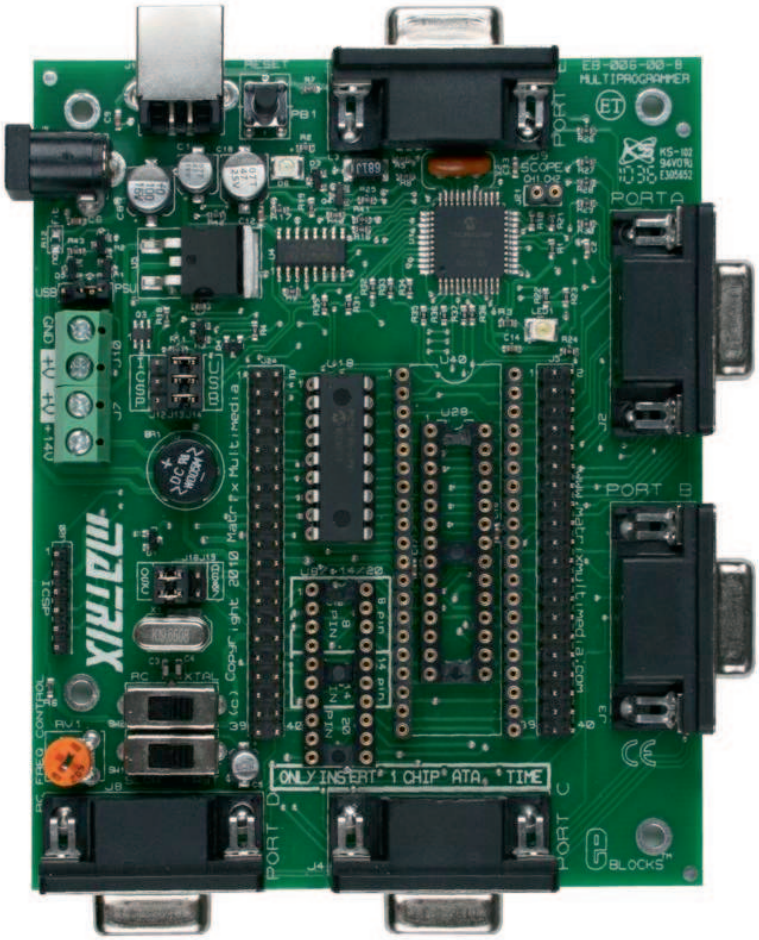
PICmicro® MCU Multiprogrammer
EB006-00-8
Technical datasheet



Contents

1. About this document

This document concerns the E-blocks PICmicro Multiprogrammer code EB006 version 8.

The order code for this product is EB006.

1. Trademarks and copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc.
E-blocks is a trademark of Matrix Multimedia Limited.

2. 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.

C and assembly strategies

Not provided for this product.

3. 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. This product is for development purposes only and should not be used for any life-critical application.

4. 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.com . If you still have problems please email us at: support@matrixmultimedia.co.uk.

2. General information

1. Description

The 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, 20, 28 and 40 pin flash PICmicro microcontroller devices using the flexible programming software provided. The board also provides 'clean' access to all I/O lines on the relevant PICmicro MCU devices. When used with Flowcode for PICmicro microcontrollers V4.2 and greater, the board has additional In-Circuit Debug facilities.

2. 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 available
- Selectable oscillator source, resistor capacitor or crystal
- Removable crystal
- 5 I/O ports
- In-Circuit Debugging via PICkit2 connector
- In-Circuit Debug with Flowcode for PICmicro microcontrollers V4.2 via USB lead
- Charge pump capability to allow high voltage programming from USB supply

3. Change log

New features for Version 8

1) Charge pump to allow for high voltage programming from USB supply.
2) Simplification of the on-board jumper systems.
3) Removal of the Microchip ICD2 Socket.
4) Target pin digital and analog scope implemented in software.

