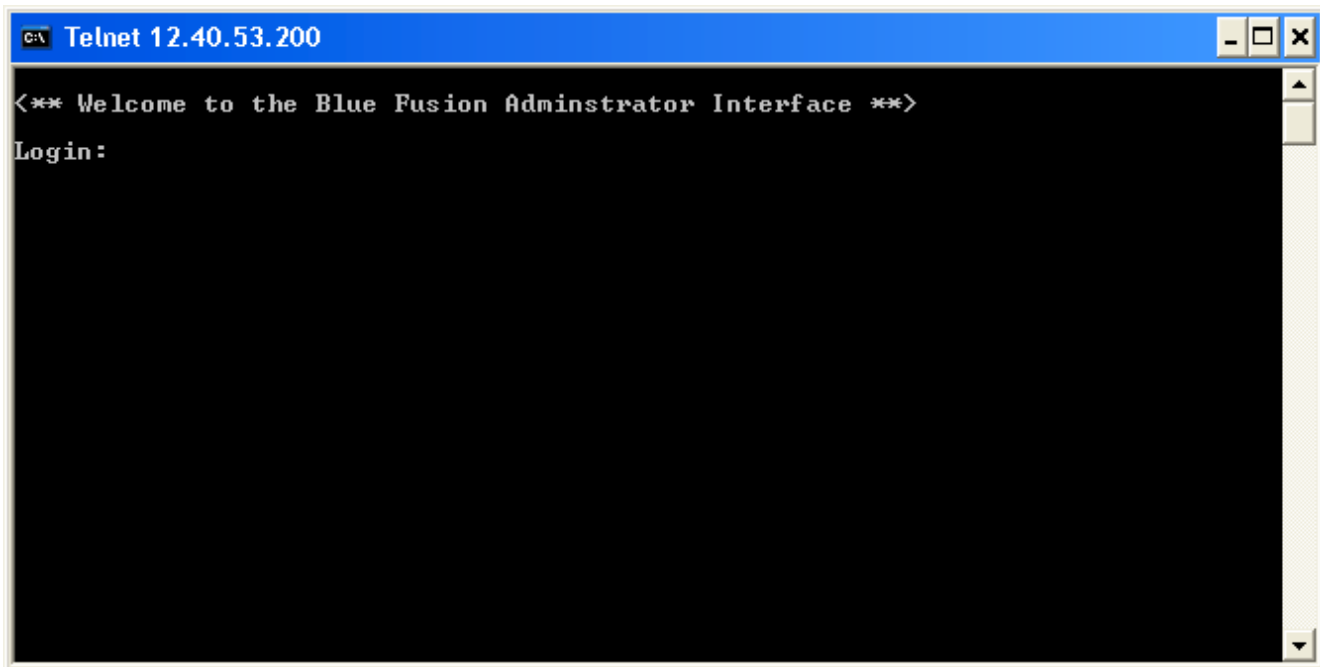


Figure 2.0: Windows telnet screen

Typically all that is required is typing “telnet” and the ip or dns name of the desired 5100 controller. For example “telnet 12.40.53.200”, a sample screen is shown below:

