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EasyPIC3 User's Manual



with on board

USB

2.0 programmer

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November 2005**

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CONNECTING THE SYSTEM

The development system box in basic option contains a development system, CD, USB cable, serial cable and this manual.

- Step no.1** The first thing to do is to insert the CD into your PC's CD-ROM drive.
- Step no.2** Take the system out of a box. Unpack the USB cable and connect it to the PC. Please use USB ports from the back of the PC, with direct contact to the motherboard.
- Step no.3** Connect the USB cable to the EasyPIC3 board.
- Step no.4** The PC will start the procedure for installing the USB driver for the on-board USB 2.0 programmer. Follow the procedure from the document “*Installing Driver for USB programmer*” and install the USB driver.
- Step no.5** Copy the file PICFlash2.exe to the folder of your choice. You can find this file in the PICFLASH2 folder on the CD.
- Step no.6** Run and use PICflash2 as explained in the document ‘*PICflash programmer*’.

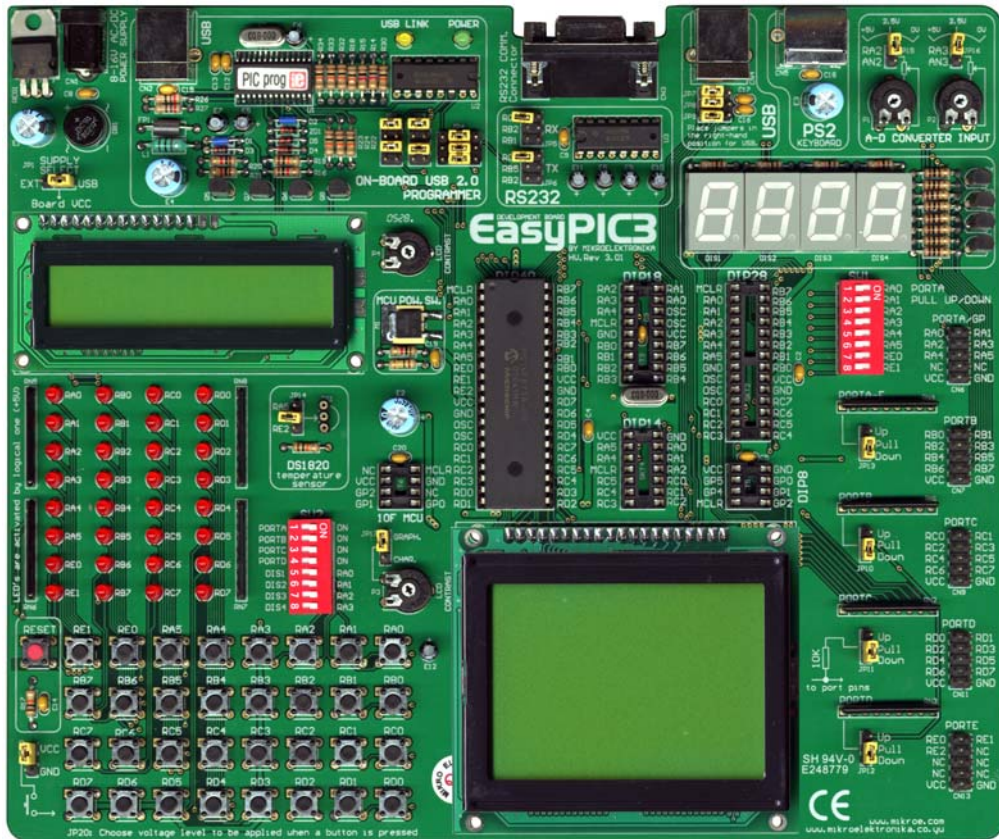
After these 6 steps, your EasyPIC3 is installed and ready for use. You should try to read a program from the chip or to load an example from the examples folder.

INTRODUCTION

The EasyPIC3 development system is a full-featured development board for Microchip PIC microcontrollers. It has been designed to allow students and engineers to easily exercise and explore the capabilities of PIC microcontrollers. It allows PIC microcontrollers to be interfaced with external circuits and a broad range of peripheral devices, allowing the user to concentrate on software development.

Figure 1 illustrates the development board. Each component is marked on a silkscreen. These marks describe connections to the microcontroller, operation modes, and provide some useful notes. The need for additional schematics is minimized as all the information is printed on the board.

Figure 1. EasyPIC3 development board



SWITCHES

The EasyPIC3 development board features a number of peripheral devices. In order to enable these devices before programming, you need to check if appropriate jumpers or switches have been properly set.

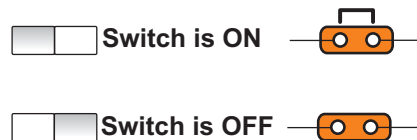
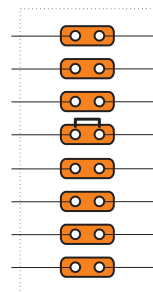
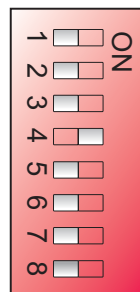
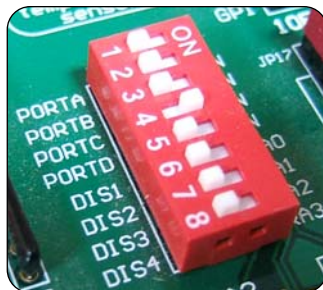
Switches are devices that have two positions - ON and OFF, which have a role to establish or break a connection between two contacts. The EasyPIC3 development system has two groups of switches.

The first group, **SW1**, enable a connection between the microcontroller ports with analog capabilities (PORTA and PORTE) and external pull-up/down resistors. The pull up/down resistors should be disconnected from the analog input pins, otherwise they will affect the input voltage level. When PORTA and PORTE pins are used as digital inputs/outputs, the appropriate pull-up/down resistors should be enabled.

The upper four switches of **SW2** are used to enable LEDs connected to PORTA/E, PORTB, PORTC and PORTD. For example, if switch PORTB is OFF, all PORTB LEDs will be turned off.

The lower four switches of **SW2** are used to enable the 7-segment displays. If you don't need the 7-segment displays in your project, these switches should be OFF.

Figure 2.
Group of 8 switches



JUMPERS

Jumpers, like switches, can break or establish a connection between two points. Beneath the plastic cover of the jumper is a metal contact, which makes a connection if the jumper is placed between two disconnected pins.

For example JP15 and JP16 are used to connect or disconnect potentiometers to RA2 or RA3 analog inputs. Connection is made when the jumper is placed between two contacts.

Figure 3.

Jumper as a switch



Jumper is ON



Jumper is OFF



More often jumpers are used as a selector between two possible connections using a three pin connector. As illustrated in Fig. 4, the middle contact can be connected to the left or right pin, depending on the jumper's position.

Figure 4.

Jumper as a multiplexer



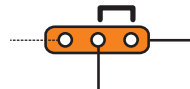
All lines are disconnected



Left line is selected



Right line is selected



MCU SOCKETS

The EasyPIC3 is delivered with a 40-pin microcontroller. Users can remove this, and fit a different microcontroller in DIP40, DIP28, DIP18, DIP14 or DIP8 packages of an adequate pin-out.

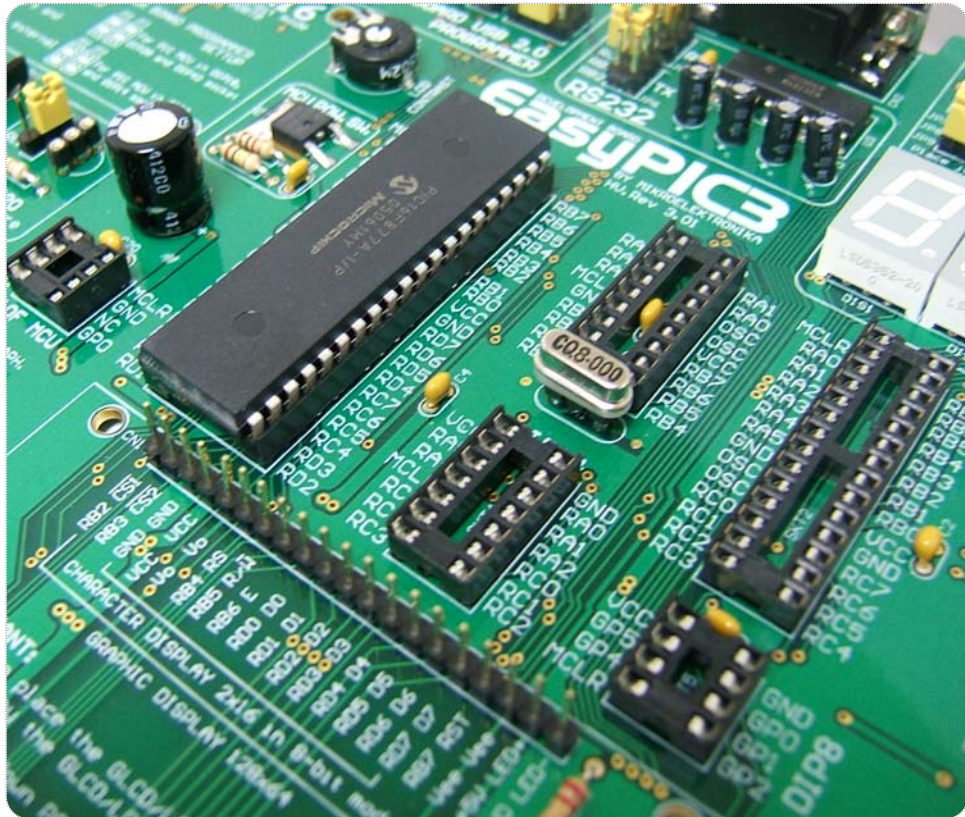


Figure 5.

