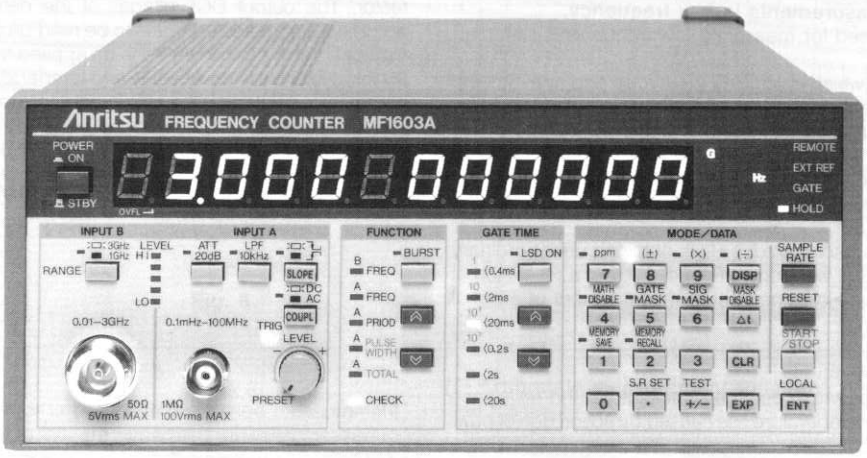
FREQUENCY COUNTER

MF1601A/1602A, MF1603A/1604A

0.1 mHz to 1 GHz **0.1 mHz to 3 GHz**

- High resolution/fast measurement time
- Frequency/period/pulse width/totalizing
- Parts per million (ppm) display/processing
- Burst signal measurement



《GP-IB》 OPTION

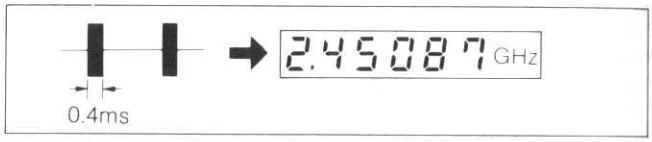
The MF1600 series are compact and easy to operate frequency counters. We are convinced of the world highest level of their performance. The reliability and cost-performance has been upgraded by developing a new custom LSI to reduce the number of logic circuits and by using a microprocessor. Multi-functions, such as 0.1 mHz to quasi-microwave frequency measurement, period measurement, pulse width measurement, and totalizing are provided. High resolution with a fast measurement time (10 digits displayed in 1 second) for a super-wide frequency range has been achieved by using reciprocal plus verniar techniques.

Burst signal measurement and signal masking functions, and low-pass filters expand the measurability of various input waveforms.

A ppm display and arithmetic operation functions are provided to permit display of final data expressed in a most effective numerals such as ratios, deviations or in a converted unit by processing measured results.

In addition, measurement and setting conditions can be easily stored and recalled for repeat measurements.

An optional GP-IB interface enables easy configuration of automatic measurement and monitoring systems.



Features

• High-speed/high-resolution measurement

The reciprocal method, which displays the measured frequency after counting back from the input signal period, plus the verniar technique, give a high resolution with a fast measurement time (10 digits displayed in 1 second).

• Burst signal measurement

The gate is opened synchronously after confirming the input signals. Intermittent signals, such as pulse-modulated waves can be accurately measured. A 6-digit display is available even when the gate time is 0.4 ms.

• Pulse width measurement

The input signal pulse width can be measured with a 10 ns single-shot resolution. It can also be measured in the average measurement mode with 300 ps resolution. Either a width of positive or negative pulse can be measured easily by the SLOPE setting.

• Totalizing

The number of pulses between the start and stop triggers can be totalled for signals up to 100 MHz.

• Mask function

It is difficult to eliminate the chattering noise influence on measured results when measuring relay switching time and so on. Using the SIG MASK function permits period measurement irrespective noise for periods from 5 μs to 1600 s.

For burst signal measurement, early signal fluctuations should be disregarded. The measurement start can be delayed by 1 μs to 16 s using the GATE MASK function.

• Processing function

Results can be displayed as required data such as rotation, speed, pressure, etc. after processing by setting a combination of ppm and arithmetic processing functions.

