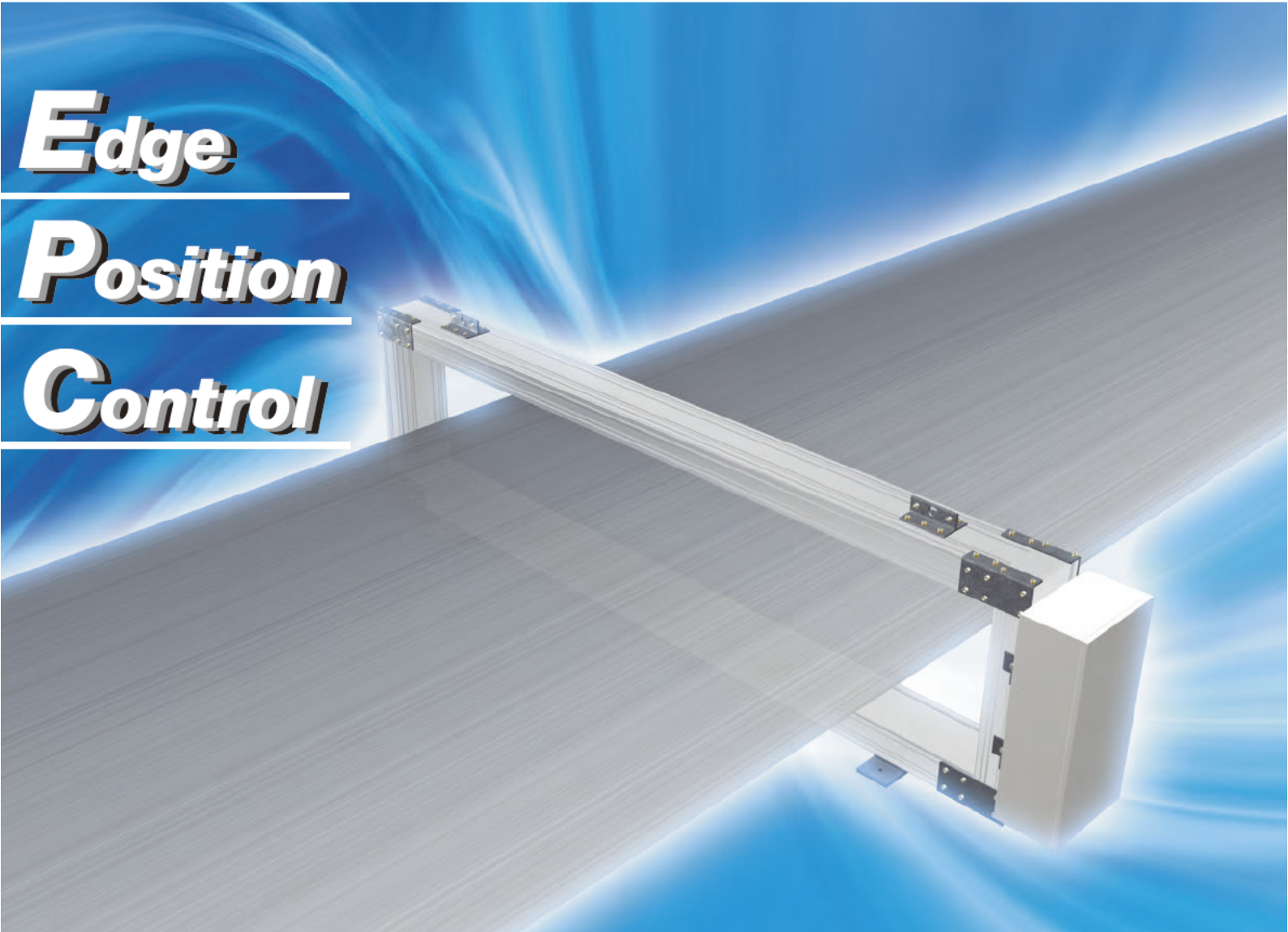
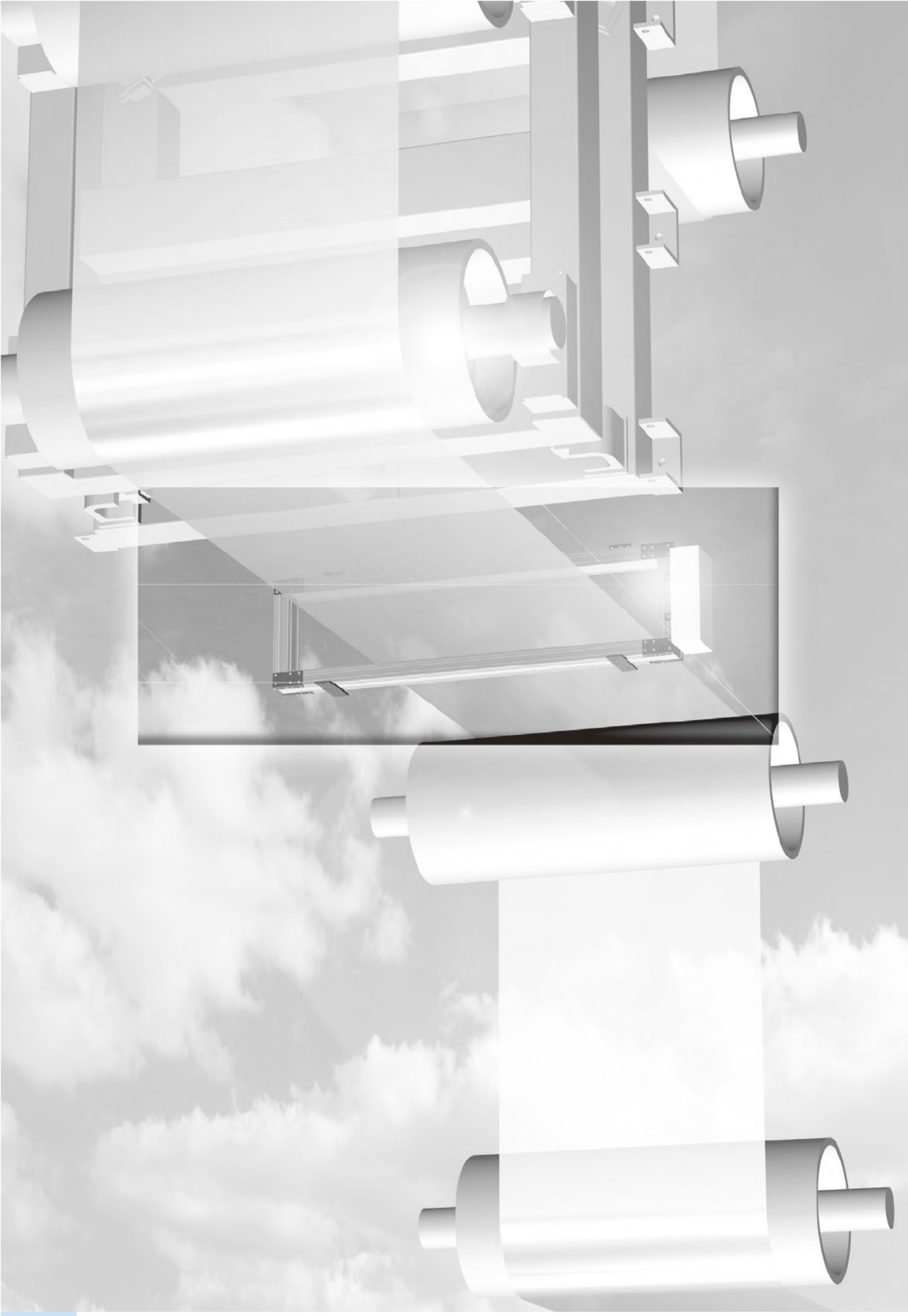


# EPC<sup>®</sup> /CPC SYSTEM

**Edge**  
**Position**  
**Control**



**NIRECO CORPORATION**



# Introduction

## NIRECO EPC®/ CPC System

EPC is a NIRECO registered trademark which stands for Edge Position Control. This control system automatically and uniformly aligns the edge positions of products (strips) in rolling, heat treatment, pickling and surface treatment of thick plates and thin plates. CPC (Center Position Control), which controls the center position of the strip, is also widely used as an application of EPC.

This system can be easily installed in either a new or existing plant.

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# An overview of EPC®/CPC

## ■ Production cost reduction and labor saving

The use of EPC eliminates the need for side trimmers, which were previously used to remedy strip edge position inconsistency, and protects the sides of coils. Operations such as strip surface treatment, lamination, marking and cutting can be carried out at the required position, without waste, helping to reduce production costs and save labor. Continuous production lines have become increasingly common, as a means for improving productivity, and line speeds have increased, so a growing number of plants cannot make their products without EPC. CPC systems control the position of the

center of the web. CPC control keeps the web centerline without changing the position of the sensors in situations where the web will keep running regardless of changes in web width (large changes such as splices).

## ■ Feedback-based automatic control

EPC is a feedback-based automatic control system. With EPC control, the correction distance for the controlled subject is measured and compared to the target value, with corrective action to match the target value when any discrepancy arises.

