

# AUDIO DIGITAL PROCESSING JITTER METER

Applicable to Blu-ray Disc, Ideal for Adjusting and Inspecting Optical Pickup on the Production Line (Dedicated for x1 Speed)

CE  
Upon request



## LE 1871 DIGITAL PROCESSING JITTER METER

### GENERAL

The LE 1871 Jitter Analyzer is designed to measure the jitter conforming to Blu-ray Disc (Part 1, version 1.0, June 2002) standards.

Since the Conventional Equalizer, PLL clock regenerator, and jitter measurement section are provided as standard, HF signal output from a pickup can be directly applied to this instrument for measuring jitter. Using digital processing method as well as a TIA is used for the jitter measurement, quick and accurate measurement can be performed.

A large meter and LED panel allow this instrument ideal for production and inspection applications, as well as R&D.

The Limit Equalizer for Blu-ray Disc and various jitter measurement units for a DVD/CD or HFM are optionally available. Thus, jitter of DVD and CD, and HF and HFM of Blu-ray Disc can be measured using a single unit.

Optional GPIB and LAN are convenience to construct an automatic measurement system and ensure quality control.

### FEATURES

#### [Features on Blu-ray Disc measurement]

- **Applicable to three types of disc capacity (x1 speed)**  
Jitter of Blu-ray Disc with disc capacity of 23.3 GB, 25.0 GB, and 27.0 GB can be measured.
- **Equipped with Equalizer conforming to Blu-ray Disc standards**  
The Conventional Equalizer conforming to Blu-ray Disc standards is provided.  
The boost level of Conventional Equalizer can be varied.
- **Digital processing method for quick and accurate measurement**  
Root-mean-square value calculation using digital processing method enables quick and accurate measurement.
- **Measures the jitter of all-T components conforming to Blu-ray Disc standards**  
Measures all components of 2T to 8T and 9T of the HF (DATA) signal with respect to the CLOCK signal, then displays it as jitter in sigma format.
- **Displaying jitter in unit of %**  
Jitter component with respect to the clock signal is displayed in unit of percentage (%). No clock period setting is required since the clock is automatically regenerated from the HF (DATA) signal. Measurement will be made correctly even when the HF (DATA) signal deviation is 8%.

- **Three polarity modes**

Rising edge, falling edge, and both edges of DATA signal can be selected.

- **Applicable dual-layer disc**

The 2T component can be eliminated in DATA to CLOCK measurement mode used when inspecting a dual-layer disc.

#### [Features on Measurement]

- **High sensitivity**  
The HF (DATA) signal with a signal level between 0.1 Vp-p and 2.0 Vp-p can be measured.
- **Selectable response time**  
The jitter indication response time can be set from 0.1 to 5 seconds. Response time of the DC output can be separately set.
- **Analog and digital displays**  
The large analog meter is convenient for adjusting the device under test. Jitter measurement values are also displayed on the large LED panel for parallax-free reading.
- **ARMING/INHIBIT functions to specify measurement block on a disc**  
This instrument can correctly measure jitter even when faulty operation (e.g., track jumping) occurs based on the following functions:  
ARMING function can specify the block on a disc to measure jitter.  
INHIBIT function specify the block on a disc to inhibit measurement.  
The delay time, measurement time, and number of repetition measurements can be set.  
Monitor output connector for an oscilloscope is provided to check measurement block for correct.
- **Various monitor outputs**  
Input signal and equalized signal can be monitored.  
DC voltage in proportion to the meter indication is output.
- **Auto slicer**  
Auto slicer conforming to Blu-ray Disc standards is provide.

#### [Features on Production Line]

- **GO/NO GO judgment mode convenient for production line**  
Jitter measurement values are compared with the preset judgment limits, then displays the results on the LED. The result can also be output
- **Remote control function**  
Front panel controls such as jitter measurement range can be remotely controlled.
- **RS232C interface**  
This instrument can transfer front panel settings and jitter measurement value to a personal computer via the RS232C interface.  
The computer-control system can be used to construct an automatic measurement system and ensure quality control.
- **Simple operation**  
Equalizer boost level, judgment reference, and response time can easily be set with a jog dial.
- **Universal voltage**  
Since this instrument operates on 90 to 250 V, it can be used throughout the world.

