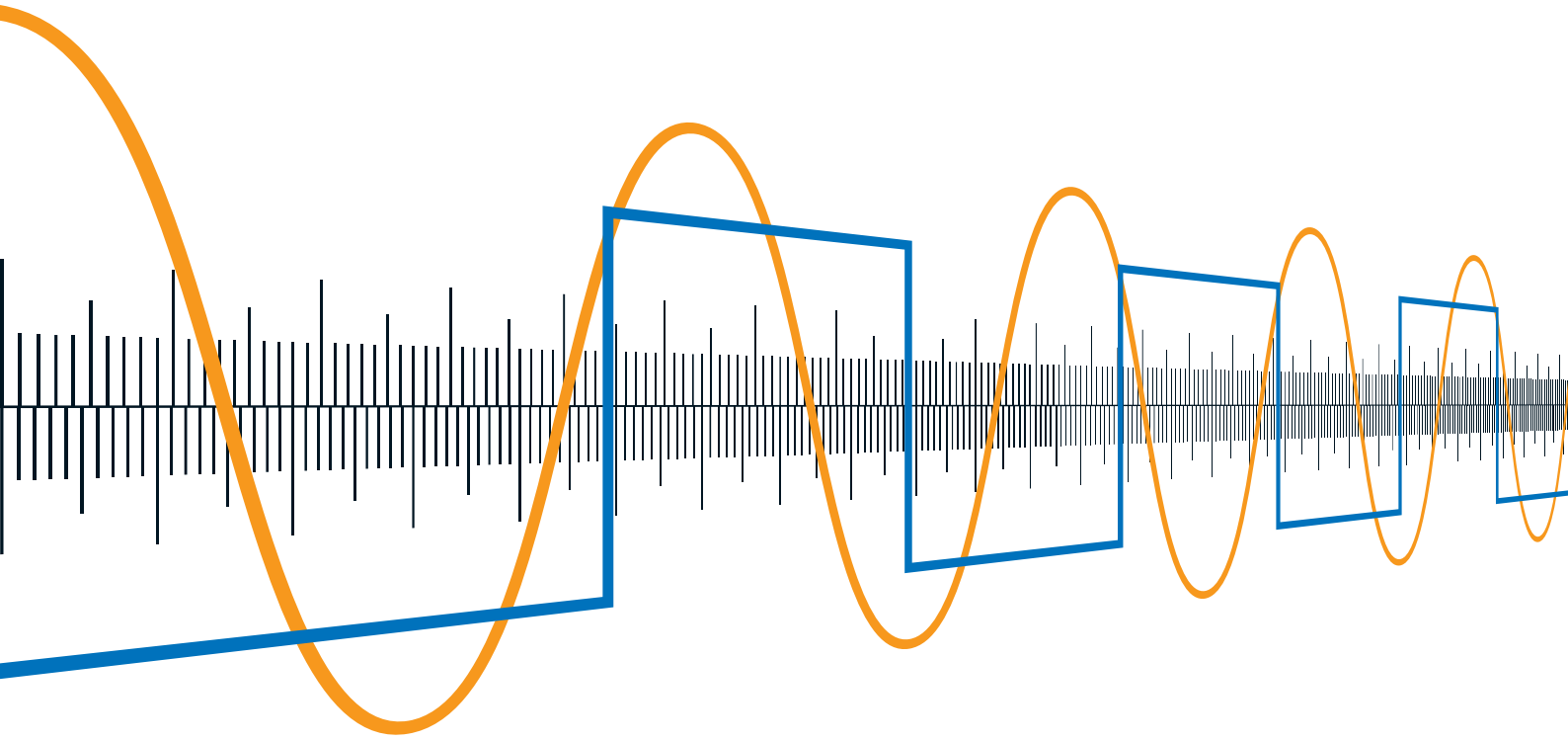
solartron metrology

World leaders in
linear measurement

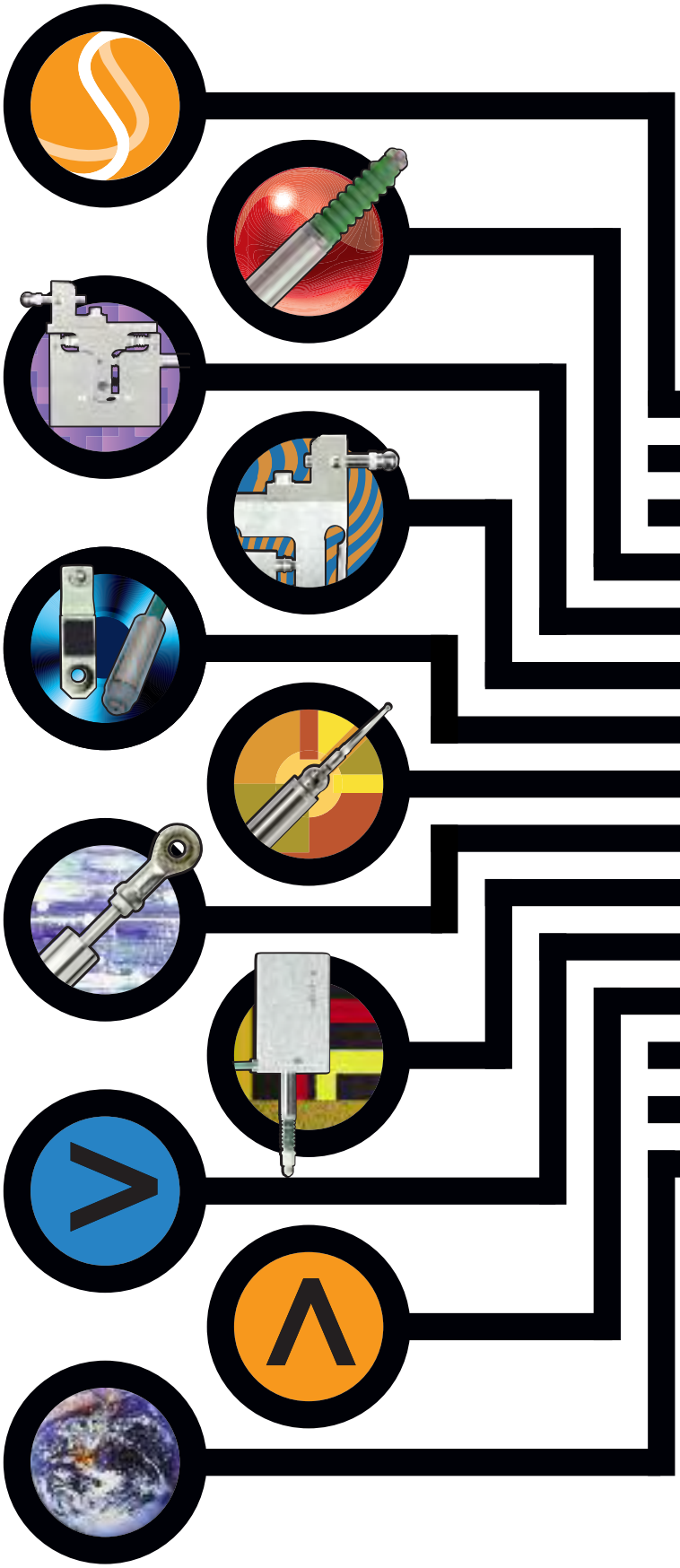


AMETEK
ULTRA PRECISION TECHNOLOGIES

Welcome to the Solartron Metrology catalogue. Since the last edition, we have introduced a host of new products, many of which are available in both analogue and digital format. To make selection more convenient, measurement devices are now grouped in families, irrespective of format. Analogue products are colour coded orange and digital products, blue. Analogue electronics and digital electronics appear in separate chapters towards the back of the catalogue.

analogue **digital**

Contents



World leaders in linear measurement...

Solartron Metrology is a world leader in the innovation and manufacture of precision digital and analogue dimensional gauging probes, displacement transducers, optical linear encoders and associated instrumentation.

Headquartered in the UK, with sales offices in the Americas, Europe and Asia, and distributors in over 30 countries worldwide, around 90% of our production is exported.

In the lab, on the shop floor or in the field, Solartron Metrology products provide precise linear measurements for quality control, test and measurement and machine control in, for example, the automotive, electronics, aerospace, materials, optics and semiconductor industries... anywhere, in fact where accuracy and consistency are critical to the process.

The inherent reliability of Solartron Metrology measurement technologies reduces the cost of ownership, a big factor for many users.

As mechanical components become smaller and more intricate, the accuracy of their manufacture is an increasingly complex challenge. Our latest smaller, more adaptable gauging products, including flexure, lever and mini probes, and block gauges are designed to address these problems. We also have a new range of advanced displacement transducers, the S Series, engineered to interface with modern data acquisition and control systems.

The inherent simplicity and flexibility of the company's Orbit digital network system makes it the perfect platform for all these new measuring devices plus, of course, others in the pipeline.

Solartron Metrology recently became part of the Electronic Instruments Group of AMETEK Inc, a leading global manufacturer of electronic instruments and electric motors with annual sales of more than $1.6 billion.

Rest assured that wherever you are, whatever your application, we have the technology, the commitment and the resources to help you make it better.

solartron metrology

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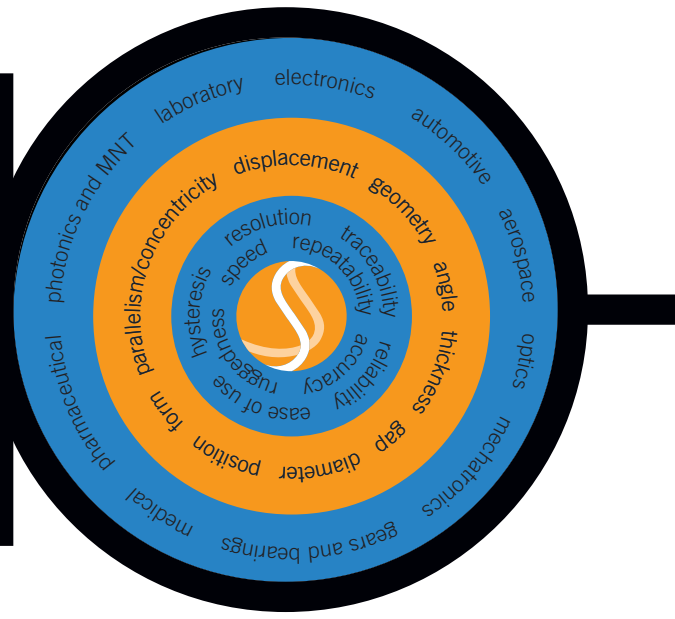
ULTRA PRECISION TECHNOLOGIES



...with sixty years' continuous innovation

1946

Solartron Metrology has its origins in a company called Faroll Research who were formed in 1946 as a mechanical engineering company sub-contracting to the Admiralty. At the same time Faroll Research was engaged with Professor K. Weissenberg in the development of a Rheogoniometer, an instrument used to measure the properties of fluids and other non-Newtonian materials. The partnership between Faroll Research and Weissenberg flourished in that the Rheogoniometer became the world wide standard during the 1950's and 60's in the measurement and determination of fluidic properties such as viscosity, elasticity and thixotropic properties of many compounds. It was during the development of the Rheogoniometer that the first displacement transducer was used, this initially being purchased from a company called Boulton Paul Wolverhampton and was an essential measurement feature within the instrument.

1965

In 1965 Faroll Research was sold with its product range, including the Rheogoniometer, to Sangamo Weston Limited and became known as Sangamo Weston Controls Limited. During the latter part of the 1960's and into the 1970's Sangamo Weston continued to market and manufacture the Rheogoniometer and develop other instruments involved in various forms of physical measurement. It was during this period that Boulton Paul indicated they no longer wished to manufacture the displacement transducer and offered the product line to Sangamo Weston Controls Limited.

1976

After the acquisition of this new displacement transducer product line, Sangamo Weston Control developed it further to give a wider range for differing operational uses, and introduced a complementary set of signal conditioning electronics. In 1976 Sangamo Weston was acquired by Schlumberger and the Division in Bognor Regis became known as Sangamo Transducers. In 1979 Sangamo Transducers produced its first gauging transducer using a linear ball race which gave significant advantages in repeatability over the products available on the world market at the time.

In the 1980's Sangamo Transducers continued to develop complementary products to the displacement transducer adding further models to the range, and at the same time extending the signal conditioning electronics to add computer system capability for the user. It was during this period the Rheogoniometer, originally developed by Dr. Weissenberg, began to decline in sales as newer techniques and technologies became available and in 1985 this product line was sold to another U.K company.

1985

From this period in 1985 Sangamo Traducers became known as Schlumberger Industries, Transducers Division, Bognor Regis. They concentrated solely on the manufacture of displacement transducers, gauging transducers and supporting electronics to the point that they became recognised as a world leader in this form of technology with products being sold throughout the western world.

1993

In November 1993, following a management buyout, the Transducer Division became part of the Solartron Group Ltd and became known as Solartron Metrology. Then in April 1994, the ROXBORO GROUP PLC bought Solartron Metrology and the other Solartron Group Ltd companies.

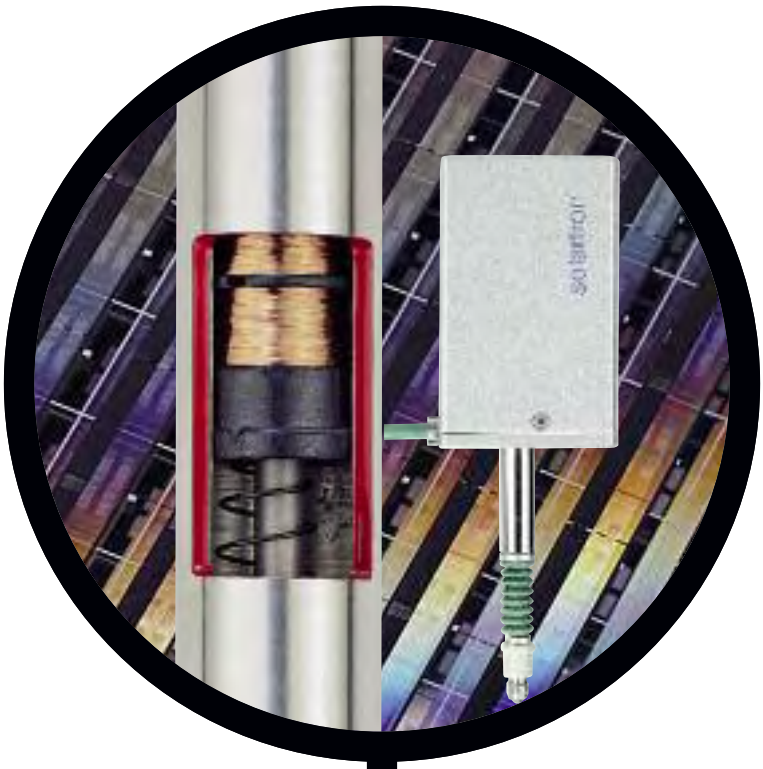
2006

In 2005, three of the Solartron group companies, including Solartron Metrology were acquired by AMETEK, a leading global manufacturer of electronic instruments and electric motors.

