

than 300 times at normal condition. This means it can be used for about one year when charging is done once a day.

f) When the battery pack is used as a spare battery for emergency, periodic charging (about 15 hours) is needed once a month.

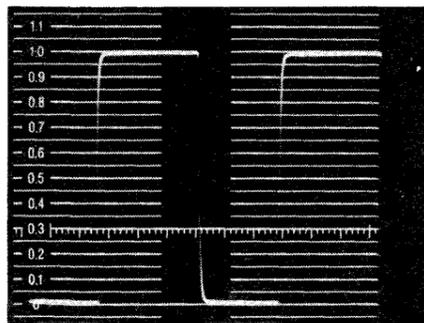


Fig. 6-1 VOLTS FULL SCALE control set to 1 V CAL.

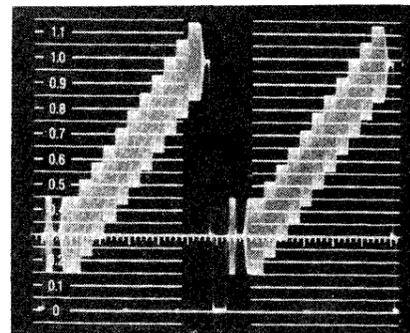


Fig. 6-2 RESPONSE control set to FLAT.

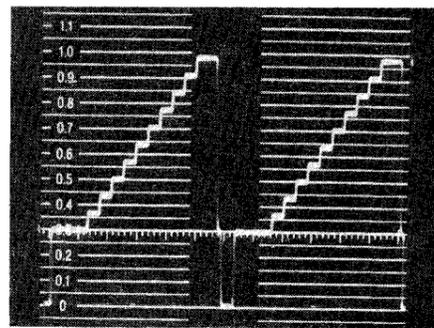
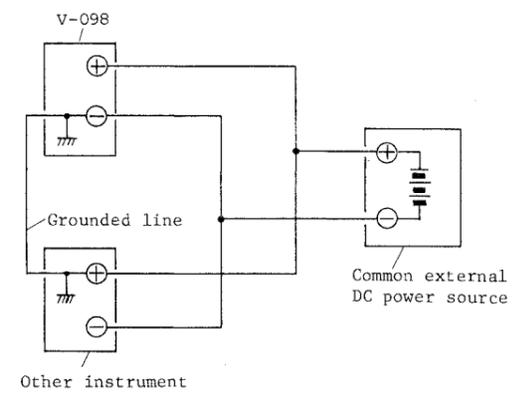


Fig. 6-3 RESPONSE control set to IRE.

it is very dangerous because a large current flows through the grounded line.



< DANGEROUS CONNECT >

- * Do not apply reverse polarities to EXT DC IN.
- * Do not increase the brightness too much. Your eyes may be strained and the fluorescent surface of CRT may be burnt.
- * Do not apply an excessive voltage. The maximum voltage of each input is as follows.

Never apply a voltage higher than specified.

VIDEO INPUT +5 volts DC
EXT SYNC INPUT +5 volts DC

Calibration interval

To maintain instrument accuracy, perform the calibration of the V-099 at least every 1,000 hours of operation, or every six months if used infrequently.

3. Composition

Composition of the Model V-098 is as follows.

- (1) V-098 waveform monitor 1
- (2) AC power cable 1
- (3) Fuse 250V 3A 1
250V 0.5A 1
- (4) Operation manual 1

4. Specifications

CRT

95CB31 (3.5" rectangular with external graticule).
 Accelerating voltage Approx. 2 kV.
 Scale illumination Operating when setting the POWER SOURCE control to AC and EXT DC.

VERTICAL DEFLECTION

Frequency response (at 1V FULL SCALE or 4V FULL SCALE)
 FLAT Response from 25Hz to 5MHz within $\pm 5\%$ of response at 50kHz
 IRE Response per 1958 IRE STD 23S-1 $\pm 10\%$.
 4.43 BANDPASS Response at 4.43MHz does not vary between FLAT and 4.43 BANDPASS by more than 1%.
 Deflection factor
 1V FULL SCALE 1.0 unit within $\pm 2\%$ with 1 volt input.
 4V FULL SCALE 1.0 unit within $\pm 3\%$ with 4 volts input.

