

# LEADER

ELECTRONIC MEASURING INSTRUMENTS

			1989 1990

LEADER ELECTRONICS CORP.

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## ACCURATE TRACEABILITY ENSURES HIGHLY RELIABLE MEASUREMENTS

### Measuring Standards and Traceability

As technological innovations are making significant advances possible in the electronics industry, users are demanding higher product quality and reliability. As a result, the measuring instruments used for the research, development, production, inspection, and measurement of products must also provide higher performance and precision. Such instruments must also offer trouble-free operation and must provide high reliability and uniformity. If measuring instruments lack this reliability and uniformity, the results of important research or testing will prove unreliable. Consequently, the precision of each measuring instrument used must be carefully checked.

The management of measuring instruments is of vital importance. To maintain high measuring accuracy, periodic calibration must be done. For such calibration, standards and measuring devices must be prepared and calibrated according to higher-level standards, up to and including the national standards, in order to comply with international standards. For this reason, a high level of traceability must be established.

### Traceability of Leader Electronics

The figure to the right shows an example of the traceability system used by Leader Electronics. At Leader, a standards room is provided where international standard values are set for the internal measuring devices. The internal standards that are periodically determined by public organizations are well managed to maintain high precision. These standards are used for periodic of the various measuring instruments used by the production, research and development, and maintenance sections. As a result, all internal measuring instruments perform tracing according to international standards to ensure the production of high-precision products.

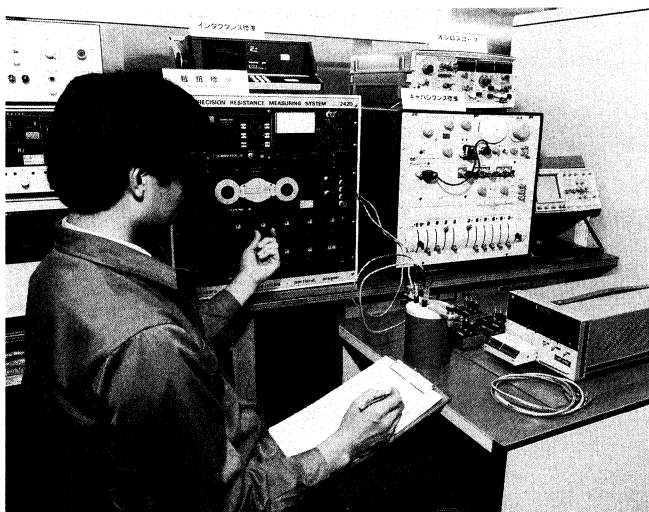
### Standards Room

When standards are to be maintained or newly established, changing environmental factors may adversely affect the results. To ensure that the same results are always obtained, such environmental conditions as temperature and humidity must remain constant. This is very important for accurate traceability. The standards room of Leader Electronics has a shielded wall structure in which air is blown in from the entire ceiling. Air is blown out linearly from the side walls to maintain a stable distribution of temperature and humidity. The room temperature is  $23^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$  at a relative humidity of  $55\% \pm 2\%$ , with an electromagnetic shielding effect of 40dB or more.

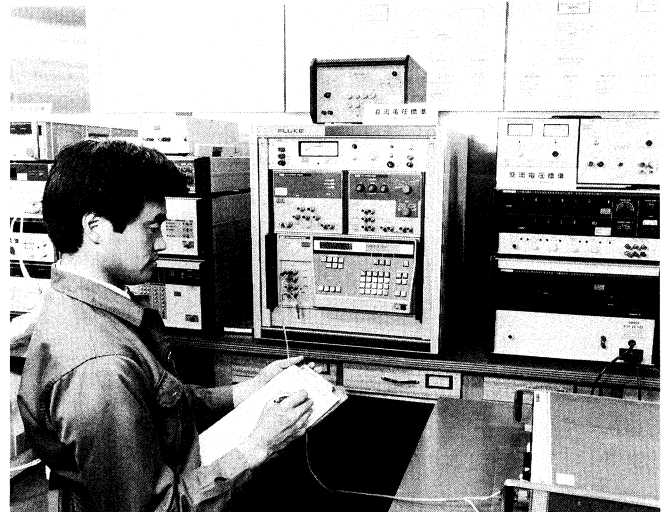
### Standards

The traceability standards used in the standards room are classified into collation, primary, and secondary standards according to actual applications. The collation standards use the national standard values provided by the Japan Electric Meters Inspection Corporation (JEMIC) and Japan Machinery and Metals Inspection Institute (JMI) for direct calibration. The primary standards are high-precision standards for measuring instruments used to maintain the internal standard values for establishing the secondary standards. The established collation standards are used for calibration. The secondary standards are for measuring instruments used to directly calibrate measuring instruments at work sites.

Leader Electronics will continue to develop high-level measurement technologies and establish internal standards for management to improve the quality and reliability of its products for safe operation.

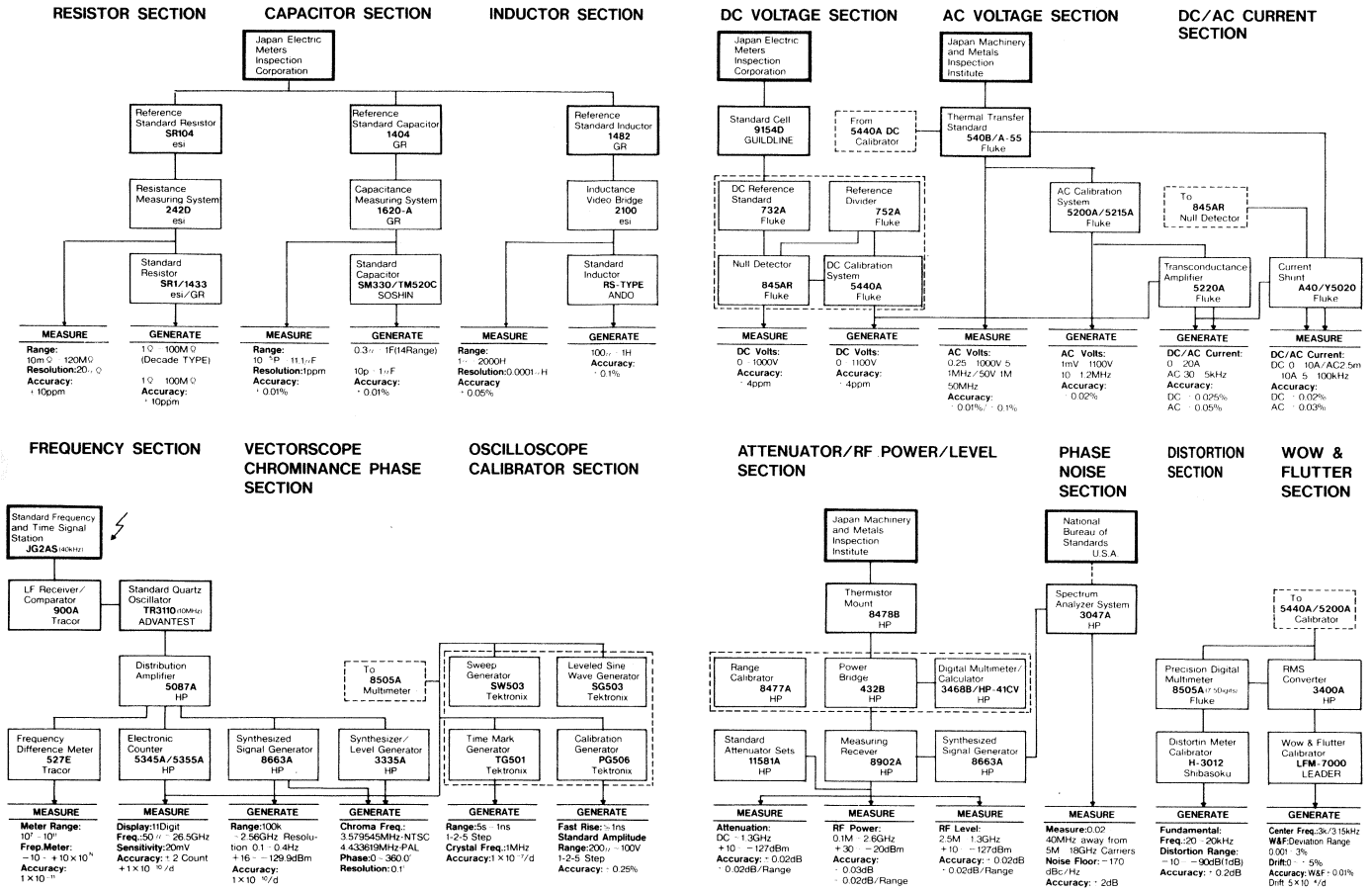


Resistance and capacity standards

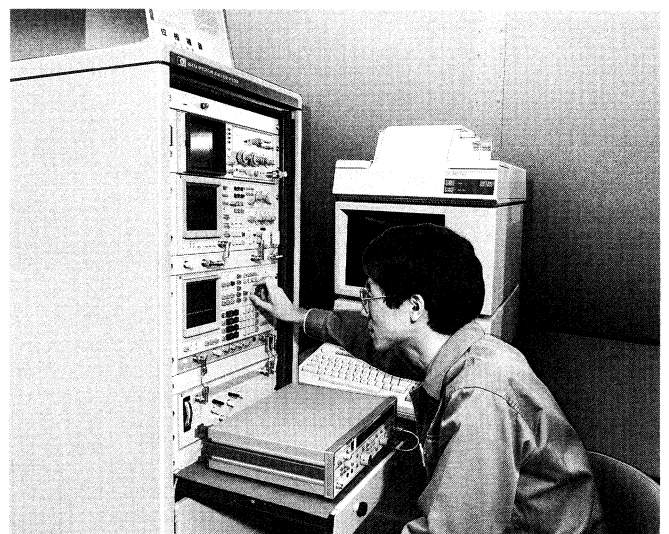


Voltage standards

# LEADER CALIBRATION TRACEABILITY CHART



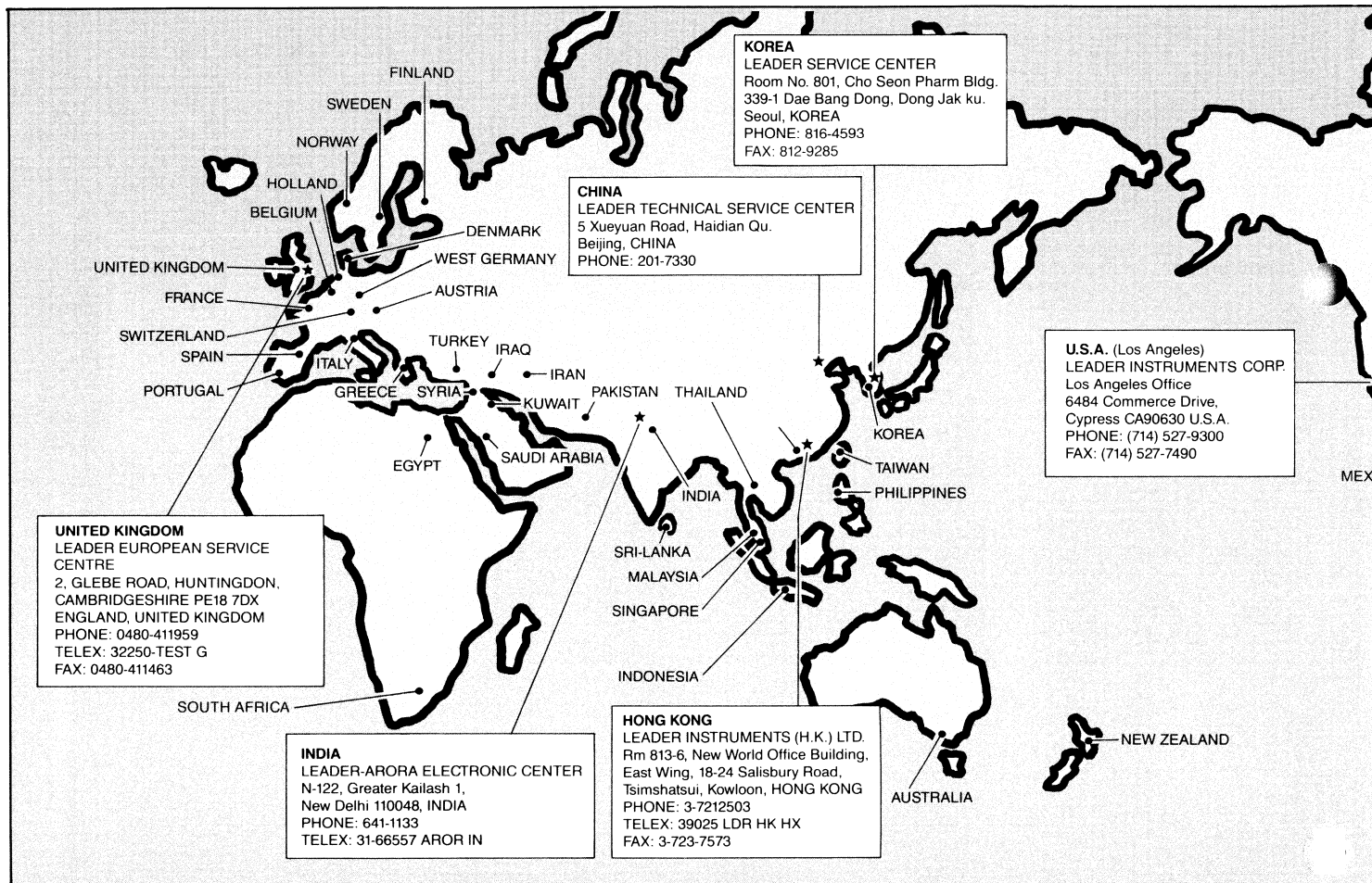
Frequency and Attenuation standards

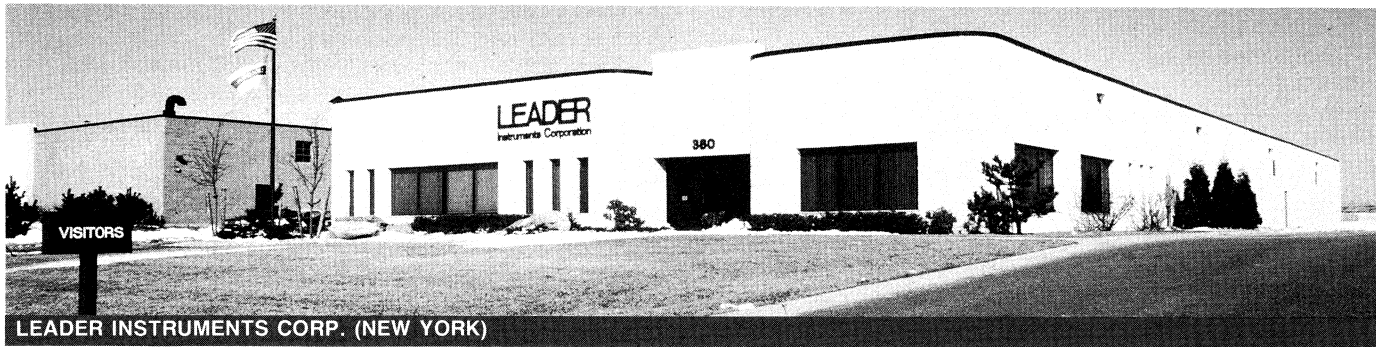


Automatic phase noise measurement system

# Sales and Service System

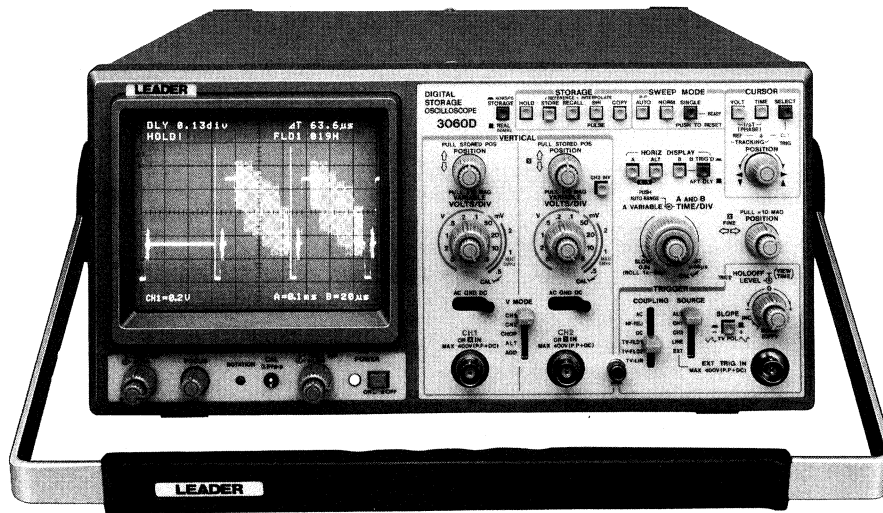
## Service Network with Sales Representatives stationed in 49 countries





# OSCILLOSCOPE

## Multi Function, Upgraded D.S.O



**NEW**

### Model 3060D DIGITAL STORAGE OSCILLOSCOPE



#### ● GENERAL

The Model 3060D, a portable digital oscilloscope, provides a digital storage of a maximum sampling speed of 40MS/s and a 60MHz oscilloscope with delay sweep function. Capable of storing waveforms like one shot signal found in an impact test and video signals, the Model 3060D allows speedy waveform observations with its CRT readout function. Its application range is broad; from basic researches to the production line and servicing of TVs, VTRs and computers.

#### ● FEATURES

##### [Storage Mode]

- A maximum sampling speed of 40MS/s (20MS/s at dual trace) for storing waveforms of up to 8MHz.
- The vertical axis resolution of 8 bits (256 points) and the horizontal axis resolution of 11 bits (2048 points).
- Per-channel reference memory for storing up to four waveforms.
- Pre-trigger function for observing waveforms before triggering.
- The delayed sweep function makes enlarged sweep sampling available from an arbitrary position after triggering.
- Up to 100-time magnification of the timebase of a sampled waveform.
- In the magnification mode, the interpolation can be switched from PULSE to SIN and vice versa.
- A GPIB interfaced is used to exchange waveform data and panel setting with external equipment.
- Waveforms and range settings can be directly output to a plotter through the standard, plotter interface (compatible with HP-GL) for obtain hard copies.

##### [Common Features]

- A 150mm post-accelerating CRT with internal graticule and aluminized screen ensures bright, sharp waveform displays.
- The CRT readout function literally displays all necessary information including the setting status of vertical sensitivity, sweep time, etc on the CRT, allowing quick measurements.
- When both cursors are set to the signal amplitude and cycle, measured values are indicated by characters on the CRT. This greatly reduces measurement errors and mistakes.
- The set and measured values are automatically converted even in the  $\times 10$  MAG mode or when using the special 1/10 probe. This also prevents measurement errors.
- The time axis auto-ranging for automatically changing the sweep range according to the frequency of the input signal.
- The TV field/line selector function displays an arbitrary line in an arbitrary field of a video signal.
- The p-p auto-trigger level feature automatically sets up the trigger level range according to the amplitude of signal, thus easily synchronizing with various types of signals, low level to high level signals.
- The switching power supply accepts AC voltages of 90V to 250V without switching, thus it is suited for all over the countries.

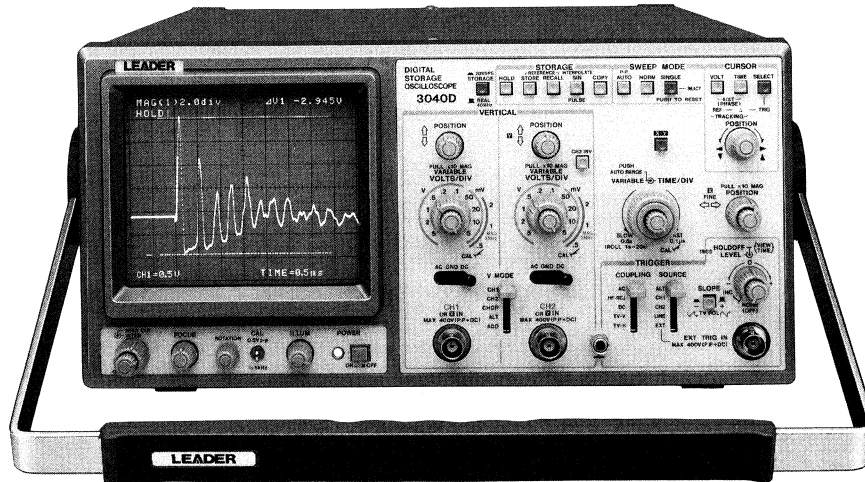
##### [Real Mode]

- Easily switchable to a high sensitivity of  $500\mu\text{V}/\text{div}$  (to 5MHz) for measuring low level signals.
- The one-touch horizontal axis magnification function " $\times 10$  MAG" sets up a maximum sweep rate of  $10\text{ns}/\text{div}$ , thus displaying a 60MHz waveform in three cycles.
- The ALT TRIG function obtains stable for a synchronous two signals.
- Variable hold-off time ensures efficient observations of video signals and computer-generated pulse trains (like digital word pulse signals) with a stable synchronization.
- Easily switchable to operate as an X-Y oscilloscope with CH1 as the X-axis and CH2 as the Y-axis.



# OSCILLOSCOPE

## Storage Mode 20MS/s, Real Mode 40MHz



# NEW

## Model 3040D DIGITAL STORAGE OSCILLOSCOPE

**GPIB**  
OPTION

### • GENERAL

The Model 3040D, a portable digital oscilloscope, provides a digital storage of a maximum sampling speed of 20MS/s and a 40MHz oscilloscope. Capable of storing waveforms like one shot signal found in an impact test and video signals, the Model 3040D allows speedy waveform observations with its CRT readout function. Its application range is broad; from basic researches to the production line and servicing of TVs, VTRs and computers.

### • FEATURES

#### [Storage Mode]

- A maximum sampling speed of 20MS/s (dual trace simultaneous sampling) for storing waveforms of up to 8MHz.
- The vertical axis resolution of 8 bits (256 points) and the horizontal axis resolution of 11 bits (2048 points).
- Per-channel reference memory for storing up to four waveforms.
- Pre-trigger function for observing waveforms before triggering.
- Up to 100-time magnification of the timebase of a sampled waveform
- In the magnification mode, the interpolation can be switched from PULSE to SIN and vice versa.
- The attached X-Y pen recorder output connector for obtaining hard-copies of a waveform easily.

#### [Common Features]

- A 150mm post-accelerating CRT with internal graticule and aluminized screen ensures bright, sharp waveform displays.
- The time axis auto-ranging for automatically changing the sweep range according to the frequency of the input signal.
- The p-p auto-trigger level feature automatically sets up the trigger level range according to the amplitude of signal, thus easily synchronizing with various types of signals, low level to high level signals.
- The switching power supply accepts AC voltages of 90V to 250V without switching, thus it is suited for all over the countries.
- The CRT readout function literally displays all necessary information including the setting status of vertical sensitivity, sweep time, etc on the CRT, allowing quick measurements.

#### [Real Mode]

- Easily switchable to a high sensitivity of 500 $\mu$ V/div (to 5MHz) for measuring low level signals.
- The one-touch horizontal axis magnification function "x 10 MAG" sets up a maximum sweep rate of 10ns/div., thus displaying a 40MHz waveform in three cycles.
- The ALT TRIG function obtains stable for a synchronous two signals.
- Variable hold-off time ensures efficient observations of video signals and computer-generated pulse trains (like digital word pulse signals) with a stable synchronization.
- Easily switchable to operate as an X-Y oscilloscope with CH1 as the X-axis and CH2 as the Y-axis.
- Waveform observation of TV or VTR signals using the built-in sampling circuit for easier synchronization with TV composite video signals.

# OSCILLOSCOPE

## A Digital Storage Oscilloscope to Handle Virtually Any Application in Any Field

### APPLICATIONS

#### Mechatronics

These scopes are ideal for observation of signals having slow repetition rates and of one-time events. This capability is ideal for use in adjustments of electronic control equipment such as used in robots.

#### Video and Audio-Visual

The 3060D features a TV field/line selector which enables display of any line within any given field. Without sacrificing display intensity. The both models are convenient for applications such as room reverberation testing.

#### Automobiles

By using the pre-triggering function, it is possible to observe ignition and fuel-injector waveforms. These scopes are also highly suited to such electronic control system maintenance applications as analysis of diagnosis patterns.

#### Medicine

The 500 $\mu$ V/div sensitivity of these scopes enables observation of extremely low-level signals, making them useful in observing electrocardiograph signals without flicker.

#### Computers and Office Automation Equipments

Weighting only 8.1kg, these digital storage scopes are ideal for use in maintenance of computers and OA equipment. The memory features a battery backup, enabling phenomena captured in the field to be analyzed later. In addition, a hard-copy can be produced for use in service reports.

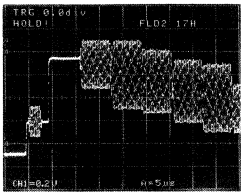
#### Electronic Components

In addition to comparison measurements respects to known good components using the reference memory, such features as cursor measurements make these scopes ideal for inspection of semiconductors and other electronic components. The GPIB interface (optional on 3040D) can be used to implement an automated production-line measuring system.

#### Research and Development

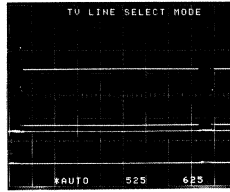
High-speed sampling, high resolution, and a versatile of cursor functions combine with remote control via the GPIB and other versatile features to make these scope the ideal choices for a diverse spectrum of research and development applications.

#### High-speed (40MS/s) sampling



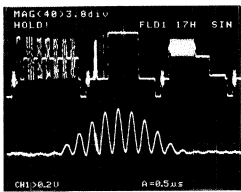
- Sampling up to 40 MS/s (20 MS/s for the 3040D) is possible, with an effective storage bandwidth of 10 MHz (8 MHz for the 3040D), providing ample bandwidth for video signals.

#### Field/line selector (3060D)



- A full-line selector with TV sync separator has been provided. This enables selection of any desired field of any line.

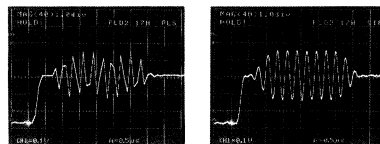
#### Waveform expansion up to $\times 100$



Expanded waveform

- The time-axis can be expanded up to 100 times for display of stored waveforms.

#### Convenient interpolation function



Pulse interpolation  
Sine interpolation  
Video signal burst waveform

- An interpolation function takes over when using an expanded waveform display and whenever the range exceeds the maximum sampling speed.
- Selection is possible of pulse (linear) or sine interpolation, depending upon the waveform being measured.

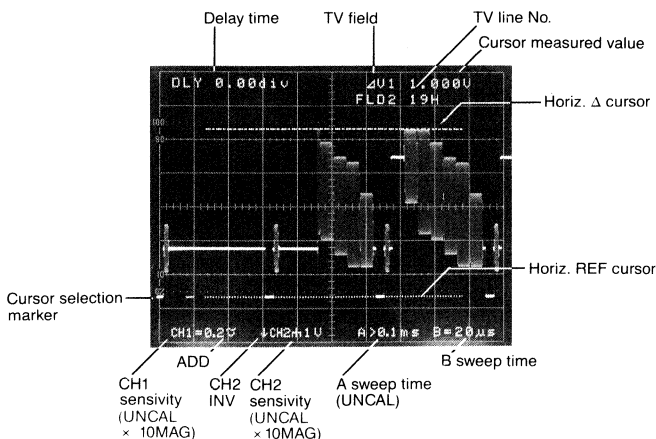
#### CRT Readout

- Panel settings such as vertical sensitivity and sweep time are displayed digitally on the CRT.
- Settings and cursor measurement values are automatically converted to ensure true display values even when using the  $\times 10$  MAG function or the special 1/10 attenuating probe.

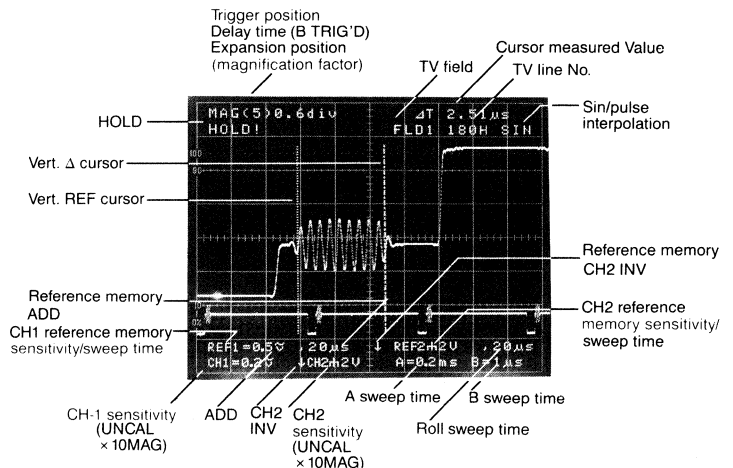
#### Advanced cursor measurements

- Simply align two cursors on the waveform to display measured values digitally.
- Measured values; voltage difference, voltage ratio, time difference, time ratio, frequency, phase difference.

#### Real-Time Mode



#### Storage Mode



# OSCILLOSCOPE

## ● SPECIFICATIONS

**CRT Type:** 150mm rectangular, internal graticule, post-acceleration, beam rotator, scale illumination

**Real Mode:**  
**Vertical Axis Sensitivity:** 5mV/div to 5V/div  
 500 $\mu$ V/div to 2mV/div ( $\times 10$  MAG ON)  
**Calibration Accuracy:** Within 3% (Within 5%:  $\times 10$  MAG ON)  
**Band width:** DC (10Hz) to 60MHz  $\times 10$  MAG ON: DC to 5MHz } (3060D)  
 DC (10Hz) to 40MHz  $\times 10$  MAG ON: DC to 5MHz } (3040D)  
**Rise Time:** 5.8ns,  $\times 10$  MAG ON: 70ns (3060D)  
 8.8ns,  $\times 10$  MAG ON: 70ns (3040D)  
**Signal Delayed Time:** 20ns on the CRT (3060D only)  
**Input Impedance:** 1M $\Omega$ , 30pF  
**Input Coupling:** AC, GND, DC  
**Maximum Input Voltage:** 400V (DC + AC p-p)  
**Operation Mode:** CH1, CH2, CHOP, ALT, ADD  
**Polarity Invert:** CH2, INVERT  
**CH1 OUT:** 50mV/div into 50 $\Omega$  } (3060D)  
 DC to 60MHz, 50 $\Omega$  } (3060D)  
 50mV/div into 50 $\Omega$  } (3040D)  
 DC to 40MHz, 50 $\Omega$  } (3040D)

**Horizontal Axis Sweep Mode:** Trigger sweep, automatic trigger sweep, single sweep, continuous delayed sweep, trigger delayed sweep and ALT sweep } (3060D)  
 Trigger sweep, automatic trigger sweep and single sweep } (3040D)

**Sweep Time:** A: 50ns/div to 0.5s/div } (3060D)  
 B: 50ns/div to 0.5ms/div } (3060D)  
 0.1 $\mu$ s/div to 0.5s/div (3040D)

**Calibration Accuracy:** Within 3% (Within 5%  $\times 10$  MAG ON)  
**Variable Hold-off Time:** One sweep or more  
**Delay Sweep Jitter:** 1/10,000  
**Sweep Magnification:**  $\times 10$  MAG (3060D only)  
**Maximum Sweep Time:** 5ns/div  $\times 10$  MAG ON (3060D)  
 10ns/div  $\times 10$  MAG ON (3040D)

**Auto Range Function:** The sweep range is automatically set up so that the CRT always displays one to four waveforms.

**Triggering Signal Source:** ALT, CH1, CH2, LINE, EXT  
**Coupling:** AC, HF-REJ, DC, TV-FLD1, TV-FLD2, TV-LIN } (3060D)  
 AC, HF-REJ, DC, TV-V, TV-H (3040D)  
 +, -

**Slope Sensitivity:** 3060D

	Frequency Range	INT	EXT
NORMAL	DC to 10MHz	0.5div	0.2Vp-p
	DC to 60MHz	1.5div	0.6Vp-p
AUTO	30Hz to 10MHz	0.5div	0.2Vp-p
	30Hz to 60MHz	1.5div	0.6Vp-p

3040D

	Frequency Range	INT	EXT
NORMAL	DC to 10MHz	0.5div	0.2Vp-p
	DC to 40MHz	1.5div	0.6Vp-p
AUTO	30Hz to 10MHz	0.5div	0.2Vp-p
	30Hz to 40 MHz	1.5div	0.6Vp-p

**TV Synchronization:** Synchronizing pulses are extracted from composite video signals for triggering. (with sync slope switch)

**Line Selector:** Sweep is started from any line of composite video signal. (525 lines/625 lines changing) (3060D only)

**X-Y Mode:** X-axis: CH1, Y-axis: CH2  
**Sensitivity:** Both X-axis and Y-axis are identical to the vertical axis.

**Calibration Accuracy:** Within 3%  
**X-Axis Bandwidth:** DC (10Hz) to 1MHz  
**X-Y Phase:** 100kHz: within 3 $^\circ$

**Storage Mode Vertical Axis Resolution:** 8 bit (25 point/div)  
**Sensitivity:** 5mV/div to 5V/div  
**Calibration Accuracy:** Within 3% + 1/2 point

**Maximum Sampling Speed:** 40MS/s, 20MS/s at 2CH (3060D)  
 20MS/s (3040D)

**Bandwidth:** DC (10Hz) to 10MHz (3060D)  
 DC (10Hz) to 8MHz (3040D)

**Rise Time:** 50ns (3060D)  
 0.1 $\mu$ s (3040D)  
**Operation Mode:** CH1, CH2, DUAL (CHOP, ALT), ADD

**Horizontal Axis Resolution:** 11 bit (200 point/div)  
**Sweep Mode:** Trigger sweep, automatic trigger sweep, single sweep, continuous delayed sweep, trigger delayed sweep and roll mode } (3060D)  
 Trigger sweep, automatic trigger sweep, single sweep and roll mode } (3040D)  
**Sweep Time:** A sweep output 50ns/div to 50s/div (Less than 1s/div: roll mode operation) } (3060D)  
 B sweep time 50ns/div to 0.5ms/div } (3060D)  
 0.1 $\mu$ s/div to 20s/div (Less than 1s/div: roll mode operation) } (3040D)

**Calibration Accuracy:** Within 3% + 1/2 point  
**Pre-Trigger Point:** 0 to 10div, 0.1div step, the trigger point is intensified

**View Time:** 0.5 to 5s or OFF  
**Delayed Sweep Jitter:** 1/10,000 (3060D only)  
**Magnification:** The time axis can be magnified up to 100 times for the waveform hold. Waveform interpolation is done during magnification. PULSE or SIN

**Waveform Interpolation:** PULSE or SIN  
**Memory Capacity:** 8 bit  $\times$  2k word  $\times$  2CH  
**Display Memory:** 8 bit  $\times$  2k word  $\times$  2CH; Display memory waveform and reference memory waveform can be displayed at the same time.  
**Reference Memory:** Same as the real time mode, sampling clock is variable by A sweep range (3060D only)

**X-Y Mode:** available 3060D  
**GPIO:** option (3040D)

**Hard Copy Output:** Protter output for HP-GL, X-Y recorder output (3060D)  
 X-Y recorder output (3040D)

**CRT Readout Display Area:** 30 characters  $\times$  2 lines  
**Real Mode:** 30 characters  $\times$  2 to 4 lines  
**Storage Mode Display Item:**

**Vertical Axis:** Range setting value of CH1, CH2, input coupling, UNCAL, MAG, INV, ADD

**Horizontal Axis Real Mode:** Range setting value of A, B sweep, UNCAL, delayed time, TV LINE number. } (3060D)

**Storage Mode:** Sweep range setting value, UNCAL (3040D)  
 Range setting value of A, B sweep, UNCAL, delayed time, TV LINE number, pre-trigger point and MAG point } (3060D)  
 Sweep range setting value, pre-trigger point and MAG point. } (3040D)

**Cursor Measurement Component:** Two horizontal or vertical cursors (REF,  $\Delta$ )  
**Voltage Difference:** Measure the voltage between REF and  $\Delta$   
**Measurement Range:** More than  $\pm 3.6$ div from the center of the CRT

**Measurement Accuracy:** Within  $\pm 3\%$   
**Resolution:** 1/100div  
**Time Difference:** Measure the time between REF and  $\Delta$   
**Measurement Range:** Within 4.6div from the center of the CRT  
**Measurement Accuracy:**  $\pm 3\%$   
**Resolution:** 1/100div  
**Frequency:** Measurement the frequency with one cycle between REF and  $\Delta$

**Phase Difference:** Measurable when TIME VAR is in UNCAL mode.

**Automatic conversion:** The setting value and cursor measurement value are automatically converted and displayed on the CRT when the vertical or horizontal axis adopts the  $\times 10$  MAG mode and when the dedicated probe is used.

**Reference Memory Setting Display:** Storage mode only  
 Vertical axis range setting value: UNCAL, MAG Sweep range setting value: MAG 0.5Vp-p, 1kHz square wave

**Calibration Signal:** Temperature 10 to 35 $^\circ$ C  
**Environmental Condition (for guaranteed accuracy):** Humidity 80% or less  
 90 to 250 VAC, 50/60Hz, 52W (3060D)  
 90 to 250VAC, 50/60Hz, 48W (3040D)  
 310(W)  $\times$  150(H)  $\times$  430(D)mm, 8.1kg  
**Power Supply:** Probel LP-061X ..... 2  
 BNC terminal adaptor ..... 2  
 Spare fuse ..... 1

# OSCILLOSCOPE

## 100MHz, 3-CH 6-Trace, CRT Readout

### NEW



## Model 2100R CRT READOUT OSCILLOSCOPE

### • GENERAL

The Model 2100R is a portable oscilloscope with a CRT readout function that displays control settings and cursor measurement values on the CRT in alphanumeric characters. The 6-inch rectangular CRT has an aluminized high-brightness internal graticule with a maximum sweep rate of 5 ns/div ( $\times 10$  MAG). The 2100R operates at 100MHz (5 mV/div) or 5MHz (500 $\mu$ V/div).

Such features as 3-CH 6-trace, time-axis auto range, relative hold-off, and a TV field/line selector make the 2100R ideally suited for research and development, as well as the production and servicing of TVs, VTRs, computers, and peripheral devices.

### • FEATURES

- A newly developed 6-inch rectangular, dome-mesh assures high-brightness sharp waveforms.
- The CRT readout function enables all displayed control settings (including VOLTS/DIV and TIME/DIV) to be checked for quick measurements.
- Measurement values are displayed in alphanumeric characters by adjusting two cursors to the signal amplitudes or cycles to minimize errors and mistakes during measurements and to ensure accurate measurements.
- Setting values and cursor measurement values are converted automatically even when using  $\times 10$  MAG or a dedicated 1/10 probe.
- The time-axis auto-range function enables automatic range selection according to input signals to be displayed.
- A field selection function is added exclusively for TV synchronization. The TV-LINE sync function is also available.
- The P-P auto trigger level function sets a variable to trigger level range according to the trigger signal amplitude to facilitate small-signal synchronization.
- One-touch selection to highly-sensitive 500 $\mu$ V/div (bandwidth of 5MHz)
- The alternate (ALT) function displays the pre-magnified sweep (A INTEN BY B)
- The ALT TRIG function displays two asynchronous signal in stable.
- The triple trace display (CH1, CH2 and CH3) function is available for observing logic timing.
- Compact size. A handle is attached for portability.

## 60MHz, 2-CH 6-Trace, CRT Readout



### LBO-2060 CRT READOUT OSCILLOSCOPE

#### • GENERAL

The LBO-2060 is a delayed sweep dual-trace CRT readout oscilloscope that operates at 60 MHz/5mV.

It simplifies waveform observation by displaying various control setting, such as VOLTS/DIV and TIME/DIV, on the CRT as well as displaying numeric readings of waveform amplitudes and periods using a cursor function. Its abundant functions, including a TV sync separator and variable hold-off, make it ideally suited for inspecting and servicing TV receivers, VTRs, and computers.

#### • FEATURE

- A 150mm post-accelerating CRT with internal graticule and aluminized screen ensures bright, sharp waveform displays.
- The CRT readout function literally displays all necessary information including the setting status of vertical sensitivity, sweep time, etc on the CRT, allowing quick measurements.
- When both cursors are set to the signal amplitude and cycle, measured value are indicated by characters on the CRT. This greatly reduces measurement errors and mistakes.
- The set and measured values are automatically converted even in the  $\times 10$  MAG mode or when using the special 1/10 probe. This also prevents measurement errors.
- Easily switchable to a high sensitivity of  $500\mu\text{V}/\text{div}$  (5MHz) for measuring low level signal.
- Delayed sweep offers accurate calibration
- The one-touch horizontal axis magnification function " $\times 10$  MAG" sets up a maximum sweep rate of  $10\text{ns}/\text{div}$ ., thus displaying a 60MHz waveform in three cycles.
- The ALT TRIG function obtains stable for a synchronous two signals.
- Waveform observation of TV or VTR signals using the built-in sampling circuit for easier synchronization with TV composite video signals.

# OSCILLOSCOPE

## • SPECIFICATIONS

**CRT Type:** 150mm rectangular, aluminized, internal graticule, with % scale.

**Acceleration Voltage:** 17kV/1.7kV regulated (2100R)  
12kV/2kV regulated (2060)

**Effective Display Area:** 8 × 10div 1div = 10mm

**Beam Rotator:** Adjustment on the front panel

**Scale Illumination:** Adjustment on the front panel

**Intensity Modulation:** Blanking at TTL H level (2100R)  
TTL level (2060)

**CRT Readout Function Vertical Axis:** Range setting value of CH1, CH2 and CH3, input coupling, UNCAL, INV, ADD, × 10 MAG (automatic scale conversion), Automatic scale conversion with the dedicated probe CH1 and CH2: VOLT, × 10 MAG, ADD, Automatic scale conversion with the dedicated probe. CH2: INV Range setting value of A, B sweep, UNCAL, delayed time, TV-LINE number, × 10 MAG (automatic scale conversion) TIME/DIV (A, B TIME) UNCAL, × 10 MAG, delayed time, trigger signal source } (2100R)  
} (2060)

**Horizontal Axis:** Range setting value of A, B sweep, UNCAL, delayed time, TV-LINE number, × 10 MAG (automatic scale conversion) TIME/DIV (A, B TIME) UNCAL, × 10 MAG, delayed time, trigger signal source } (2100R)  
} (2060)

**Cursor Measurement Component:** Two horizontal or vertical cursors (REF, Δ)

**Voltage Difference:** Measure the voltage between REF and Δ

**Measurement Range:** ± 3.6div or more from the center of the CRT

**Accuracy:** ± 3%

**Resolution:** 1/100div

**Voltage Difference Ratio:** Displayed in % between REF and Δ based on 5div as 100% when V. VAR is set to UNCAL.

**Time Difference:** Displays the time measured between REF and Δ

**Measurement Range:** ± 4.6div or more from the center of the CRT

**Accuracy:** ± 3%

**Resolution:** 1/100div

**Time Difference Ratio:** Displayed in % between REF and Δ based on 5div as 100% when A TIME VAR is set to UNCAL.

**Frequency:** Displays the frequency with one cycle between REF and Δ

**Vertical Axis (for both CH1 and CH2) Sensitivity:** 5mV/div to 5V/div, 500μV/div to 2mV/div (× 10 MAG ON) 1-2-5 steps, 10 ranges, with continuous variable } (2100R)  
5mV/div to 5V/div, 500μV/div to 2mV/div (× 10 MAG ON) 1-2-5 steps, 10 ranges, with continuous variable } (2060)

**Calibration Accuracy:** ± 3% (± 5% × 10 MAG ON)

**Bandwidth:** DC to 100MHz (8div ref.), -3dB [DC to 5MHz (8div ref.), -3dB: × 10 MAG ON] } (2100R)  
DC to 60MHz (8div ref.), -3dB [DC to 5MHz (8div ref.), -3dB: × 10 MAG ON] } (2060)

**AC Coupling Rise Time:** Low band 10Hz (-3dB) 3.5ns (70ns: × 10 MAG ON) (2100R) 5.8ns (70ns: × 10 MAG ON) (2060)

**Signal Delay Time:** Approx. 20ns on the CRT

**Input Impedance:** 1MΩ ± 1.5%, 30pF ± 3pF (Tolerance: within ± 2pF) } (2100R)  
1MΩ ± 1.5%, 30pF ± 5pF (Tolerance: within ± 2%) } (2060)

**Input Coupling:** AC, GND, DC

**Maximum Input Voltage:** 400V (p-p+DC)

**Operation Mode:** [2100R] CH1, CH2, ADD, DUAL (CHOP, ALT) ..... CH1, CH2 TRIPLE (CHOP, ALT) ..... CH1, CH2, CH3 [2060] CH1, CH2, CHOP, ALT, ADD CH2, INVERT

**Polarity:** CH1 OUT: 25mV/div into 50Ω } (2100R)  
DC to 100MHz, -3dB } (2060)  
50mV/div into 50Ω } (2060)  
DC to 60MHz, -3dB } (2060)  
20MHz, -3dB (2100R only)

**Bandwidth Limiter:** 20MHz, -3dB (2100R only)

**Vertical Axis (CH3) (only 2100R) Sensitivity:** 0.1V/div, 0.5V/div

**Calibration Accuracy:** ± 3%

**Input Impedance:** 1MΩ ± 1.5% 30pF ± 3pF

**Bandwidth:** DC to 100MHz (8div ref.) -3dB

**Rise Time:** 3.5ns

### Horizontal Axis Sweep Mode:

Trigger sweep, automatic trigger sweep, single sweep, continuously delayed sweep, trigger delayed sweep, single delayed sweep and ALT sweep } (2100R)

### A Sweep Time:

Trigger sweep, automatic trigger sweep, continuous delayed sweep and trigger delayed sweep } (2060)

### B Sweep Time:

50ns/div to 0.5s/div, 1-2-5 steps, 22 ranges, continuously variable } (2100R)  
50ns/div to 0.5s/div, 1-2-5 steps, 13 ranges } (2060)

### Calibration Accuracy:

± 3%

### Variable Hold-off:

One sweep or more

### Relative Hold-off:

Only the A sweep (2100R only)

### Delayed Sweep Jitter:

1/20,000 (2100R)

### Delayed Sweep Position:

1/10,000 (2060)

### Delayed Sweep Position:

Readout display on the CRT (2100R)

### Sweep Magnification:

Accuracy: approx. ± 3% (2060)

### Maximum Sweep Time:

10 times Within ± 5%

### Auto Range:

5ns/div (× 10 MAG ON) Automatically sets the TIME/DIV range suited to an input waveform (2100R only)

### Triggering Signal Source:

ALT, CH1, CH2, LINE, CH3 (0.1V/div, 0.5V/div) (2100R)

### Coupling:

ALT, CH1, CH2, LINE, EXT (2060)  
AC, HF-REJ, DC, TV-LIN, TV-FLD1, TV-FLD2 (2100R)

### Slope:

+, -

### Sensitivity: 2100R

	Frequency Range	INT	EXT (0.1V/div)
NORMAL	DC to 10MHz	0.5div	0.1Vp-p
	DC to 100MHz	1.5div	0.3Vp-p
AUTO	30Hz to 10MHz	0.5div	0.1Vp-p
	30Hz to 100MHz	1.5div	0.3Vp-p

### 2060

	Frequency Range	INT	EXT
NORMAL	30Hz to 10MHz	0.5div	0.2Vp-p
	2Hz to 60MHz	1.5div	0.6Vp-p
AUTO	30Hz to 10MHz	0.5div	0.2Vp-p
	30Hz to 60 MHz	1.5div	0.6Vp-p

### Auto Level (p-p AUTO):

Variable range of the triggering level is set automatically depend on trigger signal level (2100R only)

### TV Synchronization:

Trigger pulses are separated from composite video signals for synchronizing. (with sync slope switch)

### Line Selector (only 2100R):

Sweep is standard from any line of composite video signal. (525 lines/625 lines changing)

### X-Y Mode Sensitivity:

Same as the vertical axis for both X-axis (CH1) and Y-axis (CH2)

### X-axis Bandwidth:

DC (10Hz) to 1MHz -3dB

### X-Y Phase Difference:

3° or less at 100kHz

### H.IN Mode Sensitivity:

0.1V/div, 0.5V/div (2100R only)

### Bandwidth:

DC (10Hz) to 1MHz -3dB (2100R only)

### Phase:

3° or less at 100kHz (2100R only)

### Calibrator Output Voltage Frequency

0.5Vp-p ± 2%

### Output Voltage Frequency

1kHz ± 20%, square wave (2100R)

### Environmental Conditions (for guaranteed accuracy):

Approx. 1kHz, square wave (2060)

### Environmental Conditions (for guaranteed accuracy):

Temperature 10 to 35°C

### Power Supply:

Humidity 80% or less

### Power Supply:

90 to 250VAC without switching, 50W } (2100R)

### Power Supply:

100, 120, 200, 220, 240VAC 55W } (2060)

### Power Supply:

310(W) × 150(H) × 400(D)mm (2100R)

### Power Supply:

290(W) × 160(H) × 375(D)mm, 9.5kg (2060)

### Size and Weight:

[2100R]

### Accessories:

Low-capacitance probe (10:1) LP-101X ..... 2

### Accessories:

BNC terminal adaptor ..... 2

### Accessories:

Spare fuse ..... 1

### Accessories:

[2060]

### Accessories:

Low-capacitance probe (10:1) LP-061X ..... 2

### Accessories:

BNC terminal adaptor ..... 2

### Accessories:

Spare fuse ..... 1

# OSCILLOSCOPE

## Streamlined 100 MHz, 4-CH, 8-Trace



### LBO-518 QUAD TRACE OSCILLOSCOPE

#### ● GENERAL

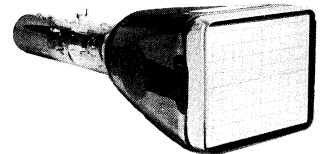
The LBO-518 is a 100 MHz oscilloscope with all of the features normally found on a lab-grade scope: Stable operation, dual time base with sweep delay, flexible triggering facilities, and a bright CRT display with internal graticule. Moreover, it also has a flat rectangular face, a feature found on few scopes in any price class: it can simultaneously display up to eight traces from four different input signals. In addition to the two vertical input channels, the signals used to externally trigger the main and delayed time bases can appear on the CRT display. The alternate sweep mode, which allows the input signal to be simultaneously displayed by both the main time base and the delayed time base, effectively doubles this four-trace display to an eight trace display. The comprehensive triggering capability of the LBO-518 includes several features that ease the problem of triggering on complex signals; a variety of frequency-selective coupling filters, a trigger hold-off control, and trigger pick-off that alternates between the two vertical channels.

#### ● FEATURES

- Newly developed rectangular dome meshed CRT (6-inch diagonal) for large screen area and high brightness display with 20-kV acceleration voltage.
- Auto-focusing for optimal images at all time.
- Localization of spot by using the beam finder function.
- 20MHz band-pass switch displays sharp waveform by removing harmonic noise.
- Viewing of logic timings through simultaneous display of up to triple or quad traces.
- Wide bandwidth of 100MHz can be measured at high sensitivity of 5mV/div. Further the sensitivity is quickly magnified to extra high sensitivity of 500 $\mu$ V/div (5MHz) by the 10 times magnifier, thus enabling accurate measurement of feeble video signals, ripples of a regulated power supply.
- Linked switch function for A/B sweepings to prevent mis-operation of delayed sweeping.
- Various alarm indicators to eliminate mis-operations.
- CH1 OUT drives the frequency counter.

#### Bright 6-inch rectangular type CRT with internal graticule

A newly developed rectangular domemesh type CRT (6-inch diagonal) is employed. Sharp high intensity waveforms can be observed with 20 kV post accelerating voltage.



#### Beam finder function

The beam finder function displays bright, contracted waveforms on the CRT allowing you to find out rough waveform positions positively when vertical and horizontal positions largely deviate or no waveform comes to appear on the CRT.

#### Wide bandwidth of 100MHz and extra high sensitivity of 500 $\mu$ V

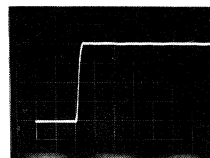
A wide bandwidth of 100 MHz can be measured at high sensitivity of 5 mV/div. Further, the sensitivity is quickly magnified to extra high sensitivity of 500  $\mu$ V/div (5 MHz) by the 10 times magnifier, thus enabling accurate measurement of feeble video signals, ripples of a stabilized power supply.

#### 20MHz band limit for sharp waveform display



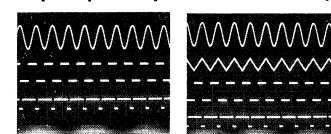
The bandwidth limiting switch is provided to limit the bandwidth of the vertical axis amplifier to 20 MHz, thus enabling display of sharp waveforms by eliminating high frequency noise.

#### Equipped with signal delay line



The signal delay line is built in for accurate measurement of rise-time of high speed pulses.

#### Triple/quadruple channels display at 100MHz



Independent observation of single channel through quad channels is possible. The quad channels display is convenient for logic timing observation.

# OSCILLOSCOPE

## Versatile, 100MHz/15mV Oscilloscope



### LBO-516 TRIPLE TRACE OSCILLOSCOPE

#### ●GENERAL

The LBO-516 is a portable oscilloscope that provides a max. sensitivity of 5mV/div (100MHz), 500 $\mu$ V/div (5MHz), a max. sweep time of 2ns/div (MAG  $\times$  10), and is equipped with 150mm rectangular CRT display. This model can be used in a wide range of research, production, and service applications for measuring and testing TV sets. VTRs and computer peripheral equipment. This is made possible by the TV synchronization separator, Hold-off variable, 3CH, 8-trace, and CH-1 OUT functions.

#### ●FEATURES

- CRT: 150mm (6 inch) rectangular, internal-graticule with illumination lamp, dome mesh type, and 20kV acceleration voltage for high-brightness display.
- Auto focus maximizes visual clarity.
- Wide bandwidth and high sensitivity of 100MHz/5mV (500 $\mu$ V:  $\times$  10 MAG ON)
- Logic timing is obtained in triple traces.
- Sweep delay offers accurate calibration.
- Signal delay line is used for accurate measurement of rise-time of high-speed pulses.
- TRIG VIEW (internal CH-3) ensures synchronization signals.
- ALT sweep simultaneously displays primary sweep and sweep expanded.
- 3CH-8-trace and B ENDS A functions.
- 4 traces display of CH-1, CH-2, CH-3, and ADD (CH 1  $\pm$  CH 2).
- B sweep TV-H synchronization provides stable display of VITS and Video Disc control codes.
- ALT trigger synchronizes different two waveforms.
- Hold-off variable synchronizes complex waveforms.
- CH 1 OUT drives the frequency counter.
- PRESET TRIG. eliminates synchronization control
- Single sweep function is useful for single trace display.
- Various alarm indicators on the front panel prevent operation errors.

#### Independent setting of triple traces.

Adjusting control with CH-1 and CH-2 waveforms on display in the vertical ALT mode causes CH-3 waveform to be displayed, to enable simultaneous viewing of three waveforms.

#### Simultaneous display of an ADD waveform with CH-1 and CH-2 inputs waveforms.

By adjusting control CH-1, CH-2, and ADD, waveforms are simultaneously displayed to simplify waveform comparisons and determination of ham noise during push-pull amp checks.

#### Increased measuring efficiency offered by continuous/synchronized delayed sweeps.

Continuous delayed sweeps are used for normal waveform measurement. Synchronized delayed sweeps make it possible to view waveforms at higher magnification rates, or to view waveforms synchronized with special pulses, or to minimize B-sweep jitter. With the A-sweep set at TV-V, the B-sweep is automatically set at TV-H to offer a stable display of waveforms in units of VITS.

#### Simultaneous viewing of up to 8-traces of 4-waveforms.

The LBO-516 offers simultaneous viewing of up to eight traces, including CH-1, CH-2, CH-3, and ADD waveforms in the ALT mode, and their main and magnified sweeps in the ALT sweep mode.

#### CH-1 OUT for precise frequency measurement.

By connecting a frequency counter to the CH-1, OUT terminal, CH-1 input signals are continuously output to the CH-1 OUT terminal via the preamp and buffer.

This enables the frequency counter to be used as a high-sensitivity counter to provide precise frequency measurement.



# OSCILLOSCOPE

## ● SPECIFICATIONS

**CRT Type:** 150mm rectangular, internal-graticule, post-acceleration, scale with illumination lamp.

**Acceleration Voltage:** 20kV/2kV

**Effective Display Area:** 8 × 10div (1div = 10mm)

**Intensity Modulation:** Blanked by TTL level signal

**Vertical Axis**

**CH1, CH2 Input:** (Identical for both channel)  
5mV/div to 5V/div

**Sensitivity:** 500 $\mu$ V/div to 2mV/div (× 10 MAG ON)  
± 3% (± 5%: × 10 MAG ON)  
1M $\Omega$  ± 2%, 25pF ± 3pF

**Calibration Accuracy:** ± 3% (± 5%: × 10 MAG ON)

**Input Impedance:** 1M $\Omega$  ± 2%, 25pF ± 3pF

**Bandwidth:** DC (10Hz) to 100MHz, 8div ref., -3dB  
DC (10Hz) to 5MHz, 8div ref., -3dB (× 10 MAG ON)

**Rise Time:** 3.5ns (70ns: × 10 MAG ON)

**Input Coupling:** AC-GND-DC

**Maximum Input:** 600V (DC + ACp-p) (518)  
400V (DC + ACp-p) (516)

**CH3, CH4 Input (516; only CH3):** (A, B EXT. TRIG. IN) (518)  
(A EXT. TRIG. IN) (516)  
CH-3; 0.2V/div, 2V/div } (518)  
CH-4; 0.2V/div, 2V/div }  
0.2V/div, 2V/div (516)

**Sensitivity:** ± 3%

**Calibration Accuracy:** ± 3%

**Input Impedance:** 1M $\Omega$  ± 2%, 25pF ± 3pF

**Bandwidth:** DC to 100MHz, -3dB

**Rise Time:** 3.5ns

**Maximum Input:** 600V (DC + ACp-p) (518)  
400V (DC + ACp-p) (516)

**CH1, CH2, CH3, CH4 Input (516; CH1, CH2, CH3):**

**Signal Delay Time:** Approx. 20ns, permits viewing of leading edge to waveform

**Operation Mode:** [518]  
CH1, CH2, ADD, (CH1 ± CH2)  
DUAL (ALT, CHOP) ..... CH1, CH2  
TRIPLE (ALT, CHOP) ..... CH1, CH2, CH3  
QUAD (ALT, CHOP) ..... CH1, CH2, CH3, CH4  
[516]  
CH1, CH2, ADD (CH1 ± CH2)  
DUAL (ALT, CHOP) ..... CH1, CH2  
TRIPLE (ALT, CHOP) ..... CH1, CH2, CH3  
QUAD (ALT, CHOP) ..... CH1, CH2, CH3, ADD (CH1 ± CH2)

**Polarity:** CH2 INVERT

**X-Y Mode:** X axis; CH1, Y axis; CH2

**Sensitivity:** Same as the vertical axis

**Bandwidth:** DC (10Hz) to 3MHz, -3dB

**Phase Difference:** Within 3° at 100kHz

**CH1 Output**

**Output Voltage:** 25mVp-p/div into 50 $\Omega$

**Bandwidth:** DC (10Hz) to 100MHz, -3dB

**Output Impedance:** 50 $\Omega$

**Horizontal Axis**

**Sweep Mode:** Trigger sweep, automatic trigger sweep, single sweep, continuous delayed sweep, trigger delayed sweep, single delayed sweep and ALT sweep

**A Sweep Time:** 20ns/div to 0.5s/div, 1-2-5 steps, 23 ranges, with continuous adjuster

**B Sweep Time:** 20ns/div to 0.5s/div, 1-2-5 steps, 23 ranges (518)  
20ns/div to 50ms/div, 1-2-5 steps, 20 ranges (516)

**Calibration Accuracy:** ± 3%

**Variable Hold-off:** One sweep or more (Only 0.5s/div; 0.5 sweep or more)

**Delay Time Jitter:** 1/20,000 or better

**Magnifier:** 10 times ± 5%

**Maximum Sweep Time:** 2ns/div (× 10 MAG ON)  
± 3%, ± 5% (× 10 MAG ON)

**Linearity:** ± 3%, ± 5% (× 10 MAG ON)

**Triggering**

**Signal Source:**

**A Sweep**  
CH1, ALT, CH2, LINE, EXT 0.2V/div, EXT 2V/div

**B Sweep:** CH1, ALT, CH2, EXT 0.2V/div, EXT 2V/div (518)  
INT (516)

**Coupling:**

**A Sweep:** AC, HF-REJ, LF-REJ, DC, TV-V, TV-H (518)  
AC, HF-REJ, DC, TV-V, TV-H (516)

**B Sweep:** AC, HF-REJ, LF-REJ, DC, TV-H (518)  
INT, TV-H (A-sweep is set at TV-V) (516)  
+, -

**Slope:**

**Sensitivity:** LBO-518

	Frequency Range	INT	EXT
NORMAL	DC to 10MHz	0.4div	0.5V
	DC to 100MHz	1.5div	1.5V
AUTO	30Hz to 10MHz	0.4div	0.5V
	30Hz to 100MHz	1.5div	1.5V

### LBO-516

	Frequency Range	INT	EXT
NORMAL	DC to 10MHz	0.4div	0.1V
	DC to 100MHz	1.5div	0.4V
AUTO	30Hz to 10MHz	0.4div	0.1V
	30Hz to 100MHz	1.5div	0.4V

**Calibrator**

**Output Voltage:** 0.5Vp-p ± 1%

**Waveform:** 1kHz ± 2%, square wave (518)  
1kHz, square wave (516)

**Environmental Conditions (for guaranteed accuracy):** Temperature 10 to 35°C  
Humidity 80% or less

**Power Supply:** 100, 120, 200, 220, 240VAC } (518)  
50/60Hz, 65W }  
100, 120, 200, 220, 240VAC } (516)  
50/60Hz, 55W }

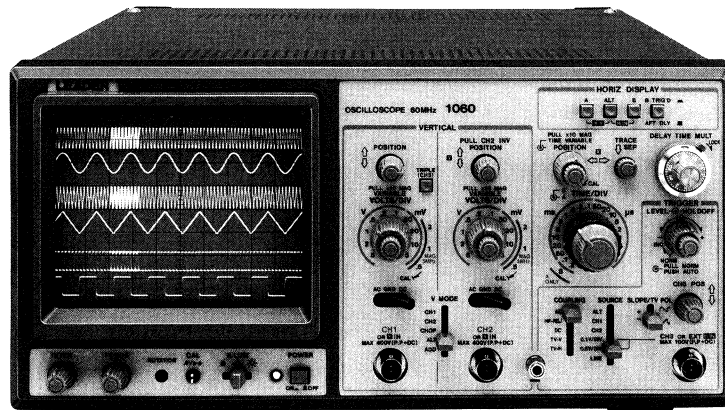
**Size and Weight:** 305(W) × 145(H) × 400(D)mm, 9.5kg

**Accessories:** Probe LP-100X ..... 2  
BNC terminal adaptor ..... 2  
Time lag fuse ..... 2

# OSCILLOSCOPE

## 60MHz, 3-CH, 6-Trace, Built-in Various Functions

**NEW**



### Model 1060 TRIPLE TRACE OSCILLOSCOPE

#### ● GENERAL

The Model 1060 is portable oscilloscope that feature 5mV/div. (60MHz), 500 $\mu$ V/div. (5MHz), and a maximum sweep rate of 10ns/div. ( $\times 10$  MAG). Both have delayed sweep functions and high-luminance, 6-inch rectangular aluminized internal graticule CRTs.

With three-channel six-trace capabilities, TV Sync. separators, variable holdoff, alternate sweep and vertical axis magnifiers, the Model 1060 is designed with optimum portability and operability for use on the production lines of television sets and VTRs, and for their servicing.

#### ● FEATURES

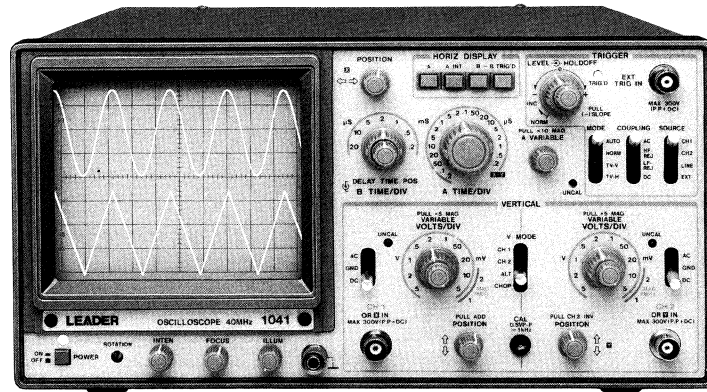
- Six-inch rectangular internal graticule CRT and regulated/accelerated high voltage ensure error-free readings and accurate measurements, with an aluminized CRT for high luminance. Scale illumination and beam rotation features are also provided.
- Switchable to a high sensitivity of 500 $\mu$ V/div (5MHz) to observe the ripple of a regulated power source and other devices, and for measuring microsignals in bio-experiments.
- The built-in signal delay line enables observation of the rising edge of a high-speed wave.
- A three-channel display is provided for logic timing observation.
- The delayed sweep function enables wider waveform observations. To simplify operation, the A and B axis switches are configured into a single-axial dual-wheel control. The alternate sweep function displays the original and magnified waveforms at one time so that the original waveform can be observed while checking the magnified waveform position.

- The  $\times 10$  MAG for quick waveform magnification sets a maximum sweep ratio of 10ns/div. to display a waveform of 60MHz by six cycles on the CRT.
- The built-in synchronous sampling circuit facilitates synchronization with TV composite video signals. The vertical or horizontal axis can be selected regardless of the time/div. switch setting. Therefore, the horizontal axis wave can be observed while synchronized with the vertical axis.
- With the main sweep set in the TV-V Sync. mode, triggering the delayed sweep synchronizes the delayed sweep with the main sweep on the TV-H axis. This feature displays the control codes of VITS and video disks.
- The ALT TRIG function enables the stationary and simultaneous display of two different signals of different timings.
- Variable holdoff time ensures the observation of video signals and computer-generated pulse trains (signals like digital word pulses) under stable synchronization.
- Switching the polarities at ADD and CH2 enables phase and level comparisons between two signals, and the observation of their sum and difference. This features also displays push-pull signals accurately.
- Signals applied to CH1 can be fetched by the vertical pre-amplifier through a buffer. This output is approx. 50mVp-p. Therefore, it can be used as a ultra high-sensible frequency counter when connected to a frequency counter.
- Switchable to an X-Y oscilloscope (with CH1 as the X-axis and CH2 as the Y-axis) through a simple operation. Dual-trace X-Y (H. IN) operation (with CH3 as the X-axis and CH1 and CH2 as the Y-axis) is also provided.

# OSCILLOSCOPE

## Higher-Quality and Lower Cost Oscilloscope

**NEW**



### **Model 1041(40MHz) Model 1021(20MHz) DUAL TRACE OSCILLOSCOPE**

#### ● GENERAL

The Model 1041 and Model 1021 are oscilloscopes that are designed to satisfy both higher-quality and lower cost requirements. Featuring high-brightness, a rectangular 6-inch CRT with an internal graticule, and an array of precision components, each model of this series integrates versatile features and easy operation in a refined design package. In addition, these models are being offered at reasonable low prices without reducing the quality.

The Model 1041 is a standard oscilloscope that features delayed sweep triggered function, signal delay lines, scale illumination and beam rotation capabilities, plus a high-brightness, aluminized 6-inch rectangular CRT with an internal graticule. The acceleration voltage is regulated to ensure accurate measurements. The Model 1041 offers 5mV/div. (40MHz), 1mV/div. (7MHz), and a maximum sweep factor of 100 ns/div. ( $\times 10$  MAG).

The Model 1021 is a utility oscilloscope that features scale illumination and beam rotation capabilities, plus a 6-inch rectangular CRT with an internal graticule. The acceleration voltage is regulated to ensure accurate measurements. The Model 1021 offers 5mV/div. (20MHz), 1mV/div. (7MHz), and a maximum sweep factor of 100ns/div. ( $\times 10$  MAG).

#### ● FEATURES

- A built-in signal delay line for quick and accurate observations of the leading edge of high-speed waveforms. (Model 1041)
- The delayed sweep feature available in the Model 1041 enables complex waveform measurements. The alternate sweep can simultaneously display the original waveform and its magnification, so that the waveform can be set while checking the location of magnification. (Model 1041)
- Both models have sync signal sampling circuits used for simple triggering with TV composite signals. Regardless of the TIME/DIV setting, this feature can select a vertical or horizontal sync signal. When the vertical axis is selected for triggering, the horizontal waveform can be observed.
- A available hold-off feature is provided by all models. Use this feature to adjust the main sweep hold-off time and synchronize with complicated signals like pulse trains (digital word pulse) of video or computer signals, while ensuring stable observation.
- Using the vertical preamplifier, the signal applied to CH1 can be fetched through the buffer as a signal of approx. 20mVp-p/div of the CRT. When connected to the frequency counter, both models can be used as a ultra-sensible frequency counter.

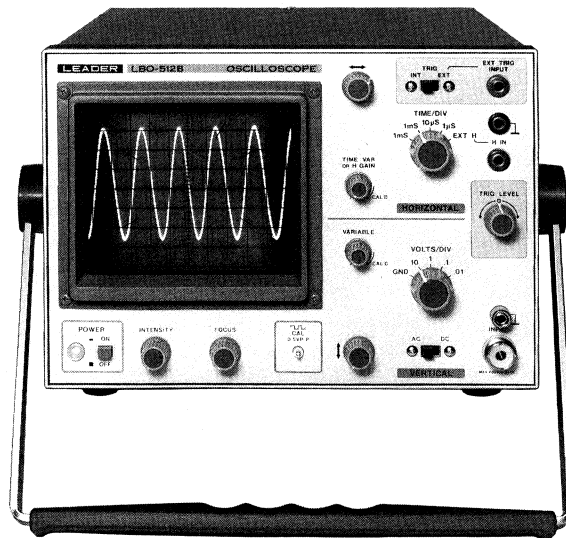
# OSCILLOSCOPE

## ● SPECIFICATIONS

	Model 1060	Model 1041	Model 1021																																																																					
<b>CRT</b>	150mm rectangular aluminized screen, internal graticules		150mm rectangular, internal graticules																																																																					
<b>Type</b>	150mm rectangular aluminized screen, internal graticules																																																																							
<b>Accelerator Voltage</b>	Regulated 12kV/2kV	Regulated 12kV	Regulated 2kV																																																																					
<b>Beam Rotator</b>	Adjustment on front panel																																																																							
<b>Scale Illumination</b>	OFF, LOW, High	Variable																																																																						
<b>Intensity Modulation</b>	Blanking at TTL H level (dark)																																																																							
<b>Vertical Axis (for both channel CH1 and CH2)</b>																																																																								
<b>Deflection Factor</b>	5mV/div to 5V/div, 500 $\mu$ V/div to 2mV/div ( $\times$ 10 MAG ON) 1-2-5 steps, 10 ranges with fine adjuster	5mV/div to 5V/div, 1mV/div ( $\times$ 5 MAG ON) 1-2-5 steps, 10 ranges with fine adjuster																																																																						
<b>Calibration Accuracy</b>	$\pm$ 3% ( $\pm$ 5%: $\times$ 10 MAG ON)	$\pm$ 3% ( $\pm$ 5%: $\times$ 5 MAG ON)																																																																						
<b>Input Impedance</b>	1M $\Omega$ , 30pF $\pm$ 5pF	1M $\Omega$ , 30pF $\pm$ 5pF																																																																						
<b>Bandwidth</b>	DC to 60MHz (8div ref.) - 3dB DC to 5MHz (8div ref.) - 3dB $\times$ 10 MAG ON	DC to 40MHz (6div ref.) - 3dB DC to 7MHz (6div ref.) - 3dB $\times$ 5 MAG ON	DC to 20MHz (6div ref.) - 3dB DC to 7MHz (6div ref.) - 3dB $\times$ 5 MAG ON																																																																					
<b>Display Mode</b>	CH1, CH2, ADD (CH1 $\pm$ CH2) DUAL (ALT, CHOP) . . . CH1, CH2 TRIPLE (ALT, CHOP) . . . CH1, CH2, CH3	CH1, CH2, CHOP, ALT, ADD																																																																						
<b>Rise Time</b>	5.8ns (70ns: $\times$ 10 MAG ON)	8.8ns (50ns: $\times$ 5 MAG ON)	17.5ns (50ns: $\times$ 5 MAG ON)																																																																					
<b>Signal Delay Time</b>	20ns																																																																							
<b>Input Coupling</b>	AC, GND, DC																																																																							
<b>Maximum Input Voltage</b>	400V (p-p + DC)	300V (p-p + DC)																																																																						
<b>Polarity</b>	CH2 INVERT																																																																							
<b>CH1 OUT</b>	50mV p-p/div into 50 $\Omega$ DC to 60MHz, - 3dB	20mV p-p/div into 50 $\Omega$ 50Hz to 5MHz	20mV p-p/div into 50 $\Omega$ 50Hz to 4MHz																																																																					
<b>Vertical Axis (CH3)</b>																																																																								
<b>Deflection factor</b>	0.1V/div, 0.5V/div																																																																							
<b>Calibration Accuracy</b>	$\pm$ 3%																																																																							
<b>Input Impedance</b>	1M $\Omega$ , 30pF $\pm$ 5pF																																																																							
<b>Bandwidth</b>	DC to 60MHz																																																																							
<b>Rise Time</b>	5.8ns																																																																							
<b>Maximum Input Voltage</b>	100V (p-p + DC)																																																																							
<b>Horizontal Axis</b>																																																																								
<b>Sweep Method</b>	Trigger sweep, automatic trigger sweep, continuously delayed sweep, trigger delayed sweep		Trigger sweep, automatic trigger sweep																																																																					
<b>A Sweep Time</b>	0.1 $\mu$ s/div to 0.2s/div, 1-2-5 steps, 20 ranges with fine adjuster	0.2 $\mu$ s/div to 0.2s/div, 1-2-5 steps, 19 ranges with fine adjuster																																																																						
<b>B Sweep Time</b>	0.1 $\mu$ s/div to 50ms/div 1-2-5 steps, 18 ranges	0.2 $\mu$ s to 20 $\mu$ s/div 1-2-5 steps, 7 ranges																																																																						
<b>Calibration Accuracy</b>	$\pm$ 3%																																																																							
<b>Maximum Sweep Time</b>	10ns/div ( $\times$ 10 MAG ON)	100ns/div ( $\times$ 10 MAG ON)	100ns/div ( $\times$ 10 MAG ON)																																																																					
<b>Delay Sweep Jitter</b>	1/1000	1/20000																																																																						
<b>Delay Time Position</b>	10-turn multi-dial setting accuracy: $\pm$ 3%	1div to 10div of A Sweep Time																																																																						
<b>Sweep Magnification</b>	$\times$ 10 MAG ON $\pm$ 5% ( $\pm$ 10%, 0.1 $\mu$ s/div)	$\times$ 10 MAG ON $\pm$ 5% (except 0.5 $\mu$ s/div, 0.2 $\mu$ s/div)																																																																						
<b>Variable Hold-off Time</b>	One sweep or more	Variable																																																																						
<b>Triggering</b>																																																																								
<b>Signal Source</b>	ALT, CH1, CH2, LINE CH3 (0.1V/div, 0.5V/div)	CH1, CH2, LINE, EXT																																																																						
<b>Coupling</b>	AC, HF-REJ, DC, TV-V, TV-H	AC, HF-REJ, LF-REJ, DC, TV-V, TV-H																																																																						
<b>Slope</b>	+, -																																																																							
<b>Sensitivity</b>	<table border="1"> <thead> <tr> <th rowspan="2">Frequency Range</th> <th rowspan="2">INT</th> <th rowspan="2">EXT</th> <th colspan="2">DC to 5MHz</th> <th colspan="2">5MHz to 40MHz</th> <th colspan="2">DC to 2MHz</th> <th colspan="2">2MHz to 20MHz</th> </tr> <tr> <th>INT</th> <th>EXT</th> <th>INT</th> <th>EXT</th> <th>INT</th> <th>EXT</th> <th>INT</th> <th>EXT</th> </tr> </thead> <tbody> <tr> <td rowspan="2">NORM DC to 10MHz</td> <td>0.5div</td> <td>0.1Vp-p</td> <td>0.5div</td> <td>1.5div</td> <td>INT</td> <td>0.5div</td> <td>INT</td> <td>0.5div</td> <td>1.5div</td> <td></td> </tr> <tr> <td>DC to 60MHz</td> <td>1.5div</td> <td>0.3Vp-p</td> <td>200mV</td> <td>800mV</td> <td>EXT</td> <td>200mV</td> <td>800mV</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">AUTO 30Hz to 0MHz</td> <td>0.5div</td> <td>0.1Vp-p</td> <td colspan="8">AUTO; 30Hz or more</td> </tr> <tr> <td>30Hz to 60MHz</td> <td>1.5div</td> <td>0.3Vp-p</td> <td colspan="8"></td> </tr> </tbody> </table>	Frequency Range	INT	EXT	DC to 5MHz		5MHz to 40MHz		DC to 2MHz		2MHz to 20MHz		INT	EXT	INT	EXT	INT	EXT	INT	EXT	NORM DC to 10MHz	0.5div	0.1Vp-p	0.5div	1.5div	INT	0.5div	INT	0.5div	1.5div		DC to 60MHz	1.5div	0.3Vp-p	200mV	800mV	EXT	200mV	800mV			AUTO 30Hz to 0MHz	0.5div	0.1Vp-p	AUTO; 30Hz or more								30Hz to 60MHz	1.5div	0.3Vp-p																	
Frequency Range	INT				EXT	DC to 5MHz		5MHz to 40MHz		DC to 2MHz		2MHz to 20MHz																																																												
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NORM DC to 10MHz	0.5div	0.1Vp-p	0.5div	1.5div	INT	0.5div	INT	0.5div	1.5div																																																															
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	30Hz to 60MHz	1.5div	0.3Vp-p																																																																					
<b>TV Synchronization</b>	Synchronizing pulses are extracted from composite video signals for triggering.																																																																							
	TV + & -	TV -																																																																						
<b>X-Y Mode</b>																																																																								
<b>Deflection factor</b>	CH1 . . . X axis, CH2 . . . Y axis Both X and Y axis are identical to the vertical axis.																																																																							
<b>X Axis Bandwidth</b>	DC (10Hz) to 1MHz (8div ref.), - 3dB	DC to 500kHz																																																																						
<b>X-Y Phase</b>	Less than 3 $^\circ$ at 100kHz	Less than 3 $^\circ$ at 50kHz, less than 3 $^\circ$ at 20kHz																																																																						
<b>H. IN Mode</b>																																																																								
<b>Deflection factor</b>	CH3 . . . X axis CH1, CH2, CHOP . . . Y axis																																																																							
<b>X Axis Bandwidth</b>	DC (10Hz) to 1MHz																																																																							
<b>X-Y Phase</b>	Less than 3 $^\circ$ at 100kHz																																																																							
<b>Calibrator</b>																																																																								
<b>Output Voltage</b>	0.5Vp-p $\pm$ 2%	0.5Vp-p $\pm$ 3%																																																																						
<b>Waveform</b>	1kHz, square wave																																																																							
<b>Environmental Conditions (for guaranteed accuracy)</b>	Temperature 10 to 35 $^\circ$ C Humidity 80% or less																																																																							
<b>Power Supply</b>	100, 120, 200, 220, 240V AC $\pm$ 10%, 40W	100, 120, 200, 220, 240V AC $\pm$ 10%, 55W																																																																						
<b>Size and Weight</b>	310(W) $\times$ 150(H) $\times$ 375(D)mm, 8kg	290(W) $\times$ 145(H) $\times$ 375(D)mm, 8kg	290(W) $\times$ 145(H) $\times$ 375(D)mm, 7.5kg																																																																					
<b>Accessories</b>	Low capacitance probe (LP-060X) . . . . . 2 BNC terminal adaptor (LC-1585) . . . . . 2 Spare fuse . . . . . 1	Low capacitance probe (LF-180) . . . . . 2 Spare fuse . . . . . 1																																																																						

# OSCILLOSCOPE

## 10MHz/10mV Oscilloscope with Auto-trigger Circuit



### LBO-512B 130mm OSCILLOSCOPE

#### ● GENERAL

The LBO-512B is a light, compact, versatile triggered scope equipped with a 130mm high-brightness CRT which is 2 times as bright as the conventional one. Its excellent performance characteristics permit a variety of uses in adjustments and testing of TV sets, radios, amateur radio equipment and other home entertainment equipment as well as in monitoring of various instruments. Also, up to 10MHz of synchronous frequency bandwidth is secured so that the 10mV/div, 10MHz vertical amplifier may be used most efficiently. Moreover, a bright screen and easy handling make the LBO-512B most suited for use in production lines, schools, and educational purposes.

#### ● FEATURES

- Direct deflection terminal for vertical and horizontal deflection plate.
- Built-in automatic trigger synchronizing circuit.
- High brightness CRT.

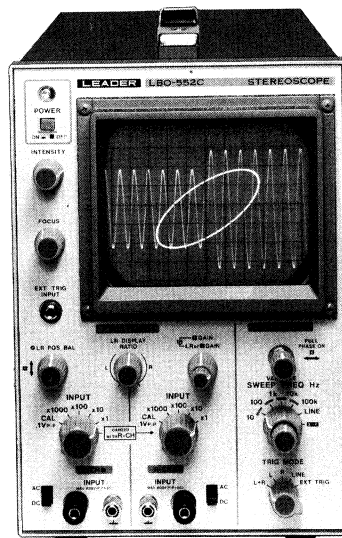
#### ● SPECIFICATIONS

##### CRT

<b>Type:</b>	130BxB31
<b>Effective Display Area:</b>	8 × 10div (1div = 10mm)
<b>Acceleration Voltage:</b>	1350V
<b>Intensity Modulation:</b>	20Vp-p or more
<b>Vertical Axis</b>	
<b>Sensitivity:</b>	10mV/div, 100mV/div, 1V/div, 10V/div, 4 ranges Covering 10mV/div to 100V/div with continuous adjuster
<b>Calibration Accuracy:</b>	± 5%
<b>Bandwidth:</b>	4div ref. DC: DC to 10MHz, -3dB AC: 2Hz to 10MHz, -3dB 8div ref. DC: DC to 6MHz, -3dB AC: 2Hz to 6MHz, -3dB
<b>Rise Time:</b>	35ns
<b>Input Impedance:</b>	1MΩ, 35pF ± 5pF
<b>Coupling:</b>	AC, DC, GND
<b>Time Base</b>	
<b>Sweep Time:</b>	1ms/div, 0.1ms/div, 10μs/div, 1μs/div, 4 ranges Covering 10ms to 1μs/div with continuous adjuster.
<b>Calibration Accuracy:</b>	± 5%
<b>Horizontal Axis</b>	
<b>Sensitivity:</b>	200mV/div, Covering 200mV to 10V/div with continuous adjuster
<b>Bandwidth:</b>	DC to 250kHz, -3dB (H. GAIN maximum)
<b>Input Impedance:</b>	100kΩ
<b>Maximum Input Voltage:</b>	100V (DC + ACp-p)
<b>Triggering</b>	
<b>Signal Source:</b>	INT., EXT. (1Vp-p, 10Hz to 5MHz, with trigger level control knob)
<b>Calibrator</b>	
<b>Waveform:</b>	Square wave (Mains frequency)
<b>Voltage:</b>	0.5Vp-p ± 3%
<b>Rear Panel Terminal:</b>	Direct deflection terminal (X, Y, vector) Intensity modulation terminal (20Vp-p)
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, 15VA
<b>Size and Weight:</b>	250(W) × 175(H) × 375(D)mm, 7.2kg
<b>Accessories:</b>	Probe LP-16 BY ..... 1 Test leads (three per set) ..... 1

# OSCILLOSCOPE

## 10MHz/20mV, Lissajous' Figure



### LBO-552C LBO-552A1

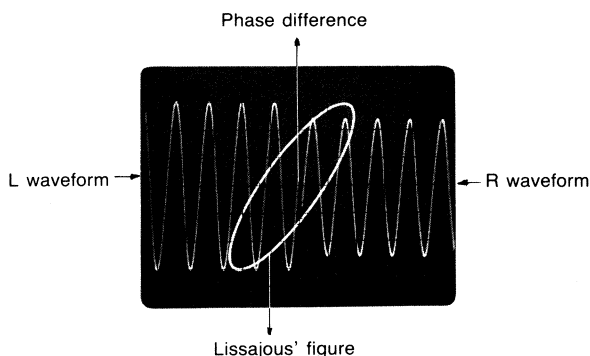
### 130mm DUAL TRACE TRIGGER STEREOSCOPE

#### • GENERAL

Here is a 130mm (5") scope specially adapted for observing waveforms in stereo circuits. It is a dual-trace type in which two waveforms, left and right signal, are displayed side by side. This feature permits instant comparison of amplitudes and phase for balance adjustments. Indispensable when checking stereo equipment tape-recorders, amplifiers, receivers in manufacturing plants and in service shops.

#### • FEATURES

• Amplitude and phase difference are observed by L.R. waveform display and Lissajous' figures is simultaneously shown in the center. (LBO-552C).



- Two input signals in the same range can be adjusted with a common gain control.
- Azimuth adjustments of the magnetic head in a tape recorder can be easily performed.
- Close inspection can be made for L and R inputs by "sliding" the waveforms to either side.
- X-Y operation requires only one switch setting; no tedious recon-nections and switching operations are needed.
- The waveform to be measured automatically stays static, since the trigger sweep circuit is employed.
- Parasitic oscillation of an audio amplifier can be readily observed, because the vertical axis has a wide band of 10MHz

#### • SPECIFICATIONS

##### CRT

Type: 130XB31  
 Acceleration Voltage: 1350V  
 Effective Display Area:  $8 \times 10$ div (1div = 10mm)  
 Intensity Modulation: 10Vp-p or more  
 Vertical Axis (L and R channels):

Sensitivity: 20mVp-p/div or better

##### Balancing Error for

L and R Channel: Less than 3%

##### Bandwidth:

DC: DC to 10MHz, -3dB, 4div ref.  
 AC: 2Hz to 10MHz, -3dB, 4div ref.

Input Impedance:  $1M\Omega$ , less than 47pF

##### Input Control:

$\times 1$ ,  $\times 10$ ,  $\times 100$ ,  $\times 1000$ , 4 ranges separate or L ganged with R.

Calibration Voltage: 0.1Vp-p at line frequency

##### Waveform Switching:

Left and right at respective sides on a common base line

##### X Axis (R-CH input at X-Y operation)

Sensitivity: 20mVp-p/div or better

##### Input Control:

Same as for the R channel, 4 ranges with continuous adjuster

Bandwidth: DC: DC to 1MHz, -3dB

AC: 2Hz to 1MHz, -3dB

Input Impedance:  $1M\Omega$ , less than 47pF

##### Calibration Voltage:

0.1Vp-p at line frequency

##### X-Y Phase:

Less than  $2^\circ$  at 20kHz

Less than  $8^\circ$  at 100kHz

##### Time Base

##### Sweep Frequency:

10Hz to 100kHz, 4 ranges, trigger, line and external sweep

##### Synchronization:

L + R, L, R, LINE, EXT. TRIG, automatic type.

##### Power Supply:

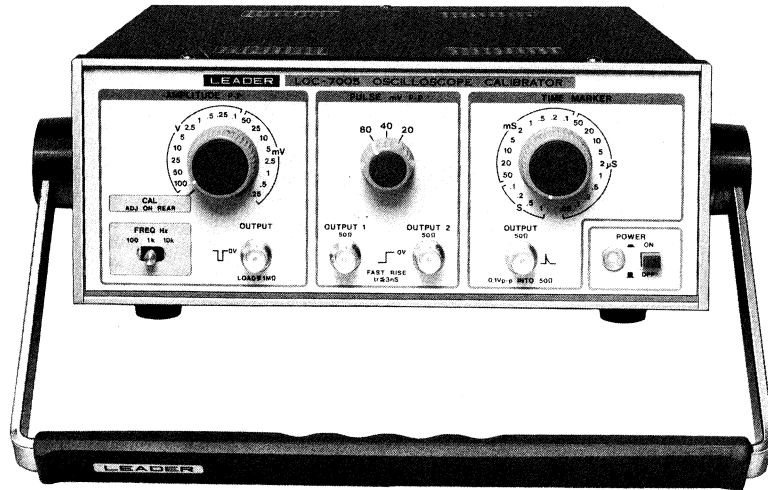
100, 120, 200, 220, 240VAC, 50/60Hz, 20W

##### Size and Weight:

175(W)  $\times$  250(H)  $\times$  375(D)mm, 7.2kg

# OSCILLOSCOPE

## Accurate Calibration by 5div Constant Amplitude Display



### LOC-7005 OSCILLOSCOPE CALIBRATOR

#### ● GENERAL

The LOC-7005 is a signal generator to calibrate vertical axis and time base of oscilloscope. It generates 0.25mV to 100V  $\pm 0.5\%$  square wave for calibration of vertical axis voltage sensitivity. Its output step sequence has been set at 1-2.5-5, generally providing a 5div display on a 1-2-5 step input range oscilloscope and prevents miscalibration.

Low, medium speed response of vertical axis can also be inspected because the frequency can be switched from 100Hz to 1kHz and 10kHz. It also generates high speed square wave of less than 3ns rise time for calibration of high speed response.

#### ● FEATURES

- Generates a high-speed square wave with a rise time of 3ns or less for calibrating high-speed characteristics.
- Calibrates the vertical axis and timebase of an oscilloscope.
- Calibrates two channels of a dual-trace oscilloscope simultaneously, thus allowing comparison of the interchannel characteristics.
- 1-2. 5-5 output steps.
- Fully obtains sharp pulse waveforms at a speed of up to the 0.05 $\mu$ s range, thus ensures accurate time calibration.

#### ● SPECIFICATIONS

##### Voltage Calibration

**Output Voltage (p-p):** 0.25mV to 100V, 1-2.5-5 step

18 ranges, Negative Polarity

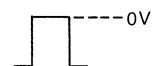
**Amplitude Accuracy:**  $\pm 0.5\%$ ,  $\geq 1M\Omega$  load

**Frequency:** 100Hz, 1kHz, 10kHz  $\pm 5\%$   
3 ranges

**Output Waveform:** Symmetrical square wave

**Rise Time:** Within 500ns

**Output Resistance:** Less than 2k $\Omega$



##### Time Calibration

##### Pulse Marker

**Sequence:** 0.05 $\mu$ s to 1 sec 1-2-5 step  
23 ranges

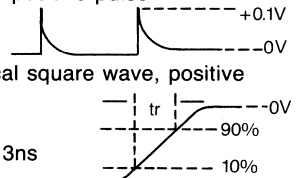
**Time Accuracy:** Within 0.05%

**Output Voltage (p-p):** More than 0.1V into 50 $\Omega$

**Output Waveform:** Differential positive pulse

##### High Speed Square Wave

**Output Waveform:** Symmetrical square wave, positive polarity



**Frequency:** 100kHz

**Rise Time:** Less than 3ns

**Output Voltage (p-p):** 20mV, 40mV, 80mV,  $\pm 5\%$   
3 ranges switchable (with 50 $\Omega$  terminator)

**Output Terminal:** 2 isolated each other

##### Environmental

##### Condition:

Temperature 10 to 35 $^{\circ}$ C

##### (for guaranteed accuracy)

##### Power Supply:

Humidity 80% or less

100, 120, 220, 240VAC, 50/60Hz

##### Size and Weight:

20VA

##### Accessories:

250(W)  $\times$  99(H)  $\times$  300(D)mm, 4kg

BNC-BNC cable (75 $\Omega$ ) ..... 1

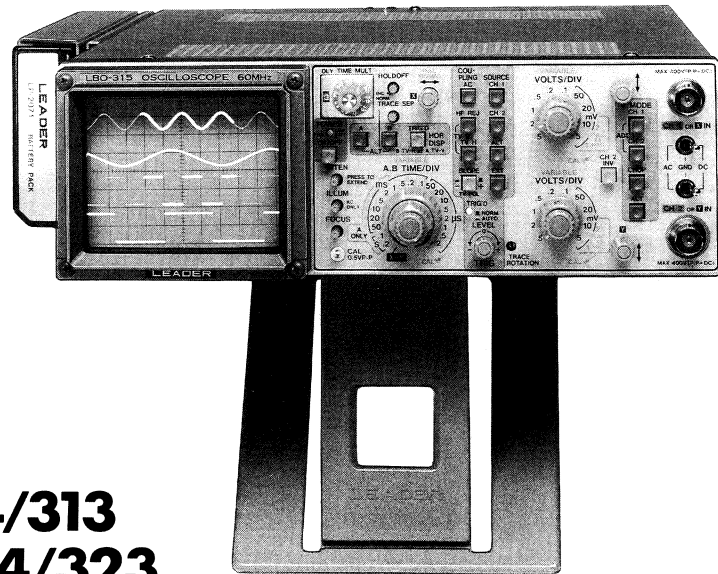
BNC-BNC cable (50 $\Omega$ ) ..... 2

50 $\Omega$  terminator (LT-2049) ..... 2

Accessory pouch (LP-2012) ..... 1

# OSCILLOSCOPE

## Hand-Carry Oscilloscope Working at Everywhere



### LBO-315/314/313 LBO-325/324/323 PORTABLE OSCILLOSCOPE

#### ● GENERAL

The LBO-315/325, -314/324 and -313/323 are oscilloscopes that can handle band width of 60MHz, 40MHz and 20MHz with a sensitivity of 5mV (1mV MAG). All are approximately magazine size and fit comfortably into a briefcase or the like.

Being compact and lightweight, these oscilloscopes have a large 95mm CRT display and provide an equivalent measuring accuracy of larger instruments.

The LBO-315/314/313 contains a newly developed power supply circuit that does not require the switching of voltages when operating within the power range of 90 to 250VAC. With its Ni-Cd battery charger and its ability to operate under DC power and battery power, this power-supply design extends the instrument's field of application even to the regions with different power voltages.

The LBO-325/324/323 are only AC operation.

#### ● FEATURES

##### Common to the LBO-315/314/313 and the LBO-325/324/323

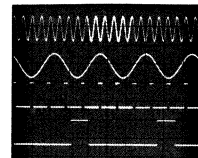
- Large 3.5-inch rectangular CRT with internal graticules.
- Auto-focusing for sharp display.
- TV-V and TV-H synchronization for stable video waveform display.
- ALT trigger to synchronize two asynchronous signals.
- Variable hold-off function for the stable display of phase relationship between logical signals.
- CH-1 output signal also used for buffer amplification.
- High-quality oriented design and manufacturing using PC boards made of glass epoxy resin and automatic assembly.
- Sturdy frames using aluminum die cast.

##### LBO-315/314/313

- Operation on different power voltages  
The newly developed power supply circuit allows the power voltages of 90 to 250VAC to be used without wiring change.
- Built-in Ni-Cd battery charging circuit allows the user to charge the Ni-Cd battery while observing waveforms in AC power operation. A timer is also built in to automatically switch the charging off.
- Operation on DC and battery power  
Because this oscilloscope can be powered by an external DC power supply of 10 to 20V, waveforms can be observed in a moving vehicle. If the chargeable battery is mounted, this oscilloscope can be used at any time and any place.

#### ALT sweep function to concurrently display main sweep and delayed sweep waveforms

##### LBO-315/314/325/324



The LBO-315/314/325/324 have an alternate (ALT) sweep function. This function allows the concurrent display of the primary sweep (A INTEN B) and extended sweep (B), can be effectively used for the comparison of both sweeps, and for the checking of waveform positions.

#### ALT triggering to synchronize two asynchronous waveforms

**All models**  
THE ADVANTAGE SERIES oscilloscopes have an ALT triggering function which perfectly synchronizes two asynchronous signals. Two waveforms that have no phase relationship can also be displayed on the CRT at the same time.

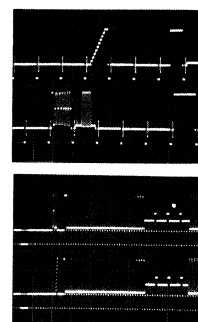
Because the ALT triggering system does not affect the shifting of the vertical position, the displayed waveform are always stable and clear.

#### Variable hold-off function to synchronize such complex signals as pulse trains

**All models**  
THE ADVANTAGE SERIES oscilloscopes have a newly developed variable hold-off function. This function enables the user to stable display such complex pulse-train as video signals and digital word pulses of computers.

#### A TV-V/B TV-H function enables observation of such test signals as VITS signals

##### LBO-315/325/314/324



When the A sweep is set to TV-V trigger in the synchronous delayed sweep mode, the extended B sweep is automatically set to TV-H during B TRIG'D. Consequently, the test signals (i.e., VITS) contained within 1H of the vertical blanking period are stably displayed.



