Product Data

Sine/ Noise Generator — Type 1054

USES:

- Precision signal generator for use in computer based test systems, requiring a high accuracy excitation source
- Automatic test and calibration of electrical and mechanical equipment for product design, development, production and service
- Signal source for evaluation of A/D converters
- 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 Hz to 2,54 MHz, sine generator with frequency resolution down to 10 mHz and crystal clock stability
- Narrow-band, white and pink noise modes
- Calibrated output from 1 mV to 5V with less than -60 dB harmonic and -80 dB spurious distortion
- Seven-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 2,54 MHz/s and 0,001 mDec to 4 Dec/s respectively
- Single, repetitive (1 -99) and continuous sweep modes with 0,O1 to 100,0 s pause between sweeps
- 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
- 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

The Brüel & Kjær Type 1054 is a microprocessor-based sine generator which combines today's needs of spectral purity, frequency resolution and stability with ease of use and versatility. The wide frequency coverage from 0,2 Hz to 2,54 MHz, with amplitude linearity and frequency resolution of ±0,1 dB and 10 mHz, makes it 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 10 mHz to 2,54 MHz. Single, repetitive and continuous sweep modes are also included and the time for each individual sweep is automatically calculated and displayed.

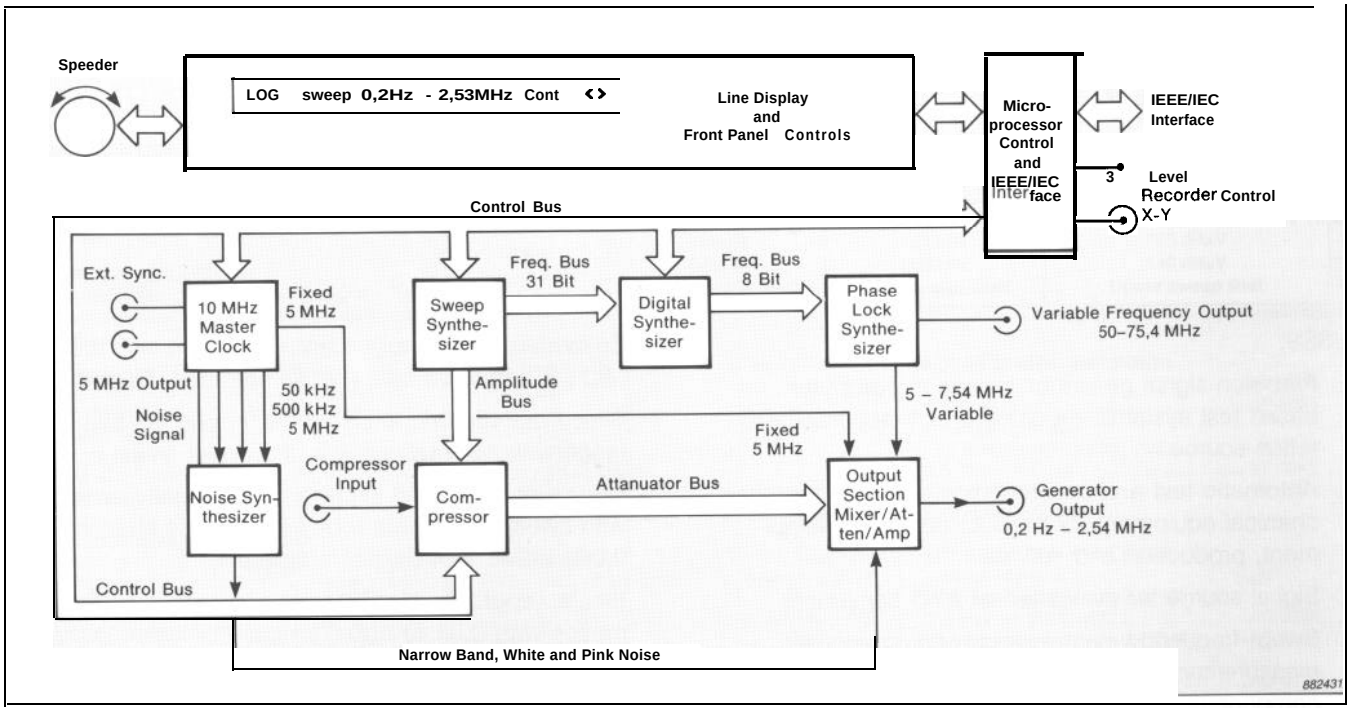

Fig. 1. Simplified block diagram of the Sine/Noise Generator Type 1054

Outputs levels from 1 mV 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 Generator 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 Generator. In addition, there is an analogue "speeder" knob for fast and 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 Generator, it may be coupled with a digital plotter.