New features for Version 7

5) In-Circuit Debugging using Flowcode for PICmicro microcontrollers V4.2
6) Target pin digital and analog scope (not implemented in software)
7) Signal injector facilities added (not implemented in software)
8) Better internal oscillator / PortA support
9) Microchip PICkit support
10) 20-Pin target PICmicro support

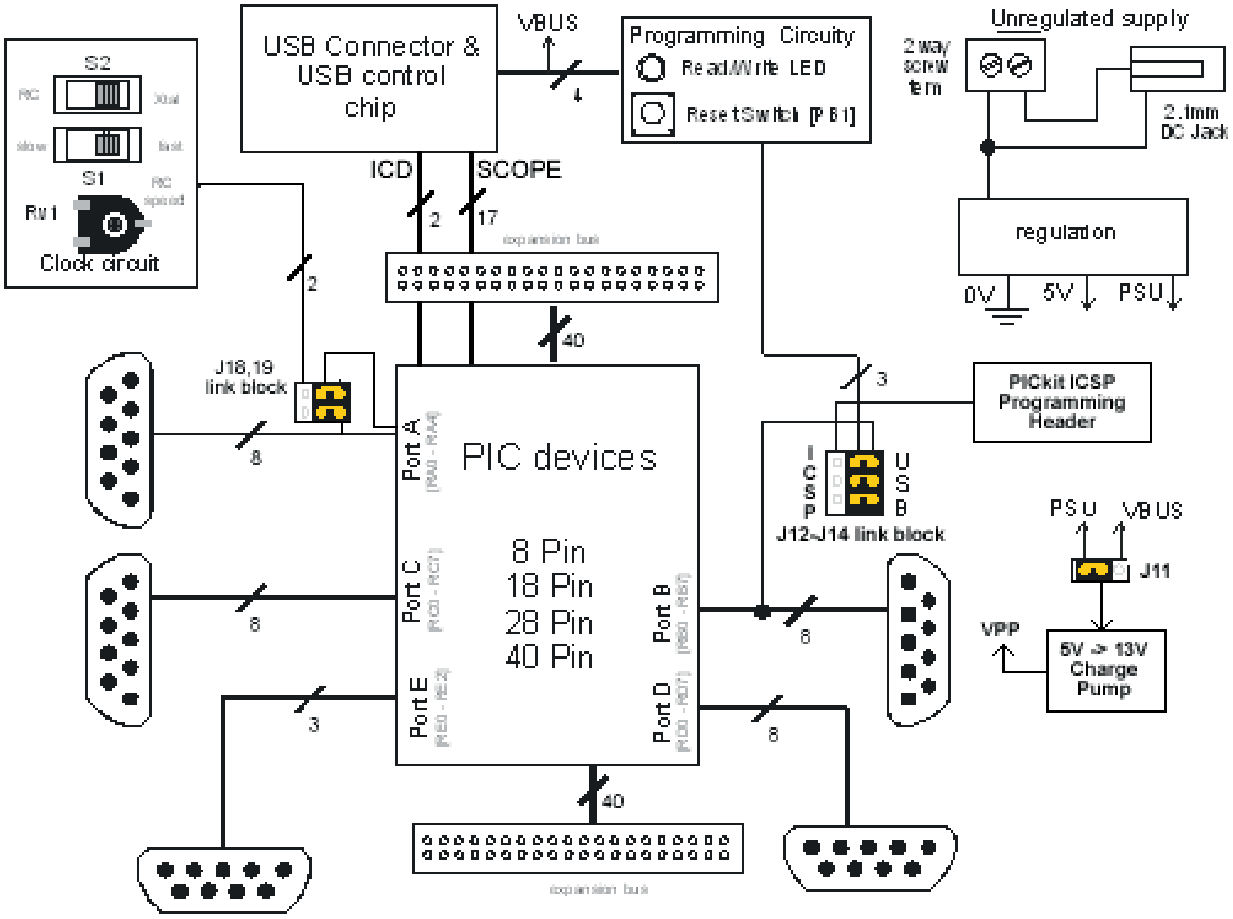
New features for Version 6

11) Minor modifications to prevent breakdown of the 4052 chip when used with a power supply with excess ripple.

New features for Version 5

12) The board can now accept power supplies of either polarity – positive inner or positive outer.
13) The board is now compatible with a wider range of PICmicros for Low Voltage Programming which use B3, 4 or 5 for the LVP pin.
14) The USB control chip on board is now much faster and can program at the rate of 1k byte per second.
15) PPP has also been improved inline with these changes.

