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**Marketing**

The Racal Instruments marketing organisation is based at Windsor and includes a highly trained technical sales force covering the whole of Great Britain, a special applications division and a well equipped service department. Overseas sales are conducted through the Company's appointed representatives abroad who have been selected for their proven ability to provide a swift and comprehensive technical service and who are supported by a specialist team of export sales engineers operating from the U.K.

**Continuing Development**

At the present time the Racal Instruments range includes some of the most sophisticated and technically advanced equipment available from any manufacturer in the world. And the range is expanding – not simply to take advantage of the latest technology but to ensure that advanced instrumentation is available *today* to engineers developing equipment for *tomorrow*.

## The heart of all quality instruments

Instruments for the measurement or generation of frequency depend for their accuracy upon a precision frequency standard – usually a crystal oscillator. Racal Instruments have developed a range of crystal controlled frequency standards for their own equipment which are also marketed as high precision components in their own right finding application wherever a reliable source of frequency or time is essential. Designed and manufactured in house under rigidly controlled conditions these oscillators are built to stringent military specifications and use only the highest quality glass or coldweld sealed crystals from carefully evaluated suppliers. They feature low power consumption, good temperature stabilization and excellent ageing performance and are ideal in communications equipment and precision instruments. Small size, robust construction and fast warm-up characteristics make them particularly suitable for transportable equipment where high accuracy is required as soon as possible after switch on.

If even higher accuracy is needed, Racal Instruments can provide miniature atomic standards – the ultimate in low cost, precision frequency references.

### 9420

#### Crystal Oscillator

5MHz output

Ageing rate  $\pm 5 \times 10^{-10}$  per day

Warm-up time 20 minutes

12V operation

A very high stability oscillator using a third overtone crystal mounted in an oven with proportional temperature control. A voltage regulator ensures high immunity to supply variations and a buffer amplifier minimises the effects of load changes. A multi-turn control allows precise mechanical setting of frequency. Frequency can also be adjusted remotely using an external potentiometer.



### 9421

#### Crystal Oscillator

5MHz output

Ageing rate  $\pm 5 \times 10^{-10}$  per day

Warm-up time 20 minutes

5V operation

A very high stability oscillator for use with 5V supplies where the utmost precision is essential. The third overtone crystal operates at a low and stabilized excitation level and is mounted in an oven with proportional temperature control. A voltage regulator and buffer amplifier provide immunity from supply and load variations whilst multi-turn coarse and fine controls permit precise mechanical setting of frequency. An external potentiometer can be used to achieve remote frequency adjustment.







## 9442 Crystal Oscillator

5MHz output  
Ageing rate  $\pm 3 \times 10^{-9}$  per day  
Warm-up time 6 minutes  
5V and 12V versions

A small, fast warm-up oscillator that combines high accuracy and stability with low power consumption. The 9442/5 is for 5V operation and the 9442/12 uses a 12V supply. In both models the crystal is mounted in an oven with proportional temperature control and a buffer amplifier isolates the oscillator from load changes. Mechanical frequency adjustment is provided by a multi-turn control.



## 9443 Crystal Oscillator

5MHz output  
Ageing rate  $\pm 3 \times 10^{-9}$  per day  
Warm-up time 6 minutes  
5V operation  
NATO No. 6625-99-638-8873

Electrically similar to model 9442, this oscillator is only 32mm high. It is recommended for use where space is limited such as in portable equipment. The fundamental crystal is mounted in an oven with proportional temperature control and a buffer amplifier isolates the oscillator from load changes. A multi-turn control provides accurate frequency adjustment.



## 9475 Rubidium Frequency Standard

1MHz output  
Stability better than  $\pm 3 \times 10^{-12}$  per day  
High spectral purity  
Fast warm-up -  $1 \times 10^{-10}$  within 1 hour  
NATO No. 6625-99-637-0540

An ultra-stable atomic oscillator of small size and rugged construction and suitable for field or laboratory installations. It bridges the gap between crystal oscillators and the more expensive and larger high performance atomic frequency standards. Three 1MHz outputs at a level of 1V r.m.s. are provided. These are all isolated and short circuit protected and well suited to division or multiplication into microwave bands by virtue of the excellent spectral purity and high signal-to-noise ratio. The 9475 is currently supplied to the British Army. Applications include primary laboratory standards, TV frequency control, communications and navigation systems, radio astronomy, doppler radar, precise time interval generators and standard time installations.

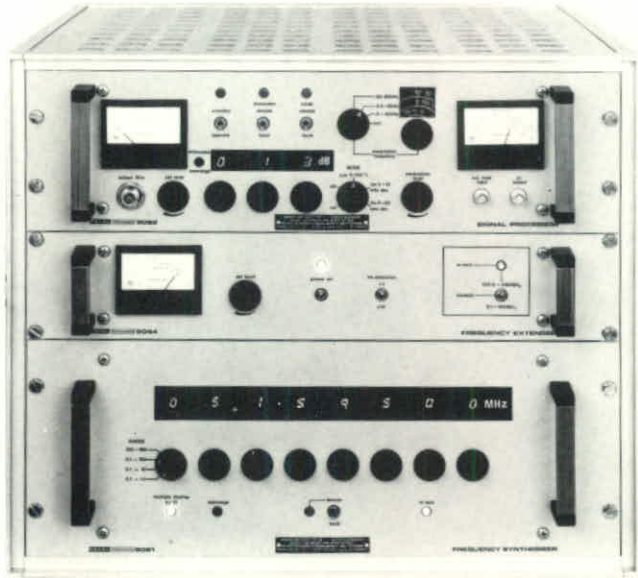
# Signal Generators

## 9060

### Signal Generation System

100kHz to 550MHz  
Stability  $\pm 5$  parts in  $10^{10}$ /day  
Fully programmable  
Signal-to-noise 145dB/Hz  
NATO Nos. 6625-99-620-7817/7818/9244

The 9061/62 is a 160MHz synthesized signal generation system for manual or ATE applications and is built to full military specifications. It combines the resolution, accuracy and stability of a synthesized source with the purity and low noise level of a conventional high quality signal generator and includes full a.m. and f.m. facilities. Frequency Extender 9064 increases the range to 550MHz allowing full remote control of all functions up to this frequency.

