Honeywell

LEVEL 66

HARDWARE

DATANET 6600 FRONT-END NETWORK PROCESSOR

SERIES 60 (LEVEL 66)

DATANET 6600 FRONT-END NETWORK PROCESSOR

SUBJECT

General Description, Functional Description, and Operating Instructions for Series 60 Level 66 DATANET 6600 Front-End Network Processor

SPECIAL INSTRUCTIONS

This manual supersedes the previous edition dated June 1974.

Change bars in the margins indicate corrections; asterisks indicate deletion of material. In Section IV, which is completely new, change bars have not been used.

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PREFACE

This manual provides reference information consisting of hardware-oriented descriptive and instructional material for the DATANET 6600 Front-End Network Processor (FNP) used with the Series 60 Level 66 systems.

Section I contains a general description of the DATANET 6600 FNP and its applications, capabilities, and optional features.

Section II contains a description of the functional capabilities of the subsystem, data formats, instructions, and status conditions.

Section III contains a description of the operator control panels, operator information, and operating instructions for the subsystem.

Section IV contains a description of the configuration controls.

All references apply to both the Series 60 Level 66 and 6000 systems unless specifically stated otherwise.

RELATED DOCUMENTS

Series 60 (Level 66)/6000 File and Record Control (Order No. DD07)

Series 60 (Level 66)/6000 General Comprehensive Operating Supervisor (GCOS) (Order No. DD19)

Series 60 (Level 66)/6000 DATANET 6600 Macro Assembly Program (MAP) (Order No. DD01)

Series 600/6000 Relocatable Loader (Order No. DA12)

Series 600/6000 DATANET 355 Simulator (Order No. BW23)

Series 60 (Level 66)/6000 Remote Terminal System (GRTS) (Order No. DD40)

Series 60 (Level 66)/6000 GRTS/355 and GRTS/6600 Startup Procedures Reference Manual (Order No. DD05)

Series 60 (Level 66)/6000 Total Online Testing System (TOLTS) (Order No. DD39)

Series 60 (Level 66)/6000 Network Processing Supervisor (NPS) (Order No. DD48)

Series 60 (Level 66)/6000 NPS Startup (Order No. DD51)

Series 6000 Introduction to Network Processing Supervisor, NPS/355 (Order No. AA46)

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SECTION I
GENERAL DESCRIPTION

SYSTEM DESCRIPTION

The DATANET 6600 Front-End Network Processor (FNP) (see Figure 1-1) provides large volume network communications power for Honeywell Series 60 Level 66 computer systems. The network processor, in conjunction with the Network Processing Supervisor (NPS) operating system provides a functional separation of information, network and communications processing activities. The DATANET 6600 FNP is connected by the DIA (Figure 1-2) to the Series 60 Level 66 IOM as a peripheral channel for the transfer of data and control information. A Level 66 system supports multiple DATANET 6600s, up to four, along with a capability for linking DATANET 6600s, monitoring their performance and reconfiguring line terminations as required.

The DATANET 6000 FNP is available in two compatible versions. The DCP6624 for entry or medium range requirements and the DCP6632 for initially heavier traffic or system upgrade from a DCP6624. Both the DCP6624 and DCP6632 feature advanced functions, components and capabilities designed to meet today's information and network processing requirements. They differ only in memory size and communications capacity.

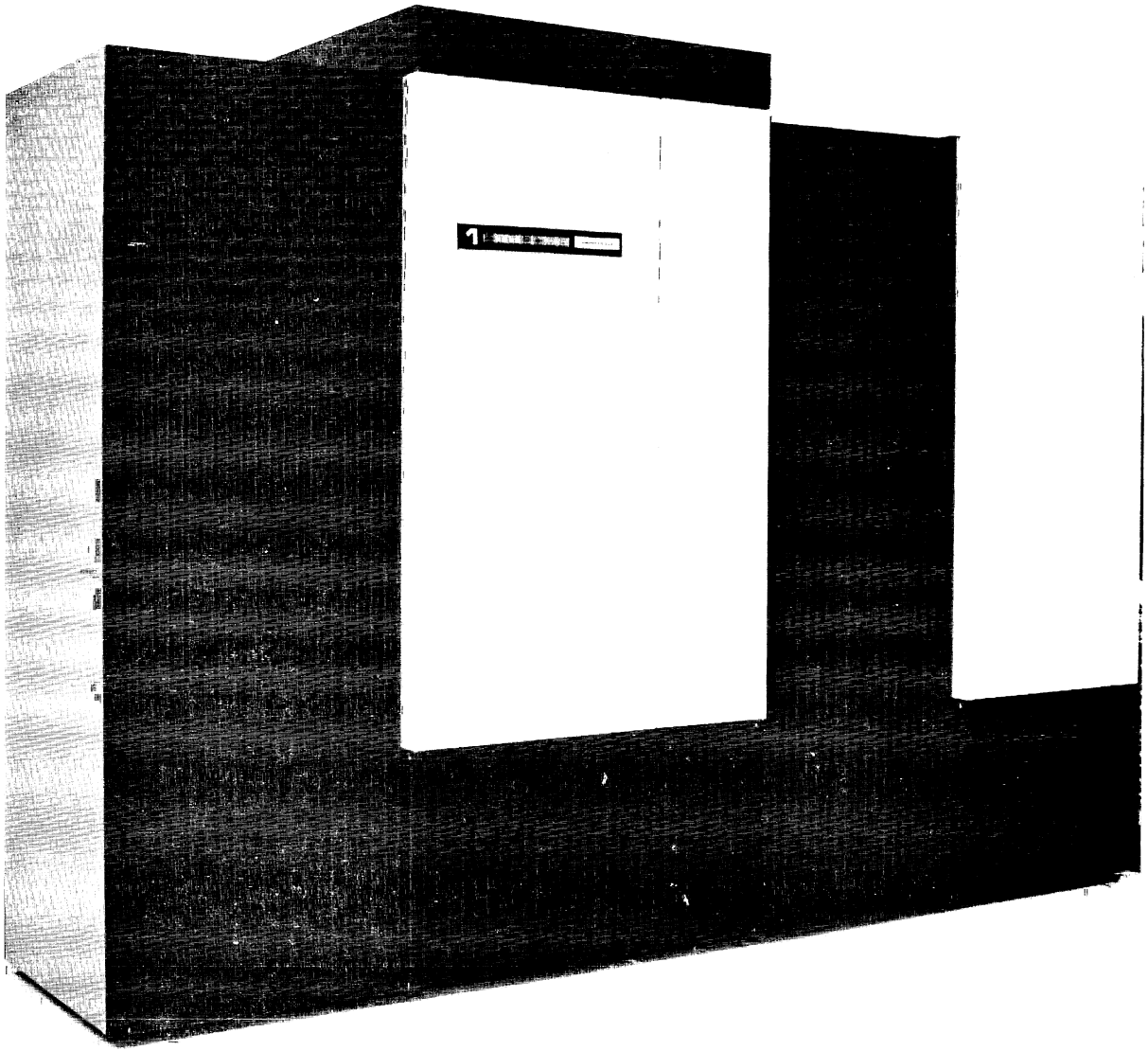


Figure 1-1. DATANET 6600 Front-End Network Processor

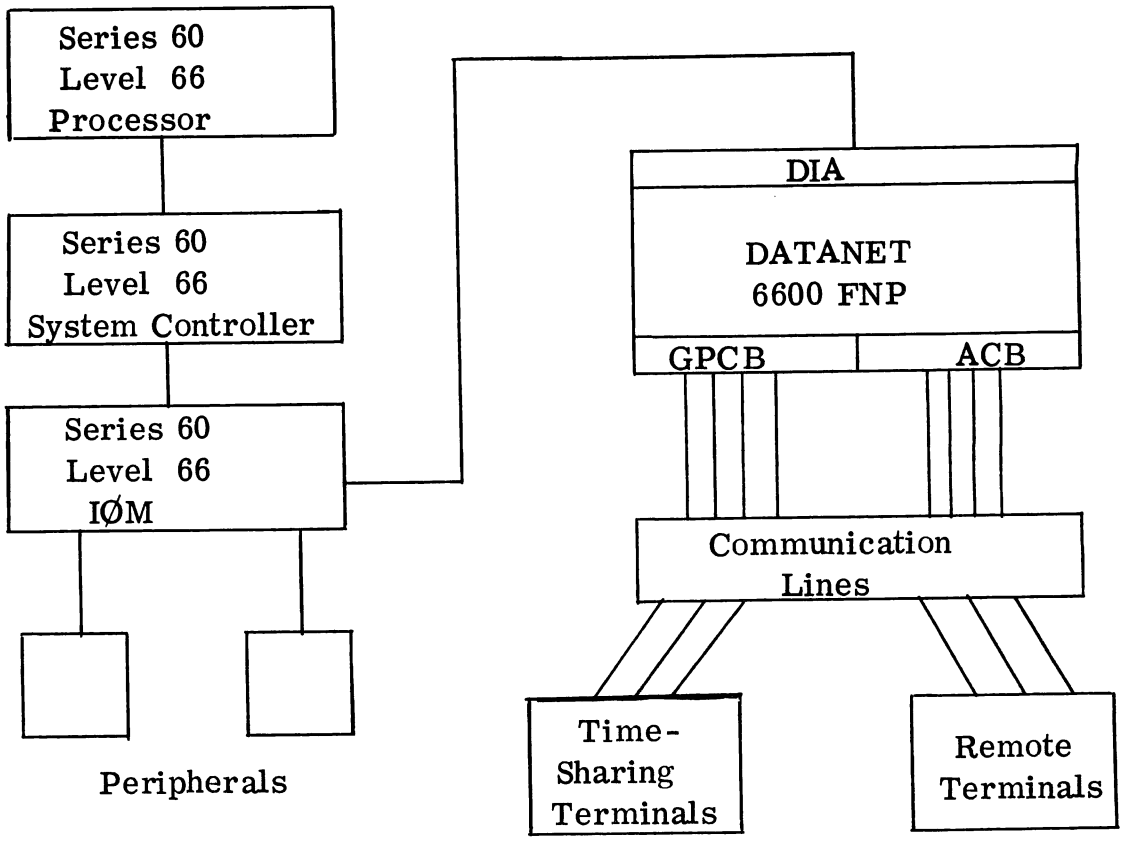


Figure 1-2. Series 60 Level 66 System with DATANET 6600 FNP connected to IOM

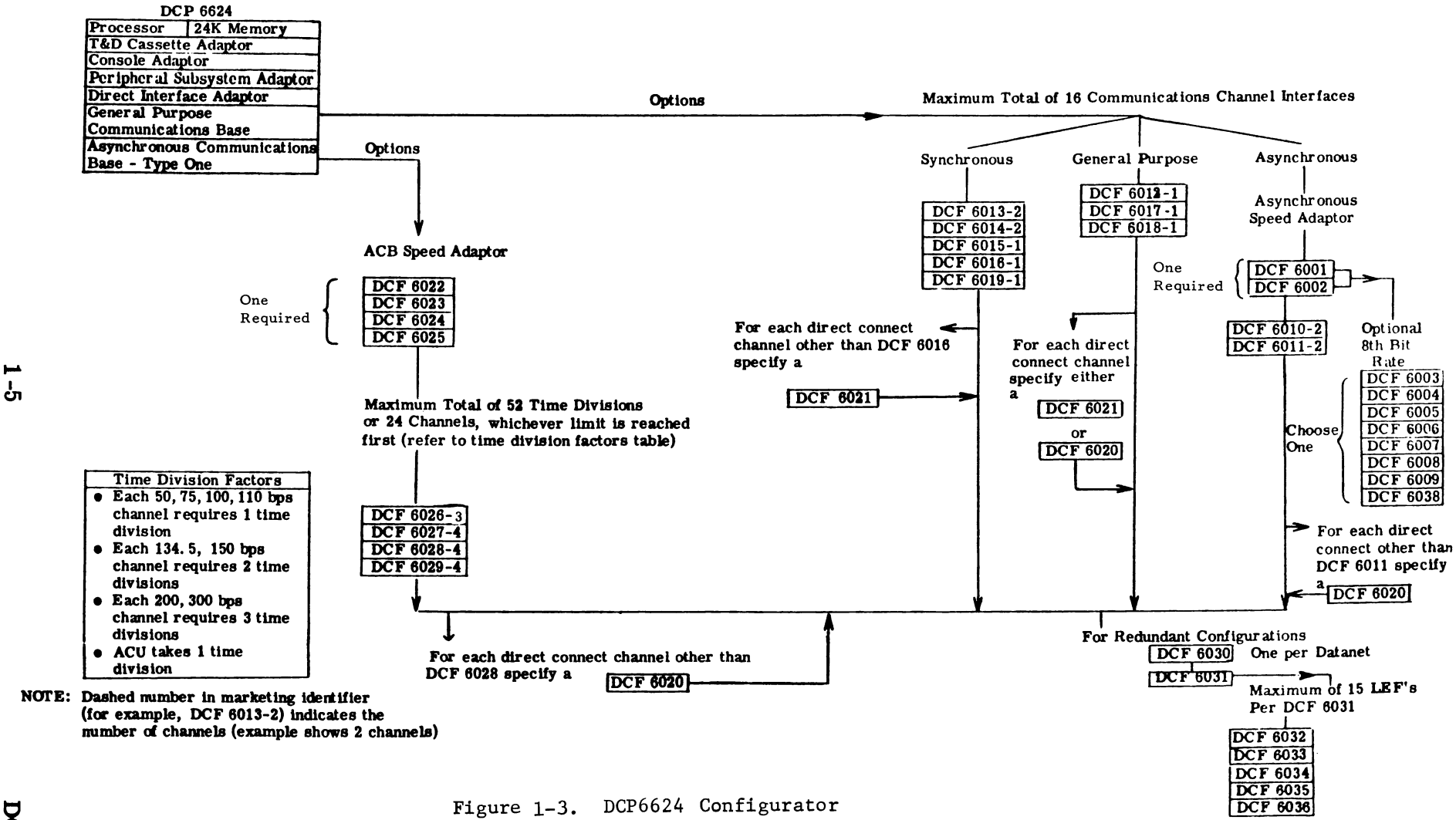
SYSTEM CONFIGURATION

The basic DATANET 6600 FNP (DCP6624) system primarily directed toward an entry level user is equipped with 48K bytes of memory and capacity for accepting 1-56 line terminations. It consists of the following:

One DATANET 6600 FNP (DCP6624) (Figure 1-3)

- 24K Memory (49,152 bytes - 9 bit)
- One Direct Interface Adapter (DIA) and Level 66 IØM channel for connecting the DATANET 6600 FNP to the Level 66 central system.
- One Peripheral Subsystem Adapter (PSA) for providing the interface to the Mass Storage subsystem.
- One Console Adapter (CCA) and console keyboard/printer.
- One T&D Cassette Adapter (TCU).
- One General Purpose Communications Base (GPCB) that accommodates up to 16 Communications Channel Interfaces (up to 32 concurrently operating transmission lines) at speeds of 50 to 50,000 bps.
- One Asynchronous Communications Base Type 1 (ACB) that can be configured for up to six asynchronous channel groups. A maximum allowable line termination (simultaneous) in a Type 1 ACB is:

  24 line terminations at 6.67, 10 or 15 characters per second, or
  17 line terminations at 20, 30 characters per second.



