For fast, reliable measurement of electromechanical phenomena

Transducers
TRANSDUCERS

FOR FAST, RELIABLE MEASUREMENT OF ELECTROMECHANICAL PHENOMENA

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For precise electrical measurement of linear motion, size, strain, position, distortion, expansion, and similar mechanical phenomena

Daytronic Linear Displacement Transducers are rugged, sensitive measuring devices that produce an electrical output signal precisely proportional to the mechanical displacement of a sensing probe.

These robust, full ratiometric instruments yield exceptional dimensional stability. With applications in gaging, automatic inspection, process control, and countless specific research operations, the models described on the following pages yield repeatable measurements from less than a micron to over three feet.

Models include

- **GENERAL-PURPOSE LVDT’s** with various electrical and mechanical configurations, for use in a broad range of industrial and research applications*

- Exceptionally reliable **PRECISION LVDT’s** with high-quality linear bearings, for the most sensitive gaging and quality control operations

- **Rugged SUBMERSIBLE LVDT’s**, hermetically sealed for use in hostile industrial and research environments (corrosive fluids and gases, high temperature and vibration, etc.)

Based on the linear variable differential transformer (LVDT) principle, the performance of these sensors depends on inductance effects that do not involve flexing wires or sliding electrical contacts. All coils are magnetically shielded, and are cased in hardened stainless-steel housings.

As a result, these transducers are virtually "noise-free," displaying extreme resistance to the effects of vibration, rotation, and electrical interference, as well as to adverse environmental factors like humidity, ambient temperature variation, and corrosive atmospheric conditions. Calibration remains stable for years of operation—even in the most unfavorable industrial surroundings.

Daytronic offers

- **AC-operated LVDT’s**
- **DC-operated LVDT’s**

For both AC- and DC-operated transducers, there are

- **Short-stroke LVDT’s**
  These LVDT’s have full-scale linear ranges from ±0.01 inch (±0.25 mm) to ±0.5 inch (±12.7 mm). A number of high-precision short-stroke models are available.

- **Long-stroke LVDT’s**
  These LVDT’s have full-scale linear ranges from ±0.5 inch (±12.7 mm) to ±18.5 inches (±470 mm). Long-stroke DC-to-DC models offer both ±2-V and ±5-V output.

Three different armature types are available, to meet varying application requirements:

- **Spring-extended armature**
- **Unguided armature**
- **Captive armature**

See LVDT Model-Numbering System and General LVDT Categories.

* Many units have a threaded shank and locking nut for secure positioning in a simple mounting fixture.
**How They Work**

Differential transformers (also known as *linear variable differential transformers*, or LVDT’s) are inductive sensing devices that produce an AC output voltage proportional to the mechanical displacement of a small iron core. They are simple and rugged, have completely stepless resolution, and can resolve fractions of a microinch, if required.

One primary and two secondary coils are symmetrically arranged to form a hollow cylinder, as shown in the cross-section of a typical LVDT with spring-extended armature (Fig. LT.1). A magnetic nickel-iron core, supported by a nonmagnetic push rod, moves axially within the cylinder in response to mechanical displacement of the probe tip.

With excitation of the primary coil, induced voltages will appear in the secondary coils. Because of the symmetry of magnetic coupling to the primary, these secondary induced voltages are equal when the core is in the central ("null" or "electric zero") position. When the secondary coils are connected in series opposition, as shown in Fig. LD.1, the secondary voltages will cancel and (ideally) there will be no net output voltage.

If, however, the core is displaced from "null" position, in either direction, one secondary voltage will increase, while the other decreases. Since the two voltages no longer cancel, a net output voltage will now result. If the transducer has been properly designed, this output will be exactly proportional to the magnitude of the displacement, with a phase polarity (as referenced to the primary excitation voltage) corresponding to the direction of displacement (see the graph in Fig. LT.1).

The actual (as opposed to the "ideal") AC output voltage of an LVDT would be represented by the solid line in the graph. Notice that there is no ability to distinguish between displacements on either side of null, and that the voltage does not go to zero at null, but retains some finite minimum value.

This "residual null" voltage, which is always present to some degree, is composed partly of extraneous electrical pickup and partly of quadrature voltage components arising from capacitive and other effects. To achieve useful readout of LVDT-generated measurement data, a signal conditioner must be used that can eliminate the effects of residual null voltages, and also discriminate between positive and negative inputs, thereby producing an output conforming to the "ideal" characteristic represented by the dashed line in the graph.

In the case of AC-excited LVDT’s, a conditioner of phase-sensitive carrier amplifier design provides optimum sensitivity and accuracy. Responding only to the modulated carrier frequency, such an instrument is insensitive to extraneous DC and AC "noise" voltages at other frequencies.

**AC vs. DC Excitation**

The major advantages of DC-to-DC LVDT’s are ease of installation and signal conditioning, the ability to operate from dry cell batteries in remote locations, and lower system cost (especially in multipoint applications).

AC-operated LVDT’s are generally smaller in body size and more accurate than DC versions. They will also normally operate at higher temperatures.
A Choice of Armature to Suit Your Requirements

Unguided Armature

This is the simplest mechanical configuration, where the armature fits loosely in the bore of the LVDT, being attached to the moving point by a male thread. It can be completely separated from the transducer body without demounting either part.

Proper installation of this type of LVDT requires that the armature and LVDT body be separately supported so as to ensure relative movement along a common axis. When properly aligned, this non-contact arrangement allows essentially frictionless movement with zero wear, and ensures continued repeatability with infinite resolution.* With no internal springs or bearings, the unit has virtually unlimited fatigue life.

A free unguided armature is most suitable for short-range, high-speed applications (such as mechanical vibration measurements) or applications with a very high number of cycles. It is also recommended for applications in which the target being measured moves parallel to the transducer body.

Captive Armature

This configuration can be used for both static and dynamic applications, including applications where the target being measured moves in a direction transverse to the transducer body. Here, the armature is both restrained and guided by a low-friction bearing assembly. This allows all units to be mounted vertically between optional self-aligning bearings, if desired. Units measuring ranges of ±3 inches (±76 mm) or less can also be mounted horizontally. Units with a range greater than ±3 inches, however, may require additional support along the transducer body, to prevent flexing.*

Captive-armature LVDT’s are suitable for applications with a longer working range, where the transducer is to be mounted by its ends only, or where misalignment might occur if the armature were unguided.

Spring-Extended Armature

In this configuration, the armature is both restrained and guided by a low-friction bearing assembly (as with the "captive" armature). In addition, it has an internal spring to continuously push the armature to its fullest possible extension, thereby maintaining light yet reliable contact with the measured object. This feature is appropriate where the contact surface moves periodically beyond the range of the transducer (as, for example, when multiple separate parts are being gaged on a production line).

Spring-loaded LVDT’s only require a fixing point for the transducer body, and are most suited to static or relatively slow-moving applications. The probe end of the armature is normally tipped with a ball, although optional flat or roller ends are also available (see the Model 106 Contact Tip).

* With all LVDT types, side loads must be kept to a minimum, since they will cause rubbing between the armature and the LVDT body, thus reducing the unit’s life and accuracy. In extreme cases, they may cause the armature to bend.
LVDT Model-Numbering System

Daytronic's LVDT products are mainly classified by

- Excitation type (AC or DC)
- Stroke length (Short or Long)
- Armature type (Unguided, Captive, or Spring-Extended)
- Operating measurement range (full stroke length expressed as ± in/mm)

Additional feature(s), including high precision and/or linearity, cable length, hermetic sealing, DC voltage output level, etc.

See the General LVDT Categories that correspond to the general model-numbering scheme.

* There are a few exceptions. The following units, for example, have retained their "traditional" Daytronic model numbers: DS20A through DS400A; DS1000A through DS6000A; DS200B, DS500, and DS2000.

Table LT.1
Model-Numbering System for AC LVDT's

Model DS [___] (P) (S) (U) (G)
     (L) (C) (H)
     (E) (M)

"DS" identifies the LVDT as AC-OPERATED

Full-scale LINEAR RANGE in milli-inches**
    (e.g., "20" = full-scale range of ±0.01 in.;
     "200" = full-scale range of ±0.1 in.;
     "800" = full-scale range of ±0.4 in.;
     "12000" = full-scale range of ±6.0 in.)

"P" indicates HIGH PRECISION

STROKE LENGTH ("S" = Short; "L" = Long)

ARMATURE TYPE
    ("U" = Unguided; "C" = Captive; "E" = Spring-Extended)

ADDITIONAL FEATURE
    ("G" = High Linearity; "H" = 6-Foot Cable; "M" = Hermetic Sealing)

Table LT.2
Model-Numbering System for DC LVDT's

Model DSD [___] (S) (U) (5)
     (L) (C) (2)
     (E) (M)

"DSD" identifies the LVDT as DC-OPERATED

Full-scale LINEAR RANGE in milli-inches
    (see Table LT.1, above)

STROKE LENGTH ("S" = Short; "L" = Long)

ARMATURE TYPE
    ("U" = Unguided; "C" = Captive; "E" = Spring-Extended)

ADDITIONAL FEATURE
    ("5" = ±5-V Output; "2" = ±2-V Output; "M" = Hermetic Sealing)

* Or, for the "PSEG" Series, in millimeters.
GENERAL LVDT CATEGORIES

AC-OPERATED ("DS") LVDT's

• Short-Stroke ("S")
  • Unguided Armature ("U")
    — **With 6-ft. Cable ("SUH")** (DS50SUH - DS1000SUH)
    — **Hermetically Sealed ("SUM")** (DS80SUM - DS1000SUM)
  • Spring-Extended Armature ("E")
    — **Standard Models (High Precision; "PSE")** (DS20B - DS400B; DS600PSE - DS1000PSE)
    — **High Precision, High Linearity ("PSEG")** (DS1000PSEGA - DS10000PSEGA)
    — **Hermetically Sealed ("SEM")** (DS800SE - DS1000SE)
    — **"Locking Nut" Models** (DS200B, DS500)

• Long-Stroke ("L")
  • Unguided Armature ("U")
    — **Standard Models ("LU")** (DS1000LU - DS16000LU)
    — **Hermetically Sealed ("LUM")** (DS1000LUM - DS12000LUM)
  • Captive Armature ("C")
    — **Standard Models ("LC")** (DS1000LC - DS37000LC)
    — **Hermetically Sealed ("LCM")** (DS1000LCM - DS12000LCM)
  • Spring-Extended Armature ("E")
    — **Standard Models ("LE")** (DS1000A - DS6000A)
    — **Hermetically Sealed ("LEM")** (DS1000LEM - DS6000LEM)
    — **"Locking Nut" Model (High Precision)** (DS2000)

DC-OPERATED ("DSD") LVDT's

• Short-Stroke ("S")
  • Unguided Armature ("U")
    — **Standard Models ("SU")** (DSD200SU, DSD400SU)
    — **High Voltage (±5-V Output; "SU5")** (DSD200SU5 - DSD800SU5)
  • Spring-Extended Armature ("E")
    — **Standard Models ("SE")** (DSD200SE, DSD400SE)
    — **High Voltage (±5-V Output; "SE5")** (DSD200SE5 - DSD800SE5)

• Long-Stroke ("L")
  • Unguided Armature ("U")
    — **Standard Models (±5-V Output; "LU5")** (DSD1000LU5 - DSD16000LU5)
    — **Low Voltage (±2-V Output; "LU2")** (DSD1000LU2 - DSD16000LU2)
    — **Hermetically Sealed ("LUM")** (DSD1000LUM - DSD12000LUM)
  • Captive Armature ("C")
    — **Standard Models (±5-V Output; "LC5")** (DSD1000LC5 - DSD37000LC5)
    — **Low Voltage (±2-V Output; "LC2")** (DSD1000LC2 - DSD37000LC2)
    — **Hermetically Sealed ("LCM")** (DSD1000LCM - DSD12000LCM)
  • Spring-Extended Armature ("E")
    — **Standard Models (±5-V Output; "LE5")** (DSD1000LE5 - DSD6000LE5)
    — **Low Voltage (±2-V Output; "LE2")** (DSD1000LE2 - DSD6000LE2)
    — **Hermetically Sealed ("LEM")** (DSD1000LEM - DSD6000LEM)
**Concerning LVDT Specifications Given in This Catalog...**

The stated linearity characteristics represent minimum values at the stated excitation level, and refer to the full-scale range over which the LVDT is calibrated. Use of less than nominal range results in the same percentage linearity but in proportionally better absolute linearity.

LVDT’s (unlike strain gages) cannot be supplied with meaningful calibration data. System sensitivity is a function of excitation frequency, cable loading, amplifier phase characteristics, and other factors. It is a practical necessity to calibrate each LVDT/cable/instrument system after installation, using a known input standard. The sensitivity and repeatability values given are typical minimum values only.
AC "SU" AND "SUH" LVDT SERIES

These are the standard AC-EXCITED SHORT-STROKE LVDT models with UNGUIDED ARMATURE. "SUH" models include a 2-meter (6.6-foot) cable.

GENERAL AC "SUH" SPECIFICATIONS

**Excitation:** 5 V-AC (RMS) at 5 kHz*; 30 mA nominal at 5 kHz

**Armature:** Unguided

**Linearity:** Better than ±0.5% of full scale**

* Will operate equally well over the range of 2 to 10 kHz, and down to 1 V-AC (RMS).

** S ±0.25% and ±0.1% linearity are available as options (contact the factory for details).

**Sensitivity:** 80 mV/V/mm (2 mV/V/0.001"), typical

**Repeatability:** Absolute, but dependent on system mechanics

**Phase Shift:** Typically 10° (depends on frequency)

**Temperature Coefficient of Sensitivity:** 0.01% of full scale/°C (0.005% of full scale/°F), typical

**Operating Temperature Range:** -20° C to +125° C (-4° F to +257° F)
AC "SUM" Sealed LVDT Series

Designed for use while submerged under fresh water and most other non-corrosive liquids and gases, these LVDT's are extensively used in industrial and R&D applications.

The stainless-steel body is hermetically sealed and has a cable exit which is double-sealed using an internal rubber gland plus a poly-olefin shrink tube covering the cable and transducer body. An alternative MI stainless-steel sheathed cable option is available for use under high liquid pressures (as in soil testing apparatus, hydraulics, vessel studies, etc.)

Fig. LT.5
AC "SUM" Series Dimensions

NOTE: All dimensions nominal, except Diameter ("D"), which is ±0.13 mm / ±0.005 in.

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<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Dimension &quot;D&quot; (mm / in.)</th>
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<th>Armature Weight (g / oz.)</th>
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<td>19.0 / 0.75</td>
<td>8.0 / 0.31</td>
<td>15.0 / 0.6</td>
<td>4 / 0.14</td>
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<td>18.5 / 0.73</td>
<td>10 / 0.35</td>
<td>36 / 1.27</td>
</tr>
<tr>
<td>DS800SUM</td>
<td>±10.0 / ±0.4</td>
<td>74.0 / 2.91</td>
<td>32.5 / 1.28</td>
<td>9.5 / 0.37</td>
<td>18.5 / 0.73</td>
<td>12 / 0.42</td>
<td>40 / 1.41</td>
</tr>
<tr>
<td>DS1000SUM</td>
<td>±12.5 / ±0.5</td>
<td>90.0 / 3.54</td>
<td>35.0 / 1.38</td>
<td>9.5 / 0.37</td>
<td>18.5 / 0.73</td>
<td>15 / 0.53</td>
<td>50 / 1.76</td>
</tr>
</tbody>
</table>

General AC "SUM" Specifications

Excitation: 5 V-AC (RMS) at 5 kHz**; 20 - 30 mA at 5 kHz
Armature: Unguided
Linearity: Better than ±0.5% of full scale***

* Excluding cable.
** Will operate equally well over the range of 2 to 10 kHz, and down to 1 V-AC (RMS).
*** ±0.25% and ±0.1% linearity are available as options (contact the factory for details).
"PSE" Precision LVDT Series

These AC units present the optimum combination of range, accuracy, versatility, and small size required for general-purpose applications. A spring-extended armature and a special linear bearing technique yield virtually friction-free probe action over a wide temperature range. With suitable signal conditioning equipment, they can provide repeatability of well within a micron (0.001 mm).

These LVDT's are a logical selection when ambient temperature control is impossible or inconvenient, since small size and AISI-446 stainless-steel construction normally reduce thermal expansion errors to insignificance.* The Models DS20A, DS40A, and DS80A have a sealed rubber boot to prevent entry of dust or liquid into the transducer housing.

