PROTON PRODUCTS

InteliSENS™

Non-Contact Speed & Length

- Accurate, Reliable, Intelligent
- Non-Contact, Zero Slippage, Laser Doppler Technology
- Automatic Direction Detection with Measurement Down to Zero

Advanced Measurement Technologies

...non-contact laser Doppler speed and length measurement:
Proven, rugged, reliable technology for the metals industry

PROTON PRODUCTS is a leading manufacturer of instrumentation and control equipment for industrial processes. The Company is owner-managed and manufactures products that are designed and produced in-house. PROTON PRODUCTS continues to expand its range of technologies and applications with affordable, innovative solutions to improve quality and productivity for its customers.

PROTON PRODUCTS InteliSENS family of non-contact laser Doppler speed and length sensors are robustly engineered for harsh metals industry environments, setting new performance standards for hot mills, cold mills and process lines. Their measurement techniques ensure high accuracy without slippage, drift or mechanical wear. The InteliSENS series has no moving parts for maintenance-free operation and delivers repeatable, precise measurement accuracy of better than ±0.05%

Steel & Aluminum Processes:
- Hot Casting Mills: Slab, billet & bloom
- Roughing Mills
- Hot Rolling Mills
- Cold Rolling Mills
- Finishing Mills
- Leveler Lines
- Inspection Tables
- Pickling Lines
- Tinning and Galvanizing Lines
- Process Lines
- Slitting Lines
- Gauge integration

Speed & Length Applications:
- Mass Flow Measurement
- Rolling Process Elongation Control
- Shear & Slitting Control
- Automatic Gauge Control

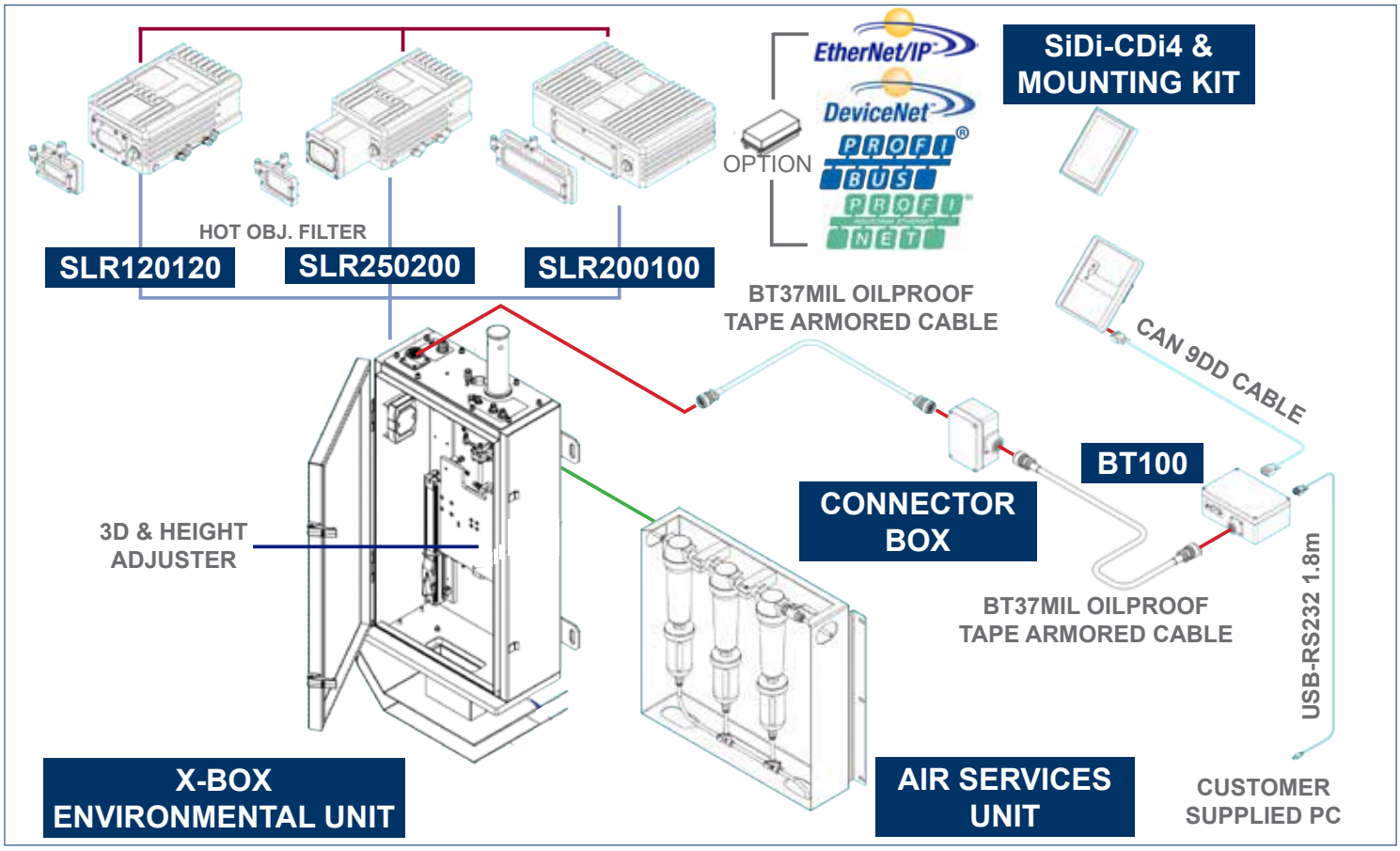
InteliSENS Non-Contact Speed & Length Sensors

Precise, versatile measurement performance for all metals applications

PROTON PRODUCTS Laser Doppler sensors set new standards of performance with non-contact speed and length measurement for all metals applications. They are designed to replace inaccurate, high-wear, high-maintenance, contacting measurement devices:

- **Precise measurement:** Calibrated to UKAS Product Certification delivers accuracy of between ± 0.02% and ± 0.05% for high operator confidence and utilization. Sensors are subjected to temperature cycling tests before final QC testing. Each sensor is supplied with a unique calibration certificate associated with the sensor serial number.
- **High-resolution measurement:** Tracks minute speed and length product movement for hot and cold rolling applications.
- **High reliability:** Solid-state digital technology with no moving parts for rock solid performance.
- **Intelligent communications:** Standard communications protocols for fast commissioning and easy integration with PLC's, DCS, automation platforms, reporting systems and metals gauging equipment.
- **Application-matched designs:** Engineered for all metals processes with stand-off distances ranging from 150mm to 2500mm.
- **X-BOX Extreme Environmental Unit:** Rugged double-wall stainless steel enclosure with air wipes, vortex coolers, water cooling and air amplifiers for hot mill operations.
- **S-BOX Harsh Environmental Unit:** Rugged stainless steel enclosure protects the measurement path from airborne cold rolling mill contaminants.

Hot Mill Solutions



InteliSENS SLR Series Hot Casting Mill Benefits

- Direct strand measurement provides accurate, repeatable cut length control
- Crop shear optimization improves caster yield and reduces downstream scrap with discrete plate, billet and bloom length control
- Accurate speed measurement helps optimize chemistry change, ladle changes, spray practice and other casting process variables
- High-resolution, non-contact speed & length measurement with better than 0.05% accuracy provides highly stable continuous caster operations
- Rugged X-BOX Environmental Unit and its optional accessories provides high-reliability measurement for harsh hot-mill environments

InteliSENS SLR Series Billet & Bloom Benefits

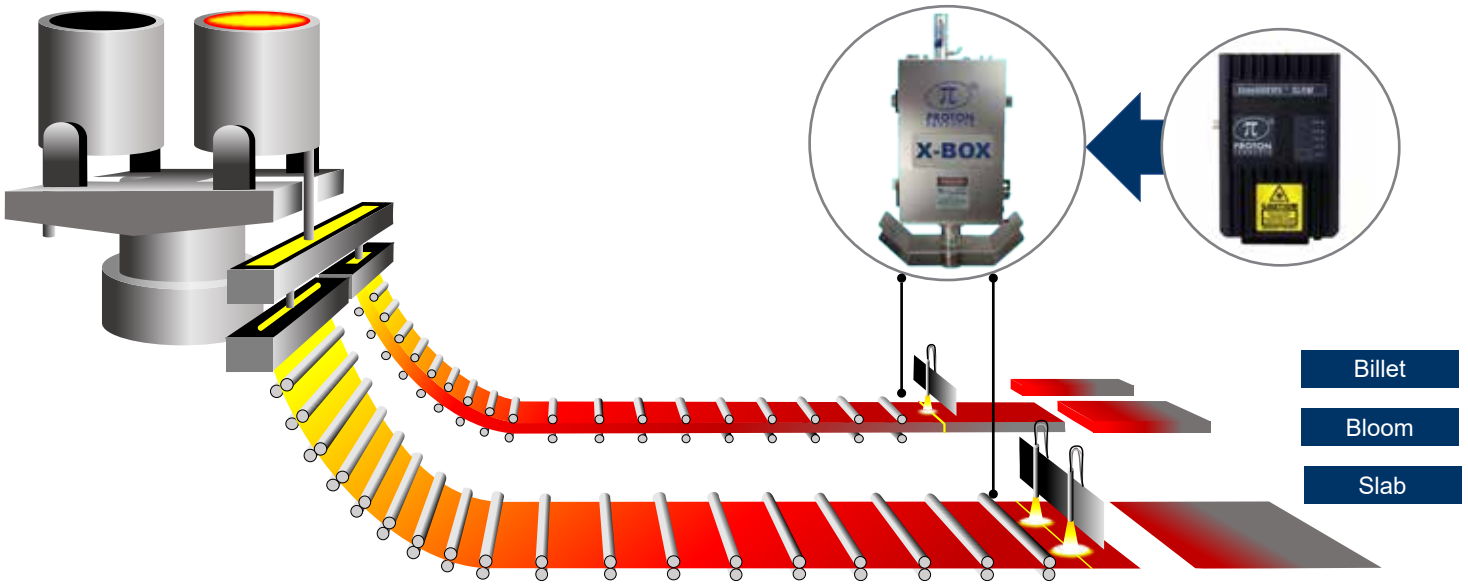
- Communicates with Automatic Gauge Controls (AGC) to accurately position the roller displacement at each stand for precise elongation measurement, optimum mass flow control and efficient rolling mill performance
- Contact output to an on-line shear unit minimizes scrap through accurate marking and cutting of tube, rod & bar products
- Enables process optimization through high-resolution speed and length measurement from standstill through crawl and reversing operations
- Rugged X-BOX Environmental Unit and its optional accessories provides high-reliability measurement for harsh hot-mill rolling environments

