

## SPECIFICATIONS

### ●Frequency A

Range	1 Hz to 120 MHz (1/2-prescaler)	1 Hz to 60 MHz
Gate Time	10 ms, 0.1 s, 1 s, 10 s	CH B gate (CH B pulse width)
Display	Hz, kHz, MHz	
Resolution	$\frac{\pm 10 \text{ ns} \pm \sqrt{2} \times \text{Trigger error}^*}{\text{Gate time}} \times \text{Frequency [Hz]}$	
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Frequency) [Hz]	

### ●Frequency B

Range	1 mHz to 60 MHz	
Gate Time	10 ms, 0.1 s, 1 s, 10 s	
Display	mHz, Hz, kHz, MHz	
Resolution	$\frac{\pm 10 \text{ ns} \pm \sqrt{2} \times \text{Trigger error}^*}{\text{Gate time}} \times \text{Frequency [Hz]}$	
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Frequency) [Hz]	

### ●Frequency C

Range	100 MHz to 2 GHz (1/128-prescaler)	
Gate Time	10 ms, 0.1 s, 1 s, 10 s	
Display	MHz, GHz	
Resolution	$\frac{\pm 10 \text{ ns} \pm \sqrt{2} \times \text{Trigger error}^*}{\text{Gate time}} \times \text{Frequency [Hz]}$	
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Frequency) [Hz]	

### ●Period B

Range	20 ns to 999.999999 s	
Multiplier	1, 10, 100, 1000	
Display	ns, $\mu$ s, ms, s	
Resolution	$\frac{\pm 10 \text{ ns} \pm \sqrt{2} \times \text{Trigger error}^*}{10^N}$ [s]	$10^N$ denotes the scaling factor (N = 0, 1, 2, 3)
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Frequency) [s]	

### ●Frequency Ratio A/B

Range	A, B: 1 mHz to 60 MHz (displays 0 in the case of A < B, if multiplier = 1)	
Multiplier	1, 10, 100, 1000	
Display	$\mu$ , m, k, M	
Resolution	$\frac{\pm A\text{-input count} \pm \sqrt{2} \times B\text{-input trigger error}^*}{10^N}$	
Accuracy	Resolution	

### ●Time Interval A $\rightarrow$ B

Range	60 ns to 999.999999 s; A, B: 1 mHz to 50 MHz	
Multiplier	1, 10, 100, 1000	
Display	ns, $\mu$ s, ms, s	
Dead Time	200 ns (Multiplier = 10, 100, 1000)	
Resolution	$\frac{\pm 10 \text{ ns} \pm A\text{-input trigger error}^* \pm B\text{-input trigger error}^*}{\sqrt{10^N}}$ [s]	
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Time) $\pm$ Trigger level timing error** $\pm$ 10 ns interchannel error***	

### ●Pulse Width B

Range	20 ns to 999.999999 s	
Multiplier	1, 10, 100, 1000	
Display	ns, $\mu$ s, ms, s	
Resolution	$\frac{\pm 10 \text{ ns} \pm \text{Rising-edge trigger error}^* \pm \text{Falling-edge trigger error}^*}{\sqrt{10^N}}$ [s]	
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Time) $\pm$ Trigger level timing error**	

### ●Duty Factor B

Range	0.00000001 to 0.99999999	
Multiplier	1, 10, 100, 1000	
Display	Indicates ratios in numerals (50% reads as 0.5)	
Resolution	$\left( \frac{\pm \text{Pulse width} +  \text{Pulse-width resolution} }{\text{Period} -  \text{Resolution of period} } - \text{Duty factor} \right)$	
Accuracy	$\left( \frac{\pm \text{Pulse width} +  \text{Pulse-width accuracy} }{\text{Period} -  \text{Accuracy of period} } - \text{Duty factor} \right)$	

### ●Totalization A

Input Frequency Range	1 mHz to 50 MHz
Count Capacity	0 to 999999999
Count Error	$\pm 1$ count through measurement by Channel B gating
Counting Control	Manual start, or Channel B gating (pulse width)

### ●Revolution B (TC110 only)

Range	60 mrpm to 120 Mrpm
Gate Time	10 ms, 0.1 s, 1 s, 10 s
Display	rpm, krpm, Mrpm
Resolution	$\frac{\pm 10 \text{ ns} \pm \sqrt{2} \times \text{Trigger error}^*}{\text{Gate time}} \times \text{Revolution [rpm]}$
Accuracy	Resolution $\pm$ (Timebase aging $\times$ Revolution) [rpm]

### ●Peak Voltage A, B

Voltage Range	$\pm 5$ V (ATT = x1)
Frequency Range	50 Hz to 20 MHz
Resolution	20 mV (ATT = x1)
Measurement Error	Typically, $\pm 10\% \pm 40$ mV (ATT = x1) of reading for sine wave
Dynamic Range	250 mVp-p to 5 Vp-p

$$*\text{Trigger error} = \frac{\sqrt{X^2 + E_n^2}}{S.R} \text{ [s]}$$

X = Noise at counter input (=600  $\mu$ Vrms),

$E_n$  = Input signal noise,

S.R = Slew rate (V/s) of input signal at trigger level.

