WiRobot™

The Heart of Robot

PMB5010 Multimedia Controller User Manual

DrRobot®

Version: 1.0.1

July 2004

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Related Document:

WiRobot SDK API Reference Manual

Dr.Robot® www.DrRobot.com
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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
    - Real-time clock
    - 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)
    - MCI3908 CMOS image sensor module (352 x 288) (x1)
    - MCB3100 Serial Bluetooth wireless module or MCR3210 RS232 interface module (x1)

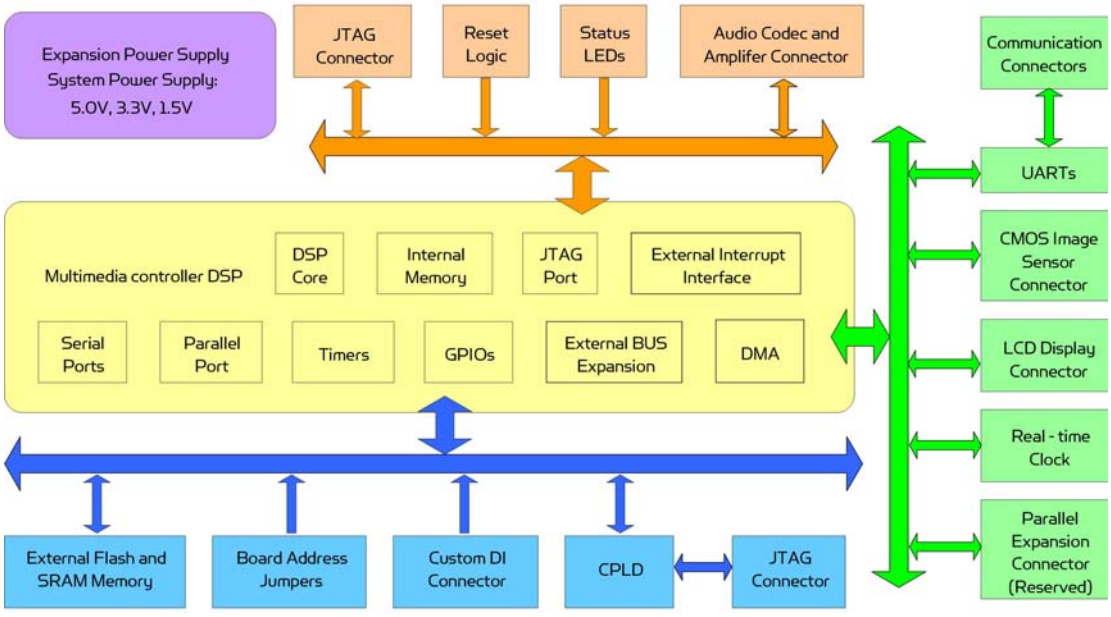

Figure I.1 Block Diagram of the PMB5010

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I.2. PMB5010 Connectors and Jumpers

