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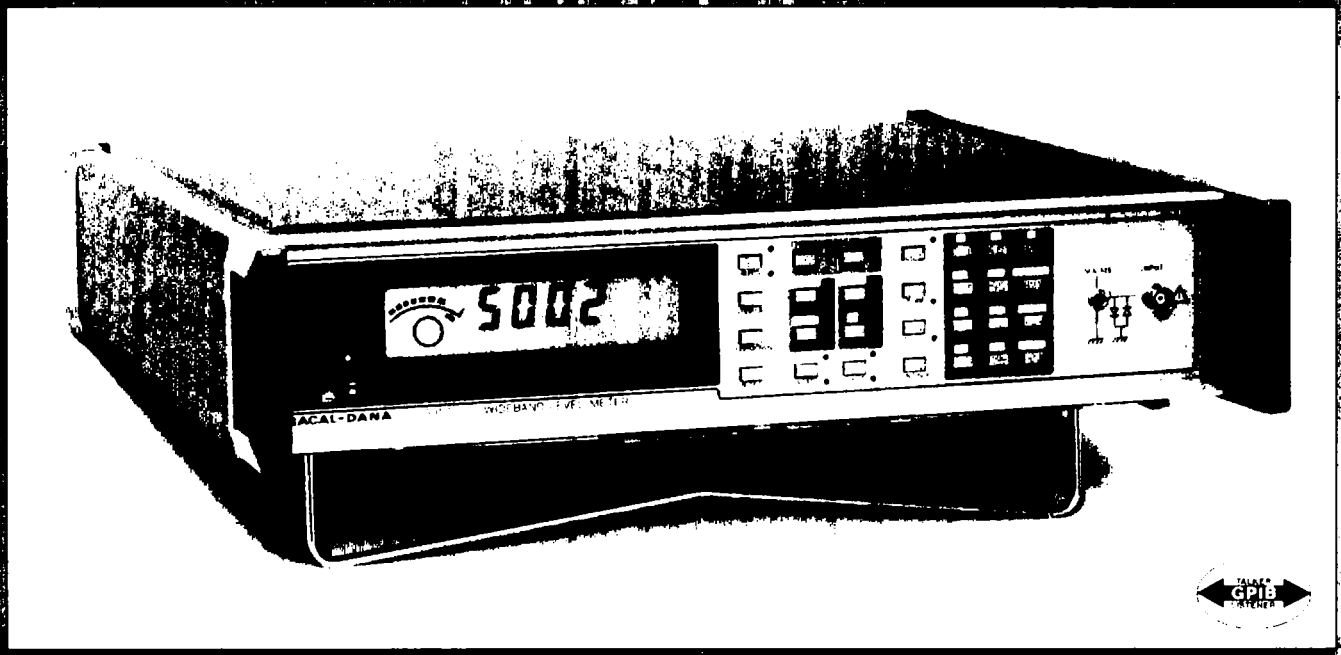
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# Wideband Level Meter
# Model 5002




## Features

- **DC to 20MHz**
- **140dB Dynamic Range**
- **True RMS, Average and Peak Detection**
- **Full GPIB Control**
- **Analog and Digital Display**
- **Direct Readout of Volts, Watts, dB and Percentage**
- **Non-Volatile Memory**

## Summary

The Model 5002 Level Meter provides wideband AC performance, power measurement and digital voltmeter capabilities. It is able to measure true rms, average, peak, peak-to-peak and DC providing full characterisation of all AC waveshapes.

The high sensitivity and frequency range, specified from DC to 20MHz and extending to 40MHz, makes the 5002 ideal for wideband gain and frequency response measurements, insertion loss measurements, switched mode power supply testing, receiver testing, audio analysis and pulse power measurement.

## General Description

### Introduction

The unique measurement capability of the 5002 makes it ideally suited to a wide range of applications not covered by conventional measuring instruments. Its ability to measure true rms, mean and peak; its wide dynamic range; its full GPIB capability; its ability to display readings directly in a choice of units and its non-volatile memory for storing complete front panel settings make the Model 5002 probably the most versatile measurement device available for bench and systems applications. All readings are displayed on a large four-digit liquid crystal display which incorporates units annunciators and a pseudo-analog meter for peaking and nulling applications.