$$**\text{Trigger level timing error} = \left( \frac{20 \text{ mV}}{S.R(\text{start})} - \frac{20 \text{ mV}}{S.R(\text{stop})} \right) \pm \frac{\text{Trigger level setting accuracy}}{S.R(\text{start})} \pm \frac{\text{Trigger level setting accuracy}}{S.R(\text{stop})} \text{ [s]}$$

\*\*\* 10 ns interchannel error (error due to the difference in the internal delays on Channels A and B)

## ■ Common Specifications

### <Input Section>

#### ●Channels A and B input

Input Impedance	1 M $\Omega$ /45 pF (separate input mode) 500 k $\Omega$ /80 pF (Common A and B input mode)
Coupling	DC, AC, AC coupling: 35 Hz cutoff frequency
Attenuator	$\times 1, \times 10, \times 100$
Trigger Level	-5 V to +5 V (ATT = $\times 1$ ; 20 mV resolution) -50 V to +50 V (ATT = $\times 10$ ; 200 mV resolution) -250 V to +250 V (ATT = $\times 100$ ; 2 V resolution) Setting accuracy: $\pm 6\%$ of setpoint $\pm 30$ mV (ATT = $\times 1$ ) Slope: Selection of + or - slope Display: 7-segment LEDs with SETTING or DISPLAY key
AUTO Trigger	Automatic setting at half of the input amplitude Operating frequency range: Sine wave of 50 Hz to 120 MHz Sensitivity: 250 mVrms Setting accuracy: $\pm 100$ mV (at 0 V cross signal)
Operating Voltage Range	$\pm 5$ V (at ATT = $\times 1$ )
Input Sensitivity	50 mVrms: DC < Input frequency $\leq$ 60 MHz 100 mVrms: 60 MHz < Input frequency $\leq$ 120 MHz
Maximum Input Voltage	250 V (DC + ACpeak): DC $\leq$ Input frequency < 5 MHz $\frac{1.2 \times 10^3}{f[\text{MHz}]}$ V (DC + AC peak): 5 MHz $\leq$ input frequency < 120 MHz
Filtering of Superimposed Noise	100 kHz (-3 dB) first-order lowpass filter
Holdoff	Ignores the input signal for a specified duration (with the multiplier set at a factor of 1). Resolution: 100 $\mu$ s to 1 ms: allows setting in 100 $\mu$ s increments 1 ms to 10 ms: allows setting in 1 ms increments 10 ms to 100 ms: allows setting in 10 ms increments Accuracy: $\pm 100$ $\mu$ s
COM A	Switching of separate/common input modes for channels A and B
CH B Gate input	Gate signal when counting frequency A and Totalize
Minimum Input Pulse Width	10 ns (except for the measurement function FREQ-A)

#### ●Channel C input

Input Impedance	50 $\Omega$
Coupling	AC
Attenuator	$\times 1$
Operating Voltage Range	+13 dBm
Maximum Input Voltage	+30 dBm
Input Sensitivity	-20 dBm: 100 MHz $\leq$ Input frequency < 1 GHz -10 dBm: 1 GHz $\leq$ Input frequency $\leq$ 2 GHz

## <Timebase>

Internal Reference Frequency	10 MHz
Frequency Stability	Aging rate: $\pm 1.5 \times 10^{-6}$ /year Temperature characteristics: $\pm 3 \times 10^{-6}$ (5 to 40°C)
Reference Output	Frequency: 10 MHz (typ.) Output level: 1 Vp-p (50Ω) (square wave)
External Reference Input	Frequency: 10 MHz $\pm 10$ Hz Input level: 1 to 7 Vp-p duty factor ranging from 40 to 60% for pulsed signals Coupling: AC Input impedance: 1 kΩ or greater

## ● High Stability Timebase (Optional)

Crystal Oscillator	Digital, temperature-compensated crystal oscillator
Frequency	10 MHz
Frequency Stability	Aging rate: $\pm 1 \times 10^{-7}$ /year Temperature characteristics: $\pm 1 \times 10^{-7}$ (5 to 40°C) Short-term stability: $\pm 5 \times 10^{-10}$ rms/s