4. Block schematic



5. Supported devices

Currently PPP and the EB006 support the following PICmicro devices:

12F Devices

PIC12F609, PIC12F615, PIC12F629, PIC12F635, PIC12F675, PIC12F635, PIC12F683

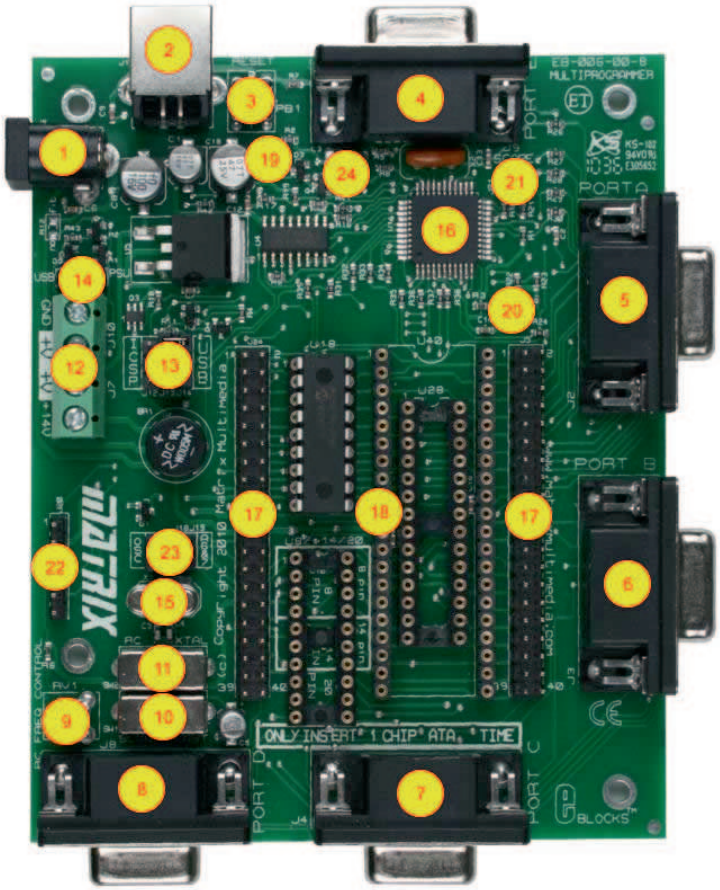
16F Devices

PIC16F616, PIC16F627A, PIC16F627, PIC16F628A, PIC16F628, PIC16F630, PIC16F631, PIC16F636, PIC16F639, PIC16F648A, PIC16F676, PIC16F677, PIC16F684, PIC16F685, PIC16F687, PIC16F688, PIC16F690, PIC16F689, PIC16F716, PIC16F72, PIC16F722, PIC16F723, PIC16F724, PIC16F726, PIC16F727, PIC16F737, PIC16F73, PIC16F747, PIC16F74, PIC16F767, PIC16F76, PIC16F777, PIC16F785, PIC16F77, PIC16F818, PIC16F819, PIC16F83, PIC16F84A, PIC16F84, PIC16F870, PIC16F871, PIC16F872, PIC16F873A, PIC16F873, PIC16F874A, PIC16F874, PIC16F876A, PIC16F876, PIC16F877A, PIC16F877, PIC16F87, PIC16F88, PIC16F883, PIC16F884, PIC16F886, PIC16F887, PIC16F913, PIC16F914, PIC16F916, PIC16F917, PIC16F946

18F Devices

PIC18F242, PIC18F248, PIC18F252, PIC18F258, PIC18F442, PIC18F448, PIC18F452, PIC18F458, PIC18F1220, PIC18F1230, PIC18F1231, PIC18F1320, PIC18F1330, PIC18F1331, PIC18F13K50, PIC18F14K50, PIC18F2220, PIC18F2221, PIC18F2320, PIC18F2321, PIC18F2331, PIC18F2410, PIC18F2420, PIC18F2423, PIC18F2431, PIC18F2439, PIC18F2450, PIC18F2455, PIC18F2458, PIC18F2480, PIC18F24J10, PIC18F2510, PIC18F2515, PIC18F2520, PIC18F2523, PIC18F2525, PIC18F2539, PIC18F2550, PIC18F2553, PIC18F2580, PIC18F2585, PIC18F2586, PIC18F25J10, PIC18F2610, PIC18F2620, PIC18F2680, PIC18F2681, PIC18F2682, PIC18F2685, PIC18F4220, PIC18F4221, PIC18F4320, PIC18F4321, PIC18F4331, PIC18F4410, PIC18F4420, PIC18F4423, PIC18F4431, PIC18F4439, PIC18F4450, PIC18F4455, PIC18F4458, PIC18F4480, PIC18F44J10, PIC18F4510, PIC18F4515, PIC18F4520, PIC18F4523, PIC18F4525, PIC18F4539, PIC18F4550, PIC18F4553, PIC18F4580, PIC18F4585, PIC18F4586, PIC18F45J10, PPIC18F4610, PIC18F4620, PIC18F4680, PIC18F4681, PIC18F4682, PIC18F4685

3. Board layout



EB006-74-7.cdr

1. Power connector - either polarity
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. Power screw terminals
13. USB/ICSP programming selector
14. USB/PSU power selector
15. Removable crystal
16. USB control chip
17. Expansion connector – two off
18. Turned pin DIL sockets for 8, 14, 18, 28, 40 pin PICmicro devices
19. ‘Ready to go’ programming LED
20. Power LED
21. Analog scope pins
22. PICkit2 ICSP Header
23. External / Internal Oscillator Jumper
24. Charge pump circuitry

4. Testing this product

The test file can be downloaded from www.matrixmultimedia.com/eblocks

1. Installing PPP

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.

