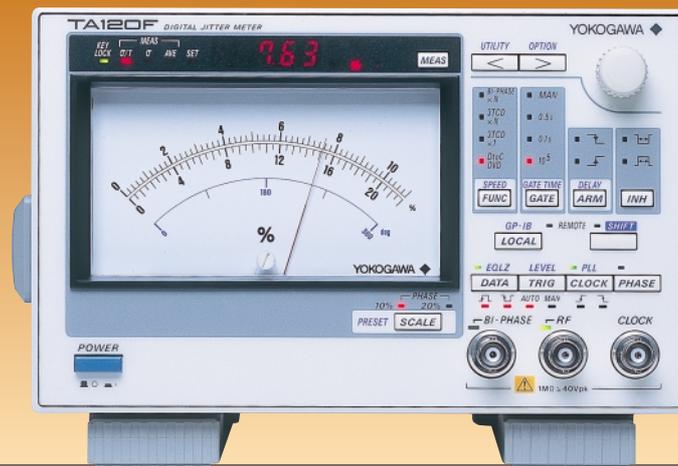


# High Precision

TIA Jitter Measurement

## Digital Jitter Meter

# TA 120F



- High-precision, high-repeatability measurements using the TIA measurement principle
  - High-speed measurements (maximum speed: 50 ms)
    - Applicable to CD/DVD
- External synchronization enabled by inhibit and external arming functions
  - Bi-Phase measurement (optional)
  - External I/O control (optional)
  - Level measurement (optional)



# Standard features include Equalizer, Auto-slicer, and PLL clock regenerator circuit!

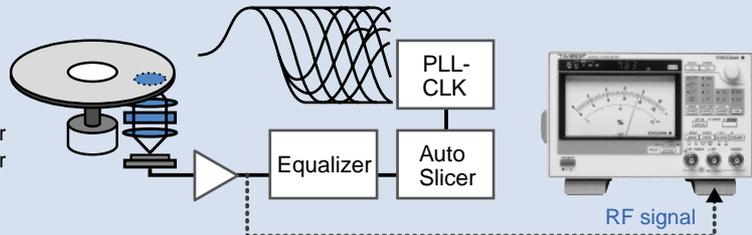
The TA120F offers diverse ways of measurement, such as direct measurement of a signal immediately after the pickup output and high-precision measurement by binarizing a signal in the same way as with Yokogawa time interval analyzers.

## DVD Jitter Measurement Examples with TA120F

### Measurement with one RF signal

Settings in TA120F : Equalizer: On  
PLL clock: On  
Auto-slicer: On

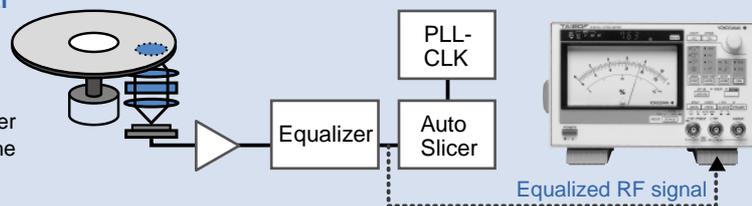
Measures the data-to-clock phase difference jitter with one input of an RF signal immediately after the pickup output.



### Measurement with one equalized RF signal

Settings in TA120F : Equalizer: Off  
PLL clock: On  
Auto-slicer: On

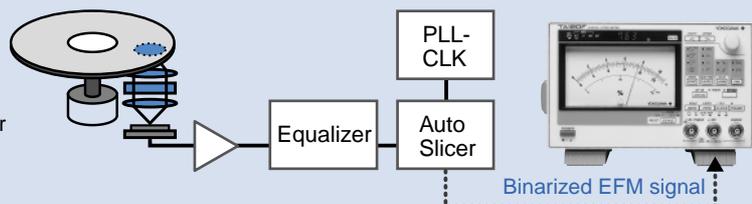
Measures the data-to-clock phase difference jitter with one input of an RF signal that has passed the equalizer.



