

Robo Kit-I Pic development Board



C- Tech
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hanks for using Robo Kit-I PIC development board. The board supports most commonly

Used 40 Pin Mid range PIC microcontroller units, and has on-board many commonly used Peripheral devices. All I/O lines are available through separate, well marked headers for daughter Boards or projects. Every I/O line group is provided with a set of power supply, so that the Daughter board can be powered up from the motherboard.

Features of Robo Kit-I.

- Single Layer PCB (easy to replace parts)
- Socket for 40 Pin PIC Microcontrollers (16F87x, 18FXXX)
- 5 independent Push Switches
- 16x 2 Characters LCD
- I2C EEPROM
- 1 PIZO Buzzer
- In Circuit Serial programming / Debugging Support
- 8 LED indicators
- USART (RS-232 Module)
- USB Communication Port
- USB Boot Loader Support
- 38 KHz Modulated Infra Red Sensor
- Connector for two Analog Inputs
- Connector for Hardware driven PWM
- Connector for T0CKI
- Connector for I2C Bus
- Changeable Crystal Oscillator (20MHz standard)
- All I/O lines available through Headers
- USB based power supply.
- On Board regulated 5V 1A power supply.

Power Supply

The board mainly shares power form the connected via USB port. It uses 5V regulated power, for external supply, we recommend a power source more than 5V. The recommendation is 9V at least 300mA load. If you are going to drive an external load through the board, like motor, or LEDs etc, make sure that the supply current is appropriate. In that case we recommend 9V-12V DC adapter, 800mA to 1000mA.

The adapter must have center pin supplying Positive. Reverse polarity is checked however. There is a Blocking diode, which will not allow the reverse polarity to reach the board. There is an On/OFF switch, and a Power-ON LED indicator. The Voltage regulator IC, 7805, is rated as 1A, and gets heat up if heavy load is put on it, or if a voltage adapter of more than 9V is used. The regulated is fitted with commercial heat sink.

The Microcontroller

The board contains a socket for 40-Pin PIC microcontroller. Board comes with standard PIC 16F84550 Microcontroller. However if you want to change, let's say to 18F452, 16F877, simply take the IC out of socket and insert the one of your choice.

The Oscillator Circuit

The oscillator circuit consists of a crystal oscillator and two 22pF capacitors. The crystal oscillator is not fixed soldered; rather there is a base, into which it can be inserted. The board comes with 20MHz crystal, however if you want to change this to another frequency, just pull it out and insert the new

one. PIC 18F series are capable of multiplying the clock frequency by 4, to generate an internal high frequency oscillator. They can run at a maximum of 40MHz, therefore using a 10MHz crystal, along with enabling an internal PLL, will give a speed of 40MHz.

In Circuit Serial Programming

Traditionally microcontrollers are programmed, using a device called programmer. The microcontroller is taken out of the circuit, and put into the programmer to get it programmed. The processor is then inserted back into the board to run the program. This is however quite cumbersome, to repeatedly take out the processor. Microchip therefore introduced the idea of In Circuit Programming. This is also called ICSP. This board supports In circuit Serial programming. However not all programmers have ICSP support. So you will need a programmer with ICSP support, such as Pic Kit -2, or [Pic Kit -2 Clone](#). ICSP uses two of the microcontroller pins, RB6 and RB7, Called PGM and PGD respectively. If you are going to use ICSP, these pins must not be tied to any circuit that should drain the signals from programmer on these pins. The board has used those Pins to 8 LEDs through dip switch, during programming it is recommended to select dip switches off mode from LEDs. However since these pins are available through headers, you can use them in your applications, and then if the ICSP fails, disconnect the device before programming.

The programmer also supplies 5V output, but this power is insufficient to supply the entire board. It is Therefore it is recommended to **keep the power on while programming**. As soon as you connect the programmer cable to the ICSP connector, the MCLR pin goes low, this inhibits the microcontroller to run any program. Therefore, if your programmer does not have the mechanism to release MCLR pin, then after programming, remove the cable, so that the program can run.

DIP Switch and LED Indicators (PORTB.0 ... PORTB.7)

There is an 8 switch DIP switches, labeled on board. This switch will connect or disconnect LEDS from PORTB. Robo Kit-I has 8 Led indicators connected to PORTB of the microcontroller. The LEDs are connected through 220 ohms current limiting resistor, and are sourced by the microcontroller. Therefore a logical 1, or on state of the microcontroller pin will turn the corresponding LED ON.

