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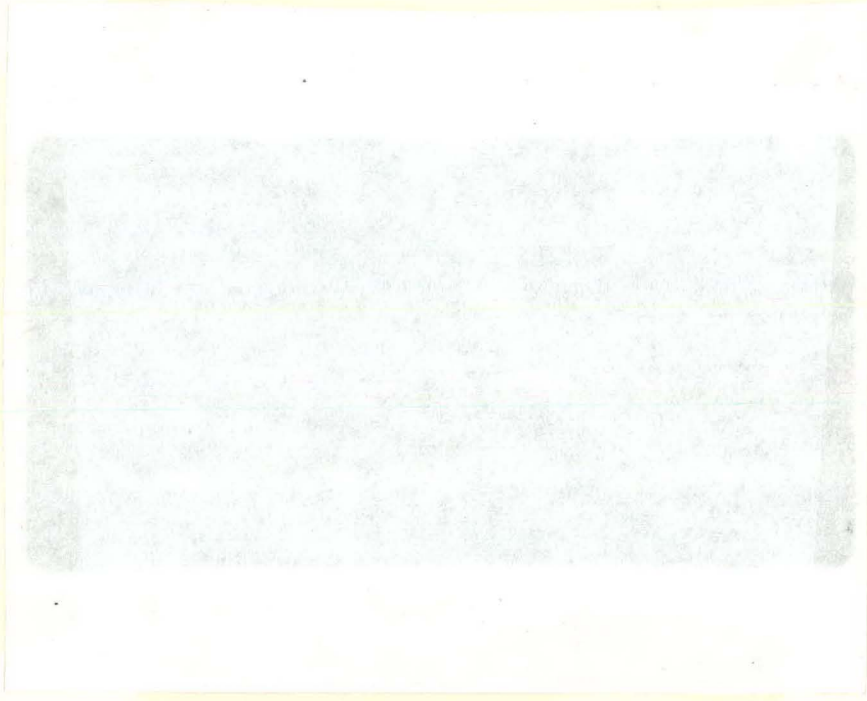

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STUDIES AND RESEARCH CONCERNING BNFP:

DESCRIPTIONS AND SPECIFICATIONS OF COMPONENTS FOR A COMPUTERIZED NUCLEAR MATERIALS CONTROL AND ACCOUNTING SYSTEM

George A. Huff
Gary D. Workman

April 1978

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PREPARED FOR THE
DEPARTMENT OF ENERGY
FUEL CYCLE PROGRAM OFFICE
UNDER CONTRACT ET-78-C-09-1040

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APPENDIX A: Descriptions and Specifications of Components for a Computerized Nuclear Materials Control and Accounting System

1.0 INTRODUCTION

Computerization of the Barnwell Nuclear Fuel Plant Nuclear Materials Control and Accounting System is planned. This system is referred to as the Computerized Nuclear Materials Control and Accounting System.

2.0 SUMMARY

The Computerized Nuclear Materials Control and Accounting System (CNMCAS) represents a modular network of computers, communications equipment, and data storage devices to demonstrate a sophisticated, automated nuclear materials management capability. The CNMCAS is comprised of the Laboratory Data System which is in place and functioning and the Special Nuclear Materials Control and Accounting System. The hardware for the latter has been installed and checked out. The two systems provide mutual redundancy which allow one system to perform all functions (at a slower pace) in the event of an outage of the other system.

3.0 RESULTS

The descriptions and specifications of the hardware are attached as Appendix A to this report. A schematic of the hardware is included in the Appendix as Drawing 82R-J-5007 (page A-72). The page numbers of the corresponding descriptions are indicated on each item on the schematic.

APPENDIX A

to

Report No. AGNS-1040-2.2-8

DESCRIPTIONS AND SPECIFICATIONS OF COMPONENTS FOR A COMPUTERIZED NUCLEAR MATERIALS CONTROL AND ACCOUNTING SYSTEM (CNMCAS)

April 1978

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PDP-11/35 CENTRAL PROCESSOR DESCRIPTION

PDP-11/35 and PDP-11/40

The PDP-11/35 and the PDP-11/40 central processors are functionally identical. The 11/40 is packaged in a 21-inch high front panel slide chassis, which in turn is mounted in a standard 72-inch cabinet, allowing convenient access and expansion. The 11/35 is mounted in a 10-1/2-inch or 21-inch high slide mounted chassis for compactness. The computers were designed to fit a broad range of applications, from simple situations where the computer consists of only 8K of memory and an I/O device, to large multi-user, multi-task environments requiring up to 124K of core memory. The machines provide a balance between high-speed processing and economy coupled with expandability. The processor assembly is pre-wired to accept a Floating Point option, and a Memory Management option for addressing over 28K of core memory. These options are included. Memory Management also provides relocation and protection, especially useful in a multi-user operation.

Included with the basic 11/35 and 11/40 are:

- 8K of core memory
- Programmer Console with LED display and removable key for Power/Panel Lock
- Power supply with excess capacity to drive internal optional equipment
- Prewired mounting space to accept Floating Point and Memory Management hardware options.

PDP-11/35 CENTRAL PROCESSOR SPECIFICATIONS

Computer	PDP-11/35	PDP-11/40 (when different)
Main Market	OEM	End User
Memory		
Min size:	8K words	16K
Max size:	124K	
Type:	core	
Parity:	optional	standard
Central Processor		
Instructions:	basic set + XOR, SOB, MARK, SXT, RTT	
Programming modes:	1 std, 2 opt	
No. of general registers:	8	
Auto hardware interrupts:	yes	
Auto software interrupts:	no	
Power fail/auto restart:	yes	
Mechanical & Environmental		
Front panel height:	10-1/2"	21" or 21"
Weight:	115 VAC ± 10%, 47-63 Hz, or 230 VAC ± 10%, 47-63 Hz	
Input power:	700 W	
Operating temperature	5°C to 50°C	
Relative humidity:	20% to 95% non-condensing	
Equipment		
I/O serial interface	optional	standard
Console terminal:	optional	standard
Line frequency clock:	optional	
Hardware bootstrap	optional	
Programmer's console:	standard	
Extended arithmetic:	optional	
Floating point:	optional	
Stack limit address:	400 or programmable (option)	
Memory management:	option MFPI, MTPI	
Cabinet:	optional	standard with 10-1/2" units

PDP-11/04 CENTRAL PROCESSOR DESCRIPTION

The PDP-11/04 computer uses MOS semiconductor memory, and is housed in a 5-1/4-inch high assembly. Between 4K and 28K words of memory can be implemented within the basic assembly unit, which includes expansion space and DC power for adding options.

The PDP-11/04 is a full-fledged computer that can execute all the basic PDP-11 instructions. It enjoys the advantage of being able to use all the extensive developed software and peripheral equipment. If there is ever a need to upgrade to a more powerful central processor, the PDP-11/04 can simply be replaced by a different PDP-11 CPU, and software and peripherals remain the same in the system.

The minimum PDP-11/04 includes:

- 4K words of MOS memory
  Increased processing speed at a lower cost per bit.

- Automatic bootstrap loader
  Automatic starts from a variety of peripheral devices.

- Self-test feature
  ROM hardware automatically performs diagnostics on the CPU and memory. Pinpoints failures to the circuit board level, thereby reducing maintenance costs.

- Operator's front panel
  Allows complete control of the computer via any ASCII terminal. All front panel functions are key entries on the terminal either local or remote, thereby eliminating the need and cost of a programmer's console.

The following optional equipment is included in the PDP-11/04 computer:

- Programmer's console
- Line frequency clock
- Serial communications line interface

PDP-11/04 CENTRAL PROCESSOR SPECIFICATIONS

Components Parts
A basic PDP-11/04 includes:

(a) central processor
(b) 4K words of MOS memory
(c) 5-1/4-inch CPU mounting box with slides
(d) power supply
(e) hardware bootstrap loader
(f) ROM hardware diagnostic
(g) operator's panel
(h) jacks for external battery backup
(i) expansion space for additional memory or peripheral controllers
(j) ASCII console program

Computer	PDP-11/04
Memory	
Min size:	4K words
Max size:	28K
Type:	MOS
Access time:	500 nsec, typ
Cycle time:	725 nsec, typ
Central Processor	
Instructions:	basic set
Programming modes:	1
No. of general registers:	8
Auto hardware interrupts:	yes
Auto software interrupts:	no
Power fail/auto restart:	yes
Mechanical and Environmental	
Size (HxWxD):	5-1/4" x 19" x 25"
Weight:	45 pounds
Input power:	115 VAC ± 10%, 47-63 Hz, or 230 VAC ± 10%, 47-63 Hz 350W
Operating temperature	10°C to 50°C
Relative humidity:	20% to 95% non-condensing

Optional Equipment
Real-time clock
Programmer's console
I/O serial interface
Battery backup

TM11 MAGNETIC TAPE SYSTEM DESCRIPTION

The TM11 is a high-performance, low-cost magnetic tape system ideally suited for writing, reading, and storing large volumes of data and programs in a serial manner. Because the system reads and writes in industry-compatible format, information can be transferred between a PDP-11 and other computers. For example, a PDP-11 might be used to collect data and record it for later processing on a large-scale computer. The 10-1/2-inch tape reels contain up to 2400 feet of tape upon which over 180 million bits of data can be stored on high density 9-track tape or over 140 million bits can be stored on high density 7-track tape.

The TM11 employs read after write error checking to verify that proper data are written on the tape. Should a tape dropout be detected, appropriate action can be taken to insure no loss of data.

Tape motion is controlled by vacuum columns and a servo-controlled single-capstan. Long tape life is possible because the only contact with the oxide surface is at the magnetic head and at a rolling contact on one low-friction, low-inertia bearing.

A Magtape System consists of up to 8 tape transports and a Control Unit. Transports are capable of operation with seven or nine-track tape and a system can contain any combination of 7- and 9-track units. A TM11 includes a control unit and the first Tape Transport.

TM11 MAGNETIC TAPE SYSTEM SPECIFICATIONS

Main Specifications

Storage medium:	1/2" wide magnetic tape (industry compatible)
Capacity/tape reel:	5 to 20 million characters
Data transfer speed:	36,000 char/sec
Drives/control, max:	8

Data Organization

Number of tracks:	7 or 9
Recording density, 7-track:	200, 556, or 800 bits/inch; program selectable
9-track:	800 bits/inch
Interrecord gap, 7-track:	0.75 inch, min.
9-track:	0.50 inch, min.
Recording method:	NRZI

Tape Motion

Read/write speed:	45 inches/sec
Rewind speed:	150 inches/sec
Rewind time:	3 minutes, typ

Tape Characteristics

Length:	2,400 feet
Type:	Mylar base, iron-oxide coated
Reel diameter:	10-1/2 inches
Handling:	direct-drive reel motors, servo-controlled single capstan, vacuum tape buffer changers with constant tape winding tension.

Register Addresses

Status	(MTS)	772 520
Command	(MTC)	772 522
Byte Record Counter	(MTBRC)	772 524
Current Mem Address	(MTCMA)	772 526
Data Buffer	(MTD)	772 530
TU10 Read Lines	(MTRD)	772 532

UNIBUS Interface

Interrupt vector address:	224
Priority level:	BR5
Data transfer:	NPR
Bus loading:	1 bus load

TM11 MAGNETIC TAPE SYSTEM SPECIFICATIONS (CONTINUED)

Mechanical

Mounting:	Mounts in a std PDP-11 cabinet (supplied)
Size:	26" panel height for tape drive + 10-1/2" for control unit
Weight (incl. cab):	500 pounds
Input current:	9 A at 115 VAC
Heat dissipation:	1000 W
Operating temperature:	15°C to 32°C
Relative humidity:	20% to 80%
BOT, EOT Detection:	Photoelectric sensing of reflective strip, industry compatible
Skew Control:	Deskewing electronics included in tape transport to eliminate static skew
Write Protection:	Write protect ring sensing on tape transport
Data Checking Features:	Read after write parity checking of characters; Longitudinal Redundacy Check (7- and 9-channel); Cyclic Redundacy Check (9-channel)
Extended Features:	Self-test of Control with tape transport offline; core dump for 7-channel units
Magnetic Head:	Duel gap, read after write.

