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|--|--|--|---|--|--|
|  Single turn absolute position sensor VRE |  Multi turn absolute position sensor MRE |  Single turn absolute heavy-duty position sensor VRE |  Multi turn absolute heavy-duty position sensor MRE |  Dual rod absolute linear sensor VLS |  Single rod 1 pitch linear sensor VLS |
|  Heavy duty linear sensor for AGC VLS-8SM |  Cylinder in-rod linear sensor IRS |  Smart linear position cylinder CYLNUC |  Magnet proximity sensor ABSO PX |  Eddy current displacement EZ-GAP |  Magnetic reluctance tension detect VR Tension |
|  Non contact & wireless power transfer ABSOCOUPLER |  Non contact & wireless temperature transfer ABSOCOUPLER |  Silver alloy slip-ring BAUMCOUPLER |  Network Electro-Magnetic Rotary Sensor ezABSO |  Pulse Count Selectable Electro-Magnetic Rotary Sensor ezABSO |  Pulse output converter ABSO PULPUL |
|  Switch output controller for VRE VARICAM |  Switch output controller with motion-control VARILIMIT |  Mitsubishi Melsec-Q PLC built-in controller VS-QA62 |  Mitsubishi Melsec IQ-R PLC built-in controller VS-R262 |  Binary / Gray output converter NCV-20 |  DeviceNet converter NCV-DN |
|  EtherNet/IP converter NCW-3DH |  SSI converter NCV-SSI |  SIEMENS profibus controller NCW-3DH |  SIEMENS profinet controller NCW-3DH |  TMEIC PLC built-in controller AB93 |  PLC built-in controller YASKAWA 2YE FUJI NCV-HFE |

NSD



POSITIONING YOU FOR SUCCESS


SENSOR SOLUTION

Best Position Sensor for Extremely Harsh Environments

SENSOR SOLUTION

When They Go Cost We Go Solution

Heavy Duty and
Fully Absolute Position Sensor,
ABSOCODER

NSD Corporation,
we focus on the solution,
not the problem

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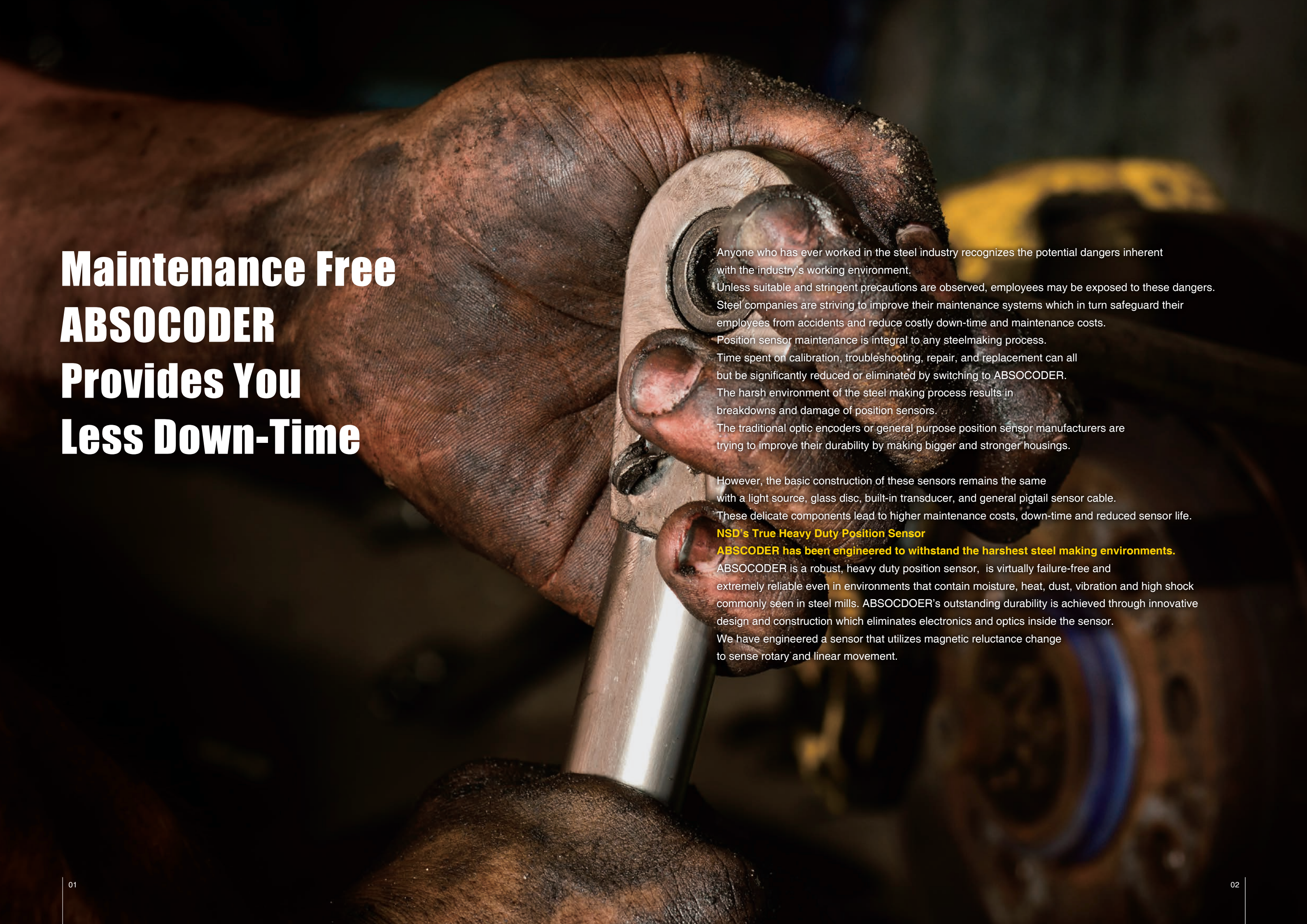
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NSP-15002-4

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Maintenance Free ABSOCODER Provides You Less Down-Time

Anyone who has ever worked in the steel industry recognizes the potential dangers inherent with the industry's working environment.

Unless suitable and stringent precautions are observed, employees may be exposed to these dangers.

Steel companies are striving to improve their maintenance systems which in turn safeguard their employees from accidents and reduce costly down-time and maintenance costs.

Position sensor maintenance is integral to any steelmaking process.

Time spent on calibration, troubleshooting, repair, and replacement can all but be significantly reduced or eliminated by switching to ABSOCODER.

The harsh environment of the steel making process results in breakdowns and damage of position sensors.

The traditional optic encoders or general purpose position sensor manufacturers are trying to improve their durability by making bigger and stronger housings.

However, the basic construction of these sensors remains the same

with a light source, glass disc, built-in transducer, and general pigtail sensor cable.

These delicate components lead to higher maintenance costs, down-time and reduced sensor life.

NSD's True Heavy Duty Position Sensor

ABSOCODER has been engineered to withstand the harshest steel making environments.

ABSOCODER is a robust, heavy duty position sensor, is virtually failure-free and extremely reliable even in environments that contain moisture, heat, dust, vibration and high shock commonly seen in steel mills. ABSOCODER's outstanding durability is achieved through innovative design and construction which eliminates electronics and optics inside the sensor.

We have engineered a sensor that utilizes magnetic reluctance change to sense rotary and linear movement.



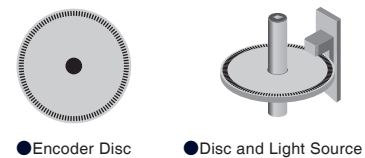
Incremental Position Sensors have to be “HOMED” to a fixed reference position to initialize its position measurement when the power is removed from the system. Absolute Position Sensors maintain position information, and the position of the sensor is available upon applying power.

Position Sensors are electro mechanical devices used for converting the angular or linear position into an analog or digital data code. In other words, they convert mechanical movement into an electrical signal.

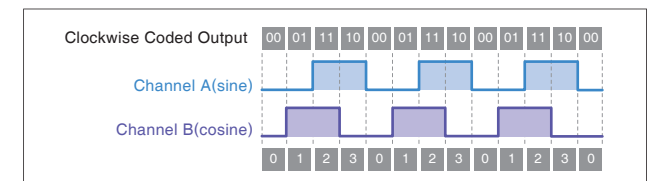
One method of determining a position, is to use either ‘distance’, which could be the distance between two points such as the distance traveled or moved away from some fixed point, or by ‘rotation’. For instance, the rotation of a robots wheel to determine its distance traveled along the ground. Either way, position sensors can detect the movement of an object in a straight line using linear sensors or by its angular movement by using rotational sensors. A rotation position sensor, also called a rotary encoder, is an electro-mechanical device that converts the angular position or motion of a shaft or axle to an analog or digital data code. There are two main types of rotation position sensors - Incremental and Absolute. The output of absolute position sensors indicates the current position of the shaft. The output of incremental sensor provides information about the motion of the shaft, which is typically further processed elsewhere into information

such as speed, distance and position. Rotation position sensors are used in wide range of applications that require precise shaft unlimited rotation, including industrial control, robotics, press equipment, crane wire hoist, water gate, elevator position, and motor speed feedback.

Incremental Position Sensors are commonly used for position and motion sensing. Basically, a disc with a pattern of cutouts around the circumference is positioned between an LED and a light detector, as the disc rotates, the light from the LED is blocked in a regular pattern. This patterns is processed to determine how far the disc has rotated. Typically the disc of an incremental sensor is made from glass or steel strip. The incremental sensor accurately records changes in position, but does



not power up with a fixed relation between sensor state and physical position. Devices controlled by incremental sensors may have to be “Homed” to a fixed reference position to initialize the position measurement. They employ two outputs called A & B, which are called quadrature outputs, as they are 90 degrees out of phase.



These signals are decoded to produce a count down pulse.

Absolute Position Sensors maintain position information when power is removed from the system. The position of the sensor is available immediately on applying power. The relationship between the sensor data and the physical position of the controlled machinery is set at assembly, the system does not need to return to a calibration point to maintain position accuracy. They are always excellent choices in systems that require a failsafe operation. There are also several different types of absolute position sensors.

Optical absolute position Sensors also have a similar disc with an incremental position sensor. A light source and photo detector array reads the optical pattern that results from the disc's position at any one time. This code can read a controlling device, such as a microprocessor to determine the angle of the shaft. The absolute analog type produces a unique dual analog code that can be translated into an absolute angle of the shaft. This type of sensor uses a battery for retaining the counts power cycles.

Magnetic absolute position Sensors use a series of magnetic stators to represent the sensor position to a magnetic sensor. The traditional type of this sensor is Synchro and Resolver. Synchro is a transformer whose primary to secondary coupling may be varied by physically changing the relative orientation of the two windings. Synchro is often used for measuring the angle of a rotation machine such as an antenna platform. The most common type of Resolver is the brushless transmitter, and it may look like a small electrical motor having a stator and a rotor. The Resolver can perform a very accurate analog conversion from polar to rectangular coordinates. Resolvers with four output leads are generally sine/cosine computational devices.

True Heavy Duty and Fully Absolute Position Sensor

ABSOCODER

Fully absolute position sensors that operate with magnetic reluctance change theory have NO electronics, optics, glass discs, or microprocessors inside the sensor which in turn drastically reduces the sensors failure rate and breakdown under harsh production environments.

1 Stainless Hard Case

Rust-proof and stain-resistance

Because stainless steel is non-porous, it resists foreign material and water condition more effectively than iron case

2 Robust & Heat Resistance Bearing

Shock resistance
vibration resistance
and
heat resistance
robust bearing

Max. 120℃
20G Vibration
500G Shock

3 Near-Zero-Backlash Gear

Variables such as manufacturing errors, mounting tolerances often increase the amount of backlash

Higher precision of ABSOCODER's inner gear achieves near-zero-backlash

5 Absolute Sensor Unit

Fully absolute with magnetic reluctance change theory

Zero electronics
Zero optics
Zero glass disc
Zero microprocessor
Zero contact parts
Only coils, stator and eccentric rotor

4 Double Protection Oil Seal and O-Ring

Increase wheel-end reliability by aggressively defecting dirt, moisture and other contaminants



ABSOCODER ALWAYS senses its current position. When the sensor is powered up, it will detect and deliver its position without the need of a reference position even if the sensor has lost power or the cable has been cut or damaged. This means ABSOCODER does not need to be calibrated when powered up or the cable has been replaced. ABSOCODER is a fully absolute position sensor that doesn't have optics or glass discs inside the sensor.

True Heavy Duty and Fully Absolute Position Sensor

Rotary ABSOCODER

Single turn ABSOCODER is used when the full range of positioning in the application is not greater than one full revolution (360°)
Multi turn ABSOCODER is used when the full range of positioning in the application requires multiple turns of the sensor shaft.

When an incremental sensor powers up, it must be re-homed before operation can commence. An absolute sensor always indicates its current position. That can be an enormous benefit of an Absolute sensor.

Re-homing of incremental sensor is just not practical, especially in a general steel making application. The construction of the absolute optical device is similar to an incremental sensor where is a light source, an LED, and a rotation disc. These components are unable to withstand the harsh production environment.

ABSOCODER, NSD's absolute position sensor, doesn't have any electronics and optics inside the sensor. It detects and measures the position through the phase difference between primary input and secondary output under the magnetic reluctance change.

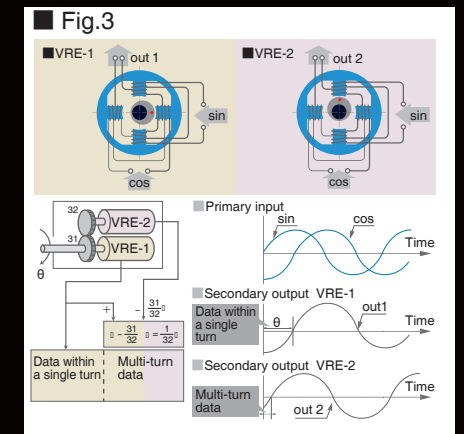
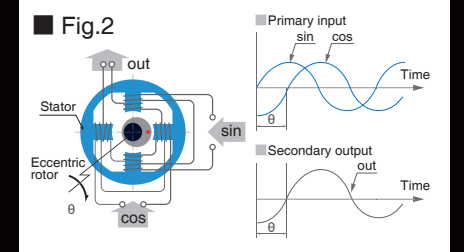
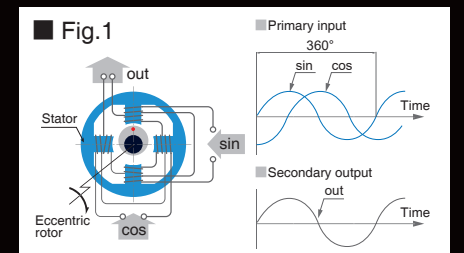
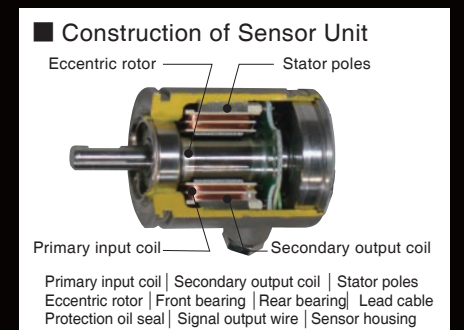
Single turn ABSOCODER named VRE is used when the full range of positioning in the application is not greater than one full revolution (360 degrees). The principle of VRE is as shown in the diagram Fig.1 and 2.

VRE operates as variable coupling transformer, with the amount of magnetic coupling between the primary winding input coils ('a sin θ' and 'a cos θ'), and secondary output coils which are wound at four stator poles ('k sin (ωt-θ)'), according to the position of the rotating element (eccentric rotor). VRE ABSOCODER is typically mounted on the 360° turn table and cam press equipment application. Heavy duty VRE series is the best solution for looper arm angle detection at the hot strip mill, open/close position of re-heater door angle, walking beam position, and hot mill run-out table position in the steel industry.

Multi turn ABSOCODER named MRE is used when the full range of positioning in the application is greater than one full revolution. The principle of MRE sensor is as show in the diagram Fig.3 and 4.

In order to detect more than one revolution angles, two single turn ABSOCODERs are connected with gears with different ratios. VRE-1 sensor unit measures the full range of 360 degree, and VRE-2 sensor unit measures the number of VRE-1 turns through the connecting gears. The angle position is detected by the phase differences among the primary and secondary winding coils of VRE-1 and VRE-2 according to the position of sensor shaft and connecting gears.

The standard of MRE has up to 3072 multi turns, and special purpose MRE is available up to 8192 multi turns with 8192 sensing resolution.

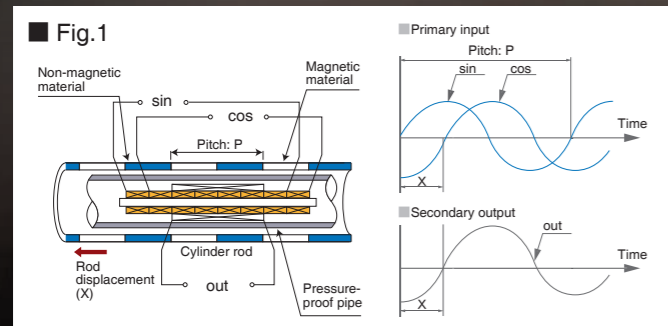
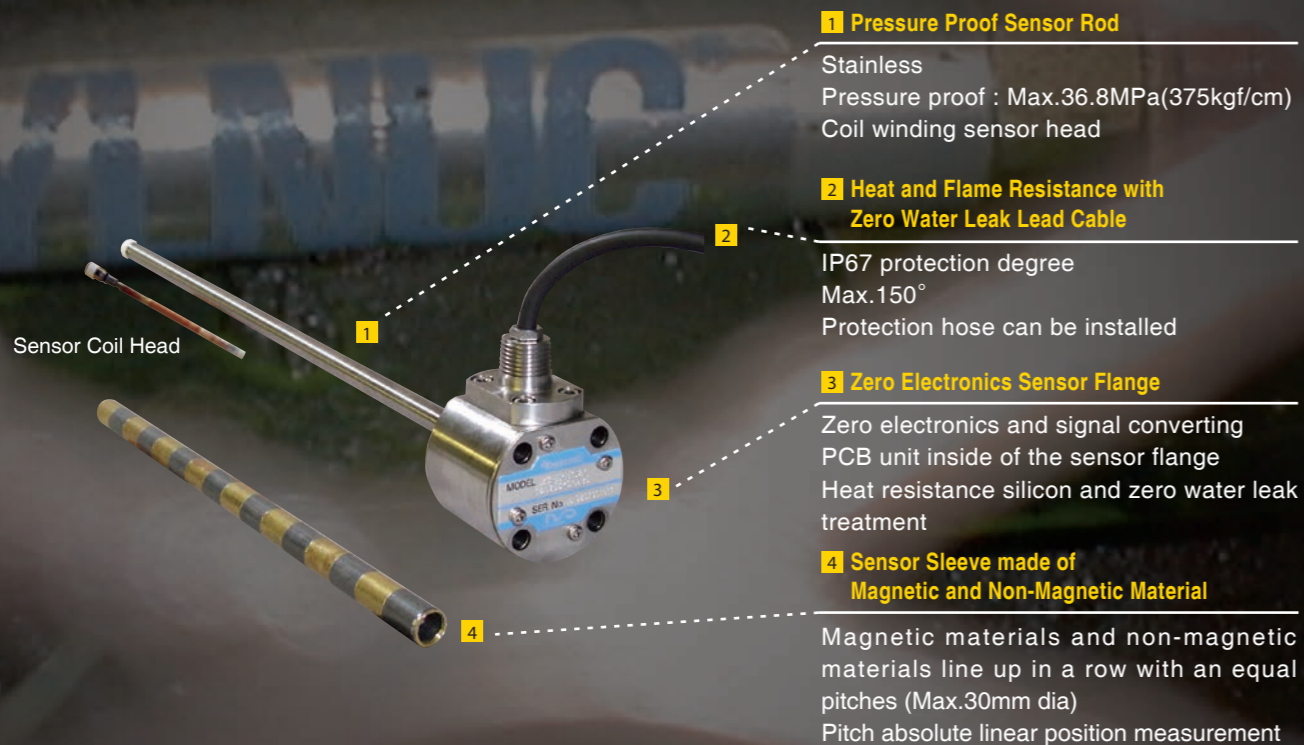


True Heavy Duty and Smart Linear Position Sensor

INRODSENSOR

Non-contact and wear-free linear position sensor IRS is suitable for a direct installation in hydraulic cylinders. The established magnetic-reluctance-change method provides for a precise and reliable position response without a fail.

NSD's smart linear position sensor, IRS (In-Rod-Sensor) is the most accurate and durable linear position sensor available in the steel industry (0.001mm~0.065mm), enabling highly accurate position detection, improving operation efficiency and safety. It's non-contact design with zero electronics and zero optics concept eliminates mechanical failure mechanisms, reducing wear and tear, improving reliability and durability, and minimizing down-time. True heavy duty IRS series has been proven its excellent performance under the most harsh environment for instance ladle turret, mold width, slide nozzle, AWC, side guide, mandrel, wrapper roll, and so on.



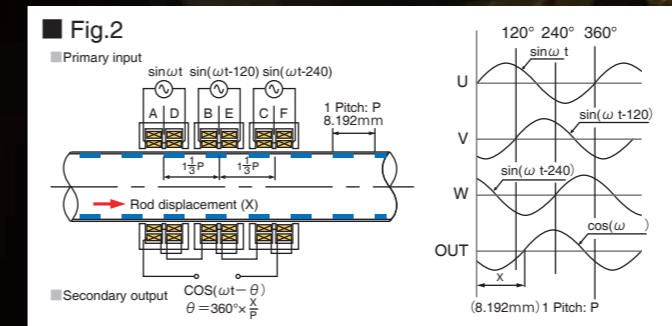
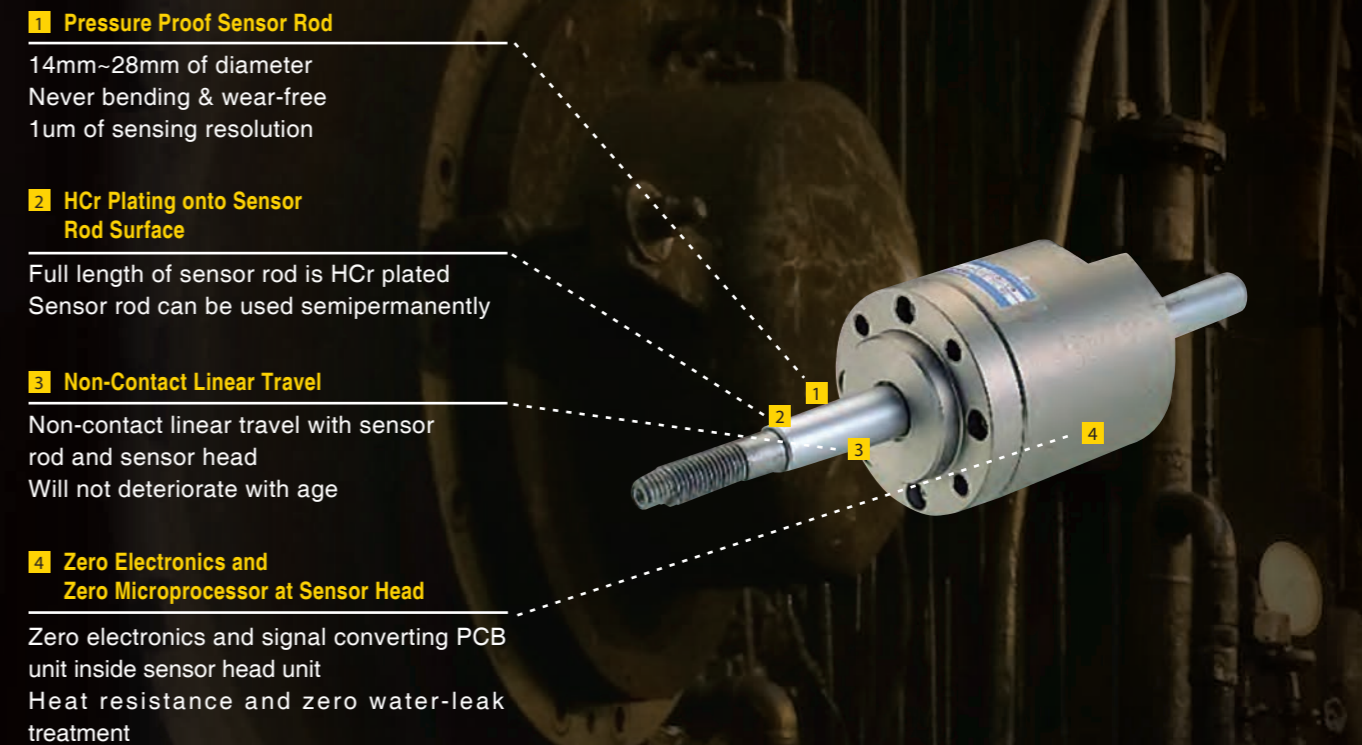
As shown in the picture, a series of magnetic materials and non-magnetic materials are lined up in a row with an equal pitch (51.2mm). Primary and secondary coils are wound into the sensor head inside of the pressure-proof sensor rod, with 'a sin ωt ' and 'a cos ωt ' for input signal. When the rod moves to a distance 'X', 'k sin ($\omega t - 2\pi X/P$)' will be induced onto the secondary coil. The value of position of 'X' can be with 'a sin ωt ' for input, and 'k sin ($\omega t - 2\pi X/P$)' for output.

