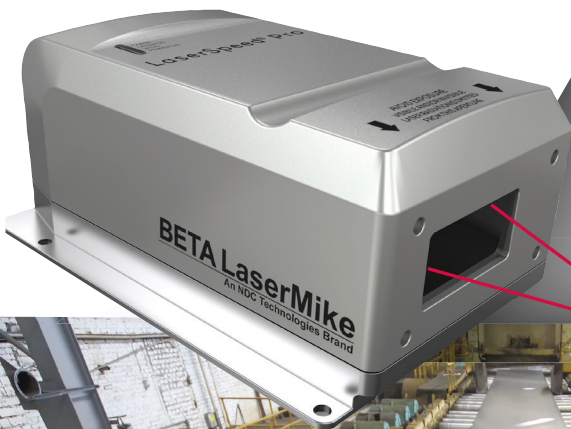


LASERSPEED[®] PRO LENGTH & SPEED GAUGE

Industry Leader in
Non-Contact
Measurement for
the Metals Industry





LaserSpeed Pro is the Gauge of Choice by the World's Leading Metals Manufacturers

With more than 30 years of proven technological performance, the Beta LaserMike LaserSpeed® gauge was among the first non-contact length and speed measurement systems on the market. Since then, it has set the standard of innovation for accuracy, repeatability, versatility and reliability that competing measurement products have tried to follow.

LaserSpeed gauges are successfully serving the precision length and speed measurement needs of more than 8,000 production operations around the globe. LaserSpeed is proven in numerous metals applications, including continuous casting, hot and cold rolling, temper and skin pass, pipe and tube, bar and rod, coil and strip, extrusion and other processes.

Now, the world's best non-contact measurement system is even better! Featuring powerful new capabilities in connectivity, communication and control consistent with Industry 4.0, **LaserSpeed Pro** integrates more easily than ever into production networks, providing the real-time data exchanges and tight processing efficiencies that today's manufacturers need to deliver true product quality.

LaserSpeed Pro's unsurpassed performance and applications flexibility – all backed by worldwide service and support – make it the measurement solution of choice for quality-conscious steel and non-ferrous mills around the globe. A complete range of LaserSpeed Pro measurement systems and accessories are available to meet your unique application needs.

LaserSpeed Pro Advantages

Here are just a few reasons why LaserSpeed Pro is the superior measurement solution for steel and non-ferrous mills:

- ▶ **Industry-Leading Performance** – Dual-Beam Laser Doppler Velocimeter technology combined with the Auto Correlation algorithm enables LaserSpeed Pro to deliver better than $\pm 0.03\%$ accuracy and $\pm 0.02\%$ repeatability for the depth of field up to 100 mm and full velocity range – the finest performance in the industry!
- ▶ **Broad Speed Measurement Capabilities** – LaserSpeed Pro accurately measures product speed at any rate, from true zero to very slow (e.g., 760 mm/min.) to maximum application speed (e.g., 20,000 m/min.) – in both forward and reverse directions.
- ▶ **Ultra-Fine Movement Tracking** – LaserSpeed Pro can track the most minute product movements back-and-forth, even at rapid acceleration/deceleration rates. These advanced monitoring capabilities help reduce elongation ratio errors.
- ▶ **Versatile Installation** – Compact design and flexible stand-off distances (300 mm – 2,500 mm) allow LaserSpeed Pro to fit practically any application. Its integrated architecture (the processor is inside the gauge) works with all PLCs, making LaserSpeed Pro easy to set up and operate.
- ▶ **Adjustment-Free Operation** – With its 100% solid-state digital technology, LaserSpeed Pro never needs to be recalibrated after setup, saving the time and money previously spent tweaking the mill control system to keep product within specifications.
- ▶ **NEW Long, Rugged Service Life** – Our new advanced laser diode technology, backed by a 3-year warranty, doubles the life of conventional diodes – providing the longest service life in the industry! All other LaserSpeed Pro components come with a 2-year product warranty.

