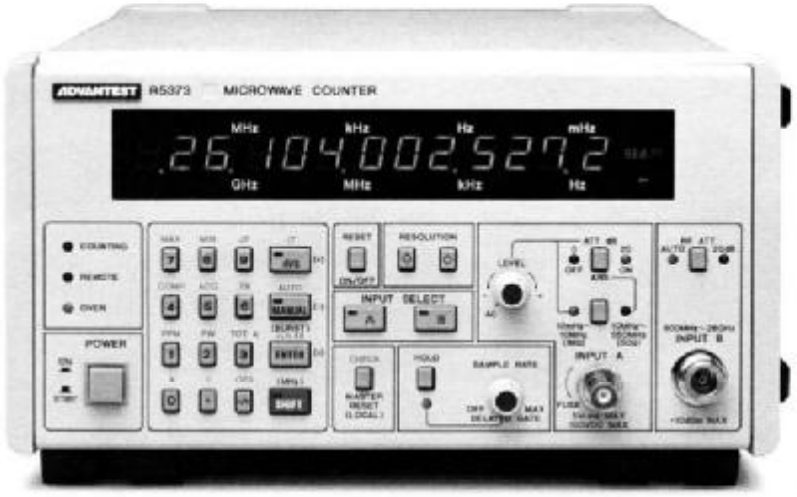
Electronic Counters

10 mHz to 18 GHz/27 GHz

R5372/5373

- **Wide Selection**
- **Digital TRAHET Technique**
- **Wide FM Allowable Range**
- **Digital Comparator Function and Wide Range of Built-In Calculation Functions**



(Photo is R5373)

R5372/5373

Microwave Frequency Counters

Recent research in communications and broadcast systems using microwaves in applications such as broadcast satellites, telephone circuits and the new field of submillimeter microwave and millimeter-wave communications systems have resulted in dramatic development in components and practical product designs. This research and development work requires highly accurate frequency measurements. Previous approaches to measure frequencies in these bands involved the use of frequency converters or converting oscillators. These methods, however, were difficult to use as it required troublesome tuning and calculations to determine the actual frequency.

To solve these problems, ADVANTEST has employed a digital TRAHET technique to achieve 1 Hz resolution with a gate time of just one second. It enables not only frequency measurement but the application of offset to frequency results and calculation of standard deviation, ppm, maximum values, minimum values and other useful parameters. In addition, a digital comparator has been provided and totalizing and measurements of the carrier frequency of pulse-modulated signals are also possible.

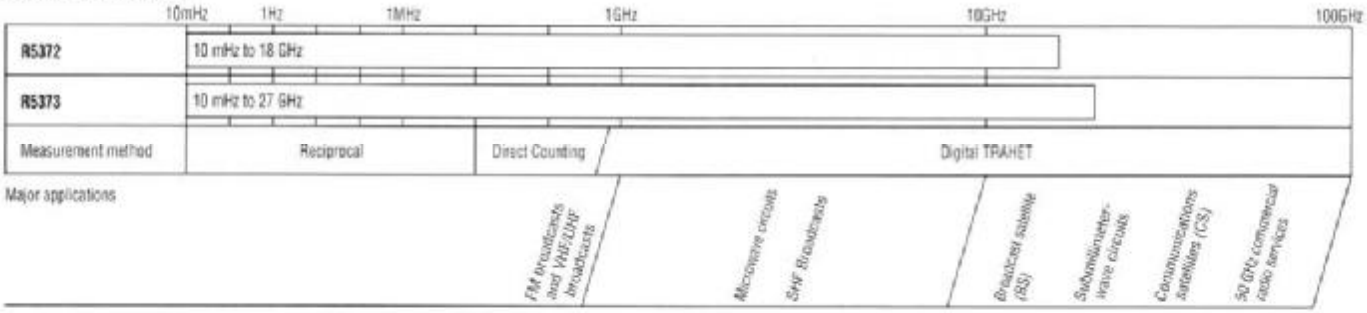
■ Measurements up to the Microwave and Millimeter-wave Bands

Measurement ranges extend from 10 mHz to 18 GHz for the R5372 and 10 mHz to 27 GHz for the R5373. It enables a single counter to be used for broadcast satellite, satellite communications, pilot-signal measurements for radio equipment and many more diverse applications.

■ Reciprocal Counting Technique for High-Resolution Measurements

The 10 mHz to 10 MHz mode for the A input uses a reciprocal technique that calculates the frequency from the period of the input signal, thereby achieving high resolution in a short counting time. This enables high-resolution measurements of the pulse width of pulse-modulated signals and of pulse repetition frequencies. Making a measurement is as simple as setting the required measurement resolution; the rest is automatic with extremely easy selection of number of displayed digits, counting time and frequency.

