

7854 MAINFRAME AND WAVEFORM CALCULATOR SPECIFICATIONS

The electrical characteristics listed in Table 2-1 apply when the following conditions are met: (1) Calibration of the instrument must have taken place at an ambient temperature between $+20^{\circ}$ and $+30^{\circ}$ C, (2) the instrument must be allowed a 20-minute warm-up period, (3) all specifications are valid at an ambient temperature of 0° to $+50^{\circ}$ C, unless otherwise stated, and (4) the instrument must be in an environment that meets the limits described in Table 2-2.

Any applicable conditions not listed above are expressly stated as part of that characteristic. Environmental Characteristics are listed in Table 2-2 and Physical Characteristics are listed in Table 2-3.

TABLE 2-1
Electrical Characteristics

Characteristic	Performance Requirement
REAL-TIME VERTICAL SYSTEM	
Deflection Factor as Checked With 067-0587-02 Calibration Fixture, Referenced to 6 Div	Compatible with all 7000-series plug-in units.
Difference Between Vertical Channels	1%, or less.
Low-Frequency Linearity	0.1 div, or less, compression or expansion of a center-screen 2 div signal repositioned vertically anywhere within the graticule area.
System Bandwidth	Varies with plug-in unit selected. See 7000-Series Oscilloscope Systems Specification at the end of this section.
Step Response	
System Rise Time	Varies with plug-in unit selected. See 7000-Series Oscilloscope Systems Specification at the end of this section.
Channel Isolation	
All Vertical Modes (Except ADD)	At least 100:1 from dc to 250 MHz; and at least 40:1 from 250 MHz to 475 MHz.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
REAL-TIME VERTICAL SYSTEM (Cont)	
Delay Line	Permits viewing the leading edge of triggering signal.
Displayed Difference in Signal Delay Between Vertical Channels	
Externally Triggered	60 ps, or less.
Internally Triggered	200 ps, or less.

REAL-TIME HORIZONTAL SYSTEM

Deflection Factor as Checked With 067-0587-02 Calibration Fixture	Compatible with all 7000-series plug-in units.
Difference Between Horizontal Channels	1%, or less.
Linearity at 1 ms/Div	0.05 div, or less, error at each graticule line after adjusting for no error at the second and tenth graticule lines.
Fastest Calibrated Sweep Rate	500 ps/div.
Horizontal Bandwidth Referenced to 10 Div of 50-kHz	Dc to at least 1 MHz (-3 dB).
Phase Shift Between Vertical and Horizontal Systems	2°, or less, from dc to at least 35 kHz.
With Option 02 (B HORIZ Compartment Only)	2°, or less, from dc to 1 MHz.

DIGITIZER

Vertical Acquisition Window	From +5 div above, to -5 div below the center horizontal graticule line.
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TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
DIGITIZER (Cont)	
Vertical (cont)	
Resolution: Stored and Numeric Data Paths ¹	Nominally 0.0098 div.
Noise: Numeric Data Path ¹	0.008 div or less, mean value of 100 rms measurements, mainframe only.
DC Gain Accuracy as Checked With 067-0587-02 Calibration Fixture, Referenced to 6 Div	
Stored and Numeric Data Paths ¹	Within 1% at temperature of calibration.
Change With Temperature	0.8%, or less, per 10° C.
DC Offset	
Stored Data Path ¹	Within 0.1 div of graticule center, at temperature of calibration.
Numeric Data Path ¹	Within 0.1 equivalent graticule div of zero, at temperature of calibration.
Change With Temperature	0.1 div, or less, per 10° C.
System Bandwidth: Stored and Numeric Data Paths ¹	Varies with plug-in unit selected. See 7000-Series Oscilloscope Systems Specification at the end of this section; bandwidth shall be same specification limits as given for real-time operation.
Matching To Real Time	Real time and acquisition system sine-wave amplitude response should match each other to within $1-[2.5(f/100 \text{ MHz})]^2\%$, where $0 \leq f < 400 \text{ MHz}$, (f in MHz).

¹Refer to Figure 1-1 in Section 1, Introduction.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
DIGITIZER (Cont)	
Vertical (cont)	
System Step Response: Stored and Numeric Data Paths ¹	Varies with plug-in unit selected. See 7000-Series Oscilloscope Systems Specification at the end of this section; step response shall be same specification limits as given for real-time operation.
Horizontal	
Acquisition Window	From -5 div left, to +5 div right of the center vertical graticule line.
Resolution: Stored and Numeric Data Paths ¹	Nominally: 0.0098 div at 1024 P/W; 0.0196 div at 512 P/W; 0.0392 div at 256 P/W; 0.0784 div at 128 P/W;
Noise: Numeric Data Path ¹	0.01 div or less, mean value of 100 rms measurements, mainframe only.
DC Gain Accuracy, as Checked With 067-0587-02 Calibration Fixture, Referenced to 6 Div	
Stored and Numeric Data Path ¹	Within 1% at temperature of calibration.
Change With Temperature	0.4%, or less per 10° C.
DC Offset	
Stored Data Path ¹	Within 0.1 div of graticule center, at temperature of calibration.
Numeric Data Path ¹	Within 0.1 equivalent graticule div of zero, at temperature of calibration.
Change With Temperature	0.1 div, or less, per 10° C.

