Solartron Metrology

DISPLACEMENT CATALOGUE

AMETEK®
ULTRA PRECISION TECHNOLOGIES

"Working with our customers and partners to provide complete precision linear measurement solutions"

"配合客户和合作伙伴提供完整的精密线性测量解决方案"

"Travailler avec nos clients et partenaires pour fournir des solutions de mesures linéaires précises et complètes"

"Zusammenarbeit mit Kunden und Partnern für die Bereitstellung präziser Messlösungen"

"Lavoriamo con i nostri clienti e partner per fornire soluzioni di misura lineare complete ed accurate"

"お客様へ高精度のリニア測定を実現するためのソリューションを提供します。"

"Trabalhando com nossos clientes e parceiros para fornecer soluções precisas em medição linear"

"Сотрудничество с клиентами и партнерами обеспечивает наилучшие комплексные решения в облости высокоточных систем линейных измерений."
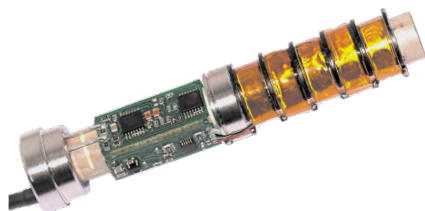
"Trabajamos con nuestros clientes y socios para proporcionarles soluciones completas en medides lineares de precísíon"
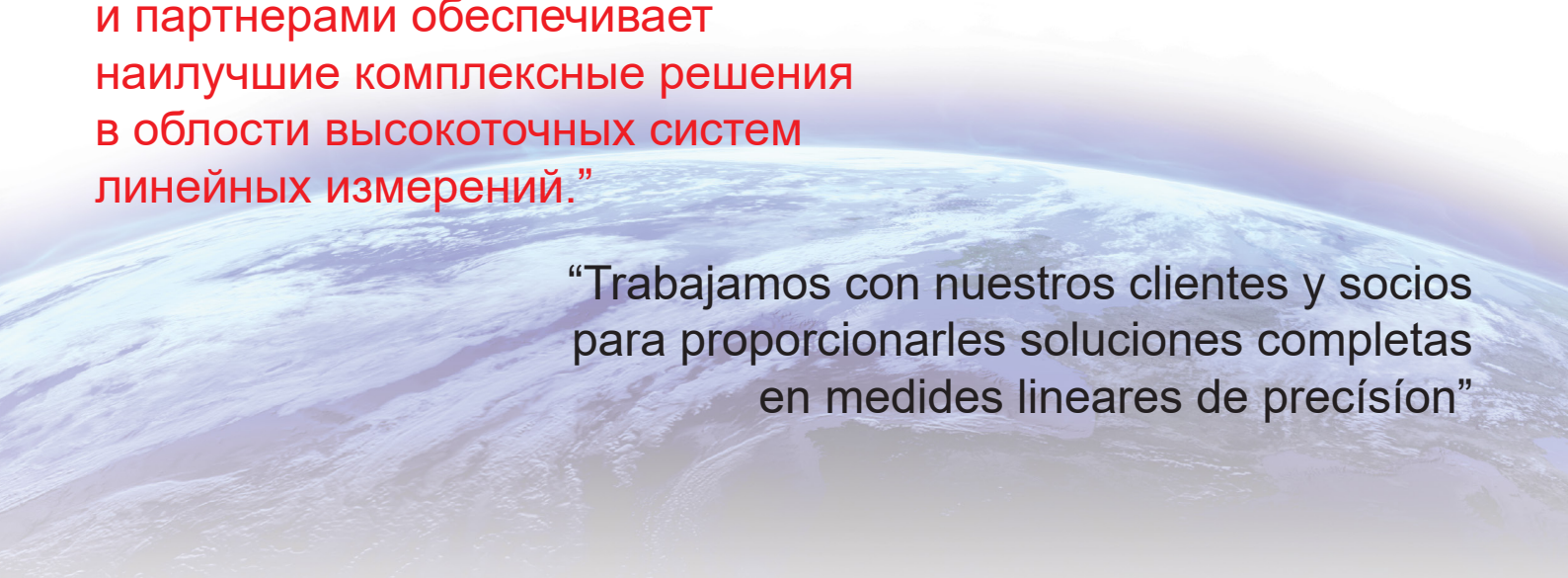
Contents
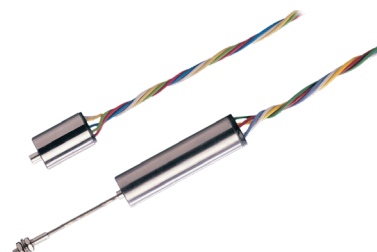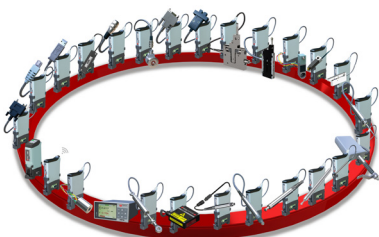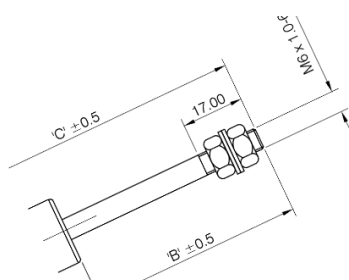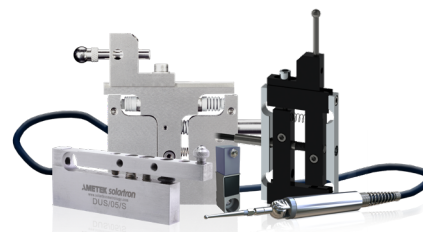
Performance products with a twist...

Configurate our standard range to create the optimum measurement solution for your application

To create the perfect package for your application...

....combine high performance digital and analogue data collection...

The culmination of Solartron's 50+ years of experience manufacturing LVDT displaicement sensors is a deep understanding of the need to match the performance of a sensor precisely to the demands of the application and environment. The cost and performance advantage in matching the best sensor to the requirement is clear, this can only be done with a company that has both an extensive range of sensors, accessories and electronics in cojunction with a philosophy of designing LVDT to customers specific requirements.

CONTROL POSITION

FEEDBACK
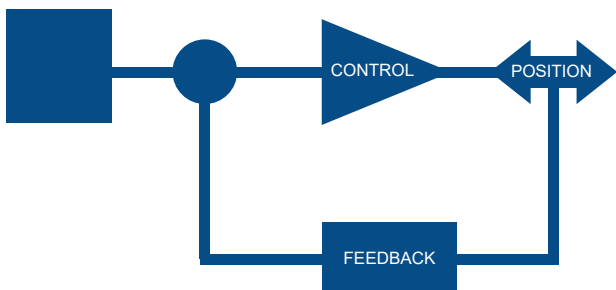
....with powerful, flexible and resilient data processing...

...for precision linear measurement whatever your industry...

An extensive range of analogue and digital sensors requires an equally extensive range of electronics and signal conditioning. The ability to transfer fast reliable data from a sensor even in harsh enviroments is made possible by Solartron's well proven Orbit3 Sensor Network. Orbit3 introduces the ability to network third party sensors such as pressure, force, strain and temperature using a common protocol.

Solartron precision measurement solutions perform vital tasks in a diverse range of products throughout industries including...

Aerospace, pharmaceutical, medical, power generation, oil and gas, paper making, civil engineering, tunneling, semiconductor manufacturing, mining, glass making, water treatment, chemical processing, steel production...

The list is endless.

FEEDBACK

Quality to the core

Simplicity of operation is the main strength of an LVDT, but to produce a reliable and stable sensor requires meticulous attention to detail in its design and manufacture.

▲
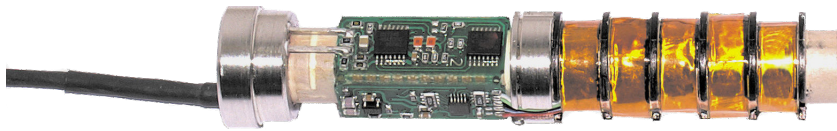
Highly stable and clean signal conditioning is essential to get the best performance from an LVDT sensor.

Precision wound coils on highly stable bobbins provide excellent linearity and temperature coefficients.

Mu metal screening gives improved protection against electromagnetic fields on some models.

▲
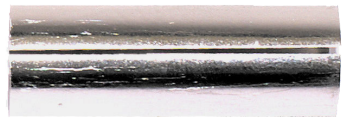
Solartron's sensor bodies, core carriers and end caps are made from high grade stainless steel.

A universal truth: data is only of true value when it is processed from a reliable source...

Integral electronics, high performance external electronics, single or multichannel digital communication from absolute displacement sensors provide the ultimate in system performance.

Core technology

Principle of operation

An LVDT Displacement Sensor works by moving the core through the body. The position of the core within the body is detected by coils wound on the bobbin.

The coils are supplied with an AC signal and return an AC signal. This signal is then processed by conditioning electronics to provide a measure of the core position.

The body is normally mounted on the static part of an element and the core attached to the moving part.

Core benefits

Absolute positioning

Unlike incremental sensors an LVDT does not lose position during a power down and does not suffer from over speeding, making it ideal for closed loop control.

Ruggedness

With good choice of materials and design the Displacement Sensor is perfect for harsh environments.

Repeatable

Submicron repeatability provides perfect limit or closeloop control.

Dynamic response

Free core sensors, fitted with low mass cores provide excellent dynamic response up to several kHz when used with Solartron's precision signal conditioning.

Flexibility

Solartron's design engineers can design sensors to fit your application.

Conventional LVDT

When the core is in a central position, the coupling from the primary (V_{EXC}) to each secondary is equal, so $V_A = V_B$ and the output $V_{OUT} = 0$. As the core is displaced V_A differs from V_B, and the output V_{OUT} changes in magnitude and phase in proportion to the movement.
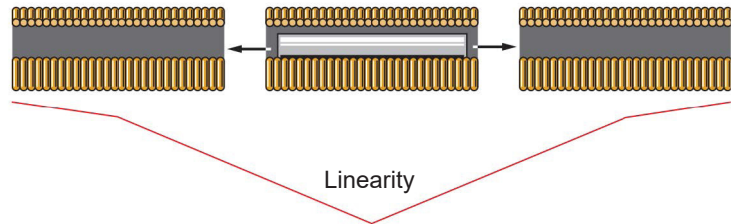
Linearity

Solartron LVDT

Solartron Metrology's continuous development of precision bobbin mouldings and multi chambered coil windings ensure excellent linearity and thermal stability throughout the range.

Linearity
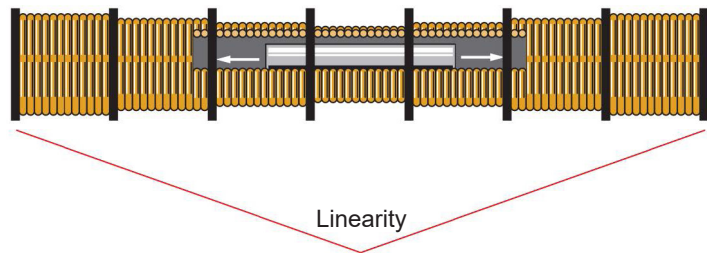
Solartron Orbit® 3 digital sensors

Solartron Metrology digital sensors are calibrated using a traceable interferometer and are issued with a calibration certificate. All digital sensors are fitted with integrated electronics, which store information such as probe ID, range, calibration error, etc. Digital sensors provide superior performance compared to traditional analogue sensors. Performance figures quoted in this catalogue include all mechanical errors within the probe head together with any errors in the electronics interface modules.
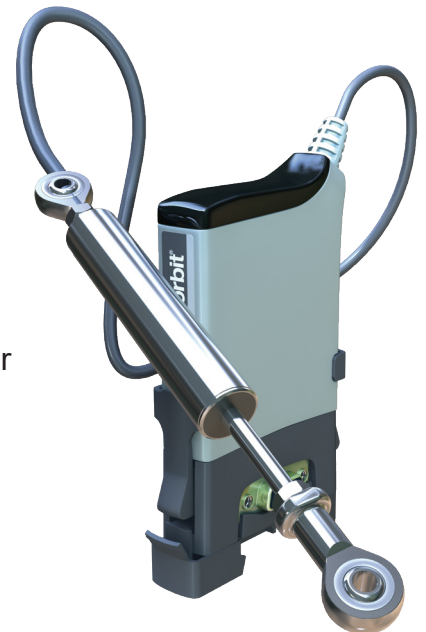
Applications in industry

Position Feedback

Energy
Power Generation
Wind Turbine
Oil and gas

Transport
Aerospace
Rail
Off-highway
Automotive
Drones

Automation
Assembly
Robotics
Electronics
Mechatronics
Metal Forming

Fluid Power
Hydraulics
Servo valves
Pneumatics
Solenoids
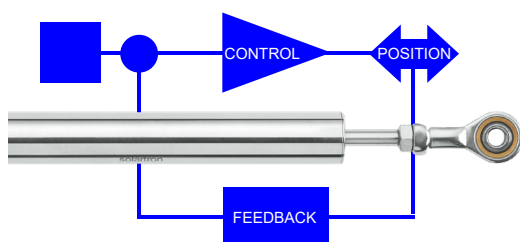
Examples

