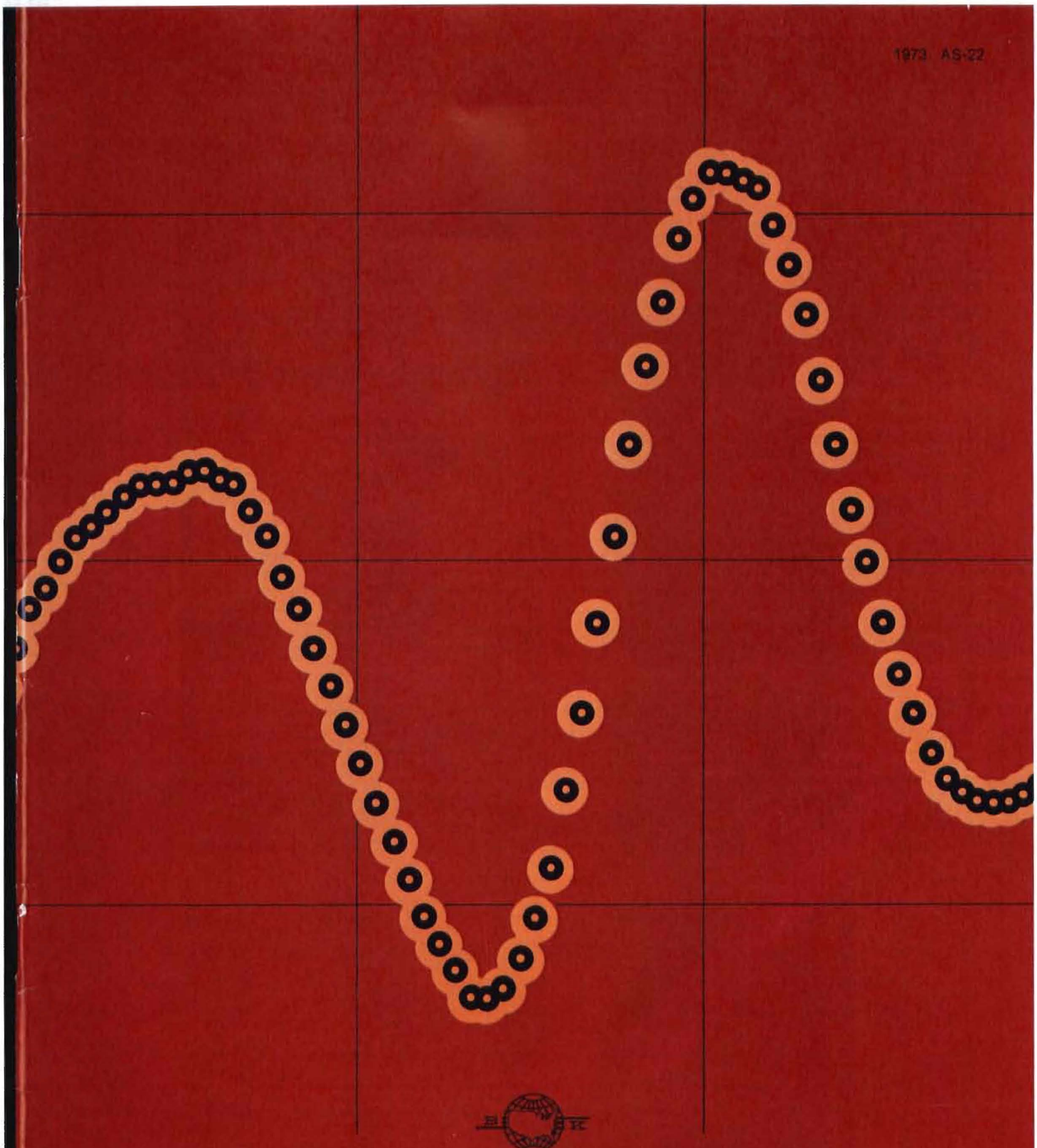
1973 AS-22



SHORT FORM CATALOG

Sound, Vibration and Data Analysis Instrumentation

B&K INSTRUMENTS, INC.
Brüel & Kjaer Precision Instruments

Headquarters of B & K Instruments, Inc. Cleveland, Ohio

Subject Index

Numerical Index

All electronic instruments may be switched to a line voltage of 100, 115, 127, 150, 220 or 240 Volts at 50 to 400 Hz unless otherwise specified.
Note: Due to our continuing program of product improvement all specifications are subject to change without notice.

January 1973

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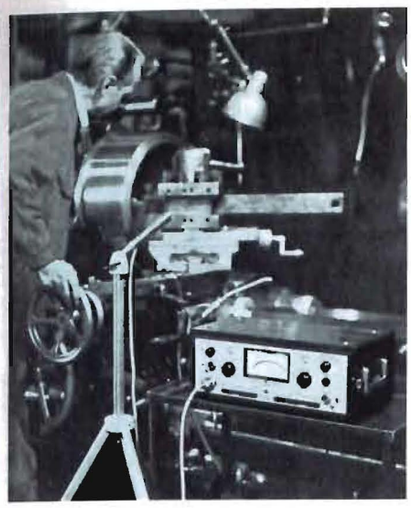
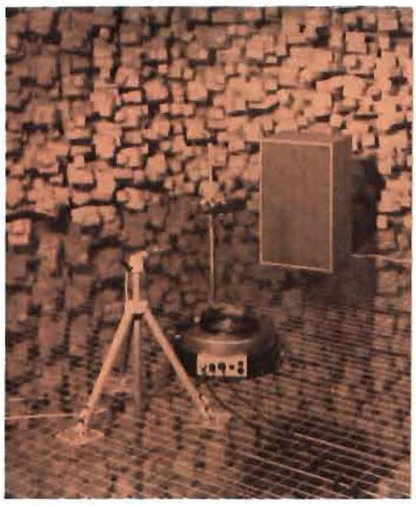




B & K Instruments, Inc.

B & K INSTRUMENTS, INC., Cleveland, ...zes in the marketing and ... of Brüel & Kjær ...in for the measurement ...f AF signals, particularly ... vibration. These ...s encompass the range ...00000 Hz. The scope of ...lents is constantly being ...equently at the very edge ...f-the-art, since Brüel & ...ays been in the vanguard ...n its field. With the full instrument line and the host of accessories available, completely integrated systems are provided from a single source.

The individual Brüel & Kjær instruments are unique and unmatched for accurate, professional measurements. This catalog presents, briefly, these individual instruments. For complete data, just ask your B & K representative. All field offices are listed in the inside back cover.

A complete staff is maintained at Cleveland to assist customers in integrating the B & K instruments into reliable systems, or to design and manufacture custom systems around them to solve specific measurement, control, or analysis problems. Most B & K instruments are available on sale or rental/purchase. Factory-trained field representatives are located in major cities. B & K Applications Engineers — located in New Jersey, Detroit, Chicago, Cleveland, and Los Angeles — stand ready to help with application information, and demonstrations.

Warranty

Each instrument sold by B & K Instruments is warrented to be free from defects in material and workmanship, and to operate in accordance with published specifications when used with the recommended B & K associated equipment and with B & K chart paper. Liability under this warranty is limited to servicing or adjusting any instrument returned, transportation charges prepaid for that purpose, and to replacing any defective parts (except batteries).

This warranty is effective for one year from date of shipment to the original purchaser — except for computers and peripherals, which are warranted for 90 days. If defective operation has been caused by misuse or abnormal condition of operations, repairs will be billed at our current rate, in which case an estimate will be furnished prior to starting of repair work.

Transportation charges to Cleveland on returned instruments must be prepaid by the customer. Return surface transportation charges will be prepaid by B & K.

New in this Catalogue

Accelerometers


1:2

Types 4339, 4343, 8301 and 8302. General purpose Uni-Gain® accelerometers equal in pairs with normalized voltage or charge sensitivity. Give very simple calibration procedure when used with fixed gain charge or voltage preamplifiers. Low all-round environmental sensitivity.

Types 4332, 4333, 4334 and 4335. General purpose accelerometers for non-critical applications. Equal in pairs with top or side mounting of cable. Top mounting of cable gives possibility for water cooling of the base while side mounting makes whip free cable mounting easy.

Types 4344, 8303 and 8307. Miniature accelerometers for high level and high frequency measurements. Ideal for delicate structures and confined spaces.

Type 4338. A high sensitivity Uni-Gain® accelerometer with low environmental sensitivity. Normalized charge sensitivity for use with fixed gain charge amplifiers.

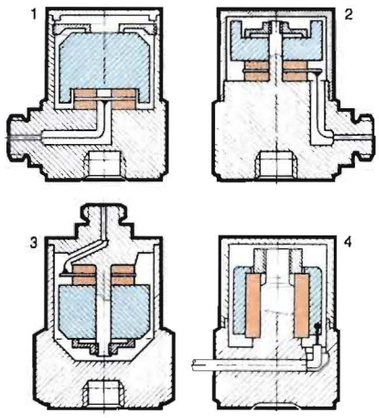
Type 4340. A triaxial accelerometer with three independent outputs of similar sensitivity. For measurement of vibration in three mutually perpendicular directions.


1:2

Type 4345. An accelerometer for measurement at temperatures up to 400°C. Very flat temperature response.

Type 8304. A high stability quartz accelerometer with low sensitivity to temperature transients and very flat temperature response.

Type 8309. 100000 g Shock Accelerometer is particularly applicable in the measurement and analysis of high level shocks such as those resulting from explosions and pneumatic impact tools. Very rugged construction. Integral cable.




1:2

Type 8306. Low g accelerometer for low frequency, low level (down to 0.000002 g) applications. Very high Uni-Gain® voltage and charge outputs. Built-in preamp. and LP filter. Requires 2 mA at 28 V.


1:2

Type 8305. Standard accelerometer for back-to-back calibration purposes using quartz as sensitive element. It has a low sitivity to temperature transients and exhibits very high stability over time. Absolute calibration of the accelerometer is performed by the laser interference method.

Type No.	4339●	4343●	8301●	8302●	4332	4333	4334	4335	4338●
Voltage sensitivity (mV/g*)	10 ± 0.2	~ 10	10 ± 0.2	~ 10	~ 60	~ 20	~ 60	~ 20	~ 100
Charge sensitivity (pC/g*)	~ 10	10 ± 0.2	~ 10	10 ± 0.2	~ 60	~ 20	~ 60	~ 20	100 ± 2
Frequency range 5 °/₀ (Hz)^	1 to 8000	1 to 8000	1 to 5000	1 to 5000	1 to 5000	1 to 7000	1 to 5000	1 to 7000	1 to 2500
Mounted Resonance (kHz)	40	40	25	25	25	35	25	35	12
Weight (grammes)	16	16	21	21	30	13	30	13	60
Base Material	St. Steel	St. Steel	St. Steel	St. Steel	St. Steel	Titanium	St. Steel	Titanium	St. Steel
Configuration (Compression type)	center mounted		inverted center mounted		peripheral mounted				inverted center mounted

● Uni-Gain® types
* 1 g = 980.7 cm/sec²
^ Lower limiting frequency determined by preamplifier used and environmental conditions.

Force Transducers – Impedance Heads

These accelerometers are electromechanical transducers which produce an electrical output proportional to the acceleration to which they are subjected. A very extensive calibration and temperature stabilizing procedure has been undertaken to ensure completely predictable performance and stable operation. Each accelerometer is delivered with an individual calibration chart. Typical calibrations given are:

Voltage and/or charge sensitivity
Capacitance
Full frequency response curve
Resonant frequency
Maximum transverse sensitivity
Variation of sensitivity and capacitance with temperature

Four different constructions are used: 1) the peripheral mounted compression type, 2) the center mounted compression type, 3) the inverted center mounted compression type and 4) the shear type. The peripheral mounted compression type gives the mechanically strongest construction while the center mounted and inverted center mounted types have a very low sensitivity to unwanted environmental effects such as acoustic noise, temperature transients, base strain, etc. The shear type has low environmental sensitivity and can be miniaturized. The Uni-Gain® types, a B & K first, offer very simple calibration of the measuring set-up. All types can be used up to 260°C without cooling with the exception of Types 8306 (85°C) and 8307 (200°C).

For measurements up to 1000°C water cooling can be used on the types with top mounted connector (except Type 8303). Alternatively, High Temperature Accelerometer Type 4345 can be used up to 400°C without cooling.

The vibration transducers are all of a waterproof, sealed construction, Types 4339, 4343, 4345, 8200, 8304, 8305 and 8309 being all welded, and will withstand operation under severe environmental conditions.

Ordering Information. The accelerometers and the force transducers can be delivered either in **sets** or in **packages.** To indicate which delivery form is desired an **S** or a **P** should be added to the type number when ordering.

S indicates that the transducer is delivered in a box with various accessories such as: cable, magnetic clamp, screws, Adaptor plug JP 0028, cementing stud, probes, wax and tap for fastening etc.

P indicates that the transducer is delivered as a package containing 5 transducers with cables and fixing studs.

NOTE: The Triaxial Accelerometer Type 4340, the Standard Accelerometer Type 8305, the Low g Accelerometer Type 8306, and the Impedance Heads Type 8000 and 8001 are only available as sets.

Preamplifier Types. The accelerometers, impedance heads and the force transducers should be used with a preamplifier, as described on the next pages, in order to match the high impedance of the transducer with the input impedance of the measuring instrumentation and to obtain a satisfactorily low lower limiting frequency. Two types of preamplifiers are available, voltage amplifiers and charge amplifiers. Transducers with fixed charge sensitivity should be used with charge amplifiers, and transducers with fixed voltage sensitivity should be used with voltage amplifiers. Charge amplifiers are recommended if long cables are required between transducer and instruments. The quartz and the high temperature accelerometers and the force transducers should always be used with a charge amplifier due to their low capacitances. Measurement of vibration velocity and displacement is possible with preamplifiers containing integration networks.

1:2

Type 8200 and 8201 Force Transducers. For measurement of tensile and compressive forces. Use quartz as force sensitive element and have extremely good linearity and long term stability, with low influence from temperature changes. All welded construction. Type 8201 can be used either without preloading to mesure compressive forces, or with preloading nuts to measure both compressive and tensile forces. Supplied with comprehensive calibration certificate.

Type No.	8200	8201
Max. Tensile	1000 N	4000 N
Max. Compr.	5000 N	20,000 N
Charge Sens.	4 pC/N	4 pC/N
Resonant Freq. (5 g load)	35 kHz	20 kHz
Material	Stainless Steel	
Height	13 mm	36.8 mm

1:2

Type 8000 and 8001 Impedance Heads contain an accelerometer and force transducer and are used for measurement of mechanical impedance. The force transducer is located close to the driving point and the driving platform is made of beryllium. This gives a high stiffness and low mass below the force transducer. The Type 8000 has a driving platform area of 1.75 cm² in accordance with BS 4009: 1966 and ISO R 512 for calibration of artificial mastoids and is also well suited for measurements on soft samples. The Type 8001 has a smaller surface of the driving platform for point impedance measurements. Typical accelerometer sensitivity 25 mV/g; force sensitivity 300 mV/N; and frequency range (± 2%) 0.1△ to 7,000 Hz; weight 28 g; material, titanium.

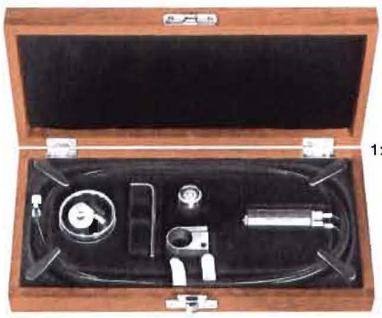
Type No.	4344	8303	8307	4340	4345	8304	8305	8306●	8309
Voltage sensitivity (mV/g*)	~ 2.5	~ 2.5	~ 1.2	~ 20	~ 5	–	–	10000 ± 200	~ 0.25
Charge sensitivity (pC/g*)	~ 2.5	~ 2.5	~ 0.4	~ 20	~ 5	~ 1.2	~ 1.2	10000 ± 200	~ 0.035
Frequency range 5 % (Hz)△	1 to 14000	1 to 9000	1 to 25000	1 to 5000	1 to 6000	0 to 6000	0 to 6000	0.3 to 900	1 to 36000
Mounted Resonance (kHz)	70	45	75	23	30	30	30	2.5	180
Weight (grammes)	2	3.5	0.4 excl. cable	35	27	30	40	600	3 excl. cable
Base Material	Titanium	Titanium	Beryllium	Titanium	St. Steel	St. Steel	St. Steel	St. Steel	St. Steel
Configuration (Compression type)	center mounted	inverted center mounted	shear type	peripheral mounted	center mounted		inverted center mounted	center mounted + preamp.	Center mounted

● Uni-Gain® types
* 1 g = 980.7 cm/sec²
△ Lower limiting frequency determined by preamplifier used and environmental conditions.

Accelerometer Preamplifiers

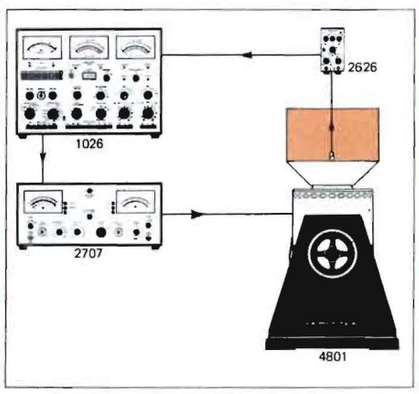
1:4

Type 2616 Accelerometer Preamplifier is a low noise voltage amplifier with variable attenuation and overload indicator. Input impedance 1200 MΩ. Output impedance <100 Ω. Frequency range: 0.13 Hz to 500 kHz. Operated from 6 internal batteries or external 6 to 35 Volts.



1:4

Type 2623 Accelerometer Preamplifier is a very small voltage amplifier with 2000 MΩ input impedance; 40 Ω output impedance, and very low noise level. Excellent response to transients. It withstands severe environmental conditions. Frequency range: 0.16 Hz to 500 kHz. Dimensions: 45 mm x 14 mm diameter. Operated from external 28 Volt.



2651 2625

1:4

Type 2651 Charge Amplifier. A general purpose charge amplifier with three sensitivity settings, 0.1, 1.0, and 10 mV/pC for use with B & K Uni-Gain® accelerometers. Wide frequency range 0.003 Hz to 200 kHz with switchable lower limiting frequency. Input switchable, either grounded or floating to avoid ground loop problems. Integrator for velocity measurements between 10 Hz and 20 kHz. Powered from single polarity + 12 V to + 35 V DC supply or dual ± 6 V to ± 18 V DC supply for negligible DC signal offset at output. Overload indicator. Multipin connector on rear panel carries all facilities.

Type 2625 Vibration Pick-Up Preamplifier. Solid state low noise preamplifier. Three selectable inputs with individual sensitivity adjustment. Variable gain from —40 to —20 dB and 0 to + 20 dB. Fixed gain 0 dB and —40 dB. Integration networks for measurement of velocity and displacement. Selectable lower limiting frequencies. Operated from internal batteries or external 28 Volts.

1:4

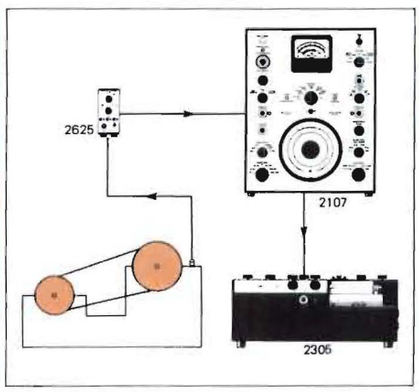
Type 2626 Conditioning Amplifier is a low noise charge amplifier with 60 dB amplification. A three digit sensitivity adjustment calibrated in pC/g and an output voltage adjustment allows calibrated output voltages to be chosen between 1 mV/g and 10 V/g for different transducer sensitivities. Adjustable high-pass and low-pass filters. Selectable lower limiting frequencies. Overload indicator. Output directly coupled or floating via transformer.

1:4

Type 2628 Low Frequency Charge Amplifier is capable of handling signals down to 10^{-5} Hz. Three digit sensitivity adjustment for programming of accelerometer sensitivity together with selectable gain gives output in decades from 100 μV/g to 10 Volt/g. Stepwise adjustable LP filter. Selectable lower limiting frequency.

1:4

Type 4292 Accelerometer Calibrator and Amplifier contains a voltage amplifier with gain adjustable from 0 to 20 dB and integration networks for measurement of velocity and displacement. A small built-in shaker table and 79.6 Hz oscillator allow accelerometer calibration by the chatter ball method. The instrument is powered from 7 pin input sockets on B & K measuring amplifiers and analyzers.




1:4

Type 2510 Vibration Meter conforms with DIN .45666, BS 4675: 1971, and the ISO Draft Recommendations 2372 and 2373. Measures RMS value of vibration velocity with 100pC/g accelerometer. Charge amplifier in input circuitry allows long connection cables between accelerometer and instrument. Full deflection 0.3 mm/sec to 30mm/sec. Frequency range 10 to 1000 Hz. Overload indicator. Low impedance output < 100 Ω. Outputs for external filter connection. Accelerometer included. May be powered from 100 to 240 V line or 3 internal rechargeable batteries (to be ordered separately, B & K order No. QB 0008.) Charging unit built-in. Can also be powered by three batteries type IEC R 20 (Standard D cells).


1:4

Type 2970 Sensitivity Comparator aids rapid back-to-back comparison calibration of accelerometers in conjunction with the Calibration Set Type 3506, the Calibration Head Type 4815, and the Calibration Preamplifier Type 2650.

Type 3506 Calibration Set consists of a Standard Accelerometer Type 8305 and a Conditioning Amplifier Type 2626 which have been calibrated together to eliminate cumulative errors. When used with a Sensitivity Comparator Type 2970 the comparative sensitivity of an unknown accelerometer can be determined within 0.2%.


1:8

Type 4290 Calibration Exciter is a small shaker which is driven from an external generator. It has a built-in control accelerometer and is used in the plotting of accelerometer frequency response curves. Attainable force level 2 Newton (0.45 lbf) RMS. Mass of moving element 180 grammes (0.4 lb). Frequency range 50 Hz to 30 kHz.


1:4

Type 2650 Transducer Calibration Amplifier for use in comparison calibration set-ups. Indicates transducer charge or voltage sensitivity to 4 digits. Integral test oscillator. Switchable high and low pass filters.


1:4

Type 2805 Power Supply gives ± 14 V or 28 V DC. Has 12 outputs in 2 channels. Output current 200 mA each channel. Stability better than 0.05% for ± 10% variation in line voltage. Noise and ripple <200 μV at full load. Output impedance <0.2 Ω.


1:4

Type 4291 Accelerometer Calibrator for calibration of accelerometers and other types of vibration transducers. Built-in 79.6 Hz ($\omega = 500$) oscillator drives shaker table; adjustable to 1 g, read off a built-in meter. Provision for back-to-back calibration, insert voltage calibration, and reciprocity calibration of accelerometers. May be driven from internal batteries or external 28 V DC power supply.


1:2

UA 0322 Insert Voltage Adaptor for calibration of accelerometers according to the insert voltage method. Delivered as standard accessory with Type 8305 S.

UA 0125 Accelerometer Accessories contains 10 isolated and 10 non-isolated studs, washers and nuts, screw tap and wrench for the mounting of accelerometers.

UA 0129 Plugs and Tool. This set contains 20 miniature plugs JP 0012 for accelerometer cable and tools for mounting the plugs.

UA 0130 Plugs. This set contains 25 plugs JP 0012 for accelerometer cables.

UA 0142, set of 5 magnetic clamps.

UA 0186, set of 25 extension connectors JJ 0032 for accelerometer miniature plugs.


1:6

ZR 0024 Stabilized Power Supply supplies 28 V DC for preamplifiers Type 2623 and 2625 from B & K Measuring Amps. and Frequency Analyzers. Max. current: 2 mA.