**Nireco provides EPC and CPC systems, and a variety of other control and measurement units for all types of plants.**

Fuel and air pressure and flow process control systems for blast furnaces, gas and coke furnaces, sintering and other fuel furnaces

EPC and CPC systems, strip width gauges, precision right angle gauges, and electroplating line edge mask servo units for all types of processing lines



Marking systems for slabs, blooms, billets and semi-finished products; marking systems for hot rolled and cold rolled products; marking of labels, metal tags and other items

Mold eddy current type level sensors for use in continuous casting





# Product Guide

# Detection Section

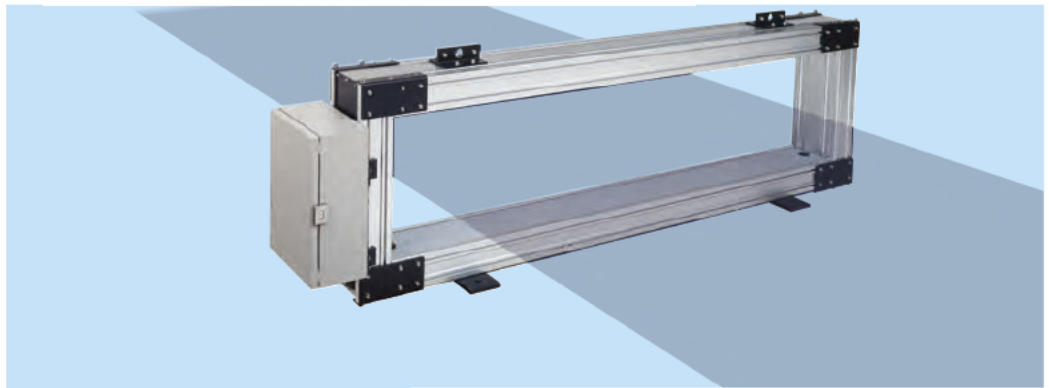
## Capacitance Autowide Sensor AWC Series

AWC640 / AWC790 / AWC940 / 1090

The Capacitance Autowide Sensor AWC is a sensor system that provides continuous, contactless detection of the center position of a strip moving on a line, for use in Center Position Control (CPC).

Like our previous sensors, the sensor is maintenance free and can be used continuously with no decline in sensitivity caused by wear over time, giving stable, long-term service. The sensor is now a far easier product to use, offering improvements such as taking away the need for on-field calibration\*.

\* If there are metal structural elements close to the sensor, some simple adjustment may be required.

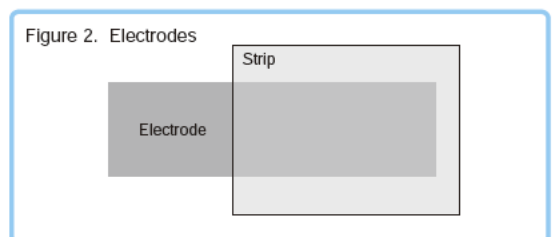
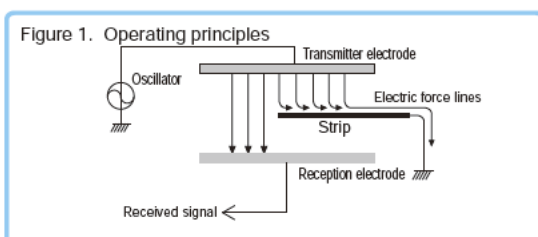


### Features

- No field calibration required
- Maintenance free
- Uninfluenced by light
- Insensitive to dirt, scale
- Unaffected by passline changes or wavy edges

### Operating principles

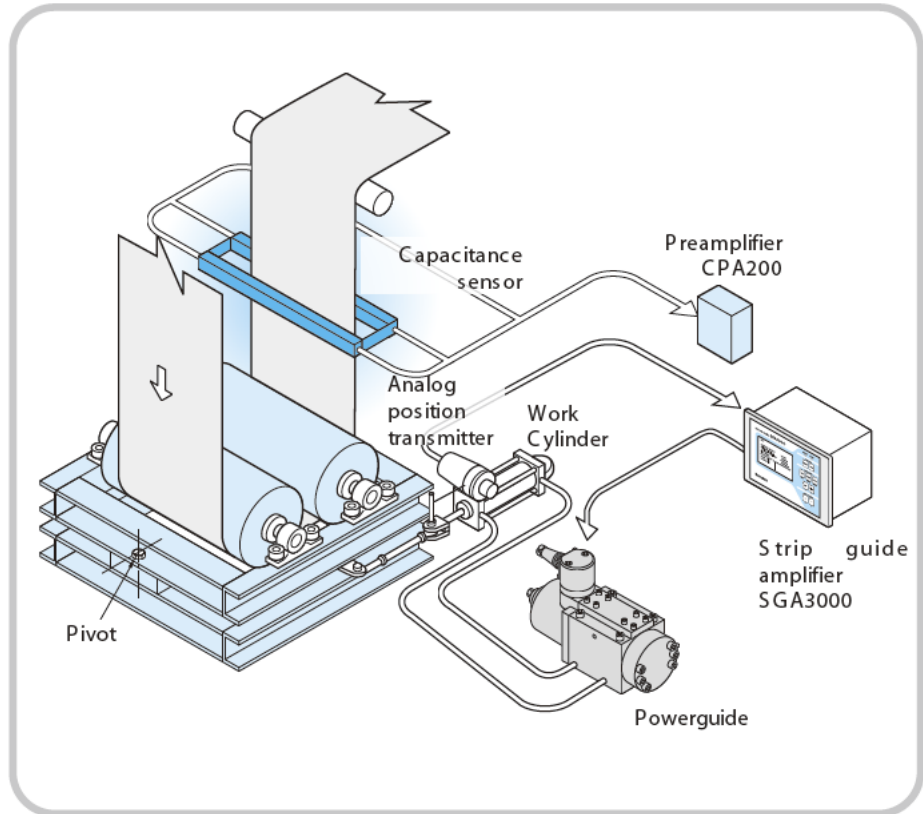
The Capacitance Autowide AWC Series generates lines of electric force between electrodes situated on each side of the strip, and calculates the position of the strip between the electrodes from the changing amount in the number of lines (see Figure 1). The sensor has two sets of transmission and reception electrodes that are installed opposite each other with the strip between them. The transmitter electrode generates electric force lines and the receiver receives them. When a strip enters between the transmitter and reception electrodes, the difference in the blocked transmitter electrodes causes a variation in the force lines received by the reception electrodes (see Figure 2). Therefore, by calculating the lines of electric force received by the reception electrodes, the position of the strip becomes apparent.



