

Table 1-1. Specifications

SOURCE CHARACTERISTICS

Frequency Characteristics

**Frequency Range:** 5 Hz to 200 MHz.  
**Frequency Resolution:** 0.001 Hz.  
**Stability:**  $\pm 5 \times 10^{-8}$ /day, 0 to 55°C.

Output Characteristics

**Level Range:** +15 dBm to -49 dBm (1.26 Vrms to 793  $\mu$ Vrms; 2 dBV to -62 dBV) into a 50  $\Omega$  load.  
**Resolution:** 0.1 dB.  
**Entry Units:** dBm, dBV, V.  
**Accuracy:**  $\pm 1$  dB at +15 dBm and 100 kHz. Below +15 dBm, add the greater of  $\pm 0.02$  dB/dB or 0.2 dB.  
**Flatness:** 1.5 dBp-p from 5 Hz to 200 MHz.  
**Impedance:** 50 $\Omega$ ; >20 dB return loss at all levels.  
**RF Output Connector:** 50  $\Omega$  Type N female.  
**Spectral Purity:**  
**Phase Noise (in 1 Hz Bandwidth):**  
 < -70 dBc at offset frequencies from carrier of 100 Hz to 20 kHz.  
**Harmonics:** < -30 dBc.  
**Non-Harmonic Spurious Signals:**  
 < -50 dBc or -70 dBm whichever is greater.  
**Reverse Power Protection:** Output is automatically opened at a signal level of approximately +22 dBm (50 $\Omega$ ), or  $\pm 4$  Vdc, or greater applied to the source output. Source output is reconnected with the Clear Trip function.

Sweep Characteristics

**Linear Frequency:**  
**Range:** 5 Hz to 200 MHz.  
**Entry:** Start/stop or center/span frequencies.  
**Span:** 0 Hz or 0.01 Hz to 200 MHz, phase continuous.  
**Sweep Time:** 100 ms/span to 6553 s/span.  
**Direction:** Increasing or decreasing frequency.  
**Log Frequency (segmented linear approximation):**  
**Range:** 5 Hz to 200 MHz.  
**Entry:** Start/stop frequencies.  
**Span:** 0.01 Hz to 200 MHz, phase continuous.  
**Log Accuracy:** 2%.  
**Sweep Time:** 200 ms/span to 6553 s/span.  
**Sweep Direction:** Increasing frequency.  
**Alternate Frequency:** Sweep alternates between two separate start/stop frequencies using linear sweep only.  
**CW:** Frequency is fixed. Data is updated with a selectable sample time from 1ms to 16 s.

Log Amplitude (fixed frequency):

**Range:** +15 dBm to -49 dBm.  
**Entry:** Start/stop level in dBm or dBV.  
**Sweep Time:** 1 ms/step to 16 s/step. Total sweep time/span depends upon total number of steps and time/step.  
**Sweep Modes:** Continuous, single, manual.  
**Trigger Modes:** Free run, immediate, line, external.

RECEIVER CHARACTERISTICS

Input Characteristics

**Frequency Range:** 5 Hz to 200 MHz.  
**Inputs:** Three receiver inputs (A, B and R)  
**Input Impedance:** Selectable 50  $\Omega$  with >25 dB return loss, or 1 M $\Omega$  in parallel with approximately 30 pF.

Full Scale Input Level:

Input Impedance	Input Attenuation	
	0 dB	20 dB
50 $\Omega$	-20 dBm	0 dBm
1 M $\Omega$	-33 dBV (22.4 mV)	-13 dBV (224 mV)

