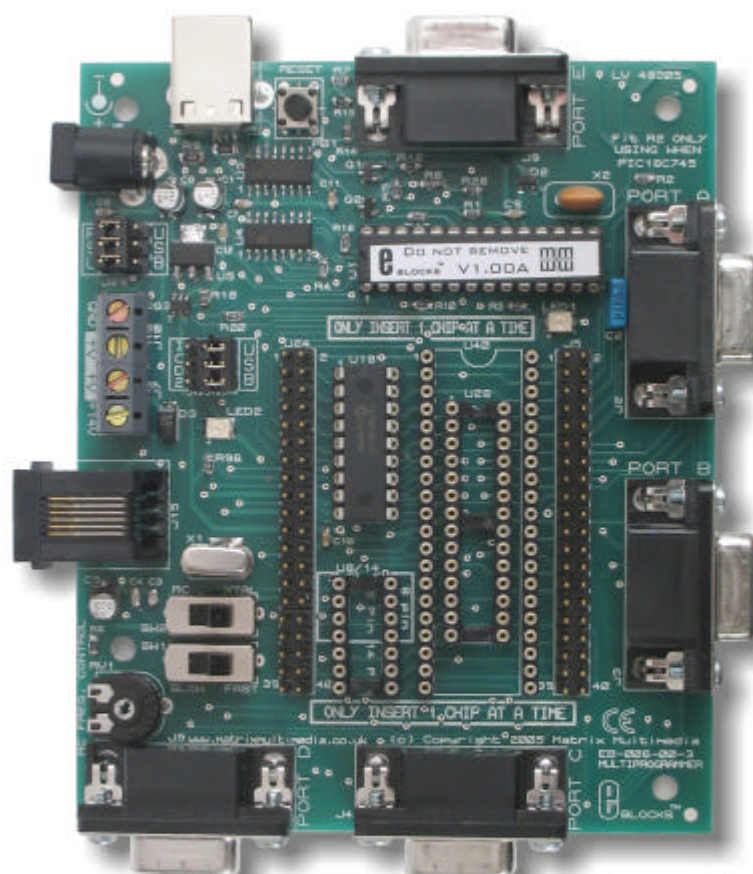




PICmicro® Microcontroller Multiprogrammer datasheet



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1 About this document

This document concerns the Matrix USB Multiprogrammer code EB-006-00-3.

Trademarks and Copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc.

E-blocks is a trademark of Matrix Multimedia Limited.

EB-006 and associates software and documentation are Copyright ©2005 Matrix Multimedia Limited.

Other sources of information

There are various other documents and sources that you may find useful:

Getting started with E-Blocks.pdf

This describes the E-blocks system and how it can be used to develop complete systems for learning electronics and for PICmicro programming.

PPP Help file

This describes the PPP software and its functionality. PPP software is used for transferring hex code to a PICmicro microcontroller.

Disclaimer

The information in this document is correct at the time of going to press. Matrix Multimedia reserves the right to change specifications from time to time.

Technical support

If you have any problems operating this product then please refer to the troubleshooting section of this document first. You will find the latest software updates, FAQs and other information on our web site: www.matrixmultimedia.co.uk. If you still have problems please email us at: support@matrixmultimedia.co.uk. When emailing please state the operating system, the hardware and the version of PPP you are using.

2 General information

Description

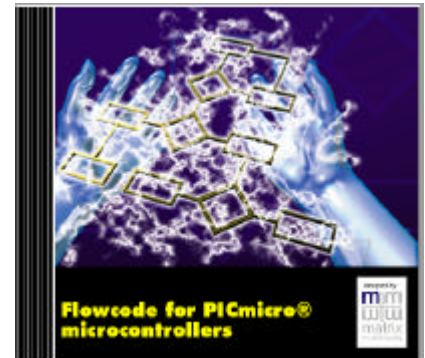
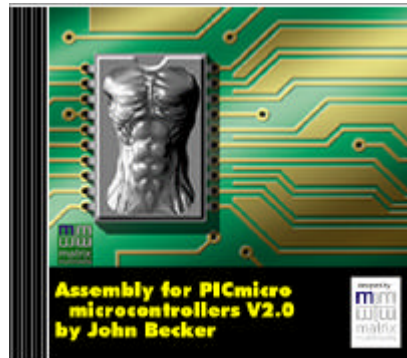
This new PICmicro microcontroller programmer connects to your PC via USB to provide you with one of the world's lowest cost and most flexible PICmicro microcontroller programmers. This board can be used with Assembly, C or Flowcode programming utilities provided by Matrix Multimedia. The board will program most 8, 14, 18, 28 and 40 pin flash PICmicro microcontroller devices' using the flexible programming software provided – PPP - and provides 'clean' access to all I/O lines on the relevant PICmicro MCU devices.

