IMLAC PDS-1 OPTIONS' DESCRIPTIONS
March 8, 1971

TAB-1 MODULAR SUPPORT TABLE
(27"h x 24"w x 27"d)

This table covers the display and mini-computer housing assembly and is supported in the front by two legs. It is an attractive as well as functional support for the monitor and keyboard assembly.

TAB-2 EXTENDED MODULAR SUPPORT TABLE
(27" h x 48" w x 27" d)

This table is twice as long as TAB-1, providing the PDS-1 operator with additional work area and space for a console or other device.

HRC-1 HIGH CONTRAST, HIGH RESOLUTION CRT

This tube has a contrast ratio of 20:1 which is twice that of the standard tube. Spot diameter is nominally 12 mils rather than 20 mils as with the standard tube. Brightness is 50 foot lamberts.

HOZ-1 HORIZONTAL CRT

This option consists of a horizontally mounted 14" CRT, which allows the display of up to 128 characters per line. Character size and number of character/line are determined by both analog and software adjustments.

SLM-1 SLAVE DISPLAY MONITOR (14")

The standard slave is a 14" CRT monitor; other sizes are available on request. There is no practical hardware limit to the number of slaves one PDS-1 can drive.

DSK-1 ADDITIONAL DISPLAY MONITOR AND KEYBOARD

In situations where multiple keyboard-monitor terminals driven by one PDS-1 are justified economically, it is possible for an applications programmer to develop software that treats each display and keyboard independently so that each keyboard operator thinks he has his own display terminal.

This option provides the interface and switching logic to allow such programs to be written. The monitor and keyboard are included and are identical in construction and appearance to the basic display head.

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CAB-1 8' CABLE FOR MODEM OR ACOUSTIC COUPLER

This 8 foot cable is used to connect the PDS-1 serial interface to modems equipped with EIA (RS232 standards) connectors.

CAB-2 8 KEYBOARD PATCH CABLE

CAB-3 8' CRT PATCH CABLE

These cables increase the versatility of the basic PDS-1 by permitting the independent relocation of the monitor and keyboard remote from the mini-computer and display processor assembly.

ROM READ ONLY MEMORY BOOTSTRAP

When either a Programmer/Maintenance Control Panel (CON-1) or Reload Cassette (REL-1) is not ordered, a Read Only Memory Bootstrap must be used to get the PDS-1 "on the air". This short program (408 instructions) allows the user to read in the block loader program. The block loader generally precedes the main program on paper tape or other input medium and is read into a transient area of the operating program in order to conserve core.

Read Only Memories must be ordered for a specific input device (teletype, photoelectric tape reader, or on-line computer). Special ROM bootstraps for reading input from other devices are available on request providing they do not exceed 408 instructions.

CON-1 PROGRAMMER/MAINTENANCE CONTROL PANEL

The price for this option includes additional software consisting of an assembler, debugger, and various diagnostic tests and loaders.

The console comprises data and address switches, memory buffer, accumulator, program counter, and memory address register content lights. Additional function lights and switches allow the user to observe and control the state PDS-1. The user is able to step through a program cycle by cycle or instruction by instruction and manually read or write any location in memory.

LVH-1 LONG VECTOR HARDWARE

The LVH-1 allows the programmer to draw solid, dotted, or invisible lines from the present cursor position to any other location on the screen using only three instructions, resulting in a considerable savings in core memory. Each display accumulator (LSB & MSB) acts as a continuous binary accumulator rather than as a dual independent unit. Because vectors generated with LVH-1 are drawn at the same rate
as those generated in increment mode and core memory need be referenced only three times, the number of memory cycles stolen by the display processor is substantially reduced. This gives the mini-computer more time for data processing I/O transfers, etc.

SGR-1 SUPPRESSED GRID FEATURE

SGR-1 consists of hardware which, when coupled with appropriate subroutines, permits the rapid drawing of horizontal and vertical lines at reduced beam intensity. For example: a 20 line x 20 line reference grid, covering the entire screen can be drawn in under 2.5 ms, thus consuming less than 10% of available display time. The high contrast between the grid lines and displayed data and characters makes this feature very useful in data display and analysis applications.

MDS-1 8 LEVEL DISPLAY SUBROUTINE FEATURE

MDS-1 provides the Display Processor with an 8 level nested subroutine capability which may be utilized to conserve core in applications where one or more image subroutines are used extensively as the basic components of more complex pictures.

For example, a subroutine could be generated which would construct a benzene ring from six short vector subroutines stored in core. The benzene ring could in turn be called to construct a variety of more complex chemical molecules, etc. For each sub-picture so generated, an additional level of nested subrouting is required.

Thus, a wide variety of composite pictures may be constructed and each called for display with a single instruction.

