EK-MULCP-UG-001

# Multi-CPU User's Guide

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# Multi-CPU User's Guide

Prepared by Educational Services
of
Digital Equipment Corporation

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# PREFACE

This user's guide is designed to be used as a reference document for operators, system administrators, and Digital Field Service personnel.

**NOTE**

**The term Multi-CPU configuration or system refers to a multiple central processor unit system made up of Multiple KL10-D (1090) CPUs.**

This user's guide gives specifications, configuration rules, installation rules, a software overview of the operating system, and acceptance procedures for multiple central processing systems. Sources of detailed information on the Multi-CPU configuration can be found in Paragraph 1.3. Information on dual-processor systems is not included, because this information is available in current documentation.

# CHAPTER 1
# INTRODUCTION

## 1.1 PRODUCT DESCRIPTION

The Multi-CPU system is made up of multiple KL10-D (1090) processors, a console terminal, MH10 core memory, multiple RP04, RP06, RP07 or RP20 disk drive configurations with controllers, and at least one 9-track 2032 or 4064 bits/cm (800 or 1600 bits/in) magnetic tape transport with controller.

These systems use shared memory and a single copy of the TOPS-10 operating system to provide improved system capacity and performance over single-processor configurations. This type of system is flexible enough to allow I/O devices (disk drives and magnetic tape units) to be shared among all of the multiple processors. This is possible because a KL10-D CPU can run a job even if the job uses devices that are connected to another KL10-D CPU in the system. Depending on the system configuration and total computing load, a Multi-CPU system can handle up to 300 active jobs.

## 1.2 SYSTEM SPECIFICATIONS

Specifications other than electrical for the Multi-CPU configuration are the same as for a single KL10-D CPU.

**NOTE**

**Specifications for I/O and communications devices can be found in the DECsystem-10 Site Preparation Guide (EK-DEC10-SP).**

### 1.2.1 Electrical

The electrical specifications given are for a single KL10-D CPU. For a Multi-CPU configuration, these specifications will change, dependent on how many KL10-D CPUs are in the system.

| AC Voltages | Low | Normal | High |
|---|---|---|---|
| Phase to Neutral (60 Hz) | 104 | 120 | 127 |
| Phase to Phase (60 Hz) | 180 | 208 | 220 |
| Phase to Neutral (50 Hz) | 208 | 240 | 254 |
| Phase to Phase (50 Hz) | 330 | 380 | 403 |

| | |
|---|---|
| Steady State Current (RMS) | 23 A/phase (60 Hz)<br>11.5 A/phase (50 Hz) |
| Surge Current | 875 A/phase (60 Hz)<br>440 A/phase (50 Hz) |
| Surge Duration | 1 cycle |
| Interrupt Tolerance | 8.1 ms (max) |
| Heat Dissipation | 6800 kg cal/hr (27,300 BTU/hr) |
| Power Dissipation | 8000 W 8280 KVA |
| Leakage Current | 12.7 mA (max) |
| Power Cord Connector | Pyle-Star ZPLT6C2449PR |

### 1.2.2 Mechanical

The mechanical specifications listed below are for one KL10-D in the Multi-CPU configuration.

| | |
|---|---|
| Weight | 1200 kg (2700 lb) |
| Height | 183 cm (72 in) |
| Width | 218 cm (86 in) |
| Depth | 81 cm (32 in) |
| Cabinet Type | H955/H956 (free-standing) |

### 1.2.3 Environmental

The environmental specifications listed below apply to the complete Multi-CPU configuration.

| | |
|---|---|
| Operating Temperature | +15° to +32° C<br>(+59° to +90° F) |
| Storage Temperature | -40° to +66° C<br>(-40° to +151° F) |
| Operating Relative Humidity | 20% to 80% |
| Storage Relative Humidity | 0% to 95% |
| Temperature Rate of Change | 7° C/hr (12° F/hr) |
| Relative Humidity Rate of Change | 2%/hr |

## 1.3 Related Documentation

The following hardware manuals have information pertaining to the Multi-CPU configuration.

| Document | Document No. |
|---|---|
| DN2X/DNHXX Communications Subsystem Technical Manual | EK-0DN2X-TM |
| DX10 Data Channel Maintenance Manual | EK-0DX10-TM |
| DX10 Data Channel Addendum | EK-0DX10-AD |
| DX20 Programmed Device Adapter Technical Manual | EK-0DX20-TM |
| KL10-Based DECsystem-10 Installation Procedures | EK-1080U-IN |
| KL10-Based Power Description | EK-1080U-PD |
| KL10-Based System Service Manual | EK-0KL10-SV |
| LP05 Maintenance Manual Volume 1 | ER-00009-MM |
| LP05 Maintenance Manual Volume 2 | ER-5V157-MM |
| LP14 Maintenance Manual Volume 1 | ER-12290-TM |
| LP14 Maintenance Manual Volume 2 | ER-22290-TM |
| LP100 Line Printer System Maintenance Manual | EK-LP100-MM |
| MH10 Maintenance Manual | EK-OMH10-MM |

| Document (Cont) | Document No. |
|---|---|
| PC10/PC20 High Speed Paper Tape Reader/Punch Technical Manual | EK-OPC20-TM |
| Power System (1080/1090) Interface Description | EK-PWR1-ID |
| RP04 Device Control Logic Users Manual | EK-ORP04-OP |
| RP04 Device Control Logic Maintenance Manual | EK-ORP04-MM |
| RP04 Disk Drive Installation Manual | EK-ORP04-IN |
| RP05/06 677-01/51 Logic Manual | EK-00014-TM |
| RP05/06 677-01/51 Logic Manual | EK-00012-TM |
| RP05/06 Disk Drive Installation Manual | EK-RP056-IN |
| RP05/06 Disk Drive Maintenance Manual | EK-RP056-MM |
| RP20 Disk Subsystem User's Guide | EK-ORP20-UG |
| TU45 Magtape System Manual | EK-TU45A-MM |
| TX01/02 3800-III Tape Control Unit STC Manual | EK-TX01-VEN |

The following software manuals have information pertaining to the Multi-CPU configuration.

| Document | Document No. |
|---|---|
| TOPS-10 Monitor Installation Guide | AD-5056B-T2 |
| TOPS-10 Networks Software Installation Guide | AD-5156E-T1 |
| TOPS-10 Operator's Guide | AD-H283A-T2 |

