4920

INSTRUCTIONS AND APPLICATIONS

Outdoor Microphone System Type 4920

The Outdoor Microphone System extends the use of the B & K Condenser Microphone into permanent outdoor installations where the microphone is situated at a considerable distance from the indicating instruments.

BRÜEL & KJÆR

Nærum, Denmark . ☎ 80 05 00 . BRUKJA, Copenhagen . Telex: 5316

BB 4920

The Outdoor Microphone System

Type 4920

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Contents

1. Description

General.

The Outdoor Microphone System Type 4920 has been designed to enable outdoor acoustical measurements to be made at a considerable distance from the indicating instruments.

Fig. 1.1. The Outdoor Microphone System Type 4920.

This system consists of: 1. A preamplifier and a condenser microphone fitted with wind screen, electrostatic actuator and rain cover, and 2. A waterproof cabinet, which encloses an amplifier, a power supply and a calibration oscillator. This set-up will convert sound pressures into electrical signals, and due to the low output impedance of the amplifier, these signals can be transmitted over a long distance by means of a cable, for instance a telephone cable or a twisted pair of wires. An easy system check-out and calibration can be made when the built-in electrostatic actuator is switched into operation.

Fig. 1.1 shows the complete Outdoor Microphone System, and its principle of operation is given in the form of a block diagram in Fig. 1.2.

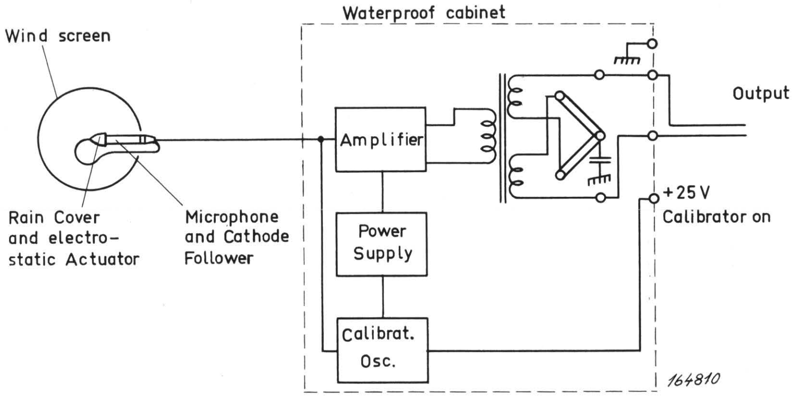


Fig. 1.2. Block diagram of the Outdoor Microphone System Type 4920.

Amplifier.

In this equipment a two stage R-C coupled transistorised amplifier is used in which the transistors are in grounded emitter connection. A maximum gain of 30 dB can be obtained, and a built-in screwdriver operated potentiometer allows gain variations of up to 31.5 times the microphone signal. Normally the signal from the microphone and cathode follower is fed to the screwdriver operated potentiometer through a capacitor, it is possible, however, to take the signal directly from the cathode follower just after the capacitor at the terminal on the printed circuit marked DIR. OUTP.

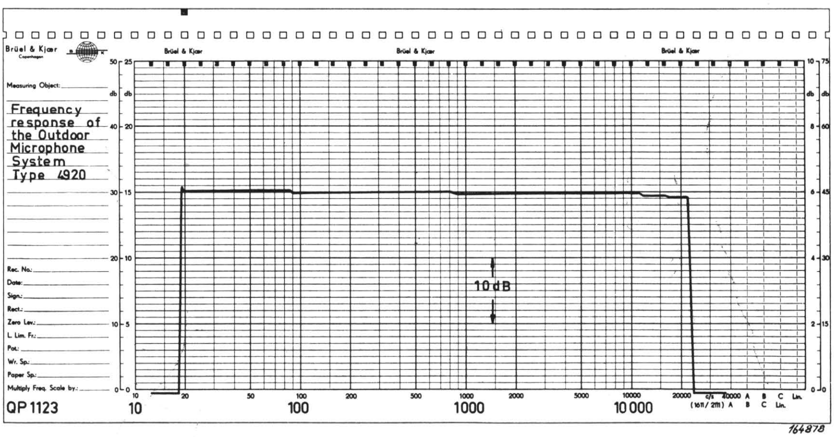


Fig. 1.3. Frequency characteristic of the amplifier loaded with a 200 Ω resistor.

