

AUDIO DIGITAL PROCESSING JITTER METER

TIA High Speed & Accuracy Jitter Measurement

CE
Upon request



PAT.PEND

LE 1870 DIGITAL PROCESSING JITTER METER

GENERAL

The LE 1870 Jitter Meter is designed to quickly and accurately measure the jitter of RF (DATA) signals conforming to the DVD Book (DVD Specifications for Read-Only Disc) with respect to the clock signal using digital processing method (i.e., same method as used by TIA). A large meter and LED panel allow this instrument ideal for production and inspection applications, as well as R&D. Since CD-R measurement unit to measure jitter of biphasic signal is optionally available, DVD, CD, and CD-R/RW can be measured using this instrument alone.

FEATURES

[DVD Measurements]

- **High speed and accuracy measurement by the digital operation system**

By adopting the same digital operation system of TIA to the rms operation, the LE 1870 deliver the high speed and accuracy measurement.

- **The LE 1870 measures 3T through 11T and 14T in the DATA signal with respect to the clock signal and displays jitter in sigma format, and also offers the measurement of narrow pulse 3T jitter.**
- **Jitter in unit of % or sigma value, selectable**
Jitter in unit of % or sigma value, selectable Jitter value can be displayed in unit of percentage with respect to the clock signal. The absolute value can also be displayed in sigma format. The Jitter of the DATA signal can accurately be measured even in the percentage display mode.
- **Jitter measurement in three polarities**
Jitter at the rise, fall, and both edges of the DATA signal can be measured in signal-signal and two-signal measurement modes.
- **Response up to double speed**
Measure the jitter between RF (DATA) signal and regenerated clock signal in inside and display in sigma value.

[For general function]

- **High measurement level sensitivity**
DATA signal can be measured for signal whose amplitude is equal to or more than 50 mVp-p.
- **Input impedance can be selected either 50 Ω or 1 MΩ**
Both 50 Ω input which is internally terminated, and 1 MΩ input which is used with 10:1 oscilloscope probe lessen the disturbance to the system under test.

- **Simultaneous measurement, jitter and RF signal level**
Display the peak level(p-p) of the DATA signal in digital.
- **Analog display for easy adjustment and digital display for parallax free**
The LE 1870 is equipped with both large meter and large digital indicators. The result of jitter measurements can be displayed either on meter or on digital indicator.
- **Measurement inhibit**
The INHIBIT IN connector is provided. This function inhibits jitter measurement when a disc replay malfunction like kickback occurs.
- **Various monitor output**
DATA signal monitor is available and the DC output proportional to the jitter and level indication are provided.
- **Build-in Auto slicer**
Auto slicer which has response features conforming to DVD book is built-in.

[On the Production Line]

- **Convenient GO/NO GO judgement for the production line**
The GO/NO GO result judgement is based on the comparison between the set standard and measured value of level, and is indicated on the LEDs and outputted.
- **REMOTE CONTROL function**
Jitter measurement range and other panel functions can be remotely controlled.
- **RS232C is equipped as standard**
RS232C provides you panel operation and lets you transfer the measured level and jitter level to a personal computer.
- **Easy setting**
Jog dial system offers you easy setting for judgement standard, response time, slice level. All the setting are stored as last memories on each mode/speed of DVD, CD, CD-R.

[Versatile Options]

- **Available to measure a jitter of CD-R/RW up to x32 speed.**
With an option for CD-R/RW, 1T jitter of Bi-phase signal can be measured.
- **Accurate measurement by equalizer conforms to DVD book**
Optional RF equalizer allows direct input measurement of the pickup signal at the production line of pickup.

SPECIFICATIONS

LE 1870

Input Section

EFM SIGNAL

Input couple: AC
Measurement Voltage Range: 50 mV to 5 Vp-p
Input Impedance: 1 MΩ/ 50 Ω
Bandwidth: 50 MHz, ≤-3 dB
Slice Level: VARIABLE (±2.5 V)
 AUTO (ASYMMETRY ON)
Maximum Input Voltage: ±5 V

INHIBIT IN

Input Impedance: 100 kΩ
Input Signal: 0/ 5 V (Measurement inhibit at 5 V)
Maximum Input Voltage: -0.7 V/ +5.7 V

Jitter Measurement Section

Corresponding Speed: DVD standard speed (27 MHz ±10 %),
 Double speed (54 MHz ±10 %)
 CD standard, 2, 4, 6, 8,10, 12 times speed
 (EFM CLOCK:4.3218 MHz to 51.8616 MHz)

