

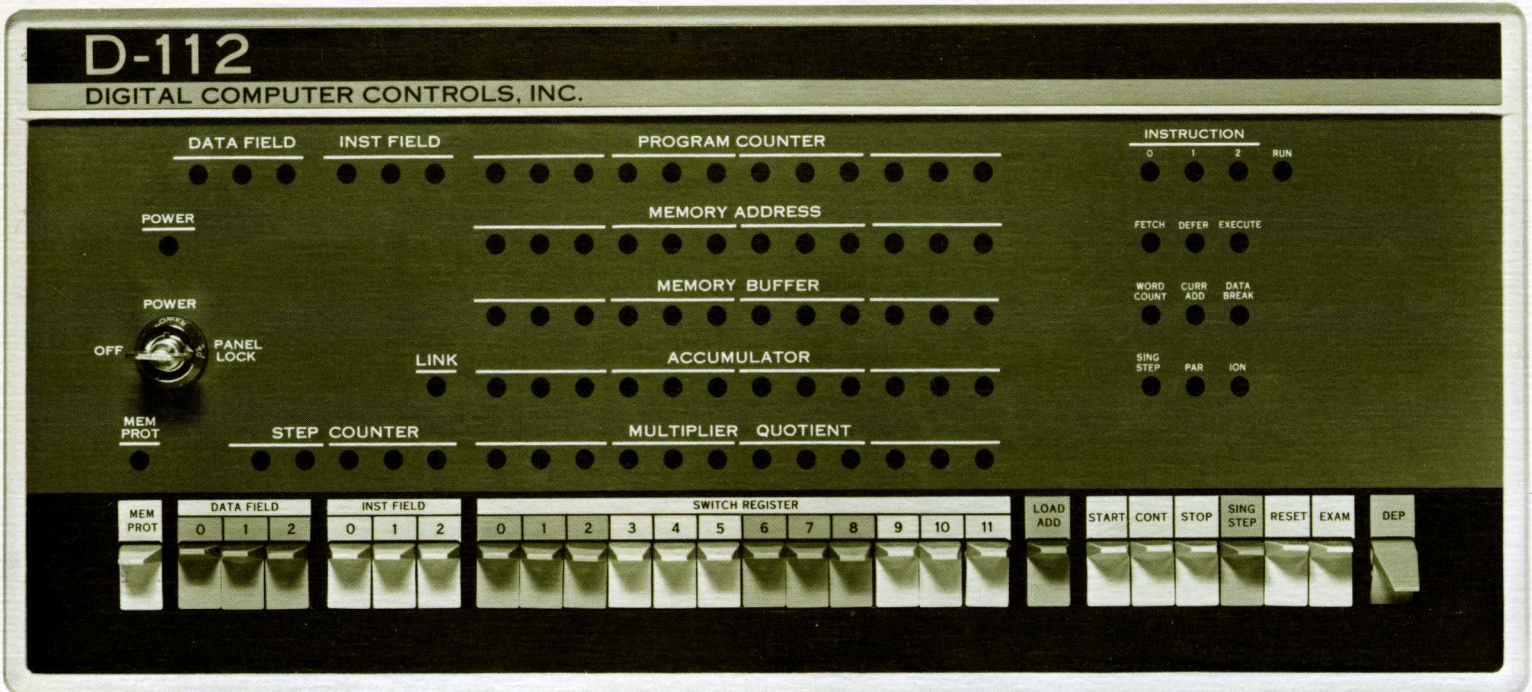
D-112
MSI
12-BIT
DIGITAL COMPUTER



DIGITAL COMPUTER CONTROLS INC

D-112

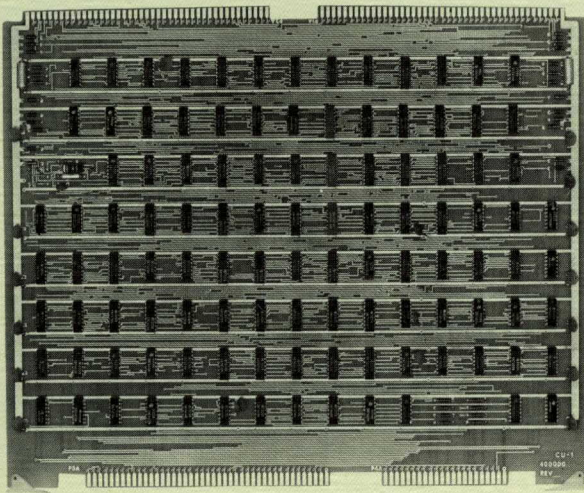
DIGITAL COMPUTER CONTROLS, INC.