**Input Section**

**HF INPUT (1-7 modulation signal input)**

**Input Coupling:** AC  
**Measurement Voltage Range:** 0.1 to 2.0 Vp-p  
**Input Range:** 3 ranges  
 0.3 V range: 0.1 to 0.3 Vp-p  
 0.9 V range: 0.3 to 0.9 Vp-p  
 2.0 V range: 0.9 to 2.0 Vp-p  
**Input Impedance:** 50 Ω  
**Auto Slicer:** Response time constant: 10 kHz  
**Maximum Input Voltage:** ±2.5 V

**Measurement Control (ARMING IN/INHIBIT IN)**

**Input Impedance:** 10 kΩ  
**Input Signal Level:** 0/+5 V  
**Maximum Input Voltage:** -0.7 V/+5.7 V

**Equalizer Section**

**Conforms to Blu-ray Disc (Part 1, version 1.0) standards.**  
**Applicable Format:** 1-7 PP modulation  
**Channel Bit Rate:** 66 MHz  
**Equalizer Mode:** Conventional Equalizer Mode  
**Gain Variable Range:** 0 to 8 dB (36 steps)  
**Gain Accuracy:** ±0.5 dB  
**Group Delay Deviation:** ≤2.0 nsp-p (5.8 dB: 3 MHz to 16.5 MHz)

**Jitter Measurement Section**

**Applicable Speed:** Clock frequency: 66 MHz ±4 %  
**Measurement Mode:** DATA to CLOCK  
 DATA to CLOCK 2T eliminate mode  
**Measurement Resolution:** 25 ps  
**Unit Displayed:** % (Sigma value with respect to clock period)  
**Measurement Accuracy**  
**Meter Indication:** ±5 % of full scale ± residual jitter  
**Digital Display:** ±5 % ± residual jitter

**Polarity Selection**

**DATA:**  $\overline{L}/\overline{F}$ ,  $\overline{L}/\overline{L}$ , BOTH  
**CLOCK:**  $\overline{L}$  (fixed)

**Measurement Time Constant:** 0.04 s to 5 s

**Measurement Control Section (ARMING/INHIBIT function)**

**Measurement Control Mode:** ARMING mode/INHIBIT mode

**Electrical Characteristics:**

**Input Impedance:** 10 kΩ  
**Input Signal Level:** 0/+5 V  
**Maximum Input Voltage:** -0.7 V/+5.7 V

**INHIBIT**

**ENABLE:** HIGH/LOW  
**COUNT:** 1 to 50, in 1 steps

**ARMING**

**SLOPE:** RISE/FALL  
**COUNT:** 1 to 50, in 1 steps  
**START DLY:** 0 to 999999 μs (in 1 μs steps min.)  
**LENGTH MODE:** SAMPLE/TIME  
**LENGTH:** 0.01 to 999999 μs (in 1 μs steps min.)(TIME only)

**Clock Regenerator (DATA to CLOCK mode only)**

**Regenerates reference clock signal from DATA signal input.**  
**HF:** 66 MHz ±8 %

**Clock Frequency Measurement Section (DATA to CLOCK mode only)**

**Measurement Range:** 60.72 MHz to 71.28 MHz  
**Measurement Accuracy:** ±0.1 %

**Judgment Section**

Outputs GO/NO GO results of jitter and frequency measured with respect to the preset value.

**GO/NO GO LED:** Indicate results corresponding to meter indications.  
**Dedicated Remote Control Connector:** Outputs judgment results for jitter measurement.

**Output Section**

**MONITOR OUT**

**To monitor the HF signal input.**  
**Output Impedance:** 50 Ω  
**Output Amplitude:** Up to 2.0 Vp-p ±30 %  
 (into 50 Ω, in proportion to input signal)  
**Output Connector:** BNC

**EQUALIZER OUT**

**To monitor equalized HF signal input.**  
**Output Impedance:** 50 Ω  
**Output Amplitude:** 0.8 Vp-p ±30 % (into 50 Ω)  
**Output Connector:** BNC

**DIGITAL OUT (DATA, CLOCK)**

**Outputs binarized DATA signal and clock signal regenerated by PLL.**  
**Output Signal:** DATA signal, CLOCK signal  
**Output Amplitude:** 0.15 Vp-p (into 50 Ω)  
**Output Offset Voltage:** 0.34 V (into 50 Ω)  
**Output Connector:** BNC

