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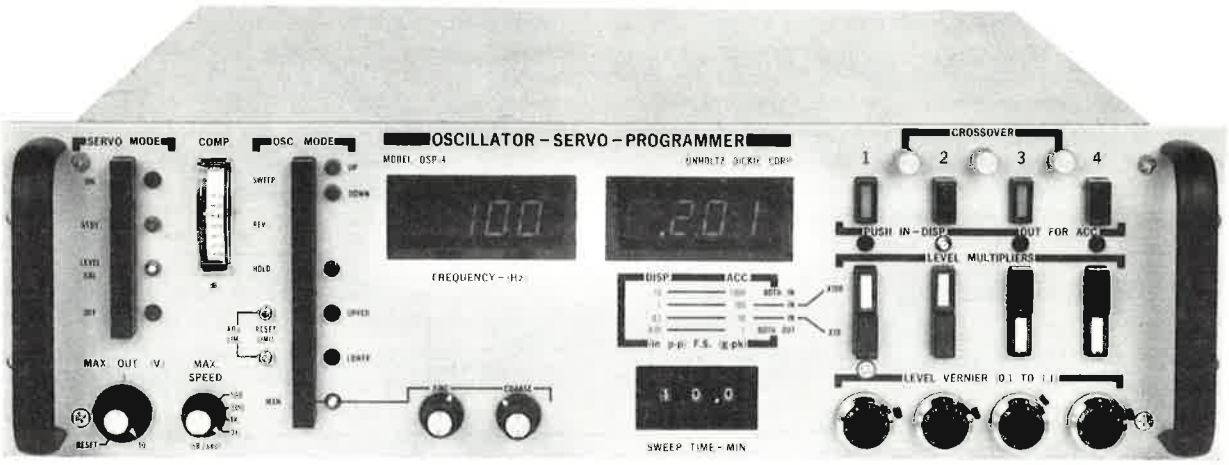
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UNHOLTZ-DICKIE CORPORATION

VIBRATION TEST EQUIPMENT

Model OSP-4 OSCILLATOR-SERVO-PROGRAMMER



Complete sine control instrument including charge amplifier and meter

- Short 10 minute warmup produces specified operation with stable log DC outputs.
- Servo has **zero** static error and more than 80 dB dynamic range.
- Amplifier drive signal has extremely low distortion, for **both** closed-loop and open-loop operation.
- Human-engineered front panel with LED indicators and color-coded push-button operation provides ease of operation and visual monitoring.
- 4-segment programming with any sequence of acceleration and displacement is possible.
- Smooth crossovers or step-changes in vibration level may be programmed between segments.
- No "off the air" presetting operation necessary with calibrated, locking 10-turn level-setting controls.
- Fully interlocked push-button controls prevent operator errors and specimen damage.
- Minimum startup delay for "on the air" operation from full compression at low frequencies.
- Compressor speed is automatically programmed as a function of frequency.
- When a standby command is received, the output signal compresses at maximum possible speed without generating high frequency transients.
- Digital frequency display with 1 Hz resolution.
- Digital vibration meter.
- Digitally-generated sine wave.
- Oscillator sweeps over any part of the 3-decade frequency range.
- Digital selection of sweep time, independent of selected frequency sweep limits.
- Integral charge amplifier accepts accelerometer signals directly with sensitivities from 1 to 100 pC/g.
- Sweep signal option is available to allow scope display of three fundamental periods of any vibration signal regardless of frequency.
- Remote control option allows the test to be started and stopped at the shaker.
- X-Y plotting with optional log DC output for amplitude.
- Low profile chassis - only 5.25 inches high.
- Solid state, plug-in card design, employing many integrated circuits and CMOS switches.

Application and Description

The Model OSP-4 is systems engineered to provide the generation, control, and measurement of a complete sinusoidal vibration test. It is compatible with all commercially available shaker-power amplifier combinations, and only an accelerometer is required to perform a complete vibration test. A typical test setup is shown in FIG. 1, in which optional instrumentation is shaded.

The programmer section provides for as many as four segment programs. Push-button controls allow range selection and selection of displacement or acceleration for each segment. The crossover frequencies are independently controlled. Tests in MIL-STD-810 and MIL-STD-331 are easily programmed, and segments of constant acceleration and constant displacement can be established in any sequence, giving complete flexibility of setup and control.