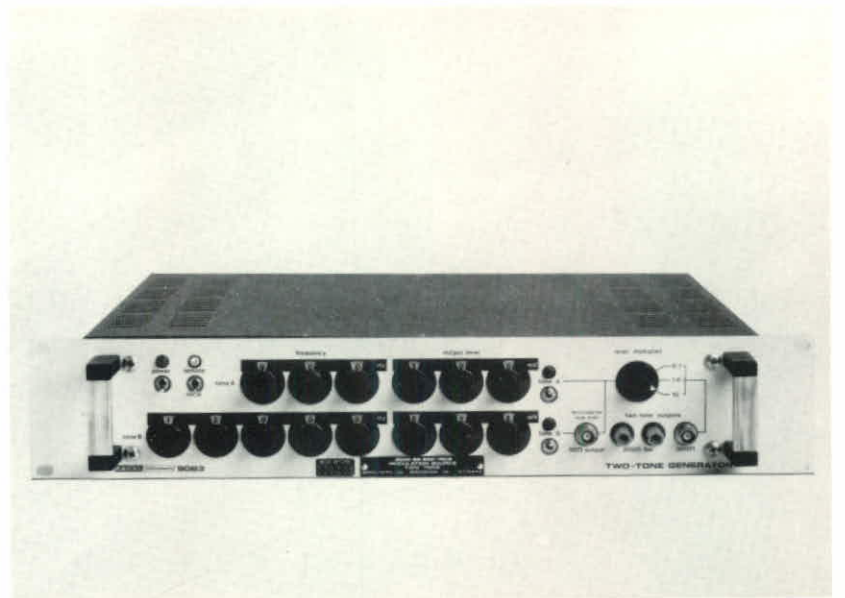


## 9063

### Synthesized Two Tone Generator

10Hz to 100kHz  
100 $\mu$ V to 10V output  
Distortion less than -70dB  
Fully programmable  
NATO No. 6625-99-620-7808

Designed to complement the 9061/62 Signal Generator, the 9063 is a self-contained, precision modulation source with inherently low distortion products. It can be used on its own as a free-standing, high quality audio source or combined with the 9061/62 to extend the range of the basic system down to 10Hz and to provide comprehensive two-tone facilities.



## 9065

### Attenuators

Attenuation in 1dB steps to 129dB  
Fully programmable  
RF performance flat up to 1.2GHz  
1W continuous dissipation  
NATO No. 5905-99-624-2067

The 9065L has a frequency range from d.c. to 600MHz while the higher frequency 9065H can be used to over 1GHz. Both attenuators are fully compatible with the 9060 Series Signal Generation System but can also be used independently as free-standing, self-contained units. Either manual or remote control is possible.

Effective use of thick film technology has made possible a design which is mechanically and electrically robust enough to comply with military environmental specifications and which enables a 1 watt continuous power rating to be achieved.





## 9081

### Synthesized Signal Generator

5 to 520MHz

*Synthesized performance with analogue tuning  
Channelised or continuous operation*

*Stability  $\pm 3$  parts in  $10^9$  per day (or external standard)*

The 9081 is the most significant development in signal generators since the advent of synthesis techniques and represents a major breakthrough in both technology and price. Although fully synthesized it is tuned by a single spin wheel and the frequency is monitored by a built-in 8 digit counter. The 9081 provides full a.m., f.m. and phase modulation facilities, exceptional output level accuracy and exhibits very low carrier leakage. Unique features include channelised tuning for the radio communications industry and – something totally new in a synthesizer – a continuous tuning capability for general purpose use.

## 9083

### Two-Tone Signal Generator

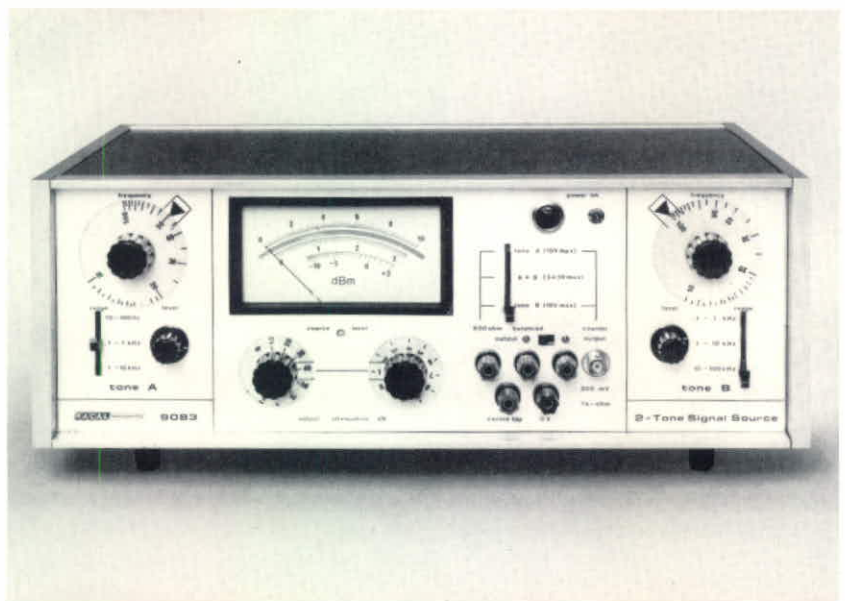
10Hz to 100kHz

*Two alternative or mixed tones*

*Output e.m.f. up to 10V r.m.s.*

*Single or balanced 600 $\Omega$  output*

An accurate, low cost and versatile general purpose and two-tone generator. Applications include two-tone distortion checks on s.s.b. transmitters, audio and r.f. intermodulation tests, telephone line level measurements and tests on equipment requiring a sub-audio or selective calling squelch tone e.g. Clansman radio sets. The 9083 contains two independently tuned oscillators and features very low distortion of approximately 0.05%.



# Communications Test Equipment

## 9008

### Automatic Modulation Meter

1.5MHz to 2GHz

Completely automatic

Fully programmable

Accuracy 2% f.s.d. 1% rdg.

Mains or battery operation

NATO No. 6625-99-642-3437

9008 measures peak, trough and mean modulation depth of a.m. signals or positive, negative and mean deviation of f.m. and phase modulated signals.

Tuning and level adjustment is automatic and the instrument has built-in provision for remote control of all main functions. Up to eight ranges are available arranged so that readings can always be displayed on the upper half of the scale where accuracy is highest. Deviation ranges are from 1.5kHz to 100kHz f.s.d. and a.m. ranges from 5% to 100% f.s.d. Mains or battery operation is possible.

