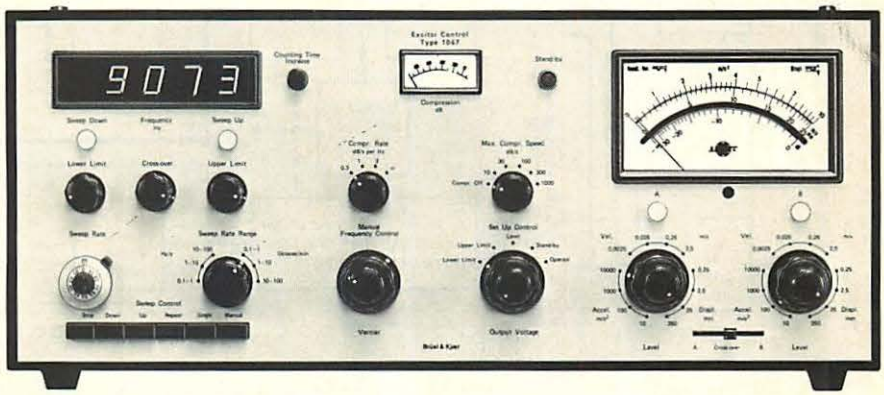
type 1047

Exciter Control

FEATURES:

- All solid state design
- Frequency coverage 5 Hz to 10 kHz in one range
- High stability voltage controlled oscillator with no moving parts
- Linear or logarithmic frequency sweep, single or repetitive between selectable frequency limits
- Continuously adjustable sweep rates
- 5 digit LED read-out for accurate frequency indication, 0,1 Hz or 1 Hz resolution
- Compressor circuit for constant acceleration, velocity and displacement
- 0 dB static regulation error
- Greater than 80 dB dynamic range of compressor circuit
- Automatic frequency controlled cross-over, option for more cross-overs
- Built-in compressor meter
- Wide selection of compressor speeds, frequency controlled or constant
- Lamp indication of sweep direction, compressor controlling channel, and for oscillator in stand-by condition
- Safety interlock on front panel switches



- Provision for off-line set-up of vibration program
- Linear and logarithmic DC ∝ frequency outputs
- Six outputs for controlling bandwidth of accessory instruments
- Short-time stop of sweep and reverse of sweep at any frequency
- Provision for remote start, stop and reverse of sweep
- Provision for parallel operation of several Exciter Controls in master-slave set-ups

USES:

- Sweep-sine excitation
- Multiple vibration exciter control
- Mechanical impedance analysis

The Exciter Control Type 1047 is designed to give sinusoidal sweep control of electro-dynamic vibration exciter systems. It provides the necessary frequency range and programming capabilities to meet all the latest vibration test specifications.

Description

General

The Exciter Control is an all electronic, solid state instrument which contains a sweep generator section, two vibration meter channels with common input and meter, and a compressor section for maintaining constant vibration level at the vibration exciter.

A frequency controlled cross-over facilitates, for example, D-A or V-A tests to be performed. Additional cross-overs, for example for D-A-D-A tests, can be provided by adding the required number of Vibration Programmers ZH 0100 (one cross-over for each ZH 0100).

In Fig.1 is shown a simplified block diagram of Type 1047.