Solartron Metrology manufactures all performance-critical components to the most exacting standards.
The honing machine shown here represents an investment of over £400,000

Process	Performance
Grinding:	< 1µm (3 - 10mm o/d)
Honing:	< 1µm (down to 4.2mm i/d)
Calibration:	Accuracy to ± 0.1µm (traceable) Repeatability to 0.05 µm (six sigma)

Principles of operation



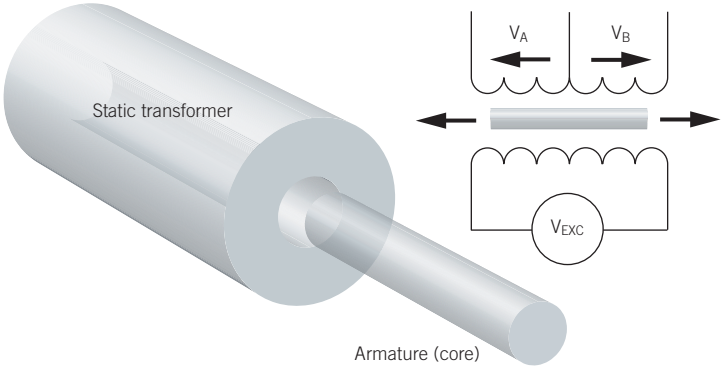
The following section explains the fundamental principles upon which Solartron Metrology's linear measurement products are based.

> Inductive technology (gauging and displacement)
> Optical technology (linear encoders)
> Digital networking (Orbit®)

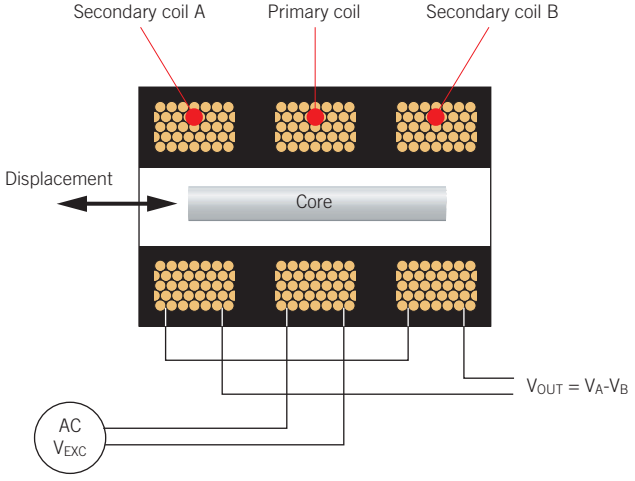
Inductive technology

6 Principle of operation

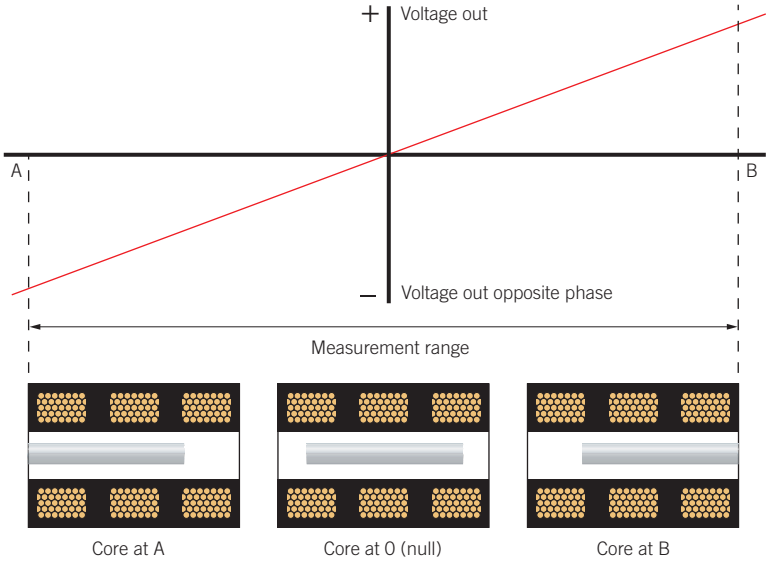
An LVDT inductive displacement transducer is constructed using a static transformer (primary winding) and two secondary windings.
The windings are formed on a hollow bobbin through which a magnetic core can travel.
The magnetic core provides a path for linking the coils via the magnetic flux.
When the primary winding is connected to an AC supply, current starts to flow in the secondary coils. A simplified electrical schematic is shown in the figure.



The secondary coils A and B are connected in series opposition so that the two voltages V_A and V_B have opposite phase and the transducer output is V_A- V_B.
If the core is in the centre position then voltages of equal magnitude but opposite phase will be induced in each secondary coil and the net output is zero.
As the core is moved in one direction, the voltage in the corresponding secondary coil increases while the other coil experiences a complementary voltage reduction. The net effect is a transducer voltage output that is proportional to displacement.
Knowledge of the magnitude and the phase of the output with respect to the excitation signal allows one to deduce the position and direction of the core motion from the null position.



The output of an LVDT is a linear function of displacement over its calibrated measurement range. Beyond this range the output becomes increasingly non-linear. Measurement range is defined as ± distance from the transducer null position.



The Linear Variable Differential Transformer (LVDT) and Half-Bridge are two alternative approaches to the coil format and are described in this section. LVDT and Half-Bridge transducers convert the movement of a core within the magnetic field produced by an energised coil into a detectable electrical signal.

Conventional Half Bridge

The Half Bridge transducer forms half of a Wheatstone bridge circuit, which enables change from null to be readily determined. The other half of the bridge is built into the amplifier. When the core is in a central position, the two signals V_A and V_B are equal. As the core is displaced, the relative inductance of the two windings changes producing a complimentary change in V_A and V_B.

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.

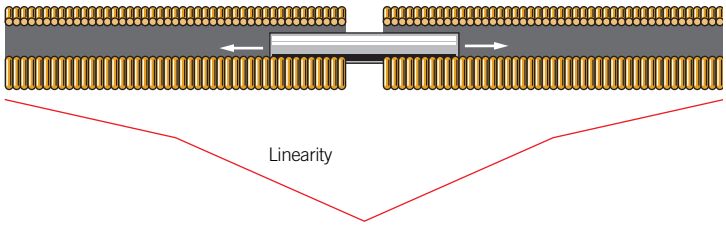
Solartron Half Bridge and LVDT transducers

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

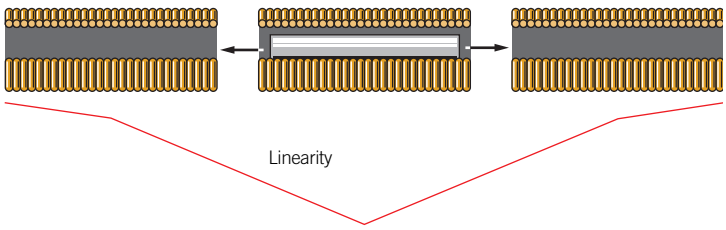
Solartron Orbit digital transducers

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

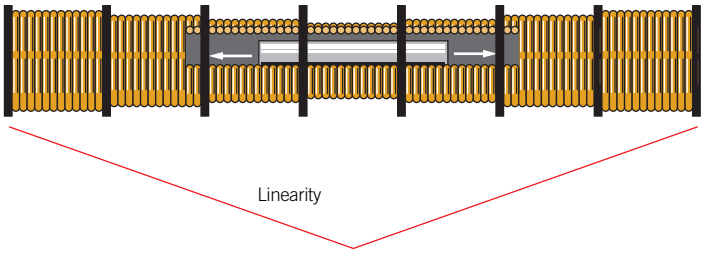
Conventional half bridge

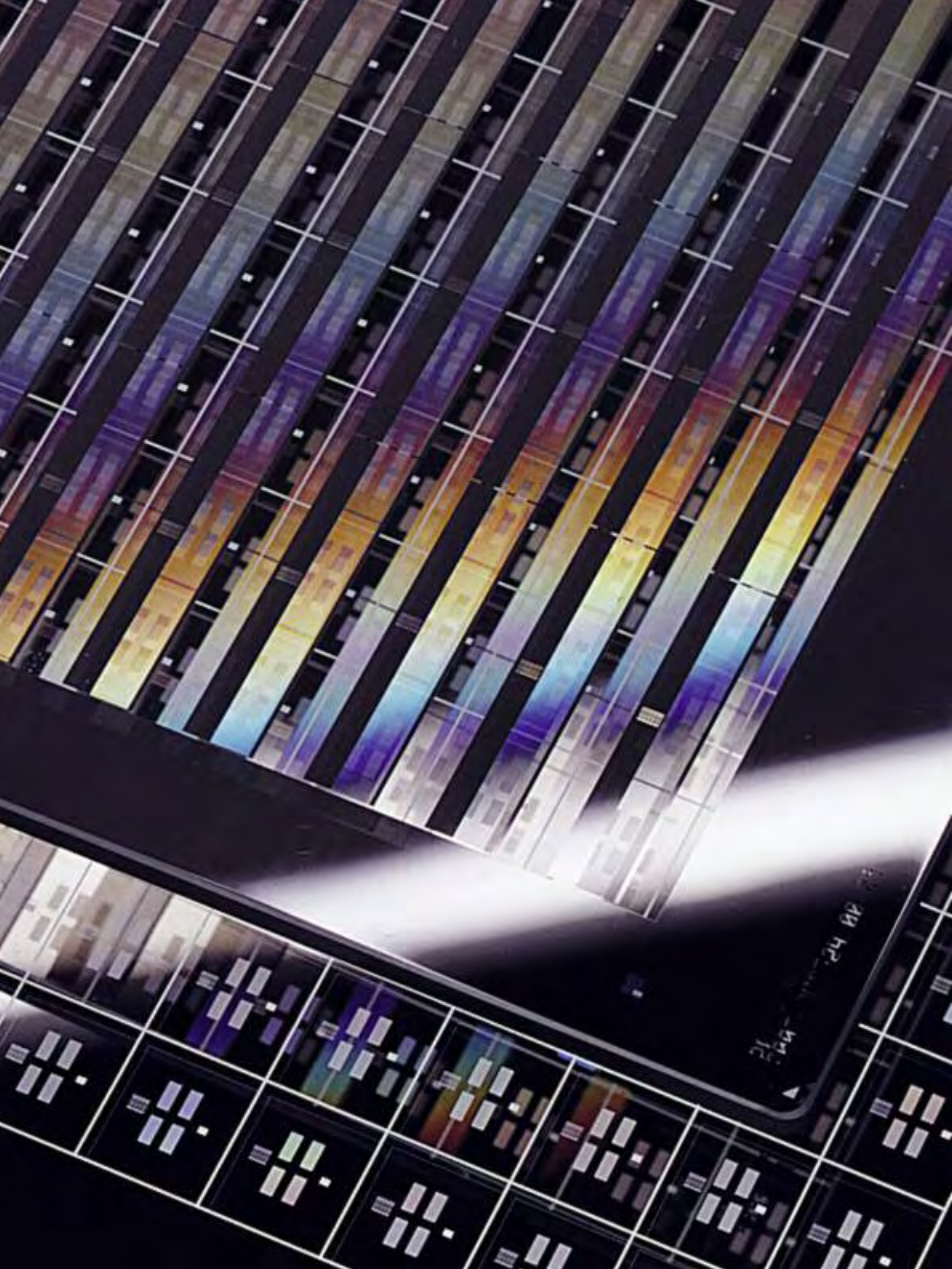


Conventional LVDT



Solartron half bridge and LVDT transducers





Optical technology

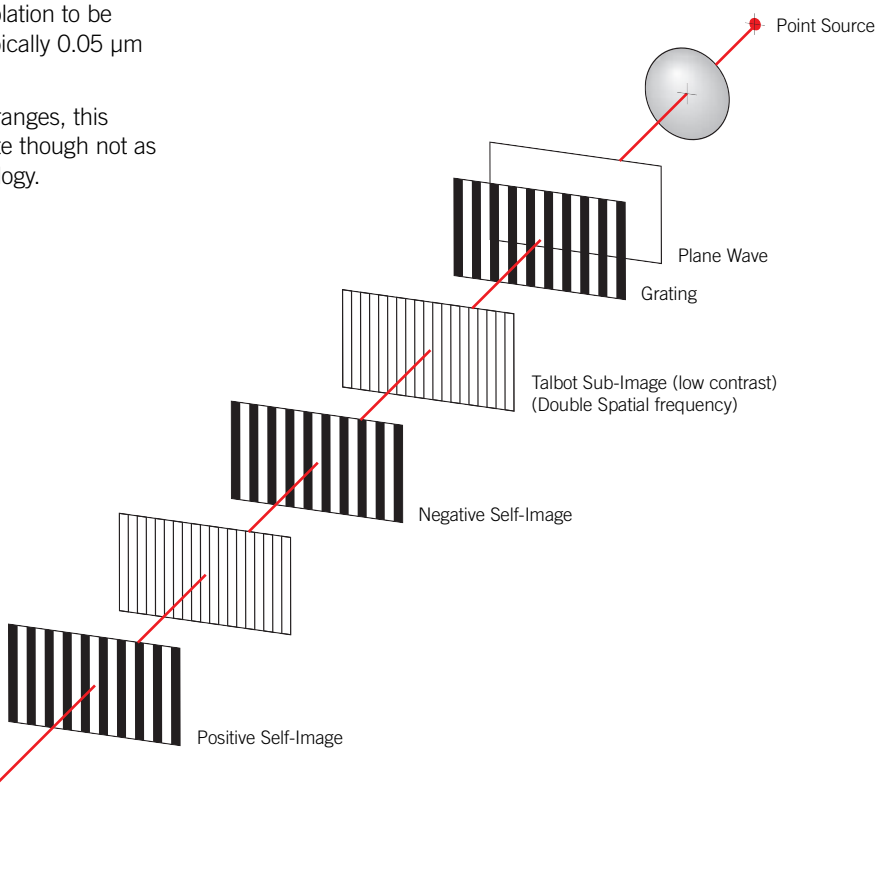
Solartron linear encoders operate on the principle of interference between two diffraction gratings. Solartron uses precision Ronchi type gratings with a 10µm period deposited on a low expansion quartz substrate.