# CHAPTER 2
# SYSTEM CONSIDERATIONS

## 2.1 MULTI-CPU CONFIGURATIONS

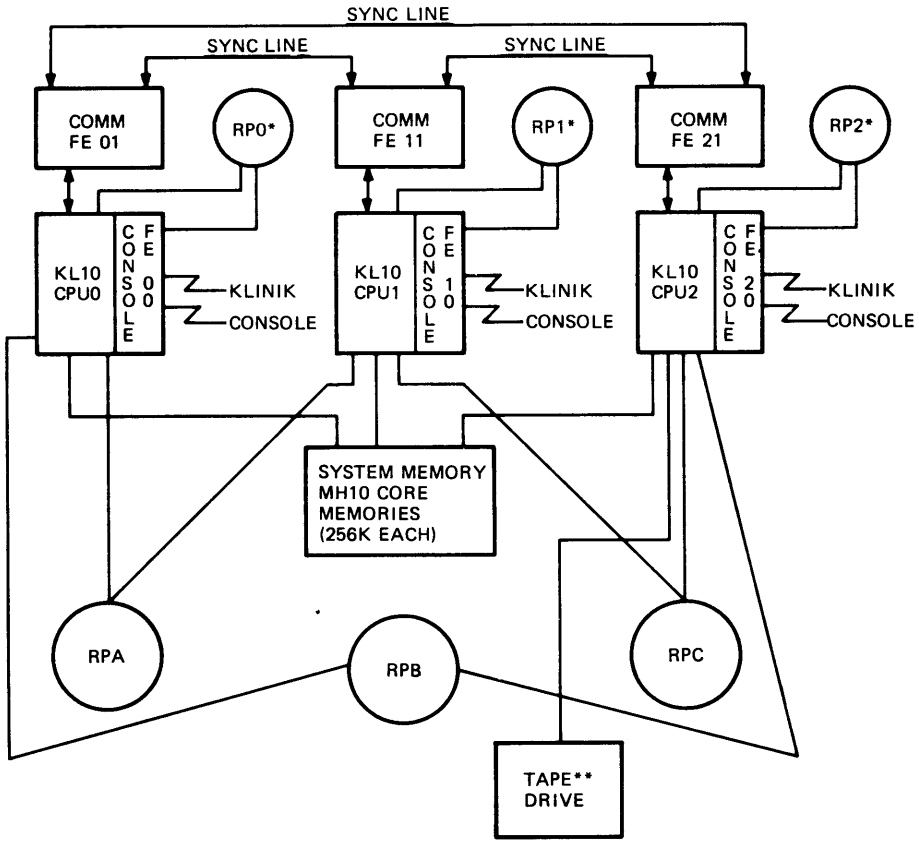
A Multi-CPU configuration (Figure 2-1) is made up of multiple KL10-D central processor units (CPUs), MH10 core memories (256K per MH10, with a minimum of 1 M word of memory), RP04, RP06, RP07 or RP20 disk drives (should be dual-ported) and at least one 9-track 2032 or 4064 bits/cm (800 or 1600 bits/in) magnetic tape transport.

The KL10-D processors are called CPU0, CPU1, and CPU2. Each KL10-D includes a PDP-11/40 console front end (console FE 00, 10, and 20) and must be connected to a dual-ported disk drive placed between the PDP-11/40 and the KL10-D. The KLINIK (KL10 Integrated Network for Investigation and Korrection) field service maintenance tool and the LA36 console teleprinter are also connected to each console front end.

The KL10-D that is first loaded and started is called the policy CPU. This CPU keeps track of the operations of the Multi-CPU system. If the policy CPU crashes and does not automatically restart, the software will select another KL10-D in the system to become the policy CPU.

A maximum of three additional communications front ends (such as a DN20) can be added to each KL10-D CPU in the Multi-CPU configuration. These communications front ends are referred to as Comm FE 01, 11 and 21 in the Multi-CPU diagrams. This allows additional synchronous and asynchronous lines to be added to the Multi-CPU configuration.

The system memory is made up of MH10 core memories, each of which has 256K words of memory, with a minimum of 1 M word for the system. Each KL10-D processor has its own path by which it can gain access to system memory. If the path from a communications front end to memory is blocked (because a KL10-D CPU crashes), a second path is used. This second path goes through a combination of other communication front ends and CPUs into memory. As long as there is a KL10-D processor available, there is always another path to memory, even if some paths are blocked.




* A MINIMUM OF ONE DISK DRIVE IS REQUIRED FOR EACH KL10-D CPU.
** A MINIMUM OF ONE TAPE DRIVE IS REQUIRED FOR THE MULTI-CPU CONFIGURATION. THE TAPE DRIVE CAN BE CONNECTED TO ANY KL10-D CPU.

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Figure 2-1 Recommended Multi-CPU Configuration

**NOTE**

**A minimum of 1.0 M word of memory is needed for the Multi-CPU configuration. Additional memory above 1.0 M word must be in increments of 512K. A minimum of 1.5 M word of memory is recommended, as this would leave 1.0 M words for system use when 512K is being used for maintenance purposes.**

Each CPU has one disk drive used for control and status information as well as general storage between the KL10-D CPU and the console front end. These drives must be RP04 or RP06 drives. They are called RP0, RP1 and RP2, as indicated in Figure 2-1. Additional disk drives in a string between the KL10-D CPUs are used for storage of users' data. These may be of any system disk type (RP04, RP06, RP07, or RP20), and are called RPA, RPB, RPC, etc. These disks are configured so that any disk drive can be used with any KL10-D CPU in the system.

At least one 9-track 2032 or 4064 bits/cm (800 or 1600 bits/in) magnetic tape drive is needed on the system. This disk drive can be a TU45, TU70, TU71, TU72 or a TU77. The drive can be connected to any KL10-D CPU.

Every Multi-CPU system has the capability of running part of the system in a stand-alone mode for maintenance and test purposes. One KL10-D CPU, a minimum of 512K of MH10 core memory, and one disk drive can be separated from the rest of the system and used for maintenance purposes. During maintenance, the rest of the system is run in its regular mode of operation for the customer's use. Using this type of configuration for maintenance purposes also makes it easy for maintenance personnel to switch devices in the system to isolate and repair the system's failing components. Refer to Figure 2-2 for stand-alone mode for memory and Figure 2-5 for stand-alone mode for disks.

**NOTE**
**Information on how to configure the Multi-CPU system in stand-alone mode can be found in the TOPS-10 Operator's Guide (AD-H283A-T2).**

**Multi-CPU Optional Devices**
I/O devices other than memory, disks, and magnetic tape drives can be used in the Multi-CPU configuration. These devices are as follows.

Card/Paper Tape Equipment

CR10 card readers
PC10 paper-tape reader/punch

Communications Front Ends

DN20/21 synchronous line interfaces
DN25 asynchronous line interfaces
DN87S universal communications front ends