NOTE: Dashed number in marketing identifier (for example, DCF 6013-2) indicates the number of channels (example shows 2 channels)

Figure 1-3. DCP6624 Configurator

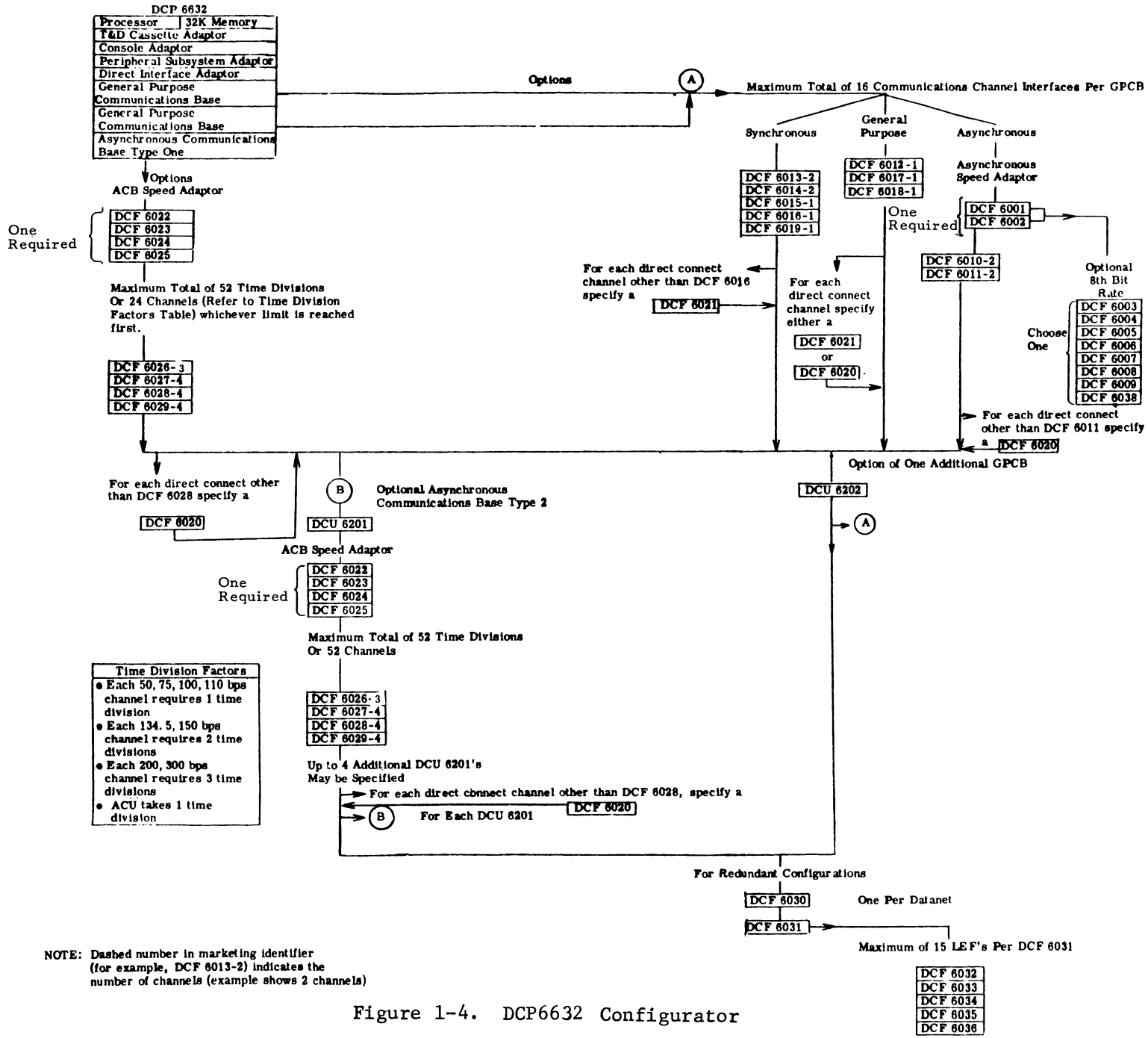
The advanced DATANET 6600 FNP (DCP6632) system provides maximum functionality and top performance to the heavily committed user of data communications. It is equipped with 64K bytes of memory, a physical capacity for up to 380 line terminations and consists of the following:

One DATANET 6600 FNP DCP6632 (Figure 1-4)

- 32K Memory (65,536 bytes - 9 bit)
- One Direct Interface Adapter (DIA) and Level 66 IØM channel for connecting the DATANET 6600 FNP to the Level 66 central system.
- One Peripheral Subsystem Adapter (PSA) for providing the interface to the Mass Storage subsystem.
- One Console Adapter (CCA) and console keyboard/printer.
- One T&D Cassette Adapter (TCU).
- Two General Purpose Communications Bases (GPCB) that each accommodate up to 16 Communications Channel Boards (up to 32 concurrently operating channels) at speeds of 50 to 50,000 bps. One additional GPCB can be added as an option to the DCP6632.
- One Asynchronous Communications Base Type 1 (ACB) that can be configured for up to six asynchronous channel groups. A maximum allowable line termination (simultaneous) in a Type 1 ACB is:

  24 line terminations at 6.67, 10 or 15 characters per second, or
  17 line terminations at 20, 30 characters per second.

  Five additional Type 2 ACB can be added as options to the DCP6632, each with a maximum capacity of 52 lines.



NOTE: Dashed number in marketing identifier (for example, DCF 6013-2) indicates the number of channels (example shows 2 channels)

Figure 1-4. DCP6632 Configurator

DATANET 6600 Front-End Network Processor

The DATANET 6600 FNP (Figure 1-5) available in either DCP6624 or DCP6632 consists of a processor, memory and input/output control that are independently timed and operate asynchronously with each other. The processor and input/output control process data at their own rate requesting cycles from memory when the need arises. The processor and input/output control communicate with each other only when executing certain input/output instructions.

The DATANET 6600 FNP processor can execute in excess of 500,000 instructions per second to facilitate real time, concurrent servicing of external devices. Ninety-eight instructions in an 18-bit format with one single address instruction per word provides similar functions and operations to the Level 66 Central System or other large scale processors. This instruction repertoire includes operations for arithmetic, shifting, comparisons, data movement, and peripheral equipment control. It is a parallel, binary, fixed point processor with multilevel indirect addressing using three index registers and the instruction counter, with indexing at all levels, that allows addressing up to 65,536 nine-bit bytes of memory.

The DATANET 6600 FNP Storage is a compact, state-of-the-art, metal-oxide semiconductor (MOS) memory, with the following features:

- Memory Sizes:

  DCP6624: 24K - 49,152 bytes (9 bit)
  DCP6632: 32K - 65,536 bytes (9 bit)

- One microsecond cycle time.
- Addressable word sizes: 6, 9, 18 or 36 bits.
- Data words of different lengths can be mixed and fully packed in storage.
- Automatic Error Detection and Correction (EDAC).

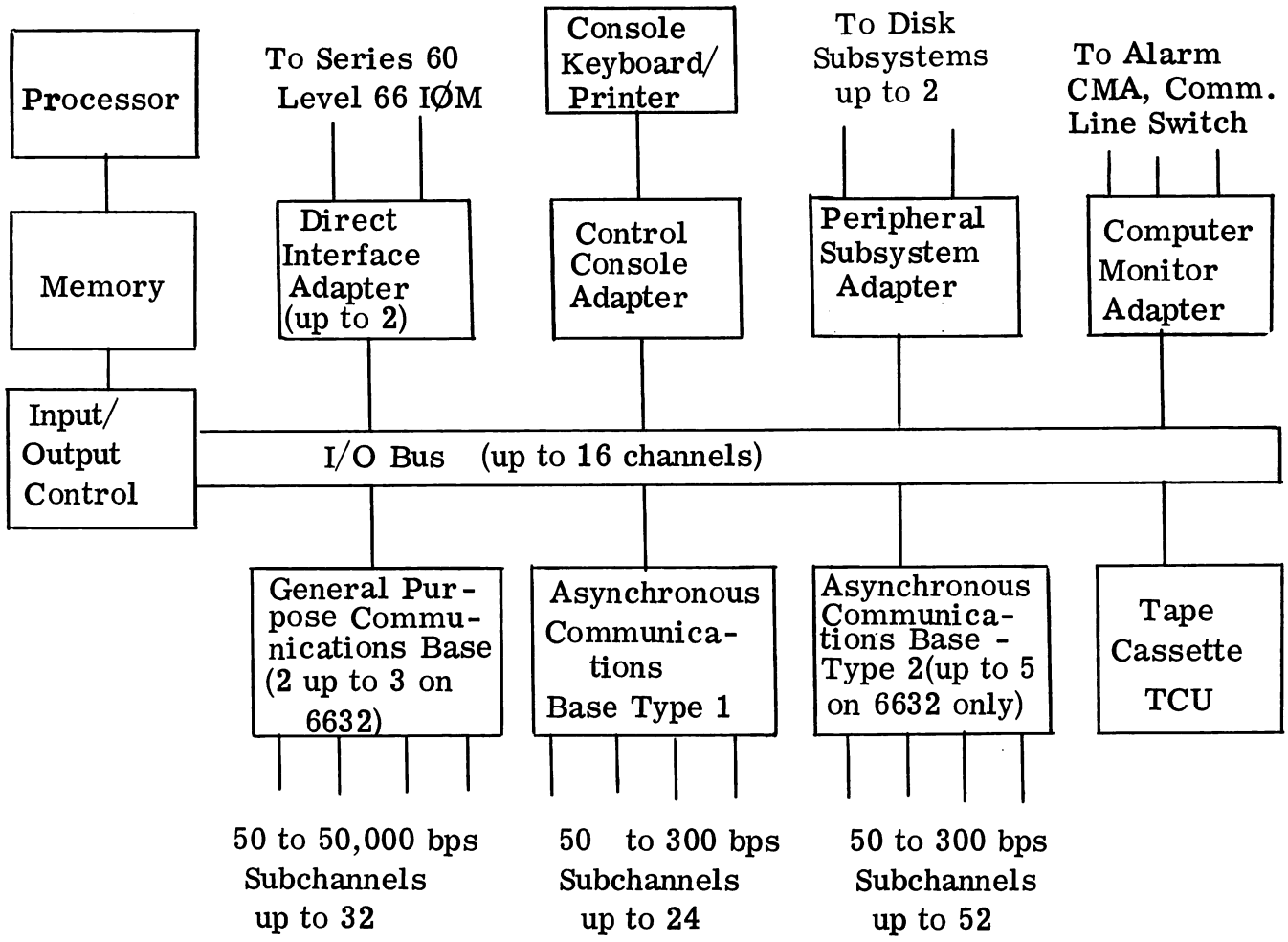


Figure 1-5. DATANET 6600 FNP Configuration

The DATANET 6600 FNP Input/Output Control is bus-oriented and designed to facilitate efficient, real-time concurrent servicing of multiple peripherals and communication devices. Up to 16 channels can be serviced on the I/O bus with a total data transfer rate of 500,000 words (6, 9, 18 or 36 bit) per second. The I/O Control operates independently of the processor and has a priority interrupt system of 16 levels each with 16 sublevels for a total of 256 levels of program interrupts that are all maskable. The DATANET 6600 FNP uses either the General Purpose Communication Base or Asynchronous Communications Base which provide a variety of subchannels for the interface of the communication lines.

General Purpose Communications Base (GPCB)

The General Purpose Communications Base (DCU6202) is a multiline communication controller that can interface up to 32 concurrently operating transmission lines. This controller interfaces to synchronous and asynchronous channels, at speeds ranging from 50 to 50,000 bps. Transmission can be simplex, half duplex or full duplex, in either two- or four-wire operation.

One General Purpose Communications Base is standard for the DCP6624, and two are standard for the DCP6632. However, for increased line handling capability, one additional General Purpose Communications Base can be added to the DCP6632.

Asynchronous Communications Base (ACB)

The Type 1 and Type 2 Asynchronous Communications Bases are local communications multiplexers which provide for time-division multiplexing by character, to and from the FNP, for a variety of low speed, asynchronous terminals (up to 300 bps per terminal). The Asynchronous Communications Bases handle terminals with differing communication speeds and code sets. Character demultiplexing is performed by the Network Processing Supervisor (NPS) in the FNP.

Type 1 Asynchronous Communications Base

- Standard on DCP6624 and DCP6632
- Up to six asynchronous channel groups can be configured on each base
- Only one Type 1 Asynchronous Communications Base per DATANET 6600 FNP (no additional option available)
- Maximum allowable line terminations (simultaneous) in a Type 1 Asynchronous Communications Base are:

  24 line terminations at 6.67 characters per second

  24 line terminations at 10 characters per second

  24 line terminations at 15 characters per second

  17 line terminations at 30 characters per second

  17 line terminations at 20 characters per second

Type 2 Asynchronous Communications Base (DCU6201)

- Up to 13 asynchronous channel groups can be configured on each Type 2 Asynchronous Communications Base
- A maximum of five Type 2 Asynchronous Communications Bases can be configured on the DCP6632 (a feature not available on the DCP6624)
- Each communications base can service up to four different transmission rates
- The maximum allowable simultaneous line terminations in each Type 2 Asynchronous Communications Base are:

  52 line terminations at 6.67 cps

  52 line terminations at 10 cps

26 line terminations at 15 cps

17 line terminations at 30 cps

17 line terminations at 20 cps

Communications Interface Base Optional Features

General Purpose Communications Base optional channels are available for use from the following list. See DCP6624 and DCP6632 Configurator, Figures 1-3 and 1-4.

SPEED ADAPTERS (Required)

- DCF6001 - Asynchronous Speed Adapter for General Purpose Communications Base (110, 134.5, 150, 300, 1,050, 1,200, 1,800 bps) (Note 1)
- DCF6002 - Asynchronous Speed Adapter for General Purpose Communications Base (50, 110, 150, 200, 300, 600, 1,200 bps) (Note 1)

OPTIONS

- DCF6003 - Additional Bit Rate Option for Asynchronous Speed Adapter - 50 bps
- DCF6004 - Additional Bit Rate Option for Asynchronous Speed Adapter - 75 bps
- DCF6005 - Additional Bit Rate Option for Asynchronous Speed Adapter - 134.5 bps
- DCF6006 - Additional Bit Rate Option for Asynchronous Speed Adapter - 200 bps

1. One DCF6001 or DCF6002 must be selected for each General Purpose Communications Base. One additional speed rate may be selected from DCF6003-DCF6009, DCF6038 as an option.

- DCF6007 - Additional Bit Rate Option for Asynchronous Speed Adapter - 600 bps
- DCF6008 - Additional Bit Rate Option for Asynchronous Speed Adapter - 1,050 bps
- DCF6009 - Additional Bit Rate Option for Asynchronous Speed Adapter - 1,800 bps
- DCF6038 - Additional Bit Rate Option for Asynchronous Speed Adapter - 2,400 bps

CHANNEL INTERFACES

- DCF6010 - Channel Interface, Asynchronous - for two (dual) channels, half or full duplex, asynchronous, operating at up to 2400 bps and utilizing 7- or 8-bit codes. Electronics Industry Association (EIA) RS232C
- DCF6011 - Channel Interface, Asynchronous - for two (dual) channels, half or full duplex, and utilizing 7- or 8-bit codes. EIA interface is replaced by 20 milliamp current interface.
- DCF6012 - Channel Interface, Synchronous or Asynchronous - for one channel, at either half or full duplex, ASCII, operating at rates up to 10,000 bps. MIL-STD 188C.
- DCF6013 - Channel Interface, Synchronous - for two (dual) channels, at either half or full duplex, synchronous, ASCII, at rates up to 10,000 bps. EIA RS232C.
- DCF6014 - Channel Interface, Synchronous with Automatic Call Unit - dual channel, same as the Synchronous Channel Interface (DCF6013); if one channel is used with an Automatic Call Unit (ACU) then communications capability is available on only the one remaining channel.

- DCF6015 - Channel Interface, Binary Synchronous, with Cyclic Redundancy Check - for one channel, in either binary synchronous, or American National Standards Institute/ECMA mode. It is capable of half or full duplex operation, utilizing either ASCII or EBCDIC code, and transparent or non-transparent operation at rates up to 10,000 bps. EIA RS232C.

- DCF6016 - Channel Interface, Broad Band - for one channel interfacing to Bell System Type 301 and 303 modems, half or full duplex synchronous modes operating at speeds up to 50,000 bps, and utilizing 5-, 6-, 7-, and 8- bit codes.

- DCF6017 - Channel Interface, General Purpose - for one channel, operating at either half or full duplex, synchronous or asynchronous character transmission and reception rates up to 10,000 bps, using 5-, 6-, 7-, and 8-bit codes.

- DCF6018 - Channel Interface, General Purpose, for one channel includes Automatic Call Unit - same as the General Purpose Channel Interface (DCF6017), with use of Automatic Call Unit.

