type 2631

Microphone Carrier System

FEATURES:

- Frequency range from DC to 150 kHz
- Dynamic range 80 dB
- Selectable lower limiting frequency
- Built-in test signal
- Automatic compensation for transducer capacitance
- Automatic balancing in AC mode
- Ability to use long microphone extension cables

USES:

- Measurement of sonic booms in accordance with ISO 2249
- Measurement of very low frequency pressure variations
- General purpose carrier system for capacitive transducers

The Microphone Carrier System Type 2631 has been designed for sound measurement in the frequency range from 0 to 150 kHz. The System consists of a power supply module, a cable and a microphone head that accepts 1 inch microphones directly, or half inch microphones with an adaptor. The microphone cartridge is not included and must be ordered separately.

This System is especially useful for measuring low frequency pressure variations, such as those found in sonic booms, thunderstorms, wind tunnels and pressure chambers.

The Microphone Carrier System with Microphone Cartridge Type 4147 opens up new possibilities for very low frequency sound measurements which were not available before due to the frequency limitations of conventional preamplifiers and condenser microphones.

In sonic boom measurements, for example, a wide bandwidth is required if an accurate representation of the pulse is to be recorded. The subjective effect of the boom is strongly dependent on the sharp

rise of the pressure pulse whereas damage to buildings etc., is dependent on the pulse length.

Fig.1 shows the pressure profile of an idealized shock wave similar to a sonic boom. In order to obtain the sharp rise and fall, a good high frequency capability is required, and to follow the whole pulse shape the system must be linear down to very low frequencies. Actual sonic booms require a linear frequency response from at least 0,1 Hz to 5 kHz (preferably from 0,01 Hz to 10 kHz). This is demonstrated by Fig.2, which is the frequency spectrum of the idealized pulse. (Fourier integral).

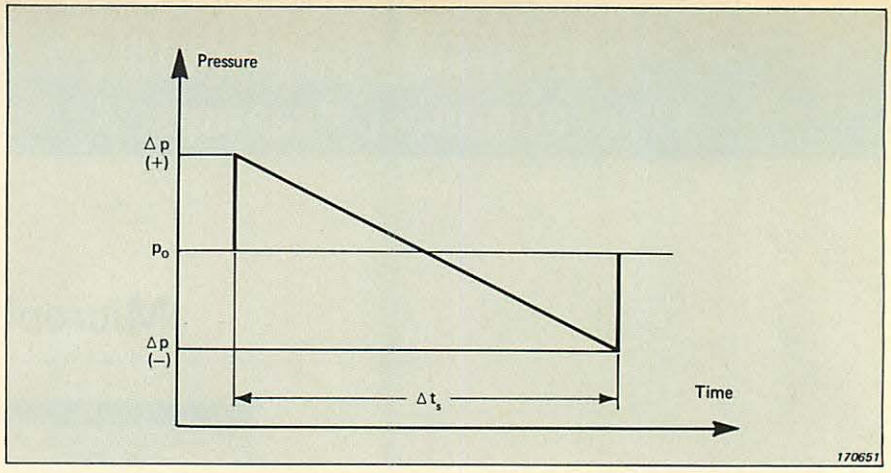

Fig.1. Idealized shock wave (sonic boom)

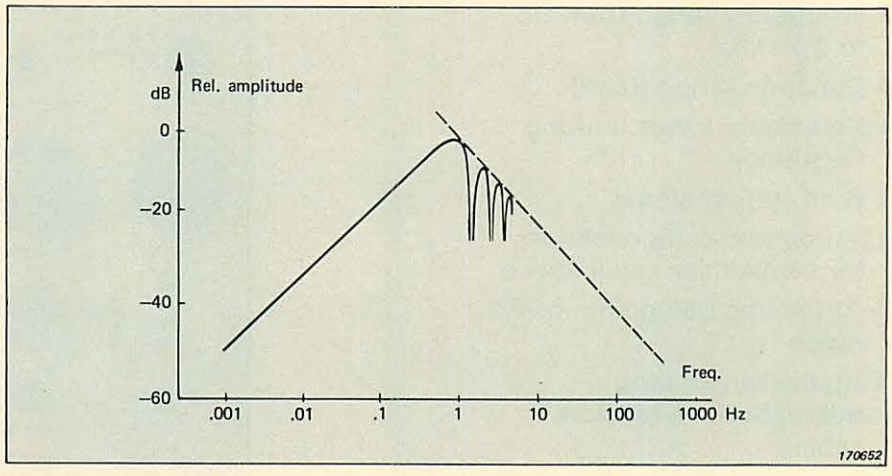

Fig.2. Frequency spectrum of shock wave (Fourier integral)

Microphones

Special condenser microphones are needed to realize the very low frequency response for sound measurement, because leakage in the microphone housing and the static pressure equalization vent normally limit the low frequency response to around 2 Hz.

