## Overview:

AN601 provides a roadmap for installing custom firmware into the ICON Interface Module with Microchip's DV164002 in-circuit-serial-programmer. The DV164002 may be used as a programmer and as an in-circuit-debugger. Therefore, the DV164002 may be used to emulate custom firmware, and speed development of applications based on the ICON Interface Module hardware. Solutions Cubed provides a stripped down piece of firmware for use with the PIC16F873 available on the ICON Interface Module. This firmware can be downloaded from www.solutions-cubed.com in the form of AN601_x.ZIP (where "x" denotes the revision number). AN601_x provides much of the functionality of the firmware provided with the ICON Interface Module when purchased.

Module Connectivity:

In order to install custom firmware into the ICON Interface Module you will need the following hardware components.

1-   ICON Adapter Board
1-   ICON H-Bridge module
1-   ICON Interface Module
1-   Microchip DV164002 (available from Digi-Key)
1-   IBM Style PC with Microchip's MPLAB design environment software
1-   Power Supply

Figure 1: Connecting the DV164002 to the ICON Interface Module
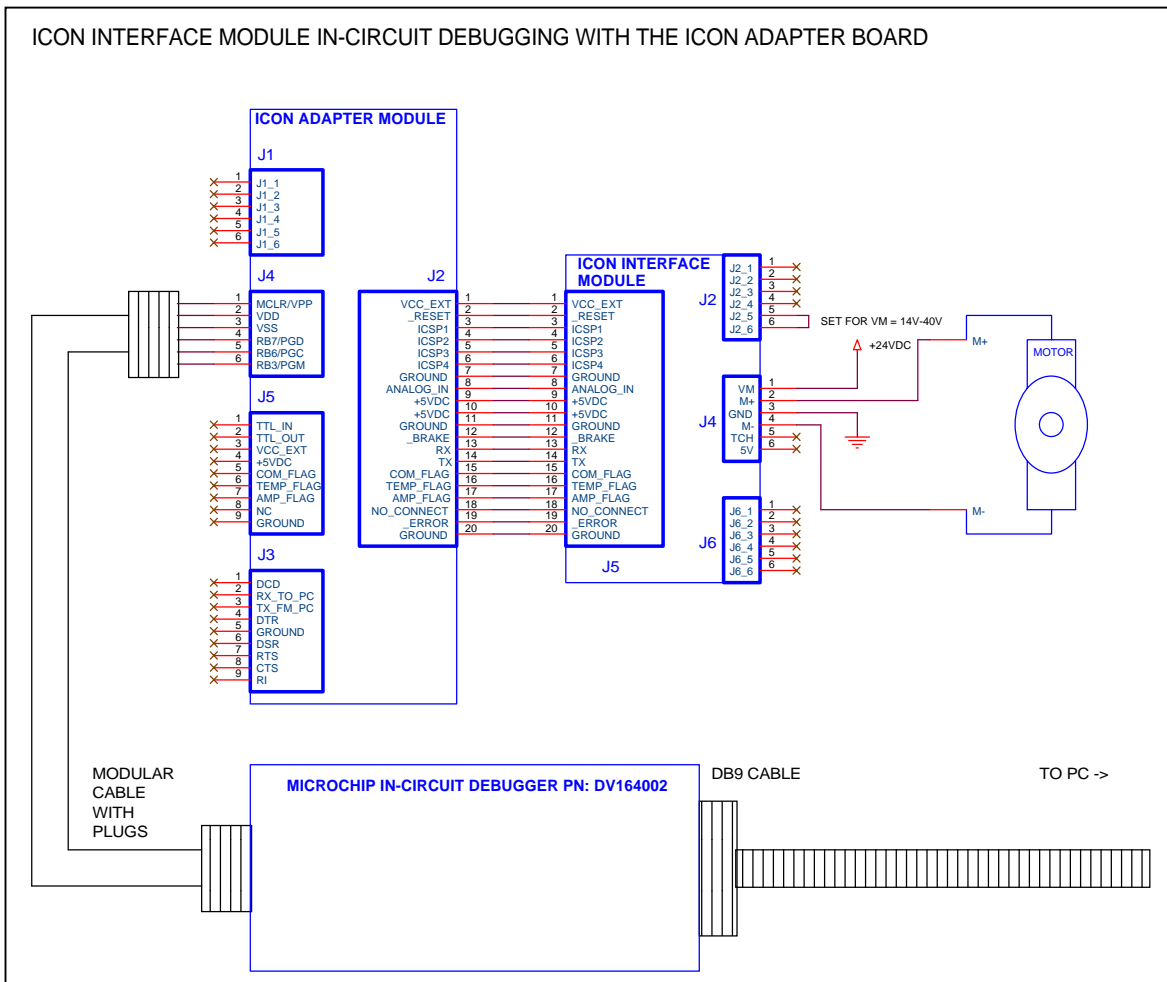
Firmware:

AN601_x.ASM (the assembly code text file provided for this application note) provides an example of methods to communicate and control the ICON Interface Module hardware and ICON H-Bridge. When this firmware is used in conjunction with the ICON Interface Module hardware custom applications can be quickly generated. AN601_x.ASM may be used with hardware other than that provided on the ICON Interface Module, and can be used as a foundation for firmware residing in custom applications designed to interface to the ICON H-Bridge.