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.

The PPP software will attempt to preinstall the required drivers during installation.

Running on Windows Vista / Windows 7

Windows Vista and Windows 7 do not allow drivers to be preinstalled the same way that older versions of Windows did. This means that the first time you plug your EB006 into your USB port you will be required to provide drivers. Simply point the driver installation wizard to the driver files that can be found on our website.

Some USB hardware allows Windows to disable USB devices that it thinks are not being used. This can cause the message "USB Cable Not Connected" when trying to program the device. There is a simple fix for this available from here. http://www.matrixmultimedia.com/support/viewtopic.php?t=509

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 Mulitprogrammer will be ready to use.

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

2. Testing the board – with an external power supply

1) Ensure power is supplied to the Multiprogrammer board
    1. USB cable required
    2. PSU cable required
2) Set Jumper J29 to 'PSU'
3) Set Jumper J12-14 to 'USB'
4) Set Jumpers J11, J16 and J17 to 'I/O PORT'
5) Set Jumper J18, J19 to 'OSC'
6) RC mode (SW2 towards the EDGE of the board)
7) FAST mode (SW1 towards the CENTRE of the board)
8) Insert EB-004 LED Board into Port B (and Port A if extra LED Board available)
9) Program the PIC16F88 with the test program RC_LVP***.hex*** found in the directory <D>:\ E-Blocks\EB006 Multiprogrammer\RC_LVP.hex
10) Check the illumination of all LEDs
11) Note that LB3 will not illuminate due to the fact that the program sets the PICmicro into Low Voltage Programming mode

2. Testing the board – with a USB power supply

The following instructions explain the steps to test and use your PICmicro® Multiprogrammer Board in low voltage programming mode. Microchip® have enabled this feature is some devices however it has some adverse effects on the architecture of the PIC chips.

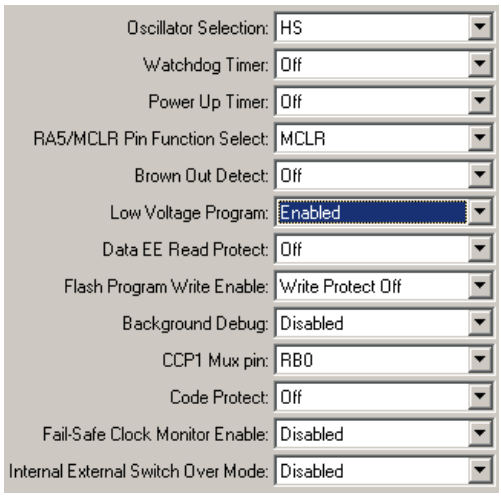
Follow these instructions to program a 16F88 PICmicro Microcontroller in Low Voltage Programming (LVP) mode.

Hardware Set-up

1) Set Jumper J29 to 'USB'
2) Set Jumper J12-14 to 'USB'
3) Set Jumper J11 to 'LVP PROG'
4) Set Jumpers J16 and J17 to 'I/O PORT'
5) Set Jumper J18, J19 to 'OSC'
6) Ensure power is supplied to the Multiprogrammer board via the USB cable being inserted into socket (J1) (no need for external power supply)

Software Set-up

1) Enter the configuration screen of PPP
2) Click on "Switch to expert config screen"
3) Select the target chip for your design.
4) The configure set-up should be as follows:
5) ***Ensure "Low Voltage Program" is ENABLED***
6) The only changes that might be required on your design are the "Oscillator Selection" (HS, XT and EXTRC) and the "Watchdog Timer" (generally off is best).
7) Once these have been set the board as stated the software is configured correctly
8) (See specific PICmicro® datasheet for more information regarding the configuration modes)
9) Click "ok" to return to programming section of PPP.
10) Send program to the chip
11) These instructions depend on the program that you are using. See relevant program (Flowcode, PPP etc.) help file for more information



5. Circuit description

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'.

