Hall-effect Rotary Position Sensors

RTY Series with Integral Actuator

RTP Series with External Actuator

Datasheet

RTY Series and RTP Series Hall-effect Rotary Position Sensors

The RTY Series and RTP Series Hall-effect Rotary Position Sensors provide non-contact sensing in harsh transportation and industrial applications at a competitive cost.

- **RTY Series:** These shaft activated products are available in two versions: an integral shaft with or without a lever. The lever may allow customers to reduce the number of mechanical linkages required for their applications, which may reduce the cost of the overall customer solution.
- **RTP Series:** Takes non-contact sensing to the next level by separating the magnet from the sensor body. The absence of the actuator shaft removes the wear and tear on the bearings caused by radial forces. A choice of a bare or a housed magnet is available.

These products use a magnetically biased, Hall-effect integrated circuit (IC) to sense rotary movement of the actuator over a set operating range. Rotation of the actuator changes the magnet's position relative to the IC. The resulting flux density change is converted to a linear output.

The IC, together with conditioning and protection circuitry, is sealed in an IP69K-qualified rugged package for durability in most harsh environments.

Eight operating ranges from 50° to 360° are tolerant to over-travel and allow use in most common applications. Low voltage and high voltage versions cover an input voltage range of 4.5 Vdc to 30 Vdc.

Honeywell's industry-leading capabilities in research and development provide the customer with known quality and support.

Features

- True, non-contact operation
- 35 M cycle product life (RTY Series); unlimited rotation (RTP Series)
- Solid-state Hall-effect technology
- Rugged IP69K-sealed package with integral connector
- Automotive-grade EMI/EMC testing, integrated reverse polarity, and short circuit protection
- Industry-standard AMP termination, 32 mm mounting pitch, North American or European pinout styles, and compact package
- Eight operating ranges up to 360°

Potential Applications

TRANSPORTATION

- Position and movement detection (pedals, throttles, gear shift, levers, steering, linkages, and hitches) in trucks, buses, off-road vehicles, cranes, and industrial/construction/agricultural vehicles and equipment)
- Suspension/kneeling position (buses, trucks)
- Tilt/trim position (boat engines, tilling equipment)

INDUSTRIAL

- Valve control
- HVAC damper control
- Irrigation equipment pivot control

RUGGED • LONG PRODUCT LIFE • NON-CONTACT SENSING

Table 1. Electrical Specifications

Characteristic	RTY Series		RTP Series	
	LV (Low Voltage)	HV (High Voltage)	LV (Low Voltage)	HV (High Voltage)
Supply voltage	5 ±0.5 Vdc	10 Vdc to 30 Vdc	5 ±0.5 Vdc	10 Vdc to 30 Vdc
Supply current: normal during output to ground short	20 mA max. 25 mA max.	32 mA max. 47 mA max.	20 mA max. 25 mA max.	32 mA max. 47 mA max.
Output: standard inverted	0.5 Vdc to 4.5 Vdc ratiometric 4.5 Vdc to 0.5 Vdc ratiometric	0.5 Vdc to 4.5 Vdc non-ratiometric 4.5 Vdc to 0.5 Vdc non-ratiometric	0.5 Vdc to 4.5 Vdc ratiometric 4.5 Vdc to 0.5 Vdc ratiometric	0.5 Vdc to 4.5 Vdc non-ratiometric 4.5 Vdc to 0.5 Vdc non-ratiometric
Output signal delay	4 ms typ.			
Overvoltage protection	10 Vdc	—	10 Vdc	—
Reverse polarity protection	-10 Vdc	-30 Vdc	-10 Vdc	-30 Vdc
Output to ground short circuit protection	continuous			
Resolution	12 bit			
Output load resistance (pull down to ground)	10 kOhm typ.			
EMI: radiated immunity conducted immunity	100 V/m per ISO11452-2 from 200 MHz to 1000 MHz		100 V/m per ISO11452-2 from 200 MHz to 1000 MHz	
	100 mA BCI per ISO11452-4 from 1 MHz to 200 MHz	100 mA BCI per ISO11452-4 from 1 MHz to 400 MHz	100 mA BCI per ISO11452-4 from 1 MHz to 200 MHz	100 mA BCI per ISO11452-4 from 1 MHz to 400 MHz
EMC	exceeds CE requirements			