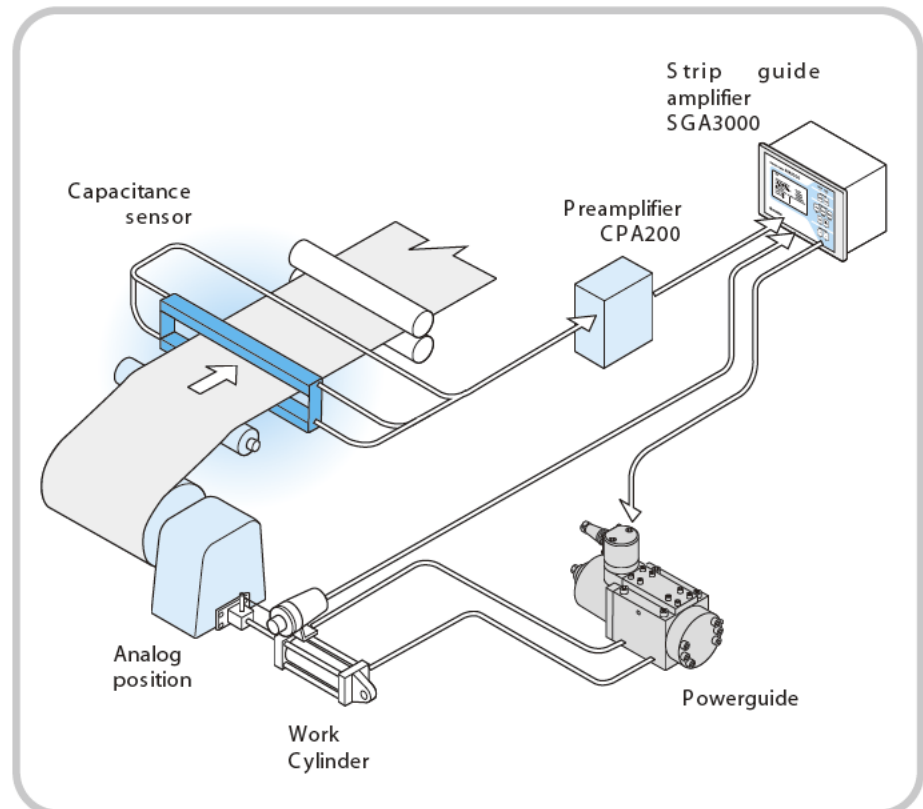


**Example of application to a CPC system**

**Steering roller system (with intermediate guide roller)**



**Payoff reel system (unwinder)**

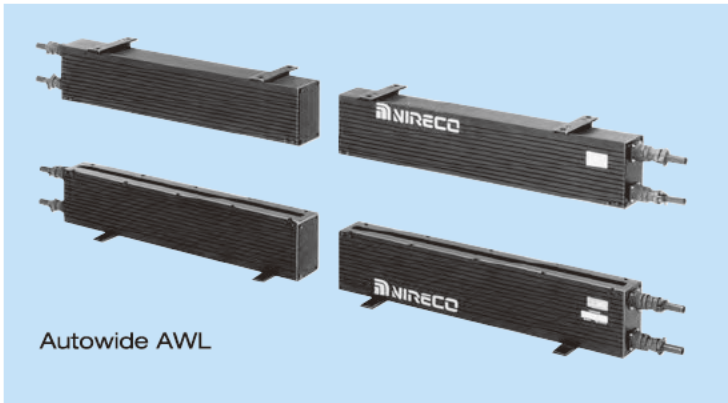


# Autowide

## Autowide AWL

This is a sensor used for a strip meandering prevention system (CPC), for a wide range of processing lines. While the line is running, both edges of the strip are detected, and the strip center is detected from the difference between the detection signals. By using the Autowide, it becomes possible to always detect the strip center position even if the strip width changes. This sensor is essential in CPC.

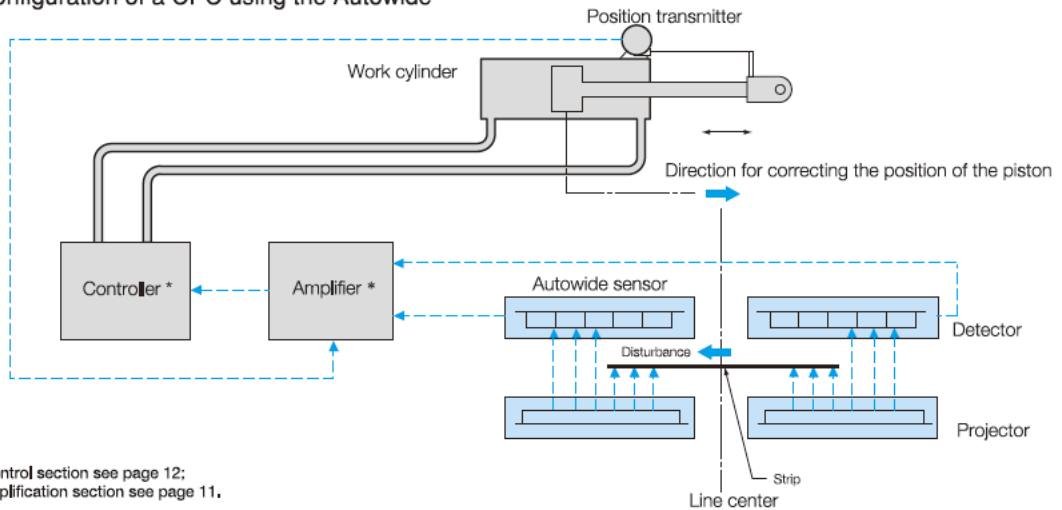
This sensor is constructed so that it is not easily affected by up-down fluctuations of the path line or by outside light.



### Autowide AWL (LED type)

This is a digital/analog type sensor in which a silicon photo diode (SPD) is used as the detection element and an LED is used as the projector. The LED projector has 6 times or more the lifetime of a fluorescent lamp. The light source is lit up and tuned at high frequency, so it is not easily affected by outside light (the effect is about 1/50 or less than a standard AW).

Example of configuration of a CPC using the Autowide



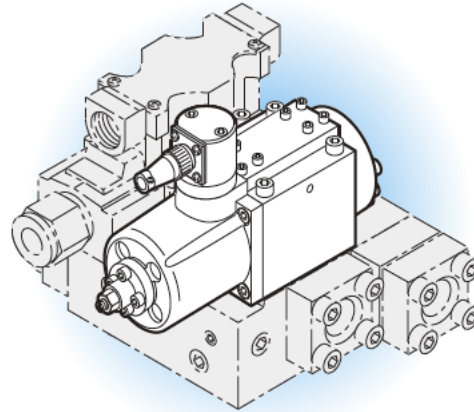
\*For details on the control section see page 12;  
for details on the amplification section see page 11.



# Control Section (Servo Valve)

## Powerguide PG

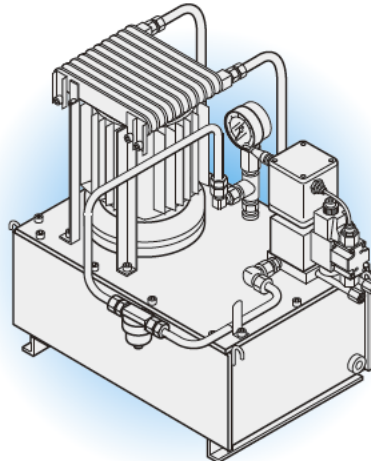
This is a high response, high output spool type servo valve.



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## Servoguide M550-AM

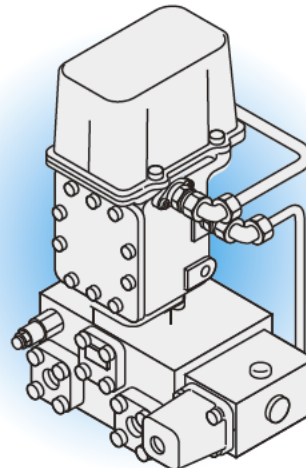
This is a spool type small electro-hydraulic servo valve, constructed for easy maintenance in one piece with the hydraulic unit.



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## Servojet SJ

This is a high response, high output dry type hydraulic jet pipe type servo valve using hydraulic jet pipe.



# Amplification- SGA 3000

## tion Section

### Strip guide Amplifier

The Strip Guide Amplifier is a high-performance, microprocessor-equipped EPC/CPC amplifier.

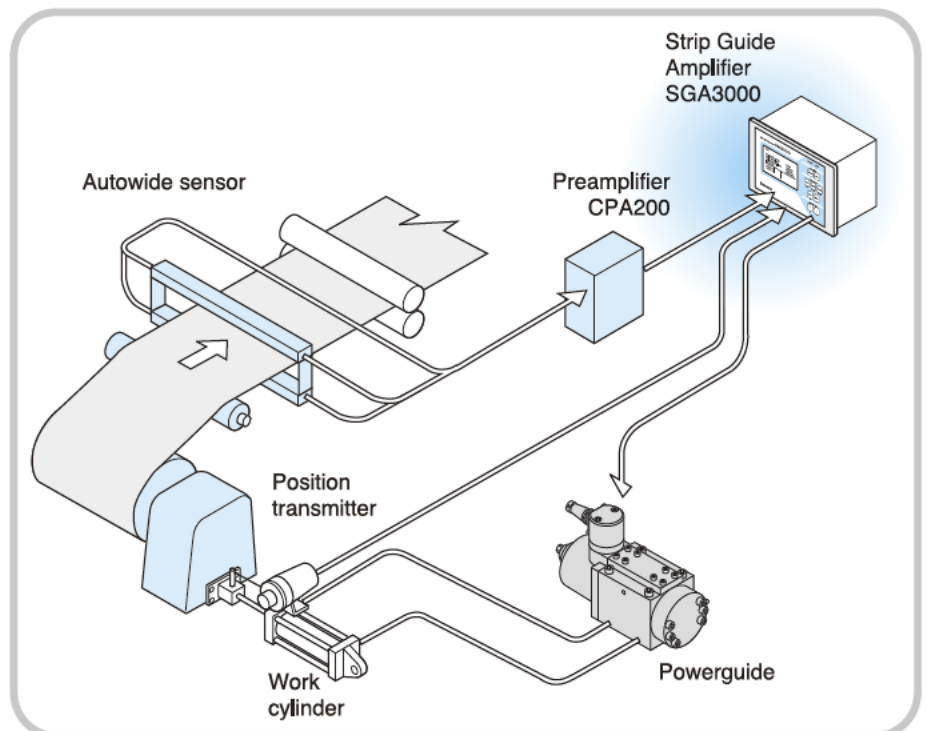
It offers advanced EPC/CPC controls such as staggered rolls and cascading control which are unavailable from conventional analog amplifiers.



#### ■ Features of the SGA3000

- The LCD screen makes it easy to check setting values and output signal status.
- All operations use the push buttons on the control panel for parameter settings.
- Control is possible by P, I or PI action.
- A line speed signal input enables automatic adjustment of control gain to compensate for changes in line speed. PLG signal input enables stagger winding.
- Sensor signals can be taken from up to two sensor systems, enabling cascading control operation.

