

HIGH LEVEL FORTH LANGUAGE

High Level Programmability: The QED Board includes an interpreter, compiler, assembler, math library, debugger, and multitasking real-time operating system in its 64K onboard ROM. The board is easily programmed with high level QED-Forth commands from any PC or terminal via an RS232 serial link. QED-Forth is a superset of the Forth language that includes hundreds of pre-coded library functions, a floating point and matrix math package, access to an integrated assembler and symbolic debugger, and features such as local variables that simplify function definitions and enhance readability.

Assembler: An integrated assembler with pseudo-high-level iteration and decision making macros simplifies coding of time-critical routines. Assembly code and high level QED-Forth code can be combined without restriction.

Symbolic Debugging: Any user-defined high level or assembly coded routine can be examined with the debugging tools. Single stepping, program tracing, register content reporting, and software breakpoints make it easy to isolate bugs. The full power of QED-Forth is available in the debugging mode. For example, even if the user has suspended operation in the middle of a routine that is being debugged, memory contents can be verified and variables can be checked; simply typing two carriage returns from the terminal then resumes execution of the suspended routine where it left off.

Documentation: You'll find that QED-Forth is superbly documented. Well written manuals thoroughly describe the language and provide numerous program examples and model applications.

OPERATING SYSTEM

Multitasking: An integrated real-time operating system implements cooperative and/or pre-emptive (timesliced) multitasking with only 60 μ sec task switch time. Resource variables and mailboxes handle inter-task communication and resource sharing.

Stand-alone Operation: The QED Board is easily configured to execute a user defined program at power-up or reset using the simple command AUTOSTART.

Memory Management: A heap-style memory manager facilitates dynamic run-time dimensioning of arrays, matrices, and data structures for optimal use of available RAM. Heaps and data structures as large as 8 Megabytes may be allocated and accessed as though they were a single contiguous block of memory.

Error Handling: The operating system's error messages are easily understood sentences. In addition, you can define your own error conditions and error responses for your application.

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Floating Point Math: The floating point math package includes simple math, log, trigonometric, and exponential functions, as well as formatted real number input/output. Floating point numbers maintain 4.8 decimal digits of precision over a range of 10^{-38} to 10^{+38} .

Decision Making and Flow Control: QED-Forth supports conditional IF ... ELSE ... ENDIF statements, multiple-branch CASE statements, definite looping with DO ... LOOP and FOR ... NEXT, indefinite looping with BEGIN ... UNTIL, and conditional looping with BEGIN ... WHILE ... REPEAT statements.

Integer Math: Integer (16-bit) and double precision (32-bit) math is fully supported.

Matrix Math: QED-Forth includes a complete matrix algebra library ranging from matrix editing functions to simultaneous equation solution, curve fitting, and fast fourier transforms.

Data Structures: Versatile string handling routines are provided. Structure utilities allow the definition of object-oriented data structures that may include combinations of text strings and numerical data.

USER INTERFACE AND I/O DEVICE DRIVERS

Keypad and Display Interfaces: Responding to user inputs and displaying results are simplified by the built-in 5x4 keypad scanner and 4 line by 20 character LCD display driver.

Analog and Digital I/O Drivers: Fast optimized drivers for the 8 bit and 12 bit A/D convertors, 8 bit D/A convertor, and digital ports make it easy to access analog and digital I/O.

Serial Communications: Revectorable driver routines provide high level access to two serial ports.

Timekeeping: An interrupt-based clock reports elapsed time, and built-in functions set and read a battery-backed real time clock.

Interrupt Support: Twenty 68HC11F1 interrupts have associated names in the QED-Forth dictionary. Interrupt service routines can be coded in either high level or in assembly code, and are debugged just like any other routine. A simple ATTACH command installs the service routine so that it will be called whenever the specified interrupt is activated.