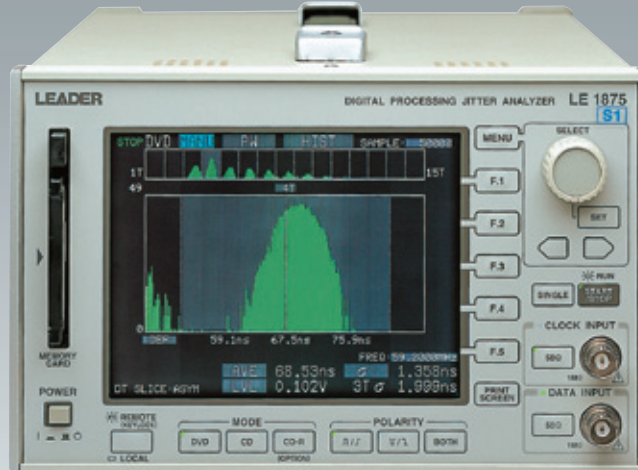


AUDIO DIGITAL PROCESSING JITTER ANALYZER

Inhibit and arming functions suitable for RAM disk jitter measurement

CE
Upon request



PAT.PEND
*Memory card is not attached.

LE 1875 (S1 version) DIGITAL PROCESSING JITTER ANALYZER

GENERAL

Leader's most advanced jitter analyzer combines digital time sampling and processing combined with a full color LCD display to provide fast, complete and accurate tracking of DVD, DVD-RAM, CD and CD-R/RW R&D, production and QC. Optional equalizers facilitate testing via direct pickup connections.

Features of S1 version:

- Suitable functions for RAM disk jitter measurement capability
- Pulse width measurement in one-signal input mode for DVD jitter measurement
- Selectable bandpass for input amplifier corresponds to timing or alignment jitter components to be measured.

LE 1875(S1 version) Rear Panel



FEATURES

- Time Interval Analyzer (TIA) Handles DVD, DVD-RAM, CD and CD-R/RW
- Histogram Color LCD Display Shows Jitter History, RF Data Amplitude, Average Sigma Reading and Clock
- Measures Jitter at 3T Through 11T + 14T
- Jitter Readings in % Clock Frequency and Sigma
- Measurements at Rise, Fall and Both Data Edges
- Response up to Double Speed
- Long Time Measurements Shows Variation of Sigma and Average Readings Versus Time
- High Sensitivity – Accurate Readings at 50 mV or More
- 50 Ω and 1 M Ω Inputs Allow the Use of 10:1 Probe to Minimize Circuit Loading
- GO/NO-GO Judgements Against Preset Entries
- Easy Settings and Memory Storage
- Auto Slicer Conforms to DVD Documentation
- Inhibit Input Suspends Tests Due to Malfunctions
- RS232C Standard

AVAILABLE OPTIONS

- OP71 CD-R/RW Bi-Phase Jitter at 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 and 32X Speeds
- OP72 GPIB (IEEE 488.1)
- OP74 Fixed Equalizer (3.2 dB at 5.16 MHz)
- OP75 Variable Equalizer (3.2 to 6 dB at 5.16 MHz)
- OP76 Variable Equalizer (3 to 4.4 dB at 5.16 MHz)

SPECIFICATIONS LE 1875(S1 version)

Input Section

DATA INPUT (EFM/8-16 Modulation signal Input)

Input Coupling: AC (2 Hz/1 kHz, selectable)
 Measurable Voltage Range: 50 mV to 5 Vp-p
 Input Impedance: 1 M Ω /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

Clock Signal

Input Coupling: AC
 Measurable Voltage Range: 0.1 V to 2.5 Vp-p
 Input Impedance: 1 M Ω /50 Ω , selectable
 Slice Level: 0 V (fixed)
 Clock Delay: ≥ 10 ns for each polarity
 Maximum Input Voltage: ± 5 V

Measurement Control (GATE IN)

Input Impedance: 10 k Ω
 Input Signal Level: TTL
 Maximum Input Voltage: -0.7 V/+5.7 V

Jitter Measurement Section

Applicable Speed

DVD: Clock Frequency: 24.3 MHz to 59.4 MHz
 (Frequency is fixed to 27/54 MHz in one-signal input mode, DATA TO CLOCK mode.)
 CD: x1, x2, x4, x6, x8, x10, x12 speed