Control Generators for Vibration Exciters

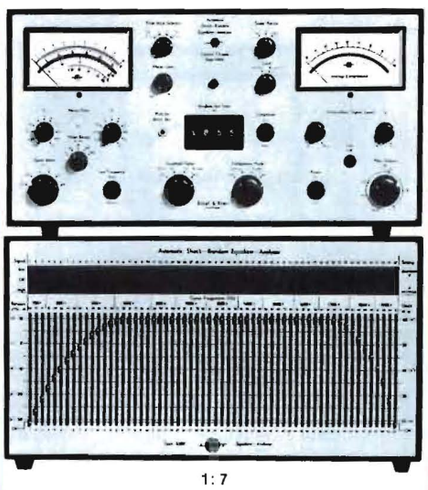
1:7

Type 1047 Exciter Control gives sinusoidal sweep control of electrodynamic vibration exciter systems. All solid state. Logarithmic and linear electronic sweep in the frequency range 5 Hz to 10 kHz. Frequency counter with Nixie read-out in five digits, 0.1 Hz or 1 Hz resolution. Automatic scanning of any predetermined part of the frequency range. Indicator lamps for sweep direction. LIN and LOG DC oc frequency outputs. Two built-in vibration meter channels with common input and meter; average detection. Automatic output regulator maintains constant acceleration, velocity or displacement when controlled by an accelerometer. Adjustable regulation speed increases continously with oscillator frequency until selectable limit, then remains constant. Dynamic range 80 dB, 0 dB static regulation error. Built-in compressor meter. Manual choice of one of the two channels. Automatic cross-over at preset frequency for performing D-A or V-A tests, for example. Additional cross-overs can be obtained by adding one or more Vibration Programmers ZH 0100 (eg. D-A-D-A tests require two ZH 0100's). Presetting of desired vibration level without vibrating the specimen. Interlock in all relevant controls. A, B or C model.

1:7

ZH 0100 Vibration programmer connects to the Exciter Control Type 1047 to provide an extra cross-over. Any number of ZH 0100's can be connected giving one cross-over each in addition to the one built into Type 1047. Stepped acceleration, velocity and displacement tests can be made as well as standard D-A-D-A tests, etc.

Type 2626 Conditioning Amplifier is a one channel charge amplifier well suited as accelerometer preamplifier in vibration test set-ups. See page 4 for photograph and description.



1:7

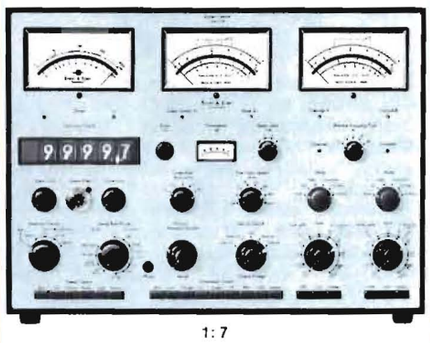
Type 3380 Automatic Shock-Random Equalizer-Analyzer contains signal sources and equalizer/analyzer filters for automatic equalization of acceleration spectral density for random vibration testing, and acceleration shock spectrum for shock testing with electrodynamic vibration exciters. Freauency range 20 Hz to 2 kHz with 120 filters having bandwidths from 5 to 25 Hz.

The system consists of a **Control Unit** and two **Filter Units**. The **Control Unit** contains a sawtooth generator, a random noise generator, all control switches and meters for reading average compression of all AGC circuits in the filter units, and for reading actual acceleration level of the vibration exciter. Reference voltages provide automatic calibration for both types of signal and a hold circuit allows the equalization to be held fixed at any time. Equalization in both modes can be made at a reduced level and provision is made for by-passing the power amplifier/shaker/accelerometer for self-checking and calibration. Inputs are provided for external sources. Each **Filter Unit** contains 60 channels and a summing amplifier. Each channel consists of an equalizer filter, an AGC circuit, an analyzer filter, a level setting attenuator, detector amplifier, integrator, and a lamp circuit. The setting of the attenuators at the same time gives a display on the front panel of the total response. A three lamp display for each channel indicates if the AGC works within range (>60 dB), under range or over range. A or C model.

Type 3379 Automatic Shock-Random Equalizer-Analyzer is similar to Type 3380 but contains only one filter unit with 60 filters with bandwidths from 10 to 50 Hz covering 20 Hz to 2 kHz.

Type 3378 Automatic Shock-Random Equalizer-Analyzer is similar to Type 3379 but contains filters covering the frequency range 1 Hz to 587 Hz having bandwidths from 1 Hz to 22 Hz.

NB. The Types 3380, 3379 and 3378 are all prepared to accept a maximum of 4 filter units (240 filters). On special order systems can be delivered covering a maximum frequency range of 1 Hz to 10 kHz with a wide variety of bandwidth combinations.



1:7

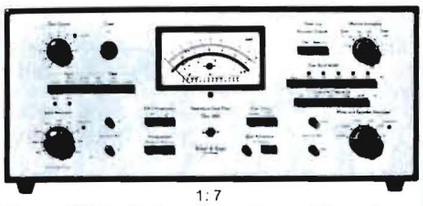
Type 1026 Exciter Control. For the most advanced sweep control of electrodynamic vibration exciter systems. All solid state. Logarithmic and linear electronic sweep of sinusoidal signal or narrow band random noise in the range 1 Hz to 10 kHz. Frequency counter with nixie read-out in six digits. Analogue logarithmic frequency meter. Automatic scanning of any predetermined part of the frequency range. Indicator lamps for sweep direction. Frequency output in transformed BCD-code. LIN and LOG DC oc Frequency outputs. Two built-in vibration meters with independent rectifier; choice of true RMS or average for each channel. Two built-in slave filters, 6% constant percentage bandwidth in sinusoidal mode, in random mode constant bandwidth following the bandwidth of the noise.

Automatic output regulator maintains constant acceleration, velocity, displacement or acceleration gradient. Regulation speed increases continuously with oscillator frequency until selectable limit, then remains constant. Dynamic range 80 dB. Built-in compressor meter. Manual choice of one of the two channels. Automatic selection of larger channel with thumpfree crossover. External control possible. Presetting of desired vibration level without vibrating the specimen. Constant level output for synchronization with auxiliary instrumentation.

Extensive safety features. Interlock in all relevant controls. Adjustable safety limits with reference to preset working level. Exceeding any limit results in output voltage shut-down. A large number of sockets are provided for monitoring and controlling internal functions. This facilitates combination with other equipment. A or C model.

Type 5660 Vibration Programmer. Programs the Exciter Control Type 1026 to provide stepped acceleration, velocity, displacement or acceleration gradient tests as well as standard D-A-D-A tests, etc. This is a System Development instrument, see page 34 for photograph and description.

Slave Filter – Motion Analyzer – Mini Shakers – Power Amplifier Magnetic- and Capacitive Transducers Complex Modulus Apparatus



1:7

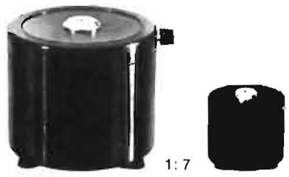
Type 2021 Heterodyne Slave Filter is a variable, narrow band filter for use in vibration analysis and vibration test set-ups. It is tuned automatically from the B & K Exciter Controls Types 1026, 1047 and most previous types, or from the B & K Tracking Frequency Multiplier Type 1901 which locks onto and tracks any submultiple or multiple of the fundamental of a periodic signal between 0.1X and 99.9X in 0.1 steps.
Frequency range 5 Hz to 10 kHz, constant bandwidths of 3.16, 10, 31.6, 100 and 316 Hz can be manually or remotely selected. Dynamic range >75 dB. $1/\sqrt{B}$ bandwidth compensation for PSD and cross power spectrum density measurements. Phase agreement between two filters better than 1°, 90° phase shift available. Built-in measuring amplifier. Unity gain outputs. AC and DC recorder outputs. Rejection output allowing distortion measurements down to 0.2%. Effective averaging times from 0.3 to 100 s. Effective averaging error <3, 10 or 30%. A, B or C model.

1:6

Type 3930 Complex Modulus Apparatus is designed for dynamic measurement of the complex modulus of elasticity (Young's modulus + internal damping factor) of solid materials and coating deadeners. Clamps sample bars and uses two transducers, either magnetic or capacitive. 2 magnetic transducers MM 0002 and one capacitive transducer MM 0004 are included. A frequency response curve and vibration build-up and decay curves of the sample bar can be automatically recorded on the Level Recorder Type 2305 or 2307.

1:7

Type 2706 Power Amplifier is a direct coupled solid state unit for driving the Vibration Exciter Type 4809. Switchable to drive the Mini-shaker Type 4810 safely to full rating. Current limitation 5 A and 1.8 A. Built-in attenuator and continuously variable gain control. Maximum voltage gain is 40 dB. Can be used for general purpose power amplification. Maximum power output is 75 VA.



1:7

4809 4810

Type 4809 and Type 4810 Mini-shakers are small permanent magnet vibration exciters with wide frequency range and low cross motion. They may be used for transducer calibration, laboratory experiments, educational demonstrations, and as the motive force source in mechanical impedance measurements.

Type		4809	4810
Frequency Range	Hz	10 to 20,000	20 to 18,000
Force, sine peak	Newton (lbf)	44.5 (10) *	7 (1.5)
Max. Bare Table Acceleration, peak	m/s^2 (g)	736 (75) *	491 (50)
Max. Displacement, peak to peak	mm (in)	8 (0.315)	6 (0.236)
Max. Input Current	A	5 *	1.8

* with assisted air cooling up to 60 N, 102 g, 7 A

4911 1:7

Type 4911 Motion Analyzer. Tracks automatically with test object to visually "freeze" the picture. Frequency range 5 Hz to 10 kHz corresponding to 300 to 600,000 RPM. Periodic synchronization voltage 100 mV to 280 V. Slow motion effect variable 0.3 to 5.7 Hz. True phase delay 0° to 360°. Contact closure synchronization 0 Hz to 110 Hz. Internal generator 5 Hz to 110 Hz. Normal and high intensity flash for photographic requirements. Synchronization with still or movie cameras. Wide range of accessories available, see also page 34, Type 5640. A, B or C model.

US 0006. Extra lamp attachment with reflector.

1:5

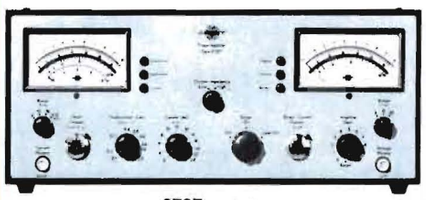
MM 0002 Magnetic Transducer is an electromagnetic transducer of the variable reluctance type which can be used as velocity-sensitive vibration pick-up or as electro-magnetic vibration exciter. Sensitivity 1.5 mV/cm/sec. when mean distance between housing and high-μdisc is 2 mm. Sensitivity in front of a large iron plate is approx. 3.8 mV/cm/sec.

1:5

MM 0004 Capacitive Transducer is a displacement sensitive vibration pick-up. Must be used in conjunction with Cathode Follower Type 2615 or Preamplifier Type 2619. Output 0.9 V for 1 mm (peak-peak) displacement when distance is 0.5 mm between electrode and test specimen.

Vibration Exciter Systems with Interchangeable Heads

System V 85-100 lbf (380-445N)



2707 1:7

4801 + 4812 1:13

Type 2707, Type 2708 and Type 2709 Power Amplifiers. For driving small and medium-sized vibration exciters, particularly the Exciter Systems V, S and M. Power output is 220 VA for Type 2707, 1200 VA for Type 2708,and 6 kVA for Type 2709. A 3 kVA version of Type 2709 is available as **Type 2732.**

All amplifiers are direct-coupled and have usable frequency range from DC to 100 kHz. Static centering of the exciter head is provided. Built-in monitoring meters and oscilloscope monitor points.

Extensive protection functions are included, with lamp display of reason for shut-down. Both the power amplifier itself and the exciter are protected against faults and misoperation. Switchable high and low output impedance is included for use in single- and multiple-vibration exciter applications. Type 2707 is powered from a single phase power line, the others require both single and three phase supplies. Types 2707 and 2708 available as A or C model, Types 2709 and 2732 in a 19 inch rack cabinet with 49 cm (19.25 in) high panel space for accessory instruments.

Types 4801T, 4802T and 4803 Exciter Bodies. The exciter bodies include all of the parts common to a number of exciter combinations and are the base onto which the various heads are mounted. They have an integral air cooling and field power supply system. Any angle of operation through 360° may be chosen and the body locked in position by handwheel. A suspension system is provided for minimising vibration transmission through to the floor at frequencies above 20 to 30 Hz. Below this frequency the suspension can be locked out by a small knob; simultaneously a higly damped, high resonant frequency suspension system is engaged.

Types 4801S and 4802S Exciter Bodies are alternatives to Types 4801/2T and have steel plate base-frames without suspension and trunnion system.

Type 4853 Exciter Body is an alternative to Type 4803 and has an open frame base with single suspension system which can be locked out. Rotable through 360° and lockable in the vertical and horizontal positions. Air cooling and field supply system is remote and coupled by flexible hose.

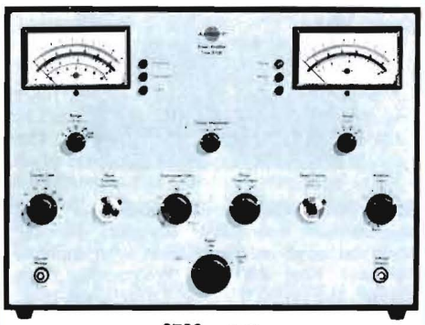
Exciter Heads

The outstanding feature of the exciters is the system of interchangeable heads whereby the dynamic characteristics of the exciter can be changed at will. The user is able to select the head best suited to the application and is able to use the power amplifier/exciter body with one head while mounting and instrumenting a test object on a second head.

Changing Exciter Heads is very fast; alignment pins on the head mate with holes in the exciter body, the two elements being secured by toggle latches.

The table tops are lapped and hardened to provide a smooth, durable flat surface for the very best vibratory coupling to the test object. Replaceable threaded inserts are set into the table tops to act as mechanical fuses, thus protecting the moving element from damage by fastening bolts. The inner threads of the insert fail before the moving element is damaged for most types of abusive treatment.

System S 325-400 lbf (1445-1780N)



2708 1:7

4802 + 4817 1:13

Vibration Exciter Systems with Interchangeable Heads

Type 4811, Type 4816 and Type 4821 High g Exciter Heads. Providing the lightest moving element which allows very high acceleration and high frequency excitation of smaller loads.

Type 4812, Type 4817 and Type 4822 General Purpose Exciter Heads. An intermediate size table with high force rating and light moving element.

Type 4813, Type 4818, and Type 4823 Big Table Exciter Heads. For larger loads on a big stiff table. Strong suspension system allows high transverse loads.

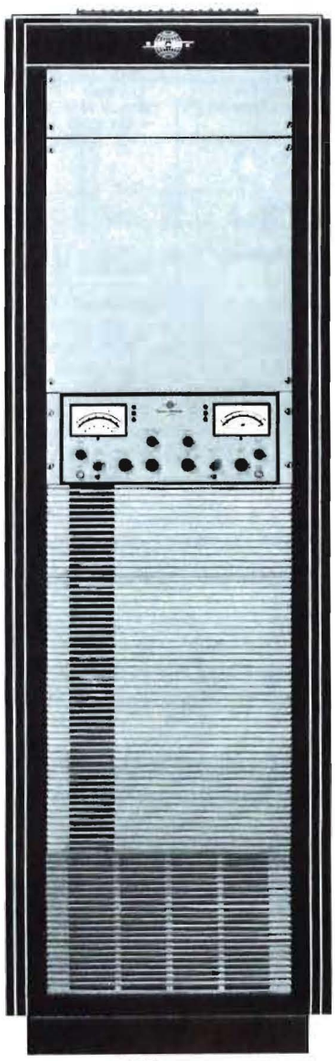
Type 4814, Type 4819 and Type 4824 Mode Study Exciter Heads. Have a larger amplitude capability with a light moving element. Particularly suitable for the excitation of structures and structural models.

Type 4815 Calibration Exciter Head. For the calibration of accelerometers and other transducers at actual use levels up to 100 g. A reference standard accelerometer is built-in.

Body	Head	Force Sine Peak		Peak Acc'n	Max. Disp. peak to peak		Reso-nance
		lbf.	N	g Max.	in	mm	kHz
4801T or S	4811	85	380	200	0.5	12.7	8.5
	4812	100	445	100	0.5	12.7	7.2
	4813	100	445	62.5	0.5	12.7	5.4
	4814	85	380	170	1.0	25.4	6.4
	4815	85	380	113	0.5	12.7	10.0
4802T or S	4816	325	1445	240	0.75	19.0	5.3
	4817	400	1780	148	0.75	19.0	5.3
	4818	400	1780	94	0.75	19.0	4.4
	4819	325	1445	163	1.50	38.1	4.3
4803 or 4853	4821	1200	5340	250	1.1	27.9	3.5
	4822	1500	6670	165	1.1	27.9	3.5
	4823	1500	6670	100	1.1	27.9	3.0
	4824	1200	5340	180	2.2	55.9	2.9

System M 1200–1500 lbf (5340-6670N)

4803 + 4823 1: 13



2709 1: 13

Measuring Microphones

The condenser microphones are designed for precision sound level measurements in the infrasonic, audio, and ultrasonic frequency ranges. They feature small dimensions, wide frequency range and excellent long term stability. 13 different cartridges with 4 different diameters, each size available with linear 0° incidence free field frequency response, and with linear pressure response (except the type 4138), give possibility to choose the best microphone for any application.

The microphones are screwed directly onto the associated preamplifiers or can be attached with adaptors. The assemblies are powered from the corresponding input sockets on the amplifiers and analyzers or from microphone power supplies. An individual calibration chart with frequency response, sensitivity etc. is delivered with each cartridge. The microphones fulfil the requirements in ANSI S1. 12-1967. Type 4146 and 4147 are made especially for use with Microphone Carrier System Type 2631. The 1/2" microphones Type 4149 and 4163 and the 1" microphone Type 4161 are backvented for use with Dehumidifiers UA 0308 and UA 0310, respectively to enable the microphones to be used in humid environments. In addition the 4149 has its backplate and diaphragm covered with thin layers of quartz, which effectively protects against damage caused by corrosive and humid environments. Temperature coefficient is less than ± 0.01 dB/°C from —50°C to + 60°C for all Types (except 4148) and less than —0.015 dB/°C from —50°C to + 60°C for Type 4148.

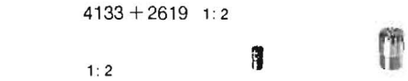
The microphone Type 4117 is a piezoelectric microphone for direct connection to amplifiers, analyzers etc. The high capacitance of the microphone gives low frequency cut-off at 20 Hz for an amplifier input impedance of about 2 MΩ. Temperature coefficient is less than —0.015 dB/°C from —10°C to 70°C.

4145 + DB0375 + 2619 1:2

4133 + 2619 1:2

4135 + 2618 1:2

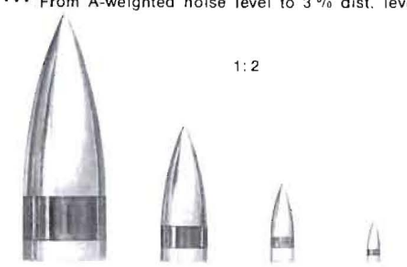
4138 + UA0160 + 2618 1:2



1:2

Cartridge Type	4138	4135	4136	4133 4163 4149	4134	4147	4148	4144	4145/4161	4146	4117
Associated Pre-amplifier (Type no.)	2618 + UA 0160, (2615 or 2619 + UA 0036)	2618, (2615 or 2619 + UA 0035)		2615 or 2619		2631 (with 2615 or 2619 same specs. as 4134)	2619. Only with Type 2804	2615, 2619 or 2627		2631 (with 2615, 2619 or 2627) same specs. as 4144	Cable AO 0062 direct to Amplifier
Sensitivity (* mV/Pa)	1	4	1.6	12.5		3.7—18	12.5	50		12—60	3
Polarization Voltage (Volts)	200	200		200		No (10 MHz c.f.)	28	200		No (10 MHz c.f.)	None
Frequency Range** (± 2 dB)	7 Hz-140 kHz	4 Hz-100 kHz	4 Hz-70 kHz	4 Hz-40 kHz	4 Hz-20 kHz	0.01 Hz—18 kHz	3 Hz-16 kHz	3 Hz-8 kHz | 3 Hz-18 kHz < 0.1 Hz when sealed		< 0.1 Hz—8 kHz	(± 3 dB) 4 Hz-10 kHz
Frequency Response	Pressure and Random	Free Field	Pressure	Free Field	Pressure and Rand.	Pressure and Random	Free Field	Pressure	Free Field	Pressure	Free Field
Dynamic Range*** (dB)	76—168	59-164	67-172	2615: 38—160 2619: 29—160		64—150	29—140	2615: 18—148 2619: 12—148 2627: 10—148		54-138	upper limit 138
Diameter	1/8"	1/4"		1/2"		1/2"	1/2"	1"		1"	1"

* 1 Pa = 1 N·m² = 10 μbar
** Free field normal incidence (0°). For 4138 90° incidence. Lower limiting frequency valid for microphone, the actual limit depends on preamp. used.
*** From A-weighted noise level to 3 % dist. level re 0.00002 Pa.



1:2

1:2

UA 0387 UA 0386 UA 0385 UA 0355 UA 0055 UA 0393 UA 0310 UA 0308 UA 0207 UA 0082 1:6 UA 0237

UA 0387 Nose Cone for mounting on all types of 1" microphones instead of the protection grid to reduce wind noise at higher wind velocities.

UA 0386 Nose Cone for all 1/2" microphones.

UA 0385 Nose Cone for 1/4" microphones.

UA 0355 Nose Cone for microphone Type 4138.

UA 0055 Random Incidence Corrector is used in place of the normal protection grid on the 1" microphones Types 4117, 4145 and 4161 to obtain an omnidirectional characteristic. To be used for measurement in diffuse sound fields.

UA 0393 Rain Cover for 1/2" condenser microphones is used instead of the normal protection grid to protect the microphone from rain when used continuously outdoors. A built-in electrostatic actuator allows remote check of microphone sensitivity.

UA 0310 Dehumidifier for 1" microphone Type 4161.

UA 0308 Dehumidifier for 1/2" microphones Types 4149 and 4163.

UA 0207 Wind Screen for 1" microphone. Delivered only in packages of 6. Ordering no. **UA 0253.**

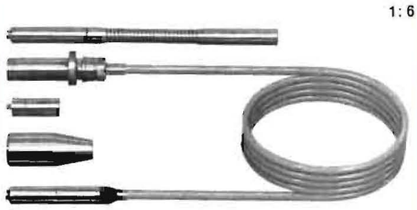
UA 0082 Wind Screen for 1" and 1/2" B & K microphones. Reduces wind noise at lower wind velocities.

UA 0237 Wind Screen for 1/2" microphones. Delivered only in packages of 6. Ordering no. **UA 0254.**

2615

2618

1:6



2619

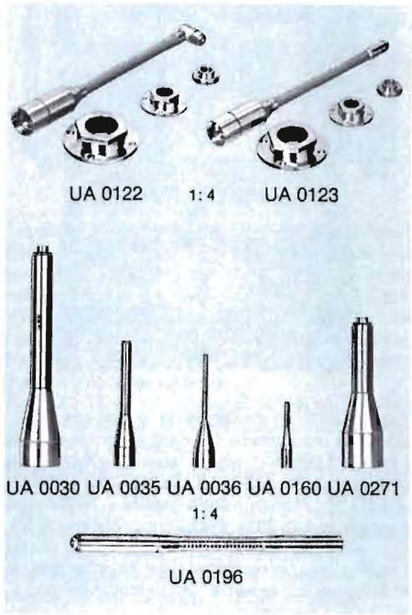
2627

Type 2615 1/2" Cathode Follower with 2 meter cable. Input impedance 700 MΩ// 3 pF. Output impedance 750 Ω. Frequency range 10 Hz to 100 kHz. Adaptor JJ 2614 included. Used with adaptor DB 0375 for 1" microphones. (This adaptor is included, and can be used only with 2615 from serial no. 249735).

Type 2618 1/4" FET preamplifier for 1/4" condenser microphones. Input impedance: 100 GΩ//0.8 pF. Output impedance 30 Ω. Gain adjustable to +20, 0 or —20 dB. Frequency range 2 Hz to 200 kHz. Used with Adaptor type UA 0160 for 1/8" microphones.