Key Specifications

Accuracy	± 0.05%
Internal Measurement Rate	100kHz
Measurement Output Interval	40µ seconds
Minimum/Maximum Line Speed	SLR120120, SLR250200: 0/10,000m/min SLR200100: 0/5000m/min all bi-directional
Standard Communications	Ethernet, RS232, RS422/485
Optional Communications	Ethernet/IP, DeviceNET, PROFIBUS, PROFINET

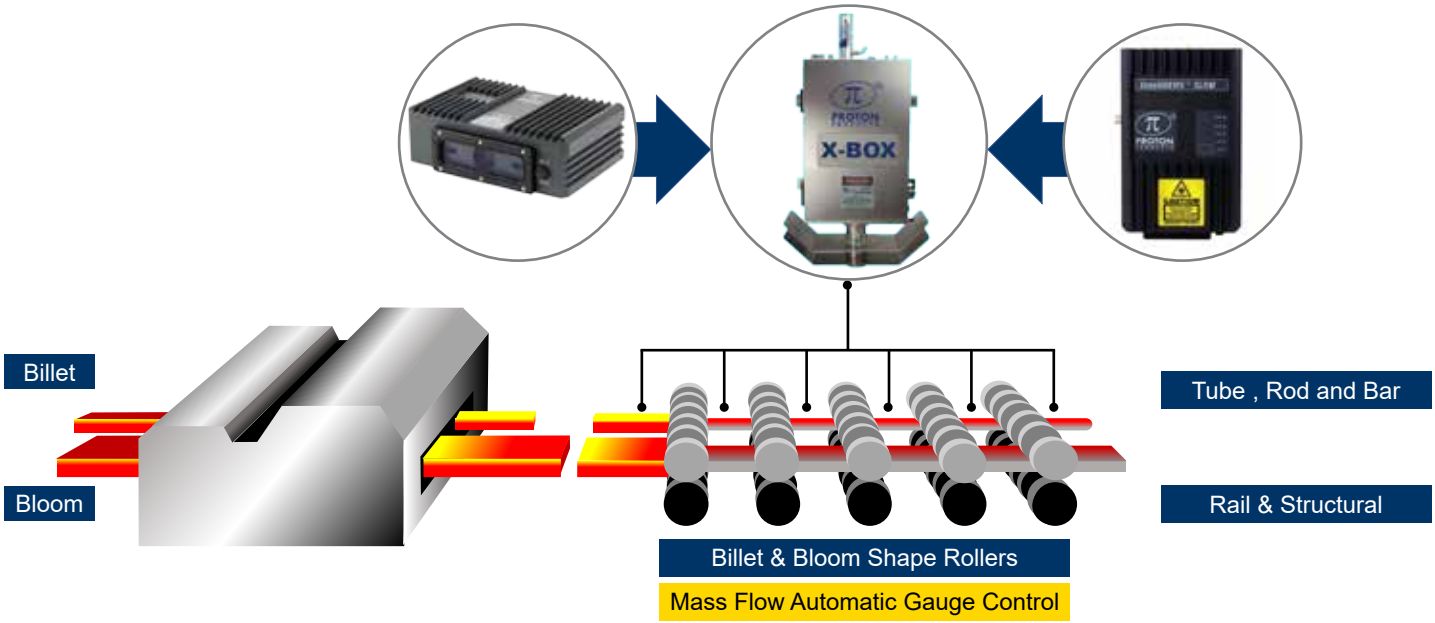
Hot Casting Mill Applications

Billet, Bloom & Slab

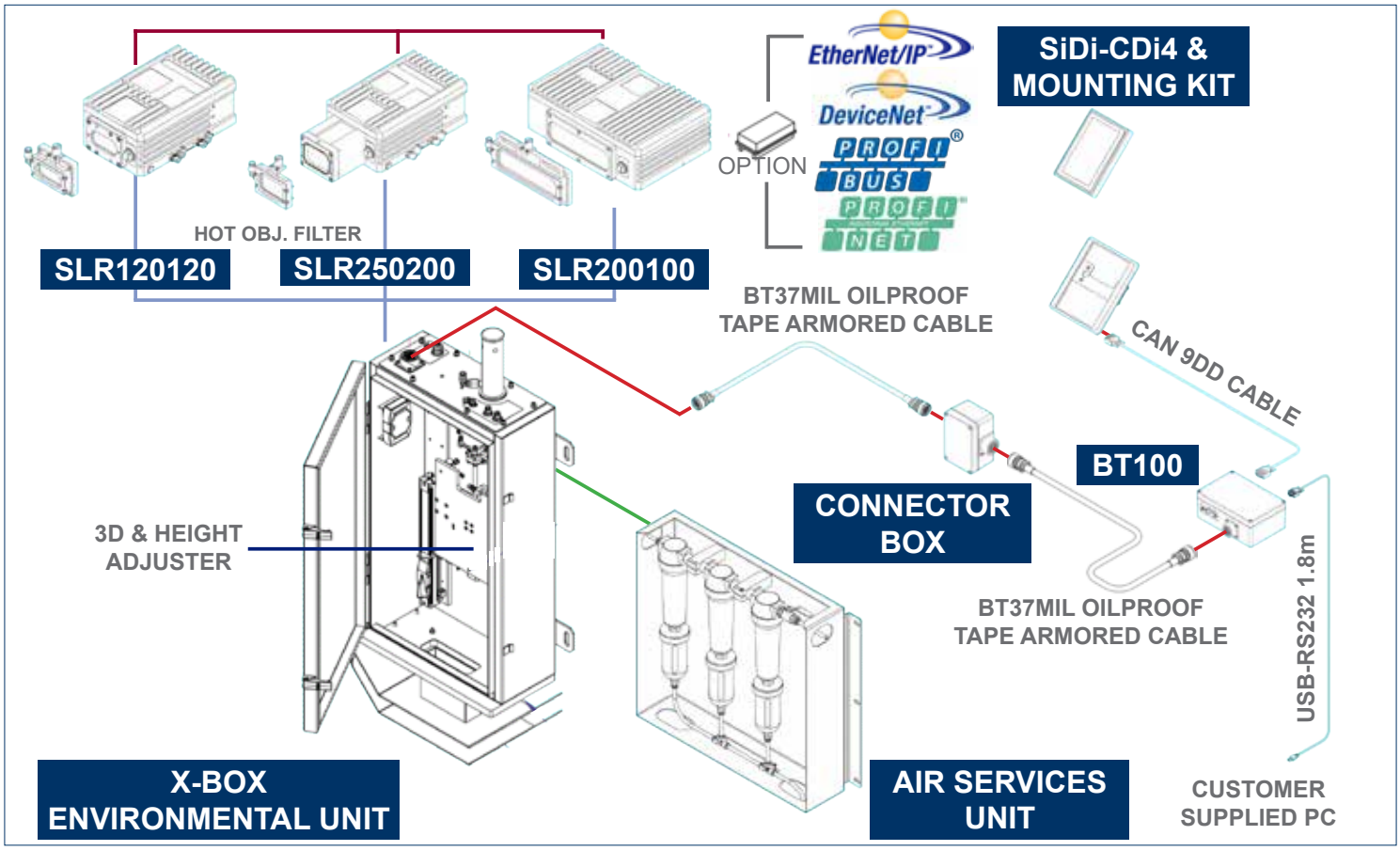


Hot Billet & Bloom Rolling Applications

Tube, Rod, Bar, Rail & Structural



Hot Mill Solutions



InteliSENS SLR Series Hot Roughing & Roughing Mill Benefits

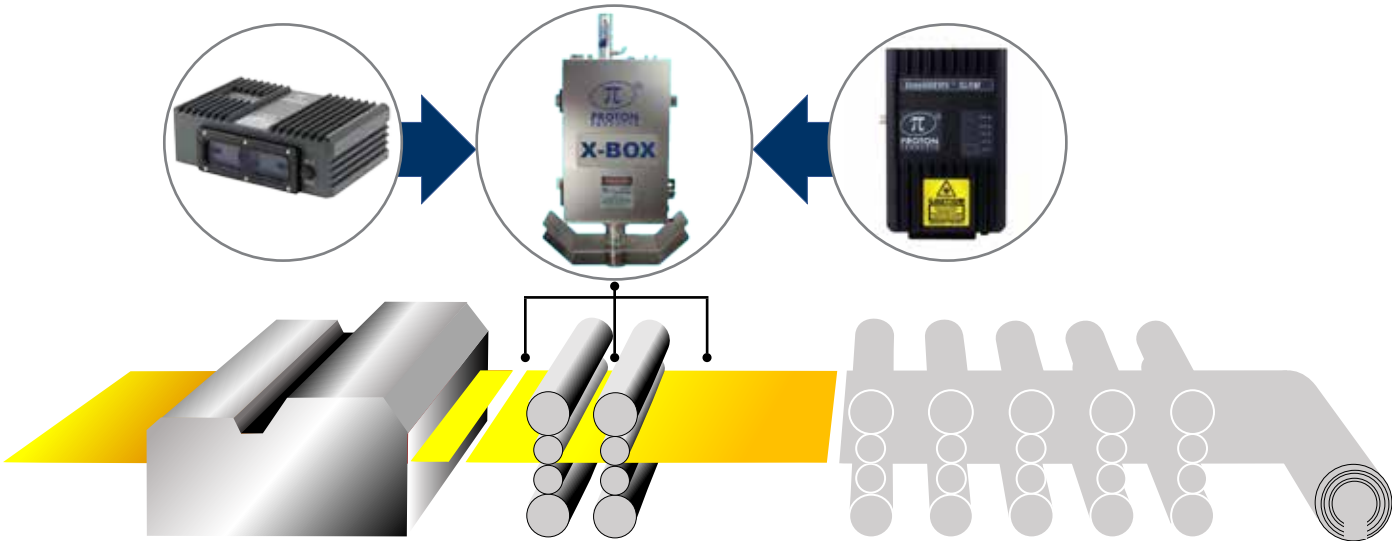
- Communicates with Automatic Gauge Controls (AGC) to accurately position the roller displacement at each stand for precise elongation measurement, optimum mass flow control, maximum reversing mill productivity and high quality
- Speed measurement provides coil box synchronization, crop optimization and cooling control
- Accurate, high-resolution speed and length measurement enables tight process optimization from standstill through crawl and reversing operations
- Contact output to an on-line shear unit minimizes scrap through accurate marking and cutting of discrete lengths
- Rugged X-BOX Environmental Unit and its accessories provides high-reliability measurement for harsh hot-mill environments

Key Specifications

Accuracy	± 0.05%
Internal Measurement Rate	100kHz
Measurement Output Interval	40µ seconds
Minimum/Maximum Line Speed	SLR120120, SLR250200: 0/10,000m/min SLR200100: 0/5000m/min all bi-directional
Standard Communications	Ethernet, RS232, RS422/485
Optional Communications	Ethernet/IP, DeviceNET, PROFIBUS, PROFINET