# OSCILLOSCOPE

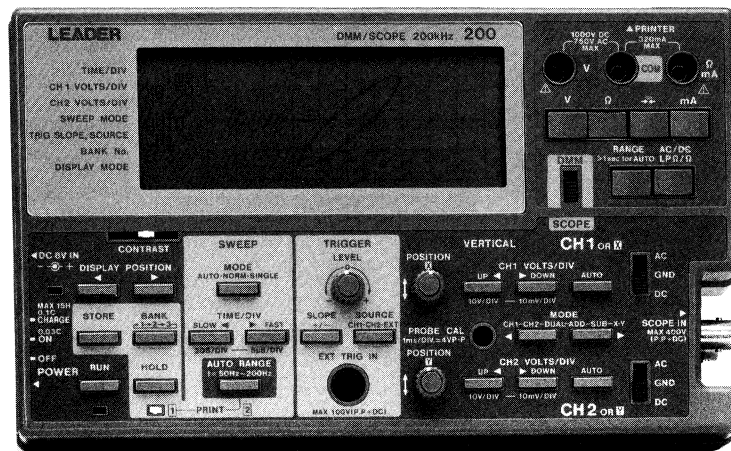
## ● SPECIFICATIONS

	LBO-315/325	LBO-314/324	LBO-313/323							
<b>CRT</b>										
Type	95mm rectangular, internal graticule, aluminized screen, % scale		95mm rectangular, internal graticules							
Scale Illumination	Front panel control									
Accelerator Voltage	Post acceleration, regulated 2kV/12kV		Regulated 1.7kV							
Effective Display Area:	8 × 10div (1div = 6.35mm)									
Beam Rotator	Inclined display due to terrestrial magnetism is adjusted from the front panel.									
Intensity Modulation	Blanking at TTL H level									
<b>Vertical Axis (for both channel 1 and 2)</b>										
Deflection Factor	5mV/div to 5V/div, (full band width), 1mV/div to 2mV (5MHz; × 5 MAG ON) 1-2-5 steps, 10 ranges, with fine adjuster									
Calibration Accuracy	± 3% (± 5%: × 5 MAG ON)									
Bandwidth (8div reference)	DC to 60MHz, -3dB	DC to 40MHz, -3dB	DC to 20MHz, -3dB							
	× 5 MAG ON: DC to 5MHz, -3dB AC Coupling: Low band 10Hz, -3dB									
Rise Time	5.8ns	8.8ns	17.5ns							
	70ns: × 5 MAG ON									
Signal Delay Time	20ns (on the CRT)									
Input Impedance	1MΩ ± 1.5%, Within 30pF ± 5pF (Tolerance ± 2pF)									
Maximum Input	400V (p-p + DC)									
Operation Mode	CH1, CH2, CHOP, ALT, ADD, CH2 INV									
CH1 OUT	DC to 60MHz	DC to 40MHz	DC to 20MHz							
	50mVp-p/div into 50Ω									
<b>Horizontal Axis</b>										
Sweep Mode	Trigger sweep, automatic trigger sweep, continuous delayed sweep, trigger delay sweep, ALT sweep		Trigger sweep, automatic trigger sweep							
A Sweep Time	0.2μs/div to 0.2s/div, 1-2-5 steps, 19 ranges, with fine adjuster									
B Sweep Time	0.2μs/div to 0.5ms/div, 1-2-5 steps 11 ranges									
Calibration Accuracy	± 3%									
Variable Hold-Off Time	One sweep or more									
Delay Sweep Jitter	1/10000									
Delay Time Position	10-turn multi-dial; setting accuracy ± 3%									
Sweep Magnification	× 10 MAG ± 5%		× 5 MAG ± 5%							
Maximum Sweep Time	20ns/div (× 10 MAG ON)		40ns/div (× 5 MAG ON)							
<b>Trigger</b>										
Trigger Signal Source	CH1, CH2, ALT, LINE (only LBO-323/324/325) EXT									
Trigger Coupling	AC, HF-REJ, TV-V, TV-H									
Trigger Slope	+, -									
Sensitivity	Frequency Range	INT	EXT	Frequency Range	INT	EXT	Frequency Range	INT	EXT	
	NORM (Trigger)	30Hz to 10MHz	0.5div	0.2Vp-p	30Hz to 10MHz	0.5div	0.2Vp-p	30Hz to 10MHz	0.5div	0.2Vp-p
		2Hz to 60MHz	1.5div	0.6Vp-p	2Hz to 40MHz	1.5div	0.6Vp-p	2Hz to 20MHz	1.5div	0.6Vp-p
	AUTO (Automatic)	30Hz to 10MHz	0.5div	0.2Vp-p	30Hz to 10MHz	0.5div	0.2Vp-p	30Hz to 10MHz	0.5div	0.2Vp-p
30Hz to 60MHz		1.5div	0.6Vp-p	30Hz to 40MHz	1.5div	0.6Vp-p	30Hz to 20MHz	1.5div	0.6Vp-p	
<b>TV Synchronization</b>										
Synchronizing pulses are extracted from composite video signals for triggering. The trigger slope switch is selected according to the polarity of video signals.										
When the A SWEEP is set to TV-V synchronization, the extended B SWEEP is set to TV-H automatically with B TRIG'D.										
<b>X-Y Mode</b>										
Deflection factor	CH1 ... X-axis, CH2 ... Y-axis Both X- and Y-axis are identical to the vertical axis.									
Bandwidth	X-axis ... DC (10Hz) to 1MHz (8div ref.), Y-axis ... Identical to the vertical axis.									
X-Y Phase Difference	3° or less at 100kHz									
Calibrator	0.5Vp-p ± 2%, 1kHz square wave									
Environmental Conditions (for guaranteed accuracy)	Temperature: 10 to 35°C Humidity: 80% or less									
Power Supply	LBO-325, 324, 323: 100, 120, 200, 220, 240VAC Selectable internally LBO-315, 314, 313: 90 to 250VAC (Free voltage) EXT DC10 to 20V, BATT. (LP-2071)									
	315: AC26W/DC16W, 325: AC25W	314: AC23W/DC16W, 324: AC22W	313: AC29W/DC19W, 323: AC 30W							
Size and Weight	230(W) × 75(H) × 290(D)mm, 4kg (323, 324, 325), 4.7kg (313, 314, 315, with battery)									
<b>Accessories</b>										
Low capacitance probe	LP-060X (1/1, 1/10) ..... 2	LP-16BX (1/1, 1/10) ..... 2	2							
Terminal and Fuse	BNC terminal adaptor ..... 2	Spare fuse ..... 1	1							
Attache Case	Furnish	Optional accessory								
Carrying Case	Optional accessory (with Front Panel Cover)									
Front Panel Cover	Optional accessory									
Hood	Furnished	Optional accessory								

# OSCILLOSCOPE

Digital Multimeter

## DMM with 2CH Digital Storage Oscilloscope



### Model 200 DMM/SCOPE

#### ● GENERAL

The Model 200 is a DMM/2CH Scope that combines a digital multimeter and a dual-trace digital storage oscilloscope. The high-performance DMM section is provided with AUTO/MANUAL range selection for a readout of up to 3199. The readout section uses a 64 × 192 dot matrix display to show large, naturally-shaped, and legible digits.

A simple continuity check can be made by using the buzzer. This is useful for diode testing. The buzzer also sounds in case of over-range detection in the manual mode. The Scope section has the same signal input circuit used in conventional oscilloscopes. A standard 10MΩ low-capacitance probe can be used here. This digital storage oscilloscope requires the simple storage of signals (with the long cycling time needed) and waveforms that are hard to observe because they flicker on oscilloscope displays, and subsequent display in the still mode. As a dual-trace type, this oscilloscope can measure the phase difference between two signals. The AUTO RANGE function is effective for both vertical and time axes so that the optimized range for each signal input is automatically selected. By presetting various functions at power-on, operating the SCOPE section is made easier. Moreover, an optional dedicated printer enables hard copies of stored waveforms (in up to four memories × two channels) to be output. (Note that the printer interface is supplied as standard.)

#### ● FEATURES

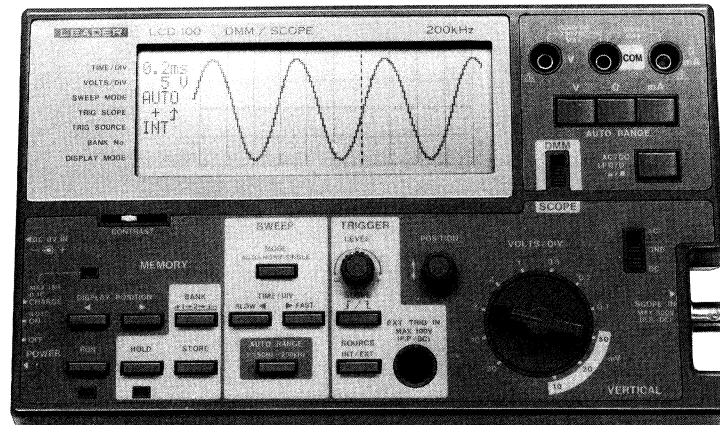
- Waveform on the LCD and setting values such as VOLTS/DIV and TIME/DIV can be printed out on the exclusive small-size thermal printer (Model 710). (Note DMM is not available.)
- Waveform which is being held or stored in bank memory can be printed out with one-touch operation.
- It is provided with the 200kHz/10mV dual trace digital storage oscilloscope with a time axis automatic storage function and the DMM function indicating up to 3199 for various applications.
- Mechanical control waveform can be displayed on the storage.
- Battery operation completely separates the mainframe from the AC line.
- Operates even in strong electric or magnetic field.
- DMM measurement items include: DC/AC voltage, DC/AC current and resistance/low-power resistance.
- DMM section and oscilloscope and completely separated from each other.
- The dedicated printer is small and light. Besides, it has a built-in Ni-Cd battery for battery operation, thus it is portable. Moreover, it has an AC adaptor with charger function, thus allowing operation with mains.



Thermal Printer Model 710 (option)

# OSCILLOSCOPE

## Waveforms Displayed By Evolutionary Digital Multimeter



### LCD-100 Model 100P (with printer interface) DMM/SCOPE

#### ● GENERAL

The LCD-100 is equipped with a DMM and a 200kHz/10mV digital storage oscilloscope. Measured current waveforms are displayed on a large-scale LCD display. As one application example, phases can be compared by using the trigger cursor and external trigger. The AUTO-RANGE function is another feature that simplifies operation, even first-time users can easily operate the DMM/SCOPE.

The Model 100P is equipped with a dedicated and compact thermal printer that prints waveforms as required. Therefore, the LCD-100P is ideally suited for a broad range of applications, including the preparation of measurement data to be attached to a report or repair statement.

#### ● FEATURES

- The display screen consists of a large dot matrix LCD that provides a 64 dot × 160 dot waveform display area.
- The DMM section can measure DC/AC voltages, DC/AC currents, and resistance/low-power resistance (LPΩ).
- The sweep time features a one-touch AUTO-RANGE function.
- Battery powered operation eliminates the concern over mutual interference and noise generated from AC lines.
- Up to four waveforms can be stored in memory by simply pressing a button.
- Because the store memories are backed up by batteries, the waveform data can also be stored after power is disconnected.
- With its high-performance digital storage oscilloscope, the DMM/SCOPE is particularly effective in measuring slowly repeated signals and single phenomenon.
- Phase can be easily compared when using the external trigger cursor with the trigger cursor.
- The DMM and SCOPE sections are electrically separated from each other.

#### ■ Compact-type Thermal Printer (Model 710) for the Model 100P and 200

- Prints out on-LCD waveform and setting values (includes VOLTS/DIV and TIME/DIV). (for SCOPE only).
- Prints out the held waveform or bank-memory-stored waveform with a simple operation.
- Being compact and light and having a built-in Ni-Cd battery for battery backup operation, this printer does not choose places for operations. With the attached AC adapter (also functions as a charger), it is operable with mains.

#### ■ MODEL 710 SPECIFICATIONS

##### Printing

##### Character

##### Configuration:

Dot: 8 × 166 dots (maximum)

Character: 7 × 5 dots

##### Character Types:

JIS: 159 types

Int'l character: 32 types

Special character: 6 types

Total 197 types

##### Maximum Printing

##### Column:

Regular-size character: 27

Double-width character: 13

##### Printing Signal

##### Printing Signal:

8-bit parallel data

Handshaking by STROBE and BUSY signals

##### Connector

32-pin amphenol,  
Simplified centronics method

##### Printer Mechanical Section

##### Printing System:

Thermosensitive Serial-thermal-dot system

##### Printing Direction:

Left-to-right, — direction

##### Character Size:

2.4 × 1.3 mm (7 × 5 dot matrix)

##### Dot Configuration:

8 (vertical) × 166 (horizontal) dots

##### Dot Pitch:

Vertical: 0.35 mm,

Horizontal: 0.277 mm

##### Printing Width:

46.00 mm

##### Printing Speed:

Approx. 0.8 line per second

##### Life:

500,000 lines

##### Power Supply:

4.8V, 500 mAh (1.2V × 4)

Ni-Cd battery

##### Charging Time:

Approx. 15 hours (when power switch is off.)

##### Battery Life for

##### Continuous Printing:

150 screens of data (at 20°C to

40°C), 70 screens of data (at 0°C)

##### “Battery Low” Alarm:

The Batt. Low LED goes on when the battery voltage is 4.45V or low.

##### Size and Weight:

135(W) × 100(D) × 35(H) mm, 400 g

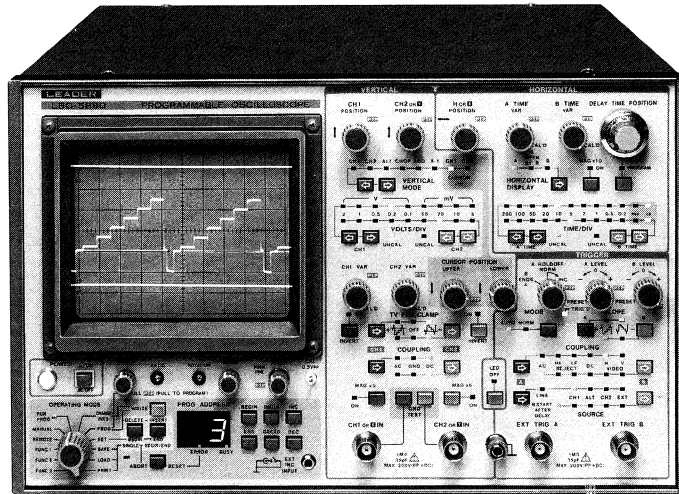
# OSCILLOSCOPE

## • SPECIFICATIONS

	Model 200	Model 100P	LCD-100
<b>Display Section</b>			
Display	Dot-matrix LCD display 64 dots (vertical) × 192 dots (horizontal)		
Waveform Display Area	64 dots (vertical) × 160 dots (horizontal)		
Setting Display Area	64 dots (vertical) × 32 dots (horizontal)		
Dot Size	0.57mm (vertical) × 0.45mm (horizontal)		
Scale	Internal scale, 4div (vertical) × 10div (horizontal) (1div = 15 dots)		
Contrast Control	Adjustable on the front panel		
<b>DMM Section</b>			
Measurement Functions	DC voltage, AC voltage, DC current, AC current, resistance, low-power resistance (LP Ω), (*1) and continuity check/diode test	DC voltage, AC voltage, DC current, AC current, resistance, low-power resistance (LP Ω) (*1)	
	(*1): In-circuit resistance measurement system for resistance of the Vth of diode lower than the terminal open voltage.		
Maximum Readout	3199 on dot-matrix LCD display		
Range Selection	Auto/manual	Auto	
Polarity Selection	Automatic displays + or -		
Input Terminal Configuration	Three terminals: V, Ω/mA, and COM		
Sampling Rate	2.5 times/s		
DC Voltage Measurement	320.0mV, 3.200V, 32.00V, 320.00V, 1000V		
Accuracy	320.0mV to 32.00V: ±0.35% rdg + 3 dgt 320.0V: ±0.5% rdg + 3 dgt 1000V: ±0.6% rdg + 3 dgt		
AC Voltage Measurement	3.200V, 32.00V, 320.0V, 750.0V 40 to 500Hz		
Accuracy	3.200V to 320.00V: ±1.0 rdg + 5 dgt 750V: ±1.2% rdg + 5 dgt		
Current Measurement	320.0mA for DC/AC, single range		
DC Accuracy	320.0mA: ±1.0% rdg + 3 dgt		
AC Accuracy	320.0mA: ±1.5% rdg + 3 dgt 40 to 500Hz		
Resistance Measurement	Normal resistance measurement mode (*2)		
Ranges	320.0Ω (*2), 3.200kΩ, 32.00kΩ, 320.0kΩ, 3200kΩ, 32.00MΩ		
Accuracy	320.0Ω to 320.0kΩ: ±0.5% (0.4% *2) rdg + 3 dgt 3200kΩ: ±1.0% rdg + 4 dgt (3 dgt *2) 32.00MΩ: ±2.0% rdg + 4 dgt (3 dgt *2)		
<b>Scope Section</b>			
Vertical Axis	6-bits (64 points)		
Sensitivity	10mV/div to 20V/div, 11 ranges in 1-2-5 steps		
Accuracy	4%		
Bandwidth	DC (10Hz) to 200kHz (4div ref.) -3dB		
Input Impedance	1MΩ ±2%, 30pF ±5pF		
Maximum Input Voltage	400V (DC + ACp-p)		
Input Coupling	AC-GND-DC		
Vertical Modes	CH1, CH2, DUAL, ADD, SUB, and X-Y		
Horizontal Axis	8-bit resolution (256 points) Only 160 points are displayed on screen		
Sweep Modes	Auto-sweep, triggered sweep, single sweep, ROLL		
Sweep Time	5μs/div to 20s/div, 21 ranges in 1-2-5 steps		
Maximum Conversion Speed	0.333μs/word (Maximum clock 3MHz)		
Roll Mode Range	50ms/div to 20s/div		
Auto Ranging Range	5μs/div to 20s/div		
<b>Triggering</b>			
Trigger Source	CH1, CH2, EXT	INT, EXT	
Sensitivity	INT (DC coupling): 0.5div, DC to 200kHz EXT (DC coupling): 0.25Vp-p, DC to 200kHz	INT (DC coupling): 0.5div, DC to 200kHz EXT (AC coupling): 0.25Vp-p, 30Hz to 200kHz	
Trigger Slope	Positive or negative		
<b>Memory</b>			
Memory Capacity	256 words × 4 × 2 channels	256 words × 4	
Work Memory	256 words × 1 × 2 channels (for acquisition of waveform data)	256 words × 1 (for acquisition of waveform data)	
Bank Memory	256 words × 3 × 2 channels (with battery backup), BANK 1 to 3	256 words × 3 (with battery backup), BANK 1 to 3	
Environmental Conditions (for guaranteed accuracy)	Temperature: 18 to 28°C Humidity: 80% or less		
<b>Power Supply</b>			
Scope	Four R6-size Ni-Cd 1.5V batteries (700mAh) or AC adaptor (which also charges the Ni-Cd batteries)	Four R6-size Ni-Cd 1.2V batteries (500mAh), or AC adaptor (which also charges the Ni-Cd batteries)	
DMM	Two R6-size 1.5V batteries, and above.	Two R6-size 1.5V batteries	
Size & Weight	228(W) × 136(D) × 52(H)mm, 1.1kg	226(W) × 136(D) × 38(H)mm, 980g	226(W) × 136(D) × 38(H)mm, 950g
Accessories	R6 batteries for DMM ..... 2 Measurement leads for DMM ..... 1 set LP-013 (× 10 probe for scope) ..... 1 LB-16BX (× 1/10 probe for scope) ..... 1 Carrying strap ..... 1 LPS-1908 AC Adaptor ..... 1 LC-2232 Carrying Case ..... 1 LC-2073 External Trigger Cable ..... 1	R6 batteries for DMM ..... 2 Measurement leads for DMM ..... 1 set LB-013 × 10 probe for scope ..... 1 Carrying strap ..... 1 LPS-1908 AC adaptor ..... 1	R6 batteries for DMM ..... 2 Measurement leads for DMM ..... 1 set LB-16BX × 1/10 probe for scope ..... 1 Carrying strap ..... 1 LPS-1908 AC adaptor ..... 1

# OSCILLOSCOPE

## Computer-Controlled One-Touch Waveform Observation



### LBO-5880 PROGRAMMABLE OSCILLOSCOPE

#### ● GENERAL

The LBO-5880 is a dual trace, delayed-sweep, programmable oscilloscope that allows all scope mode settings. This includes variable controls which are easily stored in a 100-address internal memory and can be recalled whenever needed.

It features 5mV/div (30MHz) and 1mV/div (20 MHz:  $\times 5$  MAG), and a maximum sweep rate of 20ns/div ( $\times 10$  MAG), with a 6-inch rectangular metal-back CRT with a high-brightness, internal graticule.

The waveform clamping function of the LBO-5880 and its ability to set two marker cursors for waveform amplitude adjustment provide an ideal measuring instrument for use in the production and servicing of TV sets and VTRs.

#### ● FEATURES

##### [Oscilloscope Section]

- The delayed sweep function, independent A and B trigger selection function, and separate external trigger input connectors support a wide range of observations.
- The ALT trigger function yields static waveforms of two types of signals with different timing relations.
- A built-in synchronous sampling circuit eases synchronization with TV composite video signals. Since the vertical (VIDEO-V) and horizontal (VIDEO-H) sweep periods are selectable regardless of the TIME/DIV switch setting, the waveform in the horizontal sweep period can be synchronized and observed with the vertical sweep period.
- Variable hold-off time enables video signals and pulse strings from computers (such as digital word pulses) to be observed in stabilized periods.
- The B ENDS A function lessens flickering during magnified delayed sweeps.
- ADD and CH 2 polarity selections make it possible to observe the sum of difference between two signals and to also display an accurate picture of push-pull signals.
- Signals applied to CH 1 can be isolated from the vertical preamp via a buffer. This output is about 0.1 Vp-p per division on the screen.

- The LBO-5880 can be switched by a one-key operation to X-Y oscilloscope having CH 1 as the X-axis and CH 2 as the Y-axis.
- The GND TEST switch allows checking the GND level at a single touch, independently of the program.
- Each function mode of the oscilloscope is constantly displayed on a panel LED. This LED display can be suppressed by a switch.

##### [Memory Section]

- The memory addresses are organized into 100 steps, numbered from 0 to 99. The stored program is protected by a battery backup.
- The BEGIN and END addresses can be freely set from address 0 to address 99, so that the program stored within this range can be recalled for use in a production line, as often as desired.
- Program insertion, deletion and exchanging are provided as memory editing functions to simplify program editing to meet changing process requirements.
- All oscilloscope functions including variable controls are programmable with the exception of focus, astigmatism, rotation and illumination.
- Whenever an operator error occurs, the corresponding error number is displayed to alert the operator. In this way, continued use of the oscilloscope will be inhibited until the error is recovered.
- Program contents can be printed on an external printer.
- The INC, DEC, and BEGAIN functions can be remote-controlled by attaching the optional control box (LBO-5880-03) to the front panel EXT INC INPUT jack.
- The LBO-5880 can be interlocked with an external instrument since its addresses can be controlled with externally supplied binary or BCD codes.
- During LBO-5880 memory access, binary and BCD addresses code signals are externally supplied for the external device to be able to read the address.
- As a 64-bit (8 bits  $\times$  8) external memory is provided and simple external circuit is installed, the 64 bits can be externally controlled.
- Memory write protection prevents inadvertent deletion of important programs.

# OSCILLOSCOPE

## ● SPECIFICATIONS

### Oscilloscope Section

#### CRT

**Type:** 150mm rectangular, internal-graticule, aluminized, % scale, scale illumination

**Acceleration Voltage:** 7kV/2kV regulated

**Effective Display Area:** 8 × 10div (1div=10mm)

**Beam Rotator:** Adjustable on front panel

**Intensity Modulation:** Blanked by TTL level

#### Vertical Axis (for both CH1 and CH2)

**Sensitivity:** 5mV/div to 2V/div, 1mV/div to 2mV/div (× 5 MAG ON), 1-2-5 step,

9 ranges, and continuous adjuster

± 3% (± 5%: × 5 MAG ON)

**Calibration Accuracy** DC (10Hz) to 30MHz - 3dB, 8div ref.

**Bandwidth:** DC (10Hz) to 20MHz - 3dB, 8div ref:

× 5 MAG ON

**Rise Time:** 12ns (18ns: × 5 MAG ON)

**Input Impedance:** 1MΩ ± 1.5%,

35pF ± 5pF

(Tolerance: within ± 2pF)

**Input Coupling:** AC, GND, DC

**Maximum Input Voltage:** 200V (p-p + DC)

**Display Modes:** CH1, CH2, ALT, CHOP, ADD, X-Y,

CH1 CURSOR ON, CH2 CURSOR

ON

**Polarity Invert:** CH1 INVERT, CH2 INVERT

**CH1 OUT:** 0.1V/div into 50Ω

DC to 30MHz, -3dB

#### Pedestal Clamps of

#### Composite Video Signal:

+ Clamp: Clamped to + sync

waveform pedestals.

- Clamp: Clamped to - sync

waveform pedestals.

#### Horizontal Axis

#### Sweep Mode:

Trigger sweep, automatic trigger sweep, continuous delayed sweep, and trigger delayed sweep

#### Sweep Time:

A sweep, B sweep

0.2μs/div to 200ms/div, 1-2-5 step,

19 ranges, and continuous adjuster

± 3% (for both A and B)

#### Calibration Accuracy:

#### Variable Hold-off:

One sweep or more

#### Delay Time Position:

10-turn multi-dial, setting accuracy ± 3%

#### Magnifier:

× 10 ± 5%

#### Maximum Sweep Time:

20ns/div (× 10 MAG ON)

#### Triggering

#### Source A:

CH1, ALT, CH2, LINE and EXT.

#### Source B:

B START AFTER DELAY, CH1, ALT,

CH2 and EXT.

AC HF-REJ, LF-REJ, DC,

VIDEO H and VIDEO V

#### Coupling A, B:

+, -

#### Slope A, B:

#### Sensitivity:

	Frequency Range	Internal	External
NORM	DC to 10MHz	0.5div	0.2Vp-p
	DC to 30MHz	1.5div	0.6Vp-p
AUTO	30Hz to 10MHz	0.5div	0.2Vp-p
	30Hz to 30MHz	1.5div	0.6Vp-p

#### TV synchronization:

Synchronizing composite video signals.

The slope switch is selected according to video signal polarity.

#### X-Y Mode X-axis=CH1, Y-axis=CH2

#### Sensitivity:

Same as the vertical axis

#### X-Axis Bandwidth:

DC to 1MHz - 3dB, 8div ref.

#### X-Y Phase:

Less than 3° at 100kHz

#### Calibrator:

0.5Vp-p ± 2%

1kHz, square wave

### Memory Section

#### Program Address:

0 to 99 (100 addresses)

#### Internal Memories:

2,048 words by 8 bits static CMOS RAM × 5

(Program backup; four,

8K bytes. Internal system; one, 2K bytes.)

#### Built in Battery:

Ni-Cd backup battery, 36V

Provides one-month's memory backup when fully charged at 90mAh.

#### Address Display:

7-segment two-digit LEDs display

addresses 0 to 99.

### Operating Mode

#### SET:

BEGIN and END address setting,

setting/resetting of memory write

protection

#### PROG:

Program entry, insertion, deletion,

exchanging, recall and sample program call

Alteration of variable knob data

#### CHARGE VAR'S:

#### RUN PROG:

#### MANUAL:

Operation as an ordinary oscilloscope without

using memory

#### REMOTE:

Control by externally supplied address data

#### SAVE:

Program transfer to another LBO-5880

#### LOAD:

Program transfer from another LBO-5880

#### PRINT:

Printing of program data on an external printer

#### FUNC 1:

Automatic address incrementation

#### FUNC 2:

External oscilloscope control and checking

programs

#### FUNC 3:

Checking programs and other options

#### Memory Function:

Can be memorized for all switch modes (except

memory control SW, GND TEST SW and LED

OFF SW), CH1, POS, CH2 POS, H POS, A

TIME VAR, B TIME VAR, DELAY TIME POSI-

TION, CH1 VAR, CH2 VAR, UPPER

CURSOR, LOWER CURSOR, A HOLD OFF, A

LEVEL, B LEVEL, INTEN. Each variable knobs

data has resolution of 1024 (10 bits).

### External Connectors

#### I/O Bus:

24 pins, external device control

(An additional circuit is required: 8 bits × 8

64 bits maximum) Probe

selector (LBO-5880-02)

#### I/O Port:

37 pins, program transfer, address

output, address input (address control), oscillo-

scope control by external data

#### Printer:

14 pins, program data printing (on a Centronix

compatible printer)

### Environmental Conditions

#### (for guaranteed accuracy)

#### Power Supply:

Temperature 10 to 35°C

Humidity 80% or less

#### Size and Weight:

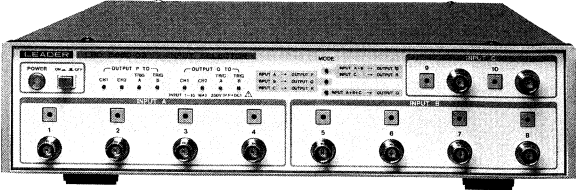
100, 120, 220, 240VAC 50/60Hz, 85W

#### Accessories:

320(W) × 198(H) × 400(D)mm, 11kg

Fuse ..... 1

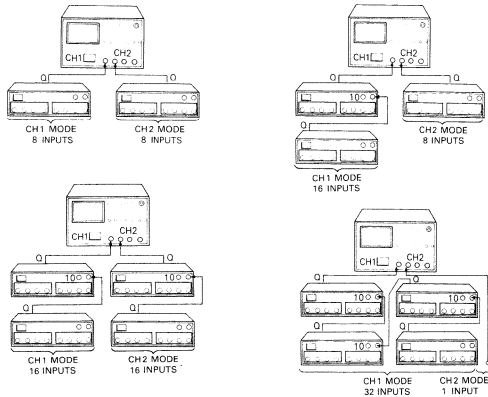
# OSCILLOSCOPE



LBO-5880-02 is the input selector designed for extension of the input channels of programmable oscilloscopes. It has 10 input terminals, which are divided into 3, group A, B and C, and those groups are used in various combinations according to operation conditions. Especially, the channel 1 is also used as a selector for either 8-input or 10-input. Up to 4 units can be connected allowing terminal extension for 32 channels.

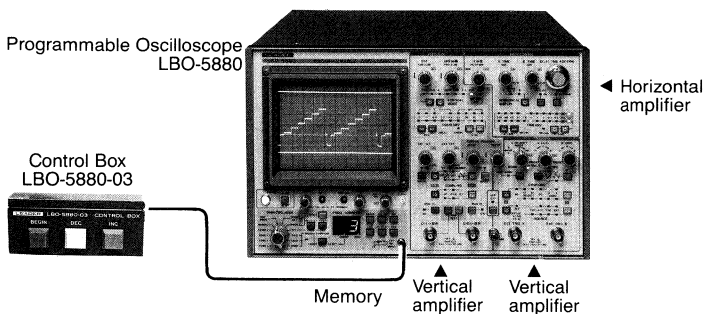
## LBO-5880-02 INPUT SELECTOR

### Expansion Cabling



## LBO-5880-03 CONTROL BOX

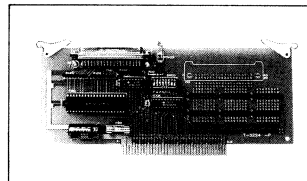
LBO-5880-03 is the controller used to remote-control oscilloscopes. Programmed control setting can be selected only by pushing three buttons. This remote-controller has achieved remarkable labor saving on the production line.



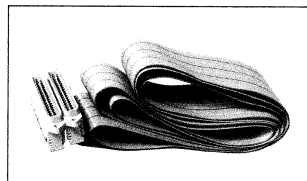
### ●SPECIFICATIONS

<b>Number of Inputs to be Selected:</b>	Input A...4, Input B...4, Input C...2
<b>Number of Output to be Selected Modes:</b>	Output P.....1, Output Q.....1, Output R.....1
<b>Input-Output Selection Modes:</b>	Mode 1. { input A+input B → output Q input C → output R Mode 2. { input A → output P input B → output Q input C → output R Mode 3. input A+input B+input C → output Q
<b>Output Mode Setting:</b>	Maximum number of units which can be connected: up to 4 units. Output P and Q to CH-1, CH-2, TRIG A or TRIG B
<b>Input Impedance</b>	1MΩ, 40pF typ
<b>Input A and B:</b>	Depends on the load requirements of output R to which the input is connected for direct relay switchover.
<b>Input C:</b>	BNC
<b>Input Connector:</b>	AC/GND/DC only for inputs A and B
<b>Input Coupling:</b>	1/1, 1/10, 1/100, 1/2.5 and 1/5
<b>Input Attenuator:</b>	The attenuator is automatically selected to match the VOLTS/DIV setting of the oscilloscope.
<b>Frequency Response:</b>	DC to 30MHz, -3dB for an output of LBO-5880-02 DC to 20MHz, -3dB when LBO-5880 and LBO-5880-02 are combined.
<b>Transfer Gain:</b>	1.0 ± 3% Input attenuation: 1/1, output termination: 50Ω
<b>Max. Allowable Input Voltage:</b>	200V (ACp-p+DC)
<b>Output Impedance:</b>	50Ω
<b>Environmental Conditions</b>	(for guaranteed accuracy): Temperature: 10 to 35°C Humidity: 80% or less
<b>Power Supply:</b>	100, 120, 220, 240VAC, 200VA
<b>Size and Weight:</b>	320(W) x 75(H) x 400(D) mm, 7kg
<b>Accessories:</b>	Bus cable, 24-pin, 1m ..... 1 Time lug fuse for 100-120V, 0.5A ..... 1 (for 200-240V, 0.25A) BNC-BNC cable 50Ω, 3D2D, 1m ..... 2 Termination 50Ω ..... 2

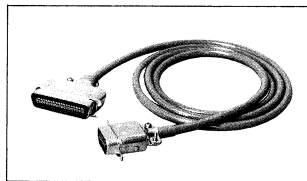
### Optional Accessories for Programmable Oscilloscope



**PPI 8255 I/O CARD**  
LC-2330



**Transfer Cable**  
LC-2066 2m

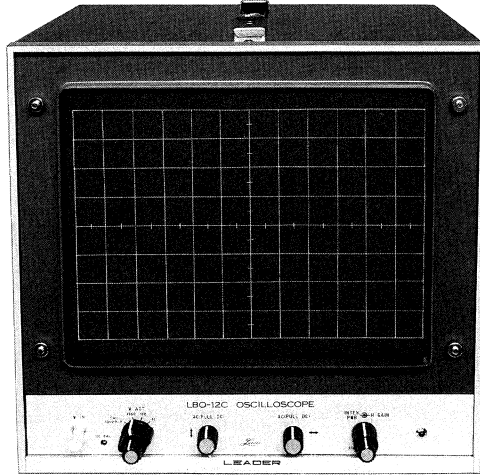


**Printer Cable**  
LC-2065 1.5m

The INC, DEC, and BEGIN functions can be remote-controlled by attaching the LBO-5880-03 (optional control box to the front panel EXT INC INPUT jack).

# ALIGNMENT SCOPE

## 2mV/10kHz



## LBO-12C LBO- 9C ALIGNMENT SCOPE

### ●GENERAL

LBO-12C and LBO-9C are high sensitivity oscilloscopes designed specially for use in conjunction with an external sweep generator in the circuit alignment of low-level front-ends and IF amplifiers in radio sets. The large screen, 16 x 24cm: 12C/16cm: 9C effective, permits the display of the response curves for accuracy in adjustments.

Low distortion of the traces is achieved with direct-coupled amplifiers. High stability against changes in line voltage is assured with use of regulated power supplies. Inputs for pulse and Z-axis (intensity) marking are provided.

### ●FEATURES

- Easy-to-monitor large-size screen for relieving eye load.
- DC amplifiers employed for both vertical and horizontal axis.
- Clear, high-sensitivity intensity modulation marker.

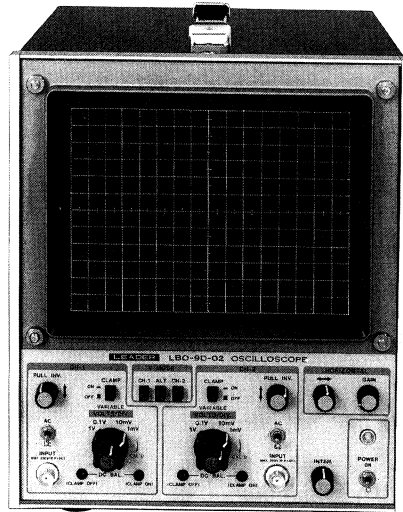
### ●SPECIFICATIONS

<b>CRT</b>	310CFB4A: 12C, 230MB4A: 9C
<b>Effective Display Area:</b>	8div x 12div (1div = 2cm): 12C 12div x 16div (1div = 1cm): 9C
<b>Acceleration Voltage:</b>	8kV
<b>Vertical Amplifier</b>	
<b>Sensitivity:</b>	2mVp-p/div or better
<b>Bandwidth:</b>	DC (2Hz) to 10kHz, -3dB
<b>Input Impedance:</b>	1M $\Omega$ , 50pF
<b>Input Attenuator:</b>	x1, x10, x100 and fine adjuster
<b>Input Coupling:</b>	AC-DC
<b>Calibration Voltage:</b>	0.02Vp-p, square wave at line freq.
<b>Max. Input Voltage:</b>	50V (DC+ ACp-p)
<b>Horizontal Amplifier</b>	
<b>Sensitivity:</b>	100mVp-p cm or better
<b>Bandwidth:</b>	DC (2Hz) to 1kHz (-3dB)
<b>Input Attenuator:</b>	Continuous variable
<b>Max. Input Voltage:</b>	50V (DC + ACp-p)
<b>Z-axis</b>	
<b>Sensitivity:</b>	2Vp-p or more
<b>Pulse Marker Input</b>	
<b>Sensitivity:</b>	2Vp-p/cm or better
<b>Polarity:</b>	- or +, switchable
<b>Power Supply:</b>	100, 120, 220, 240V AC, 50/60Hz, 70VA
<b>Size and Weight:</b>	320(W) x 300(H) x 280(D)mm, 10kg: 12C 240(W) x 230(H) x 280(D)mm, 9.5kg: 9C
<b>Accessories:</b>	BNC — BNC cable ..... 1



# ALIGNMENT SCOPE

Sensitivity 1mV, with DC Clamp, 9-inch electromagnetic deflection CRT



## LBO-9D-02 DUAL TRACE ALIGNMENT SCOPE

### ●GENERAL

The LBO-9D-02 (with DC clamp) is a dual channel alignment oscilloscope with a 9-inch electromagnetic deflection CRT. It may be used in combination with a sweep generator to monitor the frequency response of TV receivers, radio receivers, filters, etc.

### ●FEATURES

- High sensitivity of 1mV/div for the vertical axis and calibrated ranges.
- Incorporated clamping circuit for the vertical axis to provide fixed base line for input waveform changes.
- Polarity inversion for the vertical axis.
- Two types of markers; pulse marker and intensity modulation marker.

### ●SPECIFICATIONS

<b>CRT:</b>	230MB4A
<b>Effective Display Area:</b>	12div x 16div (1div = 10mm)
<b>Acceleration Voltage:</b>	8kV
<b>Vertical Axis</b>	
<b>Sensitivity:</b>	1mV/div to 1V/div, 1 - 10 steps, 4 ranges, continuous adjuster
<b>Bandwidth:</b>	DC (2Hz) to 10kHz, -3dB, 4div ref.
<b>Input Impedance:</b>	1M $\Omega$ , 50pF
<b>Input Coupling:</b>	AC-DC
<b>Max. Input Voltage:</b>	200V (DC+ ACp-p)
<b>Polarity Inversion:</b>	Switchable
<b>DC Clamping:</b>	Available by an ON-OFF switch
<b>Clamping Time:</b>	Set in synchronization with internal preset signal or external signal with positive or negative setting of a switch.
<b>Operation Mode:</b>	CH1 : CH1 only trace CH2 : CH2 only trace ALT : Dual trace mode Alternate sweeping of CH1 and CH2 Switchable by 1/2 or 1/4 of horizontal Input signal (triangle waveform of 25Hz to 200Hz) or by external switch- ing signal

### Horizontal Axis

<b>Sensitivity:</b>	100mV/div or better
<b>Input Attenuator:</b>	Continuous variable to 0 sensitivity
<b>Bandwidth:</b>	DC (2Hz) to 1kHz - 3dB
<b>Input Impedance:</b>	500k $\Omega$ , 50pF
<b>Input Coupling:</b>	AC-DC
<b>Max. Input Voltage:</b>	200V (DC + ACp-p)

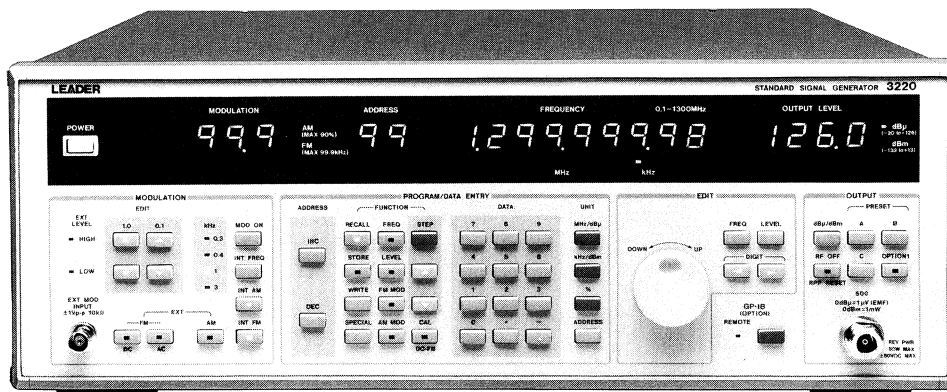
### Z-axis (Intensity Modulation Input)

<b>Sensitivity:</b>	2Vp-p or better
<b>Input Attenuator:</b>	Continuous variable to 0 sensitivity
<b>Polarity Switching:</b>	- or +, switchable
<b>Max. Input Voltage:</b>	Less than 100V (DC + ACp-p)
<b>Pulse Marker Input</b>	
<b>Sensitivity:</b>	10mV/div or better
<b>Input Attenuator:</b>	Continuous variable to 0 sensitivity
<b>Polarity Switching:</b>	- or +, switchable
<b>Input Impedance:</b>	100k $\Omega$
<b>Max. Input Voltage:</b>	100V (DC + ACp-p)
<b>Power Supply:</b>	100, 120, 220, 240V AC, 50/60Hz, 60VA
<b>Size and Weight:</b>	230(W) x 270(H) x 300(D)mm, 11kg
<b>Accessories:</b>	BNC - BNC cable ..... 2 BNC - clip cable ..... 2 Spare fuse ..... 1

# SIGNAL GENERATOR

## 100kHz to 1300MHz

### NEW



## Model 3220 AM, FM, DC-FM STANDARD SIGNAL GENERATOR



### ●GENERAL

The Model 3220, a synthesized standard signal generator, covers a frequency range from 100kHz to 1300MHz. The output level can be set from  $-20\text{dB}\mu$  to  $126\text{dB}\mu$  ( $0\text{dB} = 1\mu\text{V}$ ) in 0.1dB steps. Up to 100 combinations of frequency, modulation and output level can be preset. This equipment is ideal for use in research and development, as well as the testing and adjustment of communications equipment and mobile radio equipment.

### ●FEATURES

- High stable signals are obtained as the oscillation frequency is locked to the reference crystal oscillator.
- The output level can be set from  $-20\text{dB}\mu$  to  $126\text{dB}\mu$  ( $0\text{dB} = 1\mu\text{V}$ ) into open circuit in 0.1dB steps. The unit is selectable either  $\text{dB}\mu$  or  $\text{dBm}$ .
- Up to 100 points of selections combining frequency, modulation factor and output level can be preset in internal memory. Memory is backed up by a battery.
- Frequency, output level and modulation factor can be set with numeric keys.
- All switches on front panel, except the power switch, can be remote controlled through 24-pin connector on the rear panel.
- A GPIB interface, listener is available as an option.
- Best for the production lines of BC to FM band radio receivers, communications equipment, pocket bells, and VHF/UHF band TVs. Moreover, the Model 3220 can be used in a wide range of application from research and development to the production lines of mobile radio equipment.

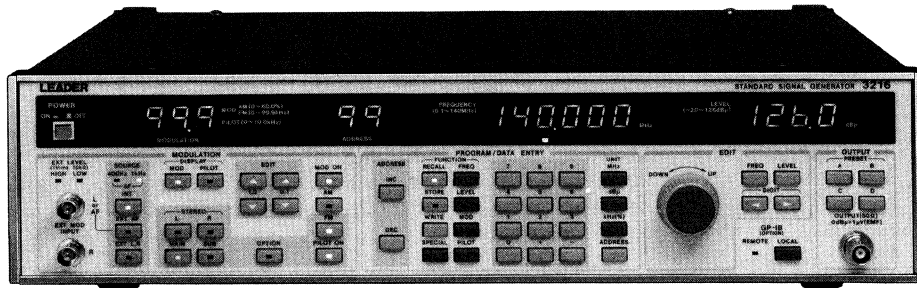
# SIGNAL GENERATOR

## ●SPECIFICATIONS

<b>Frequency</b>		<b>Accuracy:</b>	Within $\pm 100\text{Hz}$ ( $f < 650\text{MHz}$ ) Within $\pm 200\text{Hz}$ ( $f \geq 650\text{MHz}$ ) after two hours warm up
<b>Range:</b>	100kHz to 1299.99998MHz	<b>Stability:</b>	$\pm 100\text{Hz}/1\text{H}$ ( $f < 650\text{MHz}$ ) $\pm 200\text{Hz}/1\text{H}$ ( $f \geq 650\text{MHz}$ )
<b>Resolution:</b>	10Hz ( $f < 650\text{MHz}$ ), 20Hz ( $f \geq 650\text{MHz}$ )	<b>(after two hours warm up)</b>	
<b>Accuracy:</b>	$\pm 1 \times 10^{-6}$ ( $10^\circ\text{C}$ to $40^\circ\text{C}$ )	<b>Amplitude Modulation (AM)</b>	
<b>Long Term Stability:</b>	Within $\pm 2 \times 10^{-7}/\text{week}$	<b>Modulation Factor:</b>	0 to 90.0% ( $\leq 120\text{dB}\mu$ )
<b>Short Term Stability:</b>	Within $\pm 2 \times 10^{-8}/1$ to 100 sec	<b>Resolution:</b>	0.1%
<b>Settings:</b>	Numeric keys, digit select keys, and up/down rotary encoder	<b>Accuracy:</b>	$\pm 10\%$ of reading
<b>Display:</b>	9-digit digital display	<b>Distortion:</b>	1% or less (30% modulation, 1kHz modulation, demodulation band 50Hz to 10kHz)
<b>Output</b>		<b>Residual AM:</b>	50dB (30% modulation, 1kHz modulation, demodulation band 50Hz to 10kHz)
<b>SSB Phase Noise:</b>	Less than $-120\text{dBc}/\text{Hz}$ (500MHz, 20kHz offset)	<b>Display:</b>	3-digit digital display
<b>Range:</b>	$-20$ to $126\text{dB}\mu$ ( $0\text{dB} = 1\mu\text{V}$ ) into open circuit $-133$ to $13\text{dBm}$ ( $0\text{dB} = 1\text{mW}$ into $50\Omega$ load) Unit indication selectable between $\text{dB}\mu$ and $\text{dBm}$	<b>Internal Modulation</b>	
<b>Resolution:</b>	0.1dB	<b>Frequency:</b>	300Hz, 400Hz, 1kHz, 3kHz $\pm 5\%$
<b>Continuous Variable:</b>	Continuous variable mode setting key	<b>External Modulation</b>	
<b>Mode:</b>	Changes the output level within $\pm 5\text{dB}$ in 0.1dB steps starting from any output level. (Not available in AM modulation.)	<b>Input Impedance:</b>	10k $\Omega$
<b>Reference Level</b>		<b>Reference Input Voltage:</b>	2Vp-p (AC), 1V (DC)
<b>Accuracy:</b>	$\pm 1\text{dB}$ at $126\text{dB}\mu$ output	<b>Frequency Ranges:</b>	50Hz to 100kHz (AC-FM) DC to 100kHz (DC-FM) 20Hz to 10kHz (AM)
<b>Attenuator Accuracy:</b>	$\pm 1.5\text{dB}$ ( $> 0\text{dB}\mu$ output) $\pm 2\text{dB}$ ( $\leq 0\text{dB}\mu$ output)	<b>Frequency Response:</b>	Within $\pm 1\text{dB}$ (1kHz reference)
<b>Settings:</b>	Numeric keys and up/down rotary encoder	<b>Leakage:</b>	Should not affect measurements with $0\text{dB}\mu$ ( $1\mu\text{V}$ ).
<b>Impedance:</b>	$50\Omega$ , VSWR 1.5 or less	<b>Preset:</b>	Up to 100 point of selections combining frequency, modulation factor and output level can be preset in internal memory.
<b>Spurious:</b>	Harmonic: Less than $-30\text{dBc}$ Sub harmonic: $-30\text{dBc}$ ( $f \geq 650\text{MHz}$ ) Non-harmonic: Less than $-50\text{dBc}$	<b>Power Supply:</b>	100, 120, 220, 240V AC $\pm 10\%$ , 115VA
<b>ON/OFF</b>	RF output is ON and OFF by the RF ON/OFF key.	<b>Size and Weight:</b>	426(W) x 148(H) x 450(D)mm, 18kg
<b>Reverse Power</b>		<b>Accessories:</b>	3D-2W N-N ( $50\Omega$ ) cable (1m) ..... 1 Spare fuse ..... 1 2P to 3P adapter ..... 1
<b>Protection:</b>	Attenuator protected up to 50W, DC $\pm 50\text{V}$		
<b>Display:</b>	4-digit digital display Selectable either $\text{dB}\mu$ or $\text{dBm}$		
<b>Modulation</b>			
<b>Modulation Mode:</b>	AM modulation, FM modulation (AC-FM and DC-FM), AM-FM simultaneous modulation		
<b>Frequency Deviation:</b>	0 to 99.9kHz		
<b>Resolution:</b>	0.01kHz (0 to 99.9kHz deviation) 0.1kHz (10.0 to 99.9kHz deviation)		
<b>Accuracy:</b>	$\pm 10\%$ of reading		
<b>Distortion:</b>	0.5% or less (75kHz deviation, 1kHz, Demodulation band; 300Hz to 15kHz, de-emphasis 50 $\mu\text{s}$ )		
<b>Residual FM:</b>	60dB ... 0.1 to 649MHz 55dB ... 650 to 1299MHz (3.5kHz deviation at 1kHz, demodulation band 300Hz to 3kHz, 50 $\mu\text{s}$ de-emphasis)		
<b>Display:</b>	3-digit digital display		
<b>DC-FM Mode</b>			
<b>Frequency Deviation:</b>	0 to 5.00kHz		
<b>Resolution:</b>	0.01kHz		
<b>Display:</b>	3-digit digital display		
<b>Calibration:</b>	Center frequency can be calibrated with CAL key on the front panel.		

# SIGNAL GENERATOR

For Use on Production Lines of FM/AM Radios, Receivers, and Cordless Telephone Sets



## Model 3216 (built-in FM STEREO modulator) Model 3215 STANDARD SIGNAL GENERATOR



### ●GENERAL

The Model 3215 and 3216 are synthesized standard signal generators that generate CW, FM, and AM signals. The oscillation frequency is locked to a reference frequency to ensure highly stable signals. The output level ranges from  $-20\text{dB}\mu$  to  $+126\text{dB}\mu$  and is programmable in 0.1dB steps. Moreover, any frequency, modulation, and output level combinations can be stored at up to 100 points in internal memory. The battery-backup feature protects the contents of memory even after the power is turned off.

### ●FEATURES

- Expanded oscillation frequency range from 100kHz to 140MHz to enable FM receiver measurements.
- The output level ranges from  $-20\text{dB}\mu$  to  $126\text{dB}\mu$  ( $0\text{dB}=1\mu\text{V}$ ,  $50\Omega$  into open circuit), and can be set in 0.1dB steps.
- The frequency deviation for FM is 0 to 99.9kHz; the modulation factor for AM is 0 to 60%, programmable in 0.1kHz (%) steps.
- Up to 100 points of frequency, output level and modulation factor combinations can be stored in the built-in memory, which is also backed up by a battery.
- All switches on the front panel can be remotely controlled.
- The GPIB interface (listener) is optionally available.
- Because the Model 3216 has a real FM stereo modulator, it can be used for measuring FM stereo tuners and FM car stereo sets.

### ●SPECIFICATIONS

<b>Frequency Range:</b>	100kHz to 140MHz
<b>Resolution:</b>	100Hz (100kHz to 29.9999MHz) 1kHz (30MHz to 140MHz)
<b>Setting:</b>	Ten-key, digit select keys and up/down switch
<b>Accuracy:</b>	$\pm 5 \times 10^{-5}$
<b>Output Range:</b>	$-20$ to $126\text{dB}\mu$ ( $0\text{dB}=1\mu\text{V}$ open circuit)
<b>Resolution:</b>	0.1dB
<b>Setting:</b>	Ten-key, digit select keys and up/down switch
<b>Reference Level Accuracy:</b>	$\pm 1\text{dB}$ (at $126\text{dB}\mu$ output)
<b>Attenuation Accuracy:</b>	$\pm 1.5\text{dB}$ ( $\geq 0\text{dB}\mu$ ), $\pm 2\text{dB}$ ( $< 0\text{dB}\mu$ )
<b>Impedance:</b>	$50\Omega$ , VSWR: less than 1.3
<b>Spurious:</b>	Harmonic: 30dBc
<b>Modulation</b>	
<b>FM</b>	
<b>Frequency Deviation:</b>	0 to 99.9kHz
<b>Resolution:</b>	0.1kHz
<b>Modulation Accuracy:</b>	$\pm 10\%$ of the display value
<b>Distortion Factor:</b>	Less than 0.05%: 10.7MHz $\pm 1\text{MHz}$ , 76 to 108MHz Less than 0.1%: Other frequencies
<b>Residual FM:</b>	73dB or more S/N for 75kHz deviation
<b>AM</b>	
<b>Modulation Factor:</b>	0 to 60.0%
<b>Resolution:</b>	0.1%
<b>Modulation Accuracy:</b>	$\pm 10\%$ of display value
<b>Distortion Factor:</b>	Less than 0.5%: 100kHz to 29.9999MHz Less than 1.5%: 30MHz to 140MHz
<b>Residual AM:</b>	55dB or more S/N for 30% modulation
<b>FM Stereo, only Model 3216</b>	
<b>Pilot Signal</b>	
<b>Frequency Deviation:</b>	0 to 10.0kHz
<b>Resolution:</b>	0.1kHz
<b>Modulation Accuracy:</b>	$\pm 10\%$ of display value
<b>Frequency:</b>	19kHz $\pm 2\text{Hz}$
<b>Separation:</b>	55dB or more
<b>Mode:</b>	MAIN, SUB, L, R
<b>Internal Modulation</b>	
<b>Frequency:</b>	400Hz, 1kHz $\pm 5\%$
<b>External Modulation</b>	
<b>Input Impedance:</b>	10k $\Omega$
<b>Reference Input Voltage:</b>	1.0Vrms
<b>Frequency Range:</b>	FM: 20Hz to 100kHz, AM: 20Hz to 10kHz
<b>Flatness:</b>	$\pm 1\text{dB}$ (1kHz reference)
<b>Power Supply:</b>	100, 120, 220, 240V AC $\pm 10\%$ 40VA (Model 3216) 35VA (Model 3215)
<b>Size and Weight:</b>	426(W) x 99(H) x 300(D)mm, 7.5kg
<b>Accessories:</b>	BNC-BNC cable (3D-2V, 1m) ... 1, Spare fuse ... 1

# SIGNAL GENERATOR

## ■ FUNCTIONS

### • Increased oscillator stability and accuracy by the synthesizing method used

The oscillation frequency locked to the reference crystal oscillator ensures highly-stable signals. The frequency is displayed on a 6-digit digital display in MHz.

- (A) 30 to 140MHz (Resolution: 1kHz)
- (B) 0.1 to 29.9999MHz (Resolution: 100Hz)

### • Setting the frequency using the ten-key pad

To set a frequency of 98MHz, key in:

FREQ → 9 → 8 → MHz

### • Fine adjustments of frequency using the UP/DOWN keys

The UP/DOWN keys are used mainly to adjust and partially correct frequencies. In this way, frequencies may be changed regardless of the LOCAL or RECALL mode. Use the DIGIT key to specify the digit to be changed, then use the UP/DOWN keys for the setting. Digit shifting is done automatically.

### • Setting the output level using the ten-key pad

The desired dB $\mu$  value can be set by keying in order of LEVEL, numeric value and dB $\mu$ .

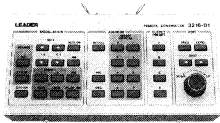
### • Setting the output level in 10dB, 1dB and 0.1dB steps

The output level is displayed in four digits. Then open circuit voltage is 1 $\mu$ V at 0dB $\mu$  indication.

### • 100-address memory presetting feature for one-touch recall

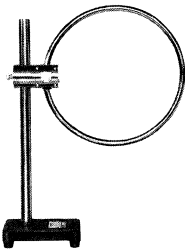
Up to 100 frequency, modulation and output level combinations can be preset in memory. After the start and end addresses are preset in memory according to the production process, they can be easily and immediately recalled from to significantly reduce the time required for adjustments and inspections.

## ■ OPTIONAL ACCESSORIES



### Remote controller Model 3216-01

For Model 3215, 3216  
Switches can be all on the front panel remotely controlled.



### Test loop LPA-070

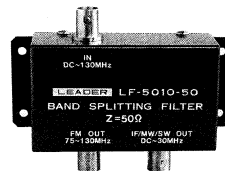
Also called a loop antenna. When used with an SSG, it generates the standard electromagnetic field that you require. This test loop is used to control and test AM/SW receives that have a bar antenna.

Frequency range 0.1 to 30MHz  
Impedance 50 $\Omega$



### Dummy antenna LDA-1554-50

Unbalanced input of 50 $\Omega$  and balanced output of 300 $\Omega$ .



### Band-splitting filter LF-5010-50

The LC filter splits bands into two: one for 30MHz or lower and one for 75MHz or higher. Each band signal is output from individual connectors. The RF output from a signal generator can be measured without switching the AM and FM bands.



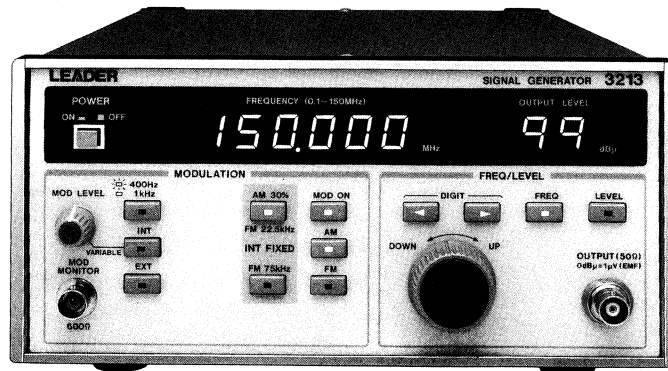
### Signal selector LSS-5011

Designed for the Model 3215 and 3216 and used in the same applications as those with the LF-5010. External control signals are required, however, because the signal selector is switched via a realy.

# SIGNAL GENERATOR

100kHz to 150MHz. Half-Rack Size, Economical SG.

**NEW**



## Model 3213 SIGNAL GENERATOR

### ●GENERAL

The Model 3213 is synthesizing standard signal generator that generates CW and FM/AM modulation signals. The oscillation frequency ranges from 100kHz to 150MHz. The frequency is locked to the reference oscillator to obtain stable signals. The output level can be set from 0dB $\mu$  to 99dB $\mu$  (0dB=1 $\mu$ V, 50 $\Omega$  into an open circuit) in 1dB steps.

The optional 3214-01 Remote Controller stores up to ten sets of frequencies, an output level, and a modulation mode. This model have storage memory.

### ●FEATURES

- Built-in AM modulation (50% max./30% preset) and FM modulation (100kHz max./75kHz or 225kHz preset) enable internal modulation (400Hz or 1kHz selectable) or external modulation (AM: 20Hz to 10kHz, FM: 20Hz to 100kHz).
- Digit selection key and rotary encoder for setting the frequency and output level.
- Half-rack size to save space and reduce cost.
- Ideally suited for adjusting and servicing FM/AM radios and cordless telephone sets.

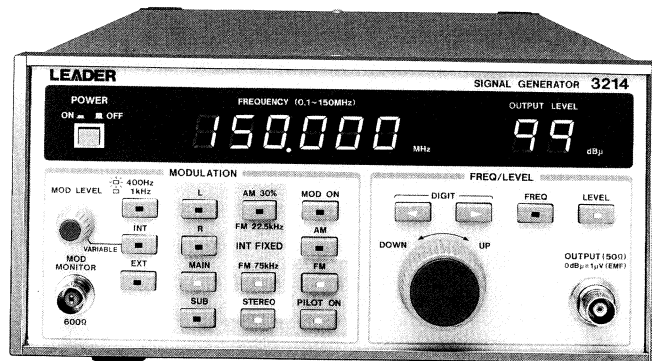
### ●SPECIFICATIONS

<b>Frequency Range:</b>	100kHz to 150MHz
<b>Setting:</b>	Digit select keys and rotary encoder
<b>Accuracy:</b>	$\pm 5 \times 10^{-5}$ ; 30MHz to 150MHz $\pm 5 \times 10^{-5} \pm 50$ kHz: 100kHz to < 30MHz
<b>Output Range:</b>	0dB to 99dB $\mu$ (0dB=1 $\mu$ V open circuit)
<b>Resolution:</b>	1dB
<b>Setting:</b>	Digit select keys and rotary encoder
<b>Reference Level Accuracy:</b>	$\pm 1$ dB (at 99dB $\mu$ output)
<b>Attenuation Accuracy:</b>	$\pm 2$ dB
<b>Impedance:</b>	50 $\Omega$ VSWR: less than 1.3
<b>Spurious:</b>	Harmonic: 30dBc
<b>Modulation FM</b>	
<b>Frequency Deviation:</b>	Up to 100kHz (preset: 22.5kHz, 75kHz)
<b>Modulation Accuracy:</b>	$\pm 10$ kHz (75kHz deviation) $\pm 3$ kHz (22.5kHz deviation)
<b>Distortion Factor:</b>	0.1%: 75kHz deviation, 1kHz
<b>Residual FM: AM</b>	70dB or more S/N for 75kHz deviation
<b>Modulation Factor:</b>	Up to 50% (preset: 30%)
<b>Modulation Accuracy:</b>	$\pm 5\%$ (to the setting value)
<b>Distortion Factor:</b>	0.5% (>30MHz, 1kHz - 30% modulation) 3% ( $\leq$ 30MHz, 1kHz - 30% modulation)
<b>Residual AM: Internal Modulation</b>	50dB or more (30% modulation)
<b>Frequency:</b>	400Hz, 1kHz $\pm 5\%$
<b>External Modulation Input Impedance:</b>	10k $\Omega$
<b>Frequency Range:</b>	FM: 20Hz to 100kHz, AM: 20Hz to 10kHz
<b>Flatness:</b>	Within $\pm 1$ dB (1kHz reference)
<b>Power Supply:</b>	100, 120, 220, 240V AC $\pm 10\%$ (250V AC maximum) 17VA
<b>Size and Weight:</b>	213 (W) x 99 (H) x 400 (D) mm, 4kg
<b>Accessories:</b>	BNC-BNC cable (3D-2V, 1m) ..... 1 Spare fuse ..... 1

# SIGNAL GENERATOR

100kHz to 150MHz. Half-Rack Size, Economical SG.

**NEW**



## Model 3214 (Built-in FM STEREO modulator) SIGNAL GENERATOR

### ●GENERAL

The Model 3214 is synthesizing standard signal generator that generates CW and FM/AM modulation signals. The oscillation frequency ranges from 100kHz to 150MHz. The frequency is locked to the reference oscillator to obtain stable signals. The output level can be set from 0dB $\mu$  to 99dB $\mu$  (0dB=1 $\mu$ V, 50 $\Omega$  into an open circuit) in 1dB steps.

Model 3214 has a FM stereo modulator, which makes it ideally suited for measuring FM tuners and FM car stereo sets. The optional 3214-01 Remote Controller stores up to ten sets of frequencies, an output level, and a modulation mode. This model have storage memory.

### ●FEATURES

- Built-in AM modulation (50% max./30% preset) and FM modulation (100kHz max./75kHz or 225kHz preset) enables internal modulation (400Hz or 1kHz selectable) or external modulation (AM: 20Hz to 10kHz, FM: 20Hz to 100kHz).
- Digit selection key and rotary encoder for setting the frequency and output level.
- Half-rack size to save space and reduce cost.
- FM stereo separation is 45dB or better.
- Ideally suited for adjusting and servicing FM/AM radios and cordless telephone sets.

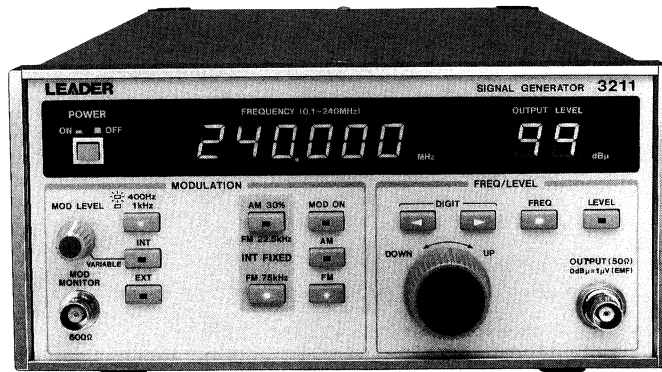
### ●SPECIFICATIONS

<b>Frequency Range:</b>	100kHz to 150MHz
<b>Setting:</b>	Digit select keys and rotary encoder
<b>Accuracy:</b>	$\pm 5 \times 10^{-5}$ : 30MHz to 150MHz $\pm 5 \times 10^{-5} \pm 50$ kHz: 100kHz to < 30MHz
<b>Output Range:</b>	0dB to 99dB $\mu$ (0dB=1 $\mu$ V open circuit)
<b>Resolution:</b>	1dB
<b>Setting:</b>	Digit select keys and rotary encoder
<b>Reference Level</b>	
<b>Accuracy:</b>	$\pm 1$ dB (at 99dB $\mu$ output)
<b>Attenuation Accuracy:</b>	$\pm 2$ dB
<b>Impedance:</b>	50 $\Omega$ VSWR: less than 1.3
<b>Spurious:</b>	Harmonic: 30dBc
<b>Modulation FM</b>	
<b>Frequency Deviation:</b>	Up to 100kHz (preset: 22.5kHz, 75kHz)
<b>Modulation Accuracy:</b>	$\pm 10$ kHz (75kHz deviation) $\pm 3$ kHz (22.5kHz deviation)
<b>Distortion Factor:</b>	0.1%: 75kHz deviation, 1kHz
<b>Residual FM:</b>	70dB or more S/N for 75kHz deviation
<b>AM</b>	
<b>Modulation Factor:</b>	Up to 50% (preset: 30%)
<b>Modulation Accuracy:</b>	$\pm 5\%$ (to the setting value)
<b>Distortion Factor:</b>	0.5% (>30MHz, 1kHz -30% modulation) 3% ( $\leq$ 30MHz, 1kHz -30% modulation) 50dB or more (30% modulation)
<b>Residual AM:</b>	
<b>FM Stereo Pilot Signal</b>	
<b>Frequency Deviation:</b>	7.5kHz $\pm$ 1kHz
<b>Frequency:</b>	19kHz $\pm$ 2Hz
<b>Separation:</b>	45dB or more
<b>Mode:</b>	MAIN, SUB, L, R
<b>Internal Modulation</b>	
<b>Frequency:</b>	400Hz, 1kHz $\pm$ 5%
<b>External Modulation</b>	
<b>Input Impedance:</b>	10k $\Omega$
<b>Frequency Range:</b>	FM: 20Hz to 100kHz, AM: 20Hz to 10kHz Within $\pm 1$ dB (1kHz reference)
<b>Flatness:</b>	
<b>Power Supply:</b>	100, 120, 220, 240V AC $\pm 10\%$ (250V AC maximum) 17VA
<b>Size and Weight:</b>	213 (W) x 99 (H) x 400 (D) mm, 4kg
<b>Accessories:</b>	BNC-BNC cable (3D-2V, 1m) ..... 1 Spare fuse ..... 1

# SIGNAL GENERATOR

100kHz to 240MHz. Half-Rack Size, SG.

**NEW**



## Model 3211 SIGNAL GENERATOR

### ●GENERAL

The Model 3211 is a synthesized standard signal generator that generates CW, FM and AM signals to provide a broad oscillation range of 100kHz to 240MHz. This oscillation is locked to a reference level to ensure stable signals. The output level ranges from 0dB $\mu$  to 99dB $\mu$  (0dB=1 $\mu$ V, 50 $\Omega$  into open circuit), and is set up in 1dB steps.

### ●FEATURES

- Covers all VHF TV bands from 100kHz to 240MHz.
- Output level of 0dB $\mu$  to 99dB $\mu$  (0dB=1 $\mu$ V, 50 $\Omega$  into open circuit).
- Both frequency and output level can be programmed using the digit select keys and rotary encoder.
- The remote controller terminal enables up to ten panel setting patterns to be stored in memory for later recall when used in with the optional 3214-01 remote controller.
- Improved operability is provided by the standard basic features to reduce overall unit cost.

#### ■ REMOTE CONTROLLER Model 3214-01

The Model 3214-01 is the remote controller used for the Model 3211, 3213 and 3214.

When combined with this controller, the instrument can store up to ten sets (points) of frequencies, output levels and modulation modes in memory. (Memories are built into the 3211/3213/3214.) Control: STORE Mode (The setting data can be written.)

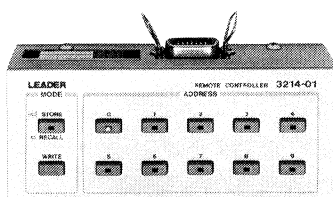
RECALL Mode (The setting data read out.)

Number of Address: 10

Power Supply: Supplied from the mainframe.

Size and Weight: 150(W) x 42(H) x 65(D)mm, 300g

Accessory: Connection cable (amphenol 14-pin—14-pin, 2m)...1



### ●SPECIFICATIONS

#### Frequency:

#### Range:

100kHz to 240MHz

#### Setting:

Digit select keys and rotary encoder

#### Accuracy:

$\pm 5 \times 10^{-5}$ : 30MHz to 240MHz

$\pm 5 \times 10^{-5} \pm 50$ Hz: 100kHz to < 30MHz

#### Output

#### Range:

0dB to 99dB $\mu$  (0dB=1 $\mu$ V open circuit)

#### Resolution:

1dB

#### Setting:

Digit select keys and rotary encoder

#### Reference Level

#### Accuracy:

$\pm 1$ dB (at 99dB $\mu$  output)

#### Attenuation Accuracy:

$\pm 2$ dB

#### Impedance:

50 $\Omega$ , VSWR: less than 1.3

#### Spurious

#### Modulation

#### FM

#### Frequency Deviation:

Up to 100kHz (preset: 22.5kHz, 75kHz)

#### Modulation Accuracy:

$\pm 10$ kHz (75kHz deviation)

$\pm 3$ kHz (22.5kHz deviation)

#### Distortion Factor:

0.1%: 75kHz deviation, 1kHz

#### Residual FM:

70dB or more S/N for 75kHz deviation

#### AM

#### Modulation Factor:

Up to 50% (preset: 30%)

#### Modulation Accuracy:

$\pm 5$ % (to the setting value)

#### Distortion Factor:

0.5% (> 30MHz, 1kHz - 30%

modulation)

3% ( $\leq$  30MHz, 1kHz - 30%

modulation)

50dB or more (30% modulation)

#### Residual AM:

#### Internal Modulation

#### Frequency:

400Hz, 1kHz  $\pm 5$ %

#### External Modulation

#### Input Impedance:

10k $\Omega$

#### Frequency Range:

FM: 20Hz to 100kHz,

AM: 20Hz to 10kHz

#### Frequency Response:

$\pm 1$ dB (1kHz reference)

#### Power Supply:

100, 120, 220, 240V AC  $\pm 10$ % (250V AC maximum)

#### Size and Weight:

213 (W) x 99 (H) x 400 (D) mm, 5kg

#### Accessories:

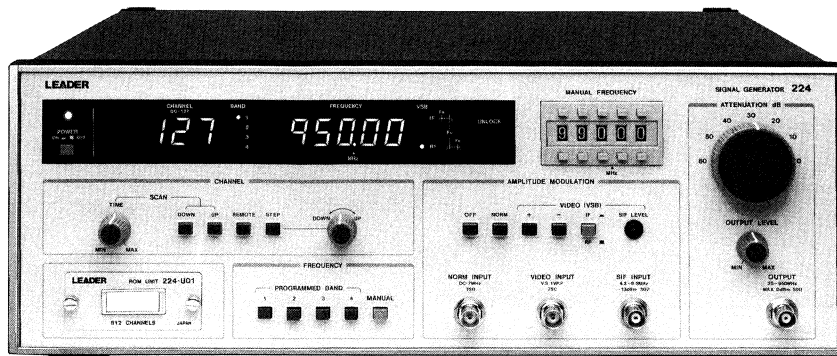
BNC-BNC cable (3D-2V, 1m) ..... 1

Spare fuse ..... 1



# SIGNAL GENERATOR

## Built-in Video Modulation Function of Vestigial Sideband System



## Model 224 SIGNAL GENERATOR

### ●GENERAL

The Model 224 is a synthesized signal generator that covers VHF to UHF bands. It provides AM modulation in all frequency bands. Vestigial sideband video modulation makes it ideally suited for use as a TV signal source. It also serves a variety of measurement roles such as a convenient signal source, and an external marker signal source for a sweep generator.

### ●FEATURES

- Vestigial sideband video modulation enables the LSG-224 to be correctly synchronized with all TV channels to check picture and when used with a pattern generator and signal generator capable of frequency modulation.
- The audio carrier can be selected between upper-side addition (RF mode) and lower-side addition (IF mode) to the video carrier frequency. The level of the audio carrier is variable in the range of 0 to -10dB with regard to the video carrier level.
- A simple AM modulation facility (external modulation frequency DC-7 MHz) extends LSG-224's application range.
- Frequencies can be set in pitches of 10 kHz steps over the entire range.
- A constant modulation factor can be maintained in all frequency bands.
- Frequencies can be set in three ways to suit specific applications; by using a thumb-wheel switch, ROM, or remote control (thumb-wheel switch, CPU, etc.).
- ROM has a generous capacity of 512 channels. Channels can be grouped into four bands and selected by using a step switch, auto-scanning, or remote control.

### ●SPECIFICATIONS

<b>Frequency</b>	25 to 950MHz
<b>Frequency Range:</b>	25 to 950MHz
<b>Preset Frequency</b>	10kHz
<b>Resolution:</b>	Within 0.01% + 10kHz:
<b>Frequency Accuracy:</b>	Less than 100MHz
	Within 20kHz: 100MHz or higher
<b>Residual FM:</b>	10kHz or less
<b>Frequency Setting:</b>	1. 5-digit thumb-wheel switch
	2. ROM 128 channels/band, or total 512 channels/four bands channel
	3. Remote control (TTL level)

<b>Output</b>	
<b>Output Voltage:</b>	0dBm into 50Ω
<b>Output Impedance:</b>	50Ω
<b>Flatness:</b>	±2dB or less
<b>Attenuators:</b>	0 to 60dB; 10dB steps, rotary
	0 to 10dB; continuously variable, electronically

<b>Spurious</b>	
<b>Harmonics:</b>	-30dBc or less
<b>Non-Harmonics:</b>	-30dBc or less
<b>Modulation</b>	
<b>Normal Amplitude</b>	
<b>Modulation:</b>	

Frequency range: DC to 7MHz  
Modulation factor: 30% with 50mVrms input  
Input impedance: 75Ω

<b>Video Modulation</b>	
<b>Frequency Range:</b>	10Hz to 6MHz
<b>Inband Flatness:</b>	Within ±2dB
	(RF mode: -0.75 to +6MHz for fv)
	(IF mode: -6 to 0.75MHz for fv)
<b>Outband Attenuator:</b>	25dB or more
	(RF mode: fv +6.5MHz or more,
	fv -1.25MHz or less)
	(IF mode: fv +1.25MHz or more,
	fv -6.5MHz or less)

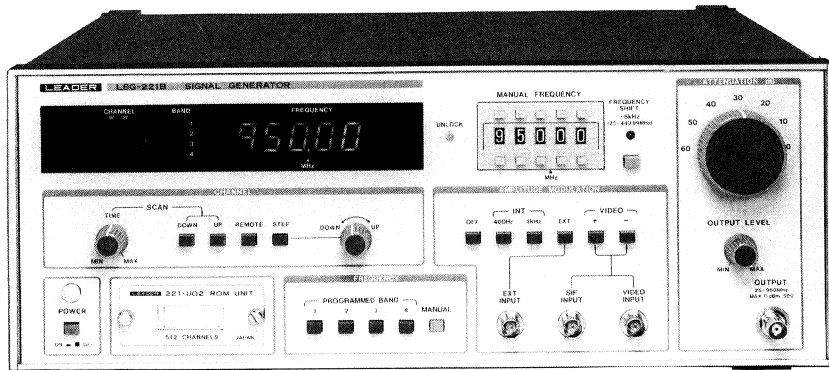
<b>Modulation Factor:</b>	*fv: Video carrier frequency
	Input level V.S. 1Vp-p
	97.0 ± 3% (Positive modulation)
	87.5 ± 3% (Negative modulation)
	With synchronizing signal clamp
	With modulation polarity selection
	With RF/IF selection
	1. RF mode (audio upper side)
	25 to 950MHz
	2. IF mode (audio lower side)
	25 to 599.99MHz

<b>SIF Input</b>	
<b>Frequency:</b>	4.5 to 6.5MHz
<b>Input Level:</b>	-13dBm
<b>SIF Level Variable:</b>	0 to -10dB with regard to video carrier
<b>Input Impedance:</b>	50Ω
<b>ROM Channel Control:</b>	
	1. Auto-scanning Time:
	0.1 to 10 seconds per channel, continuous
	variable
	2. Steps:
	25 steps per rotation, automatic UP/DOWN
	detection by pulse switches
	3. Remote 7-bit binary code
<b>Remote Control:</b>	
	1. Frequency presetting
	2. ROM band and channel control
	3. Modulation mode

<b>Environmental Conditions</b>	
<b>(for guaranteed accuracy):</b>	Temperature 5 to 40°C
	Humidity 85% or less
<b>Power Supply:</b>	100, 120, 220, 240VAC, 55VA
<b>Size and Weight:</b>	426(W) × 148(H) × 400(D)mm, 12.5kg
<b>Accessory:</b>	BNC-BNC cable (50Ω, 1m) ..... 1
	3P-2P conversion adaptor ..... 1
	Spare fuse ..... 1
	Multipin plug (for remote connector)
	36-pin ..... 1
	24-pin ..... 1

# SIGNAL GENERATOR

## 25 to 950MHz, For Measurement of Video Instruments



## LSG-221B SIGNAL GENERATOR

### ●GENERAL

The LSG-221B is a synthesized signal generator which covers the bands from VHF to UHF.

As frequency setting is possible using the ROM or thumb-wheel switches and the AM and Video modulation function is provided. The instrument can be used as an external marker signal source of a sweep generator as well as an easy-to-use signal source for various measurements.

### ●FEATURES

- Wide range of frequency band coverage, 25 to 950MHz, in 10kHz step.
- Frequency setting by thumb-wheel switches, ROM and remote control (using thumb-wheel switches external and CPU) for proper selection depending on application purposes.
- Simplified AM modulation function (internal 400Hz and 1kHz in 30% modulation factor; external DC to 10MHz) to broaden application areas.
- Built-in video modulation function (non-calibrated, double-side-band modulation) enables checking of audio & video signals in all channels of VHF, UHF, CATV for TV receiver, in combination with pattern generator and signal generator featuring frequency modulation function.
- A large capacity of the ROM to accommodate 512 channels. The stored information is divided into 4 band groups; thus, selection of step switch, auto scan and remote control is possible.
- The frequency switching speed is as fast as 100ms or less.

### ●SPECIFICATIONS

<b>Frequency Range:</b>	25MHz to 950MHz
<b>Preset Resolution:</b>	10kHz (However, 5kHz for a range of 25 to 449.99MHz using the +5kHz switch) Within 0.01%+10kHz: 100MHz or less Within 10kHz: 100MHz or more
<b>Accuracy:</b>	Within 10kHz
<b>Residual FM:</b>	1. 5-digit thumb-wheel switch 2. ROM (Total 512CH for 4 bands as 128CH available for a single band) (But, if frequency is not specified blank ROM will be shipped out.) 3. Remote Control (TTL level)
<b>Setting:</b>	6 digits, 7 segments LED 100ms or less
<b>Display:</b>	6 digits, 7 segments LED
<b>Switching Speed:</b>	100ms or less
<b>Output:</b>	0dBm with 50Ω load, no modulation, and approx. -15dBm with 50Ω load, modulation
<b>Output Voltage:</b>	50V
<b>Output Impedance:</b>	Within ±2dB
<b>Output Deviation:</b>	0 to 60dB, 10dB steps, rotary type
<b>Attenuator:</b>	0 to 10dB, continuously variable, electronic type
<b>Spurious:</b>	Less than -30dBc
<b>Non-Harmonics:</b>	Less than -30dBc (unmodulated)
<b>Harmonics:</b>	Less than -20dBc (2nd harmonic, with modulation) Less than -10dBc (3rd harmonic, with modulation)
<b>Internal Modulation:</b>	Frequency: 400Hz, 1kHz Accuracy: Within 10% Modulation: 30% Distortion: 5% or less
<b>External Modulation:</b>	1. EXT: DC to 10MHz, 30% modulation, approx. 50mVrms 2. VIDEO: (10Hz to 10MHz) with sync. signal clamp and modulation polarity switching 3. SIF: 1 to 10MHz
<b>Channel Control by ROM:</b>	1. Auto scan time: 0.1 to 10 sec. variable per channel 2. Step: 25 step pulse switch, up down automatic selection 3. Remote: 7 bits binary code
<b>Remote Control:</b>	1. Frequency preset 2. ROM band and channel control
<b>Environmental Conditions (for guaranteed accuracy):</b>	Temperature: 5°C to 40°C Humidity: 85% or less
<b>Power Supply:</b>	100, 120, 220, 240V AC, 50/60Hz, 28VA
<b>Size and Weight:</b>	400(W) x 148(H) x 300(D)mm, 7.5kg

# SIGNAL GENERATOR

## Setting frequencies using the 221-U02 ROM unit

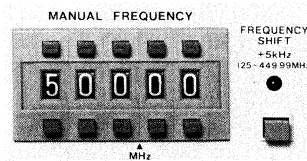
- **Setting frequencies for 512 channels is ROM**
  - Push program band frequency switches 1 to 4 to specify channels.
  - Channels 00 to 127 can be preset for each band, or up to 512 channels (128 x 4 channels) can be preset for the four bands.
- **Concurrent channel and frequency display**

An LED digital readout concurrently displays a specified channel (3 digits) and its frequency (5 digits).
- **Three-mode channel access**

Use the auto-scan or step function to access channels sequentially; use the remote-control function to access channels randomly. The auto-scan function enables the repeating speed to be changed. The remote-control output connector is on the rear panel.

## MANUAL frequency setting

- A five-digit thumb-wheel switch sets frequencies in increments of 10kHz.

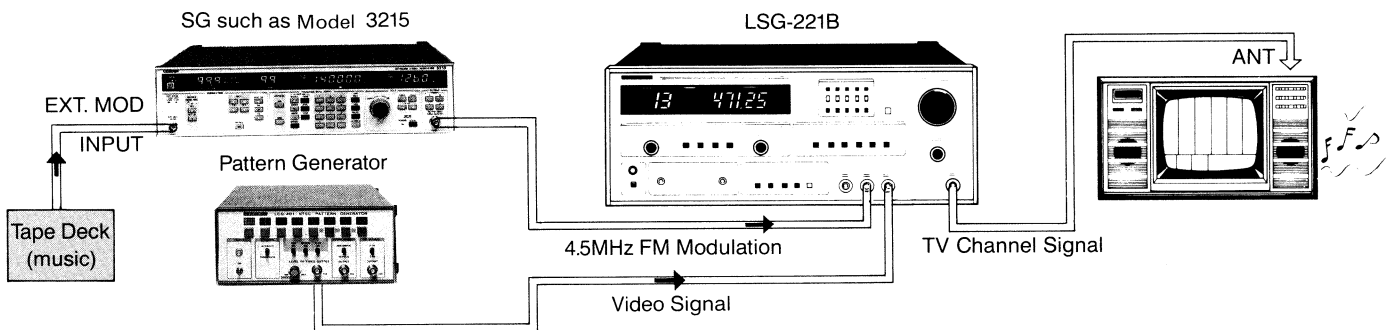


The +5kHz shift switch enables frequencies to be set in the range of 25MHz to 449.99MHz.

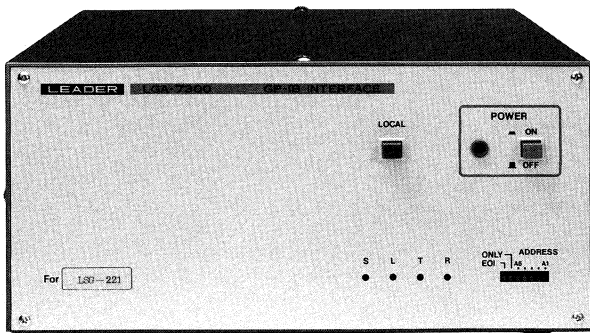
## Remote control

The remote-control 36-pin connector on the rear panel provides external control of frequency settings (thumb-wheel switch, CPU, etc.), ROM band, and channel selection.

- **Wiring diagram used for simultaneously checking patterns and audio signals of TV receivers**



## LGA-7300-01 GPIB INTERFACE



LGA-7300-01 GPIB Adaptor for LSG-221B

## ■ SPECIFICATIONS

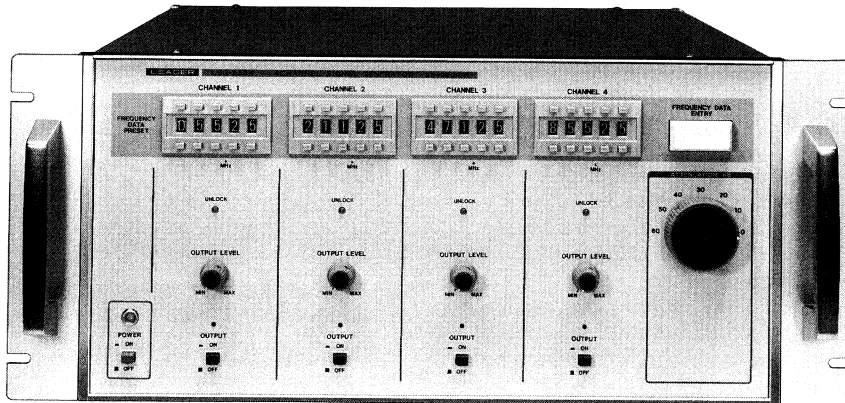
- **Compliance standard**  
IEEE-488-1978
- **Interface functions**

Category	Functions
SH0	No source handshaking function available
AH1	All acceptor handshaking functions available
T0	No talker functions available
L2	Basic talker functions available
SR0	No service request functions available
RL1	All remote local functions available
PP0	No parallel polling functions available
DC1	All device clear functions available
DT0	No device trigger functions available

- Remote control: Frequency setting
- Data code: ASCII
- Size and weight:  
200 (W) x 76 (H) x 300 (D) mm, 1.5 kg

# SIGNAL GENERATOR

## VHF/UHF Four Bands Simultaneous Output



### LSG-222A LSG-222A-01 4CH SIGNAL GENERATOR

#### ●GENERAL

The LSG-222A and LSG-222A-01 are frequency-synthesizing signal generators which deliver mixtures of four different frequencies outputs, covering a range from the VHF to the UHF band.

Thumb-wheel switches permit discrete frequency settings for the four signals, respectively allowing these instruments to be used as external marker signal sources for sweep generators or simple signal sources for various types of measurement.

LSG-222A has an amplitude modulation function, it is useful for picture and sound checks on TV sets.

The LSG-222A-01 includes provision by which frequency settings can also be made using ROM.

#### ●FEATURES

##### LSG-222A, 222A-01

- Four synthesized-oscillators are built in, and their output signals are mixed to provide one output.
- The instrument's output can be turned on and off respectively for the four signals.
- Frequency settings can be made across a wide band of 25 to 950MHz at 10kHz pitches by using thumb-wheel switches.
- Frequencies can be set respectively for the four waves.

##### LSG-222A

- Amplitude modulation function (DC to 10MHz at NORMAL position) is provided, making the instrument versatile.
- Video Modulation (double side-band modulation) function is provided, allowing the instruments to be used in combination with a pattern generator and a signal generator which has a frequency modulation function for picture and sound checks on TV sets.
- Input terminals for accepting modulation signals are provided for all four signals, permitting modulation to be switched on and off respectively for the different signals. So channels can easily be separated from one another by using different modulation signals for the four signals.

##### LSG-222A-01

- Frequency settings can also be made by using ROM. This gives a choice of 128 combinations. The selection of channels can be changed over between step switches and remote control.

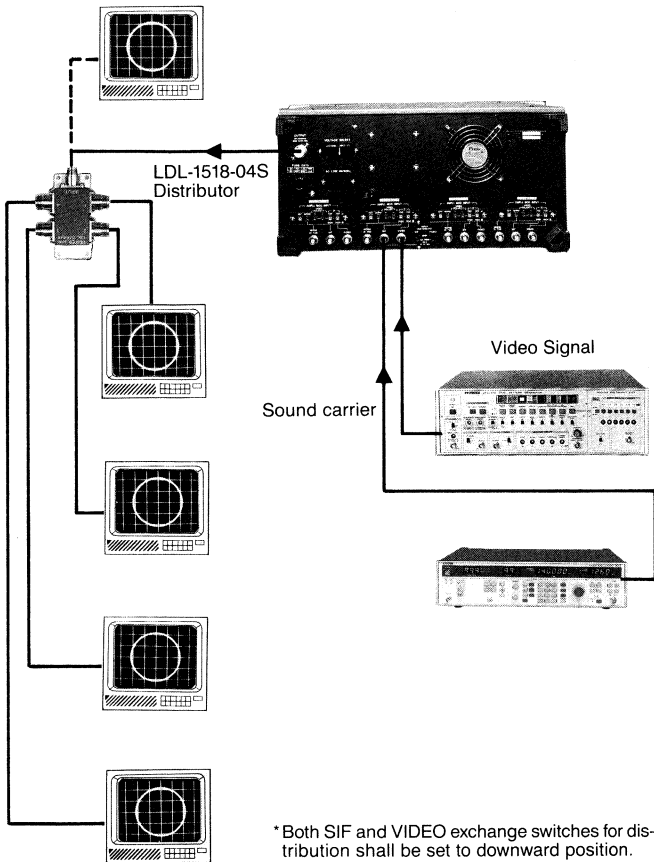
#### ●SPECIFICATIONS

<b>Frequency</b>	
<b>Frequency Range:</b>	25 to 950MHz
<b>Frequency Preset</b>	
<b>Resolution:</b>	10kHz
<b>Accuracy:</b>	Within 0.01% + 10kHz: less than 100MHz, 20kHz: more than 100MHz
<b>Residual FM:</b>	Within 10kHz
<b>Frequency Setting:</b>	Five-digit thumb-wheel switches: ROM 128 channel control (only 222A-01) A) Step: up-and-down touch switches (which can also be remote controlled) B) Remote: 7-bit binary code
<b>Output</b>	
<b>Output Voltage:</b>	0.1Vrms, 75Ω terminated (222A) 0dBm, 50Ω terminated (222A-01)
<b>Output Impedance:</b>	75Ω (222A), 50Ω (222A-01)
<b>Output Deviation:</b>	Within ± 2dB
<b>Attenuator:</b>	0 to 60dB, 10dB steps, rotary type (simultaneous for the four waves) 0 to 10dB, stepless variation, electronic type (discrete for the four waves)
<b>Spurious:</b>	Less than -40dBc
<b>Harmonic:</b>	Less than -40dBc < 450MHz Less than -20dBc ≥ 450MHz
<b>Modulation (only 222A):</b>	
<b>External Amplitude Modulation:</b>	1. Normal: DC to 10MHz 2. Video: 10Hz to 10MHz, with synchronizing signal clamping and modulation polarity change-over 3. SIF: 1MHz to 10MHz
<b>Input Impedance:</b>	75Ω, HIGH (10kΩ), selectable
<b>Power Supply:</b>	100, 120, 220, 240V AC, 50/60Hz 90W (222A), 80W (222A-01)
<b>Environmental Conditions (for guaranteed accuracy):</b>	Temperature: 5°C to 40°C Humidity: 85% or less
<b>Size and Weight:</b>	400(W) x 198(H) x 450(D)mm, 17kg
<b>Accessories:</b>	NC-BNC cable (75Ω), 1m ..... 1 (222A) BNC-BNC cable (50Ω), 1m ..... 1 (222A-01) 3P-2P conversion adaptor ..... 1 Multi-pin plug 36-P ..... 1 Spare fuse ..... 1

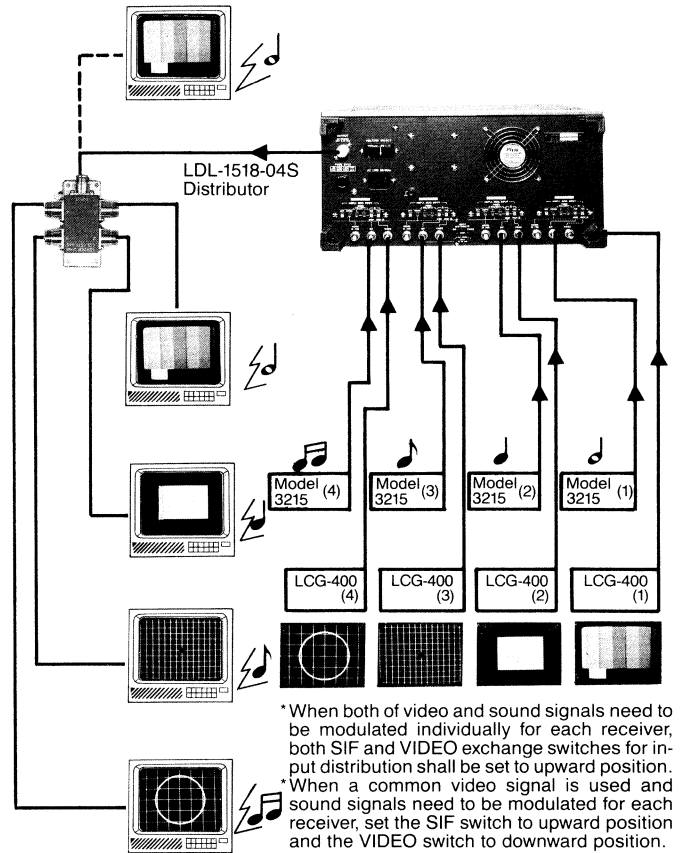
# SIGNAL GENERATOR

## Applications of the LSG-222A/222A-01

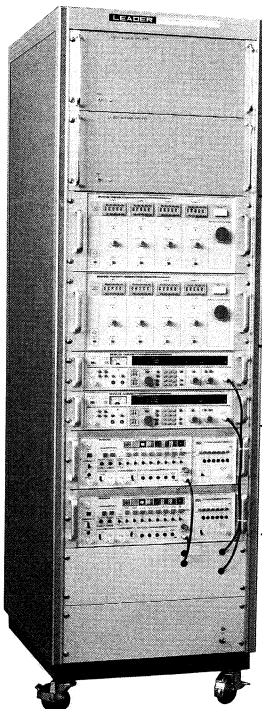
Check television receiver by modulating video/sound signal commonly applied to the receiver under test.



Check television receivers simultaneously by modulating video/sound signals individually for each receiver.