▶ Position feedback
▶ Level measurement
▶ Machine alignment
▶ Assembly checking

▶ Injection monitoring
▶ Close loop control
▶ Tool positioning
▶ Movement control

CONTROL POSITION

FEEDBACK

Applications in laboratory and test

Displacement measurement
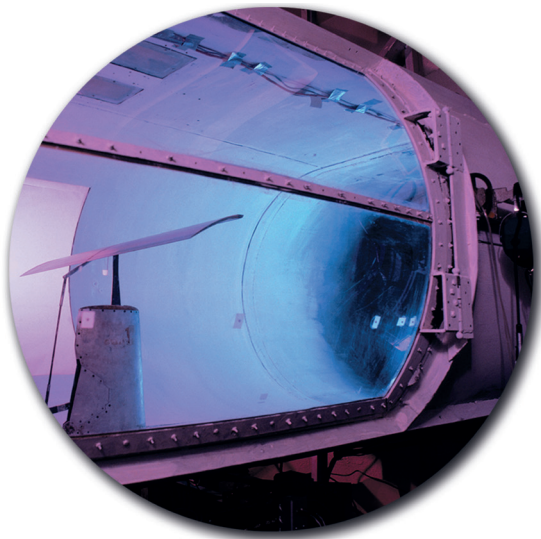
Test Machines

Traction
Compression
Creep & Stress

Structures

Building
Bridge
Barrage
Cracks
Soil
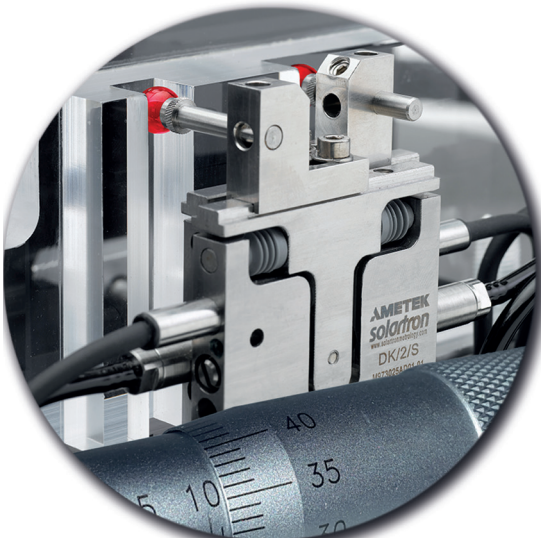
Metrology

Hardness
CMM
Calibrators
Dimension
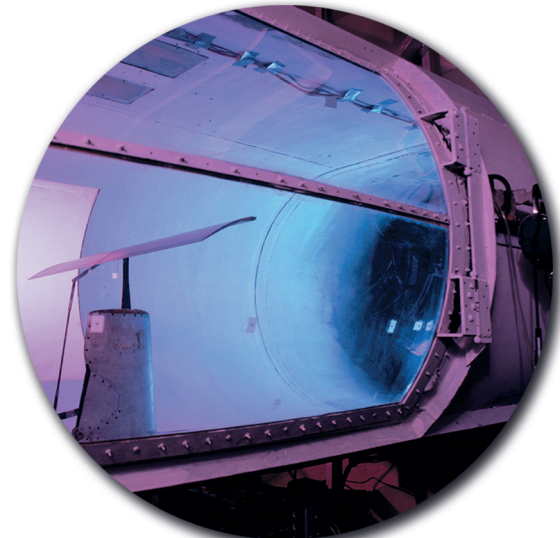
Bench Test

Wood
Metal
Aerospace
Agronomy
Automotive

Data

Examples
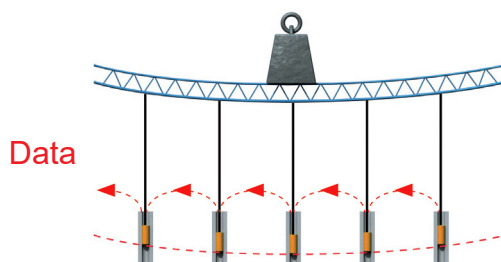
▶ Cracks monitoring
▶ Structure monitoring
▶ Alignment measurement
▶ Deformation measurement

▶ Expansion displacement
▶ Contraction displacement
▶ Crush displacement
▶ Deflection measurement

S-Series

High performance displacement sensors

▶ Linearity better than 0.2%
▶ 19 mm diameter stainless steel body
▶ IP65 and IP67 options
▶ Excellent measuring range to body length
▶ Multiple output options with integrated electronics
▶ Large bore to core clearance for ease of installation
▶ Excellent magnetic screening
▶ Wide range of signal conditioning and instrumentation

The S-Series Displacement Sensor is the culmination of many years experience gained from Solatron's pedigree a history of excellent displacement sensors coupled with attention to market feedback. The result is a large range of sensors both "off the shelf" and "customer specials" that is better able to satisfy today's demanding manufacturing and research applications.

The S base series has been expanded to include the SR (Rugged range).

Standard output options
▶ LVDT
▶ ±5 VDC
▶ ±10 VDC
▶ 0-5 VDC
▶ 5-0 VDC
▶ 0-10 VDC
▶ 10-0 VDC
▶ 4-20 mA
▶ 20-4 mA
▶ Solarton Orbit® (Digital)
▶ TTL

Mechanical options
▶ Free Core
▶ Free Core / Carrier
▶ Guided Core
▶ Tip
▶ Spring
▶ Universal Joints

Connection options
▶ Cable (wire ends)
▶ Cable + Connector
▶ Axial Connector
▶ PIE (Orbit® digital only)

For non-standard sensors please contact your local Solartron Sales Office or Distributor (see back cover)

Generic Sensor types										
LVDT	AS/2.5	AS/5	AS/7.5	AS/10	AS/15	AS/25	AS/50	AS/75	AS/100	AS/150
Voltage Output (± DC Bipolar)	VS/2.5	VS/5	VS/7.5	VS/10	VS/15	VS/25	VS/50	VS/75	VS/100	VS/150
Voltage Output (DC Unipolar)	VS/5	VS/10	VS/15	VS/20	VS/30	VS/50	VS/100	VS/150	VS/200	VS/300
Current Output (4-20 mA)	IS/5	IS/10	IS/15	IS/20	IS/30	IS/50	IS/100	IS/150	IS/200	IS/300
Digital Output (Orbit®)	DS/5	DS/10	DS/15	DS/20	DS/30	DS/50	DS/100	DS/150	DS/200	DS/300
Measurement										
Measurement Range (LVDT/±DC) (mm)	±2.5	±5	±7.5	±10	±15	±25	±50	±75	±100	±150
Measurement Range (4-20 mA/DC/ORBIT)(mm)	5	10	15	20	30	50	100	150	200	300
Pre-travel ±0.5 mm (Guided Versions only)	2.0	3.0	1.5	2.5	5	7.0	5.0	5.0	9.0	16.5
Post Travel ±0.5 mm (Guided Versions only)	4.5	5.5	4.0	5.75	9.25	9.5	7.5	7.4	11.25	18.5
Linearity (% FSO)	<0.20								<0.25	
Resolution μm *Note 1*	<0.1	<0.1	<0.1	<0.2	<0.2	<0.3	<0.5	<0.7	<1.0	<2.0
Temperature Coefficients (%FSO/°C) LVDT	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.015	<0.01	<0.01
Temperature Coefficients (%FSO/°C) DC/4-20mA	< 0.01									
Mechanical										
Body Diameter (mm)	19.00 (+0.0, -0.2)									
Case Material	300 Series Stainless Steel									
Core Material	Nickel Iron									
Tip Force ±20% (Horizontal at middle of range) N	1.1	1.0	1.0	1.1	1.2	1.5	2.1	1.9	2.3	2.6
Cable Type	FEP									
Standard Cable Length (m)	3									
Standard Cable Style	B									
Nominal Mass (g) LVDT	58	66	67	80	92	110	153	167	243	344
Nominal Mass (g) (4-20 mA/DC)	72	80	81	94	106	124	167	181	257	358
Nominal Mass of Core (g)	2.8	5.0	5.9	7.1	6.8	7.0	9.1	9.1	9.1	9.1
Nominal Mass of Mounting Parts (g) *Note 2*	20	25	27	30	34	40	55	71	85	122
Environment										
Temperature (Standard LVDT) (°C)	-40 to +120									
Temperature (HT LVDT)) (°C)	-40 to +200									
Operating/Storage Temperature (4-20 mA/DC) (°C)	0 to +65 / -20 to 85									
Sealing	IP65 or IP67									
Vibration Sinusoidal	1 to 10 g rms linear 10 to 50 Hz & 10g rms 50 Hz to 1 kHz									
Vibration Random	DO160F Curve D									
Shock	Drop test from 1m onto hard surface									
Electrical Interface (LVDT)										
Energising Voltage	1-10 (Vrms)									
Energising Current at 5 kHz (mA/V)	1.0	2.6	2.2	0.7	1.5	0.5	0.6	2.5	1.65	1.83
Sensitivity at 5 kHz ±10% mV/V/mm	144	178	121	76	60	21.5	15	10.5	6.9	3.9
Electrical Interface (4-20 mA & DC)										
Input	10 to 30 V or 4-20 mA loop powered									
Noise (DC Output) Measured in 500 Hz	<0.2 % FSO									
Output Change with Power Supply Variation	<0.5 mV									
Bandwidth (-3dB)	500 Hz									
Electrical Interface (Orbit®)										
Bandwidth	Up to 460 Hz (selectable)									
Output	Solartron Orbit®									
Power (VDC)	5±0.25 @ 0.06 A									
Sealing	IP43									
Probe Interface Electronics. Weight (g)	52									
T Connector Weight (g)	46									

▶ Note 1: Resolution specification is only applicable to Orbit® digital sensors.
The resolution of LVDT sensors is effectively infinite and is only limited by the conditioning electronics.
▶ Note 2: Moving parts are core and carrier assembly for standard guided product including 2 x M4 nuts and 2 x M4 washers.

Optimum Series

Compact and Accurate LVDT sensors

▶ Good measurement range to body length ratio
▶ Small body diameter
▶ Larger radial bore clearance
▶ Rugged Construction

The Optimum Series of LVDT sensors is an ideal choice for process control and research applications. The free core variants are designed for precise linear positioning and measurement of moving parts where zero friction and hysteresis is required within a restricted space.

The free core version is available with an optional ligthweight core for mounting on to small, rapidly moving structures without affecting their performance and integrity - important in some control applications.

The lightweight core has a 1.9 mm diameter, which improves core to bore clearance, making alignment easier. A light titanium core carrier can be supplied on request.

The Optimum is also available as a guided product and with universal joints either as an LVDT or Digital product for use in applications where it is not possible to mount the core and carrier on to the moving part.

▶ Note: the Optimum can be wired as either differential output or ratiometric (except OP/10 and OP/25)

Sensor					
LVDT Free Core	OP/1.5/F	OP/6/F	OP/10/F	OP/12.5/F	OP/25/F
LVDT Guided	OP/1.5/G	OP/6/G	OP/10/G	OP/12.5/G	OP/25/G
Digital Output (Orbit)	DO/3	DO/12	DO/20	DO/25	DO/50
Measurement					
Measurement Range (LVDT/Orbit) (mm)	±1.5 / 3	±6 / 12	±10 / 20	±12 / 24	±25 / 50
Pre-travel ±0.25 mm (Guided Versions only)	1.75	1.5	1.5	2.25	2.00
Post Travel ±0.25 mm (Guided Versions only)	1.75	1.5	1.5	2.25	2.25
Linearity (% FSO)			<0.25		
Resolution µm *Note 1*	0.015	0.025	0.08	0.1	0.2
Temperature Coefficient (%FSO/C°)			<0.05		
Mechanical					
Body Diameter (mm)			9.512 (+ 0.0 to - 0.062)		
Case Material			400 Series Stainless Steel		
Core Material			Nickel Iron		
Tip Force ±20% (Horizontal at middle of range) N	0.9	0.8	0.7	0.9	0.5
Cable Type			FEP		
Standard Cable Length (m)			5 (max)		
Standard Cable Style			A or B		
Nominal Mass (g) LVDT	7	12	12	20	20
Nominal Mass of Core (g) ø2,8 M2 Threaded	0.3	0.9	0.6	1.6	0.8
Nominal Mass of Moving Parts (g) *Note 2*	1.5	2.5	2.4	4.0	3.5
Environment					
Temperature (Standard LVDT) (°C)			-40 to +150		
Operating/Storage Temperature (4-20 mA/DC)°C			-40 to +150		
Sealing			IP65		
Electrical Interface (LVDT)					
Energising Voltage			1-5 (Vrms)		
Energising Current at 5 kHz (mA/V)	6	4.5	3.2 at 20 kHz	7	1.25
Sensitivity at 5 kHz ±10% mV/V/mm	108	78	85 at 20 kHz	69	25
Zero Phase Frequency (kHz)	13.1	24.1	>30	24.8	14
Electrical Interface (Orbit®)					
Bandwidth			Up to 460 Hz (selectable)		
Output			Solartron Orbit®		
Power (VDC)			5±0.25 @ 0.06 A		
Sealing			IP43		
Probe Interface Electronics Weight (g)			52		
T connector weight (g)			46		

▶ Note 1: Resolution specification is only applicable to Orbit® digital sensors.
The resolution of LVDT sensors is effectively infinite and is only limited by the conditioning electronics.
▶ Note 2: Moving parts are core and carrier assembly for standard guided product including 2 x M2 Nuts and 2 x M2 Washers.