Table 2. Mechanical Specifications

Characteristic	RTY Series		RTP Series	
	LV (Low Voltage)	HV (High Voltage)	LV (Low Voltage)	HV (High Voltage)
Expected life	35 M cycles		infinite rotation	
Air gap: bare magnet actuator housed magnet actuator misalignment	— — —		3,00 mm ±0.5 mm [0.12 in ±0.02 in] 2,00 mm ±0.5 mm [0.08 in ±0.02 in] 2,00 mm [0.08 in] max.	
Material: shaft magnet sensor housing housed magnet overmold sensor/housed magnet bushing sensor bushing	stainless steel — PBT plastic — — stainless steel		— NdFeB PBT plastic PPS plastic brass —	
Mating connector	AMP Superseal 282087-1			
Mechanical end stop	no			
Mounting screw sizes: sensor to mounting surface lever to mounting surface housed magnet actuator to actuator mounting shaft	non-magnetic, stainless steel M5 screws and 10 mm [0.39 in] OD washers non-magnetic stainless steel M6 screws, —		non-magnetic, stainless steel M4 X 0.7 screws and 8 mm [0.31 in] OD washers — non-magnetic, stainless steel M3 X 0.5 plain cup point set screws	
Approvals	CE			

Table 3. Environmental Specifications

Characteristic	RTY Series		RTP Series	
	LV (Low Voltage)	HV (High Voltage)	LV (Low Voltage)	HV (High Voltage)
Operating temperature range	-40 °C to 125 °C [-40 °F to 257 °F]			
Ingress protection	IP69K			
Media compatibility	heavy transportation fluids			
Shock[1]	50 G peak			
Vibration[1]	20 G peak			
Salt fog	concentration 5% ±1% for 240 hr per SAE J1455 Section 4.3.3.1 (at 5.0 Vdc, 38 °C [100 F °])		bare magnet: 96 hr for as per ASTM B117 housed magnet: 240 hr per ASTM B117	

[1] Does not apply RTY Series sensor shaft with lever.

CAUTION
ELECTROSTATIC
SENSITIVE
DEVICES
DO NOT OPEN OR HANDLE
EXCEPT AT A
STATIC FREE WORKSTATION
ESD SENSITIVITY:
CLASS 2

NOTICE
Ferrous material or magnet material more than 300 Gauss within 10 mm [0.39 in] from sensor boundary may impact sensor performance.

Figure 1. All Available Configurations
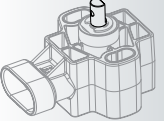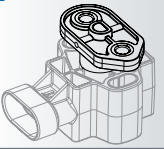
Series	Actuator Type	Series	Actuator Type
RTY	Integral shaft without lever	RTP	Separate bare magnet
	Integral shaft with lever		Separate housed magnet

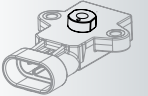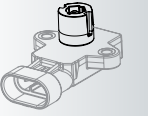## Figure 2. Product Nomenclature

RTY Series

For example, **RTY050LVEAA** defines an RTY Series Hall-Effect Rotary Position Sensor, 50° (±25°) sensing range angle, 5 Vdc supply voltage, European pinout style, 4.5 Vdc (left), 0.5 Vdc (right) output type, shaft without lever actuation type

RTY	050	LV	E	A	A
Series	Sensing Range Angle	Supply Voltage	Pinout Style	Output Type	Actuator Type

Series	Sensing Range Angle	Supply Voltage	Pinout Style	Output Type	Actuator Type
RTY Series Hall-Effect Rotary Position Sensor with Integral Actuator	**050** 50° (±25°) **060** 60° (±30°) **070** 70° (±35°) **090** 90° (±45°) **120** 120° (±60°) **180** 180° (±90°) **270** 270° (±135°) **360** 360° (±180°)	**LV** 5 Vdc **HV** 10 Vdc to 30 Vdc	**E** European: pin 1 = GND pin 2 = Vcc pin 3 = output **N** North American: pin 1 = Vcc pin 2 = GND pin 3 = output	**A** Standard: 0.5 Vdc (left), 4.5 Vdc (right) **B** Inverted: 4.5 Vdc (left), 0.5 Vdc (right)	**X** Shaft without lever **A** Shaft with lever