### CENTRALIZED TV SIGNAL GENERATOR SYSTEM



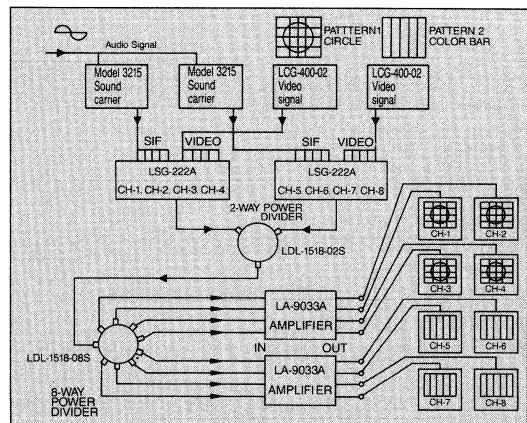
**LA-9033A × 2**  
AMPLIFIER  
4 INPUT/4 OUTPUT  
TOTAL 8-INPUT/OUTPUT

**LSG-222A × 2**  
SIGNAL GENERATOR  
4 CHANNEL × 2  
TOTAL: 8CH

**Model 3215 × 2**  
FM-AM STANDARD  
SIGNAL GENERATOR

**LCG-400-02 × 2**  
PATTERN  
GENERATOR

Diagram of rack system

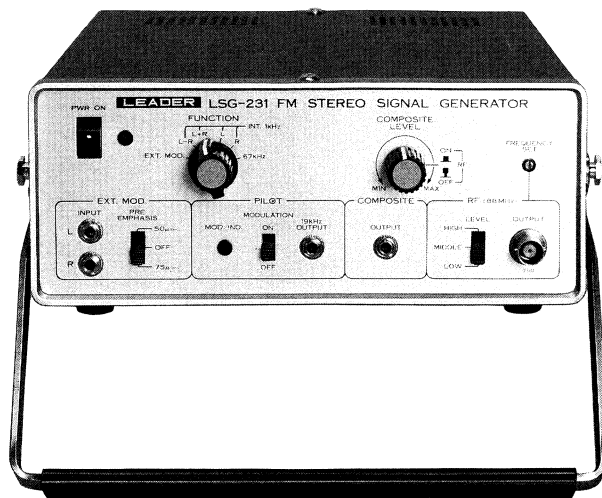


The LA-9033A is a wide-band amplifier designed to compensate for insufficient television high frequency output related to multiple distribution when using the LSG-221B or LSG-222A. From VHF to UHF bands, the LA-9033A features a high gain exceeding 20dB, and low NF (noise figure), favorable cross modulation, intermodulation, and ham modulation characteristics. This instrument is provided with four built-in amplifiers, so that you can implement a large-scale integrated system of television signal pattern.

Bandwidth	45 to 110MHz, 170 to 225MHz, 470 to 862MHz
Gain	45 to 110MHz: 20 to 23dB, 170 to 225MHz: 25 to 28 dB, 470 to 862 MHz: 27 to 34dB
Input/Output Impedance	75Ω
Max. Output Level	VHF: 95dB $\mu$ UHF: 100dB $\mu$
Size and Weight	400 (W) x 148 (H) x 400 (D) mm, 15kg

# SIGNAL GENERATOR

## Ideally Suited for Testing FM Stereo Receivers



### LSG-231 FM STEREO SIGNAL GENERATOR

#### ●GENERAL

LSG-231 is specially designed for use in testing FM stereo and monaural receivers and stereo multiplex circuits.

The composite signals for the subchannel, main channel, left and right channels at 1kHz are generated in the stereo modulation section. The 38kHz subcarrier and 19kHz pilot signal are produced by stepping down the frequencies from a 228kHz crystal-controlled oscillator. The composite signal is generated by switching two balanced diode modulators with the subcarrier signal. A lowpass filter is used to suppress undesirable spurious components. The pilot signal is added to the stereo signal in the composite amplifier. The composite signal is available directly for stereo MPX testing or for frequency modulation of the RF oscillator. Inputs are provided for external stereo modulation with pre-emphasis at 75µs or 50µs.

Testing is possible for the SCA circuit with use of the internal 67kHz signal or external input.

#### ●FEATURES

- Over 50dB left-right channel separation at 1kHz for critical separation tests.
- Phased condition of the pilot and subcarrier signals is of the highest degree.
- Modulated RF output for simulation of FM broadcasts signals used in overall receiver testing.
- Pilot signal level can be adjusted in the range, 0 to over 10%, independently of the composite signal.
- Composite signal can be adjusted in the range, 0 to 100%, independently of the pilot signal level.
- High reliability components, including integrated circuits are used for stable operation.

#### ●SPECIFICATIONS

<b>RF Output</b>	
<b>Frequency:</b>	100MHz ± 1MHz, adjustable
<b>Output Level:</b>	10, 1, 0.1mV, 3 ranges into 75Ω
<b>Modulation Signal</b>	
<b>Composite:</b>	L - R, L+R, L, R (internal 1kHz)
<b>SCA:</b>	67kHz ± 5% (internal), or external
<b>External:</b>	L and R, 50Hz to 15kHz

#### Frequency Modulation:

**Composite:** 0 to 100% (0 to 75kHz deviation), adjustable

**Pilot:** 10% (7.5kHz deviation), adjustable

**SCA:** 0 to 20%, adjustable

#### Composite Signal Output

##### Pilot Signal Output Jack

**Frequency:** Less than 19kHz ± 2Hz (± 0.01%)

**Output Voltage:** Approx. 0.8Vrms, adjustable

##### 1kHz Output Jack

**Frequency:** Less than 1kHz ± 1%

**Output Voltage:** Approx. 1Vrms

**Distortion:** Less than 0.5%

##### Ext. Modulation Input Jack

**Frequency Range:** 50Hz to 15kHz

**Pre-emphasis:** 50µsec, 75µsec, OFF

**Input Level:** 1Vrms or less

##### Composite Output Jack

**Output Voltage:** Composite signal: 0 to 1Vrms, continuously adjustable

Pilot signal: 100mVrms, adjustable

67kHz: 0 to 200mVrms

Less than ± 3kHz

Less than -40dB at 100% modulation

**L-R Separation:** Internal:

1kHz modulation: More than 50dB

External:

100Hz to 3kHz: More than 45dB

50Hz to 15kHz: More than 35dB

##### SCA Input Jack

**Input Voltage:**

Less than 1Vrms

Approx. 150mVrms, 10% (± 7.5kHz) modulation

**Frequency Range:**

10kHz to 100kHz

**Power Supply:**

100, 120, 200, 240V AC, 50/60Hz, 10VA

**Size and Weight**

200(W) x 80(H) x 250(D)mm, 2.5kg

**Accessories**

Dummy antenna with

BNC connector ..... 1

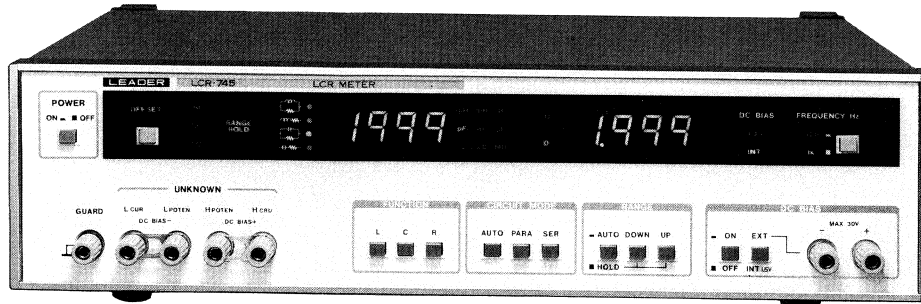
Miniplug-clip cable ..... 2

Miniplug ..... 2

Spare fuse ..... 1

# LCR METER

## Highly-Accurate LCR Measurements with Quick Digital Readout



### LCR-745 DIGITAL LCR METER

#### ● GENERAL

The LCR-745 is a digital LCR meter with a built-in CPU designed for measurements of capacitance (C), inductance (L), resistance (R), dissipation factor (D) (at capacitance measurement) and quality (Q) (at inductance measurement) at a high degree of accuracy. As this LCR meter has a wide range of measurements and the measuring ranges are automatically selected, quick and highly accurate measurement is possible. Further, equipped with an abundance of functions including the automatic offset function. It can be used for a wide range of applications such as production lines, research and development, etc.

#### ● FEATURES

- Automatic offset/deviation function for accurate measurement.
- Using 1kHz and 120Hz test signals to measure electrolytic capacitor capacitance under operating conditions.
- Selectable measurement range setting (AUTO or HOLD), with up/down function.
- Simultaneous measurement and display of L-Q and C-D.
- Selection of optimum measuring equivalent circuit (automatic, series and parallel)

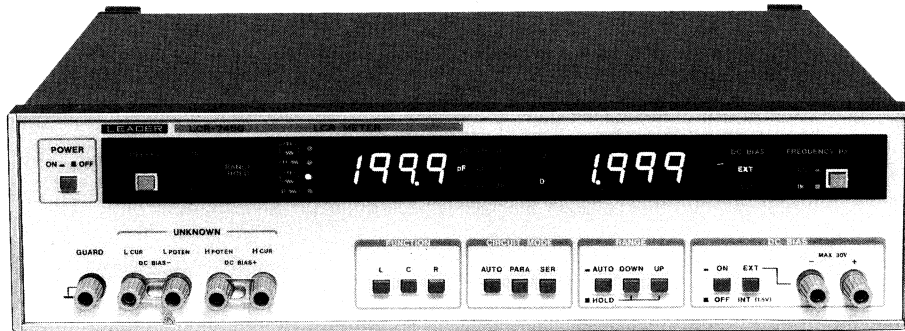
#### ● SPECIFICATIONS

<b>Measuring Items:</b>	Inductance (L) - Quality factor (Q) Capacitance (C) - Dissipation factor (D) Resistance (R)
<b>Indications:</b>	L, C, R ..... 3 1/2 digits D ..... 3 1/2 digits Q ..... 3 digits
<b>Circuit Modes:</b>	Parallel equivalent circuit and series equivalent circuit Automatic switching (AUTO) and parallel/series selection
<b>Measuring Terminals:</b>	Consist of 5 terminals of voltage, current and guard terminals.
<b>Range Selection:</b>	Automatic selection with RANGE HOLD.
<b>Test Frequency:</b>	1kHz and 120Hz $\pm 5\%$

<b>DC Bias:</b>	(only when capacitance is measured): Internal +1.5V, External 0 to +30V
<b>Measuring Range:</b>	
<b>L-Q Measurement:</b>	
<b>L Measuring Range:</b>	0.1 $\mu$ H to 199.9H, 7 ranges at 1kHz 1 $\mu$ H to 199.9H, 6 ranges at 120Hz
<b>L Basic Accuracy:</b>	$\pm (0.35\% + 2 \text{ digits})$
<b>Q Measuring Range:</b>	0.5 to 99.9, common to each range
<b>Q Basic Accuracy:</b>	$\pm (2\% + 10 \text{ digits})$
<b>C-D Measurement:</b>	
<b>C Measuring Range:</b>	0.1pF to 1999 $\mu$ F, 8 ranges at 1kHz 1pF to 1999 $\mu$ F, 7 ranges at 120Hz
<b>C Basic Accuracy:</b>	$\pm (0.35\% + 2 \text{ digits})$
<b>D Measuring Range:</b>	0.001 to 1.999, common to each range
<b>D Basic Accuracy:</b>	$\pm (2\% + 10 \text{ digit})$
<b>R Measurement</b>	
<b>R Measuring Range:</b>	0.001 $\Omega$ to 19.99M $\Omega$ , 8 ranges
<b>R Basic Accuracy:</b>	$\pm (0.35\% + 2 \text{ digit})$
<b>Offset Function:</b>	Automatic zero correction of residual component
<b>Range of Correction:</b>	Inductance: 0 to 15 $\mu$ H Capacitance: 0 to 15pF Resistance: 0 to 15m $\Omega$
<b>Deviation Measurement:</b>	Range of zero correction: All ranges Indicating value: (Measured value-reference value) + 0 or 1 count Max. 0.5 seconds
<b>Measuring Time:</b>	
<b>Environmental Conditions (for guaranteed accuracy):</b>	Temperature 23°C $\pm 5^\circ$ C Humidity 40 to 85%
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz 25VA
<b>Size and Weight:</b>	400(W) $\times$ 100(H) $\times$ 300(D)mm, 5.5kg
<b>Accessories:</b>	Shorting bar .....

# LCR METER

## Diversified Features with GPIB Interface



### LCR-745G GPIB LCR METER



#### ● GENERAL

The LCR-745G is a digital LCR meter with a GPIB interface designed for measurements of capacitance (C), inductance (L) and resistance (R) with a reference accuracy of 0.35%. As with its wide range of measurements, this meter can measure various LCRs. Here, the dissipation factor (D), at capacitance measurement, and quality (Q), at inductance measurement, can also be measured. The operation is quite simple with the fully automatic range selecting. When linked with a computer through the GPIB bus, this meter can be remotely controlled or enables the processing of measured data. Therefore, it can be used for a wide range of applications such as production lines, research and development, etc.

#### ● FEATURES

- Automatic offset and deviation function for accurate measurement.
- 1kHz and 120Hz test signals to measure capacitance of electrolytic capacitor under operating conditions.
- Selectable measurement range setting (AUTO or HOLD), with up/down function.
- Simultaneous measurement and display of L-Q and C-D.
- Selection of optimum measuring equivalent circuit (automatic, series and parallel)

#### ● SPECIFICATIONS

(For GPIB function only, all other specifications are common to the LCR-745)

##### Standard

**Conformity:**

Based on IEEE 488-1978

**Applicable Code:**

ASCII

**Available Remote**

**Controls:**

- All operations on the operation panel except ON/OFF of D and Q
- Data hold and trigger for measurement

##### Interface

**Functions:**

SH1, AH1, T5, L4, SR1, RL1, DC1, DT1

##### Interface Functions

Code	Function and description
SH1	Source handshaking
AH1	Acceptor handshaking
T5	Basic TALKER function, serial polling, TALK-ONLY mode, and TALK release by setting LISTENER mode
L4	Basic LISTENER function and LISTEN release by setting TALKER mode
SR1	SERVICE REQUEST function
RL1	Remote-control function
PP0	Parallel polling function not available
DT1	Device triggering (GET command applicable)
DC1	Device clearing function ("SDC" & "DCL" command applicable)
C0	Controller function not available



# LCR METER

## Completed with BCD Data Output



### LCR-745-01 BCD DATA OUTPUT LCR METER

### LCR-745-02 COMPARATOR UNIT

#### ● GENERAL

The LCR-745-01 is a BCD interface device to adds a function of BCD data output to the LCR-745 LCR Meter. The device can make output of the measured values and measuring conditions, including frequencies, etc., achieved in measurement of L, C, and R or Q and D.

#### ● SPECIFICATIONS

<b>Output Data LCR/QD:</b>	Positive logic parallel 4-digit BCD (L and C data output alternate with Q and D data output. The difference between the two groups of data according to flag)
<b>Measuring Conditions</b>	
<b>Range:</b>	HOLD/AUTO
<b>Circuit Mode:</b>	Ls, Lp, Cs, Cp, Rs, Rp AUTO/SER or PARA
<b>DC Bias:</b>	ON/OFF INT/EXT
<b>OFFSET:</b>	IN/OUT
<b>Other Data:</b>	Overflow/underflow, unit, decimal point and polarity
<b>Data Strobe Signal:</b>	Negative pulse about 200 $\mu$ s
<b>Data Level:</b>	TTL Level (open collector, max, low level output current of 8mA)
<b>Data Holding:</b>	Holds data by switching externally the HOLD terminal from HI to LO (TTL level)
<b>Output Connector:</b>	36-station connector (attached to the rear panel of the LCR-745) Applicable connector: the 57-30360 of Amphenol.

#### ■ Test Fixture (optional)

LF-2350

LF-2351



#### ● GENERAL

The LCR-745-02 is a digital comparator used in combination with the LCR-745-01 LCR Meter, to make GO/NO-GO (good/no good) judgment.

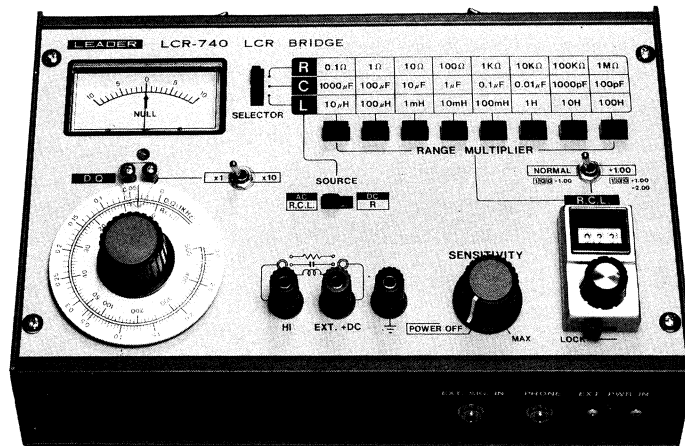
The comparator displays the result of total GO/NO-GO judgment.  
\*LCR-745-02 can be used along with LCR-745-01 only but can not be used with LCR-745 or LCR-745G.

#### ● SPECIFICATIONS

<b>Values to be Judged:</b>	LCR data and QD data
<b>Threshold Setting Range</b>	
<b>L, C, R:</b>	Normal Measurement 0000 to 1999 (upper limit > lower limit) Deviation Measurement positive side 0000 to 1999 negative side - 1999 to 0000
<b>Q, D:</b>	0000 to 19999 (upper limit > lower limit)
<b>Threshold Setting Device:</b>	4-digit digital switches for both LCR and QD
<b>Judgment Display</b>	
<b>Total Judgment:</b>	GO or NO LED and buzzer (volume adjustable)
<b>LCR:</b>	HI or LO LED
<b>QD:</b>	HI or LO LED
<b>Output of Judgment:</b>	Relay contact (30V, 0.5A)
<b>Measurements before Judgment:</b>	From 1 through 9 times (set by a thumb-wheel switch)
<b>On/Off of QD:</b>	Interlocked to QD ON/OFF switch of the LCR-745-01
<b>Trigger Setting</b>	
<b>AUTO:</b>	Judgment repeated automatically
<b>SINGLE:</b>	Only one judgment controlled by panel switch or a remote-control device
<b>Size and Weight:</b>	400(W) x 30(H) x 300(D)mm, 2.5kg
<b>Accessories:</b>	Connection cable ..... 1

# LCR METER

## Measuring LCR with a Standard Accuracy of $\pm 0.5\%$



### LCR-740 LCR BRIDGE

#### ● GENERAL

The LCR-740 is a highly efficient impedance bridge for broad and accurate measurement of Resistance (R), Capacitance (C) and Inductance (L). The D factor of a capacitor and the Q factor of a coil can also be measured. A 3-digit readout provides easy reading of the measured value.

#### ● FEATURES

- Fully movable as being of compact and light (2 kg).

#### ● SPECIFICATIONS

##### Resistance Measurement

**Range:** 0.001 $\Omega$  to 11M $\Omega$  in eight ranges with +10% extension at each range.  
**Minimum Resolution:** 1m $\Omega$  (0.001 $\Omega$ )  
**Accuracy**  
 (at 20°C  $\pm$  5°C):  $\pm$  (0.5% + 0.1% f.s.): 1 $\Omega$  to 100 $\Omega$  range  
 $\pm$  (1% + 0.1% f.s.): 1M $\Omega$  range  
 $\pm$  (2% + 0.1% f.s.): 0.1 $\Omega$  range

##### Capacitance Measurement

**Range:** 1pF to 11000 $\mu$ F in eight ranges with +10% extension at each range.  
**Minimum Resolution:** 1pF  
**Accuracy:**  
 1000pF to 100 $\mu$ F range:  $\pm$  (0.5% + 0.1% f.s.)  
 100pF range:  $\pm$  (1% + 0.1% f.s.)  
 1000 $\mu$ F range:  $\pm$  (3% + 0.1% f.s.)

##### Inductance Measurement

**Range:** 0.1 $\mu$ H to 1100H in eight ranges with +10% extension at each range.  
**Minimum Resolution:** 0.1 $\mu$ H

##### Accuracy

(at 20°C  $\pm$  5°C):  $\pm$  (0.5% + 0.1% f.s.): 100 $\mu$ H to 10H range  
 $\pm$  (1% + 0.1% f.s.): 100H range  
 $\pm$  (3% + 0.1% f.s.): 10 $\mu$ H range

##### D, Q measurements

**Range:** 0.01 to 30, at 1kHz, in two ranges.  
**Accuracy:**  $\pm$  10% + 3 scale divisions

##### Measuring Sources:

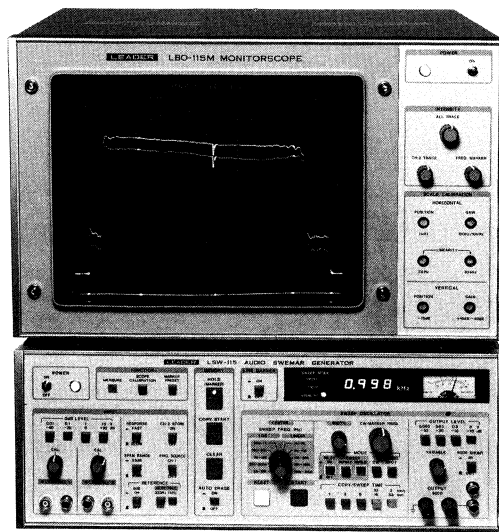
DC: Internal or external for resistance measurements.  
 AC: Internal 1kHz, or external 50Hz to 40kHz, for inductance and capacitance measurements.

##### Environmental Conditions

(for guaranteed accuracy): Temperature 20°C  $\pm$  5°C  
**Power Supply:** 9V DC (006P, NEDA 1604, or equivalent)  
**Size and Weight:** 240(W)  $\times$  85(H)  $\times$  170(D)mm; 2kg  
**Accessory:**  
 Earphone ..... 1  
 9V Battery ..... 1  
 Mini-plug-Clip cable ..... 1  
 AC adaptor, LPS-169

##### Option:

## Frequency Response Display with Still Picture



### LSW-115 LSW-115M AUDIO FREQUENCY RESPONSE TRACER

#### ● GENERAL

The LSW-115 is a 2-channel audio sweep generator particularly designed for observations of frequency response of low frequency circuits such as of various audio equipments and filters.

Entire frequency response can be displayed as a still picture when a monitor scope is used in combination with the equipment since the digital waveform memory is employed in the LSW-115. Use of the LBO-115M (12-inch electromagnetic deflection CRT), specially designed monitor scope is recommended for such purpose.

Frequency response curve can be drawn on a recording paper when a X-Y recorder is used in combination.

#### ● FEATURES

##### LSW-115

- By the use of the digital wave memory system, a still waveform of measurement waveform is available.
- The LSW-115 has dual-channel input (with built-in logarithmic amplifier) which is convenient for measurements of stereo audio equipments.
- A wide band of frequency range is available from 20Hz to 300kHz.
- Linear scaled narrow band sweeping is available which is convenient for alignments of filters.
- Holding function of CH2 measurement curve (by memorizing the waveform and to display it on the screen) is provided, thus the function can be used for alignment and comparison with a standard waveform.
- There provided two level markers with calibration control, five points frequency markers, and a variable marker with direct reading of frequency by a counter. Thus, they can be used for frequency analysis of a measurement curve.
- Calibration signal is available for calibration of the monitor scope to be used in combination.

##### LBO-115M

- In dual sweep operation, the intensity adjustment of CH-2 tracking is available, therefore, channel distinction is easy in waveform comparison of two channels.
- Bright easy-looking intensity modulation, frequency marker is used.

# AUDIO

## ● SPECIFICATIONS

### LSW-115

#### Input Section

**Frequency Range:**

**Input Impedance:**

**Input Range:**

**Voltage Range:**

**Level Measurement**

**Accuracy:**

20Hz to 300kHz

500k $\Omega$

0.01V, 0.1V, 1V, 10V, 4 ranges

100 $\mu$ V to 100V (-80dBV to +40dBV)

Range	Scale	Accuracy
50dB	+10dB	$\pm$ [1.5dB + 0.2dB (bit error)]
	0	$\pm$ [1dB + 0.2dB (bit error)]
	-10	
	-20	
	-30	$\pm$ [1.5dB + 0.2dB (bit error)]
-40		
25dB	+5dB	$\pm$ [1dB + 0.1dB (bit error)]
	0	
	-5	
	-10	
	-15	
-20		

**Frequency Response:**

20Hz to 30kHz  $\pm$ 0.5dB,

30kHz to 100kHz  $\pm$ 0.8dB,

100kHz to 300kHz  $\pm$ 1.2dB

Average, calibrated in RMS of a sine wave.

**Response:**

**Response Time:**

HIGH about 0.1 sec. 2 ranges

LOW about 0.3 sec. 2 ranges

(Riseup response time for the 50dB step

input.)

**Automatic 0dB**

**Function:**

Reference frequency; 1kHz or 315Hz

Pull-in range;  $\pm$ 10dB for 0dB set value

Start with pilot signal of input.

More than  $\pm$ 10dB (with calibration)

(This works as the position control knob.)

**Automatic Start:**

**Gain Control:**

**Digital Memory Section**

**Resolution:**

**Sampling Rate:**

8 bits  $\times$  1k words/channel

Corresponds to sweep time of the sweep

oscillator.

**Panel Operation:**

Hold

A respective single sweep response is fixed for each of dual channels or for CH-2 only.

Clear

The memory is cleared manually or automatically at the sweep start.

Hard copy

A signal screen waveform is recorded by a X-Y recorder in dual channel hold operation.

**Hard Copy:**

Recording time

1, 2, 5, 16, 53 seconds

(selectable by the sweep time set switch)

Pen movement time 0.4 second

**Hard Copy Output**

**Terminal:**

(to a recorder)

X axis (frequency)

Output voltage -2 to +2V

Output impedance 600 $\Omega$   $\pm$ 20%

Y axis (level)

Output voltage -2 to +2V

Output impedance 600 $\Omega$   $\pm$ 20%

(CH-1 and CH-2 output switching is available.)

**Recorder Calibration**

**Signals:**

HIGH X axis (frequency upper limit)

Y axis (level upper limit)

LOW X axis (frequency lower limit)

Y axis (level lower limit)

**Pen Lift Control:**

When the remote control terminals of a X-Y recorder are short circuited, the pen is down-state.

**Sweep Generator Section**

**Frequency Range:**

LOG Sweep; 20Hz to 30kHz,

200Hz to 300kHz

LINEAR Sweep; 30Hz to 300kHz

8 ranges

**Sweep Width:**

1/10 to 1 of maximum center frequency value of the range selected.

**Pilot Signal:**

(Reference frequency) 1kHz/315Hz,

Switchable

**Distortion Factor:**

**Sweep Signal:**

LOG sweep

less than 1% (20Hz to 10kHz)

less than 1.5% (10 to 30kHz)

less than 2% (30 to 300kHz)

LINEAR sweep

less than 1.5% (20Hz to 300kHz)

Less than 0.5% (1kHz and 315Hz)

**Pilot Signal:**

**Sweep Accuracy:**

LOG Sweep; 20Hz to 30kHz

$\pm$ (5% + 2Hz)

200Hz to 300kHz

$\pm$ 5% + 20Hz)

LINEAR Sweep;  $\pm$ 5%

**Output Mode:**

Automatic Sweep; Single/Repeated, Switchable

CW (manual operation); Frequency adjustment by the knob on the panel

Spot output of pilot signal

**Signal Transmission Time:**

**Sweep Signal:**

1, 2, 5 seconds

16, 53 seconds (Applicable test discs)

1 second (Sweep time: 1 to 5 sec.)

5 seconds (Sweep time 16, 53 sec.)

About 1 second

Over 3Vrms (600 $\Omega$  load)

**Repeat Interval:**

**Output Voltage:**

**Output Deviation:**

**ATT. 0 to -40dB:**

20Hz to 100kHz  $\pm$ 0.2dB

100 to 300kHz  $\pm$ 0.3dB

20Hz to 100kHz  $\pm$ 0.3dB

100 to 300kHz  $\pm$ 0.5dB

600 $\Omega$   $\pm$ 10%

**Output Impedance:**

**Output Attenuator:**

**Ranges:**

Four ranges (0, 10, 40, 60dB)

2%

**Accuracy (1kHz):**

**Output Voltmeter Accuracy:**

Voltage with 600 $\Omega$  load

$\pm$ 5% of full scale

**Marker Section**

**Line Markers:**

2-lines (with ON/OFF function)

**Frequency Markers:**

**Fixed Markers:**

Five points on measurement waveform and each of line markers

A point in memory hold operation

**Variable Marker:**

**Variable Marker Accuracy:**

LOG sweep  $\pm$ (1% + 2 counts)

LINEAR sweep  $\pm$ (sweep width  $\times$  1% + 2 counts)

**Marker Set Function:**

**Line Markers:**

By output meter and output attenuators

**Frequency Markers:**

By built-in counter

**Marker Terminal:**

**CH-2 Intensity Modulation**

**Signal Terminal:**

**Frequency Counter**

**In CW Mode:**

**In HOLD Mode:**

**In Maker Setting:**

Open collector (negative logic) TTL level

Frequency indication of output signal

Frequency indication of variable marker

Frequency indication of frequency marker

calibration signal

0.5 and 0.05 sec, automatic switching

Reference time  $\pm$  2 counts

Frequency 7.53664MHz, within  $\pm$  4  $\times$  10<sup>-5</sup>

100, 120, 220, 240VAC 50/60Hz, 65VA

400(W)  $\times$  148(H)  $\times$  400(D)mm, 10.5kg

**Gate Time:**

**Accuracy (in CW mode):**

**Reference Time:**

**Power Supply:**

**Size and Weight:**

**Accessories:**

BNC - BNC cable

BNC - clip cable

Pair plug - clip cable

Pin plug - pin plug

Fuse

**LBO-115M**

**Vertical Axis**

**Sensitivity:**

**Bandwidth:**

**Input Impedance:**

**Maximum Input Voltage:**

**Input Connector:**

**Horizontal Axis:**

**Sensitivity:**

**Bandwidth:**

**Frequency Bandwidth:**

**Input Impedance:**

**Maximum Allowable Input Voltage:**

**Input Connector:**

**Frequency Marker:**

**Sensitivity:**

**System:**

Over 15cm of effective display size in 4Vp-p

DC to 10kHz -3dB (at 5cm amplitude)

100k $\Omega$  approx., less than 80pF

50V (DC + ACp-p)

BNC

Over 20cm of effective display size in 4Vp-p

DC to 1kHz -3dB (at 8cm amplitude)

DC to 1kHz, -3dB (at 8cm amplitude)

100k $\Omega$  approx., less than 80pF

50V (DC + ACp-p)

BNC

(Intensity Modulation)

2Vp-p

Brighter indication with positive or negative pulse

**Maximum Allowable Input Voltage:**

**Input Connector:**

**CH-2 Intensity Modulation Terminal:**

15Vp-p

BNC

Input Voltage; TTL level ( $\square$   $\square$  0V<sup>+5V</sup>)

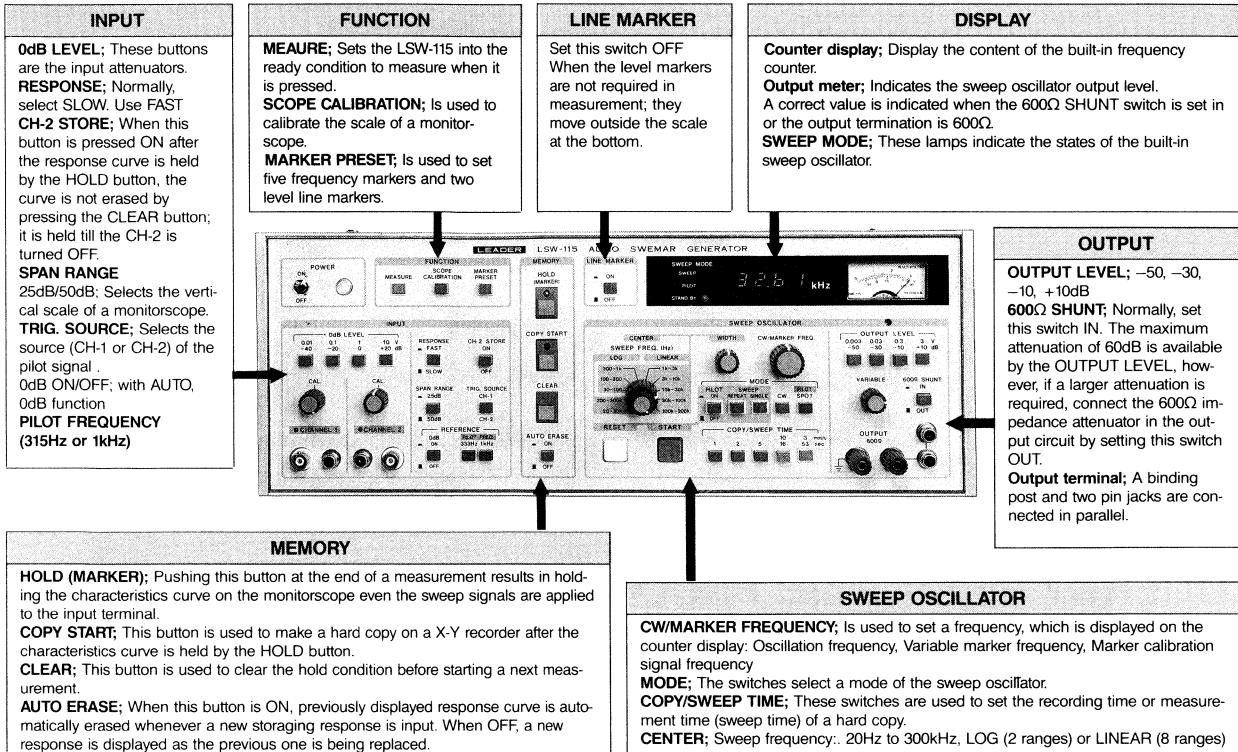
System: Low level duration is adjustable by

CH-2 TRACE intensity adjustment knob.

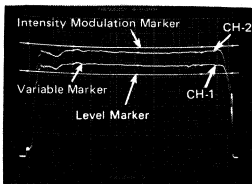
100, 120, 220, 240VAC, 50/60Hz, 80VA

400(W)  $\times$  248(H)  $\times$  400(D), 13kg

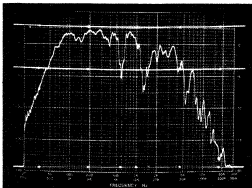
## ■LSW-115 Front Panel Explanation



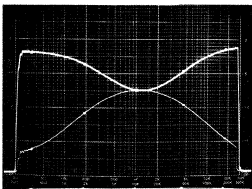
## ■Applications



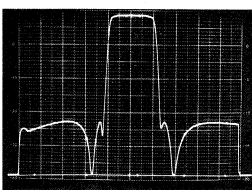
**Frequency Response of Tape Decks**  
(CH1 intensity is brighter than CH2)



**Frequency Response of Speaker**  
(LSP-5621A, speaker analyzer is used together)

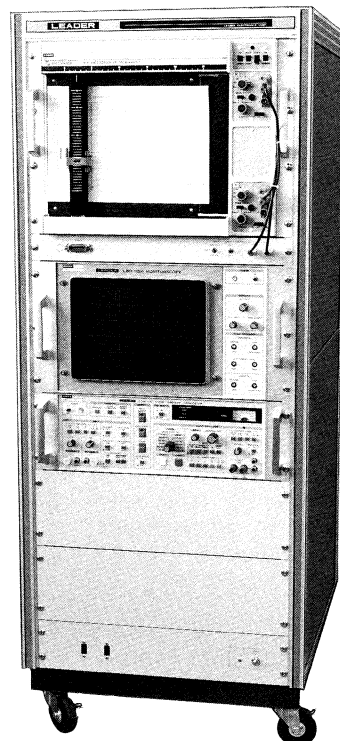


**Tone Control Characteristic of Pre-Amplifier**

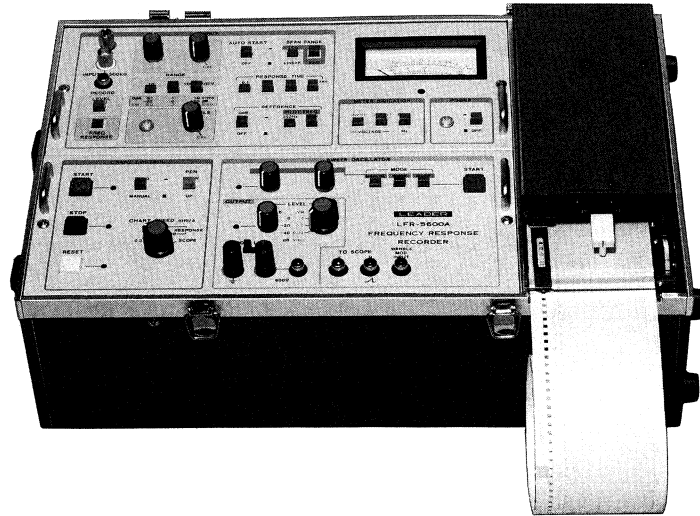


**6.3kHz Band Pass Filter Characteristic**  
(3kHz to 10kHz)  
Linear scale (option) is used.

## ■Rack-mounted LSW-115/LBO-115M with X—Y recorder



## Frequency Response Measurement and Recording



### LFR-5600A LFR-5601 LFR-5602 FREQUENCY RESPONSE RECORDER

#### • GENERAL

The LFR-5600A, LFR-5601 and LFR-5602 Frequency Response Recorders are used to record the frequency responses of various audio equipments on chart paper. The 5600A is used for monaural measurements with 50mm wide chart paper. The 5601 is used for monaural measurements, and the 5602 is used for stereo measurements. The 5601/5602 can use either wide 100mm or standard 50mm chart paper. All three types use quick-drying ink for recording, which eliminates the problems caused by smearing or smudging. A cartridge-type recording pen is also used so that different colors can be set through a one-touch operation. Because the 5602 has a pen gap compensation circuit for dual-channel measurements, it is particularly useful for stereo measurements.

This equipment records the frequency responses of tape decks and phono-cartridge, speakers, and functions as a DC recorder to record wow-flutter and to perform drift measurements of voltage and temperature. Moreover, because these recorders are equipped with a scope terminal, they can also be used to display frequency responses when used with a long persistent oscilloscope.

#### • FEATURES

##### Input Section

- The scale for frequency response recording can be selected (25dB, 50dB or LINEAR) for proper recording in required applications.
- The automatic 0dB circuit facilitates the recording of frequency response compare with the reference frequency response.
- The automatic start circuit easily measures the frequency response during tape recorder play-back. When used with the Brüel & Kjær Test Record (QR-2009 or QR-2010), a phono-cartridge frequency response (with the 5610) can be recorded.

##### Sweep Oscillator

- The reference signal frequency can be selected (from 1kHz for an open reel tape recorder or 315Hz for a cassette tape recorder. Because it generates a low distortion signal of 0.1% or less, it can be used as a signal source for bias measurements.
- The reference signal and sweep signal levels can be set separately for the tape deck to enable the recording of frequency responses at different reference signal level.
- The sweep oscillator is equipped with 20dB and 40dB attenuators for measuring of high-sensitivity devices.

##### Recording Section

- 50mm or 100mm wide recording paper can be used; the 5601 and 5602 can use both types of paper; the 5600A can only use the 50mm type.
- The 5602 (two-channel type) has two pens with calibrated pen gaps. Therefore, data on both channels can be accurately recorded on the same scale.
- Crystal control of paper-feeding ensures precise paper feeding. In particular, the recording of phono-cartridge frequency responses is more accurate than that provided by conventional models.
- The Cartridge-type quick-drying ink used for recording simplifies the changing colors. There are three ink colors available; red, black, and purple. Red and black are furnished as accessory.
- The TO SCOPE terminal (sweep output terminal) allows frequency responses to be observed using the long persistent oscilloscope.

##### Meter Section

- The meter indicates the sweep oscillator frequency, output voltage, and recorder input voltage for greater convenience when performing calibration during quantitative measurements.

## ● SPECIFICATIONS

### Frequency Response Recording

		5600A	5601	5602				
<b>Input Section</b>								
Input Frequency Range		20Hz to 30kHz						
Input Impedance		500k $\Omega$						
Input Capacitance		50pF or less	70pF or less	100pF or less				
Input Voltage Ranges		0.1V, 1V, and 10V (-20dB, 0dB, +20dB)						
Recording Accuracy	50mm Width	dB scale: $\pm 0.5$ dB (1kHz at 0dB reference) LINEAR: $\pm 2\%$ of full scale (1kHz at 0dB reference)		dB scale: $\pm 1$ dB (1kHz at 0dB reference) LINEAR: $\pm 5\%$ of full scale (1kHz)				
	100mm Width			dB scale: $\pm 0.5$ dB (1kHz at 0dB reference) LINEAR: $\pm 2\%$ of full scale (1kHz)				
	Frequency Scale	$\pm (3\% + 2\text{Hz})$						
Frequency Response (1kHz, 0dB reference), The LFR-5601 and 5602 can use both 100mm width and 50mm width recording papers.								
Range	Scale (dB)	50mm width		100mm width		50mm width		
		Input frequency		Input frequency		Input frequency		
		20Hz to 20kHz	20kHz to 30kHz	20Hz to 20kHz	20kHz to 30kHz	20Hz to 20kHz	20kHz to 30kHz	
50dB	+10	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 1$ dB	$\pm 1$ dB	
	0		$\pm 1$ dB					$\pm 1.5$ dB
	-10		$\pm 1.5$ dB					$\pm 2$ dB
	-20	$\pm 1$ dB	$\pm 1.5$ dB	$\pm 1$ dB	$\pm 1.5$ dB	$\pm 1.5$ dB	$\pm 2$ dB	
	-30	$\pm 1.5$ dB	$\pm 2$ dB	$\pm 1.5$ dB	$\pm 2$ dB	$\pm 2$ dB	$\pm 2.5$ dB	
25dB	+5	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 0.5$ dB	$\pm 1$ dB	$\pm 1$ dB	
	0		$\pm 1$ dB					$\pm 1.5$ dB
	-5		$\pm 1.5$ dB					$\pm 2$ dB
	-10	$\pm 1$ dB	$\pm 1.5$ dB	$\pm 1$ dB	$\pm 1.5$ dB	$\pm 1.5$ dB	$\pm 2$ dB	
	-15	$\pm 1.5$ dB	$\pm 2$ dB	$\pm 1.5$ dB	$\pm 2$ dB	$\pm 2.5$ dB	$\pm 3$ dB	
-20	$\pm 1$ dB	$\pm 1$ dB	$\pm 1$ dB	$\pm 1$ dB	$\pm 1.5$ dB	$\pm 2$ dB		
* Back rush: 2% of full scale (50mm width is excluded.)								
Scale		25dB, 50dB, LINEAR						
Detection System		Average responding						
Response Time		0.1s, 0.2s, 0.5s, 1s (0.1s is changed to 0.15s for 100mm width)						
Automatic 0dB Circuit	Reference Frequency	1kHz, 315Hz, selecting system						
	Capture Range	$\pm 10$ dB at 0dB setting						
<b>Recording Section</b>								
Paper Feeding Speed		Four ranges 0.3mm/s, 1mm/s, 3mm/s and 10mm/s, and SCOPE (for 4.4s sweeps)						
Recording System		Cartridge-type, quick-dry pen						
Chart Paper	50mm	Total width: 73mm; effective width: 50mm; length: 60m (LC-056)						
	100mm	Total width: 127mm; effective width: 100mm; length: 60m (LC-066)						
Paper Feeding		Start: Initiates a sweep (automatic or manual, selectable). Stop: Stops the sweep during operation. Reset: Resets the system.						
Automatic Start		Automatic start with pilot signals						
Pilot Frequency		1kHz, 315Hz, selectable system (reference frequency)						
		*The 2CH-type is provided with a pen-gap compensation circuit. System: Semi conductor memory system (RAM) Capacity: 12 bits $\times$ 1024 words						
<b>Oscillator Section</b>								
Oscillation Frequency		20Hz to 30kHz						
Pilot Frequency		1kHz, 315Hz, selectable system (reference frequency)						
Output Voltage		3Vrms or more (into 600 $\Omega$ load)						
Sweep Operation		Manual operation, automatic start Enable continuous sweeps. Sweeps can be a stopped or reset by the STOP and RESET buttons.						
Oscillation Period	Pilot Signal	5 seconds (fixed)						
	Sweep Signal	16 seconds (at a chart speed of 10mm/s)						
	S/N Measurement	2.5 seconds (at a chart speed of 10mm/s)						
Output Impedance		600 $\Omega \pm 10\%$						
Attenuator		3 ranges; 0, 20, 40dB; accuracy; $\pm 2\%$						
<b>Meter Section</b>								
Display		The sweep frequency, input voltage, or output level can be selected						
Scale		Frequency scale: 20Hz to 30kHz Voltage scale: 3.0V at full scale dB scale: -10dB to +10dB (0dB = 1V)						
<b>TO SCOPE Terminal</b>								
V OUT		3Vp-p $\pm 20\%$ at full scale deflection						
H OUT		3V $\pm 10\%$ (at 30kHz)						
Sweep Time		4.4 seconds						
Output Impedance		10k $\Omega \pm 10\%$ for both V OUT and H OUT						

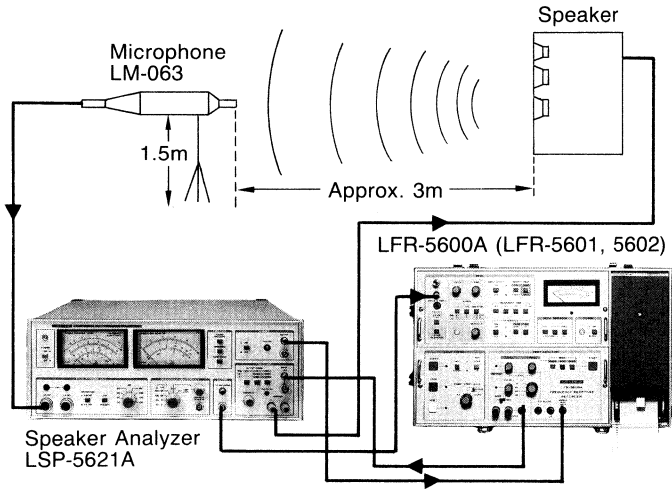
### Direct Current Recording

		5600A	5601	5602
<b>Input Section</b>				
Input Voltage Range		10mV/div, 100mV/div, 100mV/div		
Recording Accuracy	50mm Width	$\pm 2\%$ of full scale		$\pm 2\%$ of full scale
	100mm Width			$\pm 5\%$ of full scale
Power Supply		100, 120, 220, 240VAC $\pm 10\%$ , 50/60Hz		
		20VA	20VA	35VA
Size & Weight		400(W) $\times$ 150(H) $\times$ 250(D)mm 8.5kg	450(W) $\times$ 200(H) $\times$ 300(D)mm 10.6kg	450(W) $\times$ 200(H) $\times$ 300(D)mm 11.6kg

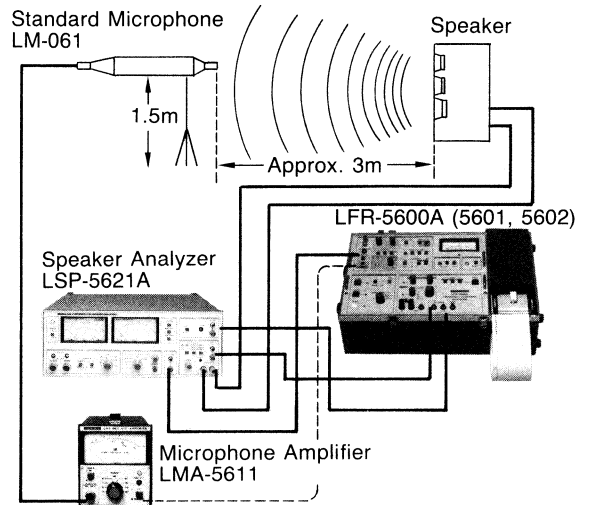
# AUDIO

## Measurement Examples Using LFR-5600 Series

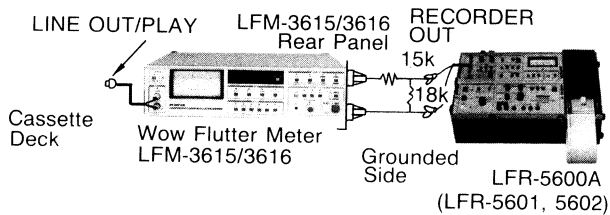
**Measurement of Speaker Frequency Characteristics Using LFR-5600A and LSP-5621A**



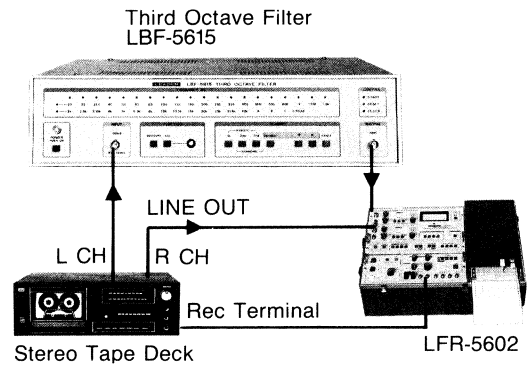
**Measurement of Sound Pressure and Frequency Characteristic of a Speaker by LFR-5600A (LSP-5621A is used as a power amplifier.)**



**Measurement of Tape Recorder Wow Flutter and Drift by LFR-5600A and LFM-3615/3616**



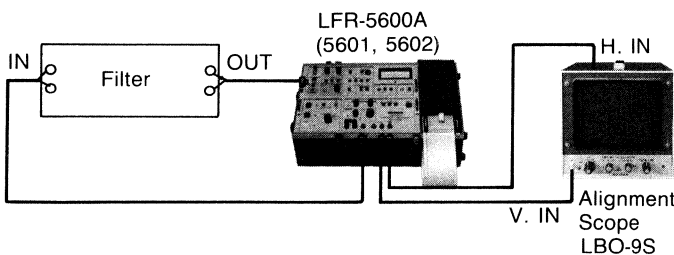
**Measurement of Recording/Playback Frequency Characteristics and 3-dimensional Distortion of Stereo Tape Recorder by LFR-5602 and LBF-5615**



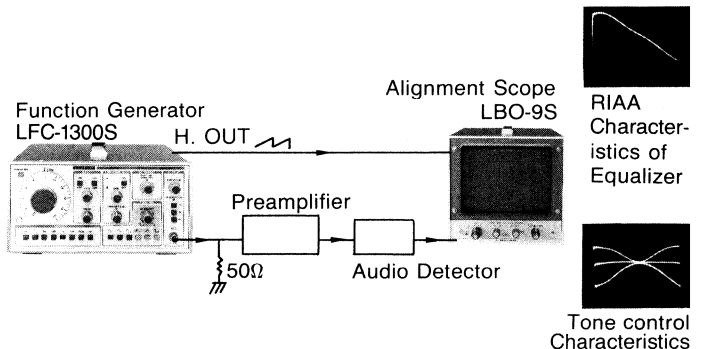
### ■ Combination Examples of LBO-9S

The LBO-9S Uses a CRT with long-persistent phosphor and has a logarithmic scale.

**Combination with Frequency Recorder (LFR-5600 Series)**

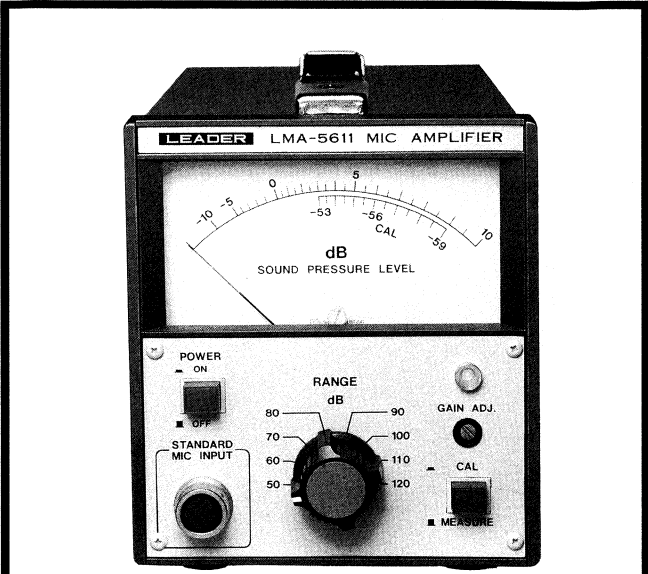


**Combination with Function Generator (LFC-1300S)**





## 20Hz to 38kHz



### LMA-5611 MIC AMPLIFIER

#### ● GENERAL

The LMA-5611 is a standard microphone amplifier for measurements of free field characteristics and sound pressure characteristics to be used in combination with LSP-5621A and LFR-5600 series.

#### ● SPECIFICATIONS

- Main Frame LMA-5611**
- Frequency Range:** 80Hz to 25kHz  $\pm$  0.2dB  
 50Hz to 30kHz  $\pm$  0.5dB  
 20Hz to 38kHz  $\left\{ \begin{array}{l} +0.5\text{dB} \\ -1.0\text{dB} \end{array} \right.$
- Level Range:** 45dB to 130dB  
**Input Range:** 50dB to 120dB 10dB step 8 ranges  
**Meter Scale:** -10dB to +10dB  
**Output Voltage:** 1Vrms (0dB indication)  
**Power Supply:** 100, 120, 220, 240V AC, 50/60Hz, 8VA  
**Size and Weight:** 132(W)  $\times$  148(H)  $\times$  250(D)mm, 2kg
- Microphone LM-061**
- Type:** Condenser type, 1/2 inch  
**Frequency Response:** 20Hz to 38kHz  $\pm$  2dB (referred at 250Hz)  
**Directivity:** non-directional  
**Sound Pressure Sensitivity:** -56dB  $\pm$  3dB (0dB = 1V/dyne/cm<sup>2</sup> 250Hz)

## 10Hz to 30kHz



### LCA-5612 COMPRESSOR AMPLIFIER

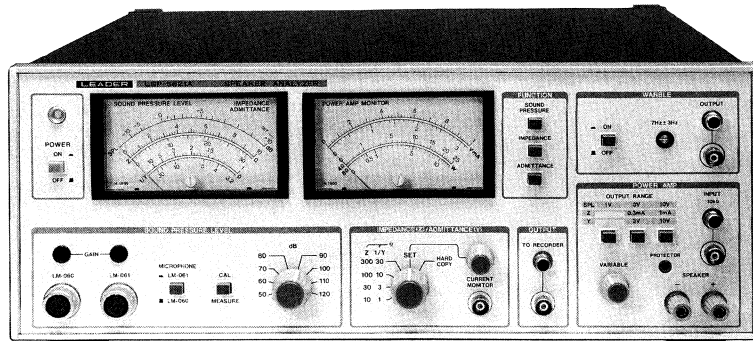
#### ● GENERAL

The LCA-5612 may be used in combination with the LSW-115 Audio Response Tracer or LFR-5600A/5601/5602 Frequency Response Recorder and LSP-5621A Speaker Analyzer Unit and Microphone to enable measurements of the frequency response of microphones.

#### ● SPECIFICATIONS

- Reference Input**
- Frequency Range:** 10Hz to 30kHz  
**Input Level Range:** -40dBV to +10dBV  
**Input Impedance:** 51k $\Omega$
- Signal Input**
- Frequency Range:** 10Hz to 30kHz  
**Input Level Range:** +10dBV  $\pm$  2dBV  
**Input Impedance:** 51k $\Omega$
- Compressor**
- Frequency Response:** 20Hz to 20kHz:  $\pm$ 0.5dB or less  
 10Hz to 30kHz:  $\pm$ 1dB or less (Both with respect to 1kHz)
- Compression Range:** 20dB  
**Compression Speed:** 3, 10, 30, 100, 300, 1000dB/s  
**Gain:** 0dB  
**Distortion:** 0.5% or less (1kHz, 100dB/s)  
**Output Impedance:** 600 $\Omega$
- Power Supply:** 100, 120, 220, 240VAC, 50/60Hz, 4VA  
**Size and Weight:** 132(W)  $\times$  148(H)  $\times$  250(D)mm, 2.2kg  
**Accessories:** BNC-BNC cable ..... 1  
 BNC-pin plug cables ..... 2

## Analyzing Various Speaker Characteristics



### LSP-5621A SPEAKER ANALYZER

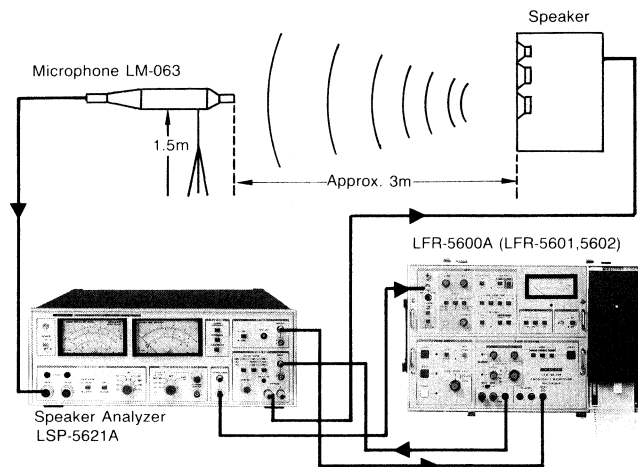
#### • GENERAL

The LSP-5621A is a speaker analyzer for measuring frequency characteristics of a speaker, combined with the use of a Frequency Response Recorder LFR-5600A series.

#### • FEATURES

- Measurement of frequency response and impedance and admittance characteristics of a speaker are easily accomplished.
- Sound pressure, impedance and admittance can be obtained by reading meter.
- The level of the power amplifier can be read on the meter.
- Impedance and admittance can be measured at desired level.
- The oscillator for warbling contained in the unit facilitates the measurement of frequency response in an audio room. The frequency is variable.
- A protective circuit (automatic recovery) for short circuits of the output terminal is attached.

#### ■ Measurement of speaker frequency response with the LSP-5621A combined with LFR-5600A



## ● SPECIFICATIONS

### Sound Pressure Measurement

**Measuring Range:** 45dB SPL to 130dB SPL  
Switches in 8 ranges;  
50, 60, 70, 80, 90, 100, 110, 120dB

**Measuring Accuracy:** Within  $\pm 5\%$  (full scale)

**Frequency Response:** (Excluding frequency response of the microphone)

**LM-063 Input:** 40Hz to 8kHz within  $\pm 0.5$ dB  
20Hz to 15kHz within  $\pm 1$ dB

**LM-061 Input:** 20Hz to 20kHz within  $\pm 0.2$ dB  
20Hz to 30kHz within  $\pm 0.5$ dB

**Detection Method:** Mean value detection

### Hard Copy (recording)

**Measuring Range:** 45dB SPL to 130dB SPL  
5 ranges;  
80, 90, 100, 110, 120dB

**Measuring Accuracy:** Within  $\pm 5\%$  (indication value)

**Frequency Response:** (Excluding frequency response of the microphone)

**LM-063 Input:** 40Hz to 8kHz within  $\pm 0.5$ dB  
20Hz to 15kHz within  $\pm 1$ dB

**LM-061 Input:** 20Hz to 20kHz within  $\pm 0.2$ dB  
20Hz to 30kHz within  $\pm 0.5$ dB

**Output Voltage:** Within 1Vrms  $\pm 5\%$   
(0dB meter indication)

**Output Impedance:** Within  $600\Omega \pm 15\%$

### Microphone

**Type:** LM-063

**Form:** Electret condenser

**Directivity:** Non-directional

**Nominal Impedance:** Within  $600\Omega \pm 30\%$

**Nominal Sensitivity:** Within 72.5dB  $\pm 2$ dB

**Frequency Response:** 100Hz to 1000Hz within  $\pm 1$ dB  
40Hz to 2000Hz within  $\pm 3$ dB  
40Hz to 15000Hz within  $\pm 5$ dB

(Actual data on sensitivity and frequency response will be attached to each separately.)

**Power Supply:** Provided from the main-frame.

### Impedance Measurement

**Measuring Method:** Constant current method  
0.1mA to 1mA

**Measuring Range:**  $2\Omega$  to  $300\Omega$   
4 ranges  
10, 30, 100,  $300\Omega$

**Measuring Accuracy:** Within  $\pm 5\%$  (full scale)

**Frequency Response:** Within 20Hz to 20kHz  $\pm 1$ dB

### Hard Copy (recording)

**Measuring Range:**  $2\Omega$  to  $300\Omega$

**Measuring Accuracy:** Within  $\pm 5\%$  (indication value)

**Frequency Response:** 20Hz to 20kHz  $\pm 1$ dB

**Output Voltage:** Within 1Vrms  $\pm 5\%$   
(at  $100\Omega$  measuring)

**Output Impedance:** Within  $600\Omega \pm 15\%$

### Admittance Measurement

**Measuring Method:** Constant voltage method  
1V to 10V

**Measuring Range:**  $2\Omega$  to  $300\Omega$   
4 ranges  
1, 3, 10,  $30\Omega$

**Measuring Accuracy:** Within  $\pm 5\%$  (full scale)

**Frequency Response:** 20Hz to 20kHz within  $\pm 1$ dB

### Hard Copy (recording)

**Measuring Range:**  $2\Omega$  to  $300\Omega$

**Measuring Accuracy:** Within  $\pm 5\%$  (indication value)

**Frequency Response:** 20Hz to 20kHz within  $\pm 1$ dB

**Output Voltage:** 1Vrms within  $\pm 5\%$   
(at measuring  $3.16\Omega$ )

**Output Impedance:** Within  $600\Omega \pm 15\%$

### Power Amplifier

**Maximum Output:** 25W ( $4\Omega$ )  
12.5W ( $8\Omega$ )

**Frequency Response:** 20Hz to 30kHz within  $\pm 1$ dB

**Amplitude Gain:** 30dB (external input terminal)

**Distortion Factor:** Less than 0.5% (20Hz to 30kHz,  
 $4\Omega$ , 0.5W to 25W)

**Input Impedance:**  $100k\Omega$

**Protection Circuit:** Protection against short circuit of speaker terminal & scale-over of the output meter. When a short circuit occurs in the speaker terminal, a red lamp lights and will reset in 5 seconds.

### Output Monitor (meter)

**Display Range:** 0.1W to 25W ( $4\Omega$ )  
0.05W to 12.5W ( $8\Omega$ )

**Display Accuracy:** Within  $\pm 5\%$  (full scale)

**Frequency Response:** 20Hz to 30kHz within  $\pm 1$ dB

**Output Range:** 3 ranges  
1, 3, 10V

### Warbling Oscillator (when driving LFR-5600A)

**Frequency Deviation:** 4Hz to 10Hz

**Distortion Factor:** Less than 5%

**Output Voltage:** Within 0.328Vrms  $\pm 5\%$

**Output Impedance:** Within  $30k\Omega \pm 5\%$

**Current Monitor:**  $0.1\Omega \pm 3\%$  resistance

**Power Supply:** 100, 120, 200, 220, 240VAC  $\pm 10\%$   
50/60Hz  
20VA at no load  
95VA on maximum output

### Size & Weight:

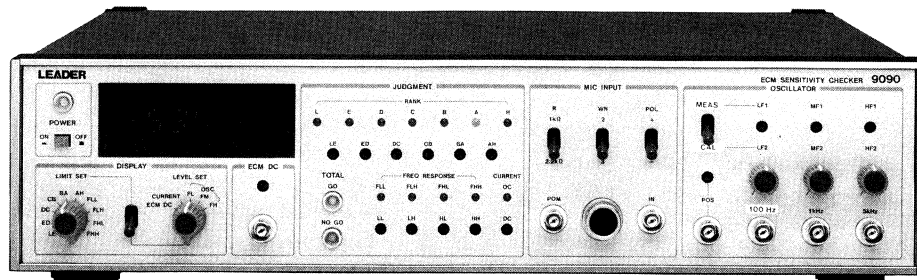
400(W)  $\times$  148(H)  $\times$  400(D)mm  
7.5kg

### Accessories

**Microphone:** LM-063 ..... 1  
Pin plug - pin plug cable ..... 3  
Spare fuse ..... 1

## Quick Checking and Judging of Frequency Response and Sensitivity

**NEW**



### Model 9090 ECM SENSITIVITY CHECKER

#### ● GENERAL

The Model 9090, a sensitivity checker, checks various characteristics of Electret Capacitor Microphones (ECMs) in the production line. It has a signal source, sound-source speaker power amplifier, microphone amplifier and judgment section and the power source to the ECM, thus enables the quick judgment of sensitivity and frequency response and also the quick checking of ECM-consumed currents. As is adoptable to any ECM specifications, the Model 9090 can select proper input impedance and polarity and balance/unbalance. Its 3-digit LED readout indicates the sensitivity, frequency response, and the measured current consumption value and its judged value.

#### ● FEATURES

- 3-frequency mixed signal source for quick judging of sensitivity and frequency response.
- Built-in ECM power source and current consumption monitor circuit for checking and judging of the amplifier operation. The microphone power voltage may be preset in between 0V and 10V.
- The calibration function checks each judgment condition through the 3-digit LED readout.
- The monitor terminal enables monitoring of signal source outputs, power amplifier outputs, microphone amplifier inputs and microphone power source.
- Sensitivity judgment (7 points), and frequency response (4 points) and current consumption judgment are available. The overall judgment readout is also provided.
- The 3-digit LED readout facilitates the judgment of criteria, frequency response and current consumption.

#### ● SPECIFICATIONS

##### Signal Source

**Oscillation Frequency:** Mixture of 3 frequencies (100Hz, 1kHz, 5kHz)

##### Power Amplifier

**Output Level:** POM: 0 to 100mVrms into open circuit  
POS: 0 to 100mVrms into open circuit

##### Power Amplifier Load Impedance:

POM: 4 to 6Ω  
POS: 4 to 6Ω

##### Monitor Terminal Output Level and Output Impedance:

POM monitor terminal: 0 to 100mVrms, 1Ω  
POS monitor terminal: 0 to 100mVrms, 1Ω  
100Hz monitor terminal: Fixed to 1Vrms, 600Ω  
1kHz monitor terminal: Fixed to 1Vrms, 600Ω  
5kHz monitor terminal: Fixed to 1Vrms, 600Ω

##### Sensitivity Measurement

**Measurement Range:** -50dB to -80dB

##### Measurement Value

**Display:** 3-digit digital readout

##### Sensitivity Checking

##### Reference Value

##### Setting:

Set with screw driver adjustment

##### Checking Range:

-50dB to -80dB

##### Rank Indication:

With 7 LEDs (H, A, B, C, D, E and L)

##### Microphone Input Section

##### Input Impedance:

100 kΩ

##### Model Selector Switch:

R ..... 1 kΩ/2.2 kΩ  
WN ..... 2-terminal/3-terminal  
POL ..... +/-

##### Frequency Response

##### Judgment Section:

For 100Hz and 5kHz bands extracted by BPF from a mixed wave.

##### Upper Limit Value

##### Setting:

Set with screw driver adjustment

##### Lower Limit Value

##### Setting:

Set with screw driver adjustment

##### Setting Range:

± 15dB

##### Judgment Display:

LOW, HIGH, LED (FLL, FLH, FHL, FHH)

##### DC Power Section

##### Voltage Setting Range:

0 to 10V set with screw driver adjustment

##### Judgment Current

##### Value Setting Range:

0 to 1mA set with screw driver adjustment  
LED lights.

##### Overcurrent:

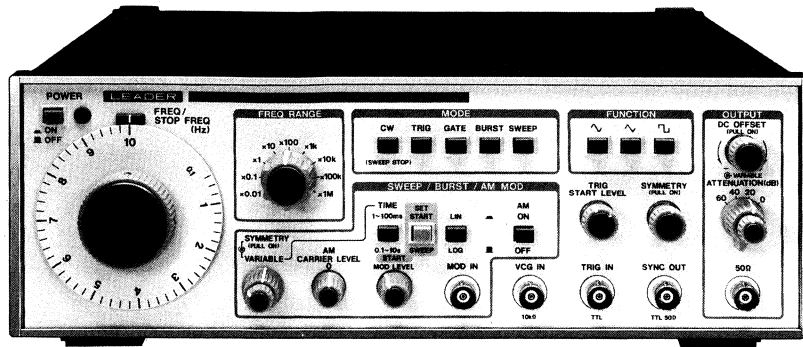
##### Power Supply:

100, 120, 200, 220, 240 VAC, 50/60Hz, 25VA

##### Size and Weight:

426(W) × 100(H) × 300(D)mm, 5kg

## Five Types of Output Waveforms & Operational Modes



### LFG-1310 FUNCTION GENERATOR

#### ● GENERAL

The LFG-1310 Function Generator produces a variety of waveforms, including sine, square, triangle, ramp, and pulse signals over a frequency range of 0.01Hz to 10MHz.

Because it provides such different operation modes as continuous wave, gate, trigger, burst, and sweep generation, the LFG-1310 can be used for diverse applications — for example, for frequency characteristic measurement of audio/video equipment and in the testing of automatic control devices.

#### ● FEATURES

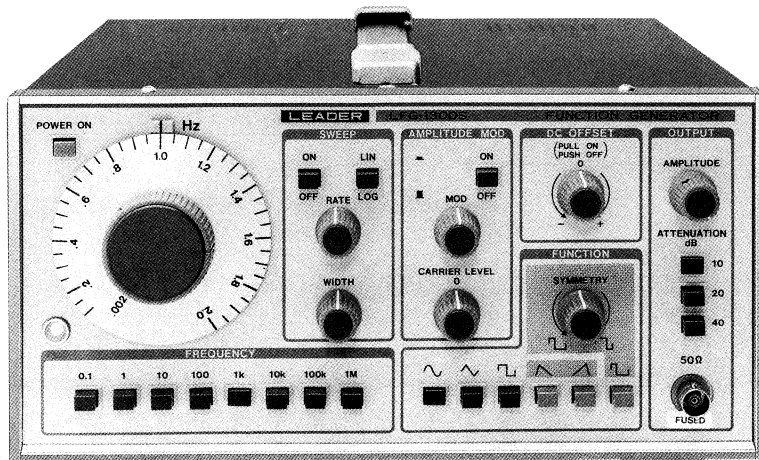
- Wide frequency range of 0.01Hz to 10MHz.
- Gate and trigger generations are possible.  
The LFG-1310 provides gate generation to supply signals for a fixed period of time, and trigger generation to supply signals for one cycle. The trigger points can be arbitrarily set.
- Burst waves can be generated by the built-in oscillator.
- Built-in linear/logarithmic sweep functions.
- VCG function for external control of output frequency.
- GCV function to generate a voltage in proportion to the frequency.
- Built-in amplitude modulation circuit with the suppressed-carrier mode.
- Variable waveform symmetry.
- DC offset function to superimpose DC voltage on output waveforms.  
In addition, DC voltage only can be obtained.

#### ● SPECIFICATIONS

<b>Frequency Range:</b>	0.01Hz to 10MHz, 9 ranges
<b>Dial Accuracy:</b>	× 0.01 to × 100k ranges, ± 5% of full scale × 1M range, ± 10% of full scale
<b>Output Signal:</b>	Sine wave, triangle wave, square wave, ramp wave, pulse wave
<b>Sine Wave:</b>	Output Flatness: 0.01Hz to 100kHz, ± 0.3dB 100kHz to 10MHz, ± 1dB Distortion: 10Hz to 50kHz less than 0.5% Linearity Error: 1% at 100Hz Rise/Fall Time: 25ns or less at max. output 20:80 to 80:20 (0.01Hz to 1MHz)
<b>Triangle Wave:</b>	
<b>Square Wave:</b>	
<b>Symmetry Variable:</b>	
<b>Operation Mode</b>	
<b>CW:</b>	Continuous generation
<b>TRIG, GATE:</b>	TRIG: one cycle oscillation triggered by in- put signal GATE: oscillation only when input is HI. Frequency Range: 0.01Hz to 1MHz Input Voltage: TTL Input Frequency: DC to 100kHz Start/Stop Phase: variable
<b>BURST:</b>	Burst wave oscillation for gate time of 1ms to 10s by built-in oscillator. ON/OFF time is symmetrical and variable.
<b>SWEEP</b>	
<b>Sweep Mode:</b>	LOG or LINEAR is selectable.
<b>Sweep Rate:</b>	1ms to 10s, 2 ranges, continuously variable Fly-back interval is variable.
<b>Sweep Width:</b>	Max. 1:100, continuously variable (sweep start frequency can be specified.)
<b>Output Characteristics</b>	
<b>Output Level:</b>	20Vp-p at open circuit
<b>Attenuators:</b>	0dB, 20dB, 40dB, 60dB continuously variable
<b>Output Impedance:</b>	50Ω ± 10%
<b>DC Offset:</b>	Maximum ± 10V at open circuit
<b>SYNC Output:</b>	TTL level (duty cycle is variable.)
<b>GCV Output:</b>	Voltage output in proportion to frequency 0 to +5V (max. frequency in each range) Sweep output in sweep mode 0 to -5V
<b>Sweep Output:</b>	
<b>Amplitude Modulation (AM):</b>	Modulation factor: 0 to 100% continuously variable Input Signal Level: Max. 5Vp-p Suppressed-carrier mode
<b>External Frequency Control (VCG):</b>	Freq. Range: Max. 1000: 1, with dial set to "10" Input Level: 0 to -5V (± 20%) (frequency is decreased by negative voltage)
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz, 30VA
<b>Size and Weight:</b>	300(W) × 99(H) × 300(D)mm, 3.5kg
<b>Accessory:</b>	BNC-clip cable (50Ω) .....

# AUDIO

## Four Types of Output Waveforms. Built-in Sweep Function



### LFG-1300S FUNCTION GENERATOR

#### ● GENERAL

The LFG-1300S is a multi-purpose function generator specially designed for generation of various waveforms with wide frequency range. The equipment has abundant functions, so that it has a wide range of applications in testing and adjustment of electronic devices and in research and development of wide areas such as medical science, physical geography, and automatic controls.

#### ● FEATURES

- Wide frequency range of oscillation, 0.02Hz to 2MHz.
- Low distortion factor, less than 0.5% (at 10Hz to 20kHz).
- Four types of output waveforms.
- Built-in sweep function with logarithmic and linear sweeping, and with variable sweep width and rate.
- Built-in AM modulator.
- DC offset function to superpose DC voltages on various waveforms.
- External sweep control (with VCG terminal).

#### ● SPECIFICATIONS

<b>Frequency Range:</b>	0.002Hz to 2MHz in 8 ranges 10 times step
<b>Dial Accuracy:</b>	±(3% set value + 3% full scale) for 0.02Hz to 200kHz ±(5% set value + 5% full scale) for 200kHz to 2MHz
<b>Output Signal:</b>	Sine, Triangle, Square, Pulse DC, TTL output
<b>Sine Wave:</b>	
<b>Output Voltage:</b>	20Vp-p (approx. 7Vrms) into open circuit
<b>Distortion:</b>	Less than 0.5% for 10Hz to 20kHz
<b>Triangle Wave:</b>	
<b>Output Voltage:</b>	20Vp-p into open circuit
<b>Symmetry:</b>	Less than 1% for 0.02Hz to 100kHz
<b>Square Wave:</b>	
<b>Output Voltage:</b>	20Vp-p into open circuit
<b>Symmetry:</b>	Less than 1% for 0.02Hz to 100kHz
<b>Rise Time:</b>	Less than 100ns
<b>Pulse Wave</b>	
<b>Output Voltage:</b>	Maximum 20Vp-p into open circuit
<b>Symmetry:</b>	9:1 to 1:9 Continuous adjustable

#### TTL Output

**Fan Out:** 20TTL  
**Output Level:** 2.4V to 5V for H, 0 to 0.4V for L  
**DC:** Any level within ±10V by DC OFFSET  
**DC OFFSET:** -10V to +10V  
 Clipping level for superposed waveform: ±10V

#### Sweep

**Sweep Mode:** LOG or LINEAR is selectable.  
**Sweep Rate:** Continuously variable, 20ms (50Hz) to 5s (0.2Hz)  
**Sweep Width:** Continuously variable, 10:1 to 1000:1 or frequency ratio

#### AM Modulation

**Modulation:** Continuously variable, 0% to 95% or more  
**Modulation Signal:** External input  
 Carrier suppress function is available

#### Output Terminal

**Output Impedance:** 50Ω ± 5%  
**Attenuators:** 10dB, 20dB, and 40dB Max. 70dB  
**Accuracy:** ±1% of set value for less than 200kHz  
 ±2% of set value for 200kHz and above  
**Rear Panel Terminals:** GCV OUT, VCG IN, MOD IN, TTL OUT, H. OUT

#### Size and Weight:

**Power Supply:** 250(W) × 123(H) × 250(D)mm, 4kg  
 100, 120, 220, 240VAC, 50/60Hz  
**Accessory:** BNC-clip cable (50Ω) ..... 1



Sine wave



Triangle wave

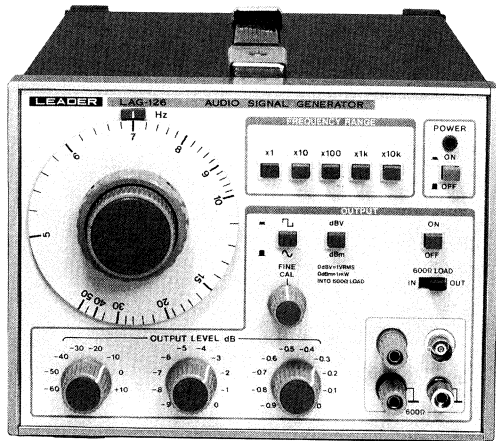


Square wave



Pulse wave

## Low Distortion 0.005%



### LAG-126 LAG-126S AUDIO GENERATOR

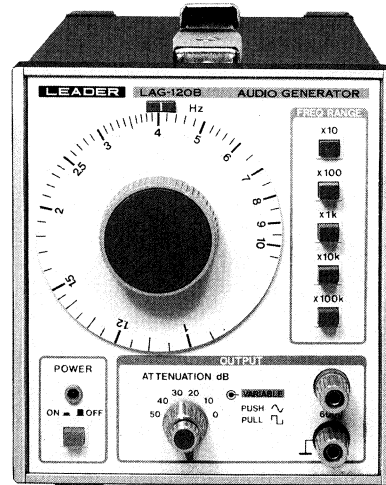
#### ● GENERAL

The LAG-126 and 126S are audio generators designed to supply sine waves having an extra-low distortion factor over the frequency range of 5Hz to 500kHz. The output voltage is calibrated in dBm (1mW, 600 Ω) and dBV (0dB = 1Vrms), and 0.1dB, 1dB and 10dB step attenuators ensure that it provides standard output. The LAG-126 delivers unbalanced output only. The LAG-126S delivers both unbalanced and balanced output which can be switched over from one to the other.

#### ● SPECIFICATIONS

<b>Frequency Range:</b>	5Hz to 500kHz
<b>Frequency Accuracy:</b>	20Hz to 20kHz at balanced output, 5 ranges ± (3% + 1Hz)
<b>Output Waveform:</b>	Sine & square waves selectable by a switch
<b>Sine Wave</b>	
<b>Maximum Output Voltage:</b>	+10dB ± 0.3dB when terminated at 600Ω, with a dBm-dBV changeover switch
<b>Distortion Factor</b>	
<b>Unbalanced Output:</b>	Less than 0.005%: 20Hz to 20kHz Less than 0.01%: 10Hz to 50kHz Less than 0.1%: 5Hz to 500kHz
<b>Balanced Output: (LAG-126S only)</b>	Less than 0.01%: 500Hz to 20kHz Less than 1.5%: 20Hz to 500Hz
<b>Level Flatness</b>	
<b>Unbalanced Output:</b>	± 0.2dB: 5Hz to 20kHz ± 0.5dB: 20kHz to 500kHz ± 0.5dB: 20Hz to 20kHz
<b>Balanced Output: (LAG-126S only)</b>	± 0.5dB: 20Hz to 20kHz
<b>Square Wave</b>	
<b>Maximum Output Voltage:</b>	Approx. 4Vp-p (when terminated at 600Ω and the output is dBV)
<b>Rise Time:</b>	Less than 200ns
<b>Overshoot:</b>	Less than 5% at higher than -30dBV output
<b>Sag:</b>	Less than 5%
<b>Attenuator:</b>	10dB × 7, 1dB × 9 and 0.1dB × 9, with a fine adjuster (for the sine wave only) and an output turn-off function
<b>Output Impedance:</b>	
<b>Unbalanced:</b>	600Ω ± 3%
<b>Balanced: (LAG-126S only)</b>	600Ω ± 10%
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz, 13VA
<b>Size and Weight:</b>	200(W) × 150(H) × 250(D)mm 3.2kg (126), 3.5kg (126S)
<b>Accessory:</b>	BNC clip cable ..... 1

## Wide Band 10Hz to 1MHz



### LAG-120B AUDIO GENERATOR

#### ● GENERAL

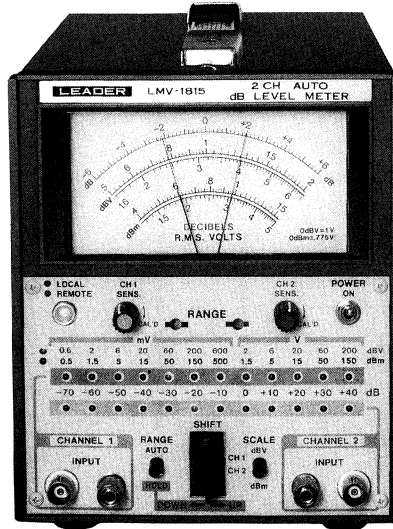
The LAG-120B is a wideband audio generator with sine and square output waveforms. Sine wave signals are available with a distortion of less than 0.4%. Square waves with fast rise time can be used for circuit performance checks. Synchronizing the output frequency is accomplished with an accurate external source. The LAG-120B is compactly constructed so that minimum space is required on the service bench.

#### ● SPECIFICATIONS

<b>Frequency Range:</b>	10Hz to 1MHz, 5 ranges
<b>Frequency Accuracy:</b>	± (3% + 1Hz)
<b>Output Waveform</b>	
<b>Sine Wave</b>	
<b>Frequency Range:</b>	10Hz to 1MHz
<b>Output Voltage:</b>	More than 3Vrms into 600Ω
<b>Output Distortion:</b>	0.05% (500Hz to 20kHz) 0.4% (50Hz to 200kHz) 0.8% (20Hz to 500kHz) 1.5% (10Hz to 1MHz)
<b>Square Wave</b>	
<b>Frequency Range:</b>	10Hz to 1MHz
<b>Output Voltage:</b>	3Vp-p into 600Ω
<b>Rise Time:</b>	200ns
<b>Sag:</b>	5%
<b>Output Impedance:</b>	600Ω ± 10%
<b>Output Flatness:</b>	Within ± 0.5dB at 600Ω terminated
<b>Output Attenuator:</b>	6-step attenuation and continuous adjuster
<b>Sync. Signal Terminal</b>	
<b>Input Impedance:</b>	10kΩ
<b>Synchronization Range:</b>	± 1%/V
<b>Power Supply:</b>	100, 120, 220, 240VAC 50/60Hz, 6.5VA
<b>Size and Weight:</b>	132(W) × 150(H) × 250(D)mm 3kg
<b>Accessory:</b>	LT-2044 600Ω Terminator ..... 1

# AUDIO

Automatic, -75 to +45dB, 10Hz to 500kHz



## LMV-1815 2CH AUTO dB LEVEL METER

### • GENERAL

The LMV-1815 is a 2-channel automatic dB linear level meter for measurement of sine wave signal levels of -75 to +45dB (0dBm = 0.775V or 0dBV = 1V) in the frequency range of 10Hz to 500kHz.

Range switching is automatic, therefore an appropriate range is automatically selected depending on the input voltage. Range switching in remote control is also available.

The LMV-1815 is provided with the sensitivity adjustment function which is convenient for measurement of S/N ratio and so forth.

### • FEATURES

- Decibel reading is easy since the meter is calibrated in dB.
- Automatic, remote control, and manual operation modes are selectable for range switching.
- A wide frequency band of 10Hz to 500kHz
- A wide input voltage range of -75 to +45dB (dBm or dBV)
- Two measurement values are indicated on the meter, therefore their comparison is available.
- Switching between dBm (0dB = 0.775V) and dBV (0dB = 1V) is available.
- The signal level from the output terminal is calibrated to 0.5V at 0dB indication.
- The ground terminals of both channels can be independently floating from the frame ground.

### • SPECIFICATIONS

#### Level Meter

#### Measurement Voltage Level

Range: -75 to +45dBm/dBV  
(dBm: 0dB = 0.775V)  
(dBV: 0dB = 1V)

#### Measurement Range:

12 ranges  
-70, -60, -50, -40, -30, -20dB  
-10, 0, +10, +20, +30, +40dB  
Within ±0.3dB (at 1kHz or 400Hz)

#### Measurement Accuracy:

#### Deviation Between

#### Channels:

Within 0.2dB (at 1kHz or 400Hz)

#### Frequency Response:

10Hz to 500kHz ±1dB  
20Hz to 200kHz ±0.5dB  
30Hz to 100kHz ±0.3dB  
(1kHz reference)

#### Input Resistance:

#### Input Capacitance:

10MΩ  
Less than 40pF (-70 to -20dB range)  
Less than 20pF (-10 to +40dB range)

#### Max. Input Voltage:

#### Input Ground Terminal:

600V (DC + AC peak)  
Selectable between floating and ground connection via a resistor by the switch on the rear panel

#### Amplifier

#### Output Voltage:

#### Frequency Response:

#### Output Impedance:

#### Distortion Factor:

0.5Vrms (at 0dB indication of the meter)  
10Hz to 300kHz -3dB  
600Ω ±20%  
Less than 1% (at 0dB indication of the meter, except the -70dB range)

#### Range Switching

#### LOCAL AUTO

Automatic range switching depending on the input level, and the response time is within 100ms/step.

#### HOLD

Everytime the SHIFT switch lever is pressed, the range shifts a step upper or lower.

When the lever is kept pressed, the range continually shifts to the upper or the lower.

#### REMOTE:

Control voltage ..... CMOS level (5V true logic)

Control current ..... 12mA at HI  
100, 120, 200, 240VAC, 50/60Hz, 17VA

#### Power Supply:

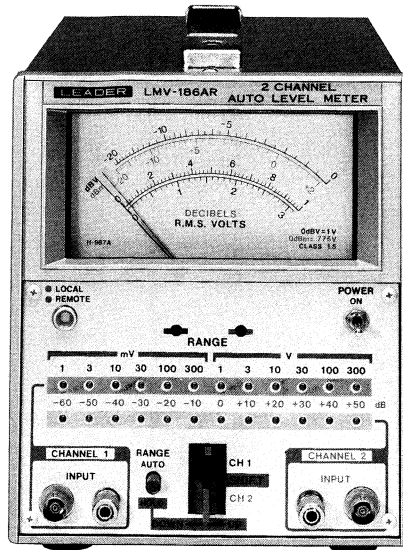
#### Size & Weight:

#### Accessories:

150(W) × 175(H) × 250(D)mm, 3.3kg  
BNC terminal adaptors ..... 2  
BNC-clip cable ..... 1  
Spare fuse ..... 1



## Two Channel Measurements with a Single Scale. 100 $\mu$ V to 300 V



### LMV-186AR 2CH AUTO LEVEL METER

#### • GENERAL

The LMV-186AR is a 2-channel auto level meter with the effective mean value scale to measure sine wave voltage levels of 100 $\mu$ V to 300V in the frequency range of 10Hz to 500kHz.

Each channel has an independent circuit and the same scale is used to read 2 channel indications as a dual indication meter is employed. Remote control of range switching is available.

#### • FEATURES

- Range switching automatically follows depending on the input level as the auto range function is provided.
- Setting of any range is available in hold condition.
- Wide frequency range of 10Hz to 500kHz ( $\pm 10\%$ )
- Two measurement level values are indicated on the same scale, therefore their comparison is available.
- The signal level from the output terminal is calibrated at 1Vrms for the full scale, therefore the output can be used for waveform monitoring. In other words, the LMV-186AR can be used as a preamplifier of low noise and high gain.
- Floating mode use of 2 channels is available.
- Remote control terminal is provided. Remote control of range switching is available by using an optional control box (LPC-1801) which is separately obtained from LEADER.

#### • SPECIFICATIONS

##### Level Meter

##### Measurement Voltage Level

Range: 100 $\mu$ V to 300V

##### Measurement Ranges (automatic selection):

##### Voltage Measurement

##### (12 ranges):

1, 3, 10, 30, 100, 300mV  
1, 3, 10, 30, 100, 300V

##### Decibel Measurement

##### (12 ranges):

-60, -50, -40, -30, -20, -10dB  
0, +10, +20, +30, +40, +50dB

##### Measurement Accuracy:

Within  $\pm 2\%$  full scale  
(at 1kHz or 400Hz)

##### Frequency Response:

10Hz to 500kHz  $\pm 10\%$   
20Hz to 200kHz  $\pm 5\%$   
30Hz to 100kHz  $\pm 3\%$   
(1kHz reference)

##### Input Resistance:

10M $\Omega$

##### Input Capacitance:

Less than 45pF (1mV to 300mV ranges)  
Less than 25pF (1V to 300V ranges)

##### Max. Input Voltage:

600V (DC + AC peak)

##### Input Ground Terminal:

Floating

##### Amplifier

##### Output Voltage:

1Vrms at no load (when 1.0 is indicated at full scale)

##### Frequency Response:

10Hz to 300kHz -3dB (1kHz reference)

##### Output Impedance:

600 $\Omega$   $\pm 20\%$

##### Distortion Factor:

Less than 1% at full scale

##### Range Switching

##### LOCAL AUTO

Automatic range switching depending on the input level

##### HOLD

Holding a certain range  
(Every time the SHIFT switch lever is pressed once, the range shifts a step upper or lower. When the lever is kept pressed, the range is continuously shifted to the upper or lower ranges.)

##### REMOTE:

Remote control of range switching is available by an external range controller, such as LPC-1801 Program Controller.

##### Power Supply:

100, 120, 220, 240VAC, 50/60Hz, 17VA

##### Size & Weight:

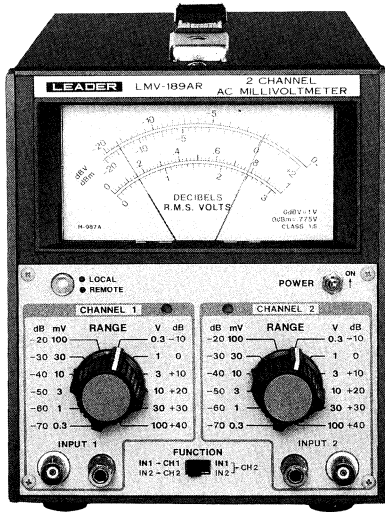
175(W)  $\times$  150(H)  $\times$  250(D)mm, 3kg

##### Accessories:

BNC terminal adaptors ..... 2  
BNC-clip cable ..... 1  
Spare fuse ..... 1

# AUDIO

## Highly-Sensitivity Measurements for Micro-Voltages



### LMV-189AR 2CH AC MILLIVOLTMETER

#### ● GENERAL

LMV-189AR is 2 channel remote controllable AC millivoltmeter with  $30\mu\text{V}$  to 100V sensitivity, 50Hz to 1MHz bandwidth and average responding RMS indication meter.

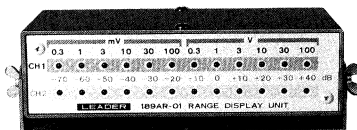
This unit has high sensitivity, high accuracy and good linearity on entire scale.

Each channel has independent circuit and meter has two pointers to read 2 values at one scale. Also, it can be used as high gain broad band amplifier with output terminal.

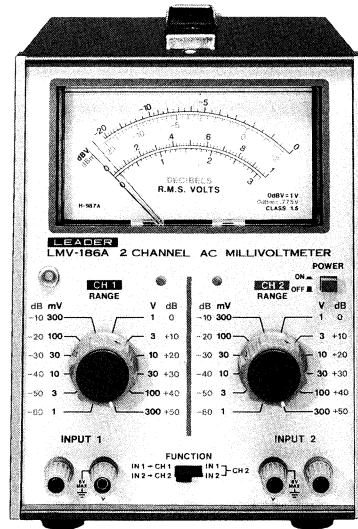
#### ● SPECIFICATIONS

<b>Voltmeter Measurement Voltage Range:</b>	30 $\mu\text{V}$ to 100V
<b>Measurement Ranges:</b>	Voltage measurement (12 ranges) 0.3, 1, 3, 10, 30, 100mV 0.3, 1, 3, 10, 30, 100V Decibel measurement (12 ranges) -70, -60, -50, -40, -30, -20, -10, 0, +10, +20, +30, +40dB (0dB = 1V, 0dB = 0.775V)
<b>Measurement Accuracy:</b>	Within $\pm 2\%$ of full scale (at 1kHz to 400Hz)
<b>Frequency Response: (1kHz reference)</b>	5Hz to 1MHz $\pm 10\%$ 10Hz to 500kHz $\pm 5\%$ 20Hz to 100kHz $\pm 2\%$
<b>Input Resistance:</b>	10M $\Omega$
<b>Input Capacitance:</b>	Less than 50pF (0.3mV to 100mV) Less than 30pF (0.3V to 100V)
<b>Max. Input Voltage:</b>	600V (DC + AC peak)
<b>Remote Control Voltage:</b>	C MOS level (5V true logic)
<b>Amplifier Output Voltage:</b>	1Vrms at full scale, into open circuit
<b>Frequency Response:</b>	10Hz to 300kHz -3dB
<b>Output Impedance:</b>	600 $\Omega \pm 20\%$
<b>Distortion Factor:</b>	Less than 1% at full scale (1kHz)
<b>Power Supply:</b>	100, 120, 200, 240VAC, 50/60Hz, 5VA
<b>Size and Weight:</b>	150(W) x 175(H) x 250(D)mm, 2.7kg
<b>Accessories:</b>	BNC type terminal adaptors ..... 2 Connection cords ..... 2 Spare fuse ..... 1

#### ■ RANGE DISPLAY UNIT 189AR-01 Optional remote controller for LMV-189AR



## Highly-Accurate Measurements for Voltages



### LMV-186A 2CH AC MILLIVOLTMETER

#### ● GENERAL

LMV-186A consists of two high sensitivity voltmeters housed in one cabinet. A single meter with two independent pointer movements is used in the measurements.

Voltages can be measured at the same time at two different points in the test circuit or for two separated loads. Switching is provided for measurement or comparison where voltages are within 10dB, such as in stereo circuits.

#### ● SPECIFICATIONS

<b>Voltmeter Measurement Voltage Range:</b>	100 $\mu\text{V}$ to 300V
<b>Measurement Range:</b>	Voltage range: 12 ranges 1, 3, 10, 30, 100, 300mV 1, 3, 10, 30, 100, 300V Decibel range: 12 ranges -60, -50, -40, -30, -20, -10dB 0, +10, +20, +30, +40, +50dB (0dB = 1V, 0dB = 0.775V)
<b>Measurement Accuracy:</b>	$\pm 2\%$ of full scale (at 1kHz or 400Hz)
<b>Frequency Characteristics:</b>	5Hz to 500kHz $\pm 10\%$ 10Hz to 200kHz $\pm 5\%$ 20Hz to 100kHz $\pm 3\%$ (1kHz reference)
<b>Input Resistance:</b>	10M $\Omega$
<b>Input Capacitance:</b>	45pF or less (1mV to 300mV) 25pF or less (1V to 300V)
<b>Maximum Input Voltage:</b>	600V (DC + AC peak)
<b>Noise:</b>	Within 2% of full scale by shorting input
<b>Amplifier Output Voltage:</b>	1Vrms at full scale into open circuit
<b>Frequency Response:</b>	10Hz to 200kHz -3dB (1kHz reference)
<b>Output Impedance:</b>	600 $\Omega \pm 20\%$
<b>Distortion Factor:</b>	Less than 1% at full scale (1kHz)
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, 5VA
<b>Size and Weight:</b>	150(W) x 200(H) x 250(D)mm, 3.5kg
<b>Accessories:</b>	Pair-plug - clip cable ..... 2 Spare fuse ..... 1

## BTL Amplifier Measurement Made Easy.



### LBA-1810 BTL ADAPTOR

#### ● GENERAL

The LBA-1810 is a balanced-to-unbalanced converter adaptor of no insertion loss (gain 0dB) for 2 channel AC voltmeter, providing accurate measurement of BTL AMP being used with high power car stereos and power boosters.

By setting the unit between the BTL Amp. and 2CH AC millivoltmeter, the BTL Amp. → BTL Adaptor (LBA-1810) → 2CH AC millivoltmeter → stereoscope connections will become possible and accurate measurement can be performed quickly with one 2CH AC millivoltmeter and one oscilloscope.