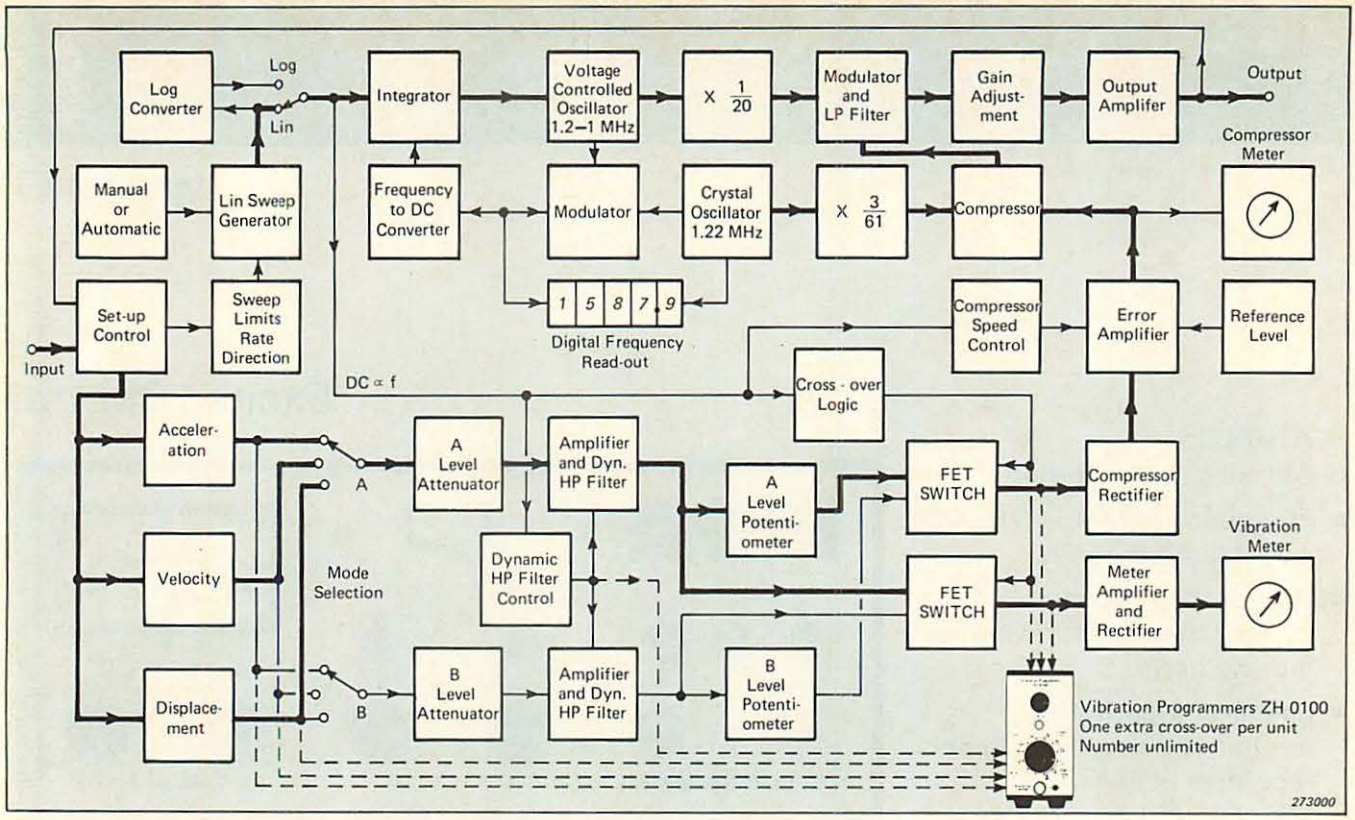


Fig.1. Block diagram of the Exciter Control Type 1047

Generator Section

The sweep generator section features sweep of a sinusoid in the frequency range 5 Hz to 10 kHz. A built-in frequency counter provides a five digit LED read-out of the frequency with a resolution of 0,1 Hz or 1 Hz (push-button selection).

The frequency of the oscillator is purely electronically controlled from either the manual frequency control or the sweep generator. Linear or logarithmic sweep modes can be selected, or an external sweep generator may be used if a special sweep curve is desired.

The built-in sweep generator features single or repetitive frequency sweeps with indicator lamps for the sweep direction. Three linear and three logarithmic sweep rate ranges are provided with accurate sweep rate adjustment within each range.

Upper and lower sweep limits may be preset precisely by 10 turn potentiometers anywhere in the entire frequency range. The sweep can be stopped and reversed at any frequency, and the start, stop and reverse of a sweep may be externally controlled.

If the Exciter Control is switched to stand-by, manually or by an automatic shut-down function, the sweep stops immediately. When switched to operation again, the sweep will continue as before stand-by when the appropriate UP or DOWN button is pressed. However, if desired it is possible to go back to the starting frequency instead. The sweep function is interlocked so that switching during the test sets the instrument to standby.

The sinusoidal output used to drive the power amplifier and vibration exciter in a test set-up has a signal-to-noise ratio higher than 75 dB. Typical third harmonic distortion curves are shown in Fig.2.

Several special outputs are also available. The DC outputs, proportional to Lin and Log frequency, are useful for controlling the paper drive of the Level Recorder Type 2307 or to control an X-Y recorder Type 2308. High frequency outputs are provided for Master Slave Operation of the Tracking Filter Type 5716.