Type 2619 1/2" FET Preamplifier for 1/2" and 1" condenser microphones. Input impedance 4 GΩ//0.5 pF. Output impedance 100 Ω. Unity gain. Frequency range 2 Hz to 200 kHz. Delivered with Adaptor DB 0375 for 1" microphones, Adaptor JJ 2615 and UA 0196 Flexible Extension Rod.

Type 2627 1" FET Preamplifier with insert voltage calibration capability. Input configuration conforms to IEC R 327. Switchable to driven or grounded shield. Attenuation <0.08 dB. Input impedance 10 GΩ// 0.5 pF. Output impedance <50 Ω. Frequency range 2 Hz to 200 kHz. Adaptor JJ 2612 included.



UA 0122 Adaptor Set contains a flexible adaptor with right angle connector for 1/4" and 1/2" microphones and 2 flush mountings for 1/4" and 1/2" microphones. Fits on 1/2" cathode followers and preamplifiers Type 2615 and 2619.

UA 0123 Adaptor Set contains a flexible adaptor with straight connector for 1/4" and 1/2" microphones and flush mountings for 1/4" and 1/2" microphones. Fits on 1/2" cathode followers and preamplifiers Type 2615 and 2619.

UA 0030 Input Adaptor adapts 1/2" condenser microphones to Sound Level Meter Type 2203 or 1" preamplifier Type 2627.

UA 0035 Adaptor for mounting of a 1/4" condenser microphone on a 1/2" cathode follower Type 2615 or preamplifier Type 2619.

UA 0036 Adaptor for mounting of a 1/8" condenser microphone on a 1/2" cathode follower Type 2615 or preamplifier Type 2619.

UA 0160 Adaptor for mounting of 1/8" condenser microphone on preamplifier Type 2618

UA 0271 Adaptor for using 1/2" microphone Type 4147 with Microphone Carrier System Type 2631.

UA 0196 Flexible Extension Rod for Type 2615 (from Serial no. 249735). 2619 and 2209. Delivered as standard accessory with Type 2619 and 2209.

JJ 2612 JJ 2614 JJ 2615 UA 0354 UA 0240

AR 0001 Tape Microphone Cable is a flat 7-cored cable for use when it is desired to carry microphone cables through closed windows or doors. Thickness 0.2 mm.

AO 0062 Cable for connection of piezoelectric microphone Type 4117 to B & K amplifiers and analyzers. Length 3 meters.

JJ 2612 Input Adaptor for B & K plug to 1" preamplifiers. Delivered as standard accessory with Precision Sound Level Meter Type 2203, and Preamplifier Type 2627.

JJ 2614 Input Adaptor for B & K plug to 1/2" preamplifiers, S.L.M. Type 2206 or 2209. Delivered as standard accessory with Type 2615 and Sound Level Meter Type 2209.

JJ 2615 Input Adaptor for microplug to 1/2" microphone preamplifiers and S.L.M. Type 2206 and 2209. Delivered as standard accessory with Type 2619.

UA 0354 Tripod Adaptor for mounting the microphone preamplifiers Types 2615 and 2619 on a tripod camera stand. Thread 3/8" W.

UA 0240 Housing for transporting and sealing microphones Type 4144 and 4145 for measurements down to 0.1 Hz. Delivered as standard accessory with Type 4146.

Hydrophone – Microphone Accessories and Calibration Equipment

1:6

Type 4142 Microphone Calibration Apparatus for accurate calibration of the B & K Condenser Microphones according to the reciprocity calibration technique as in the IEC Recommendation R327. Permits measurements of the absolute sensitivity and pressure frequency response. Built-in 800 Volts supply for Electrostatic Actuator. Accessories included: Two Electrostatic Actuators, three couplers (20-cm³, 3-cm³ and 0.3-cm³), 4144 (unless otherwise specified), AO 0013, insert voltage rings.

1:6

Type 4220 Pistonhone is a battery-driven portable instrument for calibration of Sound Level Meters and sound measuring arrangements. Sound level: 124 dB re 2×10^{-5} N/m² individually calibrated. Accuracy: ± 0.2 dB. Frequency: 250 Hz ± 1%. Sinusoidal waveform. Barometer for direct reading of corrections due to changes in atmospheric pressure included. Fits on 1" to 1/8" microphones. Batteries: 7 Mallory RM 3R mercury cells are included.

1:4

Type 4230 Sound Level Calibrator is a pocket-size, battery-driven, portable instrument for calibration of sound measuring systems and sound level meters. Sound level 94 dB re 2×10^{-5} N/m² ± 0.3 dB. Frequency 1000 Hz ± 2%, sine, gives independence of weighting networks, therefore suitable for Sound Level Meters Type 2205, 2206, 2207 and 2208, which have no linear response. Distortion less than 1%. Sound pressure independent of microphone volume and static pressure. Fits on 1" and 1/2' microphones. Battery: 1 x 9 Volt IEC Type 6F22.

1:6

UA 0040 Probe Microphone Kit consists of 4 probe tubes with 0.5, 1, 2, 4 mm outside diameters. For type 4134 1/2" microphones. A coupler is supplied for calibration of sensitivity and frequency response. Tools for cutting and materials for damping the probes are supplied. Used for sound measurements in inaccessible places.

UA 0023

UA 0033 1:4

UA 0023 Electrostatic Actuator designed for measurements of the pressure frequency characteristics of the 1" Condenser Microphone Cartridges.

UA 0033 Electrostatic Actuator for measurements of the pressure frequency characteristics of the B & K 1/2" condenser microphones. Can be used with 1/4" and 1/8" microphones by means of **Adaptors DB 0264** and **DB 0900** respectively.

1:6

Type 8100 Standard Measuring Hydrophone is a wide range underwater transducer for making absolute sound measurements over the frequency range 0.1 Hz to 200 kHz. The receiving sensitivity is —110 dB relative 1 V per N/m² with excellent omnidirectional characteristic. The hydrophone assembly employs lead zirconate titanate as the active sensing element. Special measures have been taken to obtain good electrical shielding enabling the calibration and use of this hydrophone in air. The sound transmissive boot of moulded neoprene rubber is permanently bonded to a monel support which is electrically and vibrationally isolated from the sensing element. The hydrophone is equipped with a 6 m waterblocked low noise cable with waterproof extension connector, and a 1.2 m cable is included with waterproof connector on one end and B & K standard plug on the other. The main application of Type 8100 is the calibration of hydrophones. Examples of other applications are projecting recorded signals, examining output patterns of sonars, measuring cavitation noise, measuring sea state spectra, and many other acoustic phenomena occuring in gaseous and liquid media. Suitable preamplifiers are Type 2626 or 2650. Extension Cables with waterproof connectors: **AO 0104** — 10 m, **AO 0105** — 30 m, **AO 0106** — 100 m.

Microphone Accessories – Acoustical Equipment – Microphone Carrier System

1:5

Type 2631 Microphone Carrier System consists of two units: a microphone adaptor and a power supply module. The adaptor contains a 10 MHz oscillator, preamplifier and detector circuit. The power supply module contains power supply for the microphone adaptor, amplifier, integrator, monitoring meter and reference oscillator. Should be used with condenser microphone Type 4146 or Type 4147 with adaptor UA 0271. Allows measurement of low frequency pressure variations as found in sonic booms. Selectable lower limiting frequencies of 0, 0.01, 0.1 and 1 Hz. Frequency range 0 Hz to 200 kHz. With microphone 4146: 0.1 Hz to 7.5 kHz, with 4147: <0.01 Hz to 16 kHz. Automatic AC balancing and automatic compensation of transducer capacitance differences.

1:14

Type 4921 Outdoor Microphone Unit consists of the quartz coated 1/2" condenser microphone Type 4149 with preamplifier, rain cover and windscreen **UA 0381** with spikes **UA 0404** mounted on a weather-proof housing that contains power supplies, amplifier, calibration oscillator and a dehumidifier for the microphone air equalization system. To be used in permanent outdoor noise monitoring systems.

2801 1:5 2804 1:5 2807

Types 2801, 2804 and 2807 Microphone Power Supplies supply B & K condenser microphones with associated preamplifiers with necessary voltages. Used when B & K amplifiers or analyzers are not available, for tape recordings, or when very long cables between microphones and measuring instrument have to be used.
Type 2801 is one channel; 4 outputs: direct emitter follower, 50 Ω or 200 Ω unbalanced, and 200 Ω balanced.
Type 2804 is two channel, battery driven (IEC Type R20), for use with Preamplifier Type 2619, 28 V or 200 V polarization voltage. 28 V for vibration preamplifiers. The two input signals can be fed directly to the two outputs or connected inversely by a switch for comparison measurements.
Type 2807 is two channel; built-in switch control allows automatic switching between the two channels. Used for example for sound insulation measurements or simultaneous measurement on two channels.

1:9

Type 3204 Tapping Machine is designed for field and laboratory measurements of impact sound transmission in buildings. Complies with ISO R 140. Five 500 gr. hammers fall vertically 4 cm. 10 impacts per second. Operates from 50 Hz or 60 Hz supplies.

1:5

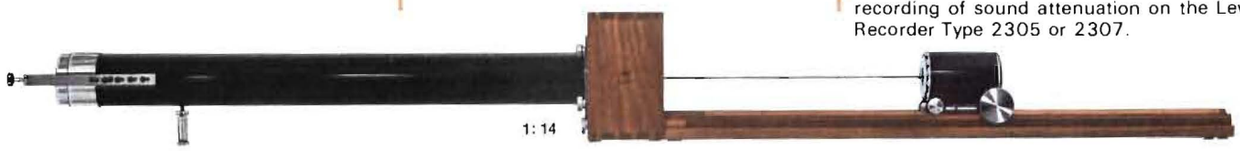
Type 4422 Reverberation Processor for easy and accurate measurement of reverberation time. High reproduceability by the Integrated Impulse Method (Schroeder/Kuttruff). Frequency range 20 Hz to 20 kHz. Measurement range 0.3 to 10 s reverberation time. Direct reading of Early Decay Time (EDT) on built-in meter. DC output for recording of reverberation curves. Digital voltmeter output. Portable system: 4422, 2209, 2 x 1616, 2706. Automatic system: 4422, 2113, B & K microphone and preamplifier, 2305 or 2307, 1615, 2706.

1:5

Type 4423 Noise Dose Meter for simple determination of equivalent continuous sound level according to the equal energy principle. Frequency range 20 Hz to 20 kHz. Three built-in counters show noise dose count, elapsed time, and overload duration. Equally applicable for assessment of risk of hearing impairment and annoyance. Fulfils the requirements of ISO Recommendations R 1996 and R 1999, and of the draft DIN 45 641 standard. **UA 0363, UA 0364** and **UA 0365** Power Supply Adaptors for SLM's 2203, 2209 and 2205/6/7/8 respectively.

1:7

Type 4408 Two-Channel Microphone Selector is a junction box for externally controlled automatic or manual switching between two B & K Microphones with associated preamplifiers fed into a single amplifier. The selector is used for instance for automatic sound insulation measurements where it allows direct recording of sound attenuation on the Level Recorder Type 2305 or 2307.



1:14

Type 4002 Standing Wave Apparatus for measurements of acoustic absorption coefficient and complex specific impedances of small samples. Two measuring tubes supplied: 10 cm and 3 cm in diameter. Frequency ranges are 100 Hz to 1.8 kHz and 800 Hz to 6.5 kHz. Should be used with BFO 1022 and Analyzer 2107 or the combination of Measuring Amplifier Type 2606 and Heterodyne Slave Filter Type 2020.

Precision and Impulse Precision Sound Level Meters

1:3

Type 2209 Impulse Precision Sound Level Meter is a compact battery operated instrument for precision sound and vibration measurements. It conforms with IEC R 179 and R 123 and proposed IEC recommendation for Impulse Sound Level Meters, and with DIN 45633 parts 1 and 2. Accepts both 1" and 1/2" condenser microphones. Adaptor UA 0035 allows a 1/4" microphone to be fitted also. Besides an impulse facility, the instrument can hold maximum RMS or maximum peak values of signals. Overload indication is provided and the meter and attenuator scales may be changed to give direct reading with different transducers. Frequency range is 2 or 10 Hz to 70 kHz. Weighting networks A, B, C and D are built-in. Measures RMS value of signals with crest factor up to 40. Plug-in input stage allows up to 100 metres of cable between instrument and microphone. Output for recorder etc.
Measuring range with 1" microphone Type 4145 is 15 to 140 dB, frequency range is 2 or 10 Hz to 18 kHz. With 1/2" microphone Type 4133 range is 38 to 150 dB, and 4 or 10 Hz to 40 kHz. With 1/4" microphone Type 4135 it is 69 to 160 dB, and 5 or 10 Hz to 70 kHz. Delivered with condenser microphone Type 4145. Extension Rod UA 0196, Adaptor DB 0375, Random Incidence Corrector UA 0055, Windscreen UA 0207 and Input Adaptor JJ 2614. Together with Filter Sets Types 1613 or 1616 it forms a portable sound analyzer. Operates from 3 standard 1.5 V batteries, IEC Type R 20 (Standard D Cells).

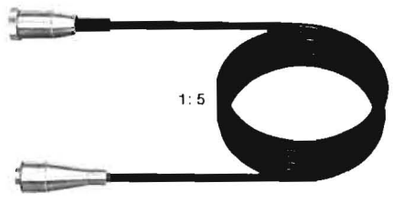
1:3

Type 2203 Precison Sound Level Meter is a compact battery operated highly accurate instrument for sound level measurements and for vibration measurements. It conforms with IEC R 179 and IEC R 123. In conjunction with Filter Sets Types 1613 and 1616 it forms a portable sound analyzer. Measuring range with 1" condenser microphone Type 4145 is 19 to 140 dB and frequency range is 10 Hz to 18 kHz. Measuring range with 1/2" condenser microphone Type 4133 is 39 to 150 dB and frequency range is 10 Hz to 25 kHz. The weighting networks A, B and C are built-in. Output for recorders etc. Delivered with condenser microphone Type 4145 and input adaptor JJ2612. Operates with 3 standard 1.5 V batteries, IEC Type R 20 (Standard D cells).

WB 0004 and WB 0073. Mains Power Supply Connectors for Type 2203 and 2209 respectively. These Power Supply Connectors are specials and mains voltage should be specified when ordering.

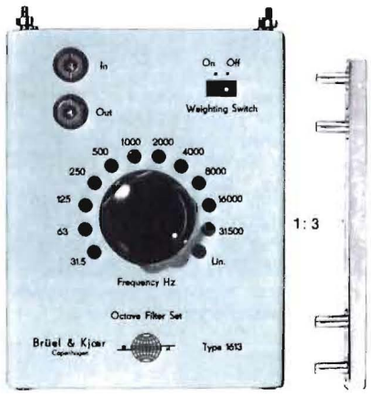
1:8

UA 0039 Extension Connector is a flexible rod used to mount 1/2" and 1" condenser microphones remote from Sound Level Meter Type 2203.



1:5

AO 0033 Microphone Extension Cable allows the 1" condenser microphones to be mounted remote from Sound Level Meter Type 2203. Length 3 metre.

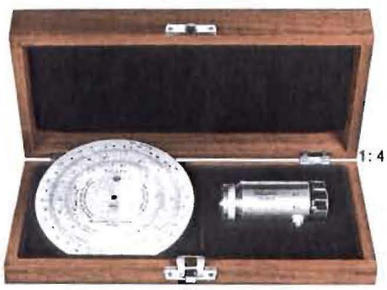


1:3

Type 1613 Octave Filter Set contains 11 octave filters with centre frequencies from 31.5 Hz to 31.5 kHz. In combination with a Sound Level Meter it fulfils the requirements of IEC R 225, DIN 45651, and ANSI S1.11 Class II. The pass-band attenuation is adjustable for each filter from 0 dB to 50 dB. The filter can be screwed directly onto the Sound Level Meters Types 2203 and 2209.

1:3

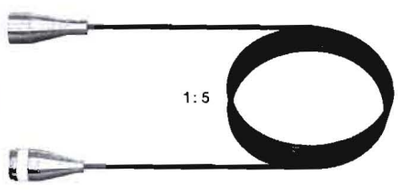
Type 1616 1/3 Octave Filter Set contains 34 active third-octave filters with centre frequencies from 20 Hz to 40 kHz. It fulfils the requirements of IEC R 225, DIN 45652, and ANSI S1.11 Class III. It can be used separately or be screwed directly onto the Sound Level Meters Types 2203 and 2209. It operates with 3 x 1.5 V standard D cells, IEC Type R 20. For mounting on Type 2203 with serial no lower than 424272 a bottom plate **DD 0135** must be ordered separately.



ZR 0020 Integrator used in conjunction with type 2203 and type 2209 for vibration measurements. Velocity range 10 Hz to 10 kHz. Displacement range 20 Hz to 4 kHz. Calculating Disc included.

UA 0049 Portable Floor Stand for all types of Sound Level Meters. Includes Adaptor UA 0354 for microphone preamplifiers.

KE 0055 Carrying Case for Type 2203 and Type 2209 with Type 1613 or 1616 and accessories for field use.



AO 0063 Microphone Extension Cable is a 3 metre cable which allows remote mounting of the input stage and microphone to Sound Level Meter Type 2206.

2205 2206

Type 2205 Sound Level Meter is a small size handy Sound Level Meter for convenient sound level measurements everywhere. It conforms with IEC R 123, and has built-in A, B and C weighting networks. It is equipped with the piezo-electric microphone Type 4117 which gives it a frequency range from 20 Hz to 10 kHz. Dynamic range is from 32 to 140 dB (A). The sound level is read directly on the large tilted meter scale where zero level is automatically indicated dependent on setting of attenuator. A 10 dB push-button attenuator gives fast convenient shift of meter range. All switches can be locked to eliminate errors caused by inadvertent switching. Output for recorder etc. Operated from single 1.5 V battery, IEC Type R 14 (Standard C cell). Delivered in moulded carrying case together with pistol-grip handle, wrist strap, Microphone Type 4117, and Wind Screen UA 0207. By replacing the piezoelectric microphone with **Input Adaptor UA 0208** and **Condenser Microphone Type 4148** the instrument becomes similar to the Precision S.L.M. Type 2206.

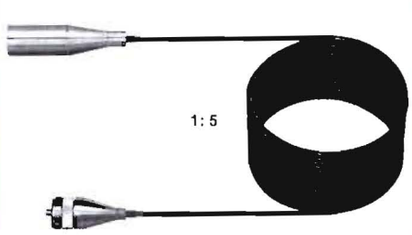
Type 2206 Precision Sound Level Meter. Basically the same instrument as the Type 2205 but equipped with condenser microphone Type 4148 and special input stage. It fulfils the requirements of IEC R 179. Measuring range is 36 to 140 dB (A). Frequency range is 20 Hz to 18 kHz. Delivered with Microphone Type 4148, input stage, pistol-grip handle, Wind Screen UA 0237, and wrist strap, in moulded plastic carrying case.

JJ 0037 Input Adaptor for microplug to input of Sound Level Meters Type 2205, 2207 and 2208.

2207 2208

Type 2207 Vehicle Noise Meter. Similar to Type 2205 but equipped with A weighting network only. It fulfils and exceeds the requirements of BS 3539 pt. 1. Dynamic range is from 54 to 140 dB (A). Delivered with Microphone Type 4117, pistol grip handle, Wind Screen UA 0207, and wrist strap, in moulded plastic carrying case.

Type 2208 Noise Event Meter. Similar to Type 2205 but equipped with max. meter hold and storage circuitry. Contains A weighting network only and has no 10 dB push button attenuator. The meter can be switched to indicate the max. RMS value of the measured noise and a held max. value can be stored. It is ideally suited for traffic noise measurements and measurements of short duration noises. Measuring range 32 to 130 dB (A). Delivered with Microphone Type 4117, pistol grip handle, Wind Screen UA 0207 and wrist strap, in moulded plastic carrying case.



AO 0061 Microphone Extension Cable is a 6 metre cable which allows remote mounting of the microphone to Sound Level Meters Type 2205, 2207 and 2208.

UA 0208 Input Adaptor for Type 2205 and 2208 with built-in preamplifier for 1/2" condenser microphone Type 4148.

Sound and Vibration Sets – Audiometer Calibrators

Complete Sets for Sound and Vibration Measurements

Four sets containing either the Precision Sound Level Meter Type 2203 or the Impulse Precision Sound Level Meter Type 2209 with Filter Sets 1613 or 1616 and accessories have been assembled as separate type numbers.
The wide selection of accessories contained in these sets provides the opportunity to draw full benefit from all the application possililities of the sound level meters for sound and vibration investigations in the field.

Type 3501 and 3509 Sound and Vibration Sets contain:
Precision Sound Level Meter Type 2203 with standard accessories.
Octave Filter Set Type 1613 (3501 only).
Third Octave Filter Set Type 1616 (3509 only).
Condenser Microphone Type 4133.
Pistonphone Type 4220.
Accelerometer Set Type 4332 S.
And following accessories: AO 0033, UA 0354, UA 0039, UA 0387, UA 0386, UA 0055, UA 0082, ZR 0020, and KE 0055.

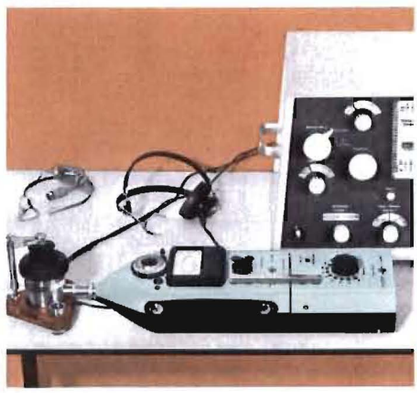
Type 3507 and 3511 Sound and Vibration Sets contain:
Impulse Precision Sound Level Meter Type 2209 with standard accessories.
Octave Filter Set Type 1613 (3507 only).
Third Octave Filter Set Type 1616 (3511 only).
Condenser Microphone Type 4133.
Pistonphone Type 4220.
Accelerometer Set Type 4332 S.
And following accessories: AO 0027, UA 0354, UA 0387, UA 0386, UA0082, ZR 0020, and KE 0055.

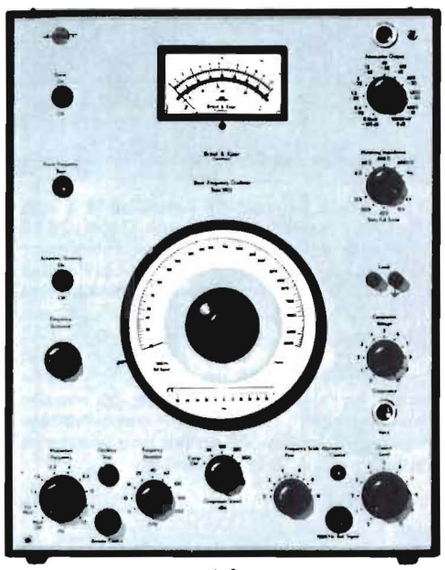
Complete Sets for Audiometer Calibration

Four sets containing either the Precision Sound Level Meter Type 2203 or the Impulse Precision Sound Level Meter Type 2209 with Filter Sets 1613 or 1616 and accessories have been assembled as separate type numbers. These sets each form a very accurate portable audiometer calibrator by connecting the Artificial Ear Type 4152, which is in accordance with IEC and ANSI recommendations, directly to the Precision Sound Level Meter. For calibration of bone vibrators Artificial Mastoid Type 4930 can be added.

Type 3502 and 3510 Audiometer Calibrators contain:
Precision Sound Level Meter Type 2203 with standard accessories.
Octave Filter Set Type 1613 (3502 only).
Third Octave Filter Set Type 1616 (3510 only).
Artificial Ear Type 4152.
Pistonphone Type 4220.
Condenser Microphone Type 4144.
Carrying Case KE 0055.

Type 3508 and 3512 Audiometer Calibrators contain:
Impulse Precision Sound Level Meter Type 2209 with standard accessories.
Octave Filter Set Type 1613 (3508 only).
Third Octave Filter Set Type 1616 (3512 only).
Artificial Ear Type 4152.
Pistonphone Type 4220.
Condenser Microphone Type 4144.
Carrying Case KE 0055.