MCU sockets

NOTE: Since all packages have parallel connections, there must not be more than one microcontroller on the board at a time.

The microcontroller's pins are routed to various peripherals as illustrated in Fig.6. All ports have direct connections to Direct Port Access connectors. Such connectors are typically used for connecting external peripherals to the board or for providing useful points for connecting digital logic probe.

All ports are connected to LEDs, push-button switches and pull-up/down resistors, which allow for easy digital pin state monitoring and testing.

Some of the pins are connected to other peripherals such as the DS1820 temperature sensor, RS-232 communication, 7-segment displays, LCD, etc.

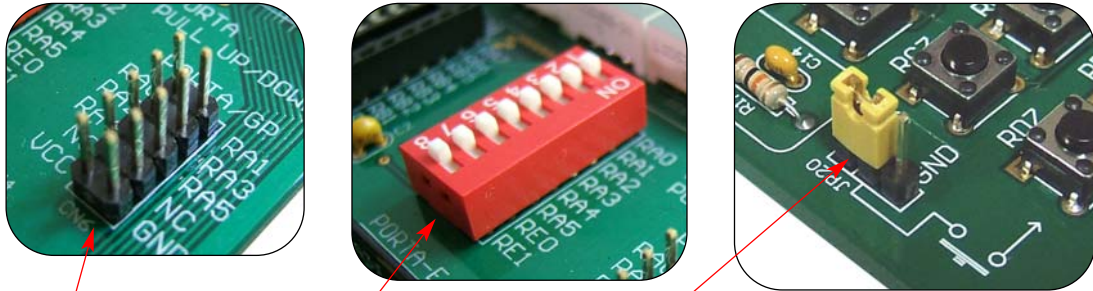
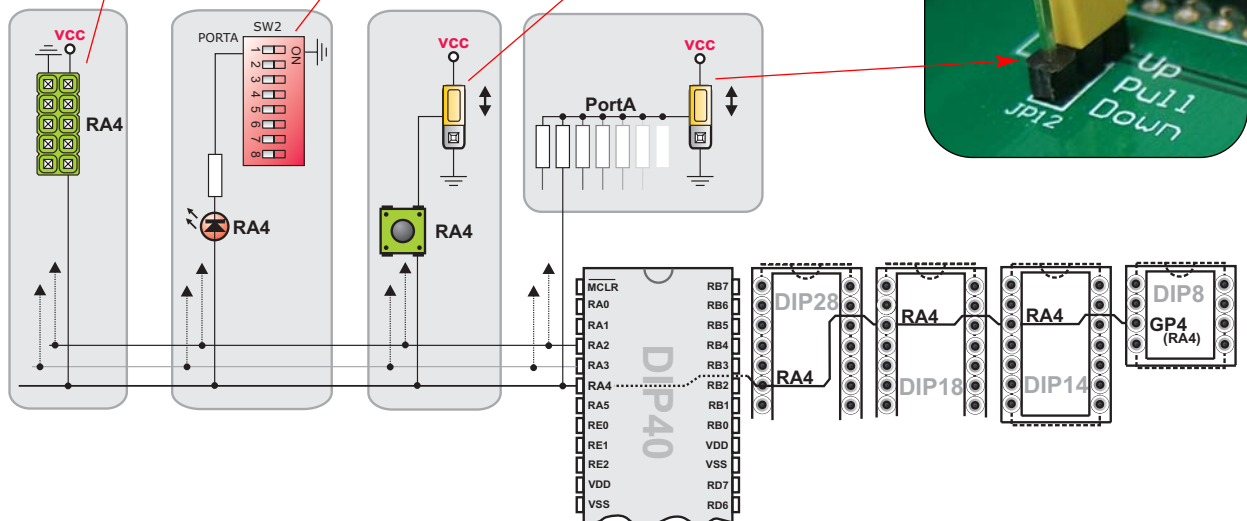


Figure 6. System connection



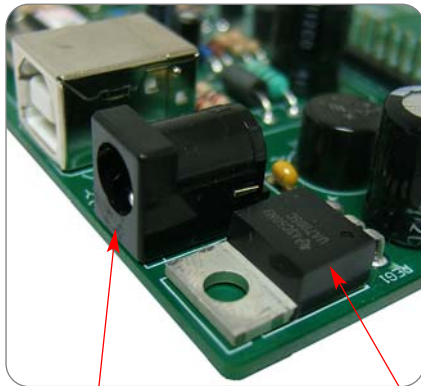
POWER SUPPLY

As a power supply source, users can select either a regulated supply from the USB cable (default) or an external non-regulated power supply.

In case of the USB power supply, the system should be connected to a PC using the USB programming cable and jumper JP1 should be set in the right-hand position.

In the case of an external power supply, the EasyPIC3 board produces +5V using an LM7805 voltage regulator. The external power supply can be AC or DC, with a voltage between 9V and 16 V and jumper JP1 should be set in the left-hand position. In Fig. 7 you can see the USB (left) and power supply (right) connectors.

Figure 7. USB and power supply connectors



JP1 in the left position: system will take power from the external AC/DC power adapter.

JP1 in the right position: system will take power from the USB cable.

Figure 8. Power supply select jumper

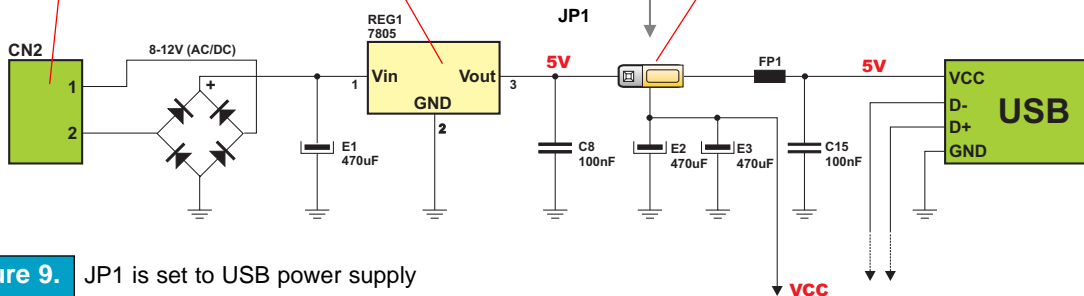
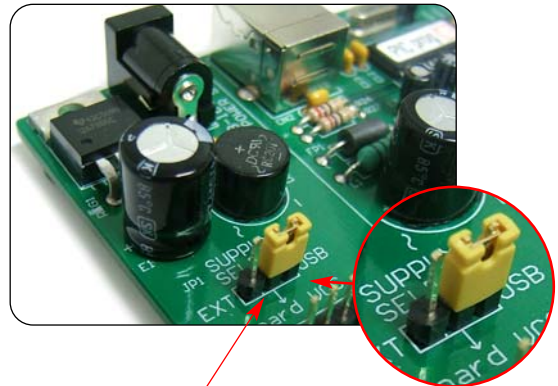


Figure 9. JP1 is set to USB power supply

ON-BOARD USB PROGRAMMER

There is no need for the use of external equipment during programming as the EasyPIC3 development system has its own on-board USB programmer. All you need to do is connect the system to a PC using the USB cable. Then, load your program into the microcontroller via the *PICFlash2* programming software which is supplied with the EasyPIC3.



Figure 10. USB programming connector

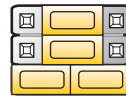
To the right of the USB programmer, there are jumpers JP2, JP3 and JP4.

Figure 11.

JP4 jumper explanation



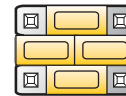
Default position



RB3 used as PGM



RB5 used as PGM



RB4 used as PGM

When using the DIP18, DIP28 and DIP40 sockets, (default) jumpers JP2 and JP3 should be in the upper position (default) as shown in Fig. 12.



Figure 12.

JP2 and JP3 for
DIP18, DIP28, or DIP40

For the DIP8 and DIP14 sockets, these jumpers should be in the lower position (Fig. 13).



Figure 13.

JP2 and JP3 for
DIP8 or DIP14

LEDs

Light Emitting Diodes (LEDs) are the most commonly used components, usually for displaying pin's digital state. The EasyPIC3 has 32 LEDs that are connected to the microcontroller's PORTA/E, PORTB, PORTC and PORTD.

Each group of eight LEDs can be enabled or disabled using switch SW2. Connection for PORTA/E is shown in Fig. 15.