To obtain a linear frequency response, see Fig. 1.3, a heavy, negative feedback has been introduced. However, when a long transmitting cable is connected to the amplifier output it may be necessary to correct for a drop-off in the response at higher frequencies to obtain the desired linear characteristic. This correction is made by connecting a capacitor from the emitter of the first stage to ground (on the printed circuit the mounting holes for this capacitor are marked C 30). The effect of the correction is illustrated in Fig. 1.4. At the output of the amplifier a transformer is used

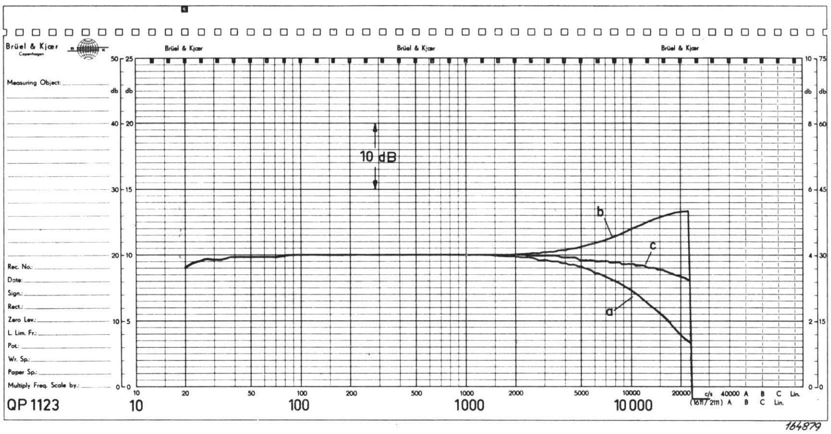


Fig. 1.4. Frequency response correction.
a. Response of amplifier and a long cable without correction.
b. Response of amplifier with correction.
c. Response of amplifier and a long cable with correction.

to obtain several output impedances. The secondary windings of this transformer are detailed in Fig. 1.5 and by means of two or three shorting links, it is possible to use any of the following load impedances: 200 Ω, 200 Ω floating, 200 Ω symmetrical or 50 Ω.

The output terminals of the amplifier, which are located on the printed circuit can be directly connected to a transmission line, the length of which may be of up to 10 km. The amplifier is highly stabilized varying less than $\pm$ 0.2 dB for a $\pm$ 10 % variation in line voltage.

The long term stability is expected to be $\pm$ 0.5 dB when the equipment is in continuous use. Furthermore the amplifier is well temperature stabilized and will be virtually unaffected from — 30° C to + 60° C if power is drawn continuously. See Fig. 1.6.

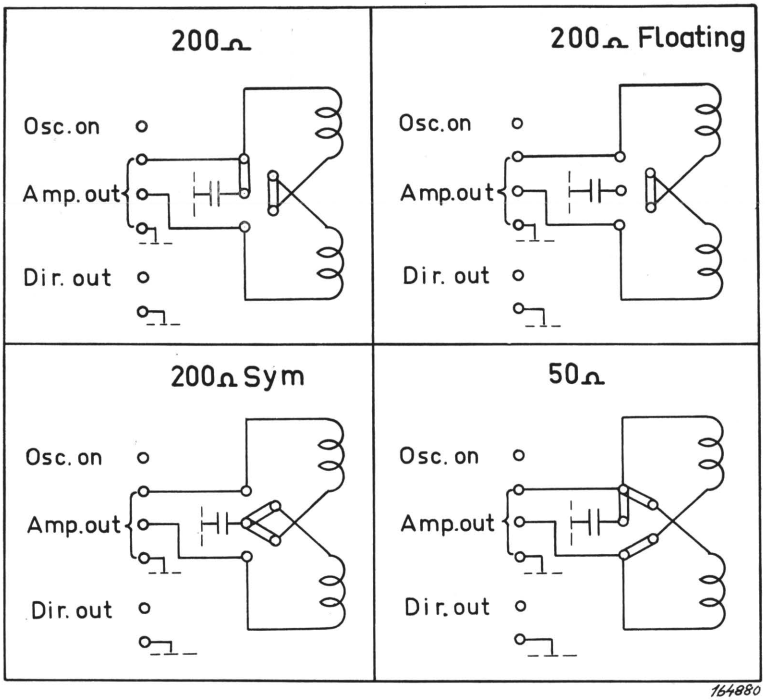


Fig. 1.5. Load impedance conditions.