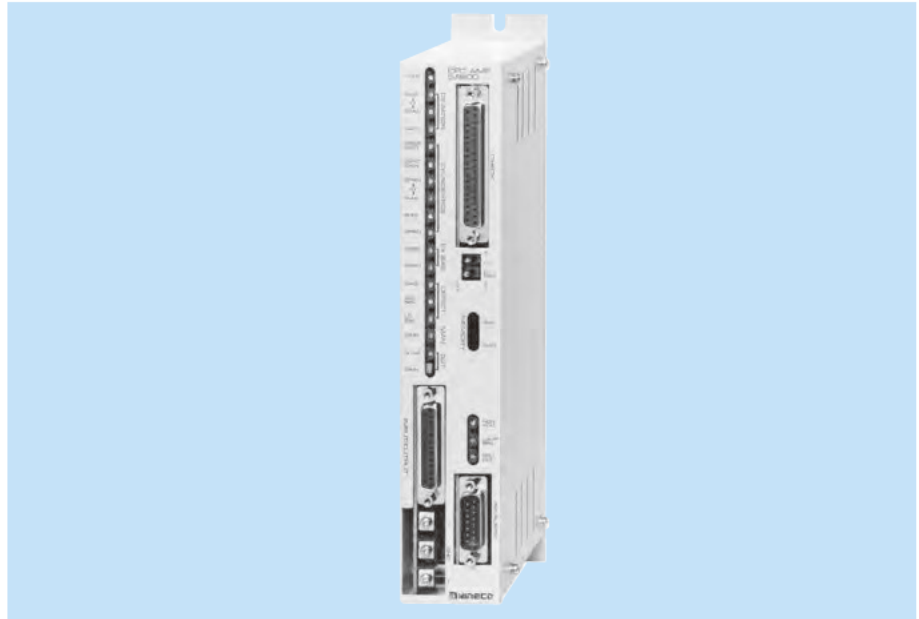
#### ■ Example of application to a CPC system



## EPC amplifier SA600

The SA600 is an analog operational amplifier for use in controlling a strip meandering prevention system (CPC, EPC).

The Autowide, linear sensor and position transmitter can all be used in combination with this amplifier. In addition, both voltage and current signals can be input. External shift setting input can be applied.

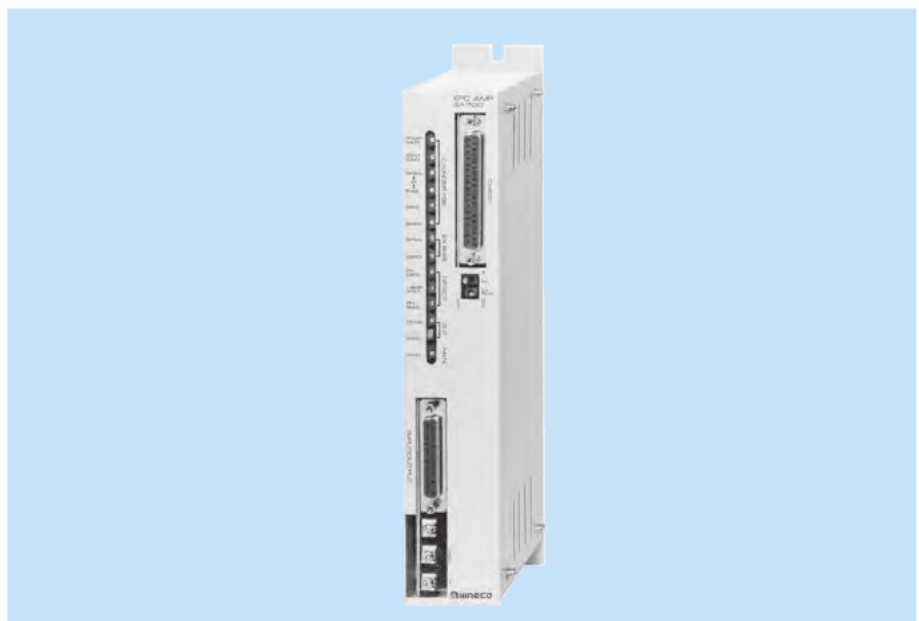


## EPC amplifier SA700

The SA700 is an analog operational amplifier used for control of a strip meandering prevention system (EPC).

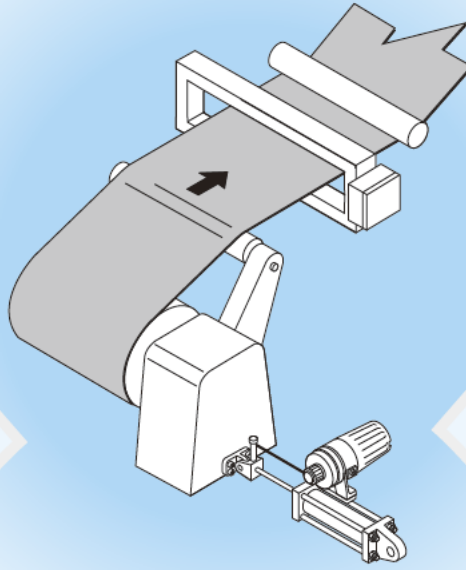
This is a single-function, simple type amplifier; a photohead and position transmitter can be used.

External shift setting input cannot be applied.

