



Application Note: AN-103-PCB (Rev L)

July 15, 2008

## In-Circuit Programming of Microchip PICs Using AM-PCB

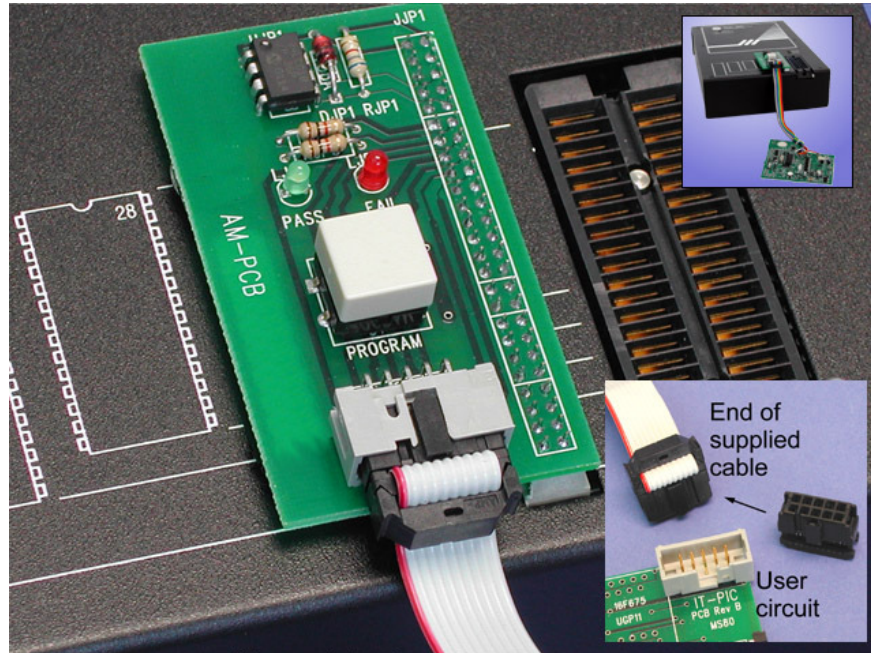
### 1.0 Introduction

AM-PCB is used for single-site programming of Microchip PICs. The following table shows the base programmers which can be used with AM-PCB and also information about other in-circuit programming modules.

| Add-on Module                          | Can be used on these programmers                           | # of sites programmed | Devices supported  |
|--|--|-----------------------|--|
| AM-PCB                                 | PILOT-MVP, PILOT-U44+, PILOT-U84+, PILOT-U128+, PILOT-1600 | 1                     | Microchip PICs, including 12Cxx, 12LCxx, 12Fxx, 12LFxx, 16C6xx, 16LC6xx, 16C7xx, 16LC7xx, 16Fxx, 16LFxx, 17C7xx, 18Fxxxx, 18LFxxxx, etc. |
| AM-SCB                                 | PILOT-MVP, PILOT-U44+, PILOT-U84+, PILOT-U128+, PILOT-1600 | 1                     | Serial PROMs, including 24Cxx, 24LCxx, 25Cxx, 25LCxx, 93Cxx, 93LCxx, etc.  |
| GM-PIC12i<br>or<br>GM-PIC08SNi         | PILOT-MVP, PILOT-U44+, PILOT-U84+, PILOT-U128+, PILOT-1600 | 8                     | Microchip PICs, including 12Cxx, 12LCxx, 12Fxx, 12LFxx, 16C6xx, 16LC6xx, 16C7xx, 16LC7xx, 16Fxx, 16LFxx, 17C7xx, 18Fxxxx, 18LFxxxx, etc. |
| Two GM-PIC12i<br>or<br>Two GM-PIC08SNi | PILOT-U84+, PILOT-U128+, PILOT-1600                        | 16                    | Microchip PICs, including 12Cxx, 12LCxx, 12Fxx, 12LFxx, 16C6xx, 16LC6xx, 16C7xx, 16LC7xx, 16Fxx, 16LFxx, 17C7xx, 18Fxxxx, 18LFxxxx, etc. |

## 2.0 Installation of adapter

AM-PCB should be plugged into the 50-pin expansion port which is right next to the ZIF socket on the programmer. (On PILOT-MVP there is one expansion port. On PILOT-Uxx-Plus models there are two expansion ports.) A 10-inch flat ribbon cable (comes with the AM-PCB) connects AM-PCB to the user circuit board.