■ ELECTRONIC COUNTERS, POWER METER, VOLTMETER

Specifications

Model				MF1601A	MF1602A	MF1603A	MF1604A
Measurement Range				0.1 mHz to 1 GHz		0.1 mHz to 3 GHz	
Frequency measurement	Range	FREQ A	DC-coupled	0.1 mHz to 100 MHz			
			AC-coupled	10 Hz to 100 MHz			
			BURST	50 kHz to 100 MHz			
		FREQ B		10 MHz to 1 GHz		10 MHz to 1 GHz: (1 GHz) 0.5 to 3 GHz: (3 GHz)	
	Gate time			<0.4 ms, <2 ms, <20 ms, <0.2 s, <2 s, and <20 s, selectable. If the input signal period exceeds the above value the gate time becomes the same value.			
	Display digits			5, 6, 7, 8, 9, and 10 digits selectable, one digit added when LSD ON			
	Measurement accuracy			±1 count ±trigger error*1 ±time base accuracy*2: (FREQ A) ±1 count ±time base accuracy*2: (FREQ B) Fraction measurement error*3 added when LSD ON			
	Unit display			μHz, mHz, Hz, kHz, MHz, and GHz			
Period measurement	Range			10 ns 10,000 s			
	Gate time			<0.4 ms, <2 ms, <20 ms, <0.2 s, <2 s, and <20 s, selectable. If the input signal period exceeds the above value, the gate time becomes the same value.			
	Measurement error			±1 count ±trigger error*1 ±time base accuracy*2 Fraction measurement error*3 added when LSD ON			
	Unit display			ns, μs, ms, s, and ks			
Pulse width measurement	Range			20 ns to 10,000 s			
	Magnifying power (N)			1, 10, 10^2, and 10^3			
	Time unit			10 ns			
	Measurement error			±1 count ±(trigger error*1/√N) ±time base accuracy*2			
	Unit display			ns, μs, ms, s, and ks			
Totalizing	Range			DC to 100 MHz			
	Counting capacity			0 to (10^{11} – 1)			
Input	Input A	Sensitivity		10 mVrms (sinusoidal wave) 30 mVp-p (minimum pulse width: 5 ns)			
		Maximum allowable level		(ATT 20 dB) OFF: 10 Vrms (≦10 kHz), 1 Vrms (≦100 MHz), 0.5 Vrms (BURST) (ATT 20 dB) ON: 100 Vrms (≦10 kHz), 10 Vrms (≦100 MHz), 5 Vrms (BURST)			
		Trigger level		Approx. −1.5 to +1.5 V continuously adjustable, PRESET: Approx. 0 V. (ATT 20 dB) ON: Approx. −15 to +15 V continuously adjustable			
		Coupling		AC/DC switchable			
		Trigger slope		+/− switchable			
		Low-pass filter		Cut-off frequency: 10 kHz, ON/OFF switchable			
		Connector/impedance		BNC-type, ≧1 MΩ ≦25 pF			
	Input B	Voltage range		10 mVrms to 5 Vrms (BURST): Max. 0.5 Vrms		10 mVrms to 5 Vrms (≦2.8 GHz) 30 mVrms to 5 Vrms (≦3 GHz) (BURST): Max. 0.5 Vrms	
		Coupling		AC		AC	
		Connector/impedance		BNC-type, 50 Ω		N-type, 50 Ω	
Common	Reference oscillator	Frequency		10 MHz			
		Starting Characteristics		≦5×10⁻⁸/day (30 min. after power-on)			
		Aging rate*4		≦2×10⁻⁸/day (after 24-hour operation)			
		Temperature characteristics		±5×10⁻⁸ (25° ±25°C)			
		External output		10 MHz, ≧2 Vp-p (open), BNC connector on rear, Internal impedance: ≦400 Ω			
		External input		1, 2, 5 or 10 MHz, 2 to 5 Vp-p, BNC connector on rear, Input impedance: ≧100 Ω			
	Calculation function			Sum, difference, product, and quotient of measured and set values, and ppm display			
	Mask function			Signal rejection within set period and measurement start delay settings			
	Memory function			Save/recall nine panel setting conditions			
	Display			11 digits, seven-segment green LED			
	Sample rate			Approx. 80 ms, 0.2 s, 2 s, and HOLD, selectable Approx. 20 ms to 9999 minutes setting available			
	Power			AC85 to 132 V or AC170 to 250 V, 50/60 Hz, ≦45 VA (at starting: ≦50 VA)			
				—	DC +10 to 30 V	—	DC +10 to 30 V
	Dimensions and weight			88H × 213W × 351D mm, <5 kg			

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■ ELECTRONIC COUNTERS, POWER METER, VOLTMETER

*1 On sinusoidal wave input of: Where, signal period is T (s), signal amplitude is Es (Vo-p), and noise peak value at 100 MHz bandwidth is En (Vo-p)

$$T \times \frac{(1.75 \times 10^{-4} + 0.32 \times En)}{Es} \text{ (s)}$$

*2 Calibration is made after 24-hour operation, at 23° ±5°C; the time base accuracy becomes (2×10^{-8} /day) × input signal frequency.
*3 At frequency measurement: (1 ns/real gate time) × input signal frequency
At period measurement: (1 ns/real gate time) × input signal period
The real gate time is varied by the input signal and 20 to 85% of the panel display.
*4 The standard model aging rate is $\leqq 4 \times 10^{-8}$ /week, $\leqq 8 \times 10^{-8}$ /month, and $\leqq 1 \times 10^{-7}$ /year.