Line Printers

LP05 line printers
LP07 line printers
LP14 line printers
LP100 line printers

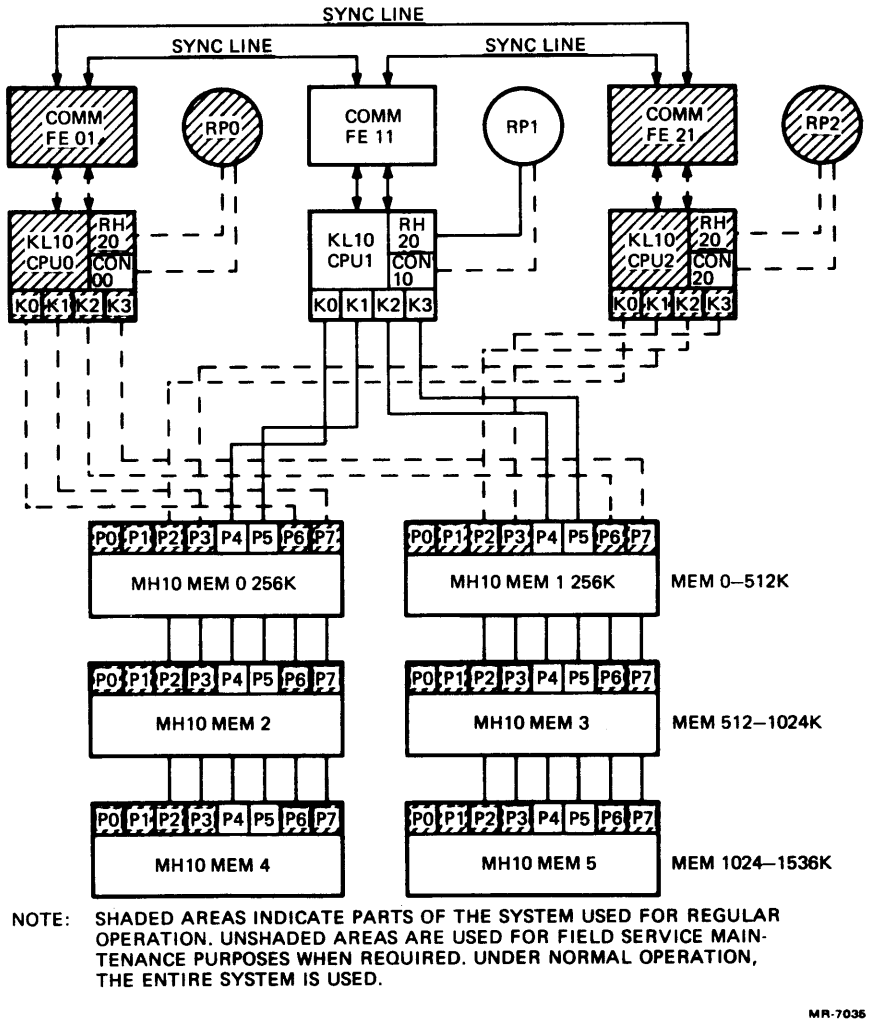



Figure 2-2 Multi-CPU Memory in Stand-Alone Mode

## 2.2 MULTI-CPU BLOCK DIAGRAMS

The easiest way to present the Multi-CPU configuration in block diagram form is by breaking up the configuration into its major I/O devices. Figures 2-3 through 2-6 show the basic configuration with each type of I/O device emphasized.

**NOTE**

**These diagrams are shown as examples only. There are many ways to configure a Multi-CPU system.**

The MH10 core memories (Figure 2-3) each contain 256K of memory and are set up in pairs in the Multi-CPU system. A minimum of four MH10s (equal to 1024K of memory) are needed in the Multi-CPU configuration. Six MH10 core memories (equal to 1536K of memory) are recommended. The spare 512K of memory can be used by maintenance personnel, so the Multi-CPU system is used at 2/3 capacity while maintenance procedures are being run. Each MH10 (MEM0-MEM5) has eight memory ports (P0-P7) which are connected to the KL10-D CPU through the four KBuses (K0-K3).

For a Multi-CPU configuration, buses K0 and K1 of CPU0 are connected to ports P6 and P7 of MEM0. Ports P4 and P5 are connected to ports K0 and K1 of CPU1. Ports P2 and P3 are connected to ports K0 and K1 of CPU2. To complete the configuration, ports K2 and K3 of CPU0 are connected to ports P6 and P7 of MEM1. Ports K2 and K3 of CPU1 are connected to ports P4 and P5 of MEM1. Finally, ports K2 and K3 of CPU2 are connected to ports P2 and P3 of MEM1. Ports P0 and P1 of each memory are reserved for input/output direct memory access (I/O DMA) and high-priority operations.

Figure 2-4 shows the configuration of disk drives, the RP04 or RP06 dual-ported disk drives (RP0-RP2), are connected to their own processor (CPU0-CPU2) and the console front-end. These disks are used for control information between the KL10-D CPU and its PDP-11/40 console front end. Disk drives RPA and RPB can be RP04, RP06, RP07, or RP20 disk drives. These disk drives are dual-ported for use with data storage between KL10-D CPUs CPU0, CPU1 and CPU2. Disk drives RPX and RPY are shown with broken lines as future add-on drives. Disk drive RPC is dual-ported for use with KL10-D CPUs CPU0 and CPU2. RPZ is shown with a broken line as a future add-on drive. Up to 72 drives (RPX, RPY,and RPZ) can be added to the Multi-CPU configuration. Figure 2-5 shows the disk drives set up in stand-alone mode, so that one drive can be used by field service for maintenance. The other two drives are used by the customer for normal operations.