**OPTIMAL COMPUTING
POWER PER DOLLAR, UTILIZING
THE LATEST DEVELOPMENTS
IN ELECTRONIC PACKAGING AND
SOLID-STATE TECHNOLOGY**



The D-112



D-112 Features

The **D-112** 12-BIT MSI Computer is a significant contribution toward the goal to avail industry of the optimal computing power per dollar, utilizing the latest developments in electronic packaging & solid-state technology. The D-112 incorporates MSI Solid-State, TTL integrated circuitry and is one of the lowest-cost, full-scale Digital Computers designed for general purpose applications.

Design emphasis has been given to the compatibility of the D-112 12-Bit computer with existing competitive machines. The D-112 is completely program compatible with PDP/8 Series Computers including the PDP*-81, 8L and PDP*-8/e. The physical outline has been configured to permit direct interchangeability with the 8L chassis — it is thus possible to accomplish a direct substitution without the need for re-programming or engineering of system interface equipment.

The unique aspects of the D-112 include features such as; smallest physical configuration for 32,768 word core memory (8.75" x 19" x 22"); simplified maintenance procedures due to advanced packaging and console layout; ultra-stable core memory capable of performance in temperature environments of from 0°C to 55°C; MTBF is calculated in excess of 10,000 hours as a result of component test — computer burn-in quality assurance procedures and thermal design; memory cycle time of 1.2 microseconds; printed circuit bussing technique in lieu of back panel wiring — spare plug-in slots to accommodate customer interfaces for special systems applications.

Digital Computer Controls' D-112 is available in several configurations including the basic 4096 word random access core memory unit — with incremental modules

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of read only memory (core or solid-state), and/or read/write memory making it a flexible system for numerous applications — from numerical control to broad general purpose scientific requirements. The computer is easy to use, small and low cost, making it an ideal tool for the engineer, as well as production line and business applications.

The D-112 Features are:

- MSI TECHNOLOGY
- TTL INTEGRATED CIRCUITRY
- 1.2 MICROSECOND MEMORY CYCLE TIME
- MEMORY EXPANSION TO 32,768 WORDS IN 8¾" x 19" x 22" CONSOLE
- 256 WORD READ ONLY MEMORY OR READ/WRITE MEMORY INCREMENTS AVAILABLE
- MASS STORAGE EXTENSION WITH MAGNETIC TAPE OR MAGNETIC DISK PERIPHERALS
- SIMULTANEOUS DISPLAY OF ALL MAJOR REGISTERS
- TWO'S COMPLEMENT ARITHMETIC
- EXTENDED ARITHMETIC OPTION FOR HIGH SPEED MULTIPLICATION/DIVISION
- EIGHT AUTO-INDEX REGISTERS
- SMALLEST CPU CONSOLE FOR 32K MEMORY
- STANDARD COMPUTER OPTIONS AND PERIPHERALS AVAILABLE FOR LOW COST EXPANSION TO A FULL SCALE SYSTEM
- RELIABLE PERFORMANCE IN AMBIENTS FROM 0°C TO 55°C, AND PHYSICAL ENVIRONMENTS ENCOUNTERED IN MANUFACTURING AND MACHINE SHOP FACILITIES

Packaging/Mechanical Configuration

The physical design of the Digital Computer Controls D-112 represents a significant step toward simplified packaging of computer circuitry. Plug-in 13" x 16" Printed Circuit Cards contain slightly more than 100 I.C. Modules each. Printed-Circuit back plane bussing, assures reliability and simplified maintenance.

A swing-away front control panel permits direct access to the central processor, Memory, I/O, Controllers and Special Interface Equipment. The Plug-In boards slide on guides into connectors mounted on the back plane P.C. Board. Fifteen boards can be accommodated in the 8.75" high chassis including eight for 32K of core memory, two for Processor Logic, one for Memory Timing and Control, one for Memory Extension, one for I/O, one for Special Interface Board and one for Extended Arithmetic Option.

Large systems are accommodated by use of an Expansion Console for configurations which require large Memories, Disk, Tape, and/or other Peripherals and their associated Controllers. The chassis is identical in size to a CPU console (8.75" x 19" x 22"), contains a power supply, back and front panels, and an I/O connector block for interconnection to the mainframe and peripherals.