Cable Style A comprises of individual twisted cores
Cable Style B comprises a sheathed and screened cable

SM / MD / DF

Miniature displacement sensors

SM

▶ Rugged construction
▶ Short body length
▶ Good performance

SM sensors cover two standard types in two measurement ranges ±1 mm and ±3 mm. They are designed for measuring displacement in applications where infinite resolution and precise repeatability is required in a very small size.

The coils are wound on a PPS (40% GL) former and housed in a stainless steel case. The epoxy bonded construction makes the device suitable for operation in wet and oily environments and in applications with high levels of mechanical stress.

The core carrier assembly moves friction free within the sensor an alternative option where the core is provided threaded at both ends is available allowing the user to manufacture their own carrier interface. Recommended carrier material is titanium.
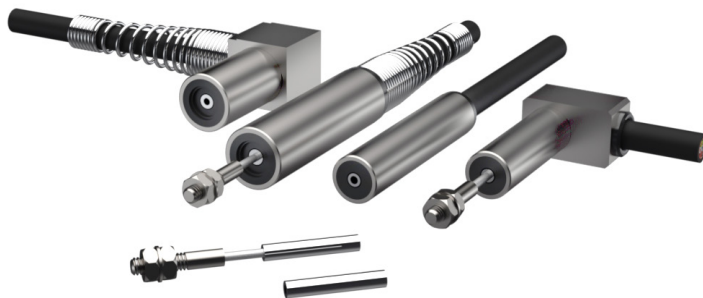
MD

▶ Small diameter
▶ Right angle cable outlet option
▶ Low core weight
▶ Screened cable

The small case diameter (6 mm and 8 mm) allows for easy installation in confined spaces. A right angle output facility is available as a retrofit for the 8 mm version.

The low core weight makes this range ideal for use in low inertia systems. Cross talk is prevented by the screened cable, which also allows for multiple use of these sensors in close proximity.

DF

▶ Measurement range to 10 mm
▶ High Output
▶ Excellent repeatability
▶ Low power

The DF DC miniature displacement sensor has a friction-free core and the DFg has a free guided core incorporating Delrin bearings. All types incorporate a linear variable differential transformer (LVDT) as the measuring source together with oscillator, demodulator and filter providing a self-contained unit accepting a DC input and providing a DC output relative to armature position.

With high linearity and low mass of moving parts, these are ideally suited to applications in civil, mechanical, chemical and production engineering. Also, when mounted in a suitable load-sensitive member such as a proof ring or diaphragm, they can provide load or pressure measurement.
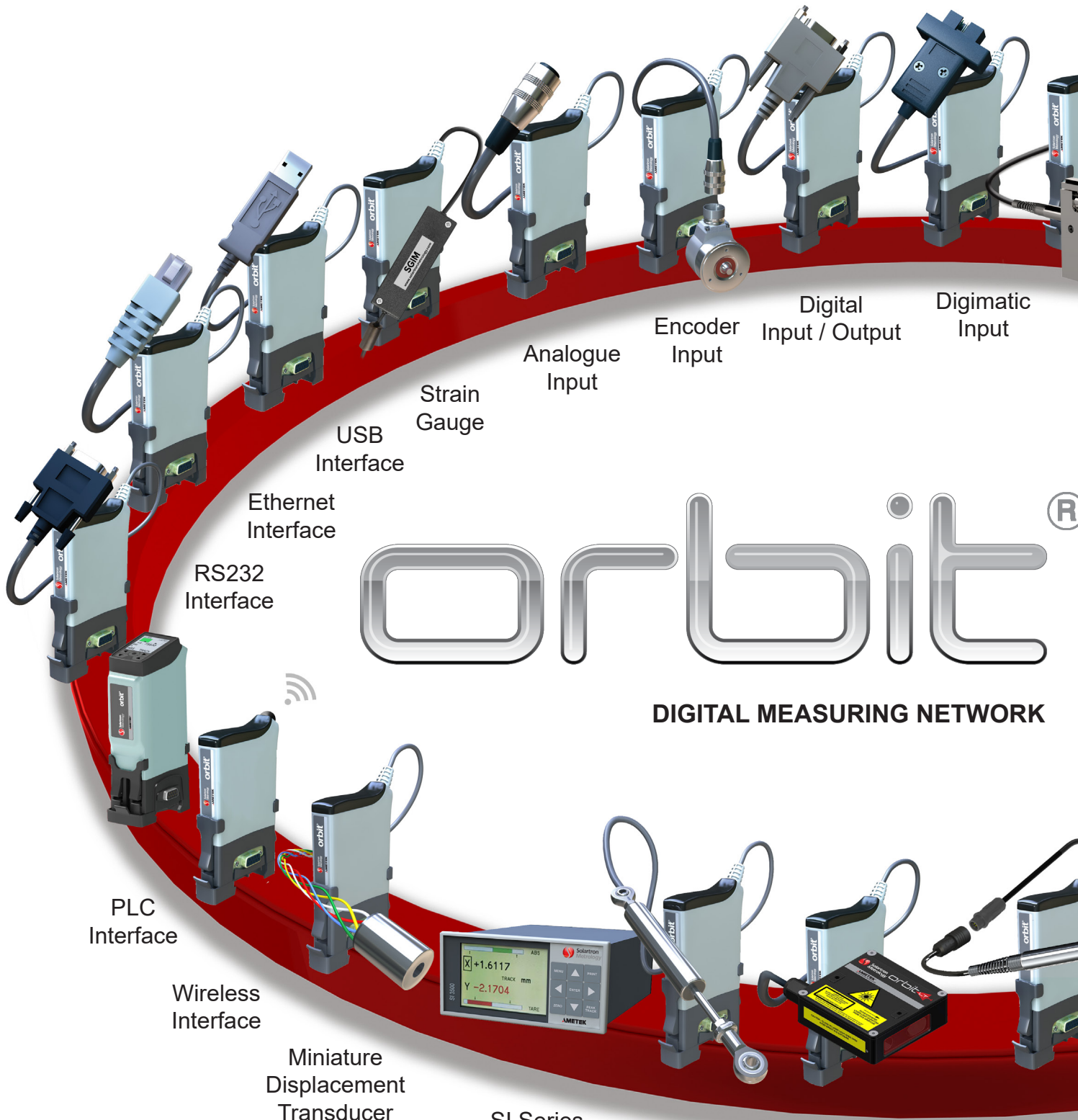
Sensor										
	SM1	SM3	M6D/1	MD/1	MD/2.5	MD/5	MD/10	DF1	DF2.5	DF5
LVDT	SM1	SM3	M6D/1	MD/1	MD/2.5	MD/5	MD/10	-		
Half Bridge	-		M6DH/1	MDH/1	MDH/2.5	MDH/5	MDH/10	-		
DC Output with Free Core	-							DF1	DF2.5	DF5
DC Output with Guided Core	-							DFg1	DFg2.5	DFg5
Measurement										
Measurement Range (mm)	±1	±3	±1	±1	±2.5	±5	±10	±1	±2.5	±5
Linearity (% FSO)	0.25		-					0.50		
Linearity (% Reading)	-		0.5					-		
Resolution μm see *Note1*	0.01	0.025	0.01	0.01	0.02	0.04	0.08	*see Note 1*		
Temperature Coefficients (%FSO/°C)	<0.03%		<0.01%					<0.025%		
Mechanical										
Body Diameter (mm)	9.52 (+0.0 to -0.062)		6h6	8h6				19.0 (+0.0 to -0.2)		
Case Material	400 Stainless Steel									
Core Material	Nickel Iron									
Cable Type	PUR									
Standard Cable Length (m)	0.5		2					3		
Standard Cable Style	A		B							
Nominal Mass (g)	6.0	8.0	2.6	5.0	7.6	8.5	13.0	26.0	26.0	30.0
Nominal Mass of Core (g)	0.25	0.5	0.1	0.2	0.25	0.35	0.4	N/A	N/A	N/A
Nominal Mass of Moving Parts *Note 2*	0.7	1.0	0.6	0.7	0.9	1.0	1.1	1.0	1.0	1.1
Environment										
Operating Temperature (°C)	-40 to +85		-10 to + 80					-5 to +70		
Storage Temperature (°C)	-40 to +100		-40 to + 105					-10 to +80		
Sealing	IP60									
Electrical Interface										
Energising Voltage	1-10 (Vrms)							10-24 (VDC)		
Energising (LVDT) Current at 5 kHz (mA/V)	3.8	1.8	3.0	1.8	2.0	1.0	0.6	-		
Energising Current (HB) at 10 kHz (mA/V)	-		1.2	1.0	-	1.2	-	-		
Energising Current (DC) at 10 V (mA)	-								10	13
Frequency Response (-3 db) Hz	Depends on Conditioning Electonics								50	75
Sensitivity at 10 VDC ±10% mV/V/mm	-								75	54
Sensitivity at 5 kHz ±10% mV/V/mm	147	136	269	210	150	105	33	-		
Sensitivity (HB) at 10 kHz ±10% mV/V/mm	-		88	83	82	51	33	-		

► Note 1: Resolution specification is only applicable to Orbit® digital sensors.
The resolution of LVDT sensors is effectively infinite and is only limited by the conditioning electronics.

► Note 2: Moving parts are core and carrier assembly for standard guided product including M2 Stud, 2 x M2 Nuts and 2 x M2 Washers

Cable Style A comprises of individual twisted cores
Cable Style B comprises a sheathed and screened cable

Orbit Digital Measuring Network

orbit®

DIGITAL MEASURING NETWORK

USB Interface

Strain Gauge

Analogue Input

Encoder Input

Digital Input / Output

Digimatic Input

Ethernet Interface

RS232 Interface

PLC Interface

Wireless Interface

Miniature Displacement Transducer

SI Series Controller

Displacement Transducer

Laser Triangulation

DP with in Line Connector

CONTACT

NON CONTACT

ENCODERS

GAUGING

DISTANCE

DIGITAL

TECHNOLOGIES

MEASUREMENT AND CONTROL

PRECISION MECHANICAL ENGINEERING

TEMPERATURE

DISPLACEMENT

LASERS

ANALOGUE

Logic IO

POSITION

STRAIN

CURRENT
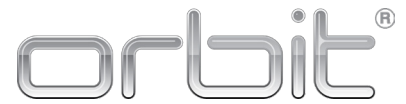
orbit®

Higher performance does not mean higher costs.

Quality standards in industry and research are becoming tighter, while demands for cost savings continue to increase. Orbit® provides the way forward for all precision measurement or positioning needs, whether on the production line or in the laboratory.

Orbit® provides a complete solution for integrating different measurement position and control sensors smoothly and simply into network solutions.

The Orbit® system architecture consists of a rugged mechanical design coupled with a high degree of electrical protection and excellent noise immunity, ensuring valid accurate data when it is needed.

All Solartron products have undergone rigorous testing to ensure a long and productive life.