RTP Series

For example, **RTP050LVEBX** defines an RTP Series Hall-Effect Rotary Position Sensor, 50° (±25°) sensing range angle, 5 Vdc supply voltage, European pinout style, inverted 4.5 Vdc (left), 0.5 Vdc (right) output type, bare magnet actuator type
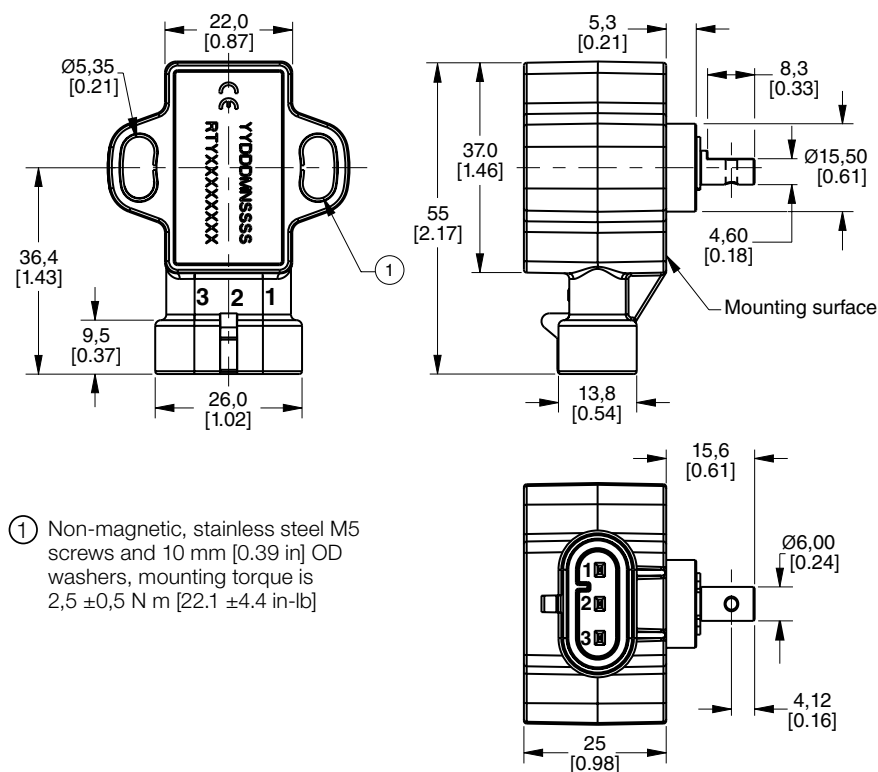
RTP	050	LV	E	B	X
Series	Sensing Range Angle	Supply Voltage	Pinout Style	Output Type	Actuator Type

Series	Sensing Range Angle	Supply Voltage	Pinout Style	Output Type	Actuator Type
RTP Series Hall-Effect Rotary Position Sensor with External Actuator	**050** 50° (±25°) **060** 60° (±30°) **070** 70° (±35°) **090** 90° (±45°) **120** 120° (±60°) **180** 180° (±90°) **270** 270° (±135°) **350** 350° (±175°) **360** 360° (±180°)[1]	**LV** 5 Vdc **HV** 10 Vdc to 30 Vdc	**E** European: pin 1 = GND pin 2 = Vcc pin 3 = output **N** North American: pin 1 = Vcc pin 2 = GND pin 3 = output	**A** Standard: 0.5 Vdc (left), 4.5 Vdc (right) **B** Inverted: 4.5 Vdc (left), 0.5 Vdc (right)	**X** Bare magnet **A** Housed magnet (carrier type "A")[2]

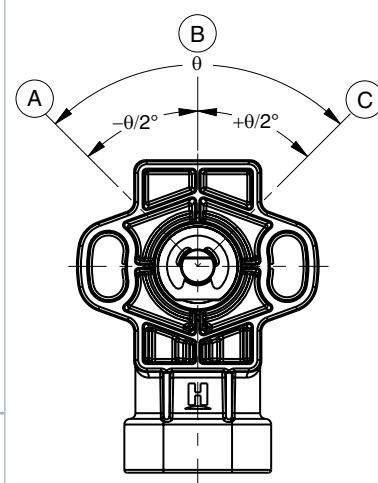[1] 360° Sensing Range Angle available upon request.
[2] Customized housed magnet actuators available upon request.