Maximum input level (AC coupled)

1V FULL SCALE ± 5 volts DC
 4V FULL SCALE ± 5 volts DC
 Input impedance (not terminated)
 1V FULL SCALE 15k Ω in paralleled with ~ 50 pF
 4V FULL SCALE 60k Ω in paralleled with ~ 50 pF
 Return loss At least 35 dB to 4MHz
 Video output
 Frequency response 25Hz to 5MHz within $\pm 8\%$
 Nominal output impedance 75 ohm $\pm 10\%$
 DC level on output 1 volt within $\pm 15\%$ for 1.0 unit display with response at FLAT

HORIZONTAL DEFLECTION

2V sweep
 Repetition rate Equal to frame rate at applied video or external sync.
 Length (when synchronized to video signal) 12.1 div within ± 1 div
 2V MAG sweep
 Magnification 20 \times within $\pm 10\%$

19. Set the SWEEP control to 2V. A two field is displayed as shown in Fig. 6-8.
20. Set the SWEEP control to 2V MAG. A magnified vertical blanking interval is displayed as shown in Fig. 6-9.
21. AD-099 battery pack
 Connect the battery pack to the BATT IN connector (15) on the rear of V-099 waveform monitor. Power is supplied to the waveform monitor from the battery pack up to 2 hours. Over 2 hours operation may cause a quick terminal voltage drop and an over-discharging state. To prevent such over discharging, an alarm circuit is energized to make the POWER lamp blink. In this case, set the POWER/INTENSITY switch (1) to off and recharge the battery pack immediately. Charging the batteries
 1. Charge the batteries with the battery pack connected to the monitor. Connect the AC cord of the battery pack to AC power supply, and turn the POWER/INTENSITY switch (1) to off, and select the POWER SOURCE switch (13) to BATT FULL CHG. Then charging starts and completes in about 15 hours.
 2. When the POWER SOURCE switch is selected to the

AC (TRICKLE CHG) position, trickle charge is done while the monitor is operating.

CAUTIONS

Do not short circuit the positive and negative terminals of the battery pack. Do not throw the battery pack into fire.

- a) To ensure the battery's life time, charging should be done in an ambient temperature of 0 to $+40^{\circ}\text{C}$ (32 to 104°F). Charging time should not exceed 3 days or 48 hours in succession.
- b) Store the battery pack at cool, dry and dark place. Ambient temperature should be -15 to $+35^{\circ}\text{C}$ (5 to 95°F). Before using battery pack not used for an extended period of time, charge it by a charger since the batteries self-discharge during storage.
- c) To avoid a possible explosion, do not short circuit the positive and negative terminals.
- d) Do not disassemble the battery pack, because electrolyte may harm skin or clothes.
- e) Life time of the battery pack depends on load conditions, especially on continuous operating time. This pack can bear the charging of more

7. Rotate the vertical POSITION control to position the trace to the 0.3 graticule.
8. Rotate the horizontal POSITION control to position the left end of the trace to the left end major division on the 0.3 graticule.
9. Check that the trace aligns with the 0.3 graticule. If not, rotate the TRACE ROTATION control to align the trace with the 0.3 graticule.
10. Set the VOLTS FULL SCALE control to the 1 V CAL.
11. Rotate the vertical POSITION control to position the display in the 0 to 1.0 unit of the graticule. The calibrator waveform of 1.0 unit within ± 0.01 unit in amplitude will be displayed (see Fig. 6-1).
12. Apply a 1-volt modulated staircase signal to the VIDEO INPUT A.

NOTE

In a video signal distribution system, its output end must be terminated in 75Ω . When the V-098 is connected to its output end, terminate the other unused VIDEO INPUT A connector in 75Ω .

13. Set the VOLTS FULL SCALE control to A 1.
14. Rotate the vertical POSITION control to align the blanking level of the waveform with the

0.3 graticule. A modulated staircase signal will be displayed as shown in Fig. 6-2. In this setting, the tolerance of a frequency response is within $\pm 5\%$ from 25Hz to 5MHz.

