

RESOLVERS

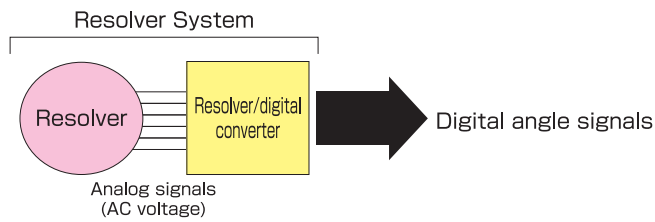
A resolver is an angle sensor that outputs rotational angles as two-phase AC voltages (analog signals). It features structurally high environmental resistance compared to other sensors due to its simple design comprised of only an iron core and a coil. An AC output voltage is induced in the winding on the output side through excitation of the excitation winding using an AC voltage.

As this output voltage will vary depending on the angle of rotation, the angle of rotation can be calculated using the voltage reading.

Features

- Wide operating temperature range
- Excellent environmental resistance
- Rotatable at high speeds
- High reliability
- Absolute value position detection
- Long-distance transmission available (Highly resistant to noise)
- Compact assembly

Resolver System Structure

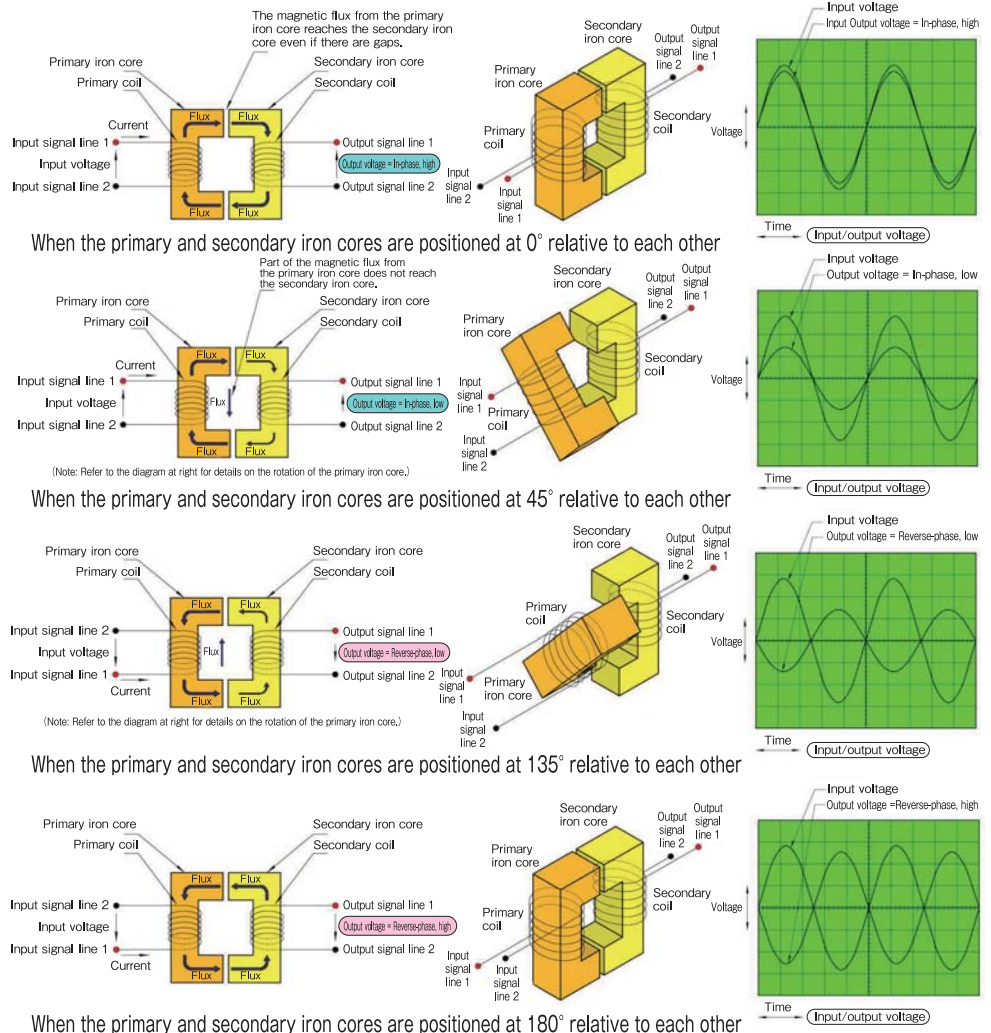


Comparison of Angle Sensors

Type of sensor Item	Singsyn® (VR series resolver)	Smartsyn® (Blushless resolver)	MRsensor	Hall effect sensor	Optical encoder	Potentiometer
Accuracy (Sensor alone)	△ 0.3° to 1°	○ 0.05° to 0.2°	△ 0.3° to 0.5°	△ 0.5° to 1°	◎ 0.02° to 0.1°	○ (Around 0.5% to 1%)
Resolution (Single-turn)	10-bit to 12-bit (In combination with RD) X (2, 3, 4-) (Up to 10000 pulses/r)	10-bit to 16-bit (In combination with RD) (Up to 65536 pulses/r)	— (Up to 4000 pulses/r)	— (Up to 500 pulses/r)	10-bit to 14-bit (Up to 5000 pulses/r)	(Equivalent to up to 14-bit)
Output signals	Absolute angle output A, B, Z UVW	Absolute angle output A, B, Z UVW	Incremental A, B	Incremental A, B	Incremental (Absolute angle) A, B, Z (UVW)	Absolute angle output Analog output
Rotational tracking speed	30000 min ⁻¹ or above ◎	20000 min ⁻¹ or above ○	30000 min ⁻¹ or above ◎	30000 min ⁻¹ or above ◎	10000 min ⁻¹ or above ○	300 min ⁻¹ or above ×
Shape/dimensions	◎	○	◎	◎	△	◎
Heat resistance	-55°C (-67°F) to +155°C (+311°F)	-55°C (-67°F) to +155°C (+311°F)	-10°C (+14°F) to 85°C (+185°F)	-10°C (+14°F) to 110°C (+230°F)	-10°C (+14°F) to 85°C (+185°F)	-10°C (+14°F) to 50°C (+122°F)
Anti-vibration	◎	◎	○	○	△	×
Reliability	◎	◎	○	△	○	×
Anti-noise	◎	◎	△	△	○	○
Price	◎	○	◎	◎	△	◎
Features	Absolute position detection High reliability Excellent environmental resistance High-speed rotation	Absolute position detection High reliability Excellent environmental resistance	Low resolution	Low resolution	High resolution but poor reliability	Contact type, finite angle

