AIM & THURLBY THANDAR INSTRUMENTS

TF960 | TF930 | PFM3000



High performance 3GHz and 6GHz frequency counters

PFM3000 - 3GHz low-cost handheld frequency counter

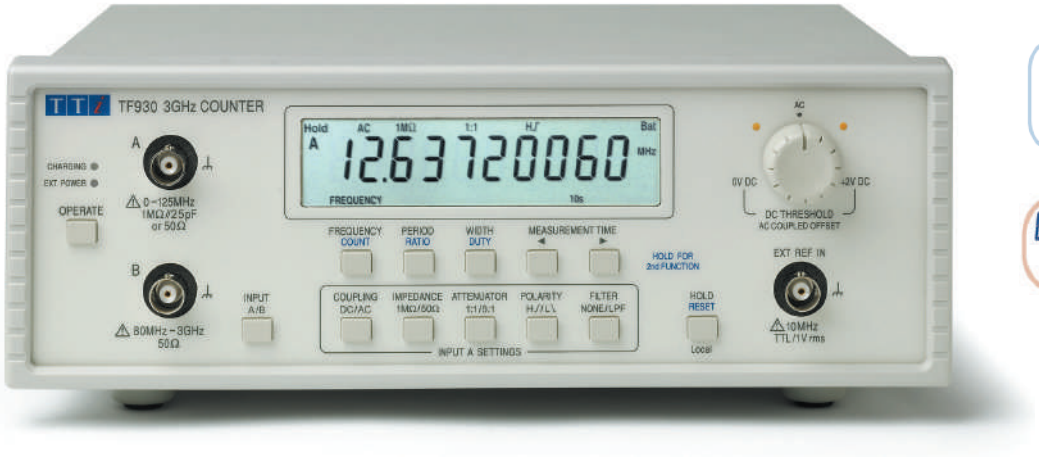
TF930 - 3GHz bench/portable universal counter with USB

TF960 - 6GHz bench/portable universal counter with USB

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TF930/960 - 3GHz and 6GHz bench/portable universal counters with USB



TCXO Timebase

USB UNIVERSAL SERIAL BUS

10 digits

High Resolution Reciprocal Measurement

- 0.001Hz to > 3000MHz or 6000MHz frequency range
- Frequency, period, pulse width, duty cycle, frequency ratio and event counting modes
- High performance temperature compensated timebase
- Reciprocal measurement technique gives superior resolution
- High input sensitivity over the full frequency range
- High impedance DC coupled input up to 125MHz
- Variable trigger threshold and switchable attenuator
- Large 10 digit LCD display with annunciators
- Operation from built-in rechargeable batteries
- Low power consumption gives up to 24 hours operation
- Remote control and readback via USB interface

High measurement accuracy

The TF930 and TF960 use a high quality temperature compensated internal frequency reference (TCXO) which has a low aging rate and is stable to within ±1ppm over the full temperature range.

Its short warm-up time allows accurate measurements to be made even under portable battery powered conditions.

An External Reference input is provided and changeover from the internal timebase is automatic when an external reference standard is connected.

High resolution

For frequency, period and frequency ratio functions the instrument uses a reciprocal counting technique to provide high resolution at all frequencies.

Eight significant digits of answer are produced in a 1 second measurement time, nine digits in 10s and ten digits in 100s with a granularity of less than 2 counts in the least significant digit.

Flexible signal conditioning

Input A has configurable coupling (AC or DC), input impedance (1MΩ or 50Ω), attenuation (1:1 or 5:1), threshold (fully variable) and active edge, and can be used for frequencies in the range 0.001Hz to >125MHz.

Input B is a nominal 50Ω input for frequencies in the range 80MHz to > 3GHz.

Input C (TF960 only) uses a standard N connector and has a nominal 50Ω input for frequencies in the range 1.8GHz to > 6GHz.

Multiple measurement functions

The TF930 and TF960 can measure frequency, period, pulse width, duty cycle and frequency ratio, as well as event counting (totalise).

Remote control and read-back via USB

The TF930 and TF960 incporporate a USB interface which allows it to be remotely controlled using RS232 protocol via a computer's USB port.

