

SHORT FORM 22



# ELECTRONIC MEASURING INSTRUMENTS

SHORT FORM

**22**

MEGURO<sup>®</sup>

**MEGURO<sup>®</sup>**  
MEGURO ELECTRONICS CORPORATION

# ***IN THE SEARCH FOR SUPREME QUALITY AND RELIABILITY.....***

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When placing an order, please specify the model number, product name and power line voltage.

All specifications given in this catalog are subject to change without prior notice.

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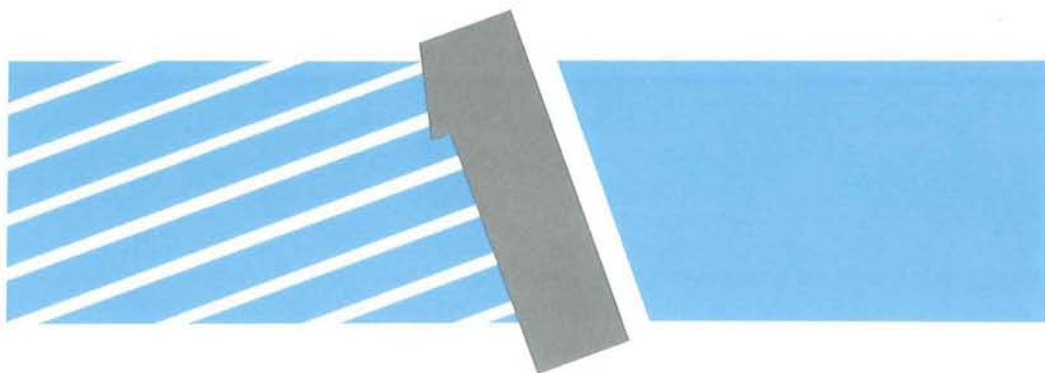
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**SIGNAL GENERATORS; FM-AM,  
STEREO, AM STEREO, ARI,  
DAD ENCODER**

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# MSG-2620

## SYNTHESIZED RF SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2620 is a synthesized signal generator covering a wide frequency range from 100 kHz to 2100 MHz. The output level range is  $-137$  to  $+16$  dBm (below 1050 MHz). A particular advantage is the high purity in output waveforms in addition to high frequency stability and resolution characteristics. The modulation is multifunctional, in addition to AM and FM, it is possible to apply phase modulation up to 40 radians and also high quality pulse modulation.

Store or recall of 50 operations is possible; other features include bright-digit editing and the self-diagnosis functions. The GP-IB interface is provided as standard for added convenience. All in all, the MSG-2620 is the most versatile signal generator for use in development and in production of high performance radar equipment, satellite communications systems and transceivers to name a few.

### < SPECIFICATIONS >

Frequency Characteristics	
Range	100 kHz to 2100 MHz $\pm 5 \times 10^{-6}$
Display	9 $\frac{1}{2}$ digit display
Resolution	10 Hz: < 1050 MHz 20 Hz: > 1050 MHz
Stability	$\pm 5 \times 10^{-7}$ /month
Output Characteristics	
Level Range	+16 to -137 dBm (0.1 to 1050 MHz), and +13 to -137 dBm (1050 to 2100 MHz), with 50 $\Omega$ termination
Display	3 $\frac{1}{2}$ digit display
Resolution	0.1 dB
Level Units	dB, dBm, V, mV, $\mu$ V, dBmV, and dB $\mu$ V
Accuracy	$\pm 1$ dB: +16 to -127 dBm (1 to 1050 MHz) $\pm 1.5$ dB: +13 to -127 dBm (1050 to 2100 MHz) $\pm 2$ dB: +16 to -127 dBm (0.1 to 0.99999 MHz)
Impedance (SWR)	50 $\Omega$ . < 1.5 at < +1 dBm and < 2.0 at other levels
Spectral Purity	
Spurious signal	In CW mode at offset more than 10 kHz: < -60 dBc (< 1050 MHz), < -54 dBc (> 1050 MHz) At fixed frequency, < -60 dBc, or < -140 dBm

Harmonics	< -30 dBm ( $\leq +13$ dBm, above 1 MHz)																	
Subharmonics	< -25 dBc (at other ranges)																	
Residual FM	< -50 dBc (1050 to 2100 MHz)																	
	<table border="1"> <thead> <tr> <th rowspan="2">Frequency</th> <th colspan="2">Demodulated Range</th> </tr> <tr> <th>300 Hz to 3 kHz</th> <th>50 Hz to 15 kHz</th> </tr> </thead> <tbody> <tr> <td>0.1 to 245 MHz</td> <td>&lt; 12 Hz rms</td> <td>&lt; 18 Hz rms</td> </tr> <tr> <td>245 to 512 MHz</td> <td>&lt; 6 Hz rms</td> <td>&lt; 9 Hz rms</td> </tr> <tr> <td>512 to 1050 MHz</td> <td>&lt; 12 Hz rms</td> <td>&lt; 18 Hz rms</td> </tr> <tr> <td>1050 to 2100 MHz</td> <td>&lt; 24 Hz rms</td> <td>&lt; 36 Hz rms</td> </tr> </tbody> </table>	Frequency	Demodulated Range		300 Hz to 3 kHz	50 Hz to 15 kHz	0.1 to 245 MHz	< 12 Hz rms	< 18 Hz rms	245 to 512 MHz	< 6 Hz rms	< 9 Hz rms	512 to 1050 MHz	< 12 Hz rms	< 18 Hz rms	1050 to 2100 MHz	< 24 Hz rms	< 36 Hz rms
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512 to 1050 MHz	< 12 Hz rms	< 18 Hz rms																
1050 to 2100 MHz	< 24 Hz rms	< 36 Hz rms																
Residual AM	< -60 dBc (demodulated bandwidth: 50 Hz to 15 kHz)																	
SSB Phase Noise	At 20 kHz offset; < -122 dBc/Hz at 500 MHz < -116 dBc/Hz at 1000 MHz < -110 dBc/Hz at 2000 MHz																	

### Amplitude Modulation

Range	0 to 99%
Display	2 digit display
Resolution	1%
Accuracy	$\pm (2\% + 4\%$ of set value); fo at or above 1 MHz $\pm (3\% + 5\%$ of set value); fo below 1 MHz
Distortion	In 1 to 1050 MHz range at < 16 dBm: < 1.5% at 30% modulation < 3% at 70% modulation < 5% at 99% modulation In 1050 to 2100 MHz range at < +13 dBm: < 3% at 70% modulation < 5% at 99% modulation
External	20 Hz to 50 kHz (3 dB) DC to 50 kHz (with use of special function)

### Frequency Modulation

#### Maximum Deviation

Modulating Frequency	Maximum Deviation	Carrier Frequency
$f_m \geq 200$ Hz	400 kHz 200 kHz 100 kHz 200 kHz	1050 to 2100 MHz 512 to 1050 MHz 245 to 512 MHz 0.1 to 245 MHz
$f_m < 200$ Hz	Above values or as calculated from below, whichever is smaller	245 to 2100 MHz 0.1 to 245 MHz
	$2f_m$ $2f_m (fo + 800)$	
	$f_m$ = Modulating frequency, kHz $f_o$ = Carrier frequency, MHz	

Display	3 digit display
Resolution	3 digits
Accuracy	$\pm (7\% + 10$ Hz), $f_m = 0.3$ to 20 kHz
Distortion	< 1% (Same condition as accuracy)
External	20 Hz to 100 kHz (3 dB)
Incidental AM	< 1% ( $f_m = 1$ kHz; to maximum deviation or 50 kHz, whichever is smaller)

### Phase Modulation

Maximum Deviation	20 rad: 0.1 to 245 MHz 10 rad: 245 to 512 MHz 20 rad: 512 to 1050 MHz 40 rad: 1050 to 2100 MHz
Display	3 digit display
Resolution	3 digits
Accuracy	$\pm (7\% + 0.01$ rad) at $f_m = 1$ kHz
Distortion	< 1% at $f_m = 1$ kHz
External	20 Hz to 10 kHz (3 dB)
Incidental AM	< 1% ( $f_m = 1$ kHz)

### Pulse Modulation

ON/OFF Ratio	> 80 dB
Rise and Fall Times	< 15 nsec ( $f_o \geq 10$ MHz)
Duty Cycle (Ext.)	0 to 100%
Repetition Frequency	DC to 16 MHz (External)
Internal frequency	Approx. 50% of duty cycle

<b>External frequency</b>	Pulse input level: TTL, $\pm 5V$ , max.; threshold level, $1 \pm 0.1V$
<b>Memory Function</b>	50 Measurement conditions can be set and stored; back-up battery provided will maintain contents for approximately 2 years
<b>Reverse Power Protection</b>	
<b>Protection Level</b>	$\leq 25 W$ ( $50 \Omega$ source) $\leq 25 VCD$ (output connections are AC)
<b>Modulation Sources</b>	
<b>Internal</b>	400 and 1000 Hz ( $\pm 3\%$ in $20^\circ$ to $30^\circ C$ range)
<b>External</b>	$\pm 5V$ max.; at 1 V peak, indication is normal. Input impedance: $600 \Omega$
<b>Modes</b>	AM, FM, $\phi M$ , PM, internal and external applicable in any combination
<b>General Data</b>	
<b>Power Requirements</b>	AC100, 120, 220 or 240 V $\pm 10\%$ , 50/60 Hz; approx. 180VA
<b>Dimensions &amp; Weight</b>	Approx. 432 (W) $\times$ 133 (H) $\times$ 508 (D) mm; approx. 16 kg
<b>Operating Temperature</b>	$0^\circ$ to $50^\circ C$
<b>Standard Accessory</b>	Power Cord 1ea.

- **Option:** Remote Control Box, High stability standard oscillator and Output & Modulation Input (see, page 21, 22)

## Ease of operation is the key-note in design

### Designed for ease in operation

The MSG-2620 is a general-purpose signal generator featuring ease of operation with use of the microprocessor control and various setting functions.

### Memory function for storage of all control panel operations

Up to 50 points can be stored and recalled as desired. This speeds up the operations when the same procedures need to be executed repeatedly.

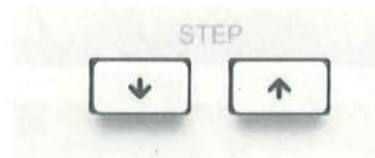
### Easy-to-see, easy-to understand highbrightness editing

When adjusting the frequency, output level or modulation depth, the digits being controlled are displayed at a higher brightness. The digit display movement and value setting are made with push-buttons which is easier than using a dial.



### Step changes using increment keys

The frequency, output level and modulation depth settings are changed in increments/decrements by speedy one-touch operation.



### Multifunctional modulation system

The system is provided for AM and FM and also for Phase modulation ( $\phi$ ) up to 40 radians for high quality pulse modulation (PM).

### GP-IB interface for external control

The GP-IB interface bus is provided as standard allowing system upgrading by connecting a personal computer there to, etc. The GP-IB enables the control of the frequency, output level and modulation depth, and its talk function makes it possible to transmit the error status externally.



# MSG-2600

## SYNTHESIZED RF SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2600 is a standard signal generator covering a wide frequency range from 10 kHz to 1050 MHz. It generates high-purity, high-accuracy signals by means of the synthesizer method.

The modulation include AM, FM and both AM-FM, and the maximum modulation depth is 99% with AM and 99.9 kHz deviation with FM. It can be used in various fields covering the above frequency range for R & D, testing as well as for manufacturing and servicing.

The output level can be varied from +13 dBm to -127 dBm with excellent spectral purity characteristic. Function keys are used extensively for easy panel operations, and all the operations can be stored in the memory making possible the store/recall up to 50 points. The GP-IB interface bus is provided as standard so that the MSG-2600 can be used as an externally-controlled 1 GHz signal source in an automated measuring system.

### < SPECIFICATIONS >

#### Frequency Characteristics

Range	10 kHz to 1050 MHz $\pm 5 \times 10^{-6}$
Display	8 1/2 digit display
Resolution	10 Hz
Stability	$\pm 5 \times 10^{-7}$ /month
Settling Time	< 100 ms

#### Output Characteristics

Level Range	+13 dBm to -127 dBm at 50 $\Omega$ termination (1V to 0.1 $\mu$ V)
Display	3 1/2 digit display
Resolution	0.1 dB
Accuracy	Above 400 kHz: $\pm 1$ dB Below 400 kHz: $\pm 2$ dB (higher than -100 dBm) $\pm 3$ dB (lower than -100 dBm)
Flatness	$\pm 0.5$ dB
Impedance (SWR)	< 1.5 (fo above 400 kHz, below 1 dBm) < 2.0 (others)
Spectral Purity Spurious	In CW mode, at offsets more than 10 kHz: < -60 dBc (fo $\geq 100$ kHz) < -55 dBc (fo < 100 kHz) Fixed spurious < -60 dBc or -140 dBm whichever is larger.
Harmonics	< -30 dBc (fo $\geq 100$ kHz) < -26 dBc (fo < 100 kHz)
Reverse Power Protection	Up to RF 50-Watt from 50 $\Omega$ source when power is on; withstands up to 50 Vdc.

#### Residual Modulation

AM Component	In demodulation frequency range from 50 Hz to 15 kHz: < 0.1% rms (-60 dBc) at and above 100 kHz. < 0.18% rms (-55 dBc) below 100 kHz.
FM Component	In demodulation frequency range from 300 Hz to 3 kHz: < 10 Hzrms (245 MHz to 512 MHz) < 20 Hzrms (others) In demodulation frequency range from 50 Hz to 15 kHz: < 22 Hzrms (245 MHz to 512 MHz) < 44 Hzrms (others)
SSB Phase Noise	At 20 kHz offset; < -116 dBc/Hz at 500 MHz < -100 dBc/Hz at 1000 MHz

#### Modulation Characteristics

Modes	AM and FM with internal or external source; Simultaneous AM and FM.
Internal	400 Hz and 1000 Hz
External	Input impedance: 600 $\Omega$ Input voltage: $\pm 5$ V max., modulation display accuracy $\pm 2\%$ at 1V peak.
< AM DATA >	
Modulation Range	0 to 99%
Display	2 digit display
Resolution	1%
Accuracy	$\pm (2\% + 4\%$ of setting value) at less than 90% (Peak output: < +13 dBm)
Distortion	< 1.5% at 30% modulation < 3.0% at 70% modulation < 5.0% at 90% modulation
Bandwidth (3 dB)	20 Hz to 30 kHz
Incidental FM	< 0.3 fm (30% internal modulation)
< FM DATA >	
Deviation Range	100 Hz to 999 Hz, 1 kHz to 9.99 kHz and 10 kHz to 99.9 kHz
Max. Deviation	Smaller value of 99.9 kHz and the following value; 10 kHz to 400 kHz.....1000 (fo -0.01)/3 400 kHz to 245 MHz.....2 fm (fo +800) 245 MHz to 1050 MHz.....2 fmfo fo = carrier frequency in MHz fm = modulation frequency in kHz
Display	3 digit display
Resolution	3 digits
Accuracy	$\pm 7\%$ (at 100 Hz deviation or more for rates of 300 Hz to 20 kHz, and 300 Hz to 1kHz for fo < 400 kHz)
Distortion	< 1% at same condition as accuracy
Bandwidth (3 dB)	20 Hz to 100 kHz; unspecified for fo < 400 kHz
Incidental AM	< 1% AM at 1 kHz rate, for the maximum deviation or 50 kHz, whichever is less.
Settings	Numeric keys, Edit keys and Step keys.
Remote Control Function	Controlled by the GP-IB interface (IEEE-488 bus).
Memory Function	50 measurement conditions can be set and stored. Memory back-up battery provided for protection of the built-in memory when power is off.
Power Requirements	AC100/120/220/240V $\pm 10\%$ , 50/60 Hz; approx. 180VA
Dimensions & Weight	Approx. 432(W) $\times$ 133(H) $\times$ 508(D) mm Approx. 16 kgs.
Operating Temperature	0°C to 50°C
Standard Accessory	Power Cord 1 ea.

■ Option: Remote Control Box, High stability standard oscillator and Output & Modulation Input (see, page 21,22).



# MSG-2580

## FM-AM STANDARD SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2580 is a high quality instrument designed to meet with stringent requirements in generation of signals in the 10 kHz to 280 MHz range. Use of a PLL system ensures high accuracy and stability in the carrier generation. Frequency and amplitude modulation, singly or simultaneously, can be applied to the RF carrier.

The RF output level covers a very wide range, -20 to +132dB $\mu$  at open circuit (also settable to EMF dB $\mu$  and dBm). Particular attention has been paid to achieve low FM distortion, high S/N, superior stereo separation, and low AM distortion. These advantages make this generator most suited for use in development and measurements of receivers, amplifiers, filters and other circuits operating in the AM, FM and TV broadcast bands.

### < FEATURES >

- All panel functions can be memorized and up to 100 points stored and recalled.
- Carrier frequencies settable to 7 digits; high stability assured with use of the PLL system.
- $\Delta$  (increment/decrement) control of frequencies and output level possible.
- Fixed crystal oscillator at 89.9 MHz used for S/N measurement.
- Wide range of output level, -20 to 132 dB $\mu$  at open circuit. With 3-digit display, settable in 1 dB steps.
- Keys provided for preset modulation levels, AM at 30% and FM at 22.5 kHz and 75 kHz deviation; moreover, modulation on/off for AM and FM can be set separately.
- Recall of preset points, modulation level settings and continuously variable increment/decrement functions can be remotely controlled.
- The GP-IB control can be built-in for the carrier frequency, output level and modulation.

### < SPECIFICATIONS >

<b>Frequency Characteristics</b>	
<b>Range &amp; Accuracy</b>	10 kHz to 280 MHz, $\pm 2 \times 10^{-6}$
<b>Fixed Frequency</b>	89.9 MHz (crystal oscillator)
<b>Output Characteristics</b>	
<b>Level Range</b>	-20 to +132 dB $\mu$ , at open circuit; unit = dB $\mu$ , EMF dB $\mu$ , dBm and offset. $\pm 1$ dB at 20 to 132 dB $\mu$ . $\pm 1$ dB, 400 kHz to 280 MHz.
<b>Accuracy</b>	
<b>Leveling</b>	
<b>Source Impedance (Switchable)</b>	50 $\Omega$ , VSWR less than 1.2. 75 $\Omega$ , (10 kHz to 130 MHz)
<b>RF Leakage</b>	Will not affect output level performance
<b>Spurious Signals</b>	Second harmonic: Less than -30 dB Non-harmonics: Less than -60 dB in 400 to 1700 kHz and 75 to 110 MHz ranges and less than -50 dB in other ranges.
<b>Residual Modulation</b>	FM: Less than 7.5 Hz in demodulated band, 80 Hz to 20 kHz with 50 $\mu$ s de-emphasis and in FM band. AM: Less than 0.03%.
<b>Modulation Characteristics</b>	
<b>&lt; FM Data &gt;</b>	
<b>Frequency Deviation</b>	0 to 150 kHz in 32.5 to 65 MHz range 0 to 300 kHz in 3 to 32.5 MHz, 65 to 280 MHz range; 0 to 30 kHz in 300 kHz to 3 MHz; 10% of carrier frequency below 300 kHz.
<b>Accuracy</b>	$\pm 5\%$ of maximum value in 3 to 280 MHz range.
<b>Internal Modulation</b>	400 Hz and 1000 Hz, $\pm 3\%$
<b>External Modulation</b>	Frequency range, 20 Hz to 120 kHz.
<b>Distortion</b>	With 1 kHz signal at 75 kHz deviation in the demodulated band, 250 Hz to 20 kHz, with 50 $\mu$ s de-emphasis applied; Less than 0.1% and less than 0.01% in the 10.7 MHz, 75 to 110 MHz range.
<b>Incidental AM</b>	Less than 0.5% at 75 kHz deviation.
<b>&lt; AM Data &gt;</b>	
<b>Modulation Range</b>	0 to 99.9%, up to 124 dB $\mu$ output at open circuit.
<b>Accuracy</b>	$\pm 5\%$ of maximum indication in 0 to 80% range.
<b>Internal Modulation</b>	400 Hz and 1000 Hz, $\pm 3\%$ .
<b>External Modulation</b>	Frequency range: 20 Hz to 10 kHz, $\pm 1$ dB; 20 Hz to 20 kHz, $\pm 1$ dB in MW band.
<b>Distortion</b>	In demodulated band, 80 Hz to 20 kHz; Less than 1% at 50% modulation with 1 kHz signal; Less than 0.1% in MW band.
<b>Incidental FM</b>	Less than 75 Hz with 1 kHz signal at 30% modulation.
<b>Remote Control Functions</b>	Store frequency, output, modulation recall.
<b>Memory Back-up</b>	Battery provided.
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 70 VA.
<b>Dimensions, overall</b>	Approx. 430(W) $\times$ 115(H) $\times$ 380(D) mm.
<b>Weight</b>	Approx. 15 kg.
<b>Accessory furnished</b>	Output cable. 1 ea.

■ Option: RF Output Adapters & Remote Control Unit (see, page 21, 22)

# MSG-2901

## FM-AM STANDARD SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2901 is a high performance instrument for generating FM, AM and simultaneous FM-AM signals in the 7.8 to 250 MHz range.

Particular attention has been paid for low distortion, high signal-to-noise ratio and stereo separation in the FM signals as required in testing high grade stereo receiving sets. In addition, characteristics of receivers, linear ICs, etc., for VHF use can be accurately determined.

The carrier frequencies with 6-digit display are continuously adjustable and can be varied in small increments. The output level is also displayed in digital form and external control is possible. Due to the high overall output and low spurious responses, this generator is most suited for testing FM receivers for selectivity and also amplifiers and filters used in the VHF spectrum.

### < FEATURES >

- Low FM signal distortion, less than 0.005% at 75 kHz deviation and over 96 dB signal-to-noise ratio, both measured with 50  $\mu$ s de-emphasis.
- External DC applicable to FM resulting in no deterioration of various characteristics in the low audio range.
- The carrier frequency counter includes the incremental and resolution functions; by switching, the counter is usable independently with 250 MHz as the upper limit.
- An independent 90 MHz crystal oscillator circuit is included for convenience in signal-to-noise (S/N) measurements.
- High output level, 132 dB $\mu$  at open circuit, with spurious responses less than -60 dB.
- A 3-digit display indicates the output level under different conditions, namely, at open circuit, with load and with different dummy antennas being used; this feature eliminates any possible errors in readout.
- Five output levels can be preset as required with the presetting function.
- The source impedance can be set at either 50  $\Omega$  or 75  $\Omega$  by switching.

### < SPECIFICATIONS >

<b>Frequency Characteristics</b>	
Range	7.8 to 250 MHz in five bands; resolution, 1 kHz; fixed oscillator, 90 MHz (crystal controlled)
Indication	6 to 4-digit counter display; increment and resolution function provided
<b>Output Characteristics</b>	
Level Range	FM: -10 to 132 dB $\mu$ , at open circuit AM: -10 to 126 dB $\mu$ , at open circuit
Attenuator	1 and 10 dB steps; presettable at 5 points
Indication	Displayed with LEDs (3 digits) for compensated values under open or loaded condition and with different dummy antennas
Accuracy	$\pm 1$ dB
Response	Flat within $\pm 0.5$ dB
Source Impedance	50 $\Omega$ , 75 $\Omega$ , selectable; VSWR less than 1.1
Spurious Signals	Second harmonic: Less than -60 dB Others: Less than -66 dB
Residual Modulation	FM Component: In demodulated bandwidth of 20 kHz: Less than 3.8 Hz (S/N at 75 kHz deviation, over 86 dB) AM Component: Less than 0.01% (S/N at 30% modulation, over 70 dB)
<b>Modulation Characteristics</b>	
<b>&lt; FM Data &gt;</b>	
Frequency Deviation	0 to 299 kHz in three ranges
Indication	3-digit LED display
Accuracy	$\pm 5\%$ of maximum value in each range
Internal Frequencies	400 Hz and 1000 Hz, within $\pm 5\%$
External Modulation	
a) Frequency Range	20 Hz to 100 kHz; separation, over 60 dB
b) Input Impedance	Approx. 600 $\Omega$ , unbalanced
c) Input Voltage	Less than 2 Vrms at 100 kHz deviation
Distortion	Less than 0.05% at 25 kHz deviation in Bands B and C Less than 0.01% at 75 kHz deviation in Bands A, D and E for 20 kHz bandwidth Less than 0.1% at 30 kHz deviation
Incidental AM	
<b>&lt; AM Data &gt;</b>	
Modulation Depth	0 to 99%
Indication	2-digit LED display
Accuracy	$\pm 5\%$ in 0 to 50% modulation range
Internal Frequencies	400 Hz and 1000 Hz, within $\pm 5\%$
External Modulation	
a) Frequency Range	20 Hz to 15 kHz
b) Input Impedance	Approx. 600 $\Omega$ , unbalanced
c) Input Voltage	Less than 2 Vrms at 99% modulation
Distortion	Less than 1% at 30% and less than 2% at 80% modulation
Incidental FM	Less than 75 Hz at 30% modulation in 7.8 to 125 MHz range
<b>Frequency Counter</b>	
Measurement Range	10 Hz to 250 MHz
Accuracy	$\pm (1 \text{ count} + \text{std. frequency accuracy})$
Standard Frequency	10 MHz $\pm 2 \times 10^{-6}$
Input Voltage Range	100 mV to 2 Vrms
Input Impedance	Approx. 1 M $\Omega$ below 10 MHz and approx. 50 $\Omega$ above 10 MHz
Resolution	10 Hz and 1 kHz
Indication	6 digits, LED display
<b>General Data</b>	
Power Requirements	AC100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 80 VA
Dimensions, Overall	Approx. 435(W) $\times$ 165(H) $\times$ 490(D)mm
Weight	Approx. 22 kg
Accessories, furnished	Output cable 1 ea Cable terminal 1 ea Termination resistor 1 ea Modulator cord 1 ea

# MSG-2570A

## FM-AM STANDARD SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2570A is a high performance instrument designed to generate signals in the AM and FM broadcast frequency ranges, 50 kHz to 140 MHz respectively. Amplitude or frequency modulation, singly or simultaneously with internal or external sources can be applied to the RF carrier. PLL system is employed for high accuracy and stability in generation of the carrier frequencies.

The RF output is  $-20$  to  $+120\text{dB}\mu$  (ref.  $\text{OdB}\mu = 1\mu\text{V}$ ) and can be set for three conditions, EMF  $\text{dB}\mu$ , at open circuit, and  $\text{dB}\mu$  or  $\text{dBf}$  under load.

Particular attention has been paid to achieve low FM and AM distortion, high S/N and superior stereo separation characteristics. These features make this generator most suitable for use in development, testing and adjustments of high grade FM and AM receiving sets.

### < FEATURES >

- All operations controlled with a microprocessor with set values indicated in digital form.
- All panel functions can be memorized and up to 90 points can be stored and recalled.
- Carrier frequencies settable to seven digits; high stability assured through use of the PLL system.
- $\Delta$  (increment or decrement) setting possible for carrier frequencies.
- Keys provided for preset modulation levels, AM at 30% and FM at 22.5 kHz and 75 kHz deviation; moreover modulation on/off for AM and FM can be separately set.
- Recall of preset points, modulation level setting and continuously variable incremental or decremental functions can be remotely controlled.
- The GP-IB control can be built-in for the carrier frequency, output level and modulation.

### < SPECIFICATIONS >

<b>Frequency Characteristic</b>	
Range & Accuracy Indication	50 kHz to 140 MHz, $\pm 2 \times 10^{-6}$ 7-digit LED.
<b>Output Characteristics</b>	
Level Range	$-20$ to $+120\text{dB}\mu$ , at open circuit; unit = $\text{dB}\mu$ , EMF $\text{dB}\mu$ , $\text{dBf}$ and offset. 3-digit LED.
Indication Accuracy	$\pm 1\text{dB}$ at 20 to 120 $\text{dB}\mu$ ; $\pm 1.5\text{dB}$ at $-20$ to 20 $\text{dB}\mu$ .
Leveling	Within $\pm 1\text{dB}$ , 400 kHz to 140 MHz and $\pm 1.5\text{dB}$ , 50 kHz to 400 kHz.
Source Impedance	50 $\Omega$ , VSWR less than 1.2.
RF Leakage	Will not affect output level performance
Spurious Signals	Second harmonic: Less than $-30\text{dB}$ . Non-harmonics: Less than $-60\text{dB}$ .
Residual Modulation	In demodulated band, 80 Hz to 20 kHz FM: Less than 17 Hz (S/N equivalent over 73 dB at 75 kHz deviation). AM: Less than 0.03% (S/N equivalent over 60 dB at 30% modulation).
<b>Modulation Characteristics</b>	
<b>&lt; FM Data &gt;</b>	
Frequency Deviation	0 to 99.5 kHz in 1 to 140 MHz range and 10% of carrier frequency below 1 MHz.
Indication Accuracy	3-digit LED.
Internal Modulation	$\pm 5\%$ of full scale.
External Modulation	400 Hz and 1000 Hz, $\pm 3\%$
Distortion	Frequency range, 20 Hz to 120 kHz. Less than 0.05% at 75 kHz deviation with 1 kHz signal at 10.7 MHz and in 70 to 110 MHz range.
Incidental AM	Less than 0.5% at 75 kHz deviation.
<b>&lt; AM Data &gt;</b>	
Modulation Range	0 to 80% in 150 kHz to 140 MHz carrier range. At below 150 kHz, for 30% modulation, lower than 1 kHz and for 80%, lower than 300 Hz.
Indication Accuracy	3-digit LED.
Internal Modulation	$\pm 5\%$ of modulation.
External Modulation	400 Hz and 1000 Hz, $\pm 3\%$ .
Distortion	Frequency range: 20 Hz to 10 kHz. Less than 0.3% modulation with 1 kHz signal in the 150 kHz to 30 MHz carrier range.
Incidental FM	Less than 75 Hz at 30% modulation with 1 kHz signal.
Remote Control Functions	Store frequency, output, modulation recall and store, frequency and output level increment control, and modulation on/off.
Memory Back-up	Battery provided.
Power Requirements	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 35 VA.
Dimensions, overall	Approx. 430(W) $\times$ 115(H) $\times$ 325(D) mm.
Weight	Approx. 10 kg.
Accessory, furnished	Output cable, 1 ea.

■ Option: RF Output Adapters & Remote Control Unit (see, page 21, 22)

# MSG-2560B

## FM-AM SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2560B is an up-to-date instrument intended primarily for use in the FM-AM radio production line. It has been developed for rapid operation by using its memory functions controlled with front panel keys. The frequency range, 100 kHz to 110 MHz, covers the AM and FM bands and separate generators are not required. The FM carrier type interphones and cordless telephones can be readily tested. In addition, the carrier frequencies, modulation and output levels up to 100 points can be stored and recalled. Remote control operation is also possible for all panel functions.

### < FEATURES >

- One instrument covers the frequency range, 100 kHz to 110 MHz, for AM and FM signals suitable for testing multiband radios in the production line.
- All operating functions are microprocessor-controlled and set values are displayed in digital form.
- Carrier frequencies are locked with a crystal oscillator for high stability.
- Frequencies are displayed in 6-digit form for accuracy in readout.
- Output level range is  $-19$  to  $+99$  dB $\mu$  with 2-digit readout and a 4-point memory function is included.
- Modulation selectable at AM 30% and FM at 22.5 and 75 kHz with preset keys.
- Back-up battery provided to retain memory contents when the line power is cut off.
- For memorizing the panel control operations, 100 points can be stored and recalled.
- External presetting is possible for frequency, type of modulation and output level with use of a remote controller.
- Compact structure occupies small installation space.

### < SPECIFICATIONS >

<b>Frequency Characteristics</b>	
<b>Range</b>	100 kHz to 110 MHz.
<b>Indication</b>	6-digit display. Resolution: 100 Hz, 100 kHz to 34.999 kHz and 1 kHz, 35 MHz to 110 MHz.
<b>Accuracy</b>	$\pm 5 \times 10^{-5}$
<b>Output characteristics</b>	
<b>Level Range</b>	$-19$ to $+99$ dB $\mu$ (0 dB $\mu$ = 1 $\mu$ V) at open circuit.
<b>Indication</b>	2-digit display.
<b>Accuracy</b>	$\pm 1$ dB at 99 dB $\mu$ .
<b>Leveling</b>	$\pm 1.5$ dB, 400 kHz $\sim$ 110 MHz $\pm 1.5$ dB, 100 kHz $\sim$ 400 kHz
<b>Attenuator Accuracy</b>	$\pm 1$ dB at $\geq 0$ dB $\mu$ output. $\pm 2$ dB at $< 0$ dB output.
<b>Source Impedance</b>	50 $\Omega$ , VSWR less than 1.2.
<b>RF Leakage</b>	Will not affect output level performance
<b>Spurious Output</b>	$< -30$ dB.
<b>Residual Modulation</b>	FM: S/N over 73 dB at 75 kHz deviation in demodulated range: 80 Hz to 20 kHz. AM: S/N over 55 dB at 30% modulation.
<b>Modulation Characteristics</b>	
< FM Data >	
<b>Deviation Range</b>	0 to 99.5 kHz and carrier frequency $\times 10\%$ at below 1 MHz.
<b>Indication</b>	3-digit LED
<b>Accuracy</b>	$\pm 10\%$ of maximum value.
<b>Internal Modulation</b>	400 Hz and 1000 Hz, $\pm 3\%$ .
<b>External Modulation</b>	Frequency: 20 Hz to 100 kHz.
<b>Modulation Distortion</b>	In Carrier Range 10.7 MHz and 65 to 110 MHz, less than 0.05% at 75 kHz deviation and less than 0.1% at other frequencies.
< AM Data >	
<b>Modulation Range</b>	0 to 60%
<b>Indication</b>	3-digit LED
<b>Accuracy</b>	$\pm 5\%$ of modulation.
<b>Internal Modulation</b>	400 Hz and 1000 Hz, $\pm 3\%$ .
<b>External Modulation</b>	Frequency: 20 Hz to 10 kHz.
<b>Modulation Distortion</b>	Less than 0.5% at 30% modulation in 400 kHz to 30 MHz carrier range and less than 1.5% at other frequencies.
<b>Remote Control Functions</b>	Store and recall of frequencies, output level and modulation. Battery provided.
<b>Memory Back-up</b>	
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 20 VA.
<b>Dimensions, overall</b>	Approx. 430(W) $\times$ 115(H) $\times$ 295(D) mm.
<b>Weight</b>	Approx. 8 kg.
<b>Accessory, furnished</b>	Output cable 1 ea.

■ Option: RF Output Adapters & Remote Control Unit (See, page 21, 22)

# MSG-2520

## AM-FM SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2520 is designed for use on the production line for AM-FM radios and TV sound receivers. It is a small-scale version of a "centralized signal generating system" in which up to eight discrete test frequencies can be generated with oscillator plug-in units. Further, it is possible to mix the outputs and distribute them to four test positions. Two types of oscillator plug-ins cover the AM bands, 0.1 to 30 MHz and three types for the FM band, 60 to 110 MHz and TV sound frequency bands. They can be used in any combination to meet the set testing requirements. The carrier frequencies are initially set, stored in an RAM and controlled with an internal microcomputer.

### < FEATURES >

- AM and FM bands covered with five oscillator plug-in units (total of eight can be installed) in any combination. Data are given in the specifications.
- Carrier frequency in each unit settable to six digits and memorized using a store switch. With an internal microcomputer, the frequency of each unit is controlled with a reference crystal oscillator. High accuracy and stability are assured.
- The reference output level of each unit is 100 dB $\mu$  and adjustable in the +1 to -6 dB range.
- Modulation applicable, internal or external, for 50% AM and 0 to 100 kHz deviation for FM.
- In addition to outputs from installed units, two external signals can be connected for additional mixed outputs.
- Lamp indication for the plug-in unit in use.
- Back-up battery included for storing memorized carrier frequencies at power off condition.
- Compact structure occupies small installation space.

### < SPECIFICATIONS >

MAIN FRAME (MSG-2520)	
Signal Generation	Up to eight frequencies with AM and FM oscillator plug-in units.
Frequency Display	Max. 6 digits.
Frequency Resolution	1 kHz: 0.1 to 30 MHz. 10 kHz: 60 to 110 MHz. 10 kHz: TV sound frequency bands
Frequency Setting	Each plug-in unit frequency can be set up or down at the selected digit order.
Output Signals	Four outputs, mixed with eight (max.) signals. 100 dB $\mu$ into load per frequency.
Source Impedance	50 $\Omega$ , VSWR < 1.2.
Spurious Signals	< -40 dB (at eight signal mixing).
External Signal Input	Two signals in the 0.1 to 110 MHz range and TV sound frequency bands.
Frequency Range	100mVrms, max.
Input Level	50 $\Omega$ , VSWR < 1.2.
Impedance	400 Hz and 1000 Hz $\pm$ 5%.
Modulation	Input Impedance: approx. 10 k $\Omega$ unbalanced.
Internal	Input Voltage: 2Vrms at maximum indication.
External	AC 100 to 253V $\pm$ 10%, 50/60 Hz, 50 VA max.
Power Requirement	Approx. 420(W) $\times$ 165(H) 450(D) mm.
Dimensions and Weight	approx. 12 kg.
AM PLUG-IN UNIT (MU-25-1, MU-25-2)	
Frequency Range	MU-25-1: 100 to 1700 kHz. MU-25-2: 1.0 to 30 MHz.
Resolution	1 kHz.
Output Level	100 dB $\mu$ at 0 dB indication; adjustable range, +1 to -6 dB.
Spurious Signals	< -40 dB (at eight signal mixing).
Residual FM	> 66 dB at 75 kHz deviation (deemphasis at 50 $\mu$ s).
Residual AM	> 50 dB at 30% modulation.
Modulation Range	0 to 50%.
Modulation Accuracy	$\pm$ 10% of full scale.
Modulation distortion	In demodulated band, 20 Hz to 20 kHz, < 1% at 30% modulation (over 400 kHz).
External Modulation	30 Hz to 10 kHz; response within $\pm$ 3 dB.
Incidental FM	< 200 Hz at 30% modulation.
Dimensions & Weight	Approx. 47(W) $\times$ 96(H) $\times$ 265(D) mm, approx. 700g
FM PLUG-IN UNITS (MU-25-3, MU-25-4, MU-25-5, MU-25-7)	
Frequency Range	MU-25-3: 60 to 76 MHz. MU-25-4: 75 to 91 MHz. MU-25-5: 87 to 110 MHz. MU-25-7: TV sound frequency bands; adjustable range per channel, $\pm$ 4 MHz.
Resolution	10 kHz.
Output Level	100 dB $\mu$ at 0 dB indication; adjustable range, +1 to -6 dB.
Spurious Signals	< -40 dB (at eight signal mixing).
Residual FM	> 76 dB at 75 kHz deviation (deemphasis 50 $\mu$ s).
Residual AM	> 50 dB at 30% modulation.
Modulation Range	0 to 100 kHz deviation
Modulation Accuracy	$\pm$ 10% of full scale.
Modulation Distortion	In demodulated band, 20 Hz to 20 kHz; < 0.05% at 75 kHz deviation.
External Modulation	30 kHz to 100 kHz, response within $\pm$ 1 dB.
Stereo Separation	> 55 dB with 1 kHz modulation signal.
Incidental AM	0.5% at 22.5 kHz deviation.
Dimension & Weight	Approx. 47(W) $\times$ 96(H) $\times$ 265(D) mm, approx. 700g.

■ Option: RF Output Adapters (see, page 21).

# MSG-2161

## FM STEREO/FM-AM STANDARD SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2161 is a versatile instrument specially developed and designed to generate not only FM and AM signals but also FM stereo signals used in the radio production line. The carrier frequency range covers the AM band, 100kHz to 30MHz and the FM band, 75 to 110MHz. High efficiency and stability are assured through use of the PLL system. In stereo modulation, the separation characteristic is greater than 55dB. With this one instrument, testing operations can be carried out most efficiently and rapidly with application of a microprocessor in control of the many functions.

### < FEATURES >

- All operations are controlled with a microprocessor and set with digital display for ease in the readout.
- Up to 100 points can be stored and recalled with panel keys through use of the memory function.
- Carrier frequencies settable to 6 digits; use of the PLL system assures high stability.
- $\Delta$  (incremental) settings possible for the carrier frequencies.
- With positioning of the cursor at a desired point the carrier frequencies can be varied as required.
- Stereo modulation can be set to 30% or 100% with preset keys.
- Superior modulation, S/N and stereo characteristics.
- Remote control may be applied to recall the preset points, modulation level and increments (continuously variable).
- Adjuster provided for stereo phase correction.
- On option, a GP-IB control can be built-in for the carrier frequency, output level and modulation.

### < SPECIFICATIONS >

Frequency Characteristics	
Range & Accuracy	AM: 100 kHz to 30 MHz, FM: 75 to 110 MHz, $\pm 5 \times 10^{-5}$

Output Characteristics	
Level Range	-9 to +99 dB $\mu$ (0 dB $\mu$ = 1 $\mu$ V) at open circuit.
Level Accuracy	$\pm 1.5$ dB above 0 dB $\mu$ and $\pm 2$ dB $\mu$ below 0 dB $\mu$ .
Source Impedance	50 $\Omega$ ; VSWR less than 1.2.
Spurious Output	Less than -30 dB.
Residual Modulation	FM component: S/N over 70 dB in 75 to 110 MHz band and in de02 modulated range, 80 Hz to 100 kHz. AM component: S/N over 50 dB on 100 kHz to 30 MHz band.
Modulation	
< FM Characteristics >	
Deviation Range	0 to 100 kHz in 1.0 to 30 MHz and 75 to 110 MHz bands, and 10% of carrier frequency below 1.0 MHz.
Accuracy	$\pm 10\%$ of maximum value.
Internal Modulation	400 Hz and 1000 Hz, $\pm 3\%$ .
External Modulation	Range: 20 Hz to 100 kHz, $\pm 1$ dB.
Pre-emphasis	Off, 25 $\mu$ s, 50 $\mu$ s and 75 $\mu$ s; accuracy $\pm 1$ dB.
Modulation Distortion	Less than 0.06% at 75 kHz deviation in 75 to 110 MHz band and demodulated band width, 80 Hz to 100 kHz.
< AM Characteristics >	
Modulation Range	0 to 50% in 100 kHz to 30 MHz and 75 to 110 MHz bands.
Accuracy	$\pm 5\%$ at indicated value.
Internal Modulation	400 Hz and 1000 Hz, $\pm 3\%$
External Modulation	Range: 20 Hz to 10kHz, $\pm 1$ dB
Modulation Distortion	Less than 0.5% at 30% modulation in 100 kHz to 30 MHz band and demodulated band width 20 Hz to 20 kHz.
< Stereo Signal Characteristics >	
Separation	Over 55 dB: 400 Hz to 1 kHz. Over 40 dB: 100 Hz to 10 kHz. Over 30 dB: 50 Hz to 15 kHz.
Pilot Frequency	19 kHz $\pm 2$ Hz.
Modulation Internal	400 Hz and 1000 Hz $\pm 3\%$
External	a) Frequency: 50 Hz to 15 kHz ( $\pm 1$ dB, 1 kHz reference). b) Input Impedance: Approx. 10 k $\Omega$ .
Modulation Distortion	Less than 0.06% at 100% modulation.
S/N Figure	Over 70 dB at 100% modulation.
SCA Signal	Input voltage: In 3Vp-p $\pm 2\%$ zone.
General Data	
Preset Function	100 points: Carrier frequency, output level, modulation and stereo signal function.
Remote Control	Applicable to: Carrier frequency, output level, modulation and stereo signal function.
Power Requirements	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 35VA. Back-up battery initially installed.
Dimensions & Weight	Approx. 430(W) $\times$ 115(H) $\times$ 380(D) mm; approx. 10 kg.
Accessory, furnished	Output cable 1 ea.

■ Option: RF Output Adapters & Remote Control Unit (see, page 21, 22)

# MSG-211G-1

## STEREO SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-211G-1 is a high performance instrument specially adapted for use in development and measurements of stereo circuits in the highest grade FM stereo receivers. Used in conjunction with an FM standard signal generator and associated automatic recording apparatus, accurate measurements of fidelity, separation and other pertinent characteristics can be readily obtained. Remote control connections are provided making it possible to select different functions such as selecting the modulation mode and level, internal modulation frequencies, Main and Sub signals, pilot signal (0 to 15%) and pre-emphasis.

### < FEATURES >

- Superior Left and Right channel separation, over 72 dB (typ.).
- Very low modulation distortion, less than 0.003% (typ.).
- Excellent phased characteristic-no need for adjustment over long periods.
- Six low distortion less than -90dB (typ.) internal modulation frequencies; signals usable for external circuit testing.
- Pilot signal presettable to 3 levels with 2-digit indication for convenience in testing.
- Pilot signal output connection provided for observing the phased condition or for adjustment.
- Input connector provided for SCA signal input.
- Presetting the modulation level is possible.
- Remote control function provided for selecting the modulation mode, internal modulation frequency, Main and Sub signals, modulation level and pilot ON/OFF.
- On option, the GP-IB interface can be included.

### < SPECIFICATIONS >

Separation Characteristics	Over 66 dB: 30 Hz to 15 kHz.
Frequency Response	±0.2 dB: 30 Hz to 15 kHz.
Output Voltage Range	0.5 to 5Vrms, at open circuit.
Output Impedance	Approx. 75Ω, unbalanced.
Distortion	Less than 0.005%, 30 Hz to 15 kHz.
Signal-to-Noise Ratio, S/N	Over 90 dB.
38 kHz Leakage	Less than -66 dB at 100% modulation.
Pilot Frequency	19 kHz ± 1 Hz.
Pilot Signal Output	Approx. 1 Vrms.
Modulation Characteristics	
Internal Modulation Frequencies	30 Hz, 100 Hz, 400 Hz, 1 kHz, 6.3 kHz, 10 kHz and 15 kHz, accuracy, ±5%
External Frequency Range	30 Hz to 15 kHz.
AF External Input	a) Input Voltage: Less than 1 Vrms. b) Input Impedance: Approx. 10 kΩ, unbalanced.
External L & R	a) Input Voltage: Less than 1 Vrms. b) Input Impedance: Approx. 10 kΩ, unbalanced.
Pre-emphasis	25 μs, 50 μs and 75 μs; applicable to internal, external AF as well as L & R signals.
Monaural Signal Characteristics	Frequency Range: 30 Hz to 80 kHz. Distortion: Less than 0.003%, 30 Hz to 15 kHz.
Indicators	Meter scale: 0 to 100%. Pilot signal: Digital display 0~15% Accuracy: ±5% of full scale.
SCA Signal	Input Voltage: Approx. 1Vrms at 10% indication. Input Impedance: Approx. 10 kΩ unbalanced.
Internal Oscillator Characteristics	a) Frequencies: Six, same as for internal modulation. b) Output Voltage: Approx. 1 Vrms, at open circuit. c) Output Impedance: Approx. 600Ω, unbalanced. d) Distortion: Less than 0.005%.
Remote Control Functions	a) Modulation Modes b) Modulation Switchover c) Internal Modulation Switchover d) Pilot Signal Switchover e) Pre-emphasis Switchover f) Output Level Switchover g) Control Level
Power Requirements	AC 100V, 115V, 215V or 230V ±10%; 50/60 Hz; approx. 20VA.
Dimensions, overall	Approx. 430(W) × 118(H) × 345(D) mm.
Weight	Approx. 7 kg.
Accessories, furnished	Input/Output cable 2 ea. Connector for remote control 1 ea.