Block Gauge

Flexure

Mini Probe

DUSM

Single Leaf Flexure

Lever Probe

Linear Encoder

3 mm Diameter Probe

Ultra Feather Touch

Feather Touch

Digital Gauging Probe (DP)

USB
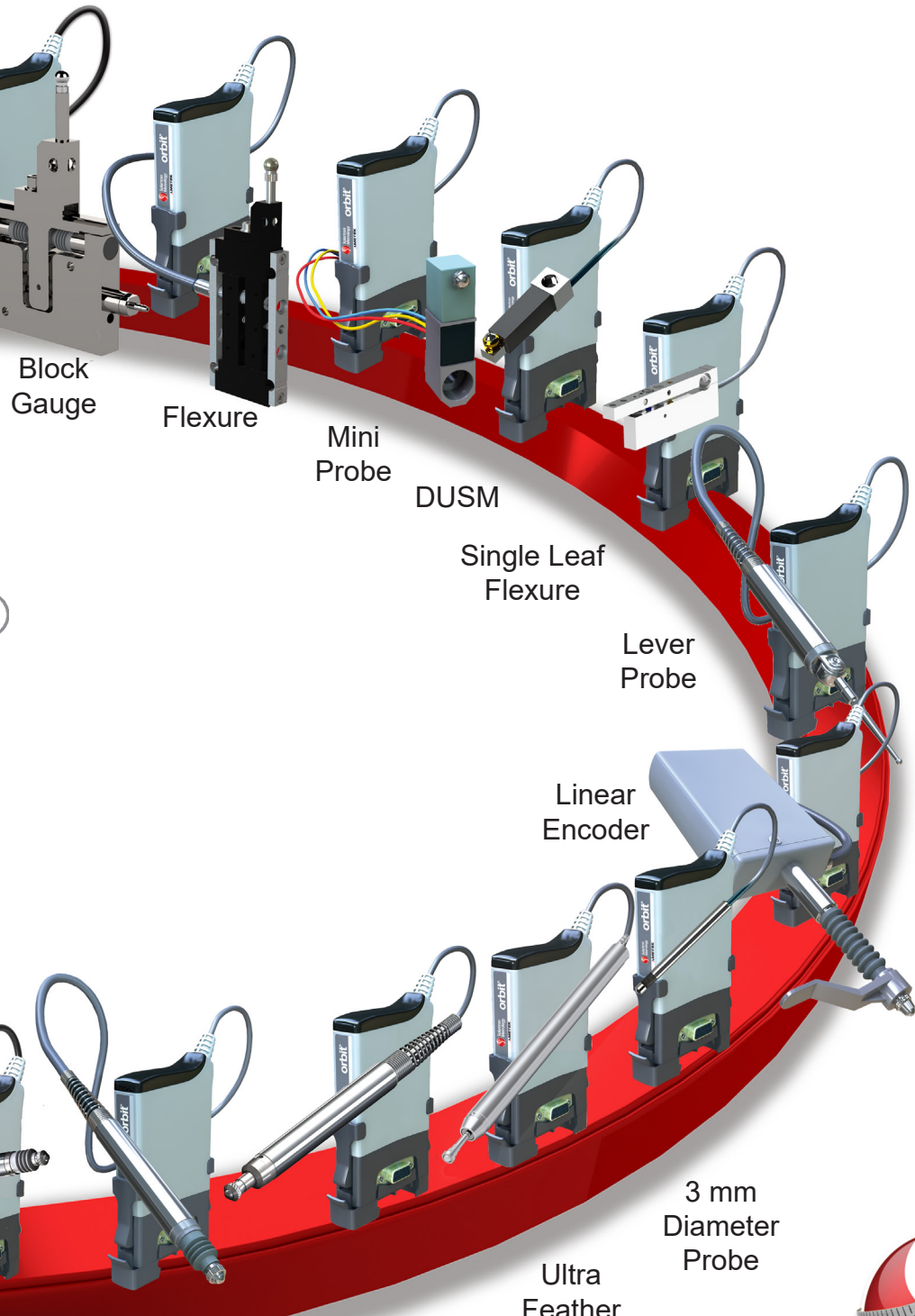
COMPUTERS

ETHERNET

INTEGRATING

SENSORS

PLCs

SERIAL

WIRELESS

Conditioning Electronics

Conditioning electronics must often be added to a LVDT or Half Bridge sensor to interface with real world environments.

Solartron Metrology's range of conditioning electronics offers users the ability to connect and configure LVDT and Half Bridge inductive sensors into an almost infinite number of combinations. Outputs include voltage, current loops (4-20 mA) and TTL.

For optimum performance in terms of transducers and electronics please consider Solartron Metrology's Orbit®3 Digital Measurement System which out performs the conventional analogue LVDT and Half Bridge sensors in all aspects.

OD Series

The OD series of conditioning units is used to interface with Solartron's sensors to provide different functions to suit different applications. The OD2 is a two wire 4-20 mA signal conditioner. It is designed for signal transmission over long distances due to low noise susceptibility. The OD4 (OD5 is a mains powered equivalent) is powered from a single 10 to 30 V DC supply. The outputs are fully adjustable for offset and gain.

DRC

The DRC is a DIN rail mounted version of the OD4 and provides all the features plus the convenience of a DIN rail mount.

BICM In Line Module

The BICM provides a simple low cost in line conditioning unit. This is ideal when the transducer set up is unlikely to require adjustment. For use in harsh environments, an IP67 version is available.

ATM TTL Converter

TTL RS 232 Differential Quadrature is one of the most commonly used methods of communication between Linear Displacement Sensors and Control or Data Acquisition Systems. Its simplicity of Interfacing with programmable systems also makes Solartron's ATM one of the most cost effective.

Module	ATM TTL converter
Measurement	
Sensor Types	All Solartron Displacement Sensors
Accuracy(%FSO)	<0.25
Resolution (x4 interpolation)	0.1
Repeatability	Sensor Dependent
Electrical	
Power	+5 ±0.25 VDC @ 100 mA
Output Signal	A & B,/ A and / B TTL square waves RS422 levels
Output frequency (kHz)	50, 100, 125, 250 & 500 (factory selectable)
Bandwidth	100 Hz
Environmental (electronics)	
Sealing	IP43
Operating Temperture(°C)	0 to +60
Storage temperature(°C)	-20 to +70

Refer to product manual 502724 for details of operation - contact sales office

Technical Specifications

Module	OD2	OD4	OD5	DRC	BICM	
Power requirements						
Input Voltage VDC	13-42	10-30	N/A	10-30	±15	24 *(Note 5)*
Input Voltage VAC	N/A	N/A	90-264	N/A	N/A	N/A
Input Current (mA)	<30	140-50	250-100	160-70	±12	24
Frequency (Hz)	-	-	47-63	-	-	-
Sensor Excitation						
Primary Voltage (Vrms)	0-9	3			1.2 - 21	
Primary Frequency (kHz)	5 or 13	2.5 or 5	-	5, 10 or 13	5	
Signal Input						
Input Range	30-530 mV *(Note 1)*	55 to 5000 mV LVDT full range			up to 3.5	
Input Load (kΩ)	2	2, 10, 100		2, 100	100	
Options	-	Forward and reverse polarity, half bridge		see *(Note 2)*	-	
Signal Output *(Note 4)*						
Voltage Output VDC	-	Up to ±10				
Current Output mA	4-20	Up to ±20 into 150 Ω load			-	
Output Ripple	<38 µA rms	<1 mV rms	-		<14 mV	
Output Offset	Up to 100% on maximum gain (coarse and fine adjustment)					
Temperature Coefficient Gain (%FSO/°C)	<0.01				<0.03	
Temperature Coefficient Offset (%FSO/°C)	<0.01				<0.02	
Warm Up (minutes)	15 Minutes					
Linearity (%FSO)	<0.02				<0.1	
Bandwidth (-3 dB) (Hz)	25	500, 1 k			250	
Environmental *(Note 3)*						
Storage Temperature	-40 to +80	-20 to +80				
Operating Temperature	0 to +60					
IP Rating	65	40		None	40/67	40
Mechanical						
Sensor Connections	Terminals	Din Connector	-	Terminals	Solder or factory fit for IP67	
Power Connections	Terminals	-	IEC320 C14	-	-	
Weight						
Material	ABS	Painted Aluminium Box		Plastic	Plastic or Stainless Steel (IP67)	
Mounting	Holes			DIN rail	-	

▶ Note 1: For transducers with sensitivity > 250 mV, an attenuator is required - contact sales
▶ Note 2: Transducer connected via external screw terminal. User can therefore configure options
▶ Note 3: For higher environmental levels (and other custom options) contact sales office
▶ Note 4: For custom options contact Sales office
▶ Note 5: 24 V BICM not available in IP67

Outputs

The correct selection of outputs is critical to accurate noise free transmission. All analogue signals are more prone to interference than digital transmission methods such as TTL. Use of current as a transmission method can offer significant advantages over long cable runs. With all external conditioning it is possible to adjust both the offset voltage and the gain to give numerous output. combinations and to increase sensitivity over a predefined measurement range.

SI 3000 Series

Twin axis display / controllers

▶ Intuitive menu
▶ 2 channel 7 digit colour displays
▶ 2 channel analogue colour displays
▶ Auto colour change for in/out range
▶ Auto course / fine resolution
▶ Peak hold facility
▶ Data logging facility
▶ RS232 output
▶ Discrete I/O
▶ 4-20 mA or DC output

Specifically designed for use with Solartron's high performance Orbit® network, the SI 3500 features an intuitive, menu driven-twin axis display which can be programmed to display readings, set Limits/Alarms, Peak Hold, Track, or act as a Data Logger for inputs from one or two sensors.

LCD Display	
Digital	2 x colour
Analogue	2 x colour horizontal bars
Update Speed	40 Hz
Display length (mm)	± xx.xxxxx (user selectable)
Display length (ins)	± xx.xxxxx (user selectable)
Resolution mm	Down to 0.05 µm (user selectable)
Resolution ins	Down to 0.000005'' (user selectable)
Keypad	
Membrane type with 9 keys	Print, Zero, Up, Down, Left, Right, Enter, Peak Hold / Track, Menu
Measurement type	A, B, A+B, A-B, (A+B/2), (A-B/2), (B-A/a) X und Y
Data Logging	A, B, A+B, A-B, (A+B/2), (A-B/2), (B-A/a) X and Y 10,000 readingsvia switch or 1 ms to 24 hr time interval
Indications	mm/inch, Lower & Upper Limits, Out of Range, Measurement Mode
Power requirement	+24 VDC ± 10%
External I/O	
Serial	RS232 serial port (for printer or PC)
Discrete Output	2 x 3 isolated
Analogue Output	2 channels DC or 4-20 mA
Environmental	
Front Panel	IP65
Case	IP51
Rear Connection	IP51
EMC	Immunity: EN61000-6-2 Emissions: EN61000-6-3
Storage Temperature (°C)	-20 to +50
Operating Temperature (°C)	0 to +50
Mechanical	
Mounting	Bench top or panel mount
Dimensions WxHxD (mm)	Without Bezel 134 x 65 x 160 With Bezel 144 x 74 x 175

Orbit® Non-Contact - Laser Triangulation
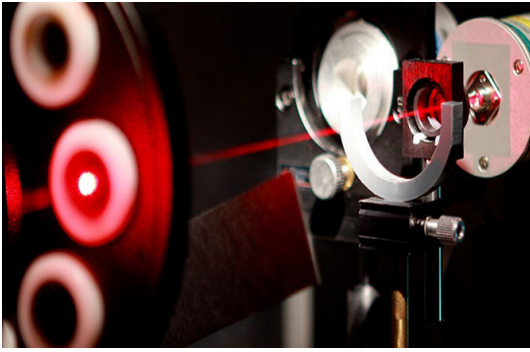
For applications where a contact gauging sensor is unsuitable, Solartron offers a range of high performance or low cost Non-Contact Laser Triangulation Transducers. This solution is fully compatible with the Orbit® Measurement Network.

LTH and LTM Features

- ▶ 2 mm to 200 mm measurement ranges
- ▶ Up to +/- 0.02% F.S. Accuracy
- ▶ Up to 0.0076 µm resolution
- ▶ 40 kHz sampling speed and up to 4 kHz output
- ▶ Laser Beam Control – on or off
- ▶ Plugs into Orbit® network up to 150 sensors with full control
- ▶ Auto gain circuitry – power automatically adjusts for optimum measurement
- ▶ Gap Time - Bridging function used when measuring parts with holes
- ▶ Diffuse or Specular modes

LT Features

- ▶ 15 mm measurement range with 45 mm offset
- ▶ Teachable settings for different surfaces
- ▶ 0.1% F.S. Accuracy
- ▶ 3 µm resolution

Laser Beam Control – the laser beam can be switched off, allowing multiple lasers to measure points very close together where the beams could interfere. In the beam off mode, the laser head is still powered allowing readings to be taken quickly (0.5 S) after turning the beam on. Beam control is via the Orbit® interface or via the Orbit® ACS using either the Menu or Modbus commands. The laser functions via the Orbit®, interface using Ethernet, Modbus, USB or Serial (RS232). The LTH can also be used with the Orbit® ACS products (with integral display) where control is via the menu or via Orbit® ACS Modbus interface.

