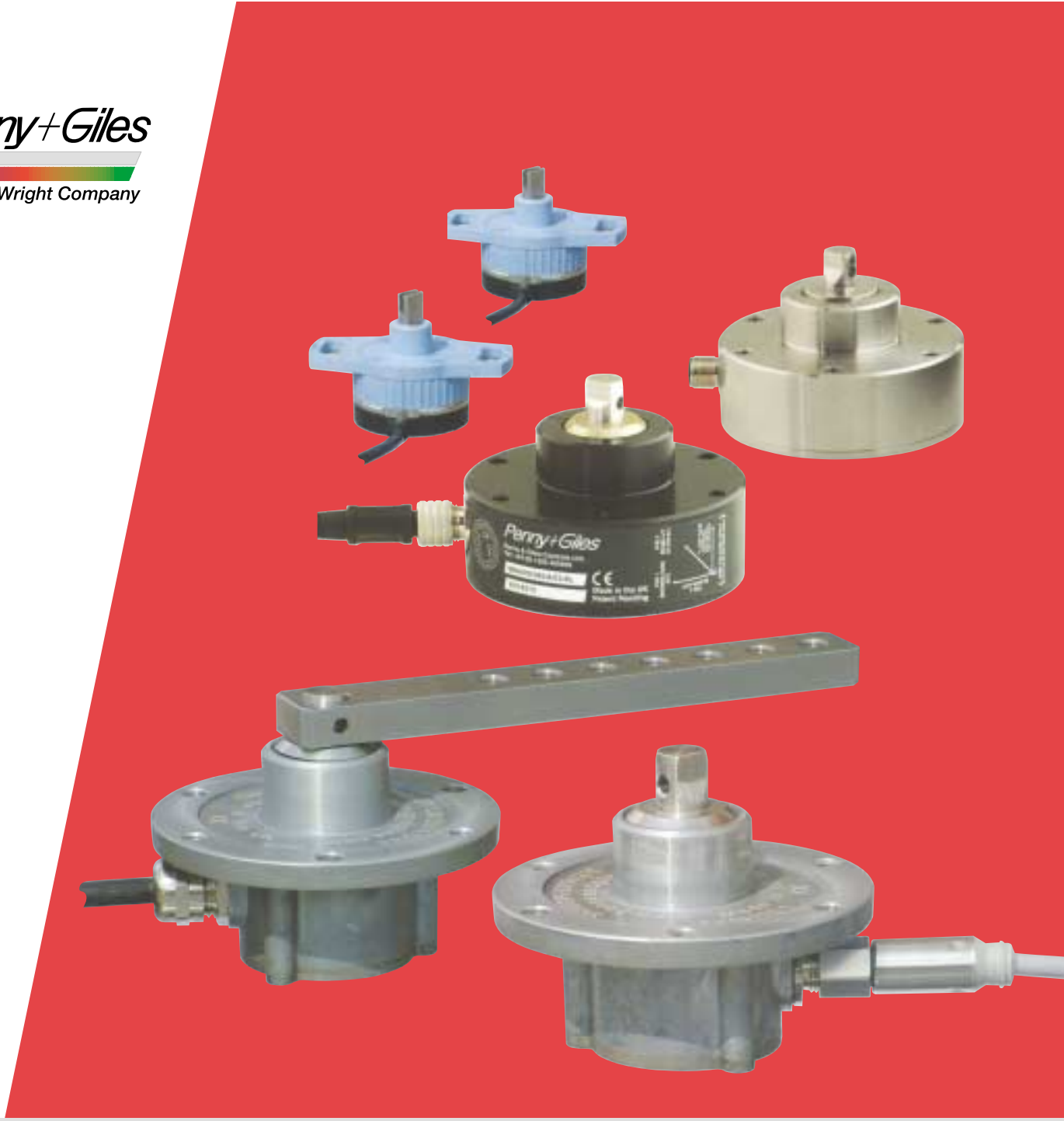
Penny+Giles

A Curtiss-Wright Company



SRH CONTACTLESS ROTARY SENSORS

Innovation In Motion

INNOVATION IN MOTION

The Penny+Giles SRH series of contactless rotary position sensors have been specially developed to provide maximum performance under extremes of temperature, humidity, vibration, shock and immersion. Using the latest advances in 12bit Hall effect sensing technology, this new generation of sensors are factory programmed to provide the user with a wide range of previously unavailable options, including single or dual redundant outputs, clockwise or anticlockwise rotation and measurement angles from 0-20° to 0-360° in only 1° increments.

This sensor range is ideally suited to operate in extremely hostile applications that are typical in motorsport, off-road specialist vehicles, military vehicles and heavy industrial machinery.

Contactless magnetic rotary sensor IC

The SRH series use a high performance, factory programmable 12 bit magnetic rotary sensor IC that includes integrated Hall elements and digital signal processing. The angular position information is provided by a two pole rare earth magnet integrated with the sensor shaft. The sensor provides a pulse width modulated signal or an absolute analogue voltage signal by using a low-pass filter circuit. The SRH rotary sensor is designed to operate from either a 5Vdc regulated or 9 - 30Vdc unregulated supply, with a high stability circuit and EMC immunity to 100V/m.

Features

- **Contactless technology**
- **Absolute analogue or digital (PWM) output**
- **Measuring range from 20° to 360° in 1° increments**
- **Single or Dual outputs**
- **Temperature error less than 50ppm/°C**
- **Rugged housing and shaft designs**
- **Protection up to IP69K**
- **Choice of shaft attachments and mountings**
- **Rapid despatch of any option**
- **CE approved**

Benefits

- **Long life and impervious to dither vibration**
- **No loss of position on power down**
- **Maximum sensitivity in all applications**
- **Optional redundant output for safety critical applications**
- **Maximises system accuracy over temperature range**
- **Suitable for extreme environments**
- **Operation in hostile environments including pressure washing**
- **Interchangeable with existing installations**
- **Eliminates customer inventory**
- **Confidence in EMC performance**

EMC Directive 2004/108/EEC
The products detailed in this document have been tested to the requirements of EN 61000-4-3 (Immunity).

Quality Assurance
Penny+Giles are accredited to BS EN ISO9001:2000
Quality is at the heart of all our systems ensuring the reliability of our products from initial design to final despatch.

Certificate No. LRQ 0924881

Design Statement

The design of models SRH501P and SRH502P are subject to Community Registered Design No 000961610-0001.

The SRH280P, SRH280DP, SRH501P, SRH502P and SRH880P designs include an Input Protector Circuit (Patent Applied For).