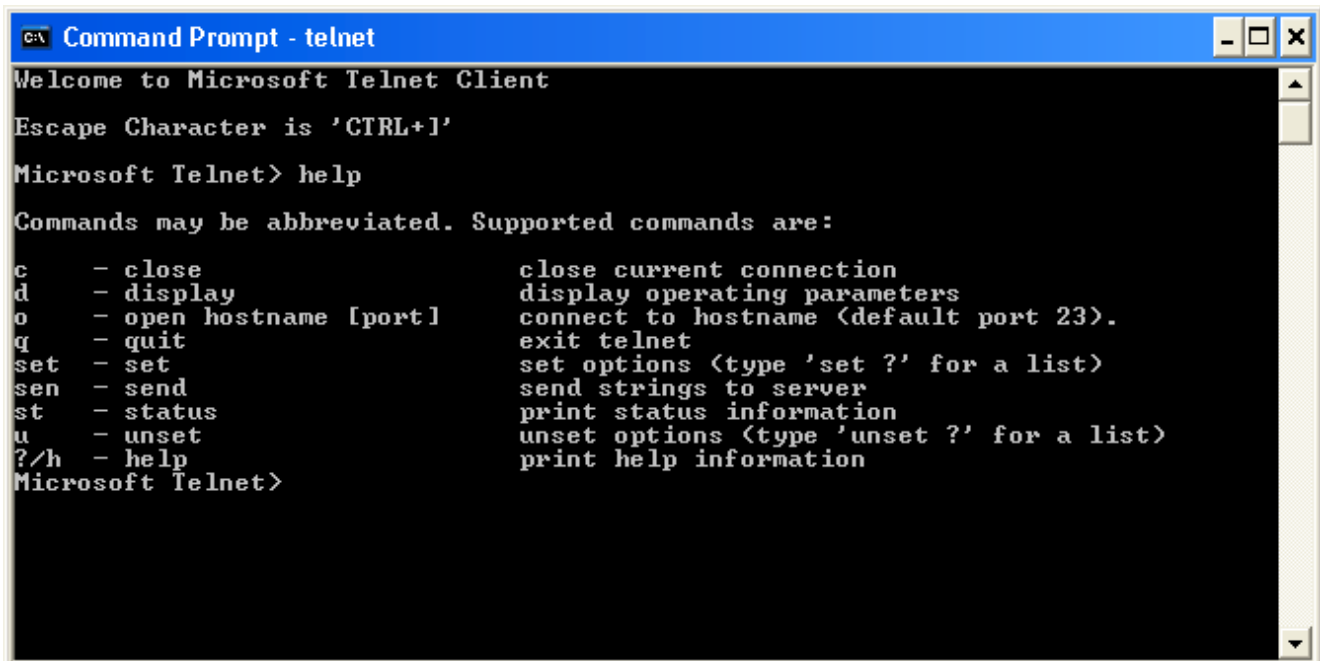


Figure 2.1: Telnet login screen for 5100 controller

Graphical Telnet programs are also available. One example is from MidaSoft another would be WS_FTP from Ipswitch (www.ipswitch.com), MidaSoft is:

<http://www.midasoft.com/koala98/trial1.htm>.

Once a telnet screen is invoked and User Login and Password (admin/BlueFusion as with FTP) sequence satisfied, numerous commands are available. These commands are detailed in the *5100 Script Language Guide*. Each Script Language command is also accepted within FTP (ls “!<cmd>”), Telnet, or as the contents of a script file. Below is the MidaSoft screen showing the “help” screen display:

```
set
*  datatable <filename>      -> Save datatable to /_system/Datatables/<filename>
date Tuesday, 12/6/2003 8:55:00 -> Set real time clock time/date (24hr)
*  password <password>      -> Set new password to restrict access
register <####> = <###> -> Set register values
Examples: set register 13002=0
          set register 13002-13006=0, 20000=5, 20005-20010=12
reset          -> Set Quickstep reset System state.
restart        -> Set Quickstep restart System state
running        -> Set Quickstep running System state
stop           -> Set Quickstep restart System state
throttles      -> Set comm. throttling to control performance
<#####>=<##>      -> same as 'set register'
update
    comm      -> Update 5102 Comm. processor /_system/Firmware/comm.bin
    sticks    -> Update all sticks to revision level in /_system/Firmware.
    5130      -> Update 5130 Analog stick with /_system/Firmware/5130.bin
    5140      -> Update 5140 Servo stick with /_system/Firmware/5140.sr
    5150      -> Update 5150 Servo stick with /_system/Firmware/5150.sr

(* = not implemented)
[quit or logout to exit telnet session]

BlueFusion/>
```

Figure 2.2: Telnet graphical screen displaying help commands for 5100 controller

```

12.40.53.200 - KoalaTerm 3.4 - [default.mkt : Connection to 12.40.53.200]
Connection Edit View Window Print Transfer

< ** Welcome to the Blue Fusion Administrator Interface ** >

Login: admin
Password: *****

BlueFusion/>help
< ** Blue Fusion Administrator Help Summary V1.10 ** >

[quit or logout to exit telnet session]

cd <directory>          -> Change directory to that specified ../. works to.
delete <filename>       -> Delete a file. <path/filename> also legal.
dir <opt. directory>    -> List all the files in the specified directory.
disable
    debugger            -> Disable debugger commands.
    safe                -> Allow Quickstep tasks to continue execution.
enable
    debugger            -> Enable debugger commands.
    safe                -> Halt Quickstep tasks when complete next step.
format flash            -> Erase flash disk, restoring full space
get
*  datatable <filename> -> Load dtable /_system/Datatables/<filename>
   date (get optional)  -> Display real time clock time/date
   register <####>      -> Read one or more registers
   register <####> > <filename> -> Read registers and write to output file
   Examples: get register 13002
               get register 13002-13006, 20000, 20005-20010 > script.ini
   status               -> Get current program state
   throttles            -> Display comm. throttle table
   versions             -> Display all firmware versions and stick info
<#####>               -> same as 'get register'
mkdir <directory>      -> Make a new directory.
pwd                    -> Display current directory path.
reset                  -> Reset the controller

