Penny+Giles

A Curtiss-Wright Company

MOTORSPORT
MEASUREMENT & CONTROL SENSORS

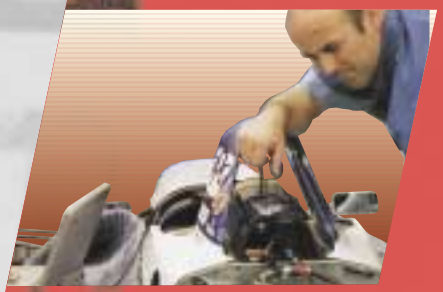
Innovation In Motion

INNOVATION IN MOTION

For more than 50 years, Penny+Giles has provided creative solutions for position measurement and control. Our success in world markets results from innovative technology, creative design, manufacturing excellence and interactive customer support.

Our experience in providing control and feedback solutions across a wide applications spectrum from aerospace, automotive and motorsport, mining and process control to medical science, broadcasting and recording allows our customers to specify Penny + Giles equipment knowing that it is industry proven in thousands of applications throughout the world.

Penny+Giles sensors are manufactured using state-of-the-art production facilities, which include cell assembly systems, ensuring products are delivered rapidly to meet customers needs.



Custom design

Using the Penny+Giles partnership approach integrates our design and product expertise with your design team, enabling a free flow of ideas to provide the most reliable and cost effective product solution.

Standard build

Specify from our wide range of position measurement and control products - many available from stock.

Motorsport

Success in motor racing depends on hundreds of components working together at peak performance under the most extreme conditions. Position sensors are essential for the control and monitoring systems that supply information to race engineers to help trim precious seconds off the lap times.

Penny+Giles have pioneered developments in motorsport position sensors by using experience gained in aerospace applications, where reliability under extremely hostile conditions are paramount.

Penny+Giles sensors have become a benchmark standard in motor racing and have helped every winning team in the Formula 1 championship since 1986.

Aerospace Products

Penny+Giles design and manufacture position sensors for civil and military applications on fixed and rotary wing aircraft and satellite launch vehicles. These products are sold under the Curtiss-Wright Controls, Integrated Sensing brand.

Industrial products

Penny + Giles industrial products are key components throughout the industrialised world providing control and position feedback in a wide range of applications as diverse as construction vehicles and leisure simulators.

Contents

EMC
The products detailed on pages 3 to 12 have been tested to the requirements of EN50081-1 (Emissions) and EN50082-2 (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

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LINEAR POTENTIOMETERS

The Penny+Giles SLS and MLS range of linear potentiometers have been designed with motorsport applications in mind. They utilise established hybrid track technology to provide low electrical noise and high accuracy output over long operating life in the most extreme environments. With a sealing system tested to IP66 and a choice of mountings, these potentiometers have become the benchmark in suspension data acquisition systems for single seat, saloon car, motorcycle and truck racing.

Features	Benefits
• Compact body to stroke length	• Reduced installation space
• Sealing to IP66 and corrosion resistant rod-end bearings	• Can be used in hostile environments
• Integrally moulded rear cable assembly	• Excellent cable strain relief with secure sealing
• Rotatable shaft	• Easy installation
• Reduced weight	• Ideal for motorsport applications
• Rapid despatch	• Eliminates customer inventory
• CE approved	• Confidence in EMC performance

SLS095 LINEAR DISPLACEMENT SENSOR

SLS095 is designed to provide maximum performance benefits within an extremely compact body diameter of 9.5mm, with stroke lengths from 10 to 100mm. The miniature size of this sensor makes it ideal for applications in robotics, animatronics, medical equipment and motorsport data acquisition.

PERFORMANCE

Electrical stroke E	**mm**	***10***	***20***	***30***	***40***	***50***	***75***	***100***	
Resistance ±10%	**kΩ**	0.4†	0.8	1.2	1.6	2.0	3.0	4.0	†±15% for SLS 095/10
Independent linearity	**±%**	0.5	0.35	0.25	0.25	0.25	0.15	0.15	
Power dissipation at 20˚C	**W**	0.2	0.4	0.6	0.8	1.0	1.5	2.0	
Applied voltage maximum	**Vdc**	8.9	17.9	26	40	44	67	74	

Resolution		Virtually infinite
Hysteresis (repeatability)		Less than 0.01mm
Operational temperature	**°C**	–30 to +100
Output smoothness		To MIL-R-39023 grade C 0.1%
Insulation resistance		Greater than 100MΩ at 500Vdc
Operating mode		Voltage divider only - see Circuit Recommendation below
Wiper circuit impedance		Minimum of 100 x track resistance or 0.5MΩ (whichever is greater)
Operating force maximum		
sealed	**gf**	300 in horizontal plane
unsealed	**gf**	100 in horizontal plane
Life at 250mm per second		Typically greater than 100 million operations (50 x 10^6 cycles) at 25mm stroke length
Dither life		200 million operations (100 x 10^6 cycles) at ±0.5mm, 60Hz
Sealing		IP50 standard - IP66 see options
Shaft seal life		20 million operations (10 x 10^6 cycles)
Shaft velocity maximum	**m/s**	2.5
Vibration		RTCA 160D 10Hz to 2kHz (random) @ 4.12g (rms) - all axes
Shock		40g 6mS half sine

CIRCUIT RECOMMENDATION

Hybrid track potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. Hybrid track potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

IP 66 sealing Designed to accept integral shaft seal to give IP66 rating

Mounting Can be supplied with self aligning bearings or a plain body for use with body clamps or flange mounting kit.

ACCESSORIES

Mounting kits
- Body clamp kit - SA200841
- Flange kit - SA200842

AVAILABILITY

All configurations can be supplied within five days from the factory

ORDERING CODES

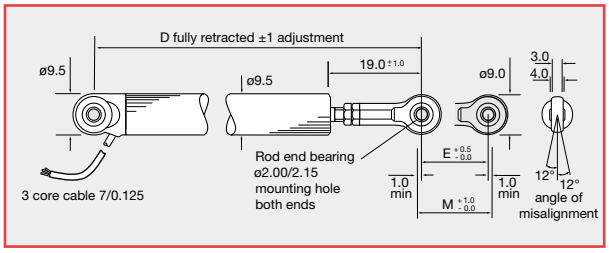
SLS095/...../...../...../.....