Innovative, rugged design - superior protection

All models in the SRH series have been designed to offer the best combination of materials and mounting styles that ensure survivability in the most rugged applications. We use sealing systems and cable connections that offer superior protection against the most hostile of operating conditions.

Impressive environmental capability

The SRH series has been designed with 21st century applications in mind. Models SRH280/DP and SRH501/2P can withstand operating temperatures from -40°C to +140°C and have been tested to withstand severe shock and vibration. All sensors have protection to at least IP68 rating, with models SRH501P & SRH502P offering protection to IP69K. With an EMC immunity of 100V/m, these position sensors are ready for the harshest applications.

Superior performance

The SRH series has an impressive performance specification and can operate from a 5Vdc regulated or 9 – 30Vdc supply.
Outputs can be PWM or analogue voltage (nominal 0.5 - 4.5Vdc) over the measurement range with clockwise or anticlockwise shaft rotation. A choice of 341 different electrical angles from 20° to 360° are possible.
12 bit resolution (0.025%) is available over the selected measuring range, with a non-linearity better than ±0.4% and temperature stability better than ±50 ppm/°C. The sensor's analogue output option has a very low output noise level of less than 1mV rms.

World leading availability

The SRH series have been 'designed for manufacture' enabling assembly in state-of the-art manufacturing cells. This means that we can supply any of the configurations possible from the options offered, in a matter of days from ordering. This allows OEMs to reduce or eliminate their inventory, and call on Penny+Giles to supply 'on demand'.

Performance assured

Penny+Giles' product development process includes exhaustive qualification testing to ensure that performance specifications published in our product brochures and technical data sheets are backed by real-life test evidence. This is our assurance to you that our designs have been tested at these parameters.

Selection Guide

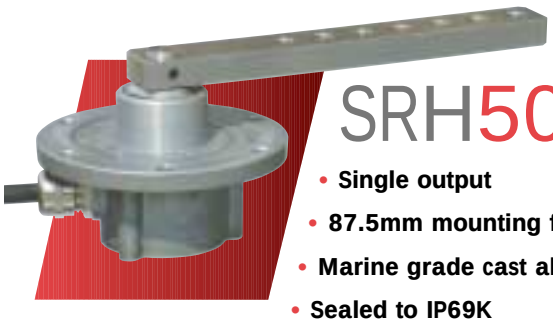
Penny+ Giles offers the widest choice of options to suit your application

SRH280P

- **Single output**
- **28mm body with crush proof flange**
- **Three shaft styles**
- **Sealed to IP68**

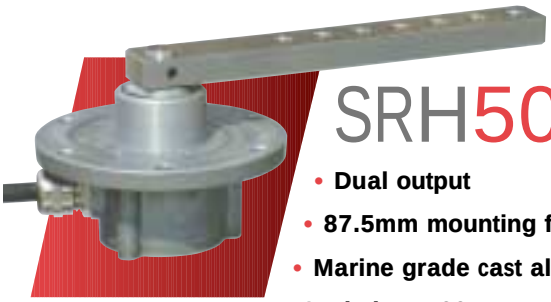
SRH280DP

- **Dual output**
- **28mm body with crush proof flange**
- **Three shaft styles**
- **Sealed to IP68**
- **Raychem™ DR25 cable**



SRH501P

- **Single output**
- **87.5mm mounting flange**
- **Marine grade cast alloy housing**
- **Sealed to IP69K**



SRH502P

- **Dual output**
- **87.5mm mounting flange**
- **Marine grade cast alloy housing**
- **Sealed to IP69K**

SRH880P

- **Single output**
- **88mm body**
- **Aluminium or stainless steel housing**
- **Sealed to IP68M**

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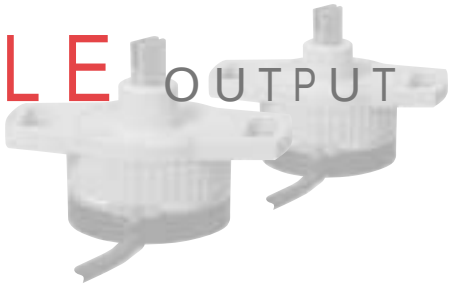
SRH280P SINGLE OUTPUT

contactless rotary sensor



PERFORMANCE

ELECTRICAL

Measurement range	**°**	20 to 360 in 1° increments
Supply voltage	**Vdc**	9 to 30 (unregulated) and 5 ±0.5 (regulated)
Over voltage protection	**Vdc**	Up to 40 (-40 to +60°C)
Maximum supply current	**mA**	<12.5
Reverse polarity protection		Yes
Short circuit protection		
Output to GND		Yes
Output to supply		In 5V regulated mode only
Power-on settlement time	**S**	<1
Resolution	**%**	0.025 of measurement range (12 bit)
Non-linearity*	**%**	<±0.4
Temperature coefficient	**ppm/°C**	<±30 in 5V supply mode; <±90 in 9-30V supply mode

*Non-linearity is measured using the least-squares method on a computerised calibration system

Analogue Output option (Order code A) – See graph on page 17

Voltage output range		
9-30V supply	**Vdc**	Absolute voltage, 0.5 to 4.5 over measurement range (±3%)
5V supply	**Vdc**	Ratiometric output voltage - 10 to 90% of Vs over measurement range (±1%)
Monotonic range	**Vdc**	0.25 (5%) and 4.75 (95%) nominal
Load resistance	**Ω**	10k minimum (resistive to GND)
Output noise	**mVrms**	<1
Input/output delay	**mS**	2.5 (see note in OEM options)

PWM Output option (Order code P) – See output characteristics on page 17

PWM frequency	**Hz**	244 ±20% over temperature range
PWM levels 9-30V supply	**Vdc**	0 and 5 nominal (±3%)
5V supply	**Vdc**	0 and Vs (±1%)
Duty cycle	**%**	10 to 90 over measurement range
Monotonic range	**%**	5 and 95 nominal
Load resistance	**Ω**	10k minimum (resistive to GND)
Rise/fall time	**µS**	<20

MECHANICAL

Mechanical angle	**°**	360, continuous
Operating torque - maximum		
sealed shaft IP68	**gm cm**	120
unsealed shaft IP50	**gm cm**	100
Shaft velocity maximum	**°/sec**	3600
Weight	**g**	<35
Mounting		Use 2 x M4 socket head cap screws and M4 washer - maximum tightening torque 2Nm
Phasing		When shaft flat (or shaft ident mark) is facing toward the cable exit, output is at mid travel. The sensor housing allows for ±20° adjustment via the mounting flange slots.

