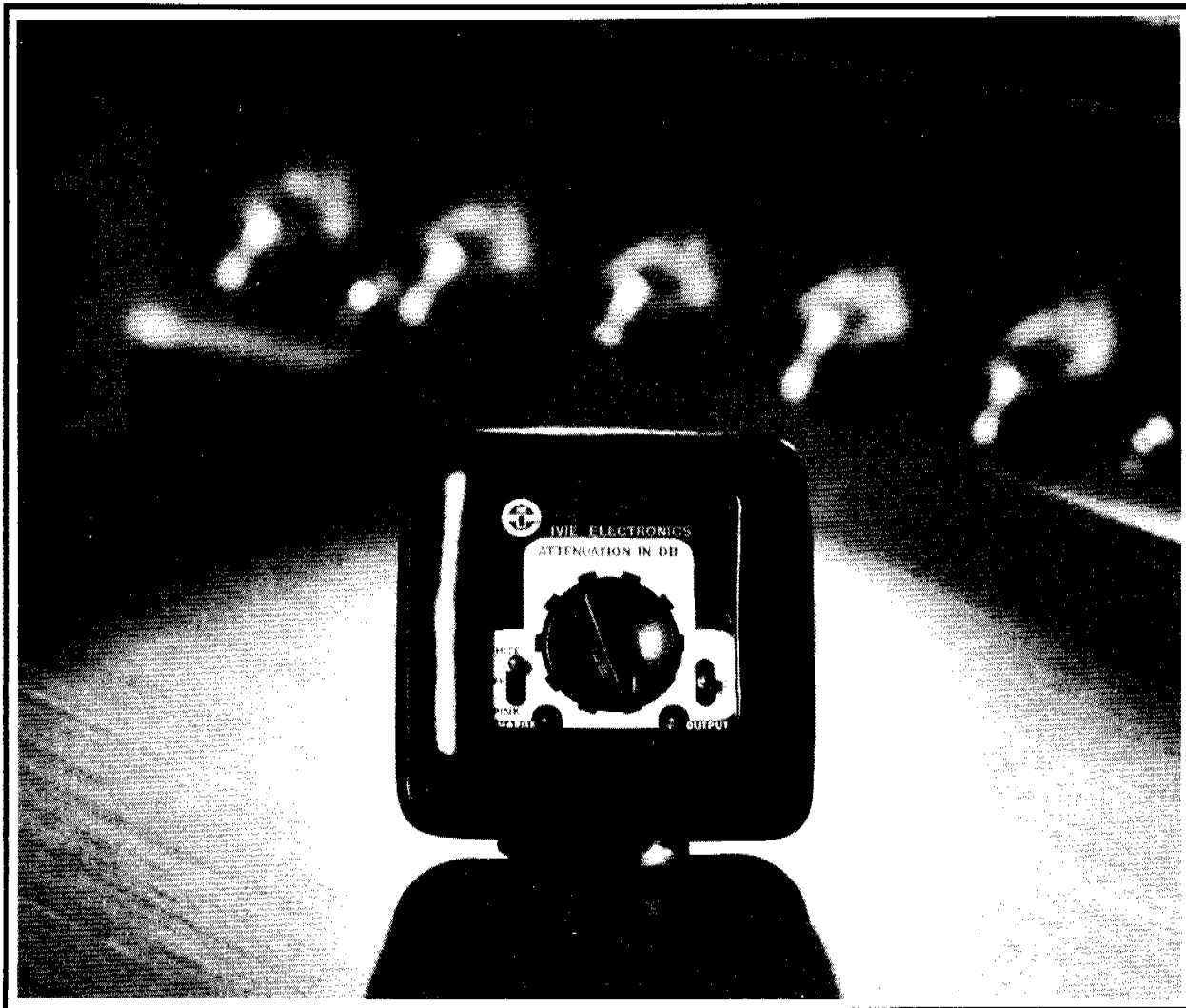


IE-20B MANUAL



Operation and Owners Manual for the IE-20B Pink & White Noise Generator

IE-20B WARRANTY

The IE-20B is warranted against defects in materials and workmanship for one (1) year from the date of purchase. During the warranty period, Ivie Technologies will repair, or at its option, replace components which prove to be defective, provided the generator is returned, shipping prepaid, to an authorized Ivie Technologies service facility. Defects caused by modifications, misuse or accidents are not covered by this warranty. No other warranties are expressed or implied. Ivie Technologies is not liable for consequential damages. All requests for repair and information should include the instrument serial number to assure rapid service.

