Penny+Giles
A Curtiss-Wright Company

STT SERIES

SEALED TILT SENSORS

STT series INSTALLATION AND APPLICATION NOTES

MOUNTING THE TILT SENSORS

STT280

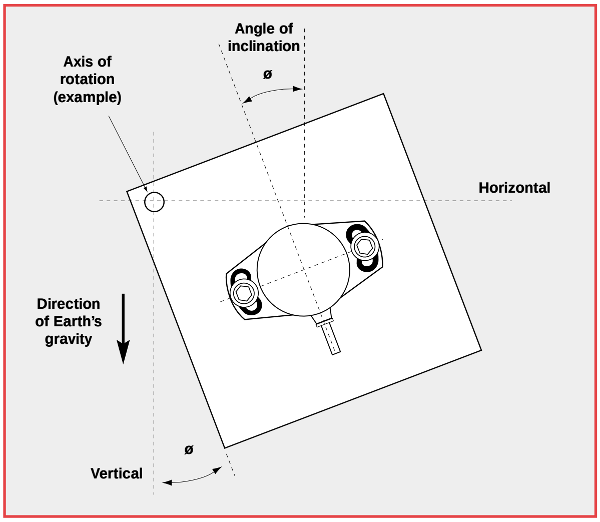
See tilt sensor Dimensions on page 5.

The STT280 is designed to be mounted on a flat and smooth vertical surface by using 2 x M4 socket head cap screws and M4 washers to retain the mounting flange. The STT280 has two radial slots 4.5mm wide on a 38mm diameter PCD, with the slot length sufficient to allow ±10° offset during attachment.

The STT280 will be at approximate mid-span position when the cable outlet is vertically down. The mounting flange is fitted with stainless steel inserts around the mounting screw area to allow tightening and re-tightening without damage to the flange material. ***Maximum recommended screw tightening torque is 2Nm***.

The STT280 measures the angle ø about the axis of rotation as shown in Fig.1. It is not a requirement that the sensor be mounted on the axis of rotation.

Fig.1 – Mounting orientation for STT280 and STT500 (STT280 shown)



STT500

See tilt sensor Dimensions on page 7.

The STT500 is designed to be mounted on a flat and smooth vertical surface by using 3 x M6 (or 1/4 UNC) socket head cap screws and suitable washers to retain the mounting flange. The STT500 has three radial slots 6.5mm wide on a 76mm diameter PCD, with the slot length sufficient to allow ±10° offset during attachment. ***Maximum recommended screw/bolt tightening torque is 5-6Nm.***

The STT500 will be at approximate mid-span position when the cable outlet (or connector) is vertically down.

The STT500 measures the angle ø about the axis of rotation. It is not a requirement that the sensor be mounted on the axis of rotation. see Fig.1 above.

APPLIED VOLTAGES

The STT280 and STT500 can operate from a 5Vdc regulated or 8−30Vdc unregulated power supply

- At **5Vdc** the sensor operates from a regulated supply in the range 4.75 to 5.25Vdc and provides a ratiometric output which is 80% of V supply over the selected full range angle of tilt, with 50% of V supply at 0° tilt. **The ratiometric output means that any change in the supply voltage will show a proportional change in the output.**

- Between **8-30Vdc** the sensor will operate from an unregulated supply in the range 8 to 30Vdc. This version has an internal voltage regulator and provides an output that is absolute and 0.5 to 4.5Vdc over the selected full range angle of tilt, with a nominal 2.5Vdc at 0° tilt. **Any variations in the supply voltage will not affect the output signal.**

The sensor circuit has a low supply current level of less than 6.5mA and has an over-voltage protection to 40Vdc.

When connecting the sensor, care should be taken when making your connections. The STT280 and STT500 are provided with indefinite reverse polarity protection and short circuit protection between output to GND, ***but if the output is connected to the supply it will result in device failure.***

OUTPUT NOISE

The STT280 and STT500 both have a very low output noise level of less than 1mVrms

TILT SENSOR OUTPUT

MEMS tilt sensors are accelerometers and are linear with respect to the horizontal component of earth's gravity 'g'. When used as inclinometers or tilt sensors, they produce an output that is sine shaped and proportional to 1g x sinø, where ø is the angle of inclination relative to the 0g position.

Ideal Output Law – see Output Characteristics graph on page 5 and 7
The output of the STT280 and STT500 follows a specific output law, depending on the supply voltage.

- **5Vdc supply**
  Output (%Vs) = V supply x (k x sinø + 0.5)
  Nominal span over full range tilt is 80% of Vsupply

- **8-30Vdc supply**
  Output (Vdc) = (5 x k x sinø + 2.5)
  Nominal span over full range tilt is 4Vdc
  where ø is angle of inclination
  and k = 0.4619 for ±60° sensor
  k = 0.8000 for ±30° sensor
  k = 1.1695 for ±20° sensor
  k = 2.3035 for ±10° sensor

The output can therefore be linearised by using a microcontroller (or other device) by calculating the offset required for each angle of inclination.