ENVIRONMENTAL

Protection class		IP68 or IP50
Life		20 million operations (10x10⁶ cycles) of ±75º Sensing element life is essentially infinite (contactless); the SRH280P life figure refers to the operating shaft seal. Mechanical load (axial and radial) on the shaft should also be considered.
Dither life		Contactless - no degradation due to shaft dither
Operational temperature†	**°C**	-40 to +140 (5V supply) -40 to +137 (9V supply) Derate upper temperature limit by 0.57°C for every 1V increase in supply: e.g. -40 to +125 @30V
Storage temperature	**°C**	-55 to +140
Vibration		BS EN 60068-2-64:1995 Sec 8.4 (14gn rms) 20 to 2000Hz Random
Shock		3m drop onto concrete
EMC Immunity level		BS EN 61000-4-3:1999, to 100V/m, 80MHz to1GHz and 1.4GHz to 2.7GHz (2004/108/EC)

† See Maximum Operating Temperature – Derating graph on page 17
If the maximum operating temperature is exceeded, the voltage regulator will shut down to protect the device from overheating

OPTIONS

Measurement range (angle)		Select from 20° to 360° in 1° increments (factory programmed)
Output		Analogue voltage (A) or PWM (P)
Output direction		Clockwise or Anticlockwise shaft rotation with increasing output
Shaft style		D section, sprung shaft (S) or 2.4mm blade shaft (H)
Shaft sealing		IP50 or IP68
Cable length	**m**	0.2 or 0.5
Custom housing		Synchro mount style with ball race bearings - ask our technical sales team for details
OEM options		Output can be programmed to provide: non linear law; switch output; clamp voltages; alternative PWM frequencies; faster input/output delay; extended analogue range; and output mapping for potentiometer replacements in motorsport gearbox applications

AVAILABILITY

All standard configurations can be supplied within five days from the factory

ORDERING CODES

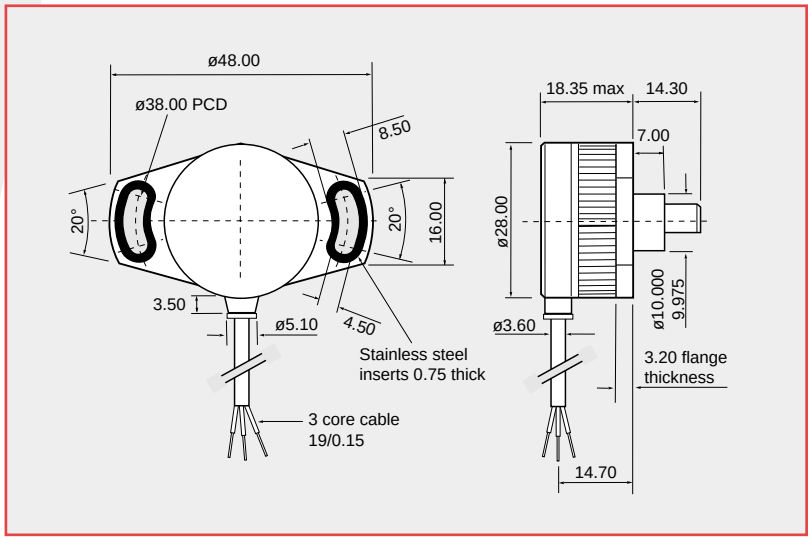
SRH280P/...../...../...../...../...../.....

Measurement range	= angle in °
Output	A = Analogue P = PWM
Direction	1 = Clockwise 2 = Anticlockwise
Shaft style	D = D shaft S = Sprung shaft H = 2.4mm blade shaft
Shaft sealing	50 = IP50 68 = IP68
Cable length	P2 = 0.2m P5 = 0.5m

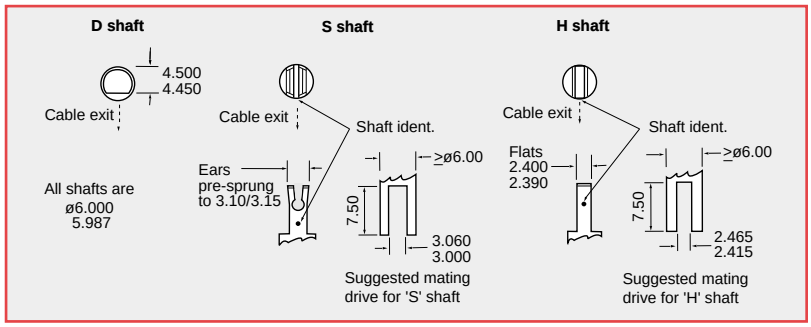
SRH280P

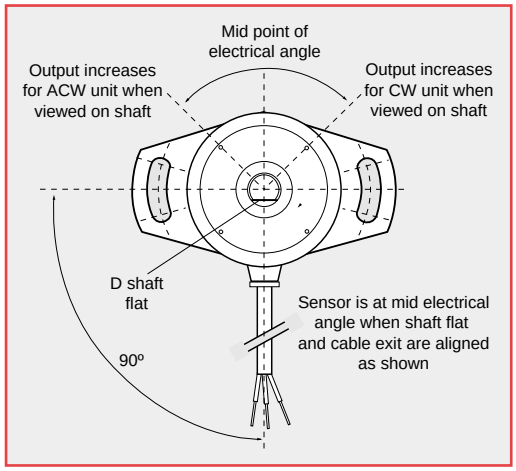
DIMENSIONS

Note: drawings not to scale



SHAFT OPTIONS





ELECTRICAL CONNECTIONS

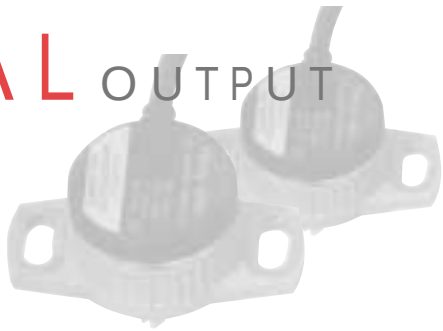
200 or 500mm of 3-core cable: PUR sheathed, with PTFE insulated 19/0.15 cores

Cable colour	Description
Red	+V Supply
Yellow	Output
Black	0V Supply (GND)

Output increases with CW or ACW rotation viewed on shaft - depending on selected order code

When connecting the sensor, care should be taken with the correct connections. The sensor is provided with reverse polarity protection and short circuit protection between output (Yellow) to GND (Black), **but if the output (Yellow) is connected to the supply it will result in device failure.**