¹Refer to Figure 1-1 in Section 1, Introduction.
TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement	
DIGITIZER (Cont)		
Equivalent Time Sampling	For proper acquisition, input signals must be repetitive single-valued waveforms of the horizontal variable. Processor does not check that these conditions are met.	
Maximum Sweep Speeds for Single-Shot Acquisition with 7B87 Time Base with Pre-trigger Acquire Clock (For Dual Trace Use Next Slower Sweep Speed)	P/W	Maximum Sweep Speed (μs/div)
	128	50
	256	100
	512	200
	1024	500

CRT SYSTEM

Graticule	
Type	Internal; illuminated with variable edge lighting.
Display Area	8 div vertically by 10 div horizontally.
Div Unit	1 div = 1 cm.
Phosphor	
Standard	P31.
Option 78	P11.
Photographic Writing Speed (With Polaroid 3000 ASA Film, Without Film Fogging P-11 Phosphor)	
TEKTRONIX C51 Camera, f1.2 Lens and 1:0.5 Object-to-Image Ratio	At least 2.5 cm/ns. Photograph is viewed with front illumination. In typical applications, P31 phosphor has approximately one-half the writing speed of P11 phosphor.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
EXTERNAL CONNECTORS	
Camera Power	Front-panel 3-contact connector (on crt bezel) compatible with Tektronix C-50 series cameras.
Bottom Pin	Ground.
Center Pin	Single-sweep reset.
Top Pin	+15 V.
CALIBRATOR Output	Front-panel bnc connector.
Wave Shape	Square wave.
Polarity	Positive-going with baseline at 0 V.
Output Resistance	450 Ω.
Output Voltage	(Selected by front-panel CALIBRATOR switch.)
Load ≥ 100 kΩ	40 mV, 0.4 V, 4 V.
Load = 50 Ω	4 mV, 40 mV, 0.4 V.
Accuracy	Within 1%.
Output Current	40 mA available through CALIBRATOR output with a bnc-to-current loop adapter. CALIBRATOR switch must be set to 4 V for calibrated output.
Repetition Rate	1.0 kHz, within 0.25%.
Duty Cycle	49.8% to 50.2%.
Rise Time and Fall Time (100 pF maximum load)	250 ns or less.
Ground post	Provides convenient user ground reference point on front panel.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
EXTERNAL CONNECTORS (Cont)	
EXTERNAL KEYBOARD	25-pin female rear-panel connector for connecting an external keyboard.
GPIO IEEE-488-1978	24-pin female rear-panel connector for connecting instrument to GPIO. Meets IEEE 488-1978. (Not available on Option 0D).
MEMORY BACK-UP POWER	Two rear-panel female banana jacks. Provides connections for external power to maintain power on RAM, thereby providing non-volatile memory.
Voltage Requirement	6.0 to 6.5 V dc.
TTL SIGNAL OUTPUT SWL/SWH	Rear-panel bnc connector provides TTL-compatible signal.
Output Level	Set by user commands available on the Waveform Calculator.
SWL Command	Selects low level output (between 0 V and +0.8 V). Maximum current sink is 16 mA.
SWH Command	Selects high level output (between +2.4 v and +5.0 V). Maximum current source is 2.6 mA.
+SAWTOOTH OUT	Rear-panel bnc connector.
Polarity	Positive-going with baseline at 0 V, within 1 V, into 1 MΩ load.
Output Voltage	10 V maximum.
Rise Time Into 50 Ω	50 mV/unit-of-time, selected by the time-base unit time/div switch, within 15%; 100 ns/div maximum.
Rise Time Into 1 MΩ	1 V/unit-of-time, within 10%, selected by the time-base unit time/div switch; 1 μs/div maximum.
Output Resistance	Approximately 950 Ω.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
EXTERNAL CONNECTORS (Cont)	
+GATE OUT	Rear-panel bnc connector.
A Gate	Derived from A HORIZ time-base unit main gate.
B Gate	Derived from B HORIZ time-base unit main gate.
Dly'd Gate	Derived from A HORIZ time-base unit delayed gate.
Polarity	
A or B Gate	Positive-going with baseline at 0 V, within 1.0 V, into 1 M Ω load.
A Dly'd Gate	Positive level when A time-base delayed sweep or B sweep is enabled; 0 V, within 1.0 V, into 1 M Ω load, when sweeps are disabled. Output is positive when no plug-in is used or when plug-in does not provide delay gate.
Output Voltage	10 V maximum.
Into 50 Ω Load	0.5 V, within 10%.
Into 1 M Ω Load	10 V, within 10%, (up to 1 μ s/div).
Rise Time Into 50 Ω	20 ns or less.
Output Resistance	Approximately 950 Ω .
SIGNAL OUT	Rear-panel bnc connector selected by A TRIGGER SOURCE switch.
Source	Same as A TRIGGER SOURCE.
Output Voltage	\pm 15 V maximum.
Into 50 Ω Load	Approximately 25 mV/div of vertical deflection.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
EXTERNAL CONNECTORS (Cont)	
SIGNAL OUT (cont)	
Output Voltage (cont)	
Into 1 M Ω Load	Approximately 0.5 V/div of vertical deflection.
Bandwidth Into 50 Ω Load (-3 dB)	Varies with vertical plug-in selected. See 7000-Series Oscilloscope Systems Specifications at the end of this section.
DC Centering	0 V, within 1 V, into 1 M Ω load.
Aberrations	15% p-p, or less, within 50 ns of step.
Output Resistance	Approximately 950 Ω .
Z-AXIS INPUT	Rear-panel bnc connector.
Polarity and Sensitivity	+2 V provides complete blanking from maximum intensity condition; -2 V provides complete unblanking from minimum intensity condition.
Low-Frequency Limit	Dc.
Input Resistance	Approximately 470 Ω .
Input Capacitance	Less than 50 pF.
Open-Circuit Voltage	Approximately 0 V.
Maximum Input Voltage	15 V (dc plus peak ac).
Maximum Repetition Rate	1 MHz.
SINGLE SWEEP RESET	Rear-panel bnc connector.
Input	Input to reset single-sweep function of time-base units installed in A and B HORIZ compartments.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
EXTERNAL CONNECTORS (Cont)	
SINGLE SWEEP RESET (cont)	
Signal Required	Closure to ground (or switching from the high level to the low level in less than 1 ms) resets the sweep.
High Level	+50 V to +10 V, sink less than 40 μ A.
Low Level	+0.5 V to -5 V, sink less than 10 mA.
Minimum Pulse Width	10 μ s at 50% amplitude points.
Maximum Input Voltage	+50 V to -5 V (dc plus peak ac).
AC Power Input	3-pin male connector.