The 9008M, with special facilities for checking Clansman radio equipment, is now in service with the British Army.



## 9009

### Automatic Modulation Meter

10MHz to 1.5GHz

Completely automatic

Accuracy 2% f.s.d. 1% rdg.

Mains or battery operation

NATO No. 6625-99-634-3388

An inexpensive portable a.m./f.m. modulation meter operating up to 1.5GHz. Tuning and level adjustment is completely automatic and measurements are displayed on a large scale meter. There are 8 deviation ranges from 1.5kHz to 100kHz f.s.d. and 6 a.m. ranges from 5% to 100% f.s.d. The instrument can be operated from normal a.c. mains supplies or from an internal battery pack.



## 9054/9055

### HF, VHF and UHF Calibrators

Frequency range 100kHz to over 500MHz

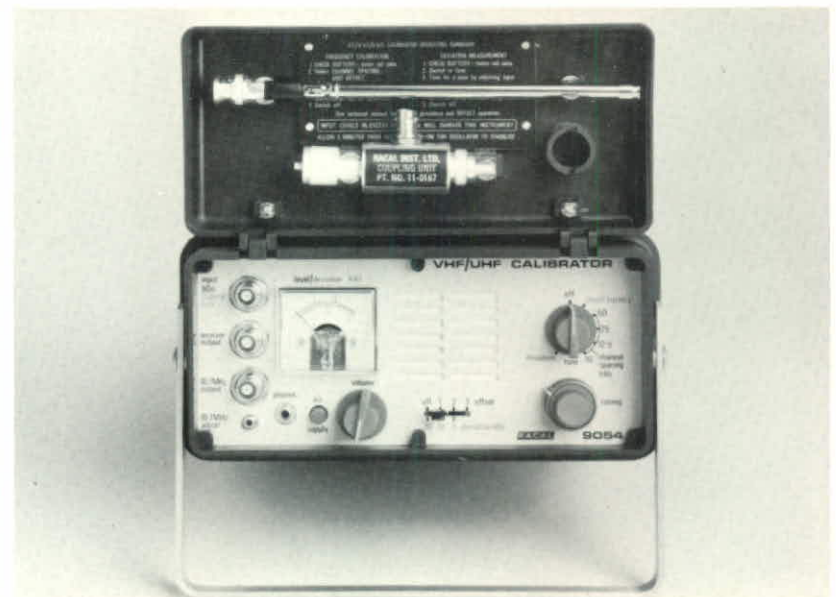
Calibrates mobile radios in situ

Accuracy  $\pm 1$  part in  $10^7$

Mains or battery versions

Enables single and multi-channel radio telephone transmitters and receivers to be checked and set quickly on frequency without the need for a frequency meter, synthesized signal source or deviation meter. All types of installation can be checked including fixed and mobile stations, marine radio and amateur equipments.

The accuracy of the calibrators is determined by the internal ovened crystal frequency standard which has a stability of better than 1 part in  $10^8$  per day and a warm-up time of only 3 minutes for an accuracy of 1 part in  $10^7$ .



## 9058

### HF Selective Analyser

*1.2 to 100MHz*

*Measures s.s.b. intermodulation products and carrier suppression*

*Measures a.m. carrier and sideband amplitudes*

*70dB dynamic range*

*Built-in 2 tone audio generator*

The 9058 performs all the functions of narrow-band spectrum analysis usually associated only with complex and expensive instruments. Particularly suitable for analysing s.s.b. transmissions it can also be used for measuring a.m. carrier and sideband amplitudes, for determining modulation depth and distortion and f.m./p.m. deviation by the Bessel function method. The 9058 can also be used as a selective voltmeter with a sensitivity down to  $30\mu\text{V}$ . Other uses include 'close-in' noise measurements and insertion gain or loss measurements on four terminal networks.



# Voltage and Power Meters

## 9077A

### Digital Multimeter

Measures voltage, current (a.c. & d.c.) and resistance  
Maximum reading  $\pm 4999$   
Mains or battery operation

The 9077A measures a.c. and d.c. voltage on five ranges with f.s.ds from 500mV to 5kV. Maximum resolution is 100 $\mu$ V. Current (a.c. and d.c.) is measured on five ranges with f.s.ds from 500 $\mu$ A to 5A and a maximum resolution of 100nA. Six resistance ranges are provided with f.s.ds from 500 $\Omega$  to 50M $\Omega$  enabling a resolution down to 0.1 $\Omega$  to be achieved. Unlike other 3 $\frac{1}{2}$  digit instruments the 9077A can display up to  $\pm 4999$  counts with full accuracy. Since many measurements require a first digit between 2 and 5 this makes the 9077A particularly suitable for use with 5V and 20V logic, 20V and 30V telephone applications, 24V industrial supplies, 28V aerospace and analogue supplies and 36V military or 230V/440V/480V industrial voltages.



## 9079

### Digital Multimeter

Measures voltage, current and resistance  
Maximum reading  $\pm 12000$   
Mains or battery operation

A high performance a.c. and d.c. measuring instrument suitable for the most diverse applications and environments, the 9079 is a 4 $\frac{1}{2}$  digit multimeter featuring excellent resolution and accuracy. The display consists of a full four digits and a  $\pm 1$  which gives a 20% over-range capability and allows accurate readings up to  $\pm 12000$ . There are five ranges for voltage and current and six for resistance. These provide a voltage resolution down to 10 $\mu$ V, a current resolution down to 10nA and enable resistance to be measured with a resolution down to 10m $\Omega$ . Ranges extend to 1kV, 1A and 10M $\Omega$  respectively.