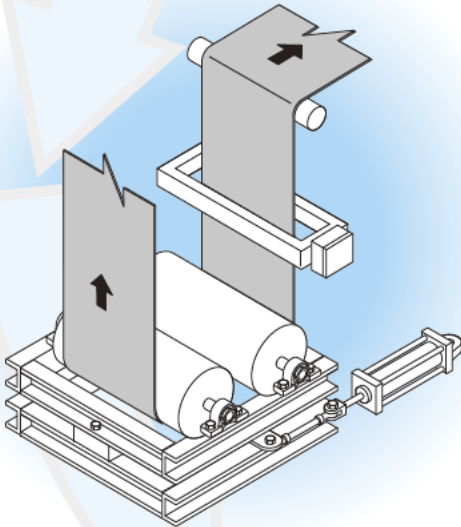


# Combination with various EPC/CPC control systems and sensors

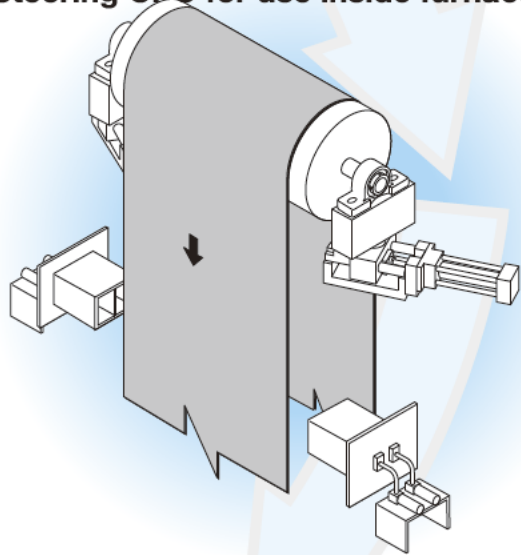
Payoff reel CPC



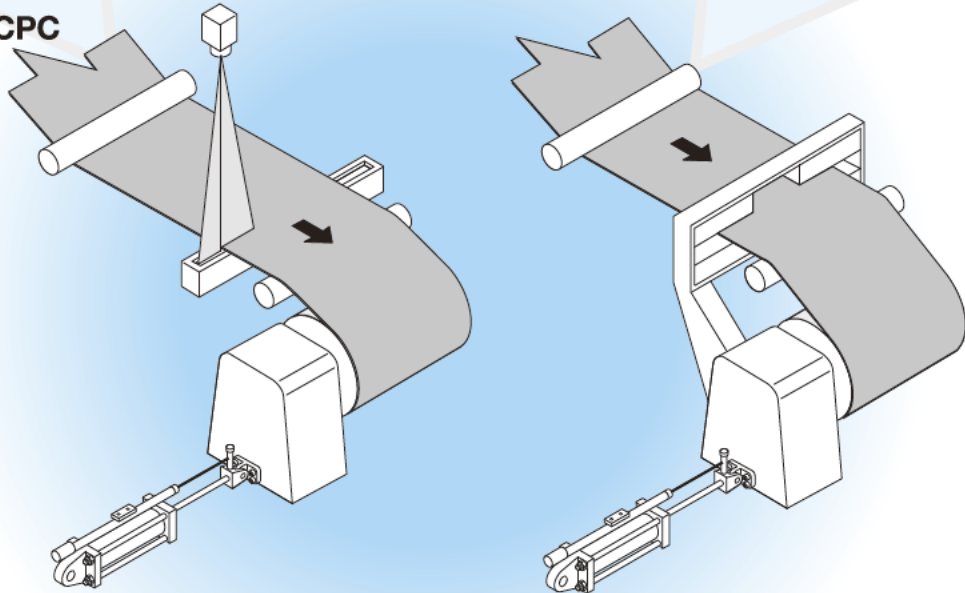
Steering roll CPC <180° wrap>



Steering CPC for use inside furnaces



Tension reel CPC





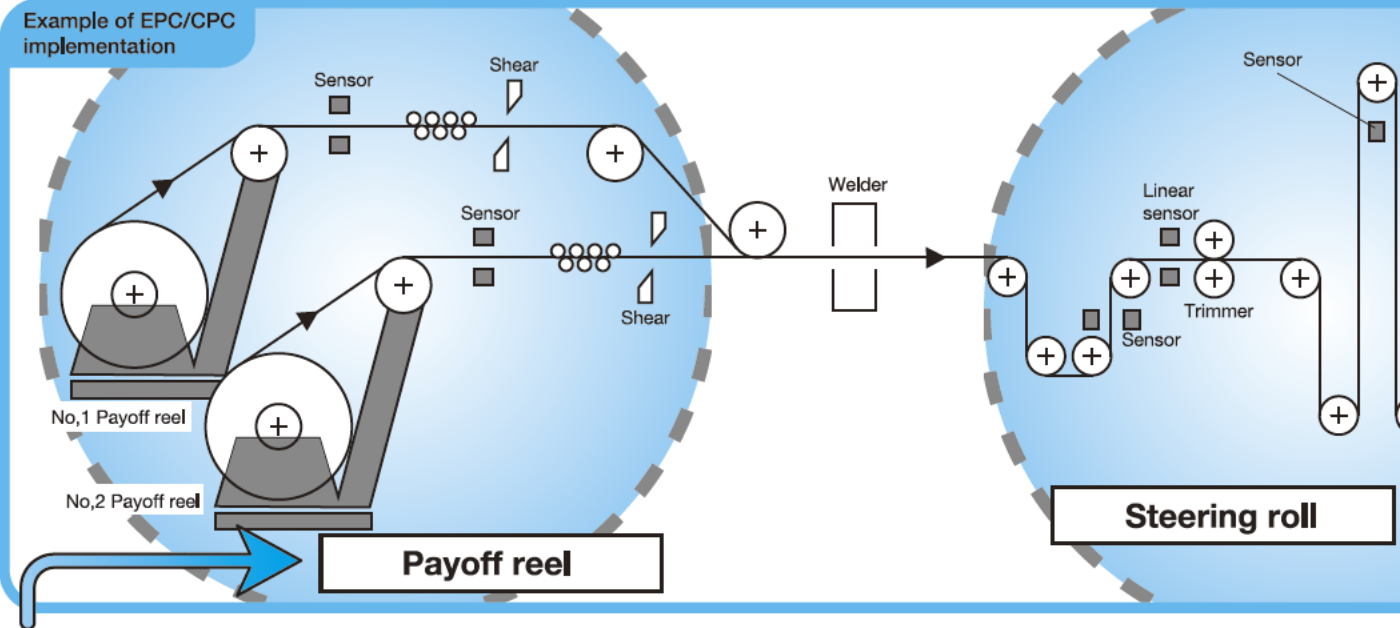


***The 3 Basic Methods  
of EPC / CPC***



# Basic control system for EPC/ CPC

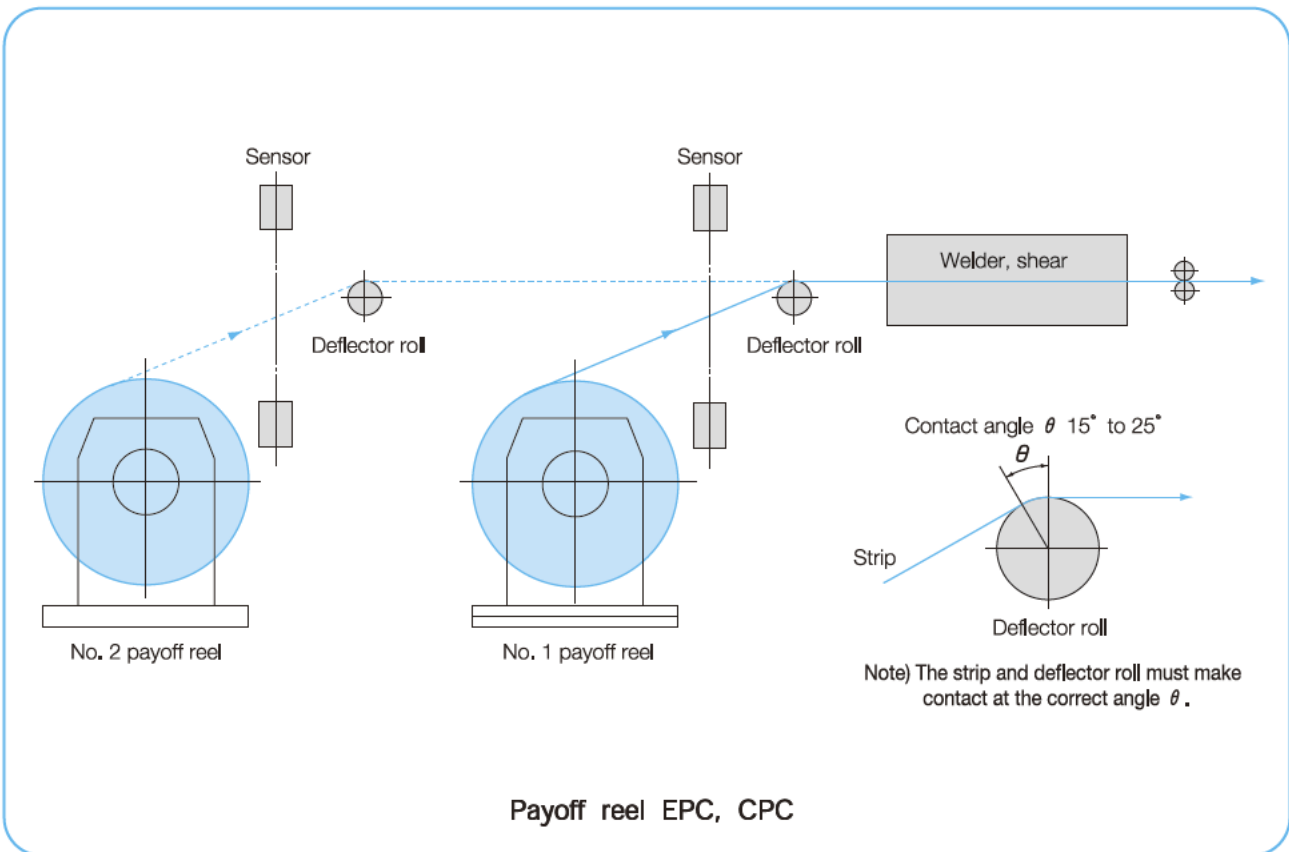
There are three basic types for controlling edge position: Payoff reel, steering roller and tension reel. The type used depends on the process.

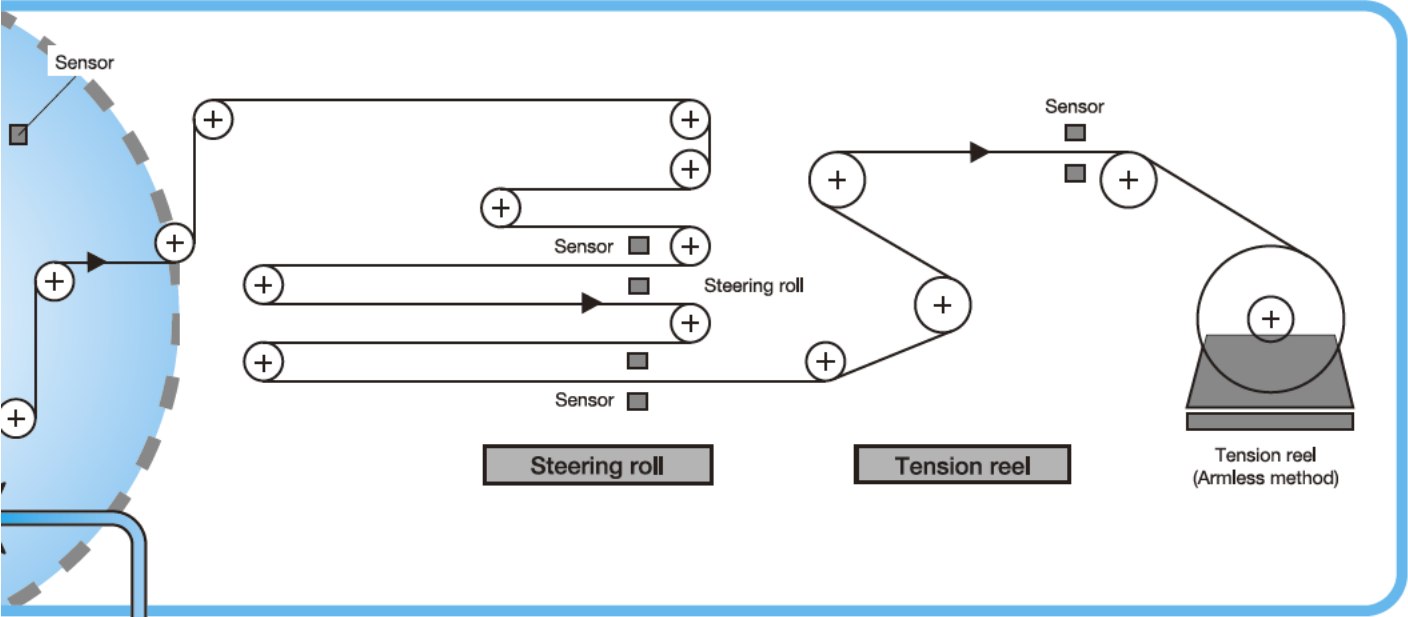


## Payoff reel EPC, CPC (unwinding reel control system)

In various types of processing lines, when a coil is rewound into the line, it is necessary to feed the strip with its edge or center in a constant position. At this time, with the coil on the mandrel, the strip edge (EPC) or strip center (CPC) position is controlled by moving the payoff reel. In EPC and CPC, unless the detector position and roll

arrangement are correct and the strip tension is maintained at an appropriate value, the control cannot be expected to be effective. It is also necessary to determine the correct selections for machine trestle mass, coil mass, reel movement speed and atmospheric conditions, as well as to select the correct unit.