ACI-1 ADDRESSABLE CLOCK WITH INTERRUPT

This real-time digital clock option is 16 bits long and may be preset to any desired value via an I/O instruction. The resolution of the clock is 1 millisecond, derived from counting PDS-1 memory cycles. Hence, the clock will not continue to count when the machine is stopped. When the 16 bit register overflows, an interrupt will occur if the interrupt function is enabled. An I/O instruction is also available to read the clock at any time. Other counting speeds are available.

ACI-2 ADDRESSABLE CLOCK WITH INTERRUPT

Same as ACI-1, except IEI-1 is not required.

HDC-1 HALF DUPLEX COMMUNICATIONS LOGIC

HDC-1 provides the logic necessary to take care of the
turn-around (sometimes referred to as "reverse channel")
condition required on Bell 202C or equivalent modems.
This option is not required for synchronous modems or for
those meeting the Bell 103 standards.

DFI-1 END OF DISPLAY FRAME INTERRUPT

When enabled, this option will generate an interrupt whenever
the display refresh sync flip-flop is set. This feature eliminates the need for the less efficient skip/wait routine usually employed by the mini-computer to determine when to restart the Display Processor.

SIT-1 ADDITIONAL ASYNCHRONOUS SERIAL INTERFACE
(CARD ONLY, NOT INSTALLED)

An additional serial card which is plug replaceable with either the standard serial interface card or TKA card. This allows the user to have additional rates for either the standard serial I/O or TKA interfaces.

DSA-1 DUAL SPEED ASYNCHRONOUS SERIAL INTERFACE
(WITH SELECTOR SWITCH) INCREMENTAL

The price for this option is the incremental cost for obtaining a second speed (manually selectable) with either the TKA or standard serial I/O interfaces. The switch is physically located on the rear connector panel.

TTS-1 SERIAL I/O SELECTOR SWITCH

This option provides the operator with manual switch control of any serial interface in order to eliminate problems caused by simultaneous transmission of data by two devices. For example, when two peripherals are interfaced with a PDS-1, and the switch option is employed, the operator can communicate with either device without manually changing the cables. This assumes, of course, that both devices communicate with the PDS-1 at the same speed. If these devices operate at different speeds through the same serial interface, the DSA-1 option must also be employed.

IEI-1 INTERFACE EXPANSION, AND EXTERNAL INTERRUPT

With this option a data or status word of 16 bits may be parallel transferred to or from an external device. All such transfers are under IOT program control via the PDS-1 accumulator. All input/output, interrupt, and I/O skip lines are presented at 2 connectors on the back panel of the PDS-1.
SEO-1 ADDITIONAL SERIAL OUTPUT (FORMERLY TTYR)

This output interface, which is under I/O program control and is completely independent of the standard serial communications interface, supplies output to asynchronous, EIA compatible peripherals, or asynchronous, current mode devices. Speeds up to 9600 baud and code levels are specifiable up to 30 days prior to delivery.

SEO-2 ADDITIONAL SERIAL OUTPUT

Same as SEO-1 except IEI-1 is not required.

TKA-1 ADDITIONAL KSR, ASR INTERFACE

This additional serial interface is independent of the standard serial interface and is under IOT program control via the IEI-1 option. This interface board is plug replaceable as is SIT-1, with speeds and codes to order.

TKA-2 ADDITIONAL KSR, ASR INTERFACE

Same as TKA-1, except IEI-1 is not required

SYN-1 SYNCHRONOUS INTERFACE

SYN-1 is provided to users who order a synchronous interface in lieu of the standard, asynchronous, I/O interface. The additional hardware includes input/output character buffers, and line sync control circuitry. It is capable of operating at any rate up to 50,000 bits per second.

SYN-2 ADDITIONAL SYNCHRONOUS INTERFACE

This interface is identical to SYN-1 except that it is provided in addition to either SYN-1 or the standard serial interface. It requires the IEI-1 option.

SYN-3 ADDITIONAL SYNCHRONOUS INTERFACE

SYN-3 is identical to SYN-2 except that the IEI-1 option is not required.

PTR-1 PHOTOELECTRIC TAPE READER INTERFACE

The 8 bit high speed Photoelectric Tape Reader interface is compatible with most tape readers of the 300 character per second category. IMLAC uses a Digitronics tape reader which provides a relatively high input speed (equivalent to 2400 baud) for programs stored on paper tape. The necessary documentation on pin connections and functions is furnished so that other makes of readers may be interfaced.
**PTP-1 PAPER PUNCH INTERFACE**

This interface may be used to drive a high-speed paper tape punch unit such as the Mohawk Data Sciences 2110S (TPH-1) and is under program control via the IEI-1 option.

**PTP-2 PAPER TAPE PUNCH INTERFACE**

Same as PTP-1 except IEI-1 is not required.