- Electrical stroke
- Resistance
- Sealing 50 = IP50, 66 = IP66
- Mounting option R = Self aligning bearing, P = Plain

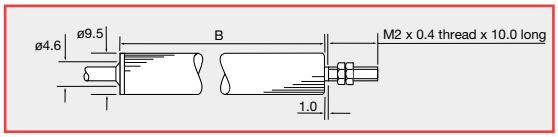
DIMENSIONS AND MOUNTING OPTIONS

Note: drawings not to scale

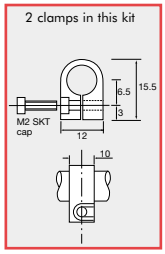
SELF ALIGNING BEARING MOUNTING



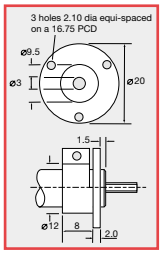
PLAIN BODY MOUNTING



MOUNTING OPTIONS



Body clamp
SA200841

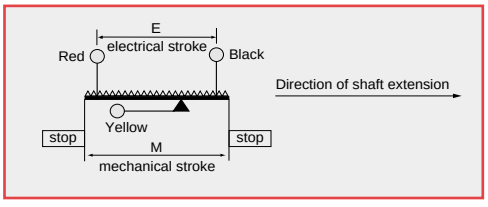


Flange mounting
SA200842

Electrical stroke E	**mm**	**10**	**20**	**30**	**40**	**50**	**75**	**100**
Mechanical stroke M	**mm**	**12.5**	**22.5**	**32.5**	**42.5**	**52.5**	**77.5**	**102.5**
Body length B	**mm**	45.5	55.5	65.5	75.5	85.5	110.5	135.5
Between centres D		70	80	90	100	110	135	160
Weight approximate (mounting option R)	**g**	11	13	14.5	16	17.5	21.5	25.5

ELECTRICAL CONNECTIONS

3 core cable: PUR sheathed 0.3m long with PTFE insulated 7/0.125 cores.



SLS130 LINEAR DISPLACEMENT SENSOR

The SLS130 range is designed to provide performance benefits within a compact, lightweight package in stroke lengths from 25 to 200mm.
With a choice of mounting options and accessories, this sensor is ideally suited to a wide range of industrial applications, and is extensively used within the motorsport industry.

PERFORMANCE

Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***
Resistance ±10%	**kΩ**	1	2	3	4	5	6	7	8
Independent linearity									
guaranteed	**±%**	0.25	0.25	0.15	0.15	0.15	0.15	0.15	0.15
typical	**±%**	0.15	0.15	0.15	0.10	0.10	0.07	0.07	0.07
Power dissipation at 20˚C	**W**	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Applied voltage maximum	**Vdc**	22	44	67	74	74	74	74	74

Electrical output		Minimum of 0.5% to 99.5% applied volts
Resolution		Virtually infinite
Hysteresis (repeatability)		Less than 0.01mm
Operational temperature	**°C**	–30 to +100 (tested to +130 for 12 hours duration)
Output smoothness		To MIL-R-39023 grade C 0.1%
Insulation resistance		Greater than 100MΩ at 500Vdc
Operating mode		Voltage divider only - see Circuit Recommendation below
Wiper circuit impedance		Minimum of 100 x track resistance or 0.5MΩ (whichever is greater)
Operating force maximum		
sealed	**gf**	500 in horizontal plane
unsealed	**gf**	250 in horizontal plane
Life at 250mm per second		Typically greater than 100 million operations (50 x 10^6 cycles) at 25mm stroke length
Dither life		200 million operations (100 x 10^6 cycles) at ±0.5mm, 60Hz
Sealing		IP50 standard - IP66 see options
Shaft seal life		20 million operations (10 x 10^6 cycles) - replaceable
Shaft velocity maximum	**m/s**	10
Vibration		RTCA 160D 10Hz to 2kHz (random) @12.6g (rms) - all axes
Shock		Less than 0.04% output change @2500g - all axes

CIRCUIT RECOMMENDATION

Hybrid track potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. Hybrid track potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

Compact shaft	Compact shaft will reduce dimension D by 25mm
Integral shaft seal - IP 66	Designed to accept integral shaft seal to give IP66 rating
Extended cable length	10m output cable can be specified
Mounting	Body clamp, flange or quick release balljoint mounting kits can be supplied
Protective sleeve	For all stroke lengths - self aligning bearings only. See ordering code

ACCESSORIES

Mounting kits
- Body clamp kit - SA200264, Flange kit - SA200266
- Quick release balljoint (Heim) - SA200337

Protective sleeve - SA202984/**.....**/**.....**
- **.....** Shaft L=Long, C=Compact
- **.....** Electrical stroke (select to match SLS130 sensor)

AVAILABILITY

All options can be supplied within five days from the factory.

ORDERING CODES

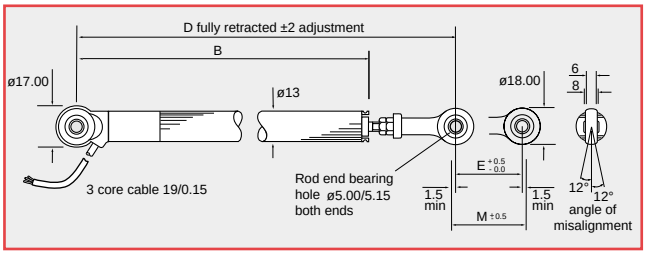
SLS130/...../...../...../...../.....

- Electrical stroke
- Shaft L = long, C = compact
- Protective sleeve N=None, P=Fitted
- Cable 1 = 1m, 10 = 10m
- Sealing 50 = IP50, 66 = IP66

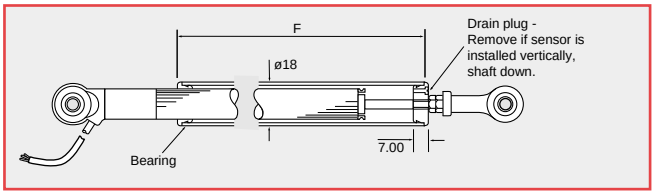
DIMENSIONS AND MOUNTING OPTIONS

Note: drawings not to scale

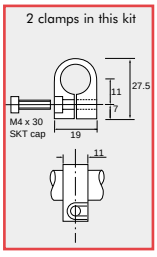
SELF ALIGNING BEARING MOUNTING



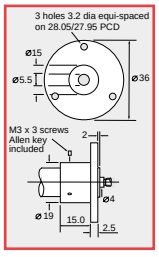
PROTECTIVE SLEEVE OPTION - P



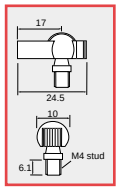
MOUNTING OPTIONS



Body clamp
SA200264



Flange mounting
SA200266

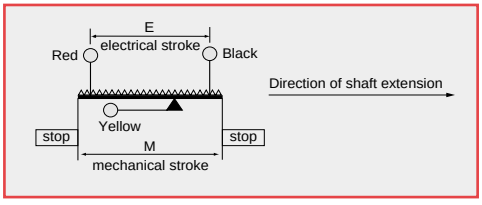


Quick release ball joint
SA200337

Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***
Mechanical stroke M	**mm**	***29***	***54***	***79***	***104***	***129***	***154***	***179***	***204***
Body length B	**mm**	110.5	135.5	160.5	185.5	210.5	235.5	260.5	285.5
Between centres D									
standard sensor (L)	**mm**	173.6	198.6	223.6	248.6	273.6	298.6	323.6	348.6
compact shaft sensor (C)	**mm**	148.6	173.6	198.6	223.6	248.6	273.6	298.6	323.6
Sleeve length F									
standard sensor (L)	**mm**	102	127	152	177	202	227	252	277
compact shaft sensor (C)	**mm**	77	102	127	152	177	202	227	252
Weight approximate									
standard sensor (L)	**g**	64	71	78	85	92	99	106	113
compact shaft sensor (C)	**g**	60	67	74	81	88	95	102	109

ELECTRICAL CONNECTIONS

3 core cable: PUR sheathed 1m long with ETFE insulated 19/0.15 cores.



