LASERSPEED® LENGTH & SPEED GAUGE

Non-contact length & speed measurement for the metals industry

- Measure products with the highest degree of accuracy and repeatability
- Perform direct, non-contact measurements on all types of products
- Meets MID (Measuring Instruments Directive) 2014/32/EU requirements
- Direct replacement for contact encoders
- Realize the lowest total cost of ownership
Non-Contact Speed & Length Measurement

Precision speed and length measurements are critical for controlling production costs and improving process control for the steel and nonferrous metals industries. Traditional contact rollers and tachometers have inherent problems with slippage and mechanical wear. Both of these problems cause increased scrap, increased maintenance costs and reduce the quality of the end product. The Beta LaserMike LaserSpeed® non-contact speed and length gauges solve all of the problems of mechanical contact rollers and tachometers.

LaserSpeed gauges can measure the speed and length of any product using an optical, non-contact technology called Dual Beam Laser Doppler Velocimetry. LaserSpeed were first introduced into the metals industry in 1984 and have been growing in usage ever since. There are thousands of LaserSpeed gauges installed worldwide.

A breakthrough in electro-optics design enables the LaserSpeed gauge to produce highly accurate, non-contact speed and length measurements at a surprisingly low cost. To accomplish this, the LaserSpeed gauge uses the Laser Doppler Velocimeter technology coupled with autocorrelation, the most advanced, digital signal processing algorithm, and new single-chip integrated circuit technology.

LaserSpeed gauges have no moving parts, use 100% solid-state digital technology, and are permanently calibrated—resulting in significant time and money savings. With accuracy better than ±0.03%, the LaserSpeed gauge is the ideal gauge for replacing contact tachometers which are prone to measurement errors caused by slippage, dirt build-up, and day-to-day wear problems.

The LaserSpeed gauge is a complete system integrated into a compact package. The processor is incorporated inside the gauge, making it easy to maintain, troubleshoot and operate—resulting in a lower cost of ownership. There are two series of LaserSpeed gauges: the LS8000 series and the LS9000 series.

**LS8000 Series**

The LS8000 series gauges measure the absolute value of speed and length using Dual Beam Laser Doppler Velocimetry, eliminating slippage and wear problems of contact rollers and tachometers. A wide range of standoff distances are available, ranging from 300 mm to over 2500 mm (12 in. to 98.4 in.) and have the ability to measure speeds up to 20000 m/min (65,000 ft/min.)

**LS9000 Series**

*(Zero Speed and direction detection)*

The LS9000 series gauge is based on the LS8000 technology with the added feature of being able to measure from true zero to very slow to maximum application speed—in both forward and reverse directions. This is accomplished by using a proprietary optics system coupled with special electronics which automatically determine the direction the product is traveling, while maintaining the same high accuracy as the LS8000.

The LS9000 gauge is well suited for applications where the product moves very slowly, like continuous casters, for positioning control where the product stops and backs up and for applications where the product reverses direction.

The LS9000 series is also Measuring Instrument Directive (MID) Certified and meets the 2014/32/EU Standard for Length Measurement.
Since 1984 …
LaserSpeed® gauges have been improving mill productivity, saving money and improving product quality with applications as varied as:

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**Laser Doppler Velocimetry Principle**

LaserSpeed uses dual-beam laser interferometer technology to measure product velocity (speed), which is integrated over time to measure length.

Fringe distance is a function of laser wavelength and beam angle:

\[ d = \frac{\lambda}{2 \sin \kappa} \]

Velocity is distance over time:

\[ v = \frac{d}{t} \]

Period is the inverse of frequency:

\[ t = \frac{1}{f} \]

Velocity is integrated to find length:

\[ L = \int_0^T v \, dt \]

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Measured by Commitment
LaserSpeed Product Line
LS8000/LS9000

**Designed for steel and non-ferrous metal manufacturing**

The LaserSpeed gauge is the base sensor for all of the models in the LaserSpeed series of gauges. With an accuracy better than ±0.03%, it is the ideal replacement for contact tachometers which are prone to measurement errors caused by slippage, dirt build-up and day-to-day wear problems in the metal manufacturing industry. There are two gauge types: the **LS8000** measures the absolute value of the speed and length and the **LS9000** measures zero speed and determines the direction the material is moving. Both gauges are well suited for a range of applications including, but not limited to:

- Steel Slabs
- Cold Steel Strip
- Steel Bar Length
- Plate Length
- Tube Length
- Bar Length
- Process Lines
- Painting Lines
- Galvanizing Lines

