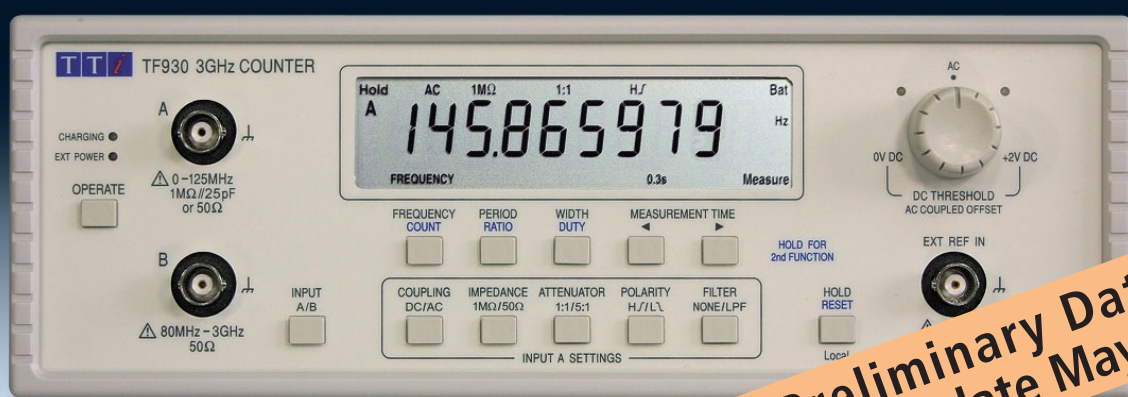




# THURLBY THANDAR INSTRUMENTS

## TF930



### 3 GHz high resolution bench/portable universal frequency counter

[tti-test.com](http://tti-test.com)

- ▶ 0.001Hz to 3000MHz frequency range
- ▶ Frequency, period, pulse width and totalise modes
- ▶ Reciprocal counting measurements
- ▶ Low pass filter, attenuator and trigger level control

The TF930 is a portable, battery-operated, universal counter with a large 0.5" 10-digit liquid crystal display (LCD). The frequency range is 0.001Hz to 3GHz and measurement functions include frequency, period, ratio, pulse width and count.

The instrument uses a high quality temperature compensated internal frequency reference which has a low aging rate and is stable to within  $\pm 1$ ppm over the full temperature range. Its short warm-up time allows accurate measurements to be made even under portable battery powered conditions.

Input A has configurable coupling (AC or DC), input impedance (1M $\Omega$  or 50 $\Omega$ ), 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 50 $\Omega$  input for frequencies in the range 80MHz to 3GHz.

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

- ▶ Large 10 digit LCD display with annunciators
- ▶ Operation from built-in rechargeable batteries
- ▶ Low power consumption
- ▶ Remote control and readback via USB

For frequency, period and frequency ratio functions the instrument uses a reciprocal counting technique to provide high resolution at all frequencies. 8 significant digits of answer are produced in a 1 second measurement time, 9 digits in 10s and 10 digits in 100s with a granularity of less than 2 counts in the least significant digit. Indicators show measurement input configuration & function, measurement time & status, external reference connection, low battery and the units of the measurement which may be Hz, kHz, MHz, ns, us, ms or s.

The instrument has a USB interface which allows it to be remotely controlled using RS232 protocol via a computer's USB port. The remote commands of its predecessor instrument, the TF830, are compatible with the TF930 command set. The instrument can also be powered from a standard USB port.

The instrument operates 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.

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## Input Specifications

### Input A

Input coupling:	AC or DC
Input impedance:	1M $\Omega$ or 50 $\Omega$
Attenuation:	1:1 or 5:1
Active edge:	Rising or falling, or width high or low
Low pass filter:	Filter In (~50kHz cut-off) or Out
Trigger threshold:	Variable threshold for both DC and AC coupling
Input Impedance:	1M $\Omega$ /25pF (DC or AC coupled); or 50 $\Omega$ nominal (AC coupled only).
Frequency Range:	0.001Hz to >125MHz (1M $\Omega$ , DC coupled); < 30Hz to >125MHz (1M $\Omega$ AC coupled); < 500kHz to > 125MHz (50 $\Omega$ , AC coupled).
Trigger Threshold:	DC coupled - 0 to 2V (1:1 attenuation) or 0 to 10V (5:1 attenuation) AC coupled - Average $\pm$ 200mV (1:1) or $\pm$ 1V (5:1 attenuation).
Input Signal Range:	1M $\Omega$ , DC coupled - 0 to 3.3V (1:1) or 1 to 12V (5:1 attenuation). 1M $\Omega$ , AC coupled - 1Vrms (3Vpp) (1:1) or 4Vrms (12Vpp) (5:1) 50 $\Omega$ , AC coupled - 1V rms above 300kHz.
Sensitivity:	Sinewave - 15mVrms 30Hz to 100MHz, 25mV to 125MHz (at optimum threshold adjustment).

### Input B

Input Impedance:	50 $\Omega$ nominal (AC coupled).
Frequency Range:	< 80MHz to >3GHz.
Sensitivity:	Sinewave - 12mVrms 80MHz to 2GHz, 25mVrms to 2.5GHz, 50mVrms to 3GHz.
Input Signal range:	<0dBm recommended, +13dBm (1Vrms) maximum.

### External Reference Input

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

### Maximum Input Voltage

Inputs A and B and External Reference:  
30Vdc; 30Vrms 50/60Hz with respect to ground, reducing to 1Vrms  
(or specified signal range) 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.

## Timebase

Measurement Clock:	50MHz.
Internal Reference:	10MHz TCXO with electronic calibration adjustment.
Temp. Stability:	Better than $\pm$ 1ppm over rated temperature range.
Initial Error:	< $\pm$ 0.2ppm at 25 $^{\circ}$ C.
Ageing Rate:	< $\pm$ 1ppm first year.
Calibration range:	> $\pm$ 8ppm.

## Measurement Functions

### Frequency (Input A or Input B)

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

### Period (Input A or Input B)

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

### Pulse Width Modes (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
Min. pulse width:	8ns

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## Frequency Ratio B:A

Resolution: Equal to the resolution of the two frequency measurements.  
If the ratio exceeds ten digits, six 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.

## Operating Facilities

### Noise Filter

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

### 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.

## Remote Control

All capabilities can be controlled remotely and measurements read through a USB port. The instrument can be powered (but the battery cannot be charged) by the USB host.

Interface:	Serial port emulation over USB.
Current consumption:	< 95mA (<5mA if AC adaptor power is present)
Command set:	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 from full charge.
Low Battery Indicator:	'Lo Bat' shows when approximately 10% of battery life remains.
Recharge Time:	<4 hours
Adaptor Supply range:	85 to 240V, 50 or 60 Hz,
Power consumption:	5W max at DC input to unit; 15VA max at AC adaptor input (charging).

## General

Display:	10 digit LCD, 12.5mm high (0.5"). Annunciators show input configuration, operating mode, measurement units and gate time.
Operating Range:	+5 $^{\circ}$ C to +40 $^{\circ}$ C, 20% to 80% RH
Storage Range:	-20 $^{\circ}$ C to +60 $^{\circ}$ 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

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

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