MLS130 LINEAR DISPLACEMENT SENSOR

The MLS130 sealed linear sensor is designed to provide superior performance within a compact, lightweight package in stroke lengths from 25 to 200mm. With a choice of mounting options, including metal rod end bearings, and an optional protective sleeve for extreme environmental conditions, this sensor is ideally suited to motorsport data acquisition applications on suspension and throttle position feedback, where high performance and reliability with competitive pricing and rapid despatch are vital. The sensor is supplied fully sealed to IP66, with an integrally moulded DR25 sheathed multicore cable.

PERFORMANCE

Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***
Resistance ±10%	**kΩ**	1	2	3	4	5	6	7	8
Independent linearity									
guaranteed	**±%**	0.25	0.25	0.15	0.15	0.15	0.15	0.15	0.15
typical	**±%**	0.15	0.15	0.15	0.10	0.10	0.07	0.07	0.07
Power dissipation at 20˚C	**W**	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Applied voltage maximum	**Vdc**	22	44	67	74	74	74	74	74
Electrical output		Minimum of 0.5% to 99.5% applied volts							
Resolution		Virtually infinite							
Hysteresis (repeatability)		Less than 0.01mm							
Operational temperature	**°C**	–30 to +100 (tested to +130 for 12 hours duration)							
Output smoothness		To MIL-R-39023 grade C 0.1%							
Insulation resistance		Greater than 100MΩ at 500Vdc							
Operating mode		Voltage divider only - see Circuit Recommendation below							
Wiper circuit impedance		Minimum of 100 x track resistance or 0.5MΩ (whichever is greater)							
Operating force maximum	**gf**	500 in horizontal plane							
Sealing		IP66							
Shaft seal life (replaceable)		20 million operations (10 x 10^6 cycles)							
Sensor track life at 0.25m/s		Greater than 100 million operations (50 x 10^6 cycles) at 25mm stroke length							
Sensor track dither life		200 million operations (100 x 10^6 cycles) at ±0.5mm, 60Hz							
Shaft velocity maximum	**m/s**	10							
Vibration		RTCA 160D 10Hz to 2kHz (random) @ 12.6g (rms) - all axes							
Shock		Less than 0.04% output change @ 2500g - all axes							

CIRCUIT RECOMMENDATION

Hybrid track potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. Hybrid track potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

Mounting	Metal rod end bearings, quick release balljoints or plain M4 stud
Protective sleeve	Available for all stroke lengths

ACCESSORIES

For maximum installation flexibility the following parts are available to purchase separately:

Metal rod end (rear)	P202605
Metal rod end (shaft)	P202604
Quick release balljoint assembly	SA200337
Locknut, M4	X63 - 072 - 340
Protective sleeve assembly	SA202984/stroke/C

A suitable stud lock compound should be used to secure the rear rod end or balljoint assembly.
Use Loctite™ activator 7471 and Loctite™ 648 on metal rod end.
Use Loctite™ 382 on quick release balljoint.

AVAILABILITY

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

ORDERING CODES

MLS130/...../...../.....

Electrical stroke

Mounting

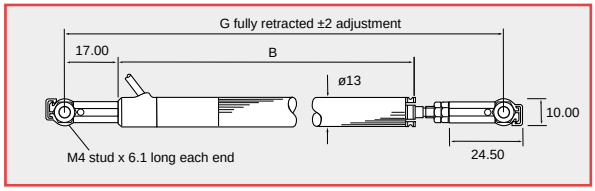
Q=Quick release balljoints, R=Metal rod end bearings, S=M4 studs

Protective sleeve N=None, P=Fitted

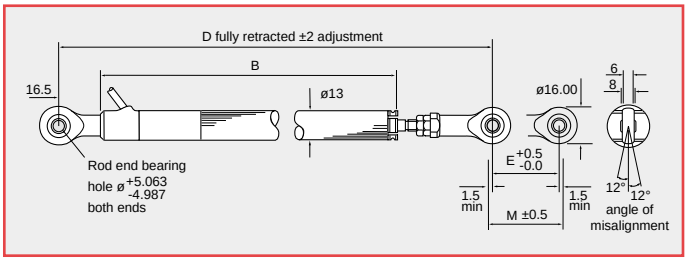
DIMENSIONS AND MOUNTING OPTIONS

Note: drawings not to scale

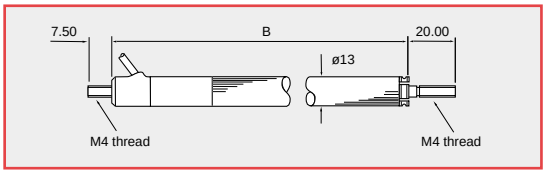
QUICK RELEASE BALLJOINTS (Q)



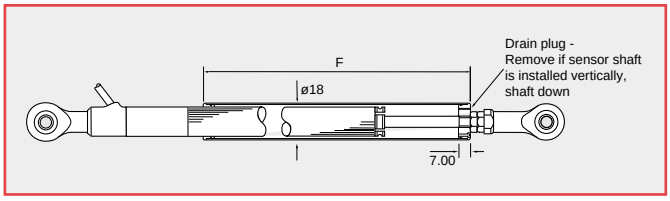
METAL ROD END BEARINGS (R)



M4 STUD END (S)



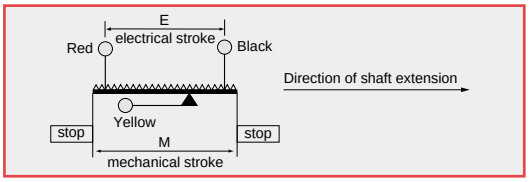
PROTECTIVE SLEEVE (P)



Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***
Mechanical stroke M	**mm**	***29***	***54***	***79***	***104***	***129***	***154***	***179***	***204***
Body length B	**mm**	110.8	135.8	160.8	185.8	210.8	235.8	260.8	285.8
Between centres D	**mm**	164.5	189.5	214.5	239.5	264.5	289.5	314.5	339.5
Between centres G	**mm**	153.6	178.6	203.6	228.6	253.6	278.6	303.6	328.6
Sleeve length F	**mm**	77	102	127	152	177	202	227	252
Weight approximate	**g**	80	87	94	101	108	115	122	129

ELECTRICAL CONNECTIONS

3 core cable: DR25 sheathed 1m long with ETFT insulated 19/0.15 cores.



SLS190 LINEAR DISPLACEMENT SENSOR

The SLS190 range is designed to provide maximum performance benefits within a compact package in stroke lengths from 25 to 350mm.
With a choice of mounting options and accessories, this sensor is ideally suited to motorsport data aquisition applications.