Calibration Oscillator.
As mentioned earlier, the microphone system contains a device by which it is possible, without any alterations being made to the measuring set-up, to make an easy system check-out and calibration. A known voltage from

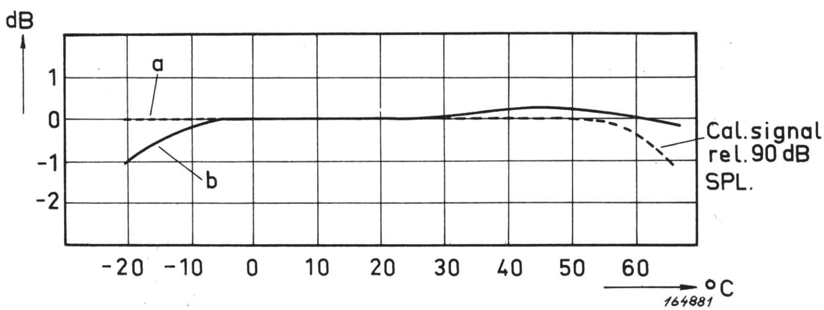


Fig. 1.6. Typical amplification and calibration voltage variations with temperature.

a calibration oscillator in the amplifier assembly is fed to an electrostatic actuator built into the microphone rain cover. This voltage produces a known force which acts on the microphone diaphragm and is comparable to a sound pressure.

The actuator, delivered with the microphone system, is adjusted at the factory so as to produce an equivalent SPL of 90 ± 1 dB by the injection of an AC voltage of 215 V, this being the output voltage from the calibration oscillator. It is possible to adjust this voltage by changing the resistor marked OSC. VOLT ADJ on the printed circuit.

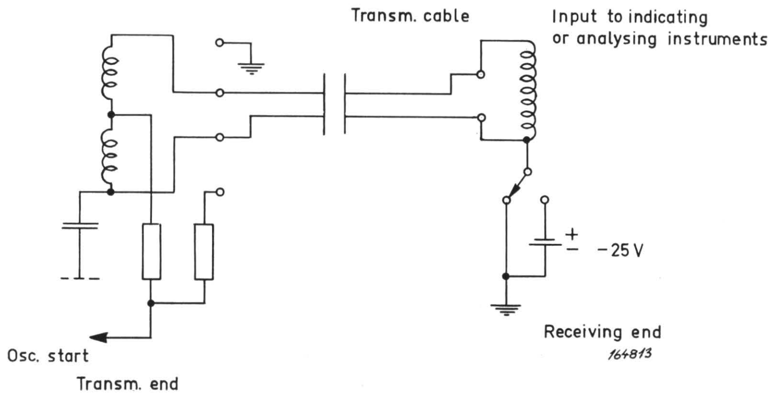


Fig. 1.7. Connection for remote control of the calibration generator.

The frequency of the oscillator is 500 Hz and it may be adjusted by means of the iron core marked OSC. FREQ. ADJ. As there is no DC bais voltage between the actuator and the diaphragm, the frequency of the signal from the microphone itself will thus be 1ooo Hz. A careful stabilization of the output voltage from this oscillator makes it practically independent of ambient temperature variations. See Fig. 1.6 curve a.

To operate the calibration oscillator a 10—25 V battery is connected either between one of the signal leads and ground (2 wire system), see Fig. 1.7, or between a special lead from the amplifier assembly and ground (3 wire system). When using the battery between signal lead and ground, care must be taken not to short circuit the signal or the DC voltage. If the indicating instruments have a capacitor in the input circuit, the DC voltage can be supplied through a 5 kΩ resistor, but in the case of a transformer input where the transformers are not floating, a series capacitor must be used.

