# SC-121 *SINE SERVO CONTROLLER*


## *Vibration testing suddenly got a whole lot easier.*

A remarkably convenient operator interface with performance found only in the best units available make the SC-121 ideal for controlling electrodynamic shakers in almost any test situation from research and calibration to production testing.

## *The SC-121 is unmatched in cost / performance value.*

- Dual microprocessor design.
- Digital signal synthesis and filtering.
- Two-channel acceleration input and control.
- Flexible programming with non-volatile memory.
- Four independent meters display all control parameters.
- Analog data outputs interface easily to computer analog inputs and x-y recorders.

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# DESCRIPTION

The Labworks model SC-121 Sine Servo Controller incorporates the latest in microprocessor technology to provide an economical solution to modern sinusoidal vibration testing requirements with a remarkably convenient operator interface. It is designed for use with vibration test systems requiring sinusoidal vibration between 2 and 10,000 Hz with acceleration levels ranging from .5 to 99.9 g pk and displacement requirements from .02 to 2.5 inches pk-pk.

The servo provides an output that will give a constant displacement and or acceleration level during a swept or stationary sine test by means of an acceleration feedback signal.

Vibration displacement is generated internally by double integration of the channel 1 servo loop acceleration signal. A dual microprocessor design ensures that all commands bring immediate control response without degrading the performance of the control system.

Crystal controlled digital signal synthesis and filtering insures that the Labworks model SC-121 has performance specifications found only in the best controllers available.

The SC-121 has two acceleration input channels to facilitate tests requiring the comparison of two signals, such as calibration or transmissibility tests. The *difference* output makes transmissibility determination and calibration tests as easy as running a simple sine test.

Tests using large head shakers, slip tables or large fixtures


## *We packed the SC-121 with performance.*

- Wide frequency range: 2.0-6,553 Hz or (4.0-10,000 Hz).
- High resolution: 0.1 Hz. or (0.2 Hz).
- Two independent input channels with built-in conditioning amplifiers.
- The built-in input amplifiers have a current source and adjustable sensitivity.
- Three separate digital meters monitor frequency, acceleration and displacement.
- Test cycle counter displayed on frequency meter upon demand.
- Control modes: channel 1 or average (channel 1 and channel 2).
- Output modes: Log channel 1 accel., Log channel 2 accel., Log average accel., linear difference ratio.
- Convenient user interface: requires little or no documentation to set up or run.
- Three program storage in internal non-volatile memory for easy recall of frequently used tests.
- Analog and TTL inputs and outputs allow the controller to function with either a PC or other test control or recording instruments.

are more precisely controlled by optionally using the *average* of the two channels for servo feedback.

The frequency generator and servo control sections are independent in order to allow either manual or automatic frequency control with the output under either manual or servo control.

In the manual frequency and output modes, the SC-121 functions as a high quality sine signal source with simultaneous control of frequency and amplitude. This mode is required for manual investigation of vibration response or general sine signal applications.

Flexible programming allows internal storage of up to three independent 2, or 4 level test profiles. Stored test profiles are easy to modify or replace and are maintained internally when the power is removed. This feature eliminates the need for external disks or memory cards and there are no batteries to wear down or replace.

Large displays indicate frequency, acceleration and displacement at all times without the need to manually switch the display function after a cross-over.

A programmable test cycle counter keeps track of the accumulated test time or can be set to terminate the test after a specific number of test sweep cycles.

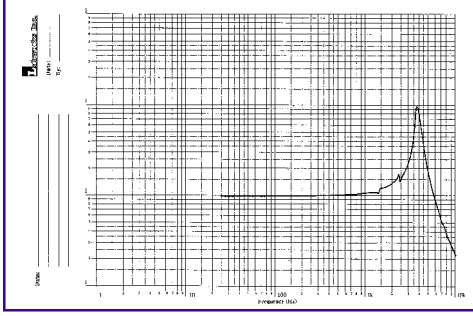
Digitally generated analog outputs for frequency and acceleration, facilitate plotting or recording test profiles, responses and transfer functions.

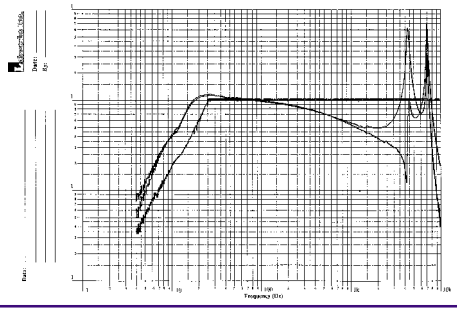

## *Analog outputs make recording or plotting test profiles easy.*

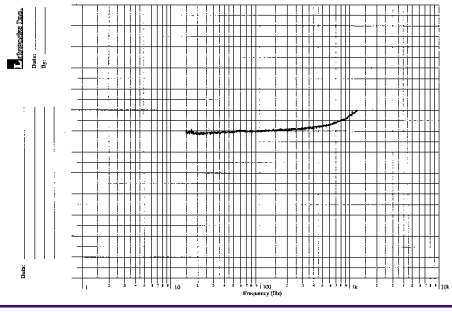
**Transmissibility.** Plotting transmissibility and acceleration response curves is a snap with the Labworks SC-121 sine servo controller. Simply place the control (channel 1) accelerometer on the input member, base or fixture and mount a response accelerometer (channel 2) on the active portion of the test load. Set the SC-121 to control on channel 1 and program for a constant acceleration output. Program the SC-121 for a frequency sweep over the band of interest and initiate a servo controlled frequency sweep. Switching the plotter output control to channel 2 allows recording or plotting the acceleration response on channel 2, producing a log transmissibility curve automatically.