PERFORMANCE

Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***	***225***	***250***	***275***	***300***	***325***	***350***
Resistance ±10%	**kΩ**	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Independent linearity															
guaranteed	**±%**	0.25	0.25	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
typical	**±%**	0.15	0.15	0.15	0.10	0.10	0.07	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05
Power dissipation at 20˚C	**W**	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
Applied voltage maximum	**Vdc**	22	44	67	74	74	74	74	74	74	74	74	74	74	74

Electrical output		Minimum of 0.5% to 99.5% applied volts
Resolution		Virtually infinite
Hysteresis (repeatability)		Less than 0.01mm
Operational temperature	**°C**	–30 to +100 (tested to +130 for 12 hours duration)
Output smoothness		To MIL-R-39023 grade C 0.1%
Insulation resistance		Greater than 100MΩ at 500Vdc
Operating mode		Voltage divider only - see Circuit Recommendation below
Wiper circuit impedance		Minimum of 100 x track resistance or 0.5MΩ (whichever is greater)
Operating force maximum		
sealed	**gf**	500 in horizontal plane
unsealed	**gf**	250 in horizontal plane
Life at 250mm per second		Typically greater than 100 million operations (50 x 10^6 cycles) at 25mm stroke length
Dither life		200 million operations (100 x 10^6 cycles) at ±0.5mm, 60Hz
Sealing		IP50 standard - IP66 see options
Shaft seal life		20 million operations (10 x 10^6 cycles) - replaceable
Shaft velocity maximum	**m/s**	10
Vibration		RTCA 160D 10Hz to 2kHz (random) @ 12.6g (rms) - all axes
Shock		Less than 0.04% output change @ 2500g - all axes

CIRCUIT RECOMMENDATION

Hybrid track potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. Hybrid track potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

Compact shaft	Compact shaft will reduce dimension D by 25mm
Integral shaft seal - IP 66	Designed to accept integral shaft seal to give IP66 rating
Extended cable length	10m output cable can be specified
Mounting	Body clamp or flange mounting kits can be supplied
Protective sleeve	For all stroke lengths - self aligning bearings only. See ordering code

ACCESSORIES

Mounting kits
- Body clamp kit - SA59019
- Flange kit - SA59020

Protective sleeve - SA202986/...../.....
- Shaft L = long, C = compact
- Electrical stroke (select to match SLS190 sensor)

AVAILABILITY

All options can be supplied within five days from the factory.

ORDERING CODES

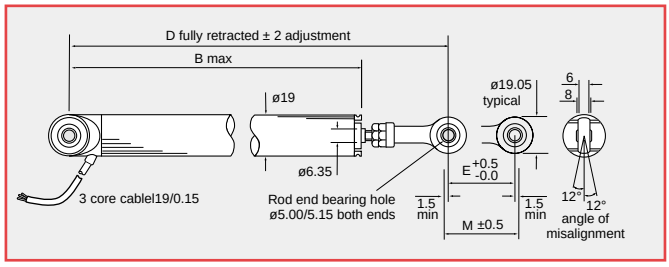
SLS190/...../...../...../...../.....

Electrical stroke
Shaft L = long, C = compact
Protective sleeve N=None, P=Fitted
Cable 1 = 1m, 10 = 10m
Sealing 50 = IP50, 66 = IP66

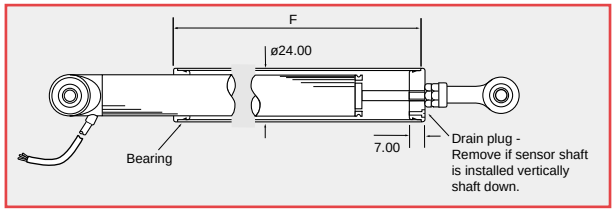
DIMENSIONS AND MOUNTING OPTIONS

Note: drawings not to scale

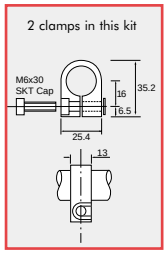
SELF ALIGNING BEARING MOUNTING



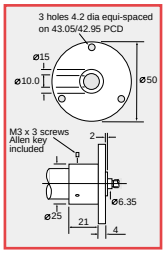
PROTECTIVE SLEEVE OPTION - P



MOUNTING OPTIONS



Body clamp
SA59019

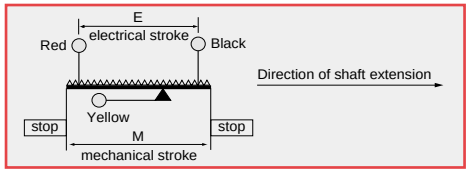


Flange mounting
SA59020

Electrical stroke E	**mm**	***25***	***50***	***75***	***100***	***125***	***150***	***175***	***200***	***225***	***250***	***275***	***300***	***325***	***350***
Mechanical stroke M	**mm**	***29***	***54***	***79***	***104***	***129***	***154***	***179***	***204***	***229***	***254***	***279***	***304***	***329***	***354***
Body length B	**mm**	110.5	135.5	160.5	210.5	235.5	260.5	285.5	310.5	333.5	360.5	385.5	435.5	460.5	485.5
Between centres D															
standard sensor (L)	**mm**	173.6	198.6	223.6	273.6	298.6	323.6	348.6	373.6	398.6	423.6	448.6	498.6	523.6	548.6
compact shaft sensor (C)	**mm**	148.6	173.6	198.6	248.6	273.6	298.6	323.6	348.6	373.6	398.6	423.6	473.6	498.6	523.6
Sleeve length F															
standard sensor (L)	**mm**	100	125	150	200	225	250	275	300	325	350	375	425	450	475
compact shaft sensor (C)	**mm**	75	100	125	175	200	225	250	275	300	325	350	400	425	450
Weight approximate															
standard sensor (L)	**g**	109	126	144	161	179	196	214	231	249	266	284	301	319	336
compact shaft sensor (C)	**g**	103	120	138	155	173	190	208	225	246	260	278	295	316	330

ELECTRICAL CONNECTIONS

3 core cable: PUR sheathed 1m long with ETFE insulated 19/0.15 cores.



Penny+Giles
A Curtiss-Wright Company

Penny+Giles - one of the world's major suppliers of measurement and control sensors

