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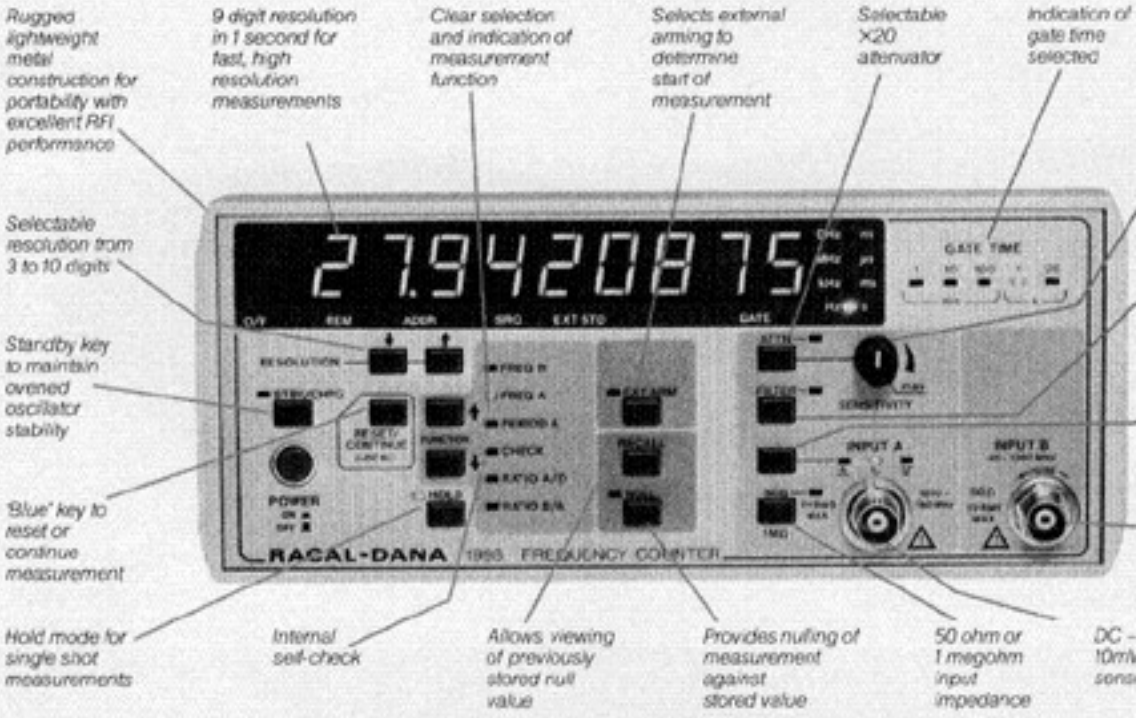
1·3/2·6 GHz Frequency Counters
Models 1998/1999



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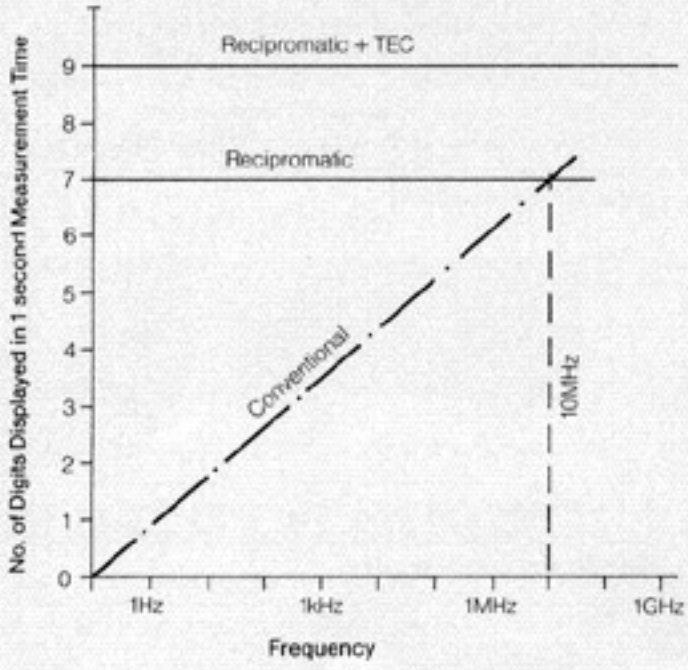


1·3/2·6 GHz Frequency Counters
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(MODEL 1998 IS ILLUSTRATED ABOVE)

Plus
- **GPIB Option offering programmability for systems applications**
- **Battery Option for field use**
- **Reference Multiplier Option for use with 1MHz and 5MHz external standards**
- **External Arming to synchronize measurement to a specific burst**
- **Choice of frequency standards to suit the application**



A comparison of different counting techniques shows the exceptional resolution achieved at all frequencies by the combined TEC and reciprocomatic techniques used in models 1998 and 1999.