Microphone Cartridge Type 4133 and the Cathode Follower 2615.

The microphone used consists of a 1/2″ microphone cartridge and a cathode follower attached to a 10 m (30 foot) cable between the microphone and the amplifier box. This microphone cartridge is screwed onto the housing of the cathode follower forming a small rugged unit.

Connection of the microphone must be made directly to the input socket on the amplifier assembly which matches the microphone connecting plug. Stabilized plate and heater voltages for the cathode follower and polarization voltage for the cartridge are available at this seven-pin socket. The 200 volt polarization voltage may be adjusted by means of a potentiometer marked POL. VOLT. ADJ. on the amplifier assembly, with the point for measuring this voltage marked MEAS.

The Microphone Cartridge Type 4133 features a normal incidence free-field frequency characteristic which is flat up to 12.5 kHz (with rain cover mounted).

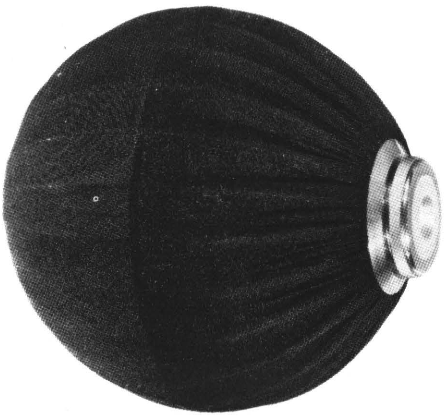


Fig. 1.8. The Wind Screen UA 0082.

Wind Screen.

The wind screen is designed for mounting on the cathode follower equipped with a condenser microphone cartridge and the rain cover. It is covered with a double layer of nylon cloth, and gives an effective reduction, of the order of 10 dB or higher of wind induced noise at lower wind velocities. It is possible to mount the 1″, 1/2″ or 1/4″ microphone inside the wind screen, but when mounting a 1/2″ or a 1/4″ microphone and cathode follower a tightening ring and mounting tube must be used, refer to Fig. 1.9. The

