TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

FOR

CENTRAL, MESSAGE SWITCHING,

AUTOMATIC AN/TYC-39(V)1

AND

CENTRAL OFFICE, TELEPHONE,

AUTOMATIC AN/TTC-39(V)2

AUTOMATIC DATA PROCESSING

ASSEMBLIES

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE
31 JANUARY 1983

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNINGS
DANGEROUS VOLTAGE

is used in the operation of this equipment
DEATH ON CONTACT

May result if personnel fail to observe safety precautions. Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas. Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

Do not be misled by the term "low voltage". Potentials as low as 50 volts may cause death under adverse conditions.

WARNINGS

USE OF CLEANING SOLVENT

Fumes of TRICHLOROTRIFLUOROETHANE are poisonous. Provide adequate ventilation whenever you use TRICHLOROTRIFLUOROETHANE. Do not use solvent near heat or open flame. TRICHLOROTRIFLUOROETHANE will not burn, but heat changes the gas into poisonous, irritating fumes. DO NOT breathe the fumes or vapors. TRICHLOROTRIFLUOROETHANE dissolves natural skin oils. DO NOT get the solvent on your skin. Use gloves, sleeves and an apron which the solvent cannot penetrate. If the solvent is taken internally, see a doctor immediately. For First Aid refer to FM21-11.

To be usable for cleaning, the compressed air source must limit the nozzle pressure to no more than 29 pounds per square inch gage (PSIG). Compressed air is DANGEROUS and can cause serious bodily harm. It can also cause mechanical damage to the equipment. DO NOT use compressed air to dry parts where cleaning compound has been used. Goggles must be worn at all times while cleaning with compressed air.

TECHNICAL MANUAL
NO. 11-5895-856-34-1
TECHNICAL MANUAL
EE640-CA-MMI-010/E154 CPU
TECHNICAL ORDER
T.O. 31W2-2T-122-1

DEPARTMENTS OF THE ARMY

THE NAVY, AND THE AIR FORCE

WASHINGTON, DC, *31 January 1983*

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

FOR

CENTRAL, MESSAGE SWITCHING, AUTOMATIC

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AN/TTC-39(V)2

AUTOMATIC DATA PROCESSING

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703.

For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward direct to prime ALCIMST.

For Navy, mail comments to the Commander, Naval Electronics Systems Command, ATTN: ELEX 8122, Washington, DC 20360.

In either case, a reply will be furnished direct to you.

LIST OF ILLUSTRATIONS

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes the maintenance data for the Automatic Data Processor (ADP) assemblies (figs. 1-1 and 1-2) which function as part of the Automatic Telephone Central Office (AN/TTC-39) Central Processor Group (CPG) and as part of the Automatic Message Switching Central (AN/TYC-39) Central Processor Group (CPG).

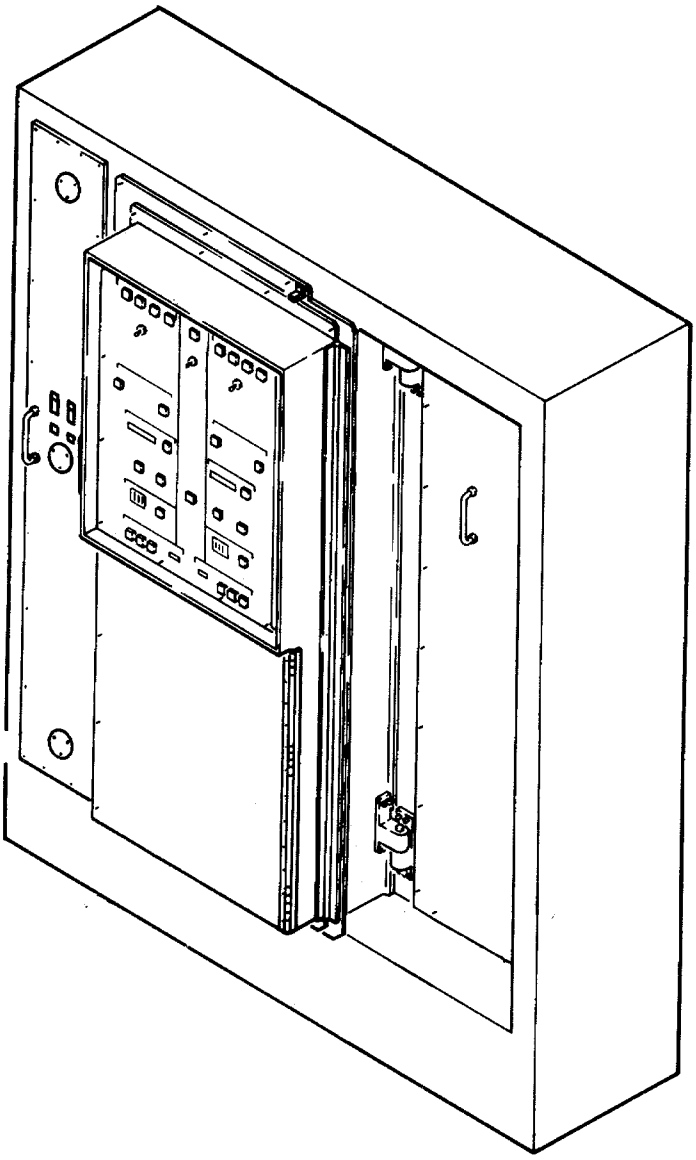


Figure 1-1. Circuit Switch Automatic Data Processor Assembly.

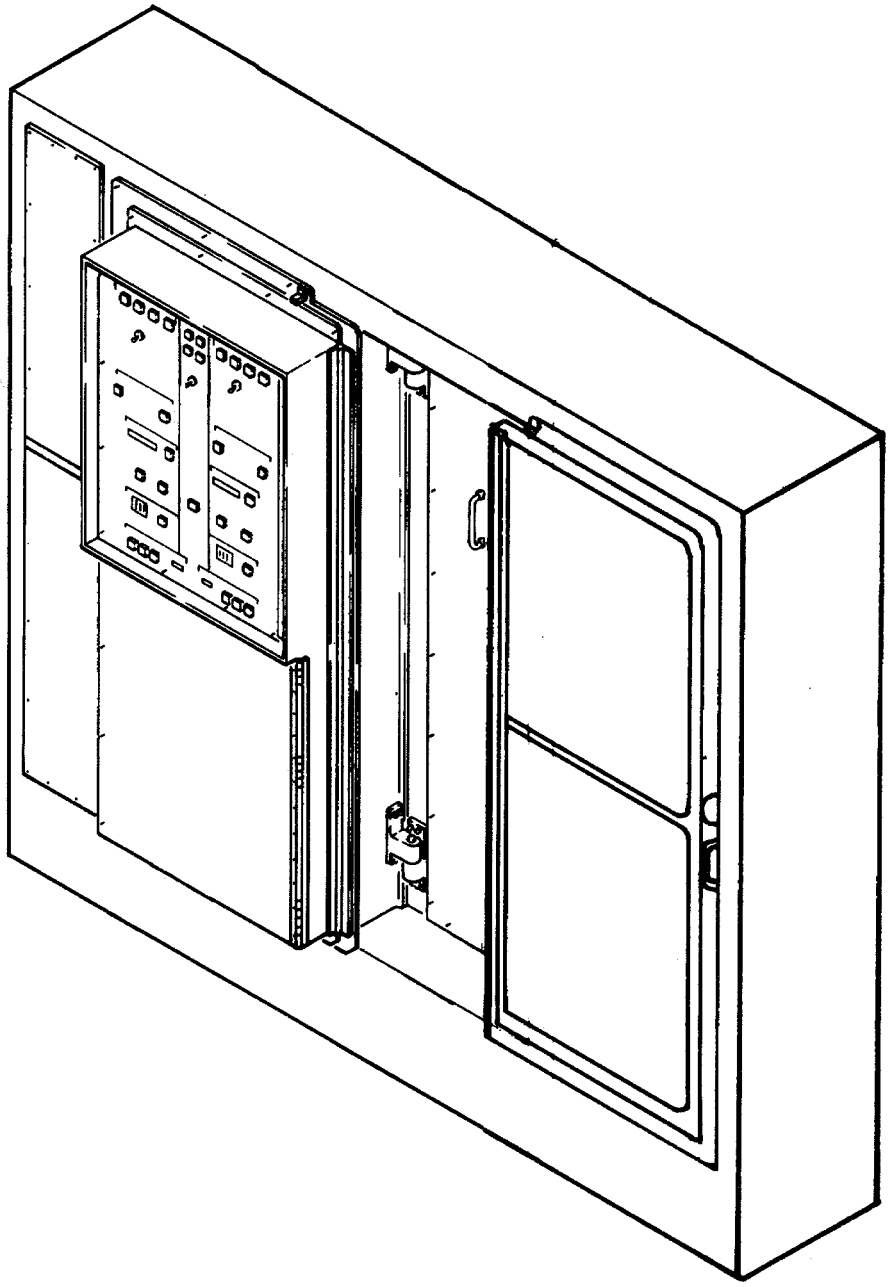


Figure 1-2. Message Switch Automatic Data Processor Assembly.

This manual contains information on the functioning of equipment and direct and general support maintenance instructions. A complete listing of reference publications is provided in Appendix A. The Maintenance Allocation Chart is located in Appendix B of TM 11-5805-681-12-2 and TM 11-5805-683-12-2. The Repair Parts and Special Tools List (RPSTL) is contained in TM 11-5895-856-34P. Throughout this manual, where appropriate, references are made to other publications which cover the installation, operation and maintenance of equipment used in conjunction with the CPG.

1-2. Consolidated Index of Army Publications and Blank Forms

a. Army. Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

b. Air Force. Use T.O. 0.1-31 Series Numerical Index and Requirements Table (NIRT).

1-3. Maintenance Forms, Records and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, the Army Maintenance Management System. Air Force personnel will use AFR 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) IAW OPNAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol 2, Chapter 17.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

1-4. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your Automatic Data Processor assembly needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

b. Air Force. Air Force personnel are encouraged to submit EIRs in accordance with AFM 900-4.

c. Navy. Navy personnel are encouraged to submit EIRs through their local Beneficial Suggestion Program.

1-5. Administrative Storage

Refer to TM 11-5805-681-12-1 or TM 11-5805-683-12-1, Administrative Storage, for information covering the administrative storage requirements of this system.

1-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-7. Description

Refer to Operator's and Organizational Maintenance Manual TM 11-5805-681-12-1 or TM 11-5805-683-12-1 for general description and illustration of the CPG.

1-8. Technical Characteristics

a. Central Processor Unit.

(1) Processing of arithmetic, logical, data handling and control instructions.

(2) Arithmetic and logical operations on bits, bytes (8 bits), half words (16 bits), and full words (32 bits) with I/O operations on bytes and full words.

(3) Privileged instructions to permit control of memory protection, I/O operations, real-time clock, and interrupts. Unauthorized use of a privileged instruction causes an interrupt.

(4) Semiprivileged instructions to permit control of program level communication. Unauthorized use of a semiprivileged instruction causes an interrupt.

(5) Priorities for up to 64 program levels with the capability to change from one level to another in response to an interrupt.

(6) A queue table that permits stacking of interrupts.

(7) Memory access protection so that memory cycles cannot be initiated unless appropriate access conditions are satisfied.

(8) Parity generation and checking on memory data transfer.

(9) Processing execution fault detection.

b. Input/Output Unit.

(1) Memory access protection so that memory cycles cannot be initiated unless appropriate access conditions are satisfied.

(2) Queue table which permits stacking of interrupts.

(3) Parity generation and checking of memory data transfers.

(4) Real-time clocks to generate time of day and for control of time dependent functions.

(5) Accepts signals from the ADP status and control panel to accommodate the following:

(a) Bootstrap program load.

(b) Malfunction indications.

(c) Assistance in performing maintenance and troubleshooting.

(d) Detection and indication of power fluctuations and power faults for CPU and IOU.

(e) Controls to conduct tests of the computer functions and peripherals including detailed diagnostic tests.

(f) Monitoring computer functions during normal operations.

c. Mass Core Memory Unit.

(1) Storage capacity. Message Switch-131K words Circuit Switch-262K words.

(2) Four modes of operation.

(3) Thirty-three bit word length (32 data bits and one parity bit).

(4) Contains self-test circuitry capable of detecting and isolating faults under computer control.

(5) Nonvolatile storage.

(6) Data access time not to exceed 1200 ns.

d. Environmental.

(1) Temperature.

(a) Normal operating range: 0°F to +80°F.

(b) Storage and transit: 70° F to + 160° F.

(c) Low temperature start: -50°F.

(d) High temperature start: + 125°F.

(2) Atmospheric Pressure.

(a) Operating: sea level to 10,000 ft.

(b) Storage and transit: sea level to 40,000 ft.

(3) Relative Humidity.

(a) Operating: 100% up to 86°F.
5% up to +125°F.

(b) Nonoperating: 100% up to +86°F.
5% up to + 125°F.

CHAPTER 2

FUNCTIONING OF EQUIPMENT

Section I. INTRODUCTION

2-1. General

The circuit switch (CS) and message switch (MS) provide automatic circuit and message switching service for both analog and digital message traffic in tactical and nontactical environments. These systems are capable of interfacing (to provide concurrent circuit and message switching) or operating independently of each other. The Circuit Switch Central Processor Group (CSCPG) provides overall control for interaction between subsystems and units within the AN/TYC-39 and AN/TTC-39. The CSCPG and Message Switch Central Processor Group (MSCPG) each employ a high-speed data processing system and associated peripheral equipment. The CSCPG and MSCPG function as integrated sets of equipment combined with computer programs and associated data for a specific mission achievement capability. This capability, primarily in areas of timeliness, efficiency and accuracy, enables centralized processing and control of circuit switching and message switching and routing to accomplish the successful actions required for tactical communications.

2-2. Circuit Switch Central Processor Group (CSCPG)

The CSCPG consists of two processors, an interface control unit, two magnetic tape transports, an automatic data processing (ADP) status and control panel, a power group, an electrical interface panel, and a MCMU frame assembly. The functional interconnection of the CSCPG is shown in block diagram figure FO-2 and a cable interconnection diagram in figure FO-3. The two processors are each composed of a central processor unit (CPU), an input/output unit (IOU), and two mass core memory units (MCMUs). The CPU is responsible for the arithmetic and control functions of the system. The IOU controls communication between the CPU and the peripheral equipments. The MCMU stores and reads out the information used by the CPU. The interface control unit (IFCU) contains a processor-to-processor interface (PPI), a magnetic tape controller (MTC), and two teletype controllers (TTYCs). The processor-to-processor interface permits the exchange of data between the two CSCPG processors. The magnetic tape controller controls the flow of data between the magnetic tape transports and the processors and also performs pairty checks on the data it handles. The teletype controllers provide the interface between the processor dc I/O channel and external teletypes A and B. The magnetic tape transports (MTTs) communicate with the processors via the MTC and provide storage and retrieval of data. The tape transports are utilized to read operational and maintenance programs into the system. The ADP status and control panel permits status monitoring and control of each of the processors and the power group. The power group contains eleven dc/dc converters which provide the dc operating voltages for the CSCPG units. The electrical interface panel connects the CSCPG power group to external power and also provides the interconnection between the IFCU and the peripheral equipment.

2-3. Message Switch Central Processor Group (MSCPG)

The MSCPG consists of two processors, four interface control units, eight magnetic tape transports, three line printers, two random access storage assemblies, an ADP status and control panel, a power group, and a peripheral interface panel. The functional interconnection of the MSCPG is shown in the MSCPG block diagram figure FO-4 and cable interconnection diagram figure FO-5. The two processors are each composed of a CPU, an IOU, and an MCMU. These components perform the same general functions as described in the preceding paragraph for the CSCPG. The IFCUs in the MSCPG differ from the IFCU in the CSCPG. Each of the four IFCUs contains an MTC which is the same as the MTC described previously. The TTYC contained in IFCU A also performs the same function as one of the TTYCs contained in the CSCPG. The MSCPG IFCUs contain three line printer controllers (LPCs), one in IFCU A and two in IFCU C. The LPCs provide the interface between the line printers and the two processors. The LPC provides a means for the processor to interrogate the status of the line printer and relays the demand for a

character from the line printer to the processor. IFCU B and D each contain a random access storage controller (RASC). The RASC accesses any given sector and track address on a random access storage (RAS) unit in a maximum of 34 milliseconds with an average transfer rate of 57,000, 32-bit words per second. The RASC also provides pairty checks on command codes and data read from the RAS and generates pairty bits for all data written into memory. The tape transports in the MSCPG are the same type as those in the CSCPG. The line printers operate in conjunction with the LPCs to provide an 80-character printout at a rate of 300 lines per minute. The RAS assemblies operate in conjunction with the RASC to provide mass data storage. Each RAS has a storage capacity of over two million words with an average access time of 16.6 milliseconds. The ADP status and control panel for the MSCPG varies slightly in its physical configuration from the CSCPG panel. The functions performed, however, are basically the same in both units. The MSCPG power group contains 12 dc/dc converters compared to the nine in the CSCPG. The peripheral interface panel performs the same function as the electrical interface panel in the CSCPG. Sections II through VIII provide block diagram level functional descriptions of each of the units that comprise the CSCPG and MSCPG. Significant differences that exist between the CSCPG and MSCPG are also explained.

Section II. AUTOMATIC DATA PROCESSOR

2-4. General

The CSCPG and MSCPG each contain two automatic data processors (ADP). Each ADP contains three major elements: CPU, IOU, and MCMU. The CPU provides central program control and performs the arithmetic functions of the processor, and also initiates input/output operations. Functional organization of the CPU is shown in the CPU block diagram (fig. 2-1). There are five major blocks in the organization with communication among the blocks, primarily via a data bus. The five blocks are instruction controller, program level controller, arithmetic section, memory interface controller, and process registers.

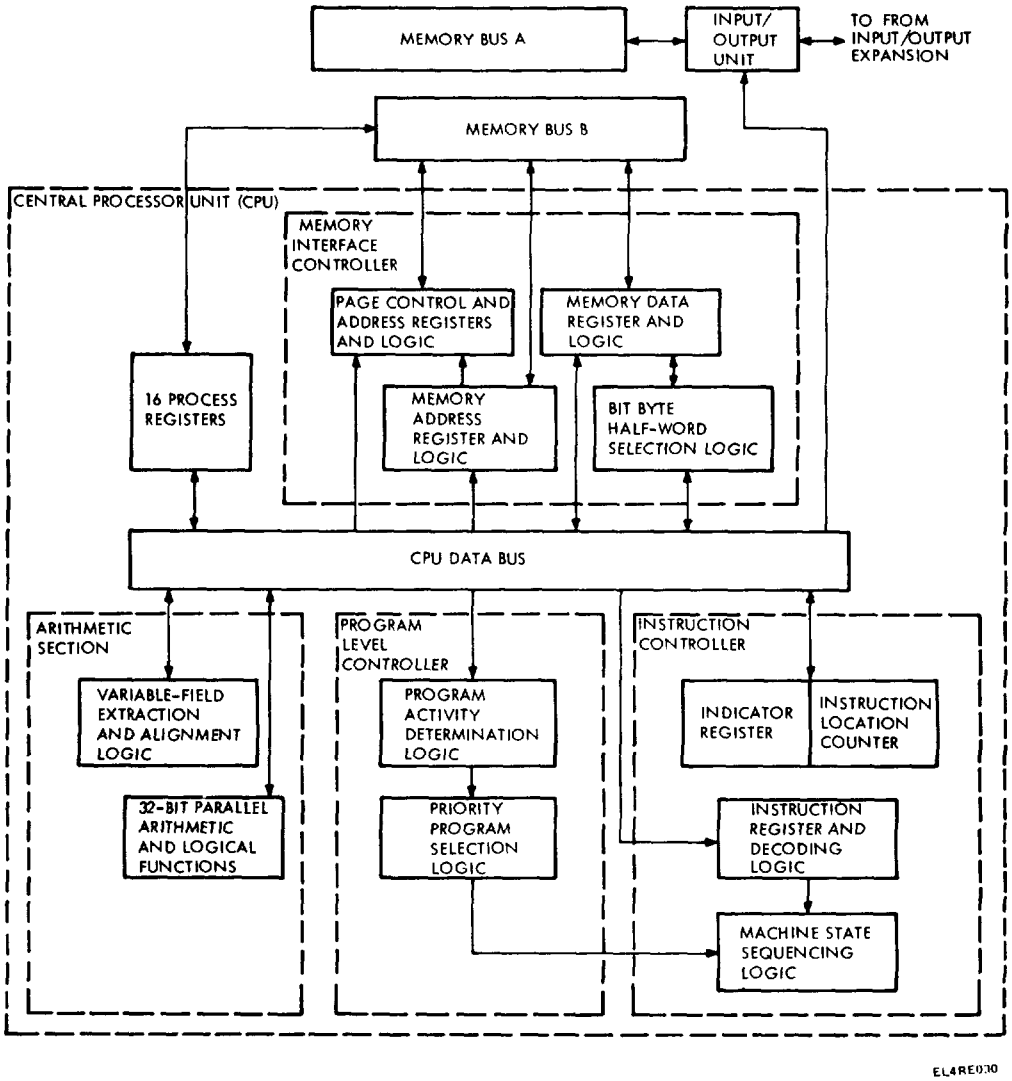


Figure 2-1. CPU Block Diagram.

The technique of communicating via the data bus minimizes the number of connections between the blocks shown in figure 2-1. This technique has the effect of shortening the signal line lengths, thus reducing propagation delays and decreasing susceptibility to noise. Each of the blocks shown in figure 2-1 is discussed in the following paragraphs.

2-5. Instruction Controller

The instruction controller controls the sequence of operations within the CPU. The instruction controller contains the indicator register which contains flags that indicate the status of the data processing system. Also contained in the instruction controller is the instruction location counter, which keeps track of the current instruction address, and the instruction register and decode logic, in which the instruction being executed is held and the details of the execution decoded.

2-6. Program Level Controller

It is within this block that the register representing the priority queue are updated and checked to determine if the highest priority program available to be run is actually running. This block also contains the switching program level logic (program activity determination logic).

2-7. Arithmetic Section

The arithmetic section contains a high-speed, 32-bit parallel adder as well as variable field extraction and alignment logic which makes possible the variable field operations of the processor. The variable field operations are utilized to pack the memory data fields and also to provide the flexibility of data processing on a bit, byte, or half-word basis.

2-8. Memory Interface Controller

The memory interface controller contains the memory address and memory data registers normally associated with a memory CPU interface. It also contains other special registers and logic which provide processor addressing and data access. The page control and address registers contain the 16-page addresses associated with the active program level. Each page address provides access to 2,048, 32-bit words. The pages may be ordered in any sequence, providing flexibility in the organization and relocation of program and data. The bit, byte, and half-word section logic is used to select regularized short fields for processing by the arithmetic section or for transfer to another block. This capability to select directly 1, 8, or 16 bits from a 32-bit word, complements the variable field capability of the arithmetic section and permits complete flexibility in the storage and processing of data files.

2-9. Process Registers

Sixteen 32-bit registers are available to the active program level. These are held in 32, 16-bit random access integrated circuit packages which operate with a cycle time of 200 nanoseconds. These high-speed memory elements may be used as accumulators, as index registers, or to hold instructions during the execution of program loops.

Section III. MASS CORE MEMORY UNIT

2-10. General

Each mass core memory unit (MCMU) provides random access, high-speed, core memory for the associated processor. The MCMU provides a memory storage capacity of 131,072 x 33-bit words of non-volatile storage. Each MCMU has a unique address by which it responds to commands from the CPU, IOU, and, in the MSCPG, the RASC. Each MCMU also has processor interface logic which permits, in the CSCPG, two-port operation from the CPU or IOU, and, in the MSCPG, four-port operation from the RASC, CPU, or IOU. The MCMU has a 2.5-microsecond memory response cycle time and a 1600-nanosecond data access time. Functional organization of the MCMU is shown in the block diagram (fig. 2-2).

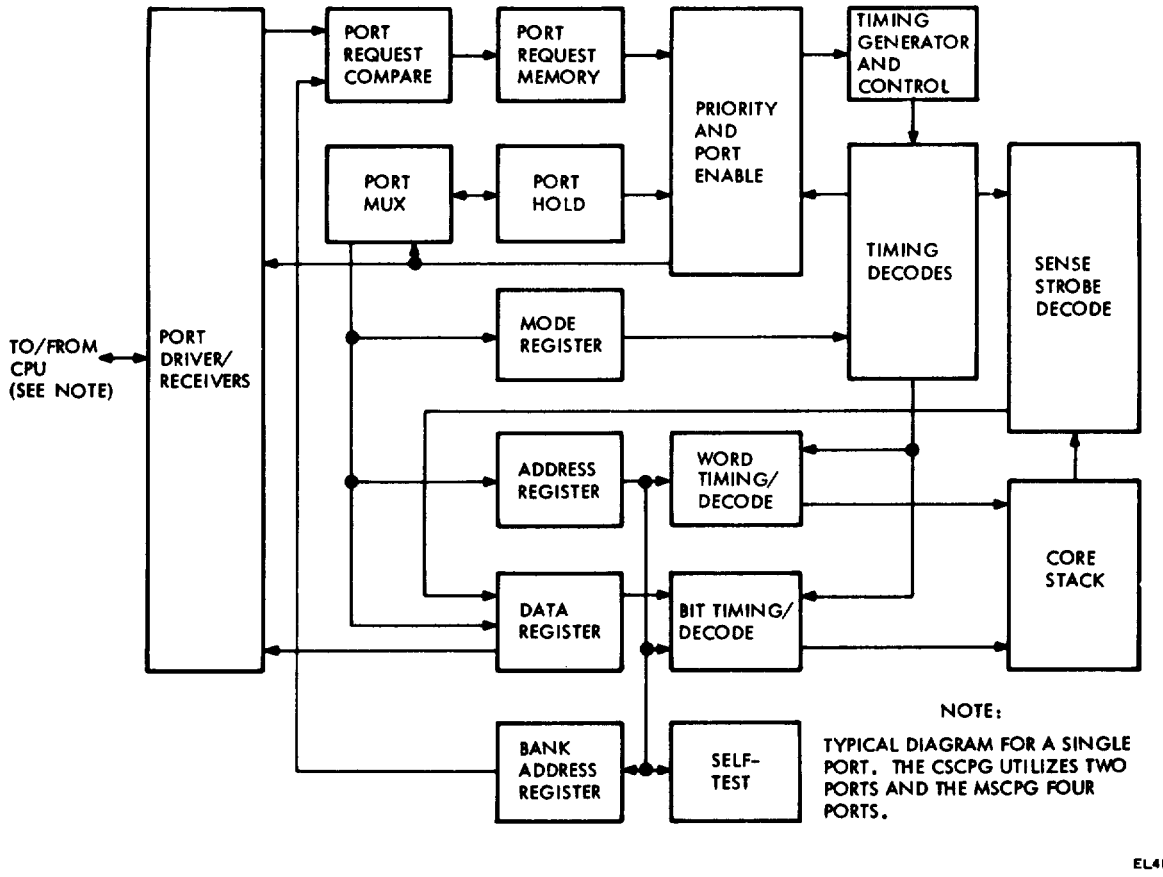


Figure 2-2. MCMU Block Diagram.

The MCMU is divided into two major functional areas: the logic and stack electronics, and the core stack. The logic and stack electronics contain all the digital and analog cards which are mounted in a card rack assembly and are used to process data. In the four-port MSCPG configuration, the CPU is connected to port D, the IOU is connected to port C, and a RASC to each of the two remaining ports. For the two-port CSCPG configuration, the CPU is connected to port B and the IOU is connected to port A. The signal connection for all ports is identical.

2-11. Operating Modes

Four memory operating modes are available: read-restore, read-modify-write, clear-write, and memory test.

a. Read-Restore. In this mode of operation, the memory reads the data in the specified address, transmits the data to the CPU/IOU/RASC, and restores the data unmodified to its former location.

b. Read-Modify-Write. When operating in this mode, the memory reads the data in the specified address and transmits the data to the CPU/IOUIRASC. However, the previously stored data is replaced by data from the CPU/IOU/RASC. The new data is then stored in the same address location selected at the start of the cycle.

c. Clear-Write. This mode of operation causes the memory to clear the contents of the specified address and replace it with data from the CPU/IOU.

d. Memory Test. When operation in this mode, no data is read or written, but the functional status of the current source is checked as well as the memory bank addressing functions.

Section IV. INPUT/OUTPUT UNIT

2-12. General

The input/output unit (IOU) is used by the processor to provide control and interface between the MCMU and peripheral devices. The IOU consists of the input/output controller (IOC), data exchange units, three real-time clocks, and ADP status and control panel logic. A block diagram showing the functional organization of the IOU is presented in figure FO-6. All of the IOU device channels have identical capabilities. The possible I/O modes are alarm, input word (four 8-bit bytes), output word (four 8-bit bytes), input byte (eight bits), output byte (eight bits), and inactive. Each device has a keyword and terminate word which defines the mode as well as starting memory location of data and quantity of data to be transferred. Devices may interrupt the CPU when an I/O sequence has been completed. The interrupt of any I/O device can be directed to any program level. All I/O operations are under control of software through the use of keywords, terminate words, and I/O commands. These are privileged instructions which allow direct commands to be sent to a device, or allow status to be obtained from a device. The commands are DEV (device command), DEX (device command and exit), ITR (input to register command), and OFR (output from register command). Status information is also available whenever a device interrupts the computer. All I/O operations on every channel are checked for correct parity. Every byte of I/O has odd parity. Memory parity is also checked whenever data is accessed prior to being sent over the I/O lines, as well as parity being generated when data is input to the memory. A parity error or any other error detection results in an IOU error interrupt. Each peripheral device serviced has a fixed deivce address and servicing is based on a priority scheme. The hierarchy of priority (highest to lowest) is as follows:

MSCPG	*CSCPG*
MTTA	MTT
MTT B	TTY A
MTT C	PPI
MTT D	TTY B
RASA	
RAS B	
LPA	
LPC	
LPB	
TTY	

2-13. Input/Output Controller

The. input/output controller (IOC) is largely responsible for the multiplexing of data between the memory and various other devices. Data transfer is accomplished independently of the CPU. The IOC has direct communication with the CPU from which it receives instructions regarding input/output requirements. These instructions usually result in the transfer of one to four bytes to or from the designated peripheral device, to determine the device status or to force the device into a specific state.

2-14. Data Exchange Units

Data may be exchanged with peripheral devices from ac input/output channels (IOX) and dc input/output channels (IOE). The data exchange units perform the interfacing function between the IOC.

Each IOX channel has up to eight independent peripheral devices attached to it. The IOE channel has the same function as the IOX channel, varying only in its drive capability.

a. IOX: 100 meters
b. IOE: 16 meters

2-15. Real-Time Clocks

The three real-time clocks are included as part of the IOU for design convenience. The real-time clocks appear to software as three separate peripheral devices and are completely under program control. The IOC sees them as high-priority devices which require count monitoring, but no memory data transfer. All three clocks have a count resolution of one millisecond.

2-16. ADP Status and Control Panel Logic

The ADP status and control panel logic interfaces with indicators and controls necessary to operate both the CPU and the IOU. These include program load capability, test selection capability and error indicators.

Section V. INTERFACE CONTROL UNIT

2-17. General

The interface control units (IFCU) contain the peripheral unit controllers which include (for the message switch), one TTY controller, three line printer controllers, four magnetic tape controllers, and two random access storage controllers; (for the circuit switch) two TTY controllers, one magnetic tape controller, and one processor-to-processor interface controller. The power supplies for the IFCUs are located within the CPG power subsystem group. Power supply status is displayed on the automatic data processing status and control panel. A block diagram of the CSCPG IFCU is shown in figure FO-2; a block diagram of the MSCPG IFCUs appears in figure FO-4.

2-18. Magnetic Tape Controller

The magnetic tape controller (MTC) operates as an interface controller and buffer between the computer and up to four magnetic tape transports. Functional organization of the MTC is shown in the block diagram (fig. 2-3). The oscillator block provides basic timing signals which are used to control the various functions performed by the MCT. The timing counters receive the oscillator output and provide control signals to the timing and control logic, which in turn, provide the actual control signals to the IOU interface, data register and tape transport interface. There sessions of the MTC control of the actual transfer of data, commands, and interrupts between the computer and tape transport units.

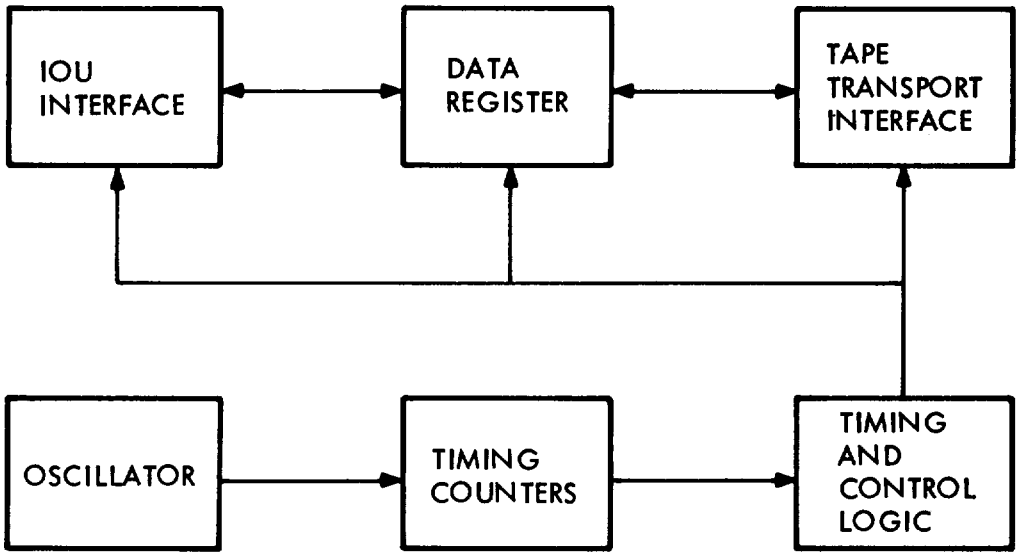


Figure 2-3. MTC Simplified Block Diagram.