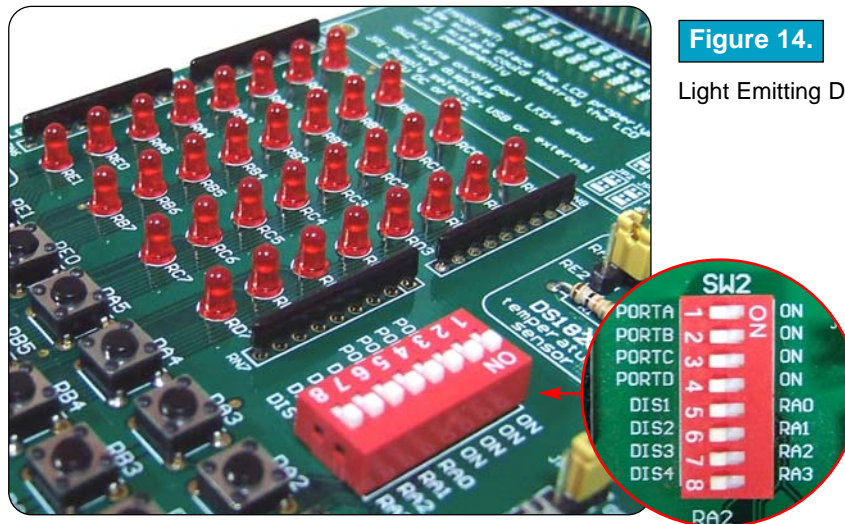
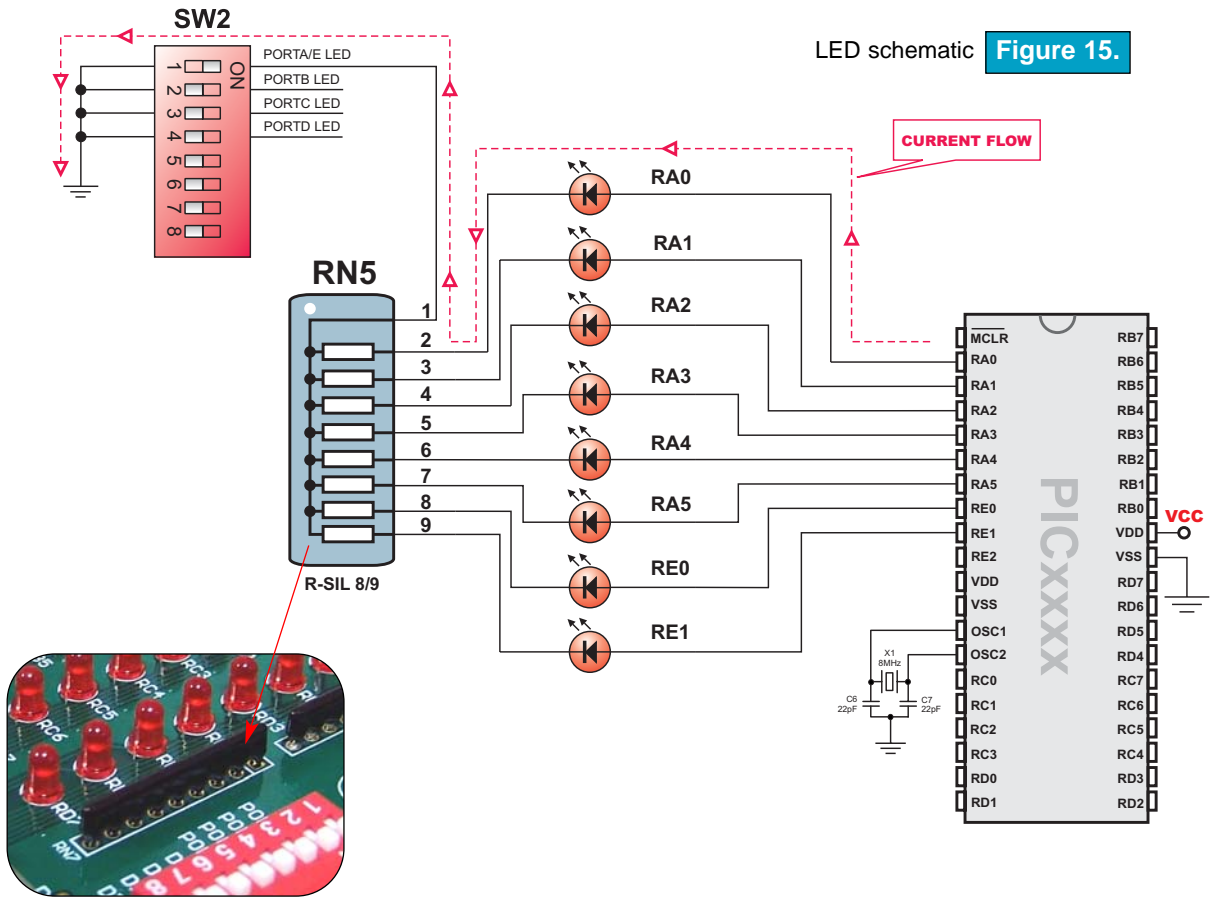


Figure 14.

Light Emitting Diodes

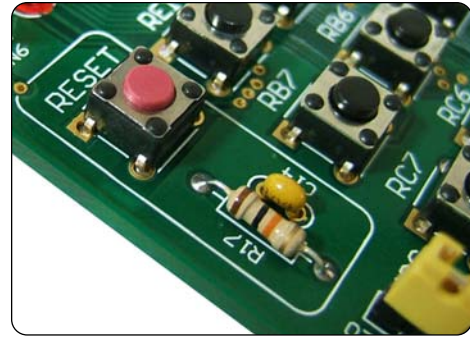
A resistor is used in series with the LED to limit the LED's current. In this case the resistor's value is 1K. All eight LEDs from one port are connected to a common point through these resistors, which can then be connected or disconnected to ground by the corresponding switch on SW2.

The LEDs are enabled when connected to ground and will display the state of the corresponding microcontroller pin; otherwise the LEDs will always be off, no matter what the port state is as no current can flow through it.



PUSHBUTTON SWITCHES

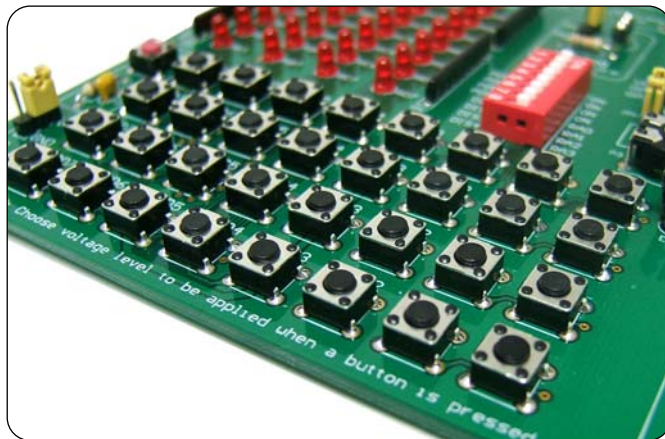
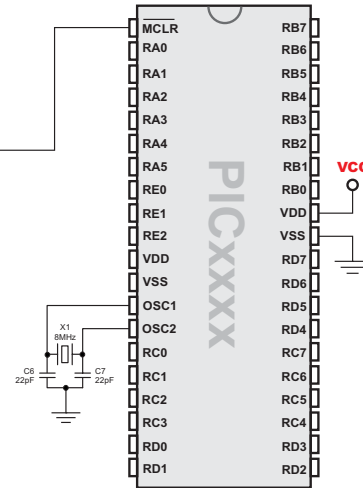
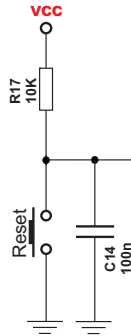
The EasyPIC3 has 32 pushbutton switches, which can be used to provide digital inputs to the microcontroller's ports. There is also one switch that acts as a RESET. Reset switch schematic is shown in Figure 17.



Reset switch **Figure 16.**

Figure 17.

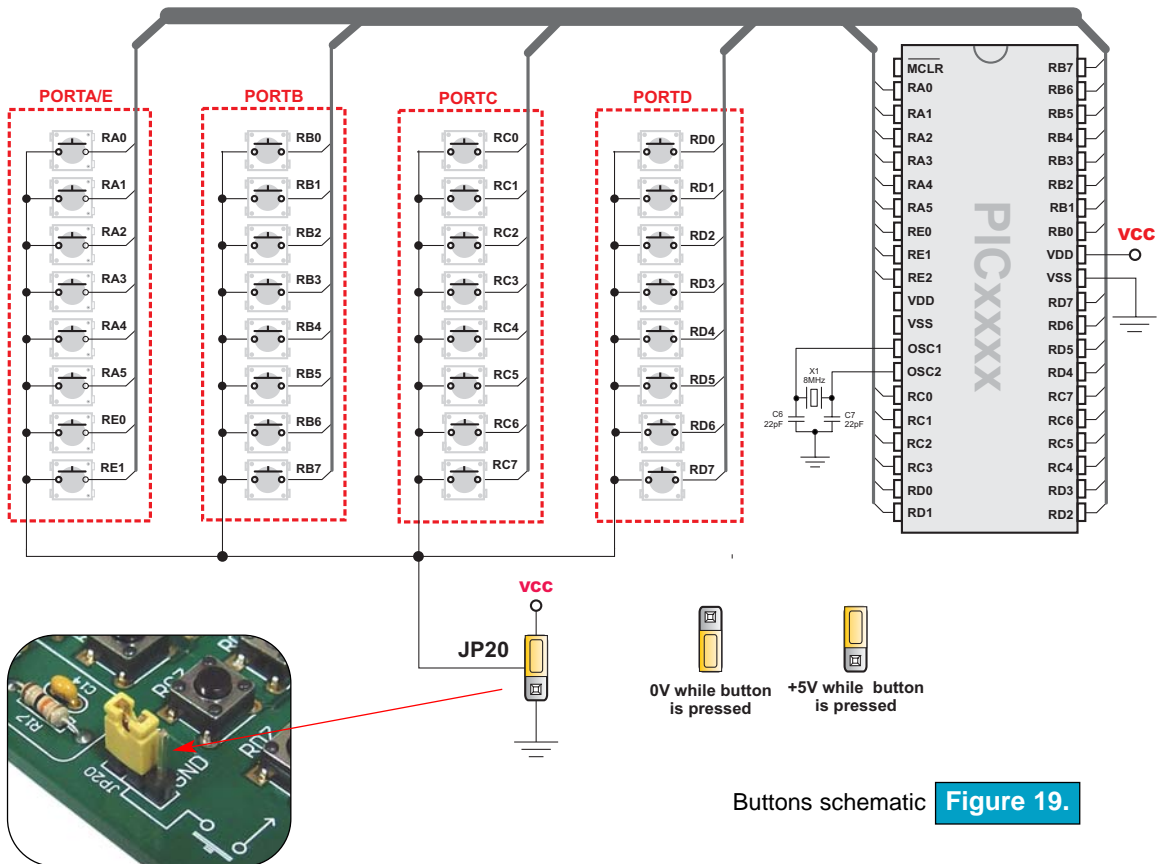
Reset switch schematic



Pushbutton switches **Figure 18.**

Switch connections to PORTA/E, PORTB, PORTC and PORTD are shown in Fig. 19. Jumper JP20 determines whether a button press will bring logical zero or logical one to the appropriate pin. In the example shown in Fig. 19, the switches are connected to +5V.