Super Strong and Super Sensitive for AGC Application

VLS-8SM for AGC

Continuous gap control between work-rolls are the utmost importance to the rolling mill process. VLS-8SM is the best known linear position sensor to satisfy both Highest Sensing Resolution and Remarkable Durability.

Hydraulic automatic gauge control (AGC) systems are used to position and to maintain the specified gap between the work-rolls precisely. Hydraulic AGC cylinders with an integrated linear position sensor are used to achieve the level of precision under extremely harsh-environment, including hot-temperature, water, high shock and high vibration. The ultra sensitive response of VLS-8SM allows for the measurement resolution (0.001mm) equal to or better than the traditional magnet-scale sensor. VLS-8SM is also the best known as the solution for Hydraulic AGC cylinder with higher durability.



As shown in the picture, a series of magnetic materials and non-magnetic materials are lined up in a row with an equal pitches (8.192mm). Primary and secondary coils are wound into the sensor head inside of the pressure-proof sensor rod, with 'sin ωt ', 'sin ($\omega t - 120^\circ$)', and 'sin ($\omega t - 240^\circ$)' for input signal. When the rod moves to a distance 'X', 'cos ($\omega t - \theta$)' will be induced onto the secondary coil. The value of position of 'X' can be with 'sin ωt ' for input, and 'cos ($\omega t - \theta$)' for output.

Performance Above and Beyond, NSD Provides Accident-Free and Maintenance-Free Heavy Duty Position Sensor to Steel Plants

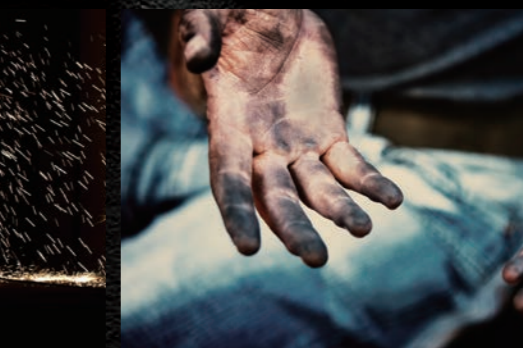
One way steel mills limit their accidents is to reduce their maintenance time and remove potential risk factors by using extremely heavy-duty, maintenance-free products.

When it comes to position detecting applications in the steel making industry, position sensors are subjected to extreme shock, high vibration, high temperature, water, and heavy dust. Often the harsh environment results in an increase in operating expenses and maintenance cost from production down-time. NSD's heavy-duty position sensor "ABSOCODER" is accident-free, failure-free, and extremely reliable for position and speed detection. A recommendation for steel making industry is to use a highly-dependable sensor that will cost relatively little to maintain. The benefits thereby gained from reliable long-lived sensors extend well beyond just lower maintenance costs. According to the analysis report, most large companies lose between 10-20% of annual turnover due to down-time, even though they maintain a highly trained work force and use appropriate information-technology controlled systems. The very first and fundamental step to reduce accidents and maintenance cost is to select and use highly-reliable products. ABSOCODER was developed and improved to eliminate unexpected down-time while decreasing operating expenses throughout the steel making process.

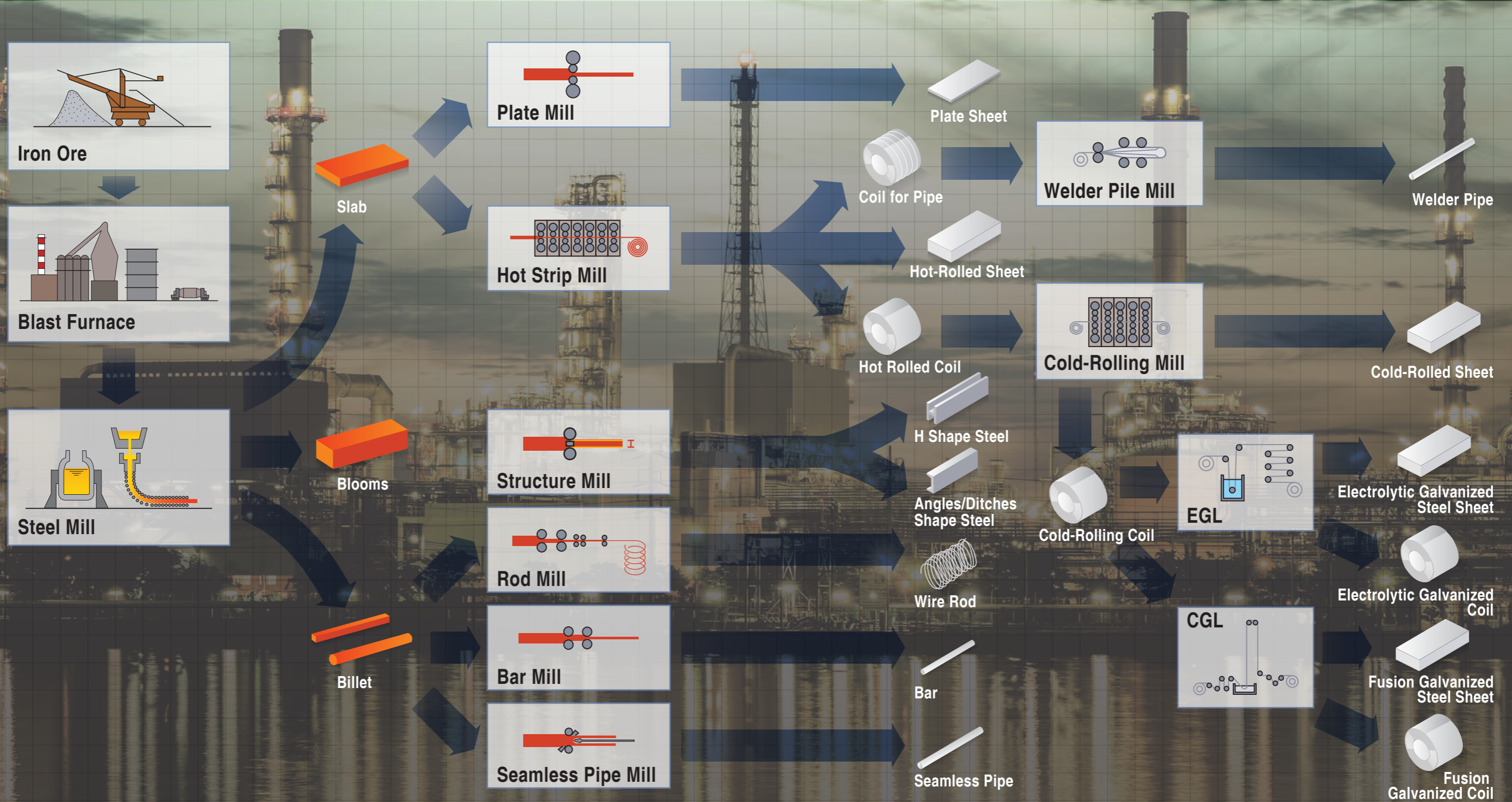
ABSOCODER's outstanding durability and performance is achieved by a creative construction and design which eliminates electronics, optics, light source components and physical contacts inside sensor. ABSOCODER will give to you less down-time. One way of reducing accidents within the steel industry is by reducing maintenance down-time and risk factors by using heavy-duty and maintenance-free products. When we talk about the accidents and maintenance, we should also consider the inherent costs as well. Within many large-scale, plant-base industries, maintenance costs can account as much as 40% of the operational budget, and therefore improving maintenance effectiveness is a potential source for making financial savings.

The top priority for every manufacturing facility is to keep its workforce safe. One effective way to keep your employees safe is to limit the time they spend working on and around hazardous areas. By using sensors that have a near zero failure rate and are maintenance free, you drastically reduce the amount of maintenance time spent in a dangerous situation. When we talk about accidents and maintenance, we should also think about the cost of making steel. Today's competitive market condition requires that industries try to sustain full-production-capabilities, while minimizing capital investment. Wise operation, careful maintenance while using maintenance-free products will together deliver cost-effective production reliability. Down-time seriously hinders a mills production capabilities, reduces average rate of output, and increases operating costs. It will also increase as a result of the ineffective implementation of just-in-time and lean total-quality management procedures.

Field technology is one of our mottos. Our sensor researchers, technical staffs and technical sales hold detailed discussion with the steelworks' counterparts in order to determine the requirements by listening to their problems for the sensing applications, and recommend the most suitable solutions on the basis of accumulated NSD experience and technical know-how. In regard to production method, NSD is following the mass customization system. We are producing our sensors to meet Individual customer's demands & their diverse & changing needs or custom-tailored products with near mass production efficiency. We combine the technical-flexibility and service -personalization of custom-made products with production efficiency to satisfy the current market needs. Based on the high technology & quality control system & mass customization system through over 60 years' experience, NSD contributes to the enhancement of steel making quality and productivity with our rigid quality control system, durable position sensors, user friendly easy to use controllers and field services.



Integrated Steel and Iron Making Process



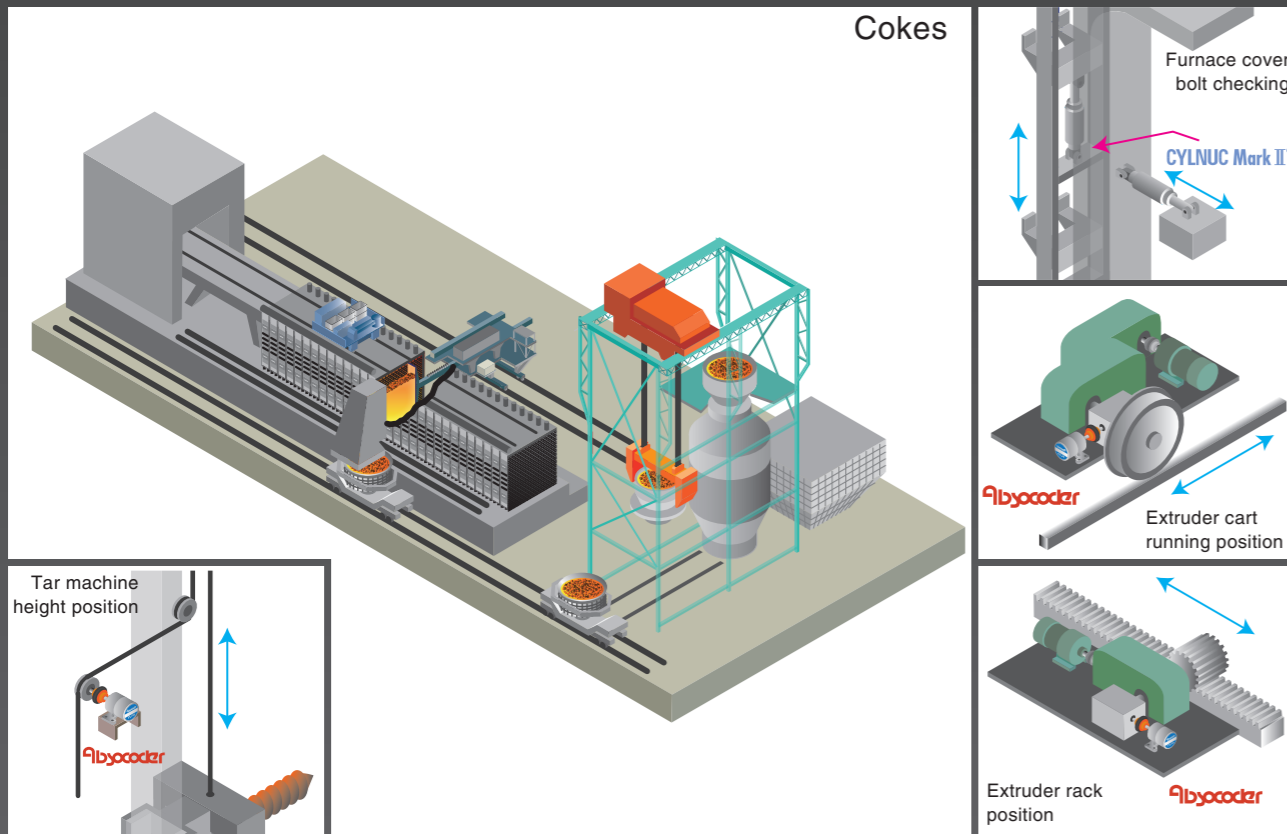
The ever-continuing requirement for cost-effective steel production means that your production system is running without much down-time. NSD corporation, one of the worldwide leading manufactures for position measurement sensor

solutions. True heavy duty and absolute position sensor ABSOCODER is reliable, durable and it has a minimum of unplanned down-time even under the most harsh steel making environment.

Major Application for Cokes



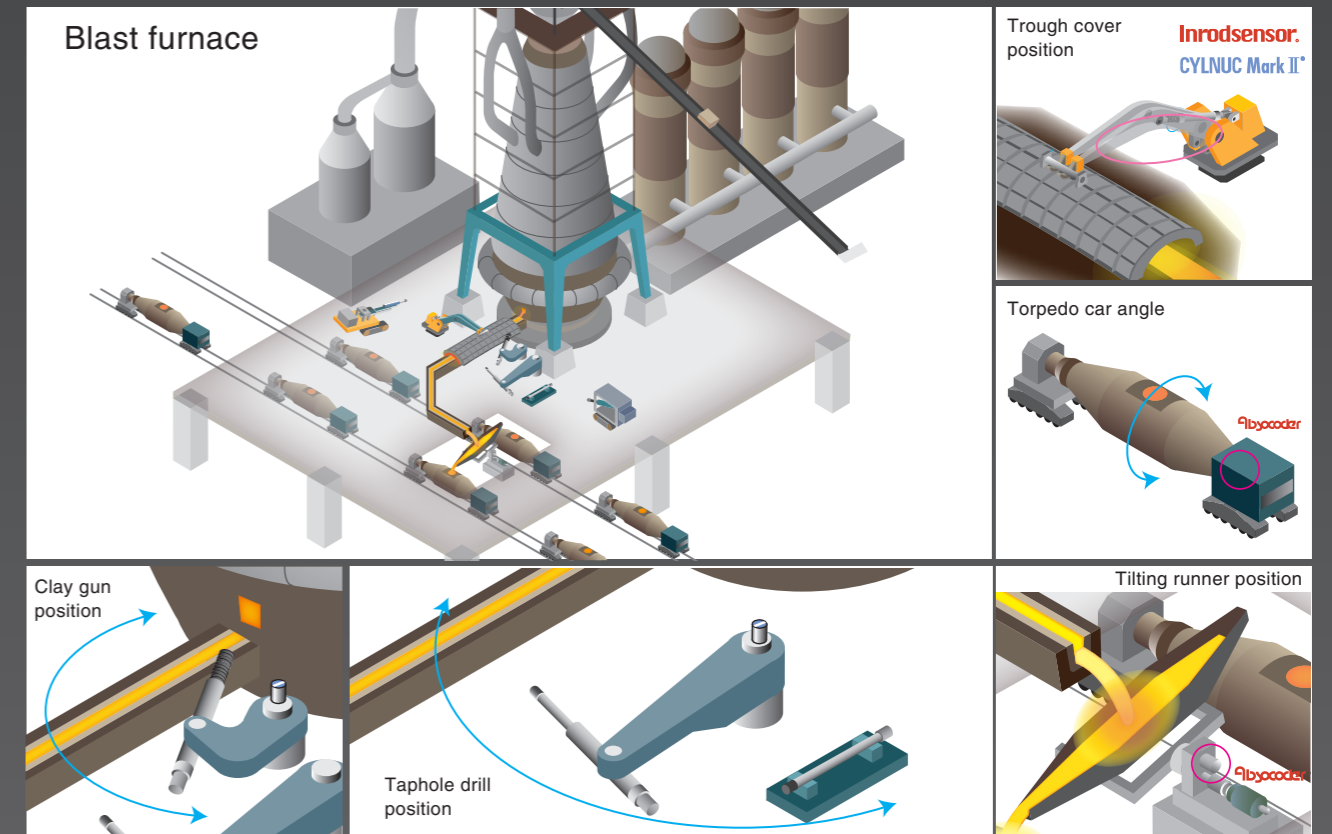
Coal is converted into coke by heating the prepared coal blend charge in the coke oven in the absence of air at a temperature of 1000°C. After leaving the coke oven chambers, the raw coke oven gas is cooled which results in a liquid condensate and gas stream. NSD provides a heavy duty ABSOCODER with heat resistance (150°C) and flame retardant sensor cable for this application.



Major Application for Blast Furnace



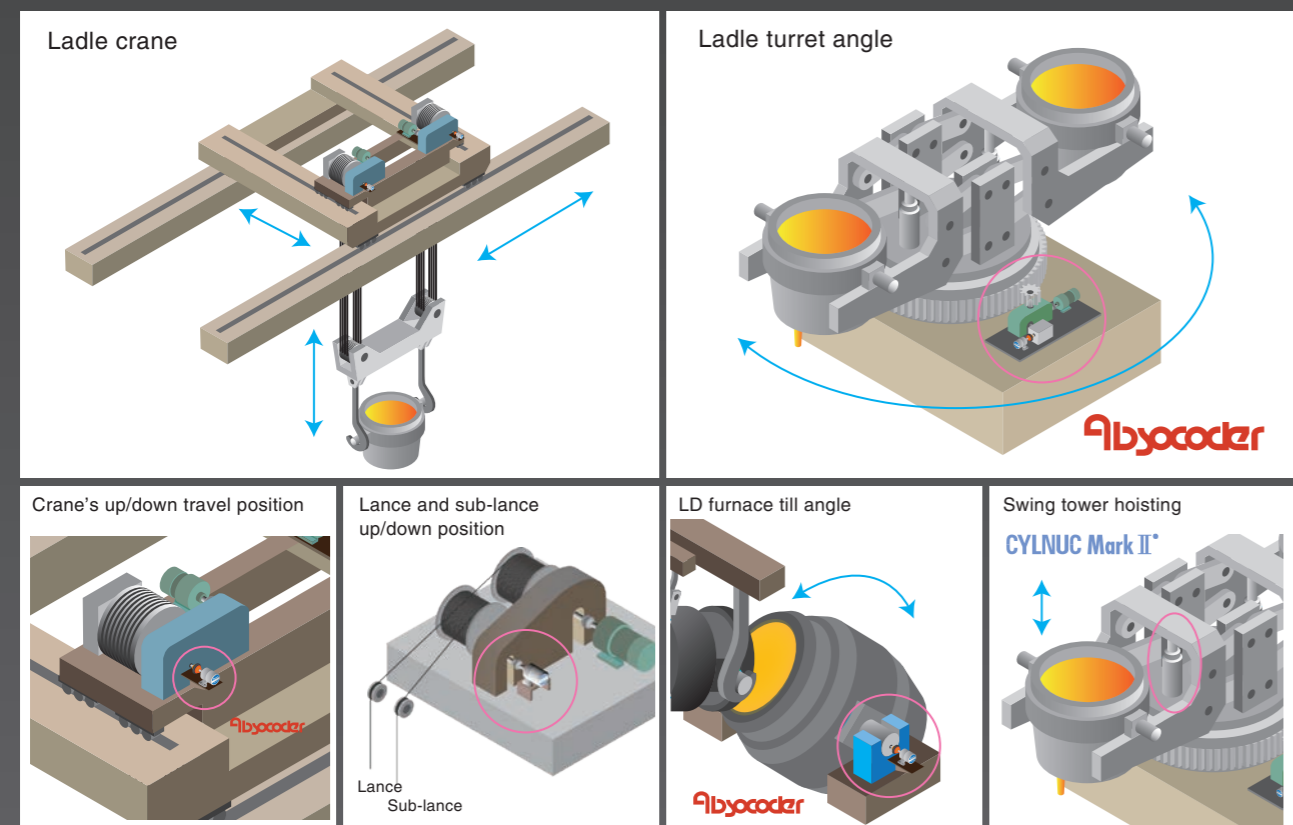
In a blast furnace, fuel, oil and flux are continuously supplied through the top of the furnace, while a hot blast of air is blown into the lower section of the furnace through a series of pipes. The end products are usually molten metal and slag phases tapped from the bottom. One of our major applications for this application is to measure the angle of tap hole driller and tilting runner position. The position sensors have to withstand the extremely hot temperature and high machine vibration.



Major Application for Ladle Crane & Ladle Turret



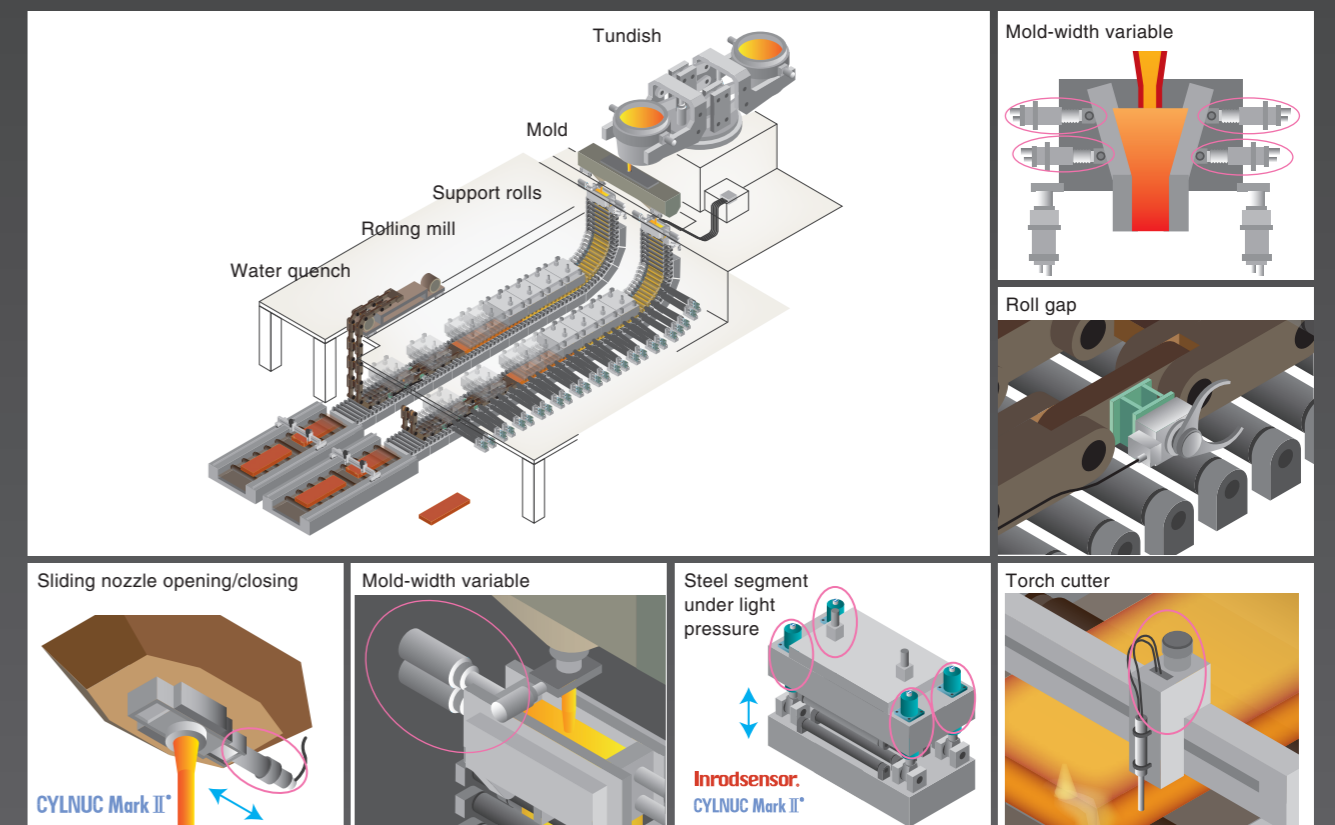
Molten metal is tapped into the ladle from furnaces. After undergoing any ladle treatments, the ladle is transported to the top of the casting machine. Usually, the ladle sits in a slot on a rotating turret at the casting machine. ABSOCODER is used in the main hoist or rotation wheel at ladle crane and turret rotation table to detect the rotation positions. BAUMCOUPLER is used in the ladle turret to control the turret rotation.