Further information on E-blocks is available in a separate document entitled Introduction to E-blocks.doc.

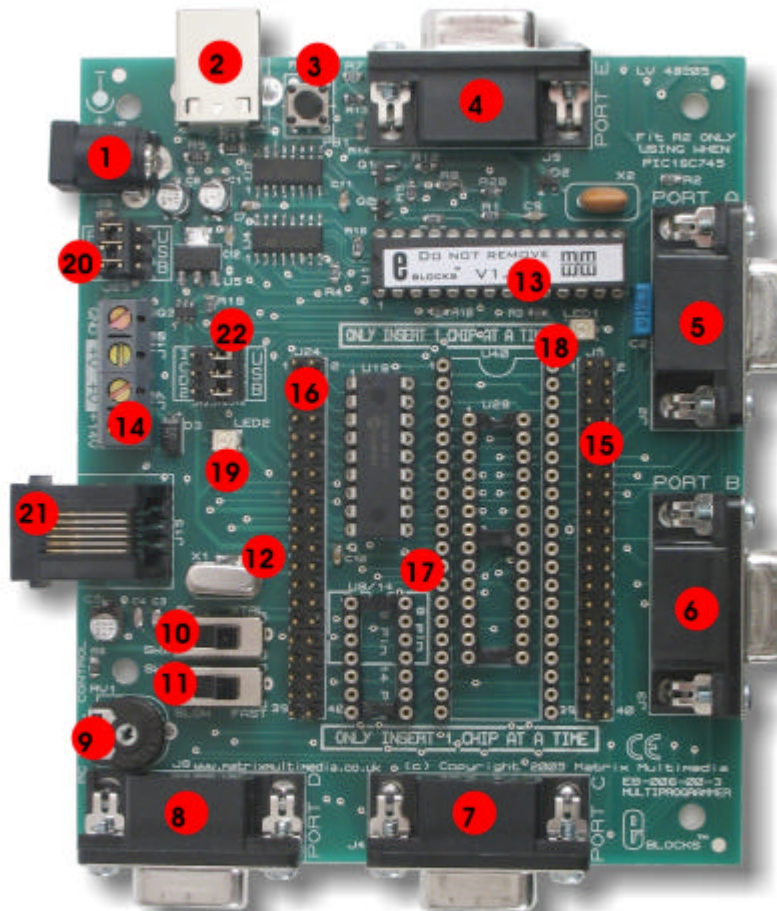
Features

- E-blocks compatible
- Low cost
- Used as a programmer and as a development board
- Programs a wide range of PICmicro MCU devices
- Full suite of programming software
- RC or Xtal operation
- 5 I/O ports
- In-Circuit Debugging via MPLAB® ICD2

Three courses and programming systems compatible with this product are available on CD ROM:



3 Board overview



1. Power connector (positive outer – negative inner)
2. USB connector
3. Reset switch
4. Port E I/O
5. Port A I/O
6. Port B I/O
7. Port C I/O
8. Port D I/O
9. RC clock speed potentiometer
10. RC clock speed switch
11. Clock crystal / RC switch
12. Crystal socket
13. PICmicro Programming chip
14. Screw Terminals
15. Expansion connector (J5)
16. Expansion connector (J24)
17. PICmicro turned pin DIL sockets
18. 'Ready to go' programming LED
19. Power LED
20. Power Selection Jumper
21. ICD2 connector
22. Programming Selection Jumper

4 Getting Started

4.1 Installation instructions - Software

Installing PPP v3

To install run PPPv3.exe, which is located at <D>:\PPPv3\PPPv3.exe and follow the instructions provided. <D> refers to your CD drive.

By default PPPv3 is installed into:

C:\Program Files\Matrix Multimedia\Common\PPPv3\

There are four 'Features' that can be installed.