- DCF6019 - High-Level Data Link Interface - for one channel utilizing the HDLC disciplines, in either half or full duplex synchronous mode. This option has an EIA RS232C interface, is bit or character oriented, with transmission rates up to 10,000 bps. The option incorporates a 16-bit CRC to ensure data integrity and information control.

- DCF6020 - Direct Connect Capability - Asynchronous (Note 2)

- DCF6021 - Direct Connect Capability - Synchronous

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2. May also be used with the Type 1 and Type 2 Asynchronous Communications Bases.

Asynchronous Communications Base Type 1 and Type 2 channels are available for use from the following list. See DCP6624 and DCP6632 Configurator, Figures 1-3 and 1-4.

SPEED ADAPTERS -(Required)

- DCF6022 - Speed Adapter for Asynchronous Communications Base - Type 1 and Type 2 (50-75-100-200 bps) (Note 3)
- DCF6023 - Speed Adapter for Asynchronous Communications Base - Type 1 and Type 2 (50-75-110-200 bps) (Note 3)
- DCF6024 - Speed Adapter for Asynchronous Communications Base - Type 1 and Type 2 (75-110-150-300 bps) (Note 3)
- DCF6025 - Speed Adapter for Asynchronous Communications Base - Type 1 and Type 2 (110-134.5-150-300 bps) (Note 3)

CHANNEL GROUPS

- DCF6026 - Asynchronous Channel Group with Automatic Call Unit - for three channels, one of which can be a dial out, using a Bell System 103A, E, or F, or 113 type data set.
- DCF6027 - Asynchronous Channel Group - same as the DCF6026 option, for four channels without an ACU.
- DCF6028 - Asynchronous Channel Group - for four channels using 20 milliamp current interface for direct connection to teleprinters, without modems.
- DCF6029 - Asynchronous Channel Group - for four channels with interface conformance to MIL-STD 188C.

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3. One speed adapter (DCF6022-DCF6025) must be selected for each Asynchronous Communications Base Type 1 or Type 2.

Direct Interface Adapter (DCF6041)

The Direct Interface Adapter (DIA) provides the interface between the DATANET 6600 input/output bus and the Level 66 Input/Output Multiplexer (IOM) for the transfer of data and control information. The DATANET 6600 FNP controls all transactions and normal data transfer activities through the DIA except for "initiate bootload" or program interrupt from the central system.

Peripheral Subsystem Adapter

The Peripheral Subsystem Adapter (PSA) provides the interface between the DATANET 6600 input/output bus and the Disk Subsystem or Microprogrammed Peripheral Controller (MPC). It is located within the DATANET 6600 FNP cabinet. Refer to Figure 1-6 for subsystem configuration. A switched channel capability is available (DCF6042) to provide nonsimultaneous connection to a second MPC.

Computer Monitor Adapter (DCF6030)

The Computer Monitor Adapter (CMA) is a DATANET 6600 IOM channel that performs the functions of: system confidence monitoring (Alarm - special option), intersystem data communication (CMA to CMA), and communication line switch control of line transfer device (CLS/LTD) (DCF6031). The CMA is located in the DATANET 6600 FNP cabinet. Figure 1-7 shows the interface of a dual DATANET 6600 FNP System.

Line Transfer Device (DCF6031)

The Line Transfer Device (LTD/CLS) is used for dual processor configuration (Figure 1-7). It allows communication lines between processors to be switched by either program or manual control. The LTD and the Line Expansion Function (LEF) options (DCF6032-6036) are housed in a freestanding cabinet.

Control Console Adapter

The Control Console Adapter (CCA) provides the interface for the console keyboard/printer to the input/output bus of the DATANET 6600 FNP. It is located within the DATANET 6600 FNP cabinet.

Tape Cassette Adapter

The Tape Cassette Option (TCU) is for loading T&D into the FNP. Presently the TCU is used only for T&D and not for bootloading the FNP software.

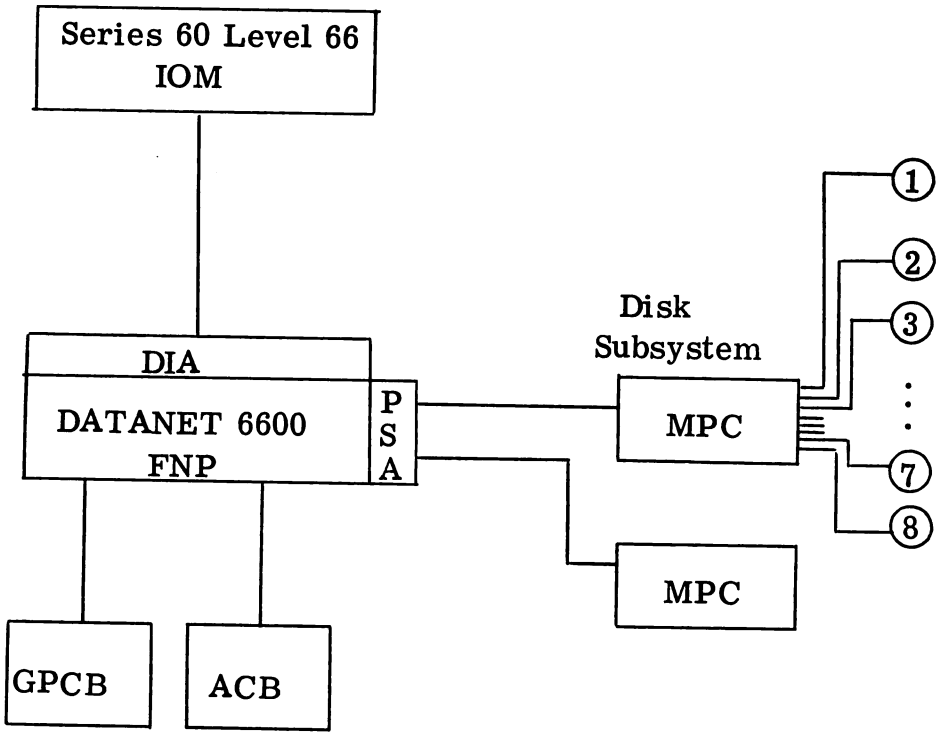

Figure 1-6. DATANET 6600 FNP Connected to Series 60 Level 66 IOM and Peripheral Subsystem Adapter Interface

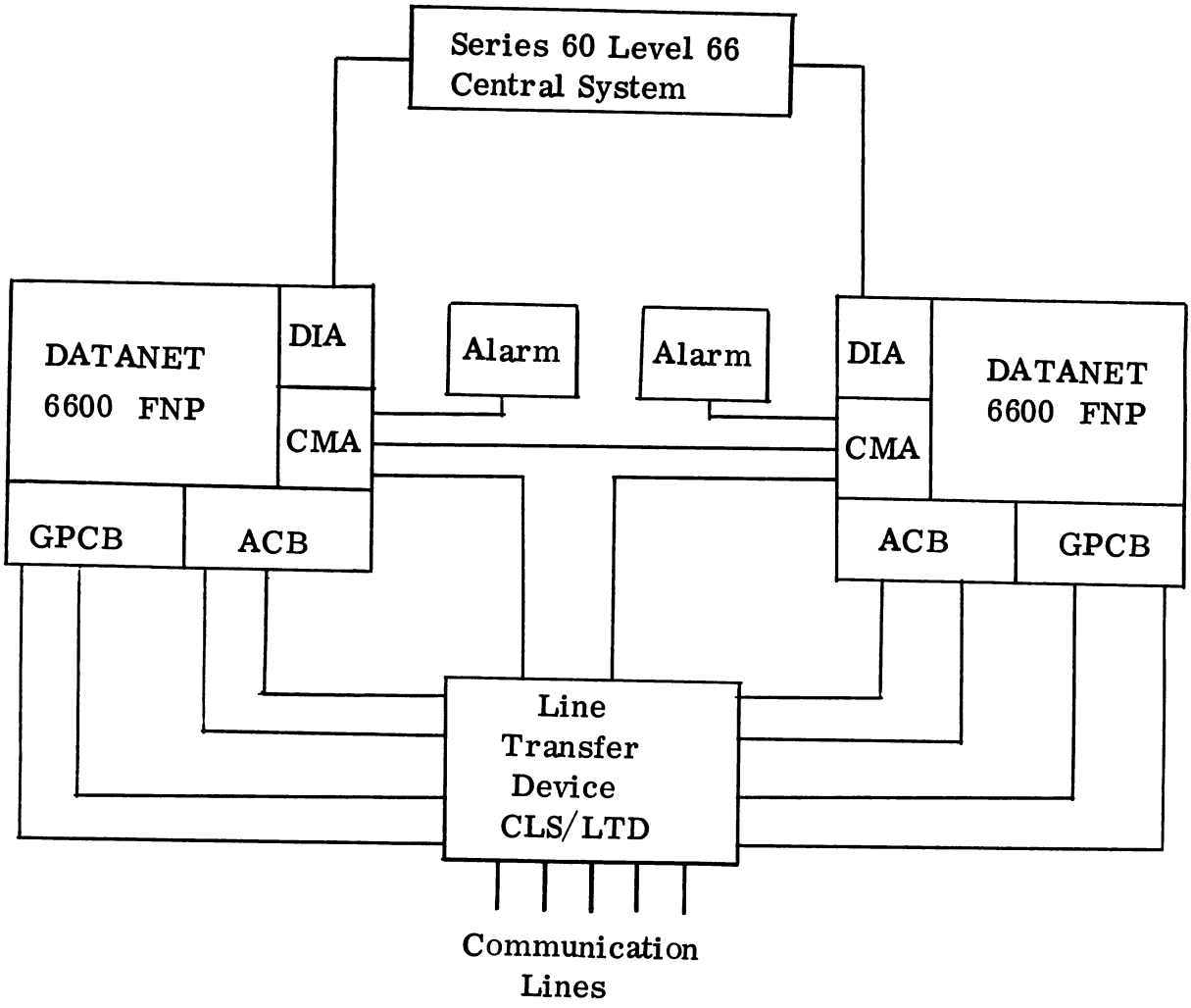

Figure 1-7. Dual DATANET 6600 FNP Message Switching System

Console Keyboard/Printer

The console provides direct communication between the operator and the operating software. The console is a freestanding unit interfaced by the Control Console Adapter (CCA) to one channel of the DATANET 6600 input/output bus. The console is required for response to software status queries, software configuration control and possible subsystem trouble analysis.

Network Control Console (DCF6037)

The Network Control Console is an option for NPS applications which require a Network Control Station. It consists of a second control console adapter and console teleprinter.

SPECIFICATIONS - DATANET 6600 FNP

Power Sources

Power for the computer system is usually obtained from a central utilities alternating current power source through a main distribution panel. This power is used for the motor generator that supplies power to the DATANET 6600 FNP. The main power distribution panel and the motor generator control panel should be accessible to the operator. The operator should know the panel's location, function, and how to power down the system/FNP in the event of an emergency.

Physical Specifications

Model	Width	Depth	Height	Weight
DCP6624	86"(218cm)	29.5"(75cm)	81.5"(207cm)	2000 lbs. (907,6kg)
DCP6632	110"(279cm)	29.5"(75cm)	81.5"(207cm)	2652 lbs. (1203,6kg)

Power Requirements

208/120V, 3-phase, 4-wire, 60Hz, 2.2kVA

Air Conditioning

3400 BTU/hour, no external air flow required.

SECTION II
FUNCTIONAL DESCRIPTION

DATANET 6600 FRONT-END NETWORK PROCESSOR

The DATANET 6600 FNP is a high performance, real-time communications subsystem that links to the Series 60 Level 66 systems a variety of terminals with widely differing operating characteristics and data transmission speeds. The flexibility designed into the DATANET 6600 FNP permits using various combinations of the options shown in Figure 2-1 and Table 2-1. All options available cannot be accommodated on one FNP. The DATANET 6600 FNP must include the following major components.

- DATANET 6600 FNP DCP6624 or DCP6632 (includes Processor, Store and Input/Output Control)
- General Purpose Communications Base
- Asynchronous Communications Base

In its capacity as a front-end network processor, the DATANET 6600 FNP receives data from remote terminals, and temporarily stores, processes, and forwards the data to the central system for processing. When the processing is completed, this sequence is reversed, with the data sent to the originating terminal, to a terminal specified by the program, or the output at the central system. In the direct access mode of operation, the DATANET 6600 FNP assumes a passive role, transferring information back and forth between a user program executing in the central system and a terminal communicating with that program.

Table 2-1. DATANET 6600 IOM Bus Connections (Card Slots)

DCP6624 (11 slots)	DCP6632 (21 slots)
9 used as follows: 2 - DIA 3 - PSA 1 - CCA 1 - GPCB 1 - ACB 1 - Tape Cassette	10 used as follows: same as DCP6624 plus 1 - for 2nd GPCB

DATANET 6600 PROCESSOR

The DATANET 6600 FNP uses a general-purpose, stored-program computer of micro-electronic construction as a processor. The range of instructions available for arithmetic and Boolean operations, shifting, comparisons, data movement, and peripheral equipment control is normally found only in large scale processors. It is a parallel binary, fixed-point computer that utilizes a random access memory with a maximum cycle time of one microsecond. Data having variable field lengths 6, 9, 18 or 36 bits is individually addressable to allow highly efficient processing of tabular data.

One of the ninety-eight instructions and a single address are contained in the 18-bit instruction word format. Three index registers and multilevel indirect addressing allow addressing of up to 32,768 18-bit words.

The control instructions are symbolically similar to the Level 66 instructions and provide characteristics functionally identical to the most commonly used Level 66 instructions.

The organization of the control is logically similar to that of a Level 66 system. The DATANET 6600 FNP is memory-oriented, with independent memory, processor, and input/output control. These three basic units are independently timed, and operate asynchronously with respect to each other. The processor and the input/output control (which are active units) process data at their own rates and request cycles from the memory (a passive unit) process data at their own rates and request cycles from the memory (a passive unit) as the need arises. Only when the processor executes certain input/output instructions must the processor and the input/output control communicate with each other. Otherwise, the only knowledge one active unit has of the other is that a request cycle to the memory may be delayed while it is responding to the other active units.