### Measurement with one binary signal

Settings in TA120F : Equalizer: Off  
PLL clock: On  
Trigger: Manual

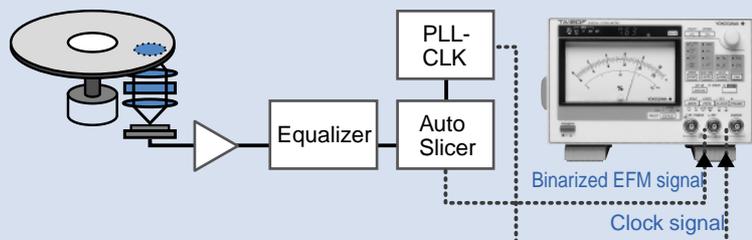
Measures the data-to-clock phase difference jitter with one input of a binarized EFM data signal.



### Measurement with two signals

Settings in TA120F : Equalizer: Off  
PLL clock: Off  
Trigger: Manual

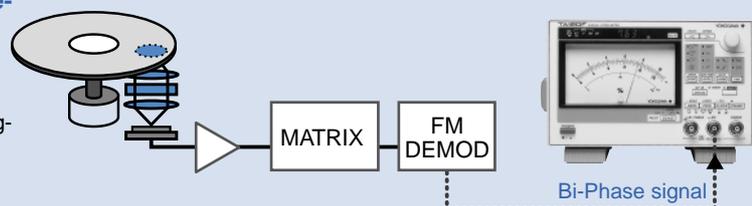
Measures the data-to-clock phase difference jitter with two inputs of a binarized EFM data signal and clock signal.



### Measurement with a Bi-Phase signal (de-modulated ATIP signal) input

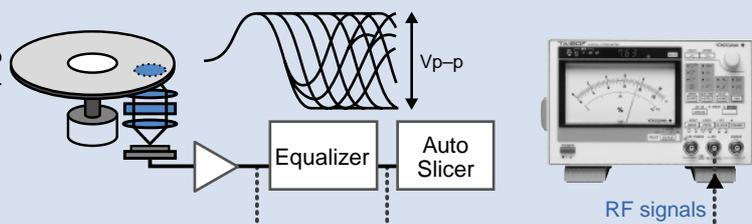
Settings in TA120F : Function: Bi-Phase xN  
Trigger: Manual

Measures the 1T jitter on a binarized Bi-Phase signal input.



### RF signal level measurement

Measures the levels of an RF signal at the pickup output and after equalizer simultaneously with jitter measurement.

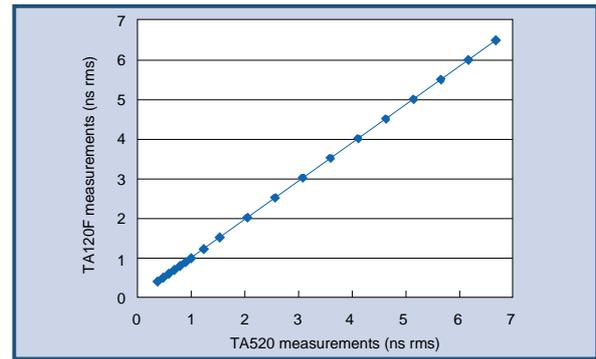


# Time interval analyzer method does high-precision measurements!

## High-precision measurements ensuring data compatibility from development to production

The TA120F is a precision jitter meter adopting the same TIA system as that found in the high-end TA320 and TA520 time interval analyzers. The TA120F's internal TIA measurement mechanism has a continuous sampling rate of 10 MS/s. Measurements are fully compatible with the TA320 and TA520, so high-precision measurements can be maintained from development to production.

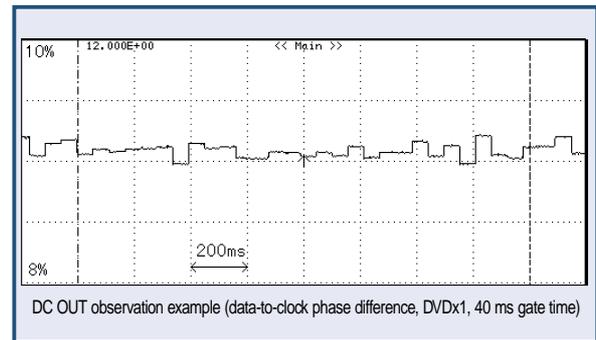
(The graph on the right shows data-to-clock phase difference jitter measurements for DVDx1)



## High speed measurements improved production efficiency

The TA120F has a fast calculation time needing only 20 ms for calculations. For DVD standard-speed EFM data (10<sup>5</sup> samples) measurements, this enables high-speed measurements at nearly 20 ms measurement time plus 20 ms calculation time. In other words, measurements are updated in approximately 40-ms intervals. This makes it possible to significantly reduce the measurement and testing time on production lines.