```

Figure 2.3: Telnet graphical screen displaying help commands for 5100 controller, cont'd

As can be seen from above there is an extensive assortment of commands. The above does not include the low level debug functions available for advanced users, figure 2.4. Refer to the *5100 Script Language Guide (Document 951-510003)* for more information in this regard.

```

12.40.53.200 - KoalaTerm 3.4 - [default.mkt : Connection to 12.40.53.200]
Connection Edit View Window Print Transfer

BlueFusion/>help debug

< ** Diagnostic Functions ** >

list -> (1) Display all events
logmask <mask> (Set Event Log mask)
    Display and set the log mask value
        App(1000), Hw(1), Io(8), Tim(4)
        OS(2), Servo(20), Reg(200), Prof(100)
        Network(10), Protocol(40), Link(400)
L X -> Clear event log
os (Operating System)
    a -> all tasks
    c -> counters
    p -> pools
    m -> mutexes
    q -> queues
    s -> semaphores
    tn -> task n
    u -> memory Used

rtc (Real Time Clock)
    R (ad) -> Read at address
    W ((ad),dat) -> Write at address
    B ((ad),len) -> Block Read at address
    T -> Time (up to 1 minute)
    Z -> Reset Chip

memory (read/write memory)
    Enter address and length
    Add a D or d for decimal display
    Add a W or w for word access display

BlueFusion/>

```

Figure 2.4: Telnet graphical screen displaying low level debug commands

3.0 Flash Disk

A flash disk, with an approximate size of 900K bytes, is available for general use. The disk may be read or written during program operation, with write operations only causing a slight degradation in system performance. The disk appears much like that of your typical personal computer; in fact, many of the standard commands of

MSDOS™ are available for administration via telnet. Simplified administration can be done using a number of low cost shareware ftp programs, such as FTP Voyager, www.RhinoSoft.com. Below is a typical FTP session using a graphical representation. Internet Explorer may also be used (section 2.1.2) and files dragged and dropped as required from your desktop. The benefit of FTP Voyager is you can monitor what is actually occurring should problems occur.