#### ● SPECIFICATIONS

##### Measurement Frequency

Range: 10Hz to 20kHz  $\pm 0.1$ dB  
3Hz to 100kHz  $\pm 0.5$ dB

Max. Input Voltage: 10Vrms (4 $\Omega$  25W) 10Hz to 100kHz

Residual Noise: Less than 40 $\mu$ V

Input Impedance: 150k $\Omega$ , Input capacitance less than 20pF

Input Terminal: Binding post

Gain: 0dB  $\pm 0.1$ dB at 1kHz

Output Impedance: 600 $\Omega$

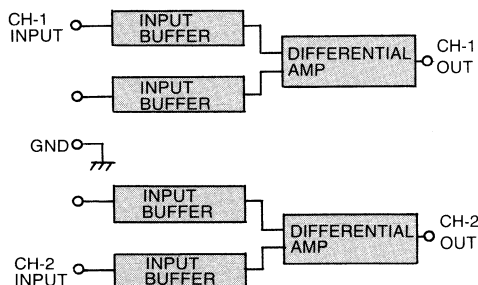
Output Terminal: Binding post

Power Supply: 100, 120, 200, 220, 240VAC, 50/60Hz, 4VA

Size and Weight: 150(W)  $\times$  45(H)  $\times$  270(D)mm, 1.3kg

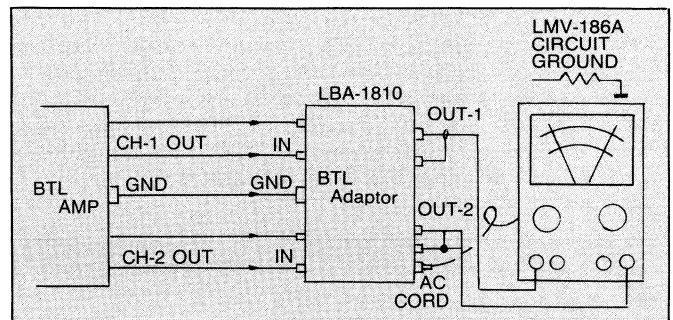
Accessories: Pair plug-pair plug ..... 2  
Spare fuse ..... 1

#### ■ Block diagram



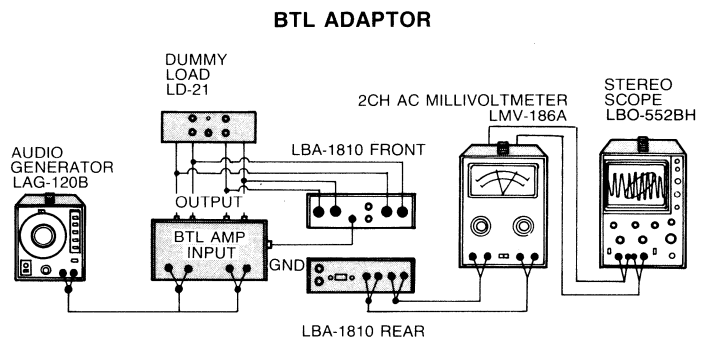
#### ■ Operating Instruction

An example is explained by use of LEADER 2-CH millivoltmeter LMV-186A

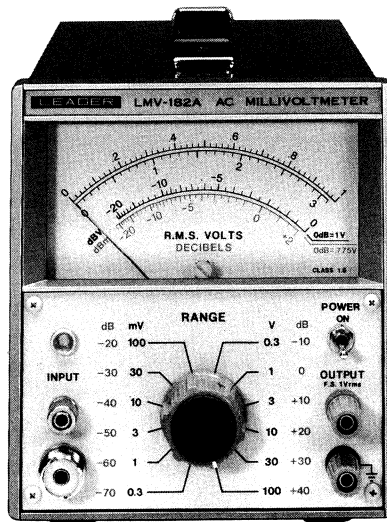


Chassis ground of BTL AMP is surely connected with GND terminal of BTL adaptor. It is not necessary for earth of AC voltmeter (LMV-186A) and oscilloscope (LBO-552) to be separated, if BTL adaptor is connected to them.

#### ■ APPLICATION



## Highly-Accurate Measurements for Voltages



### LMV-181A LMV-182A 1CH AC MILLIVOLTMETER

#### ● GENERAL

The LMV-181A and LMV-182A are millivoltmeters and voltmeters with mean value indicating devices that offer effective value calibration, and are used for measuring sine wave alternating current voltage of  $30\mu\text{V}$  to 100V (182A),  $100\mu\text{V}$  to 300V (181A) in the 5Hz to 1MHz frequency range. These instruments are highly sensitive and precise. New circuitry insures wide range readings with excellent linearity characteristics. The use of output terminals enables application of these units as wide-band high gain amplifiers or preamplifiers on other electronic apparatus.

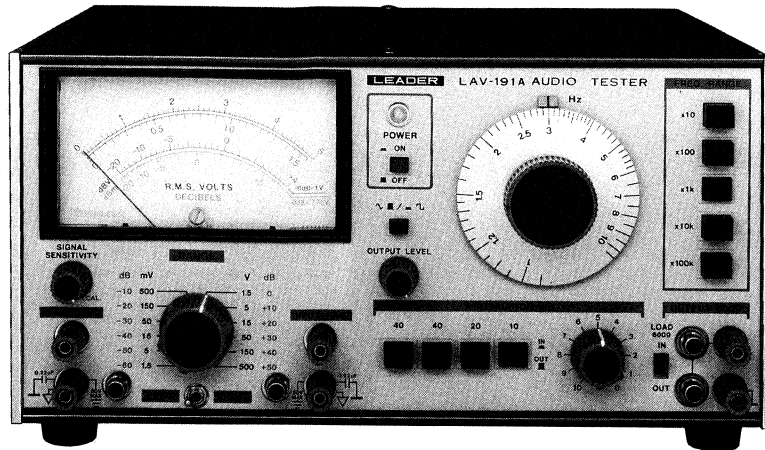
#### ● FEATURES

- Wide band-width of 5Hz to 1MHz.
- High accuracy;  $\pm 2\%$
- Highly precise, reliable and stable voltmeters of new circuit design.
- Wide-use voltmeters with two decibel scales ( $0\text{dB} = 1\text{V}$ ,  $0\text{dB} = 0.775\text{V}$ ) in addition to the effective voltage scales.
- The output is calibrated at  $1\text{V}_{\text{rms}}$  full scale, so that these instruments can be used as low-noise high-gain preamplifiers on wave form monitors.

#### ● SPECIFICATIONS

<b>Voltage Range:</b>	100 $\mu\text{V}$ to 300Vrms in 12 ranges 1, 3, 10, 30, 100, 300mV } (181A) 1, 3, 10, 30, 100, 300V } (182A) 0.3, 1, 3, 10, 30, 100mV } (182A) 0.3, 1, 3, 10, 30, 100V } (182A)
<b>Decibel Range:</b>	-80dBm to +52dB (0dB = 0.775V) } (181A) -80dBV to +50dB (0dB = 1V) } (182A) -90dBm to +42dB (0dB = 0.775V) } (182A) -90dBV to +40dB (0dB = 1V)
<b>Accuracy:</b>	$\pm 2\%$ of full scale at 1kHz or 400Hz
<b>Bandwidth:</b> (reference 1kHz)	5Hz to 1MHz: $\pm 10\%$ 10Hz to 500kHz: $\pm 5\%$ 20Hz to 100kHz: $\pm 2\%$
<b>Input Impedance:</b>	10M $\Omega$ on all ranges
<b>Input Capacitance:</b>	50pF: 1 to 300mV range } (181A) 35pF: 1 to 300V range } (182A) 50pF: 0.3 to 100mV range } (182A) 35pF: 0.3 to 100V range } (182A)
<b>Output Amplifier</b>	
<b>Voltage:</b>	1Vrms at full scale on each range
<b>Impedance:</b>	600 $\Omega \pm 20\%$
<b>Bandwidth:</b>	10Hz to 500kHz -3dB (1kHz reference)
<b>Power Supply:</b>	AC100, 120, 200, 220, 240V 50/60Hz, 2.5VA
<b>Size and Weight:</b>	132(W) x 150(H) x 250(D)mm, 2kg
<b>Accessories:</b>	Pair-plug - clip cable ..... 1 Terminal adaptor ..... 1 Spare fuse ..... 1

## Oscillator, Attenuator and AC Millivoltmeter in a Single



### LAV-191A (1CH) Model 192A (2CH) AUDIO TESTER

#### ● GENERAL

The LAV-191A and the Model 192A are combinations of a wideband audio generator, an attenuator and a wide-range AC millivoltmeter (LAV-191A; 1CH, Model 192A; 2CH). These instruments are specially useful in testing and servicing audio circuits, monaural and stereo, for frequency response and gain characteristics, and besides, designed small and light-weight.

#### ● FEATURES

- The LAV-191A and the Model 192A are equipped with built-in wideband audio generator, audio attenuator, and an AC millivoltmeter in one case.
- The audio generator has a frequency range from 10Hz to 1MHz, in 5 decade ranges, with distortion at less than 0.05%.
- The 2 channel AC millivoltmeter are provided for stereo circuit measurements (only Model 192A).
- Two switchable inputs — CH1 and CH2 — are provided for stereo circuit measurements (only LAV-191A)
- Can set the level of incoming signal at 0dB and compare signal against standard signal in making measurement of SN ratio, etc. (only LAV-191A).

#### ● SPECIFICATIONS

##### Audio Generator Section

**Frequency Range:** 10Hz to 1MHz 5 ranges  
Accuracy  $\pm(3\% + 1\text{Hz})$

##### Sine Wave

**Voltage:** Over 3Vrms into 600 $\Omega$   
**Flatness:** Within  $\pm 0.5\text{dB}$  into 600 $\Omega$  at maximum output

**Distortion:** 0.05%; 500Hz to 20kHz  
0.4%; 50Hz to 200kHz  
0.8%; 20Hz to 500kHz  
1.5%; 10Hz to 1MHz

**Impedance:** 600 $\Omega$  Internal/External load

##### Square Wave:

Output; Over 3Vp-p into 600 $\Omega$   
Rise Time; 200ns.  
Sag; 5% or less

##### Attenuator Section

###### Attenuation:

0 to 120dB in 1dB steps at 600 $\Omega$   
40dB  $\times$  2, 20dB, 10dB, 1dB  $\times$  10.

###### Accuracy:

Within  $\pm 1.5\%$

###### Freq. Characteristics:

0 to 60dB; 10Hz to 500kHz  $\pm 0.5\text{dB}$   
10Hz to 1MHz  $\pm 2\text{dB}$   
60 to 120dB; 10Hz to 150kHz  $\pm 0.5\text{dB}$   
10Hz to 500kHz  $\pm 6\text{dB}$   
10Hz to 1MHz  $\pm 10\text{dB}$

##### AC Millivoltmeter Section

###### Voltage Range:

1.5mV to 500Vrms full scale 12 ranges

###### Decibel Range:

-80dBm to +55dBm (0dB = 0.775V)  
-80dBV to +54dBV (0dB = 1V)

###### Accuracy:

Within  $\pm 2\%$  of full scale at 1kHz or 400Hz

###### Bandwidth:

20Hz to 100kHz, within  $\pm 2\%$   
10Hz to 1MHz within  $\pm 10\%$

###### Input Impedance:

10M $\Omega$

###### Amplifier Output:

1Vrms at full scale

###### Output Impedance:

600 $\Omega$   $\pm 20\%$

###### Distortion:

Less than 2% at 1kHz, full scale

###### Power Supply:

100, 120, 220, 240VAC, 50/60Hz,  
8VA (191A), 10VA (192A)

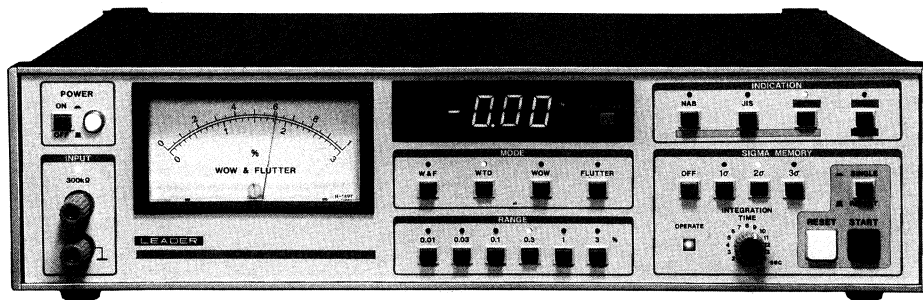
###### Size and Weight:

300(W)  $\times$  148(H)  $\times$  250(D)mm  
5.4kg (191A), 5.9kg (192A)

###### Accessories:

Pin plug — pin plug cable ..... 2  
Pin-plug — mini-plug cable ..... 1  
Banana-tip — clip cable ..... 2  
Spare fuse ..... 1

## Highly-Accurate Measurements for Wow & Flutter



### LFM-3615 LFM-3616 WOW & FLUTTER METER

#### ●GENERAL

The Model 3615 and Model 3616 are Wow/flutter Meters designed with high sensitivity (0.01% at full scale) for measurements of wow/flutters of various recording/playback devices in accordance with the standards, such as NAB, JIS, CCIR, and DIN. Because the instruments have a built-in frequency counter, they can indicate the tape speed in frequency (kHz) and deviation (%) simultaneously with measurement of the wow/flutter.

As the 3615 is equipped with the sigma memory, in measurements in accordance with the DIN and CCIR standards, the wow/flutter in a certain specified time interval can be processed depending on the standard deviation ( $\sigma$ : sigma) and meter reading is possible in a still condition.

The 3616 is equipped with the comparator (only the wow/flutter indication) for GO/NO GO judgment.

#### ●FEATURES

- A wide range of wow/flutter measurements is possible as the ranges 0.01% to 3% are provided.
- Measurements are possible in peak value indication with the center frequency 3.15kHz in accordance with DIN, peak value indication with the center frequency 3kHz in accordance with CCIR, effective value indication in accordance with JIS, and mean value indication in accordance with NAB
- In addition to weighted wow/flutter measurements, independent measurements of unweighted wow and flutter are available.
- The response time for the input signal is shorter, compared with the conventional type of wow/flutter meter.
- The counter indication is in kHz or in %.
- Measurement specifications and ranges can be externally controlled using the TTL-level signals.
- The SCOPE output terminal is provided for waveform monitoring of the wow/flutter.
- The RECORDER output terminal is provided from which DC voltage proportional to the wow/flutter is available.
- The output terminal is provided to output the high accuracy 3kHz and 3.15kHz signals generated by the crystal oscillator for the self recording/playback test.
- In measurements in accordance with the CCIR and DIN specifications, meter reading in a still condition is available using the sigma memory. (3615)
- When the sigma memory used, measurement time can be arbitrarily selected up to 15 seconds in a single-second step. The measurement result is indicated on the meter after passing the selected measurement time. Measurement result is kept indicated on the meter, until the resetting for the single measurement, and until the next measurement is finished for the repeated measurement; therefore, it is convenient and easy to read the meter. (3615)
- Sigma mode can be set to  $1\sigma$ ,  $2\sigma$ , or  $3\sigma$ . (3615)
- For the wow/flutter indication, the analog comparator is provided. Thus, GO/NO GO judgment of the measured wow/flutter can be rapidly made using the GO/NO indicator consisting of LEDs, and therefore, productivity increase of the production line is possible. (3616)

## • SPECIFICATIONS

<b>Wow &amp; Flutter Measurement</b>	
<b>Measurement Center Freq.:</b>	JIS, NAB and CCIR ..... 3kHz $\pm$ 10% DIN ..... 3.15kHz $\pm$ 10%
<b>Input Level Range:</b>	15mV to 10Vrms (0.03% to 3% range) 100mV to 10Vrms (0.01% range)
<b>Input Impedance:</b>	300k $\Omega$ or more
<b>Measurement range:</b>	0.01, 0.03, 0.1, 0.3, 1 and 3% full-scale 6 ranges
<b>Indication Accuracy:</b>	Within $\pm$ 5% of full scale
<b>Indication Mode:</b>	JIS ... effective value, NAB ... mean value CCIR, DIN ... peak value
<b>Frequency Response</b>	
<b>W &amp; F:</b>	JIS & NAB ..... 0.5 to 200Hz (-3dB $\pm$ 1dB) CCIR ..... 0.3 to 200Hz (-3dB $\pm$ 1dB) DIN ..... 0.3 to 300Hz (-3dB $\pm$ 1dB) Common specification to all JIS, NAB, CCIR and DIN
<b>Weighted:</b>	
<b>Wow:</b>	JIS and NAB ..... 0.5 to 6Hz (-3dB $\pm$ 1dB) CCIR and DIN ..... 0.3 to 6Hz (-3dB $\pm$ 1dB)
<b>Flutter:</b>	JIS, NAB and CCIR ..... 6 to 200Hz (-3dB $\pm$ 1dB) DIN ..... 6 to 300Hz (-3dB $\pm$ 1dB)
<b>Dynamic Response</b>	
<b>JIS:</b>	Time required for a predetermined input to reach 95% of indication against 100% full scale: 3.5sec $\pm$ 1sec
<b>NAB:</b>	Conforming to the NAB standard
<b>CCIR:</b>	Conforming to the CCIR standard
<b>DIN:</b>	Conforming to the DIN standard
<b>Output Terminals</b>	
<b>SCOPE Terminal:</b>	Output voltage 1Vrms $\pm$ 5% at full scale
<b>Recording Signal Output:</b>	Output frequency 3kHz and 3.15kHz, Accuracy $3 \times 10^{-5}$ , Output voltage 0.3Vrms $\pm$ 20% Output voltage 1V DC $\pm$ 5% at full scale
<b>RECORDER Output:</b>	
<b>Tape Speed and Drift Measurement</b>	
<b>Input Level Range:</b>	15mV to 10Vrms (1kHz to 5kHz) 100mV to 10Vrms (10Hz to 9.999kHz)

<b>Input Impedance:</b>	300k $\Omega$ or more
<b>Reference Time Freq.:</b>	378kHz (crystal oscillation control), $3 \times 10^{-5}$
<b>Reference Time Deviation:</b>	
<b>Tape Speed (kHz)</b>	
<b>Frequency Range:</b>	10Hz to 9.999kHz
<b>Gate Time:</b>	1 second
<b>Indication Accuracy:</b>	$\pm$ (1 count + reference time deviation)
<b>Drift Measurement</b>	
<b>Reference Frequency:</b>	3kHz and 3.15kHz
<b>Measurement Range:</b>	-9.99% to +9.99%
<b>Gate Time:</b>	3.33 seconds (3kHz), 3.17 seconds (3.15kHz)
<b>Indication Accuracy:</b>	$\pm$ (2 counts + reference time deviation)
<b>Output Terminal:</b>	Coding by 4-digit positive logic BCD
<b>External Control Input:</b>	MODE, RANGE, INDICATION, REMOTE/LOCAL
<b>Control Input Signal:</b>	Negative logic TTL level, 1 funout
<b>Power Supply:</b>	100, 120, 220, 240V AC, 50/60Hz, 20VA
<b>Size and Weight:</b>	400 (W) $\times$ 100(H) $\times$ 300(D)mm, 4.5kg

### ■ Sigma memory (3615) Only for CCIR and DIN

<b>Starting:</b>	Single and repeat
<b>Sigma Mode:</b>	1 $\sigma$ , 2 $\sigma$ and 3 $\sigma$ , switchable
<b>Measurement Time:</b>	1 to 15sec in one sec step, crystal oscillator control
<b>Operation Preparation Time:</b>	Approx. 1 second

### ■ Analog Comparator (3616)

<b>Preset:</b>	Continuous variable setting by meter indication
<b>Judgment Delay Time:</b>	0 to 5 sec, arbitrary setting
<b>Judgment Indication:</b>	NO (red) and GO (green) indication by LED's

### ■ Use of the sigma memory (3615)

In wow/flutter measurement according to the DIN or CCIR standards, the peak value of the flutter amplitude is read. But in actual measurement, such signal component as a pluse noise may be generated because of a partial fall out of magnetic coating, and therefore such unusual noise element must be eliminated from the measurement data.

The present instrument uses the sigma circuit which is based on the statistical probability theory to solve the abovementioned problem.

The statistical distribution of the random wow/flutter is considered to show a regular distribution as shown in Fig.1. Logial values of this regular distribution are as shown in Table 1.

When the values in Table 1 are applied to the wow/flutter measurement values according to the DIN standard, the peak value excluding the outside of the range, i.e., the maximum value of the integral ratio equals the wow/flutter measurement value.

With the present instrument, the time ratio for eliminating the peak value against a certain measurement time, as shown in Fig. 2, is specified, and the maximum value after eliminating the peak value is made the measurement value.

Therefore, for the same measurement time, the result for 3 $\sigma$  shows a larger value than of 1 $\sigma$ .

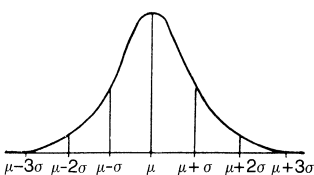


Fig. 1  $\mu$ : mean value  
 $\sigma$ : standard deviation

	Integral ratio
$\mu \pm \sigma$	68.26%
$\mu \pm 2\sigma$	95.46%
$\mu \pm 3\sigma$	99.74%

Table 1

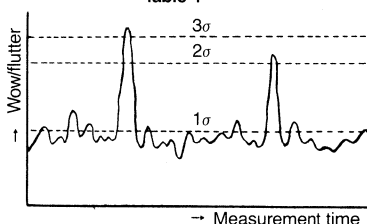


Fig. 2

### ■ Use of the analog comparator (3616)

#### Use of Analog Comparator (3616)

The analog comparator makes GO/NO GO determination in comparison between the wow/flutter measurement value and the presetting reference value.

#### Front panel setting when the analog comparator is used

Generally, wow/flutter of a sound recording and reproducing equipment, such as a tape recorder, becomes the largest at the rotation starting time of the driving mechanism. In order to avoid unusual measurement at the starting time, set the delay time using the DELAY TIME.

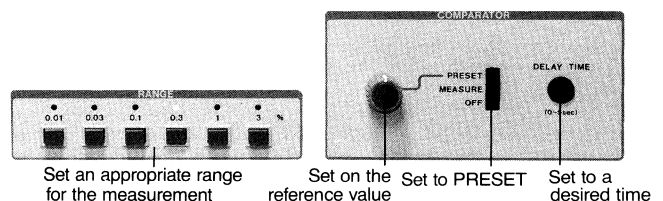
#### Setting of judgment reference value

Set the PRESET/MEASURE to PRESET, and make a presetting of the reference value using the reference value setting knob. The reference value which is set is indicated on the meter.

#### Measurement

Set the PRESET/MEASURE to MEASURE to make wow/flutter measurement.

When the wow/flutter of the signal is lower than the reference value, the GO/NO indicator indicates GO, but when the measurement value is larger than the reference value the indicator indicates NO.



# AUDIO

## GO/NO GO Judgment



### LFM-3615-01 COMPARATOR

#### ● GENERAL

The LFM-3615-01 is a comparator used, together with the LFM-3615 wow/flutter meter, to make GO/NO GO (good/no good) judgment on measured wow/flutter and tape speed of various recording/play back devices in accordance with preset reference values.

In combination with the LFM-3616 wow/flutter meter (which has a built-in comparator for GO/NO GO judgment of wow/flutter), the LFM-3615-01 offers the ability to judge propriety of tape speed.

#### ● SPECIFICATIONS

##### Tape Speed Comparator Section

**Input:** 4-digit BCD, 5V (CMOS level) positive logic  
**Presetting Method:** Upper/lower limit values set by digital switches in 4-digit respectively

**Presetting Limit-Value Range:** Upper 0 to 9999Hz  
 Lower 0 to 9999Hz

**Judgment Frequency Range:** Same as the frequency range for the wow/flutter measurement of the LFM-3615/LFM-3616

**Judgment Result Display:** Indicated by LO (red), GO (green), or HI (red) lamp on the front panel of the LFM-3615/LFM-3616

##### Wow/Flutter Comparator Section

**Input Method:** Analog signal input from the LFM-3615  
**Presetting Method:** Applying the meter of the LFM-3615  
**Presetting Reference Value Range:** Same as the measurement range of the LFM-3615

**Judgment Result Display:** Indicated by GO (green) or NO (red) lamp on the front panel of the LFM-3615

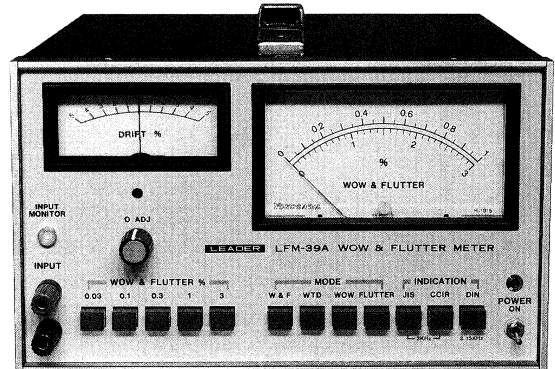
**Judgment Delay Time:** Selected in the range from 0 sec. to 5 sec. (continuously variable)

**Power Supply:** Supplied from the LFM-3615/LFM-3616 connected

**Size and Weight:** 206(W) × 54(H) × 30(D)mm, 0.3kg

**Accessories:** Connection cable (flat cable with 34-pin connector) ..... 1  
 Fixing screw ..... 2

## Built in Weighted Filter



### LFM-39A WOW & FLUTTER METER

#### ● GENERAL

The LFM-39A Wow & Flutter Meter is a direct reading type instrument designed for measurement of Wow, Flutter and Drift characteristics of tape recorders, record-players and other recording/playback equipment. The effective values, peak-to-peak values and center frequency (3kHz or 3.15kHz) of Wow & Flutter are indicated on the meter in accordance with JIS, CCIR, DIN, and weighted specification.

#### ● SPECIFICATIONS

**Input Frequency:** JIS/CCIR 3kHz ±10%

DIN 3.15kHz ±10%

**Input Voltage Range:** 15mV to 10Vrms

**Input Impedance:** 300kΩ or more

**Drift Measurement**

**Range:** ±5%

**Accuracy:** Within ±5% of full scale

**Wow & Flutter Measurement**

**Range:** 5 ranges: 0.03%, 0.1%, 0.3%, 1% and 3%

**Accuracy:** Within ±5% of full scale

**Wow & Flutter Frequency Characteristics**

**W & F:** JIS: 0.5 to 200Hz (-3dB ±1dB)

CCIR: 0.3 to 200Hz (-3dB ±1dB)

DIN: 0.3 to 300Hz (-3dB ±1dB)

**Weighted:** In accordance with JIS, CCIR and DIN specifications

**Wow:** JIS: 0.5 to 6Hz (-3dB ±1dB)

CCIR/DIN: 0.3 to 6Hz (-3dB ±1dB)

JIS/CCIR: 6 to 200Hz (-3dB ±1dB)

DIN: 6 to 300Hz (-3dB ±1dB)

**Flutter:** JIS: RMS Value

CCIR/DIN: peak to peak value

**Indicating System:**

**Output Terminal**

**Recording/Playback:** Oscillator frequency ..... 3kHz ±0.05%

**Test Signal Output:** Output voltage ..... 0.3Vrms ±10%

Distortion ..... Less than 2%

Output Voltage ..... F.S. 1V ±5%

Output Voltage ..... F.S. 1V ±5%

**Recorder Output:**

**To Scope Terminal:** 100, 120, 220, 240VAC, 50/60Hz 15VA

**Power Supply:** 250(W) × 150(H) × 250(D)mm; 4.5kg

**Size and Weight:** Banana-clip cable ..... 1

**Accessory:** Spare fuse ..... 1



## For Services



**LFM-3610**  
**WOW & FLUTTER METER**

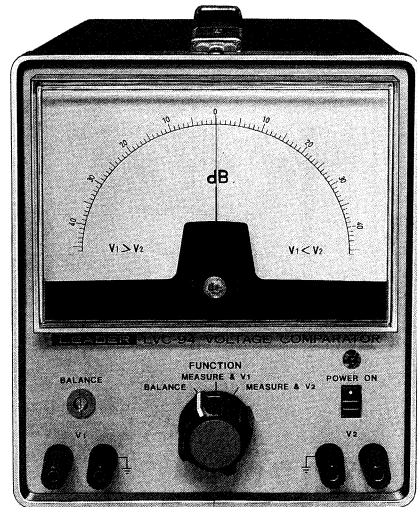
### ● GENERAL

The LFM-3610 Wow & Flutter Meter is a direct reading type instrument designed for measurement of Wow, Flutter and Drift characteristics of tape recorders, record players and other recording/playback equipment. The effective values, peak-to-peak values and center frequency (3kHz or 3.15kHz) of Wow & Flutter are indicated on the meter in accordance with JIS, CCIR, DIN, and weighted specification.

### ● SPECIFICATIONS

<b>Input Frequency:</b>	JIS/CCIR 3kHz ± 10% DIN 3.15kHz ± %
<b>Input Voltage Range:</b>	50mV to 5Vrms
<b>Input Impedance:</b>	Over 300kΩ
<b>Drift Measurement</b>	
<b>Range:</b>	± 5%
<b>Accuracy:</b>	Within ± 5% of full scale
<b>Wow &amp; Flutter Measurement</b>	
<b>Range:</b>	5 ranges: 0.03%, 0.1%, 0.3%, 1% and 3%
<b>Accuracy:</b>	Within ± 8% of full scale
<b>Wow &amp; Flutter Characteristics</b>	
<b>W &amp; F:</b>	JIS: 0.5 to 200Hz (−3dB ± 1.5dB) CCIR: 0.3 to 200Hz (−3dB ± 1.5dB) DIN: 0.3 to 300Hz (−3dB ± 1.5dB) In accordance with JIS, CCIR and DIN specifications
<b>Weighted:</b>	
<b>Wow</b>	
<b>DIN, CCIR:</b>	0.3Hz to 6Hz (−3dB ± 1.5dB)
<b>JIS:</b>	0.5Hz to 6Hz (−3dB ± 1.5dB)
<b>Flutter:</b>	
<b>JIS, CCIR</b>	6Hz to 200Hz (−3dB ± 1.5dB) 6Hz to 50Hz (−3dB ± 1.5dB) 50Hz to 200Hz (−3dB ± 1.5dB) 6Hz to 300Hz (−3dB ± 1.5dB) 6Hz to 50Hz (−3dB ± 1.5dB) 50Hz to 300Hz (−3dB ± 1.5dB)
<b>DIN:</b>	50Hz to 300Hz (−3dB ± 1.5dB)
<b>Indication:</b>	JIS: Effective value CCIR/DIN: Peak value
<b>Output Terminal</b>	
<b>Recording:</b>	JIS, CCIR...3kHz, DIN...3.15kHz
<b>Freq. Accuracy:</b>	$5 \times 10^{-4}$ (crystal controlled)
<b>Output Voltage:</b>	0.5Vrms
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz 15VA
<b>Size and Weight:</b>	200(W) × 98(H) × 300(D)mm, 2.5kg
<b>Accessories:</b>	Pin-plug—Pin-plug cable ..... 1 Pin-plug—Clip cable ..... 1

## For Services



**LVC-94**  
**VOLTAGE COMPARATOR**

### ● GENERAL

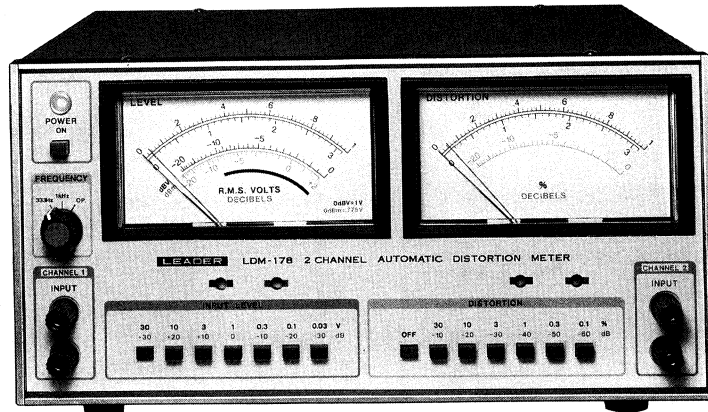
The LVC-94 voltage comparator is suited for measuring a stereo separation. According to the deflecting direction of the zero centered meter, it compares two voltage levels to each other. This comparator covers the ± 46dB band without switching ranges. Its rear panel has three sets of output connectors: the one for directly outputting two individual input voltages and the other for outputting those voltages by switching the front panel switch. Thus, the LVC-94 is suited for signal level measurements. Also, it provides an easy-to-see dB linear scale.

### ● SPECIFICATIONS

<b>Measurement Range:</b>	46dB full scale, 1 range								
<b>Input Signal:</b>									
(V1 and V2)	<table border="1"> <thead> <tr> <th>Input Voltage</th> <th>Frequency Range</th> </tr> </thead> <tbody> <tr> <td>1mV to 5V</td> <td>100Hz to 1kHz</td> </tr> <tr> <td>2mV to 5V</td> <td>100Hz to 4kHz</td> </tr> <tr> <td>5mV to 5V</td> <td>100Hz to 10kHz</td> </tr> </tbody> </table>	Input Voltage	Frequency Range	1mV to 5V	100Hz to 1kHz	2mV to 5V	100Hz to 4kHz	5mV to 5V	100Hz to 10kHz
Input Voltage	Frequency Range								
1mV to 5V	100Hz to 1kHz								
2mV to 5V	100Hz to 4kHz								
5mV to 5V	100Hz to 10kHz								
<b>Measurement Accuracy:</b>	Within ± 1.5dB at 1kHz reference Within ± 1.5dB (at 20°C)								
<b>Temperature Characteristics:</b>	Within ± 1.5dB (10 to 35°C at 20°C standard)								
<b>Input Impedance:</b>	100kΩ 90pF								
<b>Environmental Conditions</b>									
(for guaranteed accuracy):	Temperature 10 to 35°C								
<b>Power Supply:</b>	100, 115, 230VAC, 50/60Hz, 8VA								
<b>Size and Weight:</b>	170(W) × 200(H) × 250(D)mm, 5kg								

# AUDIO

## High-Pass Filter System, Automatic Level Control



### LDM-178 (2CH) LDM-177 (1CH) AUTOMATIC DISTORTION METER

#### ● GENERAL

The LDM-177 (1CH) and LDM-178 (2CH) are distortion meters using high-pass filter system with 3 spot frequencies including 1 optional frequency.

An automatic level control is adopted for measuring the distortion of tape recorders. The high-pass filter type distortion meter allows accurate measurements of distortions of waveforms having wow and flutter.

Aside from the 315Hz and 1kHz, another measurement frequency can be optionally selected from 333Hz, 400Hz or 3kHz. A level meter is installed to provide simultaneous readings of output level together with the distortion measurements. The units also have filter output terminals for monitoring harmonic components.

#### ● FEATURES

- Automatic level control circuit eliminates full scale setting against measurement level fluctuations.
- Optional selection of a measurement frequency of 333Hz, 400Hz or 3kHz is available besides the 315Hz and 1kHz.
- Level meter provides reading of output level measurement at the same time with the distortion measurement.
- Filter output terminal enables monitoring of harmonic components by oscilloscope.

#### ● SPECIFICATIONS

##### Distortion Measurements

###### Measurement

**Frequency Range:** 315Hz  $\pm$  5%, 1kHz  $\pm$  5%

**Optional:** 1 Point of 333Hz, 400Hz and 3kHz

###### Measurement

**Distortion Range:** 0.03% to 30%

**Measurement Range:** 0.1, 0.3, 1, 3, 10, 30%, 6 Ranges

**Input Level Range:** 10mV to 30V

###### Automatic Level

**Control Range:** 10dB

**Input Impedance:** 100k $\Omega$  Unbalanced

###### Measurement

**Accuracy:** Within  $\pm$  5% of full scale (However,  $\pm$  10% of full scale for 0.1% range)

###### Fundamental

###### Frequency

**Suppression:** More than - 76dB

##### Level Measurement

**Input Impedance:** 100k $\Omega$  Unbalanced

**Input Capacitance:** Less than 70pF

###### Measurement Level

**Range:** 3mV to 30V

**Measurement Range:** 0.03, 0.1, 0.3, 1, 3, 10, 30V, 7 Ranges

###### Measurement

**Frequency Range:** 20Hz to 30kHz Within  $\pm$  0.5dB  
20Hz to 20kHz Within  $\pm$  0.5dB  
(0.03V Range)

###### Measurement

**Accuracy:** Within  $\pm$  5% of full scale

##### Output Terminals

**Level Monitor:** 1V  $\pm$  5% (at full scale)

**Filter Output:** 1V  $\pm$  5% (at full scale)

##### Power Supply:

100, 120, 220, 240VAC, 50/60Hz

10VA (177), 20VA (178)

##### Size and Weight:

300(W)  $\times$  148(H)  $\times$  400(D)mm

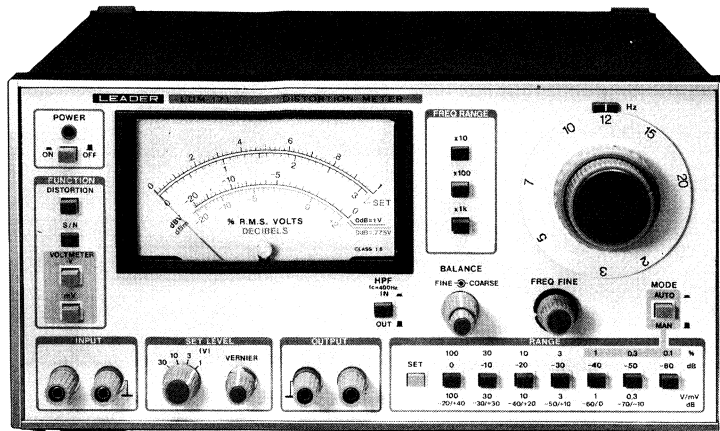
##### Accessories:

Pair plug-clip cable ..... 1 (177)

Pair plug-clip cable ..... 2 (178)

Spare fuse ..... 1

## 0.1% Full Scale, Semi-Automatic Measurement



### LDM-171 SEMI-AUTOMATIC DISTORTION METER

#### ● GENERAL

The LDM-171 is an easy-to-use, semi-automatic distortion meter that can measure total harmonic distortion in audio amplifiers and communications equipment. It covers the entire audio band from 20Hz to 20kHz with a high sensitivity of 0.1% fullscale.

An auto-tuning circuit enables distortion to be measured easily even in the 1% and lower ranges, where manual tuning is difficult.

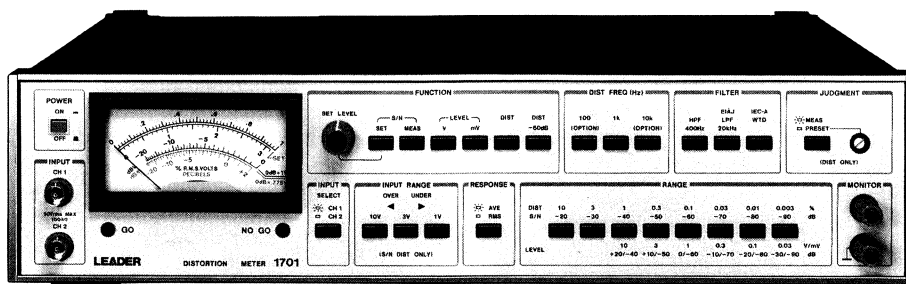
#### ● FEATURES

- Well designed with 7 ranges for distortion measurements and 6 ranges for level measurements.
- A highly sensitive built-in millivoltmeter enables the 171 to function also as a signal-to-noise (S/N) meter.

#### ● SPECIFICATIONS

<b>Distortion Measurements</b>	
<b>Frequency Ranges:</b>	3 ranges: 20Hz to 20kHz
<b>Measurement Ranges:</b>	7 ranges: 0.1%, 0.3%, 1%, 3%, 10%, 30% and 100%
<b>Input Voltage Ranges:</b>	4 ranges: 0.35 to 1V, 1 to 3V, 3 to 10V, 10 to 30V
<b>Minimum Measurable Input Voltage:</b>	350mV
<b>Maximum Measurable Input Voltage:</b>	30V
<b>Measurement Accuracy:</b>	± 5% of full-scale (except in 100% range)
<b>Residual Distortion:</b>	0.01% max.
<b>Input Impedance:</b>	100kΩ, 80pF max.
<b>Filter Characteristics</b>	
<b>Fundamental</b>	
<b>Rejection:</b>	80dB min.
<b>Harmonic Attenuation:</b>	0.6dB max. (2nd and 3rd harmonics)
<b>Auto-Tuning</b>	
<b>Capture Ranges:</b>	1%, 0.3%, 0.1%
<b>Level Measurement</b>	
<b>Frequency Ranges:</b>	20Hz to 200kHz
<b>Measurement Ranges:</b>	12 ranges (0.3, 1, 3, 10, 30 and 100) in both mV and V
<b>Measurement Accuracy:</b>	± 5% of full-scale
<b>Input Impedance:</b>	1MΩ, 50pF max.
<b>S/N Measurement</b>	
<b>Measurement Ranges:</b>	0 to 80dB
<b>Input Voltage Ranges:</b>	Same as for distortion measurement
<b>Input Impedance:</b>	100kΩ, 80pF max.
<b>High-Pass Filter</b>	
<b>Cutoff Frequency:</b>	400Hz
<b>Rolloff:</b>	12dB/oct
<b>Monitor Terminal</b>	
<b>Output Voltage:</b>	1Vrms at full-scale reading
<b>Output Impedance:</b>	1kΩ
<b>Power Supply:</b>	100, 120, 200, 240VAC, 50/60Hz, 5VA
<b>Size and Weight:</b>	300(W) × 148(H) × 250(D)mm, 5kg
<b>Accessories:</b>	Banana tip-clip cable ..... 1 Spare fuse ..... 1

## 0.003% Low Distortion Measurement



### Model 1701 DISTORTION METER

#### ● GENERAL

The Model 1701, an auto-level and highly-accurate total harmonic distortion meter, provides the minimum measurement range of 0.003% full-scale.

Besides the 1kHz of measurement frequency, two frequencies available as an option may be added. And, the ratio circuit employed has made it easier to measure distortion. The Model 1701 is, therefore, suited for measuring audio and communications equipment as well as digital audio equipment like CDs and DATs.

#### ● FEATURES

- This model is a spot distortion meter for measuring ultra-low distortion of CD players, DAT decks and HiFi amplifiers.
- The measurement frequency is 1kHz (spot).
- The ratio circuit facilitates measurements without full calibration although the level fluctuation in the measurement signal.
- Frequency tuning is not needed because of a  $\pm 1\%$  bandwidth when the fundamental suppression by notch filter is 100dB.
- The distorted waveform detection method is selectable from two types; by the effective value and by the average value.
- Built-in amplifier of a 60dB gain and built-in low-pass filter of a 20kHz cutoff frequency are suited for a CD player or DAT deck with a D/A converter, thereby measuring distortion with an input voltage at  $-60\text{dB}$  level.
- The wide fundamental rejection range allows the measurement of signal including wow & flutter.
- GO/NO-GO judgment function for outputting the judgement result.
- Remotely controllable.
- Also functions as a high-sensitivity AC millivoltmeter or S/N measuring instrument.
- Option 1701-01 can be built-in for three signal source; 100Hz, 1kHz, and 10kHz.
- Option 1701-02 can be built-in for additional signal source notch filters; 100Hz and 10kHz.
- Option 1701-03 can be built-in for three signal source (100Hz, 1kHz and 10kHz) and signal source notch filters (100Hz and 10kHz).

## ● SPECIFICATIONS

### Distortion Measurements

<b>Frequency Range:</b>	1kHz: Within $\pm 1\%$
<b>Distortion Range:</b>	8 ranges: 0.003, 0.01, 0.03, 0.1, 0.3, 1, 3 and 10%
<b>Input Level Range:</b>	0.35 to 10V
<b>Input Range:</b>	3 ranges: 1, 3, 10V
<b>Accuracy:</b>	Within $\pm 5\%$ of full scale
<b>Residual Distortion:</b>	0.001% or less (3, 10V range) 0.0015% or less (1V range)
<b>Harmonic:</b>	Within 10Hz to 100kHz $\pm 1$ dB
<b>Fundamental</b>	
<b>Suppression:</b>	More than 110dB
<b>Second Flatness:</b>	Within $\pm 0.5$ dB (Within 10kHz to 20kHz $\pm 1$ dB)

### Ratio Measurement

<b>Range:</b>	10dB
<b>-60dB Measurement</b>	
<b>Input Voltage Range:</b>	1 to 3mV
<b>-60dB Measurement</b>	
<b>Residual Distortion:</b>	0.1% or less

### Level Measurement

<b>Frequency Range:</b>	10Hz to 100kHz: Within $\pm 1$ dB 20Hz to 50kHz: Within $\pm 0.5$ dB
<b>Level Range:</b>	10 $\mu$ V to 10V
<b>Full Scale:</b>	mV range: 6 ranges 0.03, 0.1, 0.3, 1, 3, 10mV V range: 6 ranges 0.03, 0.1, 0.3, 1, 3, 10V
<b>Accuracy:</b>	Within $\pm 2\%$ of full scale

### S/N Measurement

<b>Frequency Range:</b>	10Hz to 100kHz: Within 1dB 20Hz to 50kHz: Within 0.5dB
<b>S/N Range:</b>	8 ranges -90, -80, -70, -60, -50, -40, -30, -20dB
<b>Accuracy:</b>	Within $\pm 0.5$ dB of full scale
<b>Residual Noise:</b>	-100dB (3, 10V range) -94dB (1V range) or more

### Input

<b>Input Impedance:</b>	100k $\Omega$
<b>Input Capacitance:</b>	Less than 100pF
<b>Input Changing:</b>	CH1 and CH2 (2 channels)
<b>Input Crosstalk:</b>	More than -94dB (at 1kHz, 2V input)

### Filter

#### High-Pass Filter

<b>Cutoff Frequency:</b>	400Hz
<b>Attenuator:</b>	18dB/OCT

#### Low-Pass Filter

<b>Cutoff Frequency:</b>	20kHz
<b>Attenuator:</b>	More than 65dB (29 to 45kHz) More than 55dB (45 to 70kHz)

#### Weighting Filter:

<b>Response</b>	
<b>AVE:</b>	Average value responding
<b>RMS:</b>	Effective value responding

#### Monitor Terminal

<b>Output Voltage:</b>	1Vrms $\pm 5\%$ (at meter full scale)
<b>Output Impedance:</b>	1k $\Omega$

### Remote Control

<b>Function:</b>	S/N SET S/N MEAS LEVEL V LEVEL mV DIST DIST -60dB
------------------	--

### Measurement

<b>Frequency:</b>	1kHz 100Hz (option) 10kHz (option)
<b>Filter:</b>	High-pass filter Low-pass filter Weighting filter
<b>Response:</b>	AVE/RMS
<b>Input Changing:</b>	CH1/CH2
<b>Input Range:</b>	10V 3V 1V
<b>Range:</b>	10% -20dB 3% -30dB 1% -40dB 10V 10mV 0.3% -50dB 3V 3mV 0.1% -60dB 1V 1mV 0.03% -70dB 0.3V 0.3mV 0.01% -80dB 0.1V 0.1mV 0.003% -90dB 0.03V 0.03mV
<b>Judgment:</b>	MEAS/PRESET

### DC Output

<b>Output Voltage:</b>	+1V (at meter full scale)
<b>Output Impedance:</b>	1k $\Omega$

### Judgment Output

<b>GO:</b>	Negative logic
<b>NO GO:</b>	Negative logic
<b>HI:</b>	Negative logic
<b>LO:</b>	Negative logic
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz, 18VA

### Size and Weight:

<b>Accessories:</b>	426(W) $\times$ 99(H) $\times$ 300(D)mm, 4.8kg BNC-pin plug cable ..... 2 Spare fuse ..... 1
---------------------	--

### Option

#### 1701-01 Added signal source for measurement

<b>Frequency:</b>	100Hz, 1kHz, 10kHz (Within $\pm 1\%$ )
<b>Distortion:</b>	0.001% or less
<b>Output Level:</b>	3.16V at open circuit
<b>Output Impedance:</b>	600 $\Omega$

#### 1701-02 Added notch filter for measurement

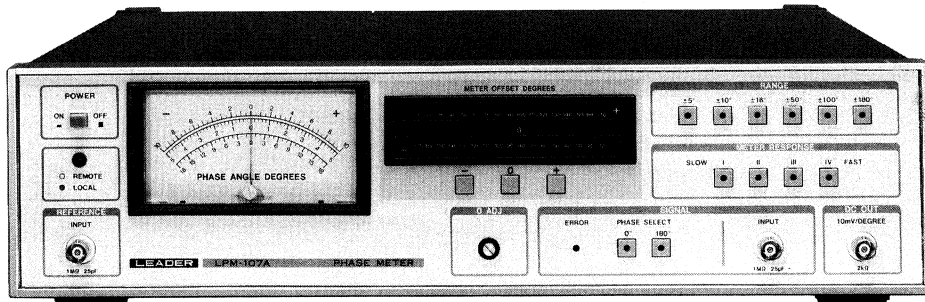
<b>Frequency:</b>	100Hz, 10kHz (Within $\pm 1\%$ )
<b>Fundamental</b>	
<b>Suppression:</b>	More than 110dB
<b>Second Flatness:</b>	Within $\pm 5$ dB, Within $\pm 1$ dB at 10kHz to 20kHz

#### 1701-03 Added signal source and notch filter for measurement

<b>Signal Source:</b>	Same as the 1701-01
<b>Notch Filter:</b>	Same as the 1701-02

# AUDIO

## Measurement for Phase Angle and Phase Characteristics



### LPM-107A PHASE METER

#### ● GENERAL

The LPM-107A is a high-sensitivity phase meter for measuring phase angle and phase characteristics over a wide band in various engineering fields including electrical equipment. This equipment is designed most suitable for phase measurement of amplifiers and filters, or phase measurement in acoustic engineering, as well as for phase characteristics measurement of the servo circuit input signals and control output of CD and LD players.

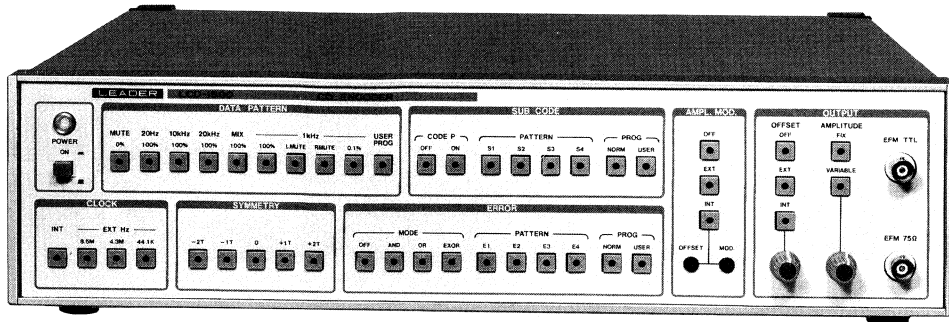
#### ● FEATURES

- High sensitivity with a full-scale range of  $\pm 5^\circ$ .
- The meter offset function makes it possible to use the full scale  $\pm 5^\circ$  range regardless of whether the phase difference is large or small.
- Wide input voltage range, 5mV to 30V.
- Wide band width, 10Hz to 2MHz
- With remote control function.

#### ● SPECIFICATIONS

<b>Measurement Frequency</b>	10Hz to 2MHz
<b>Ranges:</b>	10Hz to 2MHz
<b>Phase Angle</b>	
<b>Measurement Range:</b>	0 to $\pm 180^\circ$ , in the following 6 ranges 0 to $\pm 5^\circ$ , 0 to $\pm 10^\circ$ , 0 to $\pm 18^\circ$ 0 to $\pm 50^\circ$ , 0 to $\pm 100^\circ$ , 0 to $\pm 180^\circ$
<b>Measured Input Voltage</b>	
<b>Range:</b>	5mV to 30V, automatic internal switching between 2 ranges
<b>Input Impedance:</b>	1M $\Omega$ , 25pF
<b>Meter Offset:</b>	Maximum $\pm 170^\circ$ in $10^\circ$ steps
<b>Meter Offset Error:</b>	$\pm 0.5\%$ of the offset phase angle
<b>Measuring Accuracy:</b>	Each range $\pm [(2.5\% + 0.1^\circ) + \text{offset error}]$ of indicated maximum value. This relation holds when the identical voltage is input for REFERENCE and SIGNAL.
<b>Phase Output Signal (DC):</b>	DC voltage corresponding to measured phase angle, 10mV/degrees
<b>Phase Output Signal Error:</b>	$\pm (0.5\% + 0.1^\circ)$ , but becomes $\pm 1^\circ$ when the level difference between REFERENCE and SIGNAL is 20dB.
<b>Error Due to Input Level:</b>	$\pm 1^\circ$ when the level difference between REFERENCE and SIGNAL is 20dB.
<b>Phase Output Signal Rise Time:</b>	About 30ms/180 $^\circ$
<b>Remote Control Functions:</b>	All panel operations except for meter zero adjustment Remote control level: 5V CMOS level negative logic Remote control system: according to BCD code Meter offset: 5 bits + sign bit (1 bit) Range: 3 bits Meter response: 2 bits Phase select: 1 bit
<b>Power Supply:</b>	100, 120, 200, 240VAC 50/60Hz, 20VA
<b>Size and Weight:</b>	400(W) $\times$ 99(H) $\times$ 300(D)mm, 4.8kg
<b>Accessories:</b>	BNC-clip cable ..... 3 Spare fuse ..... 1

## Generated EFM Signal. Adjusting for CD Players.



### LCD-1500 CD ENCODER

#### ● GENERAL

The LCD-1500 is used for adjusting and inspecting CD players. The LCD-1500 is a signal generator designed to adjust and test the digital signal processing section and digital/analog converter section of a CD player.

#### ● FEATURES

- 16-bit signal patterns are used. Four sine waves (20Hz, 1kHz, 10kHz, and 20kHz), one mixed wave (250Hz + 8kHz) and one user-defined wave (50kHz step) can be used. A sine wave of 1kHz has a signal level of 0.1%, L MUTE and R MUTE (output of 0%) in addition to 100%. This is very useful for checking S/N ratio.
- For sub-codes, there are four types of combinations of code P off, and Q, R, S, T, U, V, and W (codes R to W are 0). Users can define four types of sub-codes from codes Q to W.
- The symmetry of EFM patterns can be changed.
- Errors can be added to EFM patterns. There are four types of patterns that users can define (bit clock unit × 1, symbol unit × 2, frame unit × 1).
- Output signals are available in two types: TTL signal output and 75Ω signal output. The PU signal output level can be changed. Offset and amplitude modulation are also available.
- Panel switching functions can be externally controlled.

#### ● SPECIFICATIONS

**Clock Frequency:** Internal: 8.6436MHz (crystal)  
External: 8.6MHz, 4.3MHz,  
44.1kHz ± 10%

#### Data Pattern:

	L CH	R CH
MUTE	0%	0%
20Hz	100%	100%
10kHz	100%	100%
20kHz	100%	100%
1kHz	100%	100%
L MUTE	0%	100%
R MUTE	100%	0%
0.1%	0.1%	0.1%
MIX	100%	100%
	(250Hz 80% + 8kHz 20%)	

**USER:**  
**Sub Code:**  
**P Code:**  
**Q to W Code:**

Option  
ON, OFF  
Off, S1, S2, S3, S4  
R to W code: 0  
Q code: Other programmable  
S1 to S4  
User programmable  
-1T, -0.5T, 0, +0.5T, +1T

**Variable Symmetry:**  
**Error Insertion**  
**Error:**

Off, E1 (channel dot unit), E2 (frame unit), E3 (symbol unit)  
E1 to E4: User programmable  
AND: DATA 0  
OR: DATA 1  
EXOR: DATA INVERT  
108 frames × 7 cycles

**Mode:**

**Error Ratio:**  
**Amplitude Modulation:**

Off, internal 10Hz sine wave, external 10Hz to 10kHz (variable modulation, offset function)  
Fun out 4TTL  
75Ω: 1.5Vp-p  
VAR: 0 to 1.5Vp-p  
Offset: Off, internal DC ± 1V, external DC to 10kHz

**TTL Signal Output:**  
**PU Signal Output:**

**Synchronizing Signal Output:**

Frame sync., sub-code sync., error sync.

**Remote Control Input:**  
**Power Supply:**

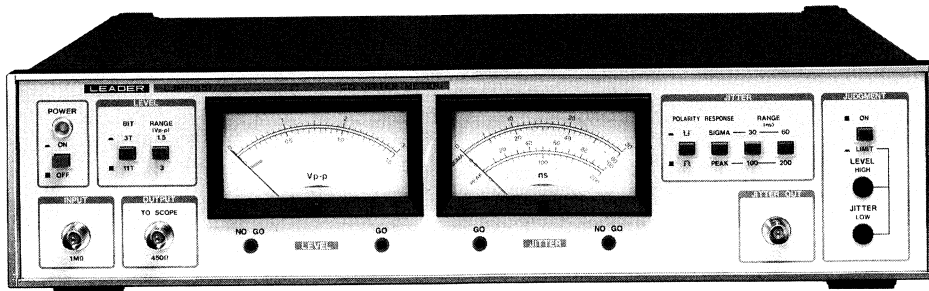
TTL level negative logic  
90 to 132VAC, 198 to 264VAC,  
50/60Hz, 25VA

**Size and Weight:**

400(W) × 99(H) × 300(D)mm, 4.3kg

# AUDIO

## Measurement Jitter Amount and Level Simultaneously



### LJM-1851 CD JITTER METER

#### ● GENERAL

The LJM-1851 is a CD jitter meter, LJM-1851, which can perform real time, simultaneous measurements of jitter amounts and levels (3T or 11T) of EFM signals used for CD players. Conventional CD jitter meters only measure the amount of jitter. Consequently, an oscilloscope or another instrument is needed to measure signal levels. The LJM-1851, however, handles both types of measurements, displays the measurement results on LED (GO/NO GO) according to the judgment function, and then outputs the judged results. This instrument improves the efficiency of such measurements, and is well-suited for mass production system requirements for CD players under established quality control guide lines.

#### ● FEATURES

- Jitter amounts are displayed as analog values for the extracted 3T component of EFM signals.
- Push-button selection of sigma value and peak value indications for jitter amounts.
- Jitter quantity can be given in term of SIGMA values or peak values.
- An EFM signal level is indicated as a p-p value for the 3T or 11T component, and can be switched by pressing a push button.
- Judgment results of "GO" or "NO GO" are displayed on LEDs for jitter and level measurements and the results can be output for TTL levels (NO GO judgment output can be used as a control signal to stop operation.)
- Built-in DC voltage output terminals for measurements results

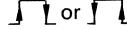
#### ● SPECIFICATIONS

##### Input Section

**Input Signal:** EFM signal (clock, 4.3218MHz  $\pm$  3%)  
**Input Voltage Range:** 0.15 to 3Vp-p (two ranges)  
**Input Impedance:** 1M $\Omega$ , 35pF

##### Jitter Measurement Section

**Measuring Range:** For peak value indication, 100 or 200ns (two ranges)  
 For sigma value indication, 30 or 60ns (two ranges)

**Measuring Accuracy:** Within  $\pm$  5% of full scale  


**Indication:** peak or sigma value

**Measurement Bits:** 3T

##### Level Measurement Section

**Measurement Bits:** 3T or 11T (switchable)  
**Measuring Range:** 1.5 or 3Vp-p (two ranges)  
**Measuring Accuracy:** Within  $\pm$  5% of full scale

##### Judgment Section

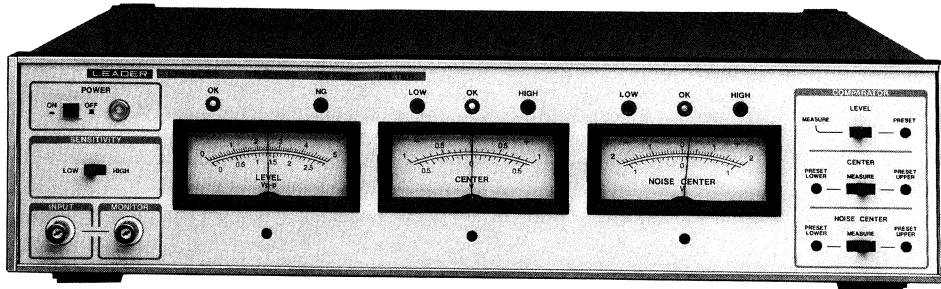
**Judged Item:** Jitter amount and signal level  
**Judging Procedure:** By setting preset values for the meters, measured values are judged and displayed as GO or NO GO on LED. GO is displayed when the measured jitter is below the preset value or the measured level is above the preset value.

##### Output Section:

**Monitor Output:** +1V at full scale of meter  
**DC Voltage Output:** Amphenol 14-pin connector  
**Judgment Result**  
**Output Voltage:** TTL level, negative logic  
**Power Supply:** 100, 120, 220, 240VAC, 50/60Hz 20VA  
**Size and Weight:** 426(W)  $\times$  99(H)  $\times$  300(D)mm, 4kg  
**Accessory:**  
 BNC-clip cable ..... 1  
 Spare fuse ..... 1



## Quick Measurement and Check of Tracking Circuit



### LTM-9055 CD TRACKING OFFSET METER

#### ● GENERAL

The LTM-9055, a tracking offset meter, adjusts and inspects CD player tracking circuit.

It has reduced labors by a meter system that provides quicker adjustment and inspection compared to the conventional meters.

This Model indicates 3 items (includes signal level, offset and noise center) through respective meters and judges for NO/NO-GO at one time.

#### ● FEATURES

- Signal level, offset and noise center measurements
- The GO/NO-GO judgment function allows the measurement result to be indicated on LEDs.
- Judged outputs may be fetched as TTL outputs.
- Each item may be output by DC voltage.

#### ● SPECIFICATIONS

##### Input Section

**Input Voltage Range:** 0.1Vp-p to 5Vp-p

**Sensitivity:** LOW, HIGH 2 ranges

Buffer amp. gain

LOW: 2.0 times ( $\pm 1\%$ )

HIGH: 3.7 times ( $\pm 1\%$ )

**Frequency Range:**

20Hz to 2.5kHz  $\pm 0.5$ dB

10Hz to 4kHz  $\pm 1.0$ dB at level measurement

##### Meter

**Level:** 2.7Vp-p, 5Vp-p full scale

**Center:**  $\pm 0.54$ V,  $\pm 1$ V full scale

**Noise Center:**  $\pm 1.08$ V,  $\pm 2$ V full scale

**Accuracy:**  $\pm 3\%$  of full scale

##### Measurement Section

**Judged Item:** Level, center, noise center

**Judged Procedure:** By setting preset values for the meters, measured values are judged and displayed as NG-OK or LOW-OK-HIGH on LED.

##### Output Section

**Judgment Output**

**Voltage:**

**Judgment Output:**

Monitor Output, DC Output

TTL level negative logic

Level: 1 bit

Center: 3 bits

Noise center: 3 bits

##### Environmental

**Conditions:** 10 to 40°C

**Power Supply:** 100, 120, 220, 240VAC, 50/60Hz, 5VA

**Size and Weight:** 426(W)  $\times$  98(H)  $\times$  300(D)mm, 4kg

## dB Linear Scale for Easier Reading



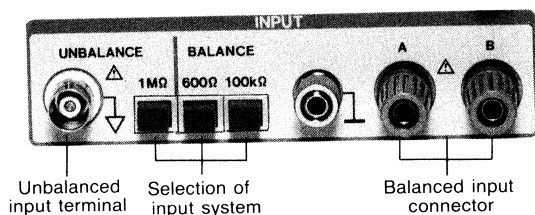
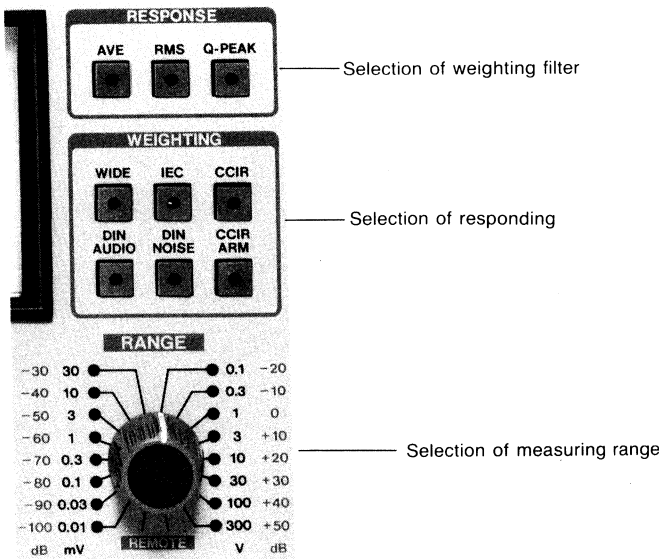
### LMV-1817 NOISE METER

#### ● GENERAL

LMV-1817 is a Noise Meter with a dB linear scale for measuring noise levels conforming to the various standards. As the response characteristics of the indicator permit selection of average value, effective value, and quasi-peak value response, when used in combination with the built-in filters. This is ideal for use as a highly sensitive level meter or noise level meter for recording and playback equipments, receivers, etc.

#### ● FEATURES

- The dB linear scale allows easier reading of numeric values during dB measurement (e.g., S/N measurement). To make a level measurement easier, it also has dBV, dBm and voltage scales.
- Five types of built-in evaluation filters according to standards, IEC, CCIR, CCIR/ARM, DIN AUDIO and DIN NOISE.
- For various noise measurements, AVE (average value response), RMS (root mean square value response) or Q-PEAK (quasi-peak response) may be selected as desired.
- High sensitivity of  $10\mu\text{V}$  ( $-100\text{dBV}$ ) full scale assures measurement from  $-110\text{dBV}$  to  $+50\text{dBV}$  in 16 ranges, thus covering from MC cartridges to power amplifiers.
- The range setting, response and filter can be switched externally by remote control.
- The built-in sensitivity adjuster is suited for reference level setting for S/N measurement.
- Balanced and unbalanced inputs available.



## ● SPECIFICATIONS

### Measuring Range

<b>AVE, RMS:</b>	- 110 to +50dBV (0dBV = 1Vrms.) - 108 to +52dBm (0dBm = 0.775Vrms) 3 $\mu$ V to 300V - 100dB (10 $\mu$ V) to +50dB (300V), 16 ranges
<b>Q-PEAK:</b>	- 110 to +50dBV (0dBV = 1Vrms) - 98 to +52dBm (0dBm = 0.775Vrms) 10 $\mu$ V to 300V - 90dB (30 $\mu$ V) to +50dB (300V), 15 ranges

### Accuracy (without weighting at 1kHz)

<b>AVE, RMS:</b>	- 100dB range $\pm$ 1dB - 90dB to +50dB range: $\pm$ 0.3dB
<b>Q-PEAK:</b>	- 90dB range: $\pm$ 1dB - 80dB to +50dB range: $\pm$ 0.5dB

### Frequency Response (1kHz reference)

#### 600 $\Omega$ or 100k $\Omega$

##### Balanced

<b>AVE, RMS:</b>	20Hz to 20kHz within $\pm$ 0.3dB 10Hz to 50kHz within $\pm$ 1dB
<b>Q-PEAK:</b>	20Hz to 50kHz within $\pm$ 1dB

##### 1M $\Omega$ Unbalanced

<b>AVE:</b>	- 100dB to - 80dB range 20Hz to 20kHz within $\pm$ 0.3dB 10Hz to 50kHz within $\pm$ 1dB - 70dB to +50dB range 20Hz to 200kHz within $\pm$ 0.3dB 10Hz to 500kHz within $\pm$ 1dB
<b>RMS:</b>	- 100dB to - 80dB range 20Hz to 20kHz within $\pm$ 0.3dB 10Hz to 50kHz within $\pm$ 1dB - 70dB to +50dB range 20Hz to 100kHz within $\pm$ 0.3dB 10Hz to 200kHz within $\pm$ 1dB
<b>Q-PEAK:</b>	20Hz to 50kHz within $\pm$ 1dB

### Meter Responding

<b>AVE:</b>	Average value responding
<b>RMS:</b>	Effective value responding
<b>Q-PEAK:</b>	Quasi-peak value responding Scale calibrated with sine wave effective value

### Weighting Responding

<b>WIDE:</b>	Flat response without weighting
<b>IEC:</b>	Filter based on IEC179 (A Curve)
<b>CCIR:</b>	Filter based on CCIR standards
<b>CCIR/ARM:</b>	Filter based on CCIR/ARM
<b>DIN AUDIO:</b>	Filter for measuring audio signals based on DIN45405
<b>DIN NOISE:</b>	Filter for measuring noise levels based on DIN45405

**Sensitivity Controller:** 0 to -12dB continuously variable

### Input Characteristics

#### 600 $\Omega$ Balanced Input

<b>Input Impedance:</b>	600 $\Omega$ $\pm$ 10%
<b>Maximum Input Voltage:</b>	17V (DC+AC peak)
<b>Maximum Floating Voltage:</b>	$\pm$ 50V

#### 100k $\Omega$ Balanced Input

<b>Input Impedance:</b>	100k $\Omega$ $\pm$ 10%
<b>Maximum Input Voltage:</b>	- 10 to +50dB range 450V (DC+AC peak) - 100 to -20dB range, DC450V, AC 30Vrms

#### Maximum Floating Voltage:

$\pm$  50V

#### 1M $\Omega$ Unbalanced Input

<b>Input Impedance:</b>	1M $\Omega$ $\pm$ 10%, 55pF or less
<b>Maximum Input Voltage:</b>	- 10 to +50dB range, 450V (DC+AC peak) - 100 to -20dB range, DC 450V, AC 17Vrms

#### Maximum Floating Voltage:

$\pm$  50V

### AC Output Terminal

**Output Voltage:** 0.1Vrms  $\pm$  10% into open circuit at full scale indication

### Output Impedance:

600 $\Omega$

### Frequency Response

#### 600 $\Omega$ /100k $\Omega$ Balanced

**Input:** 10Hz to 50kHz  $\pm$  1dB

#### 1M $\Omega$ Unbalanced

**Input:** - 100 to - 80dB range  
10Hz to 50kHz  $\pm$  1dB  
- 70 to +50dB range  
10Hz to 200kHz  $\pm$  1dB

### DC Output Terminal

**Output Voltage:** +1V  $\pm$  10% into open circuit at full scale indication

### Output Impedance:

1k $\Omega$   $\pm$  10%

### Frequency Response

#### 600 $\Omega$ or 100k $\Omega$

##### Balanced Input

**AVE, RMS:** 10Hz to 50kHz  $\pm$  10%

**Q-PEAK:** 20Hz to 50kHz  $\pm$  10%

##### 1M $\Omega$ Balanced

#### Input:

**AVE, RMS:** - 100dB to - 80dB range

10Hz to 50kHz  $\pm$  10%

- 70dB to +50dB range

10Hz to 200kHz  $\pm$  10%

- 90dB to +50dB range

20Hz to 50kHz  $\pm$  10%

#### Q-PEAK:

### Remote Control:

Function: Range, Response, Weighting

Level: Negative logic, TTL

### Power Supply:

100, 120, 220, 240VAC, 50/60Hz 11VA

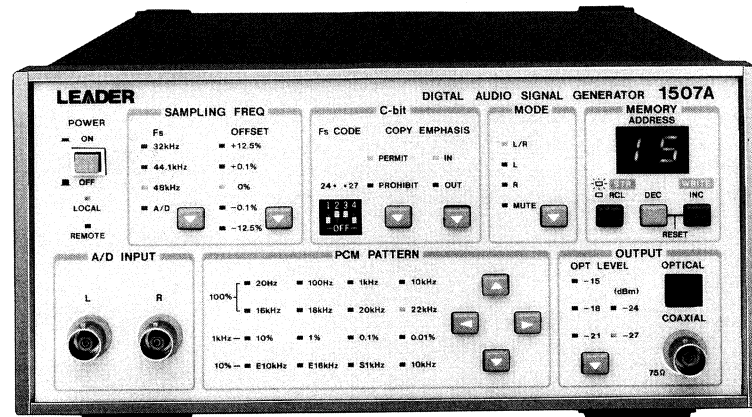
**Size & Weight:** 200(W)  $\times$  148(H)  $\times$  300(D)mm, 3.5kg

**Accessories:** BNC-clip cable ..... 1

Spare fuse ..... 1

## Signal Source for Digital Audio

**NEW**



### Model 1507A DIGITAL AUDIO SIGNAL GENERATOR

#### ● GENERAL

The Model 1507A is a digital audio signal generator according to digital audio interface format. A sampling frequency are 32.0kHz, 44.1kHz, 48.0kHz, that can be offsetting  $\pm 0.1\%$  or  $\pm 12.5\%$ .

Setting of the front panel can memory up to 16 steps, and recalled for use in a production line, as often as desired.

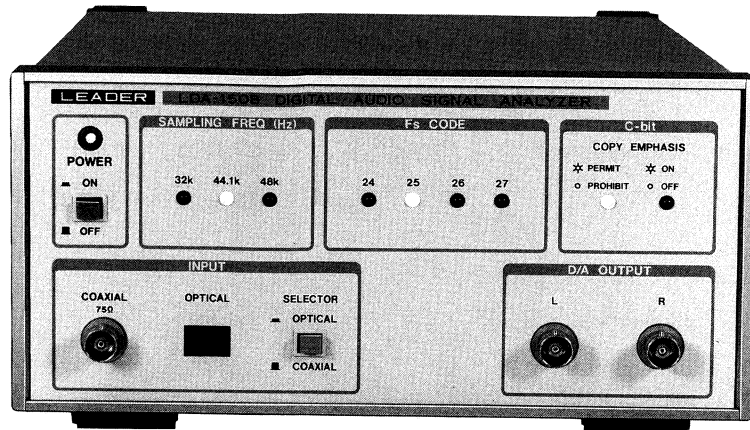
#### ● FEATURES

- A sampling frequency of 32kHz, 44.1kHz or 48kHz can be selected.
- An offset of  $\pm 12.5\%$  or  $\pm 0.1\%$  can be applied to the sampling frequency.
- 16-bit PCM data is obtained from two channels.
- The PCM data source can be selected from 16 types of built-in ROMs and external input.
- Of the channel status bits, copy, emphasis or FS code can be set.

#### ● SPECIFICATIONS

<b>Signal Format:</b>	Digital-audio interface format
<b>Sampling Frequency:</b>	32kHz, 44.1kHz, 48kHz
<b>Accuracy:</b>	Within 0.02% (with 0% offset)
<b>Offset:</b>	+ 12.5%, + 0.1%, 0%, - 0.1%, - 12.5%
<b>Data Patterns:</b>	100%: 20, 100Hz, 1, 10, 16, 18, 20, 22kHz 1kHz: 10, 1, 0.1, 0.01% 10%: 10kHz emphasis, 16kHz emphasis, 1kHz square wave, 10kHz non-emphasis
<b>Modes:</b>	L + R, L, R, MUTE
<b>A/D Input:</b>	Common to L and R Sampling frequency: 48kHz Within 2Vrms $\pm 10\%$
<b>Input Sensitivity:</b>	10k $\Omega$
<b>Input Impedance:</b>	20Hz to 15kHz, within $\pm 0.5$ dB
<b>Frequency Response:</b>	20Hz to 20kHz, within $\pm 1$ dB
<b>Distortion:</b>	0.01% or less (with input of 1kHz, 1.5Vrms)
<b>Channel Status Bits:</b>	FS code, copy, emphasis, etc.
<b>FS Code:</b>	Bits 24, 25, 26 and 27
<b>Offset OFF:</b>	As specified
<b>Offset ON:</b>	On-panel presetting
<b>Copy:</b>	0: PROHIBIT 1: PERMIT
<b>Emphasis:</b>	0: OFF 1: ON
<b>Others:</b>	0: OFF 1: ON
<b>Optical Level Accuracy:</b>	- 15dBm: within + 0.5dB or - 1.5dB - 18, - 21, - 24, - 27dBm: within $\pm 1$ dB Environmental conditions for guaranteed accuracy: Temperature: 23°C $\pm 5$ °C
<b>Output Connector:</b>	Electrical signals: 75 $\Omega$ coaxial cable Optical signals: TOSLINK, TOTX174
<b>Memory:</b>	16-step, panel-programmable parameters
<b>Remote Control:</b>	Memory address control, TTL level
<b>External Clock:</b>	Input connector on rear panel
<b>Frequency Range:</b>	6.9632 to 14.1312MHz, 256Fs
<b>Input Level:</b>	0.5 to 5Vp-p
<b>Input Impedance:</b>	10k $\Omega$
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, 18VA
<b>Size and Weight:</b>	213 (W) $\times$ 99(H) $\times$ 300(D) mm, 3.1kg
<b>Accessories:</b>	Optical cable (TOCP155P) ..... BNC-pin plug cable ..... Spare fuse .....

## Checking of Output for Digital Audio



### LDA-1508 DIGITAL AUDIO SIGNAL ANALYZER

#### ● GENERAL

The LDA-1508, a digital audio analyzer, provides standard sampling frequencies of 32kHz, 44.1kHz and 48kHz. It outputs analog audio data by using the 2-channel, 16-bit D-A converter. Besides, it displays contents of channel status bits (Fs CODE, copy and emphasis). With a 75-Ω coaxial connector and optical interface provided, this analyzer is adaptable to audio systems of different manufacturers. It is optimized for checking digital outputs from CD players and DAT decks.

#### ● FEATURES

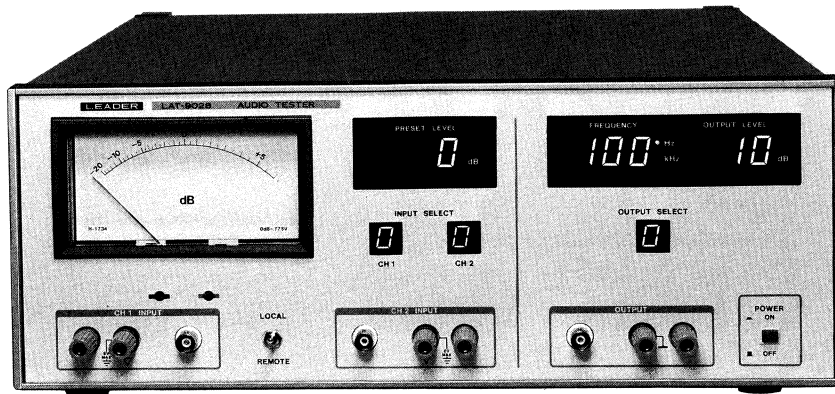
- A sampling frequency of 32kHz, 44.1kHz or 48kHz can be selected.
- Of the channel status bits Fs, CODE, copy or emphasis can be displayed on the panel.
- Audio data is analog-output by the two-channel, 16-bit D/A converter.
- The sampling frequency, Fs, CODE, and C-bit lamps go off when the internal PLL is not locked to digital signals.

#### ● SPECIFICATIONS

<b>Signal Format:</b>	Digital-audio interface format
<b>Sampling Frequency:</b>	32kHz, 44.1kHz, 48kHz
<b>Channel Status Bits:</b>	Fs code (bits 24, 25, 26 and 27) 32kHz, 44.1kHz, 48kHz lamp indications available Other frequencies: Bit sequence lamp indications
<b>Copy:</b>	ON: PERMIT OFF: PROHIBIT
<b>Emphasis:</b>	ON: ON OFF: OFF
<b>D/A Output:</b>	(Common to L and R channels)
<b>Output Voltage:</b>	2Vrms
<b>Input Connector:</b>	Electrical signals: 75Ω coaxial cable Optical signals: TOSLINK, TORX172
<b>Data Output:</b>	(Fs code, copy, emphasis)
<b>Logic:</b>	Negative logic
<b>Size and Weight:</b>	213(W) × 99(H) × 300(D)mm, 3kg
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, 15VA
<b>Accessories:</b>	Optical cable (TOCP172) ..... 1 BNC-pin plug cable ..... 1

# AUDIO

## Eight Spots Oscillator, Input/Output Selector, Indicating Voltmeter



### LAT-9028 PROGRAMMABLE AUDIO TESTER

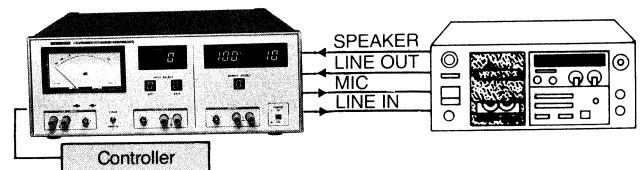
#### ● GENERAL

The LAT-9028 Audio Tester consists of an 8-spot oscillator, a dual-channel 0dB-indicating voltmeter, and 10-channel selectors for input and output levels; the tester is a general inspection instrument used for the adjusting and checking of audio equipment. The settings of the voltmeter level range and oscillating frequency level in each section of the tester shall be controlled by an external controller.

#### ● FEATURES

- Using a tuning level of 0dB, the LAT-9028 allows servicemen to complete audio equipment adjustments by simply setting the meter to 0dB. Adjustments can also be made even if there are many adjustment points. For inspection applications, the evaluation standard of 0dB enables quick visual recognition of the acceptability of audio equipment.
- Up to 20 test points (10 points × 2CH) can be selected for input to the voltmeter. Up to 10 input terminals of the device under test can also be selected for connection to oscillator output. This function make the LAT-9028 a powerful tool for testing boards many test points.
- The LAT-9028 contains a diode matrix frequency selector (100Hz to 20kHz CR oscillator) and a 15.62kHz (PAL) crystal oscillator for adjusting audio traps of VCR board.
- The ground is isolated by photocouplers to prevent interference between channels and between the voltmeter and oscillator. A common control ground is used.
- Negative logic of the voltmeter and oscillator simplify their control using relay or switch contact signals or by using open collector transistor output.

#### Tape recorder adjustment

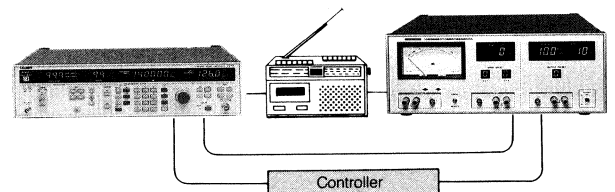


#### Measurement items

1. Output level
2. Recording and playback frequency characteristics (6 points)
3. S/N ratio
4. Playback frequency characteris-

5. Azimuth adjustment (measured using test tapes)
6. Dolby level adjustment
7. Bias level adjustment
8. Maximum output

#### Radio inspection



#### Measurement items

1. Usable sensitivity
2. Output level
3. L and R level difference
4. S/N ratio

5. Frequency characteristics (6 points)
6. Separation
7. Maximum output

## ● SPECIFICATIONS

### 8-Spots Oscillator

Oscillating Frequency  
LO OSC:

10Hz to 850Hz (in step of 10Hz), 2 spots selected in this range

HI OSC:

1kHz to 23kHz (in step of 1kHz), 4 spots selected in this range

Xtal OSC:

15.625kHz, 15.734kHz, 2 spots fixed  
The frequency values are preset by built-in diode-matrix board

Frequency Accuracy:

Total of 8 spots  
100Hz to 15kHz within  $\pm 2\%$   
15.625kHz (PAL),

Distortion Factor:

15.734kHz (NTSC): 0.001% (crystal)  
1kHz to 10kHz: 0.05%  
10Hz to 15kHz: 0.5%

Frequency Display:

Frequency Control:

By 7-segment LEDs in 3 digits  
Section

No.	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	
0	0	0	0	L01 (100Hz)
1	0	0	1	L02 (400Hz)
2	0	1	0	HI1 (1kHz)
3	0	1	1	HI2 (5kHz)
4	1	0	0	HI3 (10kHz)
5	1	0	1	HI4 (15kHz)
6	1	1	0	15.625kHz } Xtal
7	1	1	1	15.734kHz }

Figures in parentheses are the examples for settings.

Logic for control Active LOW

Output Voltage:

Setting Accuracy:

Output Impedance:

Output Level Display:

Output Level Control:

–89dB to +10dB (0dB = 0.775V), 1dB step  
Within  $\pm 1\%$  around set value at 1kHz

25 $\Omega$

+10 to –89dB (0dB = 0.775V)

This is set by applying attenuation amounts and displayed as the output levels.  
Logic for control Active LOW 8 bits

Output Selector

Number of Channels:

10 channels

Connectors:

34P

Display:

LED 1 digit

Control:

Set by using BCD codes from 1 to 10.  
Logic for control: Active LOW 4 bits

Dual-Channel

0dB-Indicating Voltmeter

Measurement Level

Range:

–89 to +36dB (0dB = 0.775V)

Preset Range:

–69 to +30dB (0dB = 0.775V)

Indication Accuracy:

$\pm 0.2$ dB (at 400Hz or 1kHz)

Frequency Characteristics:

5Hz to 500kHz, within  $\pm 10\%$   
10Hz to 100kHz, within  $\pm 3\%$   
20Hz to 50kHz, within  $\pm 2\%$   
(1kHz reference)

Input Impedance:

1M $\Omega$

Monitor:

0.5Vrms at 0dB indication

Frequency Characteristics:

10Hz to 50kHz –3dB

Output Impedance:

600 $\Omega$   $\pm 20\%$

Display (preset level):

Decimal 2 digits within –90 to +39dB

Control:

Logic for control: Active LOW 8 bits

Input Selector

Number of Channels:

CH1 10 channels, CH2 10 channels

Connector:

34P

LED Display:

CH1, one digit, CH2 one digit

Control:

Two settings by using BCD codes from 1 to 10.

Logic for control: Active LOW 8 bits

Power Supply:

Size and Weight:

Accessories:

100,120, 200, 220, 240VAC, 50/60Hz

400(W)  $\times$  148(H)  $\times$  400(D)mm, 7.5kg

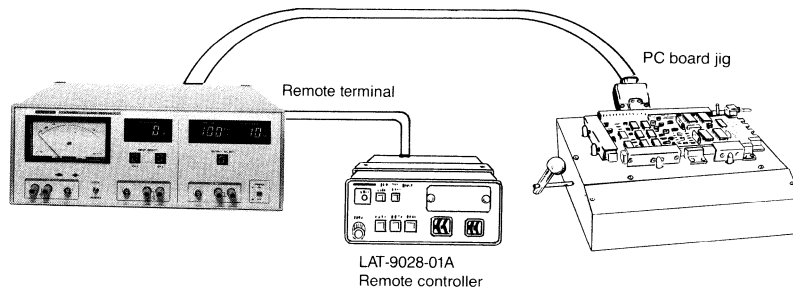
Connectors for input/output

on the rear panel ..... 3

Plug for remote control (DDK 57-3036) ..... 1

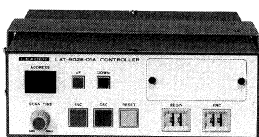
Spare fuse ..... 1

- The LAT-9028 can be conveniently coupled with jigs or tools used to adjust and inspect boards having many contacts.



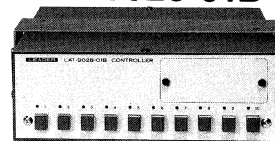
## CONTROLLER (For LAT-9028)

### LAT-9028-01A



The auto-incrementing function simplifies the testing of boards with many test points.

### LAT-9028-01B



Pushbuttons are used to select test points for convenience in repeated adjustments.

### ■ SPECIFICATIONS

[LAT-9028-01A Incrementing Type]

Steps:

Up to 100

Start/end Addressing:

Thumb-wheel switch

Key Operations:

INC: Increments the step by 1.

DEC: Decrements the step by 1.

UP: Automatically increments the step at the scan time.

Down: Automatically decrements the step at the scan time.

Scan Time:

0.1 to 10 seconds

[LAT-9028-01B Pushbutton Type]

Steps:

10 Keys with LED indicators

[Common to both the LAT-9028-01A and the LAT-9028-01B]

Memory:

EPROM 2732 type (4K bytes)

Control of

Other Instruments:

FM-AM standard signal sources

Model 3215, 3216

Power Supply:

Supplied from the LAT-9028

Accessories:

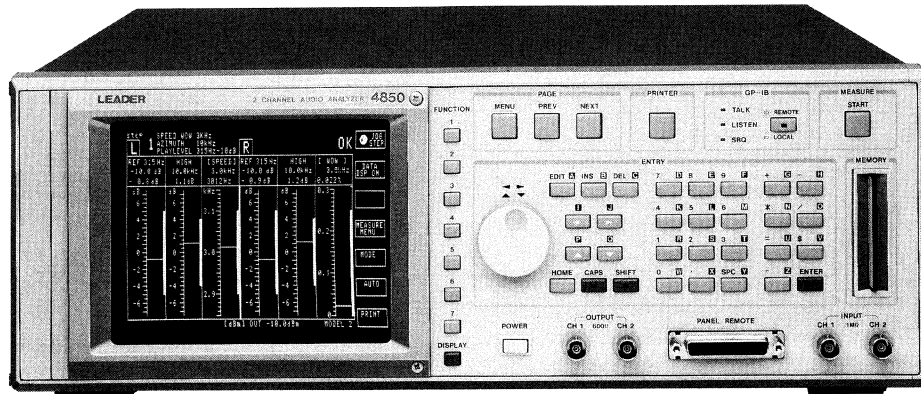
36P-36P Amphenol cable, 2m ..... 1

EPROM 2732 (mounted on the panel) ..... 1

# AUDIO

## Simultaneous Multiple Inspections Provide Dramatic Savings.

### NEW



## Model 4850 2CH AUDIO ANALYZER

### • GENERAL

The Model 4850 is a 2-channel audio analyzer which provides, in a single compact package, the voltmeter, oscillator, frequency counter, and input/output selector functions and comparators required in adjustment and inspection of VCRs, cassette decks and other audio equipment.

Measurement conditions and GO/NO GO criteria are programmed onto an IC card (20 sets per model, total of 8 models programmable). Measured values are displayed on six meters on a CRT screen, and a GO/NO GO function can be used to perform multiple adjustments and inspections simultaneously. The ability to change DUT model quickly is extremely valuable in small-lot production testing.

### • FEATURES

#### [Measurements]

- Measured values are displayed on both analog (meter) form on the CRT and as digital values. The analog display can be used in production-line adjustments. The CRT display eliminates operator-caused errors.
- The simultaneous display of six meters (3 × 2 channels) enhances adjustment and inspection speed. For example, by using the test tape reference frequency (315Hz), high-range frequency (10Hz), and wow and flutter measurement frequency (3Hz) on a mixing tape, it is possible to perform simultaneous measurement of the reference-frequency level, high-range frequency response, tape speed, and wow and flutter.
- The voltmeter provides a relative-value display, convenient for adjustments (with a setting value set to 0dB for the meter), and it is possible to select absolute-value display for such measurements as output level and S/N ratio.
- Frequency response measurements use the 3-signal mixing method. The reference frequency level and high- and low-range frequency response are instantly displayed. This is a highly effective method of performing recording and playback testing of cassette decks.

- The CRT meter display provides a bar-graph indication of the set "go" range, thereby enabling quick adjustments and inspection.
- For level measurement, the units can be selected as dBm (0dB = 0.775V) or dBV (0dB = 1V).
- The frequency counter uses a high-speed measurement technique which provides real-time measurements, a convenience in making tape-speed adjustments.
- The use of a direct digitally synthesized oscillator provides improved frequency accuracy, making the Model 4850 suitable for use in applications such as VCR trap adjustments that require high frequency accuracy.

#### [Operational Features]

- Measurement items, measurement conditions, and GO/NO GO limits are programmable on IC card (with the aid of a screen editor).
- An IC card can hold up to 20 steps for each model and can contain data for up to 8 models.
- A remote controller can be used to specify the measurements steps, increments, and decrement operations.
- After completion of a measurement, the measurement results can be printed out for use in quality control.
- A video output facilitates generation of a CRT screen hardcopy and can also be connected to an external monitor.
- DUT operational instructions (e.g., cassette deck PLAY, DOLBY ON/OFF, and tape position) are displayed on the CRT, thereby eliminating operator errors.



## Single Instrument Includes Signal Generator, Measurement Section, and Comparators.

### ● SPECIFICATIONS

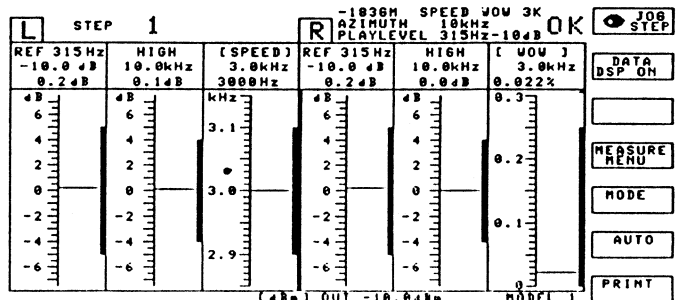
<b>2-Channel Voltmeter</b>	
Measurement Level	
Range:	-75dB to +20dB REF: -35dB to +25dB (frequency response reference level)
<b>Meter Measured Value</b>	
Display:	-7.5 to +7.5dB, in 0.1dB steps
Display Method:	0dB reference (setting value converted to 0dB)
<b>dB Units:</b> 0dB = 0.775V (dBm) or 0dB = 1.0V (dBV)	
Frequency Response:	MV: 20Hz to 200kHz, ±0.2dB REF: 200Hz to 4kHz LOW: 40Hz to 400Hz HI: 2kHz to 20kHz
<b>S/N Measurement Filter:</b> JIS-A filter	
Measurement Accuracy:	±0.2dB, 315Hz reference
Input Impedance:	1MΩ
Input Connector:	Front and rear panels (10 channels × 2, input selector)
Monitor Outputs:	LOW, REF, HIGH (MV) 1Vrms for 0dB indication (dBV) 0.775Vrms for 0dB indication (dBm)
<b>2-Channel Distortion Meter</b>	
Measurement Frequency:	315Hz
Measurement Method:	Highpass
Distortion Range:	0.3% full scale
<b>Oscillator</b>	
<b>Reference Frequency Oscillator (REF)</b>	
Oscillation Frequency:	315Hz, 400Hz, 1kHz
Output Level:	1V max.
<b>LOW Oscillator</b>	
Oscillation Frequency Range:	10Hz to 10kHz
Oscillation Method:	Digital synthesizer
Frequency Setting:	1Hz steps
Frequency Accuracy:	±0.01%
Output Level:	1V max.
<b>HIGH Oscillator</b>	
Oscillation Frequency Range:	10Hz to 200kHz
Oscillation Method:	Digital synthesizer
Frequency Setting:	1Hz steps
Frequency Accuracy:	±0.01
Output Level:	1V max.
<b>Oscillator Output Section</b>	
Output Level Range:	0 to -99.9dB, in 0.1dB steps
Output Level Setting:	Absolute value setting, dBm, or dBV
Output Impedance:	600Ω (600Ω termination resistance, switchable on/off)
Output Selector:	Channel 1 (L) only, Channel 2 (R) only, and Channels 1 and 2 simultaneous output
<b>Input Selector</b>	
Number of Channels:	10 channels, channel 1 (L) 10 channels, channel 2 (R)
Switching Method:	Relay
<b>Output Selector</b>	
Number of Channels:	10
Switching Method:	Relay
<b>DC Voltmeter</b>	
Number of Channels:	2
Measurement Voltage:	3V max., in 1mV steps (maximum 3.000 display)
<b>Frequency Counter</b>	
Measurement Frequency Range:	200Hz to 10kHz
Reference Frequency Accuracy:	±1 × 10 <sup>-4</sup>
Measurement Method:	High-speed measurement method (1/T calculated after frequency measurement)
Units:	Hz
<b>Wow and Flutter Measurement:</b>	
Measurement:	Wow and flutter display of DC output from LFM-3615 or 3616
Full Scale:	0.3%
<b>DC Voltmeter</b>	
Number of channels:	2
Measurement Voltage:	30V max., in 0.1mV steps
<b>A/D Converter</b>	
Number of Bits:	12

### Measurement Conditions Settings

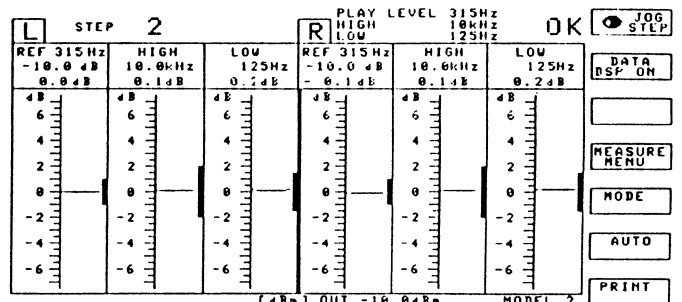
Number of Simultaneously Displayed Measured Values:	6 (3 × 2 channels, in single steps)
Number of Measured Items:	20 steps max. (for each model)
Memory:	Memory card
Capacity:	32 K bytes (for 8 models)
<b>Environmental Conditions (for guaranteed accuracy):</b> Temperature 10 to 40°C	
Power Supply:	100, 120, 220, 240VAC, 50/60Hz
Size and Weight:	430(W) × 150(H) × 400(D)mm

### ■ Measurement Screen Example

- Reference level, high frequency response, tape speed, wow and flutter.



