YOKOGAWA

704111 & 704112 Universal Counters TC110 & TC120

TC110 (704111)
213 × 100 × 330mm 3.6kg
(8-3/8 × 4-3/8 × 13" 7.9 lbs)

TC120 (704112)
213 × 100 × 330mm 3.6kg
(8-3/8 × 4-3/8 × 13" 7.9 lbs)

GP-IB

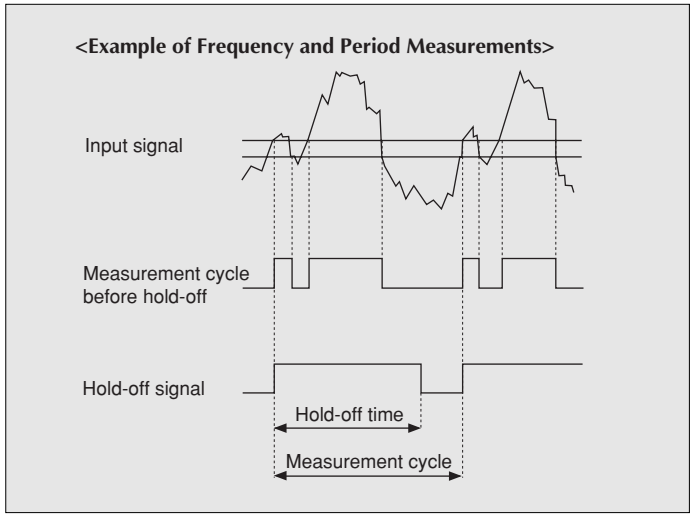
Models TC110 and TC120 are less expensive, multifunctional, universal counters equipped with a GP-IB as standard. These models are fully GP-IB programmable and allow you to control all your panel setups via the GP-IB so you can use these counters in an automated measurement system. Thanks to the internal memory that stores up to 1024 data items, you can sample and output data at high speeds with the GP-IB commands. You can also measure a variety of waveform parameters, such as the duty factor and peak voltages, as well as time parameters including frequencies, time intervals and totalizations — all with one counter. Other features include the digit-masking, scaling, D/A output and handler interface functions. Models TC110/TC120 respond to users' needs with well-balanced features in functionality, GP-IB communication, ease of use, and price.

FEATURES

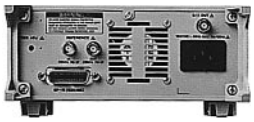
- **Resolution of 8 digits in one second with the reciprocal frequency counting**
- **Single-shot resolution of 10 ns with multiphase clock system**
- **Wide measuring range from 1 mHz to 2 GHz**
- **Fully GP-IB programmable**
- **Easy operation**
- **Convenient AUTO trigger**
- **Withstand voltage of 250 V (DC + ACpeak)**
- **Store/recall of setup data**
- **D/A output (optional)**
- **Handler interface (optional)**
- **High stability timebase (optional)**

FUNCTIONS

- **Fast Sampling**
  The TC100 Series have an internal memory which allows you to sample and store up to 1024 pieces of data using GP-IB commands. The TC100 Series can achieve a fast sampling rate since the display is not updated when storing measured data into the memory. The stored data can be transferred over GP-IB bus with a "time stamp" so you can see how your data vary with each measurement.
- **Peak Voltage Measurement**
  With the TC100 Series, you can measure peak voltages as well as time parameters. You have two simultaneous 3 digit displays of the high and low peak-voltage levels.
  These peak voltages can be used as benchmarks for voltage-based GO/NO-GO judgments in inspection lines.
- **Display of Trigger-level Setpoint**
  When you are setting the trigger level manually, you can change its setpoint while still continuing measurements. In addition, you can confirm the trigger level digitally on the display. Setting is easy. Use the SETTING key to set the trigger level in 20-mV increments (when ATT = ×1).
- **Digit-masking Function**
  You can mask the least significant digits as necessary. Masking them allows the measured value to appear only to the degree of accuracy you require (only in the number of digits you require). Use this function when the input signal is unstable or the insignificant digits fluctuate plus or minus one digit in counting a number, due to error. This function is extremely useful when using the counter as a monitor in the field or on a production line.
- **Scaling Function**
  The TC100 Series computes the algebraic formula (aX + b) for every measured value X, except for those of peak voltage measurements, where a is the scale factor (scale value), and b is the offset; the constants a and b can be set at the user's discretion. The resulting computation appears on the LED display. One or two different settings of the formula can be saved in the internal memory and retained even after the power is turned off. This function is especially useful when converting to other physical quantities or when measuring a deviation from the reference value.
- **Gate Signal Input on Channel B**
  You can use the input signal on Channel B as an external gate signal for frequency and totalization measurements. In this way, you can set an arbitrary timing to start measurement or you can change the resolution.
- **Hold-off Function**
  The hold-off function allows you to set a length of time in which signals carrying chatter from relays or systematic noise will be disregarded. The counter then ignores the input signal for that duration, making your measurements free from noise.