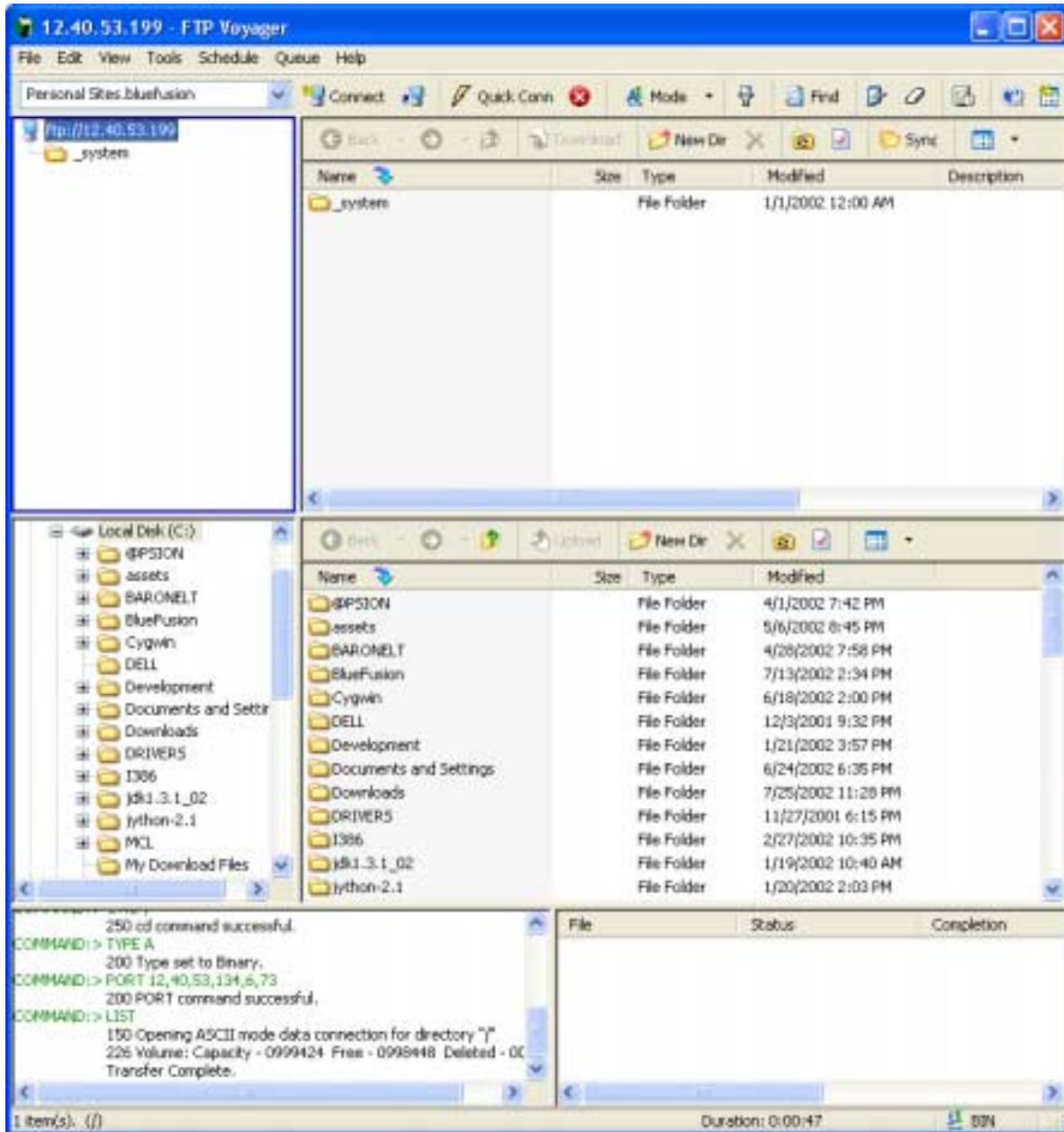


Figure 3.0: Typical FTP graphical session (FTP Voyager)

General usage and configuration is beyond the scope of this document but as a brief introduction, it functions much like typical PC Windows program where the top two window regions are for the remote 5100 device, the middle two are your local hard

disk, and the bottom two are for display only showing current operations, command status and file transfers. Typically the left window region (top two) is for directory tree information and the right two is for sub-directory and file operations, exactly like Windows Explorer.

The flash disk is made up of a reserved ‘_system’ directory created at the root of the drive; within this folder are a number of other subdirectories with special functionality.

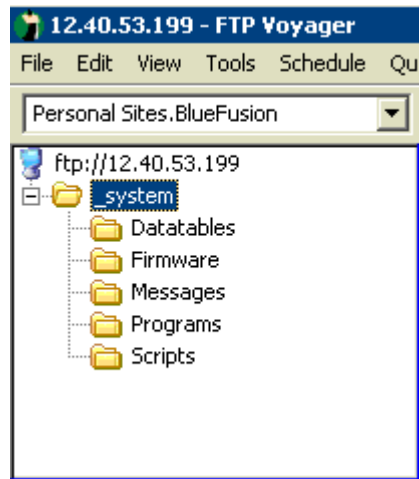


Figure 3.1: Graphical system directory representation

```
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for directory "/_system/"
drw-rw-rw- 1 owner group 000256 JAN 01 00:00 Databases
drw-rw-rw- 1 owner group 000000 JAN 01 00:00 Firmware
drw-rw-rw- 1 owner group 000000 JAN 01 00:00 Messages
drw-rw-rw- 1 owner group 000000 JAN 01 00:00 Programs
drw-rw-rw- 1 owner group 000000 JAN 01 00:00 Scripts
226 Volume: Capacity - 0999424 Free - 0998448 Deleted - 0000732
Transfer Complete.
```

Figure 3.2: Command line

Sub-Directories:

- *Databases* – All Quickstep loadable datatable images are required to be here.
- *Firmware* – All modules, monitor, and communications firmware that is to be loadable using the “update” command must be located here (see Section 4.0).
- *Messages* – The “message.ini” file, for formatted output messages must be stored here (refer to *5100 Script Language Guide* for details of its use).
- *Programs* – All Quickstep programs (.dso files) should be placed here if they are to be run from scripts or telnet commands using the “run program qsprog.dso” type command.
- *Scripts* – All system scripts, .ini files, except messages, should be placed in this sub-directory.

