

# HP 1741A Oscilloscope Controls

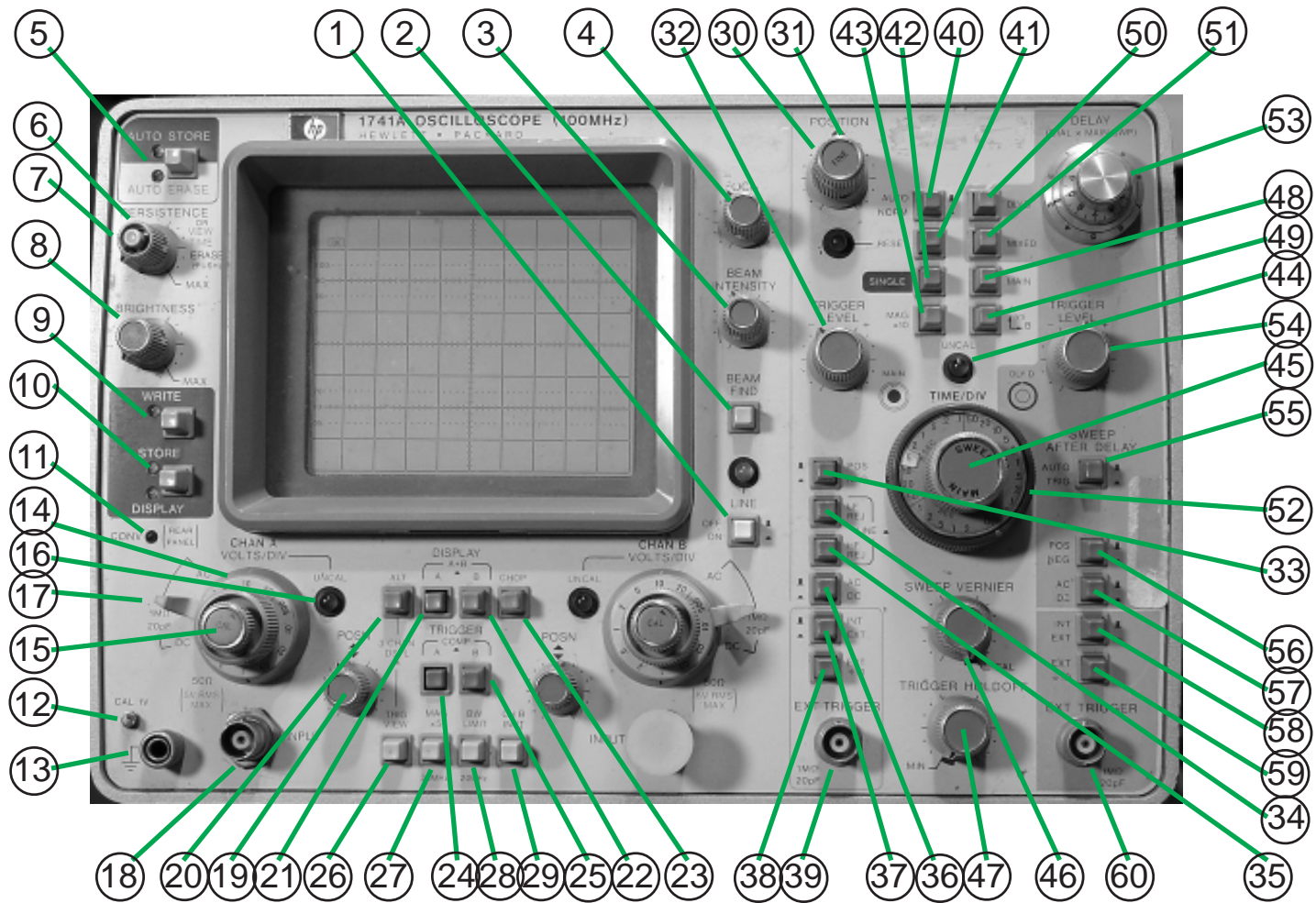


Figure 3-1

HP1741A Oscilloscope Operating Controls Diagram

## CRT CONTROLS

- 1. LINE OFF/ON.** Switch turns power on and off. Indicator lamp lights when power is ON.
- 2. BEAM FIND.** Restricts intensified beam to viewing area regardless of control settings. Permits operator to determine necessary adjustments to return beam to viewing area (reduce input signal amplitude, change deflection factor, increase intensity, change position controls, etc).
- 3. BEAM INTENSITY.** Determines intensity of electron beam as it writes on storage mesh (or CRT phosphor in conventional mode.).