# MSG-2101

## STEREO SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2101 is specially designed for use in a production line or service bench. Particular attention has been paid for ease in operation, functionality, stability and economy. Used in combination with an FM standard signal generator, accurate measurements and adjustments of FM stereo receiver characteristics, namely fidelity and separation, are made possible. Further, the modulation mode, internal modulation signal changeover and pilot signal ON/OFF functions can be remote-controlled when used as a source of stereo signals in measuring systems.

### < FEATURES >

- High channel separation figure, over 66 dB at mid-frequencies (Typ.).
- Extremely low modulation distortion, less than 0.01% (Typ.).
- Long-term phased characteristic-frequent adjustments not required.
- Pilot signal output terminals provided for convenience in phasing and adjustments.
- Terminals provided for SCA signal input.
- Remote control function provided for modulation mode, internal modulation signal changeover and pilot signal ON/OFF.

### < SPECIFICATIONS >

<b>Channel Separation</b>	Over 55 dB: 30 Hz to 3 kHz. Over 40 dB: 3 kHz to 10 kHz. Over 35 dB: 10 kHz to 15 kHz.
<b>Frequency Response</b>	±0.5 dB: 30 Hz to 15 kHz.
<b>Output voltage Range</b>	0.3 to 3Vrms at open circuit
<b>Output Impedance</b>	Approx. 600Ω, unbalanced.
<b>Distortion</b>	Less than 0.03%: 30 Hz to 10 kHz Less than 0.05%: 10 kHz to 15 kHz
<b>Signal-to-Noise Ratio, S/N</b>	Over 75 dB.
<b>38 kHz Leakage</b>	Less than -55 dB with 100% modulation.
<b>Pilot Signal</b>	19 kHz ± 2 kHz; output, approx. 1 Vrms at open circuit.
<b>Modulation</b>	
<b>Internal Frequencies</b>	400 Hz and 1000 Hz, ±5%.
<b>External Frequency Range</b>	30 Hz to 15 kHz
<b>AF External Input</b>	Less than 1 Vrms; Impedance, approx. 10 kΩ, unbalanced.
<b>Left and Right Inputs</b>	Less than 1 Vrms; Impedance, approx. 10 kΩ, unbalanced.
<b>Monaural Signal</b>	Frequency range: 30 Hz to 15 kHz. Distortion: Less than 0.01%.
<b>Meter Scale Calibration</b>	0 to 15% and 0 to 100% in two ranges. Accuracy: ±5% of full scale.
<b>SCA Input</b>	Approx. 0.2 Vrms at 10% indication. Impedance: approx. 10 kΩ, unbalanced.
<b>Internal Oscillator Output (on rear panel)</b>	
<b>Frequency</b>	Same as for internal modulation.
<b>Output voltage</b>	Approx. 1 Vrms at open circuit.
<b>Output Impedance</b>	Approx. 600Ω, unbalanced.
<b>Distortion</b>	Less than 0.01%
<b>Remote Control Function (with external control)</b>	
<b>Modulation Mode</b>	L & R, OFF, MONO, MAIN, LEFT, RIGHT, SUB.
<b>Int. Modulation Freq. Selection</b>	400 Hz, 1000 Hz and EXT.
<b>Pilot Frequency Changeover</b>	ON, OFF.
<b>Power Requirements</b>	AC, 100 V, 115 V, 215 V or 230 V ±10%, 50/60 Hz; approx. 17 VA.
<b>Dimensions, overall</b>	Approx. 430(W) × 118(H) × 295 (D) mm
<b>Weight</b>	Approx. 6 kg.
<b>Accessories, furnished</b>	Input/Output cable 1 ea.

■ Option: Remote Control Unit (see, page 22).



# MSG-2248

## AM STEREO SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-2248 is an instrument designed to generate AM stereo signals for use in development, testing and adjustments of circuits and radio receivers incorporating the Motorola and Harris systems. The composite signals are used to modulate the RF carrier in the 400 to 1700 kHz range. The carrier frequencies can be accurately set and displayed in 6-digit form.

### < FEATURES >

- 6-digit display of the carrier frequencies for accurate settings with 10 Hz resolution.
- Dial control is used for frequency setting; crystal-controlled spot frequency selection is possible for high accuracy, high stability and superior C/N figure.
- Simple selection of Motorola or Harris modes by switching.
- Remote control is possible for modulation on/off, Main, Left, Right and Sub selection, and pilot signal on/off.

### < SPECIFICATIONS >

Frequency Characteristics	
Range	400 to 1700 kHz in one band and spot frequencies at 450, 600, 1000 and 1400 kHz.
Display Accuracy	6-digit counter; resolution to 10 Hz $\pm 0.001\%$ $\pm 1$ digit.
Output Characteristics	
Level Range	-20 to +120 dB $\mu$ (0.1 $\mu$ V to 1 Vrms) at open circuit, adjustable in 1 dB steps.
Accuracy	$\pm 1$ dB.
Output Flatness	Within $\pm 1$ dB.
Source Impedance	50 $\Omega$ ; VSWR Less than 1.2.
RF Leakage	Will not affect output level performance.
Spurious Signals	at 120 dB $\mu$ output; Harmonics: Less than -30 dB. Others: Less than -50 dB.

Indication	Left Meter: 1) Left input level 2) AM level 3) AM level. Right Meter: 1) Right input level 2) Pilot level 3) Carrier level.
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Modulation Characteristics	
Modes	<b>MOTOROLA (C-QUAM).</b> <b>HARRIS (V-CPM).</b>
Internal Modulation Frequencies	400 Hz and 1000 Hz, $\pm 2\%$
External Modulation	For Left and Right inputs single-signal input (Main, Left, Right and Sub). 50 Hz to 15 kHz.
Frequency Range	Approx. 600 $\Omega$ , unbalanced.
Input Impedance	0 dBm (0.775 Vrms).
Input Voltage	

< AM > MOTOROLA, HARRIS	
Modulation Level	0 to 100%; accuracy $\pm 2\%$ at indication; red marking at 95%
Distorsion	With 1 kHz input signal; Less than 0.2% for Motorola at 95% modulation. Less than 1% for Harris at 95% modulation.
Residual Modulation	AM Component: Less than 0.03% in demodulated band, 50 Hz to 15 kHz. (S/N equivalent, over 60 dB at 30% modulation.)
Delay Time	Range: 0 to 40 $\mu$ s, adjustable in 1 $\mu$ s steps; accuracy, $\pm 1$ $\mu$ s.
Main AF Output	Impedence: 10 k $\Omega$ , unbalanced (at rear panel). Output Voltage: Over 1 Vrms at 100% modulation.

< PM > MOTOROLA, HARRIS	
Residual Modulation	PM Component: Less than 0.5° in demodulated band, 50 Hz to 15 kHz. (S/N equivalent, over 40 dB at $\pm 45^\circ$ phase deviation.)

Pilot signal	
Frequency	<b>MOTOROLA</b> 25 Hz, ON/OFF. <b>HARRIS:</b> 55 Hz, ON/OFF.
Subchannel Modulation Applicable	0 to 10% in 1 range. <b>MOTOROLA:</b> Red marking at 4%. <b>HARRIS:</b> Green marking at 7.5%.
Crosstalk	<b>MOTOROLA:</b> Over 40 dB; Main to Sub, at 95% modulation with 1 kHz. Over 50 dB; Sub to Main, at 95% modulation with 1 kHz.
Separation	<b>MOTOROLA:</b> Over 30 dB; 400 Hz to 2 kHz, Over 20 dB; 50 Hz to 7.5 kHz. <b>HARRIS:</b> Over 25 dB; 400 Hz to 2 kHz, Over 20 dB; 400 Hz to 7.5 kHz.

General Data	
Power Requirements	AC 100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 30 VA.
Dimensions, Overall	Approx. 400(W) $\times$ 165(H) $\times$ 290(D) mm.
Weight	Approx. 17 kg.
Accessories, furnished	Output cable 1 ea. Cable terminal 1 ea.

# MSG-214A

## ARI SIGNAL GENERATOR



### < DESCRIPTION >

The MSG-214A generates signals for testing the multiplex broadcast receiving sets for the ARI (Autofahrer Rundfunk information) used in West Germany. The signals are the transmitter identifying code SK, announcement code DK and the area code BK. The instrument is specially designed for use with the Meguro MSG-211 Series of stereo signal generators. The SK signal (subcarrier at 57 kHz) is derived by tripling the 19 kHz signal from the stereo signal generator making it possible to adjust the phase period. In addition, the internal modulation frequency, DK at 125 Hz and BK (A to F) are each available as the submultiple of the 19 kHz pilot signal.

### < FEATURES >

- The SK signal, (57 kHz subcarrier) can be phased with the 19 kHz pilot signal.
  - Two external modulation input connections are provided, making possible use of only these signals for modulation; in addition, internal or external modulation is also possible.
  - Connections for the modulation signals are provided so that the modulation frequency of the internal or external signal can be monitored.
- Recommended stereo signal generators: MSG-2101 (see, page 16) and MSG-211G-1 (see, page 15)

### < SPECIFICATIONS >

Transmitter Identification Code, SK								
Subcarrier Frequency Accuracy	57 kHz Within $\pm 6$ Hz							
Modulation, Internal and External								
Range	0 to 100% (BK) 0 to 50% (DK) $\pm 5\%$ of maximum value							
Accuracy								
Internal Modulation BK (Area Identification) Code	<table border="0"> <tr> <td>A: 23.75 Hz</td> <td rowspan="6">Accuracy: <math>\pm 0.02</math> Hz</td> </tr> <tr> <td>B: 28.27 Hz</td> </tr> <tr> <td>C: 34.93 Hz</td> </tr> <tr> <td>D: 39.58 Hz</td> </tr> <tr> <td>E: 45.67 Hz</td> </tr> <tr> <td>F: 53.98 Hz</td> </tr> </table>	A: 23.75 Hz	Accuracy: $\pm 0.02$ Hz	B: 28.27 Hz	C: 34.93 Hz	D: 39.58 Hz	E: 45.67 Hz	F: 53.98 Hz
A: 23.75 Hz	Accuracy: $\pm 0.02$ Hz							
B: 28.27 Hz								
C: 34.93 Hz								
D: 39.58 Hz								
E: 45.67 Hz								
F: 53.98 Hz								
DK (Announcement Identification) Code	125 Hz $\pm 0.5$ Hz							
External, EXT. 1 and EXT. 2								
a) Frequency	10 Hz to 500 Hz							
b) Input Impedance	Approx. 50 k $\Omega$ , unbalanced							
c) Input level	Less than 2 Vrms at 70% modulation							
Modulation Distortion	Less than 3% at 70% modulation							
Meter Calibration								
Output Modulation	0 to 2 Vrms 0 to 50% for DK, and 0 to 100% for BK							
Output								
Range Impedance	0 to 2 Vrms, open circuit Approx. 600 $\Omega$ , unbalanced							
Pilot Signal (19 kHz) Input								
Level Range	500 mV to 2 Vrms							
Input Impedance	Approx. 20 k $\Omega$ , unbalanced							
General Data								
Power Requirements	AC 100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 50 VA							
Dimensions, overall	Approx. 430(W) $\times$ 120(H) $\times$ 345(D) mm							
Weight	Approx. 7 kg							
Accessories, furnished	Input and output cords — 2 ea.							

# MDG-3010

## DIGITAL SIGNAL GENERATOR



### < DESCRIPTION >

The MDG-3010 is used as an audio signal source with digital input. The required test signals are generated for the digital audio interface format.

### < FEATURES >

- 80 test patterns can be generated in digital form. The patterns, namely, sampling frequency, offset of sampling frequency, generated frequency, output level, C-bit and U-bit, as prepared with a personal computer are transferred via GP-IB to this generator.
- Manual setting is possible for the copy bit of the C-bit, emphasis bit and the validity flag.
- Offset of approximately  $\pm 0.1\%$  can be applied to the sampling frequency.
- Five level of the optical output,  $-27$ ,  $-24$ ,  $-21$ ,  $-18$  and  $-15$  dBm, can be set as required.
- Simultaneous outputs are available simultaneously for the coaxial  $75\Omega$  and optical levels.
- Front panel keys can be controlled by the GP-IB.

### < SPECIFICATIONS >

<b>Data Output Format</b>	Digital audio interface
<b>Sampling Frequencies</b>	32, 44.1 and 48 kHz Accuracy: $\pm 0.02\%$
<b>Sampling Frequency Offset Accuracy</b>	$\pm 0.02\%$
<b>Quantized Bits of Test Pattern</b>	2 channels 16 bits
<b>Test Pattern Frequency</b>	1 to (Sampling frequency $\div 2$ ) Hz, settable in 1 Hz units
<b>Output Range</b>	0 to 100% in 32768 steps, including mute function Sine or square wave
<b>Pattern Waveforms</b>	
<b>Maximum Number of Test Patterns</b>	80 types
<b>Test Pattern Setting Method</b>	Initially set with a personal computer, or equivalent, and transmitted via GP-IB for reception
<b>Data Output Levels</b>	A. Coaxial Output Level: 0.5Vp-p into $75\Omega$ termination Output Impedance: $75\Omega$ Connector: BNC-R B. Optical Output Level: $-27$ , $-24$ , $-21$ or $-18$ dBm within $\pm 0.5$ dBm; at $-15$ dBm, accuracy depends on internal TOSLINK, TOT $\times 172$ Connector: TOSLINK, TOT $\times 172$
<b>Output Control</b>	GP-IB
<b>Dimensions and Weight</b>	Approx. 225(W) $\times$ 159(H) $\times$ 330(D) mm; approx. 10 kg
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 15 VA
<b>Accessories, furnished</b>	Light fiber with connector 1 ea BNC pin-plug cable 1 ea

# MDE-3020

## DAD ENCODER



### <DESCRIPTION>

The MDE-3020 generates simulated signals equivalent to the output from the laser pickup used in CD players. The instrument has been designed for high performance, multifunction, ease in operation and economy for use in the production line and for servicing.

### <FEATURES>

- Four spot sine wave frequencies 20 Hz and 1, 10, 20 kHz; 16 bits.
- Ten signal patterns settable with push-button switches.
- Output signals are TTL level and PU. The signal, at 75Ω, can be varied for the level, DC offset, superposed white noise and symmetry.
- The clock, 4.3218 MHz X1, X2 or X4 can be applied from an external source within a  $\pm 15\%$  range.
- The push-button switches can be remote-controlled with external signals.

### <SPECIFICATIONS>

Standard Signal Patterns	10
EFM Output	
TTL Output	Fanout, 5
PU Output	10 mV to 1 V <sub>p-p</sub> ; superposed DC, 0 to $\pm 0.5$ V; 75Ω, unbalanced
Symmetry	-20% to +20% of 3 T signal
White Noise	-40 dB to -10 dB; bandwidth, 10 kHz to 0.5 MHz
Eye Aperture	Over 90%
Clock Input	
Frequency	4.3218 MHz X1, X2 and X4
Input Sensitivity	0.5 V <sub>p-p</sub> , min.; Z <sub>o</sub> : 10 kΩ, min.
Maximum Input	+5 V, -15 V <sub>PEAK</sub>
General Data	
Power Requirements	AC 100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 20 VA
Dimensions and Weight	Approx. 280(W) $\times$ 110(H) $\times$ 250(D) mm; approx. 4.5 kg

# MLA-1001B

## TEST LOOP



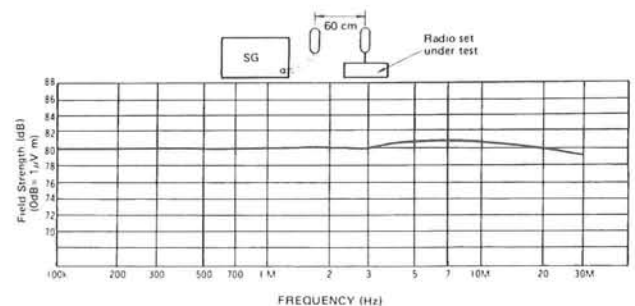
### <DESCRIPTION>

This test loop is an absolute necessity in the development, testing and checking of the present day transistorized receivers, particularly the multiband types. The loop is specially designed for use with the Meguro's Standard Signal Generators in the frequency range, 100 kHz to 30 MHz, with 50Ω output impedance. The constants are chosen to generate known field strengths at 60 cm from the loop as shown in the accompanying figure.

### <SPECIFICATIONS>

Frequency Range	100 kHz to 30 MHz.
Positioning	Vertical: Approx. 250 mm Horizontal : 360 degrees.
Loop Diameter	250 mm; 1 turn, 0.8 mm wire.
Input Connector	Type BNC-J
Dimensions, overall	Approx. 90(W) $\times$ 420(H) $\times$ 320(D) mm
Weight	Approx. 3 kg.
Accessory, furnished	Input cable 1 ea.

An illustration of Field Strength Characteristics



# OPTIONS ACCESSORIES FOR STANDARD SIGNAL GENERATORS

## AM & FM Band Splitters, Dummy Antennas and Selectors

1

For use with MSG-2580, MSG-2570A, MSG-2560B, MSG-2520 and MSG-2161

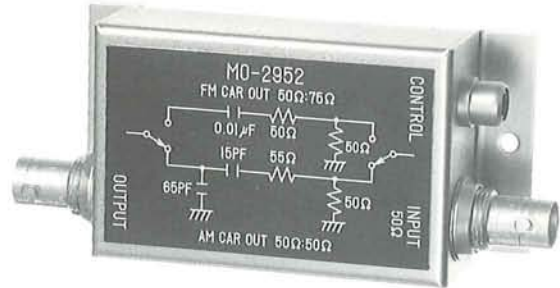
### MO-2951 Band Splitter

1 input and 2 outputs for AM and FM, 50Ω : 50Ω



### MO-2952 FM and AM Dummy Antennas for Car Radios

1 input and 1 output;  
AM, 50Ω : 50Ω; FM, 50Ω : 75Ω



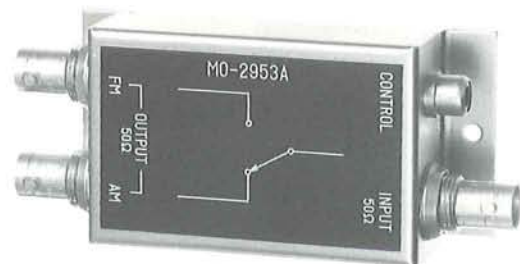
### MO-2952A FM and AM Dummy Antennas for Car Radios

1 input and 1 output;  
AM, 50Ω : 75Ω; FM, 50Ω : 75Ω  
(open type)



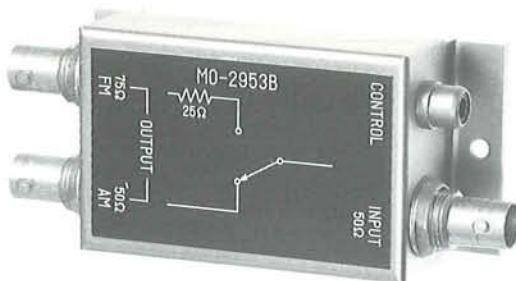
### MO-2953A Test Loop and Dummy Antenna Selector

1 input and 2 outputs;  
AM 50Ω : 50Ω; FM 50Ω : 50Ω



### MO-2953B Test Loop and Dummy Antenna Selector

1 input and 2 outputs;  
AM, 50Ω : 50Ω; FM, 50Ω : 75Ω



### MO-2954 3-Way Selector

For LW-MW, SW and FM



## High Stability Standard Oscillator, Output and Modulation Input

For use with MSG-2620 and MSG-2600

- MSG-2600-130 High stability standard oscillator: (A Unit)
- MSG-2600-132 High stability standard oscillator: (B Unit)
- MSG-2600-830 Output and modulation input (rear panel output)

# OPTIONS ACCESSORIES FOR STANDARD SIGNAL GENERATORS

## REMOTE CONTROLLERS

For use with MSG-2620 and MSG-2600 (Note:Main frame modification required)

■ MRC-349 Remote Controller  
(For MSG-2620)



■ MRC-349S Remote Controller  
(For MSG-2620)



■ MRC-348A/348S Remote Controller  
(For MSG-2600)



MRC-348A

Model	Main Frame	Frequency Control	Output Level Control	Memory Recall	Frequency Search	AFC Function
MRC-349	MSG-2620	○	○	○		
MRC-349S		Same as MRC-349 except that encoder knob is common for frequency and output level controls				
MRC-348A	MSG-2600	○	○	○		
MRC-348S		○	○		○	○

For use with MSG-2580, MSG-2570A, MSG-2560B and MSG-2161\* (\*Use MRC-341 for MSG-2161)

■ MSG-2560B, 70, 80-RE Remote Control Box



- Frequency, output, modulation memory, recall possible
- Momory address, step no. (up only), and frequency stepping

■ MSG-2560B, 70, 80-RE1 Remote Control Box



- Frequency, output, modulation memory, recall possible
- Momory address, step no. (up & down), and speed-up function (X1, X2, X4) of frequency (encoder method)

■ MRC-341 Remote Control Box



- For stepping up the memory adress only

For use with MSG-2101

■ MSG-2101-RE Remote Control Box



- Modulation mode, internal modulation frequency changeover and pilot on/off switching

For use with MSG-2161

■ MSG-2161-RE Remote Control Box



- Storing and recall possible for frequency, output level, modulation and stereo modulation



**DISTORTION OSCILLATORS,  
AUDIO OSCILLATOR**

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# MCR-4042

2

## LOW DISTORTION OSCILLATOR



### < DESCRIPTION >

The MCR-4042 is a programmable low frequency oscillator usable as a precision generator of sine waves with very low distortion, less than 0.001% in the mid-range and also for square waves with excellent characteristics. The frequency range is from 10Hz to 100kHz and most suited for use in research, development and in the production line. Key switches are used for ease in setting the frequencies. Indicators are provided for the frequency, output levels with appropriate units and the program steps. To meet with different testing requirements, the output connections can be set to unbalanced or balanced conditions. For most usefulness, the GP-IB function has been included.

### < FEATURES >

- Sine waves with very low distortion, less than 0.001% in mid-range.
- Sine or square wave output selectable.
- Practically flat output response.
- Square wave output levels settable in same manner as for sine waves.
- Output terminals switchable to floating or one-side grounded condition.
- ON/OFF switching provided for output signals.
- GP-IB function included.
- High sine wave output into 600Ω load, namely, 8.5 Vrms in unbalanced condition and 17 Vrms when balanced.

### < SPECIFICATIONS >

Oscillator Section (Sine and Square Waves)	
Frequency Range	10.0 Hz to 100 kHz
Accuracy	10.0 Hz to 100 kHz: ±5% of setting 100 Hz to 100 kHz: ±2% of setting
Output Impedance	600Ω ±5%, unbalanced or balanced
Sine Wave Characteristics	
Output Level, into 600 Ω	0.31 mV to 8.50 Vrms, unbalanced 0.62 mV to 17.0 Vrms, balanced

Voltage Settings		
Output Connections	Range	Steps
Unbalanced	0.31 to 9.99 mVrms	0.01 mV
	10 to 99.9 mVrms	0.10 mV
	100 to 999 mVrms	1.0 mV
	1.00 to 8.50 Vrms	0.01 V
Balanced	0.62 to 9.99 mVrms	0.01 mV
	10.0 to 99.9 mVrms	0.10 mV
	100 to 999 mVrms	1.0 mV
	1.00 to 9.99 Vrms	0.01 V
	10.0 to 17.0 Vrms	0.10 V

dB Settings	Unbalanced: -70.0 to +18.6 dB in 0.1 dB steps Balanced: -64.0 to +24.6 dB in 0.1 dB steps
dBm Settings	Unbalanced: -67.7 to +20.8 dBm in 0.1 dBm steps Balanced: -61.7 to +26.8 dBm in 0.1 dBm steps
Accuracy	at 1 kHz; ±0.2 dB: -30.0 to +18.6 dB ±0.5 dB: -70.0 to -30 dB
Flatness	referred to 0 dB ±0.2 dB: 30.0 Hz to 19.9 kHz ±0.5 dB: 10.0 Hz to 100 kHz
Distortion	referred to 0 dB (1Vrms) output

Unbalanced	< -90 dB: 10 Hz to 20 kHz < -70 dB: 20 to 100 kHz
Balanced	< -85 dB: 10 Hz to 20 kHz < -70 dB: 20 to 100 kHz

### Square Wave Characteristics

Output Level, into 600Ω	100 mV to 5.00 Vp-p, unbalanced 200 mV to 10.0 Vp-p, balanced
Amplitude Vp-p, Settings	
Unbalanced	100 mV to 999 mVp-p, in 1mVp-p steps 1.00 to 5.00 Vp-p, in 10 mVp-p steps
Balanced	200 to 999 mVp-p, in 1 mVp-p, steps 1.00 to 10.0 Vp-p, in 10 mVp-p steps

Rise Time	300 ns*
Sag	< 5% (above 20 Hz)*
Overshoot	< 5%*
Remote Control	* At outputs > 200 mVp-p a) The programmed Step function only is usable in the Meguro Programmable Audio Analyzer, Model MAK-6600, when connected. b) Connections with a Remote Controller: Possible
GP-IB	Conforms to IEEE Std. 488-1975 Interface Functions: Controller Co No Listener L4 yes Talker T6 Yes Service Request SRO No Remote/Local RL1 yes Parallel Pole PPO No Device Clear DC1 Yes Device Trigger DTO No

General Data	
Power Requirements	AC100V, 115V, 215 or 230 V ±10%, 50/60 Hz; approx. 87 VA
Dimensions, overall	Approx. 280(W) × 111(H) × 430(D) mm
Weight	Approx. 6 kg



# MCR-4041

## LOW DISTORTION OSCILLATOR



### < DESCRIPTION >

The MCR-4041 is an accurate source of two types of waveforms, sine waves with exceptional purity and square waves with excellent characteristics. The frequency range is 10 Hz to 100 kHz settable with key switches. Indicators are provided for the frequency, output levels with appropriate units and the program steps. Operation can be conducted with front panel controls, GP-IB function or by remote control.

The oscillator is highly recommended for use in research, development and in the production line. Wide application can be found as a device in automatic test equipment.

### < FEATURES >

- Sine wave output with very low distortion, less than 0.001% in mid-range.
- Selectable sine or square wave output.
- Square wave output can be set in same manner as for the sine wave.
- ON/OFF control provided for the output.
- Practically flat output characteristics.
- Output settable at floating condition or with one side grounded.
- GP-IB function included as standard.

### < SPECIFICATIONS >

Oscillator Section (Sine and Square Waves)																			
Frequency Range	10.0 Hz to 100 kHz																		
Accuracy of Setting	±5%: 10.0 Hz to 100 kHz ±2%: 100 Hz to 100 kHz																		
Output Impedance	600Ω ±5%, unbalanced or floating																		
Sine Wave Output																			
Output Level Range	0.31 mV to 3.16 Vrms into 600Ω termination																		
Level Settings	<table border="1"> <thead> <tr> <th>Unit</th> <th>Range</th> <th>Unit per Step</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Voltage, V</td> <td>0.31 to 9.99 mVrms</td> <td>0.01 mV</td> </tr> <tr> <td>10.0 to 99.9 mVrms</td> <td>0.1 mV</td> </tr> <tr> <td>100 to 999 mVrms</td> <td>1 mV</td> </tr> <tr> <td>1.00 to 3.16 Vrms</td> <td>0.01 V</td> </tr> <tr> <td>dB</td> <td>-70.0 to +10.0 dB</td> <td>0.1 dB</td> </tr> <tr> <td>dBm</td> <td>-67.7 to +12.2 dBm</td> <td>0.1 dBm</td> </tr> </tbody> </table>	Unit	Range	Unit per Step	Voltage, V	0.31 to 9.99 mVrms	0.01 mV	10.0 to 99.9 mVrms	0.1 mV	100 to 999 mVrms	1 mV	1.00 to 3.16 Vrms	0.01 V	dB	-70.0 to +10.0 dB	0.1 dB	dBm	-67.7 to +12.2 dBm	0.1 dBm
Unit	Range	Unit per Step																	
Voltage, V	0.31 to 9.99 mVrms	0.01 mV																	
	10.0 to 99.9 mVrms	0.1 mV																	
	100 to 999 mVrms	1 mV																	
	1.00 to 3.16 Vrms	0.01 V																	
dB	-70.0 to +10.0 dB	0.1 dB																	
dBm	-67.7 to +12.2 dBm	0.1 dBm																	
Accuracy	At 1 kHz: ±0.2 dB: -30 to +10 dB ±0.5 dB: -70.0 to -30 dB Ref'd to 0 dB																		
Flatness	±0.2 dB: 30.0 Hz to 19.9 kHz ±0.5 dB: 10.0 Hz to 100 kHz																		
Distortion	At 0 dB: < -100 dB: 30.0 Hz to 10.0 kHz < -90 dB: 10.0 Hz to 20.0 kHz < -75 dB: 20 to 100 kHz																		
Square Wave Output																			
Output Level Range	100 mV to 5 Vp-p into 600Ω termination 100 to 999 mVp-p in 1 mVp-p steps 1.00 to 5.00 Vp-p in 10 mVp-p steps																		
Waveform Characteristics (at above 200 mVp-p output)																			
Rise time	300 nsec																		
Sag	< 5%, above 20 Hz																		
Overshoot	< 5%																		
Remote Control																			
	a) With the Meguro Programmable Audio Analyzer, Model MAK-6600, only the Program Step Function is applicable. b) Use of a remote control box is possible.																		
GP-IB																			
	Conforms to IEEE Std. 488-1975 Interface Functions: Controller CO No Listener L4 Yes Talker T6 Yes Service Request SR0 No Remote/Local RL1 Yes Parallel Pole PPO No Device Clear DC1 Yes Device Trigger DT0 No																		
General Data																			
Power requirements	AC 100, 115, 215 or 230 V±10%, 50/60 Hz; approx. 80 VA																		
Dimensions, overall	Approx. 220(W) × 111(H) × 430(D) mm																		
Weight	Approx. 5 kg																		

# MCR-4031

2

## L-F OSCILLATOR



### < DESCRIPTION >

The MCR-4031 is a low frequency oscillator designed for high performance, ease in operation and low cost. It will be found to be most useful in development, testing and servicing of circuits and apparatus covering the low audio up through supersonic frequencies. The frequency range is from 5 Hz to 500 kHz with very low distortion characteristics for sine wave output. In addition, square wave output covering the same frequency range is provided. Sine wave output, referred to 0 dB = 1 Vrms, is from -69.9 dB to +10 dB, or 0.3 mV to 3 Vrms. The output is adjustable over this range in 0.1 dB steps with three attenuator switches. This is an advantage in accurate testing or checking the frequency response in high grade amplifiers and related equipment.

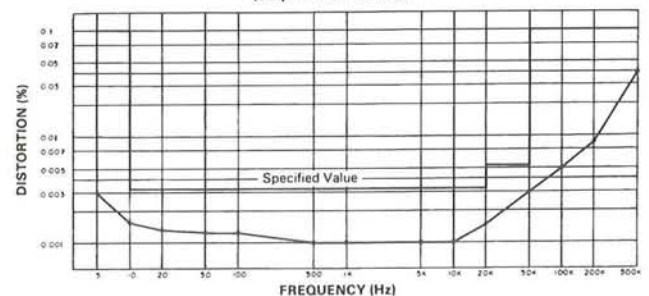
### < FEATURES >

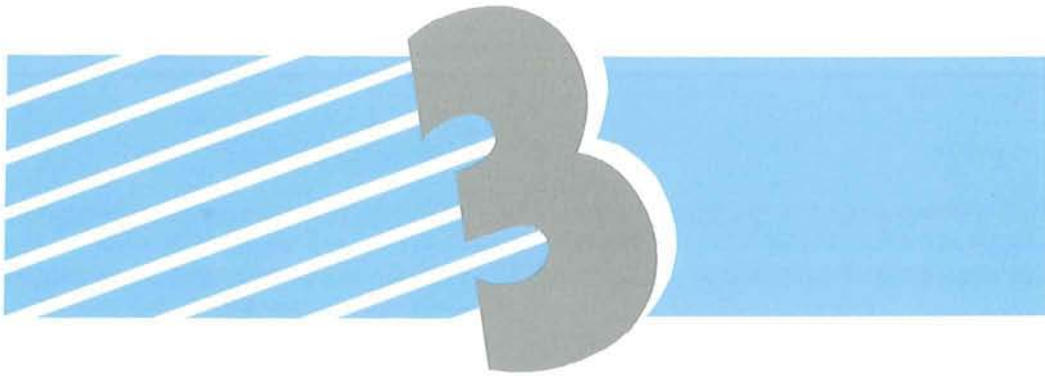
- Built-in high performance characteristics, easy to operate and low in cost.
- Low sine wave distortion, less than 0.003% in 10 Hz to 20 kHz range.
- Three attenuator switches used for output control from -69.9 to +10 dB (0 dB = 1 Vrms) in 0.1 dB steps.
- Frequency output response in practically flat.
- Output ON/OFF switch provided for convenience in S/N measurements.
- Square wave output can be based by switching at  $\pm 0V$  level or at above 0V.
- Attenuators usable for the square wave output.

### < SPECIFICATIONS >

<b>Frequency Range</b>	5 Hz to 500 kHz in five ranges. ×10 5 to 50 Hz ×100 50 to 500 Hz ×1 K 0.5 to 5 kHz ×10 K 5 to 50 kHz ×100 k 50 to 500 kHz				
<b>Dial Accuracy</b>	±(3% + 1 Hz).				
<b>Sine Wave Characteristics</b>					
<b>Maximum Output</b>	+10 dB ± 1 dB.				
<b>Output Range</b>	-69.9 dB to +10 dB (0 dB = 1 Vrms) at open circuit.				
<b>Output Flatness</b>	±0.2 dB; 5 Hz to 20 kHz. ±0.5 dB; 20 to 500 kHz.				
<b>Distortion</b>	Less than 0.003%: 10 Hz to 20 kHz. Less than 0.005%: 10 Hz to 50 kHz (except in ×100 range). Less than 0.1%: 5 Hz to 500 kHz.				
<b>Output Impedance</b>	Approx. 600Ω, unbalanced.				
<b>Output Attenuator</b>	79.9 dB in 0.1 dB steps.				
<b>Square Wave Characteristics (into 600Ω load)</b>					
<b>Output Waveform</b>	<table border="1"> <tr> <td>OV</td> <td></td> <td>OV</td> <td></td> </tr> </table>	OV		OV	
OV		OV			
<b>Output Voltage, max.</b>	4 Vp-p	3.5 Vp-p			
<b>Rise Time (output &gt; -30 dB)</b>	200 nsec	200 nsec			
<b>Sag (output &gt; -30 dB)</b>	< 5%	< 5% above 20 Hz			
<b>Overshoot (output &gt; -30 dB)</b>	< 5%	< 5%			
<b>Output Impedance</b>	Approx. 600Ω, unbalanced.				
<b>General Data</b>					
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V ± 10%, 50/60 Hz; approx. 7VA.				
<b>Dimensions, Overall</b>	Approx. 150(W) × 220(H) × 230(D) mm.				
<b>Weight</b>	Approx. 3 kg.				

TYPICAL DISTORTION CHARACTERISTIC  
(Output Level = +10dBμ)



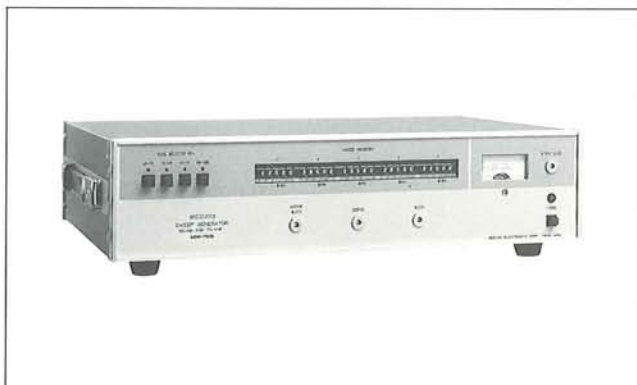


**SWEEP GENERATORS,  
SWEEPSCOPE, DIGIMARSCOPE**

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# MSW-7628

## SWEEP GENERATOR



### < DESCRIPTION >

The MSW-7628 is designed to generate sweep signals for testing the FM circuit in VHF and TV receivers. High accuracy, high stability and high output are built-in characteristics.

Used in conjunction with a sweep oscilloscope and a variable attenuator frequency coverage and circuit tracking operations can be made accurately and with high efficiency.

In particular, this instrument uses digital switches, adjustable from the front panel, for ease in setting the marker frequencies. Rapid changes in these frequencies are possible to meet with test requirements.

The MSW-7628 is so designed that it may be used singly or for signal distribution in a centralized system.

### < SPECIFICATIONS >

	MSW-7628				MSW-7625				
	40 to 72MHz	55 to 100MHz	63 to 110MHz	168 to 240 MHz	455kHz	10.7MHz	LW, MW	SW	FM
<b>BAND</b>	40 to 72MHz	55 to 100MHz	63 to 110MHz	168 to 240 MHz	455kHz	10.7MHz	LW, MW	SW	FM
<b>SWEEP SECTION</b>									
Frequency Range	40 to 72MHz	55 to 100MHz	63 to 110MHz	168 to 240MHz	405 to 505kHz	10.2 to 11.2MHz	0.1 to 3MHz	1.5 to 30MHz	63 to 110MHz
Center Frequency Range	45 to 67MHz	60 to 95MHz	68 to 100MHz	170 to 240MHz	415 to 495kHz	10.3 to 11.1MHz	0.2 to 2.8MHz	2 to 28MHz	68 to 100MHz
Sweep Width	5 to 22MHz	5 to 35MHz	5 to 36MHz	45 to 55MHz	±10 to 50kHz	±100 to 500kHz	0.2 to 2.8MHz	2 to 28MHz	5 to 36MHz
Output Level (50Ω load)	110dBμ (0.316Vrms)				120dBμ (1Vrms)				110dBμ (0.316Vrms)
Output Accuracy	±1dB								
Source Impedance	50Ω								
Repetition Rate	One-half line frequency (sawtooth wave; approx. 10Vp-p)								
Sweep Mode	Wide and narrow (in vicinity of markers)				—		Wide and narrow (in vicinity of markers)		
<b>MARKER SECTION</b>									
Frequency Range	Settable at 5 points in the swept frequency range								
Digital Switches	5 digits				4 digits	5 digits	4 digits		5 digits
Minimum Interval	10kHz				0.1kHz	1kHz	10kHz		
Frequency Accuracy	±50kHz				±500Hz	±5kHz	±500Hz	±5kHz	±50kHz
Output Level	> 4Vp-p; polarity alterable (internally)								
Marking Method	Pulse type								
Load Impedance	100Ω								
Power Requirements	AC100, 115, 215, or 230V ±10%, 50/60Hz								
	Approx. 40VA				Approx. 37VA				
Dimensions & Weight	Approx. 430 (W) × 110 (H) × 340 (D) mm, Approx. 10kg				Approx. 430 (W) × 110 (H) × 340 (D) mm, Approx. 10 kg				
Accessories, furnished	Output cable 1 ea., Marker cable 1ea.								

# MSW-7625

## SWEEP GENERATOR



### < DESCRIPTION >

The MSW-7625 is a sweep signal generator designed for testing and circuit alignment of broadcast radio receivers. Wide frequency band coverage with one instrument enables testing of the IF, LW, MW, SW and FM bands—separate generators are not required as heretofore.

The MSW-7625 can be used singly or for signal distribution in a centralized system.

# MSW-721E

## AM-FM RADIO IF SWEEPSCOPE



### < DESCRIPTION >

The MSW-721E is a compact visual alignment generator primarily designed for testing the I-F circuits in the AM and FM radio receivers, namely, in two bands at 455 kHz and 10.7 MHz respectively.

In the sweep generator, a variable capacitance diode is used for the frequency modulation. A sawtooth waveform voltage at one-half the line frequency is applied to the variable capacitance diode for the sweep action and also to the CRT circuit for the horizontal sweep. An automatic level control circuit maintains the output at a constant level and a stepped attenuator provides the output control over a 60 dB range.

The five frequency markers for each I-F band are produced for intensity modulation. The markers are superposed directly on the response curve and do not pass through the test circuit.

The oscilloscope section for the response curve display consists of a sensitive vertical amplifier and 130 mm (5 in.) CRT.

### < FEATURES >

- Minimum control adjustments, and external connections.
- Provision for calibration of the trace amplitude.
- Minimum bench space requirements.

- In addition, the MSW-7620A Sweep Generator is in production.

The MSW-7620A is a sweep generator, specially adapted for use during IF circuit adjustments of AM/FM radio sets in the production line. Used in conjunction with a sweep oscilloscope and a variable attenuator, tests can be made accurately and with high efficiency.

In particular, this instrument uses digital switches, adjustable from the front panel, for ease in setting the marker frequencies. Rapid changes in these frequencies are possible to meet with test requirements. The MSW-7620A can be used singly or for signal distribution in a centralized system.

### < SPECIFICATIONS >

<b>Sweep Oscillator Section</b>	
<b>Center Frequency Range</b>	
BAND A	400 to 500 kHz.
BAND B	9.5 to 11.5 MHz.
<b>Sweep Width, ref'd to Middle of Band</b>	
BAND A	0 to $\pm 50$ kHz.
BAND B	0 to $\pm 1$ MHz.
<b>Output Flatness</b>	
BAND A	$\pm 0.5$ dB at $\pm 50$ kHz sweep.
BAND B	$\pm 0.5$ dB at $\pm 1$ MHz. sweep
<b>Sweep Frequency Linearity</b>	Within $\pm 5\%$ .
<b>Output Level</b>	30 to 100 dB $\mu$ (0.03 mV $\sim$ 0.1 Vrms) across a 50 $\Omega$ load
<b>Output Accuracy</b>	Within $\pm 1$ dB
<b>Sweep Rate</b>	At one-half line frequency for sawtooth wave sweep.
<b>Output Control</b>	50 dB range in 10 dB steps and 0 to 10 dB continuously adjustable with meter indication.
<b>Output Impedance</b>	50 $\Omega$ , VSWR less than 1.2.
<b>Spurious Response</b>	Less than $-20$ dB.
<b>Marker Section</b>	
<b>Marker Frequency</b>	
BAND A	445, 450, 455, 460, and 465 kHz simultaneous display of 5 markers.
BAND B	10.55, 10.625, 10.7, 10.775, 10.85 MHz simultaneous display of 5 markers.
<b>Marker Accuracy</b>	
BAND A	within $\pm 0.1\%$ at $\pm 50$ kHz sweep.
BAND B	within $\pm 0.1\%$ at $\pm 1$ MHz sweep.
<b>Marker Display</b>	Intensity modulation.
<b>Oscilloscope Section</b>	
<b>Vertical Deflection Sensitivity</b>	1 mVp-p/cm; continuously adjustable, equipped with 20 dB attenuator.
<b>Frequency Response</b>	
Vertical	DC to 10 kHz; $-3$ dB.
<b>Input Impedance</b>	Over 100 k $\Omega$ shunted by 50 pF, at input connector.
<b>Input Polarity</b>	Positive or Negative.
<b>Calibrator</b>	0.1 Vp-p
<b>General Data</b>	
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; Approx. 14VA.
<b>Dimensions, overall</b>	Approx. 190(W) $\times$ 275(H) $\times$ 340(D) mm.
<b>Weight</b>	Approx. 5 kg.
<b>Accessories, furnished</b>	Input and output cable 2ea. Termination resistor 1 ea. Cable adapter 1ea.

# MSW-7127

## AM-FM RADIO/TV SOUND DIGIMARSCOPE

3



### < DESCRIPTION >

The MSW-7127 is a sweep signal generator and a 23 cm (9") monitor scope combined in one unit. The swept frequency bands covered are the IF (AM and FM), AM broadcast (0.1 to 3 MHz and 1.5 to 30 MHz), FM broadcast and TV sound channels (low and high). A memory function is included for ease in circuit alignment procedures. Pushbuttons are provided to select the frequency band in which marking frequencies have been preset. Presetting is done with up-down switches installed in the drawer section.

The narrow sweep function enables accurate circuit adjustments.

### < SPECIFICATIONS >

		AM-IF 455 kHz	FM-IF 10.7 MHz	LW-MW Band	SW <sub>1</sub> ~ 4 Bands	FM/TV LOW	TV HIGH
Sweep Section	Sweep Range	405 to 505 kHz	10.2 to 11.2 MHz	0.1 to 3 MHz	1.5 to 30 MHz	63 to 110 MHz	168 to 227 MHz
	Center Frequency Range	415 to 495 kHz	10.3 to 11.1 MHz	0.2 to 2.8 MHz	2 to 28 MHz	68 to 100 MHz	170 to 225 MHz
	Sweep Width	±10 to 50 kHz	±100 to 500 kHz	0.2 to 2.8 MHz	2 to 28 MHz	5 to 36 MHz	45 to 55 MHz
	Output Level	100 dBμ (0.1 Vrms) into 50Ω					
	Output Accuracy	±1 dB					
	Output Impedance	50Ω					
	Output Control	80 dB in 1 dB steps					
	Repetition Rate	One-half line frequency, 25 or 30 Hz					
	Sweep Mode	—			Wide, and narrow (in vicinity of markers)		
Marker Section	Frequency Range	Within each frequency band					
	No. of Markers	Five points in each frequency band					
	Point Setting (Memory method)	4-digit keys	5-digit keys	4-digit keys		5-digit keys	
	Minimum Marker Interval	0.1 kHz	1 kHz		10 kHz		
	Marker Accuracy	±500 Hz	±5 kHz	±500 Hz	±5 kHz	±50 kHz	
	Marker Indication	Simultaneous application; pulse type					
Display Section	CRT	23 cm (9-inch); electromagnetic deflection					
	Vertical Sensitivity	1 mV/DIV, variable; equipped with 20 dB attenuator					
	Vertical Response	DC to 10 kHz					
	Input Impedance	Approx. 100 kΩ					
	Calibration Voltage	0.1 Vp-p					
General	Power Requirements	AC 100V, 115V, 215V, or 230V ±10%; approx. 65VA					
	Dimensions, overall	Approx. 230 (W) × 330 (H) × 370 (D) mm					
	Weight	Approx. 10.5 kg					
	Accessories, furnished	Output cable 1ea., Input cable 1ea.					