AN601_x performs some rudimentary communication with the ICON H-Bridge, and can be used with the ICON Interface Module software (downloadable from www.solutions-cubed.com. Users may wish to reference the ICON Interface Module datasheet for detailed information on the communication protocol implemented. All of the registers and flags utilized by the ICON Interface Module have been maintained in AN601_x.ASM, but much of the functionality has been stripped out.

Solutions Cubed provides the firmware AN601_x.ASM for reference. Technical support, modifications, and additional support beyond this application note will not be undertaken by Solutions Cubed. Furthermore, implementing custom applications based on AN601_x.ASM and the ICON Interface Module hardware should only be undertaken by technically literate persons. Damage inflicted to the ICON DC Motor Control hardware or an attached system is the sole responsibility of persons or organizations implementing custom applications with this application note.

Programming AN601_x.HEX into an ICON Interface Module will erase the firmware provided with the ICON Interface Module. The only way to have the original firmware programmed back into the ICON Interface Module is to ship it to Solutions Cubed for repair.

Getting Started:

The following information provides a step-by-step process to load a new firmware program into the ICON Interface Module hardware.

1) Download AN601_x.ZIP (where "x" is the revision number) from www.solutions-cubed.com, and unzip the files into a directory in the root directory of the IBM style computer that you will be using. The zip file should have files AN601_x.ASM, AN601_x.HEX, and P16F873.INC incorporated into it.
2) Connect your hardware including the DV164002, ICON Interface Module and ICON Adapter board as displayed in figure 2. The motor connection and ICON H-Bridge may be connected into the system or left out when programming. For in-circuit-debugging it is best to connect the entire system.
3) Select the appropriate jumper setting at J2 of the ICON Interface Module for the power supply you are using.
4) Connect a serial cable between a serial communication port on your PC and the DB9-F of the DV164002. And connect a 6 conductor standard modular connector between J3 of the DV164002 and J4 of the ICON Adapter board. Connect the ICON Adapter board and the ICON Interface Module with a 20-pin ribbon cable (supplied with the ICON Adapter board). See figure 2 above.
5) **Double-check the jumper setting of J2 on the ICON Interface Module.** Apply power to your system through the VM and GND connection on your ICON Interface Module screw terminal.

6)   Start MPLAB (Microchip's free development environment available a www.microchip.com
    A)   In MPLAB select the "Project" pull-down menu and select "New Project".
    B)   In the "new Project" window select the directory where the files AN601_x.ASM, AN601_x.HEX, and P16F873.INC are located. Type in a project file name in the text box with *.pjt. Something like AN601.PJT should work. Click OK
    C)   From the "Edit Project" window click "Add Node"
    D)   From the "Add Node" window select the directory where the AN601_x.ASM file is located. Select the AN601_x.ASM file, and click OK.
    E)   From the "Edit Project" window click OK.
7)   In MPLAB select the pull down menu labeled "Options" and select "Development Mode".
    A)   In the "Processor" pull-down menu select the PIC16F873.
    B)   Under "Tools" select "MPLAB ICD Debugger".
    C)   Click the "Apply" Button. If an import error occurs click OK to close the error window.
    D)   Click OK to close the "Development Mode" window.