### CAUTION

INTENSITY set too high in conventional mode can cause residual traces or CRT damage.

- 4. FOCUS.** Adjusts writing beam for sharp, well-defined trace.
- 5. AUTO STORE/AUTO ERASE.** Two-function push-button to select either AUTO STORE or AUTO ERASE mode of operation. Respective indicator lamps light to indicate which mode is selected.

AUTO STORE – Simplifies set-up for single-shot capture applications. This mode is selected by pressing SINGLE (42) pushbutton. Pressing either RESET (41) or ERASE (7) arms trigger circuit.

AUTO ERASE – In auto erase, Instrument operates as if in repetitive single-shot mode, even when continuous signal is available. In this mode, instrument automatically switches to maximum persistence, providing maximum trace retention between erasures. This mode of operation is convenient for initial set-up to capture single-shot events by making it easier to obtain optimum focus and intensity for selected signal. Also, when viewing more than one trace (one or two channels plus trigger view), the instrument will wait for required number of sweeps to be displayed before automatically erasing display. Operating storage modes may cause storage mesh to retain residual images. These residual images may appear as a cluttered display when BRIGHTNESS (8) IS AT OR NEAR MAXIMUM. Residual traces are conveniently removed by operating auto erase mode for several minutes with INTENSITY (3) off. For stubborn image removal, a DEEP ERASE feature is provided. When using DEEP ERASE, switch (62) must be set to DEEP ERASE in addition to the AUTO ERASE mode.

- 6. PERSISTENCE/VIEW TIME.** Two-function potentiometer to vary persistence or viewing time of signal, depending on operating mode selected.

PERSISTENCE – Variable persistence adjusts trace retention for optimum display when viewing low repetition rate, fast rise time signals. Adjusting persistence to match repetition rate causes trace to “integrate up” providing sharp, clear display for accurate measurement of low-duty-cycle pulse trains such as those from disc, tape, or from peripheral units. Variable persistence permits high-resolution timing measurements on exceptionally fine traces such as those produced by dual trace, alternate sweep signals at sweep speeds of 5 ns/div.

VIEW TIME in AUTO ERASE (5) mode, this control determines length of time sweep trace is retained on display before another erase cycle is initiated.

- 7. ERASE.** Manual pushbutton which initiates erase cycle to remove stored traces from CRT storage mesh. Inoperative when STORE/DISPLAY indicators are on, preventing accidental erasure of stored signal. In AUTO/STORE mode, ERASE (7) pushbutton switch may be pressed to arm trigger signal.
- 8. BRIGHTNESS.** Trace retained on storage mesh is made visible by turning BRIGHTNESS cw. BRIGHTNESS is also used in WRITE mode to vary writing rate. Store time is inversely proportional to BRIGHTNESS.
- 9. WRITE.** Conditions instrument to write applied signals in storage and variable persistence operation. Indicator lights when WRITE is selected.
- 10. STORE/DISPLAY.** Pressing this button when operating in WRITE (9) mode causes instrument to change to STORE mode after sweep has completed. STORE indicator lights. Pressing pushbutton again causes both STORE and DISPLAY indicators to light and stored trace may be displayed by turning BRIGHTNESS (8) control cw. After trace has been examined, push pushbutton again to enter STORE mode and provide longest store time.
- 11. CONV.** Indicator lamp lights to indicate that instrument is operating as conventional oscilloscope. This mode overrides all storage modes. All measurements can be made in storage, variable persistence mode of operation.

## VERTICAL AMPLIFIER CONTROLS

12. **CAL 1V.** Provides 1 V p-p ( $\pm 1\%$ ) square wave voltage signal with frequency of 1.4 kHz (100mV p-p when terminated in 50 ohms).
13. **GND.** Provides convenient front-panel chassis ground.
14. **CHAN A (V) VOLTS/DIV.** Selects vertical deflection factor in 1, 2, 5 sequence from 0.005 V/div to 20 V/div, accurate within 3% with vernier (15) in CAL detent.
15. **Vernier.** Provides continuous control of deflection factor between calibrated ranges. Vernier range is at least 2.5:1.
16. **UNCAL.** Lights when Vernier (either CHAN A or CHAN B) is out of CAL detent. Indicates that VOLTS/DIV setting is uncalibrated.
17. **COUPLING**  
AC – Selects input coupling and impedance for vertical amplifiers. In AC position, dc component of input signal is blocked. Lower 3-dB limit is 10 Hz.  
  