In addition to the above, the Type 1054 has a number of extra facilities. These include a logarithmic amplitude sweep, as well as narrow-band, 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 Generator Type 1054 is shown in Fig. 1. It has 8 main sections, namely a Master Clock, a Digital Frequency Synthesizer, a Phase Lock Synthesizer, a Sweep Synthesizer, a Noise Generator, a Compressor 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 the IEEE/IEC interface of the Generator.

Frequency Synthesizer

The Generator employs a heterodyne synthesis technique where a 5 MHz fixed frequency is mixed with a 5 to 7,54 MHz variable frequency to produce an 0,Ol Hz to 2,54 MHz swept-frequency, sine wave output with frequency resolution of 10 mHz. The 5 MHz fixed frequency is obtained from a Master Clock, while the 5 to 7,54 MHz variable frequency is derived from the 50 to 75,4 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 Input socket on the rear panel. See Fig. 2.

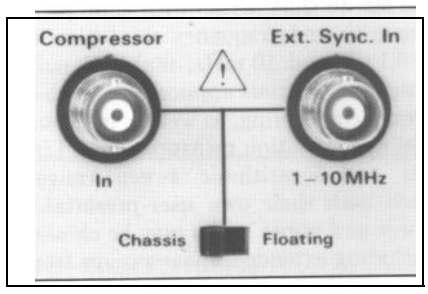

Fig. 2. External Synchronization Input on the rear panel of the 1054 Generator

For a 5 to 7,54 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 10 kHz fractional frequency setting of the Generator, while the remaining 8 bits are used to produce a 49,9 to 75,4 MHz control frequency proportional to the N *x* 10 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 75,4 MHz control frequency which after application to a 10:l frequency divider is fed to the Output Mixer where the final stages of frequency conversion take place. The use of two phase lock loops for producing 50 to 75,4 MHz control frequency, ensures that phase noise is kept to a minimum.

Output Section

From the Phase Lock Synthesizer the 10 to 15,8 MHz control frequency is applied to a second 2:l frequency divider which is included at the input of the mixer stage of the Output Section. The output is then mixed with the 5 MHz output of the Master Clock to produce a sine wave signal whose frequency corresponds directly to the frequency indicated on the display of the Generator. For removing unwanted side-band components in the mixed signal, a 2,8 MHz low-pass filter is employed.

Before application to the outputs of the Generator 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 1 mV to 5,00 V RMS via the front panel controls and interface bus of the Generator.

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.

The amplitude linearity of the output is better than ± 0,l dB at frequencies between 20 Hz and 20 kHz, decreasing to ± 0,5 dB at 0,2 Hz and 500 kHz. From 0,2 Hz to 2,54 MHz, the amplitude linearity is ± 1 dB. At lower frequencies the amplitude falls by 20 dB per decade, but by utilizing the "Memory Learn" function of the Generator to maintain a constant output level of 300 mV or less, a flat amplitude characteristic can be maintained at all frequencies down to 0,Ol Hz.

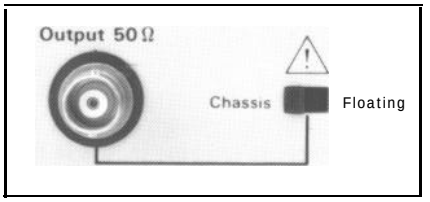

Fig. 3. BNC Output and Chassis/Floating switch on the rear panel of the 1054

Sweep Synthesizer

The Sweep Synthesizer includes a ramp register which produces a 31 bit output representing the frequency setting of the Generator. The frequency may be set by an input either from the front panel keyboard or via the interface bus of the Generator. 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 2,54 MHz/s and 0,001 mDecade/s to 4 Decade/s, respectively.

With linear and logarithmic frequency sweeps, up to seven complete frequency decades can be covered in a single range. The logarithmic sweep range extends from 0,2 Hz up to 2,53 MHz, while the linear sweep range is from 0,Ol Hz up to 2,54 MHz, 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.