Measurement Mode

DVD All T: DATA to CLOCK
DVD 3 T: PULSE WIDTH
CD 3T: PULSE WIDTH

Scale

DATA to CK Measurement: ns, % (Automatic conversion)
3T PULSE WIDTH: ns

Accuracy

Meter Display: (±4 % of full scale) ± 0.15 ns
Digital Display: (±4 %) ± 0.15 ns

Polarity

DATA: +, -, BOTH
CLOCK: -

Indication:

SIGMA
 Measurement Time Constant Variable: 0.04 s to 5 s

Level Measurement Section

Measurement Method: Peak to peak level of RF (DATA) signal
Range

Input Impedance 50 Ω: 50 mV to 5 Vp-p
Input Impedance 1 MΩ: 0.5 V to 9.999 Vp-p
 (conversion value for 10:1 probe)

Display Method:

Digital

Accuracy:

±5 %

Clock Frequency Measurement Section

Measurement Range: 27 MHz ±10 %, 54 MHz ±10 %
Measurement Accuracy: ±0.5 %

Clock Reproducing Section

Reproduce the standard clock from the input EFM plus signal
Corresponding Speed: DVD standard speed(27 MHz ±10 %)
 DVD 2 times speed(54 MHz ±10 %)

Judgement Section

Compares the set standard and measurement value of level and jitter to determine GO/NO GO and output the results.

GO/NO GO LED : Meter (Jitter measurement) judgement.
RF LEVEL/JITTER LED: Digital display (Jitter and level measurement) judgement.

Dedicated Remote Terminal: Jitter measurement,
 Level measurement judgement

Output Section

Monitor Output

Output Signal: Input signal or the signal through the equalizer
Output Impedance: 50 Ω

Digitized Output

Output Signal: DATA signal, CLOCK signal
Output Impedance: 50 Ω

DC Output:

Jitter

DATA to CLOCK: DVD: 0.05 V/% or 0.125 V/ns
3T PULSE WIDTH: DVD: 0.1 V/ns
 CDx1: 0.025 V/ns
 x2: 0.05 V/ns

x4, x6: 0.1 V/ns
 x8 to 12: 0.25 V/ns
Level: 0.4 V/Vp-p

Remote Control Section

Designated Remote Terminal: Judgement output and Panel setting
RS232C: Control, Data output

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
 55 Wmax.

Dimensions and Weight

213 (W) × 132 (H) × 300 (D) mm, 4.0 kg

Accessories

Power cord..... 1
 Instruction manual..... 1

Option

OP71 CD-R/RW Measurement (Bi-phase Jitter Measurement)

Corresponding Speed: x1, x2, x4, x6, ... x30, x32 times speed
 (Bi-phase CLOCK: 6.3 kHz to 201.6 kHz)
Input Signal: Bi-phase Digitized signal and Digitized Clock signal

Input Couple: DC
Measurement Voltage Range: 0.2 V to 5 Vp-p
Input Impedance: 1 MΩ
Bandwidth: DC to 1 MHz, ≤-3 dB
Maximum Input Voltage: ±5 V
Measurement Mode: 1 T (PULSE WIDTH), All T (DATA to CLOCK)
Scale: μs, %

OP72 GP-IB (IEEE 488.1)

Function: Data transfer and panel control

OP74 Variable Equalizer

Corresponding Clock Frequency: 27 MHz
Boost Quantity: 3.2 dB ±3 % (at 5.16 MHz)
Group Delay Fluctuation: Max. 2.5 ns

OP75 Variable Equalizer

Corresponding Clock Frequency: 27 MHz
Boost Quantity: 3.2 to 6.0 dB ±3 % (at 5.16 MHz)
Group Delay Fluctuation: Max. 4 ns

OP76 Variable Equalizer

Corresponding Clock Frequency: 27 MHz
Boost Quantity: 3.0 to 4.4 dB ±3 % (at 5.16 MHz)
Group Delay Fluctuation: Max. 3 ns

LE 1870 Rear Panel



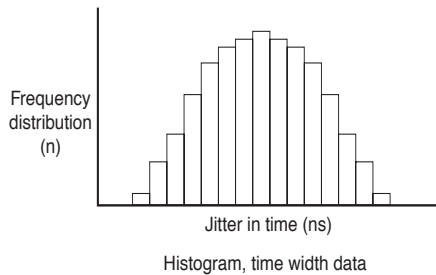
DVD Jitter Measurement Method as New Standard

Jitter Measurement using TIA Method

The models LE 1875 (S1 version) and LE 1870 use a digital processing method (i.e., same method as used by TIA) to obtain jitter values.