## Applications

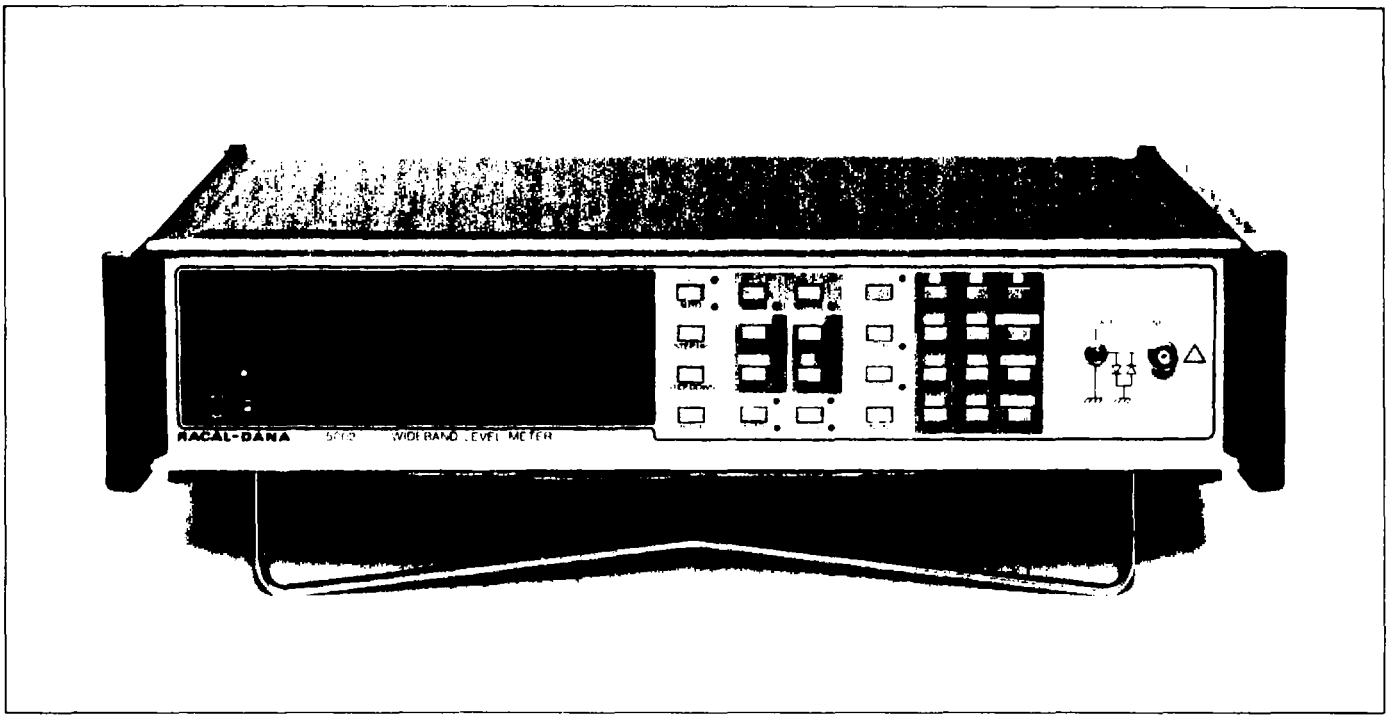
For gain and frequency response measurements, the ability of the 5002 to display readings directly in dB or percentage is invaluable. It is equipped with an autoranging capability to cater for large changes in input level which is particularly useful when the instrument is used in dB mode.

Switched mode power supplies (SMPS) are notorious for the large, short duration spikes, present on the output DC, caused by the switching action. The measurement of such spikes is of major importance to the SMPS manufacturer and user. The 5002 is unique in being able to measure these spikes in addition to the rms or mean ripple, and the DC output itself. Thus one instrument is able to measure three different but related parameters.

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# Wideband Level Meter
## Model 5002




Model 5002 is particularly well suited to receiver testing. It is able to provide high accuracy measurements of audio levels and display them as voltage, power or dBm in any external load resistance.