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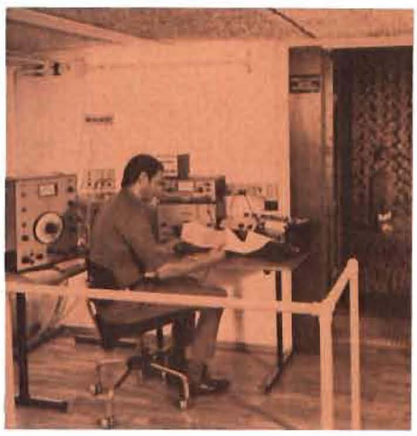

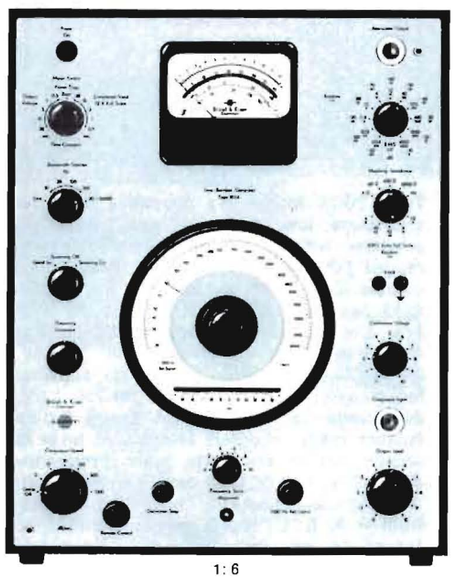

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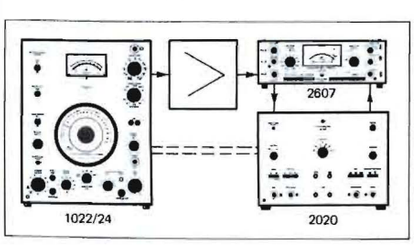
Type 1013 Beat Frequency Oscillator is a signal generator that covers the frequency range from 200 Hz to 200 kHz. The instrument includes a regulator stage for external compression regulation, an accurate built-in voltmeter, an internal generator for variable frequency modulation of the output signal and a 90 dB output attenuator variable in 10 dB steps. The output impedance is variable to give maximum power output (2.5 W) in a load of 6, 60, 600 or 6,000 Ω. It features a true logarithmic frequency scale, and a frequency interpolating scale. A clutch for connection to an external motor drive for automatic tuning allows automatic recording on frequency calibrated paper when used together with Level Recorders Type 2305 and 2307. Distortion is less than 0.3% at 10 kHz unloaded.

Type 1022 Beat Frequency Oscillator is similar to BFO Type 1013 with the exception of the following: Frequency range 20 Hz to 20 kHz. Output attenuator: 100 dB. The distortion is less than 0.1% at 1 kHz unloaded. Fully transistorized.

Type 1017 Beat Frequency Oscillator is similar to BFO 1013. Frequency range: 2 Hz to 2 kHz. No frequency modulation system. Variable meter damping. Distortion less than 0.25% at 100 Hz unloaded.

Type 1013, 1017 and **1022** are available as A, B or C models.



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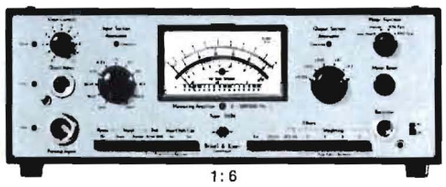
Type 1402 Random Noise Generator gives a random noise signal with uniform spectrum density ("white" noise) in the frequency range 20 Hz to 20 kHz, within ± 0.5 dB. Symmetrical Gaussian magnitude distribution to more than 4 σ. The Noise Generator has a built-in 3 dB/Octave weighting network. Selectable output impedances, intended for loads of 6, 60, 600, and 6,000 Ω. Power output 0.25 Watts (instantaneously 4 Watts at the noise peak amplitudes). Various output voltages, maximum 40 V RMS, 170 V peak. The built-in indicating meter, with selectable time constants of 0.5, 1.5, 5 and 15 sec. measures the true RMS of the noise voltage. An output is provided, having a calibrated step attenuator. The signal/hum ratio is as high as 70 dB, which ensures Gaussian magnitude distribution, even for narrow bands of noise. Additionally, the Noise Generator is provided with terminals for connection of external filters. When using the B & K Band-Pass Filter Type 1615, 1/3 or 1/1 octave noise bands can be selected successively from the Noise Generator. A, B or C model.

Type 1024 Sine Random Generator gives 3 types of signals: sine waves, narrow bands of random noise, and wide band random noise. Frequency range is 20 Hz to 20 kHz. The instrument includes a regulator stage for external compression regulation, an accurate built-in voltmeter, with variable time constants from 0.3 to 30 secs, indicating RMS value of output signal, and a 100 dB output attenuator variable in steps of 10 dB. Switchable matching impedance of 6, 60, 600 and 6000 Ω. Narrow band and wide band random noise output power is 0.25 W. Sine wave output power is 2.5 W. It features a true logarithmic frequency scale and a frequency interpolating scale. A narrow band of random noise can be swept through the frequency range 20 Hz to 20 kHz. Bandwidths of 10, 30, 100 and 300 Hz. Provision for external motor drive allows automatic frequency response recording on Level Recorders Type 2305 and 2307.
Random Noise output has symmetrical Gaussian magnitude distribution to more than 4 σ, maximum output voltage is 40 V RMS, 170 V peak and signal/hum ratio 70 dB. Sine wave output has distortion less than 0.1% at 1 kHz unloaded and maximum output voltage 120 Volt. A, B or C model.

Measuring Amplifiers – Filters



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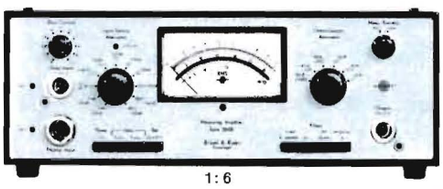
With B & K condenser microphone and preamplifier the instrument fulfils IEC R179 for Precision Sound Level Meters, and proposed IEC recommendation for Impulse Sound Level Meters. A, B or C model.



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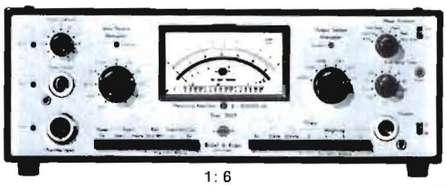
Type 2606 Measuring Amplifier is an all solid state, low noise, high gain measuring amplifier with indicating meter. Sensitivity ranges 10 μV to 300 V full scale deflection, adjustable in 10 dB steps. Indication of true RMS level for crest factors up to 40 with Fast and Slow meter response, or impulse measurement with max. Hold facility. Interchangeable meter scales are supplied for measurement of voltage, dB re. 1 μV, acceleration, and sound level. Scales can be custom made to order. Meter zero level is shown directly on meter scale. Frequency range 2 Hz to 200 kHz, can be limited from 22.4 Hz to 22.4 kHz by push-buttons. Built-in A, B, C, and D weighting networks for sound level measurements. Input and output overload indicators. B & K screened standard input socket and 7-pin socket for the B & K microphone preamplifiers. With power supply ZR 0024 it supplies 28 V DC, 2 mA, for vibration preamplifiers Types 2623, 2625 and in accelerometer 8306. DC and AC outputs. Built-in facilities for insert voltage calibration of microphones. External filters such as Types 1615, 2020 and ZS 0301 can be connected and used alone or in series with built-in filters. Type 2606 can be powered from AC mains or external 12 V DC.



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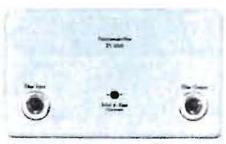
Type 2607 Measuring Amplifier is similar to Type 2606 except for the meter rectifier. In addition to the RMS, Impulse and Impulse Hold positions it provides true reading of + peak, — peak and max. peak values allowing measurements on short duration signals. The rise time of the rectifier is 20 μs. Decay time is adjustable from 0.1 s to 300 s allowing measurements on narrow bands of noise. The rectifier also includes the Fast and Slow positions standardized for sound level measurements. The meter can be switched to lin. or log. reading, and shows correct RMS values for signals with crest factor up to 5. The output has 60 dB dynamic range in pos. RMS at crest factor 1.4 (sine) and 50 dB dynamic range at crest factor 5 and in pos. peak. The Band Pass Filter Set Type 1614 is ideally suited for use with the measuring amplifier. A, B or C model.

Type 2608 Measuring Amplifier is a less sophisticated version of the Type 2606 designed especially for use in compressor feedback loops, as a calibrated amplifier and in less demanding noise and vibration measuring set-ups. Main differences are: RMS indication to crest factor 5 only. "A" weighting only, high pass filter only, overload indicator in input only, fixed meter scale, no range indicator lamps, no impulse measurement facility, no insert voltage calibration facility. AC output only and mains supply only. A, B or C model.



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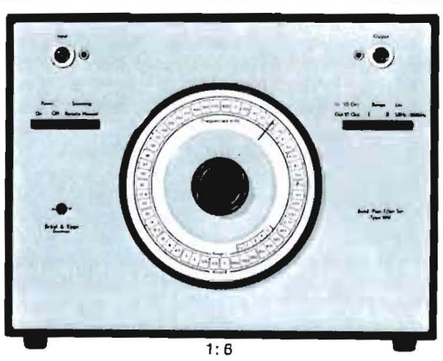
ZS 0301 Psophometer Filter for noise measurement in radio broadcasting audio systems. Should be used with Measuring Amplifiers 2606, 2607, 2608, or Analyzers 2010, 2107, 2113, 2114, 2120. Meets the requirements of CCITT (1960) and DIN recommendations. See page 35 for psophometer filter for measurements on telephone circuits.



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Type 1614 Band Pass Filter Set is an octave and third octave filter set with octave filter centre frequencies from 4 Hz to 125 kHz and third octave centre frequencies from 2 Hz to 160 kHz. Plug-in unit construction. 22.4 Hz to 22.4 kHz audio range can be selected by push-button. The filter is in accordance with IEC R225-1966 and ANSI S. 11-1966 best class. The weighting networks A, B, C, and D for sound level measurements are built-in. The filters can be manually selected by means of the 50 position switch or automatically scanned when coupled to the Level Recorder Type 2305 or 2307. The Amplifier Type 2607 is ideally suited for use with the filter set for making automatic frequency spectrum analysis. Also the amplifiers Types 2606 and 2608 or the frequency analyzers Types 2107, 2120 and 2010 can be used. A, B or C model.

Type 1615 Band Pass Filter Set is similar to Type 1614 but contains only the audio frequency range, 25 Hz to 20 kHz, of filters and the A, B, C,and D weighting networks. Simple to add extra single filters or to convert the 1615 range to the range of Type 1614.

A System Development version of **Type 1615** is available as **Type 5084** using octave selectivity for the analysis, shifting centre frequencies in third octave steps. This provides a larger signal for the measurement than normal third octave analysis. Please ask for quotation.

XZ 0013 resistance board mounts into Type 1615 and is necessary if one or both filters ZS 0164—0165 are used (from Serial no. 285328). See page 19.

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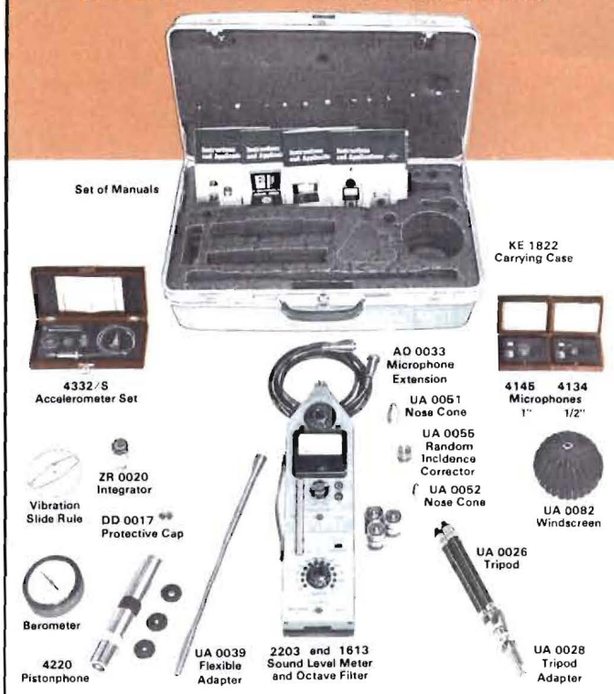
Type 2020 Heterodyne Slave Filter is a highly selective constant bandwidth filter. It is tuned automatically from the oscillators 1022 or 1024, the analyzer 2010, and the Tracking Frequency Multiplier 1901. Extremely useful for suppressing background noise. Frequency range 20 Hz to 20 kHz, bandwiths of 3.16, 10, 31.6 and 100 Hz can be manually or remotely selected. Dynamic range >70 dB. $1/\sqrt{B}$ bandwidth compensation included. Phase agreement between two filters better than 1°, 90° phase shift available. Rejection output for distortion measurements. The amplifier Type 2607 is ideally suited for use with the filter. A, B or C model.

3501/S Portable Sound and Vibration Set



The 3501/S uses the B & K Model 2203 Precision Sound Level Meter and the 1613 One-Octave Filter Set. One-inch and half-inch condenser microphones are included. The system measures sound pressure levels from 22 to 148 dB SPL over the range from 10 Hz to 20 kHz. With the microphone replaced by a piezoelectric accelerometer, vibration measurements can be made down to 0.005 g. A vibration integrator converts the acceleration measurements to velocity or displacement. The microphone can be extended up to 10 feet from the sound level meter, and nose cones for both microphones reduce wind noise when measuring in ventilation ducts. A pistonphone is included to calibrate the microphone and sound level meter. The 3501/S is used for noise and vibration measurements on cyclic noise sources which are not impulsive.

3507/S Portable Impulse Sound and Vibration Set

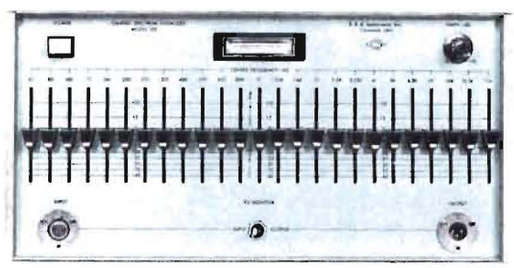
The 3507/S system is similar to the 3501/S, but uses a 2209 Sound Level Meter. The 3507/S system has all the features of the 3501/S plus the peak and impulse measuring capability of the 2209 Sound Level Meter.
The 3507/S is used for impulsive or non-impulsive noise and vibration measurements. Typical uses include plant noise studies on punch presses, vehicle drive-by noise, aircraft fly-over noise, community noise measurements, machine vibrations, gasoline and diesel engine investigations, and measurements for plant noise reduction programs.

3508/S Portable Impulse Sound and Vibration Set and Audiometer Calibrator

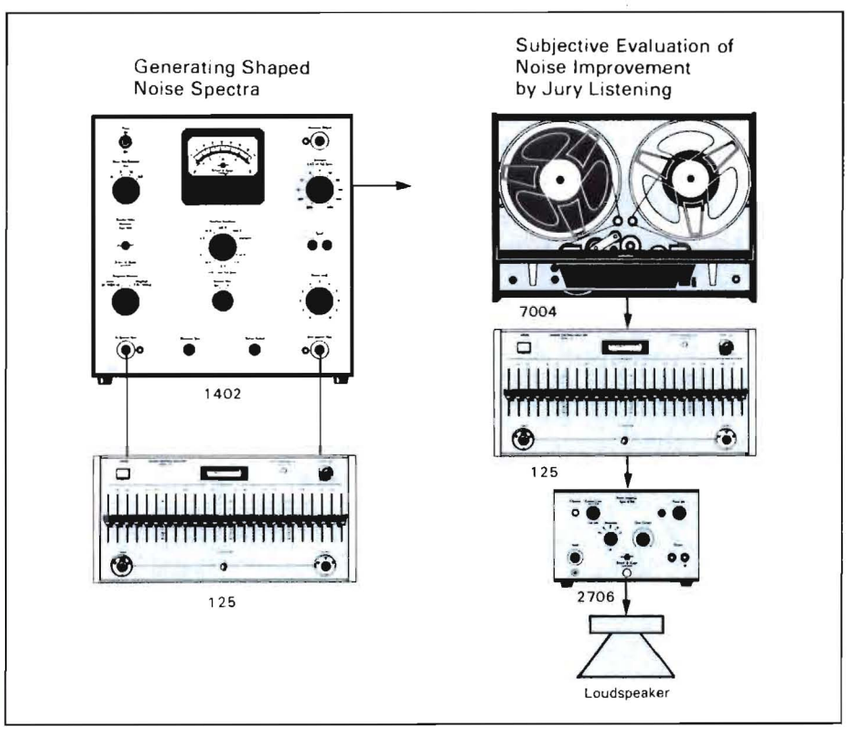
The 3508/S system is similar to the 3507/S components and also includes artificial ear, coupler, and centering ring to calibrate audiometers. The 3508/S is a comprehensive system for consultants, engineers, audiologists, and plant safety managers. The 3508/S measures all types of industrial and environmental noise, analyzes machine noise and vibration, and calibrates screening and clinical audiometers to national standards.

Noise Monitoring Equipment
Graphic Frequency Response Equalizer

The Model 166 Environmental Noise Classifier is an amplitude analyzer which classifies noise levels into amplitude bands. It has wide application in community, industry and government where irregular noise patterns must be analyzed. The 166 classifies signals into eleven bands over a 27 dB range and records the accumulated time in each band. Bands are alternately 2 and 3 dB wide. Signal exceedances above the 27 dB range, and total monitoring time, are also recorded. Base line is adjustable from 60 to 100 dB in 5 dB steps. On special order base line can be lowered to 45 dBA. Readout is by individual electromechanical counters having a resolution of 0.1 minutes. Sampling interval is 0.01 minutes. The 166 is delivered with a one-inch ceramic microphone for applications where Type 2 sound level meter performance is adequate.
The 166 also operates from the signal output of any B & K sound level meter, amplifier or analyzer to obtain Type 1 precision sound level meter performance or for the amplitude analysis of other parameters such as vibration or strain. The 166 can be used to obtain OSHA Mixed Exposure Level. In addition, it provides guidance for noise reduction engineering. Community sound levels exceeded 10, 50 and 90% of the time (L_{10}, L_{50}, L_{90}) can be readily estimated, as for instance when calculating Noise Pollution Level and Traffic Noise Index.



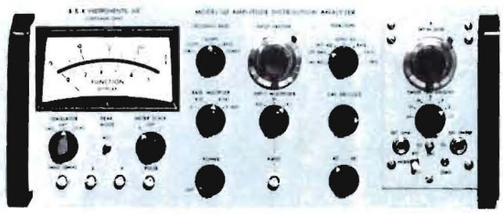
The Model 125 1/3-octave Graphic Frequency Response Equalizer modifies or shapes the frequency response of any audio spectrum.
The input signal drives twenty-five 1/3-octave filters. Separate solid-state amplifiers couple each filter to its own slide attenuator. An output amplifier sums the signal outputs from each attenuator and provides a low-impedance driving source. The twenty-five attenuators mount on the front panel of the Equalizer in a single row. Each attenuator controls the contribution of its associated 1/3-octave filter to the total output. Because the attenuators are logarithmic, the array forms a visual picture of the spectrum shape. The range of each attenuator is + 10 dB gain at the top to —40 dB attenuation at the bottom. A detent at the 0 dB level permits easy reset to initial condition. A variable gain control knob provides additional output gain from 0 to + 10 dB. VU meter on front panel allows operator to monitor input level to prevent overload, clipping and distortion, and maintains proper drive levels.
Frequency range is 63 Hz to 16 kHz filter center frequencies, 56 Hz to 17.5 kHz at the —3 dB points; 50 Hz to 20 kHz at —20 dB points. Total operating range is better than 50 dB. Selectivity of individual filters, 50 dB or greater at one-octave from center frequency. Signal to noise ratio, greater than 55 dB. Input impedance is 600 Ω or 100 kΩ, switch selectable. Other combinations of 25 adjacent filters are available on special order.
Typical uses include: signal shaping of acoustical spectra; simulating engineering changes for jury listening tests; simulation of hearing loss; simulating attenuation characteristics of structural partitions; and spectrum analysis.



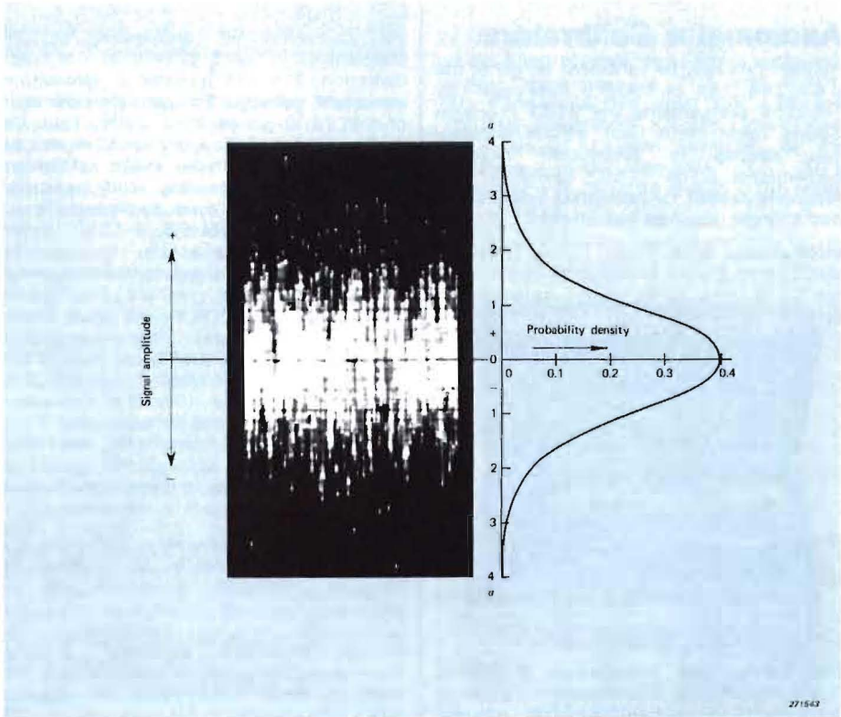
Amplitude Distribution Analyzer – Signal Conditioning System – Microphone Energizer-Multiplexer

The B & K Model 221 Microphone Energizer Multiplexer (MEM) is a multichannel power supply and main frame assembly housing seven plug-in modules. Six modules provide power supply, sensitivity, normalizing, and signal conditioning for B & K acoustic and vibration transducers when used with related preamplifiers. A seventh module serially scans the output of the six channels to provide a composite output. Features include individual channel output connections, manual stepping, and remote scan control. Specifically, up to six signals can be multiplexed to generate a phase insensitive average output which may be used in vibration control loops, vibration measurements, sound power measurements, reverberation decay measurements, multipoint acoustic control loops, or general-purpose multiplexing for economy in recording channels. The MEM is also used with the 3347 Real-Time Analyzer and 7504 Digital Computer for space averaged calculation of radiated machine noise.

The Model 222 Seven Channel Microphone Power Supply is used with Brüel & Kjær microphones and preamplifiers where up to 7 microphones are required simultaneously. Individual normalizing adjustments and switched gain from + 20 dB to —20 dB (10 dB steps) are provided on each of the plug-in signal modules. Low output impedance (< 1 Ω) and high output current (5 mA) makes the 222 ideal for driving long signal lines. Single or dual units may be rack mounted.