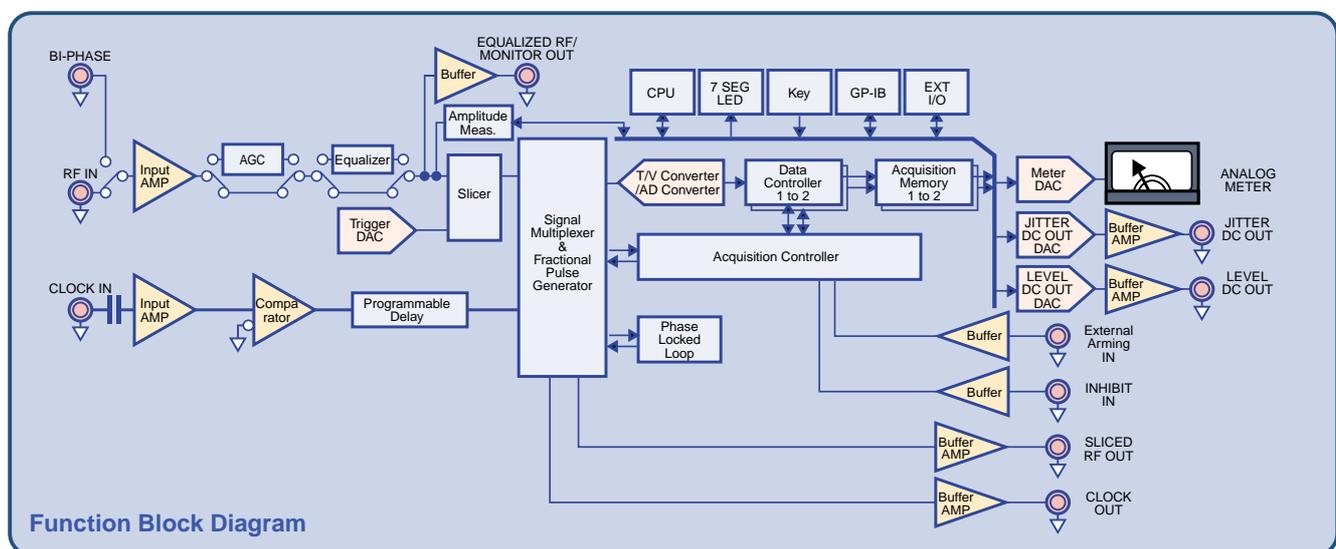
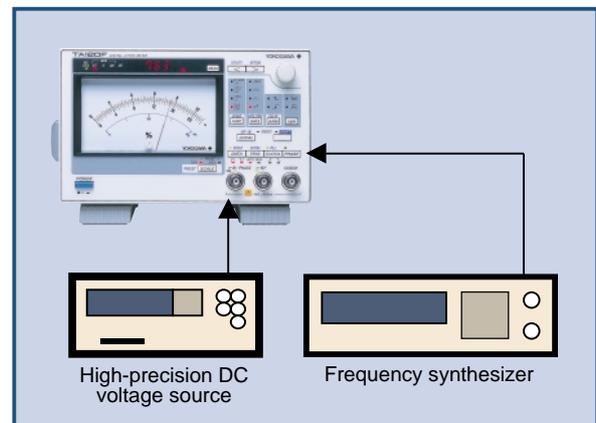
In addition, jitter values are converted to 0.2 V/% before being output through DC OUT on the rear panel. This eliminates the need for a communications interface when transferring data to a computer since measurements can be uploaded as analog voltage values.



## Self-diagnosis and self-calibration Reduction of Labor and calibration costs

The TA120F's time measurement unit and jitter calculation unit are fully digital and capable of standalone self-diagnosis and self-calibration. The self-diagnostic function utilizes an internal reference voltage and signal source for standalone calibration of trigger level, T-V converter, clock input phase compensation, and circuit-system delay.

