

RICE17A PIC12/16/17/18 Emulator

RICE17A is a full-featured in-circuit emulator supporting the 8-bit PIC family microcontrollers from Microchip Technology. It comprises of an emulator base and different processor emulation modules to support most of the PIC12, PIC16, PIC17 and PIC18 (future support) devices. The emulator offers versatile and powerful features to allow you quickly debug your codes as well as hardware design. RICE17A interfaces to an IBM PC or clone via the parallel port. It runs under Windows 95/98/2000/NT4 on any PC-386/486/Pentium or compatibles including notebook and laptop computers. The system is compact and light weight. With all electronics cased inside an anodized aluminum enclosure, it can be easily brought on the road, fit neatly in any work space, or be moved from one computer system to another.

RICE17A with different processor modules and external probe cable



Additional Features on New Emulation Modules*

On-the-fly data capture break with 2-level trigger and pass counter, stopwatch and data bus capture

Feature Highlights

- Real-time and full-speed emulation
- 3.2 volt to 5 volt emulation range
- Supports most PIC12, PIC16, PIC17 and PIC18 microcontrollers
- Flash-based firmware for easy product updates
- Self-diagnostic test board comes with selective modules
- Fast downloading and data retrieval during stepping via parallel port
- Series protective resistors on all I/O pins of the bondout device
- 64K installed program memory and 32K real-time trace memory
- 12-clip external probes for logic trace and break functions
- Source level debugging with popular PIC assemblers and compilers
- Watch variables in word, byte and bit level, plus floating points and complex variables support (depending on debug information from compilers)
- Optional PIC Time Stamp module
- Integrated Development Environment (IDE) runs under Win 95/98/2000/NT4
- User's Guide in HTML format for easy navigation

The RICE17A Hardware

The RICE17A emulator base contains all emulation and control logic, including:

- 64K emulation memory
- 12-clip external probe including 8 trace inputs, an external break input, a trigger output, a break output and a common ground pin
- 32K by 24-bit wide real-time trace memory to capture executed instructions real-time together with one of these information, depending on the hardware being connected to the DB-15 connector on RICE17A:
 - logic states of the eight trace inputs from the 12-clip external probe cable
 - time stamp information captured with the optional PIC Time Stamp module
 - content of data bus captured with the Data Bus Capture cable from selected emulation modules

Processor Emulation Modules

Different emulation modules can be installed inside RICE17A to support various PIC12/16/17/18 processors. These device specific emulation modules contain the bondout chips from Microchip Technology to provide accurate, real-time and full speed emulation. Series protective resistors are present on all I/O lines to prevent damage to the bondout chips. The newer probes employ the 160-pin bondout chip to provide extra functions like on-the-fly data capture, stopwatch and data bus capture. All modules come with DIP emulation headers to plug directly into the target application. Optional surface mount plugs are also available to suit one's need.

Emulation Voltage and Speed

RICE17A is designed to fully support the PIC processors' capability to run at the 3V level. Users can select from four different voltage settings, between 3.2V and 5V, to run the processor. Full speed emulation is supported at the 5V level, 40Mhz, 33 Mhz and 20Mhz for the PIC18, PIC17 and PIC12/16 members respectively. When emulating at 3.2V, the speed will be lower as noted in the table on the right.

Different Oscillator Sources

RICE17A provides several options to supply the oscillator frequency to run the processor:

- from the internal onboard crystal which provides frequencies at 16Mhz, 8Mhz, 4Mhz, ..., etc.
- from the emulation probes where users can plug in a 2-leaded crystal to give a custom frequency not available internally
- from the oscillator socket on selected emulation plugs
- from a crystal in the target or a frequency injected to the OSC pin of the target processor under test

Modules	Supported Devices	Max Emulation Speed	
		at 5V	at 3.2V
PB-12A	12C508/509/518/519	20Mhz	4Mhz
PB-1267X	12C671/672/673/674	20Mhz	8Mhz
PB-17B	17C42/43/44/752/756/76X	33Mhz	16Mhz
PB-18*	18C242/252/442/452	40Mhz (future support)	16Mhz
PB-505A	16C505	20Mhz	8Mhz
PB-5XA	16C52/54/55/56/57/58	20Mhz	8Mhz
PB-62XA	16C620/621/622/554/556/558	20Mhz	8mhz
PB-66XA	16C641/642/661/662	20Mhz	4mhz**
PB-71A	16C710/71/711	20Mhz	8Mhz
PB-715A	16C715	20Mhz	8Mhz
PB-74A	16C62/63/64/65/72/73/74	20Mhz	4mhz**
PB-77A	16C66/67/76/77	20Mhz	4mhz**
PB-774*	16C772/773/774	20Mhz	8mhz
PB-84A	16C84/F83/F84	10Mhz	8mhz
PB-87X*	16F873/874/876/877 and 16C66/67/76/77	20Mhz	8mhz