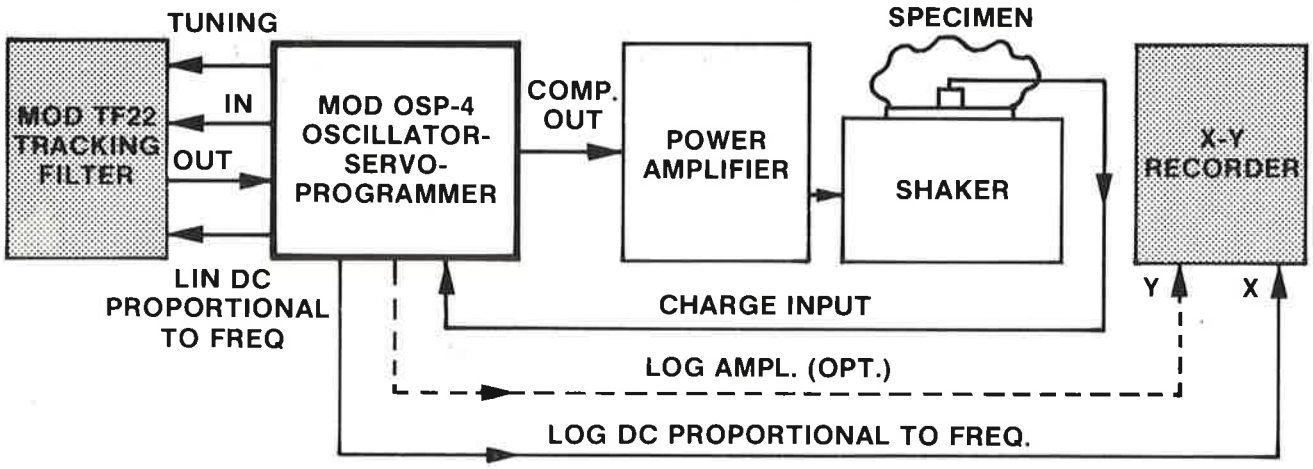


FIG. 1 TYPICAL TEST SYSTEM BLOCK DIAGRAM

The OSP-4 offers simplicity, reliability, ease of test setup and operation, and new performance features not found in other combination test instruments.

The oscillator section digitally generates a constant amplitude, extremely low distortion, log-sweep sine wave. It contains most of the features of the U-D Model OSC-1 Sweep Sine Generator.

The servo section provides a compressor or AGC circuit of improved design which provides zero static compression error instead of the heretofore typical 1 dB error for 60 dB gain variation. In addition, the turn-on time at low frequencies has been drastically reduced. Furthermore, the servo-controlled compressor output voltage contains very little harmonic content (typically 0.2%), and the distortion does not increase with compressor speed.

The zero static compression error feature and the precision ten-turn level vernier allow the test levels to be set up without resorting to the usual closed loop "off the air" presetting procedure. The level vernier settings also do not require readjustment during the actual test.

The integral charge converter and DIAL-A-GAIN sensitivity normalization allows the output from the control accelerometer to be fed directly to the OSP-4. Any sensitivity from 1 to 100 pC/g may be accommodated. Low-noise design identical to the U-D Model D22 Series instrumentation is utilized. This signal conditioning section may be bypassed if other instrumentation providing 10 mV/g control signals is utilized.

The Model OSP-4 is fully compatible with other accessories such as the U-D Models TF-22, MAC-8, and AM-123. A brief description of the operational controls and features follows.

Operational Controls and Features

The controls and indicators for each section described above are grouped together for pleasing appearance and functional simplicity.

Servo Mode

Four momentary-contact pushbuttons control the servo mode. One of the four color-coded LED indicators shows the active mode.

ON - The AGC amplifier of the servo controls the test to the programmed levels, and a continuously variable compressor speed as a function of frequency is provided.

STBY - The AGC amplifier is held at minimum gain so that the compressor (AGC) output voltage is over 80 dB below maximum output.

LEVEL CAL. - The AGC amplifier is operative and the compressor output is fed to the control input of the instrument for closed-loop operation without driving the power amplifier. This mode may be used occasionally for bench-checking the calibration of the LEVEL VERNIERS and RANGE SWITCHES. It is not required for a level presetting operation due to the precision features of the programmer.

OFF - The AGC amplifier is off and held at maximum output (0 dB compression). The output voltage is determined by the MAX. OUTPUT control for manual vibration level control.

