



OPERATING AND SERVICE MANUAL

13191A

CONTROL AND STATUS TEST ACCESSORY

(FOR THE 7970 SERIES DIGITAL MAGNETIC TAPE UNITS)

Manual Part No.: 13191-90000

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Printed-Circuit Assembly:

13191-60010, Series 1040

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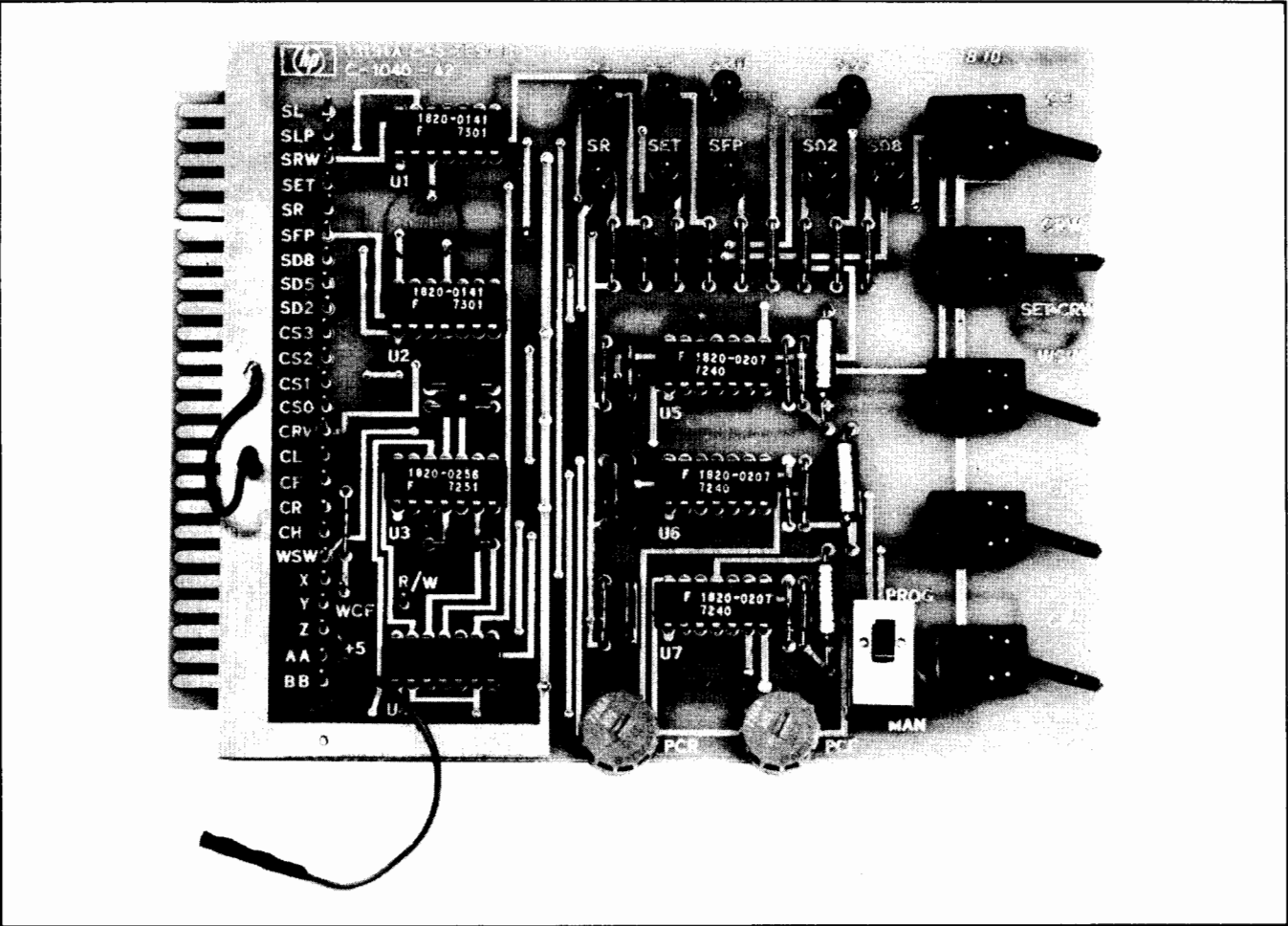
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Figure 1-1. HP 13191A Control and Status Test Accessory

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This operating and service manual provides general information, installation, operation, theory of operation, and maintenance information for the HP 13191A Control and Status Test Accessory.

1-3. DESCRIPTION.

1-4. The HP 13191A Control and Status Test Accessory printed-circuit assembly (PCA) consists of TTL and DTL integrated circuits which exercise the control functions of the HP 7970 Series Digital Magnetic Tape Units. Simulated functions, generated by the test PCA may be used to perform off-line tests and electrical adjustment of tape units with seven- or nine-track, non-return-to-zero inversion (NRZI) or phase-encode (PE) recording format.

1-5. When used with the HP 13192A Write Test Accessory and the HP 13193A Read Test Accessory, the control and status test accessory performs off-line checks of the HP 7970B/C Digital Magnetic Tape Unit (seven-, nine-track, NRZI). The control and status test PCA, in conjunction with the HP 13196A Phase-Encoded Test Accessory and the HP 13195A Write Formatter Accessory PCA, tests the phase-encoded operations of the HP 7970E Digital Magnetic Tape (seven-, nine-track, NRZI and/or PE) in an off-line environment.

1-6. The HP 13191A Control and Status Test Accessory PCA generates the commands necessary for controlling tape unit operations, such as start-stop, and speed and distance variations over a tape speed range of 10 to 45 inches per second (ips). This control allows factory-level electrical adjustments of the tape transport. These adjustments include capstan motion and off-set current. Forward or reverse tape motion may be selected manually, or activated automatically in the program mode. In this mode, forward or reverse tape motion is activated for a time interval determined by control circuits on the control and status test PCA. Test PCA light-emitting diode indicators visually display the tape unit operational mode and status.

1-7. The control and status test PCA plugs directly into the tape unit control and status PCA, (A16). Power for the test PCA operation is obtained from A16 via a jumper wire. Table 1-1 lists specifications for the test accessory.

1-8. IDENTIFICATION.

1-9. Hewlett-Packard uses five digits and a letter (00000A) for standard kit designations. If the designation

Table 1-1. HP 13191A Control and Status Test Accessory Specifications

SIZE

5-13/16 inches by 4-1/2 inches

SHIPPING WEIGHT

3 lbs



POWER REQUIREMENTS

+5 VDC @ 300 mA (supplied by HP 7970 Digital Magnetic Tape Unit)

LOGIC LEVELS

Minimum input voltage required to represent a high (logic 1):

U1 thru U3: ≥ 1.9 Vdc

U4: ≥ 2.0 Vdc

U5 thru U7: ≥ 1.7 Vdc

Maximum input voltage required to represent a low (logic 0):

U1 thru U3: 1.1 Vdc

U4: 0.8 Vdc

U5 thru U7: 0.9 Vdc

of your kit does not agree with that on the title page of this manual, there are differences between your kit and the kit described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Sales and Service Office. These offices are listed at the back of this manual.

1-10. Printed-circuit assembly (PCA) revisions are identified by a letter, a series code, and a division code stamped on the board (e.g., A-1152-22). The letter code identifies the version of the etched trace pattern on the unloaded board. The series code (four middle digits) refers to the electrical characteristics of the loaded assembly and the positions of the components. The division code (last two digits) identifies the Hewlett-Packard division which manufactured the PCA. If the series code stamped on the PCA does not agree with the series code shown on the schematic diagram in this manual, there are differences between the PCA and the PCA described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Sales and Service Office.

1-11. RELATED ACCESSORIES.

1-12. The following accessories are used in conjunction with the HP 13191A Control and Status Test Accessory.

- a. HP 13192A Write Test Accessory.
- b. HP 13193A Read Test Accessory.
- c. HP 13195A Write Formatter Accessory Kit.
- d. HP 13196A Phase-Encoded Test Accessory.

1-14. RELATED MANUALS.

1-15. The following manuals contain information related to products associated with the HP 13191A Control and Status Test Accessory:

HP 7970B/C Digital Magnetic Tape Unit Operating and Service Manual, part number 07970-90383.

HP 7970E Digital Magnetic Tape Unit Operating and Service Manual, part number 07970-90765.

HP 13192A/HP 13193A Read Test PCA and Write Test Accessory Operating and Service Manual, part number 13192-90000.

HP 13195A Write Formatter Accessory Kit Operating and Service Manual, part number 13195-90000.

HP 13196A Phase-Encoded Test Accessory Operating and Service Manual, part number 13196-90000.

2-1. INTRODUCTION.

2-2. The HP 13191A Control and Status Test Accessory is factory-checked to assure performance to published specifications before being packed for shipment. This section provides information to determine that the accessory has been received intact. Installation instructions for the test accessory and other associated tape unit accessory connections are included.

2-3. UNPACKING AND INSPECTION.

2-4. Before unpacking, inspect the shipping carton for damage. If damage to the shipping carton is evident, request that the carrier's agent be present when the accessory is unpacked. After unpacking, inspect the accessory for mechanical damage (cracks, broken parts, etc).

2-5. CLAIM FOR DAMAGE.

2-6. If the test accessory is damaged and fails to meet published specifications, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. (HP Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection. The Hewlett-Packard Sales and Service Office will arrange for the repair or replacement of the damaged test accessory without waiting for any claims against the carrier to be settled.

2-7. INSTALLATION.

2-8. Turn off power on the tape unit to be tested (the master tape unit in master-slave multiunit applications) and take the tape unit physically off-line by removing the computer interface connector cables.

2-9. Figures 2-1 and 2-2 show a typical NRZI test installation. Figures 2-3 and 2-4 show a test PCA installation used when testing a phase-encoded tape unit. Before installing the test PCA's, refer to the appropriate figure for installation details. Then set all HP 13191A controls as follows:

CH switch	- down (off) position
CRW switch	- center (off) position
WSW switch	- down (off) position

CR switch	- down (off) position
CF switch	- down (off) position
PROG-MAN switch	- down (MAN) position

2-10. Check to make sure that the +5V jumper (P2) is connected to its storage pin (J4), and that the Unit Select jumper (P1) is connected to its storage pin (J1). These jumpers and pins are shown in figure 3-1.

