

# PMB5010 Multimedia Controller User Manual



Version: 1.0.4 April 2006

#### **Table of Contents**

I.	Intro	oduction	2
1.1	1.	PMB5010 Multimedia Controller Architecture	2
1.2	2.	PMB5010 Connectors and Jumpers	3
11.	Оре	rations	З
II.	.1.	PMB5010 Power Supplies	3
II.	.2.	PMB5010 Jumper Settings	4
II.	.3.	PMB5010 System Communication Connections	4
II.	.4.	Peripheral Modules Supported by PMB5010	5
II.	.5.	PMB5010 Peripheral Module Connections	5
III.	Proc	edure to upgrade the PMB5010 firmware	7

#### **Related Document:**

WiRobot SDK API Reference Manual



# I. Introduction

The PMB5010 Robot Multimedia Controller can be used as audio, video and wireless communication processing unit for various robotic applications. Its onboard firmware makes the low level function modules such wireless communication module transparent to the users. A host (e.g. PC, DSP, or processor) will be used to communicate and control the PMS5005 for different applications through the UART (serial) interface. The system can help robotic and AI researchers and developers focus on the high level logic and algorithm designs, and avoid the hassle of writing low level device drivers, standard control schemes and troubleshooting the electronic circuits. The ease of use, powerful functionality and onboard intelligence can eliminate design risk, streamline hardware and software development, and significantly shorten the time to delivery while effectively reducing the cost. Typical applications include humanoid robot, legged robot, wheel-based robot, robot head and intelligent home device.

## I.1. PMB5010 Multimedia Controller Architecture

The PMB5010 offers multimedia functionalities that are required by most intelligent robotic applications. Figure I.1 shows the system blocks of the PMB5010.

The key features and capabilities are:

- 120MIPS 16-bit fix-point DSP
- 1M x 16-bit words flash
- Up to 256K x 16-bit words SRAM
- Build-in
  - o Real-time clock
  - o Full duplex UART (x2)
- Embedded firmware for image capturing, audio recording and playback, and wired and wireless communication
- Interfaces to
  - MAC5310 Audio codec and amplifier module (x1)
  - o MCI3908 CMOS image sensor module (352 x 288) (x1)
  - MCB3100 or MCB3101 Serial Bluetooth wireless module, or WFS802b WiFi 802.11 serial module, or MCR3210 RS232 interface module (x1)



Figure I.1 Block Diagram of the PMB5010



# I.2. PMB5010 Connectors and Jumpers

Figure I.2 shows the function and location of the connectors and jumpers on the PMB5010.



Figure I.2 PMB5010 Connectors and Jumpers

# II. Operations

The PMB5010 Robot Multimedia Controller is designed to be running as part of the WiRobot system. The hardware preparation when using PMB5010 is just simply connecting the relevant peripheral modules to the relevant connectors on the PMB5010 board and setting the proper jumper configurations. Lower device-level operations are handled by the firmware embedded in PMS5010 controller. High level programs running on PC or other processors are virtually communicating with the PMB5010 firmware using either WiRobot SDK Component and supplied WiRobot Gateway program or packet-level commands. Please refer to the WiRobot SDK API Reference Manual for using WiRobot SDK and WiRobot Communication Protocol for using packet-level commands.

#### II.1. PMB5010 Power Supplies

Up to two power supplies can be connected to the PMB5010 board supporting board system circuits (System Power Supply) and Parallel Expansion Module (Expansion Power Supply) (reserved) respectively. These power supplies can be connected to the board either through the screw terminals or the power jacks. Near each screw terminal, there are two connector ports for connecting power switches or emergency buttons. By default, these two ports are connectors together. If the power switches are needed, you could place a switch for each connector port.

Power	Power	Screw	Switch	Voltage	Current
-------	-------	-------	--------	---------	---------



Supply	Jack	Terminals	Connector	Range (V)	Capacity (mA)
System	JTI	PDMT	SW1	5.5 – 7.0	500
Expansion	JT5	PSYT	SW2	5.0 – 7.2	System Specific

### II.2. PMB5010 Jumper Settings

The board address can be set to any value between 0 and 15. Please refer to the Table II.2 for the setting values.