GND – Input signal is disconnected from amplifier, and amplifier input is grounded.  
  
DC – All elements of input signal are passed to vertical amplifier. Input impedance is 1 megohm shunted by 20 pF. 50  $\Omega$  – Input signal is dc coupled, and input impedance is 50  $\Omega$ . Pull lever forward and down to select this position. Do not apply more than 5 V rms to input connector.
18. **INPUT.** BNC connector for external signal application to channel A and B amplifiers. Impedance and coupling are selectable by (17). Do not apply more than 250 V (dc + peak ac at 1 kHz or less) or more than 500 V (p-p ac at 1 kHz or less).
19. **POSN.** Controls vertical position of display.
20. **ALT.** Channel A and Channel B signals are displayed alternately on consecutive sweeps.
21. **Channel A.** Displays channel A input signal.
22. **Channel B.** Displays channel B input signal.

A+B. Pressing both channel A (21) and channel B (22) displays algebraic sum of channel A and channel B input signals. If channel B display is inverted (press CH B INVT (29), A minus B display results.

23. **CHOP.** Channel A and B signals are displayed simultaneously by switching between channels at 250 kHz rate.

24. **TRIGGER A.** Selects sample of channel A signal as trigger signal when INT/EXT (37) is in INT.
25. **TRIGGER B.** When in INT (37), sample of channel B signal is selected as trigger signal.

COMP. When display mode is set for channel A, channel B, A+B, or ALT, and both (24) and (25) are pressed, sweep is triggered by displayed signal. When display is set for CHOP, sweep is triggered by channel A signal only.

26. **TRIG VIEW.** Displays selected internal trigger signal with same sensitivity indicated on corresponding channel VOLT/DIV (14) control. Selected external trigger signal is displayed with fixed sensitivity of 100 mV/div with INT/EXT (37) set to EXT (1 V/div if EXT, 10 (38) pressed). TRIGGER LEVEL (32) positions trigger signal vertically about center horizontal graticule line. Center screen indicates trigger threshold level with respect to trigger signal. In ALT (20) or CHOP (23) modes, three signals appear on same display: channel A, selected trigger signal (at center screen), and channel B, with no need for erasing between each display. TRIG VIEW is helpful in establishing discrete trigger levels.
27. **MAG X5.** Magnifies vertical presentation five times, and increases maximum sensitivity to 1 mV/div. Bandwidth is decreased to 30 MHz.
28. **BW LIMIT.** Reduces bandwidth of channel A and channel B to approximately 20 MHz.
29. **CH B INVT.** Inverts polarity of channel B signal. In A+B (21) & (22) mode, pressing CH B INVT (29) results in A minus B display.