Type 4147 is a half-inch microphone with a special airtight housing and a static pressure equalization vent designed to give a lower limiting frequency below 0,01 Hz. In addition to the usual calibration chart, this microphone is also delivered with an individual calibration of the low frequency response. To use the microphone with the carrier system, the Adaptor UA 0271 is necessary. This Adaptor matches the 1/2 inch microphone electrically and mechanically to the 1 inch head. It contains a coil which is connected in series with the capacitance of the microphone cartridge to obtain an equivalent capacitance within the operating range of the carrier frequency system.

The 1" Microphone Cartridges Types 4144 and 4145 can also be sealed by means of the special plastic container UA 0240 which when ordered separately is delivered with a rubber ring. In the lid of this container is a key which may be used to tighten or release the threaded collar which seals the silicone rubber ring against the back of the microphone.

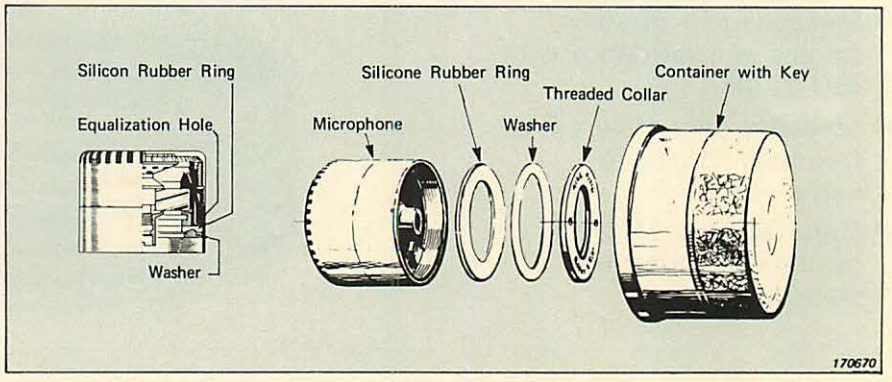

Fig.3. Method of mounting silicone rubber ring with Sealing Kit UA 0240 to a 1" microphone

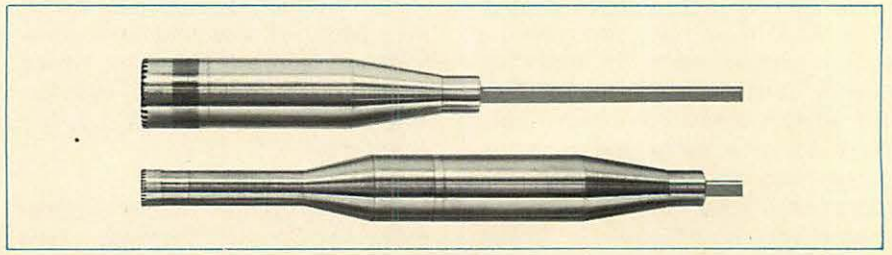

Fig.4. Mounting of 1" microphone (direct) and 1/2" microphone (with Adaptor UA 0271) to the Carrier System head