* On-the-fly data capture break, stopwatch and data bus capture functions
** emulation on TMR1 is not supported under 4V

* Emulation Modules with new features include PB-87X, PB-774, PB-18 (available by late Q4, 2000)

RICE17A PIC Emulator

Self Diagnostic Test Board

To assure the functionality of the emulation probes for the bigger processors, PB-17B, PB-74A, PB-77A, PB-87X, PB-774 and PB-18 come with a self-diagnostic test board. When running the test program provided in the software, this board automatically test the functional blocks of the processor including I/O bits, data memory and peripheral functions like interrupts, timers, A/D, PWM, USART, etc.

The Software

RICE17A comes with an Integrated Development Environment (IDE) which runs under Windows 95/98/2000/NT4. The IDE user interface is so intuitive that there is no learning curve to the system. Users can be up and running within minutes. All information regarding the PIC microcontroller and the application is available right on the screen. It provides separate windows to examine source codes, program memory, data memory, special file registers, watch variables, program stack and trace memory.

Menu Bar and Tool Bars

- Dockable tool bars with tool buttons and tool tips for common functions like file operations, compiling and all emulation controls
- All tool bars can be customized to include or exclude any function buttons




Stack Window

- Displays the contents of the available stack

Special Register Window

- Updated registers per each instruction are highlighted for easy reference
- Registers are displayed altogether in one page as well as in separate banks
- Direct register editing in hex or decimal mode
- Registers displayed in hex, decimal, binary and ASCII
- Adjustable column width to hide unwanted displays
- User defined font and color

Source Window (Editor)

- Directly edit and compile
- Syntax sensitive display
- Automatically opens corresponding source files during stepping
- Context menu functions to set breakpoints, color, font, compile, and to run application to current cursor
- Tab set and search functions
- Cursor  shows the current program counter
- Breakpoint  and trigger point  indicators
- Multiple source windows can be opened for main program and include file modules

Disassembled Window

- Splitter window shows both disassembled codes and corresponding source lines
- Synchronized code execution between the two views
- Functions for redirecting program counter and modify instruction codes
- Current program counter cursor (arrow) and line cursor (reversed bar)
- Breakpoint (B) and trigger points (T) indicators

Workbook Mode Display

- Arranges source displays as worksheets and provides a tab-based user interface for managing multiple source files

Data Memory Window

- Editable data displayed in hex, decimal or binary
- Updated registers highlighted for easy reference
- User defined font and color

Trace Buffer Window

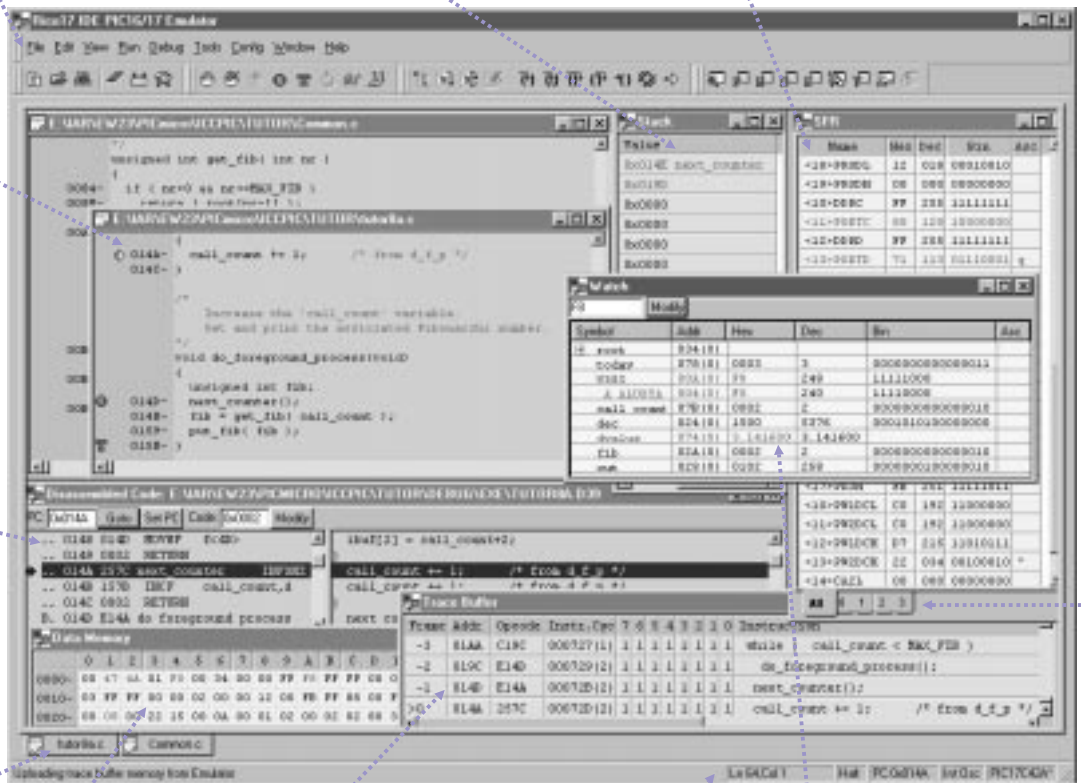
- Displays real time executed instructions and one of these data depending on the hardware being connected to the DB-15 connector:
 - logic states of the eight trace inputs
 - time stamp information
 - contents of data bus from Data Bus Capture cable of selected emulation modules