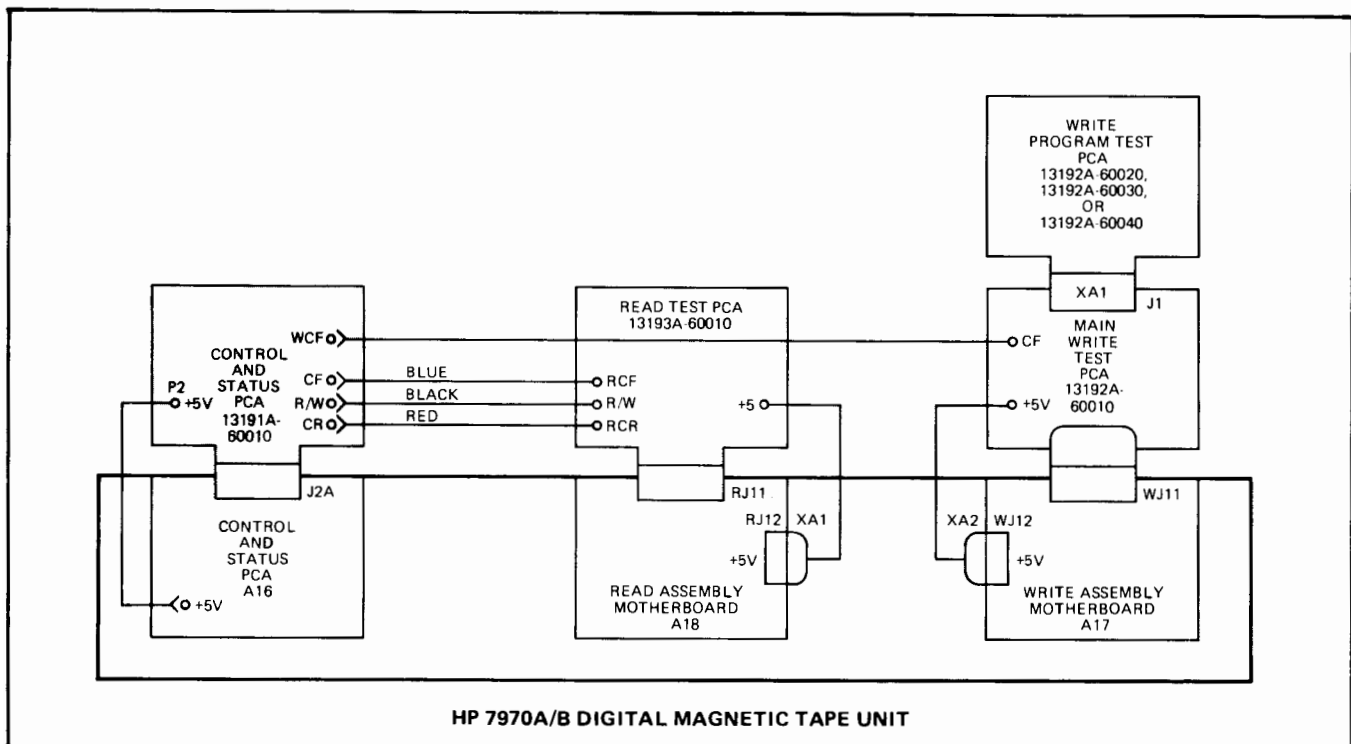
2-11. The control and status test PCA is installed directly into the multi-unit motion control and status connector provided in the tape unit. A keying slot, notched into the test PCA's connector, prevents installing the PCA in the wrong position.

2-12. After installing the test PCA (refer to figure 3-1), remove the +5V jumper (P2) from the storage pin (J4) and connect it to the +5V pin on the Control and Status PCA (A16). Next, remove jumper P1 from the storage pin (J1) and connect it to the CS0, CS1, CS2 or CS3 pin (TP10, TP11, TP12 or TP13) corresponding to the UNIT SELECT jumper strap on the Control and Status PCA (A16).

Note: In tape units having the Unit Select Option, the strapping on the control and status PCA (A16) overrides the front panel Unit Select switches. In these units, make sure that the strap remains in the OFF position and use the front panel switches to select the unit.

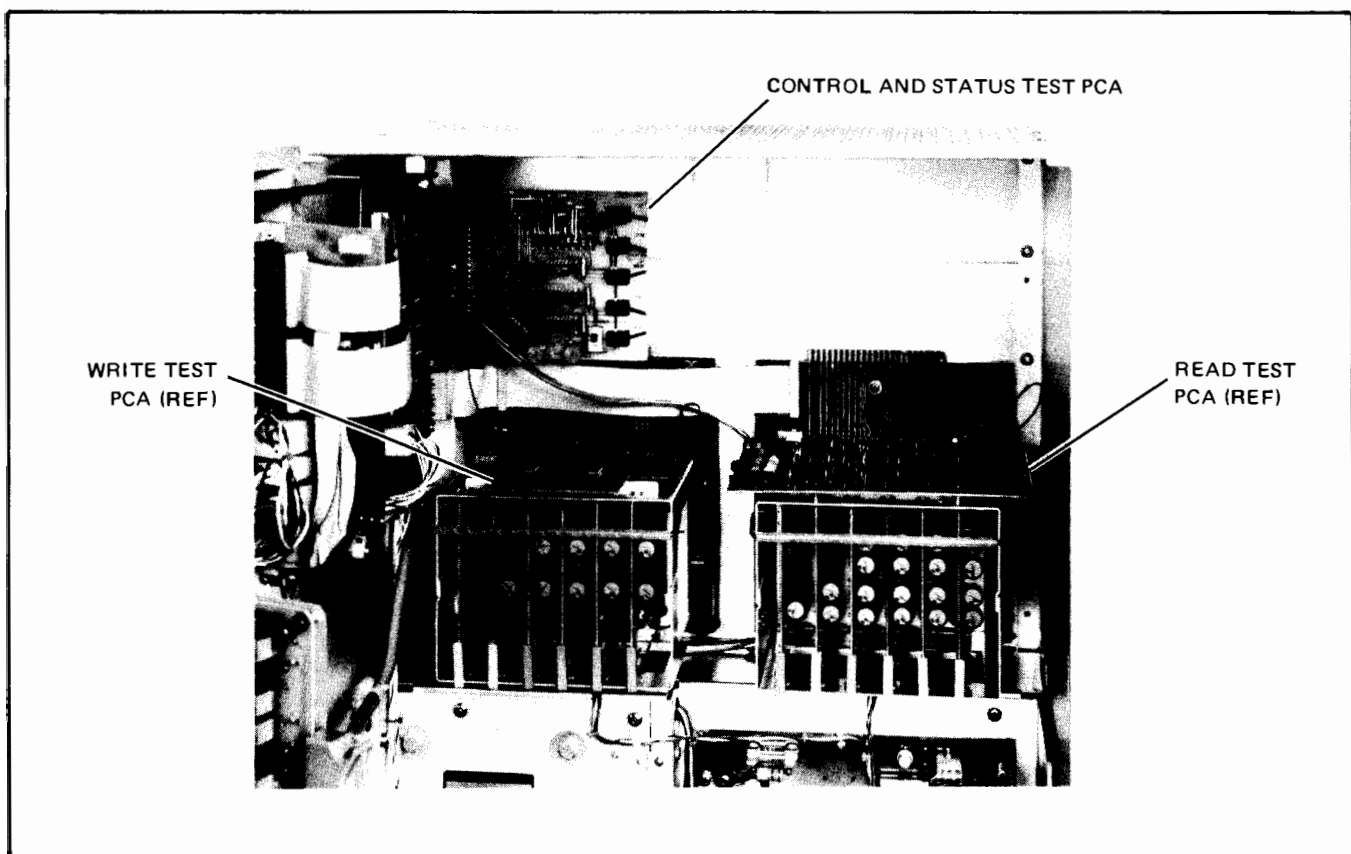
2-13. Once the test PCA has been installed, power may be applied to the tape unit. With the tape unit in the ON-LINE condition, the SL (on-line) and SR (ready) status indicators will light. The tape unit will respond to manual or programmed commands from the control and status test PCA.

Note: The OFF-LINE condition may be set by jumpering the CL test pin (TP15) on the PCA's common trace (J1). No ON-LINE/OFF-LINE switch is provided since generator error could result in the CL line beginning inadvertently placed in the assertion state indicating non-existent problems in the tape unit.