Selection Guide



Ideal For Frequency Measurements Over a Wide Band Range

R5372/5373

■ Digital TRAHET Technique for Microwave Frequency Measurements

The digital TRAHET technique combines the advantages of the transfer technique which provides relatively high-sensitivity measurements and the heterodyne technique which provides high resolution. Implementing these under microprocessor control, a dramatic improvement in cost performance can be achieved. The frequency ranges covered are 500 MHz to 18 GHz (R5372), 500 MHz to 27 GHz (R5373). After heterodyning using the digital TRAHET technique, direct counting is used to provide 1 Hz resolu-tion in just 1 second.

■ Wide Allowable FM Range

Almost all microwave carrier signals are FM modulated by noise and parasitic FM, demanding from a counter the ability to tolerate a wide range of FM. In manual measurements, for a signal of 1.4 GHz or greater, these counters can tolerate ±125 MHz or more. In the range 500 MHz to 1.4 GHz, they can tolerate up to ±25 MHz. For automatic measurements, the tolerance for FM is 10 MHz p-p in the worst case.

■ Calculation Functions and Digital Comparator Provided as Standard

The R5372/5373 feature a built-in microprocessor which is used not only to control the measurement system but to simplify operations and perform calculations on measurement results as well.
Using these calculation functions, a moving difference display, scaling, 8-by-8 digit arithmetic operations and displays of calculated measured values of A/B inputs and B/C inputs are possible. These features greatly enhance versatility.

Key setting	Description
MAX	Maximum-value hold
MIN	Minimum-value hold
±F	Deviation (Defined as the difference between maximum and minimum values)
COMP	Digital Comparator (GO/NO-GO test)
AVG	Averaging (10^1 to 10^8 samples)
σ	Standard deviation
ACQ	Acquisition mode
TR	TR4110 Series marker frequency measurement
MANL	Manual acquisition mode
PPM	Parts per million
TOT A	A input totalize
CLR-KB	Clear keyboard
x, ÷, OFS	Arithmetic operation display

■ FM Deviation Measurements Are Simple

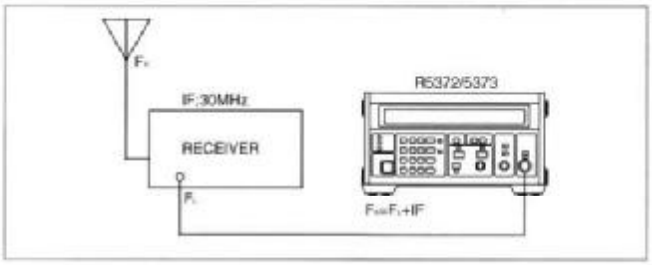
FPU and STL testing of TV relay equipment require measurements of transmitting output and frequencies as well as FM deviation measurements. The ΔF mode can be used to perform easy deviation measurements of FM modulated frequencies. Measurement by means of an external trigger signal is also possible.

■ Relay Station (STL or FPU) FM Deviation Measurements

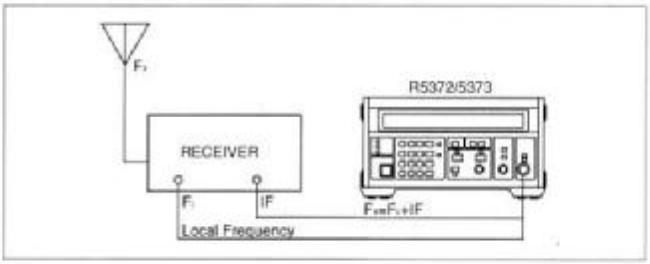
The R5372/5373 have a wide range of calculation functions which greatly simplify FM deviation measurements. By using an external signal to open a gate in sync, the ΔF mode is selected. After this, the delay knob can be turned to perform automatic internal calculation of the maximum and minimum values after measurements are started. By using an external start signal (1 μs min.) synced to an arbitrary amplitude point on a modulated signal, it is possible to determine the frequency variation with respect to amplitude of an FM-modulated (or other) signal.

■ Radio Equipment Frequency Measurements Using an IF Offset Display

The R5372/5373 have an IF offset display function which can be used to directly display the received frequency of a radio receiver. Simply input the IF frequency of the heterodyne receiver as an offset frequency from the keyboard and measure the local oscillator frequency to directly display the received frequency. The offset value can be set at any digit down to 0.1 Hz resolution when setting in MHz units. For local oscillator frequencies higher than the received frequency, the offset is simply input as a negative value.