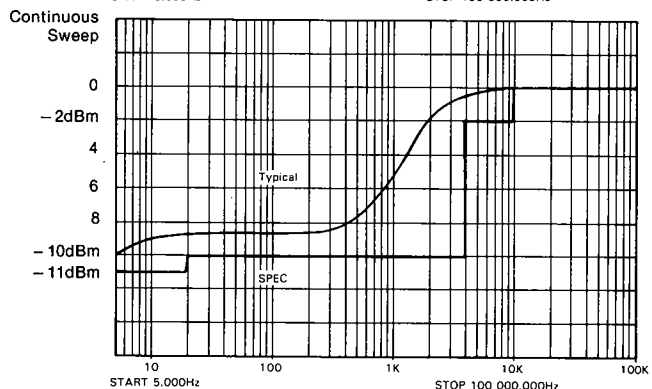
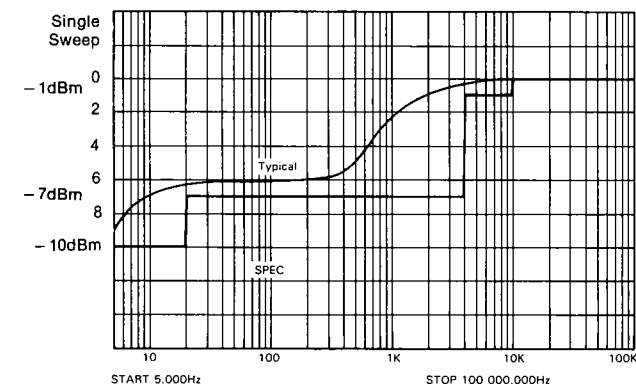


Table 1-1. Specifications (Cont)

**Input Damage Level (approximate):**

50 Ω: +30 dBm or 25 Vdc.  
 1 MΩ: +16.9 dBV(7 Vrms) or 25 Vdc.  
 The 50 Ω input impedance automatically switches to 1 MΩ at approximately +20 dBm, and can be reset with the clear-trip function.

**Input Connectors:** 50 Ω Type N female.

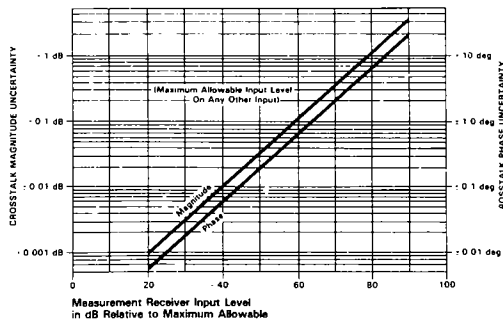
**Resolution Bandwidth:** Selectable 1 kHz, 100 Hz, 10 Hz, or 1 Hz.

**Sensitivity(Due to noise and internal crosstalk between source and receiver inputs):**

Resolution Bandwidth	Minimum Freq.	Minimum Freq. - 30 kHz		30 kHz - 200 MHz (50 Ω) 30 kHz - 20 MHz (1 MΩ)	
		Full Scale Input		Full Scale Input	
		0 dBm -13 dBV (20 dB atten)	-20 dBm -33 dBV (0 dB atten)	0 dBm -13 dBV (20 dB atten)	-20 dBm -33 dBV (0 dB atten)
1 Hz	100 Hz	-110 dBm	-130 dBm	-110 dBm	-130 dBm
10 Hz	100 Hz	-100 dBm	-120 dBm	-110 dBm	-130 dBm
100 Hz	500 Hz	-90 dBm	-110 dBm	-105 dBm	-125 dBm
1 kHz	5 kHz	-80 dBm	-100 dBm	-95 dBm	-115 dBm

**Residual Responses:** >100 dB below full scale input, except for crosstalk error limits, L.O. feedthrough, and ac line and fan related spurious signals.

**Crosstalk Error Limits:** (>100 dB isolation between inputs)



**L.O. Feedthrough:** < -33 dB below maximum input level.

**AC Line and Fan Related Spurious Signals:** < -100 dBm below 1 kHz input frequency.

**Electrical Length/Reference Plane**

**Extension:** Provides equivalent electrical line length, or delay at inputs A, B and R.

**Range:** -3 × 10<sup>8</sup> m to +3 × 10<sup>8</sup> m, or +1 s to -1 s.

**Resolution:** 5 digits or 0.1 cm (3.3 ps) whichever is greater.

**Accuracy:** ±0.1 cm or ±0.02% whichever is greater.

**Magnitude Characteristics**

**Range:** Full Scale Input to Sensitivity.

**Resolution:**

**Marker:** 0.001 dB (log); 5 digits (linear).

**Display:** 0.01 dB/div to 20 dB/div (log absolute);

0.01 dB/div to 200 dB/div (log ratio);

0.1 nV/div to 10 V/div (linear absolute);  
 10<sup>-10</sup>/div to 10<sup>20</sup>/div (linear ratio).