The 5002 is excellent for receiver SINAD sensitivity measurements on communications receivers. The AF reference level is stored in the 5002 and relative noise levels displayed directly in dB. The unique continuous averaging feature provides a steady reading of noise while enabling rapid adjustment to the −12dB level called for in SINAD measurements.

The exceptional bandwidth of Model 5002 allows it to be used for gain and frequency response measurements on frequencies as high as 40MHz.

The 5002 is also suitable for the direct measurement and display of peak envelope power (PEP) on SSB transmissions. Unlike conventional methods of measuring PEP which require a continuous tone, the peak detecting and peak hold capabilities of the 5002 allow it to be used with speech as the test signal. The instrument itself then carries out the necessary computation to give a direct reading of PEP.

The combination of peak, mean, and rms detectors makes the versatility of the 5002 second to none. Applications extend into the realms of sonar, electromedical, audio, video, telemetry, telephony and magnetic component testing.

The addition of suitable transducers expands the capability of Model 5002 into mechanical fields such as the measurement of vibration, bearing/shaft movement and critical damping of servo systems.

The full GPIB capability of the 5002 allows any measurement sequence to be automated making it an ideal systems instrument.

### 'Smart' Features

The 5002 incorporates many 'Smart' features as a result of using a microprocessor in the design. It will carry out internal mathematical functions to provide direct readings of dB, ratio and percentage for the convenience of the operator. It will also introduce offsets where required.

Furthermore, Model 5002 has the ability to compute power in any impedance from 0.0001 to 9999 ohms and display the result directly in watts or dBm.

It is a simple matter to introduce calibration factors to eliminate errors introduced by the test procedure and not due to the unit under test, giving absolute confidence in the results obtained.

In addition the microprocessor-based design allows Model 5002 to measure crest and form factor.

The 5002 'smart' features are designed to save time – no calculations, no conversions – by providing direct accurate readings.

### Measurement Modes

Model 5002 has four measurement modes: true rms, mean, peak and peak-to-peak all of which may be AC or DC coupled. The ability to DC couple in the rms mode ensures true readings on asymmetric signals or those with significant DC components. In the mean mode the rectified mean is measured when the signal is AC coupled while when DC coupling is selected, the AC is removed and only the DC component is measured. AC coupling in the peak mode gives positive or negative peak values as required relative to the mean or DC value. In the DC coupled mode, 5002 measures the peaks relative to zero volts. Peak-to-peak is the algebraic difference of the positive and negative peaks.

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# Wideband Level Meter
# Model 5002

## Ranging

There are 14 ranges for rms measurements (12 on peak and mean) in the 5002 together with the ability to select manual or automatic ranging. The autorange capability is particularly useful in gain and frequency response measurements especially when using the instrument to display levels directly in dB.

The measurement range of 5002 extends from 30μV to 316V – a full 140dB dynamic range with full overload protection on all ranges.

## Averaging for RMS and Mean Detectors

When measuring noisy signals, the ability to average the signal digitally, so minimising the effects of short term variations on the displayed reading, is a very useful feature. The averaging period is variable from 0.1 to 100 seconds after which time the average is computed and displayed. A 'continuous' average mode is also available which permits continuous monitoring of signal trends whilst still maintaining the benefit of averaging over long time intervals.

## Internal Noise Cancelling

The exceptionally low input noise levels achieved on the 5002 are obtained by a unique hardware noise cancelling circuit. This technique allows signals as low as 30μV to be measured accurately in the rms mode and signals as low as 10μV to be monitored.

## Non-Volatile Memory

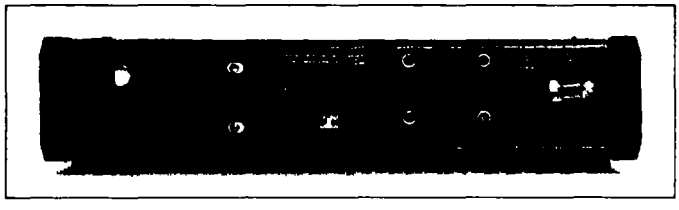
The non-volatile memory allows up to 12 complete front panel settings to be stored for recall at any time. In the production environment where measurements are repeated regularly it is a great advantage to be able to recall a particular test set-up quickly and easily. Such a feature makes it possible for all users to benefit from the tremendous versatility and power offered by the Model 5002.