Models

TM11-EA: Tape transport and control, 9-track, 115 VAC, 60 Hz
TM11-ED: Tape transport and control, 9-track, 230 VAC, 50 Hz
TM11-FA: Tape transport and control, 7-track, 115 VAC, 60 Hz
TM11-FD: Tape transport and control, 7-track, 230 VAC, 50 Hz

Specifications for TU10

Mechanical

Mounting:	mounts in a std PDP-11 cabinet (supplied)
Size:	26" front panel height
Weight (incl. cab):	450 pounds

TM11 MAGNETIC TAPE SYSTEM SPECIFICATIONS (CONTINUED)

Power

Input current:	9 A at 115 VAC
Heat dissipation:	1000 W

Prerequisite: TM11

Models

TU10-EE: Tape transport, 9-track, 115 VAC, 60 Hz
TU10-EJ: Tape transport, 9-track, 230 VAC, 50 Hz
TU10-FE: Tape transport, 7-track, 115 VAC, 60 Hz
TU10-FJ: Tape transport, 7-track, 230 VAC, 50 Hz

RJP04/RP04 DISK SYSTEM DESCRIPTION

The RJP04 is a mass storage system offering low cost per bit and high performance. Included are one disk drive and a buffered controller, expandable to 8 disk pack drives in a PDP-11 system. Each disk pack has a capacity of 44 million 16-bit words, or more than 350 million words total of on-line storage. The removable disk pack offers the flexibility of unlimited off-line storage capacity.

On multi-drive systems, positioning operations can be overlapped for efficiency. While one drive is reading or writing, one or more drives can be positioning to a new cylinder for the next transfer. All data transfers use the Non-Processor Request (NPR) facility of the UNIBUS for direct access to memory.

The RJP04 operates at a transfer rate of 403,000 words per second (2.5 microseconds per word). Data transfers can be made in block sizes of from 1 to 65,536 words. The system utilizes a first-in/first-out, 66-word data buffer to facilitate smooth UNIBUS data flow.

Parity checking is performed on both data and control information transfers for increased reliability. The controller also detects and flags memory parity errors. The disk system interrupts the processor on completion of a command and on error conditions. Extensive error indicators exist for easy on-line diagnosis. Numerous status indicators give complete program control.

The controller for the RJP04 requires two system unit mounting spaces in any PDP-11/35, 11/40, or 11/45 CPU or in an H960-D or -E expansion box.

The RP04 drive is a high-performance device, with a single head per surface. It enables the data processing system to store or retrieve information at any location on a rotating RP04-P (3336 type) disk pack.

Average access time is 36 milliseconds, which includes the time for head positioning and rotational latency.

The disk drive is designed to provide a high level of data reliability. A phase-lock-loop clock system and modified frequency modulation (MFM) recording offer a reliable reading and recording technique. Error detection and correction hardware within each disk drive provides adequate information for correcting any error burst up to 11 consecutive bits within the data field. Correction of data-field errors under software control is achieved without a re-reading of data from the disk.

Program controlled head offset positioning corrects for slight mechanical misalignment between the RP04 read/write heads and the disk pack by moving the positioner about the track centerline in incremental steps. A powerful feature that facilitates recovery of data previously recorded on another disk whose read/write heads may have been slightly misaligned provides for data recovery and enhances data reliability.

To further increase data reliability, the disk drive has a hardware write-check capability for data verification. Hardware verification of sector, track, and cylinder on read and write operations increases data integrity. Built-in registers allow for disk path checkout for ease of maintenance.

RJP04/RP04 DISK SPECIFICATIONS

Main Specifications

Storage medium:	Disk pack (3336 type)
Capacity/pack:	43,980,288 words
Data transfer speed:	2.5 μsec/word
Time for 1/2 revolution:	8.3 msec
Disk rotation speed:	3600 RPM
Drives/control, maximum:	8

Track Positioning Time

One cylinder seek:	7msec
Average seek:	28 msec
Maximum seek (typ):	50 msec

Data Organization

Surfaces/pack:	19
Tracks/surface:	411
Sectors/track:	22
Words/sector:	256
Bits/words:	16
Recording method:	Modified frequency modulation (MFM)
Recording density:	4040 bits/inch, max.
Access with single R/W:	1 to 65,536 words

UNIBUS Interface

Interrupt vector address:	254
Priority level:	BR5
Data transfer:	NPR
Bus loading:	1 bus load, each controller port

Mechanical	Disk	Control Unit
Mounting:	1 free-standing unit	2 systems units (mounts in a CPU or expander box)
Size:	40"H x 31"W or 32"D	
Weight:	600 pounds	
Cables:		
Control-to-drive	25 ft standard, 40 ft optional	
Drive-to-drive	2 ft standard, 10 ft optional	
All cables, total	60 ft max.	

RJP04/RP04 DISK SPECIFICATIONS (CONTINUED)

Power			
Frequency:	60 Hz ± 1%	50 Hz ± 1%	50 Hz ± 1%
Phasing:	3 phase delta	3 phase WYE	3 phase delta
Voltage:	208/230 ± 10%	380/400/415 ± 10%	220/230/240 ± 10%
Starting Current: (10 seconds max)	30 A/phase	16 A/phase	26 A/phase
Running Current:	6 A/phase @ 208 VAC	3.1 A/phase @ 400 VAC	5.2 A/phase @ 240 VAC
Current for control:	16 A at +5 V 0.6 A at -15 V		
Heat Dissipation:	2100 W (7000 Btu/hr)		

Environmental		
Operating Temperature:	15°C to 32°C	
Relative humidity:	20% to 80%, maximum wet bulb 25°C and minimum dew point 2°C	

Models	**60 Hz**	**50 Hz**
Disk drive	RP04-AA	RP04-AB
Duel-access disk drive	RP04-BA	RP04-BB
RP04-A & controller	RJP04-AA	RJP04-AB
RP04-B & 2 controllers	RJP04-BA	RJP04-BB

Spare data pack	RP04-P
10 ft cable	BC06S-10
40 ft cable	BC06S-40

RK11-D/RK05 DISK CONTROLLER AND DRIVE DESCRIPTION

The RK11-D DECpack cartridge disk drive and control is a complete mass storage system, offering an economical solution for large volume, random-access data storage. The system includes a modular mass storage device utilizing removable disk cartridges and a complete easy-to-program control.

A disk cartridge holds over 1.2 million words. The DECpack is ideal where a large volume of programs and data are developed and maintained for one or more users. The system is expandable up to 9.6 million words per Control (8 disks).

An RK11-D includes a Control Unit and the first Disk Drive.

RK11-D DISK CONTROLLER SPECIFICATIONS

Main Specifications

Storage medium:	disk cartridge
Capacity/cartridge:	1,228,800 words
Data transfer speed:	11.1 μsec/word
Time for 1/2 revolution:	20 msec
Disk rotation speed:	1500 RPM
Drives/control, max:	8

Track Positioning Time

One track move:	10 msec
Average:	50 msec
Maximum:	85 msec

Data Organization

Surfaces/drive:	2
Tracks/surface:	200 + 3 spare
Sectors/track:	12
Words/sector:	256
Recording method:	double frequency
Recording density:	2040 bits/inch, max
Access with single R/W:	1 to 65,536 words

Register Addresses

Drive Status	(RKDS)	777 400
Error	(RKER)	777 402
Control Status	(RKCS)	777 404
Word Count	(RKWC)	777 406
Current Bus Address	(RKBA)	777 410
Disk Address	(RKDA)	777 412
Data Buffer	(RKDB)	777 416

UNIBUS Interface

Interrupt vector address:	220
Priority level:	BR5
Data transfer:	NPR
Bus loading:	1 bus load

Mechanical

Mounting:	A standard cabinet is supplied for the drive
Disk drive:	Panel mounted, 10-1/2" high
Disk control:	1 System Unit (SU)

Power

Starting current:	10 A at 115 VAC for 2 seconds
Running current for drive:	2 A at 115 VAC
Current for control:	7.5 A at + 5 V
Heat dissipation:	160 W

RK11-D DISK CONTROLLER SPECIFICATIONS (CONTINUED)

Environmental

Operating temperature:	10°C to 40°C
Relative humidity:	10% to 90%

Models

RK11-DE:	Disk drive and control, 115 VAC, 60 Hz
RK11-DJ:	Disk drive and control, 230 VAC, 50 Hz

RK05 DISK DRIVE SPECIFICATIONS

Mechanical

Mounting:	mounts in a standard PDP-11 cabinet
Size:	10-1/2" front panel height
Weight:	110 pounds

Power

Starting current:	10 A at 115 VAC for 2 seconds
Running current:	2 A at 115 VAC
Heat dissipation:	160 W

Prerequisite: RK11-D

Models

RK05-AA:	Disk drive, 115 VAC, 60 Hz
RK05-BB:	Disk drive, 230 VAC, 50 Hz
RK05-KA:	Disk cartridge

DH11 MULTIPLEXER DESCRIPTION

The DH11 multiplexer connects the PDP-11 with 16 asynchronous serial communications lines operating with individually programmable parameters. These parameters are:

Character length:	5, 6, 7, or 8 bits
Number of stop bits:	1 or 2 for 6-, 7-, 8-bit characters 1 or 1.5 for 5-bit characters
Parity generation and detection:	Odd, Even, or None
Operating mode:	Half Duplex or Full Duplex
Transmitter speed (Baud):	0, 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, Ext A, Ext B
Receiver speed (Baud):	0, 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, Ext A, Ext B.

Breaks may be detected and generated on each line.

The DH11 Multiplexer uses 16 double-buffered MOS/LSI receivers to assemble the incoming characters. An automatic scanner takes each received character and the line number and deposits that information in a first-in, first-out buffer memory referred to as the "silo." The bottom of the silo is a register which is addressable from the UNIBUS.

The transmitter in the DH11 also uses double-buffered MOS/LSI units. They are loaded directly from message tables in the PDP-11 memory by means of single cycle direct memory transfers (NPR). The current addresses and data byte counts for each line's message table are stored in semi-conductor memories located in the DH11. This reduces the UNIBUS time required for NPR transfers to one NPR cycle per character transmitted.

As many as 16 DH11's may be placed on a single PDP-11 processor, creating a total capacity of 256 lines.

The DH11-AA consists of a double system unit, all modules necessary to implement a 16 line asynchronous multiplexer, an externally mounted 14 cm (5-1/4-inch) level conversion and distribution panel with its own power supply that can be mounted on the rear of the rack, and a data cable between the logic in the double system unit and the level conversion/distribution panel.

The modules for level conversion are not included, so that the type and quantity of lines may be customized to the customer's requirements.

DH11 MULTIPLEXER SPECIFICATIONS

Function:

The DH11 is a program-controlled interface between the PDP-11 UNIBUS and 16 asynchronous bit serial communications channels. The DH11 receiver section provides conversion of binary serial asynchronous (start-stop) signals to parallel binary data, and temporary buffering of that data. The DH11 transmitter section provides retrieval of parallel binary data from PDP-11 memory and conversion of that data to binary serial asynchronous (start-stop) signals for transmission over data communications channels.

Operating Modes:

Each individual channel may be set to operate in half- or full-duplex mode, under program control. In half-duplex, the receiver for a channel is disabled during transmission of a character on that channel.

Any individual channel may be set, under program control, to echo (retransmit) received characters automatically.

Individual receivers may be continuously disabled under program control.