![LS8000 Series LaserSpeed Gauge shown with Air Wipe](image-url)
LS8000E/LS9000E

Designed for the harsh environment of steel and non-ferrous metal manufacturing

The LaserSpeed 8000E/9000E series gauge takes the base LS8000/9000 sensor and houses it within a rugged environmental housing for double-sealed protection against hot and hostile environments. The system works on all types of products including rod, bar, tube, pipe, slabs, cold strip, hot strip, plate and profile products. With various options and accessories, this gauge provides a complete solution for the harsh environment of steel and non-ferrous metal manufacturing, including:

- Temper/Skin Pass Mills
- Foil Mills
- Slabs
- Slitter Lines
- Cold Steel Strip
- Galvanizing Line
- Bar Mills
- Annealing Line
- Profile Mills
- Painting Line
- Tube Mills
- Processing Lines
- Plate Mills
- Wire Rod Mills

Exit of Cold Rolling Mill

LS8000E WITH AIR PURGE (SEE TABLE)

LS8000E WITH AIR WIPE (SEE TABLE)

*Air Purge Model 982725 shown

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS8000/9000-325E</td>
<td>2471.5 mm (97.3 in.)</td>
</tr>
<tr>
<td>LS8000/9000-320E</td>
<td>1971.5 mm (77.6 in.)</td>
</tr>
<tr>
<td>LS8000/9000-315E</td>
<td>1471.5 mm (57.9 in.)</td>
</tr>
<tr>
<td>LS8000/9000-310E</td>
<td>971.5 mm (38.25 in.)</td>
</tr>
<tr>
<td>LS8000/9000-305E</td>
<td>571.5 mm (22.5 in.)</td>
</tr>
</tbody>
</table>
LS8000X/LS9000X

Designed for the extreme environment of steel and non-ferrous metal manufacturing

The LaserSpeed 8000X/9000X series gauge is designed for the toughest environments in metal manufacturing where heavy steam, mist and sprays occur. The LS8000X/9000X series gauge has a stainless steel housing protecting the gauge—a built-in air purge keeps the quick-change window clean for lower maintenance needs. The LS8000X/9000X series gauge is well suited for a range of applications including, but not limited to:

► Hot Rolling Steel Mills
► Interstand Cold Rolling Steel Mills
► Heavy Steam Applications
► Extreme Hot and Hostile Environments
► Continuous Caster
► Billet/Bloom Casters
► Thin Slab Caster

Measured by Commitment
# LS8000 Specifications

Length/Speed Operation without Stopping, Reversing and/or Slow Speed Operation

<table>
<thead>
<tr>
<th>LS8000</th>
<th>-303</th>
<th>-306</th>
<th>-310</th>
<th>-315</th>
<th>-320</th>
<th>-325</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standoff Distance</td>
<td>300 mm (12 in.)</td>
<td>600 mm (24 in.)</td>
<td>1000 mm (39.4 in.)</td>
<td>1500 mm (59.1 in.)</td>
<td>2000 mm (78.1 in.)</td>
<td>2500 mm (98.4 in.)</td>
</tr>
<tr>
<td>Speed Range</td>
<td>0.4-4000 m/min (1.3-13100 ft/min)</td>
<td>0.8-8000 m/min (2.6-26200 ft/min)</td>
<td>1.0-12000 m/min (3.2-39400 ft/min)</td>
<td>2.0-19000 m/min (6.5-62400 ft/min)</td>
<td>3.0-20,000 m/min (9.8-65600 ft/min)</td>
<td>4.0-20,000 m/min (13-65600 ft/min)</td>
</tr>
<tr>
<td>Measurement Depth of Field</td>
<td>35 mm (1.4 in.)</td>
<td>50 mm (2 in.)</td>
<td>100 mm (4.0 in.)</td>
<td>200 mm (8.0 in.)</td>
<td>200 mm (8.0 in.)</td>
<td>200 mm (8.0 in.)</td>
</tr>
<tr>
<td>LS8000-3 General Specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Accuracy**
- Depth of Field <100 mm: <=±0.03% of reading
- Depth of Field >100 mm: <=±0.07% of reading

**Repeatability** ±0.02%

**Measurement Rate** >50,000/s

**Acceleration Rate** >500 m/s²

**Starting / Ending Length Correction** Yes

**Serial I/O**
- Data Available: Speed, Length, Quality Factor, Status
- Baud Rate: 115K, 230K, 19.2K, 38.4K, 57.6K

**Ethernet -Optional**
- 10/100, UDP, TCP: Speed, Length, Quality Factor, Status

**Status via Serial I/O or Optional Ethernet**
- Laser at Temperature
- Laser Interlock
- Shutter Position
- Valid Measurements
- Material Present
- System Ready