Hot Roughing Mill Applications

Roughing, Edger and Plate Reversing

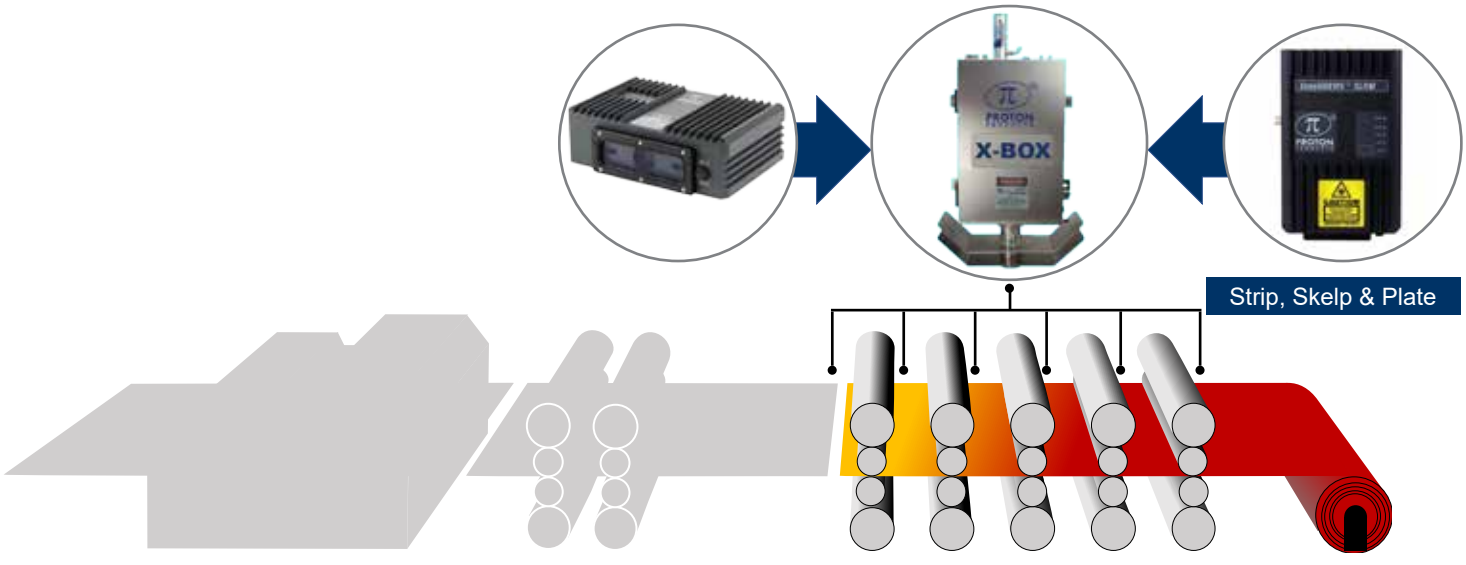


Roughing/Edger/Plate Reversing Mill

Mass Flow Automatic Gauge Control

Hot Rolling Mill Applications

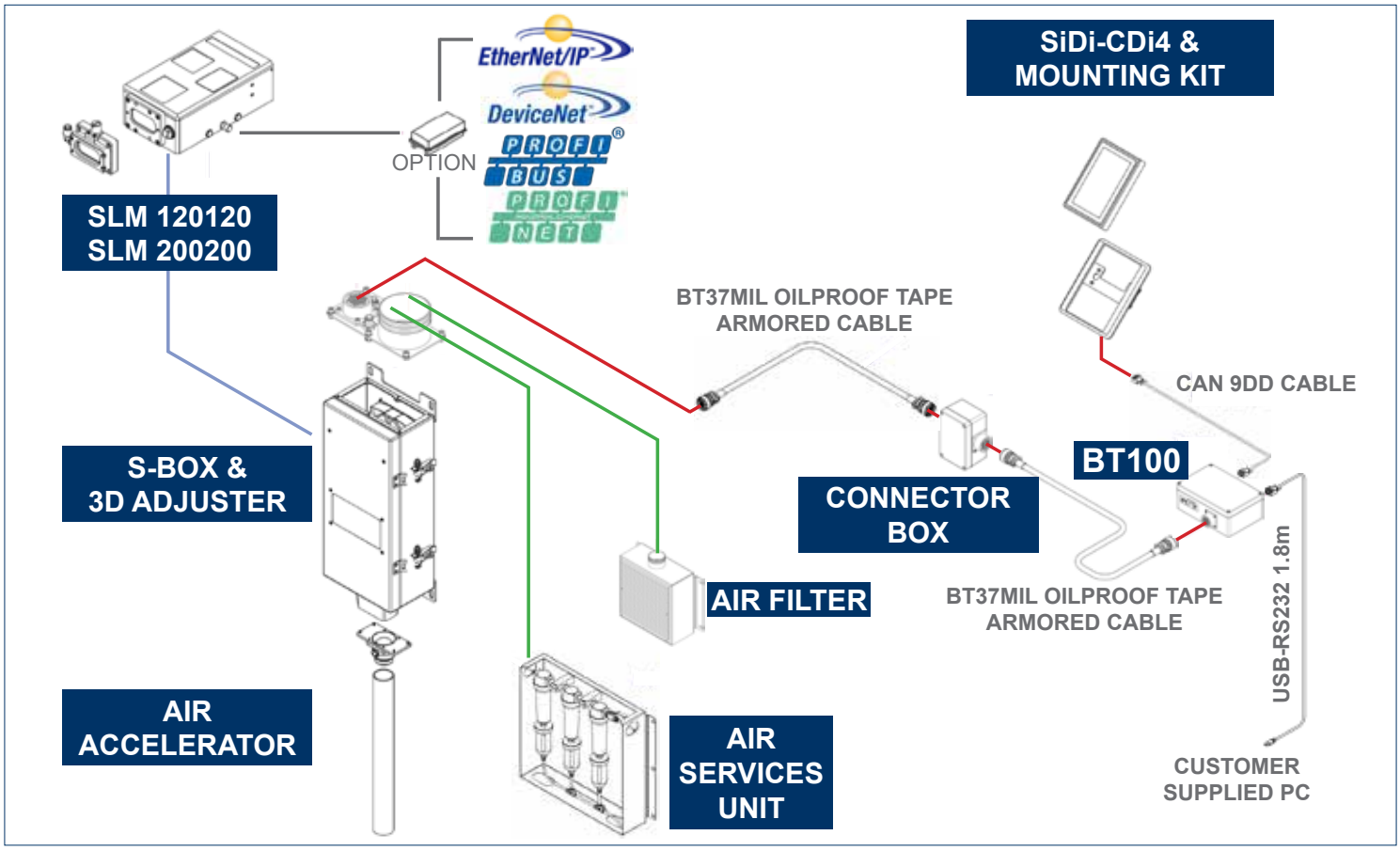
Hot Strip, Skelp & Plate Rolling



Hot Rolling Finishing Mill

Mass Flow Automatic Gauge Control

Cold Rolling Mill Solutions



InteliSENS SLM Series Cold Rolling Mill Benefits

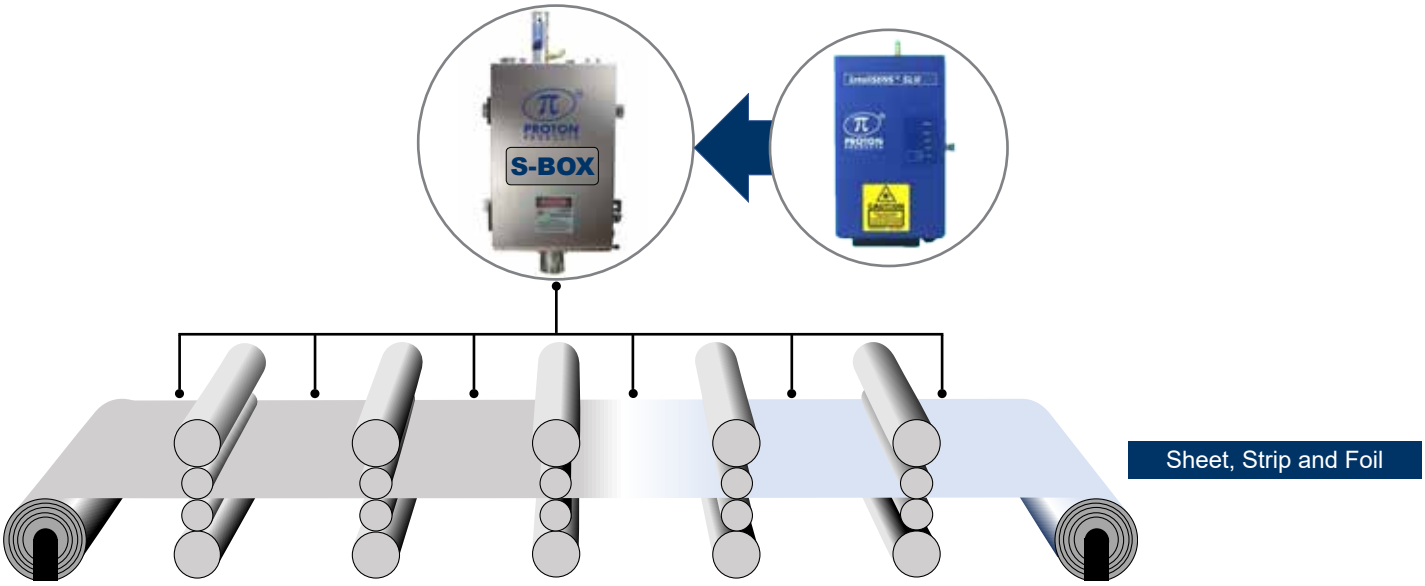
- Communicates with Automatic Gauge Controls (AGC) to accurately position the roller displacement at each stand for precise elongation measurement, optimum mass flow control, maximum cold rolling productivity and high quality
- Accurate, high-resolution speed and length measurement enables process optimization from standstill through crawl and normal running
- Contact output to an on-line shear unit minimizes scrap through accurate marking and cutting of discrete sheet, strip and foil products
- S-BOX Air accelerator removes laminar surface lubricants to provide a clean optical path for greater measurement accuracy and reliability
- Rugged S-BOX Environmental Unit and its optional accessories provides high-reliability measurement performance for harsh cold rolling mill environments

Key Specifications

Accuracy	± 0.05%
Internal Measurement Rate	100kHz
Measurement Output Interval	40µ seconds
Minimum/Maximum Line Speed	0/10,000m/min uni-directional
Standard Communications	Ethernet, RS232, RS422/485
Optional Communications	Ethernet/IP, DeviceNET, PROFIBUS, PROFINET