Data Format:

Asynchronous, serial-by-bit to/from the communications channel. Parallel-by-character to/from the UNIBUS. The serial data format is one start bit; 5, 6, 7, or 8 data bits; none or 1 parity bit (odd or even): and 1, 1-1/2 (5 level codes only), or 2 stop bits per character. All data format parameters are individually program selectable for each channel. The data format for the receiver and transmitter on a given channel, however, is the same.

A one in any bit of a character presented by the program to the DH11 for transmission will cause a Marking (logical 1) condition to appear on the Transmitted Data lead during the corresponding bit interval. A zero presented by the program will cause a Spacing (logical 0) condition to appear. A Marking condition on the Received Data lead during any data bit sampling interval will be presented to the program as a one in the Next Received Character Register, and a Spacing condition will be presented as a zero.

DH11 MULTIPLEXER SPECIFICATIONS (CONTINUED)

Order of Bit Transmission and Reception:	Low order bit first.
Data Rates:	The operating data rate (Baud rate) of the receiver and transmitter on each channel is independently program selectable from among the following 14 rates: 0, 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, and 9600 Baud. In addition, any two other speeds between 40 and 110 Baud, and between 312.5 and 9600 Baud may be added as options, by ordering an M405 or M401 clock module at the proper frequency (desired bit rate x 16).
Distortion:	The DH11 receiver will operate properly in the presence of up to 43% distortion between any two code elements (intersymbol distortion). The long term (within any one character) speed variation of the received data may not exceed ± 4.3%, provided that the auto echo feature is not used. If auto echo is used, the long term (greater than one character time) speed variation of the received data may not exceed 0 to -4%. The DH11 receiver clock is accurate to within ±.05% of the nominal data rate. The DH11 transmitter will introduce less than 2% intersymbol distortion, with a long term stability of ±.05%.
Physical Arrangement:	The DH11-AA and DH11-AC are comprised of a pre-wired, double PDP-11 system unit suitable for mounting in a PDP-11/40 or PDP-11/45 or equivalent cabinet; and all logical cards necessary to implement a 16-line multiplexer. Also included is an externally mounted distribution panel, 14 cm by 48.3 cm (5-1/2 x 19 in.), with separate power supply for individual channel termination. The DH11-AA and -AC system unit and distribution panel are pre-wired for plug-in installation of the DM11-BB 16-line Data set Control Multiplexer. The DH11-AB is supplied without distribution panel, but with cables for connection to the DIGITAL DC08 Telegraph Line Subsystem Option.
Environmental Information:	The DH11 will operate at temperatures between +5° and +45°C, and at relative humidities between 0% and 95%, noncondensing.

DH11 MULTIPLEXER SPECIFICATIONS (CONTINUED)

Bus Loading:	Each DH11 presents 2 unit loads to the PDP-11 UNIBUS. The DM11-BB Data set Control Multiplexer, if present, represents one additional unit load. The DH11-AD is three loads and the DH11-AE is two loads.
Power Consumption:	The DH11 logic draws 8.4 A of +5 VDC, and 240 mA of -15 VDC. If the DM11-BB Data set Control Multiplexer is added, the total current drain is 11.2 A at +5 VDC. The DH11-AD and DH11-AE use 10.8 A at +5 V, 0.4 A at +15 V, and 0.65 A at -15 V.
Electrical Interface:	Connection between the DH11 logic and the distribution panel is via a cable containing 16 input and 16 output data lines at Transistor-Transistor Logic levels (0, +5 VDC). The logic levels are: Mark (logical 1) = 0V, Space (logical 0) = +3 V. Input leads from the distribution panel are equipped with pull up resistors which clamp open input lines in a logical 0 (space) condition. However, logic in the DH11 receiver section prevents this from assembling continuous all-zero characters. The electrical and physical interface to the external channels is provided by optional level conversion module sets (DM11-DA, -DB, -DC) that plug into the distribution panel. These options are described in the next section.

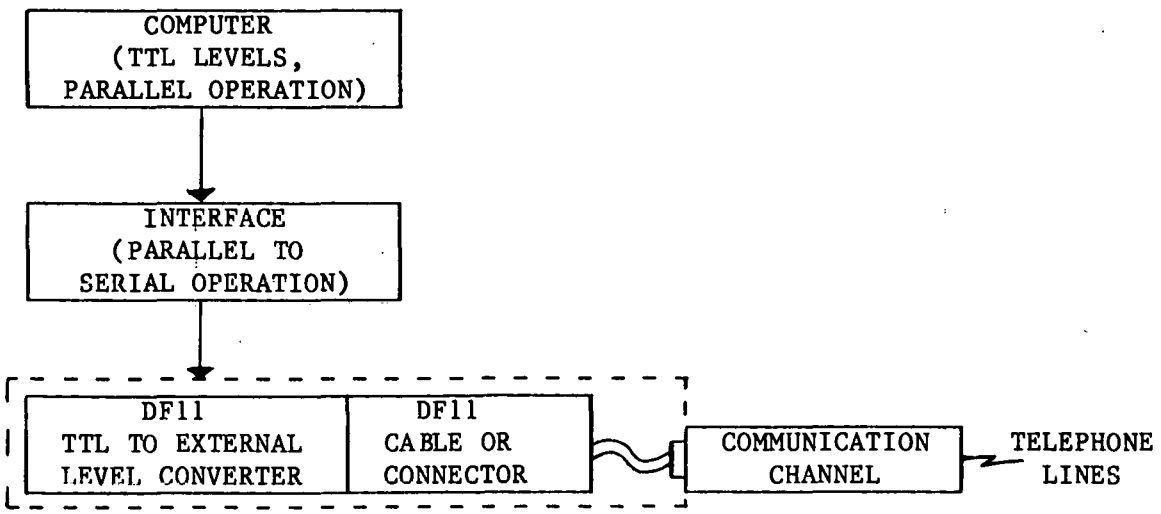
DF11 SERIAL LINE INTERFACE SIGNAL CONDITIONER DESCRIPTION AND SPECIFICATIONS

The DF11 furnishes flexible, low-cost electrical and physical signal conditioning between most Digital-supplied serial line interface equipment and terminals, and commonly used serial communications channels. DF11 units are used with the following Digital serial line interface equipment: DC11, DP11, DL11, DH11, and LA30.

Most modern digital computers handle data signals as Transistor-Transistor Logic (TTL) levels. These levels must then be converted to other voltage levels or current values to prepare them for application to communications media so that they may be transmitted to a distant processor or terminal. In addition to the need for level conversion, there is a requirement to have cables of various lengths equipped with a variety of specialized fittings for each communications medium serviced.

CONSTRUCTION

A DF11 unit will normally consist of two single-height modules. One module performs the electrical signal conditioning function of converting from the TTL signal levels internal to the computer logic to the external signal discipline required (e.g., EIA RS-232C, 20 mA Teletypes, Bell System CBS or CDT Data Access Arrangements, etc.). The second module performs the physical interface conditioning required; i.e., furnishes a cable to connect the level-converted signals produced by the first module to the desired device or channel (e.g., a dataset). In the case of the DF11-F 20 mA Teletype Interface, this second module provides a Mate-n-Lok connector for a customer-furnished cable. In the case of the DF11-A EIA Interface, the second module provides the 25-conductor cable and plug to connect the level-converted signals on the back panel wires to the dataset.



DF11 SIGNAL CONDITIONING OPTION

DF11 SERIAL LINE INTERFACE SIGNAL CONDITIONER
DESCRIPTION AND SPECIFICATIONS (CONTINUED)

MODELS

DF11-A--EIA ADAPTER
TTL to EIA/CCITT voltage levels. Connects to EIA circuits AA, AB, BA, BB, CA, CB, CE, CF, SBA, SBB, DA, CD, DB, DD, and C. Twenty-five foot cable with DB25P 25-pin male Dataset plug. Signaling rates up to 9600 Baud.

DF11-BA--INTEGRAL MODEM
Integral 103-type modem converts TTL to audio frequency shift keyed tone signals in the Originate-Only mode. Twenty-five foot cable and connector provided for connection with Bell System data access arrangement CDT or to private wireline channels. Signaling rate up to 300 Baud.

DF11-BB--INTERNAL MODEM
As above (DF11-BA) except unit operates in Answer-Only mode, and interfaces to Bell system data access arrangements CBS or CDT.

Note: The DF11-BA and BB may be used without data access arrangements on customer-owned lines, at distances up to 5000 ft.

DF11-F--TELETYPE ADAPTER
TTL to 20 mA active local Teletype loop. Connector is Amp Mate-n-Lok for connection with customer-supplied 22AWG, 2 twisted pair cable to local or remote (up to 1500 ft.) Model 33 or 35 Teletype. Signaling rates to 300 Baud.

DF11-G--303 DATASET ADAPTER
TTL to Bell System 301/303 Dataset Interface, Signal levels, cable connector, and signal pinning compatible with the Bell 301/303 Datasets. Supplied with 25-foot cable. Signaling rates to 250K Baud.

DF11-K--OPTICAL COUPLER

TTL to active or passive 4-wire current mode (20 mA) loop. Connector is Amp Mate-n-Lok for connection with customer-supplied cable. Signaling rates up to 2400 Baud, at distances up to 1500 ft.

Note: The data rates and distances cited above are recommended by DIGITAL. They are applicable in electrically quiet environments and do not necessarily represent limiting values.

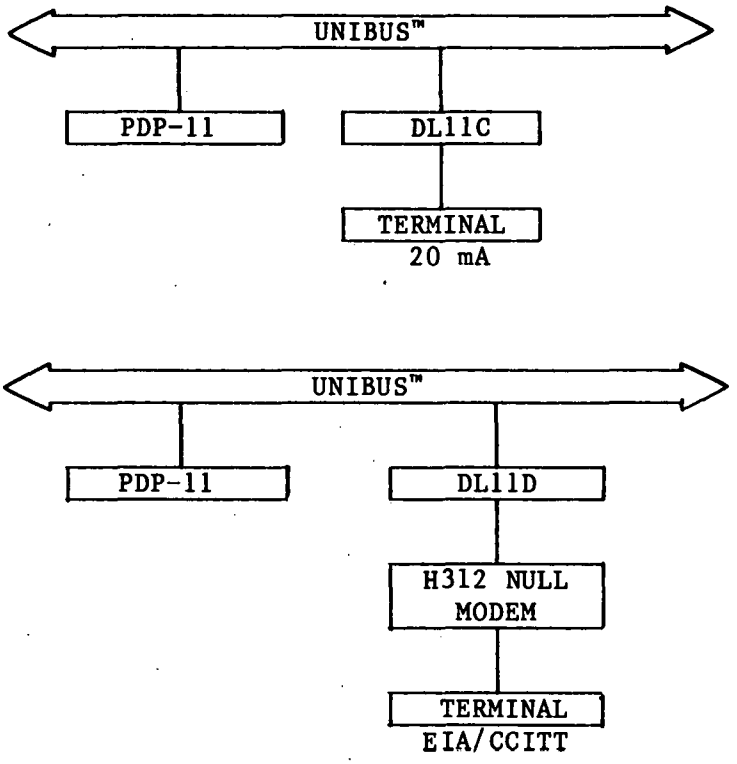
APPLICATION
The DF11 series is applicable in most DECcomm-11 communications line interface equipment. The following is a partial list of line interfaces and mating DF11 signal conditioning options:

DF11 SERIAL LINE INTERFACE SIGNAL CONDITIONER
DESCRIPTION AND SPECIFICATIONS (CONTINUED)

DL11*	DF11-BA, DF11-BB, DF11-K
DC11	DF11-A, DF11-F, DF11-K
DP11	DF11-A, DF11-G
DH11	DF11-A, DF11-BA, DF11-BB, DF11-F, DF11-K

*Available only when the DL11 is used in a DD11-B system unit, or in the top small peripheral controller slot of a PDP-11/10.