Major Application for Continuous Casting



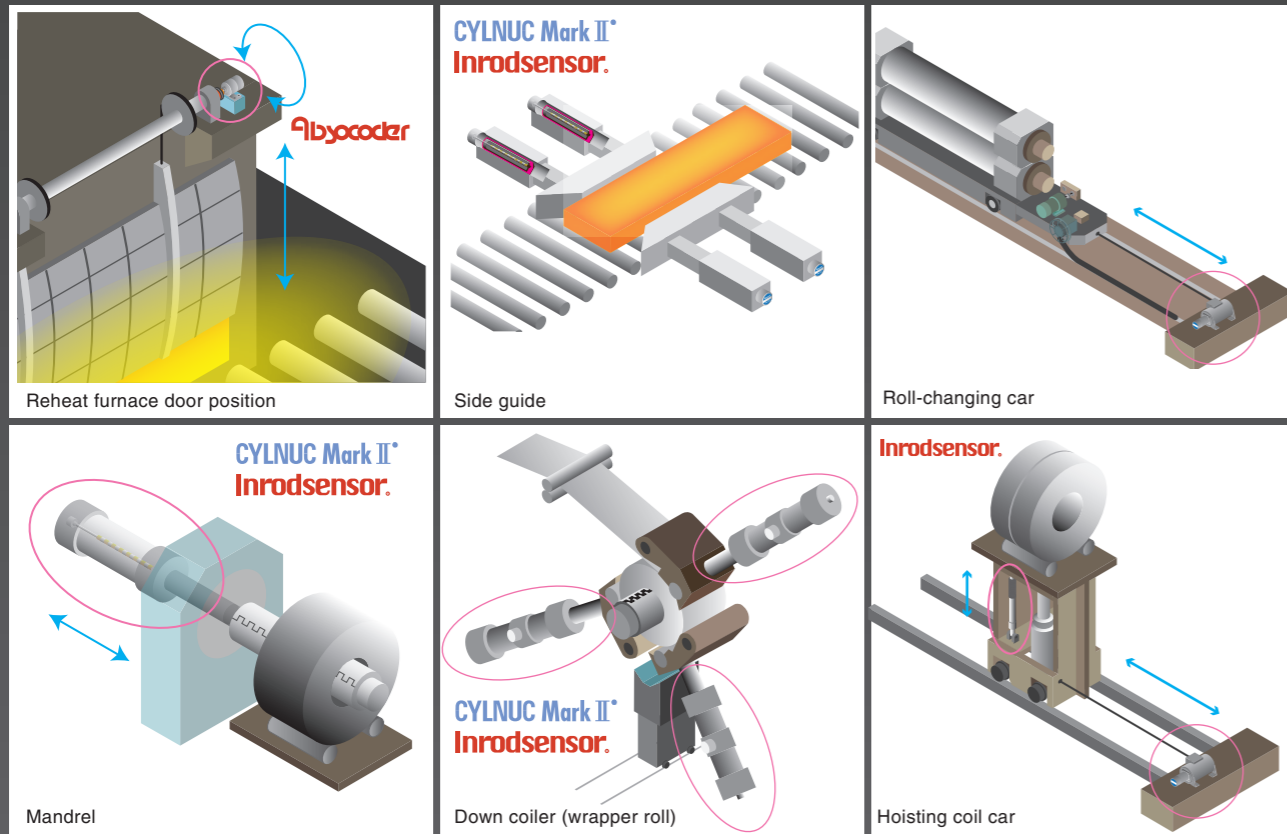
Continuous casting is the process whereby molten steel is solidified into a semi-finished billet, bloom or slab for subsequent rolling in the finishing mills. ABSOCODERs are used to continuously measure the actual position and speed of each process of continuous casting line, for instance, ladle turret, ladle slide gate, tundish, sliding nozzle, mold width, oscillation, support roll, and torch cutter.



Major Application for Hot Strip Mill



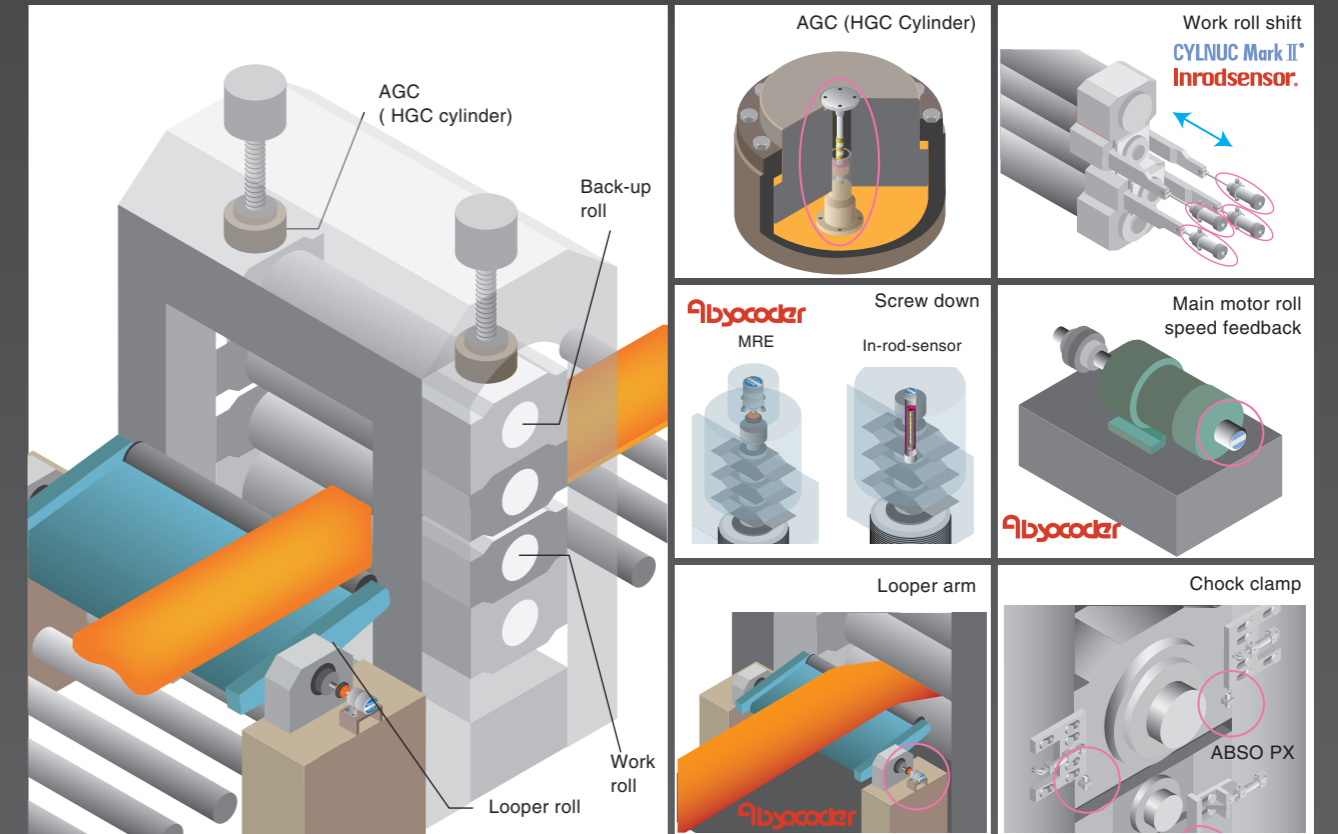
The production of hot strip is a key factor of steel production. A large proportion of steel production is hot rolled, mills demand maximum throughput and availability combined with high precision and optimum strip properties. Fully integrated position & speed measurement sensor, ABSOCODER offers a complete range of solutions and services to meet the comprehensive hot strip mill process demands.



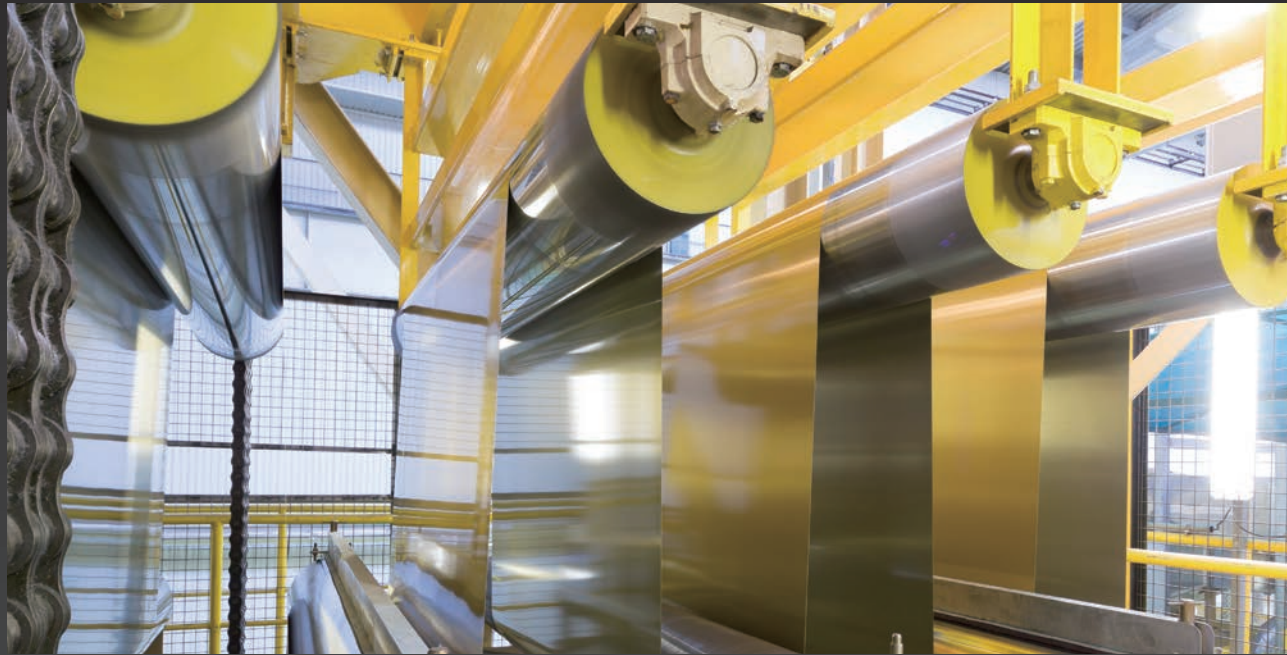
Major Application for Rolling Mill Stand



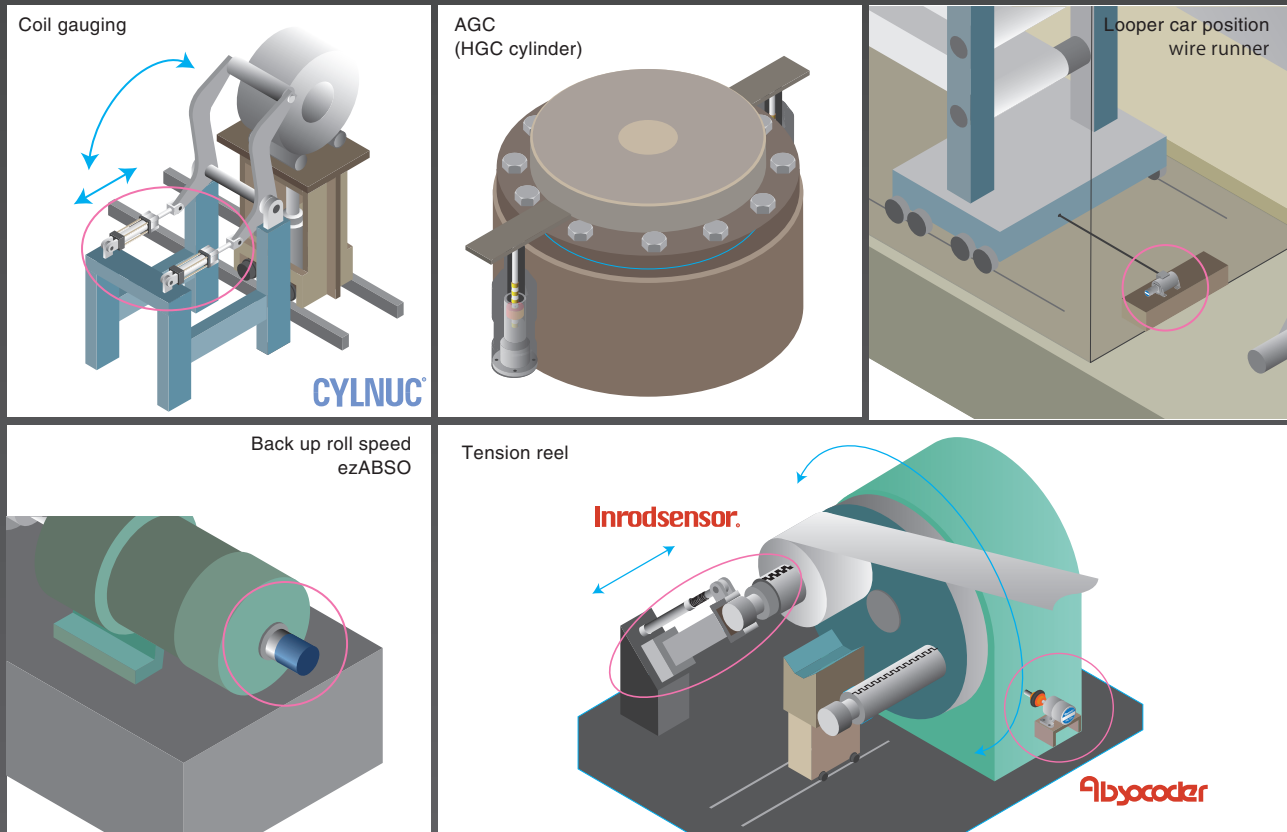
Roll stands holding pairs of rolls are grouped together into rolling mills that can quickly process metal strip. The roughing mill stands are used to form the strip to roughly the final thickness, and the finishing mill stands are used to form the strip to the final dimension. Precise rolling position control at this point in the process is very critical for a consistent surface finish, and for consistent thickness. NSD provides a complete suite of position measurement solutions for rolling mill stand applications.



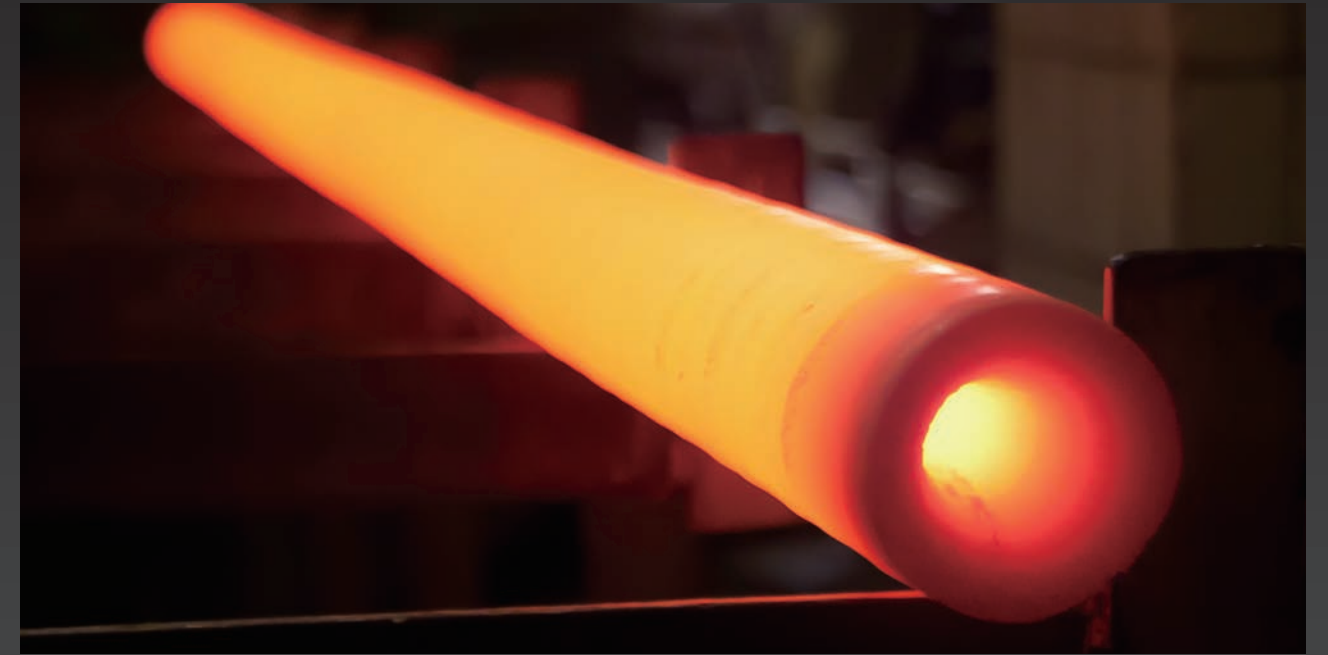
Major Application for Cold Rolling Mill



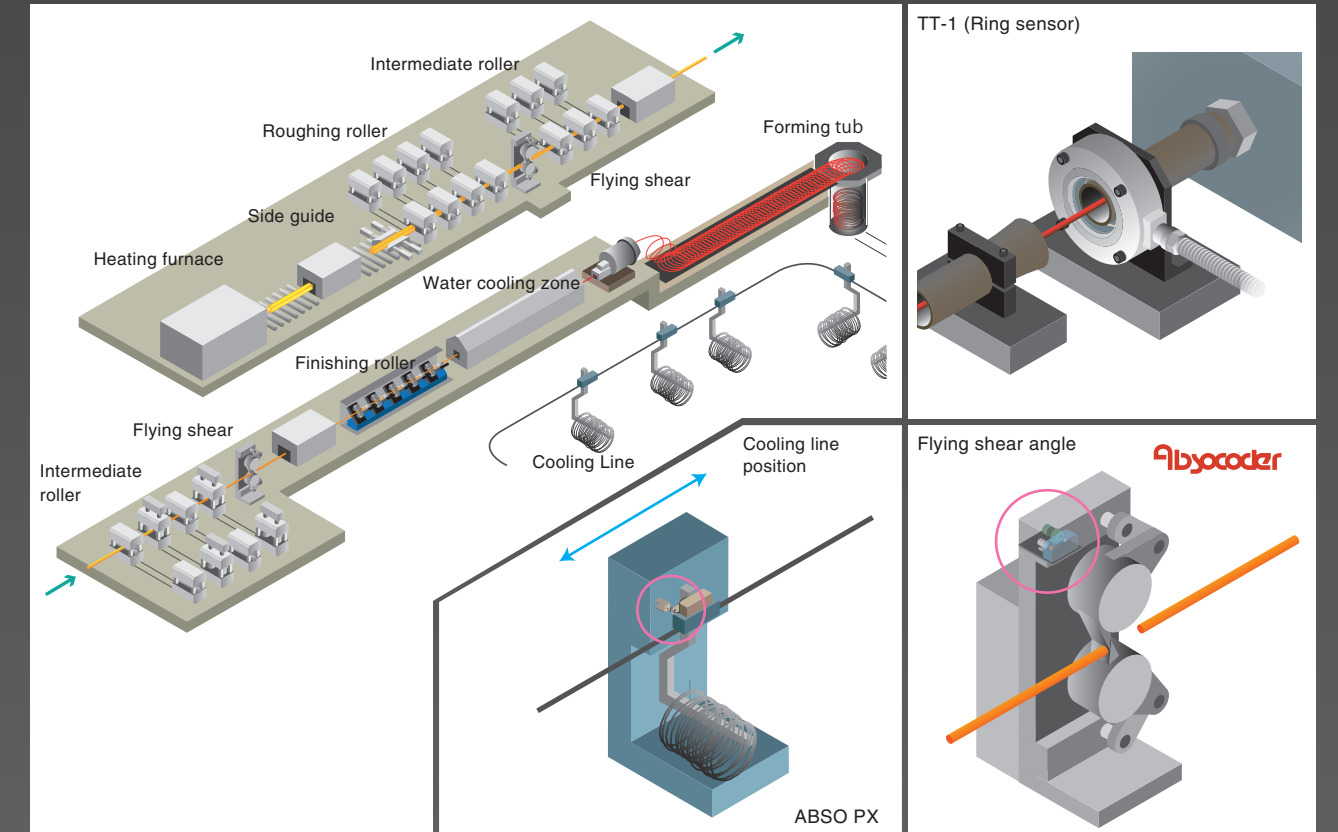
In the cold mill, the metal strip is commonly near room temperature. This mill provides excellent results especially when it comes to rolling very thin gauges, and it also provides the surface finish and holds tighter tolerances. NSD ABSOCODERS are typically used in high precision cold mills where precise gauge control is demanded while withstanding the harsh mill environment.



Major Application for Rod-Bar-Wire-Pipe-Structure Mill



NSD provides a total solution in response to the various requirements of position and speed measurement applications in Rod, Bar, Wire, Pipe and Structure mills. ABSOCODER was developed and improved to eliminate unexpected down-time while decreasing operating expenses throughout the above process under harsh process environments.



NSD MONOZUKURI

MONOZUKURI is the Japanese word for manufacturing.

This word is about having a state of spirit & principle to produce not only excellent products, but also have the ability to constantly improve the production system.

NSD has our own MONOZUKURI system which is the best indicator to understand our products.

A rigorous and steady MONOZUKURI system of NSD has clearly proved to the world the best quality.

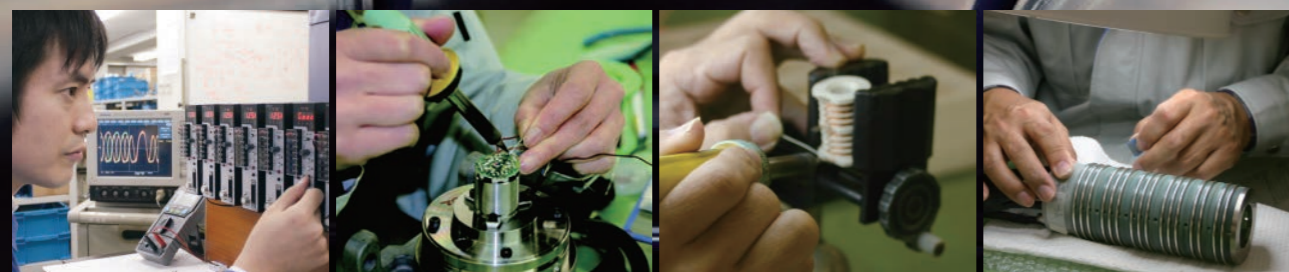
We make most of our components in-house with this system to ensure the highest quality products.



NSD COMES FROM HARSH ENVIRONMENT

Ever since it opened its doors, NSD has been at the fore-front of the evolution, development and manufacture of sensor technology, and is always ready to respond to new technologies.

NSD is committed to continuous improvement in our product design, quality, fabrication, and our production system to give you, our customer, the most reliable product in the steel industry.



Sensor Solution

Steel is essential to the modern world, and its use is critical in enabling men to move towards a sustainable future. Whether in lighter, more efficient vehicles or renewable energy generation, steel is a fundamental part of the greener world.

Steel is also necessary for new, highly efficient power stations and the construction of smart electrical grids, transport infrastructure development, energy-efficient residential housing and commercial buildings.

Steel plants operate in very harsh environments, requiring cables and wires to withstand high heat and a lot of oil.