● **Steering roll CPC (intermediate guide roll control system)**

In all types of line processing, it is necessary to correct meandering of the running strip. CPC applied by means of a steering roll mechanism properly moves the strip to the direction of the

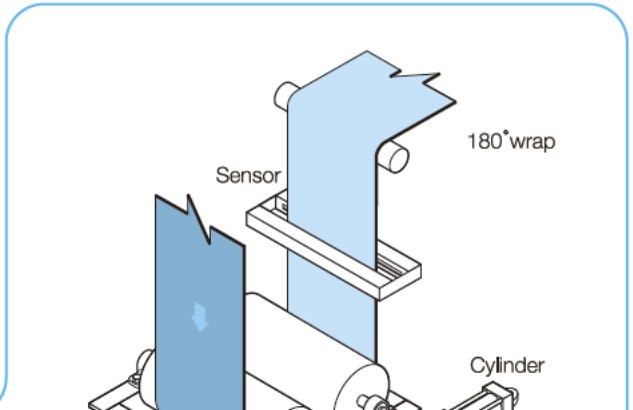
inclination of the roll and aligns the strip center with the line center.

Several steering methods are used; they can be classified into the following 2 categories.

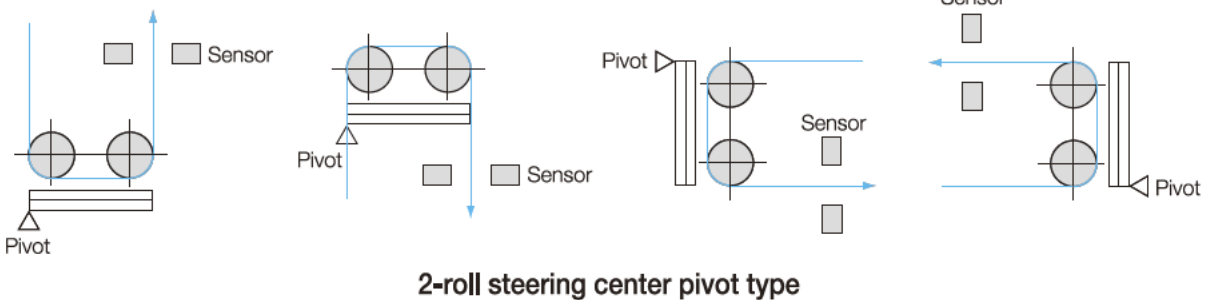
○ **Center pivot types**

These steering systems are in widespread use; there are a 2-roll center pivot type and a 1-roll center pivot type. The amount of meander correction is determined by the amount of movement produced by the span of 2 rolls (or the diameter of 1 roll) and the roll inclination angle. The angle roll inclination does not cause movement of the strip on the entry side.

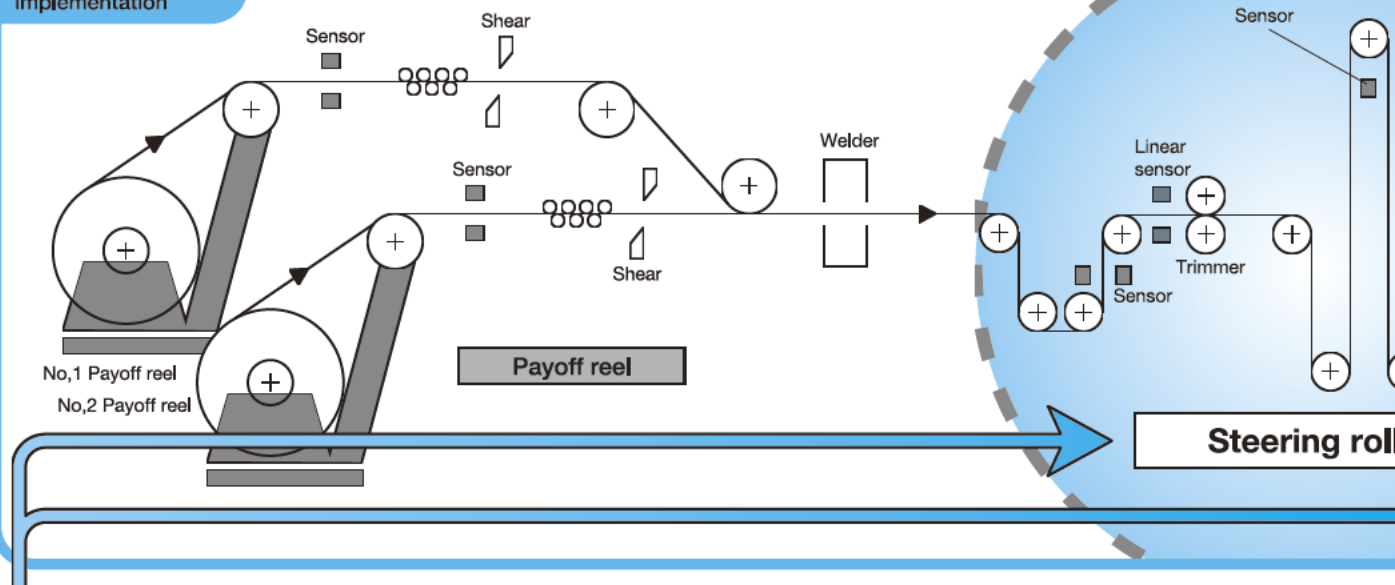
Formulas for calculating the steering entry side and exit side roll spans are given on the next page.



Steering entry side and roll span calculation formulas are given on the next page.



## Example of EPC/CPC implementation



### Steering roll (intermediate guide roll control system)

$\theta$  : displacement angle (degrees)  
 E : strip longitudinal elasticity coefficient N/mm<sup>2</sup> (kgf/mm<sup>2</sup>)  
 t : strip thickness (mm)  
 T : strip tension N (kgf)  
 L : entry / exit roll span (mm)  
 W : strip width (mm)

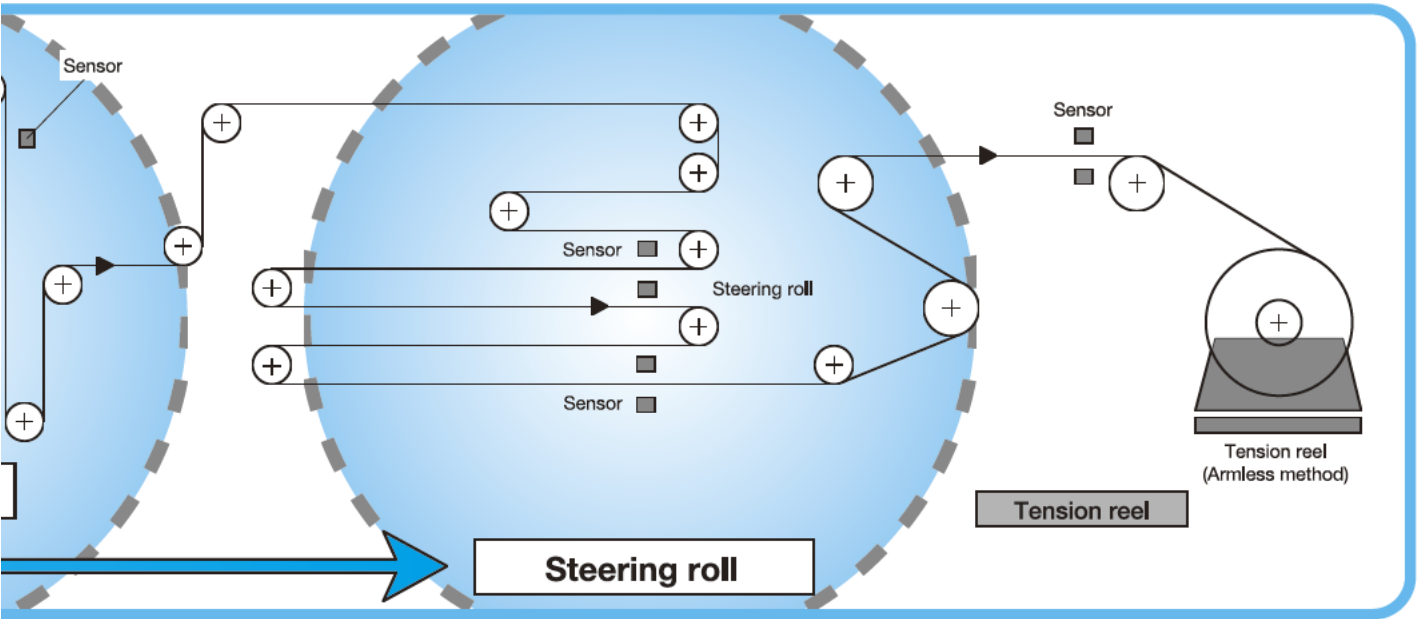
**Steering entry side and exit side roll span calculations**

$$L > 0.00356 \cdot \theta \cdot W \left( \frac{E \cdot W \cdot t}{T} \right)^{\frac{1}{2}}$$

