Brüel & Kjær

product data

types 1049 and 1051

Sine/Noise Generators

USES:

- Precision ATE signal generators for use in computer based test systems, requiring a high accuracy, low distortion excitation source
- Semi and fully automatic test and calibration of electrical and mechanical equipment for product design, development, production and service
- Swept-frequency electro- and building-acoustic measurements; vibration testing of mechanical components; plus audiological research etc.
- Storage of amplitude weightings for equalizing non-flat loudspeaker, vibration exciter responses etc.
- Remote control of Level, X-Y and Graphic Recorders for synchronous recording of amplitude, phase and distortion responses

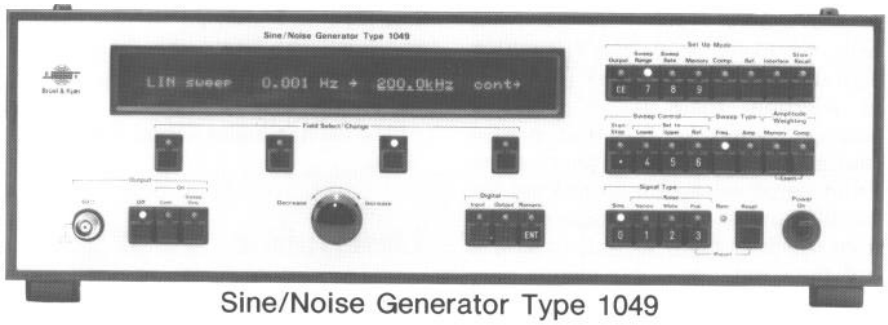
FEATURES:

- 0,2 to 200000 Hz, sine generators with frequency resolution down to 1 mHz and clock stability better than $\pm 5 \times 10^{-6}$/year
- Calibrated output from 100 μV to 5V with less than -96 dB harmonic and spurious distortion
- Six-decade frequency sweep in one continuous range with selectable lower and upper limits
- Choice of linear and logarithmic frequency sweep with sweep rates from 0,001 Hz to 999,9 kHz/s and 0,001 mDec to 2 Dec/s respectively
- Single, repetitive (l-99) and continuous sweep modes with 0,01 to 100,0 s pause between sweeps
- 1024 point amplitude memory, with automatic amplitude interpolation, for preconditioned test excitation
- 40 character, alphanumeric, line display for monitoring and setting-up of frequency and amplitude sweep parameters etc.
- 9 set-ups for recalling frequently repeated excitation test and measurement sequences
- Versatile IEEE/IEC bus for remote control and digital output of data

ADDITIONAL FEATURES 1049:

- Narrow-band random, white and pink noise modes
- Logarithmic amplitude sweep with sweep rates from 0,01 to 999 dB/s
- 118 dB compressor circuit for active control of sound or vibration level at exciter output
- Automatic learn mode for amplitude memory, via compressor

The B&K Types 1049 and 1051 are two microprocessor-based sine generators which combine today's needs of increased spectral purity, frequency resolution and stability with ease of use and versatility. Their wide frequency coverage from 0,2 Hz to 200 kHz, with amplitude linearity and frequency resolution of ±0,05 dB and 1 mHz, make them suitable for numerous applications in electronic engineering, as well as in acoustics and vibration measurements. Linear and logarithmic sweep ranges, each with their own user-presettable lower and upper limits may be chosen, including extended linear sweeps from 0,001 Hz to 200 kHz. Single, repetitive and continuous sweep modes are also included and the time for each individual sweep is automatically calculated and displayed.



Sine/Noise Generator Type 1049

Sine Generator Type 1051

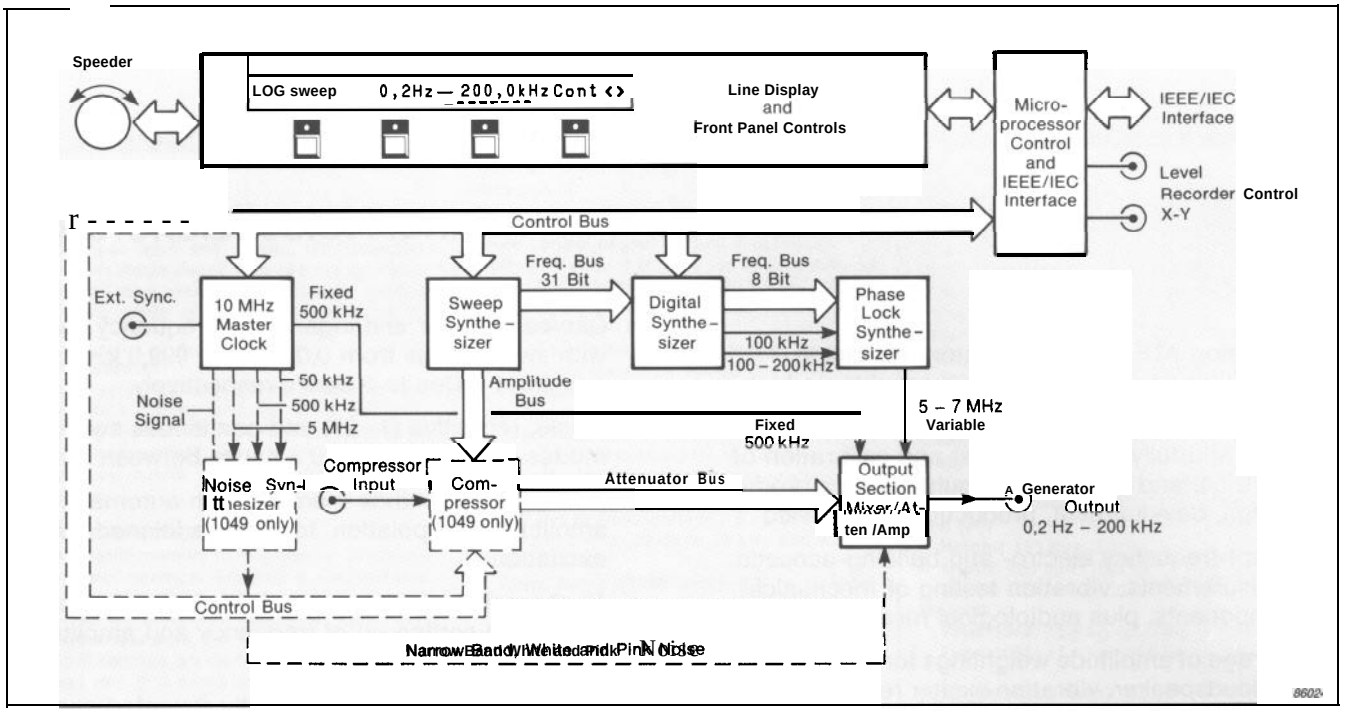


Fig. 1. Simplified block diagram of the B&K Sine/Noise Generator Type 1049 and Sine Generator Type 1051