In addition to high mechanical strength, all models have fully encapsulated, magnetically shielded windings for use with ESI or other carrier amplifier equipment.** They can be mounted in any position, and are unaffected by being clamped into the steel housings of most gaging fixtures. With a built-in "anti-rotate" mechanism, each ball-ended probe can withstand the high side loads often encountered in multipoint gaging operations, without loss of accuracy.

* Temperature errors attributable to the transducer-instrument combination amount to less than one microinch per °F. This is smaller than the errors that inevitably arise—even in the most well designed fixture systems—from ordinary thermal expansion and contraction. In general, dimensional measurement with meaningful precision to 0.0001" or better demands a carefully controlled temperature environment.

** Differential-inductance windings are also available, for use with equipment with half-bridge input circuitry.

---

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range</th>
<th>Dimension &quot;L&quot;</th>
<th>Dimension &quot;X&quot;</th>
<th>Dimension &quot;y&quot;</th>
<th>Dimension &quot;D&quot;</th>
<th>Maximum Spring Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS20B</td>
<td>±0.25 / ±0.010</td>
<td>49.25 / 1.94</td>
<td>10.9 / 0.43</td>
<td>— / —</td>
<td>8 / 0.31</td>
<td>214 / 7.5</td>
</tr>
<tr>
<td>DS40B</td>
<td>±0.50 / ±0.020</td>
<td>49.25 / 1.94</td>
<td>12.2 / 0.48</td>
<td>— / —</td>
<td>8 / 0.31</td>
<td>214 / 7.5</td>
</tr>
<tr>
<td>DS80C</td>
<td>±1.0 / ±0.040</td>
<td>52.4 / 2.062</td>
<td>13.1 / 0.515</td>
<td>22.4 / 0.88</td>
<td>9.5 / 0.37</td>
<td>214 / 7.5</td>
</tr>
<tr>
<td>DS80D</td>
<td>±1.0 / ±0.040</td>
<td>52.4 / 2.062</td>
<td>13.1 / 0.515</td>
<td>— / —</td>
<td>8 / 0.31</td>
<td>214 / 7.5</td>
</tr>
<tr>
<td>DS190B</td>
<td>±2.5 / ±0.100</td>
<td>60.8 / 2.393</td>
<td>11.5 / 0.45</td>
<td>— / —</td>
<td>9.5 / 0.37</td>
<td>170 / 6.23</td>
</tr>
<tr>
<td>DS400B</td>
<td>±5.0 / ±0.200</td>
<td>67.7 / 2.665</td>
<td>11.5 / 0.45</td>
<td>— / —</td>
<td>9.5 / 0.37</td>
<td>170 / 6.23</td>
</tr>
<tr>
<td>DS600PSE</td>
<td>±8.0 / ±0.300</td>
<td>84.5 / 3.325</td>
<td>15.2 / 0.60</td>
<td>— / —</td>
<td>9.5 / 0.37</td>
<td>245 / 8.64</td>
</tr>
<tr>
<td>DS800PSE</td>
<td>±10.0 / ±0.400</td>
<td>95.5 / 3.750</td>
<td>19.0 / 0.75</td>
<td>— / —</td>
<td>9.5 / 0.37</td>
<td>210 / 7.40</td>
</tr>
<tr>
<td>DS1000PSE</td>
<td>±12.7 / ±0.500</td>
<td>118 / 4.640</td>
<td>21.6 / 0.85</td>
<td>— / —</td>
<td>9.5 / 0.37</td>
<td>215 / 7.58</td>
</tr>
</tbody>
</table>

(cont'd)

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See LVDT Model-Numbering System.
See General LVDT Categories.
"PSE" Precision LVDT Series (cont’d)

General "PSE" Specifications

**Excitation:** 5 V-AC (RMS) at 5 kHz*; 20 mA nominal at 5 kHz for Models DS20B through DS80D; 25 mA nominal at 5 kHz for Models DS190B through DS1000PSE

**Armature:** Spring-extended

**Linearity:** Better than ±0.5% of full scale**

* Will operate equally well over the range of 2 to 10 kHz.

** ±0.25% and ±0.1% linearity are available as options (contact the factory for details).

**Sensitivity:** 80 mV/V/mm (2 mV/V/0.001"), typical

**Repeatability:** Within 0.5 micron (20 microinches)

**Phase Shift:** Typically 10° (depends on frequency)

**Temperature Coefficient of Sensitivity:** 0.01% of full scale/°C (0.005% of full scale/°F), typical

**Operating Temperature Range:** -20° C to +125° C (-4° F to +257° F)

See LVDT Model-Numbering System. See General LVDT Categories.
"PSEGA" Precision LVDT Series

Featuring high repeatability and linearity, the "PSEGA" Series LVDTs have been designed for precision measurement in gaging and quality control applications.

A spring-extended armature and a special high-precision linear bearing assembly yield virtually friction-free probe action over a wide temperature range. With suitable signal conditioning equipment, these LVDTs can provide repeatability of 0.15 micron (6 microinches).

These LVDTs are a logical selection when ambient temperature control is impossible or inconvenient, since small size and AISI-446 stainless-steel construction normally reduce thermal expansion errors to insignificance.* All models have rubber sealing bellows to prevent entry of dust or liquid into the transducer housing.

The bearing assembly has its own outer case, which adds to the high mechanical strength of these transducers. All models have fully encapsulated, magnetically shielded windings for use with ESI or other carrier amplifier equipment.** They can be mounted in any position, and are unaffected by being clamped into the steel housings of most gaging fixtures. With a built-in "anti-rotate" mechanism, each tungsten-carbide-tipped probe can withstand the high side loads often encountered in multipoint gaging operations, without loss of accuracy.

Securely clamped LVDT cables are sheathed in the highest quality polyurethane, for maximum strength and resistance to chemical/oil attack.

* Temperature errors attributable to the transducer-instrument combination amount to less than one microinch per °F. This is smaller than the errors that inevitably arise—even in the most well designed fixture systems—from ordinary thermal expansion and contraction. In general, dimensional measurement with meaningful precision to 0.0001" or better demands a carefully controlled temperature environment.

** Differential-inductance windings are also available, for use with equipment with half-bridge input circuitry.

---

**Fig. LT.7**

"PSEGA" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Dimension &quot;B&quot; (mm / in.)</th>
<th>Weight* (g / oz.)</th>
<th>Maximum Spring Force (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000PSEGA</td>
<td>±0.5 / ±0.02</td>
<td>26 / 1.02</td>
<td>7.25 / 0.285</td>
<td>5.5 / 0.216</td>
<td>7 / 0.25</td>
<td>100 / 3.5</td>
</tr>
<tr>
<td>DS2000PSEGA</td>
<td>±1.0 / ±0.04</td>
<td>53 / 2.09</td>
<td>14 / 0.55</td>
<td>14 / 0.55</td>
<td>16 / 0.56</td>
<td>101 / 3.56</td>
</tr>
<tr>
<td>DS5000PSEGA</td>
<td>±2.5 / ±0.1</td>
<td>57 / 2.26</td>
<td>20 / 0.79</td>
<td>18 / 0.71</td>
<td>18 / 0.63</td>
<td>118 / 4.16</td>
</tr>
<tr>
<td>DS10000PSEGA</td>
<td>±5.0 / ±0.2</td>
<td>82 / 3.23</td>
<td>22 / 0.87</td>
<td>30 / 1.18</td>
<td>22 / 0.78</td>
<td>150 / 5.29</td>
</tr>
</tbody>
</table>

* Excluding cable.

(cont'd)

See LVDT Model-Numbering System. See General LVDT Categories.
"PSEGA" Precision LVDT Series (cont’d)

**General "PSEGA" Specifications**

**Excitation:**
- **Voltage:** 1 to 7 V-AC (RMS) at 2 to 10 kHz; calibrated at 5 V-AC at 5 kHz
- **Current:**
  - DS1000PSEG: 14 mA nominal at 5 kHz
  - DS2000PSEG: 25 mA nominal at 5 kHz
  - DS5000PSEG: 25 mA nominal at 5 kHz
  - DS10000PSEG: 8 mA nominal at 5 kHz

**Armature:** Spring-extended

**Resolution:** Infinite

**Linearity:** ±0.25% of full scale

**Sensitivity:**
- DS1000PSEG: 240 mV/V/mm (6 mV/V/0.001"), typical
- DS2000PSEG: 150 mV/V/mm (4 mV/V/0.001"), typical
- DS5000PSEG: 150 mV/V/mm (4 mV/V/0.001"), typical
- DS10000PSEG: 120 mV/V/mm (4 mV/V/0.001"), typical

**Repeatability:** 0.15 micron (6 microinches)

**Temperature Coefficient (Zero and Span):** 0.01% of full scale/°C (0.005% of full scale/°F)

**Operating Temperature Range:** -40° C to +100° C (-40° F to +212° F)
AC "SEM" SEALED LVDT SERIES

Designed for use while submerged under fresh water and most other non-corrosive liquids and gases, these LVDT's are extensively used in industrial and R&D applications.

The stainless-steel body is hermetically sealed and has a cable exit which is double-sealed using an internal rubber gland plus a polyolefin shrink tube covering the cable and transducer body. An alternative MI stainless-steel sheathed cable option is available for use under high liquid pressures (as in soil testing apparatus, hydraulics, vessel studies, etc.)

Fig. LT.8
AC "SEM" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Dimension &quot;D&quot; (mm / in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS80SEM</td>
<td>±1.0 / ±0.04</td>
<td>52.0 / 2.04</td>
<td>11.5 / 0.45</td>
<td>8.0 / 0.31</td>
</tr>
<tr>
<td>DS200SEM</td>
<td>±2.5 / ±0.1</td>
<td>66.0 / 2.60</td>
<td>12.5 / 0.5</td>
<td>9.5 / 0.37</td>
</tr>
<tr>
<td>DS400SEM</td>
<td>±5.0 / ±0.2</td>
<td>72.6 / 2.86</td>
<td>13.7 / 0.54</td>
<td>9.5 / 0.37</td>
</tr>
<tr>
<td>DS600SEM</td>
<td>±7.5 / ±0.3</td>
<td>92.3 / 3.63</td>
<td>15.2 / 0.6</td>
<td>9.5 / 0.37</td>
</tr>
<tr>
<td>DS800SEM</td>
<td>±10.0 / ±0.4</td>
<td>103.5 / 4.07</td>
<td>21.6 / 0.85</td>
<td>9.5 / 0.37</td>
</tr>
<tr>
<td>DS1000SEM</td>
<td>±12.5 / ±0.5</td>
<td>126.0 / 4.96</td>
<td>24.0 / 0.94</td>
<td>9.5 / 0.37</td>
</tr>
</tbody>
</table>

NOTE: All dimensions nominal, except Diameter ("D"), which is ±0.13 mm / ±0.005 in.

GENERAL AC "SEM" SPECIFICATIONS

Excitation: 5 V-AC (RMS) at 5 kHz*; 20 - 30 mA at 5 kHz

Armature: Spring-extended

Linearity: Better than ±0.5% of full scale**

Sensitivity: 80 mV/V/mm (2 mV/V/0.001"), typical

* Will operate equally well over the range of 2 to 10 kHz, and down to 1 V-AC (RMS).

** ±0.25% and ±0.1% linearity are available as options (contact the factory for details).

Repeatability: 1.0 micron (40 microinches)

Temperature Coefficient of Sensitivity: 0.01% of full scale/°C (0.005% of full scale/°F), typical

Operating Temperature Range: -20°C to +125°C (-4°F to +257°F)

Spring Force (maximum): 150 g (5 oz.)
"Locking Nut" LVDT Series

The Models DS200B and DS500 each have a threaded mounting shank and locking nut to allow secure, precise positioning in a simple mounting fixture. The coil is epoxy-encapsulated and magnetically shielded, and the spring-loaded probe terminates in a hardened steel tip, rounded and polished, which is readily replaceable (see the optional Model 106 Contact Tip). An optional rubber boot is also available, for protection of the probe shaft from fluids and abrasive materials.

Combining optimal electrical properties with rugged stainless-steel construction, these instruments can tolerate years of hard industrial use with no appreciable loss of precision. Typical applications include in-process gaging control, creep test recording, structural deflection measurement, actuator and tool position feedback, dilatometry, strip thickness measurement, and much more (see Fig. LT3).

Short-Stroke "Locking Nut" Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>DS200B</th>
<th>DS500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Range:</td>
<td>±0.10 in. (±2.5 mm)</td>
<td>±0.250 in. (±6.35 mm)</td>
</tr>
<tr>
<td>Excitation:</td>
<td>1 to 5 V-AC (RMS) at 2 to 10 kHz</td>
<td>2 to 10 V-AC (RMS) at 0.06 to 10 kHz*</td>
</tr>
<tr>
<td>Linearity**:</td>
<td>±0.2% of full scale</td>
<td>±0.25% of full scale</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>1.8 mV/V/0.001&quot;, nominal</td>
<td>1.0 mV/V/0.001&quot;, nominal</td>
</tr>
<tr>
<td>Operating Temperature Range:</td>
<td>-20° C to +125° C (-4° F to +257° F)</td>
<td>-40° C to +100° C (-40° F to +212° F)</td>
</tr>
</tbody>
</table>

* With excitation below 0.4 kHz, primary voltage should not exceed 3 V.
** Minimum characteristics at 5 kHz excitation for DS200B; at 3 kHz for DS500.
"Locking Nut" LVDT Series (cont’d)

Model 106 Contact Tip

Replacing the standard rounded tip on the DS200B, DS500, or DS2000, this tip provides a precision ground-flat surface, 3/8" in diameter, for contacting rounded objects.

See also the Model 115C Calibration Kit, which may be used with the short-stroke "Locking Nut" LVDT's.
AC "LU" LVDT Series

These high-performance transducers are the standard AC-EXCITED LONG-STROKE LVDT models with UNGUIDED ARMATURE. They are ideal for harsh applications under conditions of high ambient temperature and/or vibration.

Each model requires separate signal conditioning, and will deliver its best performance when energized between 0.5 and 7 V-AC (RMS) at 5 kHz, using a high-quality carrier amplifier.

Compact size allows use where physical space is limited. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

**General AC "LU" Specifications**

**Excitation:** 0.5 to 7 V-AC (RMS), regulated*

**Armature:** Unguided

**Linearity:** ±0.5% of full scale**

**Output (full-scale RMS):** See table, above

---

**Residual Null Output:** 0.1% of full-scale output (quadrature and harmonic)

**Phase Shift:** Typically 10° (depends on frequency)

**Temperature Coefficient (Zero and Span):** 0.01% of full scale/°C (0.005% of full scale/°F)

**Operating Temperature Range:** -50° C to +125° C (-58° F to +257° F)**

---

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (Approx.) (g / oz.)</th>
<th>Total Weight (Approx.) (g / oz.)</th>
<th>Electrical Output (V/V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000LU</td>
<td>±12.5 / ±0.5</td>
<td>127 / 5.0</td>
<td>43 / 1.7</td>
<td>35 / 1.25</td>
<td>170 / 6</td>
<td>0.8</td>
</tr>
<tr>
<td>DS2000LU</td>
<td>±25.0 / ±1.0</td>
<td>155 / 6.1</td>
<td>68 / 2.7</td>
<td>50 / 1.75</td>
<td>227 / 8</td>
<td>0.9</td>
</tr>
<tr>
<td>DS4000LU</td>
<td>±50.0 / ±2.0</td>
<td>270 / 10.6</td>
<td>81 / 3.2</td>
<td>57 / 2.0</td>
<td>369 / 13</td>
<td>1.6</td>
</tr>
<tr>
<td>DS6000LU</td>
<td>±75.0 / ±3.0</td>
<td>381 / 15.0</td>
<td>120 / 4.7</td>
<td>63 / 2.2</td>
<td>454 / 16</td>
<td>1.5</td>
</tr>
<tr>
<td>DS8000LU</td>
<td>±100 / ±4.0</td>
<td>427 / 16.8</td>
<td>182 / 7.2</td>
<td>71 / 2.5</td>
<td>568 / 20</td>
<td>3.2</td>
</tr>
<tr>
<td>DS12000LU</td>
<td>±150 / ±6.0</td>
<td>617 / 24.3</td>
<td>213 / 8.2</td>
<td>114 / 4.0</td>
<td>824 / 29</td>
<td>2.4</td>
</tr>
<tr>
<td>DS16000LU</td>
<td>±200 / ±8.0</td>
<td>808 / 31.8</td>
<td>259 / 10.2</td>
<td>145 / 5.1</td>
<td>1193 / 42</td>
<td>1.5</td>
</tr>
</tbody>
</table>

---

* Factory calibration is at 5 V-AC (RMS) at 5 kHz (50 mA maximum), with output load of 100 kΩ.

** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

*** -50° C to +200° C (-58° F to +392° F) optional.
AC "LUM" Sealed LVDT Series

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and temperature/pressure ratings (contact the Daytronic factory for details).

Fig. LT.12
AC "LUM" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000LUM</td>
<td>±12.5 / ±0.5</td>
<td>153 / 6.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
</tr>
<tr>
<td>DS2000LUM</td>
<td>±25.0 / ±1.0</td>
<td>181 / 7.13</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
</tr>
<tr>
<td>DS4000LUM</td>
<td>±50.0 / ±2.0</td>
<td>304 / 11.97</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
</tr>
<tr>
<td>DS6000LUM</td>
<td>±75.0 / ±3.0</td>
<td>420 / 16.54</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
</tr>
<tr>
<td>DS8000LUM</td>
<td>±100 / ±4.0</td>
<td>453 / 17.83</td>
<td>127 / 5.0</td>
<td>67 / 2.4</td>
</tr>
<tr>
<td>DS12000LUM</td>
<td>±150 / ±6.0</td>
<td>666 / 26.26</td>
<td>183 / 7.2</td>
<td>104 / 3.7</td>
</tr>
</tbody>
</table>

General AC "LUM" Specifications

**Excitation:** 1 to 7 V-AC (RMS) at 5 kHz  
**Armature:** Unguided  
**Linearity:** ±0.5% of full scale*  
**Output (full-scale RMS):** 0.8 to 3 V/V (dependent on range)

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).  
** Higher temperature/pressure ratings available with cable options (contact factory for details).

**Phase Shift:** Typically 10° (depends on frequency)  
**Output Load (recommended):** 100 kΩ  
**Temperature Coefficient (Zero and Span):** 0.01% of full scale/°C (0.005% of full scale/°F)  
**Operating Temperature Range:** -40°C to +90°C (-40°F to +194°F)**  
**Pressure Rating:** 10 bar (150 psi)**
AC "LC" LVDT SERIES

These high-performance transducers are the standard AC-EXCITED LONG-STROKE LVDT models with CAPTIVE ARMATURE. They are ideal for harsh applications under conditions of high ambient temperature and/or vibration.

Each model requires separate signal conditioning, and will deliver its best performance when energized between 0.5 and 7 V-AC (RMS) at 5 kHz, using a high-quality carrier amplifier.

Compact size allows use where physical space is limited. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.13
AC "LC" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.) (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Total Weight (Approx.) (g / oz.)</th>
<th>Electrical Output (V/V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000LC</td>
<td>±12.5 / ±0.5</td>
<td>152 / 6.0</td>
<td>38 / 1.5</td>
<td>284 / 10</td>
<td>0.8</td>
</tr>
<tr>
<td>DS2000LC</td>
<td>±25.0 / ±1.0</td>
<td>180 / 7.1</td>
<td>63 / 2.5</td>
<td>340 / 12</td>
<td>0.9</td>
</tr>
<tr>
<td>DS4000LC</td>
<td>±50.0 / ±2.0</td>
<td>296 / 11.6</td>
<td>76 / 3.0</td>
<td>511 / 18</td>
<td>1.6</td>
</tr>
<tr>
<td>DS6000LC</td>
<td>±75.0 / ±3.0</td>
<td>406 / 16.0</td>
<td>114 / 4.5</td>
<td>653 / 23</td>
<td>1.5</td>
</tr>
<tr>
<td>DS8000LC</td>
<td>±100 / ±4.0</td>
<td>452 / 17.8</td>
<td>127 / 5.0</td>
<td>710 / 25</td>
<td>3.2</td>
</tr>
<tr>
<td>DS12000LC</td>
<td>±150 / ±6.0</td>
<td>643 / 25.3</td>
<td>178 / 7.0</td>
<td>1022 / 36</td>
<td>2.4</td>
</tr>
<tr>
<td>DS16000LC</td>
<td>±200 / ±8.0</td>
<td>833 / 32.8</td>
<td>254 / 10.0</td>
<td>1420 / 50</td>
<td>1.5</td>
</tr>
<tr>
<td>DS20000LC</td>
<td>±250 / ±10.0</td>
<td>1030 / 40.5</td>
<td>305 / 12.0</td>
<td>1590 / 56</td>
<td>2.0</td>
</tr>
<tr>
<td>DS30000LC</td>
<td>±375 / ±15.0</td>
<td>1435 / 56.5</td>
<td>406 / 16.0</td>
<td>2130 / 75</td>
<td>3.0</td>
</tr>
<tr>
<td>DS37000LC</td>
<td>±470 / ±18.5</td>
<td>1702 / 67.0</td>
<td>508 / 20.0</td>
<td>2528 / 89</td>
<td>3.7</td>
</tr>
</tbody>
</table>

NOTE: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

GENERAL AC "LC" SPECIFICATIONS

Excitation: 0.5 to 7 V-AC (RMS), regulated*

Armature: Captive

Linearity: ±0.5% of full scale**

Output (full-scale RMS): See table, above

* Factory calibration is at 5 V-AC (RMS) at 5 kHz (50 mA maximum), with output load of 100 kΩ.

** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

*** -50° C to +200° C (-58° F to +392° F) optional.

Residual Null Output: 0.1% of full-scale output (quadrature and harmonic)

Phase Shift: Typically 10° (depends on frequency)

Output Load (optimum): 100 kΩ

Temperature Coefficient (Zero and Span): 0.01% of full scale/°C (0.005% of full scale/°F)

Operating Temperature Range: -50° C to +125° C (-58° F to +257° F)***
AC "LCM" Sealed LVDT Series

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and temperature/pressure ratings (contact the Daytronic factory for details).

Fig. LT.14

AC "LCM" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000LCM</td>
<td>±12.5 / ±0.5</td>
<td>153 / 6.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
</tr>
<tr>
<td>DS2000LCM</td>
<td>±25.0 / ±1.0</td>
<td>181 / 7.13</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
</tr>
<tr>
<td>DS4000LCM</td>
<td>±50.0 / ±2.0</td>
<td>304 / 11.97</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
</tr>
<tr>
<td>DS6000LCM</td>
<td>±75.0 / ±3.0</td>
<td>420 / 16.54</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
</tr>
<tr>
<td>DS8000LCM</td>
<td>±100 / ±4.0</td>
<td>453 / 17.83</td>
<td>127 / 5.0</td>
<td>67 / 2.4</td>
</tr>
<tr>
<td>DS12000LCM</td>
<td>±150 / ±6.0</td>
<td>666 / 26.2</td>
<td>183 / 7.2</td>
<td>104 / 3.7</td>
</tr>
</tbody>
</table>

General AC "LCM" Specifications

Excitation: 1 to 7 V-AC (RMS) at 5 kHz
Armature: Captive
Linearity: ±0.5% of full scale*
Output (full-scale RMS): 0.8 to 3 V/V (dependent on range)

Phase Shift: Typically 10° (depends on frequency)
Output Load (recommended): 100 kΩ
Temperature Coefficient (Zero and Span): 0.01% of full scale/°C (0.005% of full scale/°F)
Operating Temperature Range: -40°C to +90°C (-40°F to +194°F)**
Pressure Rating: 10 bar (150 psi)**

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).
** Higher temperature/pressure ratings available with cable options (contact factory for details).
AC "LE" LVDT Series

These high-performance transducers are the standard AC-EXCITED LONG-STROKE LVDT models with SPRING-EXTENDED ARMATURE. They are ideal for harsh applications under conditions of high ambient temperature and/or vibration.

Each model requires separate signal conditioning, and will deliver its best performance when energized between 0.5 and 7 V-AC (RMS) at 5 kHz, using a high-quality carrier amplifier.

Compact size allows use where physical space is limited. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

---

**Fig. LT.15 AC "LE" Series Dimensions**

![Diagram showing dimensions of AC "LE" Series LVDTs]

---

### General AC "LE" Specifications

- **Excitation:** 0.5 to 7 V-AC (RMS), regulated
- **Armature:** Spring-extended
- **Linearity:** ±0.5% of full scale
- **Output (full-scale RMS):** See table, above

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot;</th>
<th>Dimension &quot;X&quot;</th>
<th>Total Weight (Approx.)</th>
<th>Spring Rate</th>
<th>Electrical Output (V/V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000A</td>
<td>±12.5 / ±0.5</td>
<td>133 / 5.25</td>
<td>38 / 1.5</td>
<td>184 / 6.5</td>
<td>22 / 2</td>
<td>0.8</td>
</tr>
<tr>
<td>DS2000A</td>
<td>±25.0 / ±1.0</td>
<td>161 / 6.35</td>
<td>63 / 2.5</td>
<td>227 / 8.0</td>
<td>26 / 2.3</td>
<td>0.9</td>
</tr>
<tr>
<td>DS4000A</td>
<td>±50.0 / ±2.0</td>
<td>276 / 10.85</td>
<td>75 / 3.0</td>
<td>398 / 14.0</td>
<td>37 / 3.3</td>
<td>1.6</td>
</tr>
<tr>
<td>DS6000A</td>
<td>±75.0 / ±3.0</td>
<td>387 / 15.25</td>
<td>114 / 4.5</td>
<td>483 / 17.0</td>
<td>39 / 3.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**NOTE:** All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

---

1. Note that all of the AC "LE" Series LVDT's have retained their "traditional" Daytronic model numbers.
2. Other spring rates can be accommodated.
3. Factory calibration is at 5 V-AC (RMS) at 5 kHz (50 mA maximum), with output load of 100 kΩ.
4. ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).
5. -50°C to +200°C (-58°F to +392°F) optional.
AC "LEM" Sealed LVDT Series

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and temperature/pressure ratings (contact the Daytronic factory for details).

Fig. LT.16
AC "LEM" Series
Dimensions

NOTE:
"LEM" type fitted with probe instead of M5 thread

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (g / oz.)</th>
<th>Spring Rate (g/cm / oz/in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1000LEM</td>
<td>±12.5 / ±0.5</td>
<td>153 / 6.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DS2000LEM</td>
<td>±25.0 / ±1.0</td>
<td>181 / 7.13</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DS4000LEM</td>
<td>±50.0 / ±2.0</td>
<td>304 / 11.97</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DS6000LEM</td>
<td>±75.0 / ±3.0</td>
<td>420 / 16.54</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
<td>45 / 4</td>
</tr>
</tbody>
</table>

General AC "LEM" Specifications

Excitation: 1 to 7 V-AC (RMS) at 5 kHz
Armature: Spring-extended
Linearity: ±0.5% of full scale*

Output (full-scale RMS): 0.8 to 3 V/V (dependent on range)

Phase Shift: Typically 10° (depends on frequency)
Output Load (recommended): 100 kΩ
Temperature Coefficient (Zero and Span): 0.01% of full scale/°C (0.005% of full scale/°F)
Operating Temperature Range: -40° C to +90° C (-40° F to +194° F)**
Pressure Rating: 10 bar (150 psi)**

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).
** Higher temperature/pressure ratings available with cable options (contact factory for details).
The **Model DS2000** has a threaded mounting shank and locking nut to allow secure, precise positioning in a simple mounting fixture. The coil is epoxy-encapsulated and magnetically shielded, and the spring-loaded probe terminates in a hardened steel tip, rounded and polished, which is readily replaceable.* An optional rubber boot is available, for protection of the probe shaft from fluids and abrasive materials.

Combining optimal electrical properties with rugged stainless-steel construction, this instrument can tolerate years of hard industrial use with no appreciable loss of precision. Typical applications include in-process gaging control, creep test recording, structural deflection measurement, actuator and tool position feedback, dilatometry, strip thickness measurement, and much more (see Fig. LT3).

* See the **Model 106 Contact Tip**.

**Fig. LT.17**

**Model DS2000 Dimensions (in./cm)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe extension</td>
<td>2.22 in. (5.64 cm)</td>
</tr>
<tr>
<td>3/4-16</td>
<td>3101A 14S-6P</td>
</tr>
<tr>
<td>0.25 in.</td>
<td>7.30 cm</td>
</tr>
<tr>
<td>0.64 in.</td>
<td>11.50 cm</td>
</tr>
<tr>
<td>0.19 in.</td>
<td>4.83 cm</td>
</tr>
<tr>
<td>0.48 in.</td>
<td>12.2 cm</td>
</tr>
<tr>
<td>2.875 in.</td>
<td>73.00 mm</td>
</tr>
<tr>
<td>1.50 in.</td>
<td>38.10 mm</td>
</tr>
<tr>
<td>0.68 in.</td>
<td>17.20 mm</td>
</tr>
<tr>
<td>2.22 in.</td>
<td>56.40 mm</td>
</tr>
</tbody>
</table>

**LONG-STROKE "LOCKING NUT" (DS2000) SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear Range</strong></td>
<td>±1.000 in. (±25.40 mm)</td>
</tr>
<tr>
<td><strong>Excitation</strong></td>
<td>2 to 6 V-AC (RMS) at 0.4 to 10 kHz</td>
</tr>
<tr>
<td><strong>Armature</strong></td>
<td>Spring-extended</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>±0.5% of full scale</td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>1.0 mV/V/0.001&quot;, nominal</td>
</tr>
<tr>
<td><strong>Operating Temp.</strong></td>
<td>-40°C to +100°C (-40°F to +212°F)</td>
</tr>
</tbody>
</table>

* Minimum characteristics at 3 kHz excitation.
DC "SU5" HIGH-VOLTAGE LVDT SERIES

These DC-EXCITED SHORT-STROKE LVDT models with UNGUIDED ARMATURE operate from a simple unregulated power supply to generate two high-level output signals: ±5 V-DC and 0-10 V-DC. For standard-output versions, see the DC "SU" LVDT Series.

Each model includes high-quality electronics for energization and signal conditioning. Encapsulated, integrated electronics are suitable for operation in harsh industrial environments. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

**Fig. LT.18**
DC "SU5" Series Dimensions

<table>
<thead>
<tr>
<th>Linear Range:</th>
<th>Excitation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD200SU5: ±0.1 in. (±2.5 mm)</td>
<td>Using ±5 V-DC Output: Unregulated ±10 to ±20 V-DC* or +20 to +40 V-DC; 30 mA typical</td>
</tr>
<tr>
<td>DSD400SU5: ±0.2 in. (±5.0 mm)</td>
<td>Using 0-10 V-DC Output: Unregulated ±12 to ±20 V-DC* or +24 to +40 V-DC; 30 mA typical</td>
</tr>
<tr>
<td>DSD600SU5: ±0.3 in. (±7.5 mm)</td>
<td></td>
</tr>
<tr>
<td>DSD800SU5: ±0.4 in. (±10.0 mm)</td>
<td></td>
</tr>
</tbody>
</table>

**Armature:** UNGUIDED

**Linearity:** ±0.5% of full scale**

**Outputs:**

- **Voltage:**
  - Output 1: 0 to 10 V-DC (+0%, -5%)
  - Output 2: -5 to +5 V-DC (+0%, -5%)

- **Load (minimum):**
  - Output 1: 2 kΩ***
  - Output 2: 2 kΩ

- **Ripple:** 30 mV peak-to-peak

- **Bandwidth:** 200 Hz (flat)

- **Impedance:** 2 Ω

- **Zero Temperature Coefficient:** 0.01% of full scale/°C
  (0.005% of full scale/°F)

- **Span Temperature Coefficient:** 0.03% of full scale/°C
  (0.015% of full scale/°F)

- **Operating Temperature Range:** -50° C to +80° C
  (-58° F to +176° F)

- **Armature Weight:** 2.9 g

- **Body Weight:** 83 g

* Must be floating with respect to output. Factory calibration is at ± 15 V-DC.

** ±0.25% and ±0.1% linearity are available as options for some models (contact the factory for details).

*** 10 kΩ when power supply is less than 26 V.

---

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**DC "SE" LVDT Series**

The Models DSD200SE and DSD400SE are the standard DC-EXCITED SHORT-STROKE LVDT models with SPRING-EXTENDED ARMATURE.