◎ : Excellent ○ : Good △ : Poor

Basic Resolver Principles

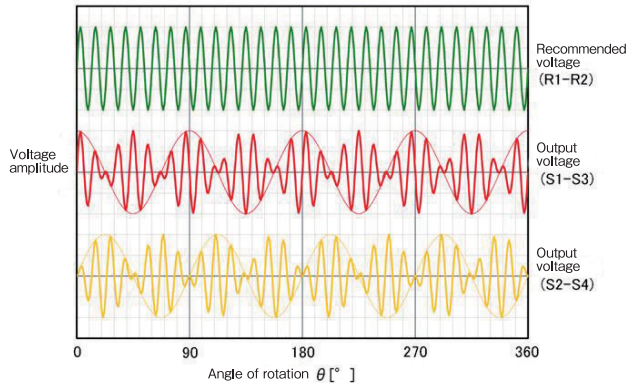


■ Type

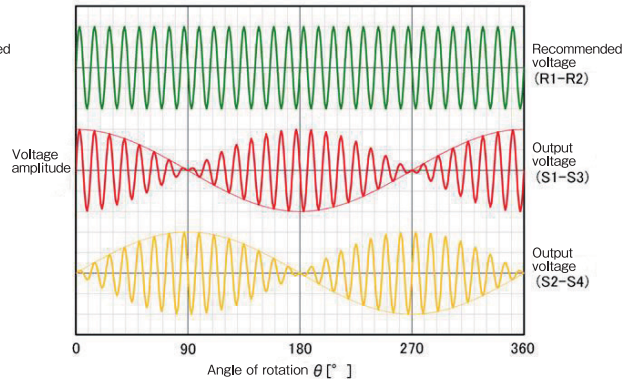
- BRX model (Amplitude-modulated) Single-phase induced/two-phase output
- BRT model (Phase-modulated) Two-phase induced/single-phase output
- BRS model (Amplitude-modulated) Two-phase induced/two-phase output

■ Multiplication Factor for the Angle for the Resolver

The multiplication factor is defined to be 1x when an output signal for a single turn is generated when the resolver axis is turned once, 2x for an output signal generated for a double turn, and 4x for an output signal generated for a quadruple turn. In most cases, the angle detection accuracy increases as the size of the multiplication factor for the angle goes up.



Changes in the output voltage of the 4X-BRX



Changes in the output voltage of the 1X-BRX

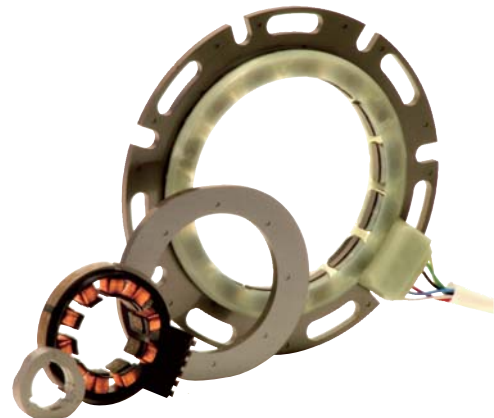
Smartsyn

The Smartsyn is a built-in, brushless resolver designed using Tamagawa Seiki's unique and fully new winding system to produce a product that is low cost and high in productivity and has superior reliability and electrical characteristics. Resolvers formed using conventional winding systems could only be operated manually, but the resolvers produced using this new winding system can be set up to operate automatically using a coil winding machine.

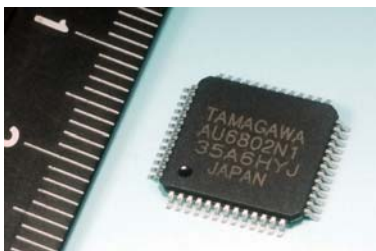


Singsyn

The Singlsyn is an ultra-thin absolute angle detector. The VR series resolver has higher reliability and can be produced at lower cost as it does not have a coil on its rotor. Forming the rotor core into a special shape and changing the width of the gap between the rotor core and the stator core generates changes in the amplitude of the output voltage. The Singlsyn can be installed in a minimal amount of space due to the ultra-thin structure of the built-in model.



SmartCoder (Resolver/digital converter)



A resolver/digital converter, which is made up of a robot, a brushless motor controller or other type of controller, and a driver, which are in turn used as an interface for CPU digital processing, works to convert analog resolver signals into digital signals and is used in a wide range of applications.