Outputs levels from 100 μV to 5 V RMS may be chosen to 3 digits, permitting either a constant amplitude or an amplitude-weighted, frequency sweep to be obtained. With the latter up to 1024 amplitudes may be stored, which enable the Generators to simulate the output of record reproducer pick-ups, tape heads and electrical circuits etc. Also, equalization characteristics can be stored for maintaining a constant sound pressure or vibration output with loudspeakers and vibration exciters.

All functions and parameters may be selected or entered by the front panel pushkeys or via the IEEE/IEC digital interface bus of the Generators. In addition, there is an analogue "speeder" knob for fast and precise continuous adjustment of parameters. Front panel set-up conditions are indicated on a 40-character line display, from which as many as four functions and their individual parameters may be monitored simultaneously.

If desired, nine sets of front panel set-up conditions may be stored and instantly recalled for performing frequently used excitation test and measurement sequences, as is normally called for in service and production testing of products. For automatic plotting of swept-frequency measurements and analyses, special provision is made for synchronizing level and X-Y recorders. Alternatively, where an IEEE/IEC system controller is used for automatic control of the Generators, they may be coupled with a digital plotter.

In addition to the above, the Type 1049 has a number of extra facilities. These include a logarithmic amplitude sweep, as well as narrow-band random, white and pink noise outputs. Also, a compressor circuit is built in as an alternative means of obtaining a constant sound or vibration level output when a loudspeaker or vibration exciter is employed with the generator. In this case, however, external feedback is employed to provide active regulation of the generator output which has the benefit that it automatically takes into account the response of the exciter under actual test conditions.

Description

A simplified block diagram of the B&K Generators Types 1049 and 1051 is shown in Fig.1. They have 6 main sections, namely a Master Clock, a Digital Frequency Synthesizer, a Phase Lock Synthesizer, a Sweep Synthesizer and an Output Section, all of which operate under the guidance of a Microprocessor Section which takes care of the user communication via the front panel controls and IEEE/IEC interface of the Generators. In addition, Type 1049 features a Noise Generator and Compressor, which greatly increase its range of applications, especially for acoustic and vibration measurements.

Frequency Synthesizer

The Generators employ a heterodyne synthesis technique where a 500 kHz fixed frequency is mixed with a 500 to 700 kHz variable frequency to produce an 0,001 Hz to 200 kHz swept-frequency, sine-wave output with frequency resolution of 1 mHz. The 500 kHz fixed frequency is obtained from a Master Clock, while the 500 to 700 kHz variable frequency is derived from the 5 to 7 MHz output of a Phase Lock Synthesizer.

The Master Clock is based on a stable 10 MHz crystal oscillator whose relative accuracy is transferred to the output frequency. If an even greater accuracy is required the internal oscillator can be phase locked with an external reference which may be coupled to an External Synchronization

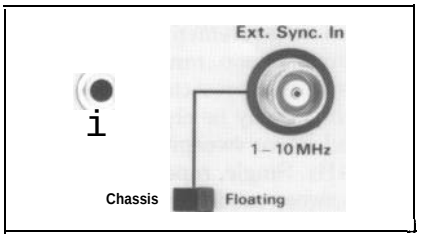


Fig. 2. External Synchronization Input of the 1049 and 1051 Generators

Input socket on the rear panel. See Fig. 2.

For a 5 to 7 MHz variable frequency proportional to the generator output frequency, a 31 bit frequency control output from the Sweep Synthesizer is utilized. To achieve a wide sweep range while maintaining a high accuracy and resolution, the Sweep Synthesizer output is split into two components. The lowest 23 bits are used to produce a 100 to 200 kHz variable control frequency proportional to the Hz and mHz frequency setting of the Generators, while the remaining 8 bits are used to produce a 49,9 to 69,9 MHz control frequency proportional to the kHz setting.

The respective control frequencies are generated by a digital synthesis and a divide by "N" phase lock loop. They are then summed by another phase lock loop to produce a 50 to 70 MHz control frequency which after application to a 10:1 frequency divider in the Phase Lock Synthesizer is fed to the Output Section where the final stages of frequency conversion take place. The use of two phase lock loops for producing 50 to 70 MHz control frequency, ensures that phase noise is kept to a minimum.

Output Section

From the Phase Lock Synthesizer the 5 to 7 MHz control frequency is applied to a second 10:1 frequency divider which is included at the input of the mixer stage of the Output Section. The output is then mixed with the 500 kHz output of the Master Clock to produce a sine-wave signal whose frequency corresponds directly to the frequency indicated on the display of the Generators. For removing unwanted side-band components in the mixed signal, a 280 kHz low-pass filter is employed.

Before application to the outputs of the Generators the filtered sine-wave signal is fed to an attenuator and amplifier for amplitude conditioning. The output attenuator gives an overall attenuation of 16 bits enabling the fraction and exponent of the output level to be accurately set within 3 digits from 100 μV to 5,00 V RMS via the front panel controls and interface bus of the Generators.

The Output Amplifier provides two low impedance signal outputs, which are made available at a BNC socket on the front and rear panels. These may be matched with 50 Ω signal lines and to suit different test system grounding requirements, may be isolated or connected to chassis by means of a slider switch on the rear panel. See Fig.3.