**Display Units:** dB, dBm, dBV, V, and linear ratio.

**Accuracy (at 100 kHz, 25° C, and Full Scale Input):**

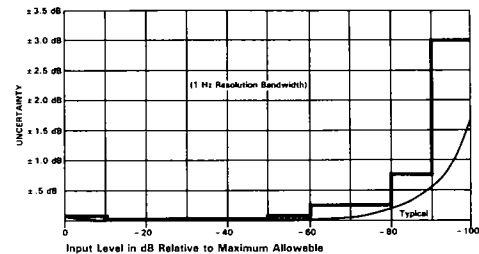
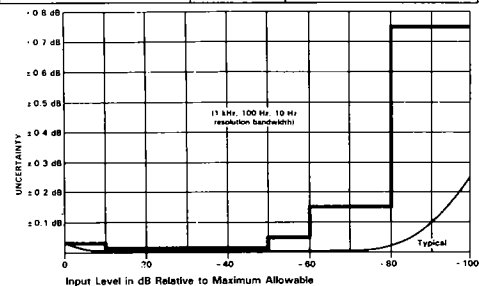
**Absolute (A,B,R):** ±0.2 dB.

**Ratio (A/R,B/R,A/B):** ±0.15 dB (50 Ω); ±0.2 dB (1 MΩ).

Accuracy and frequency response errors, and effects of different input attenuation can be calibrated out with normalization.

**Dynamic Accuracy:**

Error		Input Level Relative to Full Scale Input
Resolution Bandwidth		
1 kHz, 100 Hz, 10 Hz	1 Hz	
±.04 dB	±.04 dB	0 dB to -10 dB
±.02 dB	±.02 dB	-10 dB to -50 dB
±.05 dB	±.05 dB	-50 dB to -60 dB
±.15 dB	±.25 dB	-60 dB to -80 dB
±.75 dB	±.75 dB	-80 dB to -90 dB
±.75 dB	±3.00 dB	-90 dB to -100 dB



**Frequency Response:** Specifications apply when inputs are driven from a 50 Ω source impedance.

**Absolute (A,B,R):**

Frequency	Error	
	50 Ω Input	1 MΩ Input
20 Hz to 20 MHz	.3 dB pp	.5 dB pp
5 Hz to 200 MHz	.6 dB pp	----
5 Hz to 20 MHz	----	1 dB pp

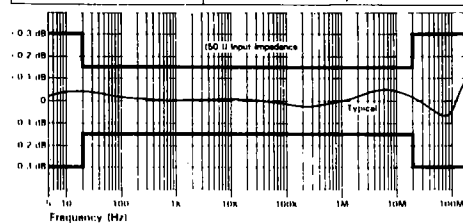
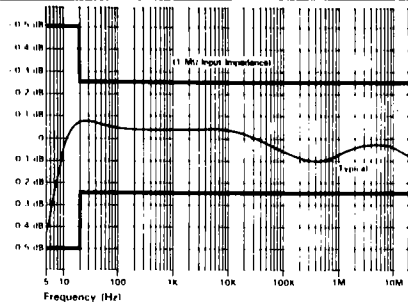
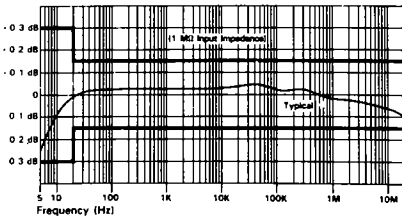
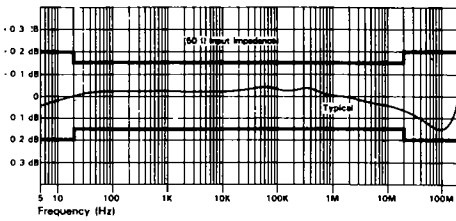


Table 1-1. Specifications (Cont)



Ratio (A/R,B/R,A/B):

Frequency	Error*	
	50 Ω Input	1 MΩ Input
20 Hz to 20 MHz	.3 dB pp	.3 dB pp
5 Hz to 200 MHz	.4 dB pp	----
5 Hz to 20 MHz	----	.6 dB pp



\*For unequal 50 Ω input attenuation add 0.15 dB pp (20 Hz to 20 MHz), 0.3 dB pp (5 Hz to 200 MHz). For unequal 1 MΩ input attenuation add 0.2 dB pp (20 Hz to 20 MHz), 0.4 dB pp (5 Hz to 20 MHz).