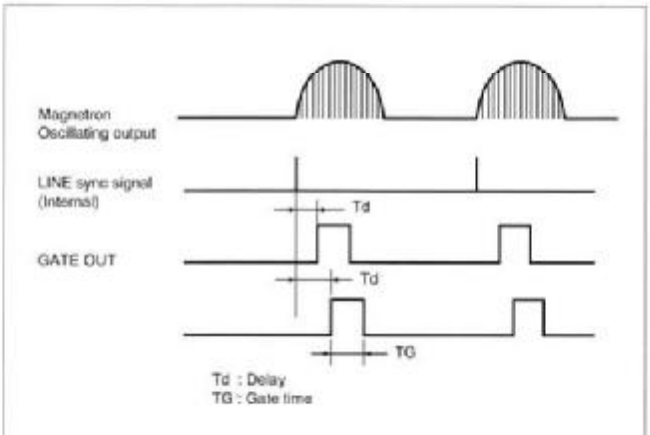


■ High-Accuracy Frequency Measurements on Radio Receivers



■ Measurement of Oscillating Frequencies In Magnetrons For Microwave Ovens

Since magnetrons in microwave ovens usually employ intermittent oscillations synched to the power frequency, measurement with conventional frequency counters has been extremely difficult. The R5372/5373 have a power sync mode to provide accurate synchronization without external apparatus for measuring oscillating frequencies. By adjusting the delay knob, the profile of the oscillating frequencies can also be measured.



Measurement of oscillating frequencies in magnetrons

Electronic Counters

10 mHz to 18 GHz/27 GHz

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Specifications

Input	Input A		Input B
Frequency measurement range	10 mHz to 10 MHz (DC coupling), 10 Hz to 10 MHz (AC coupling).	10 MHz to 550 MHz	500 MHz to 18 GHz (R5372) 500 MHz to 27 GHz (R5373)
Input impedance	Approx. 1 MΩ/60 pF max.	Approx. 50 Ω	Approx. 50 Ω
Input sensitivity	25 mVrms	25 mVrms	+10 dBm/ATT. AUTO +20 dBm/ATT.20 dB
Input attenuator	0 dB, 20 dB	ANS	AUTO, 20 dB
Maximum measurement input	500 mVrms/ATT.0 dB 5 Vrms/ATT.20 dB	500 mVrms/ANS OFF 5 Vrms/ANS ON	0 dBm/ATT.AUTO +10 dBm/ATT. 20 dB
Damage level input	6 Vrms (1 MHz to 10 MHz) 10 Vrms (400 Hz to 1 MHz) 100 Vrms (DC to 400 Hz)	6 Vrms	+10 dBm/ATT.AUTO +20 dBm/ATT.20 dB
Coupling	DC and AC	AC	AC
Trigger level	Approx. −1 V to 1V continuously variable (−10 V to +10 V with ATT at 20 dB)	–	–
Resolution / counting time	See Fig.	10 MHz/0.1 µs to 0.1 Hz/10 s switched in decade steps	
Measurement accuracy	±(Trigger error*1/measurement period) ±1 count ± time base accuracy (See Fig. for measurement period)	±1 count ± time base accuracy	±1 count ± time base accuracy ± residual stability (Residual stability: 1/10 × Measurement frequency (GHz) counts rms)
Measurement methodReciprocal method	Direct counting method		Heterodyne conversion followed by direct counting using a digital TRAHET technique
Input connector	BNC		N-type (R5372) SMA-type (with N type adaptor) (R5373)

*1 Trigger error: ±0.3% with respect to sinewave input of 40 dB or higher S/N

Pulse Modulated Carrier Frequency Measurement

(in manual mode)

Frequency range:
100 MHz to 550 MHz (INPUT A)
500 MHz to 18 GHz (INPUT B, R5372)
500 MHz to 27 GHz (INPUT B, R5373)

Pulse width: Minimum 0.5 µs

Pulse repetition frequency (f_R): 10 Hz to 5 MHz

Resolution: Set in decades from 0.1 Hz to 10 MHz (1/gate time).
Note however that the setting for resolution (gate time) must exceed the width of the pulse modulated wave being measured by at least 0.4 µs.

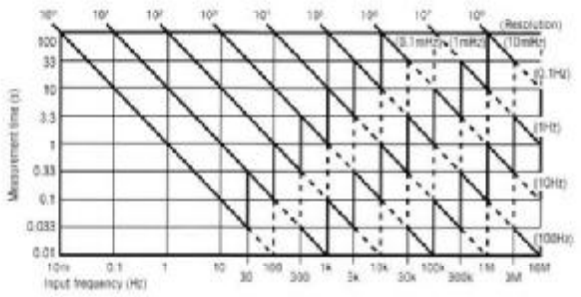
Accuracy: ±1 count ± time base accuracy

Units: Hz, kHz, MHz, GHz

Totalize: (Input A: 10 mHz to 10 MHz band)

Counting range: DC to 10 MHz

Counting capacity: 0 to 9,999,999,999



Maximum resolution: MSD 1 to 2: 9-digit display
MSD 3 to 9: 8-digit display
(resolution up to 0.1 mHz)