Cold Rolling Mill Applications

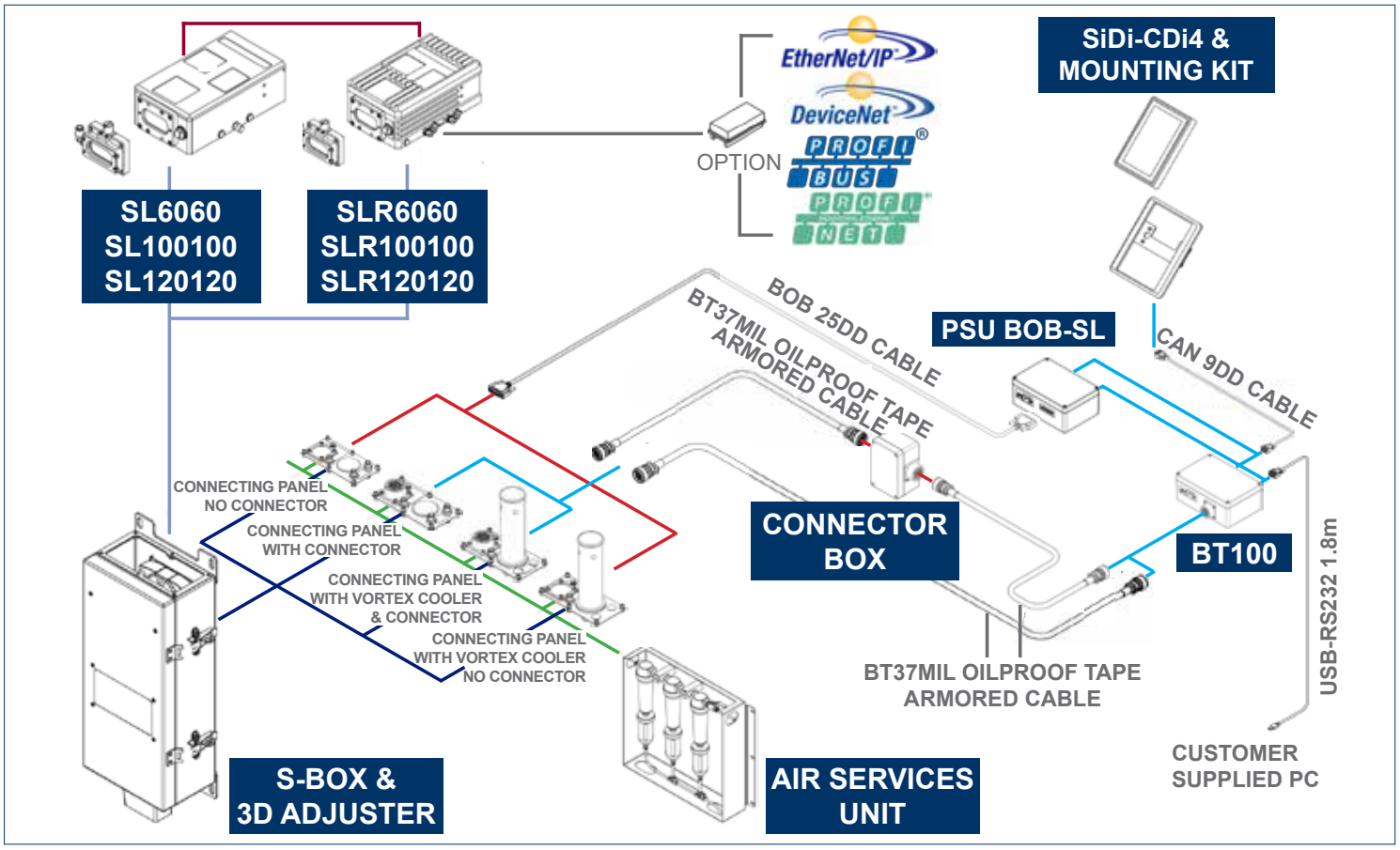
Sheet, Strip & Foil



Optimize Cold Rolled Products with AGC

... balance multi-stand rolling operations for increased productivity

Metals Coating Solutions



InteliSENS SL/SLR Series Metals Coating Benefits

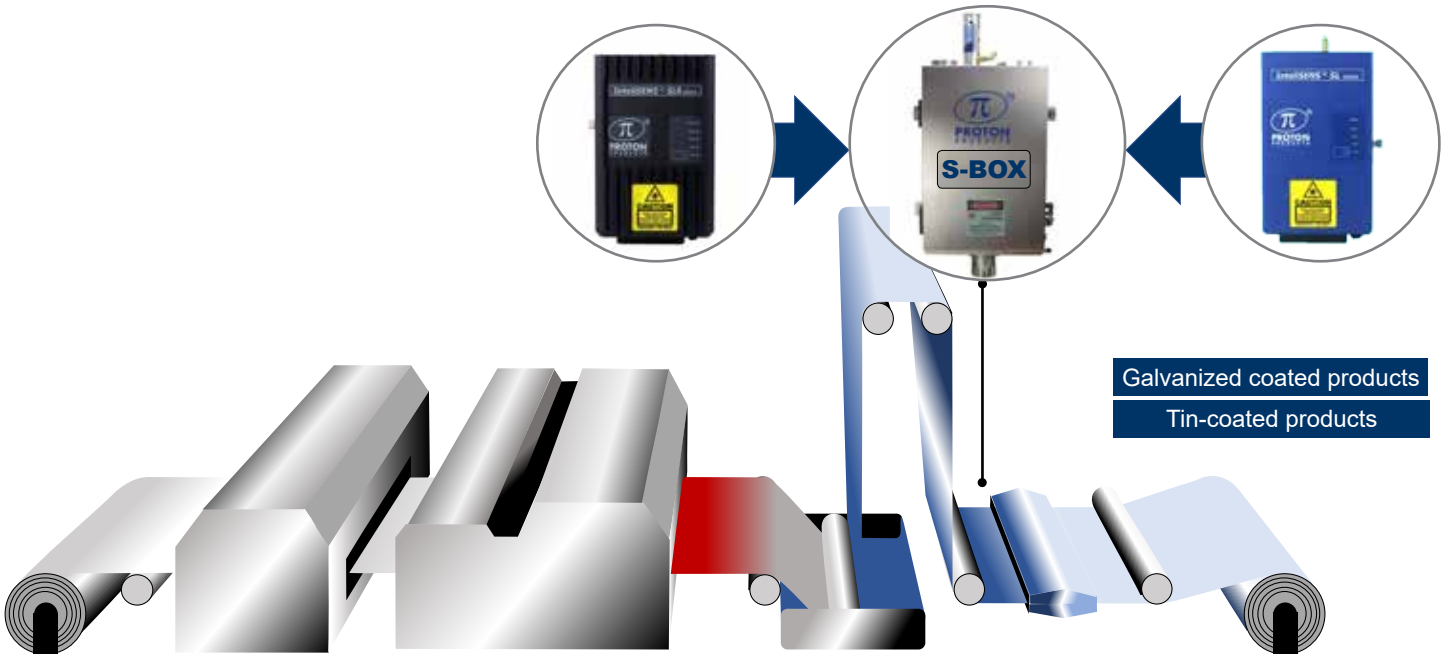
- Non-contact measurement avoids surface marking of coated finishes
- Accurate measurement without slippage, bounce or dirt accumulation
- Coordinated coat weight control efficiency during production transitions is considerably improved with accurate speed measurement
- High-resolution, non-contact speed & length measurement provides stable line speed control for uniform machine direction coat weight distribution
- Contact output to an on-line shear unit minimizes scrap through accurate marking and cutting of discrete coil lengths
- Rugged S-Box Environmental Unit and its optional accessories protects the sensor and measurement path from airborne contaminants

Key Specifications

Accuracy	± 0.05%