GPIB INTERFACE

Functions Implemented (As Per IEEE 488-1978)	Description:
SH1	Complete Source Handshake.
AH1	Complete Acceptor Handshake.
T5	Talk Function.
L3	Listen Function.
SR1	Complete Service Request Capability.
RL1	Complete Remote/Local Capability.
PP0	No Parallel Poll Capability.
DC1	Complete Device Clear Capability.
DT1	Complete Device Trigger Capability.
C0	No Controller Capability.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
COMMAND ACCURACY	
NOTE	
<i>All keyboard commands not listed below do not contribute accuracy errors, with exception of the >VCRD command. Refer to Section 9, Command Language, for additional information.</i>	
Waveform Functions	
Arithmetic Functions	
SORT LN EXP SGN +, -, /, *	Accurate to 4 significant digits $\pm(6 \cdot 10^{-4}) \cdot (\text{VSCL})$.
Cursors Functions	
HCRD	Accurate to 4 significant digits $\pm(6 \cdot 10^{-3}) \cdot (\text{HSCL})$.
VCRD	Accurate to 4 significant digits $\pm(6 \cdot 10^{-3}) \cdot (\text{VSCL})$.
Data Storage Functions	
PNT	Accurate to 4 significant digits $\pm(6 \cdot 10^{-3}) \cdot (\text{VSCL})$.
>PNT	Accurate to 4 significant digits $\pm(6 \cdot 10^{-4}) \cdot (\text{VSCL})$.
Wfm Functions	
ORD SMOOTH DIFF ITRP INTG	Accurate to 4 significant digits $\pm(6 \cdot 10^{-3}) \cdot (\text{VSCL})$.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
COMMAND ACCURACY (Cont)	
Waveform Functions (cont)	
Wfm Functions (cont)	
>ORD	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL})$.
	If autoscaling occurs, all waveform points are rescaled to: $\pm(6 \cdot 10^3) \cdot (\text{VSCL})$.
Wfm Parameters	
MAX MIN P-P MID MEAN RMS	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL})$.
ENERGY	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL}^2) \cdot (\text{HSCL})$.
AREA	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL}) \cdot (\text{HSCL})$.
FREQ	Accurate to 4 significant digits $\pm(6 \cdot 10^4) \cdot (\text{HSCL})$.
DELAY WIDTH RISE FALL PER	Accurate to 4 significant digits $\pm(6 \cdot 10^4) \cdot (\text{HSCL})$.
Wfm Scaling Functions	
VZR VSCL VSCL	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL})$.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
COMMAND ACCURACY (Cont)	
Waveform Functions (cont)	
Wfm Scaling Functions (cont)	
HSCL >HSCL	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{HSCL})$.
>VZR VXPD	Accurate to 4 significant digits $\pm(6 \cdot 10^3) \cdot (\text{VSCL})$.
Constant Functions	
Arithmetic Functions	
SORT LN EXP +, -, /, *	Accurate to 4 significant digits.
POWER SOURCE	
Voltage Range (AC, RMS)	Selected by rear-panel LINE VOLTAGE SELECTOR switch.
115 V Range	From 90 to 132 V.
230 V Range	From 180 to 250 V.
Line Frequency	From 48 to 440 Hz.
Maximum Power Consumption	230 W, nominal.
Maximum Current	3.5 A at 60 Hz, 90 V line. 1.8 A at 60 Hz, 180 V line.
Fuse	4 A fast-blowing type.

