

Models 704 & 744 LVDT Conditioners

Fast, Accurate, Versatile, User Friendly



Unexcelled for conditioning AC operated LVDT displacement transducers. Includes important, built-in, processing functions.

- **acquires, displays, classifies, holds and outputs:**
 - displacement**
 - runout**
 - diameter¹**
 - concentricity²**
 - thickness¹**
 - taper²**
 - perpendicularity²**
- **engineering unit display with legends and 0.01% resolution**
- **2000 samples/second/channel**
- **RS232/RS422/RS485 serial communication**
- **auto-scaled $\pm 5V$ and/or $\pm 10V$ analog outputs**

Notes: 1. A Model 704 requires a reference fixture or, you must use a Model 744. 2. Requires a Model 744. 3. See back cover for application details.

These instruments are full featured LVDT conditioner/readouts; the Model 704 handles one and the Model 744 handles two LVDT inputs. Both provide fast, accurate data for each input. Built-in processing functions and real-time digital calculations make the Model 704/744 powerful test analyzers with easily configured characteristics. No need to write code or add hardware to be up-and-running a productive test.

The alphanumeric readout displays measured and computed data, units of measure and test status. It guides you with English language prompts. There are no manual adjustments. Calibration is simple; enter the full scale in engineering units and the instrument provides 0.01% accuracy and $\pm 5V$ and/or $\pm 10V$ analog outputs at full scale. Keystrokes access measured data, derived data, stored data, limit status, and/or I/O status without test disruption. User set values may be password protected, when needed.

Select either RS232, RS422, or RS485 serial communications to remotely control instrument modes, settings and measurements. Input actions and output events can be controlled by user configurable logic I/O's. These can be combined to create virtually any imaginable test without the need for special software or hardware. Available software remotely controls all instrument functions from a Windows based PC. It displays, plots and saves real-time data and will also save and download the instruments' setup parameters.

The flexible, software-based operating structure simplifies integration with your production and data acquisition processes. For example, set limits to classify either current, held, max, min, or spread data. Limits can be latched or unlatched, signed or absolute and can have user set hysteresis, if desired. Similarly, control functions can be user tailored and logic I/O's can be used in logical operations together with derived signals thus, enhancing the instruments versatility.

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Model 704/744 Specifications

Transducer(s)

Type Any 4, 5 or 6 wire LVDT.
Impedance $\geq 80\Omega$ at the selected operating frequency.
Connections Includes provision for excitation sense.

Transducer Excitation 2Vrms sine wave@ 2.5kHz, 3kHz, 5kHz and 10kHz $\pm 1.0\%$, regulated, and short circuit protected.
Frequency is keyboard selectable. Frequency stability is $\pm 0.01\%$ over the full operating temperature range.

Signal Input

Sensitivity 100 to 1,000 mV/V with 50% overrange; automatically scaled.
Impedance 100k Ω .

Automatic Zero Range $\pm 10\%$ of Full Scale (with 50% overrange), $\pm 60\%$ of Full Scale (with 0% overrange).

Auto Calibration Dual polarity calibration with CAL-CHECK function.

Spurious Signal Rejection 60Hz: 120dB common mode, 70dB normal mode. Carrier quadrature: 60dB.

Antialias Filter 7 pole Bessel response filter.

Low Pass Filtering 4 pole Bessel response digital filters with 11 cutoff frequencies from 0.1 to 200Hz in 1-2-5 steps.

Signal-to-Noise Ratio¹ @ 100mV/V F.S.: 86/80/72/64dB with 1/10/100/200Hz filters.
@ 1,000mV/V F.S.: 86/82/74/66dB with 1/10/100/200Hz filters.

Resolution 0.01% of Full Scale.

Overall Accuracy (at 77°F/25°C) 0.02% of Full Scale, worst case.

Temperature Effects Zero: $\pm 0.001\%$ of Full Scale/°F (max);
Span: $\pm 0.001\%$ of Full Scale/°F (max), except $\pm 0.002\%$ of Full Scale/°F (max) when operating with 10kHz excitation.

System Display 2 line by 16 alphanumeric characters, each 0.2" wide by 0.3" high. Backlit LCD with adjustable contrast.

Views Select either 1 Channel, 2 Channels, 1 Channel with Limit Status, or 1 Channel with I/O Status.

Data Displayed Select from Current, Max, Min, Spread, Held data and Tare value.

Data Format ... Engineering units with 6 digits (1-2-5 format) and 5 character, upper/lower case, user-entered legend/descriptor.

System Response (per channel)

Data Sampling & Max/Min Update Rates 2000Hz (hardware channels), 50Hz (CH3 calculation).

Limit Checking Rate 1000Hz (hardware channels), 50Hz (CH3 calculation).