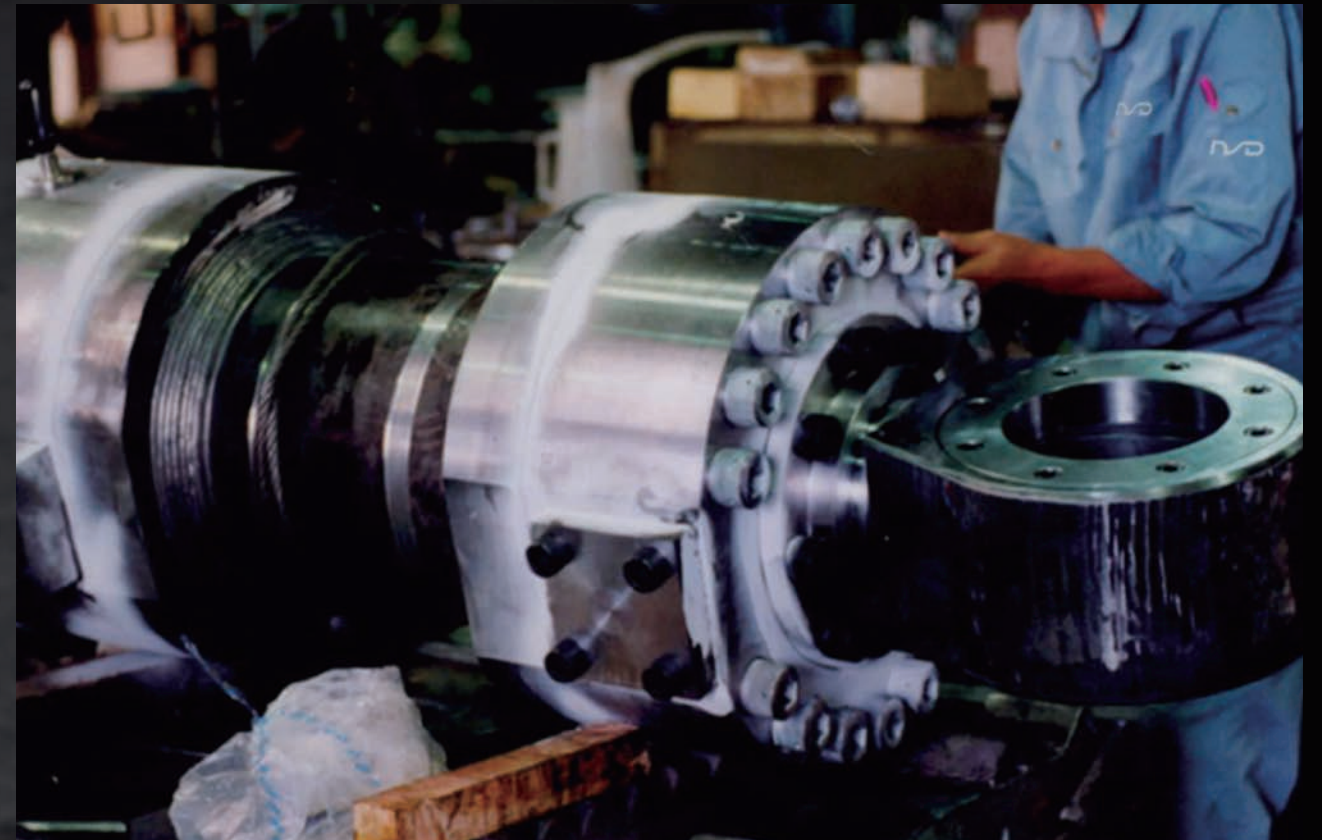
The people who work in this environment are tough and they want the same toughness out of their equipment, and its components.

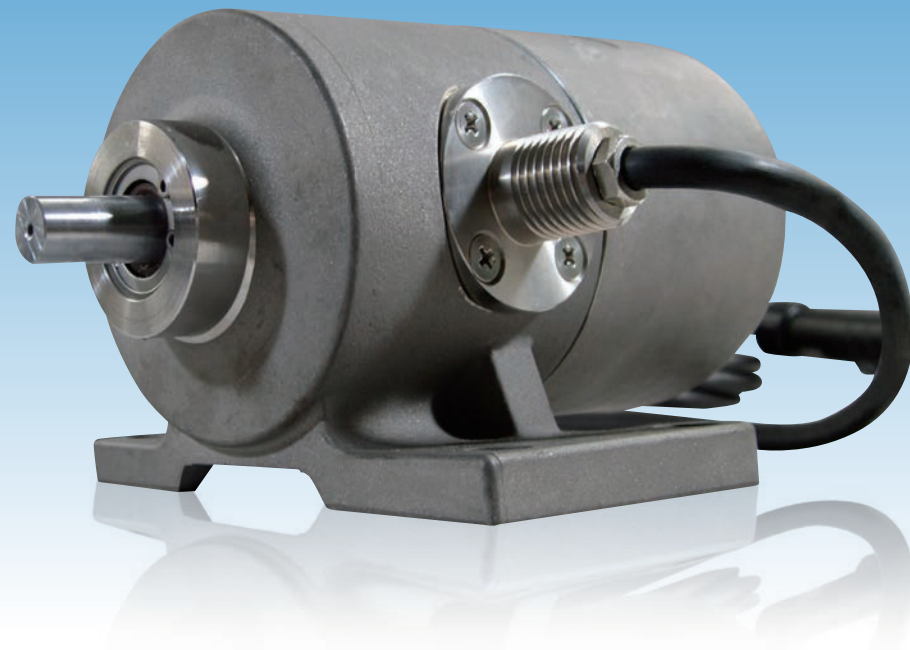
NSD manufactures heavy duty position sensors and controllers that can withstand the extreme heat, oil and molten metal that is found in such a highly abusive environment.

We look forward to assisting you in identifying the best products for your specific application and to answer any questions you might have.

ABSO SOLUTION

True Heavy Duty & Fully Absolute Position Sensor





*When ABSOCODER is powered up it will report its current position without the need for any reference information
ABSOCODER is considered one of the most durable and accurate position sensor in the world*



Absolute Rotation Position Sensor

The distinguishing feature of an incremental position sensor is that it reports an incremental change in position. When an incremental position sensor is powered up, it does not report its current position until it is provided with a reference and/or original zero position from which it can measure. An absolute sensor unambiguously reports its position within a scale or range. In other words, when an

absolute sensor is powered up it will report its position without the need for any reference information. A good test to differentiate the two types of sensors, is to see what happens when powered up. If the sensor has to go through some form of calibration step - it is incremental, if it does not - it is absolute position sensor. Some sensors claim absolute measurement performance because

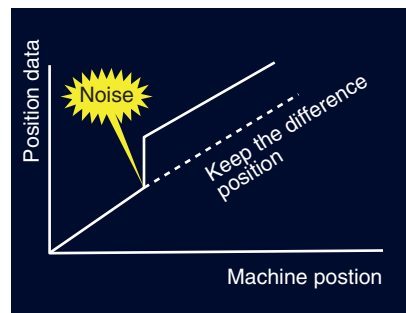
a battery stores position information from the incremental sensor when power is lost. All very well, but what happens when the battery runs out? NSD's true-absolute position sensor named ABSOCODER measures the angular position under a magnetic reluctance change method. The output of ABSOCODER always indicates the current position of the mechanical site even under power lost and/or connecting cable cut condition. ABSOCODER has no battery inside the sensor unit and it's signal converting (transmitter) device, as well.

Zero Electronics & Zero Optics & Zero Glass Disc

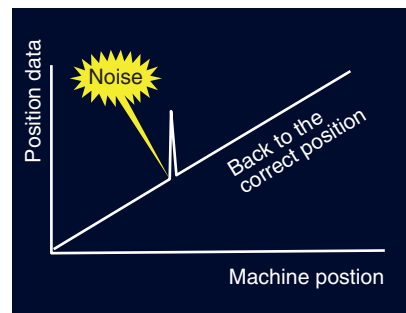
Optical rotation encoders have proven a more economical solution for many applications. But the relative fragility of their constructions typically leads to the need for frequent replacement and more maintenance time. Unlike conventional optic encoders, NSD ABSOCODER does not rely on signal converter, light source, and discs made of glass to determine rotation position.

Depending on the material employed to make these components, they are traditionally susceptible to breakage, dirt and/or debris, all of which corrupt accurate rotation position sensing. ABSOCODER detects and measures the position through the phase different between primary input and secondary output under the magnetic reluctance change. ABSOCODER's outstanding

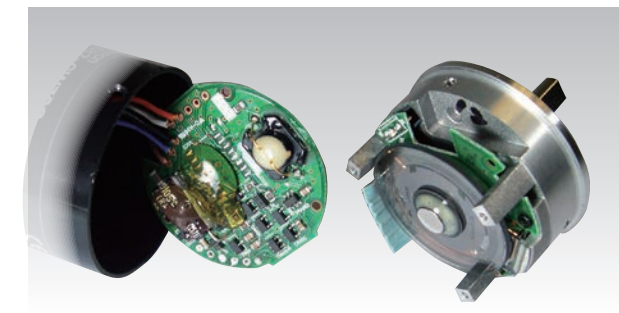
durability with field proven excellent performance is achieved by a creative construction of the design which eliminates physical contact parts and satisfy zero-electronics / zero-optics inside the sensor body. Used for decades with zero-breakdown by the most steel plants, ABSOCODER is considered one of the most stable, durable and accurate in the world.



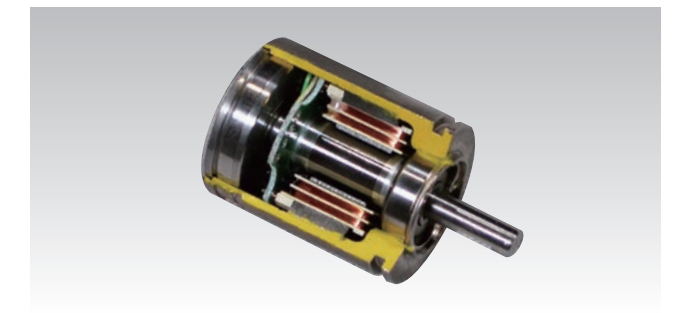
Incremental encoder .
(Pulse cunt format)



ABSOCODER (NSD)
(Absolute format)



Optic Rotary Encoder
LED with Microprocessor Transducer



NSD ABSOCODER
Magnetic Reluctance. Only Coil and Stator

VRE Specification

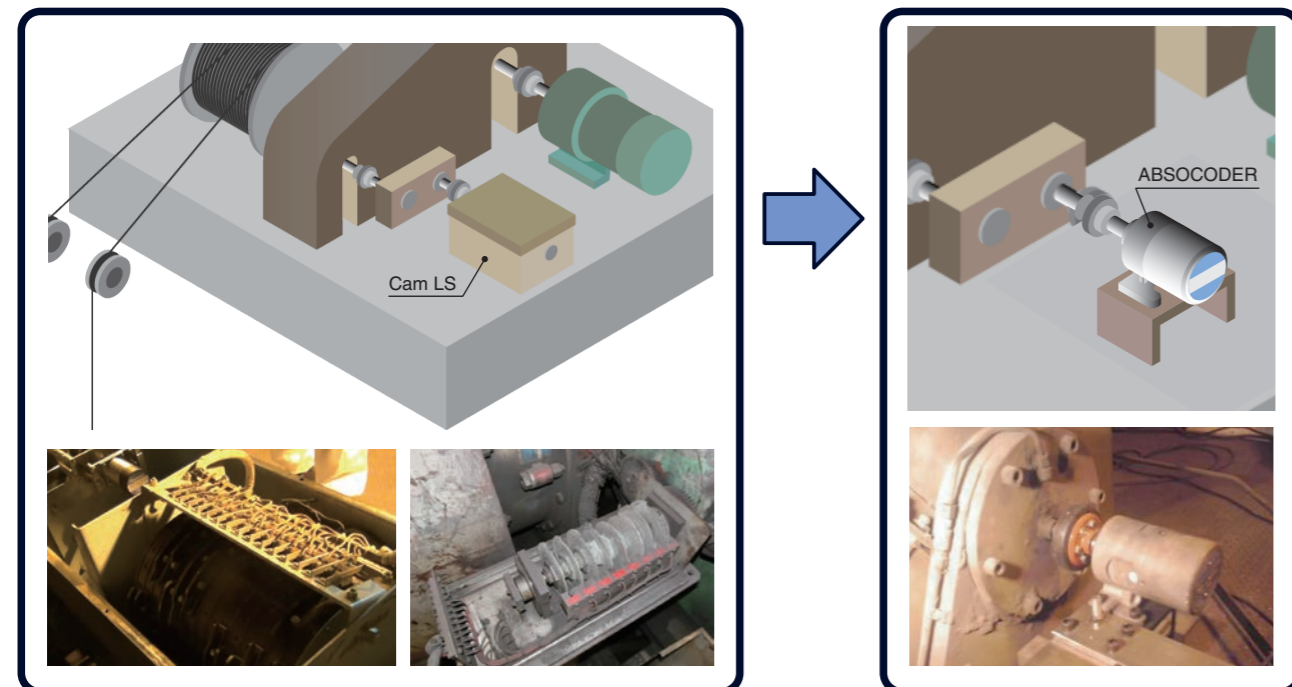
Single turn ABSOCODER, VRE is the rotation sensor that specifies the absolute position for one turn of the sensor shaft, 360 degree. The rotation application is not greater than one full revolution.

| Product Family | General Specification | | | | Environmental Specification | | | |
|----------------|-----------------------|------------|-------------|--------------|-----------------------------|-----------|----------------------|------------------|
| | Dimension | Resolution | RPM (r/min) | Cable Length | Temperature | IP Rating | Vibration Resistance | Shock Resistance |
| VRE-P061 | 68x68x101.5mm | 8192 | 3600 | Max.500m | 80°C | 65 | 20G | 500G |
| VRE-P074 | 80x80x158.5mm | 8192 | 4000 | Max.500m | 120°C | 67,69k | 20G | 500G |
| VRE-P101 | Φ 156x173mm | 8192 | 4000 | Max.500m | 120°C | 67,69k | 20G | 500G |
| VRE-10TP101 | Φ 156x173mm | - | 4000 | Max.300m | 120°C | 67,69k | 20G | 500G |
| VRE-16TS100 | Φ 156x173mm | 65536 | 4000 | Max.200m | 120°C | 67,69k | 20G | 500G |

VRE Application

Rotary cam limit switch is used to convert a mechanical motion into an electrical control signal for automatic controls for positioning and for end-of-travel switching onto mechanical side as actuators. Most of cam limit switch direct connects with motor, and each cam should be set with using the cam-adjusting screws. Therefore, operators should maintain this at actual mechanical site where the possibility for unexpected accident is high.

VRE ABSOCODER measures the angle-position of motor and digital function VARICAM controller output the same on/off signal with the existing cam limit switch. Unlike cam limit switch, NSD sensor can provide the various optional functions, such as current motor position data, preset function, motion control, and error indicator.



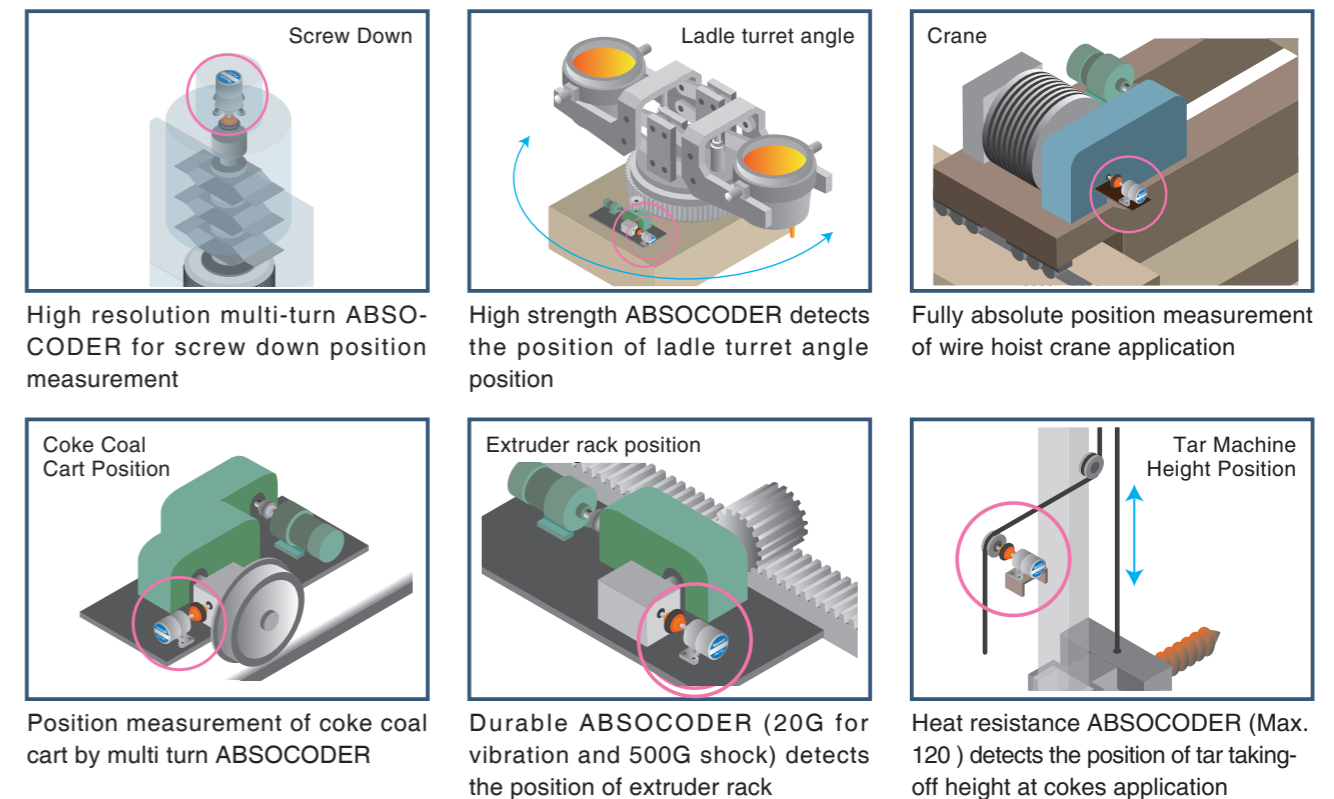
MRE Specification

Multi turn ABSOCODER MRE series are used when the full range of position in the application is greater than one full revolution. In order to measure more than one revolution angle, two VRE sensors are connected with different ratios.

| Product Family | General Specification | | | Environmental Specification | | | |
|----------------|-----------------------|---|--------------|-----------------------------|--------|----------------------|------------------|
| | Dimension | Number of Turns | Cable Length | Temperature | Rating | Vibration Resistance | Shock Resistance |
| MRE-SP061 | 68x68x105mm | 32 / 64 / 160 / 256 / 320 | Max.300m | 80°C | 65 | 20G | 500G |
| MRE-SP074 | 8080x128.5mm | 32 / 64 / 128 / 160 / 256 / 320 | Max.300m | 120°C | 67,69k | 20G | 500G |
| MRE-SP101 | Φ 156x167mm | 32 / 64 / 128 / 160 / 256 / 320 / 512 / 1280 / 2048 / 2560 / 3072 | Max.300m | 120°C | 67,69k | 20G | 500G |
| MRE-1024S16TS | Φ 156x195mm | 1024 | Max.300m | 120°C | 67,69k | 20G | 500G |

MRE Application

Multi Turn ABSOCODER model MRE meets the specification of heavy-duty applications requiring long cycle and high reliability. MRE offers absolute detection through a range of up to 8192 revolutions. The sensors are robust, and with the absence of any electronics / optics linkages. MRE is suitable for use in harsh environment where debris, fluids, vibration and high shock are present.



ABSOCODER

Waterproof and Under Water Absolute Rotation Position Sensor

ezABS0

Pulse Count Selectable Rotary Sensor

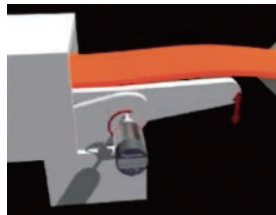


Waterproof Heavy Duty Position Sensor

When we talk about waterproofing, we often refer to an IP rating. This stands for Ingress Protection, and it usually followed by a number, which shows its ability to withstand water and dust. The first digit refers to solid particle protection and the second digit refers to liquid. Waterproof ABSOCODER scores a rating of IP67. That means it can be submerged up to 1 meter in depth for up to 30 minutes, and against string water jets and waves condition. This also means that dust particles are unable to enter the sensor body. Waterproof ABSOCODERs are designed to operate in wet, wash-down, heavy vapor and in-tank environments. Underwater ABSOCODERs are designed to operate underwater condition for instance water gate position application.

Application (Looper)

In rolling mills, loopers are normally used to control the tension of the metal strip between roll stands. The rotation angle of the looper is measured and detected by a rotation position sensor designed to meet the string water jets, and heavy vibration condition. Waterproof ABSOCODER is a true-moisture-proof and anti-rust position sensor to fit the looper arm position detection application. The sensor lead cable is also water-proofed for protection.

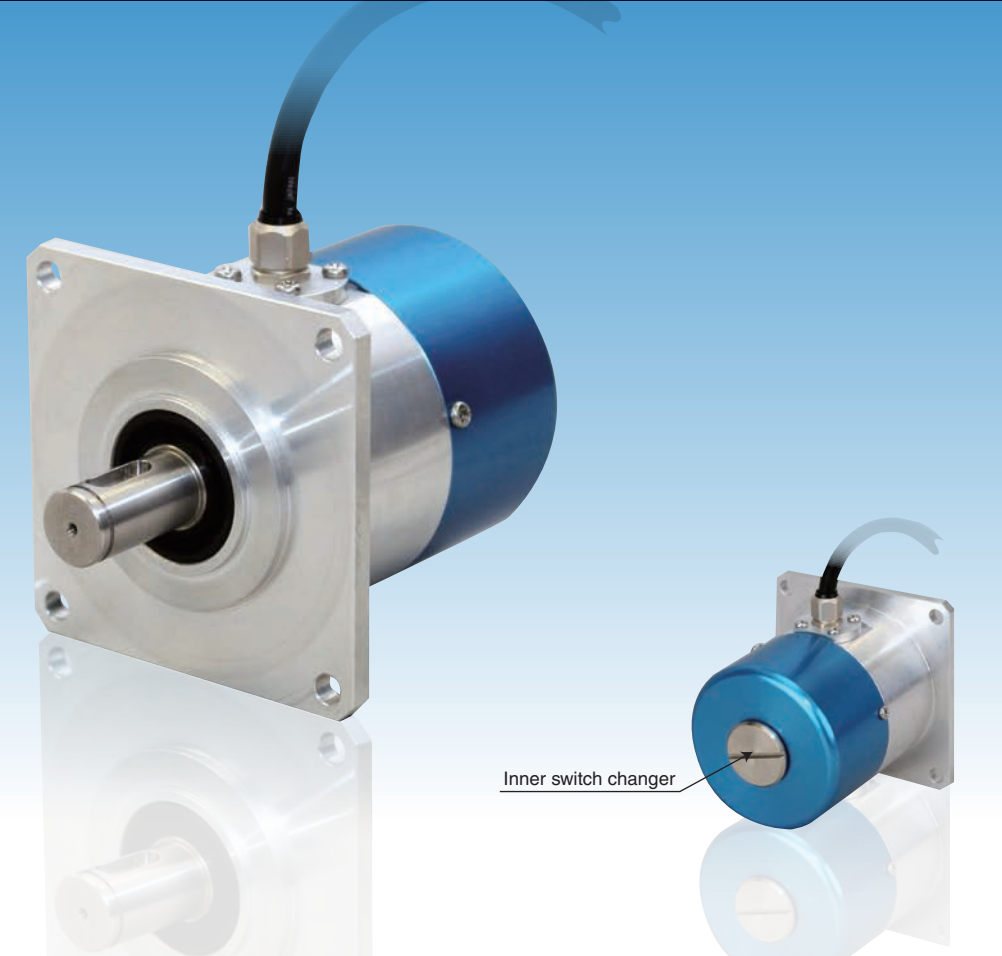


Pulse Count Selectable Heavy Duty Sensor

ezABS0 is a smart sensor which is exactly what the market has been waiting for. Users can select the 16-different pulse counts per revolution by sensor DIP switches. In order to withstand the harsh process environment in a steel plant, it is designed to eliminate optical light sources and fragile glass discs from the sensor unit. ezABS0 counts and measures the machine speed under the electro-magnetic-induction principle which is a very unique technology. ezABS0 series are used for machine feedback in order to control the speed and the sequence of the individual process steps.