DIP Switch 1to 8, will enable or disable the respectively LED1 to LED8 module

Character LCD (PORTD.2,3,4,5,6,7)

The board consists of a socket for HD44780 based character LCDs with back light. The LCD module can be any, based upon HD44780 controller. Commonly used is 16x2 character LCD. The module uses 4 bit mode, in which the highest 4 bits of PORTD are connected to data pins of LCD. PORTD.2 is connected to Enable Pin, and PORTD.3 to RS-Pin of LCD. Thus following declarations must be used before initializing

The LCD (Proton Basic).

```
LCD_ENPIN PORTD . 2
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```
LCD_RSPIN PORTD . 3
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```
LCD_DTPIN PORTD . 4
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Infra-Red Remote Control Sensor (PORTA.3)

A large number of devices are now using infra-red remote controls to communicate. The standard protocol is based upon 38 KHz, modulated infra-red communication. The Robo Kit-I board contains a 38 KHz, modulated Infra red sensor, that will detect the Infra-reds, which are modulated only at 38 KHz. Most commonly available remote controls for TV, CD and A/C use the same protocol. However they differ in codes they transmit. The Infra-red Sensor is connected to, PORTA.3. This port is also analog input, therefore make sure it is set to digital, and configured as Input to read the sensor.

Push Switches

There are five independent push switches available on board. 5 Header pins are open to connect switches to any pin of Microcontroller. These switches have all 10K pull up resistors and will be active high. Therefore when switch is not pressed the associated microcontroller pin will read a logical low or 0. The switches are named as SW3—SW7.

Reset Switch (MCLR)

Reset switch is located on the left hand corner and labeled as Reset. When pressed the switch gives a logical 0 to MCLR pin of microcontroller, which is reset, and starts the software from beginning. All RAM data is cleared. EEPROM is preserved. Timers are cleared. The Reset switch is specially useful, for boot-loader programming.

I2C EEPROM (PORTC.3, PORTC.4)

I2C communication bus is very commonly used in electronics devices. More and more devices are coming up with I2C protocol support. The board contains an EEPROM Chip, (24c08) which is 8K EEPROM. This chip is attached to microcontroller using PORTC.3 and PORTC.4. The 40 pin, PICs have these pins attached to internal hardware of I2C communication. PORTC.3 is SCL and PORTC.4 is SDA. Due to built in I2C communication hardware, the software overhead is very much reduced. The I2C bus contains 10K pull-ups on both SDA and SCL pins. EEPROM is placed on an 8 pin base, it can be removed and another one inserted, if more memory is required. The EEPROMs have three address pins, which can be used to connect many more EEPROMs in parallel. The board has however given this a permanent address of 000. The I2C code for EEPROM is 1010. Next three bits would be EEPROM chip address, and last bit is direction. Therefore the complete address to write on EEPROM would be: 1010 000 0 and to read it would be: 1010 000 1

I2C BUS (Connector)

The board also provides an I2C Bus as a connector, which contains connection for SDA and SCL pins Along with Power for daughter boards. The bus connects directly to PORTC.3 and PORTC.4 which are hardware driven I2C pins. Keep it in mind that these pins have associated 10K pull up resistors already attached. In case these pins are being used for some other application this fact must be kept in mind.

USB

The PIC-Robo Kit-I board comes with USB Female-B connector. C14 (470pf) with PORTC.3 is a stabilizing capacitor that is used for the onboard USB voltage regulator. Jumper J4 is used to select USB communication Mode for 18F45xx series. If user wants to use 16F8xxx Microcontrollers jumper J4 should keep open. PORTC.3 is shared with external header of PORTC. So care must be taken when using USB communication. All USB (HID) code samples and host pc application samples will be supplied with Robo Kit-I.

USART or RS232 Communication (PORTC.6, PORTC.7)