They have integral electronics for operation from simple, well regulated DC power supplies of between 6 and 12 V, without the need for external instrumentation. These units use the same linear variable differential transformer (LVDT) principle as the AC-excited transducers, but include an oscillator to energize the primary winding. The resulting signal from the secondary windings then passes through a demodulator, converting it to a DC output. A simple RC filter is also included, to remove most of the noise from the demodulated output. 1

Also, an internal load resistor can be introduced into the LVDT circuit for calibration purposes. 2

For "SE" models with ±5 or 0-10 V-DC output, see the DC SE5 High-Voltage LVDT Series.

---

**Fig. LT.20**

**DC "SE" Series Dimensions**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.6 mm (0.812&quot;)</td>
<td>83.5 mm (3.29&quot;)</td>
</tr>
<tr>
<td>53.5 mm (2.1&quot;)</td>
<td>4.8 mm (0.1875&quot;)</td>
</tr>
<tr>
<td>8 mm (0.3125&quot;)</td>
<td>2 m (6.6 ft.) multicore cable</td>
</tr>
</tbody>
</table>

---

**General DC "SE" Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
</table>
| Linear Range: | DSD200SE: ±0.1 in. (±2.5 mm)  
DSD400SE: ±0.2 in. (±5.0 mm) |
| Excitation: | 6 to 12 V-DC; 50 mA at 6 V  3 |
| Internal Oscillator Frequency: | 17 to 20 kHz |
| Armature: | Spring-extended |
| Linearity: | Better than 0.5% of full scale  4 |
| Output Sensitivity: | 0.16 V/mm (4 V/in), nominal |
| Temperature Coefficient of Sensitivity: | ±0.02% of full scale/°C (±0.01% of full scale/°F), typical |
| Zero Temperature Coefficient: | ±0.05% of full scale/°C (±0.025% of full scale/°F), typical |
| Noise (Filter Output): | 2 mV RMS at zero; 5 to 10 mV RMS at full travel |
| Filtered Output (Bandwidth): | DC to 75 Hz (3 dB) |
| Unfiltered Output Impedance: | 100 Ω |
| Load (recommended): | 20 kΩ |
| Operating Temperature Range: | -10° C to +50° C  (+12° F to +122° F) |
| Total Weight: | 75 g (2.75 oz) |
| Spring Rate: | 112 g/cm (4 oz/in) |

---

1 Further noise reduction can be achieved through simple capacitance connections, although this will slow down the response of the transducer to fast-changing mechanical inputs. For optimum speed, the filter may be bypassed entirely.

2 Factory calibration of the small DC-DC transducers is carried out with the internal 22-kΩ load connected and the output voltage measured across the filtered output. If it is required to make direct use of the calibration value quoted for a particular transducer, then the same conditions have to be met and a high-impedance measuring device should be used (DVM, oscilloscope, etc.).

---

3 Calibrated at 6 V.

4 ±0.25% and ±0.1% linearity are available as options (contact the factory for details).
DC "SE5" HIGH-VOLTAGE LVDT SERIES

These DC-EXCITED SHORT-STROKE LVDT models with SPRING-EXTENDED ARMATURE operate from a simple unregulated power supply to generate two high-level output signals: ±5 V-DC and 0-10 V-DC. For standard-output versions, see the DC "SE" LVDT Series.

Each model includes high-quality electronics for energization and signal conditioning. Encapsulated, integrated electronics are suitable for operation in harsh industrial environments. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.21
DC "SE5" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Spring Force (nominal) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD200SE5</td>
<td>11.5 / 0.45</td>
<td>120</td>
</tr>
<tr>
<td>DSD400SE5</td>
<td>12.7 / 0.50</td>
<td>120</td>
</tr>
<tr>
<td>DSD600SE5</td>
<td>17.7 / 0.70</td>
<td>245</td>
</tr>
<tr>
<td>DSD800SE5</td>
<td>22.25 / 0.875</td>
<td>250</td>
</tr>
</tbody>
</table>

GENERAL DC "SE5" SPECIFICATIONS

Linear Range:
- DSD200SE5: ±0.1 in. (±2.5 mm)
- DSD400SE5: ±0.2 in. (±5.0 mm)
- DSD600SE5: ±0.3 in. (±7.5 mm)
- DSD800SE5: ±0.4 in. (±10.0 mm)

Excitation:
- Using ±5 V-DC Output: Unregulated ±10 to ±20 V-DC* or +20 to +40 V-DC; 30 mA typical
- Using 0-10 V-DC Output: Unregulated ±12 to ±20 V-DC* or +24 to +40 V-DC; 30 mA typical

Armature: Spring-extended

Linearity: ±0.5% of full scale**

Outputs:
- Voltage:
  - Output 1: 0 to 10 V-DC (+0%, -5%)
  - Output 2: -5 to +5 V-DC (+0%, -5%)

Fluctuation with Supply Fluctuation:
- Output 1: 5 mV/V, typical
- Output 2: 1.25 mV/V, typical

Load (minimum):
- Output 1: 2 kΩ***
- Output 2: 2 kΩ

Ripple: 30 mV peak-to-peak

Bandwidth: 200 Hz (flat)

Impedance: 2 Ω

Zero Temperature Coefficient: 0.01% of full scale/°C
(0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C
(0.015% of full scale/°F)

Operating Temperature Range: -50° C to +80° C
(-58° F to +176° F)

Body Weight: 74 g

* Must be floating with respect to output. Factory calibration is at ± 15 V-DC.
** ±0.25% and ±0.1% linearity are available as options for some models (contact the factory for details).
*** 10 kΩ when power supply is less than 26 V.
DC "LU5" LVDT Series

These are the standard DC-exciTED LONG-STROKE LVDT models with UNGUIDED ARMA-TURE. Operating from a simple unregulated power supply of +20 to +40 V-DC (or dual ±10 to ±20 V-DC), each LVDT generates two standard ±5 V-DC antiphase output signals.

These two outputs can be used individually, or they can be combined to yield a high-level ±10 V-DC "differential output signal." For low-output (±2 V) versions, see the DC "LU2" LVDT Series.*

Each model includes high-quality electronics for energization and signal conditioning. Encapsulated, integrated electronics are suitable for operation in harsh industrial environments. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.22
DC "LU5" Series Dimensions

NOTE: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.) (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (Approx.) (g / oz.)</th>
<th>Total Weight (Approx.) (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LU5</td>
<td>±12.5 / ±0.5</td>
<td>175 / 6.9</td>
<td>43 / 1.7</td>
<td>28 / 1.0</td>
<td>213 / 7.5</td>
</tr>
<tr>
<td>DSD2000LU5</td>
<td>±25.0 / ±1.0</td>
<td>203 / 8.0</td>
<td>69 / 2.7</td>
<td>57 / 2.0</td>
<td>270 / 9.5</td>
</tr>
<tr>
<td>DSD4000LU5</td>
<td>±50.0 / ±2.0</td>
<td>317 / 12.5</td>
<td>81 / 3.2</td>
<td>71 / 2.5</td>
<td>369 / 13.0</td>
</tr>
<tr>
<td>DSD6000LU5</td>
<td>±75.0 / ±3.0</td>
<td>430 / 16.9</td>
<td>119 / 4.7</td>
<td>85 / 3.0</td>
<td>497 / 17.5</td>
</tr>
<tr>
<td>DSD8000LU5</td>
<td>±100 / ±4.0</td>
<td>475 / 18.7</td>
<td>132 / 5.2</td>
<td>99 / 3.5</td>
<td>625 / 22.0</td>
</tr>
<tr>
<td>DSD12000LU5</td>
<td>±150 / ±6.0</td>
<td>666 / 26.2</td>
<td>183 / 7.2</td>
<td>114 / 4.0</td>
<td>852 / 30.0</td>
</tr>
<tr>
<td>DSD16000LU5</td>
<td>±200 / ±8.0</td>
<td>856 / 33.7</td>
<td>259 / 10.2</td>
<td>142 / 5.0</td>
<td>1250 / 44.0</td>
</tr>
</tbody>
</table>

General DC "LU5" Specifications

**Excitation:** Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 25 mA maximum**

**Armature:** UNGUIDED

**Linearity:** ±0.5% of full scale***

**Outputs:**

- **Voltage:** Two antiphase outputs, ±5 V-DC (nominal), for working stroke (s/c proof)

* 2-wire 4-20 mA output is also available as an option.

** Factory calibration is at ±15 V-DC.

*** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

**Load (minimum):** 2 kΩ for ±10 to ±20 V-DC power; 20 kΩ to +20 to +40 V-DC power

**Ripple:** 30 mV peak-to-peak

**Bandwidth:** 200 Hz (flat)

**Impedance:** 2 Ω

**Zero Temperature Coefficient:** 0.01% of full scale/°C (0.005% of full scale/°F)

**Span Temperature Coefficient:** 0.03% of full scale/°C (0.015% of full scale/°F)

**Operating Temperature Range:** -50° C to +70° C (-58° F to +158° F)

See LVDT Model-Numbering System. See General LVDT Categories.
DC "LU2" LOW-VOLTAGE LVDT SERIES

These are DC-EXCITED LONG-STROKE LVDT models with UNGUIDED ARMATURE, for use in low-voltage applications. They may be used, for example, with digital panelmeters to form a complete readout system.

Unlike the standard DC "LU5" LVDT Series, the DC "LU2" LVDT's operate from either a +5 V-DC regulated supply or a +6 to +18 V-DC unregulated supply. Each LVDT generates a single output signal of ±2 V-DC that is electrically isolated from the input voltage.

All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.23
DC "LU2" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (Approx.) (g / oz.)</th>
<th>Total Weight (Approx.) (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LU2</td>
<td>±12.5 / ±0.5</td>
<td>175 / 6.9</td>
<td>43 / 1.7</td>
<td>28 / 1.0</td>
<td>213 / 7.5</td>
</tr>
<tr>
<td>DSD2000LU2</td>
<td>±25.0 / ±1.0</td>
<td>203 / 8.0</td>
<td>69 / 2.7</td>
<td>57 / 2.0</td>
<td>270 / 9.5</td>
</tr>
<tr>
<td>DSD4000LU2</td>
<td>±50.0 / ±2.0</td>
<td>317 / 12.5</td>
<td>81 / 3.2</td>
<td>71 / 2.5</td>
<td>369 / 13.0</td>
</tr>
<tr>
<td>DSD6000LU2</td>
<td>±75.0 / ±3.0</td>
<td>430 / 16.9</td>
<td>119 / 4.7</td>
<td>85 / 3.0</td>
<td>497 / 17.5</td>
</tr>
<tr>
<td>DSD8000LU2</td>
<td>±100 / ±4.0</td>
<td>475 / 18.7</td>
<td>132 / 5.2</td>
<td>99 / 3.5</td>
<td>625 / 22.0</td>
</tr>
<tr>
<td>DSD12000LU2</td>
<td>±150 / ±6.0</td>
<td>666 / 26.2</td>
<td>183 / 7.2</td>
<td>114 / 4.0</td>
<td>852 / 30.0</td>
</tr>
<tr>
<td>DSD16000LU2</td>
<td>±200 / ±8.0</td>
<td>856 / 33.7</td>
<td>259 / 10.2</td>
<td>142 / 5.0</td>
<td>1250 / 44.0</td>
</tr>
</tbody>
</table>

NOTE: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

GENERAL DC "LU2" SPECIFICATIONS

Excitation: Regulated +5 V-DC ± 10% or unregulated +6 to +18 V-DC; 100 mA, typical*

Armature: UNGUIDED

Linearity: ±0.5% of full scale**

Output:

Voltage: Isolated 2.2 V-DC nominal for working stroke (s/c proof)

Load (minimum): 2 kΩ

Ripple: 30 mV peak-to-peak

Bandwidth: 200 Hz (flat)

Impedance: 2 Ω

Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)

Operating Temperature Range: -50° C to +70° C (-58° F to +158° F)

* Factory calibration is at ±12 V-DC.

** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).
DC "LUM" SEALED LVDT SERIES

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and pressure ratings (contact the Daytronic factory for details).

**DC "LUM" Series Dimensions**

![Diagram of DC "LUM" Series Dimensions](image)

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LUM</td>
<td>±12.5 / ±0.5</td>
<td>203 / 8.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
</tr>
<tr>
<td>DSD2000LUM</td>
<td>±25.0 / ±1.0</td>
<td>231 / 9.1</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
</tr>
<tr>
<td>DSD4000LUM</td>
<td>±50.0 / ±2.0</td>
<td>354 / 13.9</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
</tr>
<tr>
<td>DSD6000LUM</td>
<td>±75.0 / ±3.0</td>
<td>470 / 18.5</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
</tr>
<tr>
<td>DSD8000LUM</td>
<td>±100 / ±4.0</td>
<td>503 / 19.8</td>
<td>127 / 5.0</td>
<td>67 / 2.4</td>
</tr>
<tr>
<td>DSD12000LUM</td>
<td>±150 / ±6.0</td>
<td>707 / 27.8</td>
<td>178 / 7.0</td>
<td>104 / 3.7</td>
</tr>
</tbody>
</table>

**General DC "LUM" Specifications**

*Excitation:* Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 45 mA maximum  
*Armature:* Unguided  
*Linearity:* ±0.5% of full scale*  
*Output Options:* ±5 V-DC; ±10 V-DC; 4-20 mA

**Output Bandwidth:** 200 Hz (flat)  
**Zero Temperature Coefficient:** 0.01% of full scale/°C  
(0.005% of full scale/°F)  
**Span Temperature Coefficient:** 0.03% of full scale/°C  
(0.015% of full scale/°F)  
**Operating Temperature Range:** -40° C to +70° C  
(-40 F to +158° F)  
**Pressure Rating:** 10 bar (150 psi)**

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).  
** Up to 200 bar (3000 psi) available with cable options (contact factory for details).
DC "LC5" LVDT Series

These are the standard DC-excited long-stroke LVDT models with captive armature. Operating from a simple unregulated power supply of +20 to +40 V-DC (or dual ±10 to ±20 V-DC), each LVDT generates two standard ±5 V-DC antiphase output signals.

These two outputs can be used individually, or they can be combined to yield a high-level ±10 V-DC "differential output signal." For low-output (±2 V) versions, see the DC "LC2" LVDT Series.

Each model includes high-quality electronics for energization and signal conditioning. Encapsulated, integrated electronics are suitable for operation in harsh industrial environments. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.25
DC "LC5" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot;</th>
<th>Dimension &quot;X&quot;</th>
<th>Total Weight (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LC5</td>
<td>±12.5 / ±0.5</td>
<td>194 / 7.65</td>
<td>38 / 1.5</td>
<td>340 / 12.0</td>
</tr>
<tr>
<td>DSD2000LC5</td>
<td>±25.0 / ±1.0</td>
<td>222 / 8.75</td>
<td>63 / 2.5</td>
<td>398 / 14.0</td>
</tr>
<tr>
<td>DSD4000LC5</td>
<td>±50.0 / ±2.0</td>
<td>336 / 13.25</td>
<td>76 / 3.0</td>
<td>511 / 18.0</td>
</tr>
<tr>
<td>DSD6000LC5</td>
<td>±75.0 / ±3.0</td>
<td>448 / 17.65</td>
<td>114 / 4.5</td>
<td>625 / 22.0</td>
</tr>
<tr>
<td>DSD8000LC5</td>
<td>±100 / ±4.0</td>
<td>494 / 19.45</td>
<td>127 / 5.0</td>
<td>767 / 27.0</td>
</tr>
<tr>
<td>DSD12000LC5</td>
<td>±150 / ±6.0</td>
<td>686 / 26.95</td>
<td>178 / 7.0</td>
<td>1022 / 36.0</td>
</tr>
<tr>
<td>DSD16000LC5</td>
<td>±200 / ±8.0</td>
<td>875 / 34.45</td>
<td>254 / 10.0</td>
<td>1448 / 51.0</td>
</tr>
<tr>
<td>DSD20000LC5</td>
<td>±250 / ±10.0</td>
<td>1067 / 42.0</td>
<td>305 / 12.0</td>
<td>1676 / 59.0</td>
</tr>
<tr>
<td>DSD30000LC5</td>
<td>±375 / ±15.0</td>
<td>1473 / 58.0</td>
<td>406 / 16.0</td>
<td>2215 / 78.0</td>
</tr>
<tr>
<td>DSD37000LC5</td>
<td>±470 / ±18.5</td>
<td>1740 / 68.5</td>
<td>508 / 20.0</td>
<td>2613 / 92.0</td>
</tr>
</tbody>
</table>

NOTE: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

General DC "LC5" Specifications

Excitation: Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 25 mA maximum**
Armature: Captive
Linearity: ±0.5% of full scale***
Outputs:
  Voltage: Two antiphase outputs, ±5 V-DC (nominal), for working stroke (s/c proof)

* 2-wire 4-20 mA output is also available as an option.
** Factory calibration is at ±15 V-DC.
*** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

Load (minimum): 2 kΩ for ±10 to ±20 V-DC power; 20 kΩ to +20 to +40 V-DC power
Ripple: 30 mV peak-to-peak
Bandwidth: 200 Hz (flat)
Impedance: 2 Ω
Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)
Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)
Operating Temperature Range: -50° C to +70° C (-58° F to +158° F)
DC "LC2" LOW-VOLTAGE LVDT SERIES

These are DC-EXCITED LONG-STROKE LVDT models with CAPTIVE ARMATURE, for use in low-voltage applications. They may be used, for example, with digital panelmeters to form a complete readout system.