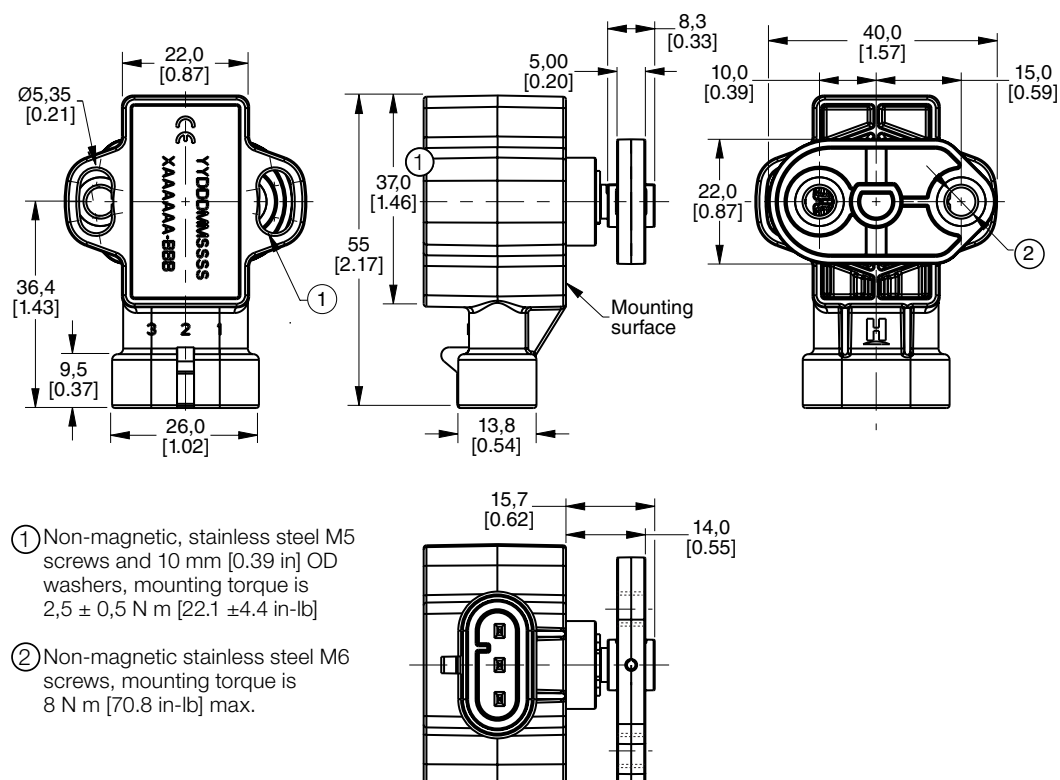**Figure 3. RTY Series Mounting Dimensions (For reference only: mm [in.])**

Sensor without lever

① Non-magnetic, stainless steel M5 screws and 10 mm [0.39 in] OD washers, mounting torque is 2,5 ±0,5 N m [22.1 ±4.4 in-lb]

Sensor with lever

① Non-magnetic, stainless steel M5 screws and 10 mm [0.39 in] OD washers, mounting torque is 2,5 ± 0,5 N m [22.1 ±4.4 in-lb]