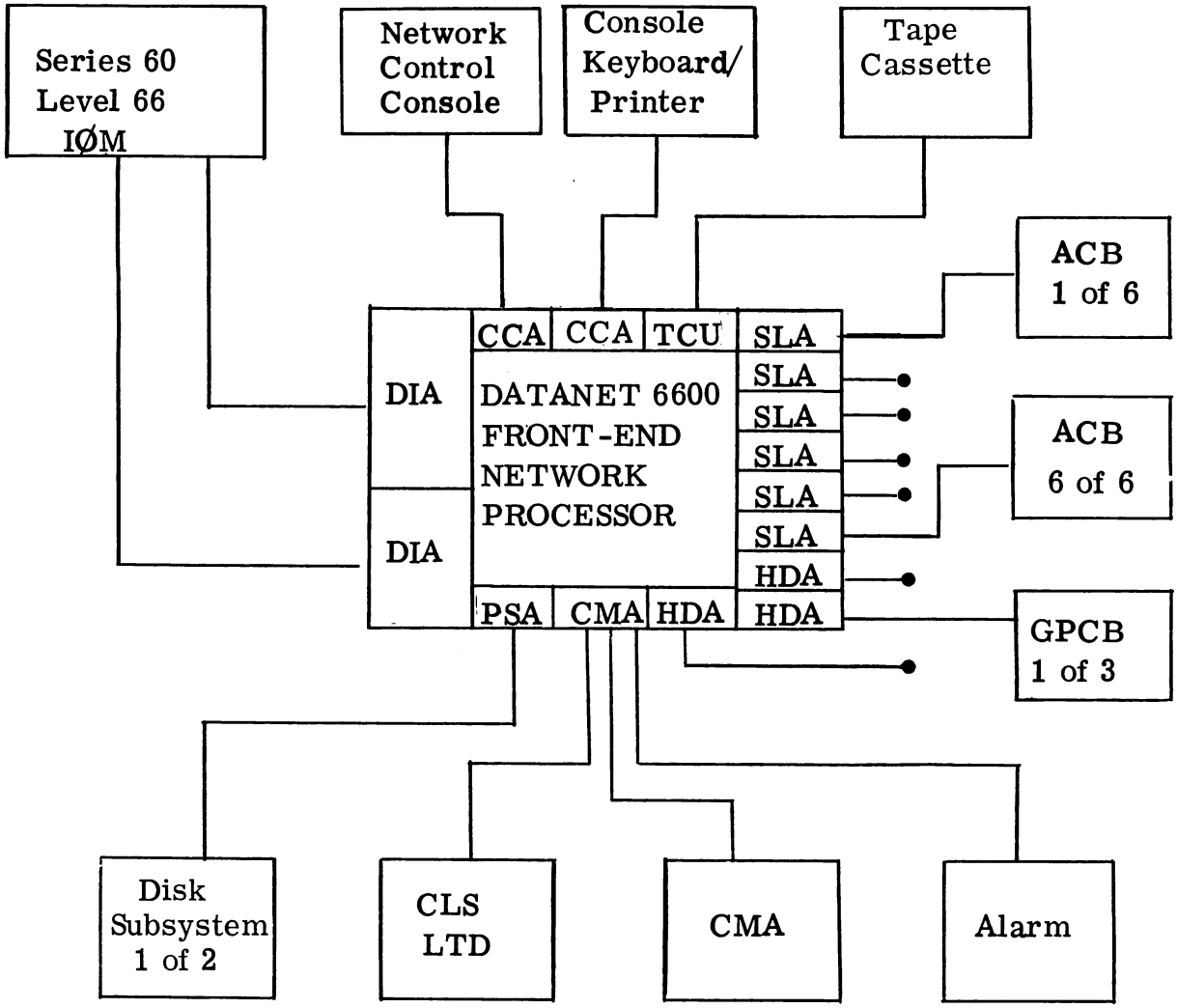

Figure 2-1. DATANET 6600 FNP Configuration with all Types of Options Available

Processor

The processor is bus-oriented, centered about a parallel, binary adder. All major data paths in the processor either converge to or diverge from the adder. One input to the adder is from memory while the other input is from one of the processor registers. The output from the adder is presented to all the registers of the processor and is placed in the desired registers by a strobe generated by the processor control unit.

Indicators show the results of processor instruction operations. These indicators are set in accordance with the operations carried out in the adder and reflect the results of the operation regardless of the destination of the resultant.

Address modification is accomplished by adding the displacement part of an instruction to a selected processor register (instruction counter or one of the three index registers) to form the effective address for the memory transactions.

Program Accessible Registers

The programmable hardware registers are as follows:

Register	Mnemonic	Length Bits
Accumulator	AQ	36
Index Registers	X1, X2, X3	18 each
Instruction Counter	IC	15
Indicator Register	I	8
Input/Output Channel Select Register	S	6

Accumulator (AQ)

The AQ-register is used as follows: (1) In fixed-point operations as an operand register for double precision operations. (2) In fixed-point operation as operands for single precision operations where each half serves independently of the other. These halves are then called A-register (AQ_{0-17}) and Q-register (AQ_{18-35}).

Index Registers (Xn)

The three index registers are general-purpose registers used for address modification, character manipulation and data movement.

Indicator Register (IR)

The indicator register is a generic term for all program-accessible indicators within the processor. The name is used where the set of indicators appear as a register; that is, a source or destination of data.

Instruction Counter (IC)

The instruction counter holds the address of the instruction being executed. The IC is also used for address modification.

Input/Output Channel Select Register (S)

This register specifies the input/output channel for the programmed input/output operations.

Faults

Processor faults (internal interrupts) are included to provide for program intervention when certain system errors or other events occur. When one of the eight types of faults occurs, program control is automatically transferred to a fixed storage location that is treated as an indirect word that points to a fault processing routine (user provided) for that specific fault.

The following are the eight processor faults:

- Power shutdown beginning
- Power-on restart
- Storage parity error
- Illegal operation code
- Overflow
- Illegal store operation
- Divide check
- Illegal program interrupt

Two faults, storage parity error and overflow, can be inhibited by the program by setting the appropriate bit in the indicator register (using the LDI instruction). If one of these two faults occurs, the indicator associated with the fault is turned on and no transfer to a fault processing routine is accomplished.

Power Shutdown Beginning Fault - Triggered by an external signal to the processor indicating impending power-off. This fault can be inhibited by a manual switch on the Operation and Maintenance Panel.

Power-On Restart Fault - Triggered by an external signal to the processor indicating that power-on has occurred. The processor initializes and transfers to the fault vector location. This fault can be inhibited by a manual switch on the Operation and Maintenance panel.

Storage Parity Error Fault - Triggered when a parity error occurs during a read from the memory by the processor. This fault can be program-inhibited by setting the parity fault inhibit bit by means of the LDI instruction.

Illegal Operation Code - Occurs when the processor detects an illegal operation code. All codes not listed in the table of operation codes are illegal.

Overflow Fault - Generated when an overflow occurs during an arithmetic operation. This fault can be program-inhibited by setting the overflow fault inhibit bit in the indicator register, by means of the LDI instruction.

Illegal Store Operation Fault - Generated for the following reasons:

- Store controller time out (hardware error)
- Illegal command to store controller (hardware error)
- Out-of-bounds address
- Illegal character code (7 is the only illegal character, position code 1 acts like 0)
- Any attempt to alter storage in a protected area

Divide Check Fault - Generated when a division cannot be carried out for any of the reasons indicated with the divide instructions.

Illegal Program Interrupt Fault - Can be generated in either of two ways:

- The processor attempted to answer an interrupt when there was no interrupt present.
- The processor answered a valid interrupt, but the contents of the word in storage containing the interrupt sublevels were all zeros. This can happen if the processor or IOM stores zero in one of the interrupt sublevel locations after an interrupt has been set.

Program Interrupt

A channel, by way of the IOM, informs the processor that an event has occurred requiring processor action by causing a cell to be set in an interrupt Sublevel Word. This cell indicates to the program the level of interrupt and the channel causing the interrupt. There are 16 levels of interrupts on the DATANET 6600. There are 16 sublevels in each level, for a total of 256 program interrupts.

Program interrupts are inhibited/enabled, by level, by the Set Interrupt Level Enable Register (SIER), Interrupt Inhibit Mode ON (INH), Interrupt Inhibit Mode OFF (ENI), and Read Interrupt Level Enable Register (RIER) processor instructions.

Indicators

The processor indicators give the programmer information about the present state of the processor and the program it is executing. The indicators are set automatically by the processor and, in general, indicate results after the execution of the present instruction. The indicators can be regarded as individual bit positions in an 8-bit indicator register (IR). An indicator is set ON/OFF by certain events in the processor or by certain instructions. The ON state corresponds to a binary one in the respective bit position of the IR; the OFF state corresponds to a zero.

The instructions LDI (Load Indicator Register) and STI (Store Indicator Register) transfer data between a storage location and the IR. The indicators and their relation to bit positions of a storage location word are shown in Table 2-2. The IR and input/output channel select register are treated as one register; however, they are functionally separate.

Table 2-2. Processor Indicators and Respective Bit Positions of a Storage Location

	Bit Position	Indicator
Indicator Register	0	Zero
	1	Negative
	2	Carry
	3	Overflow
	4	Interrupt Inhibit
	5	Parity Fault Inhibit
	6	Overflow Fault Inhibit
	7	Parity Error
	8	Not Used
	9	
	10	
	11	
I/O Channel Select Register	12	
	13	
	14	
	15	
	16	
	17	

Zero Indicator - Used to test for zero or nonzero operands or results. It is set by instructions that change the contents of a processor register (AQ, Xn) or adder or by the comparison instructions. The indicator is set ON when the new contents of the affected register or adder output contains all binary zeros; otherwise the indicator is set OFF.

The zero indicator is tested by the Transfer on Zero (TZE) and the Transfer on Not Zero (TNZ) instructions.

Negative Indicator - Used to test for negative or positive operands or resultants. It is affected by instructions that change the contents of the AQ processor register, and by comparison instructions. The indicator is set ON when the contents of bit position 0 of this register or adder output is a binary 1; otherwise it is set OFF. Operations involving the Xn registers do not affect this indicator.

The negative indicator is tested by the Transfer on Minus (TMI) and Transfer on Plus (TPL) instructions.

Carry Indicator - Used to determine if an operation has generated a carry out of the two most significant bits (bit positions 0 and 1). This is not an arithmetic overflow. The carry indicator is affected by left shifts, additions, subtractions, and comparisons. The indicator is set ON when a carry is generated out of bit position 0; otherwise it is set OFF.

The Transfer on No Carry (TNC) instruction tests the state of the carry indicator.

Overflow Indicator - Used to determine if the resultant of an arithmetic operation has exceeded the word length of the processor.

The overflow indicator is set if there is a carry out of either the most significant bit (bit position 0) or the next most significant bit (bit position 1) but not both. It is affected by the arithmetic instructions, but not by compare or Boolean instructions. Since it is not set to OFF otherwise, the overflow indicator reports any overflow that has occurred since it was last set OFF by one of the instructions TOV or LDI.

The Transfer on Overflow (TOV) instruction tests the status of the overflow indicator and sets if OFF.

Overflow Fault Inhibit Indicator - When this indicator is ON, then the setting ON of the overflow indicator does not cause an overflow fault trap to occur. The overflow fault inhibit indicator can be set ON or OFF only by the instruction LDI. Clearing of the overflow fault inhibit indicator to the enabled state does not generate a fault

from a previously set overflow indicator. The status of the overflow fault inhibit indicator does not affect the setting, testing, or storing of the overflow indicator.

Parity Error Indicator - Set to ON when a parity error is detected during the access of words from storage. It is set to ON or OFF by the LDI instruction.

Parity Fault Inhibit Indicator - When this indicator is ON, the setting of the parity error indicator does not cause a parity error fault trap to occur. When the parity fault inhibit indicator is OFF, such a trap is allowed to occur. The parity fault inhibit indicator is set to ON or OFF only by the instruction LDI. Clearing of the parity inhibit indicator to the unmasked state does not generate a fault from a previously set parity error indicator. The status of the parity fault inhibit indicator does not affect the setting, testing, or storing of the parity error indicator.

Interrupt Inhibit Indicator - This indicator is affected by the Load Indicator Register (LDI), Interrupt Inhibit (INH) and Enable Interrupt (ENI) instructions. If interrupts are to be inhibited, this indicator is turned ON.

MEMORY

The memory module consists of a memory controller and MOS store unit. There is one memory module per FNP. The memory controller interfaces with one processor and one input/output controller and provides the logic for transactions between these units and the MOS memory unit.

The MOS memory unit is a random access unit that accepts data, address, and control commands and performs the necessary control and timing operations to store and retrieve data.

Parity is checked on read and if a parity error occurs that is not correctable by EDAC, then a fault action occurs as previously described.

The MOS memory units are addressable as 6, 9, 12 or 18-bit words. This addressing capability provides for two options, 24K or 32K (18-bit) words.

The memory cycle time is 1.0 microsecond.

The memory interfaces with the processor and I/O control and is capable of performing the following operations:

- Read-Restore, Single-Precision
- Read-Restore, Double-Precision
- Read-Alter-Rewrite, Single-Precision
- Read-Alter-Rewrite, Double-Precision
- Clear-Write, Single-Precision
- Clear-Write, Double-Precision
- Set Interrupt Cells
- Read Interrupt Cells
- Set Interrupt Enable Register
- Read Interrupt Enable Register

INPUT/OUTPUT CONTROL (MULTIPLEXER)

The input/output control (IOC) provides a path for data and control information between the FNP processor and adapters connected to the IOC. The design of the IOC provides for up to 16 input/output adapters or subsystems. (Refer to Table 2-1 and Figure 2-1 for option installation information.

Input/Output Operation

I/O adapters operate in either the dynamic or static mode. In dynamic operation, data is transferred between the IOC and an external dynamic device. It is initiated by a connect instruction from the processor or directly by the adapter. In static operation, data is transferred in response to the LDEX and STEX instructions. Static operation is usually used by devices that transfer single static words or characters rather than data blocks of data. (For example, registers or switches can be read or set using hardware instructions.)

Dynamic Operation

Dynamic adapters operate either directly or indirectly. The adapter requests one cycle to transfer data. The IOC responds to the requests for transfer. Simultaneous requests are serviced on a priority basis by the IOC.

Static Operation

In this type of operation, the static data is maintained at the desired state and the program samples the data when required by the STEX instruction. Program load is accomplished by the LDEX instruction which sends out the data, accompanied by a pulse, to the adapter.

Direct Transfer

Devices that operate in the direct transfer mode must specify the memory location and character position as well as perform any character counting required for the data transactions. If the device specifies direct transfer, the address lines presented are used by the IOC as the memory address. The address generation can be wired in the adapter or the adapter can request a control word from memory. Where a control word is used, the adapter stores the control word in its registers and uses the contents to control the memory location and block length of each data transaction. The format of the word is determined by the external device.

Indirect Transfer

In the indirect mode of data transfer, the IOC performs the addressing and character counting for the adapter. When an adapter specifies indirect, the IOC uses the address lines presented to access an Indirect Control Word (ICW). Based on the command lines from the adapter (that specify load, store, add, subtract AND, or OR), the IOC uses the ICW to perform the transaction.

Each time a peripheral requests an indirect data transfer, the ICW is pulled from memory. The address is extracted for the data transaction and the indirect word is updated, rewritten into memory, and the data transfer takes place to the address in the ICW.

DIRECT INTERFACE ADAPTER

The Direct Interface Adapter (DIA) provides a data and control link between the DATANET 6600 Input/Output Control (IOC) and the Level 66 IOM Direct Channel Adapter (DCA). The DIA responds to an external CONNECT signal from either the DATANET 6600 FNP or the Level 66 DCA.

A CONNECT from either the DATANET 6600 FNP or Level 66 system causes the DIA to transfer data from one system to the other, program interrupt either system, or store status in the DATANET 6600 FNP.

Data is transferred between the DIA and DCA on a 36-bit bidirectional interface. Transfer between the DIA and DATANET 6600 IOC is in the direct 36-bit data transfer mode or indirect 36-bit data transfer mode.

The data transfer rate between the DIA and DCA is selectable by a three-position switch on the DIA configuration panel. The three selectable speeds are: (1) 64 thousand words per second; (2) 128 thousand words per second; (3) unlimited, but restrained by speeds of the DATANET 6600 IOC and Level 66 IOM.

PERIPHERAL SUBSYSTEM ADAPTER

The DATANET 6600 Peripheral Subsystem Adapter (PSA) provides the interface between the DATANET 6600 Processor and the Disk Subsystem or Microprogrammed Peripheral Controller (MPC) as shown in Figure 1-6. A single PSA is switchable to either of two MPCs and each MPC has up to eight logical channels that appear to the software as independent peripheral controllers operating in parallel. Normal data transfer activities of the PSA are initiated by the DATANET 6600 Processor but are actually controlled by the MPC.

COMPUTER MONITOR ADAPTER

The CMA provides a data and monitor link between dual systems (Figure 1-7) for use in message switching. It functions as a confidence monitor for the individual system's operational status and also controls and monitors the Line Transfer Device (LTD).

The system's operational status is monitored by the CMA with a "dead man" timer type logic that requires periodic reset by the system's operating software. System confidence is lost if timer runout occurs in the absence of the required reset command and the operator is alerted by an optional audio alarm.

On dual system configurations the CMAs provide a communication path between the two systems for constant update of each system's communication tables and status. The communication lines are switched from one system to the other by the LTD if a confidence failure occurs.

LINE TRANSFER DEVICE

The Line Transfer Device (LTD) is a multicontact switch assembly used for transferring communication lines from one DATANET 6600 system to another DATANET 6600 system (Figure 1-7). The LTD is controlled automatically by the CMAs but also may be operated manually.

Simultaneous transfer of up to 90 communication lines may be accomplished by a single LTD, with multiple LTD capability. A maximum of 15 Line Expansion Function (LEF) options may be specified for each LTD. Each LEF may provide the interface for up to 6 lines (6 data sets) for either asynchronous or synchronous channels.

