

ARRHYTHMIA MONITORING SYSTEM 78525A

INCLUDES SERVICE SUPPLEMENTS
FOR 78221 CONTROLLER AND
78512 CONTROLLER/MONITOR



78525-91998



**HEWLETT
PACKARD**

**MODEL
78525A
MONITORING
SYSTEM**

WITH RECALL AND EDIT

**SYSTEM MANUAL
78525-91998-9**

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Arrhythmia Monitoring Display
with 78501A Option M90
Basic System



Recall/Edit Station

Figure 1-1. 78525 Arrhythmia Monitoring System

SECTION I SYSTEM DESCRIPTION

1.1. INTRODUCTION.

1-2. This manual contains information required to install and service the Hewlett-Packard Model 78525 Arrhythmia Monitoring System with Recall and Edit, shown in Figure 1-1. Information is presented from a systems point of view, providing an overview of the entire system rather than a detailed description of each unit. Should more detailed information be required for any unit in the system, refer to the appropriate unit manual from the listing provided in Table 1-1. The system information in this manual is divided into the following sections:

SECTION I, SYSTEM DESCRIPTION — Provides an overview of the 78525 and a general description of the individual units in a 78525 configuration, plus system technical specifications.

SECTION II, SYSTEM INSTALLATION — Contains 78525 installation data, site requirements, and cabling procedures. (Refer to 78500 Series Installation Guide, part no. 78500-91999, for 78501/502 central station installation data.)

SECTION III, DIAGNOSTICS — Provides operating procedures and descriptions of the 78525 System diagnostics.

SECTION IV, SYSTEM START-UP — Provides 78525 System start-up procedures.

APPENDIX A, 78221 CONTROLLER — Provides service information for the 78221 Controller.

APPENDIX B, 78512 CONTROLLER/MONITOR — Provides service information for the 78512 Controller/Monitor.

APPENDIX C, PDMS LINK CHECKOUT — Test procedure for arrhythmia to PDMS link.

1-3. SYSTEM OVERVIEW.

1-4. General Description.

1-5. The 78525 Arrhythmia Monitoring System with Recall and Edit is normally interfaced to either a 78501 or 78502 Central Station (see Figure 1-2 and 1-3); it can also be linked to a 780 Series Central Station or PDMS (Patient Data Management System), depending on system requirements. The system accepts amplified ECG signals from an assortment of bedside monitoring devices, analyzes the waveforms, and displays the results of these analyses. Up to eight bedsides may be connected to a standard system, or optionally up to 16 bedsides (maximum) by adding additional units to the system. Pace pulses as well as natural ECG signals are detected, and the complete QRS complex is examined and compared to an automatically determined "learned" rhythm from each patient. Noise elements are filtered out of the received signals, allowing detection of several types of arrhythmias. Analyzed information for each patient is continually updated and stored, allowing medical personnel to select from a variety of information displays which indicate patient status, both current and for the past 24 hours.

1-6. A three-level alarm system instantly alerts the medical staff to significant changes in any patient's condition. The alarm indications enable effective emergency procedures to begin immediately, if required. Alarm indications are also updated and stored regularly providing a display of the last 16 alarm history events for every patient.

1-7. The Recall and Edit station provides trend displays of the most recent 24 hours of arrhythmia data for each patient. Segments of the arrhythmia trends can be recalled for detailed examination by a clinician, who may elect to edit and modify a particular beat classification that was determined by the system. Arrhythmias detected and classified by the system program may be changed to Normal, Supraventricular, Ventricular Premature, Paced, No Beat, or Unknown. Another display at the Recall and Edit station provides information relating to patient census, allowing an operator to enter data which is pertinent to tracking each patient's progress from time of entry to discharge.

Table 1-1. Related Publications

Manual	Description
78525 Operating Guide Part No. 78525-91999	Provides 78525 System operating procedures, including detailed descriptions for each screen presentation.
78500-Series Installation Guide Part No. 78500-91999	Contains installation data for the 78501/78502 Central Stations including cabling data, and cabinet/hardware mounting specifications.
78501/78502 Service Manual Part No. 78501-91998	Provides maintenance and service information for all units which comprise the central station monitor to which the 78525 interfaces; i.e., the 78510 Display unit, 78511 Equipment Cabinet, and 78571/78572 Annotating Recorders.
21MX E-Series Computer Operating and Service, Part No. 02109-90014	Provides operating procedures and service information for the 2113E Computer used with the 78525.
21MX E-Series Computer Installation and Service, Part No. 02109-90015	Provides installation and service information for the 2113E Computer used with the 78525.
0966 Printer Peripheral Manual Part No. 09866-90001	Contains operating instructions for the 9866 Printer used with the 78525.
9866 Printer Service Manual Part No. 09866-90031	Provides maintenance and service information for the 9866 Printer used with the 78525.
Manual of Diagnostics Part No. 24396-14001	Contains descriptions of diagnostic programs available for the 78525 System.
7906 Disc Drive User Manual Part No. 07906-90901	Provides operating instructions for the 7906 Disc Drive used with the 78525.
7906 Disc Drive Service Manual Part No. 07906-90903	Provides maintenance and service information for the 7906 Disc Drive.
7920 Disc Drive Operation Guide Part No. 07920-90030	Provides operating instructions for the optional 7920 Disc Drive available for the 78525.
7920 Disc Drive Service Manual Part No. 07920-90001	Provides maintenance and service information for the optional 7920 Disc Drive.
2648 Terminal Operation Manual Part No. 02648-90001	Provides operating instructions for the 2648 Terminal used at the 78525 Recall and Edit Station.
78171/78172 Operating Guide Part No. 78171-91999	Provides operating instructions for the 78171 or 78172 Annotating Recorder used at the 78525 Recall and Edit station.
78171/78172 Service Manual Part No. 78171-91998	Provides maintenance and service information for the annotating recorder used at the 78525 Recall and Edit Station.

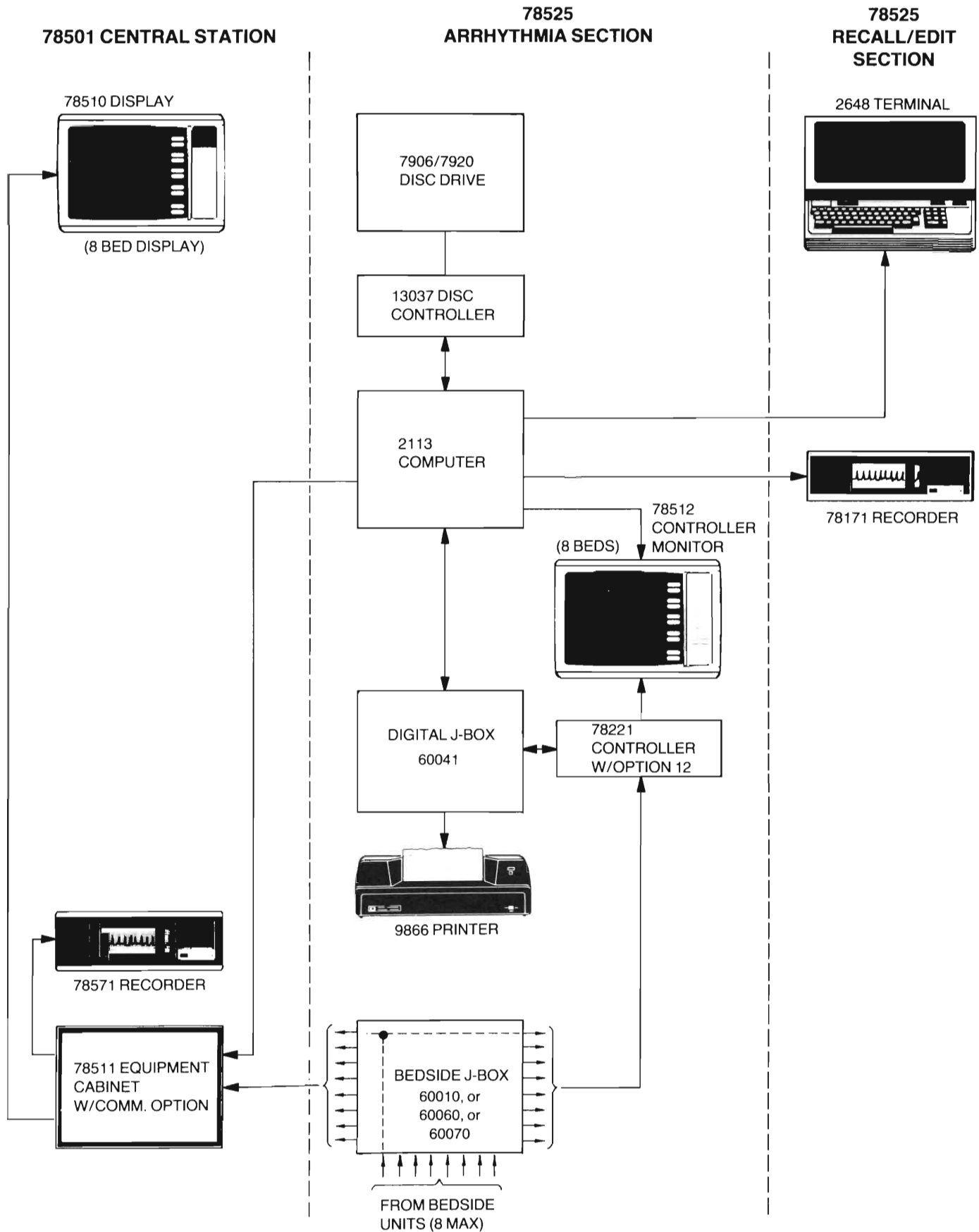


Figure 1-2. Arrhythmia/501 System Block Diagram

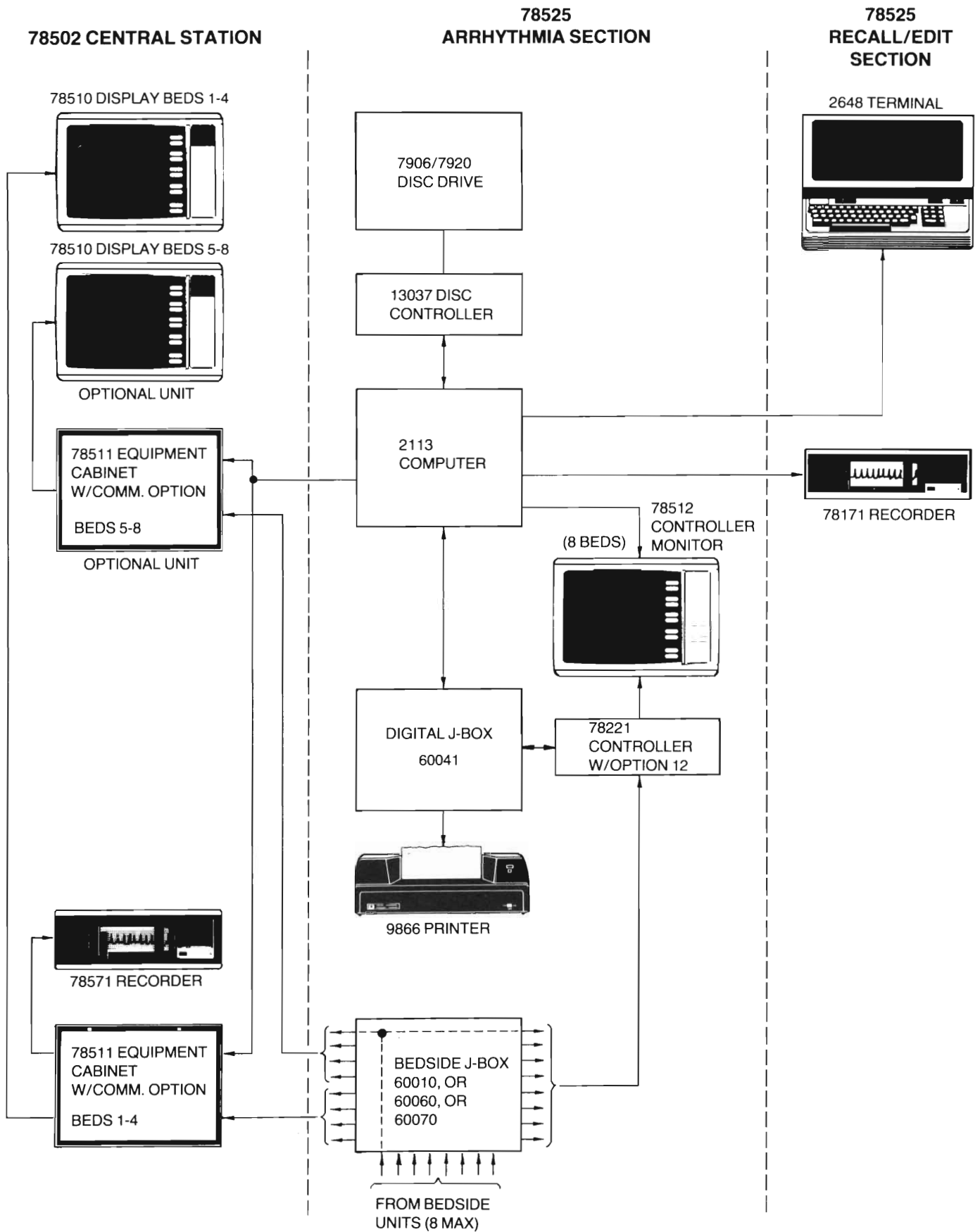


Figure 1-3. Arrhythmia/502 System Block Diagram

Table 1-2. Ordering Information

The 78525 Arrhythmia Monitoring System includes:	
(NOTE: This system assumes it is to be used with HP 78501A or 78502A Central Stations.)	
Includes:	
(1) 78512A Controller Monitor	
(1) 9866B Printer with 12554A Interface	
(1) Communications link to 78501A or 78502A	
(1) 29402B Computer Cabinet	
(1) 78221A Option 012 Controller with cover, rack mount	
(1) 2113E Computer with rack mount, 256K bytes, memory, power fail	
(1) 7906 MR Disc with 13037B Controller,	
Junction Box 78520-60010 or 60060 or 60070, Bedside	
Junction Box 78520-60041, Digital	
Recall/Edit Station	
(1) 2648A Terminal	
(1) 78171A Recorder	
Options	
D40 — Delete one channel (removes one pace pulse board from 78221A).	
D68 — Delete installation (outside USA).	
M02 — Add swivel mount hardware for 78512A.	
M41 — Add table top mount.	
	M90 — Edit and Recall Console, 78590A Opt. 048, 78591A Opt. 001.
	P08 — 50 Hz operation.
	P09 — 230V operaton.
	S04 — Four-patient display (substitute different 78512A Opt. 004 and for Opt. D40.
	S20 — Add pressure processing: 16 channels for 8-bed system, 8 channels for 16-bed system (one Opt. S20 per Controller).
	X05 — Add hard copy up to max of two hard copiers per system 9866B (only with Opt. X51). If S20 also ordered, must include YO1 option.
	X48 — Second Recall Terminal includes 2648A, 78171A (required Opt. YO1).
	X51 — Add eight beds (9-16) for 78501A or 78502A System (78221A Opt. 012 and 78512A). Includes additional communication link. (Factory option only.)
	X76 — Remote Video Monitor 78512A with non-functioning keys (max length 200 ft).
	— Y01 — I/O Extender
	Y02 — Substitute 7920M Disc for standard 7906MR.

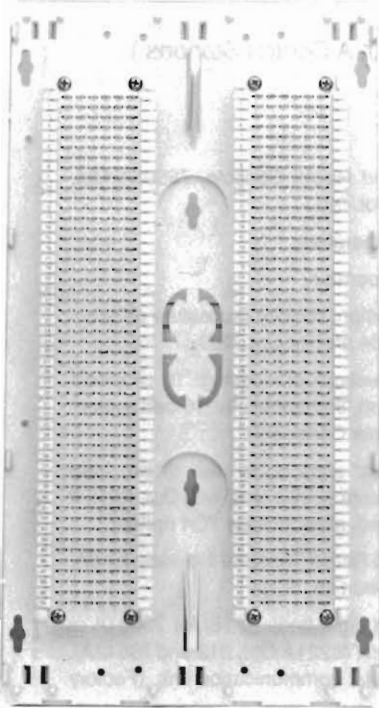
1-8. Hardware Configurations.

1-9. Table 1-2 lists the system hardware required for a basic 78525A System, used in conjunction with a 78501 or 78502 Central Station Monitor. This basic configuration may be modified or expanded to a degree, in order to accommodate many different system requirements. The options available for system modification or expansion are also listed in Table 1-2. A general description of each unit available to the system is provided in the following paragraphs.

1-10. JUNCTION BOXES (see Figure 1-4).

1-11. The 78525 System contains two junction boxes for interconnecting cables: (1) a bedside interface junction box (60010 or 60060 or 60070 and (2) a digital interface junction box (60041). The bedside interface junction box accepts interface cabling from the associated bedside modules, and interconnects the received signals to the 78221A Controller and 78511A Equipment Cabinet as shown in Figure 1-2. It can accommodate cabling from up to eight bedsides. Cabling from additional bedsides when Option X51 is installed require additional bedside junction boxes, one per eight bedsides.

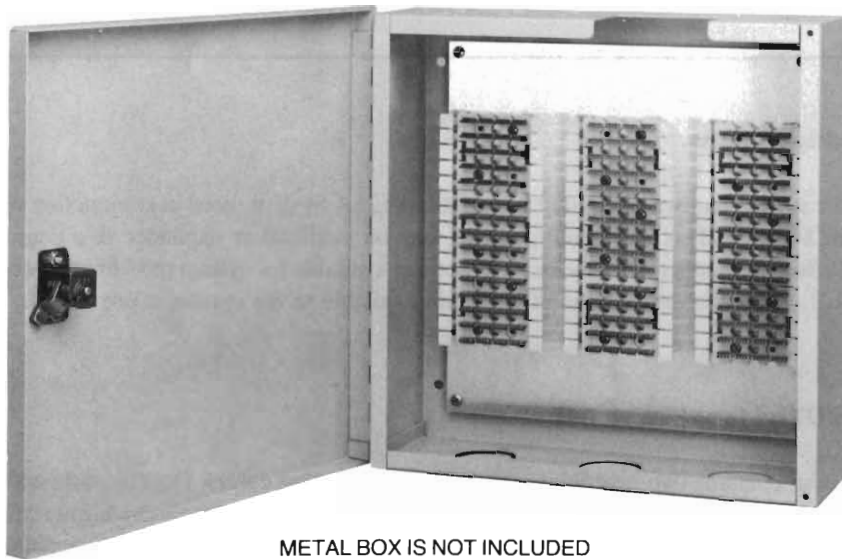
BEDSIDE INTERFACE
78520-60010



BEDSIDE INTERFACE
78520-60060 (WITH MOUNTING BARS FOR 78591/78592
CONSOLE)
78520-60070 IN 12.25 × 12.25 × 4.25-INCH JUNCTION
BOX (31 × 31 × 11 CM). FOR 78501/78502 SYSTEM,
ORDER 14027A FOR SEPARATE JUNCTION BOX



DIGITAL INTERFACE 78220-60041



METAL BOX IS NOT INCLUDED
WITH 78591A CONSOLE CABINET-MOUNTED SYSTEMS

Figure 1-4. 78525 System Junction Boxes

1-12. The digital interface junction box (60041) accepts cables internal to the system, and interconnects signal flow between units. Normally only one digital junction box is required; however, if a system is configured with a full complement of 16 bedsides in addition to other options (pressure monitoring, additional printer, etc.), another digital junction box may be required.

1-13. Cabling connections to both the bedside junction box and digital junction box are accommodated through a series of connector pins which are designated alphanumerically to facilitate proper interconnection and routing of all system signals. Procedures for installing the junction boxes and performing all wiring connections are called out in Section II of this manual.

1-14. 78221 CONTROLLER (see Figure 1-5).

1-15. The 78221A Controller is supplied with a front cover (Option 012) to inhibit operators from accessing its front panel controls and indicators. These controls/indicators are supplied only to provide service personnel a means of controlling system functions from the controller unit if required during system troubleshooting procedures. Detailed service information for the 78221 Controller is provided in Appendix A of this manual.

1-16. The 78221 Controller is electrically interconnected to the 78512 Controller Monitor, the 2113 Computer (via the digital junction box), and the bedside monitor interfaces (via the bedside interface junction box). Signals from up to eight bedsides may be interfaced to any one 78221 Controller unit. A diode pack (78520-60030) installs between one of the PATIENT ALARMS jacks and associated interface cabling at the 78221 rear panel. The diode pack enables the 78511 Equipment Cabinet to go into backup mode (no arrhythmia alarm detection) without INOP should the system 2113 computer fail.

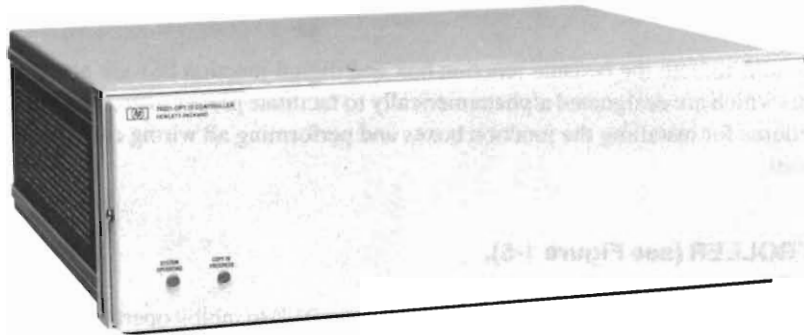
1-17. The primary function of the controller is to accept real-time, high level ECG signals from the bedside monitors, and determine the presence of noise or pacemaker artifact. The ECGs are filtered through the controller before being relayed to the analog-to-digital converter located in the 2113 computer. The controller also accepts the bedside alarm bus. Bedside alarm conditions are sensed by the controller and relayed via the computer communications link to the 78501/502 Central Station for video and audio alarm indication. Disabling of bedsides by operator accessible switches at the bedside monitor units or the 78512 Monitor will be sensed, inhibiting their alarm indications.

1-18. Another function of the controller is to act as the I/O interface between the 78512 Controller Monitor and the 2113 Computer. Whenever an operator selects a particular display for presentation at the 78512 Monitor, the 78221 relays the request to the computer which in turn transmits the video information to the monitor. The 78512 Monitor will display information being stored by the computer as well as real-time information being passed through the 78221 Controller.

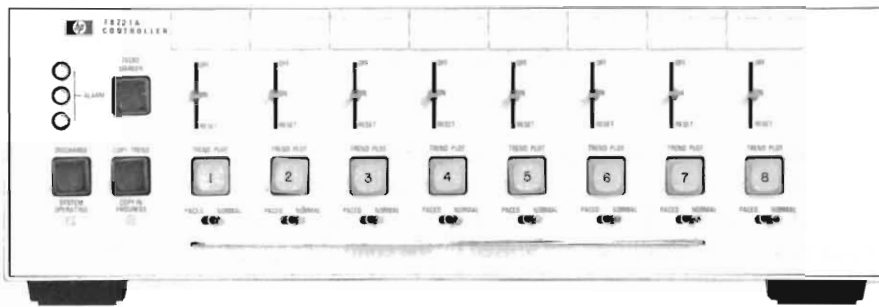
1-19. 78512 CONTROLLER/MONITOR (see Figure 1-6).

1-20. The 78512 Controller Monitor provides operator interface, control, and display capabilities to the arrhythmia section of the system. A single 78512 controls and displays arrhythmia monitoring information for up to eight patients. Additional bedsides added via system options require additional monitors, i.e., one monitor for every eight bedsides. Detailed service information for the 78512 Controller Monitor is provided in Appendix B of this manual.

1-21. The 78512 contains a control panel located at the right of the unit which is used to initiate computer monitoring, validate bedside alarms, and print reports. Located to the right of the video screen is another set of controls referred to as softkeys which select various display presentations, discharge patients, and select modes of operation for each display. The softkeys change function according to the selected displays, allowing execution of subcommands that are applicable to each presentation.



FRONT VIEW WITH OPTION 12 COVER



FRONT VIEW WITH COVER REMOVED
(CONTROLS FOR SERVICE/MAINTENANCE ONLY)

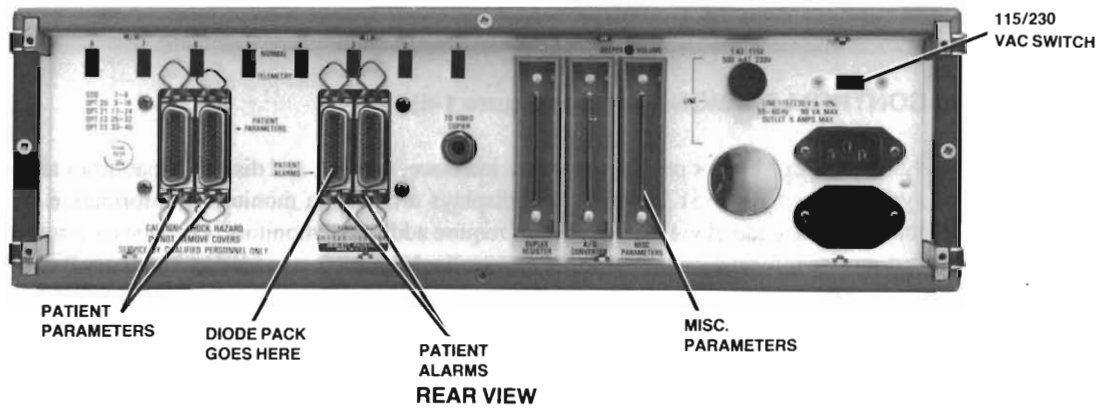


Figure 1-5. 78221 Controller

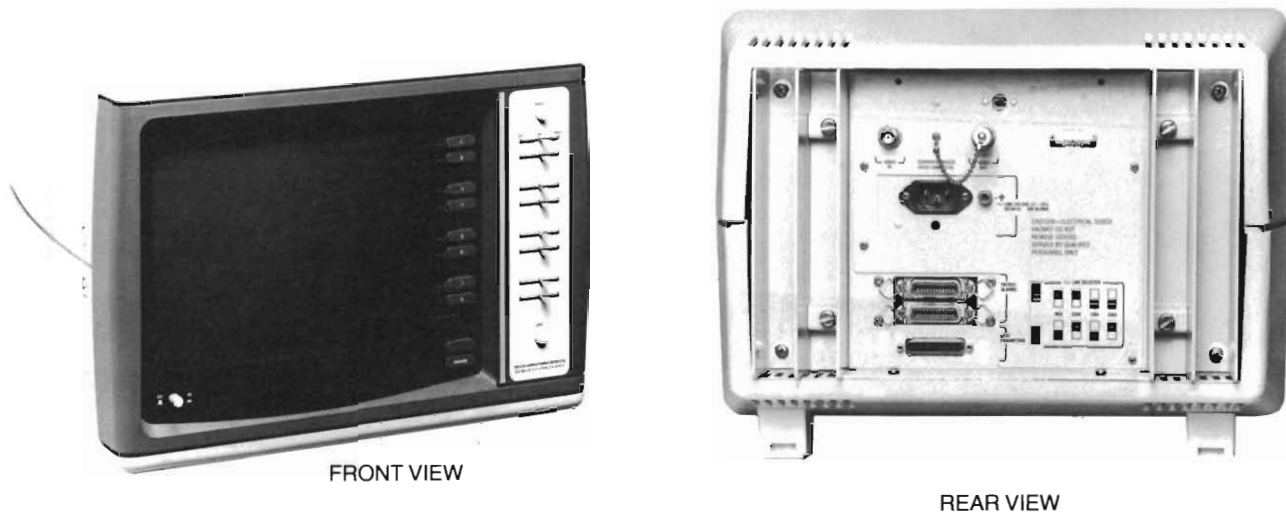


Figure 1-6. 78512 Controller/Monitor

1-22. The display presentations at the 78512 appear in three different classifications: (1) Status, (2) Data Retrieval, and (3) Control. The Status display is divided into eight segments, each segment providing current status information for a particular patient. It remains on the screen at all times except when other displays are requested. The Data Retrieval displays provide records of significant cardiac events for each individual patient. The Control displays offer a variety of operator selectable functions such as setting time of day, inhibiting alarms for a selected bed, turning pace pulse monitoring off, etc.

NOTE: Arrhythmia alarms may be validated at the 78512 Controller Monitor; however, alarms are sound at the 78510 display unit in the 78501/502 Central Station Console.

1-23. 2113 COMPUTER (see Figure 1-7).

1-24. The 2113 Computer is a microprogrammed processor unit with permanently configured firmware which directs execution of all routines used in the arrhythmia monitoring process. Microcoded computer diagnostic routines are executed automatically when power is turned on, and during operator- initiated testing. During system start-up procedures the computer memory is loaded with the arrhythmia program software read from the 7906/7920 disc drive.

1-25. The 2113 Computer accepts partially processed ECG signals from the 78221 Controller and converts these signals to their digital equivalents for further processing and evaluation. The computer initially establishes and stores a "normal" ECG pattern for each patient during a short "learning" cycle which occurs after each bed is turned on. Information received after the learning cycle is compared against the "normal" ECGs to determine patient status. Deviations from the "normal" ECG configurations as well as variations from established arrhythmia patterns result in patient status changes at the 78512 Display (or alarm indications at the central station monitor). The computer continually updates and stores patient status information, allowing medical personnel the capability to retrieve patient history reports for the past 24 hours.

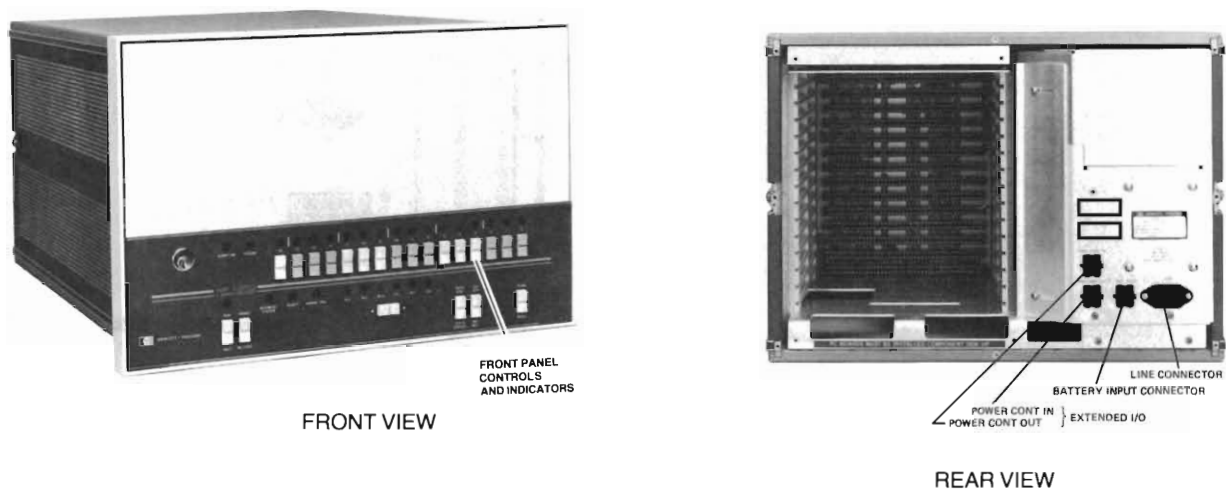


Figure 1-7. 2113 Computer

1-26. The 2113 Computer is interfaced to the 78501/502 Central Station via a direct communications link to the 78511 Equipment Cabinet. This enables the central station to monitor and display patient heart rates, as well as receive all arrhythmia alarm indications. Note that all alarm conditions detected by the computer are transmitted to the central station 78510 Display unit for audible and visual display.

1-27. When certain options requiring computer I/O channels are installed in the system, the computer I/O may become full (the computer is physically limited to a maximum of 14 I/O card slots). Therefore, the computer is sometimes interconnected to a Model 12979 I/O Extender unit. The I/O extender merely provides additional I/O card slots to the computer, to accommodate additional I/O channels for the system.

1-28. 7906 Disc Drive (see Figure 1-8).

1-29. The 7906 Disc Drive is a random access, mass-storage device which utilizes two magnetic oxide-coated discs: (1) a permanent internally mounted fixed disc, and (2) a removable 12940 disc cartridge. All surfaces of the fixed disc and the removable disc cartridge are designated data storage areas accessible by the drive's read/write heads. The top surface of the fixed disc also stores formatted sector counting information and servo information which controls positioning of the drive's read/write heads.

1-30. In the 78525 System one of the functions of the disc drive is to load or "boot" system software into the associated 2113 computer during system start-up procedures. The drive reads a disc cartridge that has been prerecorded with data which comprises the software program required to make the system function appropriately. This software loading technique enables system changes or updates to be accomplished easily, by simply changing the prerecorded data on the program loading disc cartridge in line with the hardware changes.

1-31. The disc drive also functions as a storage medium for certain arrhythmia information displays. During normal on-line operation, the disc drive records and stores particular arrhythmia trend information for each patient, providing extended storage capability over computer memory. The information storage and retrieval capability of the disc drive allows patient trend information to be readily accessed and changed if desired during operator initiated recall and edit modes of operation.

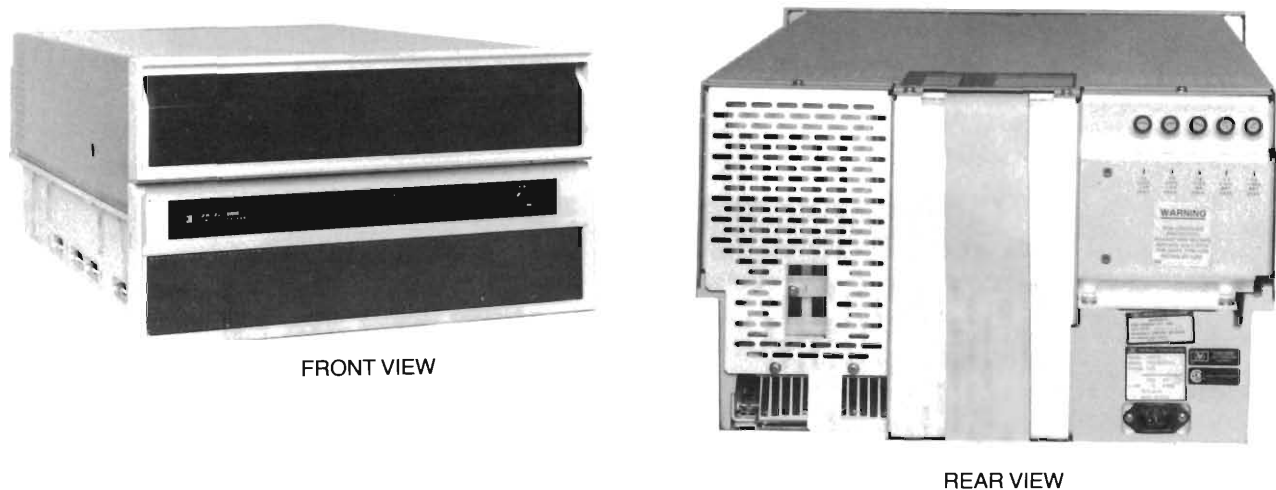


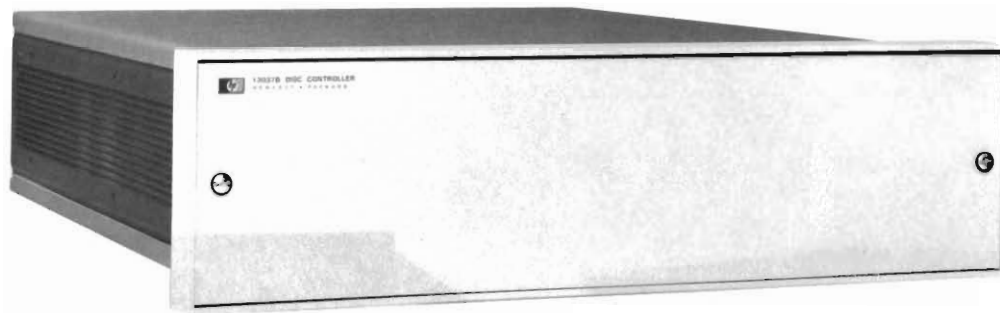
Figure 1-8. 7906 Disc Drive

1-32. Optionally, a 7920 disc drive may be used in place of the 7906 drive in a 78525 System. Unlike the 7906 rack-mount unit, the 7920 drive is a free-standing, self-contained unit which contains the associated 13037 disc controller internal to the same cabinet. In the 7920 disc drive, data is stored on three discs which comprise an easily removable pack. The triple disc pack provides five disc surfaces for data storage, and another surface for head positioning information and sector timing. Through use of five data storage surfaces instead of three as in the 7906 drive, the 7920 drive provides extended data storage.

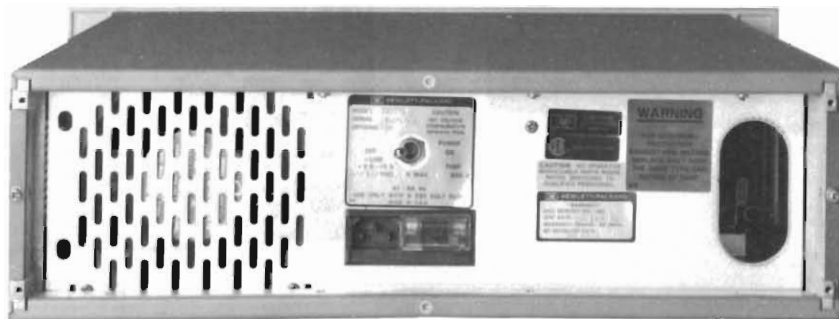
1-33. 13037 DISC CONTROLLER (see Figure 1-9).

1-34. The 13037 Disc Controller is a microprocessor-based unit which controls read/write and control operations for the system disc drive. The disc controller accepts high-level command words from the computer and translates those commands into interface control signals to the system disc. Along with the translation of commands, the disc controller transfers data bidirectionally between the disc drive and computer while assuring data integrity. Any data transfer or control errors detected by the disc controller will generate an error message to the computer.

1-35. To initiate an operation, the disc controller accepts a 16-bit command word from the computer interface, then decodes and executes the command to perform the specified operation. Commands may be directed to the disc controller only, or both. There are four different types of commands generated by the computer to the disc controller: control, sense, read, and write commands.



FRONT VIEW



REAR VIEW

Figure 1-9. 13037 Disc Controller

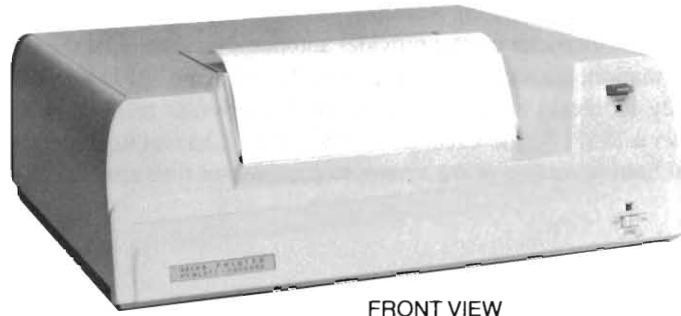
1-36. 9866 PRINTER (see Figure 1-10).

1-37. The 9866 Printer provides medical personnel with a hard copy printed report output of patient status on demand, by pressing the COPY button at the 78512 Controller/Monitor. Reports can also be scheduled for automatic output at eight-hour intervals by special programming (refer to Section IV, System Start-Up). The printer uses a unique thermal printing method which permits a fast, non-impact printout on special heat-sensitive paper. An optional second printer unit can be interconnected to the system to allow simultaneous reporting on different bedsides if desired.

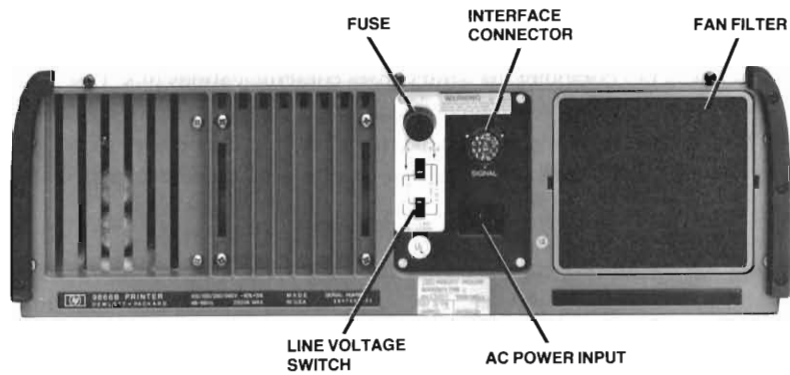
1-38. RECALL AND EDIT STATION.

1-39. The 78525 Recall and Edit station comprises a separate console which contains a 2648 graphics terminal and a 78171 Annotating Recorder. The terminal and recorder are used for entering patient data, recalling stored waveforms for editing beat classifications, initiating strip recordings of stored events, and entering drug configuration data.

1-40. The microprocessor-based graphics terminal (see Figure 1-11) provides a keyboard which facilitates operator entries and enables information display and editing functions. The microprocessor scans the terminal keyboard at discrete intervals searching for a depressed key. Each depressed key points to a position in a matrix, which in turn provides reference to a look-up table which defines the character or control operation being selected. The terminal also contains a magnetic tape cassette drive for reading preprogrammed data into the system, facilitating system start-up and diagnostic troubleshooting procedures.



FRONT VIEW



REAR PANEL

Figure 1-10. 9866 Printer



2648 TERMINAL



78171 RECORDER

Figure 1-11. Recall/Edit Station Units

1-41. The 78171 Single-Channel Annotating Recorder produces high-quality strip recording on chemical-thermal chart paper. A built-in thermal character printer provides automatic annotation of the chart record with the time and date as well as alarm information, across the top of the chart. Note that the 78171 Recorder, as part of the Recall/Edit Station, is used primarily to obtain hard-copy output of ECG events recalled at the 2648 terminal. Another annotating recorder (either a 78571 Single-Channel or 78572 Dual-Channel Recorder) operates in conjunction with the 78501/78502 Central Station section of the system to provide real time annotated recordings of detected alarm conditions and events.

1-42. 78501/78502 CENTRAL STATION (see Figure 1-12).

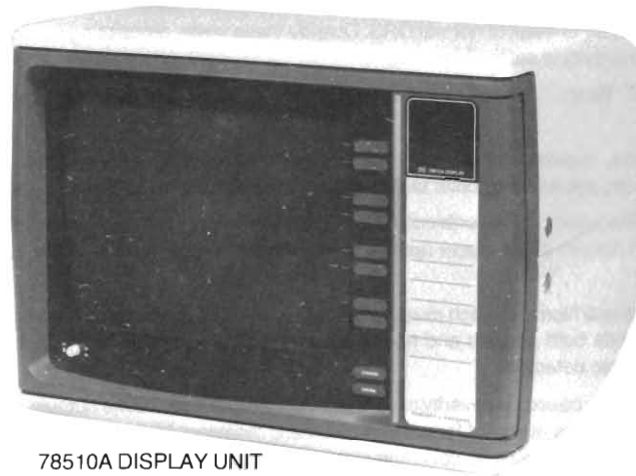
1-43. The 78501 or 78502 Central Station section of the arrhythmia system is structured around three basic units: (1) the 78511 Equipment Cabinet, (2) the 78510 Display unit, and (3) the 78571 Annotating Recorder, a single-channel unit which can be substituted with the 78572 dual-channel version. The 78511 equipment cabinet receives information from the 2113 computer via a direct data communications link. Operationally, one equipment cabinet in conjunction with one display unit can process ECG and heart rate data for up to eight patients. Additional data can be processed by the central station at the expense of limiting the number of bedsides to four maximum; monitoring additional data for more than eight patients can be accommodated only by adding another 78511 Equipment Cabinet.

1-44. Besides extending the monitoring capabilities of the arrhythmia system, the 78501/78502 Central Station receives all alarm indications from the computer. The alarm messages are transmitted from the computer to the 78511 Equipment Cabinet, and in turn displayed at a three-level alarm indicator at the 78510 Display unit. The display unit also sounds all audible alarm indications in conjunction with the visual displays.

NOTE: Detailed descriptions of the equipment cabinet, display unit, and recorder used in the 78501 or 78502 section of the arrhythmia system are provided in the 78501/78502 Service Manual, part number 78501-91998.

1-45. SYSTEM TECHNICAL SPECIFICATIONS.

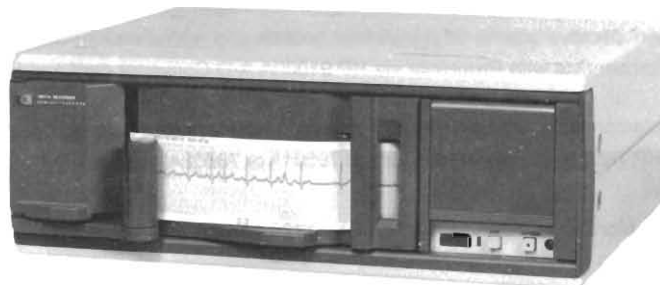
1-46. Table 1-3 lists 78525 System specifications. Technical specifications for individual units which comprise the system are listed in the associated manuals (refer to Table 1-1).



78510A DISPLAY UNIT



78511A EQUIPMENT CABINET



78571A ANNOTATING RECORDER
(MAY BE SUBSTITUTED WITH
78572A DUAL-CHANNEL VERSION)

Figure 1-12. 78501/78502 Central Station Units

Table 1-3. System Specifications

Input Voltage: ± 1.25 to 2.5V peak-to-peak of normal QRS. Outside these limits, processing continues but message is added to status display to indicate sensitivity is set too high/low.

Establishment of "Normal" Beat: "Normal" beat morphology determined at beginning of monitoring and updated continuously.

Rhythms Diagnosed: Asystole, regular/irregular/sinus/supraventricular rhythms with or without bradycardia/tachycardia, extreme bradycardia, ventricular, paced, ventricular tachycardia, ventricular bigeminy/trigeminy, ventricular fib/tachycardia.

Ectopic Beats Diagnosed: Frequent Supraventricular Premature Beats (SVPBs) or Ventricular Premature Beats (VPBs), infrequent SVPBs or VPBs, multiform VPBs, pacer non-capture and non-function, pair of VPBs, run of VPBs, R-on-T VPBs, and missed beats.

Artificial Pacer Detection: Paced/Normal switch must be set to Paced position. Pacer spikes recognized whenever second derivative of ECG signal exceeds both positive and negative thresholds set by QRS height in a single 4-ms period. Pacer non-capture and non-function also detected.

Alarms: Three-level alarm system, based on severity of condition, with visual and audible outputs. Priority system allows more serious alarms to override less serious alarms. Manual and automatic resetting, inhibiting of alarm after reset of valid alarms, prevents reactivation for same condition unless condition worsens. Higher level alarms emit signals to activate alarms and stripchart recorder.

