ICD-87XP Parallel In Circuit Debugger for PIC16F87X

ICD-87XP is a low-cost development system for Microchip's flash based PIC16F87X microcontrollers. Utilizing the chips' In-Circuit Debugging (ICD) capability and Microchip's In-Circuit Serial Programming (ICSP) protocol, the ICD-87XP allows users to debug source code in the application, debug hardware in real-time and program a target PIC16F87X device. It provides a cost-effective way to allow users to "emulate" the PIC16F87X MCU without the need of an in-circuit emulator. With special caution, the ICD-87XP can also be used to support most PIC16C6X/7X parts.

The ICD-87XP system runs under its own IDE. The software provides the front end for all the programming and emulation controls like running, stepping, setting breakpoint, etc.

ICD-87XP comes with the debugger module and a Demo Board. The ICD Module contains all debugging, programming and control logic. It is connected to the PC's parallel port which provides fast communication enabling all data registers to be updated instantaneously during stepping.

The debugger cable ends in a 40-pin DIP plug for in-system test. A 40-pin to 28-pin SDIP adapter is also included to debug the smaller 28-pin PIC16F87x parts. Optional PLCC, QFP and SOIC surface mount adapters are also available.

The ICD Demo Board is provided for demonstration and/or evaluation of the PIC16F87X in the absence of a target application board. The demo board provides LEDs, DIP switch, push buttons, and a potentiometer for demonstrating the chip's features. A small prototyping area and RS232 circuitry is also available for experimentation. The PIC16F877 can be unplugged from the ICD-87XP module and plugged directly into the demo board for stand-alone operation.
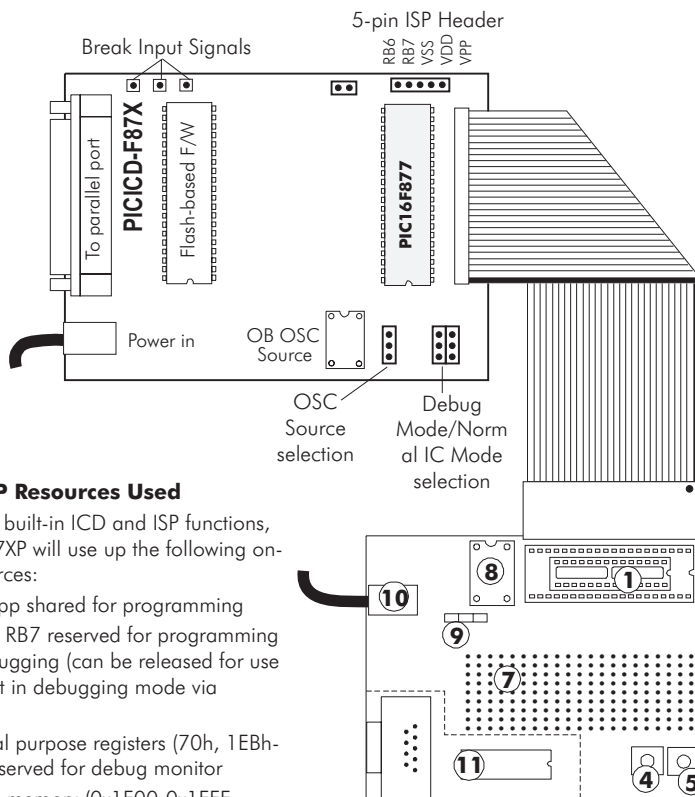
Features
- Real-time code execution
- High speed parallel port interface
- In-circuit debugger and Programmer
- 2.5V to 6.0V operating range
- One level Real-time Breakpoint
- Two External Break Inputs
- Conditional Animation Break
- Operating frequencies from 32Khz to 20Mhz
- Runs under PICICD IDE (Win 95/98/ME/NT/2000)
- Source level and symbolic debugging for MPASM(WIN), MPC, MPLABC, PCM, PicBasicPro, CCSC, C2C, C2CW
- Software animation trace captures 3 user-defined variables in addition to opcode, W, STATUS, FSR registers and corresponding instructions

Break Input Signals — 5-pin ISP Header — RB6 RB7 VSS VDD VPP — PICICD-F87X — Flash-based F/W — PIC16F877 — To parallel port — Power in — OB OSC Source — OSC Source selection — Debug Mode/Normal IC Mode selection

ICD-87XP Resources Used
Due to the built-in ICD and ISP functions, the ICD-87XP will use up the following on-chip resources:
- MCLR/Vpp shared for programming
- RB6 and RB7 reserved for programming and debugging (can be released for use when not in debugging mode via jumpers)
- 6 general purpose registers (70h, 1EBh-1EFh) reserved for debug monitor
- program memory (0x1F00-0x1FFF reserved for debug code; one stack level not available.

ICD-87XP Connection and Operation
There are two ways to connect the ICD to the target for test:

1) using ICD's 40-pin cable connector (and 28-pin conversion header for 28-pin part) to plug into a target socket. You'll need to keep the 16F877 on the ICD.

2) using the 5-pin ISP Header - use a PIC16F87X (40- or 28-pin) in the target which then connects to the ICD module via the 5-pin ISP Header. The 16F877 on the ICD needs to be removed.

To run codes without debugging capability, reprogram the codes and fuse bits (without debug codes) and set the jumpers on the ICD-87XP to "Normal IC Mode" to free RB6 and RB7 for test.