② Non-magnetic stainless steel M6 screws, mounting torque is 8 N m [70.8 in-lb] max.
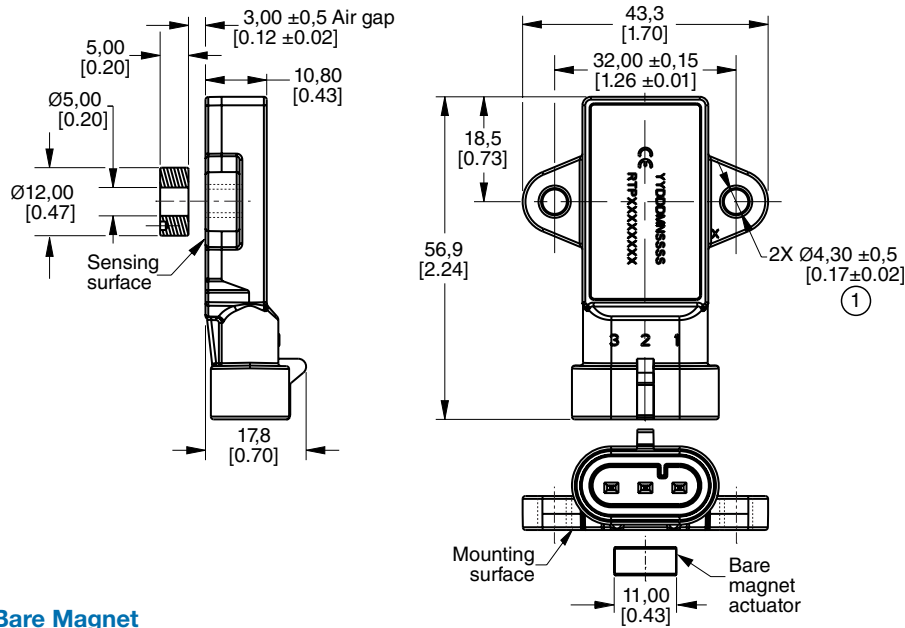
Output diagram

Standard Output

Ⓐ = Left output: 0.5 Vdc
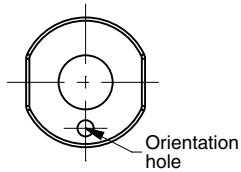Ⓑ = Zero reference
Ⓒ = Right output: 4.5 Vdc

Inverted Output

Ⓐ = Left output: 4.5 Vdc
Ⓑ = Zero reference
Ⓒ = Right output: 0.5 Vdc

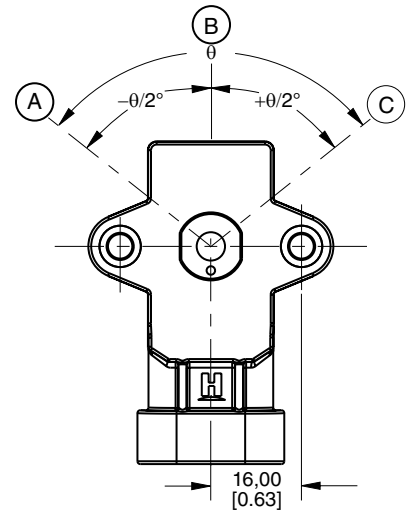**Figure 4. RTP Series Mounting Dimensions (For reference only: mm [in].)**

Sensor with bare magnet actuator

3,00 ±0,5 Air gap [0.12 ±0.02]
5,00 [0.20]
10,80 [0.43]
Ø5,00 [0.20]
Ø12,00 [0.47]
Sensing surface
17,8 [0.70]

43,3 [1.70]
32,00 ±0,15 [1.26 ±0.01]
18,5 [0.73]
56,9 [2.24]
2X Ø4,30 ±0,5 [0.17±0.02]
①
3 2 1
Mounting surface
11,00 [0.43]
Bare magnet actuator