Figure 3: Development Mode Window
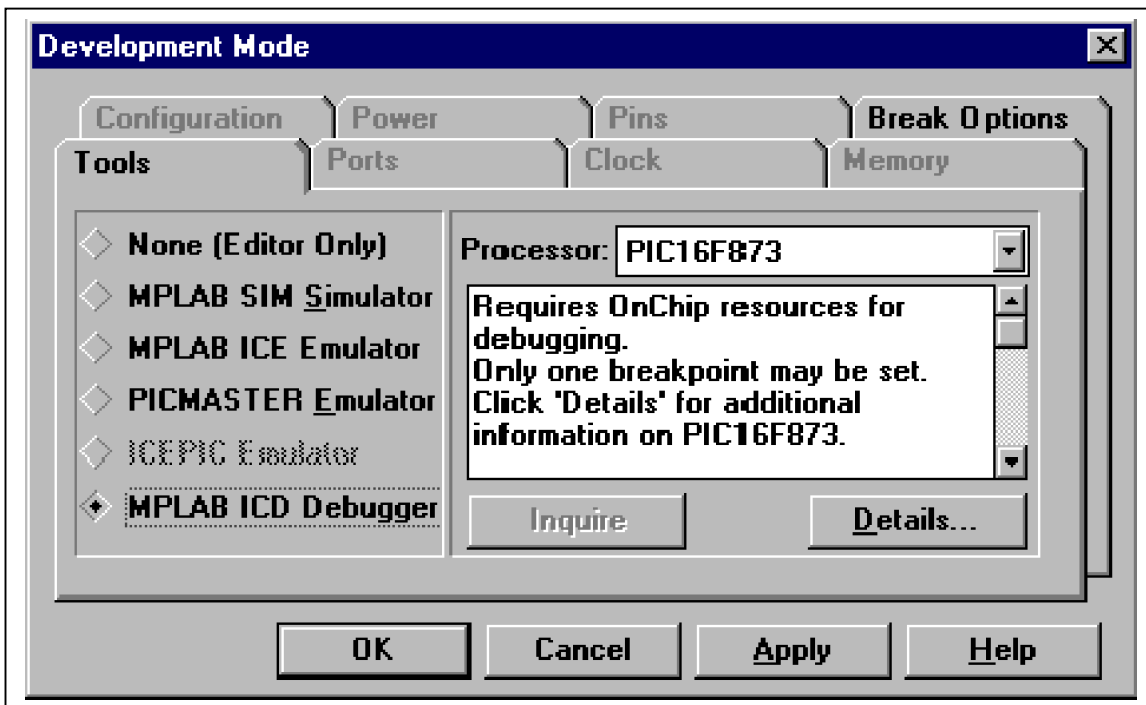
8)   You should see a small window named "MPLAB ICD" open. Click "Reconnect" to verify that the serial interface to the DV164002 is functioning.