- 3-signal mixed frequency response (REF, HIGH, LOW)



### ■ Measurement System Configuration

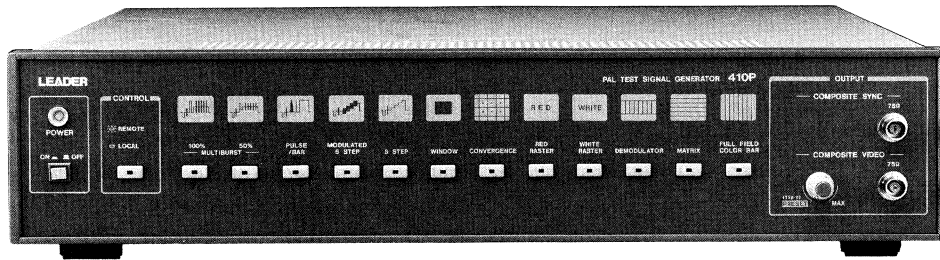
- 2-channel voltmeter
- 2-channel distortion meter.
- Reference frequency oscillator
- LOW oscillator
- HIGH oscillator
- Dual 10-channel input selector
- 10-channel output selector
- DC voltmeter
- High-accuracy DC voltmeter (optional)
- High-speed frequency counter

### ■ Measured Items

- 1) Level measurement
- 2) Frequency measurement (Tape speed)
- 3) DC voltage measurement
- 4) Three-signal mixing frequency characteristics
- 5) Wow and flutter measurement
- 6) S/N by JIS-A filter measurement
- 7) Distortion measurement
- 8) Channel balance

## Generating Precise Digital Test Signals

Black burst signal can be output simultaneously.



### Model 410P PAL TEST SIGNAL GENERATOR

#### ● GENERAL

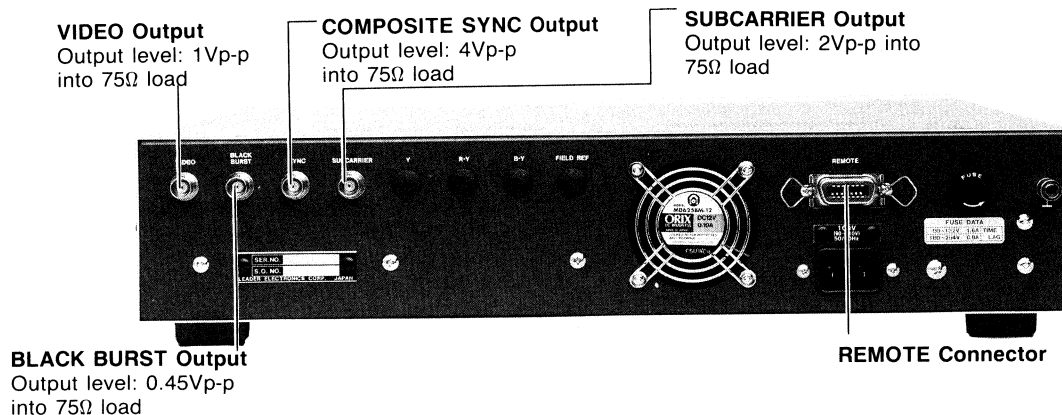
Various PAL test signals generate with 10-bit D/A converter. Digital waveform generation ensures accurate and stable signals. The test signals include color bar, multiburst, pulse & bar, and modulated staircase signals.

Moreover, this model has independent built-in black burst output. Capable of measuring video band frequency responses, DG (differential gain), and DP (differential phase), the Model 410P is ideally suited for use as a reference signal generator in such video-related fields as video research, production, and servicing.

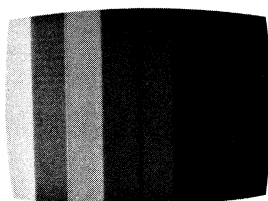
#### ● FEATURES

- The synchronous signals and waveforms are all applicable to the broadcasting standard CCIR. Accurate SCH phases are also ensured.
- Video output sync output, and subcarrier output are also provided.
- Black burst output using digital system is provided.
- Applicable for systemization.

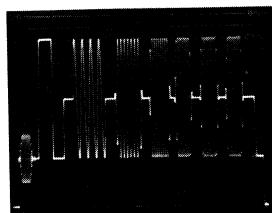
#### ■ Model 410P Rear Panel



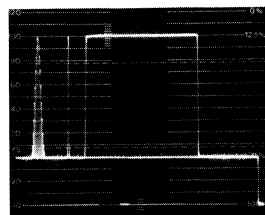
#### ■ Test Signal and Monitor Waveforms



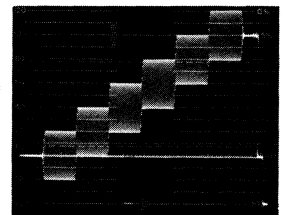
Full-field color bar



Multiburst



Pulse & bar



Modulated staircase

★ The Model 410C, NTSC system is also available.

## • SPECIFICATIONS

### Composite Video Output

System:	PAL
Number of Scanning Lines:	625, interlace
Field Frequency:	50Hz
Line Frequency:	15.625kHz
Subcarrier Frequency:	4.43361875MHz $\pm$ 15Hz (0°C to 40°C)
Full Amplitude:	1V $\pm$ 20mVp-p (75 $\Omega$ load)
Output Impedance:	75 $\Omega$
Number of Outputs:	2 (front and rear panels)

### Sync and Burst Signals

Sync Signal	
Amplitude:	300mV $\pm$ 6mV (2%)
Blanking Level:	0 $\pm$ 10mV
Rise/Fall Times:	200ns $\pm$ 100ns
Horizontal Sync Pulse Width:	4.7 $\mu$ s $\pm$ 200ns
Vertical Sync Pulse Width:	2.5H
Equalizing Pulse Width:	2.35 $\mu$ s $\pm$ 100ns
Vertical Serration Width:	4.7 $\mu$ s $\pm$ 200ns
Vertical Blanking Period:	25H

### Burst Signal

Amplitude:	300mV $\pm$ 9mVp-p (3%)
Number of Cycles:	10
Rise/Fall Times:	350ns $\pm$ 50ns
SCH Phase:	20 degrees or less

### Test Signals

#### Multiburst 100% (1% = 7mV)

Reference Bar Amplitude:	100% $\pm$ 2%
Reference Bar Rise/Fall Times:	250ns $\pm$ 20ns
Multiburst Amplitude:	100% $\pm$ 2%
Pedestal Level:	50% $\pm$ 1%
Harmonic Components:	-40dB or less
Frequency:	
0.5MHz:	100% $\pm$ 2%
1.0MHz:	100% $\pm$ 2%
2.0MHz:	100% $\pm$ 2%
4.0MHz:	100% $\pm$ 2%
4.8MHz:	100% $\pm$ 3%
5.8MHz:	100% $\pm$ 5%

#### Multiburst 50%

Reference Bar Amplitude:	50% $\pm$ 1%
Reference Bar Rise/Fall Times:	250ns $\pm$ 20ns
Pedestal Level:	50% $\pm$ 1%
Frequency:	Same as multiburst 100%

### Pulse/Bar

2T Pulse	
Pulse/Bar Ratio:	100% $\pm$ 2%
Half Amplitude Width:	200ns $\pm$ 20ns
Ringing:	14mVp-p or less

#### Modulated 20T Pulse

Pulse/Bar Ratio:	100% $\pm$ 2%
Half Amplitude Width:	2 $\mu$ s $\pm$ 200ns
Y/C Delay Time Difference:	10ns or less
Y/C Amplitude Difference:	2% or less

#### 2T Bar

Amplitude:	100% $\pm$ 2%
Rise/Fall Times:	190ns $\pm$ 20ns

### Modulated 5-step

Luminance Amplitude:	100% $\pm$ 2%
Luminance Rise/Fall Times:	250ns $\pm$ 20ns
Linearity:	1% or less
Chrominance Amplitude:	280mV $\pm$ 14mV
Chrominance Phase:	180° $\pm$ 1°
Chrominance Rise/Fall Times:	400ns $\pm$ 40ns
DG:	1% or less (at ambient temp. of 25 $\pm$ 10°C)
DP:	1° or less (at ambient temp. or 25 $\pm$ 10°C)

### 5-step

Luminance Amplitude:	100% $\pm$ 2%
Luminance Rise/Fall Times:	250ns $\pm$ 20ns
Linearity:	1% or less

### Window

Bar Amplitude:	100% $\pm$ 2%
Bar Rise/Fall Times:	190ns $\pm$ 20ns (2T bar)
Bar Size:	
Lines:	32 $\mu$ s + 0.1 $\mu$ s (0.5H)
Fields:	156 lines (0.5V)

### Convergence

Peak Amplitude:	75% $\pm$ 2%
Number of Vertical Lines:	19
Vertical Line Pulse Half-Amplitude Width:	200ns $\pm$ 20ns
Number of Horizontal Lines:	15
Horizontal Line Rise/Fall Times:	130ns $\pm$ 10ns
Horizontal Line Width:	2 lines (1 frame)
Number of Dots:	18 $\times$ 14
Dot Pulse Half-Amplitude Width:	200ns $\pm$ 30ns
Dot Pulse Vertical Width:	3 lines (1 frame)

### Red Raster

Luminance Amplitude:	28.31% $\pm$ 2%
Chrominance Amplitude:	88.21% $\pm$ 2%
Chrominance Phase:	103.4 $\pm$ 1%
Luminance Rise/Fall Times:	150ns $\pm$ 10ns
Chrominance Rise/Fall Times:	400ns $\pm$ 40ns

### White Raster

Amplitude:	100% $\pm$ 2%
Rise/Fall Times:	115ns $\pm$ 10ns

### MATRIX

Patterns:	WHITE, MODULATED 5-STEP, COLOR BAR, MULTIBURST (100%) DEMODULATOR, PULSE BAR
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### DEMODULATOR

Chroma Phase	
n Lines:	R-Y, -(R-Y), B-Y, -(B-Y), R-Y, -(R-Y), B-Y, -(B-Y)
n + 1 Lines:	R-Y, -(R-Y), B-Y, -(B-Y), -(R-Y), R-Y, -(B-Y), B-Y
Chroma Amplitude:	300mVp-p $\pm$ 6mVp-p
Luminance Level:	350mVp-p $\pm$ 6mVp-p

### Full-Field Color Bars (EBU Color Bars)

Specifications:	Eight color bars (including 100% black and white)
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Luminance Amplitude Accuracy:	$\pm$ 2% or less
Chrominance Amplitude Accuracy:	$\pm$ 2% or less
Chrominance Phase Accuracy:	$\pm$ 1° or less
Luminance Rise/Fall Times:	115ns $\pm$ 10ns
Chrominance Rise/Fall Times:	350ns $\pm$ 40ns
Y/C Delay Time Difference:	20ns or less

### Composite Sync Output

Output Impedance:	75 $\Omega$
Output Amplitude:	4Vp-p $\pm$ 5% into 75 $\Omega$
Polarity:	Negative
Rise/Fall Times:	200ns $\pm$ 30ns
Number of Outputs:	1 at front panel

### Subcarrier Output

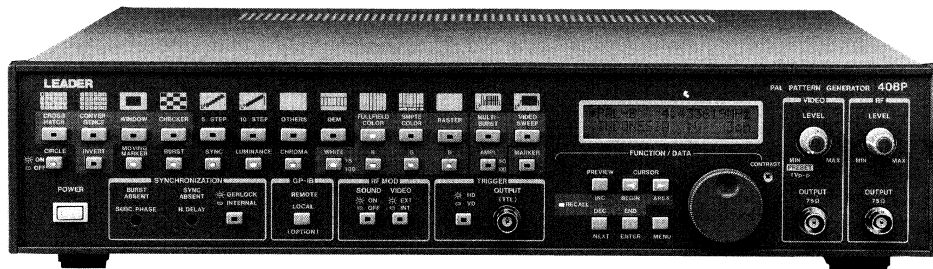
Output Impedance:	75 $\Omega$
Output Amplitude:	2Vp-p $\pm$ 0.2V into 75 $\Omega$
Frequency:	4.43361875MHz $\pm$ 15Hz
Number of Outputs:	1 at rear panel

### Power Supply:

Size and Weight:	100, 120, 220, 240VAC $\pm$ 10%, 50/60Hz 55VA
Accessories:	426(W) $\times$ 88(H) $\times$ 400(D)mm, 6.5kg
	BNC-BNC cable 1m ..... 1
	Spare fuse (time lag) ..... 1

## 13 Patterns, Built in Video Sweep and Multiburst

**NEW**



### Model 408P PAL PATTERN GENERATOR



#### ● GENERAL

The Model 408P is universal pattern generator that can provide various types of patterns. The video sweep and multiburst signal functions are used to check the frequency characteristics of video equipment.

The GENLOCK and black burst functions also facilitate pattern generator use as a sync signal source for various types of video equipment.

In addition, the all-channel, synthesized RF output function enables generator use to adjust and check TV and VTR with TV-band tuners. The frequency can be set directly from the panel or the applicable country, band, and channel (VHF, UHF, or CATV) can be selected from internal data.

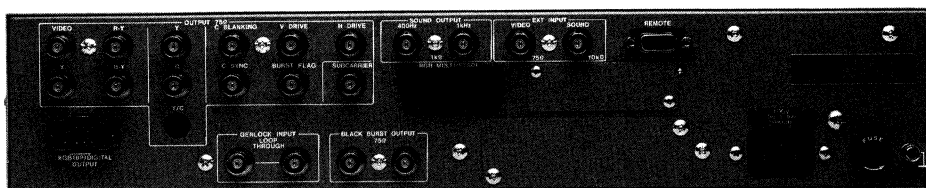
★ The Model 408 NTSC system is also available.

#### ● FEATURES

- The video sweep frequency can be selected from 100kHz to 15MHz in two bands. There are six markers in band 1 and seven markers in band 2. The markers can be turned on and off at the same time.
- The GENLOCK function enables generator synchronization with another pattern generator.

- The sync, burst, luminance, and chrominance, levels can be changed independently.
- There are 13 basic patterns including SMPTE color bar and convergence patterns. The luminance, chrominance, and RGB signals can be turned on and off, and the circle pattern and moving marker synthesizing functions can be used with the basic pattern functions to generate various patterns.
- The signal generator can separately output such video signals as composite video, RF, and black burst signals, and such sync signals as HD, VD, and composite sync signals.
- The RF output covers all VHF, UHF, and CATV channels and includes most of the necessary broadcast channel data.
- Sound modulation of 400Hz or 1kHz can be applied to RF output. The 400Hz and 1kHz audio outputs are used to check sound system.
- The RF signal can modulate internal with patterns and sound signals, as well as external video and sound signals.
- The 8-pin digital RGB, 21-pin RGB multi, and YC (S terminal) are provided as standard.
- Up to 100 types of panel setting can be stored in memory and the memory recall area can be specified. (Memory with battery backup)
- The remote function provides memory address control
- The GPIB interface is option (Factory option)

#### ■ Rear Panel



## ● SPECIFICATIONS

<b>Color Systems:</b>	PAL-B, C, D, G, H, I, K, and L
<b>Crosshatch:</b>	White lines 75%, 15(V) × 11(H) on black background and white (75%) corner marker at upper-left corner of the screen
<b>Convergence:</b>	White lines 15(V) × 11(H) on black background and white dots 14(V) × 10(H)
<b>Window:</b>	White (100%) window on black background
<b>Checker:</b>	8(V) × 6(H) white (100%) and black checker pattern
<b>5-step:</b>	Staircase luminance signal consisting of five uniform steps 40% 280mVp-p modulation on/off (Chroma on/off selection)
<b>10-step:</b>	Staircase luminance signal consisting of ten uniform steps 40% 280mVp-p modulation on/off (Chroma on/off selection)
<b>Others:</b>	Several internal patterns sequentially selectable
<b>DEM</b>	
<b>Chroma Phase:</b>	Upper and lower half of screen
<b>n Lines:</b>	R-Y, -(R-Y), B-Y, -(B-Y), R-Y, -(R-Y), B-Y, and -(B-Y)
<b>n + 1 Lines:</b>	-(R-Y), R-Y, B-Y, -(B-Y), R-Y, -(R-Y), -(B-Y) and B-Y
<b>Full-field Color Bars:</b>	75%-amplitude and 100%-saturation eight colors (EBU color bars) Conforms to SMPTE ECR standard 1-1978.
<b>SMPTE Color Bars:</b>	Eight colors in RGB combinations
<b>Raster:</b>	Six-frequency 100% or 50% multiburst signal
<b>Multiburst:</b>	0.5, 1.0, 2.0, 4.0, 4.8, and 5.8MHz
<b>Frequencies:</b>	Video sweep I or II selectable
<b>Video Sweep:</b>	
<b>Sweep Frequency Range:</b>	I: 100kHz to 5MHz II: 300kHz to 15MHz
<b>Sweep Time:</b>	Synchronous with field scan
<b>Amplitude:</b>	100% or 50%
<b>Marker:</b>	I: 0.5, 1.0, 2.0, 3.0, 4.0 and 5.0MHz II: 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, and 14.0MHz
<b>Sync Signal</b>	
<b>No. of Scan Lines:</b>	625 lines, interlaced scanning
<b>Line Frequency:</b>	15.625kHz
<b>Field Frequency:</b>	50Hz
<b>Mode Control</b>	
<b>White:</b>	Color and raster white level selection (75% or 100%)
<b>Red:</b>	Color bar and raster red on/off
<b>Green:</b>	Color bar and raster green on/off
<b>Blue:</b>	Color bar and raster blue on/off
<b>Burst:</b>	Burst signal on/off
<b>Sync:</b>	Sync signal on/off
<b>Luminance:</b>	Luminance signal on/off
<b>Chrominance:</b>	Chrominance signal on/off
<b>Invert:</b>	Black-and-white inversion of crosshatch, convergence, window, and checker patterns and circle synthesis for all patterns
<b>Moving Marker:</b>	Synthesis of moving markers for all patterns
<b>Amplitude Preset:</b>	Independent sync. burst, luminance, and chrominance signal level settings 0 to 200% (300mV=100%) 0 to 200% (300mV=100%) 0 to 120% (700mV=100%) 0 to 120% (664mV=100%)
<b>RF Output:</b>	
<b>Frequency Range:</b>	Synthesizer type 30 to 900MHz in 10kHz steps
<b>Δf in CH Mode:</b>	-9.99 to +9.99MHz in 10kHz steps
<b>Output Voltage:</b>	0.1 to 10mV (continuously variable)
<b>Output Impedance:</b>	75Ω
<b>Modulation Polarity:</b>	Positive or negative (automatic selection by color system) ON/OFF
<b>Sound:</b>	
<b>System:</b>	AM or FM modulation (automatic selection by color system)
<b>Frequency:</b>	5.5, 6.0 or 6.5MHz (automatic selection by color system)
<b>Modulation Signal:</b>	400Hz, 1kHz, or external input
<b>Y/C Output</b>	
<b>Voltage:</b>	1Vp-p (Y) or 0.3Vp-p (C) into 75Ω
<b>Output Impedance:</b>	75Ω
<b>Output Connector:</b>	Two systems: Round miniature connector (S terminal) and BNC connector (Y and C output)

<b>Digital RGB-Output</b>	
<b>Output Level:</b>	TTL level (Fan-out 1)
<b>Output Connector:</b>	Square 8-pin connector
<b>RGB multiple Output</b>	
<b>Output Configuration:</b>	Video, RGB, sound Ys, and slow switch
<b>Output Level (Impedance)</b>	
<b>Video:</b>	1Vp-p into 75Ω
<b>RGB:</b>	0.7Vp-p into 75Ω
<b>Sound:</b>	0.5Vrms into 1kΩ
<b>Ys and Ym:</b>	L (0 to 0.4V) and H (1 to 3V) into 75Ω
<b>Slow Switch:</b>	L (0 to 2V) and H (10 to 12V), open circuit (10kΩ)
<b>Output Connector:</b>	21-pin connector (21-pin EIAJ)

### Output Connector (excluding RF)

Signal Name	No. of Output Terminals		Output Level	Output Impedance	Remarks
	Front	Rear			
Composite video	1	1	1Vp-p	75Ω	With output variable function
Black Burst	—	2	0.45Vp-p	75Ω	
Subcarrier*1	—	1	2Vp-p	75Ω	
Composite Sync	—	1	4Vp-p	75Ω	*2
Composite Blanking	—	1	4Vp-p	75Ω	*2
HD/VD	1	—	TTL	—	Switch selection
H. DRIVE	—	1	4Vp-p	75Ω	*2
V. DRIVE	—	1	4Vp-p	75Ω	*2
Burst Flag	—	1	4Vp-p	75Ω	*2
Sound	—	2	1Vp-p	1kΩ	400Hz and 1kHz (one terminal each)
Y	—	2	1Vp-p	75Ω	With sync function
R-Y	—	1	0.7Vp-p	75Ω	
B-Y	—	1	0.7Vp-p	75Ω	
C	—	1	0.3Vp-p for 408P	75Ω	

\*1: Subcarrier frequency:  
4.43361875MHz ±(2Hz optional)

\*2 The output level is from 0 to -4.0V. TTL output is also available (optional).

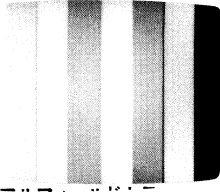
### Input

<b>EXT VIDEO</b>	
<b>Rated Input Voltage:</b>	1Vp-p into 75Ω
<b>Input Connector and Impedance:</b>	BNC connector, 75Ω
<b>GENLOCK</b>	
<b>Operating Input Range:</b>	300mV ±3dB sync signal
<b>Horizontal delay:</b>	Input signal ±2μs variable
<b>Subcarrier Lock</b>	
<b>Frequency Range:</b>	4.43361875MHz ±50Hz
<b>Subcarrier Phase:</b>	0° to 360° (continuously variable)
<b>Input connector:</b>	BNC connector, 75Ω loopthrough
<b>Program:</b>	Address control possible
<b>Address:</b>	0 to 99 (area specification possible)
<b>Contents:</b>	Pattern, mode, level, RF frequency, RF channel, and other items set from the panel (excluding of video and RF level)
<b>Power Supply:</b>	100, 120, 240VAC, 50/60Hz
<b>Size and Weight:</b>	426(W) × 88(H) × 400(D)mm, 10kg
<b>Accessories:</b>	BNC-BNC cable ..... 1 Spare fuse ..... 1

# VIDEO

## Patterns

### Color bar

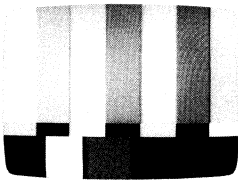


Provides the linearity of a transmission system and the amplitude/phase characteristics of color signal bands at a glance.

**Applications:**

- VTRs: Adjustment and inspection of auto-color controls, and FM modulators.
- TV: Adjustment and inspection of auto-color controls and chrominance circuitry.
- Video amplifiers: Inspection of linearity and amplitude/phase characteristics of color signal bands.

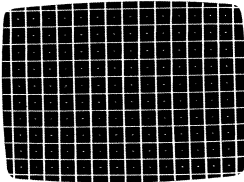
### Raster pattern



Eight colors can be displayed on the CRT depending on how the red, green and blue keys are combined.

- Adjustment and inspection of the purity of CRTs, particularly with a red raster showing a distinct picture of uneven color.

### Convergence pattern

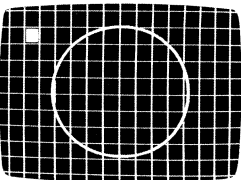


15(V) x 11(H) crosshatch with 14(H) x 10(V) dot pattern.

**Applications:**

- Still adjustment of the convergence of CRTs (includes TV and monitors). Positioning and amplitude adjustment of vertical and horizontal axis. Adjustment and inspection of focus.

### Crosshatch & circle

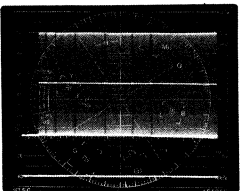


15(V) x 11(H) crosshatch with a circle and a corner marker. (Circles may be superposed with all patterns.)

**Applications:**

- Alignment of CRTs (includes displays and monitors) and inspection for screen distortion.
- The corner marker suited for a polarity checking of deflection yoke.

### Sweep pattern



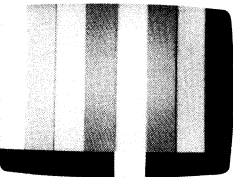
100 IRE

Video sweep pattern synchronized with 1V (one vertical field) locating the frequency position with six marker signal points.

**Application:**

- Adjustment and inspection of frequency characteristics of transmission systems like VTRs and TV.

### Color bar & moving marker

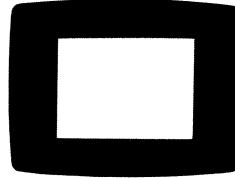


Moving marker may be superposed with all patterns.

**Application:**

- Tests for VTR recording and playback and LCD TV response characteristics.

### Window pattern

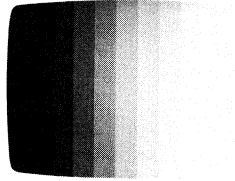


Pattern with a 100% white window in the center.

**Application:**

- Inspection of low- and middle-frequency characteristics of VTRs and TV.

### Staircase pattern

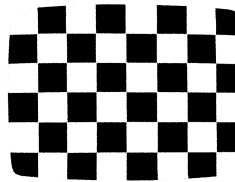


Luminance signal arranged in staircase at uniform steps. 40% chroma signal is superposed on this pattern.

**Applications:**

- Inspection of the linearity of a transmission system and the phase characteristics of color signal bands.
- Inspection of the intensity of color monitors.
- DP and DG measurements by vectorscope using a modulated staircase pattern.

### Checker

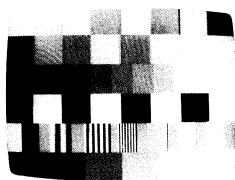


8 x 6 checker pattern.

**Application:**

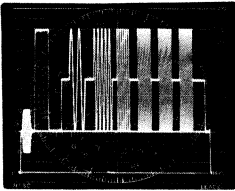
- Inspection of the linearity and distortion of vertical and horizontal lines.

### Others



Several internal patterns sequentially selectable. Matrix, centercross, reverse color bar, etc.

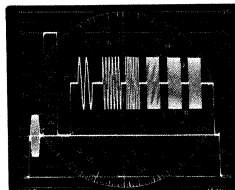
### Multiburst pattern



100% white reference signal and six burst signals of different frequencies in 1H (one horizontal field). The frequency of the last burst signal may be changed.

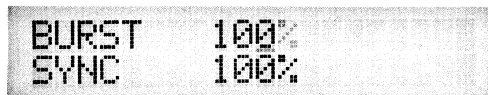
**Application:**

- Adjustment and inspection of frequency characteristics of transmission systems like VTRs and TV receivers. (Each burst signal frequency is fixed, and therefore, it is easier to monitor the characteristics.)



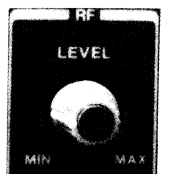
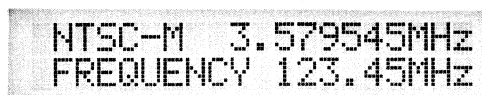
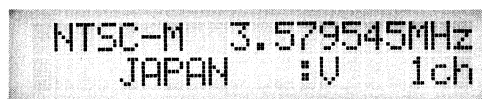
## Amplitude Presetting

The sync. burst, luminance, chrominance and levels can be modified while they appear on the LCD display.

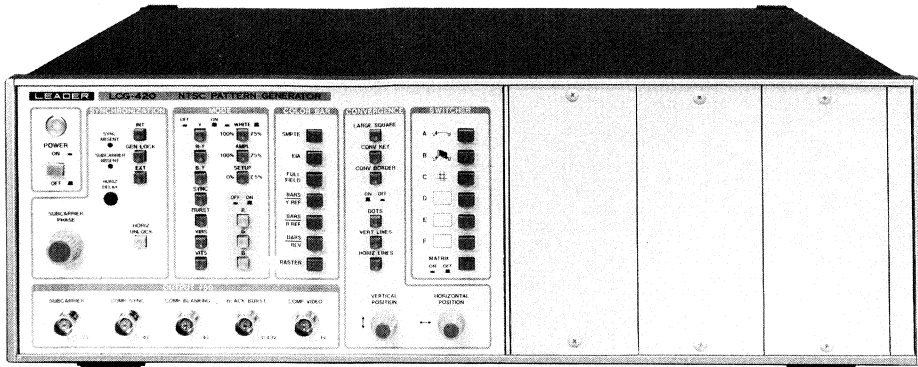


## RF Frequency Setting

RF can be set either frequency or channel. In case of set the RF with the channel,  $\Delta f$  function allows to change the frequency up to  $\pm 9.99\text{MHz}$  in 10KHz step.



## Generating Precise and Various Test Signals



### LCG-420 NTSC TEST PATTERN GENERATOR

#### ● GENERAL

The LCG-420 is a standard test signal generator that generates precision test signals needed to service and inspection NTSC video systems and various broadcasting equipment. The LCG-420 is separated into the main frame and the plug-in units. The main frame consists of a sync generator, a color bar generator, a convergence generator and a video switcher which switches various signals.

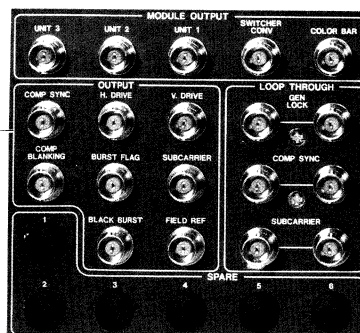
#### ● FEATURES

- Signals from the generator and its individual units can be selectively output using a switcher or can be output separately
- Synchronizing signals (including black burst, subcarrier, composite sync, composite blanking, and burst flag) enable LCG-420 use as a sync generator.
- The LCG-420 can be synchronized with externally supplied black burst, composite sync, and subcarrier signals.
- The LCG-420 can generate VITS and VIR signals to enable the measurement of transmission characteristics during broadcasting.
- Synchronizing signal specifications conform to RS-170A.

#### ■ Rear Panel

##### COMPOSITE

Generates H and V sync. signal, composite blanking, burst flag, subcarrier, black burst and field reference signals.

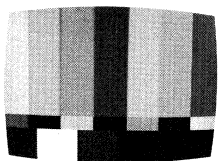


##### MODULE OUTPUT

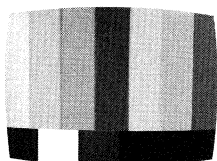
Generates color bar, convergence and unit 1, 2 and 3 test signals.

Sync. signal input connector for synchronized the LCG-420.

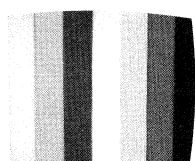
#### ■ LCG-420 Color Patterns



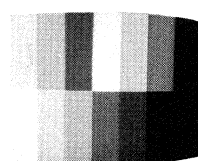
SMPTE color bar



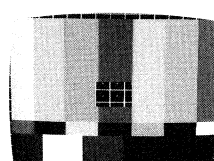
EIA color bar



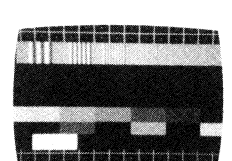
Full-field color bar



Sprite-color bar/Y REF



Border



Matrix

# VIDEO

## ● SPECIFICATIONS

### OUTPUT SIGNAL

Signal	Output	Front Output Connector	Rear Output Connector	Output Level	Output Impedance
Test Signal					
BLACK BURST		1	1	0.43Vp-p	75Ω
COLOR BAR		—	1	1Vp-p (MAX)	
SWITCHER or CONVERGENCE		1	1		
OPTION					
UNIT 1		—	1		
UNIT 2		—	1		
UNIT 3		—	1		
Synchronization Signal					
SUBCARRIER		1	1	2Vp-p	
COMP. SYNC		1	1	4Vp-p	
COMP. BLANKING		1	1		
H DRIVE		—	1		
V DRIVE		—	1		
BURST FLAG		—	1		
FIELD REFERENCE		—	1		

**Color System:** NTSC-M  
**Subcarrier Frequency:** 3.579545MHz ± 5Hz (± 1Hz: option)  
**Number of Scanning Line:** 525, interlace  
**Line Frequency:** 15,73426kHz  
**Field Frequency:** 59.94Hz  
**Sync Signal Quality:** EIA Standard RS-170A (Equivalent)

### INPUT SIGNAL

**GENLOCK:** 75Ω LOOP THROUGH  
**Input Voltage:** Composite video signal (1Vp-p) or black burst signal! (0.43Vp-p)  
**Composite Sync.:** 75Ω LOOP THROUGH  
**Input Voltage:** 2Vp-p to 8Vp-p  
**Subcarrier:** 75Ω LOOP THROUGH  
**Input Voltage:** 1Vp-p to 4Vp-p  
**Option**  
**GENLOCK:** Synchronized by input of the designated NTSC composite video signal or black burst signal  
**Horizontal Delay:** Over ± 1μs continuous adjuster  
**Subcarrier Frequency Phase:** 0° to 360° continuous adjuster

### COLOR BAR GENERATOR

**COLOR Bar Pattern:** SMPTE color bar, EIA color bar, FULL FIELD color bar, color bar/Y REF, color bar/RED, color bar/REVERSE, 8 Rasters (R, G, B switch ON/OFF)  
**Mode Control:** WHITE 100%, 75%, AMPLITUDE 100%/75%, SETUP 0%/7.5%, SYNC ON/OFF, BURST ON/OFF, VIRS ON/OFF, VITS ON/OFF, Y ON/OFF, R-Y ON/OFF, B-Y ON/OFF, R Raster ON/OFF, G Raster ON/OFF, B Raster ON/OFF  
**Composite Video Output:** Total three parallel outputs are possible. All outputs are 1Vp-p into 75Ω termination.

### CONVERGENCE GENERATOR

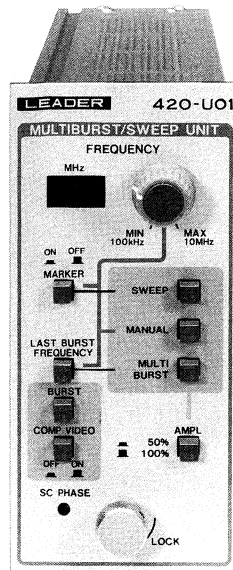
**Pattern**  
**Vertical Lines:** Large square 8 to 9 lines/screen  
 Small square 16 to 17 lines/screen  
 Line width 230ns ± 40ns, ON/OFF  
**Horizontal Lines:** Large square 6 to 7 lines/screen  
 Small square 13 to 14 lines/screen  
 Line width 2 lines, ON/OFF  
**Dot:** Dot in the middle of crosshatch  
**Selection of Size:** Pattern interval cross-hatching of large or small square (see pattern description) using LARGE SQUARE switch.  
**Positioning:** Vertical and horizontal positions adjustments  
**Keying:** The convergence signal may be keyed to the video signal selected by the switcher using the CONV. KEY switch.  
**Border:** A convergence pattern may be displayed in the border around and center of the video signal selected by the switcher, using CONV. BORDER switch.  
**Composite Video Output:** By selecting the switcher convergence output, the rear or front panel switcher output may be used as well for a total of two convergence signal outputs (1Vp-p/75Ω termination).

### SWITCHER

**Selection Signal**  
**Black Burst:** The signal, same as BLACK BURST output of front and rear panel can be selection.  
**Color Bar:** The signal, same as COLOR BAR output of rear panel can be selection.  
**Convergence:** Convergence module output can be selection  
**Unit 1 to 3:** Optional unit output can be selection  
**Matrix:** An internal ROM program provides a vertically divided display of the above described signals as selected.  
**Composite Video Output:** Dedicated switcher output signals on the front and rear panels are provided for two outputs usable in parallel (1Vp-p/75Ω termination)  
**Power Supply:** 100, 120, 200, 240VAC, 50/60Hz, 115VA  
**Size and Weight:** 426(W) × 132(H) × 450(D)mm, 14kg



## Generates Multiburst/Sweep Waveforms



### 420-U01 MULTIBURST/SWEEP UNIT

#### ● GENERAL

The Model 420-U01, a plug-in unit for the LCG-420 mainframe, has multiburst and sweep functions.

Multiburst signal contains sine wave of six frequencies with an amplitude of 50% or 100%. The last burst frequency is continuously variable.

The video sweep has a 50% or 100% amplitude, six constant markers and one variable marker. While in manual mode, the 420-U01 also provides 50% or 100% amplitude and line-scanning synchronized sine waveform.

This plug-in unit, therefore, enables high-precision, simple measurement of each video equipment frequency characteristics.

#### ● SPECIFICATIONS

<b>System:</b>	NTSC-M
<b>Pattern</b>	
<b>Multiburst Mode (six frequencies)</b>	
<b>Frequencies:</b>	0.5, 1.25, 2.0, 3.0, 3.58, 4.2MHz $\pm 3\%$ Frequency control in the last burst mode enables continuous variation in the range 4.0 to 10.0MHz.
<b>Reference Level:</b>	100% white at left of screen 714mVp-p $\pm 1\%$
<b>Synchronization:</b>	Synchronized with line scan
<b>Multiburst Amplitude</b>	
100%:	661mVp-p (92.5 IRE) $\pm 20mV$
50%:	330mVp-p (46.3 IRE) $\pm 12mV$
<b>Flatness:</b>	$\pm 14.3mV$ ( $\pm 2$ IRE)
<b>Sweep Mode</b>	
<b>Frequency Range:</b>	100kHz to 10.0MHz
<b>Start Frequency:</b>	100kHz $\pm 30kHz$
<b>Stop Frequency:</b>	10MHz $\pm 3\%$
<b>Synchronization:</b>	Synchronized with the field scan
<b>Sweep Amplitude</b>	
100%:	661mVp-p (92.5 IRE) $\pm 20mV$
50%:	330mVp-p (46.3 IRE) $\pm 12mV$
<b>Flatness:</b>	$\pm 14.3mV$ ( $\pm 2$ IRE)
<b>Marker Frequency</b>	
<b>Fixed Markers (6):</b>	0.5MHz ( $\pm 3\%$ $\pm 30kHz$ ), 1.0 ( $\pm 3\%$ $\pm 30kHz$ ), 2.0MHz ( $\pm 3\%$ ), 3.58MHz ( $\pm 3\%$ ), 5.0 ( $\pm 3\%$ ), 6.0MHz ( $\pm 3\%$ )
<b>Variable Marker:</b>	100kHz to 10.0MHz (frequency control enables continuous variation)

#### Manual Mode

<b>Frequency:</b>	100kHz to 10.0MHz
<b>Synchronization:</b>	Synchronized with line scan
<b>Manual Pattern Amplitude</b>	
100%:	661mVp-p (92.5 IRE) $\pm 20mV$
50%:	330mVp-p (46.3 IRE) $\pm 12mV$
<b>Flatness:</b>	$\pm 14.3mV$ ( $\pm 2$ IRE)
<b>Frequency Display:</b>	3 digit LED
<b>Frequency Accuracy (Frequency Control)</b>	
<b>Last Burst Frequency:</b>	Display value $\pm 3\%$
<b>Marker Frequency:</b>	100kHz to 1.99MHz: $\pm 3\%$ of display value $\pm 50kHz$ 2.0 to 10.0MHz: $\pm 3\%$ of display value $\pm 30kHz$ 100kHz to 1.99MHz: $\pm 3\%$ of display value $\pm 30kHz$ 2.0 to 10.0MHz: $\pm 3\%$ of display value
<b>Manual Frequency:</b>	

#### Pedestal Level

100%, 50%: 384mV (53.8 IRE)  $\pm 4\%$

#### Harmonic Distortion

100kHz to 10MHz: -30dB

#### Sync

**Amplitude:** -286mVp-p  $\pm 5.7mV$   
**Rise and Fall Time:** 140ns  $\pm 20ns$

#### Burst

**Amplitude:** 286mVp-p  $\pm 8.6mV$   
**Phase:**  $\pm 5^\circ$  variation from LCG-420 subcarrier standard  
**Rise and Fall Time:** 400ns  $\pm 60ns$

#### Output Impedance:

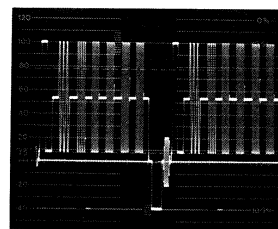
75 $\Omega$

#### Size and Weight:

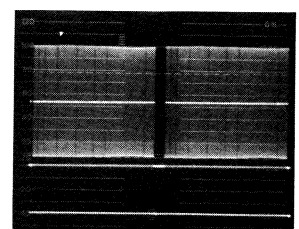
58(W)  $\times$  125(H)  $\times$  340(D)mm, 1.5kg

#### Accessories:

Switcher pattern seal ..... 3

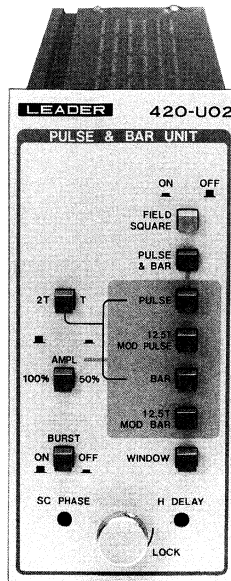


Multiburst



Sweep

## Generates Pulse & Bar Waveforms



### 420-U02 PULSE & BAR UNIT

#### ● GENERAL

The Model 420-U02, a plug-in unit for the LCG-420 mainframe, provides two patterns; pulse & bar and field square wave. The pulse & bar mode is each specified to be modulated or not modulated. The field square has white and black levels.

The auxiliary functions here include; the window, T/2T switch, AMPL50%, 100% and burst ON/OFF. Therefore, the Model 420-U02 is suited for measuring pulse characteristics after transmission by TV sets, cross and luminance signal phase difference and frequency response.

#### ● SPECIFICATIONS

<b>System:</b>	NTSC-M
<b>Patterns</b>	
<b>Field Square Waves:</b>	White lines from 75H to 206H in each field and the other line are black. White level: 714mV (100 IRE) ± 14.3mV (2 IRE)
<b>Pulse and Bar</b>	
<b>Luminance Pulse</b>	
<b>Amplitude</b>	
(at AMPL 100%):	T 714mV (100 IRE) ± 14.3mV (2 IRE) 2T 714mV (100 IRE) ± 14.3mV (2 IRE)
(at AMPL 50%):	T 357mV (50 IRE) ± 10.7mV (1.5 IRE) 2T 357mV (50 IRE) ± 10.7mV (1.5 IRE)
<b>Half Amplitude</b>	
<b>Duration:</b>	T 125ns ± 6.3ns (5%) 2T 250ns ± 12.5ns (5%) Within ± 1.5%
<b>Overshoot · Ringing:</b>	Within ± 1.5%
<b>12.5T Modulated Pulse</b>	
<b>Amplitude</b>	
(at AMPL 100%):	714mV (100 IRE) ± 21.4mV (3 IRE)
(at AMPL 50%):	357mV (50 IRE) ± 14.3mV (2 IRE)
<b>Half Amplitude</b>	
<b>Duration:</b>	1562.5ns ± 100ns
<b>Overshoot · Ringing:</b>	Within ± 2%
<b>Modulation Phase:</b>	Same as the burst
<b>Luminance Bar</b>	
<b>Amplitude</b>	
(at AMPL 100%):	714mV (100 IRE) ± 14.3mV (2 IRE)
(at AMPL 50%):	357mV (50 IRE) ± 10.7mV (1.5 IRE)
<b>Rise Time:</b>	T 120.5ns ± 12.1ns (10%) 2T 241.1ns ± 24.1ns (10%) Within ± 1.5%
<b>Overshoot · Ringing:</b>	Within ± 1.5%
<b>12.5T Modulated Bar</b>	
<b>Amplitude</b>	
(at AMPL 100%):	714mV (100 IRE) ± 21.4mV (3 IRE)
(at AMPL 50%):	357mV (50 IRE) ± 14.3mV (2 IRE)

**Rise Time:** 1506.8ns ± 150ns  
**Overshoot · Ringing:** Within ± 2%  
**Modulation Phase:** Same as the burst

#### Auxiliary Functions WINDOW:

This is operated in the pulse and bar mode. From 67H to 218H in each field Pulse and bar signals and the other line becomes black level.

#### T/2T:

This switch functions for the unmodulated pulse and bar. It switches for the half amplitude duration of the pulse and the rise time of the bar.

	T	2T
Pulse	125nsec ± 6.3nsec	250nsec ± 12.5nsec
Bar	120.5nsec ± 12.1nsec	241.1nsec ± 24.1nsec

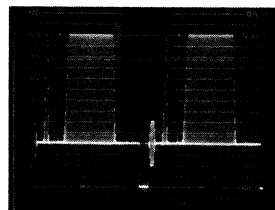
**AMPL 50% and 100%:** This switches the signal level of the video component to 50% or 100%. This function does not operate on field square waves.

**BURST ON/OFF:** This switch turns the burst on and off.

**Sync Amplitude:** 286mVp-p (40 IRE) ± 7.14mV (1 IRE)  
**Rise and Fall Times:** 140ns ± 20ns  
**H. DELAY:** Variable to more than ± 4ns (± 5°) with respect to the sync of the LCG-420 color bar.

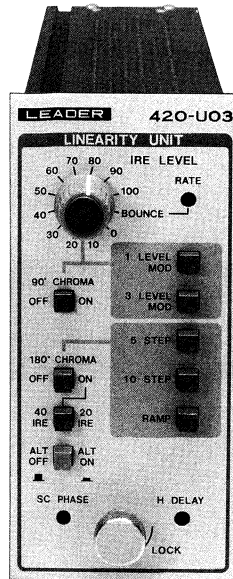
**Burst Amplitude:** 286mVp-p (40 IRE) ± 14.3mV (2 IRE)  
**Phase:** Variable to more than ± 5° from the sub-carrier standard of the LCG-420.

**Rise and Fall Times:** 400ns ± 60ns  
**Output Impedance:** 75Ω (2 outputs)  
**Size and Weight:** 58(W) × 125(H) × 340(D)mm, 1.3kg  
**Accessories:** Switcher pattern seals ..... 3



Pulse & bar

## Generates Level Modulation Signal and Staircase Signal



### 420-U03 LINEARITY UNIT

#### ● GENERAL

The Model 420-U03, a plug-in unit for the LCD-420 mainframe, provides signal patterns; level-1 modulated signal, level-3 modulated signal, 5-step staircase and ramp waveform. Using staircase and ramp signal with CHROMA, this model facilitates measurement of DG (differential gain) and DP (differential phase) when APL (average picture level) is changed. Using staircase and IRE LEVEL, it measures transmission system clamp characteristics. Also, the bounce time may be changed.

#### ● SPECIFICATIONS

System: NTSC-M  
Patterns

##### 1 Level Modulation Signals

**Pedestal Level:** IRE switch 100 IRE: 714mV  $\pm$  7.14mV (1 IRE)  
IRE switch 0 IRE: 0mV  $\pm$  7.14mV (1 IRE)  
**Chrominance Level:** 90° CHROMA ON: 35.7mVp-p (5 IRE)  $\pm$  7.14mV (1 IRE)

##### 3 Level Modulation Signals

**Pedestal Level:** IRE switch 100 IRE: 714mV  $\pm$  7.14mV (1 IRE)  
IRE switch 0 IRE: 0mV  $\pm$  7.14mV (1 IRE)  
**Chrominance Level:** 90° CHROMA ON:  
143mVp-p (20 IRE)  $\pm$  7.14mV (1 IRE)  
286mVp-p (40 IRE)  $\pm$  14.3mV (2 IRE)  
571mVp-p (80 IRE)  $\pm$  14.3mV (2 IRE)

##### 5-step Staircase Signals

**Step Amplitude:** 143mV (20 IRE)  $\pm$  7.14mV (1 IRE)  
**Peak Amplitude:** 714mV (100 IRE)  $\pm$  7.14mV (1 IRE)  
**Chrominance Level:** 180° CHROMA ON:  
20 IRE switch is ON  
143mVp-p (20 IRE)  $\pm$  7.14mV (1 IRE)  
40 IRE switch is ON  
286mVp-p (40 IRE)  $\pm$  14.3mV (2 IRE)

##### 10-step Staircase Signal

**Step Amplitude:** 71.4mV (10 IRE)  $\pm$  3.6mV (0.5 IRE)  
714mV (100 IRE)  $\pm$  7.14mV (1 IRE)  
**Peak Amplitude:** 714mV (100 IRE)  $\pm$  7.14mV (1 IRE)  
**Chrominance Level:** 180° CHROMA ON:  
20 IRE switch ON  
143mVp-p (20 IRE)  $\pm$  7.14mV (1 IRE)  
40 IRE switch ON  
286mVp-p (40 IRE)  $\pm$  14.3mV (2 IRE)

##### Ramp Wave

**Peak Amplitude:** 714mV (100 IRE)  $\pm$  7.14mV (1 IRE)  
**Chrominance Level:** 180° CHROMA ON:  
20 IRE switch ON  
143mVp-p (20 IRE)  $\pm$  7.14mV (1 IRE)  
40 IRE switch ON  
286mVp-p (40 IRE)  $\pm$  14.3mV (2 IRE)

##### Auxiliary Functions

##### ALT (Alternate):

Synchronization is repeated alternatively with a 1 : 4 ratio of the panel-switch selected pattern and the APL pattern.

##### Bounce:

The pedestal level of the APL test pattern alternately repeats between 0 IRE and 100 IRE.

##### Repeat Time:

From less than 2s to more 30s

##### DG and DP

**180° Phase Chrominance:** DG less than 0.5%  
**180° Phase Chrominance:** DP less than 0.2°

##### Sync

**Amplitude:** 286mVp-p (40 IRE)  $\pm$  7.14mV (1 IRE)  
**Rise and Fall Times:** 140ns  $\pm$  20ns

**H. DELAY:** Variable to more than  $\pm$  4ns ( $\pm$  5°) with respect to the sync of the LCG-420 color bar.

##### Burst

**Amplitude:** 286mVp-p (40 IRE)  $\pm$  14.3mV (2 IRE)  
**Phase:** Variable to more than  $\pm$  5° from the subcarrier standard of the LCG-420.

**Rise and Fall Times:** 400ns  $\pm$  60ns

##### Output Impedance:

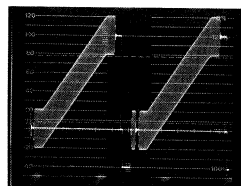
75 $\Omega$  (2 systems)

##### Size and Weight:

58(W)  $\times$  125(H)  $\times$  340(D)mm, 1.3kg

##### Accessories:

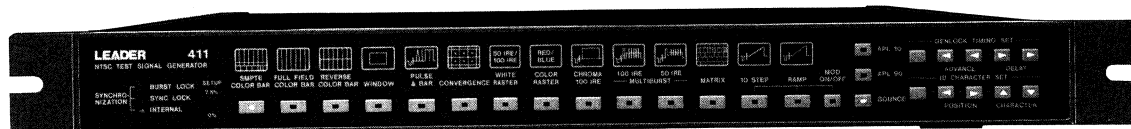
Switcher pattern seals ..... 3



Modulation ramp

# VIDEO

## Digital Sync Generator with Various Sync Signals



### Model 411 NTSC TEST SIGNAL GENERATOR

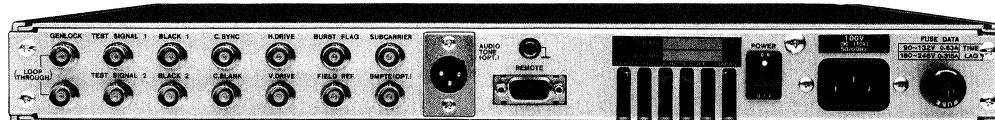
#### ● GENERAL

The Model 411 is a state-of-the-art digital test signal generator with a GENLOCK function that generates various NTSC test signals and sync signals. The Model 411 generates digital test signals and sync signals to ensure precise and stable output. Eighteen types of test signals can be generated, including pulse/bar and staircase. This unit also has built-in APL and bounce functions. The Model 411 uses eight kind for sync signals. One is used for each test signal, including black burst and subcarrier (except for the black burst signal that requires two kind). Moreover, the built-in GENLOCK function used to change the timing enables synchronized operation with other equipment. The setup level selection function is also featured. These helpful features are all incorporated in a compact, flat rack. Thus, the Model 411 can be used for such applications as research and development, production lines, and servicing various types of video equipment.

#### ● FEATURES

- A 10-bit D/A converter used to generate test signals for improved accuracy and stability that is resistant to extreme temperature fluctuations and environmental conditions.
- All signals conform to EIA RS-170A standards.
- Sophisticated sync generator with a variety of precise sync signals.
- Timing-changeable GENLOCK function used to set timing from the front panel. The operation mode suited for the input signal is automatically selected.
- Selectable setup level from 7.5% or 0%.
- SMPTE color bar with up to 16 inserted ID characters can be independently output to facilitate circuit checks.

#### ■ Rear Panel

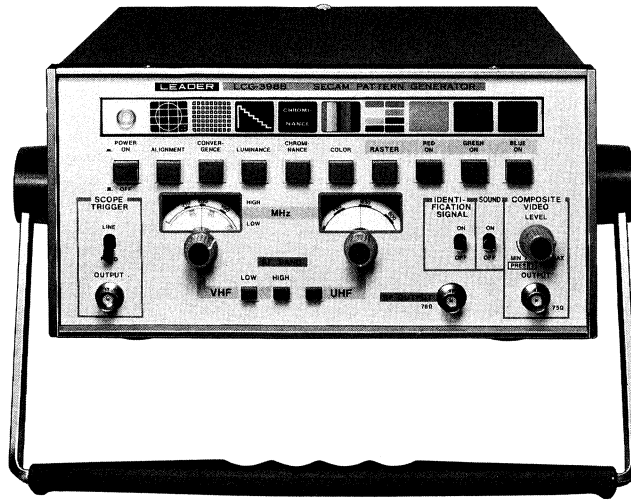


## ● SPECIFICATIONS

<b>Test Signal Generator:</b>	NTSC-M, conform to EIA standard RS-170A
<b>Composite Video Output</b>	
<b>Output Level:</b>	1Vp-p ± 20mVp-p into 75Ω
<b>Output Connector:</b>	BNC, 2 outputs 75Ω
<b>Sync Tip Level:</b>	-286mV ± 5.7mV
<b>Vertical Sync Tip</b>	
<b>Duration:</b>	3H
<b>Vertical Blanking Period:</b>	20H
<b>SCH Phase:</b>	Within 10°
<b>Setup Level:</b>	0% or 7.5%
<b>Test Signal (with a setup level of 7.5%)</b>	
<b>SMPTE Color Bar:</b>	Conform to SMPTE ECR 1-1978 Luminance amplitude accuracy ± 1% Chrominance amplitude accuracy ± 1% Chrominance phase accuracy ± 1°
<b>Full Field Color Bar:</b>	Eight colors with 100% white and black Luminance amplitude accuracy ± 1% Chrominance amplitude accuracy ± 1% Chrominance phase accuracy ± 1°
<b>Split-Reverse Color Bar:</b>	Eight color bars with 100% white and black at top, and its reverse bars at bottom of pattern. Luminance amplitude accuracy ± 1% Chrominance amplitude accuracy ± 1% Chrominance phase accuracy ± 1%
<b>Window</b>	
<b>Bar Amplitude:</b>	100 IRE ± 1 IRE
<b>Bar Size:</b>	0.5V × 0.5H
<b>Bar Tilt:</b>	Within 0.5% (V, H)
<b>Pulse &amp; Bar:</b>	2T pulse, inverted 2T pulse, modulated 12.5T pulse and 2T bar
<b>Pulse-to-Bar Ratio:</b>	100% ± 1%
<b>2T Bar Amplitude:</b>	100 IRE ± 1 IRE
<b>Subcarrier Phase:</b>	Modulated 12.5T pulse: 180° ± 2°
<b>Convergence:</b>	White lines and dots on black background
<b>No. of Lines:</b>	17(V) × 14(H)
<b>No. of Dots:</b>	16(V) × 13(H)
<b>Raster:</b>	White (50 IRE, 100 IRE), Red and Blue
<b>White Raster</b>	
<b>Amplitude:</b>	100 IRE (100%), ± 1 IRE 50 IRE (50%), ± 0.5 IRE
<b>Red Raster</b>	
<b>Amplitude:</b>	28.31 IRE ± 1 IRE (luminance) 88.21 IRE ± 2 IRE (chrominance) 15.13 IRE ± 1 IRE (luminance)
<b>Blue Raster Amplitude:</b>	62.19 IRE ± 2 IRE (chrominance)
<b>100 IRE CHROMA:</b>	50 IRE ± 0.5 IRE (luminance) 100 ± 2 IRE (chrominance)
<b>Multiburst:</b>	100 IRE or 50 IRE of 6 frequencies
<b>Reference Bar</b>	
<b>Amplitude:</b>	100 IRE ± 1 IRE (100 IRE) 50 IRE ± 0.5 IRE (50 IRE)
<b>Multiburst Amplitude:</b>	100 IRE ± 2 IRE (100 IRE) 50 IRE ± 1 IRE (50 IRE)
<b>Frequency:</b>	0.5, 1.0, 2.0, 3.0, 3.58, 4.6MHz
<b>Matrix:</b>	Pattern combined with convergence, multi burst (100 IRE), pulse & bar, and color bars.
<b>Staircase/Modulated Staircase</b>	
<b>Luminance Amplitude:</b>	100 IRE ± 1 IRE
<b>Chrominance</b>	
<b>Amplitude:</b>	40 IRE ± 1 IRE (Modulated staircase)
<b>DG:</b>	Within 0.3% (Modulated staircase)
<b>DP:</b>	Within 0.3° (Modulated staircase)
<b>Ramp/Modulated Ramp</b>	
<b>Luminance Amplitude:</b>	100 IRE ± 1 IRE
<b>Chrominance Amplitude:</b>	40 IRE ± 1 IRE (Modulated ramp)
<b>Linearity:</b>	Within 1%
<b>DG:</b>	Within 0.3% (Modulated ramp)
<b>DP:</b>	Within 0.3° (Modulated ramp)
<b>APL 10:</b>	1 field of test signal and 4 field of black rasters (0 IRE)
<b>APL 90:</b>	1 field of test signal and 4 field of white rasters (100 IRE)
<b>BOUNCE:</b>	1 sec APL 10, 1 sec APL 90

<b>Sync Generator</b>	
<b>Blackburst</b>	
<b>Sync Signal Amplitude/</b>	
<b>Burst Amplitude:</b>	286mVp-p ± 8.5mVp-p (3%)
<b>Output Connector:</b>	BNC, 2 outputs into 75Ω
<b>SCH Phase:</b>	Within 10°
<b>Sync Pulse</b>	
<b>Composite Sync</b>	
<b>Output Amplitude:</b>	4Vp-p ± 5% into 75Ω
<b>Polarity:</b>	Negative
<b>No. of Output:</b>	1 per each signal
<b>Composite Sync</b>	
<b>Horizontal/Vertical</b>	
<b>Sync Duration:</b>	4.7μs ± 50ns, 3H
<b>Equalization Pulse</b>	
<b>Duration:</b>	2.3μs ± 50ns
<b>Serration Pulse</b>	
<b>Duration:</b>	4.7μs ± 50ns
<b>Composite Blanking</b>	
<b>Horizontal Blanking</b>	
<b>Period:</b>	10.9μs ± 0.2μs
<b>Vertical Blanking</b>	
<b>Period:</b>	20H
<b>H Drive Pulse</b>	
<b>Pulse Duration:</b>	6.0μs ± 0.1μs
<b>Pulse Starting Point:</b>	Coincides with starting point of horizontal blanking period
<b>V Drive Pulse</b>	
<b>Pulse Duration:</b>	9H
<b>Pulse Starting Point:</b>	Coincides with starting point of vertical blanking period
<b>Burst Flag</b>	
<b>Pulse Duration:</b>	2.51μs ± 0.1μs
<b>Delay Time from Horiz.</b>	
<b>Sync:</b>	5.3μs ± 0.1μs
<b>Field Reference Pulse</b>	
<b>Duration:</b>	1H
<b>Pulse Position:</b>	11th line of first field
<b>Subcarrier</b>	
<b>Output Frequency:</b>	3.579545MHz ± 2Hz
<b>Output Amplitude:</b>	2Vp-p ± 0.2Vp-p into 75Ω
<b>Output Connector:</b>	BNC 75Ω
<b>GENLOCK</b>	
<b>Input Configuration:</b>	75Ω loop through
<b>Reference Input Level:</b>	286mV ± 6dB (Sync and burst signal level)
<b>Operation Mode:</b>	Automatic selection with input signal
<b>GENLOCK Timing:</b>	Variable 4μs or more advance or delay relative to input signal
<b>Burst Locking Signal</b>	
<b>Phase Shift:</b>	Within 2° for burst amplitude of 6dB down
<b>Lock-in Range:</b>	3.579545MHz ± 20Hz
<b>Jitter:</b>	Within 2°
<b>Color Frame Selection:</b>	Frame changes at SCH phase ± 110°
<b>Sync Lock</b>	
<b>Timing Shift:</b>	Within 5ns for sync amplitude of -6dB down
<b>Jitter:</b>	Within 2ns
<b>ID Provided SMPTE Color Bar</b>	
<b>ID Character:</b>	Up to 16 letters (alphanumeric), 1 line
<b>Setting:</b>	With front panel controls
<b>Audio Tone</b>	
<b>Output Connector:</b>	XLR connector, 600Ω balanced
<b>Frequency:</b>	1kHz ± 5%, 400Hz is provided with internal selection
<b>Output Level:</b>	0dBm (0.775Vms) into 600Ω (adjustable internally in range of -3dBm to +6dBm)
<b>Remote Control:</b>	Type D-SUB 9 pin, Selectable all test signals
<b>Power Supply:</b>	100, 120, 220, 240V AC ± 10%, 35VA
<b>Size and Weight:</b>	426(W) × 44(H) × 530(D)mm, 6kg

## Generates Various Patterns. PAL/SECAM



### LCG-398B (SECAM) LCG-399A (PAL) PATTERN GENERATOR

#### ● GENERAL

The LCG-398B, and the LCG-399A are color pattern generators. The LCG-398B is exclusively used for SECAM III; the LCG-399A for PAL. In addition to standard color bars, these models provide such patterns as crosshatches, circle patterns, and 8-color rasters for servicing and inspecting TV receivers and video equipments.

#### ● FEATURES

- Raster in 8 colors for testing/adjusting purity, white balance, etc.
- Convergence pattern for testing/adjusting convergence.
- Alignment pattern (circle) for testing/adjusting linearity, centering, deflection yoke polarity, etc.
- Composite video output of 75Ω impedance for video equipments.
- VHF/UHF RF output for TV receivers.
- Sound signal is available, and SIF frequency can be generated at 5.5, 6 or 6.5MHz. AM and FM in 1kHz modulation are available.
- Moving marker can be inserted into color bars for testing of multi speed VTRs. (399A)

#### ● SPECIFICATIONS

##### SECAM System LCG-398B

**Color System:** SECAM III-B, C, D, G, H, I, K, L  
**Subcarrier Frequency:**  $f_{OR} = 4.40625\text{MHz}$   $f_{OB} = 4.250\text{MHz}$   
**Identification Signals:**  $D_R = 4.75625\text{MHz}$   $D_B = 3.900\text{MHz}$

##### PAL System LCG-399A

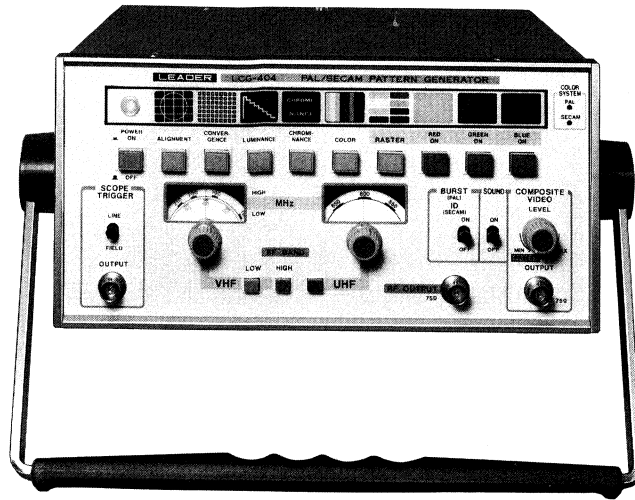
**Color System:** PAL-B, C, D, G, H, I, K, L  
**Modified Color Bars:** Following can be added by internal selector to color bars of PAL system only  
 1 100% white  
 2 Reverse alternate color bars  
 3 Rejection of chrominance  
 4 Moving marker  
**Subcarrier Frequency:** 4.43361875MHz  $\pm$  100Hz

##### LCG-398B and LCG-399A

**Patterns**  
**Color Bars:** 75% amplitude, 100% saturation color bars. From left to right on the screen, 8 color bars of white, yellow, cyan, green, magenta, red, blue and black. Full field color bar.  
**Chrominance:** Rejection of luminance component from color bar pattern.

**Luminance:** Rejection of chrominance component from color bar pattern.  
**Raster:** 8 colors by the combination of red, green and blue. 100% white, yellow, cyan, green, magenta, red, blue and black.  
**Convergence:** Composite of crosshatch of 20V  $\times$  14H and dots of 19V  $\times$  15H. Includes picture center marker and safety zone marker. White lines and dots on black background.  
**Alignment:** Composites of 5V  $\times$  5H crosshatch, single or double circle and polarity marker.  
**Composite Video Output**  
**Output Voltage:** Continuously variable 0 to 1Vp-p into 75Ω  
**Output Impedance:** 75Ω  
**Polarity:** Positive polarity (synchronization negative)  
**RF Output**  
**Picture Carrier Frequency:** (VHF) Low 55 to 63MHz, High 185 to 205MHz  
 (UHF) 471.25 to 885.25MHz  
 (VHF) More than 5mV into 75Ω  
 (UHF) More than 0.5mV into 75Ω  
**Output Voltage:** 75Ω  
**Output Impedance:** Possible to change-over positive/negative  
**Scope Trigger Output**  
**Frequency:** Line and field  
**Output Voltage:** 3Vp-p into open circuit  
**Output Impedance:** 10kΩ  
**Synchronizing Signals**  
**Number of Scanning Lines:** 625  
**Line Frequency:** 15.625kHz  
**Field Frequency:** 50Hz: Interlace scanning (luminance, chrominance, color bar and raster patterns)  
 50.08Hz: Non-interlace scanning (alignment and convergence patterns)  
**Sound Signal System:** Intercarrier system  
**Sound Intercarrier Frequency:** 5.5, 6 and 6.5MHz  
**Modulation Signal:** 1kHz sine wave  
**Modulation:** AM and FM  
**Power Supply:** 100, 120, 220, 240V AC, 50/60Hz, 20VA (LCG-398B), 25VA (LCG-399A)  
**Size and Weight:** 250(W)  $\times$  123(H)  $\times$  325(D)mm, 4.3kg  
**Accessory:** BNC-clip cable ..... 1

## Generates Various Patterns. PAL/SECAM



### LCG-404 PAL/SECAM PATTERN GENERATOR

#### ● GENERAL

LCG-404 is a PAL/SECAM-III color pattern generator designed to switch each system between PAL and SECAM-III of 625 scanning lines. This instrument generates signals necessary for making tests and adjustments of color and black & white TV receivers, video tape recorders (VTR) and other television equipments.

#### ● FEATURES

- Raster in 8 colors for testing/adjusting purity, white balance, etc.
- Convergence pattern for testing/adjusting convergence.
- Alignment pattern for testing/adjusting linearity, centering, deflection yoke polarity, etc.
- VHF/UHF RF output for TV receivers.
- Moving marker can be inserted into color bars for testing of multi speed VTRs.

#### ● SPECIFICATIONS

##### SECAM system

**Color System:** SECAM III-B, C, D, G, H, I, K, L  
**Sub-Carrier Frequency:**  $f_{OR} = 4.40625\text{MHz}$   $f_{OB} = 4.25\text{MHz}$   
**Identification Signals:**  $D_R 4.75625\text{MHz}$   $D_B 3.900\text{MHz}$

##### PAL System

**Color System:** PAL-B, C, D, G, H, I, K, L  
**Modified Color Bars:** Following can be added by internal selector to color bars of PAL system only  
 1 100% white  
 2 Reverse alternate color bars  
 3 Rejection of chrominance  
 4 Moving marker  
**Sub-carrier Frequency:**  $4.43361875\text{MHz} \pm 100\text{Hz}$

##### Patterns

- Color Bars:** 75% amplitude, 100% saturation color bars. From left to right on the screen, 8 color bars of white, yellow, cyan, green, magenta, red, blue and black. Full field color bar.
- Chrominance:** Rejection of luminance component from color bar pattern.
- Luminance:** Rejection of chrominance component from color bar pattern.
- Raster:** 8 colors by the combination of red, green and blue. 100% white, yellow, cyan, green, magenta, red, blue and black.

##### Convergence:

Composite of crosshatch of  $20V \times 14H$  and dots of  $19V \times 15H$ . Includes picture center marker and safety zone marker. White lines and dots on black background.

##### Alignment:

Composites of  $5V \times 5H$  crosshatch, single or double circle and polarity marker.

##### Composite Video Output Output Voltage:

Continuously variable 0 to approx.  $1V_{p-p}$  into  $75\Omega$  load.

##### Output Impedance: Polarity:

$75\Omega$   
Positive polarity (synchronization negative)

##### RF Output Picture Carrier Frequency:

(VHF) Low 55 to 63MHz, High 185 to 205MHz

(UHF) 471.25 to 885.25MHz  
(VHF) More than 5mV into  $75\Omega$   
(UHF) More than 0.5mV into  $75\Omega$

##### Output Voltage:

Possible to change-over positive/negative

##### Output Impedance: Modulation Polarity:

Possible to change-over positive/negative  
Line and field  
 $3V_{p-p}$  into open circuit  
Approx.  $10k\Omega$

##### Scope Trigger Output Frequency:

Line and field

##### Output Voltage:

$3V_{p-p}$  into open circuit

##### Output Impedance:

Approx.  $10k\Omega$

##### Synchronizing Signals Number of Scanning Lines:

625

##### Line Frequency:

15.625kHz

##### Field Frequency:

50Hz: Interlace scanning (luminance, chrominance, color bar and raster patterns)

50.08Hz: Non-interlace scanning (alignment and convergence patterns)

##### Sound Signal

##### System:

Intercarrier system

##### Sound Intercarrier Frequency:

5.5, 6 and 6.5MHz

##### Modulation Signal:

1kHz sine wave

##### Modulation:

AM and FM

##### Power Supply:

100, 120, 220, 240V AC, 50/60Hz, 25VA

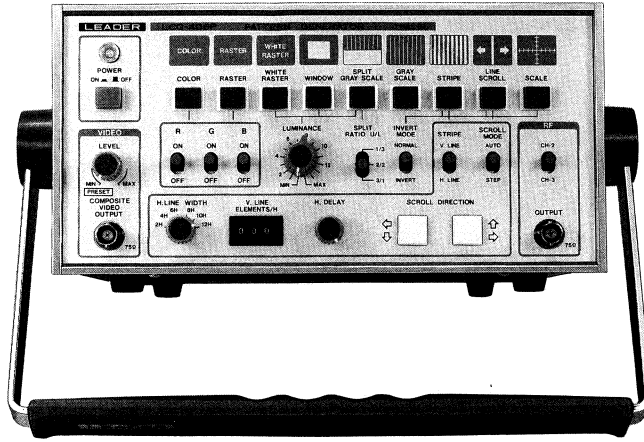
##### Size and Weight:

$250(W) \times 123(H) \times 325(D)\text{mm}$ , 4.3kg

##### Accessory:

BNC-clip cable ..... 1

## Ideally Suited for Adjusting and Inspecting for LCD TV



### LCG-406P PAL PATTERN GENERATOR

#### ● GENERAL

The LCG-406P Pattern Generator provide functions needed to adjust and inspect LCD (liquid crystal display) TV receivers, as well as regular monochrome and color TV receivers.

★ The LCG-406 NTSC system is also available.

#### ● FEATURES

- Stripe and line scroll enable inspection of the influence of bad LCD panel dots, bad drive circuitry and the influence of adjacent dots.
- Capable of checking dot defects in the LCD panel, drive circuit faults, effects of adjacent dots, and other items.
- Capable of measuring gradation with gray scale and white raster.
- Scale patterns for checking the display area of LCD panel.
- True sync signal for interlaced scan with an equalizing pulse

#### ● SPECIFICATIONS

##### Patterns

<b>Colors:</b>	Standard color bar (R, G and B can be switched on and off individually) (100% luminance for white.)
<b>Rasters:</b>	8 colors, selected by means of R, G and B selectors (100% white if all three are selected.)
<b>White Raster:</b>	White raster with gradient possible (16 levels selected by means of a rotary switch).
<b>Window:</b>	White window with 16 gradient levels on a black background
<b>Split Gray Scale:</b>	Display field is split top and bottom in the ratio of 3:1, 2:2 or 1:3 (switch selected), with a 16-level gray scale at the top of the screen and a white raster with variable gradient on the bottom part (16 levels selected by a rotary switch).
<b>Gray Scale:</b>	16-level, full-field gray scale
<b>Stripe:</b>	Vertical or horizontal (switch selected) stripe pattern of alternate white and black lines (invertible), with settable display density.
<b>Line Scroll:</b>	A vertical or horizontal line display can be step scrolled in 1-line widths or continuously scrolled to the left or right or up and down (invertible), with settable display density.
<b>Scales:</b>	Patterns with a scale provided for determination of the size of the display area at a single cross (invertible).

##### Signal Output

##### Video Output

##### Output Voltage:

Fixed 1Vp-p into 75Ω

Variable 0 to 1.5Vp-p into 75Ω

75Ω

##### Output Impedance:

##### Polarity:

Positive (negative sync.)

##### RF Output

##### Modulation Type:

Negative

##### Video Carrier

##### Frequency:

CH-2 48.25MHz ± 0.5%

CH-3 55.25MHz ± 0.5%

##### Output Voltage:

10mVrms or more into open circuit

##### Subcarrier Output

##### Frequency:

4.43361875MHz ± 50Hz

##### Output:

TTL (74LS37)

##### Scope Trigger Output:

HS, VS: TTL (74LS37)

##### R.G.B Output:

TTL (74LS37) output (8 pin rectangular connector)

##### Synchronizing Signal:

625-line, 50Hz field, interlace scanning with equalizing pulse

##### Horizontal Scanning Frequency:

15.625kHz

##### Vertical Scanning Frequency:

50Hz

##### Horizontal Blanking Period:

11.8μs

##### Vertical Blanking Period:

22H

##### Horizontal Sync. Time:

4.54μs

##### Vertical Sync. Time:

3H

##### Horizontal Front Porch:

1.82μs

##### Burst:

12 cycle (min.)

##### Power Supply:

100, 120, 220, 240V AC, 50/60Hz, 17VA

##### Size and Weight:

250(W) × 123(H) × 325(D)mm, 6kg.

##### Accessories:

BNC-clip cable (1m) ..... 1

8-pin rectangular connector ..... 1

Spare fuse ..... 1



## Full Coverage of VHF and UHF All Channels



### LCG-412C (EUROPE) LCG-412D (CHINA) PAL PATTERN GENERATOR

#### • GENERAL

The LCG-412C/D Color Pattern Generators operate according to PAL specifications. The patterns generated include full field color bar, crosshatch, dot, corner marker, white raster, red raster, green raster, and blue raster. The lightweight, compact LCG-412C/D operate using external DC sources, as well as batteries. A typical LCG-412C/D application is for the adjusting and servicing of TV receivers and VTRs.

#### • FEATURES

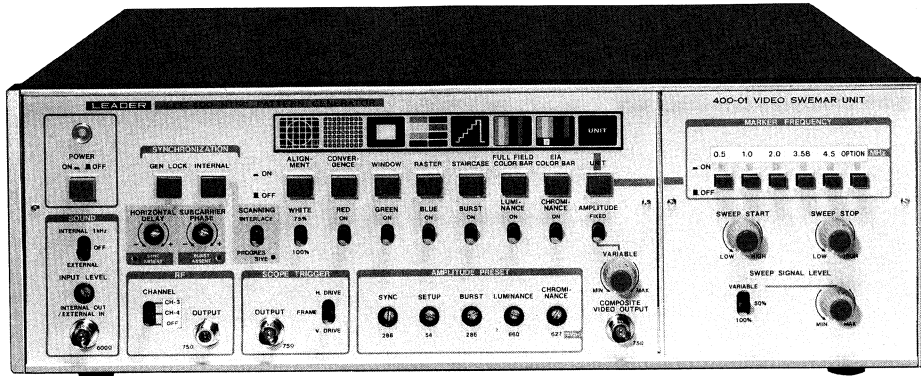
- Compact, lightweight, and battery operated.
- RF output for all channels.
- Video output available for checking video equipment.
- Full field color bars for servicing and testing VTRs.
- Operation powered by a readily available IEC R20 battery.
- ★ The LCG-412B NTSC system is also available.

#### • SPECIFICATIONS

<b>Patterns</b>	
<b>Color Bar:</b>	From the left side of the screen: 75% white, yellow, cyan, green, magenta, red, blue and black.
<b>Crosshatch:</b>	15(V) × 11(H), White lines
<b>Dot:</b>	11(V) × 15(H), White dots
<b>Corner Marker:</b>	White window at the upper left of the screen. White, red, green and blue.
<b>Rasters:</b>	
<b>Sync Signal</b>	
<b>Horizontal:</b>	15.625kHz
<b>Vertical:</b>	50Hz
<b>Scanning:</b>	Interlace
<b>Subcarrier Frequency:</b>	4.433619MHz ± 220Hz
<b>RF Output:</b>	412C CH1 to CH4 (41.25 to 62.25MHz) CH5 to CH12 (175.25 to 224.25MHz) CH21 to CH69 (471.25 to 855.25MHz) 412D CH1 to CH5 (49.75 to 85.25MHz) CH6 to CH12 (174.75 to 222.75MHz) CH13 to CH57 (471.25 to 863.25MHz)
<b>Output Level:</b>	VHF 1mV or more UHF 0.5mV or more
<b>Sound Inter-carrier Frequency:</b>	412C: 5.5MHz, 412D: 6.5MHz
<b>Video Output</b>	
<b>Output Voltage:</b>	1Vp-p into 75Ω
<b>Reverse Current Protection:</b>	White ± 6Vp-p
<b>Power Supply:</b>	IEC R20 6 pcs. 6 hours for continuous use. 7V to 10V, 60mA or more
<b>External DC Voltage:</b>	7V to 10V, 60mA or more
<b>Size and Weight:</b>	80(W) × 172(H) × 35(D)mm 390g (including battery)
<b>Accessories:</b>	IEC R20 batteries ..... 6 Antenna cable (PAL-P—PAL-P) ..... 1

# VIDEO

## Ideally Suited for Adjusting and Inspecting for Visual Equipment



## LCG-400-01/02 NTSC PATTERN GENERATOR

### ● GENERAL

The LCG-400-01/LCG-400-02 Pattern Generators produce the signal patterns required to test and adjust TV receivers, VTRs, and other types of video equipment. These patterns include EIA/full-field color bars, none-color rasters, staircases, window patterns, convergence patterns, and alignment patterns. The LCG-400-01 contains a video sweep unit while the LCG-400-02 contains a multiburst unit to facilitate easy-to-understand band characteristics of video equipment.

### ● FEATURES

- Output signals are provided by two video outputs (RF output, scope trigger output, black burst, burst flag output, and subcarrier output).
- A GENLOCK function allows both instruments to be synchronized with externally supplied synchronizing signals for a broad range of applications.
- Video sweep and multiburst functions of easy-looking of frequency characteristics of video equipments.

### ● SPECIFICATIONS

<b>Color System:</b>	NTSC-M
<b>Patterns</b>	
<b>EIA Color Bar:</b>	EIA Standard RS-189A (Equivalent) 75% Amplitude 100% Saturated Color Bar. Gray (75% white), Yellow Cyan, Green, Magenta, Red, -I, 100% White, Q and Black.
<b>Full Field Color Bar:</b>	75% Amplitude, 100% Saturated Color Bar. Gray (75% white), Yellow Cyan, Green, Magenta, Red, Blue, Black.
<b>Staircase:</b>	5 step
<b>Raster:</b>	8 colors: Red, green and Blue (combined) White (100% and 75%), Yellow, Cyan, Green, magenta, Red, Blue and Black.
<b>Window:</b>	White window on black background
<b>Convergence:</b>	Crosshatch 17 x 13, Dot 16 x 12 and center
<b>Alignment:</b>	Crosshatch 9 x 7, Circle, Corner Marker
<b>SYNC Signal:</b>	EIA Standard RS-170A (Equivalent)
<b>Number of Scanning Line:</b>	Interlace 525, Non-interlace 262
<b>Line Frequency:</b>	15.734kHz
<b>Field Frequency:</b>	Interlace 59.94Hz, Non-interlace 60.05Hz
<b>Scanning System:</b>	Interlace, Non-interlace
<b>GEN LOCK:</b>	Synchronized Video Signal Input
<b>Horizontal Delay:</b>	± 4μs continuously variable
<b>Subcarrier Phase:</b>	0° to 360° continuously variable

#### Output Signal (Front Panel)

**Composite Video Output:** Voltage: 1V fixed, 0 to 1V variable into 75Ω  
Polarity: Negative Sync

**Scope Trigger Output:** Mode: HD, VD, Frame  
Voltage: 1V into 75Ω

**Impedance:** 75Ω

**RF Output:** CH-3 61.25MHz ± 0.5%  
(Impedance 75Ω): CH-4 67.25MHz ± 0.5%

Voltage: Video more than 10mVrms  
Audio more than 1mVrms

#### Sound:

**Carrier Frequency:** 4.5MHz

**Internal Modulation:** 1kHz Sine Wave

**Sound Output:** 3Vp-p into open circuit

**Output Impedance:** 600Ω

**EXT. Mod. Frequency:** 50Hz to 10kHz

**Input Voltage:** 3Vp-p

**Input Impedance:** 600Ω

**Pre-Emphasis:** No

#### Output Signal:

**Composite Video Output:** Voltage: 1V fixed into 75Ω  
Polarity: Negative Sync.

**Black Burst Output:** Polarity: Negative Sync.  
Setup: 0.054V  
Burst: 0.286V  
Synchronizing Signal: 0.286V into 75Ω

**Composite Sync:** Polarity: Negative, Voltage: 4V into 75Ω

**Composite Blanking:** Polarity: Negative, Voltage: 4V into 75Ω

**Subcarrier Output:** Frequency: 3.579545MHz ± 5Hz (0° to 40°C),  
Voltage: More than 2Vp-p into 75Ω

**Burst Flag:** Polarity: Negative, Voltage: 4V into 75Ω

**Power Supply:** 100, 120, 220, 240V AC, 50/60Hz, 30VA

**Size and Weight:** 426(W) x 132(H) x 400(D)mm, 8.2kg

**Accessory:** BNC-clip cable (1), F-clip cable (1)

#### Video Sweep (LCG-400-01)

**Sweep Frequency Range:** 50kHz to 7MHz

**Sweep Rate:** Synchronized with Field

**Amplitude:** 50%, 100% fixed and 0 to 100% variable

**Flatness:** Within ± 1dB

**Marker Frequency:** 0.5MHz, 1MHz, 2MHz, 3.58MHz, 4.5MHz ± 3%, Option

#### Multiburst (LCG-400-02)

**Frequency:** 0.5MHz, 1.5MHz, 2MHz, 3MHz, 3.58MHz, 4.2MHz ± 3%, 6 Points

**Reference Level:** 100% White at left end of burst

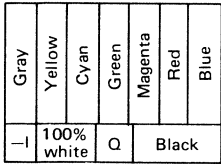
**Period:** Synchronized line scan

**Amplitude:** 50% and 100%

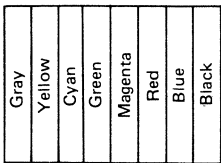
**Flatness:** Within ± 1dB

## Color Bar

Color bars: Signals synthesized for the maximum amplitudes of the three primary colors (red, green, and blue). The color bars offer linear recognition of a transmission system and amplitude and phase characteristics of the color signal frequency bands at the same time.

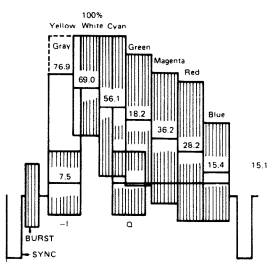


EIA color bar

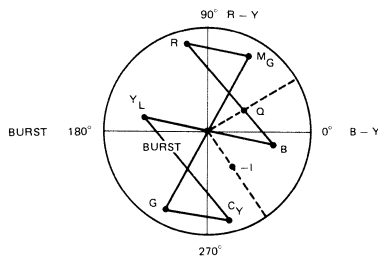


Full-field color bar

- VTRs: Adjustment and inspection of auto-color controls, modularity measurement for FM modulators, and inspection of moire, videotapes, and VTRs.
- TV receivers: Adjustment and inspection of auto-color controls and chrominance circuits.
- Video amplifiers: Inspection of linearity and the amplitude/phase characteristics of color signal bands.
- Color monitor: Inspection of brightness and color.



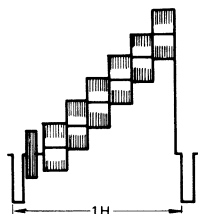
Color bar video waveform



Vector diagram

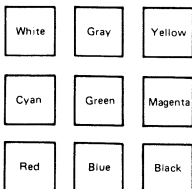
## Staircase

Signal: A staircase pattern is a waveform of luminance signals arranged in a staircase at uniform intervals. Staircases can be used to inspect the linearity of transmission systems, phase characteristics of color signal bands, and luminance of color monitors and TV receivers.



## Raster Pattern

A raster pattern of monochromatic colors can be displayed on the CRT screen depending on how the red, green, blue, and white keys are combined. Used for adjusting and inspecting the purity of CRTs (particularly, with a red raster showing a distinct picture of uneven color).



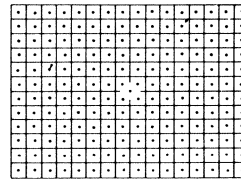
## Window Pattern

A window pattern has a 100% white window in the center. Used to inspect the lower-band frequency characteristics of such transmission equipment as VTRs, video amplifiers, and TV receivers.



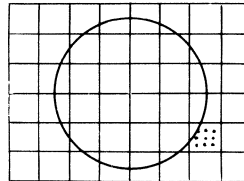
## Convergence Pattern

A convergence pattern is a synthesized 17(V) x 13(H) white cross-hatch and 16(H) x 12(V) dot pattern with a notch in the center. Used to adjust the convergence (static and dynamic) of CRTs used in TV receivers, monitors, etc., to adjust the vertical and horizontal amplitudes and positions, and to adjust and inspect raster alignment, focusing, etc.



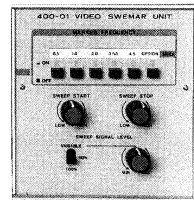
## Alignment Pattern

All alignment pattern is a synthesized 9(V) x 7(H) white cross-hatch pattern with a circle in the center of the pattern and a nine-dot corner marker at the lower-right. Used to adjust the alignment of CRTs used in TV receivers, monitors, etc., and to adjust the vertical and horizontal amplitudes and positions. Because the circle pattern allows quick visual recognition of screen distortion, the alignment pattern is best suited for adjusting the horizontal and vertical linearity.



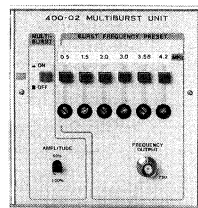
## • LCG-400-01 Video Sweep Unit

Sweep signals make it possible to measure the frequency characteristics of transmission systems. Higher-band video signals (50kHz to 7MHz) are covered. Five markers indicate frequency positions.

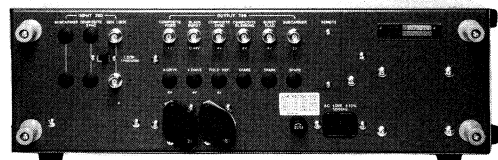


## • LCG-400-02 Multiburst Unit

Multiburst signals have fixed frequencies. Reading the amplitudes of burst frequencies indicates the frequency characteristics of transmission equipment.



## ■ LCG-400-01/LCG-400-02 Rear Panel



## 7 Patterns, 4 Rasters. For Adjusting and Inspecting of TV and Video



### LCG-396 LCG-396YC NTSC PATTERN GENERATOR

#### • GENERAL

The LCG-396/396YC are versatile NTSC video generators suitable for testing, servicing and evaluating a broad range of video systems including video tape recorders, CATV and MATV systems, video monitors and television receivers.

#### • FEATURES

- NTSC standard type color bars  
The LCG-396/396YC is capable of switching over full-field and IQW insertion and turning on or off chrominance and luminance. The setting of chrominance, luminance and setup level can be changed.
- The LCG-396/396YC is capable of checking and adjusting purity and white balance by means of red, blue, green and white rasters.
- The LCG-396/396YC is capable of checking and adjusting static and dynamic convergences simultaneously by crosshatch with dots centering around the raster.
- Dots and single cross bars are available for convergence, raster alignments, etc.
- It is possible to produce 75Ω video output for video equipment and RF output for TV receivers.
- It is possible to produce scope trigger output to facilitate waveform observation through the oscilloscope.
- The LCG-396/396YC contains an equalizing pulse, and the phase is a full-scale synchronizing signal locked in the subcarrier. It is possible to suppress the flicker in the horizontal crosshatch lines not only by ordinary interlaced scanning but also by switching over to progressive scanning.
- The LCG-396YC has RGB sync output connector and YC separation output connector for color monitors.

#### • SPECIFICATIONS

<b>Patterns</b>	
<b>Color Bars:</b>	NTSC color bars in order of 75% amplitude.
<b>Upper Picture:</b>	From left: 75% amplitude, white, yellow, cyan, green, magenta, red, blue & black.
<b>Lower Picture:</b>	From left, Q, -I 100% amplitude, black and white
<b>QIW OFF:</b>	Full-field color bars in which color bars of upper picture are inserted instead of Q, I 100% amplitude white of lower frame.
<b>CHROMA OFF:</b>	Pattern with luminance only by removing chrominance from color signals.

#### LUMINANCE OFF:

Pattern with chrominance only by removing luminance from color bar signals.

#### Crosshatch:

21(V) × 16(H), white including one center dot.

#### Dots:

20(V) × 15(H), centering around raster, white.

#### Rasters:

Red, blue, green and white.

#### RF Output:

USA, CH-5: 77.25MHz, CH-6: 83.25MHz

#### Output Voltage:

10mVrms into open circuit

#### Impedance:

75Ω, Modulation: Negative

#### Video Output

#### Output Voltage:

Fixed: 1Vp-p into 75Ω  
Continuous variable: 0 to 1.5Vp-p into 75Ω  
Positive (Sync signal is negative)

#### Polarity:

#### Scope Trigger Output

#### Frequency:

Horizontal & vertical frequency

#### Output Voltage:

1Vp-p into 75Ω

#### Output Impedance:

75Ω

#### Subcarrier Output

#### Frequency:

3.579545MHz ± 100Hz

#### Output Voltage:

1Vp-p into open circuit

#### Synchronizing Signal:

60Hz field of 525 lines, interlaced scanning with equalizing pulse, possible to switch over to non-interlace scanning.

#### Horizontal Scanning

#### Frequency:

15.734kHz

#### Vertical Scanning

#### Frequency:

59.94Hz

60.05Hz

#### Horizontal Blanking:

#### Vertical Blanking:

11.3μs

1.24ms

1.21ms

#### Horizontal Sync.:

#### Front Porch:

3H

1.3μs

#### Burst:

8 cycles min.

#### Power Supply:

100, 120, 200, 220, 240V AC, 50/60Hz, 18VA

#### Size and Weight:

198(W) × 118(H) × 300(D)mm, 3.2kg

#### Accessories:

BNC-clip cable ..... 1

F-clip cable ..... 1

#### ■ LCG-396YC

#### YC Output

#### Output Level:

1Vp-p (Y: between sync. and white signal)

0.286Vp-p (C: color burst signal)

#### Output Impedance:

75Ω (Y and C)

#### Terminal:

Round miniature connector (S terminal)

#### RGB Output

#### Color Bar Signal:

R.G.B. outputs deliver color signals respectively

#### Dots, Crosshatch, Single

#### Cross:

R.G.B. outputs deliver same color signals

#### R.G.B Output:

TTL funout 1 (Positive logic)

#### Sync. Output:

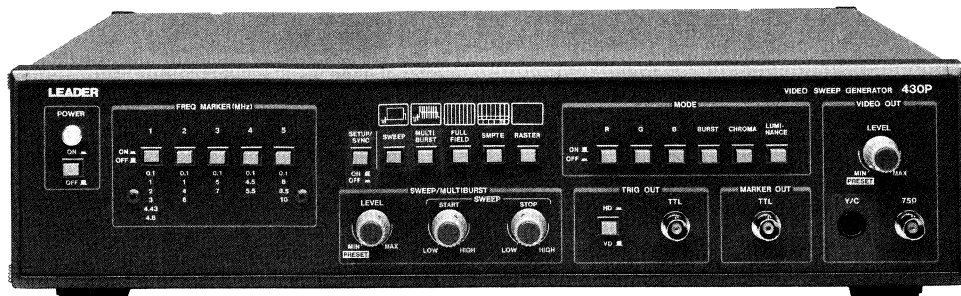
TTL funout 1 (negative logic) composite sync.

#### Terminal:

8-pin rectangular connector

## New Lineup for VTR Adjustment and Inspection

### NEW



## Model 430P PAL VIDEO SWEEP GENERATOR

### ● GENERAL

The Model 430P Video Sweep Generator has three generator functions for video sweep signals, multiburst signals, and color patterns, and is used to adjust VTRs and other video equipment. The sweep signal generator function covers a wide range from 100kHz to 10MHz, with a sweep width that can be easily selected. The multiburst signal generator function generates a 100% white reference signal and seven types of burst signals (from 0.5MHz to 7MHz). The color pattern generator function generates full-field and SMPTE color bars and raster patterns of eight colors.

★ The Model 430 NTSC system is also available.

### ● FEATURES

- The 430P Video Sweep Generator outputs composite video signals for inspecting and adjusting VTRs or television monitors.
- The sync and setup modes of the sweep output function can be temporarily turned off for partial inspection of a video circuit.
- The frequency marker is divided into five blocks to facilitate optimum use. TTL-level marker output is also available.
- Because of the sweep and multiburst signal levels can be set without changing the sync signal level, frequency characteristic changes can be measured by amplitude.
- Multiburst signals up to 7MHz can be used to check the resolution of television monitors or S-VHS VTRs.
- By using the built-in color bars, the linearity and phase characteristic of a transmission system can be checked.
- The sweep signal generator has Y/C separate output connector.
- The trigger output (HD and VD) is useful for observing waveforms on an oscilloscope.

### ● SPECIFICATIONS

<b>System</b>	
Color System:	PAL
Subcarrier Frequency:	4.43361875MHz
Line Frequency:	15.625kHz
Field Frequency:	50Hz
Setup Level:	0%
<b>Patterns</b>	
<b>Sweep</b>	
Frequency Range:	100kHz to 10MHz
Sweep Width:	Start and stop settings
Period:	Synchronized with vertical period
Amplitude:	700mVp-p preset and variable

<b>Flatness:</b>	± 0.2dB
<b>Marker Frequency:</b>	<ol style="list-style-type: none"> <li>① 0.1/1/2/3/4.43/4.8MHz</li> <li>② 0.1/1/4/6MHz</li> <li>③ 0.1/5/7MHz</li> <li>④ 0.1/4.5/5.5MHz</li> <li>⑤ 0.1/8/8.5/10MHz</li> </ol> The above five blocks can be turned on or off. Accuracy ± (3% + 50kHz)
<b>Multiburst</b>	
<b>Burst Frequency:</b>	0.5/1.25/2/4.43/4.8/5.8/7MHz
<b>Reference Level:</b>	100% white on left side of the screen, 700mVp-p Synchronized with 1H period 700mVp-p preset and variable ± 0.2dB
<b>Period:</b>	
<b>Amplitude:</b>	
<b>Flatness:</b>	
<b>Color Bar:</b>	Full-field color bar, SMPTE color bar 8-color raster (in combinations of R, G, and B)
<b>Pattern Control</b>	
<b>Luminance:</b>	On/Off
<b>Chrominance:</b>	On/Off
<b>Burst:</b>	On/Off
<b>R.G.B:</b>	Independent On/Off
<b>SETUP. SYNC:</b>	On/Off
<b>Sync Signal</b>	
<b>Amplitude:</b>	300mVp-p
<b>Burst Signal</b>	
<b>Amplitude:</b>	300mVp-p
<b>Output</b>	
<b>Video Output</b>	
<b>Output Voltage:</b>	1Vp-p into 75Ω
<b>Polarity:</b>	Positive (Sync negative)
<b>Attenuator:</b>	Continuously variable (0 to 1Vp-p)
<b>Output Impedance:</b>	75Ω
<b>Y/C Output</b>	
<b>Output Voltage:</b>	1Vp-p (Y: between sync signal and white signal) 0.3Vp-p (C: burst signal)
<b>Output Impedance:</b>	75Ω
<b>Connector:</b>	Round miniature connector (S terminal)
<b>Trigger Output</b>	
<b>Waveform:</b>	HD and VD switchable
<b>Output Voltage:</b>	3Vp-p or more into open circuit
<b>Marker Output</b>	
<b>Output Level:</b>	TTL (high for marker)
<b>Composite Sync Output</b>	
<b>Output Level:</b>	TTL
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz, 35VA
<b>Size and Weight:</b>	426(W) × 99(H) × 300(D)mm, 5kg
<b>Accessories:</b>	BNC-clip cable ..... 1 Spare fuse ..... 1

## Measuring Waveforms and Vectors Using a Single Unit



### Model 5871 PAL VECTOR/WAVEFORM MONITOR

#### ● GENERAL

The Model 5871 is a unique TV signal measurement monitor that integrates a waveform monitor with a vector scope in one body, and has a built-in SCH phase measurement circuit. Waveforms and vectors can be independently or simultaneously displayed on a single CRT by operating the provided electronic switches (this feature is only available for horizontal time limit display). In addition, this equipment has a built-in SCH phase measuring function for video editing. The SCH phase can be numerically read-out on the CRT. The phase variations of jitter are also displayed with the waveform. Furthermore, an full-line selector function is installed for reading the field and line number on the CRT. As a result, the Model 5871 is very useful not only in observing the blanking time intervals for VITS, VIR, character broadcasting and ITS, but also in checking the various characteristics of video camera resolution.