Bit	Pin	Value 1	Value O
O (LSB)	1, 2	open	1-2 short
1	3, 4	open	3-4 short
2	5, 6	open	5-6 short
3 (MSB)	7, 8	open	7-8 short

Table II.2 Board Address Jumpers B\_ADDR

#### II.3. PMB5010 System Communication Connections

Under the WiRobot system architecture, all the controllers are connected in a chain. There is one and only one host serving as the central controller. All other embedded controllers have at least two SCI ports for the system communications: upper-reach port and lower-reach port, with the direction respect to the central controller.

The system communication connection structure of the PMS5010 in the WiRobot RDK is shown in Figure II.1. PMB5010 can work solely in the WiRobot system or together with a WiRobot Sensing and Motion controller PMS5005.



Figure II.1 WiRobot System Communication Architecture



The system communication connectors on the PMB5010 are described in Table II.3. Refer to Section II.5 for the definitions of the signals attached to the connector BLUETOOTHT and SCIT.

Connector	Туре	Description
BLUETOOTHT	Upper Reach	SCI port with handshaking and control signals for both wired and wireless modules
SCIT	Lower Reach	Two-wire serial communication interface

Table II.3 System Communication Connectors

## II.4. Peripheral Modules Supported by PMB5010

Table II.4 lists the WiRobot peripheral modules that can be directly connected to the PMB5010 board and supported by the firmware embedded in PMB5010. Refer to the relevant user manuals of these peripheral modules for the detailed technical information.

Sub-module	Connector	Max No.	Description
MCB3100 / MCB3101	BLUETOOTHT	1	Bluetooth wireless communication module
MCR3210	BLUETOOTHT	1	RS232 interface module
WF5802b	BLUETOOTHT	1	WiFi 802.11 Serial Module
MAC5310	CODECO	1	Audio codec and amplifier module, which can be used to connect to microphone and speaker
MCI3908	IMAGE	1	CIF CMOS image sensor module

Table II.4 Sub-modules Supported by PMB5010

#### II.5. PMB5010 Peripheral Module Connections

The definitions of the connector signals of the power supplies and the PMB5010 peripheral modules are listed in the following tables.

Power Connection	Power Jack JT1, JT2	Screw Terminal PDMT, PSYT
Positive Power Source	Center	1
Power Supply Ground	Circle	2

Table II.5 Connections of the Power Jacks and Terminals

Table II.6	Upper Reach (	Communication	Port BLUETOOTHT
------------	---------------	---------------	-----------------

Pin	Name	Signal Description
1	VCC	+3.3 V
2	RXD	Data receiving
З	TXD	Data transmitting
ц	RTS	Request to send
5	CTS	Clear to send
6	GND	Power supply ground
7	COMRST	Reserved



8	BTIN	Reserved

#### Table II.7 Lower Reach Communication Port SCIT

Pin	Name	Signal Description	
1	VCC	+3.3 V	
2	RXD	Data receiving	
3	TXD	Data transmitting	
4	GND	Power supply ground	

#### Table II.8 Audio Codec and Amplifier Module Connector CODECO

Pin	Signal	Description
1	ADIN	Data input
2	VCC5	+ 5.0V
З	AFS	Frame sync
4,6	GND	Power supply ground
5	ADOUT	Data output
7	ASCK	Shift clock
8	АМСК	NC
9	RESET	Reset output
10	APDN	Power down output
11	AFC	Request output for secondary communication
12	AVC3	+ 3.3V

#### Table II.9 CMOS Image Sensor Connector IMAGE

Pin	Signal	Description
1	VCC5	+ 5.0V
2	DO	Image data bit O
З	ISCL	I2C Clock
4	Dl	Image data bit 1
5	ISDA	I2C data
6	D2	Image data bit 2
7	VS	Digital image vertical blank pulse input
8	D3	Image data bit 3
9	HREF	Digital image horizontal blank pulse input
10	D4	Image data bit 4
11	RCLK	Digital YUV signal synchronized clock input
12	D5	Image data bit 5
13	RESET	Reset output
14	D6	Image data bit 6
15	GND	Power supply ground
16	D7	Image data bit 7