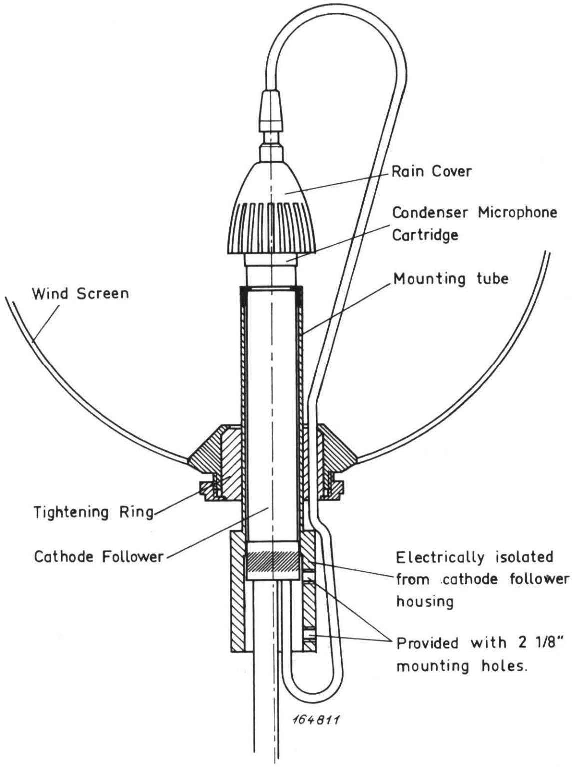


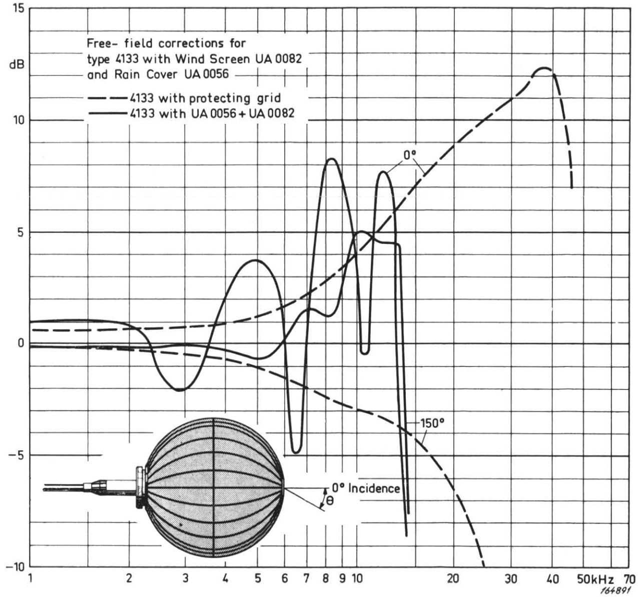
Fig. 1.9. The Wind Screen UA 0082 mounted on 1/2 cathode follower.

mounting tube is isolated from the microphone and cathode follower housing in order to avoid a disturbing ground loop, and it is rhodium plated for corrosion protection. When using the wind screen with the rain cover screwed onto the microphone cartridge, the signal lead to the electrostatic actuator inside the rain cover is fed through a slot in the tightening ring.

Shown in Fig. 1.10 is the free-field corrections for a microphone cartridge Type 4133 and cathode follower equipped with a rain cover and mounted inside the wind screen.

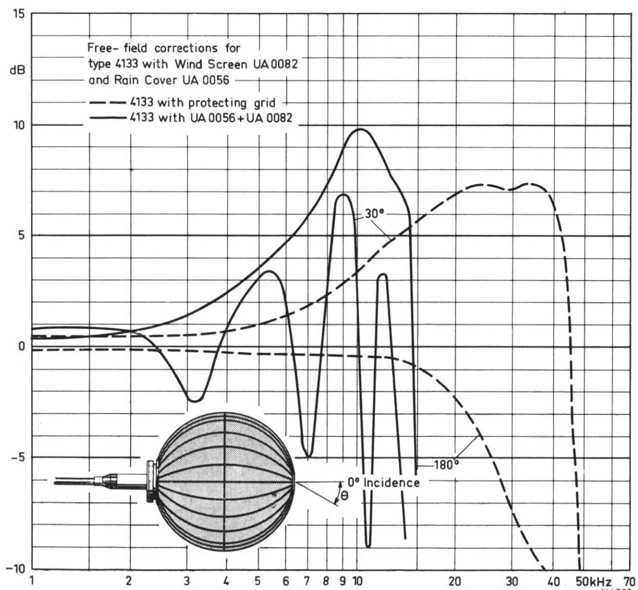
Rain Cover.

This special screen has been developed to protect the microphone diaphragm against rain and extreme weather conditions. A drawing of this Rain Cover



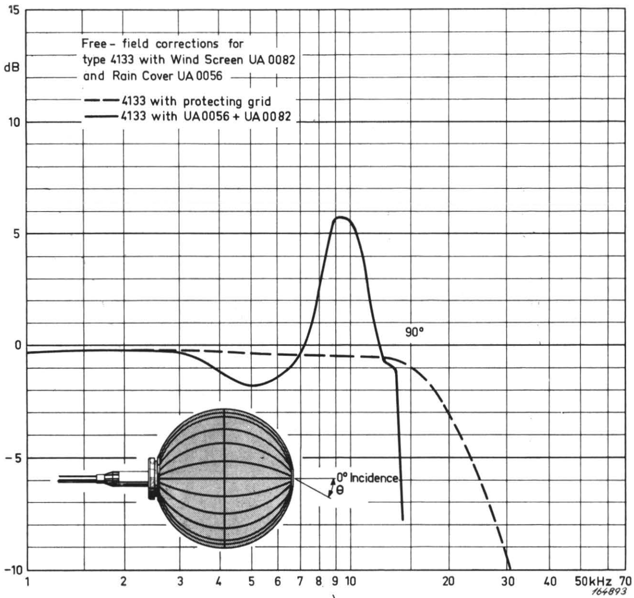
Free- field corrections for
type 4133 with Wind Screen UA 0082
and Rain Cover UA 0056
4133 with protecting grid
4133 with UA 0056 + UA 0082
dB
0°
150°
0° Incidence
θ
50kHz
164891

a)