**Reference Level:**

**Range:** -207 dBm to +33 dBm (-220 dBV to +20 dBV) (log absolute); -400 dB to +400 dB (log ratio); 0 V to 10 V (linear absolute); 0 to 10<sup>20</sup> (linear ratio).

**Resolution:** 0.001 dB (log); 5 digits (linear).

**Stability:**

**Temperature:** Typically < ±0.02 dB/°C.  
**Time:** Typically < ±0.05 dB/hour at 25°C.

**Phase Characteristics (A/R,B/R,A/B):**

**Range:** ±180 deg.

**Resolution:**

**Marker:** 0.005 deg (0.0001 rad)

**Display:** 0.01 deg/div to 200 deg/div (0.00018 rad/div to 3.49 rad/div).

**Display Units:** degrees, radians.

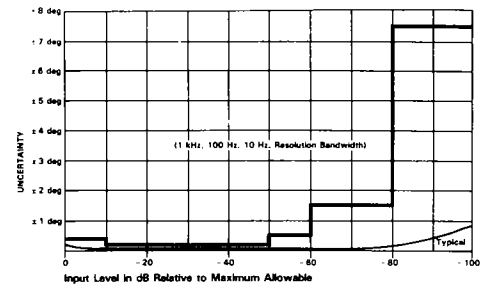
**Accuracy (at 100 kHz, 25° C, and Full Scale Input):** ±2.0 deg

Accuracy and frequency response errors, and effects of different input attenuation can be calibrated out with normalization.

**Dynamic Accuracy:**

Error*	Input Level Relative to Full Scale Input
±.4 deg	0 dB to -10 dB
±.2 deg	-10 dB to -50 dB
±.5 deg	-50 dB to -60 dB
±1.5 deg	-60 dB to -80 dB
±7.5 deg	-80 dB to -100 dB

\*Specifications do not apply below -60 dB in a 1 Hz Resolution Bandwidth.



**Frequency Response:** Specifications apply when inputs are driven from a 50 Ω source impedance.

Frequency	Error*	
	50 Ω Input	1 MΩ Input
20 Hz to 20 MHz	2 deg pp	5 deg pp
5 Hz to 200 MHz	10 deg pp	----
5 Hz to 20 MHz	----	10 deg pp

\*For unequal input attenuation add 8 deg pp.

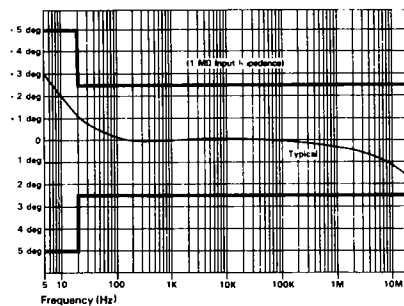
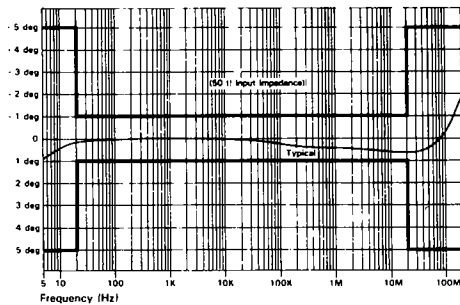


Table 1-1. Specifications (Cont)

**Crosstalk:** Specified under Input Characteristics.  
**Reference Level:**  
**Range:** - 500 deg to + 500 deg (- 8.7 rad to + 8.7 rad)  
**Resolution:** 0.01 deg.  
**Stability:**  
**Temperature:** Typically < ±0.05 deg/°C.  
**Time:** Typically < ±0.05 deg/hour at 25°C.

**Polar Characteristics**

Range, Resolution, Display Units, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Reference Level, and Stability specifications are the same as the corresponding magnitude and phase characteristics.

**Full Scale Magnitude Range:**  
**Absolute (A,B,R):** 0.1 nV to 10 V.  
**Ratio (A/R,B/R,A/B):** 10<sup>-10</sup> to 10<sup>20</sup>.

**Real/Imaginary Characteristics**

Range, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Stability specifications are the same as the corresponding magnitude and phase characteristics.

**Resolution:**  
**Marker:** 5 digits.  
**Display:** 0.1 nV/div to 10 V/div for absolute; 10<sup>-10</sup> to 10<sup>20</sup> for ratio.  
**Display Units:** V and linear ratio.  
**Reference Level:**  
**Range:** ± 10 V for absolute; ± 10<sup>20</sup> for ratio.  
**Resolution:** 5 digits.