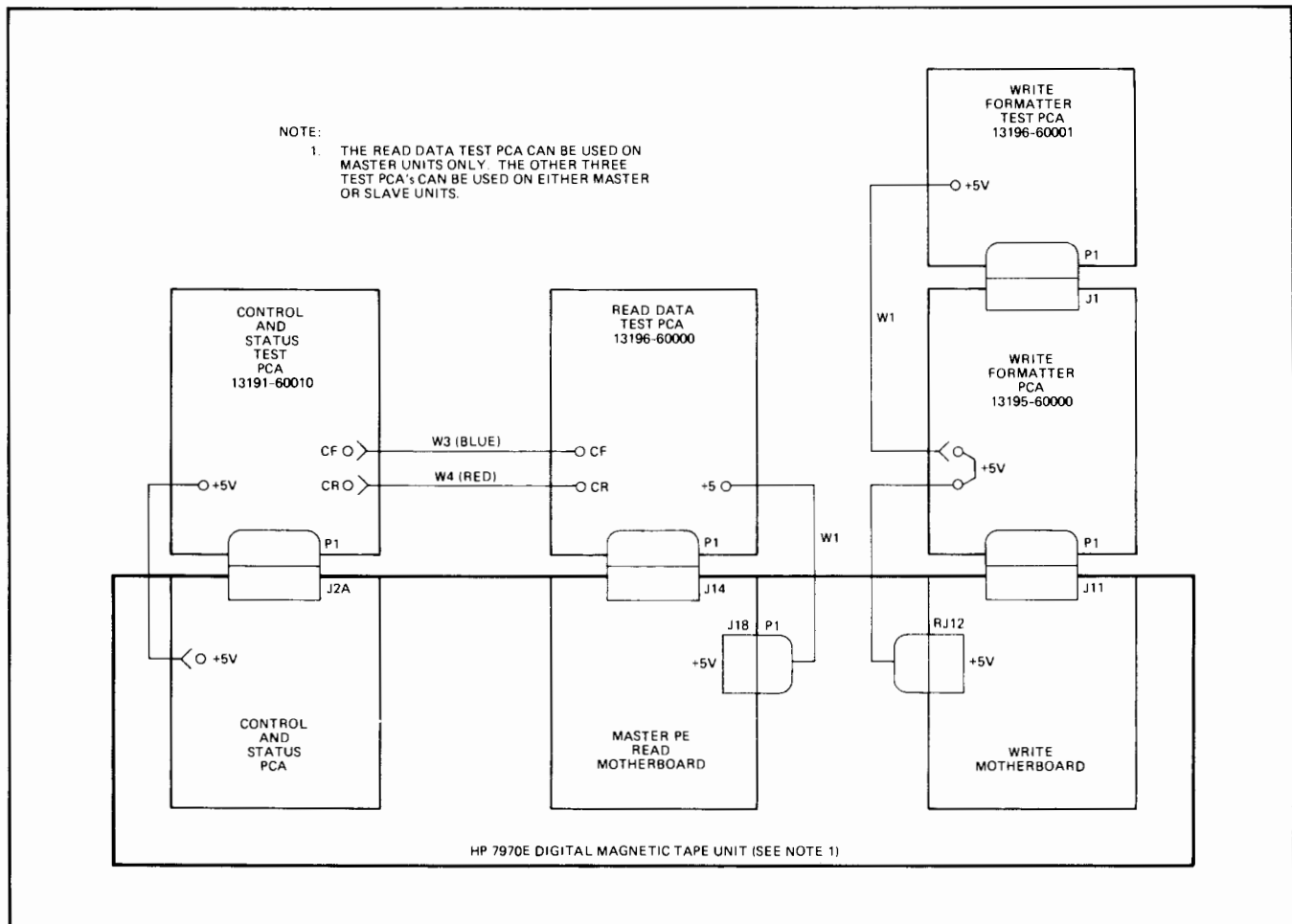
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Figure 2-1. NRZI Test Installation Diagram



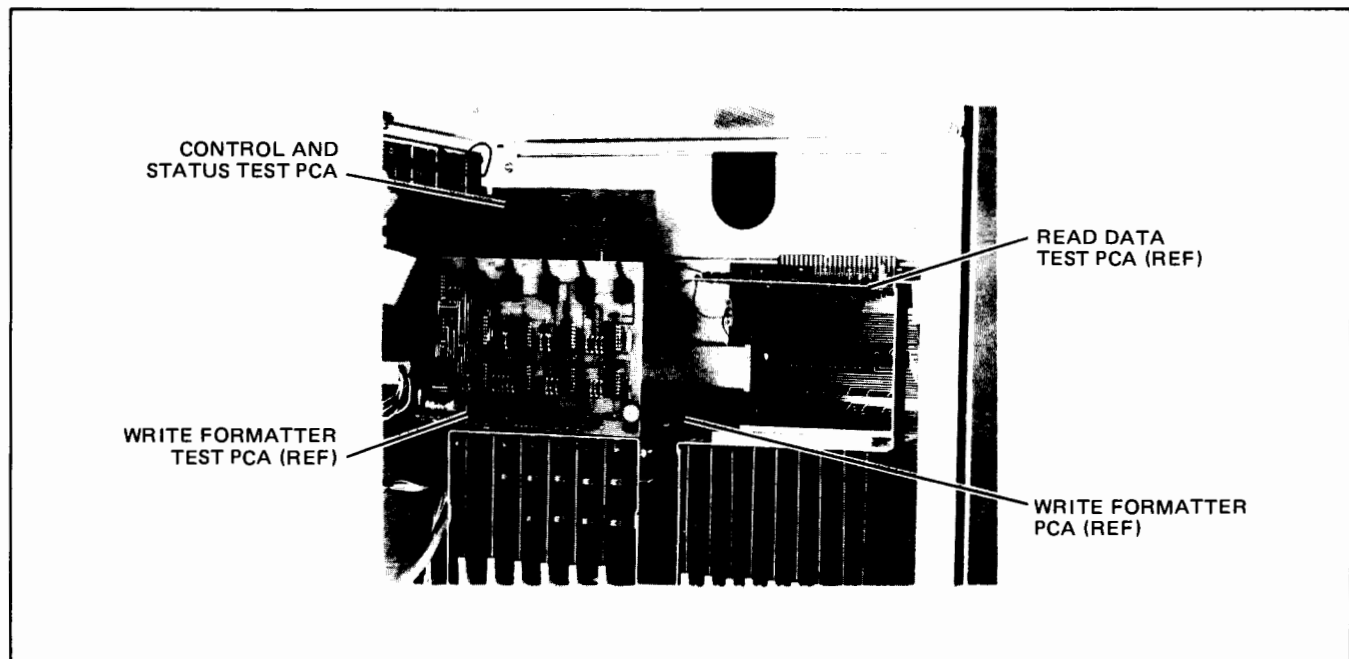
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Figure 2-2. HP 13191A Installed in the HP 7970B/C (NRZI) Digital Magnetic Tape Unit



2222-5

Figure 2-3. Phase Encoded Test Installation Diagram



2222-2

Figure 2-4. HP 13191A Installed in the HP 7970E (Phase Encoded) Digital Magnetic Tape Unit



3-1. INTRODUCTION.

3-2. This section provides information required to operate the HP 13191A Control and Status Test Accessory. All controls and indicators are identified, and the function of each is briefly discussed. The descriptions of the test PCA operations are based on the assumption that the tape unit is operating normally, and that the test PCA has been correctly installed.

3-3. CONTROLS AND INDICATORS.

3-4. Figure 3-1 shows the controls and indicators of the control and status test PCA. Table 3-1 identifies the items shown in figure 3-1, and briefly describes the function of each of these items.

3-5. MODES OF OPERATION.

3-6. The control and status test PCA provides two basic modes of operation: manual or programmed. Slide switch S6 selects these modes when set in the respective MAN or PROG position.

3-7. MANUAL OPERATION.

3-8. Manual operation is selected whenever the PROG-MAN switch is placed in the MAN position. Tape motion commands are operator-selected using the CH (high speed), CRW (rewind), WSW (set write), CR (reverse drive), and CF (forward drive) switches. Selection of the rewind command (CRW) will cause the tape unit to override all commands.