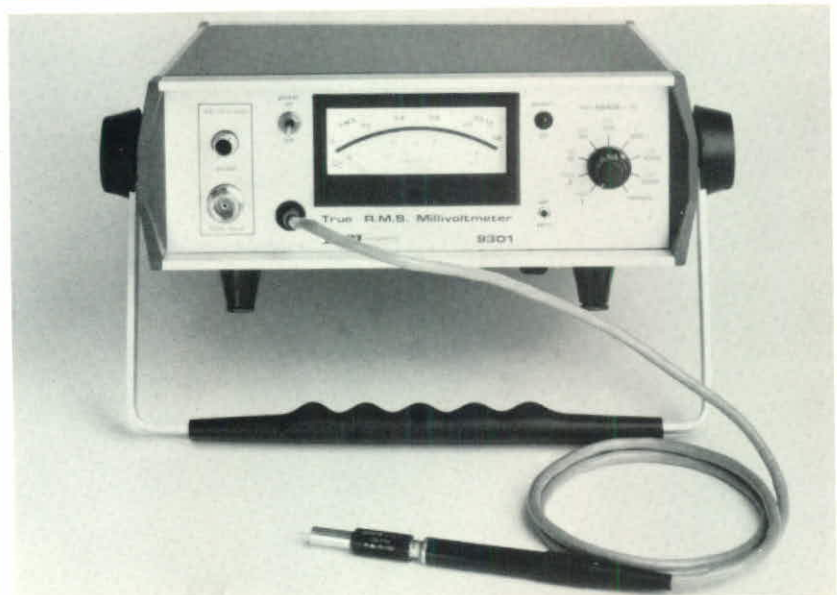


## 9301

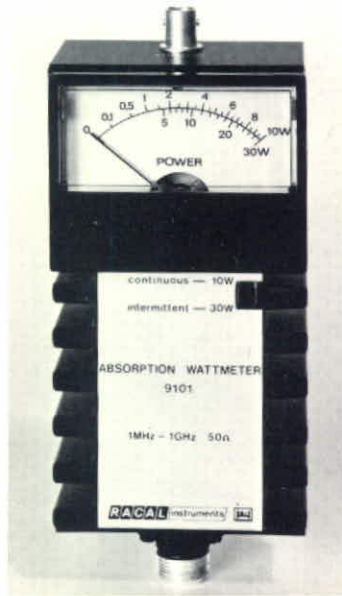
### RF Millivoltmeter (True r.m.s.)

10kHz to 1.5GHz  
True r.m.s. measurements from 100 $\mu$ V to 300V  
Extremely accurate  
Residual noise less than 20 $\mu$ V  
Remotely programmable  
Memory facility

A wideband millivoltmeter that meets the need for accurate, true r.m.s. measurements of r.f. sinusoidal, pulse and noise waveforms up to a frequency of 1.5GHz. It gives a direct indication of true r.m.s. values over the complete frequency range and achieves an exceptionally high accuracy which is independent of input waveshape, temperature, meter range and supply voltage. A unique noise-cancelling circuit reduces residual noise below 20 $\mu$ V allowing the measurement of inputs less than 100 $\mu$ V. A high impedance probe with the same wide temperature operating range as the main instrument is used for all measurements. A 'press-to-hold' button enables readings to be stored for up to three minutes.







## 9101 Absorption Wattmeter

*1MHz to 1GHz  
Power ranges 10W and 30W  
Attenuated output for other equipment  
High accuracy*

9101 is a compact and robust wattmeter giving accurate readings down to 100mW. It can also be used as an accurate 50Ω load down to d.c. A particularly useful feature is the attenuated output which provides a signal approximately 33dB down on the input level for application to frequency meters, modulation meters, spectrum analysers etc. The power and frequency range of the 9101 make it ideal for testing h.f. manpacks and v.h.f./u.h.f. mobile and base stations while its small size and independence from power supplies make it ideal for field work. A 3dB high power attenuator is available to increase the range to 60 watts up to 1GHz.



## 9104 Absorption Wattmeter

*1MHz to 1GHz  
300W continuous rating  
Fast response*

9104 measures total power, carrier power and peak envelope power on seven ranges with f.s.d.s from 300mW to 300W. It can be used for a.m., f.m., c.w. and s.s.b. signals and a fast response makes it particularly suitable for peaking or tuning transmitters. An attenuated output gives a signal approximately 46dB down on the input and is suitable for connection to other test equipment. All ranges are protected against overload by a warning lamp and a pair of contacts which can be arranged to switch off the transmitter under test. A push-button enables the contacts to be reset once the overload has been removed.

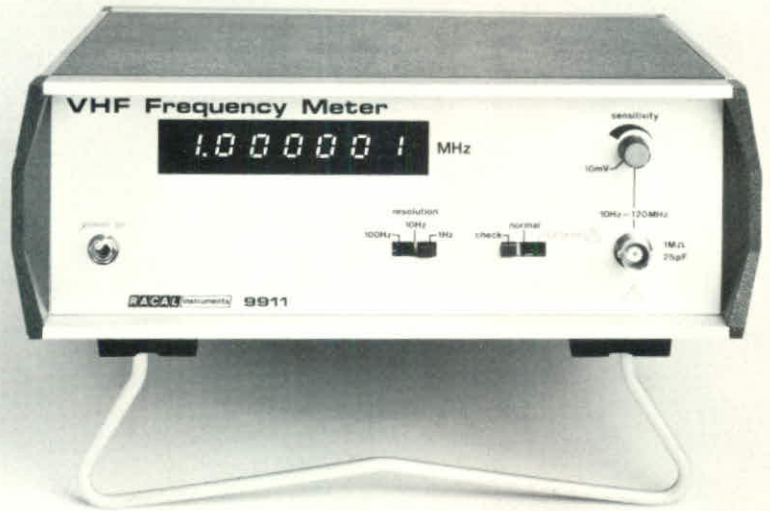
# Frequency Meters

## 9911

### VHF Frequency Meter

10Hz to 120MHz  
Sensitivity 10mV  
7 digit led display  
2 year guarantee

An easy to use, low cost v.h.f. frequency meter capable of resolving to 1Hz. Data outputs in serial bcd form are standard. Normally supplied with a frequency standard which has an ageing rate of  $\pm 1$  part in  $10^6$  per month, alternative standards with daily ageing rates as low as  $\pm 5$  parts in  $10^{10}$  can be fitted if required. Other options include a serial to parallel interface, an l.f. multiplier to increase resolution at low frequencies, a carrying case and a 19 inch rack mounting kit.