Unlike the standard DC "LC5" LVDT SERIES, the DC "LC2" LVDT's operate from either a +5 V-DC regulated supply or a +6 to +18 V-DC unregulated supply. Each LVDT generates a single output signal of ±2 V-DC that is electrically isolated from the input voltage.

All models are fitted with 2 meters (6.6 ft.) of shielded cable.

**General DC "LC2" Specifications**

- **Excitation:** Regulated +5 V-DC ± 10% or unregulated +6 to +18 V-DC; 100 mA, typical*
- **Armature:** Captive
- **Linearity:** ±0.5% of full scale**
- **Output:**
  - **Voltage:** Isolated 2.2 V-DC nominal for working stroke (s/c proof)

  * Factory calibration is at ±12 V-DC.
  ** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

- **Load (minimum):** 2 kΩ
- **Ripple:** 30 mV peak-to-peak
- **Bandwidth:** 200 Hz (flat)
- **Impedance:** 2 Ω
- **Zero Temperature Coefficient:** 0.01% of full scale/°C
  (0.005% of full scale/°F)
- **Span Temperature Coefficient:** 0.03% of full scale/°C
  (0.015% of full scale/°F)
- **Operating Temperature Range:** -50° C to +70° C
  (-58° F to +158° F)

---

**Fig. LT.26 DC "LC2" Series Dimensions**

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.) (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Total Weight (Approx.) (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LC2</td>
<td>±12.5 / ±0.5</td>
<td>194 / 7.65</td>
<td>38 / 1.5</td>
<td>340 / 12.0</td>
</tr>
<tr>
<td>DSD2000LC2</td>
<td>±25.0 / ±1.0</td>
<td>222 / 8.75</td>
<td>63 / 2.5</td>
<td>398 / 14.0</td>
</tr>
<tr>
<td>DSD4000LC2</td>
<td>±50.0 / ±2.0</td>
<td>336 / 13.25</td>
<td>76 / 3.0</td>
<td>511 / 18.0</td>
</tr>
<tr>
<td>DSD6000LC2</td>
<td>±75.0 / ±3.0</td>
<td>448 / 17.65</td>
<td>114 / 4.5</td>
<td>625 / 22.0</td>
</tr>
<tr>
<td>DSD8000LC2</td>
<td>±100 / ±4.0</td>
<td>494 / 19.45</td>
<td>127 / 5.0</td>
<td>767 / 27.0</td>
</tr>
<tr>
<td>DSD12000LC2</td>
<td>±150 / ±6.0</td>
<td>686 / 26.95</td>
<td>178 / 7.0</td>
<td>1022 / 36.0</td>
</tr>
<tr>
<td>DSD16000LC2</td>
<td>±200 / ±8.0</td>
<td>875 / 34.45</td>
<td>254 / 10.0</td>
<td>1448 / 51.0</td>
</tr>
<tr>
<td>DSD20000LC2</td>
<td>±250 / ±10.0</td>
<td>1067 / 42.0</td>
<td>305 / 12.0</td>
<td>1676 / 59.0</td>
</tr>
<tr>
<td>DSD30000LC2</td>
<td>±375 / ±15.0</td>
<td>1473 / 58.0</td>
<td>406 / 16.0</td>
<td>2215 / 78.0</td>
</tr>
<tr>
<td>DSD37000LC2</td>
<td>±470 / ±18.5</td>
<td>1740 / 68.5</td>
<td>508 / 20.0</td>
<td>2613 / 92.0</td>
</tr>
</tbody>
</table>
DC "LCM" SEALED LVDT SERIES

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and pressure ratings (contact the Daytronic factory for details).

Fig. LT.27
DC "LCM" Series
Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (mm / in.)</th>
<th>Dimension &quot;L&quot; (mm / in.)</th>
<th>Dimension &quot;X&quot; (mm / in.)</th>
<th>Armature Weight (g / oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LCM</td>
<td>±12.5 / ±0.5</td>
<td>203 / 8.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
</tr>
<tr>
<td>DSD2000LCM</td>
<td>±25.0 / ±1.0</td>
<td>231 / 9.1</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
</tr>
<tr>
<td>DSD4000LCM</td>
<td>±50.0 / ±2.0</td>
<td>354 / 13.9</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
</tr>
<tr>
<td>DSD6000LCM</td>
<td>±75.0 / ±3.0</td>
<td>470 / 18.5</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
</tr>
<tr>
<td>DSD8000LCM</td>
<td>±100 / ±4.0</td>
<td>503 / 19.8</td>
<td>127 / 5.0</td>
<td>67 / 2.4</td>
</tr>
<tr>
<td>DSD12000LCM</td>
<td>±150 / ±6.0</td>
<td>707 / 27.8</td>
<td>178 / 7.0</td>
<td>104 / 3.7</td>
</tr>
</tbody>
</table>

GENERAL DC "LCM" SPECIFICATIONS

Excitation: Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 45 mA maximum

Armature: Captive

Linearity: ±0.5% of full scale*

Output Options: ±5 V-DC; ±10 V-DC; 4-20 mA

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).

** Up to 200 bar (3000 psi) available with cable options (contact factory for details).

Output Bandwidth: 200 Hz (flat)

Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)

Operating Temperature Range: -40° C to +70° C (-40 F to +158° F)

Pressure Rating: 10 bar (150 psi)**
DC "LE5" LVDT Series

These are the standard DC-EXCITED LONG-STROKE LVDT models with SPRING-EXTENDED ARMATURE. Operating from a simple unregulated power supply of +20 to +40 V-DC (or dual ±10 to ±20 V-DC), each LVDT generates two standard ±5 V-DC antiphase output signals. These two outputs can be used individually, or they can be combined to yield a high-level ±10 V-DC "differential output signal." For low-output (±2 V) versions, see the DC "LE2" LVDT Series.¹

Each model includes high-quality electronics for energization and signal conditioning. Encapsulated, integrated electronics are suitable for operation in harsh industrial environments. All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.28
DC "LE5" Series Dimensions

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot;</th>
<th>Dimension &quot;X&quot;</th>
<th>Total Weight (Approx.)</th>
<th>Spring Rate²</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LE5</td>
<td>±12.5 / ±0.5</td>
<td>182 / 7.15</td>
<td>38 / 1.5</td>
<td>227 / 8.0</td>
<td>22 / 2</td>
</tr>
<tr>
<td>DSD2000LE5</td>
<td>±25.0 / ±1.0</td>
<td>210 / 8.25</td>
<td>63 / 2.5</td>
<td>284 / 10.0</td>
<td>26 / 2.3</td>
</tr>
<tr>
<td>DSD4000LE5</td>
<td>±50.0 / ±2.0</td>
<td>324 / 12.75</td>
<td>76 / 3.0</td>
<td>398 / 14.0</td>
<td>37 / 3.3</td>
</tr>
<tr>
<td>DSD6000LE5</td>
<td>±75.0 / ±3.0</td>
<td>436 / 17.15</td>
<td>114 / 4.5</td>
<td>511 / 18.0</td>
<td>39 / 3.5</td>
</tr>
</tbody>
</table>

Note: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

General DC "LE5" Specifications

**Excitation:** Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 25 mA maximum³

**Armature:** Spring-extended

**Linearity:** ±0.5% of full scale⁴

**Outputs:**

**Voltage:** Two antiphase outputs, ±5 V-DC (nominal), for working stroke (s/c proof)

¹ 2-wire 4-20 mA output is also available as an option.
² Other spring rates can be accommodated.
³ Factory calibration is at ±15 V-DC.
⁴ ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

Load (minimum): 2 kΩ for ±10 to ±20 V-DC power; 20 kΩ to +20 to +40 V-DC power

Ripple: 30 mV peak-to-peak

Bandwidth: 200 Hz (flat)

Impedance: 2 Ω

Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)

Operating Temperature Range: -50° C to +70° C (-58° F to +158° F)
DC "LE2" Low-Voltage LVDT Series

These are DC-EXCITED LONG-STROKE LVDT models with SPRING-EXTENDED ARMATURE, for use in low-voltage applications. They may be used, for example, with digital panelmeters to form a complete readout system.

Unlike the standard DC "LE5" LVDT Series, the DC "LE2" LVDT's operate from either a +5 V-DC regulated supply or a +6 to +18 V-DC unregulated supply. Each LVDT generates a single output signal of ±2 V-DC that is electrically isolated from the input voltage.

All models are fitted with 2 meters (6.6 ft.) of shielded cable.

Fig. LT.29
DC "LE2" Series Dimensions

NOTE: All dimensions nominal, except diameters, which are ±0.125 mm / ±0.005 in.

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range (Nom.)</th>
<th>Dimension &quot;L&quot;</th>
<th>Dimension &quot;X&quot;</th>
<th>Total Weight (Approx.)</th>
<th>Spring Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSD1000LE2</td>
<td>±12.5 / ±0.5</td>
<td>182 / 7.15</td>
<td>38 / 1.5</td>
<td>227 / 8.0</td>
<td>22 / 2</td>
</tr>
<tr>
<td>DSD2000LE2</td>
<td>±25.0 / ±1.0</td>
<td>210 / 8.25</td>
<td>63 / 2.5</td>
<td>284 / 10.0</td>
<td>26 / 2.3</td>
</tr>
<tr>
<td>DSD4000LE2</td>
<td>±50.0 / ±2.0</td>
<td>324 / 12.75</td>
<td>76 / 3.0</td>
<td>398 / 14.0</td>
<td>37 / 3.3</td>
</tr>
<tr>
<td>DSD6000LE2</td>
<td>±75.0 / ±3.0</td>
<td>436 / 17.15</td>
<td>114 / 4.5</td>
<td>511 / 18.0</td>
<td>39 / 3.5</td>
</tr>
</tbody>
</table>

General DC "LE2" Specifications

Excitation: Regulated +5 V-DC ± 10% or unregulated +6 to +18 V-DC, 100 mA, typical**

Armature: Spring-extended

Linearity: ±0.5% of full scale***

Output:

Voltage: Isolated 2.2 V-DC nominal for working stroke (s/c proof)

* Other spring rates can be accommodated.

** Factory calibration is at ±12 V-DC.

*** ±0.25% and ±0.1% linearity are available as options on some ranges (contact the factory for details).

Load (minimum): 2 kΩ

Ripple: 30 mV peak-to-peak

Bandwidth: 200 Hz (flat)

Impedance: 2 Ω

Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)

Operating Temperature Range: -50° C to +70° C (-58° F to +158° F)
DC "LEM" Sealed LVDT Series

These units are ideal for industrial use in most fluids and gases. The standard cable connection is by means of a submersible connector, but several other optional versions are available, providing different cable lengths and pressure ratings (contact the Daytronic factory for details).

Fig. LT.30
DC "LEM" Series Dimensions

NOTE: "LEM" type fitted with probe instead of M5 thread

<table>
<thead>
<tr>
<th>LVDT Model</th>
<th>Linear Range</th>
<th>Dimension</th>
<th>Dimension</th>
<th>Armature</th>
<th>Spring Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>(mm / in.)</td>
<td>&quot;L&quot; (mm / in.)</td>
<td>&quot;X&quot; (mm / in.)</td>
<td>Weight (g / oz.)</td>
<td>(g/cm / oz/in)</td>
</tr>
<tr>
<td>DSD1000LEM</td>
<td>±12.5 / ±0.5</td>
<td>203 / 8.0</td>
<td>38 / 1.5</td>
<td>21 / 0.7</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DSD2000LEM</td>
<td>±25.0 / ±1.0</td>
<td>231 / 9.1</td>
<td>63 / 2.48</td>
<td>28 / 1.0</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DSD4000LEM</td>
<td>±50.0 / ±2.0</td>
<td>354 / 13.9</td>
<td>76 / 3.0</td>
<td>30 / 1.0</td>
<td>45 / 4</td>
</tr>
<tr>
<td>DSD6000LEM</td>
<td>±75.0 / ±3.0</td>
<td>470 / 18.5</td>
<td>114 / 4.48</td>
<td>55 / 1.9</td>
<td>45 / 4</td>
</tr>
</tbody>
</table>

General DC "LEM" Specifications

Excitation: Unregulated ±10 to ±20 V-DC or +20 to +40 V-DC; 45 mA maximum

Armature: Spring-extended

Linearity: ±0.5% of full scale*

Output Options: ±5 V-DC; ±10 V-DC; 4-20 mA

* ±0.25% and ±0.1% linearity are available as options (contact the factory for details).

** Up to 200 bar (3000 psi) available with cable options (contact factory for details).

Output Bandwidth: 200 Hz (flat)

Zero Temperature Coefficient: 0.01% of full scale/°C (0.005% of full scale/°F)

Span Temperature Coefficient: 0.03% of full scale/°C (0.015% of full scale/°F)

Operating Temperature Range: -40° C to +70° C (-40 F to +158° F)

Pressure Rating: 10 bar (150 psi)**
Strain Gage Load Cells

For precise electrical measurement of weight, torque, tension, and other mechanical forces

How They Work

Strain Gages

The resistance strain gage is an electrical sensing device that varies its resistance as a linear function of the strain experienced by the structural surface to which it is bonded. "Strain" is the deformation of a solid material as the result of applied forces (internal or external), and is normally expressed in units of microinches per inch (or "microstrain").

A typical strain gage consists of a conductive grid pattern of etched metallic foil, mounted on a thin base of epoxy or fiberglass. It can then be bonded to a surface in such a way that any subsequent deformation of the surface produces a like deformation of the gage.

When the gage is deformed, its electrical resistance changes. This fact is explained partly by simple geometry. That is, when a conductor is stretched lengthwise, its cross-sectional area decreases, with a consequent increase in resistance. It is also partly explained by changes in the actual resistivity of the gage material when subjected to strain.

For a given amount of unit strain (ΔL/L), the gage will undergo a corresponding change in resistance.

(cont'd)
If the gages within a load cell are connected in a balanced Wheatstone Bridge circuit, and are excited by a source of AC or DC voltage, the transducer will produce an electrical output which is a direct linear function of the excitation voltage and the magnitude of the applied mechanical input:

\[
E_{\text{out}}(\text{mV}) = E_{\text{in}}(\text{V}) \cdot K \cdot F/100
\]

where

- \( K \) = Calibration Factor (mV/V, full scale)
- \( F \) = Input variable (% of full scale)

Transducer sensitivity is expressed in terms of millivolts per volt. The exact value of "K" for each instrument is determined by measurement at the time of manufacture and is furnished as part of that instrument's calibration data. For conventional transducers, this value usually falls between 0.5 and 3.0.

Excitation voltage can be either AC or DC, and is usually limited by heating considerations to a maximum of 10 volts for 120-ohm bridges and 20 volts for 350-ohm bridges (although good practice dictates somewhat lower values).

* In any reliable load cell, thermal expansion and temperature resistance effects must be made to cancel. In particular, temperature effects on the modulus of elasticity of the flexure material must be compensated, using carefully trimmed temperature-sensitive resistors (\( R_m \) in Fig. LC.2).

Strain Gage Transducers

In transducers, strain gage configurations are employed to measure weight, pressure, torque, and similar phenomena, by sensing the deformation of calibrated beams, diaphragms, or other flexures to which mechanical force is applied. Strain gage transducers can be rugged, compact, linear, highly accurate, and readily compensated for wide temperature ranges. They can be operated with many types of available AC and DC instruments, and are widely used in industrial and research measurement and control systems.