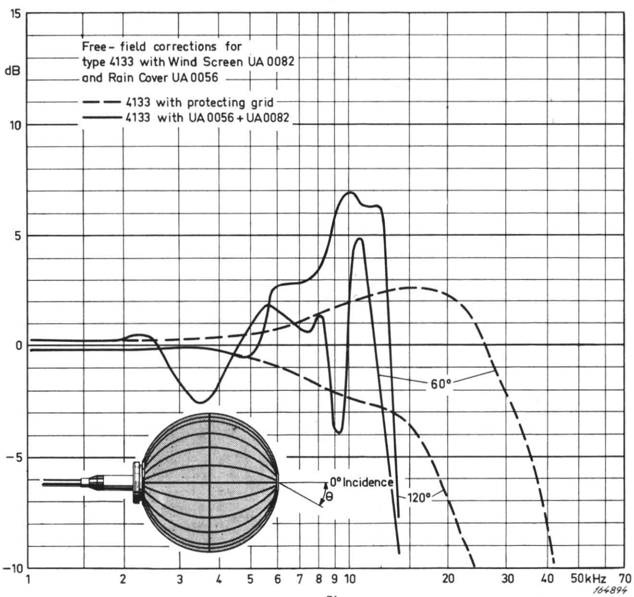


Free- field corrections for
type 4133 with Wind Screen UA 0082
and Rain Cover UA 0056
4133 with protecting grid
4133 with UA 0056 + UA 0082
dB
30°
180°
0° Incidence
θ
50kHz
164892

b)



c)



d)

Fig. 1.10. Free field corrections for microphone cartridge Type 4133 and cathode follower equipped with a rain cover and mounted inside a wind screen.

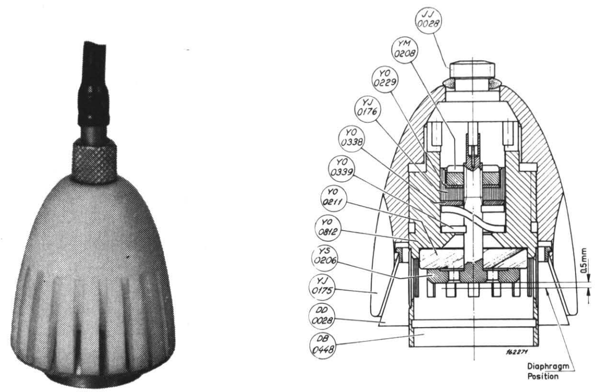


Fig. 1.11. The Rain Cover UA 0056 with cable for feeding the built-in calibrator connected on top.

is shown in Fig. 1.11. An electrostatic actuator is built into the rain cover, allowing remote controlled calibration and check of the installations to be made. This rain cover/actuator when delivered with an outdoor microphone system, is adjusted together with the particular microphone cartridge that it will be mounted on, to an equivalent SPL of 90 dB at 215 Volts. In case of replacement or repair the complete cartridge + rain cover assembly should be returned to the factory. The maximum ambient temperature for the cartridge and rain cover is 80° C *and it is only fully protected when the associated cathode follower is permanently heated.*

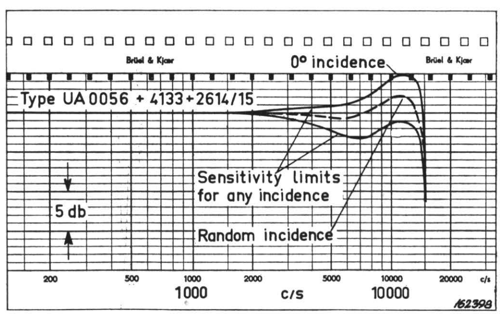


Fig. 1.12. Response of a half-inch microphone fitted with a Rain Cover UA 0056. The increase in sensitivity at high frequencies may easily be compensated for by appropriate loading of the microphone output.

2. Operation

Adjustment of the Amplifier.