The basic CPU chassis has been configured to minimize internal temperature rise by locating the exhaust fan in close proximity to high heat dissipating sub-systems. Ambient air is brought into the chassis, due to the negative pressure effect of the exhaust fan, through side vents, channeled across each printed circuit board and then exhausted out the side. The point source of maximum power dissipation and hence a factor in memory stability and overall system reliability are the inhibit power resistors. These components have been located away from the core memory and placed directly in the main air stream.

The D-112 instruction set is designed to be completely compatible with 8I & L series computers. It features 192 I/O transfer codes for servicing 64 to 192 input/output devices plus efficient microprogramming techniques to minimize code use. Simplicity and flexibility of the D-112 instruction repertoire make it easy to learn and utilize.

BASIC INSTRUCTIONS

AND 0000 logical AND
TAD 1000 2's complement add
ISZ 2000 increment and skip if zero
DCA 3000 deposit and clear AC
JMS 4000 jump to subroutine
JMP 5000 jump
IOT 6000 in/out transfer
OPR 7000 operate

GROUP 1 OPERATE MICROINSTRUCTIONS

NOP 7000 no operation
CLA 7200 clear AC
CLL 7100 clear link
CMA 7040 complement AC
CML 7020 complement link
RAR 7010 rotate AC and link right one
RAL 7004 rotate AC and link left one
RTR 7012 rotate AC and link right two
RTL 7006 rotate AC and link left two
IAC 7001 increment AC

GROUP 2 OPERATE MICROINSTRUCTIONS

SMA 7500 skip on minus AC
SZA 7440 skip on zero AC
SPA 7510 skip on plus AC
SNA 7450 skip on non-zero AC
SNL 7420 skip on non-zero link
SZL 7430 skip on zero link
SKP 7410 skip unconditionally
OSR 7404 inclusive OR, switch register with AC
HLT 7402 halts the program
CLA 7600 clear AC

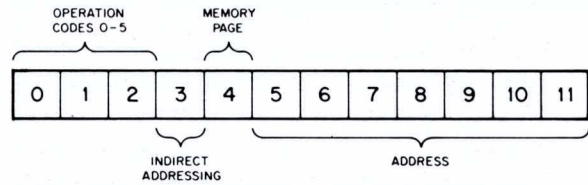
COMBINED OPERATE MICROINSTRUCTIONS

CIA 7041 complement and increment AC
LAS 7604 load AC with switch register
STL 7120 set link (to 1)
GLK 7204 get link (put link in AC bit 11)
CLA CLL 7300 clear AC and link
CLA IAC 7201 set AC = 1
CLA CMA 7240 set AC = -1
CLL RAR 7110 shift positive number one right
CLL RAL 7104 shift positive number one left
CLL RTL 7106 clear link, rotate 2 left
CLL RTR 7112 clear link, rotate 2 right
SZA CLA 7640 skip if AC = 0, then clear AC
SZA SNL 7460 skip if AC = 0 or link is 1, or both
SNA CLA 7650 skip if AC = 0, then clear AC
SMA CLA 7700 skip if AC < 0, then clear AC
SMA SZA 7540 skip if AC <= 0
SMA SNL 7520 skip if AC < 0 or link is 1, or both
SPA SNA 7550 skip if AC > 0
SPA SZL 7530 skip if AC > 0, and if the link is 0
SPA CLA 7710 skip if AC >= 0, then clear AC
SNA SZL 7470 skip if AC ≠ 0 and link = 0

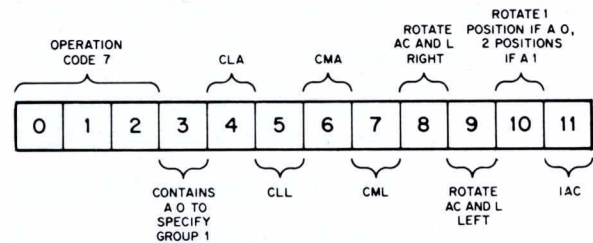
EXTENDED ARITHMETIC MICROINSTRUCTIONS

DVI 7407 divide
NMI 7411 normalize
SHL 7413 shift left
ASR 7415 arithmetic shift right
LSR 7417 logical shift right
MQL 7421 load AC into MQ, clear AC
MUY 7405 multiply
MQA 7501 inclusive OR, MQ with AC
CAM 7621 clear AC and MQ
SCA 7441 read SC into AC
CLA 7601 clear AC
SCL 7403 load the step counter