■ Option: RF Output Adapter

MO-2951 Band Splitting Filter, 50Ω: 50Ω, AM: DC to 30 MHz and FM: 75 to 130 MHz.

The MSW-7127 is highly recommended for use in the production line for speeding up the testing procedures.

### < FEATURES >

- Frequency coverage: IF (455 kHz and 10.7 MHz), AM (LW: 0.1 to 3 MHz, SW: 1.5 to 30 MHz), FM and Low TV sound (63 to 110 MHz), and High TV sound (168 to 227 MHz).
- Panel switches used in selecting one of six frequency channels.
- Frequency band, markers and the narrow/wide sweep condition can be set with controls in the drawer section (below main panel) and memorized; protection is provided against misoperation due to volatilization.
- A back-up battery is used to retain memory contents when the AC power is switched off.
- Five marking points in any frequency band can be set with up-down keys; PLL control is used for high accuracy.
- Marker frequencies can be set in consecutive order or crossed over within a given band.
- High accuracy in circuit adjustments is possible with automatic follow-up to the marking point at the narrow sweep function; refer to the figures (not applicable in IF bands). (refer to figures, see, page 32)
- Panel adjusters used in setting the sweep width, or speed, at the narrow condition.
- Terminals provided for external control of the channels (bands).

# MSW-7125A

## AM-FM RADIO BAND DIGIMARSCOPE



### < DESCRIPTION >

The MSW-7125A is a high performance digimarscope with the memory function, most suitable for accurate tuning and alignment adjustments of radio receivers in the production line. The digimarscope is a complete unit combining a multiband sweep generator, a frequency marking system and a large screen monitor scope.

The sweep frequency ranges covers IF, LW, MW, SW and FM bands. The required band can be selected with the panel switches, and five stable marking frequencies

in each band can be accurately set with incremental key operations. The narrow band sweep function is provided for high accuracy in alignment.

### < FEATURES >

- One model covers IF (455 kHz, 10.7 MHz), LW, MW (0.1 to 3 MHz), SW (1.5 to 30 MHz) and FM (63 to 110 MHz) bands.
- The frequency bands are selectable with panel switches (1 ~ 6 CH).
- Selections of bands, marker frequencies, narrow/wide can be memorized. The memory is protected from the mis-operations.
- The memory back-up battery is provided.
- The 5 accurate marker frequencies, controlled by PLL, are selectable with the incremental key operations.
- The marker frequencies can be set close together or crossed over.
- Provision for sweep expansion over a narrow range (except for IF band) in vicinity of the marking point; this permits fine alignment (refer to figures, see, page 32).
- Adjuster provided on the panel enables control of sweep speed at the narrow sweep condition.
- Terminals provided for external control for frequency band changeover.

### < SPECIFICATIONS >

		AM-IF 455 kHz	FM-IF 10.7 MHz	LW·MW Band	SW <sub>1</sub> ~ <sub>4</sub> Bands	FM Band
Sweep Section	Sweep Range	405 to 505 kHz	10.2 to 11.2 MHz	0.1 to 3 MHz	1.5 to 30 MHz	63 to 110 MHz
	Center Frequency Range	415 to 495 kHz	10.3 to 11.1 MHz	0.2 to 2.8 MHz	2 to 28 MHz	68 to 100 MHz
	Sweep Width	±10 to 50 kHz	±100 to 500 kHz	0.2 to 2.8 MHz	2 to 28 MHz	5 to 36 MHz
	Output Level	100 dBμ (0.1 Vrms) into 50Ω				
	Output Accuracy	±1 dB				
	Output Impedance	50Ω				
	Output Control	10 dB × 7, 1 dB × 10				
	Repetition Rate	One-half line frequency, 25 or 30 Hz				
Marker Section	Sweep Mode	Wide, and narrow (in vicinity of markers)				
	Frequency Range	Within each frequency band				
	No. of Markers	Five points in each frequency band				
	Point Setting (Memory method)	4-digit keys	5-digit keys	4-digit keys		5-digit keys
	Minimum Marker Interval	0.1 kHz	1 kHz		10 kHz	
	Marker Accuracy	±500 Hz	±5 kHz	±500 Hz	±5 kHz	±50 kHz
Display Section	Marker Indication	Simultaneous application; pulse type				
	CRT	23 cm (9-inch); electromagnetic deflection				
	Vertical Sensitivity	1 mV/DIV, variable; equipped with 20 dB attenuator				
	Vertical Response	DC to 10 kHz				
	Input Impedance	Approx. 100 kΩ				
General	Calibration Voltage	0.1 Vp-p				
	Power Requirements	AC 100V, 115V, 215V, or 230V ±10%; approx. 65VA				
	Dimensions, overall	Approx. 230 (W) × 330 (H) × 370 (D) mm				
	Weight	Approx. 10.5 kg				
Accessories, furnished		Output cable 1ea., Input cable 1ea.				

- Option: RF Output Adapter  
MO-2951 Band Splitting Filter, 50Ω: 50Ω, AM: DC to 30 MHz and FM: 75 to 130 MHz.

# MSW-7124

## AM-FM RADIO BAND DIGIMARSCOPE



### < DESCRIPTION >

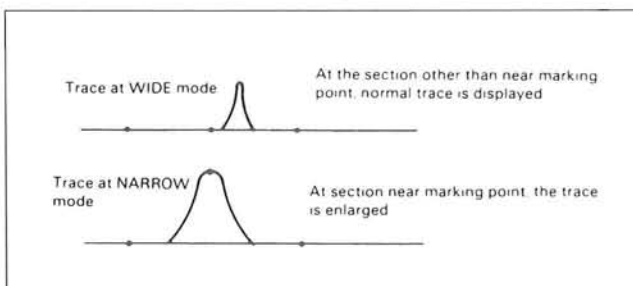
The MSW-7124 is a complete unit combining a sweep generator, a frequency marking system and a large screen monitor scope. The Digimarscope is designed for rapid and accurate alignment of frequency coverage and circuit tracking of radio receivers. Wide frequency band coverage with one instrument enables testing of the LW, MW, SW and FM bands.

Five stable marking frequencies in a given frequency range can be accurately set with 4-digit switches. Rapid changes in these frequencies are possible to meet with test requirements.

### < FEATURES >

- Wide frequency coverage — LW, MW (0.1 to 3 MHz) SW (1.5 to 30 MHz) FM (63 to 110 MHz) bands.
- Panel switching of band selection adopted for ease of use.
- Five marking frequencies, simultaneously displayed; settable in 1 kHz steps (LW, MW) and 10 kHz steps (SW, FM).
- Provision for sweep expansion over a narrow range in vicinity of the marking point; this permits fine alignment. (refer to figures)
- Adjuster provided on the panel enables control of sweep speed at the narrow sweep condition.

#### ■ Enlargement of trace near marking point



### < SPECIFICATIONS >

#### SWEEP SECTION

Sweep Range	LW, MW: 0.1 to 3 MHz. SW: 1.5 to 30 MHz. FM: 63 to 110 MHz.
Center Frequency Range	LW, MW: 0.2 to 2.8 MHz. SW: 2 to 28 MHz. FM: 68 to 100 MHz.
Sweep Width	LW, MW: 0.2 to 2.8 MHz. SW: 2 to 28.5 MHz. FM: 5 to 36 MHz.
Output Level	100 dB $\mu$ (0.1 Vrms) into load 50 $\Omega$ .
Output Accuracy	$\pm 1$ dB.
Output Impedance	50 $\Omega$ .
Attenuation	10 dB $\times 7$ , 1 dB $\times 10$ .
Repetition Rate	One-half line frequency.
Sweep Mode	Wide and narrow (in vicinity of markers).

#### MARKER SECTION

Frequency Range	Within sweep frequency range, 5 points.
Point Setting	LW, MW, SW: 4-digit switch. FM: 5-digit switch.
Min. Marking Interval	LW, MW: 1 kHz. SW: 10 kHz. FM: 10 kHz.
Marker Accuracy	LW, MW: $\pm 500$ Hz. SW: $\pm 5$ kHz. FM: $\pm 50$ kHz.
Marker Indication	Simultaneous, with intensity modulation.

#### DISPLAY SECTION

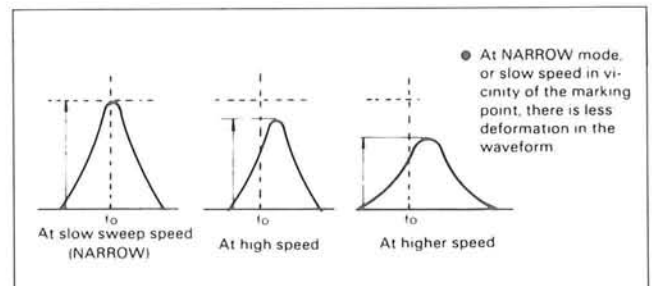
CRT	9-inch, type (23 cm) ; 90°.
Vertical Sensitivity	1 mVp-p/div, variable; equipped with 20 dB ATT.
Vertical Response	DC to 10 kHz
Input Impedance	Approx. 100 k $\Omega$ .
Calibration Voltage	0.1 Vp-p.

#### GENERAL DATA

Power Requirements	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz Approx. 65VA.
Dimensions, overall	Approx. 230(W) $\times$ 305(H) $\times$ 370(D) mm.
Weight	Approx. 9.5 kg.
Accessories, furnished	Output cable 1 ea. Input cable 1 ea.

■ Option: RF Output Adapter/MO-2951 Band Splitting Filter

#### ■ Sweep speed VS. Waveform





# MSW-7128

## AM-IF RADIO BAND DIGIMARSCOPE



### < DESCRIPTION >

The Digimarscope, MSW-7128, is a combination sweep signal generator and a monitor scope specially developed for use in testing and adjusting the 455 kHz band IF circuit in AM radio sets. The output range is from 40 to 120 dB $\mu$  (100  $\mu$ V to 1 Vrms). The center frequency is settable at one of six set channels in the 405 to 505 kHz and for a maximum sweep width of  $\pm 50$  kHz. The circuit characteristics can be displayed in the linear or logarithmic mode. Five marker frequencies can be set with keyboard switches and memorized. The instrument is highly recommended for use in the production line.

### < FEATURES >

- Use of a logarithmic amplifier in the display circuit enables measurements over a wide range.
- Marker frequencies can be set to meet test requirements.
- Five marking frequencies can be set with key switches.
- Marker frequencies can be memorized and are maintained with a back-up battery.
- PLL control system used for marking frequencies for high accuracy.
- Marker frequencies settable in consecutive order or crossed over within a given band.
- With use of manual sweep, amplitude measurements can be made at any point (terminals provided).

### < SPECIFICATIONS >

#### SWEEP SECTION

Sweep Range	405 kHz to 505 kHz (AM-IF Band, settable in 6 channels)
Center Frequency Range	$\pm 50$ kHz
Sweep Width	$\pm 10$ kHz to $\pm 50$ kHz
Output Level (terminated)	40 dB $\mu$ to 120 dB $\mu$ (100 $\mu$ Vrms to 1 Vrms)
Output Accuracy	$\pm 1$ dB
Frequency Linearity	Within 10%
Output Impedance	50 $\Omega$
Attenuation	80 dB in 1 dB steps
Repetition Rate	At and one-half line frequency, and manual

#### MARKER SECTION

Settable Frequency Range	Five frequencies
Point setting	4-digits, with up/down key switch (Memory method)
Min. Marker Interval	0.1 kHz
Marker Accuracy	$\pm 500$ Hz
Marker Indication	At 5 points, simultaneously; intensity mode

#### DISPLAY SECTION

CRT:	9-inch (23 cm), 90° type, electromagnetic deflection
Input Impedance:	Approx. 10 k $\Omega$
Scale Graduation	Switchable; Linear or log (10 dB, 5 dB and 2 dB)

#### GENERAL DATA

Power Requirements	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 80 VA.
Dimensions, overall	Approx. 230(W) $\times$ 330(H) $\times$ 370(D) mm
Weight	Approx. 10.5 kg

# MSW-7130

## DIGIMARSCOPE



### < DESCRIPTION >

The MSW-7130 Digimarscope is a sweep signal generator with a 23 cm (9 inch) monitoring scope for use with appropriate plugin units covering the world-wide TV intermediate frequencies. The memory function is used to attain high accuracy and high stability in operation. The instrument is made up with the following sections-

- Main Frame:

Monitoring scope, marker signal generator, waveform memory, output attenuator and power supply

- Sound IF Unit : 4 to 7 MHz

- Chroma IF Unit : 2 to 7 MHz

- Video IF Unit : 22 to 64 MHz

In each plugin unit, the marker frequencies can be easily set with up/down key switch for high accuracy.

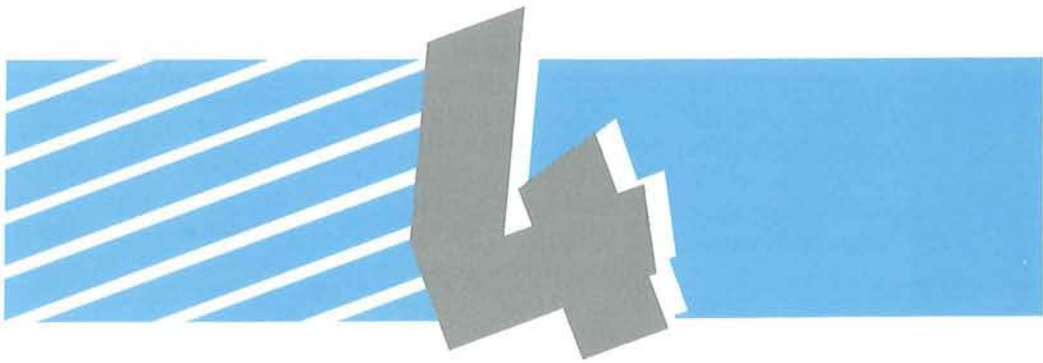
### < FEATURES >

- With one display scope, the TV IF circuits can be tested with use of plugin units designed to cover frequency bands used world over.
- Marker frequencies can be easily set with the up/down key switch.
- Six marker frequencies can be set in each plugin unit; the PLL system is used for high accuracy.
- Marker frequencies can be set in consecutive order or crossed over in a given band.
- The reference characteristic for the circuit under test can be displayed with use of the memory. Again, this memorized waveform can be used for the upper or lower limits for the allowable tolerance.
- A backup battery maintains the memory content.
- Intensity and pulse markers can be applied simultaneously on the displayed waveforms. Furthermore, the pulse marker is applicable on the memorized waveform.

### < SPECIFICATIONS >

	SOUND IF UNIT MU-71B1	CHROMA IF UNIT MU-71B2	VIDEO IF UNIT MU-71B3	
Sweep Section	Frequency Range	4 to 7 MHz	22 to 64 MHz	
	Center Frequency Range	4.5, 5.5, 6.0 & 6.5 MHz ± 0.2 MHz	3 to 6 MHz	26 to 60 MHz
	Sweep Width	±0.3 to ±0.5 MHz, in each band	±1.0 to ±2.5 MHz	±4 to ±8 MHz
	Output Level	30 to 110 dBμ [31.6 μVrms to 0.316 Vrms], into load		
	Output Impedance	75Ω		
	Output Flatness	Within ±1 dB		
	Output Attenuator	80 dB in 1 dB steps		
	Repetition Rate	One-half line frequency		
Marker Section	Sweep Mode	Center freq. locked at No. 3 marker setting		
	Marker Indication	Intensity and pulse markers applicable, separately or simultaneously		
	Marker Setting	Up/Down Key switches; PLL memory system used		
	No. of Markers	6, applied simultaneously		
	Marker Frequencies	Settable at any point in the swept band		
	No. of Digits	4, in 1 kHz steps	4, in 10 kHz steps	
Modulator Section	Frequency Accuracy	±5 kHz		±50 kHz
	Carrier Frequency	4.5, 5.5, 6.0, & 6.5 MHz	25 to 80 MHz, 1 kHz min. interval; PLL	—
	Carrier Output Level	110 dBμrms (75Ω termination)		
	Modulation Frequency	Approx. 3 kHz	400 Hz to 7 MHz	—
Display Section	Modulation Depth	Approx. 30%		
	CRT	23 cm (9-inch) type; electromagnetic deflection		
	Y-axis Sensitivity	1mV/DIV, adjustable; 20 dB attenuator provided		
	Frequency Response	DC to 10 kHz		
	Input Impedance	Approx. 100 kΩ		
General	Calibration Voltage	0.1 Vp-p		
	Operating Temp. Range	0° to 40°C (Performance guaranteed between 5° to 35°C)		
	Power Requirements	AC100, 115, 215 or 230V ±10% 50/60 Hz; approx. 50 VA		
	Dimensions, overall	Approx. 230[W] × 330[H] × 370[D] mm		
	Weight	Approx. 10 kg		
	Accessories, furnished	Output cable 1 ea., Input cable 1 ea.		

■ Plugin Units: • MU-71B1/TV Sound IF Unit (4 to 7 MHz), • MU-71B2/TV Chroma IF Unit (2 to 7 MHz),  
• MU-71B3/TV Video IF Unit (22 to 64 MHz)



## CENTRALIZED SIGNAL GENERATOR SYSTEM

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# MCS-9500

## CENTRALIZED STANDARD SIGNAL GENERATOR SYSTEM

### < DESCRIPTION >

The MCS-9500 is an economical centralized system designed for testing receivers operating in the AM and FM spectrum. It is particularly suited for installations where a limited number of test frequencies is required.

Up to eight spot frequencies – four per frame – can be set as selected in the Long Wave, Short Wave and VHF (FM) bands. Each plug-in unit contains the spot frequency generator, RF output adjuster, modulation frequency selector and modulation level adjuster.

The plug-in feature enables rapid changing of the spot frequency when required to meet test requirements.

### < FEATURES >

- No need of separate signal generators and tedious manipulation of controls at each test position.
- Two types of RF plug-in units are available to meet with variety of appli-

cation, namely, with spot frequency or with variable frequency.

The system can be set up to supply different frequencies to the production lines depending on the frequency bands with the following units-

03-40 LW and SW bands

05-51/05-57 FM band

03-45 LW and MW bands: 100 ~ 1700 kHz

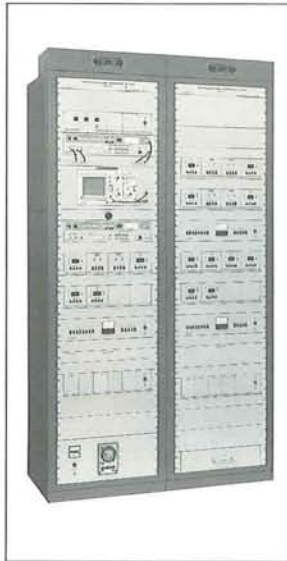
03-46 SW band: 1 ~ 30 MHz

05-54 FM band

05-55 FM band: 75 ~ 91.99 MHz

05-56 FM band: 87 ~ 109.99 MHz

- Each plug-in is provided with adjusters for the RF output and modulation level, and switches for selection of the modulation signal, internal or external.
- The PLL system, when used for the FM band plug-in, results in frequency stability of the highest order.
- Excellent L-R (in the stereo signal) separation characteristics.
- Ease in equipment maintenance.
- Reduction in installation time.



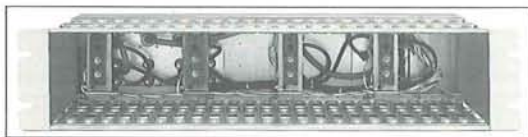
### ● Common Operating Unit MU-95A1



The MU-95A1 is the common operating unit for driving up to eight RF plug-in units, and is provided with regulated DC power supply for plug-in units, basic oscillator for PLL, internal 400 Hz, 1000 Hz modulation sources, switches for monitoring and selection of the RF outputs, metering for modulation – both AM and FM.

It is possible to mix AM with FM plug-in units for one common operating unit.

### ● Frame for Plug-in Unit MU-95B1



The MU-95B1 accommodates up to four RF plug-in units for connection with the MU-95A1.

# MCS-9200

## CENTRALIZED SIGNAL GENERATOR SYSTEM (Compact type)



The MCS-9200 is a compact centralized system consisting of a main frame and plug-in units. It serves admirably as a source of signals for distribution on a small-scale and intended for ease in operation, stability and economy as required on assembly lines. Up to eight plug-in units can be accommodated as selected from two types for AM bands (100 kHz ~ 30 MHz), three types for the FM bands (60 ~ 110 MHz) and TV sound frequency bands in any combination. Furthermore, it is possible to provide four outputs with up to eight different mixed frequencies, AM and FM simultaneously without use of an external mixing unit.

Terminals provided for two external RF input signals for additional mixed outputs when required.

- For details see the MSG-2520 (page 13)

Approx. 420 (W) × 165 (H)  
× 450 (D) mm, 12 kg

■ RF SIGNAL GENERATOR  
● Spot Frequency Plug-in Unit



SPECIFICATIONS

Model	For AM Bands	For FM Bands	For TV sound frequency bands
	03-40	05-51	05-57
Frequency Characteristics Capacity (Overall)	Up to 8 spot frequencies; simultaneous (mixed) output possible		
Range	1 spot frequency per plug-in LW to SW4 bands (100 kHz ~ 30 MHz)	1 spot frequency in FM broadcast band; settable in 10 kHz steps.	1 spot frequency in 168 MHz to 250 MHz; settable in 10 kHz steps.
Oscillator	Crystal-controlled		
Accuracy	$\pm 1 \times 10^{-4}$ (0 ~ 40 °C)   MW: $\pm 2 \times 10^{-5}$		PLL system with unlock indicator $\pm 2 \times 10^{-5}$
RF Output Characteristics Voltage	120 dB $\mu$ (1 Vrms) into 50 $\Omega$ (ALC provided)		110 dB $\mu$ (0.316 Vrms) into 50 $\Omega$
Impedance	50 $\Omega$ ; VSWR < 1.2		
Spurious output	< -30 dB	< -60 dB	< -40 dB
Modulation Characteristics Function	Each plug-in includes internal/external switchover and adjustable level control		
Range	AM: 0 ~ 50%	FM 0 ~ 100 kHz 3 range; 10, 25, 100 kHz f.s.	
Internal	400 Hz and 1000 Hz $\pm 3\%$ , Output: 2.5V, Distortion: < 0.003%		
External	Input Impedance: 10 k $\Omega$ $\pm 10\%$ , unbalanced		
	Input Voltage: 1 Vrms at maximum AM and FM		
L-R Separation	Response: $\pm 1$ dB: 50 Hz ~ 10 kHz		Response: $\pm 0.3$ dB: 30 Hz ~ 100 kHz
	—	> 60 dB: 400 Hz, 1000 Hz > 50 dB: 30 Hz ~ 15 kHz	> 50 dB: 400 Hz, 1000 Hz > 40 dB: 30 Hz ~ 15 kHz
Distortion	< 1% at 30% modulation	In demodulated band, 80 to 100 kHz, < 0.025% at 75 kHz deviation	In demodulated band 80 to 100 kHz, < 0.05% at 75 kHz deviation
Signal-to-Noise Ratio	> 70 dB at 30% modulation	> 75 dB at 75 kHz deviation	> 60dB at 75 kHz deviation
Dimensions and Weight	Approx. 105(W) $\times$ 100(H) $\times$ 250(D)mm; approx. 2 kg		

■ VARIABLE FREQUENCY PLUG-IN UNIT



SPECIFICATIONS

Model	AM Bands		FM Bands		
	03-45 (LW, MW)	03-46 (SW)	05-54 ( $\pm 1$ MHz)	05-55 (FM-J)	05-56 (FM-U)
Frequency Characteristics Frequency Range	100 kHz ~ 1700 kHz	1 MHz ~ 30 MHz	Within $\pm 1$ MHz of 1 spot frequency in FM band	75 MHz ~ 91.99 MHz	87 MHz ~ 109.99 MHz
Oscillator	PLL system with unlock indicator and ON/OFF switch				
Setting	4 digit switches			5 digit switches	
Minimum Interval	1 kHz		10 kHz		
Frequency Accuracy	$\pm 2 \times 10^{-6}$	$\pm 2 \times 10^{-5}$	$\pm 2 \times 10^{-6}$		
RF Output Characteristics Voltage	120 dB $\mu$ (1 Vrms) into 50 $\Omega$ (ALC, provided)	114 dB $\mu$ (0.5 Vrms) into 50 $\Omega$ (ALC provided)	120 dB $\mu$ (1 Vrms) into 50 $\Omega$ (ALC provided)		
Output Impedance	50 $\Omega$ ; VSWR < 1.2				
Spurious Output	< -40 dB	< -30 dB	< -60 dB		
Modulation Characteristics Function	Each plug-in unit includes internal/external modulation switchover, and adjustable level control.				
Range	AM: 0 ~ 50%		FM: 0 ~ 100 kHz in 3 ranges (10, 25, 100 kHz)		
Accuracy	$\pm 5\%$				
Internal	400 Hz and 1000 Hz $\pm 3\%$ (Output: 2.5V, Distortion: < 0.003%)				
External	Impedance: 10 k $\Omega$ $\pm 10\%$ ; unbalanced				
	Input Voltage: 1 Vrms at maximum AM and FM				
L-R Separation	Frequency Range: 50 Hz ~ 10 kHz $\pm 1$ dB.		Frequency Range: 30 Hz ~ 100 kHz $\pm 0.3$ dB		
	—		> 60 dB: 400 Hz, 1000 Hz	> 50 dB: 400 Hz, 1000Hz	
Distortion	< 1% at 30% modulation		In demodulated band 80 to 100 kHz, < 0.025% at 75 kHz deviation	In demodulated band 80 to 100 kHz, < 0.05% at 75 kHz deviation	
Signal-to-Noise Ratio	> 50 dB at 30% modulation		In demodulated band 80 to 100 kHz, > 75 dB at 75 kHz, deviation	In demodulated band 80 to 100 kHz, > 70 dB at 75 kHz deviation	
Dimensions & Weight	Approx. 105(W) $\times$ 100(H) $\times$ 250(D)mm, 2 kg				

# MCS-7001

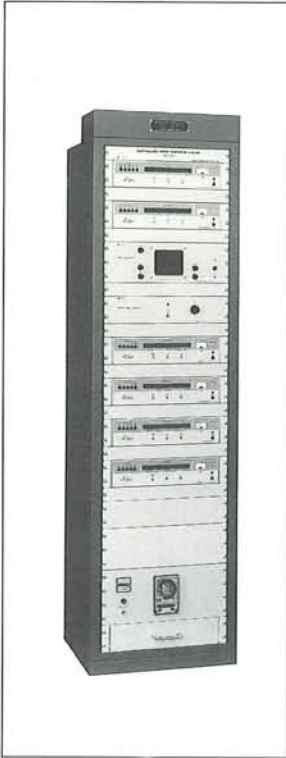
## CENTRALIZED SWEEP SIGNAL GENERATOR SYSTEM

### < DESCRIPTION >

The MCS-7001 Series is a centralized system mainly intended for generation of sweep and frequency marking signals for distribution to the radio production line. The frequency range covers the long, medium, short-wave and FM bands and in addition the 455 kHz and 10.7 MHz IF bands. MSW-7625 and MSW-7628 are used in generating signals for the different bands. Depending on various test requirements and conditions, units can be added or interchanged. The marking frequencies are accurately set with digital switches. The sweep signal can be automatically set for wide (normal) operation or in narrow (expanded) form in vicinity of the marking signals for accurate circuit adjustments. As option, a meter for level indication and a monitor scope can be installed for verification of the output signal conditions.

### < FEATURES >

- Band selection with panel-mounted push button switches.
- Accurate frequency markers settable with digital switches.
- Marker signals can be set within the swept frequency band.
- Marker signals can be set very close together depending on test conditions.
- Wide or narrow (expanded) sweep in vicinity of markers (IF bands excepted).
- At narrow sweep operation, sweep speed can be "slowed down" when required under special test conditions.
- Refer to MSW-7625 (p.28), MSW-7628 (p.28) for specifications.
- This system consists of MSW-7625 only or combination of MSW-7620A in IF bands and MSW-7625/MSW-7628 in RF bands.



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# MCS-983D

## SWEEP OSCILLOSCOPE



### < DESCRIPTION >

This oscilloscope is best suited for testing RF and IF circuits with the sweep generators described in this catalog.

### < SPECIFICATIONS >

<b>Vertical input</b>	
Sensitivity	1 mV and 10m Vp-p/cm.
Bandwidth, -3 dB	DC ~ 10 kHz.
Input Voltage	At V-GAIN max; 5V (Peak: signal + DC)
Input Impedance	Approx. 100kΩ/50pF.
<b>Horizontal Input</b>	
Sensitivity	Better than 0.1 Vp-p/cm.
Bandwidth, -3dB	DC ~ 3 kHz.
Linearity	Within 5%.
<b>Marker Input</b>	
Marking Method	Intensity modulation.
Input Voltage	1 ~ 10Vp-p; polarity, - and +.
Input Impedance	Approx. 100kΩ
<b>General Data</b>	
Power Requirement	AC 100V, 115V, 215V or 230V ±10%, 50/60 Hz; approx. 45 VA.
Dimensions, overall	Approx. 225(W) x 270(H) x 320(D) mm.
Weight	Approx. 7.5 kg
Accessory, furnished	Input cable 1 ea.

## RELATED APPARATUS FOR MCS-9500, MCS-9200, MCS-7001

### ■ AUXILIARY EQUIPMENT

#### ● SIGNAL GENERATING SECTION:

MCS-9601-16M4	AM BAND SIGNAL MIXER	These mixers are intended for distribution of multiple signals generated in a centralized system to test positions. In the AM band, for 8 or 16 inputs, distribution is possible to 1 or 4 positions. In the FM band, 8 signals can be distributed to 4 positions. The mixers feature low insertion loss and low cross-modulation.
MCS-9602-8M4	FM BAND SIGNAL MIXER	
MCS-935-12	AM BAND SIGNAL AMPLIFIER	Bandwidth: 100kHz ~ 30MHz; gain: 20 dB, dynamic range: 130 dB $\mu$ into 50 $\Omega$ , 1 input 2 outputs
MCS-935-24		Bandwidth: 100kHz ~ 30 MHz, gain: 20 dB, dynamic range: 130 dB $\mu$ into 50 $\Omega$ , 2 inputs 4 outputs
MCS-948H-12	FM BAND SIGNAL AMPLIFIER	Bandwidth: 5 ~ 200 MHz, gain: 20 dB, dynamic range: 130 dB $\mu$ into 50 $\Omega$ , 1 inputs 2 outputs
MCS-948H-24		Bandwidth: 76 ~ 110 MHz, gain: 20 dB, dynamic range: 130 dB $\mu$ into 50 $\Omega$ , 2 inputs 4 outputs
MCS-9802	MONITOR OSCILLOSCOPE (X-Y TYPE)	Bandwidth: DC ~ 20 MHz, sensitivity: 5mV ~ 20V/div Input impedance: 1 M $\Omega$ , 20 pF
MCS-966-MS MCS-966-MMS	MONITOR SIGNAL SELECTOR	For used to select and supply the monitor signal outputs of a stereo signal to a monitor oscilloscope.
MCS-991D	TIME DIVISION SIGNAL GENERATOR	For alternately supplying stereo modulation signals, gate 0.1 ~ 9.9 sec.
TDV-1	TWIN TIMER	For use with MSG-2101, 211G-1.
MSG-2101	STEREO SIGNAL GENERATOR	Page - 16
MSG-211G-1	STEREO SIGNAL GENERATOR	Page - 15
MCS-966-J	STEREO JACK PANEL	For MSG-2101 or 211G-1.
MCS-962	AC POWER DISTRIBUTOR	For supplying AC power to each unit in the mounting rack.

#### ● SWEEP SIGNAL GENERATING SECTION:

MCS-9801	MONITOR OSCILLOSCOPE	Ver: bandwidth: DC ~ 50 kHz, sensitivity: 50 mVp-p Hor: bandwidth: DC ~ 20 kHz, sensitivity: 200 mVp-p Zo: > 50 k $\Omega$
MCS-966-6/966-8	MONITOR SIGNAL SELECTOR	For MCS-7001

#### ● SIGNAL GENERATING AND SWEEP GENERATING SECTION

##### ● TIMER: MCS-998S

Automatically turns off and on the AC power operation on a weekly basis.

- **MOUNTING RACK: BTS-5G7**                      Dimensions 570 (W) x 2060 (H) x 450 (D) mm
- MMR-1000**                      Dimensions 530 (W) x 1050 (H) x 475 (D) mm

### ■ SIGNAL DISTRIBUTION COMPONENTS

#### ● TRANSMISSION CABLES

- Coaxial cable: 5D-2W                      For LW, MW, SW bands, 5D-5E                      For FM band
- Connector: N-P-5W                      For 5D-2W,                      N-P-5E                      For 5D-5E
- Markers, sawtooth wave cable: 7 core, 2 core
- Connector: 450P8MK, (Male)                      } For 7 core cable,                      P4MK (Male)                      } For 3 core cable
- 450P8FK (Female)                      }                      P4FK (Female)                      }
- P4MK (Male)                      } For 2 core cable
- Spade Tip                      }

#### ● SIGNAL DISTRIBUTOR: MCS-960 Series

Output Distribution: 2 ~ 15 lines. Input/Output impedance: 50 $\Omega$ , VSWR < 1.2, bandwidth: DC ~ 120 MHz

#### ● SIGNAL DISTRIBUTOR: MCS-9600 Series (LC type)

- MCS-9601-2/MCS-9601-4: 100kHz to 30 MHz; Loss: 3.2 dB (MCS-9601-2), 6.3 dB (MCS-9601-4)
- MCS-9602-2/MCS-9602-4: 10MHz to 250 MHz; Loss: 3.3 dB (MCS-9602-2), 6.6 dB (MCS-9602-4)
- MCS-9603-2/MCS-9603-4: 100kHz to 110 MHz; Loss: 3.5 dB (MCS-9603-2), 6.6 dB (MCS-9603-4)

#### ● MARKERS AND SAWTOOTH DISTRIBUTOR: MCS-961 Series

MCS-961-6: 1 input, 6 output, MCS-961-10 : 1 input, 10 output  
MCS-961-6M4/MCS-961-8M4W: Marker mixer distributor (For MCS-7001)

## RELATED APPARATUS FOR MCS-9500, MCS-9200, MCS-7001

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- **FIXED ATTENUATOR: MR-2120 Series**

For adjustment or equalization of the voltage level at the termination.

Bandwidth: DC ~ 200 MHz, Input/output Impedance: 50Ω, VSWR < 1.2, 1dB to 10dB.

- **TERMINATION RESISTOR: MR-2159**

For used as a dummy load. Bandwidth: DC ~ 200 MHz, Impedance: 50Ω, VSWR < 1.2.

### ■ TERMINAL EQUIPMENT

- **VARIABLE ATTENUATORS**

Bandwidth: DC ~ 120MHz, Input/Output Impedance: 50Ω VSWR < 1.2.

#### SIGNAL GENERATING SECTION:

Model	Attenuation
MCS-975	80 dB in 1 dB steps
MCS-975-S23	80 dB in 1 dB steps with 2 inputs/3 outputs; switchable
MCS-975-12	80 dB in 1 dB steps with 1 input/2 outputs; switchable
MCS-976	100 dB in 1 dB steps

#### SWEEP SIGNAL GENERATING SECTION: MCS-972 Series Attenuation: 50 dB in 2 dB steps

Model	Attenuation
MCS-972	10 dB × 4, 2 dB × 5
MCS-972-S22	10 dB × 4, 2 dB × 5 With 2 inputs, 1 or 2 outputs circuits: switchable
MCS-972-S63	10 dB × 4, 2 dB × 5 With 6 inputs, 3 outputs circuits: switchable
MCS-972-S211	10 dB × 4, 2 dB × 5 With 2 bands, 1 input/1 output circuits: switchable
MCS-972-S633	10 dB × 4, 2 dB × 5 With 6 bands, 3 inputs/3 outputs circuits: switchable
MCS-978	3, 6, 10, 20, 20dB (59dB)

- **DUMMY ANTENNAS:**

For use with the attenuator box at the test position when testing radio sets.

Type available:

MA-2000A 50Ω : 50Ω for AM/FM-IF and Sw band

MA-2000B 50Ω : 75Ω for FM band

MA-2000C 50Ω : 300Ω for FM band

MA-2000D IEC Standard for AM band

MA-2000E For whip antenna, SW band

MA-2000F For car radio, AM band

MA-2000G For car radio, FM band

- **TEST LOOP: MLA-1001B** (page 20)

- **RELAY PANEL FOR SHIELD ROOM: RP-100/RP-200, RP-141/RP-241/RP-481/RP-681**

Used when connecting cables to the shield room.

### ■ RELATED TEST EQUIPMENT

NAME	MODEL	PAGE
SWEEP OSCILLOSCOPE	MCS-983D	38
AUTOMATIC DISTORTION METER	MAK-6571C	71
2-CHANNEL AUTOMATIC DISTORTION METER	MAK-6571W	71
2-CHANNEL AUTOMATIC DISTORTION METER	MAK-6578	70
NOISE METER	MN-446	77
2-CHANNEL NOISE METER	MN-447	76



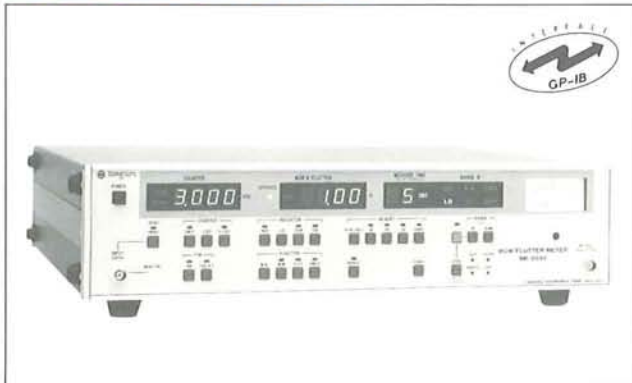


WOW FLUTTER METERS, WIDE  
BAND FLUTTER METERS, VTR  
JITTER METERS, CD JITTER  
METERS, CD JITTER ANALYZER,  
DAT JITTER METER, CALIBRATORS

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# MK-6691

## WOW FLUTTER METER



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### < DESCRIPTION >

The MK-6691 is intended for accurate measurements of the wow flutter content in audio and video recording and reproducing equipment in accordance with test standards of JIS, NAB, DIN (IEC/ANSI) and CCIR. In addition, inclusion of the GP-IB interface permits overall control of functions when used in automatic measuring systems.

For measurements in accordance with DIN and CCIR standards, the sigma figure is provided to measure the random wow flutter over a given period. Again for JIS, NAB, DIN and CCIR measurements, the peak hold feature permits reading the wow flutter with the indicating meter in a stationary condition.

The wow flutter range is from 0.0015% to 3% for testing the highest grade to general purpose recording and playback equipment.

### < FEATURES >

- Inclusion of GP-IB interface permits operation in conjunction with an automatic measuring system.
- With 20ms sampling, the maximum flutter during a given time can be measured.
- With minimum readout time interval above 20ms, the meter reading can be displayed in digital form.
- Measuring time can be set in the range, 3 to 99sec, in 1 sec steps.
- High sensitivity, 0.1mVrms minimum input, permitting determination of wow flutter direct from a reproducing head.
- Three wow flutter value indications: effective for JIS, average for NAB, and peak for DIN (IEC/ANSI) and CCIR.
- Weighted and unweighted characteristics can be determined; in addition, wow and flutter can be separately measured.

### < SPECIFICATIONS >

Input Frequency Range	3kHz $\pm$ 300 Hz, for JIS, NAB, CCIR. 3.15 kHz $\pm$ 300Hz, for DIN (IEC/ANSI).
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Input Voltage Range	0.1 to 30m Vrms and 5mV to 10Vrms.	
Input Impedance	Approx. 300k $\Omega$ ; unbalanced.	
Wow Flutter Range	0.0015% to 3% in 6 ranges.	
Indication	JIS: Effective value. NAB: Average value. DIN (IEC/ANSI), CCIR: Peak value. $\pm$ 5% of full scale of 4Hz.	
Indication Accuracy		
Frequency Characteristics	0.2 to 200Hz in accordance with standards for DIN (IEC/ANSI), NAB, CCIR and JIS.	
Weighted		
Unweighted		
Standards	Response	Roll-off
JIS, NAB	0.5 to 200Hz: -3dB $\pm$ 1dB	-6dB/oct below 0.5Hz -15dB/oct above 200Hz
DIN (IEC/ANSI) and CCIR	0.3 to 200Hz: -3dB $\pm$ 1 dB	-6dB/oct below 0.3Hz -15dB/oct above 200Hz
FIM Measurements	Ref.; DIN 45411	
Filter Characteristics	<b>FIM: ON</b> L.P.F., 500Hz: -3dB $\pm$ 1 dB. Rolloff, < -36dB/oct above 500Hz. <b>160Hz Filter; ON</b> H.P.F. 100Hz: -3dB $\pm$ 1 dB. Rolloff -12dB/oct below 100Hz	
Tape Speed Display	3kHz $\pm$ 1kHz; 4-digit indication.	
Range		
Memory Measurements	Peak hold for JIS, NAB, DIN (IEC/ANSI) and CCIR Sigma Memory for DIN and CCIR.	
Mode	1 $\sigma$ , 2 $\sigma$ and 3 $\sigma$ .	
Sigma Mode	3 to 99 seconds, adjustable in 1 sec steps; timing accuracy within $\pm$ 3%.	
Measuring Time		
Measurement by Sampling	Digital display of meter reading at minimum readout interval of over 20ms timing. Digital display of maximum value at set time in 0 to 99sec (1 sec steps) range where sampling is done at 20ms intervals.	
Wow Flutter Digital Display	Floating zero condition at end of measurement until the next measurement; effective figures, 3 digits.	
Recording Signal Output	3kHz and 3.15kHz.	
Frequency Counter		
Range	10Hz to 99.99kHz in two ranges.	
Indication	4-digit, with overflow indication.	
General Data		
GP-IB Interface	SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT1, C0 (Ref.: IEEE Std. 488-1978).	
Power Requirements	AC 100V, 115V, 215V or 230V $\pm$ 10%, 50/60 Hz; approx. 60 VA.	
Dimensions, overall	Approx. 430(W) $\times$ 115(H) $\times$ 420(D) mm.	
Weight	Approx. 10kg.	
Accessory, furnished	Input/output cord 1ea.	

# MK-669A

## WOW FLUTTER METER



### < DESCRIPTION >

The MK-669A is specially designed for accurate determination of the wow flutter content in audio and video recording and reproducing equipment. Measurements are possible under the DIN (IEC/ANSI), NAB, CCIR and JIS test conditions. In particular, the instrument has two advantages over the conventional meters of this type. One is provision for the sigma figure,  $\sigma$ , to measure the random wow flutter over a given period of time to meet with the DIN and CCIR standards. The other advantage is for the peak hold mode in accordance with the JIS, NAB, DIN, CCIR standard. Moreover, frequency inter-modulation (FIM) in cartridges can be measured with use of a standard record signal (composite 3kHz and 300Hz) for the DIN45411 tests. The 0.01% full scale range permits measurements of very low wow flutter content in highest grade equipment.

### < FEATURES >

- Wide measurable wow flutter range 0.0015% to 3% for testing the highest grade to general purpose recording and playback equipment.
- High sensitivity permitting direct determination from a reproducing head with output as low as 0.1mVrms.
- Measurements possible using center frequencies at 3kHz and 3.15kHz.
- Stationary meter indication possible at the sigma memory mode and peak hold conditions.
- Frequency counter, 10Hz to 99.99kHz, usable independently when required.
- FIM measurements possible in accordance with DIN45411 specifications. Again, wow flutter up to 500Hz can be measured.
- Internal oscillator output at 3kHz and 3.15kHz (crystal-controlled) for use as an accurate standard recording signal.

### < SPECIFICATIONS >

<b>Input Frequency Range</b>	3kHz $\pm$ 300Hz and 3.15kHz $\pm$ 300Hz.
<b>Input Voltage Range</b>	0.1 to 30mVrms, and 5mV to 10Vrms.
<b>Input Impedance</b>	Approx. 300k $\Omega$ ; unbalanced.
<b>Wow Flutter Range</b>	0.0015% to 3% in six ranges.
<b>Meter Indication</b>	JIS: Effective value. NAB: Average value. DIN (IEC/ANSI), CCIR: Peak value.
<b>Indication Accuracy</b>	$\pm$ 5% of f.s. at 4Hz.
<b>Frequency Characteristics</b>	0.2 to 200Hz in accordance with standards for DIN (IEC/ANSI), NAB, CCIR and JIS.
<b>Weighted</b>	
<b>Unweighted</b>	

Standards	Response	Roll-off
JIS, NAB	0.5 to 200Hz: -3dB $\pm$ 1 dB	< -6dB/oct below 0.5Hz < -15 dB/oct above 200Hz
DIN (IEC/ANSI) and CCIR	0.3 to 200Hz: -3dB $\pm$ 1 dB	< -6dB/oct below 0.3 Hz < -15dB/oct above 200Hz

<b>FIM Measurements</b>	Ref.; DIN45411
<b>Filter Characteristics</b>	<b>FIM; ON</b> L.P.F., 500Hz: -3dB $\pm$ 1 dB. Rolloff, < -36dB/oct above 500Hz. <b>160Hz Fil.; ON</b> H.P.F., 100Hz: -3dB $\pm$ 1 dB. Rolloff, -12dB/oct below 100Hz
<b>Tape Speed Indication Range</b>	3kHz $\pm$ 1 kHz; 4-digit indication.
<b>Memory Measurements Mode</b>	DIN, CCIR: Sigma memory. JIS, NAB, DIN CCIR: Peak hold.
<b>Driving Method</b>	Manual, repeat, and automatic.
<b>Sigma Mode</b>	1 $\sigma$ , 2 $\sigma$ , and 3 $\sigma$ .
<b>Measuring Time</b>	5, 10, and 20 sec. (crystal-controlled).
<b>Memory Readout Time</b>	Approx. 2 to 6 sec., adjustable.
<b>Wow Flutter Digital Display</b>	Indicated on the counter during readout time at memory measurement.
<b>Display Method</b>	At 3%, 0.3%, 0.03% ranges: 3 digits, effective. 1%, 0.1%, 0.01% ranges: 2-1/2 digits, effective.
<b>Accuracy</b>	$\pm$ (2% + 1 digit) of f.s.
<b>Recording Signal Output</b>	3kHz and 3.15kHz; accuracy, within 30ppm (crystal-controlled).
<b>Output Connections (on rear panel)</b>	Digital Code

<b>Frequency Counter (at independent operation)</b>	
<b>Range</b>	10Hz to 99.99kHz.
<b>Accuracy</b>	$\pm$ (1 count + reference frequency accuracy).
<b>Reference Frequency</b>	600kHz $\pm$ 1 $\times$ 10 <sup>-4</sup> (0° to 40°C)
<b>Gate Time</b>	0.1, 1 Sec.
<b>Indication</b>	4-digit display.

