Technical Specifications

Input Characteristics

Input A

Frequency Range	10Hz to 160MHz
Input Impedance (nominal)	
X1 attenuation	1 Megohm/40pF (AC coupled) or 50 ohms (DC coupled)
X20 attenuation	1 Megohm/25pF (AC coupled) or 50 ohms (DC coupled)
Dynamic Range	±1V pk (X1), ±20V pk (X20)
Sensitivity	
Sinewave	<10mV rms, 20Hz to 120MHz <50mV rms, 120MHz to 160MHz <20mV rms, 10Hz to 20Hz
Pulse	5nS min. pulse width (∿) 45mV pk-pk at 25% and 75% duty cycles (⎍/⎍) 28mV pk-pk at up to 10% duty cycles 45mV pk-pk at 25%/75% duty cycle
Input Attenuation Range	0dB to approx. 58dB in two ranges, continuously variable using sensitivity control and X1/X20 attenuator control
Maximum Input (without damage)	
50 ohms	10Vrms (DC coupled)
1 Megohm (X1 attenuation)	260V (DC + AV rms) from DC to 10kHZ, decreasing to 10V rms above 250kHz.
1 Megohm (X20 attenuation)	260V (DC + AC rms) From DC to 200 kHz, decreasing to over 10V rms at 5MHz and above.
Trigger Levels	Three selectable trigger levels are available to provide optimum triggering on waveforms with different duty cycles. (Sens control set to maximum, X1 attn.)

	Offset	Trigger edge
(⎍)	+9mV	Negative
(∿)	0mV	Positive
(⎍)	-9mV	Positive

Filter	50kHz nominal low pass filter. Attenuation rate 20dB/decade nom.

Input B (Model 1998)

Frequency Range	40MHz to 1.3GHz, AC coupled
Input	50ohms nominal (BNC connector)
VSWR	⩽2:1 (IGHz)
Operating Range (sinewave)	<10mV to 5V rms to 1GHz <50mV to 5V rms to 1.3GHz
Maximum Input	7V rms (fuse protected).
Damage Level	25W

Input B (Model 1999)

Frequency Range	80MHz to 2.6GHz (3GHz under restricted operating conditions)
Input	50ohms nominal, AC coupled ('N' type connector)
VSWR	⩽2:1 to 2.6GHz (typically <1.5:1)
Operating Range (sinewave)	<10mV to 4V rms min. 80MHz to 2.6GHz
Overload	Protection/indication above 4V min.
Damage Level	+33dBm, ±40V DC or pulsed.
AM Tolerance	⩾90% up to 1.3GHz

Input D

	Used in Ratio A/D mode.
Frequency Range	10kHz to 10MHz usable down to 1kHz with reduced sensitivity.
Input Impedance (nominal)	1kohm for signals <1V p-p, decreasing to 500 ohm for signals ⩾10V p-p. (AC coupled.)
Input Signal Range (sinewave)	100mV to 10V rms, 10kHz to 10MHz. Typically 1V to 10V rms, 1kHz to 10kHz.
Damage Level	260V (DC +AC rms) up to 384 Hz decreasing to 10V rms above 10kHz.

External Arming

	External TTL timing signal can be applied to EXT ARM INPUT (rear panel).
Damage Level	10V rms or ±15V pk
Input Impedance	1 kohm nominal, (DC coupled)
Slope	Armed on positive edge
Slew rate	2V/μs min
Pulse Width	200nS min.
Set Up Time	100nS after input edge.

Measurement Modes

Frequency A and B

Range	
Frequency A	10Hz to 160MHz
Frequency B	40MHz to 1.3GHz (Model 1998) 80MHz to 2.6GHz (Model 1999)
Digits Displayed	3 to 10 digits
LSD Displayed (Hz)	$F \times 10^{-D}$ (F = Frequency rounded up to next decade, D = No. of digits).
Resolution* (Hz)	±n LSD† ± (Trigger Error* X Freq)/Gate Time
Accuracy* (Hz)	± Resolution ± (Timebase Error X Freq.)

Period A (Period Average)

Range	6.25nS to 100mS
Digits Displayed	3 to 10 digits
LSD Displayed (Sec)	$P \times 10^{-D}$ (P = Period rounded up to next decade, D = No. of digits).
Resolution *(Sec)	±n LSD† ±1.4 (Trigger Error* X Period)/Gate Time
Accuracy *(Sec)	± Resolution ± (Timebase Error X Period).

† n = 1 for 3-5 and 10 digits or 2 for 6-9 digits.
* See Definitions

Ratio B/A (Model 1998 Only)

Specified for higher frequency applied to input B

Range

Input A	10Hz to 100MHz
Input B	40MHz to 1.3GHz
LSD Displayed	1 to 8 digits determined by Freq A and gate time selected
Resolution*	±LSD ±1.4 (Trigger Error (A)* X Ratio)/Gate Time
Accuracy*	±Resolution

Ratio A/D

Specified for higher frequency applied to input A

Range

Input A	10Hz to 100MHz
Input D	1kHz to 10MHz
LSD Displayed	1 to 8 digits determined by Freq D and gate time selected
Resolution*	±LSD ±1.4 (Trigger Error (A)* X Ratio)/Gate Time
Accuracy*	±Resolution

Burst

Min Burst time 1mS + Gate Time*

General

Internal Timebase

Crystal Controlled

Frequency	10MHz
Aging Rate	2×10^{-6} in the first year
Temperature Stability	$\pm 1 \times 10^{-5}$ over the range 0° to 50°C.
Adjustment	Via rear panel

Frequency Standard Output

Frequency	10MHz
Amplitude	TTL levels giving approx. 1V p-p into 50 ohms.
Impedance	90 ohms nominal.
Max. Reverse Input	±15V

External Standard Input

Frequency	10MHz (see also Option 10 for other frequencies). See Input D for further specifications.