Through proper flexure design and gage placement, a linear relationship can be achieved between the applied force and the sensed strain. The Wheatstone Bridge circuit shown in Fig. LC.2 is almost universally used in load cells and other strain gage transducers, because it facilitates cancellation of unwanted temperature effects.*

![Fig. LC.2: Schematic Diagram of a Typical Strain Gage Transducer](image-url)
**400 SERIES**

**GENERAL-PURPOSE LOW-PROFILE LOAD CELLS**

These load cells are environmentally sealed, temperature-compensated strain gage sensors capable of highly accurate, highly reliable force measurement under the toughest laboratory and industrial conditions. They demonstrate exceptional structural resistance to damage or measurement error ("crosstalk") from off-axis loading, side loading, and other extraneous forces and bending moments (see Fig. LC.3; "eccentric" loading can also arise from unlevel mounting or thermal expansion of supporting structures).*

Unique flexure designs, using low deflection values and premium alloy materials, give exceptional fatigue life, plus excellent linearity and hysteresis characteristics. Optional dual bridge is available on request.

All 400 Series transducers may be used in both tension and compression. Standard models in stock cover nominal ranges from ±25 through ±5000 pounds, with smaller or larger ranges available on special order. All models incorporate sealed barometrically compensated construction, and exhibit a typical zero shift of less than 0.2% of full scale for ambient pressure changes of ±2 psi.

Individually tested and calibrated in both tension and compression, each 400 Series transducer is supplied with both "mV/V" and shunt-resistor calibration data, traceable to the National Bureau of Standards.

See **400 Series Specifications** and **Load Cell Accessories**.

---

*Table LC.1 lists 400 Series Limit Load Values for static application. These are maximum extraneous forces and moments that can be applied singly and simultaneously with half the nominal load capacity without causing transducer damage or a permanent shift of zero or calibration. Actual measurement errors ("crosstalk") for each of the limit values tabulated are typically less than 0.2% of the rated (full-scale) output.

**NOTE:** Load cells are designed to respond only to the force component parallel to the loading axis.

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**Fig. LC.3 Load Cell Side and Bending Forces**

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Daytronic Corporation
Dayton, OH 45439 • (800) 668-4745
Tel: (937) 866-3300 • Fax: (937) 866-3327 • www.daytronic.com
400 SERIES GENERAL-PURPOSE
LOW-PROFILE LOAD CELLS (cont’d)

Table LC.1
400 Series Models

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity(\ast) (lb. / N)</th>
<th>Ringing Frequency(\ast) (Hz)</th>
<th>Bending Moment (M)(\ast) (lb.-in. / N-m)</th>
<th>Shear (S)(\ast) (lb. / N)</th>
<th>Torque (T)(\ast) (lb.-in. / N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-25</td>
<td>±25 / ±125</td>
<td>2100</td>
<td>150 / 17</td>
<td>150 / 667</td>
<td>40 / 4.5</td>
</tr>
<tr>
<td>400-50</td>
<td>±50 / ±200</td>
<td>2800</td>
<td>150 / 17</td>
<td>150 / 667</td>
<td>40 / 4.5</td>
</tr>
<tr>
<td>400-100</td>
<td>±100 / ±500</td>
<td>3800</td>
<td>180 / 20</td>
<td>250 / 1100</td>
<td>40 / 4.5</td>
</tr>
<tr>
<td>400-200</td>
<td>±200 / ±1000</td>
<td>5400</td>
<td>180 / 20</td>
<td>250 / 1100</td>
<td>40 / 4.5</td>
</tr>
<tr>
<td>400-300</td>
<td>±300 / ±1500</td>
<td>7000</td>
<td>180 / 20</td>
<td>250 / 1100</td>
<td>40 / 4.5</td>
</tr>
<tr>
<td>400-500</td>
<td>±500 / ±2000</td>
<td>1600</td>
<td>2800 / 316</td>
<td>1400 / 6200</td>
<td>1100 / 124</td>
</tr>
<tr>
<td>400-1K</td>
<td>±1000 / ±5000</td>
<td>2000</td>
<td>3900 / 441</td>
<td>2000 / 8900</td>
<td>1100 / 124</td>
</tr>
<tr>
<td>400-2K</td>
<td>±2000 / ±1000</td>
<td>3200</td>
<td>5000 / 556</td>
<td>2800 / 12500</td>
<td>1100 / 124</td>
</tr>
<tr>
<td>400-3K</td>
<td>±3000 / ±1500</td>
<td>4100</td>
<td>5500 / 621</td>
<td>3400 / 15100</td>
<td>1100 / 124</td>
</tr>
<tr>
<td>400-5K</td>
<td>±5000 / ±20000</td>
<td>5000</td>
<td>5500 / 621</td>
<td>4200 / 18700</td>
<td>1100 / 124</td>
</tr>
</tbody>
</table>

**GENERAL 400 SERIES SPECIFICATIONS**

Dimensions: See Fig. LC.4

Deflection at Nominal Load Limit:

| Models 400-25 through 400-300: | ±0.003 in. (±0.008 cm) |
| Models 400-500 through 400-5K: | ±0.005 in. (±0.013 cm) |

Bridge: Four-arm bonded foil gages, 350 ohms nominal

Number of Bridges: 1 or 2

Insulation Resistance, Bridge/Case: Greater than 5000 MΩ at 50 V-DC

Excitation: 20 V maximum, DC or AC (RMS)

Output (nominal):

| Models 400-25 through 400-300: | 2 mV/V ± 0.25% of full scale |
| Models 400-500 through 400-5K: | 3 mV/V ± 0.25% of full scale |

Zero Balance: ±1.0% of full scale

Linearity and Hysteresis:

| Models 400-25 through 400-300: | ±0.05% of full scale, maximum |
| Models 400-500 through 400-5K: | ±0.10% of full scale, maximum |

Repeatability:

| Models 400-25 through 400-300: | ±0.02% of full scale |
| Models 400-500 through 400-5K: | ±0.05% of full scale |

Overload Capacity: 150% of nominal rating (static)

Temperature Coefficient (Zero and Span): Less than 0.002% of full scale/°F

Compensated Temperature Range: +70°F to +170°F (+21°C to +77°C)

Operating Temperature Range: -65°F to +200°F (-54°C to +93°C)

Fatigue Life: 100 million cycles at 0 to 50% of nominal rating (minimum); 50 million cycles at +50% to -50% of nominal rating (minimum)

\(\ast\) Metric rating approximate only.

\(\ast\) Calculated or determined by test with no external force or load.

\(\ast\) See Fig. LC-3.
400 SERIES GENERAL-PURPOSE
LOW-PROFILE LOAD CELLS (cont’d)

Fig. LC.4
400 Series Dimensions (in./cm)

Fig. LC.4(a)
Dimensions for Models 400-25 through 400-300

Fig. LC.4(b)
Dimensions for Models 400-500 through 400-5K

LOAD CELL ACCESSORIES

Load Buttons

Rod Ends

Load Platform*

All dimensions in inches

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C Thread</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/32</td>
<td>3/8</td>
<td>1/4 - 28</td>
<td>1.0</td>
</tr>
<tr>
<td>3/4</td>
<td>3/8</td>
<td>1/2 - 20</td>
<td>2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C Bore</th>
<th>D</th>
<th>W</th>
<th>Thread</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.562</td>
<td>0.2500</td>
<td>3/4</td>
<td>0.375</td>
<td>1/4 - 28</td>
</tr>
<tr>
<td>1 1/2</td>
<td>2.438</td>
<td>0.500</td>
<td>1 5/16</td>
<td>0.625</td>
<td>1/2 - 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.652</td>
<td>0.625</td>
<td>0.250</td>
<td>0.500</td>
<td>1/4 - 28 UNF</td>
</tr>
<tr>
<td>3.125</td>
<td>0.937</td>
<td>0.312</td>
<td>0.750</td>
<td>1/2 - 20 UNF</td>
</tr>
</tbody>
</table>

* May be used with all models of the 400 Series, 434A Series, and 434AM Series.
The 431, 431M, 434A, and 434AM Series offer the smallest-size strain gage force transducers where good specification can still be maintained. Operating in both tension and compression from forces of 50 grams to 10,000 pounds, these precision miniature load cells have a rugged stainless-steel weld construction with a "tripled" stack design to eliminate or minimize the off-axis loading effects shown in Fig. LC.3. And the internal construction assures excellent long-term stability for ranges of 1 kg and up.

All the basic engineering concepts of larger load cells are built into these instruments, including precision calibration, stabilizing diaphragms, pressure compensation, etc. Each bonded strain gage unit is built of welded 17-4 PH stainless steel for additional ruggedness.

Models in the 431 and 431M Series have male threads, while the 434A and 434AM Series have female threaded load attachments which can accommodate the Platform shown under Load Cell Accessories.

See 431(M), 434A(M) Series Specifications.

(cont'd)

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>431-5</td>
<td>±5 lb.</td>
</tr>
<tr>
<td>431-10</td>
<td>±10 lb.</td>
</tr>
<tr>
<td>431-25</td>
<td>±25 lb.</td>
</tr>
<tr>
<td>431-50</td>
<td>±50 lb.</td>
</tr>
<tr>
<td>431-100</td>
<td>±100 lb.</td>
</tr>
<tr>
<td>431-250</td>
<td>±250 lb.</td>
</tr>
<tr>
<td>431-500</td>
<td>±500 lb.</td>
</tr>
<tr>
<td>431-1K</td>
<td>±1000 lb.</td>
</tr>
<tr>
<td>431-2K</td>
<td>±2000 lb.</td>
</tr>
<tr>
<td>431-3K</td>
<td>±3000 lb.</td>
</tr>
<tr>
<td>431-4K</td>
<td>±4000 lb.</td>
</tr>
<tr>
<td>431-5K</td>
<td>±5000 lb.</td>
</tr>
<tr>
<td>431-7500</td>
<td>±7500 lb.</td>
</tr>
<tr>
<td>431-10K</td>
<td>±10000 lb.</td>
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</table>

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>431M-50</td>
<td>±50 grams</td>
</tr>
<tr>
<td>431M-150</td>
<td>±150 grams</td>
</tr>
<tr>
<td>431M-250</td>
<td>±250 grams</td>
</tr>
<tr>
<td>431M-500</td>
<td>±500 grams</td>
</tr>
<tr>
<td>431M-1K</td>
<td>±1 kilogram</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>434A-5</td>
<td>±5 lb.</td>
</tr>
<tr>
<td>434A-10</td>
<td>±10 lb.</td>
</tr>
<tr>
<td>434A-25</td>
<td>±25 lb.</td>
</tr>
<tr>
<td>434A-50</td>
<td>±50 lb.</td>
</tr>
<tr>
<td>434A-100</td>
<td>±100 lb.</td>
</tr>
<tr>
<td>434A-250</td>
<td>±250 lb.</td>
</tr>
<tr>
<td>434A-500</td>
<td>±500 lb.</td>
</tr>
<tr>
<td>434A-1K</td>
<td>±1000 lb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>434AM-50</td>
<td>±50 grams</td>
</tr>
<tr>
<td>434AM-150</td>
<td>±150 grams</td>
</tr>
<tr>
<td>434AM-250</td>
<td>±250 grams</td>
</tr>
<tr>
<td>434AM-500</td>
<td>±500 grams</td>
</tr>
<tr>
<td>434AM-1K</td>
<td>±1 kilogram</td>
</tr>
</tbody>
</table>

NOTE: Maximum torque for installation of 431M Series units and of 431 Series units with ranges of less than 25 lb. is 12 lb-in.
# 431(M), 434A(M) Series Miniature General-Purpose Load Cells (cont’d)

**Fig. LC.5**
431(M), 434A(M) Series Dimensions

**Fig. LC.5(a)**
431/431M Dimensions

**Fig. LC.5(b)**
434A/434AM Dimensions

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Dimension &quot;A&quot; (in. / cm)</th>
<th>Dimension &quot;B&quot; (in. / cm)</th>
<th>Dimension &quot;C&quot; (in. / cm)</th>
<th>Dimension &quot;D&quot; (in. / cm)</th>
<th>Dimension &quot;F&quot; (in. / cm)</th>
<th>Dimension &quot;H&quot; (in. / cm)</th>
<th>Thread &quot;T&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>431-5, 431-10</td>
<td>0.31 / 0.79</td>
<td>0.19 / 0.48</td>
<td>0.25 / 0.64</td>
<td>0.75 / 1.91</td>
<td>0.05 / 0.13</td>
<td>0.45 / 0.11</td>
<td>#6-32 UNC</td>
</tr>
<tr>
<td>431-25, 431-50, 431-100</td>
<td>0.50 / 1.27</td>
<td>0.25 / 0.64</td>
<td>0.25 / 0.64</td>
<td>1.00 / 2.54</td>
<td>0.03 / 0.76</td>
<td>0.52 / 1.32</td>
<td>#10-32 UNF</td>
</tr>
<tr>
<td>431-250, 431-500, 431-1K</td>
<td>0.50 / 1.27</td>
<td>0.25 / 0.64</td>
<td>0.38 / 0.97</td>
<td>1.00 / 2.54</td>
<td>0.03 / 0.76</td>
<td>0.52 / 1.32</td>
<td>1/4-28 UNF</td>
</tr>
<tr>
<td>431-2K, 431-3K</td>
<td>0.50 / 1.27</td>
<td>0.38 / 0.97</td>
<td>0.50 / 1.27</td>
<td>1.00 / 2.54</td>
<td>0.03 / 0.76</td>
<td>0.72 / 1.83</td>
<td>3/8-24 UNF</td>
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<td>431-4K, 431-5K</td>
<td>0.50 / 1.27</td>
<td>0.38 / 0.97</td>
<td>0.63 / 1.60</td>
<td>1.25 / 3.18</td>
<td>0.03 / 0.76</td>
<td>0.94 / 2.39</td>
<td>1/2-20 UNF</td>
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<tr>
<td>431-7500, 431-10K</td>
<td>0.50 / 1.27</td>
<td>0.38 / 0.97</td>
<td>0.88 / 2.24</td>
<td>1.38 / 3.51</td>
<td>0.03 / 0.76</td>
<td>1.10 / 2.79</td>
<td>3/4-16 UNF</td>
</tr>
<tr>
<td>431M-50 through 431M-500</td>
<td>0.50 / 1.27</td>
<td>0.38 / 0.97</td>
<td>0.25 / 0.64</td>
<td>1.00 / 2.54</td>
<td>0.11 / 0.28</td>
<td>0.75 / 1.91</td>
<td>#6-32 UNC</td>
</tr>
<tr>
<td>431M-1K</td>
<td>0.31 / 0.79</td>
<td>0.19 / 0.48</td>
<td>0.25 / 0.64</td>
<td>0.75 / 1.91</td>
<td>0.05 / 0.13</td>
<td>0.45 / 0.11</td>
<td>#6-32 UNC</td>
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<tr>
<td>434A-5, 434A-10</td>
<td>0.31 / 0.79</td>
<td>0.19 / 0.48</td>
<td>0.72 / 1.83</td>
<td>0.75 / 1.91</td>
<td>0.60 / 1.52</td>
<td>1.75 / 4.45</td>
<td>—</td>
</tr>
<tr>
<td>434A-25, 434A-50, 434A-100</td>
<td>0.50 / 1.27</td>
<td>0.25 / 0.64</td>
<td>0.72 / 1.83</td>
<td>1.00 / 2.54</td>
<td>0.52 / 1.32</td>
<td>1.75 / 4.45</td>
<td>—</td>
</tr>
<tr>
<td>434A-250, 434A-500, 434A-1K</td>
<td>0.50 / 1.27</td>
<td>0.25 / 0.64</td>
<td>0.75 / 1.91</td>
<td>1.00 / 2.54</td>
<td>0.75 / 1.91</td>
<td>2.00 / 5.08</td>
<td>—</td>
</tr>
<tr>
<td>434AM-50 through 434AM-500</td>
<td>0.50 / 1.27</td>
<td>0.38 / 0.97</td>
<td>0.52 / 1.32</td>
<td>1.00 / 2.54</td>
<td>0.52 / 1.32</td>
<td>1.75 / 4.45</td>
<td>—</td>
</tr>
<tr>
<td>434AM-1K</td>
<td>0.31 / 0.79</td>
<td>0.19 / 0.48</td>
<td>0.72 / 1.83</td>
<td>0.75 / 1.91</td>
<td>0.60 / 1.52</td>
<td>1.75 / 4.45</td>
<td>—</td>
</tr>
</tbody>
</table>

(cont’d)
# 431(M), 434A(M) Series Miniature General-Purpose Load Cells (cont’d)

## General 431(M), 434A(M) Series Specifications

<table>
<thead>
<tr>
<th>Dimension</th>
<th>See Fig. LC.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-Scale Deflection</td>
<td>0.0005&quot; to 0.0020&quot;</td>
</tr>
<tr>
<td>Bridge:</td>
<td></td>
</tr>
<tr>
<td>431 and 434A Series: Four-arm bonded foil gages, 350 ohms nominal</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series (50 through 500 g): Four-arm bonded semiconductor gages, 500 ohms nominal</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series (1 kg): Four-arm bonded foil gages, 350 ohms nominal</td>
<td></td>
</tr>
<tr>
<td>Insulation Resistance: 5000 MΩ at 50 V-DC</td>
<td></td>
</tr>
<tr>
<td>Excitation (calibration):</td>
<td></td>
</tr>
<tr>
<td>431 and 434A Series (5 and 10 lb.): 5.0 V-DC</td>
<td></td>
</tr>
<tr>
<td>431 and 434A Series (25 lb. and greater): 10.0 V-DC</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series: 5.0 V-DC*</td>
<td></td>
</tr>
<tr>
<td>Output (standard)**:</td>
<td></td>
</tr>
<tr>
<td>431 and 434A Series: 2 mV/V</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series (50 through 150 g): 0.1 mV/V/g, maximum</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series (250 through 500 g): 20 mV/V</td>
<td></td>
</tr>
<tr>
<td>431M and 434AM Series (1 kg): 1.5 mV/V, nominal</td>
<td></td>
</tr>
<tr>
<td>Resolution: Infinite</td>
<td></td>
</tr>
</tbody>
</table>

* Series 431M and 434AM load cells require factory adjustment of excitation voltage when used with Daytronic Strain Gage Conditioners.

