One universal level meter which replaces a whole variety of measuring instruments

Up until now, in order to test AF equipment such as tape recorders, HIFI amplifiers or infrared units in the laboratory, testing bay and service department a variety of instruments had to be used. They were all necessary because each instrument could only measure certain quantities. Such an arrangement was obviously expensive in terms of both space and money. Sennheiser is now offering a practical solution in the form of a new generation of UPM modular measuring instruments. Firstly, these measuring instruments are fitted with four permanently installed filters and secondly, it is also possible to insert two additional filters. In this way each UPM can be specially fitted out to meet specific demands, then neither are the filter cards highly expensive nor does the assembly/modification take up a lot of time. Due to the multitude of available ranges one can measure voltages of a few µV right up to 300 V and thus easily get round those specialized measuring problems. Furthermore, their true RMS measurement of distortion, AM modulation factor, noise and pulse voltages means that the UPM units always give exact and clearly defined values. The peak rectification of the UPM 550 is in total accordance with the DIN norm for noise-level meters 45 405.

The perfect design

The fully transistorized precision measuring instruments UPM 550 and UPM 550-1 are fitted with an easy to use rotary switch for selecting the 15 overlapping ranges. Overload protection for the sensitive inputs is of course provided. Because the housing is not directly connected to the ground wire, measuring errors due to ground loops are avoided.

Both measuring instruments feature as standard a CCIR earcurve filter and a 1000 Hz filter for selective measurements as well as a dBA filter and a noise weighting filter for measurements according to DIN 45500 (page 4). The UPM 550-1 is also fitted, as standard, with the basic card for additional filters (UPM 550-B 17) and furthermore possesses an extra filter (UPM 550-B 17-9) for measuring the harmonic distortion of a 1 kHz fundamental wave.

Moreover, connecting sockets permit the use of external 600 Ω filters such as octave or third octave filters. Insertion loss from 1 to 15 dB can be corrected with a potentiometer.
The practical level meter

By using the UPM measuring system one can, quite but one example, determine the maximum modulation of a tape recorder by measuring the third harmonic of a recorded 333 Hz signal. Exposure of the ear is easily determined with the help of the 1000 Hz filter. All of the UPM 550's amplifiers have a wide overload range. For instance, the filter-preamplifier can be modulated by more than 50 dB above full-scale deflection by a sinusoidal voltage without distorting the signal. The overload margin of the filter amplifier for the two outputs is still sufficient to amplify without distortion a pulse amplitude ten-times greater than that of the sinusoidal voltage usually necessary for full scale deflection of the meter.

As required by the DIN norm for noise-level meters No. 45435, the indication on the meter is set so that when measuring a sinusoidal voltage — also when peak reading is relevant — the RMS value is given and not the peak value (which is higher by a factor of 1.41). This means that when measuring a continuous sinusoidal waveform of a single frequency one will get the same read-out with either mode of rectification (peak or RMS).

The practical level meter

The practical level meter

The practical level meter

The practical level meter

The practical level meter

The practical level meter

The easy-to-readout

The panel meter has two voltage scales which are used alternately in sequence with the meter. To do so a simple multiplexer can be used to interpret the readings. Two further dB-scales with range stops of exactly 10 makes it easy to read the dB levels as well. The dBm values are related, to 0.1 Hz (corresponding to 1 kHz) and according to DIN 45435, and feature additional 10 Hz steps.

The panel meter consists of four LED’s with a further auxiliary LED on the right for indications (e.g. of a zero adjustment). The LED's are designed with a red LED to indicate a further auxiliary LED on the right. The LED’s are designed with a red LED to indicate a further auxiliary LED on the right.

The UPM 550 range of plug-in filters

The UPM 550 range of plug-in filters

The UPM 550 range of plug-in filters

The UPM 550 range of plug-in filters

Universal Level Meter UPM 550-1

Along with all the standard features of the UPM 550 the UPM 550-1 also possesses the following extras:

1. Two switchable inputs for measuring standard equipment

2. Additional filter UPM 550-1 B 7-9 for measuring the harmonic distortion of a 1 kHz signal

3. Level-adjuster (can be deactivated) for the meter deflection. With the help of this the deflection can be set at any reference level

4. Because the basic board is already filled with an additional filter this means that there is only room for one more

5. Due to the need for more space on the front panel the carrying handles have been replaced by cap nuts

6. On the indicating scale the positions of the voltage and dB-scales were changed around.
Technical Data

**UPM 550 (Order no. 1290)**

**Voltage ranges**
- 0 – 30/100/300 µV
- 1/3/10/30/100/300 mV
- 1/3/10/30/100/300 V
- 1/3/10/30/100/300 V

**Frequency range for peak rectification**
- Ranges: 1 kHz to 10 kHz
- 20 Hz, 200 Hz ± 2 %
- 10 Hz, 20 Hz

**Tolerance for sinusoidal voltages and measurements without filters**

**Amplifier (µV and mV ranges)**
- Input drift: ± 0.5 %
- Scale linearity: ± 0.5 % for peak rectification
- Dynamic properties:
  - 20 Hz, 200 Hz ± 2 %
  - 10 Hz, 20 Hz and

**Amplifier (µV ranges)**
- Input: ± 0.5 %
- Scale linearity: ± 0.5 %

**Power requirements**
- Frequency: 50 Hz, 60 Hz

**Dynamic properties**
- Input: ± 0.5 %
- Scale linearity: ± 0.5 %

**Input impedance**
- Input: 1 MO ± 150 pF

**Output**
- 20 Hz...100 kHz ± 5%
- 10 Hz...20 Hz and
- 200 kHz...1 MHz ± 5%
- 10 Hz...20 Hz and

**Operating temperatures**
- +5 °C...+45 °C

**Dimensions**
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ≈ 0.5 %
- ≈ 0.5 %
- ± 0.5 %
- ± 0.5 %

**Weight**
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %

An accessory transformer, RVZ 11-1, is available to convert the input for measurements in balanced audio circuits.