D-112 Instruction Set

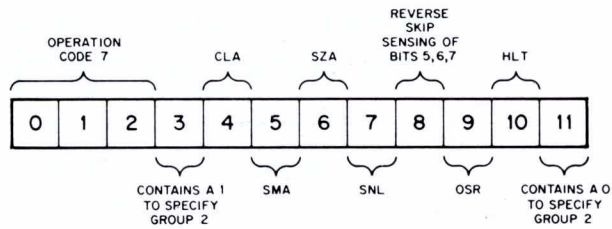


MEMORY REFERENCE INSTRUCTION BIT ASSIGNMENTS



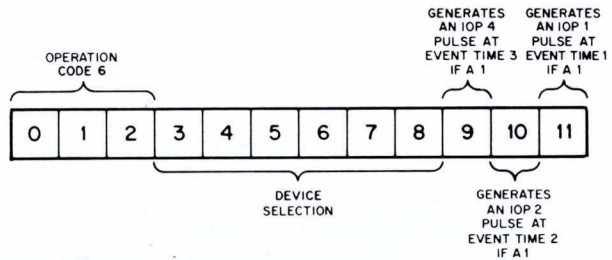
- Logical Sequences:
 1—CLA, CLL
 2—CMA, CML
 3—IAC
 4—RAR, RAL, RTR, RTL

GROUP 1 OPERATE INSTRUCTION BIT ASSIGNMENTS

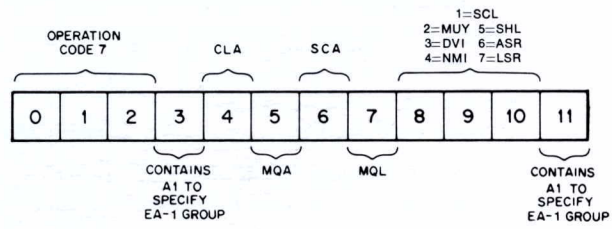


- Logical Sequences:
 1 (Bit 8 is Zero) — Either SMA or SZA or SNL
 1 (Bit 8 is One) — Both SPA and SNA and SZL
 2 — CLA
 3 — OSR, HLT

GROUP 2 OPERATE INSTRUCTION BIT ASSIGNMENTS



IOP INSTRUCTION BIT ASSIGNMENTS



- Logical Sequence:
 1 — CLA
 2 — MQA, MQL, SCA
 3 (Bits 8 thru 10 = 1) — SCL
 3 (Bits 8 thru 10 = 2) — MUY
 3 (Bits 8 thru 10 = 3) — DVI
 3 (Bits 8 thru 10 = 4) — NMI
 3 (Bits 8 thru 10 = 5) — SHL
 3 (Bits 8 thru 10 = 6) — ASR
 3 (Bits 8 thru 10 = 7) — LSR

EA-1 MICROINSTRUCTION BIT ASSIGNMENTS

D-112 Specifications

Electrical

Central Processor Unit —

Input: 115V \pm 10V, 47-63HZ @ 3 amperes for 4096 word memory

Power Dissipation: 300 Watts

Teletypewriter —

Input 115V AC \pm 10%, 60HZ \pm 0.45HZ, @ 2 amperes

Power Dissipation: 150 Watts

Functional

Memory Cycle Time: 1.2 Microseconds

Word Length: 12 Bits

Core Memory: 4096 Words expandable to 32,768 (also available with 256 word increments of ROM and/or Read/Write Memory)

Environmental

Operational: 0°C to +55°

Storage: -10°C to +60°C

Humidity: 10 to 95% (no condensation)

Physical

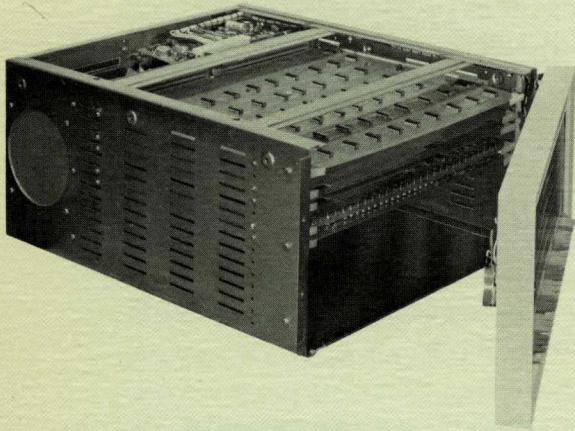
Table-Top Model — Dimensions: 9" high x 19" wide x 22" deep
(supplied with outside cover)