**DC OUT**

**Output Voltage:** 0.05 V/%  
**Output Accuracy:** ±2 %

**GATE MONITOR**

**To monitor arming/inhibit control signals.**  
**Output Amplitude:** TTL level  
**Output Impedance:** 1 kΩ

**Remote Control Section**

**Dedicated Remote Control Connector**  
**Communicates judgment results and front panel settings.**

**Pins for Front Panel Setting**  
**Input Level:** 0/5 V (pulled-up with 47-kΩ resistor)  
**Maximum Input Voltage:** -0.7/+5.7 V

**Judgment Results Output Pins**

**GO:** 5 V (open drain output, pulled-up with 47-kΩ resistor)  
**NO GO:** 0 V  
**Maximum Current Output:** 10 mA

**RS232C Interface**  
**Communication:** Controls function, outputs data.  
**Baud Rate:** 38400 bps max.

**Environmental Conditions**

**Operating Temperature:** 0 to 40 °C  
**Operating Humidity:** ≤ 85 % RH (without condensation)  
**Spec-Guaranteed Temperature:** 10 to 30 °C  
**Spec-Guaranteed Humidity:** ≤ 85 % RH (without condensation)  
**Storage Temperature:** 0 to 50 °C  
**Operating Environment:** Indoor use  
**Operating Altitude:** Up to 2,000 m  
**Overvoltage Category:** II  
**Pollution Degree:** 2

**Power Requirements**

90 to 250 VAC, 50/ 60 Hz, 35 Wmax.

**Dimensions and Weight**

213 (W) x 132 (H) x 300 (D) mm, 4.7 kg

**Accessories**

power cord ..... 1  
 Instruction manual ..... 1

**OPTION**

**OP70 Limit Equalizer (For Blu-ray HF)**

**Conforms to Blu-ray Disc (Part 1, version 1.0) standards.**

**Applicable Format:** 1-7 PP modulation  
**Channel Bit Rate:** 66 MHz  
**Equalizer Mode:** Conventional Equalizer Mode or Limit Equalizer Mode, selectable  
**Gain Variable Range:** 0 to 8 dB (36 steps)  
**Gain Accuracy:** ±0.5 dB  
**Group Delay Deviation:** ≤2.0 nsp-p (5.8 dB: 3 MHz to 16.5 MHz)

**OP71 DVD/CD Measurement**

**Input Section**

**DATA INPUT (EFM/8-16 modulation signal input)**  
**Input Coupling:** AC (2 Hz/1 kHz, selectable)  
**Measurement Voltage Range:** 50 mV to 5 Vp-p  
**Input Impedance:** 1 MΩ/50 Ω, selectable  
**Slice Level**  
**VARIABLE:** ±2.5 V  
**AUTO (ASYMMETRY ON):** 20 Hz/1 kHz/5 kHz/10 kHz, selectable  
**Maximum Input Voltage:** ±5 V

**Jitter Measurement Section**

**Applicable Speed**  
**DVD:** Clock Frequency  
 x1 speed: 27 MHz ±10 %, x2 speed: 54 MHz ±10 %  
 x1, x2, x4, x6, x8, x10, x12 speed  
**CD:**

**Measurement Mode**

**DVD:** PERIOD mode, sum of all-T data in PERIOD mode, PULSE WIDTH mode, sum of all-T data in PULSE WIDTH mode, DATA to CLOCK  
**CD:** PULSE WIDTH mode, sum of all-T data in PULSE WIDTH mode

**Unit Displayed:** ns, %  
**Measurement Resolution:** 50 ps  
**Display Resolution:** 0.01 ns

**Measurement Accuracy**  
**Sigma Value:** ±4 % ±0.15 ns  
**Average Value:** ±1 ns

**Polarity Selection**

**DATA:**  $\overline{L}/\overline{F}$ ,  $\overline{L}/\overline{L}$ , BOTH  
**CLOCK:**  $\overline{L}$  (fixed)

**Measurement Item:** σ, σ/T

**Clock Frequency Measurement Section (DVD, DATA to CLOCK mode only)**

**Measurement Range:** 24.3 MHz to 59.4 MHz  
**Measurement Accuracy:** ±0.1 %

**Clock Regenerator (DVD, DATA to CLOCK mode only)**

**Regenerates reference clock signal from DATA signal input.**  
**HF:** x1 speed: 27 MHz ±8 %, x2 speed: 54 MHz ±8 %

**OP72 HFM Measurement**

**Input Section**

**Input Coupling:** AC  
**Measurement Voltage Range:** 50 mV to 5 Vp-p  
**Input Impedance:** 1 MΩ/50 Ω, selectable  
**Frequency Range:** x1 speed: 8 MHz, x2 speed: 16 MHz  
**Slice Level:** ±2.5 V (VARIABLE)  
**Maximum Input Voltage:** ±5 V