**UPM 550-1 (Order no. 1740)**

**Voltage ranges**
- 0 – 30/100/300 µV
- 1/3/10/30/100/300 mV
- 1/3/10/30/100/300 V
- 1/3/10/30/100/300 V

**Frequency range for peak rectification**
- Ranges: 1 kHz to 10 kHz
- 20 Hz, 200 Hz ± 2 %
- 10 Hz, 20 Hz

**Tolerance for sinusoidal voltages and measurements without filters**

**Amplifier (µV and mV ranges)**
- Input drift: ± 0.5 %
- Scale linearity: ± 0.5 % for peak rectification
- Dynamic properties:
  - 20 Hz, 200 Hz ± 2 %
  - 10 Hz, 20 Hz and

**Amplifier (µV ranges)**
- Input: ± 0.5 %
- Scale linearity: ± 0.5 %

**Power requirements**
- Frequency: 50 Hz, 60 Hz

**Dynamic properties**
- Input: ± 0.5 %
- Scale linearity: ± 0.5 %

**Input impedance**
- Input: 1 MO ± 150 pF

**Output**
- 20 Hz...100 kHz ± 5%
- 10 Hz...20 Hz and
- 200 kHz...1 MHz ± 5%
- 10 Hz...20 Hz and

**Operating temperatures**
- +5 °C...+45 °C

**Dimensions**
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ≈ 0.5 %
- ≈ 0.5 %
- ± 0.5 %
- ± 0.5 %

**Weight**
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %
- ± 0.5 %

An accessory transformer, RVZ 11-1, is available to convert the input for measurements in balanced audio circuits.
General Description: The name of Sennheiser probably is associated by most of us with microphones and headphones, although this company also makes several specialized electronic devices for commercial applications. Its new UPM 550-1 is a professional-grade precision meter whose basic function is to measure AC voltages in the frequency range from 10 Hz to 1 MHz, but this "definition" hardly describes the instrument's enormous versatility.

Actually there are two versions—the UPM 550, and the UPM 550-1. The latter, which offers a few additional features, is the one chosen for this report. The basic UPM 550 can be used for making measurements of:

- standard frequency response and attenuation with true RMS or peak rectification;
- signal-to-noise ratios, weighted in accordance with DIN 45405 (for studio equipment);
- signal-to-noise ratios weighted in accordance with DIN 45500 (for hi-fi equipment);
- unweighted signal ratios in accordance with either of the above standards;
- harmonic distortion of tape recorders (the 3rd-order component above 333 Hz);
- cross-talk and erase ratios for tape equipment (using a built-in 1 kHz filter) in accordance with DIN 45511;
- various parameters using external filters as required;
- selective voltages of very small magnitude, from about 2 microvolts and up, using the built-in 1 kHz filter;
- sound-levels in accordance with DIN 45633 using an external calibrated microphone.

The UPM 550-1, in addition to the above, also can make direct measurements of harmonic distortion of a 1-kHz signal using its built-in 1-kHz notch filter. This version of the meter also contains an added input, input selector switching, level adjustment and associated defeat switch; and the 1-kHz filter control selector in the row of filter switches on the panel.

A large portion of the front panel is given over to the metering, a multi-purpose display with several scales calibrated in mV, dBV and dBm. The range selector switch and associated reference level indicators occupy the space to the right of the meter. There are LEDs for all range positions. To the right of this area (on the UPM 550-1) is the combination switch and level adjustment for the direct harmonic distortion measurement. Just below and to the right is the related input selector, and below it are the input connectors.

The instrument's power off/on switch is at the lower left; next to it are two outputs—one being rated for 60 ohms, 1 volt; the other for 600 ohms, 1 volt. The mode and filter switches form a row across the bottom of the panel. Included here are switches for both reserve and external filters which may be added as required.

The rear of the unit contains an external filter input and an associated calibration adjustment. A graph of the instrument's filter characteristics is printed here. The unit's power cord is detachable and plugs into a three-prong receptacle on the rear panel. The front may be fitted with handles.
Test Results: Because of the nature of the UPM 550-1, we had to depart somewhat from our usual “Vital Statistics” presentation. We felt that it would make no sense to try to measure the accuracy of a meter with another meter of approximately the same degree of accuracy. So instead we are simply reprinting Sennheiser’s specifications for both versions of the meter, and those who are interested in the wealth of data provided in these specs are invited to read them carefully.

About all we could do to check out the system was to use it for a while, and to plot some of the weighting filter curves and compare them with the published curves reproduced in Fig. 1 from Sennheiser’s owner’s manual.

Thus, Fig. 2 shows the familiar response curve obtained when we switched in the “A” weighting noise filter. It compares quite neatly with the curve identified as “3” in Fig. 1.

Next we selected CCIR-468 weighting (this is the original CCIR-ARM version espoused by Dolby Labs). We show this in our Fig. 3, and it compares very closely with the Sennheiser curve labeled “4” in Fig. 1.

Finally we checked out the 1-kHz band-pass filter. The response when using that filter is plotted in our Fig. 4, and it is the same as the curve “5” shown in Fig. 1.

General Info: Dimensions are approximately 11.6 inches wide; 7.7 inches high; 6.14 inches deep. Weight is approximately 13 lbs, 4 oz. Price: UPM 550, $1380; UPM 550-1, $1680.
Joint Comment by N.E. and L.F.: Any recording studio or lab involved in audio design or testing, often must make precise measurements of signal levels. However, not all meters read voltages in the same way. There are average-reading meters, peak-reading meters, quasi-peak reading meters, true RMS meters and meters with varying rise and decay time constants. The truly well equipped studio or lab that wanted to keep up with the many ballistic characteristics of meters and the various methods of meter construction would have to own at least six different AC voltmeters, and possibly more. Add in the various and sundry “weighting curves” that often are associated with such signal-level readings, and the inventory of required gear increases even further.