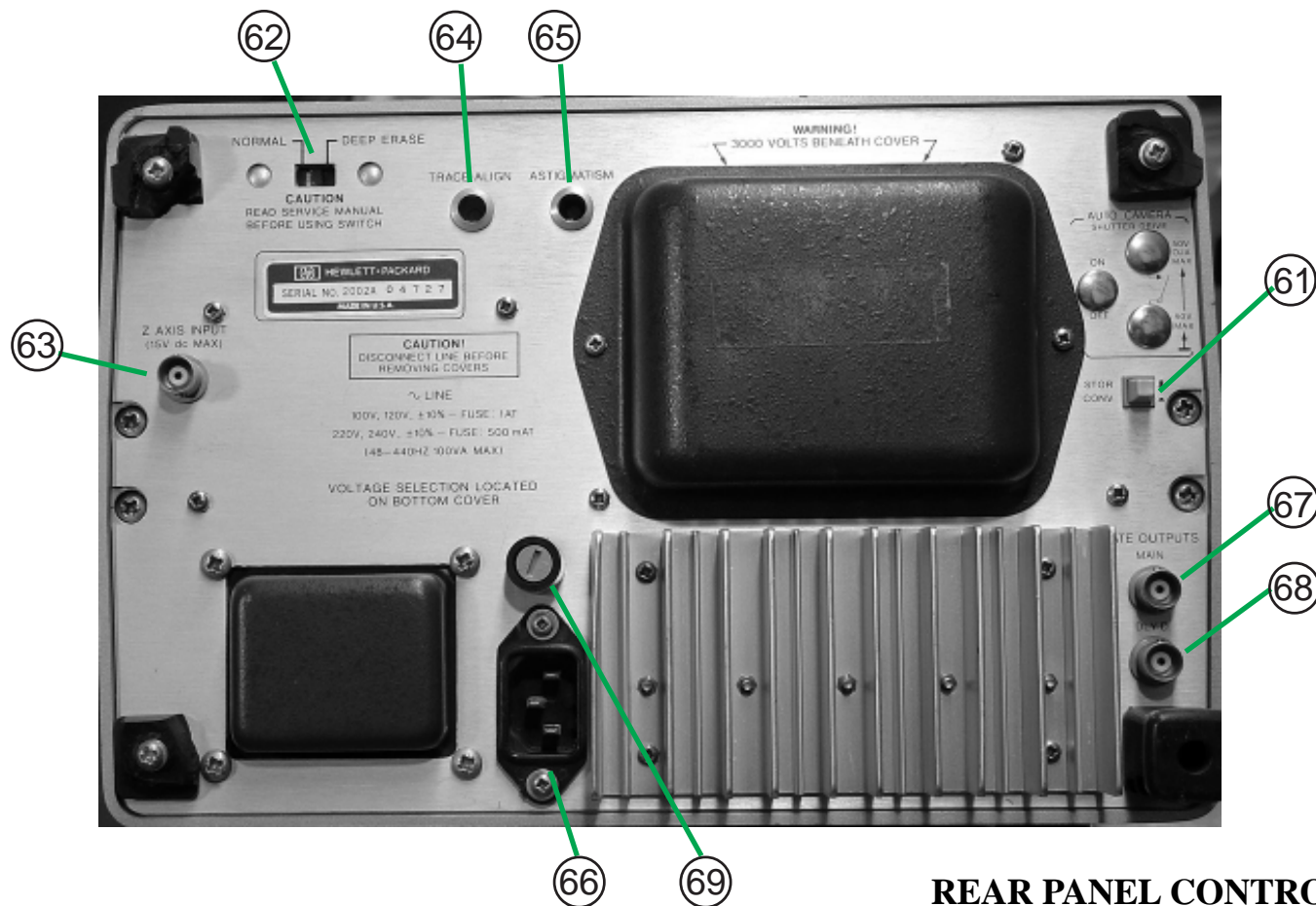
## MAIN TIME BASE CONTROLS

30. – 31. **POSITION** < >. Coarse (30) and FINE (31) adjustments position trace horizontally.
32. – 54. **TRIGGER LEVEL**. Selects voltage level on input trigger signal where sweep is triggered. With external trigger signal, trigger level is continuously variable from +1 V to -1 V on either slope of input trigger signal; +10 V to -10 V in EXT , 10 (38) mode. With internal trigger signals, with internal trigger signals, trigger level selects any point on vertical waveform displayed.
33. **POS/NEG**. Two-position push buttons used to select either positive or negative slope of trigger signal as starting point for sweep.
34. **LF REJ**. Attenuates internal or external trigger signals below 4 kHz. Useful to condition high-frequency signals for best synchronization by eliminating unwanted low-frequency signals such as power line interference.
35. **HF REJ**. Attenuates internal or external trigger signals above 4kHz. Useful to condition low-frequency signals for best synchronization by eliminating unwanted high-frequency signals such as RF.
- LINE**. Selecting both LF REJ (34) and HF REJ (35) removes all EXT (39) input or INT (37) displayed signals from trigger circuit and applies power line frequency signal for triggering.
36. **AC/DC**. Selects ac or dc coupling for EXT input (39) or (60) signal applied to trigger circuit. DC position must be selected for signals below 20 Hz.
37. **INT/EXT**. INT selects sample of internal vertical signal chosen by TRIGGER source (24) or (25), while EXT selects signal at EXT TRIGGER (39) or (60) input for application to main trigger circuit. Internal signals from dc to 25 MHz displaying 0.3-div amplitude or more are sufficient for stable triggering, increasing to 1 div of amplitude at 100 MHz. Externally applied signals 50 mV p-p from dc to 50 MHz, increasing to 100 mV p-p at 100 MHz are sufficient for stable triggering.
38. **EXT , 10**. Attenuates EXT TRIGGER (39) or (60) input signal by factor of ten.
39. **EXT TRIGGER**. BNC connector for external trigger input. Input impedance is one megohm shunted by 20 pF. Do not apply more than 250 V (dc + peak ac at 1 kHz or less), or 500 V (p-p ac at 1 kHz or less).
40. **AUTO/NORM**. AUTO sweep mode (pushbutton out). Free-running sweep provides bright display in absence of trigger signal. Trigger signal input (internal or external) of 40 Hz or more overrides AUTO operation and sweep triggering is same as in NORM mode.
41. **RESET**. Momentary pushbutton that arms trigger circuit in single-sweep mode. After RESET, sweep can be triggered by internal or external trigger signal or by rotating TRIGGER LEVEL control (32) (54) through zero.
42. **SINGLE**. Sweep occurs once with same triggering as in NORM. After each sweep, trigger circuit has to be manually RESET (41). Must also be pressed in conjunction with WRITE (9). AUTO STORE (5), and ERASE (7) to condition instrument for AUTO STORE operation. Indicator lamp lights to indicate circuit armed for next trigger signal.
43. **MAG X10**. Magnifies horizontal display ten times, and expands fastest sweep time to 5 ns/div, maintaining.
44. **UNCAL**. Lights when SWEEP VERNIER (46) is out of CAL detent position and indicates sweep is not calibrated.
45. **MAIN TIME/DIV**. Inner knob controls main sweep rate, which is indicated by numbers in knob skirt opening.
46. **SWEEP VERNIER**. Provides continuous adjustment of main sweep TIME/DIV between calibrated positions, expanding slowest sweep to 5 s/div.
47. **TRIGGER HOLDOFF**. Increases time between sweeps and aids triggering on complex displays such as digital words.
48. **MAIN**. Selects main sweep for horizontal display. Sweep rate and triggering are selected by main sweep controls (24) (25) and (32) (45).
49. **A VS B**. Selects X-Y mode of operation with channel A input (Y-axis) plotted versus channel B input (X-axis). Vertical positioning is adjusted by channel A POSN (19) and horizontal position is adjusted by POSITION (30) and (31).