Internal Measurement Rate	200kHz
Measurement Output Interval	20µ seconds
Minimum/Maximum Line Speed	0.82/5,000m/min
Standard Communications	Ethernet, RS232, RS422/485
Optional Communications	Ethernet/IP, DeviceNET, PROFIBUS, PROFINET

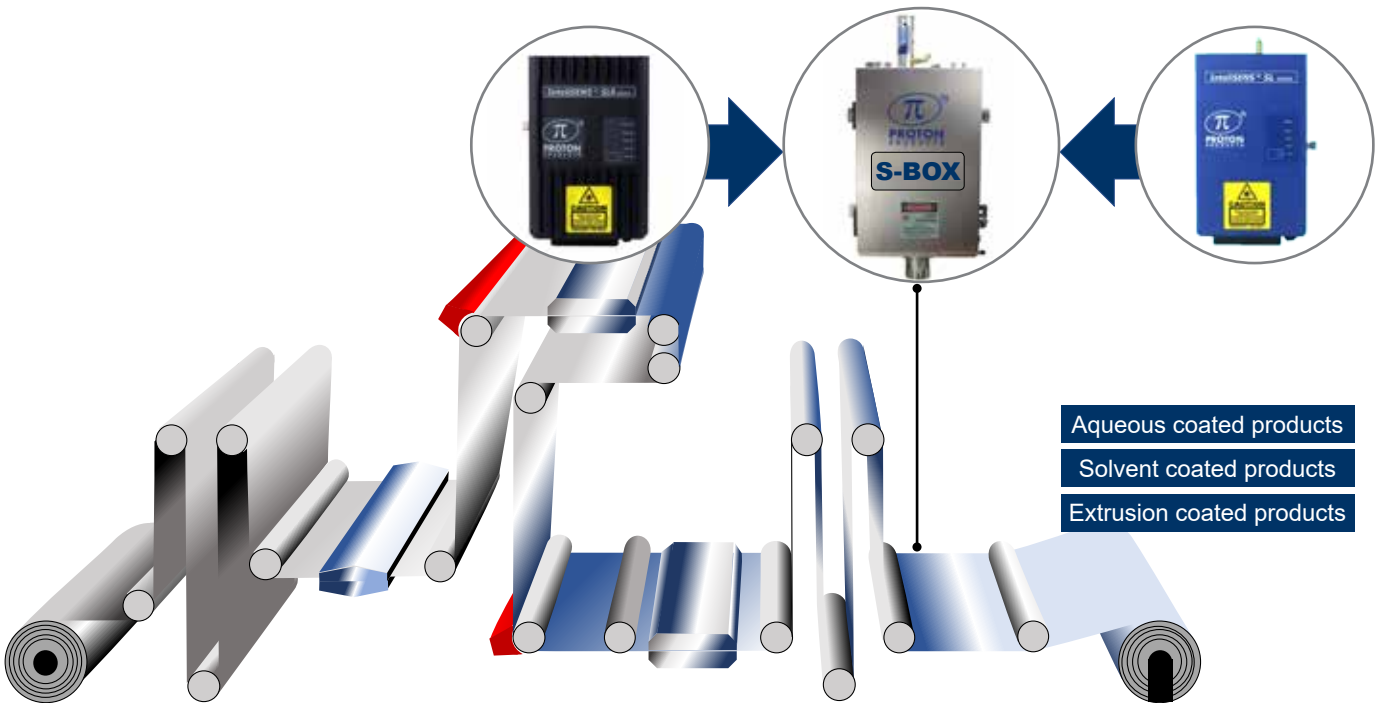
Metals Coating Applications

Galvanizing & Tinning

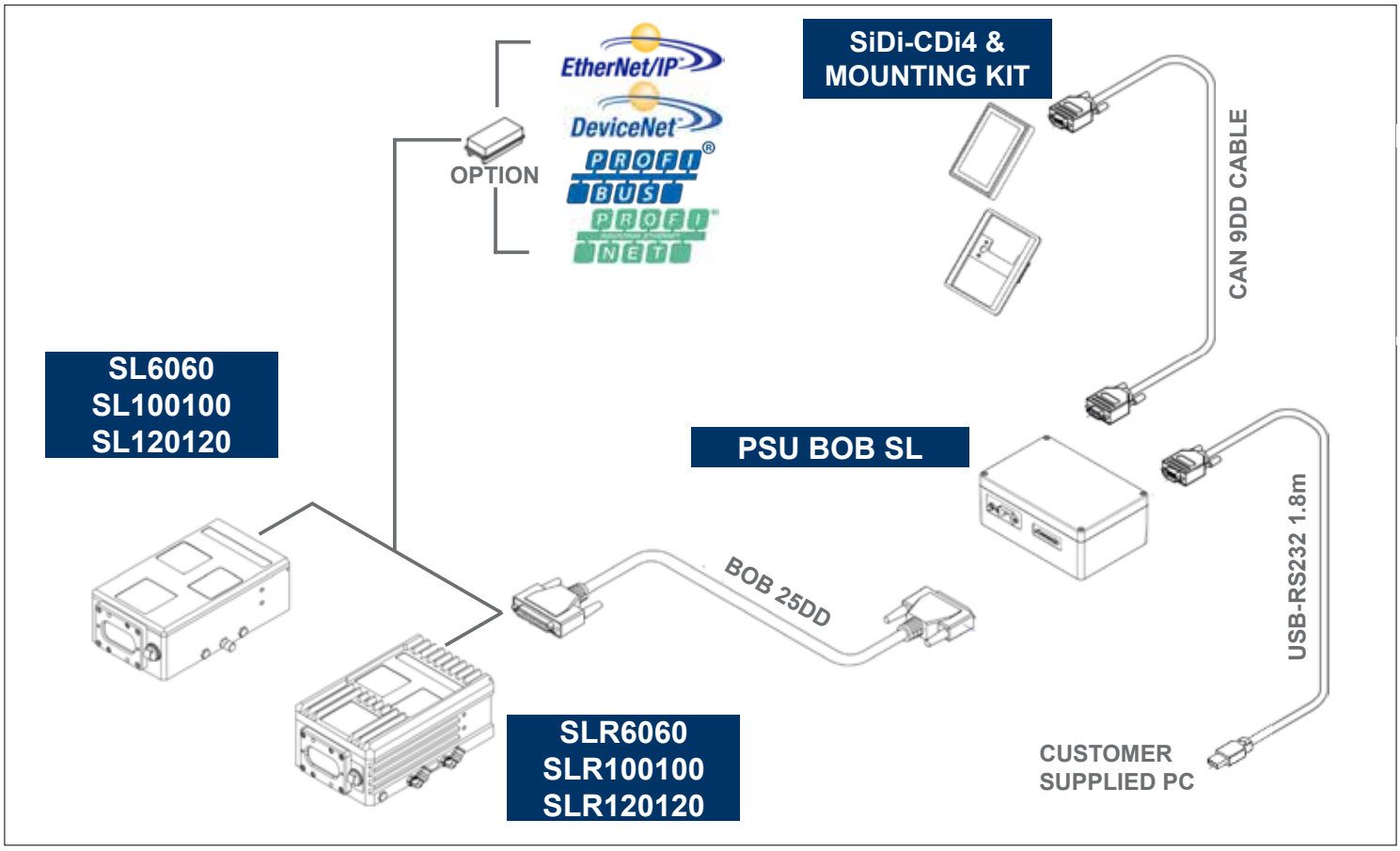


Metals Coating Applications

Solvent, Aqueous or Extrusion Metals Coatings



Process Converting Lines & Gauge Integration



InteliSENS SL/SLR Series Converting Line Benefits

- High measurement accuracy without slippage, bounce or dirt accumulation as with contacting encoders
- Rugged, reliable industrial design for many process line converting applications
- Precise speed and length measurement during line crawl and reversing operations
- Supports marking and cutting controls for discrete coil and metals foil lengths via a contact output to an on-line process shear
- Accurate cut length control avoids high value-add product give-away and short length delivery complaints