Rack Mount Version — Dimensions: 8.75" high x 19" wide x 22" deep
(supplied with slides)

Weight: 50 pounds

Teletypewriter ASR-33 — Dimensions: 33" high w/o copyholder x 23"
wide x 18" deep

Weight: 70 pounds (including stand)



Digital Computer Controls, Inc. offers a comprehensive line of options and peripherals for the D-112. Through the use of advanced Electronic Packaging such features as 32K of core memory, peripheral controllers, and special interface units can be incorporated into the basic console. The options & peripherals described below are available with compatible interface to perform as a completely flexible and integrated computing system.

Core Memory (4K) MM-1

A 4K Memory Module consists of a single 13" x 16" printed circuit board that plugs into the console panel. The MM-1 is available in 12-Bit, 4096 word increments (MC-1 Memory Extension Control included for core in excess of 4K).

Memory Parity Control PC-1

This option adds circuitry and a 13th parity bit required to generate and test parity for up to 32K of core memory words.

Power Failure Detect and Automatic Restart PF-1

The option protects an operating program in the event of a power failure by allowing continued operation for 1 millisecond, generating an interrupt and setting a flag that is used to identify the cause of the interrupt. Power restoration initiates a 200 millisecond delay to allow time for slow peripherals to complete operations, and a signal is generated simulating the start pulse. Subsequent action is the execution of the instruction in memory location zero.

The option permits the software to store in memory, the contents of active registers when a power failure is detected, and to restore them when power is again on the machine.

D-112 Options and Peripherals

Extended Arithmetic, EA-1

This hardware option implements parallel arithmetic operations with greater speed than by programmed subroutine. The option multiplies two 12-bit, unsigned numbers to obtain a 24-bit product in an average of 6.0 microseconds and divides a 24-bit unsigned number by a 12-bit number in an average of 6.5 microseconds. A plug-in printed circuit board (13" x 16") contains all the necessary hardware to implement the extended arithmetic option.

Real Time Clocks, RTC-1 thru -5

Utilizing crystal controlled oscillators, variable frequency timing sources, or power line frequency, the option offers accurate means of measuring time intervals. There are five configurations classified in two groups as programmable interval and fixed interval clocks. Programmable interval versions include RTC-1 (crystal control), RTC-2 (Power Line Frequency), and RTC-3 (variable frequency timing source). The fixed interval clocks include RTC-4 (Power Line Frequency) and RTC-5 (crystal Control).

High Speed Paper Tape Punch, PP-1

The PP-1 High Speed Paper Tape Punch generates perforated tape at a rate of 110 characters per second. It is capable of punching any code requiring eight channels or less, such as ASCII, EBCDIC, BCD and so on.

High Speed Paper Tape Reader, PR-1

The PR-1 High Speed Paper Tape Reader can read any eight bit code at a rate of 400 characters per second. The option utilizes a photo electric reader and includes hoppers for handling fanfold tape.

Data Break, DB-1

This option is utilized for Data Transfers for high speed peripherals which require rapid access to the computer in order to transfer large blocks of data at high speed.

Data break permits an external device to insert or remove data directly from memory, bypassing computer control and causing a temporary suspension of the in-progress program. Two types of data break exist: single-cycle and three-cycle. Single-cycle uses registers either in the I/O device or device interface to specify the core memory address for each transfer, and for counting data transferred to detect end of data block. During a three-cycle data break, two core memory locations are used to perform these functions thereby eliminating the need for two registers in the device interface.

Magnetic Tape Transport Storage

A comprehensive selection of magnetic tape transports are available as peripherals for the D-112 computer. Dual 5 track Linctape, 7 and 9 track IBM compatible tape transports and associated controllers comprise the specific types for expanded computing systems.

TC-1 is a solid-state TTL logic controller designed to handle 8 Linctape transports of the TU-5 series. Two Linctape transports are mounted on an 8.75" x 19" chassis in the TU-5 configuration. The Linctape is a dual 5 track magnetic tape system originally developed at Lincoln Laboratories of MIT.

TC-2 is a solid-state TTL logic controller capable of handling 8 IBM compatible tape transports of the TU-7 or TU-9 series. The TU-7 is a seven track transport while the TU-9 is a nine track version. Both versions are available in tape speeds of 25 ips up to 45 ips. Data densities of 200/556/800 BPI are available.