The microphone system may be used in the range from approx. 60 dB to 150 dB SPL. When the Outdoor Microphone System is connected to a telephone cable the cross talk from neighbour lines may cause trouble which will determine the lower limit for the transmitted signal. The built-in amplifier will, however, enable some adjustment of the microphone output voltage level to the telephone line. At the 200 Ω output of the transformer the maximum signal handling capacity will be 3 V r.m.s. and for 50 Ω, 1.5 V r.m.s. at 200 Ω the gain is 30 dB and at 50 Ω, 24 dB therefore the gain should be adjusted so that the 3 V r.m.s. (1.5 V r.m.s.) is obtained for the highest signal level expected. This means that: For a microphone cartridge sensitivity of 1 mV/μbar the gain adjustment may be at maximum for any measurement of SPL's up to 114 dB. For SPL's above 114 dB the gain adjustment should be reduced by as many dB as the SPL. is expected to exceed 114 dB. This will ensure the best possible signal to noise ratio on the cable.

Calibration Oscillator.

The electrostatic actuator inside the rain cover is adjusted at the factory so as to obtain a SPL of 90 dB by the injection of an AC voltage of 215 V. Normally it should not be necessary to adjust this voltage from the calibration oscillator, but if it is found necessary to do so, it can be adjusted by changing the parallel resistor marked OSC. VOLT. ADJ. on the printed circuit. Furthermore it is possible to adjust the oscillator frequency by means of the iron core marked OSC. FREQ. ADJ. this frequency should be 500 Hz in order to produce a 1ooo Hz signal from the microphone.

Polarization Voltage.

The polarization voltage of 200 V for the microphone cartridge can be adjusted by means of the potentiometer marked POL. VOLT. ADJ. this voltage can be measured at the point marked MEAS.

3. Application

Airport Noise Monitoring System.

In recent years it has been obvious that the noise from aircraft taking off and landing at commercial airports in the neighbourhood of large cities has raised a tremendous problem for people living in the vicinity of the airport. Many measurements have been carried out, and the sound from different types of planes under various conditions of loading, power, rate of climb, speed, height etc. has been analyzed. The purpose of the system shown in Fig. 3.1 is to monitor the noise of every aircraft taking off or landing in directions where noise disturbance may be exptected, and in order to avoid criticism of the system and the technique, the accuracy of these measure-

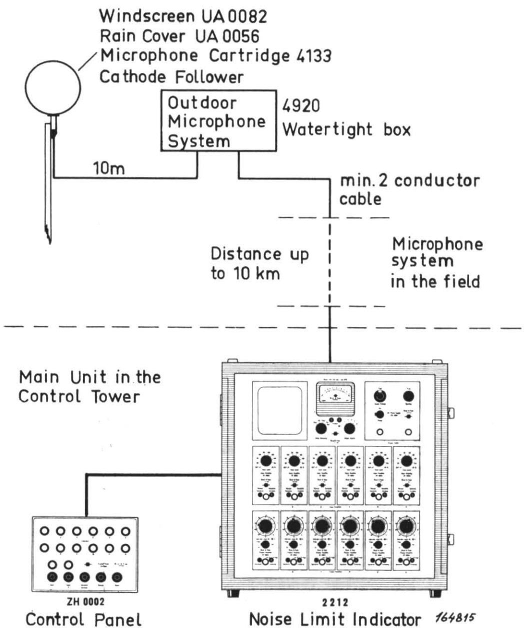


Fig. 3.1. The different parts in the complete noise limit indicator set-up.

ments must be high. Both the absolute accuracy of the system and also the long term stability are extremely important factors. For such measurements the Outdoor Microphone System Type 4920 is used as shown in the figure, connected by a normal telephone cable to the measuring unit in the airport control tower. Here all the lines from the microphone positions are fed to the Noise Limit Indicator Type 2212. Sound limit indications are given on a small control box by one or more of the red lamps lighting up if the sound limit is exceeded at any of the microphone positions. This control box also contains some pushbuttons for starting and stopping the whole measuring procedure.

Analysis of Noise Signals.