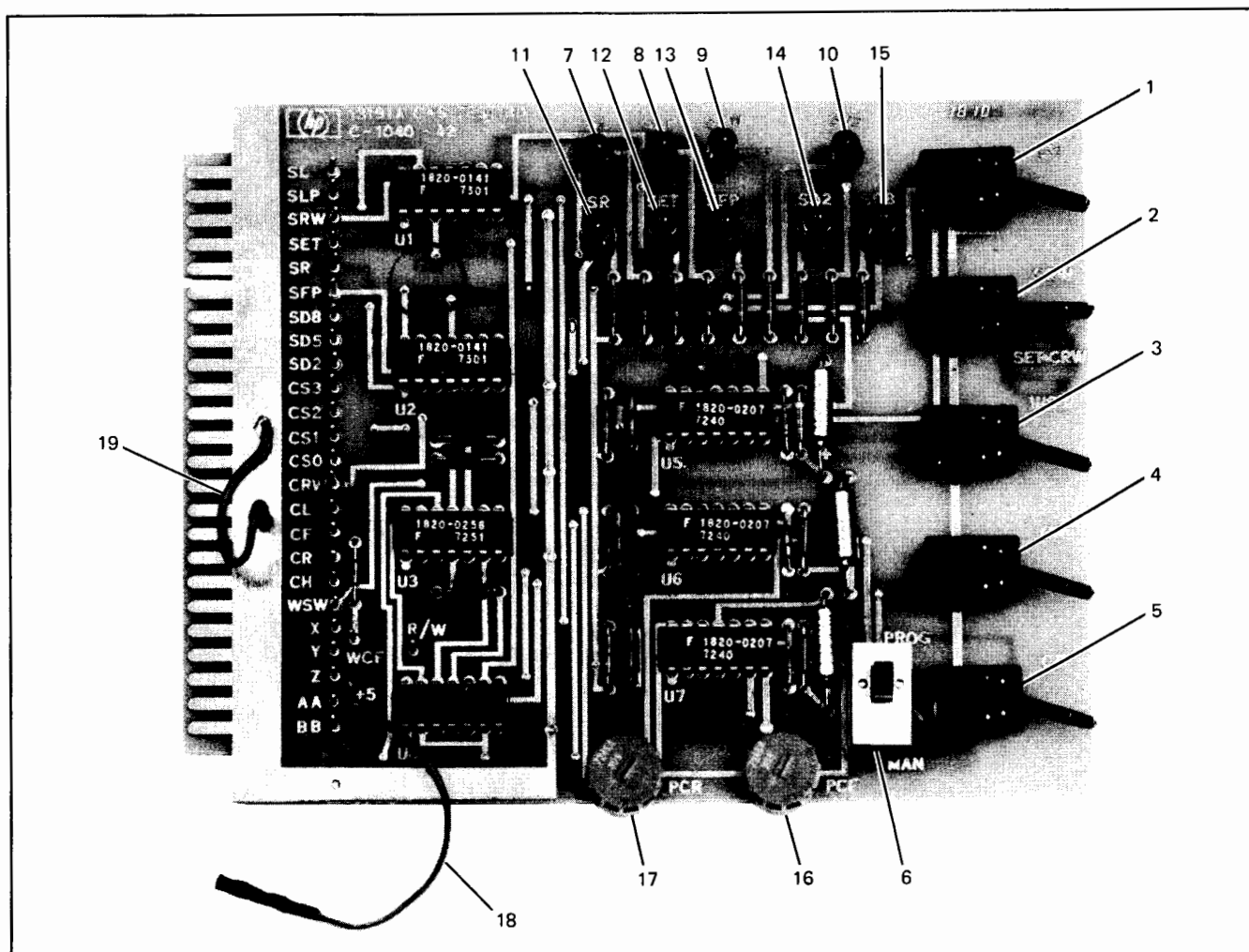


Figure 3-1. Control and Status Test PCA Controls and Indicators

Table 3-1. Control and Indicator Descriptions

FIG & INDEX NO.	NAME	REF DES	FUNCTION
3-1; -1	CH switch	S1	Selects high tape speed in either forward or reverse direction.
-2	CRW switch	S2	Selects one of three functions: <ol style="list-style-type: none"> 1. Rewind. 2. Stop at end-of-tape (EOT). 3. Rewind at EOT.
-3	WSW switch	S3	Enables the set write condition.
-4	CR switch	S4	Selects reverse tape motion.
-5	CF switch	S5	Selects forward tape motion.
-6	PROG-MAN switch	S6	Selects either programmed or manually controlled forward or reverse tape motion.
-7	SL lamp	CR5	Indicates the tape unit is in the on-line status.
-8	SLP lamp	CR6	Indicates tape is at the load point (BOT).
-9	SRW lamp	CR7	Indicates tape is in the rewind status.
-10	SET lamp	CR8	Indicates end-of-tape (EOT) has been detected.
-11	SR lamp	CR9	Indicates tape is in the remote ready status.
-12	SFP lamp	CR10	Indicates tape is in the file protect (read only) status.
-13	*SD2 lamp	CR11	Indicates 200-bpi density has been selected.
-14	*SD5 lamp	CR12	Indicates 556-bpi density has been selected.
-15	*SD8 lamp	CR13	Indicates 800-bpi density has been selected.
-16	PCF adjustment	R20	Allows setting of the forward tape motion command time in the programmed mode of operation.
-17	PCR adjustment	R19	Allows setting of reverse tape motion command time in the programmed mode of operation.
-18	+5V jumper	P2	Provides operating power from the tape unit.
-19	Unit select jumper	P1	Selects unit address for multiple tape unit operation.
*These indicators are used only with seven track tape units or tape units with density select capability.			

Note: When operating in the manual mode, the selection of forward (\overline{CF}) and reverse (\overline{CR}) commands at the same time will cause the transport unit to *halt* all tape motion.

3-9. The three position CRW switch provides continuous cyclic operation of the tape unit whenever the switch is placed in the SET-CRW position. This feature allows the tape unit to automatically rewind upon reaching the end-of-tape marker, and then resume the selected forward motion mode at the loadpoint. This precludes re-threading the tape. Whenever using this feature, make sure the CR switch is turned off and that the CF switch is turned on.

3-10. PROGRAMMED OPERATION.

3-11. In the programmed mode of operation, independent adjustments (PCF and PCR) establish the forward and reverse motion command on-time, and in some applications, data write time. These adjustments allow start-stop operation in either a unidirectional or bidirectional mode.

3-12. The programmed mode is selected by placing the PROG-MAN slide switch in the PROG position and turning the CF and/or CR switches on. The forward and/or reverse command on-times may then be established using the PCF and PCR adjustments. Clockwise rotation of these adjustments increases command on-time and counterclockwise rotation reduces command on-time. Range of adjustment for command on-time is 35 to 400 milliseconds with intermediate stop-times fixed at 50 milliseconds nominal.

3-13. For NRZI test operations, the PCF adjustment also controls the amount of time in which the HP 13192A/HP 13193A Write Test Accessory is permitted to write data bits. This arrangement is provided when the

control and status test PCA is configured with the write test accessory to perform the write block function (refer to the *HP 13192A Read Test and Write Test Accessory Operating and Service Manual*, HP part no. 13192-90000). In the block mode of operation, the length of the written data block is determined by the PCF adjustment on the control and status test PCA. The block length adjustment procedure is provided in paragraph 3-14 of the Read Test and Write Test Accessory Operating and Service manual.

3-14. For phase encoded test operations, the control and status test PCA, in conjunction with the HP 13196A Test Accessory, exercises the functions of the HP 7970E tape unit. Refer to section III of the HP 13196A Operating and Service Manual (HP part no. 13196-90000).

3-15. VISUAL DISPLAY.

3-16. Visual display of status is achieved by using light-emitting diodes. Functions displayed are listed and described in table 3-1. The SD2, SD5, and SD8 status lines will not be displayed unless the density select option is provided in the tape unit.

3-17. PERFORMANCE CHECKS.

3-18. Procedures for making tape unit checks and adjustments are provided in the HP 7970A, HP 7970B/C and the HP 7970E Operating and Service Manuals.

3-19. Table 3-2 provides a list of preliminary switch settings to configure the control and status test PCA for the various NRZI tape unit tests. Additionally, initial switch configurations for the write test accessory and the read test accessory are listed here for convenience. Refer to the read and write test accessory manual for more detailed testing information.

Table 3-2. Preliminary NRZI Test Accessory Switch Settings

HP 7970 TEST	HP 13191A CONTROL AND STATUS TEST ACCESSORY SWITCH CONFIGURATION						HP 13192A WRITE TEST ACCESSORY SWITCH CONFIGURATION		HP 13193A READ TEST ACCESSORY SWITCH CONFIGURATION	
	CH SWITCH	CRW/OFF/ SET CRW SWITCH	WSW SWITCH	CR SWITCH	CF SWITCH	PROG/ MAN	X TALK/ BLOCK SWITCH	EVEN/ODD SWITCH	RD/BL/OFF SWITCH	EVEN/ODD SWITCH
Forward (Steady Sync)	OFF	SET CRW	OFF	OFF	ON	MAN				
Reverse (Steady Sync)	OFF	SET CRW	OFF	ON	OFF	MAN				
High-Speed Forward	ON	SET CRW	OFF	OFF	ON	MAN				
High-Speed Reverse	ON	SET CRW	OFF	ON	OFF	MAN				
Forward Stop/Start	OFF	SET CRW	OFF	OFF	ON	PROG				
Reverse Stop/Start	OFF	SET CRW	OFF	ON	OFF	PROG				
Bi-Directional	OFF	SET CRW	OFF	ON	ON	PROG				
Rewind	N/A	CRW	N/A	N/A	N/A	N/A				
Search EOT (End-of-Tape) Sync	OFF	OFF	OFF	OFF	ON	MAN				
Search EOT, High-Speed	ON	OFF	OFF	OFF	ON	MAN				
Write Data, Continuous	OFF	SET CRW	ON	OFF	ON	MAN	X TALK	(See Note)		
Write Data Block	OFF	SET CRW	ON	OFF	ON	PROG	BLOCK	(See Note)		
Write/Read	OFF	SET CRW	ON	OFF	ON	PROG	BLOCK	(See Note)	RD BL	(See Note)
Read Data	OFF	SET CRW	OFF	OFF	OFF	N/A	N/A	N/A	RD BL	(See Note)
Note: Even or odd parity is selected by the operator, and must agree with the test tape parity format. In addition, the parity selected for the write test accessory must agree with the parity selected for the read test accessory.										

4-1. INTRODUCTION.

4-2. This section describes the theory of operation of the HP 13191 Control and Status Test Accessory. Except where specified, the fold-out schematic and signal summary table, figure 5-2, contained in the maintenance section, provides illustrative support to this theory description. The supporting illustrations in this section contain functional diagrams and waveforms timing diagrams. These diagrams are keyed to text by numeric and alphabetic notations. Figure 4-1, for example, consists of a functional diagram and a waveform timing diagram. The circled numbers, arranged in a column at the left side of the waveform timing diagram, relates the waveforms to circuits illustrated on the functional diagram above it, as well as to similarly keyed text sentences. The circled letters, arranged in a row above the waveform timing diagrams, are time sequence references. These letters correlate in time, illustrated signal level changes to the specific text sentences that describe the event.

4-3. CONTROL AND STATUS TEST PCA CIRCUIT DESCRIPTION.

4-4. The control and status test PCA provides off-line control and indicates the status of the HP 7970 Series Digital Magnetic Tape Units. Functionally, the test PCA can be divided into two sections; status indication and test control.

4-5. STATUS INDICATION.

4-6. As shown in figure 5-2, nine light-emitting diodes (LED's) indicate the status of the tape unit under test. These indicators are buffered by "and" gates U1 and U2, and "nand" gates U3A. All tape unit status input signals are active low when asserted. The buffers respond to these inputs by going low, supplying current paths to ground through respective LED indicators. This current flow causes the indicators to light. "Nand" gate U3A is an exception. This gate responds to an active low $\overline{SD2}$ input signal by going high at its output. This high signal level causes current flow from ground to activate LED indicator DS9. The status input signals are identified in figure 5-2.

4-7. TEST CONTROL.

4-8. The control and status test PCA contains logic circuits that control tape unit motion in either a manual or program mode. In the manual mode, forward or reverse tape motion commands are selected by the CF (command forward) switch or the CR (command reverse) switch. In the programmed mode of operation, forward and reverse tape motion is controlled automatically. The time in which

the tape travels in the forward or reverse direction is directly controlled by the control and status PCA test PCF or PCR potentiometer.

4-9. **MANUAL OPERATION.** In order to activate the manual mode of operation, S6 is placed in the MAN position (see figure 5-2). As a result, switches S2, S4, and S5 directly control tape motion. When reverse tape motion is desired, S4 is placed in the CR position. This transfers ground (from S6) to the \overline{CR} output line, resulting in a true (low) reverse tape motion command. Forward tape motion is manually activated when S5 is placed in the CF position. As long as the tape has not reached the end-of-tape (EOT) mark, the \overline{SET} (EOT) status line remains false (high). This level is inverted by U4 to provide a true (low) CF signal. This forward motion command signal is applied to the tape unit control circuits via S5. A true (low) \overline{SET} input indicates that the tape has reached the end-of-tape mark. The resulting high output of Forward One-Shot (OS) multivibrator U4 terminates the manual forward motion command. The \overline{SET} status line is also tied to the tape rewind (\overline{SET} CRW) terminal of S2. When S2 is placed in the \overline{SET} CRW position, an active low \overline{SET} (\overline{EOT}) signal is transferred to the \overline{CRW} line. The resulting active (low) \overline{CRW} signal responds to the end-of-tape condition by automatically rewinding the tape (as long as S2 is in the \overline{SET} CRW position). When it is desired to rewind the tape before the end-of-tape mark has been reached, S2 is placed in the CRW position. The resulting low (ground) output immediately forces the tape to rewind and overrides any other tape motion command. When S2 is left in the OFF position the tape motion simply halts when the \overline{SET} line goes low (i.e., the end-of-tape mark has been reached).