SRH280DP DUAL OUTPUT
contactless rotary sensor



PERFORMANCE

ELECTRICAL

Measurement range	**°**	20 to 360 in 1° increments
Supply voltage	**Vdc**	9 to 30 (unregulated) and 5 ±0.5 (regulated)
Over voltage protection	**Vdc**	Up to 40 (-40 to +60°C)
Maximum supply current	**mA**	<25 (12.5 each channel)
Reverse polarity protection		Yes
Short circuit protection		
Output to GND		Yes
Output to supply		In 5V regulated mode only
Power-on settlement time	**S**	<1
Resolution	**%**	0.025 of measurement range (12 bit)
Non-linearity*	**%**	<±0.4
Temperature coefficient	**ppm/°C**	<±30 in 5V supply mode; <±90 in 9-30V supply mode

*Non-linearity is measured using the least-squares method on a computerised calibration system

Analogue Output option (Order code A) – See graph on page 17

Voltage output range		
9-30V supply	**Vdc**	Absolute voltage, 0.5 to 4.5 over measurement range (±3%)
5V supply	**Vdc**	Ratiometric output voltage - 10 to 90% of Vs over measurement range (±1%)
Monotonic range	**Vdc**	0.25 (5%) and 4.75 (95%) nominal
Load resistance	**Ω**	10k minimum (resistive to GND)
Output noise	**mVrms**	<1
Input/output delay	**mS**	2.5 (see note in OEM options)

PWM Output option (Order code P) – See output characteristics on page 17

PWM frequency	**Hz**	244 ±20% over temperature range
PWM levels 9-30V supply	**Vdc**	0 and 5 nominal (±3%)
5V supply	**Vdc**	0 and Vs (±1%)
Duty cycle	**%**	10 to 90 over measurement range
Monotonic range	**%**	5 and 95 nominal
Load resistance	**Ω**	10k minimum (resistive to GND)
Rise/Fall time	**µS**	<20

MECHANICAL

Mechanical angle	**°**	360, continuous
Operating torque - maximum		
sealed shaft IP68	**gm cm**	120
unsealed shaft IP50	**gm cm**	100
Shaft velocity maximum	**°/sec**	3600
Weight	**g**	<35
Mounting		Use 2 x M4 socket head cap screws and M4 washer - maximum tightening torque 2Nm
Phasing		When shaft flat (or shaft ident mark) is facing toward the cable exit, output is at mid travel. The sensor housing allows for ±20° adjustment via the mounting flange slots.

SRH280DP

ENVIRONMENTAL

Protection class		IP68 or IP50
Life		20 million operations (10 x 10^6 cycles) of ±75° Sensing element life is essentially infinite (contactless); the SRH280DP life figure refers to the operating shaft seal. Mechanical load (axial and radial) on the shaft should also be considered.
Dither life		Contactless - no degradation due to shaft dither
Operational temperature†	°C	-40 to +140 (5V supply) -40 to +135.7 (9V supply) Derate upper temperature limit by 1.7°C for every 1V increase in supply: e.g. -40 to +100 @30V
Storage temperature	°C	-55 to +140
Vibration		BS EN 60068-2-64:1995 Sec 8.4 (31.4gn rms) 20 to 2000Hz Random
Shock		3m drop onto concrete
EMC Immunity level		BS EN 61000-4-3:1999, to 100V/m, 80MHz to1GHz and 1.4GHz to 2.7GHz (2004/108/EC)

† See Maximum Operating Temperature – Derating graph on page 17.
If the maximum operating temperature is exceeded, the voltage regulator will shut down to protect the device from overheating

OPTIONS

Measurement range (angle)		Select from 20° to 360° in 1° increments (factory programmed)
Output		Analogue voltage (A) or PWM (P)
Output direction		Both clockwise, both anticlockwise or one CW, one ACW
Shaft style		D section, sprung shaft (S) or solid blade (H)
Shaft sealing		IP50 or IP68
Cable length	m	0.2 or 0.5
Custom housing		Synchro mount style with ball race bearings - ask our technical sales team for details
OEM options		Output can be programmed to provide: non linear laws; switch outputs; clamp voltages; alternative PWM frequencies; different output phasing CH1/CH2; faster input/output delay; extended analogue range; and output mapping for potentiometer replacements in motorsport gearbox applications

AVAILABILITY

All standard configurations can be supplied within five days from the factory

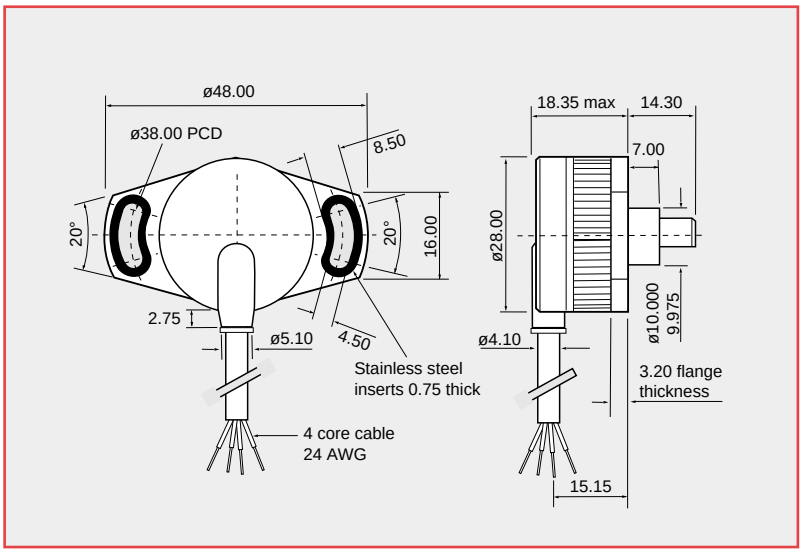
ORDERING CODES

SRH280DP/..../..../..../..../..../..../....