In the design of the Generators, particular attention has been paid to obtaining very low signal distortion and good amplitude linearity. As indicated in Fig. 4 the maximum harmonic and spurious distortion is guaranteed better than -96 dB at frequencies between 20 Hz and 20 kHz, with second and third harmonic distortion components typically -110dB down at 1 kHz.

The amplitude linearity of the output is better than $\pm$0,05 dB at frequencies between 20 Hz and 20 kHz, decreasing to $\pm$0,2 dB at 0,2 Hz and 200 kHz. At lower frequencies the amplitude falls by 20 dB per decade, but by utilizing the "Memory Learn" function of the Generators to maintain a constant output level of 300 mV or less, a flat amplitude characteristic can be maintained at all frequencies down to 0,001 Hz.

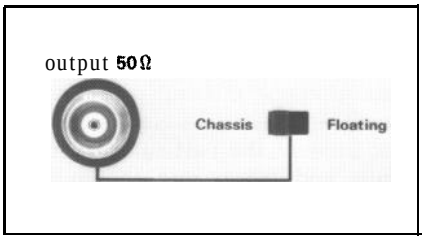


Fig. 3. BNC Output and Chassis/Floating switch of the 1049 and 1051

Sweep Synthesizer

The Sweep Synthesizer includes a ramp register which produces a 31 bit output representing the frequency setting of the Generators. The frequency may be set by an input either from the front panel keyboard or via the interface bus of the Generators. For a frequency sweep, however, an internal clock signal is used, enabling either "Linear" or "Logarithmic" frequency sweeps to be chosen with sweep rates from 0,001 Hz/s to 999,9 kHz/s and 0,001 mDecade/s to 2 Decade/s, respectively.

With linear and logarithmic frequency sweeps, six or more complete frequency decades can be covered in a single range. The logarithmic sweep range extends from 0,2 Hz up to 200 kHz, while the linear sweep range is from 0,001 Hz up to 200 kHz, however, either can be independently set to any lower or upper frequency limit within these ranges if so desired.

In addition to the above, "Up", "Down", "Up/Down", "Single", "Repetitive" (1 to 99) and "Continuous" sweeps modes may be chosen. Also there is a "Pause" function whereby a preset delay of between 0 and 100 s may be included between each consecutive sweep.

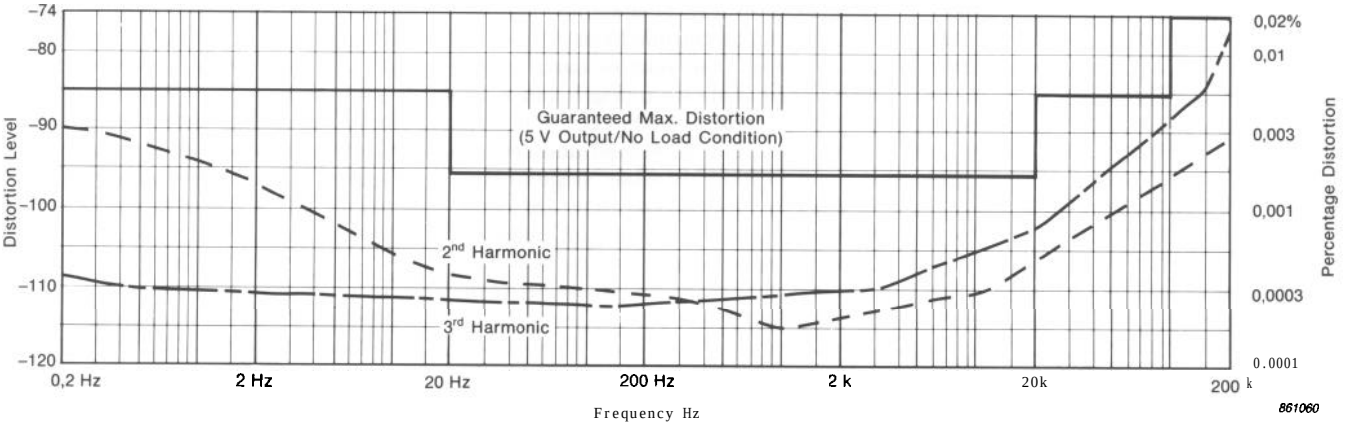


Fig. 4. Typical and maximum *guaranteed distortion levels produced by the 1049 and 1051 Generators (5 V output, no load condition) in the frequency range from 2 Hz to 200 kHz*

A convenient feature is that the Generators automatically compute the time for a single sweep. The sweep time is indicated directly on the front panel display and automatically takes into account the particular frequency limits and sweep rate chosen. With single and repetitive Up/Down sweeps a minimum sweep time of 8 ms can be achieved, while with sweeps including pause or single sweeps in one direction, sweep times as short as 62,5 μs are possible.

Because the frequency sweep of the 1049 and 1051 is rate based a higher sweep accuracy can be maintained. With generators which are programmed with respect to time the sweep accuracy is generally lower, particularly with logarithmic sweeps.

Amplitude Memory

Besides a ramp register for frequency synthesis, the Sweep Synthesizer contains an amplitude register for controlling the Output Section Attenuator.

For manual setting of the output level, the amplitude register accepts a numeric input from the front panel keyboard or a digital input applied over the interface bus of the Generators. The input may be applied directly to the amplitude register or, if the "Memory Learn" function is used, via the internal memory of the Generators. In the latter case, up to 1024 amplitudes can be stored for successive frequencies within any desired frequency range of the Generators, and when recalled enable almost any type of single or repetitive, amplitude weighted, frequency sweep to be generated.

The "Memory Learn" function is of particular benefit for swept frequency sound and vibration measurements. When one of the Generators is employed to drive a loudspeaker or vibration exciter, for example, its output level can be weighted according to the dynamic response of the loudspeaker or vibration exciter so that a constant sound pressure or vibration level output is maintained over the entire frequency range of interest.