**Quadrature Pulse Output 1**
- Opto isolated Scaleable pulse amplitude (5-24 V)
- Selectable pulses/unit
- 250 KHz max pulse rate

**Quadrature Pulse Output 2**
- RS422 Drivers
- Selectable pulses/unit
- 5 MHz max pulse rate

**Gauge Power** 24 VDC (±4 VDC) @ 1.5 Amp

**Gauge Temperature** 5 to 45°C (41 to 113°F)

Specifications are subject to change without notice.

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# LS8000E

**Gauge Size** 228.6 x 159 x 95.2 mm (9 x 6.3 x 3.75 in.)

**Gauge Weight**
- -303, -306, -310: 3.4 kg (7.5 lbs)
- -315, -320, -325: 3.7 kg (8.3 lbs)

**Water Cooling** 1.0 to 3.8 l/min, Typical 1.5 l/min (0.4 gpm)

**Relative Humidity** Non-condensing

**Degree of Protection** IP67

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# LS8000X

**Gauge Size**
- -306, -310: 362 x 229 x 158 mm (14.25 x 9 x 6.25 in.)
- -315, -320, -325: 362 x 229 x 158 mm (14.25 x 9 x 6.25 in.)

**Gauge Weight**
- -306, -310: 18 kg (40 lbs)
- -315, -320, -325: Varies depending on Air Wipe/Air Purge

**Environment Temp** -10 to 200ºC (14 to 392ºF)

**Water Cooling** 1.0 to 3.8 l/min (0.26 – 1 gpm)

**Compressed Air**
- Instrument Grade
- Air Wipe: 50 l/min (1.8 cfm) Typical,
- Air Purge: 6.2 – 8.3 Bar, 1.200 l/min (90 -120 psi, 45 scfm)

**Relative Humidity** Non-condensing

**Degree of Protection** IP67

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# LS8000 Specifications

**Gauge Size**
- -306, -310: 508 x 327 x 186 mm (20 x 12.88 x 7.32 in.)
- -315, -320, -325: 508 x 327 x 186 mm (20 x 12.88 x 7.32 in.)

**Gauge Weight**
- -306, -310: 24.9 kg (55 lbs)
- -315, -320, -325: 24.9 kg (55 lbs)

**Environment Temp** -10 to 200ºC (14 to 392ºF)

**Water Cooling** 1.0 to 3.8 l/min (0.26 – 1 gpm)

**Compressed Air**
- Instrument Grade
- Air Wipe: 50 l/min (1.8 cfm) Typical,
- Air Purge: 6.2 – 8.3 Bar, 1200 l/min (90 -120 psi, 45 scfm)

**Relative Humidity** Non-condensing

**Degree of Protection** IP67

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Measured by Commitment
# LS9000 Specifications

## Length/Speed with Stopping, Reversing and/or Slow Speed Operation

<table>
<thead>
<tr>
<th>LS9000</th>
<th>-303</th>
<th>-306</th>
<th>-310</th>
<th>-315</th>
<th>-320</th>
<th>-325</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standoff Distance</td>
<td>300 mm (12 in.)</td>
<td>600 mm (24 in.)</td>
<td>1000 mm (39.4 in.)</td>
<td>1500 mm (59.1 in.)</td>
<td>2000 mm (78.1 in.)</td>
<td>2500 mm (98.4 in.)</td>
</tr>
<tr>
<td>Speed Range</td>
<td>0..±4000 m/min (0..±13100 ft/min)</td>
<td>0..±8000 m/min (0..±26200 ft/min)</td>
<td>0..±12000 m/min (0..±39400 ft/min)</td>
<td>0..±19000 m/min (0..±62400 ft/min)</td>
<td>0..±20000 m/min (0..±65600 ft/min)</td>
<td>0..±20000 m/min (0..±65600 ft/min)</td>
</tr>
<tr>
<td>Measurement Depth of Field</td>
<td>35 mm (1.4 in.)</td>
<td>50 mm (2.0 in.)</td>
<td>100 mm (4.0 in.)</td>
<td>200 mm (8.0 in.)</td>
<td>200 mm (8.0 in.)</td>
<td>200 mm (8.0 in.)</td>
</tr>
</tbody>
</table>

