HITACHI

MODEL VC-6145
DIGITAL STORAGE
OSCILLOSCOPE

SERVICE MANUAL

WARNING

TO AVOID ELECTRIC SHOCK , DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

IMPORTANT

READ RULE FOR SAFE INSTALLATION, OPERATION AND INSTRUCTION CAREFULLY.
RETAIN THIS MANUAL FOR FUTURE REFERENCE.

Hitachi Denshi,Ltd.

1. SPECIFICATIONS

o CRT

Graticule	6-inch screen with internal graticule and 0%, 10%, 90% and 100% markings 8 x 10DIV (1DIV = 1cm)
Phosphor	P31
Accelerating potential	17kV approx.
External intensity modulation	Coupling : DC coupling (dark at positive voltage) Voltage : 5Vp-p or more Maximum input voltage : 30V (DC + AC peak) or 30Vp-p AC at 1kHz or less Bandwidth : DC to 5MHz

o Vertical deflection system

Sensitivity	CH1 and CH2: 2mV/DIV to 5V/DIV ± 3% (switchable in 11 steps) Continuously adjustable by fine control CH3 and CH4: 0.1V/DIV and 0.5V/DIV ± 3% (switchable in 2 steps)
Frequency response	DC: 5mV/DIV to 5V/DIV: DC to 100MHz (-3dB) 2mV/DIV: DC to 20MHz (-3dB) AC: 5mV/DIV to 5V/DIV: 10Hz to 100MHz (-3dB) 2mV/DIV: 10Hz to 20MHz (-3dB)
Rise time	3.5ns approx. 2mV/DIV: 17.5ns approx.
Vertical signal delay	Leading edges can be observed (only in real-time mode).
Maximum input voltage	400V (DC + AC peak at 1kHz)
Input coupling	CH1 and CH2: AC, DC, GND CH3 and CH4: AC, DC
Input impedance	1M ohms ± 1.5%, 23pF approx.
Display modes	CH1, CH2, DUAL, CHOP (250kHz approx.), QUAD, ADD (DIFF mode can be established when the CH2 is in the INVERT mode.)
Bandwidth limiting function	20MHz
CH2 Polarity	Normal or inverted
Common-mode rejection ratio (CMRR)	20dB minimum at 20MHz

X-Y operation

Input	X-axis: Channel selectable from CH1, CH2, CH3 and CH4 (CH1 or CH2 only in storage mode) Y-axis: Channel selectable from CH1, CH2, and CH1&CH2 (CH3 or CH4 only in storage mode)
Sensitivity	CH1, CH2: 2mV to 5V/DIV CH3, CH4: 0.1V/DIV, 0.5V/DIV
Phase error	3° or less from DC to 50kHz (in real-time mode)
X bandwidth	DC to 500kHz (-3dB) (Depends on time range in storage mode.)

o Horizontal deflection system

Sweep mode	Main sweep, delay sweep, alternate sweep (in real-time mode only), single sweep
Sweep time	
A(main) sweep	50ns/DIV to 0.5s/DIV (UNCAL symbol ">" is displayed.) Continuously adjustable
B(delay) sweep	50ns/DIV to 50ms/DIV

Accuracy

	10 to 35°C	0 to 50°C
X1	±3%	±4%
MAG X10	±4%	±6%

(in real-time mode)

Holdoff	Variable
Delay time	1μs to 5s
Delay jitter	1/20,000 or less
Sweep magnification	X10
Maximum sweep rate	5ns/DIV
Trace separation	Variable (in real-time mode only)
Trigger lock function	Provided
Auto range function	Provided

o Trigger

Modes	Trigger and auto trigger
Source	A: CH1, CH2, CH3, CH4, ALT, and LINE B: Follows A.

TV sync

Exclusive sync separator circuit provided
Sensitivity: SYNC section
INT: 1 DIV or more
Sync polarity: Negative

Level

Variable range AUTO: Follows the trigger signal.
NORM: INT: ±4DIV or more

Sensitivity

NORM mode

	DC to 20MHz	20MHz to 100MHz
CH1, CH2	0.35DIV	1.5DIV
CH3, CH4	0.5DIV	1.5DIV

AUTO mode

	30 to 100Hz	100Hz to 20MHz	20 to 100MHz
CH1, CH2	1.5DIV	1DIV	1.5DIV
CH3, CH4	1.5DIV	1DIV	1.5DIV

DC coupling: DC
Slope: + or -
AUTO low frequency band: 30Hz

o Readout function

Panel setting display

Vertical axis: V/DIV (CH1, CH2), UNCAL, probe conversion, ADD(+)
Sweep speed: S/DIV, UNCAL, MAG (converted value)
Other: Delay time, X-Y, trigger, number of averaging, aliasing error display, smoothing display, sampling mode display, interpolation system, holdoff

o Cursor readout function

Voltage difference ΔV : Δ-REF (CH1 and CH2 waveforms)
Time difference ΔT : Δ-REF
Frequency 1/ΔT : Δ-REF

o Frequency counter

Frequency measurement

Source: A trigger signal selected by TRIG SOURCE OR X switch
Measuring range: 20Hz to 100MHz
Time base error: ±100ppm (15 to 35°C)