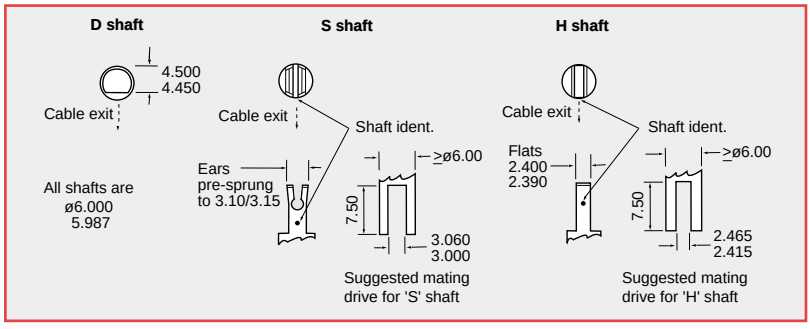
Measurement range	CH1 = angle in °
Measurement range	CH2 = angle in °
Output	A = Analogue P = PWM
Direction	3 = Both clockwise 4 = Both anticlockwise 5 = CH1 CW, CH2 ACW
Shaft style	D = D shaft S = Sprung shaft H = 2.4mm blade shaft
Shaft sealing	50 = IP50 68 = IP68
Cable length	P2 = 0.2m P5 = 0.5m

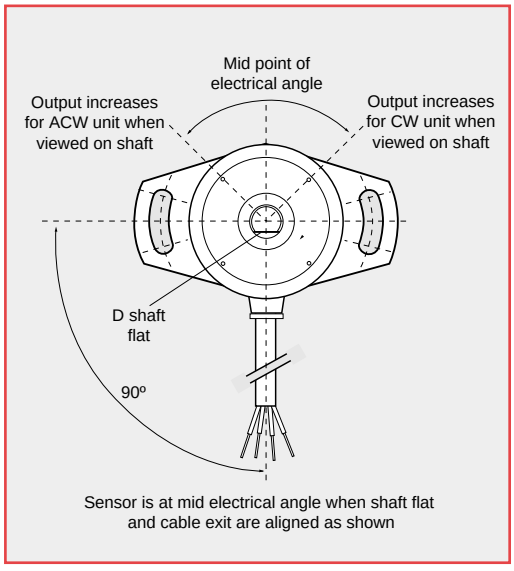
DIMENSIONS

Note: drawings not to scale



SHAFT OPTIONS





ELECTRICAL CONNECTIONS

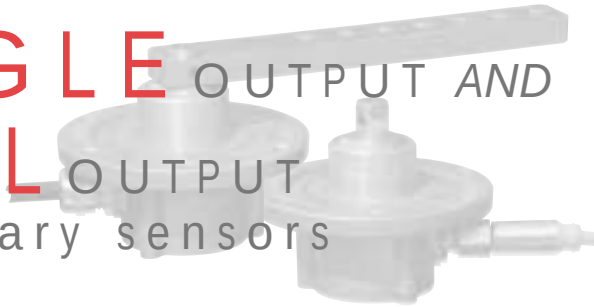
200 or 500mm of 4-core cable: DR-25 sheathed, with 55A spec (24AWG) cores

Cable colour	Description
Red	+V Supply
Yellow	Output 1
White	Output 2
Black	0V Supply (GND)

Output increases with CW or ACW rotation viewed on shaft - depending on selected order code.

When connecting the sensor, care should be taken with the correct connections. The sensor is provided with reverse polarity protection and short circuit protection between outputs (Yellow & White) to GND (Black), **but if the outputs (Yellow & White) are connected to the supply this will result in device failure.**

SRH501P SINGLE OUTPUT *AND*
SRH502P DUAL OUTPUT
submersible contactless rotary sensors



PERFORMANCE

ELECTRICAL

Measurement range	**°**	20 to 360 in 1° increments
Supply voltage	**Vdc**	9 to 30 (unregulated) and 5 ±0.5 (regulated)
Over voltage protection	**Vdc**	Up to 40 (-40 to +60°C)
Maximum supply current	**mA**	<25 (12.5 each channel)
Reverse polarity protection		Yes
Short circuit protection		
Output to GND		Yes
Output to supply		In 5V regulated mode only
Power-on settlement time	**S**	<1
Resolution	**%**	0.025 of measurement range (12 bit)
Non-linearity*	**%**	<±0.4
Temperature coefficient	**ppm/°C**	<±30 in 5V supply mode; <±90 in 9-30V supply mode

*Non-linearity is measured using the least-squares method on a computerised calibration system

Analogue Output option (Order code A1) – See graph on page 17

Voltage output range		
9-30V supply	**Vdc**	Absolute voltage, 0.5 to 4.5 over measurement range (±3%)
5V supply	**Vdc**	Ratiometric output voltage - 10 to 90% of Vs over measurement range (±1%)
Monotonic range	**Vdc**	0.25 (5%) and 4.75 (95%) nominal
Load resistance	**Ω**	10K minimum (resistive to GND)
Output noise	**mVrms**	<1
Input/output delay	**mS**	2.5 (see note in OEM options)

PWM Output option (Order code P1) – See output characteristics on page 17

PWM frequency		**Hz**	244 ±20% over temperature range
PWM levels	**9-30V supply**	**Vdc**	0 and 5 nominal (±3%)
	5V supply	**Vdc**	0 and Vs (±1%)
Duty cycle		**%**	10 to 90 over measurement range
Monotonic range		**%**	5 and 95 nominal
Load resistance		**Ω**	10k minimum (resistive to GND)
Rise/fall time		**µS**	<20

MECHANICAL

Mechanical angle	**°**	360, continuous
Operating torque - max	**gm cm**	1000
Shaft velocity maximum	**°/sec**	3600
Weight	**g**	265 (without cable)
Mounting		Use 3 x M6 threaded holes in front face or 3 x M6 (or 1/4 UNC) clearance holes through the flange - See dimensions for details
Phasing		When the shaft flat is facing towards the cable exit, sensor output is at mid electrical angle (±5°)

ENVIRONMENTAL

Protection class		IP69K with cable codes B01, B05 and B10 IP67 with cable code C01 (IP69K when mating connectors - see page 13 - are attached and fully engaged)
Life		20 million operations (10 x 10^6 cycles) of ±75° Sensing element life is essentially infinite (contactless), and the SRH501P/502P life figures refer to the operating shaft seal. Mechanical load (axial and radial) on the shaft should also be considered.
Dither life		Contactless - no degradation due to shaft dither
Shaft side load		2kg mounted on sensor shaft - tested 3 million cycles
Operational temperature†	°C	-40 to +140 (5V supply) -40 to +135.7 (9V supply) Derate upper temperature limit by 1.7°C for every 1V increase in supply: e.g. -40 to +100 @30V
Storage temperature	°C	-55 to +140
Vibration		BS EN 60068-2-64:1995 Sec 8.4 (14gn rms) 20 to 2000Hz Random
Shock		3m drop onto concrete and 2500g - all axes
EMC Immunity level		BS EN 61000-4-3:1999, to 100V/m, 80MHz to1GHz and 1.4GHz to 2.7GHz (2004/108/EC)
Salt spray		BS EN 60068-2-52: 1996, Test Kb Severity 2 (48hr)
Humidity		BS EN 60068-2-30: 2005, Severity Db (55°C, 93%RH)

† See Maximum Operating Temperature – Derating graph on page 17.
If the maximum operating temperature is exceeded, the voltage regulator will shut down to protect the device from overheating