DL11 MODEM CONTROL DESCRIPTION AND SPECIFICATIONS



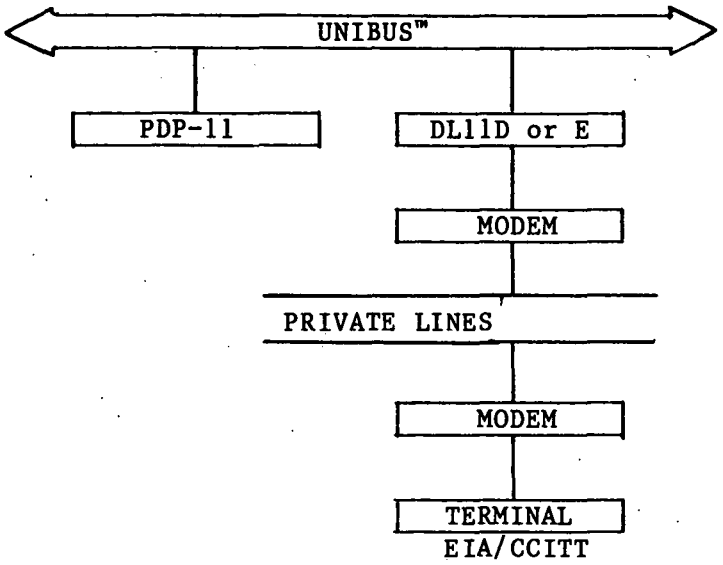
Interfacing A Local Terminal

The DL22 series of asynchronous single line interfaces handle full or half duplex communication between a wide variety of serial communication channels and a PDP-11 computer.

With a DL11 interface, a PDP-11 computer can communicate with a local terminal such as a console teleprinter, with a remote terminal via data sets and private line or public switched telephone facilities, or with another local or remote PDP-11 computer.

DL11 systems provide wide flexibility. The user can specify data rate from a selection of 13 standard rates between 40 and 9600 Baud, or he can order a non-standard rate device. With most of the standard rates, the interface can offer split-speed operation for faster, more efficient handling of computer output.

For additional flexibility, character size is strap selectable for 5, 6, 7, or 8-level codes. Also strap selectable are parity checking (even, odd, or none) and stop code length 1, 1.5, or 2 bits).



Remote Communication via Private Lines

There are five DL11 models.

Model DL11-A replaces and is compatible with DIGITAL's KL11 interface, handling 20 mA neutral current loop devices (such as console teleprinters) which use 8-level code and two stop bits.

The DL11-C handles the same current levels but provides the flexibility of a wide choice of speeds and stop bit configurations. This model is recommended for direct interfacing of DIGITAL-supplied teleprinters, the VT05 alphanumeric display, and the LA30-C DECwriter--a DIGITAL-designed electronic keyboard printer.

Model DL11-B meets the interface specifications of Electronic Industries Association Standard RS232C and CCITT Recommendation V.24 and handles either local or remote (data only) communication for 8-level code devices. With local devices, this model requires a null modem; in private line communication, modems are required.

Model DL11-D meets the specifications of and is applied in the same manner as Model DL11-B. However, like the C model, it gives the user a choice of operating speeds and stop bit configurations, so that it is easily adaptable to a wide range of terminals. With a null modem, this model may be used for local interfacing of a terminal or another PDP-11.

Model DL11-E meets the EIA and CCITT interface specifications cited for Models B and D. This interface provides the user with the full range of data rates as well as with complete dataset control for remote communication with either a terminal or another PDP-11 computer.

Using the PDP-11's versatile UNIBUS as a multiplexer, a PDP-11 can handle multiple DL11 interfaces. Assigned addressing space allows a single system to support up to 16 DL11-A and or B models and up to 31 DL11-C, D, or E models. Each DL11 module represents one unit load to the UNIBUS and plugs into a standard small peripheral controller slot in a PDP-11 system unit.

With its exceptional versatility, the DL11 is ideally suited for such applications as numerical control and data acquisition and reduction, especially in such fields as biomedicine and physics where input and processing often require multiple asynchronous lines.

OPERATION

General

The DL11 is an interface between a single Asynchronous Serial Communication Channel and the PDP-11. It performs serial-to-parallel and parallel-to-serial conversion of serial start-stop data with a double character buffered MOS/LSI circuit called a UART (for Universal Asynchronous Receiver-Transmitter). This 40-pin dual-in-line package includes all of the circuitry necessary to double buffer characters in and out, serialize-deserialize data, provide selection of character length and stop code configuration, and present status information about the unit and each character.

Receiver

The receiver section performs serial to parallel conversion of 5, 6, 7, or 8-level codes. The character length is selectable by split-lug jumpers on the circuit card, and is specified by the customer at the time of the order. Each character appears right justified in the Receiver Data Buffer Register (RBUF), stripped of start, stop, and parity bits.

The data rate may lie anywhere in the range between 40 Baud and 10,000 Baud, and in many cases need not necessarily be the same for the receiver as for the transmitter. (See section on DATA RATES.) The receiver samples the line at 16 times the data rate.

A complete character is formed in the UART and is transferred to the Receiver Data Buffer Register (RBUF) at the time the center of the first stop bit is sampled. At that time, the Receiver Done Bit (Bit 7) is set in the Receiver Status Register (RCSR). If the Receiver Interrupt Enable Bit (Bit 6) is also set in RCSR, an interrupt request is generated. The BR level is set by jumper plug. BR4 is standard.

The program then reads the RBUF. The character appears right justified in bits 7-0 of RBUF, stripped of start, stop, and parity (if odd or even is selected) bits. Unused high order bits (6 and 7 in the case of a 6-level code) are zero-filled. Bits 8-11 are always zero and bits of 12-15 contain status information about the character supplied by the UART* (See section on PROGRAMMING.)

Data Rate: The DL11 is supplied to customer order with 13 standard data rates in four groups.

Group 1. 110 Baud receive and transmit.

Group 2.** 134.5 Baud receive and transmit.

Group 3. Following 8 speeds, which may be different for receive and transmit: 50, 75, 150, 300, 600, 1200, 1800, 2400 Baud.

Group 4.** Following 8 speeds, which may be different for receive and transmit: 200, 300, 600, 1200, 2400, 4800, 7200, 9600 Baud.

Models

DL11-A: Single Asynchronous Serial Line Interface Unit. Full duplex operation, 20 milliampere neutral current loop electrical interface. Replaces and is program compatible with the DIGITAL KL11 for control of PDP-11 console teleprinters. Furnished with 2-1/4-foot cable terminated in female Mate-n-Loc connector, suitable for connection to DIGITAL terminals. Supplied only with code configuration of 8 data bits, 2 stop bits, no parity generation or checking. Customer must specify speed group 1 (110 Baud) or 3 (50, 75, 150, 300, 600, 1200, 1800, 2400 Baud) only. If not specified, unit will be supplied at 110 Baud.

DL11-B: As DL11-A above, except electrical interface conforms to EIA RS232C. Supports Transmitted and Received data leads. Request to Send and Data Terminal Ready leads are clamped always ON. Supplied with 25-foot cable terminated by Cinch DB25P plug for connection to modem (BC05C-25 cable).

*All references to the character status and error bits (12-15) apply to the DL11-C, D, and E models only. The DL11-A and B are KL11 compatible, and therefore have no such status bits.

**Not available on DL11-A and DL11-B.

DL11-C: Single Asynchronous Serial Line Interface Unit. Full duplex operation, 20 mA neutral current loop electrical interface. Code configuration (5, 6, 7, 8 data bits; 1, 1.5, 2 stop bits; odd, even, or no parity) and speed (Groups 1, 2, 3, or 4) customer specified. Furnished with 2-1/4-foot cable terminated in female Mate-n-Loc connector; suitable for connection to DIGITAL LA30-C DECwriter. DIGITAL VT05 Display Terminal, or DIGITAL-supplied Teletype. If speed and code configuration are not specified, unit will be supplied as 8 data bits, no parity, 2 stop bits, 110 Baud.

DL11-D: As DL11-C above, except EIA RS232C electrical interface. Supports Transmitted and Received Data leads, and clamps ON Request to Send and Data Terminal Ready leads. Furnished with 25 foot cable terminated in Cinch DB25P plug, for connection to modem (BC05C-25 cable).

DL11-E: As DL11-D above, except supports full dataset control interface, including Data Terminal Ready, Clear to Send, Request to Send, Carrier, Ring, Secondary Received and Secondary Transmitted leads.

DD11 PERIPHERAL MOUNTING PANEL DESCRIPTION AND SPECIFICATIONS

The DD11 Peripheral Mounting Panel is a pre-wired System Unit designed for mounting up to 4 Small Peripheral Controller (SPC) interfaces. It is pre-wired for logic and UNIBUS signals, and for power. The physical construction of the DD11 is similar to the BB11 Blank Mounting Panel.

Use of the DD11 requires specialized logic modules for the actual interface, since the pin assignments are fixed for the various control and data signals. Customers may design interfaces to go into a DD11 by using modules which have the same pin assignments for the signals.

There are two versions of the DD11, differing in only one functional aspect. The DD11-B is pre-wired for 2 DF11 interfaces, while the DD11-A is not. The DD11-B contains 4 SPC slots and 2 DF11 slots.

BA11-KE UNIBUS EXPANDER DESCRIPTION AND SPECIFICATIONS

The BA11-KE/KF is a general purpose PDP-11 expansion mounting chassis (10-1/2" x 17" x 25") and mounts in standard DIGITAL cabinets. It includes the H765 power system for either 115 V or 230 V operation and it supplies multiple voltages which deliver 660 W of DC power. The expansion mounting chassis also includes mounting hardware, UNIBUS cable, and a pop panel. The BA11-K has been approved by the Underwriter Laboratories (UL approved).

FEATURES

- Accommodates any mix DIGITAl modules, including both quad and hex modules
- Provides space for up to five system units or 22 module slots.

Physical Characteristics

Chassis Size: 10.5 x 17 x 26.5 inches

Weight (unloaded/loaded):
90/115 lbs

Rack Slides (3-position):
horizontal, 45° & 90°

Configuration Expansion:
5 SU or 22 module slots (2 double SU and 1 single SU)

Environmental Characteristics
Air Inlet Temp: 41°F-122°F
(5°C-50°C)

Cooling Efficiency: temperature rise no greater than 18°F (10°C) from inlet air to exhausted air

Operating Humidity: 10-95% (non-condensing)

Air Flow Direction: horizontally towards rear of box; air is drawn through filtered front pop panel and from within rack

Multiple Voltages:

(2)	H744 regulators	+ 5V @ 25 A (each)
(1)	H745 regulator	-15V @ 10 A
(1)	H754 regulator	+20V @ 8 A
		- 5V @ 1 1 A
(1)	54-11086 regulator	+15V @ 4 A

BA11-K Input Power Specifications

Voltage:	90-132 (180-264) Vac, 47-63 Hz, single phase 115 (230) Vac nominal sustained operation: 104-132 (208-264) Vac
Power:	1200 maximum at 115/230 Vac nominal line (1380 VA)
Current:	12/6 amp AC maximum at 115/230 Vac nominal line

DT03-F PROGRAMMABLE UNIBUS SWITCH DESCRIPTION

The DT03-F UNIBUS Switch is an electronic switch that allows a single peripheral or a group of peripherals to be switched from one processor to another. It provides on-line system back-up and dynamic reconfiguration for systems where very high reliability is required.