CONTROL CONSOLE ADAPTER

The Control Console Adapter (CCA) provides the interface between the console keyboard/printer and the DATANET 6600 FNP. This enables the system operator to control and monitor the system operation when under the Software or T&D environment. The console and communication equipment can be located locally or remotely as required since they are not part of the CCA.

The CCA provides a 9-bit character interface to the DATANET 6600 bus and a communication EIA standard interface to the console. Operation of the CCA is initiated by a connect operation which transfers a Peripheral Control Word (PCW) to the CCA.

TAPE CASSETTE ADAPTER

The Tape Cassette Adapter (TCU) offers a low cost method of entering T&D programs into the subsystem. The Tape Cassette Option can be obtained with the interface I/O Bus to Tape Cassette Handler Channel and Tape Cassette Handler Unit or only the interface channel for the case where a Handler Unit is available in other equipment.

The Tape Cassette Unit consists of the magnetic tape transport device and the electronic control and read-write circuits packaged as a self-contained unit. This unit is capable of recording and reproducing digital information on a standard tape cassette.

The Tape Cassette Channel has two 6-bit byte buffers which are used to transform the data of the bit parallel I/O bus interface to the bit serial recorder interface and vice versa. Two buffers are necessary, one for read and one for write, since the channel performs an automatic read after write to ensure data integrity.

GENERAL PURPOSE COMMUNICATION BASE

The General Purpose Communications Base (High-Speed Line Adapter) is a multiline communications controller that can interface up to 32 low, medium- and high-speed data communications terminals and other communications subsystems to the DATANET 6600 FNP (Figure 2-2).

The GPCB is wired for 110/134.5/150/300/1050/1200/1800 asynchronous baud rates with one optional baud rate. Installation of option DCF6002 (4WHSK354AA) makes additional asynchronous baud rates of 50/200/600 available instead of 134.5/1050/1800 baud. This option for European application results in an asynchronous baud rate group of 50/110/150/200/300/600/1200 baud with one optional baud rate.

It handles both synchronous and asynchronous character-oriented communications terminals operating at various transmission rates (50 to 50,000 bits per second) with a variety of bit orders, character sizes, information codes, character sets, message formats, auxiliary signaling techniques, and control procedures.

Each communication line can be used in simplex, half-duplex or full-duplex mode, two- or four-wire operation, interfacing with both voice grade (including teleprinter terminals) and/or Telpak data communication lines. GPCB subchannels normally service any terminal that can transmit/receive character-oriented, bit-synchronous messages with information codes not exceeding eight bits. Each subchannel is double-character buffered.

The GPCB controller bus provides the interface between the subchannel units which respond when addressed by a unique enable line. Data transfer between the controller and the character-buffered subchannels is normally parallel by character. The data transfer between the subchannels and terminals is normally in serial bit form.

Figure 2-2 illustrates the following four methods of configuring the GPCB communications channels:

- Terminal 1 utilizes a pair of modems and private or direct lines. In this case the channel is always open, i. e., the link between the terminal and the subchannel remains established. This is normally referred to as four wire and TELPAK (wideband) services.
- Terminal 2 illustrates the direct connection to a terminal through an adapter. Functionally, the operation is the same as for terminal 1.
- Terminals 3 and 4 utilize the telephone direct-dial network which requires a telephone call to establish the data link. Terminal 3 differs from terminal 4 in that it utilizes an automatic call unit (ACU) which enables the DATANET 6600 FNP to initiate a call to a terminal.

Binary Synchronous Communication Subchannel

The Binary Synchronous Communication DCF6015 (4WHSB355AA) subchannel of the General Purpose Communication Base (GPCB) provides the interface between the GPCB common logic and a synchronous data link to allow communication between the DATANET 6600 FNP and a data terminal or communication controller operating with BSC procedures.

Communication using the BSC procedures will require a combination of hardware and software provided functions. The BSC subchannel logic will provide only those general functions that are not terminal or application dependent and operate with either ASCII or EBCDIC code. The BSC operation is two-way alternate only, but is capable of two-way-simultaneous operation for testing the subchannel in a wraparound mode or the operation of full-duplex ASCII terminals (using American National Standards Institute/ECMA control procedures).

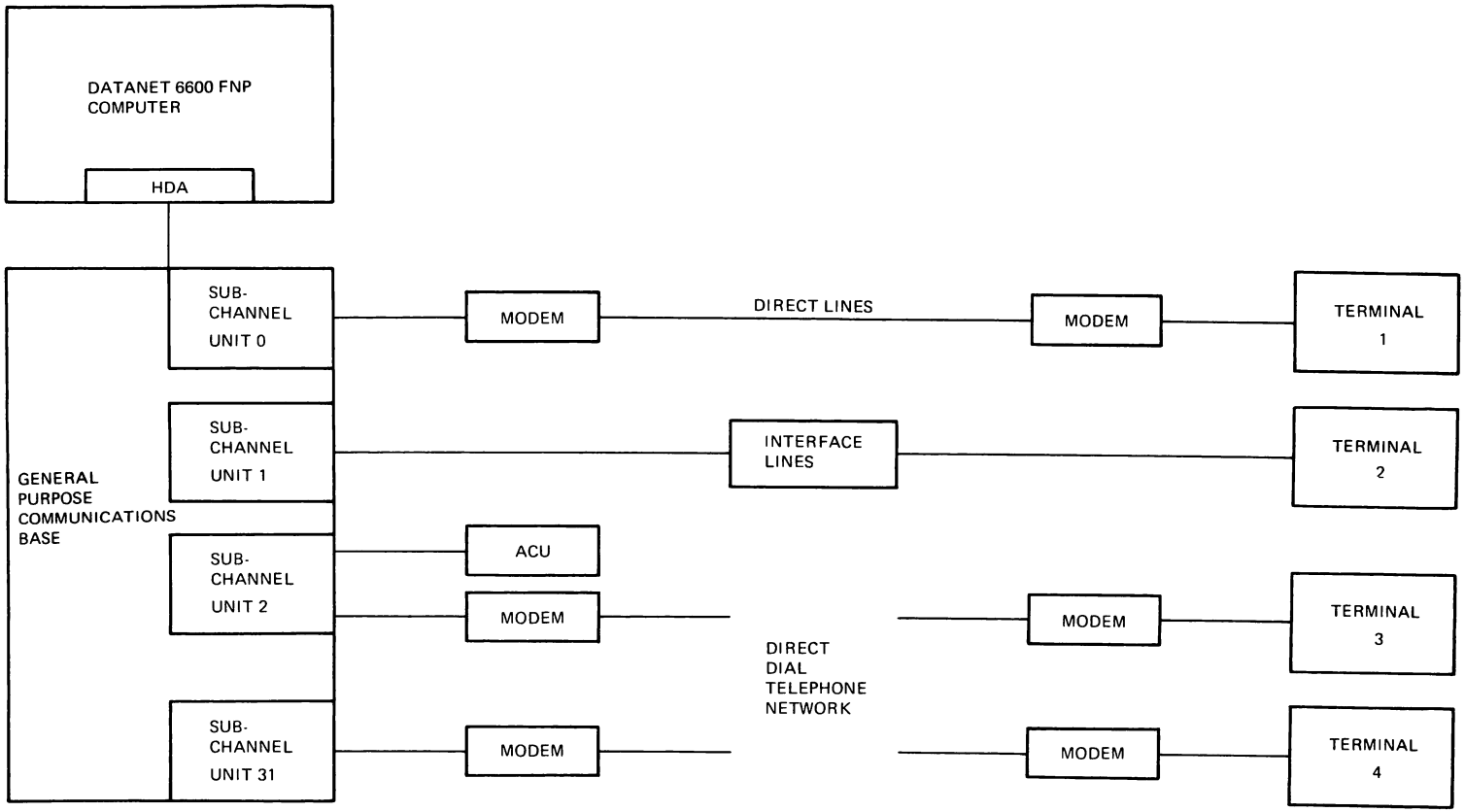

Figure 2-2. DATANET 6600 FNP GPCB Configuration

The subchannel is designed to respond to commands generated by the DATANET 6600 FNP program. These commands are used to control the subchannel configuration for operation in the various code/transparency combinations possible in BSC, to control the operating state of the subchannel, and to control the data set attached to the subchannel. Special commands facilitate testing the subchannel in the wraparound mode by disabling hardware functions that generate and delete certain characters.

The subchannel reports both subchannel and data set status to the DATANET 6600 FNP program when requested, or spontaneously in special situations.

GPCB Terminal Equipment

Table 2-3 shows the types of terminals that can be connected to HSLA subchannels with information concerning applicable communications adapters.

ASYNCHRONOUS COMMUNICATIONS BASE

The Asynchronous Communications Base (ACB) is a communications controller that provides time-division (time slot) multiplexing by character, for up to 52 low-speed terminals operating at speeds up to 110 bps, or 26 terminals operating at speeds of up to 150 bps, or 17 terminals operating at speeds of up to 300 bps.

Terminals with different transmission speeds can be mixed on a single ACB. Operation is full or half duplex for asynchronous data transfer.

The standard ACB is wired for 110/134.5/150/300 asynchronous baud rates with optional rates of 50/75/100/200 baud available. ACB options offering different combinations of baud rates and Baudot codes for European applications are available. Option DCF6024 (4WLSK354AA) provides baud rates of 75/110/150/300 with Baudot code at 75 baud, option DCF6023 (4WLSK353AA) provides baud rates of 50/75/110/200 with Baudot code at 50 and 75 baud, and option DCF6022 (4WLSK352AA) provides baud rates of 50/75/100/200 with Baudot code at 50 and 75 baud.

Table 2-3. GPCB Terminal Equipment

Terminal	Communications Adapter	Communications Device (MODEM)
DATANET-760	DLC765, DLC766, DLC760	Bell 201 A/B Bell 202C
G-105/115	DATANET-10	Bell 201B1 Milgo 4400/48 Milgo 4400/24
G-115/130	DATANET-12	Bell 303C
Teleprinter Equipment		
DATANET-730	None	None
Teleprinter Model 33	None	Bell 101C
Teleprinter Model 35	None	Bell 101C
Teleprinter Model 37	None	Bell 103 (or equivalent)
IBM 2741	None	Bell 103 (or equivalent)
TermiNet-300	None	Bell 103 (or equivalent)
IBM 2780	DCF6015	Bell 201 (or equivalent)

The DATANET 6600 FNP is interfaced to the ACB by a Synchronous Line Adapter (SLA) as shown in Figure 2-3. The SLA consists of a single wire-wrap board (WWB) located in the DATANET 6600 FNP cabinet.

The ACB has a line side (multiplexed data) to interface the DATANET 6600 and a subchannel side to interface the data sets. It combines a single character (or group of characters) from each of up to 52 remote teleprinter terminals (subchannels) into a single frame of characters. This frame is then sent to the DATANET 6600 FNP. The frame is sent continuously, whether or not any data is available from the subchannels. If no data is available, a fill character (FIL) is sent in that character position to preserve the integrity of the frame. The FIL (the ASCII character US) is ignored by the DATANET 6600 FNP program.

The DATANET 6600 FNP formats a frame in a similar manner, which is sent via the SLA to the ACB. The character positions are demultiplexed by the ACB and routed to the appropriate subchannel at the proper asynchronous speed.

- The Asynchronous Communications Base - Type 1 supports asynchronous lines at speeds up to 300 bps. The quantity of lines is a function of speeds selected; the maximum, at speeds up to 150 bps, is 24 lines. At 300 bps, the quantity becomes 17. One Type 1 Base is included with any DATANET 6600 FNP. There is no option providing additional Type 1 Bases.

- The Asynchronous Communications Base - Type 2 supports asynchronous lines at speeds up to 300 bps. The capacity Type 2 Base exceeds that of Type 1, although line speed mix determines actual quantities. At speeds up to 110 bps, capacity is 52 lines; at 300 bps, 17 lines is maximum. The Type 2 Base is available as a priced option only on DCP6632.

ACB Terminal Equipment

Table 2-4 shows the terminals that are serviced by the ACB. Any combination of this list can be used. All low-speed inputs are a maximum of 300 bps in an asynchronous mode.

Table 2-4. ACB Terminal Equipment

Terminal	Typical Modem
DATANET-730	None
Teleprinter Model 33	Bell 101C
Teleprinter Model 35	Bell 101C
Teleprinter Model 37	Bell 103
IBM 2741	Bell 103
TermiNet-300	Bell 103
Or terminals having same operating characteristics as the above.	

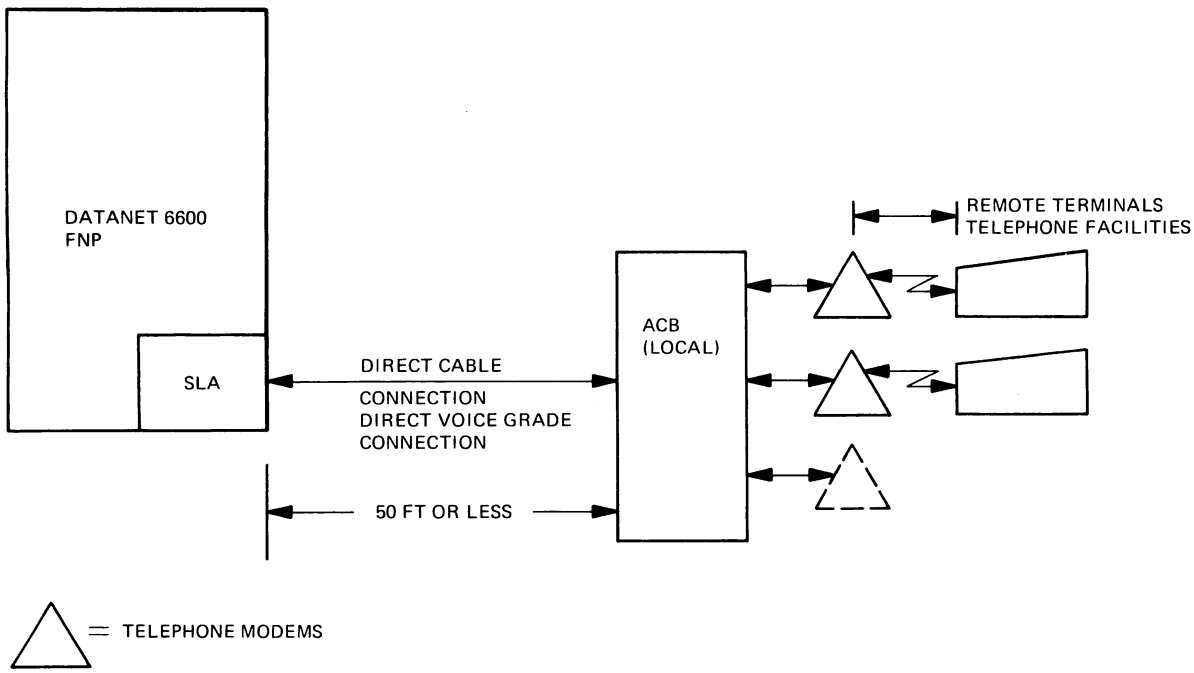

Figure 2-3. DATANET 6600 ACB Configuration

DATA COMMUNICATIONS

Data communications is basically the transfer of encoded data between two or more points via one or more types of electrical transmission mediums such as telephone, telegraph, microwave, etc. As described in this manual, data communications requires a data set to interface the computer equipment with the transmission system. The elements a basic data communications sytem may contain are shown in Figure 2-4.

