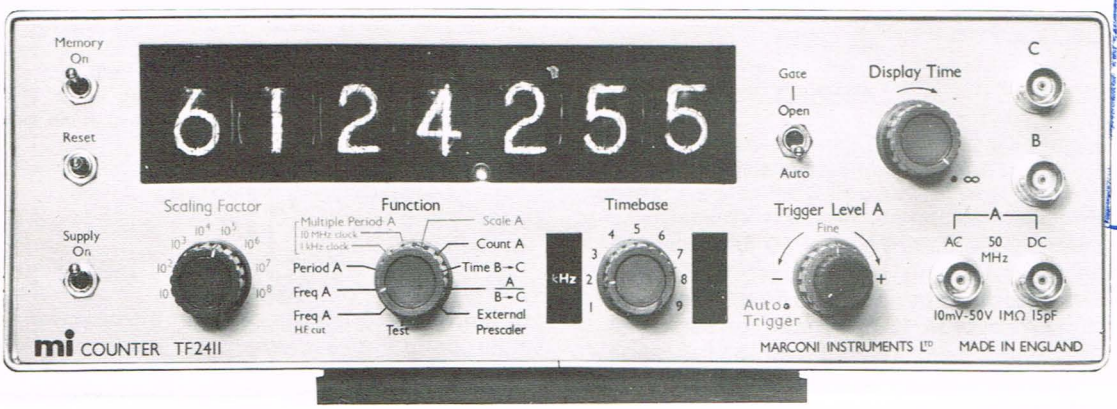
Counter TF 2411

- ☐ Direct frequency measurement up to 50 MHz
- ☐ 0·1 μsec timing resolution
- ☐ 10 mV sensitivity
- ☐ Auto-trigger
- ☐ Plug-in frequency standard
- ☐ Budgetary Price: £510 to £580 depending on frequency-standard unit fitted



In this compact 50 MHz counter, integrated-circuit techniques have been employed to achieve a standard of performance, reliability and measurement versatility normally associated with larger and more expensive instruments.

With a sinewave input level of only 10 mV, the TF 2411 is capable of frequency measurement up to 50 MHz, and period or multi-period measurement up to 10 MHz. It has a two-channel time-interval measurement facility with a resolution of 100 nsec for intervals up to 1 second and a total time measurement range extending to 10^8 seconds. The instrument can also be used for scaling, simple totalising, and counting events per externally triggered time interval.

Among the very useful features of this counter is the automatic trigger system, which centres the trigger level close to the mean level of the input waveform. With the instrument switched to *Auto-Trigger* satisfactory counting is obtained for any input signal of more than 20 mV r.m.s. amplitude. Coarse and fine manual trigger-level controls are, of course, also provided for use with low level signals or particularly difficult waveforms.

For frequency measurement below 10 MHz on noisy signals, the bandwidth of the input circuit can be reduced to obviate spurious triggering from high-frequency noise transients.

An unusual feature, which presents an important economic flexibility, is the use of a plug-in frequency-standard unit. The instrument is available with any one of three plug-in units, so that the purchaser can select the stability appropriate to his application, with commensurate adjustment of the price.

Notwithstanding the small size of the TF 2411, its mechanical layout is such that ready access is available to all internal components, and the instrument is easily demountable for easy servicing.

The Display

The display system consists of a seven-tube in-line readout, with automatic indication of decimal point. Units of measurement—i.e. kHz, msec, etc.—are indicated in a separate window. A storage memory maintains the display while the count is in progress to give a continuous coherent readout, only those digits that alter being affected by successive counting. Steadily drifting frequencies can, for example, be monitored at a high sampling rate without ambiguity. If desired, the memory may be switched off so that the display follows the decades as the count proceeds.