1. Power Supply

The board is normally operated from a regulated DC supply of 13.5V or from a USB supply. This allows full operation including programming. The board can be operated solely from the USB cable provided. However care must be taken, as there is only limited power that can be taken from a computer's USB port.

The jumper link system, J11, allows the user to decide on the source of the power supply. If using a regulated 13.5V power supply the jumper should be positioned to the right hand side of the jumper system labeled 'PSU'. If using USB power place the jumper on the left hand side of the jumper system. LED D6 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 Multiprogammer board BEFORE changing the position of this jumper.

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 E-Block that requires a voltage.

2. Programming circuit

The Multiprogrammer connects to a personal computer via the USB socket. Any USB socket on the PC can be used. The host microcontroller is used to communicate between the USB bus and the Multiprogrammer circuitry. The host is connected to a network of analogue switches formed by U4 and a charge pump circuit which is used to multiply the 5V operating voltage up to the 13V programming voltage. This circuitry routes 0V, 5V and Vpp to appropriate pins on the slave PICmicro devices as and when necessary.

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

3. 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). Port E has only 3 connections, which reflects the pin outs of the various PICmicro devices themselves. When using an 8-pin or 14-pin device it should be placed in the upper pins of the 20-pin DIL socket as marked on the board. Please refer to device datasheets for availability of port outputs on each device.

NOTE: RA4 on some PICmicro devices has an open collector output. This means that you will most likely need a pull up resistor to be able to drive an LED etc. Please see the datasheet on the device you are using for further details.

WARNING: Only fit one PICmicro device at a time. Inserting more then one PICmicro device will cause programming to fail and may even cause damage to the board or the PICmicros.

4. Reset Push Button

PB1 provides a reset by pulling the MCLR pin low. Note that the PPP programming chip 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. If you are using a device with internal MCLR functionality then you will have to ensure that the chip is configured with an external MCLR to allow the reset operation to work. Devices using the internal MCLR configuration setting will be able to use the reset switch as a digital input.

5. 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 older 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.

The Jumper link system J18, J19 allows PICmicro devices with internal oscillators to route the signals from the oscillator pins through to Port A pins 6 and 7. This allows the devices with internal oscillators to use all 8-bits of the Port A for I/O operation.

6. In-Circuit Debugging

The Multiprogrammer board has an in-circuit debugging (ICD) connection between the USB peripheral device and the target microcontroller. This allows the Flowcode software to start, stop, step and inspect an active program, synchronized both in hardware and Flowcode software. As well as the standard ICD operation, Flowcode is capable of reading back real time variable values from the target device.