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

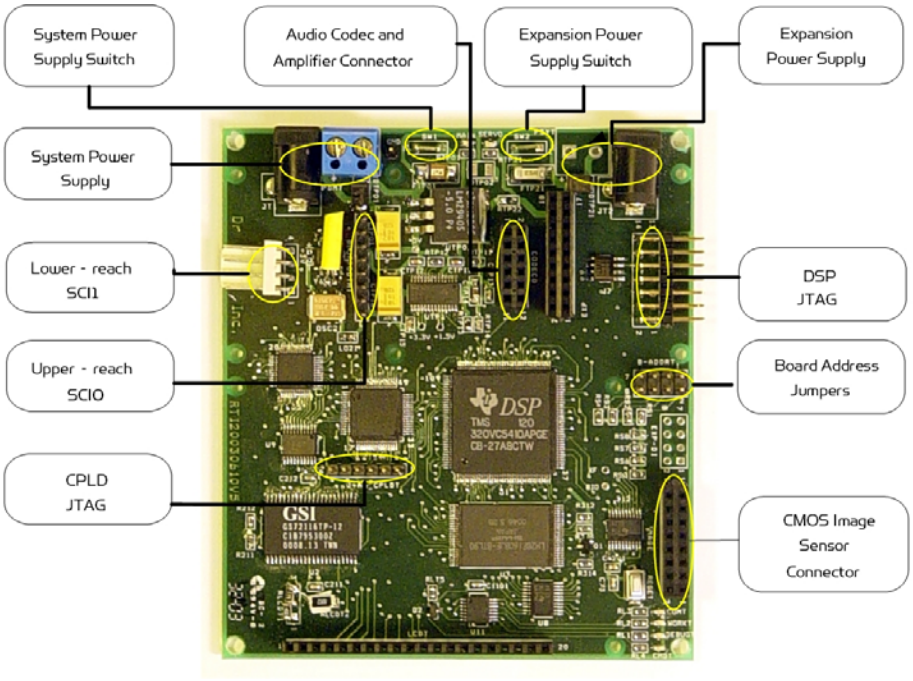

Figure I.2 PMB5010 Connectors and Jumpers

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.

Table II.1 Specification of Power Supplies

Power	Power	Screw	Switch	Voltage	Current

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Supply	Jack	Terminals	Connector	Range (V)	Capacity (mA)
System	JT1	PDMT	SW1	5.5 – 7.0	500
Expansion	JT2	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.

Table II.2 Board Address Jumpers B_ADDR

Bit	Pin	Value 1	Value 0
0 (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

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.

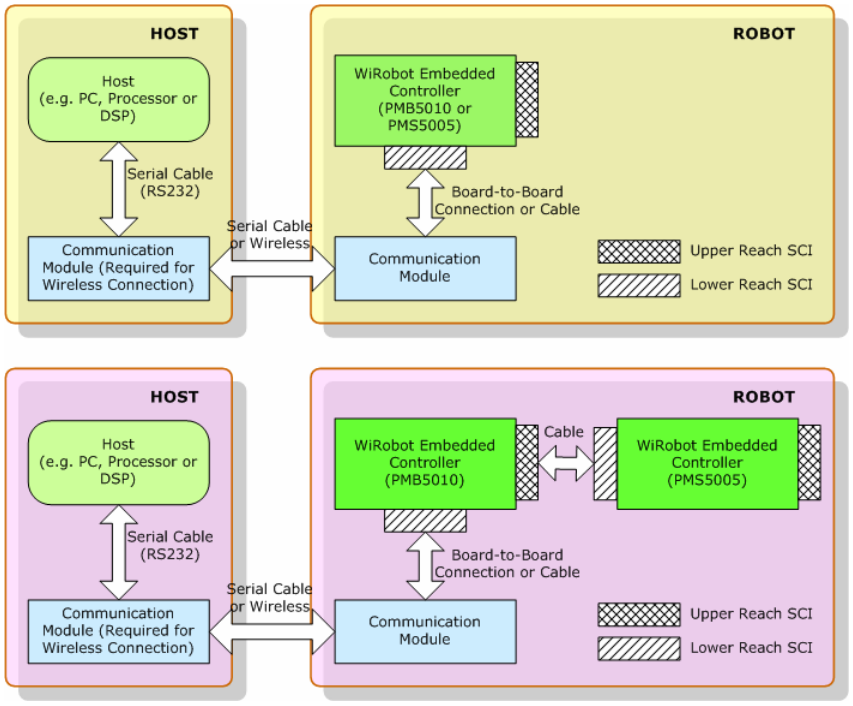

Figure II.1 WiRobot System Communication Architecture

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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.

Table II.3 System Communication Connectors

Connector	Type	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

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.

