

MoteConfig User's Manual

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About This Document

The following annotations have been used to provide additional information.

◀ NOTE

Note provides additional information about the topic.

☑ EXAMPLE

Examples are given throughout the manual to help the reader understand the terminology.

▷ IMPORTANT

This symbol defines items that have significant meaning to the user

●^{**} WARNING

The user should pay particular attention to this symbol. It means there is a chance that physical harm could happen to either the person or the equipment.

The following paragraph heading formatting is used in this manual:

1 Heading 1

1.1 Heading 2

1.1.1 Heading 3

This document also uses different body text fonts (listed in Table 0-1) to help you distinguish between names of files, commands to be typed, and output coming from the computer.

Font Type	Usage
Courier New Normal	Sample code and screen output
Courier New Bold	Commands to be typed by the user
Times New Roman Italic	TinyOS files names, directory names
Franklin Medium Condensed	Text labels in GUIs

Table 0-1. Font types used in this document.

1 Introduction

1.1 MoteConfig

MoteConfig is a Windows-based GUI utility for programming Motes. This utility provides an interface for configuring and downloading pre-compiled *XMesh*/TinyOS firmware applications onto Motes. MoteConfig allows the user to configure the Mote ID, Group ID, RF channel and RF power. The user can also enable the over-the-air-programming feature present on all *XMesh* - based firmware. High-power and low-power *XMesh* applications are available for each sensor board and platform manufactured by Crossbow as part of the MoteView install (see section 2.3).

MICAz Mote (MPR2400 and MPR2600)			
Board Model	Binary file name		
	MTS boards		
MTS101	XMTS101_2420_ <mode>.exe</mode>		
MTS300CA	XMTS300CA_2420_ <mode>.exe</mode>		
MTS300CB	XMTS300CB_2420_ <mode>.exe</mode>		
MTS310CA	XMTS310CA_2420_ <mode>.exe</mode>		
MTS310CB	XMTS310CB_2420_ <mode>.exe</mode>		
MTS400	XMTS400_2420_ <mode>.exe</mode>		
MTS410	XMTS410_2420_ <mode>.exe</mode>		
MTS420	XMTS420_2420_hp.exe		
MTS450	XMTS450_2420_ <mode>.exe</mode>		
	MDA board		
MDA100CA	XMDA100CA_2420_ <mode>.exe</mode>		
MDA100CB	XMDA100CB_2420_ <mode>.exe</mode>		
XBW-DA100CA	XBW-DA100CA_2420_hp.exe		
XBW-DA100CB	XBW-DA100CB_2420_hp.exe		
MDA300	XMDA300_2420_ <mode>.exe</mode>		
MDA300 (precision)	XMDA300p_2420_ <mode>.exe</mode>		
MDA320	XMDA320_2420_ <mode>.exe</mode>		
XBW-DA325	XBW-DA325_2420_ <mode>.exe</mode>		
Base Stat	ion (common to all boards)		
XMeshl	XMeshBase_2420_ <mode>.exe</mode>		

Table 1-1. Pre-compiled MICAz XMesh applications

<mode> = hp or lp.

hp = high power mesh networking. lp = low-power mesh networking via low-power listening and time synchronized data transmissions.

MICA2 Mote (MPR4x0, $x = 0, 1, or 2 and MPR600$)			
Board Model	Binary file name		
MTS boards			
MTS101	XMTS101_xxx_ <mode>.exe</mode>		
MTS300CA	XMTS300CA_xxx_ <mode>.exe</mode>		
MTS300CB	XMTS300CB_xxx_ <mode>.exe</mode>		
MTS310CA	XMTS310CA_xxx_ <mode>.exe</mode>		
MTS310CB	XMTS310CB_xxx_ <mode>.exe</mode>		
MTS400	XMTS400_xxx_ <mode>.exe</mode>		
MTS410	XMTS410_xxx_ <mode>.exe</mode>		
MTS420	XMTS420_xxx_ <mode>.exe</mode>		
MTS450	XMTS450_xxx_ <mode>.exe</mode>		
MDA board			
MDA100CA	XMDA100CA_xxx_ <mode>.exe</mode>		
MDA100CB	XMDA100CB_xxx_ <mode>.exe</mode>		
MDA300	XMDA300_xxx_ <mode>.exe</mode>		
MDA300 (precision)	XMDA300p_xxx_ <mode>.exe</mode>		
MDA320	XMDA320_xxx_ <mode>.exe</mode>		
Base Statio	n (common to all boards)		
XMeshBase_xxx_ <mode>.exe</mode>			

Table 1-2. Pre-compiled MICA2 XMesh Applications

xxx = 315, 433, or 915. <mode> = hp or lp. hp = high power mesh networking. lp = low-power mesh networking via low-power listening and time synchronized data transmissions.