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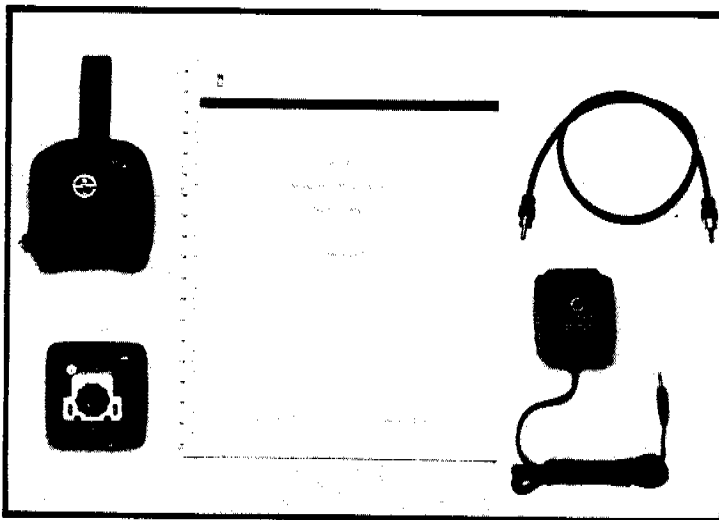
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INTRODUCTION

It is the intention of Ivie Electronics to provide high quality equipment of innovative design to help satisfy the ever increasing technical needs of the audio industry. We are always ready to lend engineering support and assistance when the need occurs. When questions arise, please contact us. We are interested in your applications.

We believe in rugged quality — that an instrument should be able to withstand constant and demanding usage. Your new IE-20B Noise Generator is such an instrument, and properly cared for, it will give you long and reliable service.

With your IE-20B you should have received the following items pictured below:



IE-20B Noise Generator

"Fast Charge" nickel cadmium batteries mounted inside the IE-20B.

AC adaptor/charger that provides continuous line operation.