throttle pedal position

gear select position indication

hydraulic reservoir level

front and rear suspension movement

throttle actuator position

steering angle position

gearbox actuator position

clutch pedal position

clutch actuator position

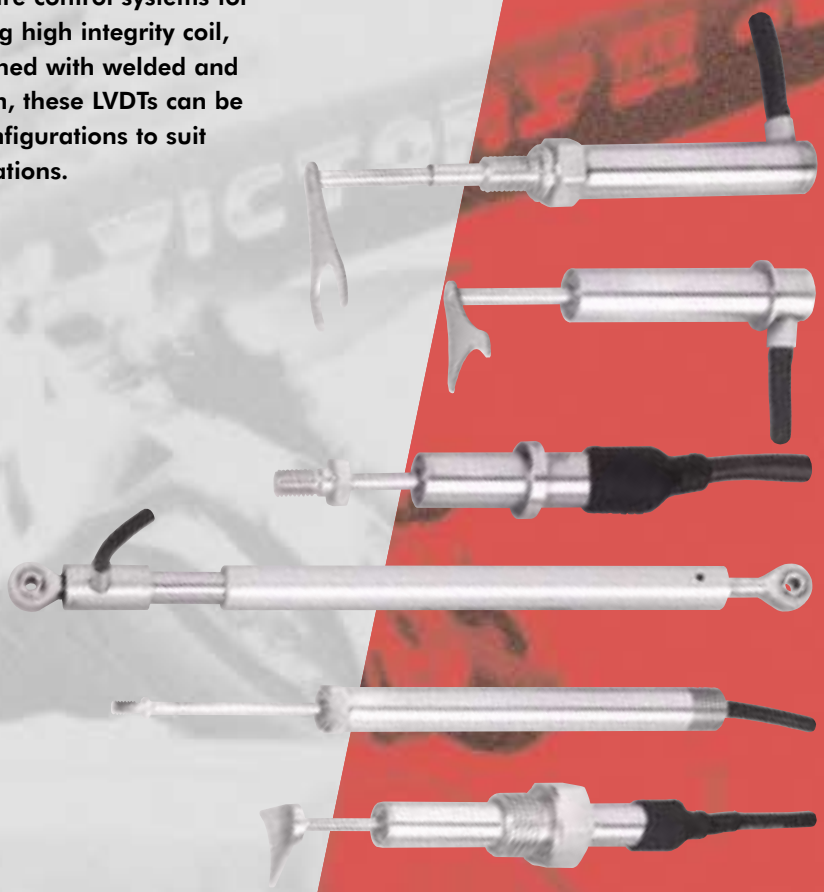
brake balance measurement

brake pad/disc wear indication

Penny+Giles
A Curtiss-Wright Company

LVDT DISPLACEMENT TRANSDUCERS

The Penny+Giles high performance ratiometric LVDTs benefit from our extensive experience in fly-by-wire control systems for flight critical aerospace applications. Using high integrity coil, screen and connection assemblies, combined with welded and vacuum brazed stainless steel construction, these LVDTs can be supplied in a range of shaft and body configurations to suit clutch, gearbox, engine and brake applications.



Features

- No contact between the sensing elements
- Infinite resolution
- Small transducer body length to stroke ratio
- Welded and vacuum brazed stainless steel construction
- Sealed to IP66
- Temperature range -55 to +200°C
- High integrity coil, screen and connection assemblies
- Screened and sheathed interface cable
- Temperature error less than 35ppm/°C

Benefits

- Virtually infinite life and fast dynamic response
- All displacement will be sensed
- Minimal operational footprint and weight
- Maximum reliability in hostile environments
- High performance in electrically noisy environments
- Maximises system accuracy

AF111 LVDT

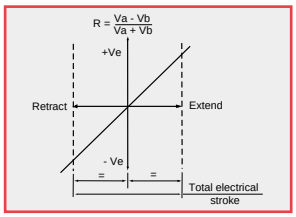
The AF111 range of high accuracy LVDT displacement transducers have been designed primarily for use in the ratiometric configuration and have a compact size, with stroke lengths from 5mm to 150mm. Suitable for clamp mounting, the AF111 range has a threaded, unguided core assembly to simplify installation. Suited to numerous applications, such as vehicle research, and test rigs.

PERFORMANCE

Electrical stroke E	**mm**	***5***	***15***	***25***	***50***	***75***	***100***	***125***	***150***
	±	***2.5***	***7.5***	***12.5***	***25.0***	***37.5***	***50.0***	***62.5***	***75.0***
Input voltage and frequency		1 to 10VRMS at 400Hz to 12.5kHz (sinewave)							
Insulation resistance		Greater than 100MΩ at 500Vdc							
Operational temperature	**°C**	-35 to +125							
Storage temperature	**°C**	-55 to +135							
Vibration		RTCA/DO - 160C, Section 8, Fig 8 - 1 Curve C (Random), 10 - 2000Hz, 4.12g rms							
		RTCA/DO - 160C, Section 8, Fig 8 - 3 Curve L (Sine), 10 - 2000Hz, 3g rms							
Environmental protection		IP66							
Electrical output R proportional to position		$R = \frac{Va - Vb}{Va + Vb}$							
Electrical output R at extremes from null	**±1% total stroke**	0.3	0.3	0.4	0.4	0.6	0.6	0.6	0.6
Non-linearity	**±% total stroke**	0.25	0.25	0.25	0.25	0.25	0.125	0.125	0.125
Secondary coil output voltage		3.3VRMS maximum							
Input impedance		Greater than 300Ω							
Load resistance (per coil)		Greater than 50kΩ (non reactive)							
Temperature error maximum % total stroke/°C		0.0012	0.0012	0.0012	0.0018	0.0018	0.0035	0.0030	0.0030

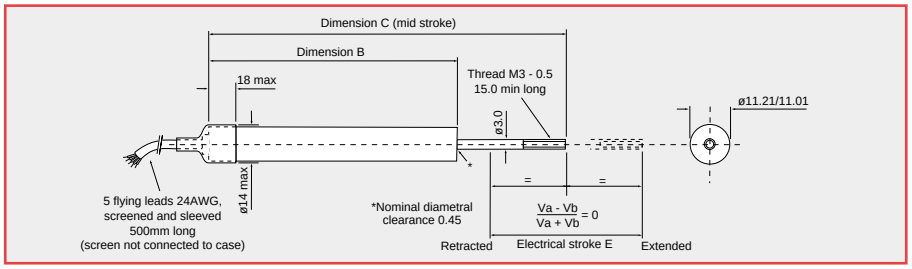
OUTPUT SCHEMATIC

Ratiometric configuration



DIMENSIONS

Note: drawings not to scale



Electrical stroke E	**mm**	***5***	***15***	***25***	***50***	***75***	***100***	***125***	***150***
Mechanical stroke M (non captive shaft)	**mm**	***9***	***19***	***29***	***54***	***79***	***104***	***129***	***154***
Dimension B	**mm**	55	65	80	105	150	175	215	240
Dimension C	**mm**	75	90	110	147.5	205	242.5	295	332.5
Weight (maximum)	**g**	45	50	55	67	90	100	120	140

AVAILABILITY

Normally available from stock

ORDERING CODE

AF111/.....

Electrical stroke (total) mm

ELECTRICAL CONNECTIONS

See AF145 page 15

AF145 LVDT

The AF145 range of high accuracy LVDT displacement transducers have been designed primarily for use in the ratiometric configuration, and have a compact size, with stroke lengths from 5mm to 150mm. The AF145 has self-aligning rod end bearing mounting, with an outer sliding sleeve which protects the movable core whilst enhancing the rigidity of the transducer during operation. Suited to harsh automotive and industrial environments.