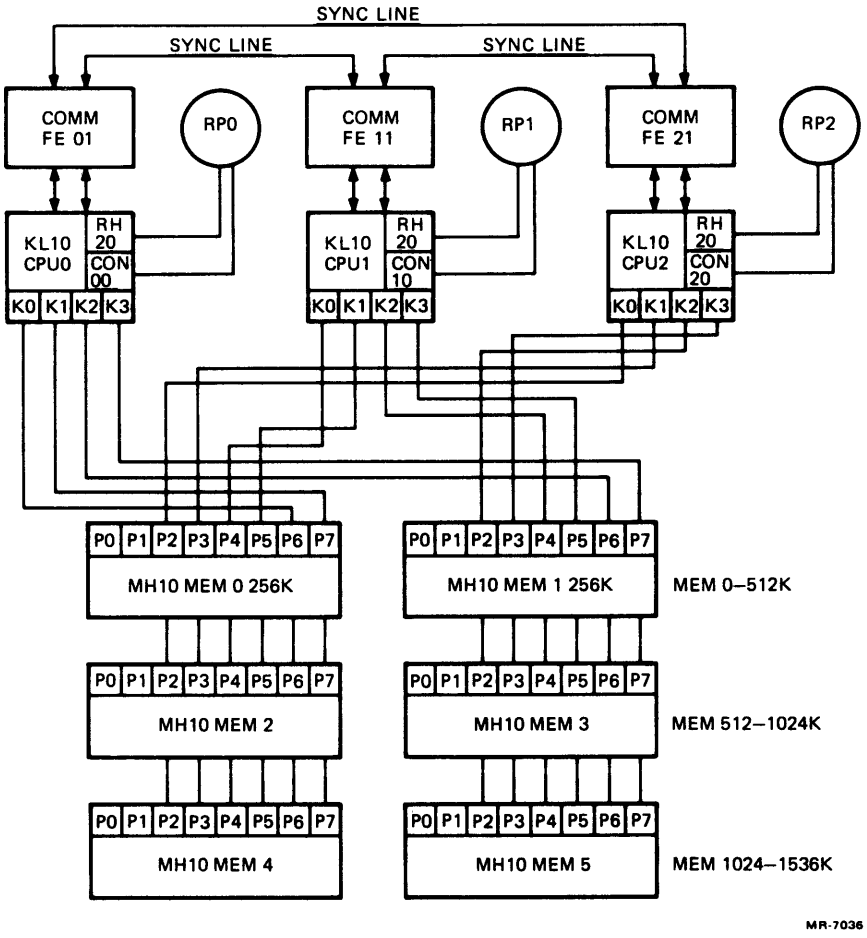



Figure 2-3 Multi-CPU Configuration Showing Core Memory

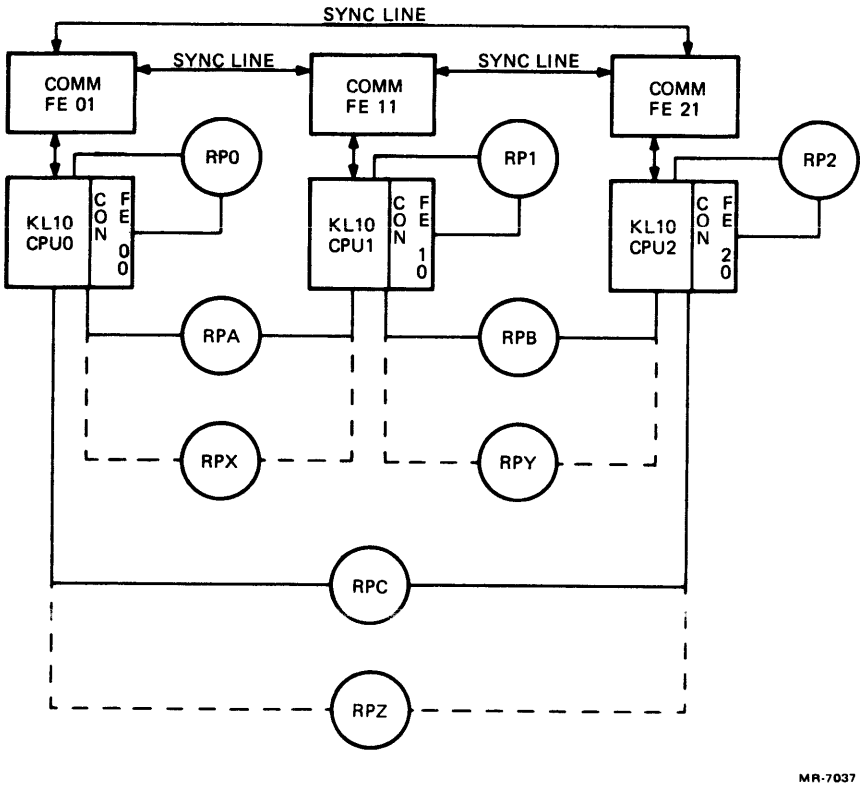
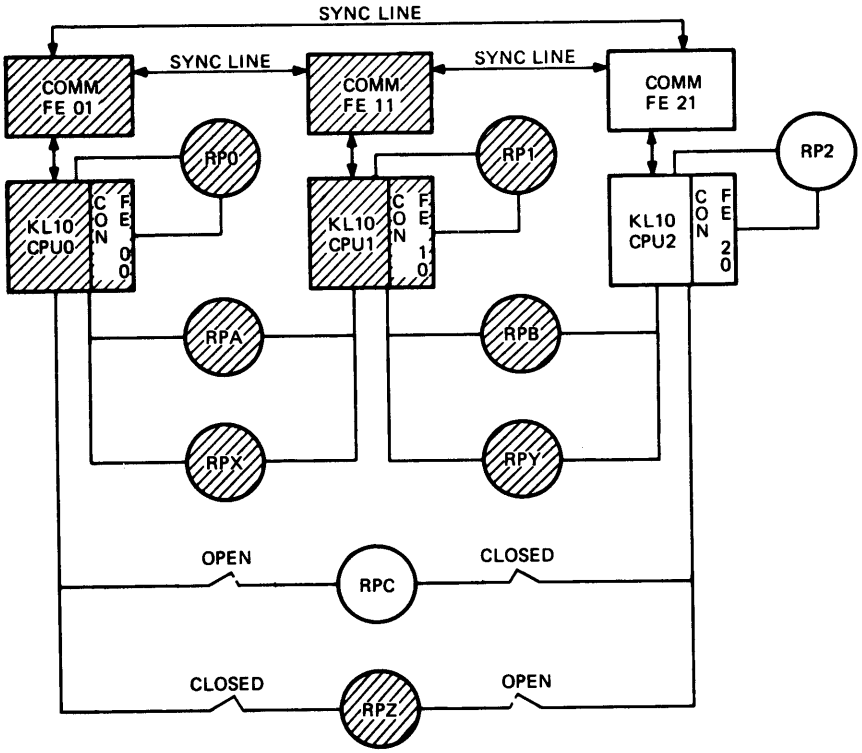



Figure 2-4 Multi-CPU Configuration Showing Disk Drives

The TU45 or TU70 series of tape drives (Figure 2-6) can be used in the Multi-CPU configuration. The TU45 and TU77 tape drives use TM02/03 type controllers. The TU70, TU71 and TU72 tape drives use TX01/02 controllers with an optional TX05 switch. The tape drives operate through a DX10 data channel via the I/O bus, or through a DX20 programmed device adapter via the RH20 Massbus controller in the KL10-D CPU.




NOTE: SHADED AREAS INDICATE PARTS OF THE SYSTEM USED FOR REGULAR OPERATION. UNSHADED AREAS ARE USED FOR FIELD SERVICE MAINTENANCE PURPOSES WHEN REQUIRED. UNDER NORMAL OPERATION, THE ENTIRE SYSTEM IS USED.

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Figure 2-5 Multi-CPU Disk Drives in Stand-Alone Mode

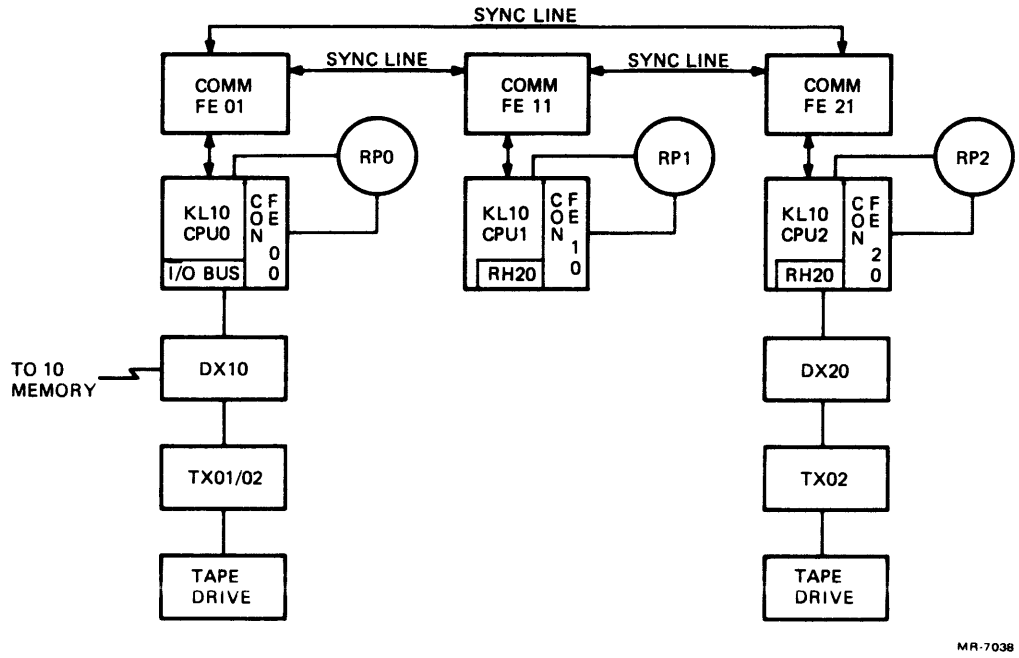



Figure 2-6 Mulit-CPU Configuration Showing Tape Drives

## 2.3 OPERATING SYSTEM SOFTWARE

This paragraph provides a general overview of the TOPS-10 operating system. For specific information, refer to the DECsystem-10 Technical Summary (EE 2104126/81 20) and the TOPS-10 MPE Software Product Description (AE-1004J-TB).