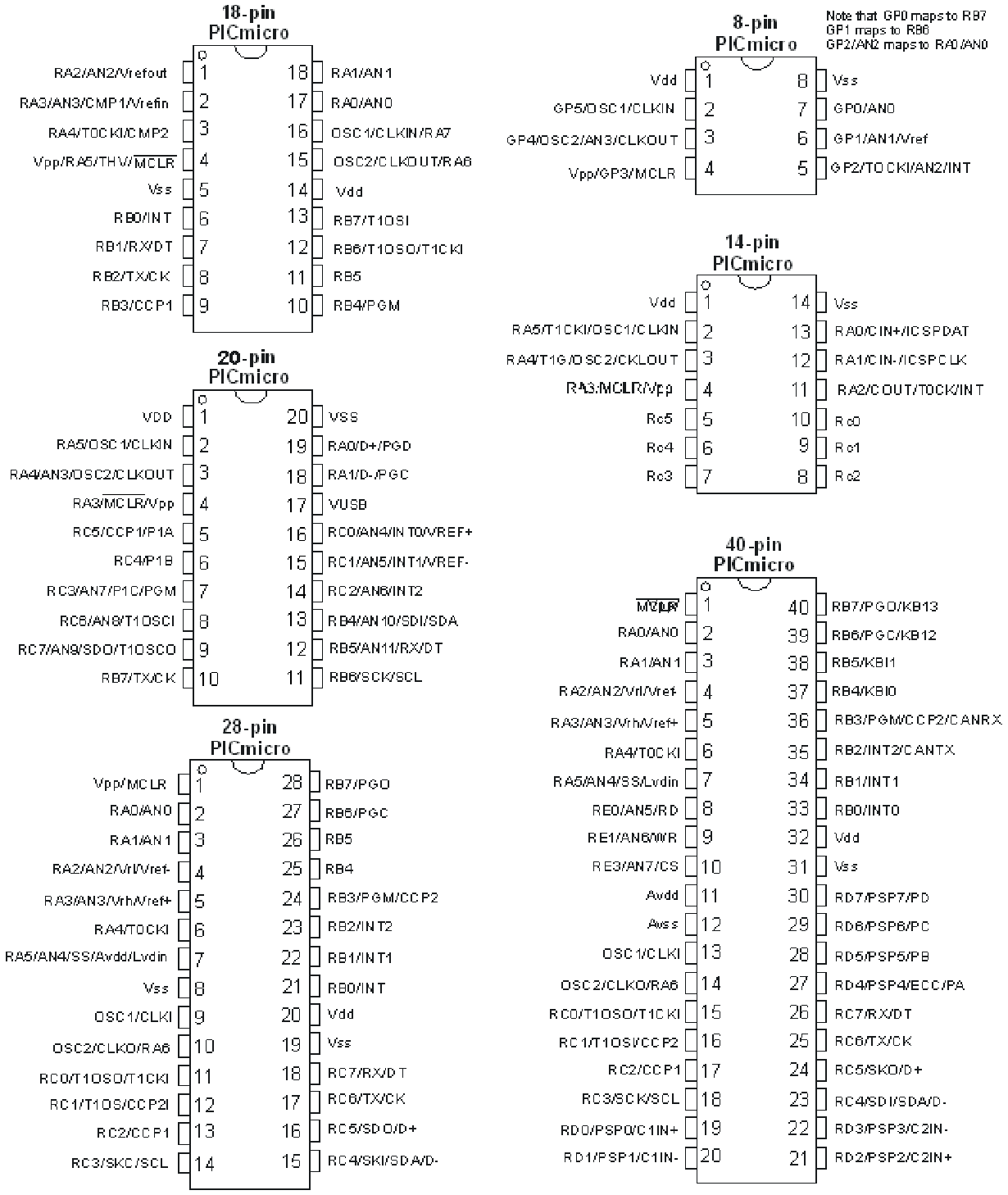
To use the Microchip PICkit2 ICSP interface, remove the power supply and the USB cable from the Multiprogrammer. Then place the 3-way jumper link associated with J12-14 to the left hand side of the 3 x 3 header pins, labeled ‘ICSP’. Then simply connect the PICkit into the Multiprogrammer via header J20.

7. Low voltage programming

Many PICmicros have a low voltage programming mode where it is possible to program the device without the need for a 12V supply line. The difficulty here is that different families of PICmicro devices use different pins as the Low Voltage programming pin. B3 is predominantly used for this function but B4 and B5 are also used on some devices. The version 8 EB006 does not support low voltage programming modes so care must be taken when generating the chip configuration to disable the low voltage programming functionality. If the low voltage programming configuration is left enabled then you will not be able to use the LVP pin as an I/O pin in your application.

6. PICmicro microcontroller 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:



7. Bus connections

1. 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

	PICmicro Pinout					
Bus Name	18 Pin	8 Pin	14 Pin	20 Pin	28 Pin	40 Pin
Vpp/MCLR	4	4	4	4	1	1
Vdd	14	1	1	1	20	11 & 32
Vss	5	8	11	20	8 & 19	12 & 31
OCS1	16	2	2	2	9	13
OCS2	15	3	3	3	10	14
RA0/AN0	17			19	2	2
RA1/AN1	18			18	3	3
RA2/AN2	1				4	4
RA3/AN3	2			4	5	5
RA4	3			3	6	6
RA5/AN4	4			2	7	7
RB0	6				21	33
RB1	7				22	34
RB2	8	5*	11*		23	35
RB3	9				24	36
RB4	10			13	25	37
RB5	11			12	26	38
RB6	12	6*	12*	11	27	39
RB7	13	7*	13*	10	28	40
RC0			10	16	11	15
RC1			9	15	12	16
RC2			8	14	13	17
RC3			7	7	14	18
RC4			6	6	15	23
RC5			5	5	16	24
RC6				8	17	25
RC7				9	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, 14 and 20 pin devices due to programming requirements which means that there are anomalies with the pin connections for the 8, 14 and 20 pin devices as follows:

Multiprogrammer port line	Connection pin on 20 pin device	20 pin port line
RB2	5	RA2
RB6	6	RA1
RB7	7	RA0