S series

Dimensions (mm)

Standard Guided Carrier
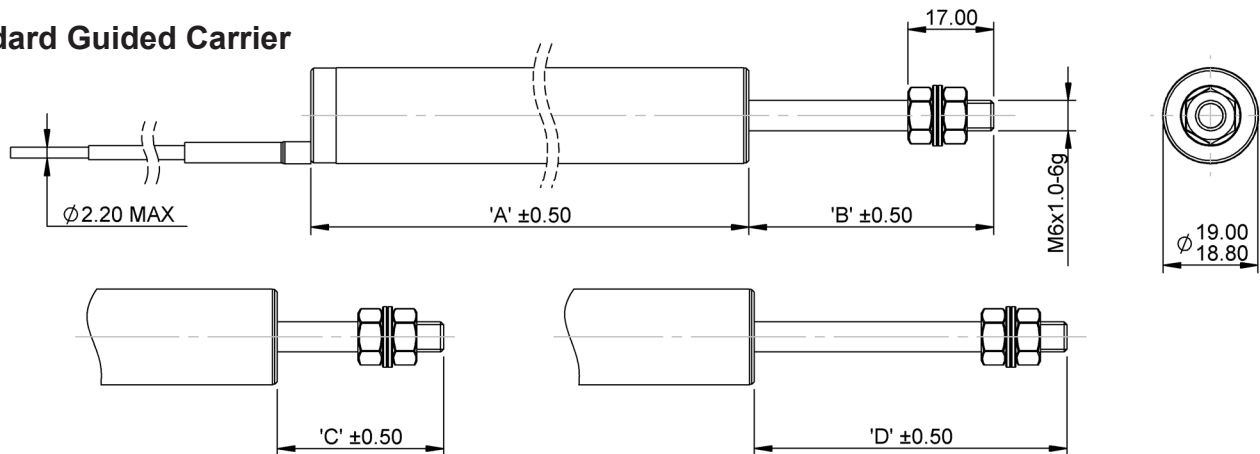
Spring Push
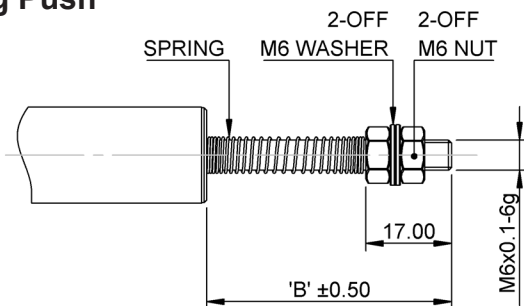
Spring Push With Tip
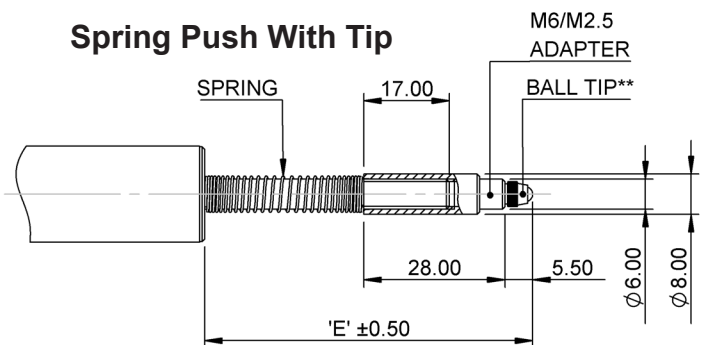
Universal Joint
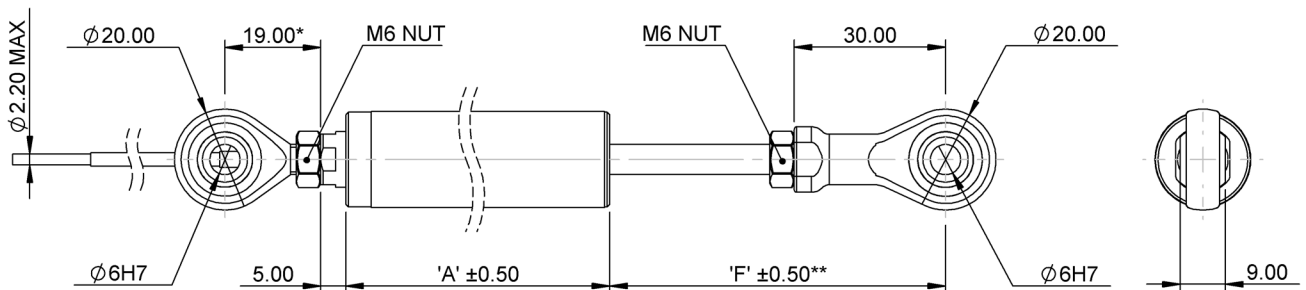
A = Body length including end plates
B = Carrier protrusion at mid calibration/null position
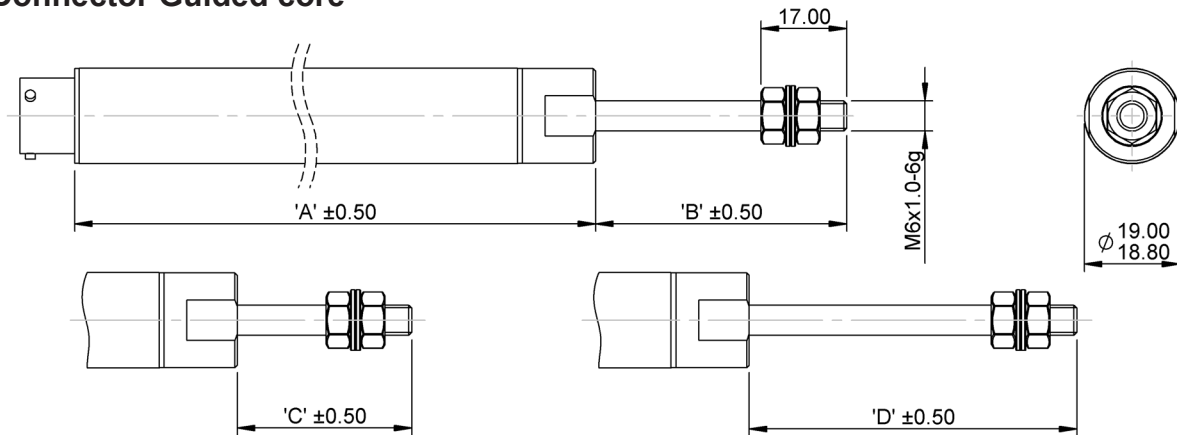**C** = Fully retracted carrier
D = Fully extended carrier

E = Carrier protrusion at mid calibration/null position with adapter and ball tip fitted
F = Distance from centre of universal joint at mid calibration/null position
 *** = Components are in fully screwed position
**** = Other tip variants available

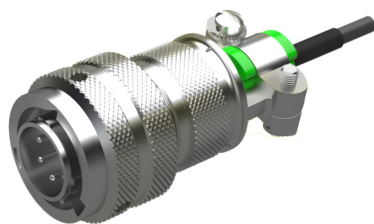| Range (mm)		Guided core, Spring Return and Universal Joints						
		LVDT	DC & 4-20 mA	All				
LVDT	DC & 4-20 mA	A	A	B	C	D	E	F
± 2.5	0-5	55.00	94.00	31.50	24.50	36.00	48.00	66.50
± 5.0	0-10	74.50	113.50	39.00	28.50	47.00	55.50	74.00
± 7.5	0-15	81.50	120.50	42.00	30.50	51.00	58.50	77.00
± 10.0	0-20	96.00	135.00	48.75	33.00	62.00	65.25	83.75
± 15.0	0-30	110.50	149.25	58.25	34.00	80.00	74.75	93.25
± 25.0	0-50	132.00	171.00	71.00	36.50	103.00	87.50	106.00
± 50.0	0-100	189.50	228.50	106.00	48.50	161.00	122.50	141.00
± 75.0	0-150	240.00	278.50	152.00	69.25	232.00	168.50	187.00
± 100.0	0-200	297.50	336.00	183.00	71.75	292.00	199.50	218.00
± 150.0	0-300	412.50	451.00	291.50	123.00	458.00	308.00	326.50

S series

Dimensions (mm)

Axial Connector Guided core

Standard Temperature Plug
MIL-C-26482 Series 1
-40°C + 120°C
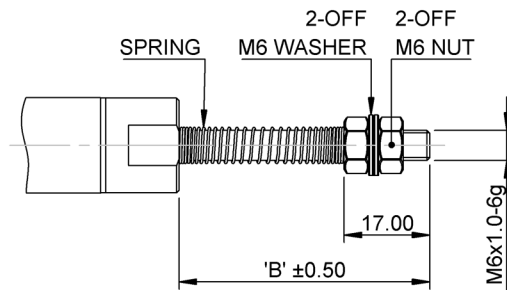
High Temperature Plug
MIL-C-26482 Series 2
-40°C + 200°C

Axial Connector Spring Push
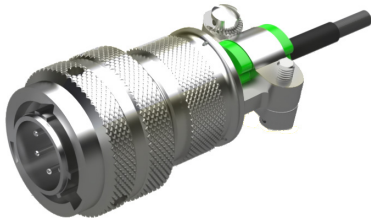
Axial Connector Spring Push with Tip
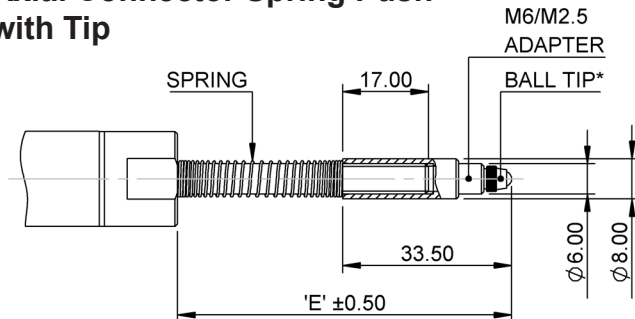
A = Body length including end plates
B = Carrier Protrusion at mid calibration/null position
C = Fully retracted carrier
D = Fully extended carrier

E = Carrier protrussion at mid calibration/null position with adapter and ball tip fitted
C = Fully retracted carrier
* = Other tip variants available

Range (mm)		Guided core, Spring Return and Universal Joints					
		LVDT	DC & 4-20 mA	All			
LVDT	DC & 4-20 mA	A	A	B	C	D	E
± 2.5	0-5	68.50	101.50	32.50	27.00	39.00	49.00
± 5.0	0-10	87.80	118.50	40.00	30.25	50.00	56.50
± 7.5	0-15	94.50	128.00	43.00	32.25	54.00	59.50
± 10.0	0-20	109.50	142.50	49.75	34.75	65.00	66.25
± 15.0	0-30	124.50	156.50	59.25	36.00	83.00	75.75
± 25.0	0-50	145.50	178.50	72.00	38.50	160.00	88.50
± 50.0	0-100	202.50	235.50	107.10	50.50	164.00	123.50
± 75.0	0-150	253.50	286.50	153.00	71.25	235.00	169.50
± 100.0	0-200	309.50	341.50	184.25	73.75	295.00	200.75
± 150.0	0-300	424.50	456.50	292.75	125.00	461.00	309.25

S series

Dimensions (mm)

Standard Free Core Carrier
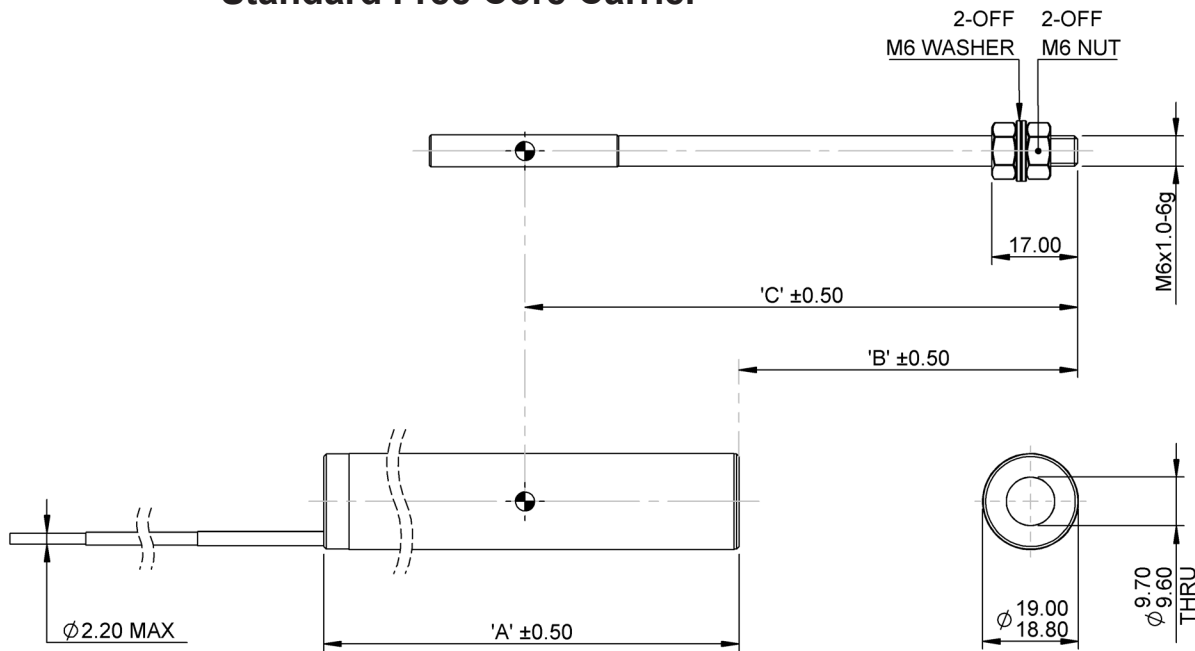
Standard Free Core

A = Body length including end plates
B = Carrier Protrusion at mid calibration/null position
C = Null point to end of the carrier at mid calibration/null position
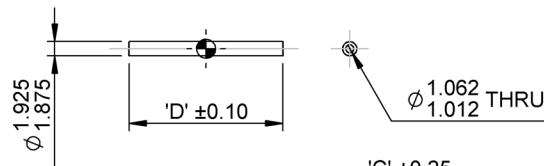D = Core lenght
 * = Cores shorter than 24.00 mm are threaded thru