LaserSpeed Pro can also be equipped with up to three layers of protection – water-cooled jacket, stainless-steel housing and heat-shield plate – for durable day-in, day-out operation, even in the most harsh production environments. Protection class is to IP 67.

- ▶ **User-Selectable Outputs** – Standard LaserSpeed Pro outputs consist of full RS-422 compatible quadrature or voltage scaleable pulse outputs to the existing control system and RS-422 and RS-232 serial outputs. Pulses per unit (e.g., m/min.) are configurable.
- ▶ **NEW Industry 4.0 Connectivity** – LaserSpeed Pro now includes expanded Ethernet connectivity that supports Industry 4.0 standards such as ModBus TCP, Ethernet/IP, and Profinet IO – as well as fieldbus support for Profibus DP. This new platform also lays the foundation for future connection via WIFI, Bluetooth or ZigBee.
- ▶ **LaserTrak Software** – This software suite provides complete digital control over LaserSpeed Pro setup and operation. Tools include gauge communication setup, length and speed pulse setup, high- and low-speed pulse output control, graphing/charting and data storage.



Highly Accurate Length & Speed Measurements at Any Location

Laser Doppler Velocimetry Principle

LaserSpeed Pro 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:

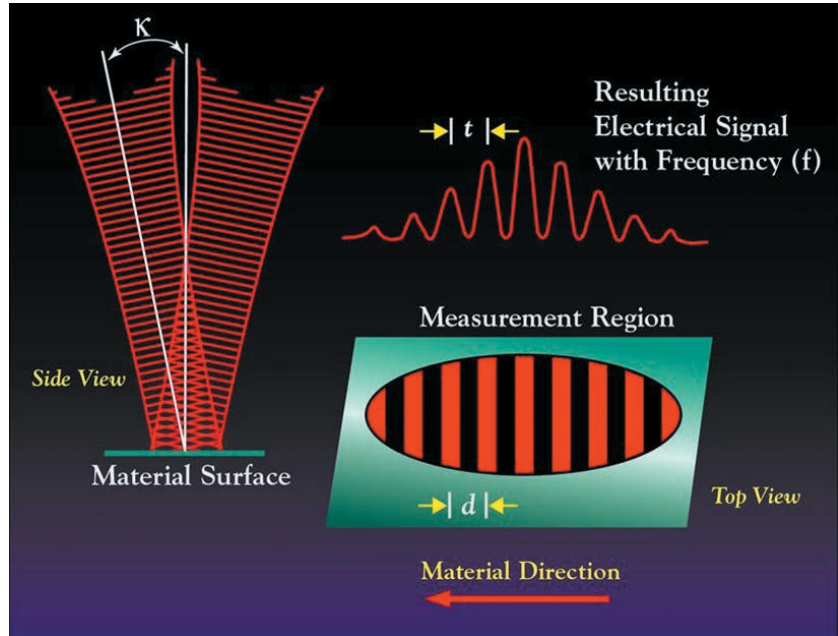
$$v = \frac{d}{t}$$

Period is the inverse of frequency:

$$t = \frac{1}{f}$$

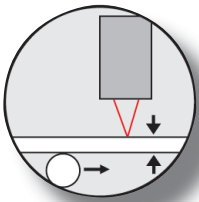
Velocity is integrated to find length:

$$L = \int_0^T v dt$$

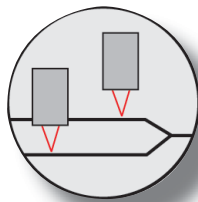


Applications

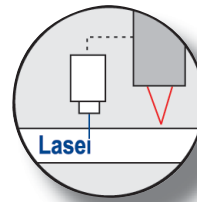
LaserSpeed® gauges have been improving mill productivity, saving money and improving product quality with applications as varied as:



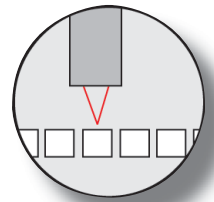
Crop Shear Optimization



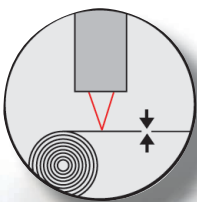
Laminating Control



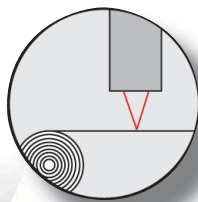
Marking Control



Discrete Part Length



Cutting Control



Coil Length

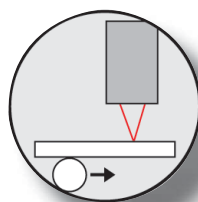
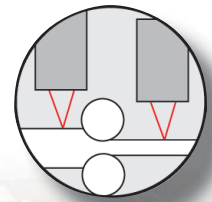


Plate Length



Elongation & Differential Speed

LaserSpeed in Action



1 Continuous and Cut-to-Length

LaserSpeed measuring the continuous length of aluminum strip and making shear cuts with better than $\pm 0.03\%$ accuracy.

2 Cut Control

LaserSpeed on a slitter line, capturing accurate product length measurements to ensure correct coil length and avoid overages and shortages.



3 Elongation Control

LaserSpeed at the entry and exit sides of a cold-rolling station in foil mill to control elongation and reduce product thickness to specified dimensions.

4 Mass Flow Automatic Gauge Control (MFAGC)

LaserSpeed on cold-rolling mill providing MFAGC to increase the amount of coil on gauge while significantly reducing gauge control inaccuracies.



5 Continuous and Cut-to-Length

LaserSpeed measuring the continuous length of slab casters and making cuts with $\pm 0.03\%$ or better precision.

6 Length and Speed

LaserSpeed on a cold-rolling mill, accurately measuring the length and speed of product as it is being processed.

7 Continuous Length

LaserSpeed measuring the continuous length of hot billets. Also monitors mould oscillation and cut billets to specified length.

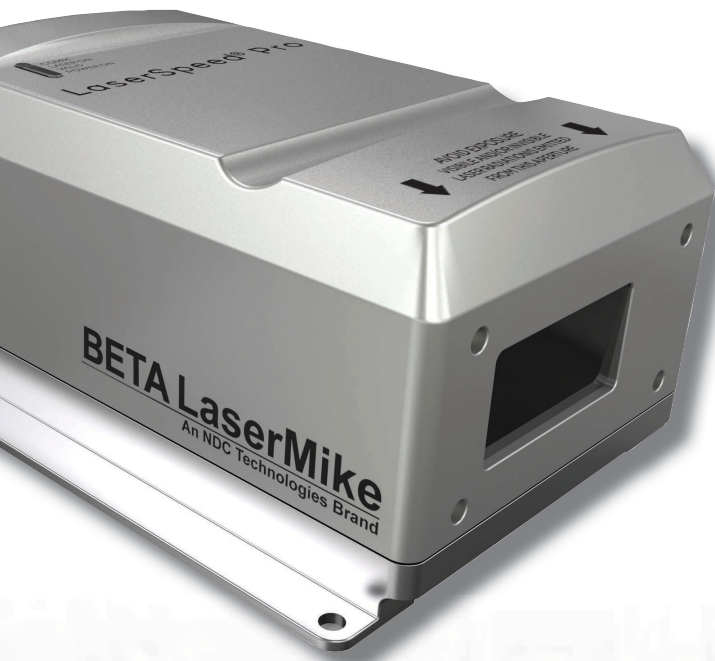


8 Tension Control

LaserSpeed at the entry and exit sides of a cold-rolling tension leveler, providing the measurements needed for proper material tension and shape control.

LaserSpeed Pro 8500/9500

Designed for steel and non-ferrous metals manufacturing



The LaserSpeed Pro gauge is the base gauge for all of the models in the series. With an accuracy better than $\pm 0.03\%$, 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 metals manufacturing industry. There are two gauge types: the **LS Pro 8500** measures the absolute value of the length and speed, and the **LS Pro 9500** measures forward and reverse directions the material is moving and down to true zero speed. 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



LS Pro 8500 Series

The LS Pro 8500 series gauges measure the absolute value of length and speed using Dual Beam Laser Doppler Velocimetry, eliminating slippage and wear problems of contact rollers and tachometers. A wide scope of standoff distances are available, ranging from 300 mm to 1000 mm (12 in. to 39.4 in.) and measurement speeds up to 12,000 m/min (39,400 ft/min.)