- * PPP v3 core files - this is PPP v3 itself, and should be installed.
- * Update ASM4PICs - This feature allows you to update ASM4PICs to use PPP v3.
- * Update C4PICs - This feature allows you to update C4PICs to use PPP v3.
- * Update Flowcode - This feature allows you to update Flowcode to use PPP v3.

The three updates will be automatically installed. Select the 'X' 'Do not install option' if you do not to update a feature.

If you need to update a product at a later date you can re-run the install and update that feature.

There is more help and information available on the CD provided at <D>:\PPPv3\readme.txt
<D> refers to your CD drive.

4.2 Installing in the Multiprogrammer

When you connect the Multiprogrammer to your computer, via the USB cable, the first time there will be installation routine for this 'new hardware'. This for most users will be a 'plug and play' routine where your computer will automatically recognize the hardware.

Running on Windows 2000 / ME / XP

These programs allow 'plug and play' for your new hardware. Therefore when you first connect the Multiprogrammer to your computer you will receive a pop-up screen that indicates that there is new hardware connected to the computer. The program itself will deal with any installation of any drivers that it requires internally. Therefore you can use your Multiprogrammer immediately.

Running on Windows 98 (you will need the Windows 98 CD at hand)

When you connect the Multiprogrammer to the computer your Windows 98 program will run a 'New Hardware Wizard'. This procedure is straightforward and easy to understand. Follow the on-screen instructions. Once this has been completed the Multiprogrammer will be ready to use.

There is more detailed information and help on the CD provided at <D>:\blocks\Installation Guide.doc

4.3 Programming the PIC16F88

Testing the Multiprogrammer Board – RC_LVP.hex

The following instructions explain the steps to test and use your PICmicro® Multiprogrammer Board. The instructions assume that PPP is installed and functional. It also assumes that you are confident in sending a program to the PIC via the PICmicro Development Board.

More information on the procedures of programming via PPPv3 are given in the document located at <D>:\eblocks\Installation Guide.doc and in the PPPv3 help file.

Follow these instructions to test the PICmicro Multiprogrammer Board

1. Ensure power is supplied to the Multiprogrammer board
 - USB cable required
 - PSU cable recommended
2. Set Jumper J29 to appropriate position
 - Left hand side labelled 'PSU' if using PSU power supply
 - Right hand side labelled 'USB' if ONLY using USB cable as power supply
3. Ensure Jumper J12-14 set to USB
4. Ensure that the PICmicro Development Board is in correct configuration
 - RC mode (SW2 towards the EDGE of the board)
 - FAST mode (SW1 towards the CENTRE of the board)
 - Ensure that a 19.6608MHz crystal is inserted in the PICmicro Multiprogrammer Board
5. Insert EB-004 LED Board into Port B (and Port A if extra LED Board available)
6. Program the a PIC16F88 with the test program RC_LVP.hex found in the directory <D>:\E-Blocks\EB006 Multiprogrammer\RC_LVP.hex
7. Check the illumination of all LEDs
 - Note that LB3 will not illuminate due to the fact that the board is set to Low Voltage Programming mode

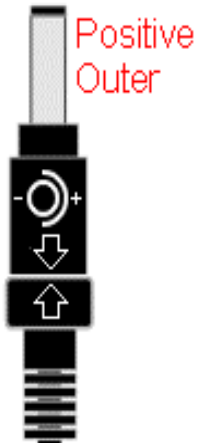
This should satisfy that the PICmicro Development Board is fully functional!

Please note C4PICs V1 & V2 and FLOWCODE V1 will NOT program the PIC16F88.