	Table 1-3.	Pre-compiled	MICA2DOT	XMesh	Applications
--	------------	---------------------	----------	-------	--------------

MICA2DOT Mote (MPR5x0, x = 0, 1, or 2)			
Board Model Binary file name			
MTS boards			
MTS510 XMTS510_xxx_ <mode>.exe</mode>			
MDA boards			
MDA500 XMDA500_xxx_ <mode>.exe</mode>			
Base Station (common to all boards)			
XMeshBase_Dot_xxx_ <mode>.exe</mode>			

xxx = 315, 433, or 915. <mode> = hp or lp. hp = high power mesh networking. lp = low-power mesh networking via low-power listening and time synchronized data transmissions.

Table 1-4. Pre-compiled MSP XMesh applications

MSP410 Mote Security Package			
MSP410 Module	XMSP410_433_hp.exe		
MSP410 Base Station	XMeshBase_433_hp.exe		

MEP410 Mote Environmental Package			
MEP410 module	MEP410_433_ <mode>.exe</mode>		
MEP510 Mote Environmental Package			
MEP510 module	MEP510_433_ <mode>.exe</mode>		
Base Station (common to both modules) XMeshBase_433_ <mode>.exe</mode>			

|--|

<mode> = hp or lp. hp = high power mesh networking. lp = low power mesh networking via low-power listening and time synchronized data transmissions.

1.2 Over – The – Air – Programming (OTAP)

The Over-The-Air-Programming (*OTAP*) feature allows users to reprogram a *Mote* over a wireless link. *OTAP* allows one or more *Motes* in the *XMesh* network to receive new firmware images from *XServe* (via the *XOtap* service).



Figure 1-1: XOTAP Architecture

Each *Mote* has a 512kB external non-volatile flash divided into 4 slots. These slots have a default size of 128 kB. Slot 0 is reserved for the OTAP image. Slots 1, 2 and 3 can be used for user-specified firmware.

During the *OTAP* process, the server sends a command to the Mote to reboot into the *OTAP* image (slot 0). A user-specified firmware image is broken up into fragments and transmitted to the Mote and stored into Slot 1, 2 or 3. The server can send a message to transfer the newly uploaded firmware into the program flash and reboot the *Mote*.

The following components are required for OTAP to work:

- XServe and XOtap running on the server
- Firmware applications that include the *XOTAPLiteM* component (this is automatically included when the firmware is built with *XMesh*)
- The Mote needs to have pre-configured with a bootloader in the program flash, and the OTAP image in slot 0 of the external flash. Both of these conditions are met by selecting OTAP enable during the MoteConfig download process outlined in Section 4.

2 Installation

2.1 Supported Platforms

MoteConfig is supported on the following operating systems:

- Windows XP Home
- Window XP Professional
- Windows 2000 with SP4

2.2 PC Interface Port Requirements

The gateway platform used in the base station determines the PC interface port required by *MoteConfig*.

- 1. For a **MIB510** serial gateway: an RS-232 serial port.
- 2. For a **MIB520** USB gateway: a USB port.
- 3. For a **MIB600** Ethernet gateway: A wired Ethernet or 802.11 wireless card (if the MIB600 is on a LAN with wireless access).
- 4. For a **Stargate** server: A wired Ethernet, an 802.11 wireless card (if the Stargate has a wireless modem or is on a LAN with wireless access), or a cellular modem for wireless Internet access.

2.3 Installation Steps

MoteConfig is shipped as a component of *MoteView* and *MoteWorks*:

- 1. *MoteConfig* is automatically installed with the *MoteView* installer. Refer to the *MoteView Users Manual* for additional details.
- 2. *MoteConfig* is an optional component in the *MoteWorks* installer. Make sure that MoteConfig 2.0 and OTAP item is selected as shown in Figure 2-1.