In order to detect a switch state, pull-up or pull-down resistors should be used. Which is used depends on how JP20 is set and is illustrated on the next page. For the example shown in Fig. 19, pull-down resistors would be required.



Buttons schematic **Figure 19.**

In the case of Fig. 20 the pull-up resistor pulls the microcontroller port pin to +5V when the button is not pressed. A button press causes the port pin to be connected to ground (JP20 is in the lower position). Thus, only when the button is pressed will the microcontroller sense a logical ZERO; otherwise the pin state will always be logical ONE.

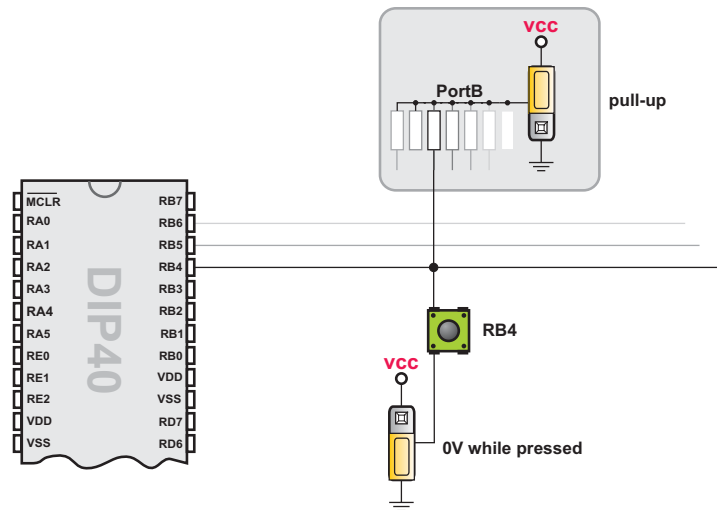


Figure 20. Button with pull-up resistor

In the case of Fig. 21 the pull-down resistor pulls the microcontroller port pin to ground when the button is not pressed. A button press causes the port pin to be connected to +5V (JP20 is in the upper position). Thus, only when the button is pressed will the microcontroller sense a logical ONE; otherwise the pin state will always be logical ZERO.

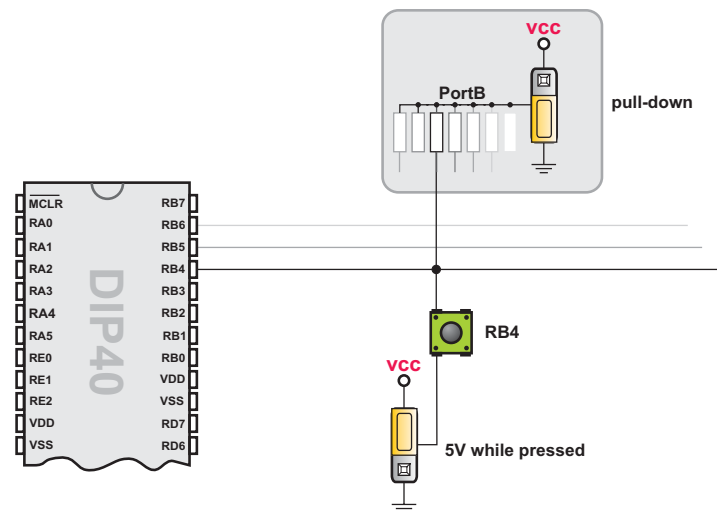


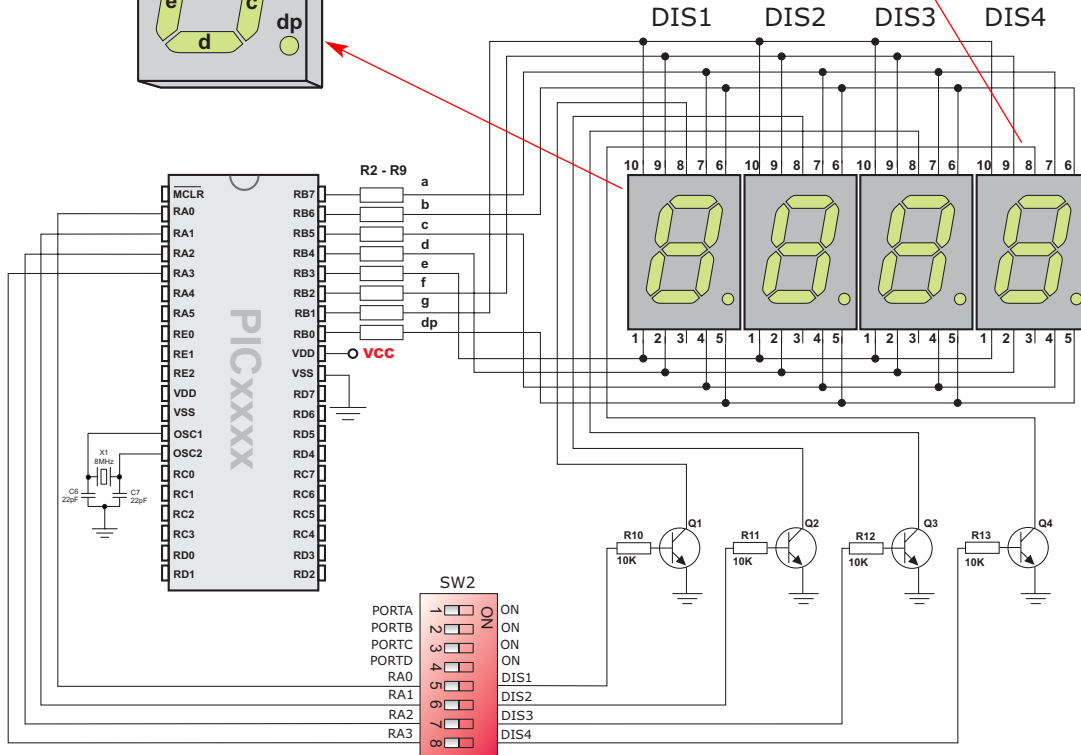
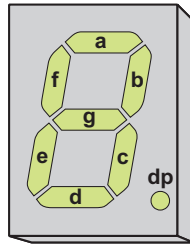
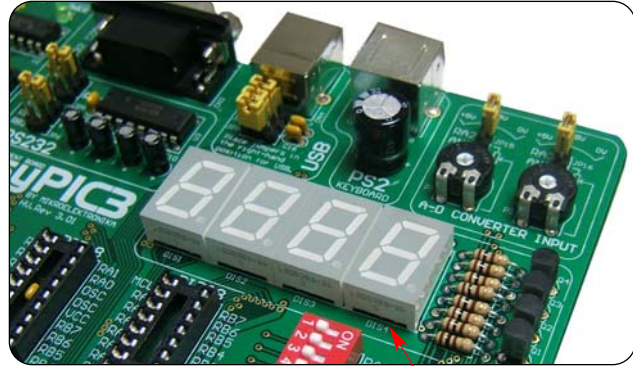
Figure 21. Button with pull-down resistor

7-SEGMENT DISPLAYS

The EasyPIC3 has four 7-segment displays in multiplex mode. Data lines are connected to PORTB, while each display is enabled through the lower four bits of PORTA.

Figure 22.

7-segment displays



7-segment displays schematic

Figure 23.

7 SEGMENT DISPLAYS

GRAPHIC LCD

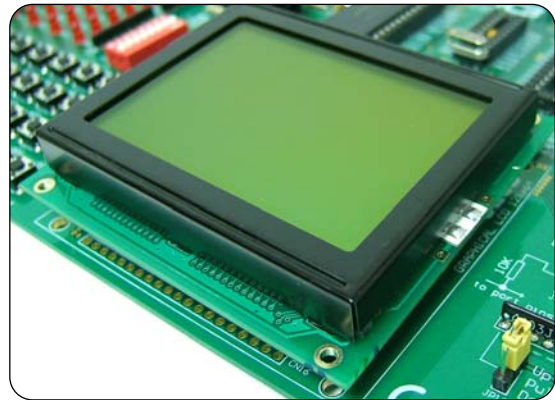
The Graphic LCD (GLCD) allows advanced visual messages to be displayed. While a character LCD can display only alphanumeric characters, a GLCD can be used to display messages in the form of drawings and bitmaps. The most commonly used graphic LCD has a screen resolution of 128x64 pixels. Before a GLCD is connected, the user needs to set jumper JP17 (Fig. 24) to the upper position. The GLCD's contrast can be adjusted using potentiometer P3, which is placed to the left of the GLCD below jumper JP17.