Printer Output

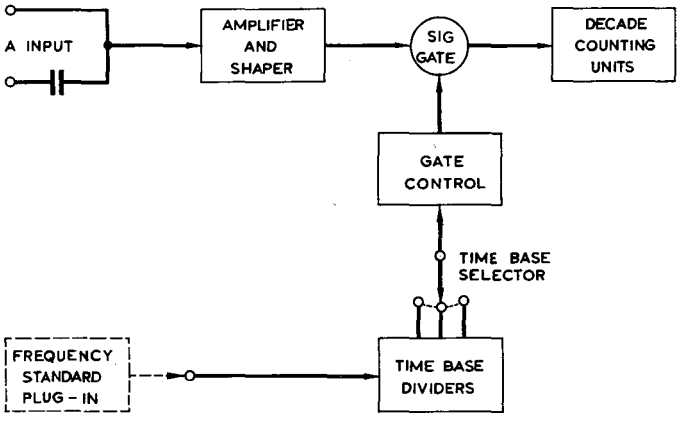
A four-line b.c.d. (1-2-4-8) printer drive output can be provided as an optional facility. The output is drawn via a multiway plug at the rear of the instrument. Positive logic is used, with 0 volts representing the '0' condition and +3 volts representing the '1' condition. There is a four-line output for each of the seven digits, with an additional +2 volt print-command pulse output and a contact-closure counter inhibit input.

Measurement Functions

The mode of operation of the instrument is determined by the setting of the ***Function*** switch. In addition to the measurement functions already mentioned in this leaflet, there is a switch position for ***Test***—where the instrument measures its own standard frequency to check that the logic circuits are working correctly—and an ***External Prescaler*** position. With the switch set to this last position the instrument can be operated with a prescaler to extend its frequency measurement range. Suitable prescaler units are in an advanced state of development.

1. Frequency Measurement

Direct measurement of frequency up to 50 MHz can be made, with gate times ranging from 1 μsec to 10 sec, switch selected in decade steps. The measured frequency is read directly in Hz, kHz, or MHz, depending on setting of the ***Time Base*** switch. For measurement over the full range of the counter the ***Function*** switch is set to ***Freq A.*** With the switch set to ***Freq A-H.F. cut*** a low-pass filter is introduced, which reduces the amplitude of frequency components above 1MHz for elimination of high frequency noise.

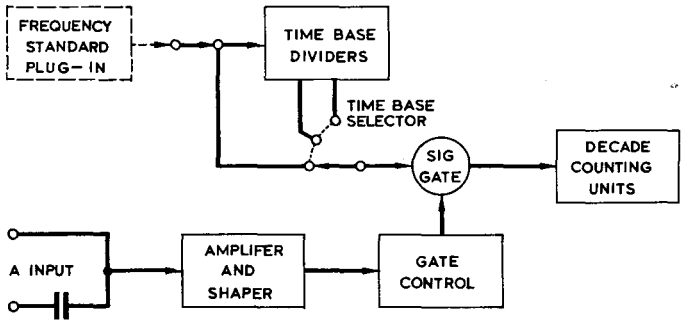


With the ***Function*** switch set to ***Freq A*** or ***Freq A-HF cut,*** the instrument measures the frequency of a signal applied to the ***A*** input by counting the number of cycles of the input signal over a selected interval of time.

The signal gate is opened and closed by a selected output of the time base, as controlled by the ***Time Base*** switch. During the time that the gate is open the input signal is passed through the gate to be counted by the decade counting units.

2. Waveform Period Measurement

When the unknown frequency is low, measurement of a single waveform period (i.e. the duration of one cycle) is often preferred to direct measurement of frequency because an indication to the required number of significant figures can be obtained without recourse to an inordinately long gate time. The period measurement range extends from 0·1 μsec to 10^8 seconds.

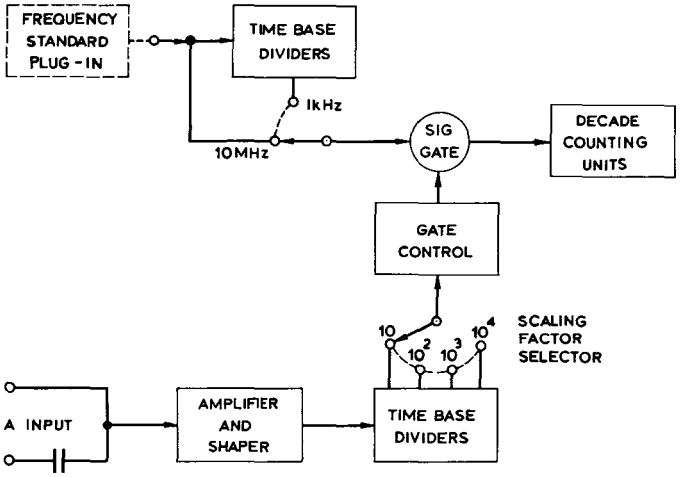


With the ***Function*** switch set to ***Period A,*** the instrument measures the period of one cycle of a signal applied to the ***A*** input.