● D/A Output (Optional)



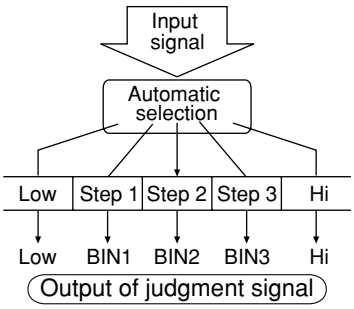
You can equip your counter with the optional D/A output.
This function converts and outputs in analog form measured data such as frequency, period, time interval, duty factor, pulse width, and frequency ratio. You can thus use the TC100 Series as an F/V converter. Connecting the TC100 Series to a recorder enables you to visually check the change in each measured value so you can also use it as a counter that can record data.

< Overview of specifications of D/A output function >

Output voltage range	0 to +10 V (full scale), 15 bits D/A
Range setting	Setting in 6 digits of the maximum and minimum values of the D-to-A converted span
Response Time	4 ms or greater
Output Terminal	BNC

● Handler Interface Function (Optional)

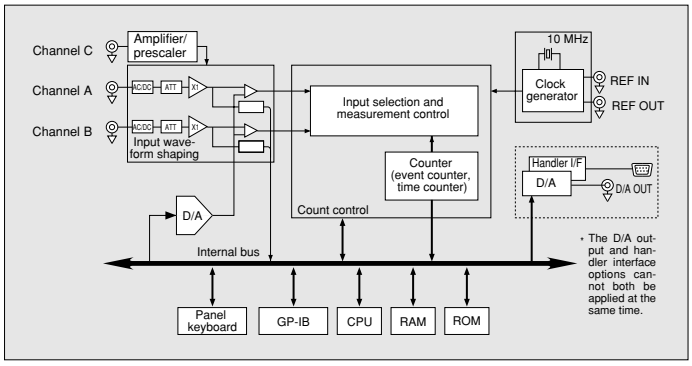
You can equip your counter with the optional handler interface.
This function partitions the span of measured data, such as frequency, period, time interval, duty factor, pulse width, or frequency ratio into a maximum of five segments. Thus, the interface automatically identifies to which segment the measured data belong, and outputs the appropriate BIN signal from the rear connector.
The TC100 Series makes it possible for you to carry out automatic GO/NO-GO selection of products in a production line without the use of a controller.



< Overview of handler interface function specifications >

Input/Output Signal Type	Optically isolated open-collector input/output
Output of Judgment Signal	Partitions the measured values into a maximum of five segments for use as judgment criteria
Handshake Signal	/EXT_TRIG: Start-of-measurement signal (input) /EOM: End-of-measurement signal (output)
Connector type	9-pin D sub

■ TC120 BLOCK DIAGRAM



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 ±(Timebase aging × 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 ±(Timebase aging × 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 ±(Timebase aging × Frequency) [Hz]

●Period B

Range	20 ns to 999.999999 s
Multiplier	1, 10, 100, 1000
Display	ns, µs, 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 ±(Timebase aging × 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	µ, m, k, M
Resolution	$\frac{\pm\text{A-input count} \pm \sqrt{2} \times \text{B-input trigger error*}}{10^N}$
Accuracy	Resolution

●Time Interval A ➛ B

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

●Pulse Width B

Range	20 ns to 999.999999 s
Multiplier	1, 10, 100, 1000
Display	ns, µs, 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 ±(Timebase aging × Time) ±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	$\left(\pm\frac{\text{Pulse width} + \lvert\text{Pulse-width resolution}\rvert}{\text{Period} - \lvert\text{Resolution of period}\rvert} - \text{Duty factor}\right)$
Accuracy	$\left(\pm\frac{\text{Pulse width} + \lvert\text{Pulse-width accuracy}\rvert}{\text{Period} - \lvert\text{Accuracy of period}\rvert} - \text{Duty factor}\right)$

●Totalization A

Input Frequency Range	1 mHz to 50 MHz
Count Capacity	0 to 999999999
Count Error	±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	mrpm, 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 ±(Timebase aging × Revolution) [rpm]

●Peak Voltage A, B

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

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

X = Noise at counter input (=600 µVrms),
En = Input signal noise,
S.R = Slew rate (V/s) of input signal at trigger level.