4-10. **PROGRAMMED OPERATION.** On the control and status test PCA, PROG/MAN Switch S6 is placed in the PROG position to activate the programmed tape control function. Switches S4 and S5 can now be configured to provide the following tape motion operations:

1. Programmed reverse tape motion.
2. Programmed forward tape motion.
3. Programmed forward/reverse tape motion.

4-11. **Programmed Reverse Tape Motion.** For programmed reverse tape motion, CF switch S5 is placed off and CR switch S4 is placed on (the CF position). The low output of S5 then sets the Forward/Reverse latch U4. The resulting high set-side output enables "nand" gate U3C at pin 9. At the same time, the low clear-side output inhibits "nand" gate U3B at pin 6. As a result, the triggering path to Forward One-shot U7 is blocked, and U7 remains in the clear state during the reverse tape motion operation. The

high clear-side output of the Forward One-shot enables “nand” gate U3D at pin 12. The signal generation sequence described in figure 4-1 then occurs (see figure 4-1).

4-12. This cycling, reverse-pause-reverse signal generation process continues for as long as the programmed reverse function is activated by the switches on the control and status test PCA.

4-13. Programmed Forward Tape Motion. Forward tape motion is effected when the CF switch is placed on, the CR switch is placed off, and the PROG/MAN switch is placed in the PROG position. (See figure 5-2.) Ground is applied through S4 to pin 1 of U4. The Forward/Reverse latch U4 responds to this input by going to the clear state. As a result, U4 pin 6 goes low to inhibit “nand” gate U3 at pin 9. Since the triggering path to U7 is blocked, the one-shot remains in the clear during forward tape motion operations. The resulting high clear-side output enables “nand” gate U3D at pin 12. Pin 12 of the cleared Forward/Reverse latch U4 goes high to enable the “nand” gate U3B at pin 6. The signal generation sequence shown in figure 4-2 then occurs.

4-14. This cycle, forward-pause-forward signal generation process continues for as long as the control and status

test PCA switches are configured for the programmed command forward operation. When the control and status test PCA is used in conjunction with the HP 13193A Read Test PCA and the HP 13193A Write Test PCA (as during the write/read test mode operation), an $\overline{R/W}$ signal is received from the read test PCA. This signal inhibits \overline{CF} signal generation for 250 milliseconds, during which time the read test PCA is evaluating tape data for correct longitudinal parity.

4-15. Programmed Forward/Reverse Tape Motion. Cyclic forward and reverse tape motion is initiated by placing both the CF and CR switches on, and placing the PROG/MAN switch to the PROG position (see figure 5-2). Assuming the Forward One-shot is activated first, the Forward/Reverse FF is initially set (i.e., U4 pin 6 is high and U4 pin 12 is low) and the tape motion command signal generation sequence functions in the manner described in figure 4-3.

4-16. This cycling, forward-pause-reverse operation continues for as long as the control and status test PCA switches are configured for the forward/reverse tape motion function.

- 1 a Assuming the Pause One-shot, U5, starts in the clear state, nand gate U3C responds to the low input at pin 8 by going high at pin 10. This high signal transition triggers Reverse One-shot U6 at pins 3 and 4.
- 2 a The clear-side output of the Reverse One-shot is driven low in response to the triggering input from U3C pin 10. Programmed command reverse (PCR) potentiometer R19 determines the duration of this low output signal which is adjustable from 35 to 400 milliseconds. This output is applied to the tape unit control and status PCA (A16) as the Command Reverse (\overline{CR}) signal. The tape unit responds to this input by initiating reverse tape motion.
- 3 b When the \overline{CR} signal terminates, its positive transition drives enabled "nand" gate U3D low at pin 11. This signal transition triggers Pause One-shot U5. The rc timing components of this one-shot provides a fixed output signal of 50 milliseconds.
- 4 b The positive 50-millisecond signal, derived from the Pause One-shot, maintains the output of enabled "nand" gate U3C at a low level.
- c When the Pause One-shot signal terminates, the resulting low signal transition is inverted by "nand" gate U3C to provide a positive-going signal level change. This positive-going signal change triggers the Reverse One-shot.

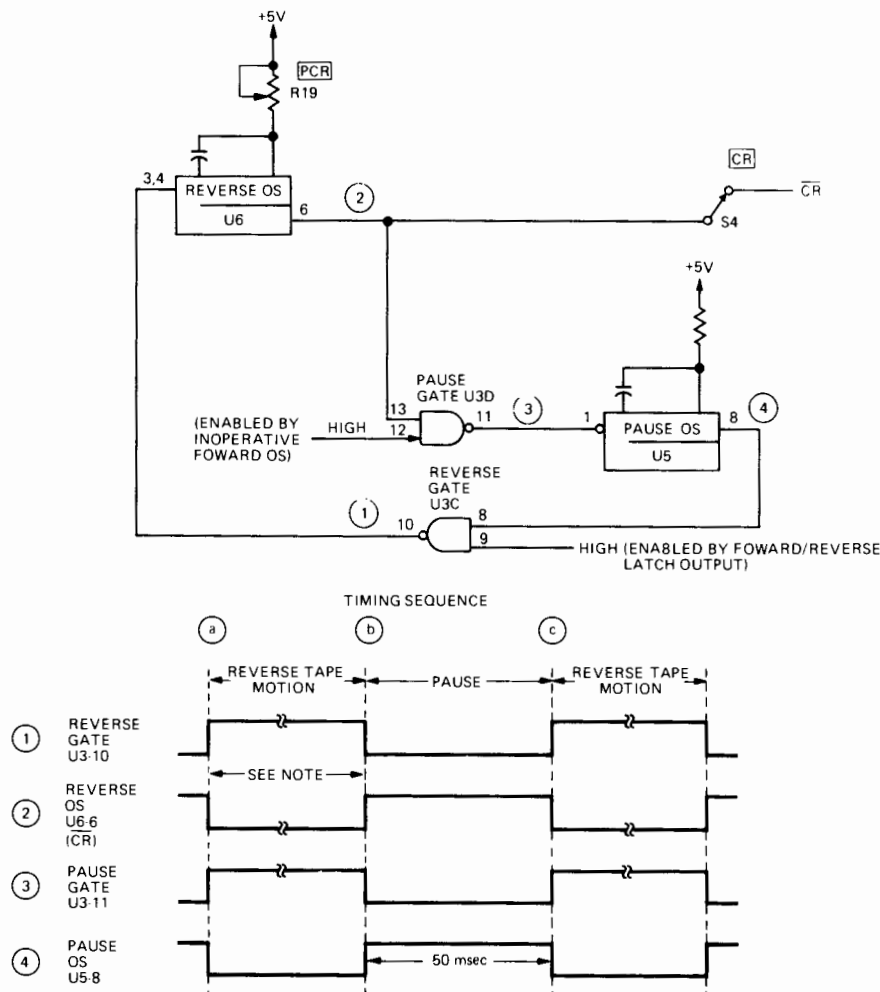
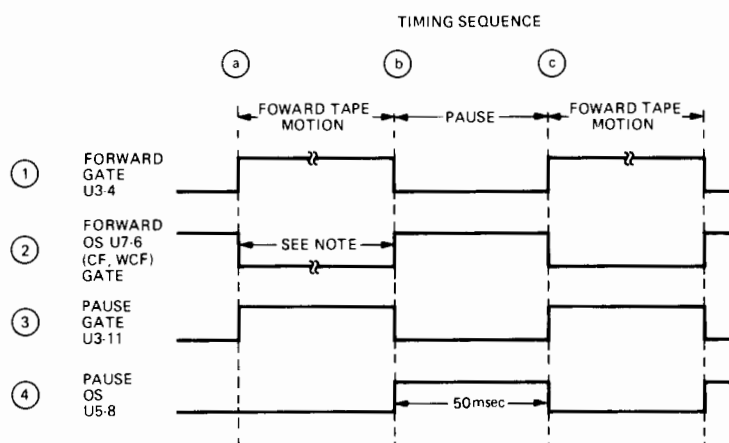
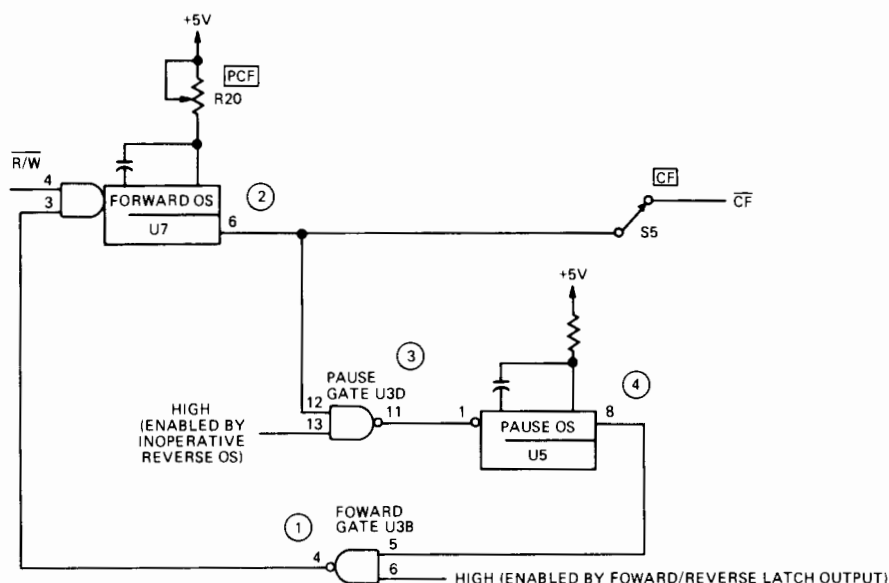