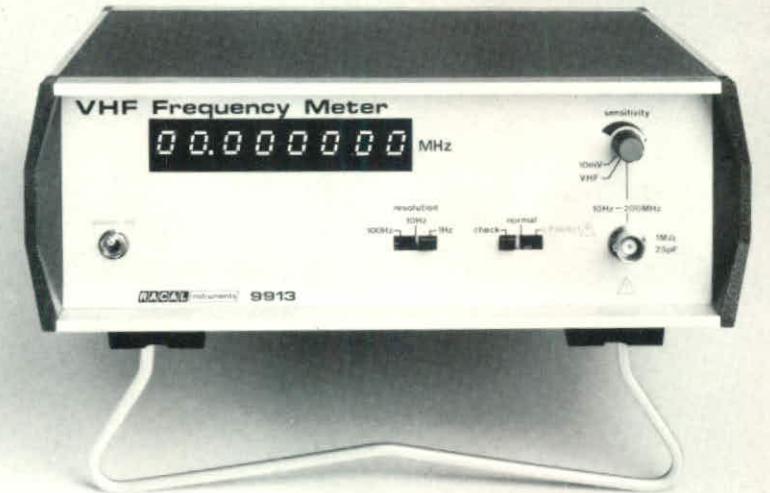


## 9913

### VHF Frequency Meter

10Hz to 200MHz  
Sensitivity 10mV  
8 digit led display  
2 year guarantee

This is an eight digit frequency meter with a frequency range extending to 200MHz to allow the accurate calibration of radio equipment in the low, mid and high band v.h.f. regions. Data outputs in serial bcd form are standard. Accuracy is determined by a crystal controlled frequency standard with an ageing rate of  $\pm 1$  part in  $10^6$  per month. Higher accuracy can be obtained using optional frequency standards with ageing rates as low as  $\pm 5$  parts in  $10^{10}$  per day. Also optional are an l.f. multiplier, serial to parallel data interface, carrying case and rack mounting kit.



## 9915

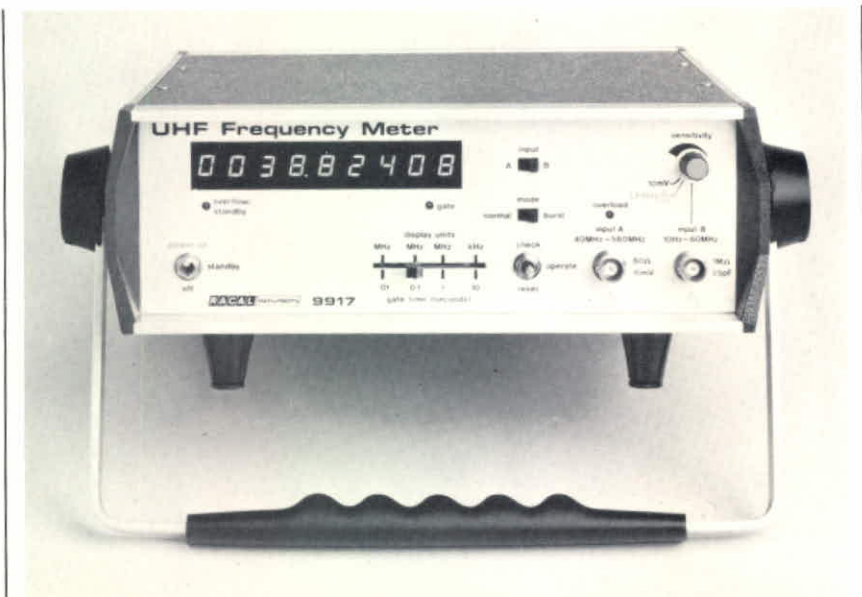
### UHF Frequency Meter

10Hz to 520MHz  
Sensitivity 10mV  
Frequency burst facility  
Mains or battery operation  
Input overload protection up to 25W  
NATO No. 6625-99-533-0938.

9915 is an eight digit instrument for mains or battery operation. It measures to 520MHz on two input channels. The u.h.f. channel includes a.g.c. to simplify high frequency measurements and is protected against r.f. overloads by a fast-acting p.i.n. diode attenuator and reed relay. Standard features are a frequency burst facility, serial bcd data outputs and an economiser that automatically conserves battery power when the 9915 is not actually making measurements. An l.f. multiplier, higher precision frequency standard with an ageing rate of  $\pm 5$  parts in  $10^{10}$  per day, serial to parallel bcd output interface and carrying case are among the options available. 9915 has been adopted by the British Ministry of Defence (Naval)







**9917**  
UHF Frequency Meter

10Hz to 560MHz, directly gated  
Sensitivity 10mV  
9 digit led display  
LF multiplier fitted as standard  
Input overload protection up to 25W  
2 year guarantee  
NATO No. 6625-25-121-6819

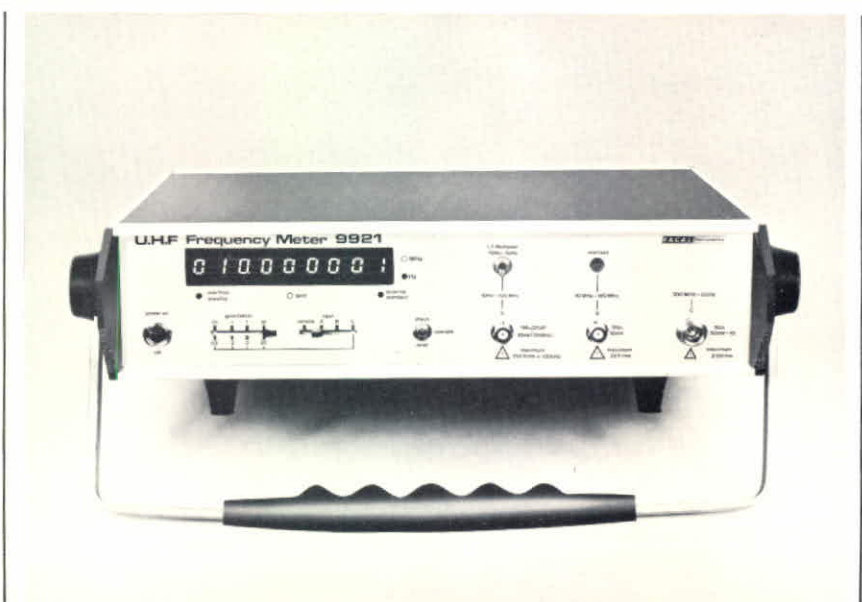
9917 can display a full 560MHz without overspill – direct gating enabling a resolution of 1Hz to be achieved in a measurement time of only 1 second. Standard features are a frequency burst facility and an l.f. multiplier which increases the resolution at low frequencies by a factor of 100 without lengthening the measurement time. In the u.h.f. channel a.g.c. simplifies measurements and high power input overload protection is provided by a fast acting p.i.n. diode attenuator and reed relay.