Ranges	Display format	Resolution	Accuracy
20Hz ≦ f < 100Hz	99.99Hz	0.01Hz	±time base error ±1 count
100Hz ≦ f < 1kHz	999.9Hz	1.0Hz max	
1kHz ≦ f < 10kHz	9.999kHz	0.002kHz max	
10kHz ≦ f < 100kHz	99.99kHz	0.04kHz max	
100kHz ≦ f < 1MHz	999.9kHz	0.1kHz	
1MHz ≦ f < 10MHz	9.999MHz	0.002MHz max	
10MHz ≦ f < 100MHz	99.99MHz	0.01MHz	
100MHz ≦ f	(100.0MHz)	Not specified	

o Memory backup — The panel settings and the save memory can be retained for about 48 hours after the power off.

o External output

TRIGGER SIGNAL OUT

Output voltage: 25mV/DIV approx. (Full scale on the CRT)
Frequency response: DC to 10MHz
Output impedance: 50 ohms approx.
(When terminated with 50 ohms.)

o Calibrator

Waveform: 1kHz ±20%, square wave
Voltage: 0.5V ±1%

DIGITAL STORAGE FUNCTION

o Maximum sampling rate

100Msps, 1-channel sampling (1μs/DIV)
50Msps, 2-channel simultaneous sampling (2μs/DIV)
25Msps, 4-channel simultaneous sampling (4μs/DIV)

o Memory capacity

Acquisition memory	4000 words (1-channel and 1μs/DIV to 50s/DIV) 2000 words/channel (2 channels or 4 channels and 2μs/DIV to 50s/DIV) 1000 words/channel (1 channel and 50ns/DIV to 0.5μs/DIV) (2 channels or 4 channels and 50ns/DIV to 1μs/DIV)
Display memory	1000 words x 4 waveforms
Save memory	1000 words x 4 waveforms (backup)

o Vertical resolution — 250 points/10 DIV

o Horizontal resolution — 100 points/DIV

o Maximum storage frequency — 5MHz (a single shot signal)
(Maximum amplitude error: 30% or less)
100MHz (repetition signal) (20MHz at 2mV/DIV) (-3dB)

o Sweep time

Sampling system	Number of channel(s)	Sweep time
Equivalent sampling (Repetition trace, and only A sweep)	1	50ns/DIV to 0.5μs/DIV
	2, 4	50ns/DIV to 1μs/DIV
A sweep realtime sampling (single shot trace)	1	1μs/DIV to 0.1s/DIV
	2, 4	2μs/DIV to 0.1s/DIV
B sweep realtime sampling (single shot trace)	1	1μs/DIV to 50ms/DIV
	2, 4	2μs/DIV to 50ms/DIV
Roll (A sweep only)	1, 2, 4	0.2μs/DIV to 50s/DIV

- Alternate sampling is made when two or four channels are operated in the time range from 50ns/DIV to 1μs/DIV
- Simultaneous samplings are made for CH1 and CH2, and CH3 and CH4 when the four channels are operated in 2μs/DIV. However, alternate sampling is made when either of CH1 or CH2 and either of CH3 or CH4 are operated.
- Simultaneous samplings are made for the two- or four-channel operation other than the above condition.

o Interpolation function	Linear interpolation or sine interpolation selectable (effective only in magnified display mode)
o Smoothing display	ON/OFF possible
o Pretrigger	Maximum 0 to 20DIV (1 channel and 1μs/DIV to 0.1s/DIV) (in 0.1DIV steps)
o Posttrigger	Maximum 0 to 10DIV (1 channel and 1μs/DIV to 0.1s/DIV) (in 0.1DIV steps)
o Data acquisition	
NORM storage mode	Updates the data on the CRT at each triggering.
AVG mode	Averages input signals by acquiring data specified times and displays the result after the specified number of averaging is reached. (Number of averagings: 4, 16, 64 and 256)
ROLL mode	Writes new data at the right edge of the CRT and shifts waveform from right to left continuously on the CRT. (The updating point is the right edge.)
HOLD mode	Holds the waveform displayed on the CRT.
SINGLE sweep	Performs an operation of the NORM storage, or AVG mode once at each pressing of the SINGLE RESET switch in the HOLD mode, and updates the data on the CRT.
o Data save	Up to four waveforms on the CRT can be saved. Maximum four stored waveforms out of four saved wave-forms and four current sampling waveforms can be displayed on the CRT.
o Plotter output	A hard copy can be produced by the plotter by using the HP-GL through RS-232C. The color is selectable from 6 colors.
o External output	The RS-232C interface is provided as a standard.

o Magnifying display

A storage waveform can be magnified ten times in the horizontal direction.
(A save waveform cannot be magnified.)

o Power supply

Voltage	90V to 250V AC
Frequency	48 to 440Hz
Power consumption	80W approx.

o Environment

Temperature	
Operating	0 to 40°C
Full specification	10 to 35°C
Storage	-20 to +70°C
Humidity	
Operating	45 to 85%
Storage	35 to 85% (70% or less at the temperature of 50°C or more)

o Dimensions and weight

Dimensions	310(W) x 130(H) x 450(D)mm approx. (excluding projections) (12.2 x 5.1 x 17.7 in. approx.)
Weight	9kg approx. (19.8 lb. approx.)

o Others

EMI	Conforms to VDE0871, Category B.