Incremental tape transports with associated controllers are included in the list of peripherals to meet the demands of greater flexibility in manipulating data.

Random Access Disk Files

The options for disk storage are available in three capacities — 32K, 262K and 831K 12-bit words. A controller has been designed (DC-1) utilizing solid-state TTL

logic, capable of handling as many as eight individual disk units. The DC-1 can control the 32K (DU-1) disk, and the 262K (DU-2) random access disk. In addition, a controller, the DC-2, operates with the DU-3 cartridge disk unit and DU-3C disk cartridge, having a capacity of 831K 12-bit words. The single DC-2 controller will handle up to four DU-3 disk cartridge units, providing a total storage of 3.3 million words. Double density units are also available at twice the memory capacity.

Data Communications Interfaces

A broad line of synchronous and asynchronous Modem Control Interfaces are available for systems utilizing Digital Data Communications techniques at remote terminals to communicate with a central computer.

ITTY-1 asynchronous interface, full-duplex, 0-10,000 Baud, 7.0, 7.5, or 11.0 unit code modem control and interface.

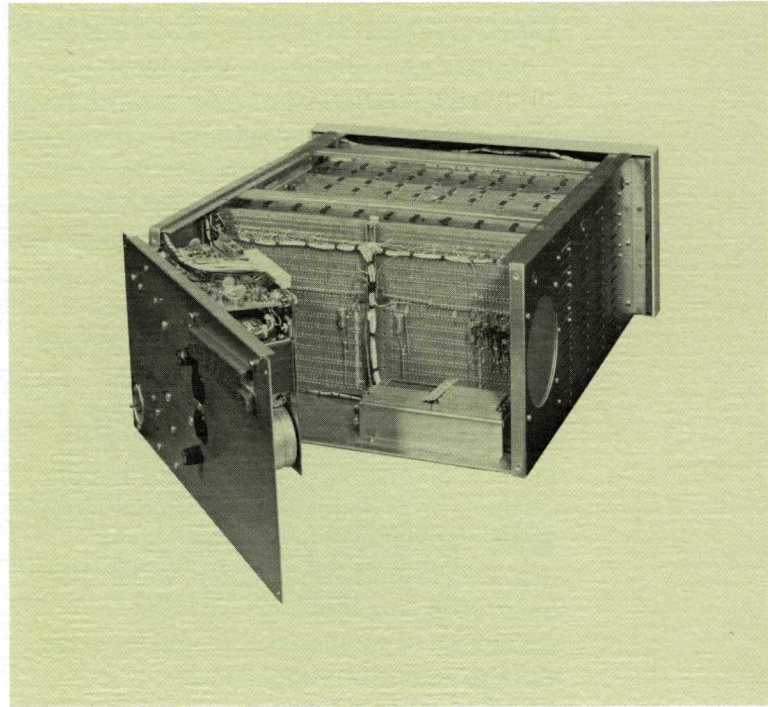
ITTY-4 asynchronous interface, 4 full-duplex channels, 0-10,000 Baud, 7.0, 7.5, or 11.0 unit code, modem controls and interface.

ITTY-8 asynchronous interface, 8 full-duplex channels, 0-10,000 Baud, 7.0, 7.5, or 11.0 unit code, modem controls and interface.

SLU-1 synchronous line unit and modem control (series 200 or 300).

SLU-2 synchronous line unit, modem control and parity control (series 200 or 300).

MUX-128 communications multiplexor for up to 128 full-duplex low speed asynchronous lines configured to the specific requirement.



Documentation/Software

Digital Computer Controls offers an extensive library of documentation for use on the D-112 computer. Basic data supplied with equipment includes User's Handbook, Installation and Maintenance Manual, diagnostic programs and loaders (in the form of documents and paper tape). System software in both forms can be provided to utilize and operate within the basic 4096 core memory — or take advantage of additional core and/or mass storage extension supplied via magnetic tape and disk.

System Programs

The programs available include Compilers (FORTRAN, ALGOL, BASIC®), and Interpreter (FOCAL®), Symbolic Assemblers (PAL III, MACRO-8, SABR, PAL-D), a Symbolic Editor, 8K Programming System (PS-8), Time Sharing System, Disk Monitor System, on-line Debugging Programs (DDT, ODT), Utility Programs, Loaders, a Floating Point Package and a business oriented software system (DIBOL®).