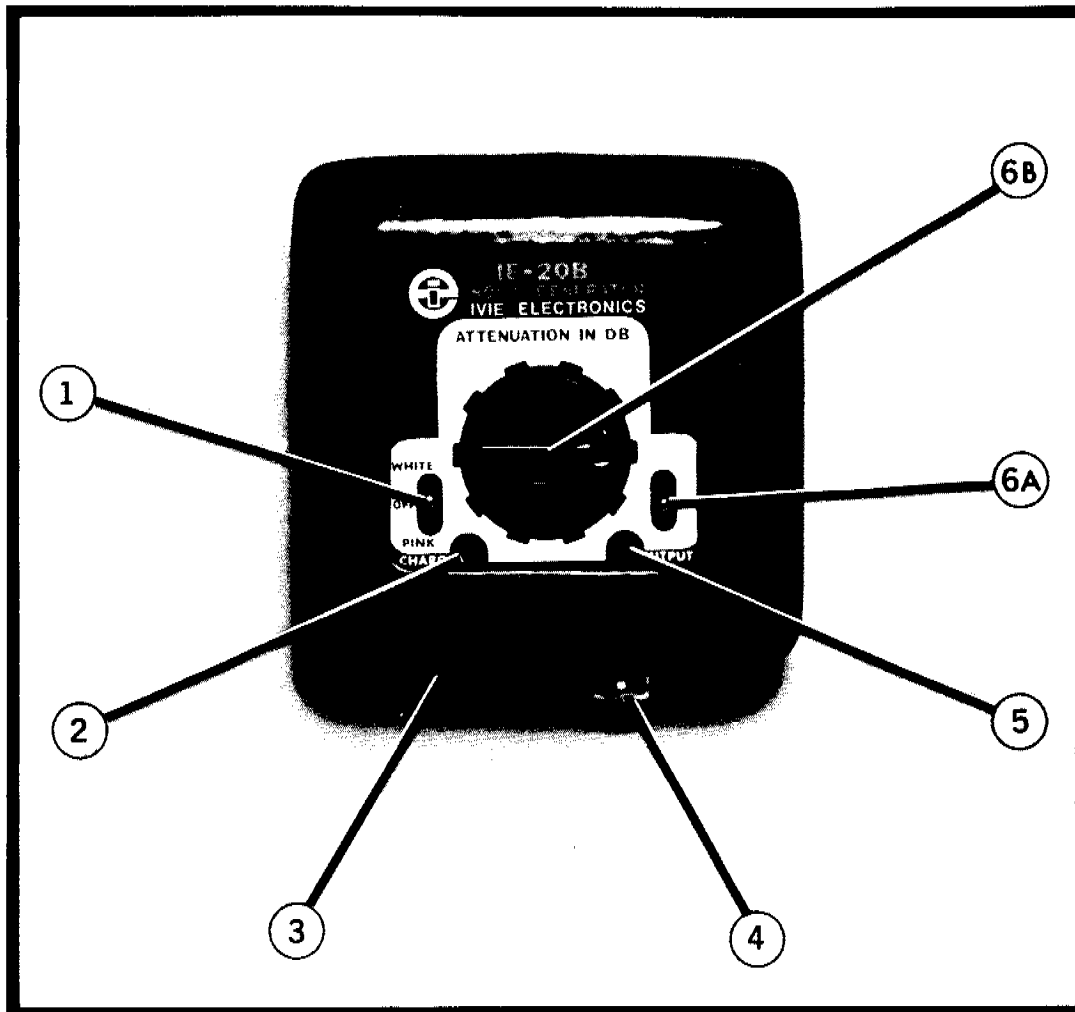
Vinyl carrying case with belt loop.

Standard phono plug patch cord.

Operator's Manual with illustrations and examples.

It is recommended that your IE-20B be charged for three hours after it is unpackaged. This will assure a full ten hours of operating time before recharging is again necessary.

Make sure the voltage selection switch on the IE-165A Adaptor/Charger is in the correct position for the line voltage being used (either 115v. or 230v. AC at 50-60 Hz).



IE-20B Front Panel Controls
Figure 1

IE-20B OPERATION

FRONT PANEL DESCRIPTION

The IE-20B has been designed for ease of operation. Referring to Figure 1, the controls are as follows.

- ① Power Switch. Selects pink noise output, white noise output, or power off.
- ② "Charge" indicator. This LED indicator has two important functions. It lights when the IE-20B is being charged, thus providing indication of a properly working battery charger. Its second function is providing indication of battery level. It illuminates when the NI-Cad batteries are low and require charging.
- ③ Input jack for the battery charger.
- ④ Noise Output jack.
- ⑤ Noise Output indicator.
- ⑥ Precision attenuator. The attenuator is comprised of two controls, the "Range" toggle ⑥A and the Dial ⑥B . Total output attenuation is determined by adding the Dial setting to the Range setting.

BATTERY AND LINE OPERATION

An IE-165A Adaptor/Charger has been supplied with your IE-20B Noise Generator that will recharge the batteries in about 3 hours. The IE-20B will operate approximately 10 hours between charges.

When the "CHARGE" LED lights indicating low batteries, recharging is immediately necessary. The noise output ceases to be accurate shortly after the LED illuminates.

CAUTION: Use of an adaptor/charger other than the IE-165A may cause damage to your IE-20B.