Ensuring correct polarity for power supply

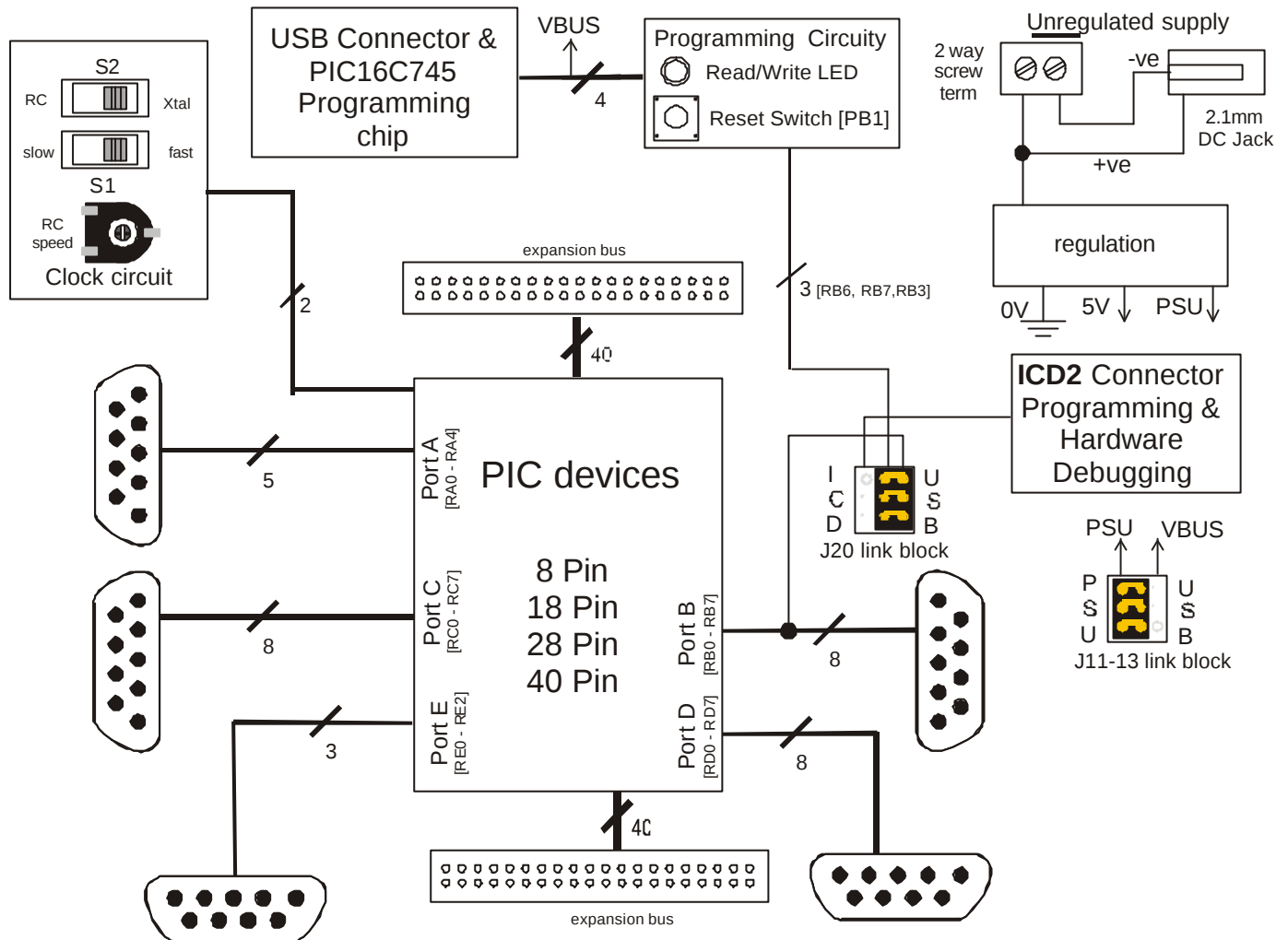
Positive Inner/Positive Outer polarity

To set up the correct polarity the connection symbols on the jack need to match those shown below.

	Connector dimensions The PSU is supplied with a number of connectors. The correct connector for Matrix Multimedia products is: Type D 5.0mm external diameter 2.1mm internal diameter “D” is marked on one side, down by the pins, and “5.0x2.1” is marked on the other side. EB-006-00-1 Multi Programmer Board requires Positive Outer power supply
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The two arrows – one on the connector socket and one on the connector pin, help you select the correct side of the power jack, and the symbol shows the correct outer connection.

5 Block schematic and description



Default switch/jumper conditions

S1 = Fast [RC Speed]

S2 = RC [RC Mode]

J29 = USB

J12-14 = USB

The Multiprogrammer solution is made up of two parts: A circuit board that allows various slave PICmicro devices to be programmed, and the program to be executed 'seamlessly', and the Windows based programming utility 'PPP'.

Power Supply

The board is normally operated from an unregulated DC supply of 12V. This allows full operation including programming.