Disk administrative tasks can be generally done either via FTP or telnet, supporting the standard `dir`, `cd`, `mkdir`, `rmdir`, `delete`, and `type` commands. Directory references use the forward slash '/', like UNIX, not the backward slash like MSDOS™, in order to be compliant with standard ftp programs. Also note that all filenames are case sensitive and you are limited to 79 characters total for directory and filenames, combined.

When using the FTP graphical approach, right clicking the mouse on the relevant window typically allows you to create your own subdirectories, while dragging and dropping a file to a folder causes a transfer to occur and the file to be stored to the flash disk.

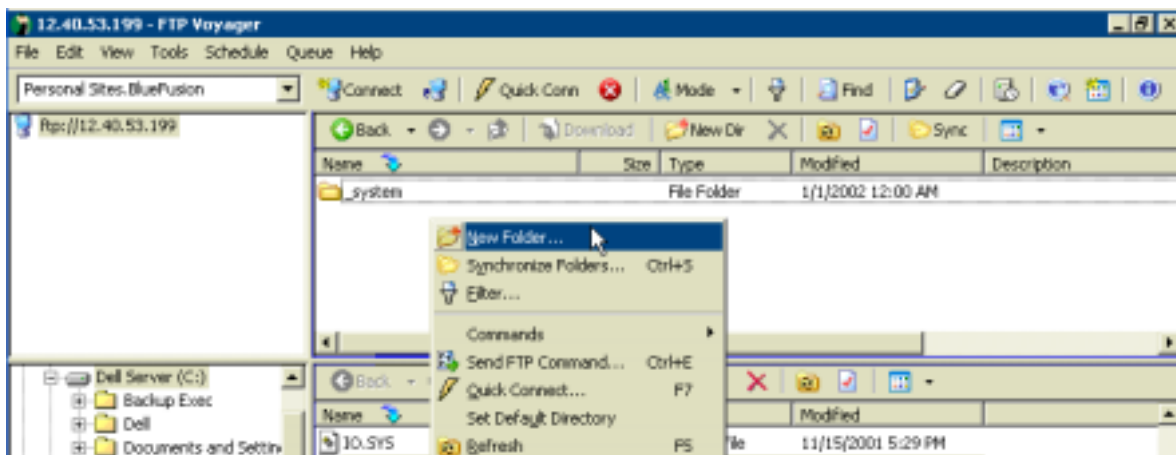


Figure 3.3: FTP graphical folder creation

The only exception to this is dragging and dropping either a firmware update or a Quickstep program (.dso, .sr, sr1, and .bin file extensions), to the root directory "/" will cause that file to be cached in dynamic ram instead of written to the flash disk and then immediately activated upon complete transfer. If it is a Quickstep program, the system will be stopped, the program loaded into non-volatile memory, and restarted with the new program, if a .sr, sr1, or .bin file the appropriate firmware update will be applied. Refer to the firmware update section for any special system resetting required since VBIAS is turned off during an update to ensure system safety. A telnet "reset" command must be initiated to reboot the system properly.

The flash disk must be periodically re-formatted if files are deleted a lot. This is because deleted files are marked as deleted but reclaiming their space and erasing flash is typically too time consuming in a real-time control environment. As such, the Telnet administrative session or a script file can be setup to execute the "format flash" command whenever needed. One nice thing of most graphical FTP programs is they allow for directory synchronization. This means if you keep a backup of your files at the PC you simply have to tell the software to synchronize the folders and all data will be restored after a format. The available disk space may be displayed at any time by using the "dir" command within a telnet or ftp session. The amount of space

consumed by deleted files will also be shown, refer to Figure 3.2, next to the last line where it referenced “Deleted 0000732”, this refers to 732 bytes currently wasted by deleted files.