Logic I/O Response Time 1ms (hardware channels), 20ms (CH3 calculation).

Update Rate for Each Analog Output 1000Hz.

System Control All I/O functions can be OR'd in any combination. The *pattern* function adds ANDING capabilities.

Input Actions/Channel Logic inputs, outputs, and internal Matrix signals control following actions. Tare, Clear Tare, Hold, Clear Hold, Reset Max/Min, Clear Latched Limits, Check Limits, Do Max/Mins, Apply +CAL, Apply -CAL.

Output Events/Channel The following events drive Logic outputs and internal Matrix signals.
HI Limit, NOT HI Limit, IN Limit, NOT IN Limit, LO Limit, NOT LO Limit, At Max, NOT At Max, At Min, NOT At Min.

Eight User-defined Patterns .. Patterns of Logic inputs, outputs and Matrix signals drive Logic outputs and internal Matrix signals.

State Machine Capability . User enabled/disabled. Permits up to eight states and allows event driven testing. See AN7000 for details.

Limit Checking Each channel has a HI and LO limit which may be latched or unlatched, absolute or signed, and with or without hysteresis. Select either Current, Max, Min, Spread or Held data for limit checking.
Limit violations on any or all channels can be set to trigger backlight flashing in any of the display view modes.

Four Logic Inputs Each with programmable destination, protected to $\pm 130\text{VDC}$ or 130Vrms.

Type TTL compatible, Schmitt Trigger, low-true with 47k Ω pull-up. Input current is -100 μA @ 0V.

Six Logic Outputs Each with programmable source, short circuit (current and thermal limits) and overvoltage (fuse) protected.

Type Open collector, low-true. Operating @ 24V (max) and 0.3A max sink current.

External +5VDC Power (on I/O connector) 250mA, short circuit (current limit) and overvoltage (fuse) protected.

Serial Communication Port (selectable as RS232, RS422, or RS485. Supports 32 devices on RS485 port and 1 device on RS232/422)

BAUD Rate 300 to 38400. Maximum Cable Length: 4000ft (RS422/RS485), 50ft (RS232).

120 Ω Termination Resistors (RS485) User selectable for RXD and TXD.

RS422/485 Transceivers Slew-rate limited, short circuit protected (current & thermal limits).

RS232 Drivers Short circuit protected (current limit).

Serial I/O's Use a 9 pin D connector. They are $\pm 15\text{kV}$ ESD protected and float (100k Ω) with respect to Earth Ground.

Commands Control of all modes, settings, and measurements.

Non-Volatile Memory Storage for System Settings EEPROM, batteries are not used.

Dual Analog Outputs Each assignable to any of the 3 channels are short circuit (current limit) and overvoltage (fuse) protected.

Output Impedance/Minimum Load Resistance <1 Ω /10k Ω .

Full Scale $\pm 5\text{V}$ or $\pm 10\text{V}$ (user selectable). Resolution is 2mV @ $\pm 5\text{V}$ F.S. or 4mV @ $\pm 10\text{V}$ F.S.

Overrange $\pm 8.2\text{V}$ @ $\pm 5\text{V}$ F.S. or $\pm 13.5\text{V}$ @ $\pm 10\text{V}$ F.S.

Non-linearity $\pm 2\text{mV}$ @ $\pm 5\text{V}$ F.S. or $\pm 4\text{mV}$ @ $\pm 10\text{V}$ F.S.

Overall Error (worst case, including temperature effects) $\pm 5\text{mV}$ @ $\pm 5\text{V}$ F.S. or $\pm 10\text{mV}$ @ $\pm 10\text{V}$ F.S.

Filter 100Hz, 5 pole Bessel response low pass filter.

Size and Weight 6.5" wide, 2.9" high, 8.7" deep. Weight is 3 pounds.

Operating Temperature +41°F to +122°F (+5°C to +50°C).

Input Power 90VAC to 250VAC, 50/60Hz @ 25VA, max. Two 2A/250V fuses, line filter, and rear power switch.
Option 12D1 converts from AC line power to 10 to 15VDC operation @ 15 Watts, max. It includes a rear power switch, fuse & filter.