<b>General Data</b>	
<b>Power Requirements</b>	AC 100V, 115V, 215V, or 230V $\pm$ 10%, 50/60Hz; approx. 25VA.
<b>Dimensions, overall</b>	Approx. 360(W) $\times$ 165(H) $\times$ 290(D) mm.
<b>Weight</b>	Approx. 6kg.
<b>Accessory, furnished</b>	Input/Output cable 1 ea.

# MK-668E

## WOW FLUTTER METER



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### < DESCRIPTION >

The MK-668E is designed for measuring the wow flutter in recording/playback equipment such as recorders for sound and video tapes, discs, and film.

Measurements can be made under standards presently in effect, namely, at 3kHz for the JIS, NAB, and CCIR, and at 3.15kHz for DIN (IEC/ANSI).

Moreover, frequency intermodulation (FIM) in cartridges can be measured with use of a standard record signal (composite 3kHz and 300Hz) for the DIN45411 tests.

The 0.01% full scale range permits measurements of very low wow flutter content in highest grade equipment. Drift, or tape speed, can be measured on a 4-digit frequency counter simultaneously with the wow flutter.

### < FEATURES >

- Wide measurable wow flutter range 0.0015% to 3% for testing the highest grade to general purpose recording and playback equipment.
- Wow flutter measurements under standard weighted and specified unweighted conditions; in addition, wow and flutter values can be separately determined.
- Monitor lamp indicates the proper input voltage level for wow flutter and tape speed measurements.
- Overscale prevention circuit provided.
- Stable and accurate signal output at 3kHz and 3.15kHz (crystal-controlled) available for recording a test tape, disc, etc.
- Two counter gate times, 0.1 and 1 sec, permit frequency measurements to 99.99kHz.
- FIM measurements possible in accordance with DIN45411 specifications. Again, wow flutter up to 500Hz can be measured.

### < SPECIFICATIONS >

<b>Input Frequency Range</b>	3kHz $\pm$ 300Hz, for JIS, NAB, CCIR. 3.15kHz $\pm$ 300Hz, for DIN (IEC/ANSI)
<b>Input Voltage Range</b>	0.1 to 30mVrms, and 5mV to 10Vrms.
<b>Input Impedance</b>	Approx. 300k $\Omega$ ; unbalanced.
<b>Wow Flutter Range</b>	0.0015% to 3% in six ranges.
<b>Meter Indication</b>	Peak value for DIN (IEC/ANSI), CCIR Average value for NAB. Effective value for JIS.
<b>Indication Accuracy</b>	$\pm$ 5% of full scale of 4Hz.
<b>Frequency Characteristics Weighted</b>	0.2 to 200Hz in accordance with standards for DIN (IEC/ANSI), NAB, CCIR and JIS.
<b>Wow Flutter Separation</b>	Wow: 0.5 to 6Hz Flutter: 6 to 200Hz
<b>Unweighted:</b>	

Standards	Response	Rolloff
JIS, NAB	0.5 to 200Hz: -3dB $\pm$ 1dB	< -6dB/oct below 0.5Hz < -15dB/oct above 200Hz
DIN (IEC/ANSI) and CCIR	0.3 to 200Hz: -3dB $\pm$ 1 dB	< -6dB/oct below 0.3Hz < -15dB/oct above 200Hz

#### FIM Measurements Filter Characteristics

(Ref.; DIN 45411)  
**FIM; ON** L.P.F., 500Hz: -3dB  $\pm$  1 dB.  
 Rolloff, < -36dB/oct above 500Hz  
**160Hz Fil.; ON** H.P.F., 100Hz:  
 -3dB  $\pm$  1dB Rolloff,  $\pm$  12dB/oct below 100Hz.  
 3kHz  $\pm$  1kHz; 4-digit indication.

#### Tape Speed Range Internal Recording Signal Frequencies

3kHz and 3.15kHz; accuracy,  $\pm$ 30 ppm (crystal-controlled).

#### Output Terminal Drift

Output voltage:  $\pm$  1 V per  $\pm$  1% drift.  
 Output impedance: 600 $\Omega$   $\pm$  10%, unbalanced.

#### To Recorder

Output voltage: DC 1V  $\pm$  5% at full scale.  
 Output impedance: 600 $\Omega$   $\pm$  10%, unbalanced.

#### Flutter

Output voltage: 1Vrms  $\pm$  5% at full scale.  
 Output impedance: 600 $\Omega$   $\pm$  10%, unbalanced.

#### Frequency Counter (at independent operation)

<b>Range</b>	10Hz to 99.99kHz. Two ranges
<b>Accuracy</b>	$\pm$ (1 count + reference frequency accuracy).
<b>Reference Frequency</b>	600kHz $\pm$ 1 $\times$ 10 <sup>-4</sup> (0° to 40°C).
<b>Gate Time</b>	0.1 sec, 1 sec Two Ranges
<b>Indication</b>	4-digit display.

#### General Data

<b>Power Requirements</b>	AC 100V, 115V, 215V, or 230V $\pm$ 10%, 50/60Hz; approx. 15VA.
<b>Dimensions, overall</b>	Approx. 360(W) $\times$ 165(H) $\times$ 290(D) mm.
<b>Weight</b>	Approx. 5kg
<b>Accessory, furnished</b>	Input/Output cable 1ea.

# MK-668U

## WOW FLUTTER METER



### < DESCRIPTION >

The MK-668U is designed for measuring the wow flutter in recording/playback equipment such as recorders for sound and video tapes, discs, and film.

Measurements can be made under standards presently in effect, namely, at 3 kHz for the JIS, NAB, and CCIR, and at 3.15 kHz for DIN (IEC/ANSI).

Use of two widescale meters permit unweighted (UNWTD) measurements simultaneously with weighted (WTD), wow, flutter and UNWTD characteristics.

The 0.01% full scale range permits measurements of very low wow flutter content in highest grade equipment. Drift, or tape speed, can be measured on a 4-digit frequency counter simultaneously with the wow flutter. Output terminals are provided for the wow flutter in terms of DC and AC for waveform analysis by recording or oscilloscopic display, and for tape speed recording with DC.

Superior performance characteristic of this instrument make it most suitable for its use in the production line, research, inspection, and maintenance purposes.

### < FEATURES >

- Convenient in measurements of UNWTD characteristics and WTD, WOW, FLUTTER and UNWTD characteristics simultaneously.
- Wide measurable wow flutter range 0.001% to 3% for testing the highest grade to general purpose recording and playback equipment.
- Accurate measurement under different standards: Effective value for JIS, average value for NAB, and peak value for DIN, CCIR, IEC, and ANSI.
- Wow flutter measurements under standard weighted and specified unweighted conditions; in addition, wow and flutter values can be separately determined.
- Monitor lamp indicates the proper input voltage level for wow flutter and tape speed measurements.
- Large meter with wide scales for ease in readout.
- Overscale prevention circuit provided.
- Stable and accurate signal output at 3 kHz and 3.15 kHz (crystal-controlled) available for recording a test tape, disc, etc.

- Frequency counter, 10Hz to 99.99 kHz, usable independently when required.
- Two counter gate times, 0.1 and 1 sec, permit frequency measurements to 99.99 kHz.

### < SPECIFICATIONS >

<b>Input Frequency Range</b>	3 kHz $\pm$ 300 Hz, for JIS, NAB, CCIR. 3.15 kHz $\pm$ 300 Hz, for DIN (IEC/ANSI).
<b>Input Voltage Range</b>	5 mV to 10 Vrms.
<b>Input Impedance</b>	Approx. 300 k $\Omega$ ; unbalanced.
<b>Wow Flutter Range</b>	0.0015% to 3% in six ranges.
<b>Meter Indication</b>	Peak value for DIN (IEC/ANSI), CCIR. Average value for NAB. Effective value for JIS. $\pm$ 5% of full scale at 4 Hz.
<b>Indication Accuracy</b>	
<b>Frequency Characteristics</b>	
<b>Weighted</b>	0.2 to 200 Hz in accordance with standards for DIN (IEC/ANSI), NAB, CCIR and JIS.
<b>Wow Flutter Separation</b>	Wow: 0.5 to 6 Hz. Flutter: 6 to 200 Hz.
<b>Unweighted</b>	

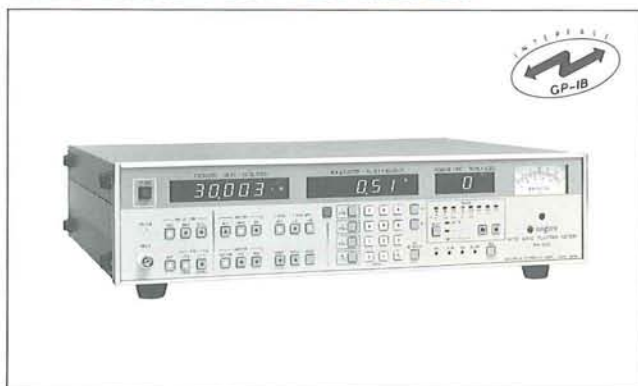
Standards	Response	Rolloff
JIS, NAB	0.5 to 200Hz: -3dB $\pm$ 1dB	< -6dB/oct below 0.5Hz < -15dB/oct above 200Hz
DIN (IEC/ANSI) and CCIR	0.3 to 200Hz: -3dB $\pm$ 1 dB	< -6dB/oct below 0.3Hz < -15dB/oct above 200Hz

<b>Tape Speed Range</b>	3 kHz $\pm$ 1 kHz; 4-digit indication.
<b>Internal Recording Signal Frequencies</b>	3 kHz and 3.15 kHz; accuracy, $\pm$ 30 ppm (crystal-controlled).
<b>Output Terminals (on rear panel)</b>	
<b>Drift</b>	Output voltage: $\pm$ 1 V per $\pm$ 1% drift. Output impedance: 600 $\Omega$ $\pm$ 10%; unbalanced.
<b>To Recorder</b>	Output voltage: DC 1 V $\pm$ 5% at full scale. Output impedance: 600 $\Omega$ $\pm$ 10%; unbalanced.
<b>Flutter</b>	Output voltage: 1 Vrms $\pm$ 5% at full scale. Output impedance: 600 $\Omega$ $\pm$ 10%; unbalanced.

<b>Frequency Counter (at independent operation)</b>	
<b>Range</b>	10 Hz to 99.99 kHz Two ranges.
<b>Accuracy</b>	$\pm$ (1 count + reference frequency accuracy).
<b>Reference Frequency</b>	600 kHz $\pm$ 1 $\times$ 10 <sup>-4</sup> (0° to 40°C).
<b>Input Voltage</b>	100 mV to 10 Vrms.
<b>Input Impedance</b>	Approx. 300k $\Omega$ unbalanced.
<b>Gate Time</b>	0.1 sec, 1 sec Two Ranges
<b>Indication</b>	4-digit display.
<b>General Data</b>	
<b>Power Requirements</b>	AC 100V, 115V, 200V, or 230V, $\pm$ 10%, 50/60 Hz; approx. 15 VA.
<b>Dimensions, overall</b>	Approx. 360(W) $\times$ 165(H) $\times$ 290(D) mm.
<b>Weight</b>	Approx. 5 kg.
<b>Accessory, furnished</b>	Input/Output cable 1 ea.

# MK-616

## WIDE BAND FLUTTER METER



5

### < DESCRIPTION >

The MK-616 is a high sensitivity measuring instrument for determination of wow, flutter and drift in the 10Hz to 300kHz frequency range. It is most useful in determining the wow flutter in tape recorders, VTRs, record players and movie cameras, the flutter in small motors such as used in record players and drives for floppy disks. With use of a rotary encoder, it is possible to measure the revolution and other characteristics of rotating mechanisms-gasoline engines for example. Since a GP-IB interface is included in the instrument for all functions, it can be used in an automatic measuring system. The wow flutter measuring range is 0.0015% to 30% and flutter components to one-fourth of the measuring frequency is possible.

The frequency, drift and revolution are measured in a short time with the high resolution on measurement of the period of the input signal. Output terminals are provided for AC and DC voltages for oscilloscopic observation, plotting and recording the various results, such as starting and stopping characteristics with the F/V signals, and drift and flutter over a given length of time. With use of a frequency analyzer, the cause of flutter can be readily determined.

### < FEATURES >

- Highly accurate measurements of flutter and drift can be made in the frequency range from 10Hz to 300kHz.
- Frequency tuning is automatic and adjustments are not required.
- The flutter rate can be measured at one-fourth of the measuring frequency.
- With use of the synchronized measuring function, flutter per one revolution can be easily measured.
- Measurements can be made in accordance with different standards, namely JIS, and CCIR/DIN in addition to the peak indications.
- It is possible to apply the "hold" with a memory for the maximum peak value of flutter during a measurement and also the sampled value at any period.

- Terminals are provided for output voltages proportional to the flutter with AC and DC and for drift with DC. In addition, analog DC output proportional to the input frequency is available. These outputs are most useful in oscilloscopic observation, recording and analysis of waveforms.
- The F/V (frequency/voltage) output and the flutter AC output are produced at each period of the input signal and the phase delay is a maximum of one period and fixed.
- The GP-IB interface is included and makes possible the installation of the instrument in an automatic measuring system.

### < SPECIFICATIONS >

Flutter Measuring Section	
Frequency Range	10Hz to 300kHz.
Center Frequency Tuning	
Automatic	
Tuning time	Within 2sec after input is applied.
Tuning accuracy	Within $\pm 1\%$ of input frequency; when off by over $\pm 5\%$ , retuning is automatic and within 1 sec.
Manual	Set with keys to the desired frequency.
Input Level Range	100mV to 30Vrms.
Input Impedance	Approx. 100k $\Omega$ ; unbalanced.
Measuring Range	
Drift	0.03% to 30% (minimum resolution, 0.001%); 5-digit display (decimal system).
Wow Flutter	
Overall	0.0015% to 30% f.s., covered in 8 ranges in 0.01, 0.03.. sequence; 5-digit display (decimal system), with minimum resolution at 0.0001%.
Indication Method	
Drift	Peak value.
Flutter	
Peak	Quasi-peak value.
Effective	According to JIS standards.
Peak	According to IEC (CCIR, DIN, ANSI, IEE and EIAJ) standards.
Frequency Characteristic	
Drift	DC to 0.5 Hz.
Flutter	
Weighted	IEC and JIS (in common). -3 dB $\pm 1$ dB: 0.5Hz to meas. freq./4.
Unweighted	-3dB $\pm 1$ dB: 0.5Hz to meas. freq./10.
Rolloff	Lowpass: Better than -6dB/oct. Highpass: Better than -15dB/oct. -24 dB/oct.
Lowpass Filter	
Automatic Setting	At 1/4 or 1/10 of measuring frequency.
Manual Setting	With use of keys; 3-digit setting (decimal system) in 1.00 Hz to 99.9kHz range.
Frequency Setting	
Accuracy	Within -3 dB $\pm 2$ dB at cutoff frequency.

<b>Memory Measurements Method</b>	Peak hold of value of flutter.
<b>Measuring Time</b>	Between 1 to 99sec, settable in 1 sec steps, except 3 to 99sec for CCIR/DIN/JIS form measurement. Within $\pm 5\%$ .
<b>Time Setting Accuracy</b>	
<b>Drive Method</b>	
<b>Local mode</b>	Single and repeat.
<b>Remote mode</b>	Single.
<b>Read-out Time</b>	
<b>Single mode</b>	Until application of start trigger
<b>Repeat mode</b>	Until end of next measurement.
<b>Measurement by Sampling</b>	Digital display of the meter reading with minimum readout interval above 20msec of the selected timing. At one second intervals on the counter. $\pm 5 \times 10^{-5}$ .
<b>Digital Display of Drift</b>	
<b>Digital Display of Flutter</b>	From end of one measurement to start of next measurement.
<b>Measurement Accuracy</b>	With memory $\pm 2\%$ of full scale. Sampling method $\pm 5\%$ of full scale.
<b>Output Terminals</b>	
<b>Drift Output</b>	$\pm 1$ VDC $\pm 5\%$ at full scale of each range. Output impedance: $600\Omega \pm 20\%$ .
<b>Flutter Output</b>	Without lowpass filter, 1% of 30%: 1 Vrms $\pm 10\%$ at each full scale range; output impedance, $600\Omega \pm 20\%$ . With lowpass filter: 1Vrms $\pm 5\%$ at full scale of each range; output impedance, $600\Omega \pm 20\%$ .
<b>Recorder Output</b>	1VDC $\pm 5\%$ at full scale of each range.
<b>External Filter Terminals</b>	Input impedance: $100k\Omega \pm 20\%$ , unbalanced 0.1Vrms $\pm 10\%$ at full scale of each range.
<b>Input Terminals</b>	
<b>Flutter Synchronizing Input</b>	TTL level, positive logic.

#### Frequency and Revolution Measuring Section.

<b>Frequency Range</b>	1Hz to 1 MHz.
<b>Counter only Mode</b>	10Hz to 1MHz.
<b>Flutter Mode</b>	100mV to 30Vrms.
<b>Input Level Range</b>	100k $\Omega \pm 20\%$ ; unbalanced.
<b>Input Impedance</b>	
<b>Reference Frequency</b>	
<b>Counter</b>	
<b>Indication</b>	5-digit display (decimal system), each second.
<b>Measurement Range</b>	1.000Hz to 999.99kHz.
<b>Revolutions Counter</b>	
<b>Indication</b>	5-digit display (decimal system), each second.
<b>Range</b>	1.0000 to 99,999 rpm (Condition: when a transducer is used, the output must be within the range as given.)
<b>No. of Transducer Pulses</b>	10 to 9990 pulses (for each 10 pulses). 1 pulse (for single).
<b>Frequency Conversion</b>	
<b>F/V</b>	1Hz $\sim$ 1MHz 5 range.

<b>Output voltage</b>	10.0V DC $\pm 5\%$ at f.s. for each range, $Z_0 = 600\Omega \pm 20\%$ .
<b>Digital Output</b>	12bit binary cord positive logic. Print command negative logic. Measuring start negative logic. fanout 2TTL level.

#### General Data

<b>GP-IB control</b>	SH1, AH1, T5, TE0, L3, LE0, SR1, PPO, DT1, RL1, C0.
<b>Power Requirements</b>	AC100V, 115V, 215V or 230V $\pm 10\%$ , 50/60Hz; approx. 55VA.
<b>Dimension, overall</b>	Approx. 430(W) $\times$ 115(H) $\times$ 420(D) mm.
<b>Weight</b>	Approx. 11kg.
<b>Accessories, furnished</b>	Input cable 1 ea. Output cable 1 ea.

# MK-617

## WIDE BAND FLUTTER METER



5

### < DESCRIPTION >

The MK-617 is a wideband FM demodulator covering the frequency range of 10 Hz to 100 kHz. It is capable of wow and flutter measurements on audio and video tape recorders, record players and cinefilm equipment. In addition, with use of an rpm transducer, rotational variations in phonomotors and other small motors can be readily measured.

The wow flutter measurement ranges are 0.01% to 10% full scale and flutter components to 1/10 of the measuring frequency. The frequency, drift and rpm can be measured within a short time with high resolution. Output connections are provided for AC and DC voltages for oscilloscopic observation, plotting and recording the various results, such as starting and stopping characteristics with F/V signals, and drift and flutter over a given length of time. With use of a frequency analyzer, the cause of flutter can be readily determined.

The instrument includes many functions for convenience in operation such as the Go/no-go judgement, instant center-frequency tuning and storage and recall of all front-panel settings.

A GP-IB capability (optional) enables all functions to be remotely controlled, making the MK-617 an ideal choice for use in automated systems as well as on the test bench.

### < FEATURES >

- Covers the wide frequency range of 10 Hz to 100 kHz.
- Instant center-frequency tuning dramatically shortens the time required for measurements.
- Wide-range and highly accurate measurement of wow, flutter and drift.
- The cutoff frequency of the lowpass filter used to eliminate the carrier can be arbitrarily selected by front panel keys, or automatically set (to 1/10 of the input signal frequency).
- In addition the peak-value indication, the MK-617 has a wide range of indication methods, conforming to JIS, CCIR and DIN standards.

- A peak hold function stores in memory the maximum wow and flutter value over a set period of time.
- Go/no-go comparison of drift as well as wow and flutter is possible, LEDs and a rear-panel output indicating the comparison results.
- All front-panel function settings can be stored into and recalled from memory when required (up to 10 steps).
- Large, easy-to-read meter.
- An optional GP-IB capability enables easy design of the MK-617 into your automated measurement system.

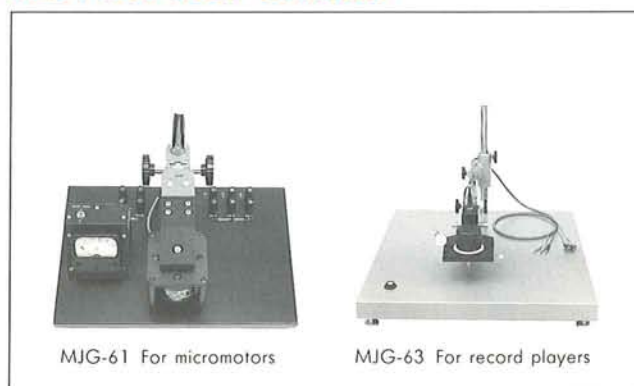
### < SPECIFICATIONS >

FLUTTER MEASUREMENT	
Frequency Range	10 Hz to 100 kHz
Center Frequency Tuning	
Direct	Single key for instant setting
Manual	Set with keys to the desired frequency
Input Level Range	30 mV to 10 Vrms
Input Impedance	Approx. 100 kΩ, unbalanced
Range of Measurements	
Drift	±0.01% to ±10%; 4-digit display
Wow & Flutter	0.01% to 10% in 7 ranges, in 1-3 sequence
Indication Method	
Drift	Peak value
Wow & Flutter	Peak hold for memory mode Rms conforming to JIS standards Peak value conforming to IEC (CCIR, DIN, ANSI, IEE and EIAJ) standards
Frequency Response	
Drift	DC to 0.5 Hz
Wow & flutter	Conforming to IEC and JIS standards
Weighted	
Unweighted	-3 ±1 dB at 0.5 Hz to meas.freq./10
Rolloff	Lowpass: < -6 dB/oct Highpass: < -24 dB/oct
Lowpass Filter	-24 dB/oct Automatic tuning to 1/10 of measurement frequency Manual tuning with keys
Frequency accuracy	Within -3 dB ±1 dB/oct at cut-off
Memory-mode Measurements	
Method	Peak-hold of wow and flutter value
Measuring time	1 to 99 sec range in 1 sec steps
Starting mode	Single or repeated
Readout time	Single mode: Held until start trigger is applied Repeat mode: Held until completion of next measurement
Display of Measured Result	
Drift	Digital: 4 digits each second; Accuracy: ±5 × 10 <sup>-3</sup> , at manually set measuring frequency



# MJG-61·63

## FLUTTER TEST STANDS



MJG-61 For micromotors

MJG-63 For record players

### < DESCRIPTION >

Two models of test stands have been developed for precise measurements of the flutter in micromotors, record players (phonomotors) and similar rotating devices. The stands have been designed specially for use with Meguro's Wide Band Flutter Meters, MK-616 and MK-617.

A rotary encoder coupled to the rotating element is used to simplify measurements and also to eliminate personal error in the measurements. These features are of great advantage when used in the production line and in product development.

The MJG-61, for micromotors, is made up with a rotary encoder, coupler and a millimeter.

The MJG-63, specially designed for record players, consists of a rotary encoder, coupler and a fine adjusting dial gage for high precision in measurements.

### < SPECIFICATIONS >

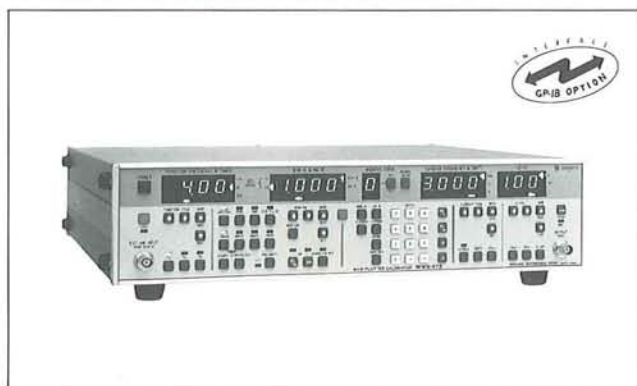
Model	MJG-61	MJG-63
Residual Wow Flutter	Less than 0.03%	Less than 0.02%
Indicator	Millimeter with 2 ranges; 100 and 200 mA	Dial gage, PC-3; Range, 0 to 0.5 mm; minimum reading, 0.01 mm
Rotary Encoder, RX-1000	Maximum allowable revolutions; 5000, r/min. Driving torque: Less than 5 g/cm Axial moment: 35 g/cm <sup>2</sup> Allowable axial load: Radial = 2 kg; thrust = 1 kg Power supply: +5 V ± 5%; 200 mA, max.	
Coupling	2φ or 2.5φ, furnished; others on option	For spindle: No. 1 or No. 2, furnished
Accessories	Connection cords, 3 ea	Spirit level 1 ea Deer-skin wiper 1 ea
Dimensions, W × H × D mm, and Weight	Approx. 305 × 225 × 210; approx. 4.3 kg	Approx. 600 × 440 × 600 (800, max.); approx. 27 kg
Remarks	<ul style="list-style-type: none"> <li>The rotary encoder is thoroughly tested prior to shipment.</li> <li>For MJG-63, the RD type (wow flutter = 0.015%) is available.</li> </ul>	

■ Related instruments; Wide Band Flutter Meters, MK-616 and MK-617.

Wow & Flutter	Digital: 3 digits each second; Accuracy: ±(5% + 1 digit) Analog: accuracy: within ±5% of f.s.
Go/No-Go Judgement	
Drift	Comparison between set limit and measured result
Wow and flutter	Comparison between set limit and measured result
Indication	With red and green LEDs
Limit setting range	Drift: ±0.01% to ±10% Wow and flutter: 0.0001% to 10%
Preset Function	
Store/Recall	Up to 10 steps of panel settings
Remote control	Applicable to store and recall; TTL input, negative logic
Output Connections	
Drift	±10 V at ±10%, max.; resolution, 100 mV; output impedance, 600Ω ± 20%
Wow & flutter	0.01% to 10% in 7 ranges; at full scale in each range: CCIR/DIN: 1 V <sub>peak</sub> ± 10% Rms: 1 V <sub>rms</sub> ± 10% Output impedance: 600Ω ± 20%
Recorder output F/V output	1V ± 5% at each f.s. range Ranges: 1 to 100 Hz, 100 Hz to 1 kHz, 1 to 10 kHz, 10 to 100 kHz 10 VDC at maximum frequency in each range; output impedance, 600Ω ± 20%
External filter	Output impedance: 600Ω ± 20%; 0.1 V <sub>rms</sub> ± 10% at f.s. in each range. Input impedance: 100 kΩ ± 20%, unbalanced; 0.1 V <sub>rms</sub> ± 10% at f.s. in each range.
Outputs for Judgement	
Drift	TTL "1" at No-go; fan-out, 2 (LS-TTL)
Wow & flutter	TTL "1" at No-go; fan-out, 2 (LS-TTL)
<b>FREQUENCY AND RPM MEASUREMENTS</b>	
Frequency	
Display Range	4 digits 10 Hz to 100 kHz
Accuracy	±5 × 10 <sup>-5</sup>
RPM	
Display Range	4 digits 1,000 to 99990 rpm (the rpm transducer output must be within this range)
Transducer pulses	1 to 9999 pulses
Accuracy	±5 × 10 <sup>-5</sup>
<b>GENERAL CHARACTERISTICS</b>	
AC Noise (hum) Eliminator	Highpass filter with cut-off at 300 Hz (-3 ± 1 dB); roll-off, -12 dB/oct
GP-IB Interface	Optional
Power Requirements	AC 100V, 115V, 215V or 230V ± 10%, 50/60 Hz; approx. 24 VA
Dimensions, overall	Approx. 300(W) × 165(H) × 340(D) mm
Weight	Approx. 5.5 kg
Accessories, furnished	Input cord 1 ea Output cord 1 ea

# MWS-672

## WOW FLUTTER CALIBRATOR



5

### < DESCRIPTION >

The MWS-672 is intended for use in accurate calibration of wow flutter meters. It is designed to generate wow flutter signals over a wide frequency range using sine, triangle and square waves.

### < FEATURES >

- A microprocessor is incorporated.
- Calibration signals available for instruments used in JIS, NAB, DIN (IEC/ANSI) and CCIR wow flutter testing.
- Generates standard wow flutter signals in the 10Hz to 100kHz range.
- Digital display of the wow flutter, center frequency, center frequency drift,  $\Delta f$ , modulation frequency output voltage, time and amount of AM.
- Following modes and data can be entered: wow flutter value, center frequency, modulation frequency, output voltage and amount of AM.
- All modes and data can be memorized and used in the sequency mode with simple keyboard manipulation.
- Equipped with a function for JIS operating characteristic check.
- Self-checking function provided.
- Usable as a function generator in the 0.1Hz to 30kHz range.
- On option, the GP-IB interface can be incorporated.

### < SPECIFICATIONS >

<b>Carrier Frequency</b>	
Range	10.00Hz to 99.99kHz in four bands.
Drift Setting	0 to $\pm 19.99\%$ , in one band.
<b>Frequency-Modulation (FM) frequency</b>	
Range	0.1Hz to 30kHz in five bands.
Response Accuracy	$\pm 0.1\text{dB}$ . $\pm 0.01\%$ .
<b>IEC/CCIR/DIN/ANSI pulse Characteristics</b>	
Pulse Width	10ms, 30ms, 60ms and 100ms.
Repetition Period	1 second.
Polarity	Positive and negative.
<b>Frequency Modulation (FM)</b>	
Range Accuracy	0 to 3.999%. $\pm 1\%$ at 3% deviation.
<b>Amplitude Modulation (AM)</b>	
Range Internal Modulator	0 to 100%. 4Hz square wave.
<b>Output Characteristics</b>	
Range Distortion	0.01mV to 6.32Vrms, at open circuit Less than $-50\text{dB}$ at 3.16Vrms into $600\Omega$ .
Residual FM	Less than 100dB at 3kHz deviation in demodulated range, 0.1Hz to 300Hz.
<b>General Data</b>	
Back-up battery provided	AC 100V, 115V, 215V or 230V
Power Requirements	$\pm 10\%$ , 50/60Hz; approx. 100VA.
Dimensions, overall	Approx. 430(W) $\times$ 115(H) $\times$ 475(D) mm.
Weight	Approx. 15.5kg.

# MK-6110A

## VTR JITTER METER



### < DESCRIPTION >

The MK-6110A is designed for accurately measuring the jitter in home videos, tape recorders (VTR) and video disk equipment. In the measurements, use is made of the horizontal synchronizing signal in the reproduced standard composite video signal as recorded in the NTSC or CCIR mode. The maximum jitter in the VTR or video disk is indicated digitally in  $\mu\text{s}$  and % unit per second. This is most convenient for use in research and in the production line. For quantitative measurements and with use of monitoring TV set, the jitter waveform at  $\times 10$ , or magnified to  $\times 30$ , can be set at the center of the screen. The trace can be observed for the top to bottom or from center to bottom condition. Marker lines can be set at the desired spacing at both sides of the waveform for estimation of the jitter. Measurements can be made with the flat response characteristic or with one of the three internal weighting filters, normal (JVC specifications), low or high range as required in the jitter analysis.

### < FEATURES >

- Measurements are made with reproduced signals based on the NTSC and CCIR modes.
- Maximum peak-to-peak values of the jitter indicated in  $\mu\text{s}$  (3-digit) and in % (2-digit) minimizes error in readout.
- The GP-IB interface is included for panel controls (excluding adjusters and power switch) and for data readout for versatility
- Output provided for use with an X-Y recorder makes possible the determination of jitter versus time.
- Use of the upper limit function enables GO/NOGO judgement by means of the digital setting.

### < SPECIFICATIONS >

Television Signal Mode	NTSC and CCIR, selectable
Input Signal Level	0.5 to 3Vp-p
Input Impedance	10 k $\Omega$ $\pm$ 10% unbalanced
Video Weighting Filter Characteristic	Normal (JVC specification); low and high ranges and provision for external (EXT terminals)

Unweighted Filter Characteristic	Flat: 0.4 Hz to 4 kHz $-3\text{dB} \pm 1\text{dB}$ Rolloff: Below 0.4 Hz $< -6\text{dB/oct}$ Above 4 kHz $< -12\text{dB/oct}$
Residual Jitter Range	$< 0.01\ \mu\text{s}$ with Normal (JVC) filter 0.050 to 0.500 $\mu\text{s}$ with 3 digits 0.08 to 0.80% with 2 digits
Voltage Range	Settable at 0.5, 0.75 and 0.85V
Measurement Accuracy	$\pm 5\%$ $\pm 1$ digit of maximum measured value
Indication	Peak-to-peak value at hold
Measuring Method	Measurement at 1 second, display time at approx. 1.1 second, with auto-reset $\mu\text{s}$ unit: 3-digit memory display % unit: 2-digit memory display

#### Monitor TV Indication

Range	0.05 to 0.5 $\mu\text{s}$ (0.05 to 0.15 $\mu\text{s}$ at $\times 30$ ) 0.08% to 0.8% (0.08% to 0.24% at $\times 30$ )
Indication Multiplier	$\times 10$ and $\times 30$ , selectable
Display Accuracy	$\pm 10\%$
Marker Generator Range	5 points: 0.05, 0.1, 0.15, 0.2, 0.25 $\mu\text{s}$ 0.08, 0.16, 0.24, 0.32, 0.39% Continuously adjustable range, at preset VR: 0.05 to 0.5 $\mu\text{s}$ and 0.08% to 0.8%
Marker Accuracy	$\pm 5\%$
Marker Positioning Range	Between 1/2H Settable in vicinity of center of the display
Display Range	Between 1/2V or 1V, selectable
Brightness Adjustment	Jitter waveform and marker line brightness adjustable at the same time
Monitor Output Terminals	Internally connected to the input connector

#### Jitter Output Terminal

Output Level	Approx. 0.1 Vp-p (AC) at 0.1 $\mu\text{s}$ , at $\times 10$
Output Impedance	2k $\Omega$ $\pm 10\%$ unbalanced

#### Recorder Output, Terminal

Output Level	Approx. 0.1 Vp-p (DC) at 0.1 $\mu\text{s}$
Output Impedance	2k $\Omega$ $\pm 10\%$ , unbalanced

#### Vertical Synchronizing Signal

Output Level	Approx. 1Vp-p
Output Impedance	2k $\Omega$ $\pm 10\%$ , unbalanced
Marker Check Output Terminal	$> 3\text{Vp-p}$

#### External Filter Terminals

Input Impedance	Approx. 100k $\Omega$ , unbalanced
Output Impedance	Approx. 2k $\Omega$ , unbalanced
Power Requirements	AC 100V, 115V, 215V, 230V $\pm 10\%$ , 50/60 Hz, approx. 20 VA
Dimensions, overall	Approx. 360(W) $\times$ 165(H) $\times$ 330(D) mm
Weight	Approx. 5.9 kg
Accessories, furnished	Input cable 1 ea. Output cable 1 ea.

# MK-611A

## VTR JITTER METER



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### < DESCRIPTION >

The MK-611A measures the jitter in the home-type VTR and Video Disk Player. In the tests, the reproduced signal of the standard composite video signal, derived from the recorded content of VTR, is detected and measured. The amount of jitter can be shown on the digital display, or on the monitor television set. The two marker lines in the display can be set at a desired spacing to position the jitter waveform between the lines. The enables ease of use in the workshop as well as production.

3 weighing filters are incorporated internally.

### < FEATURES >

- Measurements can be made with the reproduced signals recorded in the NTSC and CCIR modes.
- Maximum values (peak-to-peak) of the jitter easily read out in  $\mu\text{s}$  and in % with three and two digits respectively
- Used in conjunction with a monitor TV set, the jitter display can be magnified 10 or 30 times for easy viewing.
- Two vertical marker lines on a monitor TV screen enables visual measurements of the jitter.
- When a color bar test pattern is used as the reproduced signal, use of the marker lines make possible to measure the color deviation.
- Brightness control is provided for resolution tests, etc., at the same time with jitter measurements.
- Used in conjunction with a digital printer or a digital comparator, the jitter value can be typed out; in addition, code output terminals are provided for GO-NO GO judgement
- When an X-Y recorder is used, the variation of jitter with respect to time can be recorded; output terminals are provided.

### < SPECIFICATIONS >

Television Mode	NTSC and CCIR
Input Signal Level	0.5 to 3Vp-p.
Input Impedance	10 k $\Omega$ $\pm$ 10% unbalanced.
Weighting Characteristics	Normal (JVC specification), Low and High ranges, and for external filter.
Unweighted Response	Flat: -3dB $\pm$ 1dB, 0.4 Hz to 4kHz Rolloff: < -6 dB/oct below 0.4 Hz < -12 dB/oct above 4kHz.
Residual Jitter	Less than 0.01 $\mu\text{s}$ with Normal filter.

### JITTER MEASUREMENT

Range	0.050 to 0.500 $\mu\text{s}$ ; 3-digit display. 0.08 to 0.80%; 2-digit display.
Accuracy	$\pm$ 5% $\pm$ 1-digit of maximum value at range in use.
Indication Mode	Hold at peak-to-peak value.
Measurement Method	Measuring time, 1 second; display time, 1.1 second, with auto-reset. $\mu\text{s}$ unit: 3-digit, recording indication. % unit: 2-digit, recording indication.

### MONITOR TV SET INDICATION

Measurement Range	0.05 to 0.5 $\mu\text{s}$ (0.05 to 0.15 $\mu\text{s}$ at $\times$ 30) 0.08% to 0.8% (0.08% to 0.24% at $\times$ 30)
Display Magnification	$\times$ 10 and $\times$ 30, with manual switching.
Marker Generator Range	5 points; 0.05, 0.1, 0.15, 0.2, 0.25 $\mu\text{s}$ 0.08, 0.16, 0.24, 0.32, 0.39% continuously adjustable range, at rear panel 0.05 to 0.5 $\mu\text{s}$ and 0.08 to 0.8%
Marker Accuracy	$\pm$ 5%
Marker Positioning Range	Between 1/2 H,
Indication Range	Between 1/2V or between 1V
Brightness Control	Jitter waveform and marker lines simultaneously adjustable.
Monitor Output	Internally connected to the input connector.
Jitter Output	Approx. 0.1 Vp-p AC at 0.1 $\mu\text{s}$
Recorder Output	Approx. 0.1 Vp-p DC at 0.1 $\mu\text{s}$ , output impedance, 2k $\Omega$ $\pm$ 10%, unbalanced.
Vertical Sync signal	Approx. 1 Vp-p; output impedance, 2 k $\Omega$ $\pm$ 10%, unbalanced.
Marker Check Output	> 3Vp-p.
Digital Code Output	
Indication Output	4-digit BCD, positive logic.
Control output	Print command, digit and unit selection signals, negative logic
Fan-out	2, maximum.
External Filter Connections	Input impedance: Approx. 100k $\Omega$ unbalanced Output impedance: Approx. 2k $\Omega$ , unbalanced

### General Data

Power Requirements	AC 100V, 115V, 215V or 230V $\pm$ 10%, 50/60Hz; approx. 20VA.
Dimensions, overall	Approx. 360(W) $\times$ 165(H) $\times$ 290(D) mm.
Weight	Approx. 5.9 kg.
Accessory, furnished	Input and output cable 2ea.

# MK-612A

## VTR JITTER METER



### < DESCRIPTION >

The MK-612A measures the jitter in the home-type VTR designed for magnetic tape recording in accordance with NTSC and CCIR standards.

In the tests, the horizontal synchronizing signal in the recording is detected and measured. This signal is derived from the recorded content of a conventional TV broadcast or the reproduced signal of the standard composite video signal. The amount of jitter in the VTR under test, through use of monitor television set, can be magnified 10 or 30 times at approximately the center and the waveform displayed from top to bottom. At this point, two marker lines in the display can be set at a desired spacing to position the jitter waveform between the lines. This enables ease in the measurements. For weighting filters, circuits are incorporated internally for the normal, low, and high ranges. Again, the flat characteristic may be used for analysis of the jitter components.

### < FEATURES >

- Has the measuring function of automatically distinguishing the reproduced signal based on the NTSC and CCIR standards.
- Observation of the displayed jitter is simplified since it can be magnified by 10 or 30 times.
- The width of the jitter can be measured by portraying two marker lines, left and right, on a monitor television set.
- With use of the reproduced signal of a color bar test pattern and the marker lines, the degree of the color shift can be determined.
- Brightness control provided permits jitter measurements on a monitor television set at the same time with tests for the amount of resolution.

### < SPECIFICATIONS >

Measuring Range	0.05 to 0.3 $\mu$ s, and 0.05 to 0.1 $\mu$ s at $\times 30$ magnifications.
Input Signal Level	0.5 to 3Vp-p.
Input Impedance	10k $\Omega$ $\pm 10\%$ , unbalanced.
Indication Multiplier	$\times 10$ and $\times 30$ , with manual switching.
Indication Accuracy	$\pm 10\%$
Marker Generator Range	0.05 to 0.3 $\mu$ s; continuously variable with on/off switch, $\pm 5\%$
Marker Positioning Range	Settable near center of screen in 0.5 H range (except at $\times 30$ magnification).
Visual Weighting Filters	Normal (JVC specification), low, and high ranges, and for external filter
Unweighted Visual Weighting	0dB $\pm 1$ dB: 1Hz to 1kHz -3dB $\pm 1$ dB: 0.4Hz to 4kHz. Rolloff Below 0.4 Hz: $< -6$ dB/oct. Above 4 kHz: $< -12$ dB/oct.
Residual Jitter	0.02 $\mu$ s, with Normal (JVC specification) filter.
Television Signal Mode	NTSC: Scanning, 525 lines; 60 Hz. CCIR: Scanning, 625 lines; 50 Hz. (With automatic switchover.)
Brightness Control	Jitter waveform and marker lines both settable to same brightness.
Monitor Output	Direct internal connections to the input.
Jitter Output	Approx. 0.3 Vp-p at 0.3 $\mu$ s; output impedance, 2k $\Omega$ $\pm 10\%$ , unbalanced.
Vertical Sync Signal	Approx. 1 Vp-p; output impedance, 2k $\Omega$ $\pm 10\%$ , unbalanced.
External Filter Terminals	Input Impedance: Approx. 100k $\Omega$ $\pm 10\%$ , unbalanced. Output Impedance: Approx. 2k $\Omega$ , unbalanced.
Power Requirements	AC 100V, 115V, 215V, or 230V $\pm 10\%$ , 50/60Hz; approx. 8VA.
Dimensions, overall	Approx. 360(W) $\times$ 115(H) $\times$ 305(D) mm.
Weight	Approx. 4.3 kg.
Accessory, furnished	Input and output cords 2ea.

# MJS-690

## JITTER METER CALIBRATOR



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### < DESCRIPTION >

The MJS-690 generates two types of signals, NTSC and CCIR PAL, for calibration of Meguro MK-6110A, MK-611A and MK-612A Jitter Meters. These instruments are widely used in research and testing of the family type VTRs and also video disk equipment. An internal measurement function is included for determining the marker widths in the jitter meter.

### < FEATURES >

- Generation of NTSC and CCIR PAL signal waveforms.
- Known values of jitter are indicated numerically and can be continuously varied.
- Low frequency signals in the 0.001 Hz to 9.99 kHz range for jitter generation are digitally indicated and can be continuously varied.
- A special circuit for the interval measurement function enables readout without troublesome flickering.

### < SPECIFICATIONS >

#### COMPOSITE SYNCHRONIZED SIGNALS

Center Frequencies	
NTSC	63.49 $\mu$ s (15.75 kHz)
CCIR, PAL	64.00 $\mu$ s (15.625 kHz)
Jitter	0.5 $\mu$ s max., adjustable; LED display; Accuracy: $\pm(1\% + 0.005 \mu$ s) of f.s.
Output Level	0.3 to 3 Vp-p, adjustable; fixed values: 0.5, 1, 2 and 3 Vp-p into 75 $\Omega$ ; accuracy: 5%
Output Impedance	75 $\Omega \pm 10\%$

#### LOW FREQUENCY SIGNAL GENERATION

Range	0.001 Hz to 9.99 kHz in five bands
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#### INTERVAL MEASUREMENT

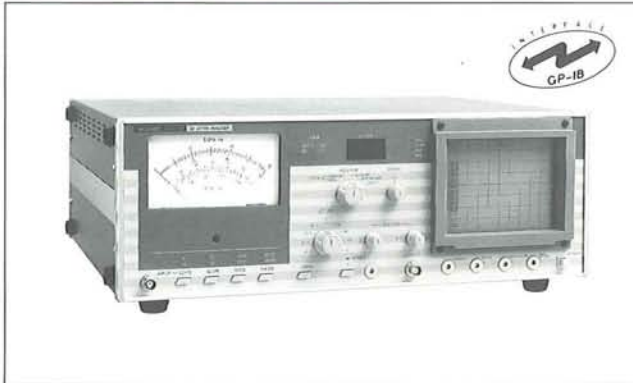
Range	0.3 $\mu$ s to 5 $\mu$ s
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#### GENERAL DATA

Power Requirements	AC 100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 12 VA
Dimensions, overall	Approx. 430(W) $\times$ 165(H) $\times$ 380(D) mm
Weight	Approx. 9.2 kg

# MJA-6331

## CD JITTER ANALYZER



### < DESCRIPTION >

The MJA-6331 is intended for analyzing time jitter of the EFM modulated signals in compact disk (CD) players and similar devices. It is possible to separate each component in the 3T to 11T of the EFM signal and measure the jitter in realtime for meter indication. Furthermore, the values are indicated in digital form with the LED. The frequency/voltage conversion method is used for measurements at high speed. An oscilloscope enables simultaneous observation of the EFM input waveforms and the jitter variation waveforms from 3T to 11T. By presetting the limiting values, the GO/NO judgement can be made easily. In addition, automated operation is possible with the incorporated GP-IB function.