As with anything that is flash based, the technology is limited to the number of write operations you can perform before it is no longer useable. Due to this limitation you should not perform continual writing to flash from within a program. It is really meant to be written to a limited number of times and read as often as you like. Even with this limitation, it is rather large, you typically have up to 100,000 erase cycles before you can expect errors to occur. This should be more than sufficient for any operation. Note that when transferring firmware updates and Quickstep files to the system root directory no flash write operations occur.

4.0 Firmware Updates and Version Control

All 5100 Firmware is field upgradeable via an Ethernet FTP connection. This typically consists of transferring either a binary (.bin) or S Record (.sr and .sr1) file to the controller. There are numerous different files available, each to update differing functionality and modules. Filenames used are created as follows and are case sensitive:

[base name] V [revision, #####].[file type extension]

Where ##### is the revision level of the firmware.

BF5100V#####.sr1 – Main Quickstep operating environment firmware, typically 1.5 meg S record file which can not be stored directly to the flash disk due to its large size. Place only in flash disk root directory for immediate update.

com5100V#####.bin – Main board communications controller firmware (Atmel), about 2K binary file.

5130V#####.bin – Analog Input Module firmware, about 3K binary file.

5131V#####.bin – Analog Input Module firmware, about 3K binary file.

5132V#####.bin – Analog Output Module firmware, about 3K binary file.

5140V#####.sr – Servo Module firmware, about 350K S Record file.

5150V#####.sr – Stepper Module firmware, about 350K S Record file.

mon5100V#####.sr – Main board CPU boot monitor file, rarely updated, about 100K S Record file.

File transfers to the root directory of the 5100 file system are temporarily stored in dynamic memory and then immediately begin re-flashing the appropriate module

(refer to Section 3.0). Small firmware files can be stored on the flash disk in the /_system/Firmware sub-directory to allow updating of modules via the telnet “update” script command, at any time. Quickstep programs are automatically stopped during re-flash operations and once all firmware is updated a “reset” command must be initiated to re-activate VBIAS and restart the application program.

Note: Upon initiating a firmware update the 5100 FAULT LED will provide the following visual feedback:

1. Flash once then turn off during the erase cycle.
2. Rapidly flash at different rates as blocks are programmed.
3. Flash 3 times at completion to signify the flash has been programmed correctly.

Once firmware has been updated and the unit reset, it is best to observe the current revision levels of firmware to confirm that the modules updated are operating properly. This can be done by issuing the telnet “get versions” script command.

As an example, the following shows the process of updating the 5100 main board communications controller chip with a file called “com5100V0109.bin”. There are two approaches. If you are near the unit you may simply invoke an FTP session and send the “com5100V0109.bin” file to the root directory:

```
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for directory "/"
drw-rw-rw-  1 owner group 000256 JAN 01 27:19 _system
226 Volume:  Capacity - 0999424  Free - 0996008  Deleted - 0000000.
ftp: 55 bytes received in 0.01Seconds 5.50Kbytes/sec.
ftp> send c:\5100\com5100V0109.bin
200 PORT command successful.
150 Opening Binary data connection for com5100V0109.bin Flash ROM loading.
226 Programming Complete.
ftp: 1236 bytes sent in 0.00Seconds 1236000.00Kbytes/sec.
ftp>
```

Figure 4.0: Sending com5100V0106.bin to root directory for re-flash via FTP

You will notice the FAULT LED rapidly flashing and then stopping. Although the controller is still functional it is typically recommended that either power be cycled or a reset command be initiated prior to use. From FTP this would be ls “!reset”. Note the double quotes are required and connection would be lost since the watchdog timer will force a reset.