Collimated light from a light emitting diode (LED) is used to illuminate an amplitude diffraction grating thus producing spatially modulated light intensity at the output. At a specific distance behind the modulating grating, a second diffraction grating with similar diffraction properties (the scale) is used to scan this intensity modulation as it is moved. A photodiode positioned behind the two gratings converts the high contrast optical fringes into a current, which is directly related to scale displacement.

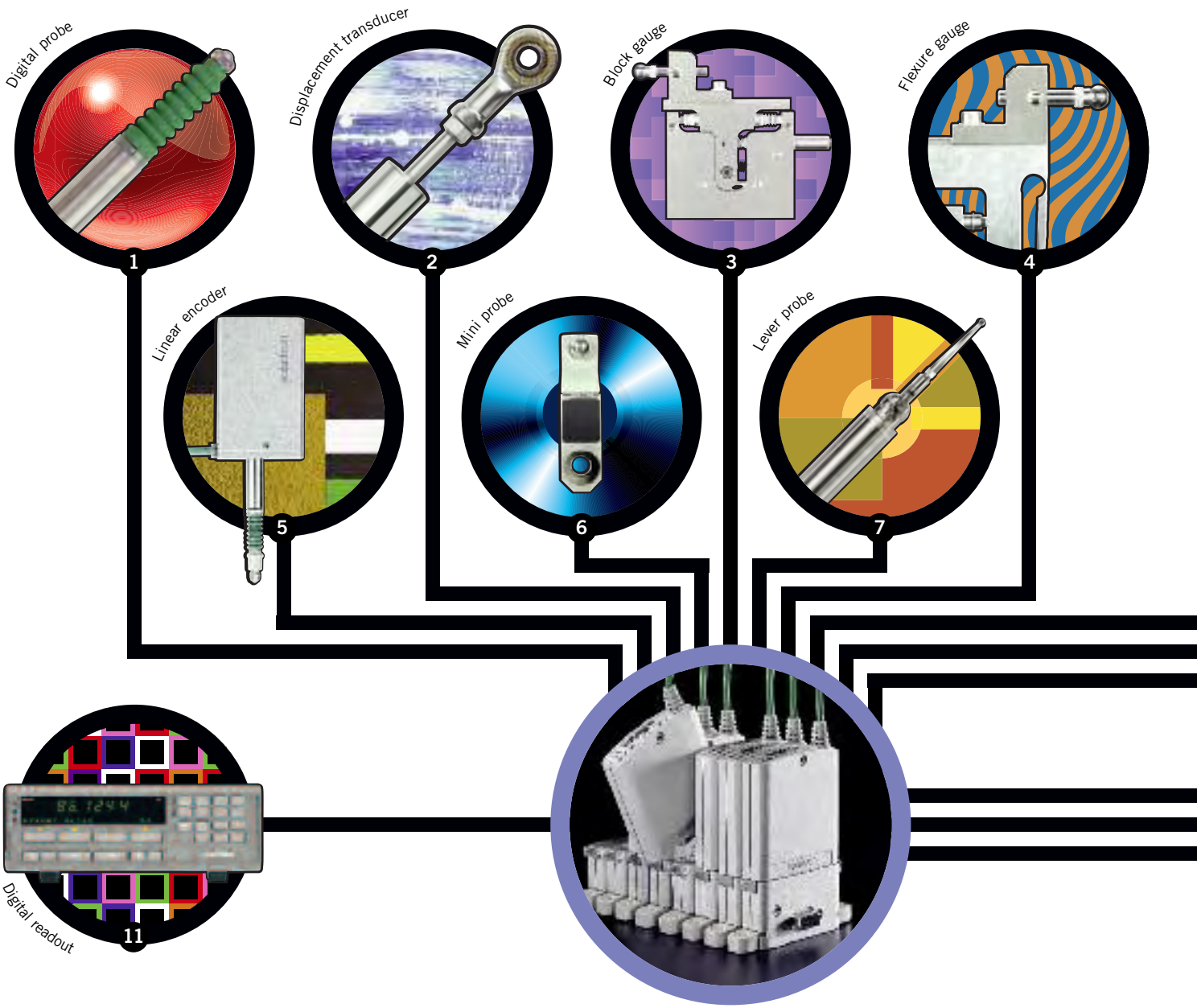
The periodic nature of the encoder signals means that the scale displacement can only be determined unambiguously over a short distance corresponding to the scale period. By using a four field scanning grating, the direction of displacement of the scale is determined. Also, the incorporation of a reference mark overcomes the displacement ambiguity after system power down.

The low noise nature of the encoder output signals allows electronic interpolation to be used to achieve resolutions, typically 0.05 µm or less.

Over relatively long measuring ranges, this technology is extremely accurate though not as rugged as the inductive technology.



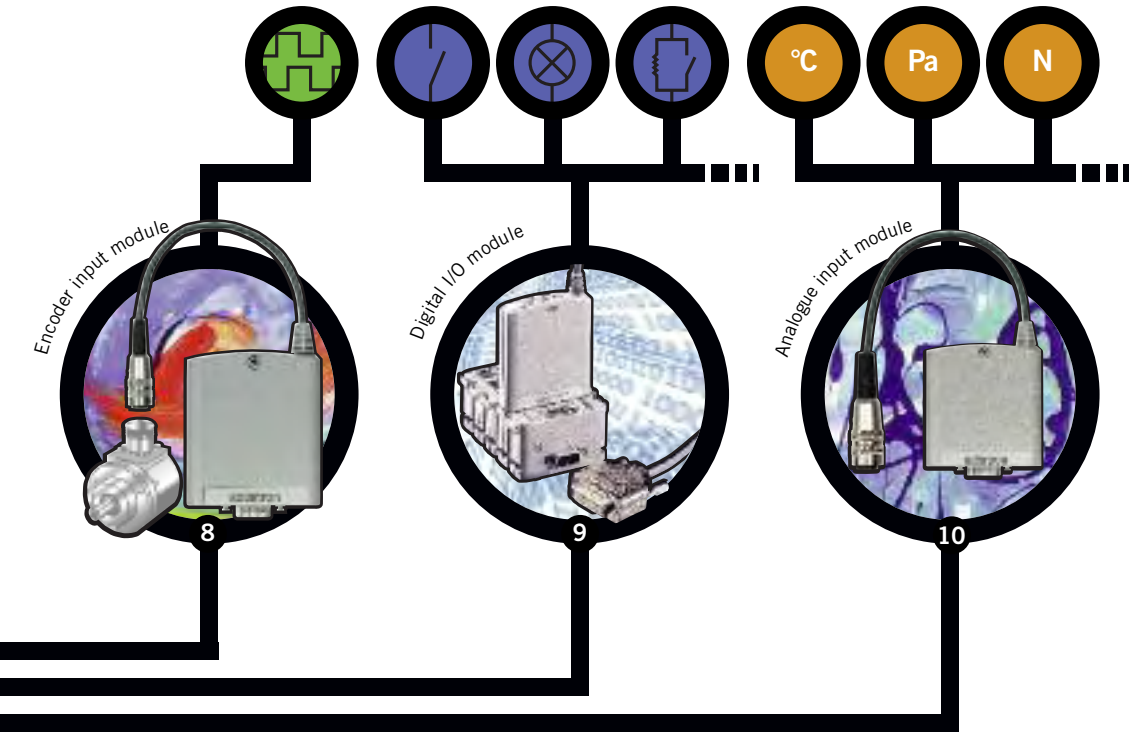
Orbit® digital network

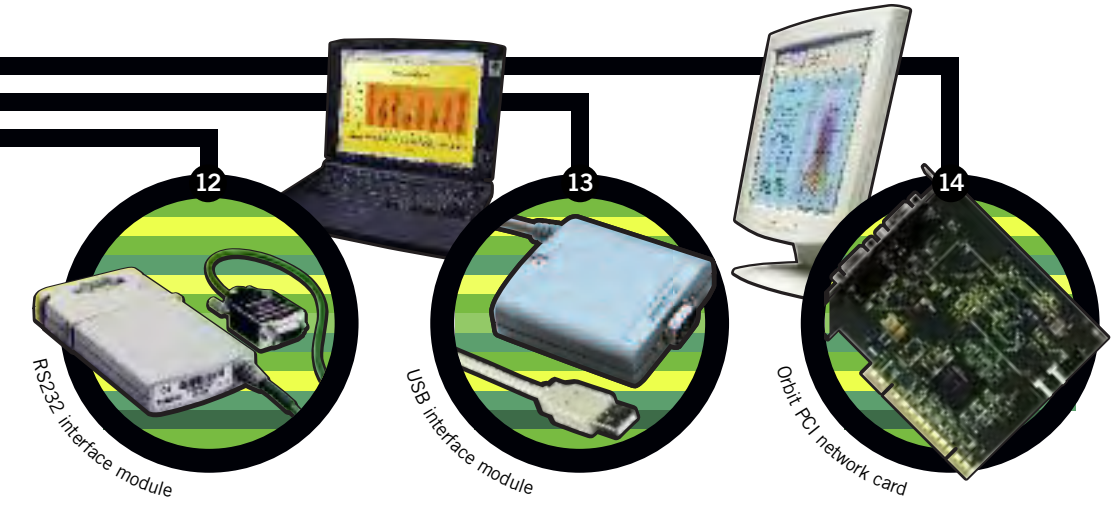


Orbit® is based on an RS485 half-duplex multi-drop network. Multiple transmitters and receivers may reside on the communications line. Only one transmitter may be active at any given time. The Orbit protocol serves to designate the identity of the active transmitter. Orbit is a very effective system for use within small to medium size industrial networks with a data rate up to 1.5Mbaud.
Each module connected on the network translates its input (AC, DC or digital) into digital data which is transmitted on the RS485 network using asynchronous transmission (poll/response).
At the receiver end of this communications link, there is a choice of controllers - a PCI network Card for use with a PC, a USB Interface, an RS232 Interface Module or Solartron's own digital display. The choice of interface is dependent on the application and the Orbit operating mode (Standard Buffered or Dynamic).

CE

All Orbit products carry the CE mark





Orbit® controllers

Orbit Controllers	No. of devices	Description	Module support
11 Digital Readout	Up to 30	Display Module	Standard
12 RS232 Interface Module	Up to 31	Single Channel serial interface	Standard & buffered
13 USB Interface Module	Up to 31	Single Channel serial interface	Standard & buffered
14 Network Card	Up to 62 in standard mode	2 Channel / PCI card. Can interface 31 modules per channel	Standard, Dynamic (high speed) & buffered

Orbit® inputs

1 Spring push or pneumatic gauging probes with 8mm or 6mm diameter and measurement ranges of 1, 2, 5, 10 or 20mm

2 Digital displacement transducers with 2 to 200mm measuring ranges

3 Robust transducer for industrial gauging 2, 5 and 10mm measuring ranges

4 High repeatability transducer probe interface without bearings. 2mm measuring range

5 High accuracy guided optical encoder gauges with 12, 25, 50, 100mm measuring ranges

6 Low profile miniaturized transducer with 0.5mm measuring range

7 Small stylus probe offering versatile mounting capabilities, 0.5mm measuring range

8 Interface to rotary and linear scale incremental encoders (TTL)

9 Interface to discrete switches and to provide switch outputs. 8 I/O lines

10 Interface to physical sensors with a DC output or 4-20mA

Other Orbit modules (not shown)

Power Supply Interface Module: Provides power to Orbit modules

Motor Drive Module: Control module for use with motorised versions of the Linear Encoders

Orbit® software

Solartron Metrology provides support software for Microsoft Windows. This software includes a COM object library for COM applications and DLL's for lower level programming. This enables transducer readings to be acquired directly into Excel. Support is also provided for all major programming languages such as VBA, VB, C++, Borland C Builder and Delphi.

Advantages of **Orbit®**

> Simple modular system means that measurement systems can be put together easily, quickly and cost effectively.

> One stop shop: all measurement components supplied including sensors, electronics, interconnection system and software drivers.

> Mix transducer types on a single network, with one common interface, regardless of sensor technology. In addition to Solartron digital transducers, connect third party sensors, e.g. pressure, temperature, force through the Orbit Analogue Input Module (AIM). Read switch inputs and set control outputs through the Orbit Digital Input / Output Module (DIOM).

> Reduce cabling between the measurement system and computer - up to 31 measurement modules connected through a single cable. Build large measurement systems (up to 372 modules in a single system), with minimal cabling.

> Take readings directly into Microsoft Excel® for powerful data processing capability and rapid measurement system development. Support for all common programming languages including National Instruments® LabVIEW®

> Up to 3,906 readings per second for high performance dynamic capability. Synchronise readings across multiple transducers. Synchronise linear measurements with angular measurements, through the Orbit Encoder Input Module (EIM).

> Programmable resolution and measurement bandwidth, allows quasi-static measurements to be made with high resolution (up to 18 bits) and very low noise.

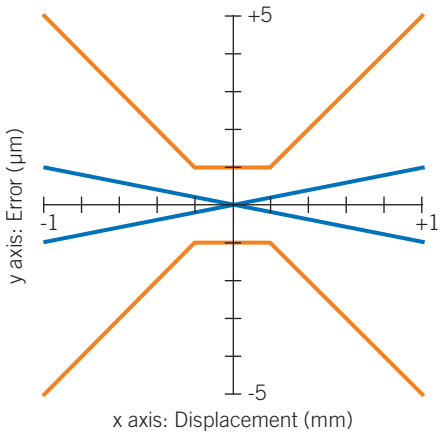
> Transducers permanently connected to electronics and calibrated as a single unit needing no adjustment. This gives confidence that the calibration cannot be inadvertently nullified or tampered with. Specifications include the total measurement system error.