Since jitter basically occurs in random phenomena from optical discs, pickup, and driver characteristics, it is obtained by using the statistical method from measurement data by calculating data accumulated for standard deviation display in sigma format.

The histogram refers to a graph consisting of a horizontal axis for jitter in time (period) and a vertical axis for frequency distribution.



Since jitter is considered standard deviation (i.e., dispersion of data in time), it is obtained from the following formulas:

Dn: Time data Xn: Frequency distribution

$$\bar{D} = \frac{\sum_{k=1}^n (Dk \times Xk)}{\sum_{k=1}^n Xk} \dots \dots \dots \text{Average value}$$

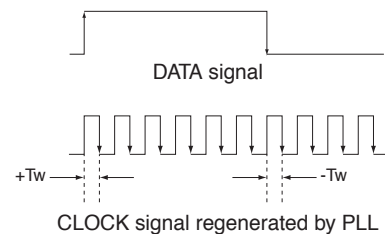
$$\sigma = \sqrt{\frac{\sum_{k=1}^n (Dk - \bar{D})^2 \times Xk}{\sum_{k=1}^n Xk}} \dots \dots \dots \text{Sigma value}$$

Measuring Jitter of DVD

There are two methods as follows:
All-T jitter measurement method conforming to DVD Book 3T jitter measurement method to measure DATA signal pulse width (previously used for CDs)

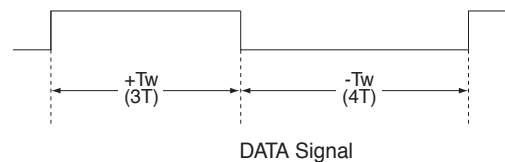
All-T Jitter Measurement

This method is also called the DATA to CLOCK measurement method. A pulse string (i.e., 3T to 11T, 14T) called 8-16 modulation is recorded on the DVD. This method measures all rising and falling edges of the pulse string with respect to the clock signal regenerated by PLL.



Pulse Width Measurement

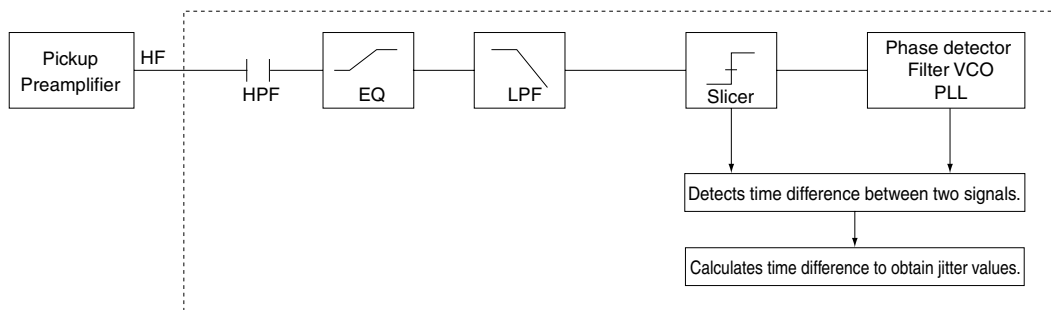
This method is mainly used for measuring the jitter of CDs. A pulse string (i.e., 3T to 11T) called 8-14 modulation (EFM) is recorded on the CD. This method measures the jitter of each pulse width. This instrument can also measure DVDs.



Measurement Method Conforming to DVD Book

The figure below shows the signal flow (from a pickup) conforming to DVD Specifications for Read-Only Disc Version 1.0. Applying the HF signal directly from the pickup satisfied the standards since the LE 1875 and LE 1870 are designed based on DVD Book.

This circuit is only used for DVD players and pickup inspection systems.



The w Book prescribes measurement conditions as follows:

Block	Measurement Conditions
High-Pass Filter	Transmission characteristics
Equalizer	Transmission characteristics to 10 MHz Allowance of group delay
Low-Pass Filter	Transmission characteristics
Slicer	Closed-loop transmission characteristics
PLL	Open-loop transmission characteristics
Measurement Method	Jitter at all edges