The MTC interfaces with the computer through a standard I/O channel. The four message switch MTCs use the highest priority channel to ensure against data loss. The proximity of the MTCs to the IOU allow an IOE to be used for data exchange. A given MTT has a transfer rate of 20,000 bytes per second with the data transfer taking place in word-by-byte mode. The magnetic tape subsystem undergoes automatic initialization and orderly shutdown as a function of reset signals from the computer. Software can also cause a master reset signal to be sent to the MTC. The program can

interrogate the MTC to determine its status. This status interrogation is augmented by the MTC presenting status each time it interrupts following completion of a command. Fault detection capabilities incorporated in the magnetic tape subsystem interface include loop test, I/O parity error, longitudinal redundancy checks (LRC) and tape parity. Loop test allows software to ensure that the I/O interface is working. Checking for I/O parity error occurs on all bytes of I/O data. All data transfers, automatic or loop test initiated, are monitored. The MTC generates and checks the LRC bits at the end of each record on the tape. Each byte within the record has a parity bit generated and recorded; thus parity is checked over the I/O interface and again between the MTC and MTT. Whenever a Timing or Write Parity error is sensed, the computer is interrupted and the type of error is presented in the status word. Detected parity errors on read operations are not reported until inter-record gap (IRG) is encountered. The MTCs are dual port devices with an IOE interface to each processor. While each MTC is logically connected to only one processor at a time, it may be switched to either, via a manual or logic switch. This allows the MTCs to be switched to the off-line computer for additional data processing, or all units to be placed on-line to the alternate computer during a switchover.

2-19. Teletypewriter Controller

The teletypewriter controller (TTYC) provides the interface between the IOE and an externally buffered AN/UGC-74 (V) 3 Teletypewriter (TTY). The TTY has a serial input line and a serial output line. The computer puts the TTYC into an input mode to accept keyboard input messages to the computer or into an output mode to accept computer messages for printing. Seven-bit ASCII characters (plus 1 bit, odd parity) are sent with appropriate start and stop bits as the TTYC-to-TTY serial interface. Data is transmitted at a 30-character-per-second rate for the AN/UGC-74(V)3. The TTYC operates in the byte mode, transferring characters to or from the TTY. The TTYC can be connected to either of the two computers by signals contained in a dual-channel switch interface. This is a logic connection which places the TTYC on-line to either computer but never to both simultaneously. If neither computer is selected on-line, the TTYC is off-line to both and it will neither send nor receive signals.

2-20. Line Printer Controller

The line printer controller (LPC) provides the interface between the line printer and the computer. Demands for a character from the printer are relayed to the computer by the LPC. The LPC provides a means for the computer program to interrogate the status of both the printer and the LPC. Data output to the LPC is in the byte mode. The LPC also alerts the computer program to parity errors detected in the data output. Proper functioning of the LPC is checked by a program-initiated self-test sequence. The LPC is connected to the computer by means of an IOE interface. Functional organization of the LPC is shown in the block diagram (fig. 2-4).

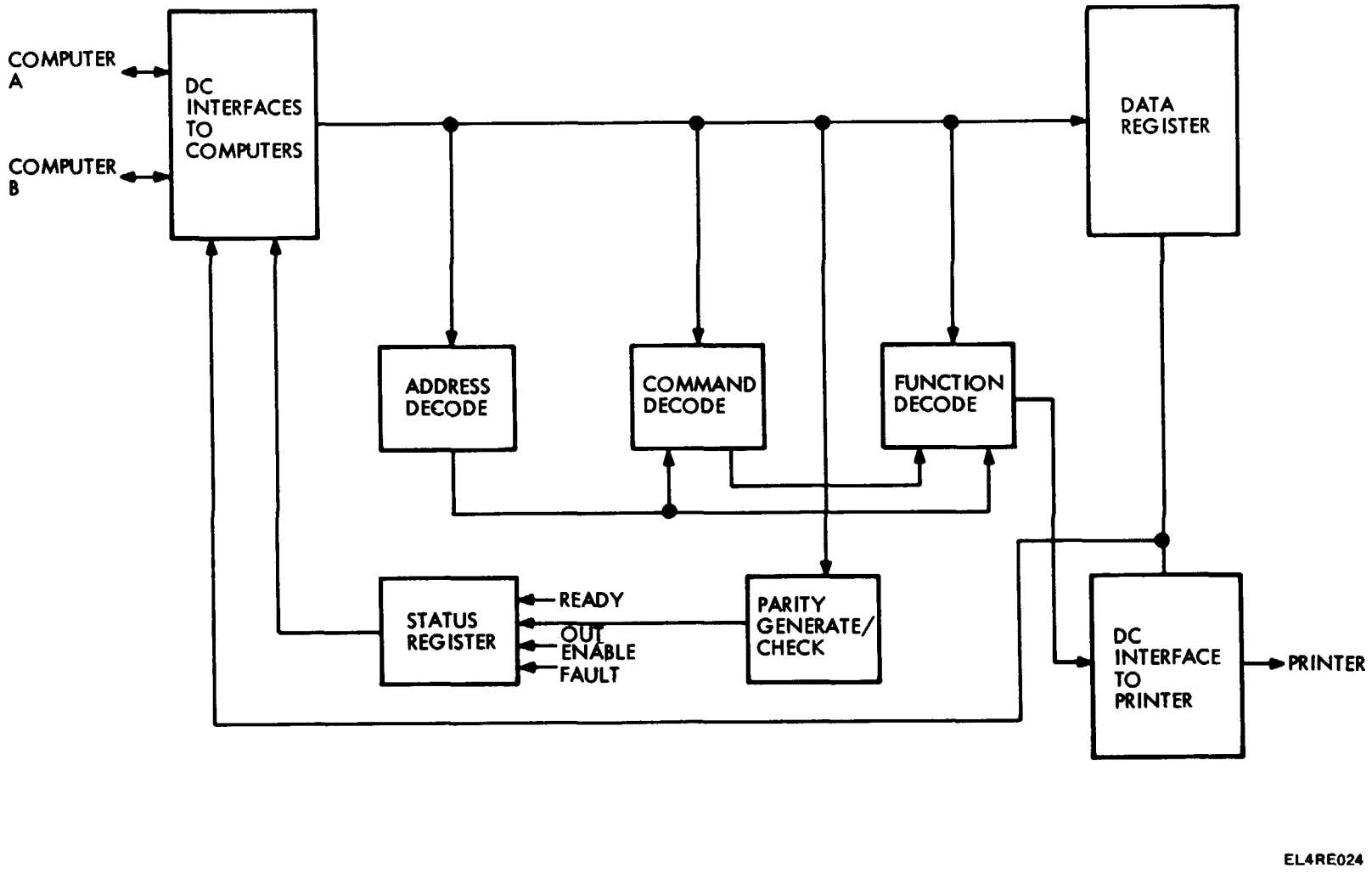


Figure 2-4. LPC Block Diagram

The LPC operates in one of two states: active or inactive. The active state is entered whenever a device command to enable data transfer is detected. In this state, data is transferred from the computer to the line printer in response to a data request from the line printer. A command to determine status will be acknowledged in the active state; however, a command to perform the self-test will not be accepted. The inactive state is entered on power up, receipt of a master reset or device stop command, and on detection of an end-of-block. A command to determine status will be acknowledged in the inactive state as well as in the active state. A command to perform self-test will also be acknowledged in the inactive state.

2-21. Random Access Storage Controller

The random access storage controller (RASC) provides the interface between a random access storage (RAS) unit and the two processors. The RASC can access any given sector and track address on any selected RAS in a maximum of 34 milliseconds. Each track is divided into 90 data sectors and one maintenance sector. A sector contains 21 data words and a longitudinal redundancy check word, each consisting of 32 data bits plus one parity bit. The RASC has an average transfer rate of 57,000 33-bit words per second. The RASC is connected to the computer via an IOE interface. Functional organization of the RASC is shown in the block diagram (fig. 2-5).

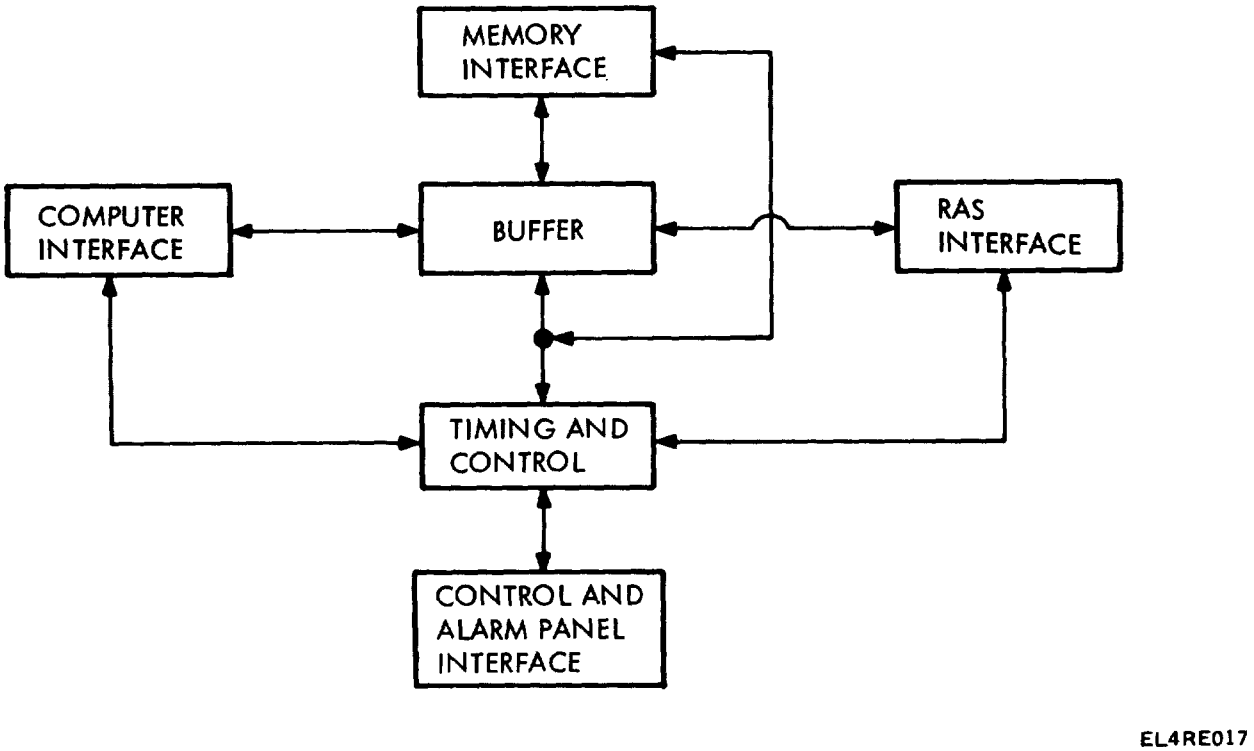


Figure 2-5. RASC Block Diagram.

A dual-channel switch allows access to the RASC by either or two computers on a switched basis. The I/O module connected between the RASC and RAS monitors the ready status of each of the discs and controls and data paths between the RASC and RAS. All command codes and data from the computer are checked by the RASC for correct parity. Each word read from the RAS includes a parity bit which is checked and each word written includes a parity bit generated by the RASC. In addition, a cyclic check-word is written and checked for each sector of the disc. An on-line cycle test capability is provided whereby the RASC is commanded to read the contents of an entire disc, checking all data for parity and cyclic check errors, without transferring any data to the computer. The RASC receives commands either from the processor or directly from memory. These commands are divided so that the RASC control type commands originate in the processor while the operational type commands are

directly from memory. Normal transfer of data to or from the disc is accomplished with the RASC in the direct memory access mode. All data read from the disc is checked for correct parity. Data written into the memory has correct parity added by the RASC.

2-22. Processor-to-Processor Interface

The processor-to-processor interface (PPI) is a unit which interfaces the two processors through standard I/O channels. The primary function of the PPI is to transfer single blocks of data from the online or transmitting CPU to the off-line or receiving CPU. Either CPU can initiate the action. In any single block 32,768 words may be transferred with a transmittal rate of up to 50,000 words per second. The data is transmitted in the word mode only. Functional organization of the PPI is shown in the block diagram (fig. 2-6).

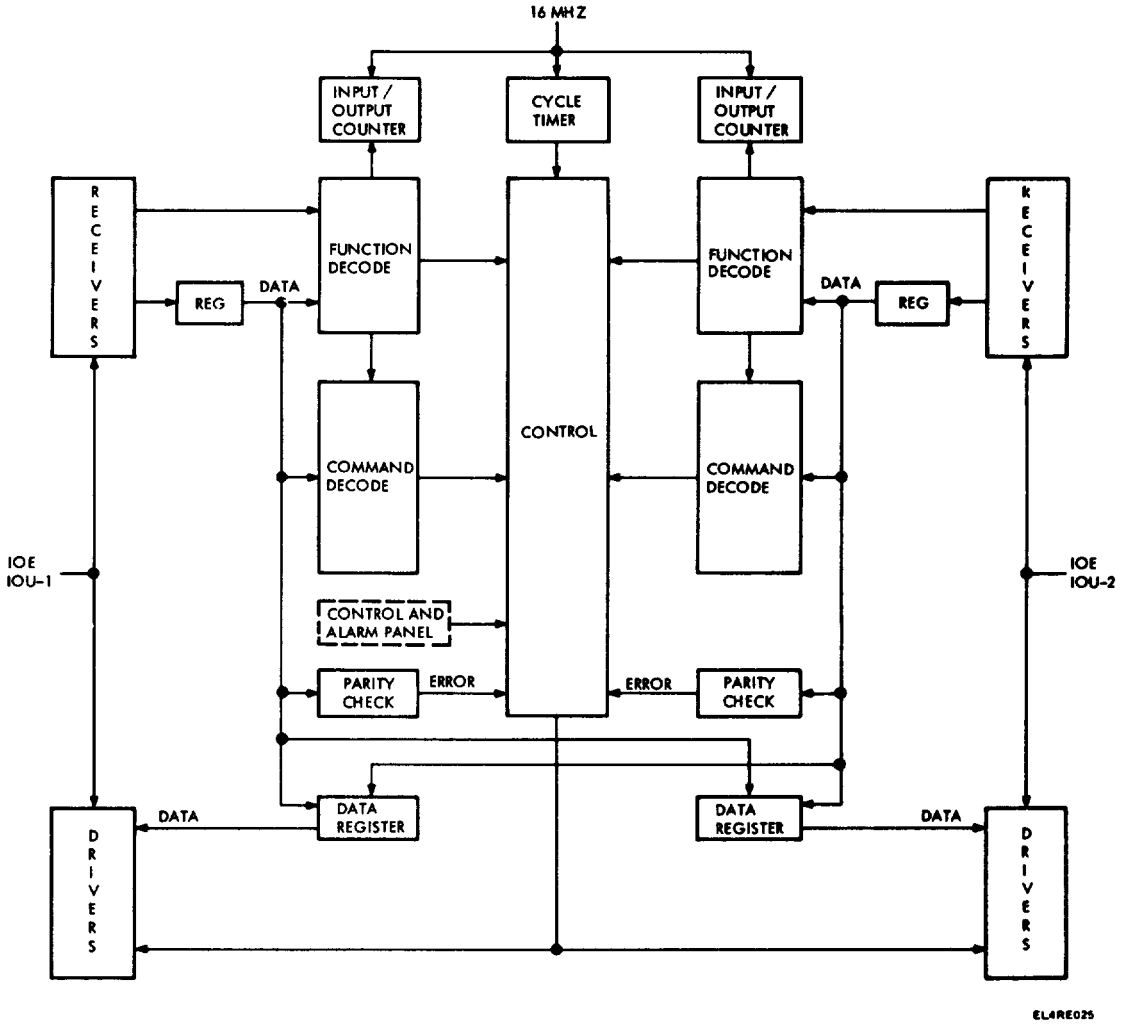


Figure2-6. PPI Functional Block Diagram

The CPU that is sending data will initiate the sequence by executing an input-to-register (ITR) to determine the PPI status. If neither CPU is on-line, the interrogating CPU is made on-line, and the status byte is automatically modified. If simultaneous interrogations are executed by both CPUs, one will be given priority, thus preventing the possibility of both CPUs being on-line at the same time. The on-line CPU will issue one of the following two device commands: Start 1-initiate priority information transfer; i.e., starting address, block length, special status, etc.; and Start

2-initiate information transfer. Upon receipt of a start command, the PPI will execute an interrupt to the off-line CPU. The status byte will be transmitted via the interrupt. The PPI then waits until an acknowledge device command is received from the off-line CPU before initiating the automatic transfer from the on-line CPU (auto output) to the off-line CPU (auto input). The data transfer at this point is limited up to 50,000 words-per-second by a free-running timer. The PPI will continue transferring data words via the automatic functions until terminated by the on-line CPU. At this point, the PPI will execute an interrupt to the off-line CPU. The off-line CPU then issues one of the following two device commands: indicated data received without error and indicated error detected during input. Upon receiving the device command, the PPI will modify the status byte by clearing the start command and executing an interrupt to the on-line CPU. The data error command will cause the parity error bit for the off-line CPU to be set in the status byte. Upon receiving the interrupt, the on-line CPU will issue a release command to give up control of the PPI or a new start command to continue operation. On power-up and upon receipt of a master reset or device stop command from either CPU, the PPI control logic will be initialized.

Section VI. ADP STATUS AND CONTROL PANEL

2-23. General

The ADP status and control panels (figs. 2-7 and 2-8) contains the controls and indicators necessary for status monitoring and functional control of the processors.

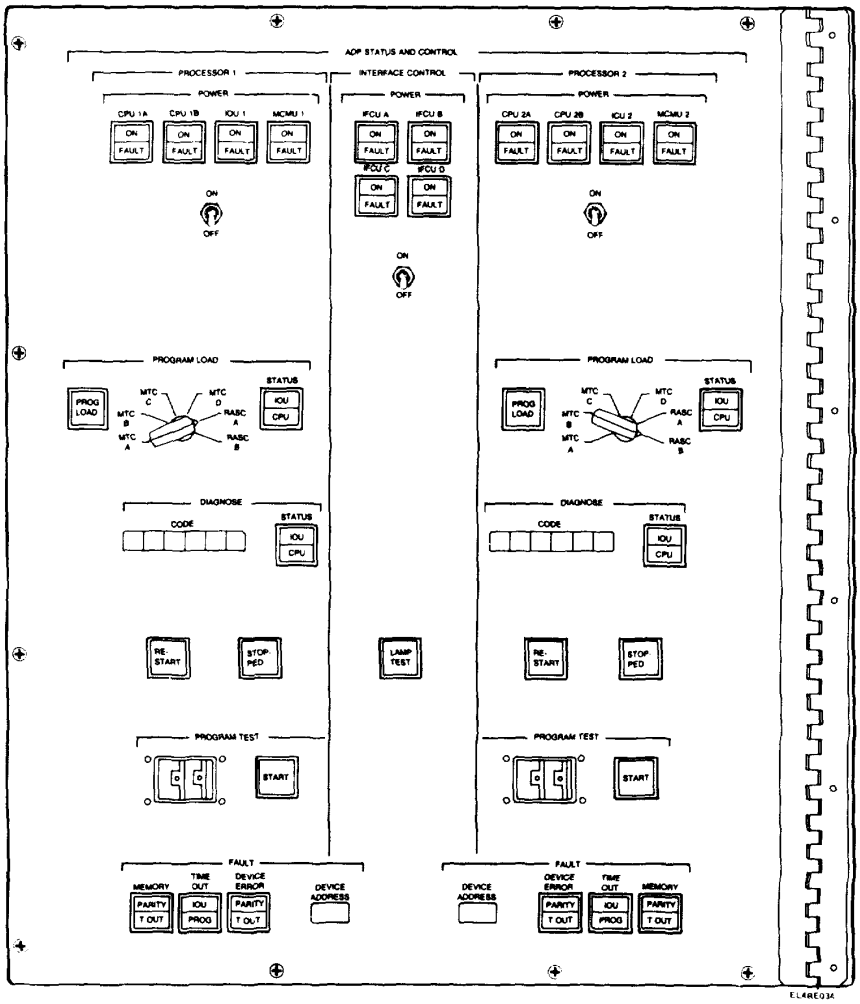


Figure 2-7. ADP Status and Control Panel (Message Switch).

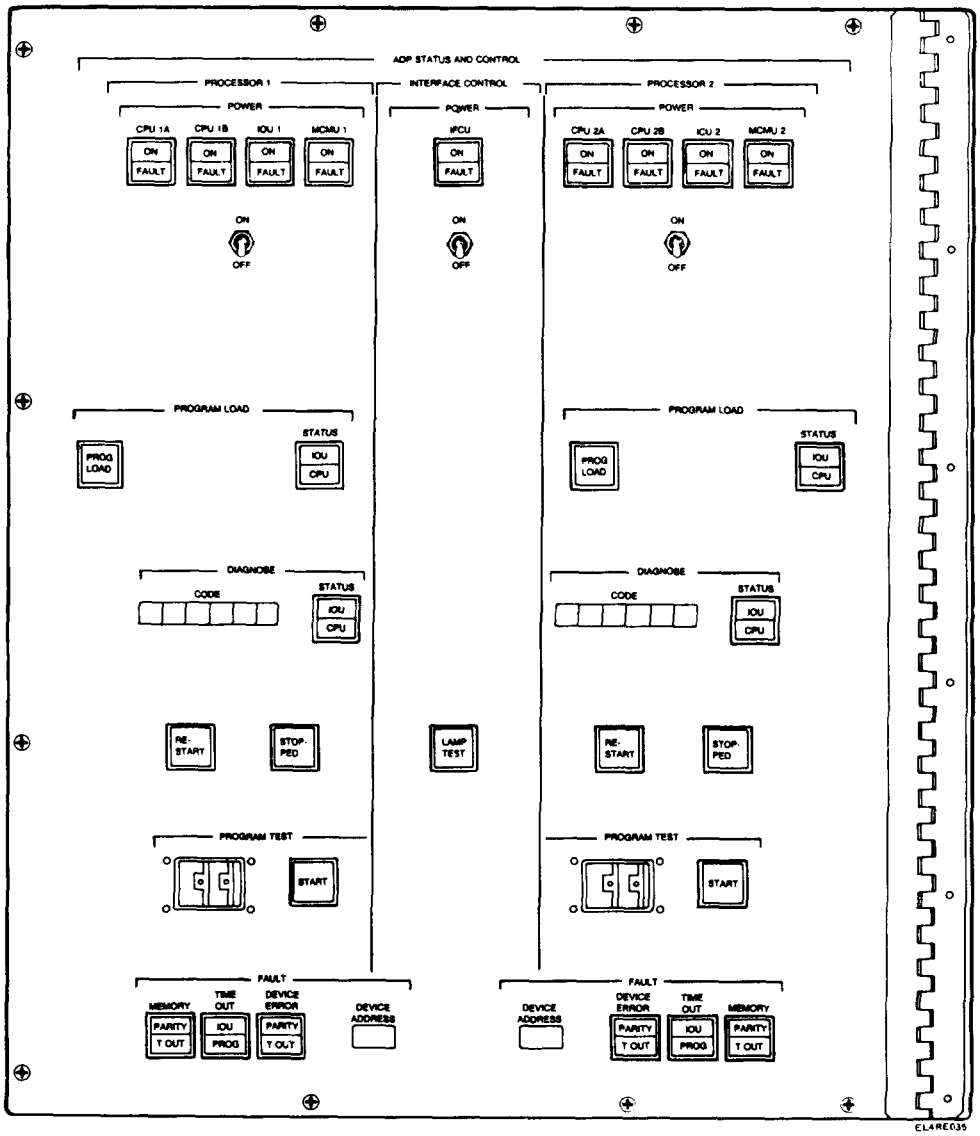


Figure 2-8. ADP Status and Control Panel (Circuit Switch).

Nine indicators on the CSCPG (12 on the MSCPG) display the status of the dc/dc converters of the power group. Independent power controls are provided for the dc/dc converters associated with processor 1, processor 2, and the IFCU. (Two additional power supplies are controlled and monitored at the CS MCMU frame assembly.) A separate six-digit readout is provided for each processor to display codes that define the location of detected faults or for whatever purpose the program desires to use them. Controls are also provided for each processor to initiate program load, restart, and program test. Parity error, timeout, and device address fault indicators are also duplicated for each processor. Since the MSCPG contains six peripheral devices from which a program load can be accomplished, a rotary switch is provided to allow selection of the desired device.

2-24. ADP Status and Control Panel Indicators

Many of the status and control indicators are programmable. Each programmable indicator has a bit in the associated monitor register. In all cases, when the bit in the monitor register is ZERO, the associated indicator light goes out. When the bit in the register is ONE, the indicator is lighted. A functional description of ADP status and control panel controls and indicators is provided in TM 11-5805-681-12-1 and TM 11-5805-683-12-1.

Section VII. PERIPHERAL INTERFACE PANEL

2-25. General

The peripheral interface panel (PIP) in the form of the electrical interface panel in the CSCPG provides the power interface between the input 28-vdc bus and the CSCPG power subsystem. (The same function is performed by the PIP in the MSCPG and, unless otherwise stated, this description applies equally to both units.) 2-26. PIP Interface The PIP also provides the data and control interface between the IFCUs and the peripheral units associated with the system. Connection between the computer and external devices is by twisted-pair signal and return lines. Each signal line is terminated by a resistor in the computer and also at the remote end of the line. Each signal line is capable of servicing eight elements in addition to the controlling element. Logic levels for the I/O communication channel (DC IOE) are as follows:

a. A logical ONE is a pulse having a pulse width greater than 120 nanoseconds and an amplitude less than 1.5 volts.

b. A logical ZERO is a signal greater than 3.25 volts.

The PIP is located adjacent to the power group in the MSCPG and the electrical interface panel is located adjacent to the power group in the CSCPG. Connectors J1 through J54, on the PIP, are provided to connect cables from the peripheral equipment to the MSCPG. Connectors J55 through J66 are used to connect the MSCPG to an external power source. On the electrical interface panel, connectors J1 through J32 are provided to connect cables from the peripheral equipment to the CSCPG. Connectors J35 through J43 and J17 and J18 are used to connect the CSCPG to an external source of power. Signal connectors on both the PIP and the electrical interface panel are 55-pin connectors for interfacing with the peripheral units, and 80-pin card slot connectors for interfacing with the CPG.

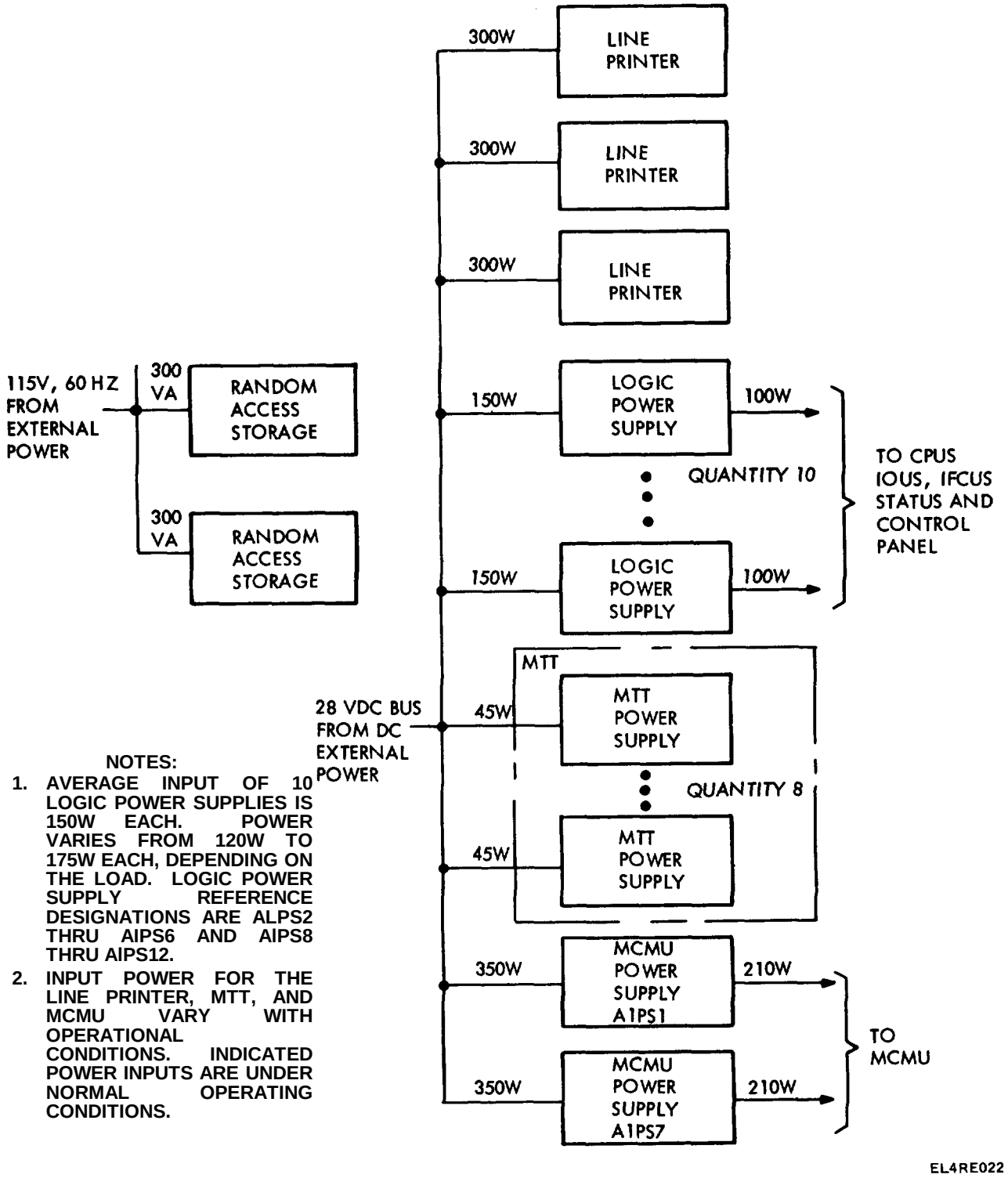
Section VIII. DC/DC CONVERTERS

2-27. General

The MSCPG and CSCPG each contain a power subsystem which provides the necessary operating power to the CPG equipment. These power subsystems are described in subsequent paragraphs.

2-28. MSCPG Power Group

The MSCPG power group (fig. 2-9) contains 12 dc/dc converters which provide dc operating voltages to the CPUs, IOUs, IFCUs, ADP status and control panel, and MCMUs. The power group receives +28 volts primary power via the PIP and produces the dc operating voltages required for MSCPG operation. There are two types of dc/dc converters in the power group, two of one type and ten of the other. The group of two, A1PS1 and A1PS7, supply the dc operating voltages for 2-14 MCMU 1 and MCMU 2, respectively. The remaining ten converters are identical to each other and provide power as follows: dc/dc converters A1PS4, AlPS5, and ALPS6 provide power to IOU 1, CPU 1A, and CPU 1B, respectively; dc/dc converters AlPS2, A1PS3, A1PS8, and A1PS9 provide the dc operating voltages to IFCU A, IFCU B, IFCU C, and IFUC D, respectively; and dc/dc converters ALPS10, AIPS11, AlPS12, provide dc operating voltages to IOU 2, CPU 2A, and CPU 2B, respectively. ALPS1 and AlPS7 each require approximately 350 watts of primary dc power in order to supply dc voltage and current required for MCMU operation. These converters also contain circuits for orderly MCMU startup and shutdown sequence during input power on and off transitions.



NOTES:

1. AVERAGE INPUT OF 10 LOGIC POWER SUPPLIES IS 150W EACH. POWER VARIES FROM 120W TO 175W EACH, DEPENDING ON THE LOAD. LOGIC POWER SUPPLY REFERENCE DESIGNATIONS ARE ALPS2 THRU AIPS6 AND AIPS8 THRU AIPS12.
2. INPUT POWER FOR THE LINE PRINTER, MTT, AND MCMU VARY WITH OPERATIONAL CONDITIONS. INDICATED POWER INPUTS ARE UNDER NORMAL OPERATING CONDITIONS.

Figure 2-9. MSCPG Power Group Block Diagram.

The ten remaining dc/dc converters require an average of 150 watts of dc input power each to supply the necessary output voltages required for CPU, IOU, IFCU, and ADP status and control panel operation. The power supply located in each of the magnetic tape transports requires approximately 45 watts of +28v primary dc power during operation. The power supply in the line printers requires approximately 300 watts of +28v primary dc power during printing. The random access storage units require 116v 60-Hz primary power. The input primary power requirement of each random access storage unit requires approximately 300vA.