Options

Option 01 Reference Oscillator	Aging rate: After 24-hour operation, $\leqq 5 \times 10^{-9}$/day ($\leqq 5 \times 10^{-8}$/month and $\leqq 7.5 \times 10^{-8}$/year) Temperature characteristics: $\pm 5 \times 10^{-8}$ (25° ±25°C)
Option 02 Reference Oscillator	Aging rate: After 24-hour operation, $\leqq 2 \times 10^{-9}$/day ($\leqq 3 \times 10^{-8}$/month and $\leqq 4.5 \times 10^{-8}$/year) Temperature characteristics: $\pm 1.5 \times 10^{-8}$ (25° ±25°C)
Option 03 Reference Oscillator	Aging rate: After 48-hour operation, $\leqq 5 \times 10^{-10}$/day ($\leqq 1 \times 10^{-8}$/month and $\leqq 1.5 \times 10^{-8}$/year) Temperature characteristics: $\pm 5 \times 10^{-9}$ (25° ±25°C)
Option 06 GP-IB Interface	IEEE STD 488 Interface functions: SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, and C0

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name		Remarks
	Main frame		
MF1601A	Frequency Counter		0.1 mHz to 1 GHz
MF1602A	Frequency Counter		0.1 mHz to 1 GHz
MF1603A	Frequency Counter		0.1 mHz to 3 GHz
MF1604A	Frequency Counter		0.1 mHz to 3 GHz
	Standard accessories		
J0127A	Coaxial Cable, 1 m:	1 pc	BNC-P•RG-58A/U•BNC-P
J0017	Power Cord, 2.5 m:	1 pc	
J0266	Adaptor:	1 pc	3-pole to 2-pole
J0474	Power Cord (for DC Operation):	1 pc	MF1602A/1604A only
F0010	Fuse, 1.6 A:	2 pcs	T1.6A250V
F0042	Fuse, 0.8 A:	1 pc	MF51NN250V0.8ADC01 (MF1601A/1603A only)
F0043	Fuse, 1 A:	1 pc	MF51NN250V1ADC01
F0046	Fuse, 3.15 A:	2 pcs	MF51NN250V3.15ADC01 (MF1602A/1604A only)
W0458AE	MF1601A/1602A Operation Manual:	1 copy	For MF1601A/1602A
W0458BE	MF1601A/1602A Service Manual:	1 copy	For MF1601A/1602A
W0459AE	MF1603A/1604A Operation Manual:	1 copy	For MF1603A/1604A
W0459BE	MF1603A/1604A Service Manual:	1 copy	For MF1603A/1604A
	Options		
MF160□A-01	Reference Oscillator		Aging rate: $\leqq 5 \times 10^{-9}$/day
MF160□A-02	Reference Oscillator		Aging rate: $\leqq 2 \times 10^{-9}$/day
MF160□A-03	Reference Oscillator		Aging rate: $\leqq 5 \times 10^{-10}$/day
MF160□A-06	GP-IB Interface		
	Peripheral instruments		
MH648A	Pre-Amplifier		100 kHz to 1200 MHz
MZ5004A	Battery Pack/Charger		For MF1602A/1604A
	Optional accessories		
J0025A	Coaxial Cable, 1 m		S-5DWP•5D2W•S-5DWP
J0025C	Coaxial Cable, 2 m		S-5DWP•5D2W•S-5DWP
J0054A	Coaxial Cable, 1 m		3CA-P2•RG-58A/U•Alligator clips
J0104A	Coaxial Cable, 1 m		BNC-P•RG-55/U•N-P
J0001	Probe		For transmitter, 10 kHz to 30 MHz
J0040	Coaxial Adaptor		N-P•BNC-J
J0395	High-Power Fixed Attenuator		30 dB, 30 W, N-type, DC to 9 GHz
MP613A	RF Fuse Element		5 pcs/pack
MP526C	High-Pass Filter		For 250 MHz band
MP526D	High-Pass Filter		For 400 MHz band
J0007	GP-IB Cable, 1 m		408JE-101
J0008	GP-IB Cable, 2 m		408JE-102
Z0140	Battery		For MZ5004A, 2 pcs/set
B0270	Carrying Bag (small)		For frequency counter only
B0271	Carrying Bag (big)		With battery pack/charger
B0272	Carrying Case (small)		For frequency counter only
B0273	Carrying Case (big)		With battery pack/charger
B0274A	Rack Mount Kit		IEC3U (with handles)
B0274C	Rack Mount Kit		JIS, 149H mm (without handles)
B0026	Protective Cover		
Z0152	Service Kit		