With the Sennheiser instrument, it all comes together in one unit which, as far as we could determine, is both accurate (our own filter curves are in excellent agreement with Sennheiser’s), and “idiot proof”—thanks to the front panel indicators that tell you what range or scale on the meter is being used, what filters you have selected for a particular reading and whether peak or RMS readings are being made. The owner’s manual is written in three languages (German, French and English). While some of the translation to English is a bit awkward in style, it is perfectly understandable and usable. The presentation is hardly on what could be described as an “elementary” level since it does presume previous knowledge and experience in making audio measurements. The device, in other words, is not intended for the casual or even enthusiastic “audiophile.” However, for the professional user who is tired of having to plug in an assortment of different meters to check out equipment or to conduct proof-of-performance tests, the Sennheiser device may well be the one unit to replace several outdated or outmoded meters. Anyone who is planning to buy a group of new meters for a studio or lab would do well to consider this single device which may well be the only meter you require.

SENNESEI UPM 550 and 550-1 UNIVERSAL LEVEL METER: Vite Statistics

<table>
<thead>
<tr>
<th>PERFORMANCE CHARACTERISTIC</th>
<th>UPM 550</th>
<th>MANUFACTURER’S SPEC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage ranges</strong></td>
<td>0–30/100/300 mV</td>
<td>0–30/100/300 mV</td>
</tr>
<tr>
<td>1/3/10/30/100/300 mV</td>
<td>1/3/10/30/100/300 mV</td>
<td></td>
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<tr>
<td>1/3/10/30/100/300 V</td>
<td>1/3/10/30/100/300 V</td>
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</tr>
<tr>
<td>100 mV ... +52 dBm</td>
<td>92 ... +52.6 dBm</td>
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</tr>
<tr>
<td>(selective – 115 ... + 50 dBV dBm)</td>
<td>(selective – 115 ... + 50 dBV dBm)</td>
<td></td>
</tr>
<tr>
<td>90 ... +52.5 dBm</td>
<td>92 ... +52.6 dBm</td>
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<tr>
<td>(selective – 113 ... + 52.5 dBm)</td>
<td>(selective – 113 ... + 52.5 dBm)</td>
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<tr>
<td><strong>Frequency range for peak rectification</strong></td>
<td>10 Hz ... 1 MHz</td>
<td>10 Hz ... 1 MHz</td>
</tr>
<tr>
<td>Ranges 3 mV to 300V</td>
<td>10 Hz ... 100 kHz</td>
<td>10 Hz ... 100 kHz</td>
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<tr>
<td>For RMS-rectification in all ranges</td>
<td>10 Hz ... 100 kHz</td>
<td>10 Hz ... 100 kHz</td>
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<tr>
<td><strong>Tolerance for sinusoidal voltages and measurements without filters:</strong></td>
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<tr>
<td>Amplifier (mV and V-ranges)</td>
<td>20 Hz ... 200 kHz ± 3%</td>
<td>20 Hz ... 200 kHz ± 3%</td>
</tr>
<tr>
<td>10 Hz ... 20 Hz and 200 kHz ... MHz ± 5%</td>
<td>10 Hz ... 20 Hz and 200 kHz ... MHz ± 5%</td>
<td></td>
</tr>
<tr>
<td>1 MHz ± 5%</td>
<td>1 MHz ± 5%</td>
<td></td>
</tr>
<tr>
<td>Amplifier (V-ranges)</td>
<td>20 Hz ... 50 kHz ± 3%</td>
<td>20 Hz ... 50 kHz ± 3%</td>
</tr>
<tr>
<td>10 Hz ... 20 Hz and 50 kHz ... 100 kHz ± 5%</td>
<td>10 Hz ... 20 Hz and 50 kHz ... 100 kHz ± 5%</td>
<td></td>
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<tr>
<td>100 kHz ± 5%</td>
<td>100 kHz ± 5%</td>
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</tr>
<tr>
<td><strong>Input divider</strong></td>
<td>± 0.5%</td>
<td>± 0.5%</td>
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<td><strong>Scale Linearity of rectifiers</strong></td>
<td>tolerance class 1.0</td>
<td>tolerance class 1.0</td>
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<tr>
<td>at RMS-rectification</td>
<td>± 0.5%</td>
<td>± 0.5%</td>
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<tr>
<td><strong>Scale Linearity of rectifiers</strong></td>
<td>± 3%</td>
<td>± 3%</td>
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<tr>
<td>at peak-rectification</td>
<td>according to DIN 45 405</td>
<td>according to DIN 45 405</td>
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<tr>
<td><strong>Dynamic properties</strong></td>
<td>according to DIN 45 633 and 45 500</td>
<td>according to DIN 45 633 and 45 500</td>
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<td>for peak-rectification</td>
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<tr>
<td>for RMS-rectification</td>
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<td>Specification</td>
<td>Value</td>
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<tr>
<td>-------------------------------------</td>
<td>--------------------------------------------</td>
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<tr>
<td>Frequency of built-in calibration generator</td>
<td>1000 Hz ± 1%</td>
<td></td>
</tr>
<tr>
<td>Voltage constancy</td>
<td>0.2% of K, 0° bis +50° C</td>
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<tr>
<td>Input impedance</td>
<td>1 MΩ (50 pf)</td>
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<tr>
<td>Max tolerable D.C.-voltage at the input</td>
<td>400 V</td>
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<tr>
<td>Max tolerable A.C.-voltage at the input: In the mV and V-ranges</td>
<td>500 V peak</td>
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<tr>
<td></td>
<td>10 VRMS</td>
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<tr>
<td>Noise voltage referred to input: unconnected, screened input without filters</td>
<td>≤ 15 µV eff</td>
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<tr>
<td>1000 Hz filter terminated with 10 kΩ without filters</td>
<td>≤ 2 V eff</td>
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<tr>
<td>Input impedance of the external filter input</td>
<td>600 Ω ≤ 20%</td>
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<tr>
<td>Sensitivity of the external filter input</td>
<td>2.5 ... 12.5 mV adjustable on rear panel</td>
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<tr>
<td>Max. e.m.f. of outputs: Filter output</td>
<td>28 Vpp (10 VRMS for sinusoidal voltages)</td>
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<td></td>
<td>28 Vpp (10 VRMS for sinusoidal voltages)</td>
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<tr>
<td></td>
<td>28 Vpp (10 VRMS for sinusoidal voltages)</td>
<td></td>
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<tr>
<td>Standard integrated filters</td>
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<tr>
<td>1000 Hz filter</td>
<td>Attenuation at 1000 Hz 0 dB</td>
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</tr>
<tr>
<td>Weighting filter to CCIR 468</td>
<td>Characteristic: see curve 5</td>
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<tr>
<td>Weighting filter to DIN 45 405 and 45 500</td>
<td>Attenuation at 1000 Hz 0 dB</td>
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<td>dB (A)-Weighting filter to DIN 45 500</td>
<td>Characteristic: see curve 2</td>
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<tr>
<td>1000 Hz Stop filter</td>
<td>Attenuation at 1000 Hz 0 dB</td>
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<tr>
<td>Setting range of level potentiometer</td>
<td>1 or 2 on plug-in board</td>
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<tr>
<td>Optional plug-in filters</td>
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<tr>
<td>Operating temperature</td>
<td>-10°C to +50°C</td>
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<tr>
<td>Power requirements</td>
<td>15 VA</td>
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<td>Sennheiser Electronic Corporation (N.Y.)</td>
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<tr>
<td>Sennheiser Electroni c Corporation (NY)</td>
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<td></td>
<td>10 West 37th Street</td>
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<td></td>
<td>New York, N.Y. 10018</td>
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<tr>
<td></td>
<td>(212) 239-0190</td>
<td></td>
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<tr>
<td></td>
<td>Wissenschaftliche Fabrik, D-30022 Wedemark, West Germany</td>
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</tbody>
</table>
CAN ONE MICROPHONE CAPTURE IT ALL?
Now, one modular microphone system lets you put your listeners right in the middle of the action with an omnidirectional head...