To save entry of each individual level manually, the "Memory Learn" function includes automatic amplitude interpolation between consecutive amplitudes input. Alternatively, amplitudes may be entered as a voltage signal via the Compressor Input of the 1049.

Additional Features Type 1049

Noise Generator

In the Sine/Random Generator Type 1049 wide band, pseudo random noise of very even spectral density is generated by two long shift registers followed by a low- and high-pass filter. The noise signal has a symmetrical gaussian amplitude distribution up to 4,5 σ with upper frequency limit, line spacing and sequence length depending on the shift register clock frequency. See "Specifications".

BY selecting the appropriate -0,5 dB lower and upper frequencies of the filters, nine combinations of white noise can be obtained, ranging from 2, 20 or 200 Hz up to 2, 20 or 200 kHz. The filters are 3-pole Chebishev types giving less than 0,1 dB ripple and an 18 dB/octave low- and high-frequency roll-off. For a pink noise output over the same frequency ranges, the white noise signal is fed through a -3 dB/octave filter before being applied to the attenuator and amplifier stages of the Output Section.

For a swept-frequency, narrow-band noise output, the white noise signal is fed to a balanced modulator circuit. This produces two DC to 1,25 kHz noise signals with relative phase of 0 and 90° which are applied to two identical low-pass filters. The filters are 3-pole Butterworth type which have a high frequency attenuation slope of 18 dB/octave with selectable cut-off frequency of exactly half the particular noise bandwidth chosen on the Generator.

From the low-pass filters the two signals are mixed and summed to produce two complementary signals which on an amplitude basis represent each half of the narrow-band noise characteristic shown in Fig. 5, but with centre frequency of 500 kHz. The two signals are then combined and fed to the 500 to 700 kHz mixer stage of the Output Section where they are converted to a swept-frequency, narrow-band, noise output operating over the same sweep range as the sine-wave output of the Generator.

Because of the high crest factor of the narrow-band, white and pink noise generated by the 1049, the noise is attenuated by 12 dB (factor of 4) with respect to the sine output. The generator automatically accounts for this, so that the exact output level in the noise as well as the sine modes is displayed.

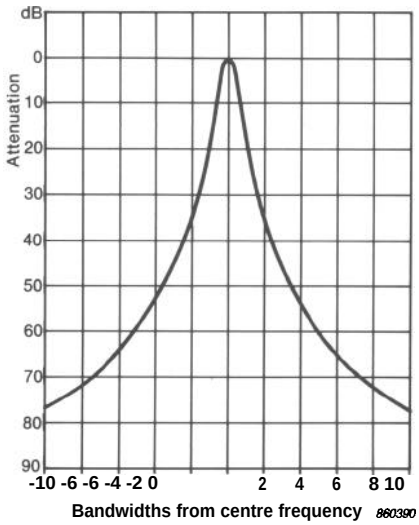


Fig. 5. Pass band of the 1; 3,16; 10; 31,6; 100 and 316 Hz narrow-band noise bandwidths of the 1049

Compressor

As an alternative means of maintaining a constant output level with a loudspeaker or vibration exciter, the 1049 includes a Compressor. This enables a "live" control signal from an external preamplifier and measurement transducer to be used to automatically regulate and weight the output level of the Generator according to the dynamic characteristics of the loudspeaker or vibration exciter under actual test conditions.

The Compressor comprises an Input Attenuator and RMS Detector, followed by a VCO and Voltage Comparator. The VCO is used to produce a variable-frequency clock signal which is proportional to the rate of change of the input signal and is fed to the amplitude sweep register for automatic control of the Output Attenuator. The decision as to whether an increasing or decreasing amount of compression is needed to maintain a constant excitation level is made by the Comparator, which actuates the up/down input of the amplitude register.

The Compressor is equally adept at regulating the random noise as well as sine-wave outputs of the 1049 and gives no regulation error when dwelling at a single frequency. In both modes regulation over a 118 dB range is achieved, relative to a maximum output level of 5 V RMS.

The amount of compression is adjustable over a wide range using the Input Attenuator and either the input level or the amount of compression can be monitored directly on the 1049. For regulating low frequency signals without distorting the signal waveform, as well as counteracting excitation peaks of loudspeakers and vibration exciters, there is a choice of eight compressor speeds ranging from 0,3 to 1000 dB/s.

Amplitude Sweep

Also available with the 1049 is a logarithmic amplitude sweep. This may be chosen in place of a frequency sweep and is useful for investigating the electrical limiting and delimiting characteristics of audio recording and reproducing equipment, plus studying the dynamic behaviour of loudspeakers, earphones and telephone handsets. For these applications, either the random noise or sine output may be employed and the output level swept up and down with a sweep rate between 0,Ol and 999 dB/s.

As with the Compressor, the amplitude sweep is obtained by utilizing the amplitude register of the Sweep Synthesizer to automatically step the Output Section Attenuator of the 1049. In this case, however, a separate clock signal is applied whose frequency determines the particular sweep rate selected. The amplitude resolution of the sweep is better than 0,l dB.

Monitoring and Set-Up Adjustments

Display and Field Entry

For convenient setting-up and monitoring of control settings, frequency sweep and output voltage limits etc., the front panel is furnished with a 40-character vacuum fluorescent line display plus a keyboard for selection of set-up and operating modes (see Figs.6 and 7). Depending on the particular set-up and operating mode chosen, the display is capable of indicating as many as four control settings simultaneously which also makes it useful for monitoring control parameters during the course of measurements.

Just below the display are four Field Select keys for selecting control settings to be changed. These may be used either to select and set a particular control setting directly, enabling a linear sweep to be changed to a logarithmic sweep for example, or for increasing the number of digits by which the frequency may be entered using the numeric pushkeys on the right of the front panel. Alternatively, the frequency and amplitude limits may be altered by employing the Speeder knob which is located beneath the Field Select keys.