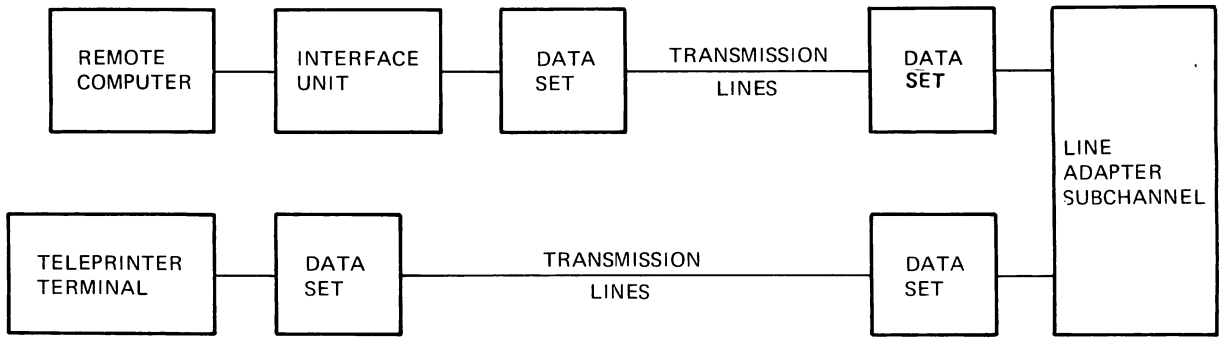

Figure 2-4. Data Communications Interface

Interface Units

The terminal originates and is the final recipient of the data. When the terminal is a remote computer system, an interface unit (SLC112 or SLC113) must interface the terminal and the data set (modem). The interface unit converts parallel 8-bit characters to bit serial format for transmission to the data set.

Data Sets

In transmit mode, the data set converts incoming digital data to a signal suitable for transmission over a common carrier system. In receive mode, the data set converts the line signal to a format

acceptable to the interface unit or the terminal. This process permits the transmission of data, in signal form, over long distances, via electrical transmission media of all types. The data sets used on a line must be compatible with one another.

Transmission Lines

Transmission lines link the terminals and the DATANET 6600 FNP. The following transmission lines, classified according to transmission rates, are typical of the services used with the DATANET 6600 FNP. The characteristics of this service may vary depending upon the data sets used in the system.

- 2000 bps - Standard telephone service, usually referred to as a Common Carrier Switched Network (CCSN) line.
- 2400 bps - Private, leased telephone line provided by communications common carriers.
- Telpak (40,800 bps) - Special service for large volume, high-speed, point-to-point transmission of data.
- 110 bps - Any line capable of at least 100-bps data transfer (includes voice-grade line).

The 2000-bps CCSN line provides the type of telephone service available to the general public for personal use. This class of service allows any one of the many subscribers to connect with any of the other subscribers.

The 2400-bps line is also referred to as a voice-grade line even though it operates at a slightly higher transmission speed. However, its big advantage is that it is a restricted private line.

TELPAK is a high-speed, broadband communications line, capable of handling large volumes of data at high data transfer rates (40,800 bps). It provides a special type of point-to-point service.

SOFTWARE CONSIDERATIONS

The Series 60 Level 66 system software is GCOS. It is the operating system which supervises the overall programming and operation of the system. The DATANET 6600 FNP operates under the Network Processing Supervisor (NPS[1]) software. NPS as an extension of GCOS provides the communication capabilities for the Series 60 Level 66 system operating under GCOS.

Network Processing Supervisor - NPS

The Network Processing Supervisor (NPS) software under which the DATANET 6600 FNP operates is an associated three-part routine to GCOS that controls the operation of the remote system. The control program resides in the three hardware systems.

- NPS/6600 in the DATANET 6600 Front-End Network Processor
- NPS/66 in the central computer system
- NPS/100 in the remote computer terminal (G-100)

NPS/6600 Control Program

NPS/6600 controls the operation of the DATANET 6600 FNP as it performs the following functions:

1. Receives and processes information from remote terminals. NPS/6600 allows any type of job to be submitted from a remote terminal for input to a central computer system. All or part of the output may be directed to the originating terminal, to specified terminals, or to be output at the central computer system.

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[1] Series 60 (Level 66)/6000 Remote Terminal System Manual (GRTS) (Order No. DD40)
Series 60 (Level 66)/6000 GRTS/355 and GRTS/6600 Startup Procedures (Order No. DD05)
Series 60 (Level 66)/6000 Network Processing Supervisor (NPS) (Order No. DD48)
Series 60 (Level 66)/6000 NPS Startup (Order No. DD51)
Series 6000 Introduction to Network Processing Supervisor, NPS/355 (Order No. AA46)

2. Allows a slave (user) program, executing in the central system, to communicate with a teleprinter terminal in a direct-access mode of operation.

3. Permits the use of a mixture of communications lines (2000 - 50,000 bits per second for synchronous transmission; 110 - 1800 bits per second for asynchronous transmission), which can handle a variety of terminals.

4. Permits a terminal user at a remote location to communicate with GCOS and request specific system action.

5. Safeguards access to the central computer system by requiring a password from the terminal when communication is established.

6. Allows a terminal operator to disconnect after inputting a program and its data, and to reestablish the connection later in order to request the output.

7. Formats batch input from remote computer terminals into standard 320-word blocks that are compatible with GCOS file format.

8. Formats batch output from the central computer system into line format for transmission to the remote computer terminals.

The Direct Access (DAC) capability of NPS/6600 enables a program in the central computer system to communicate directly with a terminal. Once the DAC connection has been established, NPS/6600 passes messages back and forth between the terminal and user program as the program is executed.

NPS/66 Program

The NPS/66 program is made up of a group of GCOS modules in the Series 60 Level 66 system. Although they are an integral part of GCOS, these modules operate as a software system to handle NPS activities in the central computer system.

Basically, NPS/66 provides the software interface between GCOS in the central computer system and the NPS/6600 program in the DATANET 6600 FNP. It facilitates input, execution and output of jobs transmitted to the computer system by the remote terminals, and works with the other NPS system components to provide terminal users the same functions that would be available to them at the central computer site.

NPS/100 Program

The NPS/100 program is the software interface between a G-115 remote computer terminal and the NPS/6600 software in the DATANET 6600 FNP. The NPS/100 program may take either of two forms, depending on the configuration of the data communications system linking the terminals and the DATANET 6600 FNP.

- NPS/100 FNP Voice Grade - for a remote computer terminal with a Single Line Controller SLC113 or SLC114.

- NPS/100 TELPAK - for a remote computer terminal with a Single Line Controller SLC112 interface unit (40,800 bits per second transmission rate).

NETWORK PROCESSING SUPERVISOR - NPS/6600

NPS/6600 for the DATANET 6600 FNP is a new software system designed especially for network processing. It offers to the user a new level of control over remote information processing. Used with the Series 60 Level 66 system operating under GCOS, the multidimensional processing concept for all types of terminals is supported within a single information network. All functions and features of GRTS/355 are incorporated into NPS/6600, therefore the major difference of the two software systems would be the following new features of NPS:

- Integration of front-end network processing functions with message switching functions.

- Complete data and system integrity protection including an automatic restart/recovery system and support of fail safe configurations consisting of dual DATANET 6600 FNPs.

- Supervisor control and statistical recording/reporting functions which make it easy to monitor events in the network and exert control over these events when necessary.

- Customization features which make it simple and fast to configure the set of NPS/6600 software modules required in each network.

- Device control parameterization, which makes it easy to add new terminal types and new line disciplines to NPS/6600.

DATANET 6600 FNP SUPPORTING SOFTWARE

The support software consists of several programs: MAP, SIM, GPACK, RLOD, TOLTS/COLTS and T&D.

MAP

The DATANET 6600 Macro Assembly Program (MAP)[1] operates on any Series 60 Level 66 computer under the standard Comprehensive Operating Supervisor (GCOS) utilizing the input/output services of the File and Record Control program.

The Assembler translates symbolic language programs into absolute or binary relocatable machine instructions. It combines the convenience of a compiler with the flexibility of an assembler. It provides the ability to design desired macros; thus providing a convenient shorthand notation for more complete or repeated instruction patterns. Assembler features include:

- Set of 98 instructions that include:

  Boolean
  Algebraic
  Shift

[1] Series 60 (Level 66)/6600 DATANET 6600 Macro Assembler Program (MAP) (Order No. DD01)

- Set of pseudo-operations including:

  Storage allocation
  Output control
  Symbol defining
  Data generating
  Conditional assembly
  Program linkage
  Location counter control

- Compressed source program deck (COMDK)

- Insertion, correction, and deletion of source programs using the $ ALTER control card.

- Indirect modifier

- Built-in macro instructions (CALL, RETURN, SAVE)

SIM

The Simulator (SIM) is a program that executes on any Series 60 Level 66 computer under GCOS and uses the generalized input/output services of the File and Record Control program. It simulates all DATANET 6600 processor and common peripheral input/output instructions.

GPACK

The General Utility PACKage (GPACK) is a basic set of common subroutines programmed with a limited subset of the instruction repertoire (for program reliability). GPACK loads absolute format object programs; processes processor faults; dumps core and processor registers; interfaces with the card reader, line printer, and teleprinter providing exception processing procedures for each device (similar to those found in GCOS).

RLOD

The Relocatable LOaDer (RLOD) is a general purpose loader whose primary function is to initiate an execution activity. RLOD loads both absolute and relocatable subprograms. Its most extensive use is for loading relocatable subprograms from various sources and tying them together such that the subprograms execute as one program.

TOLTS/COLTS (Online Testing)

The Series 60 Level 66 system executing under control of GCOS uses the Total Online Testing System (TOLTS)[1] as an approach to improving maintainability and availability. This concept features Online Test and Diagnostic Programs operating concurrently with the user programs. The "Online" version used to test the DATANET 6600 FNP executing under control of NPS/355 (Network Processor Supervisor) is the Communications Online Testing System (COLTS). COLTS is one of the four major test subsystems that makes up TOLTS which in turn is an integral part of the operating software GCOS.

COLTS/TOL (Total Online) provides the capability of testing the DATANET 6600 adapters and remote devices in an online environment with GCOS and NPS/355. This can be accomplished without disturbing the customer operation also using GCOS and still test the DATANET 6600 Line Adapter Subchannels or a remote terminal such as the DATANET 760.

Offline Test and Diagnostic System

The Offline or Stand Alone tests are used when the DATANET 6600 FNP is not connected to the central system. Offline tests are loaded into the DATANET 6600 FNP via tape cassettes.

Several T&D Tape Cassettes are available for specific testing functions of the DATANET 6600 FNP as follows:

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[1] Series 60 (Level 66)/6000 Total Online Testing System (TOLTS) Reference Manual (Order No. DD39)
Series 600/6000 Total Online Testing System (TOLTS) Test Pages (Order No. DA73)

- PAS - covers testing of the DATANET 6600 FNP processor, System Controller, IOM functions and BOS.
- I/O1 - covers testing IOS, HSLA (GPCB), BSC and SLA/LSLA (ACB).
- I/O2 - covers testing IOS, Console, Cassette Phase 2, Multi-I/O, DIA, ICA, Remote Teletype and Card Reader.
- I/O3 - covers testing IOS, CIA, DCA, PSA, CPH, MRS200, DRD236, LFA, CMA, RLP300/DN355, HSLA/UIP785 and Cassette Phase 1.
- MEM 1 - covers testing 355 Core Store.
- MEM 2 - covers testing 355 core store MOS.

SECTION III
OPERATING INSTRUCTIONS

SUBSYSTEM CONSIDERATIONS

DATANET 6600 Front-End Network Processor operation is actually controlled by the software except for occasional operator interventions. The operator duties and responsibilities in regard to the DATANET 6600 system will normally be governed by the rules and regulations in effect for the Series 60 Level 66 system on the site. All subsystem maintenance required on the equipment will be performed by the Honeywell Field Engineer, except routine site cleaning which will be the responsibility of the operating personnel.

Emergency Conditions

A procedure should be established and be thoroughly familiar to all operating and maintenance personnel in the event an emergency occurs. The type of emergency situation would naturally govern the course of action but personnel safety would have priority even over equipment damage. Several types of emergencies may occur such as:

- Injury to personnel
- Equipment failure
- Damage to facilities (fire, earthquake, flood, etc.)
- Utilities failure

Emergency Shutdown

The operator should be thoroughly versed in emergency shutdown procedures in the event of danger to personnel or equipment.

If the danger is confined to one cabinet or console, the operator should turn off the main circuit breaker on that cabinet or console.

In the event the entire site is endangered or has become a hazard, turn off the main power circuit breaker that controls power to all equipment in the computer room. This varies from site to site, so it is the operator's responsibility to learn where the power control panel is located.

NOTE

Turning off the power source to a computer system can be an extremely costly and sensitive operation. The operator, site supervisor, customer and maintenance supervisor should have a common understanding of what constitutes an emergency.

Any emergency action must be logged and generally rates a detailed report by the operator. However, this would be covered by this site procedure.

Injury to Personnel

In the event of injury to personnel, follow the listed procedures and:

- Allow only individuals with approved first aid training or medical training to treat or attend the injured party.
- If conditions indicate a prolonged delay in resuming operations, follow the normal shutdown procedures.

Equipment Failure

In the event of equipment failure, the operator will take immediate action to prevent further damage. For example, overheating components detected by an unusual odor or smoke. Proceed with the following action:

- If the trouble can be quickly and certainly related to a particular equipment cabinet, remove power from that cabinet only.
- If the trouble cannot be isolated, initiate power-down procedures and notify the site supervisor immediately.

Facility Damage

Damage to facilities can result from fire, flood, explosions, and a variety of other unexpected causes. Procedures for shutting down the system depend on the urgency of the situation; that is whether:

- Its effect on the computer system or FNP is immediate.
- It will occur within a definable time.
- It is directly concerned with continuing operation.

In reaching a decision, the operating staff must consider the importance of saving data in the system against the amount of time remaining before power must be turned off.

Power Failure

Check to make sure that the failure is not a momentary, tolerable power fluctuation. The power supply in the DATANET 6600 has a power failure alarm. In case of momentary power fluctuation, the alarm stops ringing when the ALARM RESET button on the Computer Operator's Panel is pressed. In this event, record a "momentary tolerable power fluctuation" in the facility log. In case of a prolonged power failure, proceed with the following instructions.

If the FNP is remote from the central computer or for other reasons has its own motor generator, check to make sure that the motor generator turned off automatically. If this did not occur turn it off.

A complete loss of power causes the motor generator to shut down. This type of power failure, that is, on the source side of the motor generator, allows safe store procedures to be automatically implemented.

When the power has been restored and power stability is assured (cause of power failure corrected and damage repaired), restart the motor generator by holding the START pushbutton down for approximately 10 seconds or until the motor generator can be heard to start.

Once the motor generator has started, check the voltmeter mounted at one end of the motor generator. When the voltmeter indicates 118 volts, wait at least 30 seconds and then press the RESET button located next to the voltmeter. Pressing the RESET button applies technical power to the computer system or FNP.

Failure of Air Conditioning

Air conditioning failure may cause room temperature to rise beyond the safe operating limits of the equipment. The following action is recommended:

- Notify the appropriate service engineer and site supervisor. Make sure the facility maintenance staff is notified of the problem.

- If the room temperature rises above 85 °F (approximately 24.9 °C), notify the site supervisor and/or maintenance supervisor. It may be necessary to shut down until normal operating temperatures return.

- If the site supervisor or maintenance supervisor orders a shutdown, follow the normal shutdown procedure.

Safety

Personal safety cannot be overemphasized. The operator should never attempt to run the units with cover, shrouds, or panels removed, both for his own safety and to prevent damage to the equipment.

Operator Duties

The operator's duties are concerned generally with the online operations. These duties such as observing the indicators on the Control Panel, and turning the equipment on and off are described in detail as follows:

- Turn power ON from the Operator Panel by pressing the POWER ON pushbutton/indicator.

- If the NORMAL indicator fails to light and the TEST indicator lights, set the MAINTENANCE PANEL MODE TEST/NORMAL switch on the SYSTEM CONFIGURATION section of the Maintenance Panel to the NORMAL position.

- Monitor the Operator Panel for trouble indications. When trouble indications are observed, the operator should attempt to correct the trouble if possible. If he cannot correct the trouble, he should notify the Honeywell Field Engineering Representative.

- When software or hardware changes take place to either the DATANET 6600 FNP or the Series 60 Level 66 system, consideration should be given to the configuration section of the Direct Interface Adapter (DIA). Such changes may necessitate revising the system configuration of the switches on the panel.

- Turn power OFF from the Operator Panel by pressing the POWER OFF pushbutton/indicator.