It is recommended that the TA120F be calibrated once a year. However, if precision is checked using a jitter-free signal generator (such as a frequency synthesizer) and a high-precision DC voltage generator (to check the trigger level), then you can perform the calibration at your factory. This significantly reduces on-site costs, such as shipping costs, calibration costs, shipping labor, and repair time.

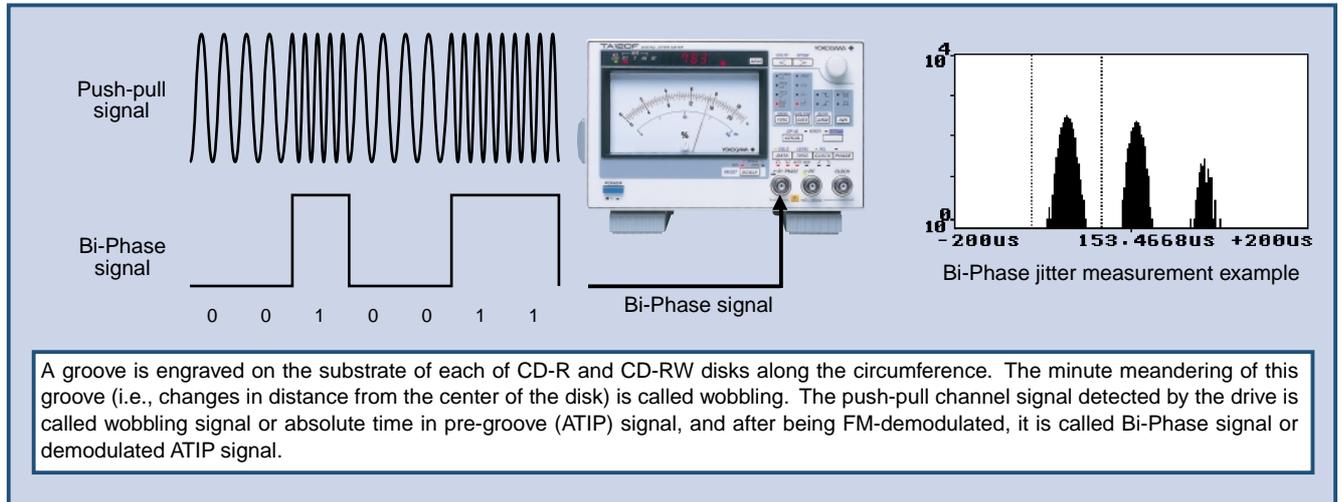


# Extensive features provide superb jitter measurement support!

## ■ Bi-Phase measurement function (option code /BP1)

With the optional Bi-Phase measurement function, the TA120F can measure the jitter on a Bi-Phase signal (i.e., an FM-demodulated wobble signal) of x1 to x32 speed CD-R/RW. In addition, it can:

- Calculate the jitter ratio  $\sigma/T$  from the clock signal T (158.730  $\mu\text{s}/N$  where N is the multiple of speed from 1 to 32), in the Bi-Phase signal;
- Display the digital value of the average of the 1T pulse widths in the Bi-Phase signal and;
- Output Bi-Phase jitter values as an analog voltage signal and output the judgment signal from the rear panel, not merely displaying them.



## ■ Preset function and external I/O control function (option code /E1)

You can previously save up to 7 sets of settings for your TA120F to memory and load a desired set from memory. These preset settings include all necessary settings except for the GP-IB address—very convenient for switching among settings for different measured objects such as when you have to measure jitters for CD and DVD disks. With the optional external I/O control function, the settings can be switched by simply selecting the preset No. remotely.