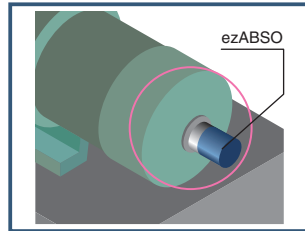
Advantages

- User selectable pulses per revolution by DIP switches
- Zero optics components and zero fragile discs inside

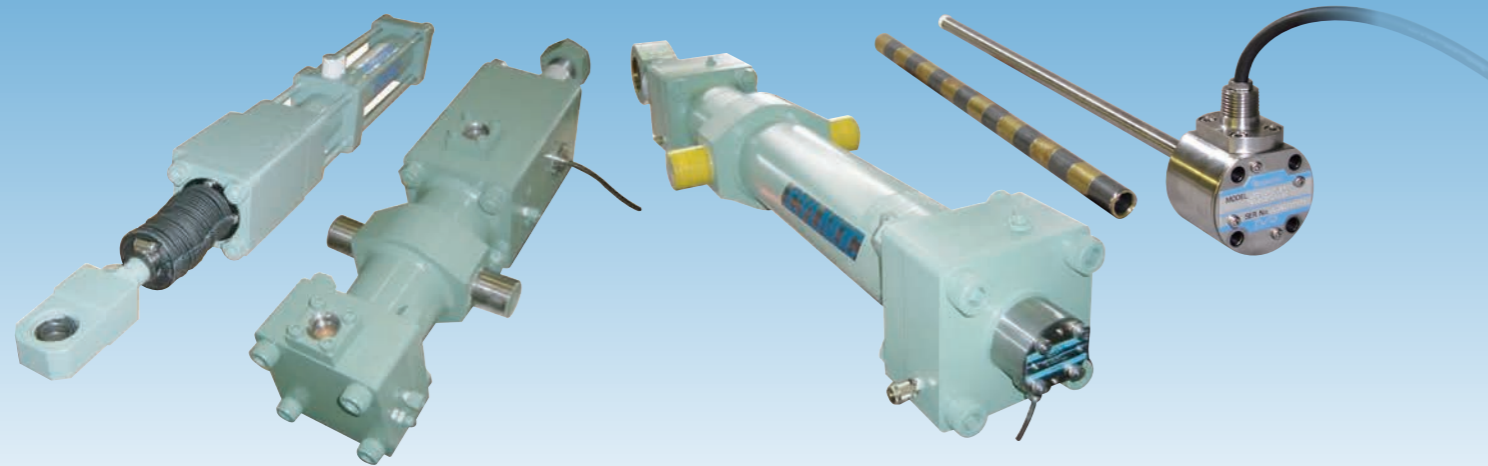


Application | Main Motor Seed Feedback

One of the important features of the DC motor is that its speed can be controlled with relative ease. Sensors are a critical component in a motor control system. One of the major application of ezABS0 is measuring the rotation speed of motor. It is used to sense the speed and direction of rotation motor. ezABS0 is developed to eliminate unexpected down-time for this application.



| Product Family Sensor | General Specification | | | | Pulse Count Select | | | | Environmental Specification | |
|-----------------------|-----------------------|----------------------|----------------|----------------|---|--|---|--|-----------------------------|-------------|
| | Dimension | Power Supply Voltage | Output Circuit | Rotation Speed | A Type | B Type | C Type | D Type | IP | Temperature |
| EZ000 | 68x113mm | DC10.8~26.4 | Push Pull | 6000 r/min | 100 / 200 / 300 / 500 / 512 / 600 / 1000 / 1024 / 1200 / 1500 / 1536 / 2000 / 2048 / 2400 / 3600 / 4096 | 10 / 128 / 192 / 256 / 360 / 384 / 400 / 720 / 800 / 900 / 1600 / 1800 / 2500 / 2560 / 3000 / 8192 | 25 / 100 / 120 / 200 / 300 / 400 / 500 / 600 / 900 / 1200 / 1500 / 1536 / 2000 / 2048 / 2400 / 2500 | 3 / 4 / 20 / 24 / 30 / 40 / 60 / 150 / 250 / 600 / 750 / 900 / 1200 / 2800 / 5000 / 6500 | IP66 | -20~80 |



NSD smart linear position sensor IRS is non-contact and wear-free linear sensor for direct installation in hydraulic cylinders.

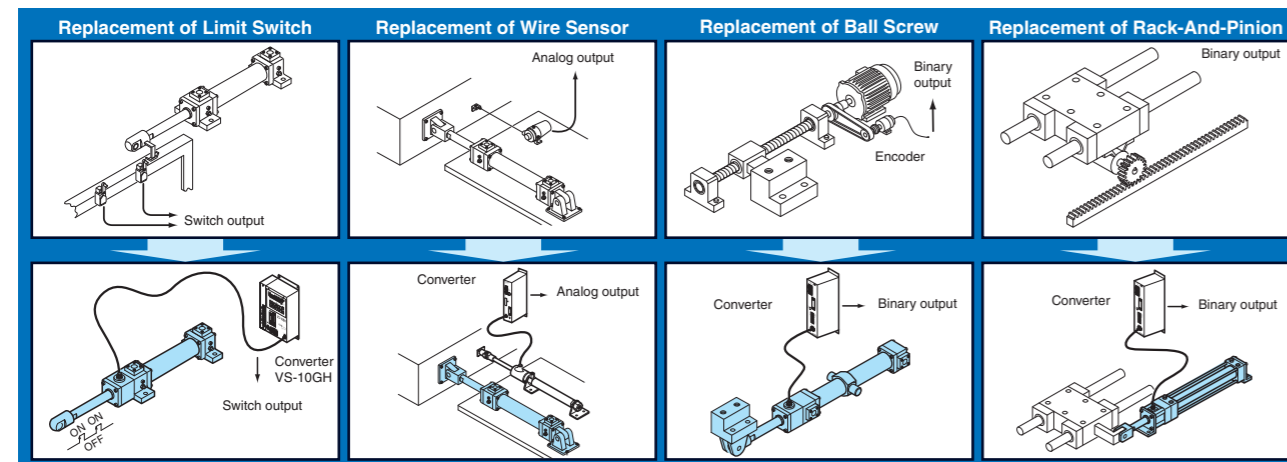


Smart Linear Position Sensing Hydraulic Cylinder

Hydraulic cylinders get their power from pressurized hydraulic fluid. The hydraulic cylinder consists of a cylinder barrel, in which a piston connected to a piston rod moves back and forth. The barrel is closed on one end by the cylinder bottom and the other end by the cylinder.

Hydraulic cylinders have many applications in the steel industry, because the extremely harsh environment of the steel industry demands highly resistant finishing and quality sealing material. Add to this fact that machines are required to run 24hours and 7days per week, and the machinery of the highest quality is demanded.

NSD CYLNUC and IRS is the best solution for linear position sensing cylinder application to satisfy both heavy-duty and high-accuracy demands.



Idea of IRS

External linear displacement transducers (LVDT) is the linear position sensor to measure the position of the hydraulic cylinder's. It is equipped with external sensing bar.

This kind of external LVDT is readily accessible and easy to replace. External LVDTs are exposed to the danger of the harsh steel making environment such as a hot temperature, water, high vibration, debris contamination, and physical shock.

NSD's smart linear position sensor, IRS (In-Rod-Sensor) is a non-contact and wear-free linear sensor for direct installation in hydraulic cylinders.

IRS is one of the most accurate and durable linear sensor available. For the sensor installation, the hydraulic cylinder's piston rod must be bored with a gun-drilling process through its center to accommodate the IRS.

Maximum 1um of IRS sensing resolution accuracy is much greater than is needed for most equipment applications.

Its non-contact design with zero-pulse-generator and zero-microprocessor inside the sensor unit, eliminates mechanical failure mechanisms, reducing wear & tear, while minimizing down-time by improving durability and reliability. True heavy duty IRS series has been proven its excellent performance under the most harsh environments for steel industry.

NSD makes most of sensor parts and progress the rigid quality check process.



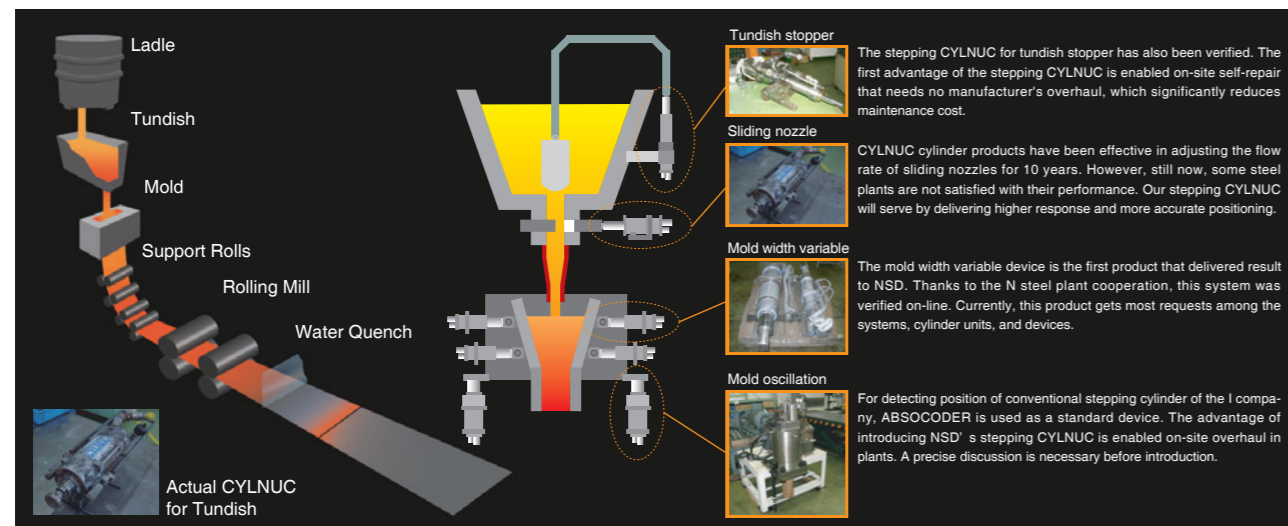
Hydraulic Cylinder Sensor, CYLNUC Family

The steel industry is one of the places where the hydraulic cylinder sensor has been able to show its large advantage in comparison to other industries. The highly compressed power and the resulting forces are crucial to some specific applications. Whether it is smelting, refining or finishing the product, without the power inherent to hydraulics, most products would not be produced at all. In each of these fields, hydraulic cylinders and its built-in linear position sensors are exposed to extreme conditions. High levels of pollution, high temperatures and extreme working environments. CYLNUC has been proven its extraordinary performance under the most harshest environments in the steel industry.



CYLNUC Application

From the ladle, the hot metal is transferred via a refractory shroud (pipe) to a holding bath called a TUNDISH. The tundish allows a reservoir of metal to feed the casting machine while ladles are switched, thus acting as a buffer of hot metal, as well as smoothing outflow, regulating metal feed to the molds and cleaning the metal. One of the traditional linear sensor for tundish is external LVDT, but it requires a great deal of down-time for maintenance to adjust sensitive null position and breakage of a sensor part from the harsh environment. CYLNUC is the best solution for this application to satisfy higher durability and 5um of higher accuracy.



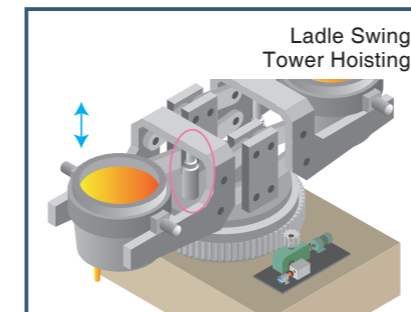
IRS Specification

Non-contact and wear-free linear position sensor IRS is suitable for a direct installation in hydraulic cylinders. NSD's IRS (In-Rod-Sensor) can have the best of both precise sensing and physical durability for smart cylinders. IRS satisfies IP67 protection degree, 20G for vibration, 500G for shock, and up to 120°C of high temperature with zero electronics, zero microprocessor unit, and sensitive core unit inside the sensor unit.

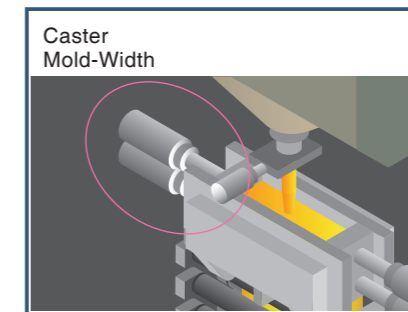
| Product Family | General Specification | | | | Environmental Specification | | | |
|----------------|-----------------------|--------------|------------|--------------|-----------------------------|-----------|----------------------|------------------|
| | Absolute Pitch | Rod Diameter | Resolution | Cable Length | Temperature | IP Rating | Vibration Resistance | Shock Resistance |
| IRS-51.2P18A | 51.2mm | 18mm | 6.25um | Max.200m | 120°C | 67,69K | 20G | 500G |
| IRS-51.2P30A | 51.2mm | 30mm | 6.25um | Max.200m | 120°C | 67,69K | 20G | 500G |
| IRS-32.8P18A | 32.8mm | 18mm | 1.00um | Max.200m | 120°C | 67,69K | 20G | 500G |

IRS Application

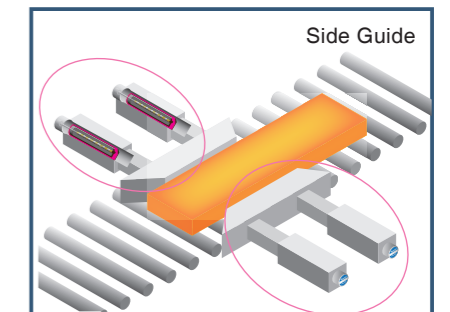
Current hydraulic cylinders for steel industry requests for position-sensing option, such units are also referred to as an electro-hydraulic control or a smart position sensing hydraulic cylinder. IRS is the best solution for a cylinder built-in linear position sensor.



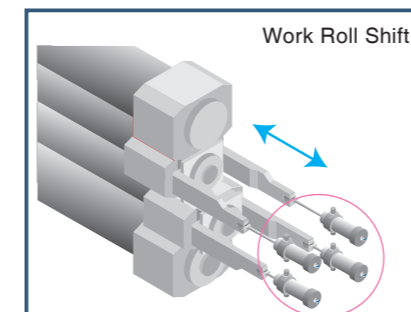
Position Measurement of Ladle Swing Up / Down



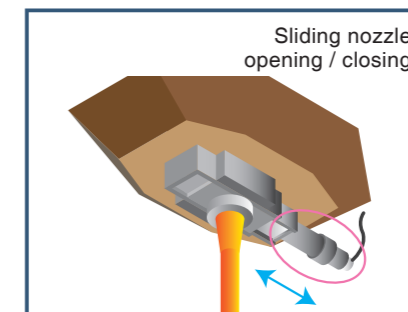
Mold width position detection



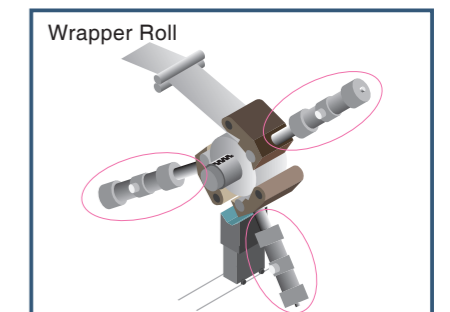
Position Measurement of Slab Side Guide



Work Roll Shift Leaner Position Sensor



Position Detection of sliding nozzle open / close



Linear Position for Wrapper Roll at Down Coiler



VLS-8SM allows for the measurement resolution equal to or better than a traditional magnetscale position sensor



Automatic Gauge Control and Linear Sensor

Sheet and strip thickness accuracy is an important quality indicator, and thickness control is the strip rolling in the field of key technologies.

In modern strip rolling mills, the hydraulic AGC system has replaced the old electric screw-down AGC system.

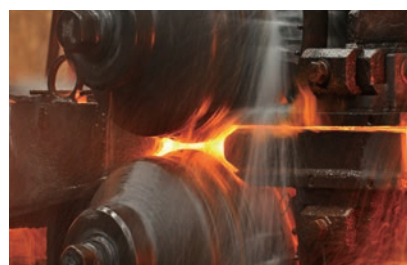
Automatic Gauge Control system (or AGC) is used to continuously measure the actual thickness of the strip through the thickness by the sensor, according to deviation signal of the measured value comparing with a given value.

The hydraulic AGC system uses a pair of hydraulic AGC screw-up/down cylinders (one for each side of the mill) to change the gap between the work rolls. The rolls generate a rolling force to control the thickness of the strip and keep the desired flatness of the strip. AGC position sensors are the most important elements to guarantee the accuracy of the rolling / strip thickness.

The hydraulic gap adjusting cylinders are located under the bottom back-up roll or on top back-up roll. The servo valves and high resolution linear sensor

The rolling mill automatic gauge control system is one of the most critical and sensitive processes. The rolling mill vibration phenomena often occurs in the rolling processes, which not only affects the rolling accuracy, strip surface smoothness, but also cause the damage of the rolling equipment.

Therefore, the AGC linear position sensors are required to be both highly accurate and mechanically durable.



1um of High Accuracy and True Heavy Duty Linear Position Sensor

NSD's high-accuracy and true heavy-duty linear position sensor for AGC application,

VLS-8SM plays to its strength when installed inside a Hydraulic AGC cylinder and will provide the exact position with an accuracy of 1um.

VLS-8SM allows for the measurement resolution equal to or better than the traditional Magnescale sensor.

One of the unique & core technologies which satisfy 1um of sensing resolution is based upon the ultra-precision sensor rod fabrication, and

coil wound sensor head.

The robust linear position sensor VLS-8SM series has a sturdy 14mm sensor rod and 52mm sensor head diameter, with hard chrome plating on the sensor rod surface.

Two double contact shaft seals to keep fluids and solid contaminations out of its bore, and it offers maximum 150°C heat-resistance sensor cables.

Non-contact and wear-free VLS-8SM series is suitable for direct installation inside hydraulic AGC cylinders.

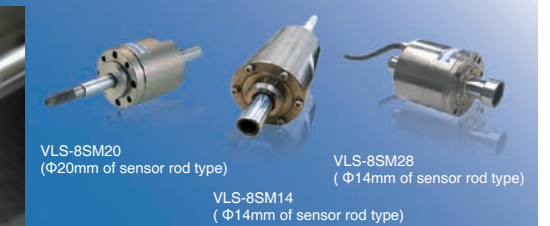
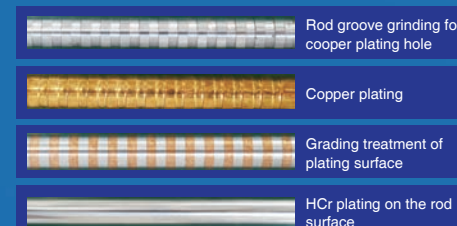
More than 2000 units (until 2010) of VLS-8SM sensors have been installed

in hydraulic AGC cylinders in the world.

Advantages

- 1um of high accuracy
- Non-contact sensor linear travel
- Hard chrome plating on rod surface
- Robust sensor design
- No electronics in sensor unit

Sensor Rod of VLS-8SM



VLS-8SM Specification

VLS-8SM is an electro-mechanical position sensor that measures the AGC's linear travel length and amount under magnetic reluctance change. Its outstanding accuracy and durability is achieved by a high precision sensor rod while eliminating all electronics in the sensor head.

| Product Family | General Specification | | | | Environmental Specification | | | |
|----------------|-----------------------|------------|----------------|--------------|-----------------------------|-----------|----------------------|------------------|
| | Rod Diameter | Resolution | Sensing Stroke | Cable Length | Temperature | IP Rating | Vibration Resistance | Shock Resistance |
| VLS-12.8PRA28 | 28mm | 1.56um | Max.1,200mm | Max.200m | 120°C | 67,69K | 20G | 500G |
| VLS-8SM20 | 20mm | 1.00um | Max.350mm | Max.200m | 80°C | 67,69K | 20G | 500G |
| VLS-8SM14 | 14mm | 1.00um | Max.200mm | Max.200m | 80°C | 67,69K | 20G | 500G |
| VLS-8SM14S | 14mm | 1.00um | Max.200mm | Max.200m | 80°C | 67,69K | 20G | 500G |

Application

Hydraulic AGCs have been an essential system that are used to promote rolling precision. Excellent thickness and high accuracy control can be achieved by a high precision linear position sensor. NSD VLS-8SM series is the best known solution for the linear position sensor for the Hydraulic AGC cylinder for the rolling mill application.

Hot Rolling Mill AGC Application

Sensor housing for the modification / replacement of the existing linear sensor to VLS-8SM

AGC outer mounted linear position sensor VLS-8SM

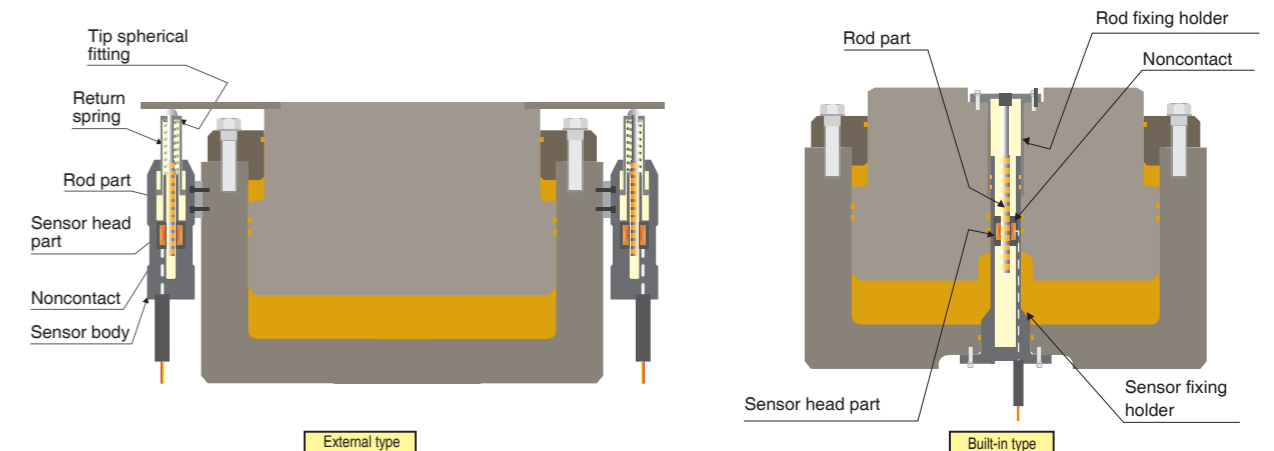
True Heavy Duty and High Accuracy Linear Position Sensor

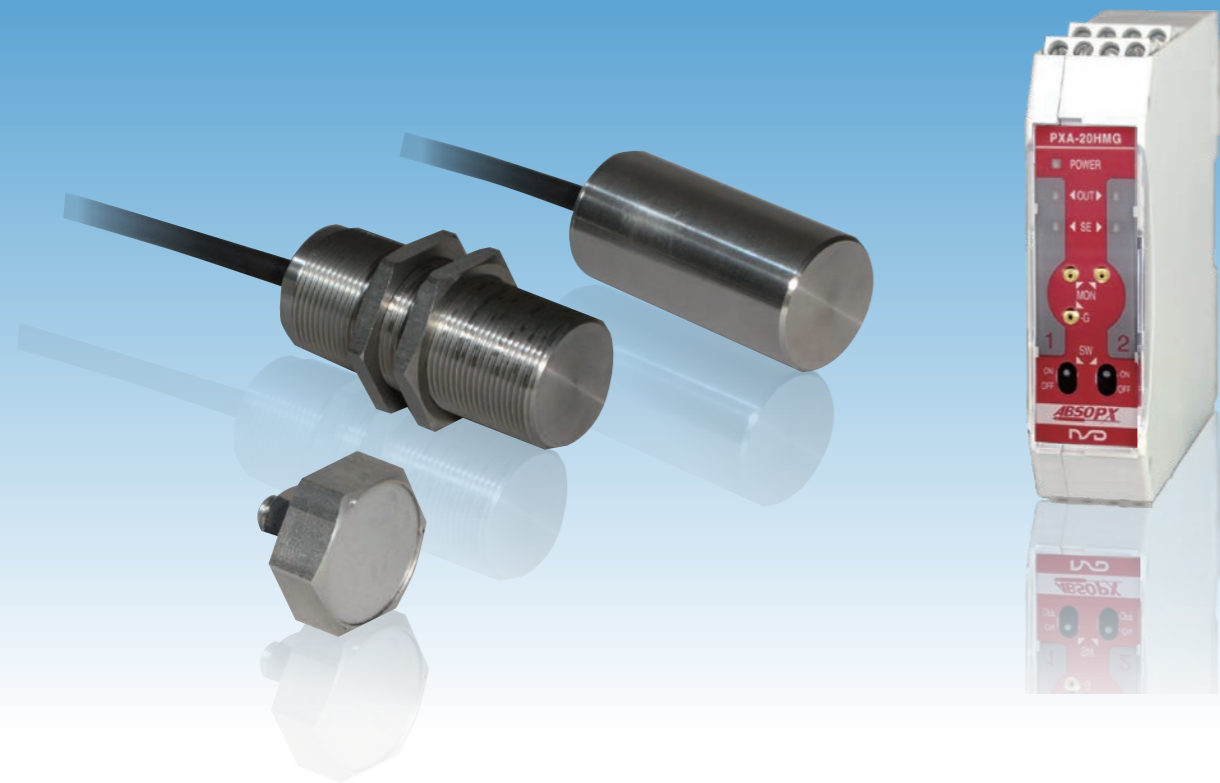
Linear position sensors for AGC application is a critical component on rolling mills. VLS-8SM can allow to automatically adjust the roll gap to provide accurate product gauge control. Linear position sensor failures can shut a mill down, and sensors that are not operating properly can adversely impact strip quality. This is the reason why heavy duty position sensors are required in this application.

| Specification comparison of AGC linear position sensors | | |
|---|--|--|
| | | |
| Magnet linear scale position sensor | Magnetostrictive linear position sensor | Heavy duty magnetic reluctance change linear position sensor |
| Traditional rolling mill application to control thickness of strip to be rolled. It outputs pulses corresponding to the displacement and moving direction on the scale. | Electronic pulse called a current pulse is created in the head of the sensor head and sent speeding down the sensor tube. The position of the circular magnet ring is determined by the time it takes between launching the electronic pulse and strain pulse to return. | Next generation heavy duty linear position sensor under magnetic reluctance change between sensor rod and coil-wound sensor head |
| Contact travel with sensor rod and head | Non-contact travel with sensor rod and magnet ring | Non-contact travel with sensor rod and head |
| Transducer / converter is separated with sensor head | Transducer / converter is installed in sensor head | Transducer / converter is separated with sensor head |
| 2mm of sensor rod without HCr plating treatment | 2mm~10mm of sensor rod without HCr plating treatment | 14mm~ 28mm of sensor rod with HCr plating treatment |
| IP 65 with Max.400 | IP30~IP67 with Max.750 | IP67,IP69K with Max.800 (sensor rod for Max.150°C) |
| Resolution for 1um~10um | Resolution for 0.5um~5um | Resolution for 1um |

Replacement of Your Existing AGC Sensor to VLS-8SM

VLS-8SM will help you to improve your existing roll position control system as the replacement solution. Selecting and ordering VLS-8SM is also incredibly easy; please tell us your existing AGC specification with mechanical and electrical specs. NSD and our local partner will work with our customers' specs to insure a proper modification. NSD's engineering team will provide a seamless installation of VLS-8SM to your existing system. NSD's engineering team will provide a seamless installation of VLS-8SM to your existing system. NSD will also design the sensor housing to fit with the cylinder and VLS-8SM, in that case the additional.