LS Pro 9500 Series (Zero Speed and Direction Detection)

The LS Pro 9500 series gauge is based on the LS Pro 8500 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 LS Pro 8500.

The LS Pro 9500 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.



LaserSpeed Pro 8500E/9500E

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

The LaserSpeed Pro 8500E/9500E series gauge takes the base LS Pro 8500/9500 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 metals manufacturing, including:

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



*Close up
of Air Wipe*

LaserSpeed Pro 8500X/9500X

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

The LaserSpeed Pro 8500X/9500X series gauge is designed for the toughest environments in metals manufacturing where heavy steam, mist and sprays occur. The LS Pro 8500X/9500X 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 LS Pro 8500X/9500X 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



LS Pro 8500/9500 Specifications

	-403	-406	-410	-415	-420	-425	-430
Standoff Distance	300 mm (12 in.)	600 mm (24 in.)	1000 mm (39.4 in.)	1500 mm (59.1 in.)	2000 mm (78.1 in.)	2500 mm (98.4 in.)	3000 mm (118.1 in.)
LS Pro 8500 Speed Range	0.4-4000 m/min (1.3-13100 ft/min)	0.8-8000 m/min (2.6-26200 ft/min)	1.0-12000 m/min (3.2-39400 ft/min)	Not available	Not available	Not available	Not available
LS Pro 9500 Speed Range	0..±4000 m/min (0..±13100 ft/min)	0..±8000 m/min (0..±26200 ft/min)	0..±12000 m/min (0..±39400 ft/min)	0..±19000 m/min (0..±62400 ft/min)	0..±20000 m/min (0..±65600 ft/min)	0..±20000 m/min (0..±65600 ft/min)	0..±20000 m/min (0..±65600 ft/min)
Measurement Depth of Field	35 mm (1.4 in.)	50 mm (2 in.)	100 mm (4.0 in.)	200 mm (8.0 in.)	200 mm (8.0 in.)	200 mm (8.0 in.)	200 mm (8.0 in.)

General Specifications

Accuracy

Depth of Field <100 mm	<±0.03% of reading
Depth of Field >100 mm	<±0.07% of reading

Repeatability

±0.02%

Measurement Rate

LS Pro 8500: >50,000/s
LS Pro 9500: >100,000/s

Acceleration Rate

>500 m/s²

Starting / Ending Length Correction

Yes

Serial I/O

Data Available
RS-232 / RS-422
Speed, Length
Quality Factor, Status

Baud Rate
460K, 230K, 115K, 57.6K,
38.4K, 19.2K, 9.6K, 4.8K

Ethernet

10/100, UDP, TCP
Speed, Length
Quality Factor, Status

Status via Serial I/O or 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

Output 2
RS-422 Drivers
Selectable pulses/unit
5 MHz max pulse rate

Fieldbus Connectivity

Ethernet (ModBus TCP, Ethernet/IP, Profinet IO); Profibus DP

Gauge Power

24 VDC (±4 VDC) @ 1.5 Amp

Gauge Temperature

5 to 45°C (41 to 113°F)

Product Warranty

2 years

Diode Warranty

3 years

Specifications are subject to change without notice.

LS Pro 8500/9500

Gauge Size

8500	-403, -406, -410	203 x 159 x 97.5 mm (8 x 6.25 x 3.84 in.)
9500	-403, -406, -410, -415, -420, -425, -430	203 x 159 x 97.5 mm (8 x 6.25 x 3.84 in.) 229 x 159 x 97.5 mm (9 x 6.25 x 3.84 in.)