2-29. CSCPG Power Group

The CSCPG power group (fig. 2-10) contains eleven dc/dc converters which provide dc operating voltages to the CPUs, IOUs, IFCU, ADP status and 2-16 control panel, and MCMUs. The power group receives +28 vdc primary power via the PIP and produces the dc operating voltages required for CSCPG operation. There are two types of dc/dc converters in the power group, four of one type and seven of the other. The group of four, AlPS1 and A1PS7, supply the dc operating voltages for MCMU 1A and MCMU 2A; AlPS2 and AlPS3 supply the dc operating voltages for MCMU 1B and MCMU 2B, respectively. The remaining seven converters are identical and provide power as follows: dc/dc converters AiPS4, AlPS5, and A1PS6 provide dc operating voltages to IOU 1, CPU 1A, and CPU 1B, respectively; dc/dc converter AlPS8 provides dc operating voltages to the IFCU; and dc/dc converters AlPS10, AlPS11, and A1PS12 provide operating voltages to IOU 2, CPU 2A, and CPU 2B, respectively.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section 1. GENERAL

3-1. Introduction

Maintenance of the CSCPG and MSCPG is performed at Organizational, Direct Support, General Support and Depot levels. This chapter provides instructions for direct support maintenance only. Direct support maintenance is performed by those maintenance activities designated to support the using organization and emphasizes corrective maintenance at the equipment site. Direct support maintenance personnel perform corrective maintenance on items which are identified as faulty by organizational maintenance personnel, but are beyond their capability to correct using the maintenance resources authorized at the organizational maintenance level. Direct support maintenance personnel also provide technical assistance to the using organization in all areas which require skills and training that are beyond the capabilities of the organizational maintenance personnel. Direct support maintenance is limited to the activities described below.

a. Visually inspect components for evidence of potential failure conditions such as lack of cleanliness, improper seating of connectors, loose hardware or other items, discoloration due to excessive heat, frayed cables or wiring, or bent pins. Correction of observed conditions is to be accomplished as necessary at the time of observance by the maintenance level authorized to perform the task.

b. Replace an unserviceable subassembly, module, assembly or unit with a like subassembly, module, assembly or unit.

c. Verify serviceability and isolate an equipment malfunction by measuring the mechanical or electrical characteristics with established standards. The standards authorized for direct support maintenance include built-in test equipment (BITE), fault detection software, fault isolation software, and technical manuals, including wire, connector, and logic lists.

d. Perform the repairs required to correct a specific failure or unserviceable condition and restore an item to a serviceable condition. This function includes, but is not limited to, soldering, wire wrap, piece part replacement, and cable or harness replacement.

3-2. Voltage measurements

Voltage, resistance, and continuity measurements are made by direct support maintenance personnel for troubleshooting faults which cannot be resolved or repaired by organizational level personnel. Normally such faults are traceable to wiring or chassis-mounted components. Generally, signal voltages are at standard 11L logic levels and measurements are made using an oscilloscope. Power supply voltages are measured with multimeter ANIUSM-223.

Section II. TOOLS AND EQUIPMENT

3-3. Tools and Test Equipment

Tools and teat equipment required to perform the maintenance procedures given in this chapter are listed in table 3-1. Any tools or test equipment authorized for use at the organizational level are also authorized for use by direct support personnel.

3-4. Repair Parts

Repair parts and accessories authorized for use by direct support personnel are listed in Repair Parts and Special Tools List (RPSTL) TM 11 -5895-856-34P.

Table 3-1. Tools and Test Equipment

Part no.	Description
Litton TS-3317 ()/TSQ-73	Test set, Electronic Circuit Plug in Unit (MTS) w/accessories
Litton TE- 113980	Test Aid Assembly, MTS
Litton 06-6323-03	Connector repair tool kit:
06-6323-0102/-1401	Removal punch
06-6323-0105/90-2362-0011	Pliers
06-6323-0106/66-6323-1201-01	Dummy card
06-6323-0110/-0601	Pick A
06-6323-0111/-0701	Pick B
TK- 101/G	Tool kit
TK- 106/G	Tool kit
Litton 861179- 1 PC	card extractor
AN-SM-223	Multimeter
124602	Card cage transit cane
124603	MCMU transit ease
OS 261/U	Oscilloscope
PLSM-B-814880	Wire-/electrical connector tool kit
AN/USM-451	or equivalent voltmeter
PLSM-B-814891	Supplementary tool kit-IL
Sylvania SM-A-838409-1	PC card extractor
Sylvania SM-A-810658	PC card extender
	Connector repair tool kit:
06-7700-01	Crimping tool, contact
06-7690-01	Extraction tool
06-7698-01	Insertion tool

Section III. TROUBLESHOOTING

3-5. General

Aria section provides the fault isolation and detailed troubleshooting procedures required to identify and correct a malfunction in the automatic data processor IADP). The troubleshooting procedures are divided into two sections: verification of faults indicated by organizational maintenance, and troubleshooting procedures which may be either organizational or direct support.

a. Verification of Organizational Maintenance. Verification of organizational maintenance action is required to determine if the malfunction is correctable using organizational level procedures and, because of an incomplete diagnosis, the problem has not been found, or the fault requires direct support troubleshooting procedures to locate it. Perform the following procedure to verify the organizational maintenance actions:

(1) Reviewer the maintenance forms and records of unsatisfactory equipment performance, as prepared by the organizational maintenance personnel to determine which circuit card assemblies and modules have already been replaced.

(2) Review the reported malfunction with organizational personnel. Determine the troubleshooting results (e.g., error stop numbers and other symptoms) and actions taken.

NOTE

An error stop number may indicate which cards are tested with the MTS and/or which must be substituted or replaced to determine if they are faulty.

(3) Based on (1} and (2} above, perform such additional corrective maintenance or inspection as may be clearly indicated (e.g., replace cards, or modules listed in TM 11-5805-681-12-6 (Circuit Switch) or TM 11-5805-683-12-9 (Message Switch). Retest if required.

NOTE

If a peripheral fault is indicated by the ADP diagnostic program at organizational level and all cards in the error stop list check good, then direct support maintenance should check all other cards associated with the indicated peripheral controller.

b. Troubleshooting Procedures. TM 11-6805-681-12-6 and TM 11-5806-683-12-9 contain the procedures for running diagnostic programs for the CPGs. Fault isolation flow charts are provided to guide the organizational maintenance personnel through the logical decisions that

must be made to efficiently and quickly correct malfunctions.

3-6. Card Cage Troubleshooting

Card cage failures result in the same type of failure indications as card failures but are not correctable by card replacement. If all organizational level card replacement attempts fail to correct a fault, nest wiring is probably faulty. Using the MTS, MTS test aid (pare 3-7), and wiring lists, check and repair wiring in cages where card replacements were attempted. If card Cage wiring checks good, check cables between cages and to external devices. Refer to the organizational maintenance manual TM 11-5805-681-12-6 (Circuit Switch) or TM 11-5805-683-12-9 (Message Switch) for listings of failure indications. The majority of card cage failures can be isolated using the MTS, MTS test aid, and wire lists. Instructions for use of the MTS are contained in the organizational maintenance manuals. Refer to Section V for wire list information pertaining to this equipment.

3-7. MTS Test Aid

NOTE

Use the MTS test aid to isolate card cage wiring problems will be indicated if, after replacing cards at organizational or direct support, a CONTINUITY or FUNCTIONAL ERROR indicator display is still observed on the MTS.

The controls and indicators of the MTS test aid are shown in figure 3-1 and are listed in table 3-2. (It should be noted that several groups of indicators on the MTS test aid will be disregarded in following procedures since their functions are not used to identify continuity or short circuit wiring problems.) Perform the following procedures to connect and use the MTS test aid.

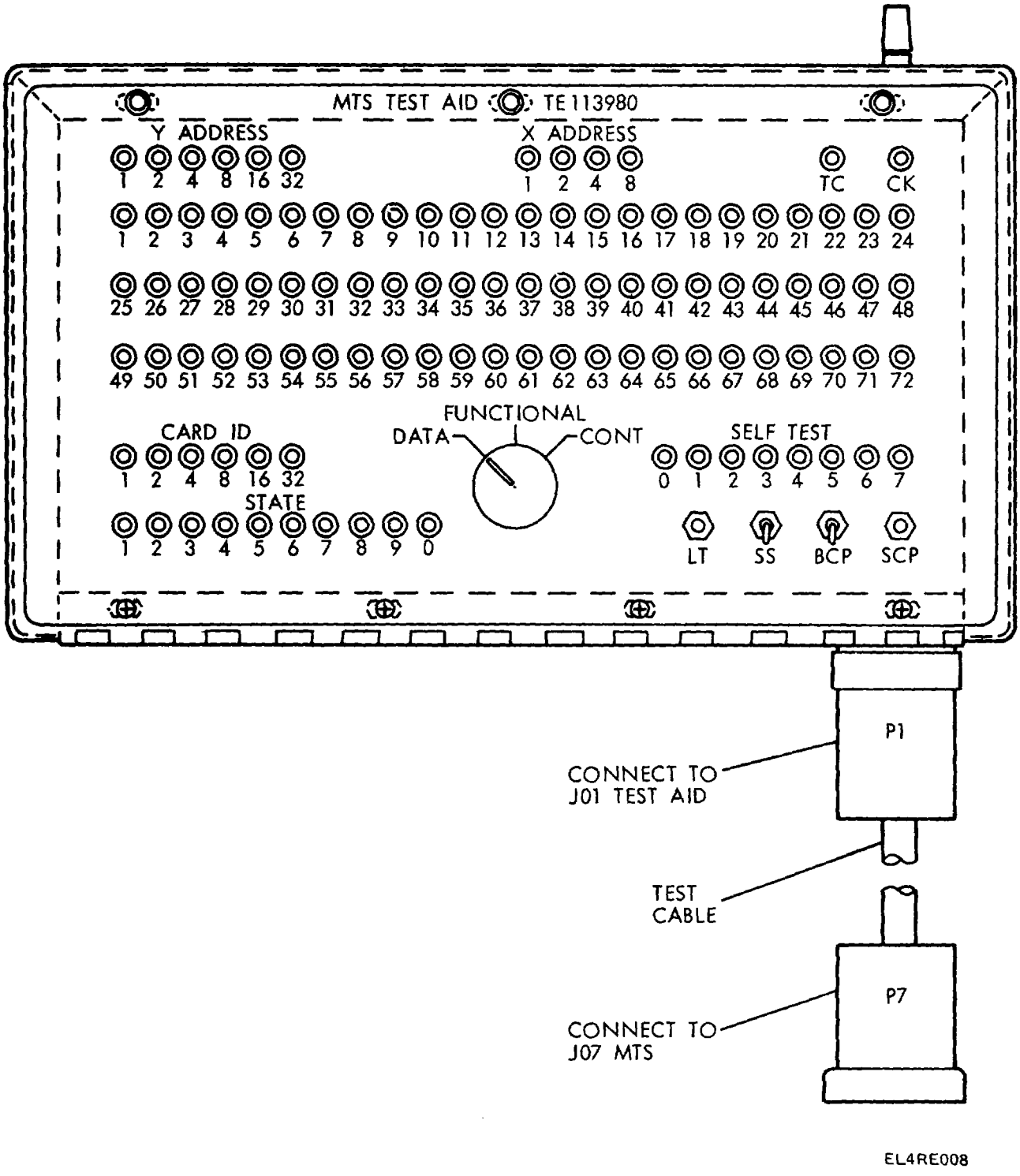


Figure 3-1. MTS Test Aid Controls and Indicators.

Table 3-2. MTS Test Aid Controls and Indicators

Control or Indicator	Function
Y ADDRESS indicators 1, 2, 4, 8. 16, 32	Lights (RED) to display binary configuration of MTS Y address counter.
X ADDRESS indicators l, 2, 4, 8	Lights (RED) to display binary configuration of MTS X address counter.
TC indicator	Light (RED) to display the status of test clock control logic.
CK indicator	Light (RED) to display the status of clock signals to card under test.
Indicators 1 through 72	Lights (RED) to display the Status of selected control lines dependent on position of DATA/FUNCTIONALICONT selector switch.
CARD ID indicators 1, 2, 4, 8, 16, 32	Lights (RED) to display binary code which identifies card under test.
STATE indicators 1 through 9, 0	Lights (RED) to display status of MTS state counter.
SELF TEST indicators 0 through 7	Lights (RED) to display status of self test data check logic.
LT pushbutton switch	When depressed, lights all indicators for lamp test.
SCP pushbutton switch	When depressed, enables substate counter to advance one cycle (16 clocks) when stopped by either SS or BCP toggle switches.
BCP toggle switch	When set to up position, stops substate counter at end of each cycle for single stepping.
SS toggle switch	When set to up position, stops substate counter at end of cycle if an error has occurred during that cycle.
Selector switch:	
DATA position	Enables indicators 1 through 72 to display data being strobed onto MTS probe.
FUNCTIONAL position	Enables indicators 1 through 72 to display functional errors detected by data comparison logic.
CONT position	Enables indicators 1 through 72 to display continuity errors detected by data comparison logic.

NOTE

Refer to TM 11-7010-201-40-5 for detailed information on MTS Test Aid.

a. Connect the MTS and MTS test aid as shown in figure 3-2.

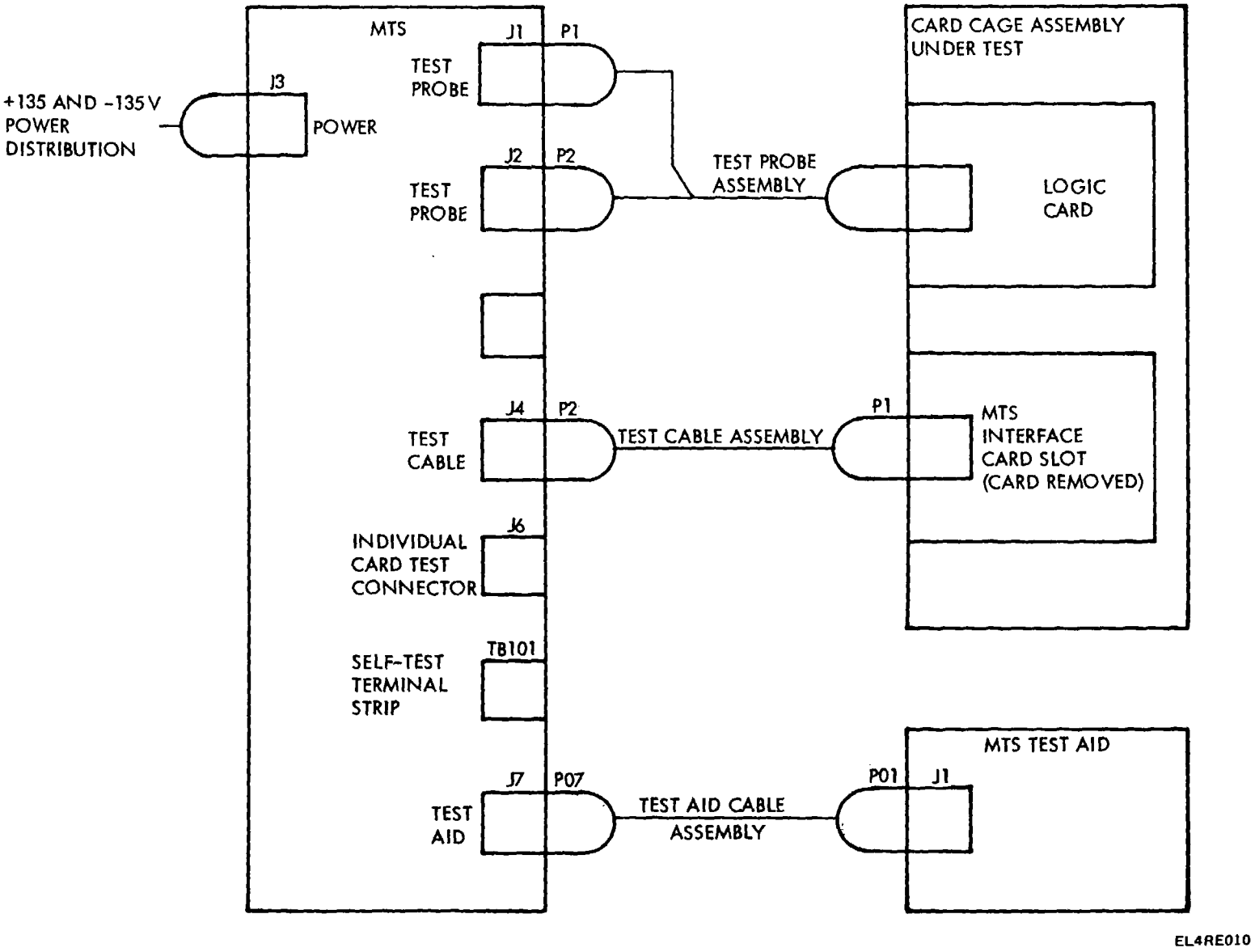


Figure 3-2. MTS Test Aid Connections

b. Set BCP toggle switch to down position.

c. Set SS toggle switch to down position.

d. Depress LT pushbutton and verify that all indicators light.

e. Perform card cage troubleshooting with MTS.

f. Check CARD ID indicators and verify that binary code configuration (lamp on/off conditions) match the card type under test as listed in table 3-3.

g. Set DATA/FUNCTIONAL/CONT (S01) switch to FUNCTIONAL or CONT position, depending on error condition observed on MTS display.

h. Set SS toggle switch to up position.

NOTE

If both FUNCTIONAL INPUT ERROR and FUNCTIONAL OUTPUT ERROR indicators on the MTS are on, short circuit condition is in input signal line. If only the FUNCTIONAL OUTPUT ERROR indicator is on, the short circuit is in the output signal line.

i. Place probe on card under test.

j. Check indicators 1 through 71 and note which one is on.

k. Depress SOP switch and repeat step i. until the MTS has repeated its cycle if continuous cycle switch is on.

l. Refer to table 3-4, column 1, MTS test aid lamp no., and locate lamp no. corresponding to indication in step i.

m. Locate pin number in table 3-4 for related lamp and card assembly part number.

n. Refer to section V to determine applicable wire list number, then to the wire list supplied in separate volumes.

o. Turn off power to MTS and system under test and isolate problem to the open or short circuit wiring for the indicated pin number.

p. Refer to paragraph 3-10 for information regarding card cage repair when the open or short circuit has been located.

Table 3-3. MTS Test Aid Card Type Identification

CARD ID indicators[1]						Decimal equivalent of binary number	Card type
32	16	8	4	2	1		
0	0	0	0	0	0	0	587102
0	0	0	0	0	1	1	587103
0	0	0	0	1	0	2	587104
0	0	0	1	0	0	4	587108
0	0	0	1	0	1	5	587110
0	0	0	1	1	0	6	587117
0	0	1	0	0	0	8	149513
0	0	1	0	0	1	9	149580
0	0	1	1	1	0	14	587106
0	0	1	1	1	1	15	587109
0	1	0	0	0	1	17	587105
0	1	0	0	1	1	19	149512
0	1	0	1	0	0	20	149616
0	1	0	1	1	0	22	149576

[1]Indicator On = 1, Indicator Off = 0

Table 3-4. MTS Test Aid Lamp Numbers and Related Circuit Card Pin Numbers

MTS test aid lamp no.	Circuit card assy TP no.	Circuit card assemblies and I/O pin numbers			
		149612-100, 149513-100	149616-100, 149676-100, 149680-100	587102- 102 thru 587106-102, 587108-102 thru 587110- 102	587117-102
1	7A	13	13	10	11
2	6A	14	14	8	13
3	6A	10	10	6	6
4	4A	8	8	4	8
5	3B	6	3	5	5
6	2B	3	1	1	1
7	2A	4	4	3	4
8	3A	6	6	7	3
9	4B	7	5	9	7
10	5B	9	7	11	9
11	6B	11	9	13	10

Table 3-4. MTS Test Aid Lamp Numbers and Related Circuit Card Pin Numbers- Continued

MTS test aid lamp no.	Circuit card assy TP no.	Circuit card assemblies and I/O pin numbers			
		149612-100, 149513-100	149616-100, 149676-100, 149680-100	587102- 102 thru 587106-102, 587108-102 thru 587110- 102	587117-102
12	7B	15	11	16	16
13	14A	27	25	26	22
14	13A	26	26	24	24
15	12A	24	24	22	23
16	11A	22	22	20	25
17	10A	20	20	18	20
18	9A	18	18	14	18
19	8B	17	15	17	14
20	9B	19	17	19	17
21	10B	21	19	21	19
22	11B	23	21	23	21
23	12B	25	23	25	26
24	13B	29	27	27	27
25	20A	42	42	42	38
26	19A	40	40	40	40
27	18A	38	38	38	35
28	17A	36	36	36	37
29	16A	33	34	34	36
30	15A	30	30	30	34
31	14B	31	29	29	30
32	15B	34	31	31	29
33	16B	35	33	33	31
34	17B	37	35	35	33
35	18B	39	37	37	42
36	I9B	41	39	39	39
37	26A	54	56	56	52
38	25A	52	54	54	54
39	24A	50	52	52	47
40	23A	47	50	50	49
41	22A	48	48	48	50
42	21A	46	46	46	48
43	22B	43	41	41	46
44	23B	45	43	43	41
45	24B	49	45	45	43
46	25B	51	47	47	45
47	26B	53	49	49	53
48	27B	55	51	51	61
49	33A	68	68	70	64
50	32A	69	66	68	66
51	31A	63	64	66	61
52	30A	64	62	64	63
53	29A	62	60	62	62
54	28A	60	57	60	60
55	28B	56	53	53	56
66	29B	57	55	66	65
57	30B	59	59	67	67
58	31B	61	61	59	59
59	32B	66	63	61	68
60	33B	71	65	63	65
61	39B	-	79	79	79
62	38B	80	77	77	80
63	37B	79	75	75	73
64	36B	77	73	73	71
65	36A	74	74	71	78
66	34A	70	70	72	72
67	34B	73	69	65	70
68	35B	75	71	74	69
69	36A	72	72	69	74
70	37A	76	76	76	76

Table 3-4. MTS Test Aid Lamp Numbers and Related Circuit Card Pin Numbers- Continued

MTS test aid lamp no.	Circuit card assy TP no.	Circuit card assemblies and I/O pin numbers			
		149612-100, 149513-100	149616-100, 149676-100, 149680-100	587102- 102 thru 587106-102, 587108-102 thru 587110- 102	587117-102
71	38A	78	78	78	77
72	39A	-	80	80	75

Section IV. REPAIR

3-8. General

a. This section provides information required for direct support maintenance of the ADP assemblies in both the CSCPG and MSCPG; and consists of card cage repair, connector repair, and removal and replacement procedures for the major subassemblies. The scope of direct support maintenance is limited by the authorized repair parts, tools, and test equipment. Refer to paragraph 3-3 for tools and test equipment and to the RPSTL TM 11-5895-856-34P for repair parts authorized at this level of maintenance.

b. Direct support personnel are called by the using organization to perform corrective maintenance actions on the ADP assemblies when the repair task is beyond the skill level, repair authorization, or resources of the organizational level personnel. Direct support personnel are authorized to perform on-site minor repairs to the card cages. This includes first, any repairs that could be performed by organizational personnel and, second, minor card cage repairs including items such as chassis-mounted resistors, capacitors, and diodes; and limited chassis wiring repairs which include connector pin replacement. Soldered component replacements can be accomplished with the card cage in place if no more than ten wires must be removed from the component. Wire wrap termination's can be accomplished if the repair does not involve replacement of the ground or power-sleeved connector pins (sleeved pins require special tools and procedures for replacement), or does not involve replacement of pins or wires which would result in a pyramiding wire replacement situation. In the event there is multiple pin damage or the connector itself is damaged, the card cage must be removed for depot repair. Replacement of all card cages is accomplished by direct support personnel. Visual aids for removal and replacement procedures are provided in the form of location diagrams and cable interconnection diagrams.

3-9. Frame and Support Structure Maintenance

a. Inspect for loose hardware, cleanliness, seating of connectors and discoloration of components due to excessive heat.

b. Check for damage to frames, mounting brackets, hinges and hinge pins.

NOTE

Refer to TM 11-5805-681-34 and TM 11-5805-683-34 for replacement instructions on hinge pins and mounting brackets.

3-10. Card Cage Repair

a. The card cage assemblies provide the interface connections between the analog and the digital cards within the unit. They also provide input/output connectors which interface the unit with the rest of the system. The card cages are made by sandwiching a sheet of insulation between two conducting aluminum alloy plates. The front plate, card connector side, is the power plate (+5 vdc) and the back plate, wire wrap side, is the ground plate. The 80-pin card connectors are mounted on the power plate with the pins feeding through holes in both plates to the wire wrap side. Ground and power connections are made using press-in ferrets to make contact between the pin and the desired plate. All connector interconnections are accomplished using wire wrap termination's.

b. Card cage failures will result in the same type of failure indications as failed cards but will not be corrected by card replacement. The majority of card cage failures can be isolated and corrected on-site by direct support personnel using visual inspection, the module test set (MTS), and the MTS test aid (a functional lamp display box), and wire lists Section V).

c. Two general categories of card cage repair can be accomplished at direct support level: wire replacements subject to pyramiding conditions

noted in paragraph 3-11), and connector pin removal and replacement. When the fault requires extensive repair, i.e., broken connector pins and pyramiding wire replacement, the card cage must be removed by direct support personnel for repair at the depot facility. Refer to paragraph 3-14 for specific removal and replacement procedures for the card cages in each of the subassemblies.

3-11. Pyramiding Wire Replacement

When new wiring must be installed, the degree of pyramiding must first be determined before proceeding. The general restrictions are listed below.

a. A wire that has been unwrapped cannot be rewrapped. If an adequate service loop is available, the wire can be clipped and rewrapped; if not, a new wire must be installed.

b. No more than three wires can be wrapped on a single pin; a wire that has been clipped off and left in place counts as one of the three.

c. Unwrapping a clipped wire and "sliding" the topmost wire(s) down is not permissible. An example is provided in figure 3-3 where a pin must be replaced as shown in figure 3-3, example A. Wires A, B. and C must be removed to remove pin 1. Figure 3-3, example B. shows the wires removed, and example C shows the new wires (AA and AC) installed, with the exception of wire AB to pin 4. Since three connections are already in place (X, Y. and B cut-end}, these three connections must be removed to permit wrapping wire AB. However, if wires X and Y were to be replaced, a pyramiding condition could be encountered where it may become impractical and too time-consuming to replace all other affected wires; i.e., all other wires related to wires X and Y replacement. A judgment is then necessary before starting to replace any wire, whether card cage repair or replacement should be undertaken.

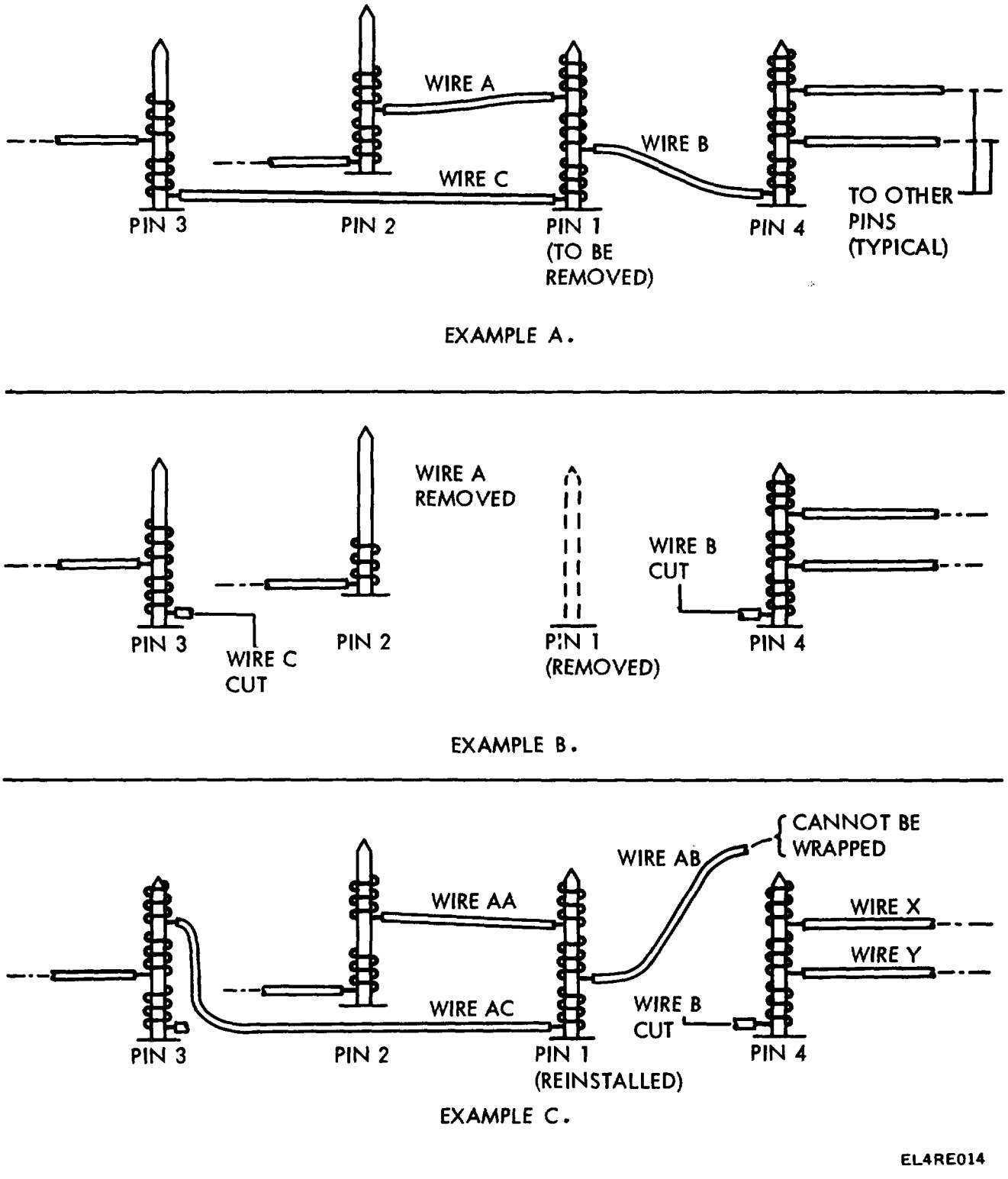


Figure 3-3. Pyramiding Wire Replacement Examples.

3-12. Wire Wrap Connection

A wire wrap connection may be removed and replaced by performing the following procedures:

a. Removal To remove a wire wrap connection, proceed as follows:

(1) Determine if wire wrap connection to be removed is a right or left hand wrap.

(2) Set unwrapping tool (table 3-1) over wire wrap post. (Use end of unwrapping tool marked R for right hand wrap or end marked L for left hand wrap.)

(3) Unwrap wire from wire wrap post by twisting unwrapping tool.

b. Replacement. To install a wire wrap connection, proceed as follows:

(1) Install battery (table 3-1) into wire wrap gun (table 3-1).

(2) Install bit (table 3-1) and sleeve (table 3-1) into wire wrap gun.

(3) Strip 1.00 inch of insulation from wire to be installed.

NOTE

It is not permissible to rewrap the portion of wire that has been previously wrapped on a wire wrap post. Therefore, if there is insufficient service loop in the wire to be rewrapped, a complete wire may require replacement. When a wire is replaced, the replacement wire shall follow the same route as the replaced wire.

(4) Insert stripped wire into small hole of bit until 0.250 inch of insulation is in hole.

(5) Route wire through slot in sleeve.

(6) Set bit in place over wire wrap post (wire wrap post goes into large hole in bit).

NOTE

When wrapping a wire on a wire wrap post, the wire wrap connection shall be in the lowest position possible on the wire wrap post that does not overlap an existing wire wrap connection.

(7) Holding wire wrap gun lightly, squeeze trigger of wire wrap gun until wire is wrapped on wire wrap post.

(8) Remove bit from wire wrap post.

c. Installation. Inspect the wire wrap connection to verify that the following criteria are met: (1) Minimum of seven turns of uninsulated wire.

(2) Insulated wire makes contact with a minimum of three corners of wire wrap post.

(3) No overlapped turns of wire.

(4) Maximum space between adjacent turns of uninsulated wire less than one-half the nominal diameter of uninsulated wire.

(5) End of wrapped wire does not extend away from outside diameter of uninsulated wire more than the diameter of uninsulated wire.

(6) All wire turns are below top of wire wrap post.

3-13. Card Cage Connector Contact Repair.

NOTE

To determine if a card cage connector contact has been damaged and requires removal and replacement, refer to figure 3-4.