TABLE 2-1 (CONT)
Electrical Characteristics

Characteristic	Performance Requirement
WAVEFORM CALCULATOR	
Keyboard	
Controls	An array of key switches which allows the user to execute commands; depressing a key issues a command to the processor (except in the GPIB Remote mode).
External Connector	25-pin male connector on 56 inch (± 3 inches) cable for connecting the keyboard to the mainframe.

TABLE 2-2
Environmental Characteristics

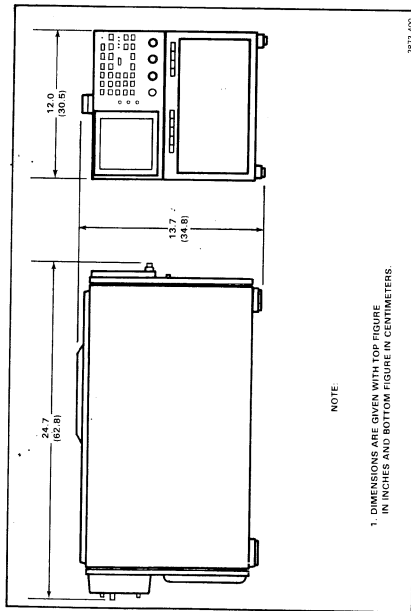
Characteristic	Information
NOTE	
<i>This instrument will meet the electrical characteristics given in the Performance Requirement column of Table 2-1 over the following environmental limits (unless otherwise stated in Table 2-1).</i>	
Temperature	
Operating	0° to $+50^{\circ}$ C.
Nonoperating	-55° to $+75^{\circ}$ C.
Altitude	
Operating	5 KM (15,000 ft).
Nonoperating	15 KM (45,000 ft).

TABLE 2-2 (CONT)
Environmental Characteristics

Characteristic	Information
EMC (Electromagnetic Compatibility, Option 3 Only)	
Without External Keyboard	Meets requirements of MIL-STD-461A, when tested in accordance with the following test methods given in MIL-STD-462: CE-01, CE-03, CS-01, CS-02, CS-06, RE-02 (limited to 1 GHz), (T) RE-0H, RS-01 and RS-03 (limited to 1 GHz).
With External Keyboard Connected	Same as above, except delete RE-02.
Vibration	
Operating and Nonoperating	Tested to MIL-T-28800B, SECT. 4.5.5.3.1 Type 2, Class 5, Style E & F.
Shock	
Nonoperating	Tested to MIL-T-28800B, SECT. 4.5.5.4.1 Type 2, Class 5, Style E & F.
Bench Handling	Tested to MIL-T-28800B, SECT. 4.5.5.4.4 Type 2, Class 5, Style E & F.
Transportation	National Safe Transit Assoc., Pre-Shipment Test procedure.
Vibration of Packaged Product	NSTA. Project 1 A-B-1.
Drop of Packaged Product	NSTA. Project 1 A-B-2.

TABLE 2-3
Physical Characteristics

Characteristic	Information
Net Weight	
Mainframe (Without Plug-Ins)	19.0 Kg (42.0 lbs).
Waveform Calculator	1.14 Kg (2.5 lbs).
Overall Dimensions	
Mainframe	Refer to Figure 2-1.
Waveform Calculator	Refer to Figure 2-2.
Ventilation	Safe operating temperature maintained by electronically driven dc fan. Automated resetting, thermal cutout switch protects instrument from overheating.
Finish	Anodized front panel. Blue vinyl painted aluminum cabinet.



NOTE:

1. DIMENSIONS ARE GIVEN WITH TOP FIGURE
IN INCHES AND BOTTOM FIGURE IN CENTIMETERS.

2873-400

Figure 2-1. 7854 Mainframe dimensional drawing.