FOONLY

The Foonly "F" Series Computer Family
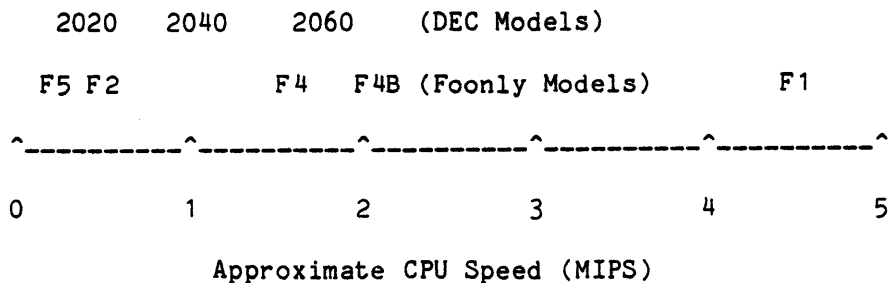
Product Line Overview

The Foonly "F" series computer family is a group of four microprogrammed computing engines designed to provide a more capable and cost effective alternative to Digital Equipment Corporations's PDP-10* line.

The four models of the "F" series cover a performance range from the very small (or personal) configuration (F5) to the fastest PDP-10* type machine available today (F1).

The F1, F2, F4 and F5 execute the PDP-10* instruction set and may be extended to execute other instruction sets as well. All models support the same extensive set of peripheral devices, and present the same environment to the user and system manager.

All models are available as complete systems, with hardware maintenance and software support from Foonly. OEM customers may purchase various levels of subsystems and support.

Performance of the "F" series Models

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      2020    2040    2060    (DEC Models)

      F5 F2           F4    F4B (Foonly Models)         F1

   ^_____^_____^_____^_____^_____^

   0           1           2           3           4           5
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Approximate CPU Speed (MIPS)

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*An asterisk will denote trademarks or product names of Digital Equipment Corporation

Characterizing the "F" Series Computers

Technical Characteristics of the "F" Series

Foonly Model Number	CPU Speed (MIPS)	Micro Cycle (nsec)	Max IO Bandwidth (Mbits)	Memory Speed (nsec)	Memory Capacity (Mwords)	IO Device Slots
F1	4.5	90	180	350*	4	26
F2	.5	350 - 550	45	400	1	9
F4	1.4 - 1.6	125 - 350	90	350	2	13
F4B	1.8 - 2.2	125 - 275	90	350*	2	13
F5	.3 - .5	300 - 550	45	450	.5	5

* cached

Functional Characteristics of the "F" Series

Foonly Model Number	Typical User Load	Total System Price Range (Thousands)	Mainframe Size (bays)	Max Power Consumption (watts)
F1	80 - 90	600 - 700	4	5000
F2	8 - 12	100 - 150	1	800
F4	25 - 30	180 - 300	1	1000
F4B	30 - 35	230 - 350	1	1500
F5	1 - 4	50 - 80	.5	800

Outstanding Features of the "F" Series

PDP-10[*] Compatibility

Because all "F" series machines execute the same instruction set as the PDP-10[*] models, an extensive library of software is available which will run on Foonly machines.

What is available? Due to extensive use of the PDP-10[*] in industry and academia, a wide range of software has been developed. Most programming languages are represented as well as a variety of text editors, document formatters, message systems, software development tools, and more specialized applications. Request the "Foonly Software Referral Index" for currently available detail.

What PDP-10[*] software will run on "F" series machines? Basically any PDP-10[*] software that is available. Caveats exist such as minor variations in the instruction sets of PDP-10[*] models, differences in operating systems, and dependencies on system configuration.

The TENEX operating system used at most Foonly sites is a compatible subset of TOPS-20[*] and will run most TOPS-20[*] programs without modification. TENEX also offers TOPS-10[*] compatibility through the PA1050 package. Foonly is committed to TENEX support and development and projects are underway or planned for enhancing filesystem reliability and performance, adding sophisticated display terminal support, improving TOPS-20[*] compatibility, adding packet stream network support, and improving overall system performance.

Foonly recognizes that the ability to run existing PDP-10[*] software is a major selling point and will assist the customer in identifying and obtaining software from this large and rich base, and will offer support if necessary to ensure successful application.

Economy

The "F" series computer systems offer unusual economies of ownership and operation.

System Price. For equivalent amounts of computing service, "F" series systems are 1.5 to 3 times less expensive than the competition.

Unbundling. Because Foonly supports industry standard disk and tape interfaces, the customer may select from a wide range of price competitive peripherals. The customer may elect to obtain the devices through Foonly or may order them directly. In either case the resulting price is usually one half or less than from a conventional computer vendor.

Flexibility. Because of the unmatched flexibility of the "F" series hardware and of Foonly support, the user benefits from wider application opportunities and extended system lifetime.