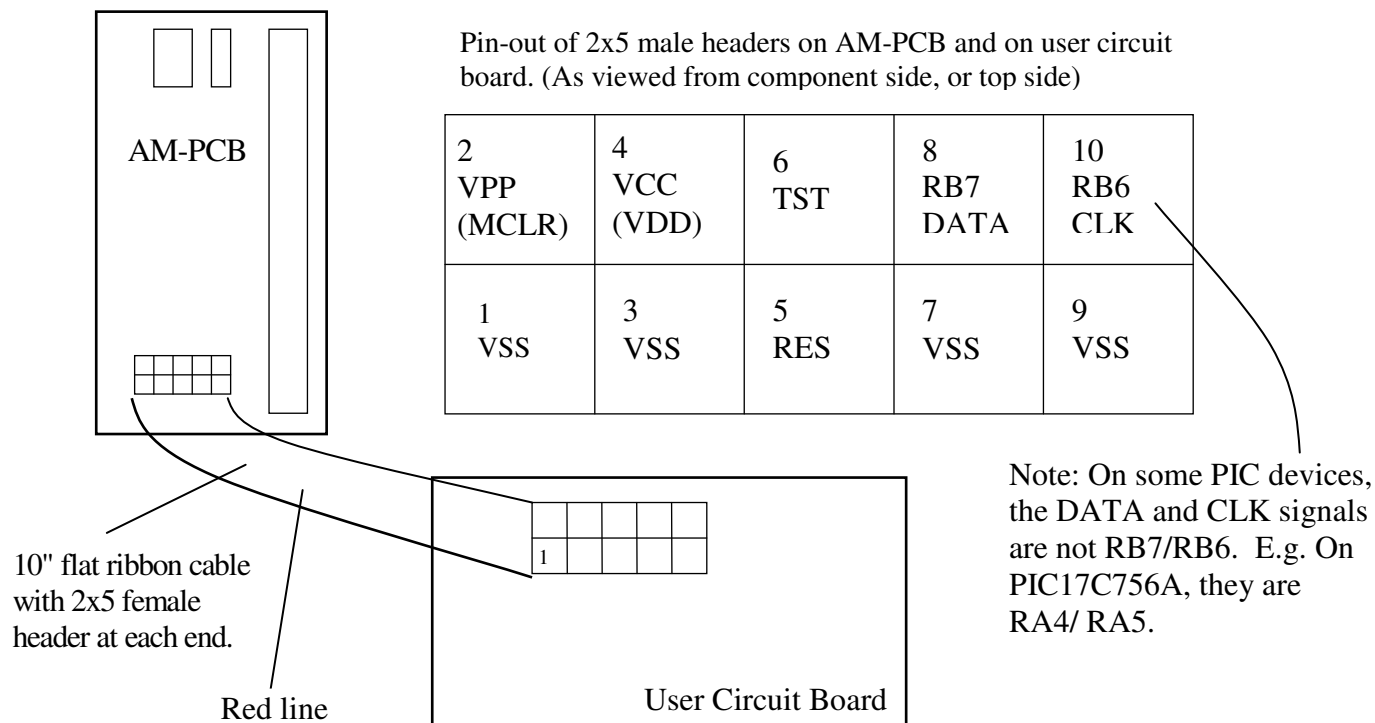


## 3.0 Pin assignment of connector

The user circuit board is expected to have a 10-pin square-post male header, with 0.1" centers, arranged as shown in the following diagram. The following signals are to be connected:

|      |   |
|------|---|
| CLK  | Labeled as RB6 on most PIC pin-out diagrams.<br>(Note, on some devices, such as PIC17C756A, the CLK pin is RA5)   |
| DATA | Labeled as RB7 on most PIC pin-out diagrams.<br>(Note, on some devices, such as PIC17C756A, the DATA pin is RA4)  |
| VCC  | This signal is optional. If it is present then programmer does not drive VCC. If it is absent, then programmer provides VCC. Current capability 200ma.<br>(This signal is labeled as VDD in Microchip data sheets.) |
| VPP  | Programming voltage supply pin. Programmer sets this to 9v-13v.<br>(This signal is labeled as MCLR/VPP in Microchip data sheets.)   |
| VSS  | Common ground between programmer and user circuit.  |
| TST  | Required by certain devices only. Please see section 3.0.   |
| RES  | Reserved pin. Do not connect.   |

Following is the pin-out for the AM-PCB module. The cable is placed with the red strip at Pin 1 of the 10-pin header.



#### 4.0 Voltage requirements

At the beginning of the programming operation (or any other operation such as reading from device, device verify, erase, etc.), the programmer measures the level of Vcc from the user circuit via the Vcc pin. The programmer compares this measured value with an arbitrary value of 1.0v, and determines if the user circuit is supplying Vcc or not.

##### Source of Vcc

If Vcc is less than 1.0v, the programmer assumes user circuit is not supplying Vcc and will then provide Vcc to the user circuit.

If the measured Vcc is more than 1.0v, the programmer assumes user circuit is supplying Vcc and therefore will not provide Vcc to the circuit lest it will create conflicts by supplying an undesirable level of Vcc (e.g. User circuit may have peripheral circuits which cannot tolerate a certain voltage).

##### When User Supplies Vcc

If the user circuit supplies Vcc, it should supply the proper level of Vcc as required by Microchip programming specs. For the user's convenience, the minimum level of Vcc required is shown in the following table (as MinVcc). Since programming specs change from time to time, the user should always check with Microchip to make sure the right level of Vcc is used instead of depending on the following table.

##### When Programmer Supplies Vcc

For non-LF and non-LC devices (e.g. 16Cxxx, 16Fxxx, 18Fxxxx), the programmer supplies 5v via the 10-pin connector to the user circuit.

For LF and LC devices (e.g. 16LCxxx, 16LFxxx, 18LFxxxx), the programmer supplies either 3.3v or 5v to the user circuit. Some LF or LC devices can be programmed at low voltages of Vcc whereas others cannot. If the device can use 3.3v, the programmer supplies 3.3v, otherwise it supplies 5v.

In either case, the software will display the voltage being supplied so that the user always knows what is being used.

Verification Voltages, Vcc Low and Vcc High

According to Microchip programming specs, a production programmer (versus a prototype programmer) needs to verify the device at Vcc Low and Vcc High after programming. These are the low and high operating limits of the device as specified in the Microchip data sheets.

At device selection time, the software automatically sets the Vcc Low and Vcc High values.

For non-LF and non-LC devices (e.g. 16Fxxx, 17C752, 18Fxxxx), the typical values are 2v to 3v for Vcc Low and 5.5v for Vcc High. If these values are not acceptable to the user circuit, the user can change them via the **Configure ISP Options** menu in the Captain software.

|  | Vcc                              |                                      | Vpp  |  |  |
|--|----------------------------------|--------------------------------------|--|--|--|
| If user selects                          | If user supplies Vcc and Vcc is: |                                      | If user does NOT supply Vcc:   | Low Vpp Option supported by device: (Note 2) | Notes about TST (pin 6 of the 10-pin connector):   |
|  | 4.5v <= Vcc <= 5.5v              | 2.2v <= Vcc <= 4.5v                  |  |  |  |
| 16F870-877, 16F870A-877A (MinVcc=2.2v)   | Erase operation allowed          | Erase operation NOT allowed (Note 1) | Programmer supplies <b>Vcc=5v</b>  | Yes  | If using Low Vpp Option, user needs to connect <b>RB3</b> to <b>TST</b> . (e.g. RB3 is pin 24, if the device is a 28-pin SOIC) |
| 16LF870-877, 16LF870A-877A (MinVcc=2.2v) | Erase operation allowed          | Erase operation NOT allowed (Note 1) | Programmer supplies <b>Vcc=3.3v</b>  | Yes  | If using Low Vpp Option, user needs to connect <b>RB3</b> to <b>TST</b> .  |
| 16F873A-877A (MinVdd=2.0v)               | Erase operation allowed          | Erase operation NOT allowed (Note 1) | Programmer supplies Vdd=5v   | Yes  | If using Low Vpp Option, user needs to connect RB3 to TST.   |
| 16LF873A-877A (MinVdd=2.0v)              | Erase operation allowed          | Erase operation NOT allowed (Note 1) | Programmer supplies Vdd=3.3v. Erase operation not allowed. (Note 1) (Note 2) | Yes  | Same as above.   |