Artifact Rejection: Constant check of signal quality. Monitoring continues successfully in presence of most artifacts, with message added to status display.

Power-Fail/Restart: System restarts automatically following restoration of power.

Patient Storage

7906 Disc: 2000 events (8-bed system); 1000 events (16-bed system).

7920 Disc (optional): 3000 events (8 bed system); 1500 events (16-bed system).

Power Requirements

115/230V $\pm 10\%$, 50-60 Hz, 1710 VA max, from a single source, stable and noise free to assure uninterrupted operation, for standard system with single control/display modules. Add 150 VA per additional module.

Consoles

The desktops and enclosures available for the 78501A and 78502A Systems, as well as 78525A, are included in HP 5953-1388 data sheet for Consoles 78590A, 78591A, 78592A.

Environmental Requirements

Temperature Range: 50-86°F (10-30°C).

Relative Humidity: 50-95% at 77-104°F (25-40°C).

Heat Dissipation: 6227 BTU/hr (557 kcal/hr) max for basic 78525 System with single control/display module. Add 512 BTU/hr (128 kcal/hr) for additional module.

78221A Controller Interconnections

Input Signals: ECG analog/inoperative/alarms-off signals from bedside and central station instruments for up to 8 patients.

Computer Connectors: Interconnects with Processor via HP 91000A A-D Converter card and HP 12554A 16-bit Duplex Register card.

Video Copier Connector: Interconnects with an HP 9866 Printer for initiating printed reports.

Alarm Outputs: Signals to HP 78512A Controller Monitor and 78501A or 78502A.

78512A Controller Monitor

The Central Interface Display Monitor also serves as a switching device for the many softkey functions in the arrhythmia system.

Mechanical Characteristics

Size: Central processor and 7906M disc drive are designed for installation in any standard 48.3 cm (19.0 inch) wide cabinet. 29402B Cabinet: 163.2 cm (64.25 in.) H X 53.4 cm (21 in.) W X 93.3 cm (36.75 in.) D. 78221A Controller: 13.3 cm (5.25 in.); 78512A: 30.6 cm (12.1 in.) H X 43.2 cm (17 in.) W X 36.8 cm (14.5 in.) D.

Weight: Central processor, 20.5 kg (45 lb) max; processor cabinet, 67.2 kg (148 lb); 78221A Controller, 10 kg (22 lb); 7906M Disc Drive, 73.55 kg (162 lb); 7920M Disc Drive (optional), 168 kg (375 lb), 78512A Controller Monitor, 20.8 kg (46 lb).

Total System Weight, 78525A, 285 kg (628 lb).

Total System Weight, 78525B, 314 kg (700 lb).

SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. The 78525 Arrhythmia Monitoring System consists of two types of equipment, which must be installed in separate enclosures, and which must be connected to separate power outlet strips. These are:

- a. *Computer equipment*, consisting of the computer, terminal/keyboard, printer, disc drive/controller, 78512 Controller/Monitor, and 78171 Recorder.
- b. *Medical equipment*, consisting of the controller, display, and telemetry units, if present in the system, and the associated patient monitoring system, with its 78571 Recorder, 78510 Display, and 78511 Equipment Cabinet.

The computer, disc drive, and disc controller must be racked in a ventilated enclosure, such as the 29402 Upright Cabinet, with airflow equivalent to at least 170 cfm for adequate cooling. Typical instrument arrangements in the cabinets are shown in Figure 2-1.

Site preparation considerations are discussed in the 501-502 Central Station Installation Guide (78500-91999).

2-3. Installation Sequence.

2-4. Installation of the 78525 System consists of mechanical installation into the equipment bays, jumper and switch settings, and electrical installation. However, since the system must be installed together with a 500-series Patient Monitoring System, an overall installation program must be considered:

- a. Inventory the equipment against the packing sheets and configuration list to ensure that all of the material is present and undamaged.
- b. Using the large, blue-line cabling diagram provided with the system, verify that all cables have been pulled and are located correctly.
- c. Wire the 78520-60010 Patient Monitoring System junction box, including the 78221A Parameter and Alarm cables and the S20 pressure option cable, if present. Refer to 78520-60010 cabling instructions in this section.
- d. Complete installation of the Patient Monitoring System instruments, using the information provided in the 501-502 Central Station Installation Guide.
- e. Turn on the Patient Monitoring System and verify that it is operating properly, using the checkout procedure in the Installation Guide. After verification proceed with Arrhythmia System installation.
- f. Wire the 78220-60041 Computer Junction Box (see 78220-60041 cabling instructions in this section). Also set jumpers and switches as in this section.
- g. Verify that the computer I/O cards are loaded properly (Figure 2-18), and connect the cables to the computer. Also connect the cables to the peripheral instruments (Figures 2-19 to 2-24), following the cabling diagram provided with your system, or the typical cabling illustrated in Figure 2-17.
- h. Turn on the complete system and perform:
 - (1) The system startup procedure in Section IV.
 - (2) The system diagnostics.
 - (3) If computer problems are apparent, perform the computer diagnostics. Diagnostics for the computer link to Patient Data Management System (PDMS) 78706 are provided in Appendix C.

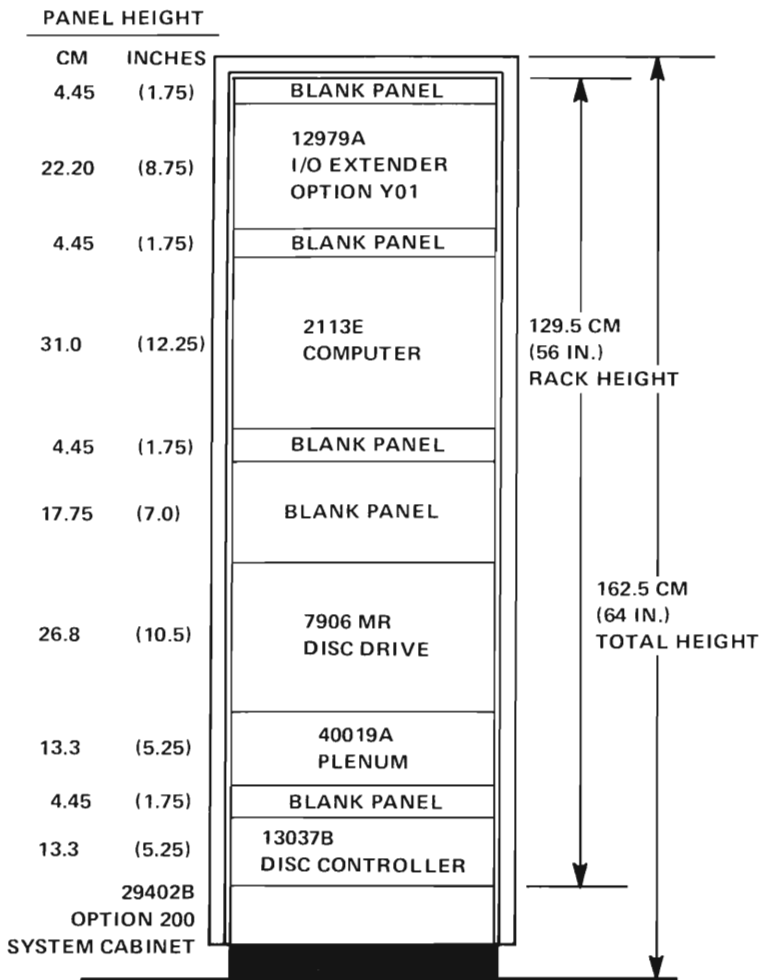
2-5. MECHANICAL INSTALLATION.

2-6. The Disc Drive and Computer of the 78525 System are shipped installed in a metal cabinet (Figure 2-1). For cabinet installation information, refer to Service Manual 02940-90306. The optional recall console is assembled on site. Refer to Figures 2-2 through 2-4 for recall station installation instructions. If the recall desk is in the central station area, it may be used to house up to eight telemetry receivers, Model 78101A. For general information and telemetry receiver instructions, refer to the 501-502 Central Station Installation Guide (78500-91999).

2-7. Tools and Equipment Required.

2-8. Special tools required to install the 2648A Terminal (if a console desk surface is used) are a 13 mm (0.5 inch) electric drill and an 8 cm (3-inch) round hole saw (see Figure 2-3). For installation of optional desktop swivels for 78512 Controller/Monitors, using the same special tools, refer to the Installation Guide.

1. COMPUTER AND PERIPHERALS



2. RECALL STATION

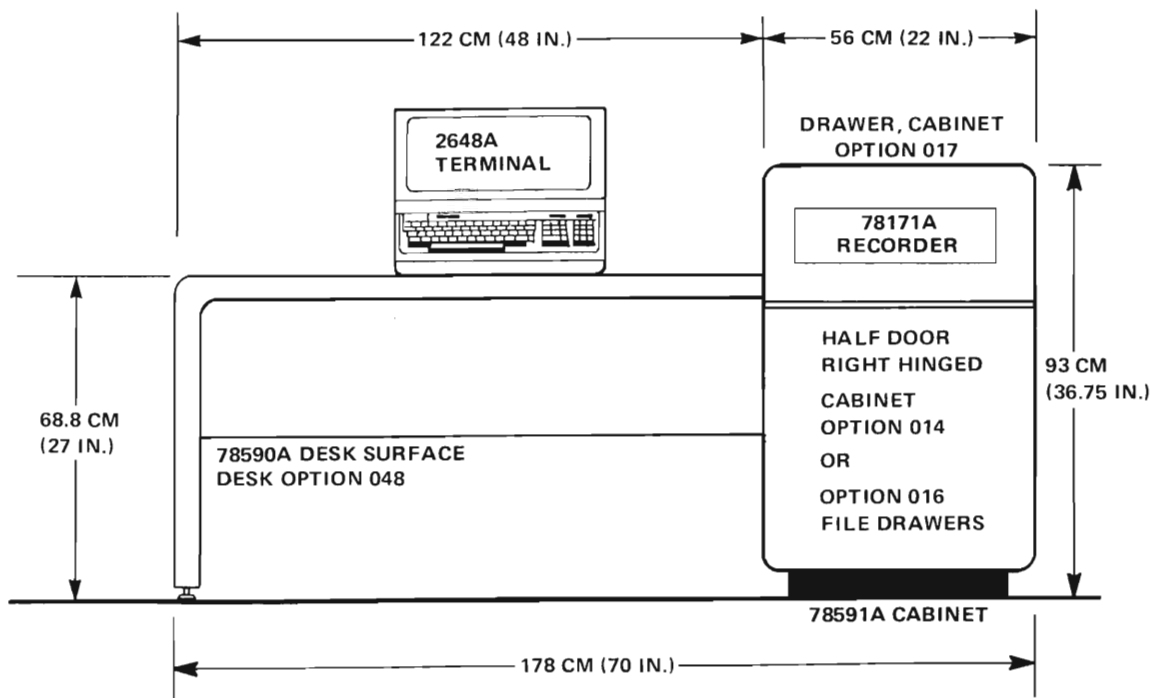


Figure 2-1. Arrhythmia System Instrument Locations (Part 1 of 3)

3. PATIENT MONITORING SYSTEM CONSOLES

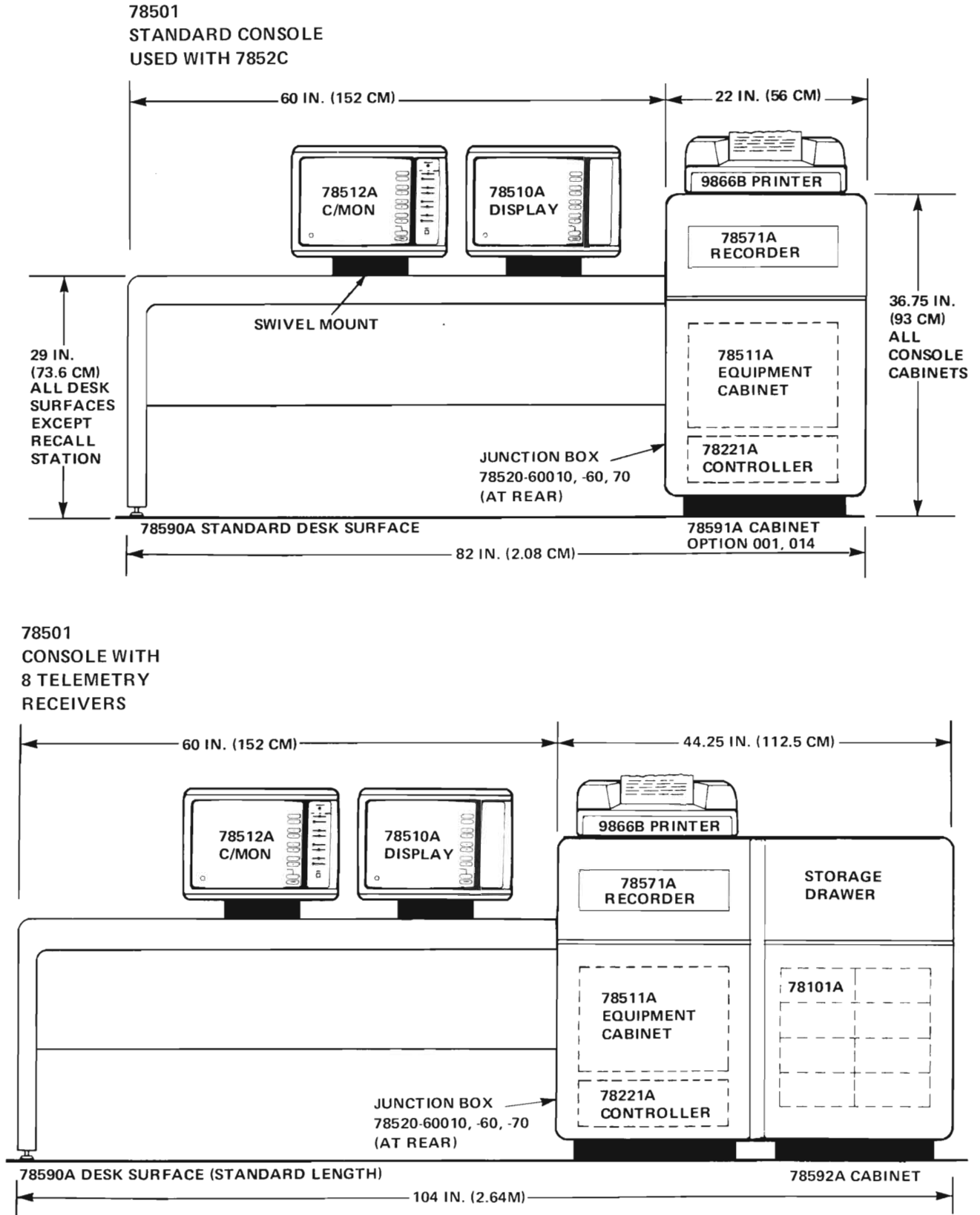
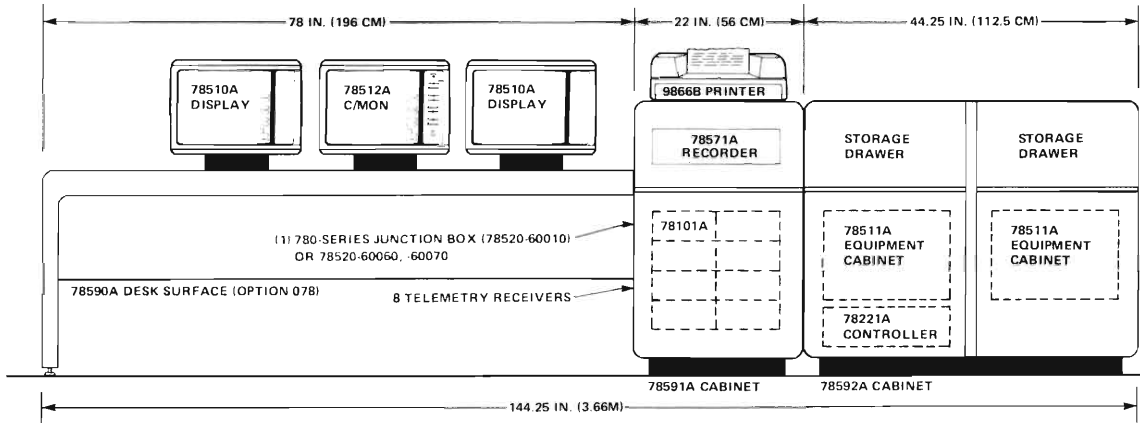


Figure 2-1. Arrhythmia System Instrument Locations (Part 2 of 3)

3. PATIENT MONITORING SYSTEM CONSOLES (CONTINUED)

78502 CONSOLE
WITH 8 TELEMETRY
RECEIVERS



78502 CONSOLE
WITH 16 TELEMETRY
RECEIVERS

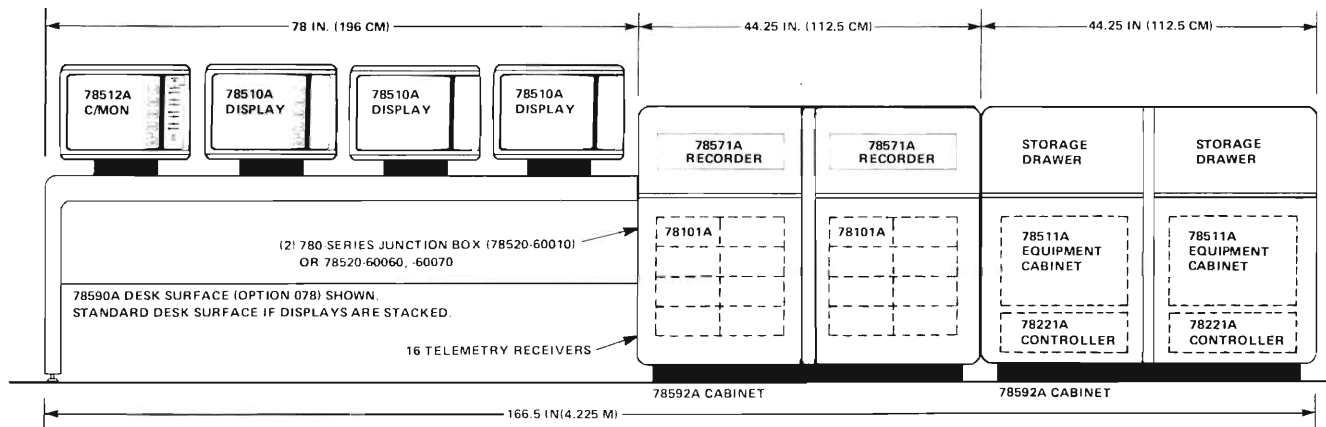


Figure 2-1. Arrhythmia System Instrument Locations (Part 3 of 3)

Two cabinets may be installed side-by-side using the Option 030 combining bolts and nuts provided in the accessories bag.

1. Using a 14 mm (5/16-inch) wrench, remove the existing bolts on the insides of both cabinets, which hold the filler pieces in place.
2. Push out both filler pieces and discard them and their bolts. Do not remove the internal X-braces, yet.
3. Move the cabinets into their *final locations*, side-by-side.
4. Level the cabinets using their adjustable feet. This is especially important on uneven floors.
5. Using the Option 030 long bolts and nuts in the filler piece holes, bolt the two cabinets together as shown.
6. Remove the cabinet X-braces and continue with instrument installation.

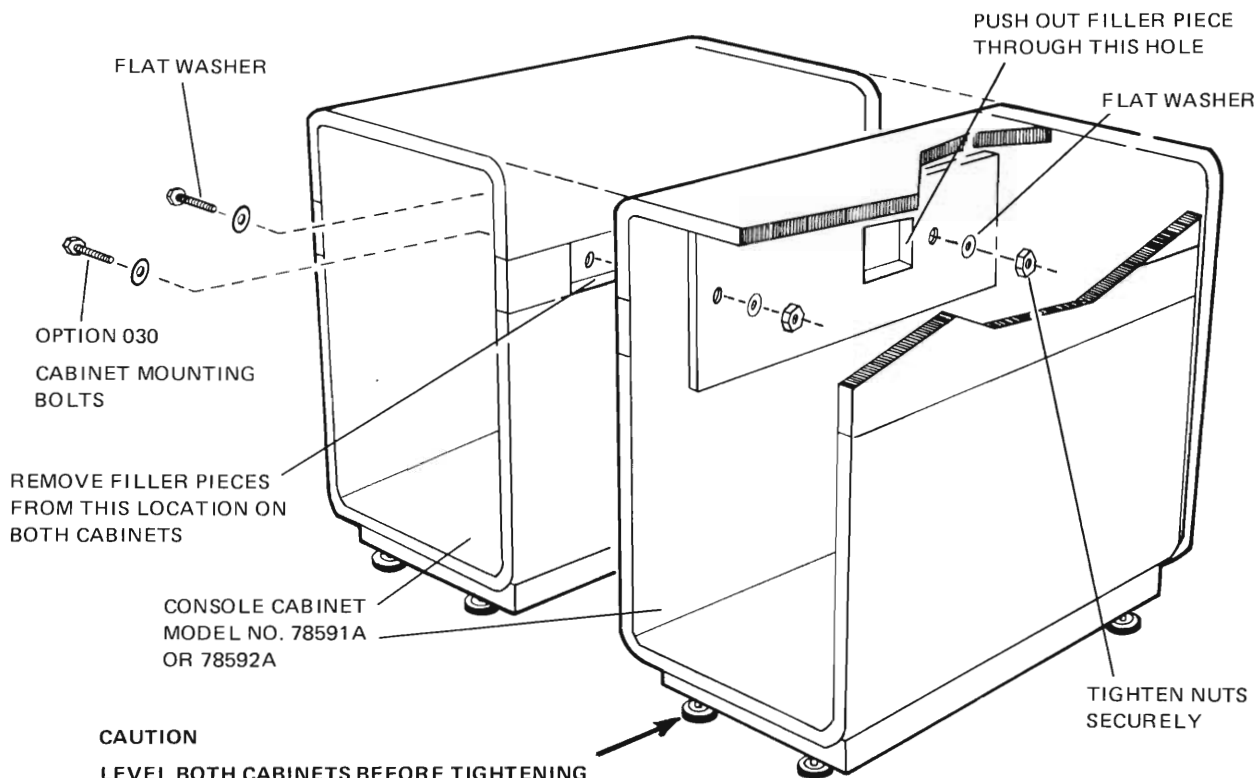


Figure 2-2. Installing Two Console Cabinets to Each Other

The console cabinet and optional desk surface require installation to each other with bolts that are already installed in the cabinet. The desk surface may be installed to either side of the cabinet.

1. If a cable hole is not provided, locate the center as shown in the diagram and mark it onto the desktop.
2. Using a 14 mm (5/16-inch) wrench, remove the existing bolts on the side of the cabinet to which the desk surface is to be mounted. They are bolted from the inside of the cabinet, as shown, to hold the filler piece in place.
3. Push out the filler piece by hand and discard it. Save the two bolts. Do not remove the internal X-braces, yet.
4. With the cabinet in its final location, level the cabinet using the four adjustable feet. This is especially important on uneven floors.
5. Place the end of the desk with the bar that corresponds to the filler piece against the cabinet, and work the bar into the cabinet slot.
6. Using the two bolts, secure the desk surface to the cabinet side.
7. Level the desk surface using the two adjustable feet on the end upright.
8. Cut the 3-inch cable hole with round hole saw and 1/2-inch (13 mm) electric drill. Carbide-tipped teeth are recommended for the hole saw (as in Milwaukee Tool Co. Part Number 49-56-3003). Start the lead drill into the punched center (step 1), and keep drill and saw absolutely vertical to prevent binding in the hole. To prevent cable wear, smooth the hole edges with coarse sandpaper.

CAUTION

DO NOT TRY TO MOVE ASSEMBLED CONSOLE OR DESK SURFACE WILL BE DAMAGED AT POINT OF ATTACHMENT. DISASSEMBLE DESK FROM CABINET AND REASSEMBLE AT NEW LOCATION, FOLLOWING THESE INSTRUCTIONS.

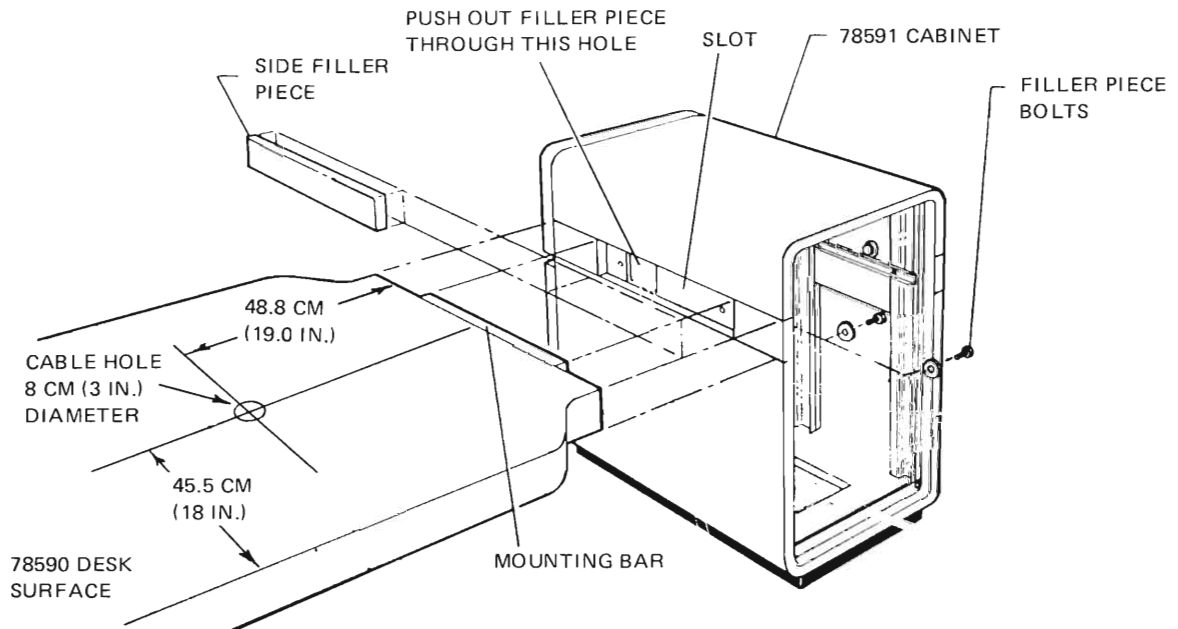


Figure 2-3. Installing System Recall Desk Surface

1. Refer to installation procedure illustration, and remove front strut (two 10-32 screws). Pull recorder drawer fully out of console cabinet and remove drawer from slides.
2. As shown, place recorder on drawer surface.
3. Push recorder forward through panel of drawer until recorder feet drop into holes in drawer bottom.
4. Find recorder cables and tape them to cabinet top, temporarily.
5. Replace drawer on slides, and push recorder part way into cabinet.
6. In the small space available, carefully attach the recorder cables to the rear panel connectors. Be sure to add connector lock clips (Figure 2-23).

WARNING

DO NOT PERMIT DRAWER TO SLIP OUT OF CABINET. THE RECORDER IS HEAVY AND LIABLE TO CAUSE PERSONAL INJURY IF IT FALLS.

7. Push drawer fully into console cabinet.
8. Replace front strut (two screws).

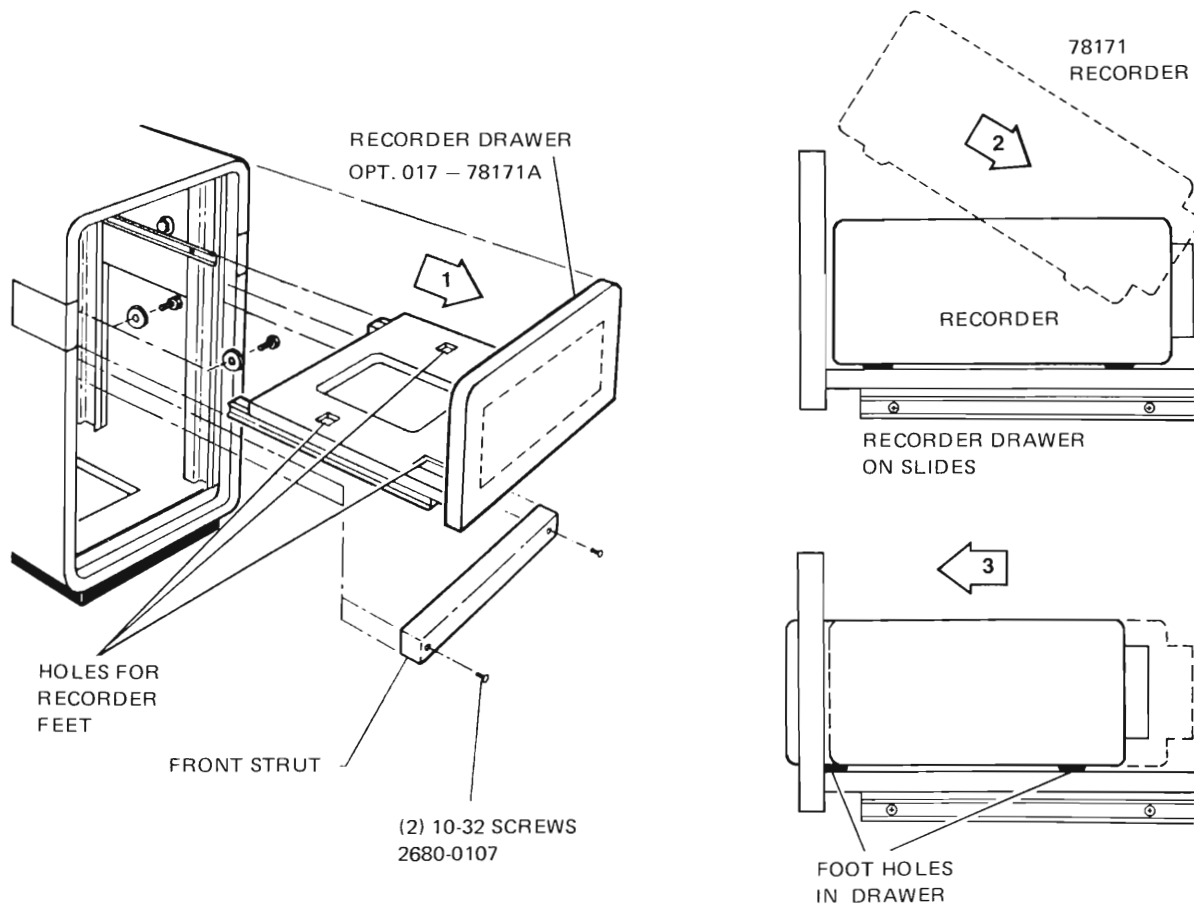


Figure 2-4. Installing 78171 Recorder into Recall Console

2-9. ELECTRICAL INSTALLATION.

2-10. Arrhythmia Monitoring System cabling is shown in a general way in Figure 2-17. This diagram is useful in getting an overall picture of a simple system and interpreting the configuration, and cabling information provided with your system.

2-11. Electrical installation consists of setting the configuration jumpers and switches, wiring the junction boxes, and installing the cables onto the proper connectors. If a PDMS system link is to be added in the field, refer to HP 917408 Distributed Systems (DS/1000) Firmware Installation Manual 91740-90009 for instructions.

2-12. Configuration Strapping.

2-13. The 78525 System is normally shipped from the factory with its internal boards stripped according to system requirements. However, strap settings should also be checked during system installation to verify that each board is configured properly. Configuration straps should also be checked prior to substituting or replacing equipment within the system, to assure that the new equipment is configured the same as the equipment being replaced.

2-14. Table 2-1 lists all 78525 System configuration jumpers and switches. Note that some of the configuration settings are always the same for all 78525 Systems, while others are determined by particular options provided with a system.

NOTE: The 12554 I/O card used for the 78221 Controller is jumpered differently from the 12554 card for the 9866 Printer. Be sure that jumpers are set correctly before swapping, substituting, or replacing these cards. System operation is unpredictable if any of the system configuration strapping is incorrect.

2-15. Computer I/O Configuration.

2-16. Refer to Figure 2-18 for computer rear panel connections and positions of the I/O interface cards in the computer card cage. The cards are loaded component-side up into the octal-numbered slots, labelled at the side of the cage. These slots are configured from the bottom up, with no slots skipped. For answers to specific questions, refer to the Configuration Record supplied with your system.

2-17. The interface card will be assigned to the computer I/O slots in the following order:

	FUNCTION	I/O CARD	COMMENTS
TOP	Second Recorder ASCII	12966A Communication Interface	Option X48
	Second Terminal	12966A Communication Interface	Option X48
	Pressures	91000A A/D Converter	Option S20
	PDMS Link (if any)	12771A Serial Interface	78706 System
	Recorder ASCII Data	12966A Communication Interface	Std
	Display Video (78512)	91200B Video Generator	(78510A Video comes from 78501/02 System)
	Print Data (Hard Copy)	12554A Duplex Register(s)	Std (Second is Opt. X05)
	78501/02 Communication	12966A Communication Interface	Std
	Recall Terminal	12966A Communication Interface	Std
	Disc	13175B Disc Interface	Std
	Time Base	12539C Time Base Generator	No cabling
	Privileged Fence	12620A Privileged Interrupt Fence	8-bed System only
	C/Station Parameters	12554A Duplex Register(s)	Parameter inputs
	ECGs	91000A A/D Converter	ECG inputs
	Recorder ECG Output	12555 D/A Converter (dual)	Std and Opt. X48

Refer to Figure 2-18 for examples of typical system loading configurations. If the pressure option is included, note that all channels are wired for pressure; however, only eight may be selected for use at any one time.

2-18. Cable Installation.

2-19. In addition to the configuration assignments in Figure 2-18, the cable connections and destinations are shown. To install cabling, connect the card-edge connector (normally P1) of the indicated cable to the I/O card in each slot. Cable connections to the other instrument rear panels are shown in Figures 2-19 through 2-14. The BNC end of the video cable will be field-terminated. To do this, follow standard soldering techniques. The remainder of the section gives instructions for installing 78520-60010 and 78220-60041 Junction Box cables using the special tools required. To install the 78520-60020 Communication Link cable and 78511-60410 board(s), refer to Step C-13 of the electrical installation procedure for the 78511A in the 501-502 Central Station Installation Guide (78500-91999), or Installation Note 78511-91994 if provided as Kit 14381A (78511 Option 020).

2-20. Power Connections.

2-21. For environmental, line power, ventilation and other site-preparation considerations, refer to the 78501-502 Central Station Installation Guide (78500-91999).

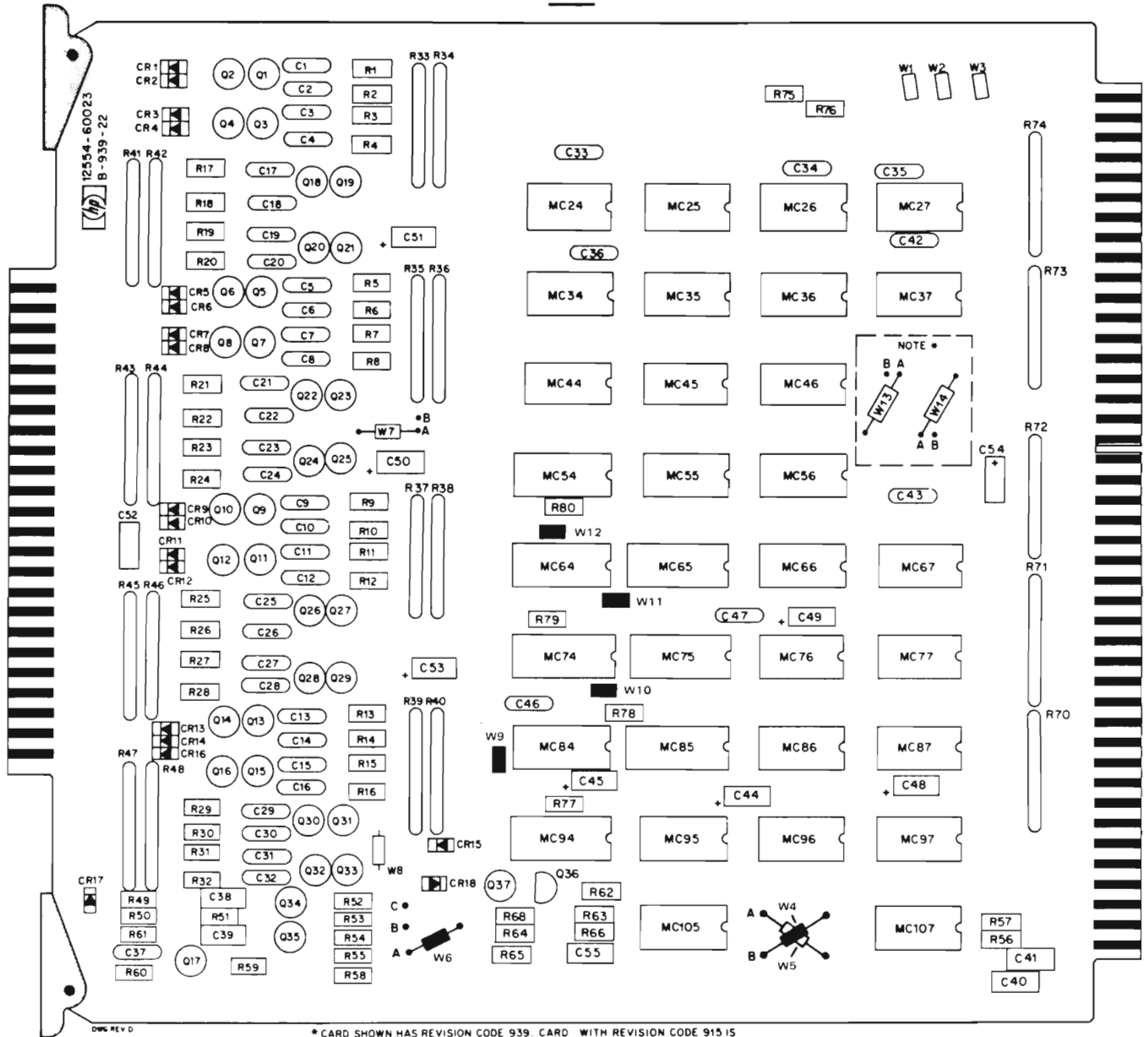
Table 2-1. 78525 System Configuration Straps

UNIT	STRAP LOCATION	CONFIGURATION		
2113 Computer	78221 Controller 12554 I/O PCB (Figure 2-5)	Jumpers W1 to W14. Position as follows:		
		JUMPER	POSITION	
		W1	+ 12	
		W1	- 12	
		W3	- 2	
		W4 to W6	B	
		W7	A	
		W8 to W12	IN	
	9866 Printer 12554 I/O PCB (Figure 2-5)	Jumpers W1 to W14. Position as follows:		
		JUMPER	POSITION	
		W1	+ 12	
		W2	- 12	
		W3	- 2	
		W4	B	
		W5 to W7	A	
		W8	IN	
		W9 to W12	OUT (removed)	
		W13, W14	A	
	Video Interface 91200 I/O PCB (Figure 2-6)	Jumpers W1 to W19, and a crystal. Positioned for either domestic (USA) or European operation: Domestic Crystal: 0410-0592 European Crystal: 0410-0035		
		JUMPER	DOMESTIC POSITION	EUROPEAN POSITION
		W1	A	A
		W2	A	B
		W3, W4	A	A
		W5	A	B
		W6	IN	IN
		W7	OUT	IN
		W8	IN	IN
		W9	OUT	OUT
		W10	OUT	IN
		W11	OUT	OUT
		W12	IN	OUT
		W13	A	A
		W14, W15	IN	IN
		W16	A	A
		W17	IN	IN
		W18	A	A
		W19	IN	IN
	A/D Converter 91000 I/O PCB (Figure 2-7)	Jumpers W1 to W4, and "S" Jumpers. Position as follows:		
		JUMPER	POSITION	
		"S" (5 ea.)	IN	
		W1	Install a 24 μ H inductor for ECG ONLY bedsides; Leave open for pressure bedsides.	
		W2 to W4	IN	

Table 2-1. 78525 System Configuration Straps (continued)

UNIT	STRAP LOCATION	CONFIGURATION													
2113 Computer	Disc Subsystem 13175 I/O PCB (Figure 2-8)	Jumpers W1 to W4. Position so that designations PR, O, O, O are visible.													
	Computer Firmware 13304 PCB (Figure 2-9)	The firmware PCB (78220-63000) comprises a User Control Store board and several user written microprograms on ROMs that are mounted on the board. Refer to Figure 2-9 for ROM location and jumper positioning.													
	Time Base Generator 12539 PCB (Figure 2-10)	Jumpers W1 and W2. Connect both jumpers to position A.													
	Privileged Interrupt Fence 12620 I/O PCB (Figure 2-11)	Installed in systems that have only eight beds or less. Install a jumper between TP1 and TP4.													
	Computer Mother Board (Figure 2-12)	Toggle switches A1S1, and A1S2. Accessible via the computer rear panel. Set as follows: <table border="0"> <thead> <tr> <th>SWITCH</th> <th>POSITION</th> </tr> </thead> <tbody> <tr> <td>A1S1</td> <td>HALT</td> </tr> <tr> <td>A1S2</td> <td>ARS</td> </tr> </tbody> </table>	SWITCH	POSITION	A1S1	HALT	A1S2	ARS							
	SWITCH	POSITION													
A1S1	HALT														
A1S2	ARS														
Serial Interface 12771 PCB (Figure 2-13) USED ON 78706 PDMS INTERFACE ONLY	Jumper W1 (Bit Rate) A to A. A system interconnect cable of up to 150M (600 ft) may be used. Jumper W2 (Hardwired interface) to A. NOTE: Operating characteristics are changed with PDMS linkage, which affects: <ol style="list-style-type: none"> 1. Admit/discharge/move, and patient data. 2. Integrated Arrhythmia data in 78706 PDMS. 3. VPB/HR/pressure trends as available 78706 displays. Drug packages, however, are not interactive. For more information, refer to: 78225-91997 Recall-Edit Operating Guide 78525-91999 Central Station Operating Guide														
78221 Controller	Unit Rear Panel (Figure 2-14)	NORMAL/TELEMETRY Slide Switches 1-8. Set to TELEMETRY position only for corresponding bedsides containing telemetry. Set to NORMAL position for other beds.													
	Clock/Driver 60130 PCB	MASTER Jumper. Always installed in the 78221 that controls Beds 1-8. Removed in the 78221 that controls Beds 9-16 (option).													
	78221 Mother Board 60100 PCB	Master/Slave Jumpers to Beds 1-8. Installed in M position for corresponding bedsides that contain telemetry. Installed in S position for all other beds.													
2648 Terminal	Extended Comm. 13260 PCB	Four DIP Switch Platforms. Set DIP switches for A9 to A11 Closed, and DIP switch for THE Closed. All other DIP switches set to Open. (Figure 2-15).													
	Keyboard Interface 60123 PCB (Figure 2-15)	Three DIP Switch Platforms. Set switch F Open. Set all other switches Closed.													
	Keyboard Switches at Top Left of Keyboard	Set switches as follows: <table border="0"> <thead> <tr> <th>SWITCH</th> <th>POSITION</th> </tr> </thead> <tbody> <tr> <td>BAUD RATE</td> <td>9600</td> </tr> <tr> <td>DUPLEX</td> <td>FULL</td> </tr> <tr> <td>PARITY</td> <td>NONE</td> </tr> <tr> <td>REMOTE</td> <td>Latched In</td> </tr> <tr> <td>CAPS LOCK</td> <td>Latched In</td> </tr> <tr> <td>All Others</td> <td>Out</td> </tr> </tbody> </table>	SWITCH	POSITION	BAUD RATE	9600	DUPLEX	FULL	PARITY	NONE	REMOTE	Latched In	CAPS LOCK	Latched In	All Others
SWITCH	POSITION														
BAUD RATE	9600														
DUPLEX	FULL														
PARITY	NONE														
REMOTE	Latched In														
CAPS LOCK	Latched In														
All Others	Out														
78171 Recall/Edit Recorder	780 Interface 60030 PCB (Figure 2-16)	Plug the blue wire from the recorder rear panel connector to RR1. Leave RR2 empty.													
	ASCII Interface 60122 PCB	Set ASCII Switch S1 to ASCII. (Figure 2-16)													

TOP



NOTE: 12554 JUMPER CONFIGURATION FOR 78221 CONTROLLER IS DIFFERENT THAN 12554 JUMPER CONFIGURATION FOR 9866 PRINTER. REFER TO TABLE 2-1.