Table II.4 Sub-modules Supported by PMB5010

Sub-module	Connector	Max No.	Description
MCB3100	BLUETOOTHT	1	Bluetooth wireless communication module
MCR3210	BLUETOOTHT	1	RS232 interface module
MAC5310	CODEC0	1	Audio codec and amplifier module, which can be used to connect to microphone and speaker
MCI3908	IMAGE	1	CIF CMOS image sensor module

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.

Table II.5 Connections of the Power Jacks and Terminals

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

Table II.6 Upper Reach Communication Port BLUETOOTHT

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

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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 CODEC0

Pin	Signal	Description
1	ADIN	Data input
2	VCC5	+ 5.0V
3	AFS	Frame sync
4, 6	GND	Power supply ground
5	ADOUT	Data output
7	ASCK	Shift clock
8	AMCK	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	D0	Image data bit 0
3	ISCL	I2C Clock
4	D1	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

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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:

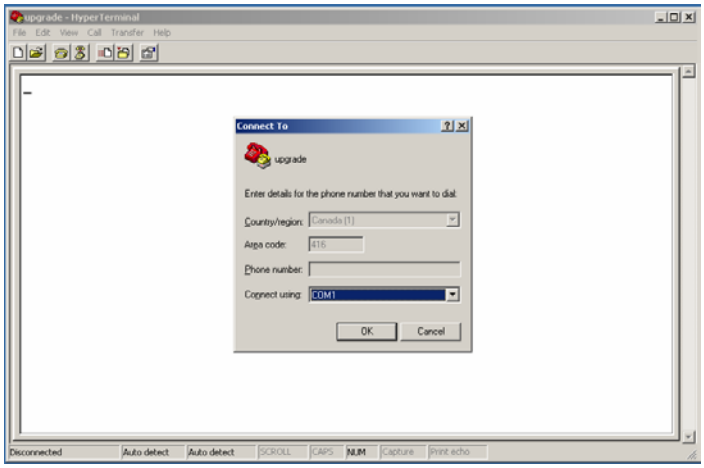

Figure III.1 Choosing COM Port Connection

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,

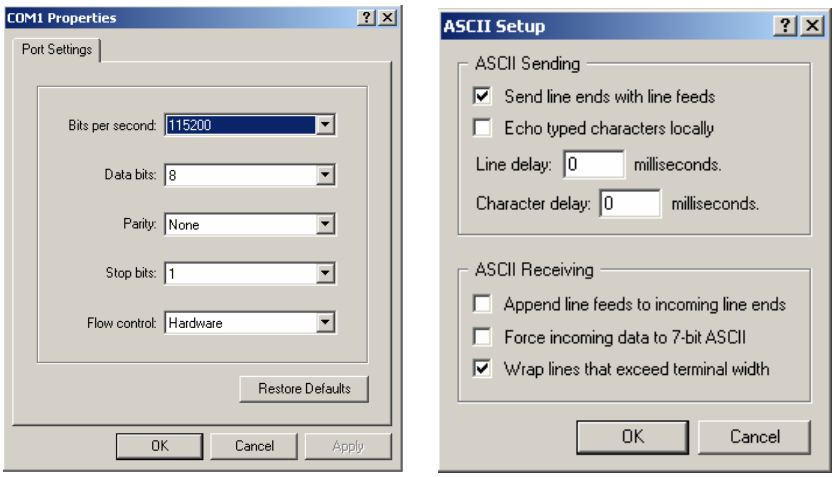

Figure III.2 COM Port Setting

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!).