High Resolution/Fast Measurement Time

The TEC technique enables measurements with very high resolution or with measurement times a hundred times better than with conventional reciprocomatic methods to be made. For example, 1Hz resolution in 1 second may be obtained at 1.3GHz, while at 10MHz a 1Hz resolution can be obtained with a gate time of only 10msec.

Input Control

Optimized controls produce an easy-to-use counter. On input A, both fixed attenuation and variable sensitivity give enhanced control when dealing with noisy signals. Trigger offset is also available to accept both sinewave and wide mark-to-space ratio pulses.

UHF Performance

The 1998 accepts up to 7V r.m.s. with fuse protection to 25W, thus minimizing risk of damage. The 1999 has a high performance 2.6GHz amplifier having a VSWR typically <1.5:1 for easier, unobtrusive connection into a system, and a wide amplifier operating range, fully protected to +33dBm.

Full GPIB Control (IEEE-STD-488 (1978))

The highly versatile GPIB option allows front panel function keys and the majority of signal conditioning controls to be fully programmable. (Ideal for both bench configurable or full ATE applications). The interface is extremely user-friendly and follows the guidelines and conventions recommended in IEEE-STD-728 (1982) and IEC 625-2.

Single Key Nulling

These counters incorporate a single key nulling capability which enable measurements to be made relative to any previously measured value or any value entered over GPIB. This feature is particularly valuable for accurate monitoring of frequency change, or for subtracting IF frequencies from measured signals.

Choice of Frequency Standards

A wide range of internal frequency standards is available to provide the counters with the ideal accuracy and stability for any application. Packaged crystal, temperature compensated crystal oscillators (TCXO) and a range of proportionally controlled ovened oscillators are available for bench, system, battery-portable or precision measurement applications. A standby mode ensures that power is supplied continuously to the frequency standard to maintain maximum stability, if required.

For maximum accuracy and to enable synchronization to a master standard, a 10MHz external standard input is included. To provide full application and system flexibility, an optional, internally-fitted frequency standard multiplier is available for use with external standards operating at either 1, 2, 5 and 10MHz.

Single Shot/Hold Capability

For sophisticated applications where only short bursts of signal are available, the counters have the capability to enable fast, accurate measurements to be made, displayed and held.

External Arming

External arming is included as a standard feature allowing individual tones in a serial tone sequence to be extracted for measurement and analysis.

DC Supply Operation

For field applications, an internal rechargeable battery option provides the counters with 'go-anywhere' capability. A battery economizer feature maximizes battery life by shutting down to the standby mode when an instrument is not in continuous use.

An external DC input of 11-16V is also included, allowing the counters to be powered from a vehicle or other external DC supply.

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	10V rms (DC coupled)
1 Megohm (X1 attenuation)	260V (DC + AC rms), from DC to 2kHz, decreasing to 10V rms at 50kHz and above.
1 Megohm (X20 attenuation)	260V (DC + AC rms) From DC to 40kHz, decreasing to over 10V rms at 1MHz 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 (1GHz)

Operating Range (sinewave) <10mV to 5V rms to 1GHz
<75mV 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 x 10^{-D} (F = Frequency rounded up to next decade, D = No. of digits).
Resolution* (Hz)	±n LSD† ±1.4 (Trigger Error* × Freq)/Gate Time
Accuracy* (Hz)	± Resolution ± (Timebase Error × Freq)

Period A (Period Average)

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

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)* × 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)* × 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	±1 × 10^{-6} 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).

† n = 1 for 3-5 and 10 digits or 2 for 6-9 digits.
*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	90–110V 103–127V 193–237V 207–253V (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 × 360 × 280mm (16.91 × 14.2 × 11.0 in)

Options

Options 04T

Temperature Compensated Crystal Oscillator

Frequency	10MHz
Aging Rate	3×10^{-7}/month 1×10^{-6} in the first year
Temperature Stability	$\pm 1 \times 10^{-5}$ 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.

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 +45°C (operable to +50°C)
Warm Up	$\pm 1 \times 10^{-7}$ within 20 minutes

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 ($\pm 1 \times 10^{-9}$)

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 × decade and downranges at 1.05 × 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

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

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

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Supplied Accessories

Power Cord
Spare Fuse
Operator's Manual
Spare 1.3GHz Fuse (Model 1998 Only)