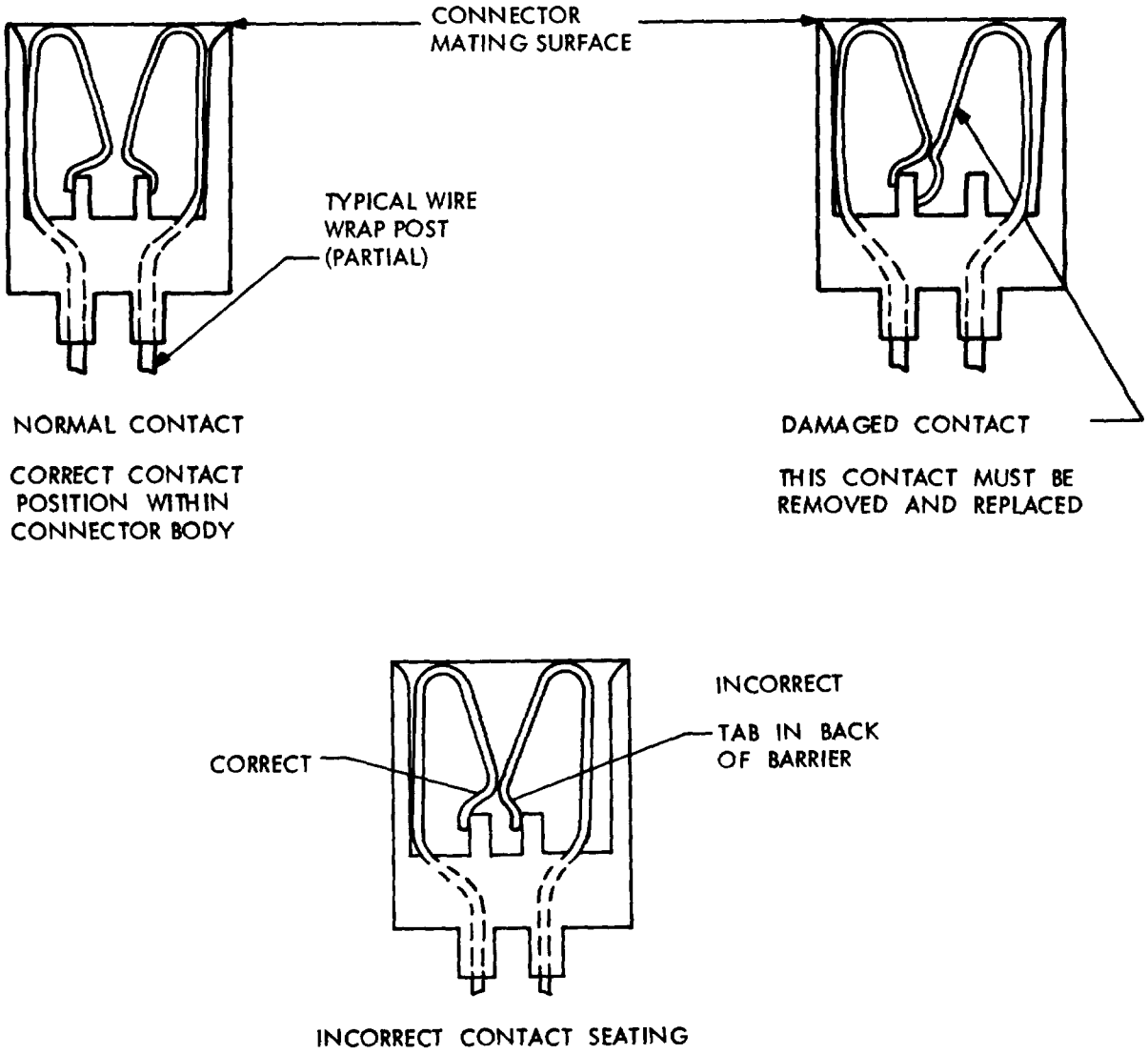


Figure 3-4. Card Cage Connector Contact Inspection.

a. Removal. To remove a card cage connector contact, proceed as follows:

NOTE

The following procedure applies only to removal and replacement of a signal contact; ground and power contacts employ a special sleeve and require depot repair facilities for removal and replacement.

To remove a damaged connector contact, remove wires (para 3-12a) and then place removal punch (06-6323-0102/-1401, table 3-1) over wire wrap post; tap contact out as shown in figure 3-5, example A.

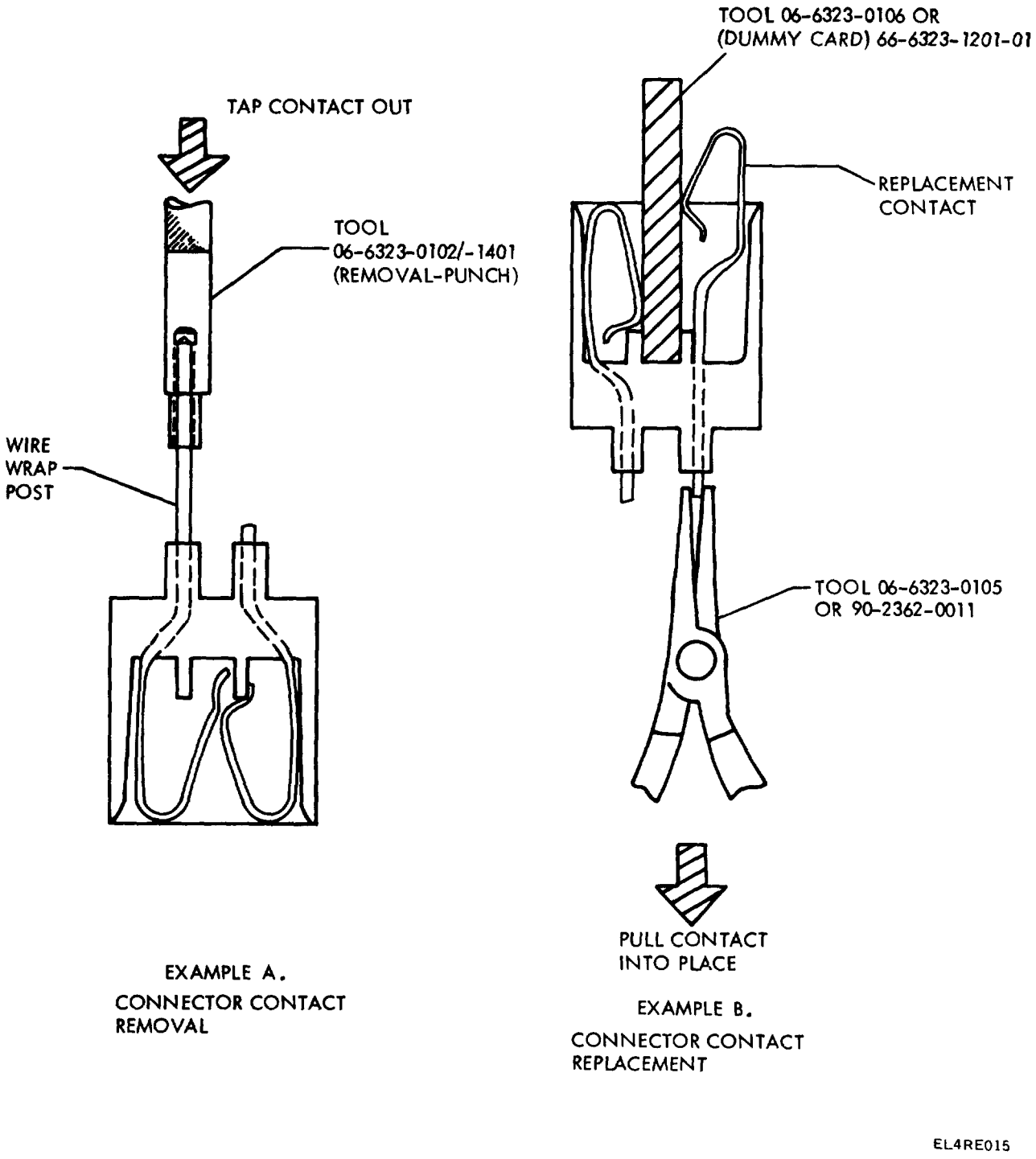


Figure 3-5. Card Cage Connector Contact Removal and Replacement.

b. Replacement. To replace a connector contact, proceed as follows:

(1) Insert Dummy card (06-6323-0106 or 66-6323-1201-01, table 3-1) into connector as shown in figure 3-5, example B.

(2) Insert replacement contact pin into connector and, using pliers (06-6323-0105 or 90-2362-0011, table 3-1), pull contact into place.

(3) Remove dummy card and inspect contact to ensure it is installed flush or approximately within 0.006 inch below connector mating surface.

(4) Check that contact tab is not in back of barrier as shown in figure 3-6.

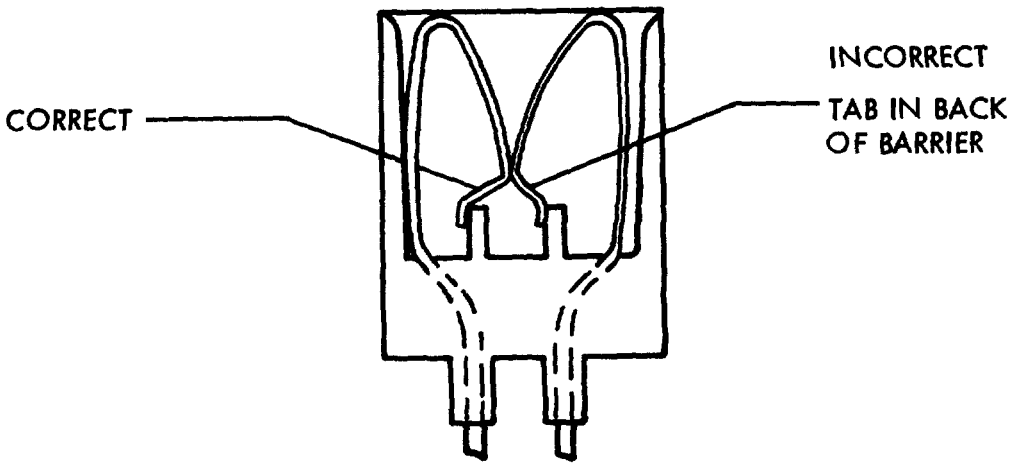


Figure 3-6. Incorrect Contact Seating.

If contact is not seated properly, perform the following:

(5) Insert pick B (06-6323-0111/-0701, table 3-1) between contacts and snap tab back and up over barrier as shown in figure 3-7, example A.

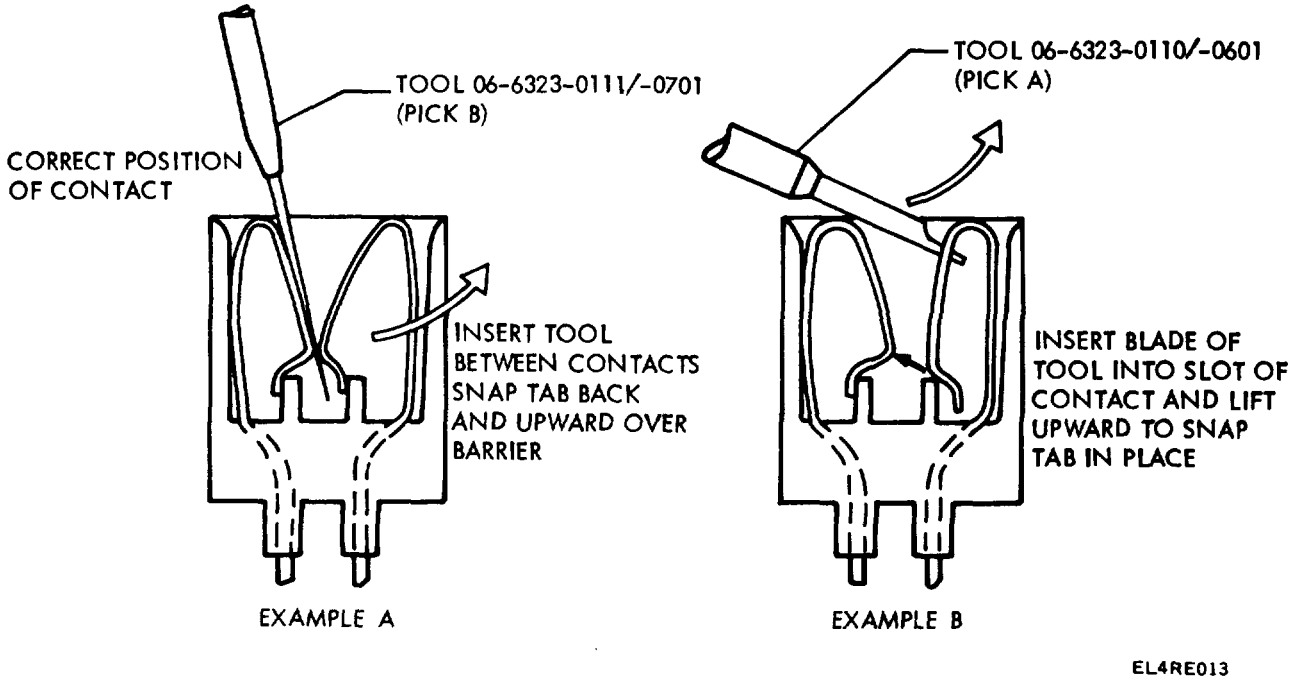


Figure 3-7. Reseating Connector Contact.

(6) Insert blade of pick A (06-6323-0110/-0601, table 3-1) into slot of contact and lift up to snap tab in place as shown in figure 3-7, example B.

3-14. Removal and Replacement Procedures

Refer to figures 3-8 through 3-11 for ADP assembly locations, and cable interconnection diagrams figure FO-3 and figure FO-5 during the following removal and replacement procedures.

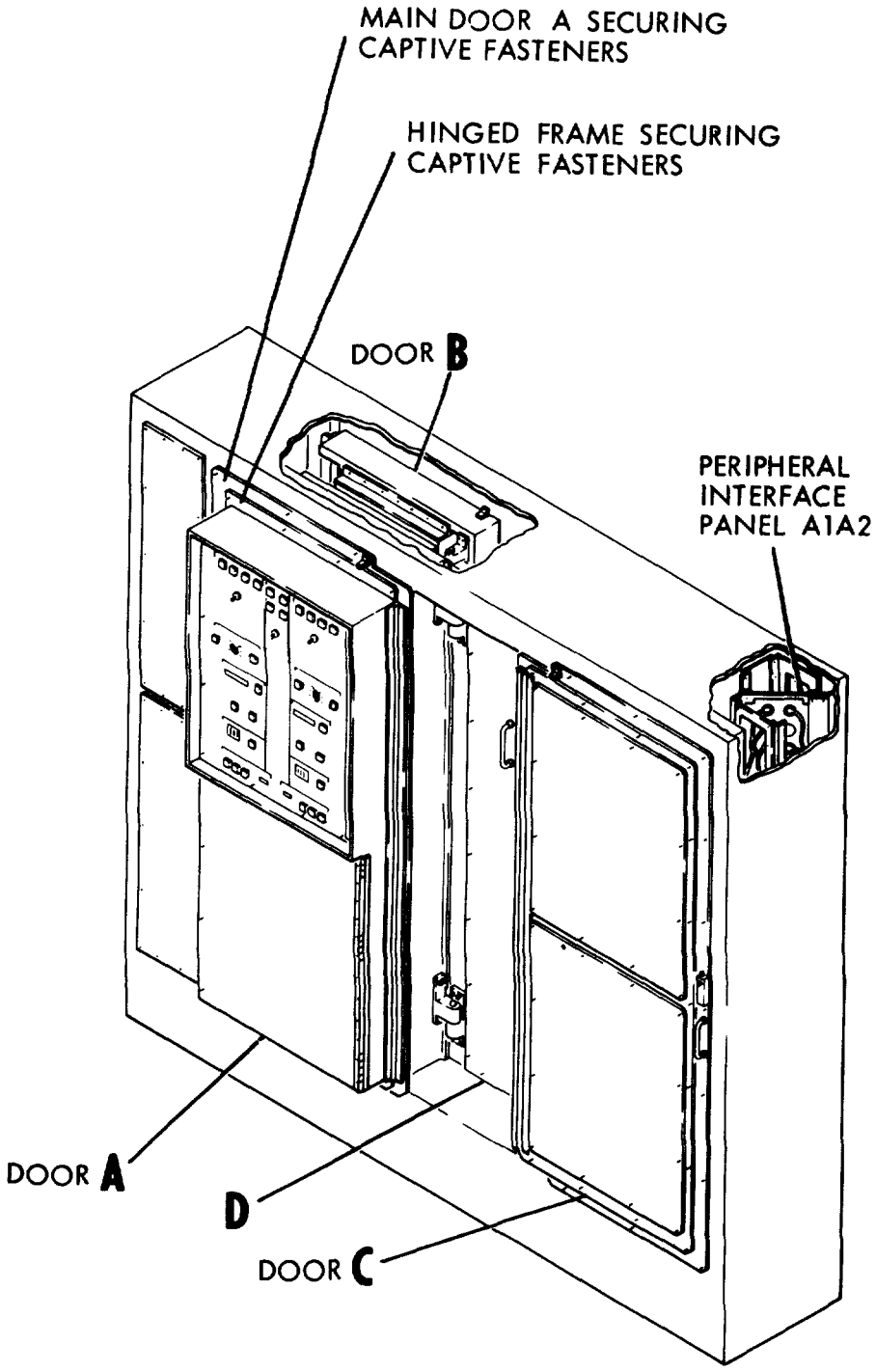


Figure 3-8. Message Switch ADP Assembly (Sheet 1 of 5).

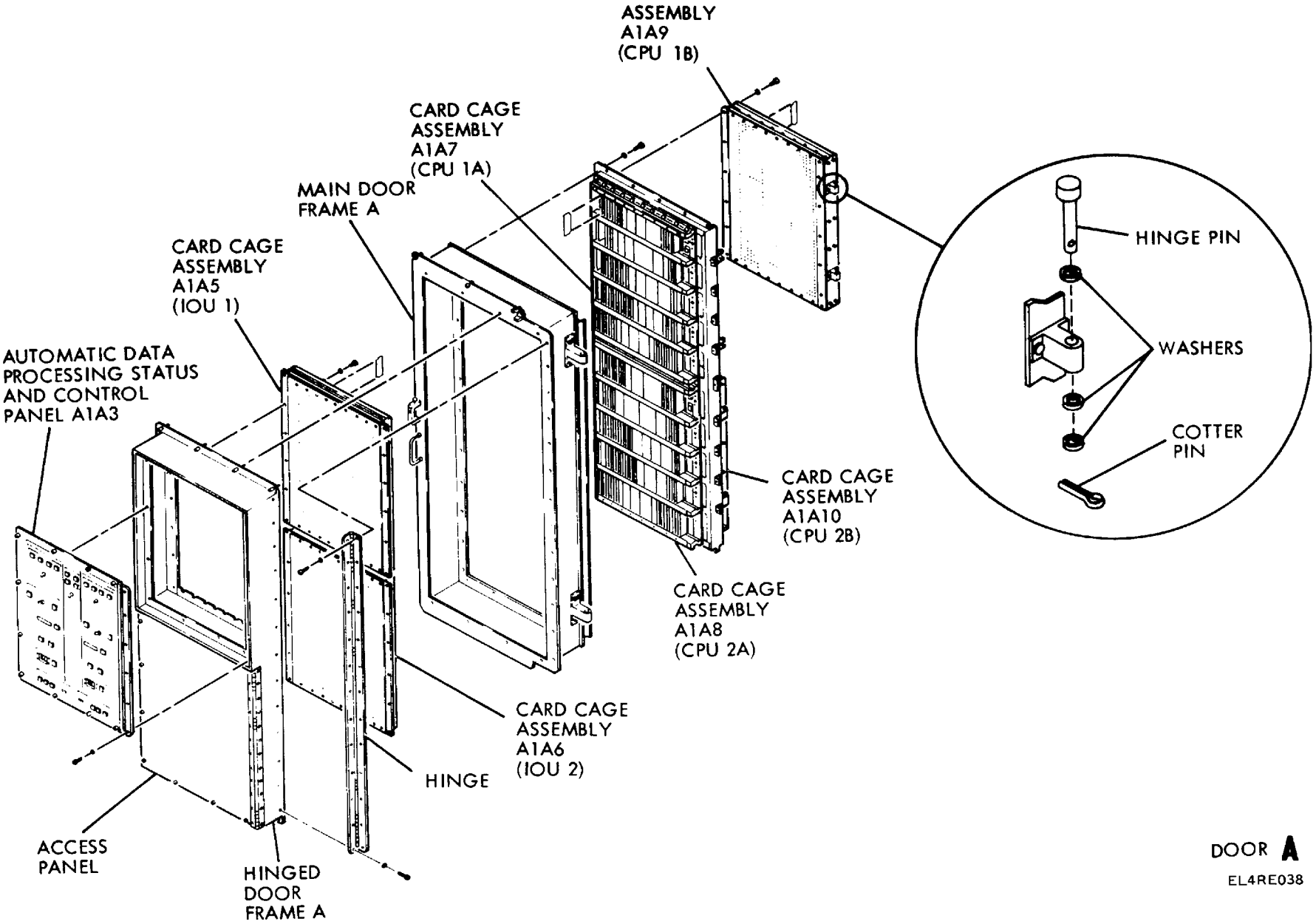


Figure 3-8. Message Switch ADP Assembly (Sheet 2 of 5).

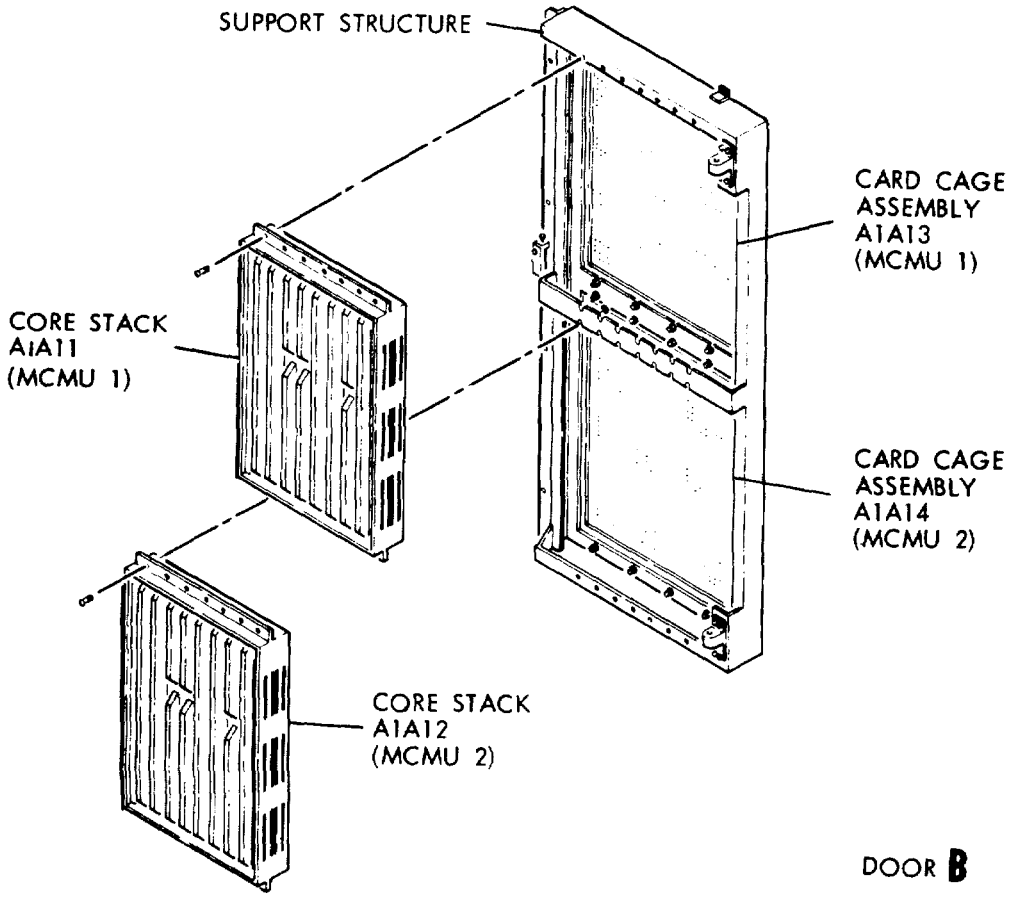
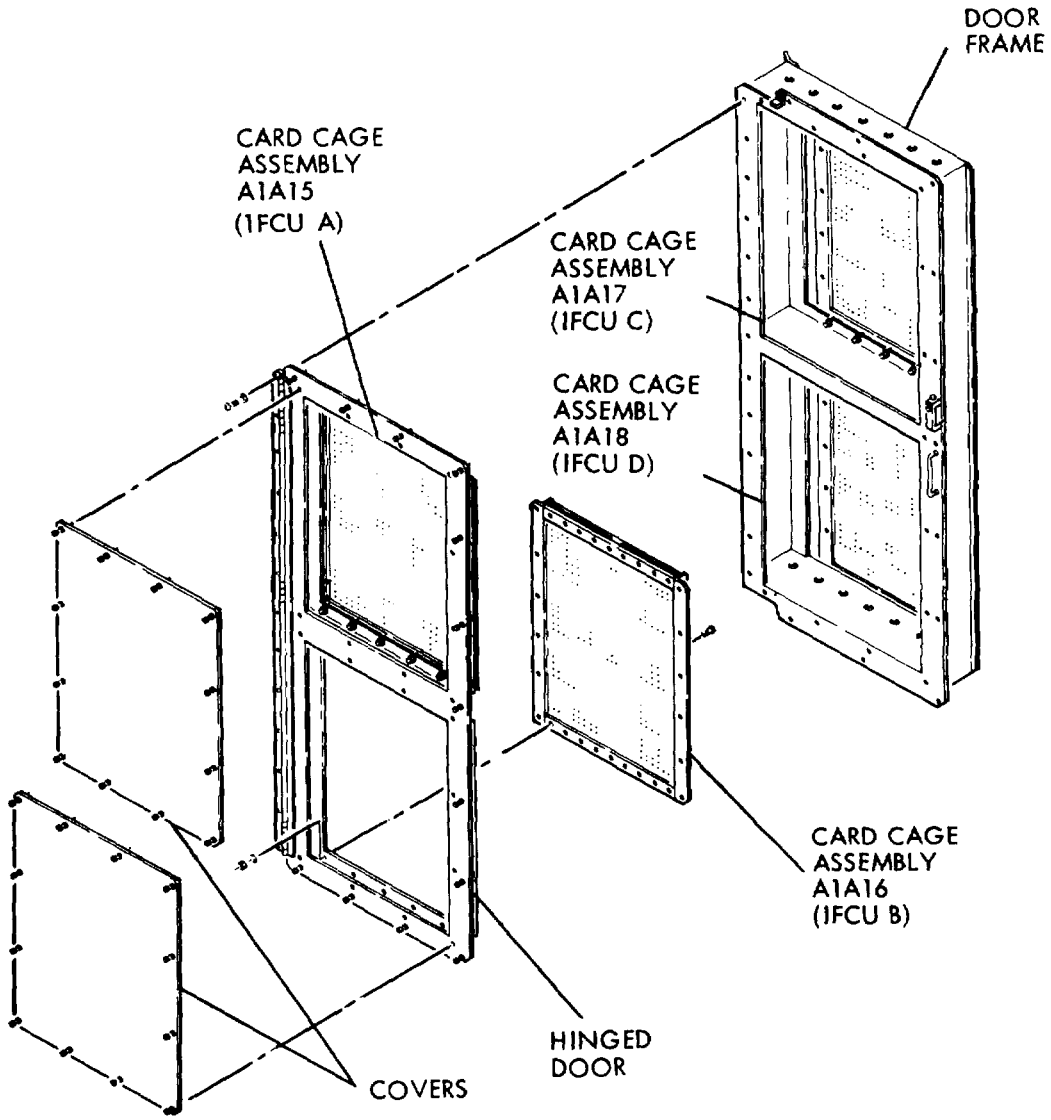


Figure 3-8. Message Switch ADP Assembly (Sheet 3 of 5).



DOOR C

Figure 3-8. Message Switch ADP Assembly (Sheet 4 of 5).

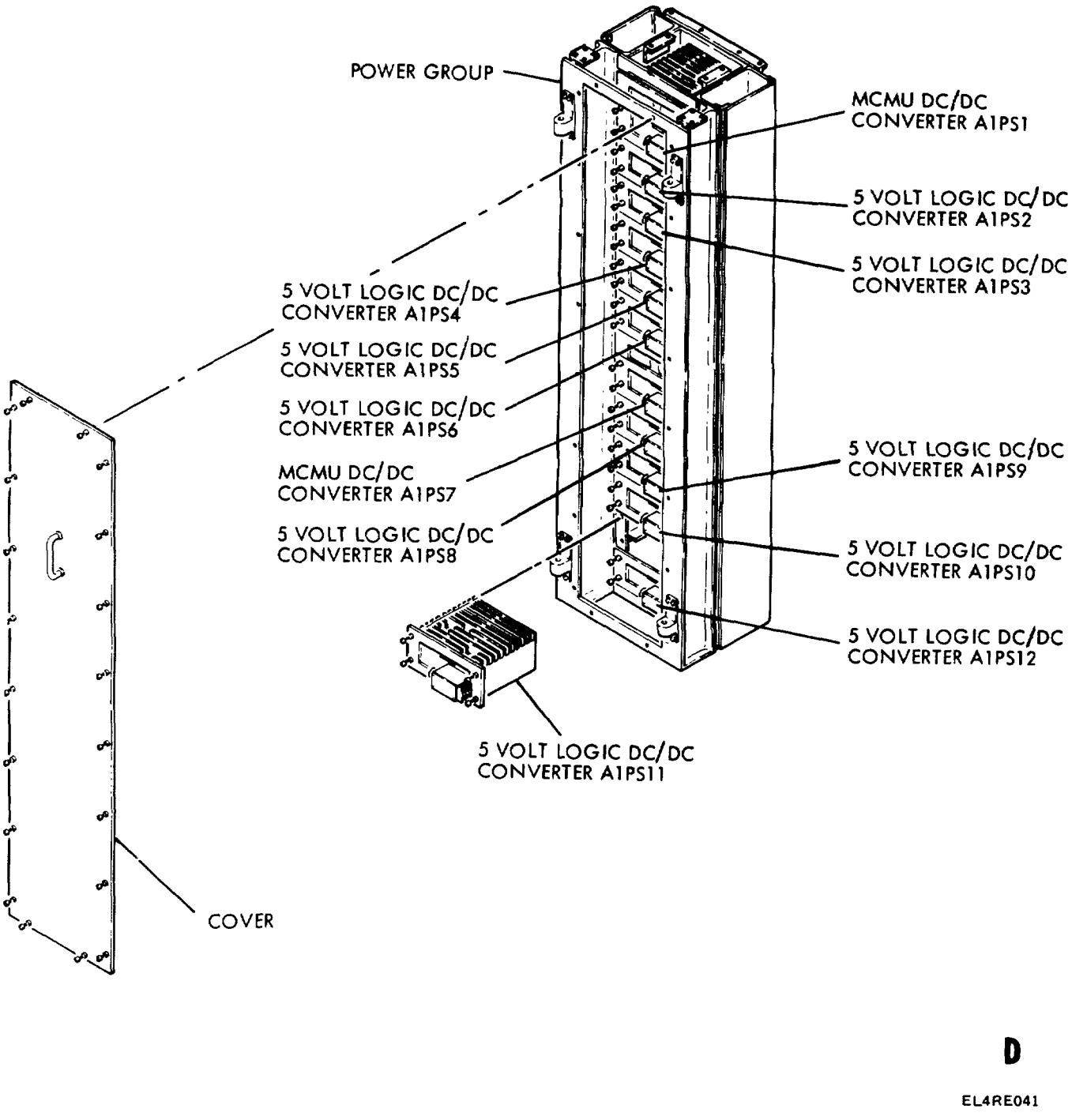


Figure 3-8. Message Switch ADP Assembly (Sheet 5 of 5).

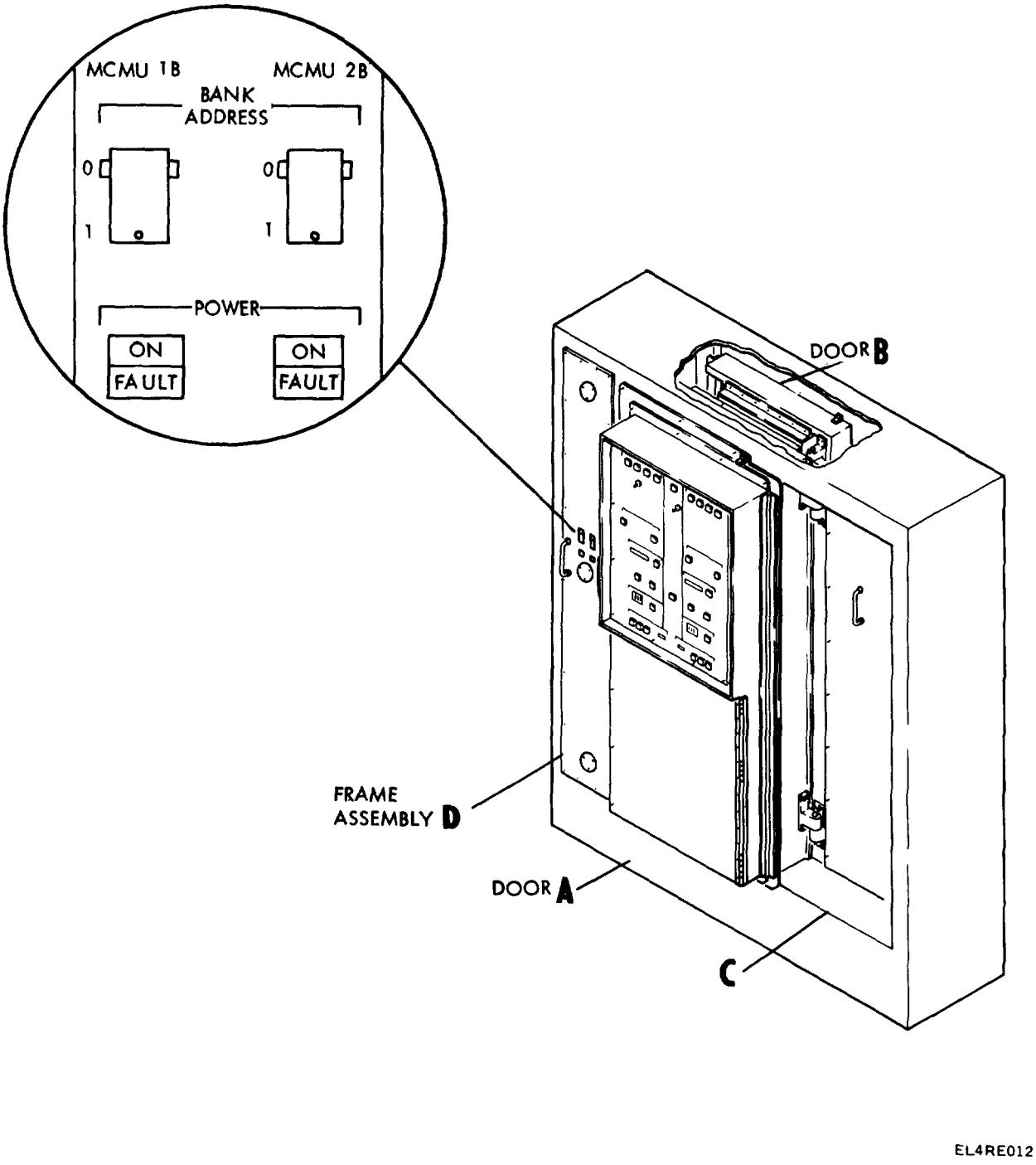


Figure 3-9. Circuit Switch ADP Assembly (Sheet 1 of 5).