Figure 2-5. Computer 12554 I/O PCB

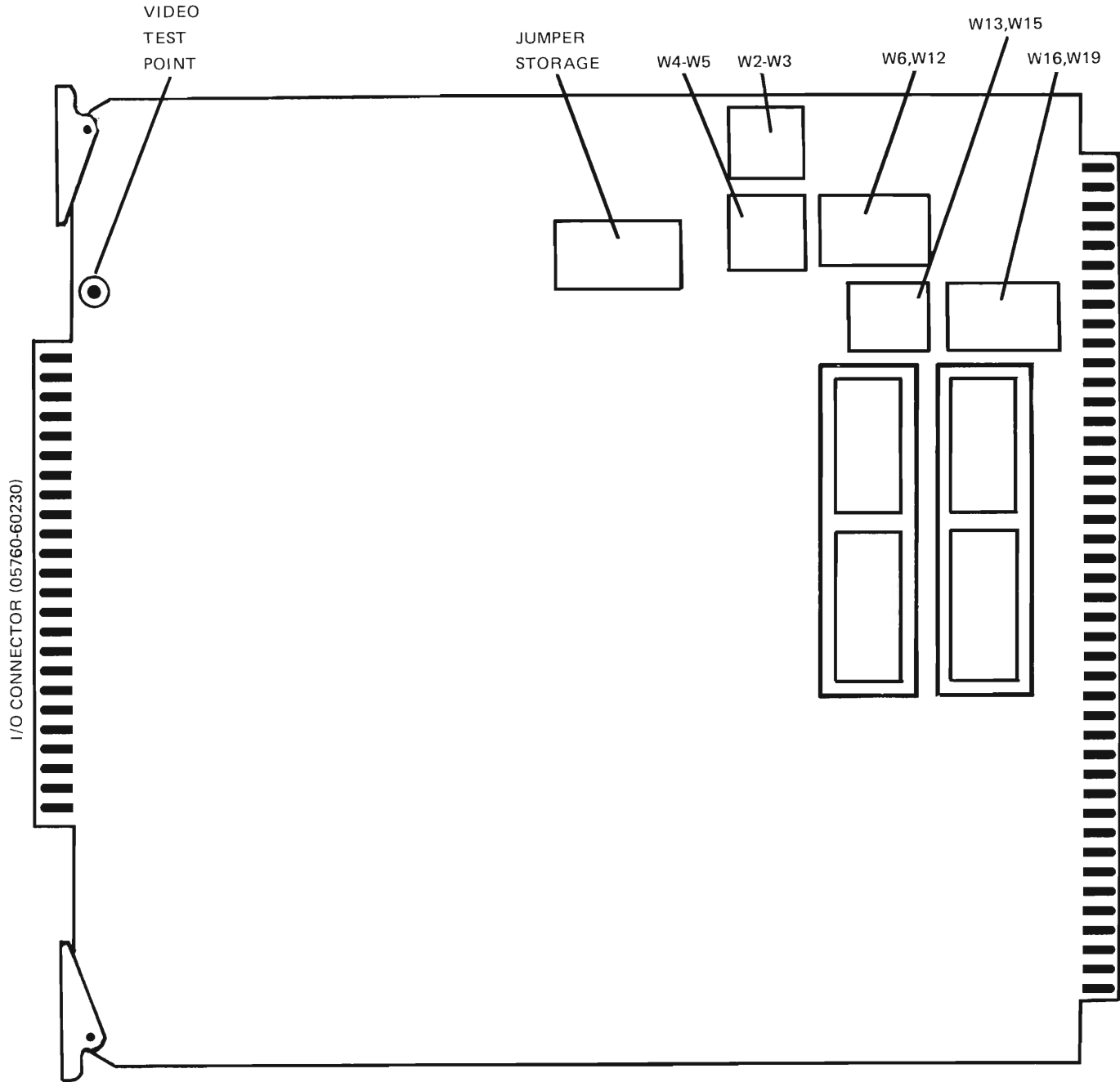
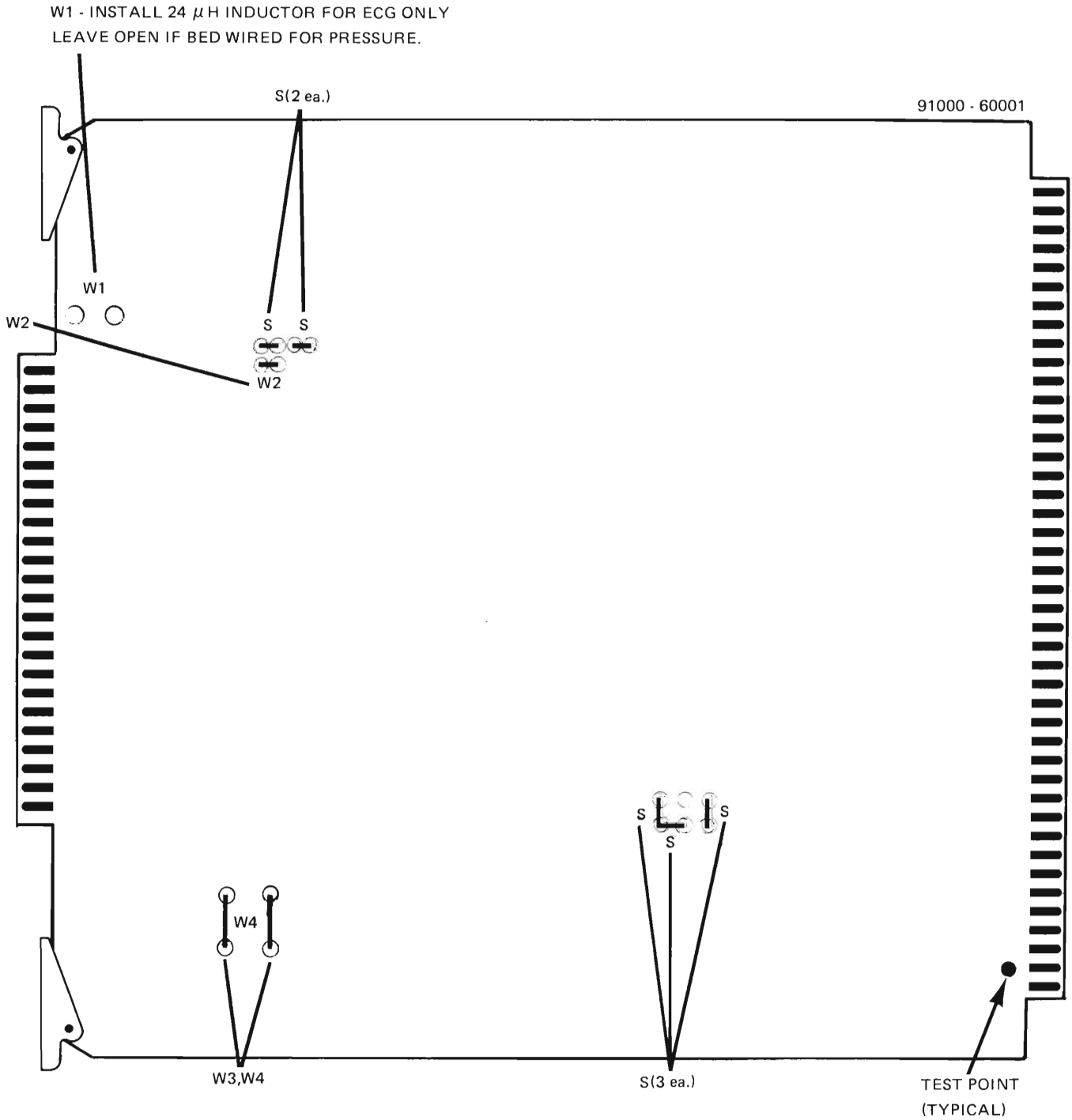


Figure 2-6. Computer 91200 Video I/O PCB (91200-60007)



NOTE: JUMPERS SHOWN ARE FOR SINGLE-ENDED OPERATION.

Figure 2-7. Computer 91000 A/D Converter I/O PCB

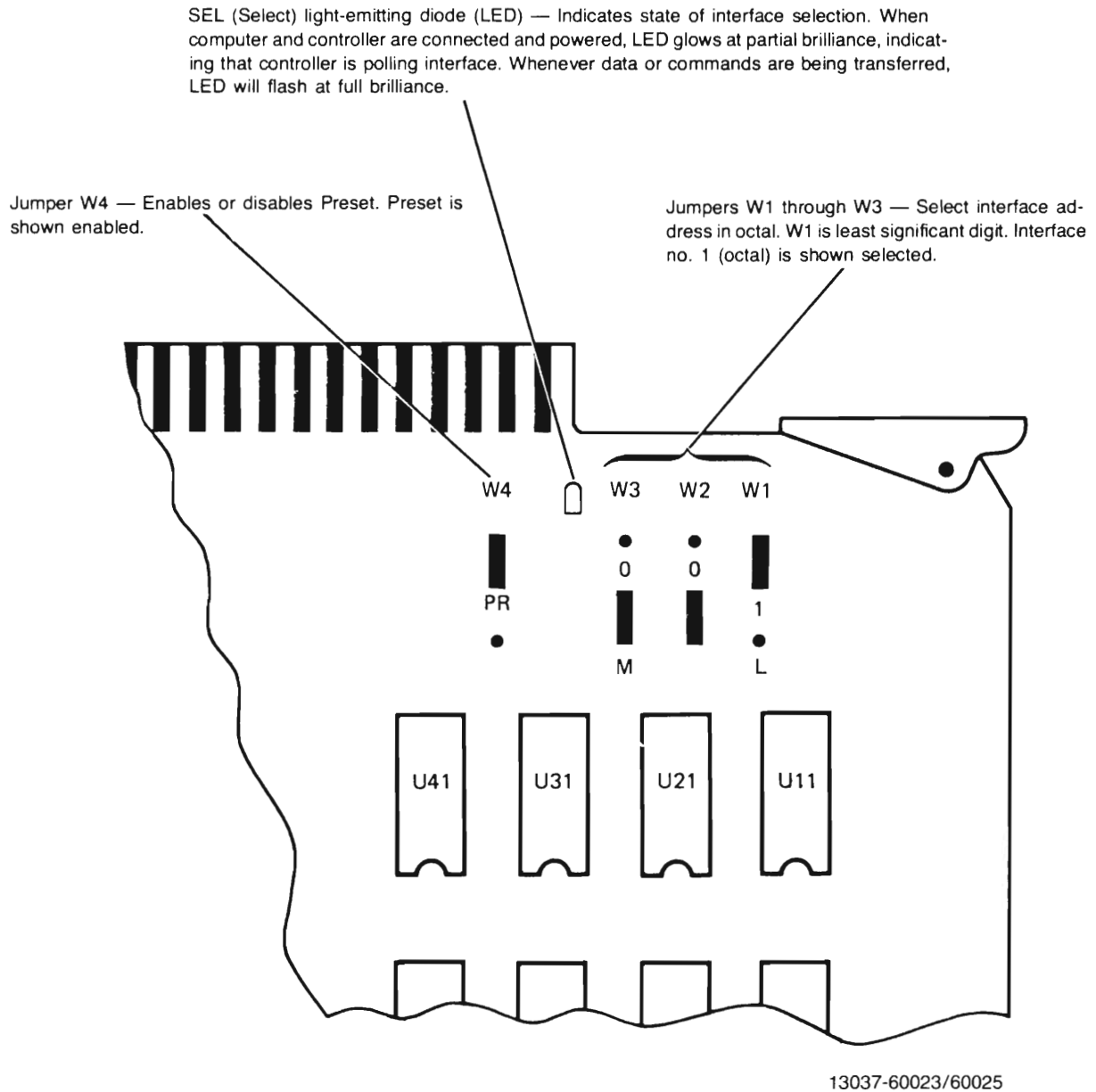
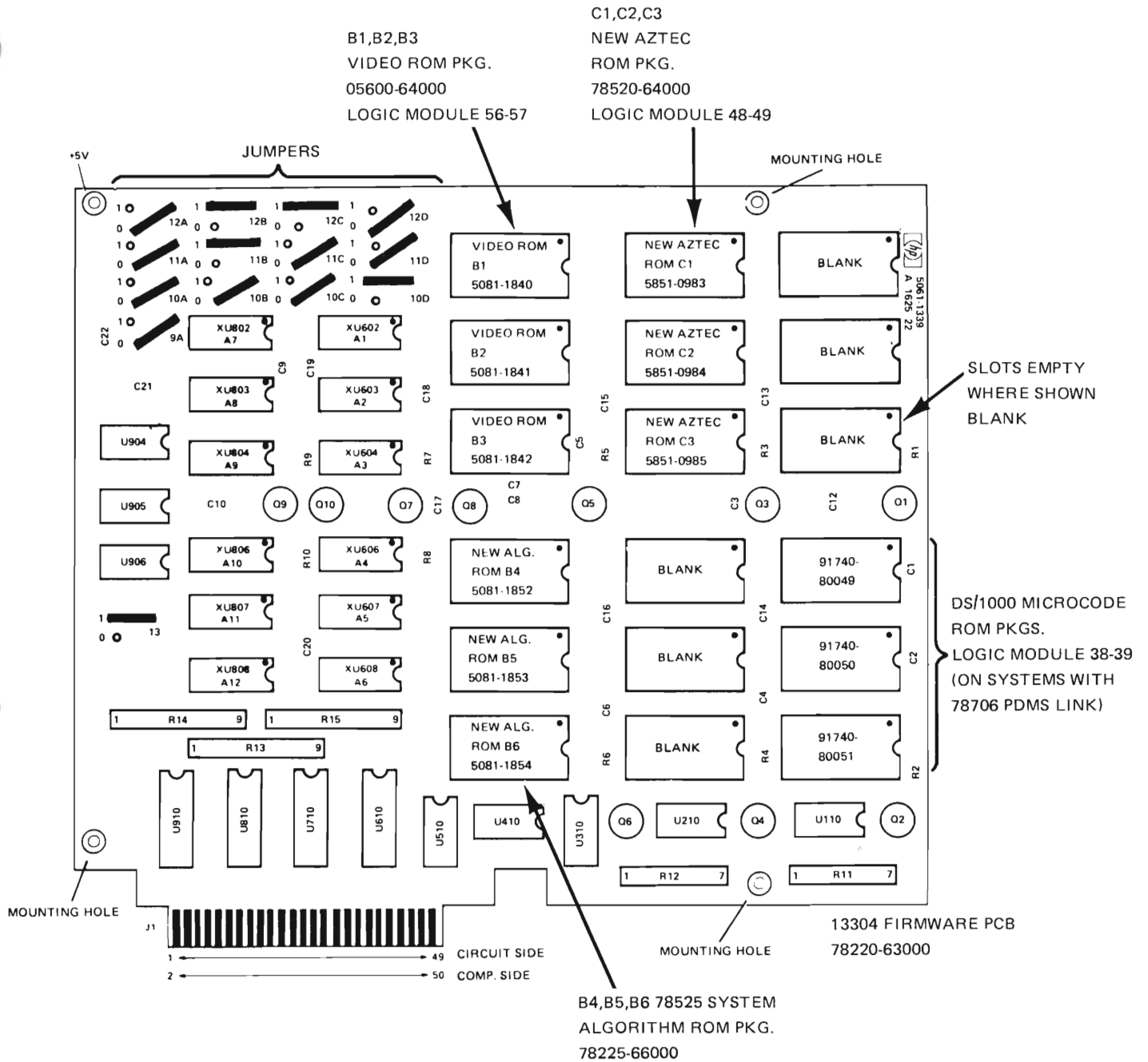


Figure 2-8. Computer 13175 Interface I/O PCB



NOTES: JUMPER POSITIONS ARE CORRECT FOR 78525 SYSTEM.

Figure 2-9. Computer 13304 Firmware Accessory PCB

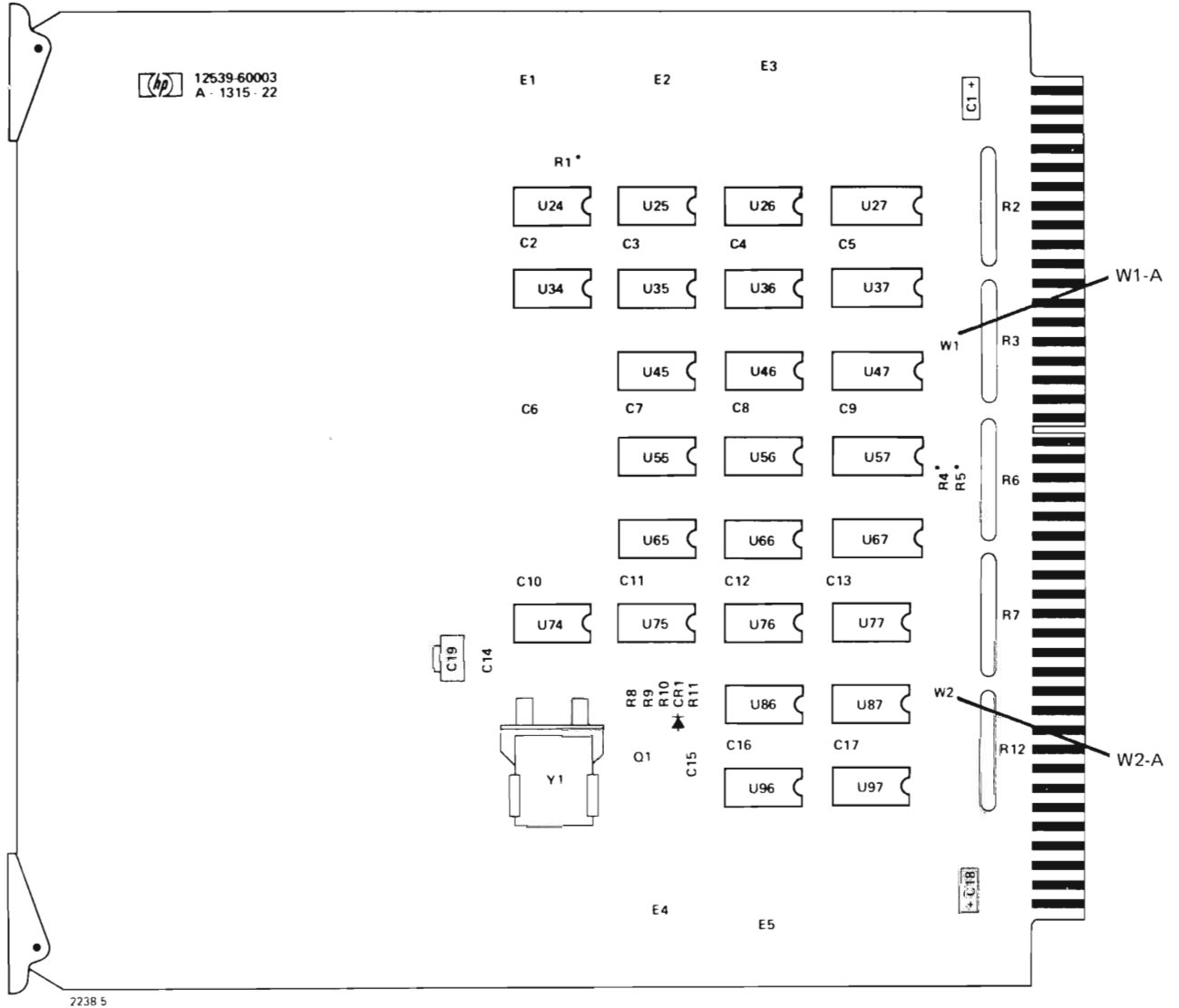
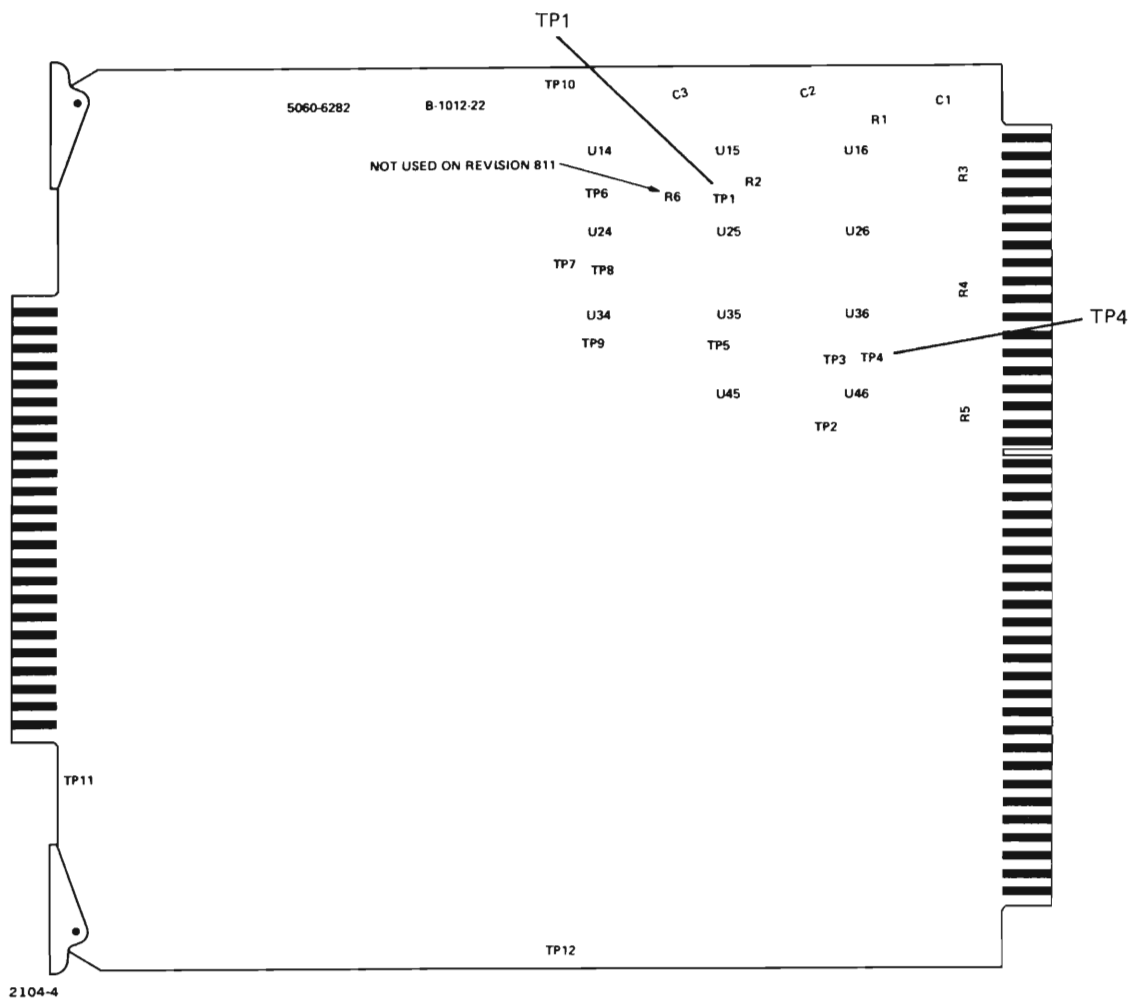


Figure 2-10. Computer 12539 Time Base Generator PCB



NOTE: Used only in systems with eight beds or less.

Figure 2-11. Computer 12620 Privileged Interrupt (Fence) I/O PCB

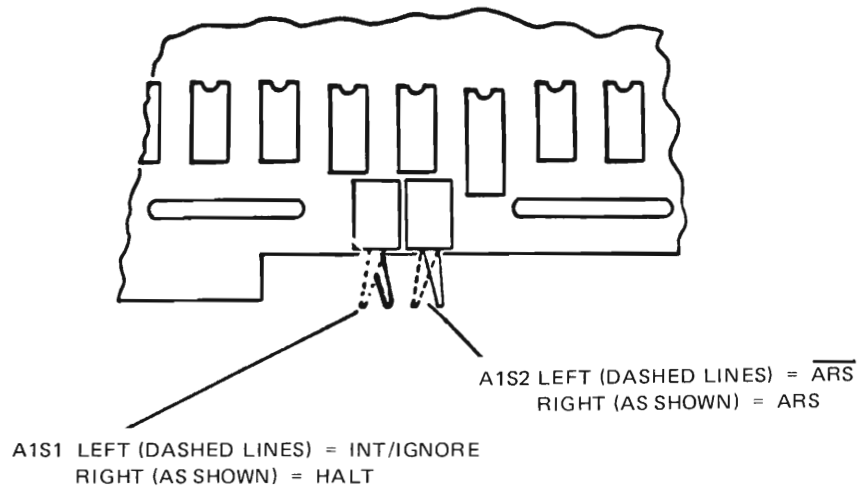


Figure 2-12. Computer Mother Board Switches A1S1, A1S2

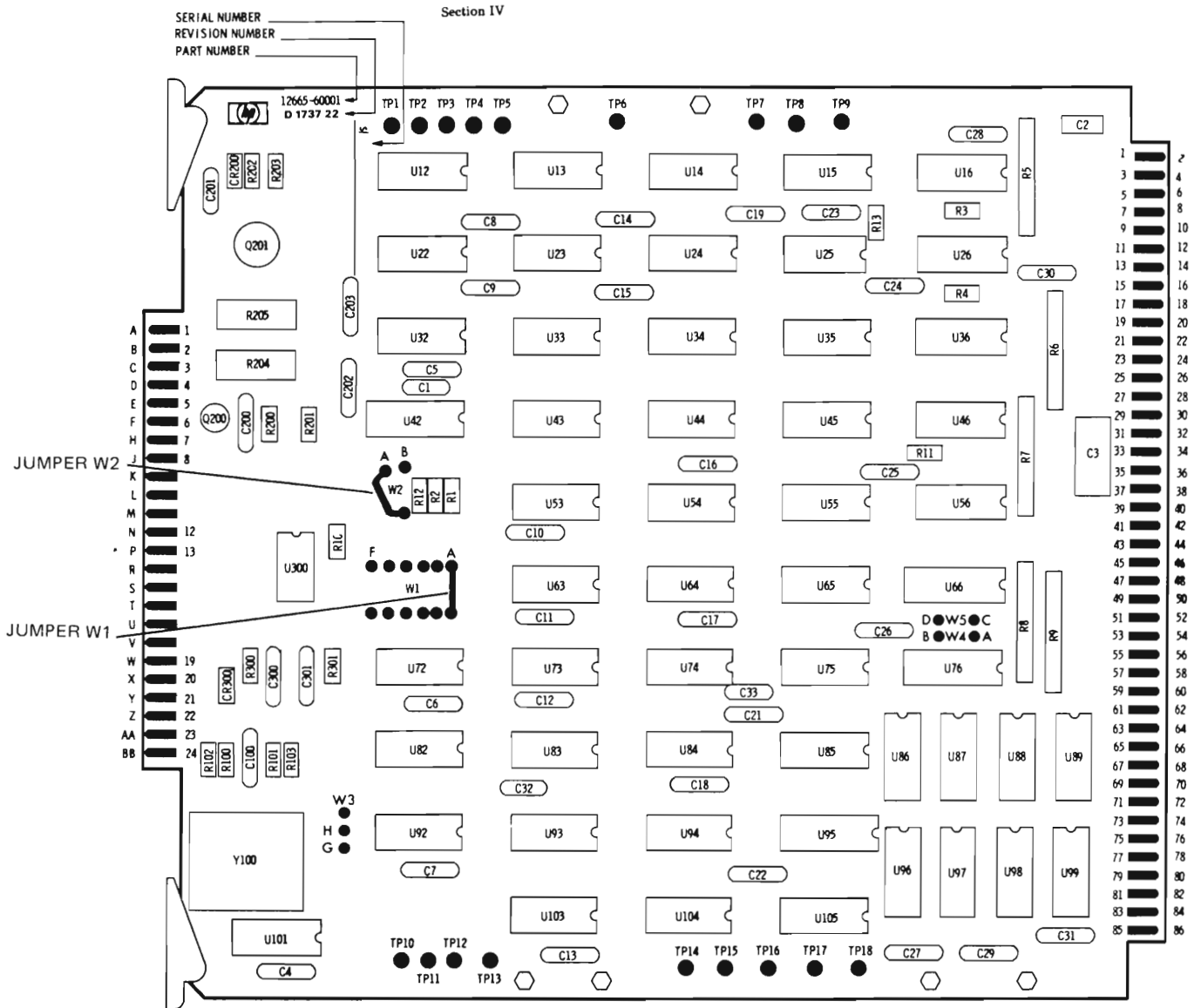
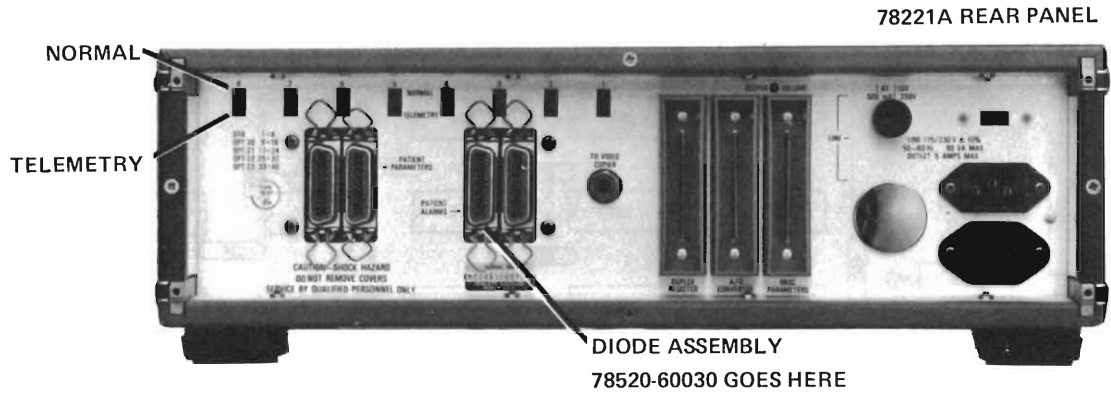


Figure 2-13. Computer 12771 Serial Interface I/O PCB



NOTE: SEE FIGURE 2-19 FOR CABLE
INSTALLATION INSTRUCTIONS.

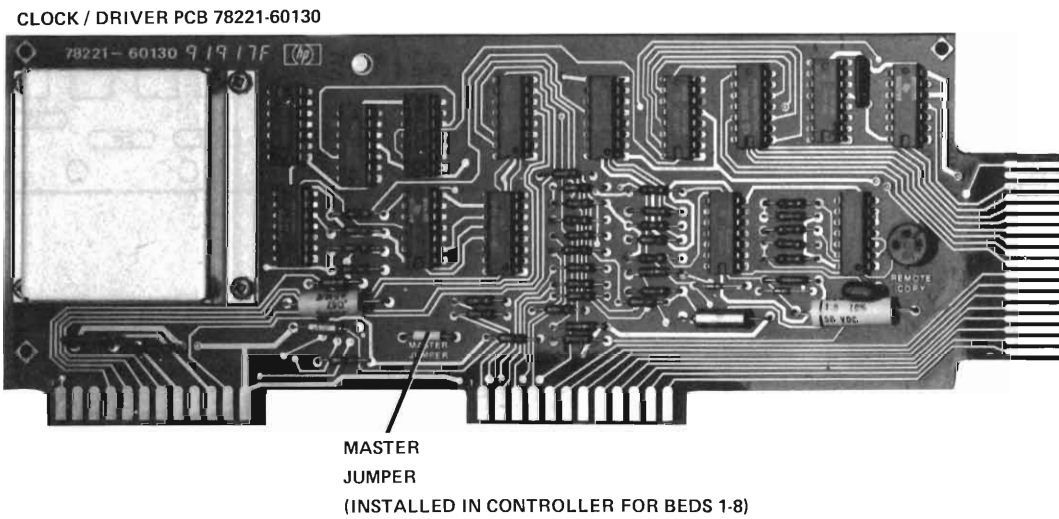


Figure 2-14. 78221 Controller Configuration Strapping (Sheet 1 of 2)

TYPICAL
SLAVE JUMPER



TYPICAL MASTER
JUMPER (TELEMETRY)

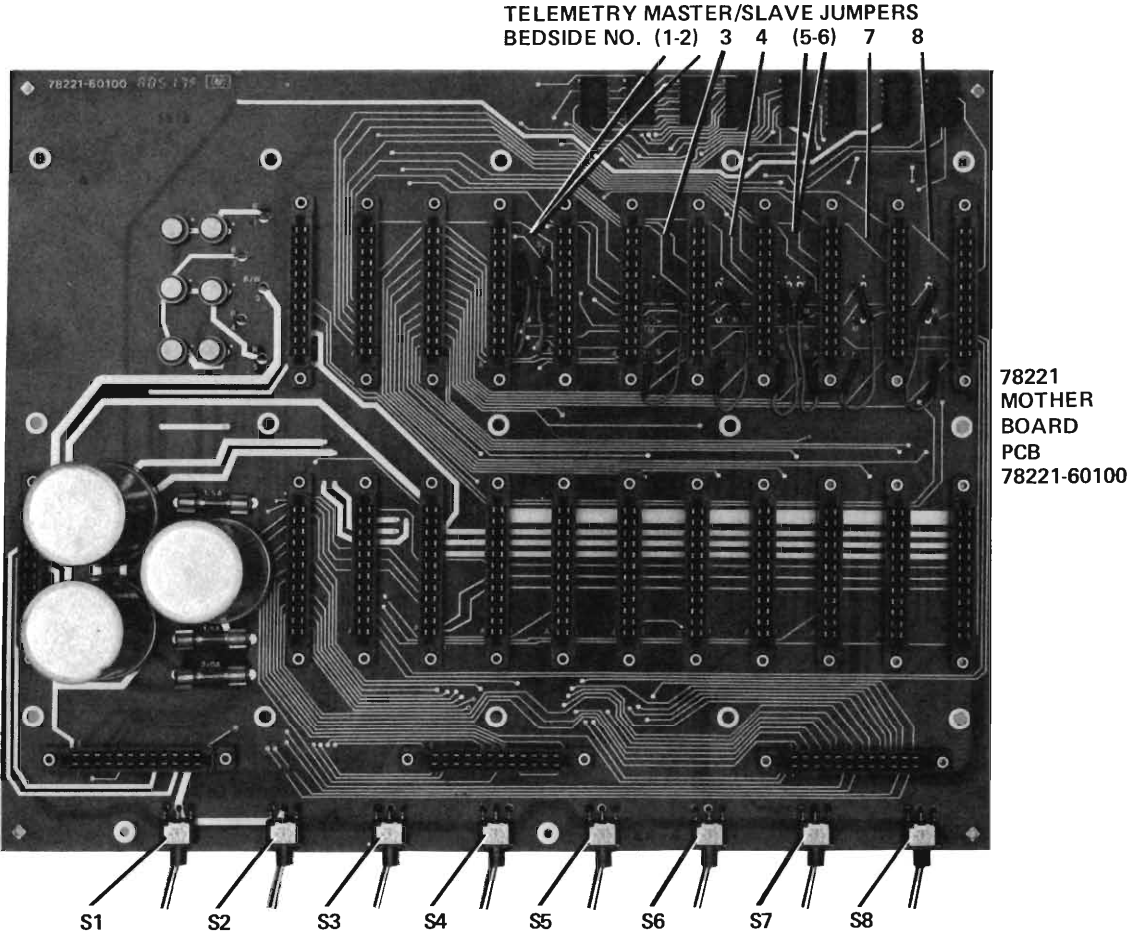


Figure 2-14. 78221 Controller Configuration Strapping (Sheet 2 of 2)

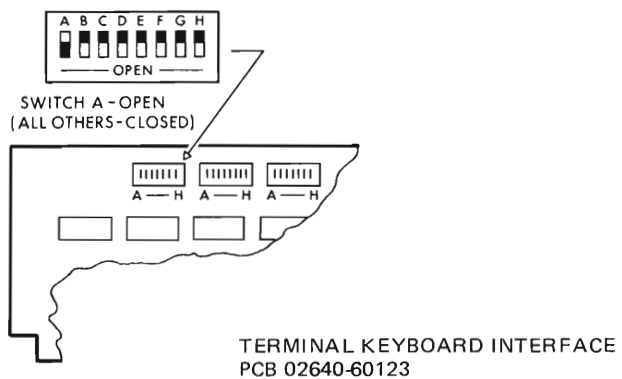
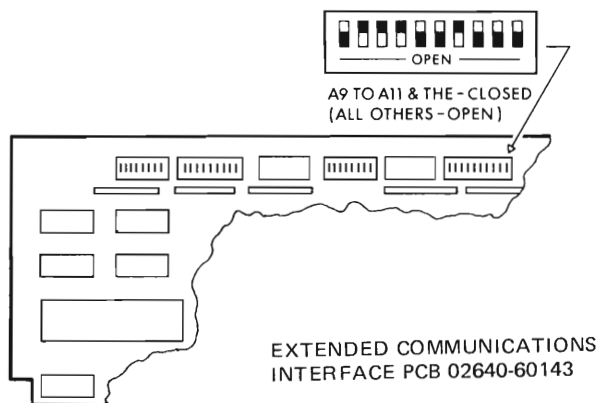
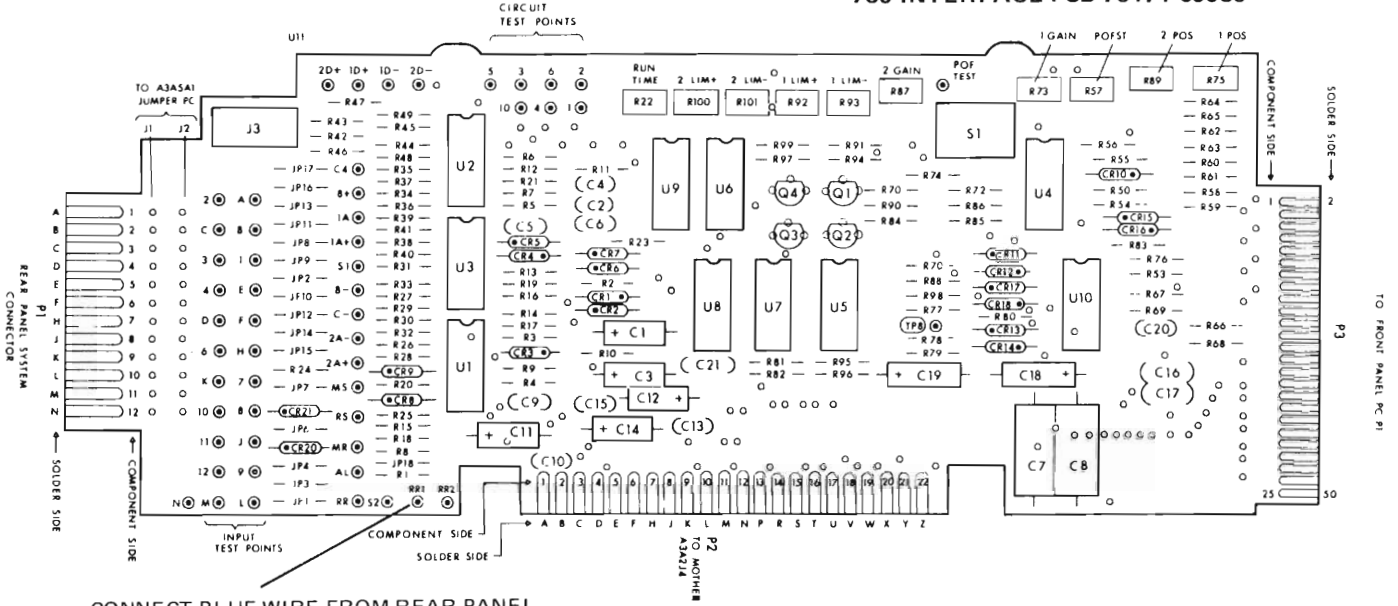


Figure 2-15. 2648 Terminal Configuration Strapping

780 INTERFACE PCB 78171-60030



CONNECT BLUE WIRE FROM REAR PANEL ASCII CONNECTOR TO RR1.

ASCII INTERFACE PCB 78171-60122

SET ASCII SWITCH TO ASCII POSITION.

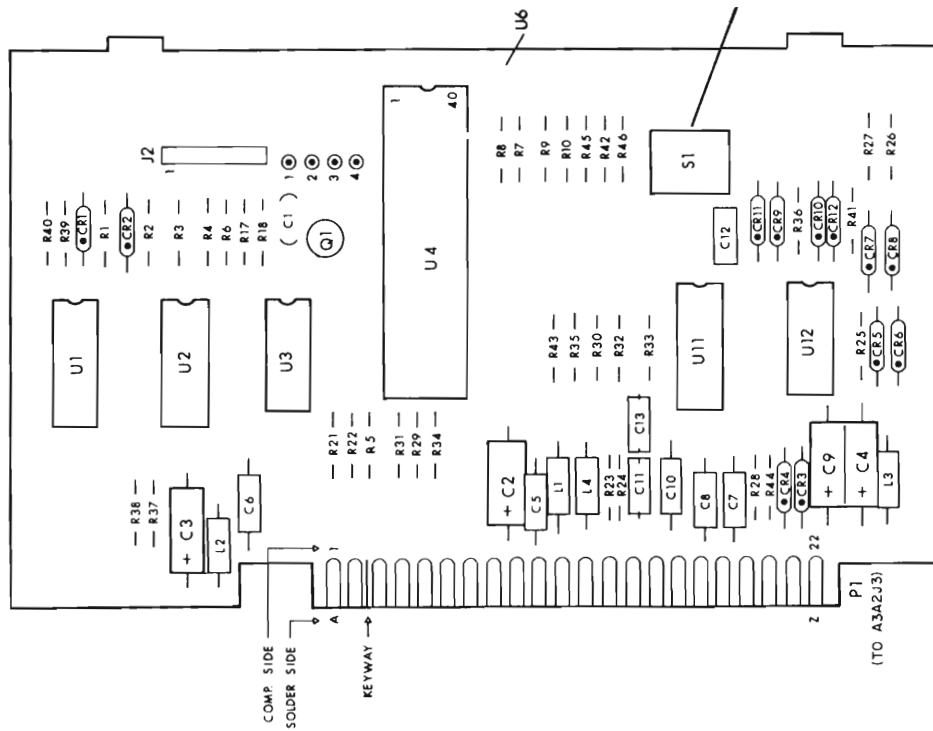
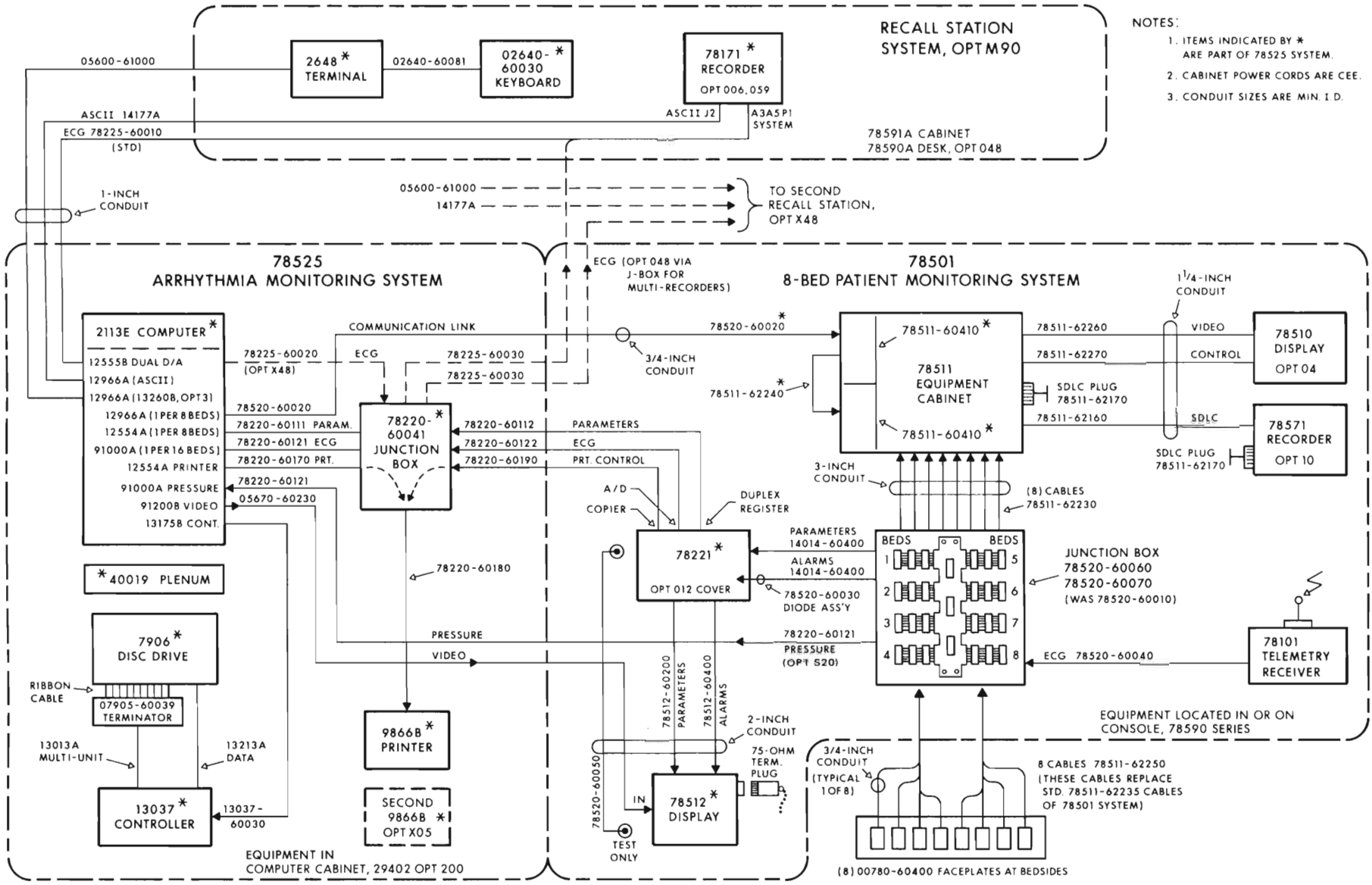


Figure 2-16. 78171 Recorder Configuration Strapping

Figure 2-17. Cabling Diagram, 78525 Arrhythmia Monitoring System, Shown with 78501 System



EQUIPMENT IN COMPUTER CABINET, 29402 OPT 200

EQUIPMENT LOCATED IN OR ON CONSOLE, 78590 SERIES

(8) 00780-60400 FACEPLATES AT BEDSIDES

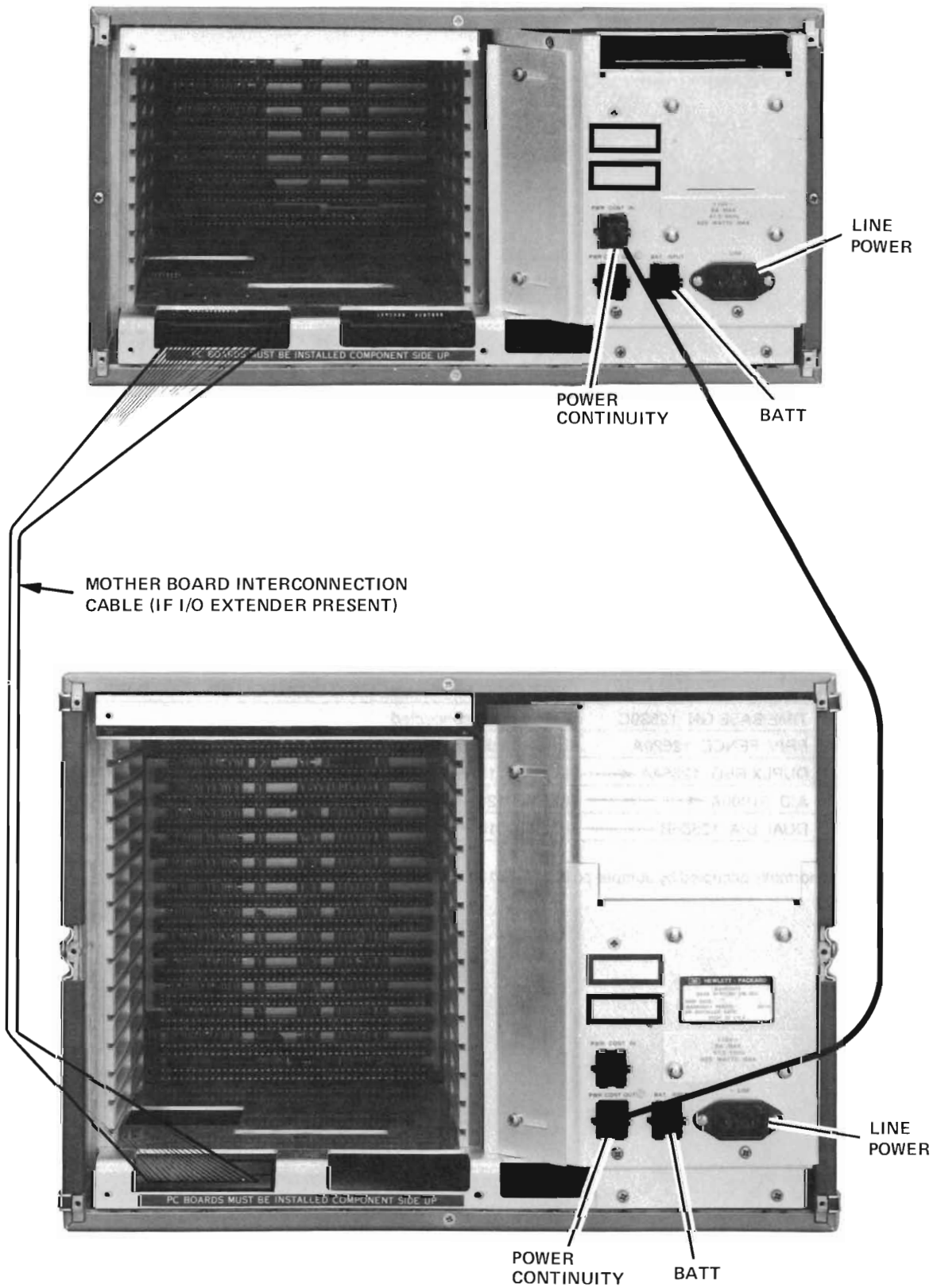


Figure 2-18. 2113E Computer Rear Panel Connections (Part 1 of 4)

78525 8-Bed Standard System
(Optional PDMS Link Shown)

Slot No.	Card No. And Type	Cable No. and Signal Direction	Destination or Source	Function
24	Comm Intfc 12966A	14177A →	78171 RECORDER	ASCII INTFC
23	Serial Intfc 12771A	12665-60003 →	78706 PDMS SYSTEM	DATA
22	Video 91200B	05670-60230 →	78512 DISPLAY	VIDEO
21	DUPLX REG 12554A	78220-60170 →	60041 J-BOX	HARD COPY
20	Com Intfc 12966A	78520-60020 →	78511A (-60410)	COMM. LINK
17	02116-66110 Jumper	--		
16	Com Intfc 12966A	05600-61000 →	2648 TERMINAL	DTA ENTRY/RCALL
15	DISC INTFC 13175A	13037-60030 →	13037 CONTROLLER	DISC
14	TIME BASE GN 12539C	Not externally connected		
13	PRIV. FENCE 12620A	Not externally connected		
12	DUPLX REG 12554A	78220-60111 →	-60041 J-BOX	PARAMETERS
11	A/D 91000A	78220-60121 →	-60041 J-BOX	ECG INPUTS
10	DUAL D/A 12555B	78225-60010 →	78171 RECORDER	ECG

*Slot 23 normally occupied by Jumper pc 02116-66110 in systems without 78706 PDMS Link.