## DELAYED TIME BASE CONTROLS

- 50. **DLY'D.** Selects delayed sweep for horizontal control.
- 51. **MIXED.** Selects main and delayed sweeps for horizontal display. First portion of sweep is at main sweep rate, and second portion (starting point chosen by DELAY (53) is at delayed-sweep rate.
- 52. **DLY'D TIME/DIV.** Outer rotating ring selects delayed sweep rate (Indicated by marker on ring). Sweep accuracy is same as with MAIN TIME/DIV (45). Interlock is incorporated so that delayed sweep is always faster than main sweep. When rotated from OFF position in MAIN (48) mode, portion of main sweep is intensified indicating length and delayed position of delayed sweep with respect to main sweep.
- 53. **DELAY.** Provides variable delay time from 0.5 to 10X MAIN TIME/DIV (45) setting of 100 ns to 2 sec.
- 54. **TRIGGER LEVEL.** Refer to TRIGGER LEVEL (32).
- 55. **SWEEP AFTER DELAY AUTO/TRIG.** Selects method of starting delayed-sweep when in delayed or mixed mode operation. In AUTO (pushbutton released), delayed sweep starts immediately after delay interval, which is the product of DELAY (53) dial reading (div) and MAIN TIME/DIV (45) reading. In TRIG (pushbutton pressed), delayed-trigger circuit is armed after delay interval and delayed sweep must be triggered by either internal or external trigger signal.
- 56. **POS/NEG.** Refer to POS/NEG (33).
- 57. **AC/DC.** Refer to AC/DC (36).
- 58. **INT/EXT.** Refer to INT/EXT (37).
- 59. **EXT ,10.** Refer to EXT , 10 (38).
- 60. **EXT TRIGGER.** Refer to EXT TRIGGER (39).

Figure 3-1



### REAR PANEL CONTROLS

- 61. **CONV.** Two-position pushbutton to disable variable persistence and storage functions of instrument so it operates as a conventional oscilloscope. Refer to CONV (11).
- 62. **NORMAL/DEEP ERASE.** Switch to allow stronger erasure of stubborn images.
- 63. **Z-AXIS INPUT.** BNC connector allowing input of signal to modulate CRT beam intensity.
- 64. **TRACE ALIGN.** Aligns horizontal trace parallel to horizontal graticule lines.
- 65. **ASTIGMATISM.** Controls roundness of displayed spot. (interacts with FOCUS (4).)
- 66. **Line Input.** Power cord connector.
- 67. **MAIN GATE OUTPUT.** Provides rectangular output of +2.5 V coincident with main gate.
- 68. **DELAYED GATE OUTPUT.** Provides rectangular output of +2.5 V coincident with delayed gate.
- 69. **LINE FUSE.** AC power input fuse.