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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

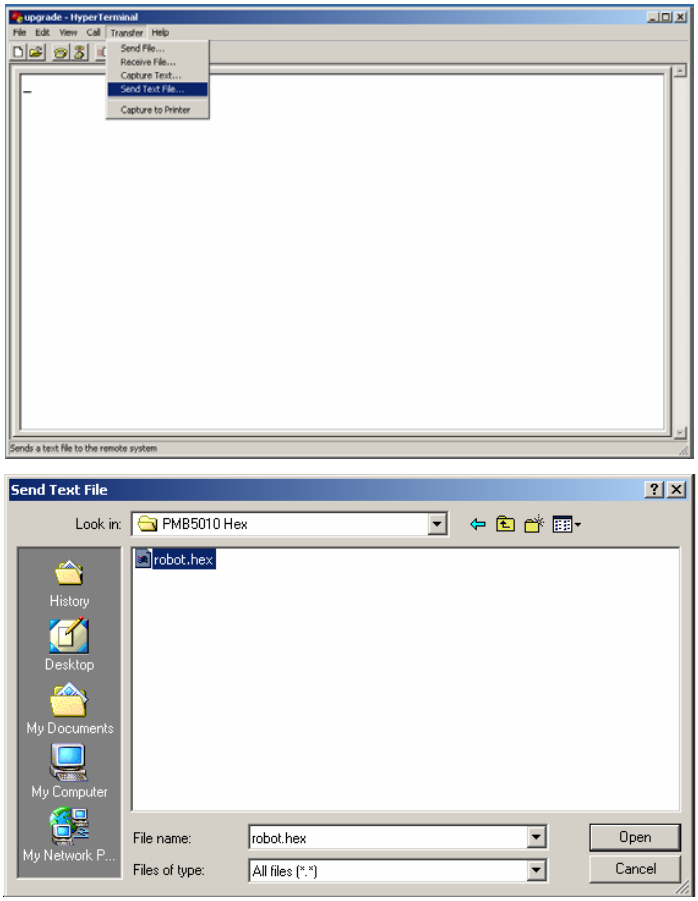

Figure III.3 Locating the HEX File

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:

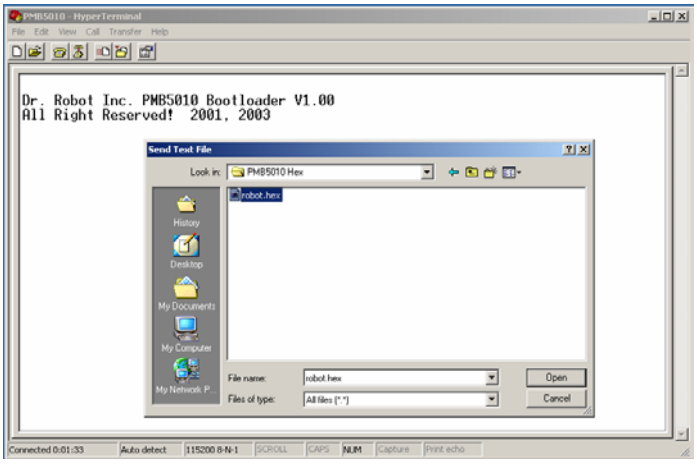

Figure III.4 Status after Turning on the PMB5010

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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

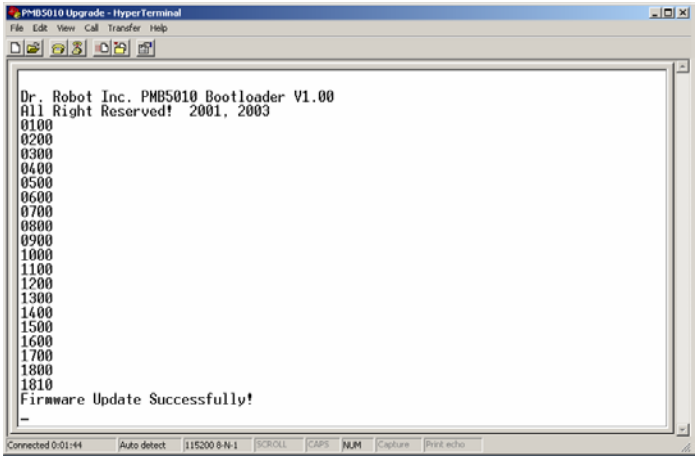

Figure III.5 Successful PMB5010 Firmware Upgrade

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

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