### General Specifications of External I/O Control

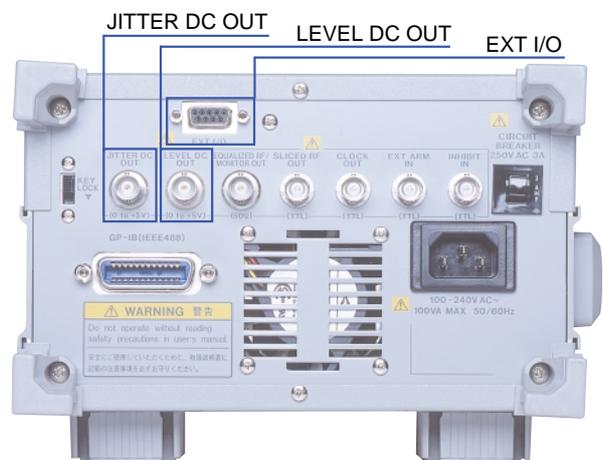
Connector:	D-sub 9 pins (female)
Input/output level:	TTL level
Input/output signals:	On/off of remote control
	PRESET No. : 3 bits (up to 7 sets of settings)
	Jitter judgment output
	Level judgment output

## ■ Level measurement function (option code /L1)

The level measurement function enables measurement of the amplitude ( $V_{p-p}$ ) of an input RF or Bi-Phase signal simultaneously with jitter measurement. The measurements are shown as digital values on the LED display as well as output as an analog voltage signal from the connector on the rear panel. In addition, the judgment signal can be output via the optional external control I/O connector.

### Measurement outputs from rear panel

JITTER DC OUT:	Analog voltage signal of or judgment signal for jitter measurements
LEVEL DC OUT:	Analog voltage signal of or judgment signal for level measurements
EXT I/O:	Judgment signal for jitter or level measurements

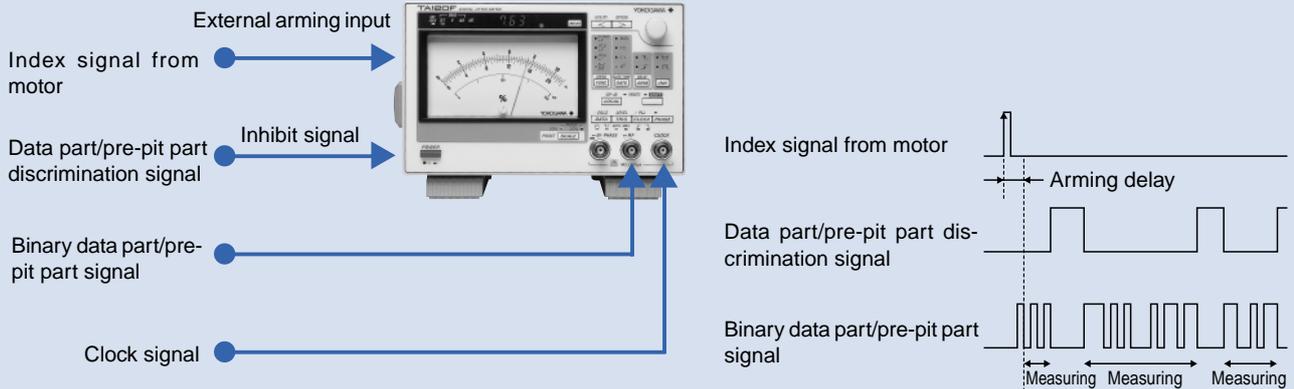


Rear panel of TA120F provided with optional level measurement and external I/O control functions

## Inhibit and external arming functions

The TA120F features the inhibit and external arming functions for synchronization with an external signal. This allows for jitter measurements on only the data part or only the pre-pit part of each sector of optical disks. Since the TA120F calculates the jitter value based on the measured values stored to memory just like the time interval analyzers do, the TA120F can perform jitter measurements even when the standby period is long such as when performing pre-pit jitter measurements.

### Example of jitter measurement for data and pre-pit parts using inhibit and external arming functions



## Measured-jitter correction

The measured jitter ratios can be corrected using a linear equation with preset factors a and b such that:

$$\text{Corrected jitter ratio (\%)} = a \times \text{measured jitter ratio} + b (\%)$$

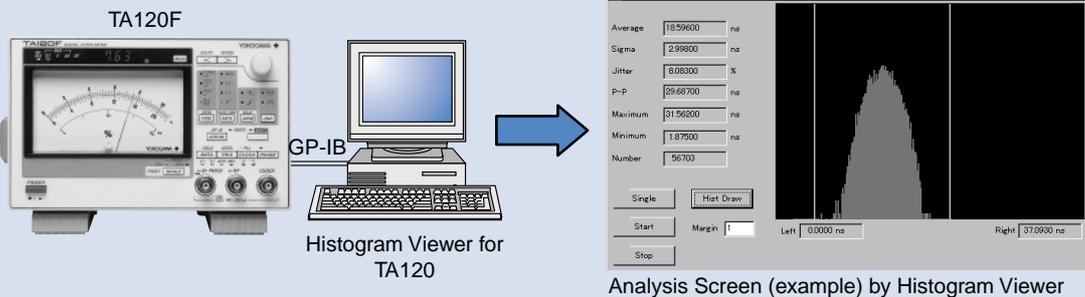
All of the LED's digital indication, meter reading, and jitter DC output show the corrected jitter ratio.