**Jitter Measurement Section**

**Measurement Range:** Clock frequency: 3.37 MHz to 3.96 MHz  
**Measurement Mode:** DATA to CLOCK  
**Measurement Resolution:** 50 ps  
**Measurement Accuracy**  
**Sigma Value:** ±5 %

**Polarity Selection**

**DATA:**  $\overline{L}/\overline{F}$ ,  $\overline{L}/\overline{L}$ , BOTH  
**CLOCK:**  $\overline{L}$  (fixed)

**Measurement Item:** σ/T

**Unit Displayed:** %

**Clock Regenerator**

**Regenerates reference clock signal from DATA signal input.**

**HFM:** x1 speed: 3.667 MHz ±8 %

**Clock Frequency Measurement Section**  
**Measurement Range:** x1 speed: 3.37364 MHz to 3.96036 MHz  
**Measurement Accuracy:** ±0.1 %

**OP73 GPIB (IEEE 488.1)**

**Function:** Transfers data, controls front panel settings.

**OP74**

**Function:** Transfers data, controls front panel settings.

**OP71 and OP72 can not be installed together.**  
**OP73 and OP74 can not be installed together.**

# AUDIO Selection Guide

Applicable to Blu-ray Disc and DVD/CD (LE 1871/LE 1876)

		JITTER METER		JITTER ANALYZER			
							
		DVD/CD LE 1870	Blu-ray Disc LE 1871	DVD/CD LE 1875	Blu-ray Disc LE 1876		
Applicable Speed	Blu-ray Disc	x1 speed		○		○	
		x2 speed				○	
	DVD	x1 speed	○	Option	○	Option	
		x2 speed	○	Option	○*4	Option	
	DVD-RAM	2.6 G, 4.7 G			○*1	Option	
	CD	x1 speed	○	Option	○	Option	
		x2, x4, x6, x8, x10, x12 speed	○*2	Option	○	Option	
CD-R (Bi-Phase)	x1, x2, --- x32 speed	Option	Special order	Option	Special order		
Measurement Mode	Blu-ray Disc	HF DATA to CLOCK		○		○	
		HFM DATA to CLOCK		Option		Option	
	DVD (ROM)	DATA to CLOCK	○	Option	○	Option	
		DATA to CLOCK (2 inputs)		Special order	○	Special order	
		PULSE WIDTH mode (3-11, 14T)	○*2	Option*2	○	Option	
		DVD-R/RW	Sum of all-T data in PULSE WIDTH mode			○	Option
			PERIOD mode (6-25T)			○	Option
			Sum of all-T data in PERIOD mode			○	Option
	DVD-RAM	DATA to CLOCK (2 inputs)			○	Special order	
		PULSE WIDTH mode (3-11, 14T)			○	Option	
		Sum of all-T data in PULSE WIDTH mode			○	Option	
		PERIOD mode (6-25T)			○	Option	
		Sum of all-T data in PERIOD mode			○	Option	
	Equalizer	Blu-ray Disc	Conventional Equalizer		○		○
Limit Equalizer				Option		○	
DVD (ROM)		Fixed boost level (3.2 dB)	Option		Option		
		DVD-R/RW	Variable boost level (3.2 to 6.0 dB)	Option	Option *3	Option	Option *3
DVD-RAM			2.6 G (for x1 speed)			Special order	Special order *3
		4.7 G (for x2 speed)			Special order	Special order *3	
Interface	GPIB		Option	Option	Option	Option	
	RS232C		○	○	○	○	
	LAN			Option		Option	

\*1 DVD-RAM equalizer is required.

\*2 For the LE 1870/LE 1871, 3T can only be measured in PULSE WIDTH mode; it cannot be selected via the front panel.

\*3 Digital system is used.

\*4 For the LE 1875, x1 and x2 speeds can be measured in PULSE WIDTH mode.