15. Set the RESPONSE control to IRE. A modulated staircase signal will be displayed as shown in Fig. 6-3. In this setting, a frequency response reduces as shown in Fig. 4-1.
16. Set the RESPONSE control to 4.43 BANDPASS. A modulated staircase signal will be displayed as shown in Fig. 6-4. In this setting, only the components of the signal within the 3.9 to 4.9 MHz frequency range are displayed. (In this setting, the signal from sweep oscillator with composite sync is displayed as shown in Fig. 6-5.)
17. For setting of 4.43 BANDPASS, pull and rotate the PULL VAR control. Then, the display is continuously magnified up to five times as shown in Fig. 6-6.
18. Press the PULL VAR control, and set the RESPONSE control to FLAT and the SWEEP to $1\mu\text{S}/\text{DIV}$. A magnified H sync interval or picture blanking interval is displayed as shown in Fig. 6-7.

2H sweep

Repetition rate	Equal to half line rate of applied video or external sync.
$1\mu\text{S}/\text{DIV}$ sweep accuracy	Within $\pm 3\%$
DC RESTORATION	
Clamp time	Back porch
Blanking level shift with 10% to 90% APL change	APL changes from 50% to either 10% or 90% will cause blanking level shift of 0.02 unit or less.

CALIBRATOR

Frequency	At least 2 cycles will be displayed in 2H sweep. Must synchronize 2H sweep 1 volt within $\pm 1\%$
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Amplitude

EXTERNAL SYNC

Input signal requirement	1.5 volts to 4.5 volts composite sync will synchronize sweeps
Input impedance	$\sim 15k\Omega$ in parallel with $\sim 10\text{pF}$

POWER

Line voltage	AC 220/240 volts within $\pm 10\%$
Line frequency	50 to 400 Hz

Power consumption	~ 30 watts on AC line source of 220 volts
External DC source	DC 11.5 to 14 volts at EXT DC IN terminals
Optional battery	2 hours or more

AMBIENT TEMPERATURE

Rated range of use	$+10$ to $+30^\circ\text{C}$
Operating	0 to $+40^\circ\text{C}$
Storage	-15 to $+60^\circ\text{C}$ (without battery pack)

DIMENSIONS

145(W) \times 88(H) \times 395(D)mm

WEIGHT

Approx. 4.0kg (without battery pack)
Approx. 2.5kg (battery pack)

OPTION

19" \times 3.5" rack (mountable up to three sets)	
AD-099 battery pack (Ni-Cd battery)	
Nominal capacity	3500 mAh
Nominal voltage	12 V
Discharge ending voltage	10 V
Recharging current	350 mA
Recharging time	About 15 hours

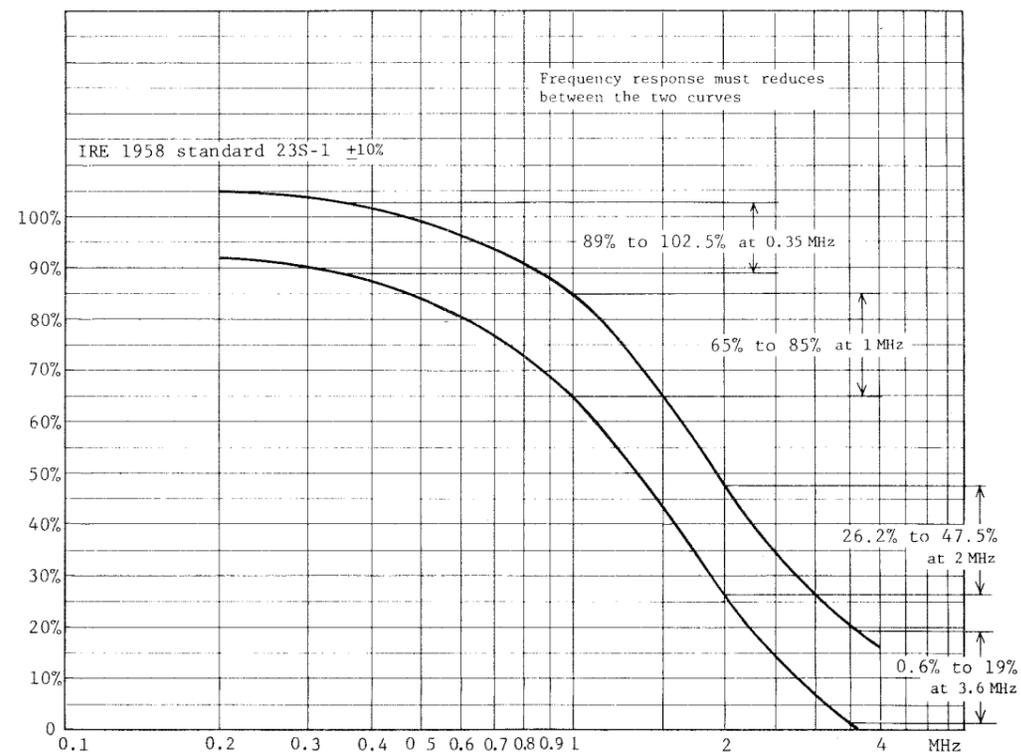


Fig. 4-1 Frequency response at IRE.

signal to VIDEO INPUT B. The inputs are loop-through and compensated for 75Ω.