Figure 4: MPLAB ICD Window
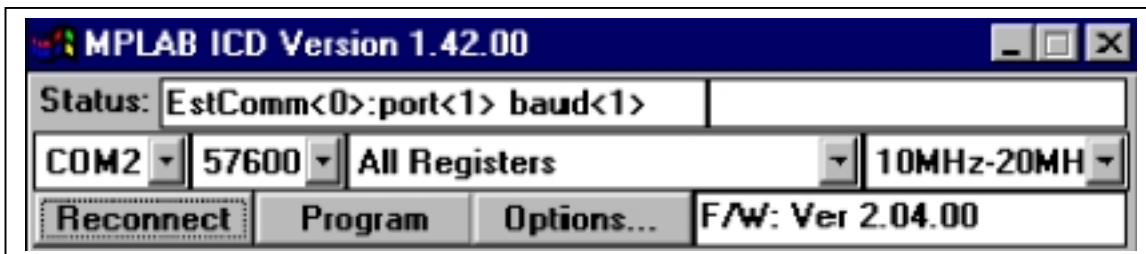
9)   Click on the "Options" button at the bottom of the MPLAB
    A)   To use the DV164002 ICD as an in-circuit-debugger click the check-box next to
            "Enable Debug Mode". If using the DV164002 for programming then make sure
            the "Enable Debug Mode" check-box is not enabled. The example window in
            figure 5 has the debug function enabled. It is important to know that the
            hardware used on the ICON Interface Module will not allow the AN601_x.ASM to
            run in debug mode if the DV164002 is not connected. Therefore to store a
            custom piece of firmware and operate the ICON Interface Module without the
            DV164002 the "Debug Mode" must be disabled before programming.
    B)   From the MPLAB main window (don't close the ICD windows, just click on the
            MPLAB background) use the "File" pull-down menu and select "Open". Then
            open the AN601_x.ASM file. Verify that the checksum located on line 63 of the
            code matches the ID Code in the "ICD Options" window. Verify that the
            configuration bit settings in the "ICD Options" window matches those above line
            63 of the AN601_x.ASM firmware.
    C)   Press the "Program" button to load the AN601_x.ASM firmware into the ICON
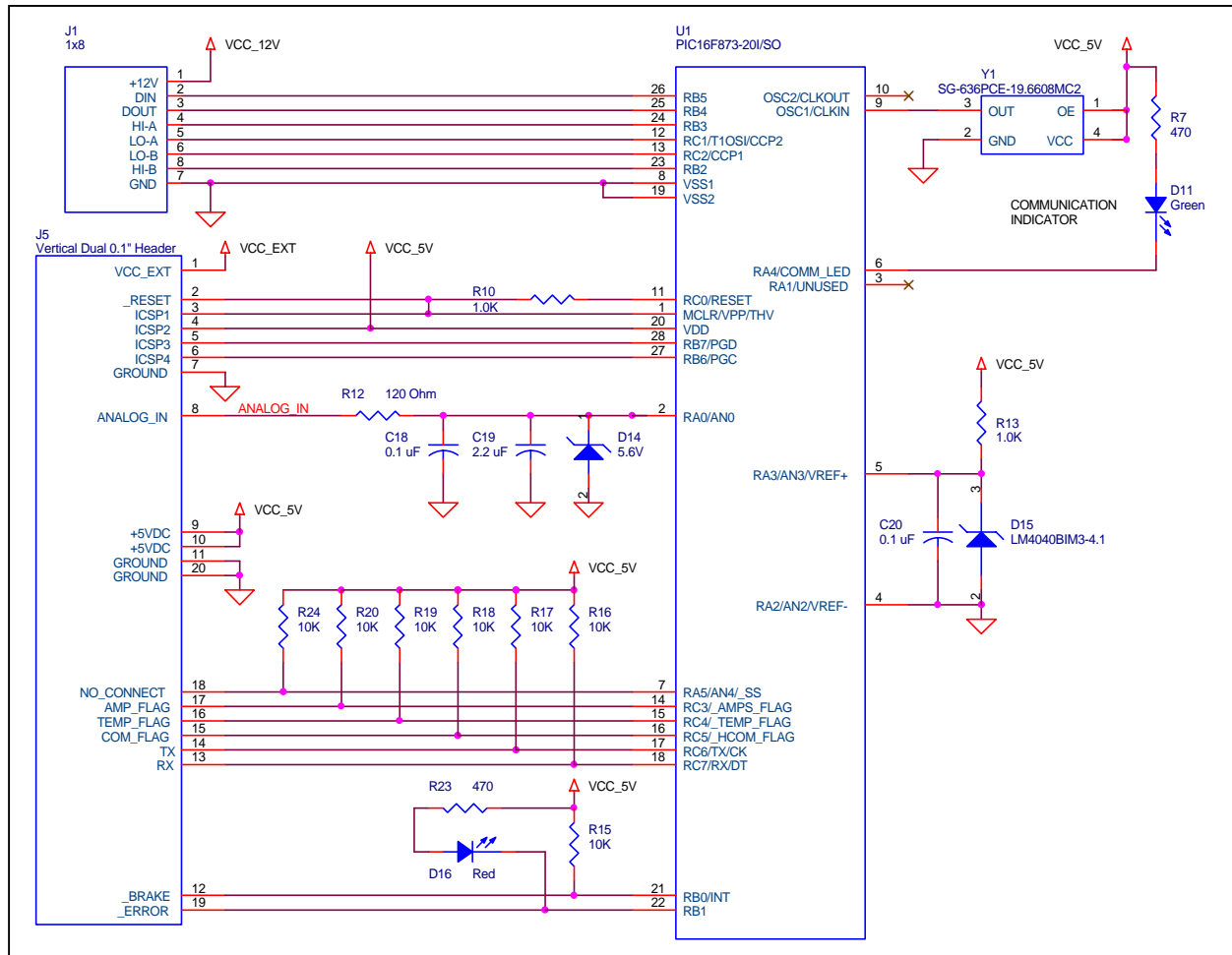   Interface Module.

Figure 5: ICD Options Window

10)   In debug mode you may step through the program using commands from the "Debug" pull-down menu in MPLAB. Further information on the DV164002, Microchip's MPLAB design environment, or the PIC16F873-20I/SO used on the ICON Interface Module can be found at www.microchip.com.

Hardware:

The schematics referenced here depict the general connectivity between the PIC16F873 on the ICON Interface Module. Not all components are detailed in these schematics, and they are provided solely for reference.

These schematics may be useful when making modification to the firmware provided in AN601_x.ASM.

Figure 6: PIC16F873 Connections

The ICON Interface Module maintains a frequency to voltage conversion circuit that is used in Speed Control mode of operation. The Speed Control related firmware has been stripped from AN601_x.ASM but the hardware remains for the user to work with. The part used for frequency to voltage conversion is the LM2907 (National Semiconductor). Figure 7 is included in this application note for reference. Included in figure 7 are the frequency to voltage converter, the analog input and frequency resolution selection header, and the 1x8 header to terminal block connectivity.

Figure 7: Additional ICON Interface Module Connectivity