OPTIONS

Measurement range (angle)	Select from 20º to 360º in 1 increments (factory programmed) for each output channel
Output	Analogue voltage (A1) or PWM (P1)
coming soon in 2009	*-additional analogue outputs A2 (0-10Vdc) and A3 (4-20mA)* *-new CANbus outputs J1 (J 1939), O1 (CANopen), S1 (CANopen safety)*
Output direction	Both clockwise, both anticlockwise or one CW, one ACW
Electrical connections	No cable, 1m, 5m, 10m cable or M12 receptacle
Cabled sockets	1.5, 2, 5 & 10m mating cabled sockets can be ordered separately. See details on page 13.
Operating levers	Operating levers 155 or 230mm long. Should be ordered separately. See details on page 12
OEM options	Output can be programmed to provide: non linear laws; switch outputs; clamp voltages; alternative PWM frequencies; different output phasing CH1/CH2; faster input/output delay; extended analogue range & shaft to output mapping for potentiometer replacements

AVAILABILITY

All standard configurations can be supplied within five days from the factory

ORDERING CODES

For no cable option A. Extra cable can be ordered separately from 1m to 10m length in 1m increments. eg

SRH501P SA206419/MK .....
SRH502P SA206420/MK .....

Length
(1m increments)

SINGLE OUTPUT SRH501P — SRH501P/..../..../..../....

Measurement range = angle in °

Output
A1 = Analogue 0.5-4.5Vdc
P1 = PWM

Direction
1 = Clockwise
2 = Anticlockwise

Cable code
A00 = No cable, gland fitting
B01 = 1m 3-core cable (IP69K)
B05 = 5m 3-core cable (IP69K)
B10 = 10m 3-core cable (IP69K)
C01 = M12 screw locking receptacle

DUAL OUTPUT SRH502P — SRH502P/..../..../..../..../....

Measurement range CH1 = angle in °

Measurement range CH2 = angle in °

Output
A1 = Analogue 0.5-4.5Vdc
P1 = PWM

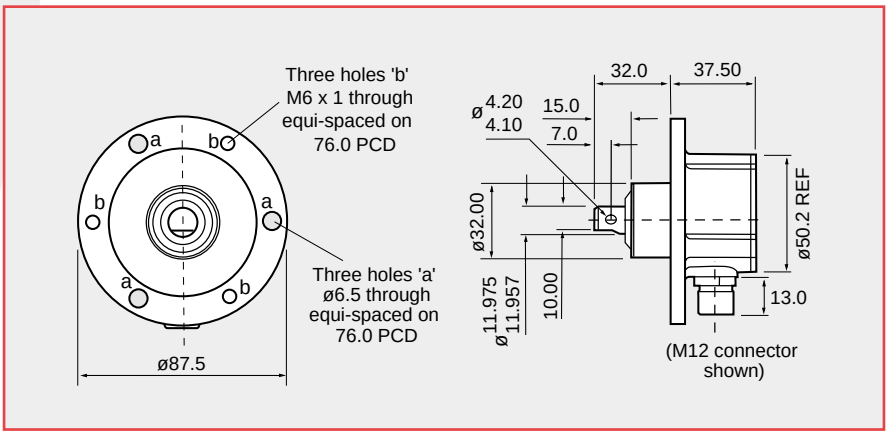
Direction
3 = Both clockwise
4 = Both anticlockwise
5 = CH1 CW, CH2 ACW

Cable code
A00 = No cable, gland fitting
B01 = 1m 4-core cable (IP69K)
B05 = 5m 4-core cable (IP69K)
B10 = 10m 4-core cable (IP69K)
C01 = M12 screw locking receptacle

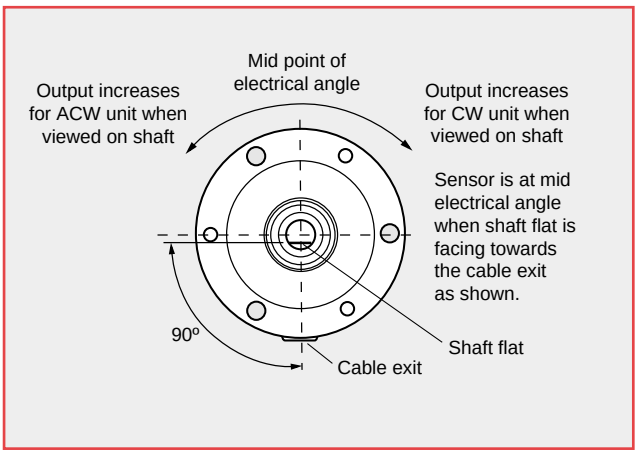
SRH501P AND SRH502P

DIMENSIONS

Note: drawings not to scale

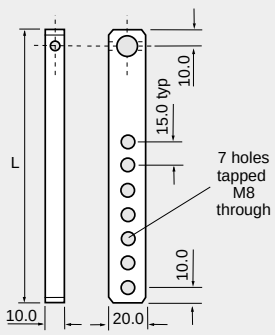


PHASING OF SHAFT TO HOUSING



LEVER OPTIONS (order separately)

Lever SA202195/MK1 L = 155
Lever SA202195/MK2 L = 230



ELECTRICAL CONNECTIONS

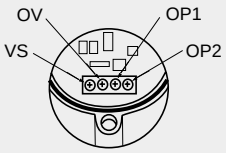
Option A00 – No cable supplied

Option Bxx – Cable supplied (1m, 5m or 10m)

Option C01 – Series M12 screw locking receptacle to IEC 61076-2-101 (Ed.1) /IEC 60947-5-2 fitted to sensor body. Mating cabled sockets to be ordered separately.

CONNECTING CABLE OPTIONS

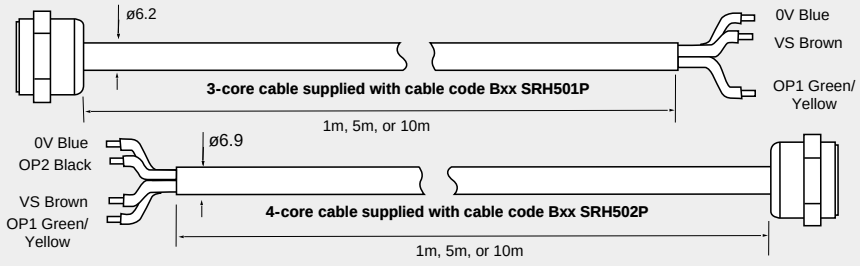
Connection details for no cable option A00