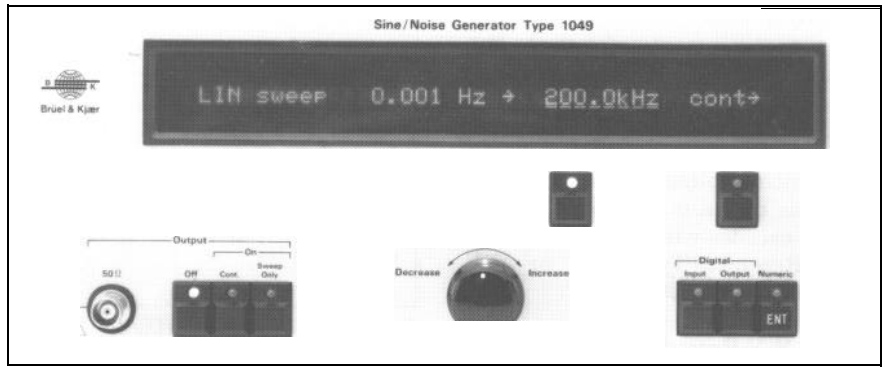


Fig. 6. Vacuum fluorescent line display, plus the field select and speeder controls of the 1049 and 1051

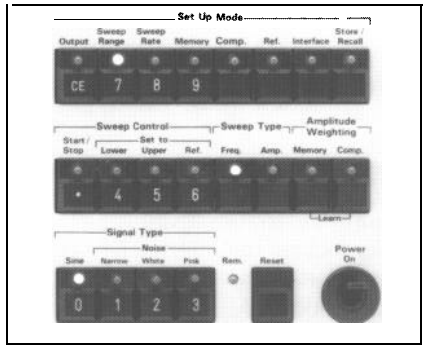


Fig. 7. The Setup Mode, Sweep and Signal *keys of the 1049*

The Speeder emulates the function of the coarse and fine tuning knobs of analog types of generator. Turning the knob a fraction to the left or right gradually decreases or increases the displayed value for the function selected with the Field Select keys, while a proportionately larger turn increases the speed at which the displayed value is altered.

Operating Set-Ups

When first switched on the Generators are automatically set to the control settings selected during previous use. The settings are stored in a continuous memory which is capable of storing 9 complete sets of front panel settings or setups so that a number of exciter control programmes may be kept on hand for performing frequently repeated swept frequency tests and measurements.

The individual setups may be instantly recalled whenever desired, simply by entering their set-up number. Provided that the memory back-up battery is kept charged by subjecting the Generators from between 2 to 4 hours use per week, then the set-ups may be retained indefinitely. See the "Specifications" section.

If required an entire setup may be copied in another setup so that only a limited number of control settings changes need be made to obtain a new setup suited to a specific test or task. Where more than 9 setups are required, they may be stored externally using a digital tape or disk station and input over the digital interface of the Generators.

Interfacing

Digital Interface

The digital interface of the 1049 and 1051 conforms with the IEEE Std. 488-1978, and is fully compatible with the IEC 625-l standard. It may be interconnected with as many as 15 separate instruments at one time, thus enabling numerous, fully integrated, ATE (automated test equipment) systems to be built which may be operated via a desk-top calculator, computer or purpose built controller.

The interface has a full Talker (T5) and Listener (L3) capability, permitting remote sensing and selection of the generator controls, plus printing of the control status. As with other B &K instruments, the interface accepts easy to interpret acronyms as well as complete control names for commands, thus enabling users to setup their own fully automatic control sequences with the minimum of programming experience.

Recorder Interface

For graphic recording of swept frequency tests and measurements analog outputs are available for coupling level or X-Y recorders. These are shown in Fig.8 and provide the necessary control voltages for synchronous recording over a maximum of six frequency decades with either the B&K Level Recorder Type 2307 or X-Y Recorder Type 2308.

With X-Y Recorders, recordings can be made on linearly or logarithmically graduated paper, irrespective of which type of frequency sweep is chosen on the Generators. Also plotting of forward and reverse frequency sweeps is possible and for tape recorder and acoustic investigations the X-Y synchronization can be delayed between 0 and 1 s in 10 ms steps to coincide with the arrival of the measured signal. For continuous monitoring of measurements the wide choice of sweep rates of the Generators enable the X-Y output to be used to control an oscilloscope.

Auxilliary Outputs

Supplementing the sine-wave and noise outputs of the Generators is a square wave output. This provides a 1 mHz to 200 kHz TTL signal corresponding with the frequency setting of the Generators which will be found ideal for pulse testing of electronic measuring, recording and reproducing equipment.

Also available with the Generators are a fixed frequency (5 MHz) and a variable frequency (5 – 7 MHz/50 – 70 MHz user selected) output which may be used as clock references for external equipment.

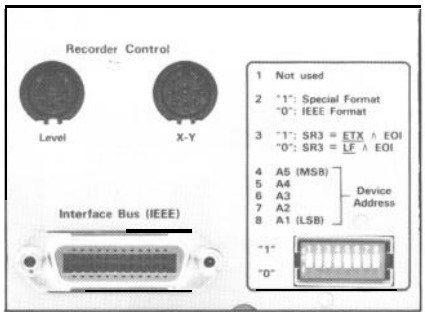


Fig. 8. The Recorder and Digital Interface connectors of the 1049 and 1051

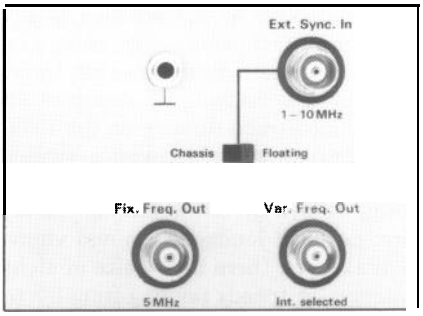


Fig. 9. The Fixed and Variable Freq. Outputs, plus the External Synchronization Znput of the 1049 and 1051

Synchronization Input

For locking the internal clock of the Generators with an external source, a Synchronisation Input is provided which accepts a 10 MHz signal or an appropriate sub-harmonic. See "Specifications".

Examples of Use

Because of their high performance capability and extreme operating flexibility, the Sine/Noise Generator Type 1049 and Sine Generator Type 1051 can be used for a very wide range of applications.