Compressor Speed

The compressor speed function is controlled by the setting of the MAX. SPEED switch. The speed varies continuously from 10 dB/sec at 5 Hz to the switch setting at 5 kHz. For most tests an upper limit of 1000 dB/sec is satisfactory.

Oscillator Mode

Six momentary contact pushbutton switches control the oscillator mode. LED indicators show the active mode.

SWEEP - Depressing this pushbutton initiates a frequency sweep starting from the frequency determined by the HOLD, RESET, or MANUAL mode. The SWEEP TIME switch is active in this mode and determines the time between the UPPER and LOWER LIMITS, independent of the setting of the latter controls.

REVERSE - The direction of the frequency sweep is reversed by pushing this button.

HOLD - The frequency sweep is stopped by pushing this button. The HOLD mode is automatically actuated from the SWEEP mode when the servo goes to STBY for any reason.

RESET, MANUAL - Pushing either of the RESET buttons (UPPER or LOWER) or the MANUAL button sets the frequency at the value determined by the associated controls.

Programmer Controls

Push in/out buttons provide selection of acceleration or displacement and the appropriate range for the desired test level for each of the four segments. An internal green indicator indicates the selection of displacement (IN) and the black color indicates acceleration (OUT). The two range pushbuttons provide four decade ranges with possible selection of no multiplier (X1) or either or both of the X10 or X100 multipliers. An internal white indicator shows active multiplier buttons.

The locking dial on the LEVEL VERNIERS allow the test levels to be set directly without presetting operations, with a settability of 1% or better. A lighted red LED indicates the segment in control.

Metering

A digital vibration meter automatically indicates the amplitude of the segment in control, and compression is indicated by another meter. A four-digit counter indicates frequency with a large LED readout. Frequency is updated 10 times/second.

In the Compressor ON mode, the LEVEL CAL, OFF, A-D, X10, X100, oscillator RESET, and MAN switches are interlocked. Pushing any of these switches inadvertently could cause abrupt changes in the vibration level and possibly disastrous results. If any of these is switched, the compressor returns automatically to the STBY mode and the compression is increased at optimum speed to its maximum value. The oscillator is also automatically put in the HOLD mode from the SWEEP mode.

To establish automatic amplitude servo control, it is merely necessary to turn the MAX. OUTPUT full CW and depress the ON button until the ON indicator lights. If the OSP-4 is initially in the OFF or LEVEL cal modes, the servo will first go to the STBY mode and following full compression, automatically switch to the ON mode.

If manual vibration control in the servo OFF mode is desired, the MAX. OUTPUT must be turned CCW to the RESET position first. Otherwise, pushing the OFF button merely returns the servo automatically to STBY. This insures starting from zero vibration magnitude under manual control. The interlocks for the A-D, X10, and X100 switches are inactive in the OFF mode to allow switching of the vibration meter without causing shutdown. These same interlocks are inactive in the LEVEL CAL mode since the shaker is inoperative.

Specifications

All specifications apply after 10 minutes warmup

1. Frequency

1.1 Range: 5-5000 Hz

1.2 Stability: ±1% or 0.5 Hz, whichever is larger for 8 hours in MANUAL or RESET mode.

1.3 Display: 4-digit counter with .56 in. high LED display. Resolution is 1.0 Hz at a 10 sample/second rate

1.4 Display Accuracy: ±resolution ±power frequency accuracy

2. AC Outputs

2.1 Oscillator Output: 1 V rms, ±.5 dB, 5-5000 Hz; Distortion less than 0.3% 20-3000 Hz, less than 0.5% 5-5000 Hz; Output impedance - 100 ohms

2.2 Compressor Output: 10 V rms max; Distortion less than 0.3% 20-3000 Hz, less than 0.5% 5-5000 Hz, Compressor OFF mode and ON mode, 0-20 dB compression, 10-3000 dB/sec; Output impedance - 50 ohm

2.3 Charge Output: 10 mV/g, 10 V p max; output impedance - 50 ohm

3. DC Outputs

3.1 DC proportional to LOG FREQ: 0 - 1.2 V (.4 V/decade); Linearity and stability 0.3 Hz or ±3%

3.2 DC proportional to FREQ: 0 - 10 V (2 mV/Hz); Stability ±2% or 1 Hz.

3.3 DC proportional to LOG AMPL (OPTIONAL): -3V to 0V (50 mV/dB); Accuracy ±.2 dB 0 to -40 dB, ±.5dB -40 to -60 dB

4. Compressor (AGC) Amplifier

4.1 Dynamic Gain Range: greater than 80 dB with compression indicated by front panel meter 0-80 dB

4.2 Compression Characteristic: Linear from 0 to 70 dB

4.3 Correction Accuracy: Essentially **zero** static error, 70 dB gain change results in less than 0.1 dB change in test level.