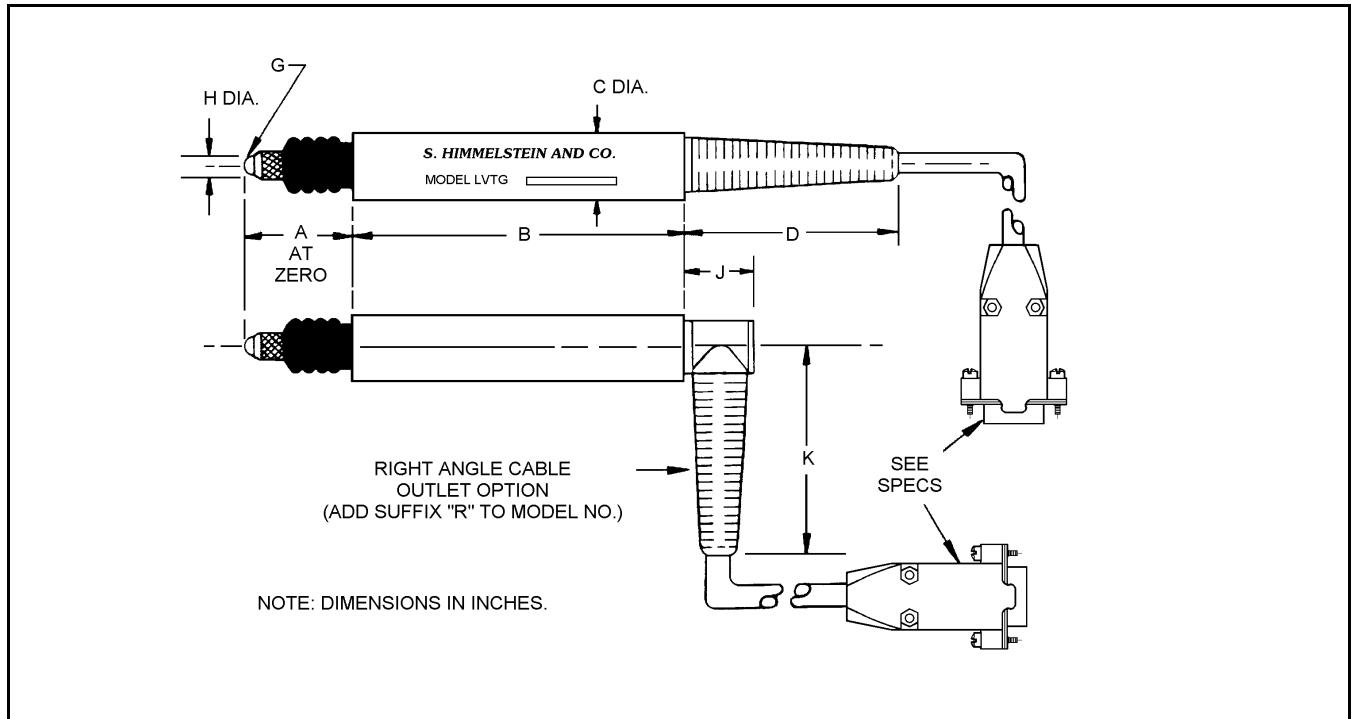
Notes:

1. The ratio expressed in decibels (dB), of full scale (F.S.) signal to noise spread. Measurements are made for a 1 minute interval using a 100 Ω source impedance.
2. Specification is subject to change without notice.

Model LVTG-4000 Precision Gauge Heads

The LVTG-4000 Series precision gaging transducers have full scale ratings from ± 0.04 to ± 0.4 inches. Linear ball bearings reduce friction while providing smooth, repeatable operation. All stainless steel construction minimizes corrosion and also reduces errors from thermal expansion. The contact tip, which is made

of tungsten carbide, can easily be replaced with any standard 4-48 or M2.5 thread gauge tip. A chemically inert Viton accordion cover prevents dust and liquids from entering the transducer housing. See the back cover of this bulletin for typical applications. Bulletin 580A describes long stroke (0.6 to 12") LVDT's.



