

Tutorial: blackbox

“A black box is any device, sometimes highly important, whose workings are not understood by or accessible to its user.”

blackbox

```
*** blackbox demonstrates use of the debugger
*** uses pushbuttons 1,2 and 3 (RB0, RB1 and RB4)

LIST      p=16F88
INCLUDE   <p16F88.inc>
__CONFIG _CONFIG1, 0x377C
banksel   OPTION_REG          ; bank select OPTION_REG
bcf       OPTION_REG, NOT_RBPU ; enable weak pullups on PORTB
goto      $                   ; loop forever
end
```

As a standalone program blackbox will appear to do nothing. To see anything happen you must run the project in debug mode from MPLAB.

After a “build all” the ICD2 debugger should show the following message.

Connecting to debug executive

The real work of blackbox is done using the debug executive. The debug executive is a small program that loads automatically into the upper 1/4 K of program memory whenever the ICD2 debug mode is used, its function is to set breakpoints and allow examination of the microcontrollers’ state at any time. This effectively removes the black box from your programs. We will now need to add a **View/Watch** window and choose **Add SFR PORTB** you should see a screen similar to the one below.

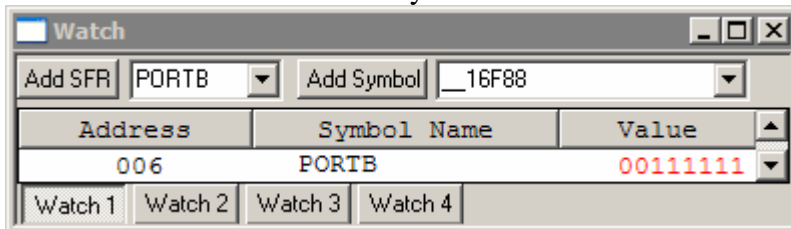
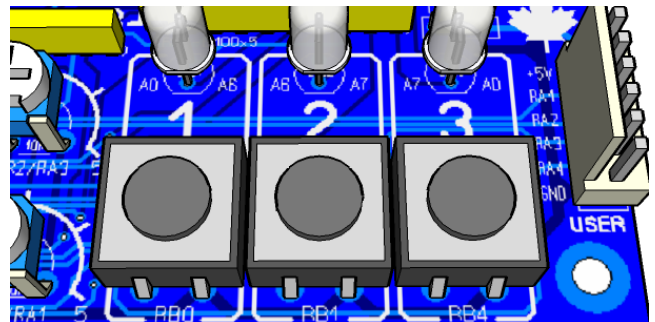


Figure 1 Pullups enabled show all push buttons open (RB6 & 7 are reserved for the debugger and display as zero)

Fireflys three user pushbuttons 1,2 & 3 are physically connected to PORTB 0, 1 & 4. Remember Watch windows will update (on the screen) only when a breakpoint is reached, in single step or animate modes. For blackbox we want to run the debugger in animate mode, this will refresh the Watch window every two seconds or so. Try pressing Fireflys #1 switch and keep your eye on the Watch window. *To see the results in binary right-click on PORTB and choose properties/binary.* The bits are displays from msb (bit 7) to lsb (bit 0) so button #1 is the rightmost bit.



The debugger is a very powerful tool and when combined with the MPLAB simulator finding and fixing bugs is easy.