...conduct an on-the-spot, hidden-mike interview with a super cardioid head mounted to a telescopic boom...

**SENNHEISER'S OMNIDIRECTIONAL SHOTGUN, SPOT, LAVALIER MULTIPLE CAPABILITIES**

Capture it all. All the performance of a full-range collection of the most advanced electret microphones. In one Sennheiser system.

The Sennheiser Multimike Electret Microphone System. A modular microphone that brings you all the capabilities you'll ever need. When you need them.

Start with the powering module and the microphone heads you use most. Then add on as the demands of your work—and your budget—expand.

Or begin with it all. With the complete System, you'll have all the microphone capabilities required for every aspect of ENG, sports reporting, documentary making, and more. At only one third the cost of a similar collection of separates.

But more important, you'll enjoy a standard of quality and performance no comparable microphone—separate or modular—can provide. Because the Multimike System uses Sennheiser's unique back-electret technology.

For extended frequency response and temperature range. Plus a reduction in weight over conventional electret microphones.

Start working with the System yourself. And experience firsthand the quality, the performance, the perfection of Sennheiser. To capture it all.

**K3U Powering Module** Equipped with a 5.6V battery—or remote-controlled with a recorder or console via a 12 to 48V phantom circuit—the K3U powers any one of the five modular heads. Battery life is approximately 600 hours. An LED indicator flashes when the K3U is switched on, indicating at least 20 hours of remaining battery life.

A three-position roll-off switch (flat, -7 dB and -20dB at 50Hz) permits reduction of wind and handling noise without affecting voice pickup.

The K3U has a balanced, low-impedance output.

**K1U Powering Module** (not shown) can be used for unbalanced inputs with medium or high impedance, such as those required by audio recordings.

**ME 80 Super Cardioid Shotgun Head**

**ME 10-3 Clip-On Lavalier**

**MZS 802 Telescopic Boom**

**K3U Powering Module**

**K1U Powering Module**

**ME 20 Omnidirectional Head**

**ME 40 Super Cardioid Head**

**Desk Stand Mount**
...record the band without the grandstand, using a super cardioid shotgun head...

...or zero in on the voice of a speaker from across a crowded auditorium with a sensitive spot head. All just the beginning of the most versatile microphone ever.

IONAL, SUPER CARDIOID MIKE SYSTEM CAPTURES IT ALL.