A convenient feature is that the Generator automatically computes 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 1054 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 Generator. The input may be applied directly to the amplitude register or, if the "Memory Learn" function is used, via the internal memory of the Generator. In the latter case, up to 1024 amplitudes can be stored for successive frequencies within any desired frequency range of the Generator, 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 the Generator 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 1054.

Noise Generator

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,l 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 or 12,5 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. 4, but with centre frequency of 5 MHz. The two signals are then combined and fed to the 5 to 7,54 MHz 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 1054, 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.

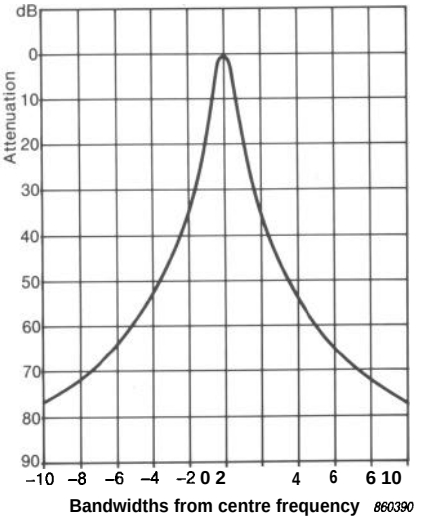

Fig. 4. Pass band of the 10; 31,6; 100; 316; 1000 and 3160 Hz narrow-band noise bandwidths

Compressor

As an alternative means of maintaining a constant output level with a loudspeaker or vibration exciter, the 1054 includes a Compressor. (See Fig. 5.) 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.

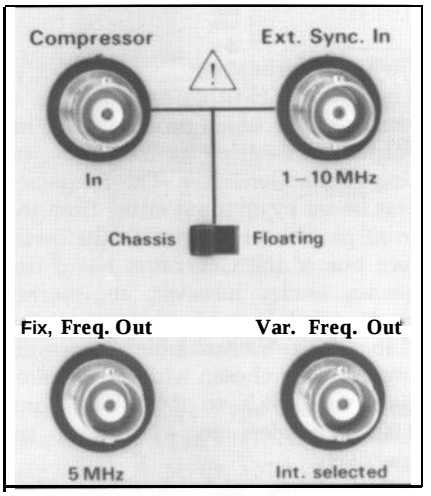

Fig. 5. The Compressor, Fixed and Variable Freq. Outputs, and External Synchronization Input sockets on the rear panel of the 1054

The Compressor comprises an Input Attenuator and RMS Detector, followed by a Voltage Controlled Oscillator (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 1054 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 5V 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 1054. 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 included with the 1054 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 1054. 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.

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 Generator is 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 Generator 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 Generator.

Interfacing

Digital Interface

The digital interface of the 1054 conforms with the IEEE Std. 4881978, 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, ATS (automated test 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

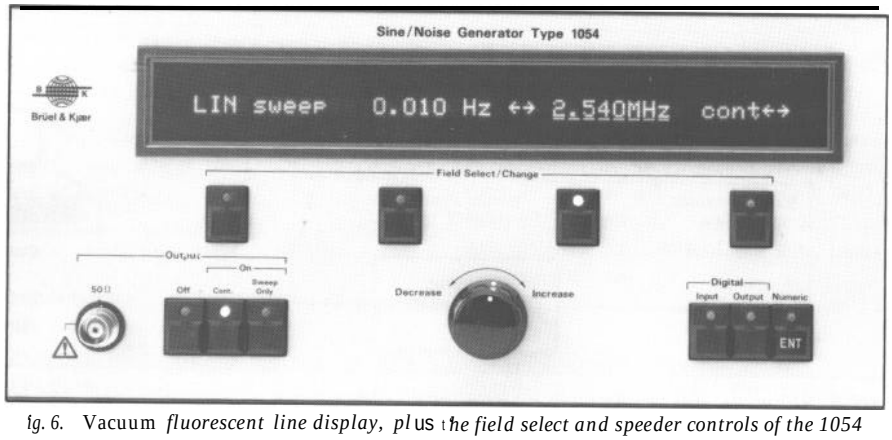

Fig. 6. Vacuum *fluorescent line display, plus the field select and speeder controls of the 1054*