A very convenient method of measuring trafic noise vs. time over a long period for instance, would be to install the Outdoor Microphone System

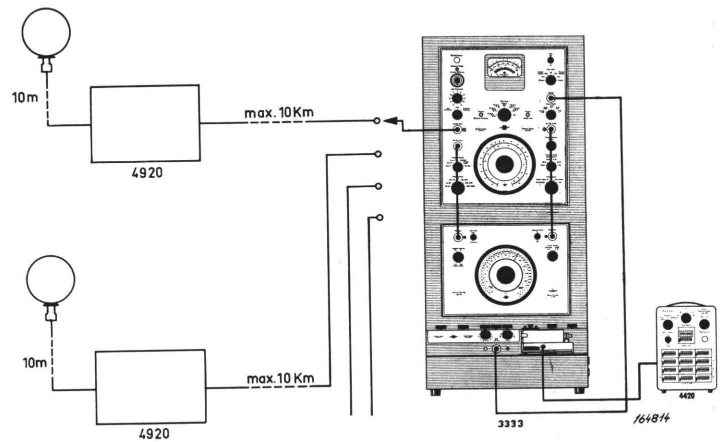


Fig. 3.2. Practical measuring set-up for field noise measurement.

Type 4920. By employing several of these systems, it is possible to take measurements at different positions covering a large area, as the signals detected by each different Microphone System can be fed back to only one set of data reduction equipment where the sound pressure level, statistical distribution of the noise or the spectrogram can be measured. Due to the fact that the transmitting cable between Microphone Systems and indicating instrument can be up to 10 km long, the indicating and analyzing equipment may be situated at any suitable place within this distance.

In the particular arrangement shown in Fig. 3.2 spectrograms of the noise signal can be recorded automatically on the frequency calibrated paper of the

Level Recorder Type 2305 either in narrow bands, or, when the Selective Section of the Frequency Analyzer Type 2107 is switched out, and the Band Pass Filter Type 1612 is switched in as external filter, in 1/1 or 1/3 octave bands. Again switching the selective section of the Frequency Analyzer out, this instrument can be used as a microphone amplifier where provided that the instrument has been calibrated correctly, the Sound Pressure Level of the noise signal can be read directly off the instruments indicating meter. The statistical distribution of the noise signal may be recorded over 24 hours if so desired. This is achieved by employing the Statistical Distribution Analyzer Type 4420 connected to the Level Recorder, and using the Frequency Analyzer as an amplifier.

Specification

Frequency Characteristics:

Electrical System:

$^{+0.2}_{-1}$ dB 20—40000 Hz	No load
$^{+0.2}_{-1}$ dB 20—18000 Hz	Nominal load

Acoustical System:

$^{+1}_{-1}$ dB 25—5000 Hz	Random incidence
$^{+3}_{-1}$ dB 5000—12500 Hz	Random incidence

Amplification: Max. 30 dB continuously variable downwards.

Noise: $< 40\ \mu V$ referred to the input terminals.

Output:

200 Ω	No load max. 3 V_{rms}
	Loaded max. 2.2 V_{rms}
50 Ω	No load max. 1.5 V_{rms}
	Loaded max. 1.1 V_{rms}

Calibration: 90 ± 1 dB from the electrostatic actuator inside the rain cover for 215 V AC from the built-in generator.

Stability: Variation is less than ± 0.2 dB for a ± 10 % variation in line voltage. Long term stability ± 0.5 dB to be expected when continuously connected. Life expectancy more than 20000 hours for electronic parts, when continuously switched on. (Based on factory tests but without obligations). For microphone cartridge in normal country atmosphere the life expectancy is the same but may be somewhat lower in very corrosive atmospheres.

Temperature and Humidity: Virtually unaffected from — 30° C to + 60° C if power is drawn continuously.

Microphone Sensitivity: 1 mV/μbar.

Dynamic Range: 60 dB—160 dB depending on amplifier potentiometer setting.

The Outdoor Microphone System can be operated from 240, 220, 150, 127, 115, or 100 V AC power line, the proper condition is selectable by a switch-fuse combination. Power consumption approx. 15 W.

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