The UNIBUS Switch implements a switched or "common" bus that can be selectively connected to the UNIBUS of any processor in a multiprocessor system. Any device or devices except a processor may be connected to this common bus. When the switch is connected to a particular processor's UNIBUS, all peripherals and memory on the common bus operate just as though they were permanently connected to that bus. When the switch is disconnected, all peripherals on the common bus are removed from that UNIBUS and are available for connection to any other processor's UNIBUS. Once switched to a particular UNIBUS, the Bus Switch is transparent to the processor program. The switch is engineered to preserve the transmission properties of all busses attached to it regardless of the switch's position. Even during on-line switching all busses are synchronized to prevent interfering with individual programs. In order to guarantee bus operations, the switching elements are electronic circuits that receive and regenerate all bus signals passing through the switch. These electronic circuits not only eliminate impedance-mismatch and crosstalk problems, but also provide the long-term reliability inherent in solid-state circuits.

The bus switch is available in two versions:

- DT03-FP -- Both programmable and manual control
- DT03-FM -- Manual control only

Both models are constructed from modular sections, each of which is analogous to a multi-pole, single-throw switch that connects the shared bus to one processor bus at a time. The module consists of a UNIBUS isolation circuit, a bus repeater, bus-synchronization logic, and, in the case of the -FP version, a programmable controller.

Each DT03-F section (a DT03-F has one section for each processor that can attach to the common bus) has two switch positions: Connected and Neutral, defined as follows:

Connected: In this position the switched bus is connected directly to the processor associated with that section, and all of the devices on the switched bus are available to that processor. Only one section of a switch can be in the connected position at a time (i.e., the common bus can only be used by one processor at a time).

Neutral: In this position the switched bus is not connected to the processor. When the switches in all sections are in the neutral position, devices on the switched bus can then be serviced or repaired without disturbing operations on any processor busses.

In the manual-control mode, the operator can select either local- or remote-command inputs to the DT03-F. Local control is derived from a toggle switch that either enables or disables the bus signal-flow through the switch section. In the remote mode, the DT03-F position can be manually controlled via signal wires from a distant location.

The FP version includes a programmable control that allows switch operation under processor control.

In both manual and programmable modes, the bus synchronizer assures that the switch changes position without interfering with any operations on the processor bus, i.e., the switch can be thrown while a program is running. If two or more processors request use of the shared bus simultaneously, a priority-arbitration circuit within the switch specifies which processor will be serviced first. The priority-arbitration circuit assures that no more than one processor at a time is connected to the shared bus.

All DT03-F's include circuitry to isolate the switch itself from the processor buses in the event that either the switch power supply is de-energized or a peripheral-device power supply is de-energized on the shared bus. When the supply is off, a relay disconnects the + 5 V and ground lines between the supply and the logic modules. The UNIBUS interface circuits are held in a high-impedance state that will not load down the processor busses. At the same time, another set of relays close and provide an alternate path to preserve continuity of the bus grant signals on each processor bus. The DT03-F logic panel can then be serviced without interfering with program operation.

An important feature of the bus switch in high-reliability applications is the ability to disconnect itself from a processor that is no longer operational. The DT03-FP contains a "watch-dog" timer that monitors the processor currently using the switch. If that processor does not reset the timer within the allotted interval (thereby indicating that the processor has halted or is executing an invalid program), the switch automatically disconnects. Similarly, a power failure in the system to which the common bus is connected automatically disconnects the switch. A back-up processor can then assume control of the switch and proceed to operate the devices on the shared bus.

DT03-F PROGRAMMABLE UNIBUS SWITCH SPECIFICATIONS

Option Designations:	DT03-FP UNIBUS Switch (Programmable and Manual Control). DT03-FM UNIBUS Switch (Manual Control Only).
Interrupt Vector:	Requires one vector assigned from either the User Reserved Vectors (170, 174, 270, 274) or from the Floating Vector Field.
Priority Level:	BR7
Switching Time:	Less than one microsecond; busses automatically synchronized.
Watch-dog Timer:	Interval set to approximately 10 milliseconds.
Latency:	Bus cycles that go through the switch (i.e., between a switched and a non-switched peripheral) are extended 450 nanoseconds.
Bus Loading:	Each DT03-F module places a one-unit load on its processor UNIBUS and on the shared UNIBUS.
Power Supply:	Power supply is mounted on rear door of cabinet. Relay power isolation when de-energized.
AC Power:	115/230 V, 50/60 Hz, 2A.
Installation:	Each DT03-F section is constructed on a standard 5-1/4 x 19-inch rack-mountable logic panel.
UNIBUS Compatibility:	Can be used with any PDP-11 Family processor. (When used with the PDP-11/20, the KH11-A Large-System Capability Option must be installed in the processor).

LA36 DECWRITER DESCRIPTION

The LA36 DECwriter II is an advanced technology teleprinter designed to offer fast reliable operation with the best price/performance ratio of any 30 cps teleprinter in the industry. The DECwriter II is equally at home in communications applications or computer console applications.

The DECwriter II is loaded with many practical, functional, and operator features. Among these are the true 30 cps throughput accomplished by a 60 cps catchup mode which is activated any time more than one character is present in the 16 character buffer. Also featured are quiet 48 db operation, infinitely variable vertical forms adjustment vernlet, variable width and up to six-part forms handling and countless other features.

The integral stand design always provides correct height for easy operator use of the typewriter-style keyboard.

LA36 DECWRITER SPECIFICATIONS

Printing Speed:	10, 15 or 30 characters/second asynchronous
Number of Print Columns:	132
Printing Characters:	63/95 character ASCII set (Excludes space)
Keyboard Characters:	96 or 128 selectable by caps lock switch
Printing	
Type Font:	Impact 7 x 7 dot matrix technology
Vertical Spacing:	6 lines per inch
Horizontal Spacing:	10 characters per inch
Paper	
Type:	3"-14-7/8" wide continuous forms tractor driven. One to six parts (up to 20 mils maximum pack thickness).
Slew Speed:	30 lines per second
Mechanical	
Mounting:	Self-contained unit with integral stand
Size:	33.2 inches H x 27.5 inches W x 24 inches D
Weight:	102 pounds uncrated -- 140 pounds crated
Power	
Input Current:	Maximum no options -- 2A Maximum with options -- 5.5A
Heat Dissipation:	300 watts printing maximum (no options) 700 watts printing maximum (options) 160 watts non-printing (no options) 350 watts non-printing (options)
Operating Temperature:	10°C to 40°C
Relative Humidity:	10% to 90%
Altitude:	0 ft to + 8,000 ft mean sea level
Ribbon:	Digital-specified nylon fabric, spool assembly 0.5 inch wide x 40 yards. Supply item #36-10558.

VT50 VIDEO DISPLAY TERMINAL DESCRIPTION

The VT50 is a microprocessor driven alphanumeric display terminal priced to be competitive with standard 10 character per second mechanical teletypewriter devices. The VT50 (with system software) can be used to compose, edit, and forward messages to a host computer; retrieve and update alphanumeric data contained in computer files; receive data and instructions from the processor; and perform on-line debugging. The interface to the computer is logically the same as for a teletypewriter except the VT50 is (1) a soft copy device, (2) markedly faster, (3) quieter, (4) easier to use and maintain, and (5) considerably more reliable than an electromechanical device.

VT50 VIDEO DISPLAY TERMINAL SPECIFICATIONS

Transmission Speed:	Switch-selectable Full Duplex: 75, 110, 150, 300, 600, 1200, 2400, 4800, and 9600 baud Full Duplex with Local Copy: 110, 600, 1200, 2400, 4800, and 9600 baud
Keyboard:	Character set: 64 ASCII upper case, alpha, numeric, and punctuation characters Typewriter format keyboard Audio/tactile response mechanism for fast operator feedback 3-key rollover feature to minimize typing errors BREAK key included for half duplex software
Number of Columns:	80
Number of Lines:	12
Data Transmission:	20 mA current loop standard; EIA or CCITT interface optional
Interface to PDP-11:	DL11
Mechanical	
Mounting:	1 table-top unit
Size:	14" H x 21" W x 28" D
Weight:	45 pounds
Power	
Input Current:	1 A at 100 to 126 VAC, 60 ± 1 Hz
Heat Dissipation:	110 W
Environmental	
Operating Temperature:	10°C to 40°C
Relative Humidity:	10% to 90%
Miscellaneous	
Terminal Modes:	Off-line mode On-line mode: Full Duplex or Full Duplex with Local Copy
Operator Controls:	Power on/off, intensity control, Baud rate switches, Full Duplex or Full Duplex with Local Copy Switch

VT50 VIDEO DISPLAY TERMINAL SPECIFICATIONS (CONTINUED)

Cursor:	Control: up or down one line, right or left one position, home, erase from cursor to end of line, erase from cursor to end of screen Type: non-destructive, underscore
Page Overflow:	Upward Scroll
Character Matrix:	5 x 7
Sharacter Size:	0.11 inch x 0.20 inch
Screen Size:	8.7 inches x 4.3 inches
Display Capabilities:	Control data transmission at high Baud rates; will contain FORTRAN or COBOL full-card images, operator adjustable character intensity
Case Material:	Noryl SE-100 plastic (polythenylene oxide modified with polystyrene)
Overload Protection:	Thermal switch in line transformer
Transmission Code:	USASCII extended through Escape Sequence
Parity:	Even or mark (no parity) switch-selectable

104 CENTRONICS PRINTER DESCRIPTION

The Model 104 is a high speed impact printer which uses 9x7 or 5x7 dot matrix for character generation. The printer contains four print head assemblies which operate in unison and print in both the forward and reverse directions. The bi-directional printing of the unit eliminates the need for carriage returns. Print heads No. 1 and No. 3 print 32 characters each and print heads No. 2 and No. 4 print 34 characters each, resulting in 132 characters per line (maximum). The overall print speed is 200 lines per minute (nominal).

Print format is 10 characters to the inch horizontally and operator selectable 6 or 8 lines to the inch vertically. Paper is sprocket-fed with widths varying from 4 to 14-7/8 inches. One original plus four clean legible copies can be produced by the printer.

Special optional character sets of 64, 96, and 128 characters are available for both the 9x7 and 5x7 dot matrix. (Refer to Printer Character Set Brochure, C332-20).

104 CENTRONICS PRINTER SPECIFICATIONS

Printing Method:	Impact, one line at a time
Printing Rate:	200 lines per minute (+10%, -5%)
Paper Slew Rate:	8 inches per second
Character Density:	10 characters per inch
Line Density:	6 or 8 lines per inch (operator selectable).
Characters per Line:	132 (maximum)
Forms:	Up to five copies of fanfold, edge-perforated paper, widths from 4 to 14-7/8 inches (11-inch optimum fanfold)
Form Feed:	Sprocket tractor feed
Form Control:	Standard two channel Vertical Format Unit
Indicators:	ON/OFF, SELECT, ALERT, FAULT
Manual Controls:	ON/OFF, SELECT, TOP OF FORM, FORMS OVERRIDE, SINGLE/DOUBLE LINE FEED (optional)
Character Set:	64-character (9x7) ASCII is standard. Other optional sets up to 128 characters are also available. (Refer to Printer Character Set Brochure, C332-20.)
Temperature:	
Operating:	40 to 100 degrees Fahrenheit
Storage:	-40 to 160 degrees Fahrenheit
Humidity:	
Operating:	20% to 90% (Non-Condensing)
Storage:	5% to 95% (Non-Condensing)
Dimensions:	40 inches high, 22 inches deep, 31 inches wide
Weight:	277 pounds
Electrical Requirements:	Input Voltages of 100, 110, 115, 120, 200, 220, 230, or 240 VAC; 50 or 60 Hz

104 CENTRONICS PRINTER SPECIFICATIONS (CONTINUED)

Standard Features:	Self-contained Test Print Switch Automatic Motor Control Line Feed Switch Paper Runaway Protect
Optional Features:	Bottom of Form Elapsed Time Indicator Single/Double Line Feed Inhibit Delete Code

306C CENTRONICS PRINTER DESCRIPTION

The Model 306 printer is a medium-speed impact printer which uses a standard 5x7 or optional 9x7 dot matrix for character generation.