### < FEATURES >

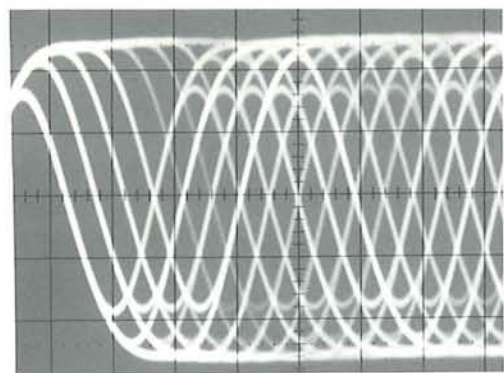
- Direct readout of selected EFM signal, 3T to 11T, for jitter value.
- Jitter waveforms of each 3T to 11T simultaneously displayed on a scope.
- Peak or Sigma values can be selected as required.
- Use of frequency/voltage conversion in measuring for continuous direct reading of jitter variation.
- GO/NO judgement relative to preset values.
- Jitter indicated in analog (meter) and digital (LED) forms.
- Observation of EFM signal at the input or the envelope and eyepattern possible by switchover.
- Polarity of the input EFM waveform, (+) or (-), can be selected by switchover.
- Output of the measured data available with the GP-IB; remote control possible for Slope, Mode, Range, Bit set.
- Envelope method applicable for EFM signal level measurements.

### < SPECIFICATIONS >

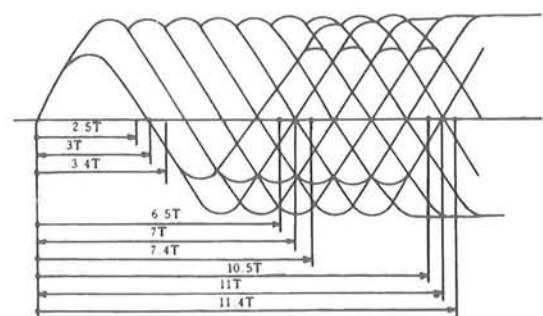
<b>Input Signal</b>	EFM modulated (Clock: 4.3218 MHz)
<b>Input Signal Level</b>	0.1 to 10 V <sub>p-p</sub> in 2 ranges, LO and HI
<b>Input Impedance</b>	100 k $\Omega$ or higher
<b>Measurement Range</b>	3T to 11T, individually, within $\pm 100$ ns
<b>Indication</b>	Peak and Sigma values Meter Peak: Two ranges, 100 and 200ns, full scale Sigma: Two ranges, 30 and 60ns, full scale
<b>Measurement Accuracy</b>	Digital: 3-digit; minimum unit, 1ns Within $\pm 5\%$ of full scale
<b>Polarity</b>	Selectable: At fall, $\downarrow$ , or at rise $\uparrow$
<b>Input Waveform Display</b>	Envelope: 0.2V/div, 2ms/div Eye pattern: 0.2V/div, 0.5 $\mu$ s/div
<b>Jitter Signal Display</b>	Wide: 1V/div, 1ms/div Narrow: 0.2V/div, 1ms/div
<b>Output Connection</b>	Output signal: At same level as the input, or attenuated to 1/10, at open circuit; 75 $\Omega$ Jitter: Approx. 1V <sub>p-p</sub> at 200ns, fullscale, at open circuit; 600 $\Omega$ Recording Signal: Approx. 1VDC at meter full scale GP-IB: For output of the jitter value
<b>Power requirement</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60Hz; approx. 80VA
<b>Dimensions &amp; Weight</b>	Approx. 430(W) $\times$ 165(H) $\times$ 400(D) mm, Approx. 14.5 kg

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### EYE PATTERN



### MEASURING POINTS



# MJM-6310

## CD JITTER METER



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

### < DESCRIPTION: >

The MJM-6310 is designed for simultaneous real time measurements of jitter in the 3T component of the EFM signal and the 3T, 4T and 11T levels used for the compact disks. With use of the judgement function, the measured result, GO/NO GO, is indicated with LED display and further this signal at the TTL level is available when required. In addition, measurements at high speed are possible since the FV conversion system is employed.

### < FEATURES >

- Simultaneous real time measurements are possible with separate indicating meters for the jitter and level.
- Direct readout of the 3T component in the EFM signal.
- Jitter indication is selectable in peak or Sigma (1 sigma) value.
- The F/V conversion system is used for high speed jitter measurements.
- For the EFM signal level measurements, the 3T, 4T or 11T component can be indicated in peak-to-peak values.
- The GO/NO GO judgement for the jitter and levels can be preset.
- The judged output is available at the TTL level.
- The AGC function is used to minimize the effect of amplitude variation in the EFM signal.
- DC output for the different measurements and also the monitor output are provided.

### < SPECIFICATIONS >

<b>Input Characteristics</b>	
<b>Input Signal</b>	EFM Signal
<b>Signal Level</b>	Two ranges: 0.1 to 0.5 Vp-p and 0.5 to 2.5 Vp-p
<b>Impedance</b>	100 k $\Omega$
<b>Jitter Measurements</b>	
<b>Bits</b>	3T
<b>Modes</b>	SIGMA Two ranges: 30 ns and 60 ns PEAK Two ranges: 100 ns and 200 ns
<b>Polarity</b>	At fall  , or at rise 
<b>Accuracy</b>	$\pm 5\%$ of maximum value for each scale
<b>Level Measurements</b>	
<b>Measured Bits</b>	3 T, 4 T and 11 T
<b>Level</b>	0.1 Vp-p to 2.5 Vp-p
<b>Accuracy</b>	$\pm 5\%$ of maximum value for each scale
<b>Judgement Function</b>	As preset on the front panel, GO/NO GO
<b>Output Characteristics</b>	
<b>Monitor Output</b>	Referred to the Input EFM Signal 1:1 $\pm 0.5$ dB at 0.5V range $-20$ dB $\pm 0.3$ dB at 2.5V range
<b>To Recorder</b>	+1 VDC at sigma 60 ns
<b>To Level Meter</b>	+1 VDC at meter full scale
<b>Jitter Output</b>	1 Vp-p at sigma 60 ns
<b>Judgement Output</b>	GO/NO GO signals respectively at TTL level
<b>(Note: BNC connectors used for output signals)</b>	
<b>GENERAL DATA</b>	
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60Hz
<b>Dimensions, overall</b>	Approx. 275(W) $\times$ 160(H) $\times$ 340(D) mm
<b>Weight</b>	Approx. 6 kg
<b>Accessories, furnished</b>	Input/output cable 2 ea



# MJM-631

## CD JITTER METER



### < DESCRIPTION >

The MJM-631 is a practical and accurate instrument for measuring the time jitter of the EFM and EFM RF signal used in the compact disk (CD).

For measurements the 3T component in the EFM signal is extracted and its periodic variation is indicated on the meter.

Indication of the jitter can be selected to read in PEAK or SIGMA values. In addition, a GO/NO function is included for indication above or below a set limit.

### < FEATURES >

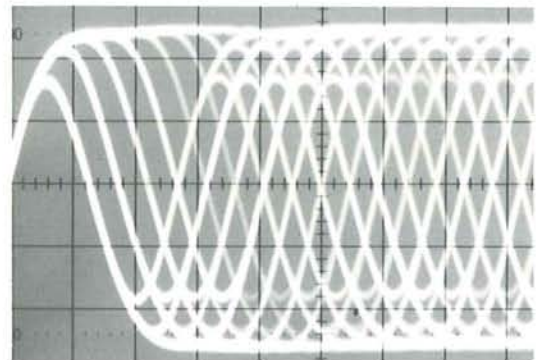
- Direct indication of jitter in the EFM 3T signal.
- Automatic compensation for asymmetry is provided with the ALC function.
- Measurements are possible with either the EFM or the RF (Eye-pattern) signals.
- Periodic variations in the jitter are measured with the FV conversion method continuously at high speed.
- Either the peak or sigma indication of jitter can be selected.
- GO/NO GO function provided for rapid judgement of jitter.
- Output provided for 3T waveforms for oscilloscopic observation, recording, etc.
- Small size, light weight and low cost with high reliability characteristics.

### < SPECIFICATIONS >

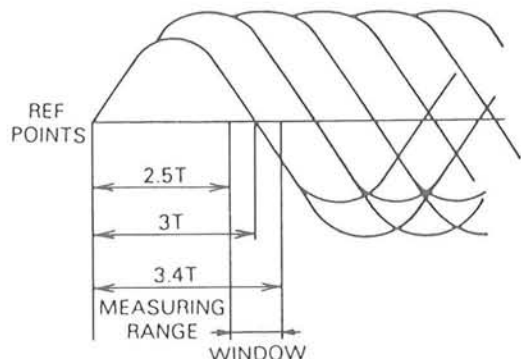
<b>Input Signal</b>	EFM signal, RF signal (Clock: 4.3218 MHz $\pm$ 3%)
<b>Input Signal Level</b>	0.1 to 5Vp-p (DC MAX. 10V)
<b>Input Impedance</b>	100k $\Omega$ or higher.
<b>Input Terminal</b>	BNC connector
<b>Measuring Range</b>	For 3T signal, 2.5 to 3.4T; 100 and 200ns; peak, at full scale. 30 and 60ns; 1 sigma, at full scale. Within 5% of full scale of each mode.
<b>Measurement Accuracy</b>	5ns or less at sigma mode.
<b>Residual Jitter</b>	5ns or less at sigma mode.
<b>Polarity</b>	or
<b>Indication</b>	PEAK and SIGMA, in ns.
<b>Judgement Function</b>	The front panel adjuster is used in setting the upper limit. The "GO" LED (green) will light when the input level is within this limit; the "NO" LED (red) lights when the limit is exceeded.
<b>Monitor Output</b>	JITTER TO SCOPE Probe CAL, Input Signal Monitor RECORDER For the meter indicated value.
<b>Power Requirements</b>	AC 100V, 115V, 215V, or 230V $\pm$ 10%, 50/60Hz; approx. 30VA
<b>Dimensions, overall</b>	Approx. 150(W) $\times$ 220(H) $\times$ 325(D) mm
<b>Weight</b>	Approx. 4.2' kg

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### EYE PATTERN



### MEASURING POINTS



# MJM-6410A

## DAT JITTER METER



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### < DESCRIPTION >

The MJM-6410A measures the important characteristics of the R-DAT (rotary digital audio tape) decks and similar equipment. Measurements are possible for the RF level relative to the PCM of the RF signal or the margin and also the jitter in the selected bit from the PCM.

In jitter measurements, the RF signal is suitably converted from the PCM data of the ETM signal and directly indicated on the analog meter.

It is possible to select the heads A, B or A + B in combination from the PCM data, 0.8T, 1.6T, 2.4T and 3.2T can be selected for different tests of the RF signal. Furthermore for the selected bit with the fixed window width, its position can be manually set or automatically followed up. Thus its position can be shifted and the jitter can be measured even when its distribution is not normal.

The RF level can be measured as required with respect to either PCM for the ETM signal or the margin.

A two-pointer RF level meter enables not only simultaneous measurement of the independent A and B head RF levels on the same scale but also the relative difference between the heads as well.

For both jitter and the RF levels, it is possible to preset the levels as a high-sensitivity comparator for go/nogo testing with blue and red LEDs.

Real-time measurements can be made with signals for monitoring and recording and also with remote control functions.

### < FEATURES >

- Jitter and RF level measurements can be made simultaneously for enhanced efficiency.
- Direct measurement of the jitter in any bit of the ETM signal.
- Jitter indicated in rms or peak value.
- RF head write-in signals can be selected from one of three modes, namely, A, B or A + B heads.
- Continuous measurements and direct readout of RF level and jitter in virtually real time.
- Selection of either rising edge or falling edge of each bit for measurements.

- Recorder output terminals provided for continuous recording of the jitter.
- Monitor output terminals for connection to a scope or other instruments for analysis of the RF characteristics.
- RF meter with two pointers enables comparison of levels in the A and B heads.
- The level points, PCM/MARGIN, of the RF signal per one head can be selected to meet the measuring conditions.
- The window positioning is flexible to meet the conditions for the signal under investigation.
- An automatic centering function is used to follow the jitter, using the window.

### < SPECIFICATIONS >

<b>Overall Characteristics</b>	
<b>Input Signal</b>	ETM modulation signal (clock freq. = 9.408 MHz)
<b>Input Level</b>	0.1 to 5 Vp-p (50 VDC, max.) in two ranges: LOW: 0.05 to 0.5 Vp-p HIGH: 0.5 to 5 Vp-p
<b>Input Impedance</b>	1 MΩ ± 1%, less than 35 pF; unbalanced BNC connector
<b>Signal Polarity</b>	Rising or falling slope, selectable
<b>Judgement Function</b>	Presetable to the maximum value of the jitter meter range and to minimum value of the RF level meter range
<b>Monitor Output</b>	Usable for monitoring the input ETM signal and when an oscilloscope probe (10:1) is used in calibration; the output level is unity referred to the input signal
<b>Remote Control Connections</b>	24 pin type used for — (rear panel)
<b>Input</b>	All switches except for power and adjusters
<b>Output</b>	Jitter, Levels A and B; approx. 1 V at full scale, Zo = 1 kΩ
<b>External Switching Pulses</b>	
<b>Frequency</b>	33 Hz
<b>Duty ratio</b>	50%
<b>Input level</b>	0.5 to 5.0 Vp-p (AC coupling, high Z)
<b>Polarity</b>	+ or — (rear panel switching)
<b>Phasing</b>	Settable at suitable value (rear panel adjuster)
<b>Jitter Meter Characteristics</b>	
<b>Measurement Range</b>	± 45 ns at following switch settings: 0.8T, 1.6T, 2.4T and 3.2T
<b>Measurement Mode</b>	Jitter for heads A, B and A/B (automatic discrimination with switch setting)
<b>Indication</b>	Peak value: To 90 ns, on 110 ns scale Rms value: To 35 ns, on 40 ns scale
<b>Jitter Resolution</b>	0.5 ns
<b>Residual Jitter</b>	Less than 3 ns
<b>Recorder Output</b>	Approx. 1 V at full scale; Zo = 1 kΩ
<b>Judgement Indication</b>	GO/NO GO with LEDs
<b>RF Level Meter Characteristics</b>	
<b>Measurement Range</b>	LOW: 0 to 0.5 Vp-p HIGH: 0 to 5 Vp-p (linked with input range)
<b>Indication</b>	Peak-to-peak value
<b>Frequency Response</b>	Accuracy: ± 5% of f.s. at 1.5 MHz 70 kHz to 6 MHz (within ± 3% at 4.7 MHz)
<b>Judgement Indication</b>	GO/NO GO with LEDs for A and B respectively
<b>General Data</b>	
<b>Operating Temperature</b>	0 to 40°C (5° to 35°C for guaranteed operation)
<b>Power Requirements</b>	AC100V, 115V, 215V or 230V ± 10%, 50/60 Hz; approx. 32 VA
<b>Dimensions, overall</b>	Approx. 297(W) × 161(H) × 347(D) mm
<b>Weight</b>	Approx. 6 kg
<b>Accessory, furnished</b>	Input cable 1ea.

# MHC-40

## MAGNETIC HEAD CHECKER



### < DESCRIPTION >

The MHC-40 is specially designed for measurements and checking of magnetic heads, both stereo and mono, used in tape recorders. It is possible to measure the playback sensitivities, frequency response and differences in the sensitivities relative to low and high frequencies.

With use of a standard tape with composite low and high frequencies recorded at prescribed levels, the azimuth adjustment can be made during measurements by observing the two-pointer level meter.

Selection of the various modes of measurements can be made with the panel switch or by remote control making this instrument most suited for use in the production line.

### < FEATURES >

- Readout of measurements on a two-pointer meter with 0 to 30dB linear scale at each measuring range.
- Measurements can be made during azimuth adjustments.
- Measuring items can be selected with remote control to speed up testing in the production line.
- A bandpass filter is included to eliminate the effect of noise in the signals.
- Output connections on the rear panel are provided for waveform observation on a scope and for monitoring the sound output on a loudspeaker.

### < SPECIFICATIONS >

Measurement Frequencies	Low Band: 333, 500 Hz and 1 kHz High Band: 6.3, 8 and 14 kHz
Input Impedance	1M $\Omega$ , unbalanced; less than 70 pF in shunt
Level Measurement Range	-50 to -90 dB in 3 ranges (where 0 dB = 1 Vrms) -50 to -80 dB -55 to -85 dB -60 to -90 dB
Indicating Meter	Linear 0 to -30 dB scale with two pointers, red for right and black for left channels respectively Within $\pm 1$ dB ( $\pm 0.3\%/^{\circ}\text{C}$ )
Accuracy	$\pm 0.5$ dB
Accuracy between Measurement Ranges	
Filter Characteristics	
Passband Frequencies	333 Hz to 1 kHz : $\pm 0.3$ dB 6.3 to 14 kHz : $\pm 0.5$ dB
Cut off Characteristics	Below 333 Hz: Approx. 6 dB/oct Above 1 kHz: Approx. 60 dB/oct Below 6.3 kHz: Approx. 60 dB/oct Above 14 kHz: Approx. 15 dB/oct
Noise Level	< -95 dB, referred to the input, with input terminals shorted
Output for Azimuth	Output level: Approx. 1 Vrms Frequency : $\pm 1$ dB, 6.3 to 14 kHz
Output to Monitor loudspeaker	Level: 0 to 0.3 Wmax. into 8 $\Omega$ , continuous adjustable Frequency: 3 kHz
Phase Confirmation Output	For left and right channels -Level: Approx. 1 Vrms Frequency: 3 kHz
Output for Wow-Flutter Measurement	Use one channel of phase confirmation output
Stability VS Change in Line Voltage	$\pm 10\%$ line voltage variation not to affect above specifications
Power Requirements	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 12 VA
Dimensions, overall	Approx. 210(W) $\times$ 230(H) $\times$ 310(D) mm
Weight	Approx. 5.3 kg
Accessories, furnished	Input cord 2 ea Output cord 2 ea



## MODULATION METERS

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# MDA-453

## FREQUENCY MODULATION METER



### < DESCRIPTION >

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The MDA-453 is a high-performance instrument for use of measuring and adjusting FM signal generators and similar broadcast equipment as to a frequency deviation, harmonic and intermodulation distortions, and signal-to-noise ratio in the 10.7 MHz IF band and 22 to 550 MHz FM broadcast band. In particular, it is useful in measuring and adjusting the channel separation, distortions, and signal-to-noise ratio as it is designed to provide a superior discriminator differential gain, AF circuit frequency response flatness, distortion characteristic, and low noise involved.

The MDA-453 provides a range of frequency deviation as wide as 0 to 300 kHz in five full scales: 3, 10, 30, 100, and 300 kHz. It, also, provides a demodulation frequency range 10 Hz to 100 kHz. If the built-in high-pass filters and low pass filters are used in combination, the demodulation frequency range can be set depending on specific purpose of measurement.

### < FEATURES >

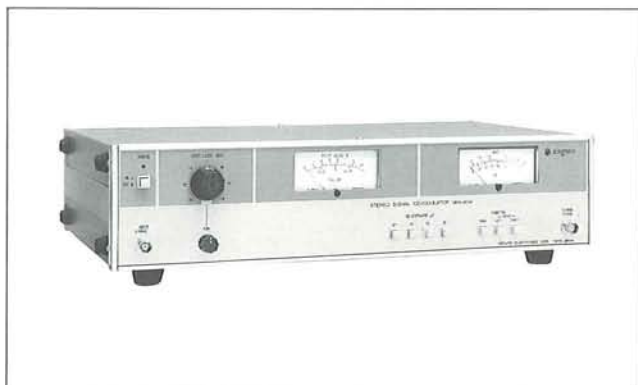
- Tuning can be made easily and quickly.
- The frequency discriminator provides excellent differential gain and the AF circuit is very low in the distortion and noise.
- The direct-coupled amplifier in the MDA-453 provides a flat frequency response in a wide frequency range and little channel separation deterioration due to the stereo signal demodulation, with measurement accomplished in rather short time.
- The built-in high-pass and low-pass filters are available in combination for setting any of 12 demodulation frequency ranges as many.

### < SPECIFICATIONS >

Carrier Frequency Range	10.7 MHz $\pm$ 100 kHz and 22 to 550 MHz in 6 ranges:
Frequency Dial Error	$\pm$ 1%.
Input Level Range	94 to 120 dB $\mu$ (0.05 to 1Vrms).
Input Impedance	Approx. 50 $\Omega$ , unbalanced
Deviation Measurable Ranges	Five ranges for 3, 10, 30, 100, and 300 kHz full scale deviations
Deviation Meter Error	$\pm$ 5% of each full scale.
Differential Gain	0.1% in range of 2.5MHz $\pm$ 500kHz.
Signal-to-Noise Ratio	Greater than 80dB at 10.7MHz IF and 22 to 130MHz carrier and Greater than 76dB at 130 to 550MHz carrier, with 100kHz deviation and 100kHz AF bandwidth.
Channel Separation	Better than 60dB at 30Hz to 7kHz AF, and better than 54dB at 7 to 15kHz AF, as measured in 100kHz frequency deviation range.
Output Impedance	Approx. 600 $\Omega$ unbalanced.
AF Circuit Distortion	Less than 0.005% at 20Hz to 50kHz AF. Less than 0.01% at 50 to 100kHz AF.
De-emphasis	25, 50, and 75 $\mu$ ec.
High-Pass Filters	80Hz and 250Hz. and out.
Low-Pass Filters	4kHz, 20kHz, and 100kHz.
Power Requirements	AC100V, 115V, 215V, or 230V $\pm$ 10%, 50/60Hz; approx. 30 VA.
Dimensions, overall	Approx. 430(W) $\times$ 165(H) $\times$ 370(D) mm.
Weight	Approx. 12 kg
Accessories, furnished	Output cable 2 ea.

# MDA-456A

## STEREO SIGNAL DEMODULATOR



### < DESCRIPTION >

The MDA-456A is an exceedingly faithful demodulator of stereo signals based on the standard AM-FM system.

In use, the left L and right R signals are demodulated by sampling the FM stereo composite signal. Again, for a monophonic input signal, the signal output is available without passing through the stereo demodulator circuit. Long term stability and high precision together with low distortion, high signal-to-noise ratio and high separation characteristics have been built-in. These advantages make the MDA-456A most suited, when used with a linear detector, for use in testing and checking FM signal generators, broadcast equipment and for research. Three de-emphasis circuits, 25, 50 and 75  $\mu$ s, are included and enable obtaining measured data in same manner as in actual receiving sets.

### < FEATURES >

- The zero phase condition can be detected since a peak level detection circuit for zero pilot phase is included.
- Two output connections are provided to enable the separation between the left and right channels to be measured with a two-channel input voltmeter.

### < SPECIFICATIONS >

<b>Input Characteristics</b>	
<b>Signal Frequency Range</b>	Monophonic : 30 Hz to 80 kHz Stereo : 50 Hz to 53 kHz Pilot : 19 kHz
<b>Level Range</b>	-15 to +15 dBm (0 dBm = 0.775 Vrms); 30 dB in 1 dB steps Approx. 600 $\Omega$ , unbalanced
<b>Impedance</b>	
<b>Indicator Scale (Pilot level)</b>	0 to 15%
<b>Output Characteristics</b>	
<b>Frequency Range</b>	Monophonic Signal: 30 Hz to 80 kHz, within $\pm 0.5$ dB Stereo Signal: 50 Hz to 15 kHz, within $\pm 0.5$ dB
<b>Level</b>	0 dBm (= 0.775 Vrms) at maximum modulation, into load
<b>Impedance</b>	Approx. 600 $\Omega$ , unbalanced
<b>Separation</b>	Over 72 dB: 100Hz to 10 kHz Over 50 dB: 30 Hz to 15 kHz
<b>Distortion</b>	Monophonic: Less than 0.003% Stereo: Less than 0.005%
<b>Signal-to-Noise Ratio, (S/N)</b>	Over 90 dB at 0 dBm
<b>De-emphasis</b>	25, 50 and 75 $\mu$ s, within $\pm 0.5$ dB of standard de-emphasis
<b>Indicator Scale</b>	Pilot Level: 0 to 15% Output Level: -20 to +3 dBm, 0 to 100%
<b>General Data</b>	
<b>Power Requirements</b>	AC100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60Hz; approx. 10VA
<b>Dimensions, overall</b>	Approx. 430(W) $\times$ 118(H) $\times$ 345(D) mm
<b>Weight</b>	Approx. 7 kg
<b>Accessories, furnished</b>	Input and output cords 2 ea

# MDA-470A

## AMPLITUDE MODULATION METER



### < DESCRIPTION >

6

The MDA-470A is a linear detector for measurements of modulation, distortion, signal-to-noise ratio and other characteristics in standard signal generators, AM transmitters and other related equipment operating in the medium to short wave bands, 500 kHz to 30 MHz. Low pass and highpass filters are included so that by switching, the demodulated bandwidth can be selected depending on the required tests.

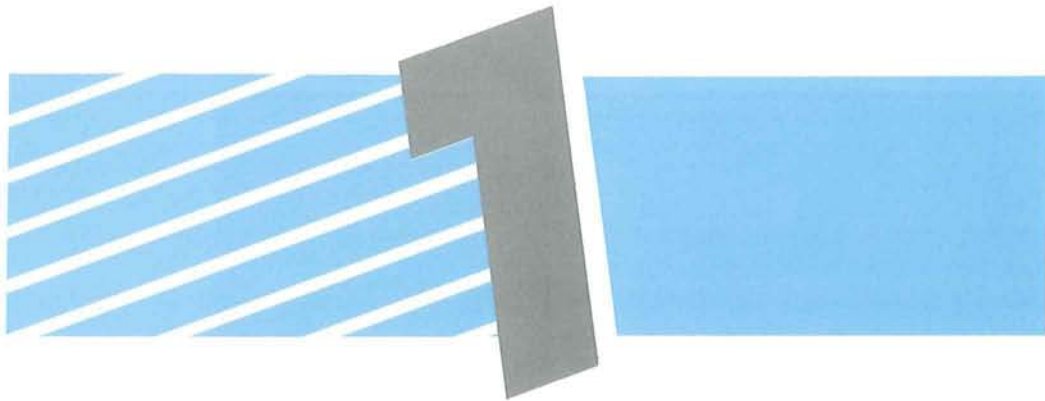
A very low distortion audio oscillator, at 1000 Hz, is included as a test modulation signal when determining the distortion with related audio measuring equipment. For observation of the envelope characteristic with an oscilloscope, a connector is provided for the RF signal at the detector input.

### < FEATURES >

- The wideband characteristic of the input circuit requires no tuning operation.
- Lowpass and highpass filters, selectable with switches, make it possible to set the band used in measurements.
- Oscilloscopic observation of the RF envelope is possible by connection to an external scope.
- Internal low distortion 1 kHz oscillator usable as a test signal for modulation of an RF signal generator for measurements of distortion and other characteristics.

### < SPECIFICATIONS >

<b>Input Characteristics</b>	
Carrier Frequency Range	500 kHz to 30 MHz
Level Range	50 mV to 1 V (94 to 120 dB $\mu$ )
Impedance	Approx. 50 $\Omega$ ; BNC connector
Modulation Frequency Range	30 Hz to 10 kHz
<b>Output Characteristics</b>	
Modulation Measurement	Two ranges: 0 to 30%, 0 to 100% $\pm 0.5$ dB: 30 Hz to 16 kHz (ref.: 1 kHz)
Low Frequency Response	
Lowpass Filters	OUT: 3dB, max. at 60 kHz $\pm 5\%$ 20 kHz: 3dB, max. at 20 kHz $\pm 2\%$ 4 kHz: 3 dB, max. at 4 kHz $\pm 2\%$
Highpass Filters	OUT: 20 Hz max. 80 Hz : 3 dB, max. at 80 Hz $\pm 2\%$ 250 Hz : 3 dB, max. at 250 Hz $\pm 2\%$
Distortion	Less than 0.2% at 50% modulation
Signal-to-Noise Ratio (S/N) Level	Over 70 dB at 30% modulation 10 dBm $\pm 0.5$ dB at 100% modulation
Impedance	Approx. 600 $\Omega$ ; unbalanced
Output Indication	Scales: 0 to 30%, and 0 to 100% 100% f.s. for 10 dBm Accuracy: $\pm 5\%$ at 50% modulation, 1000 Hz; $\pm 0.5$ dB for output voltage on the dB scale
<b>Modulation Signal Source</b>	
Frequency Level	1000 Hz $\pm 2\%$ Approx. 10 dBm (2.45 V) into 600 $\Omega$ ; fixed
Impedance	600 $\Omega$ $\pm 5\%$
Distortion	Less than 0.01%
<b>General Data</b>	
Power Requirements	AC 100V, 115V, 215V, or 230V $\pm 10\%$ , 50/60 Hz; approx. 10 VA
Dimensions, overall	Approx. 280(W) $\times$ 150(H) $\times$ 250(D) mm
Weight	Approx. 6 kg
Accessories, furnished	Coaxial cord 1 ea Output cord 1 ea Adapter, N(P) – BNC(J) 1 ea



**AUDIO ANALYZERS, DISTORTION  
OSCILLATOR, DISTORTION METERS,  
CALIBRATOR**

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# MAK-6600

## PROGRAMMABLE AUDIO ANALYZER



### < DESCRIPTION >

The MAK-6600 Programmable Audio Analyzer allows the multifunction, high-accuracy and high-speed measurements of various characteristics of stereo amplifiers, AM-FM receivers and other electronics appliances, such as voltage, distortion and weighting characteristics. When the MAK-6600 is combined with our standard signal generator, wow & flutter meter, low-distortion oscillator, etc., an automatic measuring system can also be created. The fully microprocessor-controlled operations and standard GP-IB interface make the MAK-6600 a measuring instrument suitable for use with various new media, as well as improving the ease of operation and efficiency of work.

### < FEATURES >

- AC voltage measurement covering a wide range is possible.
- DC voltage measurements are possible.
- Relative level measurements cover a wide range.
- Relative to the input signal voltage.
- Relative to the value set by keys.
- Low-distortion measurements (more than  $-90$  dB in medium frequency range) is possible.
- Measured results are shown both with digital (5 digits) and analog (bar-graph) displays.
- Various filters are provided as standard to meet with different conditions.  
IEC-A, CCIR, CD LPF, 19 kHz LPF, 400Hz HPF, 40kHz LPF, 80kHz LPF, EXT.FIL
- All operating functions provided on the control panel can be programmed up to 100 steps. Several programs can also be stored by dividing the 100-step area.
- The optional low-distortion oscillator (MAK-6600AG) allows wider applications when used with the MAK-6600.
- All panel key functions can be controlled externally via the CONTROL connector on the rear panel.

### < SPECIFICATIONS >

<b>Distortion Measurements</b>	
<b>Frequency Range</b>	10.0 Hz to 100 kHz
<b>Measurement Range</b>	$-10$ dB to $-90$ dB (30% to 0.003% f.s.) at over 1 Vrms input $\pm 1.0$ dB (at fundamental wave from 30 Hz to 10.0 kHz), $\pm 1.5$ dB (at fundamental wave from 30 Hz to 15 kHz) $\pm 3.0$ dB (at fundamental wave from 10Hz to 100kHz)
<b>Accuracy</b>	At input over 1 Vrms 30 Hz to 10.0 kHz (bandwidth 20 kHz) $-100$ dB (0.001%) 10 Hz to 15 kHz (bandwidth 40 kHz) $-96$ dB (0.0016%) 10 Hz to 20 kHz (bandwidth 80 kHz) $-95$ dB (0.0018%) 20.1 kHz to 100 kHz (bandwidth 600 kHz) $-80$ dB (0.01%)
<b>Input Level Range</b>	0.1 V to 100 Vrms
<b>Residual Noise/Distortion</b>	At input over 1 Vrms 30 Hz to 10.0 kHz (bandwidth 20 kHz) $-100$ dB (0.001%) 10 Hz to 15 kHz (bandwidth 40 kHz) $-96$ dB (0.0016%) 10 Hz to 20 kHz (bandwidth 80 kHz) $-95$ dB (0.0018%) 20.1 kHz to 100 kHz (bandwidth 600 kHz) $-80$ dB (0.01%)
<b>Voltage Measurements</b>	
<b>a) AC</b>	
<b>b) Relative value referencing the input voltage</b>	
<b>c) Relative value referencing the key setting.</b>	
<b>AC Measurement Range</b>	$+40$ dB to $-90$ dB (100 Vrms to 0.03 mVrms), Relative value: $\pm 140$ dB
<b>Accuracy</b>	Larger values of the following. $-80.0$ dB to $+40.0$ dB $\pm 0.3$ dB Less than $-80.1$ dB $\pm 1.0$ dB 20 Hz to 100 kHz $\pm 0.3$ dB 10 Hz to 300 kHz $\pm 1.0$ dB
<b>DC Measurement Range</b>	$\pm 10$ V to $\pm 100$ mVf.s., 5 ranges
<b>Accuracy</b>	(0.8% of rdg. + 1% of f.s.) + 1 digit
<b>General specifications</b>	
<b>Input Impedance</b>	100 k $\Omega$ $\pm 1\%$ , unbalanced
<b>Input Capacity</b>	100pF or less
<b>Filters</b>	400 Hz HPF (18 dB/oct), 40 kHz LPF (18 dB/oct), 80 kHz LPF (18 dB/oct), LPF (for CD player), 19 kHz BPF (for stereo), IEC-A (loudness compensation filter), CCIR (loudness compensation filter), EXT. FIL (external-connection filter)
<b>Indicators</b>	Measurements: Rms responding, 5-digit display using 7-segment indicators (% , dB, V and m V scales) and analog display using a bar graph Input level: Average response, 3-digit display using 7-segment indicators (V and dB scales)
<b>Mode setting</b>	Setting keys including value entry keys, cursor keys and increment keys
<b>DC Output</b>	1 Vdc per 10 dB in each range, output impedance 1 k $\Omega$ , unbalanced
<b>AC Output</b>	1 Vrms per 10 dB in each range, output impedance 600 $\Omega$ unbalanced.
<b>Program Steps</b>	Number of steps Max.: 100 (00 to 99), Programmable range: All panel functions
<b>Remote control Functions</b>	External control of all panel functions
<b>Logic Output</b>	Cmos output, positive logic, 256 combination possibilities from 0 to 255
<b>GP-IB Functions</b>	External control of all functions, output of measurement data
<b>Back-Up Battery</b>	Rechargeable (N-SB3)
<b>Power Requirement</b>	AC 100V, 115V, 215V, 230V $\pm 10\%$ 50/60 Hz approx. 60 VA
<b>Dimensions, overall</b>	Approx. 430 (W) $\times$ 110 (H) $\times$ 430 (D) mm
<b>Weight</b>	Approx. 12.4kg

■ Options: AF Oscillator: MAK-6600AG (see, page 67)  
Remote Control Box (see, page 73)

# MAK-6600AG

## LOW DISTORTION OSCILLATOR



### < DESCRIPTION >

The MAK-6600 AG is a low distortion oscillator for use with the MAK-6600 (Programmable audio Analyzer). All frequencies from 10 Hz to 100 kHz, it can output either very low-distortion sine wave or excellent square wave by simple switching.

### < FEATURES >

- The sine waves show very low distortion of less than 0.001% (-100 dB) at the medium frequency range (20 Hz to 10kHz).
- The output level can be set to 0.00 V or 0.00 mV, convenient for S/N measurement, etc., because this virtually turns the output off.
- The outputs have superb frequency characteristic.
- The level of the square wave can be set as desired as well as the sine wave.
- The output can be switched either for floating or casegrounded status by a switch.
- When the MAK-6600 is connected and the MAK-6600AG' output is set for floating status, measurement of a BTL amplifier is also possible.

### < SPECIFICATIONS >

FREQUENCY	
Frequency Range	10 Hz to 100 kHz
Accuracy	$\pm 2$ kHz of set value (100 Hz to 100 kHz)
Impedance	600 $\Omega$ $\pm 5$ kHz, unbalanced, floating
SINE-WAVE RANGE	
Output Level Range	At 0.31 mV to 3.16 Vrms with 600 $\Omega$ load termination; 0.31mV to 9.99 mVrms (0.01mV steps) 100 mV to 99.9 mVrms (0.1mV steps) 100mV to 999 mVrms (1 mV steps) 1.00mV to 3.16 mVrms (0.01 V steps) -70.0 dB to +10.0 dB (0.1 dB steps) -67.8dBm to +12.2dBm (0.1 dBm steps)
Accuracy	At 1 kHz; -30 dB to +10 dB $\pm 0.2$ dB Less than -30.0 dB $\pm 0.5$ dB
Flatness	30 Hz to 19.9 kHz: 0.2 dB 10 Hz to 100 kHz: 0.5 dB
Distortion	30 Hz to 10 kHz (bandwidth 20 kHz): -100dB (0.001%) 10 Hz to 20 kHz (bandwidth 80 kHz): -90dB (0.003%) 20 kHz to 100 kHz (bandwidth 600 kHz): -75dB (0.018%)
SQUARE-WAVE OUTPUT	
Output Level	100m Vp-p ~ 5 Vp-p
Rise Time	300 ns (output level more than 200mVp-p)
Sag	Less than 5% (at 20 Hz or more) (output level more than 200m Vp-p)
Overshoots	Less than 5% (output level more than 200 mVp-p)
General Data	
Power Requirements	AC 100V, 115V, 215V, 230V $\pm 10\%$ 50 60 Hz: approx. 20 VA
Dimensions, overall	Approx. 210(W) $\times$ 110(H) $\times$ 430(D) mm
Weight	Approx. 5.1 kg

# MAK-6581

## AUDIO ANALYZER



### < DESCRIPTION >

The MAK-6581 is intended for overall analysis of audio frequency equipment and circuits. It includes a very low distortion oscillator and provision for measurements of output level, distortion and S/N figure.

A microprocessor is used to simplify operation. In addition the performance characteristics make the instrument ideal for use in research and development of audio equipment. The memory function included is most suited for use in the production line.

### < FEATURES >

- One instrument including an audio signal generating system and a measuring section for output characteristics of amplifiers.
- Frequency and output levels can be rapidly set with the ten-key and incremental key operations.
- Oscillator output level settable to volts, dBv or dBm depending on test requirements.
- Input level meter and measuring meter (for volts, distortion and S/N) are independent; this enables reading the levels at the same time.
- At level setting for distortion measurement an input ALC circuit is used so that residual noise will have no effect when the input level is varied.
- Operating time of the fundamental suppression circuit is very fast and measuring time is shortened.
- Filters included which are usable at all measuring modes, namely for 400Hz highpass, 30kHz/80kHz lowpass and weighted (JIS-A characteristic) for voltage and S/N measurements.
- Accurate measurements are possible through use of effective value responding meter circuits with superior frequency characteristics.
- 100 different measuring functions can be selected with memory keys on the panel. (10 memory addresses  $\times$  10 step numbers for maximum of 100 steps.)
- S/N measurements are simplified with automatic signal level hold and off operations.

- Remote operation is possible for the following: memory recall, frequency and incremental output level setting, selection of filters and meter ranging.
- On option, a GP-IB control with data output function can be installed for use in testing system.

### < SPECIFICATIONS >

#### Oscillator Section

<b>Frequency Range</b>	5Hz to 199.9kHz.
<b>Frequency Accuracy</b>	Within $\pm 2\%$ of setting.
<b>Output Level Range</b>	Overall: 0.238mV to 2.37Vrms.

Range	Step
0.238 to 0.999mVrms	0.001mV
1.00 to 9.99mVrms	0.01mV
10.0 to 99.9mVrms	0.1mV
100 to 999mVrms	1.0mV
1.00 to 2.37Vrms	0.01V
-72.5 to +7.5dB	0.1 dB
-70.3 to +9.7dBm	0.1dB

<b>Level Accuracy</b>	At 1kHz; $\pm 0.2$ dB: -32.5 to +7.5dB. $\pm 0.5$ dB: Below -32.6dB.
<b>Output Flatness</b>	$\pm 0.2$ dB: 20Hz to 19.99kHz. $\pm 0.5$ dB: 5.0Hz to 199.9kHz.
<b>Distortion</b>	Less than -95dB (0.0018%): 20Hz to 10.00kHz (bandwidth: 80kHz). Less than -85dB (0.0056%): 5.0Hz to 50kHz (bandwidth: 600kHz). Less than -75dB (0.018%): 50 to 199.9kHz (bandwidth: 600kHz).
<b>Output Impedance</b>	600 $\Omega$ $\pm 5\%$ ; unbalanced and floating.

#### Measurement Section

<b>Range</b>	-90 to +40 dB (0.03mV to 100 Vrms) f.s. in 14 ranges.
<b>Frequency Characteristics</b>	$\pm 0.3$ dB: 20Hz to 100kHz, $\pm 1$ dB: 5Hz to 300kHz.

#### Distortion Measurements

<b>Frequency Range</b>	5.0Hz to 199.9kHz.
<b>Input Level Range</b>	0.1V to 100Vrms
<b>Measurement Range</b>	30% to 0.003% f.s. (over 1Vrms input) 30% to 0.01% (over 0.1Vrms input)
<b>Fundamental Suppression</b>	Over 100dB: 20Hz to 19.99kHz. Over 90dB: 5Hz to 50kHz. Over 80dB: 50 to 199.9kHz.
<b>Second Harmonic Deviation</b>	$\pm 1.0$ dB: 5.0Hz to 19.99kHz (fundamental). $\pm 2.0$ dB: 20kHz to 199.9kHz (fundamental).
<b>Residual Distortion</b>	At input over 1 Vrms. Less than -95dB (0.0018%): 20Hz to 10.00kHz (bandwidth: 80kHz) Less than -85dB (0.0056%): 6.0Hz to 50kHz (bandwidth: 600kHz). Less than -75dB (0.018%): 5.0Hz to 199.9kHz (bandwidth: 600kHz).

S/N Measurements	
Range Signal Level Range Residual Noise	0 to 90 dB f.s in 10 ranges 0.1 to 100Vrms Less than -100dB (10 $\mu$ V); bandwidth: 80kHz. Less than -90dB (32 $\mu$ V); bandwidth: 600kHz.
General Specifications	
Input Impedance Filters:	100k $\Omega$ $\pm$ 5% unbalanced, shunted with less than 100pF
400Hz highpass: 18dB.oct 30kHz lowpass: do. 80kHz lowpass: do.	For all measuring modes
WTD (JIS-A):	For voltage and S/N measurements
Indicating Meters	Input Level: Average responding with rms calibrations; Volts, dB and dBm scales. Measurements: Rms responding with rms calibration, V, %, dB and dBm scales.
Setting of Oscillator Frequency, Fundamental Frequency for Distortion measurement and Output Level Keys for numerical enter, cursor and incremental	
To Scope DC Output Presetting Remote Control Functions Back-up Battery Provided	1 Vrms at meter full scale; output impedance, 1k $\Omega$ unbalanced. 1VDC at meter full scale; output impedance, 1k $\Omega$ unbalanced. Memory, 100, max. at front panel. Memory recall, incremental frequency and output level, filter selection, and meter ranging; GP-IB control installable.
General Data	
Power Requirements Dimensions, overall Weight Accessory, furnished	AC 100V, 115V, 215V or 230V $\pm$ 10%, 50/60Hz; approx. 45VA. Approx. 430(W) $\times$ 110(H) $\times$ 380(D) mm. Approx. 9.5 kg. Input and output cable 2 ea.

■ Option: Remote Control Unit (see, page 73)

# MAK-6578

## 2CH AUTOMATIC DISTORTION METER



### < DESCRIPTION >

The MAK-6578 is an accurate instrument for simultaneous measurements of two audio channels at 400 or 1000 Hz. In addition, it can be used as a high precision level meter in the 10 Hz to 100 kHz frequency range. An automatic frequency selection system is used to facilitate measurements.

For measuring input levels with varying waveforms, there is no need for full scale correction. This feature enables rapid determination of levels when used in the production line.

The full scale range provided for 0.003% in distortion measurements makes possible to measure very low values, i.e., down to 0.001%.

### < FEATURES >

- Measurements of very low distortion, -100 dB or 0.001% is possible.
- Automatic frequency selection, 400 or 1000 Hz, speeds up operation.
- Simultaneous measurements of two input channels.
- Accurate measurements of distortion even when the input signal levels are not steady.
- No need to set the meter at full scale.
- Usable as a high sensitivity level meter in dB or volts.
- On option, measurements can be made at frequencies other than 400 and 1000 Hz.

### < SPECIFICATIONS >

#### DISTORTION MEASUREMENTS

<b>Frequencies of Measurements</b>	1. THD at 400 Hz 2. THD at 1000 Hz 3. On option, one fundamental between 20 Hz and 3 kHz for THD or 3rd harmonic
<b>Tuned Frequency Range</b>	Approx. $\pm 7\%$ , referred to the fundamental
<b>Measurement Range</b>	9 ranges: 0.003% to 30% f.s. 0 to 0.003% (input > 1V); 0 to 0.01% (input > 0.3V); 0 to 0.03% (input > 0.1V) and above in 1-3 sequence to 30% f.s.
<b>Input Level Range</b>	3 mVrms to 100 Vrms in 9 ranges in 3-10 sequence, 100 V max. (Note: There is a limitation depending on the distortion measurement range.)
<b>Input Impedance</b>	Approx. 100 k $\Omega$ , unbalanced
<b>Input Capacitance</b>	Less than 45 pF
<b>Automatic Input Limiting Range</b>	Approx. 12 dB
<b>Accuracy of Measurements</b>	$\pm 5\%$ of f.s. at 0.3% and higher ranges $\pm 10\%$ of f.s. at 0.01%, 0.03% and 0.1% range $\pm 20\%$ of f.s. 0.003% range
<b>Fundamental Rejection Method</b>	For total harmonics: BEF System
<b>Fundamental Rejection Characteristics</b>	Less than -80 dB at $F_0 \pm 3\%$ Less than -100 dB at $F_0 \pm 1\%$
<b>Level at Output Connector</b>	Approx. 1 Vrms for each range at maximum indication

#### LEVEL MEASUREMENTS

<b>Frequency Response</b>	20 Hz to 50 kHz: $\pm 0.5$ dB, ref'd to 1 kHz 10 Hz to 100 kHz: $\pm 1$ dB, ref'd to 1 kHz
<b>Measurement Range</b>	9 ranges: 0.01 to 100 Vrms f.s. in 1-3 sequence (min. rdg. 1 mVrms)
<b>Accuracy of Measurements</b>	$\pm 3\%$ of f.s. at each range (ref'd to 1 kHz)
<b>Input Impedance</b>	Approx. 100 k $\Omega$ , unbalanced
<b>Input Capacitance</b>	Less than approx. 45pF
<b>Level at Output Connector</b>	Approx. 1 Vrms for each range at maximum indication

#### GENERAL DATA

<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz
<b>Dimensions, overall</b>	Approx. 285(W) $\times$ 165(H) $\times$ 295(D) mm
<b>Weight</b>	Approx. 6.8 kg
<b>Accessory, furnished</b>	Input cord 1 ea.

■ Option: Remote Control Unit (see, page 73)

# MAK-6571W

## 2CH AUTOMATIC DISTORTION METER



### < DESCRIPTION >

The MAK-6571W is designed to speed up measurement of distortion in radio sets, stereo amplifiers, tape recorders, and other audio equipment. Measurements of the total harmonic distortion, THD, can be made simultaneously for two channels at 400Hz or 1000Hz. In use, the input signal may be at either 400Hz or 1000Hz for each channel since automatic frequency selection is applied during measurements.