Ordering Information

1998	1.3GHz Frequency Counter
1999	2.6GHz Frequency Counter

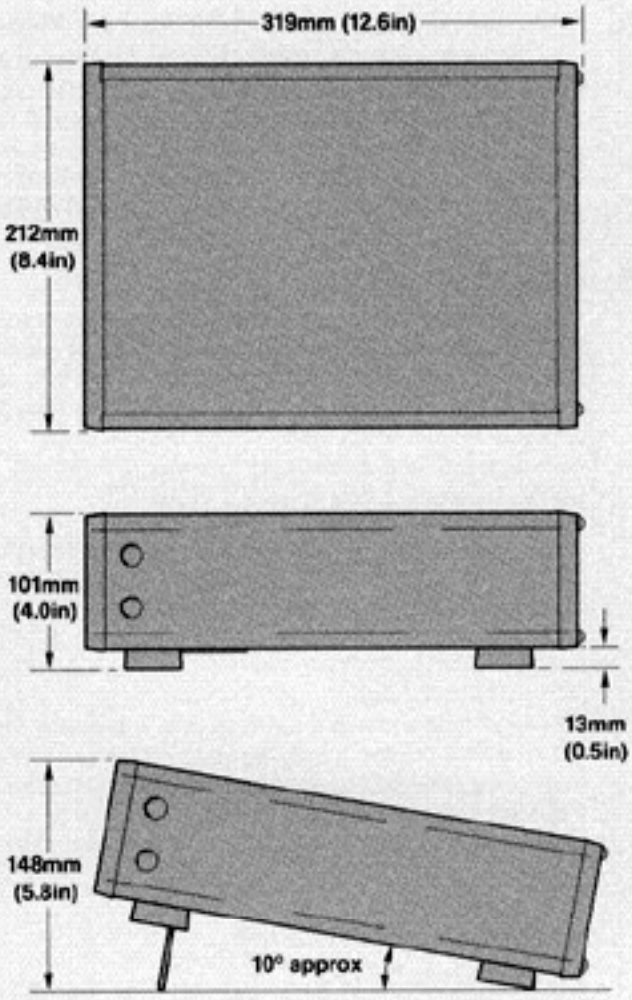
Options and Accessories

01*	Rear Panel Inputs (1998/1999)	11-1734/1735
04T**	TCXO	11-1713
04A**	Oven Oscillator	11-1710
04B**	High Stability Oven Oscillator	11-1711
07†	Battery Pack	11-1625
10	Reference Frequency Multiplier	11-1645
55†	GPIB Interface	11-1724
60	Handles	11-1730
60A	Rack Mounting Kit (Fixed Single)	11-1648
60B	Rack Mounting Kit (Fixed Double)	11-1649
61	Carrying Case	15-0773
61M	Protectormuff Case	15-0736
65	Chassis Slides (incl. Rack Mounts)	11-1716
	Telescopic Antenna	23-9020
	High Impedance 100 MHz Probe	23-9104
	1.3GHz Fuse (Pkt. 5) Model 1998 Only	11-1718

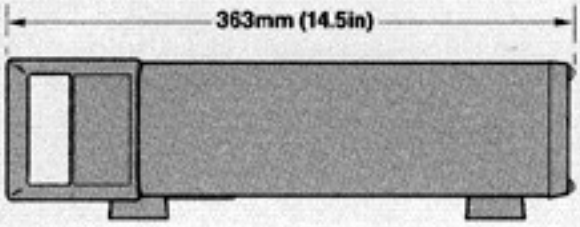
† The battery pack and GPIB options cannot both be fitted.

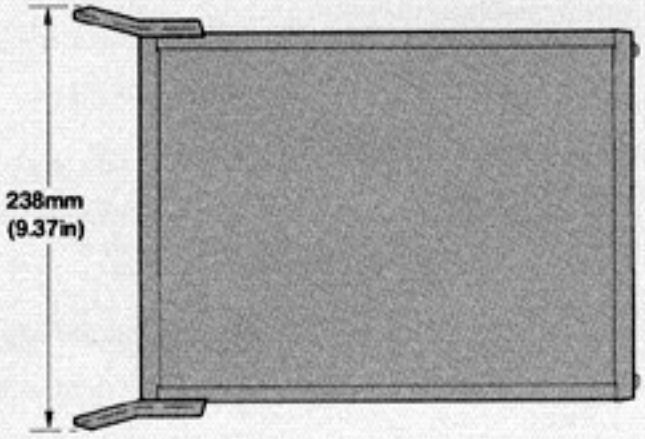
** Only one frequency standard may be fitted at any one time. The standard reference will be supplied unless option 04T, 04A or 04B is specified.

* Fitting Option 01 may affect certain specification parameters.



With Optional Handles Fitted





RACAL-DANA

Racal-Dana Instruments Inc. 4 Goodyear Street, P.O. Box C-19541, Irvine, CA 92713, USA. Telephone: (714) 859-8999. TWX: 910-595-1136. Telex: 678-341.
Racal-Dana Instruments Ltd. Hardley Industrial Estate, Hythe, Southampton, Hampshire SO4 6ZH, England. Telephone: (0703) 843265. TLX: 47600. Fax: (0703) 848919.
Racal-Dana Instruments S.A. 18 Avenue Dutartre, 78150 Le Chesnay, France. Telephone: (3) 955 88 88. TLX: 697215.
Racal-Dana Instruments GmbH. Hermannstrasse 29, D-6078 Neu Isenburg, Federal Republic of Germany. Telephone: 06102 2861/2. TLX: 412696.
Racal-Dana Instruments Italia SRL. Via Mecenate 84/A, 20138 Milano MI, Italy. Telephone: (02) 5062767/5062686/503444. Telex: 315697.

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Publication No. 909-4 F/NT286/GP Printed in England

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