Their wide frequency and dynamic ranges, high accuracy, resolution and stability, plus extensive remote control possibilities via a standard IEEE/IEC digital interface, make them an ideal ATE signal source for electronic design and development work, quality control, production test and service of a wide variety of electrical products. In addition, the noise output and compressor facilities of the 1049 will find extensive applications in electro-acoustic and building acoustic investigations, as well as in vibration testing of mechanical components and structures.

For use of the 1049 and 1051 as part of a larger measurement system Brüel & Kjær markets a range of analogue and digital equipment. These include the Digital Voltmeter Type 2432, Dig-

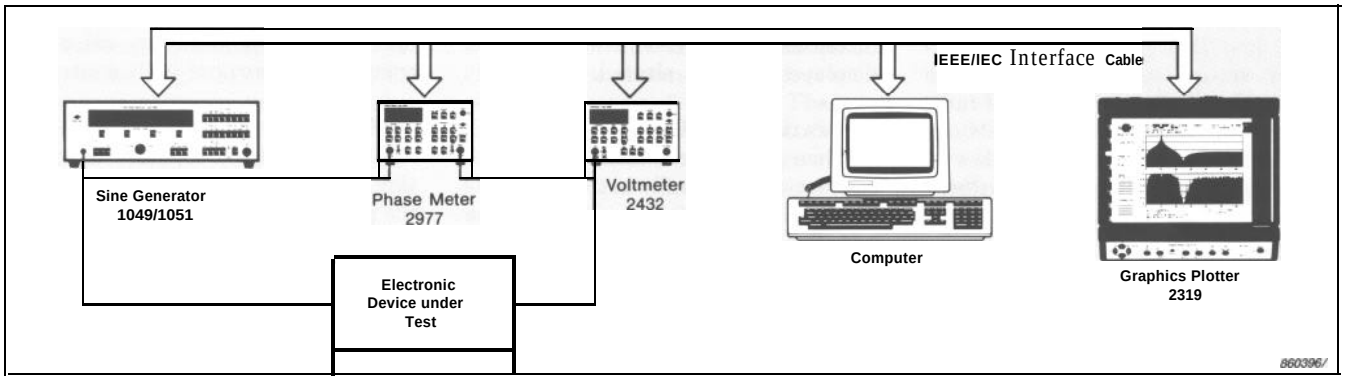


Fig. 10. Automatic test arrangement for frequency response measurements (amplitude and phase) on electronic equipment. Using their internal memory for preconditioning, the 1049 and 1051 Generators can simulate a record pick-up, tape head, preamplifier equalization network output etc.

ital Phase Meter Type 2977, High Resolution Signal Analyzer Type 2033 and Dual Channel Signal Analyzers Type 2032 and 2034 – all of which are especially designed for a wide variety of response measurements and frequency analyses. For storage and documentation of results the Digital Cassette Recorder Type 7400, plus Graphics Recorder and Plotter Type 2313 and 2319 are available. Some typical examples of the use of these instruments with the Generators are shown in Figs.10 to 12.

As with the Generators, all the digital equipment mentioned can be controlled via a computer or purpose built system controller which features an IEEE/IEC interface. This makes them ideal for use in laboratory, production and environmental testing where very many performance tests and calibration checks have to be carried out which are of a repetitive nature. Here it is useful that tests are carried out on an automatic basis using a computer or system controller to control the entire test setup. Also, a computer can be used for reformatting measured data to produce a hardcopy readout of frequency, phase and amplitude responses etc., with a graphics recorder or plotter. In more advanced systems a computer may be used to decide on whether test results are within acceptable limits as well as to diagnose faults.

For further details on the B&K equipment mentioned, please consult the B&K Short-Form or Master Catalogues.

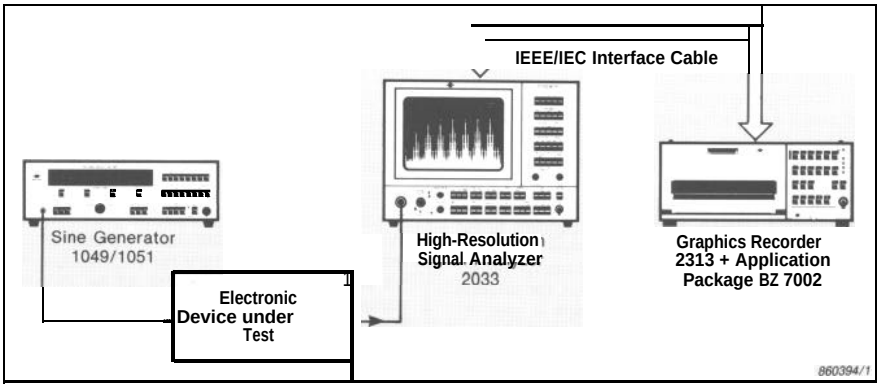


Fig. 11. Harmonic distortion measurements using the 1049 or 1051 Generator with the 2033 High-Resolution Signal Analyzer

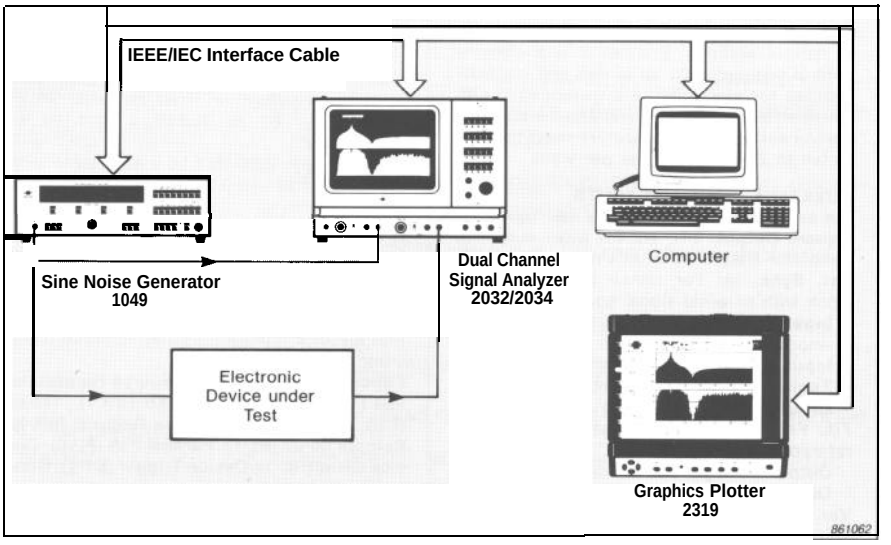


Fig. 12. Automatic test arrangement using the 1049 Sine/Noise Generator with the 2032 or 2034 Dual Channel Signal Analyzer for transfer function and distortion measurements on electronic equipment. Using the amplitude sweep function of the 1049 the attach and release time of compressor/expander circuits and other non linear equipment may be measured