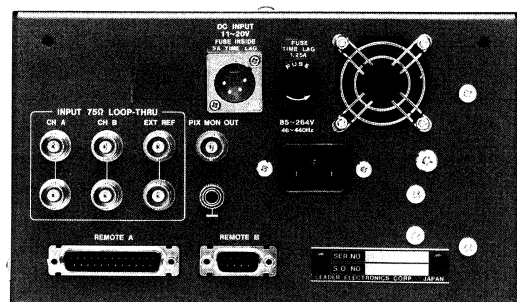
★ The Model 5870 and the Model 5872, NTSC system are also available.

\* The model 5872 is the model which the line selector function and the SCH phase measuring functions are eliminated from the Model 5870.

#### ● FEATURES

- 150mm rectangular CRT with internal graticule. The 16.5kV high-acceleration voltage facilitates legible, clearly defined display.
- CRT displays of SCH measurements enable correct monitoring without reading errors.
- The line selector function used to select optional lines from the panel also monitor vertical interval test signals (VITS). Up to 9 fields and lines can be preset in memory.
- The field and line numbers selected by the line selector function are displayed on the CRT for confirmation during waveform observation.
- The dual channel display function displays A and B inputs concurrently.
- The newly developed power supply circuit enables instrument operation using supply voltages of 90 to 250 VAC without switching. The standard DC operation function (11 to 20 VDC) enables instrument use in vehicles.
- All front-panel switches can be externally remote-controlled.
- Differential gain (DG)/differential phase (DP) can be displayed through single mode key operations.
- RGB/YRGB display function.

#### ■ Rear Panel



## ● SPECIFICATIONS

<b>CRT</b>		<b>CAL:</b>	Amplitude: 1V ± 1% Frequency: 100kHz ± 0.1kHz
<b>Type:</b>	150mm rectangular	<b>DG and DP Display</b>	
<b>Acceleration Voltage:</b>	16.5kV/2kV	<b>DG Measurement:</b>	Range: ± 10% Accuracy: ± 1%
<b>Effective Display Area:</b>	100mm × 80mm	<b>DP Measurement:</b>	Range: ± 10° Accuracy: ± 1°
<b>Scale:</b>	Internal graticule (for waveform and vector display) with scale illumination	<b>Vectorscope Section</b>	
<b>Waveform Monitor Section</b>		<b>Chrominance Processing</b>	
<b>Vertical Axis</b>		<b>Bandwidth:</b>	Fsc = 4.43361875MHz High frequency: Fsc + 500kHz Low frequency: Fsc - 500kHz
<b>Deflection Sensivity:</b>	1V full scale 1.0 scale: ± 1% × 5 MAG: ± 3%	<b>Phase Accuracy:</b>	± 2°
<b>VA-R Variable Range:</b>	× 1 full scale: 0.7 to 2V × 5 MAG: 0.14 to 0.4V	<b>Amplitude Accuracy:</b>	± 3%
<b>Maximum Input Voltage:</b>	± 2V (DC + ACp-p)	<b>Differential Phase:</b>	± 1°
<b>Frequency Response</b>		<b>Differential Gain:</b>	± 1%
<b>FLAT:</b>	25Hz to 6MHz ± 2% 6MHz to 8MHz ± 2% or -5% at 50kHz reference	<b>Subcarrier Regenerator:</b>	Sync capture range: ± 50Hz
<b>LUM:</b>	Attenuation: -3dB or less at 1MHz, 40dB or more at 4.43MHz Flatness between FLAT and IRE: 1% or less at 15kHz	<b>Phase Adjustment Range:</b>	360°
<b>CHROMA:</b>	4.43MHz bandpass filter Bandwidth: 2MHz Flatness between FLAT and CHROMA: 1% or less at 4.43MHz	<b>Display</b>	
<b>Transient Response:</b>	1V full scale (2T pulse and 2T bar for FLAT) Overshooting: ± 2% Preshooting: ± 2% Ringing: ± 2% Pulse-to-bar ratio: Within ± 1% Vertical window signal tilting: Within ± 2%	<b>GAIN Variable Range:</b>	× 1 MAG input: 210mV to 1.05V × 5 MAG input: 43.2mV to 210mV
<b>Input Impedance:</b>	15kΩ or more	<b>SCH Mode</b>	
<b>Return Loss:</b>	40dB or more (at 50kHz to 6MHz)	<b>Absolute Accuracy:</b>	± 5° at of 25°C
<b>Video Output:</b>	1V ± 5% at 1.0 scale deflection Frequency response: 25Hz to 6MHz ± 5% Output impedance: 75Ω Clamped on the back porch.	<b>Relative Accuracy:</b>	± 2°
<b>DC Restorer:</b>		<b>Display Range:</b>	External reference: 360° Internal reference: ± 80° SCH + 80° to SCH - 80°
<b>Horizontal Axis</b>		<b>CRT Readout:</b>	
<b>1H Sweep:</b>	Displays 1H waveform	<b>Required Input Voltages</b>	
<b>2H Sweep:</b>	Displays 2H waveform	<b>SCH Mode:</b>	Sync and burst of composite video or black burst signal: 300mV ± 3dB
<b>1μs/div:</b>	10 times of 2H sweep	<b>Other Modes:</b>	Sync and burst of composite video or black burst signal: 300mV ± 6dB
<b>0.2μs/div:</b>	25 times 1H sweep	<b>EXT REF</b>	
<b>1V Sweep:</b>	Displays 1V waveform	<b>Sync Amplitude:</b>	Synchronization with 143mV to 4V
<b>2V Sweep:</b>	Displays 2V waveform	<b>Input Impedance:</b>	15kΩ or more
<b>V. MAG:</b>	20 times 1V and 2V sweeps	<b>Return Loss:</b>	40dB or more (at 50kHz to 6MHz)
<b>Sweep Time Accuracy:</b>	1μs/div: ± 3% 0.2μs/div: ± 3%	<b>Maximum Input Voltage:</b>	± 12V (DC + ACp-p)
<b>Sweep Length:</b>	12.5 div	<b>Line Selector:</b>	Field 1.3: 1 to 313 lines Field 2.4: 314 to 625 lines Field selection: FD1, 3, FD2, 4 or FD1, 2, 3, 4 Preset: 1 to 9; 9 points Preset No.: P1 to P9 Field: FD1, 3, FD2, 4 or FD1, 2, 3, 4 1 to 313 or 314 to 625
<b>Linearity:</b>	Within ± 3%	<b>CRT Readout:</b>	
<b>RGB/YRGB:</b>	Selectable (RGB at shipment) Staircase Input: 10V ± 15% for 9 div display Maximum Input: ± 12 VDC + ACp-p Timebase: RGB: 30% of standard length (1H sweep) YRGB: 22% of standard length (1H sweep) Control Signal: Apply TTL LOW active signal to rear panel remote connector.	<b>Line Number:</b>	
		<b>Remote Control</b>	
		<b>Controllable Section:</b>	All front-panel functions
		<b>Control Signal:</b>	TTL (active low)
		<b>Control Input Connectors:</b>	Rear panel: D-sub 25-pin (Remote A) D-sub 9-pin (Remote B)
		<b>Power Supply:</b>	AC: 90V to 250V (at 48Hz to 440Hz) without switching DC: 11V to 20V, 2.8A at 12V
		<b>Size and Weight:</b>	215(W) × 132(W) × 429(D)mm, 7.1kg

# VIDEO

## Vector Display of Chrominance Signal of Video Signal

**NEW**



### Model 5851V PAL VECTORSCOPE

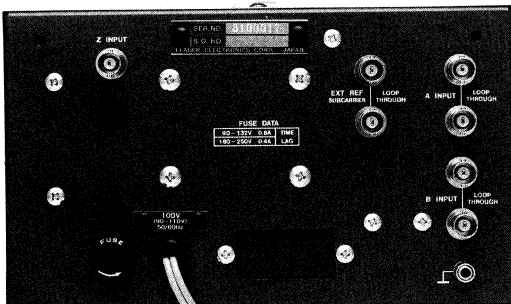
#### ● GENERAL

The Model 5851V is a PAL color TV system vectorscope for vector display of relative amplitude and phase of chrominance components contained in composite video signals on the CRT. Phase (direction of rotation) and amplitude (radial length from the center) of chrominance components against burst signals can be measured by demodulating chrominance components, which convey color information in video signals and by vector-displaying them on the CRT. As the scale is provided on the internal-graticule (with the scale illumination), it is possible to measure color bar signal without parallax reading error.

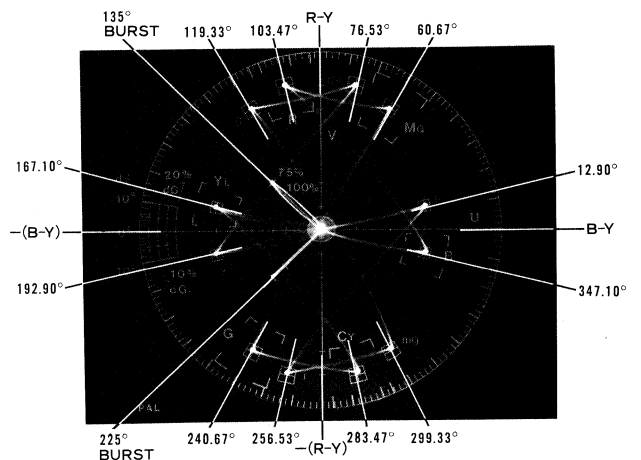
#### ● FEATURES

- The 150mm rectangular CRT with internal gradicules (with the scale illumination), it is possible to measure without parallax reading error.
- DP and DG measurements enable using the modulated staircase.
- Use with a waveform monitor to observe the vector of VITS and VIR signals.
- The optional rack-mounted adapter enables a pattern generator, color monitor, and vectorscope to be integrated into a system.

#### ■ Rear Panel



#### ■ The Angles for Each Hue

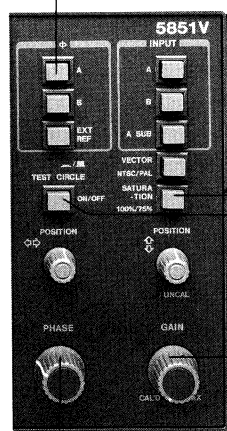


★ The Model 5850V, NTSC System is also available.



## ● SPECIFICATIONS

<b>CRT</b>	
<b>Type:</b>	150mm, rectangular, internal-graticule with scale illumination
<b>Accelerating Voltage:</b> 12kV/2kV	
<b>Effective Display</b>	
<b>Area:</b>	100 × 80 mm
<b>Scale:</b>	Allowable frame; ±20%/±10° of standard color bar, circle, angle, U axis, V axis, and DG and DP, ±5%/±3° of standard color bar, and burst signal
<b>Composite Video Signal Input</b>	
<b>Sensitivity:</b>	Input A, input B Calibrated value Color saturating; 75%, 100%, full scale Amplitude; 1Vp-p, 1.24Vp-p Variable range; Approx. 0.5 to 5 times of the calibrated value EXT. REF: Subcarrier; 2Vp-p ± 6dB Black burst; 0.45Vp-p ± 6dB
<b>Input A:</b>	Rear panel, loop-through, BNC connector Input impedance: 2MΩ
<b>Input B:</b>	Rear panel, loop-through, BNC connector Input impedance: 2MΩ
<b>EXT REF:</b>	Rear panel, loop-through, BNC connector for subcarrier Input impedance: 10kΩ
<b>Blanking Input</b>	
<b>Sensitivity:</b>	DC ± 1V
<b>Polarity:</b>	Bright at positive
<b>Chrominance</b>	
<b>Bandwidth:</b>	Fsc = 4.43361875MHz High band: Fsc + 500kHz Low band: Fsc - 500kHz
<b>Phase Accuracy:</b>	± 2°
<b>Amplitude Accuracy:</b>	± 3%
<b>Differential Phase:</b>	± 1°
<b>Differential Gain:</b>	± 1%
<b>Measurement Items</b>	
<b>Vector Measurement:</b>	Phase and amplitude of; 75% or 100% color single saturation of chrominance on color bar signal
<b>Horizontal Synchronization</b>	
<b>Input:</b>	Synchronization by the horizontal Sync signal of composite video signal from input A or B.
<b>Sync Polarity:</b>	Negative
<b>Sync Level Range:</b>	0.3Vp-p ± 6dB
<b>Subcarrier Signal Synchronization</b>	
<b>Synchronization by burst signal (of composite video signal)</b>	
<b>Sync Level Range:</b>	0.3Vp-p ± 6dB
<b>Synchronization by external subcarrier signal (which is applied to the EXT REF input)</b>	
<b>Subcarrier Signal</b>	
<b>Sync Level Range:</b>	2Vp-p ± 6dB
<b>Synchronization by black burst signal (which is applied to the EXT REF input)</b>	
<b>Black Burst Sync</b>	
<b>Level Range:</b>	0.45Vp-p ± 6dB
Note: The external subcarrier signal is switched to and from the black burst signal internally. (Set in black-burst mode at shipment)	
<b>Subcarrier Frequency:</b>	4.43361875MHz
<b>Sync Capture Range:</b>	± 50Hz (0°C to 40°C)
<b>Phase Adjustment</b>	
<b>Range:</b>	360°, continuously variable
<b>Calibration</b>	
<b>Test Circle:</b>	Set the chrominance signal applied from the input connector in asynchronous mode.
<b>Power Supply:</b>	100, 120, 200 or 240VAC, 40VA
<b>Size and Weight:</b>	215(W) × 132(H) × 429(D)mm, 6kg



Press A, B or EXT REF to synchronize the internal subcarrier oscillator with the sync signal and burst signal of the composite video signal.

The test circle appears when the vector is rotated while the chrominance signal applied to input A or B, is set in asynchronous mode. If a perfect circle is drawn, it means that the Model 5851V has been adjusted correctly.

Select 100% or 75% saturation color bar.

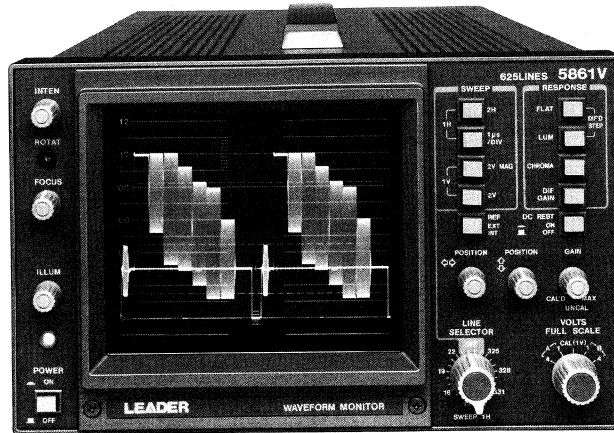
A phase adjuster to change the vector phase. A full rotation changes the phase by 360 degrees.

Changes the amplitude of the chrominance signal applied to input A or B.

# VIDEO

## Measurements of Composite Video Signal Amplitude, Timing, and Frequency Response

**NEW**



### Model 5861V PAL WAVEFORM MONITOR

#### ● GENERAL

The Model 5861V Waveform Monitor is an oscilloscope that is capable of quickly monitoring amplitude, time, frequency response, etc. of complex TV signals, which are hard for ordinary oscilloscopes to measure.

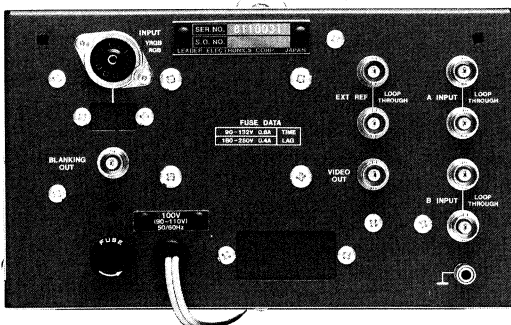
The waveform monitor is equipped with various mode and trigger functions that are optimum to video signal monitoring. Such various modes as 2H, 1H, 1 $\mu$ s/div, 2V, 1V, and 2V MAG can be selected by the horizontal axis sweep. As FLAT, LUM, CHROMA and DIF GAIN can be switched, it is possible to observe various characteristics of video signals.

Furthermore, the line selector function is provided for observing VITS and VIR signals which are inserted during the vertical blanking period. In addition, the blanking output connector for blanking other periods that lines selected by the line selector, video output connector and other functions necessary for video signal monitoring are provided.

#### ● FEATURES

- Differentiated-step methods are used to display the differential of staircase signals to make measuring the linearity of transmission system luminance components easier.
- Built-in line selector function for monitoring VITS and VIR signals, a blanking output, and a video output.
- Horizontal sweep mode selection from 2H, 1H, 1 $\mu$ s/div., 2V, 1V, and 2V MAG. The frequency response of the vertical axis is switchable among FLAT, LUM, CHROMA, DIF GAIN, and DIFF'D STEP.
- The half-rack size monitor (conforming to EIA) can also be integrated into a system with a pattern generator, color monitor and vector-scope using the optionally available rack-mounted adapter.

#### ■ Rear Panel



#### ■ Front Panel

Selects the sweep; 2H, 1H, 1 $\mu$ s/div, 2V, 1V, 2V MAG

Selects frequency response; FLAT, LUM, CHROMA, DIF GAIN, DIFF'D STEP

Selects internal synchronization and external synchronization. Apply the external synchronization signal to the SYNC connector on the rear panel.

Maintains the back porch to a constant level by setting the switch to ON, when the waveform moves up and down because of a change in APL (average picture level) and/or existence/nonexistence of burst.


Selects lines which are inserted for monitoring the signals of the VIT and VIR.

The sensitivity is calibrated at the CAL'D position.

The sensitivity is set to calibrated, 1V full scale at input connector A, 4V full scale at input connector B.

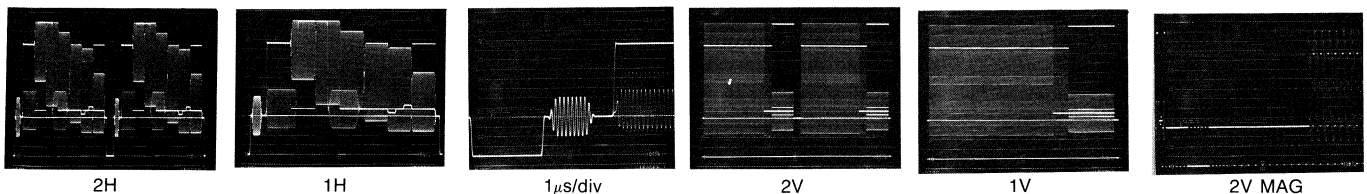
★ The Model 5860V, NTSC system is also available.

## ● SPECIFICATIONS

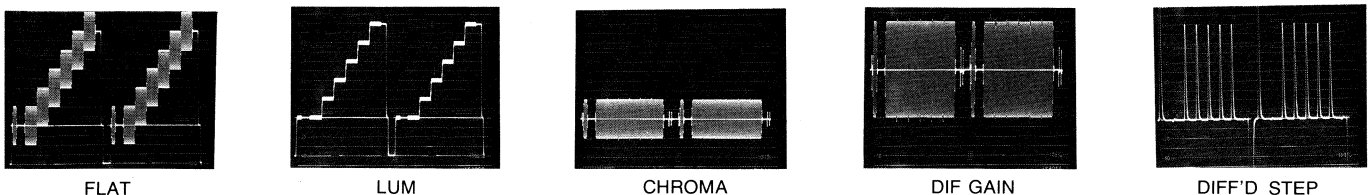
<b>CRT</b>					
<b>Type:</b>	150mm, rectangular, internal-graticule with scale illumination	<b>Output Impedance:</b>	75Ω ± 10%	<b>Frequency Characteristics:</b>	25Hz to 5MHz ± 5%
<b>Acceleration Voltage:</b>	12kV/2kV	<b>Sweep</b>			
<b>Effective Display Area:</b>	100mm × 80mm	<b>Sweep Mode:</b>			
<b>Input Section</b>		<b>1H Sweep:</b>	Display of 1H waveform		
<b>Input Connector:</b>	A and B on the rear panel, 2 connectors each, loop-through type	<b>2H Sweep:</b>	Display of 2H waveform		
<b>Input Impedance:</b>	1V range 15kΩ, 50pF	<b>1μs/div:</b>	10 times magnification of 2H sweep, 1μs/div ± 3%		
	4V range 60kΩ, 50pF	<b>1V Sweep:</b>	Display of 1V waveform		
<b>Maximum Input Voltage:</b>	± 5V DC + ACp-p	<b>2V Sweep:</b>	Display of 2V waveform		
<b>Scale Graticule:</b>	FULL SCALE 1.0 scale	<b>2V MAG Sweep:</b>	Approx. 20 times magnification of 2H sweep, 1μs/div ± 3%		
	SYNC 0.3 scale				
	VIDEO 0.7 scale	<b>Linearity:</b>	± 3%		
<b>Deflection Accuracy</b>		<b>RGB/YRGB Display:</b>	RGB is standard (YRGB is optional)		
<b>1V Range:</b>	Within ± 2% of 1.0 scale at 1V input	<b>Staircase:</b>	10V ± 15%/9 div		
<b>4V Range:</b>	Within ± 4% of 1.0 scale at 4V input	<b>Maximum Input Voltage:</b>	± 12V DC + ACp-p		
<b>Frequency Characteristics:</b>	25Hz to 3.6MHz ± 2%	<b>Sweep:</b>	1H display at 2H sweep		
	3.6MHz to 5MHz + 2%, -5%		1V display at 2V sweep		
	50kHz reference at filter "FLAT"	<b>Sweep Line Length:</b>	RGB; 30% × 3 of composite display		
			YRGB, 22% × 4 of composite display		
<b>Filter Characteristics</b>		<b>Composite-YRGB Changing:</b>	Remote control from external or internal control signal		
<b>LUM:</b>	Conforming to IRE STD 23S-1 of year 1972, more than 22dB of attenuation at 4.43MHz	<b>Control Signal:</b>	12 to 15V (negative or positive), 15mA		
<b>CHROMA:</b>	4.43MHz bandpass filter	<b>Signal Input Connector:</b>	Pin 9 MT socket at the rear panel		
	Response: Within ± 2% at filter "FLAT"		Pin 9 D-sub connector (option)		
<b>DIF GAIN:</b>	4.43MHz bandpass filter	<b>External Synchronization</b>			
	About 3 to 5.5 times of CHROMA amplitude	<b>Input Connector:</b>	2 terminals, BNC, loop through type in rear panel		
<b>DIF STEP:</b>	For measuring the linearity of luminance	<b>Input Impedance:</b>	15kΩ		
	400kHz band pass filter	<b>Input Sensitivity:</b>	0.143 to 5V (Sync signal level is a composite video signal)		
	Response (at filter "FLAT")	<b>Maximum Input Voltage:</b>	± 8V		
	400kHz Within ± 2%	<b>Line Selector</b>			
	500kHz Within + 0, - 20%	<b>Display Line:</b>	13 to 22 lines and 325 to 334 lines		
	14kHz, 2MHz Within - 90%	<b>Blanking Output</b>			
	3.58MHz Within - 99%	<b>Output Connector:</b>	BNC connector in rear panel		
<b>Transient Response:</b>	± 1.5% or less in overshoot, preshoot, and ringing using the sin <sup>2</sup> pulse & bar signal at FLAT with 1V full scale range.	<b>Voltage Level:</b>	Selected by the line selector .. 0V... For other duration ..... - 2V... 		
<b>Sag (Vertical Window Signal):</b>	2% or less	<b>Calibrator</b>			
<b>Variable Range:</b>	Input voltage of 1.0 fullscale	<b>Waveform:</b>	Square waveform		
<b>1V Range:</b>	0.25V or less to 1V	<b>Amplitude:</b>	1Vp-p ± 1%		
<b>4V Range:</b>	1V or less to 4V	<b>Frequency:</b>	32kHz		
<b>DC Regeneration:</b>	Clamp at the back porch	<b>Power Supply:</b>	100, 120, 200, 240 VAC, 50/60Hz, 45VA		
<b>Video Output</b>		<b>Size and Weight:</b>	215(W) × 132(H) × 429(D)mm, 6.5kg		
<b>Output Connector:</b>	Provided on the rear panel				
<b>Output Voltage:</b>	1V ± 15% at full scale input				

## ■ Waveforms Display

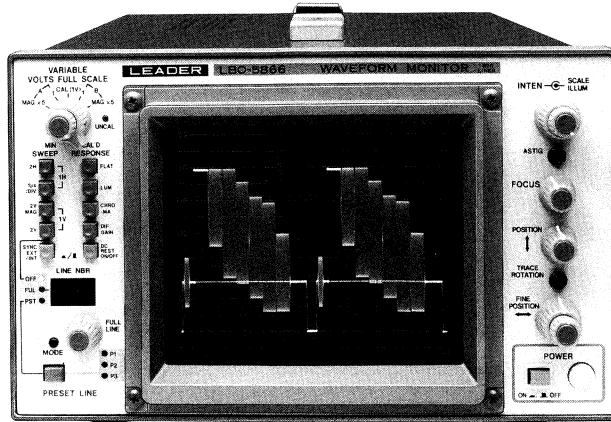
### ● Sweep Range



### ● Frequency Response Range



## Built-In Full Line Selector



### LBO-5866 625 LINES WAVEFORM MONITOR

#### ● GENERAL

In addition to conventional waveform monitoring functions, the LBO-5866 can monitor all lines on the television screen and any one selected line including the vertical blanking period, and display a bright marker on the television screen to indicate which line is being monitored.

The CRT is bright enough (PDA 16.5kV) to display a bright, sharp waveform when either one horizontal line is displayed in the vertical frame or both fields are displayed simultaneously.

The LBO-5866 is useful not only on the TV camera production as well as in studio and other outdoor location work.

#### ● FEATURES

- Black level can be confirmed by  $MAG \times 5$  ( $1V \rightarrow 0.2V$ ).
- The instrument can be set up to cycle through three preset lines (five if remote control is used), which is a convenient feature for inspection during the camera production process.
- A bright marker indicates the selected line (including the full line selector) on the TV screen.
- The selected line number including preset lines is always indicated by a 3-digit LED display.
- A pushbutton switch stores the final settings (including the line numbers) in battery backed up memory so they are held even with power turned off.

#### ● SPECIFICATIONS

##### CRT Acceleration

**Voltage:** 16.5kV/2kV  
**Sensitivity:** 1Vp-p full scale  $\pm 2\%$   
 $\times 5$  MAG full scale  $\pm 4\%$   
 CAL'D at turned fully to right

##### Line Display:

One selected horizontal line is displayed. A LED display indicates the line number.

##### Full Line Select:

Any line from 1 to 625 can be selected by a pulse switch.

##### Preset Line Select:

Any three or five selected lines can be internally preset.

##### Remote Control

**Function:** Line select, full line select, and mode select.

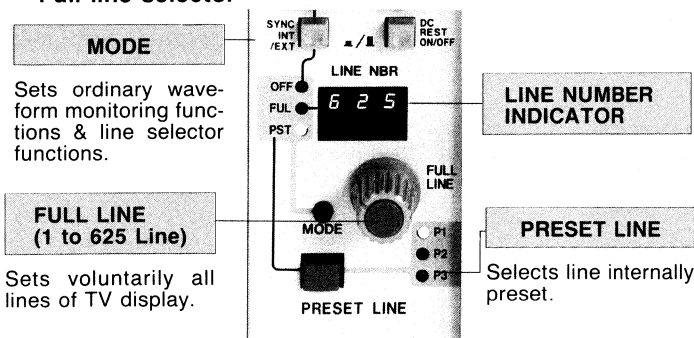
**Last Memory Function:** The last switch settings and line numbers are held in memory even when power is turned off.

##### Video Output:

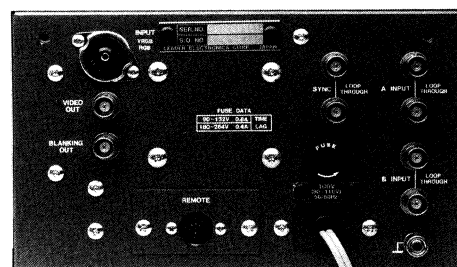
A pulse corresponding to the selected horizontal line is added to the video output, to display a white-line marker on the video monitor screen.

\* All other specifications are common to the Model 5861V.

#### ■ Full line selector



#### ■ Rear Panel



★ The LBO-5865, NTSC system is also available.

## Combination of a Waveform Monitor and a Picture Monitor



### LVM-5863A NTSC-M VIDEO MONITOR

#### ● GENERAL

The LVM-5863A Video Monitor consists of the combination of a waveform monitor and a picture monitor — all in one compact carrying case.

This video monitor, however, provides the ability to monitor the color picture and sound and makes waveform measurements as pictures are taken, greatly enhancing the reliability of such field video work. The LBO-5864 Waveform Monitor provides a 2V/2H, FLAT/IRE display and has selectable 1V/0.25V input sensitivity, valuable functions for use in field electronic news-gathering applications and in EFP applications as well.

#### ● FEATURES

- Clear and sharp waveform display
- 25Hz to 5MHz frequency response
- Selectable FLAT/IRE filter characteristics
- Selectable 1V/0.25V fullscale sensitivity (vertical axis expandable × 4)
- Sweep: Switchable 2H/2V display
- Pilot lamp flashes when battery is low
- Quickly removable batteries

#### ● SPECIFICATIONS

##### Picture Monitor Section

<b>Power Supply:</b>	12V DC, 450mA, 5.7W
<b>Audio Output:</b>	170mW
<b>Speaker:</b>	4cm round-shaped
<b>Input Connectors:</b>	Video input: 1Vp-p, 75Ω unbalanced Audio input: 390mVrms (-6dBs) High impedance (47kΩ)
<b>Output Connectors:</b>	Same as input
<b>Size:</b>	96(W) × 79(H) × 234(D)mm

##### Waveform Monitor Section

<b>CRT</b>	
<b>CRT size:</b>	75mm rectangular
<b>Acceleration Voltage:</b>	1.5kV
<b>Effective Display Area:</b>	52mm × 41.6mm
<b>Beam Rotator:</b>	Adjustable by external preset
<b>Graticule:</b>	Internal

##### Vertical Axis

<b>Sensitivity:</b>	1V ± 2%, 0.25V ± 4% full-scale range
<b>Filter:</b>	FLAT/IRE
<b>Frequency Response:</b>	25Hz to 5MHz ± 5% (FLT), 4.43MHz - 22dB (IRE)
<b>Maximum Input Voltage:</b>	± 5V DC (1V, 0.25V full-scale range), AC, coupled
<b>Input Connectors:</b>	Rear panel two BNC input connectors (loop- through), 75Ω
<b>Input Impedance:</b>	0.25V full-scale range, 15kΩ 1V full-scale range, 60kΩ
<b>DC Restoration:</b>	Clamped to TV-H back porch
<b>Horizontal Axis:</b>	2H sweep: Display of 2H waveforms 2V sweep: Display of 2V waveforms Linearity: ± 3% or less

<b>Power Supply:</b>	+ 11V to + 13.8V (Falling battery voltage below 10.5V are indicated by a pilot lamp flashing on and off), 720mA 95(W) × 74(H) × 235(D)mm, 1.2kg DC plug (with 1m cable) Fuse, 1.6A, anti-rush
<b>Power Supply:</b>	12V (11V to 13.8V), 14W (waveform moni- tor: 8.6W, 720mA, picture monitor: 5.7W, 450mA)

<b>Continuous Operation:</b>	• With the battery pack LP-2071 (1.7Ah) If using only the waveform monitor: 140 minutes If using only the picture monitor: 220 minutes
<b>Size and Weight:</b>	222(W) × 85(H) × 255(D)mm, 4kg (including battery pack LP-2071 and carrying case)
<b>Accessories:</b>	Carrying case ..... 1 Battery pack LP-2071 ..... 1 DC plug (with 1m cable) ..... 1 Fuse, 1.6A anti-rush ..... 1
<b>Continuous Operation:</b>	• With the battery pack LP-2071 (1.7Ah), 90minutes If using only the waveform monitor: 140 minutes If using only the picture monitor: 220 minutes
<b>Size and Weight:</b>	222(W) × 85(H) × 255(D)mm, 4kg (including battery pack LP-2071 and carrying case)
<b>Accessories:</b>	Carrying case ..... 1 Battery pack LP-2071 ..... 1 DC plug (with 1m cable) ..... 1 Fuse, 1.6A anti-rush ..... 1

## Handy-Type Vectorscope for Location and ENG

**NEW**



### Model 5857 PAL VECTORSCOPE

#### ● GENERAL

The Model 5857 is the ultra-compact size vectorscope for outdoor rebroadcasting operating with a battery-driven or external DC power source.

This vectorscope displays the chrominance component (amplitude and phase) on the CRT; they are included in PAL system composite video signals. It demodulates the chrominance component, which contains color information, included in video signal. It then displays the chrominance in vector field for measuring the phase and amplitude to the burst signals in each chrominance component. In combination with a Leader's handy type series such a picture monitor or a waveform monitor, this PAL vectorscope realizes easier outdoor location or on-the-spot broadcasting.

#### ● FEATURES

- A 75mm rectangular internal graticule CRT for bright and vivid picture with an acceleration voltage of 1.5kV.
- Input connectors A and B can be switched over on the front panel.
- Loop-through type BNCs are used as input connectors.
- Input sensitivity is selectable from either CAL or VARIABLE.
- Horizontal synchronization is selectable from either A or B on the front panel.
- Phase can be set with the PHASE control on the front panel.
- Push-in type extend mechanism has been used for the GAIN and PHASE controls to prevent them from being moved after setting.
- NTSC display is possible.

★ The Model 5854 NTSC system is also available.

#### ● SPECIFICATIONS

##### CRT

**Display Area:** 41mm(V) × 52mm(H), rectangular type  
**Acceleration Voltage:** 1.5kV  
**Scale:** Internal graticule  
 Circle, angle, U axis, V axis, DG, DP, ±5%/±3% and ±20%/±10% tolerance of standard color bar, burst

##### Composite Video Signal Input

**Sensitivity**  
**CAL:** Color saturation: 75% } Full scale  
 Amplitude: 1Vp-p  
 Variable range 0.5 to 5 times of CAL (for both inputs A and B)  
**VARIABLE:** Rear panel, BNC connector loop-through  
**Input A:** Input Impedance: 2MΩ  
**Input B:** Rear panel, BNC connector loop-through  
 Input impedance: 2MΩ

##### Chrominance Band Width

**Center Frequency:** Fsc = 4.43361875MHz  
**Upper Cut-Off Frequency:** Fsc + 500kHz  
**Lower Cut-Off Frequency:** Fsc - 500kHz

**Phase Accuracy:** ±3°  
**Amplitude Accuracy:** ±5%  
**Differential Phase:** ±1°  
**Differential Gain:** ±1%

##### Measurement Item

**Vector measurement**  
**Color Signal Saturation:** 75%, chrominance signal phase and amplitude of color bar signal

##### Sync Signal

**Synchronization:** Synchronized with horizontal sync signal of composite video input from A or B

**Synchronization Signal Polarity:** Negative  
**Synchronization Level Range:** 0.3Vp-p ± 6dB

##### Subcarrier Signal

**Synchronization With Burst Signal:** Synchronization with burst signal of composite video input

**Synchronization Level Range:** 0.3Vp-p ± 6dB  
**Subcarrier Frequency:** 4.43361875MHz

**Synchronization Capture Range:** ±50Hz (0 to 40°C)  
**Phase Control Range:** ±60°, variable

**Power Supply:** +11V to +13.8V (The pilot lamp blinks when battery voltage falls under 10.5V)

**Size and Weight:** 95(W) × 74(H) × 235(D)mm, 1.2kg

## 2H/2V Display of Video Waveform

### NEW



## Model 5867 PAL WAVEFORM MONITOR

### • GENERAL

The Model 5867 Waveform Monitor provides a 2V/2H, FLAT/IRE display and has selectable 1V/0.25V input sensitivity, valuable functions for use in field electronic news-gathering applications and in EFP applications as well. The Model 5867 can also be conveniently used as a picture tester in checking the inter-equipment repeater cables in far-reading reporting applications involving telecast vans, as well as in studios.

### • FEATURES

- Clear and sharp waveform display
  - 25Hz to 5MHz frequency response
  - Selectable FLAT/LUM filter characteristics
  - Selectable 1V/0.25V fullscale sensitivity (vertical axis expandable × 4)
  - Sweep: Switchable 2H/2V display
  - Pilot lamp flashes when battery is low
  - Quickly removable batteries
- ★ The Model 5854 NTSC system is also available.

### • SPECIFICATIONS

#### CRT

**CRT size:** 75mm rectangular

#### Effective Display

**Area:** 52mm × 41.6mm

**Acceleration Voltage:** 1.5kV

**Beam Rotator:** Adjustable by external

**Graticule:** Internal

#### Vertical Axis

**Sensitivity:** 1V ± 2%, 0.25V ± 4% full-scale range

**Filter:** FLAT/LUM

**Frequency Response:** 25Hz to 5MHz ± 5% (FLT), 4.43MHz – 22dB

#### Maximum Input

**Voltage:** ± 5V DC (1V, 0.25V full-scale range), AC, coupled

**Input Connectors:** Rear panel two BNC input connectors (loop-through), 75Ω

**Input Impedance:** 0.25V full-scale range, 15kΩ  
1V full-scale range, 60kΩ

**DC Regeneration:** Clamped to TV-H back porch

#### Horizontal Axis:

2H sweep: Display of 2H waveform  
2V sweep: Display of 2V waveform  
H. MAG sweep: 2H sweep × 5  
2V sweep × 15

Linearity: ± 3% or less

#### Power Supply:

+ 11V to + 13.8V (Falling battery voltage below 10.5V are indicated by a pilot lamp flashing on and off), 720mA

#### Size and Weight:

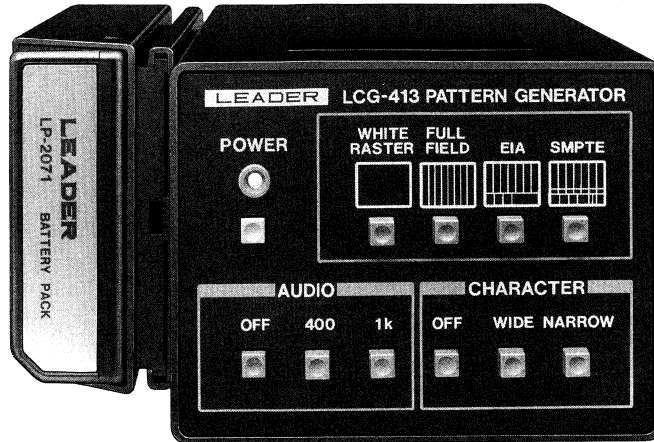
95(W) × 74(H) × 235(D)mm, 1.2kg

#### Accessories:

DC plug (with 1m cable).....1  
Fuse, 1.6A, anti-rush.....1

# VIDEO

## Easy Recognition Circuits by Character Display



### LCG-413 Model 413S NTSC PATTERN GENERATOR

#### ● GENERAL

The LCG-413 is a unique pattern generator that can output four optional-alphanumeric-character signals over conventional color bars. Audio signal output (1kHz/400Hz) is also available. The LCG-413 is particularly effective in identifying lines on spots crowded by multiple TV station broadcasting, such as outdoor telecasting.

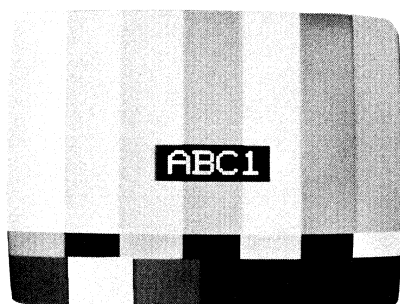
#### ● FEATURES

- Four-character output overlaid over conventional color bars facilitates line checking.
- The compact, lightweight design of the LCG-413 facilitates its use for broadcasting from spots events, stage productions, etc.
- Patterns includes SMPTE color bar, EIA, full-field and white raster.
- Wide/narrow selector switch for changing character width with a simple operation. (This function may be set OFF.)
- Sound signal of 400Hz or 1kHz is selectable with one-touch operation, thereby checking for sound circuit.

The Model 413S is a Satellite News Gathering (SNG) pattern generator used to:

- Satisfy communications satellite requirements.
- Insert up to eight characters into a color pattern containing the color bar used exclusively for satellite broadcasting, and to set a narrower bandwidth.

#### ■ Character Display in SMPTE (WIDE)



#### ● SPECIFICATIONS

##### Video Signals

**Test Signal:** SMPTE  
EIA, full-field color bar, white raster

##### Character Signal Display:

Four alphanumeric characters  
(Can be turned on and off from the panel.)

##### Character Width:

Selectable between narrow and wide.

##### Output Impedance:

75Ω

##### Output Levels:

Synchronization: 0.286Vp-p  
±21mVp-p

Video: 0.714Vp-p ±21mVp-p

3.579545MHz ±50Hz

##### Subcarrier Frequency:

##### Audio Signals

**Frequency:** 400Hz/1kHz ±2%

##### Level:

0dBm

##### Output Plug:

3-pin audio type

##### Power Supplies

##### Internal:

Battery pack LP-2071

##### External:

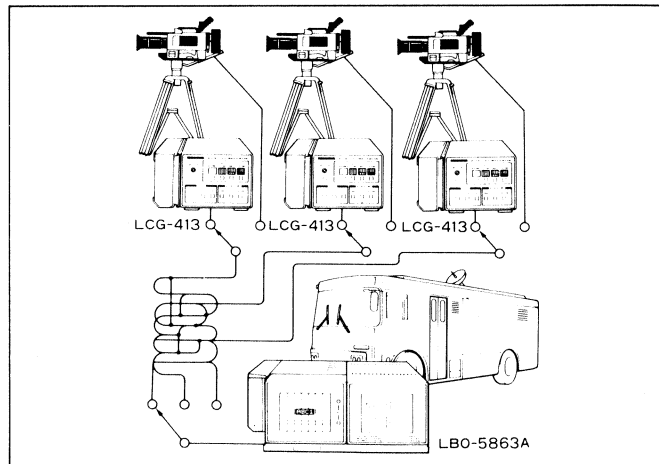
10-14VDC, 300mA

##### Size and Weight:

132(W) × 74(H) × 235(D)mm, 2kg (including battery)

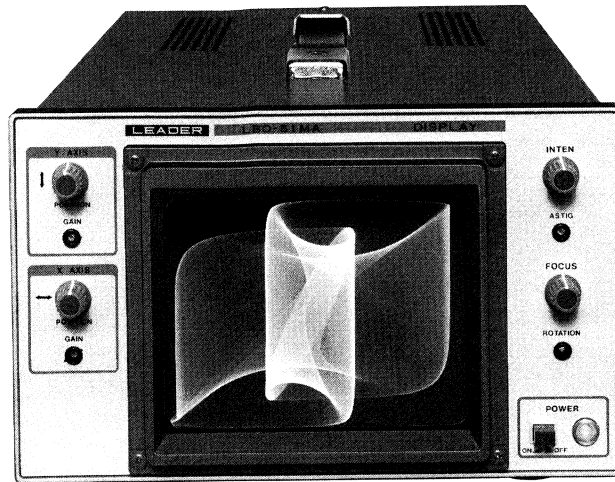
##### Accessories:

Battery Pack LP-2071 ..... 1





**X-Y Axis at 3MHz and Z Axis at 4MHz; Various Signals Displayable in Three-Dimensions.**



## LBO-51MA X-Y DISPLAY

### ● GENERAL

The purpose for developing the LBO-51MA, with a post-acceleration 150mm rectangular CRT, is to provide a display which can be used independently and is most adapted for OEM uses. Its 3MHz X·Y Axis bandwidth and 4MHz Z-Axis bandwidth allow applications as instrument to display response curve, spectrum and oscillation analysis, etc.

### ● FEATURES

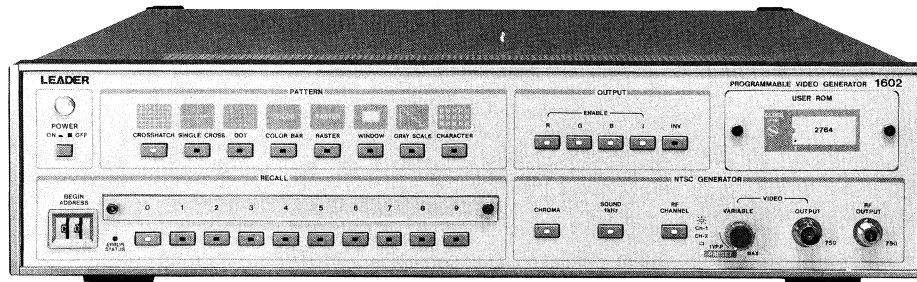
- X-Y Phase Difference is less than 3° at 1MHz
- Besides its independent use, its half rack size offers convenience for being mounted into various systems.
- CRT phosphor, X-Y Axis Sensitivity, A-Axis polarity, etc. are optionally available.

### ● SPECIFICATIONS

<b>CRT</b>	
<b>Type:</b>	150mm, Rectangular, post-acceleration
<b>Effective Display Area:</b>	8 × 10div (1div = 10mm)
<b>Acceleration Voltage:</b>	7kV/2kV Stabilized
<b>X·Y Axis</b>	
<b>Deflection Sensitivity:</b>	Adjustable between 50mV to 150mV/div with gain control on front panel. 50mV/div ±3% set at time of shipment.
<b>Frequency Response:</b>	DC (2Hz) to 3MHz -3dB
<b>Input Coupling:</b>	DC/AC Internally switchable (Shipped in DC setting)
<b>X-Y Phase Difference:</b>	Less than 3° at 1MHz
<b>Rise Time:</b>	Less than 120ns
<b>Polarity:</b>	Beam shifts upwards (Y-Axis) and to the right (X-Axis) at positive input, reversible with internal switch.
<b>Linearity:</b>	Less than 5%
<b>Input Impedance:</b>	1MΩ ±2%, Less than 50pF
<b>Input Voltage:</b>	100V (DC + ACp-p)
<b>Z Axis (Intensity)</b>	
<b>Input Voltage:</b>	Maximum intensity at +1V and blanked at -1V when intensity knob positions at center
<b>Frequency Response:</b>	DC to 4MHz -3dB
<b>Rise Time:</b>	Less than 90ns
<b>Input Impedance:</b>	1MΩ ±2%, Less than 50pF
<b>Max. Input:</b>	100V (DC + ACp-p)
<b>Optional:</b>	CRT phosphor, CRT Internal Graticule, X-Y Axis Sensitivity, X-Y-Z Input Resistance (50Ω), Z-Axis Polarity, Z-Axis TTL Input.
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, 35W
<b>Size and Weight:</b>	215(W) × 132(H) × 419(D)mm, 6kg
<b>Accessory:</b>	CRT Filter Plate (without scale) ..... 1 Fuse ..... 1

## Built-in Pattern Generator

# NEW



## Model 1602 PROGRAMMABLE VIDEO GENERATOR

### ● GENERAL

The Model 1602, programmable video generator, generates synchronous and video signals to adjust and test raster scanning CRT display units.

This equipment generates programmable signals generated through Leader's Model 1603/1603A/1604/1604A Programmable Video Generators with the user ROM. Two analog RGB outputs and two digital RGB outputs are available. In addition, composite video signals, YC separation signals (S terminal), and RF signals are output from the NTSC pattern generator. With its versatile functions, this model can easily accommodate a wide variety of applications from AV television to CRT displays to provide a higher cost-performance ratio.

\* Before ordering, specify one from the RF channel, PAL and NTSC system.

### ● FEATURES

- The synchronization timing is programmable in the user ROM in dot units (4096 dots max.) horizontally; and in line units (4096 lines max.) vertically.
- A character size of up to 16 dots (horizontal) × 64 lines (vertical) can be set.
- The built-in PLL frequency synthesizer enables a dot clock frequency between 1.024 and 65.536MHz of being programmed at a resolution of 1kHz.
- Two types of character generator (5 × 7 and 7 × 9 dots) are built in the system. (Alphabetic characters: ASCII or equivalent), graphics characters/Katakana: JIS or equivalent)
- Up to 16 types of 32 × 32 dot characters or symbols can be programmed in user ROM. (No data can be written to user ROM.)
- Three selectable modes are provided: interlace, non-interlace, and interlace shrink modes.
- The dot size can be set to 50% or 100% of the dot frequency.
- Composite synchronous signals may be added to each of analog outputs R, G, and B.
- The TTL video output is applicable to a TTL 64-color monitor.
- Vertical synchronous signals may be interlaced with the horizontal synchronous signal output.
- A remote controller (option) can be connected for manual operation.

### ■ Options

#### Model 1602-01 BNC Adaptor

**Features:** This output connector conversion adapter converts analog output from the Model 1602 so that they can pass through the BNC connector. Fix this adaptor on the rear of the Model 1602.

**Size and Weight:** 120(W) x 35(H) x 30(D) mm, 140g

#### Model 1602-02 Remote Controller

**Features:** All switches (other than power switch) on the front panel can be controlled remotely. This model indicates the address of the program being executed.

**Size and Weight:** 200(W) x 40(H) x 135(D) mm, 460g

#### Model 1602-03 RGB Multiadaptor

**Features:** This output connector conversion adapter converts analog signals output from the Model 1602 so that they can pass through the RGB multiadaptor. Fix this adaptor on the rear of the Model 1602. With this adaptor, the Model 1602 mainframe must be modified.

**Size and Weight:** 120(W) x 35(H) x 30(D) mm, 160g

## ● SPECIFICATIONS

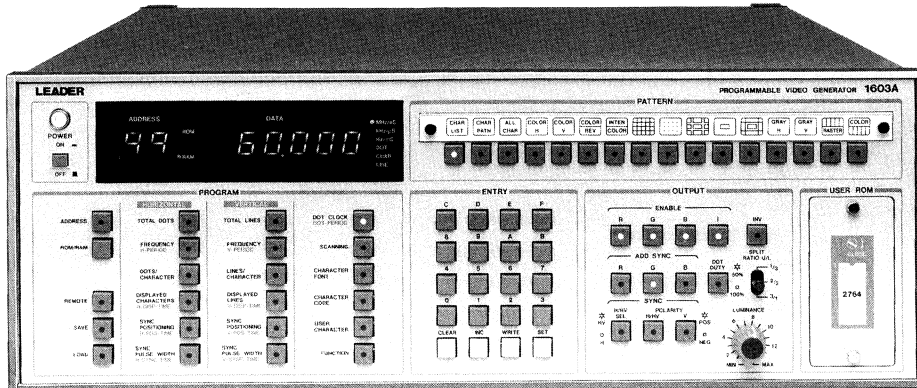
### PROGRAM SPECIFICATIONS

<b>Clock Frequency</b>	
Oscillating Range:	1.024 to 65.536MHz
Resolution:	1kHz steps
<b>Horizontal Synchronization</b>	
Total Dots:	64 to 4096 dots
Frequency:	1.024 to 131.072kHz in 1Hz steps
Dots per Character:	4 to 16 dots in 1 dot steps
Displayed Character:	2 to 255 characters in 1 character steps
<b>Synchronization</b>	
Positioning:	1 to 4096 dots in 1 dot steps
Synchronization Pulse Width:	1 to 4095 dots in 1 dot steps
<b>Vertical Synchronization</b>	
Total Lines:	10 to 4096 lines in 1 line steps
Frequency:	1.024 to 131.072Hz in 0.001Hz steps
Lines per Character:	1 to 64 lines in 1 line steps
Displayed Lines:	2 to 4095 lines in 1 line steps
Synchronization	
Positioning:	1 to 4096 lines in 1 line steps
Synchronization Pulse Width:	1 to 4095 lines in 1 line steps
<b>Interlace Selection:</b>	The non-interlace, interlace, or interlace shrink mode (SYNC and VIDEO) can be selected.
<b>Output Setting</b>	
<b>Synchronous Signal</b>	
Polarity:	Positive or negative
<b>Composite Synchronous Signal:</b>	HHS and HVS separation output or HV composite output can be programmed.
<b>Composite Video Signal:</b>	Analog video signals with or without composite synchronous signals can be programmed.
<b>Dot Duty Cycle:</b>	A dot horizontal line display validity of 50% (RZ signal) or 100% (NRZ signal) can be programmed.
<b>Character Selection</b>	
<b>Character Font:</b>	Selectable from 5 × 7 dots or 7 × 9 dots
<b>Character Set:</b>	Alphabetic (upper/lowercase), numeric, Katakana characters are selectively displayed in code conforming to JIS standards.
<b>User-Defined</b>	
<b>Character Font:</b>	16 types of 32 × 32 dots (max.) characters can be programmed.
<b>Pattern Selection:</b>	Crosshatch (17 × 13 lines with polarity marker in upper-left corner), Single cross, Dot (cross section of cross-hatch), Color bar (8, 16, or 64 colors), Raster, Window, Gray scale (16 contrasts) and All characters.
<b>User ROM:</b>	Conforms to Model 1603, 1603A, Model 1604, 1604A user ROM formats
<b>Programmable Part:</b>	Ten address (starting from the BEGIN address)
<b>REMOTE (Amphenol 36P Connector):</b>	Remotely controllable using the remote controller.

### OUTPUT SPECIFICATIONS

<b>Analog Output:</b>	R, G, B, HS/HVS, VS (level variable)
<b>D-SUB Connector:</b>	15P (level variable)
<b>D-SUB Connector:</b>	9P (level variable)
<b>TTL, Output</b>	
<b>Rectangular</b>	
<b>Connector:</b>	8P (8 or 16 colors) R, G, B, I, HS/HVS, VS
<b>Amphenol Connector:</b>	24P (8, 16, or 64 colors) R, G, B, I, R', G', B', HS/HVS, VS
<b>NTSC Output</b>	
<b>BNC Connector</b>	Composite Video Output
<b>Output Level:</b>	1Vp-p (75Ω termination), color bar
<b>Output Impedance:</b>	75Ω
<b>F-type Connector:</b>	RF output
<b>Miniature Circular</b>	
<b>Connector:</b>	YC separation output (rear panel)
<b>Y Output Level:</b>	1Vp-p (75Ω termination color bar)
<b>C Output Level:</b>	Burst level 0.286Vp-p (75Ω termination)
<b>Output Impedance:</b>	75Ω
<b>Sound Output</b>	
<b>Pin Connector</b>	
<b>Output Level:</b>	0.4Vrms
<b>Output Impedance:</b>	10kΩ
<b>Frequency:</b>	1kHz
<b>Power Supply:</b>	90 to 132V AC (option; 180 to 250V AC), 50/60Hz, 77VA
<b>Size and Weight:</b>	426(W) × 99(H) × 450(D)mm, 8.0kg
<b>Accessories:</b>	BNC-clip cable: 3C2V ..... 1 F-type-clip cable: 3C2V ..... 1 D-sub connector: DE-9P ..... 1 Rectangular clamp: DE-24567 ..... 1 D-sub connector: DA-15P ..... 1 Rectangular clamp: DA-24658 ..... 1 Amphenol connector: 57E-30240 ..... 1 Amphenol connector: 57E-30360 ..... 1 Rectangular connector: X-12857 ..... 1 Optional paper ..... 10 Spare fuse: ..... 1

## Generates Various Patterns



### Model 1603A Model 1604A PROGRAMMABLE VIDEO GENERATOR

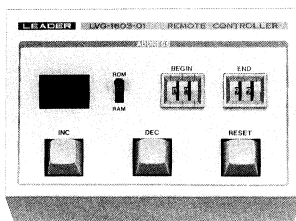
#### ● GENERAL

The Model 1603A and the Model 1604A programmable video generators are wide-band, multi-purpose video signal generators that generate, under program control, sync and video signals that are used to test raster scan type CRT display units. These find applications in adjustment, test, and demonstration of video monitors, computer peripheral displays, high-resolution color graphics displays, and other video equipment.

The Model 1603A and the Model 1604A consist of a micro-processor-controlled block, a wide-band clock frequency synthesizer which handles dot clocks as high as 65MHz (1603A), 131MHz (1604A), a programmable CRT controller, and various input/output devices which, being able to handle analog, ECL (only 1604A), and TTL level signals, permit the Model 1603A and the Model 1604A to accommodate to almost all types of CRT display units. It allows sync timing to be taken in dot units horizontally and in line (scan line) units vertically.

The Model 1603A and the Model 1604A can read, as needed, programming data, which can be defined by the user according to the test display unit, stored in a (2764-type) EP-ROM replaceable from the front panel. The user can reset it freely from the keypad on the front panel. The Model 1603A and the Model 1604A can also restore the programming data in a battery backed RAM.

#### ● LVG-1603-01 REMOTE CONTROLLER



The LVG-1603-01 is a control box used to remotely control the addresses of programmable video generators (LVG-1603A/1604A).

- The increment-type remote control box has three keys: INC, DEC, and REST.
- The BEGIN and END positions can be preset.
- The 7-segment LED displays remote addresses.

#### ● FEATURES

- Sync timing can be taken in dot units (4096 dots maximum) horizontally and in line units (4096 lines maximum) vertically.
- Character cell sizes as large as 16 dots (horizontal) by 64 lines (vertical).
- The dot clock frequency can be set to from 1.024 to 131.072MHz: 1604A, 1.024 to 65.536MHz: 1603A by the built-in PLL frequency synthesizer in 1kHz resolution.
- Contains two (5 × 7 dots and 7 × 9 dots) character generators (alphanumeric characters conform to ASCII standard and graphics and katakana characters to JIS standard).
- Allows a composite sync signal to be added to each output of the analog R, G, and B signals.
- A maximum of 16 universal window patterns of any size can be defined in any position by specifying the window coordinates.
- Can generate up to 31 (1604A), 27 (1603A, 31: option) display patterns including character lists, all characters, character patterns, color bars, crosshatches, dots, circles, windows, gray scales, overlay patterns, etc.
- Can store 100 program lines each in ROM and RAM, allowing a total of 200 lines of memory.
- Can handle ECL, analog, and TTL level outputs. (Model 1604A)
- Can display patterns such as circles and universal windows using 2048 × 1024 dot graphics planes. (Model 1604A)

#### ■ SPECIFICATIONS

- Address Display:** 7 segments 2 digits LED  
**Address Step:** Maximum 100 steps (each ROM mode and RAM mode)
- BEGIN, END Address:** Setting digital switch on the panel  
**Key Operation:** INC: Increase one step  
 DEC: Decrease one step  
 RESET: Return to BEGIN address
- Size:** 150(W) × 36(H); front part, 57(H); rear part 100(D) mm
- Accessories:** 36P-36P amphenol cable (2m) .....1

## ● SPECIFICATIONS

### PROGRAM

#### Clock Frequency

**Frequency Range:** 1.024 to 65.536MHz (1603A)  
1.024 to 131.072MHz (1604A)

**Setting Resolution:** 1kHz step

#### Horizontal and Vertical Sync

	Horizontal	Vertical
Total Dots	64 to 4096 dots	—
Total Lines	—	10 to 4096 lines, 1 line step
Frequency	1.024 to 131.072kHz 1Hz step	1.024 to 131.072kHz 0.001Hz step
Dots/Character Line/Character	4 to 16 dot 1 dot step	—
Displayed Character	2 to 255 characters 1 character step	1 to 64 lines 1 line step
Displayed Lines	—	2 to 4095 lines 1 line step
Sync. Positioning	1 to 4096 dots 1 dot step	1 to 4096 lines 1 line step
Sync. Pulse Width	1 to 4095 dots 1 dot step	1 to 4095 lines 1 line step

#### Time Setting Mode

**Dot Clock:** DOT-PERIOD 15.26 to 976.56ns (1603A)  
DOT-PERIOD 7.63 to 976.56 ns (1604A)

**Horizontal Conditions:** H - PERIODO 7.63 to 99.99 $\mu$ s  
H - DISP-TIME 1.00 to 90.00 $\mu$ s  
H - POS-TIME 0.01 to 99.99 $\mu$ s  
H - SYNC-TIME 0.01 to 99.99 $\mu$ s

**Vertical Conditions:** V - PERIOD 0.076 to 99.990ms  
V - DISP-TIME 0.050 to 99.980ms  
V - POS-TIME 0.010 to 99.990ms  
V - SYNC-TIME 0.010 to 99.990ms

**Selection of Interlace:** Non-interlace, Interlace, Interlace Shrink (Sync & Video)

#### Output Setting

**Sync Signal Polarity:** Set at either positive or negative polarity

**Composite Sync Signal:** H or V sync output can be set either or composite sync of H & V

**Composite Video Signal:** Set to select whether composite sync signal is added to analog video signal or not.

**Dot Duty:** Horizontal display time of dots can be set at 50% (RZ signal) or 100% (NRZ signal). Analog video signal has 100% only. (1604A)

#### Selection of Characters

**Character Font:** Convertible between 5 × 7 dots & 7 × 9 dots

**Character Set:** Selection display of a alphabetical character (capital/small), symbol, numeric character and Katakana per JIS code.

**Character Font Defined by Users:** Up to 16 kinds (the maximum size of 32 × 32 dots) can be set.

#### Selection of Patterns:

Character list, total characters, character patterns, color bars, crosshatch, dot, circle, window, gray scale etc.  
16 kinds of patterns out of 27 (1603A), 31 (1604A) ones can be selected and displayed.

#### Memory Section:

Program address 0 to 99 (100 address) ROM or RAM  
Program back-up memory capacity 8k bytes.

#### Serial Input/Output

**Interface (SAVE and LOAD):** Signal Level: RS-232C  
Baud Rates: 9600, 4800, 2400, 1200, 600, 300 and 110  
Data Format: INTELLEC HEX format

#### REMOTE connector (Amphenol 36-pin connector):

Manually remote-controllable with an optional remote controller.

#### Output Signal Specification

##### Analog Output

**Video Output:** R (red), G (green), B (blue) 3 outputs (impedance: 75 $\Omega$ )  
0.5Vp-p to 1.5Vp-p into 75 $\Omega$ , level variable (1603A)  
Maximum 1Vp-p into 75 $\Omega$ , level variable (1604A)

##### Output Level:

##### Dot Clock Frequency:

60MHz (1603A)  
125MHz (1604A)

##### Composite Sync

##### Signal Added:

##### HS/HVS Output:

ON/OFF possible at each output of R.G.B.  
Selection between the horizontal sync signal output in the range from TTL level (2Vp-p) to 0.5Vp-p with level adjuster and horizontal/vertical composite sync signal output.

##### VS Output:

Vertical sync signal output in the range from TTL (2Vp-p) to 0.5Vp-p with level adjuster.

#### TTL Output 1 (24-pin Connector)

##### Video Output:

Video Output: R (red), G (green), B (blue), I (intensity) 4 outputs

##### Sync Output:

##### Output Level:

HS/HVS, VS 2 outputs  
TTL level, L = 0.5V maximum, H = 2.5V minimum (test condition: high impedance)  
60MHz

##### Dot Clock Frequency:

#### TTL Output (14-pin Connector)

##### Video Output:

Suitable for 64-color, R' (red), G' (green), B' (blue) 3 outputs

##### Output Level:

TTL level, L = 0.5V maximum, H = 2.5V minimum (test condition: high impedance)

##### Dot Clock Frequency:

60MHz

#### ECL Output (25-pin Connector) only 1604A

##### Video Output:

R,  $\bar{R}$ , G,  $\bar{G}$ , B,  $\bar{B}$ , I,  $\bar{I}$ , R',  $\bar{R}'$ , G',  $\bar{G}'$ , B',  $\bar{B}'$

##### Sync. Output:

HS/HVS,  $\bar{H}$ S/ $\bar{H}$ VS, VS,  $\bar{V}$ S

##### Clock Output:

##### Output Level:

CLK,  $\bar{C}$ LK  
ECL level, L = -1.8 ± 0.3V,  
H = -0.8V ± 0.4V (test condition: high impedance)

##### Dot Clock Frequency:

125MHz

#### Power Supply:

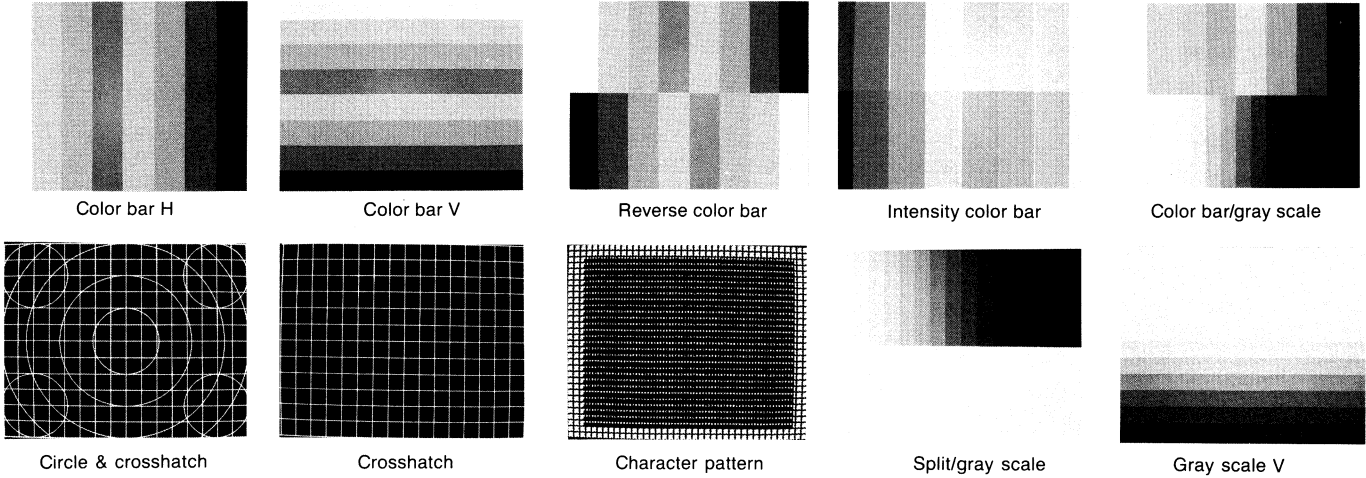
90 to 132V AC (option: 180 to 250VAC)  
50/60Hz, 180VA (1603A), 250VA (1604A)

#### Size and Weight:

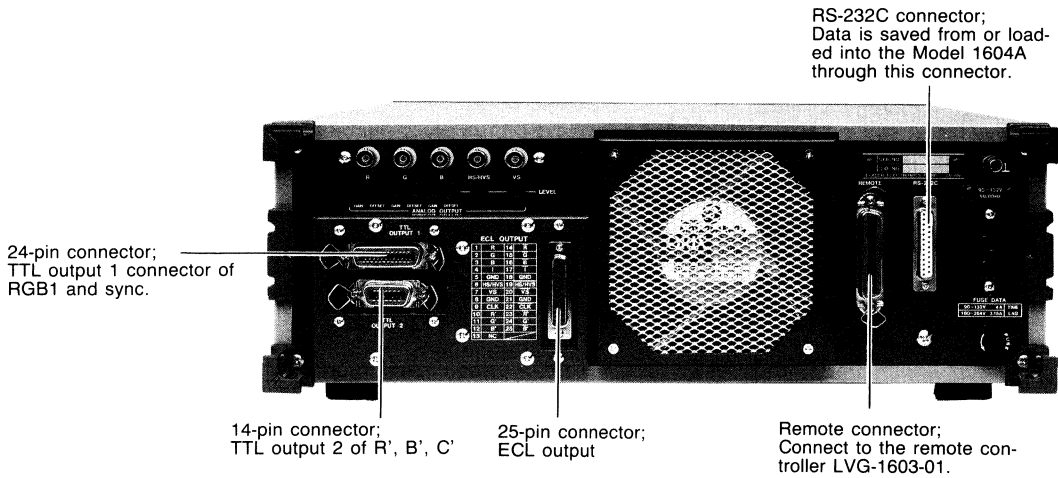
426(W) × 150(H) × 450(D)mm, 10kg (1603A), 12 kg (1604A)

# VIDEO

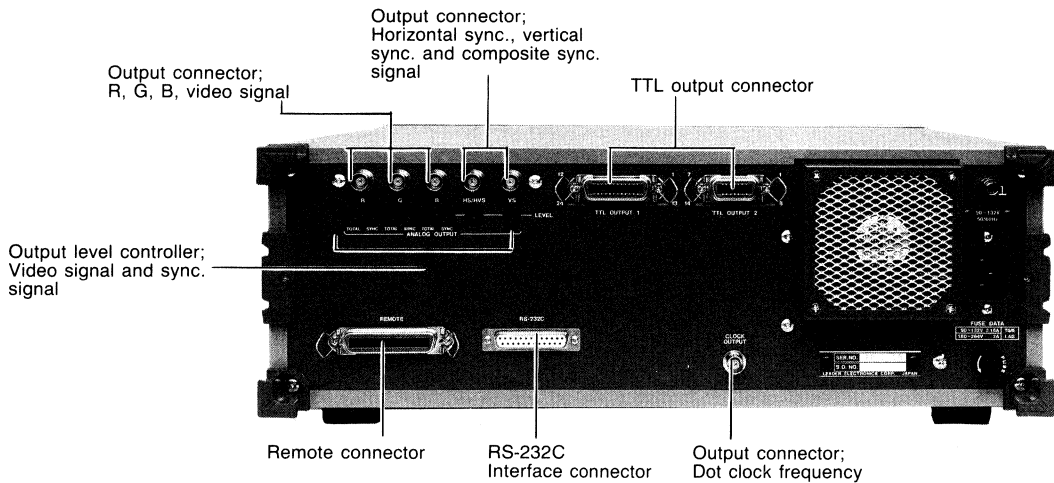
## Model 1604A, 1603A Patterns



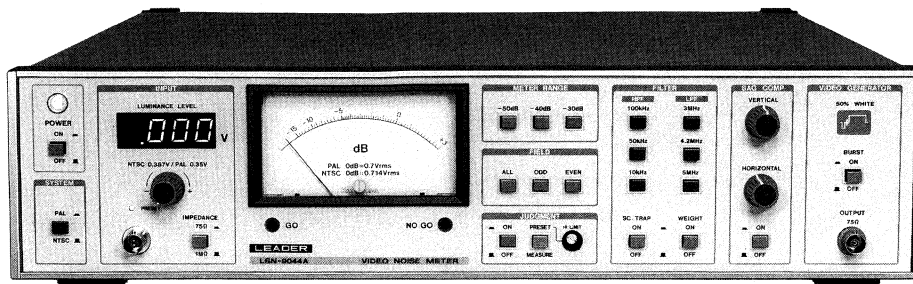
## Model 1604A Rear Panel



## Model 1603A Rear Panel



## Measuring the S/N of VTR



### LSN-9044A VIDEO NOISE METER

#### ● GENERAL

The LSN-9044A Video Noise Meter measures the noise level of the luminance components of video signals. The measuring range selection function and result evaluation function make the LSN-9044A ideally suited for a broad range of applications, from production lines to research and development activities.

#### ● FEATURES

- Built-in signal source (50% white signals) and measuring unit to facilitate video noise measurement, such as that emitting from VTRs.
- Applicable to both NTSC and PAL.
- GO-NO GO evaluations displayed on LEDs, as well as metered indications.
- Selectable measurement fields (all, even, and odd).
- Built-in weighting filter.
- Subcarrier trap to remove color noise effects.
- SAG compensation circuit to enable the measurement of only the noise components of a signal that contains horizontal and vertical sags.
- Selectable measuring ranges of -30, -40, and -50dB in 10dB steps for settings suited to specific applications.

#### ● SPECIFICATIONS

<b>Measuring Section</b>	
<b>Noise Measured:</b>	Luminance noise
<b>Noise Level Measuring Range:</b>	-65dB to -27dB 0.4mVrms to 32mVrms
<b>Ranges:</b>	-30, -40, -50dBm; 3 ranges
<b>Measuring Accuracy:</b>	±0.3dB ±1% of full scale
<b>Detection System:</b>	True rms detection
<b>Filter</b>	
<b>HPF Cutoff</b>	
<b>Frequencies:</b>	10, 50, and 100kHz
<b>LPF Cutoff Frequencies:</b>	3.0 4.2, and 5 MHz
<b>Weighting Filter:</b>	$\tau = 0.245\mu\text{s}$ conforming to CCIR REC. 587-1
<b>Subcarrier Trap:</b>	-18dB or more at center frequency for both NTSC and PAL.
<b>Measuring Gate:</b>	H/2 gate waveform

#### Measured Signal Input

**Waveform:** 1Vp-p white signal (50%), positive polarity  
**Input Impedance:** 75Ω ±3% or HIGH (1MΩ/30pF)  
**Input Level Range:** 0.7 to 1.4Vp-p (100% WHITE)  
**Input Level Compensation Range:** ±3dB

**Noise Level Definition:** Noise level (dB) = 20 log (S (p-p)/N (Vrms))  
**NTSC:** S = 0.714Vp-p  
**PAL:** S = 0.7Vp-p  
**Noise:** N (Vrms)

**SAG Compensation Range:** ±5% or less; linear SAG in H and V

**Input Level Readout:** 3-1/2 digit LED

**Setting:** Manual

**Presetting:** Preset at an input signal of 1Vp-p.

#### Output Terminal

**Monitor Output:** Output impedance: 75Ω, 2Vp-p into open circuit

**Noise Output:** Output impedance: 75Ω, H/2 gate waveform

**DC Output:** 1VDC at full scale indication

**Trigger Signal:** Horizontal, negative polarity, TTL level

Vertical, negative polarity, TTL level

**GO/NO GO Judgment:** Negative polarity output for NO GO, TTL level

#### GO/NO GO Judgment LEDs

**GO:** Green LED on

**NO GO:** Red LED on

#### Signal Generator

**System:** NTSC-M and PAL-B

**Color Burst Signal:** A color burst signal is mixed with the video signal by turning the burst switch on.

**Output:** 50% white signal

NTSC system  
 Sync level: 0.286Vp-p  
 Luminance level: 0.357Vp-p  
 Burst level: 0.286Vp-p

PAL system  
 Sync level: 0.3Vp-p  
 Luminance level: 0.35Vp-p  
 Burst level: 0.3Vp-p

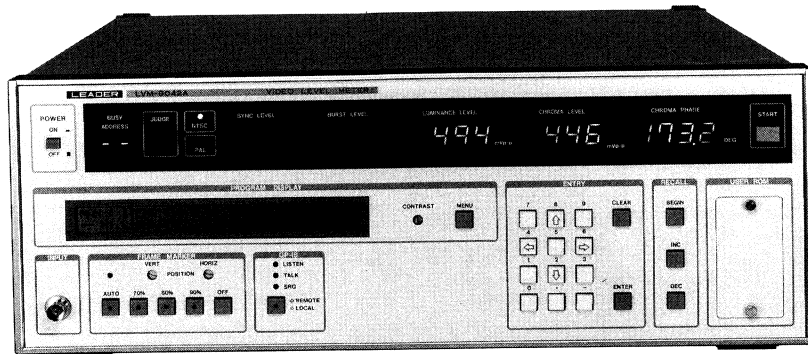
**Output Impedance:** 75Ω (±3%)

**Power Supply:** 100, 120, 220, 240V AC, 50/60Hz, 40VA

**Size and Weight:** 426(W) × 99(H) × 400(D)mm, 6kg

**Accessories:**  
 BNC-BNC cable ..... 1  
 Spare fuse ..... 1

## Auto Measuring the Level and Phase of Video Signal



### LVM-9042A VIDEO LEVEL METER



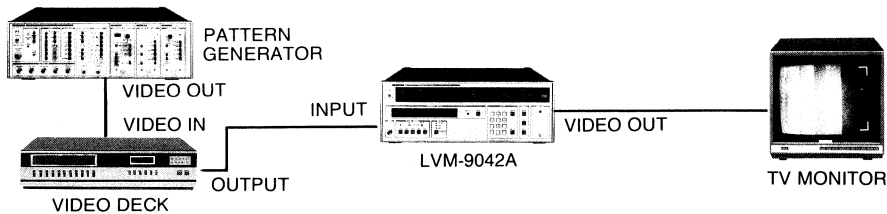
#### ● GENERAL

The LVM-9042A Video Level Meter was designed to simplify the production of video cameras, including self-contained models, and video cassette decks. This meter measures the levels of luminance, sync, color burst and chroma, and also measures the phase of color burst and chroma of the composite video signals. Measurement item selections and GO/NO GO evaluation thresholds are all programmable using the numeric keyboard. In half the time required by manual measurement. The LVM-9042A reduces production line work to, facilitate large-volume production.

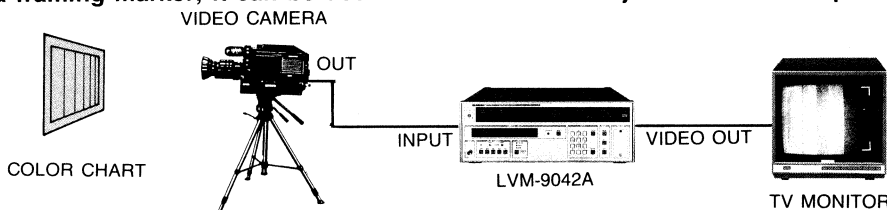
#### ● FEATURES

- Test points can be arbitrarily set within a single frame.
- Test points can be recognized in connection with a monitor.
- Chart positions are automatically detected to facilitate TV camera measurement. (Frames selected for 90%, 80%, and 70% can also be displayed)
- A printer interface and GPIB are supported as standard.
- GO-NO GO evaluations. Threshold level can also be stored in EEPROM on the front panel.
- Threshold level can be interactively set and test items can be selected from the LCD display.

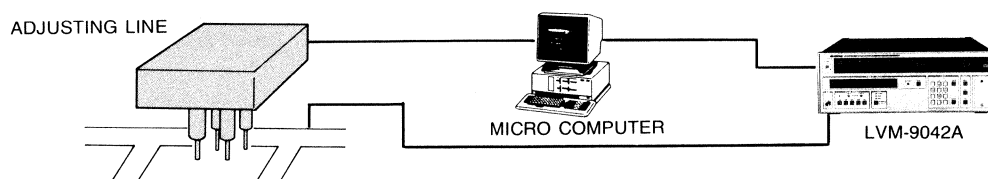
- Combined with a pattern generator, it can be used for VTR adjustments and inspections.



- Using a camera framing marker, it can be used for video camera adjustments and inspections.



- Micro-computer and adjustment line are connected to each other through a GPIB, thus ensuring automatic adjustment lines.





## ● SPECIFICATIONS

**Color Systems:** NTSC-M, PAL-B  
**Input Signals:** Composite video signals (can be externally synchronized with composite sync signal)  
**Test Signal Level:** 0.5 to 2.0Vp-p  
**Input Impedances:** Front-panel input terminal: 75Ω  
Rear-panel input terminal: 1MΩ (loop-through)

### Test Items and Detection

**Methods:** One item per frame measurement

Test Item	Method	Unit
Simultaneous luminance and chroma display	Y level or Y+S	Specified test point sampling (central sampling for horizontal synchronization)
	Chroma level	Synchronous detection
	Chroma phase	Synchronous detection
Burst level	Synchronous detection	(mVp-p or IRE)
Horizontal sync level	Central sampling	(mVp-p or IRE)
Y peak (measurement of multibursts, etc.)	Envelope detection	(mVp-p or IRE)

### Data Measurement

**Methods:** The following two methods can be selected for measuring data:  
• Single data measurement  
Data is measured as one specified test point.  
• Four-data averaging  
The average of data measured at four test points is assumed as data.  
..... Line n (a selected line) in field 1  
..... Line n in field 2  
..... Line n + 1 in field 1  
..... Line n + 1 in field 2

### Measurement Methods:

- Auto measurement  
Programs in a specified address range among the preprogrammed 100 addresses can be measured automatically for overall evaluation.
- Step measurement  
Measurements can be looped within the program being run at a specified address from among 100 addresses, 0 to 99.
- Manual measurement  
Measurements can be made by setting test items, test points, etc. through simple panel operations.

### Average Count:

1, 2, 4, 8, 16, 32, 64 times

### Programs:

- Interactive programming using the LCD display and numeric keys.
- Programs can be written to EEPROM. (A program loading function is also available).

### Setting Programs:

- Display unit
- Selecting test items
  - 1) Burst level
  - 2) Sync level
  - 3) Luminance level and chroma
- GO/NO GO judgment threshold levels
- Test lines
- Luminance and chroma test points  
Measurement data  
Single data and four-data averaging

### Measurement Accuracies

#### (1Vp-p input):

Luminance and Sync Level: ±3%  
Color Burst and Chroma Level: ±3%  
Chroma phase: ±2°

### Setting Test Point:

In a Frame  
X-axis direction; 10.0μs to 63.5 (NTSC)  
0.1μs step  
10.0μs to 64.0μs (PAL)  
Y-axis direction; 1 line step from minimum

### Camera Picture Frame Markers:

1. Manual  
Picture frames (90%, 80%, and 70%) with center marker are selectable.
2. Auto  
Measure picture frame size and calibrate measurement points. Then, shoot a white frame on the black field as in Fig. 1. Adjust the camera so the white pattern will fit 70% to 90% of the picture frame of the monitor in Fig. 2. Here, start auto-framing to calibrate measurement point. Next, select the desired pattern to proceed measurement.

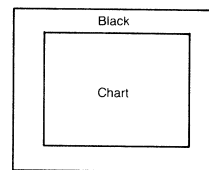


Fig. 1. Measurement chart

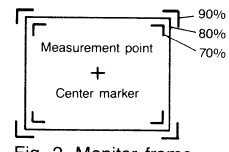


Fig. 2. Monitor frame

### Monitor Output:

Output Impedance: 75Ω ± 5%  
Output Level: 1Vp-p into 75Ω

### GPIO

#### Remote Control:

Panel operation except for markers and programming such as setting test items. Measurement triggering.

#### Data Output:

All measurement values and GO/NO GO evaluation output or specified measurement values.

#### Service Request:

Measurement end, invalid commands  
Specifications: Centronics conformed Output Data:

#### Printer Output:

- Auto measurement:  
One of the following is output at the end of every a program or upon request:
  1. All data ... All measurement data and judging results are output.
  2. NG data ... Program data judged as NO-GO are output.

- Step and manual measurements  
Measurements can be interrupted to output final data for printing.

### Power Supply:

#### Size and Weight:

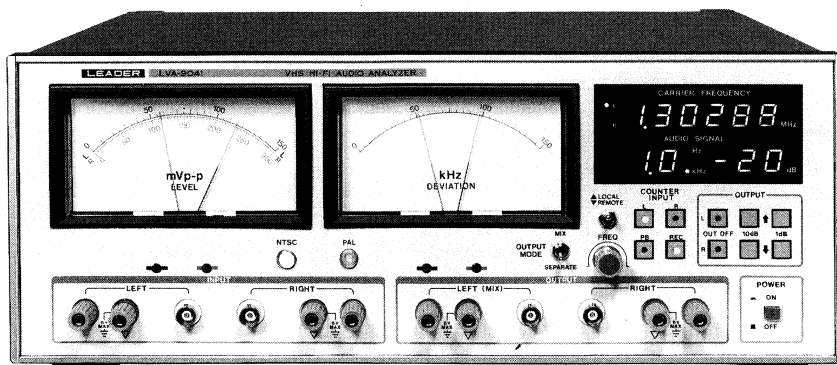
100, 120, 200, 220, 240V AC, 50/60Hz 60VA  
426(W) × 148(H) × 400(D)mm 7.8kg

#### Accessory:

Spare fuse ..... 1

# VIDEO

## Ideally Suited for Adjusting VHS Hi-Fi VTR



### LVA-9041 VHS Hi-Fi AUDIO ANALYZER

#### ● GENERAL

The LVA-9041 is a servicing instrument provided with signal source, level meter, deviation meter, and frequency counter for use in the production of VHS Hi-Fi audio VCRs. The LVA-9041 is applicable to both NTSC and PAL.

#### ● FEATURES

- Self-contained functions needed to service VHS Hi-Fi audio VCRs.
  - 1) Input level meter (mixed signals input possible)
  - 2) Frequency counter
  - 3) Deviation meter (FM demodulation)
  - 4) Audio generator
  - 5) FM modulator
- Applicable to both NTSC (1.3MHz, 1.7MHz) and PAL (1.4MHz, 1.8MHz)
- Unmodulated output convenient for S/N ratio measurements.
- MIX input to measure MIX output from VCRs.
- MIX output available.
- All LVA-9041 operations are remote-controlled.

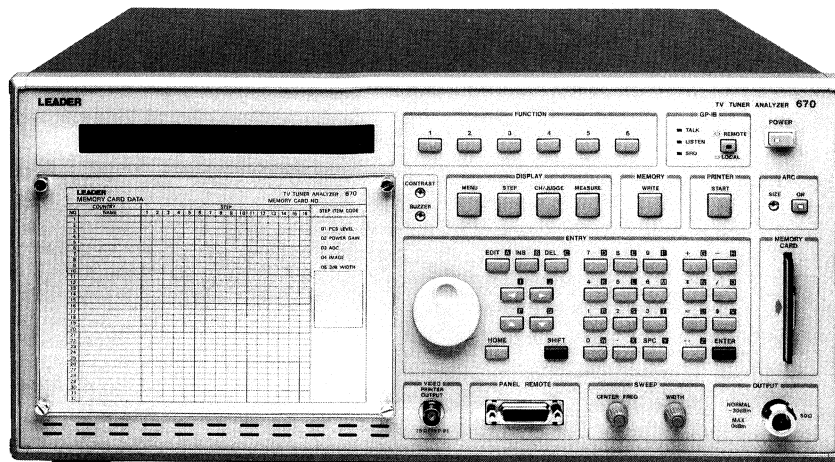
#### ● SPECIFICATIONS

<b>Input Level Meter</b>	
<b>Measured Frequency:</b>	NTSC L 1.3MHz $\pm$ 20kHz R 1.7MHz $\pm$ 20kHz PAL L 1.4MHz $\pm$ 20kHz R 1.8MHz $\pm$ 20kHz
<b>Measuring Range:</b>	L-channel 10 to 50mVp-p (3 to 17mVrms) R-channel 40 to 200mVp-p (13 to 70mVrms)
<b>Measuring Accuracy:</b>	$\pm$ 2% of full scale
<b>Input Impedance:</b>	1M $\Omega$
<b>Full Scale:</b>	L-channel 50mVp-p R-channel 200mVp-p
<b>Detection Method:</b>	Peak value detection
<b>DC Output:</b>	1V in full scale
<b>Deviation Meter</b>	
<b>Full Scale:</b>	150kHz for both L- and R-channel
<b>Measuring Accuracy:</b>	$\pm$ 2% of full scale
<b>Detection Method:</b>	Peak value detection
<b>DC Output:</b>	1V in full scale
<b>FM Modulator</b>	
<b>Carrier Frequency:</b>	NTSC L 1.3MHz R 1.7MHz PAL L 1.4MHz R 1.8MHz
<b>Carrier Output Voltage:</b>	150mVp-p
<b>Output:</b>	L and R independently, and MIX (L-output)
<b>Output Impedance:</b>	200 $\Omega$ or less
<b>Internal Modulation Frequency:</b>	8 points; 20Hz, 100Hz, 400Hz, 1kHz, 5kHz, 10kHz, 15kHz, and 20kHz
<b>Frequency Accuracy:</b>	$\pm$ 2% spot of setting
<b>Deviation Setting:</b>	50kHz deviation at -20dB setting
<b>Frequency Counter</b>	
<b>Display:</b>	Six digits LEDs
<b>Resolution:</b>	10Hz
<b>Reference Frequency Accuracy:</b>	$5 \times 10^{-7}$
<b>Unit:</b>	MHz
<b>Power Supply:</b>	100, 120, 200, 240V AC, 50/60Hz, 35VA
<b>Size and Weight:</b>	400(W) $\times$ 148(H) $\times$ 400(D)mm, 7kg

# SWEEP GENERATOR

Dramatically Fast Measurements and GO/NO-GO Testing of Electronic Tuners

**NEW**



## Model 670 TV TUNER ANALYZER



### • GENERAL

The Model 670 is a TV tuner analyzer which operates at dramatically high speed and provides comprehensive TV electronic tuner adjustment, inspection, and GO/NO-GO testing capabilities.

The Model 670 consists of a single package which includes a sweep generator, a tuner power supply, and a waveform capture on display, enabling you to use your current tuner test fixtures in performing inspection and GO/NO-GO testing. By storing a sequential program on a memory card, it is possible to program adjustment data for up to 32 countries.

Since inspection and GO/NO-GO testing is possible instantly while making adjustments, the Model 670 is the ideal choice for use on the automated production line in ensuring both product quality and stability. Test results are available in a matrix form accessible at a 24-pin amphenol connector, enabling a separately sold GO/NO-GO indicator to be used for viewing of test results at a glance. In addition, further detailed data can be checked using a separately sold video monitor.

#### [Configuration]

- (1) Sweep generator section: 25 to 480 MHz, 445 to 925 MHz, VHF/UHF sweep generator
- (2) Sweep control section: controls the sweep generation section using a measurement sequence corresponding to various measurement items (uses a 6303 CPU).
- (3) Data processing: Sweep waveform capture and data processing and comparison using a high-speed 11-bit A/D converter (uses a 16-bit 68000 CPU).
- (4) Programming section: operating conditions and comparison conditions setting and storage for various measurement items (uses a memory card).

### • FEATURES

#### [Measurement Capabilities]

- Single-package configuration saves space and performs all electronic tuner measurements with a single unit.
- The use of VHF/UHF sweeping and auto-tracking method with built-in markers means that a variety of tuner measurement, inspection, and Go/No-Go testing is as simple as selecting the band and step from the controller.
- Measurements and inspection are performed simultaneously, thereby reducing the number of operations required. This enables all units to be inspected on the adjustment line, with virtually no increase in the number of adjustment operations.
- LOG output provided for use in simultaneous observation of the measured waveform, waveform when using AGC gain reduction, and image waveform.

#### [Operation]

- Input of setting data is simplified by using a screen editor (using a separately sold 670-D01 External Display). Step settings are made automatically by inputting the measurement step, it being necessary to input only those items that change.
- A single memory card can store setting data for up to 32 types of tuners, and changing of conditions can be done rapidly.
- Up to 15 alphanumeric characters can be entered into the measurement screen and printout data, a convenient feature for recording lot numbers and operator names.
- Setting selection is possible via the RS-232C and GPIB (option), as is transfer of measured results, enabling easy management of tuner characteristics and adjustment conditions. A printer interface is also provided. A video output connector is provided which enables a printout of display using a printer.

#### [Measured Items]

- (1) PCS level ratio, (2) n-dB bandwidth, (3) power gain, (4) gain reduction, (5) image rejection.

# SWEEP GENERATOR

## Memory Card Stores Setting Data for 32 Types of Tuners

### • SPECIFICATIONS

#### Sweep Section

##### Oscillation Frequency

Range: VHF: 25 to 480 MHz  
UHF: 445 to 925 MHz

Center Frequency: VHF: 30 to 470MHz,  
UHF: 450 to 920MHz

Sweep Width:  $\pm 5$  to  $\pm 30$ MHz

Sweep Time: 3.2ms, line synced (100/120Hz for each sweep)

Display Value Linearity:  $\pm 5\%$

##### Output Voltage:

Normal Mode:  $-30$ dBm, into  $50\Omega$  load

AGC Image Measurement:  $0$ dBm, into  $50\Omega$  load

Output Impedance:  $50\Omega$ , unbalanced

##### Output Flatness

20MHz Sweep:  $\pm 0.5$ dB

##### Full Bandwidth:

Output Connector: N Type (U/V common output)

Attenuator:  $0$  to  $63$ dB, in  $1$ dB steps, programmable  
Settable for each country and each band.  
 $0$  to  $10$ dB, in  $0.1$ dB steps, electronic Settable for L, M, and R channels for each band.  
 $-30$ dBc or lower (VHF),  $-20$ dBc or lower (UHF)

Spurious Harmonic:  $-40$ dBc or lower

Non-Harmonic: SINGLE, DUAL, TRIPLE

Modes: Settable for each band.

Functions: AUTO (VHF/UHF automatically switched),  
MANUAL, WIDE  
Settable for each band

Bands: VHF (VL, VM, and VH settable), UHF  
Horizontal Output Voltage:  $10$ Vp-p min. output impedance:  $10k\Omega$

#### Marker Section

##### (670-U01 IF Unit)

IF Markers (pulses): 3 points, accuracy:  $\pm 0.5\%$

IF Marker Frequencies: 58.75, 45.75, 39.5, 38.9, 38.0, 37.0, 36.875, 32.7MHz  
4 IF frequencies of the above built-in.  
Changeable in groups of 4 IF frequencies by switching units.

RF Markers (Birdies): Single point for each of L, M, and R channels.  
Accuracy:  $\pm 50$ kHz

##### RF Marker

Frequencies: VHF: 30 to 470MHz, in 250kHz steps  
UHF: 450 to 920MHz, in 250kHz steps  
Data input keys usable to set markers for each country, each band, and each channel.

#### Auto-tracking Section

IF Auto-tracking Range: 1 to 300m Vrms

Input Impedance:  $75\Omega$

##### Allowable Input

Deviation:  $10$ dB or greater, in Multisweep mode between auto

#### Measurement and Comparison Section

Measurement Item	P.C.S Level Ratio	ndB Bandwidth	Power Gain	Gain Reduction Ratio	Image Rejection
Measurement Range	0 to $-8$ dB	0 to 25MHz	20 to 70dB	$-20$ to $-70$ dB	VHF $-20$ to $-60$ dB UHF $-20$ to $-70$ dB
Measurement Resolution	0.1dB	0.1MHz			0.1dB
Measurement Error	Within 0.3dB	Within 0.3dB	Within 3dB (1dB after calibration)		Within 2dB
Measurement Points	PCS point level from peak level and CS point level from P point.	Bandwidth at attenuation set in the range $-0.5$ to $-6$ dB, in 0.1dB steps			Settable as peak point or marker point.

#### Tuner Power Supply + B Supply

MB1: 3 to 15V, in 0.1V steps, accuracy:  $\pm 50$ mV  
2 to 14V, MB2  $\leq$  MB1  $- 1$  (V)  
200mA max.

MB2:

Output Current:

AGC Voltage:

AFT Voltage:

Vr Voltage:

External Supply:

Remote Control:

Remote Function:

0 to 15V in 0.1V step  
0 to 15V, in 0.1V steps  
0 to 30V, in 10mV steps  
 $+ 12$ V, 100mA max. (fixed)  
(Using 670-C01 Controller)  
Band switching, step selection, scan, Vr voltage variation, OUTPUT LEVEL variable

#### Display and Data Input/Output Section

Display: 40 characters  $\times$  2 lines, LCD display

Displayed Contents: Setting data, Vr voltage, test results

Video Output: 1Vp-p composite video signal for displayed data

(I/O)

Interface: Centronics compatible

Printer Output: 25-pin D-sub connector

RS-232C I/O: Factory option

GPIO: 24-pin Amphenol connector

GO/NO-GO display I/O: Memory card (RAM card)

Setting Data Storage: 32K bytes for 32 countries

Memory Capacitance:

Backup:

Backed up for 2 years by a replaceable lithium battery. (Memory contents not lost when battery is replaced.)

#### Remote Control Functions:

1. BAND, 2. STEP, 3. SCAN, 4. Vr, 5. Output level, 6. Sweep center frequency, 7. Sweep width, 8. Panel keys (excluding of POWER, GPIO and ARC) (FUNCTION, PAGE, ENTRY sections) 1 to 5 are controllable from the 670-C01 controll (accessory), 8 is controllable from the 670-E01 Panel Remote Box (separately sold).