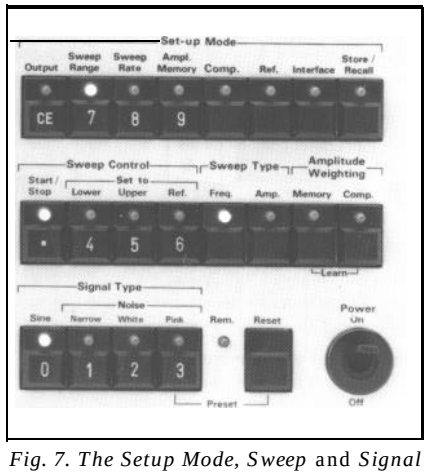

Fig. 7. The Setup Mode, Sweep and *Signal keys*

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 seven 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 Generator. 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.

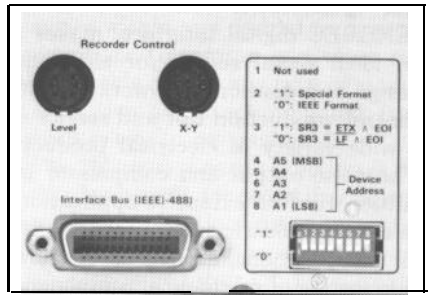

Fig. 8. The Recorder and Digital Interface connectors

Auxilliary Outputs

Supplementing the sine wave and noise outputs of the Generators is a square wave output. This provides a 10 mHz to *2,54* MHz TTL signal corresponding with the frequency setting of the Generator which will be found ideal for pulse testing of electronic measuring, recording and reproducing equipment.

Also available with the Generator is a fixed frequency (5 MHz) and a variable frequency (50 – 75,40 MHz) output which may be used as clock references for external equipment.

Synchronization Input

For locking the internal clock of the Generator with an external source, a Synchronization Input is provided which accepts a 10 MHz signal or an appropriate sub-harmonic. See Fig. 2 and the "Specifications".

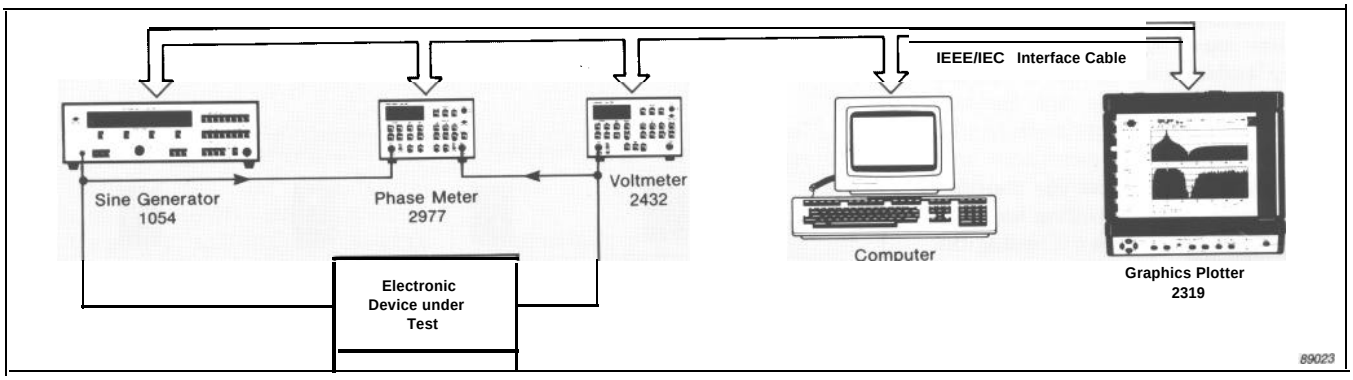

Fig. 9. Automatic test arrangement for frequency response measurements (amplitude and phase) on electronic equipment. Using the internal memory for preconditioning, the 1054 Generator can simulate a record pick-up, tape head, preamplifier equalization network output etc.

Examples of Use

Because of the high performance capability and extreme operating flexibility, the Sine/Noise Generator Type 1054 can be used for a very wide range of applications.