# III. Procedure to upgrade the PMB5010 firmware

- 1. Download and save the latest PMB5010 firmware from www.DrRobot.com
- 2. Turn off PMB5010 and keep it off until step 9
- 3. Use a null modem cable to connect the PC to PMB5010. All peripheral modules (e.g. LCD and etc.) can still be plugged to the PMB5010 without affecting the upgrade process
- 4. Close all WiRobot software on PC (e.g. WiRobot Gateway and all sample applications)
- 5. Start the hyper-terminal (which come with MS Windows OS), give a name to this new connection and choose the COM port that is connected to the PMS5005 (normally COM1 or COM2) as shown in the following figure:

-	Connect To	
	OK Cancel	

Figure III.1 Choosing COM Port Connection

6. Configure the COM port with the setting 115200, 8, N, 1, Hardware and turn on "Send line ends with line feeds" under Properties - > Settings -> ASCII Setup,

COM1 Properties	<u>? ×</u>	ASCII Setup	<u>! ×</u>
Port Settings		ASCII Sending	_
		Send line ends with line feeds	
Bits per second: 115200		Echo typed characters locally	
Data bits: 8		Line delay: 0 milliseconds.	
Parity: None		Character delay: 0 milliseconds.	
Stop bits: 1		ASCII Receiving	
		Append line feeds to incoming line ends	
Flow control:  Hardware		Force incoming data to 7-bit ASCII	
Restore Defaults		✓ Wrap lines that exceed terminal width	
OK Cancel Ap	ply	OK Cancel	

Figure III.2 COM Port Setting

7. The lower left corner of the hyper-terminal will show the connection status. If the hyper-terminal is still not connected, click the connect icon on the hyper-terminal to establish the connection (don't turn on the PMB5010 yet!).





8. Choose "Transfer -> Send Text File" from the toolbar and set "files of type" to ALL. Locate the PMB5010 firmware HEX file only by HIGHLIGHTING the file (e.g. robot.hex). Please make sure that you DON'T double click the file or click the "Open" button