Range (mm)		Guided core, Spring Return and Universal Joints				
LVDT	DC & 4-20 mA	LVDT	DC & 4-20 mA	All		
		A	A	B	C	D
± 2.5	0-5	33.50	72.50	40.75	55.25	16.50*
± 5.0	0-10	53.00	92.00	48.25	72.50	29.00
± 7.5	0-15	60.00	99.00	51.25	79.00	34.00
± 10.0	0-20	74.50	113.50	58.00	93.00	40.00
± 15.0	0-30	89.00	128.00	67.50	109.75	37.50
± 25.0	0-50	110.50	149.50	80.25	133.25	38.50
± 50.0	0-100	168.00	206.75	115.25	197.00	50.00
± 75.0	0-150	218.50	257.00	161.00	268.00	50.00
± 100.0	0-200	276.00	314.50	192.25	328.00	50.00
± 150.0	0-300	391.00	429.50	300.75	494.00	50.00

S series

Dimensions (mm)

Axial Connector Free Core Carrier

2-OFF M6 WASHER
2-OFF M6 NUT

M6x1.0-6g

17.00

'C' ±0.50

'B' ±0.50

'A' ±0.50

⌀ 19.00
18.80

⌀ 8.60
8.50

▽ 'E' ±0.50

Axial Connector Free Core

'D' ±0.10

⌀ 6.40
6.30

*M4x0.7-6H ▽ 13.00 MIN
⌴ ⌀ 4.10 ▽ 2.20
       4.00   2.00
BOTH CORE ENDS
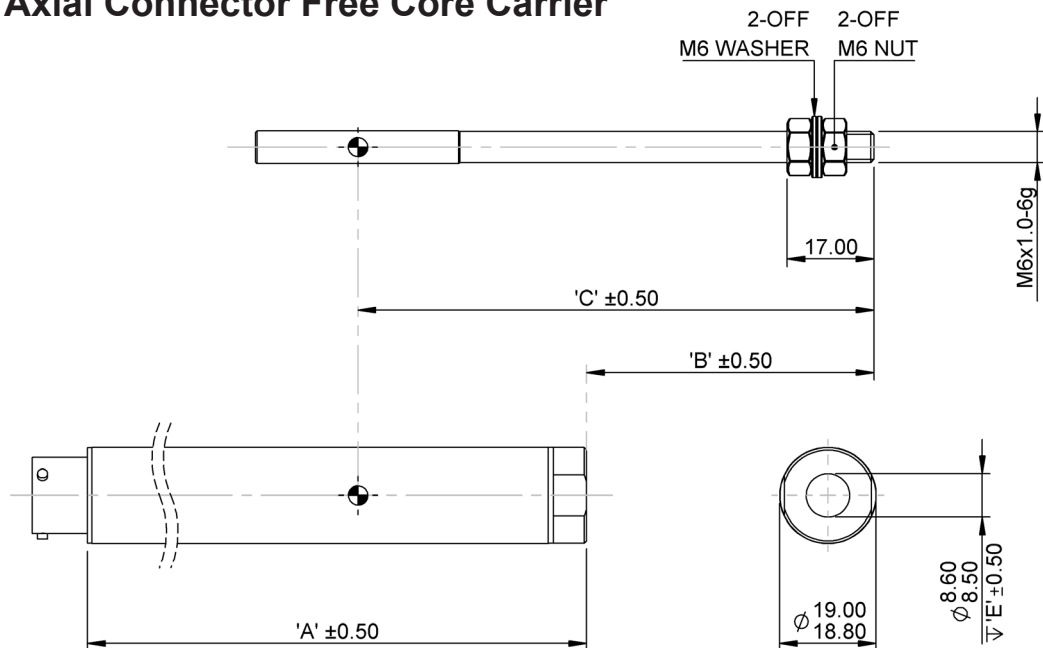
HighTemperature Plug
MIL-C-26482 Series 2
-40°C +200°C

Standard Temperature Plug
MIL-C-26482 Series 1
-40°C +120°C

A = Body length including end plates
B = Carrier Protrusion at mid calibration/null position
**C** = Null point to end of the carrier at mid calibration/null position

D = Core length
E = Bore depth
* = Cores shorter than 24.00 mm are threaded thru

Range (mm)		Guided core, Spring Return and Universal Joints						
		LVDT	DC & 4-20 mA	All			LVDT	DC & 4-20 mA
LVDT	DC & 4-20 mA	A	A	B	C	D	E	E
± 2.5	0-5	60.50	93.50	39.00	63.25	16.50*	41.75	73.75
± 5.0	0-10	79.50	110.50	46.50	80.50	29.00	62.50	93.50
± 7.5	0-15	86.50	120.00	49.50	87.00	34.00	69.50	100.50
± 10.0	0-20	101.50	134.50	56.25	101.00	40.00	84.00	115.00
± 15.0	0-30	116.50	148.50	65.75	117.75	37.50	98.25	129.25
± 25.0	0-50	137.50	170.50	78.50	141.25	38.50	120.00	151.00
± 50.0	0-100	194.50	227.50	113.50	205.00	50.00	177.25	208.25
± 75.0	0-150	245.50	278.50	159.50	276.00	50.00	227.50	258.50
± 100.0	0-200	301.50	333.50	190.75	336.00	50.00	285.00	316.00
± 150.0	0-300	146.50	448.50	299.25	502.00	50.00	400.00	431.00

Optimum Series

Dimensions (mm)

Standard Free Core

$\phi \frac{1.925}{1.875}$ 'D' ±0.10 $\phi \frac{1.062}{1.012}$ THRU

Standard Free Core/Carrier

'C' ±0.25
2-OFF M2 WASHER
2-OFF M2 NUT
6.00
$\phi \frac{1.925}{1.875}$ 'D' ±0.10
10.25
'B' ±0.25
M2x0.4-6g

5 Way Cable Option

ϕ 2.20 MAX
20.00 / 18.00
15.00 / 10.00
'A' ±0.25
$\phi \frac{9.512}{9.450}$
$\phi \frac{3.20}{3.10}$ THRU
M2x0.4-6g
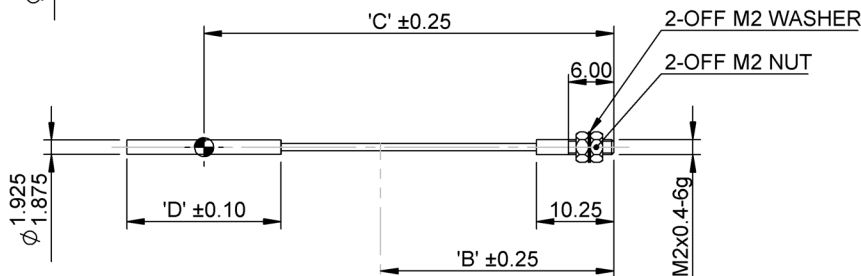
Reinforced Free Core/Carrier

'G' ±0.10 'E' ±0.25
$\phi \frac{2.800}{2.750}$
'F' ±0.25
8.00
2-OFF M2 NUT
2-OFF M2 WASHER

Threaded Free

$\phi \frac{2.800}{2.725}$ 'G' ±0.10
M2x0.4-6H
$\llcorner \phi \frac{2.20}{2.10} \downarrow 0.50$
BOTH CORE ENDS

5 Wire Option

300.00
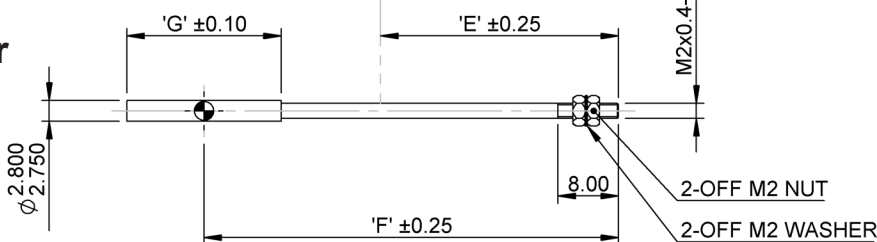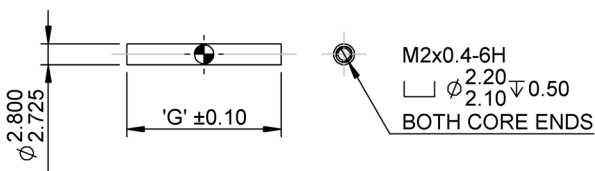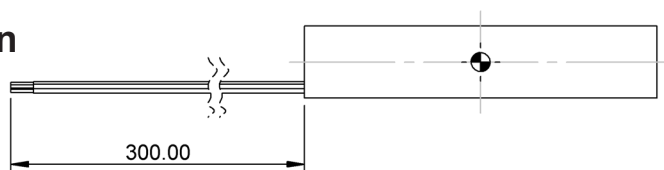
A = Body length
B = Stud protrusion at mid calibration/null position
C = Null point to end of the stud at mid calibration/null position
D = Ø1.90 core length

E = Carrier protrusion at mid calibration/null position
F = Null point to end of the carrier at mid calibration/null position
G = Ø2.75 core length

Range (mm)		A	B	C	D	E	F	G
LVDT	Digital							
± 1.5	0-3	20.60	14.75	25.00	12.00	16.00	26.50	11.00
± 6.0	0-12	46.50	23.00	46.25	28.40	23.00	46.25	28.40
± 10.0	0-20	46.50	31.00	54.25	20.40	31.50	54.75	20.40
± 12.5	0-25	83.30	34.00	75.50	50.80	34.00	75.50	50.80
± 25.0	0-50	83.30	51.00	80.00	26.00	51.00	80.00	26.00

Optimum Series

Dimensions (mm)

Standard Guided Core/Carrier

5 Way Cable Option
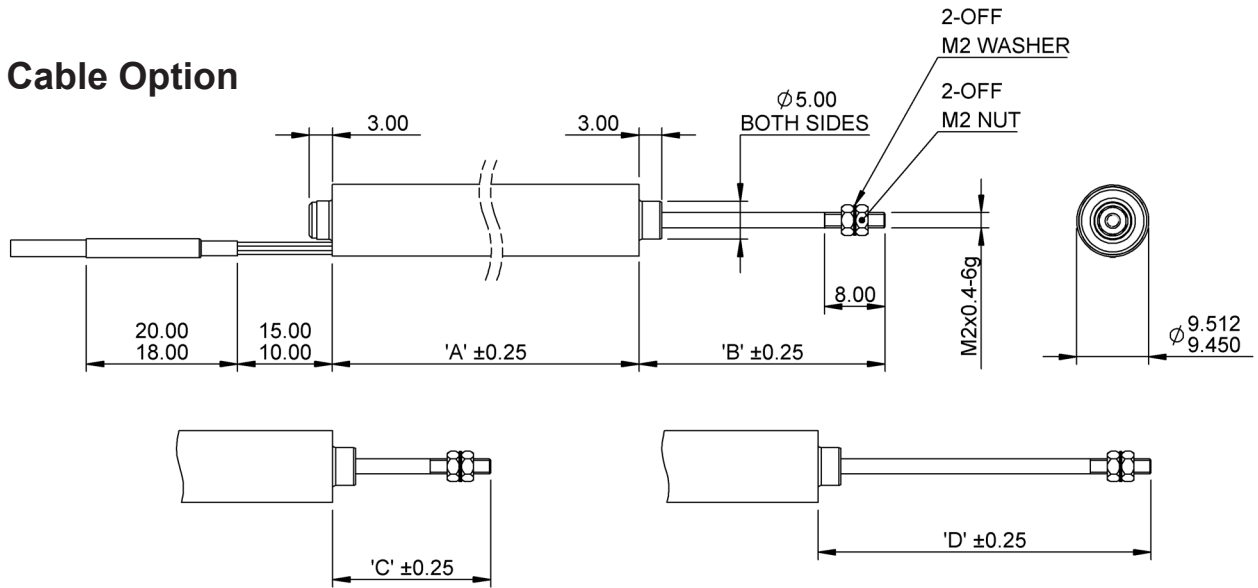
5 Wire Option

OP - Series Accessories

SPRING
(Part No. 208158)

BALL TIP
(Part No. 804619)
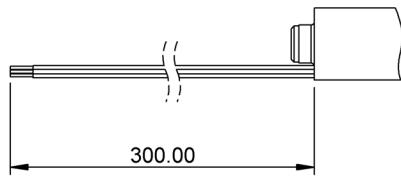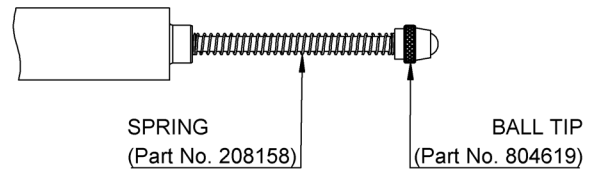
Universal Joint Kit
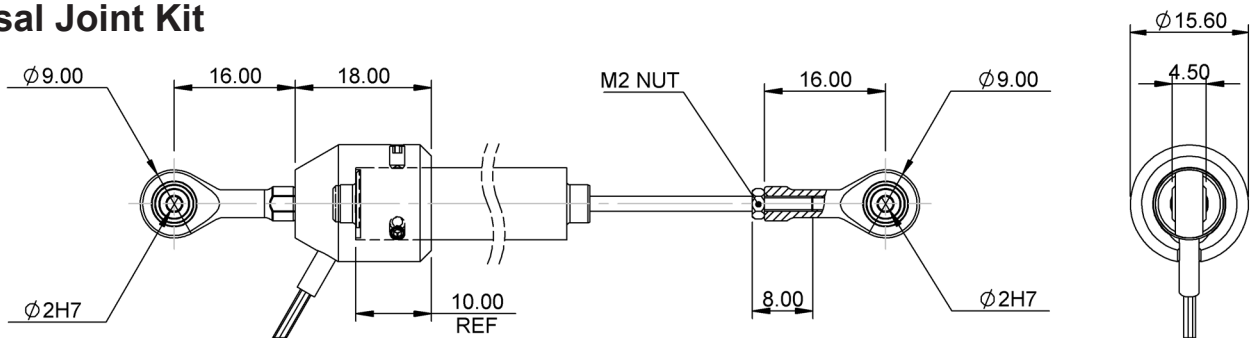
A = Body length
B = Carrier protrusion at mid calibration/null position
C = Fully retracted carrier
D = Fully extended carrier