| If user selects                                 | If user supplies Vcc:           | If user does NOT supply Vcc:      | Low Vpp Option supported by device: (Note 2) | Notes about TST (pin 6 of the 10-pin connector):   |
|---|---------------------------------|-----------------------------------|--|--|
| 16F627, F628, F627A, F628A, F648A (MinVcc=4.5v) | Programmer does not supply Vcc. | Programmer supplies <b>Vcc=5v</b> | Yes  | If using Low Vpp Option, user needs to connect <b>RB4</b> to <b>TST</b> . If not using Low Vpp, RB4 should have a pulled down to ground. <b>RB4 cannot be left floating.</b> |

|   |                                 |                                      |     |  |
|---|---------------------------------|--------------------------------------|-----|--|
| 16LF627,<br>LF628,<br>LF627A,<br>LF628A,<br>LF648A<br>(MinVcc=4.5v) | Programmer does not supply Vcc. | Programmer supplies Vcc= <b>5v</b> . | Yes | If using Low Vpp Option, user needs to connect <b>RB4</b> to <b>TST</b> . If not using Low Vpp, RB4 should have a pulled down to ground. <b>RB4 cannot be left floating.</b> |
| 16F73-77<br>(MinVcc=4.75v)  | Programmer does not supply Vcc. | Programmer supplies Vcc= <b>5v</b>   | No  |  |
| 16LF73-77<br>(MinVcc=4.75v)   | Programmer does not supply Vcc. | Programmer supplies Vcc= <b>5v</b>   | No  |  |

| If user selects              | If user supplies Vcc:           | If user does NOT supply Vcc:         | Low Vpp Option supported by device:<br>(Note 2) | Notes about TST (pin 6 of the 10-pin connector):   |
|------------------------------|---------------------------------|--------------------------------------|---|--|
| 17C752-766<br>(MinVcc=3.0v)  | Programmer does not supply Vcc. | Programmer supplies Vcc= <b>5v</b>   | No  | User needs to connect the <b>TEST</b> pin of the device (e.g. pin 17 if device is in PLCC pkg) to <b>TST</b> .<br><br>Programmer supplies high voltage to Vpp pin and TST pin of 10-pin connector.<br>(Note 3) |
| 17LC752-766<br>(MinVcc=3.0v) | Programmer does not supply Vcc. | Programmer supplies Vcc= <b>3.3v</b> | No  | Same as above.   |

Note 1: **Bulk** erase operation not supported by device if programming Vcc is less than 4.5v. This means the **/PR** command in DOS, or the **PROM Erase** in Captain are not allowed. During programming, **each word** in the device will be erased when it is being programmed. If device is secured, it cannot be erased and further programming will not be possible using Vcc of less than 4.5v.