😥 Setup - MoteWorks	
Select MoteWorks Components Which components should be installed?	
Select the components you want to install; clear the corr install. Click Next when you are ready to continue.	ponents you do not want to
Full installation	•
 	478.7 MB 🔺 6.7 MB
✓ Graphviz 2.6 ✓ XSniffer	6.2 MB 1.7 MB
✓ TortoiseLVS 1.8.22 ✓ PuTTY Utilities ✓ Viutikkeren 2.4.5	15.8 MB
Wirlweige 2.4.6 MoteConfig 2.0 and OTAP Microsoft NET Framework	17.3 MB
Current selection requires at least 653.7 MB of disk space	e.
< <u>B</u> ack	: <u>N</u> ext > Cancel

Figure 2-1: MoteConfig 2.0 and OTAP – MoteWorks Installer

3 Starting MoteConfig

If *MoteConfig* was installed using the *MoteView* installer, use the following steps:

- Open *MoteView1.4C* by either clicking on the shortcut located on the Desktop, or by going to *Start* > *Programs* > *Crossbow* > *MoteView* 1.4*C*.
- Press the Program Mote button ()) on the *MoteView* toolbar to spawn the *MoteConfig* GUI as shown in Figure 3-1

MoteConfig File Settings Help Local Program Remote Program	X
Select File to be Uploaded: Platform Type Radio Band MHz Addresses MOTE ID GROUP ID 100 Hex Radio RF Power RF Channel MHz Read Fuses Clear Text View Details	Select. Type Route Update: Sec Packet Size Bytes Payload Size Bytes Program OTAP Enable Stop
Crossbow Inc. 2006 Device: mib5	10; Port: com1

Figure 3-1: MoteConfig Application GUI

If MoteConfig was installed using the MoteWorks installer

- Click on the shortcut located on the Desktop, or select *Start* > *Programs* > *Crossbow* > *MoteConfig* 2.0.

4 Local Programming

The Local Program tab is used to upload firmware onto the Motes via a gateway.

IMPORTANT: To program motes correctly, set up the hardware as follows:

- 1. The gateway should be powered and connected to the PC via a serial, USB or Ethernet port.
- 2. If using the MIB510, the SW2 switch should be in the "OFF" position.
- 3. The motes should be firmly attached to the gateway.
- 4. The motes should be turned off before the programming.

4.1 Settings

Click on *Settings* > *Interface Board*... to select the correct gateway and port settings. Figure 4-1 shows the Interface Board Settings for a **MIB510** on COM 1.

🔌 Interface Board Settings	×
Parameters • MIB510 Serial Port: COM: 1 57600 C MIB520's First Serial Port	
C MIB600 Host localhost 10001 10002	
Apply	

Figure 4-1: MIB510 Gateway Settings

The MIB520 virtual COM port drivers will install two sequential ports on the PC. The lownumbered port is used for programming and the high-numbered port is used for communication. Figure 4-2 shows the Interface Board Settings for a **MIB520** that has created COM 6 and 7 on the PC. In this example, COM 6 must be selected as the serial port.

🚿 Interface Board Settings	×
Parameters	
C MIB510 Serial Port:	
© MIB520's First Serial Port	
C MIB600 Host localhost 10001 Comm	
Apply	

Figure 4-2: MIB520 Gateway Settings

♦ NOTE: The **MIB520** requires the installation of the *FTDI FT2232C* drivers. Once these drivers are installed, the **Device Manager** (**Start > Control Panel > System > Hardware**) will display the **MIB520** as two new virtual com ports. Refer to the *MPR-MIB Series User's Manual* for details.

Figure 4-3 shows the Interface Board Settings for a **MIB600** on the same LAN as the PC with an assigned IP address of 10.1.1.99.

🔞 Interface Board Settings		×
Parameters		
C MIB510 Serial Port: COM: 6	€ 57600 €	
MIB600 Host 10.1.1.99	Prog Comm 10001 10002	
Apply	Close	

Figure 4-3: MIB600 Gateway Settings

♦ NOTE: The IP address of the **MIB600** can be identified by using the *Lantronix DeviceInstaller* application. Refer to the *MPR-MIB Series User's Manual* for details.

4.2 Programming

The pre-compiled XMesh applications installed with MoteView are located in C > ProgramFiles > Crossbow > MoteView > XMesh.

Press the Select button to open a file browser as shown in Figure 4-4. Navigate to the folder that corresponds to your Mote processor/radio board, radio frequency (for MICA2 and MICA2DOT) and sensor board type.



Figure 4-4: File Browser for selecting XMesh applications.

Low-power and high-power applications have been included for most sensor boards.

Note that the MEP and MSP node firmware is located in separate named folders.

