



**Twin Peaks  
Robotics**

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**RADIO ROBOTICS CONTROLLER  
BOARD USERS GUIDE**

## 1 Introduction

### 1.1 Overview

The Radio Robotics Controller (RRC) utilizes a ©Microchip PIC24FJ256GB106 integrated with a ©Texas Instruments CC1101 low-power radio transceiver to provide a wireless robotics control implementation.

- 16 MIPS Microchip PIC24FJ256GB106 processor
- Power input between 6 and 15 volts
- Integral 915MHz Transceiver with built in antenna
- USB Controller or USB Device port
- 28 IO connections for robotics control
- IO programmable to support various peripherals
- 1Mbit EEPROM
- Real Time Clock
- Accessory Power of 1 Amp at 3 Volts and 1 Amp at 5 Volts
- Low Power Capable
- Programmable in C and Assembly, Powerful debuggers available

### 1.2 Support

If you cannot find the information you need in this document or the associated resources listed at the end of this document email your question to [support@TwinPeaksRobotics.com](mailto:support@TwinPeaksRobotics.com) or [sales@TwinPeaksRobotics.com](mailto:sales@TwinPeaksRobotics.com).

## 2 Core Features

### 2.1 Processor

The Microchip PIC is 16-Bit processor clocked at 32 MHz resulting in an instruction rate is 16 MIPS. Program memory is 256 Kbytes (87,552 instructions). Data memory is 16,384 bytes. For detailed information about this processor reference the Microchip PIC24FJ256GN110 Family Data Sheet.

### 2.2 Input Power

Input power to the RRC should be between 6 and 15 volts. Current requirements depend on external devices to be powered. If reduced functionality can be tolerated input voltages as low as 3 volts can be used.

### 2.3 Power Out

Through the use of voltage regulators 3 and 5 volts at 1 amp each are available to power external devices.

## 2.4 Radio

Radio communication is accomplished with a © Texas Instruments CC1101 low-power RF transceiver operating in the 915MHz ISM band. An antenna is part of the PCB so an external antenna is not needed. For more information about this IC reference the Texas Instruments CC1101 Low-Power Sub-1GHz RF Transceiver Data Sheet.

Caution: Any changes or modifications not expressly approved by Twin Peaks Robotics could void the user's authority to operate the equipment.

## 2.5 USB

The RRC has a built in USB port that can be configured as a controller or device. In controller mode 5 volts at 500 mA is available to power the USB device.

## 2.6 EE Prom

The RRC has 1 Mbit of EE Prom. The processor accesses this resource with the system SPI port.

## 2.7 IO

The RRC has 24 primary and 5 secondary I/O ports that can be used for robotics control. The primary ports are grouped with a power and ground connection to facilitate connection to sensors. Secondary ports are just signal lines.

## 2.8 Peripheral Pin Select

To maximize the availability of peripheral devices 22 of the primary IO ports can be configured as one of:

- 4 External Interrupts
- 9 Input Captures
- 2 SPI Ports
- 5 Timer External Clocks
- 4 UARTs

## 2.9 I2C

Registers x and y can be configured as an I2C port

## 2.10 5V Digital IO

All IO pins on the RRC can be configured as digital input or digital output. The PIC 24 is a 3V device. In order to support 5V digital IO the 12 primary IO connections on the top connector are 5V input tolerant. The power pin associated with each connection is 5V. By default the signal pin of each connection is 3V but it can be configured as an open collector output and pulled up to 5V.

## 2.11 3V Digital IO and Analog Input

The 12 primary IO connections on the bottom connector are 3V only. They can all be configured as digital input or digital output. 10 of these can be configured as analog to digital input.

## 2.12 Secondary IO Ports

The 7 secondary IO ports do not support peripheral pin select.