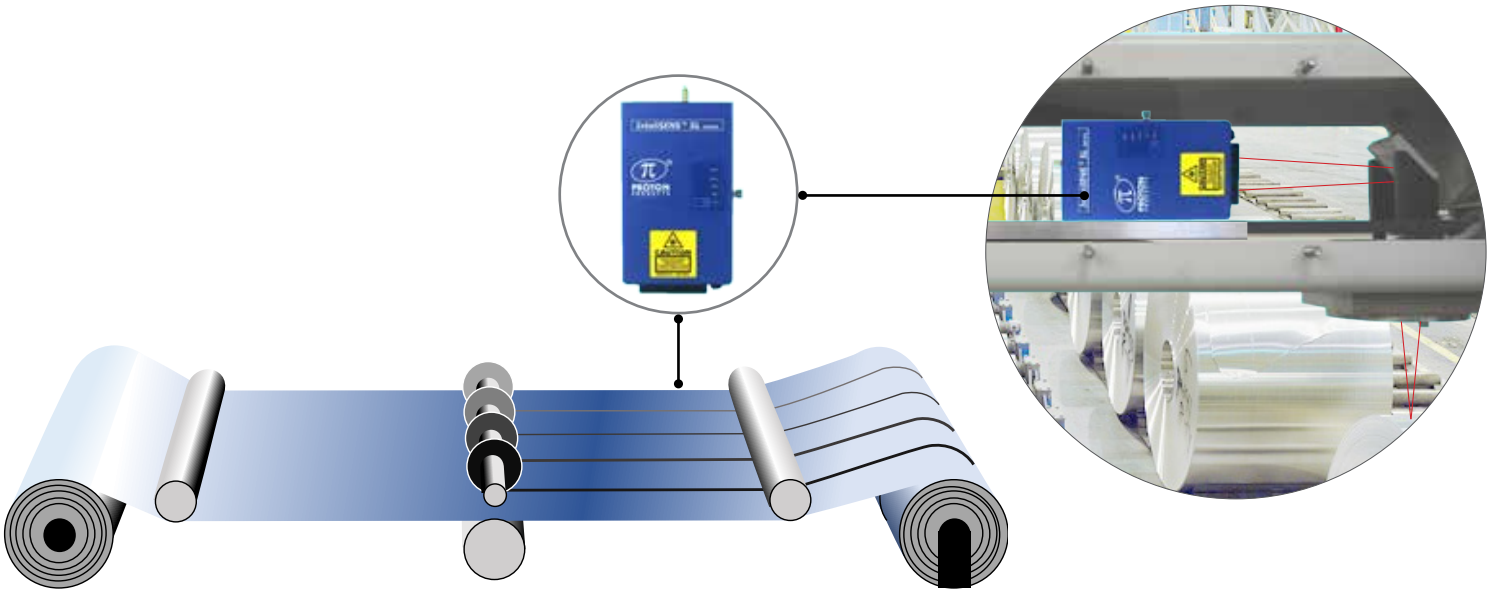
InteliSENS SL/SLR Series Gauge Integration Benefits

- Straightforward, cost-effective measurement integration solution with on-line thickness gauges without complex interconnections/ power supplies/communications devices/ air systems or environmental equipment

Key Specifications

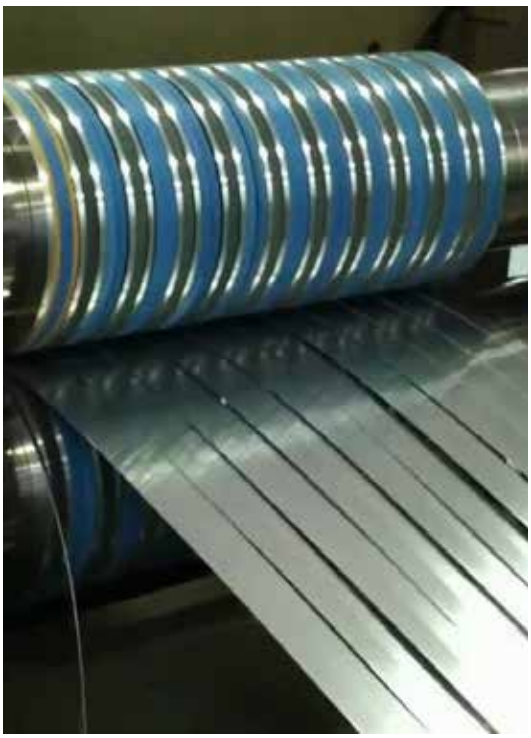
Accuracy	± 0.05%
Internal Measurement Rate	100kHz
Measurement Output Interval	40µ seconds
Minimum/Maximum Line Speed	0.82/5,000m/min
Standard Communications	Ethernet, RS232, RS422/485
Optional Communications	Ethernet/IP, DeviceNET, PROFIBUS, PROFINET

Process Lines & On-Line Gauging Applications



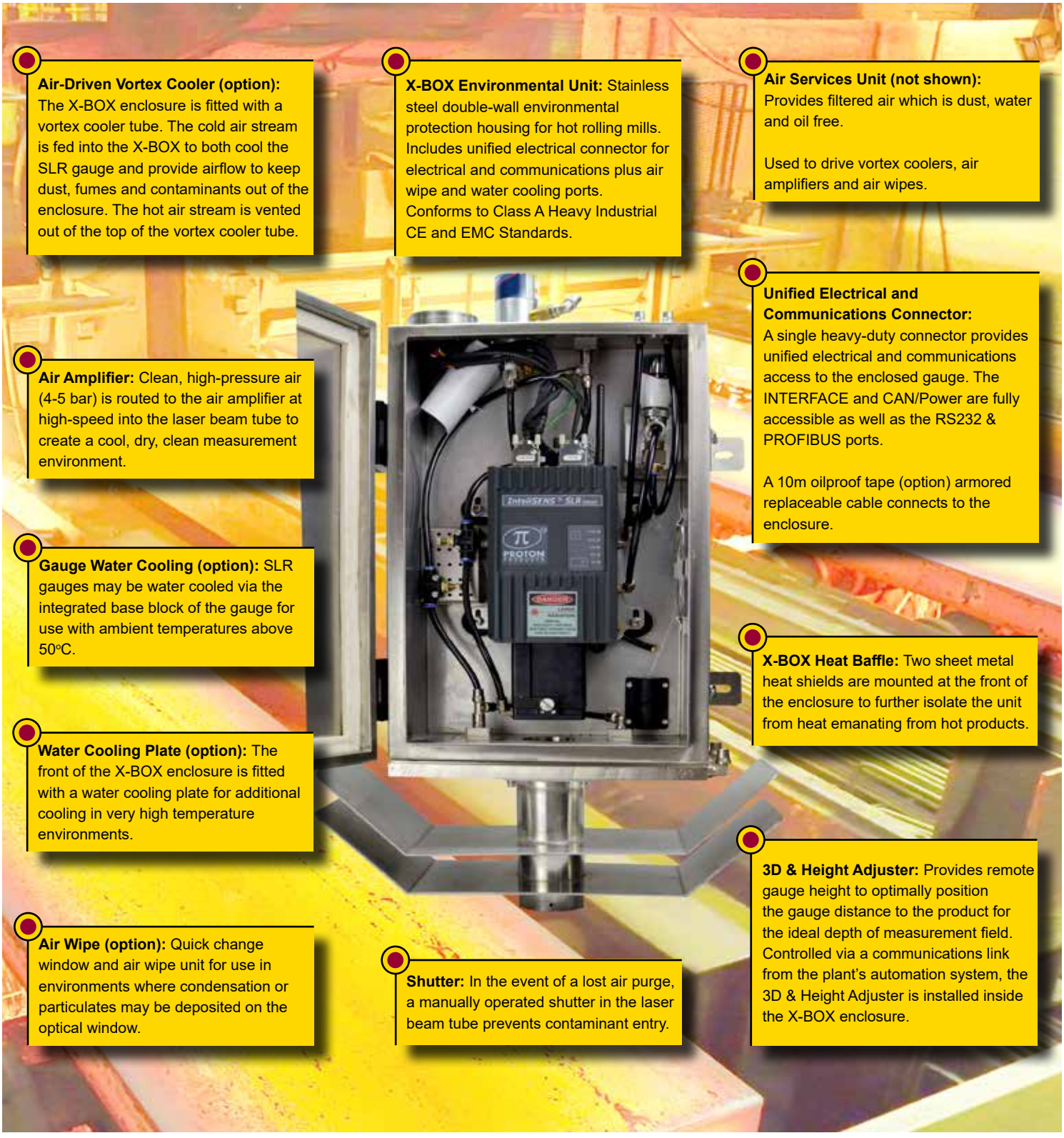
Precision Cut-to Length Converted Products

...avoids product give-away and short-length delivery



X-BOX for Extreme Hot Mill Environments

The Ultimate Protection for Reliable Measurement



Air-Driven Vortex Cooler (option): The X-BOX enclosure is fitted with a vortex cooler tube. The cold air stream is fed into the X-BOX to both cool the SLR gauge and provide airflow to keep dust, fumes and contaminants out of the enclosure. The hot air stream is vented out of the top of the vortex cooler tube.