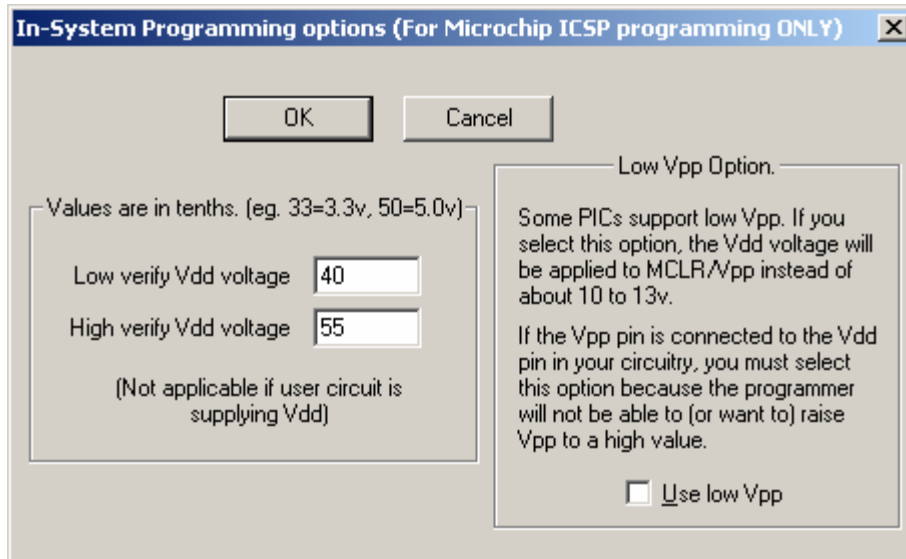
Note 2: The Low Vpp Option is defaulted to be DISABLED (i.e. not used by user) at device selection time. If the user desires to use the Low Vpp Option, it can be changed by clicking the **Configure ISP Options** menu under Captain.

Note 3: These devices need high voltages for both Vpp and TEST. Ref: Microchip programming spec.

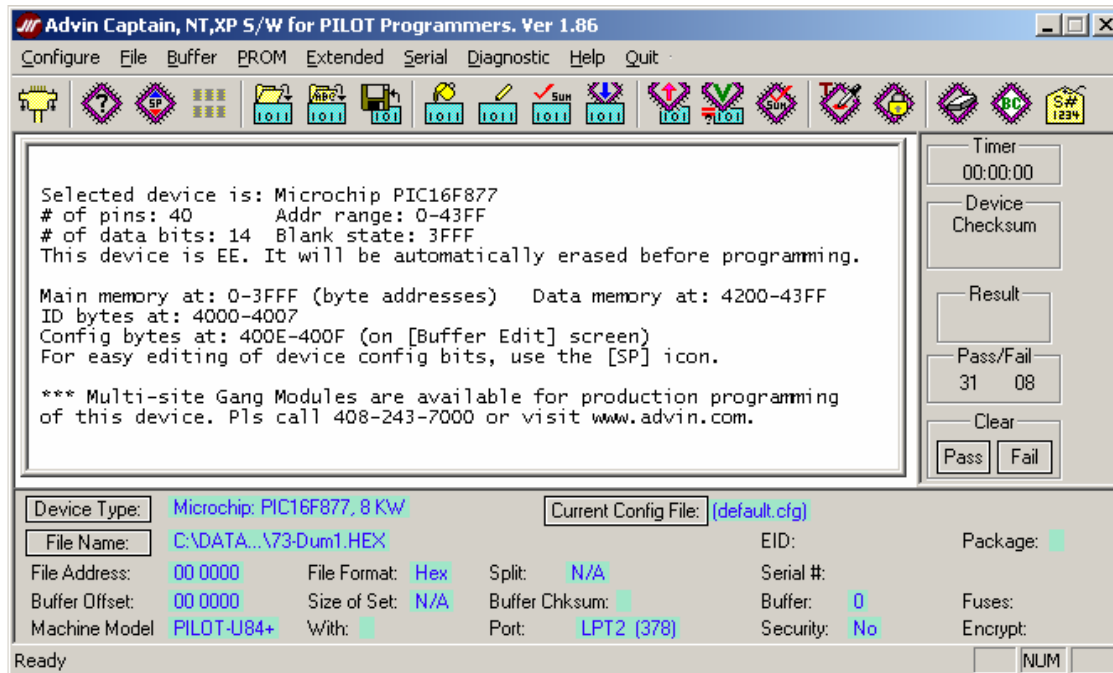
This table and actions of the software are subject to change at anytime without notice to users.