System Controls and Indicators

Controls and indicators for the DATANET 6600 consist of operating, configuration, and maintenance switches and operational status display lamps. Operating controls and indicators are used during the normal daily operations of the system and are easily accessible and visible to operations personnel. The DATANET 6600 configuration switches are set during the initial installation or reconfiguration of the FNP and are not easily accessible to prevent changing the state of these switches during normal operation. The Series 60 Level 66 system is assumed to be properly configured for normal operation with the DATANET 6600 FNP. The maintenance switches and indicators are for the exclusive use of the service engineer for offline maintenance and are not easily accessible. The description of controls and indicators other than the normal operating controls and indicators is beyond the scope of this manual. Operating controls and indicators for each device are describe in detail in the following sections.

OPERATOR PANEL

The DATANET 6600 FNP and Communication Interface Base Free-standing Cabinet are equipped with identical sets of indicators and pushbutton/indicators for starting and stopping the device. These operator controls are described below: See Figure 3-1.

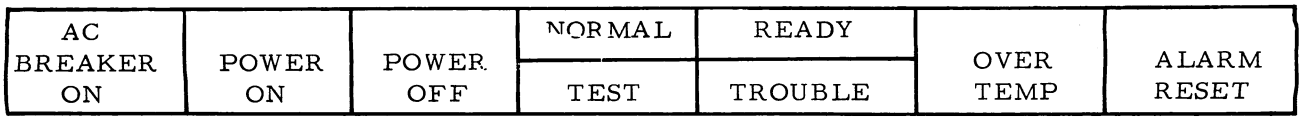


Figure 3-1. Operator Panel

- AC BREAKER ON, indicator. The red AC BREAKER ON indicator lights when the primary power circuit breaker of the AC Power Panel is turned on.

- POWER ON, pushbutton/indicator. Pressing the POWER ON pushbutton turns on the cabinet power, lights the amber POWER ON indicator and extinguishes the POWER OFF indicator.

- POWER OFF, pushbutton/indicator. Pressing the POWER OFF pushbutton turns off the cabinet power, lights the green POWER OFF indicator and extinguishes the POWER ON indicator.

- TEST/NORMAL, indicator. The amber/green TEST/NORMAL indicator shows the position of the Maintenance Panel TEST/NORMAL switch which determines the operational condition of the cabinet. The green NORMAL indicator lights when the switch is in the NORMAL position for online operation. If the switch is in the TEST position for testing purposes the amber TEST indicator lights.

- READY/TROUBLE, indicator. The green READY indicator shows that the cabinet is in an operational condition. If there is a logic or power supply malfunction, the red TROUBLE indicator lights.

- OVER TEMP, indicator. The red OVER TEMP indicator lights when a temperature in excess of 60 °C is detected by the sensors on the logic racks or in the power supply. If an over temp sensor detects an overtemperature condition, it energizes an over-temperature circuit that lights the OVER TEMP indicator and causes the Alarm to ring.

- ALARM RESET, pushbutton/indicator. An overtemperature or logic alert condition enables control circuits which lights the ALARM RESET indicator and sounds the Alarm Bell. Pressing the ALARM RESET indicator stops the Alarm Bell, but the over-temperature condition must be corrected to extinguish the OVER TEMP indicator.

System Initial Power-On Procedure

The following procedures apply to an initial power-up, or after a complete power turn-off. The normal daily turn-on and turn-off procedures are covered under Normal System Turn-On procedures immediately following this initial power-up sequence.

The motor generator (MG) set supplying power to the DATANET 6600 FNP must be on and up to speed before attempting to power up the DATANET 6600 FNP. If the MG set is not on, check the main circuit breaker supplying power to the MG set. Press the START pushbutton and hold it down for approximately 10 seconds or until you hear the MG running. Check the voltmeter; when the voltmeter indicates 118 volts, wait at least 30 seconds and then press the RESET pushbutton located next to the voltmeter. This applies technical power to the system.

DATANET 6600 FNP CABINET

1. On the DATANET 6600 FNP Power Supply:

   - Make sure that the LOCAL/REMOTE switch is in the LOCAL position. It is located on the Power Control Module, Figure 3-4.

2. On the AC POWER PANEL:

   - Switch the AC BREAKER ON. See Figure 3-2.

   - The Operator Panel indicators AC BREAKER ON, POWER OFF, TEST, and TROUBLE should light.

3. On Operator's Control Panel:

   - Press POWER ON button.

   - Check that READY indicator lights.

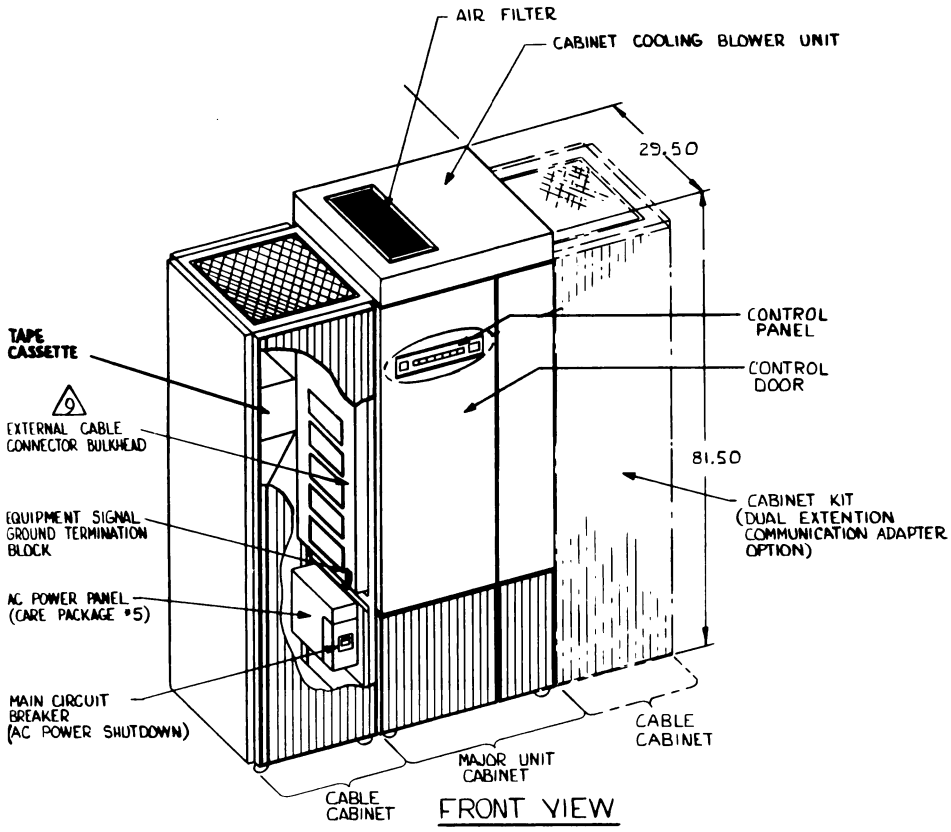
Communication Base Cabinet

The GPCB and ACB adapters are usually contained in the DATANET 6600 FNP cabinet. Some subsystem configurations with additional GPCB and/or ACB adapters and DATANET 6600 FNPs, have them housed in separate cabinets and in this event individual POWER ON sequences are required. Repeat steps 1 through 3 for each cabinet.

Normal System Turn-On Procedures

This procedure covers the normal daily turn-on procedures as may be required at the start of a shift, beginning of the work week, or after maintenance shutdown.

1. Press the POWER ON button on the DATANET 6600 FNP Operator's Panel.



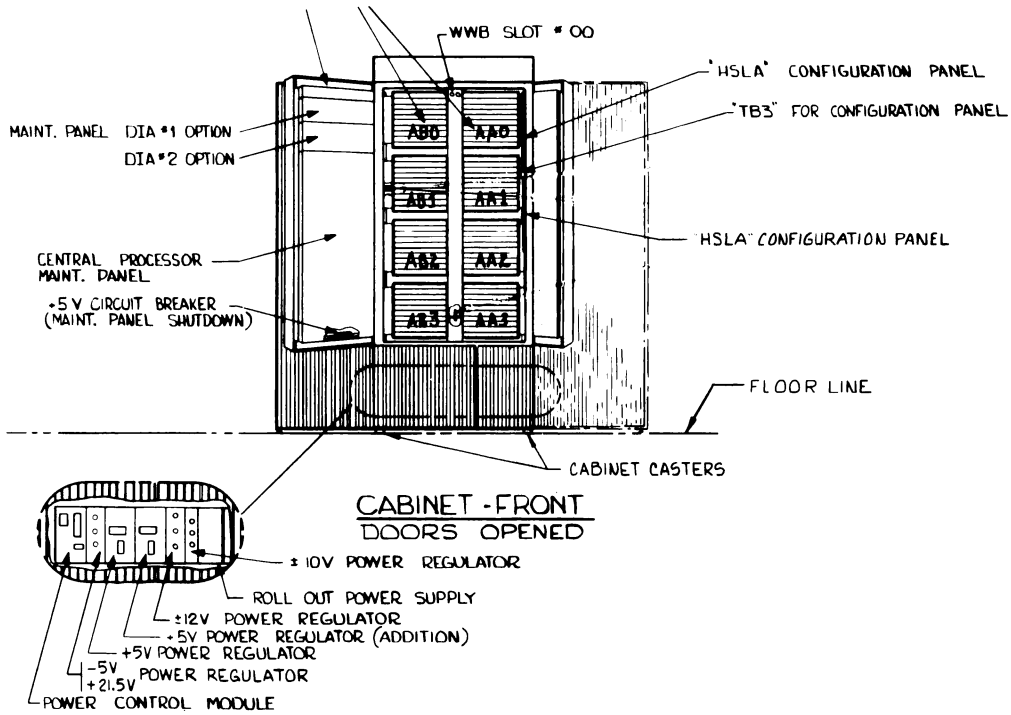
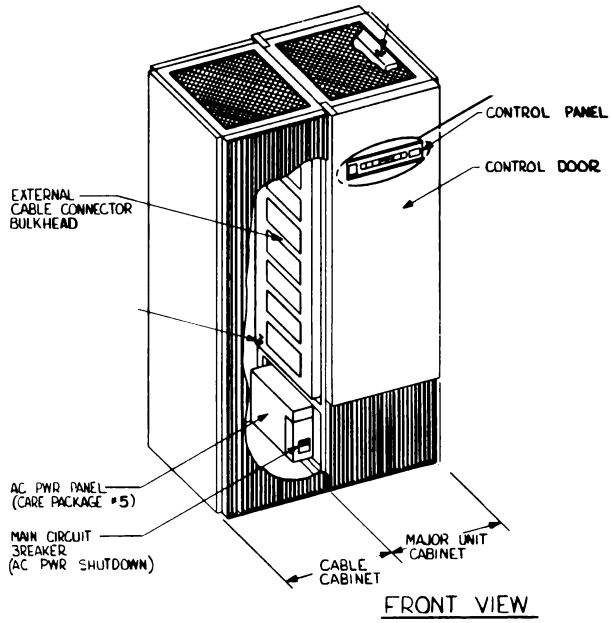


Figure 3-2. DATANET 6600 FNP Layout



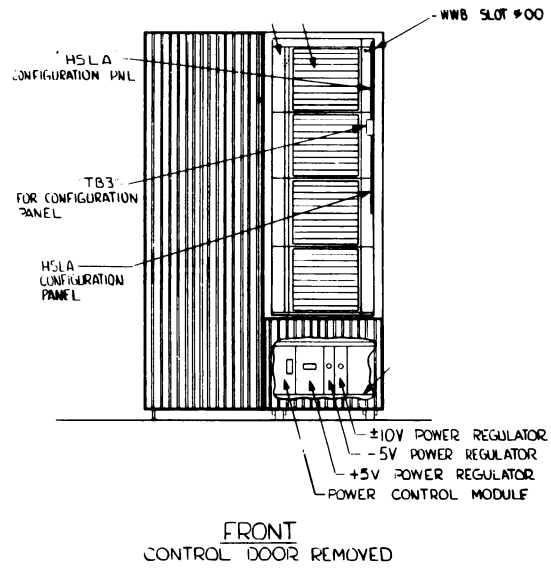


Figure 3-3. DATANET 6600 FNP Communications Base Cabinet Layout

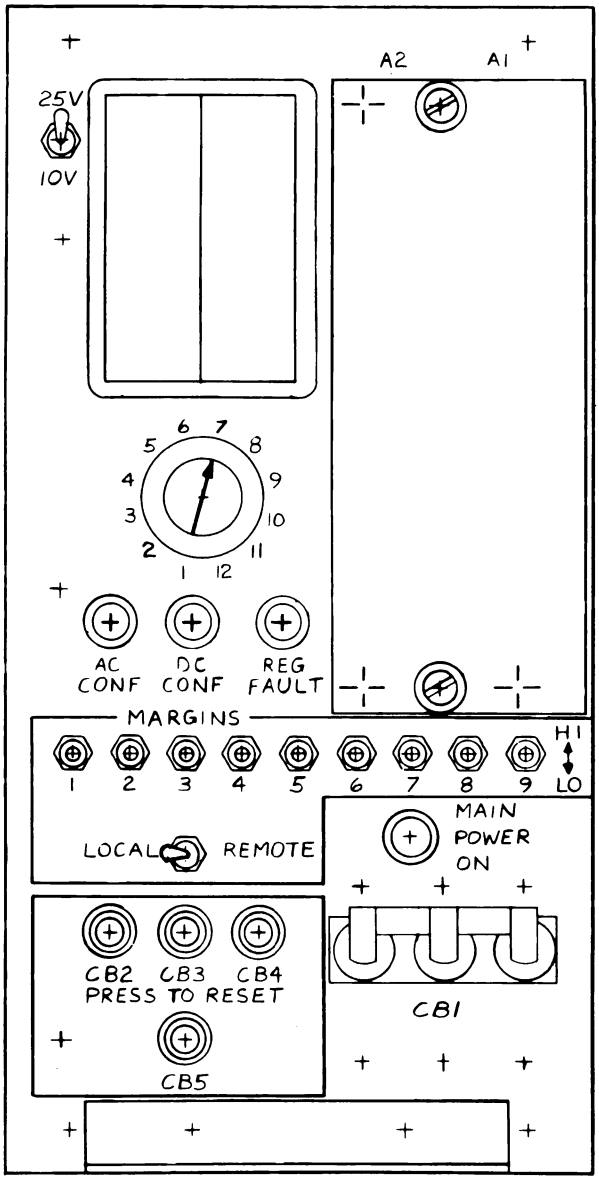


Figure 3-4. Power Control Module

2. Press the POWER ON button on the Communications Base Cabinet Operator's Panel.

3. Power UP all the peripherals on the system.

Normal System Turn-Off Procedures

The operator generally needs to be concerned only with the normal turn-off procedures, as opposed to the complete power-down procedures which may be required in an emergency or for prolonged shutdown.

To turn off the equipment use the operator control panels on each equipment cabinet.

1. Press the POWER OFF button on the DATANET 6600 FNP Operator's Panel.

2. Press the POWER OFF button on the Communications Base Cabinet Operator's Panel.

3. Power off all the peripherals on the system.

SECTION IV

CONFIGURATION CONTROLS

The Level 66 DATANET 6600 components (FNP, DIA, GPCB, ACB) have controls that logically configure the DATANET 6600 into a working communications system compatible with its software and with the Level 66 central system. The controls are set during the initial installation of the system and do not require adjustment during normal operation. However, adjustment may be required when hardware or software upgrades are made to the system or when the system requires reconfiguration. All of the DATANET 6600 configuration controls are described in the following paragraphs. No other controls should be adjusted or accessed except by a qualified field service representative.

FRONT-END NETWORK PROCESSOR (FNP)

The FNP configuration controls are mounted on the back of the cabinet left front door. The controls are labeled SYSTEM CONFIGURATION and are divided into four sections (see Figure 4-1).