Gate Time

Automatically determined by number digits selected. LED annunciators indicate gate time.

No. of Digits Selected	Gate Time (Seconds)
10	20
9	1
8	0.1
7	0.01
6,5,4,3	0.001

These nominal gate times will be extended depending on period of input signal (see definitions).

Gate Output	Available as a TTL compatible signal at the rear panel.

Single Cycle (Hold)

Enables a single measurement to be initiated and held.

Display

10 digit high brightness, 14mm LED display.

Power Requirements

Voltage	90–110 103–127 188–237 212–265 (externally selectable)
Frequency	45–440Hz
Rating	25VA typically.

Operating Temperature Range	0° to +50°C (0° to +40°C with battery pack).
Storage Temperature Range	-40°C to +70°C (-40°C to +60°C with battery pack).
EMC/RFI	MIL-STD-461B
Environmental	Designed to meet MIL-T-28800 and DEF-STD-66/31
Safety	Designed to meet the requirements of IEC 348 and follow the guidelines of UL1244.
Weight	Net 3.6kg (8lb) excluding battery 6.8kg (15lb) including battery Shipping 5.5kg (12lb) excluding battery 8.7kg (19lb) including battery
Normal Dimensions	See back page
Shipping Dimensions	430 X 360 X 280mm (16.91 X 14.2 X 11.0 in)

Options

Option 01 Rear Panel Inputs

A rear panel input, factory fitted option, is available for ATE applications. Input A is in parallel with those on the front panel while input B is fitted in place of the front panel input.

Options 04T

Temperature Compensated Crystal Oscillator

Frequency	10MHz
Aging Rate	3×10^{-7}/month 1×10^{-6} in the first year
Temperature Stability	$\pm 1 \times 10^{-6}$ over the range 0°C to +40°C (operable to +50°C)

Option 04A

Ovened Oscillator

Frequency	10MHz
Aging Rate	3×10^{-9}/day averaged over 10 days after 3 months continuous operation.
Temperature Stability	$\pm 3 \times 10^{-9}$/°C averaged over range 0°C to +45°C (operable to +50°C)
Warm Up	Typically $\pm 1 \times 10^{-7}$ within 6 minutes.

† n = 1 for 3-5 and 10 digits or 2 for 6-9 digits.
* See Definitions

Option 04B

High Stability Ovened Oscillator

Frequency	10MHz
Aging Rate	5×10^{-10}/day averaged over 10 days after 3 months continuous operation.
Temperature Stability	$\pm 6 \times 10^{-10}$/°C averaged over range 0°C to + 50°C
Warm Up	$\pm 1 \times 10^{-7}$ within 20 minutes

Option 04E

Ultra High Stability Ovened Oscillator

Frequency	10MHz
Ageing Rate	$\leq 5X10^{-10}$ per day after 2 days
Temperature Stability	$\pm 7X10^{-9}$ over range 0-50°C (with respect to 25°C)
Warm Up	$\pm 5X10^{-9}$ within 5 hours

Option 07

Rechargeable Battery Pack and External DC Operation

Battery Type	Sealed lead-acid cells
Battery Life (at 25°C)	Typically 5 hours (24 hrs on standby) - 1998
	Typically 3.75 hours (12 hrs on standby) - 1999
Battery Condition	Display indicates battery low
External DC	11-16V via socket on rear panel (-ve ground, not isolated).

Option 10

Reference Frequency Multiplier

Input Frequency	1,2,5 or 10MHz ($\pm 1 \times 10^{-6}$)

Option 55

GPIB Interface	Complies with IEEE-STD-488 (1978) and to conform with the guidelines of IEEE-STD-728 (1982).
Control Capability	All functions/controls programmable except power on/off, standby/charge and sensitivity potentiometer.
Output	Engineering format (11 digits and exponent)
IEEE-STD-488 Subsets	SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2.
Handshake Time	250 μS to 1mS/character dependent on message content.
Read Rate	Typically 18/sec dependent upon measurement function.

Definitions

† **LSD** (Least Significant Digit)
In frequency and Period modes display automatically upranges at 1.1 X decade and downranges at 1.05 X decade, except on Input B for input frequency >1GHz. Above 1GHz no ranging on 1998. Model 1999 upranges at 1.25GHz and downranges at 1.3GHz. Accuracy and Resolution expressed as an RMS value.

* **Trigger Error** RMS

$$\text{Trigger Error} = 1.4\ \frac{\sqrt{(e_i^2 + e_n^2)}}{S}$$

Where e_i = input amplifier RMS noise (typically 150μV RMS in 160MHz bandwidth)
e_n = input signal RMS noise in 160MHz bandwidth
S = Slew rate at trigger point V/Sec.

Gate Time
The gate time will be extended as below.

Function	Gate Time extended by
Freq. B	64 periods (1998)
	256 periods (1999)
Freq. A, Period A (∿)	2 periods
Freq. A, Period A (⊓, ⊔)	1 period
Ratio B/A, A/D	1 period of Input A