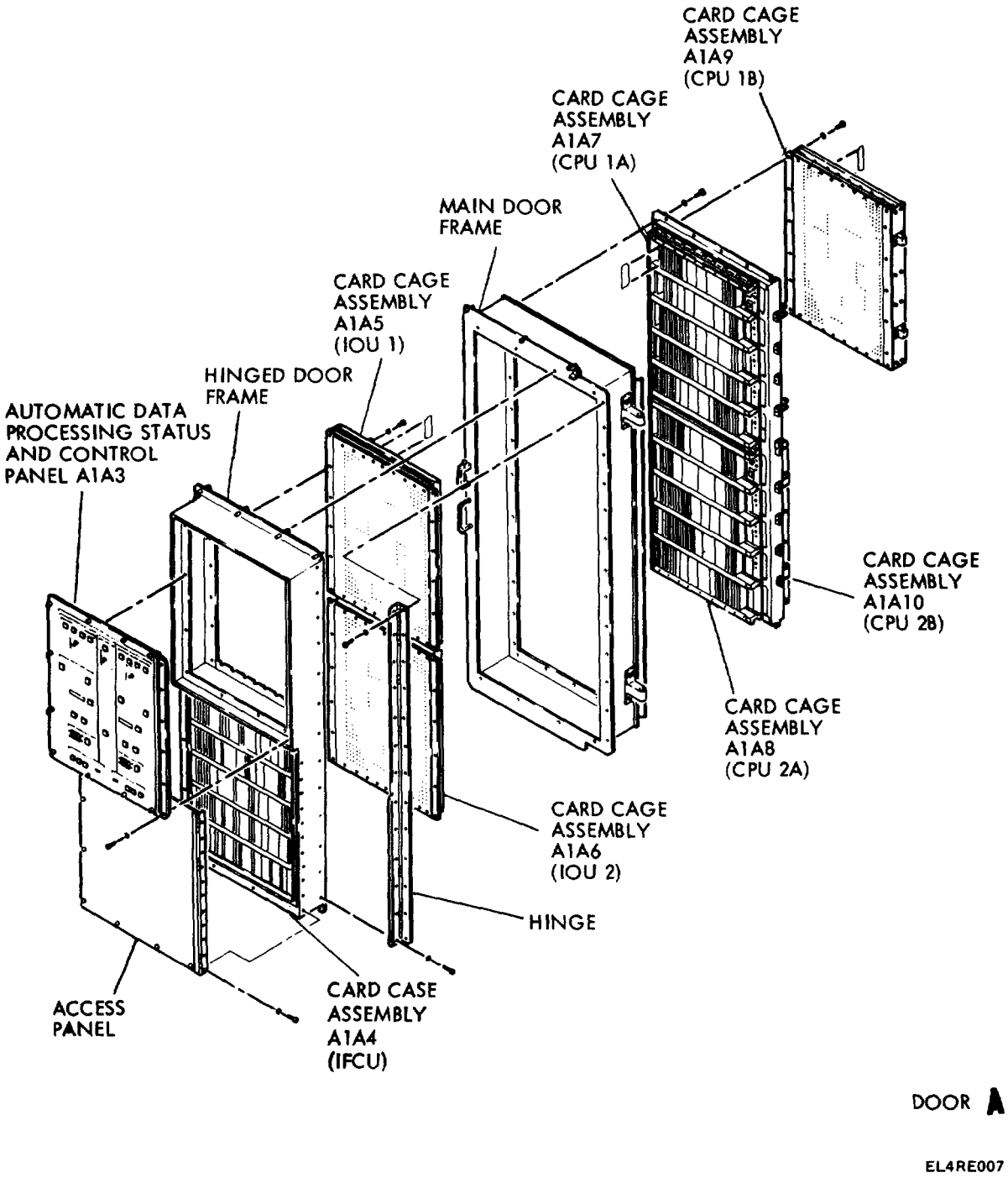


Figure 3-9. Circuit Switch ADP Assembly (Sheet 2 of 5).

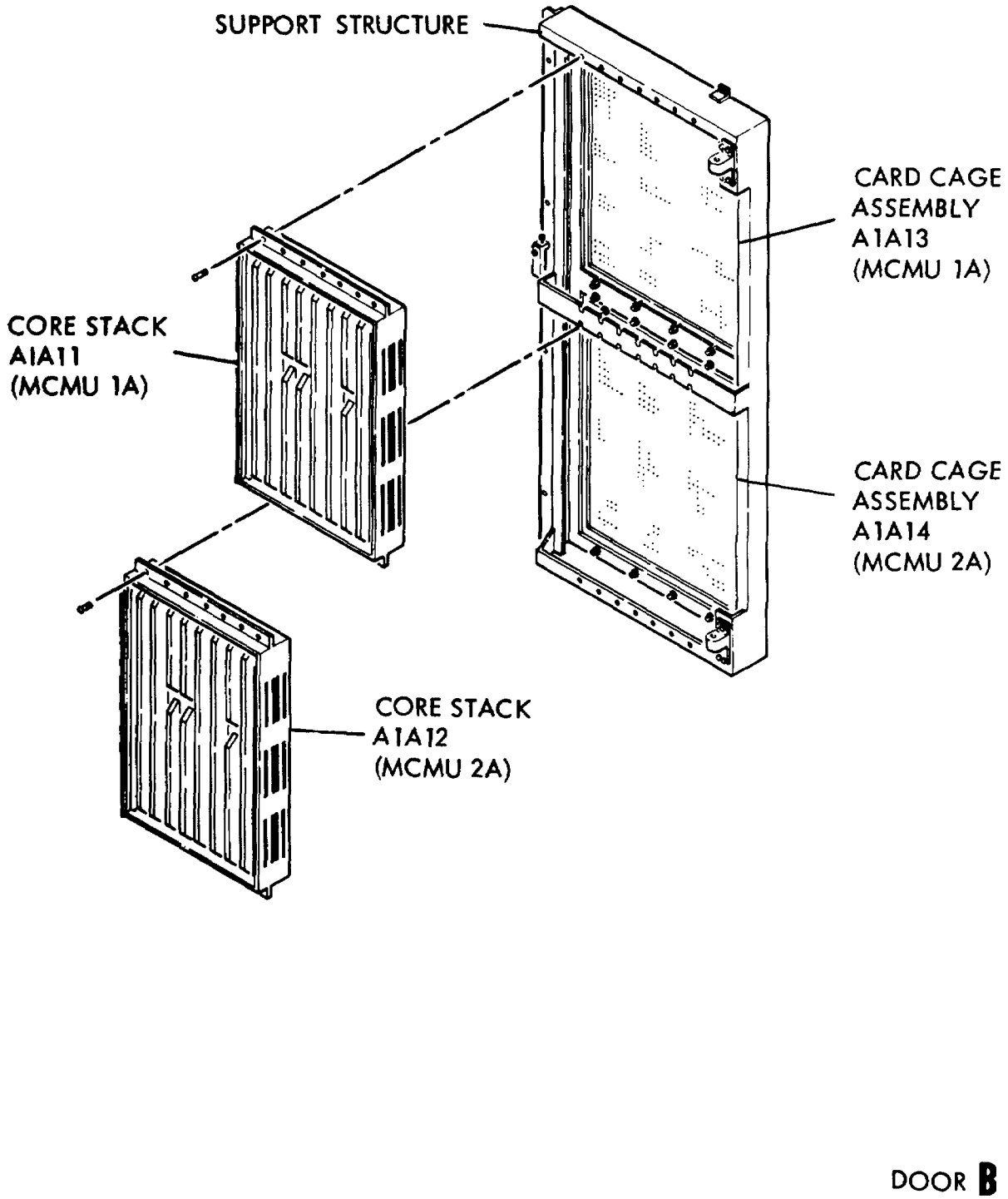


Figure 3-9. Circuit Switch ADP Assembly (Sheet 3 of 5).

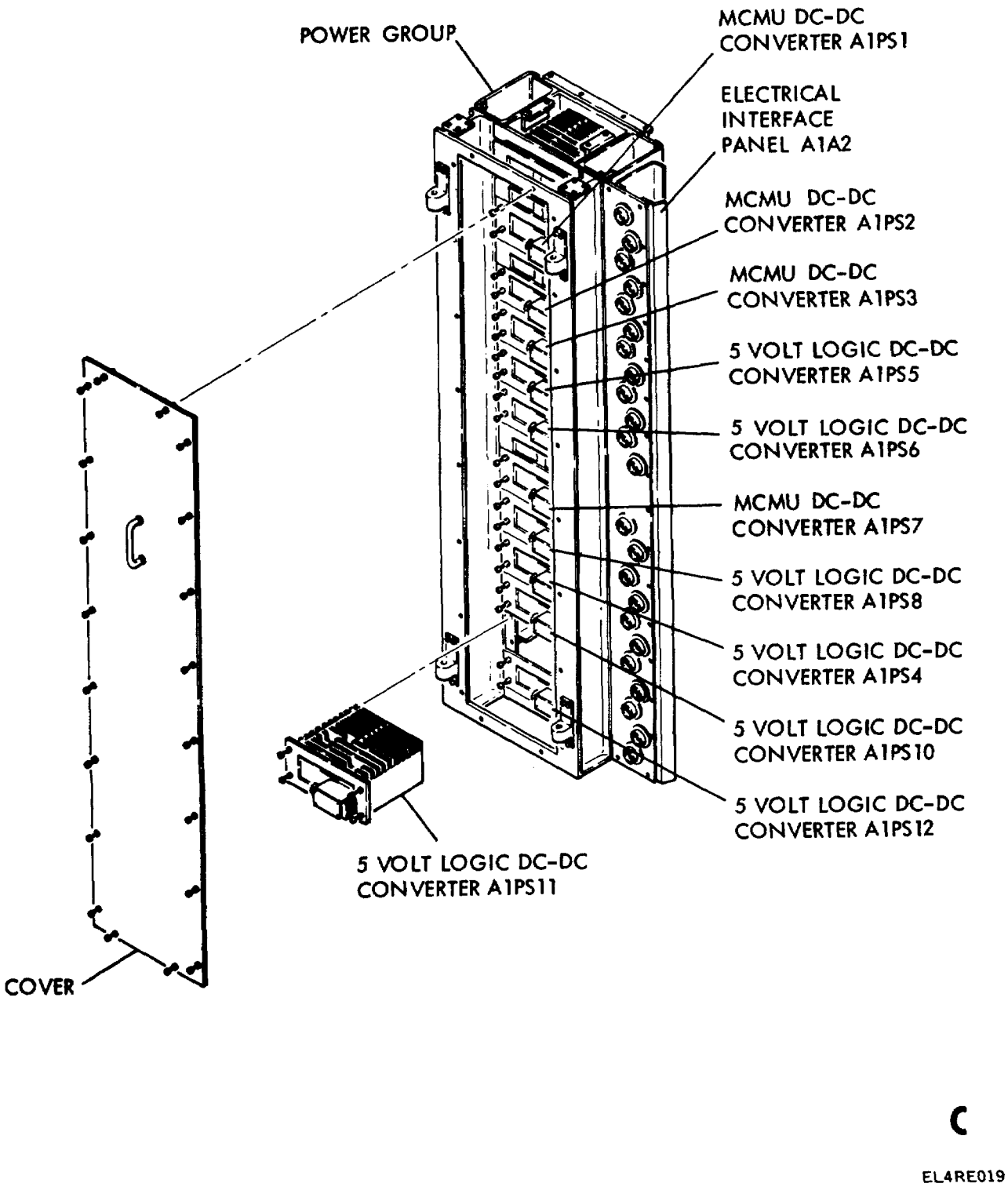


Figure 3-9. Circuit Switch ADP Assembly (Sheet 4 of 5).

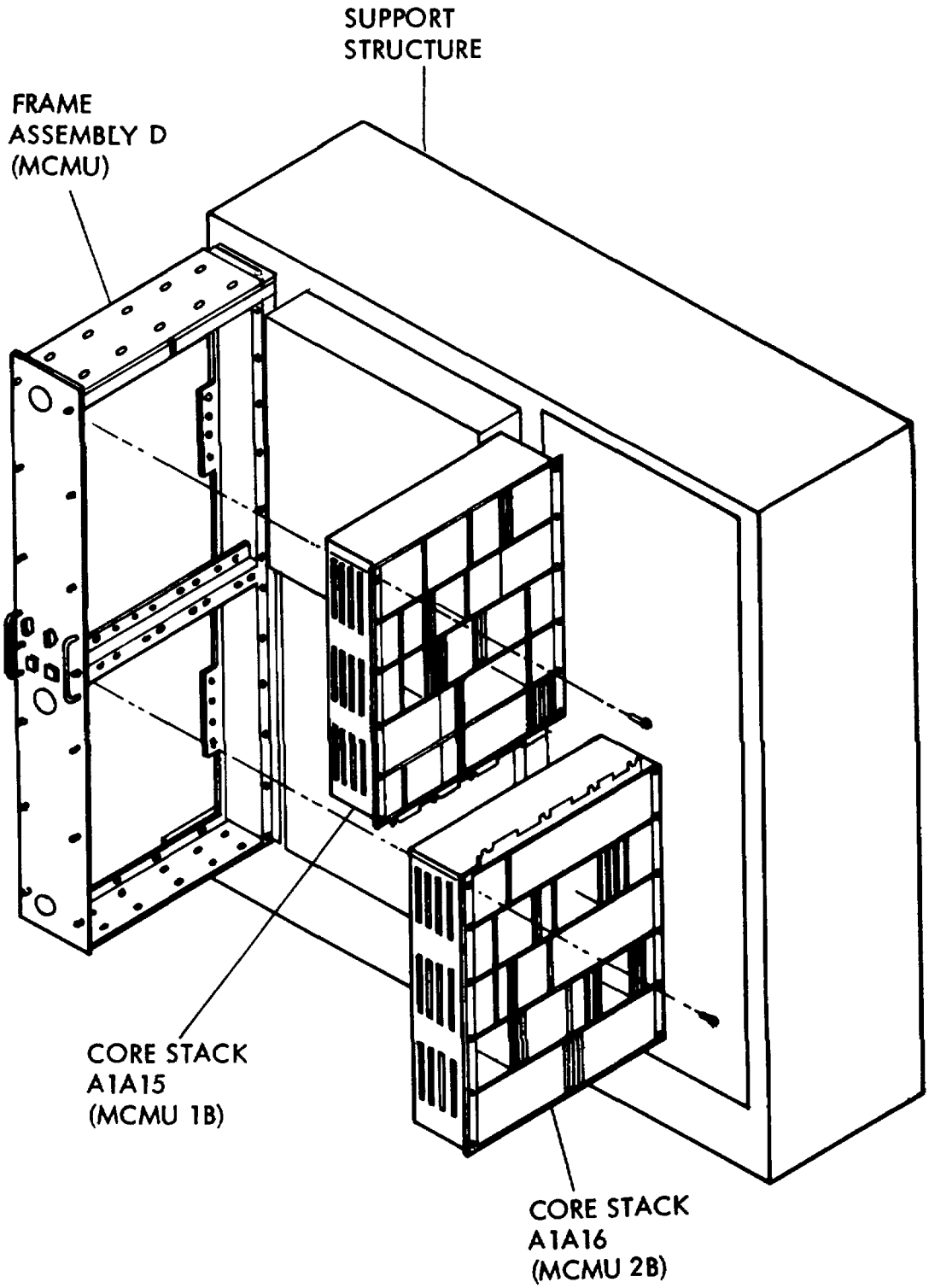
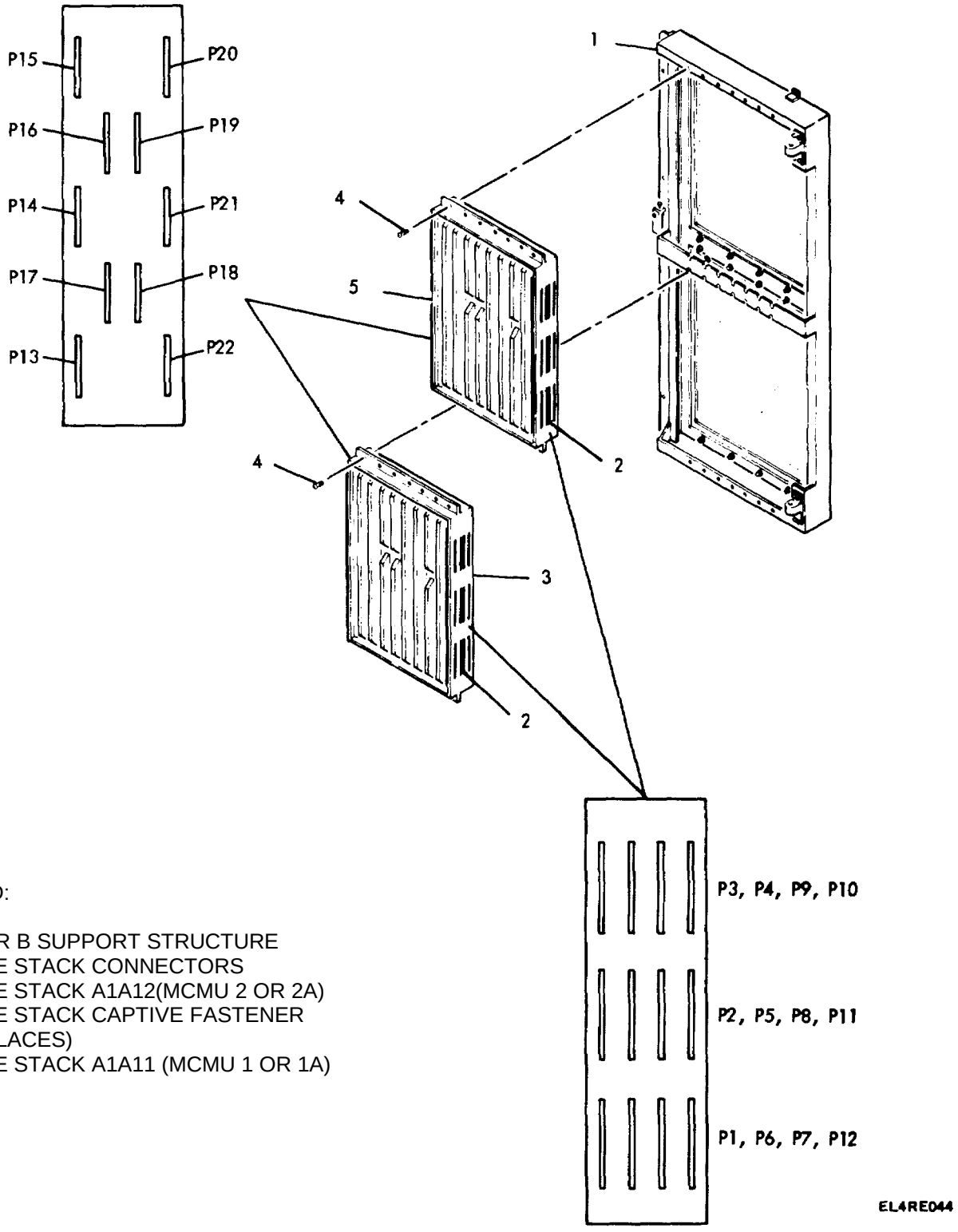


Figure 3-9. Circuit Switch ADP Assembly Sheet 5 of 5).



LEGEND:

1. DOOR B SUPPORT STRUCTURE
2. CORE STACK CONNECTORS
3. CORE STACK A1A12(MCMU 2 OR 2A)
4. CORE STACK CAPTIVE FASTENER (14 PLACES)
5. CORE STACK A1A11 (MCMU 1 OR 1A)

Figure 3-10. MCMU Core Stack A1A11 and A1A12) Assembly Removal and Replacement

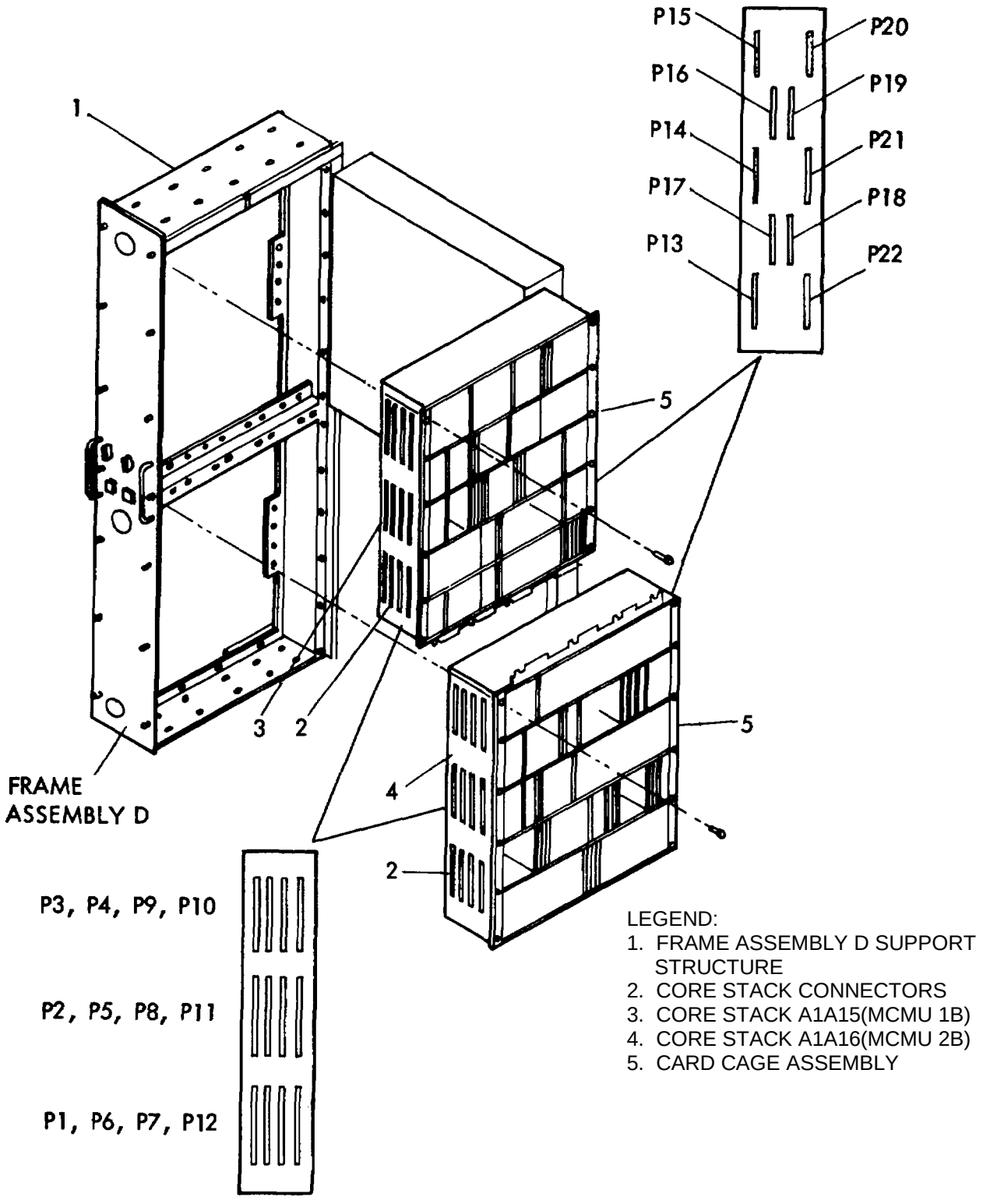


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Figure 3-11. MCMU Card Cage/Core Stack A1A15 and A1A16) Assembly Removal and Replacement.

3-15. Card Cage (CPU, IOU and MCMU) Removal and Replacement

The card cages (figs. 3-8 and 3-9) comprising either CPU, IOU or MCMU may be replaced without shutting down the entire switch. The automatic data processor involved must be shut down during replacement. A card cage is replaced with all of its circuit cards removed. Perform the following procedures to remove a CPU, IOU or MCMU card cage.

CAUTION

Replacement of card cages is a two person operation. One must support the cage while the other removes attaching hardware. If the card cage is allowed to fall when hardware is removed, backplane wire-wrap pins will be bent, shorted, or broken. Also, wiring may be damaged.

a. On the circuit breaker panel set the four PROCESSOR 1 or PROCESSOR 2 (as applicable) circuit breakers to OFF position. This shuts off power to all four card cages (IOU, CPU, MCMU) which comprise the ADP.

b. On ADP status and control panel and on circuit switch MCMU frame assembly D (fig. 3-8), verify that all POWER indicators (CPU 1A or 2A, CPU 1B or 2B, IOU 1 or 2, MCMU 1 or 2; MCMU 1A or 2A, MCMU 1B or 2B) for applicable processors are off.

c. Gain access to card cages by opening appropriate door:

(1) For A1A9 (CPU 1B) or AlA10 (CPU 2B) (fig. 3-8 and 3-9), loosen captive fasteners securing main door A. Grasp handle and pull door A open.

(2) For A1A5 (IOU 1) or A1A6 (IOU 2) (fig. 3-8 and 3-9), loosen captive fasteners which secure hinged door frame A to main door A. Open hinged door A.

(3) For A1A7 (CPU 1A) or A1A8 (CPU 1B) (fig. 3-8 and 3-9), loosen captive fasteners which secure hinged door frame A to main door A. Open hinged door A. This provides access to front of card cages. Loosen captive fasteners which secure main door A. Grasp handle and pull main door A open. Remove screws securing card cage to rear of card cage being removed (A1A9 if removing A1A7; A1A10 if removing A1A8). Swing rear cage open on its hinge for access to the rear of AlA7 or AlA8.

(4) For A1A13 (MCMU 1 or 1A) and A1A14 (MCMU 2 or 2A) (figs. 3-8 and 3-9), loosen captive fasteners which secure door A. Open door A. Loosen door B support structure captive fasteners. Pull door B open.

(5) On circuit switch for A1A15 (MCMU 1B) and A1A16 (MCMU 2B) (fig. 3-9), loosen captive fasteners which secure frame assembly D to support structure. Grasp the two handles on frame assembly D and pull to open position.

d. Using card extractor, disconnect all ribbon cables from card cage. If removing MCMU (1 or 1A or 2 or 2A) card cage, disconnect connections to associated core stack and remove core stack.

e. Disconnect power cable connector from card cage.

CAUTION

Card cage will drop when last two screws are removed.

f. Remove all but two screws (on opposite upper corner) that secure card cage. On A1A7 (CPU 1B) and A1A8 (CPU 2B), securing screws on left side are removed from front of card cage; screws on right side are removed from rear of card cage. If removing A1A9 or A1A10, remove all screws allowing nest to rotate on its hinge pins. The hinge pins should be the last support removed. First person, hold card cage to assure it will not fall; second person remove remaining supporting screws or hinge pins. Hinge pins are removed by removing cotter pin, then sliding out hinge pin.

g. Both persons lift out card cage, being very careful not to damage rear wiring and pins.

h. Replacement is the reverse of removal procedure. All cables are marked to indicate mating connectors. When replacing. A1A13 (MCCMU 1 or 1A) or A1A14(MCMU 2 or 2A), do not tighten attaching screws until is checked that no core stack connecting wires are pinched between the card cage and the support structure.

3-16. MCMU Core Stacks A1A11 (MCMU 1 or 1A) and AlA12 (MCMU2 or 2A) Removal and Replacement

a. Removal.

(1) At the circuit breaker panel DC group, set PROCESSOR 1 or 2 (MCMU 1 or 2) to OFF.

(2) Loosen door A main door captive fasteners securing door A to cabinet assembly.

(3) Grasp handle on door A main door and pull to opening position.

(4) Disconnect connectors from core stack A1A11 or A1A12.

WARNING

The weight of a MCMU core stack is approximately 53 pounds. To avoid injury to personnel, two persons are required to remove MCMU.

(5) Loosen core stack captive fasteners

securing ore stack to door B (fig. 3-10) support structure and remove core stack.

b. Replacement.

WARNING

The MCMU core stack weight is approximately 53 pounds. To avoid injury to personnel, two persons are required to replace MCMU.

(1) Insert core stack and tighten core stack captive fasteners securing it to door B support structure (fig. 3-10).

(2) Tighten connectors to core stack.

(3) Grasp handle on door A main door and pull to closed position.

(4) Tighten door A main door captive fasteners securing door A to cabinet assembly.

(5) At the circuit breaker panel DC group, set PROCESSOR 1 or 2 (MCMU 1 or 2) to ON.

3-17. MCMU Card Cage/Core Stacks A1A15 (MCMU 1B) and A1A16 (MCMU 2B) Removal and Replacement

a. Removal

(1) At the circuit breaker panel DC group, set PROCESSOR 1 or 2 (MCMU 1B or MCMU 2B) to OFF.

(2) Loosen frame assembly D (fig. 3-11) captive fasteners securing frame assembly to cabinet assembly.

(3) Grasp the two handles on frame assembly D and pull frame assembly out to opening position. This provides access to front of the card cages.

(4) Using card extractor, disconnect all ribbon cables from card cage/core stack assembly being removed.

(5) Disconnect power cable connectors from card cage/core stack assembly being removed.

WARNING

The MCMU card cage/core stack assembly weight is approximately 100 pounds. Replacement of card cage/core assembly is a two-person operation. One must support the assembly, while the other removes attaching hardware. If the assembly is allowed to fall when hardware is removed, core stack or card cage damage may result.

(6) Remove ten hex screws which secure top of card cage/core stack assembly to frame assembly.

(7) Remove eleven hex-recessed screws which secure bottom of card cage/core stack A1A15 assembly to frame assembly.

(8) Remove all but two cross-slotted screws (on opposite upper corners) which secure left and right side of card cage/core stack to frame assembly. First person hold card cage/core assembly to assure it will not fall; second person remove remaining supporting cross-slotted screws.

WARNING

Card cage/core assembly will drop when last two screws are removed.

(9) Both persons lift out card cage/core stack assembly being very careful not to damage wiring and pins.

NOTE

To remove core stack from card cage perform the following steps:

WARNING

The MCMU card cage/core stack assembly weight is approximately 100 pounds. To avoid injury to personnel, two persons are required to place assembly on soft surface.

(10) Place the card cage/core stack assembly AlA15 or AlA16, card cage face down on a soft surface.

(11) Disconnect connectors (P1 through P22) from core stack A1A15 or A1A16.

(12) Loosen core stack captive fasteners securing core stack to mounting brackets and remove core stack.

b. Replacement.

(1) Place core stack on mounting brackets and tighten captive fasteners to secure core stack to card cage.

(2) Insert and tighten connectors (P1 through P22) to core stack.

WARNING

The MCMU card cage/core stack assembly weight is approximately 100 pounds. To avoid injury to personnel, two persons are required to install card cage/core stack assembly into frame assembly.

(3) Insert card cage/core stack assembly A1A15 or A1A16 into frame assembly D. First person hold the card cage/core stack assembly; second person replace two cross-slotted screws (en opposite upper corners which secure left and right side of card cage/core stack to frame assembly.

(4) Install and tighten ten hex screws, 11 hex recessed screws, and cross-slotted screws.

(5) Install ribbon cables connectors to card cage. All cables are marked to indicate mating connectors.

(6) Install power cable connectors to card cage.

(7) Grasp two handles on frame assembly D and

push to closed position.

(8) Tighten frame assembly D captive fasteners securing frame assembly to cabinet.

(9) At circuit breaker panel DC group, set PROCESSOR 1 or 2 (MCMU 1B or 2B) to ON.

3-18. IFCU Card Cage Removal and Replacement

The entire IFCU must be shut down when a card cage is replaced. This interrupts operation of the message switch. However, the circuit switch can continue processing calls with the IFCU shut off. Therefore, if possible, such procedures should be scheduled into system operation. Due to redundant nature of peripheral equipments and partitioning of IFCU circuits it is often possible to continue operation with a reduced complement of equipment until the repair activity can be conveniently scheduled. A card cage is replaced with all cards installed (figs. 3-8 and 3-9).

a. Removal

WARNING

Removal of card cage is a two-person operation. One must support the cage while the other removes attaching hardware. Card cage will drop when last two screws are removed. If the card cage is allowed to fall when hardware is removed, back-plane wire-wrap pins may be bent, shorted, or broken. Also, wiring may be damaged.

(1) On circuit breaker panel set all IFCU circuit breakers to OFF position.

(2) On ADP status and control panel (figs. 2-7 and 2-8) verify that all INTERFACE CONTROL POWER indicators/switches are OFF.

(3) Gain access to card cage by opening appropriate door:

(a) On message switch for A1A15 (IFCU A) and A1A16 (IFCU B) (fig. 3-8, sheet 4), loosen captive fasteners which secure hinged door C to door frame C. Pull door open.

(b) On message switch for A1A17 (IFCU C) and A1A18 (IFCU D) (fig. 3-8, sheet 4), loosen captive fasteners which secure door frame C to cabinet assembly.

(c) On circuit switch for A1A4 (IFCU) (fig. 3-9, sheet 2), loosen captive fasteners which secure access panel on front of hinged door frame A. Swing access panel open.