Specifications 1049/1051

SINE GENERATOR:
Frequency Range: 0,2 Hz to 200kHz. The generator can be used at frequencies down to 0,001 Hz. See "Amplitude Linearity" Spec.
Frequency Resolution: 1 $^{+0,18}_{-0,00}$ mHz
Frequency Stability: <25 ppm from 10 to 40°C with <5 ppm aging per year
Harmonic and Spurious Distortion:
(-96 dB within 20 Hz to 20 kHz
<-85 dB within 0,2 Hz to 100 kHz
<-75 dB within 100 kHz to 200 kHz
Phase and A.M. Noise: <-85 dB measured over 200 kHz range with 5 V output and 1 Hz rejection band centered on output frequency
Amplitude Linearity:
± 0,05 dB from 20 Hz to 20 kHz
± 0,2 dB from 0,2 Hz to 200 kHz
-3 dB limit ~0,01 Hz with 20 dB/decade attenuation slope down to 0,001 Hz

GENERATOR OUTPUTS:
Via BNC sockets on front and rear panel
Output Voltage: 100 μV to 5 V RMS selectable to 3-digits with ± 0,026dB relative attenuator accuracy. Output readout based on no-load condition
Output Impedance: 50 Ω
Grounding: Chassis/Floating (0,1 V max.)

OUTPUT On/Oft
Fast: <0,1 ms rise and decay time
Slow: -30 ms for raising and suppressing output signal 60 dB

AMPLITUDE MEMORY:
1024 amplitudes can be memorized within any given frequency range and later recalled for successive single or repetitive amplitude weighted frequency sweeps. Amplitudes may be input numerically via the front panel push-keys, digitally via the IEEE/IEC interface or as a voltaae input to the 1049 compressor. Includes automatic amplitude interpolation between consecutive amplitudes input

FREQUENCY SWEEP:
Linear/Logarithmic with or without amplitude weighting from amplitude memory

Sweep Limits: from 0,2 Hz to 200 kHz, selectable to 4 digits. In extended range 0,001 Hz to 200 kHz linear sweep. The limits will be reached within the resolution of the programmed stop frequency ± 0,001 Hz

Sweep Rate:
Linear: 0,001 Hz/s to 999,9 kHz/s selectable to 4 digits with $\pm 2^{-15}$ accuracy
Logarithmic: 0,001 mDec/s to 2,000 Dec/s selectable to 4 digits with $\pm 2^{-15} \pm 0,2\%$ per Dec/s accuracy

Sweep Resolution:
Linear: <1 mHz at rate <4,768 kHz/s or <0,244 Hz at rate >4,788 kHz/s
Logarithmic: <1 mHz at rate <8,089m-Dec/s or frequencies <1 kHz. 0,244 Hz outside the above limits

Sweep Modes: Up, Down, Up and Down, Single, Repetitive 1 – 99 times and Continuous are selectable
Amplitude Weighting: 1024 amplitude levels can be played back during the frequency sweep. See "AMPLITUDE MEMORY" Spec.

Sweep Pause: 0,00 to 100,0 s pause between repetitive sweeps, selectable with 10 or 100 ms resolution and 1 ms accuracy
Pause Output: Output may be set "On" or "Off" between repetitive sweeps
Control Limits: Sweep on may be individually preset to reference or any preset lower and upper frequency or amplitude limit dependent on sweep type
Sweep lime: Computes and displays time for single sweep between particular lower and upper limit and sweep rate selected. Minimum single sweep time is 8 ms for repetitive Up/Down sweeps and 62,5μs for sweeps including pause or single sweeps in one direction

LINE DISPLAY:
40-character, vacuum fluorescent, line display with 4 display fields for entry and storage of generator control settings, as well as simultaneous monitoring of generator output frequency, output voltage, compressor voltage, etc.

TEST PROGRAMMES:
Non volatile memory for storage of front panel control settings. Enables 9 user-defined control sequences to be stored and instantly recalled for electronic, electro-acoustic and vibration test work. For continuous storage of control settings the Generators must be subjected to 2 to 4 hours use per week.

AUXILIARY INPUTS/OUTPUTS:
Via separate BNC sockets on rear panel
Square Output: TTL square wave output of generator frequency from 1 mHz to 200 kHz
Ext. Sync. In: For phase locking internal clock with external signal source
- Input Freq: 10 MHz down to tenth sub-harmonic
- Input Voltage: 0,6 to 30 V Peak-to-Peak
- Tuning Range: ± 100 ppm
- Ground: Chassis/Floating (0,1 V max)

Fix. Freq. Out: 5 MHz square-wave output reference frequency
- Output Voltage: 0,6 V Peak-to-Peak
- Output Impedance: 200 Ω

Var. Freq. Out: User selected 5 to 7 MHz or 50 to 70 MHz output depending on generator frequency
- Output Voltage: 0,6 V Peak-to-Peak
- Output Impedance: 25 Ω

Sweep Start: TTL output for trigger recording

RECORDER INTERFACE:
Level Recorder: 7-pin DIN socket providing remote control of start, stop, automatic stop and pen lift