The Model 161 Amplitude Distribution Analyzer permits direct study of instantaneous signal amplitude distribution. It performs statistical analyses of complex, random, nonperiodic, and transient waveforms from 0.2 Hz to 20 kHz. Applied to stress and fatigue studies, the Model 161 can produce directly useful and meaningful data in chart form or digital form, depending on the readout instrument. For example, the distribution of stress reversal amplitudes can be displayed in chart form from tape recorded strain gage data. By superimposing the distribution data on a stress range diagram, a fatigue life prediction can be extrapolated. The Model 161 Amplitude Distribution Analyzer offers several distinct advantages over conventional frequency analysis methods. While spectral analysis of random signals appears as a neat, straight line, amplitude analysis preserves the signal peaks and phase formation necessary to fully characterize the random signal. Both analog and digital outputs are provided for plotting: probability density, cumulative distributions of amplitude probability, distributions of positive and negative amplitude peaks, and joint probability distribution. Outputs are included for counting or measuring level crossing (exceedances) and level crossing rates. In the case of zero-axis crossings, the 161 is a random noise frequency meter.



Hearing Aid Test Chamber – Audiometer Calibrators – Mastoid Control Oscillator

Hearing Aid Test Chamber.

The Model 4217/S Desk-like Hearing Aid Test Chamber was designed for the smaller calibration center to test all types of aids. It is a compact version of the larger B & K chambers used by hearing aid manufacturers and clinics. A significant simplification is provided as this new unit comes equipped with a built-in solid state sound generator test system variable in nine 5 dB steps from 50 — 90 dB. The 15 freq. checkpoints provided are at 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000 and 5000 Hz (cps). The anechoic test cell consists of a 9-inch cube, whose 3-inch thick sound-absorptive walls surround a screened test platform. In the center of this test area, a rectangular location marker is provided for correct and uniform positioning in the sound field, directly over the axis of the sound generator. In the 4217/S, the desired test environment is obtained by adjustment of potentiometers that correspond to each of the 15 test tones. For special tests and tape recorder efforts, an additional amplifier input jack is provided. The hearing aid under test is simply placed within the desk-like enclosure and subjected to the sound field being generated. An ANSI standardized 2-cc coupler conveys the output to a sound analyzer which gives the readout.
A sound analyzer is required, but not furnished as an integral part of the unit. The 2203 Sound Level Meter and 1613 Octave Analyzer are most commonly used. The 4217/S System can be used to perform the following tests: Frequency Response, Maximum Gain, Maximum Output, Relative Gain, Distortion, Linearity, and Stability. Audiometers can be tested by adding a 4152 Artificial Ear to the system.

The Model 230 Calibration Control Oscillator (CCO) is an 11 frequency push-button oscillator with preamplifiers to calibrate the B & K 4930 Artificial Mastoid. The 230 is used with the B & K 4931 Mastoid Calibrator and any of the B & K measuring instruments. The system is used to measure the absolute force sensitivity of the artificial mastoid. A mass compensation circuit corrects for impedance head errors. A complete bone conduction calibrator consists of 230 Calibration Control Oscillator, 4930 Artificial Mastoid, 4931 Mastoid Calibrator, and readout meter (such as 2203, 2209, 2606, or 2113).

Audiometer Calibrators.

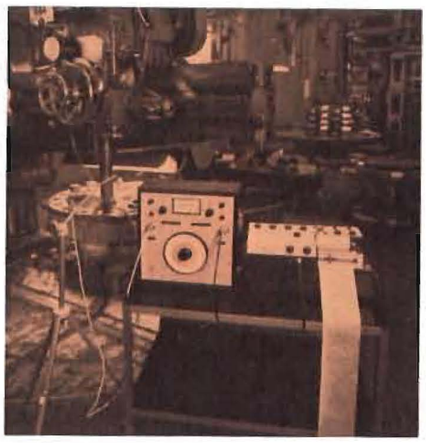
Audiometers may be calibrated on either the B & K 158, 159, or 3508/S. (See page 16). The 158 set contains the 2203 Precision Sound Level Meter and all the accessories needed to acoustically calibrate audiometers. The 159 combines the functions needed for calibrating audiometers into a single, compact instrument.

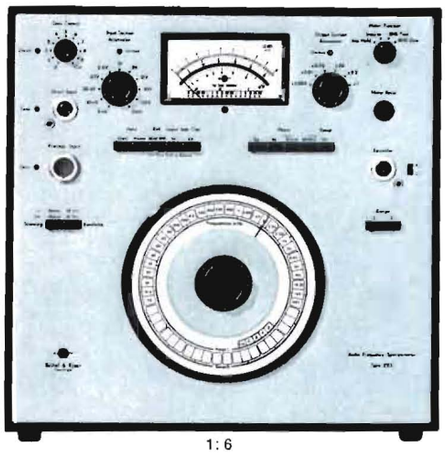
The Model 158 Audiometer Calibrator System meets an acute need for portable equipment to perform accurate acoustical calibration of audiometers at all compensatable hearing levels and to check distortion. The 158 includes a pistonphone acoustical calibrator for accurate calibration of the 2203 sound level meter. Thus the 158 can be used for every sound measuring need in the audiometer room: calibration, routine sound measuring, and measuring audiometric testing room background noise as required by ANSI S3. 1-1960. It has been approved and adopted by hospitals, universities, military establishments, manufacturers, and many others. The System includes: Model 2203 Sound Level Meter, 1613 Octave Band Filter Set, 4220 Pistonphone, 4152 Artificial Ear, 4144 Precision Condenser Microphone, DB-0909 Acoustic Coupler (6 cm^3), Calibration Procedure Manual, and Carrying Case.
Note: At a small additional cost, the 158 is available with the 2203 SLM replaced by the 2209 Precision Impulse Sound Level Meter.

The Model 159 Audiometer Calibrator is a self-contained, portable AC-operated instrument designed to provide all the necessary functions required to check and acoustically calibrate audiometers. The testing procedure employed provides proof-of-conformance to specifications outlined in ANSI S.3.6-1969 for audiometers. The Model 159 can serve also as a readout for calibrating bone vibrators when using the Model 4930 Artificial Mastoid as a reference.
The Model 159 reduces the calibration of conventional audiometers to simple terms. The operator depresses push-buttons to select the test frequency and hearing level. A meter reads ± dB deviation in output from the level set by the standard. Filters in the measuring system minimize the effects of room ambient noise and allow measurements down to 0 dB HL at each of the 11 test frequencies. Distortion is indicated 0 to 6% on the meter. Frequency is indicated digitally. Plug-in programming module is supplied for ANSI and ISO specifications for air conduction. Modules are also available for ASA air conduction and for bone conduction.

Frequency Analyzer – Spectrometers
Tracking Frequency Multiplier

1:6





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Type 2010 Heterodyne Analyzer is a frequency selective high gain measuring amplifier and a beat frequency oscillator. Frequency range is 2 Hz to 200 kHz in three ranges: 2 Hz to 2 kHz, 20 Hz to 20 kHz, and 200 Hz to 200 kHz continuously tuneable within each range. The weighting networks A, B, C and D are also built-in. The measuring amplifier contained is similar to Type 2607 but without impulse and peak indication. The meter indicates true RMS value for signals with crest factor up to 5 and averaging time is adjustable from 0.1 to 100 sec. Interchangeable meter scales with automatic meter zero level indication. Fast and Slow meter response as standardized for sound level measurements. AC and DC output. Lin-log converter allows lin or log meter indication and DC output. Built-in supply for B & K microphones and preamplifiers. The selective part has 3.5 dB bandwidth adjustable to 3.16, 31.6, 100, 316 and 1000 Hz. Automatic frequency control can be used with 4 lower bandwidths. Frequency scale lin and log. Frequency sweep can be controlled manually, mechanically from external drive or from ext. DC voltage. 6 digit Nixie display for very accurate frequency reading. B & T program allows Bandwidth and Time constant of rectifier to be varied with frequency at 5 fixed cross-over frequencies for Power Spectral Density measurements. 3 modes are available: B variable, T variable or B and T variable (B x T constant). Bandwidth compensation according to $1/\sqrt{B}$ can be switched in. B & T program can also be externally controlled. External filters can be connected and signals for tuning of Heterodyne Slave Filter Type 2020 are available. The BFO has compressor circuit with adjustable compressor speed for automatic control of output voltage and 50 dB regulation range. Output voltage is adjustable in 10 dB steps from 0.1 mV to 10 V and continuously within each 10 dB. Output impedance 600 Ω. 5 Ω — 0.7 W output continuously adjustable from 0 to 10 V is also available. Driven from Level Recorder Type 2305 or 2307 frequency analyses and response curves can be recorded automatically. Marker pulses for exact frequency determination on recording paper are available. Also tunable from Tracking Frequency Multiplier Type 1901 which locks onto and tracks the fundamental or harmonics of a periodic signal. A, B or C model.

1:8

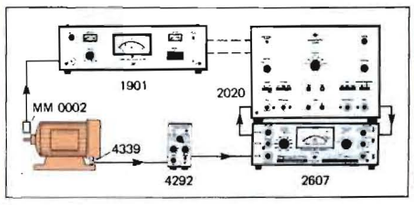
Type 1901 Tracking Frequency Multiplier controls the Slave Filters Types 2020 and 2021 and the Frequency Analyzer Type 2010. The 1901 locks onto and tracks the fundamental or harmonics of a periodic signal whose frequency may vary over wide limits. Typical applications are measurement on rotating machinery and automatic harmonic analysis. Type 1901 input accepts 30 mV to 300 V RMS (80 dB) signals with practically any periodical waveform. Frequency range 20 Hz to 200 kHz with 2010, 10 Hz to 20 kHz with 2020, and 5 Hz to 10 kHz with 2021. Frequency multiplication from N = 0.1 to 99.9 with 2020 and 2021 in 0.1 steps, and N = 1 to 999 with 2010. Also N x line frequency triggering. With simple external frequency divider any fraction is obtainable. Frequency meter shows input frequency (f_1) or $N \times f_1$. $N \times f_1$ output, TTL level square wave. Automatic bandwidth control information to 2020, 2021 and 2010. DC output: Lin or Log frequency to DC converter following f_1 or $N \times f_1$, may be used to control the Level Recorder Type 2307 or an X-Y recorder. A, B or C model.

Type 2113 Frequency Spectrometer for frequency analysis in the frequency range from 25 Hz to 20 kHz, contains measuring amplifier with specifications as Type 2606 and filter set with specifications as Type 1615. A, B or C model.

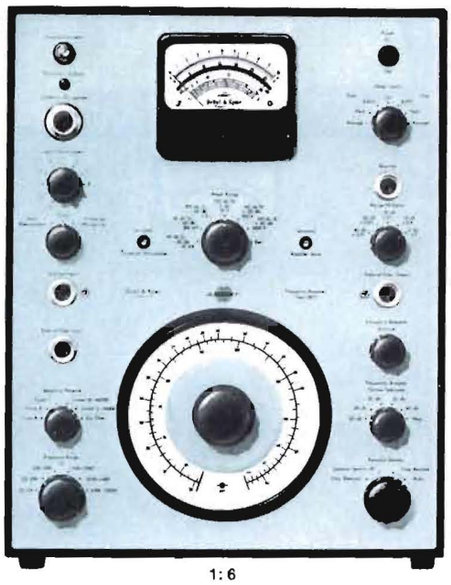
Type 2114 Third-Octave and Octave Spectrometer for frequency analysis in the frequency range from 2 Hz to 160 kHz. Contains measuring amplifier with specifications as Type 2607 and filter set with specifications as Type 1614. A, B or C model.

ZS 0163 — ZS 0164 — ZS 0165 third octave filters contain three filters each with centre frequencies 25, 31.5 and 40 kHz; 50, 63 and 80 kHz; and 100, 125 and 160 kHz respectively. Mount into Types 1615 and 2113 for extension of the frequency range upwards. XZ 0013 necessary with ZS 0164 and ZS 0165 when used in 1615.

ZT 0001 — ZT 0011 third octave filters with centre frequencies from 2 Hz to 20 Hz mount into Types 1615 and 2113 for extension of the frequency range downwards.



Frequency Analyzers – Noise Limit Indicator



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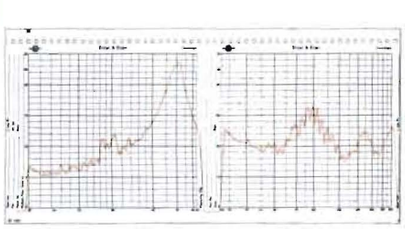
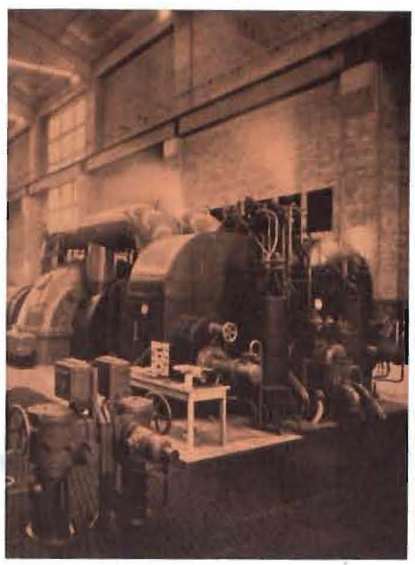
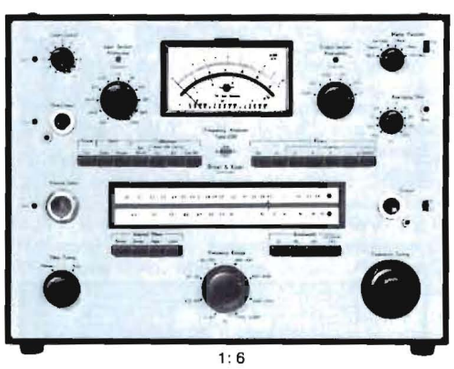
Type 2107 Frequency Analyzer is a frequency selective high gain measuring amplifier, continuously tuneable through the frequency range 20 Hz to 20 kHz, divided into six ranges. The filter is a constant percentage bandwidth type, with bandwidth adjustable in steps from 6% to 29%. The weighting networks A, B and C standardized for sound level measurements are built-in and can be inserted in series with the filter allowing frequency analysis of weighted signals. Automatic recording on preprinted, frequency calibrated paper of frequency analysis when the analyzer is connected via flexible shaft to Level Recorder Type 2305 or 2307. Meter indication for true RMS, average or peak value, with two meter dampings. Meter scale is calibrated in Volt, dB and in % absorption for measurements in connection with Type 4002. Input sockets, and power supply for preamplifier, as described for Type 2606. Sensitivity 100 μV to 1000 V for full deflection. Used as voltmeter or measuring amplifier frequency response is linear from 2 Hz to 45 kHz. Used with condenser microphone and preamplifier the instrument fulfils the IEC R179 for precision sound level meters. Possibility for connection of external filters such as Types 1615, 2020 or ZS 0301. A, B or C model.







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Type 2120 Frequency Analyzer is a frequency selective, high gain measuring amplifier, continuously tunable through the frequency range 2 Hz to 20 kHz, in eight sub-ranges. The measuring amplifier section is identical with the Type 2607 including RMS, impulse and peak indication, switchable lin. or log. meter deflection and output, and interchangeable meter scales. The frequency selective section can be switched as a tunable constant percentage pass band filter with bandwidths of 1%, 3%, 10% and 1/3 octave, as a tunable band stop filter and as tunable high or low pass filter. The weighting networks A, B, C and D for sound level measurement are built in, and these or external filters can be used alone or inserted in series with the frequency selective section. Automatic recording of frequency analyses can be made on preprinted frequency calibrated paper when the analyzer is connected via a flexible shaft to Level Recorder Type 2305 or 2307. B & K standard screened input socket and 7-pin socket supplying all voltages for B & K condenser microphone assemblies. Used with a condenser microphone and preamplifier the instrument fulfils the IEC R179 for precision sound level meters and the proposed standard for impulse sound level meters. A, B or C model.

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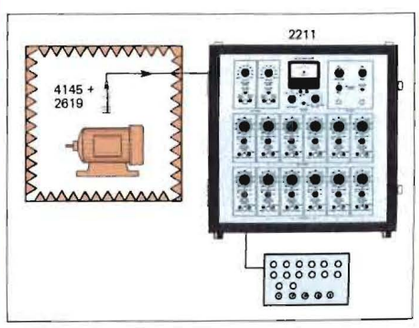
Type 2211 Noise Limit Indicator is designed to check that the noise generated by manufactured units (such as vacuum cleaners, refrigerators, gear boxes etc.) does not exceed a pre-determined limit and to classify the products in noise classes.
It contains two input amplifiers, twelve output amplifiers, relay and meter circuits, and power-supply. Each output amplifier can be equipped with a band-pass filter to measure noise in twelve frequency bands simultaneously. Each band can be set to maintain its own individual noise or vibration limit. Lamps indicate in which frequency band the limit has been exceeded. Each input amplifier has input sockets for microphone and accelerometer. The instrument can be switched to control two inputs successively with all 12 filters or to control two inputs simultaneously with 6 filters each. A or C model.

ZS 0250 Filter Set for Type 2211. To be ordered separately. Contains 33 third octave filters with center frequencies of 12.5, 16, 20 Hz . . . 20 kHz. The filters with center frequencies of 16, 31.5, 63 Hz . . . 16 kHz can be switched to a width of 1/1 octave, maintaining their center frequencies.

ZS 0251 Filter Set comprises the 11 switchable filters contained in ZS 0250.

ZS 0240 Filter Set contains A, B and C weighting networks for Type 2211.



Real-Time 1/3 Octave Frequency Analyzer

Type 3347 Real-Time 1/3 Octave Analyzer is a versatile measuring system for fast frequency analysis of sound, vibration and other phenomena in the audio frequency range. It can investigate any complex or impulsive signal and provide the results in a real-time CRT display and digital readout. The complete channel display is renewed every 20 msec. The level in each channel can be read in dB directly on the screen, while a Nixie display shows the output level of any selected channel.

The standard version of the analyzer is fully prepared for 38 channels. It contains 30 third octave filters with center frequencies from 25 Hz to 20 kHz. One channel is used for one of the weighting networks A, B, C and D selected by a push-button, and one channel is reserved for the lin. filter. With options, the center frequency range can be extended to 12.5 Hz to 40 kHz and the lin. filter with frequency range 22.4 Hz to 22.4 kHz can be used.

Outputs are provided for analogue instrumentation such as X — Y and level recorders and for digital data receivers, such as a tape puncher, printer or computer "on-line". The digital output is in BCD code.

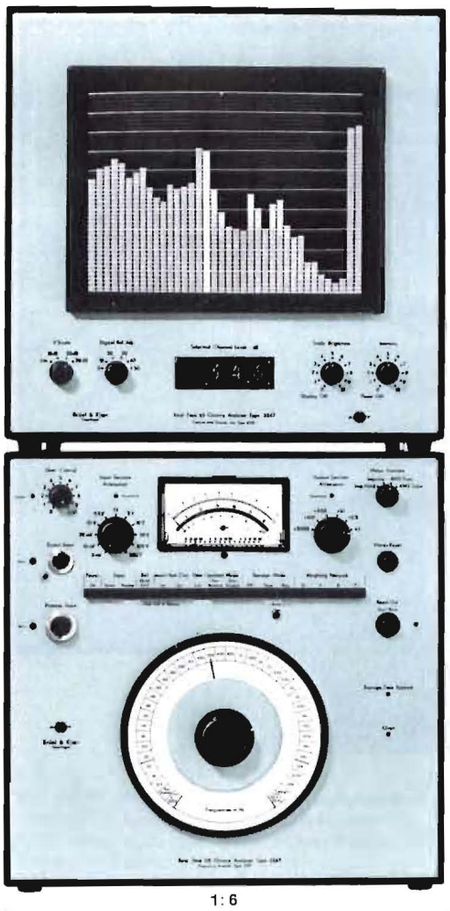
The external digital equipment controls the read-out function. Joining the 3347 to a suitably programmed computer forms a flexible and very rapid system for automatic data processing with the advantages of real-time analysis. Typical calculations that can be performed are PN dB and all its variations, vehicle noise analysis, Kryter, Stevens and Zwicker loudness etc.

The 3347 is a combination of the **Frequency Analyzer Type 2130** and the **Control and Display Unit Type 4710.**

In the standard version the **2130** contains a measuring amplifier similar to the 2606 (described on page 18), filter channels with 1/3 octave bandwidth, one weighting channel, and the synchronization system for scanning the channels. Each channel includes a true RMS detector, integrator and storage circuit. The RMS detector can handle signals with crest factors up to 5 (14 dB). The filter characteristics conform to DIN 45652, IEC 225-1966 and ANSI S1. 11-1966 Class III. Time constant can be selected to "Sine", "Fast Random" and "Slow Random". In the two first positions the time constant is varied with frequency at low frequencies to maintain similar confidence levels. Time constants for weighting networks are 0.2 sec, 2 sec and 20 sec in the three different time constant modes.

Time constants from 20 msec to 20 sec can be supplied on special order. Three storage modes can be selected: "Store Off", "Store" and "Store Max".

The 4710 contains the circuitry for the 12" CRT and Nixie displays and a logic control. The CRT displays the audio spectrum in up to 36 columns and in 2 columns the levels in one of the weighting networks and in the linear pass-band (option). Upper line can be varied to indicate from 150 dB to 50 dB above 10 μV. Display ranges of 10, 25 and 50 dB and a linear range can be selected.



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Scales are produced electronically on the screen giving parallax-free reading and are changed automatically according to selected display range. Overload of the 2130 is indicated by a brightening of the whole CRT display, and lamps on the 2130. The 4-digit Nixie display shows the signal level in dB in the channel selected by the 50-position dial on the 2130. Simultaneously this channel is lit up more intensely on the CRT. Multiplexer output for recorders is DC. When connected to a B&K Level Recorder the channel switching rate is controlled by the recorder. When connected to an X — Y recorder the X — Y recorder control ZH 0045 must be added. Two recording modes are available. In the "Via Store" setting a stored signal is recorded and in the "Store Off" setting the level recorded is the true value at the instant the channel is scanned. Continuous recording (AC or DC) of any manually selected channel can also be made. Digital output is in 8—4—2—1 BCD code and contains 16 parallel bits per channel. Read out time for complete spectrum is 2.15 msec independent of time constant.

Calibration is easily made by built-in ref-voltage at 1 kHz. Once adjusted to correct reading on the displays, range changing does not affect calibration. Display Units with serial numbers higher than 423127 can without modification be combined with the 2030 and 6701 (see under 3348) to become a Real Time Narrow Band Analyzer (400 channels). A or C model.

Options:

ZT 0997	12.5 Hz filter and detector
ZT 0998	16 Hz filter and detector
ZT 0999	20 Hz filter and detector
ZS 1010	25 kHz and 31.5 kHz filter and detectors
ZS 1011	40 kHz filter and detector

Together with one or more of the above mentioned filters one **ZH 0026** Scanner must be ordered. Other options:

ZL 0010 Detector for Lin. filter, **ZH 0045** X — Y recorder control, **ZT 0040** A-weighting filter, plugs into the preamplifier input socket and allows frequency analysis of the weighted signal. **AR 0500** Set of Extension boards (for service use).

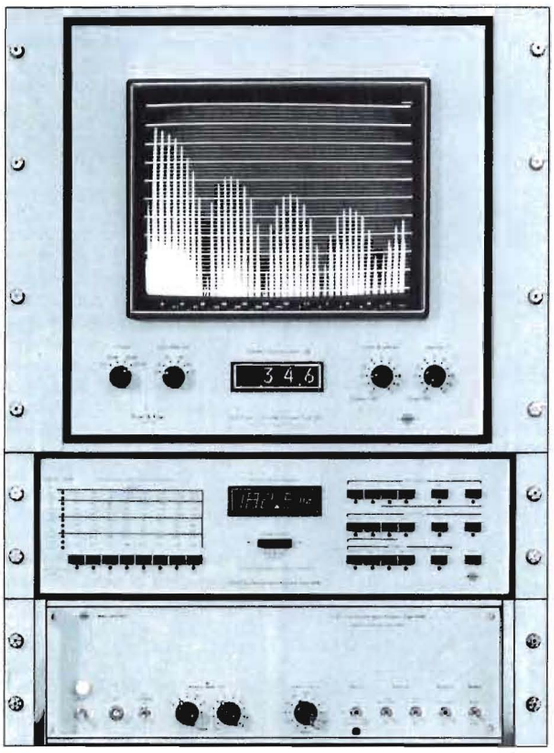
Special Options: (Instruments to special order).