TOPS-10 is the operating system software for the Multi-CPU configuration. Programs written for use with a single-processor KL10-D can be run without changes on the Multi-CPU configuration. All TOPS-10 features for single processors operate in the multiple configuration.

TOPS-10 services a range of simultaneous job types and response requirements, including timesharing, batch, remote batch, and real-time. It allocates memory, storage, peripherals, and processing time among system users, and has an installation-adjustable scheduler to control system operations. The Multi-CPU system uses multiprogramming, virtual memory, and swapping to service multiple users at the same time. The TOPS-10 monitor operates so that one copy of a reentrant language processor or program in memory can be used by multiple users at the same time. The monitor performs all I/O user communications, resource arbitration, and other necessary services.

In a Multi-CPU environment, the processor used for control functions, such as system loading, is called the policy CPU. A CPU can continue to run a job even if it needs devices that are connected to a different CPU, because most monitor calls can be executed on any CPU. I/O requests for non-unit-record equipment are entered by means of a queued I/O protocol, in the I/O queue of the processor that is physically attached to the I/O device. The queued I/O protocol makes sure that the I/O request is controlled efficiently, regardless of which CPU executes a job or where the devices are physically found. A job can be run on a specific CPU to meet the special applications needs such as real-time processing.

The TOPS-10 command language, file structure, I/O processing, and job scheduling are independent of the application language used. In addition, standard software interfaces make it easy for users to develop their own languages or systems.

Batch processing is done with Galaxy, which is designed for simple and flexible control over job processing. The command language for batch is an extension of the timesharing language and allows easy movement between batch and interactive processing. An interactive user can prepare jobs and enter them into the batch input queue for processing. The user specifies the characteristics and limits of the job, while the system operator controls the batch system and specifies operating parameters.

TOPS-10 synchronous communication provides error-correcting, high-speed paths among TOPS-10 systems. This high-speed synchronous transmission allows network communications to take place. Protocol software provides the efficient use of high-speed transmission in both directions at the same time over a full-duplex line. Data transmissions are "pipelined," which is a way that increases line efficiency by overlapping messages.

Remote stations and KL10-D CPUs can be connected via network topologies with up to 63 nodes. The basic network topology is a type of connection where one link or path occurs between systems in the network. The nodes are the points where these paths or links meet. Complex topologies are created by a route-through method where information/data is sent between systems, through other systems, so the computer receiving and the one sending are not directly connected to each other.

The TOPS-10 synchronous communications extends the capabilities of the Multi-CPU system through the use of remote stations. The monitor allows simultaneous operation of multiple remote stations. Peripheral devices at many remote stations provide the user with more capabilities.

The user controls the running of a job through a command language. Specifically, the user can perform the following functions.

- Compile, execute, and debug programs.
- Use available resources such as tape drives, disk drives and other peripherals.
- Communicate with the system operator and request services such as mounting and dismounting of a disk pack or magnetic tape.
- Start, discontinue or terminate a job.
- Determine the status of the system and resources available.
- Request data on time and resource utilization.

TOPS-10 real-time software features fast response, high throughput, system protection, high-priority queues, disk transfer priorities, and the ability to lock jobs in memory. Direct access to real-time systems is also available.

The TOPS-10 virtual memory allows the user to run programs with address space bigger than the physical memory.

# CHAPTER 3
# INSTALLATION

## 3.1 SITE CONSIDERATIONS

Site considerations for the Multi-CPU system are the same as for any other KL10 installation. These considerations include the following.

1. Building requirements
2. Space and location
3. Electrical power
4. Fire and safety
5. Protection
6. Environmental requirements
7. Communications facilities
8. Acoustics

The building structure should be strong enough to support the weight of additional KL10-Ds and any new I/O devices for Multi-CPU operation. The location and space within the area should provide for access, operation, and maintenance of the system.

The electrical service and power distribution system must handle the electrical loads caused by the additional KL10-D processors and new I/O devices. The ground system should be checked and new KL10-Ds and I/O devices grounded correctly. System grounding decreases electromagnetic interference (EMI). Systems used to control voltages and provide back-up power should be updated so they can handle the complete load (which includes the new KL10-D processor and I/O devices).

The components of the Multi-CPU system should be configured such that fire and safety rules are followed. The system should have the same type of protection as any other system. Additional communications equipment (telephones and modems) may be installed to provide more efficient operation of the Multi-CPU system. The installation of this additional equipment may call for additional acoustical considerations in the computer room.

Additional KL10-D processors, I/O devices, and personnel increase the environmental requirements. These include air conditioning, air filtering, and the storage of media (magnetic tapes, disks and paper).

## 3.2 UNPACKING AND CHECKOUT

Before unpacking any equipment, be sure that all boxes are moved into the computer area. Check the shipment against the packing list to be sure all boxes were sent. If any boxes are missing, contact the customer and the branch field service manager.

### 3.2.1 Checkout

Check that all boxes are sealed. Check that system cabinets and free-standing peripherals are not opened in their shipping containers. Check all boxes for external damage such as dents, holes, or damaged corners. If any boxes are opened or damaged, document it on the installation or field service report and inform the customer.

### 3.2.2 Unpacking

Open the boxes, one at a time (starting with the READ ME FIRST box), and find the packing slip. Check the contents of the box against the packing slip and examine each item for damage. Note missing or damaged items on the installation report or field service report.

Check the system cabinets and free-standing peripherals for external damage to the shipping skids. Remove the plastic covers and check the external surfaces for any signs of damage that occurred during shipment.

Check each cabinet and free-standing peripheral for internal damage as follows.

1. Remove the tape or plastic shipping pins from the rear access doors. Open the rear doors of the cabinet and make sure that each module is set in its correct place. Check the cabinets for cable damages (ac and dc cables), loose mounting rails, loose fans or blower motors, loose nuts, bolts, or screws, loose module clips or module holding bars, broken switches and lights, breakers, connectors on power controllers or power supplies, broken cable connectors, and console switches.

2. Remove the shipping bolts of each expander chassis or peripheral on slides. Check each box and peripheral for damage such as bent pins, and loose or broken modules, switches, lights, or backplanes.

3. Document and report any damages to the customer. If there is much damage, report the damage to the branch field service manager.

Check each system cabinet and free-standing peripheral to be sure it has the items shown on the key sheet or transfer sheet. Check

the ECO revision level and serial numbers against the key sheet or the ECO status sheets. Document missing items, wrong serial numbered items, or incorrect revision level items on the installation report or field service report. Confirm that missing items are not covered by a waiver or an approved partial ship. Update the key sheet if the ECO status does not appear on it.

This completes the unpacking and checkout phase. Advise the branch field service manager of any problems during this phase. If any items are damaged, the branch field service manager may want the customer to file an insurance claim. For missing items, the branch field service manager should get a short-ship request.

Customer claims on damaged equipment are hard to check if the equipment in question is removed from its skid. Therefore, if damages appear, the equipment should be left on its skid and not moved until authorized by the branch field service manager.