Figure 24.

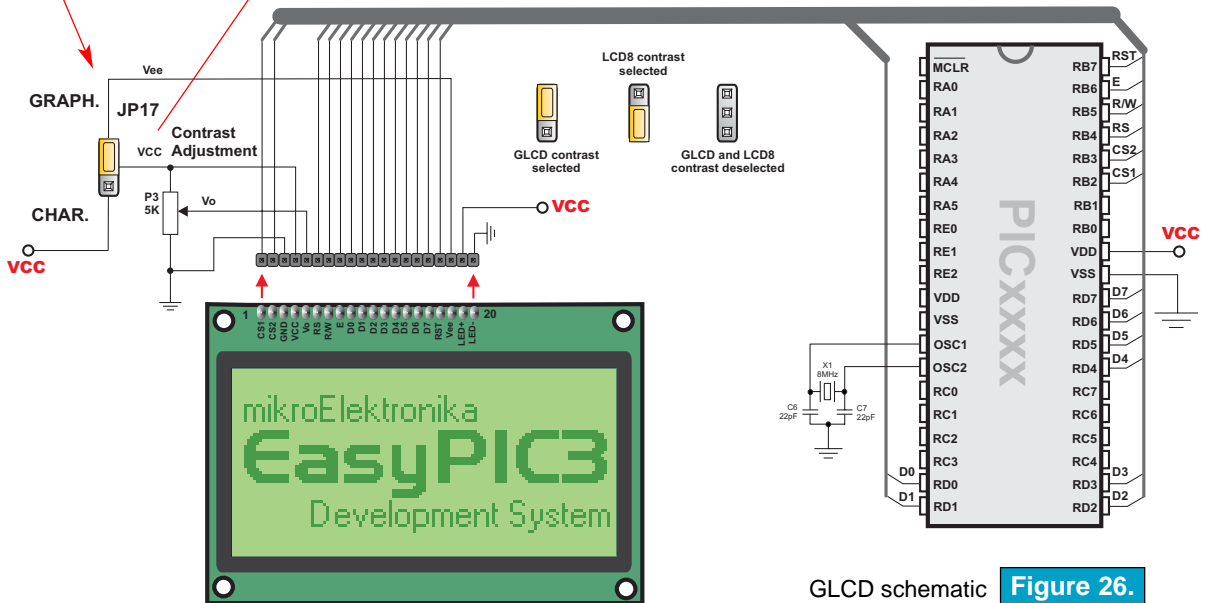
GLCD selection jumper



In order to enable GLCD, jumper JP17 should be set to the upper position, labeled as GRAPH.



GLCD **Figure 25.**



GLCD schematic **Figure 26.**

GRAPHIC LCD 128X64

LCD 2X16 IN 4-BIT MODE

The standard character LCD is probably the most widely used data visualization component. Normally, it can display two lines of 16 alphanumeric characters, each made up of 5x7 pixels. The character LCD communicates with the microcontroller via a 4-bit or 8-bit data bus, each requiring the use of a different connector on the EasyPIC3. For 4-bit data bus use, the LCD should be placed in the upper left of the board above the LEDs. The connection to the microcontroller is shown in Fig. 28 where there are only four data lines. It is important that the LCD is only added or removed from the EasyPIC3 when the power is off.

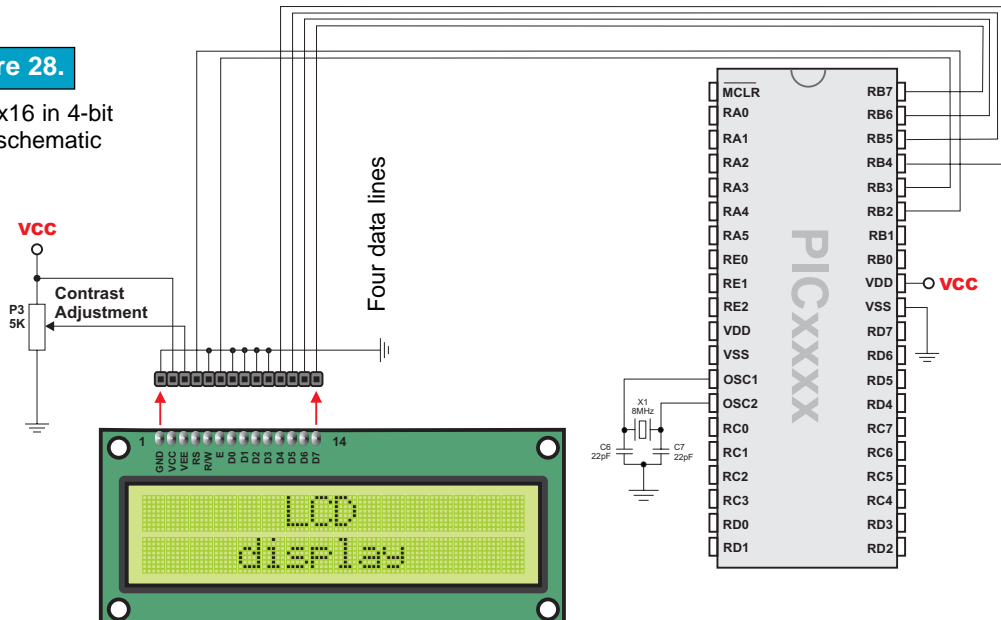


Figure 27.

LCD 2x16 in 4-bit mode

Figure 28.

LCD 2x16 in 4-bit mode schematic



LCD 2X16 IN 8-BIT MODE

When using a character LCD in 8-bit mode, the connector that is shared with the GLCD should be used. Since this connector has 20 pins and the character LCD has only 14 pins, special attention is required when placing the LCD. Otherwise the LCD can be permanently damaged.

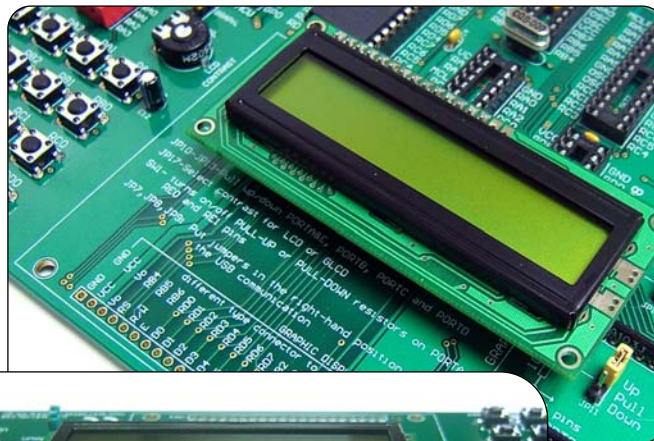
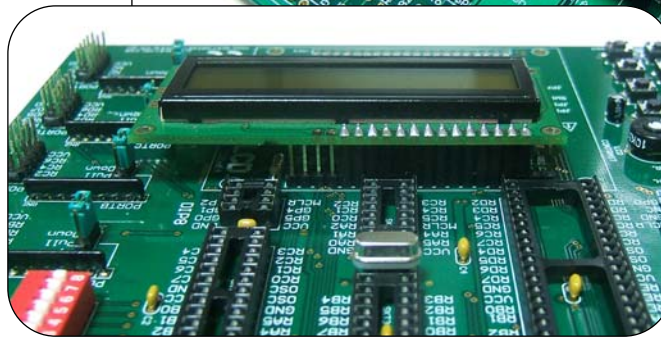


Figure 29.

LCD 2x16 in 8-bit mode

View from the back:
shows which pins
stays disconnected.

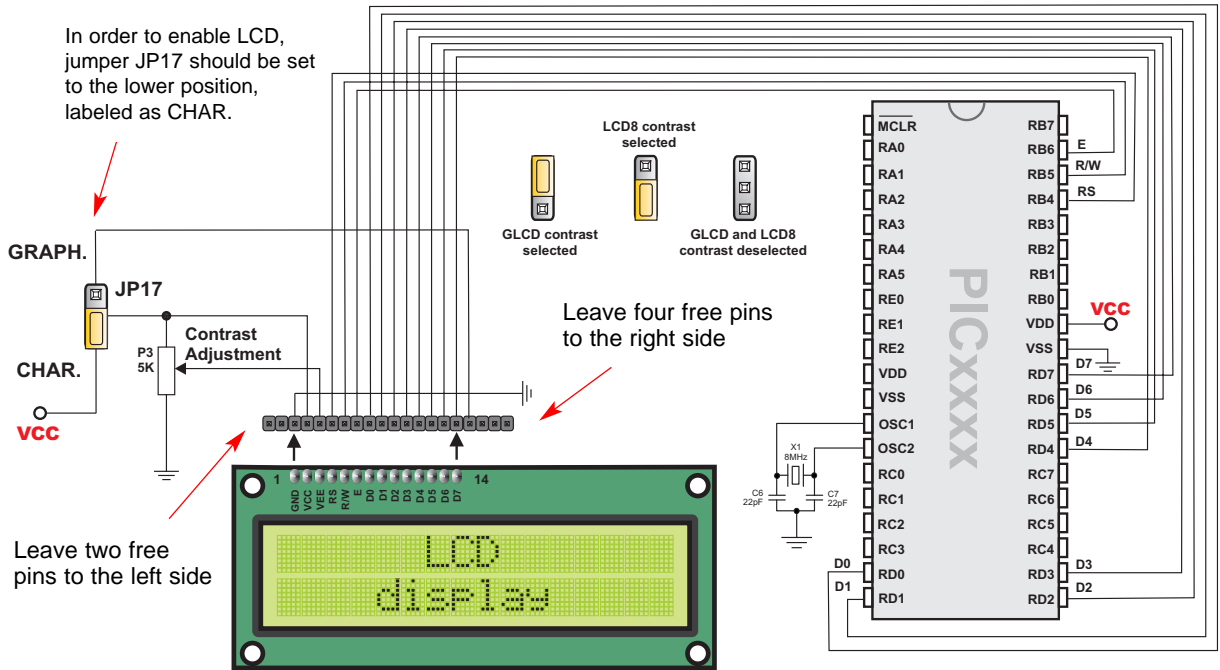


The LCD must be placed in the marked position with two free pins to the left and four free pins to the right (Figure 29). Only add or remove the LCD from the EasyPIC3 when the power is off. Before adding the LCD, set jumper JP17 to the lower position. The LCD's contrast can be adjusted using potentiometer P3 which is located to the left of the GLCD/LCD connector.