X-Y Recorder: 8-pin DIN socket providing remote control of pen lift and X-deflection
Voltage Ramp: 0 to 10 V for X-deflection 12 bit D/A Converter. Linearity 10 bit. 200 Hz sample frequency
Ramp Voltage Limits:
Lin. or Log. voltage ramp selectable for either
Lin. or Log. frequency sweep
- Lin. Ramp: 0 to 10 V for any lower or upper frequency limit from 0 Hz to 200 kHz or fixed limits of 0 Hz to 200 Hz, 0 Hz to 2 kHz. 0 Hz to 20 kHz and 0 Hz to 200 kHz
- Log. Ramp: 0 to 10 V ramp for any lower or upper frequency limit from 0,2 Hz to 200 kHz or fixed limits of 0,2 Hz to 200 kHz, 2 Hz to 2 kHz, 20 Hz to 20 kHz and 200 Hz to 200 kHz
- Amp. Ramp (1049 only): 0 V to 10 V for any lower or upper amplitude limit from 40 to 140 dBμV or fixed limits of 40 to 100 dBμV, 60 to 120 dBμV and 80 to 140 dBμV

Ramp Delay: 0,00 to 1 ,00 s selectable with resolution down to 0,01 s

IEEE/IEC DIGITAL INTERFACE:
Conforms to IEEE 488 and IEC 625-I standards. Connection into an IEC interface system is made using cable A0 0264 or cable A0 0194 and Adaptor A0 0195. Connection into an IEEE interface system is made using cable A0 0265.
Functions Implemented: Source Handshake (SH 1). Acceptor Handshake (AH I), Talker (T 5). Listener (L 3). Service Request (SR 1), Remote Local (RL 1), Parallel Poll (PP 0), Device Clear (DC 1). Device Trigger (DT I), Controller (C 0)
Data Ouput: Generator frequency, output level etc., plus all front panel control settings
Remote Control: All functions and instrument front panel settings can be remotely controlled via the digital interface. Amplitude-/frequency can be set with full resolution in less than 20 ms Binary (30 ms ASCII) format
Code: IS0 7 bit code

GENERAL
Warm-Up lime: -20 minutes
Temperature Range:
- Operation: 10 to 40°C (50 to 104°F)

Max. Humidity: 90% RH (non condensing) at 30°C
Electromagnetic Compatibility: Complies with Class B Device of the American FCC Rules
Power Requirements: Complies with IEC 348 Safety Class II
- Supply Voltage: 100; 115; 127; 200: 220; 240 V AC (50 to 60 Hz) ± 10%
- Consumption: 50 VA

Cabinet: Supplied as Model A (light-weight metal cabinet) or Model C (as A but with flanges for standard 19 in rack)
Dimensions: Metal cabinet, excluding knobs and feet
- Height: 133 mm (5,2 in)
- Width: 430 mm (16,9 in)
- Depth: 320 mm (12,6 in)

Weight:
- Type 1049: 11,6 kg (25,5 lb)
- Type 1051: 11,1 kg (24,5 lb)

ACCESSORIES INCLUDED:
1 x Mains Cable ..... AN 0020
1 x BNC Plug ..... JP 0035
1 x IEEE Std. 488 Bus Connector Kit ..... UA 0814
2 x 250 mA Fuse ..... VF 0031
2 x 500 mA Fuse ..... VF 0023
Instruction Manual

ACCESSORIES AVAILABLE:
Service Manual
Interface Cable (2 m), IEC 625-I (25-way to IEEE 488 ..... AO 0264
Interface Cable (2 m), IEEE-488 ..... AO 0265
X-Y Recorder
Control Cable (1,5 m) ..... AQ 0034
Level Recorder
Control Cable (1,5 m) ..... AQ 0035
Rack Mounting Flanges ..... KS 0023

Additional Specifications 1049

NOISE GENERATOR:
Generator Type: Pseudo Random
Distribution: Symmetrical Gaussian amplitude distribution up to 4,5 σ
Line Spacing and Sequence Length:

Upper Limit	2 kHz	20 kHz	200 kHz
Line Spacing	11,37 nHz	113,7 nHz	1,137 μHz
Sequence Length	24434 h	2443 h	244,3 h

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Spurious Distortion: As for Sine Generator +12 dB
Spectral Flatness: ± 0,5 dB within freq. range
Output Voltage: As for Sine Generator -12 dB

Narrow-Band Random Mode:
Centre Frequency: As for Sine Generator
Noise Bandwidth: 1: 3,16; 10; 31,6; 100 and 316 Hz. Actual -3dB bandwidth 4,7% narrower than noise bandwidth
Filter Types: 3-pole Butterworth

White Noise Mode:
Frequency Range Limits:
Lower: 2; 20 and 200 Hz – 0,5 dB 1,4; 14 and 140 Hz noise limit. The actual –3dB lower limit is 4,6% greater
Upper: 2; 20 and 200 kHz – 0,5 dB 2,8; 28 and 280 kHz noise limit The actual –3 dB upper limit is 4,6% less
Filter Type and Ripple: d-pole Chebishev <0.1 dB ripple

Pink Noise Mode: As for White Noise Mode, but with -10 dB/decade attenuation above 2; 20 and 200 Hz lower limits

AMPLITUDE SWEEP:
Rate: 0,01 to 999 dB/s with resolution down to 0,1 dB and 2^{-8} to 2^{-14} accuracy
Switching: Amplitude sweep and compressor regulation causes small transients due to range switching at the following levels:
Down Sweep: 612,5 μV; 10 mV and 160 mV
Up Sweep: 1,25 mV; 20 mV and 320 mV
Sweep Limits: Selectable to 4 digits in whole amplitude range with 0,1 dBμV resolution

COMPRESSOR:
Compression: 118 dB max. for sine and noise modes
Speed: 0,3; 1; 3; 10; 30; 100; 300; and 1000 dB/s
Input Attenuator: 0,10 to 2,50 V accuracy 1%. 3 digit, 0,01 V resolution
Input Detector: RMS
Freq. Response: 2 Hz to 200 kHz ± 0,2 dB

Brüel & Kjær

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