Type 5649 Expander Unit contains 8 third octave filters with center frequencies from 2 Hz to 10 Hz. When connected to optional version of 3347 including filters down to 12.5 Hz, 38 of the total 46 (38 + 8) channels can be displayed on 4710 and read-out.

See Page 34 and 35 for the following instruments which also expand the application possibilities of the Real-Time Analyzer:

Type 5614 Maximum Spectrum Selector
Type 5617 Spectrum Reference
Type 5619 Channel Selector
Type 5623 Gauss Impulse Multiplier

Real-Time Narrow Band Frequency Analyzer



3348 C 1:6

Type 3348 Real-Time Narrow Band Analyzer is a hybrid measuring system for fast, narrow band, real-time frequency analysis. It is designed for use within the fields of vibration and noise monitoring and analysis, speech and shock analysis and power spectral density measurements.

It provides a 400 channel, constant bandwidth calibrated spectrum, which can either be displayed on the 12" CRT, be recorded in analog form on Level Recorders Types 2305 and 2307 or on an X — Y recorder (option) or be digitally read out, stored, or processed further in peripheral data handling equipment.

The spectrum displayed is updated every 45 msec or a spectrum can be held in the memory and displayed continuously. Automatic switching enables comparison between different spectra.

The instrument is equipped with an automatic transient capturing facility which is activated when a preset trigger level is exceeded. The memory stores 800 samples after the trigger point and 400 samples prior to triggering.

The analyzer works according to the principle of time compression i.e. speeding up the signal to be analysed in order to compress it in its time domain, thus forming a high frequency replica of the signal. Hereby, a very short analysis time is achieved, compared to that of conventional analyzers. The system is also characterized by having a lower limiting frequency of 0 Hz and by the ease with which frequency range and analysis bandwidth can be selected to suit the purpose.

The system features eleven frequency ranges from 0 to 10 Hz through 0 to 20 kHz in a 1 — 2 — 5 sequence. The bandwidth (3 dB point) is 0.4% of the frequency range selected (with Hanning function active) which in the 0 to 10 Hz range gives an actual bandwidth of 0.040 Hz. The dynamic range of the system is 50 dB (below single tone overload level). The system offers facilities for linear as well as exponential averaging of statistically independent spectra with 8 averaging times/time constants in each frequency range. The system also offers full remote control of all functions.

The 3348 consists of three units: Type 2030 Spectrum Analyzer, Type 6701 Averager and Interface Control, and Type 4710 Control and Display Unit.

Type 2030 Time Compression Analyzer consists principally of three sections: Input and Timing, Memory section, and Analog Output and Filter section. In the Input and Timing section the signal is lowpass filtered in antialiasing filters, sampled at three times the frequency range chosen, (the sampling may also be externally controlled) and converted into digital words of eight bits. In the Memory section the digital samples are circulated at a rate of 12×10^6 words/sec (recirculation time 0.1 msec). In the Output and Filter section the words are converted to an analog signal in the range 0 to 4 MHz. The compression factor (frequency multiplying factor) is hereby, for a 10 Hz signal, 4×10^5 and for a 20 kHz signal 200. The signal is further mixed and band pass filtered to a 250 kHz signal of varying amplitude. This signal can, at the users choice, be $\cos^2$ time weighted (Hanning Window) in order to avoid the effects of truncation. The 250 kHz signal is sampled in order to form the output signal which is the frequency spectrum. The 2030 offers the possibility of squaring the single values of the spectrum (for PSD measurements).

Type 6701 Averager and Interface Control operates on the output of the 2030 in one of three ways:

1. It provides a non-averaged "speeded-up" spectrum to the Display Type 4710 at double rate to avoid flickering,
2. It provides a linear averaged spectrum of a preset number of statistically independent spectra. The number of spectra averaged can be set to 8, 16, 32, 64, 128, 256, 512 and 1024 thus giving eight averaging times in each frequency range.
3. It provides an exponentially averaged (equal to RC averaging) spectrum with time constants identical to the averaging times available in the lin. averaging mode.

The 6701 contains two display memories which enable comparison of two different spectra. This set-up has three working modes:

1. Comparison of two continuously updated spectra,
2. Comparison of a continuously updated and a stored constant spectrum,
3. Comparison of two stored, constant spectra.

The 6701 has a digital display which shows the frequency of a manually selected channel, the level of which is displayed on the 4710. The channel in question is shown on the CRT with greater intensity than the other channels.

Type 4710 Control and Display Unit (see under 3347) displays the 400-channel spectra received from the 6701. The 4710 can however also be combined with the 2130 (see under 3347) to form a Real-Time 1/3 Octave Analyzer (38 channels).

3348 is available as A or C model.

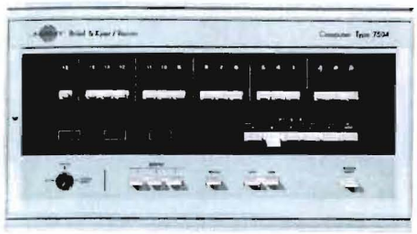
The following instruments are available for expanding the application possibilities of the Real-Time Narrow Band Analyzer:

Type 5619 Channel Selector

Type 5623 Gauss Impulse Multiplier

A description of these instruments appears on pages 34 and 35.

Instrumentation Computer and Peripherals
Digital Event Recorder



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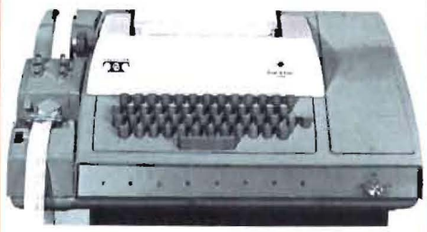
Type 7504 Computer is a Varian computer modified for direct attachment of B & K digital equipment. The 7504 features a memory of 4096 (4 k) 16 bit words expandable to 32 k in modules of 4 k, a memory cycle time of 950 nsec, nine hardware registers and various programs for analysis, computation and testing. Compilers for FORTRAN and BASIC (min 8 k). C model only.
For specialized application programs the technical staff at B & K includes application programming specialists well qualified to assist the user.



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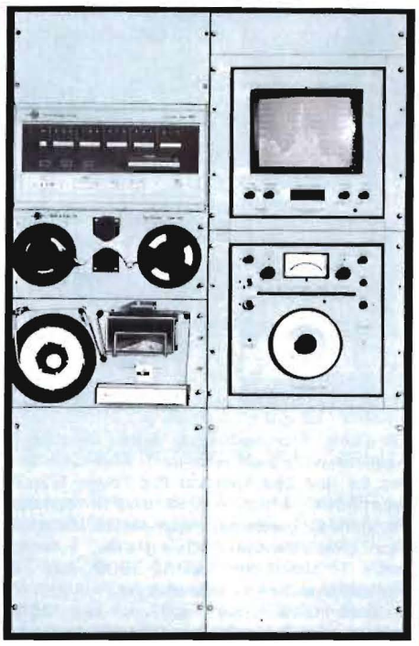
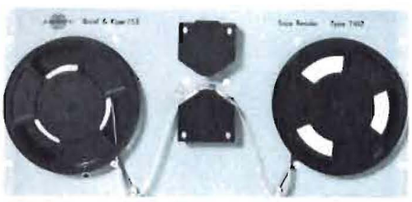
Type 6401 Teletypewriter is used for communication between the Computer 7504 and the user. It is a "Teletype" ASR 33 modified to work together with the computer. It features a speed of 10 characters per second, a paper tape punch mechanism and a tape reader.



ZH 0075 Memory Extension expands the memory of Type 7504 by 4,096 words (4 k). First extension fits into main frame of Computer 7504.

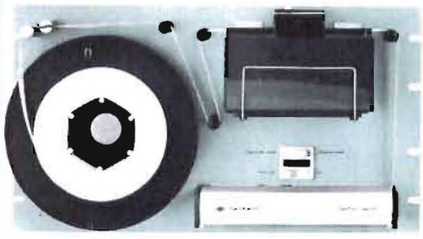
QP 6000 Roll of 1" paper tape for Tape Punch Type 6301 and Teletypewriter Type 6401. Length 300 m (900 ft).

QP 6100 Roll of 8.5" wide paper for Teletypewriter Type 6401. Length 100 m (300 ft).



1: 8

Type 7102 Tape Reader reads punched standard 1" tape with a speed of up to 125 characters per second. It is a photoelectric tape reader modified to work with the Computer 7504 and features normal and reverse reading, simple tape loading and high speed spooling. C model only.



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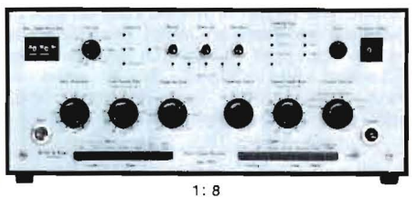
Type 6301 Tape Punch is a 1" paper tape punch capable of punching 8 channels at up to 75 characters per second. It is used mainly for fast read-out from the Computer 7504 and the Real-Time Analyzers 3347 and 3348. The read-out is in two selectable standard formats. A or C model.



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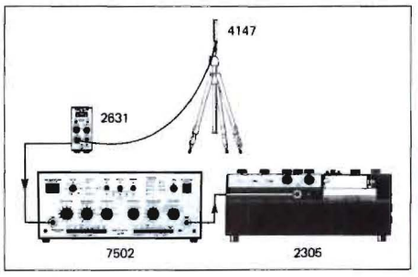
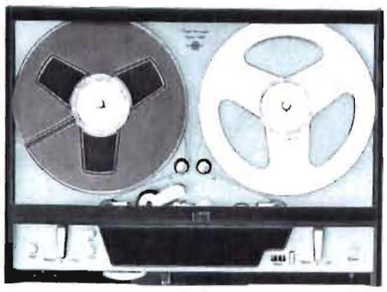
Type 7502 Digital Event Recorder is designed to capture short duration events and to reproduce them when desired in almost any speed transformation ratio. The instrument is ideally suited for use in systems for monitoring, frequency analysis of shocks, transients and low frequency signals and as a delay line. The instrument has the possibility for internal or external triggering and independent choice of record and play-back sample rate. Trigger level, delay, and record time after triggering are all adjustable. Built-in antialiasing filters ensure proper operation both at record and play-back at all sampling frequencies. Frequency range is DC to 25 kHz (Sample rate 100 S/sec to 100 kS/sec) in record mode and DC to 125 kHz (Sample rate 0.5 S/sec to 500 kS/sec) in play-back mode. With internal antialiasing filters the frequency range is DC to 1/4 x sample frequency. External sampling is also possible. The instrument has analog and digital inputs and outputs, 8 bit resolution and memory size can be varied in 2 k steps from 2048 to 10240 points. Delivered with 4096 points memory. Extra 2048 points plug-in memory modules available as **ZD 0046.** A, B or C model.



Tape Recorders-Frequency Response Tracer



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Types 7003 and 7004 Tape Recorders are portable, battery powered instrumentation recorders using 1/4" professional tape on 7" reels. Their flutter values are extremely low and a differential capstan drive eliminates tape speed changes due to movement of the recorder. Circuitry for the recording of comments is included. Exchangeable plug-ins allow the 7003 to be converted to a 7004 and vice versa. The **7003** is a four channel FM recorder intended mainly for vibration measurements and has two tape speeds for frequency transformation. Direct recording and reproducing plug-in cards are available for this model. The **7004** is a two channel Direct recorder intended mainly for acoustic

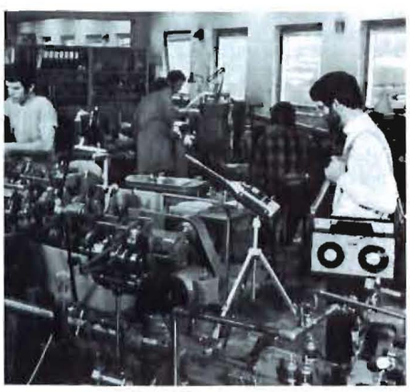
1:7

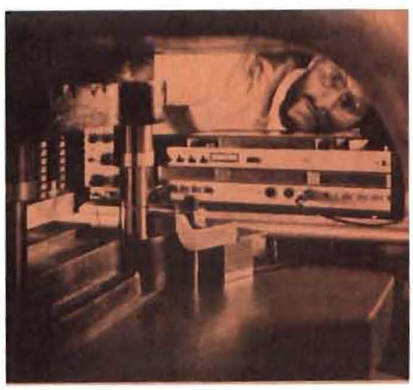
measurements. It has three tape speeds in two modes to provide wide frequency and dynamic ranges.
An easily attached Tape Loop Casette is supplied with both recorders. The recorders can be line operated via the Power Supply Type 2808, which is also used to recharge the built-in batteries. Accessories included: Tape loop cassette, carrying case, 1 empty reel, 1 tape reel with 3600 feet of professional tape, 1 microphone.
Accessories available: Tape reel with 3600 feet of professional tape **QR 1004**. Direct record and reproduce plug-in cards **ZE 0120** and **ZE 0121** for 7003.

Type No.	7003				7004			
Mode	"FM"		"Direct"▲		"Direct"		"Audio"	
Tape speeds	1.5 ips 3.81 cm/s	15 ips 38.1 cm/s	1.5 ips 3.81 cm/s	15 ips 38.1 cm/s	1.5 ips 3.81 cm/s	15 ips 38.1 cm/s	7.5 ips 19.05 cm/s	15 ips 38.1 cm/s
Frequency Ranges	0 Hz to 1 kHz (± 1 dB)	0 Hz to 10 kHz (± 1 dB)	25 Hz to 5 kHz (± 3 dB)	100 Hz to 50 kHz (± 3 dB)	2.5* Hz to 5 kHz (± 3 dB)	25 Hz to 50 kHz (± 3 dB)	25 Hz to 18 kHz (± 2 dB)	25 Hz to 20 kHz (± 2 dB)
S/N Ratios	> 39 dB	> 44 dB	> 39 dB	> 39 dB	> 50 dB (Lin)	> 50 dB (Lin)	> 60 dB (A)	> 60 dB (A)

▲ With optional plug-ins

* Recording only





1:7

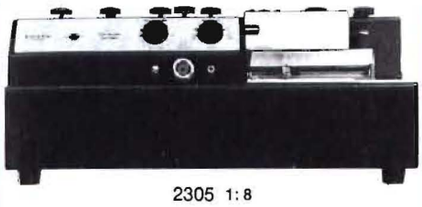
Type 4712 Audio Frequency Response Tracer for production testing and inspection of amplifiers, record players, tape recorders, filters, loudspeakers and other elec-troacoustic devices in connection with a sweep oscillator. Displays frequency response curves on a 14", long persistance screen. Dynamic ranges are: 50 dB, 25 dB, 5 dB logarithmic and 0 to 1 V linear. The horizontal deflection is determined by the frequency of the input signal. Standard frequency ranges are 20 Hz to 20 kHz and 200 Hz to 5 kHz. Used with generators type 1022 or 1024 frequency sweep is automatic with built-in motor (included with 4712). Sweep speed, range and direction is adjustable. A or C model.

1:7

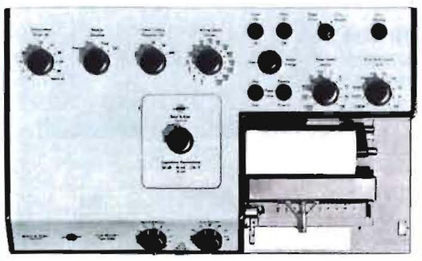
Type 2972 Tape Signal Gate is designed for gating signals so that only the desired part of the signal is allowed to pass to the output. The length of the window as well as the time between an initial point and the window can both be varied in steps between 0.1 msec and 30 sec. It is used in connection with the Tape Recorders 7003 and 7004 and the Digital Recorder 7502.

1:7

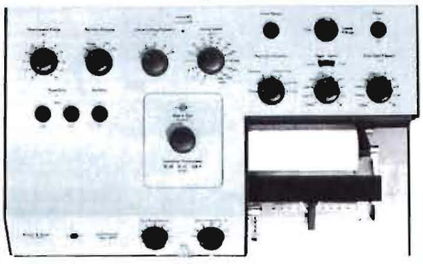
Type 2808 Power Supply is intended for line operation of Tape Recorders Types 7003 and 7004 and for recharging their internal NiCd-batteries. It can also be used for recharging NiCd-batteries for Sound Level Meters Types 2203 and 2209.



2305 1:8



2307 1:8



ZR 0001/06

1:6

QI 0001/02

Types 2305 and 2307 Level Recorders are designed for the accurate recording of signal levels in the frequency range from 2 Hz to 200 kHz as well as for the recording of DC signals. The two recorders are based on the same working principle, the type 2307 including several features offering easier operation and greater versatility than Type 2305.

Levels may be recorded as a function of time using lined paper or as a function of frequency, in conjunction with one of the B & K Beat Frequency Oscillators or Frequency Analyzers, using frequency calibrated paper. Type 2307 furthermore features possibility for the control of the paper drive movement in both directions by means of an external DC voltage. It can thus be used to record the relationship between two varying voltages. Sensitivity in this mode is 15 to 50 mm/V.

Recordings on both recorders can be made by means of ink or by means of a sapphire stylus writing on wax-coated paper. Two chart widths: 100 mm (4") or 50 mm (2"). Peak-to-peak, average or true RMS detection. (Crest factor capability for Type 2305 is 5 while it is 10 for Type 2307). 15 different writing speeds can be chosen: 4 mm to 2000 mm per sec with 100 mm writing width, and 2 mm to 1000 mm per sec with 50 mm writing width. Twelve chart speeds from 0.0003 mm/sec to 100 mm/sec. 6 high resolution input potentiometers available providing dynamic ranges from 10 dB to 75 dB. Built-in reference voltage of 100 mV. Built-in polar plotter. Two shafts with individually variable speed for connection to other B & K instruments are included (for synchronous operation with oscillators, analyzers etc.). Remote control of pen lifting, eventmarker and paper drive motor. Built-in control switch for Spectrometers Type 2113, 2114, Filters 1614 and 1615 and read-out control with Real-Time Analyzers 3347/48 and Digital Encoder 4421. Specify 50 or 60 Hz when ordering. A, B or C model. See also combining system pages 28—29.

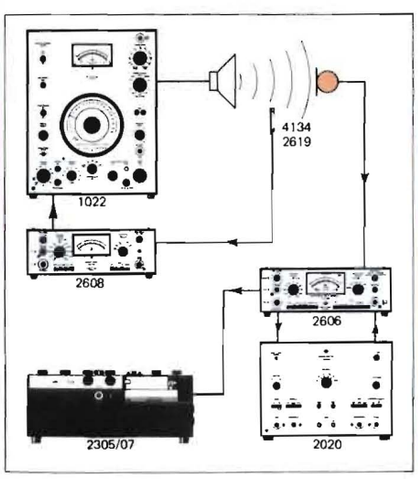
Accessories included: 1 Range Potentiometer (ZR 0005, 50 dB unless otherwise specified). 2 rolls of paper, 2 sapphire styli, 1 reverberation curve protractor, SC 2361 and (for 2305) 1 inking kit **QI 0001** containing: inking pens, eventmarker pen, 10 cartridges of black, 10 cartridges of red and 10 cartridges of green ink. Type 2307 includes Inking **Kit QI 0002** containing same items as QI 0001 less the eventmarker pen as no special pen is required.

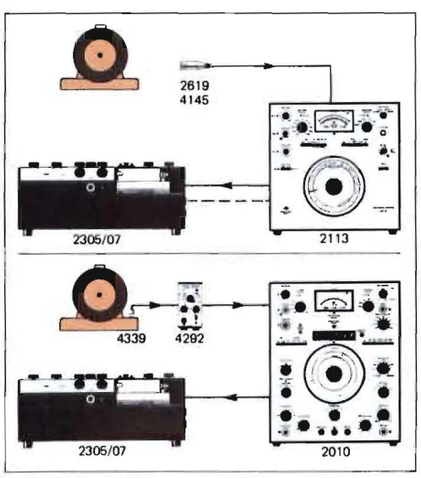
Order No.	Response	Range Potentiometers for 2305 and 2307: 2305 AC (RMS) / 2307 AC (RMS) / 2307 DC	2305 DC
ZR 0001	Linear	5-17.5 mV	10-35 mV
ZR 0002	Linear	5-55 mV	10-110 mV
ZR 0003	Log, 10 dB	50-160 mV	100-315 mV
ZR 0004	Log, 25 dB	5-90 mV	10-180 mV
ZR 0005*	Log, 50 dB	5 mV-1.6 V	10 mV-3.15 V
ZR 0006	Log, 75 dB	5 mV-28 V	10 mV-56 V

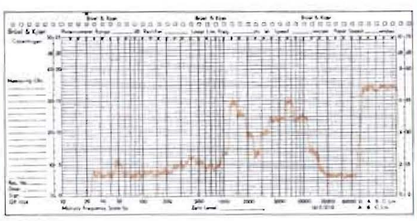
*) Included unless otherwise specified.

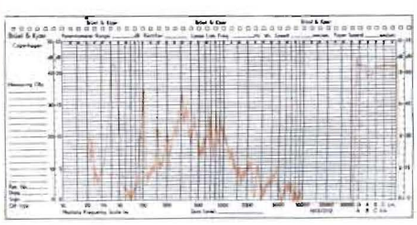
Accessories available:

QI 0100 100 cartridges of black ink.
QI 0200 100 cartridges of red ink.
QI 0300 100 cartridges of green ink.
QI 0003 6 fibre pens, 2 black, 2 red, and 2 green.
QI 0004 6 black fibre pens.
QI 0005 6 red fibre pens.
QI 0006 6 green fibre pens.
Note: The fibre pens cannot be fitted to 2305 Event Marker.





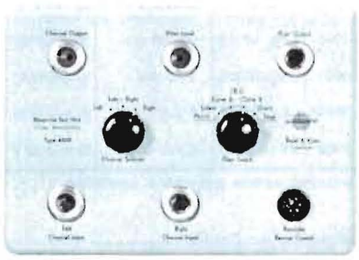




Instruments and Accessories for Level Recorders

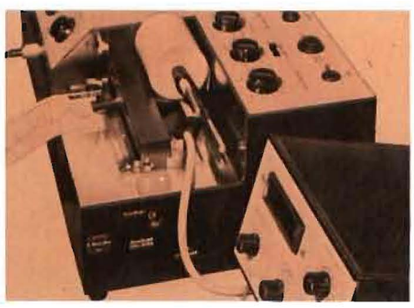
1:8

Type 3921 Turntable is designed to rotate a test object (such as antenna, loudspeaker etc.) in synchronism with the rotation of the polar diagram paper on the Level Recorder Type 2305 or 2307. Max. table load at center: 100 kg. Specify 50 or 60 Hz when ordering.



1:6

Type 4409 Response Test Unit for Tape and Record Players is designed for automatic recording of frequency response curves and testing for cross talk of sound reproducing equipment. Used in conjunction with Level Recorder 2305 or 2307, Beat Frequency Oscillator 1022 or Frequency Recordings QR 2009 and Amplifiers 2606, 2607 or 2608. Contains synchrostarter, equalizing filters, and two channel selector for simultaneous recording of stereophonic signals.



1:6

Type 4420 Statistical Distribution Analyzer resolves the writing width of the Level Recorder 2305 or 2307 into 12 class intervals, and presents a digital display of the distribution of recorded levels. Connected to Noise Limit Indicator Type 2211, it indicates the time input level has exceeded preset limit in each frequency band.
For use with Type 2305 Mounting Set UA 0325 must be ordered separately.

1:6

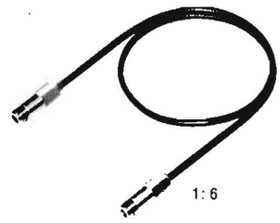
Type 4421 Digital Encoder is designed for transforming the analog data recorded on the Level Recorder Type 2305 or 2307 into B—C—D code. The Encoder features an addition and subtraction network which in connection with an internal or external reference allows easy calibration for read-out of correct dB values. These values are available either on the built-in Nixie display or at the output in B—C—D code which can be transferred directly to the Tape Punch 6301 or the Computer 7504. For use with Type 2305 Mounting Set UA 0325 must be ordered separately.

1:6

SC 2361 Protractor for determination of reverberation time from decay curves recorded on Level Recorder Type 2305 or 2307.