**1-roll steering center pivot type**

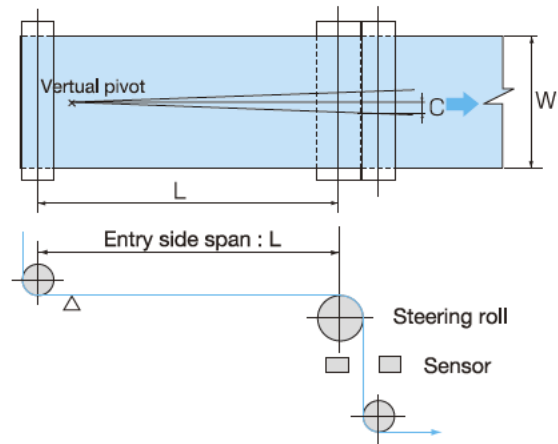
**Z-wrap steering center pivot type**





○ End pivot type

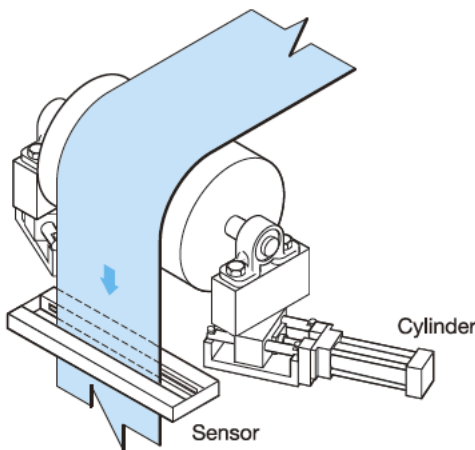
The steering roll virtual support point is on the steering entry side. The steering action is similar to that in the case of end pivot steering. It is applied to a section before and after the roll where the strip tension is small.



Roll entry side span calculation formula

$$L > \frac{W}{3} \left( \frac{C \cdot t \cdot E}{T} \right)^{\frac{1}{2}}$$

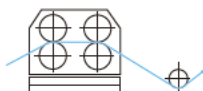
- C : amount of correction (mm)
- E : strip longitudinal elastic coefficient N/mm<sup>2</sup> (kgf/mm<sup>2</sup>)
- t : strip thickness (mm)
- T : strip tension N (kgf)
- L : entry side roll span (mm)
- W : strip width (mm)



End pivot type

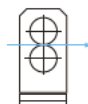
Some analogous types of CPC, though they are not the same as the end pivot type, are shown in the diagrams at right.

Example 1 Pickling line



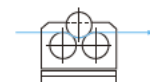
Wringer rolls (4 rolls)

Example 2 Color coating line



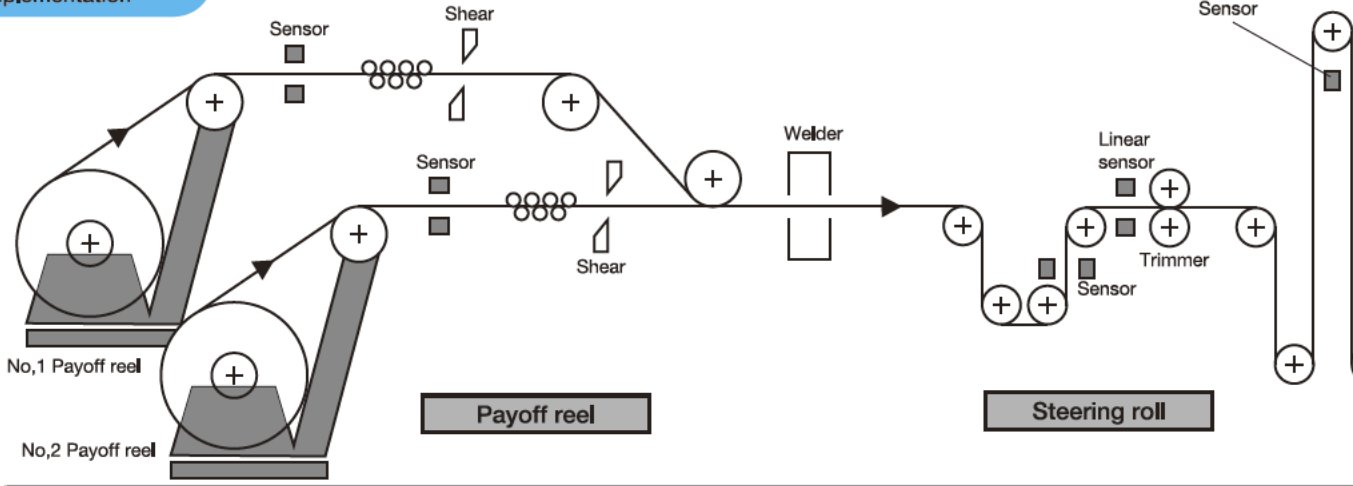
Pinch rolls (2 rolls)

Example 3 Slitter/ trimmer



Pinch rolls (3 rolls)

## Example of EPC/CPC implementation

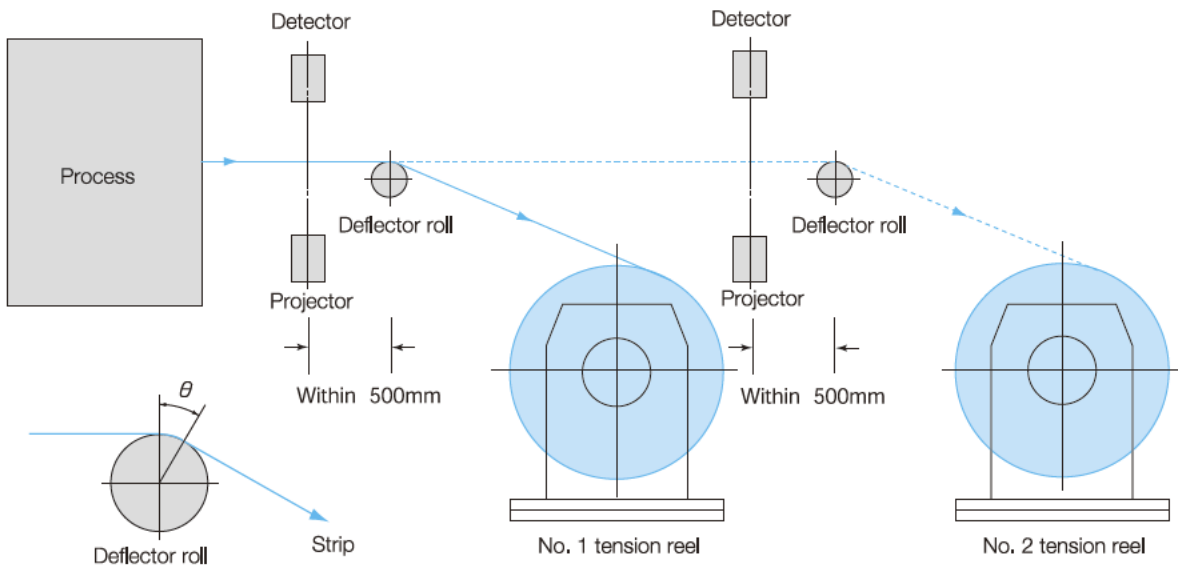


### ● Tension reel EPC, CPC (winding reel control system)

In various types of processing lines, when the coil is wound up at the end of the line, and when it is necessary to align the coil edge or the coil center at a constant position during the wind-up, control is applied by moving the tension reel while winding the strip up on the mandrel.