Watch Window

- Displays assigned watch variables in hex, decimal, binary and ASCII
- Watches can be set at word, byte, bit level or as long variables
- Supports IEEE754 24-bit and 32-bit floating point
- Supports complex structures from selected debug format (d39 from IAR)
- Modify watch variables directly in the window

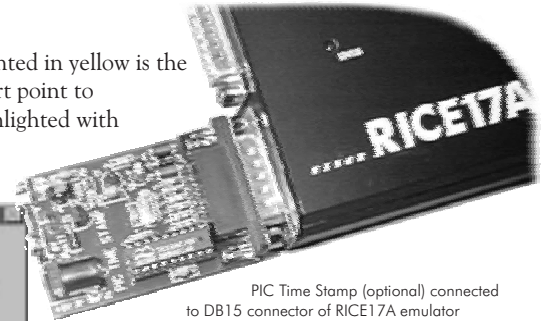
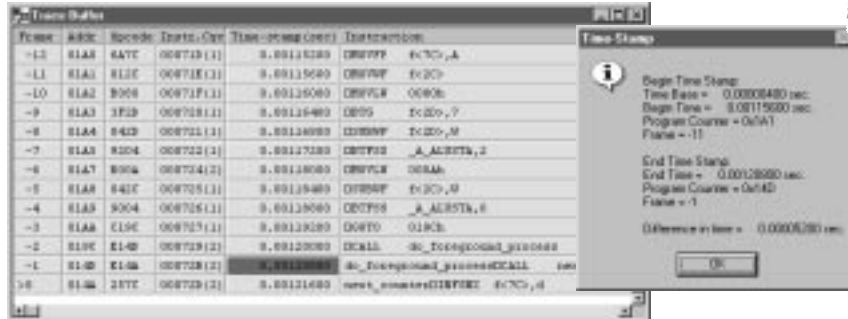
Status Bar

- Displays context sensitive help information
- Shows Line and column numbers in the active source window
- Shows processor status: Run, Halt or Wait
- Displays current program counter
- Shows oscillator source: Int OSC, Ext OSC
- Shows current device



PIC Time Stamp - This optional module connects to the DB-15 connector on RICE17A. When powered up and configured in the software, it captures all elapsed times for program execution in the 32K real-time trace buffer. Trigger addresses are used to clear and start the time capture.

All elapsed time information can be retrieved by uploading the trace buffer. The field highlighted in yellow is the start address defined by the user via the context menu. To find the elapsed time from this start point to another address, click the end point anywhere within the trace buffer which will then be highlighted with a pop-up dialog displaying the total time taken to execute the instructions within the range.



PIC Time Stamp (optional) connected to DB15 connector of RICE17A emulator

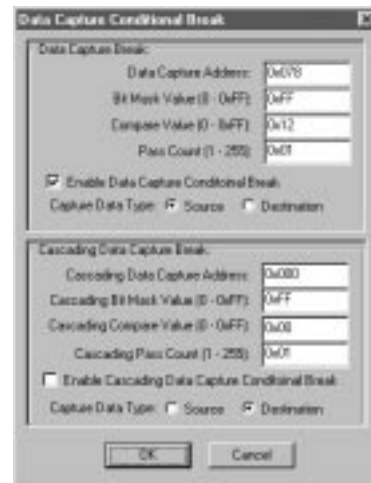
Real-time Trace Buffer - RICE17A comes standard with a 32Kx24-bit real time trace memory. Of the 24-bit data, 8 of which is for one of the followings, depending on the hardware being connected to the 15-pin connector on the emulator:



- 8 trace inputs from the external logic probe
- contents of data bus from Data Bus cable of new probes
- time stamp details for all executed instructions

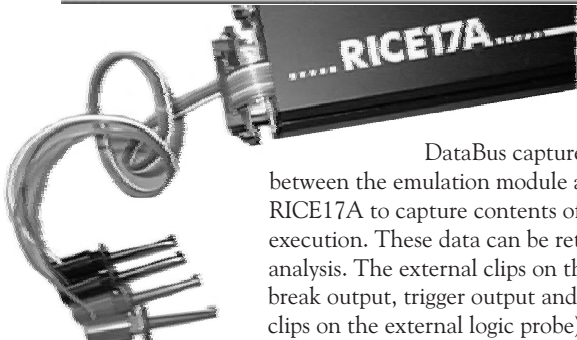


Real-time Data Conditional Break - New



emulation modules like PB-87X, PB-774 use the 160-pin 16C03-ME/PQ emulator chip. Together with extra circuitry, they provide on-the-fly memory access for real-time data breakpoints. This conditional break offers 2-lever trigger, bit mask for data comparison, as well as pass count support for versatile and powerful real-time data break.

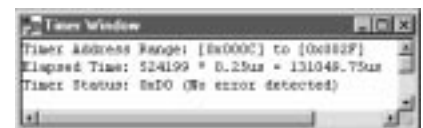
Trace buffer with data bus contents in hex and binary codes captured from Data Bus cable.



Data Bus Capture -

New emulation modules like PB-87X and PB-774 come with a special

DataBus capture cable. This is connected between the emulation module and the DB-15 connector on RICE17A to capture contents of the data bus during program execution. These data can be retrieved to the trace buffer for analysis. The external clips on the cable are for break input, break output, trigger output and ground (same as the four clips on the external logic probe).

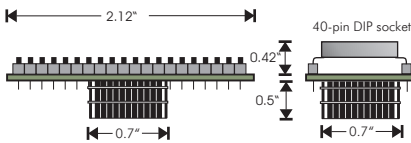


Stopwatch - Available on the new emulation modules like PB-87X and PB-774, the stopwatch provides the total time used to run the instructions between two given program addresses, input by the users.

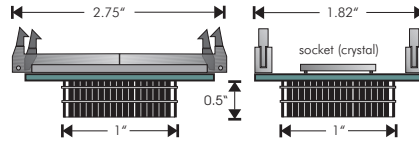
Optional Emulation Headers

The **PLCC** emulation headers is a one-piece adapter which connects to the emulation cable of the processor module via a socket or connectors on top and have a PLCC plug on the underside. It can be plugged into any matching PLCC socket on the target application for emulation.

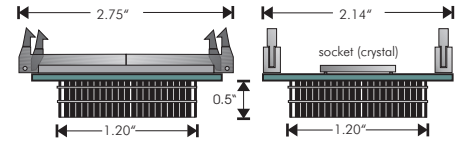
PLUG-PLCC16/PLCC17 (PIC16,18/PIC17 44-pin PLCC)



PLUG-EM75X (PIC17C75X 68-pin PLCC)



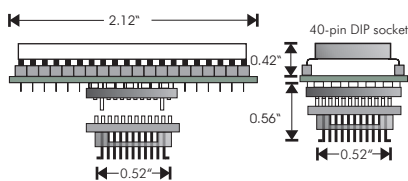
PLUG-EM76X (PIC17C76X 84-pin PLCC)



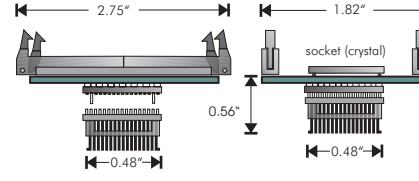
All the **QFP** emulation plugs consist of two parts:

- a PCB with a socket or connectors on top to connect to the cable from the emulation module and a receptacle on the underside of the PCB
- the matching pin-count surface mount base to be soldered onto the foot pattern of the target application

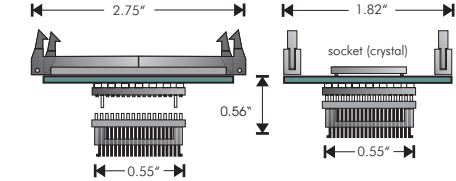
PLUG-QFP16/QFP17 (PIC16,18/PIC17 44-pin QFP)