Symbolic Editor

Symbolic Editor reduces the effort of writing and editing symbolic programs. It effectively minimizes the number of assembly passes required to obtain binary coded tapes and permits a programmer to accomplish changes, corrections or updating directly from the keyboard of a teletype. Specific commands are available with which it is possible to accomplish any

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FOCAL & DIBOL are registered trademarks of Digital Equipment Corporation.

desired program change that could involve a deletion as well as an insertion or a transposition of a line or group of lines.

Symbolic Assemblers

Translation into machine code from symbolic source programs is accomplished using these programs. There are at the present time a minimum of four assemblers which can be utilized and are described in the following paragraphs.

Pal III Assembler (4K)

As a two-pass assembler, PAL-III translates symbolic programs into binary coded format tapes; an optional third pass can be utilized to obtain an octal and symbolic printout of the program.

Macro-8 Assembler (8K)

The Macro-8 symbolic assembler is capable of accepting programs written in Macro-8 language and perform translation to a binary coded program in two passes. An octal and symbolic program listing is attainable with an optional third pass. Macro-8 is compatible with Pal III and includes facilities for handling user defined Macros, Double-precision integers, arithmetic and boolean operators, Text facilities, Literals, Floating-point constants and automatic off-page link generation.

Pal-D Assembler (4K with Disk)

This assembler is for use with the Disk Monitor System as a symbolic assembly program for systems incorporating Disks, and offers virtually all the features of Macro-8 and Pal III.

8K Sabr Assembler

The symbolic assembler for binary relocatable programs (SABR) is a one pass assembler for 8K to 32K core configurations of the D-112. An optional second pass is available producing side-by-side octal/symbolic listing of the program. The programs are core page independent allowing programs to be written without regard for the specific page in which they will exist when executed.

Automatic generation of off-page/off-field references for direct and indirect statements are performed as well as automatic connection from one page to another for program overflow. Extensive pseudo-ops permit external subroutine calling, argument passing and conditional assembly.

Binary tapes produced by Sabr are loaded into any core field and executed with the 8K Linking Loader. This is also true for the library of subprograms, which can also be used with 8K Fortran. SABR also acts as the second pass of the 8K Fortran System.

Compilers

Compilers are programs that perform translation from a program written in a higher level language into machine code. At the present time 4 Compilers (appearing in the following paragraphs) are being offered.

4K Fortran

The 4K FORTRAN language contains four general types of statements: Arithmetic, Logic, Control, and I/O. Fortran functions include Addition, Subtraction, Multiplication, Division, Sine, Cosine, Arctangent, Square root, Log to the Base e and Exponentiation. The program operates in a 4K memory configuration.

8K Fortran

The system translates a source program into relocatable binary code on paper tape for program execution. 8K Fortran contains USA Standard Fortran Syntax; Subroutines; two levels of Subscripting; Function Sub-programs; I/O Supervisors; Relocatable Output loaded by the 8K Linking Loader; Common Statements; I, F, E, A, X and H Format Specifications; and Arithmetic and Trigonometric Library Subroutines. The system consists of a one pass compiler, Sabr Assembler, Linking Loader and a Library of Sub-programs. Equipment required to utilize the software includes a minimum of 8K of core up to 32K, a Teletypewriter, High Speed Paper Tape Punch and Reader. 8K Fortran is a revision of the USASI Basic Fortran.

Algol -8

The Algol Compiler conforms to the Subset Algol 60 approved by the International Federation of Information Processing Societies (IFIPS). Algol is the standard publication language of the Association for Computing Machinery (ACM) and is a procedure oriented language widely used internationally.

Basic[®] -8

With little experience this language can be utilized to prepare programs for solving numerical problems in the fields of Science, Business and Education. Inherent features make it possible to apply Basic -8 to the solution of complex problems.

OTHER PROGRAMS

Focal[®] -8

The system is an on-line conversational interpreter used for solving numerical problems. By means of short imperative statements and mathematical expressions in standard notation, the user, without knowledge of computers, can gain complete access to the machine capabilities. Programs can be executed directly from the teletypewriter keyboard with interpretive editing, compiling and execution of the program in core. Focal is available with additional segments in overlay tapes for greater accuracy, expanded programs with larger core or graphic display applications. A time sharing system segment gives each of seven Focal users the access to one computer as if the entire system were completely to himself.