Figure 2-18. 2113E Computer Rear Panel Connections (Part 2 of 4)

78525 16-Bed Standard System

Slot No.	Card No. And Type	Cable No. and Signal Direction	Destination or Source	Function
2113E COMPUTER XX	Serial Intf 12771****	-12665-60003	↔ 78706 PDMS SYSTEM;	SYS DATA
24	Com Intfc 12966B	→ 14177A	→ 78171A RECORDER	ASCII DATA
23	Video 91200B	→ 05670-60230	→ 78512A (2)	VIDEO*
22	Video 91200B	→ 05670-60230	→ 78512A (1)	VIDEO*
21	Dupl Reg 12554A***	→ 78220-60170	→ -60041 J-BOX	HARD COPY**
20	Com Intfc 12966A	→ 78520-60020	→ 78511A(-60410)	COMM LINK 2*
17	Com Intfc 12966A	→ 78520-60020	→ 78511A(-60410)	COMM LINK 1*
16	Com Intfc 12966A	← 05600-61000	→ 2648 Terminal	DTA ENTRY/RCALL
15	Disc Intfc 13175B	← 13037-60030	→ 13037 Controller	DISC DATA
14	TIME BASE 12539C	Not externally connected		
13	DUPL REG 12554A	← 78220-60111	→ -60041 J-BOX	PARAMETERS 2*
12	DUPL REG 12554A	← 78220-60111	→ -60041 J-BOX	PARAMETERS 1*
11	A/D 91000A	← 78220-60121	→ -60041 J-BOX	ECG**
10	DUAL D/A 12555B	→ 78225-60010	→ 78171 RECORDER	ECG

*One per 8 beds

**One per 16 beds

***Jumper Card 02116-66110 if no standard Hard-Copy Interface

****Optional link goes here in 16-bed systems without pressure option

Figure 2-18. 2113E Computer Rear Panel Connections (Part 3 of 4)

78525 16-Bed Fully Loaded

	Slot No.	Card No. And Type	Cable No. and Signal Direction	Destination or Source	Function	
12979A I/O EXTENDER (Opt Y01)	35	—	—	—	—	
	34	—	—	—	—	
	33	—	—	—	—	
	32	A/D Conv 91000A	← 78220-60121	→ J-BOX -60010	PRESSURES (2)	
	31	A/D Conv 91000A	← 78220-60121	→ J-BOX -60010	PRESSURES (1)	
	30	Comm Intfc 12966A	← 14177A	→ 78171A	RECORDER ASCII (2)	
	27	Comm Intfc 12966A	← 14177A	→ 78171A	RECORDER ASCII (1)	
	26	Comm Intfc 12966A	← 05600-61000	→ 2648A TERMINAL	DTA ENTRY/RECALL (2)	
	25	Comm Intfc 12771A	← 12665-60003	→ 78706 SYSTEM	PDMS LINK	
	2113E COMPUTER	XX	I/O Buffer	← PART OF 12979A	→	I/O EXTENDER
24		Video Gen 91200B	← 05670-60230	→ 78512A	VIDEO (2)	
23		Video Gen 91200B	← 05670-60230	→ 78512A	VIDEO (1)	
22		Duplex Reg 12554A	← 78220-60170	→ J-BOX -60041	9866B PRT DATA (2)*	
21		Duplex Reg 12554A	← 78220-60170	→ J-BOX -60041	9866B PRT DATA (1)	
20		Comm Intfc 12966A	← 78520-60020	→ 78511 (-60410)	COMM LINK (2)	
17		Comm Intfc 12966A	← 78520-60020	→ 78511 (-60410)	COMM LINK (1)	
16		Comm Intfc 12966A	← 05600-61000	→ 2648A TERMINAL	DTA ENTRY/RECALL (1)	
15		Disc Intfc 13175B	← 13037-60030	→ 13037 CONTROLLER	DISC DATA	
14		Timebase Gen 12539C	Not connected externally			
13		DUPL REG 12554A	← 78220-60111	→ 60041 JCT BOX	PARAMETERS 2	
12		DUPL REG 12554A	← 78220-60111	→ -60041 JCT BOX	PARAMETERS	
11		A/D 91000A	← 78220-60121	→ -60041 JCT BOX	ECG's	
10	DUAL D/A 12555B	← 78225-60020	→ -60041 (On Op x 48)	RECORDER ECG (2)		
			← 78225-60010	→ -60041 J-BOX	RECORDER ECG (1)	
		plugs in here				

*With PDMS link, diagnostics will not test second hard-copy channel.

Figure 2-18. 2113E Computer and 12979 (2109B) I/O Extender, Rear Panel Connections (Part 4 of 4)

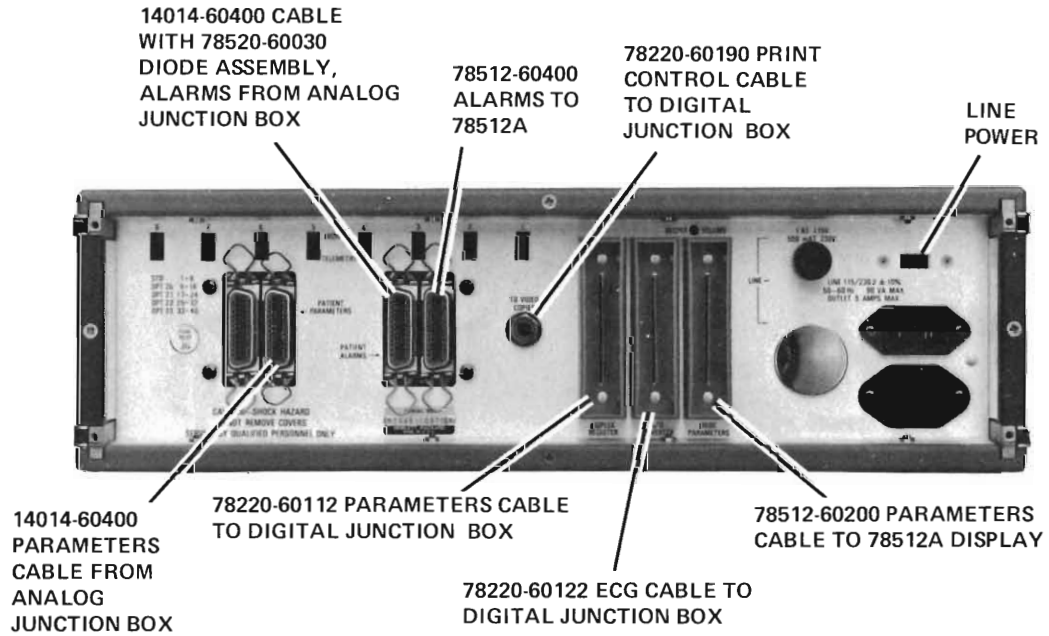


Figure 2-19. 78221A Controller, Rear Panel Connections

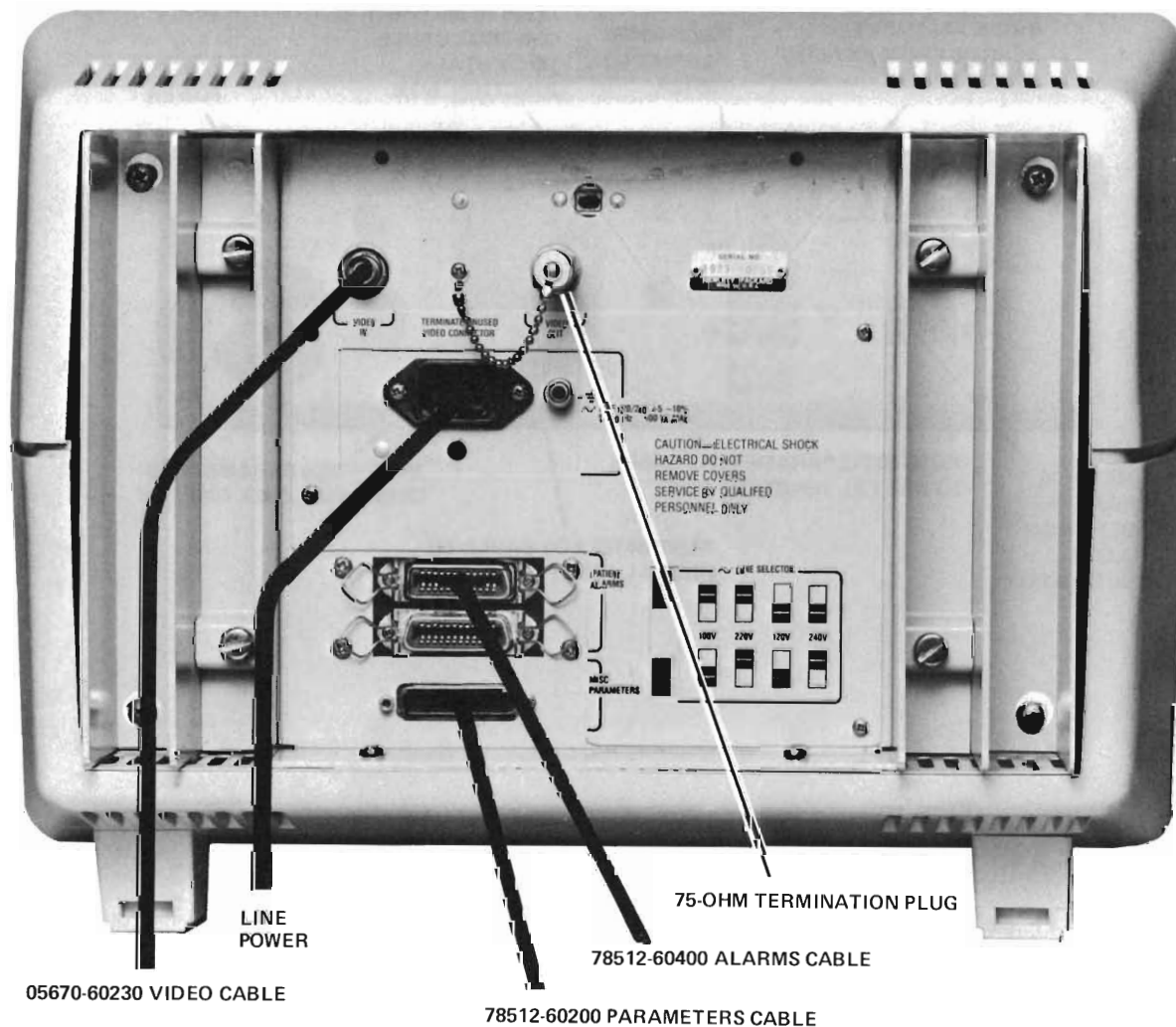


Figure 2-20. 78512A Display, Rear Panel Connections

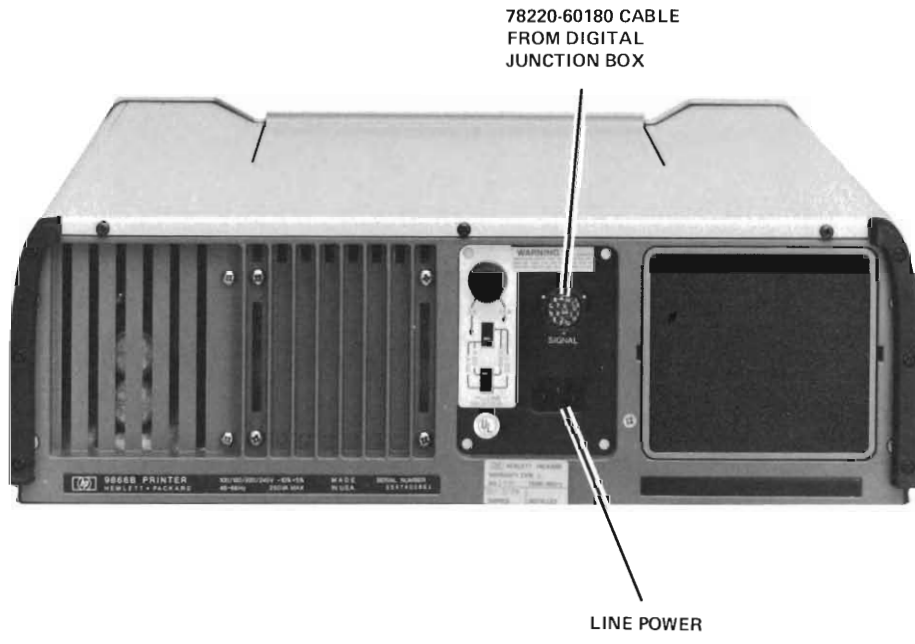


Figure 2-21. 9866B Printer, Rear Panel Connections

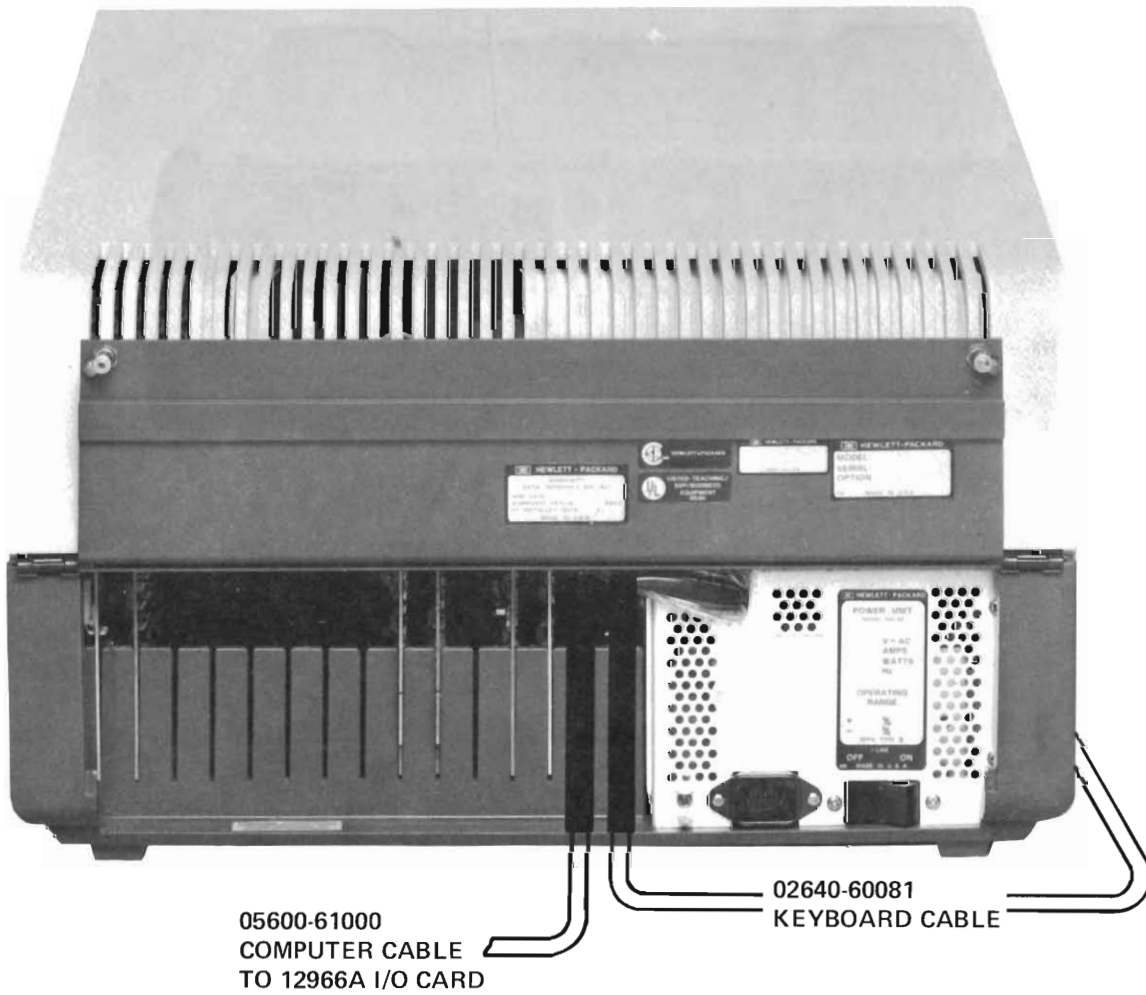
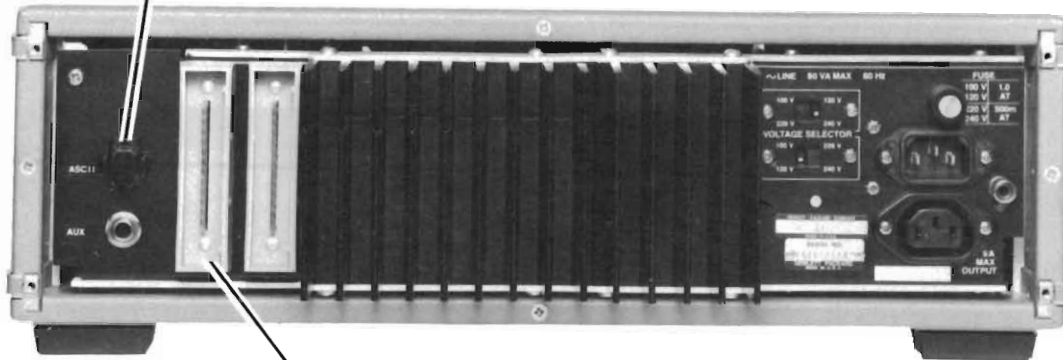
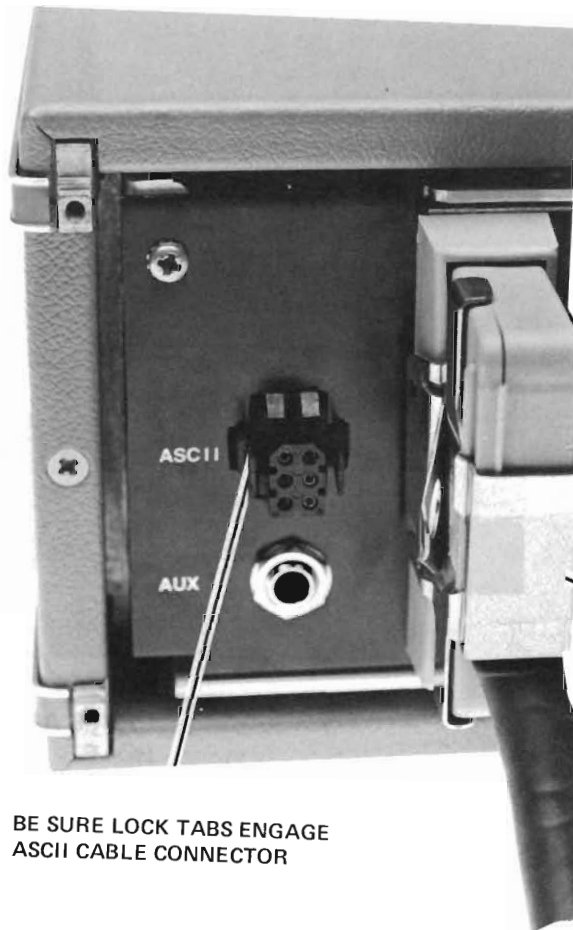


Figure 2-22. Keyboard and Terminal 2648 Connections

CABLE 14177A FROM 2113E
COMPUTER ASCII OUTPUT, 12966A



CABLE 78225-60010 FROM 2113E COMPUTER D/A CONVERTER 12555B
OR 78225-60030 FROM 78220-60041 JUNCTION BOX

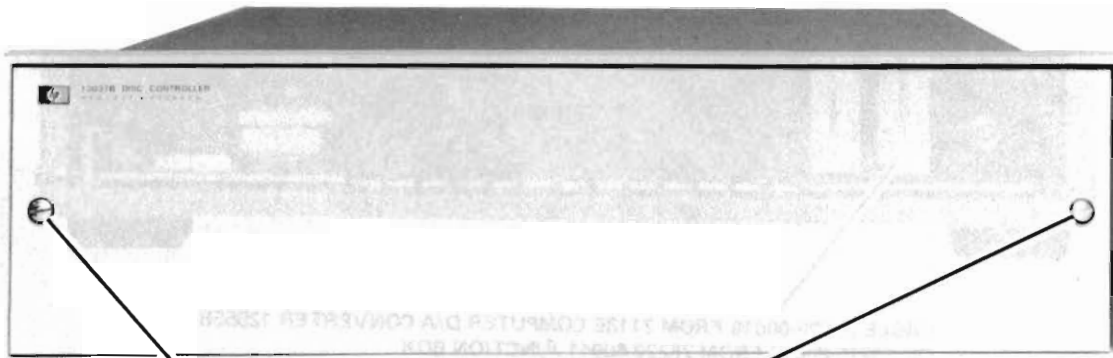


CONNECTOR
DETAIL

CONNECTOR
LOCK

BE SURE LOCK TABS ENGAGE
ASCII CABLE CONNECTOR

Figure 2-23. 78171 Recorder Connections

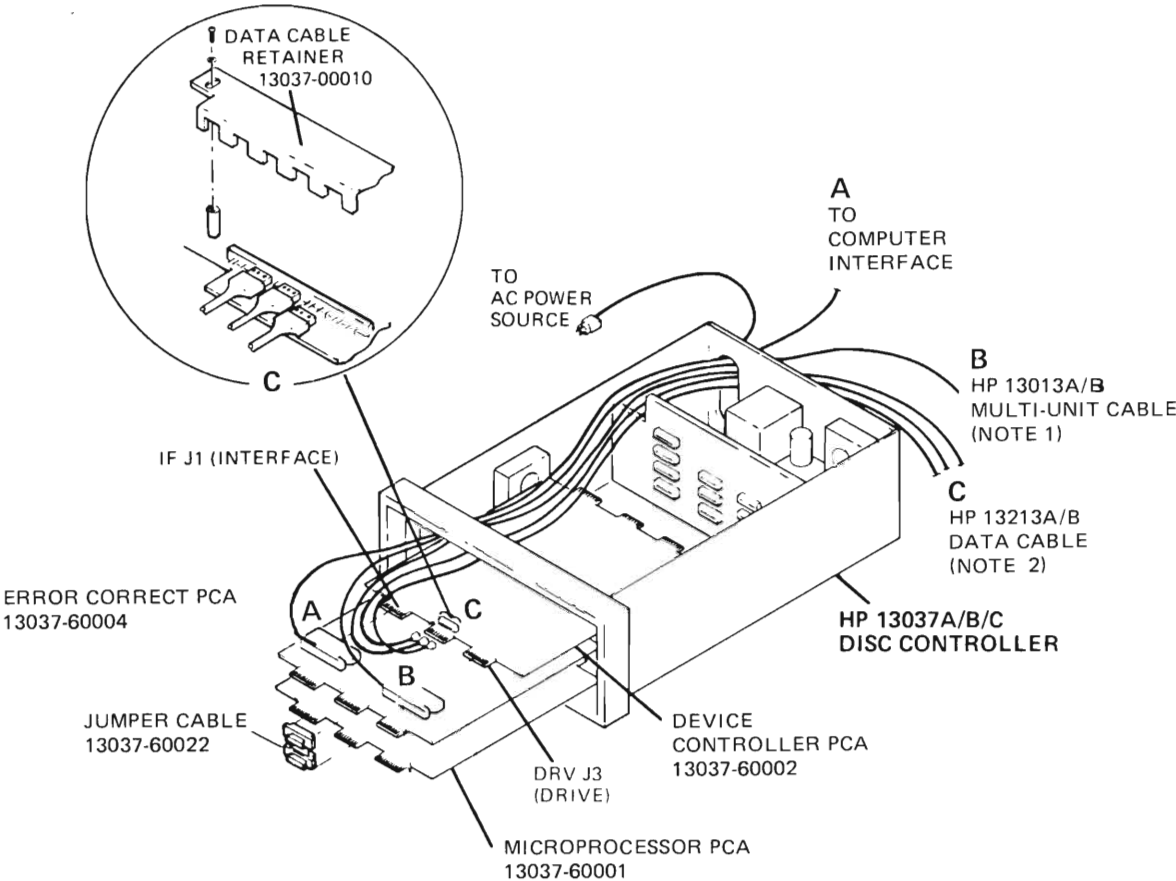


REMOVE SCREWS FOR
ACCESS TO CONNECTIONS



CABLE ACCESS
HOLE

Figure 2-24. Disc Drive and Controller Interconnection (Sheet 1 of 4)



NOTES:

1. THE HP 13013B MULTI-UNIT CABLE IS AVAILABLE IN FOUR LENGTHS AS FOLLOWS. MAXIMUM CUMULATIVE CABLE LENGTH, CONTROLLER TO LAST DISC DRIVE, IS 25.5 METRES (74 FEET).

CABLE	PART NO.	LENGTH
HP 13013B	13013-60013	3.66 m (12 ft)
HP 13013B-001	13013-60011	1.83 m (6 ft)
HP 13013B-002	13013-60014	5.49 m (18 ft)
HP 13013B-003	13013-60012	2.44 m (8 ft)

2. THE HP 13213B DATA CABLE IS AVAILABLE IN FIVE LENGTHS AS FOLLOWS:

CABLE	PART NO.	LENGTH
HP 13213B	13213-60007	3.05 m (10 ft)
HP 13213B-001	13213-60008	7.62 m (25 ft)
HP 13213B-002	13213-60009	15.24 m (50 ft)
HP 13213B-003	13213-60010	22.86 m (75 ft)
HP 13213B-004	13213-60006	1.83 m (6 ft)

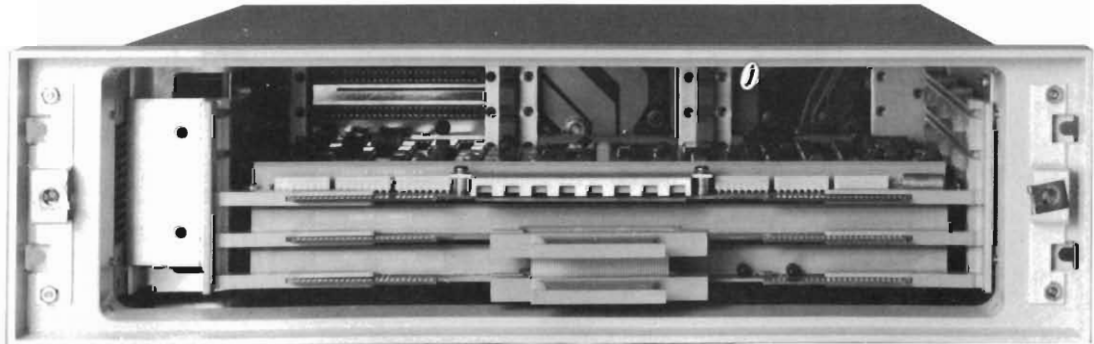


Figure 2-24. Disc Drive and Controller Interconnection (Sheet 2 of 4)

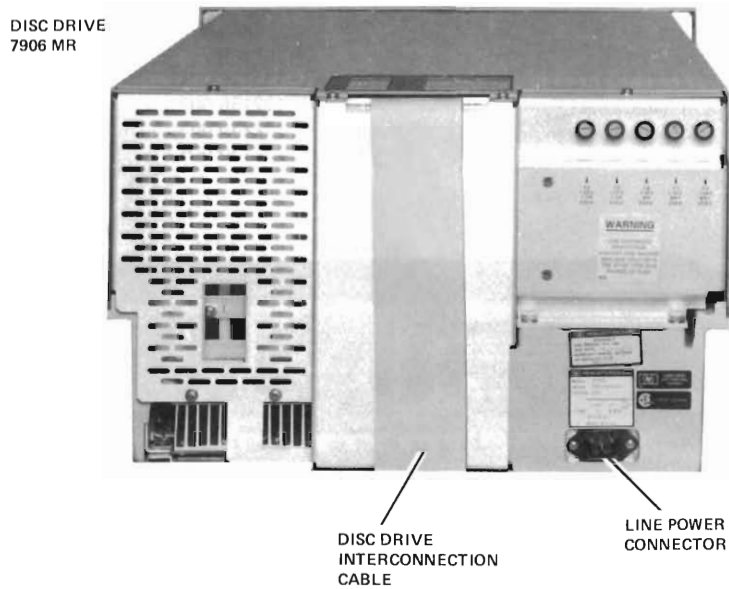
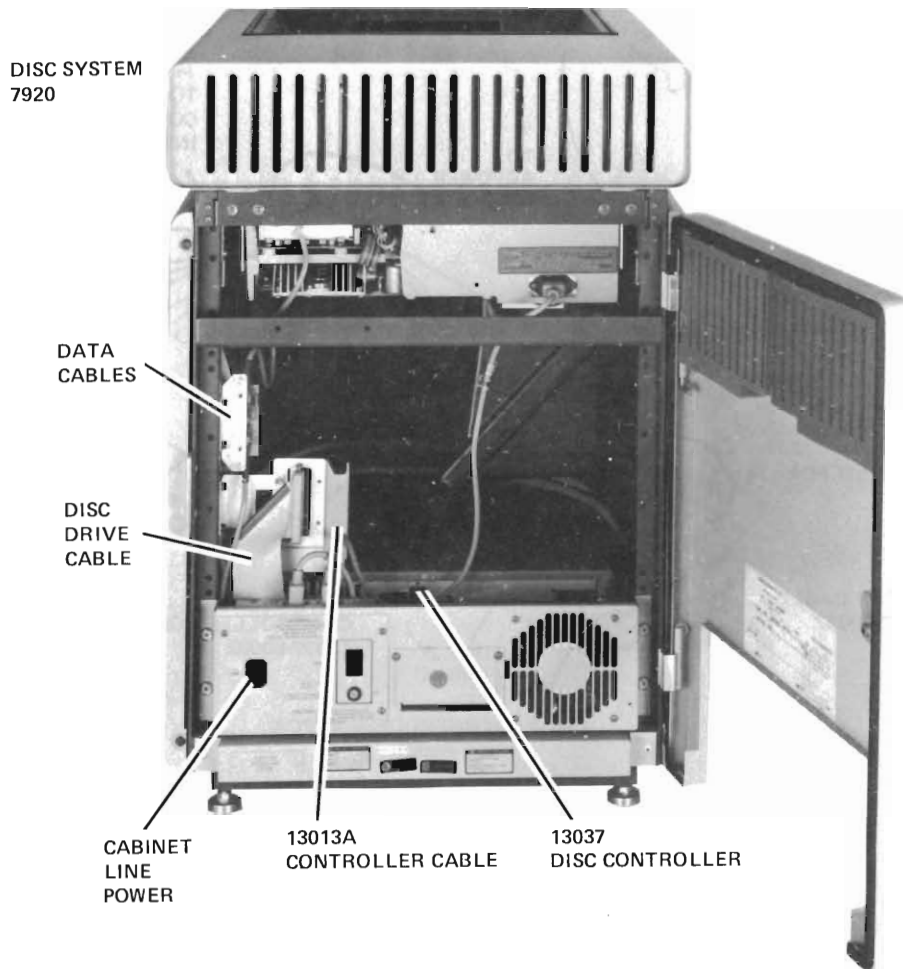
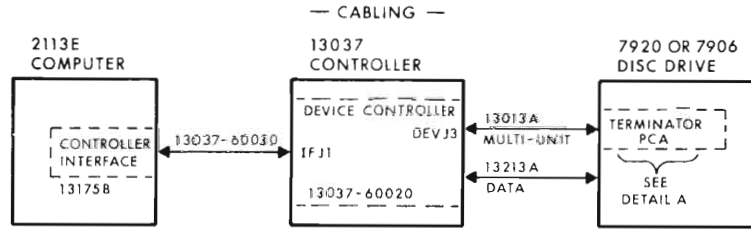


Figure 2-24. Disc Drive and Controller Interconnection (Sheet 3 of 4)



NOTE:
SINGLE UNIT INSTALLATION
SHOWN. FOR MULTIPLE
UNIT CONNECTION, REFER TO:

--7920A OPERATING AND
SERVICE MANUAL, P/N
07920 - 90001

13037A/B INSTALLATION
AND SERVICE MANUAL,
13037 - 90006

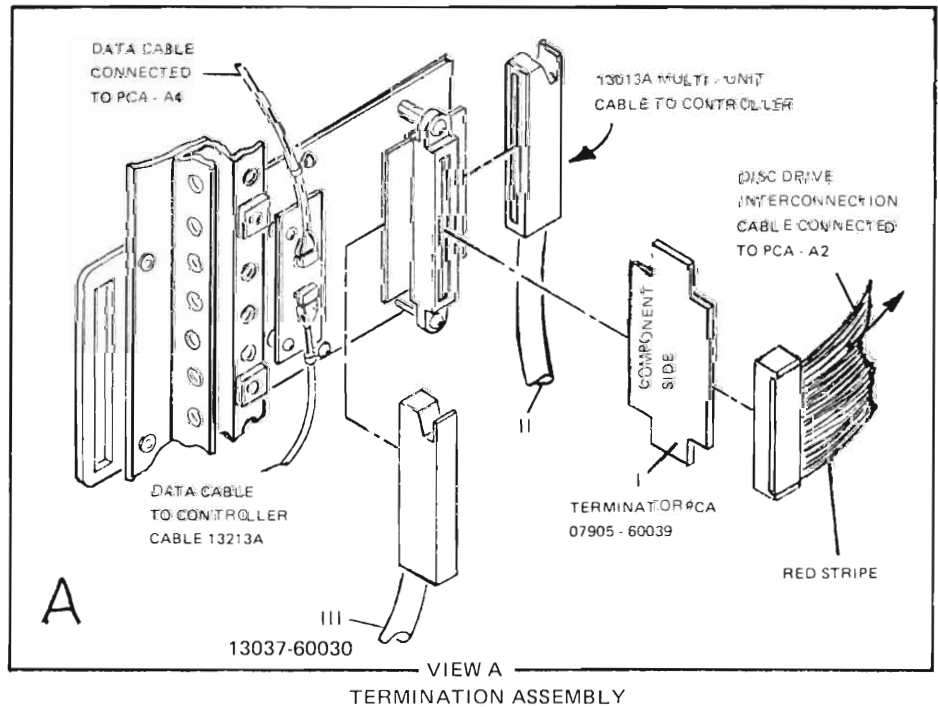


Figure 2-24. Disc Drive and Controller Interconnection (Sheet 4 of 4)

Section II — Installation — 78525 — 2nd Edition

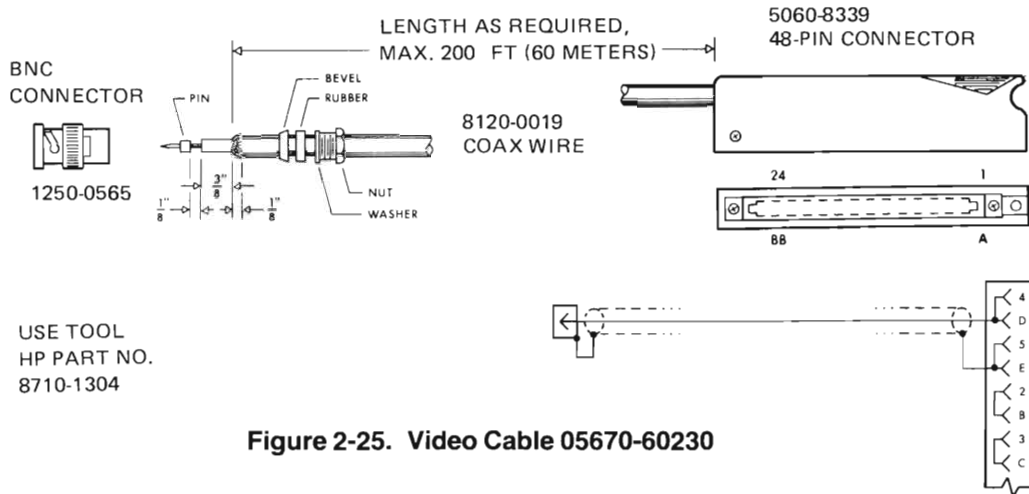
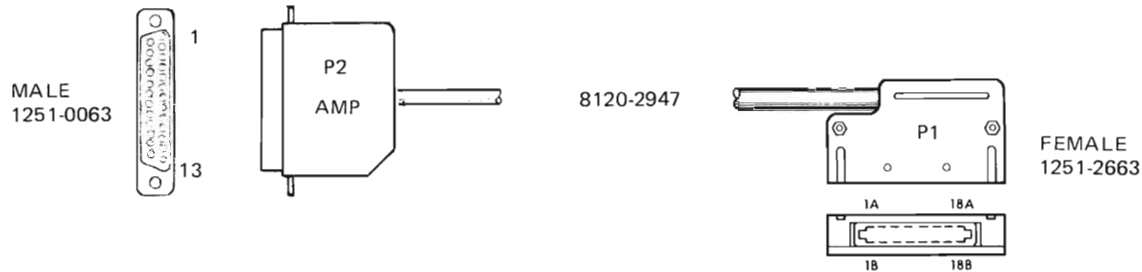
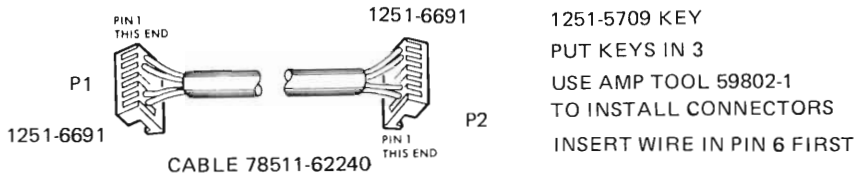


Figure 2-25. Video Cable 05670-60230



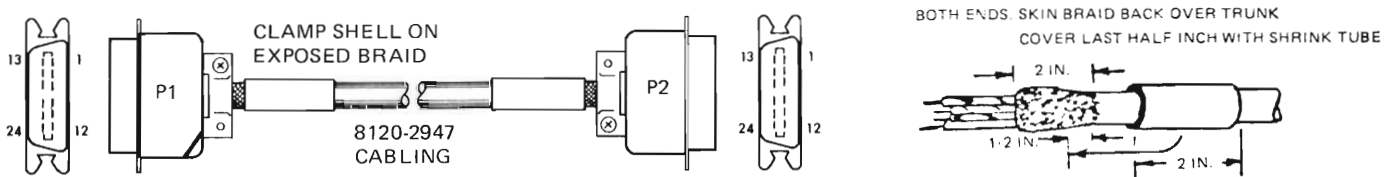
P1 Pin	Color	P2 Pin	Signal
9A	N.C.	1	
18B	GRAY	2	DISCHARGE
16B	WH VIOL	3	TREND 8
14B	WH GREEN	4	TREND 6
12B	WH OR	5	TREND 4
10B	WH BRN	6	TREND 2
9B	WHITE	7	COPY
9B	SHIELD	8	GND
7A	BLACK	9	GND
5A	WH BK BLU	10	RESET 7
3A	WH BK YEL	11	RESET 5
1A	WH BK RED	12	RESET 3
	WH GRAY	13	RESET 1
	NC	14	
10A	RED	15	EVENT
17B	WH BLU	16	TREND 7
15B	WH YEL	17	TREND 5
13B	WH RED	18	TREND 3
11B	WH BLK	19	TREND 1
	NC	20	GND
	NC	21	GND
8A	VIOLET	22	RESET 8
6A	WH BK GRN	23	RESET 6
4A	WH BK OR	24	RESET 4
2A	WH BK BRN	25	RESET 2

Figure 2-26. Parameters Cable 78512-60200



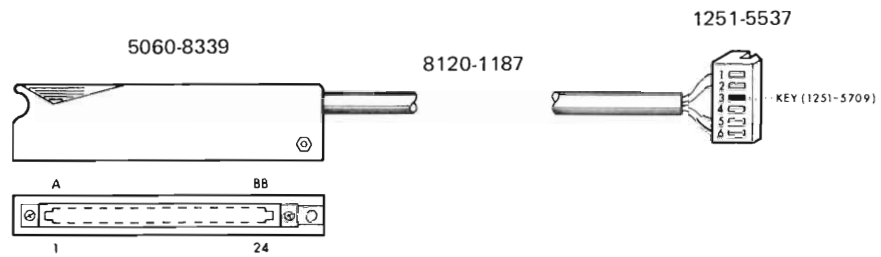
P1 Pins	Wire Color	P2 Pins	Signal
1	RED	1	TRANS. DATA
2	GRN	2	SIGNAL GND
3	(KEY)	3	
4	SHIELD	4	
5	BLK	5	SIGNAL GND
6	WHT	6	RECORDER DATA

Figure 2-27. Communication Link Jumper for 78511-60410 Boards
If Two Are Installed in 78511A Equipment Cabinet



P1 Pin	Wire Color	P2 Pin	Signals	Notes
1	BRN	1		USE ALARM STEERING DIODE ASSY 78520-60030 BETWEEN P1 AND 78221A SEE FIG. 2-30.
2	RED	2		
3	ORG	3		
4	YEL	4		
5	GRN	5		
6	BLU	6		
7	VIO	7		
8	GRY	8		
9	WHT	9		
10	WHT BLK	10		
11	WHT BRN	11		
12	WHT RED	12		
13	WHT ORG	13		
14	WHT YEL	14		
15	WHT GRN	15		
16	WHT BLU	16		
17	WHT VIO	17	ALARM OFF 1	
18	WHT GRY	18	ALARM OFF 2	
19	BLK	19	ALARM OFF 3	
20	WHT BLK BRN	20	ALARM OFF 4	
21	WHT BLK RED	21	ALARM OFF 5	
22	WHT BLK ORG	22	ALARM OFF 6	
23	WHT BLK YEL	23	ALARM OFF 7	
24	WHT BLK GRN	24	ALARM OFF 8	
—	WHT BLK BLU	—		CUT OFF

Figure 2-28. 78512-60400 ECG or Alarm Cable Assembly



NOTE: USE TOOL 59802-1 (HP 8710-1303) TO INSTALL CONNECTOR. INSERT PIN 6 WIRE FIRST. REFER TO 78501/502 CENTRAL STATION INSTALLATION GUIDE (78500-91999) FOR CABLE FABRICATION INSTRUCTIONS.

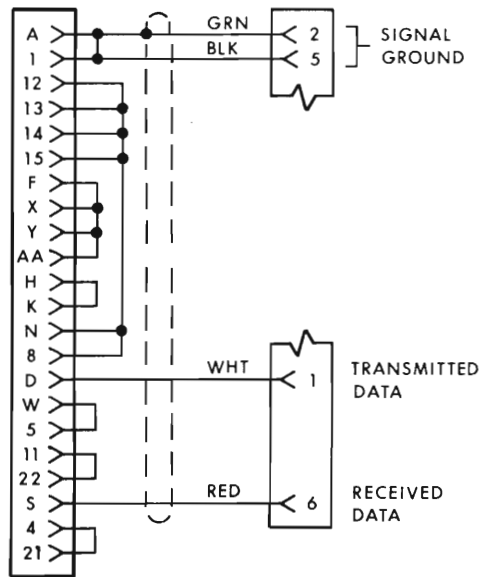
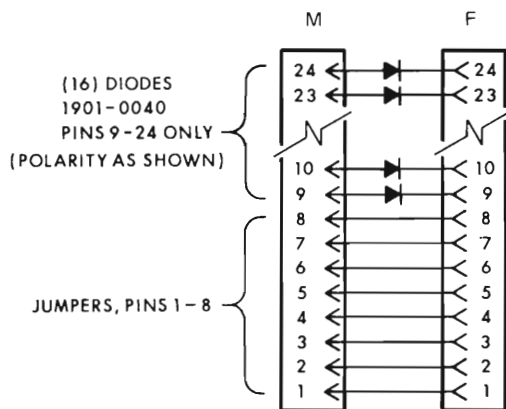
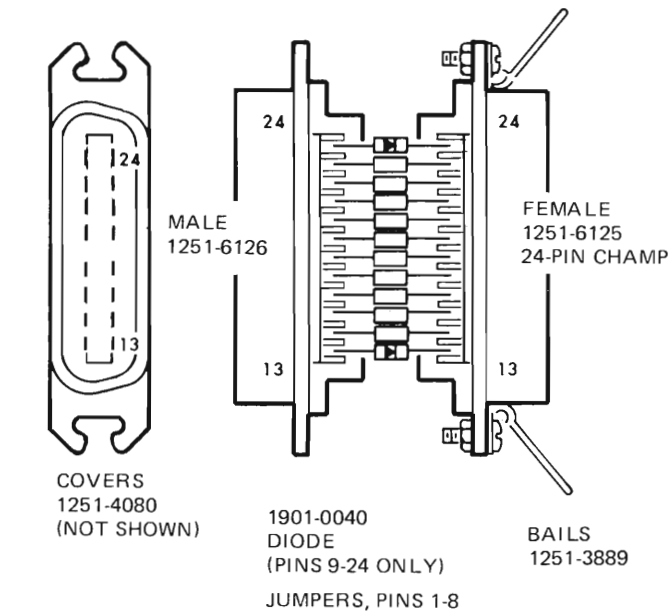


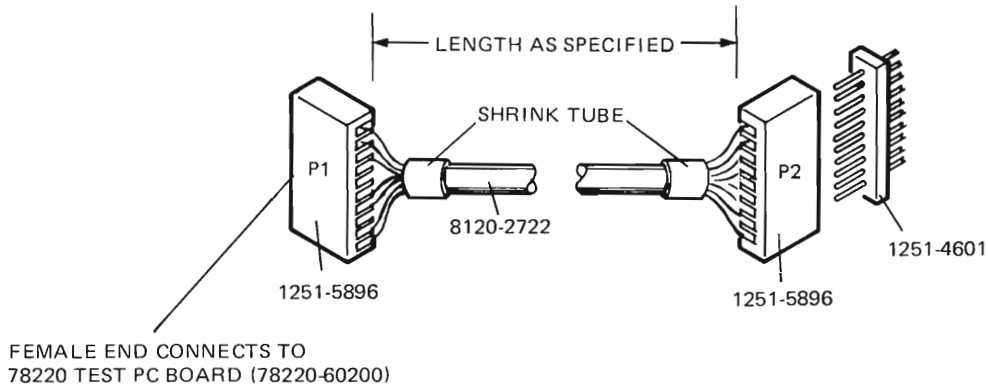
Figure 2-29. Communication Link Cable to 78511A Equipment Cabinet (78520-60020)



NOTE:

1. THIS ASSEMBLY SHOULD BE REPLACED IF FAULTY. COVERS ARE CEMENTED ON AND DIODES HAVE STEEL LEADS.
2. USE TOOL 8710-0653, T-HANDLE.
3. SEE FIGURE 2-14 FOR APPLICATION.