## Indication of moving average jitter

The TA120F can calculate the moving average for a specified number (1 to 10) of the most recently measured jitter or level values. The calculated average can be displayed in the LED digital indicator and meter (only at jitter measurements) as well as output as the jitter DC output.

### Use free Histogram Viewer for jitter histogram analyses on PC!

With Histogram Viewer for TA120 (free software), you can transfer TA120F's histogram data (data-to-clock phase difference jitter,  $3T\sigma$ ) to a PC through the GP-IB interface, analyze the jitter histograms, and check measurement reliability. Histogram Viewer for TA120 can be downloaded from Yokogawa's web site at <http://www.yokogawa.com/tm/Bu/TA120F/>. (This software is for TA120, TA120-S1, TA120E and TA120F.)



## Standard Specifications

Item	Specification
Sampling rate	10 MS/s at data-to-clock phase difference jitter measurements
Internal jitter	3T jitter: 300 ps rms; data-to-clock phase difference jitter: 400 ps rms
Sample size	100,000 samples/100 ms/500 ms/arbitrary (1.0 ms to 1 second, in steps of 0.1 ms)
Measurement Function	3T jitter, data-to-clock phase difference jitter, and moving average 3T jitter: CDx1/arbitrary (x1.0 to x10, in steps of x0.1) Polarity: RF input (↕) or (↗) Data-to-clock phase difference jitter: 0 ns to 40 ns Polarity: RF input (↗/↕/↖ & ↘), clock input (↗/↕)
Display	Analog meter: CD and DVD jitter ratio (%) LED display: jitter value (ns or %) Display range: 0 to 20% (LED goes up to 25%)
Measurement update rate	Maximum 50 ms (100,000 samples, DVDx1, measurement on both edges)
Input specifications	RF input Input signal: RF signal (before/after passing equalizer), sliced signal (minimum input pulse width: 15 ns) Input: DC coupled, 1 MΩ, 35 pF (typical) (Equalizer, auto-slicer ON: AC coupled) Input sensitivity: 100 mVp-p (equalizer ON or Auto-slicer ON: 200 mVp-p) Input range: -5 V to +5 V (equalizer, auto-slicer ON: 4 Vp-p) Trigger level: MANual = -5 V to +5 V (1 mV steps) Level precision: Setting ±(4% + 10 mV) AUTO = Auto-slicer ON AUTO + MANual = AUTO + set voltage (-1 V to +1 V) Maximum input voltage: 40 V (DC + ACpeak)(DC ≤ input frequency ≤ 100 kHz) Clock input Input: AC coupled, 1 MΩ, 35 pF (typical) Input sensitivity: 100 mVp-p Input range: -5 V to +5 V Maximum input voltage: 40 V (DC + ACpeak)(DC ≤ input frequency ≤ 100 kHz) Trigger level: 0 V fixed, ↕/↖ (select) Maximum input frequency: 25 MHz to 60 MHz (Duty: 45 to 55%) Phase adjustment: 0 to 40 ns (in steps of 0.1 ns) Arming input Setting: Internal/External ↕/↖ (select) Input: Zin = 10 kΩ TTL level Arming delay: 0 ms to 1 second, in steps of 0.1 ms Inhibit input Setting: POS/NEG (select) Input: Zin = 10 kΩ TTL level
Other functions	GP-IB interface Preset function: Up to 7 settings can be saved. The desired setting can be loaded (remotely by optional external I/O control, too) JITTER DC OUT: 50 Ω Output mode: Jitter ratio output/judgment output (select) Output level: 0 to +5 V DC (0.2V/% by default, can be scaled arbitrarily). Judgment output level: TTL level (Upper and lower judgment level can be set) Output accuracy: ±10 mV Output filter: Moving average of 1 to 10 most recently measured values EQUALIZED RF/MONITOR OUT Equalized RF output: 1 Vp-p, 50 Ω Monitor output: ±5 V, 50 Ω SLICED RF OUT: 50 TTL level CLOCK OUT: 50 Ω TTL level PLL clock regeneration 8-16 modulation setting equivalent to base clock of 27 MHz ± 10% INHIBIT IN, EXT ARM IN Equalizer (DVDx1) Equalizer circuit ON/OFF switching capability Frequency characteristic: +3.2 ± 0.3 dB (at 5.16 MHz, 300 kHz amplitude base) Group delay characteristic: Maximum group delay deviation: 6 ns (typical.) (range: 0.7 MHz ≤ f ≤ 6.7 MHz) Boost value setting range : 2.0 to 6.0 dB (0.1dB steps)
Rated supply voltage	100 V AC to 240 V AC
Rated supply frequency	48 Hz to 63 Hz
Maximum power consumption	100 VA
Display	Analog meter and seven-segment LED
External dimensions	Approximately 213 (W) × 132 (H) × 350 (D) (excluding protrusions)
Weight	Approximately 5 kg