- ①9 EXT SYNC
BNC connectors for applying an external composite sync signal. The inputs are loop-through and compensated for 75Ω.
- ②0 VIDEO OUT
BNC connector for monitoring the displayed signal on the picture monitor.
- ②1 FUSE
Secondary protective fuse 3A.
— AD-099 Battery Pack (option) —
- ②2 CHARGE lamp
Lights when the AD-099 is under charging except trickle charging.

7. Operating Procedure

The operation procedure is explained by using a 1-volt modulated staircase signal.

1. Set the POWER/INTENSITY control fully counter-clockwise.
2. Set the POWER SOURCE control to AC (TRICKLE CHG).
3. Check that AC line voltage is within 198-242 (at 220VAC)/216-264 (at 240VAC) volts.
4. Connect the V-098 to AC line.
5. Set the V-098 front panel controls as follows:

Horizontal POSITION (coarse and fine)	Midrange
Vertical POSITION	Midrange
PULL VAR	Push in
SYNC	INT
SWEEP	2H
TRACE ROTATION	As is
RESPONSE	FLAT
VOLTS FULL SCALE	A1
DC REST	ON

6. Rotate the POWER/INTENSITY control clockwise at the midrange. A trace is displayed after several minutes and rotate the POWER/INTENSITY control until the trace is at the desired brightness.

- ⑧ RESPONSE
Selects FLAT, IRE or 4.43 BANDPASS frequency response characteristics.
- ⑨ VOLTS FULL SCALE
Selects the full scale vertical deflection factors for video input A, video input B, or the internal 1 V CAL (1 volt calibrator) signal.
- ⑩ DC REST
Selects the DC restorer ON or OFF.
- ⑪ LOCK
Uses for rack-mounting.
(Rear-Panel)
- ⑫ FOCUS
Adjusts for optimum display definition.
- ⑬ POWER SOURCE
Selects AC(TRICKLE CHG), EXT DC, BATT or BATT FULL CHG.
AC(TRICKLE): The instrument is operated on AC line source of 198-242 (at 220VAC)/216-264 (at 240VAC) volts. The AD-099 Battery Pack (option) is Trickle-Charged when connected to AC line source.
EXT DC: The instrument is operated on an external DC power source of 11.5-14 volts (-1.3A) at EXT DC terminals.
BATT: The instrument is operated with the AD-

099 Battery Pack (option).
BATT FULL CHG: The AD-099 Battery Pack is charged when connected to AC line source. It requires at least 15 hours to full charge level after Power Lamp begins blinking.

CAUTION!

The - (negative) terminal of EXT DC IN is inside connected to chassis.

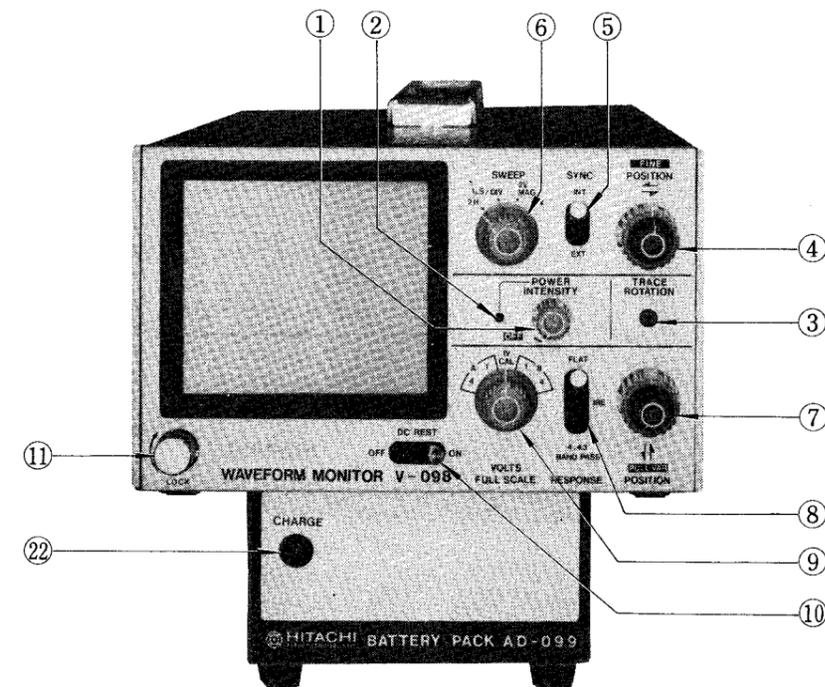
- ⑭ EXT DC IN ±
Terminals for applying External DC power source.