> All active Orbit components are CE marked and have excellent electrical noise immunity and very low emission levels.

> Fewer transducer electrical configurations, significantly reduces spares holding requirement.

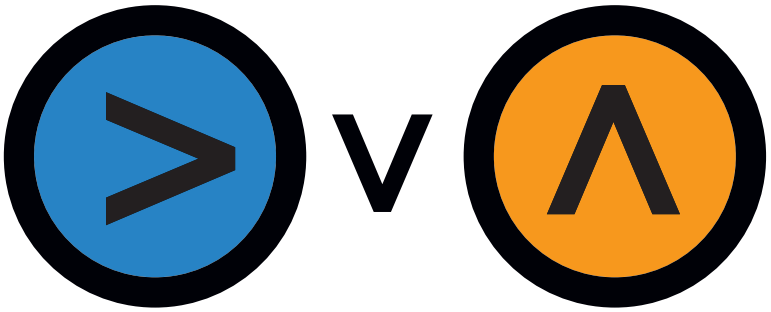
> Flexible gauge design is possible because it is not imperative to use a gauge probe with a short measuring range to attain a high resolution.

> Solartron Digital transducers calibrated using laser interferometers are error mapped to significantly improve linearity. In gauging applications this minimises number of setting masters required, reducing investment costs and ongoing cost of ownership.

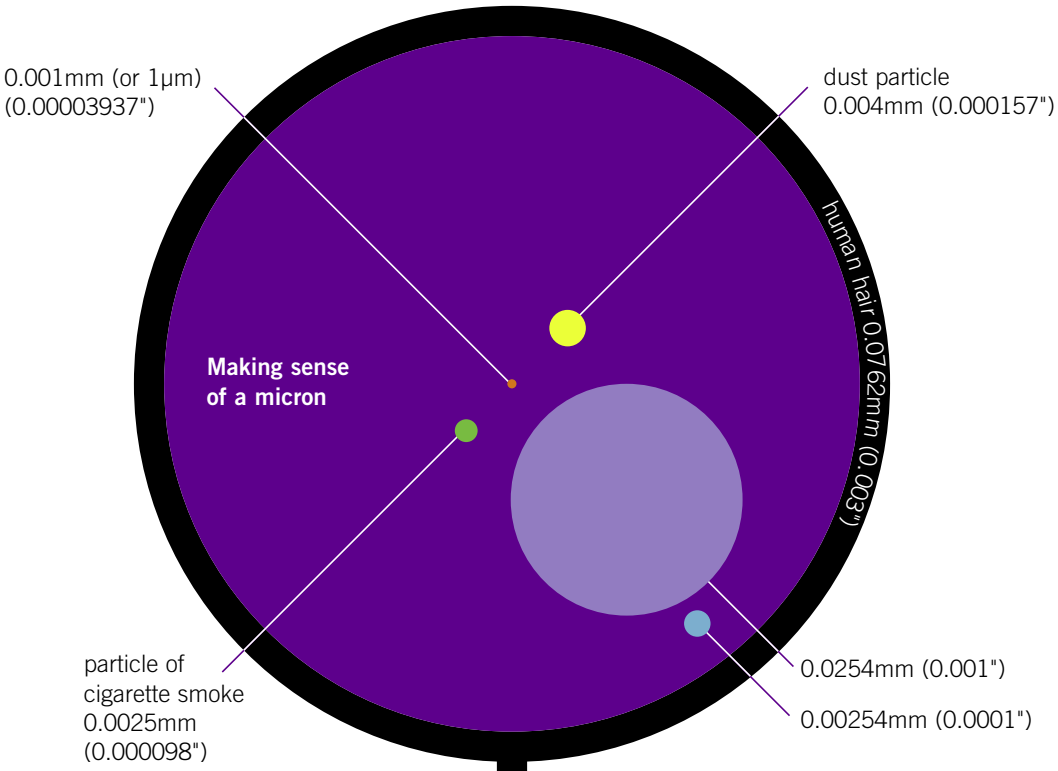


Linearity

Comparison between a 2 mm **digital probe** and a ±1 mm **analogue probe**



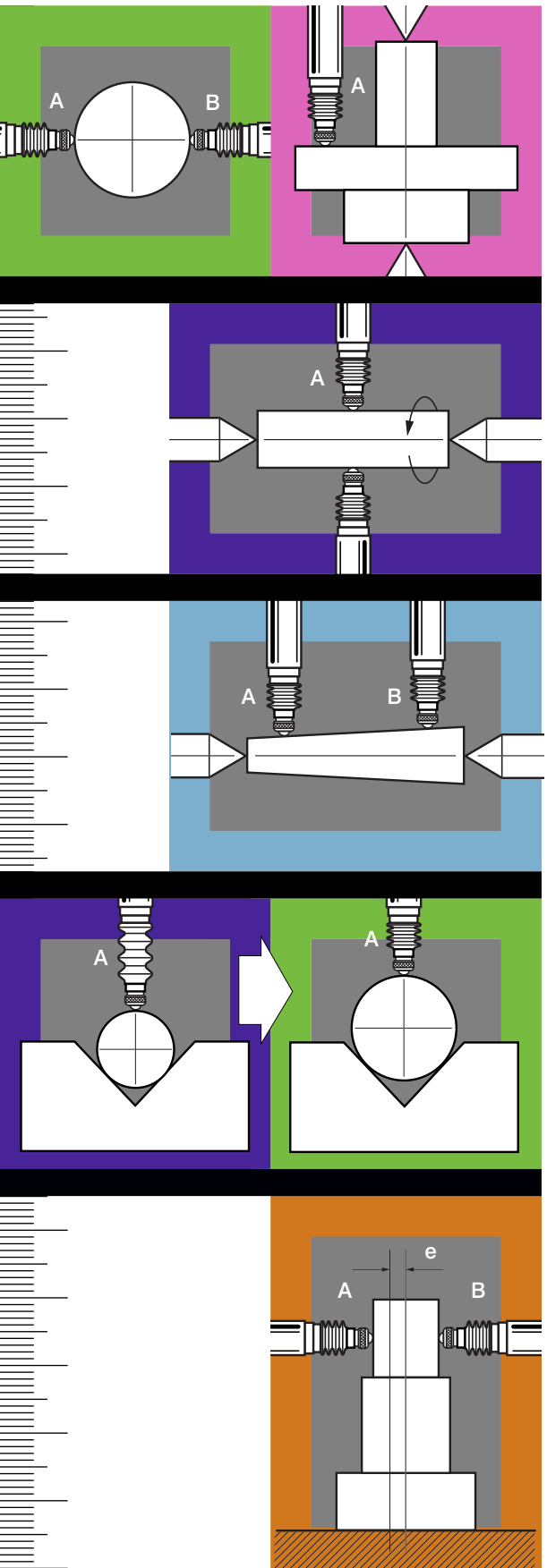
Applications



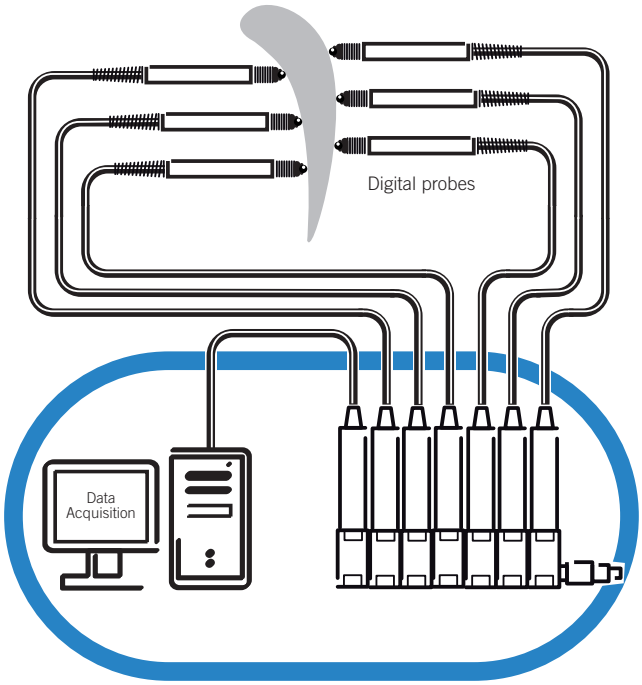
The following section covers applications and techniques for typical gauging (dimensional) and displacement (position) measurements together with an overview of the many measurement parameters obtainable via other Orbit Interface Modules.

> Dimensional measurement applications
> Position measurement applications
> Orbit test and measurement applications

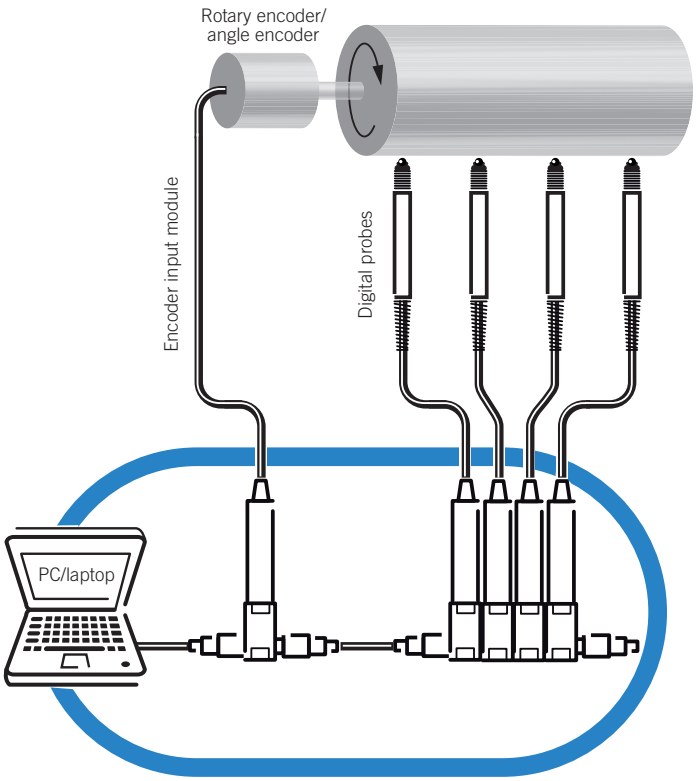
Dimensional measurement applications



Freeform measurement

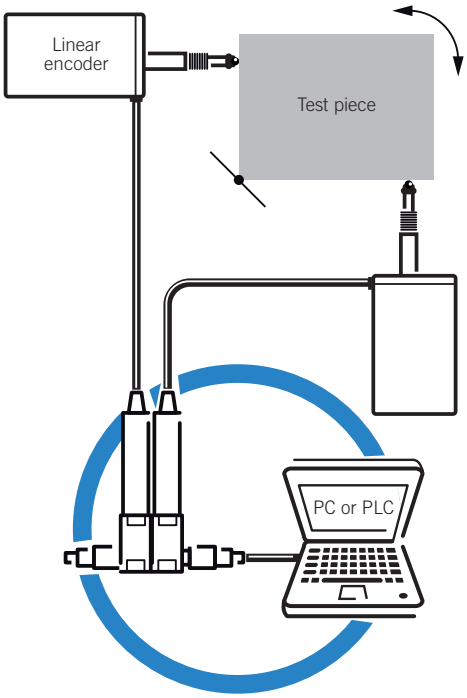


Dynamic/triggered measurement



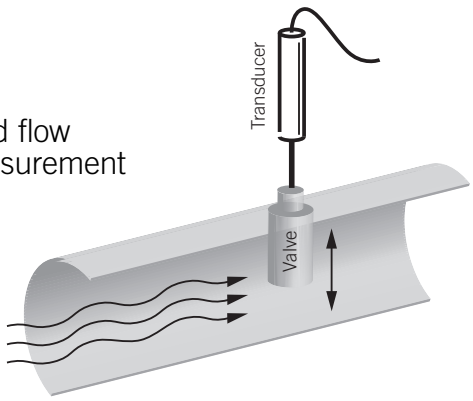
Position measurement applications

Angle/tilt measurement

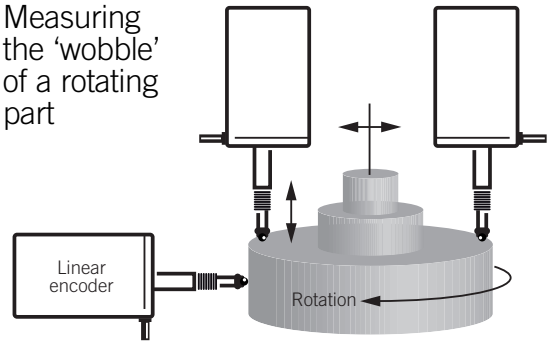


Orbit® network

Fluid flow measurement

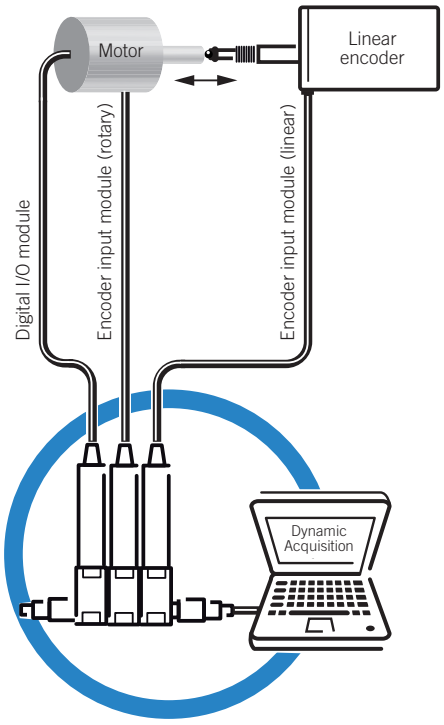


Measuring the 'wobble' of a rotating part

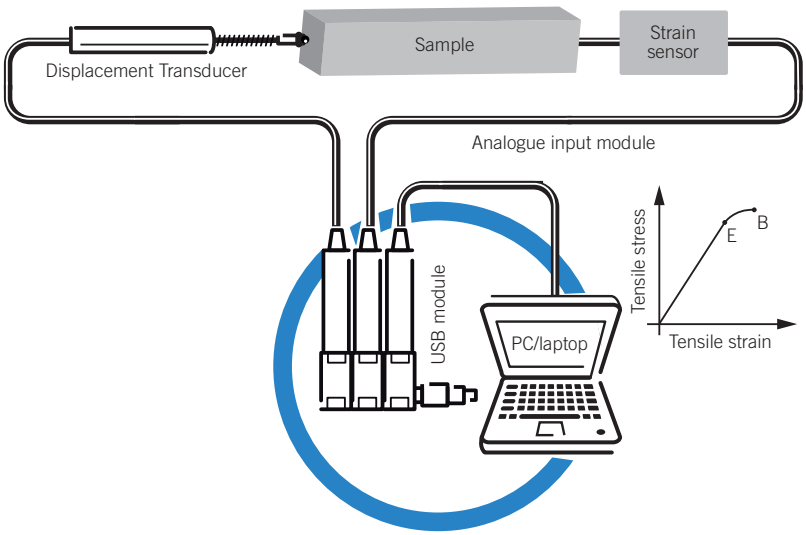


Control & Test of precision actuation mechanisms

(eg. motors, solenoids, piezo actuators, etc.)