The unit prints at a rate of 100 characters per second, which is approximately one full 80-character line per second (including carriage return time). Paper is sprocket-fed, and paper widths from 4 inches to 9-1/2 inches can be accommodated. The printer can produce one original and four copies. Standard print format consists of 10 characters per inch horizontally and 6 lines per inch vertically.

The Model 306C printer contains most of the features of the Model 306, but with the additional capability of printing normal as well as condensed characters (i.e., 10, 12, 15, and 16.5 characters per inch). Any 306C printer is capable of printing any two of these four character densities. Selection between the two character densities is accomplished remotely via control code, and locally by a switch located on the operator's panel. Reception of a condensed character control, selects the alternate character density, i.e., the density not specified by the switch. After the line of characters is printed, the character density returns to that selected by the switch.

Other functional differences include the following:

(a) To accommodate condensed character printing, the forward speed of the print head in the 306C is 10 inches/second rather than 12 inches/second.

(b) The SINGLE/DOUBLE LINE FEED switch on the 306 control panel is not available on the 306C, but is replaced by a switch to select one of the two available character densities.

(c) The 306C logic card contains a 133-bit shift register to accommodate up to 132 characters per line.

306C CENTRONICS PRINTER SPECIFICATIONS

Printing Method:	Impact, character-by-character, one line at a time
Printing Rate:	
Characters:	100, 120, or 165 characters per second
Full Lines:	55 lines per minute (80, 96, 120, or 132 character line)
Transmission Rate:	
Serial:	100 to 9600 Baud (with Serial option)
Parallel:	Up to 75,000 characters per second
Data Input:	Parallel (Serial option available)
Character Structure:	5x7 dot matrix, 10-point type equivalent 9x7 dot matrix, 10-point type equivalent (option)
Code:	USASCII - 64 characters printed
Indicator-Switch Controls:	ON/OFF, SELECT, FORMS OVERRIDE, NORMAL/CONDENSED Option: LINE FEED, TOP OF FORM
Indicators:	PAPER OUT, SELECT
Manual Controls:	Form Thickness, Paper Advance Knob
Buffer:	One Line Character Buffer
Format:	80, 96, 120, or 132 characters maximum per line, 6 lines per inch
Paper Feed:	Sprocket fed, 4 I.P.S. slew, adjustable to 9-1/2 inches width
Paper:	Standard sprocketed paper
Number of Copies:	Original and up to four carbon copies
Dimensions:	12-3/4" high, 18-3/4" deep, 23-1/4" wide
Weight:	66 pounds
Electrical Requirements:	115 VAC ± 10%, 60 Hz 115/230 VAC ± 10%, 60 Hz (option)

306C CENTRONICS PRINTER SPECIFICATIONS (CONTINUED)

Temperature:	
Operating:	40° to 100° F
Storage	-40° to 160° F
Humidity:	
Operating:	5% to 90% (non-condensing)
Storage:	0% to 95% (non-condensing)

RTP 7480/32/34 - 7485/30/31 WIDE RANGE ANALOG INPUT SYSTEM DESCRIPTION

PHYSICAL DESCRIPTION

The complete RTP7480 System is composed of a basic 128-channel common equipment chassis, up to three optional 128-channel expansion chassis, plug-in channel cards, optional Gain Autorange and Open Transducer Detect circuits, and an optional display and control panel. In addition, an optional programmable voltage calibrator card is also available.

All analog and digital circuit elements are mounted on plug-in printed-circuit cards that mate with connectors mounted in the card files. The printed-circuit cards are constructed of laminated, copper-clad glass epoxy material with etched land patterns on one or both sides. Circuit components are mounted on only one side of the cards and wave solder techniques are employed to provide consistent and reliable connections.

Interconnection of the circuit card connectors mounted in the card files is accomplished using a two-sided printed circuit backplane that is placed over all connector pins and wave soldered into position. This interconnecting method eliminates wiring errors in assembly and greatly improves reliability.

All circuit cards and interconnecting RTP I/O cables are inserted from the front of the card files into mating connectors.

Common Equipment Unit (128-Channels)

The RTP7480 Series common equipment unit consists of a single two-row 19-inch wide card file requiring 14.0 inches of vertical rack space. The depth of the unit is 18.0 inches including self-contained power supplies. The power supplies are mounted on a hinged rear door that also provides access to the wiring side of the circuit card connectors for test and troubleshooting purposes. The common equipment unit also includes the standard RTP interface controller with I/O bus drivers and receivers, three control and timing cards, the dual-slope integrator with floating power supply, and the programmable gain amplifier. The analog input relay cards are not included with the common equipment unit; however, the unit is wired to accept up to sixteen of these 8-channel cards on a plug-in basis. The common equipment unit is also wired to accept the optional gain autorange and open transducer detection circuits and the optional control and display panel.

Expansion Chassis (128-Channels)

Each RTP7480 Series Expansion chassis consists of a single 19-inch wide card file requiring 7.0 inches of vertical rack space and 18.0 inches of depth. Also included is a P/N021-108 wide range expansion card.

The expansion chassis is wired to accept up to sixteen 8-channel analog input relay cards on a plug-in basis. The 8-channel relay cards are not included with the expansion chassis and are ordered separately. The sixteen connectors for the 8-channel relay cards are interconnected by a printed-circuit backplane. A cable that provides interconnection to the RTP7480 common equipment unit is connected to the backplane in the expansion chassis on one end and has a 28/56 pin connector on the other. This connector plugs into the front-edge connector of the 021-108 wide-range expansion card and the card then is plugged into one of the expansion card slots (11A, 12A, or 13A) in the common equipment card file.

The expansion chassis contains no power supplies since power is supplied from the common equipment unit. The expansion chassis is provided with a hinged rear door for access to the wiring side of the card connectors for test and troubleshooting purposes.

FUNCTIONAL DESCRIPTION

The RTP7480 Series Wide-Range Analog Input System is directly plug-in compatible with all Computer Products' RTP7410 Series I/O Expanders and all other RTP7400 Series Real-Time Peripheral Devices. The RTP7480 Systems contain all the necessary analog and digital circuitry to randomly sample a particular channel when commanded and digitize the resultant analog value into a two's complement binary digital word. The digital word is stored in a counter/register until transferred into the computer.

The following list describes the various models of common equipment units and optional devices available.

Model Number	Description
RTP7480/32*	Wide-Range AIS Common Equipment for up to 128 input channels, 15-bit binary A/D converter and sample rates up to 40 samples/second (use RTP7485/30 mercury-wetted or RTP7485/31 dry-reed analog input cards in any combination.)
RTP7480/34	128-channel expansion chassis for all RTP7480 Series Wide-Range Analog Input Systems (3 maximum/common equipment unit).

*12-bit binary A/D converter optionally available on special order basis.

Model Number	Description
RTP7485/30	Eight-channel analog input card for wide-range AIS or expansion chassis (3-pole mercury-wetted contacts). For use with 100, 40, or 33.33 sample/second units.
RTP7485/31	Eight-channel analog input card for wide-range AIS or expansion chassis (3-pole dry-reed contacts). For use with 200, 100, 40, or 33.33 sample/second units.

RTP 7480/32/34 WIDE RANGE ANALOG INPUT SYSTEM SPECIFICATIONS

The characteristics and specifications of particular interest related to the RTP7480 Series Wide-Range Analog Input System are listed below:

Functional Characteristics	
I/O Interface Compatibility:	The RTP7480 Series Wide-Range Analog Input System is compatible with all models in the RTP7410 Series of I/O Expanders and all other RTP7400 Series Real-Time Peripheral Devices.
RTP Instruction Set:	The RTP7480 Series Systems respond to the following RTP I/O instructions: DATA OUTPUT, COMMAND OUTPUT, DATA INPUT, TEST DEVICE, INTERRUPT QUERY
Device Number:	Any available device number (00 to 63) can be used for the RTP7480 System provided that no restrictions have been imposed by the computer. Device number is switch selectable on the standard RTP interface card in the system.
Number of Analog Input Channels:	From 8 to 128 in the basic RTP7480 common equipment unit. Each expansion chassis allows from 8 to 128 additional channels. Up to three expansion chassis can be used with each common equipment unit making the maximum number of input channels per system 512.
Digital Data Format:	Two's complement binary, sign extended (16 bits total).
Digital Data Resolution:	13 bits binary for 200 SPS model, 13 bits binary for 100 SPS model, 15 bits binary for 40 SPS model, and 15 bits binary for 33.33 SPS model.
Sample Rates:	RTP7480/30, up to 200 Samples/Second RTP7480/31, up to 100 Samples/Second RTP7480/32, up to 40 Samples/Second RTP7480/33, up to 33.33 Samples/Second

RTP 7480/32/34 WIDE RANGE ANALOG INPUT SYSTEM SPECIFICATIONS (Continued)

Functional Characteristics

Channel Selection:	Random Access under program control or from optional Control panel.
Integration Time:	1.0 millisecond for 100 and 200 samples/second models. 16.667 milliseconds for 40 samples/second model. 20.0 milliseconds for 33.33 samples/second model.
Operating Temperature Range:	+30° to +140°F (0° to 60°C)
Operating Relative Humidity:	80% Maximum.

Electrical Specifications

Full-scale Analog Input Voltage Ranges: (Programmable on a per channel basis):	±2.5 mV, ±5mV, ±10 mV, ±20 mV, ±40 mV, ±80 mV ±160 mV, ±320 mV, ±640 mV, ±1.28 V, ±2.56 V, ±5.12 V, and ±10.24 V.
Input Impedance:	50 megohoms
Source Impedance:	Up to 1K ohms to meet specified accuracies. Will operate with higher source impedance at reduced accuracy.
Feedback Current:	<20.0 nA, ±0.5 nA/°F
Common Mode Voltage:	200 V DC or peak AC.
Common Mode Rejection:	
33.33 SPS Rate. . .	130 db @ 50 Hz with 1K ohm source unbalance.
40 SPS Rate	130 db @ 60 Hz with 1K ohm source unbalance.
100 SPS Rate. . . .	100 db @ 0 to 60 Hz with 1K ohm source unbalance.
200 SPS Rate. . . .	100 db @ 0 to 60 Hz with 1K ohm source unbalance.

RTP 7480/32/34 WIDE RANGE ANALOG INPUT SYSTEM SPECIFICATIONS (Continued)

Electrical Specifications	
*Gain Accuracy:	±0.1%
Gain Stability:	
Random.	±0.02% for 6 months
Temperature Coefficient	±0.005%/°F
Zero Stability:	
*Random	±10.0 µV/day RTI
*Temperature Coefficient. . . .	±1.0 µV/°F RTI
Channel-to-Channel Offset:	±2.0 µV
Crosstalk:	120 db down from previous channel for on-scale signals, 100 db for overload condition, or 0.01% of full-scale, whichever is greater.
Common Mode Crosstalk:	120 db down from previous channel or physical adjacent channels to 0 to 60 Hz.
Noise:	5.0 µV peak or ±1 LSB, whichever is greater (at ±3 standard deviations).
Single-Pole Filter:	Cutoff frequency 2.5 Hz, down 28 db at 60 Hz.
Double-Pole Filter:	Cutoff frequency 1.9 Hz, down 40 db at 60 Hz.
Autorange Time:	600 µsec per gain change added to normal scan time.

*Error that can be removed by on line calibration to provide greater system accuracy.