Bare Magnet

Orientation hole

① Non-magnetic, stainless steel M4 X 0.7 screws and 8 mm [0.39 in] OD washers, torque is 2,0 ±0,2 N m [17.7 ±1.8 in-lb].
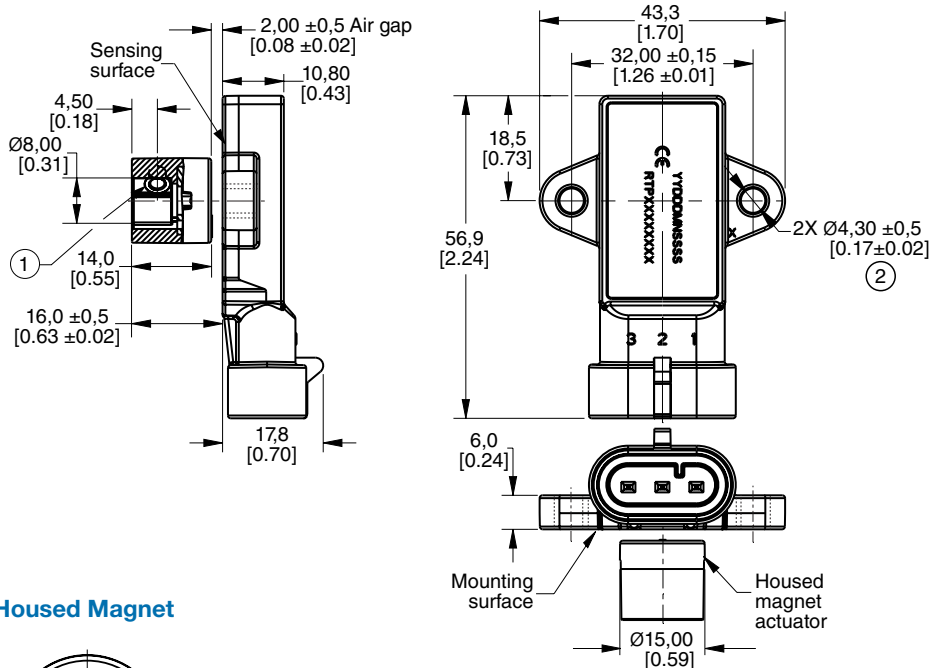
Output diagram

B θ
A −θ/2°   +θ/2° C
16,00 [0.63]

Standard Output
Ⓐ = Left output: 0.5 Vdc
Ⓑ = Zero reference
Ⓒ = Right output: 4.5 Vdc

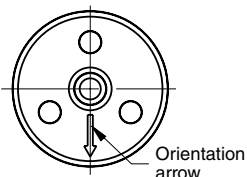**Inverted Output**
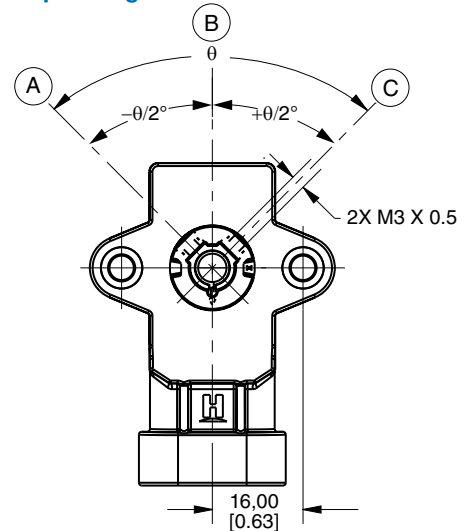Ⓐ = Left output: 4.5 Vdc
Ⓑ = Zero reference
Ⓒ = Right output: 0.5 Vdc

Sensor with housed magnet actuator

2,00 ±0,5 Air gap [0.08 ±0.02]
Sensing surface
10,80 [0.43]
4,50 [0.18]
Ø8,00 [0.31]
① 14,0 [0.55]
16,0 ±0,5 [0.63 ±0.02]
17,8 [0.70]

43,3 [1.70]
32,00 ±0,15 [1.26 ±0.01]
18,5 [0.73]
56,9 [2.24]
2X Ø4,30 ±0,5 [0.17±0.02]
②
3 2 1
6,0 [0.24]
Mounting surface
Housed magnet actuator
Ø15,00 [0.59]

Housed Magnet

Orientation arrow

① Non-magnetic, stainless steel M3 X 0.5 plain cup point set screws, torque is 0,5 N m to 0,6 N m [4.42 in-lb to 5.31 in-lb]
② Non-magnetic, stainless steel M4 X 0.7 screws and 8 mm [0.31 in] OD washers, torque is 2,0 ±0,2 N m [17.7 ±1.8 in-lb].

