

# BRUSHLESS RESOLVERS

## MEET YOUR NEEDS IN MOTION CONTROL APPLICATIONS

Wide Range of Built-in types  
for Direct Mounting onto Motors

Smartsyn, and brushless resolvers, are to offer you highly enhanced reliability which has been enabled by excluding human-dependent works in the major production / inspection procedures from parts processing, assembling to shipping.

We'd like to offer the resolvers for such applications as follows.

- Commutation of brushless motors
- Feedback sensor of servo systems
- Robots
- Machine tools
- Aerospace servo systems
- Others where harsh environmental condition is involved

Smartsyn is a name of our brushless resolvers of a new type. They have their inherent characteristics as a resolver : maintenance-free brushless design, immunity to noise, vibration, shock, and high temperature.

And now they have more to offer : homogeneity in the ever-variable parameters like accuracy, transformation ratio, phase shift, etc., which has been realized by highly automated production. Now this new quality can be taken for granted.



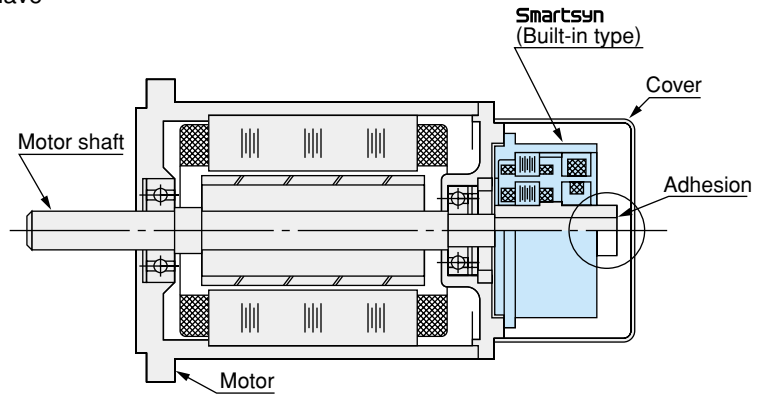
## FEATURES

- Wide Operating Temperature Range
  - 55 to +155°C (Built-in type)
  - 30 to +100°C (All Shaft types, TS2028, and TS2054)
- Usable in Demanding Environments
  - Vibration : 196m/s<sup>2</sup> (20G) at 10~500Hz
  - Shock : 981m/s<sup>2</sup> (100G) for 11ms
  - Humidity : 90% Rh Min. at 60°C
- High reliability and long life owing to brushlessness
- Operating speed up to :
  - 100~500<sup>-1</sup> (6000~30000min<sup>-1</sup>) / (Built-in type)
  - 100s<sup>-1</sup> (6000min<sup>-1</sup>) / (Shaft type)
- Free from electrical and mechanical noise

## MOUNTING REQUIREMENTS

The following mounting requirements should be kept to satisfy the specifications.

- Shaft Run-out  
A motor shaft on which Rotor is mounted should have a run-out less than 0.050mm (TIR).
- Concentricity  
Centers of resolver and motor shaft should be aligned within 0.050mm (TIR).
- Perpendicularity  
Resolver case should be perpendicular to the motor shaft within 0.050mm (TIR).
- Axial Alignment  
For built-in types, Stator and Rotor should be axially aligned within the tolerance of MTG.DIM.



## PRINCIPLE

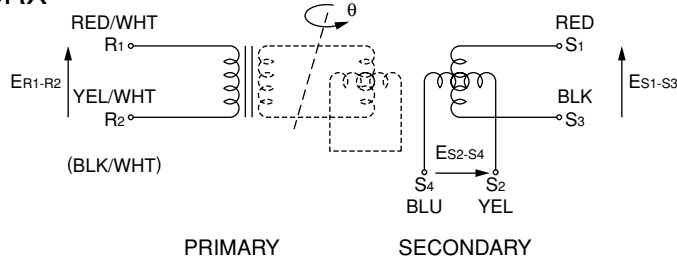
Resolver is a rotary transformer, which outputs AC voltage in accordance with angular position of the shaft. There are two types of resolvers, BRX and BRT, having different types of winding.

BRX resolver is excited by AC voltage to the rotor winding, and outputs from the stator windings sine and cosine voltages proportion to the rotation angle  $\theta$ .

BRT resolver is excited by sine and cosine voltages to the stator windings, and outputs from the rotor winding a sine voltage phase-shifted in proportion to  $\theta$ .

The difference is illustrated as follows.

### BRX



Excitation :  $E_{R1-R2} = E \sin \omega t$

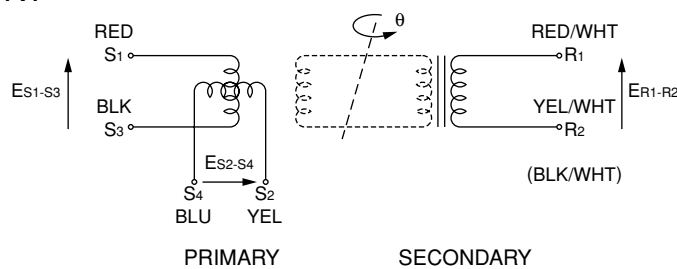
Output :  $E_{S1-S3} = K E_{R1-R2} \cos \theta$

$E_{S2-S4} = K E_{R1-R2} \sin \theta$  (Normal Type)

$E_{S2-S4} = -K E_{R1-R2} \sin \theta$  (Reverse Type)

$K$  : Transformation Ratio

### BRT



Excitation :  $E_{S1-S3} = E \sin \omega t$

$E_{S2-S4} = E \cos \omega t$

Output :  $E_{R1-R2} = K E_{S1-S3} \cos \theta - K E_{S2-S4} \sin \theta$   
 $= K E \sin (\omega t - \theta)$  (Normal Type)

$E_{R1-R2} = K E_{S1-S3} \cos \theta + K E_{S2-S4} \sin \theta$   
 $= K E \sin (\omega t + \theta)$  (Reverse Type)

$K$  : Transformation Ratio

+ $\theta$ :CCW is positive when viewed from mouting end.