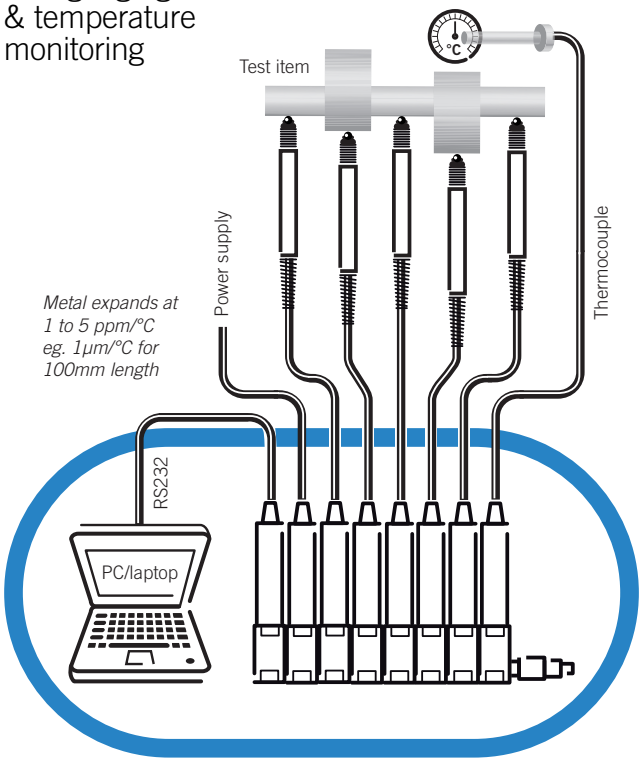


Strain measurement

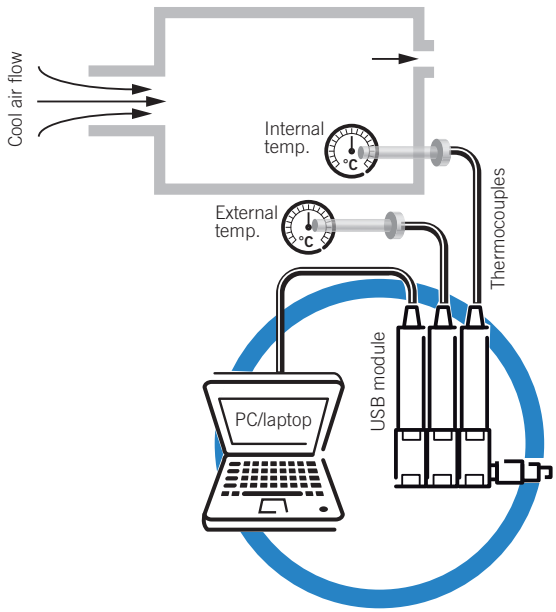


Orbit® test & measurement applications

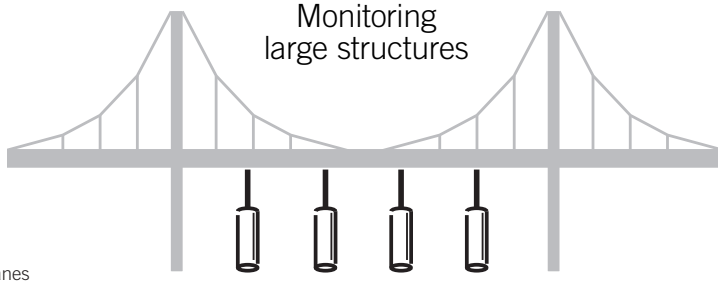
Part gauging & temperature monitoring



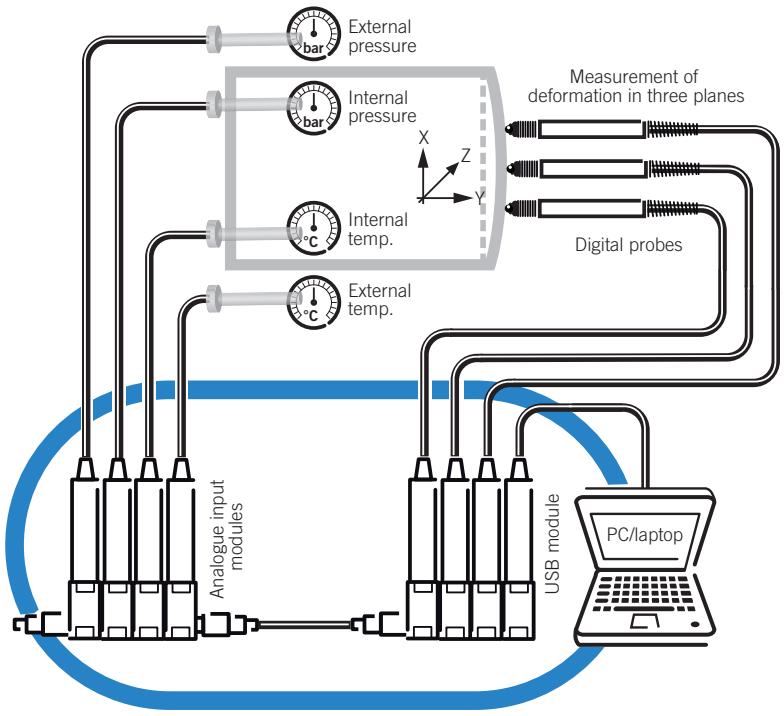
Air conditioning testing



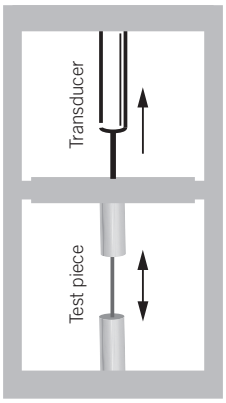
Monitoring large structures



Gas chamber measurement



Tensile testing



Gauge probes

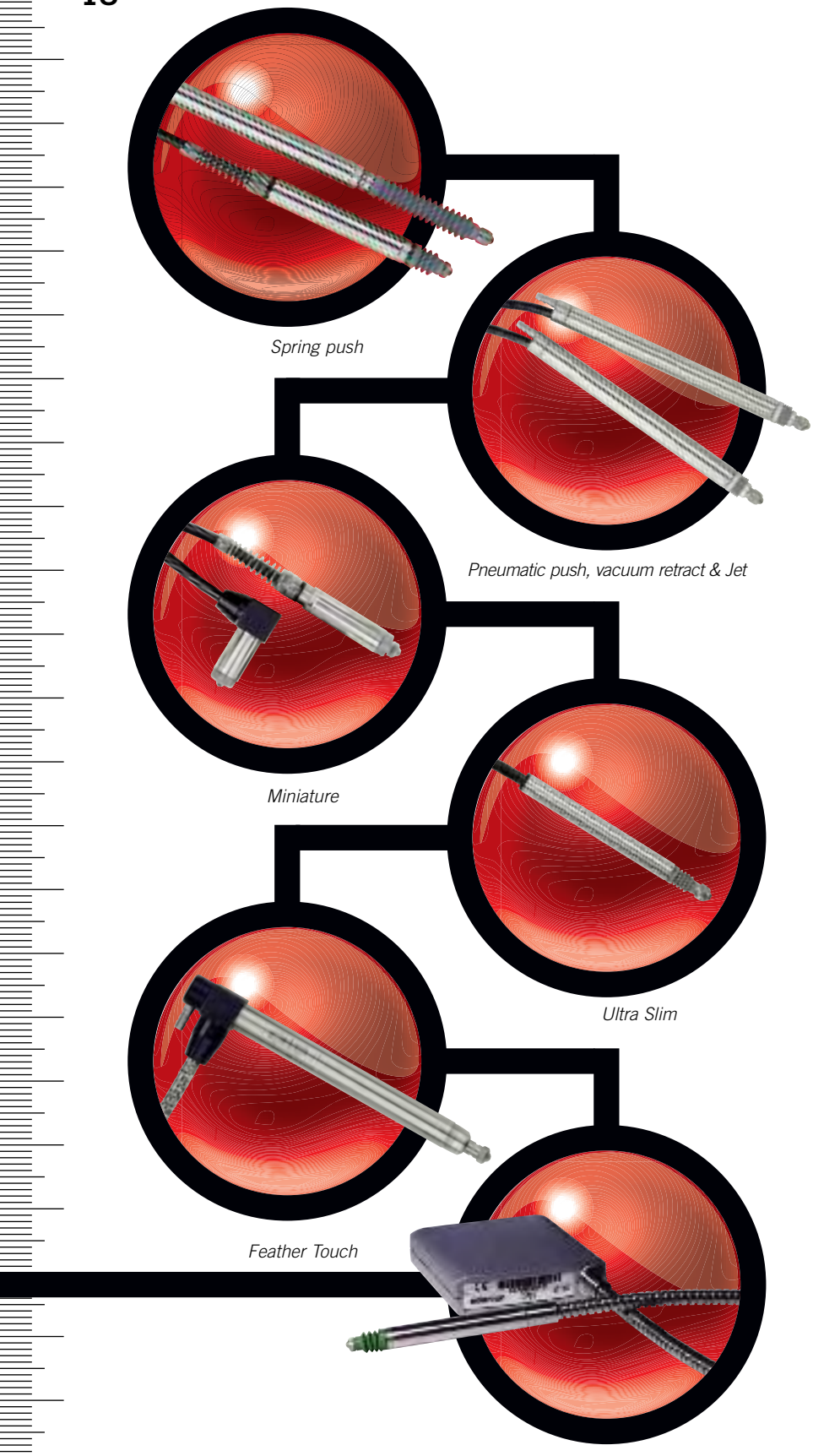
Solartron is the world's largest manufacturer of 'pencil' style electronic gauging probes.

Probes are either spring or pneumatically actuated with Feather Touch (low tip force) variants available.

The extensive range includes Analogue Probes (LVDT & Half Bridge), Digital Probes and probes with integrated electronics.

> Wide range of measurement ranges; 0.5mm to 20mm
> Traceability to NPL (National Physical Laboratory, UK)
> Spring push; standard or with vacuum retract
> Pneumatic push; standard, Feather Touch and Jet range
> Spring push with integral DC:DC electronics
> Special application probes
> LVDT, Half Bridge or Digital (Orbit Network) interface
> Tungsten Carbide, Nylon, Ruby or Silicon Nitride tips
> Accuracy to 0.1% of reading
> Precision linear bearings

Finest quality...



Spring Push, Pneumatic Push or Vacuum Retract (AX & DP)

In a conventional 'pencil' probe the tip pushes outwards under the influence of an internal spring. When installed in a fixture it is frequently required to design a mechanism to bring the probe into contact with the piece part being gauged.
In contrast, pneumatic operation (pneumatic push or vacuum retract) allows the number of moving parts in a fixture to be reduced, resulting in improved reliability and reduced fixture costs. It also enables fast and safe automatic loading of components into a gauge when required. Probe types AX/5/1 and DP/10/2 feature an extended movement of 9 mm before entering the total measurement range of 2 mm.

Feather Touch Probes (AT & DT)

Feather Touch probes have been designed especially to gauge delicate surfaces such as car windscreens, TV tubes, pharmaceutical bottles, electro-mechanical components and plastic parts. Whereas a traditional probe exerts a tip force of approximately 0.7N, the Feather Touch exerts a mere 0.18N when used in the horizontal position. This reduction is achieved by replacing the naturally elastic traditional gaiter with a close tolerance gland. On pneumatic versions the air leakage through the gland is restricted to less than 2.5 millilitres per second at 1 bar to minimise the possibility of contamination to the surface being gauged. Despite the low volume of air flow the bearing within the probe is constantly purged, avoiding the build up of dust (use of filtered air is recommended).
Replaceable nylon tips are used to guard against surface damage, although, for measuring hot glass, tungsten carbide tips can be fitted. Woven steel braid covering on the cable provides additional protection for applications where down time is critical.
For ultimate low force, Feather Touch probes can be supplied without a spring. Forward and return movements are activated by pneumatic/vacuum retract, but adjustment of air pressure allows all probes to have identical tip force, constant over the entire measurement range. If the probe is mounted vertically (tip up), retraction is by the dead weight of the moving parts, eliminating the need for vacuum.

...widest choice

Special Application Probes

When space is at a premium the extremely compact dimensions of the AX/0.25, DP/0.5, AX/0.5 and DP/1 can be exploited whilst retaining standard 8 mm diameter fixings. Also, when it is required to stack a number of probes close to each other, the A6G/1 and D6P/2 are only 6 mm in diameter, but still incorporate a precision linear ball bearing.

New Jet range Pneumatic Gauging Probes (AJ & DJ)

With conventional pneumatic transducers, the air pressure is contained within the gaiter. The new Jet range pneumatic gauging transducers are designed so that the gaiter is not pressuried. This has the advantage that gaiter damage will not effect transducer performance, resulting in less down-time and reduced cost of ownership

Environmental Protection

A6G/1, D6P/2 and the AX and DP series of probes are all fitted with Viton® gaiters to exclude moisture and dust.
Viton® is chemically inert and does not degrade when subjected to cutting fluids.
Probes in the Feather Touch range (AT, DT series) have glands instead of gaiters, and therefore should only be used in a dry environment.