*ABSO PX was developed specially to detect the presence of an object and used on heavy duty equipment in a harsh environment
Max.100mm Sensing Range*

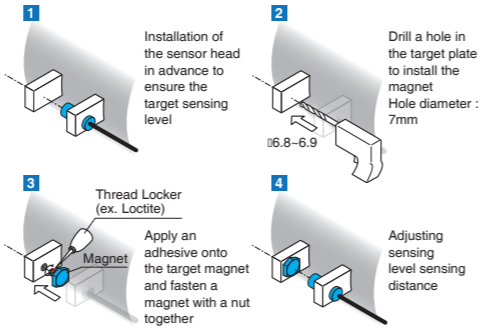
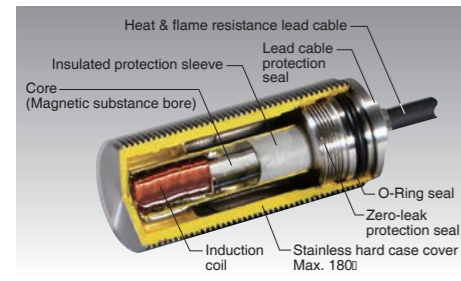


True Heavy Duty Proximity Magnet Sensor

Magnetic proximity sensors are actuated by the presence of the permanent magnet. The reciprocal attraction of both reeds in the presence of a magnetic field, due to magnetic induction, establishes an electrical contact. The plate's surface has been treated with a special material particularly suitable for low current or high inductive circuits. Presence detecting is well activated by means of a magnetic field rather than mechanical contacts.

NSD's magnetic proximity sensor, ABSO PX, is the best solution under a heavy duty environment which has no any electronics and reed contactors inside the sensor, but induction coils and core to enhance its durability. ABSO PX was developed specifically to detect the presence of an object and use in heavy duty equipment in harsh, high temperature, high vibration, water condition, and outdoor environments.

- Major application for steel industry**
- Cokes ASP
 - Cokes CDQ Up/Down
 - Side Guide
 - Pinch Roll Open/Close
 - Chock Clamp
 - Dummy Bar Cut
 - Plate Rolling Mill CLC
 - Down Coiler
 - Cokes Coal Cart Limit
 - Back Up Roll Limit
 - Pressure Block
 - Side Shift Roll Change
 - Spindle Shaft Support
 - Work Roll Change Level
 - Re-Heater Door
 - Turn Table

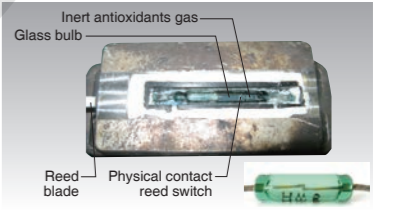
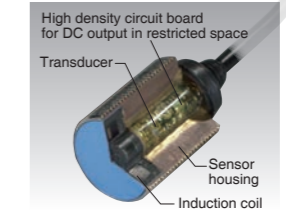
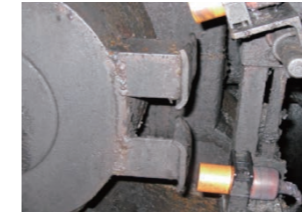


True Heavy Duty Proximity Magnet Sensor

A proximity sensor or switch opens or closes an electrical circuit and detects the presence of a nearby object without any physical contact. They are most commonly used in manufacturing equipment, robotics, and security systems. The object being sensed is often referred to as the proximity sensor's target. For instance, an inductive proximity sensor always requires a metal target, and a capacity sensor might be suitable for a plastic target.

Inductive proximity switches are the traditional sensor in the steel industry to sensing distance to objects by generating magnetic fields / eddy current. They are similar in principle to metal detectors. A coil of wire is charged with electrical current, and an electronic circuit measures this current. If a metallic part gets close enough to the inner coil, the current will increase and the switch will open or close accordingly.

Inductive proximity sensors operate under the electrical principle of inductance. Inductance is the phenomenon where a fluctuating current, which by definition has a magnetic component, induces an electromotive force in a target object. Eddy circuits build up in the metallic object, magnetically push back, and finally reduce the inductive sensor's own oscillation field. Traditional proximity sensors are based on the use of reed contacts whose thin plate are hermetically sealed in a glass blub containing inert-gas.



ABSO PX Specification

When it comes to presence detection applications in steel industry, proximity sensors are subjected to extremely harsh environments. ABSO PX is the best solution with world-best-durability, it should last for years without breakage.

| Product Family Sensor | General Specification | | | | Environmental Specification | | | |
|-----------------------|-----------------------|-----------------|--------|--------------|-----------------------------|-----------|----------------------|------------------|
| | Dimension | Detection Range | Weight | Cable Length | Temperature | IP Rating | Vibration Resistance | Shock Resistance |
| HPS-M30M | Ø 30x70mm | 33mm | 400g | Max.500m | 150°C | 67,69k | 20G | 500G |
| HPS-M34D | Ø 34x70mm | 33mm | 400g | Max.500m | 150°C | 67,69k | 20G | 500G |

| Product Family Sensor | General Specification | | | | | Environmental Specification |
|-----------------------|-----------------------|--------------|---------------|--------------------------------|--------|-----------------------------|
| | Dimension | Power Supply | Signal Output | Response Time | Weight | Temperature |
| PXA-20HMG | 22.5x85x92mm | DC24V | On / Off | On→Off : 30ms Off→On : 35ms | 150g | 55°C |

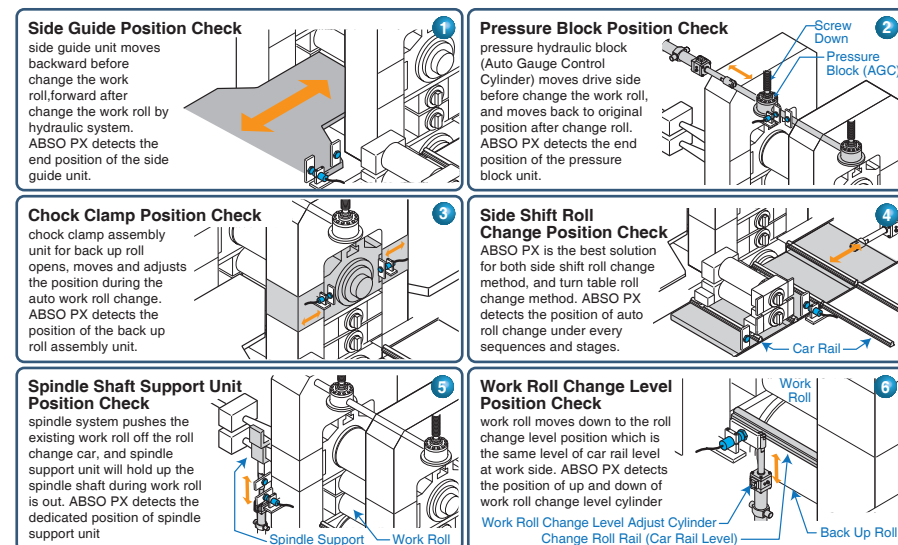
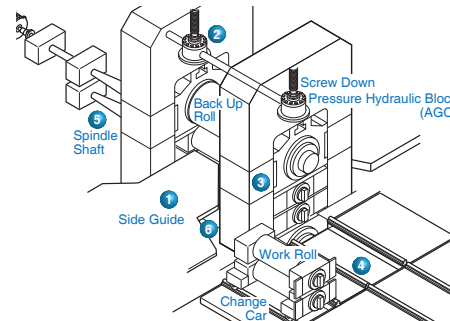
ABSO PX Application | Automatic Work Roll Change

The change of work rolls is a necessary process for every rolling mill to perform. The change of worn or marked work rolls requires a great effort and time, which can relate to the mill's productivity. The improvement and modernization of a rolling mill is an effective way of adapting to the recent market requirements and reducing conversion costs.

Today's stringent demands on product quality and lower-cost production make it imperative for metal strip producers to improve equipment and make their rolling operations more efficient.

Automatic roll change systems became a usual technology to suit market needs in recent years. It assists the operator to carry out this hard task, reducing safety risks, time lost in its execution, and increasing the productivity of the mill.

All sequence steps are performed automatically when the respective interlocks are set. Despite that the roll change is an automatic process, confirmation of position by the operators always will be required to start introduction, and extraction of roll sequences.

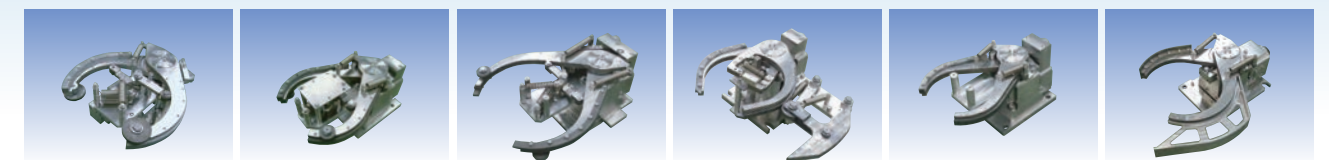
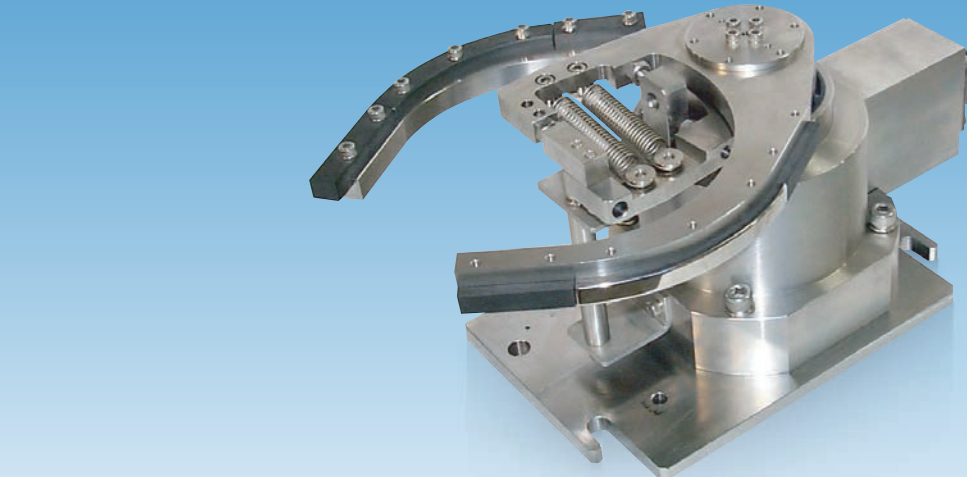


Most of roll change positions are detected, measured and controlled by proximity sensors, and most proximity sensors are installed at the mill stands area.

Therefore, sensors are required to withstand such a harsh environment during the rolling mill operation. Production time lost when changing work rolls are from proximity sensor errors and its correction by operators.

NSD's ABSO PX has been proven its excellent performance and superior durability. It is the extremely robust, durable, water sealed and failsafe sensor.

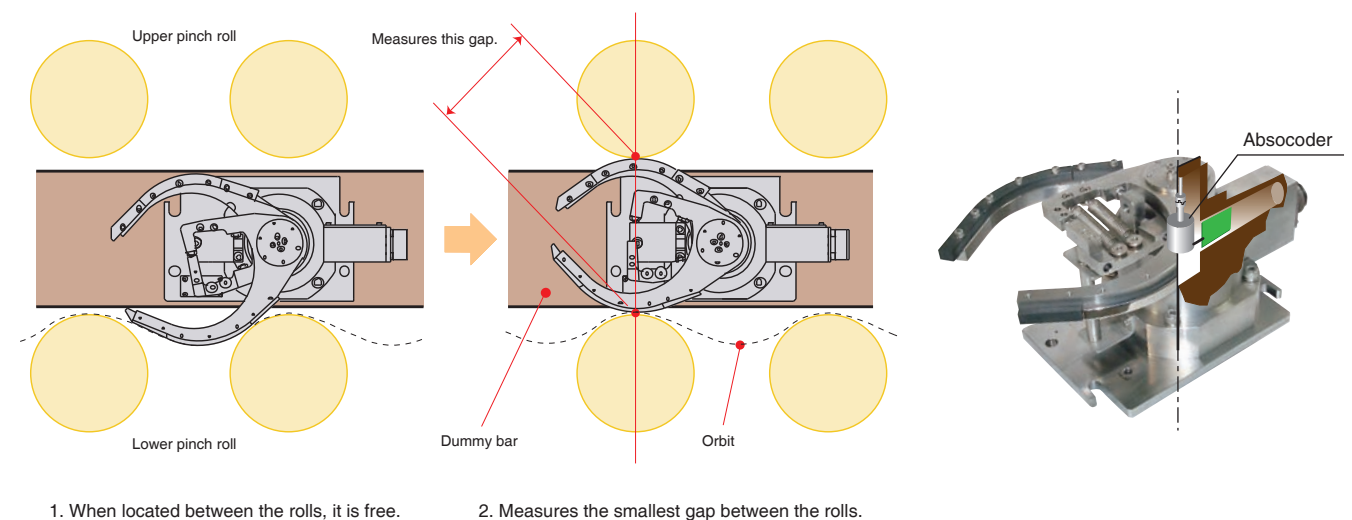
NSD's ABSO PX has been proven its excellent performance and superior durability. It is the extremely robust, durable, water sealed and failsafe sensor.



The Idea of Roll Gap Measurement by RGS

The roll gap measurement, RGS enables the control of all potential error sources and provides detailed information about the condition of the strand guidance and roll gap condition. The roll checker GRS is available as well for the slab caster applications.

When it comes to roll gap measurement applications in a slab caster, gap sensors are subjected to high vibration and unexpected mechanical shock. Often these environments result in an increase in operating expenses and maintenance cost from production down-time along with the sensor damage and breakage. NSD's true heavy duty roll gap sensor, RGS is failure-free and extremely robust designed. RGS provides accident-free and less down-time.



Sensor Solution

Cost-efficient steel production under increasingly stringent quality requirements becomes more demanding in the industry's current economic environment.

Since prices for many steel products are declining or reached a very low level, already, there is great price pressure on the industry's suppliers.

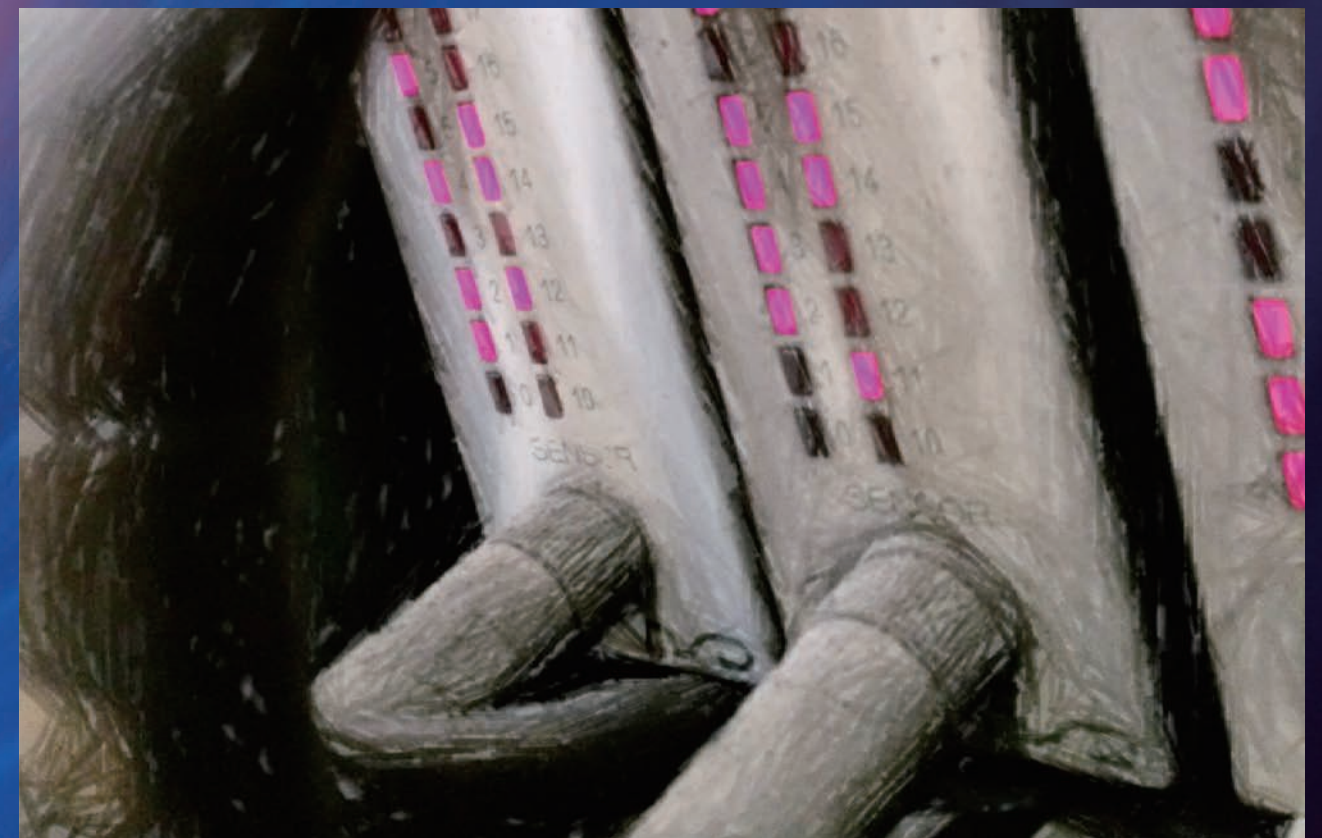
The ever-continuing requirement for cost-effective steel production means that your production system is running without much down-time.

Japanese company NSD Corporation, one of the worldwide leading manufactures for position measurement sensor solutions.

True heavy duty and absolute position sensor ABSOCODER is reliable, durable and it has a minimum of unplanned down-time even under the most harsh steel making environment.

ABSO SOLUTION

True Heavy Duty & Fully Absolute Position Sensor



NCV Digital Output Converter

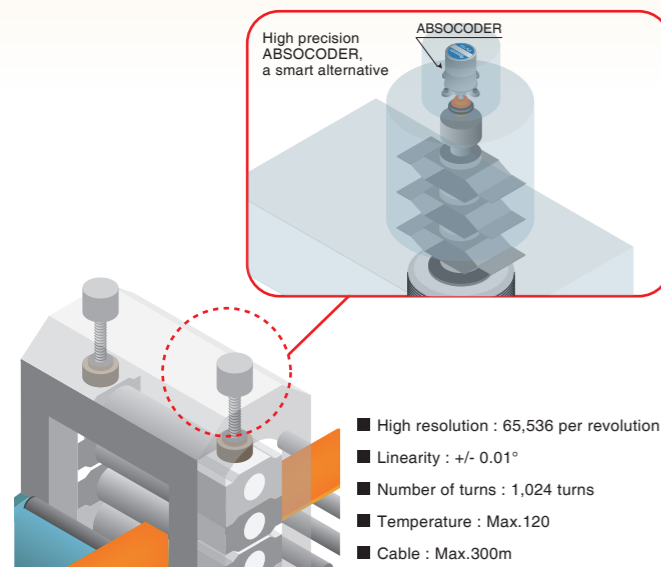


Digital Binary / Gray Code Output Converter

The most common types of numerical encoding used in the absolute position sensor are binary and gray codes. Binary code can have a large number of changes between one code and the next. Gray code, on the other hand, has the important characteristic that only one bit changes between one code and the next. See the table for examples of binary code and gray code for the codes from 0 to 15 for a 4 bit code. The advantage of binary code is that it is easy to convert to a numeric value. The advantage of gray code is that it makes very stable position digitizers, because only one bit changes at a time, resulting in uncertainty of only 1 bit. NSD offers both binary and gray code output converters for rotation and linear ABSOCODER.

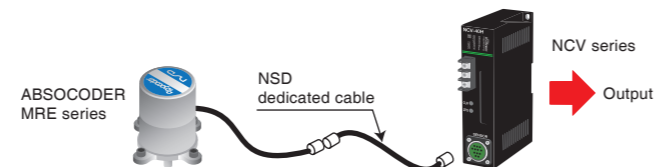
| Decimal Code | Rotation Range (deg.) | Binary Code | Gray Code |
|--------------|-----------------------|-------------|-----------|
| 0 | 0 ~ 22.5 | 0000 | 0000 |
| 1 | 22.5 ~ 45 | 0001 | 0001 |
| 2 | 45 ~ 67.5 | 0010 | 0011 |
| 3 | 67.5 ~ 90 | 0011 | 0010 |
| 4 | 90 ~ 112.5 | 0100 | 0110 |
| 5 | 112.5 ~ 135 | 0101 | 0111 |
| 6 | 135 ~ 157.5 | 0110 | 0101 |
| 7 | 157.5 ~ 180 | 0111 | 0100 |
| 8 | 180 ~ 202.5 | 1000 | 1100 |
| 9 | 202.5 ~ 225 | 1001 | 1101 |
| 10 | 225 ~ 247.5 | 1010 | 1111 |
| 11 | 247.5 ~ 270 | 1011 | 1110 |
| 12 | 270 ~ 292.5 | 1100 | 1010 |
| 13 | 292.5 ~ 315 | 1101 | 1011 |
| 14 | 315 ~ 337.5 | 1110 | 1001 |
| 15 | 337.5 ~ 360 | 1111 | 1000 |

Application Example | Screw Down



The screw-down drive system must be capable of operation under rolling loads. The design must be rugged as loading torques, and should be encountered in additional to frictional effects. The condition for a high speed strip thickness control is the fast and precise hydraulic-screw-down of the rolls. The hydraulic cylinders must move to the nominal position with a sufficiently low friction and the highest speed. The position is controlled by a high resolution position sensor with 1um level. NSD provides 1024 multi turn ABSOCODER with high resolution Binary or Gray code converters (65,536 divisions per one revolution).