Disk Keyboard Monitor

The Disk Keyboard Monitor System comprises a package of software programs and a keyboard oriented Monitor. The

package includes a Fortran Compiler, PAL-D, Editor, and Dynamic Debugging Technique (DDT-8). A system builder program is provided for generating a User's Monitor version based upon the quantity of core, number of Disks or other mass storage devices, etc.

The system has a modular, open-ended construction allowing the user to develop his software and to access the disk for storage or retrieval. With appropriate commands a program can be loaded, saved and later recalled for execution.

Dynamic Debugging Programs

DDT- and ODT are on-line Dynamic Debugging service programs that permit the programmer to run his binary program on the computer for debugging purposes. A programmer can control program execution, examine registers, change their contents, alter the program, and considerably more, directly from the teletype keyboard. DDT (Dynamic Debugging Technique) uses either the Mnemonic coding of the symbolic Program or the Octal coding of the Binary format program. ODT (Octal Debugging Technique) performs the previously noted actions using the octal representation of the binary program with less use of core than DDT, and can be loaded into upper or lower memory depending upon the location of the program to be debugged.

PS-8 Programming System

The system utilizes 8K of core plus a mass memory device (disk or tape) to allow independent access to 15 I/O devices including eight tapes, four disk units,, teletype, high-speed paper tape reader and punch, card reader, line printer, or other devices for which it is possible to write a handler in one or, under certain circumstances, two pages of core.

PS/8 provides the user with language processors, absolute and relocatable loaders, Symbolic Editor, a program that provides file compatibility with the Disk

Monitor System (CONVERT) and an invisible ODT allowing the debugging of programs without relinquishing core space.

TSE Time Sharing System

TSE is a general purpose time sharing system capable of responding to 13 users simultaneously. A minimum of 12K of core memory and a disk is necessary for an extensive library of system programs in order to perform functions such as compiling, assembling, editing, loading, saving, calling, debugging, and executing user programs on-line.

At the heart of TSE is a repertoire of programs called Monitor which coordinates the functions of several units, allocates time and services of the computer to the users and controls access to the system. Programs are interlaced in a way that prevents interference with one another without noticeable delays to the user.

Dibol®

Dibol* is a comprehensive business oriented software system allowing an inexperienced programmer to generate extensive business applications on a small computer. Designed for the small business capable of writing in-house accounting and management programs, Dibol can fulfill the needs for billing, accounts receivable, inventory control, payroll, general ledger and many other business requirements.

The language is a business-oriented selective combination of Cobol and Fortran that is simple to learn. The system provides automatic input, sorting and file maintenance, and a monitor that performs a cohesive function.

Dibol performs all required data and file manipulation commands, converts Alphanumeric elements to decimal and vice versa, and contains GO-TO statements and subroutine calls. The commands are in simple Algebraic expressions in a manner similar to Fortran. It is organized in two sections, file set-up and data manipulation.

*DIBOL is a registered Trademark of Digital Equipment Corporation.

**Digital Computer Controls, Inc. (Seller)
Equipment Warranty**

The Computer Systems are warranted against defects in workmanship and material under normal use and service for a period of one year from the date of shipment. Any such defect discovered by Buyer in any computer, or computer options, shall be remedied by Seller at the Seller's depot repair facility as specified in writing at the time of delivery of the D-112 Computer System. Defective equipment returned to the Seller's depot repair facility will be repaired without cost to buyer.

Transportation charges covering the return of the repaired equipment shall be paid for by Buyer. Buyer may select method of shipping for the return to the said Seller's depot repair facility of any equipment covered under the terms of this warranty. In giving shipping instructions, Buyer will also thereby assume all liability in connection with the shipment. The carrier will not be in any way construed to be the agent for the Seller.

In the event that Seller, upon request, makes a field service trip to the Buyer's equipment location to render warranty service hereunder, all costs for labor will be paid by Buyer at the then prevailing Seller's field service rates, however, Seller will supply all materials without cost to the Buyer.

Any defect referred to above, discovered after one year from the date of shipment, upon notice, shall be remedied either at the nearest depot repair facility or at Buyer's equipment location, all at Buyer's expense.

All parts are warranted against defects in workmanship and material under normal use and service for a period of one year from date of shipment. Replacement parts shall be provided at the specified depot repair facility. Defective parts returned to the Seller's repair depot will be replaced without charge. Transportation charges covering shipment of replacement parts shall be paid by the Buyer.

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