10.4 GenRad Systems

A few years ago, Futuredata offered a popular single processor-based universal development system called the AMDS (Advanced Microcomputer Development Systems). Recently, General Radio bought Futuredata and modified the Futuredata systems to provide a number of new development systems. These are the 2300 series, 2301 systems, and the 2302 slave emulator control unit. The 2300 system is a universal stand-alone software station whereas the 2301 system is a universal multistation hardware/software network supporting up to eight stations. Both of these systems are designed using the Z80-based single-processor architecture. Each 2301 network system can be interfaced to up to eight 2302 slave emulators via RS-422. Therefore, a 2301–2302 configuration can provide both hardware and software development capabilities for a maximum of 64 microprocessors (any combination supported by GenRad).

The GenRad 2300 Series system includes the Models 2300-9100 and 2300-9200 Universal Stand-alone Software Development Systems and the 2301-9100, 2301-9200, 2301-9300, and 2301-9400 Universal Multistation Hardware/Software Development Network Systems. The 2302-9000 Slave Emulator Control Unit is provided to support various 8- and 16-bit microprocessors and microcomputers. With the 2302-9000, emulation is performed transparently at full processor speed to 10 MHz. The slave emulator requires a Z80-based stand-alone system for operation.

10.4.1 2300 Stand-Alone Software

The 2300 system is a universal stand-alone software station and includes a keyboard, CRT, and CPU in one package. The 2300 can develop software for the 8086, 8085, 8080, Z80, 6800, Z8000, 6809, 8048, 1802, 6502, 3870, and SC/MP.

Two models are available: the 2300-9100 (48K bytes) and the 2300-9200 (64K bytes). Both models have 1 megabyte of floppy disk storage.

Both 2300 models have the following software: a relocatable macroassembler, object program linker, screen-based editor, debugger with disassembly, and symbolic debugging and command control language. A basic interpreter is available for the 8080/6800 families. The Z8000, 8086, 6809, 8085, 8080, and Z80 have BASIC and PASCAL compilers.

The GenRad 2301

The 2301 system is a universal multistation hardware/software network that supports up to eight users simultaneously. The 2301 supports the 8086, 8080, 8085, 6800, 6802, and Z80.

The 2301 offers four systems. The 2301-9100 (48K bytes) and the 2301-9200 (64K bytes) are both software development network stations. The 2301-9300 (48K bytes) and the 2301-9400 (64K bytes) are both hardware/software development network stations.

The customer's requirements determine how many of each of the hardware/software stations and of the software stations are bought. The cost per station is lowered by sharing a network control processor, a disk facility, a printer, and a PROM programmer.

Each hardware/software station is a complete development system and has optional plug-in boards to in-circuit emulate five microprocessors (the 8080, 8085, 6800, 6802, and Z80). In order for a hardware/software station to emulate and logic analyze other supported microprocessors (such as the 8086) the GenRad 2302 Slave Emulator Control Unit and Universal Slave Logic Analyzer must be used. Each hardware/software station

comes with its own real-time in-circuit emulator, logic analyzer, and high-speed static RAM.

The network control processor oversees the sharing of the floppy disk, printer, and PROM programmer with up to eight stations.

The CRT is a high-speed (over 20K characters per second), high-resolution (24 × 80) display. The system software (NDOS) takes advantage of this speed to offer the display of hexadecimal memory, ASCII data, and disassembled data, combined with symbolic debugging and string search capabilities.

These string search capabilities eliminate the need for linker maps and assembly listings because specific program steps can be located by their label names.

This high-speed CRT permits all editing results to be displayed instantaneously which reduces editing errors. The editor permits scrolling through 2,500 lines of workspace.

GenRad system software (NDOS) includes a relocatable macroassembler, object program linker, powerful screen-based editor, and interaction debugger with assembly and symbolic debugging and command control language. A command file can be used to reduce numerous steps to one simple command.

Two high-level languages are available: BASIC and PASCAL. A BASIC interpreter and compiler is offered for the 8080/6800 families (just as for the 2300). A PASCAL interpreter and compiler is available for the 8080, Z80, and 8086 16-bit processor. Due to its highly structured design PASCAL is easier and thus faster (up to 50% faster) than other nonstructured high-level languages.

During in-circuit emulation RAM is used as ROM so that errors can be easily reprogrammed.

The GenRad Real-Time Logic Analyzer has 256 × 48 bits of storage, three hardware break registers, loop counters, and a delay counter. Complex or simple break conditions can be specified. The utility of the Logic Analyzer (LA) is greatly expanded because the user can eliminate the storage of extraneous data by qualifying the data to be stored.

Even difficult hardware and software problems can be solved by the combined use of real-time emulation and real-time logic analysis.