(4) Using card extractor, disconnect all ribbon cables from card cage.

(5) Disconnect power cable from card cage.

(6) Remove all but two screws (on opposite top corners) which secure card cage. First person, hold card cage to assure it will not fall; second person, remove remaining screws.

(7) Both persons lift out card cage being very careful not to damage rear wiring and pins.

b. Replacement.

WARNING

Replacement of card cage is a two-person operation. One must support cage while the other replaces attaching hardware. If card cage is allowed to fall when hardware is being replaced, back-plane wire-wrap pins can be bent, shorted, or broken. Also, wiring may be damaged.

(1) Both persons life card cage into position. First person, hold card cage; second person secure card cage with screws.

(2) Reconnect all ribbon cables.

(3) Reconnect power cables.

(4) On circuit switch for A1A4 (IFCU), tighten captive fasteners which secure access panel on front of hinged door frame A. Close access panel.

(5) On message switch for A1A17 (IFCU) and A1A8 (IFCU D), tighten captive fasteners which secure door frame C to cabinet assembly.

(6) On message switch for A1A15 (IFCU A) and A1A16 (IFCU B), tighten captive fasteners which secure hinged door C to door frame C, and close door.

(7) Set appropriate circuit breakers to ON position .

3-19. ADP Status and Control Removal and Replacement

Replacement of the message switch or circuit switch ADP status and control panel (figs. 2-7 and 2-8) requires shutting down entire ADP assembly, and, therefore, an interruption to the operation of the switch.

a. Removal

(1) On circuit breaker panel set the following circuit breakers to OFF position:

(*a*) PROCESSOR 1 (four circuit breakers).

(*b*) PROCESSOR 2 (four circuit breakers).

(*c*) IFCU (four circuit breakers in message switch, one circuit breaker in circuit switch).

(2) Loosen ten captive fasteners which secure hinged portion of panel. Swing panel open.

(3) Disconnect all ribbon cables from panel.

(4) While holding panel, remove screws which secure panel to door and remove panel.

b. Replacement.

(1) Hold up panel to door and secure with screws.

(2) Connect all ribbon cables.

(3) Secure panel with captive fasteners.

(4) Set all circuit breakers to ON position.

3-20. ADP Status and Control Panel Repairs

To remove and replace a defective component mounted on MS or CS ADP status and control panel (figs. 2-7 and 2-8) follow procedures in paragraphs 3-21 through 3-27.

3-21. Indicator Removal and Replacement

a. Removal.

(1)Loosen captive fasteners which secure panel. Swing hinged panel open for access to rear of panel.

(2) Shut off power to area of panel being repaired by setting applicable circuit breakers on circuit breaker panel to OFF position:

c) While repairing PROCESSOR 1 area of panel, set all four PROCESSOR 1 circuit breakers to OFF.

(b) When repairing PROCESSOR 2 area of panel, set all four PROCESSOR 2 circuit breakers to OFF.

(c) While repairing INTERFACE CONTROL area of panel, set all IFCU circuit breakers (four in message switch, one in circuit switch) to OFF.

(3) Tag and unsolder wires.

(4) Squeeze retaining spring and push indicator out through front of panel.

b. Replacement.

(1) Insert indicator in front panel until retaining spring snaps in place.

(2) Solder wires.

(3) Secure panel with captive screws.

(4) Set applicable circuit breakers to ON position.

3-22. Indicator Switch Removal and Replacement

a. Removal.

(1) Perform steps a(l) and (2), paragraph 3-19.

(2) Tag and unsolder wires.

(3) Loosen screws on rear side of switch securing switch to panel.

(4) Slide retaining brackets of switch and remove switch from panel.

b. Replacement.

(1) Insert switch in panel.

(2) Slide retaining brackets on switch.

(3) Secure screws on rear side of switch.

(4) Solder wires.

(5) Secure panel with captive screws.

(6) Set applicable circuit breakers to ON position.

3-23. Toggle Switch Removal and Replacement

a. Removal.

(1) Perform steps a(1l) and (2), paragraph 3-19.

(2) Tag and unsolder wires.

(3) Remove attaching nut and washers and remove switch from panel.

b. Replacement.

(1) Insert switch on panel and secure with washers and nut.

(2) Solder wires.

(3) Secure panel with captive screws.

(4) Set applicable circuit breakers to ON position.

3-24. Rotary Switch Removal and Replacement a. Removal.

(1) Perform steps a(1) and (2), paragraph 3-19.

(2) Tag and unsolder wires.

(3) Remove knob.

(4) Remove attaching nut and remove switch from panel.

b. Replacement.

(1) Insert switch in panel and secure with nut.

(2) Install knob.

(3) Solder wires.

(4) Secure panel with captive screws.

(5) Set applicable circuit breakers to ON position.

3-25. Digital Thumb Switch Removal and Replacement a Removal.

(1) Perform steps a(1) and (2), paragraph 3-19.

(2) Tag and unsolder wires.

(3) Remove screws securing switch and remove switch from panel.

b. Replacement.

(1) Insert switch in panel and secure switch to panel with screws.

(2) Solder wires.

(3) Secure panel with captive screws.

(4) Set applicable circuit breakers to ON position.

3-26. LED Digital Assembly Removal and Replacement

NOTE

Replacement of a digital readout assembly requires unsoldering of numerous connections. It may be more convenient to remove entire panel before proceeding. Also, it may be more expedient to replace individual defective digit LED readout since less unsoldering is involved.

a. Removal.

(1) Perform steps a(1l) and (2), paragraph 3-19.

(2) Tag and unsolder all wires.

(3) Remove screws securing bracket and remove readout assembly from panel.

b. Replacement.

(1) Insert readout assembly in panel and secure bracket with screws.

(2) Solder wires.

(3) Secure panel with captive screws.

(4) Set applicable circuit breakers to ON position.

3-27. Terminal Board Mounted Diode Removal and Replacement

a. Removal.

(1) Perform steps a(1) and (2), paragraph 3-19.

(2) Unsolder diode and remove from terminal posts.

b. Replacement.

(1) Solder diode to terminal posts.

(2) Secure panel with captive screws.

(3) Set applicable circuit breakers to ON position.

3-28. Cable Maintenance

Cables used in the circuit switch and message switch CPGS are of three basic types: ribbon, special purpose (signal), and power cables.

a. Ribbon Cables. The ribbon cables (W501-W639) are non-repairable and maintenance consists of removal and replacement when inspection or test discloses that a ribbon cable is damaged. Refer to paragraph 3-29 for removal and replacement procedures.

b. Special Purpose Cables (Signal). The special purpose cables (W101-W127, W129-W133 and W640) are repairable and consist of removal and replacement of damaged connector or pins. Refer to TM 11-5805-683-34-3 for repair procedures.

c. Power Cables. The power cables (W201-W213, W214-W235, W650 and W651) are repairable and consist of removal and replacement of damaged connector or contact pins. Refer to paragraphs 3-30 and 3-31 for power cable repair.

3-29. Ribbon Cable Removal and Replacement

Perform the following procedures to remove and replace ribbon cables.

a. Removal.

(1) Determine location of both ends of cable by referring to cable interconnection diagrams (figs. FO-3 and FO-5).

(2) Gain access to both ends of cable by loosening captive fasteners and swinging out appropriate doors.

(3) Shut off power to involved equipment using circuit breakers on circuit breaker panel.

(4) Disconnect any cables in the way of cable to be replaced. Note location of these cables. Use circuit card extractor to disconnect flat ribbon cable connectors.

(5) Disconnect cable to be replaced.

(6) Disconnect clamps and retainers which secure cable. Remove cable.

b. Replacement.

(1) Install new cable.

(2) Connect clamps and retainers to secure cable.

(3) Reconnect any cable that was in the way of the cable to be replaced.

(4) Close door.

(5) Set applicable circuit breakers on circuit breaker panel to ON position.

3-30. Power Cables (W201-W213, W235, W650 and W651) Repair

The power cable assembly (fig. 3-12) is used in the circuit switch and message switch to connect the power group to the MCMU, IFCU, CPU, and IOU (figs. FO-3 and FO-5 cable interconnection diagrams). Repair of these cables consists of removal and replacement of contact pins on P1.

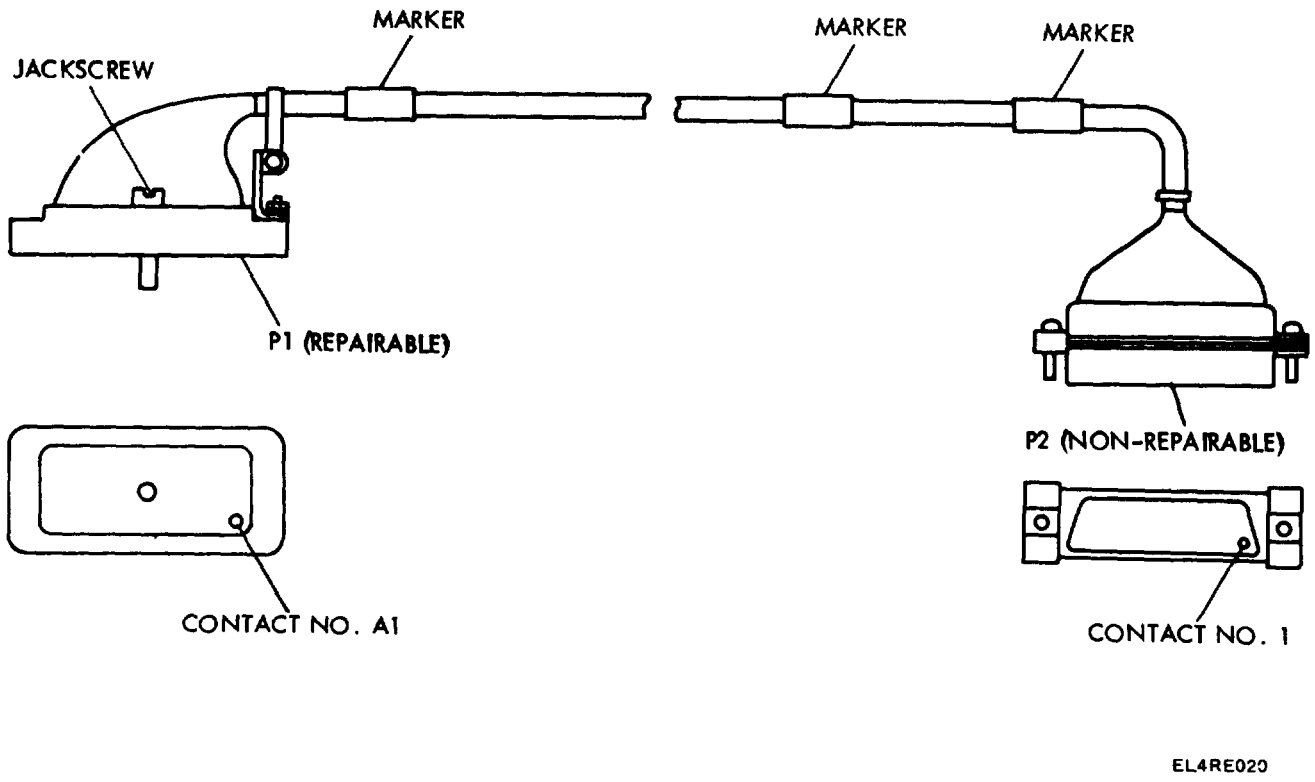

Figure 3-12. Power Cables W201, W213, W235, W650 and W651.

NOTE

Only P1 of power cable W201 through W213, W235, W650 and W651 is repairable. P2 is fabricated with epoxy compound and is nonrepairable.

Refer to tables 3-5 through 3-20 for cable wire run lists. Perform the following step-by-step procedure for removal and replacement of contact pin.

a. Connector (P1l) Contact Removal.

(1) Loosen connector jackscrew to disconnect connector from unit.

(2) Insert extraction tool 06-7699-01 over the contact pin to be removed. Apply a firm, steady pressure to plunger on extractor tool until the contact is released from the internal shoulder in the connector.

(3) Remove extraction tool and pull contact pin from rear of connector.

(4) Cut off contact pin close to pin as possible.

b. Stripping and Crimping.

(1) Strip insulation back 0.10 inch from end of wire. Check for cut or broken wires and frayed insulation.

(2) Insert wire into rear of new contact. Wire insulation must butt against rear of contact pin.

(3) Using crimp tool 06-7858-01, insert contact

pin into locator and crimp wire. Squeeze handles firmly to ensure a proper crimp.

c. Connector Contact Replacement.

(1) Using insertion tool 06-7698-01, insert contact into connector by applying firm even pressure on contact, directly at the end of insulation crimp. Push contact until contact snaps into locking groove.

(2) With tool holding contact in connector, pull back slightly on wire to assure that contact pin is locked.

(3) Install cable connector and tighten jackscrew to secure connector.

Table 3-5. Power Cable W201 Wire Run List

From AIAI5JI	To AIPS1J2	Wire type	From A1A13JI	To A1PSIJ2	Wire type
P1-MS	P2-1	TW PR	P1-R2	P2-18	TW PR
P1-M4	P2-21		P2-R1	P2-37	TW PR
pl-M5	P2-2		P1-S1	P2-19	TW PR
P1-Ms	P2-22		P1-S2	P2-38	TW PR
pl-N4	P2-3		Pl-BI	P2-42	TW PR
P1-N3	P2-23		P1-B2	P2-62	
P1-N6	P2-4		P1-B3	P2-43	
P1-N5	P2-24		PI-B4	P2-63	
P1-P3	P2-5		P1-B5	P2-44	
P1-P4	P2-25		PI-B6	P2-64	
P1-P5	P2-6		P1-C2	P2-45	
P1-P6	P2-26		PI-Cl	P2-65	
P1-R4	P2-7		P1-C4	P2-46	
P1-R3	P2-27		PI-C3	P2-66	TW PR
PI-R6	P2-8		P1-E2	P2-16	
P1-R6	P2-28		P1-C6	P2-47	TW PR
P1-S3	P2-9		P1-C5	P2-67	
PI-S4	P2-29		PI-Dl	P2-48	
Pl-S5	P2-10		P1-D2	P2-68	
PI-S6	P2-30	TW PR	P1-D3	P2-49	
P1-A4	P2-11		P1-D4	P2-69	
P1-M2	P2-31		P1-D5	P2-50	
P1-L6	P2-12	TW PR	P1-D6	P2-70	
P1-L5	P2-32		P1-E4	P2-51	
PI-HI	P2-13		P1-E3	P2-71	
P1-Ji	P2-33		P1-E6	P2-52	
P1-L4	P2-14		P1-E5	P2-72	
P1-L3	P2-34		P1-F3	P2-53	
P1-L2	P2-15		P1-F4	P2-73	
P1-Li	P2-35	TW PR	P1-F5	P2-54	
P1-F6	P2-74				
P1-H2	P2-55	TW PR			
P1-F2	P2-75				
P1-H6	P2-56				
P1-H6	P2-76				
PI-KI	P2-57				
P1-K2	P2-77				
P1-KS	P2-58				
P1-K6	P2-78	TW PR			

Table 3-6. Power Cable W202 Wire Run List

From A1A15Jl	To AlPS2J2	Wire type	From AIA15J1	To AlPS2J2	Wire type
P1-L6	P2-1	TW PR	Pl-Di	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-Ll	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
P1-Bl	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		P1-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	'
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41	'	P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3- 7. Power Cable W203 Wire Run List

From AIA17Jl	To AlPS3J2	Wire type	From AIA17Jl	To AlPS3J2	Wire type
P1-L6	P2-1	TW PR	Pl-Dl	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-Ll	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
Pl-M2	P2-8		P1-E3	P2-28	
P1-Bl	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		Pl-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		Pi-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	'
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-& Power Cable W204 Wire Run List

From AlA5J1	To AiPS4J2	Wire type	From AIA5J1	To AlPS4J2	Wire type
P1-L6	P2-1	TW PR	Pl-Dl	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		Pl-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-Li	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
P1-BI	P2-36	TW PR	Pl-E6	P2-46	
P1-B2	P2-19		Pl-E5	P2-29	
P1-B3	P2-37		Pl-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B6	P2-38		P1-F3	P2-48	

Table 3-8. Power Cable W204 Wire Run List-Continued

From AIA5JI	To AIPS4J2	Wire type	From AIA5JI	To AIPS4J2	Wire type
P1-B6	P2-21	↑	P1-F4	P2-31	↓
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-9. Power Cable W205 Wire Run List

From A1A7J1	To AIPSJ2	Wire type	From AIA7JI	To AIPSJ2	Wire type
P1-L6	P2-1	TW PR	Pl-Dl	P2-42	TW PR
P1-L5	P2-2	↓	P1-D2	P2-25	↓
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-Ll	P2-6	TW PR	PI-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
Pi-Bi	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19	↓	P1-E5	P2-29	
P1-B3	P2-37		P1-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-33	↓
P1-C6	P2-41	↓	P1-E2	P2-9	TWPR
P1-C5	P2-24	TW PR			

Table 3-10. Power Cable W206 Wire Run List

From AIA9J1	To AIPS6J2	Wire type	From A1A9Ji	To AIPS6J2	Wire type
P1-L6	P2-1	TW PR	Pl-Dl	P2-42	TW PR
P1-L5	P2-2	↓	P1-D2	P2-25	↓
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-Ll	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
P1-Bi	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19	↓	P1-E5	P2-29	
P1-B3	P2-37		Pl-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		Pl-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	↓
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41	↓	P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-11. Power Cable W207 Wire Run List

From AIA14J1	To A1PS7J2	Wire type	From AIA14Jl	To AIPS7J2	Wire type
P1-M3	P2-1	TW PR	P1-S2	P2-38	TW PR
P1-M4	P2-21		Pl-Bl	P2-42	
P1-M5	P2-2		P1-B2	P2-62	
P1-M6	P2-22		P1-B3	P2-43	
P1-N4	P2-3		P1-B4	P2-63	
P1-N3	P2-23		P1-B5	P2-44	
P1-N6	P2-4		P1-B6	P2-64	
P1-N5	P2-24		P1-C2	P2-45	
P1-P3	P2-5		P1-Cl	P2-65	
Pl-P4	P2-25		P1-C4	P2-46	
P1-P5	P2-6		P1-C3	P2-66	TW PR
P1-P6	P2-26		P1-E2	P2-16	
P1-R4	P2-7		P1-C6	P2-47	TW PR
P1-R3	P2-27		P1-C5	P2-67	
P1-R6	P2-8		Pl-Dl	P2-48	
P1-R5	P2-28		Pl-D2	P2-68	
P1-S3	P2-9		P1-D3	P2-49	
P1-S4	P2-29		P1-D4	P2-69	
P1-S5	P2-10		Pl-D5	P2-50	
P1-S6	P2-30	TW PR	P1-D6	P2-70	
P1-A4	P2-11		P1-E4	P2-51	
P1-M2	P2-31		P1-E3	P2-71	
P1-L6	P2-12	TW PR	P1-E6	P2-52	
P1-L5	P2-32		P1-E5	P2-72	
P1-Hi	P2-13		P1-F3	P2-53	
P1-Ji	P2-33		P1-F4	P2-73	
P1-L4	P2-14		P1-F5	P2-54	
P1-L3	P2-34		P1-F6	P2-74	
P1-L2	P2-15		P1-H2	P2-55	
P1-LI	P2-35		P1-F2	P2-75	
P1-R2	P2-18		P1-H6	P2-56	
P1-Rl	P2-37		P1-H5	P2-76	TW PR
P1-Si	P2-19				
Pi-Kl	P2-57				
P1-K2	P2-77				
P1-K6	P2-58				
P1-K5	P2-78	TW PR			

Table 3-12. Power Cable W208 Wire Run List

From AIA16J1	**To AIPS8J2**	**Wire type**	**From A1A16J1**	**To AIPS8J2**	**Wire type**
P1-L6	P2-1	TW PR	PI-Dl	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		PI-D5	P2-44	
P1-LI	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
Pi-Bl	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		P1-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	.
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41	.	P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-13. Power Cable W209 Wire Run List

From AIAII&	To AIPSI92	Wire type	From AIAI1tI	To AIPSSU2	Wire type
P1-L6	P2-1	TW PR	PI-DI	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		Pi-D5	P2-44	
P1-LI	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-46	
P1-M2	P2-8		PI-E3	P2-28	
PI-BI	P2-36	TW PR	PI-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		Pi-FI	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		PI-F5	P2-49	
PI-CI	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-14. Power Cable W210 Wire Run List

From A1A6JI	To AIPSiOJ2	Wire type	From AIA6JI	To AIPSiOJ2	Wire type
P1-L6	P2-1	TW PR	PI-DI	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		Pi-D5	P2-44	
P1-Li	P2-6	TW PR	Pi-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
PI-BI	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		P1-FI	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
PI-CI	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P2-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-23	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-15. Power Cable W211 Wire Run List

From A1AS8JI	To AIPSIIJ2	Wire type	From AIA8JI	To AIPSIIJ2	Wire type
P1-L6	P2-1	TW PR	PI-DI	P2-42	TW PR
P1-L5	P2-2		PI-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		PI-D4	P2-26	
P1-L2	P2-5		Pi-D5	P2-44	
P1-LI	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
PI-BI	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		P1-FI	P2-47	

Table 3-15. Power Cable W211 Wire Run List-Continued

From A1ASJ1	To A1PSI1J2	Wire type	From A1ABJi	To A1PS11J2	Wire type
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		Pl-N3	P2-33	
P1-C6	P2-41		P1-E2	P2-9	TW PR
P1-C5	P2-24	TW PR			

Table 3-16. Power Cable W212 Wire Run List

From A1AlOJl	To A1PS12J2	Wire type	From A1AlOJl	To AlPS12J2	Wire type
P1-L6	P2-1	TW PR	P1-D1	P2-42	TW PR
P1-L5	P2-2		P1-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		PI-D5	P2-44	
P1-Li	P2-6	TW PR	P1-D6	P2-27	
PI-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
P1-Bl	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		PI-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		Pl-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-1 7. Power Cable W213 Wire Run List

From A1A4Ji	To A1PSSJ2	Wire type	From AiA4Jl	To AlPS8J2	Wire type
P1-L6	P2-1	TW PR	Pi-Dl	P2-42	TW PR
P1-L5	P2-2		Pi-D2	P2-25	
P1-L4	P2-3		P1-D3	P2-43	
PI-L3	P2-4		P1-D4	P2-26	
PI-L2	P2-5		P1-D5	P2-44	
P1-LI	P2-6	TW PR	P1-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
P1-Bl	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-BS	P2-37		P1-Fl	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		PI-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		P1-F5	P2-49	
P1-Cl	P2-22		P1-F6	P2-32	
P1-C4	P2-40		P1-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-18. Power Cable W235 Wire Run List

From A1A5JI	To AIPS4J2	Wire type	From AIA5JI	To AIPS4J2	Wire type
P1-L6	P2-1	TW PR	Pi-DI	P2-42	TW PR
P1-L5	P2-2		PI-D2	P2-25	
P1-L4	P2-3		Pi-D3	P2-43	
P1-L3	P2-4		P1-D4	P2-26	
P1-L2	P2-5		P1-D5	P2-44	
P1-LI	P2-6	TW PR	Pi-D6	P2-27	
P1-A4	P2-7		P1-E4	P2-45	
P1-M2	P2-8		P1-E3	P2-28	
Pi-Bi	P2-36	TW PR	P1-E6	P2-46	
P1-B2	P2-19		P1-E5	P2-29	
P1-B3	P2-37		P1-FI	P2-47	
P1-B4	P2-20		P1-F2	P2-30	
P1-B5	P2-38		P1-F3	P2-48	
P1-B6	P2-21		P1-F4	P2-31	
P1-C2	P2-39		PI-F5	P2-49	
P1-CI	P2-22		P1-F6	P2-32	
P1-C4	P2-40		PI-N2	P2-50	
P1-C3	P2-23		P1-N3	P2-33	TW PR
P1-C6	P2-41		P1-E2	P2-9	
P1-C5	P2-24	TW PR			

Table 3-19. Power Cable W650 Wire Run List

From AA15A1J1	To AIPS2J2	Wire type	From AIA15AIJI	To AIPS2J2	Wire type
Pi-M3	P2-1	TW PR	HY44	P2-28	TW PR
P1-M4	P2-21		P1-S3	HY45	
Pi-M5	P2-2		P1-S4	HY47	
P1-M6	P2-22		HY45	HY46	
P1-N4	P2-3		HY47	HY48	
P1-N3	P2-23		HY45	HY46	
P1-N6	HY33		HY47	HY48	
P1-N5	HY35		HY46	P2-9	
HY33	HY34		HY48	P2-29	
HY35	HY36		P1-S5	HY49	
HY33	HY34		P1-S6	HY51	
HY35	HY36		HY49	HY50	
HY34	P2-4		HY51	HY52	
HY36	P2-24		HY49	HY50	
P1-P3	P2-5		HY51	HY52	
P1-P4	P2-25		HY50	P2-10	
P1-P5	P2-6		HY52	P2-30	TW PR
P1-P6	P2-26		P1-A4	P2-11	
P1-R4	HY37		P1-M2	P2-31	
P1-R3	HY39		P1-L6	P2-12	TW PR
HY37	HY38		P1-L5	P2-32	
HY39	HY40		PI-HI	P2-13	
HY37	HY38		P1-Ji	P233	
HY39	HY40		P1-L4	P2-14	
HY38	P2-7		P1-L3	P2-34	
HY40	P2-27		P1-L2	P2-15	
P1-R6	HY41		P1-Li	P2-35	
P1-R5	HY43		P1-R2	P2-18	
HY41	HY42		PI-Ri	P2-37	
HY43	HY44		Pi-Si	P2-19	
HY41	HY42		P1-S2	P2-38	
HY43	HY44		Pi-Bi	HY1	
HY42	P2-8	TW PR	P1-B2	HY3	TW PR

Table 3-19. Power Cable W650 Wire Run List-Continued

From AIA1A5A1J	To AIPS2J2	M ire t-pe	From A1A15A1JI	To A1PS2J2	Wire type
HY1	HY2	TA PR	P1-C6	P2-47	TW PR
HY3	HY4		P1-C5	P2-67	
HY1	HY2		PI-DI	P2-48	
HY3	HY4		P1-D2	P2-68	
HY2	P2-42		P1-D3	P2-49	
HY4	P2-62		P1-D4	P2-69	
P1-B3	HY5		P1-D5	P2-50	
P1-B4	HY7		P1-D6	P2-70	
HY5	HY6		P1-E4	P2-51	
HY7	HY8		P1-E3	P2-71	
HY5	HY6		P1-E6	HY17	
HY7	HY8		P1-E5	HY19	
HY6	P2-43		HY17	HY18	
HY8	P2-63		HYI9	HY20	
P1-B5	HY9		HY17	HY18	
P1-B6	HYII		HY19	HY20	
HY9	HY10		HY18	P2-52	
HYII	HY12		HY20	P2-72	
HY9	HY10		P1-F3	HY21	
HYII	HY12		P1-F4	HY23	
HY10	P2-44		HY21	HY22	
HY12	P2-64		HY23	HY24	
P1-C2	HY13		HY21	HY22	
P1-Cl	HY15		HY23	HY24	
HY13	HY14		HY22	P2-53	
HY15	HY16		HY24	P2-73	
HY13	HY14		P1-F5	P2-54	
HY15	HY16		P1-F6	P2-74	
HY14	P2-45		P1-H2	HY25	
HY16	P2-65		P1-F2	HY27	
P1-C4	P2-46		HY25	HY26	
P1-C3	P2-66	TW PR	HY27	HY28	
P1-E2	P2-16		HY25	HY26	TW PR
HY27	HY28	TW PR			
HY26	P2-55				
HY28	P2-75				
P1-H6	HY29				
P1-H5	HY31				
HY29	HY30				
HY31	HY32				
HY29	HY30				
HY31	HY32				
HY30	P2-56				
HY32	P2-76				
PI-KI	P2-57				
P1-K2	P2-77				
P1-K6	P2-58				
P1-K5	P2-78	TW PR			

Table 3-20. Power Cable W651 Wire Run List

From A1A16A1J1	To A1PS3J2	Wire type	From AIA16AIJI	To AIPS3J2	Wire type
P1-M3	P2-1	TW PR	HY44	P2-28	TW PR
P1-M4	P2-21		P1-S3	HY45	
P1-M5	P2-2		P1-S4	HY47	
P1-M6	P2-22		HY45	HY46	
P1-N4	P2-3		HY47	HY48	
P1-N3	P2-23		HY45	HY46	
P1-N6	HY33		HY47	HY48	
P1-N5	HY35		HY46	P2-9	
HY33	HY34		HY48	P2-29	
HY35	HY36		P1-S5	HY49	

Table 3-20. Power Cable W651 Wire Run List-Continued

From AIA16Ai1J	To AIPS3J2	Wire type	From AIA16A1J1	To AIPS3J2	Wire type
HY33	HY34	TW PR	P1-S6	HY51	TW PR
HY35	HY36		HY49	HY50	
HY34	P2-4		HY51	HY52	
HY36	P2-24		HY49	HY50	
P1-P3	P2-5		HY51	HY52	
P1-P4	P2-25		HY50	P2-10	
P1-P5	P2-6		HY52	P2-30	TW PR
P1-P6	P2-26		P1-A4	P2-11	
P1-R4	HY37		P1-M2	P2-31	
P1-R3	HY39		P1-L6	P2-12	TW PR
HY37	HY38		P1-L5	P2-32	
HY39	HY40		PI-Hl	P2-13	
HY37	HY38		Pi-Ji	P2-23	
HY39	HY40		PI-L4	P2-14	
HY38	P2-7		P1-L3	P2-34	
HY40	P2-27		P1-L2	P2-15	
P1-R6	HY41		P1-Li	P2-35	
P1-R5	HY43		PI-R2	P2-18	
HY41	HY42		P1-Rl	P2-37	
HY43	HY44		P1-Si	P2-19	
HY41	HY42		Pl-S2	P2-38	
HY43	HY44		PI-Bl	HY1	
HY42	P2-8		P1-B2	HY3	
HY1	HY2		P1-C6	P2-47	
HY3	HY4		P1-C5	P2-67	
HY1	HY2		PI-DI	P2-48	
HY3	HY4		P1-D2	P2-68	
HY2	P2-42		Pi-D3	P2-49	
HY4	P2-62		PI-D4	P2-69	
P1-B3	HY5		Pi-D5	P2-50	
P1-B4	HY7		P1-D6	P2-70	
HY5	HY6		P1-E4	P2-51	
HY7	HY8		PI-E3	P2-71	
HY5	HY6		PI-E6	HY17	
HY7	HY8		P1-E5	HY19	
HY6	P2-43		HY17	HY18	
HY8	P2-63		HY19	HY20	
P1-B5	HY9		HY17	HY18	
P1-B6	HYII		HY19	HY20	
HY9	HYO1		HY18	P2-52	
HYll	HY12		HY20	P2-72	
HY9	HY10		P1-F3	HY21	
HYll	HY12		P1-F4	HY23	
HY10	P2-44		HY21	HY22	
HY12	P2-64		HY23	HY24	
P1-C2	HY13		HY21	HY22	
P1-Cl	HY15		HY23	HY24	
HY13	HY14		HY22	P2-53	
HY15	HY16		HY24	P2-73	
HY13	HY14		P1-F5	P2-54	
HY15	HY16		PI-F6	P2-74	
HY14	P2-45		P1-H2	HY25	
HY16	P2-65		P1-F2	HY27	
P1-C4	P2-46		HY25	HY26	
P1-C3	P2-66	TW PR	HY27	HY28	
P1-E2	P2-16		HY25	HY26	TW PR
HY27	HY28				
HY26	P2-55				
HY28	P2-75				
P1-H6	HY29				
P1-H5	HY31				
HY29	HY30				
HY31	HY32				

Table 3-20. Power Cable W651 Wire Run List-Continued

From AIA16A1J1	To A1PS3J2	Wire type
HY29	HY30	TW PR
HY31	HY32	
HY30	P2-56	
HY32	P2-76	
PI-KI	P2-57	
P1-K2	P2-77	
P1-K6	P2-58	
P1-K5	P2-78	TW PR

3-31. Power Cables (W214-W234, W652 and W653) Repair

switch and message switch. (See figs. FO-3 and FO-5 cable interconnection diagrams.) Repair of these cables consists of removal and replacement of contact pins. The wiring is pin-to-pin as shown in figure 3-13. See figure 3-14, step-by step procedure, and perform the following steps.