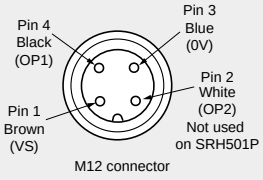
Cable gland for cable between ø4-8mm

Connection capacity - AWG 26-16 or 0.14-1.5mm^2

Connection details for cable option Bxx



Connection details for option C01 - M12 connector



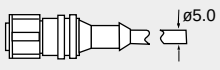
Pin No.	Cable colour	Description
1	Brown	+V Supply
2	White	Output 2 (not used on SRH501P)
3	Blue	0V Supply (GND)
4	Black	Output 1

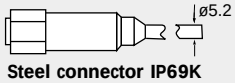
Output increases with CW or ACW rotation viewed on shaft - depending on selected order code

M12 mating connectors for cable option C01 (order separately)

Connector IP68

2 metre	X61-169-102
5 metre	X61-169-105
10 metre	X61-226-002





Steel connector IP69K

1.5 metre	X61-222-001
5 metre	X61-222-003
10 metre	X61-222-005

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

SRH880P SINGLE OUTPUT
submersible contactless rotary sensor

PERFORMANCE

ELECTRICAL

Measurement range	°	20 to 360 in 1° increments
Supply voltage	Vdc	9 to 30 (unregulated) and 5 ±0.5 (regulated)
Over voltage protection	Vdc	Up to 40 (-40 to +60°C)
Maximum supply current	mA	<12.5
Reverse polarity protection		Yes
Short circuit protection		
output to GND		Yes
output to supply		In 5V regulated mode only
Power-on settlement time	S	<1
Resolution	%	0.025 of measurement range (12 bit)
Non-linearity*	%	<±0.4
Temperature coefficient	ppm/°C	<±30 in 5V supply mode; <±90 in 9-30V supply mode

*Non-linearity is measured using the Least-Squares method on a computerised calibration system

Analogue Output option (Order code A) – See graph on page 17

Voltage output range		
9-30V supply	Vdc	Absolute voltage, 0.5 to 4.5 over measurement range (±3%)
5V supply	Vdc	Ratiometric output voltage - 10 to 90% of Vs over measurement range(±1%)
Monotonic range	Vdc	0.25 (5%) and 4.75 (95%) nominal
Load resistance	Ω	10k minimum (resistive to GND)
Output noise	mVrms	<1
Input/output delay	mS	2.5 (see note in OEM options)

PWM Output option (Order code P) – See output characteristics on page 17

PWM frequency		Hz	244 ±20% over temperature range
PWM levels	**9-30V supply**	Vdc	0 and 5 nominal (±3%)
	5V supply	Vdc	0 and Vs (±1%)
Duty cycle		%	10 to 90 over measurement range
Monotonic range		%	5 and 95 nominal
Load resistance		Ω	10k minimum (resistive to GND)
Rise/Fall time		µS	<20

MECHANICAL

Mechanical angle	°	360, continuous
Operating torque - max	gm cm	1000
Shaft velocity max	°/sec	3600
Weight	g	500
Mounting		Use 3 x M6 threaded holes in front face or 3 x M6 clearance holes through the body - see dimensions for details
Phasing		When the shaft flat is facing the scribed mark on the front face (as shown in the diagram), sensor output is at mid travel (±5°)

ENVIRONMENTAL

Protection class		IP68
Life		20 million operations (10 x 10^6 cycles) of ±75° Sensing element life is essentially infinite (contactless), but the SRH880P life figures refer to the shaft seal. Mechanical load (axial and radial) on the shaft should also be considered.
Dither life		Contactless - no degradation due to shaft dither
Operational temperature†	°C	-40 to +120 (5V and 9V supply) -40 to +90 (30V supply)
Storage temperature	°C	-55 to +125
Vibration		10 to 2000Hz Random – 12.6gn rms – all axes
Shock		Survival to 2500g – all axes
EMC Immunity level		BS EN 61000-4-3:1999 to 100V/m, 80MHz to 1GHz and 1.4GHz to 2.7GHz (2004/108/EC)

† If the maximum operating temperature is exceeded, the voltage regulator will shut down to protect the device from overheating

OPTIONS

Measurement range (angle)	Select from 20° to 360° in 1° increments (factory programmed)
Output	Analogue voltage (A) or PWM (P)
Output direction	Clockwise or Anticlockwise shaft rotation with increasing output
Cabled socket	2m or 5m cabled socket assemblies available
Body material	Optional anodised aluminium or corrosion resistant stainless steel housing
Operating levers	Operating levers 155 or 230mm long should be ordered separately. See details on page 12
OEM options	Output can be programmed to provide: non linear law; switch output; clamp voltages; alternative PWM frequencies; faster input/output delay; extended analogue range and output mapping for potentiometer replacements

AVAILABILITY

All standard configurations can be supplied within five days from the factory

ORDERING CODES

SRH880P/ ..... / ..... / ..... / ..... / .....

Measuring range	= angle in °
Output	A = Analogue P = PWM
Direction	1 = Clockwise 2 = Anticlockwise
Cabled socket	00 = None 02 = 2m 05 = 5m
Body material	AL = Aluminium SS = Stainless steel

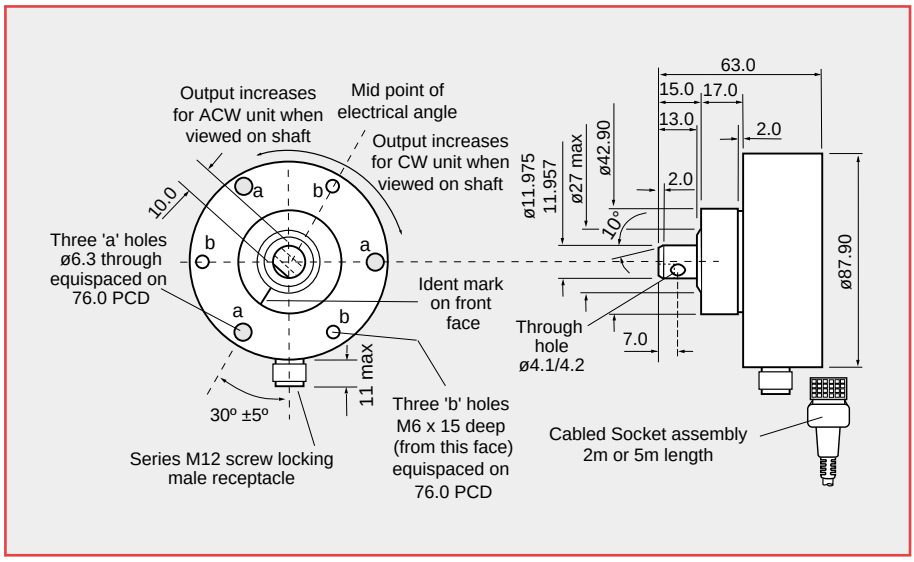
SRH880P dimensions and electrical connections on next page