Output Diagram

B θ
A −θ/2°   +θ/2° C
2X M3 X 0.5
16,00 [0.63]

Standard Output
Ⓐ = Left output: 0.5 Vdc
Ⓑ = Zero reference
Ⓒ = Right output: 4.5 Vdc

Inverted Output
Ⓐ = Left output: 4.5 Vdc
Ⓑ = Zero reference
Ⓒ = Right output: 0.5 Vdc
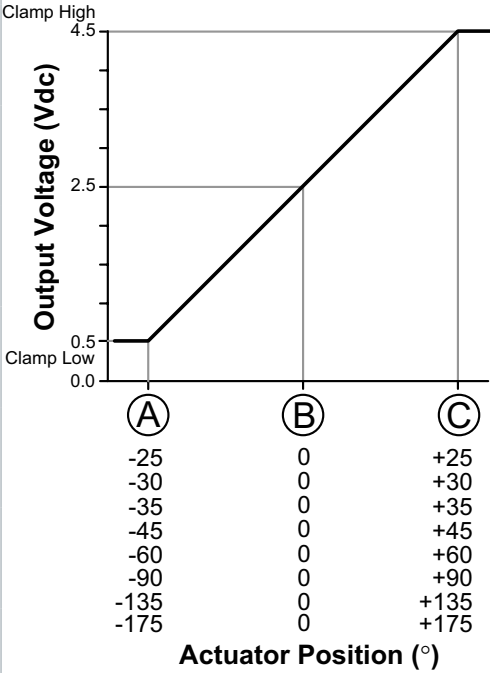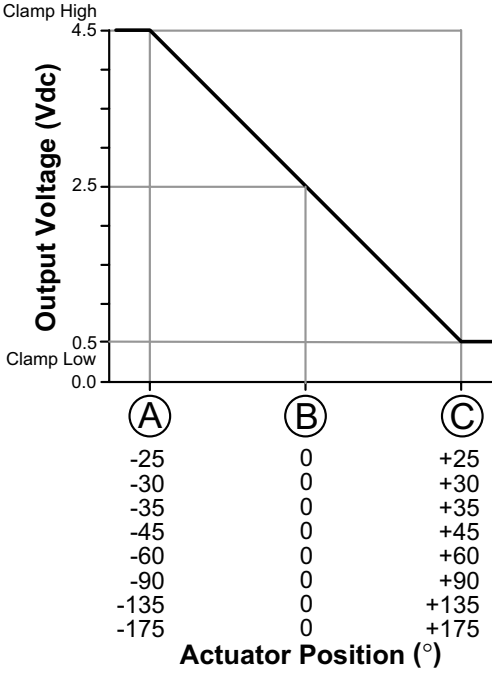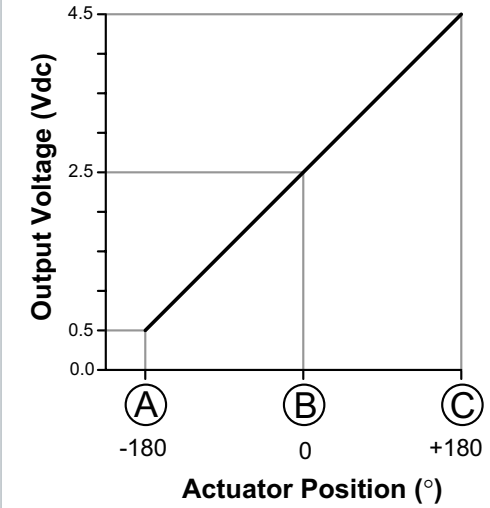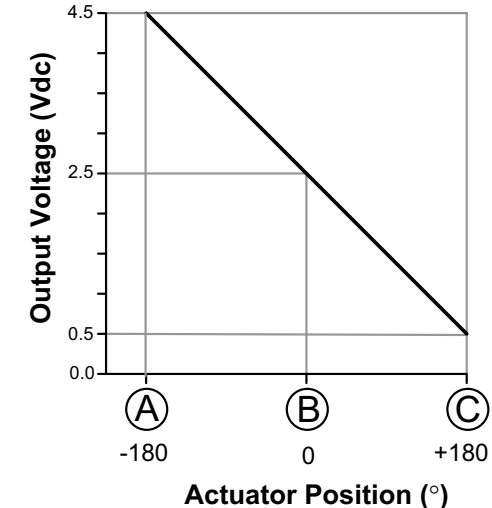
Table 4 RTY Series Functional Characteristics[1]