RTP 7480/32/34 WIDE RANGE ANALOG INPUT SYSTEM SPECIFICATIONS (Continued)

Power Requirements

RTP7480 System:
- Voltage . . . . . 115±10 VAC (230±20 VAC available)
- Current . . . . . 0.9 A, maximum
- Frequency . . . . . 50 to 400 Hz
- Phase . . . . . Single

RTP7481/21 Optional Control Panel:
- Voltage . . . . . 115±10 VAC (230±20 VAC available)
- Current . . . . . 0.3 A, maximum
- Frequency . . . . . .50 to 400 Hz
- Phase . . . . . Single

Physical Specifications

Dimensions:	Width	Height	Depth
RTP7480/30, /31, /32 and /33	19"	14"	18"
RTP7480/34 (Expansion Chassis)	19"	7"	18"
RTP7481/21 (Optional Panel)	19"	7"	6"

Weight:
- RTP7480/30. . . . . 50 pounds, nominal
- RTP7480/31. . . . . 50 pounds, nominal
- RTP7480/32. . . . . 50 pounds, nominal
- RTP7480/33. . . . . 50 pounds, nominal
- RTP7480/34. . . . . 35 pounds, nominal
- RTP7481/21. . . . . 15 pounds, nominal

RTP 7410/23 I/O BUS EXPANDER DESCRIPTION

PURPOSE OF EQUIPMENT

The RTP7410 I/O Expander Unit, provides the necessary signal conversions to allow the PDP-11 computer to communicate with any of the Computer Products standard RTP7400 Series Real Time Peripheral Devices over the RTP I/O bus lines. The I/O Expander converts computer output signals to meaningful RTP I/O output signals and also converts RTP I/O input signals to computer input control signals.

PHYSICAL DESCRIPTION

The RTP7410/23 I/O Expander consists of a single PC board measuring 8.4 inches x 10.45 inches designed to plug directly into a small peripheral controller slot on the PDP-11 peripheral mounting panel. Interconnection between the I/O Expander and the first RTP7400 peripheral is accomplished using a RTP7417 I/O cable which contains two ribbon cable connectors on the I/O Expander and a standard RTP 56-pin paddleboard connector on the peripheral device end. Additional peripheral devices are daisy-chain connected from the first device using standard RTP7417 I/O cables. The RTP I/O bus is terminated at the last device in the chain by inserting the RTP7416 Resistor Termination Card into slot 2A of the last device chassis. The RTP7416 card is shipped as part of the I/O Expander.

RTP 7410/23 I/O BUS EXPANDER SPECIFICATIONS

Functional Characteristics

Computer Compatibility:

Computer Type	I/O Expander Model Number
Digital Equipment Corporation Model PDP-11	Computer Products, Inc. Model RTP7410/23

Computer Instructions used with the RTP7410/23 I/O Expander:

MOV/MOVB	ADD
COMP/COMPB	SUB
BIT/BITB	
BIC/BICB	
BIS/BISB	
CLR/CLRB	
TST/TSTB	

RTP Internal Control Set:

DATA INPUT, TEST INPUT:
Derived from the MOV(B), COMP(B), BIT(B), BIC(B), BIS(B), ADD and SUB Instructions.

DATA OUTPUT, COMMAND OUTPUT:
Derived from the MOV(B), COMP(B), BIT(B), CLR(B) and TST(B) instructions.

INTERRUPT QUERY:
Generated automatically during processing of interrupt request by the computer.

I/O Expander Base Address: (octal)

Jumper wired to address 764000 - may be wired within range of 760000 to 777400. (Expander Base Address forms prefix for all RTP devices attached to the Expander)

I/O Expander Device Address: (octal)

Jumper-wired to address 764000 - may be wired within range of 764000 to 777774 (assuming base address of 764000).

RTP Device Addresses:

Each RTP device has 6 switches allowing the selection of the same range as the I/O Expander device address.

RTP 7410/23 I/O BUS EXPANDER SPECIFICATIONS (CONTINUED)

Functional Characteristics

Interrupted Vector Address: (octal)	
Option 1:	Condensed (8-bit): Range of 000 to 374 (determined by position of the 6 address-select switches on the device.)
Option 2:	Extended (12-bit): Range of 00000-7774 (determined by position of the 6 address-selected switches on the device (6 MSB) and the card position (in Digital Input/Output Systems only; 4 LSB). *(System is shipped with Option 2 jumper-selected.) NOTE: Device addresses should be selected to maintain the vector address within the address range of 400-774 with either option.
Operating Capability:	Program-controlled or Interrupt driven *No DMA capability is provided.
Number of RTP Devices Connectable to One I/O Expander:	Eight RTP devices may be connected to one RTP7410/23 I/O Expander through daisy-chain connectors.
Maximum I/O Cable Length:	Total cumulative I/O cable length may not normally exceed 50 feet.
Operating Temperature Range:	+30° to +140°F (0° to +60°C)

Electrical Specifications

Power Requirements:	+5 V logic supply (derived from computer power bus)

RTP 7410/23 I/O BUS EXPANDER SPECIFICATIONS (CONTINUED)

Electrical Specifications

RTP I/O Bus Lines:	
High Logic Level	2.4 V
Low Logic Level	0.5 V
Computer I/O Bus Lines:	Compatible with the PDP-11 UNIBUS

Physical Specifications

Dimensions	8.4 inches x 10.45 inches (plug-in compatible with the PDP-11 computer card frame I/O slots).
Weight	Approximately 10 ounces

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) DESCRIPTION

PURPOSE OF THE EQUIPMENT

The RTP7420/30 Remote Serial Link provides serial communication between any standard computer serial communication module and up to four Computer Products RTP7400 devices. The link includes one RTP7420/32 Serial Formatter Module, two RTP7420/31 Optically-Isolated Line Driver/Receiver units, one RTP7416 Resistor Termination Card and an RTP7420/33 EIA RS232C Adapter Cable. This equipment allows serial communication between one to four RTP7400 Series analog and digital input and output devices located up to 15,000 feet from a computer over a dual twisted-pair cable. The serial Link may also be used at longer distances through the use of standard modems or locally with a direct TTL interface. The various configurations are described in detail in Section II of this manual.

PHYSICAL DESCRIPTION

The Serial Formatter module is a single PC board measuring 9.45 by 4.53 inches that is inserted in card slot 1A of the first RTP7400 Series Peripheral Device. Three additional RTP Peripheral Devices may be connected in a daisy-chain parallel bus fashion to the first device. A special cable with a Cannon 9-pin connector on the card end and a standard RS 232 Modem mating plug on the other end is used to connect the Serial Formatter card (and the RTP System) with either a modem or an RTP7420/31 Line Driver/Receiver unit. The Line Driver/Receiver units are completely self-contained and constructed for mounting in a standard 19-inch rack as are the RTP Peripheral Devices. Both the Line Driver/Receiver and the RTP Peripheral Devices contain all necessary power supplies and operate from 115 VAC (or 230 VAC) sources. The remote Line Driver/Receiver (or Modem) connects to the Line Driver/Receiver (or Modem) at the computer Serial interface through the computer-supplied Modem connector cable and plug.

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) SPECIFICATIONS

RTP7420/31 Line Driver/Receiver

Performance Specifications

1. Driver Section

A.	Inputs		3 types
	1.	EIA	RS-232C Compatible
		Voltage	±3 to ±25 V bipolar (-V = data 1)
		Impedance	3K - 7K ohms
		Frequency	DC-20000 Baud
	2.	Current Loop	Active or Passive
		Current	20-60 mA (Active) or can be supplied by internal 20 mA ±10% source for passive systems (0 current = data 1.)
		Frequency	DC-600 Baud
	3.	Logic Level	TTL-1 load with 2.2K pullup
		Voltage	(2.4 V min. for data 0) (0.8 V max. for data 1)
		Current	(Data 0 = -1.6 mA) (Data 1 = 40 uA)
		Frequency	DC-20000 Baud
B.	Output		Bipolar Current
	1.	Current	±30 mA nominal ±10%
	2.	Frequency	DC-20000 Baud

NOTE: Output is fused with 1/8 A fuses and clamps to protect against overvoltage fault conditions.

RTP 7420/30 I/O REMOTE SERIAL LINK
(20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

2. Receiver Section

A. Outputs		3 types
1. EIA		RS-232C compatible
	Voltage	5 to 14 V bipolar (-V = data 1)
	Current	4.0 mA max.
	Frequency	DC-20000 Baud
2. Current Loop		Active or Passive
	Current	20 mA - 60 mA (Active) or can be supplied from internal 20 mA 10% source for passive circuits, 0 current = data 1
	Frequency	DC-600 Baud
3. Logic Level		TTL - will drive 4 loads
	Voltage	(2.5 V min. for data 0) (0.5 V max. for data 1)
	Current	Will drive up to 4 standard TTL loads
	Frequency	DC-20000 Baud
B. Input		Bipolar current
1. Current		30 mA nominal 10%
2. Frequency		DC-20000 Baud

NOTE: Input is fused with 1/8 A fuses, current limiting and spark gap to protect against overvoltage fault conditions.

3. Common Sections

a. Line Voltage . .	105-125 V AC (230 V optional)
b. Line Frequency .	50 - 400 Hz

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

c. Power . . . . . 12 W

d. Operating Temperature . . 0° to 60°C

e. Logic Supply . . 5 V ±5%

f. Common Mode Voltage . . . . (applied to transmission line receiver) Up to 400 V P. P. without errors (60 Hz) at 19200 Baud

g. Normal Mode Voltage . . . . (applied to transmission line) Protected up to 300 V DC or peak AC (will blow fuse)

h. Maximum Input to Output Delay . . . . . 10 sec

i. Maximum Throughput Distortion . . 5%

j. Transmission Cable Requirements (customer)

1. Resistance . Total loop resistance must not exceed 250 ohms

2. Capacitance (Conductor to conductor plus conductor to shield) . . Total cable capacitance determines speed

19200 Baud	0.2 µf max.
9600 Baud	0.5 µf max.
4800 Baud	1.0 µf max.
2400 Baud	2.0 µf max.
1800 Baud	3.0 µf max.
1200 Baud	3.5 µf max.
600 Baud	6.0 µf max.

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

300 Baud	6.0 µf max.
150 Baud	6.0 µf max.
110 Baud	6.0 µf max.
75 Baud	6.0 µf max.

NOTE: If unshielded, capacitance is 1.7 times conductor to conductor capacitance.

Physical Specifications

Rack Mountable	Standard 19-inch Equipment Racks
Width	19 inches
Height	1-3/4 inches
Depth	3-3/4 inches from rail 4-1/2 inches including connector assembly
Weight	Approximately 5 pounds
Connection Types	2
A. EIA	Per RS-232C 25 pin, Rectangular Type DB25
B. I/O Terminal Strip	16-position Cinch #353-18-16-001

Electrical Specifications

Voltage	105-125 V (230 V optional)
Frequency	50-400 Hz
Dissipation	12 W
Operating Temperature	0° - 60°C

RTP7420/32 Serial Formatter

Performance Specifications

A. Receiver

1. Inputs	EIA-RS-232C or Logic Level

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

a. Received Data. . EIA - Signal BB - Pin #7

Voltage. . . . . ±3 to ±25 V bipolar OR 0-5 V Logic Level (0 or -V = data 1)

Impedance. . . . 3K - 7K ohms

b. Data Set Ready . . . . . EIA - Signal CC - Pin #3

Voltage . . . . ± 3 to ±25 volts (+V signifies Ready)

Impedance . . . 3K - 7K ohms

2. Outputs . . . . . Data and Control to RTP Bus

NOTE: For output specifications see standard RTP I/O Bus Interface information.