The board can be operated in Low-voltage mode via solely the USB cable provided. However care must be taken, as there is only limited power that can be taken from a computers USB port. Also only certain chips can be reprogrammed in this Low-voltage mode, refer to the specific chip datasheet to determine if it has LVP function. The PIC16F88 provided with this board has been set-up to accept low-voltage programming (LVP), but some features are not available in this mode, such as LB3. If this mode is disabled then the 12V unregulated DC power supply must be used, and only this high-voltage programming mode can re-enable the low-voltage programming. Please refer to the specific PIC datasheet regarding LVP function. Please note that not all chips have the Low-Voltage Programming function and therefore these chips must be programmed using an external power supply as stated above. .

The jumper link system, J29, allows the user to decide on the source of the power supply. If using an unregulated 12V power supply the jumper should be positioned to the left hand side of the jumper system labelled 'PSU'. If using USB power place the jumper on the right hand side of the jumper system. The jumper should always be orientated so that the 3 links in the jumper block are always position horizontally – thus connecting the centre pins to either the left hand or right hand pins. LED2 indicates that Power is supplied to the board from either the external power supply or the USB cable.

Please note that both USB and the PSU cables should be removed for the development board BEFORE changing the position of this jumper.

The optional power supply shipped with the PICmicro board (UK versions) is rated at a maximum of 500mA. You should be aware that the board could consume more current than this if you are connecting several external devices on the external I/O.

Remember that other E-blocks will have to receive 5V by placing a connecting wire from the "+V Out" screw terminal of the Multiprogrammer to the "+V" screw terminal of each EBlock that requires a voltage.

Programming (hardware)

The Multiprogrammer connects to a personal computer via the USB socket. Any USB socket on the PC can be used. The host PIC16C745 microcontroller is used to communicate between the USB bus and the Multiprogrammer circuitry. The PIC16C745 is connected to a network of analogue switches formed by U3 and U4. These devices route 0V, 5V and Vpp to appropriate pins on the slave PICmicro devices as and when necessary.

The 'ready to go' indicator LED 1 connects to the host PIC16C745. The '745 has an on-board A/D converter that detects the level of the supply voltage. LED 1 is used to indicate that the host PIC16C745 is communicating with the PC and that the connection with the PC is valid.

DIL Sockets and I / O Ports

The slave PICmicro DIL sockets are wired in parallel (see table of connections below) and the ports are fed out to 5 D-type sockets grouped in ports. These signals are also available on a 40-way header (J5) for expansion purposes. Other important signals can be accessed via the other expansion header J24 (see table of connections below). Some ports are only partially complete – Port A has only 5 connections, and Port E has only 3 connections. This reflects the pin outs of the various PICmicro devices themselves. When using an 8-pin device it should be placed in the upper 8 pins of the 14-pin DIL socket. Please refer to device datasheets for availability of port outputs on each device.

NOTE

RA4 on many PICmicro devices has an open collector output. This means that you will most likely need a pull up resistor to be able to detect a change in status. Please see the datasheet on the device you are using for further details.

Reset Push Button

PB1 provides a reset by pulling the MCLR pin low. Note that the PIC16C745 will reset the slave PICmicro as part of the send routine so that you do not need to press this switch each time you send your program to the board.

Frequency Selection

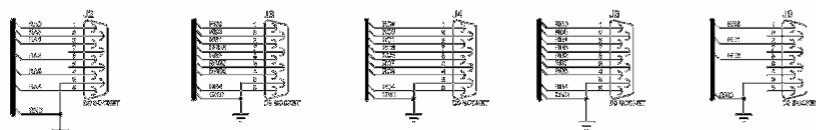
The clock signal for this board can be either from the RC network or by the Crystal. SW2 dictates whether an RC circuit or a crystal circuit is used on the slave PICmicro device. SW1 dictates whether a fast or slow RC network is used and in this mode RV1 will allow you to vary the oscillator speed. By default the board is fitted with a 19.6608MHz crystal. The crystal fits into a small socket, which allows the crystal to be easily changed. For Matrix Multimedia courses a 3.2768MHz crystal is recommended. These frequencies are chosen as they divide down by PICmicro prescalers to give suitable frequencies for clock systems and for facilitating serial communication using standard baud rates.