Its wide frequency and dynamic ranges, high accuracy, resolution and stability, plus extensive remote control possibilities via a standard IEEE/IEC digital interface, makes it an ideal signal source for electronic design and development work, quality control, production test and service of a wide variety of electrical products. The noise output and compressor facilities 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 1054 as part of a larger measurement system Brüel & Kjær markets a range of analogue and digital equipment. These include the Digital Voltmeter Type 2432, Digital Phase Meter Type 2977, High Resolution Signal Analyzer Type 2033, Dual Channel Signal Analyzers Type 2032 and 2034, and Real-time Frequency Analyzers Type 2123 and 2133 – 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 Generator are shown in Figs.9 to 11.

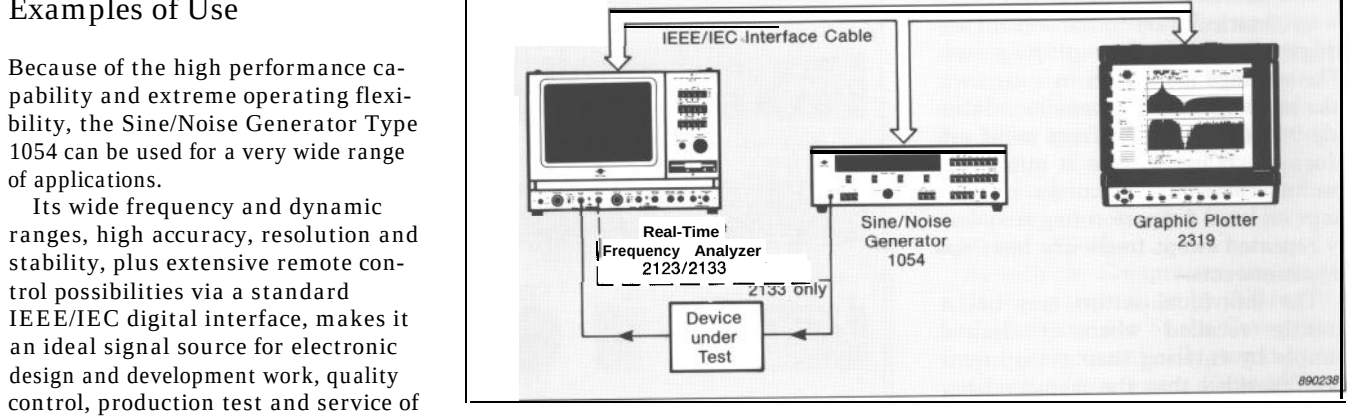

Fig. 10. General frequency response and distortion measurements using the 1054 Sine/Noise Generator with the Real-Time Frequency Analyzer Type 212312133

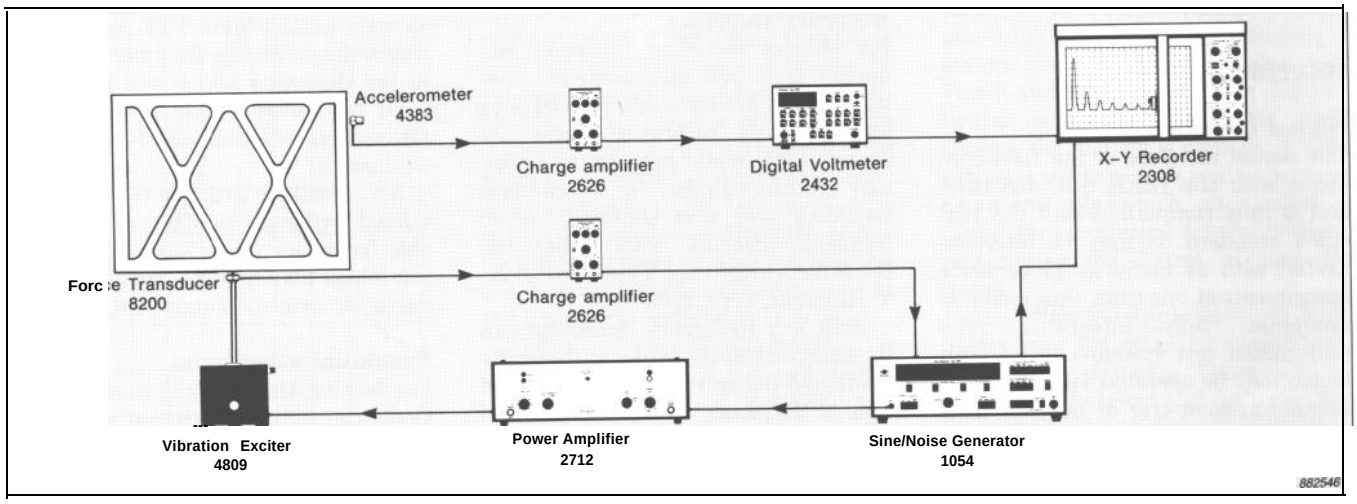

Fig. 11. Mobility measurement of mechanical structure using the compressor to maintain a constant excitation level. This method is particularly suited to measuring non-linear structures where the response is not proportional to the excitation level