The IE-165A Adaptor/Charger is selectable for voltages of 115v. or 230v. AC at 50 to 60 Hz. Make sure the voltage switch on the IE-165A is in the correct position for the AC power line being used. Using the IE-165A with AC power other than 115v. or 230v. at 50-60 Hz may cause damage to your IE-20B.

The IE-20B may also be operated directly from the AC power line using the IE-165A as an adaptor. The Ni-Cad batteries will continue to charge when the noise generator is being operated in this manner.

The Ni-Cad batteries in the IE-20B are of the highest quality and are capable of withstanding extended overcharging. It is recommended that they be completely discharged (until the "Charge" LED on the IE-20B illuminates) from time to time to minimize the possibility of "memory effect" on the batteries. Ni-Cad batteries can lose their ability to give up 100% of their charge if they are only partially discharged on a frequent basis.

If permanent power line operation of the IE-20B is desired, it is recommended that the Ni-Cad batteries be removed and that a line operated DC power supply of 6V. and 50ma be provided in their place. The external power supply can be conveniently provided to the IE-20B through the charge jack (3 Figure 1) (center pin is positive).

CHANGING THE REFERENCE LEVEL

The REFERENCE level on the IE-20B is defined as the rms output voltage level when the attenuator is set to 0dB. At the factory the reference is set to .940v RMS (pink noise output) because this output level corresponds to calibrations on the IE-10A Audio Spectrum Analyzer.

For many applications it may be desirable to change the reference output level on the IE-20B. The reference level is adjustable between 0 V rms and 1.0 V rms using the potentiometer which is accessed through the back of the noise generator as demonstrated in Figure 2. Rotating the shaft clockwise increases the reference output level and counter-clockwise motion reduces the reference level.



Changing the Reference Level
Figure 2

It should be noted that changing the reference level does not change the accuracy of the attenuator. The attenuator will provide 0-58dB of signal reduction (in 2dB steps), regardless of the reference level setting.

USING THE ATTENUATOR

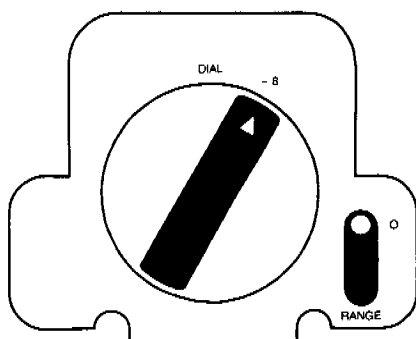
One of the unique features of the IE-20B Noise Generator is its calibrated output. For loads greater than 600 ohms, the step attenuator on the front panel allows up to 58dB of attenuation from the reference output level, selectable in 2dB increments.

The step attenuator is comprised of the "dial" and the "range" toggle switch. (See figure 1, 6A & 6B, page 4). To determine total attenuation in dB, add the dial and the toggle values together. The two illustrations below provide simple examples. The total attenuation in figure 3 is -8dB. In figure 4, the attenuation selected is -56 dB.

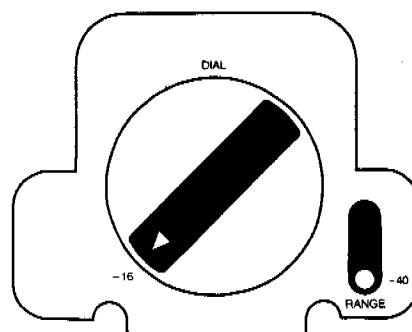
Figure 3: Dial = - 8, Range = 0; $(-8) + 0 = -8\text{dB}$.

Figure 4: Dial = -16, Range = -40; $(-16) + (-40) = -56\text{dB}$.

The 2dB increments of the step attenuator are very precise. Cumulative error is not more than $\pm .5\text{dB}$ over the entire 58dB range.