## 5.0 Software

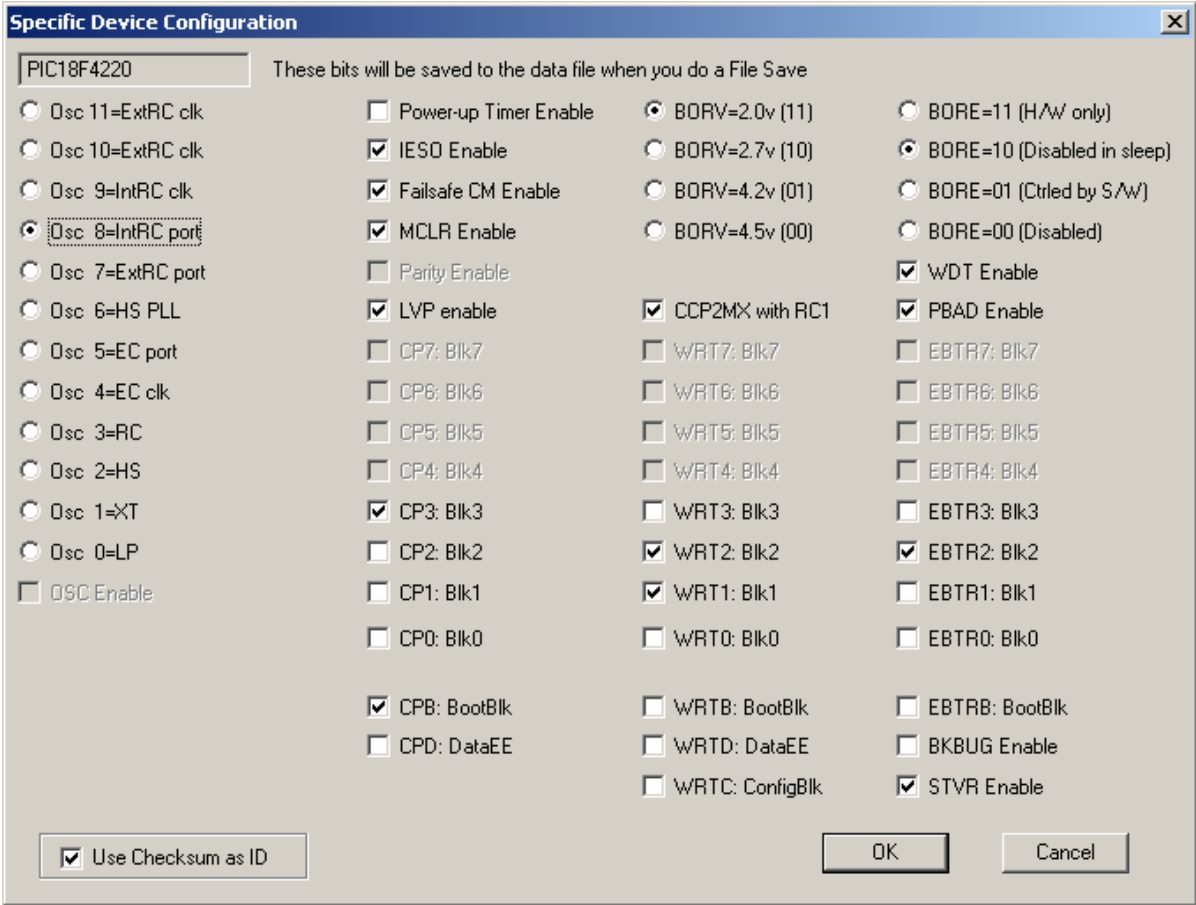
Either the DOS software or the Windows based Captain software can be used. However, the following **Configure ISP Options** screen only exists in Captain..



Here is a screen example of Captain:



The **Specific Device Configuration** screen can be used to easily select the many configuration choices of Microchip PICs:



This document revision corresponds to Windows S/W Captain version 1.86. Current software can be downloaded at no charge from our website at [www.advin.com](http://www.advin.com).