**Delay Characteristics (Linear Frequency Sweep; A/R, B/R, A/B; 50 Ω input impedance)**

**Range:** Group delay is a computed parameter, defined by the equation

$$t_g = - \frac{\Delta\phi}{2\pi\Delta f}$$

**Minimum:** The minimum delay time is given by the expression

$$\frac{1.4 \times 10^{-5}}{\text{Aperture [Hz]}}$$

**Maximum:** The maximum delay is given by the expression

$$\frac{N - 1}{2 \times \text{Span [Hz]}}$$

where N = number of points per sweep (51,101,201,401).

**Effective Range:** 1 ps to 20,000 s.

**Resolution:**  
**Marker:** Same as minimum delay time or 5 digits, whichever is greater.  
**Display:** 0.01 ns/div to 1000 s/div.  
**Aperture:** Selectable 0.5%, 1%, 2%, 4%, 8%, 16% of frequency span.  
**Display Units:** s.  
**Accuracy:**

$$\frac{.13 \text{ s}}{(\text{freq [Hz]})^2} \pm 2 \text{ ns}$$

or

$$\frac{\text{Dynamic Phase Accuracy}}{360 \times \text{Aperture [Hz]}} \pm 2 \text{ ns}$$

whichever is greater.

The  $\frac{.13 \text{ s}}{(\text{freq [Hz]})^2} \pm 2 \text{ ns}$  term can be

calibrated out with normalization.

**Crosstalk:** Determined by the expression

$$\frac{\text{Phase Crosstalk}}{360 \times \text{Aperture [Hz]}}$$

**Reference Level:**

**Range:** ± 10<sup>3</sup> s.

**Resolution:** 5 digits.

**Stability:**

**Temperature:** Determined by the expression

$$\frac{\text{Phase Temperature Stability}}{360 \times \text{Aperture [Hz]}}$$

**Time:** Determined by the expression

$$\frac{\text{Phase Time Stability}}{360 \times \text{Aperture [Hz]}}$$

DISPLAY CHARACTERISTICS

**Annotation:** Start/stop, center/span or CW frequency, source level, scale/div, reference level, delay aperture, marker data, and soft key functions.

**Graticules:** Rectangular logarithmic and linear, polar, and Smith. All graticules are electronically generated.

**Traces:** Two simultaneous traces may be present with a rectangular graticule. One trace with polar or Smith graticules.

**Markers:** Each trace has one main marker and an offset marker. Markers indicate data at corresponding trace coordinates in the same units as used to set the Reference Level. Markers can be used to modify certain display parameters. Marker resolution is the same as horizontal display resolution.

**Reference Line Position:**

**Rectangular Graticule:** 0% to 100% full scale deflection in 0.05% increments.

**Polar/Smith Chart Graticule:** ± 500 deg in 0.001 deg increments.

**Data Storage:** Measured data can be stored in vector format in non-volatile storage registers D1,D2,D3,D4. Stored data can be redisplayed later or operated on with Vector Math.

Table 1-1. Specifications (Cont)

**Vector Math:** Input Magnitude and Phase Data, Stored Data, and User Defined Constants and Functions can be mathematically combined into expressions which define displayed or stored data. Mathematical operations are: add, subtract, multiply, and divide.

**Calibration:**

**Normalization:** Both traces can be normalized to measured data with full accuracy, and resolution. Scale factors can be changed after normalization without affecting calibration.

**Normalize(Short):** Compensates for frequency response errors.

Requires a short termination.

**One Port Part Cal:** Compensates for directivity errors and frequency response errors. Requires open and load terminations.

**One Port Full Cal:** Compensates for directivity, frequency response and source match errors. Requires open, short, and load terminations.

**Noise Averaging:**

**Type:** Exponentially weighted vector averaging on successive sweep data.

**Averaging Factor:** Selectable 1(off), 4,8,16,32,64,128,256.

The current trace  $A_n$  is always displayed and updated at the sweep rate according to the expression

$$A_n = S_n/F + (F-1)(A_{n-1})/F$$
, where  
 $S_n$  = current input signal,  $F$  = averaging factor,  $A_{n-1}$  = previously averaged trace.

Averaging Factor is fixed at 1 in alternate sweep.