1:6

UB 0009 Mechanical Extension Connector for the connection of two flexible shafts UB 0041.



1:6

UB 0041 Flexible Shaft for the mechanical connection between Type 2305 or 2307 and other B & K instruments. Included with Types 1022, 1013, 1017, 1024, 2107, 2120 and 2010.

1:6

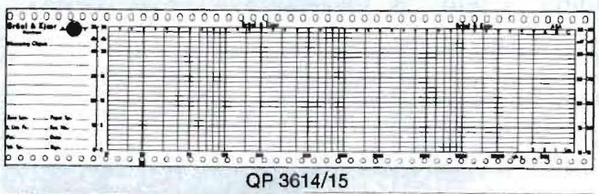
UG 3000 Gear mounts onto the Oscillators Type 1022 and 1024, and should be used when the Level Recorders are used in set-ups with Heterodyne Slave Filter Type 2020. Secures more accurate sweep speed regulation.

1:8

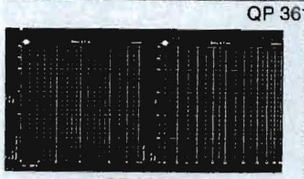
QR 2009 Stereophonic Gliding Frequency Records. Five 12" 45 rpm records with identical surfaces bearing a series of calibrated stereophonic recordings. Each side contains 2 x 4 tracks with a 20 Hz to 20 kHz logarithmic frequency sweep modulated as follows: 45° left, 45° right, lateral and vertical in accordance with IEC R 98/98-1. For use with Type 4409.

1:6

ZR 0021 Analog Voltage Read-out for Level Recorder Type 2305 or 2307 contains a potentiometer mechanically linked to the writing arm of the Level Recorder providing a voltage output suitable for analog to digital converters.
For use with Type 2305 Mounting Set UA 0325 must be ordered separately.

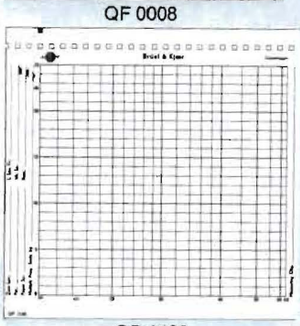


QP 3614/15

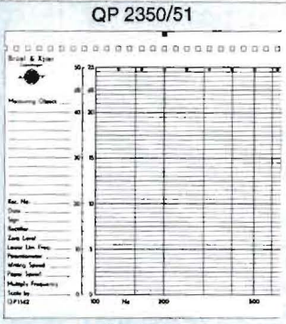


QF 0008

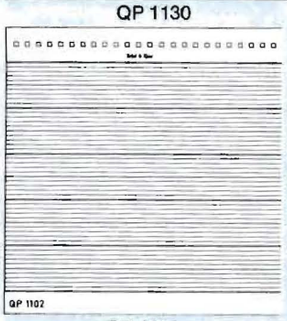
QP 2350/51



QP 1130



QP 1142



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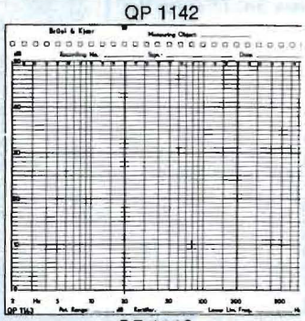
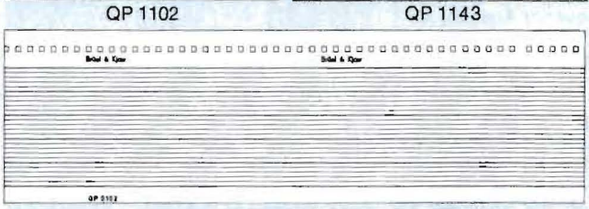


QP 1143

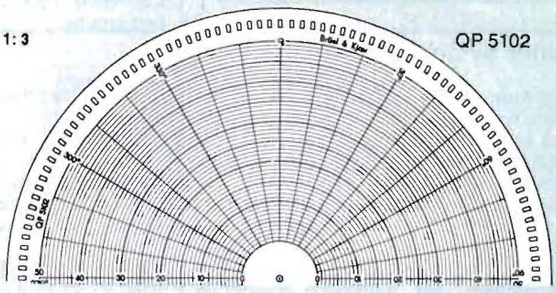


QP 0102/0202

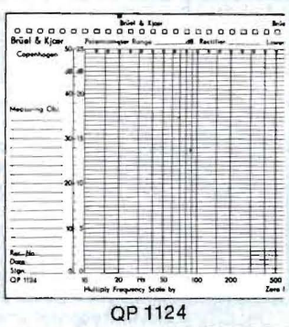
RECORDING PAPER FOR TYPE 2304 (early model)
Rolls of 60 metres

	Lined for 10, 25 and 50 dB potentiometer	Frequency calibrated 10 Hz—32 kHz
White paper for ink writing	QP 2350	QP 3614
White waxed black paper for stylus writing. Width 50 mm	QP 2351	QP 3615
QF 0008. Photographic negative and dia-positive for blueprinting of the calibration graph corresponding to the frequency calibration of Type 2107.		

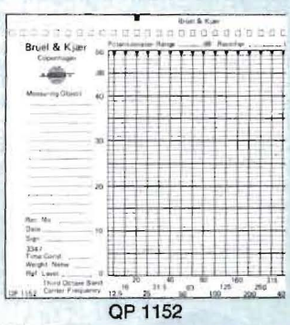
1:3



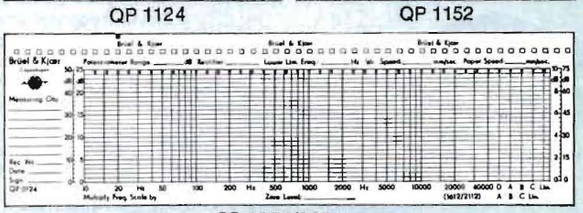
QP 5102



QP 1124



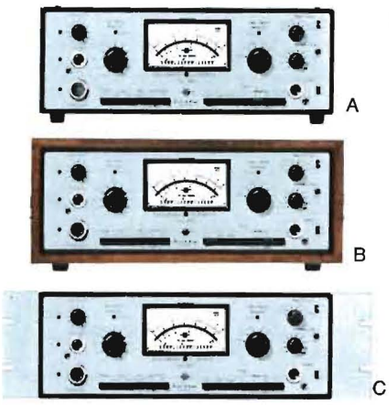
QP 1152



QP 0124/0224

All suitable for direct copying	Lined (used with 2010 in lin scale mode)	Frequency calibrated 10 Hz to 40 kHz for Types 1612, 1615, 2112, 2113, 1022 and 1024 (2010 log scale)	Frequency calibrated for Types 3347 2113 and 1615 10 Hz to 40 kHz	Frequency calibrated for Types 2107 and 2120 2 Hz to 20 kHz	Frequency calibrated for Type 2114 and 1614 2 Hz to 200 kHz	Frequency calibrated for Type 3352 100 Hz to 10 kHz
White paper for ink writing width 100 mm	QP 1102	QP 1124	QP 1152	QP 1130	QP 1143	QP 1142
White paper for ink writing width 50 mm	QP 0102	QP 0124	—		—	—
White-waxed black paper for stylus writing width 50 mm	QP 0202	QP 0224	—		—	—
QP 5102. Polar diagram charts, radius 100 mm, for ink writing. Used with 2305 or 2307 and 3921. Packages of 100 sheets.						

Cabinet and Combining System



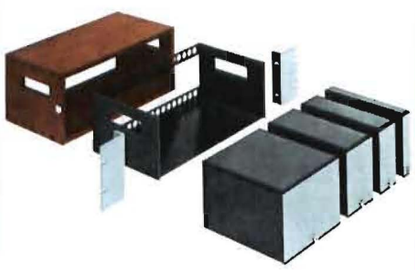
Cabinet System

Most instruments are available with three different types of cabinet. To indicate which type of cabinet is required, a letter, A, B or C should be added to the type number when ordering the instruments.

A: Indicates that the instrument is delivered in a light-weight metal cabinet.

B: Indicates that the A-version is housed in a mahogany cabinet with lid for transportion. The mahogany cabinet is fitted as an extra protection for the instrument.

C: Indicates that the A-version is inserted in a frame which allows it to be mounted directly into a standard 19" rack.



Modular Cassette System

This system allows for a very flexible mechanical system build-up. The instruments belonging to the system can be mounted in various combinations of sizes into a metal cabinet which can be used alone, be mounted in a 19" rack, or be inserted in a wooden cabinet with lid for transportation. The system is made up of slide-on panels making assembly and disassembly very simple.

Instrument Combining System

The B & K Combining System consists of ten different steel cabinets, offering a wide selection of possibilities for combining standard instruments, with the Level Recorder as the basic instrument (see scheme, opposite page).

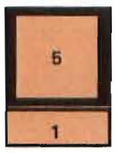
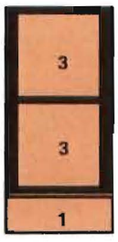
The frequency scanning of the Oscillators, Frequency Analyzers and Filters is electrically or mechanically controlled from the Level Recorder. This gives the possibility for automatic recording of frequency analyses, frequency response curves, reverberation decay curves etc. on frequency calibrated paper.
Combined instruments can be divided into two groups.

1. Automatic Frequency Response Recorders
Combinations in this group may consist of a Level Recorder and an Oscillator and in some cases also a Measuring Amplifier or an Analyzer. These combinations are used for automatic frequency response recording of loudspeakers, microphones, filters and amplifiers. The Measuring Amplifier may be used either as a compressor amplifier for the oscillator or as a measuring amplifier. A combination which includes an analyzer provides facility for excitation of an object and measuring selectively. The analyzer will automatically follow the frequency tuning of the oscillator (except in the case of Types 2107 and 2120) offering a feature which is very useful in acoustic and vibration work where high background noise has to be suppressed.

2. Automatic Spectrum Recorders
Combinations in this group may consist of a Level Recorder and a Frequency Analyzer (or a Filter Set and Measuring Amplifier).
Combinations including both a narrow band analyzer and an octave and third octave filter set offer the possibility of performing both kinds of analyses which is a very useful feature where both sound and vibration measurements have to be made. Also as the octave and third octave filter set can be driven synchronously with the analyzer, a very high attenuation outside the pass-band can be obtained.
The combination which consists of a Level Recorder and a Real-Time 1/3 Octave Analyzer displays the ever changing spectrum instantaneously on a 12" TV picture tube. The spectrum can be recorded on the Level Recorder. At all times a digital output is available for computer processing.

1: 13

1: 13

Combining Units (Order No. including assembly kit)	Size reference No.	Instruments Containable (For suggested combinations see text opposite page)
 KQ 0035  KQ 0036	1	2305 Level Recorder 2 Hz to 200 kHz 2307 Level Recorder 2 Hz to 200 kHz
	2	2606 Measuring Amplifier 2 Hz to 200 kHz 2608 Measuring Amplifier 2 Hz to 200 kHz 2607 Measuring Amplifier 2 Hz to 200 kHz 4911 Motion Analyzer 0 Hz to 10 kHz
 KQ 0037  KQ 0038	3	3347 Real Time Frequency Analyzer 12.5 Hz to 40 kHz
	4	1614 Band Pass Filter Set 2 Hz to 160 kHz 1615 Band Pass Filter Set 22 Hz to 22 kHz 2020 Heterodyne Slave Filter 20 Hz to 20 kHz 2120 Frequency Analyzer 2 Hz to 20 kHz
 KQ 0076  KQ 0077	5	2113 Frequency Spectrometer 22 Hz to 22 kHz 2114 Frequency Spectrometer 2 Hz to 160 kHz
 KQ 0078  KQ 0092	6	1013 Beat Frequency Oscillator 200 Hz to 200 kHz 1017 Beat Frequency Oscillator 2 Hz to 2 kHz 1022 Beat Frequency Oscillator 20 Hz to 20 kHz 1024 Sine Random Generator 20 Hz to 20 kHz 2107 Frequency Analyzer 20 Hz to 20 kHz 2010 Frequency Analyzer 2 Hz to 200 kHz
 KQ 0108  KQ 0109		

Accessories Necessary

Instrument combinations including:	Need:
1013, 1017, 1022, 1024, 2010, 2107, 2120 + 2305	Chain Drive Assembly UA 0324
+ 2307	Chain Drive Assembly UA 0405
Instrument combinations including:	**Need also:**
2120 and 1614 or 1615 + 2305	2 Filter Tuning Cables AQ 0027
+ 2307	Filter Tuning Cables AQ 0027 and AQ 0035
Instrument combinations including:	**Need also**
2107 and 1614 or 1615 + 2305	Filter Tuning Cable AQ 0010
+ 2307	Filter Tuning Cable AQ 0010

Hearing Aid Test Chambers – Artificial Mastoid

1:10

Type 4212 Hearing Aid Test Box is an anechoic chamber for measurements of frequency response, distortion etc., of all types of hearing aids and small microphones. The box contains a loudspeaker, a regulating microphone and an artificial ear. The Beat Frequency Oscillator Type 1022 should be used as signal source to the loudspeaker. The signal from the regulating microphone is then fed via a Measuring Amplifier Type 2606, 2607 or 2608 to the compressor input of the oscillator whereby the sound level can be kept constant. The signal from the artificial ear is measured with another measuring amplifier or, if distortion measurements are required, with an Analyzer. Frequency response curves can be recorded automatically on a Level Recorder or be displayed on the Frequency Response Tracer Type 4712. The artificial ear has a 2 cm^3 coupler designed for use both on hearing aids with built-in microphone and the conventional types. The ear is in accordance with ANSI standard Z.24.9 and IEC recommendation R126. It can be equipped with 6 cm^3 couplers, to be ordered separately, Type DB 0909 and DB 0161 according to ANSI, NBS and IEC standards. See Type 4152 next page.

3505 1:6

4930 1:6

Type 4930 Artificial Mastoid is made for objective calibration of bone conduction hearing aids and bone conductors. It conforms with BS 4009-1966 and IEC R373. The mechanical inpedance of the human mastoid can be simulated over the frequency range from 50 Hz to 10 kHz. Static force of application of the vibrator can be adjusted from 2 N to 8 N directly measured on a calibrated force gauge. Inertia mass is 3.5 kg and the built-in accelerometer has sensitivity 0.7 mV per m/sec^2 (—63 dB re 1 volt per m/sec^2). Capacitance is 3000 pF. Output can be connected to a Voltmeter, one of the Measuring Amplifiers Type 2606, 2607 or 2608, or to the Precision Sound Level Meters Type 2203 or 2209.

Type 3505 Artificial Mastoid with Calibrator includes the Artificial Mastoid Type 4930, the Mini-shaker Type 4810 and the Impedance Head Type 8000. The set allows calibration of the Artificial Mastoid and measurement of the mechanical impedance of human mastoids and foreheads. The Impedance Head has accelerometer sensitivity 25 mV per g and force sensitivity 300 mV per Newton. Effective mass below force gauge is 1.1 gram, and the capacitance of each transducer is 1000 pF.

The Model 4931 Mastoid Calibrator contains the B & K 4810 Mini Shaker, 8000 Impedance Head, and the mechanical assembly to convert the 4930 Mastoid to the 3505 system.

4930 + 4931 = 3505

1:10

Type 4217 Small Hearing Aid Test Box is an anechoic chamber acoustically similar to the Type 4212 for measurement of the frequency response and sensitivity of all types of hearing aids.
The box has a built-in generator which provides 15 fixed frequencies adjustable to give equal sound pressure level in the frequency range from 200 Hz to 5 kHz.
Dynamic range is 50 to 90 dB re 2×10^{-5} N/m^2 variable in 5 dB steps. The Precision Sound Level Meter Type 2203 or 2209 equipped with a 2 cm^3 coupler is used as indicating instrument. The coupler is in accordance with IEC R 126. To be ordered separately: SLM 2203 with microphone 4144, Cable **AO 0059** and Power Supply Connector **UA 0363** or SLM 2209 with microphone 4144, Cable **AO 0027** and Power Supply Connector **UA 0364.** Cable AO 0033 required if 2203 is used with Filter Set 1613 or 1616.

Telephone Measuring Systems – Artificial Ears and Voice

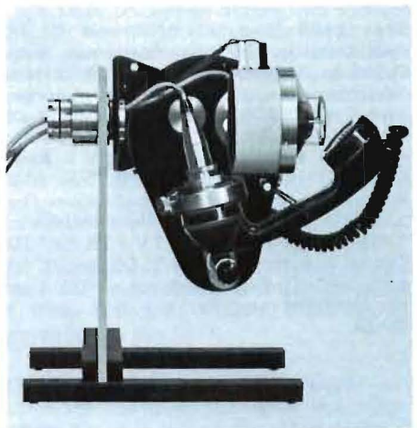
Type 4219 Artificial Voice is a constant sound pressure source for frequency response measurements on microphones and hearing aids. The Voice is supplied with a replaceable output coupler and a lip ring placed in the plane of the acoustic center. A microphone preamplifier is built into the voice and a regulating microphone Type 4136 is supplied.

Type 4152 Artificial Ear for measurement on audiometers, telephone and hearing-aid receivers. Should be used in conjunction with Preamplifier 2619, Cathode Follower 2615, Sound Level Meter 2203 or with Sound Level Meter 2209 all with Microphone 4144. The ear includes a 2 cm^3 coupler **DB 0138** for insert-type telephones, meeting requirements of ANSI Z. 24.9-1949 and IEC R 126 for measurement on hearing aids and a 6 cm^3 coupler **DB 0909** in accordance with the new version of NBS Type 9A, ANSI S3.6-1969 and IEC R303. **DB 0161** which fulfils the requirement of the ANSI Z. 24.9-1949 Type I Coupler and the ANSI Z. 24-13-1953 Coupler is available at extra cost.

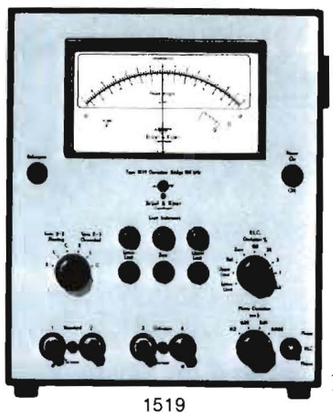
Type 4153 Artificial Ear in accordance with IEC R318. The aoustic coupler contains three cavities acoustically connected in parallel by means of a narrow annular slit and four parallel holes. Used with a 1/2" Microphone Cartridge Type 4134 and Cathode Follower Type 2615 or Preamplifier Type 2619. Test earcap and device for circumaural earphone measurement included.

Type 3352 Electroacoustic Telephone Transmission Measuring System is designed for the acoustic analysis of complete telephone sets and transmission systems. It can measure objective reference equivalent, frequency response, distortion and sensitivity for sending, receiving and sidetone conditions, each selected by a front-panel control without the need for cable changes.
A modified 1022E Oscillator supplies a precise and stable stimulus to the telephone, either electrically or accoustically, in the form of a continuous fast reciprocating sweep or a slow one-way sweep. The output from the telephone is fed to a 4904 Meter, 2113 Spectrometer, 4712 Tracer and 2305 Recorder for measurement, analysis, display and recording. Sweep ranges: 200 to 4000 Hz and 300 to 3300 Hz, reciprocating once per second. 20 to 20,000 Hz synchronized with Level Recorder. Type 4904 Meter: three integrating indices of 1, 0.6 and 0.45. Meter scale in Neper or dB, using interchangeable scales, plus blanks. Subset connections via 600 and 900 Ω balanced transformers, centre-tapped with optional earthing.
Type 4905 Test Head uses REF and AEN modal positions and meets the requirements of European and American conditioning practices. Artificial ears: NBS9A, ANSI (ASA), Braun and IEC Audiometric. Telephone Power Supply Type 4906: stabilized voltage from 0 to 72 volts delivered through wide selection of feed bridge resistances. Artificial Voice Type 4219 with linear, SFERT and Male Speech Spectrum Weighting. Quick-action holders for production testing of transmitters and receivers. Calibrator Type 4230. Many parts available for conversion of old 3350 systems to new specification.

Type 3353 Electroacoustic Telephone Transmission Measuring System is designed for production testing of telephone transmitters and receivers, using a subset circuit built into the Power Supply to the user's own requirements. It contains the same units as the 3352 with the following exceptions: types 2305, 4712 and 4905 omitted: type 2113 replaced by 2608.

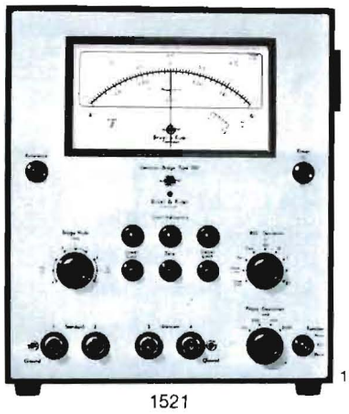


Deviation Bridges – Voltmeters



1519

1:6



1521

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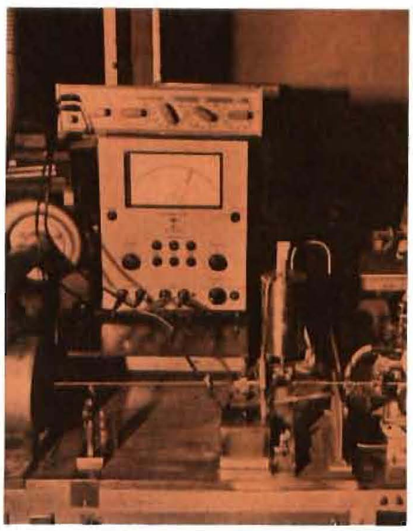


Type 1519 and 1521 Deviation Bridges are direct reading instruments for fast, accurate determination of the percentage deviation of impedance and phase angle of resistors, inductors and capacitors compared to an external standard. Interchangeable scales are supplied with the instruments for the different measuring ranges. Three lamps indicate tolerance limits. Guard rings are included for remote measuring of small capacitances. The instruments have relay outputs for sorters and analogue outputs for recording and automatic control of measuring value. The Measuring ranges of test components are indicated in the scheme below.

ZR 1702 Box for Standard resistors, inductors, or capacitors for Deviation Bridges Types 1519 and 1521. Min. quantity 10 units.

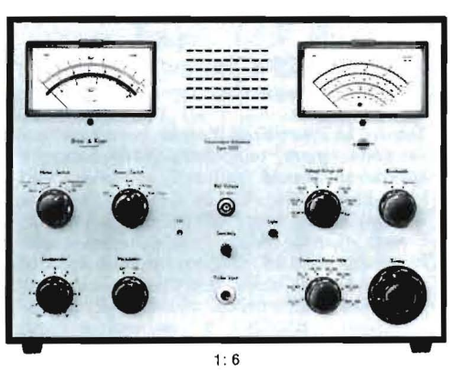
Type	1519	1521		
Test freq.	100 kHz	100 Hz	1 kHz	10 kHz
Resistance	10 Ω to 100 kΩ	1 Ω to 30 MΩ	1 Ω to 10 MΩ	1 Ω to 1.4 MΩ
Capacitance	12 pF to 1 μF	200 pF to 5000 μF	20 pF to 200 μF	20 pF to 20 μF
Inductance	5 μH to 20 mH	2 mH to 500 H	0.2 mH to 100 H	20 μH to 10 H

1:4

Type 2425 Electronic Voltmeter for AC measurements in the frequency range 0.5 Hz to 500 kHz within ± 0.5 dB, 2 Hz to 200 kHz within ± 0.2 dB. 12 voltage ranges from 1 mV to 300 V full scale deflection. dB ranges —80 dB to 50 dB re. 1 V and —80 dBm to 52 dBm re. 0.775 V. + Peak, —Peak, Max Peak, Peak Hold, True RMS and True Average meter rectification. Fast and Slow meter response. Input impedance 1 MΩ//47 pF. AC output: 1 V ± 2% for FSD. Output impedance ≅ 100 Ω. DC output: 1 V ± 2% FSD. Output impedance <10 Ω. Used as calibrated amplifier the max. gain is 60 dB.

1:4

Type 2426 Autoranging Electronic Voltmeter has identical specifications to the Type 2425 but is further equipped with a range selector which automatically secures correct choice of range. Information on the chosen range is available at a BCD output and the range selector can be controlled remotely.