- ME 20 Omnidirectional Head: Preserves the entire acoustic ambiance. For interviews and meetings in quiet surroundings, or when pickup of background noise is essential. Internal acoustic isolation to minimize handling noise.
- ME 40 Super Cardioid Head: Sharp attenuation of sound arriving from behind to eliminate ambiant reverberations and feedback from loudspeakers. For interviews in noisy surroundings, film dubbing, PA...wide frequency response in musical applications.
- ME 80 Super Cardioid Shotgun Head: Pressure gradient interference transducer for accurate, noise-free sound pickup at a distance, even in acoustically poor environments. Can also be used to solve extremely severe PA system feedback problems.
- ME 88 Spot Head: The ultimate in clarity, even at long distances. A long interference tube transducer for an almost beam-like pickup pattern. Extremely light weight (2 oz.) to permit direct mounting on a handheld camera or attachment to the MZS 802 Telescopic Boom. Fixed windscreen for imperviousness to wind and handling noise.
- MKE 10-3 Clip-On Lavalier: Ultra-compact design, conspicuous only for its sound quality. Steel-reinforced cable and snap-proof clamp connection for unsurpassed ruggedness and safety. Ideal for newscasters, announcers, actors, panelists, etc.
- MZG 802 Camera Mount: Fits Multimike Electret Microphone System to almost any make of camera.
- MZS 802 Telescopic Boom: Fits between powering module and microphone head to extend reach up to 27 inches, with three click-stopped mike positions. Cable-free double-rod design for improved reliability.
- MZK 802 Connection Cable: Connects the powering module directly to a sound camera with compact coiled cable extending a full three feet. Steel-reinforced for durability and safety.
ACCESSORIES

MZS 802 Telescopic Boom
MZG 802 Camera Mount
MZW 30 Windscreen for ME 20/ME 40
MZW 415 Windscreen for ME 80
MZX 802 Connection Cable
MZW 105-1 Desk Stand

Frequency response: ME 20

Frequency Response: ME 80

Frequency Response: ME 40

Frequency Response: ME 88

TECHNICAL DATA

<table>
<thead>
<tr>
<th>K 3 U with:</th>
<th>Frequency Response</th>
<th>Open Circuit Output Level at 94 dB SPL</th>
<th>S/N Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 20</td>
<td>50 Hz—16 kHz</td>
<td>48 dBm</td>
<td>64 dB</td>
</tr>
<tr>
<td>ME 40</td>
<td>80 Hz—16 kHz</td>
<td>48 dBm</td>
<td>64 dB</td>
</tr>
<tr>
<td>ME 80</td>
<td>40 Hz—15 kHz</td>
<td>44 dBm</td>
<td>70 dB</td>
</tr>
<tr>
<td>ME 88</td>
<td>40 Hz—16 kHz</td>
<td>44 dBm</td>
<td>70 dB</td>
</tr>
<tr>
<td>MKE 10-3</td>
<td>60 Hz—18 kHz</td>
<td>52 dBm</td>
<td>64 dB</td>
</tr>
</tbody>
</table>
FINALLY. CONDENSER MICROPHONES WITH STUDIO PERFORMANCE. AND FIELD DURABILITY.
SENNHEISER RF CONDENSER MICROPHONES.

The Condenser Dilemma

Audio engineers have long known that condenser microphones provide the ultimate in wide frequency response, sensitivity and excellent transient response. Until Sennheiser however, there have been certain practical drawbacks. Conventional condenser microphones are very sensitive to mechanical shock. Because of the high DC polarizing voltage, problems of high humidity or dielectric breakdown can frequently impair performance, especially at low frequencies (sometimes, even resulting in arc-over). Relatively bulky, cumbersome and inconvenient, they require outboard power supplies and impedance-matching transformers, or extremely short cables. Their generally larger diaphragms dictate larger housing dimensions. Moreover, the larger moving mass of conventional condenser diaphragms, is mechanically far more sensitive, requiring elaborate shock mounts.

Attempts to overcome these drawbacks have been only partially successful. While substituting FET transistors for vacuum tubes in conventional condenser designs has made the units more portable, the problems of critical amplifier input impedance and the likelihood of dielectric breakdown remains.

Electret microphones offer some advantages, by eliminating external DC bias. But the lower bias permanently "frozen" into the microphone capsule actually reduces the signal-to-noise ratio, impairing performance in critical applications.

The net result: while condenser microphones offer superior performance in high-quality recording and broadcast applications, their critical nature limits utility even in the studio. And all but eliminates their ability to function in the field. Until Sennheiser.

The Sennheiser Solution: The RF Condenser Principle

At Sennheiser, we have virtually re-invented the condenser microphone, by making the capacitive transducer part of an RF bridge. Without need for DC bias or high impedance. Because a small change in capacitance produces high output, the result is unparalleled sensitivity and high signal-to-noise ratio. Our RF capsule also tolerates high sound levels without overload, a quality especially apparent in our phantom-powered models. Sennheiser's transformerless, low-impedance FM design also provides other benefits, including RFI protection at the capsule, immunity from hum pickup and interference by stray magnetic fields. Superior response with long cables. And direct connection to most equipment (bypassing transformer problems).

The inconvenience of complicated hook-up arrangements is also eliminated, with a choice of three powering systems: a compact, line battery supply or two external methods. Sennheiser low-frequency response is exceptional. Operating on the same principle as data recorders, they are essentially capable of transducing frequencies of less than 1 Hz. While our scientific microphones function at these ultra-low frequencies, our Studio models must actually use ultra-low frequency attenuation to prevent overloading associated equipment.