As with the Generator, 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 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.

Specifications 1054

SINE GENERATOR:
Frequency Range: 0,2 Hz to 2,54 MHz. The generator can be used at frequencies down to 0,01 Hz. See "Amplitude Linearity" Spec.
Frequency Resolution: 0,01 Hz with numeric entry. 5 or 9 digits with speeder entry
Frequency Stability: <25 ppm from 10 to 40°C with <5 ppm aging per year
Frequency Accuracy: $\pm 1{,}192$ mHz $\pm$ Frequency Stability
Harmonic Distortion:
<-60 dB from 0,2 Hz to 500 kHz raising from 500 kHz with 6 dB per octave and from 1,5 MHz with 9 dB per octave. No load condition.
Spurious Distortion:
<-80 dB from 0,2 Hz to 2,54 MHz with 5 V output
Phase and A.M. Noise: <-60 dB in a 30 kHz band centered on the carrier with 5 V output and 1 Hz rejection band centered on output frequency
Amplitude Linearity and Accuracy:
$\pm 0{,}1$ dB from 20 Hz to 20 kHz
$\pm 0{,}5$ dB from 2 Hz to 500 kHz
± 1 dB from 0,2 Hz to 2,54 MHz
Output RMS Voltage: 1 mV to 5 V RMS selectable to 3-digits with $\pm 0{,}026$ dB relative attenuator accuracy at 1 kHz. Output readout based on no-load condition

NOISE GENERATOR:
Generator Type: Pseudo Random
Distribution: Symmetrical Gaussian amplitude distribution up to $4{,}5\sigma$
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

T01029GB1

Spurious Distortion: As for Sine Generator
Spectral Flatness: $\pm 0{,}5$ dB within freq. range
Output RMS Voltage: As for Sine Generator -12 dB

Narrow-Band Mode:
Centre Frequency: 0,2 Hz to 2,54 MHz (as sine)
Noise Bandwidth: 10; 31,6; 100; 316; 1000 and 3160 Hz
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 -3 dB 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: 3-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

GENERATOR OUTPUTS:
Via BNC sockets on front and rear panel
Output Impedance: $50 \pm 0{,}15\ \Omega$
Grounding: Chassis/Floating (Max. $\pm 0{,}1 V_p$; diode-clamped)

OUTPUT On/Off:
Fast: $<0{,}1$ ms rise and decay time
Slow: -30 ms for raising and suppressing output signal 80 dB

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 0,09 dB. 3 digit, 0,01 V resolution
Input Detector: RMS
Freq. Response: 2 Hz to 200 kHz $\pm 0{,}2$ 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 voltage input to the 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 2,53 MHz, selectable to 4 digits. In extended range 0.01 Hz to 2,54 MHz linear sweep. The limits will be reached within the resolution of the programmed stop frequency $\pm 0{,}01$ Hz

Sweep Rate:
Linear: 0,001 Hz/s to 2,54 MHz/s selectable to 4 digits with $\pm 2^{-15}$ accuracy
Logarithmic: 0,001 mDec/s to 4,000 Dec/s selectable to 4 digits with $\pm 2^{-15}$ accuracy. $\pm 0{,}2\%$ fluctuation when lower frequency is above 40 Hz. Same accuracy down to 0,4 Hz for rates below 129,4 mDec/s

Sweep Resolution: Dependant on sweep rate and output frequency. Step sizes: 1,19 mHz/step. 153 mHz/step or 39,06 Hz/step Lowest size automatically selected

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 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 Time: 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 62,5 μs for sweeps including pause or single sweeps in one direction

AMPLITUDE SWEEP:
Rate: 0.01 to 999 dB/s with resolution down to 0,0l dB/s 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: 10 mV and 160 mV
Up Sweep: 20 mV and 320 mV
Sweep Limits: Selectable to 4 digits in whole amplitude range with 0,1 dBμV resolution

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.