Figure 2-30. Alarm Steering Diode Assembly (78520-60030)

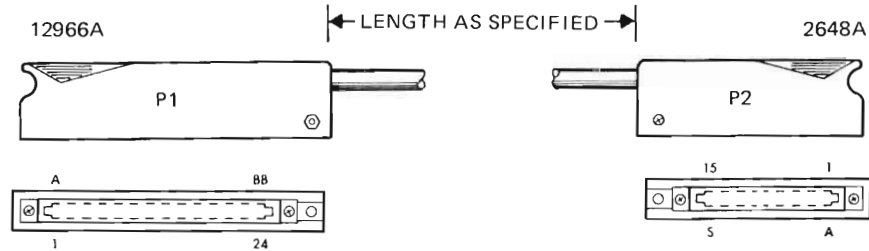


P1 Pins	Wire Color	P2 Pins	Signals
1	BRN	1	TEST
2	RED	2	FUNCTIONS
3	ORG	3	
4	YEL	4	
5	GRN	5	
6	BLU	6	
7	VIO	7	
8	GRY	8	
9	WHT	9	
10	WHT BRN	10	

NOTE: This test cable is pulled through the wall with the other cables going from the 78221A to the 78512A Display. It extends the test board, which is used in testing the system, over to the location of the Display since the Display is usually remote from the 78221A and cannot be seen during the test mode from the 78221A location.

For instructions that will permit field fabrication of this cable, refer to 500-Series Central Station Installation Guide 78500-91999.

Figure 2-31. Test Cable for 78221 Controller (78520-60050)



P1 PINS	WIRE COLOR	P2 PINS	SIGNAL	NOTES
D	GRN	C	TRANSMITTED DATA	JUMPER P1 AS FOLLOWS: A-1-12-13-14-15-SHIELD F-X-Y-AA H-K, N-H, W-5, 11-22, 4-21
R	ORG	L	EXTERNAL CLOCK	
S	RED	B	RECEIVED DATA	
Z	YEL	D	REQUEST TO SEND	
1	BRN	H	GROUND	
3	BLU	E	CLEAR TO SEND	JUMPER P2 AS FOLLOWS: E-J

Figure 2-32. Graphics Terminal 2648A Cable to 12966A I/O Card (05600-61000)

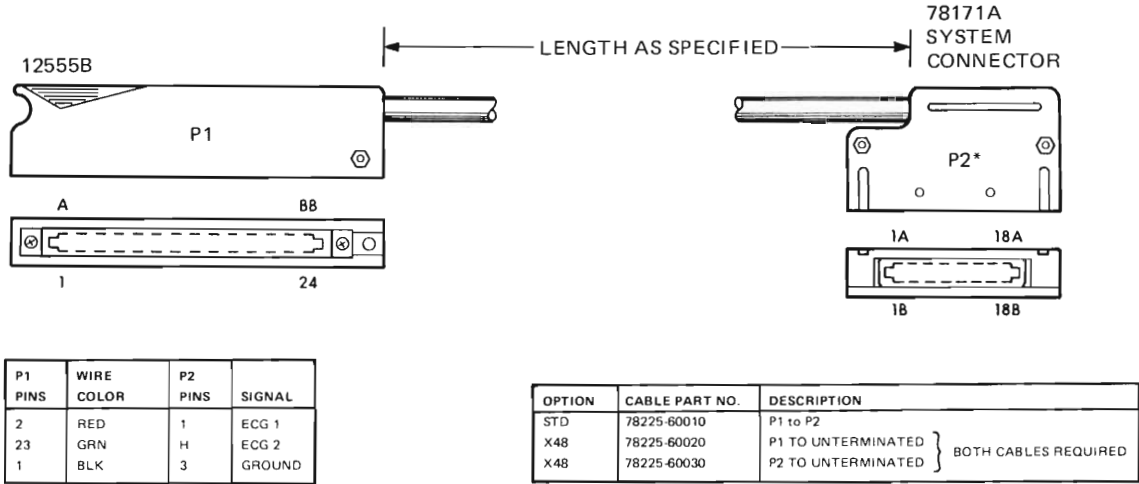


Figure 2-33. Recorder 78171A ECG Cables from 12555B I/O Card (78225-60010, 20, 30)

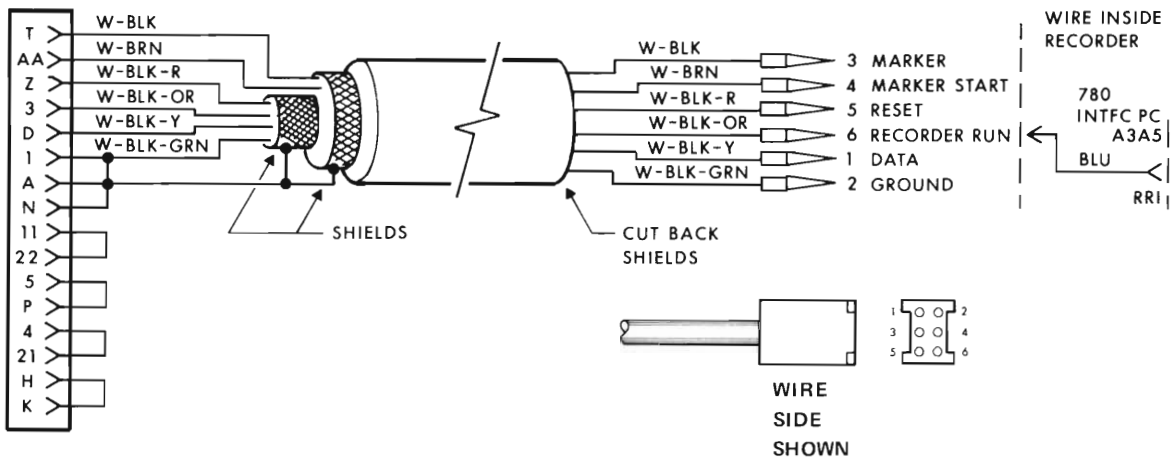


Figure 2-34. Recorder 78171A ASCII Cable from 12966A I/O Card (14177A)

2-22. Computer Junction Box Cables.

2-23. Use the following procedure to cable the 78220-60041 Junction Box. Pin destinations are listed in Tables 2-2 through Table 2-13.

The Pistol-Grip Insertion Tool (Part Number 8710-0636, see Figure 2-34) is used to insert individual wires into printed circuit contacts, Part Number 1251-3664.

Supplied with the insertion tool is an extractor (see Figure 2-35) for removing wires from the same type of terminals.

These instructions cover the use of the insertion tool and extractor and include procedures for tool inspection.

CAUTION

Read these instructions carefully before using insertion and extraction tools, to prevent equipment damage.

The insertion tool consists of a handle assembly, pusher pin assembly, pusher, spindle assembly (with spindle hook), collar, trigger assembly, hand strap, and wire extractor.

CAUTION

Do not attempt to disassemble the tool, other than removing the collar to replace the spindle assembly. To replace pusher pin assembly (when required) it is not necessary to remove collar.

The wire extractor is retained in the handle assembly and is used to remove wires from terminals (see Figure 2-35).

The protection cap provides protection for the tool and should ALWAYS be installed when the tool is not being used.

The spindle assembly can be rotated to any one of eight positions in relation to the handle assembly to adjust for terminal position and accessibility. The part number and insulation diameter range are molded into the sides of the mounting flange for reference.

A hand strap is anchored to the back of the handle assembly at one end. The other end is adjustable and hooks to the extractor when inserted in the bottom of the handle assembly.

2-24. Inspection of Insertion Tool.

Inspect all parts of tool before starting a job and occasionally during use as follows:

- a. Check the pusher pin assembly is in place and not bent.
- b. Inspect spindle hook for possible damage.
- c. Inspect tip of pusher for possible damage.
- d. Check tool for smooth operation by squeezing and releasing the trigger assembly.
- e. Check that collar is screwed down snugly on the spindle assembly.
- f. Remove any pieces of wire from pusher.

2-25. Using the Insertion Tool (Figure 2-36).

- a. Place wire in slot entrance of terminal so wire extends approximately one-half inch minimum beyond terminal cutter bar.
- b. For convenience of operation and accessibility to the terminal, the spindle assembly can be set to any one of eight positions. To do so, lay tool on right side (side with part number down), then loosen collar maximum of four turns. Pull spindle assembly out and rotate to the desired position. Push spindle assembly in so internal locators in the handle assembly enter notches in the mounting flange, then tighten collar.
- c. Place the spindle hook over terminal cutter bar.
- d. With pusher centered on slot in terminal, squeeze trigger assembly until it bottoms on the internal stop. This will extend the pusher the correct distance to shear the wire and make the proper termination. See Figure 2-36.

IMPORTANT: If wire is not cut clean, tool may be damaged or improperly assembled. Inspect tool as described.

- e. Remove spindle hook from terminal and visually inspect wire for proper termination. Remove end of wire that was cut off.

2-26. Using Extractor (Figure 2-35).

- a. Hook tip A of extractor blade onto wire as close as possible to terminal.
- b. Pull extractor straight out to free the wire from slit in terminal.
- c. If necessary, or more convenient, hook extractor blade over wire between cutter bar and slot in terminal, then perform Step b.

2-27. Inspection of Terminations.

Inspect terminations for proper wire insertions (Figure 2-36). Proper insertion should place wire and insulation below edge of terminal cutter bar. Wire and insulation should be sheared completely during insertion. Occasionally the following conditions may occur:

- a. Some types of soft insulation may not completely shear even though conductor is sheared. In this case, pull end of wire to break insulation not sheared. This will not affect the electrical connection.
- b. Terminal cutter bar may be bent out of position through abuse or after having been used many times. If conductor is sheared and the unsheared insulation breaks easily by pulling end of wire, termination should perform satisfactorily.

2-28. Probable Cause of Faulty Terminations.

- a. Conductor and insulation NOT sheared. Correct by reinstalling the tool over the wire and squeezing the trigger assembly until it BOTTOMS. Also refer to inspection of terminations, steps a and b.
- b. Tool has been damaged. Check by placing spindle hook over an empty terminal, then squeezing trigger assembly to make sure tip of pusher passes edge of cutter bar.
- c. Spindle assembly loose in tool. Make sure spindle assembly is keyed in position, then tighten collar.
- d. Tip of pusher damaged. Examine surface for nicks, grooves, or fractures.
- e. Spindle hook bent or broken.
- f. Bent pusher pin assembly. (If d, e, or f are true, do not use the tool.)

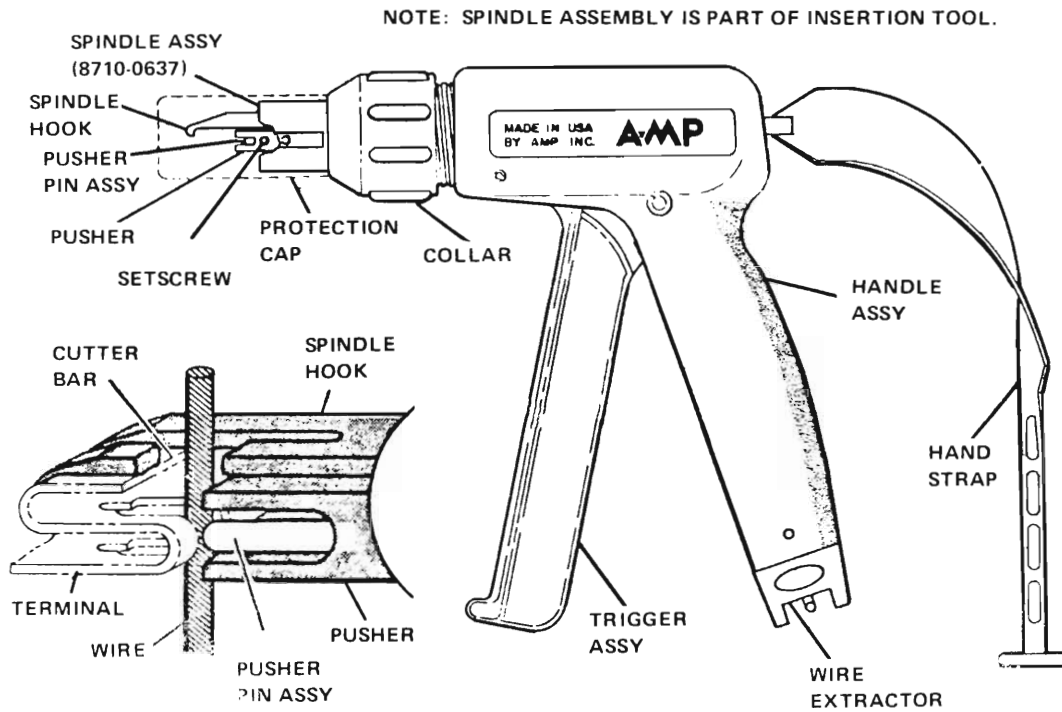


Figure 2-35. Pistol-Grip Insertion Tool

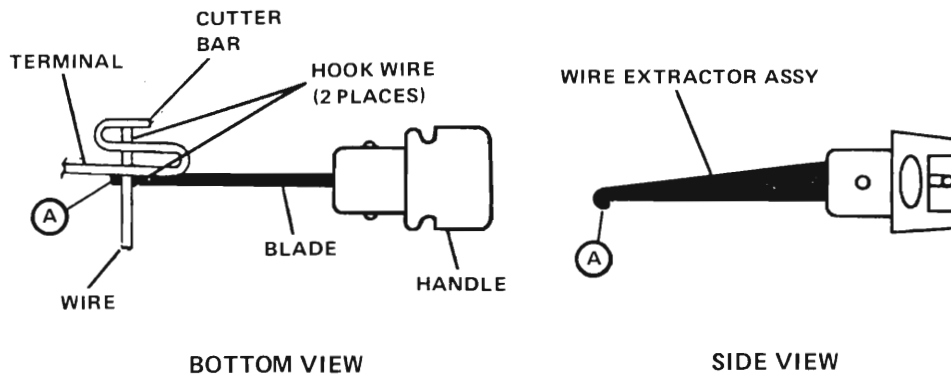


Figure 2-36. Wire Extractor

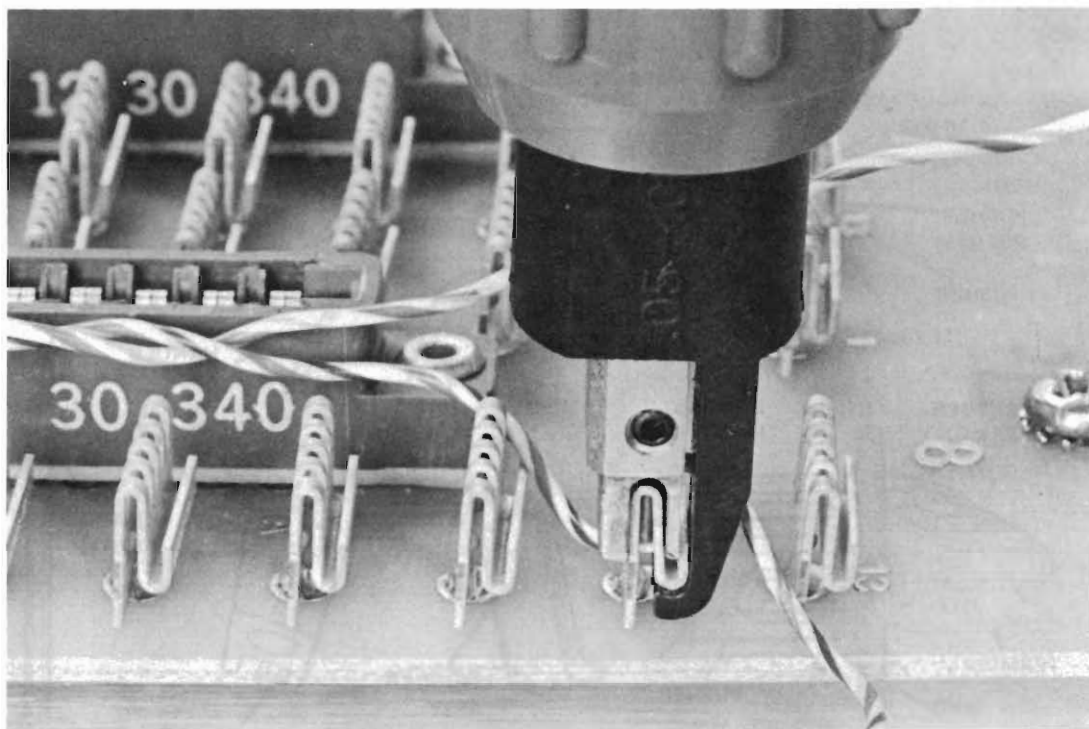


Figure 2-37. Proper use of Pistol-Grip Insertion Tool

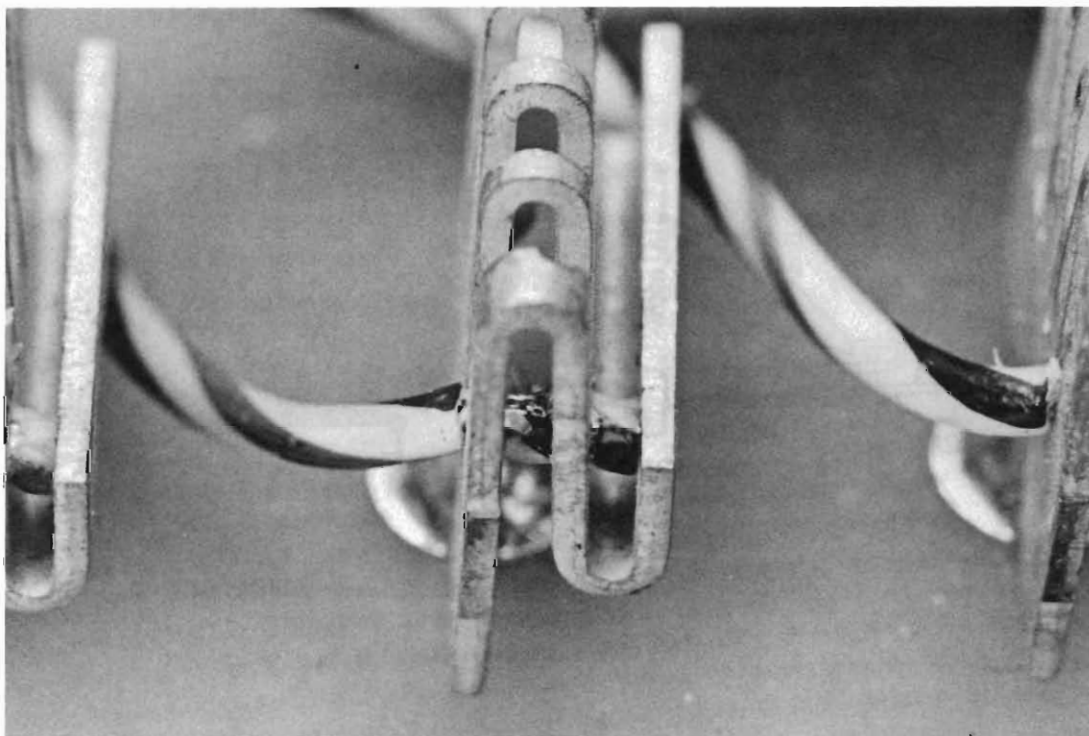
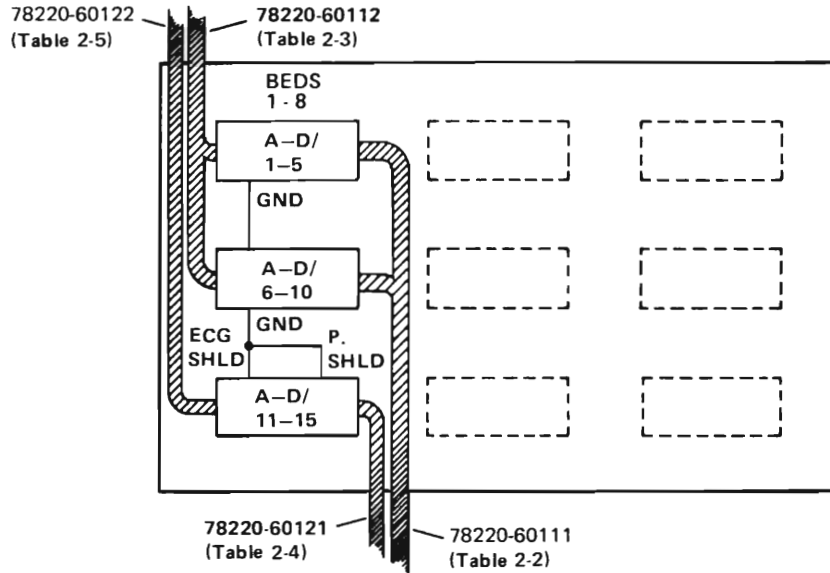


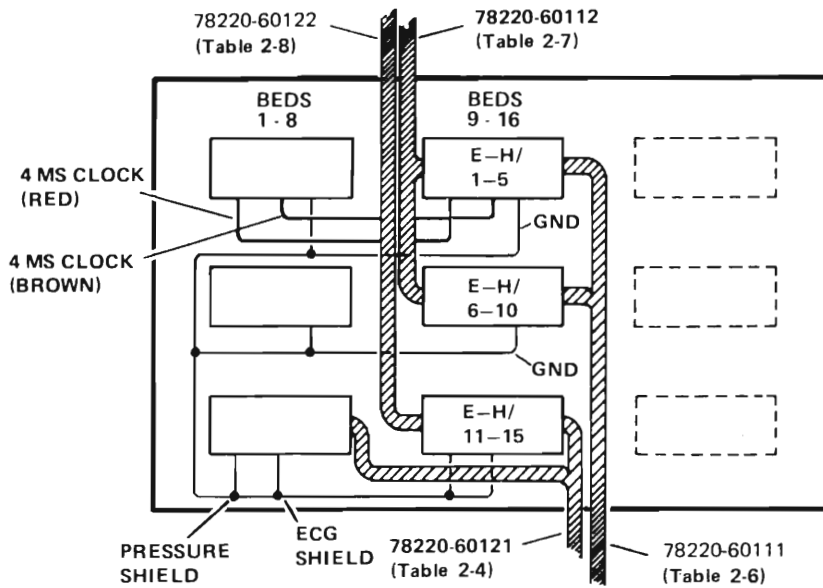
Figure 2-38. Proper Connection



SIGNAL NAMES BEDS 1-8

	A	B	C	D
1	PACE PULSE BED 1	PACE PULSE BED 3	PACE PULSE BED 5	PACE PULSE BED 7
2	PACE PULSE BED 2	PACE PULSE BED 4	PACE PULSE BED 6	PACE PULSE BED 8
3	TREND	ALARM RESET	NOISY SIGNAL	OFF LINE/ ALARM OFF
4	INVALID ECG	BED 1 BIT	EVENT	DISCHARGE
5	4 MS CLOCK (RED)	4 MS CLOCK (BRN)	GND	
6	SYSTEM ALARM BED 1	SYSTEM ALARM BED 3	SYSTEM ALARM BED 5	SYSTEM ALARM BED 7
7	SYSTEM ALARM BED 2	SYSTEM ALARM BED 4	SYSTEM ALARM BED 6	SYSTEM ALARM BED 8
8	RED ALARM	YELLOW ALARM	GREEN ALARM	COPY ENABLE
9	TEST BIT 1	TEST BIT 2	TEST BIT 3	TEST BIT 4
10	DEVICE COMMAND	GND		
11	ECG BED 1	ECG BED 3	ECG BED 5	ECG BED 7
12	ECG BED 2	ECG BED 4	ECG BED 6	ECG BED 8
13	ART BED 1	ART BED 3	ART BED 5	ART BED 7
14	ART BED 2	ART BED 4	ART BED 6	ART BED 8
15	ECG A/D INV INP	ECG SHLD INV INP	PRESSURE GND	PRESSURE SHIELD

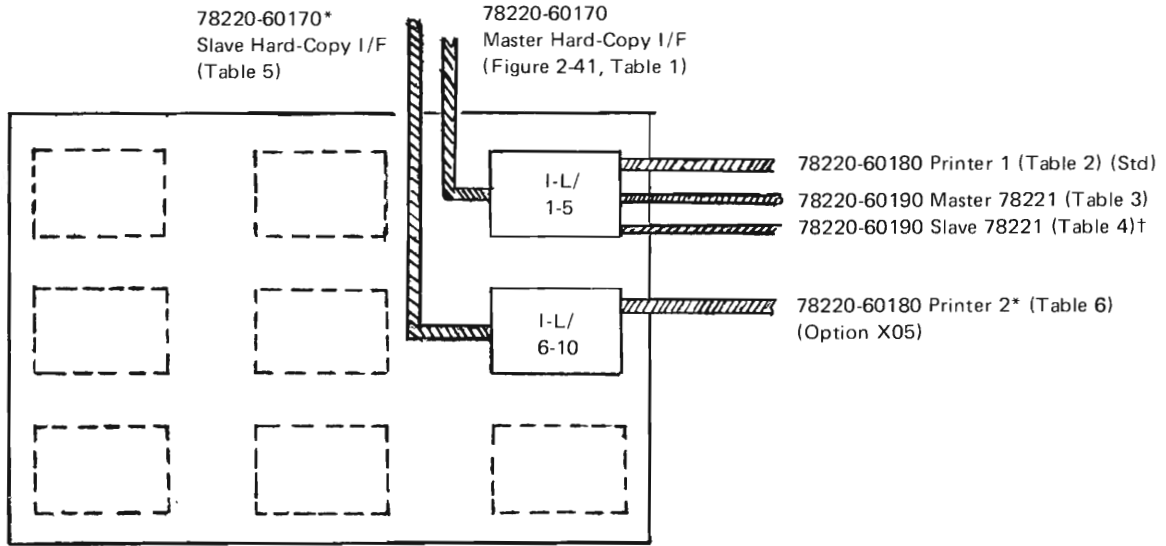
Figure 2-39. Signal Table, HP 78220-60041 Digital Junction Box (8-Bed Configuration)



SIGNAL NAMES BEDS 9-16

	E	F	G	H
1	PACE PULSE BED 9	PACE PULSE BED 11	PACE PULSE BED 13	PACE PULSE BED 15
2	PACE PULSE BED 10	PACE PULSE BED 12	PACE PULSE BED 14	PACE PULSE BED 16
3	TREND	ALARM RESET	NOISY SIGNAL	OFF LINE/ ALARM OFF
4	INVALID ECG	BED 1 BIT	EVENT	DISCHARGE
5	4 MS CLOCK (RED)	4 MS CLOCK (BRN)	GND	
6	SYSTEM ALARM BED 9	SYSTEM ALARM BED 11	SYSTEM ALARM BED 13	SYSTEM ALARM BED 15
7	SYSTEM ALARM BED 10	SYSTEM ALARM BED 12	SYSTEM ALARM BED 14	SYSTEM ALARM BED 16
8	RED ALARM	YELLOW ALARM	GREEN ALARM	COPY ENABLE
9	TEST BIT 1	TEST BIT 2	TEST BIT 3	TEST BIT 4
10	DEVICE COMMAND	GND		
11	ECG BED 9	ECG BED 11	ECG BED 13	ECG BED 15
12	ECG BED 10	ECG BED 12	ECG BED 14	ECG BED 16
13	ART BED 9	ART BED 11	ART BED 13	ART BED 15
14	ART BED 10	ART BED 12	ART BED 14	ART BED 16
15	ECG A/D GND	ECG SHLD	A/D GND	SHIELD

Figure 2-40. Signal Table, HP 78220-60041 Digital Junction Box (16-Bed Configuration)



*Delete on 8-bed system, or if 16-bed system, has only one printer.
 †Delete on 8-bed systems.

SIGNAL NAMES — HARD COPY SUBSYSTEM (OPTION X05)

	I	J	K	L
1	CONTROL	DATA 0	DATA 1	DATA 2
2	DATA 3	DATA 4	DATA 5	DATA 6
3	FLAG	GND	REM CPY 0	CPY GATE 0
4		GND	REM CPY 1	CPY GATE 1
5				
6	CONTROL	DATA 0	DATA 1	DATA 2
7	DATA 3	DATA 4	DATA 5	DATA 6
8	FLAG	GND		
9				
10				

Figure 2-41. Signal Table, HP 78220-60041 Junction Box, with HP 9866B Thermal Printer (Part 1 of 2)

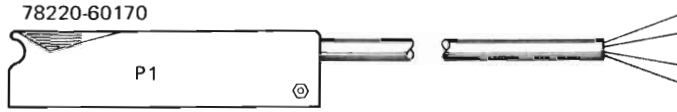


Table 1. Cable 78220-60170 (Master Hard-Copy Interface)

P1 PINS	WIRE COLOR	JUNCTION BOX TERMINAL	SIGNAL	NOTES
AA	CENTER	1I	CONTROL	CENTER COAXIAL COND CENTER AND OUTER SHIELDS
BB	SHIELDS	3J, 4J, 5J	GROUND	
A	WHT-BLU	1J	DATA 0	
B	BLU	1K	DATA 1	
C	WHT-RED	1L	DATA 2	
D	WHT-BRN	2I	DATA 3	
E	GRY	2J	DATA 4	
F	VIO	2K	DATA 5	
H	WHT-BLK	2L	DATA 6	
K	BLK	3L	COPY GATE 0	
L	WHT-GRN	4L	COPY GATE 1	
M	WHT-YEL	5L	COPY GATE 2	
9	RED	3K	REMOTE COPY 0	
10	GRN	4K	REMOTE COPY 1	
11	YEL	5K	REMOTE COPY 2	
23	WHT-ORG	3I	FLAG	

Table 5. Cable 78220-60170 (Slave Hard Copy Interface)

P1 PIN	WIRE COLOR	JUNCTION BOX TERMINALS	SIGNAL	NOTES
AA	CENTER	6I	CONTROL	CENTER COAXIAL CONDUCTOR CENTER AND OUTER SHIELDS
BB	SHIELDS	8J	GROUND	
A	W-BLU	6J	DATA 0	
B	BLU	6K	DATA 1	
C	WHT-RED	6L	DATA 2	
D	WHT-BRN	7	DATA 3	
E	GRY	7J	DATA 4	
F	VIO	7K	DATA 5	
H	WHT-BLK	7L	DATA 6	
23	WHT-ORG	8I	FLAG	

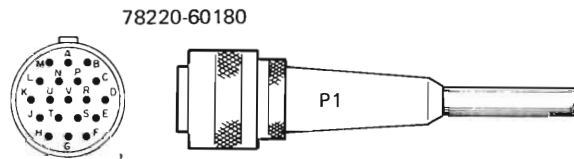


Table 2. Cable 78220-60180 (Printer No. 1)

P1 PINS	WIRE COLOR	JUNCTION BOX TERMINAL	SIGNAL	NOTES
A	CENTER	1I	CONTROL	CENTER COAXIAL CONDUCTOR CENTER AND OUTER SHIELDS
C	WHT-BLK	2L	DATA 6	
D	WHT-RED	1L	DATA 2	
E	BLU	1K	DATA 1	
F	WHT-BLU	1J	DATA 0	
H	WHT-ORG	3I	FLAG	
J	WHT-BRN	2I	DATA 3	
K	GRY	2J	DATA 4	
L	VIO	2K	DATA 5	
V	SHLDS	3J	GROUND	

Table 6. Cable 78220-60180 (Printer No. 2)

P1 PINS	WIRE COLOR	JUNCTION BOX TERMINAL	SIGNAL	NOTES
A	CTR	6I	CONTROL	CENTER COAXIAL CONDUCTOR CENTER AND OUTER SHIELDS
C	WHT-BLK	7L	DATA 6	
D	WHT-RED	6L	DATA	
E	BLU	6K	DATA 1	
F	WHT-BLU	6J	DATA 0	
H	WHT-ORG	8I	FLAG	
J	WHT-BRN	7I	DATA 3	
K	GRY	7J	DATA 4	
L	VIO	7K	DATA 5	
V	SHLDS	8J	GROUND	



Table 3. Cable 78220-60190 (Master 78221A)

P2 PINS	WIRE COLOR	JUNCTION BOX TERMINAL	SIGNAL	NOTES
RING	RFD	3K	REMOTE COPY 0	JUMPER
TIP	BLK	3L	REMOTE COPY GATE 0	
SLEEVE	SHIELD	3J, 4J	GROUND	

Table 4. Cable 78220-60190 (Slave 78221A)

P2 PINS	WIRE COLOR	JUNCTION BOX TERMINAL	SIGNAL	NOTES
RING	RFD	4K	REMOTE COPY 1	JUMPER
TIP	BLK	4L	COPY GATE 1	
SLEEVE	SHIELD	3J, 4J	GROUND	

Figure 2-41. Signal Table, HP 78220-60041 Junction Box, with HP 9866B Thermal Printer (Part 2 of 2)

Cable 78225-60020 (12665 D/A Card)

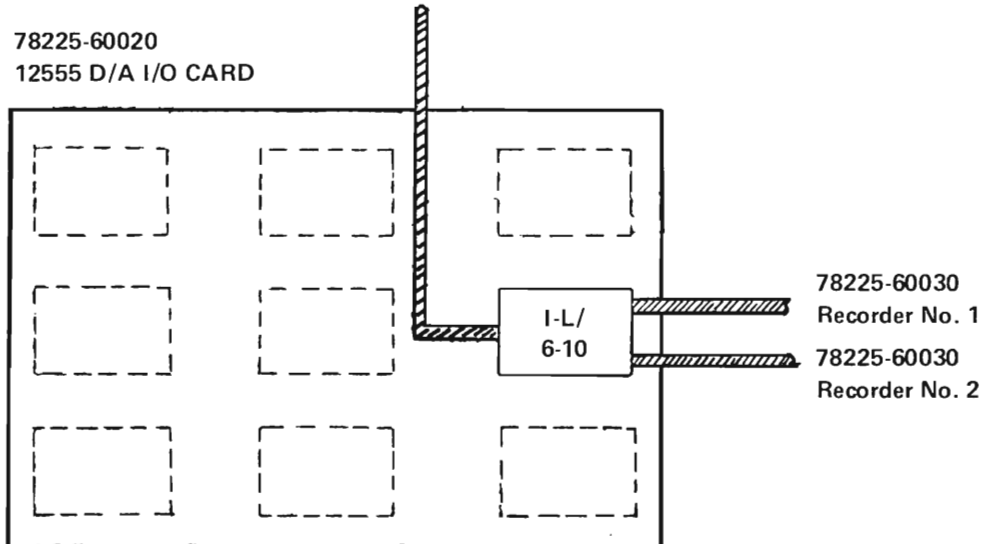
Wire Color	Terminal	Signal
RED	9I	D/A CH1
GRN	9J	D/A CH2
BLK	9K	D/A GND
WHT/BLK (shield)	9L	D/A SHIELD

Cable 78225-60030 (Recorder No. 1)

Wire Color	Terminal	Signal
RED	9I	D/A CH1
BLK	9K	D/A GND
WHT/BLK (shield)	9L	D/A SHIELD

Cable 78225-60030 (Recorder No. 2)

Wire Color	Terminal	Signal
RED	9J	D/A CH2
BLK	9K	D/A GND
WHT/BLK (shield)	9L	D/A SHIELD



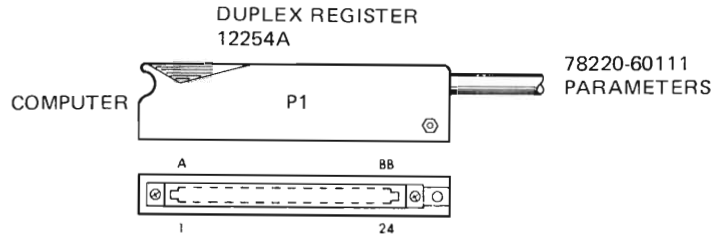
SIGNAL NAMES

	I	J	K	L
6	*	*	*	*
7	*	*	*	*
8	*	*		
9	D/A CH1	D/A CH2	D/A GND	D/ASHIELD
10				

*See Figure 2-24, Hard Copy Subsystem

Figure 2-42. Signal Table, HP 78220-60041 Central Station Junction Box, Multiple 78171 ECG Recall Recorders (Option X48)

Table 2-2. 78220-60111 Parameters Cable, Computer to J-Box 78220-60041, Connections for Beds 1-8

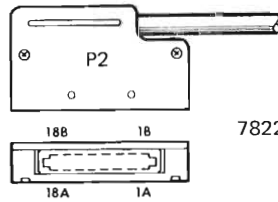


WIRE COLOR	J-BOX TERMINAL	P1	SIGNAL
O	1A	1	PACE PULSE BED 1
Y	2A	2	PACE PULSE BED 2
GRN	1B	3	PACE PULSE BED 3
BLU	2B	4	PACE PULSE BED 4
V	1C	5	PACE PULSE BED 5
GY	2C	6	PACE PULSE BED 6
W/BK	1D	7	PACE PULSE BED 7
W/BR	2D	8	PACE PULSE BED 8
W/R	3A	9	TREND DISPLAY
W/O	3B	10	ALARM RESET
W/Y	3C	11	NOISY SIGNAL
W/GRN	3D	12	OFF LINE/ALARM OFF
W/BLU	4A	13	INVALID ECG
W/V	4B	14	BED 1 BIT
W/GY	4C	15	EVENT MARKER
W/R/O	4D	16	DISCHARGE PATIENT
BN	5A	23	4 MS CLOCK
R	5B	23	4 MS CLOCK
W/BR/GRN	6A	A	SYSTEM ALARM BED 1
W/BR/Y	7A	B	SYSTEM ALARM BED 2
W/BR/O	6B	C	SYSTEM ALARM BED 3
W/BR/R	7B	D	SYSTEM ALARM BED 4
W/BK/BR	6C	E	SYSTEM ALARM BED 5
W/BK/R	7C	F	SYSTEM ALARM BED 6
W/BK/O	6D	H	SYSTEM ALARM BED 7
W/BK/Y	7D	J	SYSTEM ALARM BED 8
W/BK/GRN	8A	K	RED ALARM
W/BK/BLU	8B	L	YELLOW ALARM
W/BK/V	8C	M	GREEN ALARM
W/BK/GY	8D	N	COPY ENABLE
W	10A	AA	DEVICE COMMAND
SHIELD*	5C	24, BB	GND (TIE GO SYSTEM GND)
W/BR/BL	9A	P	TEST BIT 1
W/BR/V	9B	R	TEST BIT 2
W/BR/GY	9C	S	TEST BIT 3
W/R/Y	9D	T	TEST BIT 4

JUMPER

NOTE: CONTINUED IN TABLE 2-6 FOR BEDS 9-16.

Table 2-3. 78220-60112 Parameters Cable, 78221A to J-Box 78220-60041, Connections for Beds 1-8



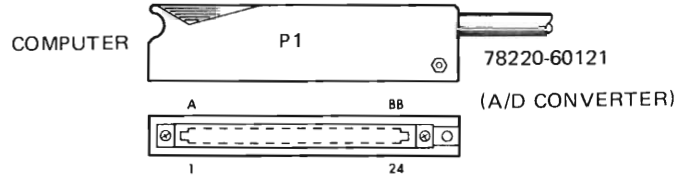
78221A DUPLEX REGISTER CONNECTOR

WIRE COLOR	J-BOX TERMINAL	P2	SIGNAL
O	1A	1B	PACE PULSE BED 1
Y	2A	2B	PACE PULSE BED 2
GRN	1B	3B	PACE PULSE BED 3
BLU	2B	4B	PACE PULSE BED 4
V	1C	5B	PACE PULSE BED 5
GY	2C	6B	PACE PULSE BED 6
W/BK	1D	7B	PACE PULSE BED 7
W/BR	2D	8B	PACE PULSE BED 8
W/R	3A	9B	TREND DISPLAY
W/O	3B	10B	ALARM RESET
W/Y	3C	11B	NOISY SIGNAL
W/GRN	3D	12B	OFF LINE/ALARM OFF
W/BLU	4A	13B	INVALID ECG
W/V	4B	14B	BED 1 BIT
W/GY	4C	15B	EVENT MARKER
W/R/O	4D	16B	DISCHARGE PATIENT
BN	5A	18B	4 MS CLOCK
R	5B	18B	4 MS CLOCK
W/BR/GRN	6A	1A	SYSTEM ALARM BED 1
W/BR/Y	7A	2A	SYSTEM ALARM BED 2
W/BR/O	6B	3A	SYSTEM ALARM BED 3
W/BR/R	7B	4A	SYSTEM ALARM BED 4
W/BK/BR	6C	5A	SYSTEM ALARM BED 5
W/BK/R	7C	6A	SYSTEM ALARM BED 6
W/BK/O	6D	7A	SYSTEM ALARM BED 7
W/BK/Y	7D	8A	SYSTEM ALARM BED 8
W/BK/GRN	8A	9A	RED ALARM
W/BK/BLU	8B	10A	YELLOW ALARM
W/BK/V	8C	11A	GREEN ALARM
W/BK/GY	8D	12A	COPY ENABLE
W	10A	18A	DEVICE COMMAND
SHIELD*	5C	17A, B	GND (TIE GO SYSTEM GND)
W/BR/BL	9A	13A	TEST BIT 1
W/BR/V	9B	14A	TEST BIT 2
W/BR/GY	9C	15A	TEST BIT 3
W/R/Y	9D	16A	TEST BIT 4

JUMPER

NOTE: CONTINUED IN TABLE 2-7 FOR BEDS 9-16.

Table 2-4. 78220-60121 ECG Cable, Computer to J-Box 78220-60041, Connections for Beds 1-16



WIRE COLOR	J-BOX TERMINAL	P1	REMARKS
BRN	11A	1	ECG BED 1
O	12A	3	ECG BED 2
Y	11B	4	ECG BED 3
BL	12B	6	ECG BED 4
W/BRN	11C	7	ECG BED 5
W/O	12C	9	ECG BED 6
W/Y	11D	10	ECG BED 7
W/BL	12D	12	ECG BED 8
W/BK/BRN	11E	13	ECG BED 9
W/BK/R	12E	15	ECG BED 10
W/BK/O	11F	16	ECG BED 11
W/BK/Y	12F	18	ECG BED 12
W/BK/G	11G	19	ECG BED 13
W/BK/BL	12G	21	ECG BED 14
W/BK/V	11H	22	ECG BED 15
W/BR/R	12H	24	ECG BED 16
W/BR/O	15A	23, AA	ECG A/D INV. INP. 1-8
W/BR/Y	15E	23, AA	ECG A/D INV. INP. 9-16
SHIELD*	15B	23, AA	GND

Table 2-5. 78220-60122 ECG Cable, 78221 Controller to J-Box 78220-60041, Connections for Beds 1-8

WIRE COLOR	J-BOX TERMINAL	P2	REMARKS
BRN	11A	1A	ECG BED 1
R	12A	2A	ECG BED 2
O	11B	3A	ECG BED 3
Y	12B	4A	ECG BED 4
GRN	11C	5A	ECG BED 5
BLU	12C	6A	ECG BED 6
V	11D	7A	ECG BED 7
GRY	12D	8A	ECG BED 8
BRN/W	15A	9A	A/D INV. INPUT.

NOTE: USE ONE -60122 CABLE FOR EACH 78221A — SEE TABLE 2-8 FOR BEDS 9-16.

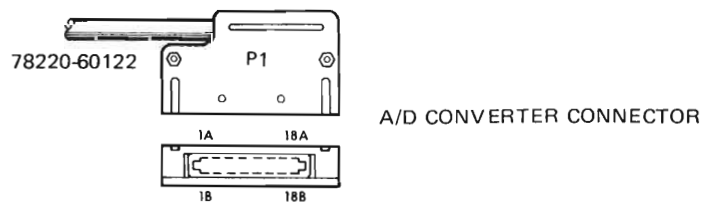


Table 2-6. 78220-60111 Parameters Cable, Computer to J-Box 78220-60041, Connections for Beds 9-16

WIRE COLOR	J-BOX TERMINAL	SIGNAL
O	1E	PACE PULSE BED 9
Y	2E	PACE PULSE BED 10
GRN	1F	PACE PULSE BED 11
BLU	2F	PACE PULSE BED 12
V	1G	PACE PULSE BED 13
GY	2G	PACE PULSE BED 14
W/BK	1H	PACE PULSE BED 15
W/BR	2H	PACE PULSE BED 16
W/R	3E	TREND DISPLAY
W/O	3F	ALARM RESET
W/Y	3G	NOISY SIGNAL
W/GRN	3H	OFF LINE/ALARM OFF
W/BLU	4E	INVALID ECG
W/V	4F	BED 1 BIT
W/GY	4G	EVENT MARKER
W/R/O	4H	DISCHARGE PATIENT
BN	5E	4 MS CLOCK
R	5F	4 MS CLOCK
W/BR/GRN	6E	SYSTEM ALARM BED 9
W/BR/Y	7E	SYSTEM ALARM BED 10
W/BR/O	6F	SYSTEM ALARM BED 11
W/BR/R	7F	SYSTEM ALARM BED 12
W/BK/BR	6G	SYSTEM ALARM BED 13
W/BK/R	7G	SYSTEM ALARM BED 14
W/BK/O	6H	SYSTEM ALARM BED 15
W/BK/Y	7H	SYSTEM ALARM BED 16
W/BK/GRN	8E	RED ALARM
W/BK/BLU	8F	YELLOW ALARM
W/BK/V	8G	GREEN ALARM
W/BK/GY	8H	COPY ENABLE
W	10E NOT CONNECTED*	DEVICE COMMAND
SHIELD**	5G	GND
W/BR/BL	9E	TEST BIT 1
W/BR/V	9F	TEST BIT 2
W/BR/GY	9G	TEST BIT 3
W/R/Y	9H	TEST BIT 4

*OR OPERATING LIGHT ON 78221 WILL FLASH (SVC-N-6).