**9919**  
UHF Frequency Meter

10Hz to 1.1GHz  
AGC on both input channels  
Remotely programmable  
Mains or battery operation  
2 year guarantee

The 9919 combines high performance with versatility. Measuring to well over 1GHz it is an 8 digit frequency meter with full remote programming facilities, frequency burst capability and a.g.c. on both input channels. It is capable of operating from mains or optional internal rechargeable cells. An l.f. multiplier is available for increasing low frequency resolution. Other options include a higher accuracy frequency standard, a serial to parallel interface, a carrying case and a 19 inch rack mounting kit.



**9921**  
UHF Frequency Meter

10Hz to 3GHz  
9 digit display  
AGC  
Remotely programmable  
2 year guarantee

Built to full military specifications the 9921 is a precision instrument covering the whole of the v.h.f. and u.h.f. bands. A range of internal frequency standards with daily ageing rates up to  $\pm 5$  parts in  $10^{10}$  ensures high accuracy and the 9 digit display allows the full 3GHz to be resolved to 10Hz. A sampling technique used on the u.h.f. channel simplifies measurements by adjusting the input level automatically – avoiding the need for a sensitivity control. On the h.f. and v.h.f. input channels this is achieved by the inclusion of a.g.c. The sensitive 50Ω v.h.f. input is protected by a fast acting p.i.n. diode attenuator and reed relay. An option allows the 9921 to be remotely programmed for ATE applications and also converts the standard serial bcd data outputs into parallel form. An l.f. multiplier is also available.

# Counter Timers

## 9901

### Universal Counter-Timer

Frequency range d.c. to 50MHz (0.01Hz resolution)  
 Time Range 100ns to 2.8 hours  
 Six digit display  
 Frequency auto-ranging  
 Time interval averaging (300ps resolution)  
 2 year guarantee

This is a low cost instrument for measuring frequency, period, ratio, time interval, time interval average and for totalising. It incorporates two d.c. channels and a high sensitivity a.c. channel with a continuously variable attenuator for noisy signals or complex waveforms. Important standard features include independent positive and negative trigger slope selection, clock units down to 100ns and a time interval average mode that can be used to improve resolution or average out any input signal jitter. Higher accuracy frequency standards, a serial to parallel data interface, a carrying case and rack mounting kit are available as options.

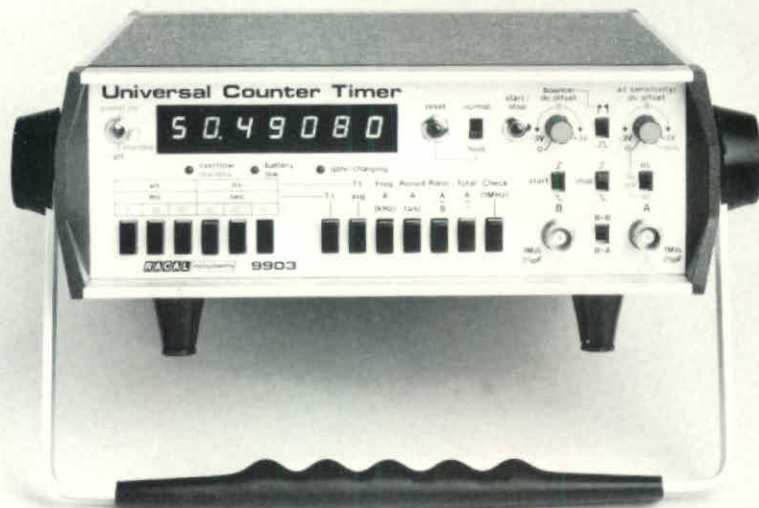


## 9903

### Universal Counter-Timer

Frequency range d.c. to 50MHz (0.01 Hz resolution)  
 Time range 100ns to 28 hours  
 Seven digit display  
 Variable d.c. offset and bounce protection  
 Mains or battery operation  
 Time interval averaging (300ps resolution)  
 2 year guarantee  
 NATO No. 6625-25-121-2652

9903 measures frequency, period, ratio, time interval, time interval average and can also totalise. It includes one a.c. and two d.c. input channels and is packed with features such as independent positive and negative trigger slope selection, fully variable offset controls on both d.c. channels, adjustable bounce protection with the ability to read off the actual bounce protection time on the display and serial bcd data outputs. Options available are a battery pack, a serial to parallel interface, a carrying case and a rack mounting kit.

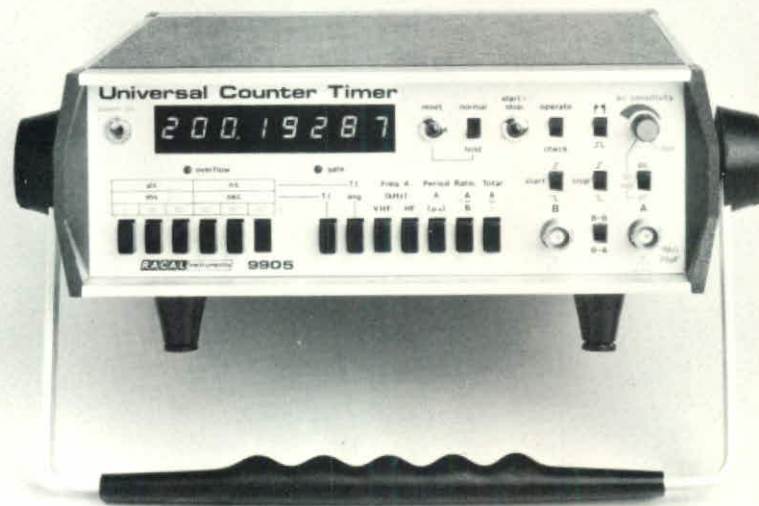


## 9905

### Universal Counter-Timer

Frequency range d.c. to 200MHz (0.01Hz resolution)  
 Time range 100ns to 280 hours  
 Eight digit display  
 Time interval averaging (300ps resolution)  
 2 year guarantee

This instrument offers all the measurement facilities of the 9901 with the additional benefits of higher resolution and an extended frequency range. It is an extremely versatile and accurate instrument that enables measurements to be made well into the v.h.f. band. Comprehensive single and multiple period facilities are provided for the measurement of low frequencies.