The signal gate is opened at a point on one cycle of the signal applied to the ***A*** input. This allows pulses, selected by the ***Time Base*** switch, from the time base dividers or the frequency standard to pass through the gate to the decade counting units. These pulses are counted by the d.c.u.'s until the gate is closed at the same point on the next cycle of the input signal.

3. Multiple Period Measurement

For higher frequencies, where the discrimination on a single period measurement is insufficient, the average period of a number of cycles may still give a higher accuracy than is attainable by direct measurement of frequency with a manageable gate time. With multiple-period measurement the trigger-level error is also reduced by a factor equal to the number of periods averaged, as compared with single period measurement. The total of any number from 10 to 10^8 periods can be indicated in μsec (***10 MHz clock***) or from 10 to 10^4 periods in msec (***1kHz clock***). The number of periods measured is determined by the setting of the ***Scaling Factor*** switch, and the average period is found by dividing the indicated time by the scaling factor.



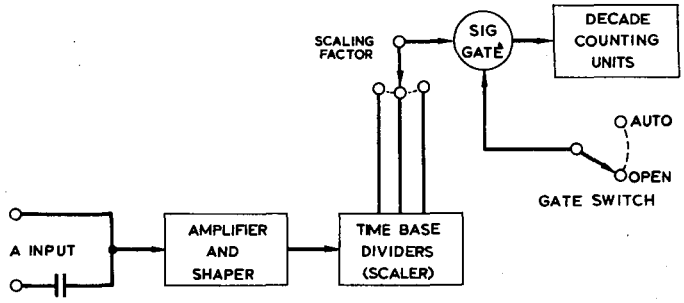
With the ***Function*** switch set to ***Multiple Period A*** the instrument measures the sum of the number of periods selected by the ***Scaling Factor*** switch.

The action of the circuit is similar to that for single period measurement except that the input signal does not operate the signal gate directly, but goes to a decade divider which, in turn, operates the gate. The gate is thus held open for a time corresponding to that of a single period multiplied by the division ratio—i.e., the scaling factor.

4. Totalising and Scaling

With the ***Function*** switch set to ***Count A*** the instrument indicates the total number of input pulses that occur while the signal gate is open. The gate is opened and closed manually; and the instrument resets to zero when the ***Reset*** switch is operated. By making two or more sequential counts without resetting; the sum of their results can be indicated on the display.

Scaling is similar to totalising except that the input signal is passed through a number of decade dividers—determined by the setting of the ***Scaling Factor*** switch—before going to the counting circuits. The counter then indicates the number of times that scaling factor occurs; i.e., it divides by the scaling factor and shows the quotient to the nearest integer.

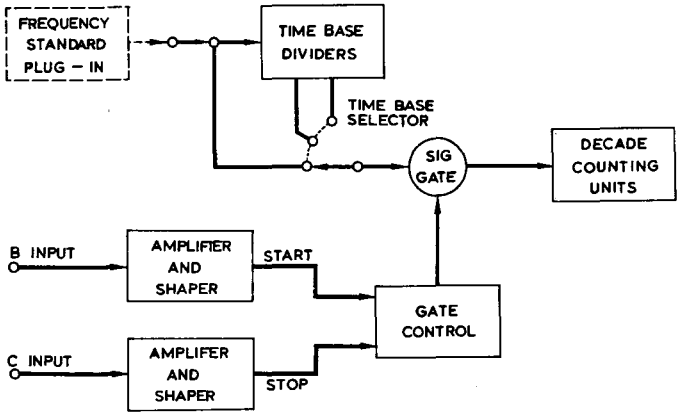


With the ***Function*** switch in the ***Count A*** the input signal goes directly to the decade counting units, which count the total number of cycles that occur while the signal gate is open. The gate is opened and closed manually by setting the ***Gate*** switch to ***Manual*** and ***Auto*** respectively.

With the ***Function*** switch set to ***Scale A*** the action is similar to that for ***Count A*** except that a decade divider is introduced between the input and the decade counting units. The number of cycles counted is then equal to the number of cycles of the input signal divided by the scaling factor.

5. Time Intervals

Independent channels are used for the "start" and "stop" transients. The measured time interval is read off directly in μsec, msec, or seconds depending on the setting of the ***Time Base*** switch.