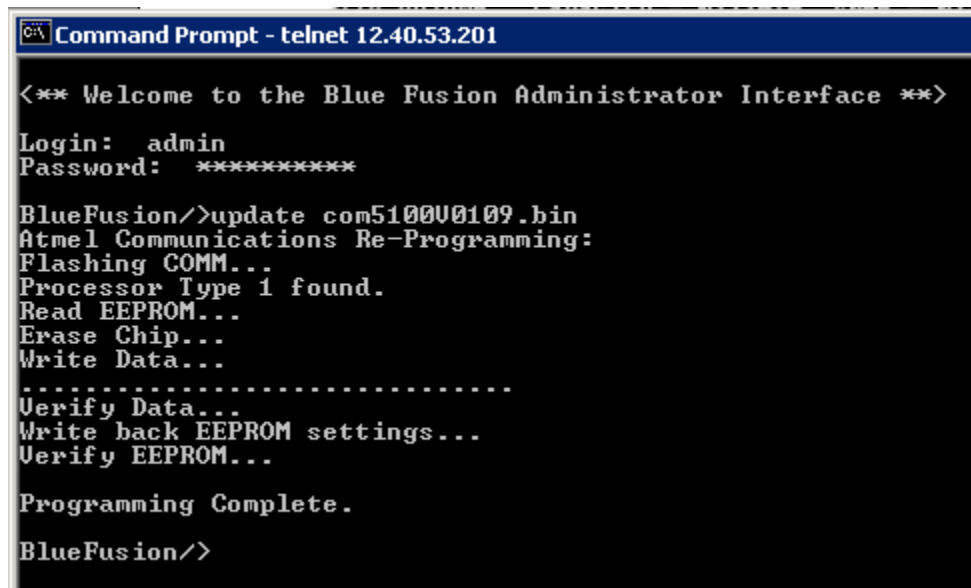
A better way to do an update is to have the “com5100V0109.bin” (or other image file) stored on the flash disk in the /_system/Firmware subdirectory. Then invoke Telnet and issue the ‘update’ command. In addition to the flashing FAULT LED you will get descriptive feedback during the re-flash process and if an error occurs it will be displayed.

First begin with storing the file to the `/_system/Firmware` directory. Using the graphical FTP interface is simply a drag and drop but the command line interface is shown below for more detailed information:

```
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for directory "/_system/Firmware/"
226 Volume: Capacity - 0999424 Free - 0997716 Deleted - 0000000.
ftp> send com5100V0109.bin
200 PORT command successful.
150 Opening Binary data connection for com5100V0109.bin
226 Transfer complete.
ftp: 1236 bytes sent in 0.00Seconds 1236000.00Kbytes/sec.
ftp> dir
200 PORT command successful.
150 Opening ASCII mode data connection for directory "/_system/Firmware/"
-rw-rw-rw- 1 owner group 001236 MAR 04 00:25 com5100V0109.bin
226 Volume: Capacity - 0999424 Free - 0996008 Deleted - 0000000.
ftp: 64 bytes received in 0.01Seconds 6.40Kbytes/sec.
ftp>
```

Figure 4.1: Transferring com5100V0106.bin to `/_system/Firmware` directory

Now invoke a Telnet session and run the ‘update com5100V01096.bin’ command:



```

C:\> telnet 12.40.53.201

<*** Welcome to the Blue Fusion Administrator Interface ***>
Login: admin
Password: *****

BlueFusion/>update com5100V0109.bin
Atmel Communications Re-Programming:
Flashing COMM...
Processor Type 1 found.
Read EEPROM...
Erase Chip...
Write Data...
.....
Verify Data...
Write back EEPROM settings...
Verify EEPROM...

Programming Complete.

BlueFusion/>
```

Figure 4.2: Updating com5100V0106.bin from Telnet

Note that there will be a several second delay after the “Programming Complete” message and the return of the “BlueFusion>” prompt, this is normal and your FAULT LED may flash 3 times during this period. Now re-flash any other firmware you desire, and then enter the ‘reset’ command, which will cause your connection to be dropped since the unit is essentially rebooted.

When re-flashing the main program, “BF5100V#####.sr1”, the process is the same as depicted in figure 4.0. You simply connect to the 5100 via ftp, don’t change directories and issue the command “send BF5100V#####.sr1”; this assumes the file

exists in the directory where you invoked ftp. The file will be transmitted to dynamic ram with the normal Quickstep program running in the background. Once properly loaded the Quickstep program will be halted and you will see LED 2 flicker for about 20 seconds as the file integrity is confirmed, then off for several seconds, flash once, delay, then flash rapidly while re-programming the unit. **DO NOT POWER OFF** during this time period. After about 40 seconds the rapid flashing will stop and the controller will reset itself, in about 5 seconds the program will restart automatically and you will be back online and operational. No power cycling is needed. Should you loose power during reprogramming or not be able to proceed, refer to the *5100 Bootloader Installation Guide (Document 951-510005)*.

Note: Anytime that firmware is replaced within the controller a backup of the flash disk and any resident Quickstep program should be made, if it does not already exist elsewhere. Although loss is unlikely, it is still possible should power failure occur.