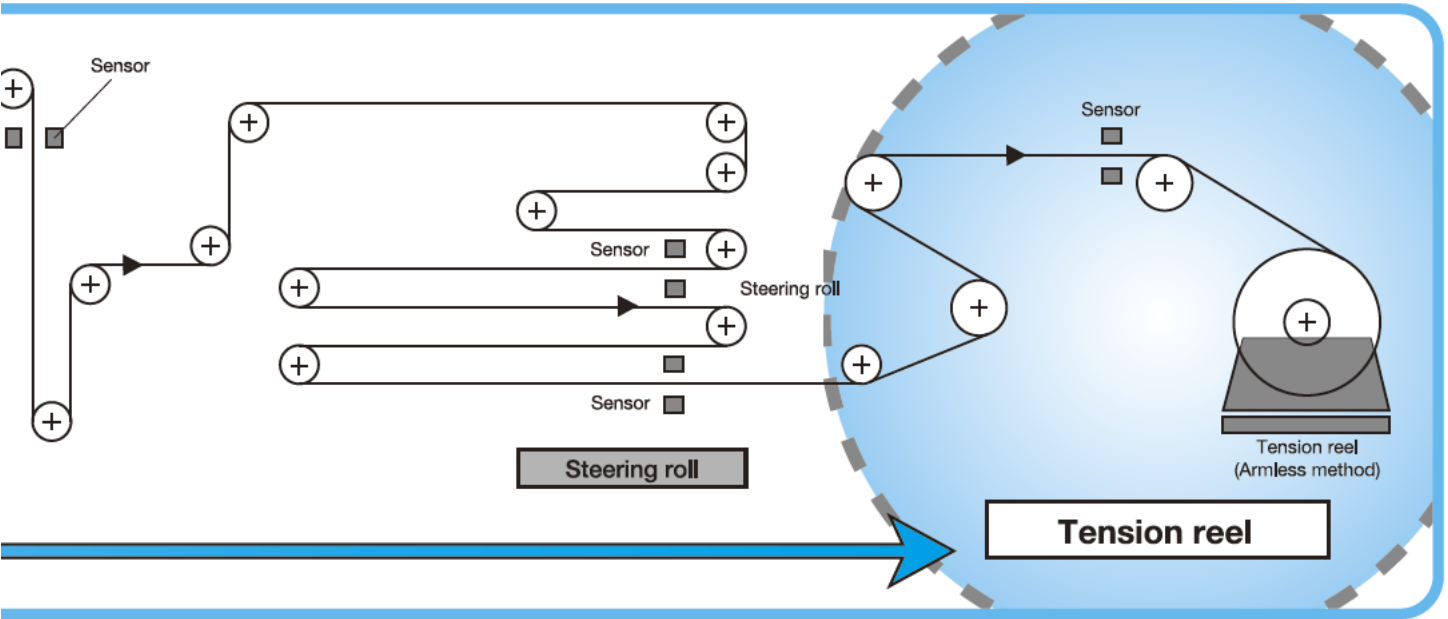
The carousel reel windup EPC method, in which 2 reels are coupled together, has been 100% successful within Japan.

In EPC and CPC, it is necessary to determine the correct detector position, roll arrangement and strip tension. At the same time, it is also necessary to determine the correct machine trestle mass, coil mass, necessary cylinder speed and atmospheric conditions.



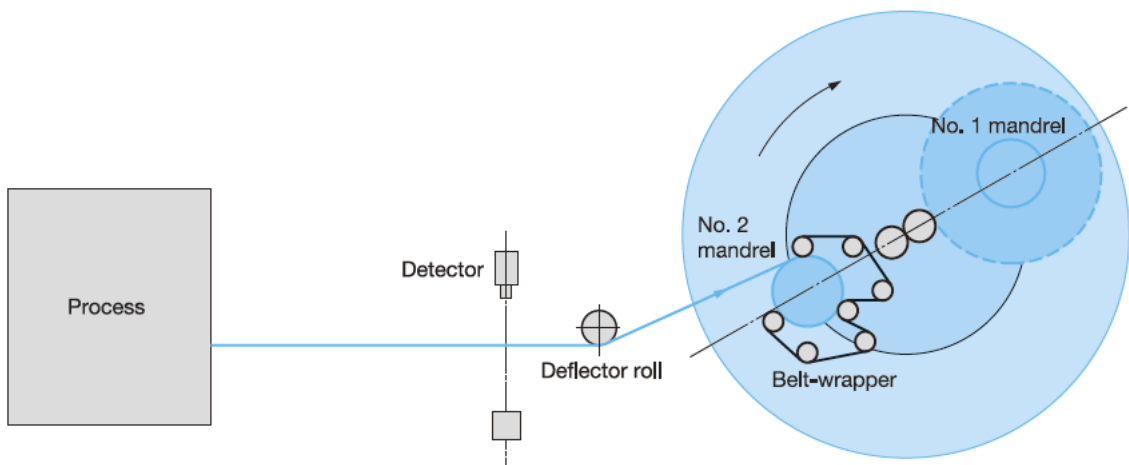
It is desirable for this contact angle  $\theta$  to be about 20 to 30 degrees.

Tension reel EPC, CPC



### Carrousel tension reel EPC

In this method 2 mandrels are mounted on a common disc which revolves while the strip is wound up on the No. 1 reel and the No. 2 reel. There are many factors which require caution in planning. One sensor is shared by the two reels.



Carrousel tension reel EPC

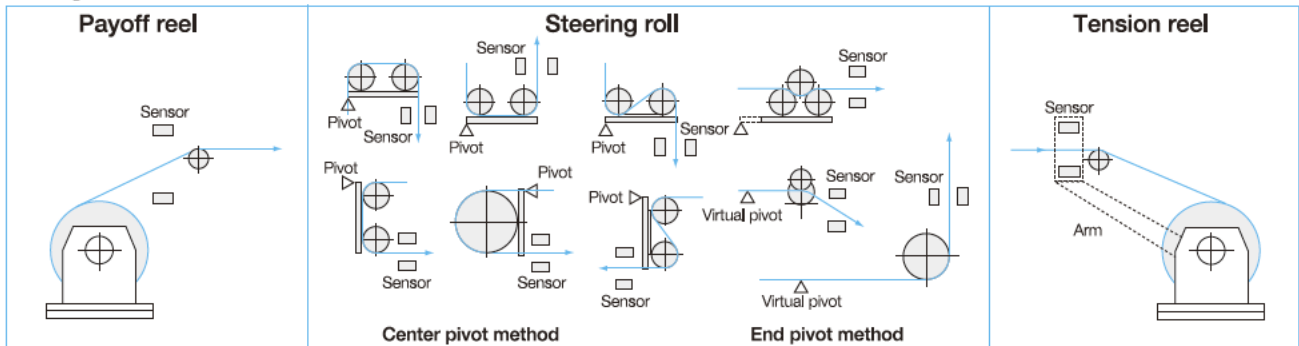
# EPC / CPC System Specifications Inquiry Form

Shipment destination \_\_\_\_\_

Facility name \_\_\_\_\_

Please fill out the following conditions to help us estimate for a unit that you wish to purchase.

## 1. Layout



## 2. Specifications for purpose of estimate

1	Line specification	Value			Note	
1-1	Line speed	Max	m/min	Min	m/min	
1-2	Strip thickness	Max	mm	Min	mm	
1-3	strip width	Max	mm	Min	mm	
1-4	Tension	Unit	N/mm <sup>2</sup>			
		Total	N			
1-5	Strip material	Carbon steel	Stainless steel	Other		
1-6	Mechanism mass	N				
1-7	Coil mass	N				
1-8	Friction coefficient	$\mu =$				
1-9	Operating force	N (Piston rod thrust)				
1-10	Manipulated variable	Shifting value $\pm$ mm, Correction angle $\pm$ °				
1-11	Cylinder size	Bore	mm,	Rod dia.	mm, Stroke	mm
2	Controlled system	<input type="checkbox"/> Tension reel <input type="checkbox"/> Payoff reel <input type="checkbox"/> Steering roll <input type="checkbox"/> EPC <input type="checkbox"/> CPC				
3	Control method	Tension reel: <input type="checkbox"/> Arm method <input type="checkbox"/> Arm less method				
		Payoff reel: Sensor gap                      mm				
4	Meander value	$\pm$ mm				
5	Hydraulic unit	<input type="checkbox"/> Provide Motor <input type="checkbox"/> Provide <input type="checkbox"/> Not provide				
		Cooling water	Temperature	°C		
		<input type="checkbox"/> Not provide		Supply pressure	Pump capacity	
		Fire law <input type="checkbox"/> Apply <input type="checkbox"/> Not apply				
6	Power supply	Instrumentation power supply <input type="checkbox"/> AC V Hz				
		Solenoid power supply <input type="checkbox"/> AC V Hz <input type="checkbox"/> DC V				
		Motor power supply <input type="checkbox"/> AC V Hz				

### 3. Selection table

Cylinder speeds for each line speed

Line speed	Cylinder speed	
	Payoff, Tension reel	Steering roll
30 to 100 m/min	5 to 10 mm/sec	5 mm/sec
100 to 200 m/min	10 to 15 mm/sec	5 to 10 mm/sec
200 to 400 m/min	15 to 25 mm/sec	10 to 15 mm/sec
400 to 600 m/min	25 to 30 mm/sec	15 to 20 mm/sec
600 to 900 m/min	30 to 40 mm/sec	20 to 30 mm/sec
900 m/min or more	40 mm/sec or more	30 mm/sec or more

If you wish to request special specifications or specified items, please explain what you want. Unless otherwise specified, the estimate will be based on NIRECO's standard specifications.

*We reserve the right to change the specifications in this catalog without prior notice to improve and update our products.*

**NIRECO**  
NIRECO CORPORATION

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