### < SPECIFICATIONS >

#### DISTORTION MEASUREMENTS (Two channels, simultaneously)

Fundamental Frequencies (Automatic selection)	400Hz $\pm 7\%$ for THD. 1000Hz $\pm 7\%$ for THD. Option: Choice of one frequency, namely, 2nd or 3rd harmonic of 300, 315, 333Hz or 1, 2, 3 kHz.
Measuring Range Accuracy	0.1% to 30% f.s. 6 ranges.
Fundamental Rejection Characteristics	$\pm 5\%$ of full scale of each range.
Input Voltage	Less than $-76$ dB at 400 and 1000Hz $\pm 5\%$ .
Input Impedance	Less than $-70$ dB at 400 and 1000Hz $\pm 10\%$ .
Automatic Input Control Range	3mV to 100Vrms. f.s. 9 ranges. Approx. $100k\Omega$ ; unbalanced.
Accuracy	10 dB.

#### LEVEL MEASUREMENTS (Two channels, simultaneously)

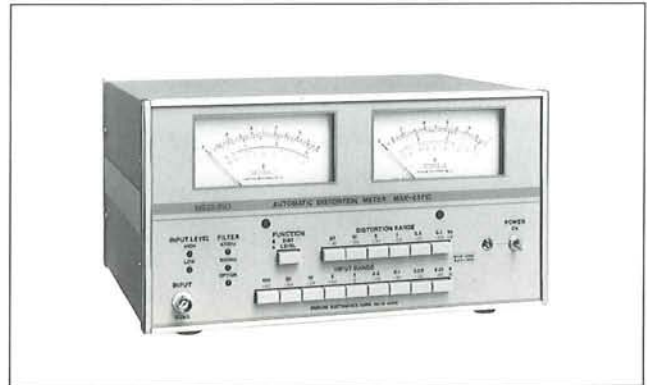
Frequency Range	$\pm 0.5$ dB: 20Hz to 50kHz (ref. 1kHz). $\pm 1$ dB: 20Hz to 100kHz (ref. 1kHz).
Input Impedance	Approx. $100k\Omega$ ; unbalanced.
Measuring Range Accuracy	1 mV to 100Vrms. f.s. 9 ranges. $\pm 3\%$ of full scale of each range. (at 1000Hz)

#### GENERAL DATA

Power Requirements	AC 100V, 115V, 215V, or 230V $\pm 10\%$ ; 50/60Hz approx. 8VA.
Dimensions, overall	Approx. 270(W) $\times$ 165(H) $\times$ 290(D) mm.
Weight	Approx. 7.3kg.
Accessory, furnished	Output cable 2ea.

# MAK-6571C

## AUTOMATIC DISTORTION METER



### < DESCRIPTION >

The MAK-6571C is designed to speed up measurement of distortion in radio sets, stereo amplifiers, tape recorders, and other audio equipment. Measurements of the total harmonic distortion, THD, at 400 Hz and 1000 Hz (automatic changeover) can be easily made. This instrument can be used as a level meter, when required, for signal inputs, 10mV to 100Vrms, in the 20Hz to 100kHz band.

### < SPECIFICATIONS >

#### DISTORTION MEASUREMENTS

Fundamental Frequencies (Automatic selection)	400 Hz $\pm 7\%$ THD. 1000Hz $\pm 7\%$ for THD. Option: Choice of one frequency, namely 2nd or 3rd harmonic of 300, 315, 333Hz, or 1, 2, 3 kHz.
Measuring Range Accuracy	0.1% to 30% f.s. 6 ranges.
Fundamental Rejection Characteristics	$\pm 5\%$ of full scale of each range.
Input Voltage	Less than $-76$ dB at 400 and 1000Hz $\pm 5\%$ .
Input Impedance	Less than $-70$ dB at 400 and 1000Hz $\pm 10\%$ .
Automatic Input Control Range	3mV to 100Vrms f.s. 9 ranges. Approx. $100k\Omega$ ; unbalanced.
Accuracy	10dB.

#### LEVEL MEASUREMENTS

Frequency Range	$\pm 0.5$ dB: 20Hz to 50kHz (ref. 1kHz). $\pm 1$ dB: 20Hz to 100kHz (ref. 1kHz).
Input Impedance	Approx. $100k\Omega$ ; unbalanced.
Measuring Range Accuracy	1 mV to 100Vrms. f.s. 9 ranges. $\pm 3\%$ of full scale at each range. (at 1000Hz)

#### GENERAL DATA

Power Requirements	AC 100V, 115V, 215V, or 230V $\pm 10\%$ ; approx. 4VA.
Dimensions, overall	Approx. 270(W) $\times$ 165(H) $\times$ 290(D) mm
Weight	Approx. 5.9 kg.
Accessory, furnished	Output cable 1ea.

# MKS-682

## DISTORTION METER CALIBRATOR



### < DESCRIPTION >

The MKS-682 generates signals for calibration and checking of distortion meters. Six fundamental frequencies, 20/110/400 Hz and 1/10/20 kHz are used for outputs with inclusion of a known amount of second harmonic content. Two frequencies, 400 Hz and 1 kHz, can be used which include the third harmonic. The distortion range is wide, from  $-100$  to  $-10$  dB or 0.001% to 31.6%. This range can be set in 0.1 dB steps for readout in dB or in percent (%). For convenience in setting low values, the m% unit can be used.

The distorted output signal level is settable from  $-40$  to 0 dB in 0.1 dB steps. The 0 dBv reference is 1.0V; furthermore, the output level can be set in terms of V and mV.

A modifier function can be used to vary the desired amount, up or down, of the distortion and output levels from the set values. The timing for one step can be set in the modifier and programming. In addition, the desired amount of distortion and output level can be set automatically. A panel lock is provided to prevent possible changes in the set positions of the keys.

A program step function is included to memorize 10 steps set separately for distortion, meter calibration and the spot frequency oscillator respectively (modifier function excepted).

### < FEATURES >

- Six fundamental frequencies, 20/110/400 Hz and 1/10/20 kHz, with very low distortion, less than  $-110$  dB.
- GP-IB function included for use in measuring systems.
- Positive setting of keys-any click noise or wrong settings indicated with buzzer warning.
- Digital display of distortion and output levels in dB, volts and millivolts.

### < SPECIFICATIONS >

#### Distortion Calibrating Function

Fundamental Frequencies	20, 110, and 400 Hz/1.0, 10 and 20 kHz Accuracy: $\pm 2\%$
-------------------------	---

Harmonic Frequencies	$\times 2$ of the 6 fundamentals and $\times 3$ of 400 Hz and 1 kHz
Distortion Setting Range	$-100$ to $-10$ dB (0.001% to 31.6%) in 0.1 dB steps
Accuracy of Distortion	At 1 Vrms into 600 $\Omega$ termination

FREQUENCY	RANGE			
	$-10 \sim -69.9$ dB	$-70 \sim -79.9$ dB	$-80 \sim -89.9$ dB	$-90 \sim -100$ dB
20 ~ 400 Hz	$\pm 0.2$ dB	$\pm 0.5$ dB	$\pm 1.0$ dB	$\pm 3.0$ dB
1 kHz	$\pm 0.2$ dB	$\pm 0.5$ dB	$\pm 1.0$ dB	$\pm 2.5$ dB
10 kHz	$\pm 0.25$ dB	$\pm 0.5$ dB	—	—
20 kHz	$\pm 0.3$ dB	$\pm 1.0$ dB	—	—

Output Level	Termination: 600 $\Omega$ $-40$ to 0.0dB : 0.1 dB steps 100 mV to 1.0 Vrms : 1.0 mV steps 10.0 to 99.9 mVrms : 0.1 mV steps Accuracy: $\pm 0.3$ dB
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#### Spot Frequency Function

Oscillator Frequencies	20, 110 and 400 Hz/1.0, 10 and 20 kHz Accuracy: $\pm 2\%$
Output Level	Termination: 600 $\Omega$ $-70$ to 0 dB : 0.1 dB steps 100 mV to 1.0 Vrms : 1.0 mV steps 10 to 99.9 mVrms : 0.1 mV steps 1.00 to 9.99 mVrms : 0.01 mV steps 0.316 to 0.999 mVrms : 0.001 mV steps Accuracy: $\pm 0.3$ dB
Distortion	Less than $-110$ dB, 20 Hz to 20 kHz

#### Modifier Function

Distortion Range	$-100$ to $-10$ dB : 0.1 dB steps 0.001% to 31.6% : 0.00001% steps 1 to 31600 m% : 0.01m% steps
Output Level Range Calibrating Range	$-40$ to 0.0 dB : 0.1 dB steps 0.010 to 1.0V : 0.001 V steps 10 to 1000 mV : 0.01 mV steps
Spot Frequency Function	$-70$ to 0.0 dB : 0.1 dB steps 0.001 to 1.0 V : 0.001 to 1.0 V steps 0.316 to 1000 mV : 0.001 mV steps
Repetition Time Setting Range	0.10 to 60.00 sec (minimum resolution: 0.01 sec)

#### General Specifications

Output Impedance	600 $\Omega$ , unbalanced
Program Steps Number of Steps	For distortion calibrating : 10 steps, max. (0 to 9) Spot frequency function : 10 steps, max. (0 to 9)
Store Range	All panel settings except the modifier functions
GP-IB	Practically all panel settings can be controlled
Back-up Battery	Chargeable type: 3.6 V, 90 mAh (N-SB3)
Power Requirements	AC100 V, 115 V, 215 V, or 230 V $\pm 10\%$ , 50/60 Hz; approx. 48 VA
Dimensions, overall	Approx. 295(W) $\times$ 110(H) $\times$ 438(D) mm
Weight	Approx. 8 kg

# OPTIONS AUDIO ANALYZERS AND DISTORTION METERS

## REMOTE CONTROL BOXES

### For MAK-6600

#### ■ MRC-346 Remote Control Box

For controlling a part of the functions from an external source for MAK-6600 and MAK-6600AG.

- For MAK-6600: Frequency increments, up and down program steps, skip of begin and end and display of program steps.
- For MAK-6600AG: Increments of frequency and output.

#### ■ MRC-3410 Remote Control Box

For only the memory step up of the measuring program memory.

#### ■ MRC-3411 Remote Control Box

For automatic step up of the measuring program.



MRC-346

### For MAK-6581

#### ■ MAK-6581-RE5 Remote Control Box

For meter ranging (INPUT, AUTO/MANUAL, MEASURE), DISPLAY (Frequency & Level), increment, memory and recall.



#### ■ MAK-6581-RE6 Remote Control Box

For control of two Audio Analyzers, MAK-6581; otherwise same as MAK-6581-RE5



#### MRC-341 Remote Control Box

Foot switch for stepping the sequence (step number).



### For MAK-6578

#### ■ MAK-6578-RE Remote Control Box

For setting the FUNCTION (LEVEL/DISTORTION changeover), INPUT RANGE (UP/DOWN) and DISTORTION RANGE (UP/DOWN).



7





**NOISE METERS, VOLT METER,  
Q METERS, PHASE METER,  
FREQUENCY COUNTERS, DMM,  
MILLI OHM METER**

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# MN-447

## 2 CHANNEL NOISE METER



### < DESCRIPTION >

The MN-447 is intended for accurate determination of noise and signal levels in the audio range.

It is equipped with two identical measuring channels to permit simultaneous measurements of two input signals. Measurements of noise voltages is possible with use of one of five weighting filters based on standards of DIN, CCIR and JIS.

Indicating systems are for quasi peak, average and effective values to meet with requirements of the different standards. For convenience in S/N measurements, a variable sensitivity control is provided for use in conjunction with the dB scales. High sensitivity (10  $\mu$ V, f.s.) and wideband (10 Hz to 500kHz) characteristics make this instrument most useful in testing all types of audio equipment.

### < FEATURES >

- Five weighting filters included:
  - (a) DIN 45405 (1967) for audio voltage at DIN/AUDIO.
  - (b) DIN 45405 (1967) for noise voltage at DIN/NOISE.
  - (c) JIS C1502A, JIS C5551A, IHF-A-202, IEC 179-A, NAB for noise voltage at JIS A.
  - (d) CCIR (468-1), CCIR(468-2), DIN 45405(1978) for noise voltage at CCIR.
  - (e) CCIR/ARM, IHF-A-202 for noise voltage at CCIR/ARM
- Indication modes in accordance with-
  - (a) DIN 45405 (1967), DIN 45405 (1978), CCIR (468-1), CCIR (468-2) for quasi-peak of effective value of a sinusoidal voltage at QUASI-PEAK.
  - (b) Average value referred to the effective value of a sinusoidal voltage at AVER.
  - (c) Effective value referred to the effective value of a sinusoidal voltage at R.M.S. (When using the CCIR/ARM filter, indication will be for the average value.)
- Two-pointer meter enables comparison of two input levels at the same time.

### < SPECIFICATIONS >

(Applicable to each of two channels)

<b>Input Frequency Range</b>	10Hz to 500kHz, without weighting filters.									
<b>Voltmeter Range</b>	10 $\mu$ V to 300V, full scale, 16 range in 1,3,10 sequence; -100dB to +50dB, full scale (0dB = 1 Vrms) and -98 to +52 dBm, full scale (0dBm = 0.775 Vrms).									
<b>Accuracy</b>	a) At AVERAGE reading: $\pm 3\%$ of full scale, except 10 $\mu$ V range. b) At QUASI-PEAK and R.M.S reading: $\pm 5\%$ of full scale, except 10 $\mu$ V and 30 $\mu$ V ranges. (Note: Not applicable at above 100V or 42dBm, or when using a weighting filter.)									
<b>Frequency Characteristic</b>	a) At AVERAGE: 10 $\mu$ V range $\pm 5\%$ : 20Hz to 20kHz $\pm 7\%$ : 10Hz to 30kHz $\pm 15\%$ : 10Hz to 50kHz 30 $\mu$ V & 100 $\mu$ V ranges $\pm 5\%$ : 20Hz to 100kHz $\pm 7\%$ : 10Hz to 200kHz $\pm 15\%$ : 10Hz to 300kHz Above 300 $\mu$ V range $\pm 3\%$ : 20Hz to 200kHz $\pm 7\%$ : 10Hz to 500kHz b) At QUASI-PEAK and R.M.S.: 10 $\mu$ V range $\pm 10\%$ : 20Hz to 20kHz $\pm 15\%$ : 10Hz to 30kHz Above 30 $\mu$ V range $\pm 10\%$ : 10Hz to 50kHz									
<b>Adjustable Sensitivity Range</b>	0 to more than -10dB.									
<b>Input Impedance</b>	1M $\Omega$ , approx. 30pF in shunt; unbalanced.									
<b>Maximum Input Voltage</b>	AC: 10Vrms, DC: 450 V, in 10 $\mu$ V to 30mV/range. AC: 330Vrms, DC + AC peak, above 100mV range.									
<b>Output Voltage</b>	At meter full scale and at open circuit: AC: 1Vrms $\pm 10\%$ DC: 1V $\pm 10\%$									
<b>Output Frequency Response</b>	AC: 10Hz to 500kHz $\pm 5\%$ (600 $\Omega$ termination.) DC: 10Hz to 500kHz $\pm 5\%$ .									
<b>Output Impedance</b>	AC: Approx. 600 $\Omega$ , unbalanced. DC: Approx. 1k $\Omega$ , unbalanced.									
<b>Residual Noise</b>	<table border="1"> <thead> <tr> <th>Range</th> <th>AVER. &amp; R.M.S.</th> <th>QUASI-PEAK</th> </tr> </thead> <tbody> <tr> <td>10 <math>\mu</math>V</td> <td>&lt; 1.5 <math>\mu</math>V</td> <td>&lt; 2.0 <math>\mu</math>V</td> </tr> <tr> <td>30 <math>\mu</math>V</td> <td>&lt; 3.0 <math>\mu</math>V</td> <td>&lt; 4.0 <math>\mu</math>V</td> </tr> </tbody> </table>	Range	AVER. & R.M.S.	QUASI-PEAK	10 $\mu$ V	< 1.5 $\mu$ V	< 2.0 $\mu$ V	30 $\mu$ V	< 3.0 $\mu$ V	< 4.0 $\mu$ V
Range	AVER. & R.M.S.	QUASI-PEAK								
10 $\mu$ V	< 1.5 $\mu$ V	< 2.0 $\mu$ V								
30 $\mu$ V	< 3.0 $\mu$ V	< 4.0 $\mu$ V								
<b>Remote Control</b>	Parallel method, positive logic, C MOS level; with photo-isolator INDICATION 2-bit (common channel). WEIGHTING 3-bit (common channel) RANGE Switching 4-bit + 4-bit (separate channels).									
<b>Power Requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 40VA.									
<b>Dimensions, overall</b>	Approx. 150(W) $\times$ 225 (H) $\times$ 380 (D) mm.									
<b>Weight</b>	Approx. 7 kg.									
<b>Accessories, furnished</b>	Input cable, w/clip and BNC plug 2 ea.									

■ **Option:** Programmable Controller, (see, page 85)

■ **Optional filters:** On order, any or all special types given below can be installed in place of the standard types:

- |                             |                            |
|-----------------------------|----------------------------|
| (1) Bandpass: 1 kHz, 36 dB  | (2) Bandpass: 1 kHz, 60 dB |
| (3) Bandpass: 400 Hz, 60 dB | (4) IHF/T-200              |

# MN-446

## NOISE METER



### < DESCRIPTION >

The MN-446 is a high sensitivity voltmeter specially adapted for noise and signal level measurements in the audio to supersonic frequency range. A prominent advantage is the ability to be operated by remote control.

Measurements cover the frequency range from 10 Hz to 500 kHz. Three modes of indication are included, namely, quasi-peak to meet DIN and CCIR standards, and the average and effective values for conventional measurements. Five weighting filters are provided for measurements of noise and signal-to-noise ratios under conditions for DIN, IEC and CCIR requirements. The 10  $\mu\text{V}$  full scale range permits measurements of very low level noise in sound recording/reproducing equipment. Relative measurements of levels are made possible with the adjustable gain function.

### < FEATURES >

- Five weighting filters included:
  - (a) DIN 45405(1967) for audio voltage at DIN/AUDIO.
  - (b) DIN 45405(1967) for noise voltage at DIN/NOISE.
  - (c) JIS C1502A, JIS C5551A, IHF-A-202, IEC 179-A, NAB for noise voltage at JIS A.
  - (d) CCIR(468-1), CCIR(468-2), DIN 45405(1978) for noise voltage at CCIR.
  - (e) CCIR/ARM, IHF-A-202 for noise voltage at CCIR/ARM
- Indication modes in accordance with—
  - (a) DIN 45405(1967), DIN 45405 (1978), CCIR (468-1), CCIR (468-2) for quasi-peak of effective value of a sinusoidal voltage at QUASI-PEAK.
  - (b) Average value referred to the effective value of a sinusoidal voltage at AVER.
  - (c) Effective value referred to the effective value of a sinusoidal voltage at R.M.S. (When using the CCIR/ARM filter, indication will be for the average value.)

### < SPECIFICATIONS >

<b>Input Frequency Range</b>	10 Hz to 500 kHz, without weighing filters									
<b>Voltmeter Range</b>	10 $\mu\text{V}$ to 300 V, full scale, 16 ranges in 1, 3, 10 sequence: -100dB to +50dB, full scale (0dB = 1 Vrms) and -98 to +52dBm, full scale (0dBm = 0.775 Vrms)									
<b>Accuracy</b>	a) At AVERage reading: $\pm 3\%$ of full scale, except 10 $\mu\text{V}$ range. b) At QUASI-PEAK and R.M.S reading: $\pm 5\%$ of full scale, except 10 $\mu\text{V}$ and 30 $\mu\text{V}$ ranges. (Note: Not applicable at above 100V or +42dBm, or when using a weighting filter.)									
<b>Frequency Characteristics</b>	a) At AVERage: 10 $\mu\text{V}$ range $\pm 5\%$ : 20Hz to 20kHz $\pm 7\%$ : 10Hz to 30kHz $\pm 15\%$ : 10kHz to 50kHz 30 $\mu\text{V}$ and 100 $\mu\text{V}$ range $\pm 5\%$ : 20Hz to 100kHz $\pm 7\%$ : 10Hz to 200kHz $\pm 15\%$ : 10Hz to 300kHz Above 300 $\mu\text{V}$ range $\pm 3\%$ : 20Hz to 200kHz $\pm 7\%$ : 10Hz to 500kHz b) At QUASI-PEAK and R.M.S.: 10 $\mu\text{V}$ range $\pm 10\%$ : 20Hz to 20kHz $\pm 15\%$ : 10Hz to 30kHz Above 30 $\mu\text{V}$ range $\pm 10\%$ : 10Hz to 50kHz									
<b>Adjustable Sensitivity Range</b>	0 to more than -10 dB.									
<b>Input Impedance</b>	1 M $\Omega$ , approx. 30pF in shunt; unbalanced.									
<b>Maximum Input Voltage</b>	AC: 10 Vrms, DC: 450V, in 10 $\mu\text{V}$ to 30mV/range. AC: 330Vrms, DC + AC peak, above 100mV range.									
<b>Output Voltage</b>	At meter full scale and at open circuit: AC: 1Vrms $\pm 10\%$ DC: 1V $\pm 10\%$									
<b>Output Frequency Response</b>	AC: 10Hz to 500kHz $\pm 5\%$ (600 $\Omega$ termination.) DC: 10Hz to 500kHz $\pm 5\%$ .									
<b>Output Impedance</b>	AC: Approx. 600 $\Omega$ , unbalanced. DC: Approx. 1k $\Omega$ , unbalanced.									
<b>Residual Noise</b>	<table border="1"> <thead> <tr> <th>Range</th> <th>AVER. &amp; R.M.S.</th> <th>QUASI-PEAK</th> </tr> </thead> <tbody> <tr> <td>10 <math>\mu\text{V}</math></td> <td>&lt; 1.5 <math>\mu\text{V}</math></td> <td>&lt; 2.0 <math>\mu\text{V}</math></td> </tr> <tr> <td>30 <math>\mu\text{V}</math></td> <td>&lt; 3.0 <math>\mu\text{V}</math></td> <td>&lt; 4.0 <math>\mu\text{V}</math></td> </tr> </tbody> </table>	Range	AVER. & R.M.S.	QUASI-PEAK	10 $\mu\text{V}$	< 1.5 $\mu\text{V}$	< 2.0 $\mu\text{V}$	30 $\mu\text{V}$	< 3.0 $\mu\text{V}$	< 4.0 $\mu\text{V}$
Range	AVER. & R.M.S.	QUASI-PEAK								
10 $\mu\text{V}$	< 1.5 $\mu\text{V}$	< 2.0 $\mu\text{V}$								
30 $\mu\text{V}$	< 3.0 $\mu\text{V}$	< 4.0 $\mu\text{V}$								
<b>Remote Control</b>	Parallel method, positive logic, C MOS level; with photo-isolator INDICATION 2-bit WEIGHTING 3-bit RANGE Switching 4-bit									
<b>Power Requirements</b>	AC 100V, 115V, 215V, or 230V $\pm 10\%$ , 50/60 Hz; approx. 40 VA.									
<b>Dimensions, overall</b>	Approx. 150(W) $\times$ 225(H) $\times$ 315(D) mm.									
<b>Weight</b>	Approx. 5 kg.									
<b>Accessory, furnished</b>	Input cable 2 ea.									

■ **Optional filters:** On order, any or all special types given below can be installed in place of the standard types:

- (1) Bandpass: 1 kHz, 36 dB
- (2) Bandpass: 1 kHz, 60 dB
- (3) Bandpass: 400 Hz, 60 dB
- (4) IHF/T-200

# MV-19C

## RF MILLIVOLT METER



### < DESCRIPTION >

The MV-19C is a sensitive instrument for measurement of voltages from 1mV to 10Vrms in the 10kHz to 1000MHz range. Seven voltage ranges in 1-3 sequence are calibrated on linear scales extended to 1.12 and 3.5Vrms at full scale. This has the advantage that usual range switching is not required when readings are taken at high ends of the scales. Two decibel scales are provided for power level measurements on 50Ω and 75Ω circuits. High stability in operation is assured even at low input voltages due to use of an electronic type chopper amplifier using an analog switch low noise and low drift are featured. The probe includes two specially selected diodes for high stability against temperature variations; furthermore, negative feedback is applied for high performance characteristics.

### < SPECIFICATIONS >

<b>Voltage Range</b>	1 mV to 10Vrms in seven ranges: 10, 30, 100 and 300mVrms at full scale; 1, 3 and 10Vrms at full scale.	
<b>Frequency Range</b>	10 kHz to 1000MHz; using accessory probes. (see below)	
<b>Model</b>	<b>Probe Tip</b>	<b>Frequency Range</b>
MP-3106	VHF Probe Tip	10kHz to 250MHz
MP-3107	100: 1 Divider	500kHz to 250MHz
MP-3108	Type N "TEE"	500kHz to 1000MHz
MP-3109	Termination Probe, 50Ω, Type BNC	10kHz to 1000MHz
MP-3110	Termination Probe, 75Ω, Type BNC	10kHz to 250MHz
<b>Accuracy</b>	Relative to full scale, with appropriate probe tips; within ±3%: 10kHz to 100MHz. within ±5%: 100 to 300MHz. within ±10%: 300 to 1,000MHz.	
<b>Meter Scales</b>	Voltage: 0 to 1.12Vrms and 0 to 3.5Vrms with linear graduations; calibrated in rms value of a sine wave. Decibels: -12 to +4dB, where 0dB = 1 mW into 50Ω -12 to +2dB, where 0dB = 1 mW into 75Ω.	
<b>Input Impedance</b>	Depends on the probe tip, frequency and input voltage.	
<b>Power Requirements</b>	AC100V, 115V, 215V or 230V ±10%, 50/60Hz; approx. 16VA.	
<b>Dimensions, overall</b>	Approx. 150(W) × 215(H) × 300(D) mm.	
<b>Weight</b>	Approx. 3.5 kg.	
<b>Accessory, furnished</b>	VHF Probe Tip, MP-3106: 10kHz to 250MHz.	

■ Option: RF Probe set (see, page 85)

# MQ-171

## VHF Q METER



### < DESCRIPTION >

The MQ-171 is intended for measuring the characteristics of coils and capacitors used in the VHF range. Q (figure of merit) measurements are possible for coils and capacitors; in addition the effective inductance and capacitance, RF resistance and the parallel resistance of tuned circuits may be determined. The measuring frequency range, 20 to 230MHz, is covered in four bands.

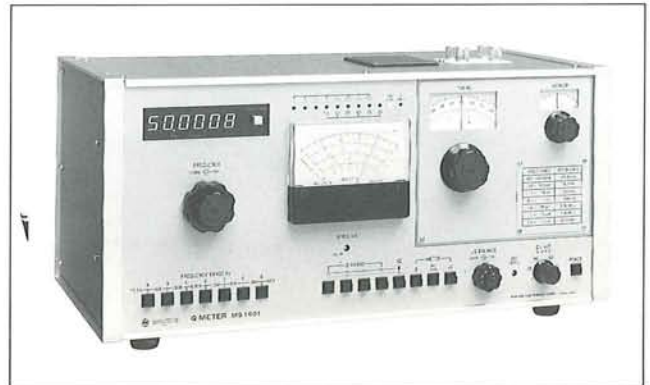
### < SPECIFICATIONS >

Frequency Range	20 to 230MHz in four bands								
Frequency Counter	6-digit, or 5 digit								
Resolution	0.1kHz below 100MHz. 1kHz above 100MHz.								
Q Measurements Range	10 to 750, overall.								
Range Multiplier	1.0 to 1.5.								
Accuracy	±15% f.s. below 100MHz. ±25% f.s. above 100MHz. (At X1 multiplication)								
Δ Q Range	2 ranges; magnification. X10.								
	<table border="1"> <thead> <tr> <th>Q Range</th> <th>Δ Q</th> </tr> </thead> <tbody> <tr> <td>500</td> <td>0 to 50</td> </tr> <tr> <td>150</td> <td>0 to 15</td> </tr> <tr> <td>50</td> <td>—</td> </tr> </tbody> </table>	Q Range	Δ Q	500	0 to 50	150	0 to 15	50	—
Q Range	Δ Q								
500	0 to 50								
150	0 to 15								
50	—								
Q Range Accuracy	±10% f.s.								
Q Limit Judgement	Lamp indication when Q is above set value.								
Resonating Capacitor Range	7.0 to 100pF.								
Accuracy	±0.3pF: 7 to 20pF. ±0.5pF: 20 to 50pF. ±1.0pF: 50 to 100pF.								
Residual Inductance	Less than 1.5nH.								
Power Requirements	AC 100V, 115V, 215V, or 230V ±10%, 50/60Hz; approx. 25VA.								
Dimensions, Overall	Approx. 430(W) × 185(H) × 300(D) mm.								
Weight	Approx. 10kg.								

■ Option: Auxiliary Coils, etc (see, page 85).

# MQ-1601

## Q METER



### < DESCRIPTION >

The MQ-1601 is designed for measurements of the figure of merit, Q, of inductors and capacitors. Effective values of inductance, capacitance, resistance, distributed capacitance and high frequency cables can be determined. The overall frequency range is from 15.5kHz to 50MHz settable with use of a 6-digit counter display.

### < SPECIFICATIONS >

Frequency Range	15.5kHz to 50MHz in 7 bands:
Frequency Counter	6-digit, or 5-digit with final figure blanked.
Frequency Accuracy	±(0.01% + 1 count).
Q Measurement Range	5 to 750 in 7 ranges:
Q Accuracy	±10% f.s. below 20MHz. ±20% f.s. above 20MHz.
Δ Q Range	0 to 7.5 (in Q = 15 to 75 range). 0 to 12 (in Q = 25 to 120 range). 0 to 25 (in Q = 50 to 250 range). 0 to 40 (in Q = 100 to 400 range). 0 to 75 (in Q = 100 to 750 range).
Tuning Capacitance	19 to 483pF, overall. Main: 22 to 480pF (1 pF divisions to 100pF and 5pF divisions above 100pF). Vernier: -3 to +3pF (minimum division = 0.1pF). Accuracy: ±(1% + 1pF).
Inductance Measurement	0.1μH to 1H in 7 ranges at specified frequencies. Accuracy: ±5% above 0.5μH. ±10% below 0.5μH.
Measuring Voltage	7.5 Vrms at Q = 750: (Q × 0.01) Vrms for 25/75/250/750 ranges and (Q × 0.00625) Vrms for 40/120/400 ranges.
Q Meter Range Adjuster	Over ±15% for correlation.
Power Requirements	AC 100V, 115V, 215V or 230V ±10%, 50/60Hz; approx. 20VA.
Dimensions, overall	Approx. 430(W) × 220(H) × 300(D) mm.
Weight	Approx. 10kg.

■ Option: Auxiliary Coils, etc (see, page 85).

# MPM-551

## PHASE METER



### < DESCRIPTION >

The MPM-551 is a sensitive instrument for the accurate determination of phase relations from 0 to  $\pm 180^\circ$  in the frequency range from 10Hz to 2MHz. It is specially suitable for use in the development and improvement of wideband amplifiers and networks where only the response measurements are not sufficient. In pulse work, phase adjustments can be made from 0 to  $\pm 180^\circ$  by its use.

### < FEATURES >

- Maximum sensitivity is  $\pm 5^\circ$  full scale, and by offsetting it is possible to obtain direct readings to  $0.1^\circ$  regardless of the phase angle.
- DC voltage output proportional to the phase angle is available for operating a digital voltmeter when desired.
- Ease of operation and maintenance are the keynotes in design.

### < SPECIFICATIONS >

Frequency Range	10Hz to 2MHz.
Phase Angle Range	0 to $\pm 180^\circ$ in six ranges: $\pm 5^\circ$ , $\pm 10^\circ$ , $\pm 18^\circ$ , $\pm 50^\circ$ , $\pm 100^\circ$ and $\pm 180^\circ$ full scale.
Input Voltage Range	Two ranges: 5mV to 2Vrms and 100mV to 30Vrms. (50mV to 20Vrms and 1 to 300Vrms at 10:1 probe used.)
Input Impedance	1M $\Omega$ , 25pF in shunt.
Meter Offset	in $10^\circ$ steps to $\pm 170^\circ$
Meter Offset Accuracy	$\pm 0.5\%$
Meter Accuracy	within $\pm[(2.5\% + 0.1^\circ) + (\text{offset error})]$ of full scale for each range.
Phase Output Signal	10mV/degree, referred to the phase angle as measured.
Phase Output Signal Accuracy	within $\pm(0.5\% + 0.1^\circ)$ .
Phase Output Signal Response Time	Approx. 30ms minimum.
Power Requirements	AC100V, 115V, 215V or 230V $\pm 10\%$ 50/60Hz; approx. 17VA.
Dimensions, overall	Approx. 430(W) $\times$ 165(H) $\times$ 360(D) mm.
Weight	Approx. 7kg.
Accessories, furnished	Input Cord 2 ea. Output cord 1ea.

■ On special order, Model MPM-551T with balanced input terminals for 600 $\Omega$  and 10k $\Omega$  available.

#### < Pertinent Specifications >

Measuring Frequency Range .....	20Hz to 20kHz.
Input Voltage Range.....	5mV to 2Vrms 1 range.
Input Impedance .....	600 $\Omega$ and 10k $\Omega$ , switchable.

# MFC-1305

## 1400 MHz FREQUENCY COUNTER



### < DESCRIPTION >

The MFC-1305 is a wide-band frequency counter covering the range from 10 Hz to 1400 MHz. It has been designed for high stability, ease of operation and low cost. In addition to measurement of frequencies, it is possible to determine the periods.

Highly accurate measurements can be made since the counter uses a quartz crystal oscillator with high stability, i.e.,  $\pm 3 \times 10^{-8}$  in the 0 to  $+40^\circ\text{C}$  temperature range.

Ease in readout is assured with use of the 7-segment LED memory method for an 8-digit display.

Small size, high stability and low cost of the MFC-1305 make this instrument most suited for a wide range of tests and measurements of consumer and industrial equipment in the field and on the service bench.

### < FEATURES >

- The upper frequency range is specially suited for measurements required in satellite broadcast tuners and converters.
- High frequency stability for accurate measurements.
- Measurements of the period are possible.
- Memorized display and zero-blanking functions are used for special measurements.

### < SPECIFICATIONS >

<b>Frequency Measurements</b>	
<b>Input A (Direct readout)</b>	
Frequency Range	10 Hz to 80 MHz
Sensitivity	20 mVrms
Input Attenuator	1 and 1/10
Input Impedance	Approx. 1 M $\Omega$
Resolution	0.1, 1 and 10 Hz
Gate time	10, 1 and 0.1 sec
Display Unit	kHz
Maximum Input Voltage	10 to 400 Hz: 100 Vrms 400 Hz to 100 kHz: 20 Vrms 100 kHz to 80 MHz: 5 Vrms
Accuracy	$\pm 1$ count $\pm$ standard time accuracy
<b>Input B (Prescaler)</b>	
Frequency Range	10 to 1400 MHz
Sensitivity	50 mVrms: 50 to 1300 MHz 100 mVrms: 10 to 50 MHz, 1300 to 1400 MHz
Input Impedance	50 $\Omega$
Resolution	10, 100 and 1000 Hz
Gate Time	10, 1 and 0.1 sec
Display Unit	MHz
Maximum Input Voltage	5 Vrms
Accuracy	$\pm 1$ count $\pm$ standard time accuracy
<b>Period Measurements</b>	
Range	1 $\mu\text{s}$ to 100 ms
Multiplier	$\times 10$ , $\times 100$ and $\times 1000$
Resolution	10, 1 and 0.1 $\mu\text{s}$
Accuracy	$\pm 1$ count $\pm$ standard time accuracy $\pm$ triggering error
<b>Standard Time</b>	
Frequency	1 MHz
Stability	$\pm 3 \times 10^{-8}$ ( $0^\circ$ to $+40^\circ\text{C}$ )
<b>Standard Frequency Output</b>	
Frequency	1 MHz
Open Circuit Voltage	Approx. 2.5 Vp-p
Into 50 $\Omega$ load	Approx. 250 mVp-p
<b>Standard Frequency Input</b>	
Frequency	1 MHz
Input Voltage	1V to 50 Vrms
Input Resistance	Approx. 1 k $\Omega$
Input Coupling	AC
Display Figures	8 digits
Display Modes	LED (7-segment type) Memory display Zero-blanking Overflow Gating
<b>General Data</b>	
Power Requirement	AC 100V, 115V, 215V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 30 VA
Dimensions, overall	Approx. 200(W) $\times$ 92(H) $\times$ 340(D) mm (handle not included)
Weight	Approx. 3 kg
Accessories, furnished	Output cable 1 ea. Input cable 1 ea.

# MFC-1304

## 600 MHz FREQUENCY COUNTER



### < DESCRIPTION >

The MFC-1304 covers the frequency range from 10 Hz to 600 MHz. The counter has been developed for high accuracy, high stability and ease in measurements. 7-segment LEDs are used in the 8-digit display. In addition, the zero-blanking function has been included to prevent any misreading. Compact structure, portability and low cost make this instrument most convenient for use in the production line and in the field.

### < FEATURES >

- Wide frequency range covers the low audio to the VHF spectrum.
- High stability crystal oscillator used for accurate measurements.
- Measures of the period are possible.
- Memorized display and zero-blanking functions are included for ease in measurements.

### < SPECIFICATIONS >

<b>Frequency Measurements</b>	
<b>Input A (Direct readout)</b>	
Frequency Range	10 Hz to 80 MHz
Sensitivity	20 mVrms
Input Attenuator	1 and 1/10
Input Impedance	Approx. 1M $\Omega$
Resolution	0.1, 1 and 10Hz
Gate Time	10, 1 and 0.1 sec
Display Unit	kHz
Maximum Input Voltage	10 to 400 Hz: 100 Vrms 400 Hz to 100 kHz: 20 Vrms 100 kHz to 80 MHz: 5 Vrms
Accuracy	$\pm 1$ count $\pm$ standard time accuracy
<b>Input B (Prescaler)</b>	
Frequency Range	10 to 600 MHz
Sensitivity	50 mVrms
Input Impedance	50 $\Omega$
Resolution	10, 100 and 1000 Hz
Gate Time	10, 1 and 0.1 sec
Display Unit	MHz
Maximum Input Voltage	5 Vrms
Accuracy	$\pm 1$ count $\pm$ standard time accuracy
<b>Period Measurements</b>	
Range	1 $\mu$ s to 100 ms
Multiplier	$\times 10$ , $\times 100$ and $\times 1000$
Resolution	10, 1 and 0.1 $\mu$ s
Accuracy	$\pm 1$ count $\pm$ standard time accuracy and triggering error
<b>Standard Time</b>	
Frequency Stability	10 MHz $\pm 1 \times 10^{-6}$ (0° to 40°C)
<b>Standard Frequency Output</b>	
Frequency	1 MHz
Open Circuit Voltage	Approx. 2.5 Vp-p
Into 50 $\Omega$ Load	Approx. 250mVp-p
<b>Standard Frequency Input</b>	
Frequency	1 MHz
Input Voltage	1V to 50 Vrms
Input Resistance	Approx. 1k $\Omega$
Input Coupling	AC
Display Figures	8 digits
Display Modes	LED (7-segment type) Memory display Zero-blanking Overflow Gating
<b>General Data</b>	
Power Requirements	AC100V, 115V, 215V or 230 V $\pm 10\%$ , 50/60 Hz; approx. 30VA
Dimensions, overall	Approx. 200(W) $\times$ 92(H) $\times$ 340(D) mm (handle not included)
Weight	Approx. 3 kg
Accessories, furnished	Output cable 1 ea. Input cable 1 ea.



# MD-30 / MD-30KIT

## DIGITAL MULTIMETER



▲ MD-30

- Built-in high reliability
- 3<sup>1</sup>/<sub>2</sub> digit LCD display
- Manual and Auto ranging

### < FEATURES (MD-30/MD-30KIT) >

- DC voltage/current, AC voltage/current and resistance can be measured.
- Highly accurate measurements are possible.
- Manual and auto ranging selectable.
- Beeper for continuity test.
- Added range for diode testing.
- Built-in protection circuit prevents damage to the unit from excessive input.
- MOS LSI and LCD used for low power consumption.

### < A Feature of MD-30KIT >

Two booklets "Basic Principles of digital Testers" and "Instructions for Assembling" are furnished with this kit. The information will be found that this kit is invaluable in vocational training.

### < GENERAL >

Measurement System Display	Integrated type 3 <sup>1</sup> / <sub>2</sub> digital with liquid crystal display; maximum reading, 1999, and provided with symbols
Ranging	Automatic and manual
Over-range Condition	Indicated with "1" at the highest digit
Polarity Switching	Automatic with display of "-"
Low Battery Voltage Indication	"B" mark lights at insufficient voltage for operation
Sampling Rate	2 per second
Operating Temperature	0 to +40°C, at lower than 80% R.H. and no dew condensation
Storage Temperature	-20°C to +60°C, at lower than 70% R.H. and no dew condensation
Power Consumption	Less than about 5 mW
Power Source	Two UM-3 (1.5V) batteries, or equivalent
Dimensions	Approx. 75 (W) × 170 (H) × 32 (D) mm
Weight	Approx. 200 g (including batteries)
Accessories	Batteries (size "AA" (R6)/1.5V x 2), A pair of test leads, Fuse × 1 Instruction manual × 1

## < SPECIFICATIONS >

### DC Voltage

Range	Resolution	Accuracy	Input Impedance	Max. applicable Voltage
200mV	0.1mV	±0.5% rdg ±3dgt	Over 1000MΩ	DC: 1100V AC: 1100Vp-p
2000mV	1mV	±0.8% rdg ±1dgt	Approx. 10MΩ	
20V	10mV			
200V	100mV			
1000V	1V			

### AC Voltage

Range	Resolution	Accuracy	Input Impedance	Max. applicable Voltage
2000mV	1mV	±1.0% rdg ±5dgt (40 to 500 Hz)	Approx. 10MΩ	DC: 1100V AC: 800Vrms
20V	10mV			
200V	100mV			
750V	1V			

### DC Current

Range	Resolution	Accuracy	Voltage Drop (max)	Overload Protection
200mA	100μA	±1.2% rdg ±1dgt	Less than 0.5V	250V 0.2A Fuse
10A	10mA			

### AC Current

Range	Resolution	Accuracy	Voltage Drop (max)	Overload Protection
200mA	100μA	±1.2% rdg ±5dgt (40 to 500 Hz)	Less than 0.7V	250V 0.2A Fuse
10A	10mA			

### Resistance

Range	Resolution	Accuracy	Max. Measurement Current	Max. Applicable Voltage	
200Ω	0.1Ω	±0.8% rdg ±3dgt	1.0mA	250V (0.2A fuse used)	
2000Ω	1Ω	±0.8% rdg ±2dgt	0.1mA		
20kΩ	10Ω		30μA		
200kΩ	100Ω		4μA		
2000kΩ	1kΩ		±1.0% rdg ±2dgt		0.4μA
20MΩ	10kΩ		±2.0% rdg ±2dgt		0.04μA

### Continuity Checking

Range	Resolution	BEEPER ON Resistance	Measurement Current	Open Circuit Voltage
0 ~ 200Ω	0.1Ω	Less than 20Ω ± 10Ω	Less than 0.7mA	Approx. 1.5V

### Diode Test

Range	Resolution	Accuracy	Measurement Current	Open Circuit Voltage
0 ~ 1000mV	1mV	±5% rdg ±1dgt	Approx. 0.6mA	Approx. 1.5V

# MZ-820D

## MILLI OHM METER



## < SPECIFICATIONS >

Measurement Range	1 to 200 mΩ
Accuracy	±5% in 1 to 50 mΩ range
Measuring Current	Approx. 100 mA at 10 mΩ
Measuring Frequency	1000 Hz ±5%
Stability	No change after initial 0 setting
Indicating Meter	50 μA, f.s., grade 2.5; mΩ scale
Power Supply	6 VDC using 4 UM3 (1.5 V) cells or equivalent. Life is approx. 300 hr with continuous use
Dimensions, overall	Approx. 215(W) × 135(H) × 115(D) mm
Weight	Approx. 1.7 kg

The MZ-820D is a direct reading instrument for measurements of very low resistances, namely in the 1 to 200 milliohm range. It is useful in determining the contact resistance of switches, relays under operating conditions. For portability, it is small in size and light in weight. Battery operated, i.e., at 6 volts using four UM3 cells (pen-light type), it will be found very useful in laboratories and for maintenance work.

8

## < CHARACTERISTICS >

- Main Frame..... 1000 Hz oscillator circuit  
Balancing circuit  
Indicator with mΩ scale  
Measuring terminals  
Power supply
- Accessory, furnished..... Measuring leads 1 set

# OPTIONS ACCESSORIES FOR VOLTMETERS, Q-METERS AND COUNTERS

## Programmable Controller, MPC-343

For MN-447 Two Channel Noise Meter  
Used to set the meter ranges INDICATION and WEIGHTING functions as required; eight settings. Range settings for CH1 and CH2 are independent.



## Auxiliary Coils, ML-2630

A set of six coils for use with MQ-171 VHF Q-Meter; packed in wooden case.



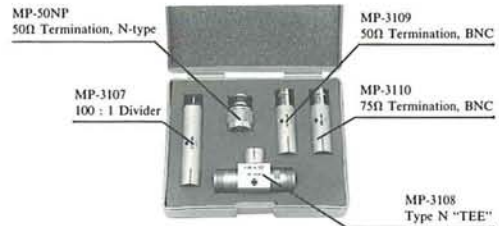
Model	Inductance	Frequency Range
ML-2631	1.85 $\mu$ H	20 ~ 35 MHz
ML-2632	0.71 $\mu$ H	20 ~ 55 MHz
ML-2633	0.47 $\mu$ H	25 ~ 70 MHz
ML-2634	0.29 $\mu$ H	30 ~ 100 MHz
ML-2635	0.1 $\mu$ H	50 ~ 160 MHz
ML-2636	0.05 $\mu$ H	70 ~ 230 MHz

Case: Approx. 220(W)  $\times$  105(H)  $\times$  165(D) mm;  
weight, approx. 1.5 kg

## Set of Probes, MP-3160

For MV-19C RF Millivoltmeter

- 100 : 1 Divider MP-3107
- Type N "TEE" MP-3108
- 50 $\Omega$  Termination, BNC MP-3109
- 75 $\Omega$  Termination, BNC MP-3110
- 50 $\Omega$  Termination, N-type MP-50NP



## Shielding Case, ME-2502

For MQ-171 VHF Q Meter in shielding the measurement circuit.



## Auxiliary Coils for MQ-1601 Q Meter

ML-2600A, B : A set of 16 coils, packaged in two cartons (8 coils in each).