■ **NOTE:** The base station Mote must be programmed with *XMeshBase_xxx_<mode>.exe* and a node ID of 0.

After an application has been selected, the binary scan feature built into *MoteConfig* will display the default parameters programmed into the application (see Figure 4-5).

Ø MoteConfig	_ 🗆 🗙
File Settings Help	
Local Program Remote Program	
Select File to be Uploaded:	
C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMeshBase_903_hp.exe	Select
Platform XMesh	
Type Mica2 Radio Band 916 MHz Type XMESH2 HP	-
Addresses	
MOTE ID U 🛨 🗌 Hex 🗌 Auto Inc 🛛 Route Update: 36	Sec
GROUP ID 100 🛫 🔽 Hex Backet Size 55	Butes
Radio	bytes
RF Power 255 S dBm Payload Size 48	Bytes
RF Channel CHANNEL_00 💌 903.018 MHz	
Read Fuses Clear Text View Details Program OTAP Enab	ole Stop
Platform: 1 Node ID: 1	
Group ID: 125 Bracket Size: E5	
Base Station: 1	
XMesh Power: 144	
XMesh Flags: N/A	
XMesh Route Update: 36000	
RF Power: 255	-
Crossbow Inc. 2006 Platform: Mica2 Device: mib510; Port: com1	

Figure 4-5: Binary Scan Result of an XMeshBase application

These default parameters can be overwritten by the user by specifying the desired MOTE ID, GROUP ID, RF Power, and RF Channel.

■ **NOTE:** Remote nodes must be programmed with a non-zero Mote ID.

Press the **Program** button to download the selected firmware and configuration into the mote, as shown in Figure 4-6.

When programming is complete, the "Upload SUCCESSFUL!" message is printed in the status box as shown in Figure 4-7.

The Stop button can be used to cancel a firmware download in progress.

Ø MoteConfig	× □_	×		
File Settings Help				
Local Program Remote Program				
Select File to be Uploaded:		_		
C:\Program Files\Crossbow\MoteView\xmesh\mica2\X	XMeshBase 903 hp.exe Select.			
Platform	C Mesh	٦		
Type Mica2 Radio Band 916	6 MHZ Type XMESH2 HP			
	Auto Inc Houte Update: 36 Sec			
GROUP ID 100 🛨 🗖 Hex	55			
Radio	Packet Size 199 Bytes			
RF Power 255 🗾 5	dBm Payload Size Ao Bytes			
RF Channel CHANNEL_00 903.0	3.018 MHz			
Read Fuses Clear Text View Details	Program CTAP Enable Stop			
\xmesh\mica2\XMeshBase_903_hp.exe.out.srec				
Setting fuse using mib510 uisp -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128wr_fuse_h=0xd9wr_fuse_l=0xffwr_fuse_e=0xff				
Erasing binary using mib510 uisp -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128erase				
installing binary using mib510 uisp -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128upload if="C:\Program Files\Crossbow\MoteView\xmesh\mica2 \XMeshBase_903_hp.exe.out.srec'				
Crossbow Inc. 2006 Platform: Mica2	Device: mib510; Port: com1	1.		

Figure 4-6: MoteConfig programming in progress

Ø MoteConfig	
File Settings Help	
Local Program Remote Program	
Select File to be Uploaded:	
C:\Program Files\Crossbow\Mote\View\xmesh\mica2\903MHZ\XMeshBas	e\XMeshBase_903_hp.exe Select
-Platform	-XMesh
Type Mica2 Radio Band 916 MHz	Type XMESH2 HP
Addresses	
MOTE ID U 🕂 I Hex I Auto Inc	Route Update: 36 Sec
GROUP ID 100 🛨 🗖 Hex	Proket Size 55 Puter
Radio	Packet Size i Dytes
RF Power 255 T p dBm	Payload Size 48 Bytes
RF Channel CHANNEL_00 V 903.018 MHz	
Read Fuses Clear Text View Details	Program CTAP Enable Stop
Setting fung uping mih 520	_
uisp -dprog=mib510 -dserial=/dev/ttyS11 -dpart=ATmega128wr_fuse_h=0xc	19wr_fuse_l=0xffwr_fuse_e=0xff
Erasing binary using mib520	
uisp -dprog=mib510 -dserial=/dev/ttyS11 -dpart=ATmega128erase	
installing binary using mib520	
uisp -dprog=mib510 -dserial=/dev/ttyS11 -dpart=ATmega128 -upload if="C:\F \903MHZ\XMeshBase\XMeshBase 903 hp.exe.out.srec"	<pre>'rogram Files\Crossbow\MoteView\xmesh\mica2</pre>
Uploading SUCCESSFUL!	
Crossbow Inc. 2006 Platform: Mica2 Device: mib520;	Port: com12

Figure 4-7: MoteConfig programming successful

The table below describes the advanced options available in the *MoteConfig* GUI.