PERFORMANCE

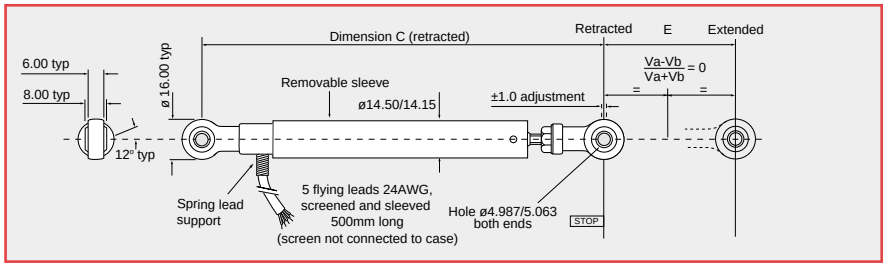
Electrical stroke E	**mm**	***5***	***15***	***25***	***50***	***75***	***100***	***125***	***150***
	±	***2.5***	***7.5***	***12.5***	***25.0***	***37.5***	***50.0***	***62.5***	***75.0***
Input voltage and frequency		1 to 10VRMS at 400Hz to 12.5kz (sinewave)							
Insulation resistance		Greater than 100MΩ at 500Vdc							
Operational temperature	**°C**	-35 to +125							
Storage temperature	**°C**	-55 to +135							
Vibration		RTCA/DO - 160C, Section 8, Fig 8 - 1 Curve C (Random), 10 - 2000Hz, 4.12g rms							
		RTCA/DO - 160C, Section 8, Fig 8 - 3 Curve L (Sine), 10 - 2000Hz, 3g rms							
Environmental protection		IP66							
Electrical output R proportional to position		$R = \frac{Va - Vb}{Va + Vb}$							
Electrical output R at extremes from null	**±1% total stroke**	0.3	0.3	0.4	0.4	0.6	0.6	0.6	0.6
Non-linearity	**±% total stroke**	0.25	0.25	0.25	0.25	0.25	0.125	0.125	0.125
Secondary coil output voltage		3.3VRMS maximum							
Input impedance		Greater than 300Ω							
Load resistance (per coil)		Greater than 50kΩ (non reactive)							
Temperature error maximum % total stroke/°C		0.0012	0.0012	0.0012	0.0020	0.0020	0.0030	0.0030	0.0030

OUTPUT SCHEMATIC

See AF111 page 14

DIMENSIONS

Note: drawings not to scale



Electrical stroke E	**mm**	***5***	***15***	***25***	***50***	***75***	***100***	***125***	***150***
Mechanical stroke M (non captive shaft)	**mm**	***9***	***19***	***29***	***54***	***79***	***104***	***129***	***154***
Dimension C retracted	**mm**	100	110	125	150	195	220	260	285
Weight (maximum)	**g**	65	80	90	115	155	175	200	220

AVAILABILITY

Normally available from stock

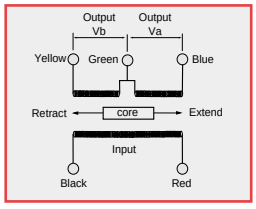
ORDERING CODE

AF145/.....

Electrical stroke (total) mm

ELECTRICAL CONNECTIONS

5 flying leads 24AWG, screened and sleeved 500mm long



Phasing notes

With blue and black leads common, the output on the yellow lead will be in-phase with the red lead (input) as the shaft retracts from the null position.

Ø8mm LVDT SPECIAL

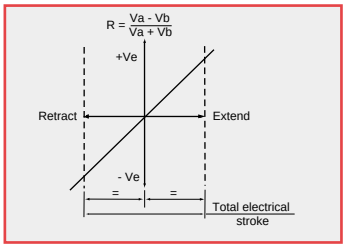
This specially developed ac LVDT is an example of our capability in producing an extremely compact size (8mm diameter) with a minimal footprint (20mm stroke within a 44mm body length). This LVDT is also suitable for continuous operation at temperatures up to +200°C and is ideally suited for use in clutch position and brake caliper position measurement in the premier classes of motor sport. For optimum performance this LVDT is designed to operate in the ratiometric configuration.

PERFORMANCE

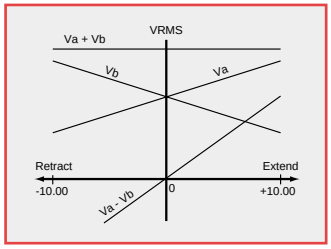
Electrical stroke E	**mm**	**20**
	±	**10**
Input voltage and frequency		3VRMS at 5kHz (sinewave)
Insulation resistance		Greater than 20MΩ at 500Vdc
Operational temperature	**°C**	-55 to +200
Environmental protection		IP66
Electrical output R proportional to position		$R = \frac{Va - Vb}{Va + Vb}$
Electrical output R at extremes from null	**±1% total stroke**	0.441
Non-linearity	**±% total stroke**	1
Ratiometric sensitivity per mm	**±3%**	0.0441
Summed output voltage (Va+Vb)	**±20%**	0.7V/V
Total stroke ratio		0.882
Input impedance		Greater than 150Ω
Load resistance (per coil)		Greater than 50kΩ (non reactive)
Temperature error maximum % total stroke/°C		0.0030

OUTPUT SCHEMATIC

Ratiometric configuration



ac output schematic



AVAILABILITY

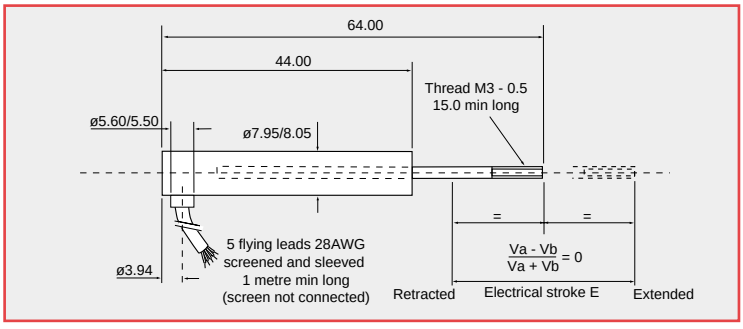
Please consult our sales office for details

ORDERING CODE

Please consult our sales office for details

DIMENSIONS

Note: drawings not to scale



Electrical stroke E	**mm**	**20**
Mechanical stroke M	**mm**	**22**
(non captive shaft)		
Weight (maximum)	**g**	47 (15g for sensor and core only)

Ø11mm LVDT SPECIAL

This high accuracy LVDT displacement transducer has been designed for use in the ratiometric configuration and has a compact size, with stroke lengths from 25mm to 75mm. This design has self-aligning rod end bearing mounting and features an outer sliding sleeve which protects the movable core whilst enhancing the rigidity of the transducer during operation. Suited to suspension and throttle position feedback applications in premier classes of motorsport.