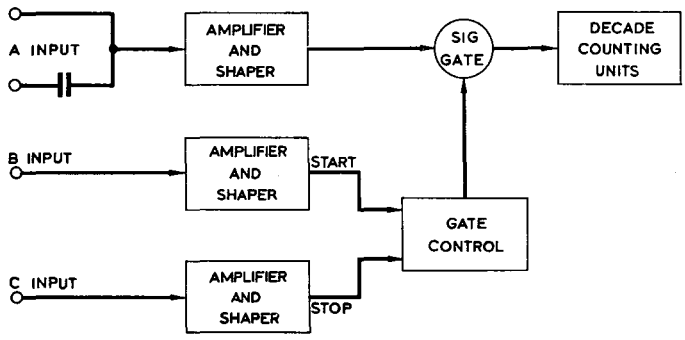


With the ***Function*** switch set to ***Time B→C*** the instrument measures the time interval between the "start" signal applied to the ***B*** input and the "stop" signal applied to the ***C*** input.

Pulses selected by the ***Time Base*** switch are drawn from the time base circuit and applied to the input of the signal gate. The gate is opened by the "start" signal, allowing the time base pulses to pass to the decade counting units, where they are counted until the "stop" signal closes the gate.

6. Events per Time Interval

In this mode the instrument indicates the number of pulses applied to the ***A*** input that occur in the time interval between "start" and "stop" pulses applied to the ***B*** and ***C*** inputs respectively.



With the ***Function*** switch set to $\frac{A}{B-C}$ the instrument measures the number of pulses applied to the ***A*** input between the application of a "start" signal to the ***B*** input and a "stop" signal to the ***C*** input. The action is similar to that for time interval measurement except that the pulses counted are derived from an external source instead of the time base circuit.

Frequency Standard Units

The TF 2411 is available with any one of three frequency standard units, only two of which carry built-in crystal oscillators, the third being intended for use with an external standard source. The unit to be fitted should be specified by the customer at the time of ordering.

HIGH STABILITY FREQUENCY STANDARD UNIT TM 9933

This unit provides a highly stable internally generated standard frequency, without provision for connection of an external standard. Its crystal is mounted in a temperature controlled oven, so that its drift with change in ambient temperature is less than 1 part in 10^9, and its short term drift at a constant temperature is of the order of 1 part in 10^{10} over 5 minutes. A special feature of this frequency standard unit is its remarkably short warm-up time; within 10 minutes of switch-on—after being switched off for 24 hours—the oscillator in this unit stabilises to less than 1 part in 10^7 from its final frequency.

10 MHz FREQUENCY STANDARD UNIT TM 9888

This frequency standard unit comprises a 10 MHz crystal oscillator followed by an amplifier. The unit carries a separate input socket for an externally generated standard-frequency signal, which is also amplified in the unit. A toggle switch facilitates selection of the internal or external standard.

EXTERNAL FREQUENCY STANDARD UNIT TM 9890

This unit contains no internal oscillator, and is essentially a multiplier circuit, which will accept any submultiple frequency of 10 MHz above 833 kHz and deliver to the counter the 10 MHz harmonic of this frequency. The unit can, for example, be used with externally generated standard frequencies of 1, 5, or 10 MHz.

Counter TF 2411

RANGE

Frequency	0 to 50 MHz. Using the h.f. cut function there is more than 20 dB cut above 10 MHz and more than 25 dB cut above 20 MHz.
Single period	0 to 10 MHz.
Multiple period	0 to 10 MHz.
Scaling	0 to 10 MHz.
Scaling factors	10 to 10^8.
Time interval	0·1 μsec to 10^8 seconds.

PULSE PAIR RESOLUTION 35 nsec.

SENSITIVITY

Input A	Manual trigger—10 mV r.m.s. Auto trigger—20 mV r.m.s. above 1 kHz. Useable below 1 kHz with reduced sensitivity.
Inputs B and C	0.4 volts peak, positive pulse. The input pulse must be at least 0·2 μsec wide.

MAXIMUM INPUT

Input A	50 volts r.m.s.
Inputs B and C	10 volts peak.

ACCURACY

Frequency	±1 count ± stability of standard frequency.
Time B-C (pulses)	± stability of standard frequency.
Single period	Trigger level error ± stability.
Multiple period (sine)	$\frac{\text{Trigger level error}}{\text{number of periods}}$ ± 1 count ± stability
Trigger level error	±3% with 10 mV input; ±0·3% with 100 mV input.