** Optional 0-5 V-DC or 4-20 mA output is available. Shunt calibration data is included with the transducer. Standard calibration is in tension only.

- **Linearity and Hysteresis:**
  - 431 and 434A Series (5 through 250 lb.): ±0.15% of full scale
  - 431 and 434A Series (500 through 10000 lb.): ±0.2% of full scale
  - 431M and 434AM Series (50 g through 1 kg): ±0.15% of full scale

- **Repeatability:**
  - 431 and 434A Series: ±0.05% of full scale
  - 431M and 434AM Series (50 through 1 kg): ±0.1% of full scale

- **Overload Capacity:** 150% of nominal rating (static)

- **Temperature Coefficient (Zero and Span):**
  - 431 and 434A Series: ±0.005% of full scale/°F
  - 431M and 434AM Series (50 through 500 g): ±0.015% of full scale/°F
  - 431M and 434AM Series (1 kg): ±0.005% of full scale/°F

- **Compensated Temperature Range:** +60° F to +160° F (+16° C to +71° C)

- **Operating Temperature Range:** -65° F to +250° F (-54° C to +121° C)

- **Weight (nominal):**
  - 431 and 431M Series: 1.6 oz.
  - 434A and 434AM Series: 2.5 oz.
441 Series

"Pancake-Thin"

General-Purpose Load Cells

With ranges of ±5 through ±50,000 pounds*, the tension/compression load cells of the 441 Series employ two stabilizing diaphragms which are welded to the sensing member to reduce off-axis and side-loading effects.** Cased in 17-4 PH stainless steel, they have a threaded hole running completely through the center of the cell. *These models must be used on a flat, smooth surface to achieve rated specifications.

An optional 1"-thick Center Pull Plate is available for attachment to any Series 441 unit. This allows the applied force to be directed along the load axis. Separate load buttons (similar to the one shown under Load Cell Accessories) may also be obtained, to be threaded directly into the center hole. If required, any Series 441 load cell can be supplied with a clearance hole instead of a thread.

(cont'd)

Table LC.3

441 Series Models*

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>441-5</td>
<td>±5 lb.</td>
</tr>
<tr>
<td>441-10</td>
<td>±10 lb.</td>
</tr>
<tr>
<td>441-25</td>
<td>±25 lb.</td>
</tr>
<tr>
<td>441-50</td>
<td>±50 lb.</td>
</tr>
<tr>
<td>441-100</td>
<td>±100 lb.</td>
</tr>
<tr>
<td>441-250</td>
<td>±250 lb.</td>
</tr>
<tr>
<td>441-500</td>
<td>±500 lb.</td>
</tr>
<tr>
<td>441-1K</td>
<td>±1000 lb.</td>
</tr>
<tr>
<td>441-2K</td>
<td>±2000 lb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>Nominal Load Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>441-3K</td>
<td>±3000 lb.</td>
</tr>
<tr>
<td>441-4K</td>
<td>±4000 lb.</td>
</tr>
<tr>
<td>441-5K</td>
<td>±5000 lb.</td>
</tr>
<tr>
<td>441-7500</td>
<td>±7500 lb.</td>
</tr>
<tr>
<td>441-10K</td>
<td>±10000 lb.</td>
</tr>
<tr>
<td>441-15K</td>
<td>±15000 lb.</td>
</tr>
<tr>
<td>441-20K</td>
<td>±20000 lb.</td>
</tr>
<tr>
<td>441-30K</td>
<td>±30000 lb.</td>
</tr>
<tr>
<td>441-50K</td>
<td>±50000 lb.</td>
</tr>
</tbody>
</table>

* Ranges above 50,000 pounds are available on request.

** Allowable extraneous forces without damage, as % of load capacity, are as follows (see Fig. LC.3):

- **Bending Moment (lb.-in.)**
  - 5 - 500 lb.:
    - 40% Shear (lb.)
    - 25% Torque (lb.-in.)
    - 100% Total Extraneous Force
  - 1000 - 7500 lb.:
    - 25% Shear (lb.)
    - 25% Torque (lb.-in.)
    - 100% Total Extraneous Force
  - 10000 - 50000 lb.:
    - 20% Shear (lb.)
    - 15% Torque (lb.-in.)
    - 100% Total Extraneous Force

** General 441 Series Specifications **

- **Dimensions:** See Fig. LC.6
- **Full-Scale Deflection:** 0.003”
- **Bridge:** Four-arm bonded foil gages, 350 ohms nominal
- **Insulation Resistance:** 5000 MΩ at 50 V-DC
- **Excitation:** 10 V-DC (calibration); up to 15 V-DC or AC acceptable
- **Output (standard)***:
  - Models 441-5 through 441-25: 2 mV/V, full scale
  - Models 441-50 through 441-50K: 3 mV/V, full scale
- **Resolution:** Infinite

*** Optional 0-5 V-DC or 4-20 mA output is available. Shunt calibration data is included with the transducer. Standard calibration is in tension only.

- **Linearity:**
  - Models 441-5 through 441-25: ±0.2% of full scale
  - Models 441-50 through 441-50K: ±0.1% of full scale
- **Hysteresis:**
  - Models 441-5 through 441-25: ±0.1% of full scale
  - Models 441-50 through 441-50K: ±0.08% of full scale
- **Repeatability:**
  - Models 441-5 through 441-25: ±0.1% of full scale
  - Models 441-50 through 441-50K: ±0.03% of full scale
- **Overload Capacity:** 150% of nominal rating (static)
- **Temperature Coefficient (Zero and Span):** ±0.002% of full scale/F
- **Compensated Temperature Range:** +60° F to +160° F (+16° C to +71° C)
- **Operating Temperature Range:** -65° F to +250° F (-54° C to +121° C)
441 SERIES "PANCAKE-THIN"
GENERAL-PURPOSE LOAD CELLS (cont’d)

Fig. LC.6
441 Series
Dimensions

"N" clearance holes equally spaced on
"G" dia. B.C., "K" dia. through
(bolt holes counterbored
for ranges 15000 lb. and below)

5 - 5000 lb.:
PT1H-10-6P or equiv.
(Hermetic stainless)
7500 - 50000 lb.:
MS3102E-14S-6P
or equiv.

<table>
<thead>
<tr>
<th>Load Cell Model</th>
<th>No. of Holes</th>
<th>Thread</th>
</tr>
</thead>
<tbody>
<tr>
<td>441-5 through 441-25</td>
<td>6</td>
<td>1/4-28 UNF</td>
</tr>
<tr>
<td>441-50 through 441-1K</td>
<td>6</td>
<td>3/8-24 UNF</td>
</tr>
<tr>
<td>441-2K through 441-5K</td>
<td>6</td>
<td>1/2-20 UNF</td>
</tr>
<tr>
<td>441-7500 through 441-15K</td>
<td>8</td>
<td>1-14 UNS</td>
</tr>
<tr>
<td>441-20K through 441-50K</td>
<td>8</td>
<td>1 1/2-12 UNF</td>
</tr>
</tbody>
</table>

Load Cell
Model

<table>
<thead>
<tr>
<th>Dimension</th>
<th>&quot;A&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;B&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;C&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;D&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;G&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;H&quot; (in. / cm)</th>
<th>Dimension</th>
<th>&quot;K&quot; (in. / cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>441-5 through 441-25</td>
<td>0.82 / 2.08</td>
<td>0.75 / 1.91</td>
<td>1.25 / 3.18</td>
<td>2.50 / 6.35</td>
<td>2.00 / 5.080</td>
<td>0.80 / 2.03</td>
<td>0.19 / 0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>441-50 through 441-1K</td>
<td>0.82 / 2.08</td>
<td>0.75 / 1.91</td>
<td>1.25 / 3.18</td>
<td>3.00 / 7.62</td>
<td>2.250 / 5.715</td>
<td>1.00 / 2.54</td>
<td>0.28 / 0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>441-2K through 441-5K</td>
<td>0.82 / 2.08</td>
<td>0.75 / 1.91</td>
<td>1.25 / 3.18</td>
<td>3.50 / 8.89</td>
<td>2.625 / 6.668</td>
<td>1.00 / 2.54</td>
<td>0.34 / 0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>441-7500 through 441-15K</td>
<td>1.25 / 3.18</td>
<td>1.50 / 3.81</td>
<td>2.00 / 5.08</td>
<td>5.50 / 13.97</td>
<td>4.500 / 11.43</td>
<td>1.80 / 4.57</td>
<td>0.40 / 1.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>441-20K through 441-50K</td>
<td>1.25 / 3.18</td>
<td>1.50 / 3.81</td>
<td>2.00 / 5.08</td>
<td>6.00 / 15.24</td>
<td>4.875 / 12.38</td>
<td>1.80 / 4.57</td>
<td>0.53 / 1.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Strain Gage Pressure Transducers**

For gage, absolute, and differential pressure measurement in industrial and scientific applications

Using 4-arm, 350-Ω bonded foil *strain gage* bridges, these tough stainless-steel transducers are designed for safe, accurate, and reliable electrical measurement of gas or fluid pressure in any number of industrial and research applications. Daytronic provides the following pressure transducers:

- **Precision Gage/Absolute (502A Series)**
- **General-Purpose Gage/Absolute (512 Series)**
- **Low-Cost Gage (515A Series)**
- **Wet/Wet Differential (513 Series)**

**Three Types of Pressure Measurements**

**Gage Pressure**

Gage pressure ("psig") is pressure measured relative to ambient atmospheric pressure (approximately 14.7 psi). That is, a gage pressure measurement does not include atmospheric pressure itself.

For a gage pressure transducer, one side of the pressure-sensing diaphragm must be vented to the local environment. The transducer will then indicate a pressure of "zero" when it is not connected to the process pressure of interest, but while the sensing element is still exposed to atmospheric pressure.

Gage pressure is actually a kind of differential pressure. It always equals the difference between the local absolute pressure and the local atmospheric pressure.

**Absolute Pressure**

Absolute pressure ("psia") does include atmospheric pressure, and is measured relative to vacuum (0 psi).

For an absolute pressure transducer, the reference side of the pressure-sensing diaphragm is isolated.

(cont’d)
from the local environment, being hermetically sealed in a vacuum.* The transducer will then indicate a pressure of 14.696 pounds per square inch at sea level, when it is not connected to the process pressure of interest, but with the sensing element exposed to atmospheric pressure.

Absolute pressure is always the sum of the local "gage" pressure (induced by some source) and the atmospheric pressure at the location of the measurement.

**Differential Pressure**

Differential pressure ("psid") is pressure measured relative to a reference pressure. If the reference pressure is one atmosphere, the differential pressure equals the gage pressure.

Normally, a differential pressure transducer will have two pressure ports, and its pressure reading is generated by subtracting the pressure at the low port from that at the high port.** Differential pressure may be either absolute or gage, as long as pressure is being measured in the same units at both ports.

* Absolute pressure sensors are thus not only isolated from environmental contaminants, but (theoretically) have better thermal performance than sealed gage units, because there is no trapped volume of gas to expand and contract with ambient temperature changes.

** One port may be "dry" and the other "wet," or both may be "wet," as with the 513 Series, or both may be "dry."
502A SERIES
PRECISION GAGE/Absolute PRESSURE TRANSDUCERS

The 502A Series are rugged transducers designed for industrial applications requiring high-accuracy gas or liquid pressure measurements—within 0.1% of full scale—ranging from 1 to 15000 psi (70 mbar to 1000 bar).*

All units have welded stainless-steel construction and excellent long-term stability. Gage units employ a special "True Gage" design with a second welded diaphragm that hermetically seals the strain gage circuitry while allowing the transducer to reference atmospheric pressure. Models for absolute pressure measurement have an internal sealed "zero" reference.

### General 502A Series Specifications

- **Standard Full-Scale Ranges:** See table to [Fig. PT.2](#)
- **Type:** Absolute or True Gage**
- **Measured Fluids:** Gas, liquid
- **Wetted Parts Material:** 17-4 PH Stainless/15-5 PH Stainless
- **Case Material:** 17-4 PH Stainless
- **Dimensions:** See [Fig. PT.2](#)
- **Bridge:** Four-arm bonded foil gages, 350 ohms nominal
- **Insulation Resistance to Ground:** 5000 MΩ at 50 V-DC
- **Excitation:** 10 V-DC (calibration); up to 12 V-DC or AC acceptable
- **Output (standard)***:
  - Models 502A-1G and 502A-2G: 1 mV/V
  - All Other Models: 3 mV/V
- **Resolution:** Infinite
- **Accuracy:** ±0.1% of full scale

* Gage and absolute anges above 15000 psi are available on request.
** Gage pressure units greater than 500 psi (35 bar) are sealed at atmospheric pressure.
*** Optional 0-5 V-DC or 4-20 mA output is available.