If all items and parts are present, inform the customer and continue with the installation. For more detailed information on the installation procedures, refer to the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN).

## 3.3 EQUIPMENT NEEDED FOR INSTALLATION AND CHECKOUT

In order to install and deskid a Multi-CPU system (additional KL10 processors and other I/O devices) you need the following tool kit.

Digital Basic Field Service Tool Kit
(Digital Part No. 76-06864)

Additional tools that are needed are listed below.

| Description | Digital Part No. |
|---|---|
| Screw holder | 29-12529 |
| Miniature combination wrench set | 29-12577 |
| Soldering iron | 29-13452 |
| Soldering iron tip | 29-19333 |
| Burnishing blade | 29-13512 |
| Unwrapping tool - 24 gauge | 29-13513 |
| Unwrapping tool - 30 gauge | 29-18387 |
| Hardware tool - 24 gauge | 29-13450 |
| Hardware tool - 30 gauge | 29-18301 |
| Module extender | |
| IC clips (2) | |
| Flashlight | |
| Large adjustable wrench | |
| Electric drill | |
| 0.87 cm (11/32 in) drill bit | |
| Hammer | |
| Crimping tool for Fast-On connectors | |
| Tightening tool for Fast-On connectors | |

## 3.4 DESKIDDING PROCEDURE

At least two people are needed when deskidding KL10-D CPUs. Do not try to deskid any equipment with only one person present.

**CAUTION**

**All outside cabinet doors must be removed before any equipment is deskidded. Do not open any inside rear doors until the processor is correctly set and leveled, as it is possible for the processor to tip over. Take care to prevent doors from opening so as to bend pins and/or logic.**

To remove KL10-D processors, proceed as follows.

1. Remove the outside doors from the front and rear.
2. Remove both end panels.
3. Remove the shipping bolts which hold the KL10-D to the skid. They are found in the lower front to back cabinet bracket of each end of the KL10-D.

4. If the power distribution terminal blocks on the KL10-D cause problems in removing the shipping bolts, loosen and move the power distribution terminal blocks. Remove the shipping bolts and replace the power distribution terminal blocks.

5. As you face the KL10-D, the cabinets are called (from left to right) the I/O cabinet, the CPU cabinet and the console cabinet. Raise the leveling feet of all cabinets.

6. Slide a channel mount under each cabinet, front to rear (or rear to front) and center each one under its own cabinet. Refer to Figure 3-1.

7. Attach a zee to each end of all three channels, using the provided 3/8-16 hardware. Finger-tight is enough, as it will allow easier removal later.

8. Place the jacks under each zee and, using the jacks, move the channels up to the cabinet bottoms.

9. Using the jacks in pairs (one person on one of the front three jacks and a second person on the rear jacks), start to lift the KL10-D assembly from the skid. Be careful to lift it equally so that it will not drop or overload one zee.

NOTES

It is recommended that a third person check while the two persons operate the jacks. The third person can command the operation, routing the two persons to keep the processor level.

The channels are designed to bend under load conditions. If used correctly, the aluminum channels will not break.

10. Once the processor is removed from the skid, remove the wooden blocks that are held under the cabinet.

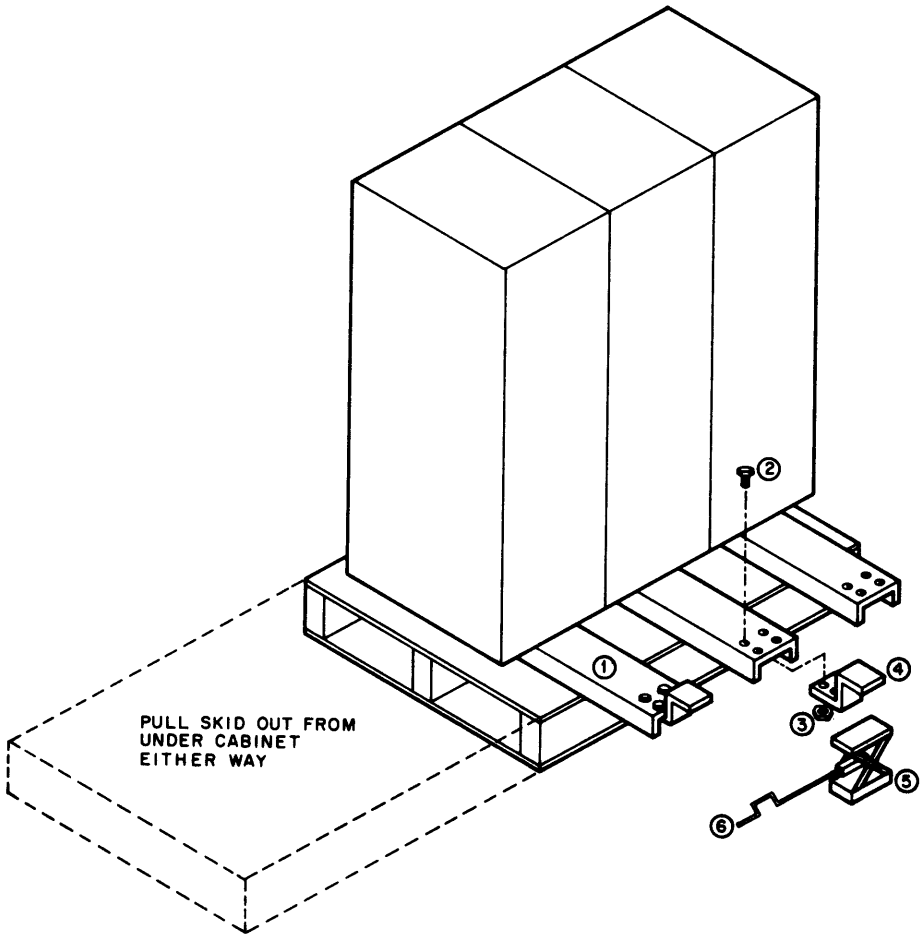
11. Slide the skid out from under the processor, being careful not to move the jacks.

12. Raise all feet above wheel height.

13. Lower the processor to its wheels and remove the zees and channels.

14. Move the processor to its site location.

For more information refer to the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN).




1. CHANNEL (1 REQUIRED PER CABINET)
2. BOLT 3/8-16 x 1 (8 REQUIRED PER CABINET)
3. NUT 3/8-16 (8 REQUIRED PER CABINET)
4. Z SHAPE (2 REQUIRED PER CABINET)
5. SCISSOR OR OTHER TYPE JACK (2 REQUIRED PER CABINET)
6. JACK HANDLE

10-2060

Figure 3-1 KL10-D Cabinet Deskidding Parts Diagram

## 3.5 INSTALLATION AND CABLING PROCEDURE

The installation procedure for the Multi-CPU system is as follows.

1. Starting with the KL10 processor and extending toward the outside, position all new components of the Multi-CPU system.
2. Bolt frames together and install end panels.
3. Lower the leveling feet so that the cabinets are not set on the casters and are stable on the floor.
4. Connect all cabinets together with no. 4 AWG ground wire.
5. Check all ground wires going to the cabinets.
6. Check the ac power for correct voltages.
7. Check each power supply and controller for damages, loose components, or loose hardware.
8. Check all crimp connectors for solid connections.
9. Check all cables and harnesses for bent or broken wires.
10. Check for short circuits between the voltage terminals and ground.
11. Check each backplane for bent pins and broken or bent wires.
12. Check modules for loose hardware or solder splashes.