Gauge Weight

8500	-403, -406, -410	3.4 kg (7.5 lbs)
9500	-403, -406, -410, -415, -420, -425, -430	3.4 kg (7.5 lbs) 3.8 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

LS Pro 8500E/9500E

Gauge Size

8500	-406, -410	362 x 229 x 158 mm (14.25 x 9 x 6.25 in.)
9500	-406, -410, -415, -420, -425, -430	362 x 229 x 158 mm (14.25 x 9 x 6.25 in.) 362 x 229 x 158 mm (14.25 x 9 x 6.25 in.)

Gauge Weight (with air wipe)

8500	-406, -410	15.7 kg (34.7 lbs)
9500	-406, -410, -415, -420, -425, -430	15.7 kg (34.7 lbs) 16.1 kg (35.5 lbs)

Environment Temp

-10 to 150°C (14 to 302°F)

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

LS Pro 8500X/9500X

Gauge Size

8500	-406, -410	508 x 327 x 186 mm (20 x 12.88 x 7.32 in.)
9500	-406, -410, -415, -420, -425, -430	508 x 327 x 186 mm (20 x 12.88 x 7.32 in.) 508 x 327 x 186 mm (20 x 12.88 x 7.32 in.)

Gauge Weight

8500	-406, -410	25.2 kg (55.6 lbs)
9500	-406, -410, -415, -420, -425, -430	25.2 kg (55.6 lbs) 25.6 kg (56.4 lbs)

Environment Temp

-10 to 200°C (14 to 392°F)

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

LaserSpeed Pro C-Frame

Designed for steel and non-ferrous metals manufacturing.
Provides highest accuracy and fastest ROI.

The unique electro-optics design enables the LaserSpeed Pro series gauge to produce highly accurate, non-contact length and speed measurements. A fine-tuned optical engine combined with an ultra-stable laser diode enables the LaserSpeed Pro to deliver the highest accuracy in the industry for a measurement precision 20 to 40 times that of mechanical encoders.

The LS Pro 8500-C/LS Pro 9500-C series is an industrial gauge 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 LS Pro 8500-C/LS Pro 9500-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 LS Pro 8500-C/LS Pro 9500-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 and foil mills.



LaserSpeed Pro C-Frame Specifications

LS Pro 8500-C/9500-C	-406	-410
Standoff Distance	195 to 510 mm (7.68 to 20.08 in.)	595 to 910 mm (23.43 to 35.83 in.)
Speed Range	LS8500: 0.8 to 8,000 m/min (2.6 to 26,200 ft/min) LS9500: 0..±8,000 m/min (0..±26,200 ft/min)	LS8500: 1.0 to 12,000 m/min (3.2 to 39,400 ft/min) LS9500: 0..±12,000 m/min (0..±39,400 ft/min)
Measurement Depth of Field	50 mm (2 in.)	100 mm (4.0 in.)

LS Pro 8500-4/LS Pro 9500-3

Ethernet	10/100, UDP, TCP Speed, Length Quality Factor, Status	Accuracy	<±0.03% of reading
Quadrature Pulse	Opto isolated	Repeatability	±0.02%
Output 1	Scaleable pulse amplitude (5-24 V) Selectable pulses/unit 250 KHz max pulse rate	Measurement Rate	LS Pro 8500: >50,000/s LS Pro 9500: >100,000/s
Output 2	RS422 Drivers Selectable pulses/unit 5 MHz max pulse rate	Acceleration Rate	>500 m/s ²
Index Pulse Output	Yes	Starting / Ending Length Correction	No
Gauge Power		Serial I/O	RS-232
LS8500	24VDC (±4 VDC) @ 1.5 Amp	Data Available	Speed, Length Quality Factor, Status
LS9500	24VDC (±4 VDC) @ 2 Amp	Baud Rate	460K, 230K, 115K, 57.6K, 38.4K, 19.2K, 9.6K, 4.8K
		Status via Serial I/O	Sensor at Temperature Laser On Shutter Open Valid Measurements

Specifications are subject to change without notice.