- **Overload (safe):** 50% over capacity
- **Burst Pressure:**
  - Models 502A-1G through 502A-5000(G,A): 300% over capacity
  - Models 502A-7500(G,A) through 502A-10000(G,A): 200% over capacity
  - Model 502A-15000(G,A): 170% over capacity
- **Dead Volume:**
  - Models 502A-1G through 502A-5(G,A): 0.32 in³
  - Models 502A-10(G,A) and 502A-15(G,A): 0.25 in³
  - Models 502A-25(G,A) through 502A-1500(G,A): 0.17 in³
  - Models 502A-2000(G,A) through 502A-15000(G,A): 0.12 in³
- **Temperature Coefficient (Zero and Span):** ±0.0025% of full scale/°F (±0.0045% of full scale/°C)
- **Compensated Temperature Range:** +60° F to +160° F (+16° C to +71° C)
- **Operating Temperature Range:** -100° F to +325° F (-73° C to +163° C)
- **Weight (nominal):** 10 oz. (283 g)

(cont’d)
## 502A Series Precision Gage/Absolute Pressure Transducers (cont’d)

### Fig. PT.2
502A Series Dimensions

<table>
<thead>
<tr>
<th>Pressure Transducer Model</th>
<th>Full-Scale Range</th>
<th>Dimension &quot;L&quot; (in. / cm)</th>
<th>Dimension &quot;D&quot; (in. / cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>502A-1G</td>
<td>1 psig</td>
<td>1.93 / 4.90</td>
<td>2.25 / 5.72</td>
</tr>
<tr>
<td>502A-2G</td>
<td>2 psig</td>
<td>1.93 / 4.90</td>
<td>2.25 / 5.72</td>
</tr>
<tr>
<td>502A-5G</td>
<td>5 psig</td>
<td>2.54 / 6.45</td>
<td>2.25 / 5.72</td>
</tr>
<tr>
<td>502A-10G</td>
<td>10 psig</td>
<td>2.00 / 5.08</td>
<td>1.75 / 4.45</td>
</tr>
<tr>
<td>502A-10A</td>
<td>10 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-15G</td>
<td>15 psig</td>
<td>2.00 / 5.08</td>
<td>1.75 / 4.45</td>
</tr>
<tr>
<td>502A-15A</td>
<td>15 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-25G</td>
<td>25 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-25A</td>
<td>25 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-50G</td>
<td>50 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-50A</td>
<td>50 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-75G</td>
<td>75 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-75A</td>
<td>75 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-100G</td>
<td>100 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-100A</td>
<td>100 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-150G</td>
<td>150 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-150A</td>
<td>150 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-200G</td>
<td>200 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-200A</td>
<td>200 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-300G</td>
<td>300 psig</td>
<td>2.00 / 5.08</td>
<td>1.50 / 3.81</td>
</tr>
<tr>
<td>502A-300A</td>
<td>300 psia</td>
<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
</tr>
</tbody>
</table>

* Autoclave AE F250-C for 15000-psi version.
512 Series
General-Purpose Gage/Absolute Pressure Transducers

2000 - 10000 psi

Cased in 17-4 PH stainless steel, these general industrial transducers offer high reliability for both gage and absolute pressure measurements from 10 to 10000 psi (700 mbar to 700 bar)*.

Gage models for ranges of 500 psig and below are drift-free "true gage" design, with a second welded diaphragm to hermetically seal the gage reference from moisture or corrosive gases. A small hole vents the second diaphragm to ambient pressure.

All absolute models have an internal sealed 0-psiia reference.

General 512 Series Specifications

Standard Full-Scale Ranges*: See table to Fig. PT.3

Type: Absolute or True Gage**

Measured Fluids: Gas, liquid

Case and Wetted Parts Material: 17-4 PH Stainless

Dimensions: See Fig. PT.3

Bridge: Four-arm bonded foil gages, 350 ohms nominal

Insulation Resistance to Ground: 5000 MΩ at 50 V-DC

Excitation: 10 V-DC (calibration); up to 12 V-DC or AC acceptable

Output (standard)***: 3 mV/V

Resolution: Infinite

Accuracy: ±0.25% of full scale

Linearity: ±0.15% of full scale

Hysteresis: ±0.10% of full scale

Repeatability: ±0.05% of full scale

Overload (safe): 50% over capacity

Burst Pressure:
- Models 512-10(G,A) through 512-5000(G,A): 300% over capacity
- Models 512-7500(G,A) through 512-10000(G,A): 200% over capacity

Dead Volume:
- Models 512-10(G,A) and 512-15(G,A): 0.25 in³
- Models 512-25(G,A) through 512-1500(G,A): 0.17 in³
- Models 512-2000(G,A) through 512-10000(G,A): 0.12 in³

Temperature Coefficient (Zero and Span): ±0.005% of full scale/F (±0.009% of full scale/°C)

Compensated Temperature Range: +60°F to +160°F (+16°C to +71°C)

Operating Temperature Range: -100°F to +325°F (-73°C to +163°C)

Weight (nominal): 10 oz. (283 g)

* Gage and absolute ranges below 1 psi and above 10000 psi are available on request.

** Gage pressure units greater than 500 psi (35 bar) are sealed at atmospheric pressure.

*** Optional 0-5 V-DC or 4-20 mA output is available.

(cont'd)
### 512 Series General-Purpose Gage/Absolute Pressure Transducers (cont’d)

**Fig. PT.3**

512 Series Dimensions

<table>
<thead>
<tr>
<th>Pressure Transducer Model</th>
<th>Full-Scale Range</th>
<th>Dimension &quot;L&quot; (in. / cm)</th>
<th>Dimension &quot;D&quot; (in. / cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>512-10G</td>
<td>10 psig</td>
<td>2.00 / 5.08</td>
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<td>512-15G</td>
<td>15 psig</td>
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<td>1.50 / 3.81</td>
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<td>100 psia</td>
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<td>1.50 / 3.81</td>
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<td>2.35 / 5.97</td>
<td>1.50 / 3.81</td>
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<table>
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<tr>
<th>Pressure Transducer Model</th>
<th>Full-Scale Range</th>
<th>Dimension &quot;L&quot; (in. / cm)</th>
<th>Dimension &quot;D&quot; (in. / cm)</th>
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<td>1.50 / 3.81</td>
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<td>1.50 / 3.81</td>
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<td>1.90 / 4.83</td>
<td>1.50 / 3.81</td>
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<td>1.50 / 3.81</td>
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<td>10000 psia</td>
<td>1.90 / 4.83</td>
<td>1.50 / 3.81</td>
</tr>
</tbody>
</table>
515A Series
Low-Cost Gage Pressure Transducers

These pressure transducers offer an economical alternative with good performance for high-volume gage requirements from 300 to 10000 psi (21 to 700 bar)*. Each unit is constructed of welded stainless steel for durability in dry rugged environments. Both gas and liquid pressure overloads of up to 50% over capacity are safely accepted.

Fig. PT.4
515A Series Dimensions

<table>
<thead>
<tr>
<th>Pressure Transducer Model</th>
<th>Full-Scale Range</th>
<th>&quot;L&quot; (in.)</th>
<th>&quot;H&quot; Hex (in.)</th>
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<tbody>
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<td>515A-300G</td>
<td>300 psig</td>
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<td>515A-500G</td>
<td>500 psig</td>
<td>2.00 / 5.08</td>
<td>0.875</td>
</tr>
<tr>
<td>515A-750G</td>
<td>750 psig</td>
<td>2.00 / 5.08</td>
<td>0.875</td>
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<tr>
<td>515A-1000G</td>
<td>1000 psig</td>
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<td>0.750</td>
</tr>
<tr>
<td>515A-1500G</td>
<td>1500 psig</td>
<td>1.78 / 4.52</td>
<td>0.750</td>
</tr>
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<td>515A-2000G</td>
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<td>1.78 / 4.52</td>
<td>0.750</td>
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<td>3000 psig</td>
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<td>0.750</td>
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<td>515A-5000G</td>
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<td>1.78 / 4.52</td>
<td>0.750</td>
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<td>515A-7500G</td>
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<td>0.750</td>
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<td>10000 psig</td>
<td>1.78 / 4.52</td>
<td>0.750</td>
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</tbody>
</table>

General 515A Series Specifications

- **Type:** Gage
- **Measured Fluids:** Gas, liquid
- **Case and Wetted Parts Material:** Stainless steel
- **Bridge:** Four-arm bonded foil gages, 350 ohms nominal
- **Excitation:** 10 V-DC
- **Output (nominal):** 2 mV/V
- **Resolution:** Infinite
- **Accuracy:** ±0.5% of full scale
- **Overload (safe):** 50% over capacity
- **Zero Temperature Coefficient:** ±0.01% of full scale/°F
- **Span Temperature Coefficient:** ±0.02% of full scale/°F
- **Compensated Temperature Range:** +60° F to +160° F (+16° C to +71° C)
- **Operating Temperature Range:** -65° F to +250° F (-54° C to +121° C)
- **Electrical Termination (standard):** 3-ft. cable

* Ranges below 300 psig are available on request.
Series 513 Pressure Transducers are bi-directional wet-wet (BDWW) sensors designed for a wide range of differential measurements where both pressure sources can involve wet or corrosive fluids, each port having a welded, stainless-steel diaphragm. Typical applications include flow measurement, depth sensing, pressure equalization, and liquid level.

Series 513 models are constructed of stainless-steel, and come in three sizes, depending on nominal range (see the table below). All units feature mechanical stops to prevent damage when infrequently overloaded. The diaphragm will hit the stops at about 50% above full-scale range, thus minimizing the possibility of damage from depressurization of one input line. Low- and middle-range units include viton O-ring seals (metal seals optional). All high-range units have metal seals. See 513 Series Specifications.

### Table PT.1 513 Series Models*

<table>
<thead>
<tr>
<th>Low Ranges</th>
<th>Middle Ranges</th>
<th>High Ranges</th>
</tr>
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<tbody>
<tr>
<td><strong>Pressure Transducer Model</strong></td>
<td><strong>Full-Scale Range</strong></td>
<td><strong>Pressure Transducer Model</strong></td>
</tr>
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<td>0.5 psid</td>
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</tr>
<tr>
<td>513-25D</td>
<td>25 psid</td>
<td>513-500D</td>
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</tbody>
</table>

* Transducers with exceptionally high differential pressure (up to 30000 psid) or extremely high line pressure (up to 50000 psi) are available on request.
513 Series Wet/Wet Differential Pressure Transducers (cont’d)

Fig. PT.6
513 Series Dimensions (in./cm)

Fig. PT.6(a)
Dimensions for Low-Range Models (513-.5D through 513-25D)

Fig. PT.6(b)
Dimensions for Middle-Range Models (513-50D through 513-750D)

Fig. PT.6(c)
Dimensions for High-Range Models (513-2000D through 513-10000D)

(Cont’d)
513 Series Wet/Wet Differential Pressure Transducers (cont’d)

General 513 Series Specifications

Standard Full-Scale Ranges: See Table PT.1
Type: Differential
Measured Fluids: Gas, liquid
Case Material:
Models 513-.5D through 513-25D: 316 Stainless
Models 513-50D through 513-750D: 17-4 Stainless
Models 513-2000D through 513-10000D: 17-4 PH Stainless
Wetted Parts Material:
Models 513-.5D through 513-25D: 316 Stainless
Models 513-50D through 513-750D: 17-4 PH Stainless
Models 513-2000D through 513-10000D: 17-4 PH Stainless
O-Ring Seals:
Models 513-.5D through 513-750D: Viton
Models 513-2000D through 513-10000D: Metal
Dimensions: See Fig. PT.6
Bridge: Four-arm bonded foil gages, 350 ohms nominal
Insulation Resistance to Ground: 5000 MΩ at 50 V-DC
Excitation: 10 V-DC (calibration); up to 10 V-DC or AC acceptable
Output (standard)*:
Model 513-.5D: 1.0 mV/V
Models 513-1D and 513-2D: 1.5 mV/V
All Other Models: 2 mV/V
Resolution: Infinite
Accuracy: ±0.25% of full scale
Linearity: ±0.15% of full scale

Hysteresis: ±0.10% of full scale
Repeatability: ±0.05% of full scale
Line Pressure (maximum):
Models 513-.5D through 513-750D: 1500 psi
Models 513-2000D through 513-10000D: 2000 psi
Overload (safe, either side):
Models 513-.5D through 513-750D: 1500 psi
Models 513-2000D and 513-3000D: 100% over capacity
Models 513-5000D through 513-10000D: 50% over capacity
Dead Volume:
Models 513-.5D through 513-750D: 0.4 in³
Models 513-2000D through 513-10000D: 0.06 in³
Temperature Coefficient (Zero and Span): ±0.5% of full scale/100°F
Compensated Temperature Range:
Models 513-.5D through 513-25D: +30° F to +130° F
(-1° C to +54° C)
Models 513-750D through 513-10000D: +60° F to +160° F
(+16° C to +71° C)
Operating Temperature Range:
Models 513-.5D through 513-25D: +30° F to +190° F
(-1° C to +88° C)
Models 513-750D through 513-10000D: -65° F to +250° F
(-54° C to +121° C)
Weight (nominal):
Models 513-.5D through 513-25D: 8.3 lb.
Models 513-50D through 513-750D: 5.0 lb.
Models 513-2000D through 513-10000D: 4.0 lb.

* Optional 0-5 V-DC or 4-20 mA output is available. Shunt calibration data is included for all models.
Model MP1A
High-Sensitivity Magnetic Pickup

For reliable measurement of flow and rpm, or for other tachometric, counting, or accumulating applications

How It Works

A magnetic pickup is essentially a coil wound around a permanently magnetized probe. When discrete ferromagnetic objects—such as gear teeth, turbine rotor blades, slotted discs, or shafts with keyways—are passed through the probe's magnetic field, the flux density is modulated. This induces AC voltages in the coil. One complete cycle of voltage is generated for each object passed. If the objects are evenly spaced on a rotating shaft, the total number of cycles will be a measure of the total rotation, and the frequency of the AC voltage will be directly proportional to the rotational speed of the shaft.*

Fig. OT.3 shows a magnetic pickup used in conjunction with a 60-tooth gear to measure the rpm of a rotating shaft. Such a gear is often selected because the output frequency (in Hz) is numerically equal to rpm—a situation that allows frequency meters to be employed without calibration. For very high rotational speeds, a smaller number of teeth may be called for.

Illustrating a similar principle, Fig. OT.4 shows how a turbine flowmeter can measure the volumetric flow of a fluid. The fluid flow exerts a force on the turbine blades, causing the meter to rotate. In properly designed flowmeters, the output

Fig. OT.3
Typical Magnetic Pickup

* Output waveform is a function not only of rotational speed, but also of gear-tooth dimensions and spacing, pole-piece diameter, and the air gap between the pickup and the gear-tooth surface. The pole-piece diameter should be less than or equal to both the gear width and the dimension of the tooth's top (flat) surface; the space between adjacent teeth should be approximately three times this diameter. Ideally, the air gap should be as small as possible—typically 0.005". A number of steel or cast-iron gears, precisely manufactured to AGMA standards, are available for use with the Model MP1A. The standard solid gear comes with various dimensions and with 48, 60, 72, 96, or 120 teeth. For assistance in selecting proper gear type and size, contact the factory.
frequency produced by the magnetic pickup is a linear function of the volumetric flow rate. Each output cycle therefore represents the passage of a known volume of fluid, and the flowmeter can be accordingly calibrated in cycles per gallon or similar units. This rating is known as the "K factor" of the flowmeter. It will vary somewhat with viscosity and flow rate, but is usually quite predictable, with repeatability to within 0.1% in many units.

A magnetic pickup may also be used as a timing or synchronization device—as, for example, in ignition timing of gasoline engines, angular positioning of rotating parts, or strobeoscopic triggering of mechanical motion.

The Model MP1A

The Model MP1A Magnetic Pickup is a fast, general-purpose sensor, providing an effective, accurate means of measuring the speed and frequency of mechanical rotary motion without the necessity of mechanical linkage—and the contact, wear, cabling, and alignment problems such linkage entails. It is recommended for maximum-sensitivity applications with low speed and/or large air gaps.

The MP1A is a "passive" or "self-generating" device, requiring no external excitation. When mounted in proximity to the teeth (or blades) of a conventional rotating gear (or turbine), it produces an approximately sinusoidal AC voltage-signal output with a frequency directly proportional to the speed of rotation (see Fig. OT.6).

Housed in a stainless-steel shell, the MP1A is reliable over a wide temperature range, at repetition rates exceeding one megahertz, and under severe environmental conditions of mechanical shock, vibration, humidity, immersion in water or oil, salt spray, sand and dust, radiation, and pressure. It has a threaded mounting shank and locking nut.

See Model MP1A Specifications.
MODEL MP1A HIGH-SENSITIVITY MAGNETIC PICKUP (cont’d)

![Graph showing MP1A Typical and Minimum Output vs. Surface Speed](Fig. OT.6)

**MODEL MP1A SPECIFICATIONS**

- **Dimensions:** See Fig. OT.5
- **Pole-Piece Dimension:** 0.106 in. (0.27 cm)
- **Gear Pitch (optimum):** 20 DP**
- **Gear Pitch Range:** 24 DP or coarser
- **Output Voltage (peak-to-peak):** See Fig. OT.6, above;
  190 V-AC minimum output at 1000 in/sec, with 20-pitch,
  30-tooth gear at 0.005" pole-piece clearance and
  100-kΩ load

- **DC Resistance:** 1200 Ω, maximum
- **Inductance:** 450 mH, maximum
- **Output Polarity:** When ferrous metal is introduced into the
  magnetic field, Pin B will be positive with respect to Pin A
- **Operating Temperature Range:** -100° F to +225° F
  (-73° C to +107° C)

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* At +75° F (+18° C).
** Optimum gear pitch is a compromise between waveform purity
  and voltage output.