## Full GPIB Control

The Model 5002 is equipped with full GPIB control allowing it to be used as part of an automated test system – a feature which is growing in importance especially in production environments.

For use in particularly high noise environments the 5002 may be equipped with an opto-isolated GPIB option.

The overall capability of 5002 makes it a superb instrument for use in design, production and service environments both on the bench and as an integral part of an automated system.



## Technical Specification

| | |
|---|---|
| **Frequency Range** | DC and 5Hz to 20MHz (3dB frequency typically 40MHz). |
| **Voltage Range** | 30μV to 316V (10μV detectable) RMS 316μV to 316V Peak and Mean. |

### Ranges

| | |
|---|---|
| **RMS** | 100.0μV, 316.2μV, 1.000mV, 3.162mV, 10.00mV, 31.62mV, 100.0mV, 316.2mV, 1.000V, 3.162V, 10.00V, 31.62V, 100.0V, 316.2V. |
| **Peak and Mean** | 1.000mV, 3.162mV, 10.00mV, 31.62mV, 100.0mV, 316.2mV, 1.000V, 3.162V, 10.00V, 31.62V, 100.0V, 316.2V. |
| **Ranging** | Autorange or manual selectable. Autorange at 31.5% and 115% of range. |
| **Power Range** | 18pW to 2kW in a 50Ω system. Computed as $\frac{V^2}{R}$ where R is the external load resistance. (0.0001 ohms <R <9999 ohms). |
| **Input Impedance** | 1 Megohm/50pF. |
| **Maximum Input** | 350Vrms up to 140kHz. Thereafter not to exceed $5.0 \times 10^7$V.Hz. |
| **Crest Factor** | 4:1 at full scale (300μV to 100V) increasing to 12:1 at one third of full scale. |
| **Display Resolution** | 0.1% range. |
| **Decibel Resolution** | 0.01 dB. |

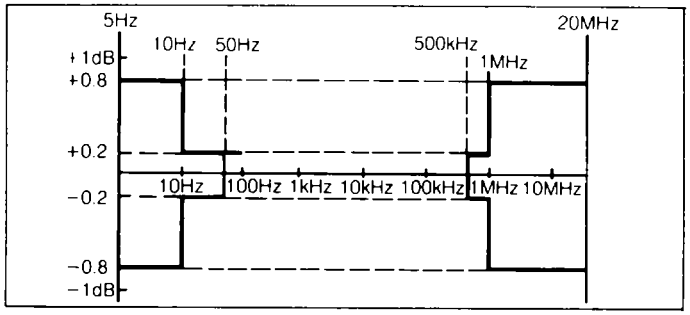
### Measurement Modes

| | |
|---|---|
| **RMS** | Measures the true rms value of the input signal. AC and DC coupling ensures valid measurements on waveforms with DC components. |
| **Mean** | On AC, the rectified mean of the signal is measured. On (AC + DC) the AC component is removed and the DC component is measured. |
| **Peak** | On AC, the positive or negative peak of the signal relative to its mean or DC value is measured. On (AC + DC) it measures the positive or negative peak relative to 0 volts. |
| **Peak-to-Peak** | Displays the algebraic difference of the positive and negative peaks. |
| **Voltage Accuracy** | (23°C ± 5°C, 30% to 100% Range). |
| **AC** | |
| RMS | ±(0.5% Rdg.+0.5% Range +4μV) |
| Mean | ±(1.5% Rdg.+0.5% Range +30μV) |
| Peak | ±(1.5% Rdg.+0.5% Range +100μV) |
| **AC + DC** | |
| RMS | ±(0.7% Rdg.+0.5% Range +30μV) |
| Mean | ±(0.5% Rdg.+0.5% Range +60μV) |
| Peak | ±(1.5% Rdg.+0.5% Range +130μV) |
| **DC** | ±(0.5% Rdg.+0.5% Range +60μV) |

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# Wideband Level Meter
## Model 5002

**Frequency Response*** (31.6μV RMS <Input> 1mV Mean & Peak)




*5Hz to 10MHz on Peak and Mean

**Temperature Coefficient** (0–18°C, 28–55°C)

| Mode | |
|---|---|
| AC | 0.04% Reading/°C |
| (AC + DC) | (0.1% Reading +10μV)/°C |
| DC | (0.1% Reading +10μV)/°C |

**Power Accuracy** Corresponding percentage voltage accuracy multiplied by 2, plus any errors in external load resistance.