Image: Section Section     Section     Section     Ceture to Priver     Ceture to Priver     Ceture to Priver     Section     Section     Section     PMB5010 Hex     Y     Ceture to Priver     Section     PMB5010 Hex     Y     Ceture to Priver     PMB5010 Hex     Y     Ceture to Priver     PMB5010 Hex     Y     Ceture to Priver     PMB5010 Hex     Y     PMy Documents   My Documents   My Documents   My Documents   My Documents   My Documents   My Network P.   File name:   robot.hex     Piles of type:     All Files (`.')	🏶 upgrade - HyperTermi	al			
Send a best file     Cadvare text.     Cadvare text.     Cadvare text.     Cadvare text.     Send a best file to the remote system     Send Text File     2) ×     Look in:     PMB5010 Hex     Picture to Photoch.hex     Picture to Photoch.hex     Picture text.	File Edit View Call Tran	fer Help			
Send Text File     Send Text File     Send Text File     Y     Look in: PMB5010 Hex     Y     Image: Send Text File     Y     Image: Send Text File     Y     Image: Send Text File     Image: Send Text	D 📽 🔊 🕉 🖉 💈	nd File			
Send Text File Cature to Protect Send Text File Cature to Protect		ceive File			
Capture to Preter		nd Text File			
Sends a text file to the remote system         Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Send Text File         Image: Send Te		phure to Drinker			
Send Text File   Send Text File   Look in:   PMB5010 Hex   Image: Send Text File   Image: Send Te		poure to Prenter			
Sends a text file to the remote system     Send Text File     Look in:     PMB5010 Hex     Image: Send Text File     Image: Send Text File  <					
Sends a text file to the remote system         Sends a text file to the remote system         Send Text File       2 ×         Look in:       PMB5010 Hex       Image: Comparison of the comparison of t					
Send a text file to the remote system     Send Text File     Look in: PMB5010 Hex     Implementation     Implementation </td <td></td> <td></td> <td></td> <td></td> <td></td>					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Desktop         My Documents         My Documents         Image: PMB probatility         File name:         robot.hex         File name:         robot.hex         Image: PMB probatility         File name:         robot.hex         Image: PMB probatility         File name:         robot.hex         Image: PMB probatility         File name:         robot.hex         Image: PMB probate         File name:         robot.hex         Image: PMB pr					
Send Text File   Look in:   PMB5010 Hex   Look in:   PMB5010 Hex   Improbation					
Sendia a text. File to the remote system     Sendia a text. File     Look in:     PMB5010 Hex     Image: Cobot.hex     Image: Cobot.hex     File name: Cobot.hex     Piles of type: All files (*.*)					
Sends a text file to the remote system         Sends a text file         Send Text File         Look in:       PMB5010 Hex         Possibility         History         Improbed.frex         History         Improbed.frex         File name:         robot.hex         Pile of type:         All files (".")					
Sends a text file to the remote system  Send Text File  Look in:  PMB5010 Hex  C  C  PMD  Desktop  My Documents  My Documents  File name: robot.hex  File name: robot.hex  Cancel					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Comparison of the system         Image: Comparison of the system         My Documents         Image: Comparison of the system         File name:         My Network P.         File name:         Image: Cobot.hex         Image: Cobot					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Send Text File					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Send Text File					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Comparison of the system         Image: Comparison of the system         My Documents         Image: Comparison of the system         File name:       robot.hex         Image: Comparison of the system         My Network P.         File name:       robot.hex         Image: Comparison of the system         Imag					
Send Text File         Look in: PMB5010 Hex         Look in: PMB5010 Hex       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2" Image: C					
Send a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Send Text File         Image: Send Text File     <					
Sends a text file       ? ×         Send Text File       ? ×         Look in:       PMB5010 Hex       • • • • • • • • • • • • • • • • • • •					
Send Text File ? Look in: PMB5010 Hex ? Look in: PMB5010 Hex ? PMB5010 He					
Sends a text file to the remote system         Send Text File         Look in:       PMB5010 Hex         Image: Send Text File         Image: Send Text File         Look in:       PMB5010 Hex         Image: Send Text File         Image: Send Text					
Send Text File       ? ×         Look in:       PMB5010 Hex       • • • • • • • • • • • • • • • • • • •	<u> </u>				<u> </u>
Send Text File       ? ×         Look in:       PMB5010 Hex       • • • • • • • • • • • • • • • • • • •					
Send Text File     ? ×       Look in:     PMB5010 Hex <ul> <li>PMB5010 Hex</li> <li>PMB5010 Hex</li> <li>PMB5010 Hex</li> </ul> History <ul> <li>Probot.hex</li> </ul> Desktop <li>PMP Documents</li> <li>PHe name:</li> <li>robot.hex</li> <li>Pile name:</li> <li>robot.hex</li> <li>Piles of type:</li> <li>All files (".")</li>	Sends a text file to the remote	system			li.
Look in: PMB5010 Hex  PMB5010 H	Sends a text file to the remote	system			li.
Look in: PMB5010 Hex  PMB5010 Hex PMB5010	Sends a text file to the remote	system			//
Image: Second state sta	Sends a text file to the remote	system			// ?×
Important       Important         History       Important         Desktop       Important         My Documents       Important         My Documents       Important         My Network Pr.       File name:       robot.hex         Files of type:       All files (".")       Important	Sends a text file to the remote Send Text File Look in:	pystem	<b>.</b>	← 🗈 💣 🖩-	// ?×
Image: Second	Sends a text file to the remote Send Text File Look in:	C PMB5010 Hex	V	⇐ È 💣 💷•	?×
History Desktop My Documents My Computer My Network P File name: robot.hex   Dpen Files of type: All files (".")   Cancel	Sends a text file to the remote Send Text File Look in:	PMB5010 Hex	×	⇐ 🖻 📸 ▾	?×
My Documents         My Documents         My Computer         My Network P.         File name:         robot.hex         Image: Computer         My Network P.         Files of type:         All files (".")         Cancel	Send Text File Look in:	PMB5010 Hex	×	← Ē ở Ⅲ•	?×
Image: Second	Sends a text file to the render	In PMB5010 Hex	¥	← 🖹 🖆 💷	» ۲
Desktop My Documents My Computer My Network P File name: robot.hex   Dpen Files of type: All files (".")   Cancel	Send Text File Look in:	PMB5010 Hex	×	← € ₫ ⊞•	* ? X
Desktop My Documents My Computer My Network P File name: robot.hex Files of type: All files (`.*)	Send Text File Look in:	PMB5010 Hex		¢ € ñ ⊞•	* ?×
My Documents         My Donputer         My Network P         File name:         robot hex         Open         Files of type:         All files (".")         Cancel	Send Text File Look in: History	In PMB5010 Hex	¥	¢ € ॉ ∰•	* **
My Documents My Computer My Network P. File name: robot.hex Files of type: All files (".") Cancel	Send Text File Look in:	PMB5010 Hex	×	⇔ 🗈 🏝 📰•	*** **
My Documents My Computer My Network P File name: robot.hex Files of type: All files (`.*) Cancel	Send Text File Look in:	PMB5010 Hex	×	¢ È ₫ II.	**************************************
My Documents My Computer My Network P File name: robot hex Files of type: All files (`.*) Cancel	Send Text File Look in: History Desktop	PMB5010 Hex	×	¢ € ॉ ∰•	2×1
My Computer My Network P. File name: robot.hex  Copen Files of type: All files (".") Cancel	Send Text File Look in: History Desktop	PMB5010 Hex		⇔ 🗈 🗳 🖩•	**************************************
My Computer My Network P File name: robot.hex Files of type: All files (`.*) Cancel	Send Text File Look in: History Desktop My Documents	PMB5010 Hex	×	<b>⇔ ট ☆ ⊞•</b>	?×
My Computer           My Computer         File name:         robot hex         Open           Files of type:         All files (`.*)         Cancel	Send Text File Look in: History Desktop My Documents	PMB5010 Hex	×	¢ € ॉ ∰•	?×:
My Network P File name: robot.hex  Copen Cancel Files of type: All files (*.*) Cancel	Send Text File Look in: History Desktop My Documents	PMB5010 Hex		<b>⇔ € ॉ ⊞•</b>	?×
My Network P         File name:         robot.hex         Open           Files of type:         All files (*.*)         Cancel	Send Text File Look in: History Desktop My Documents	PMB5010 Hex	×	<b>⇔ È ☆ ⊞•</b>	?×
High     File name:     I robot hex     Open       My Network P     Files of type:     All files (*.*)     Cancel	Send Text File Look in: History Desktop My Documents My Computer	PMB5010 Hex	×	← È <sup>*</sup> ⊞•	?×
My Network P Files of type: All files (*.*)	Send Text File Look in: History Desktop My Documents USA	PMB5010 Hex  Trobot.hex		⇔ È ☆ ;;;,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	?×
riles or type: All hies (*.*)	Send Text File Look in: History Desktop My Documents Wy Computer	PMB5010 Hex  robot.hex  File name: robot.hex	×	←	?× Open
	Send Text File Look in: History Desktop My Documents My Computer Sign My Network P	PMB5010 Hex       robot.hex			Qpen