Measurement Mode

DVD: Measurements for, PERIOD, sum of all-T data in PERIOD mode, PULSE WIDTH, sum of all-T data in PULSE WIDTH mode, DATA TO CLOCK
 CD: Measurements for, PULSE WIDTH and sum of all-T PERIOD data

Units Displayed:

ns or %

Measurement Resolution:

0.15 ns

Display Resolution:

0.01 ns

Measurement Accuracy

Sigma Value: ± 4 % ± 0.15 ns

Average Value: ± 1 ns

Polarity Selection

DATA: +, -, BOTH

CLOCK: +, -

Measurement Item:

AVERAGE, Max, Min,

σ , σ max, σ min,

σ/T , σ/T max, σ/T min

Measurement Display:

value, bar graph, histogram, TIME DEVIATION, BOTH for separate display

Number of Samples:

10 to 1,000,000

Control Function (ON/OFF, selectable)

Inhibit

Logic State Selection: ENABLE: HIGH/LOW

Number of Gating Operations: GATE COUNT: 0 to 50

Arming

Polarity Selection: SLOPE: RISE/FALL (Polarity settable)

Start Delay: START DLY: 0 to 9999 μ s in 1 μ s steps

Measurement Time Settings: LEN MODE: SAMPLE/TIME

(0.01 ms to 99.9 ms in 0.01 ms steps)

Number of Gating Operations: GATE COUNT: 0 to 50

Level Measurement Section

Measurement Method:

Peak-to-peak value of DATA (RF) signal

Measurable Voltage Range:

50 mV to 5 Vp-p

(0.5 to 9.999 Vp-p in 10:1 probe conversion mode)

Display Digit:

4 (3 digits after decimal point)

Measurement Resolution:

1 mV min.

Measurement Accuracy:

± 5 %

Display:

Item name in level measurement mode

1:1 mode --- LVL

10:1 mode --- *LVL

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

Measurable Range:

24.3 MHz to 59.4 MHz

Measurement Accuracy:

± 0.5 %

Clock Regenerator (DVD, DATA to CLOCK mode only)

Regenerates reference clock signal from DATA (RF) signal input

Applicable Speed:

DVD, x1 speed (27 MHz ± 10 %)

DVD, x2 speed (54 MHz ± 10 %)

Output Section

MONITOR OUT (PROBE CAL)

DATA (Used for DATA signal monitoring and probe calibration)

Bandwidth: 50 MHz, ≤ -3 dB

Output Impedance: 50 Ω

CLOCK (Used for CLOCK signal monitoring and probe calibration)

Bandwidth: 60 MHz, ≤ -3 dB

Output Impedance: 50 Ω

EQUALIZER OUT

Used for equalized RF signal monitoring

Output Impedance: 50 Ω

DC OUT

Output Accuracy: ± 2 %

Output Item: Level, jitter (Full scale voltage variable)

Maximum Output Voltage: 2 V

GATE MONITOR

Used for arming and inhibit control signal monitoring

Output Level: TTL level

Output Impedance: 1 k Ω

Remote Control Section

Dedicated Remote Control Connector:

Outputs judgment results

RS232C:

Controls function and outputs data

Memory Card

Interface: Conforms to PC CARD ATA standards

Environmental Conditions

Operating Temperature Range: 0 to 40 $^{\circ}$ C

Operating Humidity Range: ≤ 85 % RH (without condensation)

Spec-Guaranteed Temperature Range: 10 to 30 $^{\circ}$ C

Spec-Guaranteed Humidity Range: ≤ 85 % RH (without condensation)

Storage Temperature Range: 0 to 50 $^{\circ}$ C

Storage Humidity Range: ≤ 90 % RH (without condensation)

Operating Environment: Indoor use

Operating Altitude: Up to 2,000 m

Overvoltage Category: II

Pollution Degree: 2

Power Requirements

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

Dimensions and Weight

213 (W) x 132 (H) x 300 (D) mm, 5.0 kg

Accessories

Power cord.....1

Instruction manual1

Option

OP71 CD-R/RW Measurement (BIPHASE Jitter measurement)

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

Input Signal:

DC

Measurement Voltage Range: 0.2 V to 5 Vp-p

Input Impedance: 1 M Ω

Bandwidth: DC to 1 MHz, ≤ -3 dB

Maximum Input Voltage: ± 5 V

Measurement Mode: PULSE WIDTH, all-T, DATA to CLOCK

Scale: μ s, % (Automatic conversion, Data to CLOCK mode only)

Measurement Resolution: 20 ns

Display Resolution: 0.1 μ s

Measurement Accuracy: ± 3 %

Polarity

DATA: +, -, BOTH

CLOCK: +, -

Measurement Item:

AVERAGE, Max, Min, σ , σ max, σ min, σ/T ,

σ/T max, σ/T min

Measurement Display:

value, bar graph, histogram,

TIME DEVIATION, BOTH for separate display

Number of samples:

Max 100,000

OP72 GP-IB (IEEE 488.1)

Function:

Data transfer and panel control

OP74 Fixed Equalizer

Channel Bits Rate: 27 MHz

Boost Quantity: 3.2 dB within ± 3 % (at 5.16 MHz)

Group Delay Fluctuation: Max. 2.5 ns

OP75 Variable Equalizer

Channel Bits Rate: 27 MHz

Boost Quantity: 3.2 to 6.0 dB within ± 3 % (at 5.16 MHz)

Group Delay Fluctuation: Max. 4 ns

OP76 Variable Equalizer

Channel Bits Rate: 27 MHz

Boost Quantity: 3.0 to 4.4 dB within ± 3 % (at 5.16 MHz)

Group Delay Fluctuation: Max. 3 ns

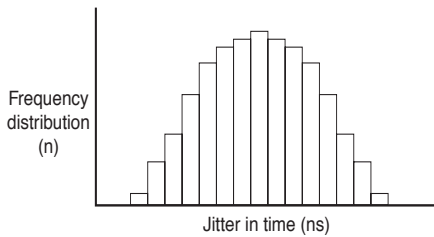
DVD Jitter Measurement Method as New Standard

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.



Histogram, time width data

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

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

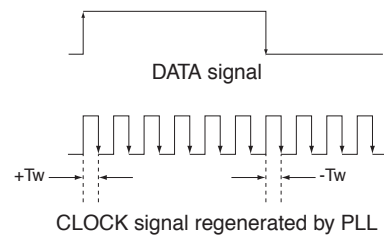
$$\sigma = \sqrt{\frac{\sum_{k=1}^n (D_k - \bar{D})^2 \times X_k}{\sum_{k=1}^n X_k}} \dots \dots \dots \text{Sigma value}$$

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)

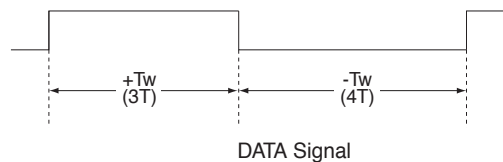
All-T Jitter Measurement

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

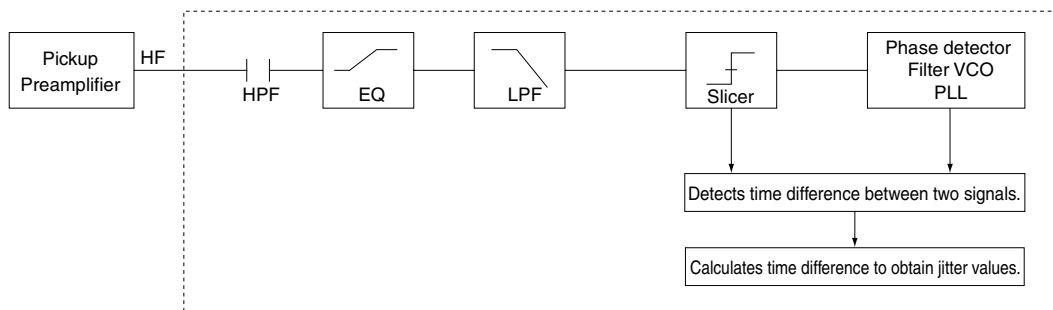
This method is mainly used for measuring the jitter of CDs. A pulse string (i.e., 3T to 11T) called 8-14 modulation (EFM) is recorded on the CD. This method measures the jitter of each pulse width. This instrument can also measure DVDs.



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