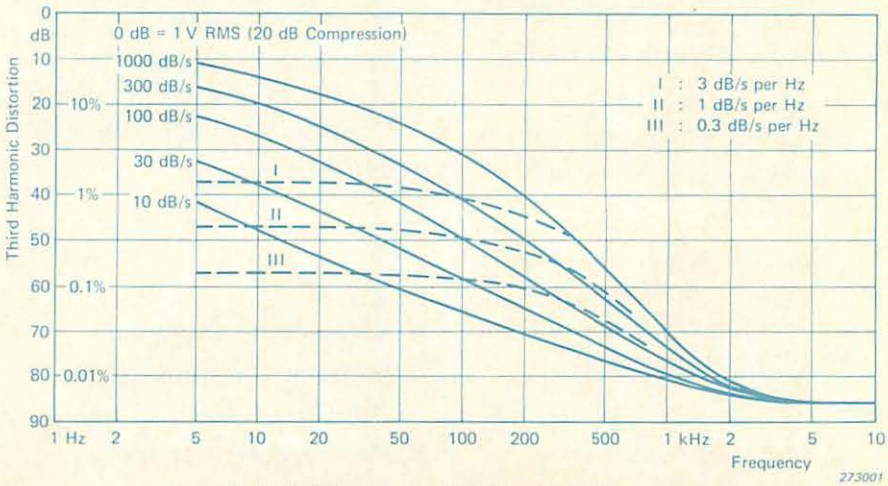


Fig.2. Typical third harmonic distortion at 20 dB compression

A constant Level Output Adaptor ZM 0100 is available as an option. It provides a constant 1 V RMS sinusoidal voltage following the frequency of the Exciter Control. It can, for example, be used to synchronize Stroboscope Type 4912 or 4913.

Vibration Meter Section

The Exciter Control contains two vibration meter channels with common input and meter, and an automatic frequency controlled cross-over is included. In each channel the mode and level can be set independently. The cross-over point can be set to any frequency within the oscillator frequency range.

More cross-overs can be obtained by adding external Vibration Programmers ZH 0100, see Fig.3. As with the two channels contained in Type 1047, each ZH 0100 can be set to acceleration, velocity or displacement, and the level can be adjusted independently. Also the additional cross-over frequency is adjusted from the ZH 0100 front plate. Any number of Vibration Programmers can be connected facilitating any combination of acceleration, velocity and displacement programmed tests to be performed. These additional Vibration Programmers do not in any way influence the 1047 performance.

The input to the vibration meter section is designed for calibrated acceleration signals of 1,0 mV per ms^{-2}. The signal from any of the B & K accelerometers fed through a Conditioning Amplifier Type 2626 will be suitable.