**JUMP 10A TO 10E (SEE TABLE 2-7).

Table 2-7. 78220-60112 Parameters Cable, 78221A Controller to J-Box 78220-60041, Connections for Beds 9-16

WIRE COLOR	J-BOX TERMINAL	SIGNAL
O	1E	PACE PULSE BED 9
Y	2E	PACE PULSE BED 10
GRN	1F	PACE PULSE BED 11
BLU	2F	PACE PULSE BED 12
V	1G	PACE PULSE BED 13
GY	2G	PACE PULSE BED 14
W/BK	1H	PACE PULSE BED 15
W/BR	2H	PACE PULSE BED 16
W/R	3E	TREND DISPLAY
W/O	3F	ALARM RESET
W/Y	3G	NOISY SIGNAL
W/GRN	3H	OFF LINE/ALARM OFF
W/BLU	4E	INVALID ECG
W/V	4F	BED 1 BIT
W/GY	4G	EVENT MARKER
W/R/O	4H	DISCHARGE PATIENT
BN	5E	4 MS CLOCK
R	5F	4 MS CLOCK
W/BR/GRN	6E	SYSTEM ALARM BED 9
W/BR/Y	7E	SYSTEM ALARM BED 10
W/BR/O	6F	SYSTEM ALARM BED 11
W/BR/R	7F	SYSTEM ALARM BED 12
W/BK/BR	6G	SYSTEM ALARM BED 13
W/BK/R	7G	SYSTEM ALARM BED 14
W/BK/O	6H	SYSTEM ALARM BED 15
W/BK/Y	7H	SYSTEM ALARM BED 16
W/BK/GRN	8E	RED ALARM
W/BK/BLU	8F	YELLOW ALARM
W/BK/V	8G	GREEN ALARM
W/BK/GY	8H	COPY ENABLE
W	10E	DEVICE COMMAND
SHIELD*	5G	GND
W/BR/BL	9E	TEST BIT 1
W/BR/V	9F	TEST BIT 2
W/BR/GY	9G	TEST BIT 3
W/R/Y	9H	TEST BIT 4

NOTE: CONTINUED IN TABLE 2-10 FOR BEDS 17-24.

*TIE ALARM GND TO SYSTEM GND, -60010. JUMPER 5A, 5B, E, 5F CLOCK.

Table 2-8. 78220-60122 ECG Cable, 78221A Controller to J-Box 78220-60041, Connections for Beds 9-16

WIRE COLOR	J-BOX TERMINAL	REMARKS
BRN	11E	ECG BED 9
R	12E	ECG BED 10
O	11F	ECG BED 11
Y	12F	ECG BED 12
GR	11G	ECG BED 13
BL	12G	ECG BED 14
V	11H	ECG BED 15
GY	12H	ECG BED 16
BRN/W	15E	A/D INV. INPUT 9-16
SHIELD*	15F	ECG DIFF. INPUTS

*JUMPER 5C, 15B, 5G, 15F SHIELDS.

USE A/D CONVERTER CONNECTOR

78520-60010

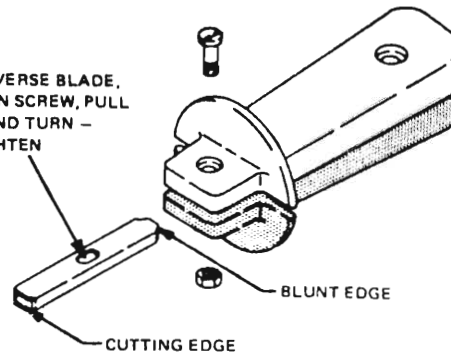
JUNCTION BOX CABLES

JUNCTION BOX WIRE INSERTING TOOL HP PART NUMBER 8710-0868

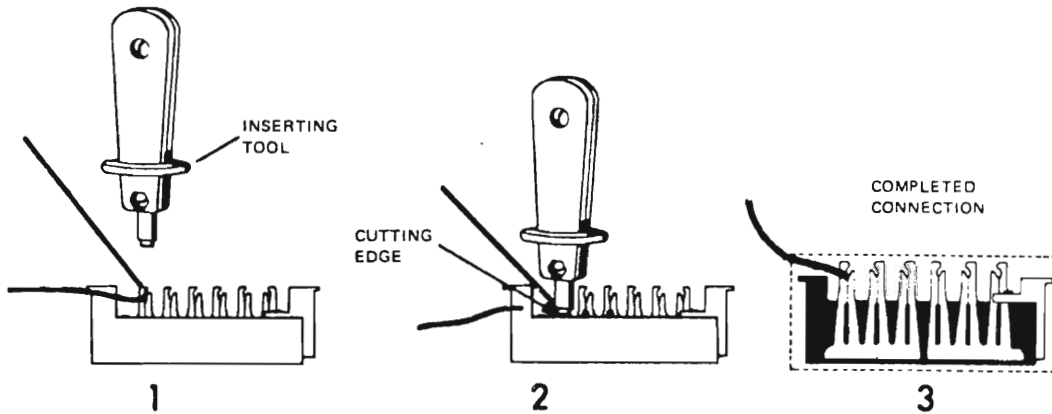
CONSTRUCTION OF INSERTING TOOL

INSERTING TOOL. The inserting tool is used to connect unstripped wires to spring-clip terminal blocks in the central station junction box. The construction of the inserting tool and the ways it is used are shown below. The blade has a cutting edge at one end and a blunt edge at the other. The cutting edge is used for trimming off excess wire at the spring clip, and the blunt edge is used to install jumpers between two or more sets of spring clips. The blade is reversed without removing the holding screw by loosening the screw and rotating the blade to the other position.

TO REVERSE BLADE,
LOOSEN SCREW, PULL
OUT AND TURN —
RETIGHTEN



CONNECTING AND TRIMMING WIRE



CONNECTING JUMPERS

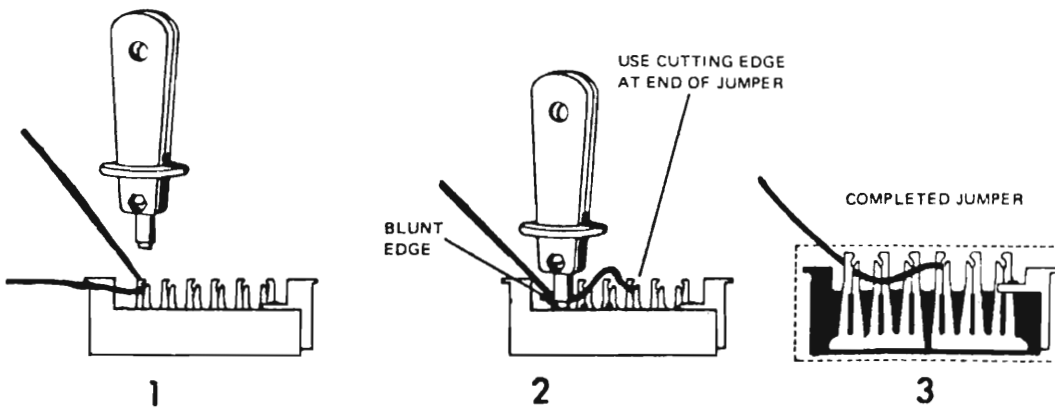
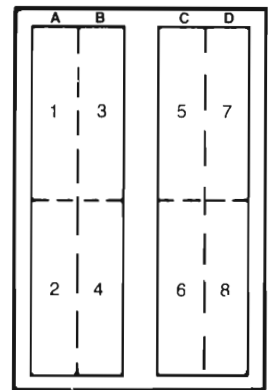


Figure 2-43. Junction Box Wire Inserting Tool 8710-0868

**BEDSIDE CABLES, 78511-62250,
AND 78511-62230 CABLES TO 78511A
RUN CABLES THROUGH THE TOP OF JUNCTION BOX**

WIRE COLOR	TERMINAL FOR BED:								78500-SERIES STANDARD II (3 PRESSURES)
	1	2	3	4	5	6	7	8	
BR	A1	A26	B1	B26	C1	C26	D1	D26	ECG
RED	A2	A27	B2	B27	C2	C27	D2	D27	A1 PULSE (or P3)
OR	A3	A28	B3	B28	C3	C28	D3	D28	SIG GND
Y	A4	A29	B4	B29	C4	C29	D4	D29	DEL ALARM
GRN	A5	A30	B5	B30	C5	C30	D5	D30	ALM GND
BLU	A6	A31	B6	B31	C6	C31	D6	D31	HEART RATE
VIOL	A7	A32	B7	B32	C7	C32	D7	D32	INOP
GRA	A8	A33	B8	B33	C8	C33	D8	D33	RGSG T
WH	A9	A34	B9	B34	C9	C34	D9	D34	ALARM
W BK	A10	A35	B10	B35	C10	C35	D10	D35	TEMP 1
W BR	A11	A36	B11	B36	C11	C36	D11	D36	RESP RATE/
W RED	A12	A37	B12	B37	C12	C37	D12	D37	DEL INOP
W OR	A13	A38	B13	B38	C13	C38	D13	D38	P2 WAVE (PA)
W Y	A14	A39	B14	B39	C14	C39	D14	D39	P1 WAVE (ART)
W GRN	A15	A40	B15	B40	C15	C40	D15	D40	SYST PI
W BLU	A16	A41	B16	B41	C16	C41	D16	D41	DIAS PI
W VIOL	A17	A42	B17	B42	C17	C42	D17	D42	P2 MEAN ()
W GRA	A18	A43	B18	B43	C18	C43	D18	D43	SYST P2/TEMP 2
BLACK	A19	A44	B19	B44	C19	C44	D19	D44	DIAS P3
W BK BRN	A20	A45	B20	B45	C20	C45	D20	D45	MEAN P3
W BK R	A21	A46	B21	B46	C21	C46	D21	D46	STANDBY
W BK OR	A22	A47	B22	B47	C22	C47	D22	D47	DIAS P2
W BK Y	A23	A48	B23	B48	C23	C48	D23	D48	MEAN P1
W BK GRN	A24	A49	B24	B49	C24	C49	D24	D49	CONTROL
W BK BLU SHIELD									(CUT OFF) TIED TO ALM GND AT BEDSIDE

WIRE THESE CABLES FROM THIS END



78520 60010
JCT BOX ASS'Y
(discontinued 11/80)

* Venous pressure in patient monitoring systems

**TELEMETRY CABLES
78520-60040
TO JUNCTION BOX
RUN CABLES THROUGH THE TOP OF JUNCTION BOX**

WIRE COLOR	TERMINAL FOR BED:								SIGNAL
	1	2	3	4	5	6	7	8	
BROWN	A1	A26	B1	B26	C1	C26	D1	D26	ECG
RED	A7	A32	B7	B32	C7	C32	D7	D32	INOP
ORANGE	A3	A28	B3	B28	C3	C28	D3	D28	SIGNAL GND
GREEN	A9	A34	B9	B34	C9	C34	D9	D34	ALARM
YELLOW	A6	A31	B6	B31	C6	C31	D6	D31	STATUS
SHIELD	A5	A30	B5	B30	C5	C30	D5	D30	ALM GND

NOTE: Control terminal 24 must be jumpered to alarm ground on telemetry beds.

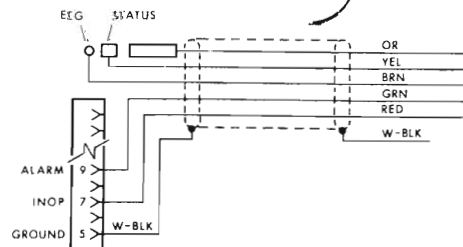
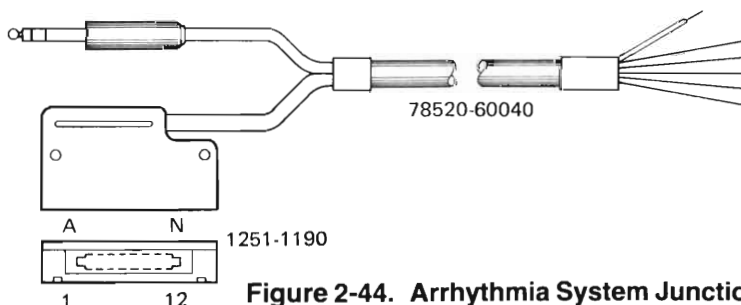


Figure 2-44. Arrhythmia System Junction Box 78520-60010 Wiring (Sheet 1 of 2)

**14014-60400 ALARM CABLE TO 78221A
RUN CABLES THROUGH THE BOTTOM OF JUNCTION BOX**

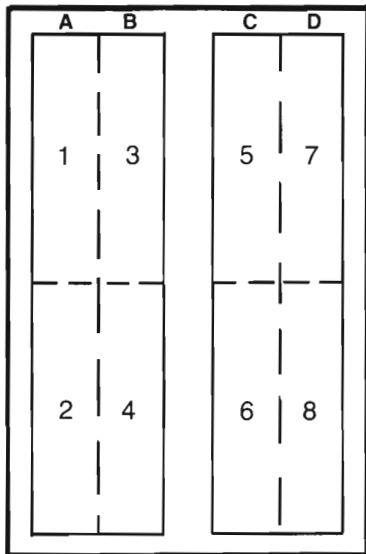
WIRE COLOR	FROM	TO	SIGNAL	
BR	P1-1	A9	ALARM	BED 1
RED	P1-2	A34		2
OR	P1-3	B9		3
YEL	P1-4	B34		4
GRN	P1-5	C9		5
BLU	P1-6	C3		6
VIOL	P1-7	D9		7
GRA	P1-8	D34		8
WHITE	P1-9	A7	INOP	BED 1
W BLK	P1-10	A32		2
W BRN	P1-11	B7		3
W RED	P1-12	B32		4
W OR	P1-13	C7		5
W YEL	P1-14	C32		6
W GRN	P1-15	D7		7
W BLU	P1-16	D32		8
W VIOL	P1-17	A21	STAND BY	BED 1
W GRA	P1-18	A46		2
BLACK	P1-19	B21		3
W BK BR	P1-20	B46		4
W BK R	P1-21	C21		5
W BK OR	P1-22	C46		6
W BK YEL	P1-23	D21		7
W BK GRN	P1-24	D46		8
W BK BLU				(CUT OFF)

**14014-60400 PARAMETERS CABLE TO 78221A
RUN CABLES THROUGH THE BOTTOM OF JUNCTION BOX**

WIRE COLOR	FROM	TO	SIGNAL	
W-OR	P1-13	A-1	REAL TIME ECG,	BED 1
W YEL	P1-14	A26		2
W GRN	P1-15	B1		3
W BLU	P1-16	B26		4
W VIOL	P1-17	C1		5
W GRAY	P1-18	C26		6
BLACK	P1-19	D1		7
W BK BR	P1-20	D26		BED 8
W BK GRN	P1-24	A5, B5, C5, D5 A30, B30, C30, D30	ALARM GND	

78220-60121 PRESSURES CABLE to 2113E COMPUTER

Option S20 Only. One -60121 Cable is used for each set of 8 beds, so wiring noted for Beds 1-8, 9-16, is similar. See Table 2-9 for wiring.



78520-60010
JCT BOX ASS'Y

INTERNAL WIRING

1. ALARM GND
A5-B5-C5-D5-
A30-B30-C30-D30
- 2.

WIRE THESE CABLES
FROM THIS END

AVAILABLE PINS: A-B-C-D: 25 and 50

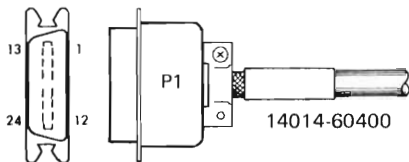
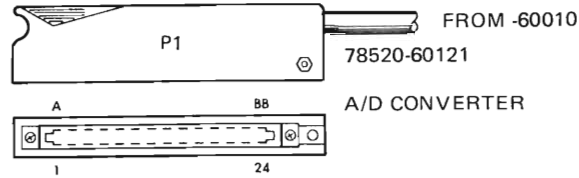


Figure 2-44. Arrhythmia System Junction Box 78520-60010 Wiring (Sheet 2 of 2)

Table 2-9. 78220-60121 Pressure Cable (Option S20 Only), from 78520-60010 Junction Box to 91000A A/D Computer Input



NOTE: ART Pressure is 78500-Series System Pressure P1 (Wave)
 PA Pressure is System Pressure P2 (Wave)

-60121 CABLE WIRE COLOR	J-BOX TERMINAL	P1	BED NUMBER / REMARKS
BRN	A14	1	ART 1 / 9
O	A13	3	PA 1 / 9
Y	A39	4	ART 2 / 10
BLU	A38	6	PA 2 / 10
W/BRN	B14	7	ART 3 / 11
W/O	B13	9	PA 3 / 11
W/Y	B39	10	ART 4 / 12
W/BL	B38	12	PA 4 / 12
W/BK/BRN	C14	13	ART 5 / 13
W/BK/R	C13	15	PA 5 / 13
W/BK/O	C39	16	ART 6 / 14
W/BK/Y	C38	18	PA 6 / 14
W/BK/G	D14	19	ART 7 / 15
W/BK/BL	D13	21	PA 7 / 15
W/BK/V	D39	22	ART 8 / 16
W/BR/R	D38	24	PA 8 / 16
W/BR/O	A5 (1)	23, AA	GND* BEDS 1-8
W/BR/Y	A5 (2)	23, AA	GND* BEDS 9-16
SHIELD	B5	23, AA	GND

KIT 14352A	ECG		
	To J9 14014 - 60400		
	#22 AWG Wire Champ Connector 1251-3840 Has Green Dot		
WIRE COLOR	Display:		
	Horiz	Vert	SIG.
BRN	1		
RED	2		
ORG	3		
YEL	4		
GRN	5		
BLU	6		
VIO	7		
GRY	8		
WHT	9		
W BLK	10		
W BRN	11		
W RED	12		
W ORG	13	13	BED 1
W YEL	14	17	2
W GRN	15	14	3
W BLU	16	18	4
W VIO	17	15	5
W GRY	18	19	6
BLK	19	16	7
W B BRN	20	20	8
W B RED	21		
W B ORG	22		
W B YEL	23		
W B GRN	24	24	ALM GND
W B BLU			
SHIELD	CUT OFF		

KIT 14352A	Alarm			
	To J10 14014 - 60440			
	#22 AWG Wire Champ Connector 1251-3840 Has Green Dot			
WIRE COLOR	Display:			
	Horiz	Vert	SIG.	
BRN	1	1	ALM	BED 1
RED	2	5		2
ORG	3	2		3
YEL	4	6		4
GRN	5	3		5
BLU	6	7		6
VIO	7	4		7
GRY	8	8	ALM	BED 8
WHT	9	9	INOP	BED 1
W BLK	10	13		2
W BRN	11	10		3
W RED	12	14		4
W ORG	13	11		5
W YEL	14	15		6
W GRN	15	12		7
W BLU	16	16	INOP	8
W VIO	17	17	STD BY	1
W GRY	18	21		2
BLK	19	18		3
W B BRN	20	22		4
W B RED	21	19		5
W B ORG	22	23		6
W B YEL	23	20		7
W B GRN	24	24	STD BY	8
W B BLU				
SHIELD	CUT OFF			

NO CONNECTION

ARRHYTHMIA SYSTEM JUNCTION BOX 78520-60060 OR -60070

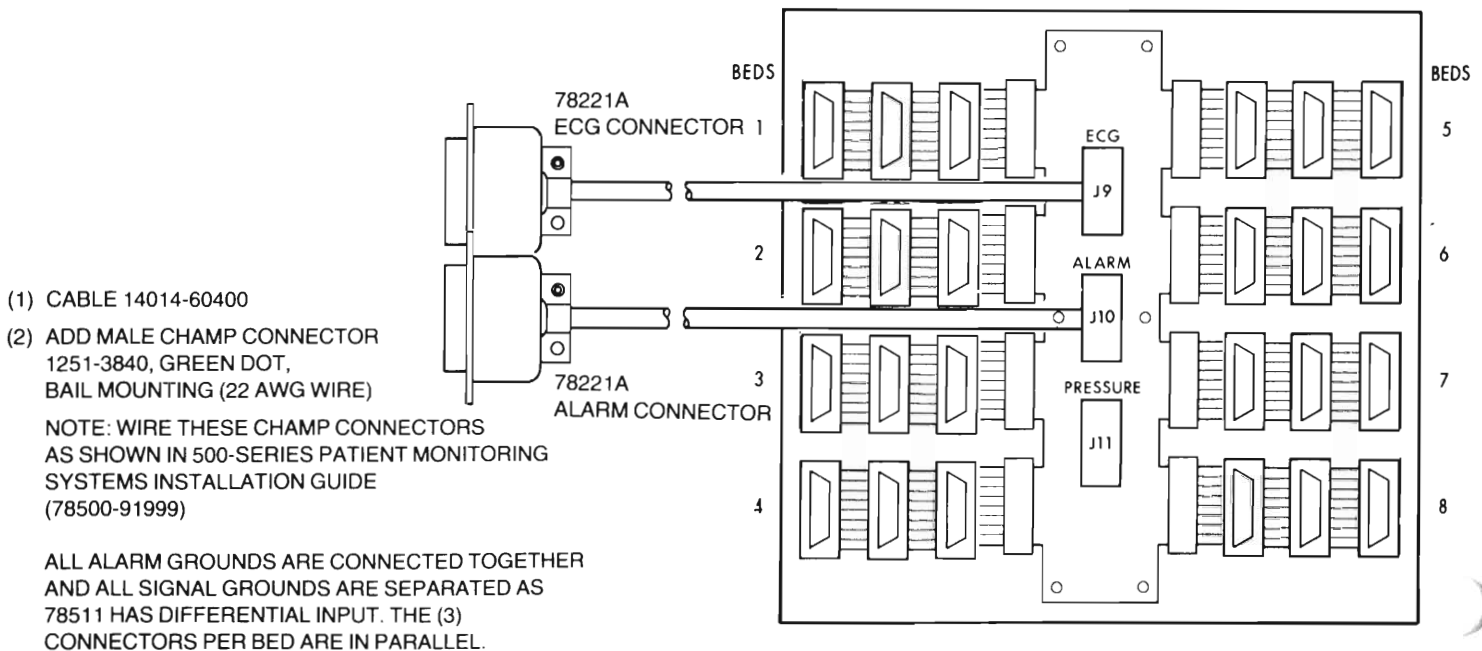


Figure 2-45. Arrhythmia System Junction Box 78520-60060 or 78520-60070 (Sheet 1 of 3)

KIT 14342A	Bedside Cable	
	78511-62230 -62235 -62250	
WIRE COLOR	#22 AWG Wire Champ Connector 1251-5530 Has Green Dot	
	Pin	Signal
BRN	1	ECG
RED	2	A1 PULSE
ORG	3	SIG GND
YEL	4	DEL ALARM
GRN	5	ALARM GND
BLU	6	HEART RATE
VIO	7	INOP
GRY	8	RESET
WHT	9	ALARM
W BLK	10	TEMP 1
W BRN	11	RESP RATE/P3
W RED	12	DEL INOP
W ORG	13	P2 WAVE (VEN)
W YEL	14	P1 WAVE (ART)
W GRN	15	SYSTOL P1
W BLU	16	DIASTOL P1
W VIO	17	P2 MEAN (VEN)
W GRY	18	SYSTOL P2/TEM 2
BLK	19	DIASTOL P3
W B BRN	20	MEAN P3
W B RED	21	STAND BY
W B ORG	22	DIASTOL P2
W B YEL	23	MEAN P1
W B GRN	24	CONTROL
W B BLU	CUT OFF	
SHIELD	5	TIE TO ALM GND

KIT 14353A	Pressure		
	To J11 78220 - 60121		
WIRE COLOR	#24 AWG Wire Champ Connector 1251-6126 Has Red Dot		
	Display: Horiz Vert SIG.		
BRN	1	1	ART 1/9
RED			
ORG	2	2	PA 1/9
YEL	3	5	ART 2/10
GRN			
BLU	4	6	PA 2/10
VIO			
GRY			
WHT			
W BLK			
W BRN	5	9	ART 3/11
W RED			
W ORG	6	10	PA 3/11
W YEL	7	13	ART 4/12
W GRN			
W BLU	8	14	PA 4/12
W VIO			
W GRY			
BLK			
W B BRN	9	3	ART 5/13
W B RED	10	4	PA 5/13
W B ORG	11	7	ART 6/14
W B YEL	12	8	PA 6/14
W B GRN	13	11	ART 7/15
W B BLU	14	12	PA 7/15
SHIELD	17	17	GND
W B VIO	15	15	ART 8/16
W B GRY			
W BRN RED	16	16	PA 8/16
W BRN ORG	17	17	GND
W BRN YEL	17	17	GND

Figure 2-45. Arrhythmia System Junction Box 78520-60060 or 78520-60070 (Sheet 2 of 3)

14039A — E 8-Ch. Switch		
Cable 14028A (2 REQD)		
WIRE COLOR	#24 AWG Wire Champ Connector 1251-6126 Has Red Dot	
	Pin	Signal
BRN		WHEN 78340
RED		SERIES, CONNECT
ORG		WIRE ON PIN 2 (*)
YEL		TO PIN 12
GRN		INSTEAD:
BLU		(DATA SYNC)
VIO		
GRY		
WHT		
W BLK	P1-1	ECG
W BRN	P1-3	SIG GND
W RED	P1-2	* P3
W ORG	P1-4	DATA SOURCE
W YEL	P1-13	P2
W GRN	P1-14	P1
W BLU	P1-19	RESP.
W VIO	P1-20	CO ₂
W GRY	P2-1	ECG
BLK		
W B BRN	P2-3	SIG GND
W B RED	P2-2	* P-3
W B ORG	P2-4	DATA SOURCE
W B YEL	P4-1	GCG
W B GRN	P4-3	SIG GND
W B BLU	P2-13	P2
SHIELD	P4-5	ALM GND
W B VIO	P2-14	P1
W B GRY	P2-19	RESP
W BRN RED	P2-20	CO ₂
W BRN ORG	P3-1	ECG
W BRN YEL	P3-3	SIG GND
W BRN GRN	P3-2	* P3
W BRN BLU	P3-4	DATA SOURCE
W BRN VIO	P3-13	P2
W BRN GRY	P3-14	P1
W RED ORG	P3-19	RESP
W RED YEL	P3-20	CO ₂
W RED GRN	P4-2	* P3
W RED BLU	P4-4	DATA SOURCE
W RED VIO	P4-13	P2
W RED GRY	P4-14	P1
W OR YEL	P4-19	RESP
W ORG GRN	P4-20	CO ₂
W ORG BLU	P3-6	ALM GND
W ORG VIO	P2-5	ALM GD

KIT 14346A		Telemetry 78520 60040	
WIRE COLOR	#22 AWG Wire Champ Connector 1251-5530 Has Green Dot		
	Pin	Signal	
BRN	1	ECG	
RED	7	INOP	
ORG	3	SIG GND	
YEL	6	STATUS	
GRN	9	ALARM	
BLU			
VIO			
GRY			
WHT			
W BLK			
W BRN			
W RED			
W ORG			
W YEL			
W GRN			
W BLU			
W VIO			
W GRY			
BLK			
W B BRN			
W B RED			
W B ORG			
W B YEL			
W B GRN			
W B BLU			
SHIELD	5, 24	ALM GND	

*SEE NOTE
*TERMINAL 24 MUST BE JUMPERED TO TERMINAL 5, (ALM GND) PLUS SHIELD CONNECTION

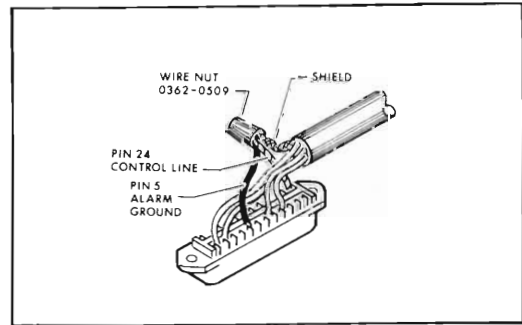


Figure 2-45. Arrhythmia System Junction Box 78520-60060 or 78520-60070 (3 of 3)

Table 2-10. 78520/78525 Arrhythmia System Cable Index

Arrhythmia System Cable Number	Function	Overall Diagram	Hookup Diagrams	Pinout Table or Schematic	REMARKS
00780-60400	Faceplate	2-17	None	500 Inst. Guide	Bedside
05600-61000	Terminal	2-17	2-18, 2-22	2-32	
05670-60230	91200 I/O to 78512	2-17	2-18, 2-20	2-25	Video
12665-60003	12771 I/O to PDMS	—	2-18	—	System Data
13037-60030	13175 Disc I/O	2-17	2-18, 2-24 (4)		To 13037 Control
14014-60400	Analog J-Box to 78221A	2-17	2-19, 2-44, 2-45	2-44, 2-45	Parameters or Alarms
14028A (was 78520-60080)	Switch 14039A	—	2-45	2-45	
14177A	12966 I/O to 78171	2-17	2-18, 2-23	2-34	ASCII
78220-60041	Digital J-Box	2-17	2-39, 2-40, 2-41		In Arrhyth. Console
78220-60111	Parameters 2113E	2-17	2-18, 2-35, 2-40, and	Table 2-2, 2-6	-60041 J-Box
78220-60112	Parameters 78221	2-17	2-39, 2-40, and	Table 2-3, 2-7	To -60041 J-Box
78220-60121	Analog J-Box to 91000I/O	2-17	2-18, 2-39, 2-40, and	Table 2-4, 2-9, 2-45	Pressure Opt S20
78220-60122	78221 to Digital J-Box	2-17	2-19, 2-39, 2-40, and	Table 2-5, 2-8	ECG
78220-60170	12554 I/O to Digital J-Box	2-17	2-18, 2-41	2-41	Print Data 9866
78220-60180 (Opt X05)	Digital J-Box to 98668	2-17	2-21, 2-41	2-41	Print Data 9866
78220-60190	Master/Slave 78221	2-17	2-19, 2-41	2-41	Print Control 9866
78225-60010 (Recall Opt M90)	12665 I/O to 78171	2-17	2-18, 2-23	2-33	Analog (single)
78225-60020 (w/2 M90)	12665 to Digital J-Box	2-17	2-18, 2-42	2-33	Analog (Opt X48)
78225-60030 (w/2 M90)	Digital J-Box to 78171 (2)	2-17	2-23, 2-42	2-33	Analog (Opt X48)
78511-62230	Analog J-Box to 78511	2-17	2-44, 2-45	2-44, 2-45	See 500 C/Sta. Inst. G.
78511-62235	Faceplate to Analog J-Box	2-17	2-45	2-45	See 500 C/Sta. Inst. G.
78511-62240	Conn. (2) 78511-60410			2-27	Inside 78511A
78511-62250	Faceplate to Analog J-Box		2-44, 2-45	2-44, 2-45	
78512-60200	78221 to 78512	2-17	2-19, 2-20	2-26	Parameters
78512-60400	78221 to 78512	2-17	2-19, 2-20	2-28	ECG or Alarms
78520-60010	Analog Junction Box	1-3, 2-17	2-44	2-44, Table 2-9	Obsolete 11/80
78520-60020	12966 I/O to 78511	2-17	2-18	2-29	Communication Link
78520-60030	Diode Assy (78221)	2-17	2-19	2-30	For Cable 14014-60400 Alm.
78520-60040	78101 to Analog J-Box	2-17	2-44, 2-45	2-44, 2-45	Telemetry
78520-60050	Test Cable-78221	2-17		2-31	Used for test only.
78520-60060	Analog J-Box (Plate)	1-3, 2-17	2-45	—	Straps for console
78520-60070	Analog J-Box (Wall)	1-3, 2-17	2-45	—	In metal box

SECTION III SYSTEM DIAGNOSTICS

3-1. GENERAL INFORMATION.

3-2. This section provides information and procedures used to execute diagnostic routines which exercise the arrhythmia section of the 78525 System and its link to the 78501/78502 section. (Diagnostics for testing the 78501/78502 Central Station are described in the 78501/78502 Service Manual.) All of the arrhythmia diagnostics are provided on three magnetic tape cassettes as listed in Table 3-1.

3-3. Although a variety of diagnostic cassette tapes are available for the 78525 System, this section of the manual describes only the System Diagnostic sequence; i.e., file number 1 on cassette number 3. This diagnostic sequence will provide adequate testing of the complete arrhythmia section of the system. If further testing is desired, instructions for executing the remaining diagnostic sequences listed in Table 3-1 are provided in the Manual of Diagnostics, Part Number 24396-14001.

3-4. The System Diagnostic can be read into computer memory via the associated 2648 Terminal at the recall/edit station. The entire diagnostic sequence consists of the following tests:

Test 1—Checks the video portion of the arrhythmia system, excluding the video pattern ROMs, by testing the 91200B PC Board in the computer and the 78512 Controller/Monitor Display unit including the video cable.

Test 2—Extends Test 1 by adding a test of the computer video pattern ROMs and 12554A Sixteen-Bit Duplex Register PC Boards. Test 2 also tests the 78221 Front Panel PC Board (60150), the Clock/Driver PC Board (60130), the controls at the 78512, and the 9866 Printer.

Test 3—Tests the A/D Converter PC Board (91000A) in the computer and its interface cabling to the 78221 Controller, checking the channel for each patient connected to the central station.

Test 4—Tests the ECG filters on the Pace Pulse Detector PC Board (60160) in the 78221 Controller, and the associated interface cabling.

Test 5—Tests the Aztec ROMs in the computer, and the noise and pace pulse filters on the Pace Pulse Detector PC Board in the 78221 Controller.

Test 6 (Link Test)—Seven subtests which test the communications link between the computer and 78511 Equipment Cabinet in the 78501/78502 Central Station. The interface cabling as well as the Communications PC Board in the 78511 (60410) and the Communications PC Board in the computer (12966) are exercised.

Test 7—This test is executed only if the system contains Option S20 for pressure processing. When executed, the diagnostic tests the 91000A Pressure A/D Converter PC Board and pressure cabling.

NOTE: If the arrhythmia system is linked to a 78706 Patient Data Management System (PDMS), refer to Appendix C in this manual for PDMS link diagnostic procedures.

Table 3-1. Diagnostic Cassette Tapes

TAPE NO. 1 — CPU AND MEMORY DIAGNOSTICS

File No.	Description	Diagnostic Serial No.
1	Diagnostic Configurator	000200
2	Mem. Per. Inst. Group	101100
3	Alter Skip Inst. Group	101001
4	Shift Rotate Inst. Group	101002
5	Semicond. Mem. (21MX)	102104
6	EAU Inst. Group	101004
7	Floating Point Inst. Group	101207
8	Mem. Prot./Par. Error	102305
9	Power Fail Auto Restart	101206
10	Input/Output Inst. Group	101003
11	D. M. A. (2100/21MX)	101220
12	Ext. Inst. Group Index	101001
13	Ext. Inst. Group (W/B/B)	101112
14	21MX Fast FORTRAN PK #1	101213
15	21MX Fast FORTRAN PK #2	101114
16	Memory Expansion Unit	102003

TAPE NO. 2 — ADDITIONAL DIAGNOSTICS		
File No.	Description	Diagnostic Serial No.
1	Diagnostic Configurator	000200
2	12539C Diagnostic	103201
3	12966 Diagnostic	103017
4	7905/06/20 Diagnostic	151403

TAPE NO. 3 — 78525 SYSTEM DIAGNOSTICS		
File No.	Description	Diagnostic Serial No.
1	System Diagnostic*	23122-14824
2	91200B Video Diagnostic	91200-16003

*The System Diagnostic File on cassette no. 3 is the diagnostic sequence described in this manual. Refer to the Manual of Diagnostics (Part No. 24396-14001) to obtain descriptions and operating instructions for all other diagnostic files listed above. The Diagnostic Configurator (000200) is not required for the System Diagnostic. For PDMS link diagnostics, refer to Appendix C in this manual.

3-5. Special Diagnostic Test Equipment.

3-6. In addition to the diagnostic tape cassette, special diagnostic test equipment is required to execute diagnostic Test 3, Test 4, Test 5, and (if pressure processing is installed) Test 7. The required special equipment is listed in Table 3-2.

Table 3-2
Special Diagnostic Test Equipment

SPECIAL EQUIPMENT	SYSTEM DIAGNOSTIC	TEST INTERCONNECTION
Diagnostic Test PC Board, 78220-60200*	Test 3 through Test 5	78221 Controller rear panel (para. 3-8, step c.)
Diagnostic Test Box 78220-60800*	Test 3 through Test 5	Diagnostic Test PCB, or equipment extension cable (para. 3-8, step c.)
Diagnostic Test Jumper Cable, 14014-60700	Test 3 through Test 5	78221 Controller rear panel (para. 3-8, step c.)
Pressure Test Cable, 78220-60220	Test 7	Computer I/O cards (para. 3-37)

*The Test PC Board and Test Box can be ordered as one assembly using part no. 78220-60250.

3-7. Diagnostic Test Setup.

3-8. Prior to executing the arrhythmia diagnostic routines, certain test conditions must be set up in the system. To set up these proper test conditions, perform the following procedures:

- a. Set all bedside monitor units which interface to the system to ALARM ON, and place patient test connector into ECG input connector at monitor.
- b. Set all bedside switches at the 78512 Monitor Display to OFF.
- c. Connect the Diagnostic Test PCB, Diagnostic Test Box, and Diagnostic Test Jumper Cable, at the 78221 Controller (see Figure 3-1). If more than one controller is present in the system, perform the connections at the master controller first; i.e. the 78221 for beds 1-8 which normally has the MASTER JUMPER installed on its Clock/Driver PC Board (60130). Perform the test equipment interconnections as follows:
 1. If the 78221 is within viewing range of the 78512 monitor, plug the cable from the Test Box into the 10-pin connector at the side of the Test PCB, assuring that the brown wire in the cable connects to pin 1. In systems where the 78221 is remote from the 78512 an extension test cable (78520-60050) should have been positioned between both units during system installation. Locate the end of the extension cable near the 78221 and plug it into the Test PCB 10-pin connector as described above. The other end of the extension cable near the 78512 has a pin adapter which mates with the Test Box cable — this arrangement enables remote Test Box control of the 78221 while in viewing range of the 78512.
 2. Disconnect the cable from the DUPLEX REGISTER jack at the 78221 rear panel and reconnect it to the rear of the Test PC Board.
 3. Plug the Test PC Board into the DUPLEX REGISTER jack at the 78221 rear panel.
 4. Disconnect the parameter cable (60200) from the 78221 PATIENT PARAMETERS jack, and leave disconnected.
 5. Connect the Test Jumper Cable (60700) between the 78221 PATIENT PARAMETERS jack, and the 24-pin Amphenol connector on the side of the Test PC Board.
 6. Disconnect the A/D cable from the 78221 A/D CONVERTER jack and reconnect it to the top of the Test PC Board.
- d. Clear computer memory by placing the battery switch (on the battery pack at the rear of the computer) to the OFF position. Next, momentarily switch the computer power switch OFF then ON, then reset the battery switch to ON.

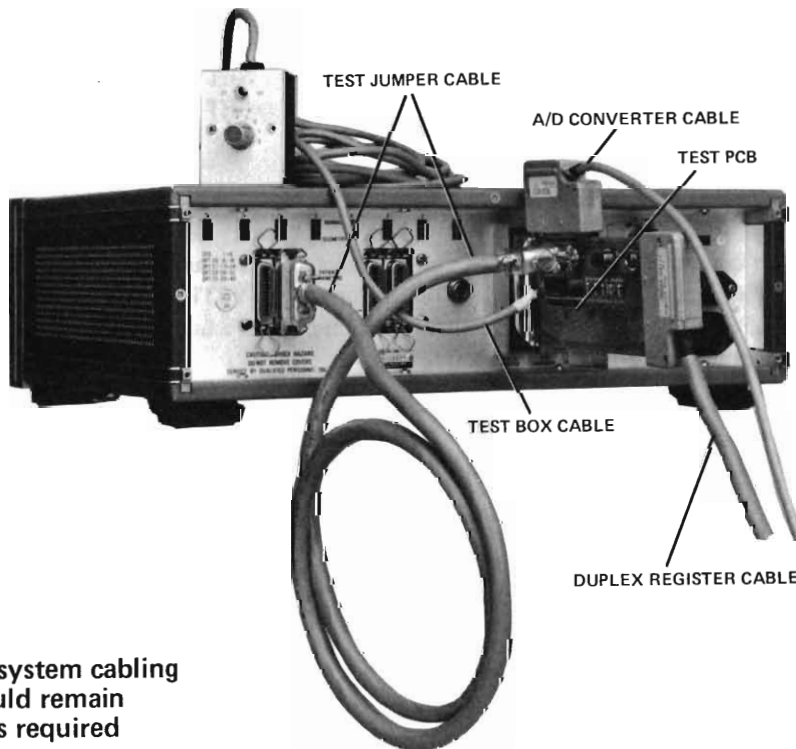
3-9. The system is now set up for diagnostic testing. If more than one central station is present, all tests will be executed for the first station, followed by the second station, and then the third if present. Note that the Test PC Board must be moved to subsequent 78221 Slave Controllers after testing of each central station is completed.

3-10. DIAGNOSTIC LOADING AND EXECUTION.

3-11. The diagnostic test routines are executed sequentially via operator interface at the 78512 Controller/Monitor. To load, initiate, and execute the diagnostic sequence, perform the following:

- a. Insert the system diagnostic tape cassette into the left cassette reader at the front panel of the 2648 Recall/Edit Terminal.
- b. At the computer, select the S-Register via the REGISTER SELECT switch, then clear it to all Zeros with the CLEAR DISPLAY switch.
- c. Depress S-Register bit 14 (this selects the loader routine to load the diagnostic program from the 2648 terminal), then set bits 6-11 as described in step d.
- d. Set S-Register bits 6-11 to the octal select code of the 12966 PC Board for the recall/edit terminal. Octal select codes begin with octal ten (10) representing the bottom card slot in the computer, and increment one octal unit per card slot toward the top of the computer. For example, if the terminal 12966 PC Board occupies the seventh card slot up from the bottom in the computer, its octal select code is 16. This would be placed into the S-Register display as follows:

REGISTER BIT →	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0 = Off	-----															
1 = On	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
					└──────────┘											
					EXAMPLE BITS 6-11 = 16 ₈											



NOTE: Normal system cabling (not shown) should remain connected, unless required for test setup.

Figure 3-1. Diagnostic Test Setup for Tests 3-5

- e. After setting bit 14 and entering the proper octal select code at the S-Register display, press the STORE button to store the code in the S-Register.
- f. Press the computer PRESET button, then the IBL (Initial Binary Load) button. This clears system I/O channels and loads the ROM loader routine into computer memory.
- g. Press the computer RUN button to execute the Loader routine and read the diagnostic tape from the terminal.
- h. After the tape is read the computer should halt with an octal 102077 displayed in the T-Register. If any other octal display is present, remove the cassette and start the loading sequence over again at step a. Should problems persist, try using another diagnostic tape. (Halt displays of 102011 or 102055 indicate cassette, terminal, or computer problems; i.e., 102011 is a checksum error and 102055 is an illegal address error.)
- i. Select the P-Register at the computer and press CLEAR DISPLAY, then enter an octal 2 by pressing bit 1. Press STORE, then PRESET, then RUN. The computer will halt with an octal 102000 displayed at the T-Register, enabling configuration parameters to be entered into memory.
- j. Select the A-, B-, and S-Register displays and verify that each register is storing the proper system configuration bits as shown in Figures 3-2 through 3-4. If not, enter and STORE the appropriate data in the registers.
- k. Depress PRESET, then RUN. The computer will load all of the A-, B-, and S-Register parameters into memory and halt with an octal 102012 displayed in the T-Register.
- l. The 78525 may be interfaced to 7811B Central Stations as well as 78501/78502 Central Stations. If a 7811B Central Station is utilized for any bedsides, CLEAR the A-Register at the computer and set it as indicated below. Be sure to press STORE after setting the appropriate bits in the register.

IF 7811B CENTRAL STATION	A-REGISTER
AT BEDS 1 to 8	SET BIT 0
AT BEDS 9 to 16	SET BIT 1

- m. Press RUN at the computer. Verify that the system diagnostic is running by observing that the computer INTERRUPT and RUN lights are On. Also, the 78221 Controller SYSTEM OPERATING light should be ON. If the SYSTEM OPERATING light is not ON, the 78221 may have a faulty Clock PC Board (60130), Switch PC Board (60150), bulb, or cable.

- n. After verifying that the diagnostic sequence is executing, perform the procedures for each Test in the sequence as described in the following paragraphs. If any computer I/O card is suspected of failing during any Test, power down the computer (be sure the battery is connected) and replace the faulty card. Then, power up the computer and restart the diagnostic sequence at step i. above.

NOTE: To skip over or terminate any one of the test routines and initiate the next in the sequence, press the DISCHARGE button at the 78512 display.