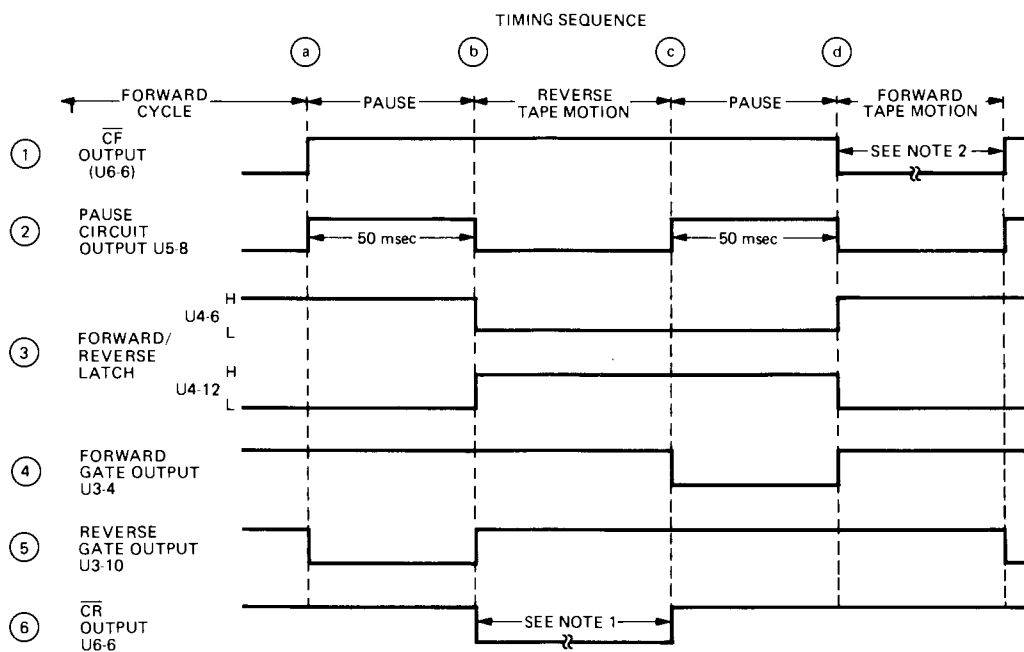
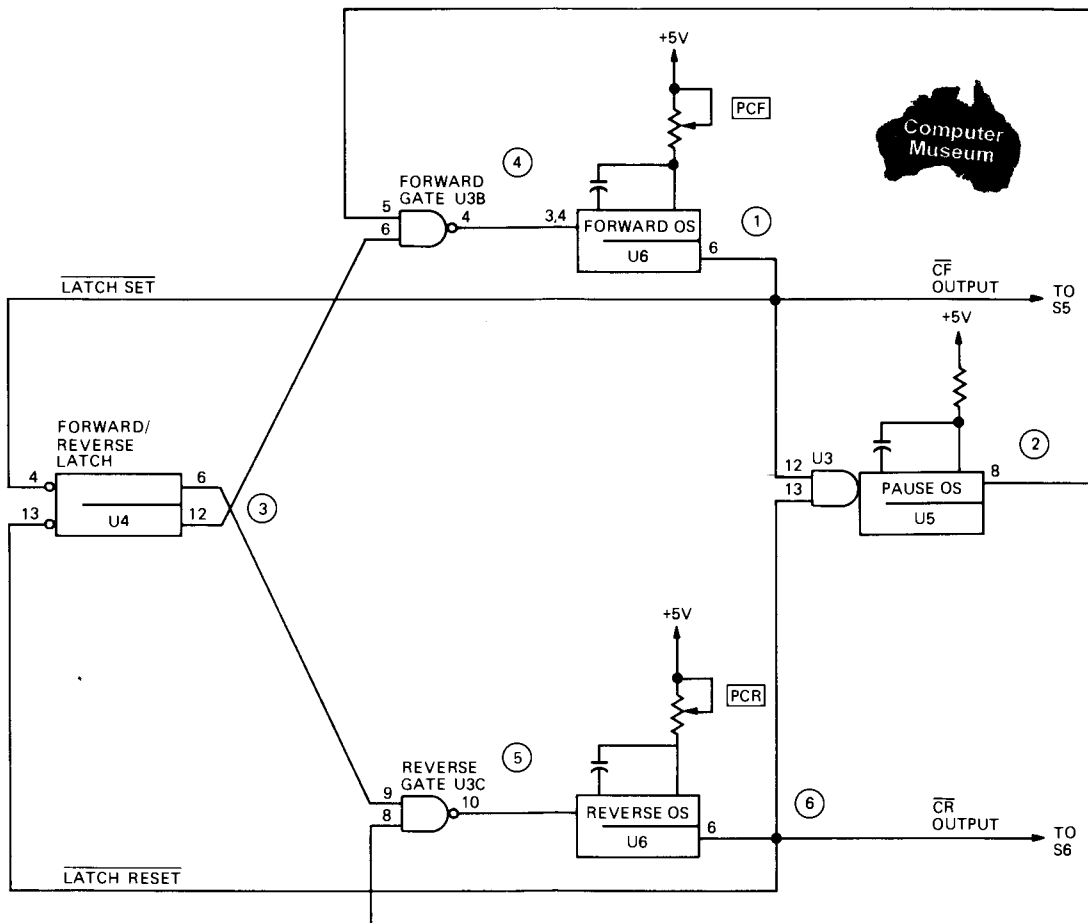
Figure 4-1. Reverse Tape Motion Control Simplified Schematic and Timing Diagram

- 1 a Assuming Pause One-shot U5 starts in the clear state, enabled "nand" gate U3B responds to a low input by going high at pin 4. This high signal transition triggers Forward One-shot U7 at pin 3.
- 2 a The clear-side output of the Forward One-shot goes low in response to the input from U3 pin 4. Programmed Command Forward (PCF) potentiometer R19, determines the width of this low output signal which is adjustable from 35 to 400 milliseconds. This output is applied to the tape unit control and status PCA (A16) as the \overline{CF} (Command Forward) signal. When test write block operations are performed, this low signal output becomes the \overline{WCF} Gate signal (Write Command Forward) that activates the write function of the HP 13192A Write Test PCA. The tape unit responds to the active (low) \overline{CF} signal by providing forward tape motion.
- 3 b When the \overline{CF} signal terminates, its positive transition drives enabled "nand" gate U3D low at pin 11. This low signal transition triggers Pause One-shot U5. The rc timing components of this one-shot provide a fixed output signal duration of 50 milliseconds.
- 4 b The positive, 50-millisecond Pause One-shot output maintains the output of enabled "nand" gate U3B at a low level.
- c When the one-shot output signal terminates, the resulting high-to-low signal transition is inverted by U3C to provide a low-to-high signal change. This signal level change triggers the Reverse One-shot again.



NOTE: CF signal gate duration variable from 35 to 400 milliseconds, depending on PCF (R20) setting.

Figure 4-2. Forward Tape Motion Control Simplified Schematic and Timing Diagram



NOTES:

1. CR Gate width determined by setting of PCR potentiometer.
2. CF Gate width determined by setting of PCF potentiometer.

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Figure 4-3. Forward/Reverse Control Simplified Schematic and Timing Diagram

- ① ① a When the low \overline{CF} (Forward Command) output signal from U6 pin 6 terminates, the high signal transition triggers Pause One-shot U5 and initiates a pause interval.
- ② ① a When triggered, the Pause One-shot generates a 50-millisecond positive signal. During this 50-millisecond pause interval, tape motion is stopped and the tape unit does not read or write data. This positive pause signal is felt at the inputs to "nand" gates U3B and C, pins 5 and 8.
- ③ ① a Since at this time the Forward/Reverse FF is in the set condition, "nand" gate U3C is enabled, and "nand" gate U3B is inhibited. As a result, only the "nand" gate U3C is able to respond to the 50-millisecond Pause One-shot output signal.
- ⑤ "Nand" gate U3C responds to the Pause One-shot output by:
 - ① a Going low at pin 10 during the trailing edge of the input signal.
 - ② b Then going high (50 milliseconds later) when the input signal terminates. This high signal transition triggers the Reverse One-shot.
- ⑥ ② b Reverse One-shot U6 goes low in response to "nand" gate U3C triggering input. This low output signal resets Forward/Reverse FF U4. The output of U6 remains low for a time interval that is determined by the setting of the PCR potentiometer. This time interval is adjustable within a 35- to 400-millisecond range. The resulting low \overline{CR} (Command Reverse) output of the Reverse One-shot is applied to the tape unit via CR switch S6. The tape unit responds to this signal by moving the tape in the reverse direction for the duration of the \overline{CR} signal time. When the \overline{CR} signal terminates, the resulting low-to-high signal transition triggers the Pause One-shot through U3 pin 13.
- ③ ③ c The triggered Pause One-shot then generates a 50-millisecond positive signal, which is applied to "nand" gates U3B and U3C. Since the Forward/Reverse FF is set at this time (i.e., U4 pin 6 is low and U4 pin 12 is high), only the enabled "nand" gate U3B will respond to the Pause One-shot output signal.
- ④ ③ c "Nand" gate U3B responds to the high signal input by going low at pin 4.
- ① ④ d When the signal ends (50-milliseconds later), the high-to-low signal level change results in a high "nand" gate U3B output signal transition. This output triggers Forward One-shot U6.
- ① ① d One-shot U6 generates the \overline{CF} signal (Command Forward) and sets the Forward/Reverse FF. The \overline{CF} signal is transferred to the tape unit via S5 and results in forward tape motion.

5-1. INTRODUCTION.

5-2. This section contains maintenance information for the HP 13191A Control and Status Test Accessory. Included are troubleshooting diagrams, a parts location diagram, table of signal mnemonic definitions and a schematic diagram.

5-3. TROUBLESHOOTING.

5-4. Troubleshooting the test PCA consists of analyzing improper operation to determine which component is faulty. This is accomplished with the aid of fault isolation procedures and the schematic/component location diagrams (figure 5-2) supplied in this section, and the theory of operation contained in section IV.

5-5. INDICATOR CHECK.