In-Circuit Debugging

The Multiprogrammer board has a connection to allow the user to connect the Microchip® MPLAB® ICD2. This allows the user to run the software that is running on the actual hardware. The ICD2 allows the user to step through the actual program whilst it interacts with the hardware. Full information on the MPLAB® ICD2 can be found on the Microchip website at www.microchip.com

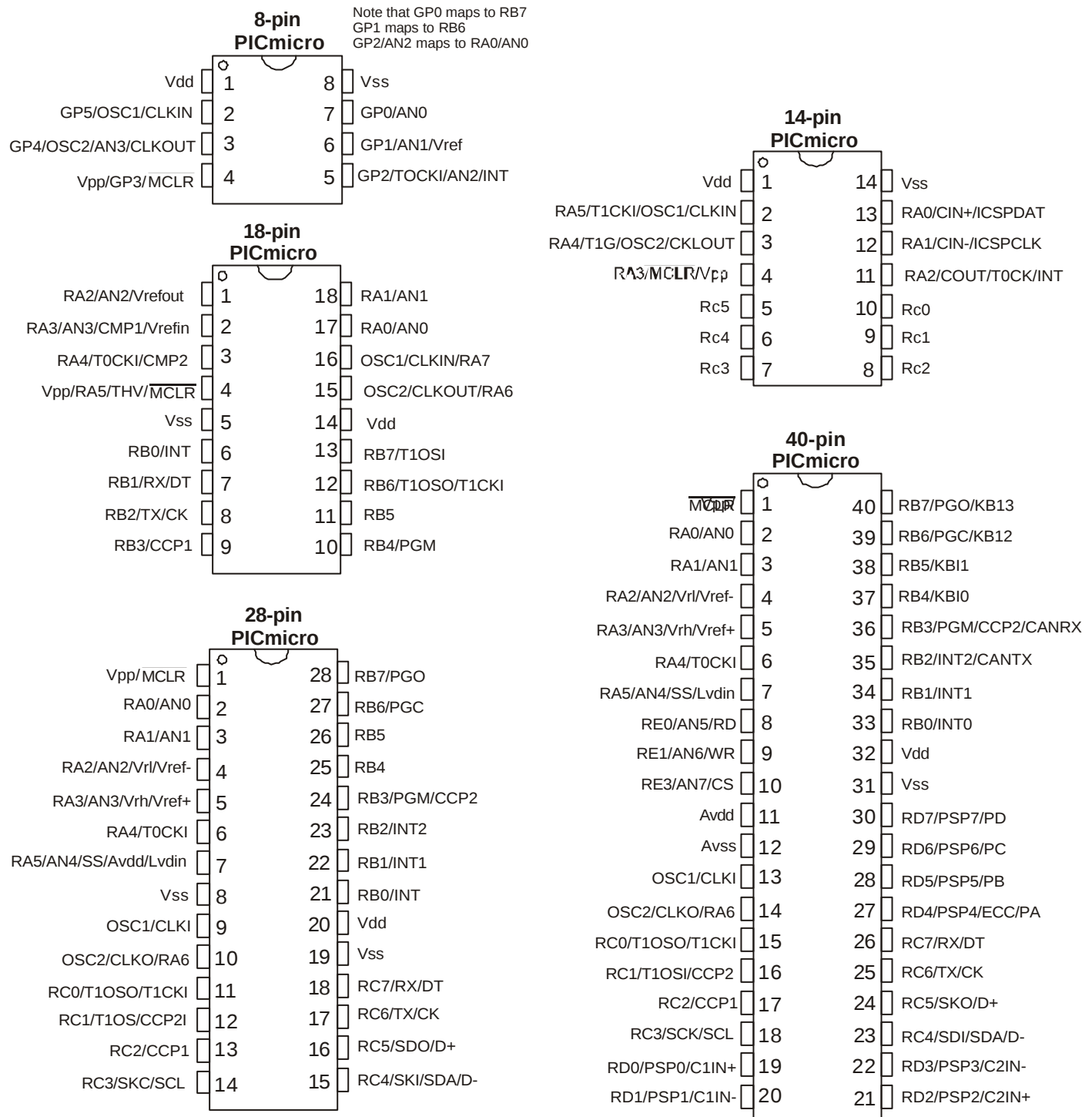
To use the In-Circuit Debugger, remove the power supply and the USB cable to the Multiprogrammer. Then place the 3-way jumper link associated with J11-13 to the left hand side of the 3 x 3 header pins. This is labelled 'ICD2'. Then simply connect the ICD2 cable into the Multiprogrammer via socket J15 and the user can then use the full functions of the MPLAB® ICD2 In-Circuit Debugger.