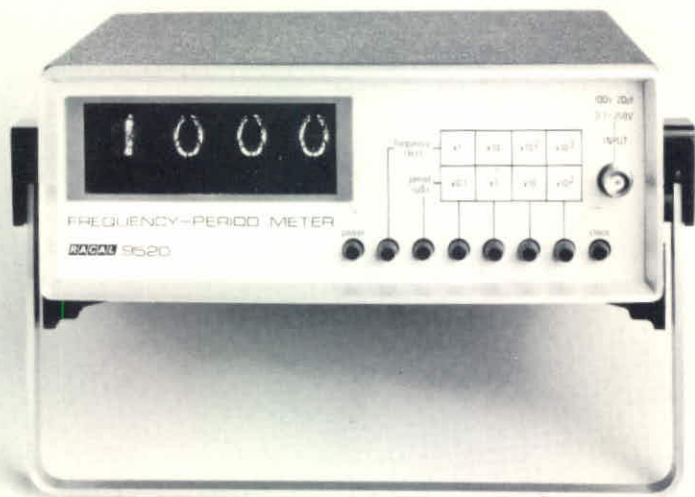
# Industrial Counters

## 9520

### Frequency-Period Meter

5Hz to 10MHz  
 Crystal accuracy  
 High noise immunity  
 NATO No. 6625-99-618-9864

A general purpose frequency-period meter for a wide variety of applications throughout industry, research departments and educational establishments. Designed primarily for industrial environments the 9520 is very simple to use. Efficient power supply filtering, variable signal bandwidth, input protection and insensitivity to electrical interference assure maximum reliability over wide ranging applications. A full range of Racal speed transducers allows the 9520 to be used as a tachometer for accurate speed measurement.

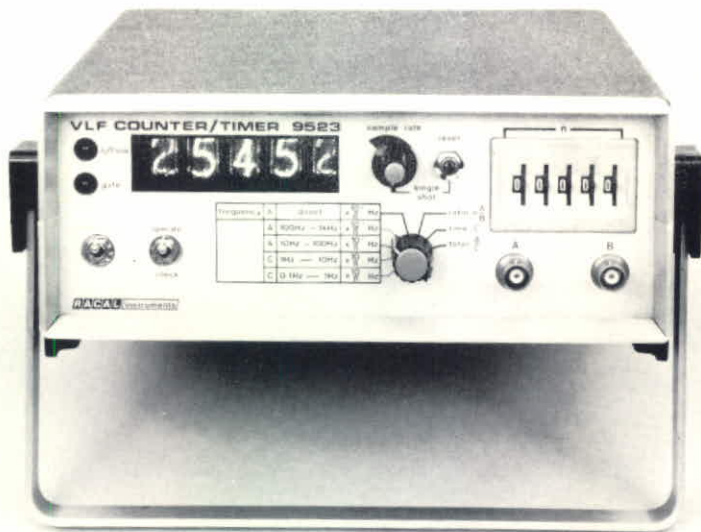


## 9523

### VLF Counter

0.1Hz to 10MHz  
 Recipromatic measurements for high resolution  
 Fully variable timebase  
 NATO No. 6625-99-620-5835

A versatile counter-timer with two input channels designed for arduous industrial environments and capable of measuring frequency, ratio, time interval, and totalising. A unique reciprocal computing technique improves low frequency resolution by up to 1000 times and a variable timebase allows results to be displayed directly in any engineering units - rev/min, km/hour, litres/sec etc. An option is available to convert displayed readings to bcd form suitable for peripheral equipment. 9523 in conjunction with the appropriate transducers finds wide application as an electronic tachometer in steel and paper mills, glass works and engine testing facilities.

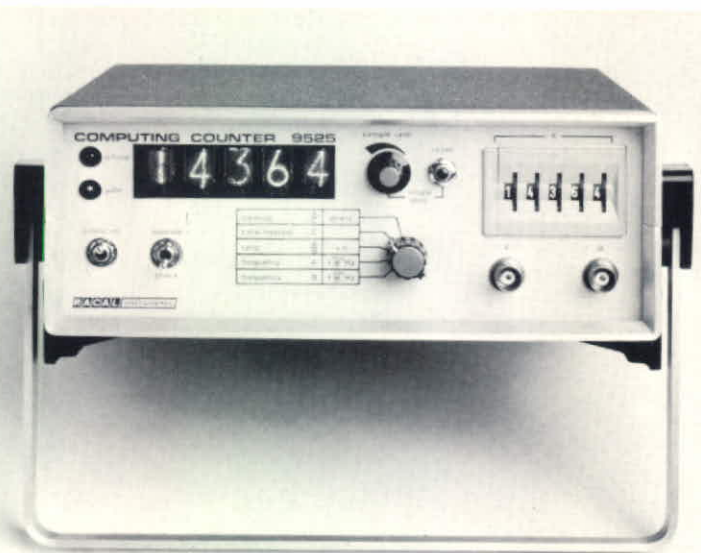


## 9525

### Computing Counter

5Hz to 10MHz  
 Fully variable timebase

The 9525 is an easy to use, versatile counter-timer for industrial applications. It is also suitable for research institutions and educational establishments as a general purpose laboratory instrument. The two input channels have a frequency range from 5Hz to 10MHz and can be used for ratio, time interval and totalising measurements in addition to direct frequency measurement. The variable timebase enables the display to be scaled in any convenient units thus avoiding the need for tedious calculations. An option is available which provides bcd data outputs for use with peripheral equipment.



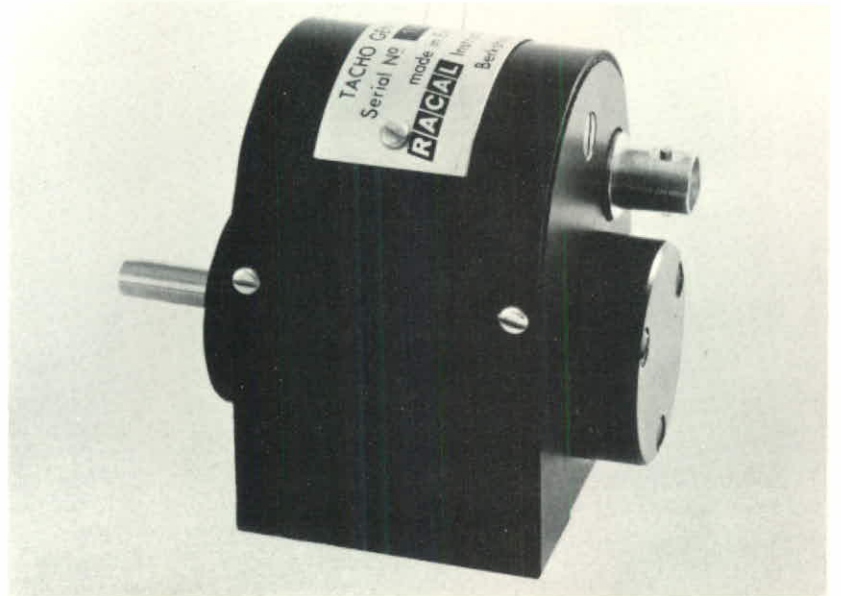
# Speed Transducers

## MA38

### Tacho-Generator

*Generates 60 pulses per revolution  
No special wheels or materials required  
Needs no power supply*