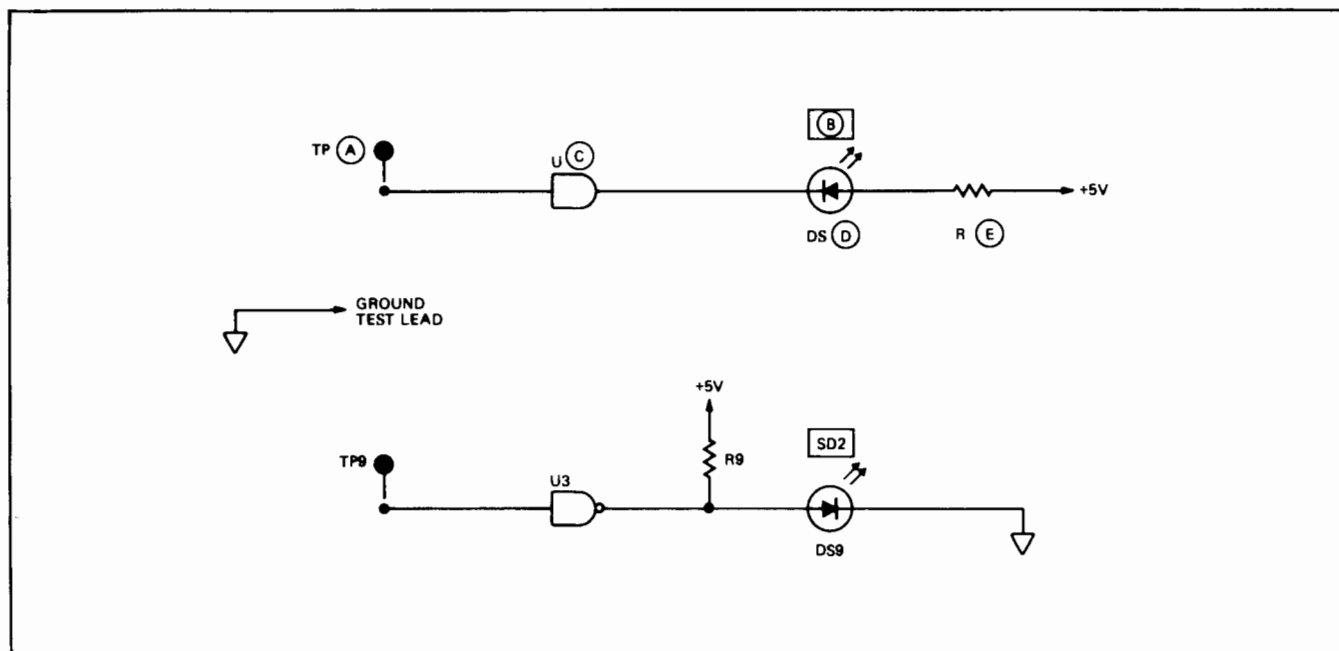
5-6. To check the operation of the control and status test PCA indicator circuits, ground the pin indicated in table 5-1, as shown in figure 5-1, and observe that the appropriate indicator lights. If the indicator fails, check and replace the faulty component indicated in the table.

5-7. TAPE MOTION COMMAND CHECKS.

5-8. Tape motion test commands are checked when the control and status test PCA is operating in the programmed mode. Table 5-2 provides a basic, failed-component isolation procedure for the programmed \overline{CR} (Command Reverse) function. Table 5-3 provides fault isolation procedures that are performed when the \overline{CF} (Command Forward) function fails. When the programmed forward/reverse tape motion function does not operate properly, troubleshooting is accomplished by using the procedures in both table 5-2 and table 5-3.

Table 5-1. Indicator Troubleshooting Table

GROUND TEST LEAD CONNECTION TP (A)	ILLUMINATED INDICATOR (B)	RESPONSIBLE COMPONENTS		
		GATE U (C)	LED INDICATOR DS (D)	RESISTOR R (E)
1	SL	1	1	1
2	SLP	1	2	2
3	SRW	1	3	3
4	SET	1	4	4
5	SR	2	5	5
6	SFP	2	6	6
7	SD8	2	7	7
8	SD5	2	8	8
If grounding TP (A) fails to light (B) Indicator DS (D), check or replace the faulty components: U (C), DS (D) or R (E)				



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Figure 5-1. Indicator Troubleshooting Diagram

Table 5-2. Control and Status Test PCA Reverse Tape Operation Troubleshooting Chart

Initial Switch Configuration: CR Switch (S4) = CR position CF Switch (S5) = off position (down) PROG/MAN Switch (S6) = PROG	
CORRECT INDICATION -(See Note)	PROCEDURE FOR INCORRECT INDICATION
1. U4-6 is high, U4-12 is low	Check and replace U4 or S5
2. U7-6 is high	Replace U7
3. CR signal at U6-6 correct as shown in figure 4-1 (2)	Check and replace U3, U5, or U6
4. $\overline{\text{CR}}$ signal at TP17 correct as shown in figure 4-1 (2)	Check and replace S4 or S6
Note: High = +2V to +5V Low = less than +1V	



Table 5-3. Control and Status Test PCA Forward Tape Operation Troubleshooting Chart

Initial Switch Configuration: CR Switch (S4) = off position (down) CF Switch (S5) = CF position PROG/MAN Switch = PROG	
CORRECT INDICATION (See Note)	PROCEDURE FOR INCORRECT INDICATION
1. U4-12 is high, and U4-6 is low.	Check and replace S4 or U4.
2. U6-6 is high	Replace U6.
3. $\overline{\text{CF}}$ signal at U7-6 correct as shown in figure 4-2, (2)	Check and replace U3, U5, or U7.
4. CF signal at TP16 correct as shown in figure 4-2, (2)	Check and replace S5 or S6.
Note: High = +2V to +5V Low = less than +1V	

ID STATUS TEST PCA
SERIES 10401

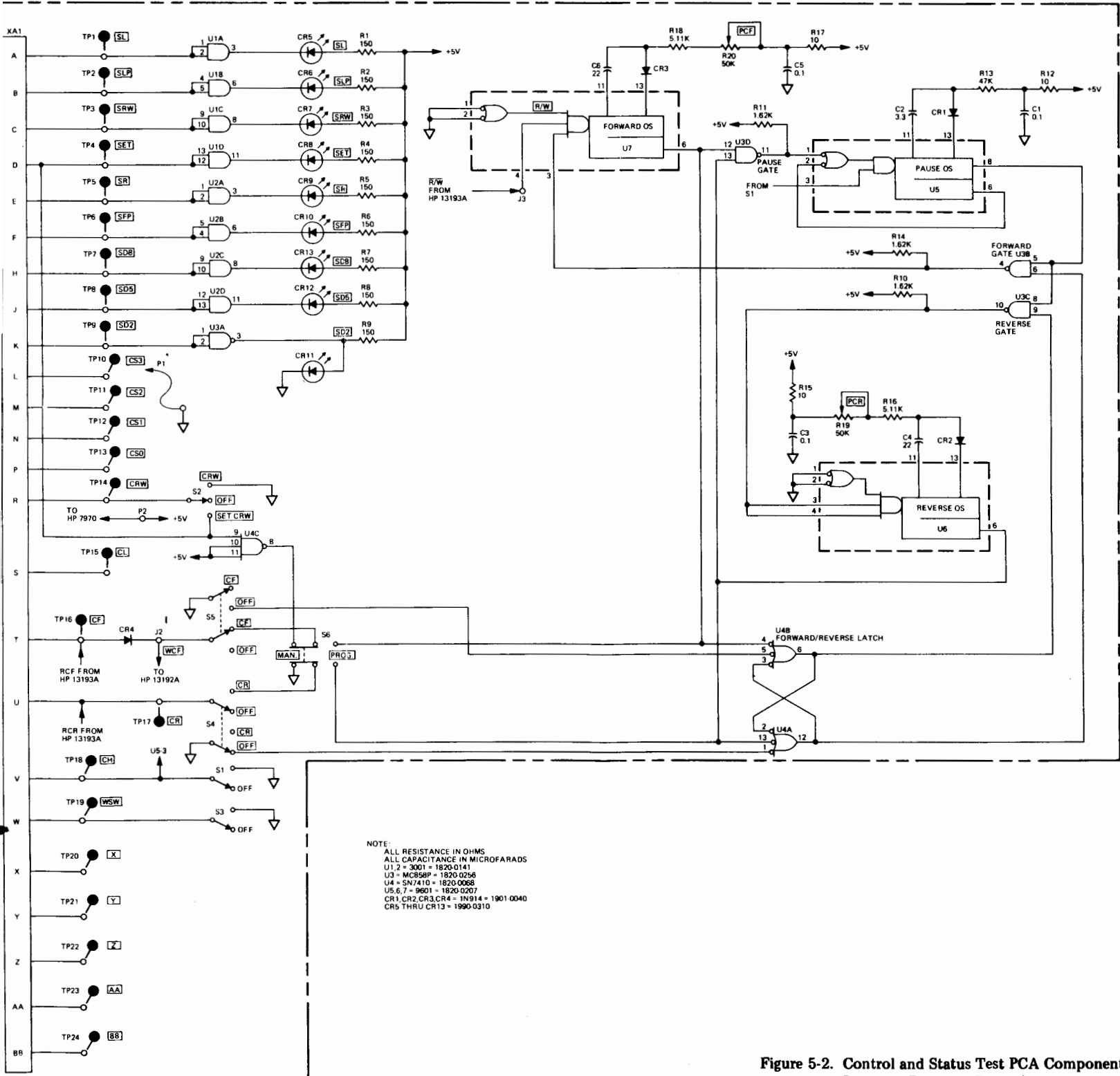
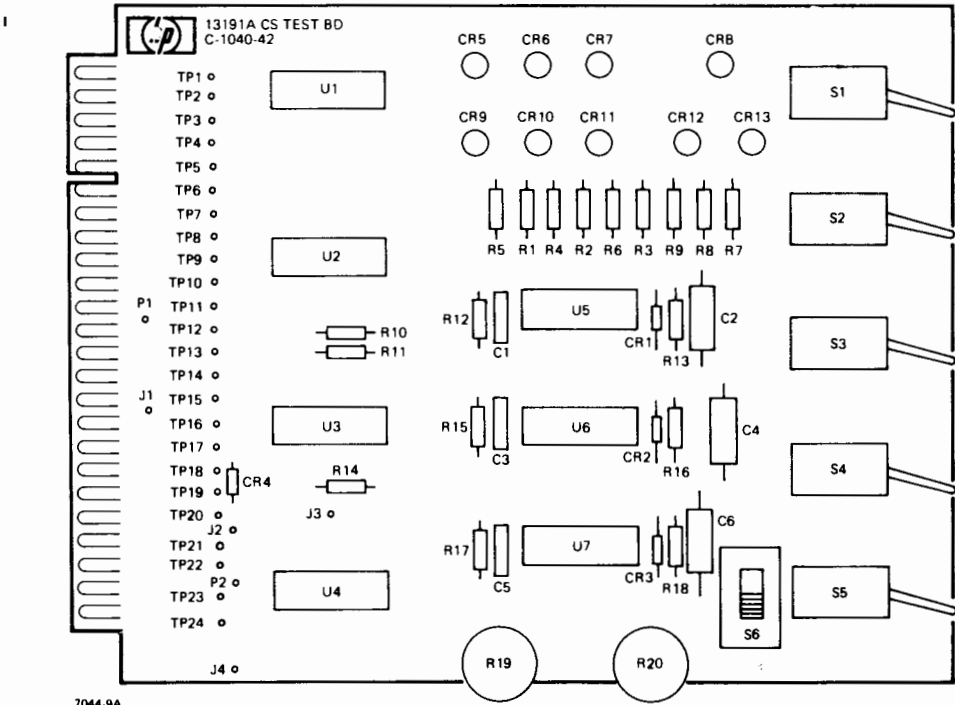
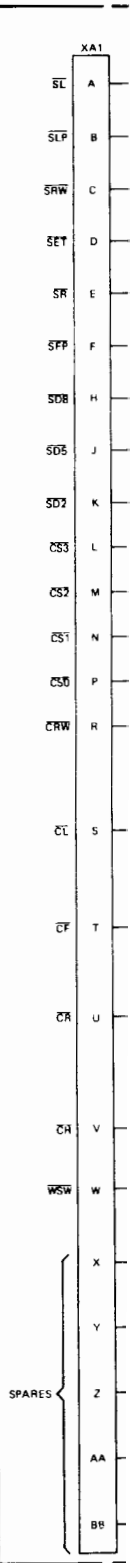