DIMENSIONS

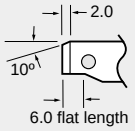
Note: drawings not to scale

LEVER OPTIONS

See SRH501P page 12



SHAFT FLAT DETAIL



ELECTRICAL CONNECTIONS

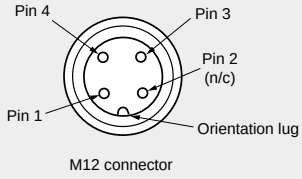
Straight cabled socket

E series M12 to IEC 61076-2-101(Ed.1) /IEC 60947-5-2,

PUR jacket

Conforms to VDE 0472 part 804

Cable temperature range -25 to +90°C



M12 connector

Cabled socket

2 metre long No. X61-169-102

5 metre long No. X61-169-105

Pin No.	Cable colour	Description
1	Brown	0V Supply (GND)
2	Not connected	
3	Blue	+V Supply
4	Black	Output

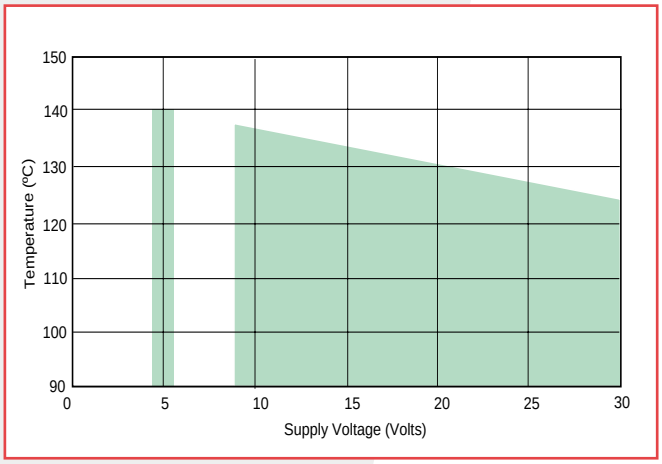
Output increases with CW or ACW rotation viewed on shaft - depending on selected order code

When connecting the sensor, care should be taken with the correct connections.
The sensor is provided with indefinite reverse polarity protection and short circuit protection between output (Pin 4 - Black) to GND (Pin 1 - Brown), **but if the output (Pin 4 - Black) is connected to the supply this will result in device failure.**

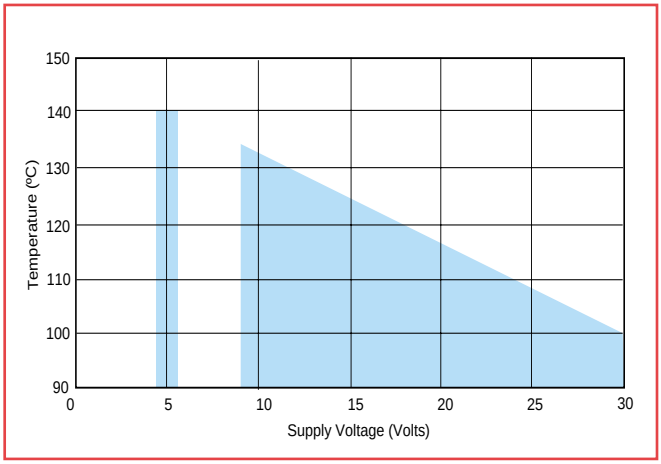
TEMPERATURE AND OUTPUT GRAPHS

MAXIMUM OPERATING TEMPERATURE - DERATING GRAPHS

SRH280P

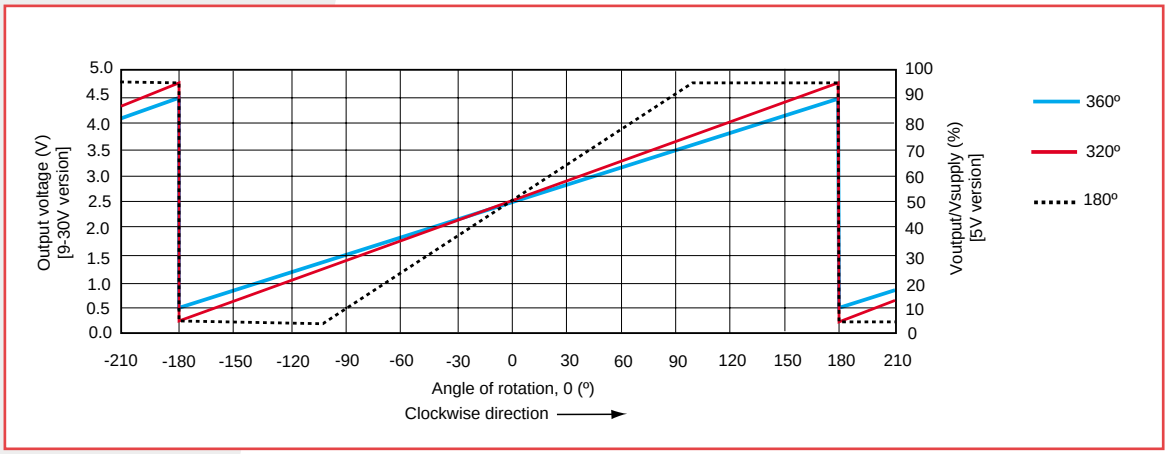


SRH280DP SRH501P/502P



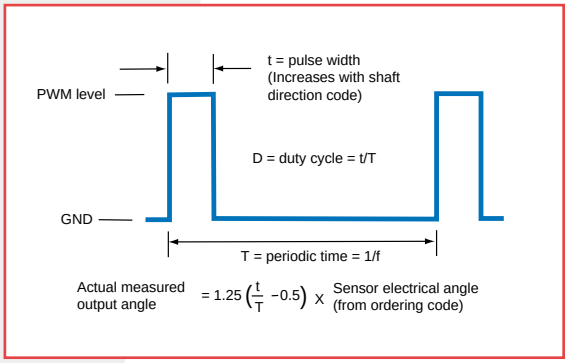
SENSOR OUTPUT GRAPH- examples for three different angles

SRH280P SRH280DP SRH880P - OUTPUT A
SRH501P/502P - OUTPUT A1



PWM OUTPUT CHARACTERISTICS

SRH280P SRH280DP SRH880P - OUTPUT P
SRH501P/502P - OUTPUT P1



PWM level = 5V (±3%) for 9-30V supply
= V_S (±1%) for 5V supply

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