A rotational speed transducer for accurate speed measurement from 10 to 10,000 rev/min. Sixty output pulses are generated per revolution so that by connecting the transducer to the shaft under test and using a digital counter to count the number of pulses occurring in one second an indication of shaft speed in rev/min. can be obtained. Used with two channel counters, the ratio between two different speeds can be determined.

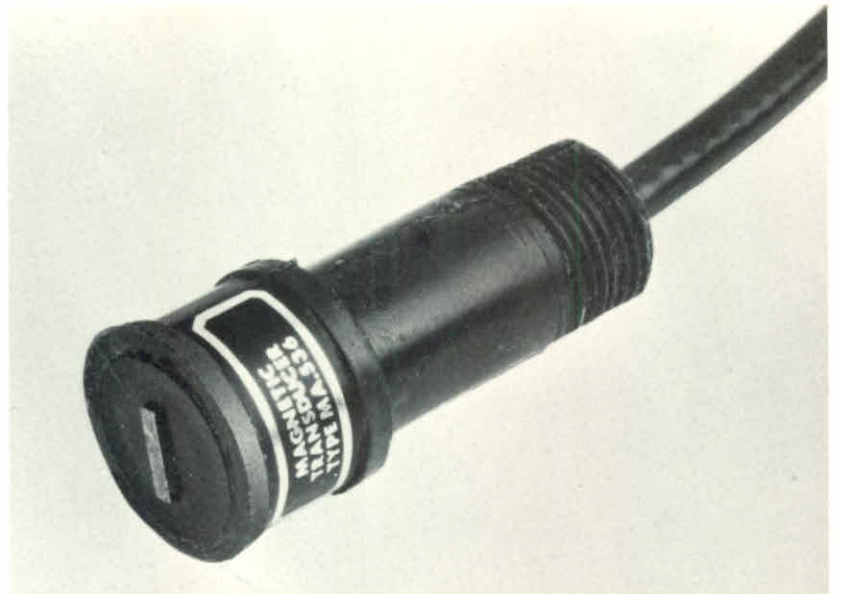


## MA536

### Electro-Magnetic Speed Transducer

*Needs no power supply  
Unaffected by hostile environments  
No physical contact with shaft necessary*

The MA536 is suitable for all speed and speed ratio measurements. It is extremely robust, completely waterproof and unaffected by dust or liquids. The gap between the shaft or object under test and the pole-piece of the transducer forms part of a magnetic circuit. Irregularities such as splines, keyways or gear teeth passing the pole-piece change the magnetic reluctance and can be accurately counted and displayed on a digital frequency meter.

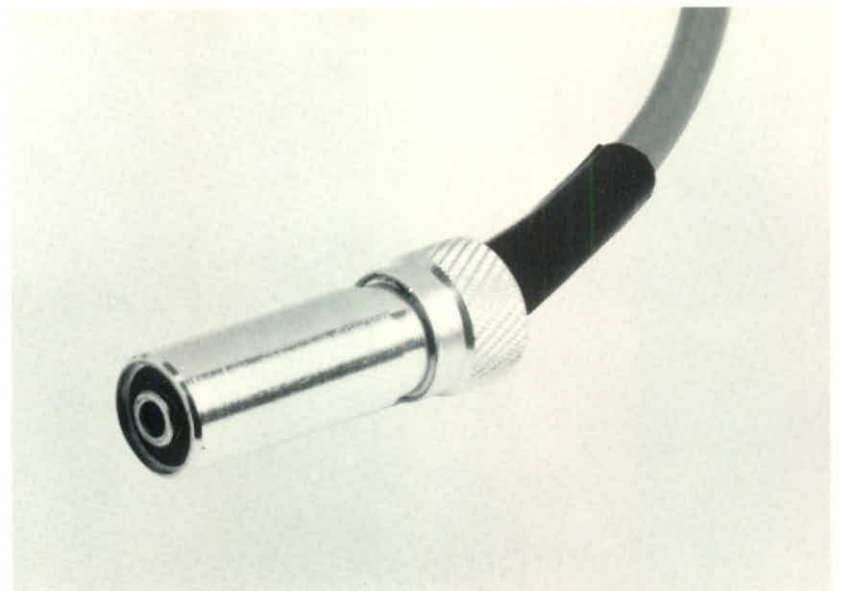


## MA549

### Photo-Electric Probe

*Operates with any material  
Operates down to zero rev/min  
Needs no special wheels or shaped parts*

This miniature probe is ideal where no mechanical contact or magnetic coupling with the shaft under test is permissible. Its small size allows the MA549 to be used in locations inaccessible to larger transducers. It comprises a photo-diode and a lamp. When positioned near the shaft under test, light is reflected from the shaft into the diode. Suitable black/white shaft markings change the intensity of the reflected light causing corresponding variations in output voltage which can be counted by a digital frequency meter. Since the change in output level is not a function of velocity, the probe will operate down to zero rev/min.





# Oscilloscopes

## 9386

### Dual Trace Oscilloscope

*d.c. to 25MHz*  
*10mV sensitivity*  
*3% accuracy*

Simple to use and low cost, the 9386 is a portable oscilloscope ideal for production testing, servicing, design and development and for educational purposes. Complicated controls have been eliminated by careful design and application of modern semiconductor technology. Both Y channels have a 25MHz bandwidth and a sensitivity variable from 10mV/cm to 50V/cm. Highly stabilised supplies ensure a 3% calibration accuracy. A signal delay allows close examination of complex waveforms. The timebase has 19 calibrated ranges from 200ns/cm to 200ms/cm and an external facility. A x 5 position provides speeds up to 40ms/cm. The 4in CRT gives a bright display comparable with far more expensive instruments.



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