Refer to the detailed cabling diagram that was prepared during the planning of the installation when performing the remaining steps.

**NOTES**

**All cables (including ground cables) run under the floor except cables between disk and tape drives of the same string, which run in between channels.**

**Do not run signal cables parallel with power cables. Cross them at a 90 degree angle.**

NOTES (Cont)

Do not pull cables around cabinet corners or floor posts.

Cabling length restrictions apply for the Multi-CPU system and are listed in Table 3-1. Refer to the DECsystem-10 Site Preparation Guide (EK-DEC10-SP) and the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN) for detailed information.

13. Label all cables on both ends. State the device types and slot numbers, where the cables come from, and where they go.

14. Install the S-wrap power cables to all devices.

15. Connect the KBus cables and terminators.

16. Connect the IBus cables and terminators.

17. Connect all Massbus cables and terminators.

18. Connect all device cables and terminators.

19. Connect all margin cables and terminators.

20. Connect all Digital power control bus cables.

21. Check all power and system cabling and grounding before continuing.

22. Check that all shipping restraints are removed.

Table 3-1 Maximum Multi-CPU Configuration Cable Lengths

| Device | Cable Type | Maximum Length |
|---|---|---|
| CR04-C/D/K/L | Device | 7.5 m (25 ft) |
| DN20/21/25 | Other | 7.5 m (25 ft) |
| | Unibus | 7.2 m (24 ft) |
| DX10 | Device | 30.0 m (100 ft) |
| | I/O Bus | 10.5 m (35 ft) |
| | Memory | 10.5 m (35 ft) |
| DX20 | Device* | 60.0 m (200 ft) |
| | Massbus | 39.0 m (130 ft) |
| KL10-D | Channel Bus | 30.0 m (100 ft) |
| | I/O Bus | 30.0 m (100 ft) |
| | KBus | 30.0 m (100 ft) |
| | Massbus | 44.2 m (145 ft) |
| LP05 | Device | 7.5 m (25 ft) |
| LP07-A/B | Device | 30.0 m (100 ft) |
| LP14 | Device | 30.0 m (100 ft) |
| LP100 | Device | 30.0 m (100 ft) |
| MH10 | Memory | 30.0 m (100 ft) |
| RP04-A/B | Device | 0.60 m ( 2 ft) |
| | Massbus | 44.2 m (145 ft) |
| RP06-A/B | Device | 0.75 m (2.5 ft) |
| | Massbus | 44.2 m (145 ft) |
| RP20 | Device | 30.0 m (100 ft) |
| | Other | 30.0 m (100 ft) |
| TU45 | Device | 1.8 m ( 6 ft) |
| | Massbus | 30.0 m (100 ft) |

* 63 characters/mm at 8 mm/s (1600 characters/in at 200 in/s) Device cable length for 246 characters/mm at 5 mm/s (6250 characters/in at 125 in/s) is 30.0 m (100 ft)

**Table 3-1 Maximum Multi-CPU Configuration Cable Lengths (Cont)**

| Device | Cable Type | Maximum Length |
|---|---|---|
| TU70/71 | Channel Bus | 30.0 m (100 ft) |
| | Drive Bus | 30.0 m (100 ft) |
| TU72-EA/EB | Channel Bus | 30.0 m (100 ft) |
| | Drive Bus | 30.0 m (100 ft) |
| TU77 | Device | 1.8 m ( 6 ft) |
| | Massbus | 30.0 m (100 ft) |
| TX01/02/03/05 | Channel** | 30.0 m (100 ft) |
| | Device** | 30.0 m (100 ft) |

** 9 m (30 ft) for 15875 characters/cm (6250 characters/in)

For detailed installation information, refer to the installation procedure for the specific device being installed.

Refer to the DECsystem-10 Site Preparation Guide (EK-DEC10-SP), the DECsystem-10 Layout Kit (EK-DEC10-LK), and the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN) for information on installing the Multi-CPU system. Chapter 2 of this Multi-CPU User's Guide shows the Multi-CPU system configuration in detail.

## 3.6 POWER-UP PROCEDURE

Perform the following prepower-up procedures to check out the PDP-11/40 front end of the KL10 processor.

1. Pull out and completely extend the PDP-11/40.

2. Check all connections from the H7420 power supply to the PDP-11/40 power distribution panel.

3. Check that all harnesses are fastened down and that all connections are made correctly. Refer to the 1080/1090 console processor power harness distribution print set.

4. Check the power harness cabling internal to the KL10 CPU (BA11-F). This is usually connected before shipping. If it is not connected, refer to the PDP-11/40/35 System Manual (EK-11040-TM) for more information.

5. Check to be sure the SYSTEM ON and the MARGIN SELECT switches are in the OFF position. The SYSTEM LOCK OFF switch should be in the down position.

6. Check all power wiring connections to the processor and I/O backplanes to be sure no errors were made. Refer to the 1080/1090 ac/dc wiring prints.

7. Using a volt-ohm meter (VOM), check for short circuits between the power tabs and ground on the backplanes as listed below.

| Power Tab | Voltage | Backplane |
|---|---|---|
| CPU | +5 V | A, B, C, D |
| | -2 V | A, B, C, D |
| | -5.2 V | A through K |
| I/O:1090 | -5 V | A, B, C, D, E, F, H, J, K, L |
| | -15 V | A, B, C, D, E, F, H, J, K, L |
| KD11-A | +5 V, +15 V, -15 V | |
| MF11-UP,MM11-UP | +5 V, -5 V, +20 V | |
| RH11-AB | +5 V, +15 V, -15 V | |
| DD11-B | +5 V +15 V | |

8. Check all power wiring connections of the front end (PDP-11/40) to make sure no errors were made in the position of the wiring harness. Refer to the 1080/1090 console processor prints (7010229).

9. Check that all console power switches are OFF.

10. Check module position per the module utilization list (MUL).

11. Connect the 1090 main power cable to its power source.

12. Place the site's main power feed disconnect switch in the ON position.

13. Check that the circuit breakers on the following power supplies and power controllers are ON.

    H7420 Power Supply Number 1
    863 Power Controller
    861 Power Controller
    H720E Power Supply
    H760 Power Supply
    H761 Power Supply
    H783C Power Supply
    H732 Power Supply
    H7420 Power Supply Number 2
    H7420 Power Supply Number 3
    H7420 Power Supply Number 4

14. After checking that the SYSTEM LOCK OFF switch is in the down position, set the 1090 SYSTEM ON switch, which is found on the margin check panel, to the ON position.

15. The G8010 and G8011 modules each have three LEDs on each module and are shown in Figure 3-2. The LEDs that are marked in Figure 3-3 should be ON. Each letter refers to a voltage that was checked on the -5.2 V and -2 V sense outputs. Check to be sure the correct LEDs are ON.