Approx. 760(W)  $\times$  150(H)  $\times$  200(D); 3.5 kg

Model	Inductance	Distributed Cap., pF	Frequency Range
ML-2601A	25 mH	12	50 ~ 140 kHz
ML-2602A	10 mH	9	80 ~ 200 kHz
ML-2603A	5 mH	8	110 ~ 300 kHz
ML-2604A	2.5 mH	8.5	150 ~ 450 kHz
ML-2605A	1.0 mH	8	250 ~ 700 kHz
ML-2606A	500 $\mu$ H	8	350 ~ 1000 kHz
ML-2607A	250 $\mu$ H	7.5	500 ~ 1400 kHz
ML-2608A	100 $\mu$ H	7.5	800 ~ 2000 kHz
ML-2609A	50 $\mu$ H	7	1.1 ~ 3 MHz
ML-2610A	25 $\mu$ H	7	1.1 ~ 4.5 MHz
ML-2611A	10 $\mu$ H	7	2.5 ~ 7 MHz
ML-2612A	5 $\mu$ H	7	3.5 ~ 10 MHz
ML-2613A	2.5 $\mu$ H	6.5	5.0 ~ 14 MHz
ML-2614A	1.0 $\mu$ H	6	8.0 ~ 20 MHz
ML-2615A	0.5 $\mu$ H	5	10.5 ~ 31 MHz
ML-2616A	0.25 $\mu$ H	4	15.0 ~ 50 MHz

## Dielectric Test Jig, for MQ-1601



Electrode Diameter 38 mm  
Electrode Spacing 10 mm, max.  
Micrometer Pitch 0.5 mm  
Smallest Reading 0.01 mm  
Residual Inductance  $L_0 = < 0.03 \mu$ H  
Dielectric Constant Range  $\epsilon = 1 \sim 100$   
Loss Angle Range tan  $\tan \delta = 2 \times 10^{-4} \sim 2.0$

## Adapter for Series Measurements

ME-2501 for MQ-1601 Q Meter





**PATTERN GENERATORS,  
VECTORSCOPES,  
WAVEFORM MONITORS**

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# MPG-4301/MPG-4301J

## PATTERN GENERATOR



▲ MPG-4301

## < DESCRIPTION >

The MPG-4301 and MPG-4301J are color pattern generators designed to generate the composite, digital and analog RGB and sound signals for testing and adjusting the NTSC-M system television receivers. In particular, the 200 and 400 line (for high resolution) digital RGB outputs enable tests of the monitor TV sets for personal computers. The MPG-4301J model is provided with the bilingual mode and will generate the multiplex modulated sound signal. Furthermore, it is possible to switchover the vertical sync signal in conformity with the instrument, industrial and others, under test.

## < FEATURES >

- For audio-video testing –
  - a) 21-pin analog RGB output provided.
  - b) 200 and 400 line digital RGB outputs for video testing and adjusting the monitor TV for personal computers.
  - c) Video and RF signal outputs, at 75 Ω, for testing cameras with the input connector.
- Video signals for testing NTSC system monochrome and color receivers –
  - a) Dots and single crossbar pattern signals for convergence and raster adjustments.
  - b) Composite single cross and crosshatch pattern for static and dynamic convergence adjusting.
  - c) Non-interlaced video signal applicable to all patterns as required in testing and adjusting.
- Color functions
  - a) Outputs for NTSC color 200 and 400 line RGB can be independently selected at front panel for red, green and blue, for inspection of discoloration, purity and white balance.
  - b) Full field color bars generated for NTSC color and 200/400 line RGB outputs.
- Sound functions
 

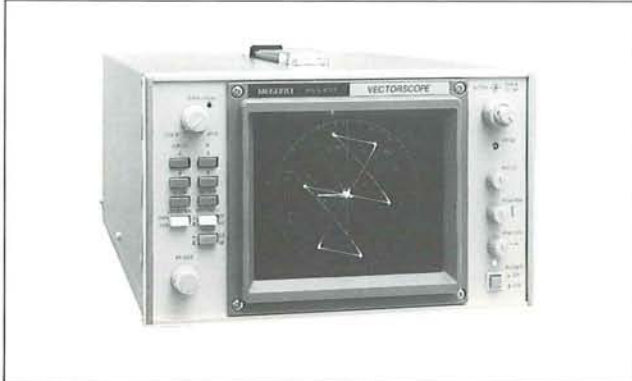
Outputs for monophonic, stereo and bilingual (MPG-4301J only) can be set at the front or rear panel.
- In addition to basic functions in MPG-4301/4301J, the MPG-4301S/4301JS with the S-VIDEO output connection are in production.

## < SPECIFICATIONS >

<b>Video Signal</b>	
Output Voltage	0 to approx. 1.5Vp-p, variable into 75Ω
Output Impedance	75Ω
Polarity	Video: Positive; sync: negative
Subcarrier	3.579545MHz ± 100ppm
Color Burst Signal	8 to 10 waves
Horizontal Sync Signal	Sweep timing: 63.5μs Approx. 15.75 kHz (NEGATIVE) Front porch: Approx. 1.4μs Sync timing: Approx. 4.7μs Back porch: Approx. 2.2μs
Vertical Sync Signal	Approx. 60Hz (For others: approx. 60Hz waveforms, selectable)
Scanning Lines	525 lines (interlaced or progressive, selectable)
<b>RF Signals</b>	
Modulation Mode Negative modulation	
Video Carrier Frequency	Japan: Ch-1 91.25MHz Ch-2 97.25MHz
Frequency Accuracy	±140kHz
Sound Carrier Frequency	Japan: Ch-1 95.75MHz Ch-2 101.75MHz
Frequency Accuracy	±5kHz (fs = 4.5MHz)
Video/Sound Carrier	
Output Level Ratio	-13dBμ ± 3dBμ, at video modulation
Output VSWR	Less than 3
Spurious Signals within Passband	56dB (referred to video carrier output level and including video output at 3.58MHz; 1.4Vp-p beat)
<b>Digital RGB Signals</b>	
Display Luminance Signal	200 & 400 lines: TTL level, positive pol.
<b>Horizontal Sync Signals</b>	
200-Line Mode	TTL level, negative pol., approx. 15.75kHz
400-Lines Mode	TTL level, negative pol., approx. 25.231kHz Front porch, approx. 2.9μs Horizontal sync, approx. 2.9μs Back porch, approx. 3.8μs
<b>Vertical Sync Signals</b>	
200-Line Mode	TTL level, negative pol., approx. 60Hz Pulse width, approx. 580μs Horizontal resolution, 262 lines
400-Line Mode	TTL level, negative pol., approx. 57Hz Front porch, approx. 290μs Vertical sync signal, approx. 320μs Back porch, approx. 740μs Horizontal resolution, 384 lines
<b>Analog RGB Outputs</b>	
Display Luminance Signal	200 & 400 lines: Approx. 0.7Vp-p (75Ω load) positive pol.
<b>Video Sync Signals</b>	
200-Line Mode	Approx. 1Vp-p, negative pol., 15.75kHz Front porch, approx. 1.4μs Horizontal sync, approx. 4.76μs Back porch, approx. 2.4μs
400-Line Mode	Approx. 1Vp-p, negative pol. Vertical sync signal, approx. 56.2Hz Pulse width, approx. 320μs Horizontal sync signal, approx. 25.231kHz Front porch, approx. 2.9μs Horizontal sync, approx. 2.9μs Back porch, approx. 3.8μs Horizontal resolution, 384 lines
A-V Control Signal	Output impedance, 1kΩ Output level: HI = +5V, LO = 0V, at no load
YS Control Signal	TTL level: HI = +5V, LO = 0V, at no load
YM Control Signal	TTL level: HI = +5V, LO = 0V, at no load
LEFT/RIGHT Sound Output	Output impedance, approx. 10kΩ Approx. 480Hz, 3Vp-p
<b>Patterns</b>	
Color Bars	In the order at 100% amplitude, 8 colors
Crosshatch	200-line RGB output, 400-line RGB output
Single Cross	At raster center, white, with 1 (V) and 1 (H) line
Dots	White dots, 15 (V) × 15 (H)
Raster	Front panel selection for red, green and blue
<b>Sound Output</b>	
Stereo signals	MPG-4301, MPG-4301J
Monophonic signals	MPG-4301, MPG-4301J
Bilingual	MPG-4301J only
<b>General</b>	
Power requirements	AC100V, 115V, 215V, 230V ± 10%, 50/60Hz; approx. 12VA
Dimensions & Weight	Approx. 210 (W) × 110 (H) × 380 (D) mm; approx. 3 kg

# MVS-4351

## VECTORSCOPE (NTSC System)



### < DESCRIPTION >

The MVS-4351 is an oscilloscope designed for the vector display of chrominance components in the NTSC system video signals.

The MVS-4352 is an oscilloscope designed for the vector display of chrominance components in the PAL system video signals (PAL-M excepted).

#### MVS-4351/MVS-4352

The CRT includes the angular graduation ( $360^\circ$  at  $2^\circ/\text{div.}$ ), B-Y, R-Y, I and Q axes. In addition, tolerance limits are provided for the amplitude and phase of  $Y_L$ , R,  $M_G$ , B,  $C_Y$  and G colors. This enables observation of the condition of the color signals in simple manner.

### < SPECIFICATIONS >

<b>CRT</b>	
Effective area	150mm type; effective display $100 \times 80\text{mm}$ , with illuminated graticule
<b>Input Signals</b>	
Calibrating Value	For color saturation: 75%, 100% full scale
Variable Range	At 0.2 to 2Vp-p input: Approx. 0.5 to X5 of calibrated value
External CW Input A	2Vp-p $\pm 6\text{dB}$ Composite video and subcarrier signals; BNC connector, loop through, on rear panel
Input B	Composite video signal; BNC connector, loop through, on rear panel
EXT CW	Subcarrier signal; BNC connector, loop through, on rear panel
Blanking Input	BNC connector, on rear panel
<b>Chrominance</b>	
Bandwidth	Fsc $\pm 500\text{kHz}$ Fsc = 3.579545 MHz
Phase Accuracy	$\pm 2^\circ$
Amplitude Accuracy	$\pm 3\%$
Differential Phase	$\pm 2^\circ$
Differential Gain	$\pm 1\%$
<b>Synchronization</b>	
Internal	Burst signal from Input A or B; Level: 0.286Vp-p $\pm 6\text{dB}$
External	Subcarrier signal applied to EXT CW connector; Level: 2Vp-p $\pm 6\text{dB}$ 3.579545MHz $\pm 50\text{Hz}$
Pull-in Range	
Phasing Range	$360^\circ$ , variable
Calibrating Function	Test circle with chrominance input signal in non-synchronized condition
Power Supply	AC100V, 115V, 215V, 230V $\pm 10\%$ , 50/60Hz; approx. 40VA
Dimensions and Weight	Approx. 215(W) $\times$ 132 (H) $\times$ 400 (D) mm; approx. 7kg

# MVS-4352

## VECTORSCOPE (PAL System)



In addition, it is possible to check the dG (differential gain) and dP (differential phase) as well as to measure the phase difference between two video signals.

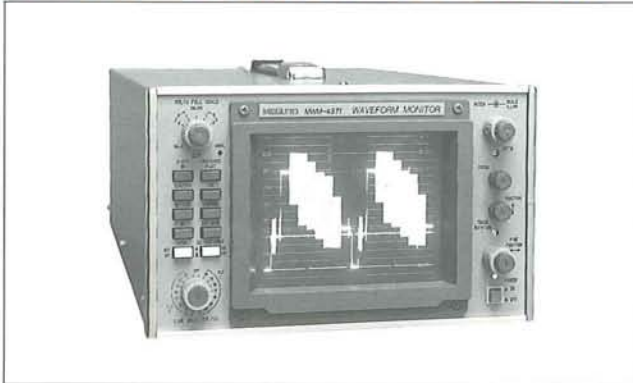
Moreover, the vector display can be pushbutton-selected for the following: (1) conventional or amplitude of one color, or (2) to eliminate the trace line between the phase-indication points. Using this method, observation of the display is made easier since confusing traces are eliminated. Thus, accurate measurements are possible even when a large amount of noise is present in the signal.

### < SPECIFICATIONS >

<b>CRT</b>	
Effective area	150mm type; effective display $100 \times 80\text{mm}$ , with illuminated graticule
<b>Input Signals</b>	
Calibrating Value	For color saturation: 75%, 100% full scale
Variable Range	At 0.2 to 2Vp-p input: Approx. 0.5 to X5 of calibrated value
External CW Input A	2Vp-p $\pm 6\text{dB}$ Composite video and subcarrier signals; BNC connector, loop through, on rear panel
Input B	Composite video signal; BNC connector, loop through, on rear panel
EXT CW	Subcarrier signal; BNC connector, loop through, on rear panel
Blanking Input	BNC connector, on rear panel
<b>Chrominance</b>	
Bandwidth	Fsc $\pm 500\text{kHz}$ Fsc = 4.43361875 MHz
Phase Accuracy	$\pm 2^\circ$
Amplitude Accuracy	$\pm 3\%$
Differential Phase	$\pm 2^\circ$
Differential Gain	$\pm 1\%$
<b>Synchronization</b>	
Internal	Burst signal from Input A or B; Level: 0.3Vp-p $\pm 6\text{dB}$
External	Subcarrier signal applied to EXT CW connector; Level: 2Vp-p $\pm 6\text{dB}$ 4.43361875 MHz $\pm 50\text{Hz}$
Pull-in Range	
Phasing Range	$360^\circ$ , variable
Calibrating Function	Test circle with chrominance input signal in non-synchronized condition
Power Supply	AC100V, 115V, 215V, 230V $\pm 10\%$ , 50/60Hz; approx. 40VA
Dimensions and Weight	Approx. 215(W) $\times$ 132 (H) $\times$ 400 (D) mm; approx. 7kg

# MWM-4371

## WAVEFORM MONITOR (NTSC System)



### < DESCRIPTION >

The MWM-4371 is an oscilloscope specially developed for analyzing the NTSC system video signals. In addition, for the vertical axis, the FLAT, IRE (low-pass) and CHROMA (3.58 MHz bandpass) can also be selected.

It is possible to conveniently measure the amplitudes of different components in the video signal and also the timing of sync signals. Furthermore, with use of a pattern generator, the dG (differential gain) in the video circuit and frequency characteristics can be determined.

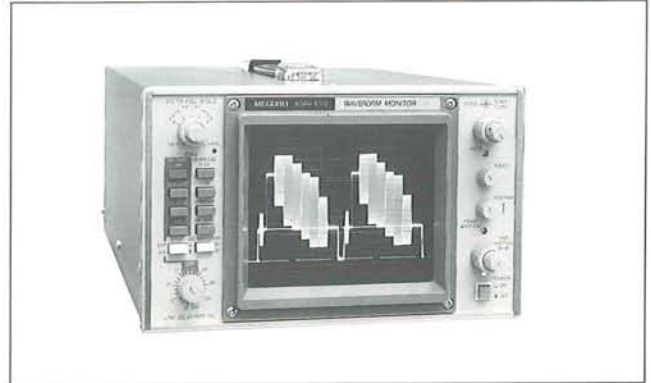
Again, a line selector is provided to enable observation of any 1 line in the 14 to 21 scanning lines.

### < SPECIFICATIONS >

<b>CRT</b>	
Effective area	150 mm type; effective display 100 × 80 mm with illuminated graticule
<b>Vertical Axis</b>	
FLAT	25 Hz to 3.6 MHz ±2% } ref'd to 50 kHz 3.6 MHz to 5 MHz +2% ~ -5% } > 22 dB atten. at 4.43 MHz (IRE STD 23-S)
IRE	Same as CHROMA; amplitude, approx. X3 to X5.5
CHROMA	3.58 MHz bandpass filter
DIF GAIN	Same as CHROMA; amplitude, approx. X3 to X5.5
Sensitivity	At 1V: 1 Vp-p at full scale; 140 IRE ±2% At 4V: 4 Vp-p at full scale; 140 IRE ±4%
Variable Range	At 1V: > 0.25 to 1V At 4V: > 1 to 4V
Input	A, B, at rear panel, BNC connectors; loop through
Input Impedance	1V range: 15 kΩ, approx. 50 pF 4V range: 60 kΩ, approx. 50 pF
Calibrator	1V ±1%
<b>Video Output</b>	
Level	On screen: 1 vp-p ± 15% at 140 IRE input
Freq. Response	25 Hz to 5 MHz ±5%
Impedance	Approx. 75Ω
<b>Horizontal Axis</b>	
2 H Sweep	For 2 H waveform display
1μs/DIV	2 H display magnified X10
2 V Sweep	For 2 V waveform display
2 V MAG Sweep	2 V display magnified ×20
Linearity	±3%
DC Regeneration	Clamp on back-panel
Line Selector	No. 1 & No. 2 field from 14 to 21 lines
Blanking Output	0 V for period of selected line and -2 V for others
External Synchronizing	Input: At rear panel BNC, loop through; approx. 15 kΩ Level: 1.5 to 5V
Power Requirements	Approx. 100V, 115V, 215V or 230V ±10%, 50/60 Hz; approx. 40 VA
Dimensions and Weight	Approx. 215(W) × 132 (H) × 400 (D) mm; approx. 7 kg

# MWM-4372

## WAVEFORM MONITOR (PAL System)



### < DESCRIPTION >

The MWM-4372 is an oscilloscope specially developed for analyzing the PAL system video signals, with exception of the PAL-M.

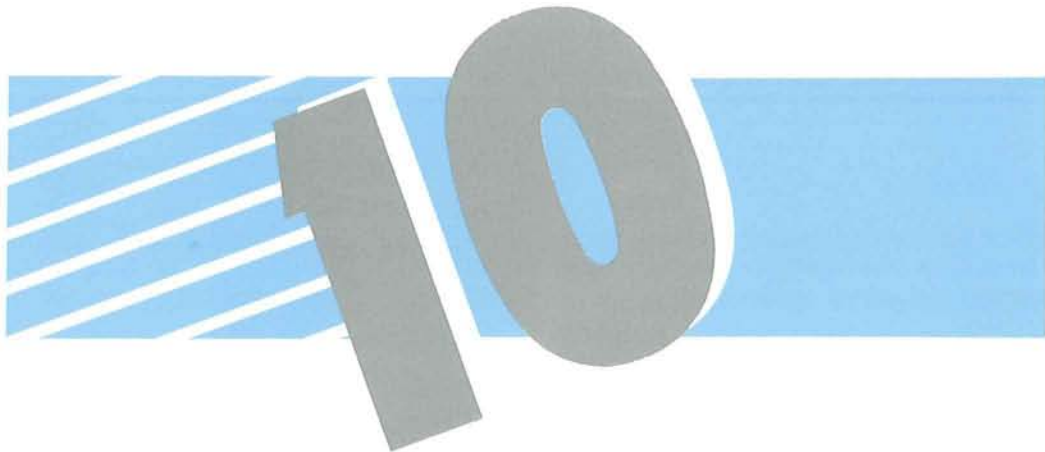
In addition, for the vertical axis, the FLAT, LUM (lowpass) and CHROMA (4.43 MHz bandpass) can also be selected.

It is possible to conveniently measure the amplitudes of different components in the video signal and also the timing of sync signals. Furthermore, with use of a pattern generator, the dG (differential gain) in the video circuit and frequency characteristics can be determined.

Again, a line selector is provided to enable observation of any 1 line in the 13 to 22 scanning lines.

### < SPECIFICATIONS >

<b>CRT</b>	
Effective area	150 mm type; effective display 100 × 80 mm with illuminated graticule
<b>Vertical Axis</b>	
FLAT	25 Hz to 3.6 MHz ±2% } ref'd to 50 kHz 3.6 MHz to 5 MHz +2% ~ -5% } > 22 dB atten. at 4.43 MHz (IRE STD 23-S)
LUM	Same as CHROMA; amplitude, approx. X3 to X5.5
CHROMA	4.43 MHz bandpass filter
DIF GAIN	Same as CHROMA; amplitude, approx. X3 to X5.5
Sensitivity	At 1V: 1 Vp-p at full scale; 1 div ±2% At 4V: 4 Vp-p at full scale; 1 div ±4%
Variable Range	At 1V: > 0.25 to 1V At 4V: > 1 to 4V
Input	A, B, at rear panel, BNC connectors; loop through
Input Impedance	1V range: 15 kΩ, approx. 50 pF 4V range: 60 kΩ, approx. 50 pF
Calibrator	1V ±1%
<b>Video Output</b>	
Level	On screen: 1 Vp-p ± 15% at per 1.0 div input
Freq. Response	25 Hz to 5 MHz ±5%
Impedance	Approx. 75Ω
<b>Horizontal Axis</b>	
2 H Sweep	For 2 H waveform display
1μs/DIV	2 H display magnified X10
2 V Sweep	For 2 V waveform display
2 V MAG Sweep	2 V display magnified ×20
Linearity	±3%
DC Regeneration	Clamp on back-panel
Line Selector	No. 1 field: 13 to 22 lines; No. 2 field: 325 to 334 lines
Blanking Output	0 V for period of selected line and -2 V for others
External Synchronizing	Input: At rear panel BNC, loop through; approx. 15 kΩ Level: 1.5 to 5V
Power Requirements	Approx. 100V, 115V, 215V or 230V ±10%, 50/60 Hz; approx. 40 VA
Dimensions and Weight	Approx. 215(W) × 132 (H) × 400 (D) mm; approx. 7 kg



**SPECTRUM ANALYZERS,  
OSCILLOSCOPES,  
DIGITAL STORAGE SCOPE,  
LOGIC ANALYZER**

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# MSA-4903

## 1.4GHz SPECTRUM ANALYZER



### < DESCRIPTION >

The MSA-4903 is a portable spectrum analyzer covering the wide range from 1 to 1400 MHz. It is most useful in determining the frequency distribution, spectrum analysis of waveforms and signal levels. In particular, accurate measurements can be made for CATV, VHF-UHF TV and cable terminal levels, fields strengths, spurious signals, IF output of BS terminals and other level measurements. An added advantage is that the analyzer is designed to measure video levels in TV signals and making it useful in CATV maintenance and servicing.

### < FEATURES >

- Measures the peak levels in the video signal.
- Wide frequency band coverage 1 to 1400 MHz.
- Direct readout of spectrum levels using the attenuator and CRT scale.
- Center frequency indicated with LCD display for ease in setting and readout.
- Level and frequency standardization with CAL output signal at 100 MHz, 80 dB $\mu$  (loaded).
- With bandwidth changeover to WIDE (TV), the TV signal waveforms can be observed.
- Buzzer indication when the battery voltage is low.
- 3-way power supply (including the internal battery); compact design; only 7.5 kg in weight; 1-hour operation with battery and high-speed, 2-hour, for recharging.
- IF output from a BS converter can be observed with use of a coupler for BS (option).

### < SPECIFICATIONS >

<b>Frequency Characteristics</b>			
<b>Measurement Frequency Range</b>	1 to 1400 MHz		
<b>Center Frequency Indication</b>	3 $\frac{1}{2}$ digit LCD display Resolution: 1 MHz Accuracy: $\pm 8$ MHz ( $\pm 3$ MHz after calibration)		
<b>Scan and 3 dB Bandwidth</b>	Interlocked operation; fixed at 1000 kHz when bandwidth is set to wide		
<b>Scan width, MHz/DIV</b>	<b>3dB Bandwidth, kHz</b>		
		NORM	WIDE (TV)
	100	1000	1000
	50	300	
	20		
	10	100	
	5		
	2	30	
	1		
	0.5	10	
0.2			
0.1			
<b>Scan Width Accuracy</b>	Center frequency: $\geq 100$ MHz $\pm 6\%$ $< 100$ MHz $\pm 10\%$		
<b>Scanning Time</b>	Approx. 3 msec/DIV; approx. $\pm 5\%$ adjustable		
<b>Amplitude Characteristics</b>			
<b>Measurement Range</b>	15 to 123 dB $\mu$ (80 to 123 dB $\mu$ on panel and 15 to 80 dB $\mu$ on screen)		
<b>Input Impedance</b>	75 $\Omega$ , VSWR $< 1.3$ at reference level set above 100 dB $\mu$		
<b>Maximum Input Levels</b>	123 dB $\mu$ at settings above 100 dB $\mu$ 103 dB $\mu$ at settings below 100 dB $\mu$ DC: $\pm 25$ V		
<b>Dynamic Range</b>	70 dB at frequencies above 10 MHz and $> 90$ dB settings 60 dB at frequencies below 10 MHz		
<b>Display Indication</b>	Scale: 10 dB/DIV Accuracy: $\pm 2$ dB		
<b>Frequency Response</b>	Flat within $\pm 2$ dB, for standard characteristics		
<b>Calibration Signal</b>			
<b>Frequency</b>	100 MHz $\pm 10$ kHz (including harmonics)		
<b>Output Level</b>	80 dB $\mu$ $\pm 0.5$ dB (load)		
<b>Output Impedance</b>	75 $\Omega$		
<b>General Data</b>			
<b>CRT</b>	3.5 inch, rectangular with graticule, 8 $\times$ 10 div.		
<b>Operating Temperature</b>	0 to 40°C		
<b>Power Requirements</b>	AC: 100 V, 115 V, 215 V or 230 V $\pm 10\%$ , 50/60 Hz DC: 12 to 15V, less than 1.2A Battery: 12V, 1.8AH (1 hour or more at continuous operation after 2 hour recharging)		
<b>Dimensions and Weight</b>	Approx. 300(W) $\times$ 115(H) $\times$ 340(D)mm; approx. 7.5 kg		
<b>Accessories, furnished</b>	Input cable, MC2052-B 1 ea. DC source connector, S-16902 1 ea. AC power cord 1 ea. Adapter, BNCP-FJ 1 ea. Hood for CRT, MB-2941 1 ea. Adjusting screw-driver 1 ea.		

■ **Options:** Carrying case, Battery charger, Battery pack (see, page 101)  
Coupler for BS

# MSA-4902TV

## 1000MHz SPECTRUM ANALYZER



### < DESCRIPTION >

The MSA-4902TV is a portable spectrum analyzer covering the 1 to 1000 MHz range. It is most useful in determining the frequency distribution, spectrum analysis of waveforms and signal levels. In particular, it is suited for measurements of CATV, VHF-UHF TV and cable terminal levels, field strengths and spurious signals in radio equipment.

An added advantage is that the analyzer is designed to measure the video levels in the TV signals making it useful in CATV maintenance and servicing.

### < FEATURES >

- Measures the peak levels in the video signal.
- Wide frequency band coverage 1 to 1000 MHz.
- Direct readout of spectrum levels using the attenuator and CRT scale.
- Center frequency indicated with LCD display for ease in setting and readout.
- Level and frequency standardization with CAL output signal at 100 MHz and 80 dB $\mu$  (loaded).
- With the band-width changeover to WIDE (TV), the TV signal waveforms can be observed.
- Buzzer indication when the battery voltage is low.
- 3-way power supply (including the internal battery; compact design and only 7.5 kg in weight for portability. 1-hour operation with battery and high-speed, 2-hours), for recharging.

### < SPECIFICATIONS >

Frequency Characteristics	
Measuring Frequency Range	1 to 1000 MHz
Center Frequency Indication	3 $\frac{1}{2}$ digit LCD display Resolution : 1 MHz Accuracy : $\pm 8$ MHz ( $\pm 3$ MHz after calibration)

Scan and 3 dB Bandwidths	Interlocked operation; with bandwidth, BW at WIDE, it is fixed at 1000 kHz	
Scan Width, MHz/DIV	3 dB Bandwidth, kHz	
	NORM	WIDE (TV)
	100	1000
	50	
	20	
	10	300
	5	
	2	100
	1	
0.5	30	
0.2		
0.1	10	
Scan Width Accuracy	Center frequency : $\geq 100$ MHz $\pm 6\%$ $< 100$ MHz $\pm 10\%$	
Scanning Time	Approx. 3msec/DIV; adjustable, approx. 5%	
Amplitude Characteristics		
Measurement Range	15 to 123 dB $\mu$ (80 to 123 dB $\mu$ on panel and 15 to 80 dB $\mu$ on screen)	
Input Impedance	75 $\Omega$ , VSWR $< 1.5$ at inputs over 100 dB $\mu$	
Maximum Input Levels	123 dB $\mu$ at level setting above 100 dB $\mu$ 103 dB $\mu$ at level setting below 100 dB $\mu$ DC: $\pm 25$ V	
Dynamic Range	70 dB, at frequencies above 10 MHz 60 dB, at frequencies below 10 MHz	
Display Calibration	Scale: 10 dB/DIV Accuracy: $\pm 2$ dB	
Frequency Response	Flat within $\pm 2$ dB	
Calibration Signals		
Frequency	100 MHz $\pm 10$ kHz (including harmonics)	
Output Level	80 dB $\mu$ $\pm 0.5$ dB (at open circuit)	
Output Impedance	75 $\Omega$	
General Data		
CRT	3.5 inch, rectangular with graticule, 8 $\times$ 10 DIV	
Operating Temperature	0 to 40 $^{\circ}$ C	
Power Requirements	AC: 100, 115, 215 or 230 V $\pm 10\%$ , 50/60 Hz DC: 12 to 15 V, less than 1.2 A Battery: 12 V, 1.8 AH (1 hour or more at continued operation and approx. 2 hours after recharging)	
Dimensions, overall	Approx. 300(W) $\times$ 115(H) $\times$ 340(D) mm.	
Weight	Approx. 7.5 kg	
Accessories, furnished	Input cable, MC-2052-B 1 ea. DC source connector 1 ea. AC power cord 1 ea. Adapter 1 ea. Hood for CRT, MB-2941 1 ea. Screw-driver for adjustments 1 ea.	

■ OPTION: Carrying case, Battery charger, Battery pack (see, page 101)

# MSA-4902

## 1000MHz SPECTRUM ANALYZER



### < DESCRIPTION >

The MSA-4902 is a portable spectrum analyzer covering the 1 to 1000 MHz range. It is most useful in determining the frequency distribution, spectrum analysis of waveforms, and signal levels. In particular, it is suited for measurements of CATV, VHF-UHF TV and cable TV terminal levels, field strengths, and spurious signals in radio equipment. Small size, light weight and three-way power source operation are prominent advantages.

### < FEATURES >

- Wide frequency range, 1 to 1000 MHz.
- Direct readout of spectrum levels using the attenuator calibration.
- Center frequency indicated with LCD display for ease in setting and readout.
- Two calibration points, 100 MHz and 100dB $\mu$  (open circuit), for frequency standardization and level measurements.
- Compact and light in structure; operates with AC power, or DC (using internal batteries or external source).

### < SPECIFICATIONS >

#### Frequency Characteristics

Measuring Frequency Range	1 to 1000MHz																	
Center Frequency Indication	3 $\frac{1}{2}$ digit LCD display Resolution: 1MHz Accuracy: $\pm 8$ MHz																	
Scan and 3dB Bandwidths	Interlocked operation																	
	<table border="1"> <thead> <tr> <th>Scan width, MHz/DIV</th> <th>3dB bandwidth (kHz)</th> </tr> </thead> <tbody> <tr> <td>100</td> <td rowspan="2">1000</td> </tr> <tr> <td>50</td> </tr> <tr> <td>20</td> <td rowspan="2">300</td> </tr> <tr> <td>10</td> </tr> <tr> <td>5</td> <td rowspan="2">100</td> </tr> <tr> <td>2</td> </tr> <tr> <td>1</td> <td rowspan="2">30</td> </tr> <tr> <td>0.5</td> </tr> <tr> <td>0.2</td> <td rowspan="2">10</td> </tr> <tr> <td>0.1</td> </tr> </tbody> </table>	Scan width, MHz/DIV	3dB bandwidth (kHz)	100	1000	50	20	300	10	5	100	2	1	30	0.5	0.2	10	0.1
Scan width, MHz/DIV	3dB bandwidth (kHz)																	
100	1000																	
50																		
20	300																	
10																		
5	100																	
2																		
1	30																	
0.5																		
0.2	10																	
0.1																		

Scan Width Accuracy	Center frequency: $\geq 100\text{MHz} \pm 6\%$ $< 100\text{MHz} \pm 10\%$
Scanning Time	Approx. 3msec/DIV
<b>Amplitude Characteristics</b>	
Measurement Range	15 to 129dB $\mu$ EMF (80 to 129dB $\mu$ on panel and 15 to 80dB $\mu$ on screen).
Input Impedance	75 $\Omega$ , VSWR $< 1.5$ at input level over 100dB $\mu$
Maximum Input Levels	130dB $\mu$ at input level setting above 100dB $\mu$ 110dB $\mu$ at input level setting below 100dB $\mu$ DC: $\pm 25\text{V}$
Dynamic Range	70dB, at frequencies above 10MHz 60dB, at frequencies below 10MHz
Display Calibration	Scale: 10dB/DIV Accuracy: $\pm 2\text{dB}$
Frequency Response	Flat within $\pm 2\text{dB}$
<b>Calibration Signals</b>	
Frequency	100MHz $\pm 10\text{kHz}$ (including harmonics)
Output Level	100dB $\mu$ $\pm 0.5\text{dB}$ (at open circuit)
Output Impedance	75 $\Omega$
<b>General Data</b>	
CRT	3.5 inch, rectangular, with internal graticule, 8 $\times$ 10 DIV
Operating Temperature	0 to 40 $^{\circ}\text{C}$
Power Requirements	AC: 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60Hz DC: 12 to 15V, $< 1.2\text{A}$ Battery: 12V, 1.65A (1 hour or more at continuous operation; approx. 2 hours after recharging).
Dimensions, overall	Approx. 300(W) $\times$ 115(H) $\times$ 340(D) mm
Weight	Approx. 7.5kg
Accessories, furnished	Input cable 1 ea. DC source connector 1 ea. AC power cord 1 ea. Hood for CRT 1 ea.

■ **Option:** Carrying case, Battery charger, Battery pack (see, page 101)

★ **Note:** On special order, the input impedance may be modified to 50  $\Omega$ .

# MSA-4901

## 300MHz SPECTRUM ANALYZER



### < DESCRIPTION: >

The MSA-4901 is a spectrum analyzer designed to cover the 1 to 300MHz range. The oscilloscope is a time-domain type in which the frequency domain and vertical axis are calibrated in logarithmic form. For the signal under test, frequency distribution, spectrum of waveforms and levels can be readily determined. In particular, the TV scanning mode permits measurements in CATV and VHF TV bands for terminal levels and field strengths. In addition, tests are possible for spurious signals and levels in amateur communications equipment.

### < FEATURES: >

- Frequency range, 1 to 300MHz covers the TV VHF band; the TV SCAN mode enables determination of TV field strengths and terminal voltages of CATV equipment.
- Calibration output level provided at  $-30\text{dBm}$  at 20MHz for reference level measurements and also for frequency.
- Center frequency indicated with LCD display for ease in frequency measurements.
- Compact and light in structure; usable with AC power internal batteries or external DC source.

### < SPECIFICATIONS >

Frequency Characteristics															
Measuring Frequency Range	1 to 300MHz														
Center Frequency Indication	3-digit LCD display Resolution: 1MHz Accuracy: $\pm 10\text{MHz}$														
Scan and 3dB Bandwidths	Interlocked operation <table border="1"> <thead> <tr> <th>Scan width, MHz/DIV</th> <th>3dB bandwidth (kHz)</th> </tr> </thead> <tbody> <tr> <td>TV (80 ~ 230)</td> <td>300</td> </tr> <tr> <td>10</td> <td rowspan="3">100</td> </tr> <tr> <td>5</td> </tr> <tr> <td>2</td> </tr> <tr> <td>1</td> <td rowspan="3">30</td> </tr> <tr> <td>0.5</td> </tr> <tr> <td>0.2</td> </tr> <tr> <td>0.1</td> <td>10</td> </tr> </tbody> </table>	Scan width, MHz/DIV	3dB bandwidth (kHz)	TV (80 ~ 230)	300	10	100	5	2	1	30	0.5	0.2	0.1	10
Scan width, MHz/DIV	3dB bandwidth (kHz)														
TV (80 ~ 230)	300														
10	100														
5															
2															
1	30														
0.5															
0.2															
0.1	10														
Scan Width Accuracy	$\pm 20\%$														
Scanning Time	Approx. 3msec/DIV														
Amplitude Characteristics															
Measurement Range	$-100$ to $+20\text{dBm}$														
Input Impedance	$75\Omega$ , VSWR $< 1.5$ with input attenuator set above 10dB step														
Maximum Input Levels	$+20\text{dBm}$ at input attenuator above 10dB $+7\text{dBm}$ at input attenuator below 10dB DC: $\pm 25\text{V}$														
Dynamic Range	70dB														
Display Calibration	Scale: 10dB/DIV Accuracy: $\pm 2\text{dB}$														
Frequency Response	Flat within $\pm 2\text{dB}$														
IF Gain	0 to 12dB, continuously adjustable														
Calibration Signals															
Frequency	20MHz $\pm 2\text{kHz}$ (including harmonics)														
Output Level	$-30\text{dBm} \pm 1\text{dB}$														
Output Impedance	$75\Omega$														
General Data															
CRT	3.5 inch, rectangular, with internal graticule, $8 \times 10$ DIV														
Operating Temperature	0 to $40^\circ\text{C}$														
Power Requirements	AC: 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60Hz DC: 11 to 15V, $< 1.3\text{A}$ Battery: 12V, 1.2A/H (40 min. or more at continuous operation; approx. 16 hours after recharging).														
Dimensions, overall	Approx. 300(W) $\times$ 115(H) $\times$ 340(D) mm														
Weight	Approx. 8kg														
Accessories, furnished	Input cable 1 ea. Connector BNC-P-FJ 1 ea. DC source connector 1 ea. AC power cord 1 ea.														

■ Option: Hood for CRT, Carrying case, Battery charger, Battery pack (see, page 101)

# MO-1255

## 100MHz 3-CHANNEL OSCILLOSCOPE



### < FEATURES >

- The 3-channel function is convenient for timing observation of video signals, etc. (Up to 8 waveform traces can be observed with use of the alternate sweep function.)
- For enlargement and comparison of waveforms, the alternate sweep function (ALT switch) enables simultaneous display of main and delayed sweep waveforms.
- The 6-inch rectangular CRT featuring high luminance is provided with an internal graticule so waveforms can be easily observed without parallax error.
- The wide dynamic range guarantees the linearity for 8 divisions on the CRT from DC to 100 MHz.
- The TV sync signal separator circuit is convenient for observation of video signals. Stable triggering is possible with TV-V and TV-H sync signals, corresponding to the set time axis.
- The 20 MHz BPF allows highly accurate observation of signals containing high frequency noise.
- Even when signal inputs CH1 and CH2 are at different frequencies, they can be triggered at the same time by pressing the INT. TRIG CH1 and CH2 switches.
- The 2-trace X-Y operation uses CH1 for X axis and CH2 and CH3 for Y axis. This function is useful for measuring phase relationships between two signals or for simultaneous observation of two phenomena such as amplitude characteristics and delay characteristics.
- The vertical deflection mode switches and sweep mode switches are arranged on the center and colored according to function.

#### ■ Optional accessories:

Optical monitor (see, page 101)

### < SPECIFICATIONS >

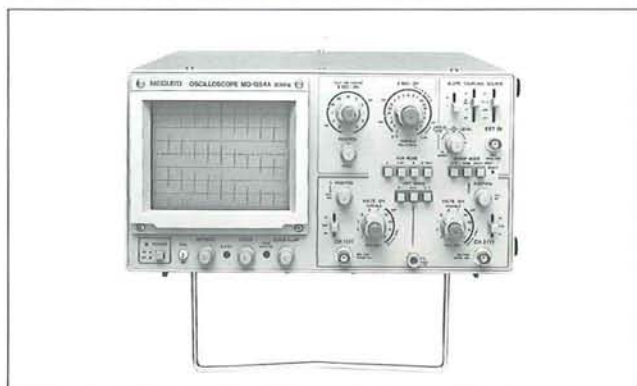
<b>Vertical axis</b>	
<b>Sensitivity</b>	5 mV ~ 5V/div $\pm 3\%$ 10 steps selectable in 1-2-5 sequence
<b>Magnification</b>	5 times, 1 mV ~ 1V/div (at $\times 5$ MAG)
<b>Bandwidth</b>	DC: DC ~ 100MHz (within $-3$ dB) AC: 10 Hz ~ 100 MHz (within $-3$ dB) At $\times 5$ MAG DC: 10 Hz ~ 20 MHz (within $-3$ dB)
<b>Rise time</b>	3.5ns or less (Approx. 17.5ns or less at $\times 5$ MAG)
<b>Overshoot</b>	5% or less (at 10 mV/div range)
<b>Input impedance</b>	1M $\Omega$ /22pF
<b>Maximum input voltage</b>	300V (DC + AC peak)
<b>Operation mode</b>	CH1, ADD, CH2, CH3 ALT/CHOP selectable
<b>Chop frequency</b>	Approx. 500 kHz
<b>Polarity selection</b>	Possible only in CH2
<b>Delay line</b>	Signal delay; approx. 20ns
<b>Horizontal axis</b>	
<b>Sweep time</b>	A sweep: 20ns ~ 0.5 s/div, 1-2-5 sequence 10 times, 2ns ~ 50ms/div B sweep: 20ns ~ 50ms/div, 1-2-5 sequence
<b>Magnification</b>	10 times, 2ns ~ 5ms/div
<b>Delay time</b>	0.2 $\mu$ s ~ 0.5s
<b>Sweep mode</b>	AUTO, NORM, SINGLE, A, ALT, B, B TRIG'D
<b>Synchronization</b>	
<b>Signal source</b>	INT (CH1, CH2), LINE, EXT, EXT $\div 5$
<b>Sensitivity</b>	DC ~ 10 MHz: 0.6 div (INT) 0.06V (EXT) 10 MHz ~ 100 MHz: 1.5 div (INT) 0.15V (EXT) Video signal: 2 div (INT) 0.2V (EXT)
<b>Coupling</b>	AC, HF REJ, TV, DC (TV mode is selected for TV-V and TV-H with SEC/DIV switch)
<b>Polarity</b>	+ or -
<b>Maximum input voltage</b>	100V (DC + AC peak)
<b>X-Y operation</b>	
<b>Operation mode</b>	X-axis: CH1, Y-axis: CH2 or Y-axis: CH2, Y-axis: CH3
<b>Bandwidth</b>	DC ~ 2 MHz (within $-3$ dB)
<b>Phase difference</b>	Within 3 $^\circ$ at DC ~ 100 kHz
<b>Z-axis</b>	
<b>Input voltage</b>	3Vp-p or more (Bright at negative-going)
<b>Input resistance</b>	50V (within $-3$ dB) (DC + AC peak)
<b>Voltage</b>	
<b>Bandwidth</b>	DC ~ 2 MHz
<b>Calibration</b>	
<b>Output voltage</b>	2Vp-p $\pm 2\%$ (Square wave of 1 kHz)
<b>Cathode-ray tube</b>	
<b>Effective area</b>	8 $\times$ 10 div (1 div = 10 mm) 6" square with internal graticule
<b>Acceleration voltage</b>	19 kV
<b>General Data</b>	
<b>Power requirements</b>	AC100V, 115V, 215V, 230V, $\pm 10\%$ , 50/60 Hz, Approx. 45VA
<b>Dimensions, overall</b>	Approx. 294(W) $\times$ 152(H) $\times$ 390(D)mm Body dimensions Approx. 328(W) $\times$ 180(H) $\times$ 456(D)mm Max. dimensions (with handle)
<b>Weight</b>	Approx. 7.8 kg

#### ● Accessoires:

Probe MP-3051 (with 10:1/1:1 selector) <option>	2
Power cord	1
Instruction manual	1
Fuse	2

# MO-1254A

## 50 MHz 2-CHANNEL OSCILLOSCOPE



### < FEATURES >

- High sensitivity design, featuring the vertical axis gain of 1 mV/div for both CH1 and CH2 (20 MHz). High speed sweep of 20 ns/div allows accurate observation of even signal with fast rise time.
- While observing a waveform using the main sweep time axis (A sweep), a desired part of the waveform can be magnified and observed using the delayed sweep time axis (B sweep). The Possibility of continuous variation makes the observation free. The lumination of B sweep can be intensified.
- By setting the trigger coupling mode to "TV", triggering can easily be made using TV video signal.
- The trigger signal level can be fixed at around the center of the observed waveform. As the trigger point error due to wave variation is reduced, adjustments does not have to repeated every time.
- When triggering is difficult with only the trigger level adjustment, the HOLD OFF control allows to continuously vary the trigger hold time by more than 5 times, so that observations of complex waves are possible.
- In addition to the single trace operation with the main time axis set for the X-Y mode, 2-input X-Y operation is possible by setting the CH1 and CH2 input signals for the Y axis, setting the main time axis for the X-Y mode, and by applying the X-axis signal to the EXT IN input of SOURCE EXT.
- The CRT provides high luminance sufficient even for high-speed sweep and has a widescaled surface. The scale illumination mechanism is useful of taking photographs of display.
- The new design provides high stability with reduced drift, making observations of signals including DC components more stable.
- The vertical, horizontal and triggering mode switches are arranged on the center of the panel in consideration of their functions and of the ease of operation.