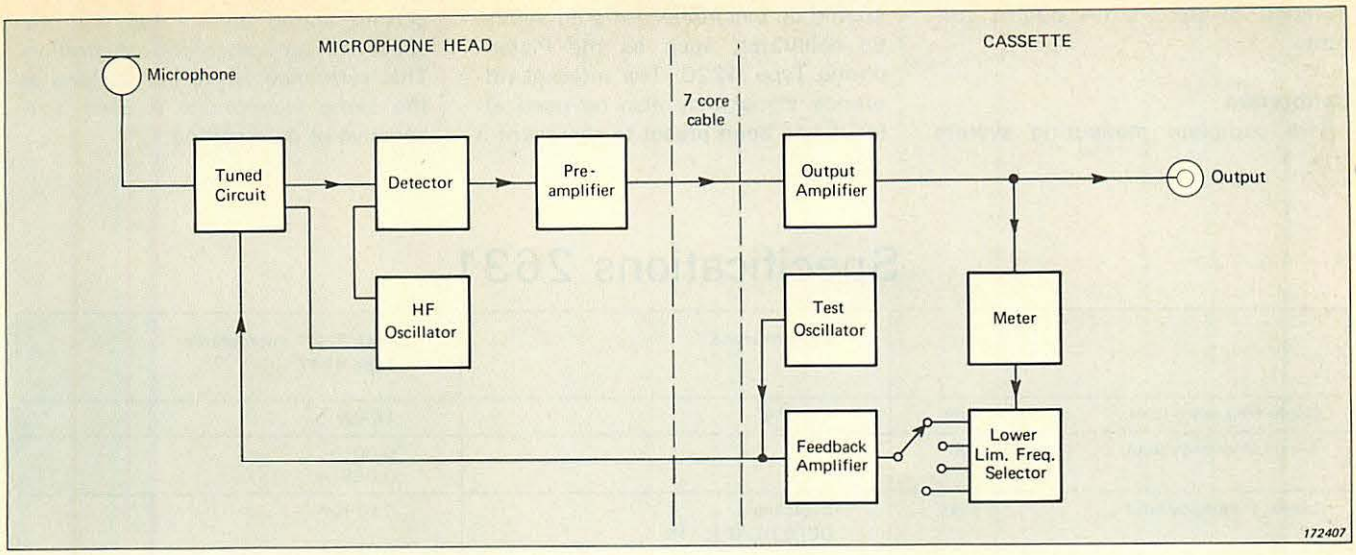

Fig.5. Block diagram

Working Principle

The condenser microphone (with adaptor for 1/2 inch type) is connected into a tuned circuit whose resonance frequency is determined by the microphone capacitance. The resonance frequency is 10 MHz and the circuit is driven by a 10 MHz crystal controlled oscillator. Small changes in microphone capacitance, caused by sound pressure on the diaphragm, will modulate the resonance frequency of the tuned circuit. This circuit is made as an FM detector which feeds the detected signal to a preamplifier. The oscillator, FM detector and preamplifier are contained in the microphone head. A two meter long cable connects this unit to a power supply module, which contains an output amplifier, peak indicating meter etc. The peak indicating meter detects the signal level and indicates overload.

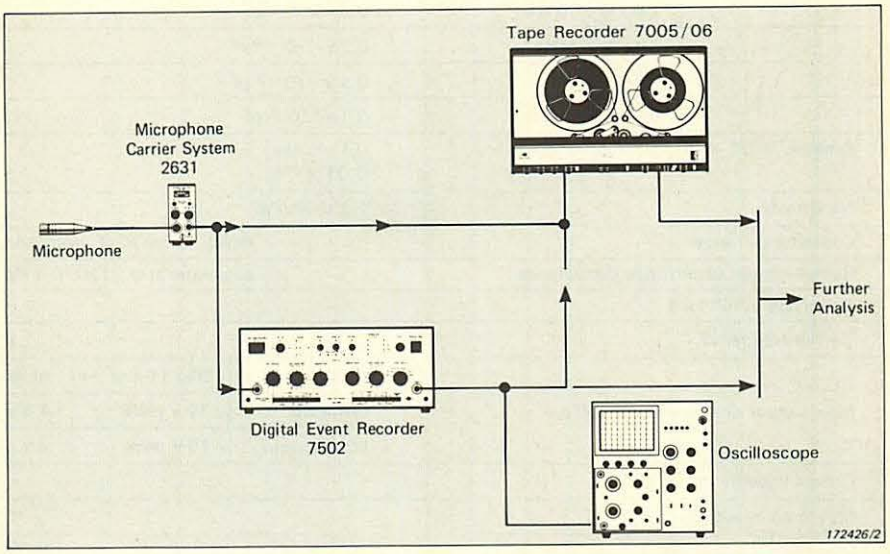

Fig.6. Some of the measuring arrangements possible with the 2631

Automatic Compensation of Transducer Capacitance

To enable microphone cartridges with different capacitances to be used, automatic compensation is incorporated. From the output, a feedback amplifier controls the voltage applied to two variable capacitance diodes in the tuned circuit. The feedback amplifier is a "Miller Integrator" whose time constant determines the lower limiting frequency. This feedback also produces an automatic AC balance. Balance in the DC mode is obtained manually with the aid of the monitoring meter. Four lower limiting frequencies can be selected: DC; 0,01; 0,1; and 1 Hz.