NOTE: Special attention is required when placing the LCD. Otherwise the LCD can be permanently damaged.

LCD 2X16 IN 8 BIT MODE

Figure 30. LCD 8-bit mode schematic



LCD 2X16 IN 8 BIT MODE

RS-232 COMMUNICATION

RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications for the transfer of data between the microcontroller and a PC. Since the voltage levels of a microcontroller and PC are not directly compatible with those of RS-232, a level transition buffer such as the MAX232 must be used.

In order to provide a more flexible system, the microcontroller is connected to the MAX232 through the two jumpers JP5 and JP6. Jumper JP5 is used to connect the Rx line to RC7, RB2 or RB1. Jumper JP6 is used to connect the Tx line to RC6, RB5 or RB2. Note that JP5 and JP6 must not be connected to RB2 at the same time.

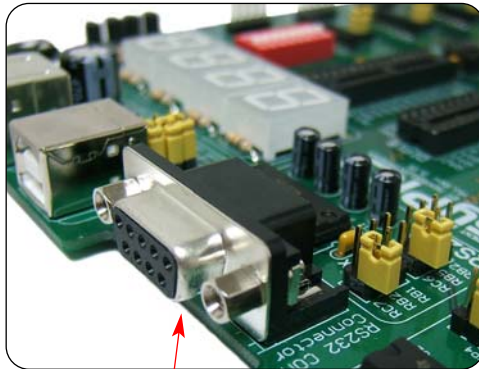
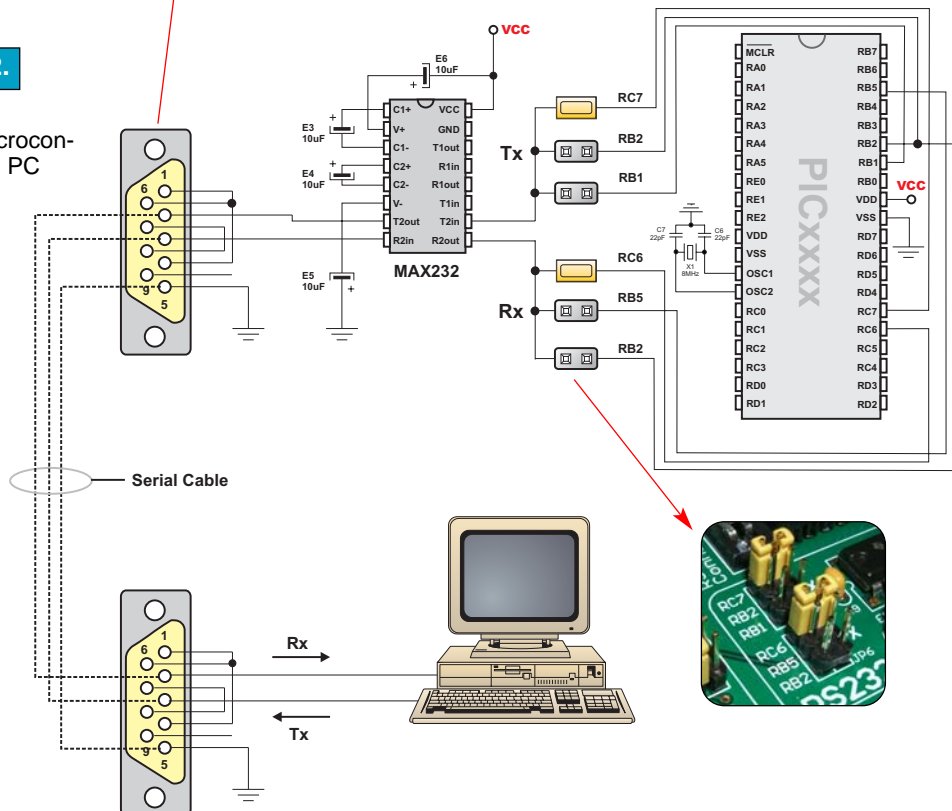


Figure 31. RS232 connector

Figure 32.

Connection between microcontroller and a PC



USB COMMUNICATION

A USB communication connector is placed in the upper right corner of the EasyPIC3 between the RS-232 and PS/2 connectors. It is used with specific PIC microcontrollers that have USB support, such as PIC18F2450 and PIC18F4550. Note that the USB communication connector cannot be used for programming and that the USB programming connector cannot be used for communication. In order to enable connection between the microcontroller and USB communication connector jumpers JP7, JP8 and JP9 should be set to the right-hand position. As a result, the microcontroller's RC3, RC4 and RC5 pins are disconnected from the rest of the system and connected to the USB communication connector.

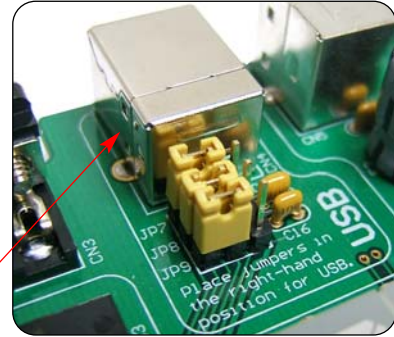


Figure 33.

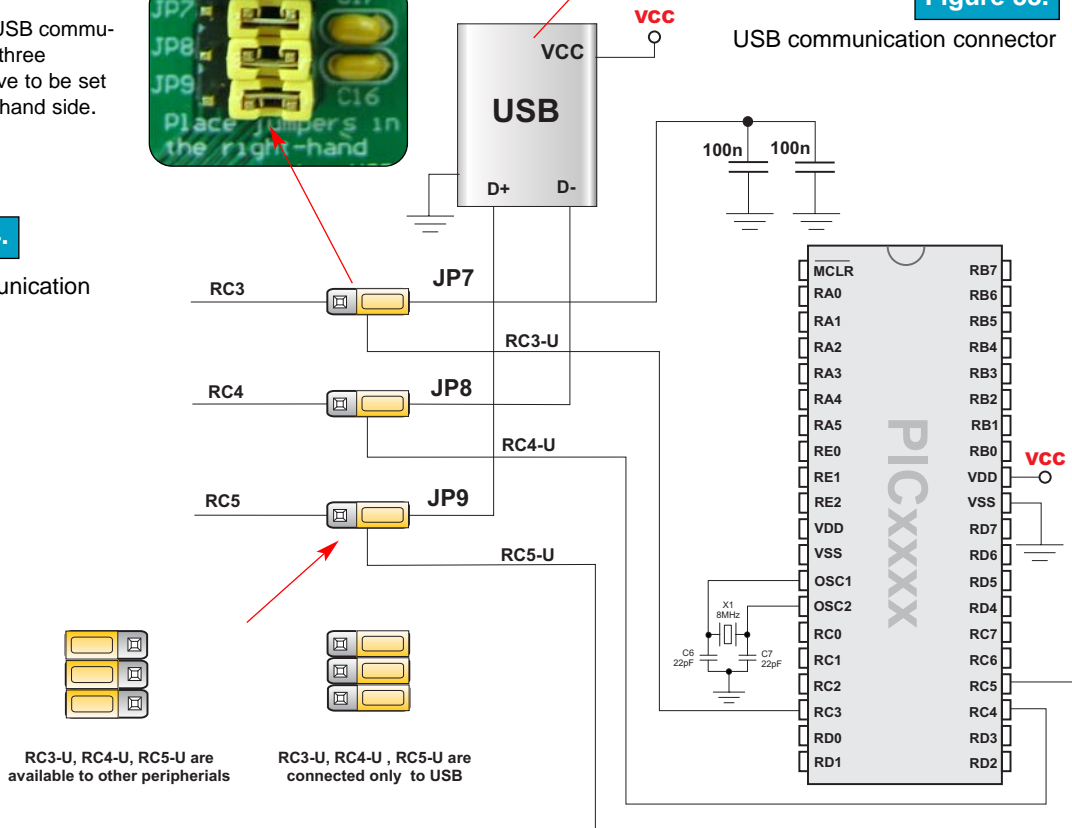
USB communication connector

To enable USB communication all three jumpers have to be set to the right-hand side.



Figure 34.

USB communication schematic



RC3-U, RC4-U, RC5-U are available to other peripherals

RC3-U, RC4-U, RC5-U are connected only to USB

PS/2 COMMUNICATION

The PS/2 connector allows direct connection between the EasyPIC3 and devices that use PS/2 communication, such as a PC, keyboard or mouse. For example, the microcontroller can be connected to a keyboard to read the pressed keys or it can be connected to a PC to act as a keyboard. For data transfer CLK and DATA lines are used. In this case, they are connected to pins RC1 and RC0 respectively.