1:6

Type 2007 Heterodyne Voltmeter is a frequency selective voltmeter for the measurement of amplitude, frequency, and modulation of radio frequency signals, within 100 kHz to 300 MHz in 8 overlapping ranges. Variable oscillator DC controlled. Interchangeable frequency scales. Dynamic range 10 μV to 100 V. FET high impedance input probe, 50 or 75 Ω termination, and 60 dB attenuator. Modulation meter calibrated in % AM and kHz FM, two ranges 0 to 30 and 0 to 100. Bandwidths 2 kHz and 200 kHz. AGC active, when modulation is measured. More than 50 dB image-frequency and intermediate frequency rejection by double conversion. Peak detector for TV measurements. Internal calibration generator 27 MHz. Power from Mains or built-in rechargeable batteries. Built-in charging unit. Built-in loudspeaker facilitates quick identification of signals. A, B, or C model.

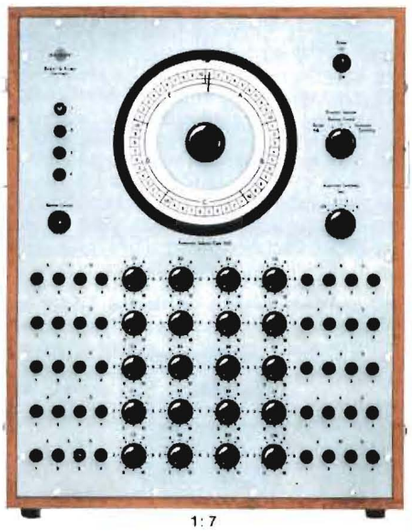
1:7

Type 1516 Strain Gage Apparatus consists of a 3 kHz oscillator, a bridge circuit, a four-stage amplifier and an illuminated, zero-centered indicating meter calibrated in μstrain. Built-in R and C balancing components. Using the 3 kHz carrier signal, static and dynamic strain up to 300 Hz can be measured. When used with the DC Bridge Supply Unit 1535, measurements of dynamic strain with frequencies up to 100 kHz can be carried out. Max. sensitivity with four active gauges is 25 μstrain (25 μinches per inch) for full scale deflection. Least sensitive range 30,000 μstrain with one active gauge. A wide range of resistance strain gauges can be used (10 to 1000 Ω).
Different output facilities for connection to recording instruments such as Level Recorder or Cathode-Ray Oscilloscope. Accessories included: Type 1530 and 1531, ZR 1540, ZR 1541, two strain gauges mounted for testing purpose. Available only in mahogany cabinet.

NOTE: When used with Level Recorder Type 2305 or 2307 linear potentiometer ZR 0001 or ZR 0002 should be specified.

1:6

Type 1531 Balancing Unit is a four-channel bridge switch and balancing unit with separate R and C balancing controls for each channel. Balancing units may be coupled together for manual selection of any desired number of channels.



1:7

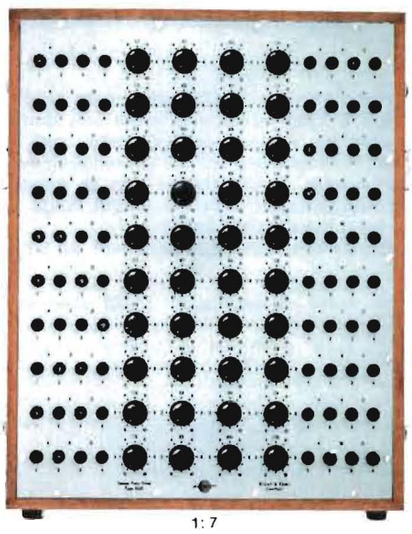
Type 1542 Automatic Selector is a 50-channel selector switch for sequentially connecting a maximum of 50 strain measuring points to the Strain Gage Apparatus Type 1516. Bridge inputs and R and C balancing controls are provided for 10 channels. For the remaining 40 channels two Twenty-Point Panels Type 1543 should be used. The switch may be operated manually or automatically by means of a built-in drive unit. Measuring intervals can be set to 0.5, 1, 2, or 4 seconds between switching steps. An arbitrary number of positions can be used, and a "fast return" arrangement can accelerate the switch through the non-measuring portion to the starting point. The switch may also be remotely controlled from Level Recorder Type 2305 or 2307. Available only in mahogany cabinet.

1530 1:6 1533 1:6 1538

Type 1530 Balancing Unit used when the strain gauge installation is remote from the 1516.

Type 1533 Variable Balancing Resistor for separating dynamic and static components of complex signals.

Type 1538 Low-Pass Filter eliminates the 3 kHz component of the rectified output signal of Type 1516 making possible the direct visual presentation of both static and dynamic strains on an oscilloscope screen. Frequency range 0 to 100 Hz.



1:7

Type 1543 Twenty-Point Panel consists of 20 independent R and C balancing units. For use with the Automatic Selector Type 1542. Accessories included: 2 x 30-cored cables with plugs AO 0030.
Available only in mahogany cabinet.

Type 1534 Balancing Unit for the separation of bending and elongation of structural members. Measurements may be taken from two points each consisting of two active and two dummy strain gauges. R and C balancing components. Any number of units may be employed.

1:6

Type 1535 DC Bridge Supply Unit provides 0.3, 1 and 3 Volt DC bridge voltage for strain measurements in the frequency range from 20 Hz to 100 kHz. A calibration bridge and meter for gauge factor compensation are integral parts of the instrument.

ZR 1540 Fixed Balancing Resistor used when the inital unbalance in a strain gauge circuit is outside the range of the R-balance component in the 1516.

ZR 1541 Fixed Balancing Condenser used when the capacitive unbalance in a strain gauge circuit is outside the range of the C balance component in the 1516.

Systems Engineered Instruments

Systems Engineering

A long-standing, basic requirement of any Brüel & Kjær instrument is not only that it should be an independent entity, and as such fulfil as many application requirements as possible, but it should also be directly interconnectable with the entire range of Brüel & Kjær instruments.
Because of this basic requirement, all B & K standard, production instruments have a designed-in system compatibility. However, many customers require systems to perform very specific functions, and therefore Brüel & Kjær introduced into its development programme, a group of specialists devoted to the engineering of systems, on a contract basis, to meet these special requirements. Wherever possible, this group will modify standard instruments to suit the system in question, but when necessary, new designs may be incorporated.

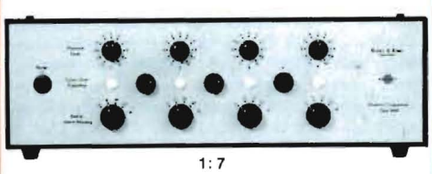
The instruments shown in this section of the catalogue are examples of developments designed to fulfil specific functions, yet which will find application over a relatively wide area. Their specifications can be modified to suit individual requirements. Your local representative is in possession of all information regarding systems engineering and will be happy to give you full details regarding prices and delivery times.


1:3

Type 5600 Differential Accelerometer is a Uni-Gain® type balanced to give minimum noise. Charge sensitivity is 10 pC/g. Mounting foot dimensions to ARINC Characteristic No. 554, June 15, 1963 and connectors in Amphenol 115 series. This accelerometer should be used with **Type 5703 Charge Amplifier** which is a differential amplifier especially designed for use with the Type 5600.


1:7

Type 5500 Vibration Monitor is intended for permanent installation in monitoring systems for continuously operating machinery. It keeps constant surveillance on the vibration levels, gives a continuous meter display and a three stage indication if the levels fall above or below predetermined values. It can initiate an automatic shut-down sequence to prevent further deterioration and operate an alarm system. Provision for on-line computer control. Weather-proof case to "MIL" spec.


1:7

Type 5660 Vibration Test Programmer used with the Exciter Control Type 1026 provides stepped acceleration, velocity, displacement or acceleration gradient tests and also standard D-A-D-A tests. Four sub ranges are available, more when further Programmer units are connected in series.


1:7

Type 5584 Vibration Meter contains a charge amplifier in the input stage to allow long cables to be used. Plug in filter units give the correct bandwidth to suit customers' test specifications. The instrument has nine meter ranges and can be supplied with any combination of displacement, velocity or acceleration scales. Powered by Ni-Cd batteries. Built-in charger unit.


1:7

Type 5664 Tunable Filter is a portable 15% band pass filter for frequency analysis. It is continuously tunable over approx 8.5 octaves in 5 sub-ranges which can be ordered anywhere in the frequency range 0.2 Hz to 20 kHz. Powered by internal Ni-Cd batteries. Built-in charger unit.


1:7

Type 5565 Mass Compensation Unit used with the Impedance Head Type 8001 in mechanical impedance measurements. It compensates electrically for the signal caused by the mass of the force gauge driving platform.


1:7

Type 5586 Tacho Unit is both tachometer and frequency meter. It features photodiode and normal electrical triggering, and can be used as a trigger unit for the Type 4911 Motion Analyzer.

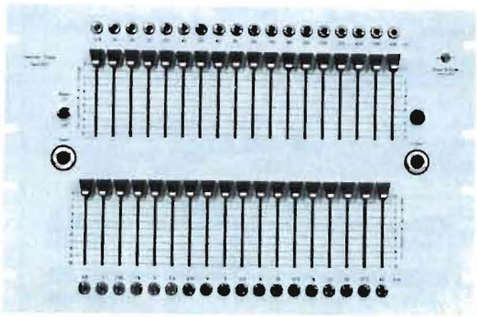

1:7

Type 5620 Filter Set used for portable analysis, in a reduced frequency range. It can contain up to seven 1/3 octave filters, or special filters to customer's order. Powered from 4 internal batteries Type IEC R20.


1:7

Types 5640, 5651, 5652, 5653 and 5654 Systems for Stroboscopic Motion Analysis of the Larynx provide a steady slow motion view of the Larynx under phonation. Correctly synchronized triggering of the stroboscope lamp is achieved by picking up the voice sounds with a microphone, amplifying them and then filtering the result to achieve a clean signal without harmonics which could cause false triggering.
Systems of varying complexity are available to suit diverse examination or budget requirements. They range from the inexpensive Type 5654 System which, using standard instruments, just fulfils the basic function of showing motion of the Larynx, through the Type 5640 System with instruments specially adapted to facilitate Larynx examination, to the Type 5651 system which, with its interconnection options gives comprehensive research and examination possibilities.

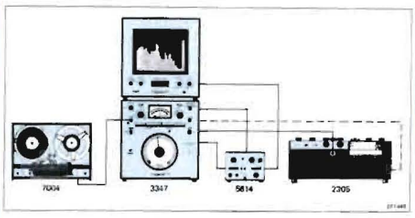
1:7



1:7

1:7

Type 5614 Maximum Spectrum Selector used with the Real-Time Third Octave Analyzer Type 3347 stores a time-coincident spectrum for the instant of maximum signal level in any selected channel. Also it triggers automatic read-out, at regualr intervals or when preset reference level is exceeded.

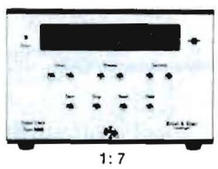


Type 5587 Spectrum Shaper modifies the overall frequency response of acoustic systems to create a "shaped" spectrum. It contains 36 third octave band pass filters each with its' own attenuator.

1:7

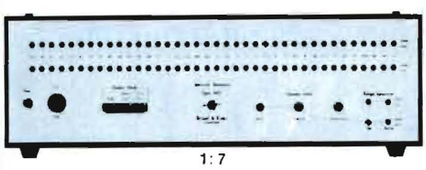
WB 0078 Weighting Network, —3 dB/Octave operates over the frequency range from 2 Hz to 200 kHz and is used as a supplementary filter with B & K frequency analysis systems. It enables direct measurement of power spectral density with constant percentage bandwidth analyzers.

Type WB 0071 Psophometer Filter for commercial telephone circuits gives a frequency weighting according to CCITT Recommendation P 53 (1960).



1:7

Type 5603 Digital Clock shows the time of day or elapsed time in hours, minutes and seconds on a Nixie display and also gives an output in B-C-D code for use in digital systems. Time interval pulses are also available for control circuits.
When connected on-line with the B & K Varian Computer Type 7504, the **Type 5609 Digital Clock Interface** must be used.

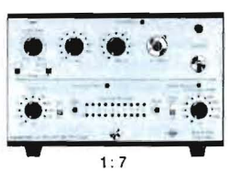


1:7

Type 5617 Spectrum Reference used with the Real-Time Third Octave Analyzer Type 3347 gives instant indication when the measured spectrum falls outside preset upper and lower reference levels in any channel. This instrument is used for noise and vibration monitoring and is particularly suitable for a rapid Go/No-go decision in automatic quality control systems.

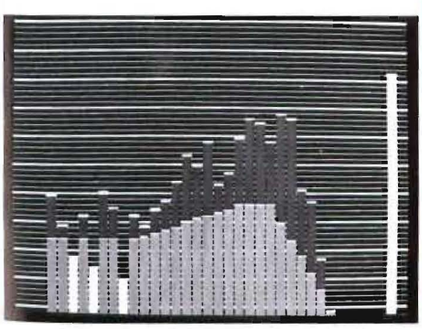
1:7

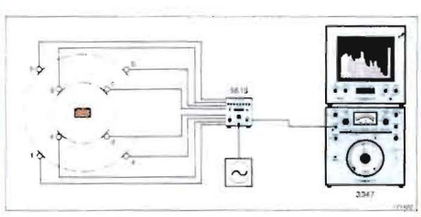
Type 5619 Channel Selector for fast, two to eight channel switching with negligible switching transients. Used as an input multiplexer for B & K Measuring Amplifiers and Frequency Analyzers for signals in the millivolt range. Several Selectors can be interconnected to give more channels.

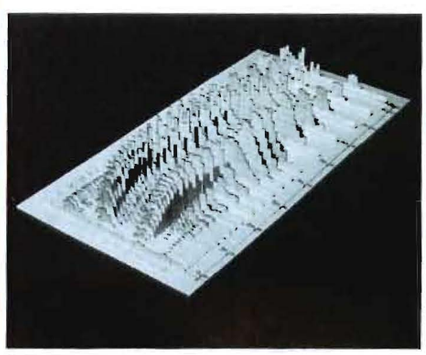


1:7

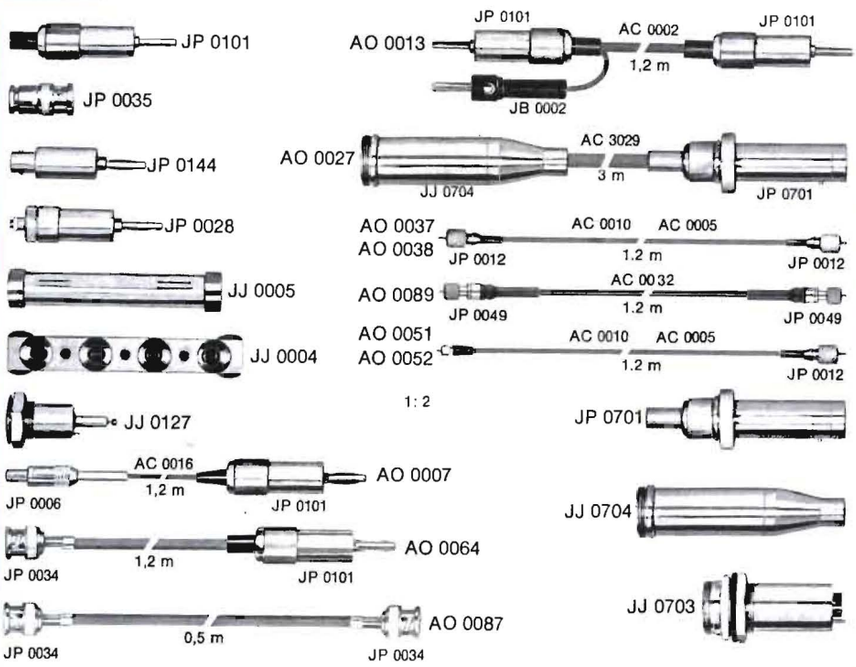
Type 5623 Gauss Impulse Multiplier produces the gaussian shaped time function used to divide a signal into relatively short time intervals so that the variation of frequency content with time can be determined. This instrument is intended for use with the Tape Recorders 7003 or 7004, or with the Digital Recorder 7502.







General Accessories – Literature



JP 0101 Screened Plug. Standard for B & K instruments. Fits socket JJ 0127.

JP 0035 Screened BNC Plug for connection to B & K instruments.

JP 0144 Coaxial Adaptor for interconnection of BNC and B & K systems.

JP 0028 Adaptor converts miniature plug to B & K plug JP 0101.

JJ 0005 Extension Connector for connection cables AO 0014, AO 0018, AO 0019 or AO 0020.

JJ 0004 Screened Connection Box for parallelling four cables AO 0014.

JJ 0127 Screened Socket for panel mounting.

AO 0007 Screened Connection Cable with plug JP 0101 on one end and microplug JP 0006 on the other end. Used to connect Type 1616, 2203 and 2209 to other B & K instruments. Length 1.2 m.

AO 0064 Screened Connection Cable with plug JP 0101 on one end and plug JP 0034 on the other end Used for connecting instruments with BNC sockets to other B & K instruments. Length 1.2 m.

AO 0087 Screened Connection Cable with plugs JP 0034. Used for interconnecting instruments with BNC sockets. Length 1.2 m

AO 0013 Screened Connection Cable with separate screen connector. Length 1.2 m.

AO 0014 Screened Connection Cable similar to AO 0013, but without separate screen connector. Length 1.2 m.

AO 0018 Screened Connection Cable similar to AO 0014. Length 0.5 m.

AO 0019 Screened Connection Cable similar to AO 0014. Length 3 m.

AO 0020 Screened Connection Cable similar to AO 0014. Length 10 m.

AO 0027 Extension Cable for the B & K Microphone Preamplifiers and Sound Level Meter Type 2209. Length 3 m. 6 mm outside diameter.

AO 0028 Extension Cable similar to AO 0027 but double screened, 9 mm outside diameter, low capacity. Length 10 m.

AO 0029 Extension Cable similar to AO 0028. Length 30 m.

AO 0034 Low **Capacitance Connection Cable** for Filter Set 1613 when desired to use it with other B & K instruments. Length 60 cm.

AO 0035 Connection Cable for connection of 1613 output to older B & K instruments. Length 60 cm.

AO 0037 Accelerometer Cable 1.2 m with miniature plugs in both ends.

AO 0038 Accelerometer Cable similar to AO 0037, but for higher temperatures. Max. amb. temp. 260°C (500°F).

AO 0089 Accelerometer Cable 3 m, reinforced with reinforced plugs JP 0049 in both ends.

AO 0051 Accelerometer Cable 1.2 m with miniature plugs for Accelerometer Type 4344.

AO 0052 Accelerometer Cable similar to AO 0051, but for amb. temperatures up to 260°C (500°F).

JP 0701 7-pole Microphone Plug as used on Extension Cables AO 0027, AO 0028, and AO 0029 as well as on Type 2615, 2619, 4212 etc. Matches JJ 0703 and JJ 0704.

JJ 0704 7-pole Microphone Connector as used in Extension Cables AO 0027, AO 0028, and AO 0029.

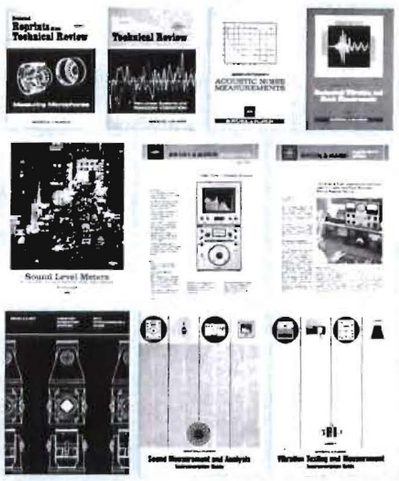
JJ 0703 7-pole Microphone Socket for panel mounting. Standard for B & K instruments.

TI 0001

TU 0005

TI 0001 Input Transformer with symmetrical input for use with Measuring Amplifiers, Frequency Analyzers, and Recorders. Ratio 1 : 1. Accurary 0.2 dB from 10 Hz to 20 kHz. Input impedance 20 kΩ or 600 Ω.

TU 0005 Output Transformer with symmetrical output for use with Oscillators and Generators. Output imp. 600 Ω. Transformer ratio $\sqrt{10}$: 1.



Literature

If more detailed information than that given in this catalog is required then please write or phone to your local representative.

The following literature is available:

Product Data Sheets
English, German, French, Russian

Main Catalog
English

Booklets are also available on:
Architectural Acoustics
Power Spectral Density Measurements and Freq. Analysis
Acoustic Noise Measurements
Mechanical Vibration and Shock Measurements
Standards, Formulae and Charts
Examples of Application
Selected Reprints from Technical Review on:
Measuring Microphones
Non Linear Systems and
Random Vibration

The Brüel & Kjær Technical Review is issued quarterly in English, German and French. The review deals with measuring technique and is mailed on request free of charge as is all other literature.

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(215) 242-6223

NEW MEXICO, Albuquerque
BARNHILL THREE, INC.
1410-D Wyoming, N.E.
Albuquerque, NM 87112
(505) 299-7658
Twx: 910-989-1650

*** NEW YORK, Long Island**

*** NEW YORK, (Metropolitan)**
MEASUREMENT TECHNOLOGY, INC.
295 Northern Boulevard
Great Neck, NY 11021
(212) 895-7177
(516) 482-3500

NEW YORK, Syracuse
DB ASSOCIATES
P. O. Box 14
DeWitt, NY 13214
(315) 446-0220

NORTH CAROLINA, Raleigh
LEE ASSOCIATES, INC.
P. O. Box 18833
Raleigh, N C 27609
(919) 787-5818

OHIO, Cleveland
ELECTRO SALES ASSOCIATES
851 East 222nd Street
Cleveland OH 44123
(216) 261-5440

OHIO (Cleveland Factory)
B & K INSTRUMENTS, INC.
5111 West 164th Street
Cleveland, OH 44142
(216) 267-4800
Twx: 810-421-8266

OHIO, Dayton
ELECTRO SALES ASSOCIATES
Overlook Branch – P. O. Box 3122
Dayton, OH 45431
(513) 426-5551

*** PENNSYLVANIA, Philadelphia & N.E.**
LEtronix, INC.
251 West DeKalb Pike
King of Prussia, PA 19406
(215) 242-6223
(215) 265-1020

PENNSYLVANIA, Pittsburgh
ELECTRO SALES ASSOCIATES
201 Penn Center Boulevard
Pittsburgh, PA 15235
(412) 371-9449

TEXAS, Dallas
BARNHILL TWO, INC.
Suite 220
312 North Central Expressway
Richardson, TX 75080
(214) 231-2573
Twx: 910-861-4711

TEXAS, Houston
BARNHILL TWO, INC.
3810 Westheimer, Suite 332
Houston, TX 77027
(713) 621-0040
Twx: 910-881-2573

UTAH, Salt Lake City
(801) 487-1327

WASHINGTON, Seattle
HARRY LEVINSON COMPANY
1211 East Denny Way
Seattle, WA 98122
(206) 323-5100
Twx: 910-444-2154

WISCONSIN, Milwaukee
CARTER ELECTRONICS, INC.
3958 N. 51st. Blvd.
Milwaukee, WI 53216
(414) 464-5555

☆ **A SPECIAL AREA REPRESENTATIVE has been selected to cover Speech and Hearing Centers; Psycho-Acoustics Laboratories; Ear, Nose and Throat Physicans; and Hearing Aid Manufacturers and Dealers. Contact:**

R. R. Guinta Associates
1377 Palisade Ave.
Teaneck, New Jersey 07666
Phone: (201) 836-7089 or (212) 594-4974

SERVICENTERS

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Western Service Center • 7116 Remmet Ave.
Canoga Park, CA 91303 • Telephone: (213) 340-1950

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B&K Instruments, Inc.
Brüel & Kjaer Precision Instruments
5111 West 164th Street • Cleveland, OH 44142 • Telephone: (216) 267-4800
1440 South State College Blvd., Suite 1A • Anaheim, CA 92806 • Telephone: (714) 778-2450