- High resolution : 65,536 per revolution
- Linearity : +/- 0.01°
- Number of turns : 1,024 turns
- Temperature : Max.120
- Cable : Max.300m



Specification

| Product Family | Applicable ABSOCODER | Dimension mm | Resolution | Power Supply | Output | Sample Time | Cable Length |
|-----------------|----------------------|--------------|------------------------------------|--------------|---------------|-------------|--------------|
| NCV-20HB(G)NV1R | VRE | 39x155x93 | 8192 | DC24V | Binary / Gray | 0.2ms | Max.500m |
| NCV-20HB(G)NV2 | VRE | 39x155x93 | 65,536 | DC24V | Binary / Gray | 0.2ms | Max.200m |
| NCV-20HB(G)NM2R | MRE | 39x155x93 | 65,536 | DC24V | Binary / Gray | 0.2ms | Max.300m |
| NCV-40HB(G)NM5 | MRE-1024 | 39x155x93 | 67,108,864 (1024turns x 65,536) | DC24V | Binary / Gray | 0.1ms | Max.300m |
| NCV-30HB(G)NLC | VLS / IRS | 39x155x93 | 1.56um(VLS) 6.25um(IRS) | DC24V | Binary / Gray | 0.2ms | Max.200m |
| NCV-30HBNL8 | VLS-8SM | 39x155x93 | 1um | DC24V | Binary | 0.2ms | Max.200m |

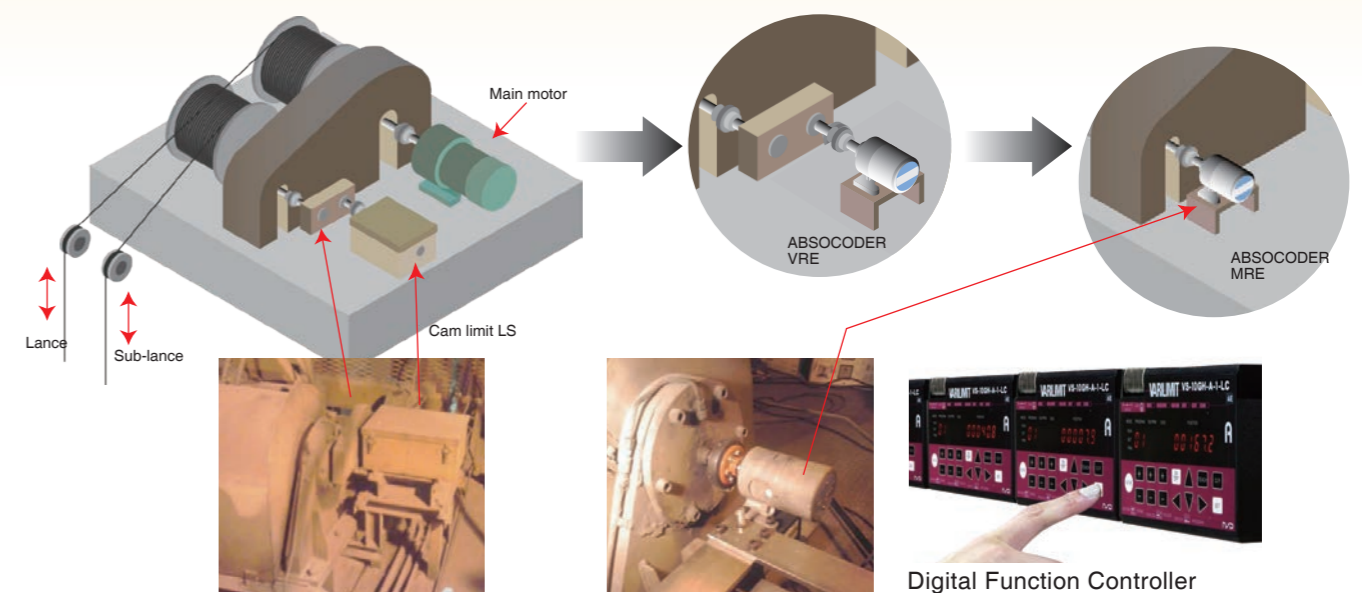
VARICAM / VARILIMIT Electrical Cam Switch Controller

On / Off Cam Switch / Limit Switch Signal Output Controller



The cam switch and limit switch are used to convert a mechanical motion into an electrical control signal with on/off formation, and for end-of-travel switching onto mechanical site. Cam switches are mounted in one enclosure and are activated by individual & adjustable cams. Switches can be set to be activated in fully open / close positions. It uses physical contact to detect the presence of an object, therefore operators should maintain the cam switch at actual production site where the possibility for accident is high. Limit contact switches are consumable parts, and it requires periodic maintenance for replacement. User friendly digital cam switch controller, VARICAM / VARILIMIT offers freely selectable and configurable cam switches and limit switches with ABSOCODER. The position data is provided to VARICAM / VARILIMIT by a position sensor ABSOCODER. For easy configuration, NSD controllers provide optional signal formation according to the connecting upper controller (PLC), for instance, on/off limit switches • analog voltage • analog current • BCD binary code • motion detection signal.

Application Example | Replacement of CAM Switch



Specification

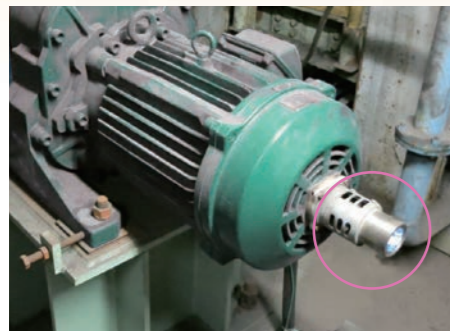
| Product Family | Applicable ABSOCODER | Power Supply | Output | Cable Length | |
|-----------------|----------------------|--------------|---|---|----------|
| VS-10GH-A-1-V1R | VRE | DC24V | 30Points Switch / Analog Voltage / Motion Detection | Max.500m | |
| VS-10GH-A-1-M2R | MRE | | | Max.300m | |
| VS-10GH-A-1-LC | VLS / IRS | | | Max.200m | |
| VS-10GH-C-1-V1R | VRE | | | Max.500m | |
| VS-10GH-C-1-M2R | MRE | | | Max.300m | |
| VS-10GH-C-1-LC | VLS / IRS | | | Max.200m | |
| VS-10GH-D-1-V1R | VRE | | 30Points Switch / Analog Current / Motion Detection | Max.500m | |
| VS-10GH-D-1-M2R | MRE | | | Max.300m | |
| VS-10GH-D-1-LC | VLS / IRS | | | Max.200m | |
| VS-10GH-A-1-LC | VLS / IRS | | | 30Points Switch / BCD Binary / Motion Detection | Max.500m |
| VS-10GH-A-1-C | MRE | | | | Max.300m |
| VS-10GH-A-1-LC | VLS / IRS | | | | Max.200m |

Pulse Output Converter

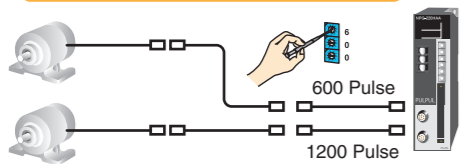
Digital signals are a series of pulses consisting of just two states, On (1) or Off (0). There are no values in between. Digital signals carry more information per second than analog signals. This is the same whether optical fibers, cables, or radio waves are used. Pulse output digital signals maintain their quality over long distances better than analog signals. ABSO PULPUL is a transmitter that converts mechanical position or speed information from ABSOCODER to pulse wave patterns which is the same with the general optic (incremental) encoders. You can select the desired number of pulse or change with ABSO PULPUL from 1 to 10,240 pulses.



Application Example | Motor Speed Feedback

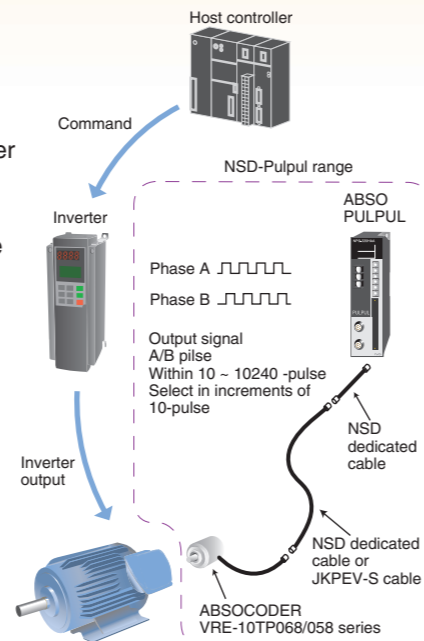


Pulse setting
Rotate the rotary switches with a driver to set [6][0][0].



Pulse setting
Rotate the rotary switches with a driver to set [1][2][0].

DC motor speed is often regulated with a closed-loop speed control using incremental optic encoder (tachometer) feedback. The optical encoder always watches the number of rotations of the shaft. Light from the LED passes through a pattern on the glass disc and is read by the light receiving component. Motor vibration causes encoder failure, especially when glass discs and electronics are present. ABSO PULPUL is the pulse-output converter which connects with the heavy duty ABSOCODER. Customer can reuse the current system and interface without any modification and can select the desired pulse numbers with ABSO PULPUL converter.



Specification

| Product Family | Applicable ABSOCODER | Dimension mm | Resolution | Power Supply | Output | Sensor Channel | Cable Length |
|----------------|----------------------|--------------|-------------------------------------|--------------|-----------|----------------|--------------|
| NPG-10HAAV1R | VRE | 39x155x93 | 1-2048 (select by 1 pulse unit) | DC24V | A / B / Z | 1 axis | Max.500m |
| NPG-10HAAVT | VRE-10TP | 39x155x93 | 10-10,240 (select by 10 pulse unit) | DC24V | A / B | 1 axis | Max.300m |
| NPG-210HAAVT | VRE-10TP | 39x155x93 | 10-10,240 (select by 10 pulse unit) | DC24V | A / B | 2 axis | Max.300m |
| VL-2PG-CH | VLS / IRS | 39x192x110 | 6.25um for VLS 25um for IRS | DC24V | A / B | 1 axis | Max.200m |



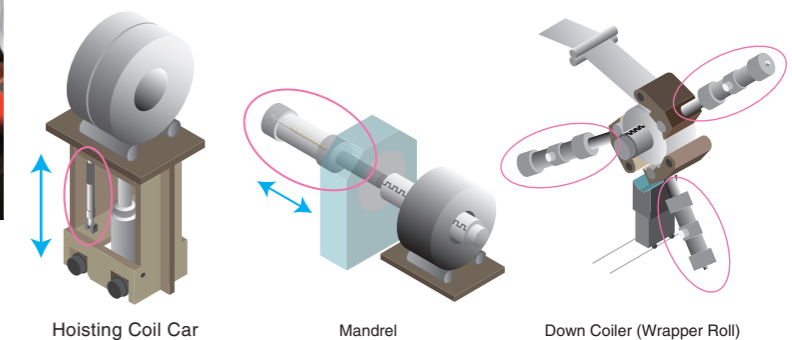
TMEIC TC-net Network Converter

TC-net provides a convenient way to upgrade the older GE control system. The VME-based hardware provides high-performance bridging to Toshiba's TC-net real-time control network. The controller is programmed for all the drives and logic using the existing configuration as a basis, and the Bridge is programmed to communicate with those drives through the interface cards. AB9 series is a ABSOCODER converter which corresponds to TC-net network.

Application Example | Coiling



Coilers begin with a pair of pinch rolls that catch the strip head-end and establish tension across the run-out table. The head-end is deflected by a gate down to mandrel associated with the coiler and is guided around the mandrel by wrapper rolls. After the strip tails out of the finishing mill, the pinch rolls continue to hold back-tension to prevent the coil from unraveling, before the strip tail is pulled through the pinch rolls, the wrapper rolls are reengaged. A hydraulic coil car moves into place beneath the coil, and after rising up to support the coil's bulk, it strips the coil from the mandrel and places it in position for transport to the tagging.



Specification

| Product Family | Applicable ABSOCODER | Dimension mm | Resolution | Output | Sensor Channel | Cable Length |
|----------------|----------------------|--------------|------------------------------------|--------|----------------|--------------|
| AB932N | VRE | 35x185x95 | 8192 | Binary | 2 axis | Max.500m |
| AB933N | MRE | 35x185x95 | 131072 (8192X32turn - 32X2048turn) | Binary | 2 axis | Max.300m |
| AB934N | VLS / IRS | 35x185x95 | 1.56um(VLS) 6.25um(IRS) | Binary | 2 axis | Max.300m |
| AB935N | VLS-8SM | 35x185x95 | 1um | Binary | 2 axis | Max.200m |

NCV-220HSSI Synchronized Serial Interface SSI



SSI (Synchronized Serial Interface) Converter

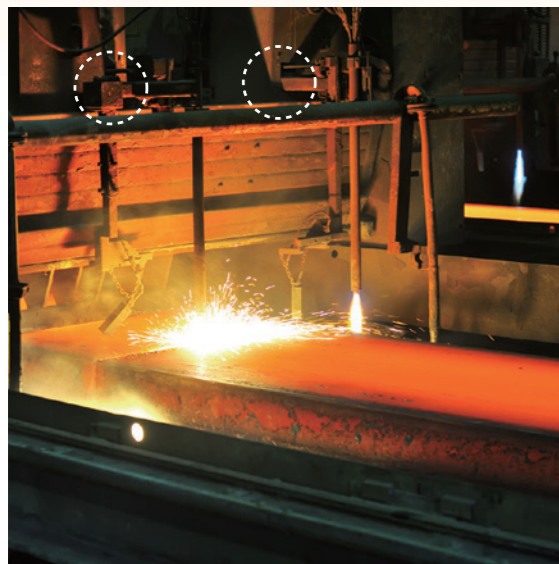
SSI (Synchronized Serial Interface) is a synchronous, point-to-point, serial communication channel for digital transmission.

Synchronous data transmission is one in which the data is transmitted by synchronizing the transmission at the receiving and sending ends using a common clock signal.

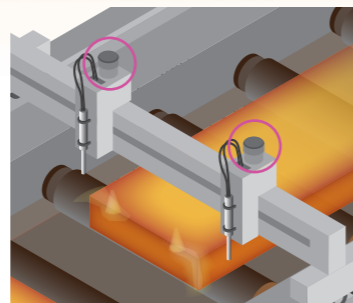
2 sensor channel of NSD SSI converter has various functions, as below.

- Zero point setting function
- Error detection function
- Rotating direction setting function
- Compact Design
- Max.500m of cable connection

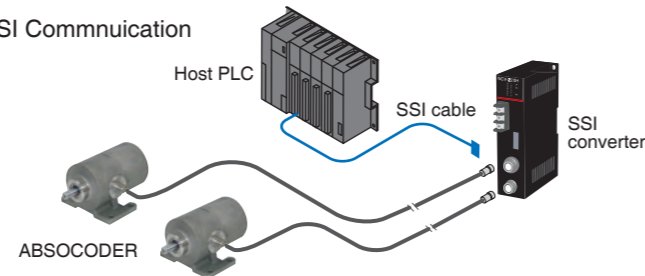
Application Example | Slab Torch Cutter



Slab torch cutter is also the piece of equipment on the cutting machine most likely to be misused, nonfunctional or even missing one of the most important applications. Two sensor channel of SSI converter can measure and deliver the absolute position of the cutters.



● SSI Communication



Specification

| Product Family | Applicable ABSOCODER | Dimension mm | Resolution | Power Supply | Output | Sensor Channel | Cable Length |
|----------------|----------------------|--------------|---------------------------------------|--------------|--------|----------------|--------------|
| NCV-220HSSIV1R | VRE | 39x155x93 | 8192 | DC24V | Binary | 2 axis | Max.500m |
| NCV-220HSSIM2R | MRE | 39x155x93 | 131072 (8192X32turn ~ 32X2048turn) | DC24V | Binary | 2 axis | Max.300m |
| NCV-220HSSILC | VLS / IRS | 39x155x93 | 1.56um(VLS) 6.25um(IRS) | DC24V | Binary | 2 axis | Max.300m |
| NCV-220HSSIL8 | VLS-8SM | 39x155x93 | 1um | DC24V | Binary | 2 axis | Max.200m |

NCW-3DHPR SIEMENS PROFIBUS Communication Converter



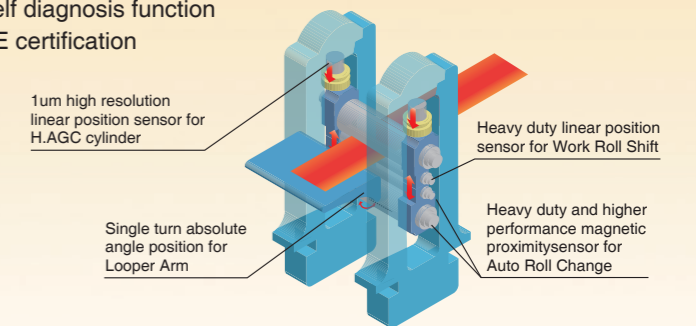
PROFIBUS Communication Converter

PROFIBUS (Process Field Bus) is a standard for fieldbus communication in automation technology by Siemens.

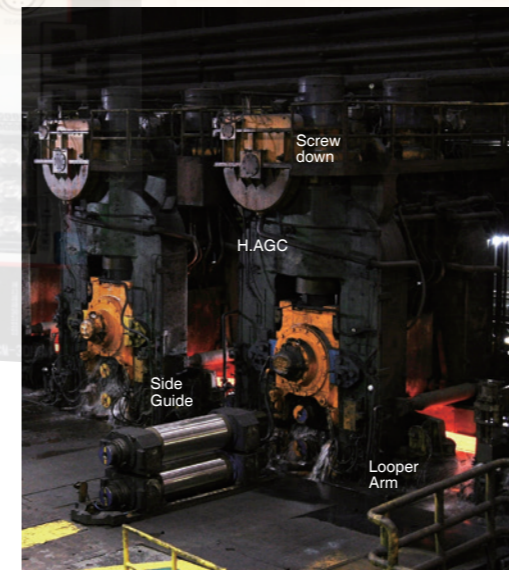
NSD provides PROFIBUS DP converter. PROFIBUS DP is used to operate sensors and actuators via a centralized controller in production control applications.

Features

- Two sensor (ABSOCODER) channels
- Sensor current position setting function
- Sensor parameter setting function
- Self diagnosis function
- CE certification

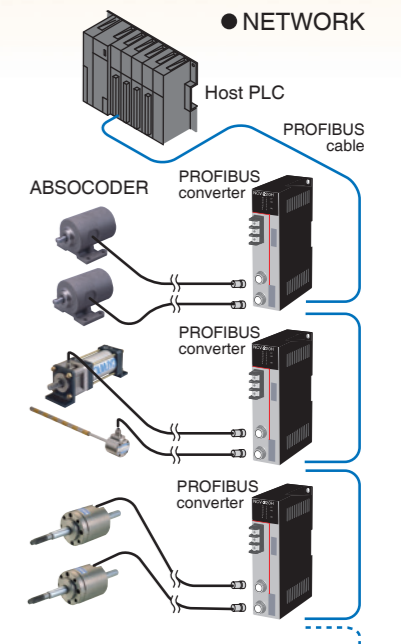


Application Example | Finishing Mill



The primary function of the hot strip mill is to reheat semi-finished steel slabs of steel nearly to their melting point, then roll them thinner and longer. The finishing mill stands are used to form the strip to the final thickness and dimension. A precise position measurement of rolling mills in this process is the most critical for a consistent surface finish and for consistent thickness of a strip. NSD has been providing our total-sensor-solution for finishing mill application with PROFIBUS DP interface.

- AGC / Screw Down / Side Guide / Looper Arm



Specification

| Product Family | Applicable ABSOCODER | Dimension mm | Resolution | Power Supply | Output | Sensor Channel | Cable Length |
|----------------|----------------------|--------------|---------------------------------------|--------------|--------|----------------|--------------|
| NCW-3DHPRV1R | VRE | 39x155x93 | 8192 | DC24V | Binary | 2 axis | Max.500m |
| NCW-3DHPRM2R | MRE | 39x155x93 | 131072 (8192X32turn ~ 32X2048turn) | DC24V | Binary | 2 axis | Max.300m |
| NCW-3DHPRLC | VLS / IRS | 39x155x93 | 1.56um(VLS) 6.25um(IRS) | DC24V | Binary | 2 axis | Max.300m |
| NCW-3DHPRL8 | VLS-8SM | 39x155x93 | 1um | DC24V | Binary | 2 axis | Max.200m |

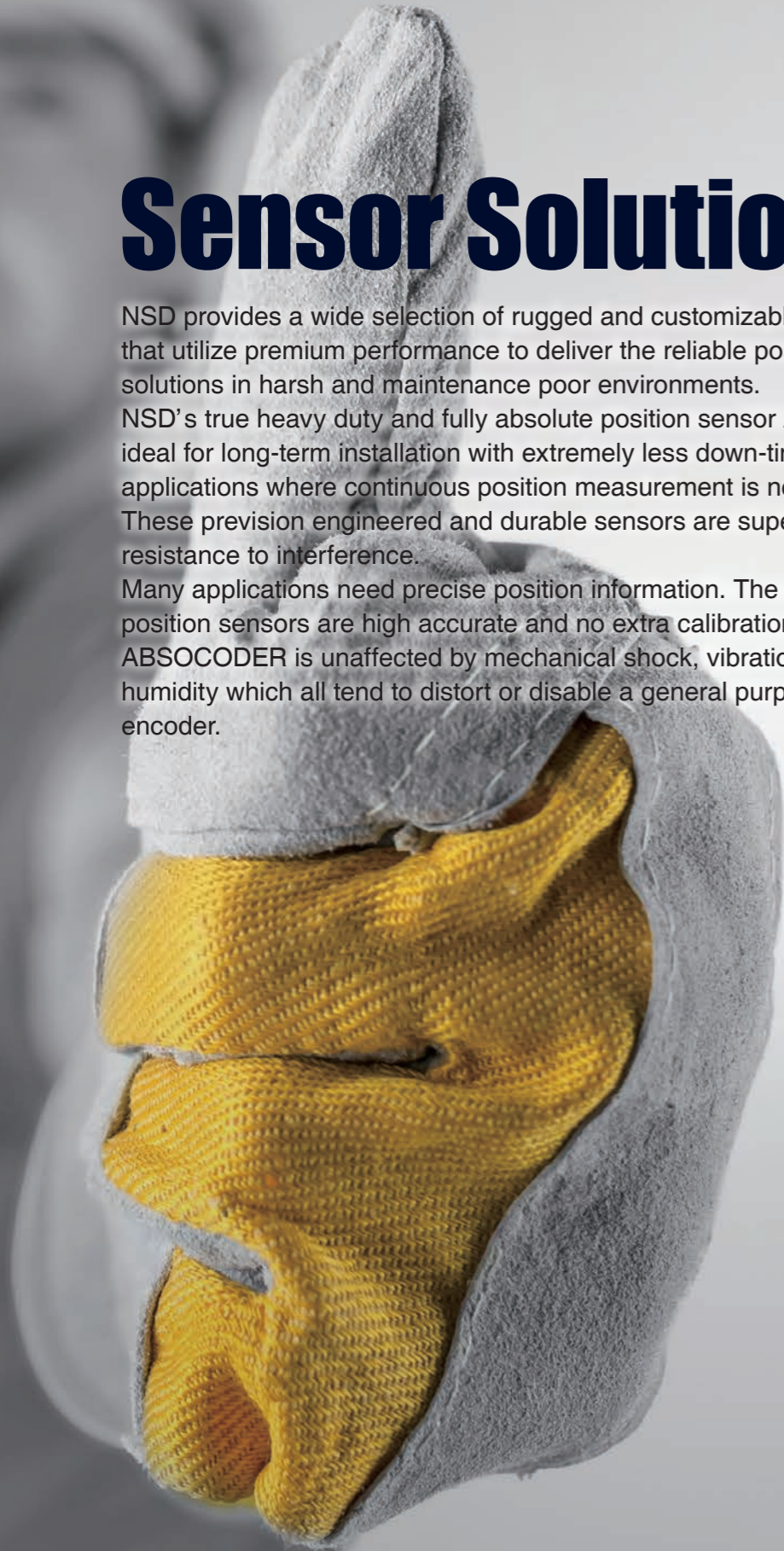
Sensor Solution

NSD provides a wide selection of rugged and customizable position sensors that utilize premium performance to deliver the reliable position sensing solutions in harsh and maintenance poor environments.

NSD's true heavy duty and fully absolute position sensor ABSOCODERs are ideal for long-term installation with extremely less down-time in industrial applications where continuous position measurement is needed.

These precision engineered and durable sensors are superb stability and resistance to interference.