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

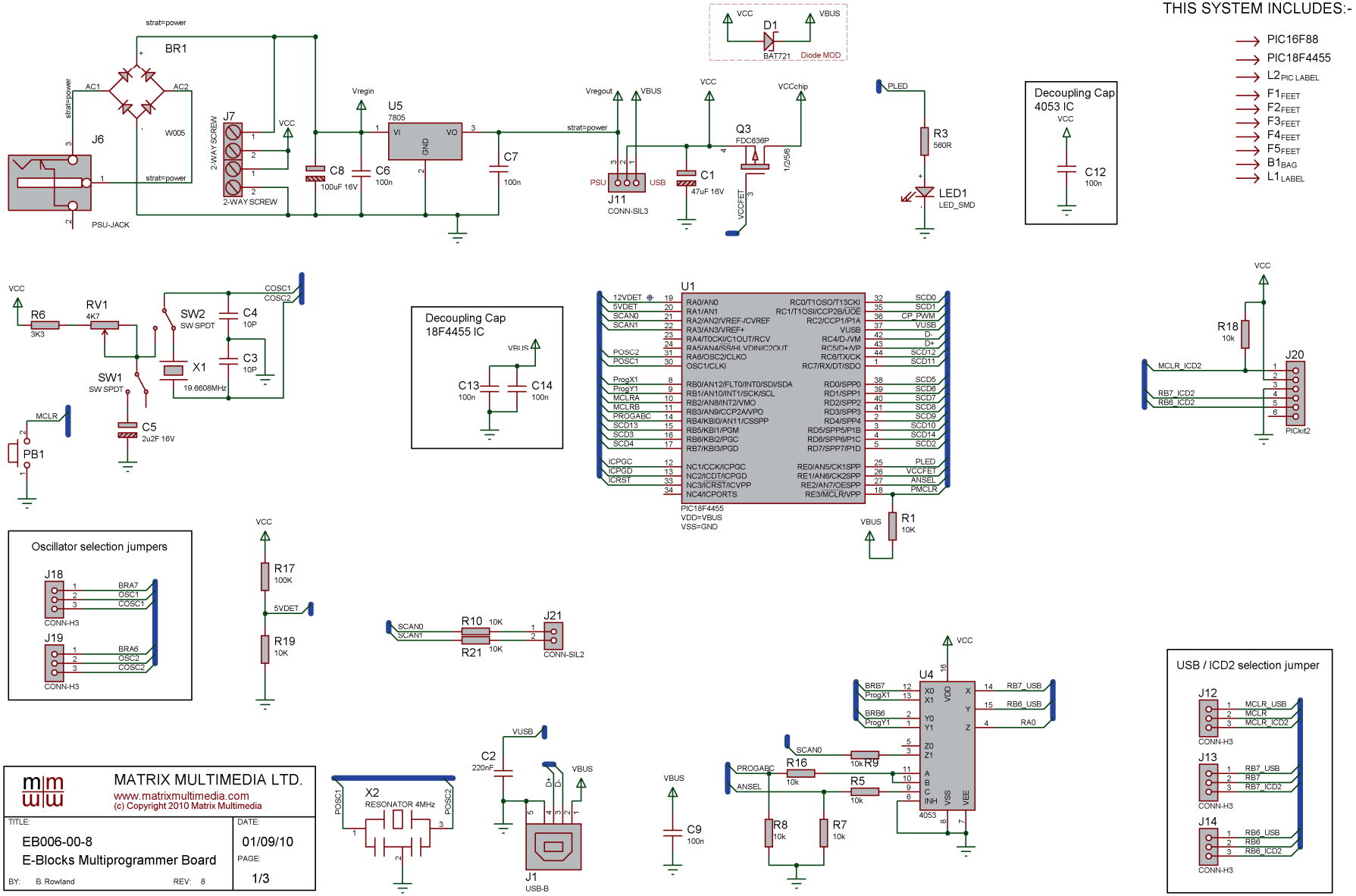
Multiprogrammer port line	Connection pin on 8 pin device	8 pin port line
RB2	1	RA2
RB6	12	RA1
RB7	13	RA0