Besides an inherent ruggedness and ability to withstand mechanical shock, Sennheiser microphones also have better vibration immunity than ordinary condenser units: smaller, lower-mass capsules in compact housings of sophisticated design, minimize vibrational effects so that shock mounts are often not needed. Smaller size also improves acoustical properties, particularly directionality. Finally, with no DC bias, the capsule is completely immune to arc-over or performance problems due to reduction of capsule isolation resistance.
Utilizing a pressure gradient transducer system with a cardioid pattern, this model provides precise directionality over the entire response curve. Its excellent audio characteristics make it ideal for studio applications requiring a directional unit. Its ruggedly engineered construction, ability to withstand severe climates and freedom from handling noises make it perfect for most field applications as well. MKH 406 T-U for AB powering MKH 406 P 48-U for phantom powering

MKH 406

Highly directional, this workhorse unit is a combination pressure gradient transducer and interference microphone. This gives it a cardioid pattern at low and medium frequencies, with a more directional club-shaped pattern at higher frequencies. The result is better isolation from wind and pop effects, as well as better immunity from breathing and clothing noises. Therefore, while it is basically a long-distance microphone designed to solve difficult problems, it is also highly favored by recording studios and performing soloists, as well as by reporters for those on-the-run sound gathering situations. MKH 416 T-U for AB powering MKH 416 P 48-U for phantom powering

MKH 416

The ultradirectional microphone with the narrow-beam pattern that picks out speakers at great distances. A combination pressure-gradient and interference system, similar to, but more directional than the MKH 416, makes it highly impervious to extraneous noise pickup, so it is perfect for the difficult environment of the crowded news conference, as well as the more controlled conditions of the movie set or TV stage. MKH 816 T-U for AB powering MKH 816 P 48-U for phantom powering

MKH 816

POWERING SYSTEMS

Sennheiser RF Condenser microphones can be popular powering systems in use today. Audio Wire (A-B) Powering - Invented by Sennheiser, this system ( DIN standard #45595) is now used, especially in Radio and TV networks. DC power is supplied through the two audio leads, effectively isolating the microphone from the circuit. While Sennheiser microphones, and in a number of convenient ways.

Battery: A battery adapter, MZA 15, available for the Sennheiser 625-45595, allows the microphone to be powered directly from a 1.5V battery, at a place along the length of the microphone. AC Supply: A convenient AC supply is available from a 100V voltage to the lower DC voltages. Many professional instrument cables have power inputs, typically the Sennheiser M 101 mixer several recorder models, as well as the Arriva and Steil recorders.

Central Studio Supply: Many studios are already equipped with low-voltage DC for microphone powering. RF Condenser microphones are compatible with this system. Phantom Powering - This system supplies DC power by utilizing both audio leads of the microphone, and the cable shield as the negative leg. This system is compatible with powered or unpowered dynamite microphones. The Sennheiser RF Condenser microphone is compatible with this system. Ports for the M 16 P 48 can be supplied with phantom powering where it is not available.
MICROPHONES.

Audio engineers have long known that provide the ultimate in wide frequencyivity and excellent transient response. Here have been certain practical drawbacks to microphone manufacturers. These microphones are very sensitive to changes in DC polarizing voltage, or dielectric breakdown can occur at low frequencies (sometimes, even above normal frequencies). Moreover, the larger condenser diaphragms are mechanically active, requiring elaborate shock mounts.

Recently, FET transistors for vacuum tubes in transmitters have made the units more portable, with input impedance and the likelihood of dielectric breakdown remains. Some advantages, by eliminating external bias, are becoming. Our phantom-powered models have less than 1 Hz (1 Hz) and ability to withstand mechanical strain without overloading associated equipment units. Smaller, lower mass capsules in illustrated design, minimize vibrational stress also not needed. Smaller size also particularly directionality. Finally, a completely immune to arc-over or perforation of capsule isolation resistance.
SENNHEISER RF CONDENSER MICROPHONES.

The Condenser Dilemma: Audio engineers have long known that condenser microphones provide the ultimate in wide frequency response, sensitivity and excellent transient response. Until Sennheiser, however, there have been certain practical drawbacks. Conventional condenser microphones are very sensitive to mechanical shock. Because of the high DC polarizing voltage, problems of high humidity or dielectric breakdown can frequently impair performance, especially at low frequencies (sometimes even resulting in arc-over). Relatively bulky, cumbersome and inconvenient, they require outboard power supplies and impedance-matching transformers, or extremely short cables. Their generally larger diaphragms dictate larger housing dimensions. Moreover, the larger moving mass of conventional condenser diaphragms, is mechanically far more sensitive, requiring elaborate shock mounts.

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### SPECIFICATIONS

#### Frequency response

<table>
<thead>
<tr>
<th>Microphone</th>
<th>Frequency Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>MKH 406, 416</td>
<td>40...20,000 Hz</td>
</tr>
<tr>
<td>MKH 406 P, 416 P</td>
<td>40...20,000 Hz</td>
</tr>
</tbody>
</table>

#### Directional characteristic

- 20 mV
- 20 mV
- 20 mV
- 20 mV

#### Open circuit output voltage

- 2 ohms, balanced
- 10 ohms, balanced
- 2 ohms, balanced
- 10 ohms, balanced
- 2 ohms, balanced
- 10 ohms, balanced

#### Source impedance at 1000 Hz

- 600 ohms (200 ohms up to 120 dB SPL)
- 600 ohms (200 ohms up to 120 dB SPL)
- 400 ohms (200 ohms up to 124 dB SPL)
- 400 ohms (200 ohms up to 124 dB SPL)
- 400 ohms (200 ohms up to 124 dB SPL)
- 400 ohms (200 ohms up to 124 dB SPL)

### Volume handling capability

- 76 dB to 94 dB SPL
- 76 dB to 94 dB SPL
- 76 dB to 94 dB SPL
- 76 dB to 94 dB SPL
- 76 dB to 94 dB SPL
- 76 dB to 94 dB SPL

### Supply voltage

- 12 V ± 2 V
- 12 V ± 2 V
- 12 V ± 2 V
- 12 V ± 2 V
- 12 V ± 2 V
- 12 V ± 2 V

### Current drawn

- 6 mA
- 6 mA
- 6 mA
- 6 mA
- 6 mA
- 6 mA

### Temperature range

- From -10°C to +70°C
- From -10°C to +70°C
- From -10°C to +70°C
- From -10°C to +70°C
- From -10°C to +70°C
- From -10°C to +70°C

### Output connector

- 3-pin XLR
- 3-pin XLR
- 3-pin XLR
- 3-pin XLR
- 3-pin XLR
- 3-pin XLR

### Dimensions in mm

- 3/8" dia. x 3/8" dia. x 3/8" dia. x 1 1/2" dia. x 1/2" dia. x 1/8" dia. x
- 1/2" dia. x 1 1/2" dia. x 1/2" dia. x
- 1 1/2" dia. x 1/2" dia. x
- 1/2" dia. x 1/2" dia. x
- 1/2" dia. x 1/2" dia. x
- 1/2" dia. x 1/2" dia. x

### Weight

- 5.3 oz.
- 5.3 oz.
- 6 oz.
- 6 oz.
- 6 oz.
- 6 oz.