Attenuator set to -8dB
Figure 3



Attenuator set to -56dB
Figure 4

TABLE OF ATTENUATION VERSUS OUTPUT VOLTAGE

Frequently, it is desirable to select a specific rms output voltage from the IE-20B for a particular application. The following table was constructed to allow a convenient means of selecting a particular voltage output level for a given IE-20B attenuator setting. The voltage levels in the table below are for an IE-20B that has been calibrated for use with an IE-10A. A conversion table is not required when using the IE-20B with an IE-30A, because the IE-30A is capable of measuring the true rms output voltage of a noise generator directly in dB μ V.

IE-20B ATTENUATOR SETTING	PINK NOISE OUTPUT LEVEL MILLIVOLTS RMS	WHITE NOISE OUTPUT LEVEL MILLIVOLTS RMS
- 0 dB	940.0 mv	620.0 mv
- 2 dB	747.0 mv	492.0 mv
- 4 dB	593.0 mv	391.0 mv
- 6 dB	471.0 mv	311.0 mv
- 8 dB	374.0 mv	247.0 mv
-10 dB	297.0 mv	196.0 mv
-12 dB	236.0 mv	156.0 mv
-14 dB	188.0 mv	124.0 mv
-16 dB	149.0 mv	98.0 mv
-18 dB	118.0 mv	78.0 mv
-20 dB	94.0 mv	62.0 mv
-22 dB	75.0 mv	49.0 mv
-24 dB	59.0 mv	39.0 mv
-26 dB	47.0 mv	31.0 mv
-28 dB	37.0 mv	25.0 mv
-30 dB	30.0 mv	20.0 mv
-32 dB	24.0 mv	16.0 mv
-34 dB	19.0 mv	12.0 mv
-36 dB	15.0 mv	10.0 mv
-38 dB	12.0 mv	8.0 mv
-40 dB	9.4 mv	6.2 mv
-42 dB	7.5 mv	4.9 mv
-44 dB	5.9 mv	3.9 mv
-46 dB	4.7 mv	3.1 mv
-48 dB	3.7 mv	2.5 mv
-50 dB	3.0 mv	2.0 mv
-52 dB	2.4 mv	1.6 mv
-54 dB	1.9 mv	1.2 mv
-56 dB	1.5 mv	1.0 mv
-58 dB	1.2 mv	0.8 mv

USES OF THE IE-20B NOISE GENERATOR

The IE-20B has been designed to meet a wide range of applications. Its attenuatable output level allows it to directly drive a broad spectrum of equipment from ultra sensitive preamps to high power amplifiers.

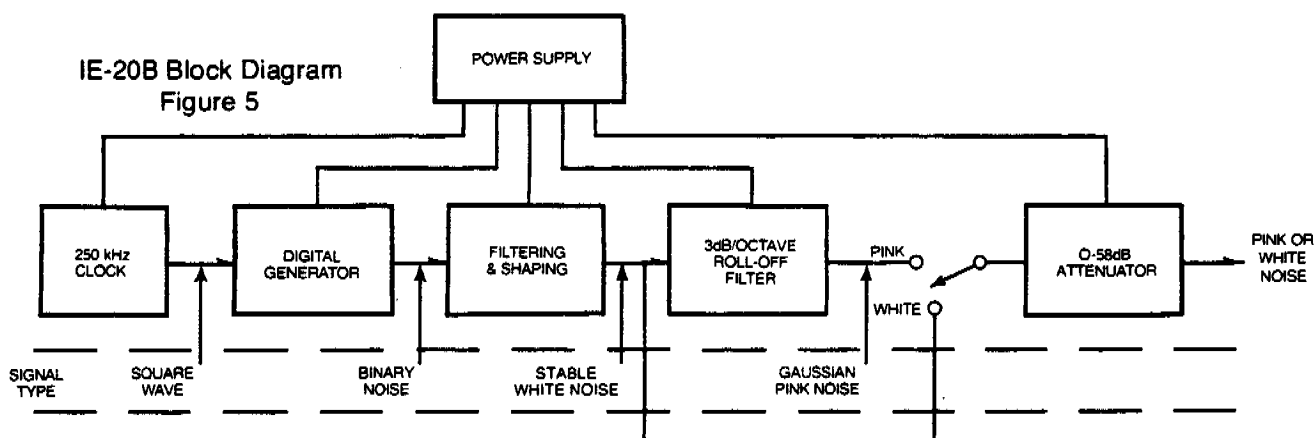
A noise generator can be used alone for some applications such as noise masking and acoustical shielding, but its full potential as a test instrument is realized when it is used in conjunction with a good real time analyzer such as the IE-10A, or the IE-30A Audio Spectrum Analyzer.