GenRad 2302 Slave Emulator

In order to develop modern multiply processor systems the emulator needs to be separate from the development system's master CPU controller. Accordingly, the 2302 (Figure 10.19) has its own emulation processor, emulation memory, and emulator bus, as well as a 64-channel logic analyzer.
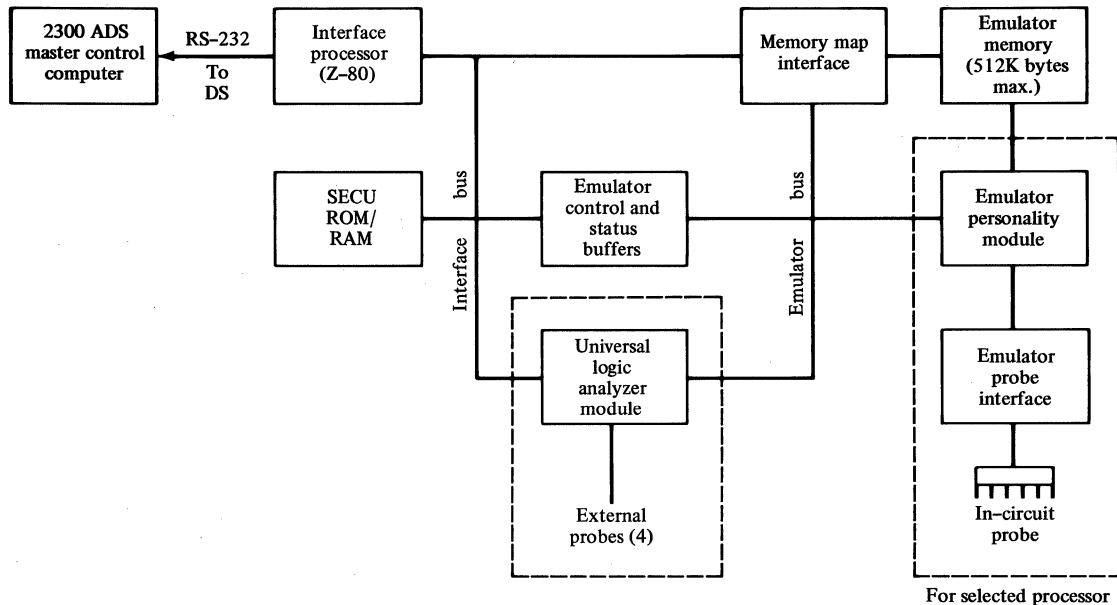
Figure 10.19   Slave emulator block diagram. Source: GenRad Corp., Development Systems Division, Culver City CA 90230.

The slave emulator is controlled by the 2300 Advanced Development System (ADS) Computer, (which supplies the necessary emulator-control and software development programs). With the addition of a disc and printer the user's development system is complete.

The 2300 ADS has multiemulator debugger software which allows a single user to control and debug a single system with up to eight microprocessors running simultaneously. Multiple slave emulators are linked together via a high-speed RS232 daisy chain. The user can debug any one microprocessor at a time via the CRT terminal and debug program. This is shown in Figure 10.20.

Each debug command to the slave emulator only briefly interrupts the emulation processor since the emulation hardware is completely separate from the development system's hardware. This is a very significant feature because the target system does not have to come to a complete halt whenever debugging occurs. In the case of a microprocessor-based engine control this means that the engine will not be stopped whenever debugging occurs.

A unique application of the slave emulator is as follows: The system under test can be stimulated while it is running normally. Variables can be forced out of range and I/O ports can be manipulated.

The above feature can also be combined with the command file
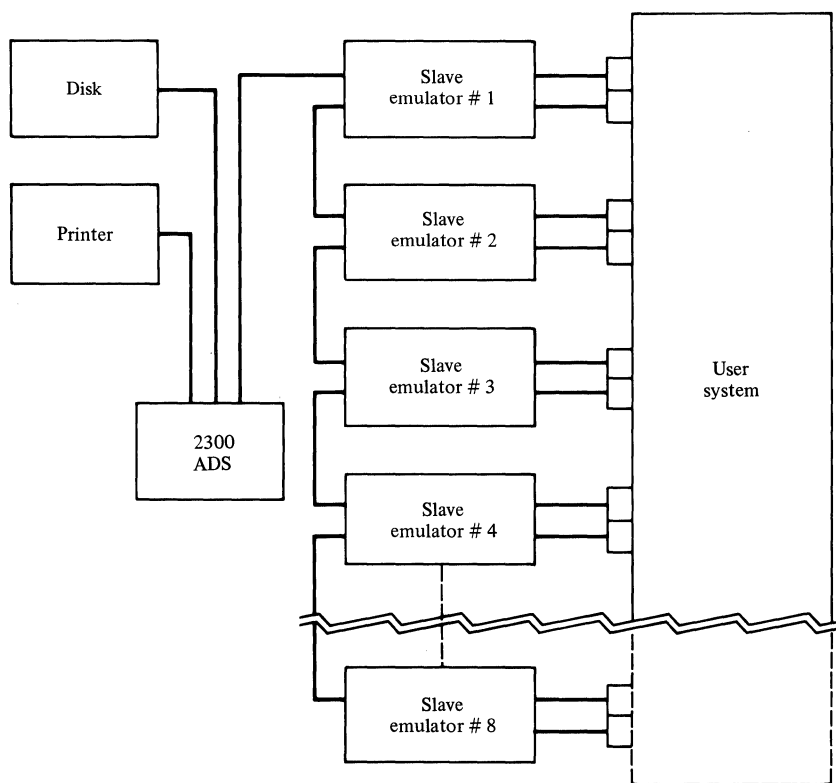
Figure 10.20 System diagram multiple slave emulators. Source: GenRad Corp., Development Systems Division, Culver City, CA 90230.

processing function of the debugger program to do automated testing of single- or multiple-processor systems.

The slave emulator uses high-speed 10-MHz RAM. Up to 128K bytes static RAM or 512K bytes dynamic RAM can be mapped in 4K or 16K blocks to any address locations within a total 1 mega byte address space. Mapping of memory references to internal or external memory is done in 256-byte sections. For ROM simulation any portion of RAM can be write-protected in 256-byte blocks. All I/O is mapped externally.