## 3 IO Ports

The RRC has four banks of IO ports. At the top of the card there are 12 primary connections. Just these are 4 secondary connections. Primary connections are sets of three pins running top to bottom consisting of a signal, power and ground connection. The signal pin is always on the inside of the board. The power pin is always in the middle and the ground is closest to the board edge. Secondary connections are just signals. All connections are located on a .1 inch grid. At the bottom of the board there are another 12 primary connections. Just above them are two secondary. The PIC register associated with the connection is printed next to the connection.

### 3.1 Top Primary Connector

Pin	Register	Capabilities	
1	G9	RP27/PMA2/C2INC/CN11/RG9	
2	G8	PMA3/ <b>RP19</b> /C2IND/CN10/RG8	
3	G7	<b>RP26</b> /PMA4/C1INC/CN9/RG7	
4	G6	PMA5/ <b>RP21</b> /C1IND/CN8/RG6	
5	E3	PMD3/CN61/RE3	
6	E2	PMD2/CN60/RE2	
7	D5	PMRD/ <b>RP20</b> /CN14/RD5	
8	D4	PMWR/ <b>RP25</b> /CN13/RD4	
9	D3	RP22/ <b>PMBE</b> /CN52/RD3	
10	D2	DPH/ <b>RP23</b> /CN51/RD2	
11	D1	RP24/ <b>VCPCON</b> /CN50/RD1	
12	D8	RP2/ <b>DMLN</b> /RTCC/CN53/RD8	

### 3.2 Top Secondary Connections

Pin	Register	Capabilities	
1	E5	PMD5/CN63/RE5	
2	E1	PMD1/CN59/RE1	
3	E4	PMD4/CN62/RE4	
4	E0	PMD0/CN58/RE0	

### 3.3 Bottom Primary Connector

Pin	Register	Capabilities	
1	B5	PGEC3/RP18/VBUSON/C1INA/AN5/CN7/RB5	
2	B4	PGED3/RP28/USBOEN/C1INB/AN4/CN6/RB4	
3	B0	PGED1/RP0/PMA6/VREF+/AN0/CN2/RB0	
4	B2	VMIO/RP13/C2INB/AN2/CN4/RB2	
5	B8	RP8/AN8/CN26/RB8	
6	B9	PMA7/RP9/AN9/CN27/RB9	
7	B12	TCK/PMA11/AN12/CTED2/CN30/RB12	
8	B14	CTPLS/RP14/PMA1/AN14/CN32/RB14	
9	B15	RP29/PMA0/AN15/REFO/CN12/RB15	
10	F4	PMA9/RP10/SDA2/CN17/RF4	
11	F5	PMA8/RP17/SCL2/CN18/RF5	
12	F3	RP16/USBID/CN71/RF3	

### 3.4 Bottom Secondary Connections

Pin	Register	Capabilities	
1	B10	TMS/PMA13/AN10/CVREF/CN28/RB10	
2	B11	TDO/AN11/PMA12/CN29/RB11	

## 4 Software Development

### 4.1 Integrated Development Environment

### 4.2 Compiler

### 4.3 Debug and Programming

### 4.4 Device Drivers

To facilitate application development a library of device drivers has been developed. These are summarized in Table 3.0 below.

Driver	Description	Compatible Hardware
Radio	Integrated RRC 915MHz ISM digital radio	RRC
USB_Joystick	USB Master Joystick Controller	Dell Mouse Logitech Attack3 Logitech Extreme3D
USB_Serial	USB Device RS232 Port	Any RS232

Table 3.0 – RRC Device Drivers

## 5 Sources of Additional Information

### 5.1 Websites

The following web sites contain useful information associated with the Radio Robotics Controller:

- [www.TwinPeaksRobotics.com](http://www.TwinPeaksRobotics.com)
- [www.Microchip.com](http://www.Microchip.com)
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### 5.2 Documentation

The following documentation should be referenced for additional information:

- Microchip Explorer 16 Development Board User's Guide

## 6 Definitions and Abbreviations

ISM – Industrial, Scientific, and Medical radio band between 902MHz and 915MHz used by the RRC

RRC – Twin Peaks Robotics Radio Robotics Controller

USB – Universal Serial Bus