Fig. 1 Measurement Time, Resolution and Number of Periods With Respect To Input Frequency

Time Base

Time Base Stability:

	Standard	Option 21	Option 22	Option 23
Aging rate	2×10^{-9}/day	5×10^{-10}/day	2×10^{-9}/day	5×10^{-11}/day
	8×10^{-8}/mo	5×10^{-9}/mo	2×10^{-8}/mo	1×10^{-9}/mo
Long-term stability	1×10^{-7}/yr	8×10^{-8}/yr	5×10^{-7}/yr	2×10^{-8}/yr
Temperature stability (+25°C ± 25°C)	$\pm 5 \times 10^{-8}$	$\pm 5 \times 10^{-8}$	$\pm 1 \times 10^{-8}$	$\pm 5 \times 10^{-9}$

Time base output: Frequency 10 MHz, voltage 1 Vp-p (min.) output impedance approx. 50 Ω, BNC connector

External Frequency Standard Input: 1 MHz, 2 MHz, 2.5 MHz, 5 MHz and 10 MHz
Voltage 1 to 10 Vp-p
Input impedance Approx. 500 Ω, BNC connector

Calculation Functions

- Digital comparator (with respect to keyed-in upper and lower limits)
- Maximum value hold, minimum value hold
- Deviation measurement (maximum − minimum)
- Standard deviation
- Averaging
- PPM
- Offset display, drift display
- Scaling display
- Sum and difference display by automatic measurement of inputs A and B
- Harmonic frequency display
- Arithmetic operations

R5372/5373

General Specifications

Measurement modes (Inputs B and C):

AUTO 300 ms (Input B) and 1 s max. (Input C) Capture time (from reset to beginning of counting)
Allowable FM index 10 MHzp-p min.

MANUAL Fixed frequency base set by keyed input, no required capture time.
Bandwidth (allowable FM) at 0.5 GHz to 1.4 GHz and ±25 MHz min.

Synchronous trigger modes:

INT Internal triggering with the gate opening and closing in sync with the pulse modulated input signal.

EXT. START An externally applied start signal is used to open the gate. (The gate can only be opened when the internal detector output is on.) The start input signal is a 1.5 V ± (2 to 10) Vp-p pulse with 1 µs min. (sinewave also usable).

EXT. GATE An external applied start signal is used to open and close the gate.

LINE The gate is opened in sync with the power line frequency. (The gate can only be opened when the internal detector output is on.)

Sampling rate: 50 ms to 5 s continuously variable and HOLD

Delay time: 25 µs to 30 ms, continuously variable and OFF (delay from INT./EXT./LINE trigger until the start of counting).

Memory backup: Panel setting conditions are held as long as the AC line is feeding power. Contents of this memory are held for approximately 2 weeks by an internal Ni-Cd battery even without connecting the power cable. Full charging of this battery requires 2 to 3 days.

Display: 7-segment green LEDs, 12-digit memory display with fixed decimal point, character height approx. 11 mm

Operating environment:

Temperature 0 to +40°C

Humidity 85% RH max.

Storage temperature: –20 to +60°C

Option No.	Standard	Opt. 32	Opt. 42	Opt. 44
Line voltage	90 V to 110 V	103 V to 132 V	198 V to 242 V	207 V to 250 V

48 Hz to 66 Hz

Power requirements: Specified at time of ordering

Power consumption: 90 VA max. (R5372/5373)

Outer dimensions:

Approx. 255 (W) × 132 (H) × 420 (D) mm (R5372/5373)

Mass: 10 kg max.

Input/Output Functions

	R5372	R5373
GPIB interface	Option 01	Option 01
BCD data output	Option 02	Option 02

*Either Option 01 or option 02 can be selected (not both).
*These options may be added after delivery of the unit by factory retrofitting.

GPIB interface:

Standard 488-1978

Function Output of displayed data and remote control of all front panel functions.

AUX INPUT/OUTPUT:

Gate signal output, detector output, external reset signal input, measurement complete signal output.
Input/output level TTL
Connector 14-pin (Amphenol type 57-40140 equiv.)

D-A converted analog output (from AUX INPUT/OUTPUT connector):

No. of converted digits: Any 3 display digits

Output voltage: –4.995 V to +4.995 V ± 20 mV/+23°C ± 5°C

Output impedance: 100 Ω max.

Digital comparator output (from AUX INPUT/OUTPUT connector):

Level TTL negative logic, open collector output

Standard Accessories

Item	Model	Product code	Remarks
Power cable	**A01402**		Angle type
Input cable	**MI-02**		BNC-BNC
Input cable	**MI-04**		N-N
Input cable	**A01602**		SMA-SMA

Accessories (Sold separately)

For R5372/5373

R16058	Transit Case
A02448	Rack Mount Set (EIA)
A02248	Rack Mount Set (JIS)