The STT280 and STT500 have a maximum deviation from ideal output law of < ±1% of span. The output is a nominal 2.5Vdc at 0° tilt. Output increases as the sensor is rotated Clockwise (viewed on label) and decreases with Anti-clockwise rotation. See Fig.2

GS GLOBAL RESOURCES
Foremost in Machine Performance for Life
GS Global Resources • 1-800-261-8735 • gsglobalresources.com
926 Perkins Drive, Mukwonago, WI 53149

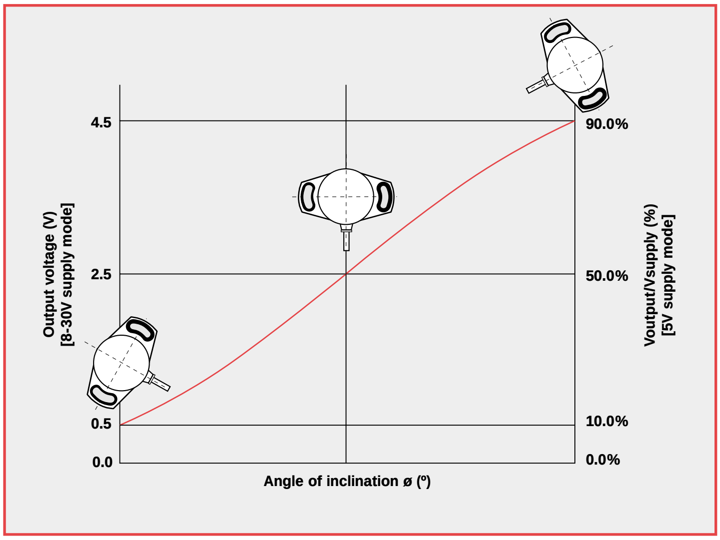


Fig. 2 – STT280 shown

CROSS-AXIS SENSITIVITY

The cross axis is the angle that the tilt sensor may be inclined away from the vertical position IN THE PLANE PERPENDICULAR TO the normal axis of rotation. The cross-axis sensitivity (<4%) shows how much perpendicular acceleration or inclination is coupled to the STT280 or STT500 output signal. For example, if the cross axis tilt is 10°, the added error due to cross-axis sensitivity is less than 0.04 x 10 = 0.4°. This value needs to be included when calculating output error.

ENVIRONMENTAL PERFORMANCE

STT280

The STT280 housing is manufactured using high strength corrosion resistant materials and is protected to IP68, with 2m submersion for 24 hours. It can operate in temperatures from -40 to +125°C (at 5Vdc), and has been tested to withstand a 3m drop onto concrete (maximum20,000g). The tilt sensor also conforms to BS EN 61000-4-3, with EMC Immunity to 100V/m.

STT500

The STT500 housing is manufactured using LM6 marine grade aluminium alloy and is protected to IP69K. It can operate in temperatures from -40 to +125°C (at 5Vdc), and has been tested to withstand a 3m drop onto concrete (maximum20,000g). The tilt sensor also conforms to BS EN 61000-4-3, with EMC Immunity to 100V/m.

By using a 3D-MEMS based sensor technology in the STT280 and STT500, this ensures a fit-and-forget installation with no moving parts that can deteriorate or wear.

LIMITATIONS OF USE

The STT280 and STT500 are designed for use in systems with a frequency response requirement of <=1.5Hz. It is not designed and cannot be used as an accelerometer unless used within the 1.5Hz maximum frequency response spectrum.

GLOBAL RESOURCES
Foremost in Machine Performance for Life
GS Global Resources • 1-800-261-8735 • gsglobalresources.com
926 Perkins Drive, Mukwonago, WI 53149

Penny+Giles

A Curtiss-Wright Company

Doc Ref: STT 02/12

www.pennyandgiles.com

Penny & Giles
Position sensors, joysticks and solenoids for commercial and industrial applications.

15 Airfield Road
Christchurch
Dorset BH23 3TG
United Kingdom
+44 (0) 1202 409499
+44 (0) 1202 409475 Fax
sales@pennyandgiles.com

36 Nine Mile Point Industrial Estate
Cwmfelinfach
Gwent NP11 7HZ
United Kingdom
+44 (0) 1495 202000
+44 (0) 1495 202006 Fax
sales@pennyandgiles.com

665 North Baldwin Park Boulevard
City of Industry, CA 91746
USA
+1 626 480 2150
+1 626 369 6318 Fax
us.sales@pennyandgiles.com

Straussenlettenstr. 7b
85053 Ingolstadt,
Germany
+49 (0) 841 885567-0
+49 (0) 841 885567-67 Fax
info@penny-giles.de

3-1-A, Xiandai Square,
No 333 Xingpu Rd,
Suzhou Industrial Park, 215126
China
+86 512 6287 3380
+86 512 6287 3390 Fax
sales@pennyandgiles.com.cn

CURTISS WRIGHT Controls