#### Environmental Conditions (for guaranteed accuracy):

Temperature: 5 to 40°C,

Humidity: 85% or less

#### Power Supply:

#### Size and Weight:

100, 120, 200, 240 VAC, 50/60Hz, 150VA

Main unit

426(W)  $\times$  199(H)  $\times$  450(D)mm, 19kg

Controller (670-C01)

150(W)  $\times$  62(H)  $\times$  140(D), 0.8kg

#### Accessories:

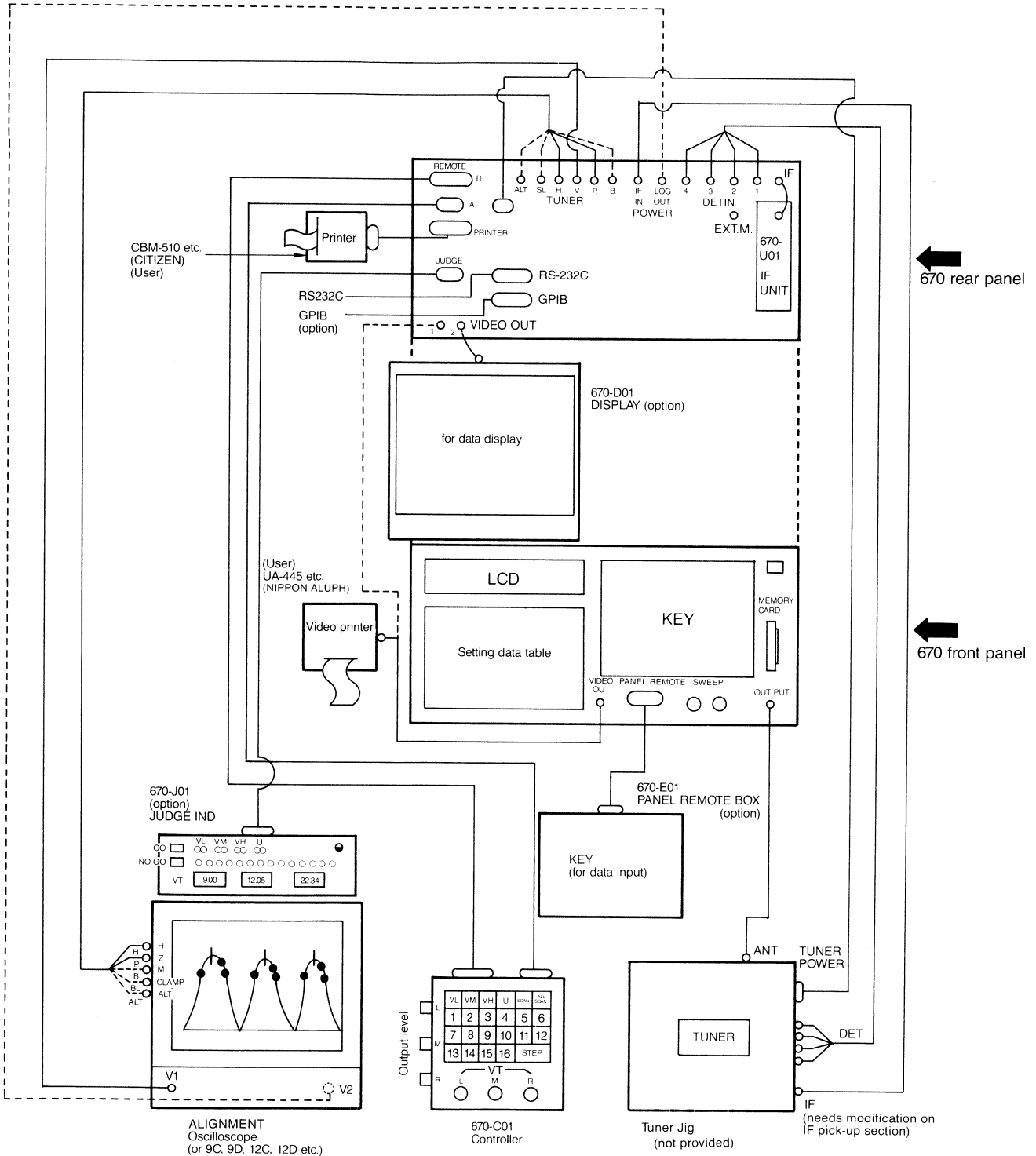
Controller (670-C01) .....1  
50 to 75 $\Omega$  matching pad (LMP-1579) .....1  
Memory card and battery .....1 each  
Cables .....13  
3P power code .....1  
3P-2P conversion adaptor .....1  
Spare fuse .....1  
IF signal pickup modification resistors  
75- $\Omega$ , 10dB pad  
107 $\Omega$  (1%) .....1  
144 $\Omega$  (1%) .....1

#### Separately Sold Accessories:

670-D01 Display  
670-J01 JUDGE Indicator  
670-E01 Panel Remote Box  
670-U01 IF Unit

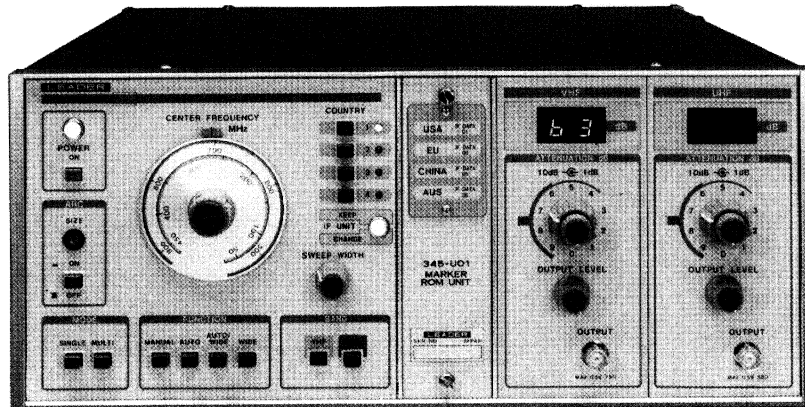
# SWEEP GENERATOR

## ■ Connection Diagram



# SWEEP GENERATOR

Available Anywhere in the World with Full Range from VHF (CATV) to UHF Bands



## LSW-345A TV-VHF/UHF SWEMAR GENERATOR

### ● GENERAL

The LSW-345A is a Swemar Generator with the built in 2-band sweep functions of VHF/UHF designed for adjustments of VHF/UHF combination electronic tuners.

Simultaneous display of 2 or 3 channels of band characteristics of electronic tuner on an oscilloscope allows efficient adjustment works of electronic tuners.

In combination with an oscilloscope the following observations are available:

- As plant option, the instrument exclusive for VHF or UHF is available.

LSW-345AV  
3CH DISPLAY TV-VHF SWEMAR GENERATOR  
25 to 480MHz

LSW-345U  
3CH DISPLAY TV-UHF SWEMAR GENERATOR  
445 to 925 MHz

\* All specifications are common to the LSW-345A.

### ● FEATURES

- Monitoring of band-pass characteristics of VHF/UHF tuners.
- Monitoring of local oscillation frequencies of VHF/UHF tuners.
- Monitoring of overall band characteristics of TV sets (tuners and IF amplifiers).
- Built-in 2-band functions VHF/UHF  
The 345A has all the necessary sweep and marker functions of VHF/UHF in a single unit. Thus it is the best suitable swemar generator for adjustments of VHF/UHF combination electronic tuners.
- Auto-tracking  
Automatic tracking of sweep center frequency to locate tuner characteristic curves of both VHF and UHF at the center of an oscilloscope screen eliminates adjustments of measurement instruments so that it is only necessary to turn the dial of a tuner.
- Auto-tracking + all-band sweeping  
By using the forward sweep for auto-tracking and the return sweep for all-band sweeping, accurate adjustment of the auto-tracking side is possible while observing tuner frequency position; thus it is possible to eliminate tracking errors.
- Remote control  
Remote control is available for all the necessary functions of electronic tuner adjustments.
- Six points of RF markers can be displayed per country for VHF and UHF. Also marker frequency can be easily changed by replacing ROM unit.
- By switching selection, tuners of 4 different countries can be adjusted.
- Up to 4 different IF frequencies can be built in. As unit system is used, selection of 4 frequencies is possible by replacement of a unit.
- The LSW-345A covers a wide band of 25 + 480MHz in VHF which includes CATV channels.
- The instrument can select and display 2 or 3 channels of VHF and UHF respectively by the internal switch.
- The instrument may also be used for normal single channel sweeping.
- As the ARC (automatic response-level control) circuit is built in, trace display of a constant amplitude is available on an oscilloscope screen, though input amplitude of a signal applied to the FROM T.P. terminal changes. Clamping operation is possible even when the ARC circuit is turned off by the internal switch.

# SWEEP GENERATOR

## ● SPECIFICATIONS

### Sweep Section

#### Oscillation Frequency

**Range:** VHF: 25 to 480 MHz  
UHF: 445 to 925 MHz

**Center Frequency:** VHF: 30 to 470MHz,  
UHF: 450 to 920MHz

**Sweep Width:** ± 5 to ± 30MHz

**Sweep Time:** 3.2ms, power line synchronization  
(single-sweep 100/120Hz)

**Linearity:** Within 5%

**Output Voltage:** VHF: 0.5Vrms into 75Ω load  
UHF: 0.5Vrms into 50Ω load

**Output Impedance:** VHF: 75Ω unbalanced  
UHF: 50Ω unbalanced

#### Output Deviation

**20MHz Sweep:** VHF: Within ± 0.5dB

UHF: Within ± 0.5dB

**All-band Sweep:** VHF: Within ± 1.0dB

UHF: Within ± 1.5dB

**Output Connector:** BNC type

**Attenuator:** 0 to 63dB, 1dB step programmable  
Electronically variable 0 to 20dB  
Less than -30dBc

**Spurious:**

#### Horizontal Output

**Voltage:** More than 10Vp-p, 10kΩ output impedance

### Marker Section

#### Marker ROM Unit

**345-U01:** Accuracy: Within ± 50kHz  
**RF Marker (birdy)** Marker frequency; 4 countries in each country.  
VHF: 30 to 470MHz, UHF: 450 to 920MHz

Minimum setting pitch: 250kHz  
**345-U07:** Accuracy: Within 50kHz  
**RF Marker (birdy):** 100 channels for a country, 4 countries, total 400-ch, VHF: 30 to 470MHz, UHF: 450 to 920MHz  
Minimum setting pitch: 250kHz  
Channel control: 7 bit binary control  
Channel display: 00 to 99 binary control, 7 segments LED  
IF frequency: 4 bit binary control

#### IF Unit

**345-U02:** Standard 2 points (PS marker), option 1 point

**IF Marker (Pulse)** Accuracy: ± 0.5%  
IF Frequency: 58.75, 45.75, 39.5, 38.9, 38.0, 37.0, 36.875, 32.7MHz, built in 4 IF frequencies

#### 345-U03

#### IF Marker (Pulse)

**(for US CATV):** 4 points possible  
Accuracy: ± 0.5%  
30 to 75MHz

IF frequency band	Video marker	Chroma marker	Sound marker	Upper adjacent video marko
US 2CH 55.25MHz	55.25MHz	58.83MHz	59.75MHz	61.25MHz
US 3CH 61.25MHz	61.25MHz	64.83MHz	65.75MHz	67.25MHz
US 4CH 67.25MHz	67.25MHz	70.83MHz	71.75MHz	73.25MHz

Markers may be suppressed at point having IF input signals of 10dB or lower than the peak value.

### Auto-Tracking Section

**IF Auto-Trigger Range:** 0.3 to 300mVrms

**Input Impedance:** 75Ω

#### Allowable Input

**Deviation:** Minimum 10dB between autos in multi-sweeping

### ARC Section

#### Amplitude Range of

**Input Detection Signal:** 5mVp-p to 200mVp-p

**Input Polarity:** Negative

(Positive input is available by the internal switching.)

**Output Voltage:** Approx. 0.3Vp-p, positive polarity

**Output Deviation:** Within ± 2dB

#### Remote Control:

MODE, FUNCTION

BAND, COUNTRY

CENTER FREQ., SWEEP

WIDTH, OUTPUT LEVEL

Programmed Att. switching in a range of 0 to 63dB

**Power Supply:** 100, 117, 220, 240 VAC 50/60Hz, 75W

**Size and Weight:** 350(W) × 148(H) × 450(D)mm, 15kg

**Accessories:** BNC-BNC 75Ω cable 1m ..... 7

BNC-Clip cable 1m ..... 1

BNC-BNC 50Ω cable 600mm ..... 1

3-P power cord ..... 1

Spare fuse ..... 1

Multi-pin plug (for remote connectors)

24-pin ..... 1

50-pin ..... 1

# SWEEP GENERATOR

## RF Marker ROM Unit, IF Unit and Local Adjuster for LSW-345A

### ■ RM MARKER ROM UNIT



#### 345-U01 (Standard)

The ROM stores data for selecting RF markers and IF frequency bands of the four countries indicated on the country indication plate is provided. By changing the unit, on the front panel, markers of various countries can be displayed. RF Marker (Birdy), Accuracy within  $\pm 50\text{kHz}$  for each country, 6 points for VHF and 6 points for UHF, 4 different countries (RF Markers for 4 countries are built-in) VHF: 30 to 470MHz, UHF: 450 to 920MHz, Minimum set table pitch 250kHz



#### 345-U07 (CATV)

The ROM stores sufficient data to select VHF-band RF markers for 400 channels on four countries, with 100 channels on each country. The change of channels is remotely controlled, thus it can be synchronized with the change of channel.

RF Marker (Birdy), Accuracy within  $\pm 50\text{kHz}$ : 100CH for a country, in total 400CH for 4 countries, 30 to 470MHz, Minimum set table pitch 250kHz, Channel Control: 7 bits binary control, Channel indication: 00 to 99 binary control.

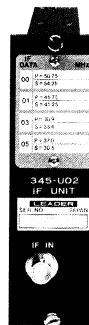
### ■ IF UNIT



#### 345-U02 (Standard)

This unit generates 4 IF bands. By selecting a country, the IF band of the selected country stored as the ROM data on the front panel, in the 345-U01 can be automatically selected.

IF Marker (Pulse), 2 points for a standard (P, S marker), 1 point for an option, Accuracy  $\pm 0.5\%$ .



#### 345-U03 (US-CATV)

The 345-U03 generates IF marker output of LSW-345A and also it works for auto-tracking sweep.

This unit is designed for use with U.S. CATV converters. IF Marker (Pulse), 4 points, Accuracy  $\pm 0.5\%$ . Built-in USA 2CH to 4CH.

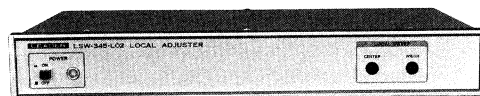
### ■ LOCAL ADJUSTERS

Additional devices  
(attached to a main frame of LSW-345A)

#### LSW-345-L01



#### LSW-345-L02



The 345-L01 is used to simultaneously check the band characteristics of CATV converters and the local frequency, and to simultaneously display two or three channels on the oscilloscope. This model has built-in US CATV IF channels.

The 345-L02 is used to simultaneously check the band characteristics of VHF tuners or CATV tuners, and local frequency. It also simultaneously displays two or three channels on the oscilloscope. This model has 8 built-in-tuner IF channels.

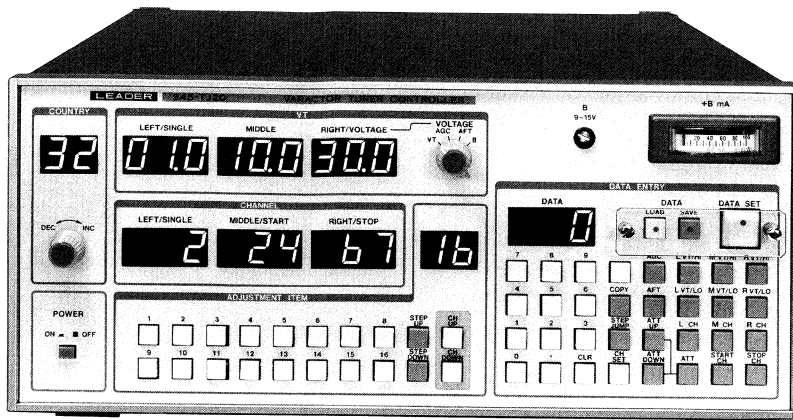
When use this LOCAL ADJUSTERS, LSW-345A must be modified. The marker ROM unit to be used is the 345-U04.

Local Adjuster	LSW-345-L01	LSW-345-L02
IF Frequency	① 55.25 MHz (US 2CH) ② 61.25 MHz (US 3CH) ③ 67.25 MHz (US 4CH)	① 58.75, ② 45.75, ③ 39.5 ④ 38.9, ⑤ 38.0, ⑥ 37.0 ⑦ 36.875, ⑧ 32.7 MHz
Sweep Width	More than $\pm 1\text{MHz}$ of each IF frequency	
Marker Frequency (Beat type or A3 type)	Birdy marker of each IF frequency (beat type) Pulse marker of each IF frequency and $\pm 0.2\text{MHz}$ (A3 type)	
Local Adjustable Type Local Marker Accuracy	Beat type or A3 type $\pm 10\text{kHz}$	
Combined with	345-U03, 345-U07	345-U02, 345-U07
Environmental Conditions (for guaranteed accuracy)	Temperature: 5 to 40°C Humidity: 85% or less	
Size and Weight	350(W) x 49(H) x 450(D) mm, 4kg	



# SWEEP GENERATOR

**Built-in All Power Supply for Tuners. Adjusting for Electronic Tuners**



## 345-TJ20 VARACTOR TUNER CONTROLLER

### ● GENERAL

The 345-TJ20 Varactor Tuner Controller has built-in power supplies for all tuners. Programs are designed for all measurement items to significantly improve the performance of the LSW-345A

The 345-TJ20 is combined with the LSW—345A TV VHF/UHF Sweeper Generator to adjust VHF and UHF electronic tuners. All power supplies required for the electronic tuner are built in, and the voltages required for each measurement item are preprogrammed. Because the functions of the LSW-345A main unit are remotely controlled at the same time, VHF and UHF electronic tuners can be quickly and easily adjusted.

### ● FEATURES

- The tuning voltage to be supplied to an electronic tuner can be freely set at the panel for each measurement item. The set values are stored in RAM.
- Frequency data for up to 32 countries (200 channels per country) can be stored in ROM. The channel data can be freely read at the front panel (for each measurement item) and stored in RAM.
- Data stored in RAM can be transferred to another 345-TJ20 controller.
- The CPU-controlled system makes specification changes easy.

### ● SPECIFICATIONS

#### LSW-345A Remote-Controlled Functions

**BAND:** VHF, UHF  
**Attenuator:** 0 to 63dB in 1dB steps  
**IF Frequency Selection:** In 4-bit binary code  
**RF Marker:** For 32 countries (200 channels per country) L, M, and R independently programmable (applies only to channel data written in ROM)

#### Power Supplies for Electronic Tuners

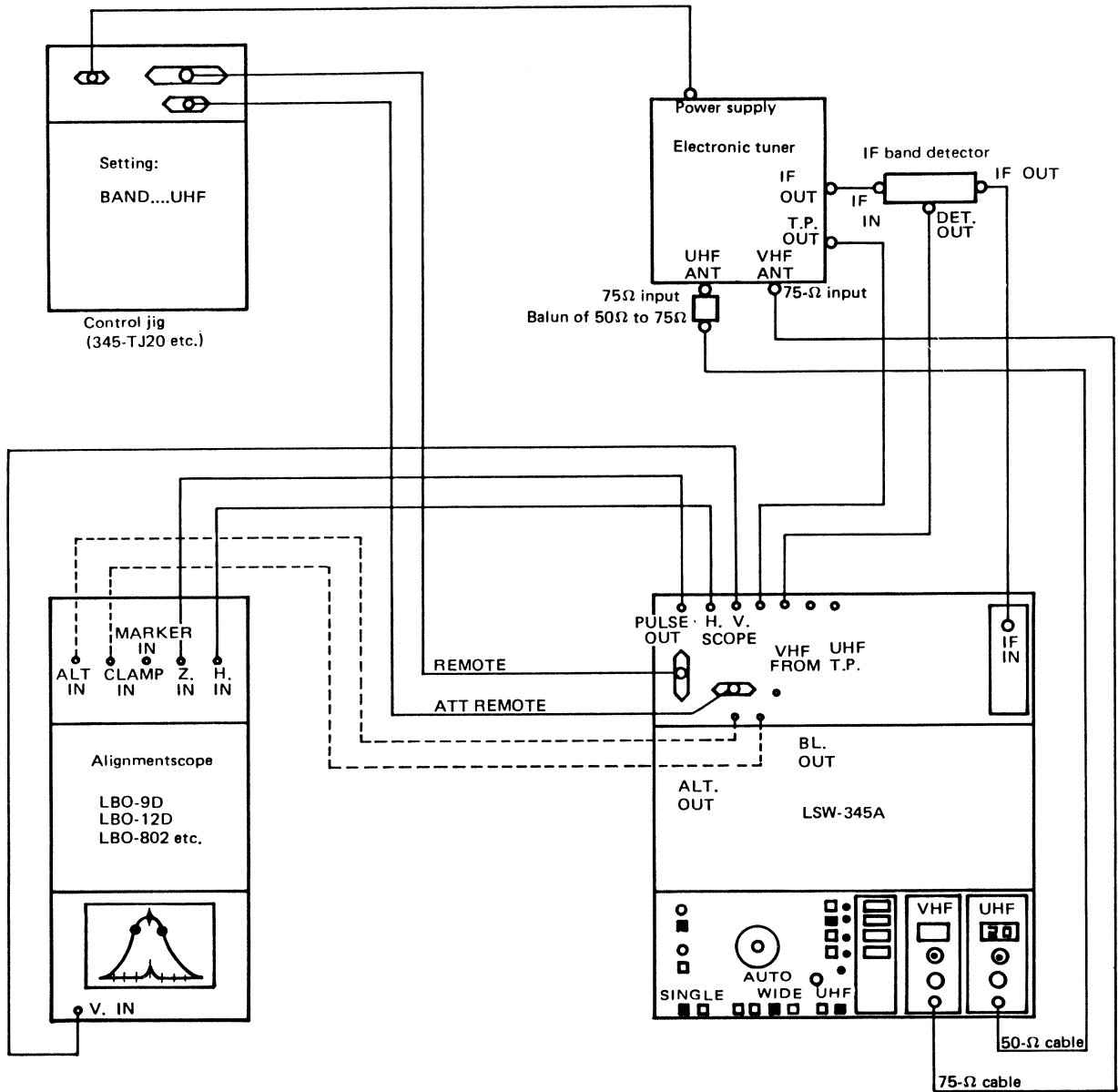
**+B, Power (BL, BM, BH, BS, Mb, Vb, Ub):** 9 to 15V adjustable, 100mA (current limiting circuit built in to 100mA ammeter)  
**AGC Power:** 0 to 15V Output Current: approx. 10mA (max.) (programmable with resolution of 0.1V)  
**AFT Power:** 0 to 15V Output Current: approx. 10mA (max.) (programmable with resolution of 0.1V)

<b>Tuning Voltage:</b>	0 to 30V (programmable with resolution of 0.1V) The lower and upper-limit voltages of L, M, and R can be programmed, and differences between voltage can be varied individually.
<b>Program Functions Channel:</b>	Channels (DISP. CH in frequency data table) written in ROM can be programmed by using the L, M, and R data program keys for each country and measurement item.
<b>Attenuator AGC Power, AFT Power:</b>	Values set for each country and measurement item can be programmed by using the data program keys.
<b>Tuning Voltage:</b>	The lower and upper-limit voltages of L, M, and R can be individually programmed by using the program keys for each country and measurement item.
<b>Data Change:</b>	Programmed data can be changed at any time by using the data program keys with the DATA SET key.
<b>Transfer:</b>	Data written using the data program keys can be transferred to another 345-TJ20 controller (same model). Transfer time: approx. 22s
<b>Others</b>	
<b>Country Selection:</b>	32 selectable countries using rotary switch (IF selection data or RF marker data)
<b>Measurement Item Selection:</b>	Selection using item or step feed switch. No. of item selection keys: 16 (max.)
<b>Voltage Display:</b>	3-digit display on 3-1/2-digit digital panel meter to first decimal place. Total of 3 displays 1. L/SINGLE tuning voltage 2. M tuning voltage 3. Using selection switch a. R tuning voltage, b. AGC voltage, c. AFT voltage, d. +B voltage
<b>Current Display:</b>	All load current of +B power supplies (BL, BM, BH, BS, Mb, Vb, Ub) for electronic tuners Full scale: 100mA
<b>Environmental Condition (for guaranteed accuracy):</b>	Temperature: 5 to 40°C Humidity: 85% or less
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz, approx. 40VA
<b>Size and Weight:</b>	Main unit: 350(W) × 148(H) × 450(D)mm 9kg Control box: 181(W) × 62(H) × 138(D)mm 0.6kg
<b>Accessories:</b>	Connection cables ..... 5 Data transfer connector ..... 1 345-MR01 ..... 1 345-TJ201 ..... 1 Spare fuse ..... 1

Be sure to check the above specifications when placing an order.

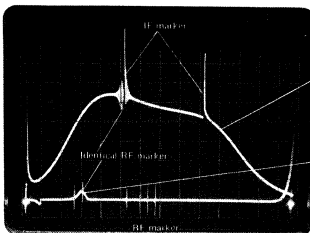
# SWEEP GENERATOR

## ■ Connection Method



## ■ LSW-345A AUTO/WIDE FUNCTION RESPONSE OF VARACTOR TUNER

### • SINGLE Display



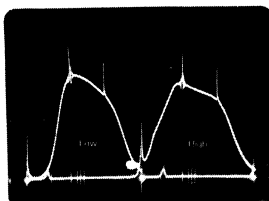
### • AUTO-Side Waveform

When the tuner dial is turned, the response automatically follows and the P-S marker is always displayed at the same position. (This is the enlarged display of the wide-side waveform).

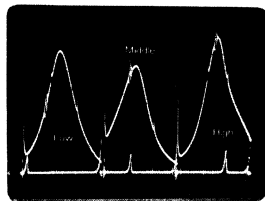
### • WIDE-Side Waveform

The waveform moves to the left and the right sides on the return trace and the tuning point is displayed.

### • DUAL Display



### • TRIPLE Display (Tracking Adjustment)



### LOW

Local oscillation frequency shifted to lower side.

### Middle

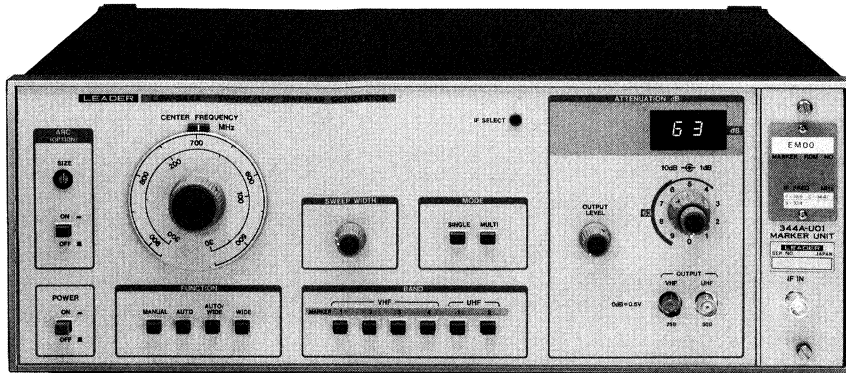
Local oscillation frequency is correct.

### High

Local oscillation frequency shifted to higher side.

# SWEEP GENERATOR

## Built-in One Country IF Frequency



## LSW-344A TV-VHF/UHF SWEMAR GENERATOR

### ●GENERAL

LSW-344A is a swemar generator, in which 2-band sweep markers of VHF & UHF are built-in, designed to adjust an electronic tuner of combined VHF and UHF. 2 or 3 different channel frequency responses of electronic tuner can be displayed simultaneously on oscilloscope to enable adjustment of electronic tuner an efficient manner.

### ●FEATURES

- 2-band of VHF/UHF is built-in: A sweep marker of VHF/UHF built-in enables to adjust an electronic tuner of combined VHF & UHF.
- Auto-tracking: Automatic tracking of the sweep center frequency to locate VHF/UHF characteristic curves at the center of the oscilloscope screen eliminates the need for instrument operations so that only the tuner's tuning frequency need be altered.
- Auto-tracking + all band sweep: Forward sweep is used for auto-tracking and reverse sweep for all band sweep. It makes accurate measurement possible by observing a tuner frequency position and so any tracking error can be avoided.
- Remote control: All functions required for adjustment of electronic tuner can be remote-controlled.
- Up to 3 RF markers can be displayed simultaneously in each of the 4VHF bands and 2UHF bands. The remote control option permits displaying up to three points of RF markers in 256 different ways for VHF and UHF each.
- The IF unit and the RF marker ROM are replaceable in a single unit (344A-U01 marker unit), making it possible to adjust various country-dependent nations.
- Broad VHF coverage of 25 to 480MHz, including CATV channels.
- Internal switch selection between concurrent two- and three-channel displays for VHF and UHF each. It also can be used as an ordinary sweep generator for 1-channel.
- ARC function is available as a factory option: ARC (Automatic Response Level Control) is a function of displaying response level in fixed amplitude on oscilloscope regardless of input amplitude of FROM T.P. terminals. Internal switch in ARC circuit is designed to enable clamp function even when ARC circuit is turned to OFF.

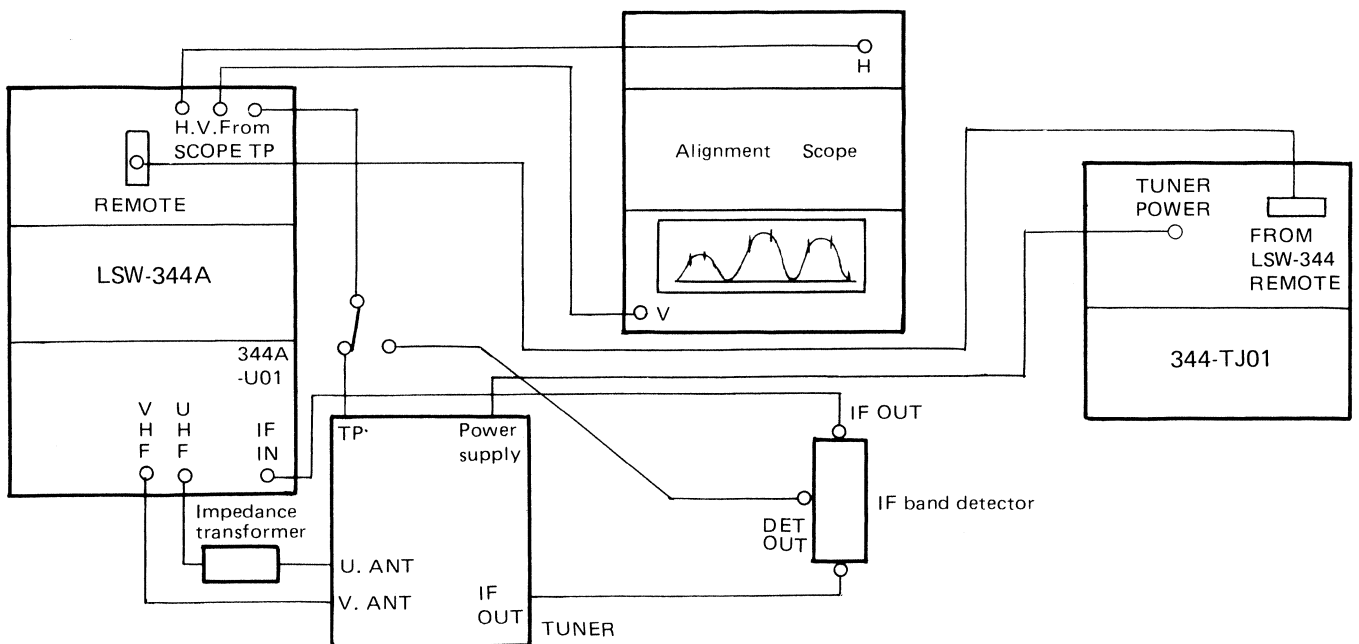
# SWEEP GENERATOR

## ● SPECIFICATIONS

**Sweep Section**  
**Frequency Range:** VHF 25 to 480MHz, UHF 445 to 925MHz  
**Center Frequency:** VHF 30 to 470MHz, UHF 450 to 920MHz  
**Sweep Width:**  $\pm 5$  to 30MHz ( $\pm 5$  to  $\pm 150$ MHz at remote-controlled)  
**Sweep Time:** 3.2ms, power line synchronization (100/120Hz)  
**Linearity:** Within 5%  
**Output Voltage:** 0.5Vrms (VHF: 75 $\Omega$  load, UHF 50 $\Omega$  load)  
**Output Impedance:** VHF: 75 $\Omega$  unbalanced, UHF: 50 $\Omega$  unbalanced  
**Output Flatness**  
**20MHz Sweep Time:** Within  $\pm 0.5$ dB (VHF/UHF)  
**All Band Sweep Time:** Within  $\pm 1$ dB (VHF),  $\pm 1.5$ dB (UHF)  
**Attenuation:** 0 to 63dB, 1dB step, programmed 0 to 20dB continuously variable, electronic Les than -30dBc  
**Spurious:**  
**Horizontal Output Voltage:** More than 10Vp-p (Output Impedance 10k $\Omega$ )  
**Marker Section (344A-U01)**  
**IF Marker (Pulse):**  $\pm 5$  to  $\pm 30$ MHz in sweep width Standard 2 points (P, S markers), option 1 point, Accuracy  $\pm 0.5\%$ .  
**IF Marker Frequency:** One IF band out of IF frequency 30 to 60MHz can be designated accuracy  $\pm 0.5\%$ .  
**RF Marker (Birdy):** VHF: 4 switches of each 3 points (12 points in total) UHF 2 switches of each 3 points (6 points in total) (Up to 256 combinations of VHF and UHF each using the RF marker remote control option.)  
**RF Marker Frequency:** Accuracy: Within  $\pm 50$ kHz VHF 30 to 470MHz, UHF 450 to 920MHz Minimum unit set (pitch) 250kHz  
**Auto-Tracking Section**  
**IF Auto-Trigger Range:** 0.3 to 300mVrms  
**Input Impedance:** 75 $\Omega$

**Allowable Input Deviation:** More than 10dB between auto at multi-sweep time  
**General Section**  
**Mode:** SINGLE, MULTI (DUAL, TRIPLE can be selected respectively for VHF/UHF by internal switch.)  
**Function:** Manual, Auto, Auto/Wide, Wide  
**Band:** VHF 1, 2, 3 and 4 UHF 1 & 2 (VHF 1 to 4 & UHF 1/UHF 2 indicate variation of RF marker frequency but frequency range should be within VHF & UHF respectively.)  
**Remote Control:** MODE, FUNCTION, BANK, CENTER FREQUENCY, SWEEP WIDTH, OUTPUT LEVEL, ATTENUATION, 0 to 63dB programmable (option; RF marker switching)  
**Environmental Conditions (for guaranteed accuracy):** Temperature: 5 to 40 $^{\circ}$ C Humidity: 85% or less  
**Power Supply:** 100, 120, 200, 220, 240V AC. 50/60Hz, 51VA  
**Size & Weight:** 426(W)  $\times$  148(H)  $\times$  300(D)mm, 11kg  
**Accessories:**  
 BNC - BNC 75 $\Omega$  cable 1m ..... 6  
 BNC - Alligator clip cable 1m ..... 1  
 BNC - BNC 50 $\Omega$  cable 60cm ..... 1  
 3P AC power cord ..... 1  
 3P - 2P conversion adaptor ..... 1  
 Spare fuse ..... 1  
 Multi-pin plug (for remote control) 50 pin .. 1  
**Factory Option**  
**ARC AMP**  
**Amplitude Range of Input** 5 to 200mVp-p  
**Detection Signal:** Negative (Positive input is available by the internal switching)  
**Input Polarity Detection Signal:** 300mVp-p, positive Within  $\pm 2$ dB  
**Output Voltage:**  
**Output Voltage Deviation:**  
**RF Marker Remote Control**  
**RF Marker Combination:** 256 different ways for VHF and UHF each 8 bits binary codes  
**Control Method:** 14 pin multi plug  
**Accessory:** (for remote connector) ..... 1

## ■ Connection Diagram



# SWEEP GENERATOR

**Built-in All Power Supply for Tuners. Adjusting for Electronic Tuners.**



## 344-TJ01 VARACTOR TUNER CONTROLLER

### ● GENERAL

The 344-TJ01 is a jig used with an swemar generator LSW-344A to adjust VHF and UHF electronic tuners. With a built-in power supply to electronic tuners, the 344-TJ01 simplifies and speeds up tuner adjustment tasks.

### ● FEATURES

- Full tuning voltage setting from lower to upper limits.
- NORMAL and TEST settings of AGC and AFT voltages.
- Voltage checking by a digital panel meter and a terminal.
- Selectable attenuation setting between the 344-TJ01 and the LSW-344A.
- NORMAL minus test attenuation setting for AGC tests.
- Alarm lamp for overcurrent of tuner power supply.

### ● SPECIFICATIONS

#### LSW-344A Remote Control Functions

**Mode:** SINGLE/MULTI  
**Band:** VHF LOW/VHF HIGH/UHF 1/UHF 2  
**Attenuation:** dB (A ATT)  
 0 to 63dB, 1dB step programmed  
**Output Level:** The settings for VHF and UHF are the same. L & SINGLE, M and R are variable.  
 Range: 0 to 20dB or more

#### Tuning Voltage of Electronic Tuner

Triple-trace tuning voltage switching circuit is built-in.

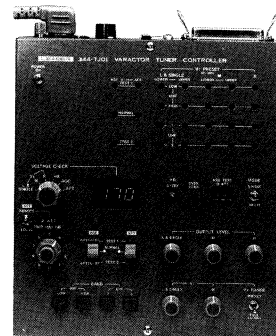
**Range:**  
**Preset:** Set of upper and lower limit voltage L & SINGLE, M  
 0 to 30V

**Full:**  
**Control of Tuning Voltage:** L & SINGLE, M: variable, R: adjustable  
 0 to 30V  
**Variable Range:**

#### Power Supply Voltage Setting for Electronic Tuner

**Power Supply + B:** BL, V<sub>H</sub>, U<sub>B</sub> and MB supply voltages are set simultaneously.  
 Range: 5 to 20V  
 Current limiting circuit is built-in, with an over-current indicator lamp that lights when current is 100mA or more.

### ■ Front Panel



#### AGC Power Supply:

NORMAL, TEST 1, TEST 2  
 Range: 0 to 15V

#### AFT Power Supply:

NORMAL, TEST 1, TEST 2  
 Range: 0 to 15V

#### Digital Display of Supply Voltage and Check Terminal:

• Supply is selectable.  
 V<sub>T</sub> L & SINGLE, V<sub>T</sub> M, V<sub>T</sub> R, + B, AGC, AFT

• Accuracy  $\pm 1\%$  rdg  $\pm 2$  dgt  
 • Display with one decimal place  
 0 to 63dB, 1dB step programmed  
 The attenuation during AGC test is a subtraction of (B ATT) from (A ATT)  
 (B ATT)  $\leq$  (A ATT)

#### Power Supply:

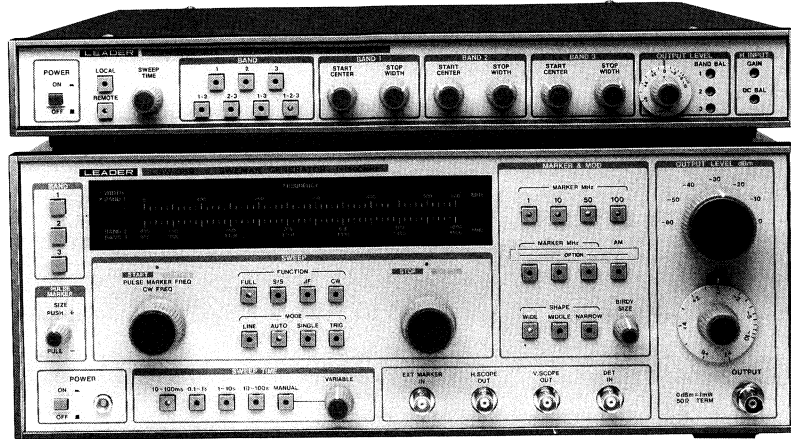
#### Size and Weight:

#### Accessories:

100, 120, 220, 240VAC, 50/60Hz, 17VA  
 230(W)  $\times$  70(H)  $\times$  260(D) mm, 3kg  
 50 pin amphenol cable ..... 1  
 DIN connector 8 pin ..... 1  
 Spare fuse ..... 1

# SWEEP GENERATOR

Full Covering 1 to 1500MHz (3 Bands)



## LSW-359 SWEMAR GENERATOR

## LSW-359-S01 STACK SWEEP CONTROLLER

### ● GENERAL

The LSW-359 Swemar Generator is a general-purpose generator with a wide frequency range of 1 to 1500MHz in three bands. It is best suited for use in the research and development, testing, and adjustment of VHF, UHF, and DBS equipment.

### ● FEATURES

- Wide sweep frequency range of 1 to 1500MHz three bands.
- Wide range of variable sweep width, permitting observation of frequency response in wide to narrow bands.
- Four convenient alternative sweep functions: FULL sweep, start/stop sweep,  $\Delta F$  sweep, and CW.
- Wide range of variable sweep times from 10ms to 100s, selectable in four steps.
- Single-sweep function and pen lift output connector facilitate connection of an X-Y recorder.
- Easy reading of frequencies by using 1MHz, 10MHz, 50MHz, and 100MHz harmonic markers (birdy). These harmonic markers have a variety of amplitude for ready identification.
- Variable markers (pulse), which allow ready reading of frequencies during a FULL sweep and enable  $\Delta F$  frequency to be set as the center frequency.
- Optional addition of up to three spot markers (birdy) or harmonic markers (birdy).

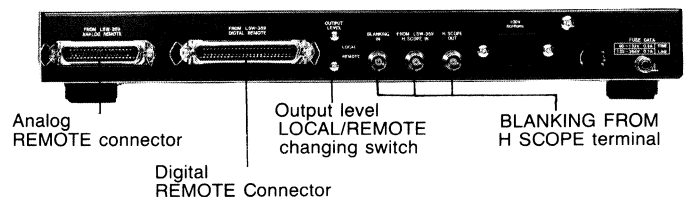
### ● GENERAL

The LSW-359-S01 stack sweep controller, when used in conjunction with LSW-359 swemar generator, displays bands 1, 2, and 3 in a single display image.

### ● FEATURES

- The oscillation frequency of the LSW-359 can be displayed in the same display image.
- Seven band choices are available.
- The start and stop frequencies, or the center frequency and width for  $\Delta F$  sweeps, can be set in each band individually.
- Joints between bands can be balanced at the output level.
- The LOCAL/REMOTE select switch allows the LSW-359 to be used independently when in the local mode.
- The instrument, identical to the LSW-359 (main unit) in width and depth, can be mounted on top of the LSW-359 for operation.

### ■ Rear Panel



# SWEEP GENERATOR

## ● SPECIFICATIONS LSW-359

<b>Sweep Section</b>	
<b>Sweep Frequency Range:</b>	BAND 1; 1 to 550MHz BAND 2; 450 to 1000MHz BAND 3; 950 to 1500MHz
<b>Center Frequency:</b>	BAND 1; 1 to 550MHz BAND 2; 450 to 1000MHz BAND 3; 950 to 1500MHz
<b>Dial Setting Accuracy:</b>	±20MHz (at +7dBm)
<b>Sweep Width:</b>	200kHz to 550MHz
<b>Sweep Function:</b>	FULL, START/STOP, ΔF, CW
<b>Output Voltage:</b>	+7dBm into 50Ω
<b>Output Impedance:</b>	50Ω Unbalanced
<b>Output Flatness:</b>	20MHz at 7dBm
<b>Linearity:</b>	Within 5% (at +7dBm)
<b>Spurious:</b>	Less than -30dBc
<b>Attenuator:</b>	Rotary type 10dB × 6 Electronic type 17dB
<b>Attenuation Accuracy:</b>	BAND 1; ± 0.5dB BAND 2; ± 1.0dB BAND 3; ± 1.5dB
<b>Sweep Time:</b>	10ms to 100s
<b>Horizontal Output Voltage:</b>	More than 10Vp-p
<b>Sweep Mode:</b>	LINE, AUTO, SINGLE, MANUAL
<b>Marker Section</b>	
<b>Marker Method:</b>	Variable Pulse Marker (at FULL sweep) Birdy Marker
<b>Marker Frequency:</b>	1MHz Harmonic Marker 10MHz Harmonic Marker 50MHz Harmonic Marker 100MHz Harmonic Marker Option: Spot Marker (1 to 1500MHz) Harmonic Marker (2, 5, 20 and 25MHz) Optionally, up to three harmonic markers or spot markers can be added.
<b>Marker Accuracy:</b>	Less than 0.01%
<b>External Marker:</b>	The LSW-359 has a connector for external markers. Input Voltage of about 70mVrms or more is necessary for external markers having identical amplitude with internal markers.
<b>Birdy Marker Band Widths:</b>	WIDE, MIDDLE, NARROW three steps selector
<b>Others</b>	
<b>AM Modulation:</b>	Option: Modulate frequency 1kHz (uncalibrated)
<b>Remote Controlled:</b>	Band Selector (BAND 1, 2, 3) Sweep Function Selector (FULL, START/STOP, ΔF, CW) Sweep Mode Selector (LINE, AUTO, SINGLE) Sweep Trigger and Sweep Time Selector (10ms to 100ms, 0.1 to 1s, 1 to 10s, 10 to 100s, MANUAL) Sweep Time Variable Control Start, Center Control Stop, Width Control Marker ON/OFF Electronic Attenuator Control
<b>Pen Lift Output:</b>	Contact on during sweep period
<b>Power Supply:</b>	100, 120, 200, 240VAC, 50/60Hz, 43W
<b>Size and Weight:</b>	400(W) × 148(H) × 400(D)mm, 12kg

<b>Accessories:</b>	BNC - BNC cable ..... 3 BNC - BNC 50Ω cable ..... 1 3P power cord ..... 1 Spare fuse ..... 1 Connector for remote controller ..... 2 Connector for pen-lifting ..... 1
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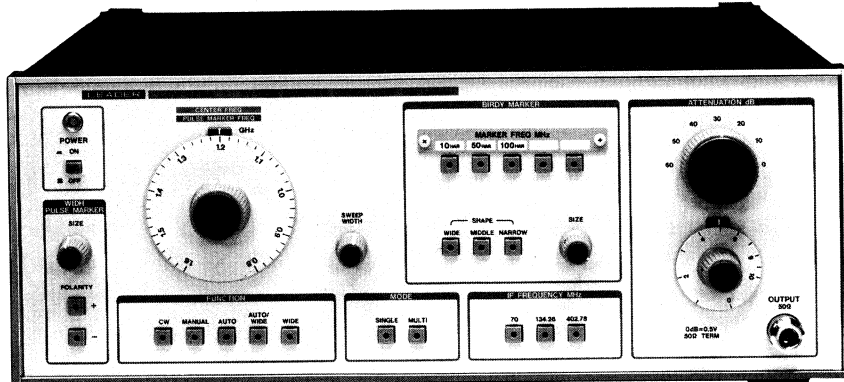
(Note): The option must be installed by us at the factory.

## ● SPECIFICATIONS LSW-359-S01

<b>Remote Control Function:</b>	•BAND •Sweep TIME VARIABLE •OUTPUT LEVEL control; can be remotely turned off with a rear-panel switch.
<b>Number of Band:</b>	7 BAND 1, BAND 2, BAND 3, BAND 1-2, BAND 2-3, BAND 1-3, BAND 1-2-3
<b>Frequency Range:</b>	BAND 1 1 to 550MHz BAND 2 450 to 1000MHz BAND 3 950 to 1500MHz BAND 1-2 1 to 1000MHz BAND 2-3 450 to 1500MHz BAND 1-3 1 to 550MHz 950 to 1500MHz BAND 1-2-3 1 to 1500MHz
<b>Output Level:</b>	17dB continuously variable Band balance setting for bands 1, 2, 3
<b>Power Supply:</b>	100, 120, 220, 240VAC 50/60Hz
<b>Size &amp; Weight:</b>	400(W) × 49(H) × 400(D) mm, 3.5kg
<b>Accessories:</b>	BNC—BNC cable .....2 36 pin amphenol cable .....1 50 pin amphenol cable .....1 Spare fuse .....1

# SWEEP GENERATOR

## 0.8 to 1.8GHz. Simultaneously Displaying 3 Channels



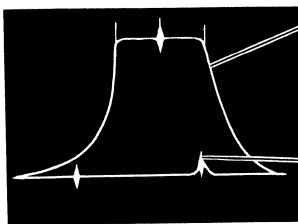
### LSW-358A TV-DBS SWEMAR GENERATOR

#### ● GENERAL

LSW-358A is a swemar generator designed for use in the 1st IF range applied to TV receiver by satellite telecast. It is utilized with oscilloscope to check and adjust the 1st IF of TV-DBS.

#### ■ Response of Varactor Tuner with Auto/Wide Function

##### ● SINGLE Display



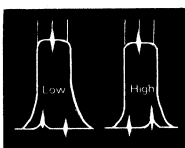
##### AUTO-Side waveform

When the tuner dial is turned, the response automatically tracks and the P-S marker is always displayed at the same position. (This is the enlarged display of the wide-side waveform.)

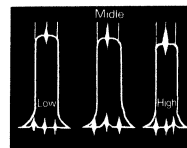
##### WIDE-Side waveform

The waveform moves to the left and the right sides on the return trace line and the tuning point is displayed.

##### ● DUAL Display



##### ● TRIPLE Display



#### ● FEATURES

- Auto-Tracking Sweep: Sweep center frequency is designed to track automatically to position response curve of BS tuner at the center of oscilloscope display. It enables to observe response just by switching BS tuner channel without any operation of this instrument.
- Auto-Tracking + All Band Sweep: Forward sweep is used for auto-tracking and return sweep for all band sweep. It makes accurate measurement possible by observing frequency position of BS tuner and so no tracking error happens.
- All band (wide) sweep, manual sweep and CW function are provided to enable observation of wide frequency response and use as a simple signal generator.
- 3 IF frequencies of 70MHz, 134.26MHz & 402.78MHz are built-in.
- Response curve observation by 2 or 3 channels is available to make adjustment of any influences in-between possible in efficient manner.
- Harmonic markers (birdy) of 10MHz, 50MHz & 100MHz enable accurate readings of frequencies. These markers can be identified easily by their amplitudes.
- It enables easy reading of frequency at WIDE sweep and its frequency to be center frequency at MANUAL sweep if variable marker (pulse) is used.
- Up to 2 spot markers (birdy) can be added as an option.



# SWEEP GENERATOR

## ● SPECIFICATIONS

### Sweep Section

**Sweep Frequency Range:** 0.8 to 1.8GHz  
**Sweep Width:** ± 10 to ± 500MHz  
**Output Voltage:** 0.5Vrms (+ 7dBm) into 50Ω  
**Output Impedance:** 50Ω unbalanced  
**Output Flatness:** ± 1dB  
**Linearity:** Within 10%  
**Attenuator:** Rotary type 10dB × 6  
 Electronic type 0 to 10dB  
**Sweep Time:** 3.2ms line synchronized (one pass 100/120Hz)

**Horizontal Output Voltage:** 10Vp-p or more

### Marker Section

**IF Marker (Pulse):** 3 point, Accuracy ± 0.5% (with polarity inversion switch)  
**IF Marker Frequency:** Center frequency and ± 13.5MHz of center frequency  
**70MHz:** 56.5, 70.0, 83.5MHz  
**134.26MHz:** 120.76, 134.26, 147.76MHz  
**402.78MHz:** 389.28, 402.78, 416.28MHz

### RF Marker

**Variable Marker:** Only WIDE sweep: (with polarity inversion switch)  
 Pulse: 1 point, Accuracy ± 20MHz  
**Harmonic Marker:** Birdy: 3 points, Accuracy ± 0.1%  
 Frequency: 10, 50, 100MHz  
**Option Marker (Spot):** Birdy: 2 points, Accuracy ± 0.1%  
 Frequency Range: 0.8 to 1.8GHz

### External Marker

**Terminal:** Birdy: 1 point  
 Input voltage of about 70mVrms (- 10dBm) or more is necessary for external markers having identical amplitude with internal markers.

**Birdy Marker Shape:** Selectable at narrow, middle and wide  
**Auto-Tracking Section:** Auto-Trigger Range: 1 to 300mVrms  
 Input Impedance: 75Ω

**FUNCTION:** Allowable Input Deviation: More than 10dB between auto at multisweep time  
 CW, MANUAL, AUTO, AUTOWIDE, WIDE

**MODE:** SINGLE, MULTI (Dual or triple can be selected by internal switch)

**Remote Control:** FUNCTION, MODE, IF, MARKER ON/OFF, BIRDY MARKER SHAPE, CENTER FREQ. control, SWEEP WIDTH control, OUTPUT LEVEL control

**Environmental Conditions (for guaranteed accuracy):**

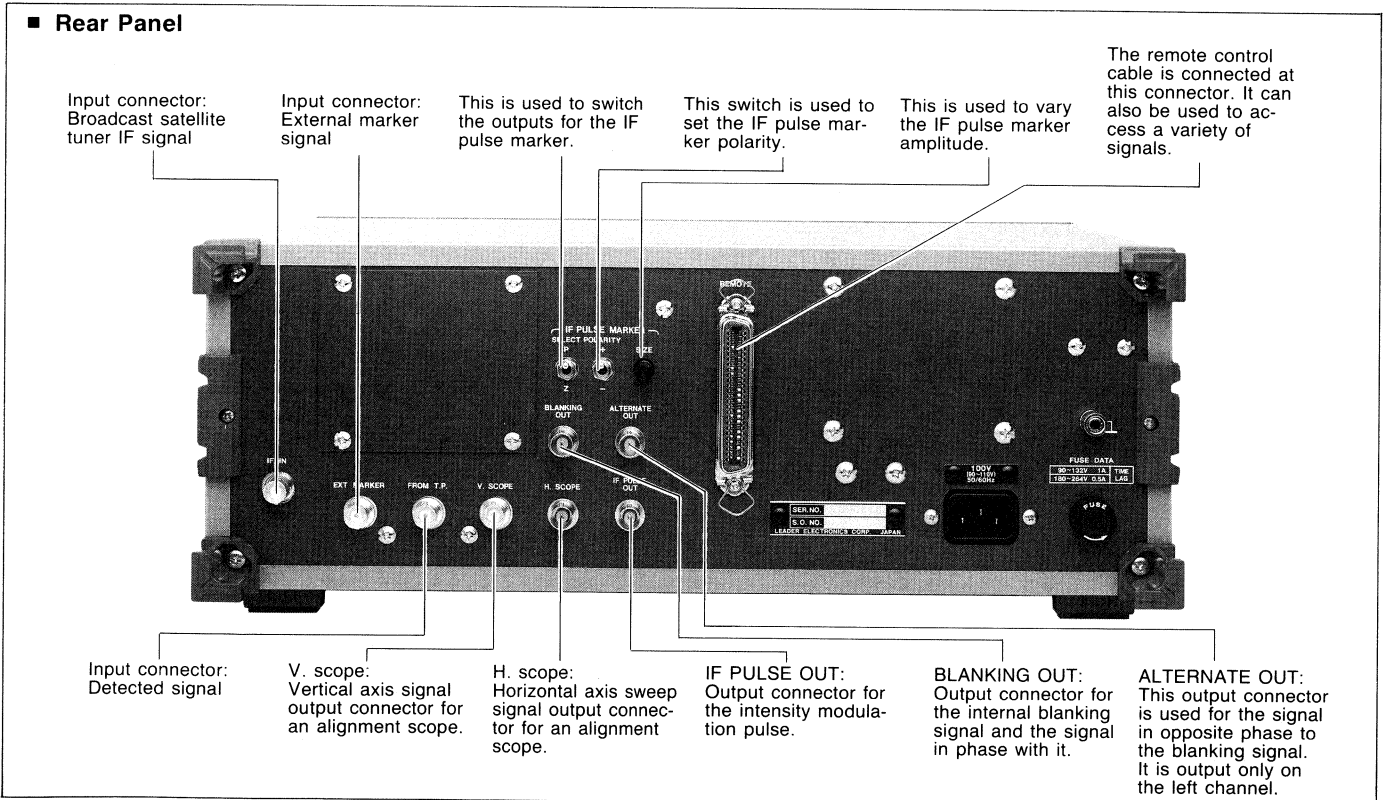
Temperature: 5 to 40°C  
 Humidity: 85% or less

**Power Supply:** 100, 120, 220, 240VAC, 50/60Hz, 35VA

**Size and Weight:** 400(W) × 148(H) × 300(D)mm, 9.5kg

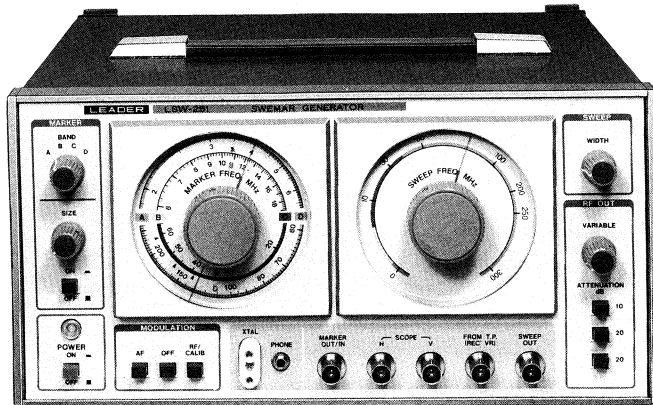
**Accessories:**  
 BNC - BNC cable ..... 6  
 BNC - clip cable ..... 1  
 NP - BNC 50Ω cable ..... 1  
 3P power cord ..... 1  
 3P-2P conversion adaptor ..... 1  
 Spare fuse ..... 1  
 Multi-pin plug (for remote connection) 50-pin ..... 1

## ■ Rear Panel



# SWEEP GENERATOR

## 2MHz to 310MHz Continuously Variable



### LSW-251 TV-FM SWEMAR GENERATOR

#### ● GENERAL

The LSW-251 Swemar Generator is an integrated sweep and marker generator used for wide frequency band. An outstanding width of the generating frequency range provides the users with various applications, including tests and adjustments of TV receivers, FM tuners, CATV equipment, and tuning coils. The instrument is a requisite particularly for the after-sales service of TV receivers.

#### ● FEATURES

- Sweep frequency is continuously variable in a range of 2 to 300MHz for a band.
- Sweep generator's center frequency is electronically variable by using variable capacitance diode.
- Maximum sweep width of 20MHz is suited for TV tuner checking.
- Built-in circuit for automatic level control.
- Variable attenuator is electronically controlled and continuously variable from 0 dB to -10 dB.
- Markers are generated in a wide frequency range; on the needle, frequency bands are classified by color, and the scales have band indications for easy reading.
- Marker adder circuit is incorporated.
- Input terminal for external marker source is equipped.
- Internal crystal-oscillator circuit requires no adjustment and its quartz crystal (FT-243) of 1 to 14MHz can be replaced.
- Solid-state components allow less power consumption, compact size, and light weight.

#### ● SPECIFICATIONS

##### Sweep Generator

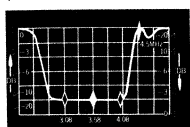
- Frequency Range:** 2 to 310MHz (1 band)
- Sweep Width:** Maximum 20MHz
- Sweep Rate:** 50/60Hz (Synchronous power frequency), triangular wave  
Within 5%
- Linearity:** Within 5%
- Output Voltage:** 100m Vrms
- Output Impedance:** 75Ω, unbalanced
- Attenuator:** Continuously variable from 0dB to 10dB, by push-buttons  
(for 10dB, 20dB, and 20dB)

##### Marker Generator

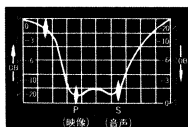
- Frequency Range:** 2 to 250MHz (four bands)  
Band A: 2 to 6.5MHz  
Band B: 6 to 18.5MHz  
Band C: 18 to 65MHz  
Band D: 60 to 250MHz  
(second harmonics)
- Frequency Accuracy:** Within ±1%
- Crystal Oscillator:** 1 to 14MHz (crystal, replaceable)
- Internal Modulation:** 1kHz (amplitude modulation)
- Accessory Circuit:** Marker Adder
- Power Supply:** 100, 120, 240VAC, 50/60Hz, 12VA
- Size and Weight:** 300(W) × 148(H) × 250(D)mm, 4.8kg
- Accessories:**
  - BNC - clips cables ..... 2
  - BNC - BNC cables ..... 2
  - Matching pad, 75 to 300Ω/200Ω [LBN-07X] ..... 1
  - Earphone ..... 1
  - 4.5MHz or 5.5MHz crystal (FT-243) .. 1

#### ■ Chroma bandwidth of tuner and TV, video IF characteristics and IF characteristics, of FM radio

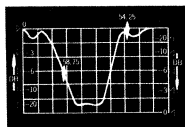
Band pass amp. characteristics



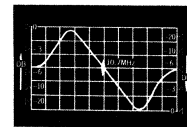
Tuner characteristics of TV



Video IF characteristics



FM-IF (10.7MHz) characteristics



# SWEEP GENERATOR

## Wide Band Sweep Generator with Various Plug-Ins



### LSW-480 UNIVERSAL SWEMAR GENERATOR

#### • GENERAL

LSW-480 is a main frame to actuate a sweep signal generator by attaching U series plug-in-unit.

By exchanging the plug-in-unit, it enables the adjustment for tracking AM/FM-IF circuit of radio and TV-VIF.

In the LSW-480 installed power circuit supply to plug-in-unit, sweep generator circuit, output attenuator, etc. are included.

#### • FEATURES

- Specifications change is easily available by replacing a plug-in unit.
- Centralized system is available for distributed 2 to 8 lines by use of a distributor with the LSW-480.
- Independent size control is available for the pulse marker and intensity modulation marker. They can be used simultaneously.
- Sweep output voltage of 1V is available, therefore centralized system of operation is available without using a distribution amplifier.

#### • SPECIFICATIONS

<b>Main Frame:</b>	LSW-480
<b>Output Impedance:</b>	75Ω unbalanced
<b>Output Attenuator:</b>	1dB × 10 (0 to 10dB), 10dB × 8 (0 to 80dB) Rotary type
<b>Sweep Rate:</b>	25/30Hz saw-tooth wave of AC line sync.
<b>Sweep Time:</b>	37ms (50Hz), 30ms (60Hz)
<b>Horizontal Output:</b>	10Vp-p ± 0.5Vp-p
<b>Marker Type:</b>	Superposed pulse and intensity modulation.
<b>Marker Output:</b>	0 to 1Vp-p (Superposed pulse) 0 to 10Vp-p (Intensity modulation)
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz
<b>Size and Weight:</b>	350(W) × 148(H) × 400(D)mm, 7kg
<b>Accessoris:</b>	BNC - Clip cable ..... 4 BNC - BNC cable ..... 1 Spae fuse ..... 1 3P-2P conversion adaptor ..... 1

#### ■ Plug-in Unit for LSW-480

	Band	Frequency Range	RF Output	Marker
480-U10	AM-IF	420 to 490kHz	1Vrms	Pulse marker 5 points (fixed)
480-U15	FM-IF	10.0 to 11.4MHz	1Vrms	Pulse marker 5 points (fixed)
480-U20	LW/BC	70 to 1800kHz	1Vrms	Pulse marker 5 points
480-U30	SW	1.5 to 30.0MHz	1Vrms	Pulse marker 5 points
480-U40	FM	70 to 115MHz	1Vrms	Pulse marker 5 points
480-U71	TV-SIF	4.5, 5.5, 6.0, 6.5 ± 0.5MHz	1Vrms	Pulse marker 7 points x 4 bands (fiixed)
480-U77	TV-CHROMA	2 to 7MHz	1Vrms	Pulse marker 4 points x 17 channels
480-U80	TV-VIF	22 to 64MHz	1Vrms	Pulse marker 6 points x 2 bands

# SWEEP GENERATOR

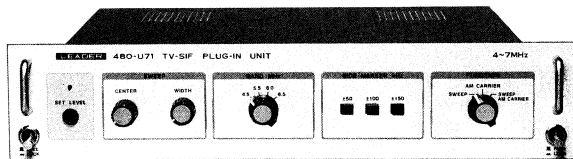
## Plug-In Unit for LSW-480/1481/1482

### 480-U71 TV-SIF PLUG-IN UNIT

For adjustment and testing of the SIF circuit of TV

#### • SPECIFICATIONS

<b>Sweep Section</b>	
Sweep Freq. Range:	4.5, 5.5, 6.0, and 6.5 ± 0.5MHz 4 bands
Center Frequency:	4.5, 5.5, 6.0, and 6.5 ± 0.2MHz 4 bands
Sweep Width:	± 0.3MHz to ± 0.5MHz
Output Voltage:	1 Vrms into 75Ω load
Output Flatness:	Within ± 0.1dB
Display Linearity:	Within 3%
<b>Marker Section</b>	
Marker System:	Pulse marker
Marker Frequency:	4.5MHz: ± 50kHz, ± 100kHz, ± 150kHz 5.5MHz: ± 50kHz, ± 100kHz, ± 150kHz 6.0MHz: ± 50kHz, ± 100kHz, ± 150kHz 6.5MHz: ± 50kHz, ± 100kHz, ± 150kHz Within ± 0.1%
<b>Accuracy:</b>	
Pulse Marker Width:	50μs
<b>Modulation Section</b>	
Carrier Frequency:	4.5MHz, 5.5MHz, 6.0MHz, 6.5MHz
Carrier Output Voltage:	1 Vrms
Modulation Freq.:	3kHz
Modulation Level:	30%
Size and Weight:	337(W) × 75(H) × 300(D)mm, 3kg
Power Consumption:	30VA

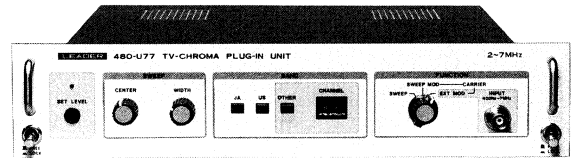


### 480-U77 TV-CHROMA PLUG-IN UNIT

For adjustment and testing of the chroma circuit of PAL, SECAM, NTSC TV.

#### • SPECIFICATIONS

<b>Sweep Section</b>	
Sweep Freq. Range:	2MHz to 7MHz (Center: 3 to 6Hz)
Sweep Width:	± 1.0MHz to ± 2.5MHz
Output Voltage:	1 Vrms into 75Ω load
Output Impedance:	75Ω
Output Flatness:	Within ± 0.5dB
<b>Marker Section</b>	
Marker System:	Pulse marker, 4 Points
Marker Frequency:	JAPAN & USA: 3.08, 3.58, 4.08, 4.5MHz OTHER: Fixed (17-ch.), Option (45-ch, 2 to 7MHz)
<b>Marker Setting Digits:</b>	
Minimum Interval:	4 digits, 1kHz step
Accuracy:	1/30 of sweep width
Pulse Marker Width:	Within ± 0.1%
50μs	
<b>Modulation Section</b>	
Carrier Frequency:	JAPAN: 58.75MHz, USA: 45.75MHz OTHER: Fixed (17-ch.), Option (45-ch, 25 to 80MHz, 5kHz step)
Carrier Output Voltage:	0.3 Vrms into 75Ω
Modulation Level:	30%
<b>EXT. Modulation Frequency:</b>	
400Hz to 7MHz	
Size and Weight:	337(W) × 75(H) × 300(D)mm, 3kg
Power Consumption:	35VA



### 480-U20 LW/BC-RF PLUG-IN UNIT

Covering LW-BC band.  
For adjustment of tracking and coil.

#### • SPECIFICATIONS

<b>Sweep Freq. Range:</b>	
70kHz to 1800kHz	
<b>Center Frequency:</b>	
170kHz to 1700kHz	
<b>Sweep Width:</b>	
200kHz min. to 1300kHz max.	
<b>Output Voltage:</b>	
1 Vrms into 75Ω load	
<b>Output Impedance:</b>	
75Ω	
<b>Output Flatness:</b>	
Within ± 0.5dB	
<b>Display Linearity:</b>	
Within 10%	
<b>Marker System:</b>	
Pulse marker	
<b>Marker Points:</b>	
5	
<b>Marker Frequency:</b>	
May be set within sweep range by thumb-wheel switches.	
<b>Marker Setting Digits:</b>	
4 digits, 1kHz step	
<b>Minimum Interval:</b>	
1/35 of sweep width	
<b>Accuracy:</b>	
Within ± 0.1% ± 1kHz	
<b>Pulse Marker Width:</b>	
50μs	
<b>Size and Weight:</b>	
337(W) × 75(H) × 300(D)mm, 2kg	
<b>Power Consumption:</b>	
28VA	

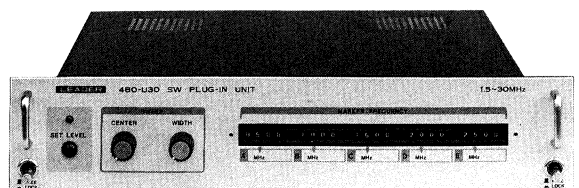


### 480-U30 SW-RF PLUG-IN UNIT

Covering short wave radio band.  
For adjustment of tracking and coil.

#### • SPECIFICATIONS

<b>Sweep Freq. Range:</b>	
1.5MHz to 30MHz	
<b>Center Frequency:</b>	
2MHz to 29.5MHz	
<b>Sweep Width:</b>	
1MHz min. to 28.5MHz max.	
<b>Output Voltage:</b>	
1 Vrms into 75Ω load	
<b>Output Impedance:</b>	
75Ω	
<b>Output Flatness:</b>	
Within ± 0.5dB	
<b>Display Linearity:</b>	
Within 10%	
<b>Marker System:</b>	
Pulse marker	
<b>Marker Points:</b>	
5	
<b>Marker Frequency:</b>	
May be set within sweep range by thumb-wheel switches.	
<b>Marker Setting Digits:</b>	
4 digits, 10kHz step	
<b>Minimum Interval:</b>	
1/90 of sweep width	
<b>Accuracy:</b>	
Within ± 0.1%	
<b>Pulse Marker Width:</b>	
50μs	
<b>Size and Weight:</b>	
337(W) × 75(H) × 300(D)mm, 2kg	
<b>Power Consumption:</b>	
28VA	



# SWEEP GENERATOR

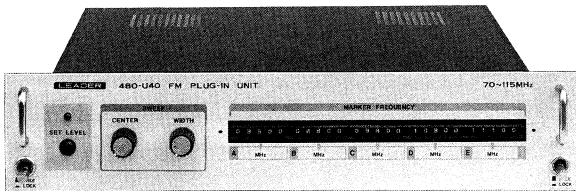
## Plug-In Unit for LSW-480/1481/1482

### 480-U40 FM-RF PLUG-IN UNIT

Covering FM radio band of various countries.  
For adjustment of tracking and coil.

#### ● SPECIFICATIONS

Sweep Freq. Range:	70MHz to 115MHz
Center Frequency:	73MHz to 112MHz
Sweep Width:	6MHz min. to 30MHz max.
Output Voltage:	1 Vrms into 75Ω load
Output Impedance:	75Ω
Output Flatness:	Within ±0.5dB
Display Linearity:	Within 10%
Marker System:	Pulse marker
Marker Points:	5
Marker Frequency:	May be set within sweep range by thumb-wheel switches.
Marker Setting Digits:	5 digits, 10kHz step
Minimum Interval:	1/30 of sweep width
Accuracy:	Within ±0.1%
Pulse Marker Width:	50μs
Size and Weight:	337(W) × 75(H) × 300(D)mm, 2kg
Power Consumption:	28VA

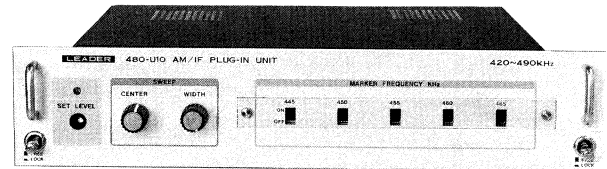


### 480-U10 AM-IF PLUG-IN UNIT

Covering 455kHz band.  
For adjustment of IF circuit and coil.

#### ● SPECIFICATIONS

Sweep Freq. Range:	420kHz to 490kHz
Center Frequency:	440kHz to 470kHz
Sweep Width:	30kHz min. to 70kHz max.
Output Voltage:	1 Vrms into 75Ω load
Output Impedance:	75Ω
Output Flatness:	Within ±0.5dB
Display Linearity:	Within 10%
Marker System:	Pulse marker
Marker Points:	5
Marker Frequency:	445, 450, 455, 460, 465kHz
Minimum Interval:	5kHz
Accuracy:	Within ±0.1%
Pulse Marker Width:	40μs
Size and Weight:	337(W) × 75(H) × 300(D)mm, 2kg
Power Consumption:	18VA

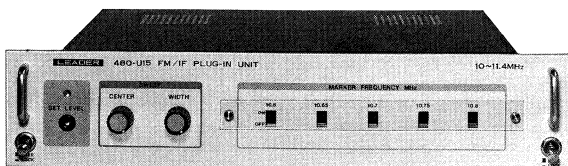


### 480-U15 FM-IF PLUG-IN UNIT

Covering 10.7MHz band.  
For adjustment of IF amplifier and coil.

#### ● SPECIFICATIONS

Sweep Freq. Range:	10.0 to 11.4MHz
Center Frequency:	10.3 to 11.1MHz
Sweep Width:	600kHz min. to 1400kHz max.
Output Voltage:	1 Vrms into 75Ω load
Output Impedance:	75Ω
Output Flatness:	Within ±0.5dB
Display Linearity:	Within 10%
Marker System:	Pulse marker
Marker Points:	5
Marker Frequency:	10.6, 10.65, 10.7, 10.75, 10.8MHz, fixed
Minimum Interval:	50kHz
Accuracy:	Within ±0.1%
Pulse Marker Width:	40μs
Size and Weight:	337(W) × 75(H) × 300(D)mm, 2kg
Power Consumption:	18VA

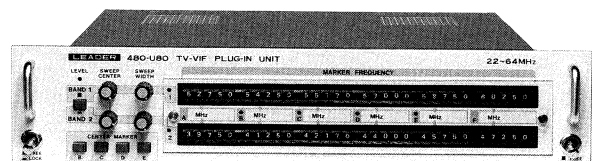


### 480-U80 TV-VIF PLUG-IN UNIT

Covering all TV-VIF circuit.  
For adjustment and testing of picture IF circuit.

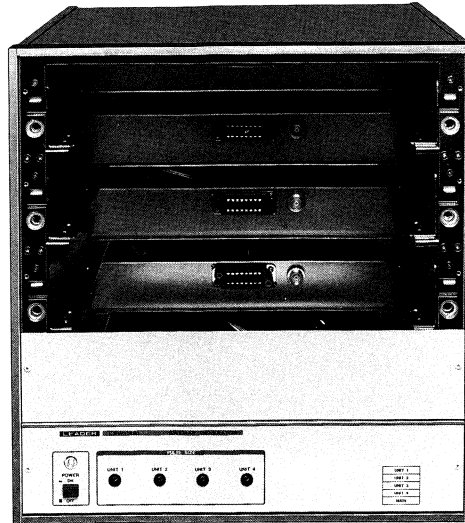
#### ● SPECIFICATIONS

Sweep Freq. Range:	22 to 64MHz
Center Frequency:	26 to 60MHz
Sweep Width:	8MHz min. to 16MHz max.
Output Voltage:	1 Vrms into 75Ω load
Output Impedance:	75Ω
Output Flatness:	Within ±0.5dB
Display Linearity:	Within 10%
Marker System:	Pulse marker
Marker Points:	6 (2-Band)
Marker Frequency:	May be set within sweep range by thumb-wheel switches.
Marker Setting Digits:	5 digits, 5kHz step
Minimum Interval:	1/60 of sweep width
Accuracy:	Within ±0.1%
Pulse Marker Width:	50μs
Size and Weight:	337(W) × 75(H) × 300(D)mm, 2kg
Power Consumption:	18VA



# SWEEP GENERATOR

## Multiple Use of the Plug-In Units



### LSW-1481/1482 SWEMAR GENERATOR

#### ● GENERAL

The LSW-1481 and LSW-1482 are main frame of the LSW-480's U-series plug-in units to form a centralized swemar generator system. Eight types of plug-in unit are available as mentioned in page 148 and 149. Up to four units into LSW-1481 or six units into LSW-1482 can be installed for 4-band or 6-band distribution.

The generation system can be used to adjust the tracking of radio receivers and to adjust and test sound and video IF circuits of TV sets (in different countries) by simply replacing the plug-in units. By operating the single-function LSW-480 units in synchronization with the system, the bands can be easily adjusted. The available accessories for this centralized system include the distributors, attenuators, test loop cables, and connectors. The LSW-1481/LSW-1482 have built-in power circuits, sweep wave generation circuits, and marker amplifiers for the plug-in units.

#### ● FEATURES

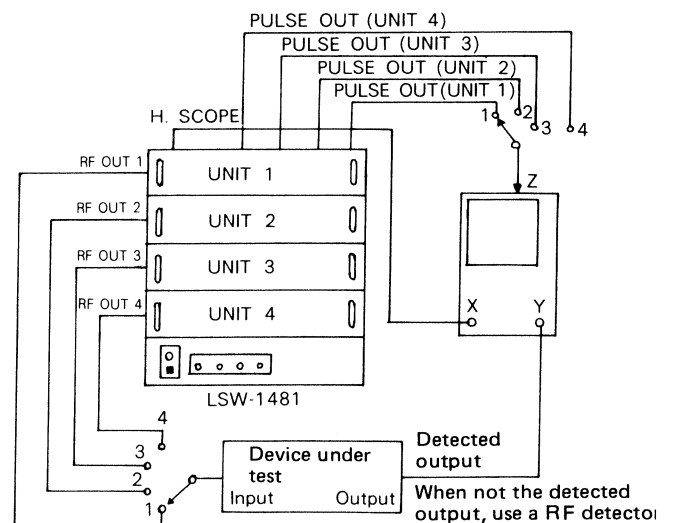
- Up to four plug-in units (LSW-1481) or up to six plug-in units (LSW-1482) can be housed in the main frame for four- or six-frequencies centralization. Changing specifications can be met by simply interchanging plug-in units. However up to three plug-in units for TV band can be housed in LSW-1481.
- A single LSW-1481 and LSW-1482 can be used with plug-in units and distributors to optionally centralize sweep generator system up to two to eight distributions.

#### ● SPECIFICATIONS

<b>Output Impedance:</b>	75Ω unbalanced
<b>Frequency Range:</b>	70kHz to 300MHz
<b>Sweep Speed:</b>	25/30Hz line synchronization sawtooth wave
<b>Sweep Time:</b>	37ms (50Hz), 30ms (60Hz)
<b>Horizontal Output:</b>	10Vp-p ± 0.5Vp-p
<b>Marker Type:</b>	Pulse

<b>Horizontal Output:</b>	10Vp-p ± 0.5Vp-p
<b>Marker Type:</b>	Pulse
<b>Marker Output:</b>	0 to 10Vp-p with positive/negative polarity switching
<b>Power Supply:</b>	100, 117, 220 and 240VAC
<b>Size and Weight:</b>	LSW-1481: 350(W) × 367(H) × 400(D)mm, 15kg LSW-1482: 350(W) × 550(H) × 400(D)mm, 20kg
<b>Accessories:</b>	3P power cord ..... 1 3P-2P conversion adaptor ..... 1 Fuse ..... 1 Blank panel (only LSW-1481) ..... 1

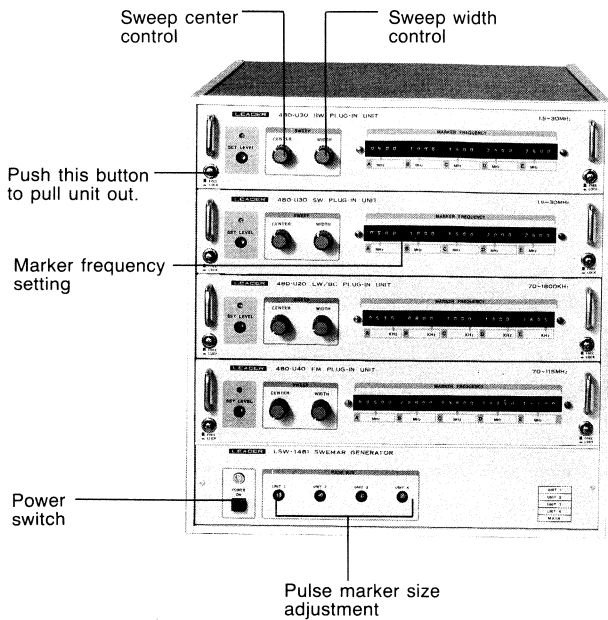
#### ■ Four different frequencies measurements using four position band switches.



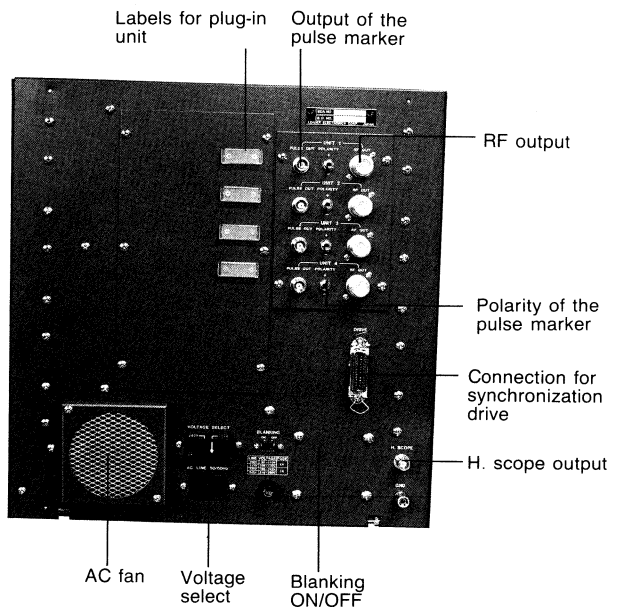
# SWEEP GENERATOR

## ■ Front and Rear Panel

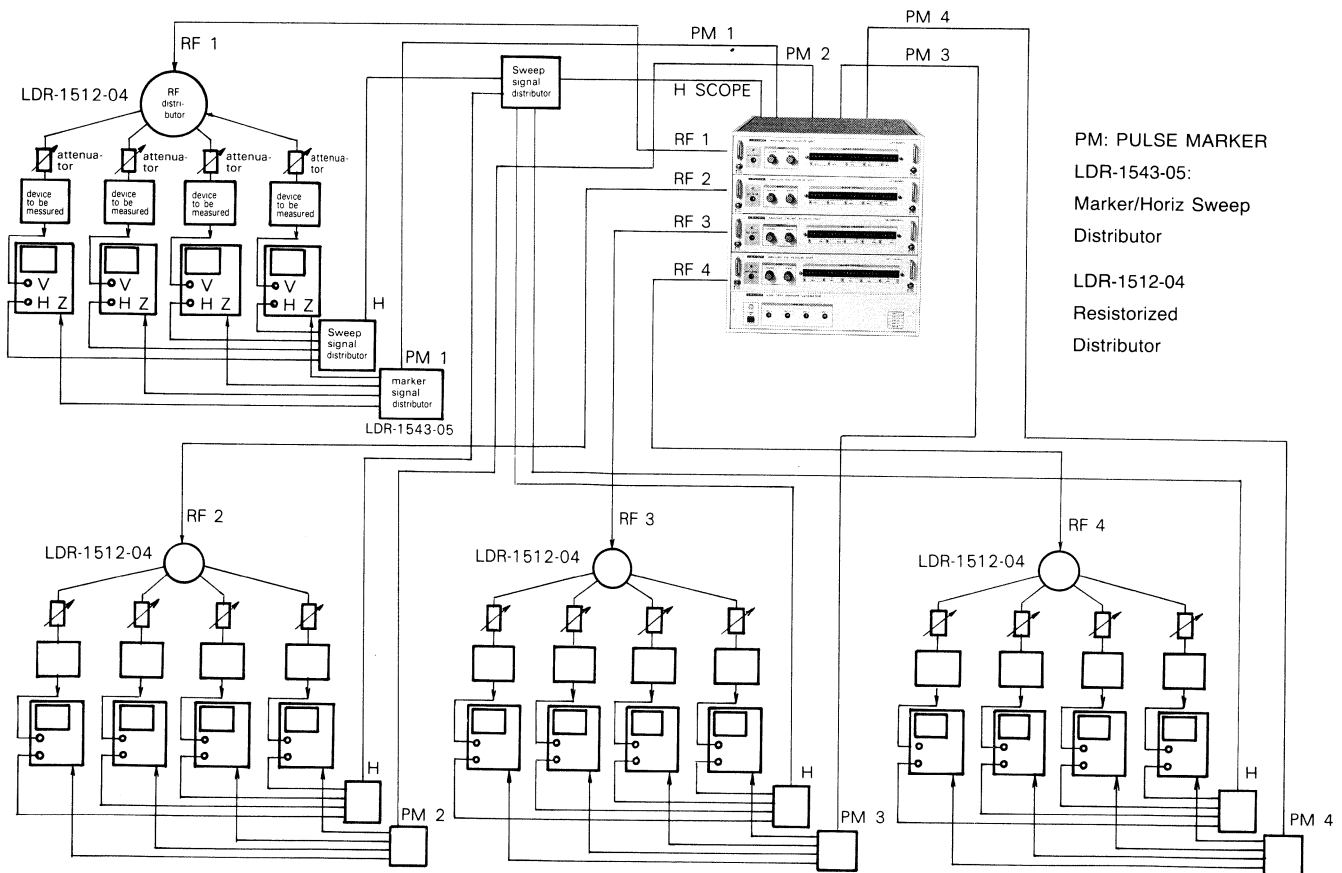
### • Front Panel



### • Rear Panel



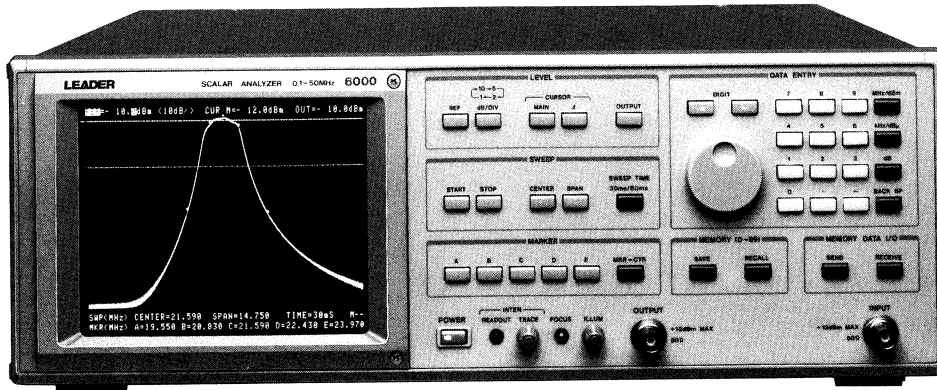
## ■ Cable Connection



# SWEEP GENERATOR

## Real-Time Display of High-Frequency Device Propagation Characteristics

**NEW**



### Model 6000 Model 6030 SCALAR ANALYZER

#### •GENERAL

The Model 6000 and the Model 6030 are scalar analyzers. The frequency range covers from 100 kHz to 50 MHz (6000), 10MHz to 300MHz (6030). A selectable level method is used, enabling high-accuracy measurement of true value, without the influence of harmonics from the signal source. Parameter settings can be made quickly by numeric use or by a rotary encoder and digital selector. These models are ideal for use in adjustments and inspection of electronic devices for video equipment, high-frequency electronic circuit, and is particularly suited for use with LC filters, coils, narrowband ceramic filters and crystal filters.

#### •FEATURES

- Digital setting of all measurement parameters
- CRT readout display of measurement parameters
- Above the displayed waveform, a display is provided of level parameters, and below the waveform is provided a display of sweep time, marker frequency, and other frequency related parameters.
- 0.1dB level resolution and 1kHz frequency resolution
- Analog-type, real-time display of waveforms with no time lag
- 7-inch rectangular CRT with high intensity and high persistence
- The RF output is available at its maximum level of +13 dBm, enabling measurements on high-attenuation devices.
- Up to 100 sets of settings can be stored in battery-backed up memory.
- Setting data can be mass-transferred between several Model 6000 analyzers.
- Setting data can be mass-transferred between several Model 6030 analyzers.
- A cursor measurement function can be used to measure the level of any selected point or the level difference between cursors.
- Markers can be set at five frequencies.
- A marker center function can be used to move any marker to the center of the display screen. When this is done, the start frequency, stop frequency or center frequency are automatically calculated and set.



# SWEEP GENERATOR

## ● SPECIFICATIONS

### Signal Generation Section

**Frequency Range:** 100kHz to 50.0MHz  
**Frequency Setting Range:** Start, stop, and center frequencies: 100kHz to 50.0MHz  
 Span frequency: 0 to 49.9MHz  
**Frequency Setting Resolution:** 1kHz  
**Sweep Time:** 30ms, 60ms  
**Sweep Mode:** Start/stop, center/span (CW operation for a span setting of "0")  
**Output Level Range:** +13 to -57dBm (dB $\mu$  display possible)

**Output Level Resolution:** 0.1dB  
**Output Impedance:** 50 $\Omega$   
**Output Connector:** BNC  
**Output Flatness:**  $\pm$ 1dB

### Signal Input Section

**Input Connector:** BNC  
**Frequency Range:** 100kHz to 50.0MHz, linked to signal-generation section

### Measurement

**Range:** 83dB or greater  
**Dynamic Range:** 70dB or greater  
**Maximum Input Level:** +13dBm  
**Input Frequency Flatness:**  $\pm$ 1.5dB  
**Input Level Display:** Log (dB scale) display  
**Level Display Range:** 10dB/div, 5dB/div, 2dB/div, 1dB/div  
**Input Level Linearity:**  $\pm$ 2dB

**Input Level Resolution:** 0.1dB

**Reference Level Setting Range:** +20 to -100dBm (dB $\mu$  display possible)

**Reference Level Setting Resolution:** 0.1dB

**Cursor Functions:** Main cursor and  $\Delta$  cursor usable to measure input level and level difference.

**Main Cursor Setting Range:** +20 to -70dBm (dB $\mu$  display possible)

**$\Delta$  Cursor Measurement Range:** +80 to -80dB

**Measurement Resolution:** 0.1dB

### Marker Function:

Markers A through E used to measure frequency. Each marker switchable on/off independently. The frequency of any marker can be brought to the center of the screen using the marker center function.

### Marker Frequency Range:

101kHz to 49.999MHz (display range screen center  $\pm$ 4.5 div)

### Marker Frequency Setting Resolution: Marker Frequency Accuracy:

1kHz  
 0.1% (2MHz and above)  
 2kHz (below 2MHz)

### Marker Type:

Intensified pulse markers

### Number of Markers:

5, independently deletable

### Marker Amplitude:

2.5 div max., adjustable using a rear-panel trimmer

### Marker Polarity:

Positive/negative switchable (rear-panel switch)

### Display

#### CRT:

7-inch rectangular electrostatically deflected CRT with high persistence  
 One line each above and below the displayed waveform

#### Readout:

- Reference level, level range, cursor data, and output level displayed above waveform.
  - Sweep mode, frequency data values, sweep time and memory address displayed below waveform on upper line.
  - Marker display status and frequencies displayed below waveform on lower line.
- \*The data edit item and digit are indicated by an edit cursor display.

### Data Input Section

#### Input Method:

Numeric keys and digit selector and rotary encoder or combination of these methods.

### Memory Function

#### Memory Function Storage Capacity:

100 sets of measurements parameters (address 0 to 99)

#### Contents Transfer:

All contents (addresses 0 to 99) mass transferable.

### Power Supply:

#### Size and Weight:

100, 120, 220, 240VAC  $\pm$ 10%,  
 50/60Hz, 100VA  
 426(W)  $\times$  149(H)  $\times$  433(D)mm, 13.0kg

#### ★ Measurement parameters:

- Reference level
- Level range
- Cursor data
- Output level
- Sweep mode and frequency data
- Sweep time
- Marker frequencies and status

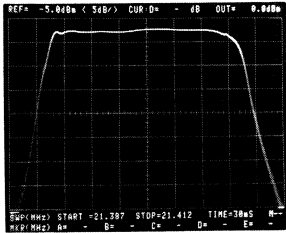
### Accessories:

BNC-BNC cable (50 $\Omega$ , 1m) .....2  
 BNC connector plug (for transfer) .....1  
 3P-2P conversion adaptor .....1  
 Spare fuse .....1

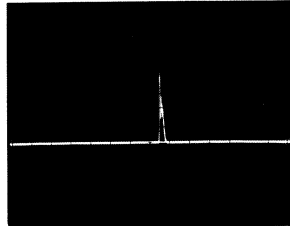
# SWEEP GENERATOR

## Unique Model 6000 Functions

### ■ Narrowband Measurements at High Frequencies



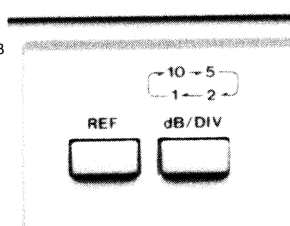
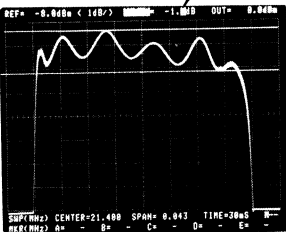
21.387MHz Model 6000 21.412MHz



Sweep generator or similar instrument

The Model 6000 features excellent frequency stability and 1kHz frequency setting resolution, which enables measurement on narrowband filters.

### ■ High-Sensitivity Ripple Measurement on Filters



Display level range

Instant display level range switching enables high-sensitivity ripple measurements on filters and similar devices.

## A Diverse Complement of Functions Enables Fast, High-Accuracy Measurements.

### ■ CRT Readout Display of Measurement Parameters



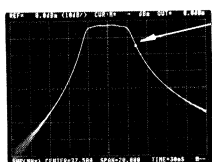
Reference level, cursor data, display level range and output level



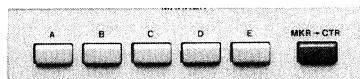
Sweep mode and frequency, Sweep time, memory address, Marker display status and frequencies

Measurement parameter settings can be made by means of numeric keys or by a jogging dial, and are displayed on a CRT readout. This enables quick setting and eliminates reading errors.

### ■ Markers at up to 5 frequencies



Level display at cursor position

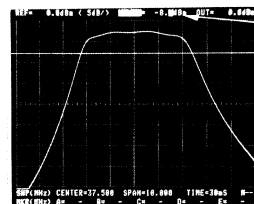


Marker push buttons

Frequency is displayed

Up to five marker frequencies can be set using numeric keys or a jogging dial.

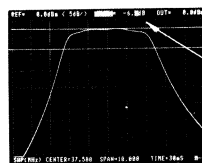
### ■ Level Measurements Using a Cursor



Setting markers flash

Simply adjust the cursor to any desired point to quickly read the corresponding level with high accuracy on a digital display.

### ■ Level difference measurements using two cursors



Main cursor  
Δ cursor

Level difference is displayed.

The level difference between the main cursor and the Δ can be measured. It is also possible to use these as reference cursors for adjustments and inspection.

## 10Hz to 1000MHz: LDC-825, 10Hz to 520MHz: LDC-824



### LDC-824 LDC-825 DIGITAL FREQUENCY COUNTER

#### • GENERAL

The LDC-824 and the LDC-825 are digital frequency counter/timer designed to measure the frequency and period of a signal, featuring a wide frequency range (10Hz to 520Hz: LDC-824, 10Hz to 1GHz: LDC-825), a high input sensitivity 20mVrms (10Hz to 80MHz), 50mVrms (50MHz to 1GHz), and high resolution to 8 digit. The period function makes the unit outstanding for video tape recorder service applications. This instrument can be used for adjustment, test and repair of audio instruments, AM/FM radios, TVs, CB radios, computer clocks, amateur-radios, electronic watches, musical instruments, etc.

#### • FEATURES

- A big fluorescent display assures easy readability of values.
- The green display does not induce eye fatigue even after an extended period of viewing.
- Readout miscounts are reduced by zero-blanking, unit-display (kHz, MHz, ms) and overrange display.
- The use of LSI and MSI in the internal circuit assures reliable performance and less power consumption.