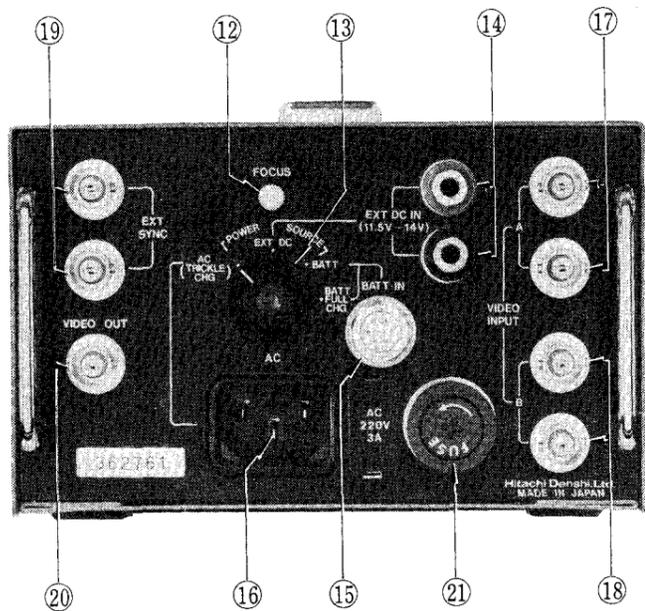
CAUTION!

Do not apply reverse polarities to EXT DC IN.

- ⑮ BATT IN
Connector for the AD-099 Battery Pack.
- ⑯ AC
Connector for applying AC line source.
- ⑰ VIDEO INPUT A
BNC connectors for applying an external video signal to VIDEO INPUT A. The inputs are loop-through and compensated for 75Ω.
- ⑱ VIDEO INPUT B
BNC connectors for applying an external video

5. Panel Controls





6. Panel Discriptions

(Front-pannel)

- ① POWER/INTENSITY
Turns the power on or off and controls the brightness of the CRT display. Clockwise adjustment increases brightness. Focusing shift caused by turning the INTENSITY control is automatically corrected.
- ② Power lamp
Lights when the instrument is on. The lamp blinks when power voltage is low, to warn the operator. The lamp goes off when power voltage is lower.

CAUTION!

"When using the V-098 in conjunction with the AD-099 Battery Pack, discontinue using the V-098 and charge the battery by setting the POWER SOURCE control to BATT FULL CHG as soon as the power lamp blinks. Failure to do so, will cause damage to the battery."

"When power voltage is lower the lamp goes off, the V-098 makes sound of vibration of DC/DC converter transformer. But it is not a trouble. When power voltage is within the specification, it does not sound."

- ③ TRACE ROTATION
Corrects slight tilting of trace caused by external magnetic fields.
- ④ FINE POSITION
Controls the position of the display horizontally. The large knob is for coarse control and the small knob for fine control.
- ⑤ SYNC
Selects INT or EXT sync.
- ⑥ SWEEP
Selects 2H, 1μs/DIV, 2V MAG or 2V sweep rates.
- ⑦ PULL VAR POSITION
The large knob controls position of the display vertically. When pulled out, the small knob controls continuously vertical deflection factors from at least 0.2 to 4 VOLTS FULL SCALE for video input A, video input B, or 1V CAL (1 volt calibrator) signal. When pushed (if turned), each vertical deflection factor is calibrated at 1 or 4 VOLTS FULL SCALE.