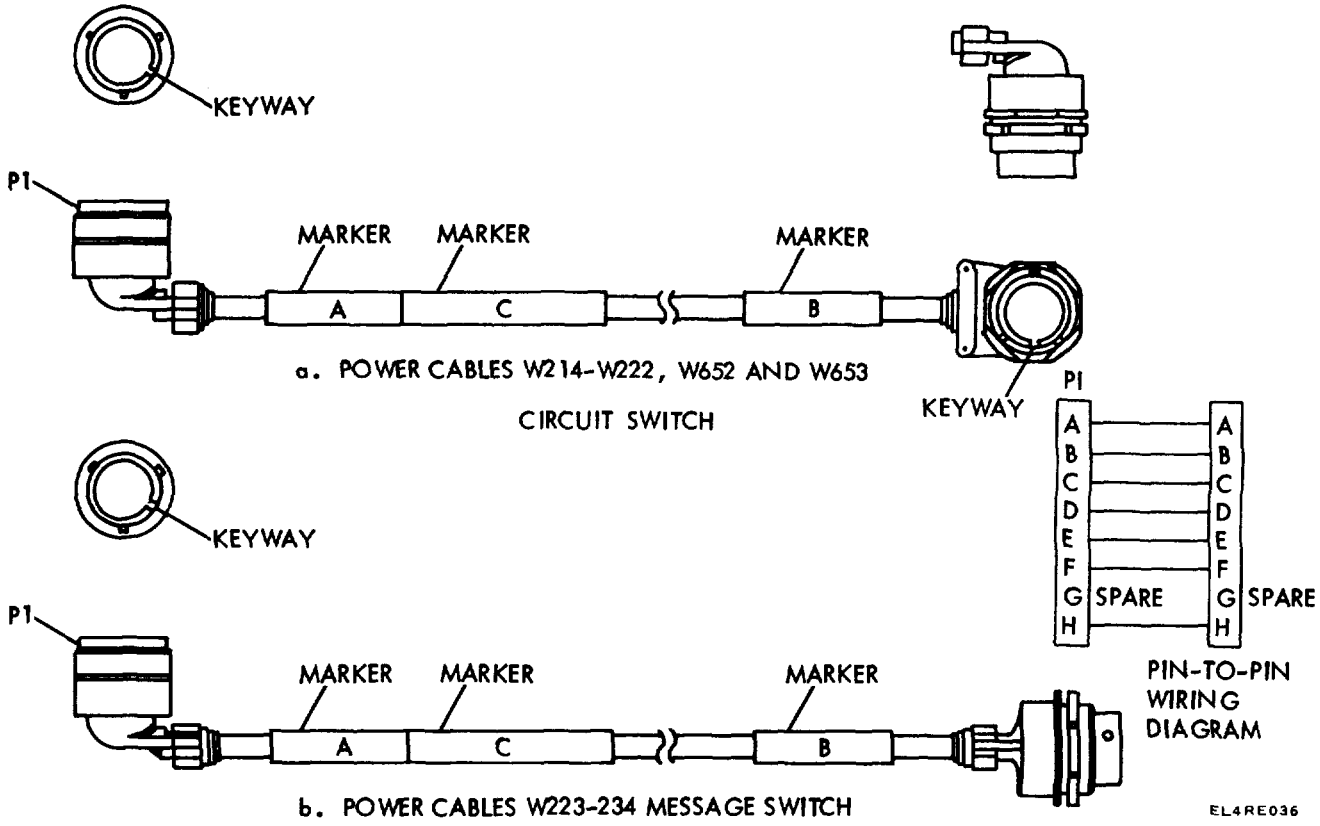

Figure 3-13. Power cables W214- W234, W652 and W653.

a. Contact Pin Removal

(1) Remove strain relief clamp and slide back along cable wires to allow access to contact pin to be removed. Extract contact pin by using white end of 3-46 extraction/insertion tool (MS27534-121 as shown in A, figure 3-14. Place wire into tool at large opening. Slide back tool on wire while holding thumb against wire at opening. Wire will slip into tool.

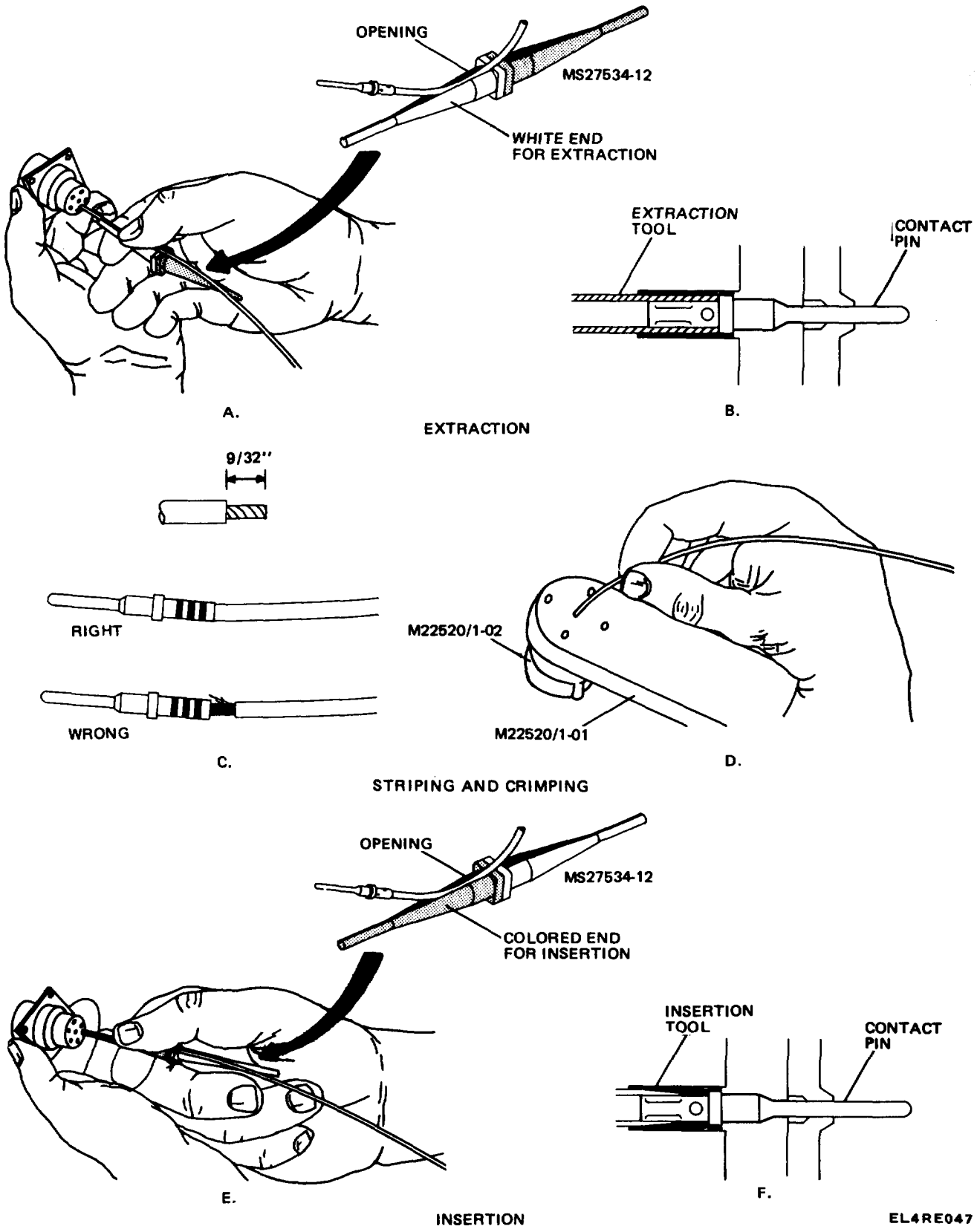

Figure 3-14. Connector Contact Pin Removal and Replacement Procedures.

(2) Push extraction tool into rear of plug until it bottoms (B, fig. 3-14). At this point, tool releases tines on retaining clip so that contact pin can be extracted.

(3) While maintaining slight insertion force on tool, firmly hold wire against serrated sholder at center of tool and extract both wired contact pin and tool from plug.

b. Stripping and Crimping.

(1) Cut off broken contact pin (close to pin as possible).

(2) Strip insulation on wire back 9132 of an inch (C, fig. 3-14).

(3) Insert wire into rear of new contact. Wire insulation must butt against rear of contact pin (C, fig. 3-14) and visible through inspection hole.

(4) With crimp tool M22520/1-01 and crimp locator M22520/1-02, insert contact pin into tool jaws (D, fig. 3-14).

NOTE

The color code band on contact (yellow for #3 wire) must match color code of locator and insertion tool throughout.

(5) to crimp, squeeze handles together fully until ratchet releases and allows handles to expand; otherwise, contact pin cannot be extracted from tool jaws. Maintain slight insertion pressure on wire while crimping contact pin to wire.

c. Contact Pin Replacement.

(1) With colored end of extraction/insertion tool (MS27534-12) place wire into tool at large opening (E, fig. 3-14). To facilitate contact pin insertion, a six-inch minimum free length of wire is recommended.

(2) Slide back tool on wire while holding thumb against wire at opening. Wire will slip into tool.

NOTE

Socket contact pin should be inserted partially into connector by hand before using insertion tool.

(3) With tool pressed against shoulder of contact, insert wired contact pin and tool into connector at rear of plug with firm even pressure (E, fig. 3-14). Do not use excessive pressure.

(4) When contact bottoms (F, fig. 3-14), a slight click can be heard as tines of metal retaining clip snaps into place behind contact pin shoulder.

(5) Withdraw tool from rear of plug. Pull back slightly on wire to assure contact pin is locked. Remove tool from wire.

(6) Slide strain relief over wires and install on rear of connector.

Section V. WIRING LISTS

3-32. General

This chapter describes wire information for the string, connector and logic lists. The wire data may be used during maintenance for replacement of damaged wiring. The string, connector, and logic lists are used during troubleshooting and signal tracing. Table 3-21 provides an explanation of the column titles used in the string, connector and logic wire lists. How to use the wiring list is explained in paragraph 3-36.

3-33. Connector List Description

The connector list (fig. 3-15) provides a listing of all connectors and pin numbers of an assembly in alphanumeric sequence with the designated logic signal on each pin. Non-wired connector pins are also listed. The connector list differs from the string list in that the connectors are listed in alphanumeric sequence, while the string list lists the SIGNAL in alphanumeric sequence.

H78-14 396

DRAWING NUMBER 149011-880 | CONNECTOR | UNIT ASSEMBLY NO. 149011 | REV C | INDEX XA103
UNIT ASSEMBLY NAME CARD CAGE ASSY, CPU R.H. | FILE IDENT T39B2CP2 | DATE 04-14-78 | PAGE 14

RECORD NUMBER	FROM PREFIX	FROM CONNECTOR	FROM PIN	FROM SH FR	TO PREFIX	TO CONNECTOR	TO PIN	TO SH FR	WIRE MULTI GROUP	WIRE CODE	WIRE COLOR	WIRE IDENT	WIRE SPEC INST MISC	SIGNAL	SEQ NO	EQUATION	TERM	FACTOR	CKT OR CHIP TYPE	GROUP	LOAD OR POWER PLANE	TEST POINTS AND	TEST POINTS OR	SIGNAL DESCRIPTION	ECO NO
13966		XA103	47							16B	9			E242CO	02	E242CO	00	1	TS8	D1		25B		AT 00-31 TO DB 00	
13877		XA103	48							16B	9			EU14CA	04	E242CO	01	5	TS8	D1		22A			
13864		XA103	49			XA103	38			16B	9			EU11CA	03	E242CO	01	8	TS8	D1		26B			
13764		XA103	50							16B	9			ET14CA	04	E242CO	01	4	TS8	D1		23A			
11733		XA103	51											DNW	01				TS8						
13746		XA103	52			XA103	31			16B	9			ET11CA	04	E242CO	01	3	TS8	D1		24A			
11734		XA103	53											DNW	01				TS8						
13758		XA103	54			XA107	68			16B	9			ET13CA	02	E242CO	01	2	TS8	D1		25A			
16573		XA103	55			XA104	48			16B	9			SPA001	03	E406CO	01	7	TS8	E1		29B			
13753		XA103	56			XA108	36			16B	9			ET12CA	02	E242CO	01	1	TS8	D1		26A			
11735		XA103	57											DNW	01				TS8						
13998		XA103	58											GND	02	GROUND			TS8						
13994		XA103	59							16B	9			E406CO	02	E406CO	00	1	TS8	E1		31B		ONE TO GA 00-03 -	
13828		XA103	60			XA104	22			16B	9			EU04CA	03	E406CO	01	6	TS8	E1		28A			
13819		XA103	61							16B	9			EU01CA	09	E406CO	01	8	TS8	E1		32B			
13702		XA103	62			XA105	27			16B	9			ET04CA	03	E406CO	01	5	TS8	E1		29A			
11736		XA103	63											DNW	01				TS8						
13727		XA103	64			XA103	42			16B	9			ET07CA	04	E406CO	01	4	TS8	E1		30A			
11737		XA103	65											DNW	01				TS8						
16584		XA103	66			XA104	70			16B	9			SPA002	04	E406CO	01	3	TS8	E1		31A			
13883		XA103	67											GND	01	GROUND			TS8						
13681		XA103	68			XA103	40			16B	9			ET01CA	01	E406CO	01	2	TS8	E1		32A			
11738		XA103	69											DNW	01				TS8						
13847		XA103	70			XA107	49			16B	9			EU07CA	05	E406CO	01	1	TS8	E1		33A			
13725		XA103	71			XA104	65			16B	9			ET07CA	02	E450CO	01	5	TS8	F1		36A			
13688		XA103	72			XA106	75			16B	9			ET01CA	08	E450CO	01	6	TS8	F1		34A			
13818		XA103	73			XA103	61			16B	9			EU01CA	08	E450CO	01	4	TS8	F1		36B			
13679		XA103	74			XA104	74			16B	9			ET00CA	06	E450CO	01	7	TS8	F1		35B			
13846		XA103	75			XA103	70			16B	9			EU07CA	04	E450CO	01	3	TS8	F1		37B			
14000		XA103	76							16B	9			E450CO	02	E450CO	00	1	TS8	F1		37A		DB 00-31 TO GR 00	
13810		XA103	77							16B	9			EU00CA	06	E450CO	01	2	TS8	F1		38B			
13879		XA103	78			XA110	74			16B	9			EU15CA	02	E450CO	01	8	TS8	F1		38A			
22658		XA103	79			XA110	71			16B	9			ET15CA	02	E450CO	01	1	TS8	F1		39B			
11739		XA103	80											DNW	01				TS8						
13812		XA104	01			XA103	14			16B	9			EU01CA	02	EU01CA	00	1	TQ2	A2		02B		(DIG).(H = 0).(ES	
13841		XA104	02											GND	01	GROUND			TQ2			01A			
13795		XA104	03							16B	9			EUDGCO	09	EU02CA	01	1	TQ2	A3		02A			
01599		XA104	04			XA103	04			16B	9			CE01DO	06	EU01CA	01	1	TQ2	A2		04A			
13794		XA104	05			XA104	03			16B	9			EUDGCO	08	EU01CA	01	2	TQ2	A2		03B			
13805		XA104	06			XA108	53			16B	9			EU00CA	01	EU00CA	00	1	TQ2	A1		05A		(DIG).(H = 0).(ES	
01716		XA104	07							16B	9			CE02HO	08	EU02CA	01	2	TQ2	A3		03A			
13792		XA104	08			XA104	11			16B	9			EUDGCO	06	EU00CA	01	2	TQ2	A1		06A			
13822		XA104	09							16B	9			EU02CA	03	EU02CA	00	1	TQ2	A3		04B		(DIG).(H = 0).(ES	
01527		XA104	10							16B	9			CE00AO	10	EU00CA	01	1	TQ2	A1		07A			
13793		XA104	11			XA104	05			16B	9			EUDGCO	07	EU03CA	01	1	TQ2	A4		05B			
00224		XA104	12											+5V	01				TQ2						
01814		XA104	13							16B	9			CE03PO	10	EU03CA	01	2	TQ2	A4		06B			
13831		XA104	14							16B	9			EU05CA	02	EU05CA	00	1	TQ2	B2		09A		(DIG).(H = 0).(ES	
CONNECTOR XA104 CONTINUED ON THE NEXT PAGE ****																									

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Figure 3-15. Connector List Example

Table 3-21. String, Connector and Logic List Column Definitions

Column	Definition
	NOTE The following entries are a composite list of all column titles used in Connector, String and Logic Lists.
Record Number	Consists of a sequence number for each wire.
FROM	The originating end of a wire.
Prefix	Not used.
Connector	Any type of originating point, plug, receptacle, etc.
Pin	Exact originating point of the respective connector. Designations are unique. a. SHXXXX indicates the junction of a shield and a pigtail, the four right-most digits are the wire identity of the shielded wire. b. JCT indicates a common point of two or more wires. c. Jacket is the terminology used when describing the line that defines the identification of a shielded wire.
Sh. Fig.	Not used.
TO	The terminating end of a wire.
Prefix	Not used.
Connector	Same as FROM connector.
Pin	Same as FROM connector.
Sh. Fig.	Not used.
WIRE	
Multi-Group	Associates a wire of a group such as twisted pair, shielded pair, jacket, pigtails and center conductor will be shown as a common group.
Code	A 3-digit code for wire type and gauge or bus bar.
Color	A color according to standard color code. a. Base stripe tracer. b. Strip. Tracer 1 and Tracer 2 if the left-most digit is other than 9 and the two right-most positions are not black and not equal. The base color is understood to be white.
Ident.	A number stamped on wire or sleeving to differentiate it from another. Not used in all wiring.
Spc Inst Misc	A code which indicates that a wire must be given special attention as follows: a, Direct routing with no service loops or harnessing. b. Not used for maintenance. c. Not used for maintenance. d. Two wires terminating in one device. e. Not used for maintenance. f Refer to Signal Description column for this line. g. This connection does not go direct to the TO connector but intersects a wire going to the TO connector. h. Not used for maintenance. i. Junction point for MLB (multiple laminate board; i.e., printed circuit cards) connections. j. Designates a bus reference point. k. through z. not used for maintenance.
Signal	An alphanumeric signal name, mnemonic, where feasible, which identifies one specific function from another. SPP denotes an available termination. SPW denotes a non-functional wire which is terminated at one or both ends. SPF denotes an unwired termination which has assigned use. SPO denotes a spare output of a circuit. DNW indicates that a termination may not be wired. SPA denotes an unassigned circuit, one of a group on a circuit card. SPI indicates a spare input of a circuit card. SPG indicates an unassigned logic gate on a circuit card. SPR indicates a spare resistor. SPD indicates an unassigned diode of an assigned gate.
Seq. No.	Not used for maintenance.
Equation	A mnemomic name assigned to each gate of an element.
Term	An OR function composed of one or more factors.
Factor	A specific input to a logic gate or active element.
Ckt. or Chip Type	Denotes a specific circuit card type.
Group	Denotes a specific circuit on an circuit card.
Load	Denotes the current drain in milliamperes of a specific circuit or voltage.
Test Points AND	Denotes the specific input test point on a circuit card.
OR	Denotes the specific output test point on a circuit card.
Signal Description	An English description or name of a signal or voltage.
ECO No	- A letter-number combination to show the ECO level of the specific wire list record.

3-34. String List Description

The string list (fig. 3-16) provides the information necessary to identify the interconnections for a specific SIGNAL designation. The string list presents interconnection data according to SIGNAL designations which are listed in alphanumeric sequence. The string list is useful in isolating shorts, opens, and grounds.

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DRAWING NUMBER 149011-800 — STRING — UNIT ASSEMBLY NO. 149011 — REV C — INDEX EUDGCO
UNIT ASSEMBLY NAME CARD CAGE ASSY, CPU R.H. — FILE IDENT T3982CP2 — DATE 04-14-78 — PAGE 278

RECORD NUMBER	FROM PREFIX	FROM CONNECTOR	FROM PIN	FROM SIG PIN	TO PREFIX	TO CONNECTOR	TO PIN	TO SIG PIN	WIRE MULTI GROUP	WIRE CODE	WIRE COLOR	WIRE IDENT	SPEC INST MISC	SIGNAL	SEQ NO	EQUATION	TERM	FACTOR	CKT OR CHIP TYPE	GROUP	LOAD OR POWER PLANE	TEST POINTS AND	TEST POINTS OR	SIGNAL DESCRIPTION	ECO NO
13794		XA104	05			XA104	03			16B	9			EUDGCO	08	EU01CA	01	2	TQ2	A2		03B			
13795		XA104	03							16B	9			EUDGCO	09	EU02CA	01	1	TQ2	A3		02A			
13796		XA111	14			XA107	54			16B	9			EUDGDO	01	EUDGDO	00	1	TQ2	B2		09A		(DIG).(H = 0).(ES	
13797		XA107	54			XA107	50			16B	9			EUDGDO	02	EU16CA	01	2	TQ2	D1		25A			
13798		XA107	50			XA107	35			16B	9			EUDGDO	03	EU17CA	01	1	TQ2	D2		23A			
13799		XA107	35			XA107	31			16B	9			EUDGDO	04	EU15CA	01	1	TQ2	C4		17B			
13800		XA107	31			XA105	40			16B	9			EUDGDO	05	EU14CA	01	2	TQ2	C3		15B			
13801		XA105	40			XA104	35			16B	9			EUDGDO	06	EU10CA	01	2	TQ2	C1		19A			
13802		XA104	35			XA104	34			16B	9			EUDGDO	07	EU13CA	01	1	TQ2	C4		17B			
13803		XA104	34			XA104	29			16B	9			EUDGDO	08	EU11CA	01	2	TQ2	C2		16A			
13804		XA104	29							16B	9			EUDGDO	09	EU12CA	01	1	TQ2	C3		14B			
13805		XA104	06			XA108	53			16B	9			EU00CA	01	EU00CA	00	1	TQ2	A1		05A		(DIG).(H = 0).(ES	
13806		XA108	53			XA107	61			16B	9			EU00CA	02	E705D0	01	3	TT3	E2		28B			
13807		XA107	61			XA106	68			16B	9			EU00CA	03	E339C0	01	2	TQ2	E4		32B			
13808		XA106	68			XA106	71			16B	9			EU00CA	04	E360C0	01	2	TD4	E1		32A			
13809		XA106	71			XA103	77			16B	9			EU00CA	05	E621C0	01	2	TD4	F2		36A			
13810		XA103	77							16B	9			EU00CA	06	E450C0	01	2	TS8	F1		38B			
13811		XA110	05			XA104	01			16B	9			EU01CA	01	E214C0	01	5	TS8	A1		03B			
13812		XA104	01			XA103	14			16B	9			EU01CA	02	EU01CA	00	1	TQ2	A2		02B		(DIG).(H = 0).(ES	
13813		XA103	14			XA103	34			16B	9			EU01CA	03	E605C0	01	6	TS8	B1		09A			
13814		XA103	34			XA107	43			16B	9			EU01CA	04	E200C0	01	5	TS8	C1		16A			
13815		XA107	43			XA110	49			16B	9			EU01CA	05	EV01C0	01	2	TQ2	D3		23B			
13816		XA110	49			XA106	77			16B	9			EU01CA	06	ERUSE0	01	8	TS8	D1		26B			
13817		XA106	77			XA103	73			16B	9			EU01CA	07	E522C0	01	2	TD4	F1		38B			
13818		XA103	73			XA103	61			16B	9			EU01CA	08	E450C0	01	4	TS8	F1		36B			
13819		XA103	61							16B	9			EU01CA	09	E406C0	01	8	TS8	E1		32B			
13820		XA107	78			XA107	62			16B	9			EU02CA	01	EV02C0	01	2	TQ2	F4		38A			
13821		XA107	62			XA104	09			16B	9			EU02CA	02	E236C0	01	2	TQ2	E2		29A			
13822		XA104	09							16B	9			EU02CA	03	EU02CA	00	1	TQ2	A3		04B		(DIG).(H = 0).(ES	
13823		XA110	61			XA107	53			16B	9			EU03CA	01	ERUSH0	01	8	TS8	E1		32B			
13824		XA107	53			XA104	15			16B	9			EU03CA	02	E237C0	01	1	TQ2	E3		28B			
13825		XA104	15							16B	9			EU03CA	03	EU03CA	00	1	TQ2	A4		07B		(DIG).(H = 0).(ES	
13826		XA110	70			XA106	62			16B	9			EU04CA	01	ERUSH0	01	1	TS8	E1		33A			
13827		XA106	62			XA103	60			16B	9			EU04CA	02	E457C0	01	2	TD4	E2		29A			
* 13828		XA103	60			XA104	22			16B	9			EU04CA	03	E406C0	01	6	TS8	E1		28A			
13829		XA104	22							16B	9			EU04CA	04	EU04CA	00	1	TQ2	B1		12A		(DIG).(H = 0).(ES	
13830		XA110	60			XA104	14			16B	9			EU05CA	01	ERUSH0	01	6	TS8	E1		28A			
13831		XA104	14							16B	9			EU05CA	02	EU05CA	00	1	TQ2	B2		09A		(DIG).(H = 0).(ES	
13832		XA110	66			XA313	49			16B	9			EU06CA	01	ERUSH0	01	3	TS8	E1		31A			
13833		XA313	49			XA103	26			16B	9			EU06CA	02	C358C0	01	8	TS8	D1		26B			
13834		XA103	26			XA104	21			16B	9			EU06CA	03	E605C0	01	1	TS8	B1		14A			
13835		XA104	21			XA404	36			16B	9			EU06CA	04	EU06CA	00	1	TQ2	B3		10B		(DIG).(H = 0).(ES	
									****	SIGNAL	(EU06CA	)		IS ON THE	NEXT	PAGE	****							

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Figure 3-16. String List Example.

3-35. Logic List Description

The logic list (fig. 3-17) provides the information necessary to identify the logic factors needed to generate a particular logic equation. Logic factors are the logic function that must be present to generate another logic function. The logic equation is a logic function that is generated when all logic factors are present. The logic list contains equations arranged in alphanumeric sequence. A logic list is provided for each major assembly (or unit within an assembly) containing digital circuitry.

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DRAWING NUMBER 149011-860
UNIT ASSEMBLY NAME CARD CAGE ASSY, CPU R.H.

LOGIC

UNIT ASSEMBLY NO. 149011
FILE IDENT T39B2CP2
REV. C
DATE 04-18-78
INDEX E242C0
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	CONNECTOR	CIRCUIT TYPE	GROUP	TEST POINTS AND	TEST POINTS OR	EQUATION	TERM	DESIGNATOR	FACTOR	COMMENT
	XA103	TS8	D1	25B		E242C0	00	=	AT 00-31	TO DB 00-31 - DIG-0
	XA103	TS8	D1	26A		(47)	01		ET12CA ET13CA ET11CA ET14CA EU14CA EU12CA EU13CA EU11CA 56 26A 54 25A 52 24A 50 23A 48 22A 46 21A 43 23B 49 26B	
	XA105	TQ2	E4	33B		E339CA	00	=	LDA +00003CK0005	
	XA105	TQ2	E4	31B		(63)	01		SPA003 E339C0 59 31B 61 32B	
	XA107	TQ2	E4	33B		E339C0	00	=	TO/(E0.DIGI)	
	XA107	TQ2	E4	31B		(63)	01		ET00CA EU00CA 59 31B 61 32B	
	XA107	TQ2	F1	37B		E345CA	00	=	BTR DB1630CL0014	
	XA107	TQ2	F1	39B		(75)	01		SPA004 E345C0 79 39B 77 38B	
	XA108	TT3	E1	30A		E345C0	00	=	DIGI.(E7/E10/E17)	
	XA108	TT3	E1	33A		(64)	01		EU07CA EU10CA EU17CA 70 33A 68 32A 66 31A	
	XA104	TQ2	E4	33B		E360CA	00	=	DTR-77777TB0015,TB1631	
	XA104	TQ2	E4	31B		(63)	01		E360C0 SPA001 59 31B 61 32B	
	XA106	TD4	E1	31B		E360C0	00	=	TO/(E0.DIGI)/T10	
	XA106	TD4	E1	33A		(59)	01		ET00CA EU00CA SPA004 EU10CA 70 33A 68 32A 66 31A 61 32B	
	XA105	TQ2	F1	37B		E361CA	00	=	BLO CN0015DB1631	
	XA105	TQ2	F1	39B		(75)	01		SPA004 EV01C0 79 39B 77 38B	
	XA104	TQ2	F1	37B		E406CA	00	=	GR 00-31	TO DB 00-31 - DIG-A
	XA104	TQ2	F1	39B		(75)	01		SPA002 E406C0 79 39B 77 38B	
*	XA103	TS8	E1	31B		E406C0	00	=	ONE TO GA 00-03 - DIG - 0	
	XA103	TS8	E1	33A		(59)	01		EU07CA ET01CA SPA002 ET07CA ET04CA EU04CA SPA001 EU01CA 70 33A 68 32A 66 31A 64 30A 62 29A 60 28A 55 29B 61 32B	
	XA104	TQ2	F2	34A		E450CA	00	=	DB 00-31	TO GR 00-31 - DIG-A
	XA104	TQ2	F2	36B		(72)	01		E450C0 SPA002 73 36B 71 36A	
	XA103	TS8	F1	37A		E450C0	00	=	DB 00-31	TO GR 00-31 - DIG-0
	XA103	TS8	F1	39B		(76)	01		ET15CA EU00CA EU07CA EU01CA ET07CA ET01CA ET00CA EU15CA 79 39B 77 38B 75 37B 73 36B 71 36A 72 34A 74 35B 76 38A	

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Figure 3-17. Logic List Example

3-36. How to Use Wiring Lists

NOTE
Read important basic information in paragraphs 3-32 through 3-35 and proceed with following sequence of steps when tracing a signal.

a. Refer to connector wire list (fig. 3-15) and locate wire connected from connector XA103, pin 60 to connector XA104, pin 22.

b. The signal name for this wire is EU04CA, located in signal column.

c. Proceed to string list (fig. 3-16) and locate signal EU04CA in signal column. This signal is associated with wires connected from XA110, pin 70 to XA106, pin 62; from XA106, pin 62 to XA103, pin 60; and from XA103, pin 60 to XA104, pin 22.

d. To use the logic list, refer to the connector list (fig. 3-15) and locate in equation column the equation E406CO. Proceed to logic list (fig. 3-17) and locate equation E406CO in equation column. The factor column identifies the logic factors needed to generate the particular logic equation E406CO.

3-37. Applicable Wire Lists

The following lists are used with TM 11-5895-856-34-1.

a. String List.

Name	Where used	Drawing number	Manual number
Card Cage Assembly, CPU-RH	CS,MS	149011-800	TM 11-5895-856-34-2
Card Cage Assembly, CPU-LH	CS,MS	149012-800	TM 11-5895-856-34-5
Card Cage Assembly, IFCU-RH	CS	149015-800	TM 11-5895-856-34-9
Card Cage Assembly "A", IFCU-RU	MS	149016-800	TM 11-5895-856-34-12
Card Cage Assembly "B", IFCU-RH	MS	149017-800	TM 11-5895-856-34-15
Card Cage Assembly, IOU-LH	CS,MS	149019-800	TM 11-5895-856-34-18
Card Cage, Wired-MCMU	CS,MS	149304-800	TM 11-5895-856-34-21
Panel Assembly, Status and Control-ADP/MS	MS	149014-800	TM 11-5895-856-34-8
Panel Assembly, Status and Control-ADP/CS	CS	149020-800	TM 11-5895-856-34-8
Panel Assembly, Interface, Peripheral Equipment-ADPICS	CS	149404-800	TM 11-5895-856-34-24
Panel Assembly, Interface, Peripheral Equipment-ADPIMS	MS	149405-800	TM 11-5895-856-34-24
Converter, DC-DC, Logic 5-Volt	CS,MS	SM-A-837702	TM 11-5895-856-34-8
Converter, DC-DC, MCMU	CS,MS	SM-A-837722	TM 11-5895-856-34-8
Frame Assembly, MCMU	CS	SM-A-837681	TM 11-5895-856-34-23
b. Logic List.			
Card Cage Assembly, CPU-RH	CS,MS	149011-860	TM 11-5895-856-34-3
Card Cage Assembly, CPU-LH	CS,MS	149012-860	TM 11-5895-856-34-6
Card Cage Assembly, IFCU-RH	CS	149015-860	TM 11-5895-856-34-10
Card Cage Assembly "A", IFCU-RH	MS	149016-860	TM 11-5895-856-34-13
Card Cage Assembly "B", IFCU-RH	MS	149017-860	TM 11-5895-856-34-16
Card Cage Assembly, IOU-LH	CS,MS	149019-860	TM 11-5895-856-34-19
Card Cage, Wired-MCMU	CS,MS	149304-860	TM 11-5895-856-34-22
c. Connector List.			
Card Cage Assembly, CPU-RH	CS,MS	149011-880	TM 11-5895-856-34-4
Card Cage Assembly, CPU-LH	CS,MS	149012-880	TM 11-5895-856-34-7
Card Cage Assembly, IFCU-RH	CS	149015-880	TM 11-5895-856-34-11
Card Cage Assembly "A", IFCU-RH	MS	149016-880	TM 11-5895-856-34-4
Card Cage Assembly "B", IFCU-RH	MS	149017-880	TM 11-5895-856-34-17
Card Cage Assembly, IOU-LH	CS,MS	149019-880	TM 11-5895-856-34-20
Card Cage, Wired-MCMU	CS,MS	149304-880	TM 11-5895-856-34-23

CHAPTER 4

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

General support maintenance of the ADP assemblies consists of printed circuit card repair. Refer to Maintenance Allocation Chart in TM11-5805-681-12-2 or TM 11-5805-683-12-2.