#### • SPECIFICATIONS

##### Frequency Measurements

<b>Range:</b>	10Hz to 80MHz (direct) 50MHz to 520MHz (pre-scaler) (824) 50MHz to 1000MHz (Pre-scaler) (825)
<b>Gate Time:</b>	100ms, 1s, 10s (824) 100ms, 1s, 10s, (direct) 0.04s, 0.4s, 4s (pre-scaler) } (825)
<b>Resolution:</b>	10Hz, 1Hz, 0.1Hz (direct) 100Hz, 10Hz, 1Hz (pre-scaler) (824) 1000Hz, 100Hz, 10Hz (pre-scaler) (825)
<b>Accuracy:</b>	±1 count ± time base accuracy

##### Period Measurements

<b>Range:</b>	100ms to 1μs
<b>Multiplication Factors:</b>	× 10, × 100, × 1000
<b>Resolution:</b>	10μs, 1μs, 0.1μs
<b>Accuracy:</b>	±1 count ± time base accuracy ± trigger error

##### Input Section

###### Input Sensitivity

<b>1MΩ:</b>	20mVrms: 10Hz to 80MHz } (824) 50mVrms: 80MHz to 520MHz } (825) 20mVrms (10Hz to 80MHz) (825)
<b>50Ω:</b>	20mVrms: 100kHz to 80MHz } (824) 50mVrms: 80MHz to 520MHz } (825) 50mVrms (50MHz to 1000MHz) (825)

###### Input Impedance:

Switchable 1MΩ and 50Ω (824)

###### Attenuator:

1MΩ (10H to 80MHz)  
50MΩ (50MHz to 1000MHz) } (825)  
1, 1/10 (824)  
1, 1/10 (10Hz to 80MHz) (825)

###### Max. Input Voltage

<b>1MΩ:</b>	10Hz to 400 Hz: 100Vrms } (824) 400Hz to 100kHz: 20Vrms } (824) 100kHz to 520MHz: 5Vrms } (825) 10Hz to 400Hz: 100Vrms } (825) 400Hz to 100kHz: 20Vrms } (825) 100kHz to 80MHz: 5Vrms } (824) 50MHz to 1000MHz: 5Vrms (825)
<b>50Ω:</b>	100kHz to 520MHz: 5Vrms (824) 50MHz to 1000MHz: 5Vrms (825)

##### Time Base

###### Frequency:

10MHz (crystal controlled) (oven) (824)  
1MHz crystal controlled (oven) (825)

###### Accuracy:

± 1 × 10<sup>-6</sup> (1ppm) (824)  
± 3 × 10<sup>-8</sup> (± 0.03ppm) (825)

###### Clock Out:

1Vp-p 1MHz (825)

###### External Clock:

1Vp-p to 10Vp-p 1MHz (825)

###### Display:

8 digits, 7 segments fluorescent display  
overflow indication, gate indication and zero blanking.

###### Power Supply:

100, 120, 200, 240VAC, 50/60Hz  
12VA (824), 15VA (825)

###### Size and Weight:

210(W) × 80(H) × 265(D)mm, 2.2kg (824)  
230(W) × 90(H) × 285(D)mm, 2.5kg (825)

###### Accessories:

BNC-Clip connector	1
Spare fuse	1
	(824)
BNC-BNC cable	1
Spare fuse	1
	(825)

# COUNTER

10Hz to 250MHz: LDC-823A, 10Hz to 80MHz: LDC-822A



## LDC-822A LDC-823A DIGITAL FREQUENCY COUNTER

### ● GENERAL

The LDC-822A and the 823A are digital frequency counters/timers designed to measure the frequency and period of a signal, featuring a wide frequency range (10Hz to 80MHz; LDC-822A), (10Hz to 250MHz: LDC-823A), a high input sensitivity (20 to 50mVrms), and high resolution to 7 to 8 digits. The period function makes the unit outstanding for video tape recorder service applications. These instruments can be used for adjustment, test and repair of audio instruments, AM/FM radios, TVs, CB radios, amateur-radios, electronic watches, musical instruments, etc.

### ● FEATURES

- A big bright fluorescent display assures easy readability of values. The green display does not induce eye fatigue even after an extended period of viewing.
- Misreadouts are reduced by zero-blanking, unit-display (kHz, MHz, mS) and overrange display.

### ● SPECIFICATIONS

#### Frequency Measurements

<b>Range:</b>	10Hz to 80MHz (822A) 10Hz to 80MHz (direct) 10MHz to 250MHz (Pre-scaler) } (823A)
<b>Gate Time:</b>	0.1s, 1s, 10s
<b>Resolution:</b>	10Hz, 1Hz, 0.1Hz (822A) 10Hz, 1Hz, 0.1Hz (direct) } (823A) 100Hz, 10Hz, 1Hz (pre-scaler)
<b>Accuracy:</b>	± 1 count ± time base accuracy

#### Period Measurements

<b>Range:</b>	100ms to 1 $\mu$ s
<b>Multiplication Factors:</b>	× 10, × 100, × 1000
<b>Resolution:</b>	10 $\mu$ s, 1 $\mu$ s, 0.1 $\mu$ s
<b>Accuracy:</b>	± 1 count ± time base accuracy ± trigger error

#### Input Section

##### Input Sensitivity

<b>1M<math>\Omega</math>:</b>	20mVrms, (10Hz to 80MHz) (822A) 50mVrms: 10Hz to 100Hz 20mVrms: 100Hz to 100Hz } (823A) 50mVrms: 100Hz to 250Hz
<b>50<math>\Omega</math>:</b>	20mVrms: 100Hz to 100MHz 50mVrms: 100MHz to 250MHz } (823A)

##### Input Impedance:

1M $\Omega$  (822A)  
Switchable 1M $\Omega$  and 50 $\Omega$  (823A)

##### Attenuator:

1, 1/10 1/100 (822A)  
1, 1/10 (823A)

##### Max. Input Voltage

<b>1M<math>\Omega</math>:</b>	100Vrms: 10Hz to 400Hz 20Vrms: 400Hz to 100kHz } (822A) 5Vrms: 100kHz to 80MHz
<b>50<math>\Omega</math>:</b>	100Vrms: 10Hz to 400Hz 20 Vrms: 400Hz to 100kHz } (823A) 5Vrms: 100kHz to 250MHz 5Vrms: 10Hz to 250MHz (823A)

#### Time Base

<b>Frequency:</b>	10MHz (crystal controlled)
<b>Accuracy:</b>	± 5 × 10 <sup>-6</sup> (5ppm)
<b>Display:</b>	7 digits (822A), 8 digits (823A) 7 segment fluorescent display overflow indication, gate indication and zero blanking.

#### Power Supply:

100, 120, 220, 240VAC, 50/60Hz,  
10VA (822A), 12VA (823A)

#### Size and Weight:

210(W) × 80(H) × 265(D)mm, 2.2kg

#### Accessories:

BNC-clip cable ..... 1  
Spare fuse ..... 1

# COUNTER/MULTIMETER

## 5Hz to 150MHz



**LDC-831**  
FREQUENCY COUNTER

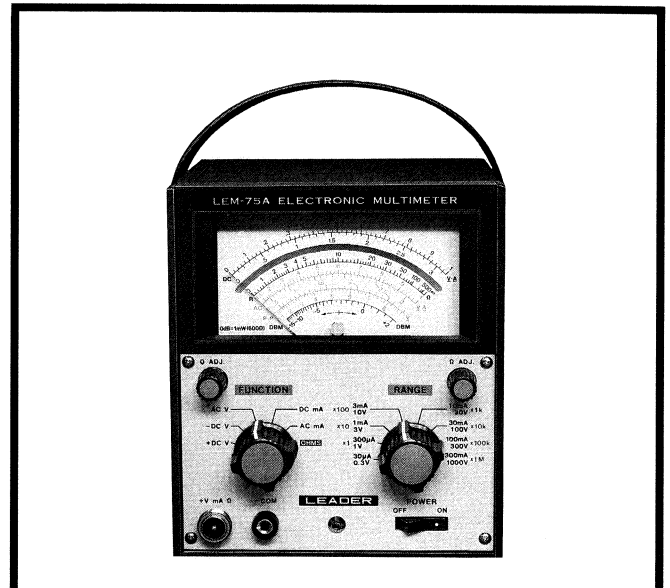
### ● GENERAL

The LDC-831 is a frequency counter designed in compact size but with excellent cost performance as well as high reliability. It has a wide range of applications in measuring frequencies from 5Hz to 150MHz, covering audio, hum, AM/FM radio, TV-VIF, SIF and CHROMA bands. It is in palm size, weighing only 650g, easy to carry and best suited for field services.

### ● SPECIFICATIONS

<b>Freq. Measurement</b>	
<b>Range:</b>	5Hz to 150MHz
<b>Gate Time:</b>	0.01s, 1s 2 ranges
<b>Resolution:</b>	kHz range (100Hz/1Hz) MHz range (10kHz/100Hz)
<b>Accuracy:</b>	± 1 count ± reference time accuracy
<b>Multiplication:</b>	LOW range: 5Hz to 2MHz HIGH range: 1MHz to 150MHz
<b>Input Sensitivity:</b>	LOW: 5Hz to 10Hz: 50mVrms, 1MHz to 2MHz: 50mVrms, 10Hz to 1MHz: 35mVrms HIGH: 1MHz to 2MHz: 50mVrms, 120MHz to 150MHz: 50mVrms, 2MHz to 120MHz: 30mVrms
<b>Input Impedance:</b>	LOW: 1MΩ, HIGH: 2.5kΩ
<b>Input Capacitance:</b>	LOW/HIGH: less than 15pF
<b>Max. Input Voltage:</b>	20Vp-p
<b>Reference Time Frequency:</b>	3.2768MHz
<b>Reference Time Accuracy:</b>	5 × 10 <sup>-5</sup> (50 ppm), 0 to 40°C 1 × 10 <sup>-5</sup> (10ppm), 23° ± 3°C
<b>Display:</b>	Digit display 4-1/2 digits LED
<b>Memory Indication:</b>	Overflow indication
<b>Power Supply:</b>	Battery UM-2 or "C" cell × 4 (6V), Power consumption about 145mA, continuous operating time 4 Hr, AC adaptor (separately available)
<b>Size and Weight:</b>	160(W) × 58(H) × 122(D)mm, 650g
<b>Accessory:</b>	BNC - clip cable ..... 1

## DC-V/mA, AC-V/mA, Ω



**LEM-75A**  
ELECTRONIC MULTIMETER

### ● GENERAL

The LEM-75A is a sensitive volt-current meter for DC and AC measurements. It features high input resistance, wide scales with mirror-backing. FET's are used for high reliability in the stable DC amplifier. Voltage down to 0.01V and currents as low as 0.001mA (1μA) can be measured for DC and AC inputs.

### ● SPECIFICATIONS

<b>DC Voltage</b>	
<b>Range:</b>	0.3 to 1000V, 8 ranges
<b>Accuracy:</b>	± 3% of full scale
<b>Input Resistance:</b>	10MΩ
<b>AC Voltage</b>	
<b>Range:</b>	0.3 to 1000Vrms, 8 ranges
<b>Input Resistance:</b>	10MΩ
<b>Accuracy:</b>	± 4% of full scale
<b>Frequency Range:</b>	25Hz to 1MHz at 0.3V range: ± 0.5dB, 20Hz to 3MHz at 1 to 1000V range: ± 1dB
<b>dB Calibration:</b>	- 15 to + 2dBm (0dB to 1mW/600Ω)
<b>Peak-to-peak Volts:</b>	0.1 to 2800Vp-p: 8 ranges
<b>DC Current</b>	
<b>Range:</b>	0.03 to 300mA, 8 ranges
<b>Accuracy:</b>	± 3% of full scale
<b>Internal Drop:</b>	0.3V at full scale
<b>Frequency Range:</b>	40 to 400Hz
<b>AC Current</b>	
<b>Range:</b>	0.03 to 300mA, 8 ranges
<b>Accuracy:</b>	± 4% of full scale
<b>Internal Drop:</b>	0.3V at full scale
<b>Resistance — OHMS:</b>	Range: 0.2Ω to 500MΩ in range; 10, 100, 1, 10, 100k, 1M and 10MΩ at midscale Accuracy: Within 3% of full scale
<b>Power Supply:</b>	100, 120, 220, 240VAC, 50/60Hz
<b>Battery:</b>	"C" cell (1.5V, NEDA 14, or equiv) . 1
<b>Size and Weight:</b>	150(W) × 175(H) × 125(D)mm, 3kg
<b>Accessory:</b>	Test prod ..... 1

# MULTIMETER

4 1/2 Digital LED Display: LDM-852A, 3 1/2 Digital LED Display: LDM-853A



## LDM-852A LDM-853A DIGITAL MULTIMETER

### • GENERAL

The LDM-852A and the LDM-853A are compact-size digital multimeters with a large LED to indicate 3-1/2 (853A), 4-1/2 (852A) digit. These are applied to measure DCV, ACV, DCA, ACA, and  $\Omega$  in 24 ranges selection and is provided with automatic polarity selection and auto-zero adjustment (853A) functions.

### • FEATURES

- High accuracy of 0.03% rdg  $\pm$  2 dgt (DCV): 852A  
0.3% rdg  $\pm$  2 dgt (DCV): 853A
- High resolution with 200mV (DC/AC) and 200 $\Omega$  ranges
- High current measurement up to 2A (DC/AC)
- Measurement functions for all of DCV, ACV, DCA, ACA and  $\Omega$
- Automatic polarity switching function
- DC/AC 200mV and 2V input impedance as high as 500M $\Omega$
- Automatic auto-zero adjustment function: 853A
- Large size LED (green) display easy to look at.

### • SPECIFICATIONS

#### Measurement Functions

<b>DC Voltage:</b>	0.2, 2, 20, 200, 1000V	5 ranges
<b>AC Voltage:</b>	0.2, 2, 20, 200, 1000V	5 ranges
<b>DC Current:</b>	2, 20, 200mA, 2A	4 ranges
<b>AC Current:</b>	2, 20, 200mA, 2A	4 ranges
<b>Resistance:</b>	0.2, 2, 20, 200, 2000k $\Omega$ , 20M $\Omega$	6 ranges

#### Measurement Accuracy

<b>DC Voltage:</b>	$\pm$ 0.03% rdg $\pm$ 2 digit (2V) (852A) $\pm$ 0.3% rdg $\pm$ 2 digit (0.2 to 200V) (853A)
<b>AC Voltage:</b>	$\pm$ 0.3% rdg $\pm$ 10 digit (2V range: 40Hz to 1kHz) (852A) $\pm$ 0.5% rdg $\pm$ 4 digit (0.2 to 200V ranges: 45 to 1kHz) (853A)
<b>DC Current:</b>	$\pm$ 0.4% rdg $\pm$ 2 digit (2 to 20mA) (852A) $\pm$ 0.4% rdg $\pm$ 3 digit (2mA range) (853A)
<b>AC Current:</b>	$\pm$ 0.6% rdg $\pm$ 10 digit (2 to 20mA) (852A) $\pm$ 1.8% rdg $\pm$ 4 digit (all ranges) (853A)
<b>Resistance:</b>	$\pm$ 0.03% rdg $\pm$ 4 digit (2 to 200k $\Omega$ ) ..... HI } (852A) $\pm$ 0.15% rdg $\pm$ 2 digit (0.2 to 200k $\Omega$ ) ..... LO } $\pm$ 0.3% rdg $\pm$ 2 digit (0.2 to 2000k $\Omega$ ) ..... LP $\Omega$ (853A)
<b>Input Impedance:</b>	DCV, ACV ..... 500M $\Omega$ /10M $\Omega$ (852A) DCV, ACV ..... 10M $\Omega$ (853A)

#### Maximum Input

<b>DC Voltage:</b>	1100V (DC + ACp-p) (852A) 1000V (DA + ACp-p) (853A)
<b>AC Voltage:</b>	1100Vrms, 1100V DC (852A) 1000Vrms, 1000V DC (853A)
<b>DC Current:</b>	$\pm$ 2A
<b>AC Current:</b>	2A
<b>Resistance:</b>	250V AC/DC (852A) 240V (DC + ACp-p) (853A)

#### Range Switching:

#### Overrange Indication:

Display 0000 and flashing (852A)  
Most significant digit "1" only (853A)  
Automatic ("—" indicates negative polarity)  
"•" indicator (low voltage indicator)

#### Sampling Rates:

2.5 times per second (852A)  
Approx. 2 times per second (853A)

#### Electric Buzzer:

Beep at less than 2 $\Omega$   $\pm$  1 $\Omega$  (852A)  
(for guaranteed accuracy: 23°C  $\pm$  5°C)

#### Power Supply:

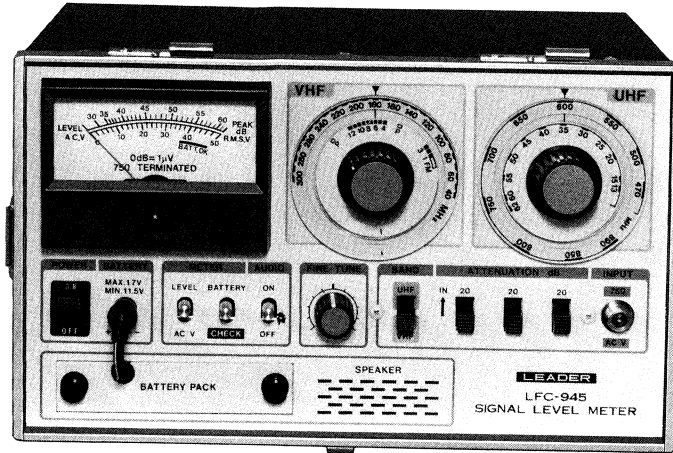
Humidity 85% or less  
100, 120, 220, 240VAC, 50/60Hz,  
5 VA (852A)  
UM-2 or "C" cell  $\times$  4 (or AC adaptor) 8V,  
Approx. 200mW (853A)

#### Size and Weight:

211(W)  $\times$  80(H)  $\times$  265(D)mm, 2.2kg (852A)  
160(W)  $\times$  62(H)  $\times$  122(D)mm, 500g (853A)

# LEVEL CHECKER

Level Measurement of VHF, UHF, CATV and FM Radio can be Made.



## LFC-945 SIGNAL LEVEL METER

### • GENERAL

The LFC-945 is a Signal Level Meter of service use for field strength measurements of broadcastings of VHF and UHF television, CATV, and FM radio.

The instrument covers the measurement frequency bands of the VHF (40 to 300 MHz) and the UHF (470 to 890 MHz), and the 75Ω termination peak level of the input RF signal can be correctly read by the sum of meter indication and attenuator setting.

Further when 50/60 Hz AC voltage is superposed on the television RF signal with the output of the common receiver's amplifier, the signal level can be measured by the F type jack for the RF input signal.

The LFC-945 has a wide range of applications, including the measurements of receiving levels, measurements of field strengths, TV and FM antenna selections, antenna installations, directivity determination of antennas, boost amplifier's gain measurements, master antenna television distribution system laying, and home antenna distribution construction.

### • FEATURES

- As the instrument covers the VHF band, 40 to 300 MHz, and the UHF band, 470 to 890 MHz, the level measurements of VHF and UHF television signals as well as CATV and FM radio broadcastings can be made.
- It indicates the 75Ω termination peak level of the input RF signal.
- Correct level measurement are available when the input RF signal is superposed on 50/60Hz AC voltage.
- AC voltage measurement is available of the 50/60Hz AC voltage superposed.
- The buzz sound can be monitored by a loudspeaker. Also the voice sound can be monitored by a loudspeaker.
- A wide dynamic range, 32dB (30 to 62 dB), of the meter.
- The provision of the fine tuning knob common to the VHF and UHF makes it easy to select signals.
- The panel cover is provided to protect the meter and switches. When the cover is placed the power is automatically turned off, so that the battery loss can be eliminated.
- The taut-band meter is used which is resistant to shocks.
- The instrument is portable with battery power. A car battery can be used as an alternative.

### • SPECIFICATIONS

#### Receiving Frequency

**Band:** VHF: 40 to 300MHz  
UHF: 470 to 890MHz

#### Measurement Level

**Range:** 30 to 120dBμ (-30 to +60dBmV)

#### Detection System and Indication Value:

Peak level detection at 75Ω termination voltage

#### Measurement Accuracy (at 20°C):

VHF: 1.5dB or less  
UHF: 2.0dB or less

#### Measurement Accuracy

**Temperature Characteristics:** ± 1.5dB or less (0° to 40°C)

#### Input Impedance,

**Connector:** 75Ω, F-J

#### Input VSWR:

VHF: Within 1.5 (ATT. OFF)  
Within 1.3 (ATT. ON)  
UHF: Within 1.8 (ATT. OFF)  
Within 1.5 (ATT. ON)

#### Attenuator:

#### Attenuator Accuracy:

20dB × 3  
VHF: ± 0.5dB or less  
UHF: ± 1.5dB or less

#### Intermediate Frequency:

45.75MHz  
Approx. 500kHz (-3dB)

#### Bandwidth:

30dB or more

#### Adjacent Channel

#### Interference Ratio:

#### Image Suppression

#### Ratio:

#### Direct Wave Jump-in

#### Interference Ratio:

35dB or more

VHF: 70dB or more  
UHF: 60dB or more

#### Output Meter Scale:

Indication range: 32dB (30 to 62dB)  
1dB scale between 27dB (35 to 62dB)  
AC50V, 50/60Hz F-type connector

#### Voltage Measurement:

#### Voltmeter Accuracy:

#### Sound Monitor:

± 5% of full scale  
Loudspeaker with on/off switch, slope detection

#### Power Supply:

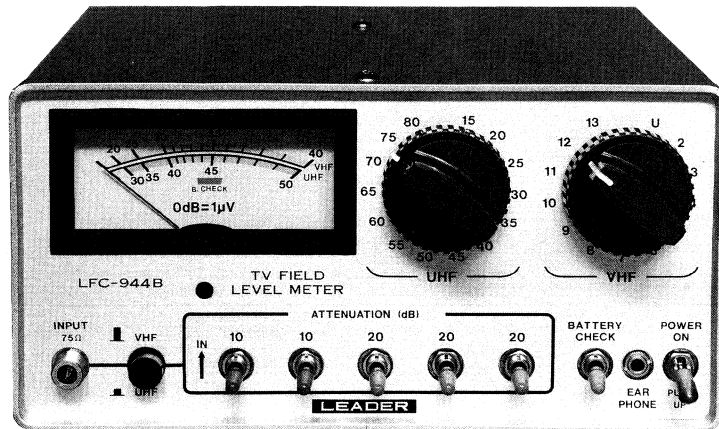
#### Size and Weight:

#### Accessories:

15VDC, UM-3 dry cell × 10  
250(W) × 148(H) × 235(D)mm, 4kg  
UM-3 dry cell ..... 10  
Shoulder band ..... 1  
Balun: 300Ω—75Ω (LBN-14) ..... 1  
Hexagonal wrench ..... 1  
Channl plate ..... 6

# LEVEL CHECKER

VHF/UHF TV Electric Field Level can be Measured Precisely



**LFC-944B(USA)**  
**LFC-944C(EUROPE)**  
**LFC-944D(CHINA)**  
**TV FIELD LEVEL METER**

## ● GENERAL

Good picture receiving is unavailable without a certain level of signal receiving though a television receiver works perfect. Therefore, the signal receiving condition such as an antenna height, direction, and its performance must be thoroughly examined. TV Field Level Checker is used for this purpose. It is usual that 65dB gain or more is necessary for good color receiving. VHF and UHF can be measured in the same operation with that of TV.

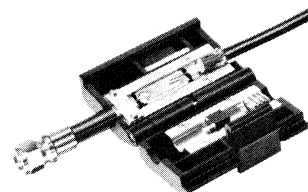
## ● FEATURES

- 75ΩF connector for common use as VHF and UHF input connector.
- The meter adopts a solid taut band system.
- Portable with battery operation system.
- Battery voltage can be supervised by the battery check function.

## ● SPECIFICATIONS

<b>TV Channels</b>	(at video frequency)
<b>USA (944B)</b>	VHF Channels: 2 to 13 UHF Channels: 14 to 83
<b>Europe (944C)</b>	VHF Channels: 2 to 12 UHF Channels: 21 to 69
<b>China (944D)</b>	VHF Channels: 1 to 12 UHF Channels: 13 to 57
<b>Input Signal Level</b>	VHF: 20 to 120dB (10µV to 1V) UHF: 30 to 100dB (30µV to 0.1V) VHF: ±3dB, UHF: ±4dB
<b>Level Accuracy:</b>	
<b>Level Indication</b>	
<b>Meter Scale:</b>	dB calibration, referred to input from 75Ω, at open circuit.
<b>Attenuator:</b>	80dB total in 20dB × 3 and 10dB × 2
<b>Amplifier Bandwidth:</b>	Approx. 500kHz at 3dB down
<b>Power Supply:</b>	13.5V, using 9 type UM2, (Type C, Burgess 1, NEDA 14, or equivalent)
<b>Size and Weight:</b>	200(W) × 100(H) × 200(D)mm, 2.6kg
<b>Accessories:</b>	Matching pad (Balun) LBN-14 (300Ω/75Ω) ..... 1 Earphone ..... 1 Carrying case ..... 1

### ■ LJ-09 (option)



Previously when F-type connector was connected to coaxial cable, no level could be measured. But with the LJ-09, they can be connected to each other simply by processing the tip of the coaxial cable. Besides, the UHF band is also tuned up well, gain can hardly be found.



# CURVE TRACER/CHECKER

## Characteristics Curves on Scope



**LTC-905**  
CURVE TRACER

### • GENERAL

Curve tracing on a scope is made easy with the LTC-905. Characteristics curves of all types of semiconductors can accurately be displayed. This is far superior to the conventional ohmmeter checks for quality. In-circuit testing is possible for quick checks. Two inputs are provided to enable comparison of two similar devices.

### • SPECIFICATIONS

#### Collector/Drain Sweep

**Frequency:** 120Hz, or 100Hz (2 × line frequency)  
**Voltage:** 8 steps: 10, 20, 30, 40, 50, 60, 80 and 100V, accuracy ± 10%  
**Sweep Waveform:** Full wave rectified waveform  
**Current:** 100mA, maximum  
**Current Limiter:** 1000Ω for low level devices, 100Ω for power devices

#### Step Generator

**No. of Steps:** 7  
**Current per Step:** 10, 20, 50μA, 0.1, 0.2, 0.5, 1.2mA, accuracy ± 5%

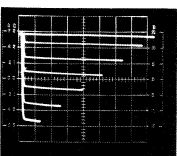
**Volt per Step:** 0.1, 0.2, 0.5V, accuracy ± 5%

**External Bias:** One curve display

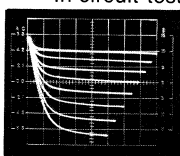
**Power Supply:** 100, 120, 200, 220, or 240VAC, 50/60Hz, 25VA, maximum, operating, and 6VA as stand by

**Size and Weight:** 240(W) × 90(H) × 170(D)mm, 2kg

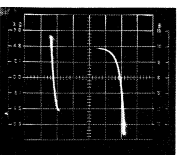
**Accessories:** 3-lead cable ..... 1  
 Scope leads, 2 red and 1 black ... 1 set  
 In-circuit test probe, LP-11 ..... 1



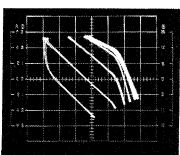
Transmitter curves



FET curves



Tunnel diode curves



In-circuit curves

## Automatically Checks and Identifies



**LTC-906A**  
TRANSISTOR CHECKER

### • GENERAL

The LTC-906A is a transistor tester which is capable of determining good/bad of transistor, FET, UJT, diode, etc. and also performing automatic determination of the base or gate leads in-circuit and out-of-circuit. This tester is also capable of DC parameter measuring transistor and diode out-of-circuit.

### • SPECIFICATIONS

#### Automatic Mode

**Item of Test:** GOOD/BAD, Polarity, Base of transistor, Gate of FET, Cathode/Anode of diode

**Measurement Mode:** Transistor and diode

**Test Voltage:** ± 2V, 10% duty cycle

**Test Current:** 4.5mA in LOW drive, 60mA max. in HIGH drive (short term)

**Scanning Rate:** 0.1 sec per test, complete scan in 1 second

**Display:** Light emitting diodes and sound by buzzer

#### DC Parameter Mode

**Measurement Mode:** Transistor and diode

**Polarity to be Measured:** PNP and NPN transistors and forward and backward diodes

**$V_{BE}$  and  $V_D$ :** 0 to 3VDC 1 range, Accuracy ± 6%

**$I_{CEO}$  and  $I_{LEAK}$ :** F.S., Measuring current: Max. 2mA  
 0 to 100, 0 to 1000 and 0 to 10000μA in 3 ranges, Accuracy ± 6% F.S.  
 Test voltage ± 5V max.

**$h_{FE}$ :** 0 to 100, 0 to 1000, 0 to 10000, 3 ranges, Base current 1μA, Collector current 30mA maximum

#### Power Supply

**Internal Battery:** Standard 9V transistor radio battery (EVEREADY 216, MALLORY MN1604)  
 8 to 10VDC, 25mA

**External:** 152(W) × 110(H) × 60(D)mm (excluding handle) 1.1kg

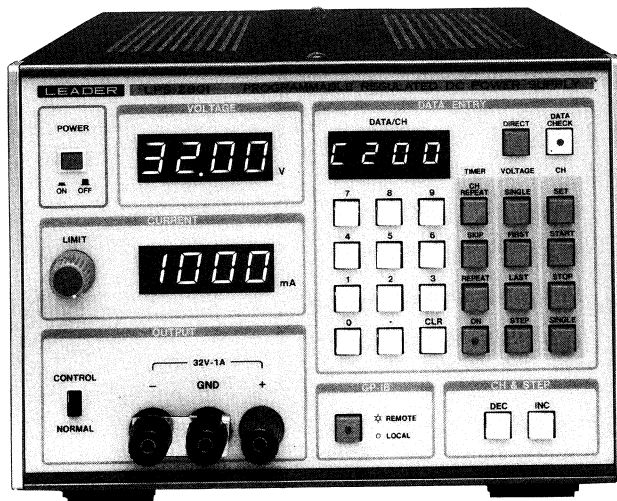
**Size and Weight:** 3-lead test cable ..... 1

**Accessory:** AC adaptor LPS-169A DC9V, 25mA... 1

**Options:** In-circuit probe LP-11Y ..... 1

# POWER SUPPLY

## Free Selection of Voltage and Time



### LPS-2801 PROGRAMMABLE REGULATED POWER SUPPLY



#### ● GENERAL

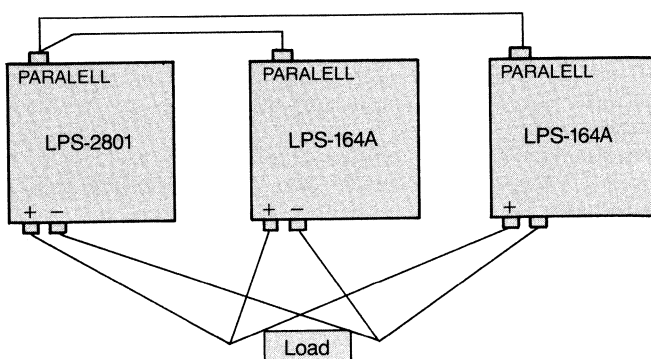
The LPS-2801 is a programmable regulated DC power supply that supports a GPIB interface with an output capacity of 32V, 1A as a standard feature.

The output voltage can be set at a resolution of 10mV over the entire voltage range, and the output current limiter value is continuously variable from 1 to 100%.

#### ● FEATURES

- Ability to store single voltage or monotonously increasing or decreasing voltage range setting for 1 to 200 channels.
- Ability to store voltage retention period and repetition counts.
- Battery back up for all stored data.
- Built-in output current limiter.
- Series/parallel operation.
- External power supply control to enable LPS-2801 use as a programmable power supply with a maximum current rating of 10A when used with the LPS-160A series power supply maximum rating in 10A with LPS-164A × 2 units.
- GPIB interface to enable LPS-2801 use with automatic instrumentation.
- Timer facility to enable LPS-2801 use as a high-output level, large-capacity, super low-frequency function generator.
- High-speed voltage variation.

#### ■ Control (Maximum current of 10A with LPS-164 × 2)

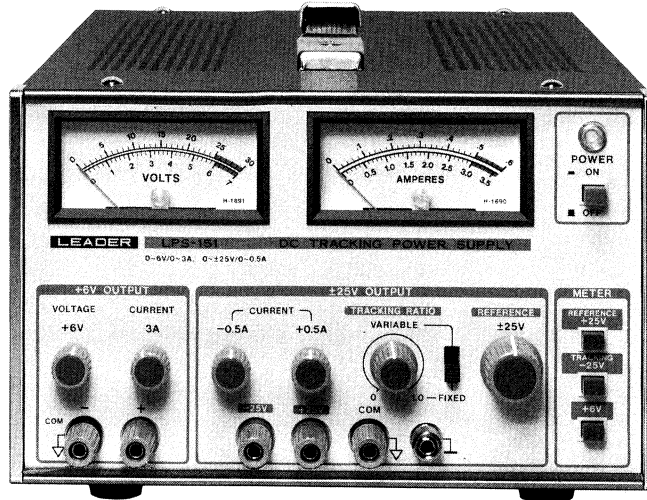


#### ● SPECIFICATIONS

<b>Output</b>	0 to 32V at resolution of 10mV
<b>Output Voltage:</b>	Positive or negative
<b>Output Polarity:</b>	0 to 1A, variable from 1% to 100%
<b>Output Current:</b>	± 0.03% of setting ± 5mV independent operation
<b>Output Accuracy:</b>	3mV or less for power line voltage change within ± 10%
<b>Output Stability:</b>	3mV or less for load variations from 0 to 100%
	3mV or less (constant voltage operation)
	2ms or less into open circuit
<b>Ripples and Noises:</b>	
<b>Rise and Fall Times:</b>	
<b>Ammeter</b>	
<b>Display:</b>	3-1/2-digit digital display
<b>Measuring Accuracy:</b>	± 1.5% of reading, ± 2 digits
<b>Timer Unit:</b>	
<b>Step Timer:</b>	0.01 to 99.99 seconds; minimum resolution of 0.01 second
	1 to 1000 or endless
<b>Repeat Cycles:</b>	
<b>Memory Section</b>	
<b>Voltages:</b>	Can store SINGLE voltage (single voltage) or FIRST/LAST/STEP (voltage ranges consisting of first, last, and step voltages) for up to 200 channels.
<b>Time:</b>	Can store SKIP TIME (voltage retention duration) for each channel. The DATA CHECK key enables programmed memory data to be checked without altering output.
<b>Insulation:</b>	Test voltage: 500VDC
	Chassis to output terminals: 10MΩ or more
	Chassis to mains plug: 50MΩ or more
<b>Circuit Protection:</b>	Overload protection circuit (constant-current automatic recovery type) with indicator
<b>Operation:</b>	Series or parallel operation
<b>Control Function:</b>	Controls up to two LPS-160A series power supplies.
<b>Remote Sensing:</b>	Available from rear-panel terminal.
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC, 50/60Hz, 100VA
<b>Size and Weight:</b>	213(W) × 161(H) × 375(D)mm, 7.3kg
<b>Accessories:</b>	Shorting bar ..... 1
	Spare fuse ..... 1

# POWER SUPPLY

## Capable of Simultaneously Supplying 3 kinds of Powers



### LPS-151 LPS-152 DC TRACKING POWER SUPPLY

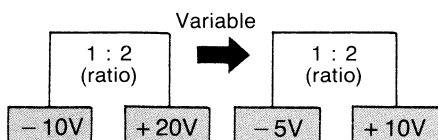
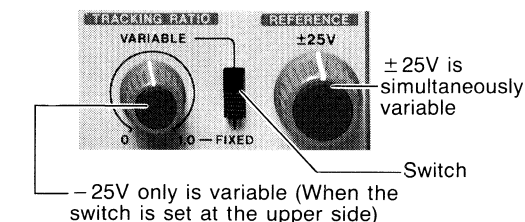
#### ● GENERAL

3 kinds of stabilized DC powers, 0 to +6V, 0 to +25V and 0 to -25V, can be taken out of the LPS-151/152. No large space is necessary as the body is in half-rack size.  $\pm 25V$  output can be used as tracking voltages, and + and - voltages can be changed simultaneously by a single knob. Further, when + power used as a reference, - power is set at the same potential or below, voltage can be changed at the same ratio and therefore, this power supply is convenient for testing and adjustment of a microcomputer or operational amplification circuit.

#### ● FEATURES

- The  $\pm 25V$  sources can be used in combination for voltage tracking. When set at different output levels, provide a means of voltage ratio tracking, using +25V source voltage as the reference voltage.
- Connection to the  $\pm 25V$  output terminals increases output from above 25 up to 50V.
- Controls are provided to set output voltage and current at the required level, which can be read on the ammeter and voltmeter selectable for indications by alternative switch selection.

#### ■ Tracking Setting of +25V, -25V is Possible.



#### ● SPECIFICATIONS

<b>Output Voltage/Range and Polarity:</b>	0 to 6V (positive), 0 to 25V (positive), 0 to 25V (negative)
<b>Output Current Range:</b>	0 to 3A, 0 to 0.5A, 0 to 0.5A (151) 0 to 5A, 0 to 1A, 0 to 1A (152)
<b>Ripple Voltage:</b>	Less than 3mVp-p
<b>Output Stability Line Regulation:</b>	At $\pm 10\%$ change in line voltage, less than 3mV plus 0.01%
<b>Load Regulation:</b>	From zero to full load, less than 3mV plus 0.01%
<b>Tracking Voltage:</b>	For tracking mode, the voltage ratio is less than 1.5%.
<b>Voltmeter Scale:</b>	0 to 7V and 0 to 30V scale, (both polarities) for indication of the switch selected range.
<b>Ammeter:</b>	0 to 0.6A and 0 to 3.5A (151), 0 to 1.2A and 0 to 6A (152), both polarities, for indication of the selected switching. Synchronized with a voltmeter indication choice by the selector switch.
<b>Accuracy:</b>	5% of the full scale.
<b>Insulation Voltage:</b>	1500VAC for one minute between the AC input and case.
<b>Circuit Protection:</b>	Overload protection circuit with automatic resetting by sensing a constant current.
<b>Heat Sink Temperature:</b>	85°C at full load, under room temperature 23°C to 25°C
<b>Preservation Temperature:</b>	-20 to +70°C
<b>Operating Humidity Range:</b>	30 to 85%
<b>Operating Temperature Range:</b>	0 to 35°C
<b>Power Supply:</b>	100, 120, 200, 220, 240VAC
<b>Power Consumption:</b>	150VA (151), 250VA (152)
<b>Size and Weight:</b>	215(W) $\times$ 132(H) $\times$ 332(D)mm, 6.1kg (151) 215(W) $\times$ 132(H) $\times$ 360(D)mm, 7.5kg (152)

# POWER SUPPLY

## 18V 1, 2, 3A



### LPS-160-1/160-2/160-3 REGULATED DC POWER SUPPLY

#### ● GENERAL

LPS-160-1/160-2/160-3, 18V series are regulated DC power supply unit with voltmeter and ammeter. They are provided with continuously variable coarse adjustment and fine adjustment of the output voltages, and with continuously variable current adjustment in a range of 10 to 100%.

#### ● FEATURES

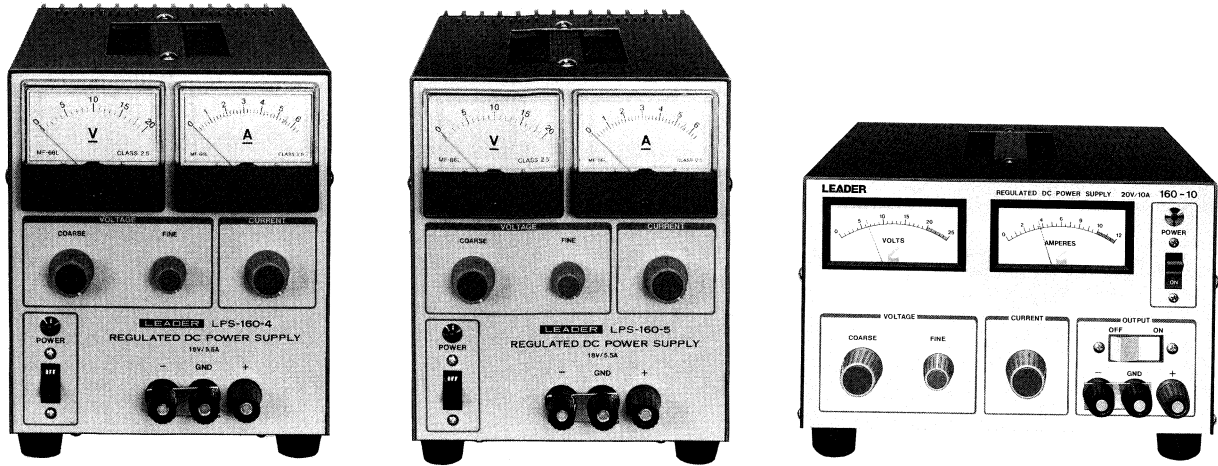
- Built-in output current limiter circuit.
- Availability of series and/or parallel operation.
- Independent voltmeter and ammeter.
- Conforms to EU safety standards.
- Built-in overload protection circuit.

#### ● SPECIFICATIONS

Model	LPS-160-1	LPS-160-2	LPS-160-3
Output Voltage	0 to 18 V Continuously variable		
Output Polarity	Positive and negative		
Output Current	0 to 1A	0 to 2A	0 to 3A
Ripple Voltage	Less than 3mVp-p		
Output Stability	Less than 5mV for power source voltage change of $\pm 10\%$ Less than 5mV for load variation of 0 to 100%		
Voltmeter	20V (F.S) Accuracy of 2.5% for full scale		
Ammeter	1.2A (F.S) Accuracy of 2.5% for full scale	2.5A (F.S) Accuracy of 2.5% for full scale	4A (F.S) Accuracy of 2.5% for full scale
Insulation	Between chassis and output terminal: More than 10M $\Omega$ at DC 500V Between chassis and AC plug: More than 50M $\Omega$ at DC 500V		
Over Load Protection	Overload protection circuit of constant current, automatic recovery		
Ambient Temperature Range	0 to +40°C		
Power Supply	100, 120, 200, 240VAC, 50/60Hz 42VA	100, 120, 200, 240VAC, 50/60Hz 90VA	100, 120, 200, 240VAC, 50/60Hz 170VA
Size and Weight	100(W) x 173(H) x 193(D) mm, 3.5kg	100(W) x 173(H) x 197(D)mm, 3.5kg	115(W) x 175(H) x 227(D)mm 7kg
Accessories	Shorting bar ..... 1, Spare fuse ..... 1		
Operation	Series and parallel		

# POWER SUPPLY

## 18V 4.5, 5.5, 10A



### LPS-160-4/160-5, Model 160-10 REGULATED DC POWER SUPPLY

#### ● GENERAL

LPS-160-4/160-5 and Model 160-10, 18V series are regulated DC power supply unit with voltmeter and ammeter. They are provided with continuously variable coarse adjustment and fine adjustment of the output voltages, and with continuously variable current adjustment in a range of 10 to 100%.

#### ● FEATURES

- Built-in output current limiter circuit.
- Availability of series and/or parallel operation.
- Independent voltmeter and ammeter.
- Conforms to EU safety standards.
- Built-in overload protection circuit.

#### ● SPECIFICATIONS

Model	LPS-160-4	LPS-160-5	Model 160-10
Output Voltage	0 to 18 V Continuously variable		
Output Polarity	Positive and negative		
Output Current	0 to 4.5A	0 to 5.5A	0 to 10A
Ripple Voltage	Less than 3mVp-p		
Output Stability	Less than 5mV for power source voltage change of $\pm 10\%$ Less than 5mv for load variation of 0 to 100%		
Voltmeter	20V (F.S) Accuracy of 2.5% for full scale		
Ammeter	5.4A (F.S) Accuracy of 2.5% for full scale	6.4A (F.S) Accuracy of 2.5% for full scale	12A (F.S) Accuracy of 2.5% for full scale
Insulation	Between chassis and output terminal: More than 10M $\Omega$ at DC 500V Between chassis and AC plug: More than 50M $\Omega$ at DC 500V		
Over Load Protection	Overload protection circuit of constant current, automatic recovery		
Ambient Temperature Range	0 to +40°C		
Power Supply	100, 120, 200, 240VAC, 50/60Hz, 230VA	100, 120, 200, 240VAC, 50/60Hz, 275VA	100, 120, 200, 240VAC, 50/60Hz, 450VA
Size and Weight	148(W) $\times$ 173(H) $\times$ 273(D) mm 7.5kg		215(W) $\times$ 132(H) $\times$ 400(D) $\times$ mm, 12kg
Accessories	Shorting bar ..... 1, Spare fuse ..... 1		
Operation	Series and parallel		

# POWER SUPPLY

## 32V 0.5, 1.2, 2.0A



### LPS-160A/161A/162A REGULATED DC POWER SUPPLY

#### ● GENERAL

LPS-160A/161A/162A, 32V series are regulated DC power supply units with voltmeter and ammeter. They are provided with continuously variable coarse adjustment and fine adjustment of the output voltages, and with continuously variable current adjustment in a range of 10 to 100%.

#### ● FEATURES

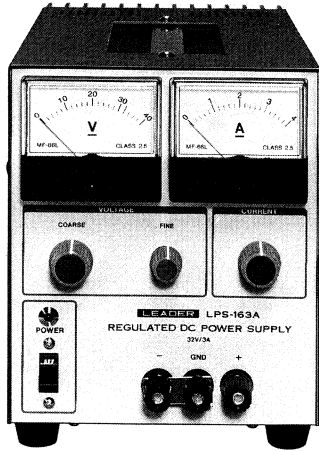
- Built-in output current limiter circuit.
- Availability of series and/or parallel operation.
- Independent voltmeter and ammeter.
- Conforms to EU safety standards.
- Built-in overload protection circuit.

#### ● SPECIFICATIONS

Model	LPS-160A	LPS-161A	LPS-162A
Output Voltage	0 to 32 V Continuously variable		
Output Polarity	Positive and negative		
Output Current	0 to 0.5A	0 to 1.2A	0 to 2A
Ripple Voltage	Less than 3mVp-p		
Output Stability	Less than 5mV for power source voltage change of $\pm 10\%$ Less than 5mV for load variation of 0 to 100%		
Voltmeter	40V (F.S) Accuracy of 2.5% for full scale		
Ammeter	0.6A (F.S) Accuracy of 2.5% for full scale	1.5A (F.S) Accuracy of 2.5% for full scale	2.5A (F.S) Accuracy of 2.5% for full scale
Insulation	Between chassis and output terminal: More than 10M $\Omega$ at DC 500V Between chassis and AC plug: More than 50M $\Omega$ at DC 500V		
Protection Circuit	Overload protection circuit of constant current, automatic recovery		
Ambient Temperature Range	0 to +40°C		
Power Supply	100, 120, 200, 240VAC, 50/60Hz, 52VA	100, 120, 200, 240VAC, 50/60Hz, 99VA	100, 120, 200, 240VAC, 50/60Hz, 150VA
Size and Weight	100(W) x 173(H) x 193(D) mm, 3.5kg	100(W) x 173(H) x 193(D)9 mm, 3.8kg	115(W) x 173(H) x 227(D)mm, 7kg
Accessories	Shorting bar ..... 1, Spare fuse ..... 1		
Operation	Series and parallel		

# POWER SUPPLY

## 32V 3, 5A



## LPS-163A/164A REGULATED DC POWER SUPPLY

### ● GENERAL

LPS-163A/164A, 32V series are regulated DC power supply units with voltmeter and ammeter. They are provided with continuously variable coarse adjustment and fine adjustment of the output voltages, and with continuously variable current adjustment in a range of 10 to 100%.

### ● FEATURES

- Built-in output current limiter circuit.
- Availability of series and/or parallel operation.
- Independent voltmeter and ammeter.
- Conforms to EU safety standards.
- Built-in overload protection circuit.

### ● SPECIFICATIONS

Model	LPS-163A	LPS-164A
Output Voltage	0 to 32V Continuously variable	
Output Polarity	Positive and negative	
Output Current	0 to 3A	0 to 5A
Ripple Voltage	Less than 3mVp-p	
Output Stability	Less than 5mV for power source voltage change of $\pm 10\%$ Less than 5mv for load variation of 0 to 100%	
Voltmeter	40V (F.S) Accuracy of 2.5% for full scale	
Ammeter	4A (F.S) Accuracy of 2.5% for full scale	6A (F.S) Accuracy of 2.5% for full scale
Insulation	Between chassis and output terminal: More than 10M $\Omega$ at DC 500V Between chassis and AC plug: More than 50M $\Omega$ at DC 500V	
Protection Circuit	Overload protection circuit of constant current, automatic recovery	
Ambient Temperature Range	0 to +40°C	
Power Supply	100, 120, 200, 240VAC, 50/60Hz 250VA	100, 120, 200, 240VAC, 50/60Hz 380VA
Size and Weight	148(W) $\times$ 173(H) $\times$ 273(D) mm, 8kg	215(W) $\times$ 132(H) $\times$ 326(D)mm, 9kg
Accessories	Shorting bar ..... 1, Spare fuse ..... 1	
Operation	Series and parallel	

# VOLTAGE TESTER

**Puncture: 5kV/500VA, Insulation: 500V/250MΩ**



## LPT-7100A PUNCTURE/INSULATION VOLTAGE TESTER

### ● GENERAL

This instrument is a breakdown voltage tester functioning as both an insulation resistance meter and a breakdown voltage test power supply. For the breakdown voltage test, voltages of 5kV and 5000VA are provided, and the requirements set by the electrical appliances control law are met. Also, it is designed to maintain the safety of the operator by setting a leak current and shutting off the timer overload. The insulation resistance is measurable at 500V.

### ● FEATURES

- One-touch switching from the breakdown voltage test to measuring of the insulation resistance.
- NG indication of the breakdown voltage test by lamp and buzzer.
- Quadruple safety measures for preventing the dangers of the breakdown voltage test including high voltage generation after operation on ground side.
- A high voltage insulation rubber gloves supplied for the breakdown voltage test.
- The insulation resistance meter and the breakdown voltage test power supply are switched from one to the other by remote control. Also, the breakdown voltage test power supply can be turned on and off by remote control.
- A zero cross switch is provided for preventing a surge at the time of turning on and off the power supply.

### ● SPECIFICATIONS

#### Breakdown Voltage Testing Section

**Test Voltage:** Switchable between 3 ranges 1.5kV, 2.5kV, or continuously variable. AC line 50/60Hz

#### Breakdown Voltage Capacity:

500VA

#### Voltmeter:

Effective value indicator, RMS scale  $\pm 3\%$  at full scale

#### Cut-Off Voltage

**Switching:** 5 ranges of 0.5, 1, 2, 5 and 10mA

#### Test Voltage Application Time:

Manual and auto.  
Auto timer operation time 0 to 60s.

#### Test Indication System:

TEST (green) and NG (red) are indicated by lamp. At the time of NG, an alarm buzzer is actuated simultaneously with the red lamp.

#### Insulation Resistance Meter Section

**Test Voltage:** 500V DC

**Insulation Resistance:** 250MΩ

**Measurement Range:** 0.1 to 250MΩ, medial at 5MΩ

**Accuracy:** 0.1 to 20MΩ, not more than  $\pm 3\%$  of indicated value

#### Remote Control:

- Insulation resistance meter and breakdown voltage test power supply switchable by remote control.
- TEST/RESET for the breakdown voltage test power supply switchable by remote control

#### Environmental

#### Conditions (for guaranteed accuracy): Power Supply:

Humidity 65% or less  
100, 120, 200, 240VAC, 50/60Hz, 100VA

#### Size and Weight:

400(W) × 255(H) × 350(D)mm, 23kg

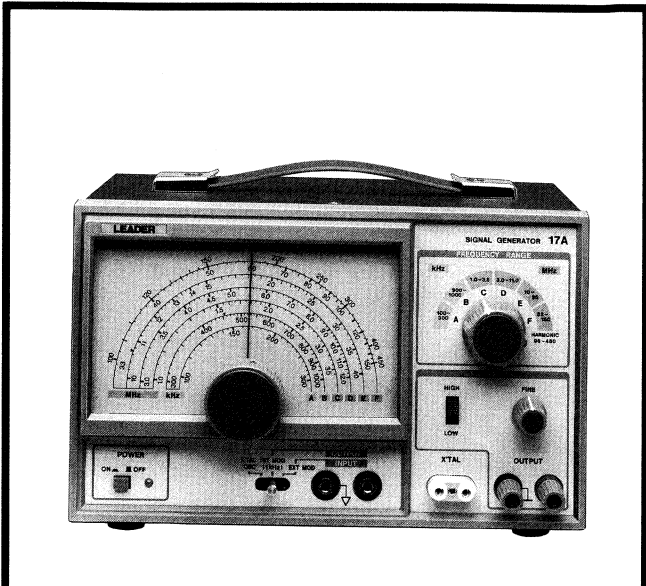
#### Accessories:

High voltage test rope ..... 1  
Ground remote probe ..... 1  
Earth cord ..... 1  
High voltage insulation rubber gloves ..... 1  
Spare fuse ..... 1



# SIGNAL/AUDIO GENERATOR

**100kHz to 150MHz (450MHz)**



**Model 17A  
SIGNAL GENERATOR**

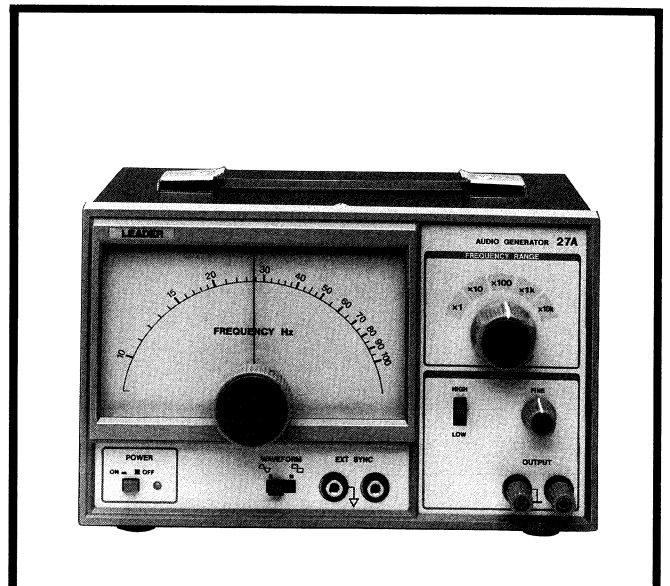
## • GENERAL

The Model 17A is a very versatile thick film integrated circuit (IC), wideband signal generator designed for the radio experimenter, hobbyist, service technician and instructional purposes. An IC is used in a stable oscillator circuit to cover the frequency range from 100kHz to 150MHz on fundamentals and up to 450MHz on harmonics. Among the many features are the large easy-to-read dial marked at 455kHz and 10.7MHz, one audio frequency for amplitude modulation or external use, provision for crystal oscillator operation. Serves as a marker generator when used with a sweep generator in checking and aligning RF and IF circuits in TV and FM receivers.

## • SPECIFICATIONS

<b>Frequency Range:</b>	100kHz to 150MHz (up to 450MHz on harmonics)
<b>Band:</b>	A 100 to 300kHz B 300 to 1000kHz C 1.00 to 3.5MHz D 3.0 to 12MHz E 10 to 50MHz F 33 to 150MHz (100 to 450MHz, calibrated harmonics)
<b>Frequency Accuracy:</b>	± 3%
<b>RF Output:</b>	100mVrms, up to 35MHz into open circuit
<b>Output Control:</b>	HIGH-LOW switch and fine adjuster.
<b>Modulation:</b>	Int.: approx. 1kHz 30% Ext.: 50Hz to 20kHz, at less than 15Vrms (30%) input
<b>Audio Output:</b>	1kHz; 1Vrms or more (fixed)
<b>Crystal Oscillator:</b>	For 1 to 15MHz crystal in Type FT-243 holder. (not included).
<b>Power Supply:</b>	100, 115 to 120, 220 to 240VAC, 50/60Hz; 3VA.
<b>Size and Weight:</b>	238(W) × 150(H) × 130(D)mm, 2.5kg

**10Hz to 1MHz, 5 ranges**



**Model 27A  
AUDIO GENERATOR**

## • GENERAL

The Model 27A is a handy generator of signals in the audio, super-sonic and radio frequency ranges. It generates two types of waveforms, sine for general testing and square for transient response testing.

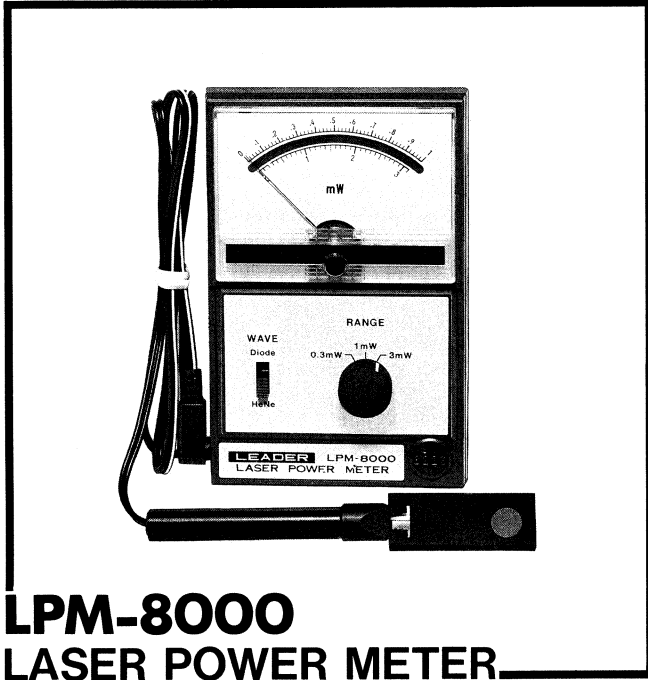
Using thick film integrated circuit (IC), synchronizing with an external frequency source, 600Ω output impedance and compact construction are featured in this instrument.

## • SPECIFICATIONS

<b>Frequency Range:</b>	10kHz to 1MHz in five decade bands.
<b>Accuracy:</b>	± (5% + 2Hz) (10Hz to 1MHz) ± (3% + 2Hz) (100Hz to 100kHz)
<b>Output Impedance:</b>	600Ω, unbalanced.
<b>Output Control:</b>	HIGH, LOW (1/10), and fine adjuster.
<b>Sine Wave Output:</b>	Range: 10Hz to 1MHz. Output voltage: 5Vrms or more into open circuit Output Distortion: Less than 0.5%, 200Hz to 100kHz. Less than 1%, 100Hz to 500kHz. Less than 2%, 10Hz to 1MHz Output flatness: Less than ± 1.5dB, ref: 1kHz.
<b>Square Wave Output:</b>	Range: 10Hz to 100kHz Output voltage: 5Vp-p or more into open circuit Rise time: Less than 200ns Sag: 5%
<b>Output Impedance:</b>	600Ω
<b>Output Flatness:</b>	Within ± 1.5dB
<b>Output Attenuator:</b>	HIGH, LOW (40dB), and continuous adjuster
<b>Synchronization:</b>	Range: ± 1% of oscillator frequency per Vrms. Input impedance: 10kΩ Maximum input: 10Vrms.
<b>Power Supply:</b>	100, 115 to 120, 220 to 240VAC, 50/60Hz, 3VA
<b>Size and Weight:</b>	238(W) × 150(H) × 130(D) mm; 2.5kg.

# METER/CHECKER

0.3mW, 1mW, 3mW



**LPM-8000**  
LASER POWER METER

## ●GENERAL

The LPM-8000 is a simplified laser power meter. Receiving laser beams with its sensor, the instrument indicates measured values on the meter. Measuring range for wavelength can be selected between two ranges, 632.8nm (633nm) and 750nm to 820nm, and the measuring range for power voltage can be selected in a range from 0.3mW to 3mW.

The measuring level of 633nm is available for the measurement of helium-neon ray apparatus; while, the measuring range of 750nm to 820nm, for the measurement done for CD players.

## ●SPECIFICATIONS

<b>Measuring Range for Wavelength:</b>	632.8nm (633nm) and 750nm to 820nm, 2 ranges
<b>Measuring Range for Power:</b>	0.3 to 3mW
<b>Power Range:</b>	Converted among 0.3mW, 1mW, and 3mW
<b>Measuring Accuracy:</b>	±5% or less of full scale
<b>Sensor Section:</b>	Light-catcher area: 10mm $\phi$ (Allowable dissipation of silicon photodiode: tolerable loss of 200mW)
<b>Meter:</b>	Moving coil-type
<b>Main Body Size:</b>	90(W) $\times$ 31(H) $\times$ 140(D)mm
<b>Sensor Section Size:</b>	18(W) $\times$ 4(H) $\times$ 40(D)mm, movable with an 80cm cable

1MHz, 3 Ranges



**LHC-909B/V**  
VTR HEAD CHECKER

## ●GENERAL

This is a video head checker used for determining whether a video head is a good condition by detecting the wear state of the video head and indicating it on a meter. As the type of video head differs depending upon model of video tape recorder or system employed, make a judgment on measured value according to the judging table. The specifications of this video head checker are outlined below. The LHC-909B is a checker for the Beta system VTR, while the LHC-909V is a checker for the VHS system VTR. Select the model applicable to the VTR system you are checking.

## ●SPECIFICATIONS

<b>Measuring Frequency:</b>	Approx. 1MHz
<b>Measuring System:</b>	Simplified bridge measuring circuit
<b>Working Voltage:</b>	DC9V (use a 6F 22 or S-006P battery)
<b>Working Time:</b>	Continuous 8Hrs
<b>Size:</b>	90(W) $\times$ 31(H) $\times$ 140(D)mm

### LHC-909B (Beta)

	Measuring Range	Nominal Inductance of 0 Point
Range A	Approx. 0.8 to 3.4 $\mu$ H	1.5 $\mu$ H
Range B	Approx. 0.6 to 2.8 $\mu$ H	1.2 $\mu$ H
Range C	Approx. 0.42 to 2.1 $\mu$ H	0.95 $\mu$ H

### LHC-909V (VHS)

	Measuring Range	Nominal Inductance of 0 Point
Range A	Approx. 0.4 to 2.8 $\mu$ H	0.9 $\mu$ H
Range B	Approx. 0.8 to 2.7 $\mu$ H	1.3 $\mu$ H
Range C	Approx. 0.5 to 1.3 $\mu$ H	0.8 $\mu$ H

# PROBE/ATTENUATOR

0 to 40kV



**LHM-80B**  
HIGH VOLTAGE METER PROBE

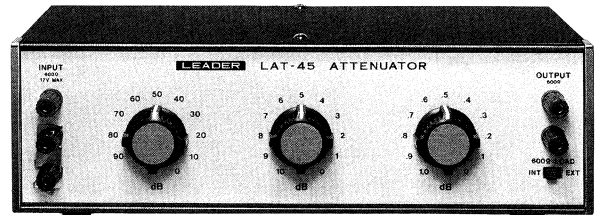
## ● GENERAL

Light weight, easy-to-grip high-impact plastic handle with arc-over protection and no need of extra equipment. An indispensable item in your TV service kit. Measures up to 40kV DC with safety and greatest of ease. Entirely self-contained. Connect the lead clip to chassis and probe tip to the check point — read the meter for voltage.

## ● SPECIFICATIONS

<b>Maximum Measuring:</b>	40kV DC
<b>Voltage:</b>	Minimum scale: 2kV 25kV DC (continuous) 40kV DC (20 seconds)
<b>Accuracy:</b>	± 3% of full scale
<b>Input Impedance:</b>	Approx. 800MΩ
<b>Ambient Requirement</b>	
<b>Operating:</b>	Temperature: 10°C to 35°C Humidity: 70% or less
<b>Storage:</b>	Temperature: -10°C to 45°C Humidity: 85% or less

0 to 101dB in 0.1dB Step



**LAT-45**  
ATTENUATOR

## ● GENERAL

The LAT-45 is designed for use in laboratories, plants and service shops where accurate results are required in measurements of audio equipment. They are useful in determination of power levels and gain-loss characteristics in amplifiers and filters, and for control of voltage or power.

## ● SPECIFICATIONS

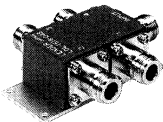
<b>Attenuation Range:</b>	0 to 101dB in 0.1dB steps
<b>Accuracy:</b>	Within ± 2% at 1kHz
<b>Input/Output</b>	
<b>Impedance:</b>	600Ω; Unbalanced
<b>Frequency Response:</b>	± 0.2dB: DC to 100kHz (70dB) ± 0.2dB: DC to 50kHz (101dB)
<b>Internal Termination:</b>	Open, or 600Ω, switched
<b>Maximum Input:</b>	0.5W (17Vrms or DC, or + 27dBm)
<b>Size and Weight:</b>	300(W) × 100(H) × 150(D)mm, 2kg

# ACCESSORIES

## For Centralization

### 75Ω LOW LOSS DISTRIBUTOR (VHF/UHF)

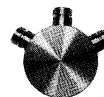
LDL-1518-02S (2 distribution)  
LDL-1518-04S (4 distribution)  
40 to 890MHz NC-J Connector



Model	No. of Dist.	Dist. Loss	Frequency Range	Specifications common to each model
LDL-1517-02	2	3.5dB	0.1 to 30MHz	Input impedance...75Ω V.S.W.R....less than 1.2 Power...1/8W Connector...N-J
LDL-1517-04	4	7dB	0.1 to 30MHz	
LDL-1517-08	8	10.5dB	0.1 to 30MHz	
LDL-1518-02	2	3.5dB	10 to 250MHz	
LDL-1518-04	4	7dB	10 to 250MHz	
LDL-1518-08	8	10.5dB	10 to 250MHz	

### DISTRIBUTORS

LDR-1512-02



#### 75Ω Resistor Type Distributors

Model	No. of Dist.	Dist. Loss	Specifications common to each model
LDR-1512-02	2	6dB	Input/Output Impedance...75Ω Frequency Range...DC to 150MHz V.S.W.R....less than 1.2 Power ... 1/2W Connector ... N-J
LDR-1512-03	3	9.5dB	
LDR-1512-04	4	12dB	
LDR-1512-06	6	15.5dB	
LDR-1512-08	8	18dB	
LDR-1512-10	10	20dB	
LDR-1512-12	12	21.6dB	

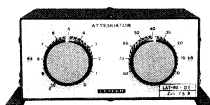
50Ω Resistor type distributors are available as LDR-1515-00

### VARIABLE ATTENUATORS

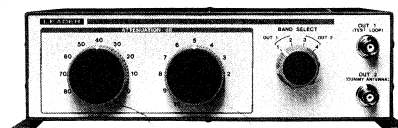
LAT-48



LAT-50-01 (75Ω)  
LAT-50-05 (50Ω)  
LAT-50-06 (75Ω)



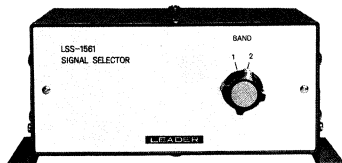
LAS-1575-42



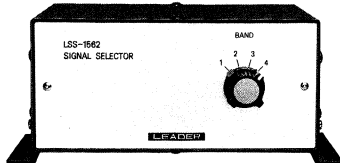
Model	Impedance	Attenuation	Frequency range	V.S.W.R.	Power	Connectors
LAT-48	75Ω	1, 2, 3, 6, 10, 10, 20, 20, 20dB	DC to 150MHz	less than 1.3	0.1W	M.J (UHF-J)
LAT-50-01	75Ω	1dB x 10 10dB x 8	DC to 300MHz	less than 1.3	1/8W	BNC · J
LAS-1575-42	75Ω	1dB x 10 10dB x 8	DC to 150MHz	less than 1.5	1/8W	4 inputs...N · J Marker in/out...BNC · J 2 outputs...BNC · J
LAS-1575-63	75Ω	1dB x 10 10dB x 8	DC to 150MHz	less than 1.5	1/8W	6 inputs...N · J Marker in/out...BNC · J 3 outputs...BNC · J

### SIGNAL SELECTORS

LSS-1561



LSS-1562

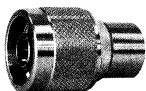


Those are used for manually switching a multiple of sweep/marker signals at the adjustment bench when their selections are required.

Model	Number of Band	Impedance	R.F. Freq. Range	RF Flatness	RF Isolation	Marker Freq. Range	Connectors
LSS-1561	2	75Ω	DC to 120MHz	±1dB	20dB at 120MHz	DC to 500kHz (-3dB)	RF 2 inputs...N · J Marker in/out...BNC · J RF output...N · J
LSS-1562	4	75Ω	DC to 120MHz	±1dB	20dB at 120MHz	DC to 500kHz (-3dB)	RF 4 inputs...N · J Marker in/out...BNC · J RF output...N · J

### TERMINATION RESISTORS

#### Termination Resistors



#### Through Type Termination Resistors



#### Termination Resistor

Model	Impedance	Frequency Range	Connector	Spec. common to each model
LD-1545-75	75Ω	DC to 300MHz	BNC-P	V.S.W.R....less than 1.05 Power...1/4W
LD-1546-75	75Ω	DC to 300MHz	N-P	
LD-1545-50	50Ω	DC to 1GHz	BNC-P	
LD-1546-50	50Ω	DC to 1GHz	N-P	

#### Through Type Termination Resistor

Model	Impedance	Frequency Range	V.S.W.R.	Power	Connector
LT-1551	75Ω	DC to 300MHz	less than 1.3	1/2W	BNC
LT-2049	50Ω				

### TEST LOOPS

LPA-070 : 50Ω

LPA-071 : 75Ω



Model	LPA-070	LPA-071
Freq. Range	0.1 to 30MHz	0.1 to 30MHz
Impedance	50Ω	75Ω
Connector	BNC—J	BNC—J
Accessory Cable	BNC · P—BNC · P 1m	BNC · P—BNC · P 1m

### UHF BALUN

LBN-1555-50



50Ω: 300Ω  
400 to 900MHz  
VSWR less than 1.2

### CONNECTORS

LC-1581  
BNC-JPJ

LC-1582  
BNC-JJJ

LC-1583  
MP-BNCJ

LC-1854  
M-A(JJ)

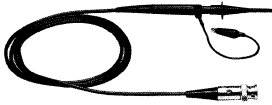


## For Oscilloscopes

### ■ PROBE, TERMINAL ADAPTOR

#### Low Capacitance Probe

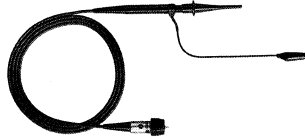
##### LP-100X



Frequency Range: DC to 100MHz (1/10)  
DC to 5Hz (1/1)  
Input Capacitance: 12pF (1/10), 150pF (1/1)  
Input Resistance: 10MΩ (1/10), 1MΩ (1/1)  
Attenuation: 1/10, 1/1  
Maximum Input: DC 600V  
For LBO-518/516

#### Low Capacitance Probe

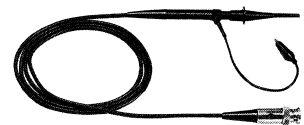
##### LP-101X



Frequency Range: DC to 100MHz (1/10)  
DC to 5MHz (1/1)  
Input Capacitance: 10MΩ  
Input Resistance: 10MΩ  
Attenuation: 1/10, 1/1  
Maximum Input: DC 600V  
For Model 2100R

#### Low Capacitance Probe

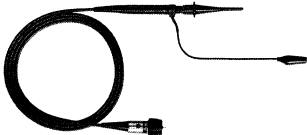
##### LP-060X



Frequency Range: DC to 60MHz (1/10)  
DC to 5MHz (1/1)  
Input Capacitance: 20pF (1/10), 200pF (1/1)  
Input Resistance: 10MΩ (1/10), 1MΩ (1/1)  
Attenuation: 1/10, 1/1  
Maximum Input: DC 600V  
For LBO-325/315, Model 1060

#### Low Capacitance Probe

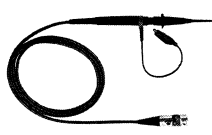
##### LP-061X



Frequency Range: DC to 60MHz (1/10)  
Input Capacitance: 21pF  
Input Resistance: 10MΩ  
Attenuation: 1/10  
Maximum Input: DC 600V  
For LBO-2060, Model 3040D/3060D

#### Low Capacitance Probe

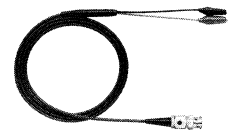
##### LP-16BX (BNC), LP-16BY (M)



Frequency Range: DC to 40MHz (1/10)  
DC to 5MHz (1/1)  
Input Capacitance: 25pF (1/10), 200pF (1/1)  
Input Resistance: 10MΩ (1/10), 1MΩ (1/1)  
Attenuation: 1/10, 1/1  
Maximum Input: DC 600V  
For LBO-324/323/314/313, Model 200, LCD-100

#### Low Capacitance Probe

##### LP-013



Frequency Range: DC to 500kHz  
Input Capacitance: 20pF  
Input Resistance: 10MΩ  
Attenuation: 1/10  
Maximum Input: DC 500V  
For Model 100P/200

#### For Jig

##### LP-010



Frequency Range: DC to 30MHz  
Attenuation: 1/10  
Input Resistance: 10MΩ  
Maximum Input: DC 500V  
For LBO-5880

#### Low Capacitance/Detection Probe

##### LP-7X (BNC), LP-7Y (M)



Frequency Range: DC to 15MHz (1/10)  
Maximum Input: AC 5Vrms/DC 400V  
Detection Section: 150kHz to 100MHz

#### High-Impedance Probe

##### LP-17AX (BNC), LP-17AY (M)



Frequency Range: DC to 40MHz (1/10)  
DC to 20MHz (1/100)  
Input Resistance: 10MΩ (1/10), 100MΩ (1/100)  
Maximum Input: DC 600V (1/10),  
DC 1500V (1/100)

\*Suited for measurement of high-impedance circuit  
(Built-in FET and C-MOS circuit)

#### High-Impedance Probe

##### LP-012X



Frequency Range: DC to 20MHz  
Input Resistance: 100MΩ  
Attenuation: 1/100  
Maximum Input: DC 2000V  
\*Suited for measurement of high voltage circuit  
such as TV horizontal output pulse.

### ■ For LBO-5880

#### PPI 8255 I/O Card

##### LC-2330



\*For NEC PC-8011 MK II, 8801  
\*With transfer cable LC-2066

#### Terminal Adaptor

##### LC-1585 (BNC)



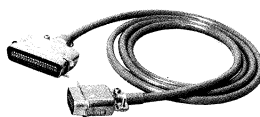
#### Terminal Adaptor

##### LC-1586 (M)



#### Printer Cable

##### LC-2065



\*1.5m bass cable

#### Transfer Cable

##### LC-2066



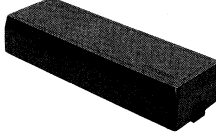



\*2m bass cable

# ACCESSORIES

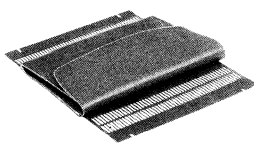
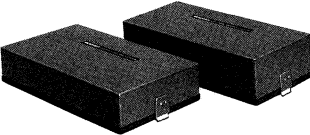
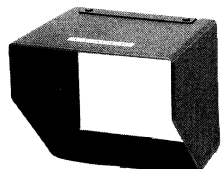
## For Oscilloscopes and Video Test Instruments

### ■ For Miniature Oscilloscope (LBO-315/314/313/325/324/323)



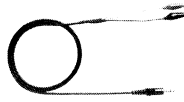

Attaché Case	Carrying Case	Front-Panel Cover	Hood
LC-2223 	LC-2221 (for LBO-325, 324, 323) LC-2226 (for LBO-315, 314, 313) 	LC-2131 	LH-2008 

\*Attaché case and hood are furnished for LBO-325 and 315, and they are sold separately for LBO-324, 314, 323 and 313. Front panel cover (LC-2131) is provided for carrying case (LC-2221, 2226).

### ■ For 6-inch CRT Oscilloscope

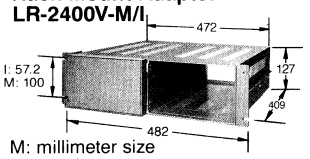
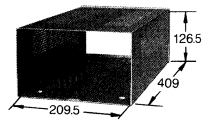
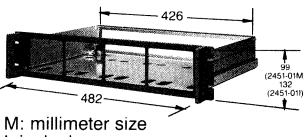
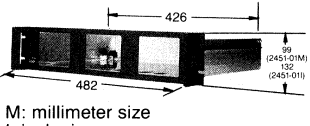
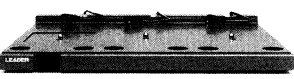
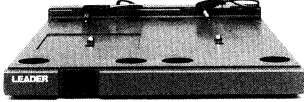


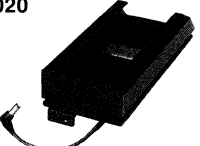
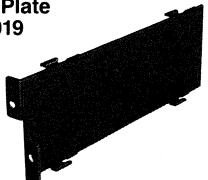

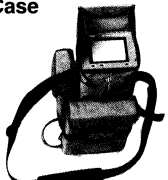
Description	Accessory Pouch				Front Panel Cover				Hood
									
Model	LP-2013	LP-2017	LP-2075	LP-2080	LC-2014	LC-2016	LC-2074	LC-2079	LH-2015
Model 1021				○				○	○
Model 1041				○				○	○
Model 1060			○				○		○
LBO-516		○				○			○
LBO-518		○				○			○
LBO-2060	○				○				○
Model 2100R			○				○		○
Model 3040D			○				○		○
Model 3060D			○				○		○

### ■ For LCD-100, Model 100P, Model 200

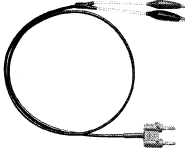

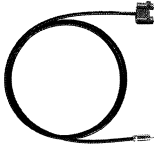

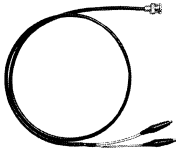
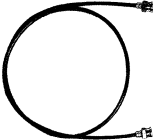
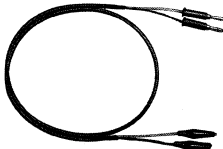
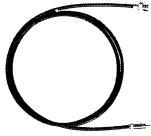


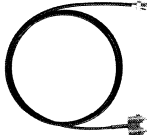


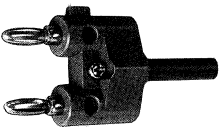



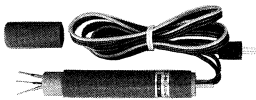

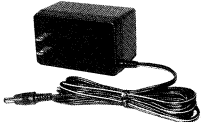
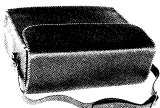

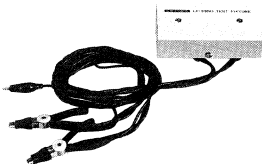
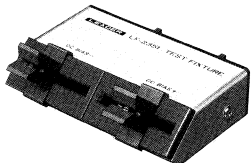
Attaché Case	Carrying Case	External Trigger Cable	Printer Cable
LC-2223-20 (for Model 100P, 200) 	LC-2227 (for LCD-100, Model 100P) LC-2232 (for Model 200) 	LC-2073 	LC-2082 (for Model 710) 

\*Carrying case and external trigger cable are furnished for Model 200, sold separately for LCD-100 and Model 100P as options.

### ■ For Video Test Instrument

<b>Rack-Mount Adaptor</b> LR-2400V-M/I  M: millimeter size I: inch size For Model 5871/5851V/5861V, etc.	<b>Rack-Mount Cabinet</b> LR-2404  For Model 5871/5851V/5861V, etc.	<b>Rack-Mount Adaptor</b> LR-2451-01M/I  M: millimeter size I: inch size For Model 5857/5867/413, etc.	<b>Rack-Mount Adaptor</b> LR-2451-13M/I  M: millimeter size I: inch size For Model 5857/5867/413, etc.
<b>Combination Rack</b> LR-2452-03  For Model 5857/5867, etc.	<b>Combination Rack</b> LR-2452-02  For Model 58857/5867, etc.	<b>Illumination-Lamp</b> LI-2306      LI-2305  For Model 5871/5870/ 5872V series      For LBO-5865/5866 Five lamps replacing      Three lamps replacing with a lamp unit      with an illumination unit	<b>Battery Pack</b> LP-2071 12V-1.7Ah  For Model 5857/5867/413, etc.
<b>Battery Attachment</b> LA-2020  For Model 5857/5867/413, etc.	<b>Joint Plate</b> LA-2019  For Model 5857/5867/413, etc.	<b>Carrying Case</b> LC-2225  For LVM-5863A	<b>Carrying Case</b> LC-2224  For LBO-5864

## Optional Accessories

<b>PAIR-PLUG-CLIP</b> LC-2021 	<b>PAIR-PLUG-PAIR-PLUG</b> LC-2022 	<b>PAIR-PLUG-PIN-PLUG</b> LC-2023 	<b>PAIR-PLUG-UHF</b> LC-2025 
<b>BNC-CLIP</b> LC-2026 (75Ω) LC-2048 (50Ω) 	<b>BNC-BNC</b> LC-2027 (75Ω) LC-2024 (50Ω) 	<b>BANANA-CLIP</b> LC-2028 	<b>BNC-PIN-PLUG</b> LC-2029 
<b>PIN-PLUG-PIN-PLUG</b> LC-2030 	<b>PIN-PLUG-CLIP</b> LC-2031 	<b>BNC-PAIR-PLUG</b> LC-2043 	<b>GPIB CONNECTION CABLE</b> LC-2067 (1m) LC-2068 (2m) 
<b>FEED THROUGH TERMINATIONS</b> LT-2049 (50Ω) LT-1551 (75Ω) 	<b>PAIR-PLUG</b> LJ-10 	<b>COAXIAL CLIP</b> LJ-09  For LFC-944, 945 Impedance: 75Ω Insertion Loss VHF: Less than 0.5dB UHF: Less than 1.0dB	<b>BALUN</b> LBN-14  For LFC-944, 945 300Ω—75Ω Matching Pad. Insertion Loss VHF: 1dB UHF: 2dB
<b>AC CLAMP PROBE</b> LC-19  For LDM-853A Measurement Current Range: AC 0.1 to 200A Accuracy: ± 3% Measurement Freq.: 50/60Hz	<b>IN-CIRCUIT PROBE</b> LP-11Y  For LTC-906A Three-Point Probe permits convenient, one-handed connection to transistors installed on printed circuited boards.	<b>DC HIGH VOLTAGE PROBE</b> LP-6A  For LDM-853A/852A Input Resistance: 1000MΩ ± 10% Range Multiplication: X1000 ± 10% Voltage Measurement: Max. 30kV ± 10%	<b>AC ADAPTORS</b> LPS-1908, 169, 166  LPS-1908: DC8V for LCD-100, Model 100P, 200, LPS-169: DC9V for LTD-906A LPS-166: DC6V for LDC-831
<b>CARRYING CASE</b> LC-2200, 2211, 2214, 2227, 2232  LC-2200 for LFC-944 LC-2211 for LDM-853A, LDC-831 LC-2214 for LTC-906A LC-2227 for LCD-100, Model 100P LC-2232 for Model 200	<b>Dummy Antenna</b> LDA-1554-50 	<b>Test Fixture (kelvin's clip type)</b> LF-2350 	<b>Test Fixture (Inserting type)</b> LF-2351 





## VHF Broadcasting Channel

### TV Frequency Table

fv : Video Carrier Frequency fs : Sound Carrier Frequency

#### Japan ch.

CH. No.	fv MHz	fs MHz
IF	58.75	54.25
1	91.25	95.75
2	97.25	101.75
3	103.25	107.75
4	171.25	175.75
5	177.25	181.75
6	183.25	187.75
7	189.25	193.75
8	193.25	197.75
9	199.25	203.75
10	205.25	209.75
11	211.25	215.75
12	217.25	221.75

fs—fv = 4.5MHz

#### U.S.A ch.

CH. No.	fv MHz	fs MHz
IF	45.75	41.25
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

fs—fv = 4.5MHz

#### C.C.I.R. ch.

CH. No.	fv MHz	fs MHz
IF	38.90	33.40
1	41.25	46.75
2	48.25	53.75
3	55.25	60.75
4	62.25	67.75
5	175.25	180.75
6	182.25	187.75
7	189.25	194.75
8	196.25	201.75
9	203.25	208.75
10	210.25	215.75
11	217.25	222.75
12	224.25	229.75

fs—fv = 5.5MHz

#### Italy ch.

CH. No.	fv MHz	fs MHz
IF	38.90	33.40
A	53.75	59.25
B	62.25	67.75
C	82.25	87.75
D	175.25	180.75
E	183.75	189.25
F	192.25	197.75
G	201.25	206.75
H	210.25	215.75
H1	217.25	222.75
H2	224.25	229.75

fs—fv = 5.5MHz

#### Australia ch.

CH. No.	fv MHz	fs MHz
IF	36.875	31.375
0	46.25	51.75
1	57.25	62.75
2	64.25	69.75
3	86.25	91.75
4	95.25	100.75
5	102.25	107.75
5A	138.25	143.75
6	175.25	180.75
7	182.25	187.75
8	189.25	194.75
9	196.25	201.75
10	209.25	214.75
11	216.25	221.75

fs—fv = 5.5MHz

#### Angola ch.

CH. No.	fv MHz	fs MHz
IF	39.5	33.5
1	43.25	49.25
2	52.25	58.25
3	60.25	66.25
4	175.25	181.25
5	183.25	189.25
6	191.25	197.25
7	199.25	205.25
8	207.25	213.25
9	215.25	221.25
10	223.25	229.25

fs—fv = 6MHz

#### New France ch.

CH. No.	fv MHz	fs MHz
IF	32.7	39.2
A	47.75	41.25
B	55.75	49.25
C1	60.50	54.00
C	63.75	57.25
1	176.00	182.50
2	184.00	190.50
3	192.00	198.50
4	200.00	206.50
5	208.00	214.50
6	216.00	222.50

fs—fv = ± 6.5MHz

#### OIRT ch.

CH. No.	fv MHz	fs MHz
IF	38.0	31.5
1	49.75	56.25
2	59.25	65.75
3	77.25	83.75
4	85.25	91.75
5	93.25	99.75
6	175.25	181.75
7	183.25	189.75
8	191.25	197.75
9	199.25	205.75
10	207.25	213.75
11	215.25	221.75
12	223.25	229.75

fs—fv = 6.5MHz

#### China ch.

CH. No.	fv MHz	fs MHz
IF	38.0	31.5
1	49.75	56.25
2	57.75	64.25
3	65.75	72.25
4	77.25	83.75
5	85.25	91.75
6	168.25	174.75
7	176.25	182.75
8	184.25	190.75
9	192.25	198.75
10	200.25	206.75
11	208.25	214.75
12	216.25	222.75

fs—fv = 6.5MHz

#### U.K. ch.

CH. No.	fv MHz	fs MHz
IF	39.5	43.0
1	45.00	41.50
2	51.75	48.25
3	56.75	53.25
4	61.75	58.25
5	66.75	63.25
6	179.75	176.25
7	184.75	181.25
8	189.75	186.25
9	194.75	191.25
10	199.75	196.25
11	204.75	201.25
12	209.75	206.25
13	214.75	211.25

fs—fv = 3.5MHz

#### New Zealand ch.

CH. No.	fv MHz	fs MHz
IF	38.90	33.40
1	45.25	50.75
2	55.25	60.75
3	62.25	67.75
4	175.25	180.75
5	182.25	187.75
6	189.25	194.75
7	196.25	201.75
8	203.25	208.75
9	210.25	215.75

fs—fv = 5.5MHz

#### Morocco ch.

CH. No.	fv MHz	fs MHz
IF	38.9	33.4
4	163.25	168.75
5	171.25	176.75
6	179.25	184.75
7	187.25	192.75
8	195.25	200.75
9	203.25	208.75
10	211.25	216.75

fs—fv = 5.5MHz

#### Ireland ch.

CH. No.	fv MHz	fs MHz
IF	39.5	33.5
A	45.75	51.75
B	53.75	59.75
C	61.75	67.75
D	175.25	181.25
E	183.25	189.25
F	191.25	197.25
G	199.25	205.25
H	207.25	213.25
J	215.25	221.25

fs—fv = 6MHz

#### French Overseas Territories ch.

CH. No.	fv MHz	fs MHz
IF	40.2	33.7
4	175.25	181.75
5	183.25	189.75
6	191.25	197.75
7	199.25	205.75
8	207.25	213.75
9	215.25	221.75

fs—fv = ± 6.5MHz

#### South Africa ch.

CH. No.	fv MHz	fs MHz
IF	38.9	32.9
4	175.25	181.25
5	183.25	189.25
6	191.25	197.25
7	199.25	205.25
8	207.25	213.25
9	215.25	221.25
10	223.25	229.25
11	231.25	237.25
12	—	—
13	247.43	253.43

fs—fv = 6MHz

## UHF Broadcasting Channel

### TV Frequency Table

#### Japan/U.S.A. ch.

CH. No.	USA CH. No.	fv MHz	fs MHz
13	14	471.25	475.75
14	15	477.25	781.75
15	16	483.25	487.75
16	17	489.25	493.75
17	18	495.25	499.75
18	19	501.25	505.75
19	20	507.25	511.75
20	21	513.25	517.75
21	22	519.25	523.75
22	23	525.25	529.75
23	24	531.25	535.75
24	25	537.25	541.75
25	26	543.25	547.75
26	27	549.25	553.75
27	28	555.25	559.75
28	29	561.25	565.75
29	30	567.25	571.75
30	31	573.25	577.75
31	32	579.25	583.75
32	33	585.25	589.75
33	34	591.25	595.75
34	35	597.25	601.75
35	36	603.25	607.75
36	37	609.25	613.75
37	38	615.25	619.75
38	39	621.25	625.75
39	40	627.25	631.75
40	41	633.25	637.75
41	42	639.25	643.75
42	43	645.25	649.75
43	44	651.25	655.75
44	45	657.25	661.75
45	46	663.25	667.75
46	47	669.25	673.75
47	48	675.25	679.75
48	49	681.25	685.75
49	50	687.25	691.75
50	51	693.25	697.75
51	52	699.25	703.75
52	53	705.25	709.75
53	54	711.25	715.75
54	55	717.25	721.75
55	56	723.25	727.75
56	57	729.25	733.75
57	58	735.25	739.75
58	59	741.25	745.75
59	60	747.25	751.75
60	61	753.25	757.75
61	62	759.25	763.75
62	63	765.25	769.75
	64	771.25	775.75
	65	777.25	781.75
	66	783.25	787.75
	67	789.25	793.75
	68	795.25	799.75
	69	801.25	805.75
	70	807.25	811.75
	71	813.25	817.75
	72	819.25	823.75
	73	825.25	829.75
	74	831.25	835.75
	75	837.25	841.75
	76	843.25	847.75
	77	849.25	853.75
	78	855.25	859.75
	79	861.25	865.75
	80	867.25	871.75
	81	873.25	877.75
	82	879.25	883.75
	83	885.25	889.75

fs—fv=4.5MHz  
CH width=6.0MHz

#### Europe/Africa ch.

CH. No.	fv MHz	fs MHz
21	471.25	476.75
22	479.25	484.75
23	487.25	492.75
24	495.25	500.75
25	503.25	508.75
26	511.25	516.75
27	519.25	524.75
28	527.25	532.75
29	535.25	540.75
30	543.35	548.75
31	551.25	556.75
32	559.25	564.75
33	567.25	572.75
34	575.25	580.75
35	583.25	588.75
36	591.25	596.75
37	599.25	604.75
38	607.25	612.75
39	615.25	620.75
40	623.25	628.75
41	631.25	636.75
42	639.25	644.75
43	647.25	652.75
44	655.25	660.75
45	663.25	668.75
46	671.25	676.75
47	679.25	684.75
48	687.25	692.75
49	695.25	700.75
50	703.25	708.75
51	711.25	716.75
52	719.25	724.75
53	727.25	732.75
54	735.25	740.75
55	743.25	748.75
56	751.25	756.75
57	759.25	764.75
58	767.25	772.75
59	775.25	780.75
60	783.25	788.75
61	791.25	796.75
62	799.25	804.75
63	807.25	812.75
64	815.25	820.75
65	823.25	828.75
66	831.25	836.75
67	839.25	844.75
68	847.25	852.75
69	855.25	860.75

fs= fv+5.5MHz  
fv=6.0MHz  
fv=6.5MHz  
The table shows only fv+5.5MHz  
CH width=8.0MHz

#### China ch.

CH. No.	fv MHz	fs MHz
13	471.25	477.75
14	479.25	485.75
15	487.25	793.75
16	495.25	501.75
17	503.25	509.75
18	511.25	517.75
19	519.25	525.75
20	527.25	533.75
21	535.25	541.75
22	543.25	549.75
23	551.25	557.75
24	559.25	565.75
25	607.25	613.75
26	615.25	621.75
27	623.25	629.75
28	631.25	637.75
29	639.25	645.75
30	647.25	653.75
31	655.25	661.75
32	663.25	669.75
33	671.25	677.75
34	679.25	685.75
35	687.25	693.75
36	695.25	701.75
37	703.25	709.75
38	711.25	717.75
39	719.25	725.75
40	727.25	733.75
41	735.25	741.75
42	743.25	749.75
43	751.25	757.75
44	759.25	765.75
45	767.25	773.75
46	775.25	781.75
47	783.25	789.75
48	791.25	797.75
49	799.25	805.75
50	807.25	813.75
51	815.25	821.75
52	823.25	829.75
53	831.25	837.75
54	839.25	845.75
55	847.25	853.75
56	855.25	861.75
57	863.25	869.75
58	871.25	877.75
59	879.25	885.75
60	887.25	893.75
61	895.25	901.75
62	903.25	909.75
63	911.25	917.75
64	919.25	925.75
65	927.25	933.75
66	935.25	941.75
67	943.25	949.75
68	951.25	957.75

fs—fv=6.5MHz  
CH width=8.0MHz

# CATV Channel

## TV Frequency Table

**U.S. ch**

CH. No.	fv MHz	fs MHz
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
A-6	85.25	89.75
A-5	91.25	95.75
A-4	97.25	101.75
A-3	103.25	107.75
A-2	109.25	113.75
A-1	115.25	119.75
A	121.25	125.75
B	127.25	131.75
C	133.25	137.75
D	139.25	143.75
E	145.25	149.75
F	151.25	155.75
G	157.25	161.75
H	163.25	167.75
I	169.25	173.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75
J	217.25	221.75
K	223.25	227.75
L	229.25	233.75
M	235.25	239.75
N	241.25	245.75
O	247.25	251.75
P	253.25	257.75
Q	259.25	263.75
R	265.25	269.75
S	271.25	275.75
T	277.25	281.75
U	283.25	287.75
V	289.25	293.75
W	295.25	299.75
AA	301.25	305.75
BB	307.25	311.75
CC	313.25	317.75
DD	319.25	323.75
EE	325.25	329.75
FF	331.25	335.75
GG	337.25	341.75
HH	343.25	347.75
II	349.25	353.75
JJ	355.25	359.75
KK	361.25	365.75
LL	367.25	371.75
MM	373.25	377.75
NN	379.25	383.75
OO	385.25	389.75
PP	391.25	395.75
QQ	397.25	401.75
RR	403.25	407.75
SS	409.25	413.75
TT	415.25	419.75
UU	421.25	425.75
VV	427.25	431.75
WW	433.25	437.75
XX	439.25	443.75
YY	445.25	449.75
ZZ	451.25	455.75
AAA	457.25	461.75
BBB	463.25	467.75
CCC	469.25	473.75

**Europe ch.**

CH. No.	fv MHz	fs MHz
2	48.25	53.75
3	55.25	60.75
4	62.25	67.75
S1'	69.25	74.75
S2'	76.25	81.75
S3'	83.25	88.75
S1	105.25	110.75
S2	112.25	117.75
S3	119.25	124.75
S4	126.25	131.75
S5	133.25	138.75
S6	140.25	145.75
S7	147.25	152.75
S8	154.25	159.75
S9	161.25	166.75
S10	168.25	173.75
5	175.25	180.75
6	182.25	187.75
7	189.25	194.75
8	196.25	201.75
9	203.25	208.75
10	210.25	215.75
11	217.25	222.75
12	224.25	229.75
S11	231.25	236.75
S12	238.25	243.75
S13	245.25	250.75
S14	252.25	257.75
S15	259.25	264.75
S16	266.25	271.75
S17	273.25	278.75
S18	280.25	285.75
S19	287.25	292.75
S20	294.25	299.75

**SPECIFICATION CHANGES:**

LEADER ELECTRONIC CORP. reserves the right to discontinue the sale of instruments and/or to change the specifications of instruments at any time without responsibility for the incorporation of new features in the instruments already sold.

**ORDERING INSTRUCTIONS:**

When inquiries or orders are made, please specify the VOLTAGE of the power supply, the FREQUENCY, the TV System etc. of the locality where the instruments are to be used. The instruments can be furnished for AC line voltages of 100, 120, 220, or 240 volts and designed to operate at the voltages which are within  $\pm 8\%$  of the rated line voltages.

**ENVIRONMENTAL CONDITIONS**

Our products can be used under the following conditions unless specially stated.

<Guaranteed rating range >

1. Temperature: 0 to 40°C
2. Humidity: 30 to 85%

**LEADER ELECTRONICS CORP.**

2-6-33 TSUNASHIMA HIGASHI KOHOKU-KU  
YOKOHAMA JAPAN    PHONE: (045) 541-2123  
TELEX: J47780JPLEADER    FAX: (045) 544-1280

**AGENT**

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