The remote commands of their predecessor instrument, the TF830, are compatible with the command set.

Battery operation when needed

The TF930 and TF960 operate from internal rechargeable NiMH batteries which give typically 24 hours operating life.

The universal AC charger supplied will recharge the batteries in less than 4 hours and can be used for continuous AC operation.

The instruments can also be powered from a standard USB port.



Ten digit LCD

The high contrast display has ten 12.5mm (0.5") high digits along with a comprehensive set of annunciators.

These show input configuration and function, measurement time and status, external reference connection, low battery and the units of the measurement which may be Hz, kHz, MHz, ns, us, ms or s.

PFM3000 - low-cost 3GHz counter



High Resolution Reciprocal Measurement

8.5 digits

- 3 Hz to > 3000 MHz in two overlapping ranges
- High input sensitivity over the full frequency range
- High impedance measurement up to 125 MHz
- Reciprocal measurement technique gives superior resolution
- Period measurement from 3 Hz to 125 MHz
- Selectable measurement time; display hold function
- Noise filter for low frequency measurements
- Large 8.5 digit display with full range of annunciators
- Battery operation; handheld format with tilt-stand
- Push-to-measure function with auto power-down

Wide frequency range and high resolution

The PFM3000 offers high sensitivity frequency measurement from 3Hz to more than 3GHz in two overlapping ranges. Period measurement is also provided from 8ns to 330ms.

The PFM3000 uses a continuous reciprocal measurement technique to provide high resolution at all frequencies with rapid update.

It offers high sensitivity across the whole frequency range. A low pass filter can be selected to reduce high frequency signal noise at lower frequencies.

A Large and clear display

Despite its compact dimensions, the PFM3000 incorporates a large 8.5 digit LCD. Annunciators are provided for measurement function, measurement time, overflow, trigger activity, low battery, and measurement units.



Low power consumption and push-to-measure

Despite its wide frequency range the PFM3000 has a power consumption that enables it to operate for many hours from a PP3 size battery.

A push-to-measure capability gives an instantaneous reading followed by an automatic power down after 15 seconds. This provides greatly extended battery life where continuous monitoring of the signal is not required.

Bench-top use

The PFM3000 has the performance needed for many bench-top applications, and its built-in tilt stand sets the display at a convenient angle.

Specifications - TF930/960

INPUT SPECIFICATIONS

Input A

Input Coupling:	AC or DC
Input Impedance:	1MΩ//25pF (DC or AC coupled), or 50Ω (AC coupled only)
Attenuation:	1:1 or 5:1
Active Edge:	Rising or falling, or width high or low
Low Pass Filter:	50kHz cut-off, or None
Frequency Range:	0.001Hz to > 125MHz (1MΩ, DC coupled) < 30Hz to > 125MHz (1MΩ, AC coupled) < 500kHz to > 125MHz (50Ω, AC coupled).
Sensitivity:	Sinewave - 15mVrms 30Hz to 100MHz, 25mV to 125MHz at optimum threshold adjustment.
Signal Range:	1MΩ, DC - 0 to 3.3V (1:1) or 1 to 12V (5:1), 1MΩ, AC - up to 1Vrms (3Vpp) (1:1) or up to 4Vrms (12Vpp) (5:1) 50Ω, AC - up to 1V rms above 300kHz
Trigger Threshold:	DC coupled - 0 to 2V (1:1) or 0 to 10V (5:1) AC coupled - Average ± 200mV (1:1) or ± 1V (5:1)

Input B

Input Impedance:	50Ω (AC coupled)
Frequency Range:	<80MHz to >3000MHz
Sensitivity:	Sinewave - 25mVrms 2GHz to 6GHz
Signal Range:	<0dBm recommended, +13dBm (1Vrms) maximum

Input C (TF960 only)

Input Impedance:	50Ω (AC coupled)
Frequency Range:	<1800MHz to >6000MHz
Sensitivity:	Sinewave - 12mVrms 80MHz-2GHz, 25mV to 2.5GHz, 50mVrms to 3GHz
Signal Range:	<0dBm recommended, +13dBm (1Vrms) maximum

External Reference

Input Impedance:	>100kΩ, AC coupled
Frequency:	10MHz
Signal Level:	TTL, 3Vpp to 5Vpp CMOS or 1 to 2Vrms sinewave

Maximum Input Voltage

Input A and Input B: 30Vdc; 30Vrms 50Hz/60Hz reducing to 1Vrms above 1MHz

Note that the inputs will not be damaged if subjected to an accidental short-term connection to a 50/60Hz line voltage not exceeding 250V rms.