Figure 5-2. Control and Status Test PCA Component Location Diagram, Signal Summary Cable, and Schematic Diagram

Mnemonic Definitions

MNEMONIC	SIGNAL NAME	MNEMONIC	SIGNAL NAME
SL	On Line Status	CS2	Unit Address Select 2
SLP	Load Point Status	CS1	Unit Address Select 1
SRW	Rewind Status	CS0	Unit Address Select 0
SET	End of Tape Set Status	CRW	Rewind Command
SR	Ready (for remote operation) Status	CL	Off-Line Command
SFP	File Protect Status	CF	Tape Forward Command
SD8	Select 800 bpi Density Status	CR	Tape Reverse Command
SD5	Select 556 bpi Density Status	CH	High Speed Command
SD2	Select 200 bpi Density Status	WSW	Write Enable
CS3	Unit Address Select 3 Status		

CONTROL AND STATUS
(13191-60010, SERIES 10)



REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information pertaining to replaceable parts for the HP 13191A Control and Status Test Accessory. Included is a replacement parts list and ordering information.

6-3. REPLACEMENT PARTS LIST.

6-4. Table 6-1 lists the replaceable parts for the HP 13191A Control and Status Test Accessory. The replaceable components are listed in alphanumeric order according

to reference designation. The total quantity of each part used on the test board is also listed. The following information is provided for each listed part:

- Hewlett-Packard part number.
- Description of the part.
- A five-digit code representing the part manufacturer.
- Quantity of each part used.

6-5. Table 6-2 provides a list that identifies the manufacturer associated with the codes in table 6-1. Table 6-3 interprets reference designations and abbreviations that are used throughout this manual.

Table 6-1. List of Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	QTY	MFR CODE	MFR PART NO.
C1,C3,C5	0150-0121	Capacitor: Fxd Cer Disc 100 PF 10% 50VDC	3	56289	C50BIS-CMI
C2	0180-0161	Capacitor: Fxd Elect 3.3 μ F 20% 35VDC	1	56289	150D335X0035B2-DYS
C4,C6	0180-0228	Capacitor: Fxd Elect 22 μ F 20% 15VDC	2	56289	150D226X9015B2-DYS
CR1-CR4	1901-0040	Diode: Silicon 30MA 30V	4	07263	FDG 1088
CR5-CR13	1990-0310	Diode: Light emitting	9	28480	1990-0310
J1-J4	0360-0124	Terminal: Solder Stud Pin	4	28480	0360-0124
P1-P2	1200-0063	Receptacle: Crimp	2	28480	1200-0063
R1-R9	0683-1515	Resistor: Fxd Comp 150 Ohm 5% 1/4W	9	01121	CB1515
R10-R11,R14	0757-0428	Resistor: Fxd Comp 1.6 Comp 1.62K Ohm 1% 1/8W	3	28480	0757-0428
R12,R15,R17	0683-1005	Resistor: Fxd Comp 10 Ohm 5% 1/4W	3	01121	CB1005
R13	0683-4735	Resistor: Fxd Comp 47K Ohm 5% 1/4W	1	01121	CB4735
R16,R18	0757-0438	Resistor: Fxd Met Flm 5.11K Ohm 1% 1/8W	2	28480	0757-0438
R19-R20	2100-1948	Resistor: Var WW 50K Ohm 5%	2	28480	2100-1948
S1,S3-S5	3101-1213	Switch: 2 PDT	4	81640	T8001
S2	3101-1513	Switch: 2 P — 3 POS.	1	81640	TB206
S6	3101-0973	Switch: Slide	1	79727	G126-0018
TP1-TP24	0360-0124	Terminal: Solder Stud Pin	24	28480	0360-0124
U1-U2	1820-0141	Integrated Circuit: 4x2 Input AND Gate	2	04713	MC3001P
U3	1820-0256	Integrated Circuit: 4x2 Input NAND Gate	1	04713	MC858P
U4	1820-0068	Integrated Circuit: 4x2 Input NAND Gate	1	12040	SN7410N
U5-U7	1820-0207	Integrated Circuit: Ret Mon M.V.	3	28480	1820-0207

Table 6-2. Code List of Manufacturers

The following code numbers are derived from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2, and the latest supplements.					
CODE NO.	MANUFACTURER	ADDRESS	CODE NO.	MANUFACTURER	ADDRESS
01121	Allen-Bradley Co.	Milwaukee, Wisc.	28480	Hewlett-Packard Co.	Palo Alto, Cal.
04713	Motorola Semiconductor	Phoenix, Arizona	56289	Sprague Electric Co.	N. Adams, Mass.
07263	Fairchild Camera Inst. Corp.		79727	Continentalwirt Electronics Corp.	Philadelphia, Pa.
	Semiconductor Div.	Mountain View, Cal.	81640	Controls Company of America	
12040	National Semiconductor Corp.	Danbury, Conn.		Control Switch Div.	Folcroft, Pa.

Table 6-3. List of Reference Designations and Abbreviations

REFERENCE DESIGNATIONS		
A = assembly B = motor, synchro BT = battery C = capacitor CB = circuit breaker CR = diode DL = delay line DS = indicator E = Misc electrical parts F = fuse FL = filter J = receptacle connector	K = relay L = inductor M = meter P = plug connector Q = semiconductor device other than diode or integrated circuit R = resistor RT = thermistor S = switch T = transformer	TB = terminal board TP = test point U = integrated circuit, non-repairable assembly V = vacuum tube, photocell, etc. VR = voltage regulator W = jumper wire X = socket Y = crystal Z = tuned cavity, network
ABBREVIATIONS		
A = amperes ac = alternating current Ag = silver Al = aluminum ar = as required adj = adjust assy = assembly b = base bp = bandpass bpi = bits per inch blk = black blu = blue brn = brown brs = brass Btu = British thermal unit Be Cu = beryllium copper cpi = characters per inch coll = collector cw = clockwise ccw = counterclockwise cer = ceramic com = common crt = cathode-ray tube CTL = complementary-transistor logic cath = cathode Cd pl = cadmium plate comp = composition conn = connector compl = complete dc = direct current dr = drive DTL = diode-transistor logic depc = deposited carbon dpdt = double-pole, double-throw dpst = double-pole, single-throw em = emitter ECL = emitter-coupled logic ext = external encap = encapsulated elctlt = electrolytic F = farads FF = flip-flop flh = flat head flm = film fxd = fixed filh = fillister head G = giga (10^9) Ge = germanium gl = glass gnd = ground(ed)	gra = gray grn = green H = henries Hg = mercury hr = hour(s) Hz = hertz hdw = hardware hex = hexagon, hexagonal ID = inside diameter IF = intermediate frequency in. = inch, inches I/O = input/output int = internal incl = include(s) insul = insulation, insulated impgrg = impregnated incand = incandescent ips = inches per second k = kilo (10^3), kilohm lp = low pass m = milli (10^{-3}) M = mega (10^6), megohm Myl = Mylar mfr = manufacturer mom = momentary mtg = mounting misc = miscellaneous met. ox. = metal oxide mintr = miniature n = nano (10^{-9}) nc = normally closed or no connection Ne = neon no. = number n.o. = normally open np = nickel plated NPN = negative-positive-negative NPO = negative-positive zero (zero temperature coefficient) NSR = not separately replaceable NRFR = not recommended for field replacement OD = outside diameter OBD = order by description orn = orange ovh = oval head oxd = oxide p = pico (10^{-12}) PC = printed circuit	PCA = printed-circuit assembly PWB = printed-wiring board phh = phillips head pk = peak p-p = peak-to-peak pt = point prv = peak inverse voltage PNP = positive-negative-positive pwv = peak working voltage porc = porcelain posn = position(s) pozi = pozidrive rf = radio frequency rdh = round head rms = root-mean-square rwv = reverse working voltage rect = rectifier r/min = revolutions per minute RTL = resistor-transistor logic s = second SB, TT = slow blow Se = selenium Si = silicon scr = silicon controlled rectifier sst = stainless steel stl = steel spcl = special spdt = single-pole, double-throw spst = single-pole, single-throw Ta = tantalum td = time delay Ti = titanium tgl = toggle thd = thread tol = tolerance TTL = transistor transistor logic U(μ) = micro (10^{-6}) V = volt(s) var = variable vio = violet Vdcw = direct current working volts W = watts ww = wirewound wht = white WIV = working inverse voltage yel = yellow

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.



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