## LS9000 General Specifications

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Depth of Field &lt;100 mm</th>
<th>&lt;±0.03% of reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Field &gt;100 mm</td>
<td>&lt;±0.07% of reading</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.02%</td>
<td></td>
</tr>
<tr>
<td>Measurement Rate</td>
<td>&gt;100,000/s</td>
<td></td>
</tr>
<tr>
<td>Acceleration Rate</td>
<td>&gt;500 m/s²</td>
<td></td>
</tr>
<tr>
<td>Starting / Ending Length Correction</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial I/O</th>
<th>Data Available</th>
<th>RS-232 / RS-422 Speed, Length Quality Factor, Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>115K, 230K 19.2K, 38.4K, 57.6K</td>
<td></td>
</tr>
</tbody>
</table>

| Ethernet -Optional | | |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Status via Serial I/O | Laser at Temperature Laser Interlock Shutter Position Valid Measurement Material Present System Ready |
| Optional Ethernet | Opto isolated Scaleable pulse amplitude (5-24 V) Selectable pulses/unit 250 KHz max pulse rate |
| Quadrature Pulse | Output 1 | RS422 Drivers Selectable pulses/unit 5 MHz max pulse rate |
| Output 2 | 24 VDC (±4 VDC) @ 2 Amp |
| Gauge Power | 24 VDC (±4 VDC) @ 2 Amp |
| Gauge Temperature | 5 to 45°C (41 to 113°F) |

Specifications are subject to change without notice.

## LS9000E

<table>
<thead>
<tr>
<th>Gauge Size</th>
<th>228.6 x 159 x 95.2 mm (9 x 6.3 x 3.75 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Weight</td>
<td>-303, -306, -310 3.4 kg (7.5 lbs)</td>
</tr>
<tr>
<td>-315, -320, -325 3.7 kg (8.3 lbs)</td>
<td></td>
</tr>
<tr>
<td>Water Cooling</td>
<td>1.0 to 3.8 l/min, Typical 1.5 l/min (0.4 gpm)</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP67</td>
</tr>
</tbody>
</table>

## LS9000X

<table>
<thead>
<tr>
<th>Gauge Size</th>
<th>508 x 327 x 186 mm (20 x 12.88 x 7.32 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Weight</td>
<td>-306, -310 24.9 kg (55 lbs)</td>
</tr>
<tr>
<td>-315, -320, -325 24.9 kg (55 lbs)</td>
<td></td>
</tr>
<tr>
<td>Environment Temp</td>
<td>-10 to 200ºC (14 to 392ºF)</td>
</tr>
<tr>
<td>Water Cooling</td>
<td>1.0 to 3.8 l/min (0.26 – 1 gpm)</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Instrument Grade Air Wipe 50 l/min (1.8 cfm) Typical, Air Purge 6.2 – 8.3 Bar, 1200 l/min (90 – 120 psi, 45 scfm)</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP67</td>
</tr>
</tbody>
</table>

Measured by Commitment
**LS8000-C/LS9000-C**

**Designed for steel and non-ferrous metal manufacturing. Provides high accuracy at a revolutionary price.**

A breakthrough in electro-optics design enables the LaserSpeed series gauges to produce highly accurate, non-contact speed and length measurements at a surprisingly low cost. To accomplish this, the LaserSpeed gauges use autocorrelation, the most advanced digital signal processing algorithm, coupled with new single-chip integrated circuit technology.

The LS8000-C/LS9000-C series gauge is an industrial sensor that can be mounted inside the C-Frame of an x-ray gauge. The gauge can connect directly to a PLC or control computer. The LS8000-C/LS9000-C consists of a gauge, a mounting rail, a right angle mirror assembly and a safety cover. The mounting rail is designed so the gauge can be positioned at a specified distance. This feature allows complete flexibility in optimizing the standoff distance for each application.

The LS8000-C/LS9000-C gauge is well suited for applications where thickness and speed or length are required in the same location. This includes:

- Interstand Cold Rolling Mills
- Foil Mills
## LS8000-C/LS9000-C Specifications

<table>
<thead>
<tr>
<th>LS8000-C/LS9000-C-C</th>
<th>-306</th>
<th>-310</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standoff Distance</strong></td>
<td>195 to 510 mm (7.68 to 20.08 in.)</td>
<td>595 to 910 mm (23.43 to 35.83 in.)</td>
</tr>
<tr>
<td><strong>Speed Range</strong></td>
<td>LS8000: 0.8 to 8000 m/min (2.6 to 26200 ft/min) LS9000: 0±8000 m/min (0±26200 ft/min)</td>
<td>LS8000: 1.0 to 12000 m/min (3.2 to 39400 ft/min) LS9000: 0±12000 m/min (0±39400 ft/min)</td>
</tr>
<tr>
<td><strong>Measurement Depth of Field</strong></td>
<td>50 mm (2 in.)</td>
<td>100 mm (4.0 in.)</td>
</tr>
</tbody>
</table>