Table 4-1. Advanced Options

Advanced Options	Description		
Hex	Enables users to specify the ID as a hexadecimal value		
Auto Inc	Increments the mote ID by 1 after a mote has been programmed		
OTAP Enable	Allows users to enable a mote for OTAP (refer to section 5)		

4.3 Fuse Settings

MoteConfig allows users to overwrite the default fuse settings of the *ATmega128* processor. The fuses are an internal set of software switches within the *ATmega128* that enable certain functions.

Select *Settings* > *Fuse Defaults*... to open the dialog box shown in Figure 4-8. Check Override default fuse settings to modify the available fuse options. These options are:

Fuse Settings	_ 🗆 🗵
✓ Override default fuse settings	
JTAG fuse on	
External oscillator on	Apply
Disable bootloader	<u>C</u> ancel

Figure 4-8: Fuse Settings Dialog

- JTAG fuse on activates the JTAG debug mode for the *ATmega128*. When enabled, the processor draws an additional current of 3 mA. By default, this fuse is turned off for all *XMesh* apps.
- External oscillator on forces the firmware app to use an external oscillator for its timer. When enabled, the processor draws more current. By default, this fuse is disabled for low power *XMesh* apps and enabled for high power *XMesh* apps.
- Disable bootloader will prevent the *Mote* from executing the boot loader code on reboot. By default, the bootloader is enabled for *XMesh* apps to provide *OTAP* functionality.

4.4 Address and Radio Defaults

The default behavior associated with setting the Group ID, RF Power and RF Channel for each node can be changed from the Address and Radio Defaults dialog shown in Figure 4-9. This can be opened be selecting *Settings > Address and Radio Defaults* ...



Figure 4-9: Address and Radio Defaults Dialog

When a new firmware application is **selected**, the default values for the Group ID, RF Power and RF Channel will:

- remain unchanged (from the previous settings)
- be replaced by values read from the firmware application (using the firmware scan)

5 Remote / Over-The-Air-Programming (OTAP)

The Over-The-Air-Programming (*OTAP*) feature allows users to reprogram a *Mote* over a wireless channel. *OTAP* allows one or more *Motes* in the *XMesh* network to receive new firmware images from *XServe* (via the *XOtap* service).

■ **NOTE:** *OTAP* is currently available only when the Motes are programmed with a high power firmware application(i.e. XMTS310CB_433_hp.exe).

5.1 **OTAP Preparation**

Before *Motes* can be programmed over the air, they must be prepared by enabling the bootloader and loading the OTAP image into slot 0. This procedure is outlined in the following steps:

1. From *Settings>Interface Board* ... select the appropriate interface board and specify the correct COM port number.

🔌 Interface Board Settings	×
Parameters MIB510 Serial Port: COM:1 ÷ 57600 • MIB520's First Serial Port 57600 •	
C MIB600 Host localhost T0001 T0002	
Apply	

Figure 5-1: Selecting Interface Board Settings

2. Switch to the Local Program tab and click Select to browse to an *XMesh* application. Choose the appropriate MOTE ID, GROUP ID, RF Power, and RF Channel. Make sure that the OTAP Enable box is checked. Click on Program.

Ø MoteConfig			
File Settings Help			
Local Program Remote Program			
Select File to be Uploaded: C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMTS310CA_903_F	p.exe Select.		
Platform Type Mica2 Radio Band 916 MHz	XMesh Type XMESH2 HP		
Addresses MOTE ID 3 🛨 🗖 Hex 🗖 Auto Inc	Route Update: 36 Sec		
GROUP ID 100	Packet Size 36 Bytes		
RF Power 255 Image: Second se	Payload Size 29 Bytes		
Read Fuses Clear Text View Details	Program CTAP Enable Stop		
Begin scan F:\CrossBow\wireless\app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe Node ID set as 3 Group ID set as 100 UARTO Baud set as 57600 XMesh Health Update set as 60 ms CC1000 Channel set as 916MHz band CHANNEL_00 channel			
CC1000 TX Power set as 255 Converting F:\CrossBow\wireless\app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe.out to F:\CrossBow\wireless \app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe.sred			
Crossbow Inc. 2006 Platform: Mica2 Device: mib510;	Port: com1		

Figure 5-2: Programming the OTAP - enabled XMTS310CA application

- 3. Repeat Step 2 for all the nodes in the network. When the bootloader has successfully installed, the LEDs will count up twice when the node is switched "on".
- 4. Program the base station Mote with the *XMeshBase* application and set Node ID to 0. For the base firmware the **OTAP Enable** box should be unchecked.