## <General Specifications>

Display	7-segment red LEDs for 9 digits decimal
Sampling Rate	4 ms or greater, or hold Peak voltage measurement: 20 ms
Memory Function	Stores/recalls eight panel setups with the STORE/RECALL key (non-volatile memory).
Scaling Function	The following algebraic formula is applicable to any measurement function except the peak voltage measurement. $aX + b$ , where <b>X</b> is the measured value, <b>a</b> is the scale factor (scale value), and <b>b</b> is the offset. Two different formulas can be set for each measured value.
Communications Function	GP-IB interface (equipped as standard) Conforming standards: IEEE STD 488-1978 (JIS C1901 - 1987) Transfer rate: Approx. 5 ms (200 data/s) Subsets: SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0 Size of internal memory: 1024 words max. Sample rate to memory: 1 ms or from 10 ms to 300 s, settable in 10 ms steps
Operating Temperature Range	5 to 40°C (41 to 104°F)
Operating Humidity Range	35 to 85% RH, where the maximum wet-bulb temperature is 29°C
Storage Temperature Range	-20 to 60°C (-4 to 140°F)
Power Consumption	60 VA max.
Supply Voltage Range	90 to 110 V AC or 108 to 132 V AC or 207 to 253 V AC
Rated Power Supply Frequency	50/60 Hz (operating frequency range: 48 to 63 Hz)
Dimensions	Approximately 213 mm × 100 mm × 330 mm (W × H × D)
Weight	Approximately 3.6 kg (counter unit alone)

Recommended operating conditions: Temperature: 23±2°C  
Humidity: 50±10% RH  
Power supply voltage: 100 V ±1%

**Note:** Allow the TC110 and TC120 to warm up for more than 30 minutes to obtain the performance specified above.

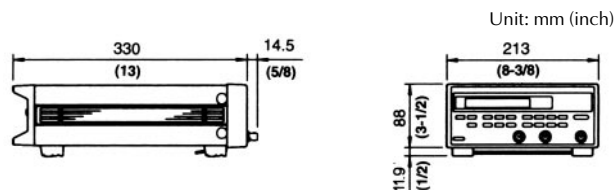
## AVAILABLE MODELS

Model	Suffix code	Description
704111		TC110: 120-MHz model having no Channel C input
704112		TC120: 2-GHz model equipped with Channel C input
Power Requirements	-1	90 to 110 V AC
	-4	108 to 132 V AC
	-7	207 to 253 V AC
Power Cord	-D	UL, CSA standard
	-F	VDE standard
	-R	SAA standard
	-J	BS standard
Optional Features	/T1	High stability timebase
	/D1	D/A output
	/H1	Handler interface (isolated model)
	/H2	Handler interface (non-isolated model)

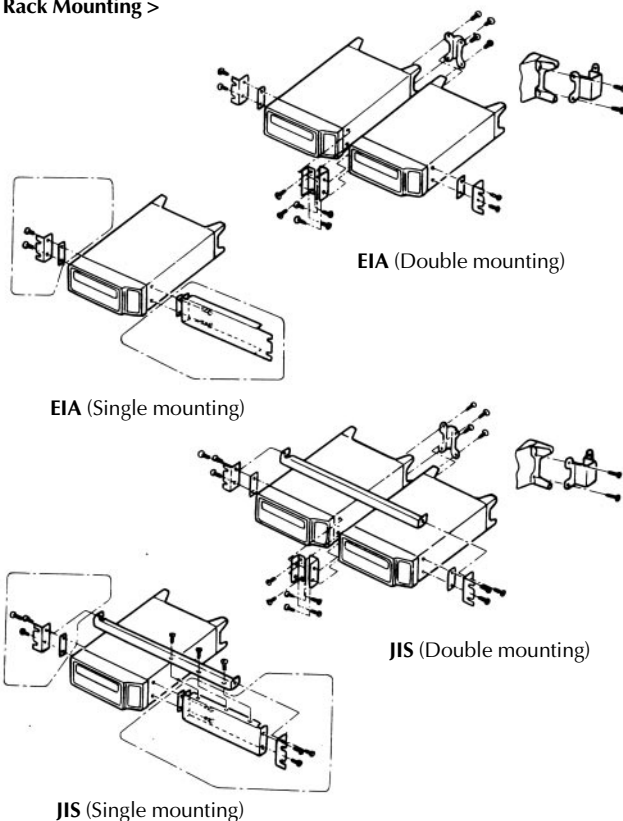
## ■ Optional Accessories

Name	Code	Description	Unit of sale
50Ω terminator	700976	Through-type	1
Conversion adapter	366921	BNC banana terminal	1
BNC cable	366924	BNC alligator clip (1 m)	1
BNC cable	366925	BNC alligator clip (2 m)	1
BNC cable	366926	With alligator clips	1
Rack mounting kit	751501	EIA single mounting (for one counter)	1
Rack mounting kit	751502	EIA double mounting (for two counters)	1
Rack mounting kit	751503	JIS single mounting (for one counter)	1
Rack mounting kit	751504	JIS double mounting (for two counters)	1

## DIMENSIONS



## < Rack Mounting >



EIA (Double mounting)

EIA (Single mounting)

JIS (Double mounting)

JIS (Single mounting)