40-pin to 28-pin conversion header
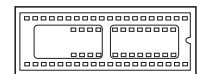
ICD Demo Board
1 40-pin/28-pin DIP sockets for in-system test connection
2 DIP switch - set to on for Port C high
3 Port C Indicator LEDs
4 Hardware Reset button
5 RB0 (active low) button
6 Potentiometer for RA0
7 Prototype Area
8 Socket for external onboard crystal
9 Oscillator setting
10 9VDC power in (not required if hosted by ICD-87XP)
11 RS232 circuitry (not populated)

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ICD-87XP PIC16F87X In-Circuit Debugger

The ICD-87XP debugger comes with an Integrated Development Environment (IDE) software which runs under Windows 95/98/ME/2000/NT. The IDE user interface is so intuitive that there is no learning curve to the system and users can be up and running within minutes. All information regarding the processor and the application is available right on the screen. It provides separate windows to examine source codes, data memory, special file registers and watch variables.

Special Function Tool Buttons

Load File - Loads COD, binary and hex files to the IDE for debug   Opens Device Configuration Window - Selects device type and fuse bit settings   Compile - Compiles the source file using supported compilers   Toggle Breakpoint - Quickly enables or disables current program counter as breakpoint   Show Next Statement - Quickly returns to the next instruction to be executed after strolling through source codes   Add Watch Variables - Isolates special variables to be inspected in a separate window   Run to Cursor - Executes codes in real-time from current program counter to the one highlighted by the cursor; can be used to step over or exit function calls   Animation Trace - Enables saving the non-real-time program execution to a memory buffer   Update Registers - Updates all registers in the current program states
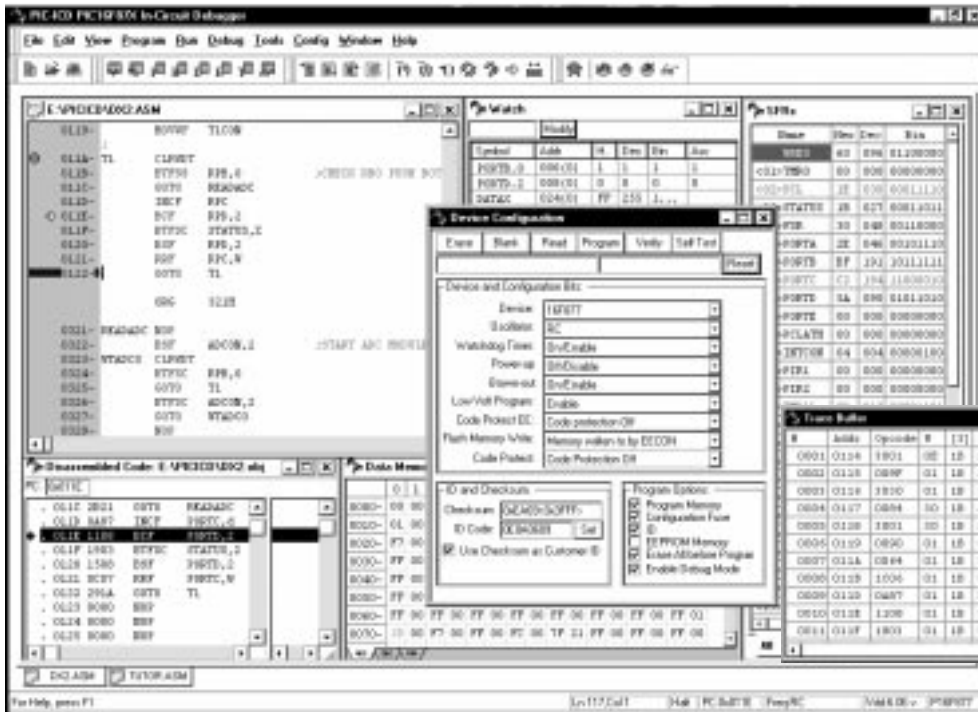
The Animation Trace allows users to specify 3 registers to be saved to the non-real-time animation trace in addition to the W, STATUS and FSR registers, opcode and source instructions.

Conditional Animation Break between 2 operands and select from a list of break conditions.

There are 2 external break input sources from the target circuit: BRK1 is an edge trigger break and BRK2 is an edge count break which halts the processors after a specified number of edge changes.

Feature Comparison between MPLAB™-ICD and ICD-87XP

	MPLAB™-ICD	ICD-87XP
Interface	Serial Port	Parallel Port
Operating Environment	MPLAB™ IDE - Win 95/98/NT	PICICD - Win 95/98/ME/2000/NT
Emulation Vdd Voltage	3 to 5.5 volt	2.5 to 6 volt
External Break	None	Edge trigger break input and edge count break input
Bits RB6, RB7	Occupied at all times	Free when not in debug mode via jumper setting
Target Frequency	Cannot read back target frequency	Can read back target frequency in debug mode
Firmware Upgrade	Reprogram a new firmware chip	Re-download codes to flash-based firmware chip
Function Timing for 8K words:	Depends on target frequency and voltage	Independent of target frequency and voltage
• Read and Verify	• 24 seconds	• 2.5 seconds
• Complete Program Cycle	• 2 min 45 seconds	• Less than 1 min 45 seconds
• Program Debug Module	• 5.5 seconds	• 4 seconds
• Reset	• 2.6 seconds	• 1.2 seconds
• Update all Registers	• 1.35 to 60 seconds	• Less than 1 second

Package Contents: ICD-87XP Programmer/Debugger with ribbon cable ends in 40-pin emulation header, 28-pin SDIP emulation header, ICD Demo Board, Win 95/98/ME/2000/NT IDE software, printed User's Guide.

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