Test Signal

A 1 kHz oscillator can feed a reference signal into the tuned circuit to test the measuring system.

Recording and Analysis

The output of the Microphone Carrier System can be connected to any recording or display instrument with an appropriate frequency range and an input impedance greater than 1,2 kΩ.

Fig.6 illustrates some of the display and recording arrangements possible. The output from the Carrier System can be displayed directly on an Oscilloscope, or it can be recorded for later analysis. The FM Tape Recorder Type 7005/06 can be used to store information and will allow frequency transformation techniques to be employed. An even more flexible arrangement is obtained when the output from the Microphone Carrier System is captured by the Digital Event Recorder Type 7502. The diagram also shows an arrangement where a succession of signals can be captured by a 7502, and transferred to a tape recorder to leave the 7502 memory free for subsequent signals.

Cables of considerable length may be used between the microphone and power supply, and between the power supply and the recording instrument subject to the li-

mitation of the 10 mA output current.

Calibration

The complete measuring system should be calibrated using an acoustic calibrator, such as the Pistonphone Type 4220. The internal reference signal may also be used after it has been preset to represent a certain sound level value with respect to an absolute calibration. This reference is correct as long as the same microphone is used, irrespective of gain setting.

Specifications 2631

		System alone	With 1/2" microphone Type 4147
Upper frequency limit	—2 dB	100 kHz	18 kHz
Lower frequency limit	—2 dB		0,001 to 0,005 Hz*
Lower frequency limit	—1 dB	Switchable DC; 0,01; 0,1; 1 Hz	0,01 Hz*
Linear range		± 6 pF	3% dist. 150 dB 10% dist. 162 dB
Noise	0,01 Hz to 200 kHz	6×10^{-3} pF	2 Pa Peak
	2 Hz to 200 kHz	$0,3 \times 10^{-3}$ pF	74 dB RMS
	2 Hz to 20 kHz	$0,25 \times 10^{-3}$ pF	72 dB RMS
	Curve C	$0,15 \times 10^{-3}$ pF	68 dB RMS
	Curve A	$0,1 \times 10^{-3}$ pF	64 dB RMS
Stability in DC mode (50 pF Source cap.)		0,1 pF/day 0,03 pF/°C	30 Pa/day 9 Pa/°C
Sensitivity		1,2 to 6 V/pF	3,7 to 18 mV/Pa
Capacitance range		direct: 40 to 70 pF; with Adaptor UA 0271: 17 to 21 pF	
Compensation of cartridge capacitance		automatic at 0,01 Hz; 0,1 Hz and 1 Hz manual at DC	
Distortion at full load		< 4%	
Carrier frequency		10 MHz	

Max. output of adaptor or amplifier	frequency	0 to 15 kHz	at 40 kHz	at 100 kHz	at 200 kHz
	unloaded	12 V peak	4,5 V peak	2 V peak	0,5 V peak
	10 mA drain	10 V peak	4 V peak	2 V peak	0,5 V peak

Output impedance	< 10 Ω
Min. load impedance	1,2 kΩ
Operation temperature	—20°C to + 60°C
Storage temperature	—30°C to + 80°C
Meter display	max. peak, DC or DC balance
Power supply	100 to 240 V AC, 50 to 400 Hz
Power consumption	approximately 20 mA RMS
Output connectors	B & K 14 mm socket and 10 — 32 NF microsocket
Built-in test oscillator	1 kHz

* individually calibrated

Dimensions and Weights:
Power Supply Module:
Height: 132,6 mm (5,22 in)
Width: 61 mm (2,40 in)
Depth: 200 mm (7,87 in)
Weight: 1,65 kg (3,63 lb)

Microphone Head:
Diameter: 23,8 mm (0,94 in)
Length: 76 mm (3 in)
Cable length: 2 m (6,5 ft)
Weight: 0,31 kg (0,68 lb)

Accessories included:
Microphone Head with cable ZB 0011
Power Cord
Spare lamps and fuses
Adaptor UA 0271

Accessories necessary:
1" Condenser Microphone Type 4144 or Type 4145 with Sealing Kit UA 0240 or 1/2" Condenser Microphone Type 4147

Accessories available:
Microphone Extension Cables:
3 m, AO 0027
10 m, AO 0028
30 m, AO 0029