**PLO-1 PLOTTER INTERFACE**

This interface is designed for use with a digital incremental plotter. (Calcomp 565 or equivalent) An interpretive software routine is supplied by IMLAC to drive plotters of this design.

**PLO-2 PLOTTER INTERFACE**

Same as PLO-1 except IEI-1 is not required.

**STI-1 STORAGE TUBE INTERFACE**

STI-1 comprises the buffers and control logic necessary for screen erase, view, etc. which are necessary to drive a Tektronix 611 (or equivalent). The combination of storage tube and refreshed display is useful in certain CAD applications for volatile data plotting.

**GSI-1 GENERAL 16-BIT INTERFACE CARD**

A fully buffered, 16 bit, interface card complete with IOT decoding, skip, and interrupt logic. This card is intended for use by designers who are interfacing peripheral equipment to the PDS via the IEI-1 option.

**MENTAL COST FOR 8K PDS-1**

The price for MEM-1 is the incremental cost for each additional 4K of core memory, memory electronics, and software over the basic PDS-1 price.

**MEM-2 CHASSIS PREWIRED FOR ADDITIONAL 4K OF MEMORY**

MEM-2 includes the wiring only for an additional 4K of memory and provides the user with the option of building his machine up to 8K of memory in the future by simply adding the core stack and plugging in the additional cards.

**MEM-3 ADDITIONAL 4K MEMORY**

MEM-3 is the additional core stack and memory electronics boards to be used in conjunction with MEM-2.
LPA-1  LIGHT PEN

A light pen is available to PDS-1 users for specific graphics or text interactive modes of operation where it is desirable to augment the input capability of the machine.

The light pen option includes a light pen, a light pen register (LPR), and appropriate I/O commands. When a light pen "strike" occurs, the mini-computer is interrupted and jumps to an interrupt service routine which identifies it as a light pen interrupt. The hardware interface for the light pen stores the contents of the Display Program Counter (DPC) in the LPR, unless the display program is in the process of executing a display processor subroutine. In this case it waits until completion of the subroutine and returns to the main display list before storing the contents of DPC in the LPR and causing the interrupt.

Upon receiving the light pen interrupt, the user program can now identify where in the display list is was interrupted and functionally determine what to do next.

LPA-2  LIGHT PEN

Same as LPA-1 except IEI-1 is not required.

XYR-1  X, Y, BEAM POSITION REGISTERS

The hardware for XYR-1 comprises additional registers which are loaded with the X, Y, beam position (from the X and Y display AC's) coincidentally with a light pen "strike." Their contents may then be read into the accumulator (AC) under program control via an IOT command.

REL-1  RELOAD CASSETTE INCLUDING ROM

For PDS-1's utilized in environments without access to input peripherals or where on-line remote loading is inconvenient or too slow, the load feature is an economical method for loading programs. This package combines a special ROM card, a control card, and cassette player which allows the user to load programs at about 1,000 baud. REL-1 includes its own interface to the PDS-1.

CBS-1  CASSETTE BULK STORE

CBS-1 incorporates all features of REL-1 in addition to permitting the writing of information on the tape at about 1000 baud. This write function, under program control, allows cassette-tape storage of the screen display or specified core locations. It is also possible to start and stop the cassette recorder under program control.
LMD-1 ACOUSTIC COUPLER WITH TAPE CASSETTE  
(300 BAUD MAX.)

LMD-1 packages an acoustic coupler and tape cassette player/recorder, into a neat, off-line mass storage device for inputting and outputting programs, data files, etc. This option provides an economical method for loading the PDS-1 either locally or remotely via the acoustic coupler. LMD-1 is interfaced to the PDS-1 through the standard serial interface or the TKA option, and operates at 300 baud.

TRD-1 PAPER TAPE READER (300 CHAR/SEC.)

IMLAC presently supplies a Digitronics photoelectric tape reader, Model 2540 EP. This reader has proven to be a reliable, high speed (300 char/sec.) input device for the paper tape storage medium. The PTR-1 interface is a prerequisite for the TRD-1.

TPH-1 PAPER TAPE PUNCH  30 CHAR/SEC.)

The high speed punch, when interfaced to the PDS-1, allows the rapid rate reproduction of programs stored in core (using block punch program) or the outputting of display and data files, etc., on punched paper tape. The PTP-1, 2 interface is a prerequisite for this option.

STO-1 STORAGE TUBE

This storage tube monitor system with appropriate function controls is interfaced to the PDS-1 via the STI-1 option. The storage tube may be used to augment the standard, display, refresh tube in applications where the simple volatile plotting of large quantities of data, in addition to the selective editing of portions of that data, is required.

HCY-1 HARD COPY DEVICE

The hard copy option provides the user with a permanent and exact copy of the PDS-1's screen content. The copy itself will not deteriorate upon exposure to heat or light. The paper may be marked on with pen, pencil, or felt tip marker.