#### ■ Optional accessories:

Optical monitor (See, page 101)

### < SPECIFICATIONS >

<b>Vertical axis</b>	
<b>Sensitivity</b>	5 mV ~ 5 V/div $\pm 3\%$ 10 steps selectable in 1-2-5 sequence $\times 5$ , from 1 mV/div ~ (at $\times 5$ MAG)
<b>Magnification</b>	$\times 5$ , from 1 mV/div ~ (at $\times 5$ MAG)
<b>Bandwidth</b>	DC: DC ~ 50 MHz (within $-3$ dB) AC: 10 Hz ~ 50 MHz (within $-3$ dB) $\times 5$ MAG mode: DC(10 Hz) ~ 20 MHz (within $-3$ dB)
<b>Rise time</b>	7.0 ns or less (17.5 ns with $\times 5$ MAG)
<b>Overshoot</b>	3% or less
<b>Input impedance</b>	1M $\Omega$ $\pm 2\%$ , 25 pF $\pm 2$ pF
<b>Maximum input voltage</b>	400 Vp-p or 200V (DC + AC peak)
<b>DC balance shift</b>	$\pm 0.5$ div ( $\pm 2.0$ div with $\times 5$ MAG)
<b>Operation mode</b>	CH1, CH2, DUAL, ADD (At DUAL, ALT and CHOP are selected according to the sweep time).
<b>Chop frequency</b>	Approx. 250 kHz
<b>Channel isolation</b>	60 dB or more (At 50 kHz), 30 dB or more (At 50 MHz)
<b>CH1 signal output</b>	Approx. 100 mV/div (open), approx. 50 mV/div (50-ohm terminated)
<b>CH2 polarity</b>	Inversion possible, trace shift less than 1 div.
<b>Signal delay time</b>	Approx. 40 ns
<b>Horizontal axis</b>	
<b>Horizontal axis modes</b>	A, A INT, B, B TRIG'D
<b>A sweep</b>	
<b>Sweep time</b>	0.2 $\mu$ s ~ 0.5 s/div $\pm 3\%$ 20 steps selectable in 1-2-5 sequence 10 times, 20 ns/div ~ (at $\times 10$ MAG) $\pm 6\%$
<b>Magnification</b>	10 times, 20 ns/div ~ (at $\times 10$ MAG) $\pm 6\%$
<b>Linearity</b>	3% or less (at $\times 10$ MAG; 6% or less)
<b>Sweep mode</b>	AUTO, NORMAL, SINGLE
<b>Holdoff time</b>	Variable to more than 5 times (at 0.2 $\mu$ s ~ 1 ms/div)
<b>B sweep</b>	
<b>Delay system</b>	Continuous delay, triggered delay (synchronized with A trigger)
<b>Sweep time</b>	0.2 $\mu$ s ~ 0.5 ms/div $\pm 3\%$ At $\times 10$ MAG: 20ns ~ 50 $\mu$ s/div $\pm 6\%$
<b>Delay time</b>	2 $\mu$ s ~ 5 ms/div
<b>Delay jitter</b>	Within 1/10,000
<b>Trigger</b>	
<b>Trigger signal source</b>	CH1, CH2, LINE, EXT
<b>Coupling</b>	AC, HF REJ, TV, DC. (AC: Accepts signal above 10 Hz, HF REJ: below 50 kHz.) + or -
<b>Polarity</b>	
<b>Trigger sensitivity</b>	INT: 0.5 div or more (DC ~ 30 MHz), 1.5 div or more (DC ~ 50 MHz) EXT: 100 mVp-p or more (DC ~ 30 MHz) 200 mVp-p or more (DC ~ 50 MHz)
<b>Level fixing</b>	Possible between 50 Hz and 50 MHz
<b>EXT trigger input</b>	
<b>Input impedance</b>	1M $\Omega$ $\pm 2\%$ , approx. 30 pF
<b>Maximum input voltage</b>	100 V (DC + AC peak)
<b>B trigger</b>	Same as A trigger signal
<b>X-Y operation</b>	
<b>Sensitivity</b>	5 mV ~ 5V/div (X-axis: CH1, Y-axis: CH2)
<b>X-axis bandwidth</b>	DC ~ 2 MHz (within $-3$ dB)
<b>Input impedance</b>	1 M $\Omega$ , approx. 25 pF
<b>Maximum input voltage</b>	400 Vp-p or 200 V (DC + AC peak)
<b>Phase shift</b>	Within 3° at 100 kHz
<b>EXT trigger</b>	
<b>Sensitivity</b>	100 mV/div (Y-axis: CH1 and CH2)
<b>Usable frequency range</b>	DC ~ 2 MHz (within $-3$ dB)
<b>Phase shift</b>	Within 3° at 100 kHz
<b>Z-axis</b>	
<b>Input voltage</b>	3 Vp-p or more (bright at negative-going input)
<b>Input resistance</b>	Approx. 5 k $\Omega$
<b>Maximum Input</b>	50 V (DC + AC peak)
<b>Usable frequency range</b>	DC ~ 5 MHz (within $-3$ dB)
<b>Calibration</b>	
<b>Output voltage</b>	3 Vp-p $\pm 2\%$ (Square wave at 1 kHz)
<b>Cathode-ray tube</b>	
<b>Effective area</b>	8 $\times$ 10 div (1 div = 10 mm), 6 rectangular with internal graticule
<b>Acceleration voltage</b>	Approx. 12 kV
<b>General Data</b>	
<b>Power requirement</b>	AC 100V, 115V, 215V, 230V $\pm 10\%$ , 50/60 Hz, Approx. 35 VA
<b>Dimensions and weight</b>	Approx. 315(W) $\times$ 165(H) $\times$ 435(D)mm, Approx. 7.5 kg

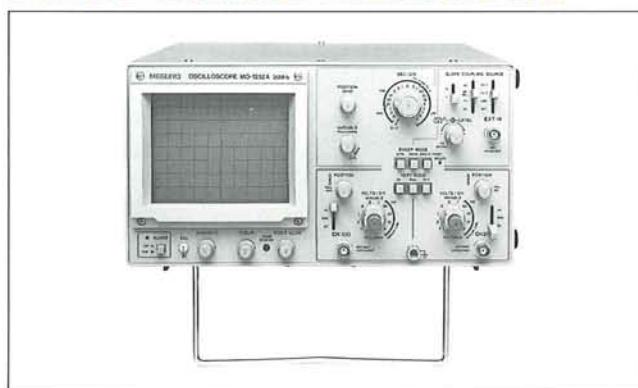
#### ● Accessories:

Probe MP-3050 (with 10:1, 1:1 selector) <option>	2
Power cord	1
Instruction manual	1
Fuse	2

10

# MO-1252A

## 25MHz 2-CHANNEL OSCILLOSCOPE



### < FEATURES >

- High sensitivity design, featuring the vertical axis gain of 1 mV/div for both CH1 and CH2 (15 MHz). High speed sweep of 20 ns/div allows accurate observation of even signal with fast rise time.
- By setting the trigger coupling mode to "TV", triggering can easily be made using TV video signal.
- The trigger signal level can be fixed at around the center of the observed waveform. As the trigger point error due to wave variation is reduced, adjustments does not have to repeated every time.
- When triggering is difficult with only the trigger level adjustment, the HOLD OFF control allows to continuously vary the trigger hold time by more than 5 times, so that observations of complex waves are possible.
- In addition to the single trace operation with the main time axis set for the X-Y mode, 2-input X-Y operation is possible by setting the CH1 and CH2 input signals for the Y axis, setting the main time axis for the X-Y mode, and by applying the X-axis signal to the EXT IN input of SOURCE EXT.
- The CRT provides high luminance sufficient even for high-speed sweep and has a wide scaled surface. The scale illumination mechanism is useful of taking photographs of display.
- The new design provides high stability with reduced drift, making observations of signals including DC components more stable.
- The vertical, horizontal and triggering mode switches are arranged on the center of the panel in consideration of their functions and of the ease of operation.

#### ■ Optional accessories:

Optical monitor (see page 101)

### < SPECIFICATIONS >

Vertical axis	
Sensitivity	5 mV ~ 5V/div $\pm 3\%$ 10 steps selectable in 1-2-5 sequence $\times 5$ , from 1 mV/div ~ (at $\times 5$ MAG)
Magnification	DC: DC ~ 25 MHz (within -3 dB)
Bandwidth	AC: 10 Hz ~ 25 MHz (within -3 dB) $\times 5$ MAG mode: DC (10 Hz) ~ 15 MHz (within -3 dB)

Rise time	14.0 ns or less (23.3 ns with $\times 5$ MAG)
Overshoot	3% or less
Input impedance	1 M $\Omega$ $\pm 2\%$ , 25 pF $\pm 3$ pF
Maximum input voltage	400 Vp-p or 200V (DC + AC peak)
DC balance shift	$\pm 0.5$ div ( $\pm 2.0$ div with $\times 5$ MAG)
Operation mode	CH1, CH2, DUAL, ADD (At DUAL, ALT and CHOP are selected according to the sweep time.)
Chop frequency	Approx. 250 kHz
Channel isolation	60 dB or more (At 50 kHz), 30 dB or more (At 25 MHz)
CH1 signal output	Approx. 100 mV/div (open), approx. 50 mV/div (50-ohm terminated)
CH2 polarity	Inversion possible, trace shift less than 1 div.
Horizontal axis	
Horizontal axis modes	
Sweep time	0.2 $\mu$ s ~ 0.5 s/div $\pm 3\%$ 20 steps selectable in 1-2-5 sequence
Magnification	10 times, 20 ns/div-(at $\times 10$ MAG) $\pm 6\%$
Linearity	3% or less (at $\times 10$ MAG, 6% or less)
Sweep mode	AUTO, NORMAL, SINGLE
Holdoff time	Variable to more than 5 times (at 0.2 $\mu$ s ~ 1 ms/div)
Trigger	
Trigger signal source	CH1, CH2, LINE, EXT
Coupling	AC, HF REJ, TV, DC (AC: Accepts signal above 10 Hz, HF REF; below 50 kHz.) + or -
Polarity	
Trigger sensitivity	INT: 0.5 div or more (DC ~ 15 MHz), 1.5 div or more (DC ~ 25 MHz) EXT: 100 mVp-p or more (DC ~ 15 MHz), 200 mVp-p or more (DC ~ 25 MHz)
Level fixing	Possible between 50 Hz and 25 MHz
EXT trigger input	
Input impedance	1 M $\Omega$ , 25 pF $\pm 3$ pF
Maximum input voltage	100V (DC + AC peak)
X-Y operation	
Sensitivity	5 mV ~ 5V/div (X-axis: CH1, Y-axis: CH2)
X-axis bandwidth	DC ~ 1 MHz (within -3 dB)
Input impedance	1 M $\Omega$ , approx. 25 pF
Maximum input voltage	400 Vp-p or 200V (DC + AC peak)
Phase shift	Within 3° at 50 kHz
EXT trigger	
Sensitivity	100 mV/div (Y axis: CH1 and CH2)
Usable frequency range	DC ~ 1 MHz (within -3 dB)
Phase shift	Within 3° at 100 kHz
Z-axis	
Input voltage	3 Vp-p or more (bright at negative-going input)
Input resistance	Approx. 5 k $\Omega$
Maximum Input	50 V (DC + AC peak)
Usable frequency range	DC ~ 5 MHz (within -3 dB)
Calibration	
Output voltage	3 Vp-p $\pm 2\%$ (Square wave of 1 kHz)
Cathode-ray tube	
Effective area	8 $\times$ 10 div (1 div = 10 mm), 6' rectangular with internal graticule
Acceleration voltage	Approx. 2.1 kV
General Data	
Power Requirement	AC 100V, 115V, 215V, 230V $\pm 10\%$ , 50/60 Hz, Approx. 32 VA
Dimensions and weight	Approx. 315(W) $\times$ 165(H) $\times$ 435(D)mm, Approx. 7.3 kg

#### ● Accessories:

Probe MP-3050 (with 10:1,1:1 selector) <option>	2
Power cord	1
Instruction manual	1
Fuse	2

# MSO-1270A

## DIGITAL STORAGE SCOPE



### < DESCRIPTION >

The MSO-1270A is a digital storage scope based on a 20 MHz, 2-channel oscilloscope. With a sampling rate of 2 MHz and a 2-kiloword memory provided for each input channel, it enables observations of two high-speed phenomena.

Its wide range of measurement and storage modes include REFRESH, SINGLE, ROLL PRE-TRIGGER, SPLIT-MEMORY RECORDING, EXTERNAL START/STOP and GATING for observation of various transient phenomena in various fields and for data before and after triggering, expanding its application into almost any field.

The MSO-1270A can also be used as a 20 MHz oscilloscope by simple switching operation.

### < FEATURES >

- As each channel is provided with 2-kiloword 8-bit A/D converter, high density monitoring is possible.
- Marker display on either side of the CRT for indicating the trigger level.
- Pre- and post-trigger functions for observation of phenomena before and after triggering.
- Split memory function for comparison of two or four waveforms.
- Hard copy possible by external triggering. The A/D converters provided independently for both channels make possible simultaneous recording and shorten the processing time.
- Each CH-positioning is available in storage dual mode.
- Time axis magnification up to 160 times.
- Linear interpolation function with dot joint mode.
- With refresh mode, monitoring is possible as in real mode.
- As this scope operates with the external clock, logarithmic axis indication or long time observation can be recorded.

#### ■ Optional accessories:

Optical monitor (see, page 101)

### < SPECIFICATIONS >

<b>- REAL MODE -</b>	
<b>Vertical axis</b>	
<b>Sensitivity</b>	5mV ~ 5V/div $\pm 3\%$ 10 steps selectable in 1-2-5 sequence
<b>Sensitive magnification</b>	5 times 1mV/div ~ (at $\times 5$ MAG)
<b>Bandwidth</b>	DC: DC ~ 20 MHz (within $-3$ dB) AC: 10 Hz ~ 20 MHz (within $-3$ dB)
<b>Rise time</b>	17.5 ns or less
<b>Overshoot</b>	3% or less
<b>Input impedance</b>	1M $\Omega$ $\pm 2\%$ , 25 pF $\pm 3$ pF
<b>Maximum input voltage</b>	400 Vp-p or 200V (DC + AC peak)
<b>Operation mode</b>	CH1, CH2, DUAL, ADD (At DUAL, ALT and CHOP are selected according to the sweep time.)
<b>Chop frequency</b>	Approx. 250 kHz
<b>Cross-talk</b>	> 60 dB (At 50 kHz), > 30 dB (20 MHz)
<b>Polarity selection</b>	Possible only in CH2
<b>Horizontal axis</b>	
<b>Sweep time</b>	0.2 $\mu$ s ~ 0.5 s/div $\pm 3\%$ 20 steps selectable in 1-2-5 sequence-REAL MODE STOR MODE: 0.1 ms ~ 0.5 s/div $\pm 3\%$
<b>Magnification</b>	10 times 20 ns/div ~ (at $\times 10$ MAG)
<b>Linearity</b>	3% or less (6% or less at $\times 10$ MAG)
<b>Sweep mode</b>	MODE SELECT: REAL, STOR
<b>Trigger</b>	
<b>Trigger signal source</b>	CH1, CH2, LINE, EXT
<b>Coupling</b>	AC, HF REJ, TV, DC (Tv mode is selected for TV-V and TV-H with SEC/DIV switch)
<b>Polarity</b>	+ or -
<b>Trigger sensitivity</b>	INT: 1.5 div or more (DC ~ 20 MHz) EXT: 200mVp-p or more (DC ~ 20 MHz)
<b>X-Y operation</b>	
<b>Sensitivity</b>	5 mV ~ 5 V/div 10 steps selectable (X-axis: CH1, Y-axis: CH2)
<b>X-axis bandwidth</b>	DC ~ 1 MHz (within $-3$ dB)
<b>Input impedance</b>	1M $\Omega$ , 25 pF
<b>Maximum input voltage</b>	400 Vp-p or 200V (DC + AC peak)
<b>Others</b>	Same specifications as CH1, CH2
<b>Z-axis</b>	
<b>Input voltage</b>	3 Vp-p or more (Bright at negative-going)
<b>Maximum input</b>	50V (DC + AC peak)
<b>Usable frequency range</b>	DC ~ 5 MHz (within $-3$ dB)
<b>Calibration</b>	
<b>Output voltage</b>	2 Vp-p $\pm 2\%$ (Square wave of approx. 1 kHz)
<b>Cathode-ray tube</b>	
<b>Effective area</b>	8 $\times$ 10 div (1 div = 10 mm), 6" square with internal graticule
<b>Acceleration voltage</b>	2.1 kV
<b>- STORE MODE -</b>	
<b>Digital storage</b>	
<b>Memory capacity</b>	2048 $\times$ 8 bit, CMOS RAM (for each channel)
<b>Resolution</b>	V axis: 0.4%, H axis 0.05%
<b>Access time</b>	Approx. 72 ns
<b>Frequency response</b>	DC ~ 300 kHz ( $-3$ dB)
<b>A/D converters</b>	8-bit (provided for each channel)
<b>V-axis resolution</b>	256 steps (for 8 div or full scale), approx. 30 steps (for 1 div)
<b>Step response</b>	Less than 500 ns (1/2 channel trace)
<b>Conversion speed</b>	440 ns/word (2.25 MHz)
<b>Max. sampling rate</b>	2.048 MHz (with 0.1 ms/div)
<b>Digital timebase</b>	0.1 ms/div ~ 0.5 s/div (in 12 steps of SEC/DIV switch)
<b>Ext. timebase</b>	DC ~ approx. 2.1 MHz, TTL positive logic (with SEC/DIV switch at range from 50 $\mu$ s/div to 0.2 $\mu$ s/div)
<b>Dot joint</b>	Step-shaped corners of converter output shaped into a continuous curve. (linear interpolation). Settable on the CRT display.
<b>Trigger level</b>	Approx. 0.5 div (DC ~ 4 MHz, CH1 or CH2, DC coupled)
<b>Trigger sensitivity</b>	
<b>Pre-trigger memory</b>	Effective in ROLL mode. Selectable between 25%, 50%, 75% and 100% of memory length. Resolution: 512 samples
<b><math>\times 160</math> magnification</b>	Digital $\times 16$ , analog $\times 10$
<b>X-Y or X-T recorder output</b>	Y = 4 V/s, X = 2 V/s, 2 mm/s, manual or automatic Plot time: 10, 20, 50 sec. Pen command: TTL positive logic
<b>Power requirement</b>	Output impedance: Approx. 1 k $\Omega$ , 100 pF AC 100V, 115V, 215V, 230V $\pm 10\%$ , 50-60 Hz, approx. 35 VA
<b>Dimensions &amp; weight</b>	Approx. 370(W) $\times$ 185(H) $\times$ 435(D)mm, Approx. 10 kg

- **Accessories:**
- Probe MP-3050 (with 10:1/1:1 selector) <option> 2
- Power cord 1
- Instruction manual 1
- Fuse 2



# MLA-3300

## LOGIC ANALYZER



### < DESCRIPTION >

The MLA-3300 is a compact, light-weight logic analyzer with 16-channel data input and 100 ns maximum resolution (at 10 MHz). The liquid crystal display results in very low power dissipation in logic circuits, making possible battery-powered operation (AC can also be used) where no other power source is available. The analyzer is designed to measure timing, state and signature and can be used in many applications from hardware to soft ware.

### < FEATURES >

- Compact (280W × 75H × 185D mm) and light. Rechargeable (automatic charge works during AC operation). For use where there is no power supply.
- 16-channel data input, external clock input, external trigger input, clock qualifier input.
- 256-bit/channel acquisition memory and 256 bit/channel reference memory. Makes comparative acquisition.
- Resolution (internal clock and external clock) of up to 100ns (at 10MHz).
- Combines three functions: timing analyzer, state analyzer and signature analyzer in one unit.
- Storage acquisition memory and reference memory have memory back-up, to be analyzed in detail later.
- Powerful trigger functions included for words, glitch-detection and clock delay, and sending all assigned data into the memory.
- A menu method makes it easy to set each operation mode.
- Glitch-detection speed at 15ns.

### < SPECIFICATIONS >

#### Logic analyzer functions

Input channel	16-channel.
External clock input	1-channel.
Qualifier input	1-channel.
External trigger input	1-channel.
Input impedance	1 MΩ approx. 10pF (at no-lead).
Allowable voltage	±30V.
Logic range	Minimum 1Vp-p
Threshold voltage	TTL. +1.4 ±0.25V } in monitor VAR. -2.2 ~ 7.5V } jack.
Glitch-detection	(latch mode) 15ns
Internal clock	100ns to 200ns (1-2-5 switch).
External clock	Minimum clock time: 100ns. Minimum clock pulse width: 20ns. Data set-up time: 25ns. Data hold time: 0ns.
Acquisition memory	16CH × 256 bit + set up data.
Reference memory	16CH × 256 bit + set up data.
Trigger source	Internal (data combination, glitch combination) and external.
Trigger position	POST: word 12 } ±1 clock. CENTER: word 127 } PRE: word 243 }
Clock delay	0 ~ 3,800 clock.
Trigger pass count	1 ~ 15 count assignment.
Timing display	8 and 16-ch. Four times (time axis) expansion function Cursor blinking display, trigger-point display
State display	HEX, OCTAL, BIN, ASCII display. Display data size: four lines.
Others	Search function, compare function, save function, change function, window display, histogram display function, comparison acquisition and others.
Signature verifier	
Input	Data input: CH 0 probe. Start input: CH 1 probe. Stop input: CH 2 probe. Clock input: probe Eck (external clock input). Other properties are those of logic analyzer sections.
Display	Four-digit signature
General Data	
Display	84 × 32 dot TN-FEM liquid display (with contrast VR). Service life: over 50,000 hours.
Power supply	AC100, 115, 215 or 230V ±10%, 50/60 Hz, approx. 3W. DC5-8V 2W approximately. Internal battery: Ni-Cd battery.
Internal battery	Low voltage-detection function: Display at about 5.5V. Auto power-off function: Effective after 5 minutes of non-operation.
Dimensions	Approx. 280(W) × 75(H) × 185(D) mm.
Weight	Approx. 3 kg.
Accessories, furnished	Input probe 1 ea Ac power supply cable 1 ea

# OPTIONS FOR SPECTRUM ANALYZERS, OSCILLOSCOPES AND LOGIC ANALYZER

## CARRYING CASE

### MB-2931 Carrying Case

For Spectrum Analyzers, MSA-4903, MSA-4902TV, MSA-4902, and MSA-4901.

Protective type with shoulder strap



## HOOD FOR CRT

### MB-2941 CRT Hood

For MSA-4901. (Furnished with MSA-4903, MSA-4902TV and MSA-4902). Used in protection against sunlight.



## BATTERY CHARGER & BATTERY PACK

For spectrum Analyzers, MSA-4903, MSA-4902TV, MSA-4902 and MSA-4901

### MB-2945A Battery Charger

For external battery; charging time, approx. 45 min.



### MB-2946 Battery Pack

1 hour or more at continuous operation (recharging, MB-2945A)



## OPTICAL MONITORS

Applicable Oscilloscopes: MO-1255, MO-1254A, MO-1252A, MSO-1270A

### MOE-5813 Optical Monitor

Used to demodulate the intensity modulated 1.3 and 1.5  $\mu\text{m}$  light wave for oscilloscopic observation.



### MOE-5808 Optical Monitor

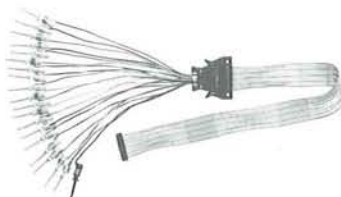
Same as the MOE-5813 except for demodulation of the 0.85  $\mu\text{m}$  light wave.



## PROBES

### MP-3301 Probe For Logic

Analyzer For use with the MLA-3300 Logic Analyzer



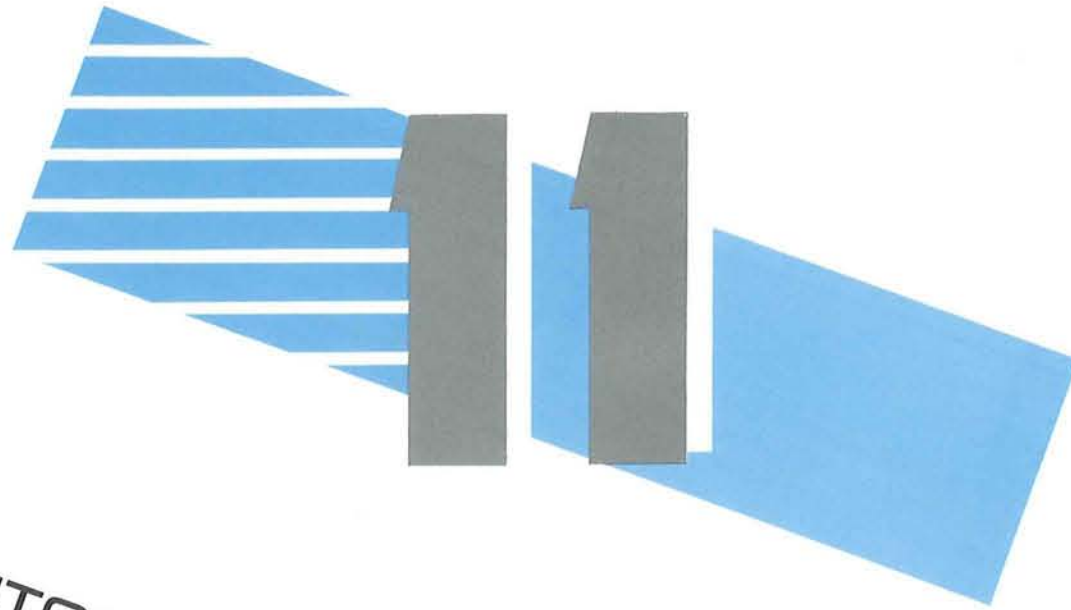
### MP-3050/3051 Probes For Scopes

MP-3050: For MO-1254A/1252A, MSO-1270A

MP-3051: For MO-1255



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**AUTOMATIC MESURING SYSTEMS**

# MS-8233

## AUTOMATIC MEASURING TEST SYSTEM



### <DESCRIPTION>

The MS-8233 is a measuring system which is adapted for measuring and testing of electronic equipment and circuits. It is composed with a controller section used in conjunction with a combination of units for specific purposes. The system is versatile in that measure-

ments can be performed for audio amplifiers, FM/AM tuners, CD/DAT, VTR, Camera, TV sets, Radio-cassettes linear ICs and related devices.

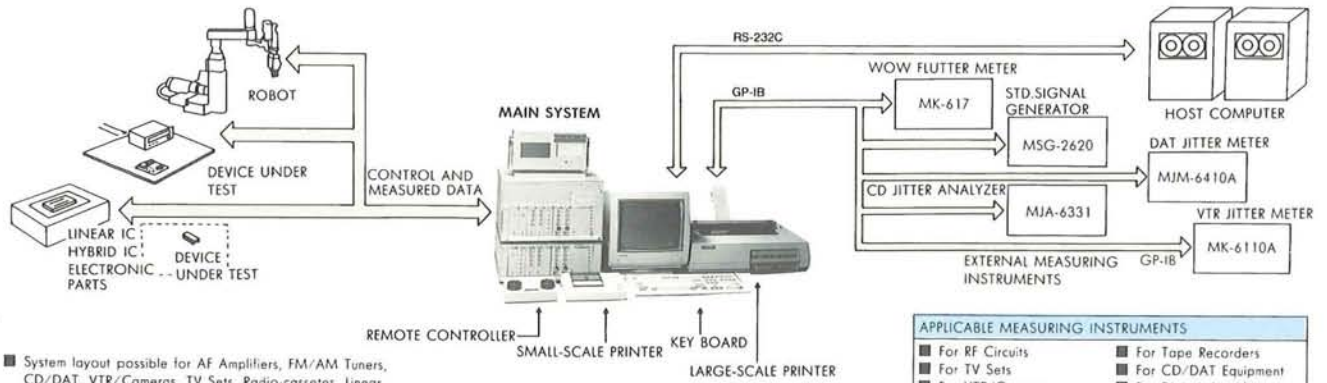
Furthermore, with a robot control unit, a system can be made up for FA needs.

The measurement program can be made up in a simple manner for the CRT display method using a keyboard. The program thus made up is stored in floppy media and supervision of the program relative to the device under measurement is greatly simplified.

At the operator's terminal, in addition to the start and stop of the measurement sequence, two controls are provided for varying the frequency and level. Again, with use of the function key, in addition to one step up or down measurement sequence, rewrite of the serial number and other functions are included.

For the operator's display, LCDs are used for data of the measured values; LEDs are used for the GO/NO GO judgement and a two-pointer meter indicates measured values in analog form.

## MEGURO'S EXPANDABLE AUTOMATIC MEASUREMENT SYSTEM



APPLICABLE MEASURING INSTRUMENTS	
■ For RF Circuits	■ For Tape Recorders
■ For TV Sets	■ For CD/DAT Equipment
■ For VTR/Cameras	■ For Digital Amplifiers

■ System layout possible for AF Amplifiers, FM/AM Tuners, CD/DAT, VTR/Cameras, TV Sets, Radio-cassettes, Linear ICs, FA/Robots, etc.

■ The Measuring program can be made up in simple manner with a keyboard employing the CTR talk system.

[1] Controller and Unit Assembly Section

Microcomputer	16-bit	
FDD	3.5 inch, 1 Mbyte: 1 unit (on option, 1 unit can be added)	
External Interface	CRT I/F: color-RGB, monochrome (option) Keyboard I/F (option) Centronics, RS-232C GP-IB, LOGIC OUT Operator terminal, display I/F	
A/D	10-bit	
Capacity for Units	Analog section units	10
	Additional units (option)	10
	Digital circuits	8
Dimensions	Approx. 420(W) × 250(H) × 450(D) mm	

[2] AF Oscillator Unit

Frequency Range	10 Hz to 100 kHz
Display	3 digits at display section
Distortion	-110 dB: 10 Hz to 10 kHz -100 dB: 10 Hz to 50 kHz -90 dB: 50.1 kHz to 100 kHz Condition: At 2 Vrms load
Output Level	4 Vrms; 14 Vrms at open circuit
Output Impedance	600Ω
No. of Outputs	2, at ON and OFF, independently
Dimensions	Approx. 35(W) × 110(H) × 270(D) mm

[3] Attenuator for Audio Signals

Total Attenuation	100 dB
Resolution	0.1 dB (0.01 dB with voltage setting)
Frequency Range	DC to 300 kHz
Input Impedance	600Ω
Dimensions	Approx. 35(W) × 110(H) × 270(D) mm

[4] Output Adapter (OA)

NO. of Input	1
No. of Outputs	4
Output Impedance and Attenuation	6Ω: -46 and -66 dB 100Ω: -26 and -46 dB 300Ω: -6, -26 and -46 dB 600Ω: 0, -26 and -46 dB 5.1 kΩ: -26 and -46 dB
Input Impedance	600Ω
Termination Resistor	0, 1 or 4.7 kΩ
Dimensions	Approx. 35(W) × 110(H) × 270(D) mm

[5] Input Adapter (IA), unbalanced input

Input Level Range	AC: 100 Vrms, max. DC: 100 V, max.
No. of Inputs	4
Input Impedance	Through, 10 kΩ and 10 kΩ with 1000 pF in shunt
Frequency Range	0 to 600 kHz
Dimensions	Approx. 35(W) × 110(H) × 270(D) mm

[6] Input Adapter (IA), with changeover for balanced or unbalanced inputs

At unbalanced input:	
Input Level Range	AC: 100 Vrms, max. DC: 100 V, max.
Input Impedance	Through, 10 kΩ and 10 kΩ with 1000 pF in shunt
Frequency Range	0 to 600 kHz
At balanced input:	
Input Level Range	AC: 100 Vrms, max. 4 ranges: 0, -10, -20 and -30 dB
Input Impedance	10 kΩ
Frequency Range	20 Hz to 20 kHz within ±0.1 dB 20.1 to 100 kHz within ±0.15 dB
S/N and Distortion	Less than -96 dB at 1 V, 20 Hz to 20 kHz
Common to both conditions	
No. of Inputs	4
Dimensions	Approx. 35(W) × 110(H) × 270(D) mm

[7] Audio Signal Measuring Section

AC Level Measurement	
Frequency Range	10 Hz to 300 kHz
Measurement Range	30 μV to 100 Vrms, at full scale
DC Level Measurement	30 mV to 100 V, at full scale
Distortion Measurement	
Range	-90 to -10 dB, at full scale
Measuring Frequencies	8 spot points, BEF method 20, 60, 400 Hz and 1, 4, 10, 15 and 20 kHz
Input Signal Level	1 mV to 100 Vrms
Noise and Distortion	-96 dB: 20 Hz (15 kHz LPF)
At inputs above 1Vrms	-100 dB: 60 Hz (15 kHz LPF) -100 dB: 400 Hz, 1 and 4 kHz (300 Hz HPF + 15 kHz LPF) -96 dB: 10, 15 and 20 kHz (300 Hz HPF + 40 kHz LPF) with ratio operation

< GENERAL SPECIFICATIONS >

Input Impedance	100 kΩ, unbalanced
Filters	300 Hz HPF: -18dB/oct 400 Hz BPF: -36dB/oct 1 kHz BPF: -36dB/oct 15 kHz LPF: Over -60dB/oct at 19 kHz 40 kHz LPF 600 kHz LPF JIS A, CCIR, CCIR/ARM External: 3 channels
Dimensions	Approx. 105(W) × 110(H) × 270(D) mm

#### Operator's Terminal

<b>Program Sequence</b>	For start and stop sequence
<b>Key START STOP</b>	For adjusting oscillator frequency and level in accordance with the measuring program
<b>FREQ. LEVEL Control</b>	Changing resolution between lowest and next step
<b>SLOW, FAST</b>	1 step, Up or DOWN, of sequence
<b>FUNCTION Key</b>	Serial number input
<b>F1 to F5</b>	Setting of printer output condition
	Measurement range: UP or DOWN
<b>ALT key</b>	Change of the F key function
<b>Dimensions</b>	Approx. 200(W) × 38(H) × 145(D) mm

#### Display

<b>LCD Display</b>	Height: 128 dots; width: 256 dots; graphic
<b>Indication</b>	Measurement item no., serial no., measurement data, upper and lower limits and operational
<b>Contents</b>	Indication of FUNCTION keys
<b>LEDs for Judgment</b>	2 CH, GO, UPPER-LOWER NO-GO
<b>Meter Indicator</b>	Linear scale, zone scale, center scale and dB scale. NOTE: Measured values cannot be read off from the scales. For the above respective values, suitable indicators must be used.
<b>Dimensions</b>	Approx. 310(W) × 150(H) × 120(D) mm

#### Outline of Operation

##### Setting up the Measurement Program

Up to ten orders for the sequence and parameters from the command and function keys and method of communicating, are stored in the floppy media. For activating the sequence, the data read off the floppy disk is sent to the RAM base.

##### Execution of the Sequence

When the data write-in is completed at the RAM base, the system is under the sequence operating condition. Then in accordance with the operator's command display, the START key at the operator's terminal is pressed for automatic measurements in sequence.

##### Sequence Debugging

The INSert and DELete functions can be executed at the sequence number line and character levels. Thus, editing of the measurement program can be done in a simple manner.

##### Other Functions

The measurement data may be readily analyzed since it can be stored in the FDD media (Option: Data analysis program). Further, with use of the EXECute command, the control can be transferred to other systems, such as robots, etc., with the data transfer card (on option). Thus it becomes possible to combine the system with a robot.

##### Options

1. Printer..... 80-line Centronics
2. CRT..... 14-inch color; 4000 characters
3. Keyboard..... ASCII full keyboard
4. Adaptable Units.....
  - For RF measurements
  - For TV measurements
  - For VTR/camera measurements
  - For Tape-recorder measurements
  - For CD/DAT measurements
  - For digital amplifier measurements
  - For robot control, ETC.

# MS-8445

## AUDIO TEST SYSTEM FOR CD PLAYERS



## < FEATURES >

- Automatic measurements of 51 items in approximately 15 minutes.
- Signal-to-noise ratio measurement to 120 dB (128 dB by actual measurement) possible.
- Distortion measureable with input level as low as  $-80$  dB (0.1 mV).
- Data available for printout and plotting after measurements.

## < DESCRIPTION >

The MS-8445 is designed for measurements of the electrical characteristics of CD players. The main characteristics include the following: output voltage, signal-to-noise ratio (S/N), frequency response, harmonic distortion, linearity, separation, deviation in de-emphasis, wow-flutter, dynamic range, etc. Measurements are made automatically using a standard test disk with the results displayed on a screen and the data printed out in graphic form on a plotter.

In addition to automatic measurements, each item can be measured manually when desired.

## < SPECIFICATIONS >

Measurements	Range and Accuracy	Remarks
Output Voltage	0 to 3V	
Accuracy of Revolution	0 to 0.0001%	Gate: 10 sec
Signal-to-Noise Ratio	0 to 120 dB (128 dB by actual measurement)	Noise level, $1.0 \mu\text{V}$ (referred to input), IHF, 20 kHz L.P.F at on
Frequency Response	$\pm 0.2$ dB: 10 Hz to 20 kHz	0 dB referred to 1 kHz
Total Harmonic Distortion	$-10$ to $-100$ dB	10 Hz to 20 kHz
Linearity	$\pm 0.2$ dB: 0 to $-100$ dB	20 kHz L.P.F at on
Input VS Total Harmonic Distortion	0.001% to 30% ( $-100$ to $-10$ dB)	THD: 20 kHz L.P.F at on
Separation	0 to $-120$ dB	100 Hz to 16 kHz
Deviation in De-emphasis	$\pm 0.2$ dB: 0 to $-110$ dB	100 Hz to 16 kHz
Wow and Flutter	0.001% to 30%	3.15 kHz
Dynamic Range	0 to $-105$ dB	For $-60$ dB distortion at 1 kHz: IHF-A at on, 20kHz L.P.F

# MS-8827

## LQ METER



### < DESCRIPTION >

The MS-8827 LQ Meter measures automatically the inductance of RF coils and also the figure of merit, Q on a GO/NO GO basis. In the circuitry, the highly reliable tuning section of Meguro MQ-1601 Q Meter plus a sweep generator together with a microprocessor and a calculator with a floating decimal point are used for the measurements with a high degree of accuracy and speed.

With this instrument, the personal equation is eliminated in the measurements (readout) and when used in a conveyor system, automatic measurements can be easily carried out. This is an advantage in speeding up and reducing the amount of work. To meet with production line conditions, compensation for the data can be made in a simple manner to simplify the data supervision. Again, with use of the serial data output, overall control in the production line is made possible.

### < FEATURES >

- The tuning circuitry is the same as used in the Meguro MQ-1601 Q Meter.
- Wide range of measurements, 0.1  $\mu\text{H}$  to 10 mH, in seven ranges and Q from 10 to 300.
- Range of judgement for inductance is  $\pm 30\%$  of the standard value and for Q, the lower value in the 10 to 300 range; for open or shorted condition, judgement is made on the RI defect basis.
- High speed in measurements, approx. 150 ms.
- Up to nine conditions for measurements and judgement can be stored and switched over as required.
- Compensation of jigs and interconnected equipment can be easily made with a panel key.
- Stepped serial data output for simple connections to a computer.
- GP-IB interface can be included (option).
- Separate measurement head section allows for flexibility in use.

### < SPECIFICATIONS >

<b>Inductance Range</b>	Range	Center Frequency
	0.1 to 1 $\mu\text{H}$	25.2 MHz
	0.3 to 3 $\mu\text{H}$	10.7 MHz
	1 to 10 $\mu\text{H}$	7.96 MHz
	10 to 100 $\mu\text{H}$	2.52 MHz
	100 $\mu\text{H}$ to 1 mH	796 kHz
	500 $\mu\text{H}$ to 5 mH	455 kHz
1 to 10 mH	252 kHz	
<b>Q Measurement Range</b>	10 to 300	
<b>Q Accuracy</b>	$\pm 10\% + 1$ count: Below 20 MHz $\pm 20\% + 1$ count: Above 20 MHz	
<b>Frequency Measurement Accuracy</b>	$\pm 0.5\%$ of tuned frequency or $< 5^\circ$	
<b>Swept Frequency Width</b>	$< \pm 15\%$ of center frequency	
<b>Tuning Capacitors</b>	Main: 22 to 450 pF (automatic) Auxiliary: $-3$ to $+3$ pF (automatic) Capacitance Accuracy: $\pm(1\% + 1$ pF)	
<b>Voltage for Measurement</b>	Q $\times 0.01$ Vrms	
<b>Processing Time</b>	Sample Hold Time: 95 ms Operating Time: 45 ms	
	Data output Timing: Stepped ..... 20 ms, at 9600 bps GP-IB ..... 1.8 ms + controller processing time	
	Maximum Continuously Measuring Rate ..... Higher than 7 per second	
<b>Judging Values Inductance</b>	LOW: $-1.0\%$ to $-29.9\%$ HIGH: $+1.0\%$ to $+29.9\%$	
<b>Q Value</b>	10 to 300	
<b>Panel Memory</b>	Storage up to 9 conditions as set (battery backup)	
<b>Data output Interfacing</b>	Stepped serial data Start signal for measurements and outputs for judgement and strobe signal (open collector)	
<b>Power requirements</b>	AC 100V, 115V, 215V or 230V $\pm 10\%$ , 50/60 Hz; approx. 80VA	
<b>Dimensions and Weight</b>	Main Frame: Approx. 430 (W) $\times$ 150 (H) $\times$ 350 (D) mm (excluding stand): approx. 10.1 kg Measuring Head: Approx. 215 (W) $\times$ 125 (H) $\times$ 200 (D) mm approx. 4 kg	
<b>Accessories, furnished</b>	Head connection cable	3 ea
	Do, 14P-14P	1 ea
	Connector, 14-pole	2 ea
	Connector for data output, 24-pole	1 ea
	Head mounting	1 set

**Option:** GP-IB Interface

**NOTE:** Accuracy of measurement refers to the value at the terminals.





## OPTIONAL ACCESSORIES

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# OPTIONAL ACCESSORIES

## DUMMY ANTENNAS



For AM Radio  
MA-2001-B 75Ω, unbalanced  
MA-2002-B 50Ω, unbalanced



For FM Radio  
MA-2003-B 75Ω, unbalanced: 300Ω, balanced  
MA-2004-B 50Ω, unbalanced: 300Ω, balanced



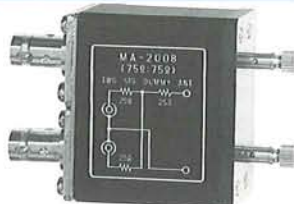
MA-2104-B 75Ω, unbalanced: 300Ω, balanced  
MA-2106-B 50Ω, unbalanced: 300Ω, balanced



MA-2005-B 75Ω, unbalanced: 75Ω, balanced  
MA-2006-B 50Ω, unbalanced: 50Ω, balanced



MA-2007 75Ω, unbalanced: 300Ω, balanced  
MA-2007-A 50Ω, unbalanced: 300Ω, balanced



MA-2008 75Ω, unbalanced: 75Ω, unbalanced  
MA-2008-A 50Ω, unbalanced: 50Ω, unbalanced



For IHF Standards  
MA-2111 50Ω, unbalanced: 300Ω, balanced  
MA-2112 75Ω, unbalanced: 300Ω, balanced  
MA-2133 50Ω, unbalanced: 75Ω, unbalanced  
MA-2138 50Ω, unbalanced: 300Ω, unbalanced



MA-2113 50Ω, unbalanced: 300Ω, balanced  
MA-2114 75Ω, unbalanced: 300Ω, balanced  
MA-2134 50Ω, unbalanced: 75Ω, unbalanced  
MA-2139 50Ω, unbalanced: 300Ω, unbalanced

## TERMINATION RESISTORS



MR-2010 500Ω, Type N  
MR-2011 75Ω, Type N  
MR-2010-B 50Ω, BNC  
MR-2011-B 75Ω, BNC



MR-2150-B 50Ω, BNC



Frequency Range : DC to 1 GHz  
VSWR : 1.05  
Output Power : 0.5W

MT-50NP 50Ω, Type N  
MT-75NP 75Ω, Type N



MT-50NJ 50Ω, Type N  
MT-75NJ 75Ω, Type N



MT-50BP 50Ω, BNC  
MT-75BP 75Ω, BNC



MT-50BJ 50Ω, BNC  
MT-75BJ 75Ω, BNC



Frequency Range : DC to 500 MHz  
VSWR : 1.2  
Output Power : 0.5W

MT-50NPJ 50Ω, Type N  
MT-75NPJ 75Ω, Type N



MT-50BPJ 50Ω, BNC  
MT-75BPJ 75Ω, BNC

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## TERMINATORS



Frequency Range : DC to 1 GHz  
VSWR : 1.15  
Attenuation Error : 3.6 dB: 0.3 dB  
: 10.20 dB: 0.5 dB  
Output Power : 0.5W

MA-50N3 50Ω 3dB  
N6 50Ω, 6 dB  
N10 50Ω, 10 dB  
N20 50Ω, 20 dB  
MA-75N3 75Ω, 3 dB  
N6 75Ω, 6 dB  
N10 75Ω, 10 dB  
N20 75Ω, 20 dB



MA-50B3 50Ω, 3 dB  
B6 50Ω, 6 dB  
B10 50Ω, 10 dB  
B20 50Ω, 20 dB

MA-75B3 75Ω, 3 dB  
B6 75Ω, 6 dB  
B10 75Ω, 10 dB  
B20 75Ω, 20 dB



MR-2017-B 75Ω 50Ω Loss 10 dB  
MR-2018-B 50Ω 75Ω Loss 10 dB

# OPTIONAL ACCESSORIES

## TERMINATORS



MS-50NP Type N  
MS-75NP Type N



MS-50NJ Type N  
MS-75NJ Type N



MS-BNCP BNC



MS-BNCJ BNC

## CABLE & ADAPTER



MP-3501 Type N  
MP-3502 BNC



MPF-4608 Fuse  
Frequency Range : DC to 800 MHz  
Impedance : 50Ω, unbalanced,  
Blow-up VSWR < 1.2  
0.5W



MC-2020 50Ω, Type N  
MC-2021 75Ω, Type N



MC-2020-B BNC



MC-2027-B BNC



MC-2027-M Type M



NP-BNCJ 50Ω  
NCP-BNCJ 75Ω



NJ-BNCP 50Ω  
NCJ-BNCP 75Ω

## COAXIAL CABLE



MC-2051 RG-58A/U 50Ω, Type N  
MC-2052 3C-2V 75Ω, Type N



MR-2053 5D-2W 50Ω, Type N  
MC-2054 5C-2W 75Ω, Type N



MC-2051-B RG-58A/U 50Ω, BNC  
MC-2052-B 3C-2V 75Ω, BNC  
MC-2055-B 3D-2V 50Ω, BNC



MC-2063 RG-58A/U 50Ω  
BNC Alligator Clip



MC-2023 Spade Tip-PJ-055B



MC-2204 Spade Tip-U Plug



MC-2207 Spade Tip-Alligator Clip



MC-2209 PJ-055B-PJ-055B

# OPTIONAL ACCESSORIES

## SHIELDED CABLES



MC-2211  
Alligator Clip-U Plug



MC-2214  
Alligato Clip-PJ-055B



MC-2224 Spade Tip-U Plug



MC-2227 Alligator Clip-U Plug



MC-2244  
Spade Tip-No. 110 Plug



MC-2247  
PJ-055B-PJ-055B



MC-2261 16P2B-AC Plug



MC-2231 BNC-BNC

## LOW IMPEDANCE CABLE

## IEEE488 BUS CABLE



MC-2295 1m  
MC-2296 2m

MC-2297 4m  
MC-2298 0.5m

## OTHERS



MC-2282  
Banana Plug (red) - Alligator Clip (red)  
Banana Plug (black) - Alligator Clip (black)



MC-2283  
Spade Tip - Alligator Clip

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MC-2058 Alligator Clip - U Plug



MX-2431 R-318-PJ-055B  
MX-2432 R-318-M3C  
MX-2433 R-318-MIC Plug

# **MEGURO ELECTRONICS CORPORATION**

**2-1-5, Chuo-cho, Meguro-ku, Tokyo 152, Japan.**

**TEL.:03 (715) 1221**

**TLX: 02468208 MEGURO J**

**FAX: 03 (711) 8472**



20090 FIZZONASCO PIEVE E. (MI) - VIA PIEMONTE 14 - TEL. 90722441 R.A. - TEI EX 325885 DLI I - FAX 02-90722742