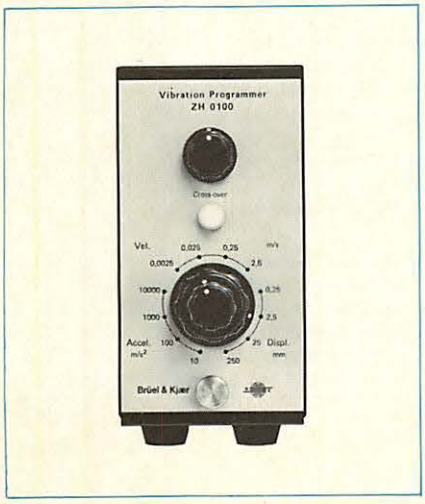


Fig.3. The Vibration Programmer ZH 0100

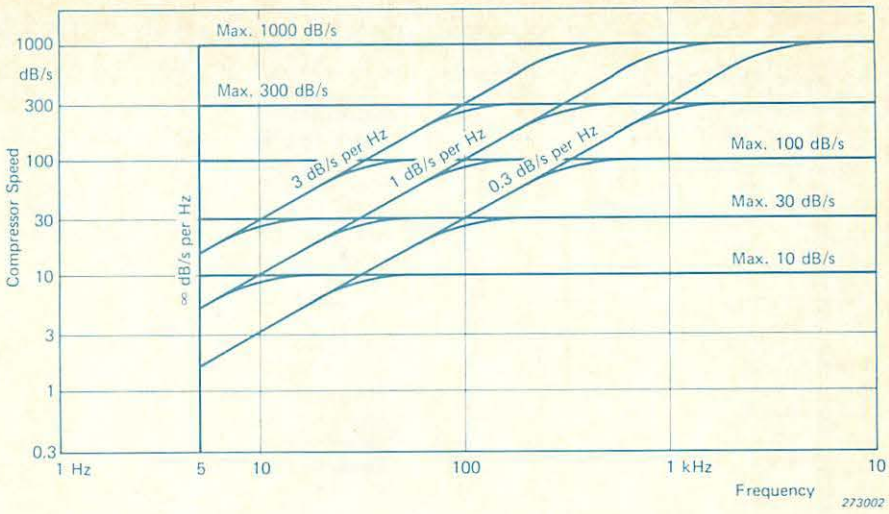


Fig.4. Compressor speed combinations

Very accurate active filters are used to convert the acceleration signal to be proportional to velocity and displacement. In combination with ZH 0100 also external filters may be inserted to give any desired frequency weighting.

Dynamic high pass filters are included to avoid low frequency noise influencing the measurement and control of exciter table vibration. The output frequency determines which filter is in circuit. In the velocity and displacement modes additional fixed high pass filters are switched in with slopes of 12 dB/octave and 6 dB/octave respectively.

The detector is an Average rectifier, and the meter is calibrated in Peak acceleration and velocity, and Peak-to-Peak displacement. The meter is fully protected against overload.

Compressor Section

The compressor section has a dynamic range of 80 dB. A special feature is that the circuit has 0 dB static regulation error. A separate compressor meter is included.

The compressor speed is controlled from the generator section by light sensitive resistors. This design allows the compressor speed to increase continuously with excitation frequency until a preset maximum limit, and then to remain constant.

The various combinations of compressor rate (dB/s per Hz) and maximum compressor speed (dB/s) are shown in Fig.4. Constant compressor speeds of 10; 30; 100; 300 or 1000 dB/s can be obtained by using a compressor rate of ∞ dB/s per Hz, see the figure. The compressor rates 0,3; 1; and 3 dB/s per Hz can be used with any of the selected maximum compressor speeds to give the desired compressor speed characteristic.

System Protection

If any of the controls involved in the servo loop are switched during the course of a test programme, the 1047 goes to stand-by immediately. The Stand-by function suppresses the output signal more than 90 dB.

Pre-Programming

The complete vibration test programme can be set up and verified without feeding any signal to the power amplifier and vibration exciter. The programming includes vibration mode, level, cross-over frequency, sweep limits, sweep speed, compressor speed, and starting frequency.

Vibration Test Set-Ups

A complete range of instrumentation for both sinusoidal and random vibration testing is available from Brüel & Kjær. This includes Accelerometers, Accelerometer Preamplifiers, Power Amplifiers, Vibration Exciters, and Analyzing Equipment.

Specifications 1047

GENERATOR SECTION

Frequency Range:
5 Hz to 10 kHz

Frequency Stability:
± 0,5 Hz for a period of 8 hours under maximum specified temperature and power variations. Typically ± 0,1 Hz under stable environmental conditions

Frequency Display:
Frequency counter with five digit LED read-out. Time base 0,5 s, accuracy ± 0,1 Hz; or 0,05 s, accuracy ± 1 Hz

Operational Modes:
Manual, automatic Lin or Log, and external

Sweep Control:
Electronic single or repetitive with indicator lamps for sweep direction. Short-time stop of sweep at any frequency. Reverse of sweep at any frequency. Start, stop and reverse of sweep may be externally controlled. External sweep by voltage ramp, 0 to +12 V, 1,2 mV/Hz (linear)

Sweep Limits:
Upper and lower frequency limits may be preset in the corresponding positions of the SET UP CONTROL by 10 turn potentiometers. The frequency counter reads the limits, which can be set anywhere in the frequency range. Accuracy ± 0,3 Hz or ± 0,5% whichever is greater

Sweep Rates:
Three Linear and three Logarithmic ranges each covering 20 dB continuously adjustable by calibrated 10 turn potentiometer
Linear Ranges:
0,1 to 1 Hz/s, accuracy ± 5%
1 to 10 Hz/s, accuracy ± 3%
10 to 100 Hz/s, accuracy ± 3%
Logarithmic Ranges:
0,1 to 1 oct./min, accuracy ± 20%
1 to 10 oct./min, accuracy ± 10%
10 to 100 oct./min, accuracy ± 10%
Accuracy quoted valid for SWEEP RATE potentiometer positions 1 to 10. Positions 0 to 1 usable but not calibrated