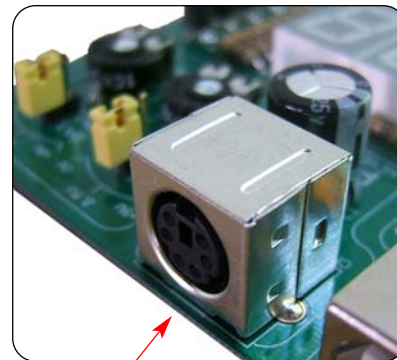


Figure 35.

PS/2 connector

PS/2 COMMUNICATION



Figure 36.

Keyboard connected to development board

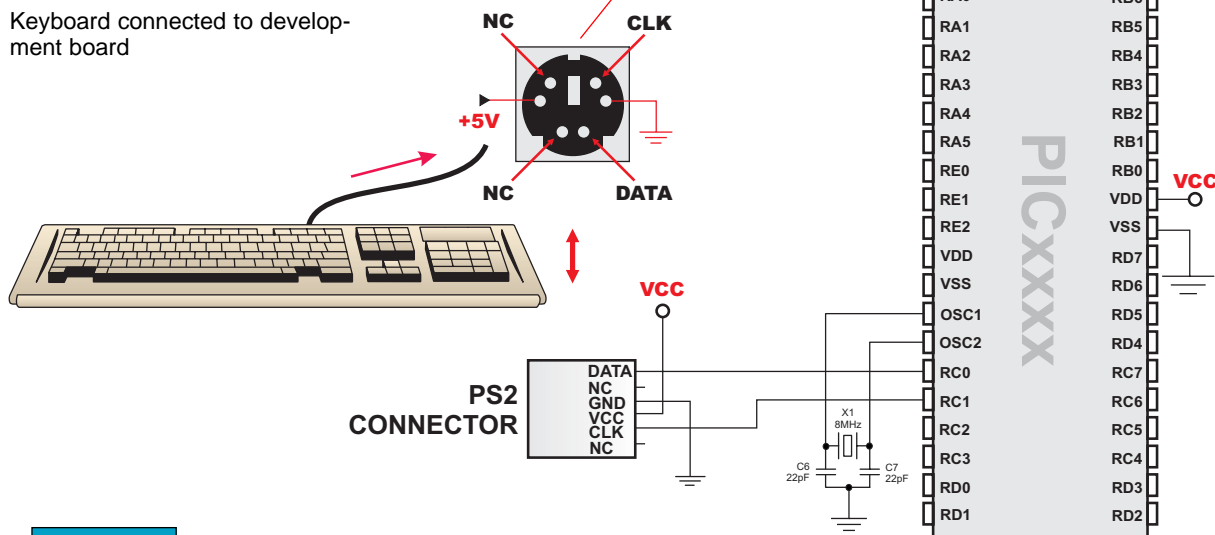


Figure 37. PS/2 communication schematic

DS1820 DIGITAL THERMOMETER

The DS1820 digital thermometer is well suited to environmental temperature measurement, having a temperature range of -55°C to 125°C and an accuracy of $\pm 0.5^{\circ}\text{C}$. It must be placed correctly in the 3-pin socket provided on the EasyPIC3, with its rounded side to the right, as marked on the board (see Fig. 38) otherwise the DS1820 could be permanently damaged. The DS1820's data pin can be connected to either the RA5 or RE2 pin, which is determined by jumper JP14.



Figure 38.

DS1820

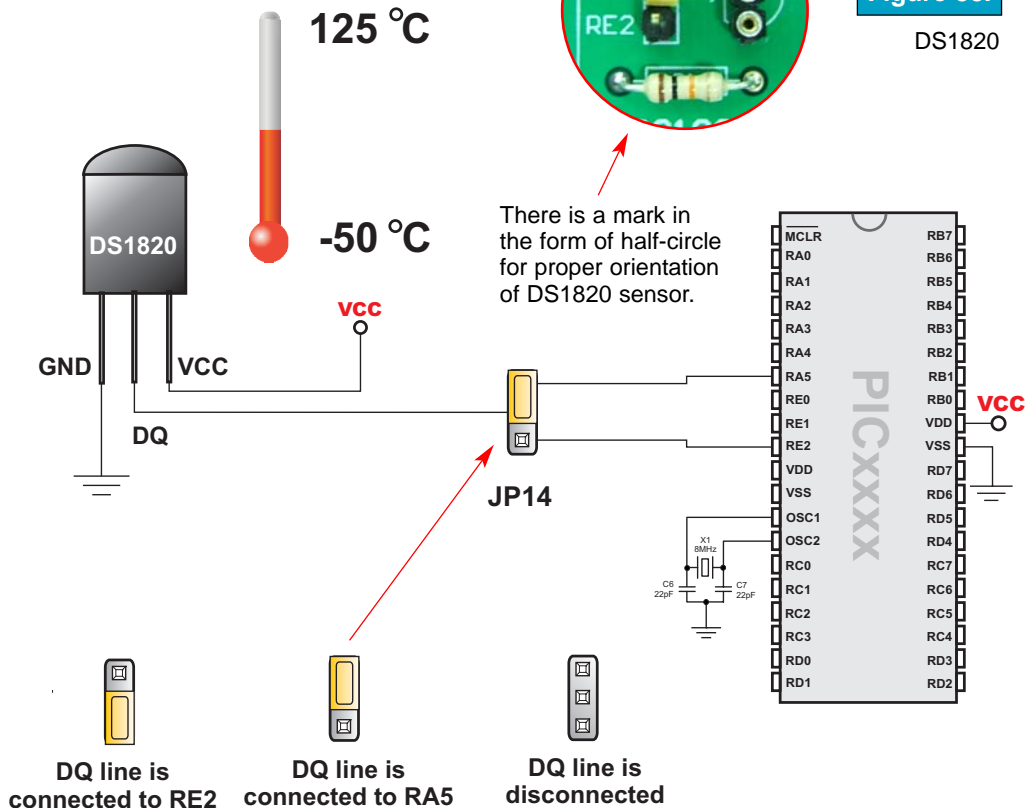
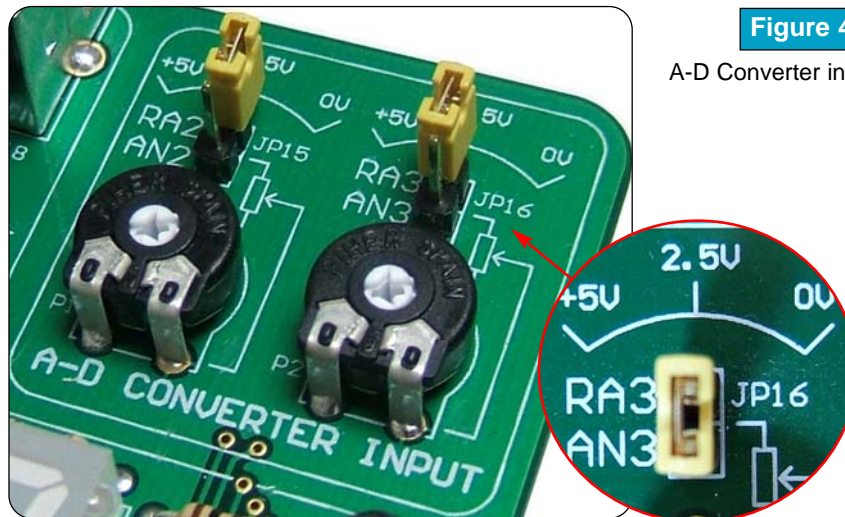