X-BOX Environmental Unit: Stainless steel double-wall environmental protection housing for hot rolling mills. Includes unified electrical connector for electrical and communications plus air wipe and water cooling ports. Conforms to Class A Heavy Industrial CE and EMC Standards.

Air Services Unit (not shown): Provides filtered air which is dust, water and oil free.

Used to drive vortex coolers, air amplifiers and air wipes.

Unified Electrical and Communications Connector: A single heavy-duty connector provides unified electrical and communications access to the enclosed gauge. The INTERFACE and CAN/Power are fully accessible as well as the RS232 & PROFIBUS ports.

A 10m oilproof tape (option) armored replaceable cable connects to the enclosure.

Air Amplifier: Clean, high-pressure air (4-5 bar) is routed to the air amplifier at high-speed into the laser beam tube to create a cool, dry, clean measurement environment.

Gauge Water Cooling (option): SLR gauges may be water cooled via the integrated base block of the gauge for use with ambient temperatures above 50°C.

X-BOX Heat Baffle: Two sheet metal heat shields are mounted at the front of the enclosure to further isolate the unit from heat emanating from hot products.

Water Cooling Plate (option): The front of the X-BOX enclosure is fitted with a water cooling plate for additional cooling in very high temperature environments.

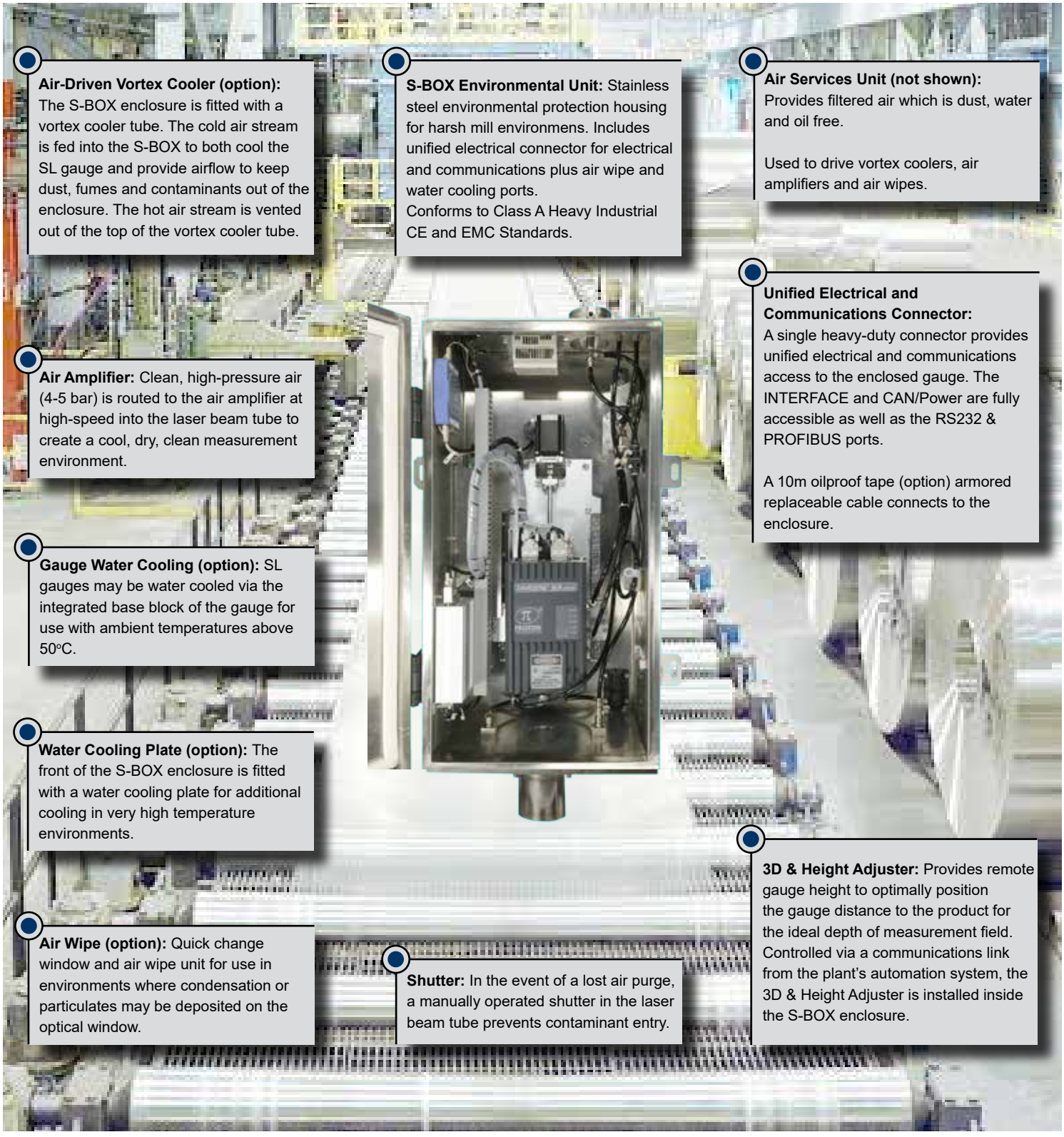
3D & Height Adjuster: Provides remote gauge height to optimally position the gauge distance to the product for the ideal depth of measurement field. Controlled via a communications link from the plant's automation system, the 3D & Height Adjuster is installed inside the X-BOX enclosure.

Air Wipe (option): Quick change window and air wipe unit for use in environments where condensation or particulates may be deposited on the optical window.

Shutter: In the event of a lost air purge, a manually operated shutter in the laser beam tube prevents contaminant entry.

S-BOX for Rolling Mill & Harsh Process Environments

Measurement Protection from Airbourne Contaminants



Air-Driven Vortex Cooler (option): The S-BOX enclosure is fitted with a vortex cooler tube. The cold air stream is fed into the S-BOX to both cool the SL gauge and provide airflow to keep dust, fumes and contaminants out of the enclosure. The hot air stream is vented out of the top of the vortex cooler tube.

S-BOX Environmental Unit: Stainless steel environmental protection housing for harsh mill environmens. Includes unified electrical connector for electrical and communications plus air wipe and water cooling ports.
Conforms to Class A Heavy Industrial CE and EMC Standards.

Air Services Unit (not shown): Provides filtered air which is dust, water and oil free.

Used to drive vortex coolers, air amplifiers and air wipes.

Unified Electrical and Communications Connector: A single heavy-duty connector provides unified electrical and communications access to the enclosed gauge. The INTERFACE and CAN/Power are fully accessible as well as the RS232 & PROFIBUS ports.

A 10m oilproof tape (option) armored replaceable cable connects to the enclosure.

Air Amplifier: Clean, high-pressure air (4-5 bar) is routed to the air amplifier at high-speed into the laser beam tube to create a cool, dry, clean measurement environment.

Gauge Water Cooling (option): SL gauges may be water cooled via the integrated base block of the gauge for use with ambient temperatures above 50°C.

Water Cooling Plate (option): The front of the S-BOX enclosure is fitted with a water cooling plate for additional cooling in very high temperature environments.

3D & Height Adjuster: Provides remote gauge height to optimally position the gauge distance to the product for the ideal depth of measurement field. Controlled via a communications link from the plant's automation system, the 3D & Height Adjuster is installed inside the S-BOX enclosure.

Air Wipe (option): Quick change window and air wipe unit for use in environments where condensation or particulates may be deposited on the optical window.

Shutter: In the event of a lost air purge, a manually operated shutter in the laser beam tube prevents contaminant entry.