2. Connections on the IDC Expansion Connectors

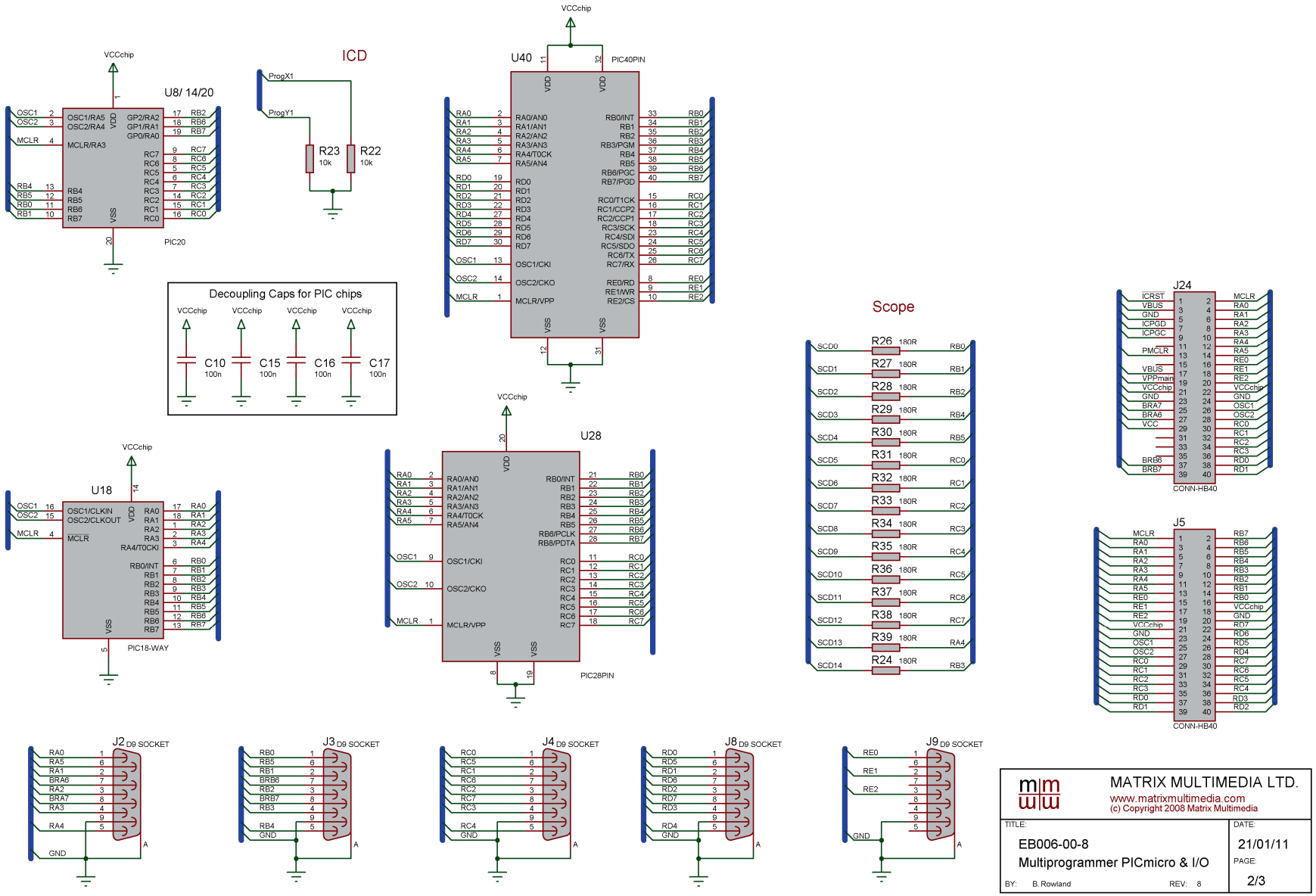
Bus Name	40 Pin	J5 IDC connector		J24 IDC connector
Vpp/MCLR	1	1		2
VCCchip	11 & 32	18 & 21		21, 22
GND	12 & 31	20 & 23		5
OCS1	13	25		26, 25
OCS2	14	27		28, 27
RA0/AN0	2	3		4
RA1/AN1	3	5		6
RA2	4	7		8
RA3/AN3	5	9		10
RA4/AN4	6	11		12
RA5	7	13		14
RB0	33	16		
RB1	34	14		
RB2	35	12		
RB3	36	10		35
RB4	37	8		
RB5	38	6		
RB6	39	4		37
RB7	40	2		39
RC0	15	29		30
RC1	16	31		32
RC2	17	33		34
RC3	18	35		36
RC4	23	36		
RC5	24	34		
RC6	25	32		
RC7	26	30		
RD0	19	37		38
RD1	20	39		40
RD2	21	40		
RD3	22	38		
RD4	27	28		
RD5	28	26		
RD6	29	24		
RD7	30	22		
RE0/AN5	8	15		16
RE1/AN6	9	17		18
RE2/AN7	10	19		20

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

Appendix 1 – Circuit diagram



Appendix 1 – Circuit diagram



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Appendix 1 – Circuit diagram