Many applications need precise position information. The benefits of NSD's position sensors are high accurate and no extra calibration is necessary. ABSOCODER is unaffected by mechanical shock, vibration, dust, dirt, oil and humidity which all tend to distort or disable a general purpose optic rotary encoder.



ABSOLUTE SOLUTION

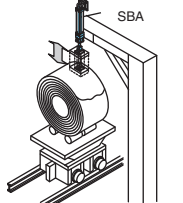
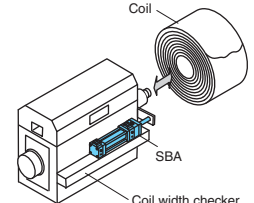
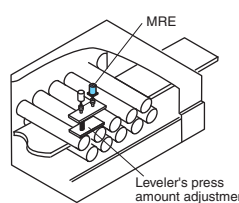
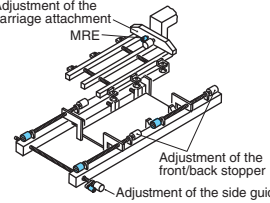
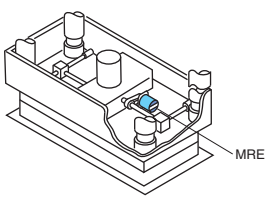
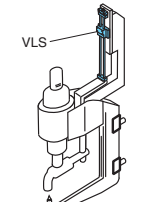
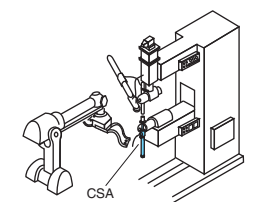
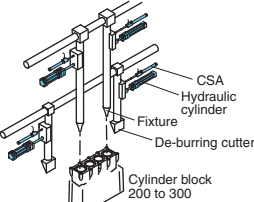
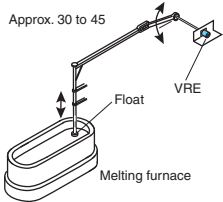
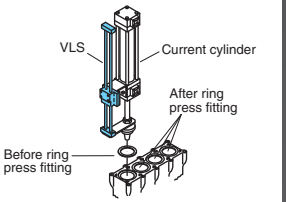
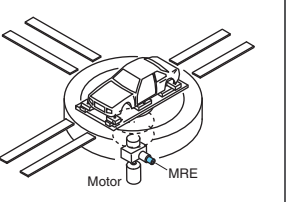
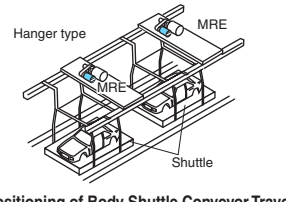
True Heavy Duty & Fully Absolute Position Sensor



ABSOLUTE Solution for Car Making Application



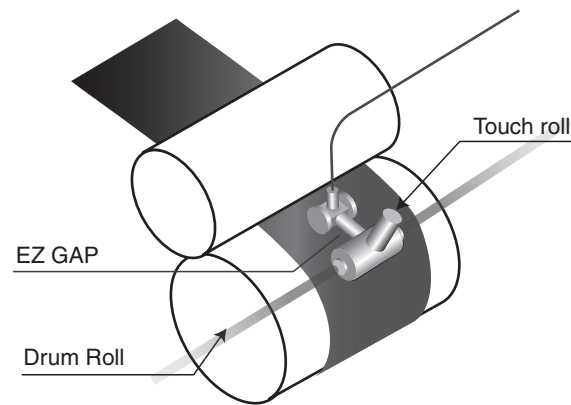
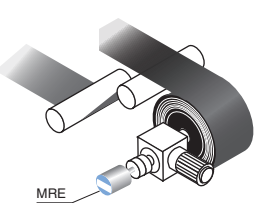
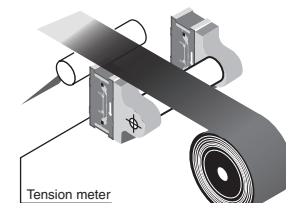
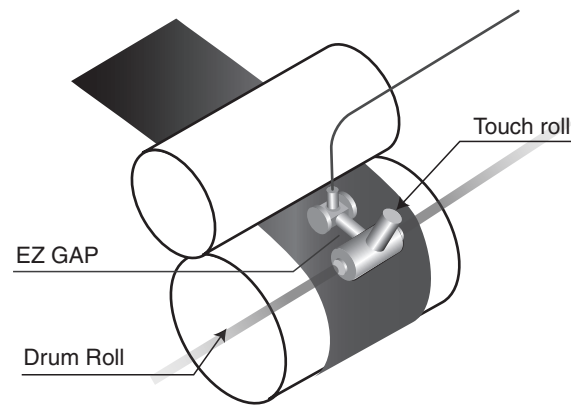
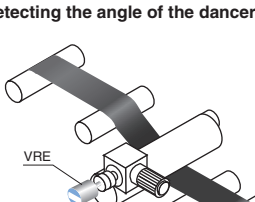
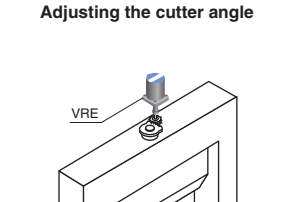
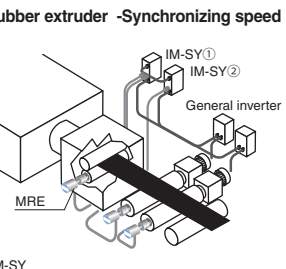

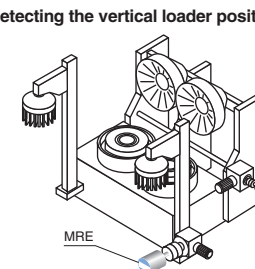
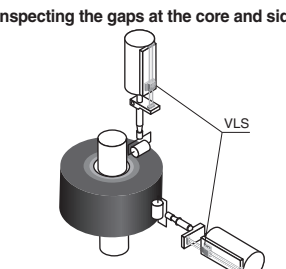
Optimizing the automotive manufacturing process with NSD's absolute position sensing solution. As a position sensing technology provider of the automotive industry, NSD has developed an integrated and absolutely aligned set of solution for the entire process from press shop to final assembly line. NSD's ABSOCODERS offer performance-oriented solutions for a wide range of tasks that include positioning, transport, handling, and controlling for heavy duty applications.

| | | | |
|---|--|---|---|
|  <p>Body Press Process Measurement of coil's outside diameter with cylinder linear sensor</p> |  <p>Body Press Process Measurement of coil's width with cylinder linear sensor</p> |  <p>Body Press Process Fully absolute detection of the precise amount of leveler's press movement</p> |  <p>Body Press Process Position adjustment of sheet feeder, carrier and side guide with multi-turn absolute sensor, MRE series</p> |
|  <p>Body Press Process Best solution for slide adjustment process with fully absolute position detection and higher durability</p> |  <p>Welding Process Fully absolute detection of up/down linear travel length with VLS dual rod ABSOCOER</p> |  <p>Welding Process One of the standard position sensors for nut welder with smart linear position sensor</p> |  <p>De-burring Positioning of Casting Process Smart linear position cylinder sensor for CSA Motion controller for VS-10F</p> |
|  <p>Melting Liquid Level Check for Casting Process Best solution for heat-resistance with fully absolute rotary position sensor for VRE</p> |  <p>Valve Sheet and Guide Fitting Press Dual rod with fully absolute linear position sensor for VLS Motion controller for VS-10F</p> |  <p>Positioning of Up/Down Pusher for Body Paint Multi-turn absolute sensor for MRE Motion controller for VS-10F</p> |  <p>Positioning of Body Shuttle Conveyor Best solution for the replacement of existing limit switches Multi-turn absolute sensor for MRE Motion controller for VS-10F</p> |

ABSOLUTE Solution for Tire Making Application



Proven solutions for every process of tire manufacturing. As an absolute and heavy duty sensor provider, NSD supports tire manufacturers and their suppliers in every step of the tire manufacturing process from raw materials processing and mixing and component preparation, to tire assembly and curing, through to final finish and inspection. NSD also provides the best solution for sulfuration process environment with sulfuration-proof technology.

| | | |
|---|---|---|
| <p>Measuring the thickness of the top and bottom rubber sheets</p>  | <p>Adjusting the speed of rubber sheet winding machine</p>  | <p>Measuring the tension of the rubber sheet winding machine</p>  |
|  | <p>Detecting the angle of the dancer roll</p>  | <p>Adjusting the cutter angle</p>  |
| <p>Rubber extruder -Synchronizing speed</p>  | <p>Positioning the cylinder for the tire fixation</p>  | <p>Detecting the vertical loader position</p>  |
| | | <p>Inspecting the gaps at the core and side</p>  |

ABSOLUTE Solution for Water Gate Application



A water gate or dam is a barrier that impounds water. The reservoirs created by dams not only suppress floods but provide water for various needs to include irrigation, human consumption, industrial use, aquaculture and navigability. Our optimized technology is the best fitted for the water gate position control, and we provide you the heavy duty and water-proof absolute position sensors with the smart gate controller.

ABSOLUTE Solution for Crane Application



A crane is a type of machine, generally equipped with a hoist, wire ropes or chains that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. In the area of crane control, it is very critical to track each individual object throughout each phase in the process. NSD provides total solution for the each position of crane movement, boom hoist / crane hook angle / main hoist up & down / rail or rubber tire position.

ASCODOER

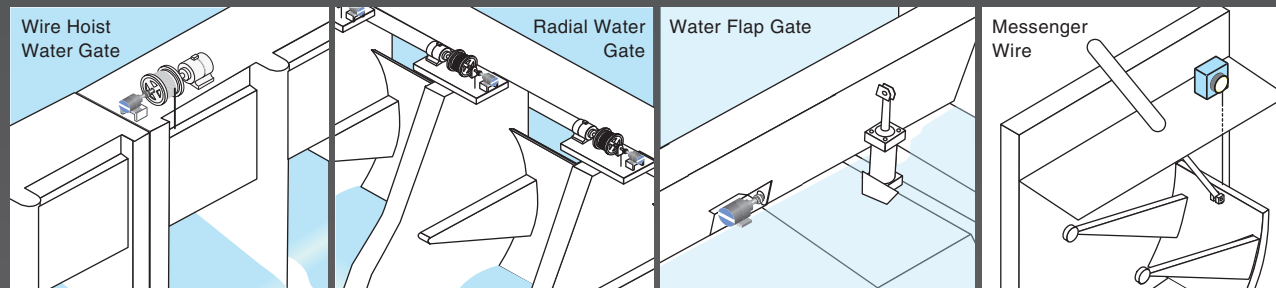
Fully Absolute & True Heavy Duty Position Sensor for Underwater Position Sensor

- Magnetic Reluctance**
 - Magnetic reluctance Change
 - Cell and Eccentric Rotor
 - Single / Multi-Turn Rotary
 - High Precision / Repeatability
- Heat Resistance**
 - Max. 120deg.
- Smart Flexibility**
 - Various of Signal Output
 - BCD, Binary, Analog Position
 - Max. 500m Cable
- Water Proof**
 - IP 67
 - Stainless Sensor Body
- Zero Electronic Parts**
 - No Electrical and Optical Components inside Sensor
- Anti Vibration & Shock**
 - Vibration Resistance
 - Stainless Shaft
 - Max. 4,000 rpm
- Absolute Position**
 - Absolute Position Detection
 - Even Power is Off and Cable is Cut

GATE CONTROLLER

User Friendly Operating & Smart Gate Control Function for Water Gate Controller that Market Has Been Waiting For

- Limit Switches Output**
 - 15 points of limit switches input/output with digital function key
- Scaling Function**
 - User friendly easy to select the parameter units of gate movement, angle (degree) or length (mm/cm)
- Calibration Function**
 - Max. 128 points calibration to enhance and raise the sensing accuracy / linearity
- Auto-Compensation Function**
 - Fully automatic compensation for wire multi-level movement
 - 1st Wire: 0% of compensation.
 - 2nd Wire: +2% of compensation.
 - 3rd Wire: +3% of compensation.
- Preset Function**
 - Best solution for the wire rope length change due to temperature change with this function
 - User select the fixed-fiducial-point for the controller preset position
- Digital Setting and Display Function**
 - Digital press button with real-time display



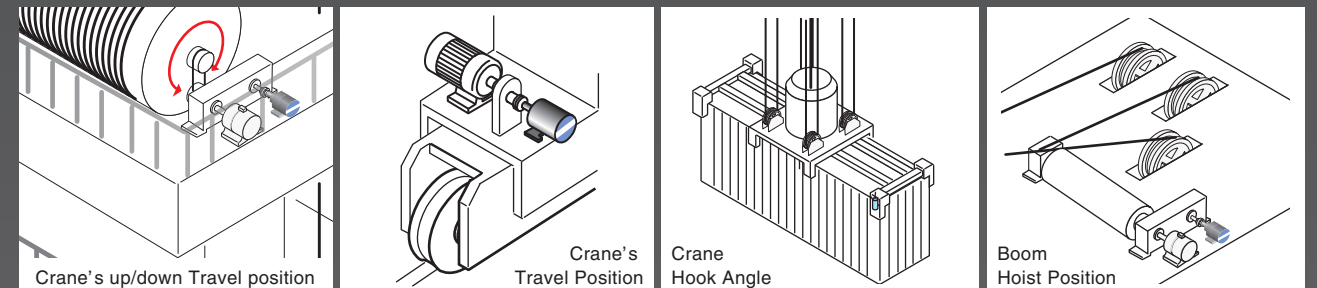
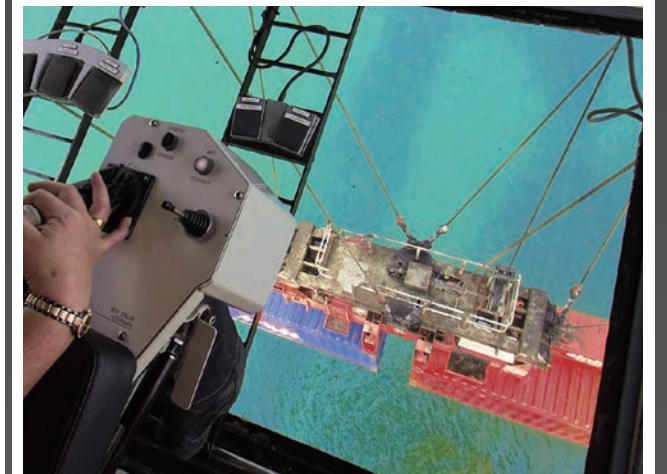
Ladle Crane at Continuous Casting

Ladle cranes are primarily used at steel plants for the transportation of molten iron and steel.



STS/RTG/RGM Crane at Container Terminals

Container cranes are a type of load dockside gantry crane found at container terminals for loading/unloading containers.



ABSOLUTE Solution for paper and Film Application



There is no universal best platform or solution for factory automation because each one has its particular strengths for specific types of applications. There is also no single leading automation system, as many factors and ideas lead to the best choice for each production field. However, position sensors are always applied at factory automation system, and ABSOCODER is the best choice if your production field is required for absolute position sensing within a harsh environment.

| | | | |
|---|--|---|---|
| Air Knife Gap Detection VLS-8PS | Tenter Clips Position MRE | Near Roller Position MRE VLS CYLNUC | Linear Position of Holder Switch Inroadsensor |
| Coater Head Gap VLS-EX18PSM | Accumulator Position MRE VLS | Dancer Roll Angle VRE VLS VARIANLOG | Tension Measurement VR TENSION |
| Calendar Roll Gap MRE Inroadsensor | Turret Angle VRE BAUM COUPLER ABSO COUPLER | Slitter / Cutter MRE ABSO SERVOR MOTOR | Roller Temperature ABSO COUPLER |

ABSOLUTE Solution for Beverage/Food Application



A precise & heavy duty position sensor for beverage and food application is getting more important since the degree of automation is increasing continuously. Our mission is to offer technology that allows customers to essentially facilitate both modernization of existing and creation of new solutions.

ABSOLUTE Solution for Energy Application



For the energy applications, NSD continues to manufacture new designs for the most challenging applications. NSD also provides explosion-proof solution into this application.



GLOBAL ACTION

From Japan to The World Over

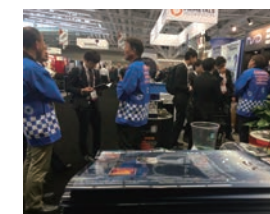
METEC 2015 | GERMANY

NSD presented a range of innovative products and introduced a total sensor solution to meet the needs of the steel industry at METEC. There is no event that can compare with the METEC in this industry. For five days Messe Dusseldorf delivers a very positive summary of 'The Bright World of Metals'. The metal fairs quartet registered good marks on the exhibitors' as well as the visitors' side. In particular the internationality again increased distinctly and now amounts to 56 percents at the visitors and 51 percent at the exhibitors. With 78,000 visitors from more than 120 countries METEC 2015 in Dusseldorf were on the level of the previous events. The experts presented themselves in high spirits to invest and the 2,214 exhibiting companies reported on numerous business transactions with customers from all over the world. NSD demonstrated a range of innovative position sensor that improve reliability, durability, and efficiency for various steel making applications ; material, cokes, blast furnace, crane, caster, plate mill, hot rolling mill, cold rolling mill, structure mill, rod mill, bar mill, seamless pipe, and so on. NSD's true heavy duty and fully absolute position sensors had caused a big interest and good reputation throughout the entire METEC 2015. VLS-8SM for HGC/AGC linear position sensor attracted the biggest attention from the visitors which has 1um high resolution, outstanding sensor durability under mill stands' harsh environments. NSD will participate in the next METEC to keep up our successful promotion, and see you next time at METEC.



AISTech | USA

The steel's premier technology event AISTech was held at David L Lawrence Convention Center at Pittsburgh in 2016, USA. It was a great success with numbers of visitor. NSD Corporation participated since 2014 as the only company to exhibit the true heavy duty and fully absolute position sensors. During the show, NSD introduced our total-sensing-solution for position sensing at steel industry. Most of visitors express their interests. NSD will also exhibit at AISTech 2017, Nashville Tennessee, USA. Please come and see our new sensor technology at the show.



SEAISI Conference | ASIA

SEAISI (The South East Asia Iron and Steel Institute) Conference and Exhibition is one of the best known for developing a competitive steel industry in ASEAN. This event offers a great opportunity to learn and discuss key issues that could contribute to greater efficiency and profitability of the steel business in Asia. NSD Corporation, we have participated in SEAISI Conference for three years in a row from 2014, and introduced the latest sensor technologies for position sensing applications of steel industry. NSD has a great reputation during the show and received a lot of attention from the visitors, especially heavy duty position sensors.



Promote NSD Solution Actively and Globally

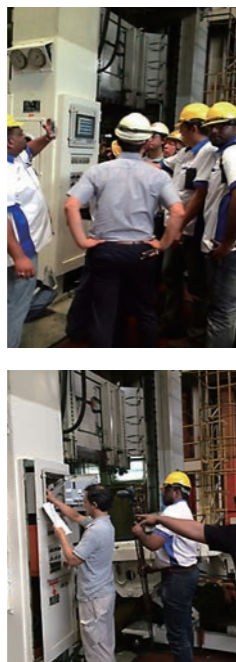
Korean Steel Industry | KOREA

The steel industry is the nation's key industry with high impact on the inter-industries and has played a crucial role in the economic growth of Korea. The steel industry has been trying to increase the self-sufficiency in steel and to improve the balance of trade by rising the export. NSD is one of the best known of the sensor manufacture in Korean steel industry. Most of Korean steel works has been using NSD heavy duty position sensor for their critical process in order to less sensor down-time and maximize their productivity. NSD and our local partner we call FAE (Factory Automation Engineering) provide the best local service and do system revamping projects in Korean steel industry.



Stamping Press System Improvement | MALAYSIA

Unfortunately, if you are working with anything that is not brand new, you run the risk of not being able to find the components you need. When it is no longer profitable or feasible for the manufacturer to build parts, they will stop. But you do not have to worry about this matter with NSD items. One of our customer in Malaysia, they use a lot of ageing press machines which is used to shape and cut metal sheet by deforming it with a die tools. There are many of old NSD position sensors and controllers which has been more than several decades installed. NSD and our local agent, we provide our very new replacement solution and support to set-up install at actual customer site.



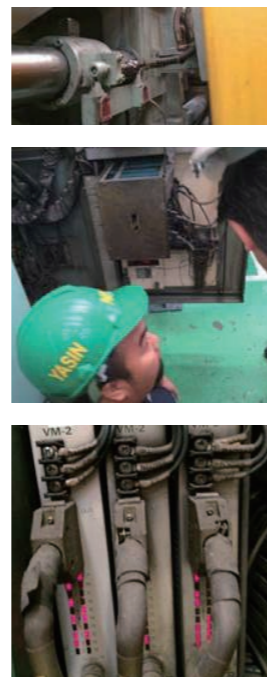
Full Automation Water Gate Control | THAILAND

Many parts of Thailand has experienced severe flooding in recent years after heavy rains hit. The office of the NESDB released the official report, and the report says that employment in the agricultural sector fell by 17.5% or 2.86 million. RID (Royal Irrigation Department) is a government agency of Thailand. They are a leading organization in water resources development and have integrated water management in order to improve the recent flooding situation in Thailand. NSD provides the most fit technology of fully automotive water gate control to RID Thailand. NSD actively engages in their several projects, for instance, improvement of water gate control, revamping of position sensors, underwater position sensor for flap gates.



Die Casting System Improvement | INDONESIA

Die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. Position sensors are available to directly measure critical process variables. If critical variables are continuously monitored and controlled, production problems can be detected and solved during the casting cycle. NSD's heavy duty position sensor ABSOCODERs will lead to less scrap, improved surface finish, higher dimensional repeatability, and improved internal integrity. Our Indonesian customer had an ageing die caster, and NSD introduced and installed the highly performance position sensors to improve their existing system.



Trust Based Partnership with Global Partner

Partner Interview | Five Star Hydraulics, USA



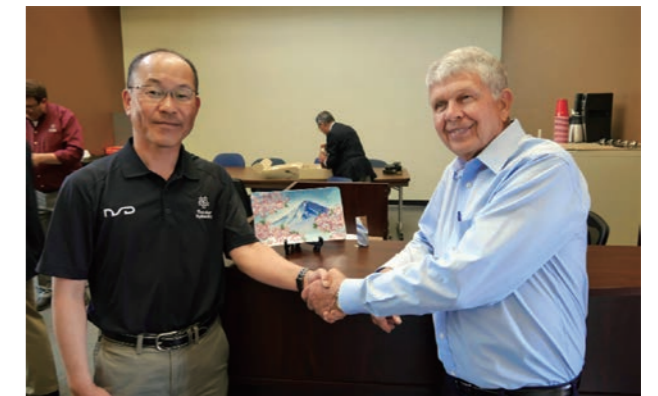
Not only Five Star Hydraulics manufactures cylinders, also provides expert service on various cylinders. They are official distributor of NSD in the North America for steel industry.

NSD : How clients evaluate NSD performance or what are the feedback you hear from them?
Five Star : Our customers are always amazed at the reliability and accuracy of NSD sensors. In the steel industry there is no equal when it comes to NSD's ruggedness.

NSD : What is your experience with NSD products/service in the U.S. market?
Five Star : Our experience is that NSD's quality and attention to detail is directly reflected in their superior product.

NSD : What are the advantages you see in NSD products/service?
Five Star : By far the biggest advantage of using NSD product and service is the reliability of your sensors. In the competitiveness of the steel market, down-time due to component failure is unacceptable. By using NSD sensors, the customer can rest at ease knowing that their sensors will perform perfectly all day, every day.

NSD : What are your expectations for further?
Five Star : Our expectations are that in a short period of time NSD sensors will be the sensor of choice in the American steel market. Once the steel mills start testing and using NSD sensors, they will fully realize that upgrading to NSD will give them return on their investment for decades. The increased production, enhanced quality and reduction in down-time will make NSD the obvious choice.



In 2001 Five Star Hydraulics entered into a partnership with NSD Group. Five Star was recognized as the exclusive North American partner for NSD's Steel Industry sales and service. Since 2001 our partnership has continually grown and NSD's broad product line has gained a strong following and high regard in the U.S. and North American steel industry. NSD's unmatched durability and quality has time and again solved position sensing issues even in the harshest steel mill environments. Daily communication and attention to detail has allowed NSD and Five Star to make the customer's needs our number one priority at all times.



► Technical training at NSD Japan



► Service and field engineering support



► Exhibition

► Open house event

► Open house event

► Annual meeting

► Five Star new factory