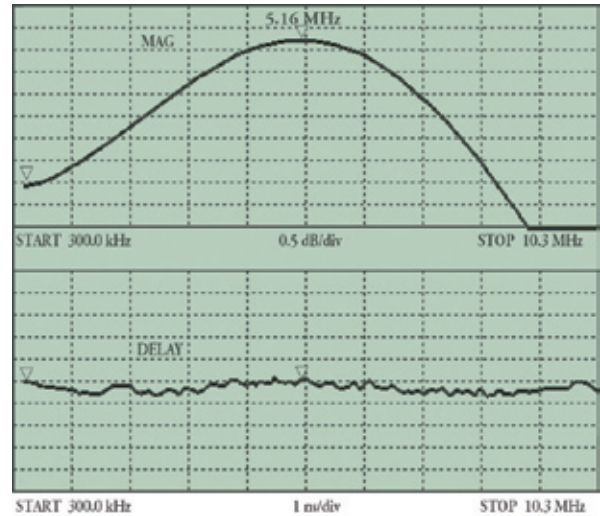


### DVD Fixed Equalizer Option

- 3.2-dB boost level equalizer conforming to DVD book

- Usable for inspecting pickups

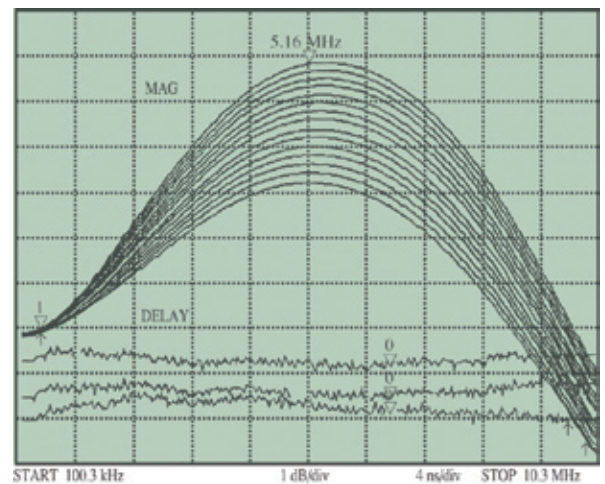
- Channel Bit Rate 27 MHz
- Boost Level 3.2 dB
- Boost Level Accuracy  $\pm 3\%$  (at 5.16 MHz)
- Group Delay Drift 2.5 ns max.



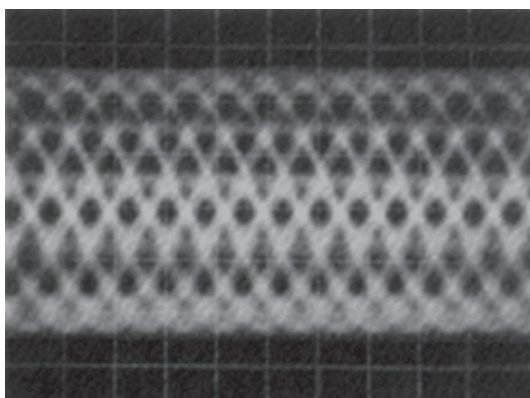
### DVD Variable Equalizer Option

- Variable boost level equalizer for jitter measurements
- Using an equalizer with a fixed boost level of 3.2 dB is recommended by DVD Book, however, applying a suitable boost level to an optical pickup ensures accurate jitter measurement and better productivity.

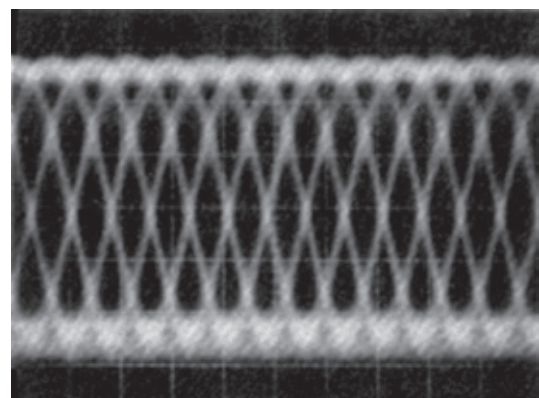
- Channel Bit Rate 27 MHz
- Valuable Boost Level 3.2 to 6.0 dB, in 0.2 dB steps
- Boost Level Accuracy  $\pm 3\%$  (in each step, at 5.16 MHz)
- Group Delay Drift 4 ns max.



### Effectiveness of Blu-ray Disc Limit Equalizer



RF waveform without limit equalizer



RF waveform with limit equalizer