PERFORMANCE

Electrical stroke E	**mm**	***25***	***50***	***75***
	±	**12.5**	**25.0**	**37.5**
Input voltage and frequency		3VRMS at 2.5kHz (sinewave)		
Insulation resistance		Greater than 20MΩ at 500Vdc		
Operational temperature	**°C**	-30 to +130		
Storage temperature	**°C**	-55 to +135		
Environmental protection		IP66		
Electrical output R proportional to position		$R = \frac{Va - Vb}{Va + Vb}$		
Electrical output R at extremes from null	**±1% total stroke**	0.5	0.5	0.5
Non-linearity	**±% total stroke**	0.5	0.5	0.5
Ratiometric sensitivity per mm		0.04	0.02	0.0133
Summed output voltage (Va+Vb)	**±20%**	0.641	0.872	0.761
Input impedance		Greater than 200Ω		
Load resistance (per coil)		Greater than 50kΩ (non reactive)		
Temperature error maximum % total stroke/°C		0.0030		

OUTPUT SCHEMATIC

See Ø8mm Special LVDT output schematic, page 16

AVAILABILITY

Please consult our sales office for details

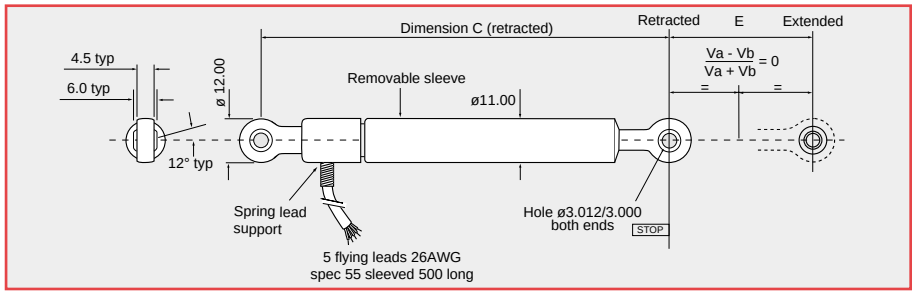
ORDERING CODE

D45371/.....

Electrical stroke (total) mm

DIMENSIONS

Note: drawings not to scale



Electrical stroke E	**mm**	***25***	***50***	***75***
Mechanical stroke M (non captive shaft)	**mm**	***27***	***52***	***77***
Dimension C retracted	**mm**	115	135	180
Weight (maximum)	**g**	42	52	68

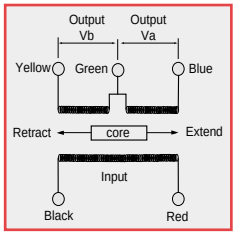
ELECTRICAL CONNECTIONS

SPECIAL Ø8mm

5 flying leads 28AWG, screened and sleeved 1000mm long

SPECIAL Ø11mm

5 flying leads 26AWG, screened and sleeved 500mm long



Ratiometric connection configuration

Phasing notes

With blue and black leads common, the output on the yellow lead will be in-phase with the red lead (input) as the shaft retracts from the null position.

Penny+Giles
A Curtiss-Wright Company

ROTARY POTENTIOMETERS

Penny+Giles high durability potentiometer track technology provides virtually infinite resolution, low electrical noise and high stability under extremes of temperature, humidity, vibration and shock over a long operating life.
These potentiometers are ideally suited and race proven in providing data acquisition systems with clean, robust signals for throttle angle, steering angle and gear select position indication.

Features

- Corrosion resistant stainless steel shaft
- Duplex shaft bearing support
- Choice of shaft attachments
- Hybrid and conductive plastic tracks
- Electrical angles from 10° to 350°
- Rugged mechanical design
- Sealing to IP68 (SRS280)
- Rapid despatch of any option (SRS280)
- CE Approved (SRS280)

Benefits

- Accurate drive location in hostile environments
- Optimum performance under vibration
- Interchangeable with existing installations
- Stable output signal over a long life
- Maximum sensitivity in all applications
- Operation in high shock and vibration environments
- Operation in hostile environments
- Eliminates customer inventory
- Confidence in EMC performance

SRS280

The SRS280 sealed rotary sensor has been specially developed to meet the harsh operating requirements of automotive and motorsport position sensing applications. Innovative design features provide maximum performance under extremes of temperature, humidity, vibration and shock. The SRS280 is completely interchangeable with similar devices already in service using the standard 38mm fixing centres format.

PERFORMANCE

Electrical angle ±2	°	10 to 350 in 10° steps
Resistance ±20%	Ω	14.3 per degree
Hysteresis (repeatability)	°	< 0.03
Accuracy		< 1 degree (e.g. ±0.3% over 330°, ±1% over 100°)
Power dissipation at 20˚C	**W**	0.003 W per angular degree
Applied voltage maximum	**Vdc**	0.2 per angular degree
Resolution		Virtually infinite
Output smoothness		To MIL-R-39023 grade C 0.1%
Insulation resistance		Greater than 100MΩ at 500Vdc
Operating mode		Voltage divider only - see Circuit Recommendation below
Wiper circuit impedance		Minimum of 0.5MΩ
Mechanical angle	°	360, continuous
Mounting		Use 2 x M4 socket head cap screws and M4 washer - maximum tightening torque 2Nm
Operating torque maximum		
unsealed shaft IP50	**gm cm**	100
sealed shaft IP66	**gm cm**	120
Shaft velocity maximum	**°/sec**	3000
Weight	**g**	32 (cable option A), 64 (cable option B)
Phasing		When shaft flat or shaft ident mark is in line with cable exit, wiper is at mid travel
Life unsealed shaft IP50		Exceeds 20 million operations (10 x10^6 cycles) of ±75°
sealed shaft IP66		20 million operations (10 x10^6 cycles) of ±75°
Dither life		200 million operations (100 x 10^6 cycles) of ±3°, 60Hz
Operational temperature	**°C**	-40 to +130 (continuous)
Vibration		RTCA-DO160D, 10Hz to 2000Hz (random), 12.61g rms - all axes
Shock		Survival to 2500g - all axes

CIRCUIT RECOMMENDATION

The SRS280 range of potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. These potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

Electrical angle	Can be supplied from 10° to 350° in 10° steps
Shaft style	D or sprung shaft
Shaft sealing	IP50 or IP68
Cable length	0.5m or 2m

AVAILABILITY

All configurations can be supplied within five days from the factory

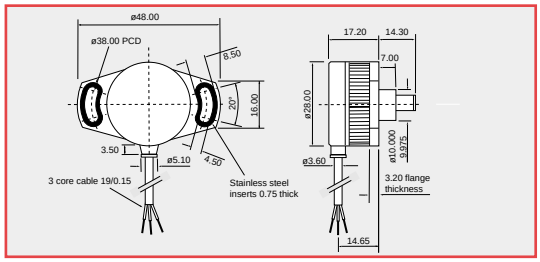
ORDERING CODES

SRS280/...../...../...../.....

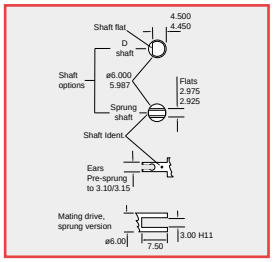
Electrical angle
Shaft style D = D shaft
S = Sprung shaft
Cable A = 0.5m, B = 2m
Shaft sealing 50 = IP50
68 = IP68

DIMENSIONS

Note: drawings not to scale



Shaft options



ELECTRICAL CONNECTIONS

See page 20

RCP11/2S

This specially developed RCP11 has dual electrical output and facilitates low electrical noise and virtually infinite resolution over exceptionally long operating life under extreme operating conditions. This potentiometer is ideally suited and race proven in providing data acquisition systems with clean, robust signals for gear select position indication.