Figure 39. DS1820 Schematic

DS1820 DIGITAL THERMOMETER

A-D CONVERTER INPUT

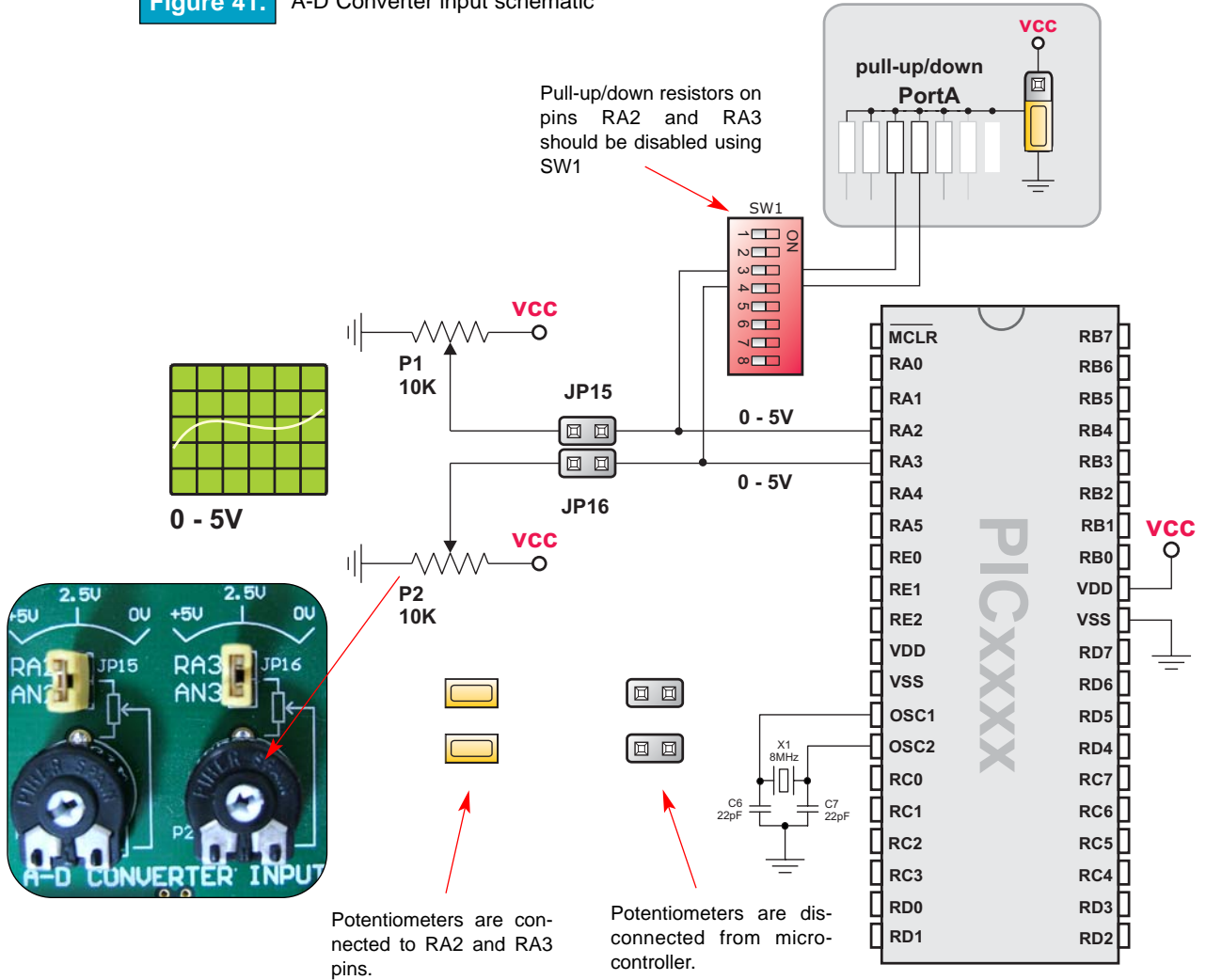
The EasyPIC3 development board have two potentiometers for working with Analogue to Digital Converter - ADC. Potentiometer P1 is active when jumper JP15 is enabled and gives analogue signal to microcontroller's RA2 pin. Potentiometer P2 is active when jumper JP16 is enabled and gives analogue signal to RA3 pin. Both potentiometers analogue output is in the range of 0V to 5V as drawn on board.



In order to measure analogue signal without interference, the pull-up/down jumper should be removed from PORTA. In this way PORTA pins remain floating.

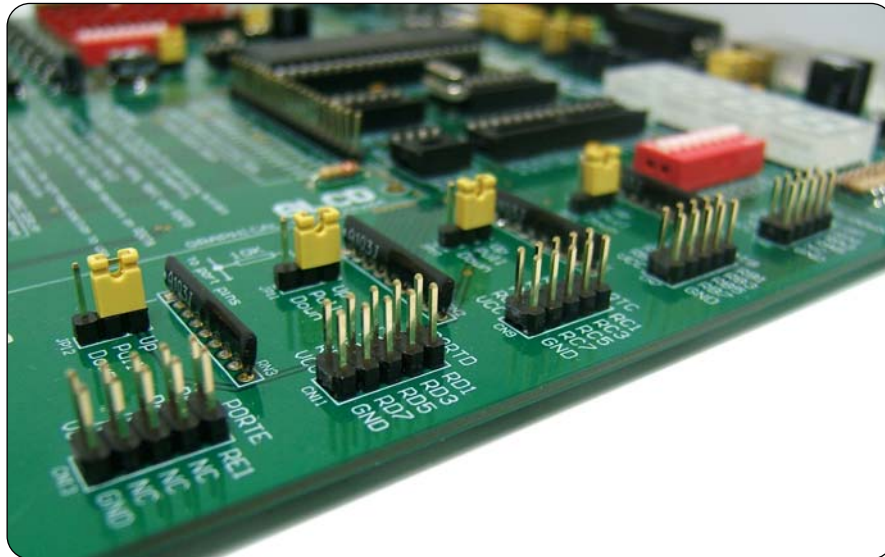
The application of A-D Conversion is various. Microcontroller takes analogue signal from its input pin and translates it into a digital number. Basically, you can measure any analogue signal that fits in range acceptable by PIC. That range is 0V to 5V.

Figure 41. A-D Converter input schematic



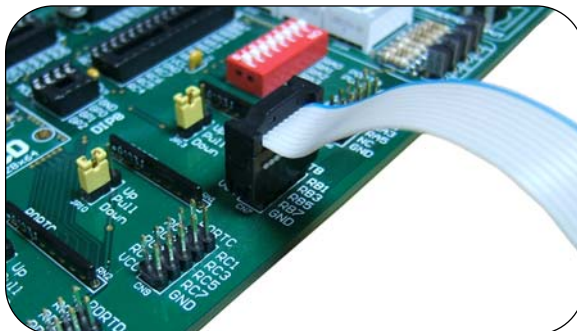
DIRECT PORT ACCESS

All microcontroller input/output pins can be accessed via connectors placed along the right-hand side of the board. For each of the PORTA, PORTB, PORTC, PORTD and PORTE, there is one 10-pin connector providing Vdd, GND and up to eight port pins.



Direct port access connectors **Figure 42.**

These connectors can be used for system expansion with external boards such as Compact Flash, CAN, RS-485, etc. Ensure that the on-board peripherals are disconnected from microcontroller by setting the appropriate jumpers while external peripherals are using the same pins. The connectors can also be used for attaching logic probes or other test equipment.

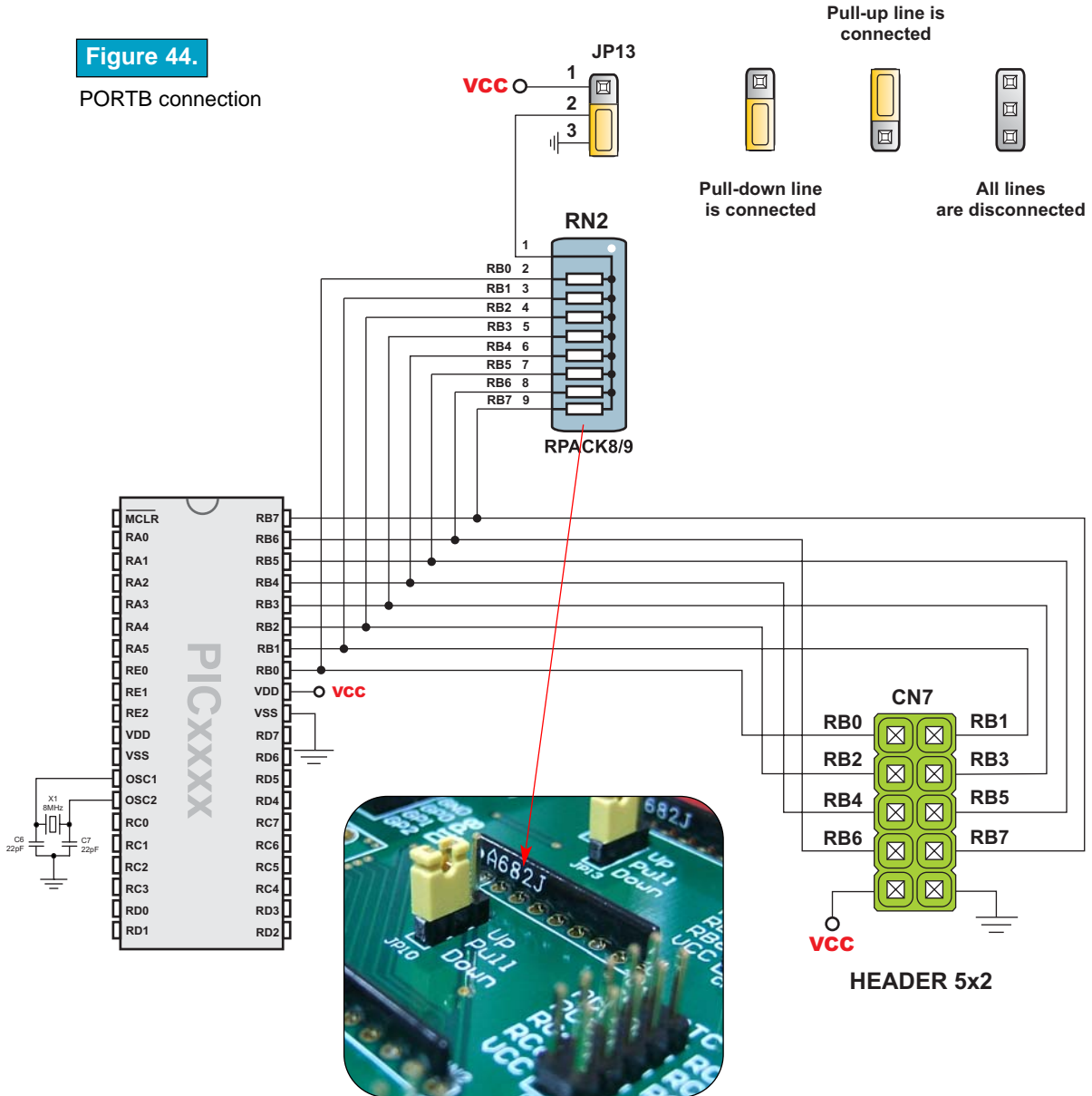


Example of how to connect external peripheral with flat cable

Figure 43.

Figure 44.

PORTB connection



DIRECT PORT ACCESS

If you are experiencing problems with any of our products or you just want additional information, please let us know. We are committed to meeting your every need.

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