APPENDIX A

REFERENCES

TM 11-5805-681-12-1 EEI 19-BA-OMI-010/E154 TTC39 T.O. 31W2-2TTC39-1	Operator's and Organizational Maintenance Manual for Central Office, Telephone, Automatic AN/TTC-39 (V)2 (to be published)
TM 11-5805-683-12-1 EE 119-AA-OMI-010/E154 TYC39 T.O. 31W2-2TYC39-11	Operator's and Organizational Maintenance Manual for Central, Message Switching, Automatic AN/TYC-39 (V)1 (to be published)
TM 11-5895-856-20P EE640-CA-PLO-010/E154 CPU	Organizational Repair Parts and Special Tools List (to be published)
TM 11-5895-856-34-2 EE640-CA-MMI-020/E 154 CPU T.O. 31W2-2T-122-2	Card Cage Assembly, Central Processor Unit-R. H., Wire List, String (149011-800) (to be published)
TM 11-5895-856-34-3 EE640-CA-MMI-030/E 154 CPU T.O. 31W2-2T-122-3	Card Cage Assembly, Central Processor Unit-R.H., Wire List, Logic (149011-860) (to be published)
TM 11-5895-856-34-4 EE640-CA-MMI-040/E 154 CPU T.O. 31W2-2T-122-4	Card Cage Assembly, Central Processor Unit-R. H., Wire List, Connector (149011-880) (to be published)
TM 11-5895-856-34-5 EE640-CA-MMI-050/E 154 CU T.O. 31W2-2T-122-5	Card Cage Assembly, Central Processor Unit-L. H., Wire List, String (149012-800) (to be published)
TM 11-5895-856-34-6 EE640-CA-MMI-060/E 154 CPU T.O. 31W2-2T-122-6	Card Cage Assembly, Central Processor Unit-L.H., Wire List, Logic (149012-860) (to be published)
TM 11-5895-856-34-7 EE640-CA-MMI-070/E154 CPU T.O. 31W2-2T-122-7	Card Cage Assembly, Central Processor Unit-L.H., Wire List, Connector (149012-880) (to be published)
TM 11-5895-856-34-8 EE640-CA-MMI-088/E 154 CPU T.O. 31W2-2T-122-8	Panel Assembly, Status and Control ADP/MS, Wire List, String (149014-800) (to be published)
	Panel Assembly, Status and Control ADP/CS, Wire List, String (149020-800) (to be published)
TM 11-5805-683-34-3	Technical Manual Direct Support and General Support Maintenance Manual for Central, Messages Switching, Automatic AN/TYC-39 (V) 1 (Schematic Diagrams) (NSN 5805-01-123-1851) (to be published)
TM 11-5895-856-34-9 EE640-CA-MMI-090/E154 CPU T.O. 31W2-2T-122-9	Card Cage Assembly, Interface Control Unit-R. H., Wire List, String (149015-800) (to be published)
TM 11.-5895-856-34-10 EE640-CA-MMI- 100/E 154 CPU T.O. 31W2-2T-122-10	Card Cage Assembly, Interface Control Unit-R. H., Wire List, Logic (149015-860) (to be published)
TM 11-5895-856-34-11 EE640-CA-MMI-110/E154 CPU T.O. 31W2-2T-122-11	Card Cage Assembly, Interface Control Unit-R. H., Wire List, Connector (149015-880) (to be published)
TM 11-5895-856-34-12 EE640-CA-MMI-120/E154 CPU T.O. 31W2-2T-122-12	Card Cage Assembly "A", Interface Control Unit-R.H., Wire List, String (149016-800) (to be published)

TM 11-5895-856-34-13
EE640-CA-MMI-130/E154 CPU
T.O. 31W2-2T-122-13
TM 11-5895-856-34-14
EE640-CA-MMI- 140/E 154 CPU
T.O. 31W2-2T-122-14
TM 11-5895-856-34-15
EE640-CA-MMI-150/E154 CPU
T.O. 31W2-2T-122-15
TM 11-5895-856-34-16
EE640-CA-MMI-160/E154 CPU
T.O. 31W2-2T-122-16
TM 11-5895-856-34-17
EE640-CA-MMI- 170/E 154 CPU
T.O. 31W2-2T-122-17
TM 11-5895-856-34-18
EE640-CA-MMI-180/E 154 CPU
T.O. 31W2-2T-122-18
TM 11-5895-856-34-19
EE640-CA-MMI- 190/E 154 CPU
T.O. 31W2-2T-122-19
TM 11-5895-856-34-20
EE640-CA-MMI-200/E 154 CPU
T.O. 31W2-2T-122-20
TM 11-5895-856-34-21
EE640-CA-MMI-210/E 154 CPU
T.O. 31W2-2T-122-21
TM 11-5895-856-34-22
EE640-CA-MMI-220/E 154 CPU
T.O. 31W2-2T-122-22
TM 11-5895-856-34-23
EE640-CA-MMI-230/E154 CPU

TM 11-5895-856-34-24
EE640-CA-MMI-240/E154 CPU
T.O. 31W2-2T-122-24
TM 11-5895-856-34P
EE640-CA-PLG-010/E154 CPU
T.O. 31W2-25-124
TM 11-6625-654-14

TM 11-6625-700-10

TM 11-6625-1541-15

TM 11-6625-2735-14
0969-LP-170-1090
T.O. 33A1-13-498-1

Card Cage Assembly "A", Interface Control Unit-R.H., Wire List, Logic (149016-860) (to be published)

Card Cage Assembly "A", Interface Control Unit-R.H., Wire List, Connector (149016-880) (to be published)

Card Cage Assembly "B", Interface Control Unit-R.H., Wire List, String (149017-800) (to be published)

Card Cage Assembly "B", Interface Control Unit-R.H., Wire List, Logic (149017-860) (to be published)

Card Cage Assembly "B", Interface Control Unit-R.H., Wire List, Connector (149017-880) (to be published)

Card Cage Assembly, Input/Output Unit-L.H., Wire List, String (149019-800) (to be published)

Card Cage Assembly, Input/Output Unit-L.H., Wire List, Logic (149019-860) (to be published)

Card Cage Assembly, Input/Output Unit-L.H., Wire List, Connector (149019-880) (to be published)

Card Cage, Wired-Mass Core Memory Unit, Wire List, String (149304-800) (to be published)

Card Cage, Wired-Mass Core Memory Unit, Wire List, Logic (149304-860) (to be published)

Card Cage, Wired-Mass Core Memory Unit, Wire List, Connector (149304-880) (to be published)
Frame Assembly-Mass Core Memory Unit, Wire List, String (SM-A-837681) (to be published)
Panel Assembly, Interface, Peripheral Equipment, Wire List, String-ADP/CS (149404-800) (to be published)

Direct Support and General Support Repair Parts and Special Tools List (Including Depot RPSTL) (to be published)

Operator's, Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Multimeter AN/USM-223 (to be published)
Operator's Manual Digital Readout, Electronic Counter AN/USM-207
(NSN 6625-00-911-6368)
Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual Hewlett-Packard RMS Voltmeter Model 3400A (to be published)
Operator's, Organizational, Direct Support and General Support Maintenance Manual (Including Depot Maintenance) for Oscilloscope OS-261/U (to be published) (NSN 6625-00-127-0079)

TM 11-6625-2953-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual Multimeter AN/USM-451 (NSN 6625-01-060-6804) (to be published)
TM 11-7010-201-40-5	General Support Maintenance Manual for Electronic Circuit Plug-in Unit Test Set TS-3317( )/TSQ-73 (to be published)
ET821-AA-MMI-050/E 154 MTS	The Army Maintenance Management System (TAMMS) (to be published)
TM 38-750	Administrative Storage of Equipment
TM 740-90-1	Procedures for Destruction of Electronics Material to Prevent Enemy Use (Electronics Command) (to be published)
TM 750-244-2	

APPENDIX B

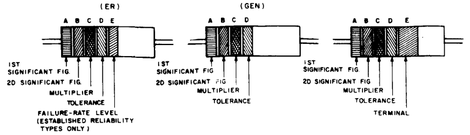
EXPENDABLE SUPPLIES AND MATERIALS LIST

Not Applicable.

GLOSSARY

ADP	Automatic Data Processor
BITE	Built-in Test Equipment
CPG	Central Processor Group
CPU	Central Processor Unit
CS	Circuit Switch
CSCPG	Circuit Switch Central Processor Group
DISREP	Discrepancy in Shipping Report
EIR	Equipment Improvement Recommendation
IFCU	Interface Control Unit
IOC	Input/Output Controller
IOE	Input/Output Channel E
IOU	Input/Output Unit
IOX	Input/Output Channel X
IRG	Inter-Record Gap
ITR	Input-to-Register
LPC	Line Printer Controller
LRC	Longitudinal Redundancy Check
MCMU	Mass Core Memory Unit
MS	Message Switch
MSCPG	Message Switch Central Processor Group
MTC	Magnetic Tape Controller
MTT	Magnetic Tape Transport
MTS	Module Test Set
NIRT	Numerical Index and Requirements Table
PIP	Peripheral Interface Panel
PPI	Processor-to-Processor Interface
RAS	Random Access Storage
RASC	Random Access Storage Controller
ROD	Report of Discrepancy
RPSTL	Repair Parts and Special Tools List
TTY	Teletypewriter
TTYC	Teletypewriter Controller

INDEX



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE I
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM
BLACK	0	BLACK	0	BLACK	1			BROWN	M=1.0	
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1	
RED	2	RED	2	RED	100			ORANGE	R=0.01	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE		SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY)			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	0.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE. (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS). ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

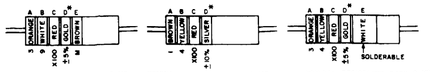
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±1%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

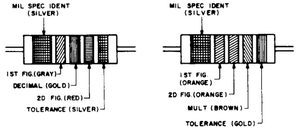
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

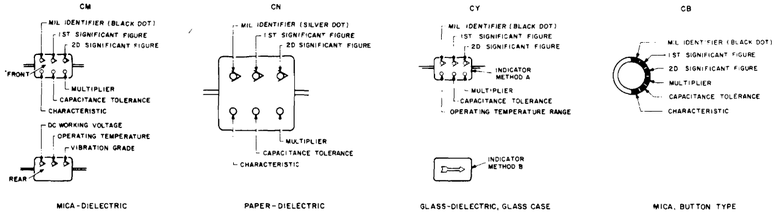
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

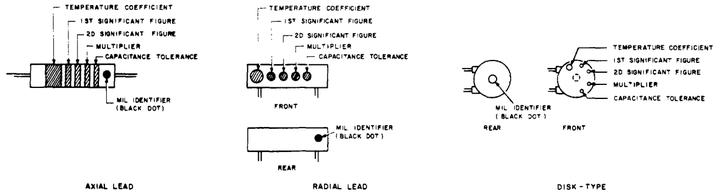
COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB





C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CN
BLACK	CM, CY, CB	0	0	1			±20%	±20%		A			-55°C to +70°C	10-55 Hz
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				-55°C to +85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				-55°C to +125°C	10-2,000Hz
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55°C to +150°C	
PURPLE (VIOLET)		7	7											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±10%	±30%	±10%	±10%						

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	-30	1	1	10	±1%		
RED	-80	2	2	100	±2%	±0.25 UUF	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		±5%	±0.5 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GRAY		8	8	0.01*			
WHITE		9	9	0.1*	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-250, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.
* OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

EL4RE006

Figure FO-1. Standard Color Coding Chart.

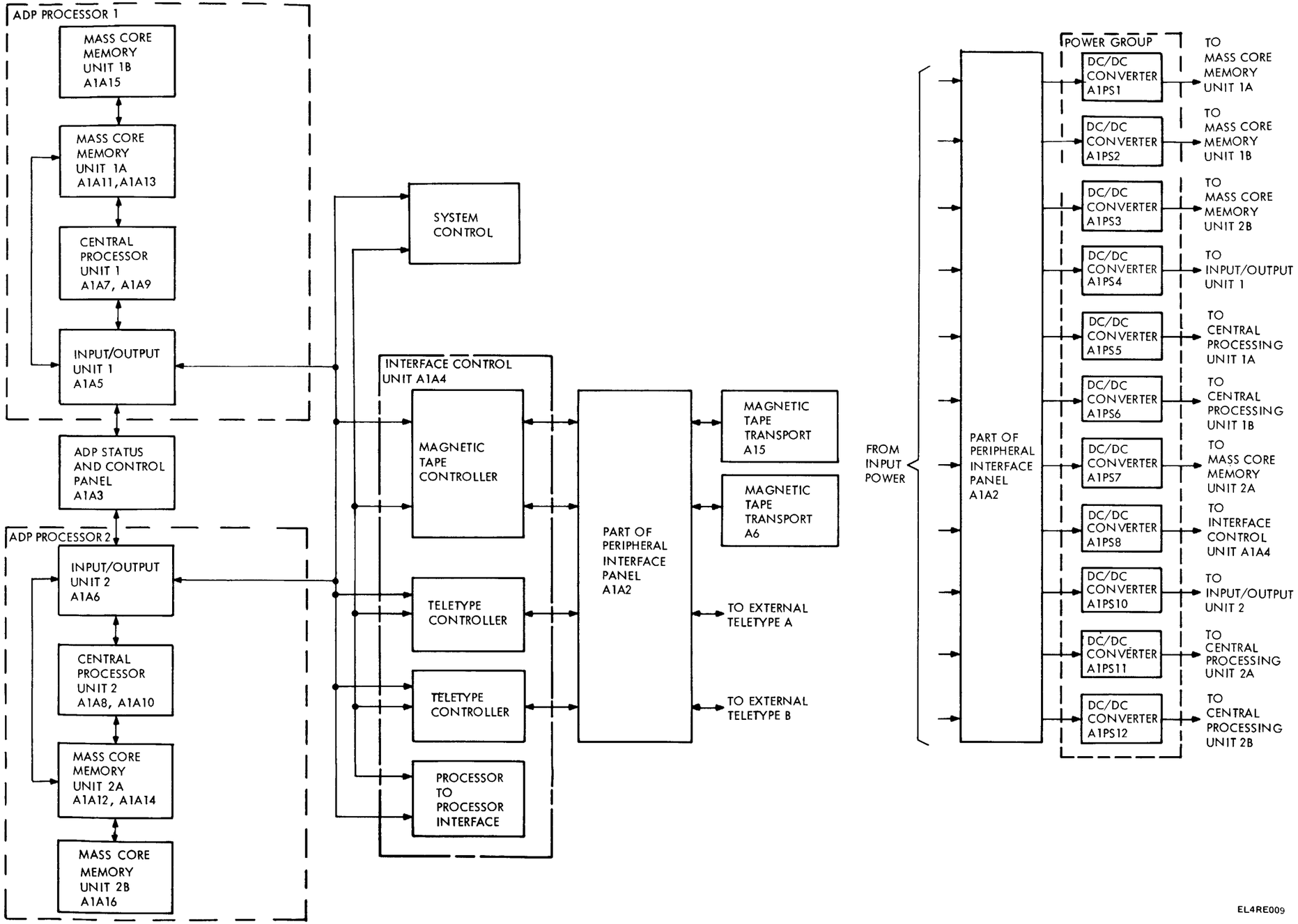


Figure FO-2. CSCPG Block Diagram.

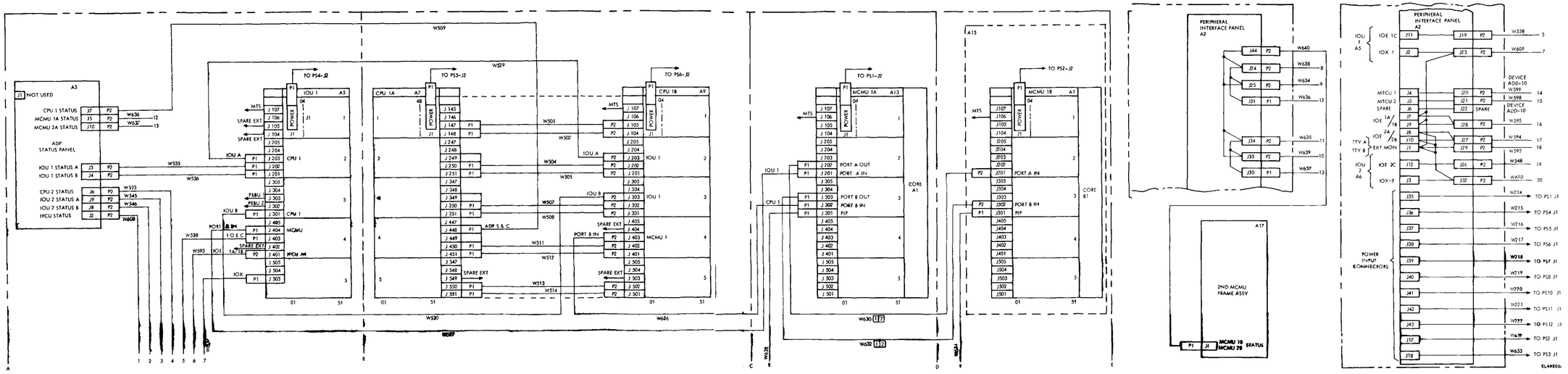


Figure FO-3. CSCPG Cable Interconnection Diagram (Sheet 1 of 2)

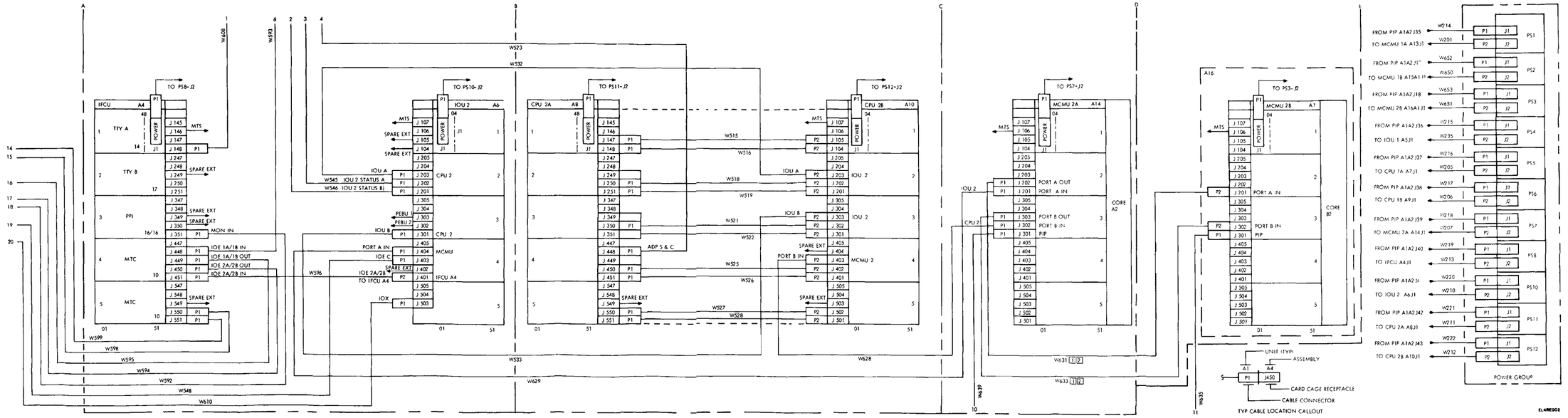


Figure FO-3. CSCPG Interconnection Diagram (Sheet 2 of 2)

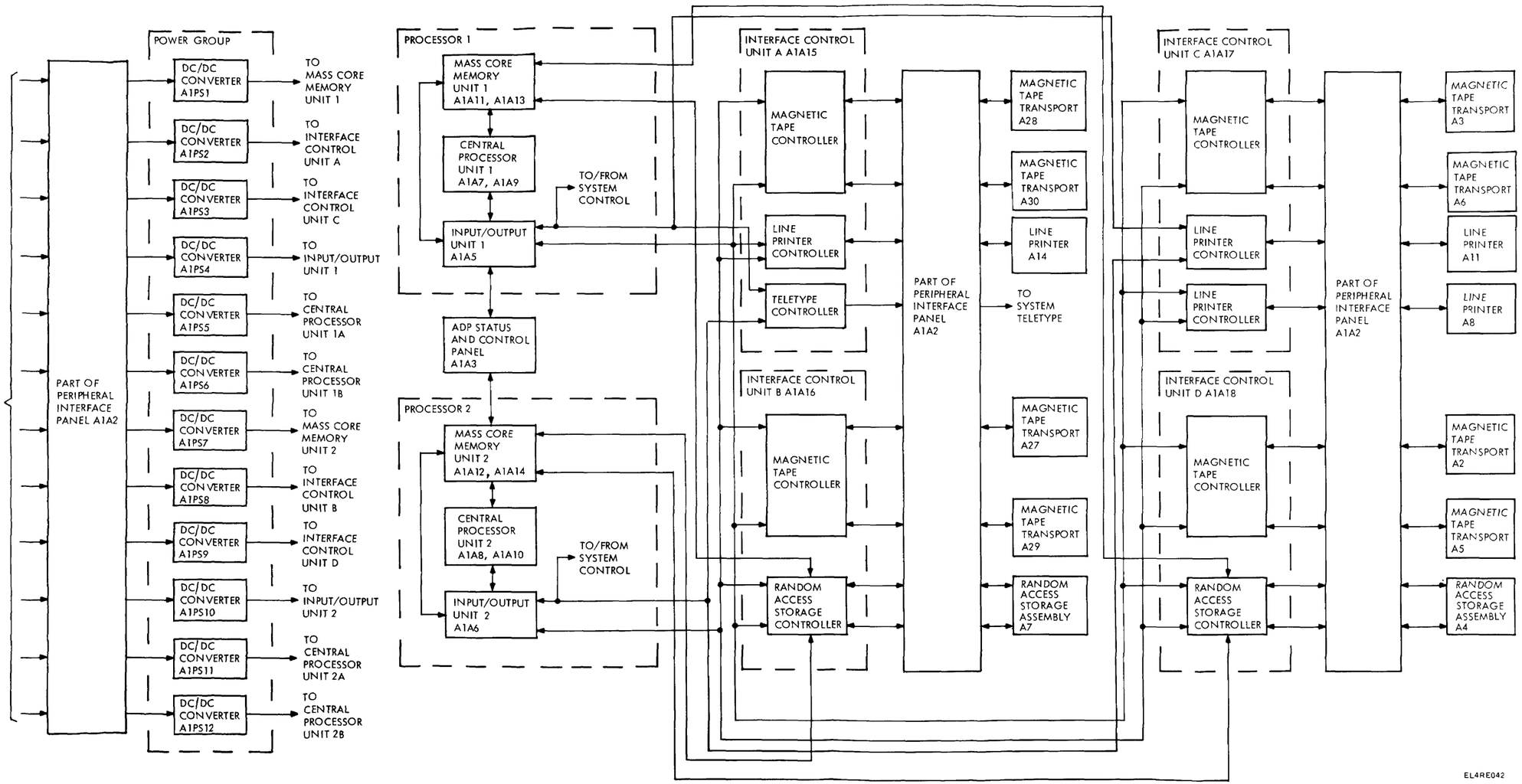


Figure FO-4. MSCPG Block Diagram.

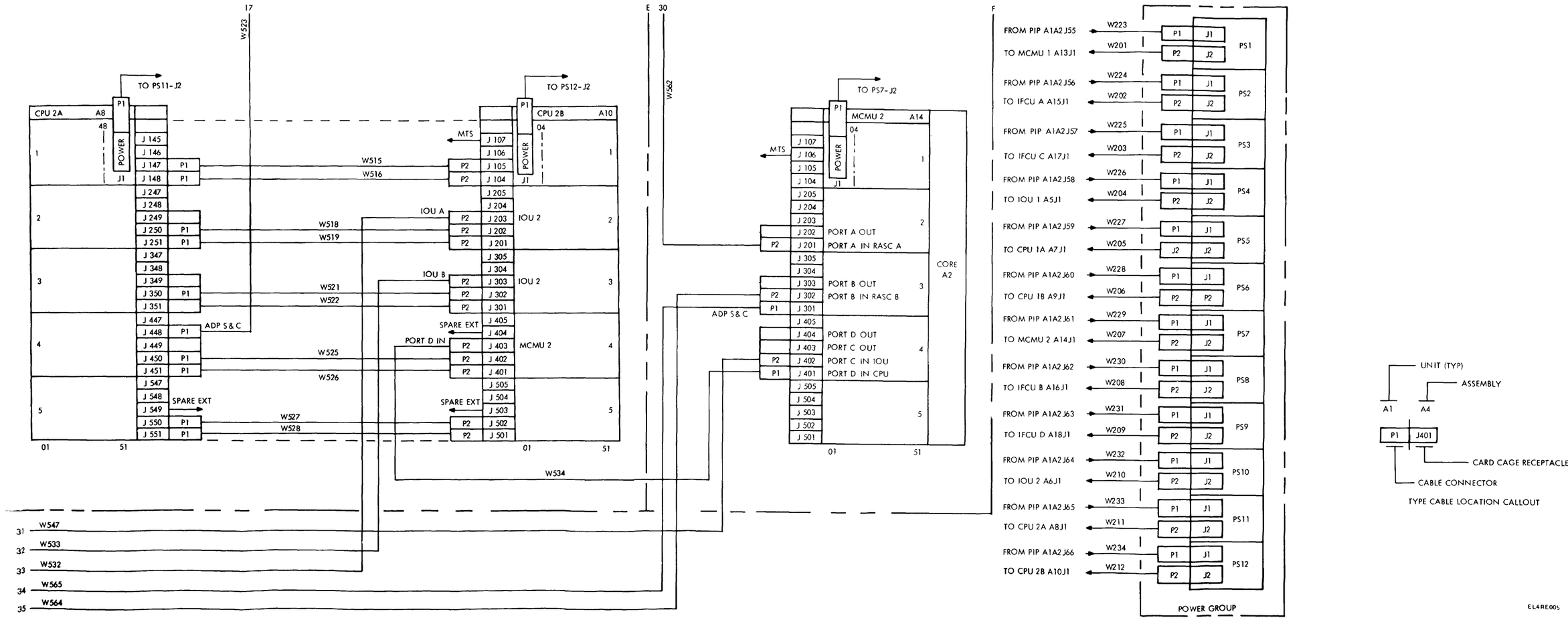


Figure FO-5. MSCPG Cable Interconnection Diagram (Sheet 1 of 3).

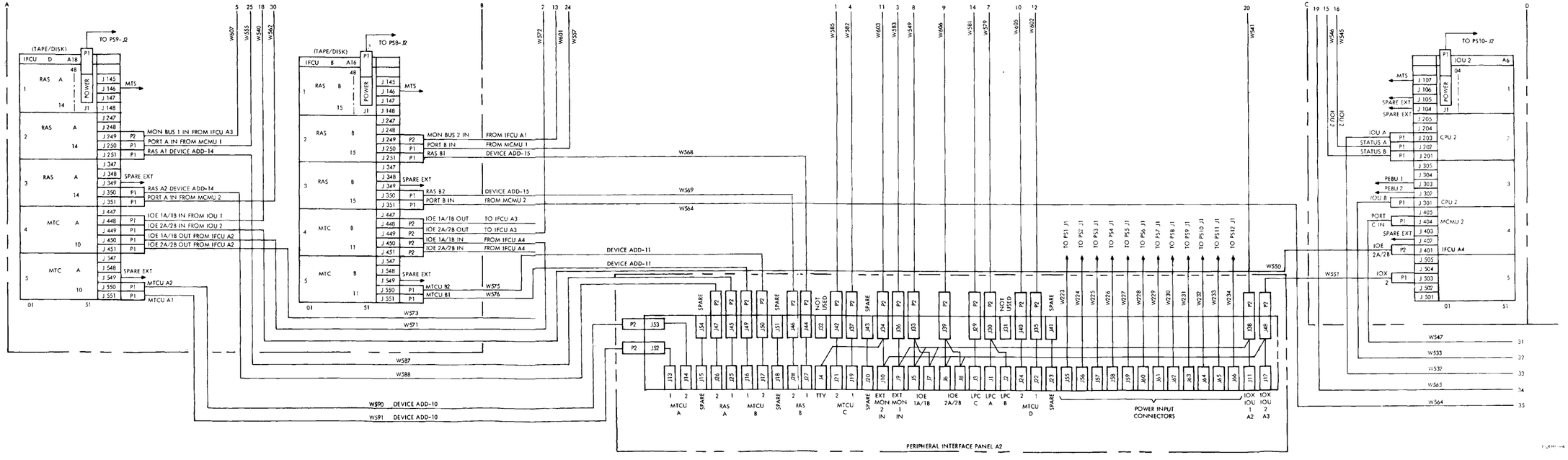


Figure FO-5. MSCPG Cable Interconnection Diagram (Sheet 2 of 3)

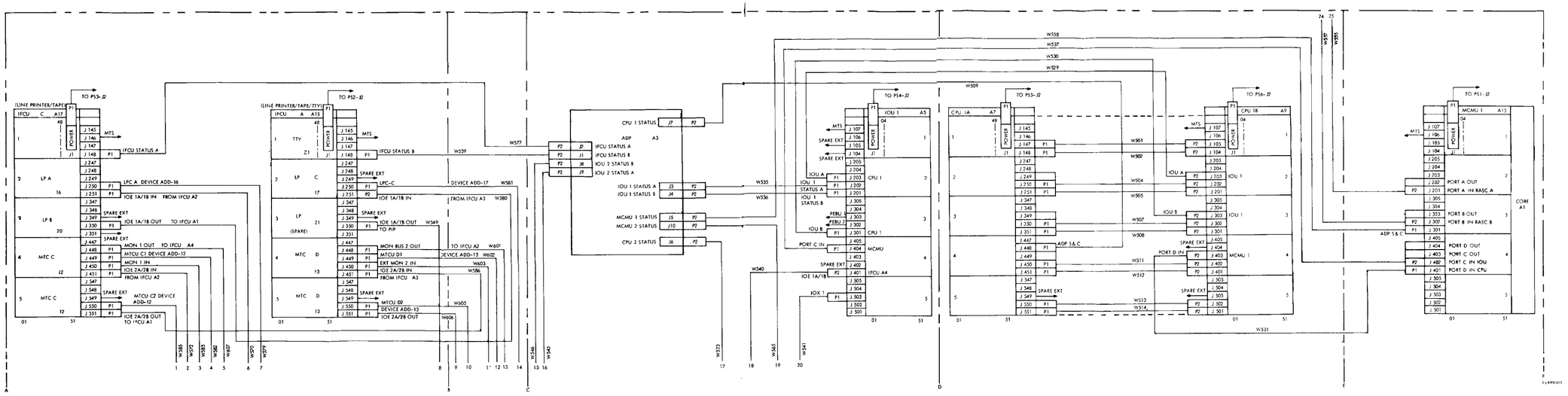


Figure FO-5. MSCPG Cable Interconnection Diagram (Sheet 3 of 3)

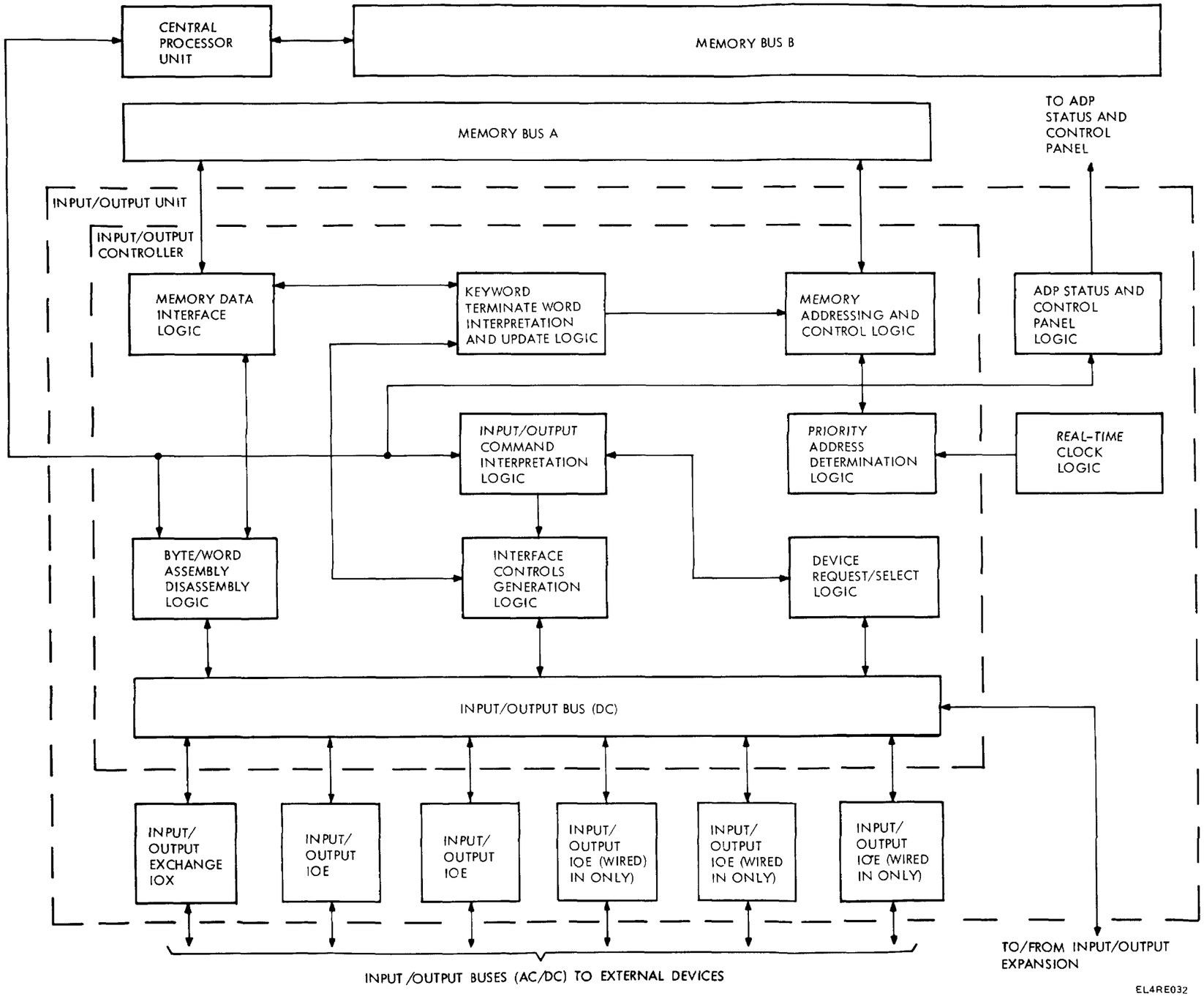


Figure FO-6. Input/Output Unit Block Diagram.

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