Ø MoteConfig				_ 🗆 🗙
File Settings Help				
Local Program Remote Program				
Select File to be Uploaded:				
C:\Program Files\Crossbow\MoteView\xmesh\mica2\XM	MeshBase 903 hp.e	exe		Select.
		C.R.J. 1		
Flatform Tupe Mice2 Badio Band 916		XMesh		
		Туре	XMESH2 HP	
MOTE ID 0 📑 🗖 Hex	🗖 Auto Inc	Route Upda	ate: 36	Sec
GROUP ID 100 🕂 🗖 Hex			,	
Badio		Packet Size	, 55	Bytes
RF Power 255 💌 5	dBm	Pauload Siz	e 40	Butes
RF Channel CHANNEL_00 903.0)18 _{MHz}	r dylodd ola	° j48	Dytes
Read Fuses Clear Text View Details		Program	🔲 OTAP Enable	Stop
\xmesh\mica2\XMeshBase_903_hp.exe.out.srec				
Setting fuse using mib510 uisp=-dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128wr_fuse_h=0xd9wr_fuse_l=0xffwr_fuse_e=0xff				
Erasing binary using mib510 uisp-dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128erase				
installing binary using mib510 uisp -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128upload if="C:\Program Files\Crossbow\MoteView\xmesh\mica2 \XMeshBase_903_hp.exe.out.srec"				
Crossbow Inc. 2006 Platform: Mica2	Device: mib510; P	Port: com1		

Figure 5-3: Programming the XMeshBase application onto the base station.

5.2 Over-the-Air-Programming

Once all the *Motes* are OTAP-enabled, use the following procedure to program them over a wireless link.

▲ IMPORTANT: Please make sure that the Mote battery power is above 2.7V before starting the OTAP procedure.

- 1. Connect the base node to the PC interface board and turn on the remote nodes that were prepared as shown in section 5.1.
- 2. Switch to the Remote Program tab.
- 3. Click on the Search button to start up *XServe* and listen for remote nodes. The *Motes* found within the network will be displayed in the tree-view control as shown in Figure 5-4.

🚿 MoteConfig				_ 🗆 X
File Settings Help				
Local Program Remote Prog	iram			
Operation: Select File to be Programm	ed:	<u>S</u> elect.	Option: Check Base HeartBeat Check Operation Timeout	
Select Nodes (e.g.: 1,4-7,1	1,12-17):	Select Slot:	🗖 Ready 📃 F	reparing
			Programming 🛛 F	{ebooting
<u>S</u> earch	Prepare Q	iery <u>P</u> rogram	<u>R</u> eboot	<u>S</u> top
	Searching ne Xserve:Conn	twork ected to XServel		
Crossbow Inc. 2006		Device: mib510; Port: com1	Search:00:00:12	

Figure 5-4: Searching for nodes within the mesh network.

◀ **NOTE:** The base node will periodically blink with a magenta background. This indicates that heartbeat packets sent by the base firmware are being received by the PC. This verifies that the base station has been correctly configured.

4. The Motes can now be rebooted to the OTAP image (OtapGold.exe) by selecting nodes from the tree-view control and pressing the Prepare button. Nodes can also be selected by entering their ID's into the Select Nodes textbox. During this process, the Prepare button will be disabled and the selected node will turn blue.

♦ NOTE: The node ID's entered in the Select Nodes textbox override the node selection in the tree-view control.

When the nodes have rebooted into the OTAP image, their background color will turn gold as shown in Figure 5-5.