InteliSENS SLR Series: Hot casting mill and hot rolling mills

Measurement Configuration

InteliSENS SLR Series Bi-Directional Measurement	SLR200100: Min Speed 2.7m/min. Min. Cut Speed 0.13m/min SLR120120: Min Speed 4.0m/min. Min. Cut Speed 0.2m/min SLR250200: Min Speed 2.9m/min. Min. Cut Speed 0.2m/min Hot object filter
X-BOX Environmental Unit	Air-Driven Vortex Cooler Air Amplifier Gauge Water Cooling Plate (option) Air Wipe (option) Shutter 3D & Height Adjuster (option) Heat Baffle Shield Plates Unified Electrical & Communications Connectors
Oilproof, Armored Cable	Connects between X-BOX and BT 100. Breakaway cable reduces replacement time, cost & sensor damage. 10m oilproof, tape-armored cable.
Connector Box	Breakaway connector box protects equipment in event of process damage.
BT100	Power supply and cable connection to the SLRXC Box. Includes DB9 connectors to access CAN, RS-232 and PROFIBUS ports. Supplies 24Vdc sensor power.
Air Services Unit	Supplies clean purge air for vortex coolers, air amplifiers and air wipes.
SiDi-CDi4 Display & Mounting Kit	Slimline color touch screen that connects via a CANbus cable. Enables the user to configure all measured parameters. including trending and graphical data.
USB-RS232	Converter cable RS232 9 Pin D type connector on one end and a USB connector on the other

SLR Series	SLR120120	SLR200100	SLR250200
Stand-off distance mm (in)	1200 (47.2)	2000 (78.7)	2500 (98.4)
Depth of field mm (in)	120 (4.72)	150 (5.91)	200 (7.87)
Maximum speed m/min (ft/min)	10000 (32800)	5000 (16400)	10000 (32800)
Measurement update rate (kHz)	100	100	100
Measurement output rate (µs)	40	40	40

InteliSENS SL Series: Cold rolling mills

Measurement Configuration

InteliSENS SL Series Uni-Directional Measurement	SL120120 SL200200
S-BOX Environmental Unit	Air-Driven Vortex Cooler Air Amplifier Gauge Water Cooling Plate (option) Air Wipe (option) Shutter Gauge Positioner Slider Unified Electrical & Communications Connectors
Oilproof, Armored Cable	Connects between the S-BOX and the Connector Box. Breakaway cable reduces replacement time, cost & sensor damage. 10m oilproof, tape-armored cable
Connector Box	Breakaway connector box protects equipment in event of process damage.
BT100	Power supply and cable connection to the S- BOX. Includes DB9 connectors to access CAN, RS-232 and PRO-FIBUS ports. Supplies 24Vdc sensor power.
Air Services Unit	Supplies clean purge air for vortex coolers, air amplifiers and air wipes.
SiDi-CDi4 Display & Mounting Kit	Slimline color touch screen that connects via a CANbus cable. Enables the user to configure all measured parameters. including trending and graphical data.
USB-RS232	Converter cable RS232 9 Pin D type connector on one end and a USB connector on the other

SL Series	SL120120	SL200200
Stand-off distance mm (in)	1200 (47.2)	2000 (78.7)
Depth of field mm (in)	120 (4.72)	200 (7.87)
Maximum Speed m/min (ft/min)	10000 (32800)	10000 (32800)
Measurement update rate (kHz)	100	100
Measurement output rate (µs)	40	40

InteliSENS SL/SLR Series: Process coating lines

Measurement Configuration

InteliSENS SL Series SL: Uni-Directional SLR: Bi-Directional	SL/SLR6060 SL/SLR100100 SL/SLR120120
S-BOX Environmental Unit	Air-Driven Vortex Cooler Air Amplifier Gauge Water Cooling Plate (option) Air Wipe (option) Shutter Gauge Positioner Slider Unified Electrical & Communications Connectors
Oilproof, Armored Cable	Connects between the S-Box and the Connector Box. Breakaway cable reduces replacement time, cost & sensor damage. 10m oilproof, tape-armored cabl
PSU-BOB-SL	Power supply, break-out box, laser safety key switch. Connects via DB25 interface and supplies 24Vdc to the sensor. Input voltage range 90-260Vac @ 45-65Hz
BOB 25DD Cable	Connects the sensor interface port to a PSU-BOB-SL , terminal strip or CS1G-SL. Lengths are 3m, 5m, 10m, 20m, 30m
SiDi-CDi4 Display & Mounting Kit	Slimline color touch screen that connects via a CANbus cable. Enables the user to configure all measured parameters. including trending and graphical data.
USB-RS232	Converter cable RS232 9 Pin D type connector on one end and a USB connector on the other

SL/SLR Series	SLR6060	SLR100100	SLR120120	SL6060	SL100100	SL120120
Stand-off distance mm (in)	600 (23.6)	1000 (39.37)	1200 (47.2)	600 (23.6)	1000(39.37)	1200(47.2)
Depth of field mm (in)	60 (2.36)	100 (3.94)	120 (4.72)	60 (2.36)	100 (3.94)	120 (4.72)
Max speed ± m/min (± ft/min)	5000 (16400)	10000 (32800)	10000 (32800)	5000 (16400)	10000(32800)	10000(32800)
Measurement update rate (kHz)	100	100	100	100	100	100
Measurement output rate (µs)	40	40	40	40	40	40

InteliSENS SL/SLR Series: Converting lines & gauge integration

Measurement Configuration

InteliSENS SL Series SL: Uni-Directional SLR: Bi-Directional	SL/SLR6060 SL/SLR100100 SL/SLR120120
PSU-BOB-SL	Power supply, break-out box, laser safety key switch. Connects via DB25 interface and supplies 24Vdc to the sensor. Input voltage range 90-260Vac @ 45-65Hz
BOB 25DD Cable	Connects the sensor interface port to a PSU-BOB-SL , terminal strip or CS1G-SL. Lengths are 3m, 5m, 10m, 20m, 30m
SiDi-CDi4 Display & Mounting Kit	Slimline color touch screen that connects via a CANbus cable. Enables the user to configure all measured parameters. including trending and graphical data.
USB-RS232	Converter cable RS232 9 Pin D type connector on one end and a USB connector on the other

SL/SLR Series	SLR6060	SLR100100	SLR120120	SL6060	SL100100	SL120120
Stand-off distance mm (in)	600 (23.6)	1000 (39.37)	1200 (47.2)	600 (23.6)	1000(39.37)	1200(47.2)
Depth of field mm (in)	60 (2.36)	100 (3.94)	120 (4.72)	60 (2.36)	100 (3.94)	120 (4.72)
Max speed ± m/min (± ft/min)	5000 (16400)	10000 (32800)	10000 (32800)	5000 (16400)	10000(32800)	10000(32800)
Measurement update rate (kHz)	100	100	100	100	100	100
Measurement output rate (µs)	40	40	40	40	40	40

InteliSENS Operation and General Specifications

Innovative, hi-spec speed & length sensors

Principle of Operation

$$d = \frac{\lambda}{2 \sin K}$$

- Fringe spacing is a function of laser wavelength and beam angle

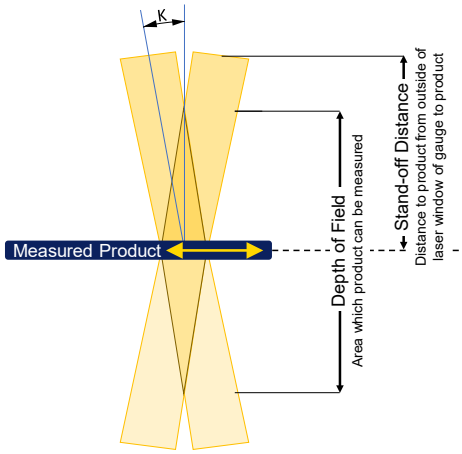
$$f \propto \frac{v}{d}$$

- Doppler frequency is proportional to speed and inversely proportional to fringe spacing

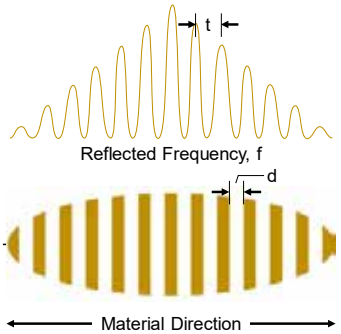
$$L = \int_0^T dvt$$

- Speed is integrated to measure length

Dual Laser Beams Side View



Laser Doppler Pattern



Doppler pattern created at the point where beams converge. Doppler pattern not visible to the human eye

- A Bragg Cell is incorporated into the SLRM and SLR sensors for 'standstill' reversing mill measurement

General Specifications

Measurement Units (Configurable)	Speed	meters/minute	feet/minute		
	Length	meters	feet	yards	
Laser Safety Control Inputs	Laser	External closed SPST contact enabled laser diode			
	Shutter	External closed SPST contact opens laser shutter			
2x Logic Inputs (Configurable)	Electrical	Maximum voltage: +24Vdc			
	Function	Length reset	Display Hold	Length Hold	
		Speed hold	Direction	Pause	
3x Relay Outputs (Configurable)	Electrical	Isolated floating relay contacts			
		Maximum voltage 50Vdc	Maximum current: 0.5A		
	Function	Gauge OK	Laser at temp	Shutter open	Laser on
		Measuring	Preset length 1	Preset length 2	
3x Pulse Outputs (Configurable)	Electrical	Opto-isolated differential pairs			
		Output voltage: 5V or user supplied (up to 24v)			
		Maximum frequency: 250kHz			
	Function	Quadrature	Index		
Analog Output (Configurable)	Electrical	Output voltage: 0 to 10v (end-user scalable)			
	Function	Speed	Good readings		
CANbus Communications		Connects to an optional PROTON PRODUCTS AiG2 interface display unit			
Serial Communications		RS232	RS-422 / 485		
Optional Communications (Factory installed, choice of one)		PROFIBUS	Ethernet/IP	DeviceNET	
Optional wireless communications (Factory installed)		Bluetooth			

InteliSENS Speed & Length Measurement:

Application-matched speed & length measurement for RESULTS

InteliSENS Speed & Length Measurement

... Innovative, robust measurements for the Metals Industries

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