Absolute Measurement

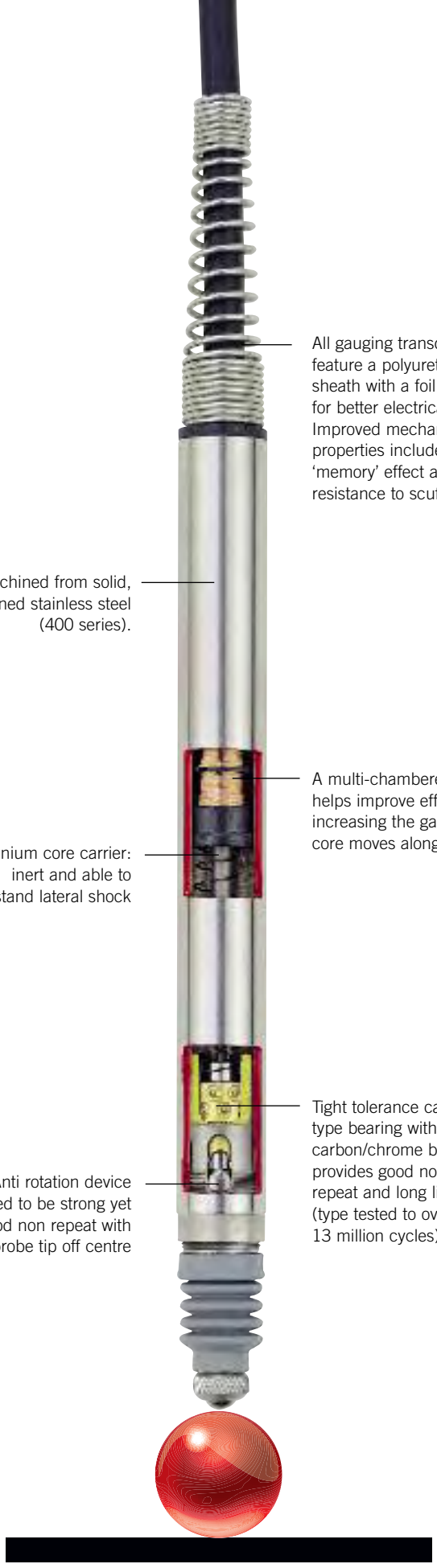
All Solartron gauge probes are absolute measuring devices, which means that when switched on they return the correct output, regardless of movements during the off period.

Multi-dimensional gauging

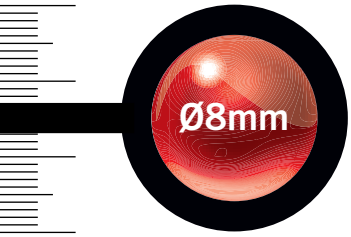
An LVDT or Half Bridge gauge probe delivers its best performance close to its null point, requiring dedicated fixtures for each size of component being gauged. In contrast, the Digital Probe can be used at any point over its entire measuring range.This permits different sizes of components to be gauged in one fixture

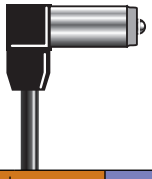
Customer Specials

Other options are available
Please contact us with your requirements.



20 Specification
Spring push





Product type	Analogue		Digital	Analogue		Digital	Analogue		Digital	Analogue		Digital
	LVDT	H/B		LVDT	H/B		LVDT	H/B		LVDT	H/B	
Axial cable outlet: Standard Spring	A6G/1/S	A6G/1/SH	D6P/2/S	AX/0.25/S	AX/0.25/SH	DP/0.5/S	AX/0.5/S	AX/0.5/SH	DP/1/S	AX/1/S	AX/1/SH	DP/2/S
Feather Touch	-	-	-	-	-	-	-	-	-	AT/1/S	AT/1/SH	DT/2/S
Vacuum	-	-	-	-	-	-	-	-	-	AX/1/V	AX/1/VH	-
Radial cable outlet: Standard Spring	-	-	-	-	-	-	-	-	-	AXR/1/S	AXR/1/SH	-
Feather Touch	-	-	-	-	-	-	-	-	-	ATR/1/S	ATR/1/SH	DTR/2/S
Measurement												
Measurement Range (mm)	**±1**		**2**	**±0.25**		**0.5**	**±0.5**		**1**	**±1**		**2**
Accuracy[1] (% of reading or µm)	0.5, 1µm		0.1	0.5, 0.5µm		0.1	0.5, 1µm		0.1	0.5, 1µm		0.1
Resolution	Analogue: Dependent on electronics											
Repeatability (µm)	0.15			0.1			0.15			0.15		
Pre-travel (mm)	0.15			0.03			0.15			0.15		
Post-travel (mm)	0.35			0.05			0.35			0.35		
Pre-travel Adjustment range (mm)	None			None			0.5		None	1		None
Tip Force: Standard/Vacuum ±20% (N)	0.7 @ mid position			0.7 @ mid position			0.7 @ mid position			0.7 @ mid position		
Tip Force: Feather Touch ±20% (N)	0.3 @ mid position			0.3 @ mid position			0.3 @ mid position			0.3 @ mid position		
Temperature Coefficient %FS/°C	0.02			0.03			0.03			0.01		
Mechanical												
Body Diameter (mm)	6h6			8h6			8h6			8h6		
Electrical Interface (Plugged)[2]												
Sensitivity (mV/V/mm ±5%)	200	73.5	-	200	73.5	-	200	73.5	-	200	73.5	-
Energising Current (mA/V±5%)	3	1.2	-	2.2	1.2	-	2.2	1.2	-	1.8	1	-
Electrical Interface (Unplugged)[2]												
Sensitivity (mV/V/mm ±5%)	269	88	-	262	82	-	262	82	-	210	83	-

Materials	
Case:	Stainless Steel
Tip:	Nylon or Tungsten Carbide*
Gaiter[3]:	Viton®
Cable[4]:	PUR

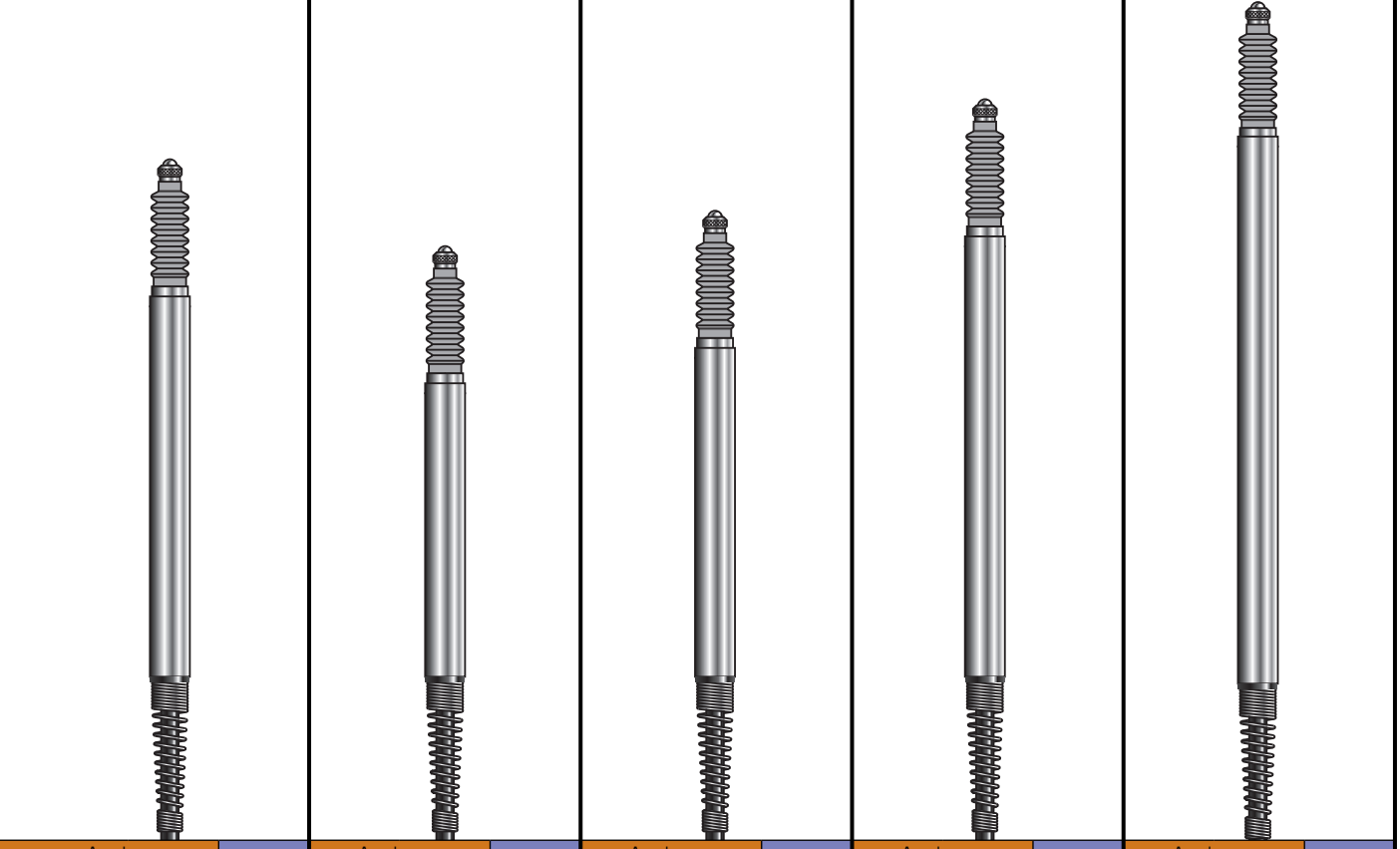
*Other options available

Environmental (Probe Head Only)	
Storage Temp (°C):	-40 to +100
Operating Temp[6] with gaiter (°C):	+5 to +80
Operating Temp[6] without gaiter (°C):	-10 to +80
IP rating:	IP65

IP rating not applicable to Feather Touch

Operating Pressure Range
Vacuum operation: 0 to 0.27 Bar absolute

Digital Probe Interface Electronics[5]	
Reading Rate:	Up to 3906 readings/second
Bandwidth:	Up to 460Hz dependent on noise performance required
Output:	Serial communication-RS485 signal level (Solartron Orbit Protocol)
Power:	5 ±0.25 VDC @ 0.06A (includes power for probe)
Storage Temp (°C):	-20 to +70
Operating Temp (°C):	0 to +60
IP Rating:	IP43



Analogue		Digital	Analogue		Digital	Analogue		Digital	Analogue		Digital	Analogue		Digital
LVDT	H/B		LVDT	H/B		LVDT	H/B		LVDT	H/B		LVDT	H/B	
AX5/1/S	AX5/1/SH	DP10/2/S	AX/1.5/S	AX/1.5/SH	-	AX/2.5/S	AX/2.5/SH	DP/5/S	AX/5/S	AX/5/SH	DP/10/S	AX/10/S	AX/10/SH	DP/20/S
-	-	-	AT/1.5/S	AT/1.5/SH	-	AT/2.5/S	AT/2.5/SH	DT/5/S	AT/5/S	AT/5/SH	DT/10/S	AT/10/S	AT/10/SH	DT/20/S
-	-	-	AX/1.5V	AX/1.5VH	-	AX/2.5/V	AX/2.5/VH	-	AX/5/V	AX/5/VH	-	AX/10/V	AX/10/VH	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	ATR/1.5/S	ATR/1.5/SH	-	ATR/2.5/S	ATR/2.5/SH	DTR/5/S	ATR/5/S	ATR/5/SH	DTR/10/S	ATR/10/S	ATR/10/SH	DTR/20/S
±1		**2**	**±1.5**		-	**±2.5**		**5**	**±5**		**10**	**±10**		**20**
0.5, 1µm		0.1	0.5, 1.5µm		-	0.5, 2.5µm		0.2	0.5, 5µm		0.2	0.7, 10µm		0.2
Digital: User selectable to <0.1µm														
0.15			0.15		-	0.15			0.15			0.15		
0.15			0.15		-	0.15			0.15			0.15		
0.85			0.85		-	0.85			0.85			0.85		
None			1.5		-	1.5		None	1.5		None	None		
0.7 @ mid position			0.7 @ mid position		-	0.7 @ mid position			0.7 @ mid position			0.7 @ mid position		
0.3 @ mid position			0.3 @ mid position		-	0.3 @ mid position			0.3 @ mid position			0.3 @ mid position		
0.01			0.01		-	0.01			0.01			0.01		
8h6			8h6		-	8h6			8h6			8h6		
200	73.5	-	133	49	-	80	29.4	-	40	14.7	-	20	7.35	-
1.8	1	-	2	1	-	2	1	-	2	1.2	-	1	1.2	-
210	83	-	150	82	-	150	82	-	105	51	-	33	33	-

1 Probe Accuracy
The accuracy of the LVDT and Half Bridge probes is quoted as % of reading or µm, which ever is greater.
The accuracy of the Digital Probe range is quoted as [(resolution) + (accuracy %) x D] where D is the distance from the setting master.
(Please refer to the Glossary for definitions)

2 LVDT and Half Bridge Probe Performance
Accuracy, sensitivity and energising current are valid for the following calibration conditions: LVDT probes calibrated at 3 V, 5 kHz frequency into a 10 kΩ load or 100 kΩ for the unplugged versions. Half Bridge probes calibrated at 3 V, 10 kHz frequency into a 2 kΩ load or 1 kΩ for the unplugged versions. The probes will operate with energising voltages in the range 1 V to 10 V and with frequencies in the range 2 kHz to 20 kHz but the performance is not specified.

3 Viton is a trademark of DuPont Dow Elastomers.

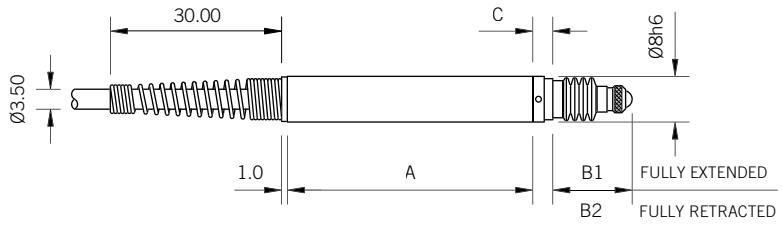
4 Cables
All probes are supplied with 2 m of PUR cable as standard. Other lengths and options such as nylon braided, metal braided and armoured are available on request.