4.4 Speed: Automatically controlled in a continuous function of frequency from 10 dB/sec at 5 Hz to a switch-selected upper limit of 100, 300, 1000, or 3000 dB/sec at 5 kHz.

4.5 Turn On: Less than 10 sec from > 80 dB compression to full test level at 5 Hz.

4.6 Modes (Indicator lights for all modes)
ON: Compressor active for closed-loop operation. Compressor speed automatically controlled.
STBY: Compressor output smoothly reduced to more than 80 dB below full output
LEVEL CAL: Allows closed-loop operation with zero compressor output. Used for occasional calibration and check of operation.
OFF: Compressor inactive. Compression held at 0 dB.

5. Sweep Oscillator

5.1 Sweep Mode - logarithmic - continuous over 3 decades

5.2 Sweep Time - 1 to 99.9 minutes in 0.1 minute increments. Thumbwheel setting with digital display. Setting is independent of sweep frequency limits. Maximum sweep rate is 3 decades/minute.

5.3 Sweep Reversal Limits - Each settable with 10 turn controls. Low Limit: 5 to 5000 Hz. High Limit: Low limit to 5,000 Hz

5.4 Modes (all are pushbutton-actuated)
SWEEP: Initiates frequency sweep from MANUAL, RESET or HOLD mode. Indicator lights for direction.
REVERSE: Causes reversal of sweep direction.
HOLD: Stops frequency sweep. Indicator light.
RESET UP/DOWN: Holds frequency at value determined by upper/lower limit control. Indicating red LED's.
MANUAL: Holds frequency at value determined by COARSE and FINE frequency controls. Indicating red LED.

5.5 External Sweep - available at rear connector

5.6 Oscilloscope sweep (Option): Oscilloscope sweep synchronized to 3 periods of oscillator output

6. Programmer

6.1 Test Programs: As many as four segments with displacement and acceleration in any combination or sequence. Displacement selection shown by color-indicative pushbutton. Active segment shown by LED indicator.

6.2 Crossover Frequencies: Independently adjustable 5-5000 Hz.

6.3 Level Verniers: Ten-turn precision potentiometer with locking dial providing 1% settability of level without presetting operation. Displacement: .001 to .011 in p-p; Acceleration: .1 to 1.1 g peak.

6.4 Level Multipliers: X10 and X100 with color-indicating pushbuttons usable in any combination providing the following full-scale ranges: Displacement: .01, .1, 1, 10 in p-p. Acceleration: 1, 10, 100, 1000 g p.

6.5 Vibration Meter: 3 1/2 digit .56 in. high LED; monitors vibration level of active program segment.
Accuracy:
Disp: ±2% of reading ±0.1% of full scale, 5 to 1000 Hz.
Accel: ±1% of reading ±0.1% of full scale, 5 to 5000 Hz.

7. Acceleration Signal

7.1 Normalized 10 mV/g input - input impedance 47 kilohm

7.2 Charge Input: Adjustable for sensitivities 1-100 pC/g.

8. Interlocks

8.1 With compressor ON, MAX. OUTPUT turned CW, STBY mode is established if LEVEL CAL, OFF, A/D, X10, X100, oscillator RESET, or MAN. pushbutton is actuated.

8.2 With compressor in LEVEL CAL (or OFF) mode and MAX OUTPUT is CW, STBY mode is established if ON, OFF (or LEVEL CAL), oscillator RESET, or MAN pushbutton is actuated.

8.3 If SERVO goes to STBY for any reason and oscillator is in SWEEP mode, the oscillator automatically goes to HOLD mode.

9. Remote Control (Optional) Model RC

Separate unit has push-buttons to provide closed-loop operating functions once programmer controls are set. Push-buttons provided: Compressor ON, STBY, SWEEP, REVERSE, HOLD, RESET UP, RESET DOWN, MAN. Indicator lights are included to indicate active control functions.

10. Power

105-125/210-250 VAC 50-60 Hz 50 VA

11. Size

5.25" HIGH x 19" WIDE x 18" DEEP plus cables

UNHOLTZ-DICKIE CORPORATION

6 Brookside Drive • Wallingford, Connecticut • 06492

(203) 265-3929

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