### LS8000-3/LS9000-3

<table>
<thead>
<tr>
<th>Ethent -Optional</th>
<th>10/100, UDP, TCP Speed, Length Quality Factor, Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quadrature Pulse</strong> Output 1</td>
<td>Opto isolated Scaleable pulse amplitude (5-24 V) Selectable pulses/unit 250 KHz max pulse rate</td>
</tr>
<tr>
<td>Output 2</td>
<td>RS422 Drivers Selectable pulses/unit 5 MHz max pulse rate</td>
</tr>
<tr>
<td><strong>Index Pulse Output</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Gauge Power</strong></td>
<td>LS8000 24VDC (±4 VDC) @ 1.5 Amp LS9000 24VDC (±4 VDC) @ 2 Amp</td>
</tr>
</tbody>
</table>

### Accuracy
- <±0.03% of reading

### Repeatability
- ±0.02%

### Measurement Rate
- **LS8000:** >50000/s **LS9000:** >100,000/s

### Acceleration Rate
- >500 m/s²

### Starting / Ending Length Correction
- No

### Serial I/O Data Available
- RS-232 Speed, Length Quality Factor, Status
- RS-422 Speed, Length Quality Factor, Status
- 115K, 230K
- 19.2K, 38.4K, 57.6K

### Baud Rate
- RS-232: 115K, 230K, 38.4K, 57.6K
- RS-422: 115K, 230K, 38.4K, 57.6K

### Status via Serial I/O
- Sensor at Temperature Laser On Shutter Open Valid Measurements

### Common Specifications

#### All LS8000/LS9000 Gauges

<table>
<thead>
<tr>
<th><strong>User Isolated Voltage</strong></th>
<th>5 to 24 VDC (300 mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature Range</strong></td>
<td>5 to 45°C (41 to 113°F)</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>Non-condensing</td>
</tr>
<tr>
<td><strong>Water Cooling</strong></td>
<td>1.0 to 3.8 l/min, Typical 1.5 l/min (0.4 gpm)</td>
</tr>
<tr>
<td><strong>Degree of Protection</strong></td>
<td>IP67</td>
</tr>
<tr>
<td><strong>Output Rate</strong></td>
<td>1 to 2047 ms in 1 ms increments</td>
</tr>
<tr>
<td><strong>Units of Measure</strong> Speed</td>
<td>Selectable m/min, m/s, ft/min, ft/s, in/min, mm/min, yards/min, yards/sec</td>
</tr>
<tr>
<td>Length</td>
<td>m, ft, mm, in, yards</td>
</tr>
</tbody>
</table>

### Optional Accessories

- **Analog Converter:** Converts 0 to 2 VDC speed output to: 0 to 10 VDC, 0 to 5 VDC, ±10 VDC, ±5 VDC, 0 to 20 mA, 4 to 20 mA
- **Sensor Cable:** 3 m, 10 m, 20 m, 30 m, 50 m lengths
- **Terminal Block:** Breakout box for sensor cable

### Laser Safety Information for All LaserSpeed Gauges

The following safety features required to comply with the Bureau of Radiological Health Class IIB laser requirements are included:

- Key-operated power switch on optional controller
- Laser indicator light on supply and laser
- Delayed laser startup-laser indicator light on prior to laser radiation
- Laser beam blocking device
- Interlock capability for remote shut-off

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**Measured by Commitment**
### Accessories

<table>
<thead>
<tr>
<th>Gauge</th>
<th>E Housing</th>
<th>X Housing</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>I/O Module</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Air Wipe/Quick Change Window</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Beam Path Air Purge</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Right-Angle Mirror Assembly</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>C-Frame Enclosure</td>
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<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Air Services Cabinet</td>
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<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Water Chiller</td>
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<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Power Line Conditioner</td>
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<tr>
<td>✓</td>
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<td>Break-Away Cable (Low Temp)</td>
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<td>✓</td>
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<td>Break-Away Cable (High Temp)</td>
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<tr>
<td>✓</td>
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<td>Sensor Cable</td>
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<td>Sealed Sensor Cable</td>
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<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Analog Converter</td>
</tr>
</tbody>
</table>

1 Comes Standard with LS8000X/LS9000X