TRIGGER LEVEL Coarse and fine trigger level controls give approximately ±1 volt d.c. offset on manual.

INPUT IMPEDANCE

Input A	1 MΩ approx. in parallel with 10 pF approx. D.C. coupled or a.c. coupled via 0·1 μF.
Inputs B and C	1 kΩ approx.

DISPLAY 7 decade in-line with memory. Decimal point and units are automatically indicated.

DISPLAY TIME Continuously variable from 50 msec to 5 seconds approx. or held indefinitely until manually reset.

AUXILIARY OUTPUTS

Time base	Amplitude: Approximately +1 volt peak into 470 Ω P.R.F. (with gate open): 0·1 Hz to 1 MHz in decade steps, for test and frequency measurement. 0·1 Hz to 10 MHz in decade steps, for period and time measurements. Multiple period scale: Input A divided by the scaling factor.
10 MHz Standard-Frequency	Amplitude: Approximately 1 volt p-p into 1 kΩ.

Both these outputs are available on the rear panel prescaler connector.

TEMPERATURE RANGE

Operating	0° to 50C°
Within specification	10° to 35°C.

POWER REQUIREMENTS 95 to 130 volts or 190 to 264 volts, 45 to 60 Hz. 30 VA approx. There is 10% regulation on the nominal mains setting.

DIMENSIONS AND WEIGHT

Height	Width	Depth	Weight
3½ in	11 in	10 in	9 lb
89 mm	280 mm	254 mm	4·1 kg

ACCESSORIES

Supplied	Two free plugs, Type BNC.
Optional	McMurdo 9 way plug, to mate with the prescaler socket.

FREQUENCY STANDARD UNITS

EXTERNAL FREQUENCY STANDARD TM 9890

Input frequency	Sub-harmonics of 10 MHz in the range 1 MHz to 10 MHz.
Input sensitivity	120 mV to 25 volts r.m.s.
Input impedance	2·5 kΩ minimum.

10 MHz FREQUENCY STANDARD TM 9888
(Internal Crystal Oscillator)

Stability	Typical age rate of $\pm 2 \times 10^{-8}$ per week at constant temperature. Temp. coeff. is $\pm 1 \times 10^{-6}$ per °C between 0 and 50°C.
External standard	Sensitivity: 120 mV to 25 volts r.m.s. Input impedance: 2·5 kΩ minimum.

HIGH STABILITY FREQUENCY STANDARD TM 9933
(Internal Crystal Oven)

Stability (after 1 hour operation)	Temperature: $\pm 1 \times 10^{-9}$ per °C. Supply: $\pm 5 \times 10^{-9}$ for ±10% mains supply variation. Short term: typically $\pm 3 \times 10^{-10}$ over 5 min.
Age rate	$\pm 1 \times 10^{-8}$ per day after 24 hour stabilisation. $\pm 1 \times 10^{-7}$ per month after 30 days continuous operation. The instrument will stabilise to $\pm 1 \times 10^{-7}$ in 10 min after 24 hour switch off.

NEWS

AMALGAMATED WIRELESS (AUSTRALASIA) N.Z. LTD.

PRICE REDUCTION ON MARCONI COUNTER

MAKES GOOD VALUE R.T. TEST SET-UP

Marconi Instruments recent price reduction on their TF2411 50MHz Counter allows a comprehensive R.T. test layout to be established for minimal cost. The TF2411 is a main frame unit and a choice of frequency standards is available. Addition of the TF2422 300MHz Divider allows measurement of final frequency. Sensitivity of 10mV is obtained from the TF2411 while 25mV is available from the TF2422.

		FOB UK	EX NZ STOCK
TF2411	50MHz Counter/Timer main unit	£350	$787.00
TM9888	10MHz Frequency Standard	£ 18	$ 40.50
TM9933	High Stability Frequency Standard	£ 91	$205.00
TF2422	300MHz Divider	£190	$450.00

For Stability of 1×10^{-6} per ^{o}C
TF2411/TM9888/TF2422.....$1277.50

For Stability of 1×10^{-9} per ^{o}C
TF2411/TM9933/TF2422.....$1442.00

Delivery is Ex Stock U.K. - ie 3 months from receipt of order. is New Zealand.

Full specifications are presented in the attached leaflets.

The special price of £350 for TF2411 applies to present stocks only.

Contact:-

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