PERFORMANCE

Electrical angle ±1	**°**	350
Resistance ±10%	**kΩ**	1
Independent linearity	**±%**	0.25
Power dissipation at 20°C	**W**	1.5
Dielectric strength	**Vrms**	750
Applied voltage - maximum	**Vdc**	38
Resolution		Virtually infinite
Output smoothness		To MIL-R-39023 grade C 0.1%
Insulation resistance		Greater than 100MΩ at 500Vdc
Phasing between tracks ±1°		at 50% applied voltage
Operating mode		Voltage divider only - see Circuit Recommendation below
Maximum wiper current	**mA**	10
Mechanical angle	**°**	360 continuous
Starting torque - maximum	**gm cm**	16
Shaft run out - TIR	**mm**	0.025
Lateral run out - TIR	**mm**	0.051
Pilot run out - TIR	**mm**	0.025
Shaft end play - maximum	**mm**	0.076
Weight	**g**	25
Life		Greater than 50 million rotations
Operational temperature	**°C**	-65 to +130

CIRCUIT RECOMMENDATION

The RCP11 range of potentiometers feature a high wiper contact resistance, therefore operational checks should be carried out only in the voltage divider mode. These potentiometers should be used only as voltage dividers, with a minimum wiper circuit impedance of 100 x track resistance or 0.5MΩ (whichever is greater). Operation with wiper circuits of lower impedance will degrade the output smoothness and affect the linearity.

OPTIONS

Electrical angle	Non standard angles can be specified
Resistance	Non standard resistance values can be specified
Single gang output	Single gang output only can be specified
Mounting	Custom mounting configurations can be specified

AVAILABILITY

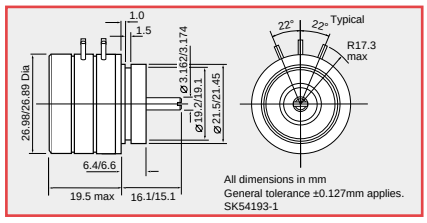
Please consult our sales office for details

ORDERING CODE

RCP11/2S D150397

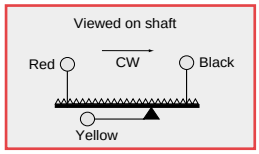
DIMENSIONS

Note: drawings not to scale



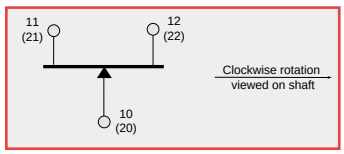
ELECTRICAL CONNECTIONS

SRS280



3 core cable: PUR sheathed, with PTFE insulated 19/0.15 cores

RCP11/2S



6x terminals, gold plated

Penny+Giles
A Curtiss-Wright Company

RVDT DISPLACEMENT TRANSDUCERS

The Penny+Giles rugged, high integrity RVDT displacement transducer is designed for operation in harsh automotive and motorsport environments. The design elements employed have evolved from the technology and experience gained over 40 successful years in the aerospace/military sensor market, where performance and reliability under extreme operating conditions are paramount

High accuracy system performance

This ac operated RVDT displacement transducer has been designed primarily for use in the 'difference over sum' (ratiometric) configuration to provide high system accuracy performance where the output is virtually unaffected by temperature and supply changes. Using high integrity coil and rotor designs, combined with a titanium housing, this RVDT can be supplied with a choice of shaft and mounting flanges to suit high performance, high temperature engine control applications.

Features

- No contact between the sensing elements
- Precision low torque bearings
- Infinite resolution
- Temperature range -40° to +180°C
- High integrity coils, screen and connection assemblies
- Corrosion resistant stainless steel drive shaft
- Rugged mechanical design with titanium housing

Benefits

- Virtually infinite life and fast dynamic response
- Long trouble free life
- All displacement will be sensed
- Maximum reliability in hostile environments
- Maximum reliability in hostile environments
- Accurate drive location in hostile environments
- Maximum reliability in high shock and vibration environments

RVDT AC OPERATED

PERFORMANCE

Electrical angle	**°**	±60 (120 total)
Mechanical angle	**°**	360 continuous
Input voltage	**Vrms**	3
Input frequency	**kHz**	2
Insulation resistance		Greater than 50MΩ at 250Vdc
Resolution		Virtually infinite
Operational temperature	**°C**	-40 to +180
Operating mode		Ratiometric
Electrical output R proportional to position		$R = \frac{Va - Vb}{Va + Vb}$
Electrical output R at ±60°		±0.504
Non-linearity (0 to ±50°)	**±%**	1
(±50° to ±60°)	**±%**	2
Input impedance		Greater than 150Ω at 2kHz
Load resistance (per coil)		Greater than 100kΩ
Phasing		With black, white and yellow leads common, the output on blue and green leads shall be in anti-phase with the red input for all shaft positions
Temperature error	**ppm/°C**	Please consult the factory for details
Weight (maximum)	**g**	85

OPTIONS

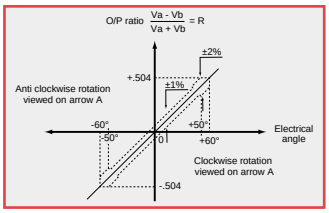
Mounting — Custom mounting configurations can be specified

ORDERING CODE

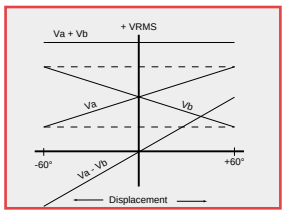
RVDT D45600

OUTPUT SCHEMATICS

Output Vs angle



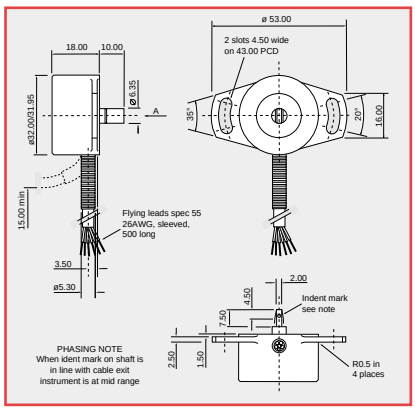
Individual output voltage schematic



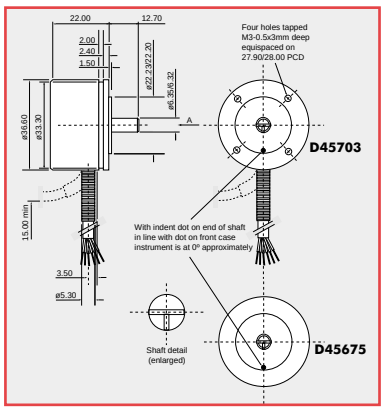
DIMENSIONS

Note: drawings not to scale

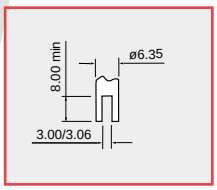
RVDT D45600



Alternative mounting styles

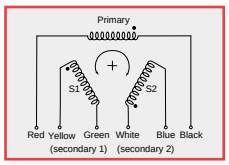


Suggested driving slot for shaft



ELECTRICAL CONNECTIONS

6 flying leads 26 AWG, sleeved 500mm long



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throttle pedal position

gear select position indication

hydraulic reservoir level

front and rear suspension movement

throttle actuator position

steering angle position

gearbox actuator position

clutch pedal position

clutch actuator position

brake balance measurement

brake pad/disc wear indication

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