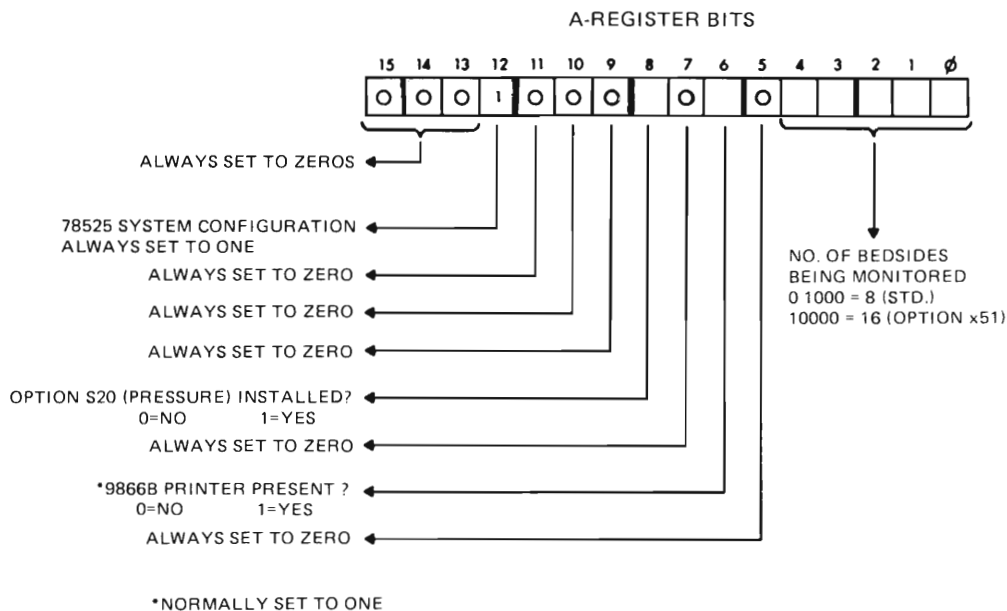


Figure 3-2. A-Register Configuration Parameters

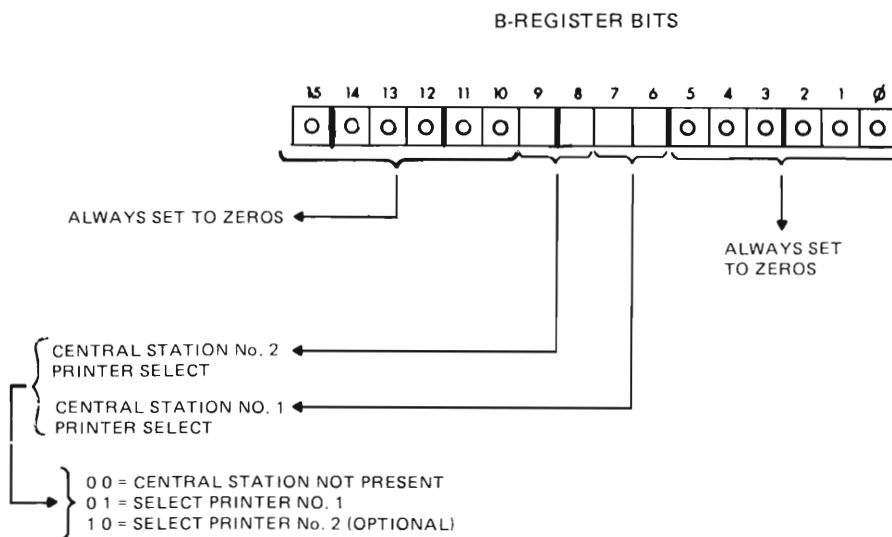


Figure 3-3. B-Register Configuration Parameters

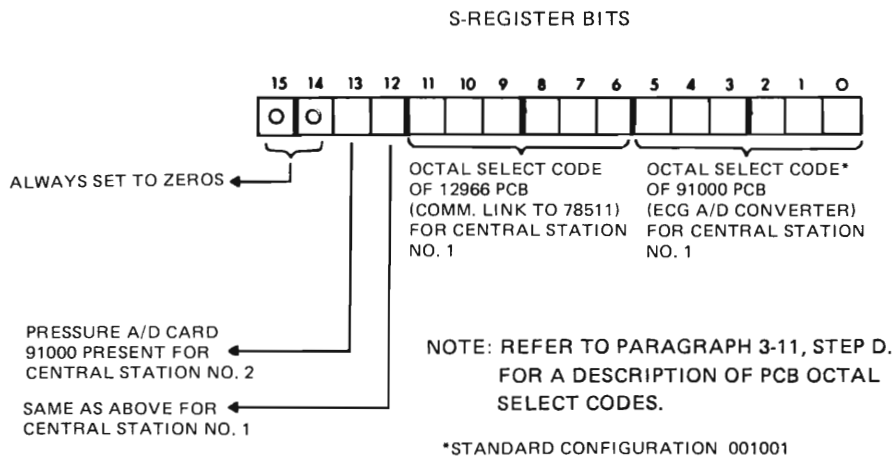


Figure 3-4. S-Register Configuration Parameters

3-12. Test 1 Routine.

3-13. Test 1 is the first routine executed when the diagnostic sequence is run. It checks the video portion of the arrhythmia system excluding the video pattern ROMs, by testing the 91200B card in the computer, and the 78512 Monitor Display unit and video cables.

3-14. The test begins by displaying a series of 16 equally spaced vertical lines across the screen at the 78512, each line being made up of small dots as shown in Figure 3-5. One line is added alongside each of the original 16, then another line, etc. until the screen is filled. There should not be any dots missing from any line.

3-15. After the screen is filled the test removes 16 lines at a time from the display until the screen is blank. The screen is then filled again in the same sequential manner, but this time the display is bulk erased all at once. These sequences of displays will cycle repeatedly until the operator presses the DISCHARGE button at the 78512 display, to terminate Test 1 and continue with Test 2.

3-16. Test 2 Routine.

3-17. Test 2 extends the video check performed during Test 1 by exercising the computer video pattern ROMs. Test 2 also checks the 12554A Sixteen-Bit Duplex Register PC Boards, 9866 Printer, 78221 front panel PC Board (60150) and Clock/Driver PC Board (60130), and all control buttons at the 78512 Monitor Display unit.

3-18. Test 2 begins executing after DISCHARGE is pressed during the Test 1 routine, and displays the following message at the 78512:

CONNECT 78220-60200A PER SYSTEM MANUAL.
PUSH DISCHARGE BUTTON

This message alerts the operator that the test setup described in paragraph 3-7 is required in order to fully utilize the remaining diagnostic routines, and also indicates that the video ROMs on the computer 13304A PC Board are functioning. If the message does not appear in response to pressing DISCHARGE during Test 1, replace video ROMs B1, B2, and B3 (i.e. 5180-1711,12,13) on the 13304 Firmware PCB in the computer, or the entire 13304 PCB.

3-19. The 9866 Printer, which produces hard-copy output of the video displays, can be tested by pressing the COPY button at the 78512. The printer should respond by printing a test page as shown in Figure 3-6. THE TEST PAGE WILL BE PRINTED REPEATEDLY UNTIL THE COPY BUTTON IS PRESSED AGAIN. If the test page does not print or is erroneous, check the printer, its interconnect cabling, and the computer to printer interface.

3-20. The 78512 should still be displaying the message described in paragraph 3-18. Test 2 continues from this point by having the operator perform a series of tests, each of which causes information to be added to the message display. Proceed as follows:

- a. Press DISCHARGE at the 78512 and verify that the display changes to:

CONNECT 78220-60200A PER SYSTEM MANUAL.
PUSH DISCHARGE BUTTON DI
PUSH EVENT MARKER BUTTON

- b. Press the Event Marker button (the blank softkey above DISCHARGE) and verify that the last line in the message changes as follows:

PUSH EVENT MARKER BUTTON EV

- c. Press DISCHARGE. The following line should be added to the message display:

PUSH TREND BUTTONS 1-8

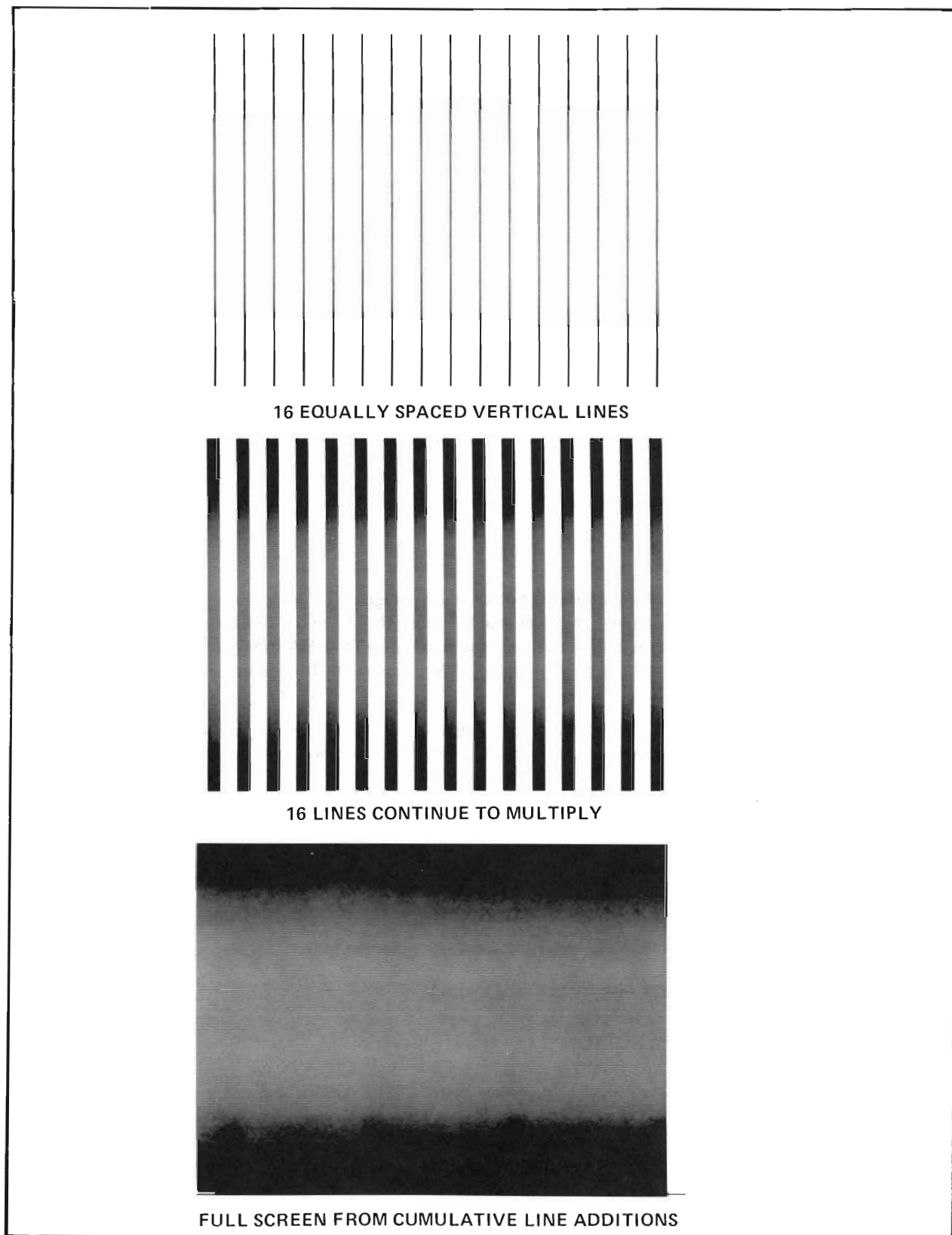


Figure 3-5. Test 1 Vertical Dot Patterns

- d. Press each Trend button (the eight softkeys at the right of the 78512 screen) and verify that as each is depressed the letter T, followed by the appropriate patient number, is added to the message. If the buttons are depressed in order from top to bottom the last line in the message should change to:

PUSH TREND BUTTONS 1-8 T1T2T3T4T5T6T7T8

- e. Press DISCHARGE and observe that the following line is added to the message display:

PUSH RESET LEVERS 1-8

- f. Set all patient levers at the 78512 control panel to ON, then momentarily set each lever to its RESET position. Verify that as each lever is reset the letter R, followed by the appropriate patient number, is added to the message:

PUSH RESET LEVERS 1-8 R1R2R3R4R5R6R7R8

- g. Press DISCHARGE and observe the following addition at the message display:

PUT OFF, THEN ON, 1-8

- h. Momentarily place each patient lever at the 78512 OFF then ON in order, from top to bottom. The last line in the message should change to:

PUT OFF, THEN ON, 1-8 0102030405060708

- i. Press DISCHARGE to add another message line to the 78512 Display:

CAUSE INOP AT BEDS 1-8

- j. Initiate an Inop condition at the bedside units for beds 1-8, noting that an inop message becomes displayed for each patient at the central station 78510 Display unit. Also verify that the last message line at the 78512 Display changes as each bedside inop is generated:

CAUSE INOP AT BEDS 1-8 I1I2I3I4I5I6I7I8

- k. Press DISCHARGE and verify that another line is added to the message at the 78512 Display:

INOP TEST--ALL BEDS OFF

- l. Switch all patient levers at the 78512 control panel to OFF. As each bedside is switched OFF the letter O, and the respective bedside number, will be displayed at the last message line:

INOP TEST--ALL BEDS OFF 0102030405060708

- m. Leaving all bedside levers at the 78512 OFF, depress DISCHARGE. The following message line should be added to the display:

PUT ON, THEN OFF, 1-8

- n. At the bedside units, switch all bedsides OFF. Then, one at a time, momentarily switch each bedside unit ON then back to OFF. The last message line should display a letter I followed by the bedside number, then a letter O followed by the bedside number. If the bedside units are switched in numerical order the last message line will appear as follows (switch contact bounce may cause multiple displays for some beds):

PUT ON, THEN OFF, 1-8 I10I120I2I30I3404
I50I5160I6170I71808

- o. This concludes the Test 2 routine. If all of the above steps were completed and no faults were detected, the complete Test 2 display message will be present at the 78512:

```

CONNECT 78220-60200A PER SYSTEM MANUAL .
PUSH DISCHARGE BUTTON          DI
PUSH EVENT MARKER BUTTON       EV
PUSH TREND BUTTONS 1-8         T1T2T3T4T5T6T7T8
PUSH RESET LEVERS 1-8         R1R2R3R4R5R6R7R8
PUT OFF, THEN ON, 1-8         O1O2O3O4O5O6O7O8
CAUSE INOP AT BEDS 1-8        I1I2I3I4I5I6I7I8
INOP TEST--ALL BEDS OFF        O1O2O3O4O5O6O7O8
PUT ON, THEN OFF, 1-8         I1O1I2O2I3O3I4O4
I5O5I6O6I7O7I8O8

```

To erase the Test 2 display and continue with Test 3, press DISCHARGE.

3-21. Test 3 Routine.

- 3-22. Test 3 exercises the computer A/D Converter PC Board and its interface to the 78221 Controller, checking the channel for each bedside. The routine begins by displaying the following message at the 78512 Display:

```

SET SWITCH TO 6V ON TEST BOARD.
SET CH SELECTOR SW TO 1-8 ON TEST BOARD.
WHEN ALL CHANNELS TESTED, PUT A/D CABLE ON
78221A, SWITCH to 2V, AND PUSH DISCHARGE.

```

- 3-23. This message indicates that the operator should set the Test Box voltage selection switch to 6V, and then slowly rotate the Test Box bedside selector switch from 1 to 8. As each bedside is selected its A/D Converter circuit is tested and another line of text is added to the 78512 Display to indicate the results of the test. For example:

```

CHANNEL 01 OF A/D IS OKAY.
      or
CHANNEL 01 OF A/D FAILS.

```

- 3-24. If any channel fails the A/D test, rotate the bedside select switch on the Test Box to the next bedside number and wait for the test result to appear. Then, move the switch back to the position of the failed A/D test position and verify that the channel is still failed. (A channel failure message may occur due to switching transients if the switch is rotated too rapidly.) If the channel is still failed, note the failure and replace the 91000A Board in the computer. Then, rerun the Test 3 routine from the beginning.

- 3-25. After all bedside channels have tested okay, remove the A/D cable from the top of the Test PC Board and plug it into the 78221 A/D CONVERTER connector. Depress the DISCHARGE button to erase the A/D message displays and continue with Test 4.

3-26. Test 4 Routine.

- 3-27. Test 4 checks the 78221 ECG filters and amplifiers on the Pace Pulse Detector PC Board. The test begins execution by displaying the following message at the 78512 Display:

```

SET CH SELECTOR SW TO 1-8 ON TEST BOARD.
WHEN ALL CHANNELS TESTED,
PUSH DISCHARGE.

```


3-32. Proceed by rotating the Test Box bedside selector switch to position 1, then press the softkey for bed 1 at the 78512. Verify that the following events occur:

- a. A Red Alarm should be issued at the 78510 Display Unit, along with the message *****BED ALARM** appearing at the screen segment for bed 1. (Alarm indications will be present for approximately four seconds.)
- b. A rhythm strip should automatically be output at the central station recorder. The strip should show a horizontal straight line pattern, with annotated bed number, time, date, and *****BED ALARM** message.
- c. A series of six test waveforms should be displayed at the 78512 screen. The six waveforms are presented one at a time, for approximately four seconds each, and cycle repeatedly. Each waveform will be accompanied by ID characters for distinguishing between each. For example, sample waveforms shown in Figure 3-7 have ID codes 81 through 86, indicating the waveforms are representative of bedside number 8, waves 1 through 6.
- d. Check the test waveforms against the samples shown in Figure 3-7 and verify that each waveform appears as specified. If the diagnostic routine crashes, or if a particular waveform is absent or distorted, replace ROMs C1, C2, and C3 on the Firmware PC Board (13304A) in the computer (5851-0983,84,85).
- e. Note that test waveforms 4, 5 and 6 display a second code next to their ID codes. A code of N4 should always be present with waveform 4, indicating the noise detection filter on the Paced Pulse PC Board tests normal. A P5 code will be present with waveform 5 only if telemetry is used, indicating normal telemetry filters. (The 78221 NORMAL/TELEMETRY switch for the corresponding bedside must be set to TELEMETRY position.) A P6 code should always appear with waveform 6 to indicate normal paced pulse filters. If any of these codes are faulty, replace the Paced Pulse Detector PC Board in the 78221 Controller.
- f. Check for crosstalk between channels by leaving the Test Box switch set to position 1 while pressing the 78512 softkey for bed 2. A flat baseline should be present for bed 2 at the 78510 display. A wavy baseline indicates the presence of crosstalk; check the wiring in the computer junction box for proper A to D ground.
- g. After verifying the above events for bed 1, switch the Test Box to bed 2 and repeat steps a through g. Continue until all bedsides have been tested.

3-33. Set the Test Box switch back to position 1, and press DISCHARGE at the 78512. The following line of text should be added to the 78512 screen:

VERIFY 2ND WAVEFORM. THEN PUSH DISCHARGE.

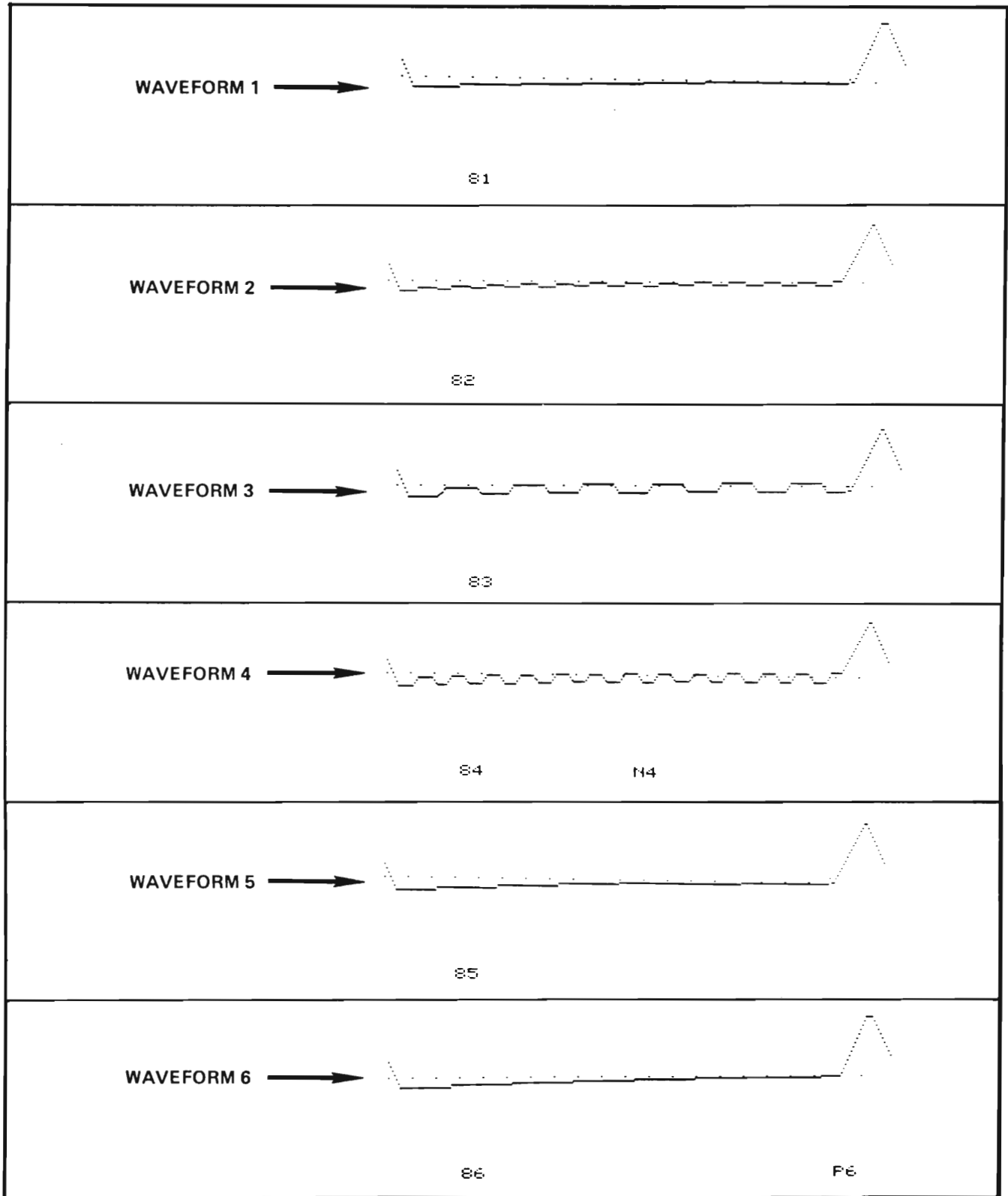


Figure 3-7. Test 5 Waveforms (Single Pattern)

3-34. Observe that another set of six waveforms appears for bed 1 as shown in Figure 3-8. These six waveforms are the same as those observed during the previous check except a second waveform is presented under each; i.e., six double waveform patterns.

3-35. Verify the six double waveforms for each bedside in the same manner as the single waveform pattern test. The double waveforms should match those shown in Figure 3-8. Coded characters should also be present, as described in paragraph 3-32. Should improper presentations be observed, replace ROMs B4, B5, and B6 on the Firmware PC Board (13304A) in the computer (5081-1852,53,54).

3-36. After verifying correct waveform presentations for all bedsides disconnect the test setup at the rear of the 78221 Controller.

- a. Unplug the Test PC Board from the rear of the 78221 Controller.
- b. Disconnect the Test Box cable from the 10-pin connector at the side of the Test PC Board.
- c. Disconnect the cable at the rear of the Test PC Board and plug it into the DUPLEX REGISTER jack at the 78221 rear panel.
- d. Reconnect the parameter cable (60200) to the 78221 PATIENT PARAMETERS jack.

3-37. Press DISCHARGE at the 78512. This will cause the following to occur. The 78512 displays "MICROCODE TEST IN PROGRESS." The microcode diagnostic sequence is executed automatically while the message is being displayed. If the new algorithm ROMs are inoperative, the computer will HALT leaving the message displayed at the 78512 screen. Replace ROMs 5081-1852,-1853, and -1854 on the Firmware PC Board (13304A) in the computer. If the test is completed successfully, the microcode test message is automatically erased and the Communications Link Test is initiated (refer to paragraph 3-38).

NOTE: The microcode test expects that the Test PC Board was removed from the 78221 Controller and cabling has been reconnected as called out in paragraph 3-36.

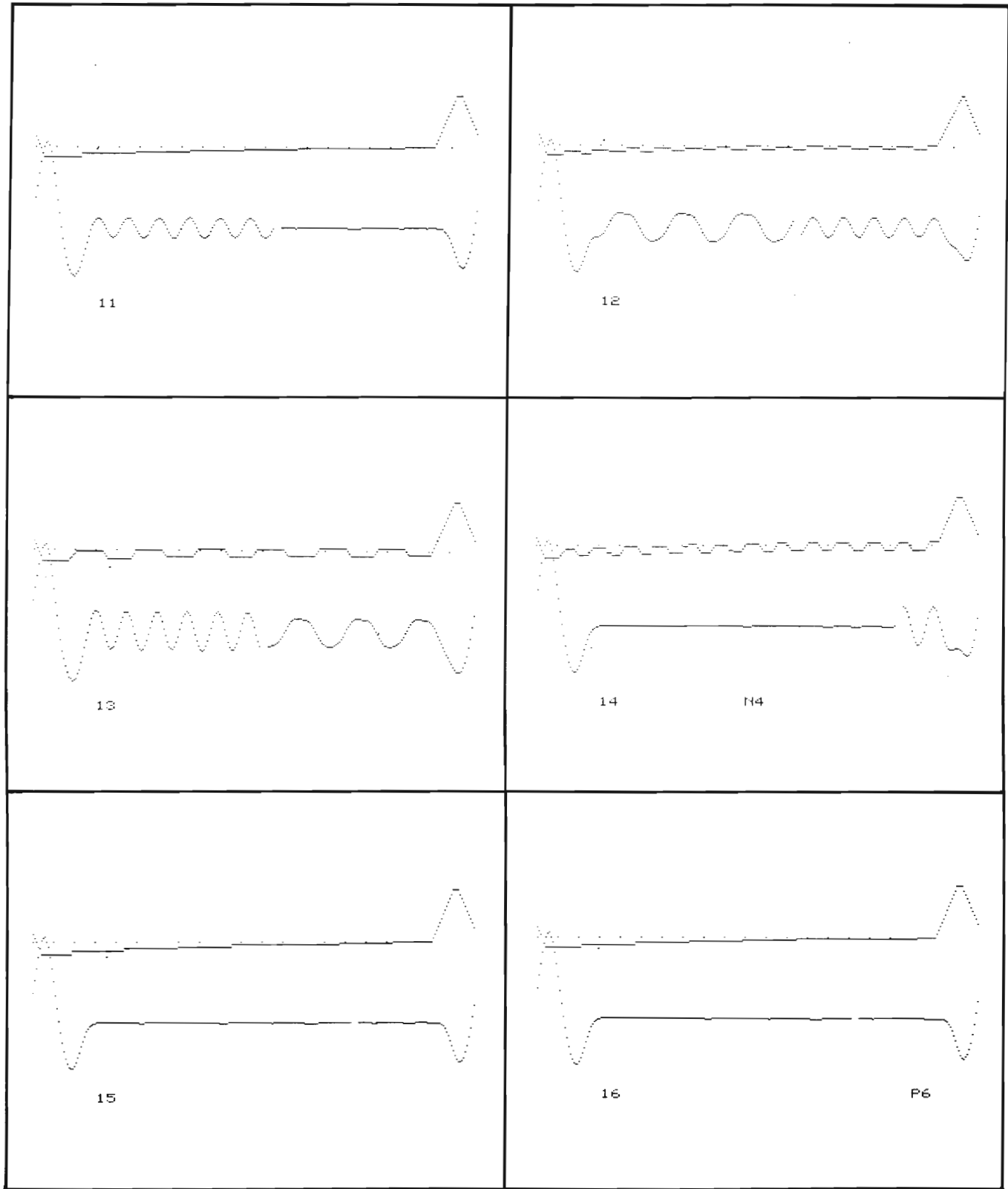


Figure 3-8. Test 5 Waveforms (Double Pattern)

3-38. Test 6 Routine (Communications Link Test)

3-39. Test 6 in the diagnostic sequence consists of seven subtests which check the interface link from the 2113 Computer to the 78511 Equipment Cabinet. The first subtest (Link Test #1) begins by displaying the following message at the 78512 Controller/Monitor.

```
***78520 CENTRAL STATION DIAGNOSTIC***
PUSH SELF-TEST - CENTRAL STATION #1
TEST #1 -- MON OFF, NO PRAM, NO ALRMS
```

3-40. Check that all bedside switches at the 78512 are OFF and the central station recorder is on line. Also check that bedside numbers are being displayed next to the softkeys at the central station 78510 Display Unit. Next, execute all seven Link Test subtests as follows:

NOTE: All 78510 display presentations described in the following procedure will not be present for telemetry bedsides. Telemetry bed displays will always remain blank.

- a. Press the SELF-TEST button at the 78510 Display Unit. The 78510 will go into self-test mode and briefly display its diagnostic test patterns, then halt with a standard monitor mode display. This monitor mode display is divided into equal segments, one per bedside. Also, verify that the central station recorder outputs a diagnostic test pattern with STATUS codes indicating no error conditions as shown in Figure 3-9.
- b. Verify that two error messages (ERROR 2A, 3A) ARE NOT PRESENT at the lower left corner of the 78510 segmented operating mode display. The absence of these error messages indicates (1) the Link PC Boards in the computer and 78511 are present, and (2) the communications interface cabling is interconnected.
- c. Should either error message (2A or 3A) remain displayed at the 78510, first check the interface link cable between the computer and 78511. Next, check that the communications Link PCBs (78511-60410 in the 78511, and 12966 in the computer) are seated properly. (If the arrhythmia system is communicating with a 78501 central station that has more than four bedsides, two Link PCBs will be present in the 78511. Be sure to check the cable that interconnects between both of these PCBs, as well as their interface cables.
- d. Verify that the 78510 is also displaying the message "ECG ALMS OFF" at each segment, excluding segments for telemetry bedsides. Should any display segment read "ALL ALMS OFF" check the diode pack at the rear connector of the 78221 Controller.

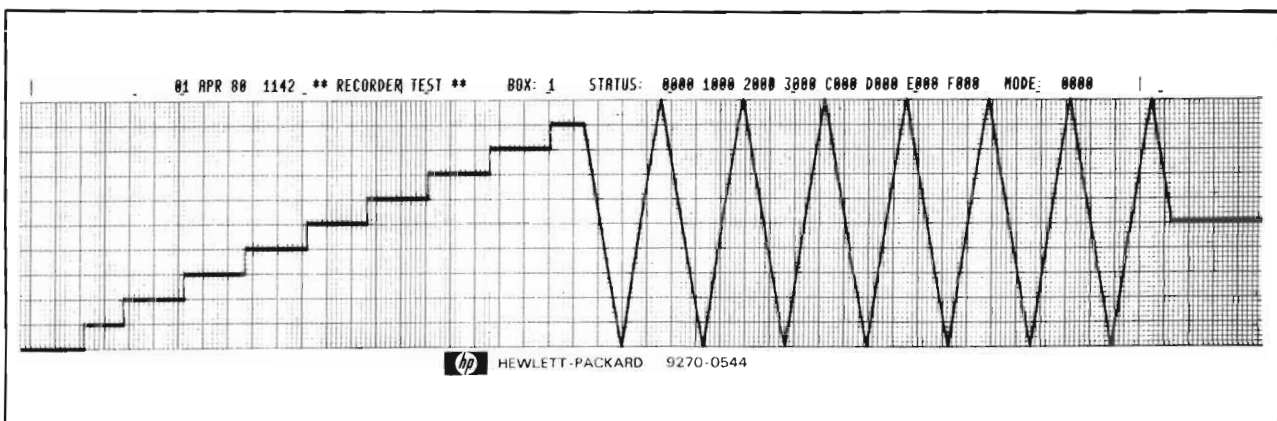


Figure 3-9. Recorder Diagnostic Test Pattern

- e. Press DISCHARGE at the 78512. This initiates the second subtest in the Link Test as indicated by the following message being added to the 78512 display:

TEST #2 -- MON ON, LRN, NO PRAMS, NO ALRMS

- f. Switch all bedsides ON at the 78512, as indicated in the above message. A learning mode display of 0 ± 1 should appear at each segment of the 78510 screen. (For example, LRN 0/ 0 (0) displayed at each segment is typical.) Also, labels P1 and P2 should appear at screen segments for beds that are configured for pressure monitoring.
- g. Verify that the learning mode displays described above are present at the 78510 screen. If not, check the computer to 78511 interface link.
- h. Manually initiate a rhythm strip recording by pressing the softkey for bedside number 1 at the 78510. Verify that the system recorder outputs a test strip with a horizontal straight line ECG pattern, with annotated HR and vital signs data that matches the data shown in Figure 3-10. Repeat this test for the remaining beds in the system. If any erroneous indications are observed, troubleshoot the 78511 Equipment Cabinet or the system recorder.
- i. Press DISCHARGE at the 78512 to terminate subtest 2 and initiate subtest 3 in the Link Test, causing the following message to be added to the 78512 screen:

TEST #3 -- MON ON, PRAMS, NO ALARMS

- j. Subtest 3 begins by erasing any P1 and P2 labels that might have been present at the 78510 screen, and displays a heart rate parameter of 65 for all beds (if using a 78502 central station, a VPB count of 3 is also displayed).
- k. At the 78510, press the softkey for bed 1. This initiates a manual rhythm strip recording which shows a straight line ECG pattern, with HR and vital signs annotation that matches the data shown in Figure 3-11. Verify that the test strip contains the appropriate test data, then repeat this test for the remaining beds in the system.
- l. Press DISCHARGE at the 78512 to terminate Link Subtest 3 and initiate Link Subtest 4. The following message should be added to the 78512 display:

TEST #4 -- MON ON, PRAMS, GRN ALRM

- m. Subtest 4 displays * GREEN ALARM messages for all patients at the 78510 display, while lighting the Green Alarm indicator. The green alarm does not sound any audible tone, nor does it provide any automatic rhythm strip recordings --- it only provides video indications.
- n. Initiate a manual recording for the green alarm by pressing a 78510 softkey for any bed. Verify that a rhythm strip with a horizontal straight line ECG pattern and annotated HR/Vital Signs parameters which match those shown in Figure 3-12 is output by the recorder.
- o. Press DISCHARGE at the 78512 to initiate Link subtest 5, as indicated by the following message display at the 78512:

TEST #5 -- MON ON, PRAMS, YLW ALRM

- p. Subtest 5 provides indications similar to subtest 4 described above, except a ** YELLOW ALARM message is displayed for all patients and the system Yellow Alarm indicator is lighted. In addition the bedside ID numbers at the 78510 display begin flashing while an intermittent tone is sounded approximately five seconds for each bedside. At the same time, a rhythm strip for each bed is automatically output at the system recorder. Verify that the rhythm strip straight line waveform and annotated parameters match those shown in Figure 3-13. (Note that annotation of VPBs and pressures does not occur on rhythm strips that are output automatically on alarm from a 78501 central station.)

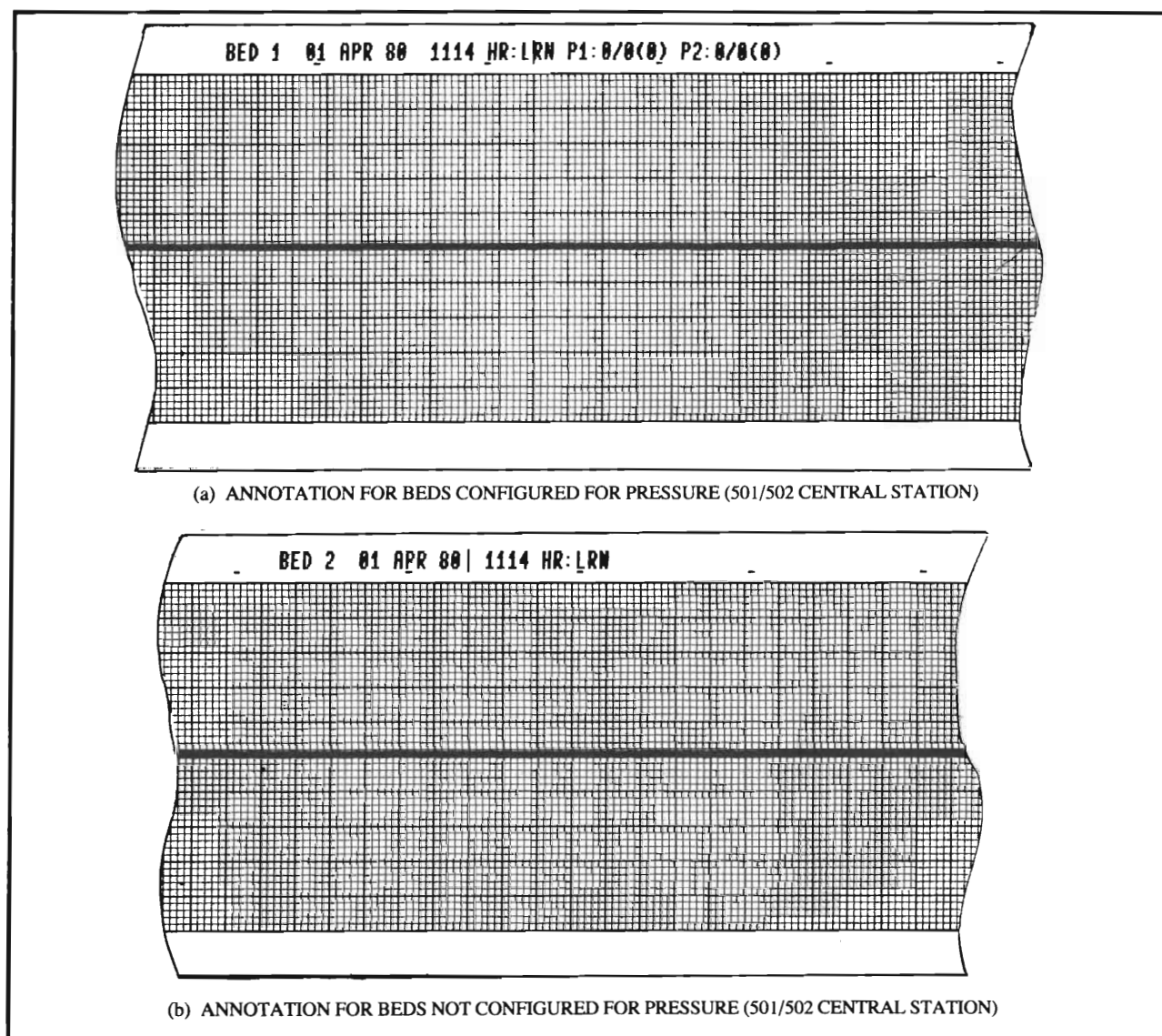


Figure 3-10. Link Subtest 2 Rhythm Test Strip

- q. Press DISCHARGE at the 78512 to execute Link Subtest 6:

TEST #6 -- MON ON, PRAMS, RED ALRM

- r. Subtest 6 generates the same indications as subtest 5, except the ***RED ALARM message is presented for each bedside at the 78510 while the Red Alarm indicator is lighted. An intermittent gong is sounded continuously, and test rhythm strips are automatically output at the system recorder. Verify that the Red Alarm rhythm strip for each bed has annotated parameters that match the test parameters shown in Figure 3-14.
- s. Press DISCHARGE at the 78512 to initiate the final phase of the Communications Link Test:

TEST #7 -- BED ALARMS LINE TEST

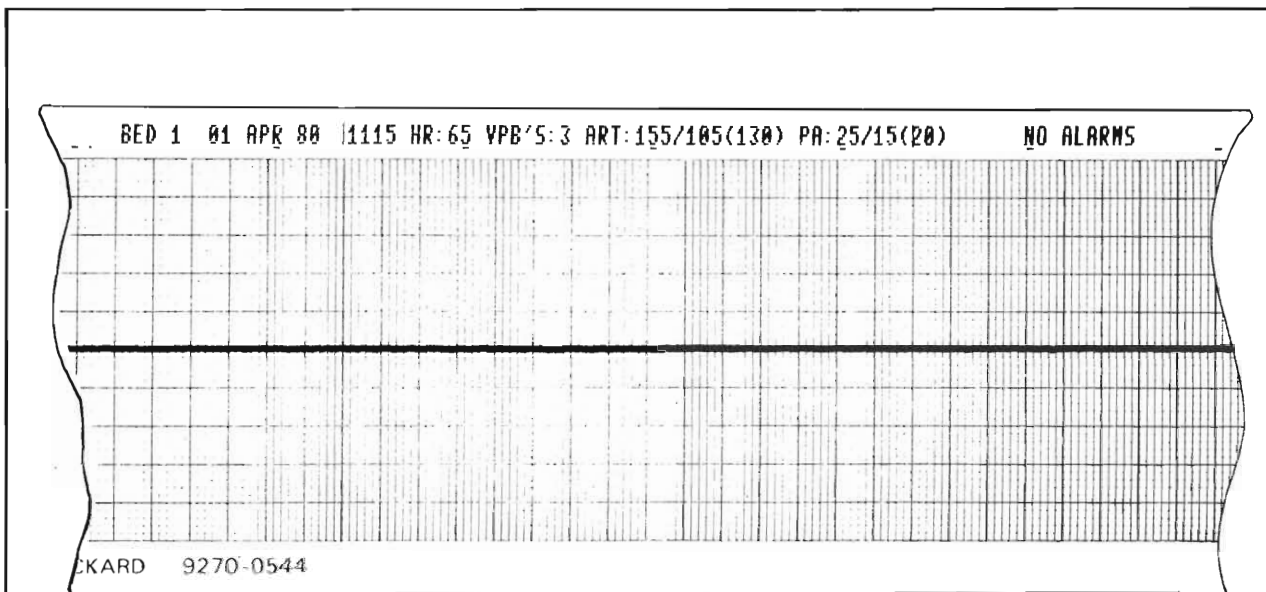
***BED ALARM LINE #1

- t. Link subtest 7 checks individual bedside alarm lines to assure that system alarm signals are not crossed or miswired. When the test is first initiated, an alarm message is displayed at the 78510 display segment for bedside number 1, and a rhythm test strip with annotation matching that shown in Figure 3-15 is automatically output at the system recorder.

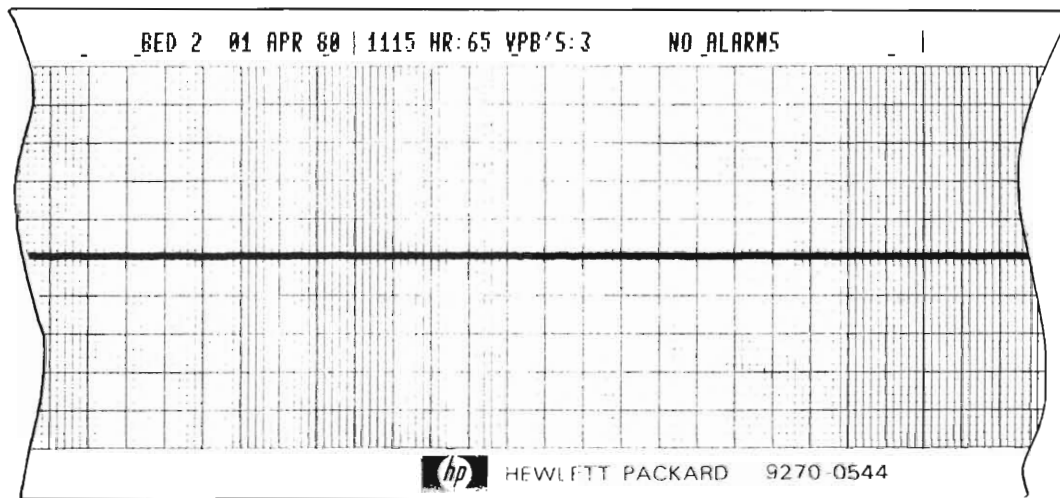
- u. Verify that the ***BED ALARM LINE #1 message at the 78512 is displayed, and that the 78510 display segment for bedside 1 is displaying a ***BED ALARM message. Also, that the rhythm test strip annotation indicates a ***BED ALARM for BED 1. If not, check the alarm line wiring connections.

- v. Press DISCHARGE at the 78512. Verify that the following changes occur. The ***BED ALARM LINE # message at the 78512 should increment to indicate bed number 2; the ***BED ALARM message at the 78510 should move to the next sequential display segment; the system recorder should output another test strip with the same alarm message for BED 2. Repeat this test to assure that 78512, 78510, and recorder bed number indications continue to match each time DISCHARGE is pressed. If any mismatch occurs, check the alarm wiring connections.

- w. After checking all alarm lines, press the 78512 DISCHARGE button again. This terminates the Communications Link Test and causes the following. All 78510 display segments indicate **COMPUTER INOP with flashing bedside numbers. If the option for pressure processing (S20) is installed in the system being tested, the diagnostic sequence will continue with Test 7 as described in the following paragraphs. If the pressure option is not installed but more than one central station is present in the system, the diagnostic sequence will loop back to the Test 1 Diagnostic (paragraph 3-12) and begin diagnostic testing for the next central station. In this case the Test Jumper Cable, Test PC Board, and Test Box should be connected to the 78221 Controller that is interconnected in that part of the system. If the system does not have more than one central station, the sequence will loop back to the Test 1 Diagnostic and begin testing the same central station a second time. To terminate this loop and stop the diagnostic sequence, press HALT at the computer. Return to normal system operation by performing the system startup sequence described in Section IV of this manual.