**Linear Phase Slope Compensation:** Provides linear phase slope offset in deg/span.

**Range:** -72,000 deg./span to +72,000 deg./span (-1256 rad/span to +1256 rad/span).

**Resolution:** 5 digits or 0.001 deg whichever is greater.

**Accuracy:** 0.02%.

**Autoscale:** Automatically adjusts the reference level and scale/div. of the displayed measurement.

**Measured No. of Points per Sweep:**

Logarithmic frequency, 401;  
 linear frequency, 51,101,201,401;  
 CW frequency, 1.

**Measure No. of Steps per Sweep:**

Logarithmic Amplitude Sweep, 5,10,20, 50,100,200,400.

**Display Resolution:** Horizontal and vertical.

**Rectangular:** 1600 points.

**Polar:** 1200 points.

## PROGRAMMING CHARACTERISTICS

**Capability:** Remote programming is via the Hewlett-Packard Interface Bus (HP-IB)\* for all 3577A front panel control functions, except the ac line switch, display intensity, entry knob, HP-IB address and talk-only on/off. The 35677A/B S-Parameter Test Sets are programmable through the 3577A interface only.

**Interface Functions:** SH1,AH1,T5,TEØ,L4, LEØ,SR1,RL1,PP1,DC1,DT1,CØ,E1.

**Output Data Transfer Time:** 401 data points (single parameter) can be transferred directly to an HP 200 series computer in Basic language as follows:

**ASCII Mode:** Typically 1500 ms.

**Binary Floating Point Mode:** Typically 160 ms.

**Graphics Capabilities:**

**Alphanumeric Characters:** 12 lines of text with 40 characters per line can be displayed. Character set includes alphanumerics special characters and line vectors.

**Vector Display:** Trace lines can be drawn on the display between any two points with a resolution of 2048 points along the horizontal and vertical axes.

\*HP-IB is Hewlett-Packard's implementation of IEEE Standard 488-1978.

Table 1-1. Specifications (Cont)

## GENERAL CHARACTERISTICS

**External Reference Frequency Input:**

**Frequency:** 10 MHz/N (N is an integer from 1 to 100).

**Level:** 0 dBm  $\pm$  10 dB, nominal.

**Impedance:** 50  $\Omega$ , nominal.

**Connector:** BNC female, rear panel.

**Reference Frequency Output:**

**Frequency:** 10 MHz.

**Level:** Typically 0 dBm.

**Impedance:** 50  $\Omega$ , nominal.

**Connector:** BNC female, rear panel.

**External Trigger:** Triggers on negative TTL transition or contact closure to ground.

**Minimum Pulse Width:** Typically 1  $\mu$ s.

**Impedance:** 50  $\Omega$ , nominal.

**Connector:** BNC female, rear panel.

**Plotter Control:** Directly compatible with HP-IB graphics plotters that use Hewlett-Packard Graphics Language (HP-GL) with listen only capability. Plotter may be controlled by the 3577A through the HP-IB connector without an external computer.

Plotted data includes trace 1, trace 2, graticule, are annotation. Additional markers can be plotted, and pen numbers, pen speed, and line type can also be selected.

**Display Adjustments:** Astigmatism, x-axis position, y-axis position, alignment, focus, and intensity.

**Save/Recall:** Front panel setups can be stored in non-volatile memory locations 1 through 5. Last state is saved when power is removed.

**Operating Conditions:**

**Temperature:** 0°C to +55°C.

**Relative Humidity:** <95% at 40°C.

**Altitude:** <4,572 m (15,000 ft).

**Non-Operating Conditions:**

**Temperature:** -40°C to +75°C.

**Altitude:** <15,240 m (50,000 ft).

**Accessories Included:**

4ea. Type N male to BNC female Adapter. (HP Part No. 1250-0780.)

1 ea. Operating Manual. (HP Part No. 03577-90000).

1 ea. Service Manual. (HP Part No. 3577-90010).

**Power:** 115V +10%, -25% (47 Hz to 440 Hz), or 230 V +10%, -15% (47 Hz to 66 Hz), 450 VA maximum.

**Weight:** 31 kg (67 lbs) net. 41 kg (90 lbs) shipping.

**Dimensions:** 222 mm H  $\times$  426 mm W  $\times$  578 mm D (8.75 in  $\times$  16.75 in  $\times$  22.75 in). Add 1 1/8 inch to depth to include front panel controls and connectors.