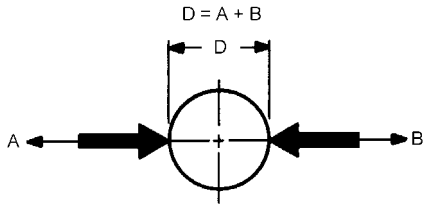
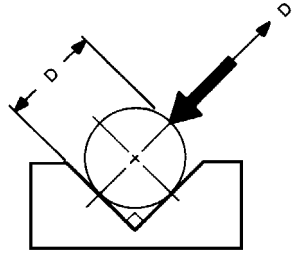
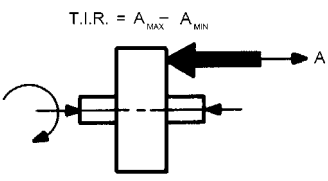
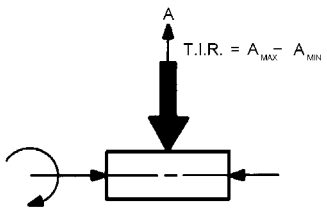
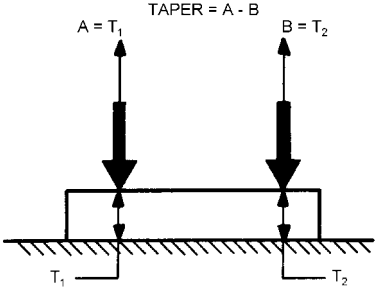
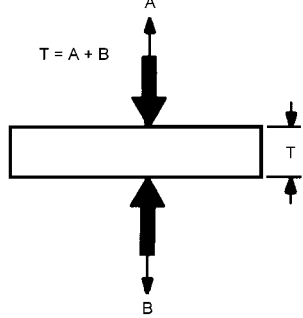
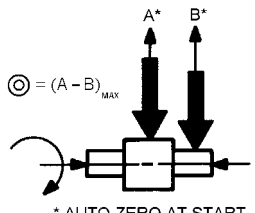
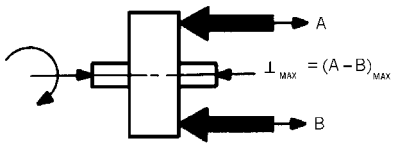
	Dimensions (inch)				
	LVTG-4000-40	LVTG-4000-60	LVTG-4000-100	LVTG-4000-200	LVTG-4000-400
A	0.502	0.541	0.581	0.797	1.329
B	1.673	2.283	2.480	3.425	5.118
C	0.375 +0.000/-0.005				
D	1 7/32				
F	1/2				
G	0.059 radius				
H	3/16				
J	3/8 (option R)				
K	1 3/8 (option R)				

DETAILED SPECIFICATIONS	Model Number LVTG-4000-				
	40	60	100	200	400
Linear Stroke (inch)	± 0.040	± 0.060	± 0.100	± 0.200	± 0.400
Linear Stroke (mm)	± 1.0	± 1.5	± 2.5	± 5.0	± 10.0
Outward Travel From Zero (inch)	0.045	0.065	0.104	0.203	0.400
Inward Travel From Zero (inch)	0.053	0.092	0.130	0.230	0.420
Spring Preload At Zero (ounce)	2.5				
Nominal Sensitivity @ 5kHz (mV/V/millinch)	5.0	3.4	2.0	1.0	0.5
Repeatability (microinch)	≤ 60				
Linearity (the greater of % of reading, or listed error in μ inches)	0.5%, 40 μ in	0.5%, 60 μ in	0.5%, 99 μ in	0.5%, 200 μ in	0.7%, 395 μ in
Temperature Effects (% of Full Scale/ $^{\circ}$ F)	0.011				
Operating Temperature Range ($^{\circ}$ F)	+14 to +175				
Storage Temperature Range ($^{\circ}$ F)	-40 to 212				
Excitation Voltage	1 to 5Vrms Sine Wave @ 2 to 20kHz				
Termination	4 1/2 foot shielded cable with type D hooded connector; Option B has Bendix PC01W-106P connector				
Standard Connector Pinout	1 = Shields 2 = NC 3 = -Sig. 4 = +Sig. 5 = NC 6 = +Exc. 7 = +Sense 8 = -Sense 9 = -Exc.				
Option B Connector Pinout	A = +Exc. B = +Sig. C = -Sig. D = -Exc. E = Shield F = NC				
Cable to Model 704/744 Instruments	Standard connector mates with Instrument; Option B Connector Requires P/N 224-4024V-20 cable.				

Typical LVDT Applications

S. Himmelstein and Company can furnish the LVDT, Model 704/744 Instrument and interconnect cables to perform the required signal conditioning, processing, display and classification functions. Additionally, if needed, we can furnish more complex systems with statistics, data storage, curve plotting, etc. Please contact the factory should you have special needs. The full LVDT range can be used for most applications.

However, highest accuracy is achieved using *differential measurements*. Thus, when a 0.35" thickness must be checked, a ± 0.4 " range LVDT-4000-400 is an obvious choice. However, a ± 0.04 " LVDT-4000-40 can also be used. First, TARE it against a 0.3500" master. Thereafter, part deviation from the master will be measured with *10 times the accuracy* of the LVDT-4000-400 using a *direct measurement*.

 <p style="text-align: center;">OUTSIDE DIAMETER USE MODEL 744</p>	 <p style="text-align: center;">OUTSIDE DIAMETER USE MODEL 704 OR 744</p>
 <p style="text-align: center;">FACE RUNOUT USE MODEL 704 OR 744</p>	 <p style="text-align: center;">RADIAL RUNOUT USE MODEL 704 OR 744</p>
 <p style="text-align: center;">TAPER & THICKNESS USE MODEL 744</p>	 <p style="text-align: center;">THICKNESS USE MODEL 744</p>
 <p style="text-align: center;">CONCENTRICITY USE MODEL 744</p>	 <p style="text-align: center;">MAXIMUM NON-PERPENDICULARITY USE MODEL 744</p>