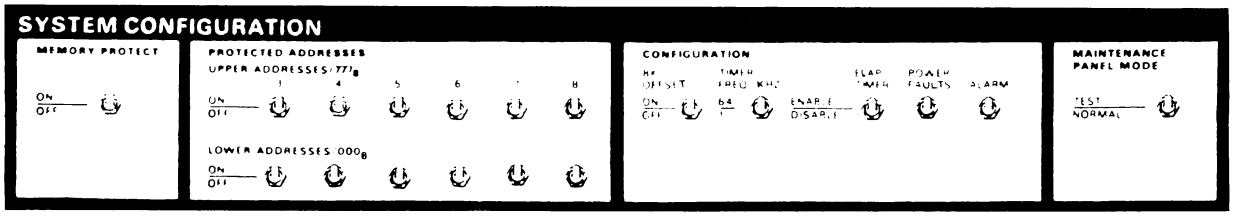


Figure 4-1. FNP Configuration Controls

MEMORY PROTECT Section

One toggle switch labeled ON/OFF. Set switch to OFF.

PROTECTED ADDRESSES Section

Two sets of six toggle switches labeled UPPER ADDRESSES/777_8, LOWER ADDRESSES/000_8, 3, 4, 5, 6, 7, 8, ON/OFF. Set all switches to OFF.

CONFIGURATION Section

Five toggle switches that are labeled and to be set as follows:

- 8K OFFSET ON/OFF. Set switch to OFF.
- TIMER FREQ (KHZ) 64/1. Set switch to 1.
- ELAP TIMER ENABLE/DISABLE. Set switch to ENABLE.
- POWER FAULTS ENABLE/DISABLE. Set switch to ENABLE.
- ALARM ENABLE/DISABLE. Set switch to ENABLE.

MAINTENANCE PANEL MODE Section

One toggle switch labeled TEST/NORMAL. Set switch to NORMAL.

DIRECT INTERFACE ADAPTER (DIA)

The DIA is equipped with one of two different sets of configuration controls. One set (on early FNP models) is mounted on the panel in back of the cabinet left front door; the other set (on later FNP models) is mounted on a free-edge connector connected to the LS circuit board.

DIA Configuration Controls (On Maintenance Panel)

This set of controls is labeled DIRECT INTERFACE ADAPTER and is divided into two sections labeled CENTRAL SYSTEM CONFIGURATION and 355 COMPUTER (see Figure 4-2).

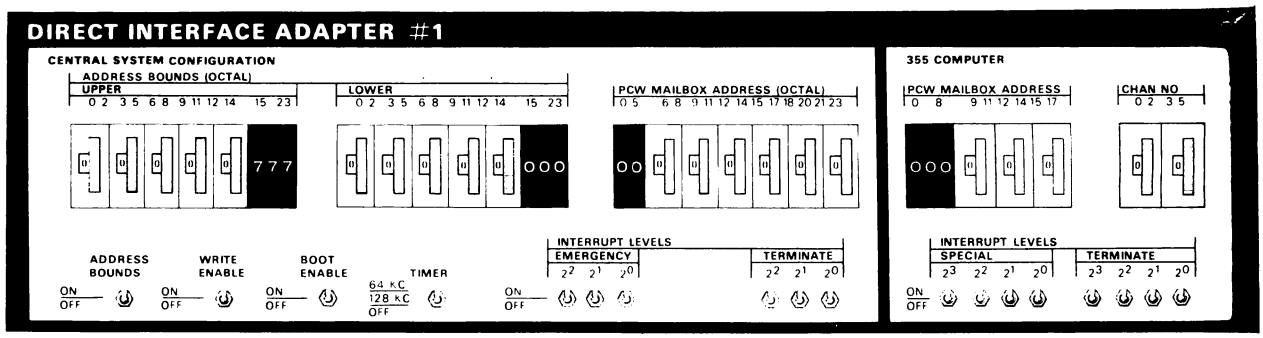


Figure 4-2. DIA Configuration Controls (Panel)

CENTRAL SYSTEM CONFIGURATION Section

This section contains three sets of thumbwheel switches and a row of toggle switches that are set as follows:

- ADDRESS BOUNDS (OCTAL) UPPER/LOWER. Two sets of thumbwheel switches. Set all UPPER switches to 7 and all LOWER switches to 0.

- ADDRESS BOUNDS ON/OFF. One toggle switch. Set switch to OFF.

- WRITE ENABLE ON/OFF. One toggle switch. Set switch to ON.

- BOOT ENABLE ON/OFF. One toggle switch. Set switch to ON.

- TIMER 64KC/128KC/OFF. One toggle switch. Set switch to OFF.

- INTERRUPT LEVELS EMERGENCY/TERMINATE ON/OFF. Two sets of three toggle switches. Set all switches to ON.

- PCW MAILBOX ADDRESS (OCTAL). One set of six thumbwheel switches. The setting of these switches depends on the number of central system IOM/ICUs and the number of FNPs in the system. Set the switches according to Table 4-1.

Table 4-1. PCW Mailbox Address (Octal) Switch Settings

FNP No.	PCW/6000 MAILBOX ADDRESS (OCTAL) Central System IOM/ICU No.			
	0	1	2	3
0	002200	003000	003600	004400
1	002300	003100	003700	004500
2	002400	003200	004000	004600
3	002500	003300	004100	004700

355 COMPUTER Section

This section contains two sets of thumbwheel switches and a row of toggle switches that are set as follows:

- PCW MAILBOX ADDRESS. Three thumbwheel switches. Set the switches to 454 unless otherwise specified by the programmer/system analyst. The address range for these switches is from 454 to 500 octal only. The starting address must be even and it must be one of every fourth one. For example, 454, 460, 464, 470, 474.....500.

- CHAN NO. Two thumbwheel switches. Set the switches to 04 unless otherwise specified by the programmer/system analyst.

- INTERRUPT LEVELS SPECIAL/TERMINATE ON/OFF. Two sets of four toggle switches labeled 2^3, 2^2, 2^1, 2^0. Set the switches as follows:

SPECIAL	TERMINATE
2^3 OFF	2^3 OFF
2^2 OFF	2^2 OFF
2^1 ON	2^1 ON
2^0 ON	2^0 OFF

DIA Configuration Controls (LS Free-edge Connector)

These controls are miniature rocker and slide switches that are divided into eight sections (see Figure 4-3).

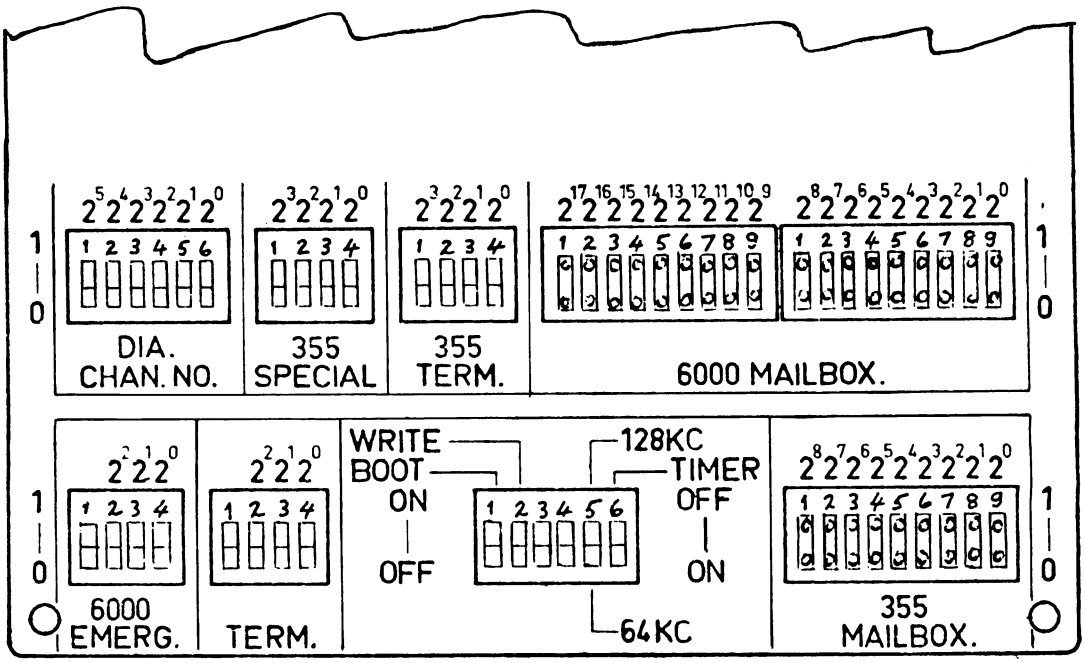


Figure 4-3. DIA Configuration Controls (LS Free-edge Connector)

DIA CHAN. NO. Section

Six slide switches. Set switches to 04 octal as follows unless otherwise specified by the programmer/system analyst:

	0			4		
Switch:	1	2	3	4	5	6
Setting:	0	0	0	1	0	0

355 SPECIAL Section

Four slide switches. Set switches as follows:

Switch:	1	2	3	4
Setting:	0	0	1	1

355 TERM Section

Four slide switches. Set switches as follows:

Switch:	1	2	3	4
Setting:	0	0	1	0

6000 MAILBOX Section

Eighteen rocker switches. The setting of these switches depends on the number of central system IOM/ICUs and FNPs in the system. Set the switches according to Table 4-1. For example, for a system with one IOM/ICU and one FNP, the switches are set as follows:

	0			0			2			2			0			0		
Switch:	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
Setting:	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0

6000 EMERG Section

Four slide switches. Set all switches to 1.

TERM Section

Four slide switches. Set all switches to 1.

355 MAILBOX Section

Nine rocker switches. Set the switches to 454 octal as follows unless otherwise specified by the programmer/system analyst. The address range for these switches is from 454 to 500 octal only. The starting address must be even and it must be one of every fourth one. For example, 454, 460, 464, 470 ..... 500.

	4			5			4	
Switch:	1	2	3	4	5	6	7	8	9
Setting:	1	0	0	1	0	1	1	0	0

BOOT, WRITE, 128KC/64KC, TIMER Section

Six slide switches (two are not used) labeled BOOT, WRITE, 128KC/64KC, TIMER. Set switches as follows:

- BOOT to ON
- WRITE to ON
- 128KC/64KC to 64KC
- TIMER to OFF

GENERAL PURPOSE COMMUNICATION BASE (GPCB)

The GPCB configuration controls are mounted on a panel labeled HIGH SPEED LINE ADAPTER (HSLA) located behind the cabinet right front door. The controls are divided into three sections (see Figure 4-4).

ADDRESS BASE Section

One toggle switch labeled 1/2/3. For a system with only one GPCB set the switch to 1. For a system with two or three GPCBs, set each GPCB switch as follows:

GPCB No. 1 to 1
GPCB No. 2 to 2
GPCB No. 3 to 3

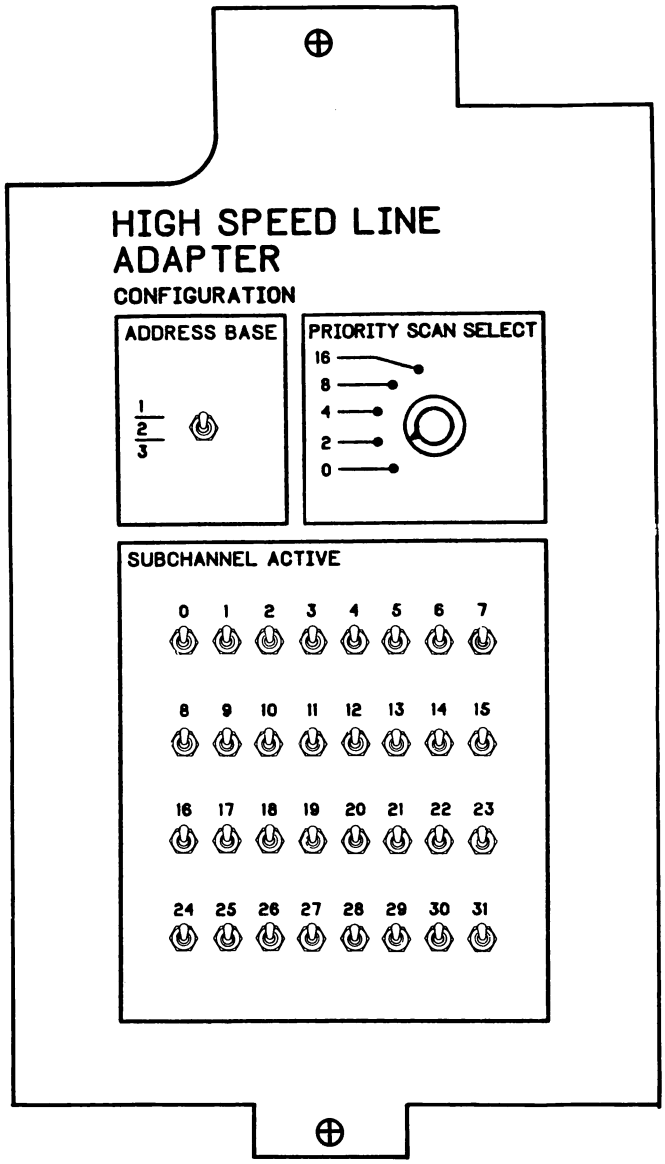


Figure 4-4. GPCB/HSLA Configuration Controls

PRIORITY SCAN SELECT Section

One rotary switch labeled 0, 2, 4, 8, 16. Set the switch to 0 when wideband channels are not in use.

SUBCHANNEL ACTIVE Section

Thirty-two toggle switches. Set switches to up position to enable the terminals connected to the corresponding lines.

The ACB configuration controls are mounted on a free-edge connector labeled LOW SPEED LINE ADAPTER CONFIGURATION that connects to the LSLCB circuit board. It has two toggle switches labeled VOICE GRADE SPEED HIGH/LOW and INCOMING FRAME LENGTH LONG/SHORT (see Figure 4-5). Set the switches as follows:

- VOICE GRADE SPEED to LOW (2400 baud) or HIGH (4800 baud) to agree with the content of the speed field of the $IOM card for the ACB.
- INCOMING FRAME LENGTH to LONG

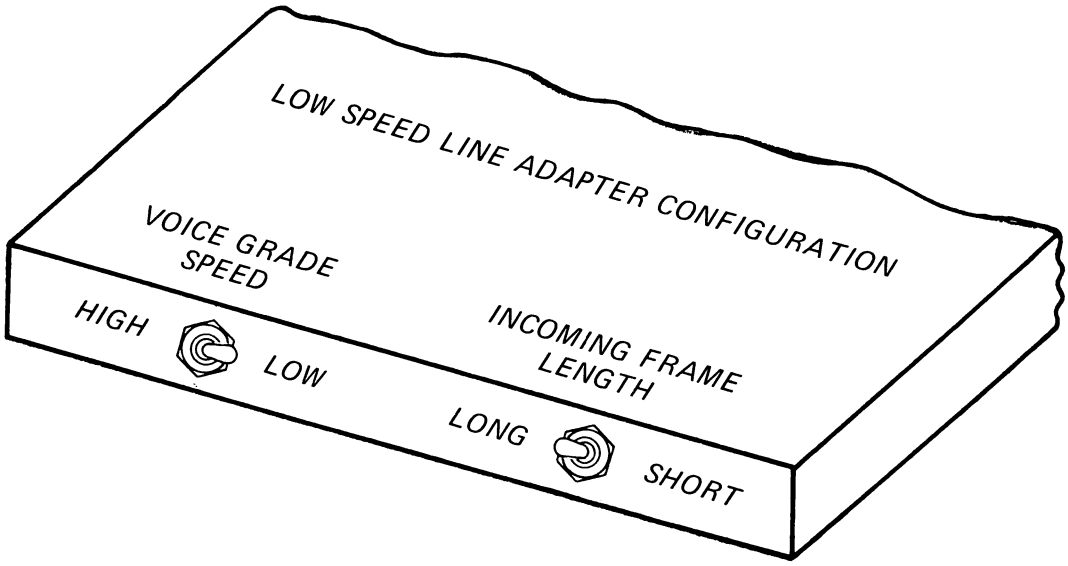


Figure 4-5. ACB/LSLA Configuration Controls

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ORDER NO. DC88, REV. 1

DATED MARCH 1979

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