Together, the noise generator and audio spectrum analyzer can be used for a wide variety of audio applications such as:

- * Equalizing audio components and systems
- * Checking flatness and gain on microphones, preamps, amplifiers and mixers
- * Measuring transducer dispersion angles at all octaves
- * Measuring speaker response
- * Trouble shooting and tracing audio circuits
- * Evaluating filter response
- * Analyzing audio transmission systems
- * Noise masking
- * Tape recorder equalization
- * Tape recorder azimuth alignment
- * Hearing aid testing

Of all the tools in the audio field, a noise generator and a real time analyzer are two of the most versatile and useful. The sound reinforcement and hifi professional, the musician, technician and serious audiophile alike, will find the combination invaluable.

CIRCUIT DESCRIPTION AND THEORY



The IE-20B is a state-of-the-art noise generator, designed to handle the most exacting laboratory requirements. Unlike gas-discharge tube and noise-diode methods, the digital techniques used in the IE-20B generate noise signals that are statistically well-defined and very stable, even at low frequencies.

The IE-20B (See Figure 5, Block Diagram) employs a digital process with special filtering and shaping to produce a very flat pink, or white noise output over a wide range of frequencies.

A linear feedback shift register is used to produce very flat binary (two-level) noise having a digital word length of more than two billion bits. Using a clock frequency of 250KHz allows the noise signal to be random over a 2.4 hour period of time before the digital word sequence begins to repeat.

Random binary noise is not considered to be a good audio test signal because its output amplitude is confined to two levels only. Signals with multilevel amplitudes, like random Gaussian noise, more closely correlate with audio program material.

Binary noise can be converted to high-quality white noise (a multilevel waveform having a stable distribution) through use of additional filtering as shown in Figure 5.

For audio work, pink noise (constant energy per octave) is generally preferred over white noise (constant energy per hertz) because white noise delivers greater energy at upper frequencies which could damage drivers. Pink noise, by contrast, delivers equal energy at the higher octaves.

Real time audio analyzers are designed with octave, or fractional octave, bandwidth filters and are intended to be used with pink noise generators. A pink noise input signal will produce a flat response on such an analyzer.

Converting white noise to an accurate pink noise signal requires a precision 3dB per octave rolloff filter as shown in the block diagram of the IE-20B.

To enable the user to make accurate audio substitution measurements when using the IE-20B in conjunction with an audio analyzer, a precision attenuator has been designed into the output stage of the noise generator.

WHEN IS NOISE FLAT?

Never! That's right, noise isn't flat! The question . . . how flat is your noise generator? . . . can be very misleading. The reader should be aware that the output voltage levels of any "noise generator" are random in nature. This means that if we try to measure the output voltage level of a noise generator with an ordinary voltmeter, we will obtain numerous readings at different voltage levels.

We can obtain an accurate, stable voltage reading from a noise generator only when we time-average its output signal over a sufficiently long time interval, using a true rms voltmeter.

The longer we sample the voltage levels of random noise, the more stable it appears. In essence, noise is never flat; it can only be made to appear flat if we allow sufficient sample time. Noise is a statistical phenomenon. A more reasonable question should be . . . how flat are the filters in your noise generator? If the filters in a noise generator are very flat, then the **time averaged** output will appear very flat.