Maintenance Costs. "F" series machines have an excellent record of reliability. The front-end diagnostic processor and remote maintenance service reduces maintenance costs, which are a major component of overall system cost.

Advanced Features.

User Microcode. Foonly provides full support for microcode customization on all its systems, which affords numerous opportunities for major improvements in system functionality and performance. One obvious application of custom microcode is the development of processor modes to support languages such as LISP or PASCAL; another is the microcoding of performance critical software. For such applications, 32 bit virtual addresses are supported by all models except the F2, which supports 24 bits.

Console Processor. Each "F" series model delivered after June 1981 will include a diagnostic front end processor. The front end will enable remote diagnosis of mainframe faults to the component level; on site spares required for repair are thereby reduced to an inexpensive selection of chips and other basic parts. The remote interface can also serve as the controlling terminal of the system allowing remote software maintenance and diagnosis.

Micro-computer Interface. The front end microcomputer is an example of an application of the Byte Multiplexer capability. The Byte Mux provides a framework which enables the user to connect standard, off the shelf micro-computer peripherals to "F" series systems. The Byte Mux provides a convenient connection between "F" series hardware and software and the micro-computer world.

Program Development Aids. Two valuable aids to program development are provided: address break and PC history. Address break is used to create an interrupt when a certain location is accessed. PC history is a record of the addresses of the last 1000 instructions executed. This unusual capability is remarkably useful in program debugging.

Standard Interfaces. The use of industry standard I/O interfaces allows the user to take advantage of the rapidly occuring improvements in peripheral devices. This helps prolong useful system life.

Custom Development. Foonly will develop, or assist the customer in developing, custom interfaces. Extensive application of computer aided design and production make such custom development cost effective.

"F" Series Hardware

System Architecture

All "F" series computer systems consist of a central processor, an FBUS, a memory system, a console processor, and several peripheral device interfaces and their associated devices. All but the central processor are common in design throughout the family.

Central Processor Architecture

Each of the "F" series central processors contains a micro-programmable sequencer, a writeable micro memory (control storage), an arithmetic-logic unit, some fast local storage, and a memory mapping unit. The F1 has additional functional units for parallel high-speed operation. Under control of the sequencer, instructions are retrieved from main memory and interpreted by the execution of microinstructions held in micro memory. Memory references normally pass through the memory mapping unit which in conjunction with the microprogram implement the desired form of memory management (eg, no paging, BBN Pager, KI* or KL* style paging).

The components of the CPU vary in speed and generality among the "F" series models; for example the F5 is a very generalized processor while the F2 is more dedicated to interpreting instructions in main memory as PDP-10* operations.

Detailed descriptions of the implementation of the "F" series processors are not present here; contact Foonly for more information.

FBUS

Each "F" series system contains one or more FBUSes, which interface peripheral device controllers. A device may use the FBUS to communicate directly with memory or to interact with the central processor.

The FBUS comprises 36 bidirectional data lines, memory address lines, device select lines, and two groups of control signals. One set of controls is for direct memory access; a device requiring this type of service requests use of the bus, waits for an acknowledgement, then places the desired memory address on the address lines and performs a memory read or write cycle. The total data rate achievable depends on the model.

The other set of control signals mediates a type of device interaction not provided by most computers. When a device requests this type of service, the micromachine branches to a microcode routine which is unique to that device. Then, using a dedicated area of special purpose memory it communicates with that device in a way tailored to its particular needs, transferring any kind of data or control information required. Thus, instead of using a fixed bus protocol which every device must implement and use, the FBUS provides a variable, customized protocol. Futher, control sequences of great complexity, such as the handling of unusual error conditions, or the initiation and termination of transfers can be provided simply by writing code for the micromachine. This mechanism for CPU intervention greatly reduces the hardware required in a typical device interface.

Memory System

All "F" series models use 150 - 200 nanosecond dynamic MOS memory. Error correcting logic corrects one bit errors and detects nearly all multiple-bit errors. ECC errors are recorded to aid preventative maintenance. All models provide direct memory access for I/O equipment.

The F1 has a high-speed buffer memory (cache) and a cache will be available for the F4 model by Q3 81, which will extend its performance range significantly above that of the DecSystem-2060* (KL*).

Byte Multiplexer Channel and the Console Processor

The Byte Multiplexer Channel provides a convenient pathway between the Foonly FBUS and common micro-computer peripherals. The Byte Mux appears to the FBUS to be 8 FBUS devices with control/status and data/address registers. The standard Byte Mux provides an industry standard micro-computer bus for which many peripheral controllers are available. A bare Byte Mux without onboard processor is available for custom and OEM applications.

The Console Processor (included in each Fx system for maintenance and operating control) contains a standard Byte Mux, with some of its devices committed to standard I/O in various Fx system configurations.

Peripherals

FBUS flexibility and the use of standard device controller interfaces creates many options for peripheral equipment, both technological and economic.

The customer has the options of purchasing a complete system package, or some mix of standard and custom devices, or just the mainframe alone.