The above performance specifications are obtained after warm-up under the reference operating conditions.  
Reference operating conditions: 23°C ± 5°C ambient temperature, 50% ± 10% (RH) ambient humidity, within 1% of supply voltage rating

## Specifications of Optional Functions

### External I/O Control

Item	Specification
Functions	External I/O control ON/OFF Switing Preset setting upto 7 measurement settings can be loaded from internal memory. Jitter judgment output Level judgment output (when the level measurement option is also provided)
Inputs/outputs	Connector: D-sub 9 pins, female Input/output impedance: Input ; 10 kΩ (typical); output ; 600 Ω (typical) Input/output level: TTL

Other than above is the same as the standard specifications

### Level Measurement Function

Item	Specification
Measured object	Maximum amplitude of RF or Bi-Phase input signal
Function	Can be switched on/off.
Measurement range	100 mVp-p to 4 Vp-p (equalizer ON or Auto-slicer ON) 100 mVp-p to 5 Vp-p (equalizer OFF, Trigger mode = MAN)
Measurement accuracy	±(5% + 10 mV) when measuring sine wave with 1 Vp-p amplitude and 100 kHz frequency
Display	Digital indication on the LED display Display resolution: 1 mVp-p
LEVEL DC OUT	LEVEL DC OUT: 50 Ω (typical) Output mode: Level (Vp-p)/judgment output (select) Output level: 0 to 5 V DC (1 V/Vp-p by default) Judgment output level: TTL level (Upper and lower judgment level can be set) Output accuracy: ±10 mV Output filter: Moving average of 1 to 10 most recently measured values

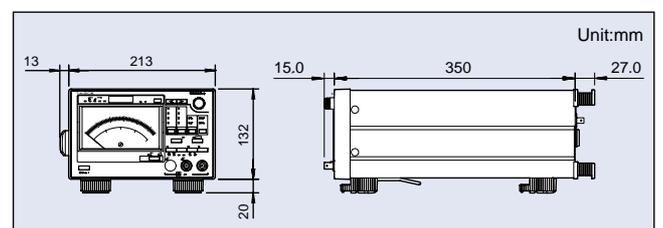
Other than above is the same as the standard specifications