Pink noise appears to be reasonably stable and flat when fed into a real-time spectrum analyzer like the IE-10A, or the IE-30A, because the analyzer detectors were designed to time-average the random noise. You will notice the very random amplitude characteristic of noise if the selected detector response in the spectrum analyzer is "too fast" causing narrow, low frequency filters to flutter over a several dB range. Making pink noise appear flat is as much a function of a good spectrum analyzer, as it is a function of a high quality noise generator, like the IE-20B.

If sufficient averaging time is allowed, a spectrum analyzer can display ultra flat noise. The analyzer would however, require an excessive amount of time between readings, and could hardly be referred to as a "real-time" analyzer. Obviously, a tradeoff must be made between a reasonable level of noise flatness, and the time required between measurements. Ivie real-time spectrum analyzers are designed to allow a noise amplitude flutter of about 1.0 dB plus or minus.

IE-20B SPECIFICATIONS

FREQUENCY RANGE

- * 10Hz to 40 KHz 3dB bandwidth
- * 20Hz to 20 KHz \pm 0.5 dB.

NOISE GENERATION

- * Digitally generated by CMOS circuitry.
- * Word length greater than 2 billion bits.
- * Clock rate: 250 KHz
- * Word repetition time: 2.4 hours.
- * Noise distribution approximates Gaussian.

OUTPUT

- * Pink: Output level variable from 0.0 — 1.0v RMS
- * White: Output level variable from 0.0 — 0.65v. RMS
- * Crest factor: 3.75
- * Output attenuation selectable in 2 dB increments from 0 dB to -58 dB.
Cumulative error not more than \pm 0.5 dB for loads \geq 600 ohms.
- * Output short circuit protected.
- * Output connector: standard phono jack.

POWER

- * BATTERY OPERATION: rechargeable nickel cadmium.
- * Operating time approximately 10 hours continuous at 25° C.
- * Fast charge cycle of 3 hours.
- * Low battery indicator light.
- * AC LINE OPERATION from AC Adaptor/Charger.
- * 115/230 VAC 50/60 Hz.
- * Charge indicator light.

ENVIRONMENTAL

- * All circuits temperature compensated.
- * Operating Temp. -10°C to +50°C.
- * Nonoperating Temp. -30°C. to +65°C.
- * Operating Humidity 0 to 90%.

MECHANICAL

- * Aluminum case fusion bonded with nylon.
- * Dimensions (w x h x d) 69 x 69 x 44 mm.
(Approx. 2¾ x 2¾ x 1⅝ in.)
- * Weight: Net 200 gm (approx. 7 oz.)
Shipping 680 gm (approx. 1½ lbs.)

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS

The pink noise generator shall be battery operated using fast charge nickel cadmium batteries. The generator shall operate not less than 10 hours between charges, and shall have a low battery and charge indicator. The generator shall be capable of direct operation from line voltages of 115v. and 230v. AC at 50-60Hz. The dimensions of the generator shall be approximately 69 X 69 X 39mm and it shall weigh approximately 200 grams.

The noise generator chassis shall be aluminum, coated with black, baked enamel.

The generator shall produce pink and white noise, digitally, utilizing CMOS circuitry. The clock rate shall be 250kHz. Output shall be calibrated providing up to 58dB of attenuation in precise 2dB increments. Cumulative attenuator error shall not be greater than $\pm 0.5\text{db}$. Output voltage levels shall be variable between 0.0v. and 1.0v. RMS for pink noise, and 0.0v. and 0.65 v. RMS for white noise.

The noise generator shall be the IE-20B manufactured by Ivie Technologies Incorporated.

SERVICE

It is the intention of Ivie Technologies to provide quality service for the IE-20B whether in or out of the warranty period. If the IE-20B should require service, please return it, shipping prepaid, to an Ivie Technologies service facility. Shipping the instrument in its original packaging is recommended. Repair will be made and the unit will be returned prepaid as soon as possible.

Due to the subminiaturized packaging techniques used, Ivie Technologies cannot assume responsibility for repairs made at other than an authorized service center.