Range (mm)		A	B	C	D
LVDT	Digital				
± 1.5	0-3	20.50	17.75	14.50	21.00
± 6.0	0-12	46.50	24.50	17.00	32.00
± 10.0	0-20	46.50	32.50	21.00	44.00
± 12.5	0-25	83.50	34.00	19.25	48.75
± 25.0	0-50	83.50	52.00	25.00	79.00

SM / DF(G)

Dimensions (mm)

SM series
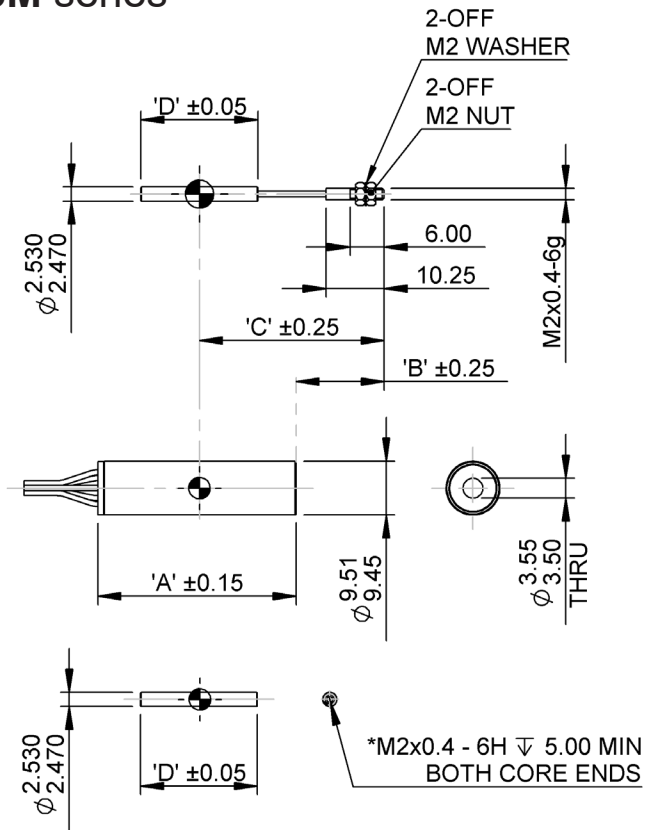
FREE CORE/CARRIER

Type	Range (mm)	A	B	C	D
SM/1	±1.0	15.15	12.75	20.00	9.70
SM/3	±3.0	35.00	15.50	32.50	20.60

A - Body length including end caps
B - Stud protrusion at mid calibration/null position
C - Null point to end of the stud at mid calibration/null position
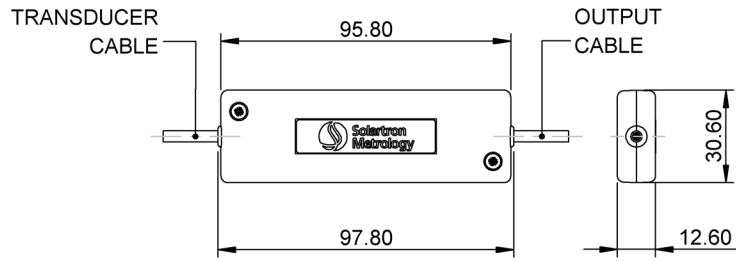D - Core length
 * - Cores shorter than 12.00 mm are threaded thru
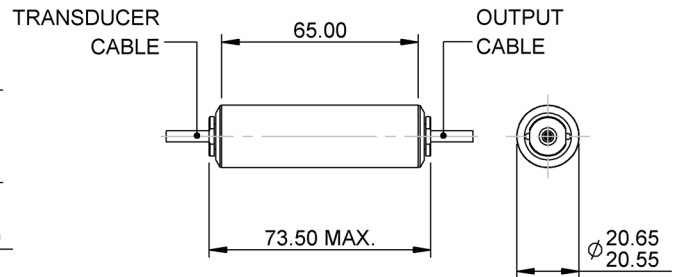
FREE CORE

DF(g) series
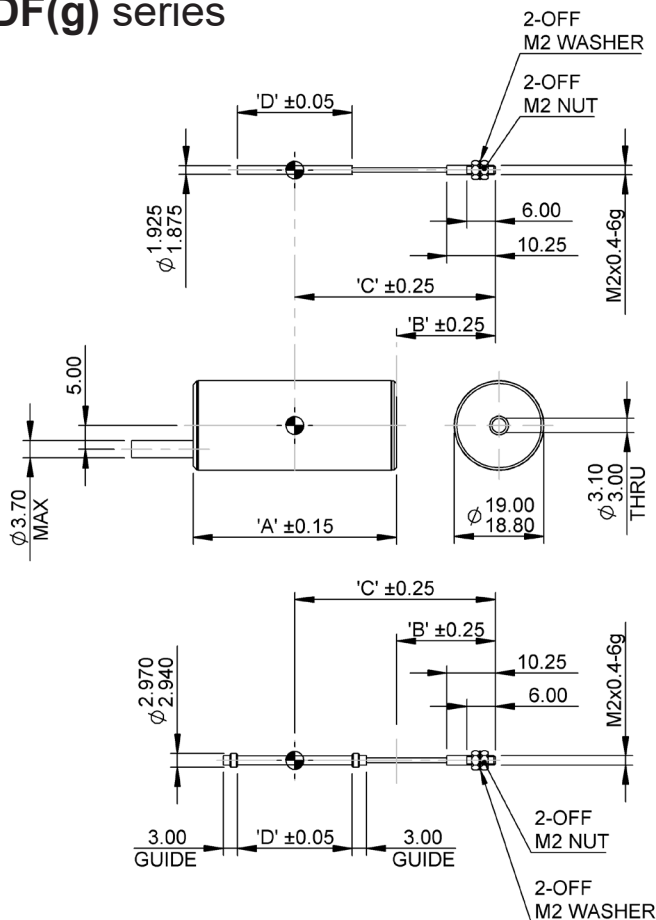
DF-SERIES CORE/CARRIER ASSEMBLY

Type	Range (mm)	A	B	C	D
DF/1.0	±1.0	37.00	21.75	40.25	20.00
DF/2.5	±2.5	37.00	21.75	40.25	20.00
DF/5.0	±5.0	43.00	21.00	42.50	24.30
DFg/1.0	±1.0	37.00	21.75	40.25	20.00
DFg/2.5	±2.5	37.00	21.75	40.25	20.00
DFg/5.0	±5.0	43.00	21.00	42.50	24.30

A - Body length including end caps
B - Carrier protrusion at mid calibration/null position
C - Null point to end of the stud at mid calibration/null position
D - Core length

DFg-SERIES CORE/CARRIER ASSEMBLY

M6D(H) / MD(H)

Dimensions (mm)

M6D(H) series
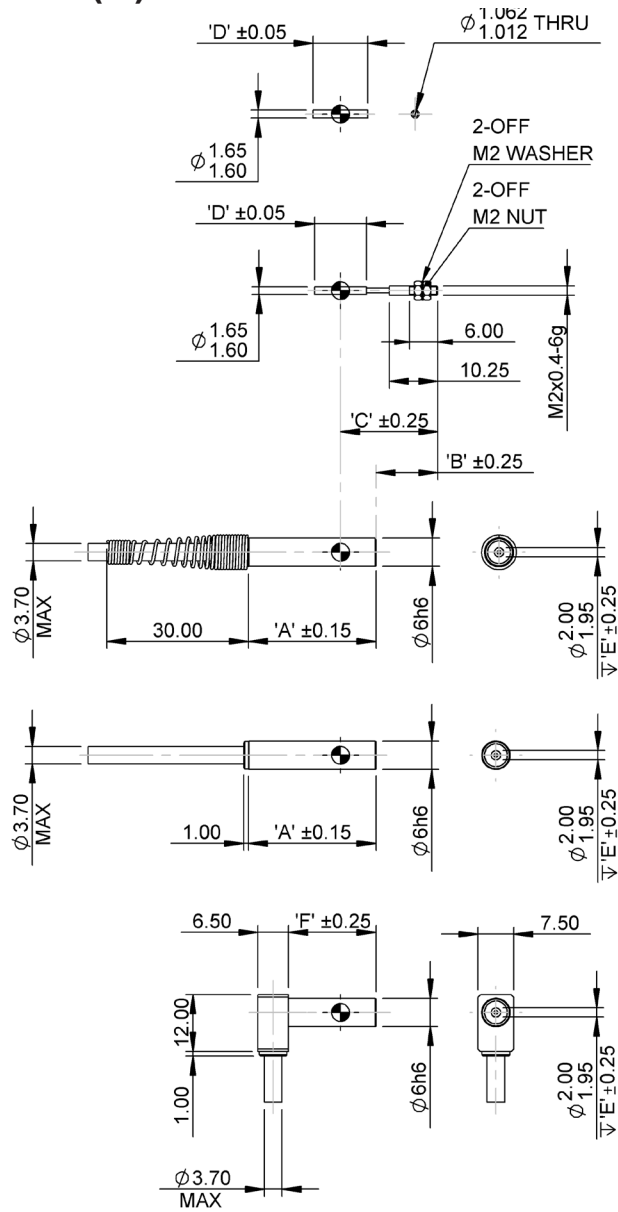
MD(H) series
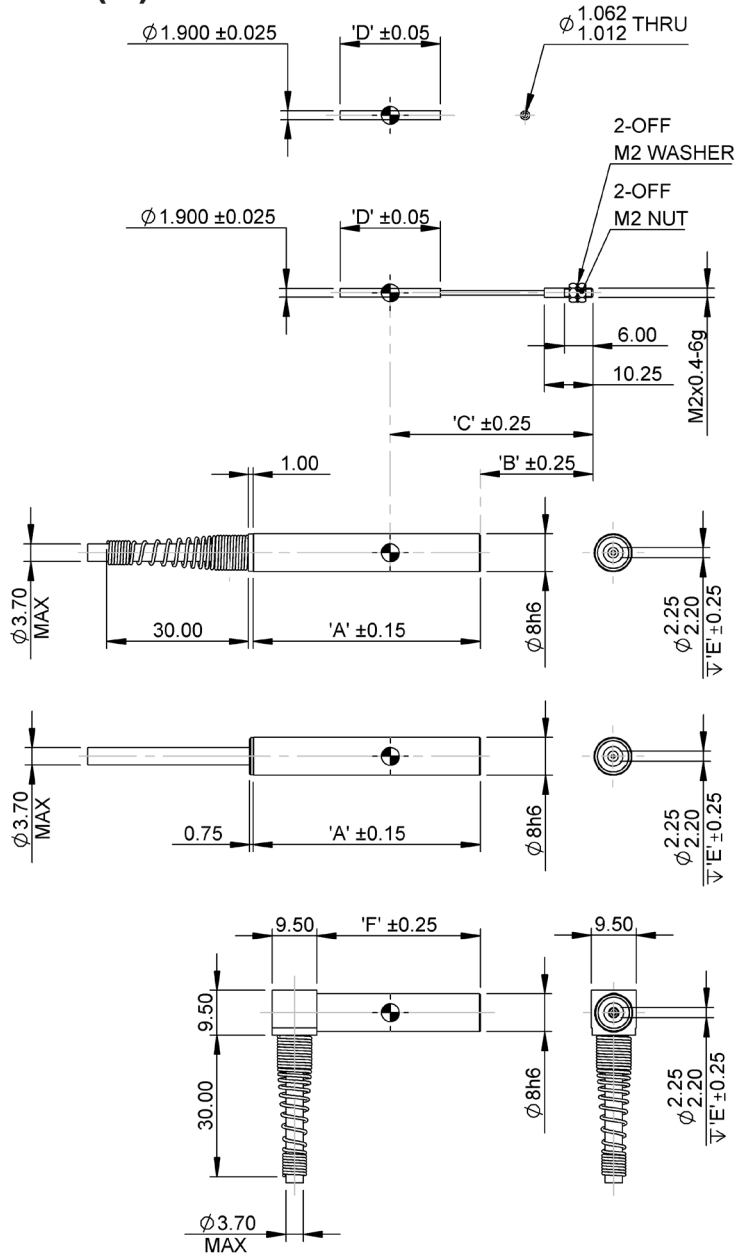
Type	Range (mm)	A	B	C	D	E
M6D/1.0	±1.0	27.00	13.00	20.50	11.00	16.25
M6DH/1.0	±1.0	27.00	13.00	20.50	10.25	16.25
MD/1.0	±1.0	27.00	11.75	20.25	11.00	16.50
MDH/1.0	±1.0	27.00	11.75	20.25	8.85	16.50
MD/2.5	±2.5	40.00	20.25	35.00	15.70	29.00
MDH/2.5	±2.5	40.00	20.25	35.00	15.00	29.00
MD/5.0	±5.0	48.00	23.75	42.75	21.20	37.50
MDH/5.0	±5.0	48.00	23.75	42.75	18.40	37.50
MD/10.0	±10.0	67.00	30.00	58.50	24.40	56.75
MDH/10.0	±10.0	67.00	30.00	58.50	28.80	56.75