### Bi-Phase Measurement Function

Item	Specification
Sampling rate	5 MS/s (mega samples/s)
Internal jitter	300 ps rms or less
Measured parameters	Bi-Phase jitter and average value. Drive speed setting range when selecting BI-PHASE (xN): X1.0 to x32.0, in steps of x0.1 Measurement range: 1T ± 80 (μs)/N (T = 158.73 μs when speed = x1; divided by speed rate N)
Measurement gate	Gate type: Select from 0.1 s/0.5 s/manual setting (1 ms to 1000 ms, in steps of 0.1 ms)
BI-PHASE input	Input connector: BNC (additional Bi-Phase input connector) Coupling: DC coupled Impedance: 1 MΩ, 35 pF (typical) Input sensitivity: 100 mVp-p Input range: -5 V to +5 V Trigger: Mode: MAN (Fixed) Slope: Hi/Lo (select) Set range: -5 V to +5 V, in steps of 1 mV Accuracy: ±(4% of setting + 10 mV) Maximum input voltage: 40 V (DC + ACpeak) (DC ≤ input frequency ≤ 100 kHz)
JITTER DC OUT	Output connector: BNC Coupling: DC coupled Impedance: 50 Ω (typical) Output mode: Jitter output/judgment output (select) Output level: 0 to +5 V (with high-impedance load) Judgment output level: TTL level (Upper and lower judgment level can be set) Output accuracy: ±10 mV (with high-impedance load) Output voltage: 0 to +5 V when T = (0 to 150)/N μs
Display	Analog meter (percentage reading) and seven-segment LED (%/ns or %/μs reading) Full scale: 10/20% (select) Display resolution: σ: 0.001 μs, σ/T: 0.01%, Average: 0.01 μs

Other than above is the same as the standard specifications

## Dimensions



## Model and suffix codes

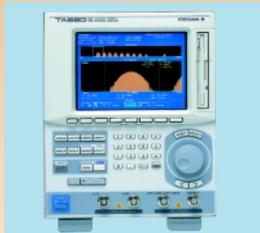
Model code	Suffix code	Description
704430		TA120F digital jitter meter
Power cord	-D	UL, CSA standard
	-F	VDE standard
	-R	SAA standard
	-J	BS standard
Options	/E1	External I/O control function
	/L1	Level measurement function
	/BP1	Bi-Phase measurement function

## Optional Accessories

Part	Model code	Suffix code	Specification	Quantity
BNC cable	366924		BNC-BNC (1 m)	1
BNC cable	366925		BNC-BNC (2 m)	1
50Ω terminator	700976		For pass-through	1
Rack mounting kit	751533	-E3	EIA standalone (one TA120F unit)	1
Rack mounting kit	751534	-E3	EIA linked (two TA120F units)	1
Rack mounting kit	751533	-J3	JIS standalone (one TA120F unit)	1
Rack mounting kit	751534	-J3	JIS linked (two TA120F units)	1

## Related models

### Time Interval Analyzer TA520



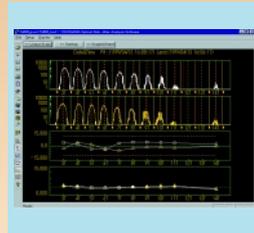
- Maximum continuous sampling rate: 43 MS/s
- Maximum sampling size: 10<sup>9</sup>
- Measurement resolution: 25 ps
- Internal jitter: 100 ps rms

### Time Interval Analyzer TA320



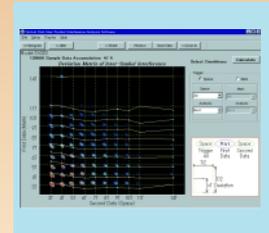
- Maximum continuous sampling rate: 14 MS/s
- Maximum sampling size: 99,999,999
- Measurement resolution: 100 ps
- Internal jitter: 300 ps rms

### Optical Disk Jitter Analysis Software for TA320/TA520



- Histogram, deviation, jitter, and trend displays
- Applicable to CD/DVD/MO/MD
- Requires National Instruments GP-IB board
- Runs under Windows 95/98/NT

### Optical Disk Inter-symbol Interference Analysis Software for TA320/TA520



- Inter-symbol interference analysis
- Deviation matrix analysis
- Applicable to CD/DVD/MO/MD
- Requires National Instruments GP-IB board
- Runs under Windows 95/98/NT

### Digital Oscilloscope DL1740



- Maximum sampling rate: 1 GS/s
- 500 MHz analog bandwidth
- Maximum record length: 1 MW
- Ethernet Interface 100 BASE-TX (optional)

### Digital Oscilloscope DL7200



- Maximum sampling rate: 2 GS/s
- 500 MHz analog bandwidth
- Maximum record length: 16 MW
- 4 channels analog input and 16-bit logic input

#### NOTICE

- Before operating the product, read the instruction manual thoroughly for proper and safe operation.
- If this product is for use with a system requiring safeguards that directly involve personnel safety, please contact the Yokogawa sales offices.

**YOKOGAWA** 

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