PLUG-PQ75X (PIC17C75X 64-pin QFP)



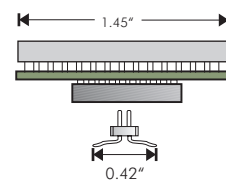
PLUG-PQ76X (PIC17C76X 80-pin QFP)



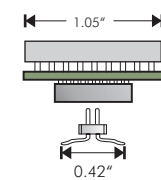
All the **SOIC/SOP** emulation plugs consist of two parts:

- a PCB with a DIP or SDIP socket on top to connect to the emulation cable from the module and a receptacle on the underside of the PCB
- the matching pin-count surface mount base to be soldered onto the foot pattern of the target application

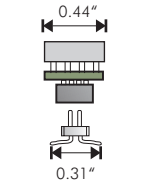
PLUG-SO28-3/6
(PIC16CXXX 28-pin SOIC)



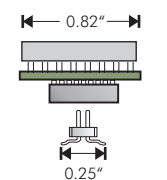
PLUG-SO18
(PIC16CXXX 18-pin SOIC)



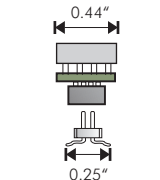
PLUG-SM8
(PIC12CXXX 8-pin SM)



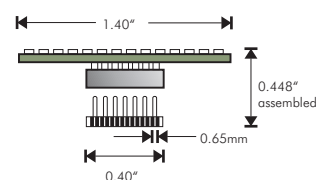
PLUG-SN14
(PIC16C505 14-pin SL)



PLUG-SN8
(PIC12CXXX 8-pin SN)



PLUG-SS28-3/6
(PIC16CXXX 28-pin SSOP)



RICE17A Features Summary

System Requirements

- PC-386/486/Pentium or compatibles
- Parallel port interface
- Windows 95/98/2000/NT4
- MS or compatible mouse
- at least 64K RAM

Hardware Features

- Supports PIC12/16/17/18 family in real time emulation using emulator and bondout chips from Microchip Technology
- Supports all operation modes of PIC17 and 64K external memory
- Supports PIC18 family to a maximum of 64K program memory only
- 3.2V to 5V range emulation
- 64K program memory
- 32K deep, 24-bit wide real-time trace memory- records program flow and one of these events: 1) external logic events from 8-trace inputs, 2) time execution from optional PIC Time Stamp module or 3) data bus information on selected processor modules
- 12-clip external probes for break input, break output, trigger output, GND and 8 logic trace inputs which record the logic states of the target
- Break input line will halt the processor from an external signal source
- Trigger output line generates a positive pulse when an instruction is qualified for trigger output, used to trigger a scope, other logic or instruments
- Internal/External clock capability
- Single flash-based firmware for all processor emulation modules
- Complete system includes emulator, Windows 95/98/2000/NT4 IDE, 12-clip external probe cable, self-diagnostic test board (per probe), power adapter, interface cable and HTML user's guide

Software Features

- Windows 95/98/2000/NT4 Integrated Development Environment (IDE) with built-in editor and direct link to most popular PIC assemblers and compilers
- Click error message after compiling to locate referenced lines in Source Window for correction if the compiler outputs an error file
- Assembly and C source level debugging for MPASM, SPASM, MPC, MPLAB-C17, PIC C from HI-TECH Software, EWPIC from IAR, PCB/PCM/PCV, CC5X, PICBasicPro and more
- Splitter disassembled code window displays source and disassembled codes side by side
- Multiple source windows for main program, header files or other include modules with editable breakpoints and trigger points
- Files displayed in Source Window are syntax sensitive and optional Workbook mode display
- Unlimited software breakpoints set directly inside disassembled or any opened source windows
- Real-time break conditions include break at address, break upon an external signal, break when trace buffer is full and break when stack overflows
- 2-level trigger data capture break with pass counter support, data bus capture and stopwatch functions on selected modules
- Automatic trace or trace on specific address range
- Trigger output on any address range
- Watch variables can be defined in word, double word, byte or individual bit levels
- Supports floating points and complex structures like arrays
- Emulation controls include Run, From new PC, To Cursor, Single Step, Step over Calls, Return to Caller and Animation
- Easily switches between assembly or C single steps via tool buttons or function keys
- Separate Windows for source codes, disassembled codes, data memory, special registers, program memory, trace, stack and watch variables
- Context menu with direct access to functions available to each window
- Customize font and color for each window
- Saves debug environment including layout, breakpoints, watches, triggers, etc to an INI file, enabling quick resumption of the debugging session