3. Baud Rate (specified at time of order)

19,200
9,600
4,800
2,400
1,800
1,200
600
300
150
110
75

4. Distortion . . . . . ±40% maximum

B. Transmitter

1. Outputs . . . . . EIA-RS-232C and Logic Level

a. Transmitted Data . . . . . EIA - Signal BA - Pin #1

(EIA)

Voltage . . . . ±3 - 5 V bipolar (-V = data 1)

RTP 7420/30 I/O REMOTE SERIAL LINK
(20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

	Current	5.0 mA maximum
b.	Transmitted Data	Serial output (will drive 4 loads)
	(TTL)	Pin #5
	Voltage	2.5 V minimum for data 0
	Current	Will sink up to 6.4 mA for data 1; will source 0.16 mA for data 0
c.	Request to send	EIA signal CA - Pin #4
	Voltage	+5 V through 330 ohms
d.	Data Terminal Ready	EIA signal CD - Pin #9
	Voltage	+5 V through 330 ohms
2.	Inputs	Data and control from RTP Bus
3.	Frequency	Same as Receive Section
4.	Distortion	±1.0% maximum
5.	Code Formats	(Selected at time of order)
a.	(1) one-stop bit	
b.	(2) two-stop bits	

C. Common Sections

1. Signal Lines

a.	Signal Ground	EIA - Signal AB - Pins #2, #6, #8

Physical Specifications

Length	9.45 inches

RTP 7420/30 I/O REMOTE SERIAL LINK (20 mA CURRENT LOOP) SPECIFICATIONS (CONTINUED)

Width	4.53 inches
Weight	Less than 9 ounces
Connector types	
To RTP Bus	56-pin Edge Connector
To External Cable	9-pin Type DE9, Rectangular (mates with RTP7420/33 Cable Assembly)
Operating Temperature	0° - 60°C

Electrical Specifications

Voltage	
+5 V	From RTP Bus
-12 V	From Integral Power Supply
Current	Approximately 900 mA from +5 V Source

PSH 96A MODEM DESCRIPTION

The PSH 96A is an asynchronous data modem designed for transmitting digital data economically for short distances over non-loaded cable pairs with DC continuity at data rates from 0 to 9600 bps.

The PSH 96A is intended for half or full duplex operation, and will operate in either a point-to-point or multipoint network over 2 or 4 wire dedicated lines.

The PSH 96A modems are equipped with line equalizers which permit operation up to 35 miles at 1200 bps. The maximum data rate depends on line length and wire gauge used in the network. (Refer to Specifications for maximum operating distances.) Exceeding recommended distances will cause excessive data jitter and bias distortion.

The PSH 96A is a stand-alone unit consisting of a single card, front and rear panels, built-in power supply chassis, and metal enclosure. A line connector cable is supplied with the unit.

Dimensions of the enclosure are 3 inches high by 8 inches long by 6 inches wide (76.2 mm x 203.2 mm x 147 mm). Total weight is 2-1/2 pounds (1.125 Kg).

PSH 96A MODEM SPECIFICATIONS

Bit Rate:	0 to 9600 bps Asynchronous
Data Format:	Serial, Binary, Non-Restricted Format
Line Requirements:	Non-Loaded Wire with DC Continuity
Operation:	Full or Half Duplex
Carrier Mode:	Continuous or Controlled (Strap Option)
Interface:	EIA-RS-232C, CCITT; and 20 ma Teletype
Output Impedance:	150 ohms Balanced
Input Impedance:	150 ohms or Hi Impedance
RTS to CTS Delay:	8.5 msec ± 1 msec
CD Response:	6 ms (Max.), 4 msec (Min)
Indicators:	Power, Carrier Detector, Rx Data (Space)
Power Requirements:	110 Vac 60 Hz, 2 W
Dimensions:	3"H x 8"L x 6"W (76.2 mm x 203.2 mm x 147.0 mm)
Weight:	2.5 pounds
Signals:	Via 25-pin connector

Pin	Signal	Data Path
1	Frame Ground	Common
2	Transmit Data	Input
3	Receive Data	Output
4	Request To Send	Input
5	Clear To Send	Output
6	Data Set Ready	Output
7	Signal Ground	Common
8	Carrier Detector	Output
9	+ 15 Volts	Testing Only
10	- 15 Volts	TTY Magnet Sink
20	Data Terminal Ready	Optional Connector to Pin 14
22	Ring Indicator (Off)	Output
25	TTY Magnet Source	Output

PSH 96A MODEM SPECIFICATIONS (CONTINUED)

Operating Distances: Max. Distance (miles) versus Wire Gauge

Bit Rate	19GA	22GA	24GA	26GA
0-600	35	17	11	7
1200	35	16	11	7
2400	30	15	8	6
4800	25	14	9	6
9600	17	10	8	5

KSR AND ASR 33 TELETYPEWRITER DESCRIPTION

The 33 Teletypewriter Sets are electromechanical apparatus that provide terminal facilities for exchanging recorded communication via appropriate transmission facilities.

Terminals in the 33 line operate at 10 characters per second (110 Baud), feature four-row keyboards, and utilize ASCII (American National Standard Code for Information Interchange). The sets offer a choice of type wheel/keytop combinations and generate alphas, numerics, and many special control codes in even parity. They also provide answer-back on most configurations. Transmission mode may be half or full duplex. Current interface is standard with Electronic Industries Association (EIA) RS-232-C available as a modification kit.

A. KEYBOARD SEND-RECEIVE (KSR) TELETYPEWRITER SET

The KSR set receives and prints messages on a paper copy. It can generate messages from its keyboard and answer-back mechanism. The KSR set consists of the following components:

- Keyboard
- Typing unit
- Call control unit
- Cover
- Stand

The KSR set can be used in the following ways:

(1) To generate and send messages from its keyboard

(2) To receive and print messages from other connected sets and its own keyboard.

B. AUTOMATIC SEND-RECEIVE (ASR) TELETYPEWRITER SET

The ASR set receives and records messages on paper tape and/or page copy. It can generate messages from its keyboard, tape reader, and answer-back mechanism. The ASR set consists of the following components:

- Keyboard
- Typing unit
- Call control
- Paper tape reader
- Paper tape punch
- Cover
- Stand

The ASR set can be used in the following ways:

(1) To send messages from the keyboard while making a printed page copy with or without punching tape

(2) To receive messages from line and print them on page copy with or without punching tape

(3) To prepare tape locally from keyboard for later sending while making a printed page copy

(4) To send messages from tape while making a page copy with or without punching tape.

KSR AND ASR 33 TELETYPEWRITER SPECIFICATIONS

Speed:	100 words per minute 600 operations per minute

Transmission Code - 8 Level Start-Stop Signals With 11-Unit Transmission Memory:

Pattern:

Start Pulse:	1 unit of time
Intelligence Pulses:	8 units of time
Stop Pulse:	2 units of time
	11-unit code

Dimensions and Weights (Approximate):

RO Set

Width:	18-5/8 inches
Depth:	18-1/2 inches
Height:	8-3/8 inches
Weight:	39 pounds

KSR Set

Width:	18-5/8 inches
Depth:	18-1/2 inches
Height:	8-3/8 inches
Weight:	40 pounds

ASR Set

Width:	22 inches
Depth:	18-1/2 inches
Height:	8-3/8 inches
Weight:	44 pounds

Stand

Width:	17-3/4 inches
Height:	24-1/2 inches
Depth (at top of enclosure):	6-1/2 inches
Length of Feet:	17-3/4 inches
Weight:	12 pounds

Electrical Requirements:

Power Requirements:	115 VAC ±10% either 60 or 50 Hz ±0.45 Hz, single phase
Signal Line Current:	0.020 or 0.060 A
Nominal Input to Selector:	0.500 A at 20 VDC

KSR AND ASR 33 TELETYPEWRITER SPECIFICATIONS (CONTINUED)

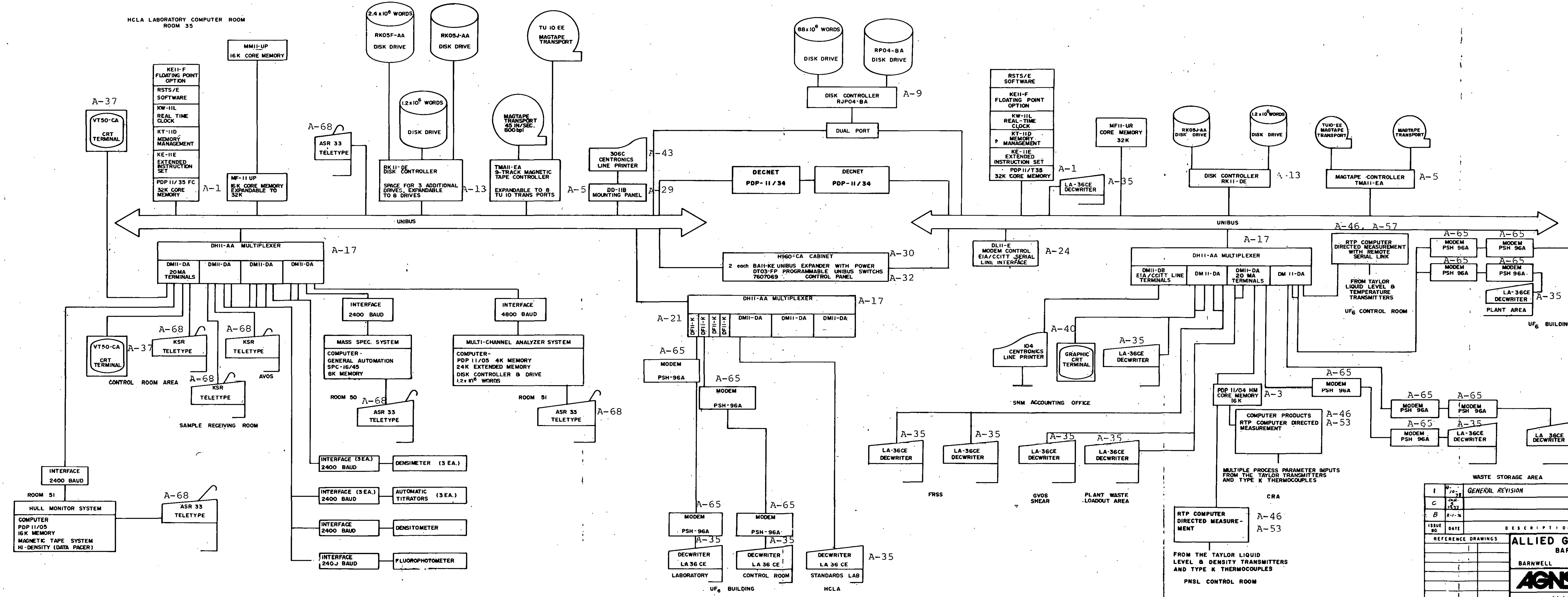
Operating Margins - All Signal Contacts and Distributor:

Long Telegraph Loops:	0.015 to 0.070 A at 48 to 240 VDC inductive
Short Telegraph Loops:	0.058 to 0.072 A at 16 to 22 VDC resistive

Environmental Tolerances:

(1) The teletypewriter will operate under worst-case conditions within a temperature range of 40°F and 110°F; a relative humidity of 2 percent to 95 percent with the room air velocity between 5 and 55 feet per minute. Altitudes may vary from sea level to 10,000 feet.

(2) Storage temperatures may range from minus (-)40°F to 150°F with altitudes up to 50,000 feet.



ISSUE NO.	DATE	DESCRIPTION	BY	CHK	DESIGN ENG.	DESIGN MGR.	APP'L	APP'L	APP'L
1		GENERAL REVISION							
C									
B									

REFERENCE DRAWINGS

ALLIED GENERAL NUCLEAR SERVICES
BARNWELL NUCLEAR FUEL PLANT
BARNWELL — SOUTH CAROLINA

AGNS DESIGN ENGINEERING DEPARTMENT
P. O. BOX 847
BARNWELL, S. C. 29812

ALLIED GENERAL MATERIALS ACCOUNTING & CONTROL SYSTEM - DWG. NO. 1

A-72

SCALE	FACILITY	DRAWING NO	ISSUE
DWG TYPE / PROCESS		82R-J-5007	1