MEASUREMENT FUNCTIONS

Frequency

A Input Range:	0.001Hz (DC coupled) to >125MHz
B Input Range:	80MHz to >3000MHz
Resolution:	up to 10 digits (see Note) or 0.001Hz

Period

A Input Range:	8ns to 100s (DC coupled)
B Input Range:	333ps to 12.5ns
Resolution:	up to 10 digits (see Note)

Pulse Width Mode (Input A only)

Functions:	Width high, width low, ratio H:L (high time to low time) and duty cycle
Pulse Width Range:	40ns to 1000s
Averaging:	Automatic within measurement time selected, up to 50 pulses
Resolution:	20ns for one pulse; up to 1ns or 10 digits with multiple pulse averaging 0.01% for Ratio H:L and Duty Cycle,

Total Count (Input A only)

Count Range:	1 to 9 999 999 999
Minimum Width:	8ns

Frequency Ratio B:A

Resolution:	Equal to the resolution of the two frequency measurements, If the ratio exceeds 10 digits, 6 digits and the exponent are displayed

Measurement Time

Selectable as 100s, 10s, 1s or 0.3s. The instrument displays the average value of the input signal over the measurement time selected, updated every 2s, 1s, 0.5s or 0.3s respectively. The hardware captures the count values and continues measuring without any dead time.

Resolution

The displayed resolution depends upon measurement time and input frequency. The basic resolution of period is 8 digits for every 2 seconds of measurement time. Frequency resolution is the reciprocal of period resolution. Usable resolution can be reduced by noise at low frequencies.

Accuracy

Measurement accuracy is timebase accuracy + measurement resolution + 2 counts.

TIMEBASE

Measurement Clock:	50MHz
Internal Reference:	10MHz TCXO with electronic calibration adjustment (> +/- 8ppm)
Temperature Stability:	Better than ± 1ppm over rated temperature range
Initial Error:	< ± 0.2ppm at 25°C
Ageing Rate:	<± 1ppm/year

OPERATING FACILITIES

Noise Filter

The Filter key controls a low pass filter, with a cut-off frequency of about 50kHz, to ensure more stable readings at low frequencies.

Specifications TF930/960 (continued) & PFM3000

Hold
Pressing the Hold key will stop further measurements being made and the current measured value will remain in the display, with the Hold indicator on, until the Hold key is pressed again. A long press on the Hold key clears old data and restarts the measurement.

Intelligent Power Switching
The unit automatically selects the best available power source of AC adaptor, USB or battery. Intelligent switching avoids discharging the battery overnight when operated from externally switched AC power.
A press-to-measure facility allows a quick measurement to be made by pressing a function select key which will power the instrument up in the corresponding function. The instrument will automatically switch off 15 seconds after the last key-press.

Signal Activity Indication
Dual bi-colour LEDs show signal activity and indicate whether a DC coupled signal is above or below the trigger threshold.

REMOTE CONTROL

Interface:	USB (Serial port emulation over USB)
Current Used:	< 95mA (<5mA if AC adaptor power is present)
Command Set:	Annunciators show input configuration, operating mode, measurement units and gate time

DISPLAY

No. of Digits:	10 digits
Size of Digits:	12.5mm (0.5")
Annunciators:	Instrument specific. TF830 compatible

POWER REQUIREMENTS

The instrument has fixed internal rechargeable batteries and is supplied with a universal voltage external mains adaptor with interchangeable UK, Euro, Australian and US power connectors.