- PIC16F88
- PIC16C745
- FEET



Appendix B - Pin out details

Broadly speaking the ranges of PICmicro devices are designed to be upwards compatible: the pin functions on an 18-pin device are available on a 28-pin device and a 40-pin device. This can be seen from the following excerpt from the Microchip product selector card. The following diagram shows the pin out of the various PICmicro devices:



Appendix C - Bus connections

Expansion bus

The pin connections on the expansion bus exactly mirror the pin numbering on the 40-pin DIL socket. Note that the pin numbering on the IDC socket is slightly different to that on a DIL socket which results in the seemingly odd arrangement of pins on the IDC pin chart.

Pin Comparison Chart

Bus Name	PICmicro Pinout				
	18 Pin	8 Pin	14 Pin	28 Pin	40 Pin
Vpp/MCLR	4	4	4	1	1
Vdd	14	1	1	20	11 & 32
Vss	5	8	11	8 & 19	12 & 31
OCS1	16	2	2	9	13
OCS2	15	3	3	10	14
RA0/AN0	17			2	2
RA1/AN1	18			3	3
RA2	1			4	4
RA3/AN3	2			5	5
	3			6	6
RA5/AN4	4			7	7
RB0	6			21	33
RB1	7			22	34
RB2	8	5*	11*	23	35
RB3	9			24	36
RB4	10			25	37
RB5	11			26	38
RB6	12	6*	12*	27	39
RB7	13	7*	13*	28	40
RC0			10	11	15
RC1			9	12	16
RC2			8	13	17
RC3			7	14	18
RC4			6	15	23
RC5			5	16	24
RC6				17	25
RC7				18	26
RD0					19
RD1					20
RD2					21
RD3					22
RD4					27
RD5					28
RD6					29
RD7					30
RE0/AN5					8
RE1/AN6					9
RE2/AN7					10

For the 18, 28, and 40 pin devices the buses on devices are largely upwards compatible – pin connections on an 18-pin device appear on a 28-pin device and a 40-pin device, and pins on a 28-pin device appear on a 40-pin device. This allows the 18, 28, and 40 pin DIL sockets to be connected in parallel with the PICmicro bus structure intact.

* This parallel connection is not possible with 8 and 14 pin devices due to programming requirements which means that there are anomalies with the pin connections for the 8 and 14 pin devices as follows:

Multiprogrammer port line	Connection pin on 14 pin device	14 pin port line
RB2	5	RA2
RB6	6	RA1
RB7	7	RA0

Multiprogrammer port line	Connection pin on 8 pin device	8 pin port line
RB2	1	RA2
RB6	12	RA1
RB7	13	RA0

Connections on J5

Bus Name	40 Pin	IDC connector
Vpp/MCLR	1	1
VCCchip	11 & 32	18 & 21
GND	12 & 31	20 & 23
OCS1	13	25
OCS2	14	27
RA0/AN0	2	3
RA1/AN1	3	5
RA2	4	7
RA3/AN3	5	9
RA4/AN4	6	11
RA5	7	13
RB0	33	16
RB1	34	14
RB2	35	12
RB3	36	10
RB4	37	8
RB5	38	6
RB6	39	4
RB7	40	2
RC0	15	29
RC1	16	31
RC2	17	33
RC3	18	35
RC4	23	36
RC5	24	34
RC6	25	32
RC7	26	30
RD0	19	37
RD1	20	39
RD2	21	40
RD3	22	38
RD4	27	28
RD5	28	26
RD6	29	24
RD7	30	22
RE0/AN5	8	15
RE1/AN6	9	17
RE2/AN7	10	19

Connections on J24

Bus Name	IDC connector
Vpp/MCLR	1
VCCchip	21 & 22
VCC	29
VPPmain	19
VBUS	17
GND	23 & 24
OCS1	26
OCS2	28
RA0/AN0	4
RA1/AN1	6
RA2	8
RA3/AN3	10
RA4/AN4	12
RA5	14
RA6	25
RA7	27
RC0	30
RC1	32
RC2	34
RC3	36
RD0	38
RD1	40
RE0	16
RE1	18
RE2	20
PRB0	15
PRB1	13
PRB2	11
PRB3	9
PRB4	7
PRB5	5
PRB6	3
PRB7	1
PRA0	31
PRA1	33
BRB3	35
BRB6	37
BRB7	39

Note J5 is a set to copy the 40-way DIL socket