5 Digital Probe Termination
Digital Probes are terminated with Solartron's Probe Interface Electronics (PIE) module. Please refer to the Orbit Network for details on this module and methods of integration for Digital Probes.

6 Below 0˚C environment must be dry

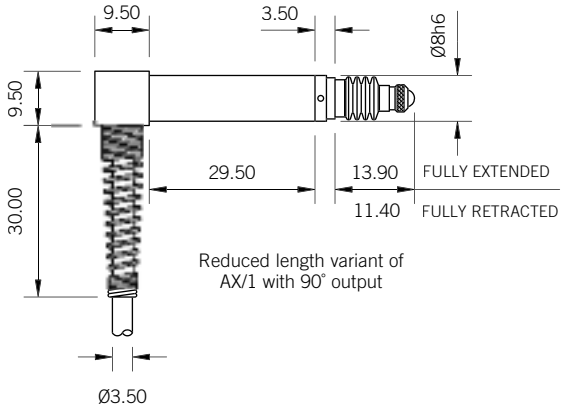
Dimensions (mm) **Spring push**

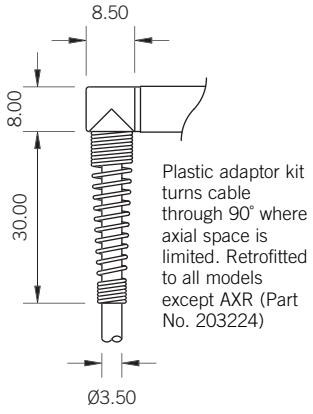
Standard Spring Push (AX/S and DP/S)



	AX/1/S	DP/2/S	AX/1.5/S	AX5/1/S DP10/2/S	AX/2.5/S	DP/5/S	AX/5/S	DP/10/S	AX/10/S DP/20/S
A	43.00	46.00	58.00	75.00	63.00	65.00	87.00	89.00	127.00
C	3.5	2.00	4.00	4.00	4.00	2.00	4.00	2.00	3.00
B1	13.9	13.9	15.40	25.40	17.40	17.40	25.40	25.40	44.90
B2	11.4	10.9	11.40	14.40	11.40	11.40	14.40	14.40	23.90

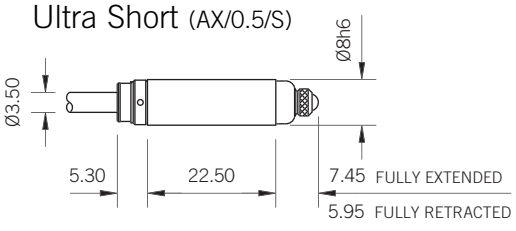
Right Angle Spring Push (AXR and DPR)



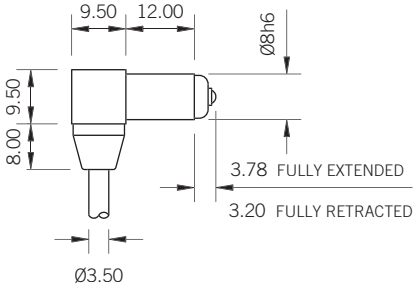


Special Spring Push Probes

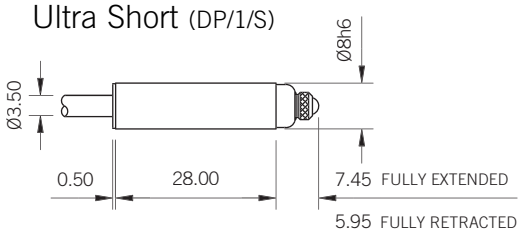
Ultra Short (AX/0.5/S)



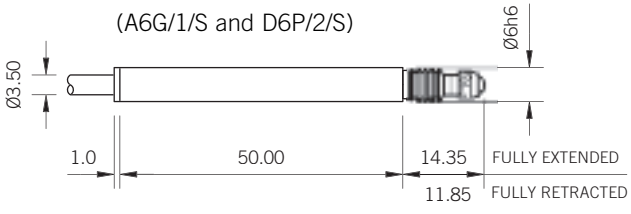
Ultra Small (AX/0.25/S and DP/0.5/S)



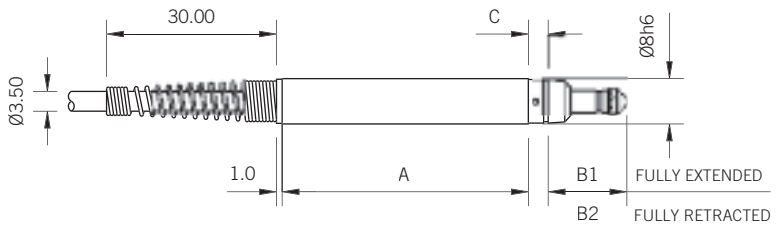
Ultra Short (DP/1/S)



Slim 6mm Diameter (A6G/1/S and D6P/2/S)

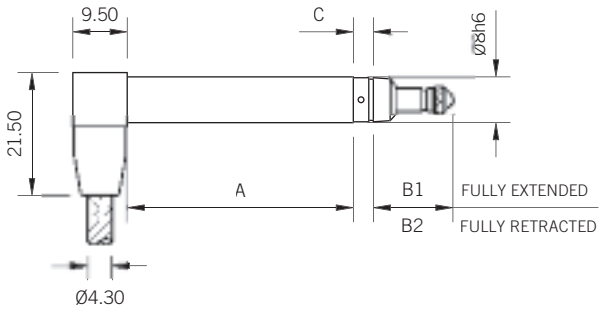


Feather Touch Spring Push (AT/S and DT/S)

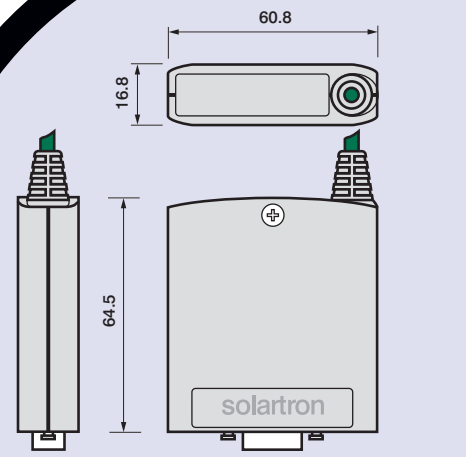


	AT/1/S	DT/2/S	AT/1.5/S	AT/2.5/S	DT/5/S	AT/5/S	DT/10/S	AT/10/S DT/20/S
A	43.00	46.00	58.00	63.00	65.00	87.00	89.00	127.00
C	3.50	2.00	4.00	4.00	2.00	4.00	2.00	3.00
B1	13.90	13.90	15.40	17.40	17.40	25.40	25.40	33.90
B2	11.40	10.90	11.40	11.40	11.40	14.40	14.40	12.90

Right Angle Feather Touch Spring Push with braided cable (ATR/S and DTR/S)

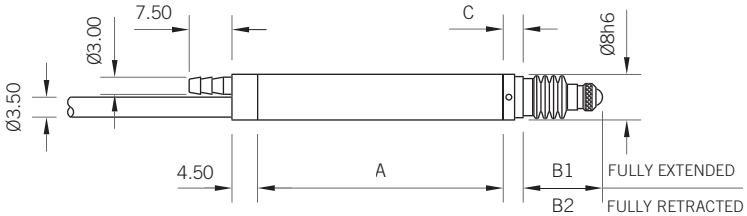


	ATR/1/S	DTR/2/S	ATR/1.5/S	ATR/2.5/S	DTR/5/S	ATR/5/S	DTR/10/S	ATR/10/S DTR/20/S
A	29.50	33.50	44.50	49.50	52.50	73.50	76.50	113.50
C	3.50	2.00	4.00	4.00	2.00	4.00	2.00	3.00
B1	13.90	13.90	15.40	17.40	17.40	25.40	25.40	33.90
B2	11.40	10.90	11.40	11.40	11.40	14.40	14.40	12.90



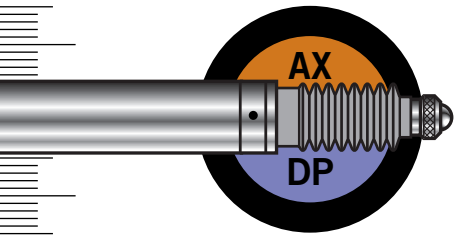
Digital Probe Interface Electronics

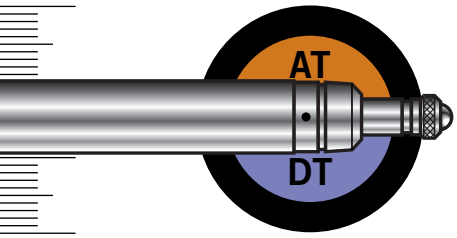
Vacuum Retract (AX/V and DP/V)

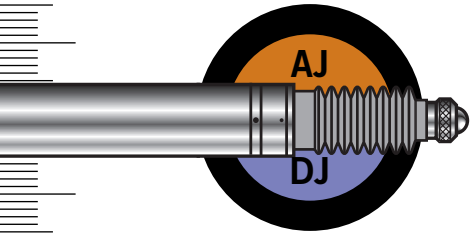


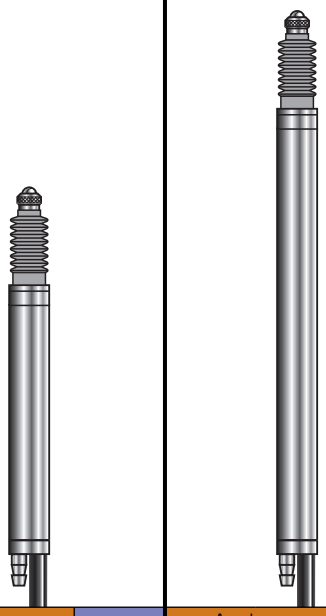
	AX/1/V	DP/2/V	AX/5/1/V	AX/1.5/V	AX/2.5/V	DP/5/V	AX/5/V	DP/10/V	AX/10/V DP/20/V
A	43.00	46.00	84.00	58.00	63.00	65.00	87.00	96.00	127.00
C	3.50	2.00	4.00	4.00	4.00	2.00	4.00	2.00	3.00
B1	13.90	13.90	25.40	15.40	17.40	17.40	25.40	25.40	44.90
B2	11.40	11.40	14.40	11.40	11.40	11.40	14.40	14.40	23.90

24 Specification
Pneumatic push









Product type		Analogue		Digital	Analogue		Digital
		LVDT	H/B		LVDT	H/B	
Axial cable outlet:	Standard Pneumatic	AX/1/P	AX/1/PH	DP/2/P	AX5/1/P	AX5/1/PH	DP10/2/P
	Jet Pneumatic	AJ/1/P	AJ/1/PH	DJ/2/P	AJ5/1/P	AJ5/1/PH	DJ10/2/P
	Feather Touch	AT/1/P	AT/1/PH	DT/2/P	-	-	-
Radial cable outlet:	Feather Touch	ATR/1/P	ATR/1/PH	DTR/2/P	-	-	-
Measurement							
Measurement Range (mm)		**±1**		**2**	**±1**		**2**
Accuracy[1] (% of reading or µm)		0.5, 1µm		0.1	0.5, 1µm		0.1
Resolution		Analogue: Dependent on electronics					
Repeatability (µm)		0.15			0.15		
Pre-travel (mm)		0.3		0.15	0.3		0.15
Post-travel (mm)		0.7		0.85	8.7		8.85
Tip Force: Standard Vacuum ±20% (N)		0.8 @ 0.4 Bar, 2.8 @ 1 Bar			0.8 @ 0.4 Bar, 2.8 @ 1 Bar		
Tip Force: Feather Touch ±30% (N)*		0.18 @ 0.3 Bar, 1.1 @ 1 Bar			0.18 @ 0.3 Bar, 1.1 @ 1 Bar		
Tip Force: Jet ±20% (N)		0.85 @ 1 Bar			0.85 @ 1 Bar		
Temperature Coefficient %FS/°C*		0.01			0.01		
Mechanical							
Body Diameter (mm)		8h6			8h6		
Electrical Interface (Plugged)[2]							
Sensitivity (mV/V/mm ±5%)		200	73.5	-	200	73.5	-
Energising Current (mA/V ±5%)		1.8	1	-	1.8	1	-
Electrical Interface (Unplugged)[2]							
Sensitivity (mV/V/mm ±5%)		210	83	-	210	83	-

*(at mid position)

Materials	
Case:	Stainless Steel
Tip:	Nylon or Tungsten Carbide*
Gaiter[3]:	Viton®
Cable[4]:	PUR

*Other options available

Environmental (Probe Head Only)	
Storage Temp (°C):	-40 to +100
Operating Temp[6] with gaiter (°C):	+5 to +80
Operating Temp[6] without gaiter (°C):	-10 to +80
IP rating:	IP65

IP rating not applicable to Feather Touch or Jet

Analogue		Digital	Analogue		Digital	Analogue		Digital
LVDT	H/B		LVDT	H/B		LVDT	H/B	
AX/2.5/P AJ/2.5/P AT/2.5/P	AX/2.5/PH AJ/2.5/PH AT/2.5/PH	DP/5/P DJ/5/P DT/5/P	AX/5/P AJ/5/P AT/5/P	AX/5/PH AJ/5/PH AT/5/PH	DP/10/P DJ/10/P DT/10/P	AX/10/P - AT/10/P	AX/10/PH - AT/10/PH	DP/20/P - DT/20/P
ATR/2.5/P	ATR/2.5/PH	DTR/5/P	ATR/5/P	ATR/5/PH	DTR/10/P	ATR/10/P	ATR/10/PH	DTR/20/P
±2.5		**5**	**±5**		**10**	**±10**		**20**
0.5, 2.5µm		0.2	0.5, 5µm		0.2	0.7, 10µm		0.2
Digital: User selectable to <0.1µm								
0.15			0.15			0.15		
0.3		0.15	0.3		0.15	0.3		0.15
0.7		0.85	0.7		0.85	0.7		0.85
0.85 @ 0.4 Bar, 2.5 @ 1 Bar			0.70 @ 0.4 Bar, 2.5 @ 1 Bar			0.70 @ 0.4 Bar, 2.5 @ 1 Bar		
0.18 @ 0.3 Bar, 1.1 @ 1 Bar			0.18 @ 0.3 Bar, 1.1 @ 1 Bar			0.18 @ 0.3 Bar, 1.1 @ 1 Bar		
0.85 @ 1 Bar			0.85 @ 1 Bar			0.85 @ 1 Bar		
0.01			0.01			0.01		
8h6			8h6			8h6		
80	29.4	-	40	14.5	-	20	7.35	-
2	1	-	1	1.2	-	0.6	1.2	-
150	82	-	105	51	-	33	33	-

1 Probe Accuracy
The accuracy of the LVDT and Half Bridge probes is quoted as % of reading or µm, which ever is greater. The accuracy of the Digital Probe range is quoted as [(resolution) + (accuracy %) x D] where D is the distance from the setting master.
(Please refer to the Glossary for definitions)

2 LVDT and Half Bridge Probe Performance
Accuracy, sensitivity and energising current are valid for the following calibration conditions: LVDT probes calibrated at 3 V, 5 kHz frequency into a 10 kΩ load or 100 kΩ for the unplugged versions. Half Bridge probes calibrated at 3 V, 10 kHz frequency into a 2 kΩ load or 1 kΩ for the unplugged versions. The probes will operate with energising voltages in the range 1 V to 10 V and with frequencies in the range 2 kHz to 20 kHz but the performance is not specified.