Figure III.3 Locating the HEX File

- 9. Please read step 10-13 ahead before turning on the PMB5010 in this step
- 10. After you turn on the PMB5010, you should see the text "Dr. Robot Inc. PMB5010 Bootloader V1.00 All Right Reserved! 2001, 2003" in the hyper-terminal as shown in the following figure:

PM85010 - HyperTerminal	_IO ×
File Edit View Call Transfer Help	
	1.0
Dr. Robot Inc. PMB5010 Bootloader V1.00 All Right Reserved! 2001, 2003	
Send Test File	
Look in: 🔁 PM85010 Hex 💌 🗭 🏝 🖽	
History History Desited My Documents My Compare	
Ny trainers P. Ny trainers P. File of type: Al fam (*) V Concel	
The second	

Figure III.4 Status after Turning on the PMB5010





- 11. Within 5 seconds (start counting when you turn on the PMB5010), you should click the "Open" button on the Hyper-terminal popup window. Firmware download will then start. If you fail to start the download within this period of time, the original firmware on PMB5010 will automatically start. You have to turn off the PMB5010, and repeat the download procedure again from Step 2
- 12. When the download is started, you will see the following text. At the end, "Firmware Update Successfully!" will be shown if the download succeeds. The whole process will take about 1 minute

PM85010 Upgrade - HyperTerminal	-0×
Dr. Robot Inc. PMB5010 Bootloader V1.00 All Right Reserved! 2001, 2003 0300 0500 0500 0600 0700 0800 0700 0800 0900 1100 1100 1100 1100 1300 1300 13	
Connected 0:01:44 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	14

Figure III.5 Successful PMB5010 Firmware Upgrade

13. When the download is finished, you could disconnect the COM connection in the hyper-terminal, and re-start your PMB5010