We reserve the right to alter specifications, in particular with regard to technical improvements.

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**MKH 406**

**MKH 416**

**MKH 816**

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**SENNHEISER**

Electronic Corporation

10 West 37th Street, New York 10018 (212) 239-0190

Manufacturing Plant: Hanover, West Germany

Printed in West Germany

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**MKH 406**

**MKH 416**

**MKH 816**
MD 441
SUPERCARDIOID
DYNAMIC MICROPHONE
Studio Accuracy.
Onstage Ruggedness.
Superb Performance with
Vocals and Instrumentals.
Our design goal was ambitious: a microphone that could offer studio-quality sound in a wide variety of applications and environments. In short, a microphone to please performers and engineers alike. The result: The MD 441. Without a doubt, the best dynamic microphone Sennheiser has ever made. So good, it actually outperforms many condenser microphones on the market today. With remarkably smooth, wide frequency response extending from 40 to 20,000 Hz. Tight, frequency-independent supercardioid pattern. Extremely low sensitivity to handling noise. Plus the kind of durability that’s absolutely essential in day-to-day professional use. As a result the MD 441 has rapidly become the studio-standard dynamic microphone for applications ranging from instrumental to vocal to speech—whenever reproduction of the highest quality is demanded.

**STUDIO QUIET IN THE PERFORMER’S HAND.**

Supercardioid directivity has always been an extremely desirable microphone characteristic for performers. But supercardioid microphones traditionally have another characteristic that is extremely undesirable: mechanical noise so severe, many can’t even be hand held. In the MD 441, the problem of mechanical noise has been solved with a double housing. The inner housing, containing the microphone element, is isolated from the outer housing by means of a highly compliant, damped spring suspension that shields it from mechanically-conducted noise. Allowing a most unusual metamorphosis: from a superb instrumental microphone to a hand-held, live-performance vocal microphone.

**For optimum close miking, the MD 441 also features an integral grille/ windshield and internal pop filter. Together, these control breath blasts and wind noise in almost any application.** 

**DEPTII, PRESENCE... AND ABSENCE.**

To make the MD 441 even more practical and flexible, we added two more features that combine to create a unique switchable equalization network. A brilliance switch offers a 5 dB boost at 5 kHz, without affecting overall level. And a second, independent equalizer switch makes possible a five-step attenuation of bass to selectively enhance vocals and instruments, while preventing over-emphasis of low frequencies. There’s also something you won’t hear with the MD 441: In tests subjecting the MD 441 to sound pressure levels greatly exceeding the human pain threshold, there was an absolute absence of microphone clipping. Even in conditions so extreme, the preamplifier overloaded. So you can feel secure in placing it close to the hottest horn... or “feeling” it to the most explosive vocalist!

**THE PROFESSIONAL’S MICROPHONE.**

The MD 441 is designed for a wide variety of professional applications, including live performances, sound reinforcement, recording studios, film and broadcasting. Human-engineered with satin-chrome finish and non-slip, leatherette grip surfaces—and acoustically engineered for superb technical performance—the MD 441 is a precision instrument that will delight any professional. Performers and engineers alike.

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Frequency Response</th>
<th>40-20,000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation Mode</td>
<td>variable</td>
</tr>
<tr>
<td>Directional</td>
<td>supercardioid</td>
</tr>
<tr>
<td>Sensitivity (1 kHz)</td>
<td>-25 dB (1 mPa)</td>
</tr>
<tr>
<td>Impedance (1 kHz)</td>
<td>200 ohms</td>
</tr>
<tr>
<td>Brilliance Switch</td>
<td>5 dB boost normal</td>
</tr>
<tr>
<td>Bass Rolloff Switch</td>
<td>variable, five-position attenuation</td>
</tr>
<tr>
<td>Dimensions</td>
<td>33 x 24 x 370 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>450 g (approx. 12 oz)</td>
</tr>
</tbody>
</table>

*1 Pa (1 millibar) = 10 dB (measured) = 94 dB SPL*
Each MD 441 is delivered with an individual frequency response curve.

INCLUDED ACCESSORIES
MZA 441 Stand Adapter and Quick Release Clamp
A button-activated mechanical latch to lock microphone in place. Standard 1/4" thread.
MC 24 Cable
Fifteen-foot shielded cable with XLR-type female connector on one end and pig tails on the other (not shown).

OPTIONAL ACCESSORIES
Windscreen MZW 441
Foam windscreen especially designed for the MD 441.
Table Stand MZT-441
Heavy die-cast base accepts the MZA 441.
MC 22 Cable
Fifteen-foot shielded cable with XLR-type connectors at both ends.

Sennheiser
Sennheiser Electronic Corporation (NY)
10 West 37th Street
New York, NY 10018
(212) 239-0190

Manufacturing Plant:
Bendorf/Hafferoth, West Germany
Today’s performers don’t have it easy. Under the most extreme conditions, in acoustics far from ideal, they’re expected to combine studio sound with the spontaneity of a live performance. It’s a difficult problem indeed. And one we at Sennheiser have been working to solve for quite some time.