Common Specifications

All LS Pro 8500/LS Pro 9500 Gauges	
User Isolated Voltage	5 to 24 VDC (300 mA)
Temperature Range	5 to 45°C (41 to 113°F)
Relative Humidity	Non-condensing
Water Cooling	1.0 to 3.8 l/min, Typical 1.5 l/min (0.4 gpm)
Degree of Protection	IP67
Output Rate	1 to 2047 ms in 1 ms increments
Units of Measure	Selectable
Speed	m/min, m/s, ft/min, ft/s, in/min, mm/min, yards/min, yards/sec
Length	m, ft, mm, in, yards
Fieldbus Connectivity	Ethernet (ModBus TCP, Ethernet/IP, Profinet IO); Profibus DP
Product Warranty	2 years
Diode Warranty	3 years

Optional Accessories

(for all LS Pro 8500-C/LS Pro 9500-C gauges)

- ▶ **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 Pro Gauges

The following safety features required to comply with the Bureau of Radiological Health Class IIIB 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



Accessories

Gauge	E Housing	X Housing	Item	Description
✓	✓	✓	I/O Module	The I/O module takes the speed, length and status information from the gauge and provides various outputs for simple interfacing to a PLC. Outputs include a parallel I/O format, as well as Profibus or Ethernet fieldbus interfaces. The indicators on the front of the module allow the operator to check the status of the gauge with a quick glance. The module also provides power to the LaserSpeed and a keyswitch to control laser power. The light stack output can control a 24 VDC Red/Yellow/Green light stack.
✓	✓	✓ ¹	Air Wipe/Quick Change Window	Designed for dirtier environments, the airwipe and quick change window help to ensure minimal downtime for cleaning.
	✓	✓ ¹	Beam Path Air Purge	In environments with heavy dust or steam, the laser beam path may need to be cleared for proper measurement. The beam path air purge efficiently accomplishes this with a 20:1 air amplification ratio.
	✓		Right-Angle Mirror Assembly	In some locations, perpendicular mounting of the gauge is not possible. The right-angle mirror assembly provides a mechanism to steer the laser at a 90° angle.
✓			C-Frame Enclosure	Designed to be mounted inside the C-Frame of an X-ray gauge, this enclosure consists of 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 for complete flexibility in optimizing the standoff distance for each application.
✓	✓	✓	Air Services Cabinet	Mill-supplied compressed air is typically laden with dirt and oil, which can adversely affect system performance and increase maintenance requirements. The air services cabinet serves as a filtering and pressure regulating system to supply conditioned air necessary to keep the sensor windows free of these substances. The cabinet can also supply air to the optional beam path air purge.
✓	✓	✓	Water Chiller	When cooling water temperature is outside the 5-40° C range, it is necessary to use a Recirculating Water Chiller/Heater to improve measurement accuracy by stabilizing the optical components. Use of a Recirculating Water Chiller/Heater can also prevent water condensation from forming on the sensor by regulating the sensor temperature above the dew point.
✓	✓	✓	Power Line Conditioner	Available in 50 Hz or 60 Hz versions, the power line conditioner continuously provides clean power (free of power surges and voltage spikes) to the gauge.
	✓	✓	Break-Away Cable (Low Temp)	Low temperature cable connects between the E or X housing and the main cable. Has circular sealed connectors on both ends. Max temperature 90°C. Available in 10 meter length only.
	✓	✓	Break-Away Cable (High Temp)	High temperature cable connects between the E or X housing and the main cable. Has circular sealed connectors on both ends. Max temperature 250°C. Available in 10 meter length only.
✓			Sensor Cable	Cable connects the gauge to breakout box. 25 Pin "D" connector on both ends.
	✓	✓	Sealed Sensor Cable	Cable with submarine circular connector for water tight connection to E and X housing. Connects to breakout box or LaserSpeed Pro I/O module with 37 pin "D" connector. Jacket rated for kerosene and mill coolant. Max temperature 90°C.
✓	✓	✓	Analog Converter	Converter module converts the supplied 0 to 2 VDC speed output to 0 to 10 VDC, 0 to 5 VDC, ±10 VDC, ±5 VDC, 0 to 20 mA or 4 to 20 mA.

¹Comes Standard with LS Pro 8500X/LS Pro 9500X

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Making Light Work