STORE AND RECALL:
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. A control sequence recalls last setup when powered on. For continuous storage of control settings the Generator 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 10mHz to 2.54 MHz
Ext. Sync. In: For phase locking internal clock with external signal source
Input Freq: 10 MHz down to tenth subharmonic
Input Voltage: 0,6 to 30 V_{pp}
Tuning Range: ± 100 ppm
Ground: Chassis/Floating ($\pm 0{,}1 V_p$; diode-clamped)

Fix. Freq. Out: 5 MHz square-wave output reference frequency
Output Voltage: 0,6 V,,
Output Impedance: 200 Ω
Var. Freq. Out: User selected 50 to 75,4 MHz output depending on generator frequency
Output Voltage: 0,6 V_{pp}
Output Impedance: 25 Ω
Sweep Start: TTL output for trigger recording. High level indicates sweep.

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
Ramp Delay: 0,00 to 1,00 s selectable with resolution down to 0,01 s
Ramp Voltage: 0 to 10 V for X-deflection 12 bit D/A Converter. Linearity 10 bit. 200 Hz sample frequency. (See Table below)

IEEE/IEC DIGITAL INTERFACE:
Conforms to IEEE 488 and IEC 825-I standards. Connection Into an IEEE interface system is made using cable A00285 Connection into an IEC interface system is made using cable A0 0284 or cable A0 0194 and Adaptor A0 0195.
Functions Implemented: Source Handshake (SH 1), Acceptor Handshake (AH 1), Talker (T 5), Listener (L 3), Service Request (SR1), Remote Local (RL I), Device Clear (DC 1), Device Trigger (DT 1)
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

Ramp Voltage	Frequency Sweep Mode		Amplitude Sweep Mode
	Linear Axis	Logarithmic Axis	Logarithmic Axis
ov	0 Hz Lower sweep limit	2 Hz 20 Hz 200 Hz Lower sweep limit	40 dBμV 80 dBμV 80 dBμV Lower sweep limit
10 V	2 kHz 20 kHz 200 kHz Upper sweep limit	2 kHz 20 kHz 200 kHz Upper sweep limit	100 dBμV 120 dBμV 140 dBμV Upper sweep limit

T02006GE

GENERAL
Warm-Up lime: -20 minutes
Temperature Range:
Operation: 5 to 40°C (41 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 80 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: 13.3 cm (5,2 in)
Width: 43 cm (16,9 in)
Depth: 32 cm (12,6 in)
Weight: 11,6 kg (25.8 lb)

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

ACCESSORIES AVAILABLE:
Service Manual
Interface Cable (2 m), IEC 825-I (25-way) to IEEE 488 ..... AO 0284
Interface Cable (2 m), IEEE-488 ..... AO 0265
Adaptor to convert IEEE-488 connector to IEC 825-I (25-way) A0 0195
X-Y Recorder
Control Cable (1,5 m) ..... AQ 0034
Level Recorder
Control Cable (1,5 m) ..... AQ 0035
Rack Mounting Flanges ..... KS 0023

Brüel & Kjær

WORLD HEADQUARTERS: DK-2850 Nærum Denmark. Telephone: +45 2800 500 · Telex: 37316 bruka dk **Fax:** +45 2801405

Australia (02) 450-2066 · Austria 02235/7550*0 Belgium 02 · 242-97 45 Brazil (011) 246-8149/246-8166 Canada (514) 695-8225 · Finland (90) 60 17044
France (1) 645720 10 · Federal Republic of Germany (04106) 4055 Great Britain (01) 954-2366 · Holland 03402.39994 Hong Kong 5-487486 · Italy (02) 5244 141
Japan 03-438-0761 Republic of Korea (02) 554-0605 · Norway 02-787096 · Portugal (1) 65 92 56/65 92 80 · Singapore 2256533. Spain (91) 268 1000
Sweden (08) 711 2730 Switzerland (042) 65 11 61 Taiwan (02) 7139303 USA (508) 481-7000 Local representatives and service organisations world-wide

BP 0777–11

PRINTED IN DENMARK BY NÆRUM OFFSET