After considerable research and in-use testing, we’ve created a microphone designed to help performers sound their best. By giving them more usable power, even in the most difficult of circumstances. We call it the MD 431. And it’s designed to provide superior performance from the inside out.

Superior directionality.

One of the most difficult problems musicians face is unwanted sound pickup from the sides and rear — especially from musical instruments and loudspeakers, as a result, performers must often restrict their movements, instruments must be specially positioned and amplifiers must frequently be turned down.

It’s the familiar feedback problem. And one that even conventional cardioid directional microphones cannot cure — because they still pick up 25% of their sound from the sides (as compared with on-axis sound from the front), which results in unacceptable stray pickup. To eliminate feedback, our MD 431 incorporates a special super-cardioid directional characteristic, reducing side pickup to a mere 12% (less than half that of conventional cardioids) — with even less pickup from the rear of the microphone. And because this directional pattern is virtually identical at all frequencies — unlike many other directional microphones — it provides an almost unbelievable freedom from feedback that must be heard to be believed. Resulting in dramatically increased usable volume, for far greater audience impact.

Technical Data

- "Presentation frequency response: 40 Hz to 16 kHz, 18 dB/ octave above 1 kHz, 85 dB SPL at 1 kHz, 1.4 mV at 1 kHz.
- "Sensitivity: 1.4 mV at 1 kHz, 1.0 k\Ω.
- "Microphone weight: 120 g.
- "Dimensions: 49 mm x 31 mm x 250 mm.
- "Connector: XLR.

The MD 431 is supplied complete with a quick-release clip and a 5 m long cable — XLR connector on both ends for balanced microphone inputs.
### Top-microphones in our line

**MD 441**
The universal microphone with studio quality for demanding soloists.

<table>
<thead>
<tr>
<th>Frequency range:</th>
<th>30 to 20,000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional pattern:</td>
<td>super cardioid</td>
</tr>
<tr>
<td>Impedance:</td>
<td>approx. 200 Ω</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>2 mV/Pa</td>
</tr>
</tbody>
</table>

**MD 416**
The soloist microphone for all vocalists and instrumentalists.

<table>
<thead>
<tr>
<th>Frequency range:</th>
<th>50 to 15,000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional pattern:</td>
<td>cardioid</td>
</tr>
<tr>
<td>Impedance:</td>
<td>approx. 200 Ω</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>1.3 mV/Pa</td>
</tr>
</tbody>
</table>

**MD 421**
The popular directional microphone used by professionals as well as discriminating audiophiles.

<table>
<thead>
<tr>
<th>Frequency range:</th>
<th>30 to 17,000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional pattern:</td>
<td>cardioid</td>
</tr>
<tr>
<td>Impedance:</td>
<td>approx. 200 Ω</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>2 mV/Pa</td>
</tr>
</tbody>
</table>

*U.S. models of all microphones equipped with XLR connector MD 421 finish (U.S. version) is Professional Matte Black.

Sennheiser Electronic Corporation (N.Y.)
10 West 37th Street
New York, New York 10018
Phone: (212) 239-0190

Manufacturing Plant:
3002 Wedemark 2/Hannover, West Germany

**The name for perfect sound**
From a bang to a whisper - controlled response means superior reproduction.

MD 421
MD 421: Superb Directionality and Freedom from Overload to more than 175 dB - from 30 to 17,000 Hz!

This is the microphone for today. Today's world of rock concerts at over 130 dB – studio recording sessions in close proximity to all types of instruments... disco, deejay applications... and location field recording – like airports – with even higher levels. No other microphone is this immune to overload, yet so precise over such a wide range of frequencies.

Ruggedly constructed to precision standards, the MD 421 withstands hard use with Sennheiser's legendary reliability. Its pressure-gradient dynamic transducer provides faultless performance both in the protected confines of the studio, and in the often-hostile environment outdoors. Its controlled, wide-frequency response is designed with an intentional sensitivity increase in the upper range, for improved definition. And for low frequency control the MD 421 incorporates a five-step adjustable bass attenuator to tailor response for optimum performance under varying conditions. Unique among dynamic microphones, the MD 421 is highly resistant to interference from stray magnetic fields, it provides the low handling-noise and freedom from feedback that all Sennheiser microphones are famous for.

Model MD 421 U 4
A balanced low impedance unit which may also be used with high impedance inputs with optional high impedance cable MC 57. It is equipped with a 5-step bass attenuator, XLR connector and stand adapter. Housing a high-impact, scratch-resistant ABS material with a black non-glare finish.
MD 421 Precision Accessories
For perfection with convenience.

MZS 142 Lightweight Floor Stand
Telescoping, collapsible unit with water-proof transit cover. Extends to 54" (138 cm), closes to 16" (41 cm).

MZS 144 Floor Stand
Adjustable between 33" (84 cm) and 62" (158 cm). Rubber-tipped legs are detachable.

MZS 210 DeLuxe Floor Stand
Heavy-duty unit with anti-vibration mounts concealed in legs. Adjustable between 33" (84 cm) and 62" (158 cm). Legs fold together for transit.

MZS 211 Boom Arm
Fits stands 142, 144 and 210. Fully adjustable for length to a maximum of 33" (84 cm) and to all angles.

Legs fold together for transit.

MC 22 Cable
Heavy duty, neoprene coated, two-conductor shielded cable with standard XLR connector at both ends.

MZW 421 Windscreen and Pop Filter
Flexible windscreen made from open-cell sponge. Measures 3" (80 mm) diameter.

MZW 22 Windscreen and Pop Filter
Fibreglass-reinforced polyester for superior wind-noise reduction. Measures 3" (80 mm) diameter.

Sennheiser