Battery Type:	Three 2500mAh NiMH cells
Operating Life:	Typically 24 hours per full charge
Low Batt. Indicator:	'Lo Bat' shows when approximately 10% of battery life remains
Recharge Time:	>4 hours
Adaptor Voltage:	85 to 240V, 50 or 60 Hz
Power Consumption:	5W max at DC input to unit; 15VA max at AC adaptor input (charging)

GENERAL

Operating Range:	+5°C to +40°C, 20% to 80% RH
Storage Range:	-20°C to +60°C
Environmental:	Indoor use at altitudes up to 2000m Pollution Degree 2
Size:	260mm(W) x 88mm(H) x 235mm(D)
Weight:	950 gms (plus 170 gms AC adaptor)
Electrical Safety:	Complies with EN61010-1
EMC:	Complies with EN61326

Specifications - PFM3000

INPUT SPECIFICATIONS

Input A

Input Impedance:	1MΩ//20pF (AC coupled)
Frequency Range:	<3Hz to >125MHz
Sensitivity:	Sinewave - 15mVrms 10Hz-125MHz

Input B

Input Impedance:	50Ω (AC coupled)
Frequency Range:	<80MHz to >3000MHz
Sensitivity:	Sinewave - 15mVrms 80MHz-2GHz, 50mVrms to 3GHz

Maximum Input Voltage
Input A and Input B: 30Vdc; 30Vrms 50Hz/60Hz reducing to 1Vrms above 1MHz
Note that the inputs will not be damaged if subjected to an accidental short-term connection to a 50/60Hz line voltage not exceeding 250V rms.

MEASUREMENT FUNCTIONS

Frequency (Range A)

Frequency Range:	3Hz to 125MHz
Resolution:	10^{-7}Hz to 100Hz (see Note)

Frequency (Range B)

Frequency Range:	80MHz to >3000MHz
Resolution:	1Hz to 10kHz (see Note)

Period (Range A only)

Period Range:	8ns to 330ms
Resolution:	10^{-7}ns to 1us (see Note)

Measurement Time
Selectable as 10s, 1s or 0.1s. (Note that for the 0.1s setting the effective measurement time is 0.3 seconds).

Resolution
The displayed resolution depends upon the measurement time and the input frequency. Eight digits (or nine using an overflow indication) are displayed for a 10s measurement time. Seven or eight digits are displayed for a 1s measurement time, and six or seven digits for 0.1s depending upon the input frequency. Usable resolution may be further reduced by noise, particularly at low frequencies.

Accuracy
Measurement accuracy is the sum of the timebase accuracy and measurement resolution plus one count.

TIMEBASE

Crystal Oscillator Frequency:	10MHz
Initial Oscillator Adjustment Error:	± 2ppm (closed-case adjustable by user)
Oscillator Temperature Coefficient:	Typically less than ± 0.3ppm/°C 18°C to 28°C, ±10ppm –20°C to 70°C
Oscillator Ageing Rate:	<± 5ppm/year

OPERATING FACILITIES

Press to measure
With the power switch off, pressing any of the function select keys will power the instrument up in the corresponding function. The instrument will automatically switch off 15 seconds after the last key press.

Hold
Pressing the Hold key will stop further measurements being made and the current measured value will remain in the display until the Hold key is pressed again.

Noise filter
The Filter key controls a low pass filter, with a cut-off frequency of about 50kHz, to ensure more stable readings at low frequencies.

Signal activity indicator
When no input signal is detected the Trig indicator will be off, indicating that no measurement is possible. The gate time indicator flashes until the first measurement interval is complete.

DISPLAY

No. of Digits:	8.5 digits (188888888)
Size of Digits:	11.5mm (0.45")
Annunciators:	15 annunciators

POWER REQUIREMENTS

Battery Type:	9V PP3 alkaline
Battery Life:	Typically 20 hours
Low Batt. Indicator:	'Bat' shows in display when approximately 10% of battery life remains

GENERAL

Operating Range:	+5°C to +40°C, 20% to 80% RH
Storage Range:	-20°C to +60°C
Environmental:	Indoor use at altitudes up to 2000m Pollution Degree 2
Size:	81mm x 178mm x 30mm (W x L x D)
Weight:	190gms excluding battery
Electrical Safety:	Complies with EN61010-1
EMC:	Complies with EN61326

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.

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