Ø MoteConfig				_ 🗆 🗙
File Settings Help				
Local Program Remote Program				
Operation:			Option:	
Select File to be Programmed:		1	Check Base Hea	artBeat
C:\Program Files\Crossbow\MoteView1.4.	20\xmesh\mica2\XMD	<u>S</u> elect	Check Operation	n Timeout
Select Nodes (e.g.: 1,4-7,11,12-17):		Select Slot:	🗌 Ready	Preparing
1.2		2 💌	🔲 Programming	Rebooting
<u>S</u> earch <u>Prepare</u>	Query	<u>P</u> rogram	<u>R</u> eboot	<u>S</u> top
	Finished: 2 motes succi Node 2 is ready to Que Node 1 is ready to Que Node 2 is ready to Que Node 1 is ready to Que Node 2 is ready to Que Node 1 is ready to Que Segin scan C:\Program 903_hp.exe XMesh protocol found. Converting C:\Program _hp.exe to C:\Program _hp.exe.ihex Process completed.	essful, 0 motes failed y,Program or Reboot, y,Program or Reboot, y,Program or Reboot, y,Program or Reboot, y,Program or Reboot, y,Program or Reboot, y,Program or Reboot, Files\Crossbow\Mote Files\Crossbow\Mote	eView1.4.20\xmesh\mic View1.4.20\xmesh\mica View1.4.20\xmesh\mica	a2\XMDA100CB_ a2\XMDA100CB_903 a2\XMDA100CB_903 v2\XMDA100CB_903
Crossbow Inc. 2006	Device:	mib510; Port: com1		11.

Figure 5-5: Nodes are running the OTAP image.

- 5. When the nodes are running the OTAP image,
 - a) The Query button allows users to see the available slots and their contents on each Mote as shown in Figure 5-6.

Ø MoteConfig				_ 🗆 ×
File Settings Help				
Local Program Remote Program				
Operation:			Option:	
Select File to be Programmed:			🔽 Check Base He	artBeat
		<u>S</u> elect	Check Operatio	n Timeout
Select Nodes (e.g.: 1,4-7,11,12-17):		Select Slot:	Ready	Preparing
1.2		•	Programming	Rebooting
Search Prepare	Query	<u>P</u> rogram	<u>R</u> eboot	<u>S</u> top
	Options: cmd = query sf = localhost: group id = 12: debug = 1 html report file motes = 1 2 Mote 1 (mica2),time sind Image flas 0 0/ 1 64 2 ***** Mote 2 (mica2),time sind Image flas 0 0/ 1 64 2 *****	9001 9 e = xotap.html h[start/stop] size 15 / 80 empty*** empty*** ereboot: 1.1 min, vol h[start/stop] size 15 / 80 empty***	tage: 3.0, boot image: 1 checksum 29773 1ce8 31109 faf2 tage: 3.1, boot image: 1 checksum 29773 49bb 31109 afa1	Type bootable bootable D Type bootable bootable
Crossbow Inc. 2006	Device:	mib510; Port: com1		

Figure 5-6: Nodes being queried for information.

- b) The Program button can be used to load firmware images into a selected slot on one or more selected nodes using the following procedure
 - 1. Select the firmware application, as shown in Figure 5-7
 - 2. Specify the slot to store the firmware application
 - 3. Choose the nodes by checking the nodes in the tree-view or by entering the node ID's in the Select Nodes textbox
 - 4. Press Program

◀ **IMPORTANT:** If nodes are specified in the Select Nodes textbox, the OTAP operations will only occur on these nodes; the nodes checked on the tree-view will be ignored. The Select Nodes textbox is an advanced feature and should be used with care.

🖗 MoteConfig				
File Settings Help				
Local Program Remote Program				
Operation:		-	Option:	
Select File to be Programmed:			Check Base He	artBeat
C:\Program Files\Crossbow\MoteView1.4.2	20\xmesh\mica2\XMD	<u>S</u> elect	Check Operation	n Timeout
Select Nodes (e.g.: 1,4-7,11,12-17):		Select Slot:	🗌 Ready	Preparing
1-2		2 💌	Programming	Rebooting
<u>S</u> earch <u>Prepare</u>	<u>Q</u> uery	<u>P</u> rogram	<u>R</u> eboot	<u>S</u> top
Finished: 2 motes successful, 0 motes failed Node 2 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program or Reboot. Node 2 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program or Reboot. Node 2 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program or Reboot. Node 2 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program or Reboot. Node 2 is ready to Query,Program or Reboot. Node 1 is ready to Query,Program Files\Crossbow\MoteView1.4.20\x				

Figure 5-7: Select an application for programming

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During the OTAP process, the color of the selected nodes will turn orange as shown in Figure 5-8 and the status message area will display how the number of pages downloaded into the external flash. When the selected nodes have been successfully programmed, the node will turn gold once again.