### Response Times

**RMS and Mean** 1 second plus autorange time. A high speed version is also available – see option CSO93.

**Peak** 1μS per 20% of range plus autorange time.

**Measurement Time** Variable 0.1 to 99.9 seconds.

**Autorange Time** 200mS/step.

### Microprocessor-Enhanced Computing Functions

| | Display | |
|---|---|---|
| **Mode** | **Volts** | **Watts*** |
| dB | $20 \log_{10} \frac{V_{in}}{\text{dB Store}}$ | $10 \log_{10} \frac{V_{in}^2/R}{\text{dB Store}}$ |
| Ratio | $\frac{V_{in}}{\text{Ratio Store}}$ | $\frac{V_{in}^2/R}{\text{Ratio Store}}$ |
| Percentage | $\frac{V_{in} - \%\ \text{Store}}{\%\ \text{Store}} \times 100$ | $\frac{V_{in}^2/R - \%\ \text{Store}}{\%\ \text{Store}} \times 100$ |
| Null | $V_{in}$ – Null Store | $V_{in}^2/R$ – Null Store |
| Cal Factor | $\frac{V_{in}}{\text{Cal Factor Store}}$ | $\frac{V_{in}^2/R}{\text{Cal Factor Store}}$ |

*In the watts mode of operation the stored references are either entered or calculated as power.

### GPIB Interface

**Programming Control:** All front panel functions are duplicated by the GPIB except POWER ON/OFF, METER and ISOLATE switches.

**Non-Volatile Memory** 12 front panel settings, including all calibration and reference constants, can be stored or recalled by a single GPIB command.

**Automatic Timeout** Software delays ensure that first readings are correct after range or function changes.

**Read Rate** The maximum read rate over the GPIB is 10 readings per second.

**Subset Capability** SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0 and E1.

### General

**Display** 4 digit, 16mm liquid crystal display with units annunciation and 1% resolution analog indication.

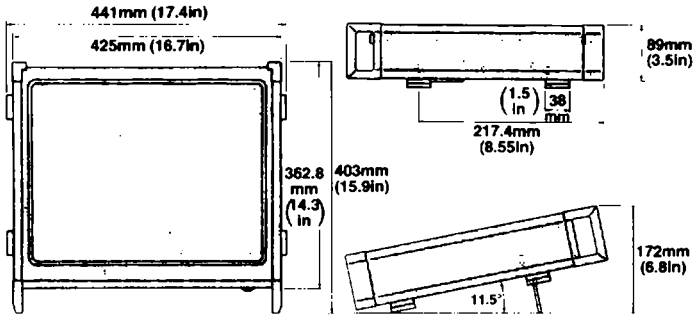
**Signal Smoothing** Digital averaging from 0.1 to 99.9 seconds.

**Power Requirements** 100, 120, 220, 240 VAC + 5%, −10% 45–440Hz

**Consumption** Approximately 40VA

**Environmental** Operating temperature 0°C to +55°C
Storage temperature −40°C to +70°C

**Weight** Nett 6.75kg (14.91lb)
Shipping 11.0kg (24.2lb)




### Supplied Accessories

Power Lead, Spare fuse, Operator's handbook.

### Ordering Information

| | |
|---|---|
| **5002** | Wideband Level Meter (inc. GPIB) |

### Options and Accessories (Please order separately)

| | |
|---|---|
| **01** | Rear Input |
| **60** | Rack Mounting Kit (11–1496) |
| **65** | Chassis Slides (including Rack Mounts) (11–1587) |
| **550** | Opto-isolated GPIB |
| **CS093** | 100mS Response Time. Frequency Range of instrument 50Hz to 20MHz. |

**RACAL-DANA**


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