The board contains a standard universal Serial Asynchronous receiver and transmitter. Many devices use this protocol to communicate with other devices. The communication is hardware independent, and just needs two wires, one for transmitting and other for receiving data. PCs and some other devices, use a level translator, to redefine the standard signals for logical 0 and 1. this is done so, to minimize noise interference as well as prolong communication distance. To use these signals, they must be converted back to TTL level logic. The PIC-Robo Kit-I board contains Rs-232 level converter which converts these signals to TTL level, and to transmission levels while sending data. Most PIC microcontrollers contain an internal hardware to manage this communication, so that software development becomes easy. Configuration pins are PORTC.6 and PORTC.7.

NOTE: since the PORTC is also connected to headers receiving data from USART is interfered. It is therefore mandatory to check headers of PORTC are connected to other daughterboard or not while using UASRT.

PIZO Buzzer (PORTA.4)

The board contains a connector for PIZO. The PIZO buzzer, module consists of a transistor and two resistors. The transistor connects directly to PORTA.4. The buzzer has to be given oscillatory signals, like a train of 0s and 1s to make a sound.

I/O PORTS

All I/O lines are available through headers on board for connection to other devices or daughter boards. The headers are separated for each PORT, and the number of header pins is according to the I/O lines available on the respective port. Each port header is provided with power supply for the daughter board.

T0CKI Connector (PORTA.4)

Although this pin is available through standard PORTA header, it has been provided separately along with power supply, to use as external clock signals for Timer 0. The pin is also general purpose and can be used as a serial communication between two boards directly connected together. Remember PORTA.4 is open collector and it will need an external PULL up resistor. Which is already been mounted on board.

Analog input Connectors (PORTA.0, PORTA.1)

Many PIC microcontrollers give analog to digital conversion on chip. This is quite advantageous, as many sensors give analog data. Although the number of analog inputs on a chip varies, yet if we talk about 16F877A, it has analog inputs on PORTA and E. all these pins are available for projects through PORT headers. However we have specially included two connectors, from PORTA.0 and PORTA.1 along with power supply, on board. These three pin connectors can be used directly to any analog device, giving up to 5V analog signal.

Pulse Width Modulation Connector (PORTC.2)

Pulse Width modulation is a common technique used to alter the speed of motors etc. although PWM can be achieved on any digital pin, PIC microcontrollers have inbuilt hardware, that once set keeps on sending PWM waveform to the device, despite processor busy in other jobs. This is really a multi tasking. 16F877, 18F4550... Most of them has two hardware PWM modules; one of them is on PORTC.2 which is available through port header, as well as through this PWM connector, which also has power supply for daughter board if required.

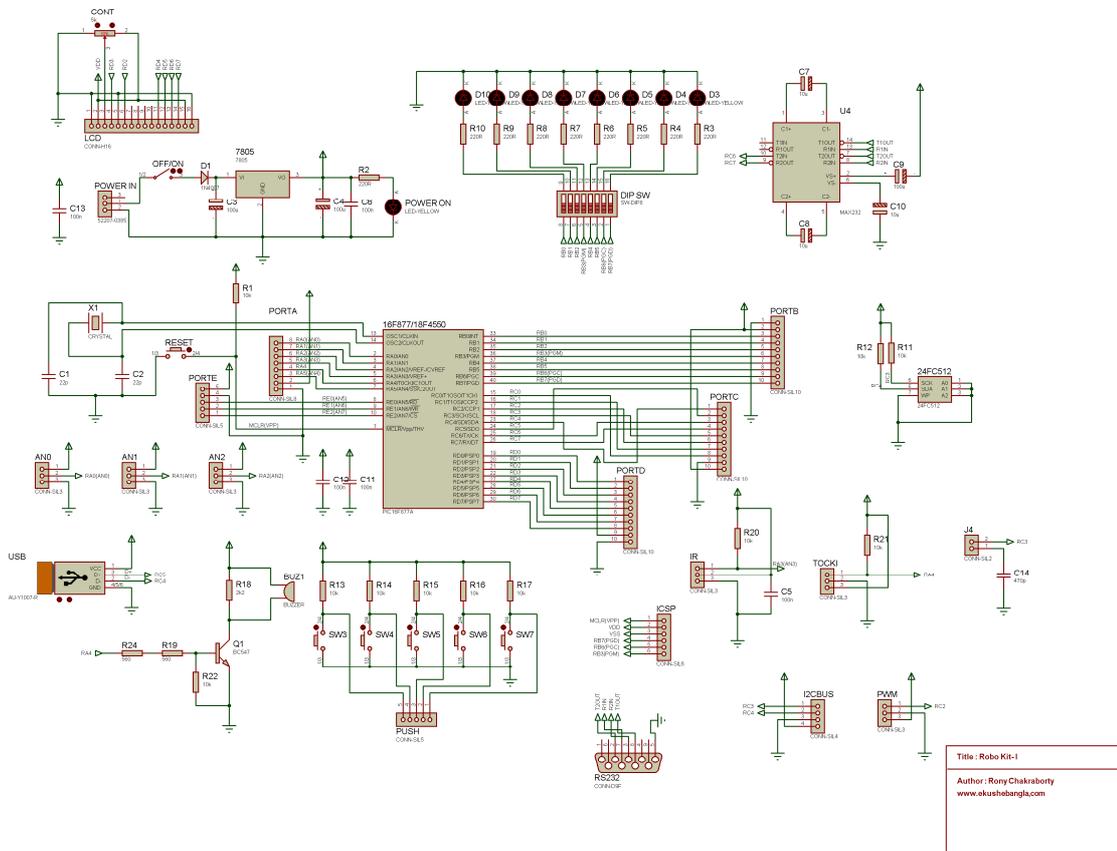
Boot Loader

In the case of Boot Loading, there are two separate topologies for USB and USART. Because the Robo Kit- I is most commonly supplied with USB supporting Chip 18F4550 so we prefer USB Boot Loader for this Board. USB boot loading is much simpler than USART, because today's most of laptop only support's USB. The boot-loader is configured to work with 20MHz crystal. **Boot Loader terminal software is also supplied with Robo Kit-I.** Turn power ON, press reset button, and immediately click on Write button on boot loader windows application. This will immediately write the software into your microcontroller. Boot Loader makes hobbyists' life easy.

In Circuit Serial Programming:

The ICSP header is available onboard. In case you want to use an external programmer, select one which has support for ICSP like [Pic Kit -2](#), this will facilitate the programming job, and you will not have to remove the microcontroller from its socket again and again. The board supports even low voltage programming, PGM pin is connected to PORTB.3 When High the microcontroller will be programmed by LVP. This is usually all set by the programmer itself. All you need to know is that the programmer might use RB3, RB6 and RB7 so, your application must not be using them at-least at the time of programming, and the pins should be free. . If you are connecting an external board, just remove the connector. Keep the system power on while programming, as the programmers can give only small amount of power, which is enough for microcontroller, but not for the entire board

Schematic of Robo Kit-I



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