Disk Subsystem

The standard Foonly disk controller will support from 1 to four (8 opt.) disk drives utilizing the "Storage Module Device" protocol. A large variety of drives may be used with this controller since the SMD protocol is a popular industry standard interface. The customer may therefore select drives which offer the best combination of capacity, performance, media removability, maintenance, and so forth. Foonly's standard offering on packaged systems is the CDC SMD 300 Mbyte removable or the CDC MMD 160 Mbyte Winchester. We have not yet selected a standard drive in the 20-60 Mbyte range.

Magnetic Tape Subsystem

The standard tape drive controller will support one to four tape

drives conforming the so-called "Pertec formatter standard".
Pertec, Kennedy, STC, and others offer this interface. NRZI/PE
(800/1600 BPI) is supported in a speed range of 12.5 to 125 IPS.
The standard tape drives offered by Foonly are the Pertec Model
T1000 and the Kennedy Model 9000/9100.

GCR encoding (6250 BPI) is available as an option.

Terminal Line Scanner

The Foonly Data Line Scanner is a 16 line terminal multiplexer which
provides RS-232 standard interface with full modem control. Line
speeds are program selectable in the range 110 to 19.2K baud. Up to
four scanners may occur on one FBUS, providing up to 64 lines on all
systems except the F1 which may have multiple FBUSes.

Lineprinters

The Foonly lineprinter controller supports the Printronix and Data
Products long line interfaces. Support for other printer interfaces
is available as an option.

Plotters

The Foonly printer/plotter controller supports Versatec devices at
high speed. Both lineprinter (character) mode and plotter (bit
raster) modes are supported. Recent price reductions in quality
plotting devices (Versatec V80, about $5,400 OEM Quan 1) bring to
mind new classes of applications.

Parallel Interface

The Foonly Parallel Interface provides a 16 bit wide (plus control)
data path to arbitrary devices. Data is transferred one word at a
time under program control. This device is compatible with the .
PDP-11[*] DR11C[*] parallel interface.

FooVision Graphics

FooVision is a medium to high performance bit mapped graphics system
which can be configured to provide binary B/W, B/W grey level, or
color graphics. Its capabilities combine many of the best features
of ordinary raster scan displays and the traditional (expensive) x-y
cursive writing display. FooVision is an FBUS device and consists of
a per-system control board which may control several per-display
display memory boards. The minimum configuration is one display
controller and one display memory. The display boards connect via
coax to either 525 line RGB color monitors or 891 line (or lower)
B/W monitors. Display memories are both readable and writeable from
the processor. Both character and vector generation are standard.
FooVision may be configured in three major ways:

Color and/or Grey Levels -- Video Resolution

525 by 704 resolution, 480 by 638 visible pixels. 3 bits per pixel selecting 8 bits per color. Up to 48 lines of 106 typical 10 by 6 binary characters, or substantially greater numbers of smaller, high density, grey-level enhanced characters. The use of grey levels permits the generation of characters in complex printing-style fonts, such as Times Roman, as well as the usual stick-figure characters seen on most computer displays. Full anti-aliasing is provided; this unusual feature greatly improves the ragged appearance of sloping or curved lines common on other raster scan displays. In addition, object may overlap on the screen without interference, a feature usually present only in expensive x-y displays.

Grey Level only -- Video Resolution

Same details as above except values in color map are interpreted solely as intensity.

Binary -- Video or High Resolution

Up to 891 by 1188 resolution, 792 by 1056 visible pixels. 1 bit per pixel. Up to 79 lines of 176 typical 10 by 6 characters, plus bitmapped vector graphics.

The key to FooVision's flexibility is the mapping process by which the display memory is interpreted into color/intensity control. There are 3 bits per pixel and an additional 3 bits per 11 pixels. These are combined with associated control bits to select a value from the user-loadable color/intensity map. This mechanism allows the user to control the assignment of color and intensity onto the available display memory bits.

Networking

Arpanet Interface

The ARPAnet is a high speed, geographically distributed network which consists of packet switchers (IMPs), 50Kb inter-IMP connections, and a variety of host computers. This network technology was developed for the Advanced Research Projects Agency of the DOD and now consists of over a hundred hosts serving the research and operational requirements of DOD, DOE, and other Federal users.

Foonly offers an IMP interface (Distant Host style) and support for the required Tenex operating system software (Network Control, TELNET, File Transfer, etc).

Because ARPAnet technology is available commercially, the customer

may consider forming a private packet switched network.

Packet Stream Network Interface

High speed (2-10Mb), geographically limited networks based on packet
stream techniques (Ethernet, Chaosnet) are currently the subject of
much interest and activity. Standardization is still a problem.

Foonly will offer a packet stream interface and Tenex software
support during Q3 81, unless customer demand raises the project's
priority. Our current plans call for the implementation of 10Mb
Ethernet hardware and using the now existing software layers.