Outputs:
Fixed Osc.: 60 kHz sine wave, 150 mV RMS ± 20%. Min. load impedance 10 kΩ
Variable Osc.: 120 to 100 kHz symmetrical square wave, 2,4 to 5 V peak-to-peak. Min. load impedance 10 kΩ
DC ∝ f: 1,2 mV/Hz (0 to 12 V, Lin and Log sweep). Linearity better than ± 1%. Min. load impedance 10 kΩ
DC ∝ log f: 1 V/octave ± 5% (0 to 12 V, Log sweep). Min. load impedance 10 kΩ
Bandwidth Control: Six outputs, + 5 V at lower and 0 V at higher frequencies. Shift at 10, 30, 100, 300, 1000, and 3000 Hz
Linear Output: 5 Hz to 10 kHz sine wave. Variable amplitude 0 to 10 V RMS with compressor and/or potentiometer control. Min. load impedance 10 kΩ//3 nF. Distortion without compressor < 0,2% for f ≤ 100 Hz, < 0,1% for f > 100 Hz. S/N > 75 dB
Constant Level Output: Option ZM 0100, gives sine wave, 5 Hz to 10 kHz following the frequency of the Exciter Control. Constant amplitude 1 V RMS

VIBRATION METER SECTION

Input Ranges:
Acceleration: 10, 100, 1,0 k and 10 k ms^{-2}; 5 Hz to 10 kHz
Velocity: 2,5 mms^{-1}; 50 Hz to 10 kHz. 25 ms^{-1} and 250 mms^{-1}; 5 Hz to 10 kHz. 2,5 ms^{-1}; 5 Hz to 2 kHz
Displacement: 250 µm; 15 Hz to 2 kHz. 2,5 mm; 5 Hz to 1 kHz. 25 and 250 mm; 5 Hz to 200 Hz

Accuracy:
4% of meter reading

Calibration:
Acceleration and velocity: peak
Displacement: peak-to-peak

Input Sensitivity:
1 mV per ms^{-2}

Input Impedance:
> 35 kΩ

Meter Rectifier:
Average

Effective Averaging Time:
0,3 s

Lamp Indication:
For compressor controlling channel

COMPRESSOR SECTION

Regulating Speeds:
Compressor speed increases continuously with oscillator frequency
Multiplication factors: 0,3; 1; 3 and ∞ dB/s per Hz
Max. Compressor speeds: 10, 30, 100, 300 and 1000 dB/s
Compressor speed is kept constant when selected max. compressor speed is reached

Dynamic Range:
80 dB

Regulation Accuracy:
0 dB static error

Compressor Meter:
Reading of compression 0 to 80 dB

Compressor Rectifier:
Average

Compressor Control:
Automatic frequency controlled cross-over
Manual of one of the two channels
External control
Provision for connecting Vibration Programmers ZH 0100 giving one extra cross-over per unit, number unlimited

Safety:
Interlock on all relevant selectors

Lamp Indication:
For oscillator in stand-by condition

GENERAL

Temperature Range:
5 to 40°C (41 to 104°F)

Warm-up Time:
5 min.

Power Supply:
100, 115, 127, 220, 240 V AC,
50 to 60 Hz, approx. 30 VA
Complies with IEC 348 Class I

Electromagnetic Compatibility
Complies with U.S. FCC requirements for Class B Computing Device in respect of electromagnetic compatibility

Cabinet:
Supplied as model A (light-weight metal cabinet), B (model A in mahogany cabinet) or C (as A but with flanges for standard 19" racks)

Dimensions (A-Cabinet):
Height: 177 mm (7,0 in)
Width: 430 mm (16,9 in)
Depth: 320 mm (12,6 in)

Weight (A-Cabinet):
10,1 kg (22,2 lb)

Accessories Included:
4 BNC plugs JP 0035
7 7-pin DIN plugs JP 0703
2 8-pin DIN plugs JP 0802
1 Banana plug JB 0002
1 Mains cable AN 0010
1 630 mA fuse VF 0032
1 315 mA fuse VF 0042

Accessories Available:
Vibration Programmer ZH 0100
Constant Level Output ZM 0100
1,5 m Control Cable AQ 0035
0,36 m Control Cable AQ 0042
(Four AQ 0042 included with ZH 0100)