Figure 5-8: Programming the nodes in the network via XOTAP

Open the Process Messages window (by clicking on *File > View Process Details...*) to trace all downloading steps as shown in Figure 5-9.

Process Messages	<u>×</u>
Starting download	
Page 1, mote 1: 128 fragments, throttle = 30 msec	
Page 1, mote 1: 29 fragments, throttle = 35 msec	
Page 1, mote 1: 6 fragments, throttle = 40 msec	
Page 1, mote 1: 0 fragments, throttle = 40 msec	
Page 1, mote 2: 0 fragments, throttle = 40 msec	
Page 1 finished	
Page 2, mote 1: 128 fragments, throttle = 40 msec	
Page 2, mote 1: 29 fragments, throttle = 45 msec	
Page 2, mote 1: 4 fragments, throttle = 50 msec	
Page 2, mote 1: 1 fragments, throttle = 50 msec	
Page 2, mote 1: 0 fragments, throttle = 50 msec	
Page 2, mote 2: 0 fragments, throttle = 50 msec	
Page 2 finished	
Page 3, mote 1: 128 fragments, throttle = 50 msec	
Page 3, mote 1: 2 fragments, throttle = 50 msec	
Page 3, mote 1: 0 fragments, throttle = 50 msec	
Page 3, mote 2: 0 fragments, throttle = 50 msec	
Page 3 finished	_
-	•

Figure 5-9: Trace all downloading steps

- 6. The final step is to **reboot** into a newly loaded image:
 - 1. Select the nodes to reboot
 - 2. Specify which slot to boot into
 - 3. Press reboot

MoteConfig File Settings Help Local Program Remote Program				_D×
Operation: Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.;	20\xmesh\mica2\XMD	Select.	Option: Check Base Heat Check Operation	artBeat n Timeout
Select Nodes (e.g.: 1,4-7,11,12-17):		Select Slot:	Ready Programming	 Preparing Rebooting
Search Prepare		Program	<u>R</u> eboot	Stop
	Node 1 is ready to Que Node 2 is ready to Que Node 1 is ready to Que xotap.exe -sf localhost: Options: cmd = boot sf = localhost group id = 12 debug = 1 html report fill image id = 2 motes = 1 2 Rebooting mote 1 from Rebooting mote 2 from	y,Program or Reboot, ry,Program or Reboot, ry,Program or Reboot, ry,Program or Reboot, ry,Program or Reboot, ry,Program or Reboot, 9001 -i 2 -p 1 2 :9001 9 = xotap.html n slot 2.Please wait for n slot 2.Please wait for	r the mote to turn greer r the mote to turn greer	
Crossbow Inc. 2006	Devices	mib510; Port: com1		

Figure 5-10: Rebooting the nodes into slot 2

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The selected nodes will turn green (as shown in Figure 5-11) when they have successfully rebooted, re-joined the wireless mesh and sent health packets to *Xserve*. The nodes will now be executing the newly uploaded firmware application.



Figure 5-11: Nodes have rebooted and joined the mesh

5.3 Advanced Options

Advanced Options	Description
Check Base Heartbeat	The application will display a warning message if the <i>XMeshBase</i> heartbeat packet is not received. This notifies the user that there is a problem with the base station hardware configuration, firmware, power or connectivity to the PC. This feature is enabled by default. The user can specify the timeout value in <i>Settings</i> > <i>OTAP Timeout</i> > <i>Base response timeout.</i>
Check Operation Timeout	The application will detect the time elapsed by each OTAP operation and warn the user if an operation takes too long. If a timeout occurs, Xserve will shut down. This feature is disabled by default. The user can specify the timeout values in <i>Settings</i> > <i>OTAP Timeout</i>

Click *Settings* > *OTAP Timeout*... to open the Set Timeout dialog shown in Figure 5-12. The default values were derived by testing with a small network of about 30 nodes. If your mesh network contains more than 30 nodes, please reset the relevant values or leave the timeout check disabled.

Set Time Out	×
BASE response Timeout:	30 🕂 s
Searching Timeout:	120 📑 s
Preparing Timeout:	180 📑 s
Querying Timeout:	30 🕂 s
Programming Timeout:	360 📑 s
Rebooting Timeout:	360 🔹 s
Apply Cancel	Set Default

Figure 5-12: OTAP timeout settings

To enable or disable the base heartbeat timeout or OTAP operation timeout, use the checkboxes located on the **Remote Program** tab of the *MoteConfig* application.

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