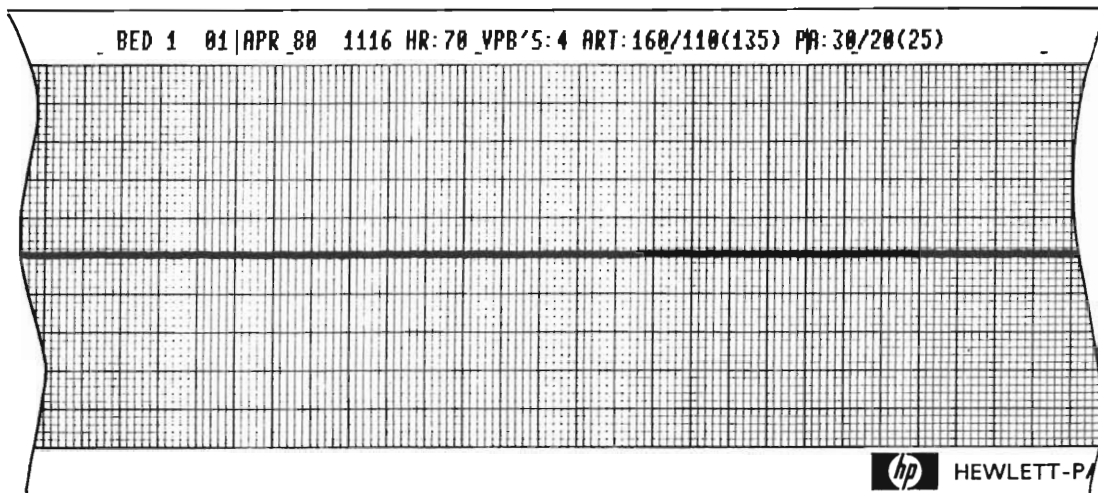


(a) ANNOTATION FOR BEDS CONFIGURED FOR PRESSURE (501/502 CENTRAL STATION)

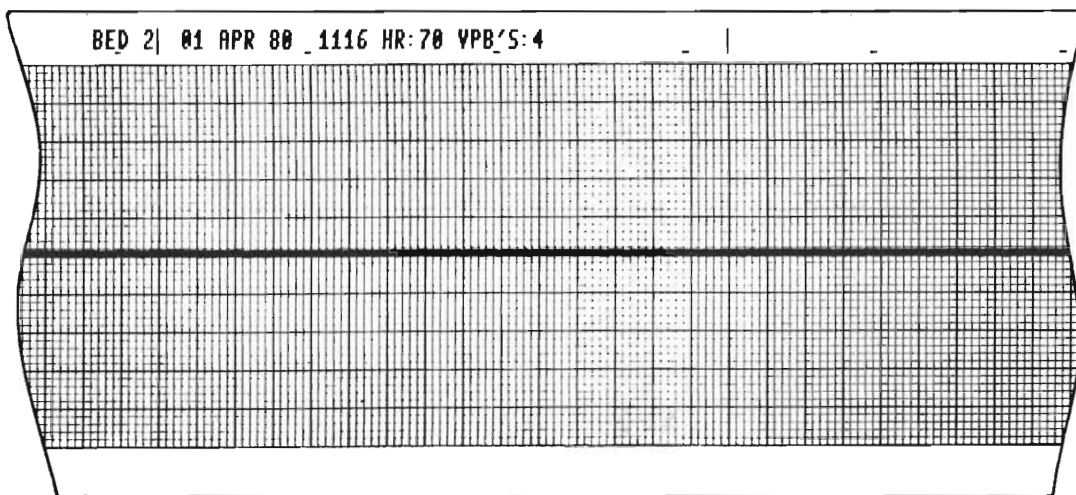


(b) ANNOTATION FOR BEDS NOT CONFIGURED FOR PRESSURE (501/502 CENTRAL STATION)

Figure 3-11. Link Subtest 3 Rhythm Test Strip



(a) ANNOTATION FOR BEDS CONFIGURED FOR PRESSURE (501/502 CENTRAL STATION)



(b) ANNOTATION FOR BEDS NOT CONFIGURED FOR PRESSURE (501/502 CENTRAL STATION)

Figure 3-12. Link Subtest 4 Rhythm Test Strip.

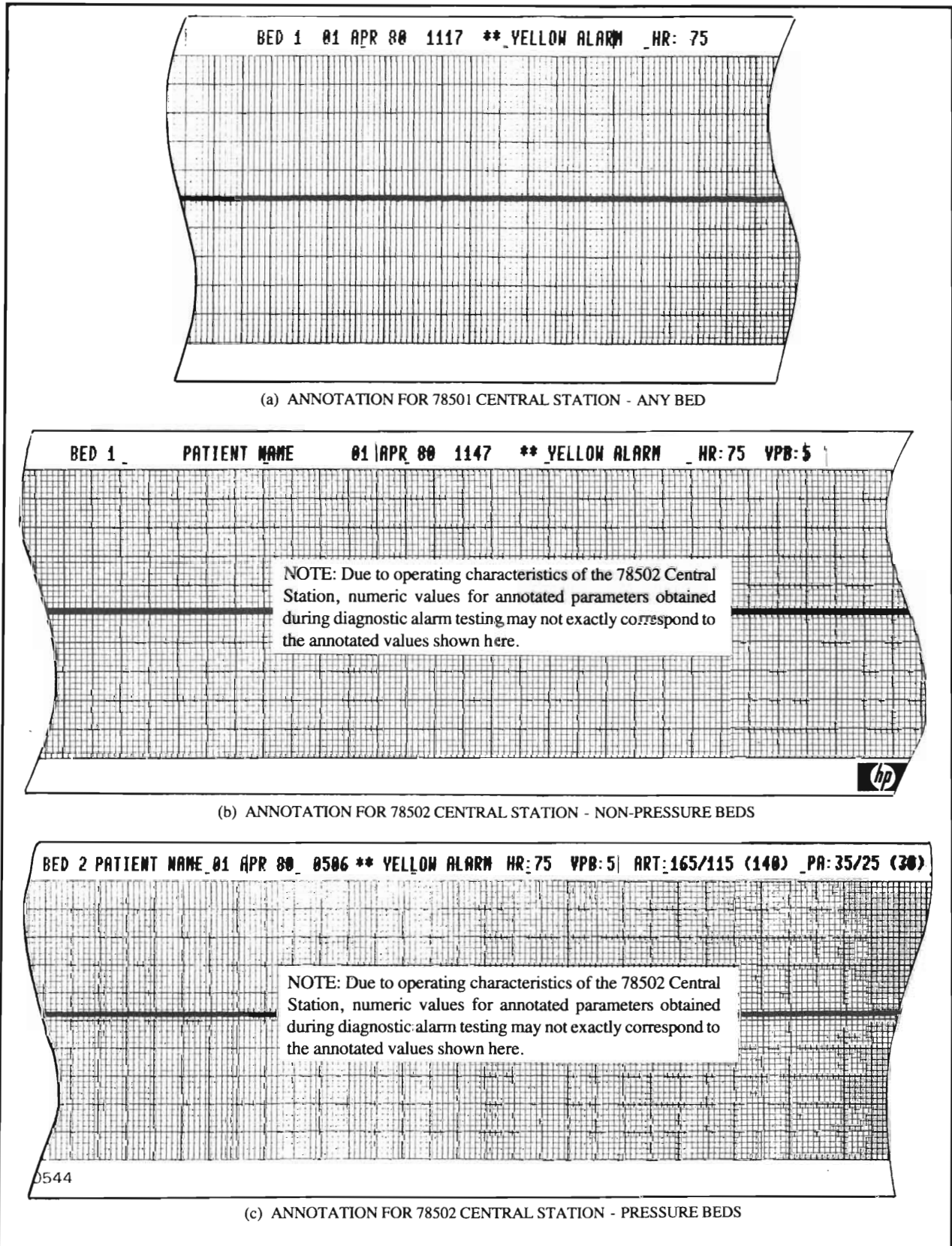
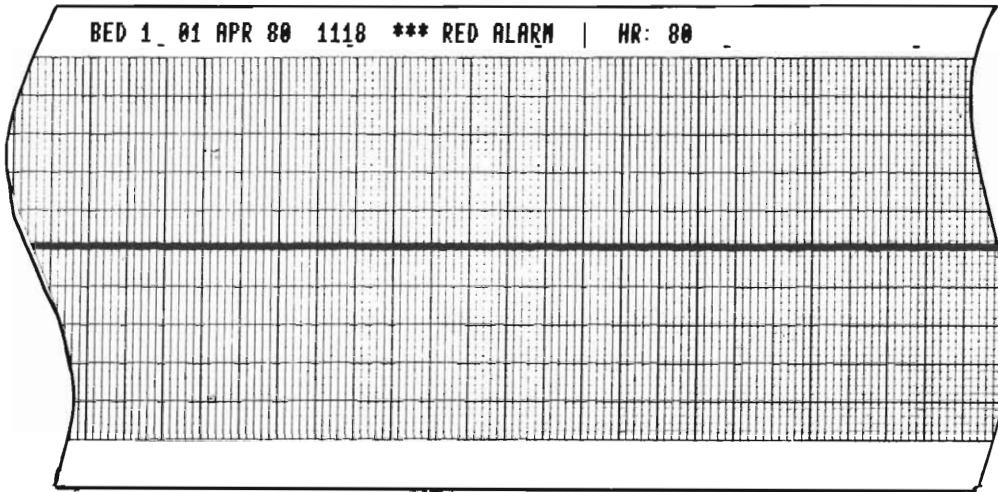
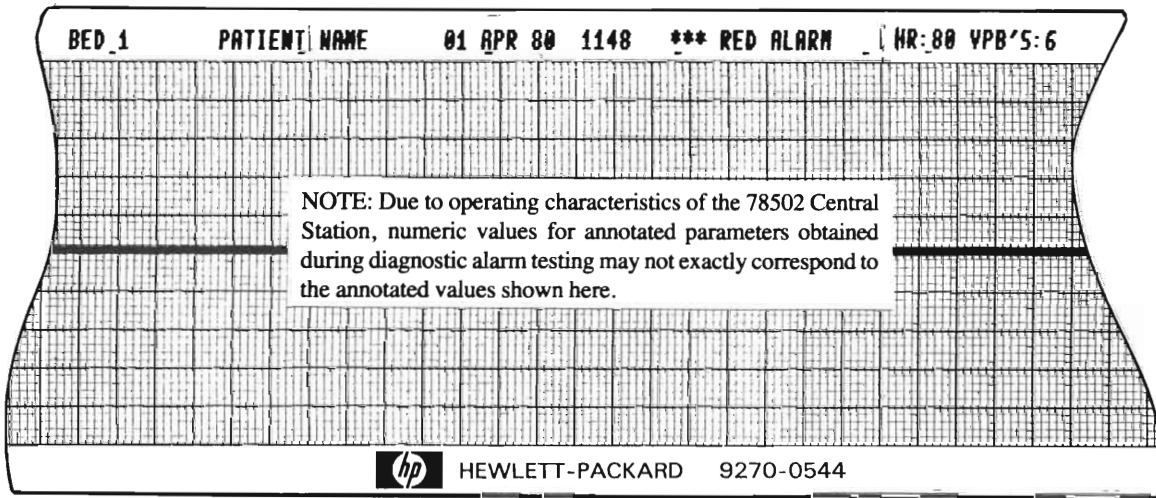


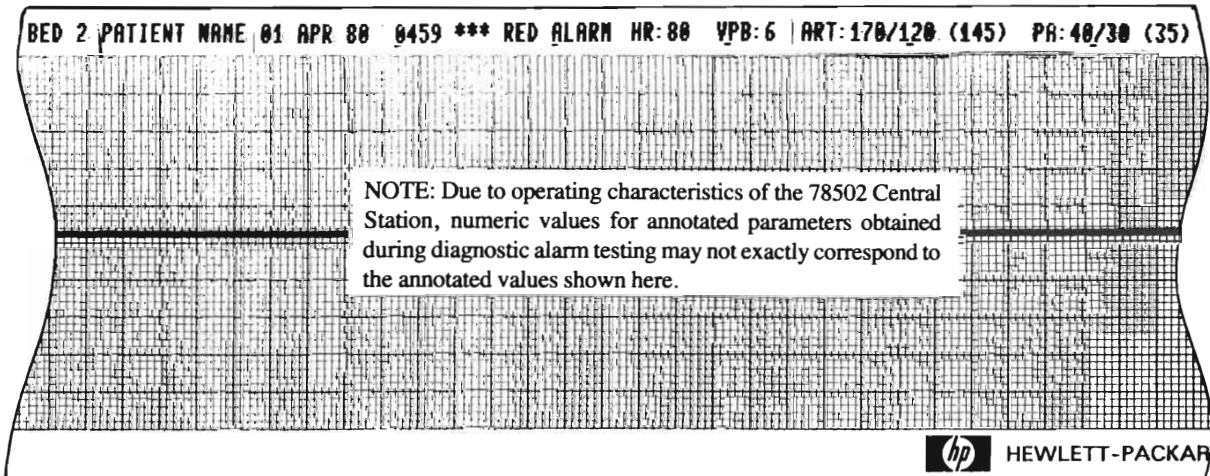
Figure 3-13. Link Subtest 5 Rhythm Test Strip



(a) ANNOTATION FOR 78501 CENTRAL STATION - ANY BED



(b) ANNOTATION FOR 78502 CENTRAL STATION - NON PRESSURE BEDS



(c) ANNOTATION FOR 78502 CENTRAL STATION - PRESSURE BEDS

Figure 3-14. Link Subtest 6 Rhythm Test Strip

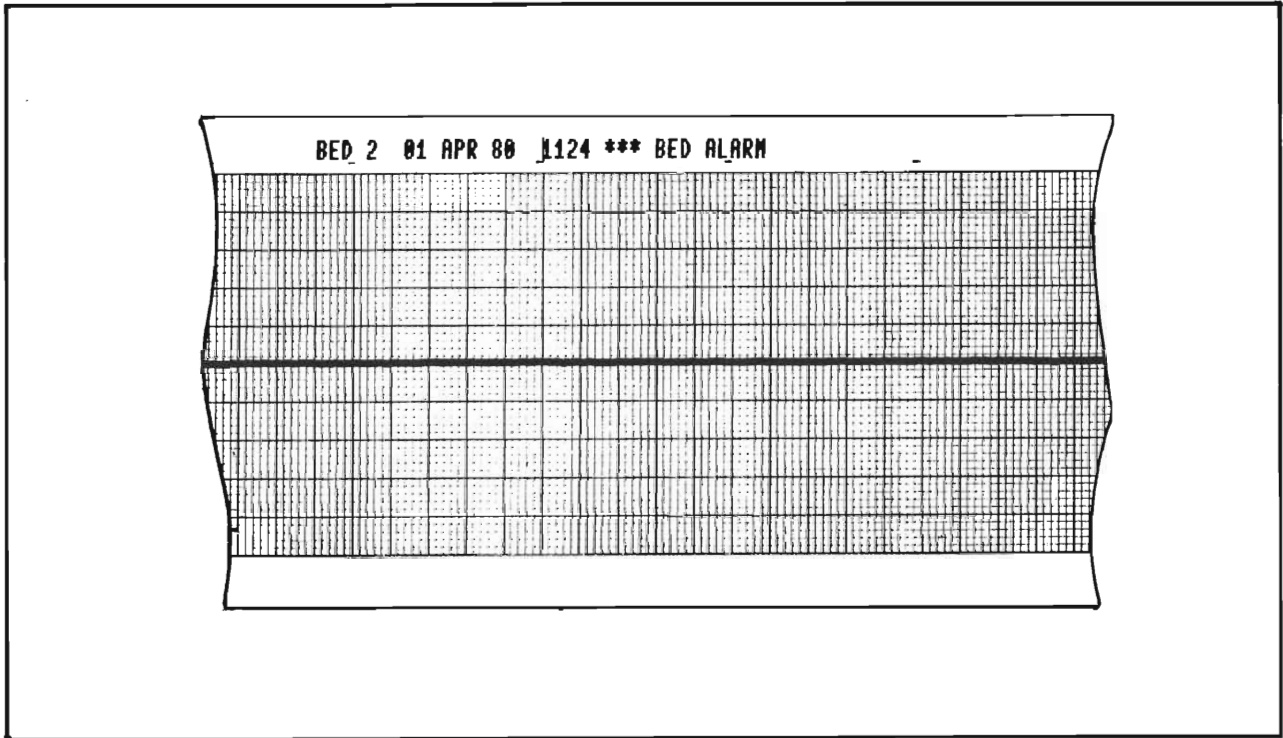


Figure 3-15. Link Subtest 7 Rhythm Test Strip

3-41. **Test 7 Routine.**

3-42. Test 7 is present in the diagnostic sequence only if Option S20 for pressure monitoring is installed in the system. The test requires use of a special Pressure Test Cable (78220-60220) as described below. If Option S20 is installed in the system, the following message will be displayed at the 78512 following termination of the Communications Link Test.

FOR LOCAL TEST OF PRESS A/D, PUSH "EVENT."
TO SKIP LOCAL TEST, PUSH "DISCHARGE."

3-43. This message indicates the start of Test 7, which is a local check of the 91000A Data Acquisition PC Board used for pressure trending in the computer. Proceed by pushing the Event Marker button (located above the DISCHARGE button at the 78512) to execute the local test, or DISCHARGE to terminate diagnostic testing.

3-44. After pressing Event Marker the following message should appear at the 78512 display:

ENTER PRESSURE A/D SC IN A-REGISTER.
PLUG TEST CONN J1 ON PRESSURE A/D.
PLUG TEST CONN J2 ON I/O CARD IN SLOT yy.
PUSH "RUN". HALT 77 INDICATES A GOOD TEST.

NOTE: Slot "yy" is an octal select code that is determined automatically by the system.

3-45. The above message instructs the operator to enter the octal select code of the 91000 Pressure A/D Converter PC Board into the A-Register, at bits 0 through 5. After entering the proper bit configuration into the A-Register, press STORE. Next, connect J1 from the Pressure Test Cable (78220-60220) to the 91000 Pressure A/D card and the J2 end of the cable to the 12554 Duplex Register card at slot 12 in the computer. THE TEST CANNOT BE EXECUTED IF THIS TEST CABLE IS REVERSED.

3-46. After connecting the Pressure Test Cable, press the computer RUN button. The pressure A/D converter circuits will be tested. If one of the A/D channels fails the test, the computer will halt with one of the following T-Register displays:

102000 — First replace the 91000A card, then rerun the test. If the test still fails, replace the 12554A card. If the test fails again, check that the test cable is connected properly and is not faulty.

102001 — Replace the 91000A card, then rerun the test. If the test fails, again, check the test cable.

3-47. If the A/D test did not fail, Test 7 continues by testing each multiplexer channel at the 91000A card. As each channel is tested the corresponding bit in the S-Register display at the computer will light. After completing the test the computer halts with one of the following T-Register displays:

102002 — Indicates any channel failed the test. The channels that failed are indicated by the S-Register bits.

102077 — Indicates all channels tested normal.

3-48. Additional 91000A pressure cards may be tested at this point. Set the A-Register to the octal select code of the card to be tested, and press STORE. Move the J1 end of the Pressure Test Cable to the 91000A card being tested. Set the S-Register to all Zeros and push STORE, and RUN.

NOTE: Any test may be repeated by setting the S-Register to all Zeros and pressing STORE, then RUN. Similarly, any test may be terminated by setting the S-Register to all Ones (lights On), then pressing STORE and RUN.

3-49. If all multiplexer channels test normal, disconnect the Pressure Test Cable and reconnect the system cables at the 91000A and 12554A circuit cards. Push RUN to display the message shown in Figure 3-16 at 78512. This display allows testing the system pressure cabling from the bedsides to the computer. This test should be performed following system installation, or whenever a pressure problem appears and all previous pressure tests have run correctly. Proceed as follows:

- a. The cabling test allows viewing all pressure inputs to the 91000A simultaneously. Begin by having all bedside equipment turned ON, with no waveforms connected. This can be accomplished by either disconnecting the transducer or having the hospital personnel turn the catheter stopcocks to the closed position if a patient is connected to the equipment. Next, set the ZERO control at each 78205 Pressure Monitor so that the display reads 0.
- b. Press the Event Marker button, above the DISCHARGE button at the 78512, then press the CAL button on the 78205 bedside monitor being tested first. (If there are two Pressure Monitors at the bedside being tested, push the CAL button on the module used for arterial pressure first, then wait several seconds and push the CAL button on the module used for pulmonary pressure.)
- c. Verify that the CAL pulse appears somewhere along the display for the bedside being tested. Figure 3-16 shows an example of this pulse appearing for arterial pressure at bedside 5. Note that all other channels have straight lines across the display. A CAL pulse appearing on any channel other than the one being tested indicates system miswiring. Lines at the display will be unpredictable if the lines are "floating" due to a 78205 bedside module being unplugged.
- d. Continue the system pressure wiring test by pressing the Event Marker button and triggering a CAL pulse for each bedside. After all beds wired for pressure have been tested, press discharge. This terminates Test 7 and allows the diagnostic sequence to begin all over again with Test 1 for the next central station if more than one central station is present, or at the same central station when only one is present. To terminate the diagnostic loop and stop the diagnostic sequence, press HALT at the computer. Be sure to execute the system startup sequence described in Section IV of this manual to return to normal system operation.

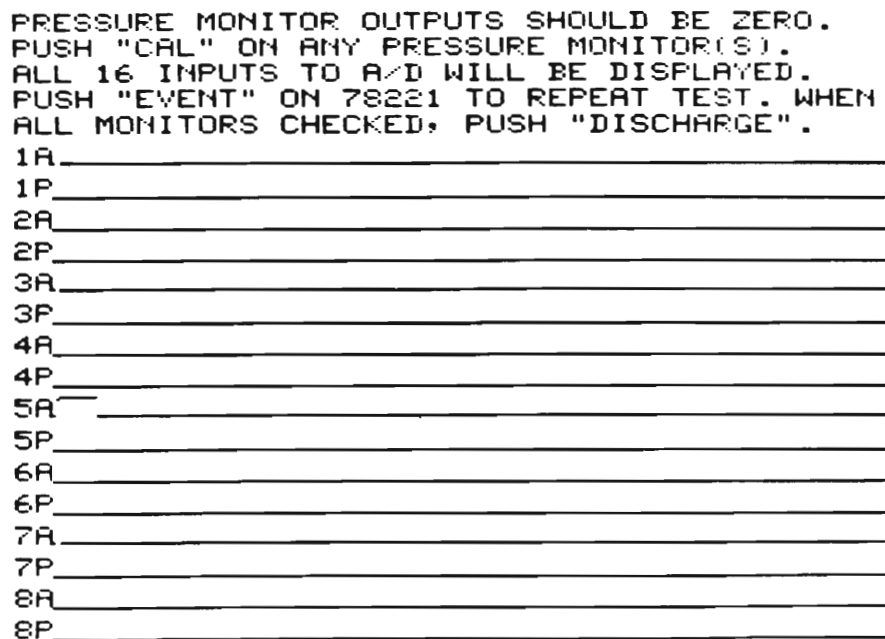


Figure 3-16. Pressure Monitor Test CAL Signal, Bed 5

SECTION IV SYSTEM START-UP PROCEDURES

4-1. INTRODUCTION.

4-2. This section provides information required to “boot” the system; that is, procedures required to load computer software which places the 78525 System into normal operating mode. Procedures are also provided for accessing the RTE File Manager (FMGR) program which enables system configuration changes, 78171 recall/edit recorder testing and calibration, and listing system messages and reports.

4-3. All of the procedures in this section require operator interface through the 2648 Terminal at the Recall and Edit station. The start-up sequence can be performed without having prior knowledge of the Hewlett-Packard Real Time Executive (RTE) operating system. However, a basic understanding of RTE operations would be helpful for performing system maintenance functions such as changing system configuration data, displaying system message logs, etc. (Refer to the manual “RTE: A Guide for New Users,” Part No. 92060-90012, Section I for an introduction to RTE.

4-4. SYSTEM START-UP.

4-5. The start-up sequence comprises two procedures: System Initialization and Set Time. Both procedures must be completed before the system becomes functional. Refer to paragraphs 4-6 and 4-11.

4-6. System Initialization Procedure.

4-7. The system initialization procedure is used to load system operating software, including configuration parameters, whenever the system is powered up after installation, after diagnostic testing, or after loss of power for significant periods of time. The operating software and configuration parameters become stored in computer memory, enabling normal system operation.

4-8. During power outages the rechargeable battery back-up unit for the computer will normally hold the operating software in computer memory for periods up to two hours. After two hours of continuous power loss, the effectiveness of the battery pack becomes increasingly diminished.

4-9. When power is restored after an outage, the system initialization procedure will have to be rerun only if the batteries failed to hold memory contents, as indicated by the POWER FAIL indicator at the computer front panel being illuminated. If the batteries did hold memory, the POWER FAIL indicator will be Off and the system will automatically restart in normal operating mode.

4-10. To perform the system initialization procedure, proceed as follows:

- a. Set all bedside switches at the 78512 to Off.
- b. Load the 78525 disc pack into the system disc drive and verify that the DRIVE READY light illuminates.
- c. At the computer, select the S-Register via the REGISTER SELECT switch, then clear it to all Zeros (all bit lights off) with the CLEAR DISPLAY switch. Set the S-Register to octal 111500 (set bit lights 15 12, 9, 8 and 6 ON) enabling the computer to accept information from the system disc.
- d. After setting the appropriate bits On at the S-Register display, press the STORE button to store the bits in the register.
- e. Press the computer PRESET button, then the IBL (Initial Binary Load) button. This clears system I/O channels and loads the ROM Loader routine into computer memory.

f. Press the computer RUN button to execute the ROM Loader routine and load system software from disc to computer memory. If the computer halts (RUN light turns Off) a problem with the disc has been encountered. Check that the disc DRIVE READY light is On, then press PRESET, IBL, and RUN at the computer to restart. If the problem persists, try using another disc pack.

g. After system software has been loaded, the following prompt is displayed at the 2648 Recall/Edit Terminal:

ENTER TR; START TO BEGIN 78525 OPERATION

h. If the system maintenance functions (hospital-specific configuration changes, etc.) are required, perform these functions next (refer to paragraph 4-14), then continue with step i below.

i. Type the following command into the 2648 terminal, then press the GO key:

TR,START

j. The following prompt is displayed next at the terminal:

78525 REVISION n yy mm dd START UP
PLEASE STAND BY

NOTE: n=78525 revision number,
yy mm dd=revision date code (year, month, day)

k. During the next minute both of the following occur: (1) If the 78525 is linked to PDMS, the 2648 Terminal displays the following prompt — ENABLE LINK TO PDMS (YES OR NO). Type in YES GO to enable the PDMS link, or NO GO to disable the link. (2)The 78525 System becomes initialized, as indicated by the SYSTEM OPERATING light at the 78221 Controller front panel becoming illuminated. Also, the 8-patient Status Display is displayed at the 78512 Controller/Monitor.

l. Continue the system start-up procedure by performing the Set Time procedure described in the following paragraph.

4-11. Set Time Procedure.

4-12. When the 78525 System is in its initialized state, the Set Time display appears at the 2648 Terminal:

SET TIME
WARNING — PATIENT DATA WILL NOT BE STORED UNTIL TIME IS SET.

4-13. The Set Time display is a prompt to quickly set system date and time parameters. Information acquired by the system prior to setting these parameters will not be stored within patient files. To set the required parameters proceed as follows:

a. The terminal will display the Current Time display (i.e., the date and time at which the system went off-line) and request that the correct DATE be entered:

CURRENT DATE AND TIME IS dd mmm yy hh:mm
ENTER DATE (EG,20 SEP 78 OR 9/20/78).

b. If the CURRENT DATE is correct, just press GO to continue. If not, enter the current date in either of the two formats shown above, then press GO . The following prompt will be displayed next:

ENTER TIME (EG,15:21)

c. Enter the current time of day using the 24-hour format shown above, then press GO . For example, 3:21 PM is entered as 15:21 GO . After the time is entered the system provides verification of the stored date and time by displaying the following message at the terminal:

DATE AND TIME ENTERED IS dd mmm yy hh:mm
DATE AND TIME CORRECT (YES OR NO)?

d. If the stored date and time are incorrect, type NO GO and return to step a. If correct, type YES GO to continue. If the entered date and time is earlier than the original date and time displayed at step a, the following message will be displayed next:

***WARNING — TIME IS BEING SET BACK. PATIENT DATA WILL BE LOST! OK to proceed (YES OR NO)?

e. Setting the time back can cause some or all previously acquired patient data to be inaccessible. Proceed by typing YES GO only if it is essential to set the time back, then continue. Otherwise, type NO GO and return to step a.

f. As confirmation that the time has been set, the following is displayed at the terminal:

TIME IS SET

g. After approximately 30 seconds the Patient Census Display will appear at the 2648 Terminal allowing 78525 recall and edit operations to begin. Refer to the 78525 Operators Guide for information concerning system operation.

4-14. RTE SYSTEM MAINTENANCE (FMGR) PROGRAM.

4-15. The RTE File Manager (FMGR) program must be accessed in order to perform various system maintenance functions such as 78525 reconfiguration, etc. The FMGR program is automatically entered after system initialization (Paragraph 4-6) as indicated by the colon prompt being displayed after the message ENTER TR,START. FMGR can be terminated at that time if the system start-up sequence is continued via entering TR, START GO at the terminal.

4-16. The FMGR program can also be accessed after system start-up as follows:

- a. Select either the Patient Census or ECG Trend display at the 2648 Terminal.
- b. Type HP 78225 into the terminal.
- c. The Display will be cleared and the following messages will appear:

***FMGOO SCHEDULED AT LU10

- d. This indicates a copy of the FMGR program named FMGOO is active at the terminal logical unit number 10.
- e. FMGR commands to run programs, list files, etc. may now be entered at the terminal. Note that if the system is equipped with a 9866 Printer, it may be accessed as LU8. To return to the Patient Census display, exit FMGR by entering EX at the terminal. The following message will be displayed:

RETURN TO PATIENT CENSUS?

f. Type YE or YES to return to Patient Census, or enter anything else to return to FMGR.

4-17. Configuring Hospital-Specific Information.

4-18. Hospital-specific information and labels presented in terminal displays and printed reports may be configured as desired. These configurable items include:

- a. Hospital Identifier — Used on displays and printed reports. Limited to a maximum of 60 characters.
- b. Units of Measurement — May be specified as either decimal (inches, pounds, etc.) or metric (centimeters, kilograms, etc.).
- c. Bed Labels - Identifier for each bedside in the system, Limited to a maximum of six characters for each.

4-19. To perform hospital-specific information and label changes, first complete steps a through g of the system initialization procedure described in Paragraph 4-10. Next, type the following command into the 2648 Terminal:

RU,CHANG

4-20. A display presentation similar to the example shown in Figure 4-1 will appear at the terminal. The display requests the operator to enter new information for each field, one field at a time, then press the GO key. If the information displayed for any field is to remain unchanged, just press GO to continue with the next field. Enter the appropriate characters to terminate the program, as specified in the display.

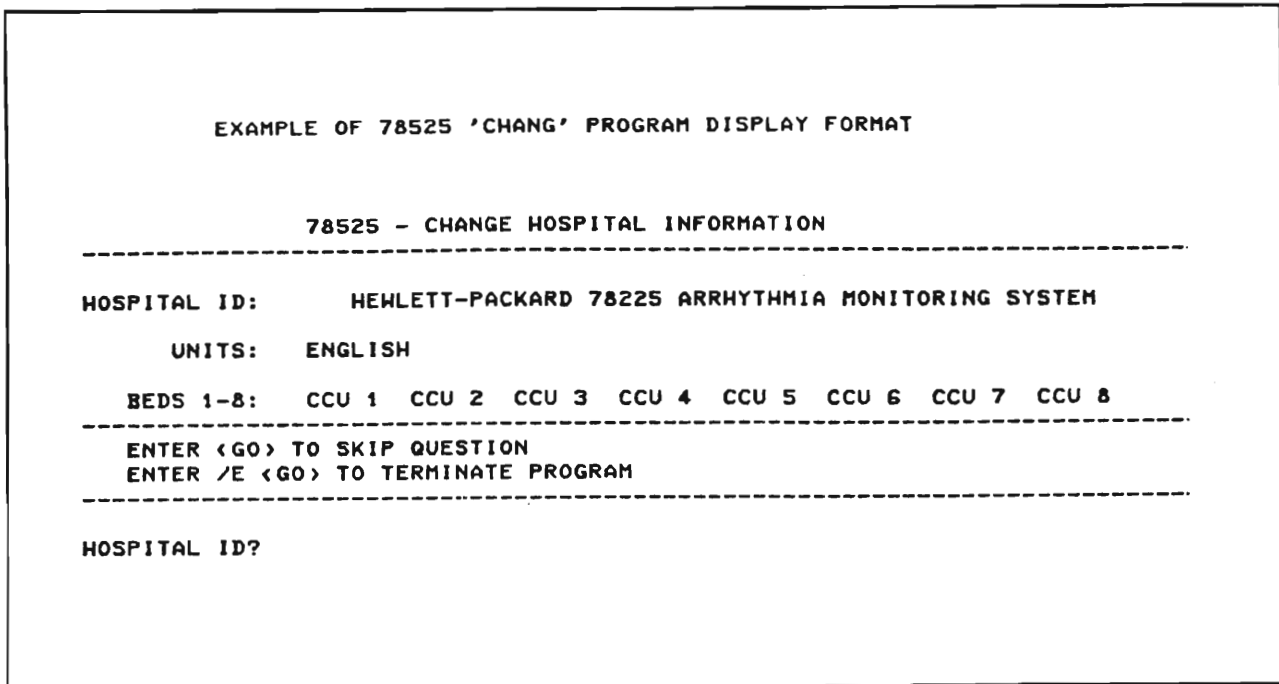


Figure 4-1. Example of 78525 "Change" Program Display Format

4-21. Listing System Messages.

4-22. System messages and error reports are displayed at the 2648 Terminal prior to system start-up. Once the 78525 is initialized and started, the terminal begins operating as a data entry and recall station; as a result, system messages and error reports become stored on the system disc for later examination via the LOGLS program.

4-23. System messages and error reports fall into four classes which indicate their severity:

- a. Informational — No action is required.
- b. Operator Error — An operating error that can easily be corrected.
- c. Warning — A system program has encountered a temporary condition which is automatically recoverable. Some patient data may have been lost, however.
- d. Failure — A system program has encountered a condition from which it cannot recover automatically. Operation of the 78525 may be compromised, in which case restarting the system is required. A failure encountered during the start-up procedure is possibly caused by incorrect system configuration. If configuration parameters were entered correctly, consult a Hewlett-Packard factory representative for assistance.

4-24. Table 4-1 lists the basic types of system messages, their format, meaning and appropriate recovery action. Table 4-2 provides more detailed information for error reports that are most frequently encountered.

4-25. 78171 Annotating Recorder Test and Calibrate.

4-26. The TS171 program verifies operation of the 78171 Annotating Recorder used at the Recall and Edit station. The program also allows the recorder front panel gain and offset controls to be adjusted for proper waveform recording. Note that the 78525 System start-up sequence must be performed prior to performing the following test.

4-27. Proceed by accessing the FMGR program described in paragraph 4-14. Next, enter the following command into the 2648 Terminal and perform the following procedure:

RU,TS171

- a. The recorder strip chart should begin to move. If not, there is a problem with either the recorder 12966 ASCII I/F card, the 14177 cable, or the 78171 internal strap settings.
- b. Verify that the full character set is printed along the strip chart annotation line as shown in Figure 4-2. If no annotation appears, there is a problem with the recorder ASCII I/F card, the 14177 cable, the 12966 computer I/F card, or the computer DCPC card.
- c. The auxiliary ECG recorder input is driven by the computer via one channel of a 12555 8-bit D/A Converter card. Each bit of the D/A is tested by outputting a succession of binary-weighted pulses to the recorder (2.56V, 1.28V, 0.64V, 0.32V, 0.16V, 0.08V, 0.04V, and 0.02V) which are attenuated by one-half the 78171 input amplifier (see Figure 4-3). If no pulses appear, either the 78171 auxiliary input is not selected or there is a problem with the 78171 Recorder, the 78225-60010 cable, or the 12555 D/A card.
- d. Verify that a 5-volt peak-to-peak sawtooth waveform is output to the auxiliary ECG recorder input, as shown in Figure 4-4. Adjust the front-panel gain and offset controls so that the peaks of the waveform just meet the top and bottom strip chart lines.
- e. To stop the recorder test strip press GO at the 2648 Terminal. If the strip recording does not stop, there is a problem with the 12966 I/F card.

Table 4-1. 78525 System Messages

TYPE: RTE OPERATOR ERRORS	
FORMAT:	OP CODE ERROR NO SUCH PROG INPUT ERROR ILLEGAL STATUS CMD IGNORED-NO MEM
MEANING:	Command entered in response to RTE prompt (either $\%$ or $\>nn$) was invalid or could not be processed.
ACTION:	Try again.
TYPE: FILE MANAGER OPERATOR ERROR	
FORMAT:	FMGR nnn
MEANING:	Command entered in response to File Manager prompt (:) was invalid.
ACTION:	Determine meaning of error by entering $??,nnn$ where nnn is FMGR error number. Retry command as appropriate.
TYPE: RTE I/O ERRORS (OPERATOR ERROR/WARNING)	
FORMAT:	I/O ET L *x E *y S *z (end of tape) I/O TO L *x E *y S *z (time out) I/O NR L *x E *y S *z (not ready) I/O PE L *x E *y S *z (parity error)
MEANING:	I/O device (LU x, EQT y, Subchannel z) error. Generally will occur only for 2648 Cartridge Tape Unit operations.
ACTION:	TO (time out): enter UP,y NR (not ready): correct not-ready condition If Cartridge Tape, check for correct tape unit (left or right) If writing to Cartridge Tape, check position of record-protect switch on tape. If disk error (x=2), check for disk drive ready.

Table 4-1. 78525 System Messages (Continued)

TYPE:	78225 PROGRAM ERRORS	(WARNING/FAILURE)
FORMAT:	prog ec nnnn [optional parameters] hh:mm:ss	
MEANING:	prog = name of program issuing error message ec = 2-character error code nnnn = 4 digit error code (hour:minute.second)	
	In general, these messages indicate a software error of moderate to extreme severity, or else a configuration error of extreme severity.	
ACTION:	See table 4-2.	
TYPE:	RTE PROGRAM ERRORS	(FAILURE)
FORMAT:	MP prog address DM prog address RQ prog address DRnn prog address SCnn prog address IOnn prog address RNnn prog address LUnn prog address	
MEANING:	prog = name of program causing error address = program address	
	Generally, these errors indicate either a severe software error or a hardware malfunction.	
ACTION:	Consult factory.	
TYPE:	DISK TRANSFER ERROR	(FAILURE)
FORMAT:	TR nnnn EQT x Uy S/U	
MEANING:	nnnn = track number x = disk EQT number y = disk subchannel number S = RTE system request caused error U = user program request caused error	
	Irrecoverable disk transfer parity error. Indicates severe hardware malfunction.	
ACTION:	Consult factory.	

Table 4-2. 78525 Program Error Reports

78525 PROGRAM ERROR REPORTS

```

*****
#
# MESSAGE FORMAT:
#
#   PROG EC NNNN [OPTIONAL PARAMETER] HH:MM.SS
#
#   PROG = NAME OF PROGRAM CAUSING ERROR
#   EC   = 2-CHARACTER ERROR CODE
#   NNNN = 4-DIGIT ERROR NUMBER
#
#   HH:MM.SS = TIME OF ERROR (HOUR:MINUTE.SECOND)
#
# SEVERITY CLASSES:
#
#   W = WARNING -- RECOVERABLE PROBLEM
#                   PATIENT DATA MAY HAVE BEEN LOST
#
#   F = FAILURE -- NON-RECOVERABLE PROBLEM
#                   SYSTEM OPERATION MAY BE COMPROMISED
#                   MAY NECESSITATE RESTARTING SYSTEMED
#
#   * = PROGRAM ISSUING MESSAGE HAS BEEN ABORTED
#
*****
    
```

ERROR	[PARAM]	SEVERITY CLASS	COMMENTS
AR 0001	NN	F	ARYTH PROGRAM LOADING FILE ERROR NN= FMP ERROR CODE
0002	NNNNN	F	ARYTH ABSOLUTE PROGRAM LOAD ERROR NNNNN= RECORD ADDRESS
0003		F	ARYTH START UP ERROR IMPROPER LU,EQT,DRIVER CONFIGURATION
CN 0001	FILE NAME	* F	CONFIGURATION FILE NOT FOUND
0002	NCS	* F	ILLEGAL # OF 78221 CENTRAL STATIONS NCS = #
0003	PAT# PP	W	MORE THAN 1 PATIENT ASSIGNED TO SAME BED PP = PATIENT #
0004	PAT# PP	W	PATIENT ASSIGNED TO ILLEGAL BED # PP = PATIENT #
0005	FILE NAME	* F	PRESSURE ALLOCATION FILE NOT FOUND

Table 4-2. 78525 Program Error Reports (Continued)

FL 0201	FILE NAME	F	FILE NOT OPENED
0202	FILE NAME	F	ILLEGAL PARAMS FOR DATA READ WRITE
0203	FILE NAME	F	ILLEGAL DATA BUFFER SIZE
0205	FILE NAME	F	CAN'T READ EXTENDED DATA HEADER (??)
0206	FILE NAME	F	FILE NOT OPEN
0207	FILE NAME	F	CAN'T POST DATA TO FILE
00NN	FILE NAME	F	FILE MANAGER ERROR NN = - FMP ERROR CODE
FO 0000	"NO FORMATTER"	F	ATTEMPT TO OUTPUT MESSAGE USING THE DUMMY FORMATTER MODULE
0001	" XXXXX "	F	FORMAT ERROR XXXXXX= FORMAT CONTROL STRING
HC 0001	ADDRESS	W	SCHEDULING PARAMETER ERROR
HC 0001	ADDRESS	F	HARD COPY PAGE SET UP PARAM ERROR
0002	ADDRESS	F	INSUFFICIENT SPACE IN HARD COPY CHARACTER BUFFER
0003	ADDRESS	W	X-Y POINT COORDINATE ERROR
MR 0001	ADDRESS	* F	MEM RES FILE SYSTEM ALREADY INIT'D
MR 0001	ADDRESS	* F	FILE NUMBER OR RECORD NUMBER ERROR
0002	ADDRESS	* F	INSUFFICIENT MEMORY SPACE FOR FILE ALLOCATION
0003	ADDRESS	* F	READ OR WRITE OUTSIDE OF RECORD BOUNDARY
0004	ADDRESS	* F	CAN'T SWITCH USER MAP TO ACCESS FILE IN EXTENDED MEMORY RESIDENT FILE AREA
0005	ADDRESS	F	CAN'T ALLOCATE RESOURCE NUMBER

Table 4-2. 78525 Program Error Reports (Continued)

PA 000N 00RR		W	PATIENT ADMIT ERROR N=1 INVALID BED #, OR BED OCCUPIED 2 INVALID REQUESTOR ID 3 MAX # OF PATIENTS ALRDY ADMITTED 4 ADMISSION NOT ALLOWED FROM REQUESTOR RR= REQUESTOR ID 1= 2648 PATIENT CENSUS 2= 78221 CENTRAL STATION 3= 5600A
PD 000N PPRR		W	PATIENT DISCHARGE ERROR N=1 INVALID PATIENT # 2 INVALID SECURITY CODE 3 INVALID REQUESTOR ID 4 DISCHARGE NOT ALLOWED FROM REQUESTOR PP= PATIENT NUMBER RR= REQUESTOR ID
RS 0001 0PPAAR		W	RTFS EVENT NOT FOUND FOR RESET EDIT TREND DATA COUND NOT BE EDITED PP = PATIENT NUMBER AA = ALARM CODE R = RESET CODE
0002 0PPAAR		W	
TM 0001		W	REQUEST TO SET SYSTEM TIME AFTER TIME INITIALLY SET
TM 0001	NNNNNN	* W	MISMATCH BETWEEN EXPECTED TIME AND TREND DATA MAILBOX TIME NNNNNN= MAILBOX TIME (MINUTE)
TM 0002	NNNNNN	W	MISMATCH BETWEEN PRESSURE, MAILBOX AND EXPECTED TIME NNNNNN= MAILBOX TIME (MINUTE)
TX 0001	,	W	TEXT HAS NOT BEEN LOADED INTO ARYTH PROGRAM ON START-UP. ALARM MESSAGES WILL NOT BE SENT TO 78511
VF 0001	ADDRESS	F	VIDEO OUTPUT FORMAT CONTROL STRING ERROR

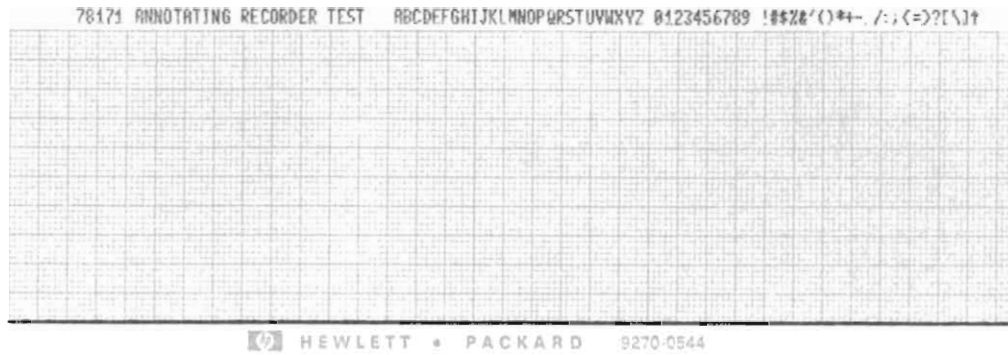


Figure 4-2. 78171 Annotating Recorder: Annotation Test

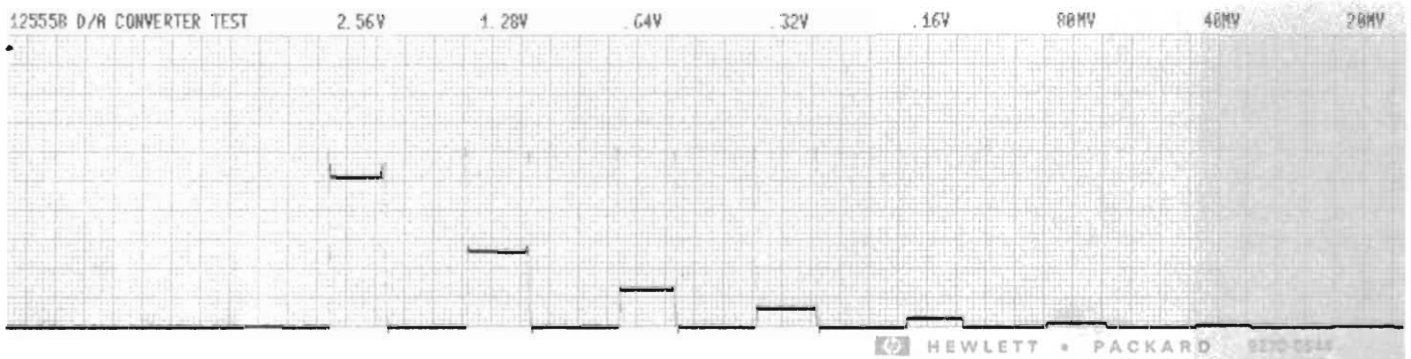


Figure 4-3. 78171 Annotating Recorder: D/A Converter Test

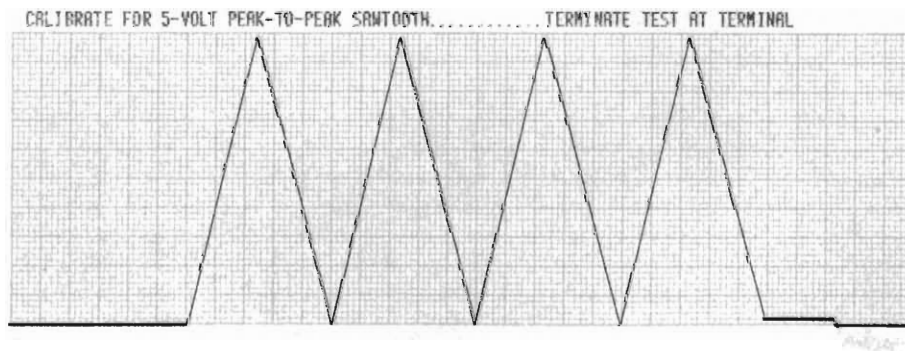


Figure 4-4. 78171 Annotating Recorder: Waveform Calibration Test

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