Characteristic			Standard Output	Inverted Output
Sensing Angle	Linearity Error[2]	Accuracy Error[3]		
50° (±25°)				
60° (±35°)				
70° (±35°)				
90° (±45°)				
120° (±60°)				
180° (±90°)				
270° (±135°)	±1.0%	±1.6%		
360° (±180°)				

Standard Output (top chart):

Output Voltage (Vdc) — Clamp High 4.5, 2.5, 0.5 Clamp Low, 0.0

(A)	(B)	(C)
-25	0	+25
-30	0	+30
-35	0	+35
-45	0	+45
-60	0	+60
-90	0	+90
-135	0	+135

Actuator Position (°)

Inverted Output (top chart):

Output Voltage (Vdc) — Clamp High 4.5, 2.5, 0.5 Clamp Low, 0.0

(A)	(B)	(C)
-25	0	+25
-30	0	+30
-35	0	+35
-45	0	+45
-60	0	+60
-90	0	+90
-135	0	+135

Actuator Position (°)

Standard Output (bottom chart):

Output Voltage (Vdc) — 4.5, 2.5, 0.5, 0.0

(A)	(B)	(C)
-180	0	+180

Actuator Position (°)

Inverted Output (bottom chart):

Output Voltage (Vdc) — 4.5, 2.5, 0.5, 0.0

(A)	(B)	(C)
-180	0	+180

Actuator Position (°)

[1] See Figure 3 for references to (A) (B) (C).

[2] Linearity error is the deviation of the measured value from the best fit line and is the quotient of the measured output ratio deviation from the best fit line at the measured temperature to the best fit line output ratio span at the measured temperature.

[3] Accuracy is measured as a deviation from the index line, where the index line is defined as the line with the ideal slope and sensor output voltage corrected at 0° position for its ideal value at 25 °C ±5 °C. Accuracy is valid only when the sensor output is correct at 0° position for its ideal value in the application.

Table 5. RTP Series Functional Characteristics[1]

Characteristic			Standard Output	Inverted Output
Sensing Angle	Linearity Error[2]	Accuracy Error		
50° (±25°)				
60° (±35°)				
70° (±35°)				
90° (±45°)				
120° (±60°)				
180° (±90°)				
270° (±135°)				
350° (±175°)	±2.0%	—		
360° (±180°)				

Standard Output (top chart)

Clamp High 4.5 / 2.5 / 0.5 Clamp Low / 0.0 — Output Voltage (Vdc) vs Actuator Position (°)

Ⓐ	Ⓑ	Ⓒ
-25	0	+25
-30	0	+30
-35	0	+35
-45	0	+45
-60	0	+60
-90	0	+90
-135	0	+135
-175	0	+175

Inverted Output (top chart)

Clamp High 4.5 / 2.5 / 0.5 Clamp Low / 0.0 — Output Voltage (Vdc) vs Actuator Position (°)

Ⓐ	Ⓑ	Ⓒ
-25	0	+25
-30	0	+30
-35	0	+35
-45	0	+45
-60	0	+60
-90	0	+90
-135	0	+135
-175	0	+175

Standard Output (bottom chart) — Output Voltage (Vdc) vs Actuator Position (°)

Ⓐ	Ⓑ	Ⓒ
-180	0	+180

Inverted Output (bottom chart) — Output Voltage (Vdc) vs Actuator Position (°)

Ⓐ	Ⓑ	Ⓒ
-180	0	+180

[1] See Figure 4 for references to Ⓐ Ⓑ Ⓒ.

[2] Linearity error is the deviation of the measured value from the best fit line and is the quotient of the measured output ratio deviation from the best fit line at the measured temperature to the best fit line output ratio span at the measured temperature.

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