16. Connect a digital voltmeter (DVM) between the -5.2 V sense output on the CPU backplane and the corresponding ground. Adjust the -5.2 V potentiometer (R14) on the G8013 module so the sense voltage reads -5.2 V. Measure all -5.2 V sense outputs for a -5.2 V sense voltage. Refer to Figure 3-2.

| Sense Output | Sense Tab | Ground |
|---|---|---|
| -5.2A | ST17 | ST16 |
| -5.2B | ST19 | ST18 |
| -5.2C | ST1 | PT15-U |
| -5.2D | ST2 | PT17-U |
| -5.2E | ST13 | PT27-L |
| -5.2F | ST7 | ST6 |
| -5.2H | ST5 | ST4 |
| -5.2J | ST3 | ST4 |
| -5.2K | ST10 | ST11 |

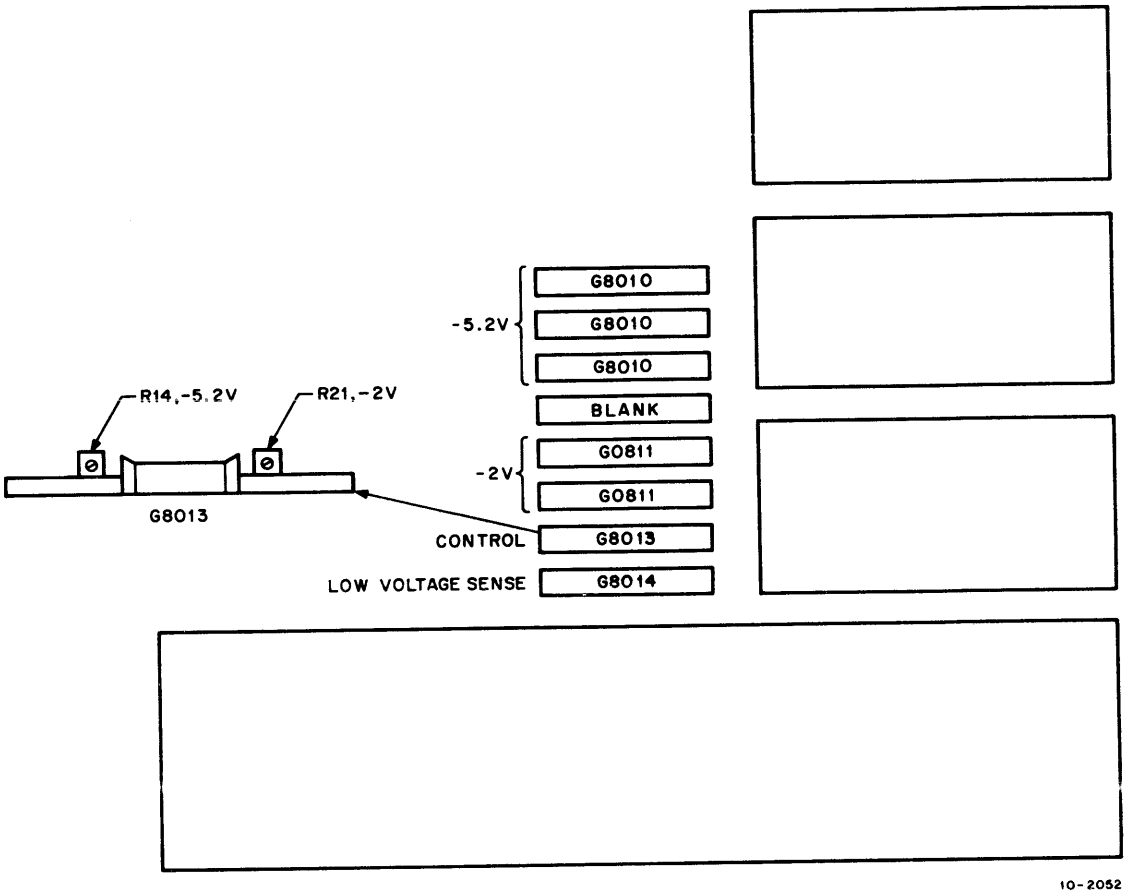



Figure 3-2 Sense Voltage Potentiometer Locations

17. Connect the DVM between the -2 V sense output on the CPU backplane and the corresponding ground. Adjust the -2 V potentiometer (R21) on the G8013 module so the sense voltage reads -2 V. Measure all -2 V sense outputs for a -2 V sense voltage. Refer to Figure 3-3.

| Sense Output | Sense Tab | Ground |
|---|---|---|
| -2A | ST15 | ST16 |
| -2B | ST14 | PT15-L |
| -2C | ST12 | ST11 |
| -2D | ST8 | ST9 |

18. Using a DVM, measure the +5 V regulator outputs at the upper (U) and lower (L) power tabs. Adjust the regulators if needed.

    CPU backplane: PT1, PT7, PT11, PT13, PT15, PT17, PT19, PT21 and PT23.

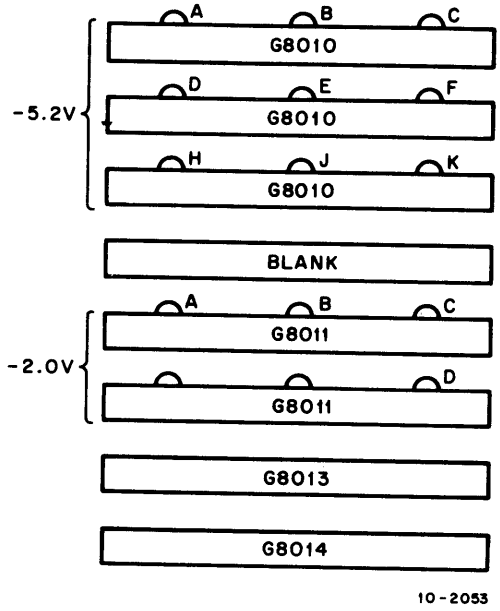



Figure 3-3 Voltage Sense LEDs

19. Using a DVM, measure the regulator outputs at the I/O backplane tabs and adjust regulators if needed. Refer to I/O dc Wiring (KL10 Print Set, Volume 1) to identify the regulators.

    -15 V PT15-L, PT15-U and PT9-L
    -5 V PT3-U

20. Using a DVM, measure all voltages on the PDP-11/40 backplane power tabs. Refer to Chapter 7 of the KL10-Based DECsystem Installation Manual (EK-1080U-IN) for more information.

Detailed information on these procedures can be found in the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN).

## 3.7 ACCEPTANCE TEST REQUIREMENTS

This paragraph describes Digital field service acceptance procedures for the Multi-CPU system.

The system must be installed in agreement with DECsystem-10 installation procedures. All cables, covers and doors should be on. All ground and power checks should be done.

The hardware acceptance check sheets are in Appendix B of the KL10-Based DECsystem-10 Installation Manual (EK-1080U-IN). These sheets include a list of standard tests to be run on the system. The tests should be run in the following sequence.

| | |
|---|---|
| Sheet 1 | Front End (PDP-11/40) |
| Sheet 2 | 11-Based Isolation |
| Sheet 3 | 10-Based Isolation |
| Sheet 4 | Memory |
| Sheet 5 | RH20 |
| Sheet 6b | Disk System |
| Sheet 7 | Tape System |
| Sheet 8 | System Exerciser |

After completing the tests, the system is considered to have met the field service criteria for installation and acceptance of the hardware. A copy of the field service summary sheet should be sent to Customer Services Systems Engineering (CSSE) in Marlboro.

MULTI-CPU USER'S GUIDE
EK-MULCP-UG-001

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