**2 Channel Average Control.** When large test articles must be tested beyond their fundamental resonance frequency, an over test condition can occur where the control accelerometer is physically located at a resonance node. For this situation and others that would benefit from a sine test based on control of the average of two accelerations, the SC-121 has average control capability. Sine signals cannot be simply combined to form an average acceleration because of phase coherence. The detected scalar sine amplitudes must be used, but are not normally available from sine analysis instrumentation. The SC-121 solves this problem by providing for control on the average acceleration of both of its channels.

**Calibration or Relative Acceleration.** The analog data output can be switched to provide a linear DC voltage proportional to the ratio of the two acceleration inputs. A semi log formatted output is automatically presented to make acceleration transducer calibration or linear transmissibility curves easy to plot. This output voltage is normalized to 1.00 Vdc when the ratio of the two different accelerations is equal to 1. This allows the output to be read and interpreted by a common volt meter for inexpensive calibration or recorded or plotted by analog/digital conversion or analog recorder-plotters. The output ranges from 0 to 200% (0 to 2.00 Vdc) in the linear difference (ratio) plotter output mode.







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# SC-121 SPECIFICATIONS

## Frequency Generator

| | |
|---|---|
| **Range @ Resolution:** | 2. to 6553 Hz @ 0.1 Hz<br>or 4 to 10,000 Hz @ 0.2 Hz [1] |
| **Accuracy**: | ± .004% |
| **Temp. stability:** | ± 100 ppm/°C |
| **Display:** | 4 digit LED |

## Feedback Analysis

| | |
|---|---|
| **Acceleration:** | |
| **Range:** | 0 to 99.9 g pk |
| **Accuracy:** | 0.2 dB ± 1 LSD / 5-7000<br>1.0 dB ± 1 LSD / 2-10,000 |
| **Display:** | 3 digit LED |
| **Displacement:** | |
| **Range:** | 0 to 2.50 in. pk-pk<br>or 0 to 50.0 mm pk-pk [1] |
| **Accuracy:** | 0.2 dB ± 1 LSD / 5-7000<br>1.0 dB ± 1 LSD / 2-10,000 |
| **Display:** | 3 digit LED |
| **Input channels / connector:** | 2 / BNC |
| **Calibrated inputs:** | 10 or 100 mV/g |
| **Variable inputs:** | 10 or 100 mV/g ± 20% |
| **Accelerometer bias:** | 3 mA nom. (on-off) |

## Sweep, Logarithmic

| | |
|---|---|
| **Modes:** | Manual, continuous or single sweep [2] |
| **Rate:** | 0.5 to 8 octaves / min. |
| **Sweep speed resolution:** | 0.5 octaves / min. |
| **Sweep cycle counter:** | -999 to 9999 sweep cycles [3] |

## Control Servo

| | |
|---|---|
| **Dynamic range:** | 70 dB min. |
| **Control accuracy:** | 0.25 dB typical |
| **Speed:** | 3 ranges, microprocessor optimized, frequency dependent. |
| **Open loop monitor:** | Adjustable, gain sensitive |
| **Output level monitor:** | 10 segment bar graph |

## Outputs

| | |
|---|---|
| **Servo voltage @ impedance:** | 0 to 2.5 Vrms @ 50 Ω |
| **Servo sine distortion (1.0 V out):** | < .3% THD, 3rd harmonic:<br>< -50 dB typical |
| **Constant sine voltage @ impedance:** | 1.2 Vrms @ 10 KΩ |
| **Normalized acceleration:** | 10 mV/g @ 50 Ω<br>(both channels) |
| **Data:** | |
| **Acceleration:** | |
| **Log ch 1,2 & avg.:** | 2 Vdc / decade |
| **Difference, linear:** | 1.0 Vdc ± .01 Vdc / % difference |
| **Impedance:** | 50 Ω |
| **Frequency:** | |
| **Log:** | 2 Vdc / decade |
| **Impedance:** | 50 Ω |
| **Sweep/Pen lift logic:** | TTL, low during sweep |

## Inputs

| | |
|---|---|
| **Reset, external:** | TTL low or contact closure to ground |
| **Shut down interlock:** | TTL low or contact closure to ground |

## Program

| | |
|---|---|
| **Levels per program:** | 2 to 4 (2 displacement, 2 acceleration) |
| **Program memory:** | |
| **Non-volatile:** | 3 programs |
| **Active:** | 1 program |

## Physical/environmental

| | |
|---|---|
| **Power:** | 110 ± 15 Vac or 220 ± 30 Vac, 50 / 60 Hz |
| **Dimensions:** | 19 in. W x 12 in. D x 3.5 in. H |
| **Weight:** | 5 lbs |
| **Temperature:** | |
| **Operating:** | ± 60 to + 100° F |
| **Storage:** | ± 40 to + 130° F |
| **Humidity:** | 5 to 90% RH |

[1] Internal switch selectable range.
[2] Sweep can start at any frequency within the programmed range, in either direction.
[3] The sweep cycle counter increments at each low frequency end point transition during continuous sweep mode and terminates the test when it increments from -1 to 0.