**Trigger level timing error = $\left(\frac{20\text{ mV}}{S.R(\text{start})} - \frac{20\text{ mV}}{S.R(\text{stop})}\right) \pm \frac{\text{Trigger level setting accuracy}}{S.R(\text{start})} \pm \frac{\text{Trigger level setting accuracy}}{S.R(\text{stop})}$ [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 MΩ//45 pF (separate input mode) 500 kΩ//80 pF (Common A and B input mode)
Coupling	DC, AC, AC coupling: 35 Hz cutoff frequency
Attenuator	×1, ×10, ×100
Trigger Level	–5 V to +5 V (ATT = ×1 ; 20 mV resolution) –50 V to +50 V (ATT = ×10 ; 200 mV resolution) –250 V to +250 V (ATT = ×100 ; 2 V resolution) Setting accuracy: ±6% of setpoint ±30 mV (ATT = ×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: ±100 mV (at 0 V cross signal)
Operating Voltage Range	±5 V (at ATT = ×1)
Input Sensitivity	50 mVrms: DC < Input frequency ≤ 60 MHz 100 mVrms: 60 MHz < Input frequency ≤ 120 MHz
Maximum Input Voltage	250 V (DC + ACpeak): DC ≤ Input frequency < 5 MHz $\frac{1.2 \times 10^3}{f[\text{MHz}]}$ V (DC + AC peak): 5 MHz ≤ 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 µs to 1 ms: allows setting in 100 µs increments 1 ms to 10 ms: allows setting in 1 ms increments 10 ms to 100 ms: allows setting in 10 ms increments Accuracy: ±100 µs
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	50Ω
Coupling	AC
Attenuator	×1
Operating Voltage Range	+13 dBm
Maximum Input Voltage	+30 dBm
Input Sensitivity	–20 dBm: 100 MHz ≤ Input frequency < 1 GHz –10 dBm: 1 GHz ≤ Input frequency ≤ 2 GHz

<Timebase>

Internal Reference Frequency	10 MHz
Frequency Stability	Aging rate: ±1.5 × 10^{-6}/year Temperature characteristics: ±3 × 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 ±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: ±1 × 10^{-7}/year Temperature characteristics: ±1 × 10^{-7} (5 to 40°C) Short-term stability: ±5 × 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 **X** is the measured value, **a** is the scale factor (scale value), and **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.

UNIVERSAL COUNTERS

TC110 & TC120

AVAILABLE MODELS

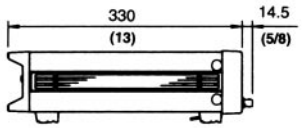
Model	Suffix code		Description
704111			TC110: 120-MHz model having no Channel C input
704112			TC120: 2-GHz model equipped with Channel C input
Power Requirements	**-1**		90 to 110 V AC
	-4		108 to 132 V AC
	-7		207 to 253 V AC
Power Cord	**-D**		UL, CSA standard
	-F		VDE standard
	-R		AS standard
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

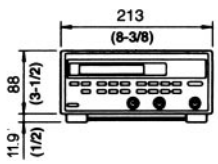
● Optional Accessories

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

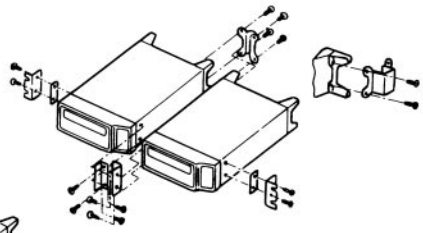
DIMENSIONS

Unit: mm (inch)

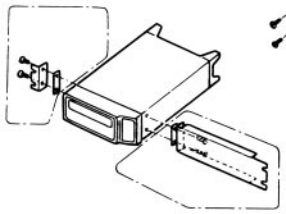




< Rack Mounting >



EIA (Double mounting)



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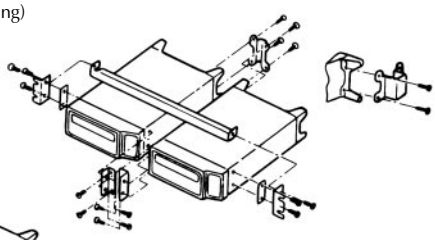
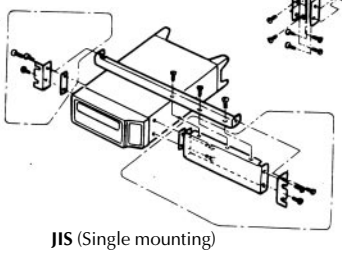


JIS (Double mounting)



JIS (Single mounting)