Type	Range (mm)	F
M6DR/1.0	±1.0	18.50
M6DHR/1.0	±1.0	18.50
MDR/1.0	±1.0	13.50
MDHR/1.0	±1.0	13.50
MDR/2.5	±2.5	26.00
MDRH/2.5	±2.5	26.00
MDR/5.0	±5.0	34.50
MDHR/5.0	±5.0	34.50
MDR/10.00	±10.0	54.00
MDHR/10.00	±10.0	54.00

A - Body length including end caps
B - Carrier portrusion at mid calibration/null position
C - Null point to end of the stud at mid calibration/null position

D - Core length
E - Bore depth
F - Short exposed length

Signal conditioning modules
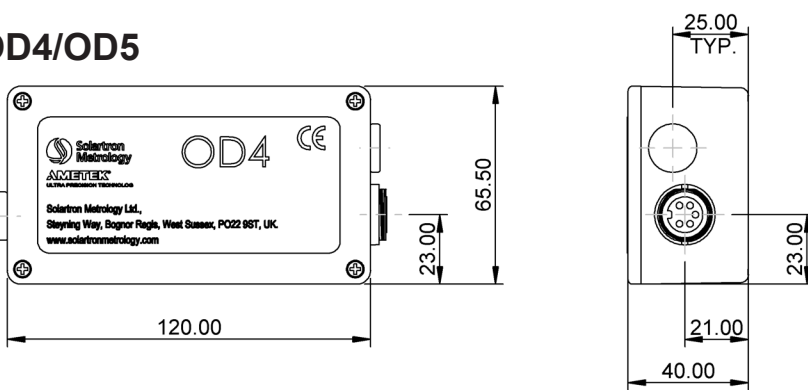
Dimensions (mm)

BICM IP40 in line module

TRANSDUCER CABLE 95.80 OUTPUT CABLE

97.80

30.60

12.60

BICM IP67 in line module

TRANSDUCER CABLE 65.00 OUTPUT CABLE

73.50 MAX.

∅ 20.65
20.55

OD2

4 x ∅ 4.25 THRU

80.00

25.00

21.00 REF.

120.00

28.00

55.00

50.00

15.00

6.00 108.00

OD4/OD5

25.00 TYP.

4.50

4 x ∅ 3.20 ▽ 8.00

65.50

23.00

120.00

23.00

21.00

40.00

56.50

22.50

22.50 22.50

4.00 112.00

ATM TTL coverter

4.25 TYP.

12.25
6.50 125.00

60.50 36.00

10.50 TYP.

112.50

OUTPUT CABLE

138.00

TRANSDUCER CABLE

31.00

7.75 4.00

9.00

DRC DIN rail module

111.50

Power
Fine Adjust
Gain
Offset

99.50

DRC

22.50

114.00 REF.
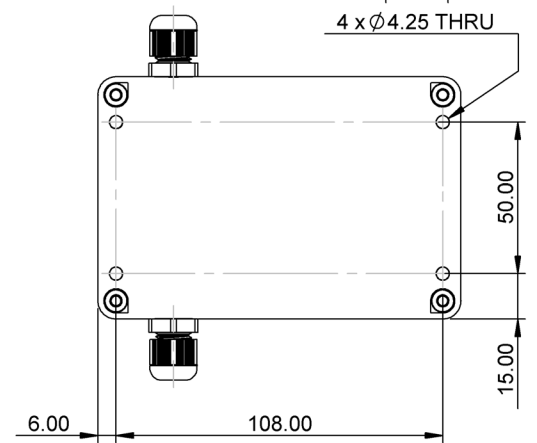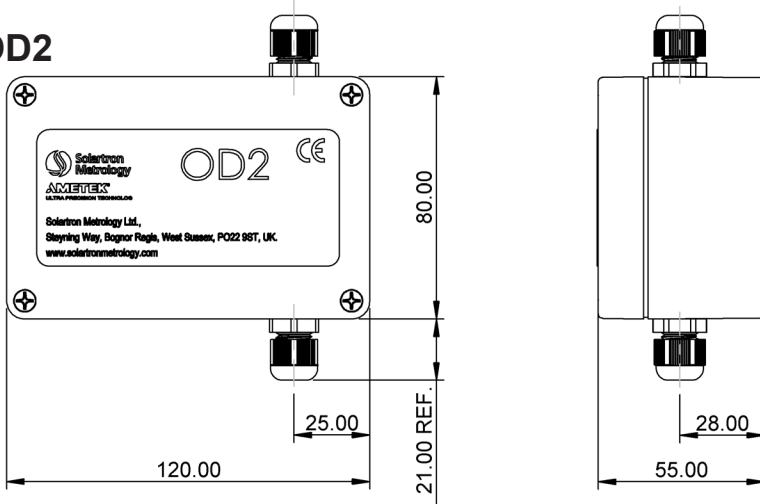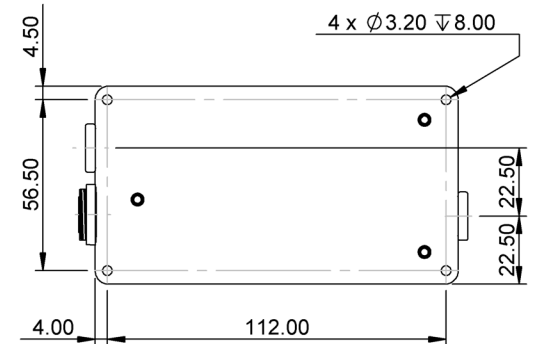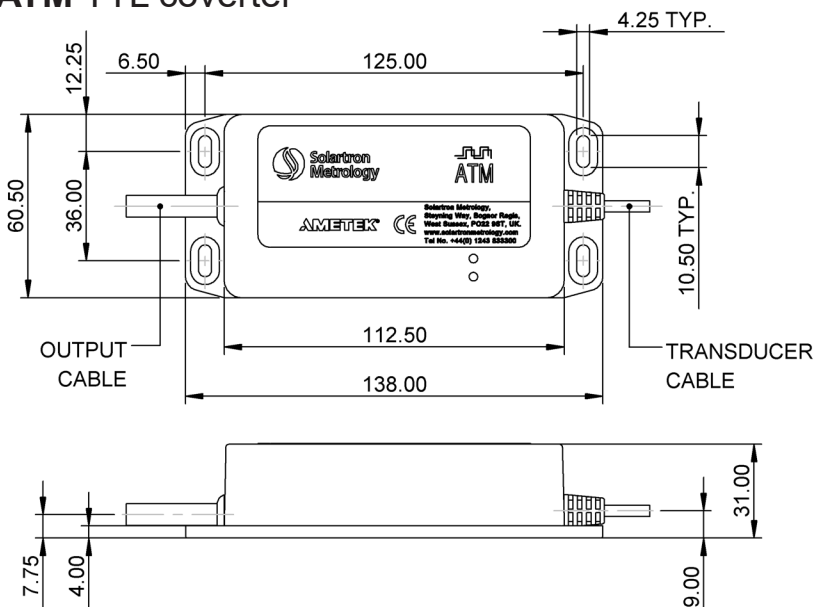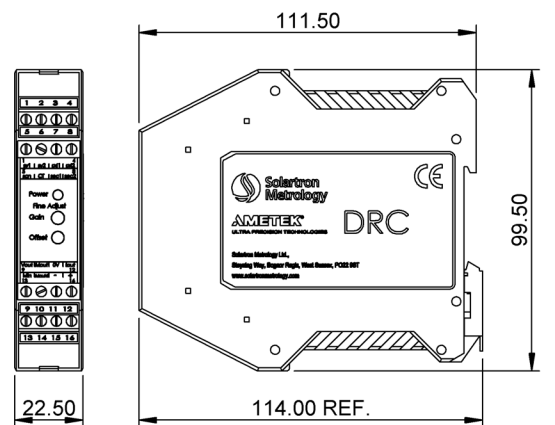
Other Solartron sensor solutions
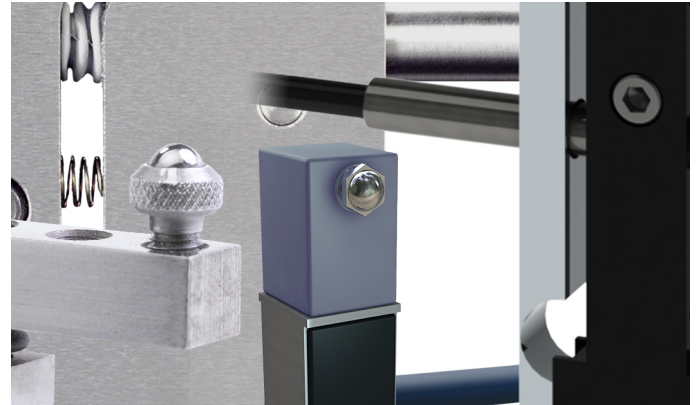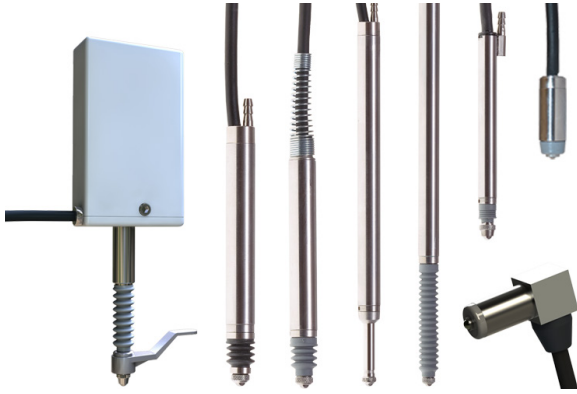
Gauging Sensors

Our Specialist Gauges make precision measurements of miniature parts, bores and cavities a simple and reliable process.

- ▶ Measurements range from 0.5 mm to 10 mm
- ▶ Resolution down to 0.01 µm
- ▶ Repeatability better than 0.25 µm
- ▶ IP65 protection
- ▶ LVDT and half bridge
- ▶ Pneumatic or spring push actuation
- ▶ Range of changeable tips

Specialist Gauging Sensors

Our extensive range includes Inductive and Optical Encoder Probes with integrated electronics.

- ▶ Measurements range from 0.5 mm to 10 mm
- ▶ Accuracy to 0.1% of reading (inductive) or 4 µm for encoders
- ▶ Resolution down to 0.01 µm or better
- ▶ Probe diameters from 6 mm
- ▶ LVDT and half bridge
- ▶ Spring push, Pneumatic push or Vacuum retract
- ▶ Precision linear bearings

Tried, tested and approved...

Sales Offices

UK (Headquarters and Factory)

Solartron Metrology
Bognor Regis, West Sussex, PO22 9ST
Tel: +44 (0) 1243 833 333
Fax: +44 (0) 1243 833 332
Email: sales.solartronmetrology@ametek.com

France

AMETEK SAS
Solartron Metrology Division
Elancourt, 78990 France
Tel: +33 (0) 1 30 68 89 50
Fax: +33 (0) 1 30 68 89 99
Email: info.solartronmetrology@ametek.fr

Germany

AMETEK GmbH
Solartron Metrology Division
40670 Meerbusch
Tel: +49 (0) 2159 9136 500
Fax: +49 (0) 2159 9136 505
Email: vertrieb.solartron@ametek.de

China

AMETEK Commercial Enterprise (Shanghai)
Co., Ltd
Shanghai, 200131, China
Tel: +86 21 5763 2509
Email: china.solartronmetrology@ametek.com

North America

Solartron Metrology
USA Central Sales Office
Gastonia, NC 28054
Tel: +1 800 873 5838
Email: usasales.solartronmetrology@ametek.com

Distributors

Solartron have 30+ distributors worldwide, see website www.solartronmetrology.com for your nearest distributor

Precision Driven...

In the laboratory, on the shop floor or in the field, Solartron Metrology's products provide precise linear measurements for quality control, test and measurement and machine control. Solartron Metrology is a world leader in the innovation, design and manufacture of precision digital and analogue dimensional LVDT gauging probes, displacement sensors, optical linear encoders and associated instrumentation.

Solartron
Metrology
AMETEK®
ULTRA PRECISION TECHNOLOGIES

BSI REGISTERED

UKAS QUALITY MANAGEMENT 003

Solartron Metrology pursues a policy of continuous development. Specifications in this document may therefore be changed without notice.