3 Viton is a trademark of DuPont Dow Elastomers.

4 Cables
All probes are supplied with 2 m of PUR cable as standard. Other lengths and options such as nylon braided, metal braided and armoured are available on request.

5 Digital Probe Termination
Digital Probes are terminated with Solartron's Probe Interface Electronics (PIE) module. Please refer to the Orbit Network for details on this module and methods of integration for Digital Probes.

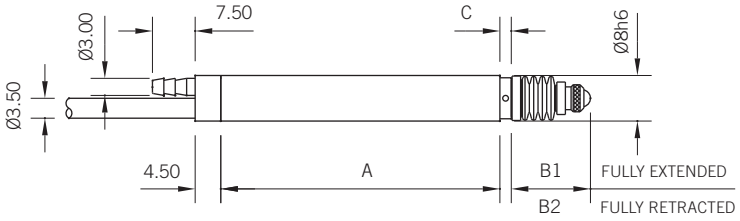
6 Below 0°C environment must be dry

Operating Pressure Range	
Standard:	0.4 to 1 Bar relative
Feather Touch:	0.3 to 2 Bar relative
Jet:	0.6 to 2 Bar relative

Pneumatic actuation: For continual reliable operation and to maximise working life, the air supply should be clean and dry. 60% maximum relative humidity, filtered to better than 5µm particle size.

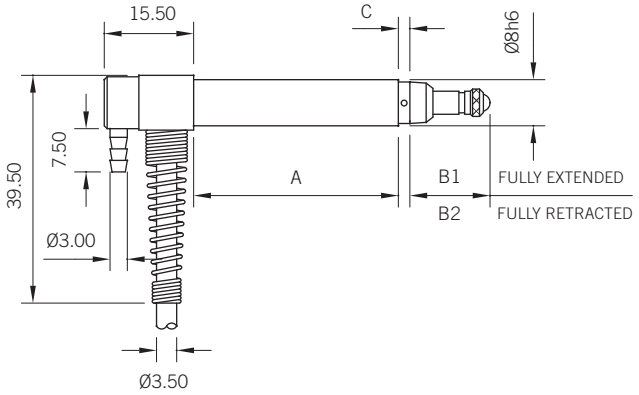
Digital Probe Interface Electronics[5]	
Reading Rate:	Up to 3906 readings/second
Bandwidth:	Up to 460Hz dependent on noise performance required
Output:	Serial communication-RS485 signal level (Solartron Orbit Protocol)
Power:	5 ±0.25 VDC @ 0.06A (includes power for probe)
Storage Temp (°C):	-20 to +70
Operating Temp (°C):	0 to +60
IP Rating:	IP43

Pneumatic Push
(AX/P and DP/P)



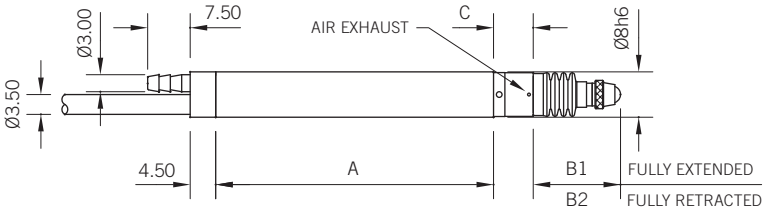
	AX/1/P	AX5/1/P	DP/2/P	AX/2.5/P	AX/5/P	AX/10/P
		DP/2/PE		DP/5/S	DP/10/P	DP/20/P
A	49.00	84.00	52.00	71.00	96.00	127.00
C	2.00	2.00	2.00	2.00	2.00	3.00
B1	13.90	25.40	13.90	17.40	25.40	44.90
B2	10.90	14.40	10.90	11.40	14.40	23.90

Right Angled Pneumatic Push
with 90˚ output and non braided cable (ATR/P and DTR/P)



	ATR/1/P	DTR/2/P	ATR/2.5/P	ATR/5/P	ATR/10/P
			DTR/5/P	DTR/10/P	DTR/20/P
A	35.50	38.50	57.50	82.50	113.50
C	2.00	2.00	2.00	2.00	3.00
B1	13.90	13.90	17.40	25.40	33.90
B2	10.90	10.90	17.40	14.40	12.90

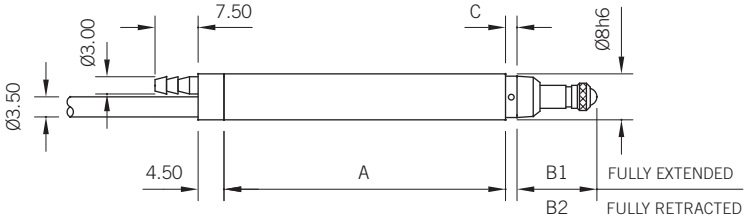
Gaiter Independent Pneumatic Push
(AJ/P and DJ/P)



During mounting, care must be taken not to clamp over the air exhaust

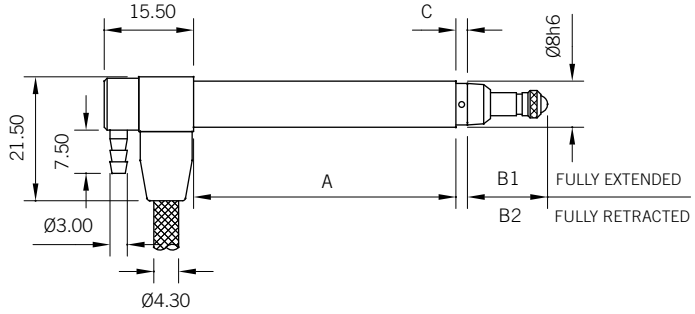
	AJ/1/P	DJ/2/P	AJ5/1/P	AJ/2.5/P	AJ/5/P
			DJ10/2/P	DJ/5/P	DJ/10/P
A	49.0	52.0	84.0	71.0	96.0
B1	15.4	15.4	26.9	18.9	26.9
B2	12.4	12.4	15.9	12.9	15.9
C	7.0	7.0	7.0	7.0	7.0

Feather Touch Pneumatic Push
(AT/P and DT/P)



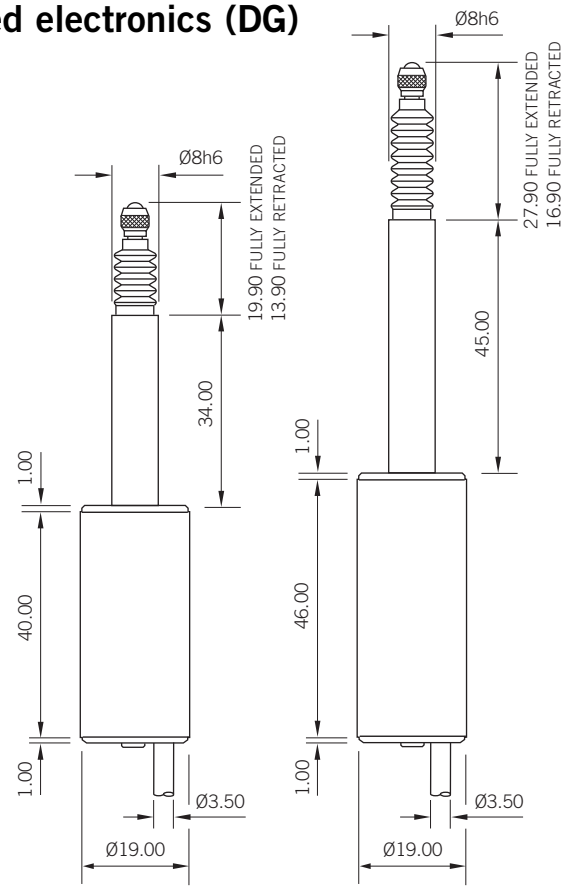
	AT/1/P	DT/2/P	AT/2.5/P	AT/5/P	DT/10/P	AT/10/P
			DT/5/P			DT/20/P
A	49.00	52.00	71.00	96.00	96.00	127.00
C	2.00	2.00	2.00	2.00	2.00	3.00
B1	13.90	13.90	17.40	25.40	25.40	33.90
B2	10.90	10.90	11.40	11.40	14.40	12.90

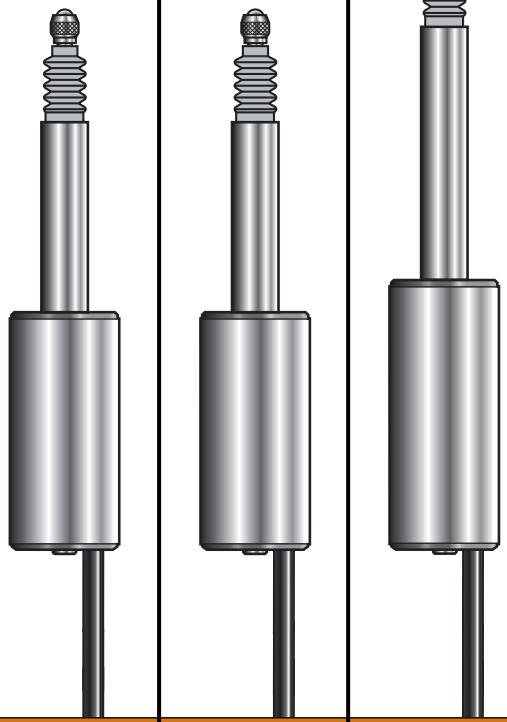
Right Angle Feather Touch Pneumatic Push
with 90˚ output and braided cable (ATR/P and DTR/P)



	ATR/1/P	DTR/2/P	ATR/2.5/P	ATR/5/P	ATR/10/P
			DTR/5/P	DTR/10/P	DTR/20/P
A	35.50	38.50	57.50	82.50	113.50
C	2.00	2.00	2.00	2.00	3.00
B1	13.90	13.90	17.40	25.40	33.90
B2	10.90	10.90	11.40	14.40	12.90

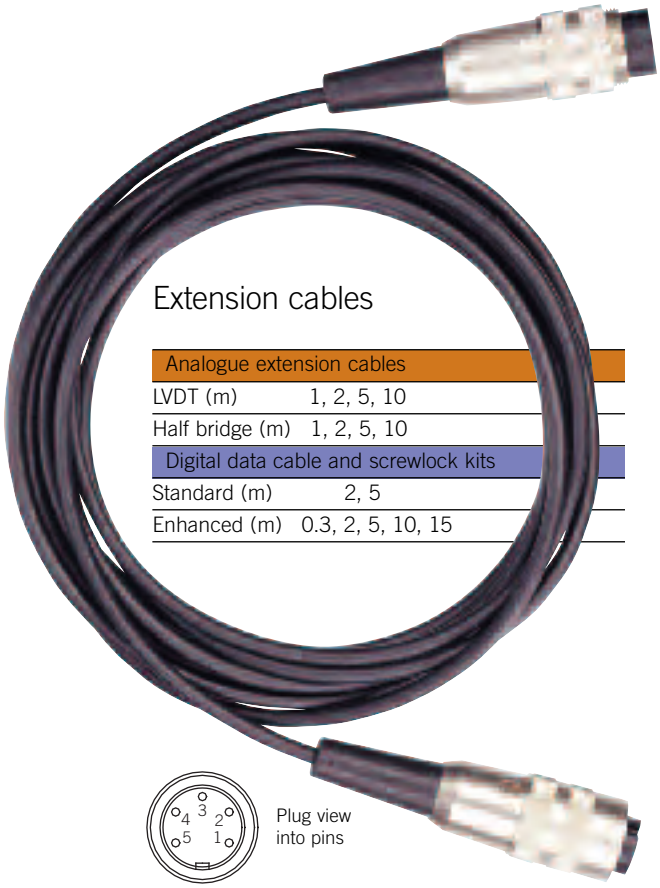
Specification
Spring push integrated electronics (DG)





Product type	DG 1.0	DG 2.5	DG 5.0
Measurement			
Measurement Range (mm)	±1	±2.5	±5
Linearity (%FRO)	0.3		
Repeatability (µm)	<0.15		
Pre-travel (mm)	1.65±0.05	0.15±0.05	
Post-travel (mm)	2.35±0.2	0.85±0.2	
Gauging force at mid point ±20% (N)	0.9		0.7
Temperature Coefficient zero (%FRO/˚C)	0.01		
Temperature Coefficient sensitivity (%FRO/˚C)	0.02		
Mechanical			
Material	Stainless Steel		
Body Diameter (mm)	19		
Standard Cable length (m)	2		
Spring rate (g/mm)	13		10
Environmental			
Storage Temperature (˚C)	-10 to +80		
Operting Temperature (˚C)	-5 to +70		
IP rating	IP65		
Electrical Interface			
Energising voltage (VDC)	10-24		
Energising current @ 10VDC (mA)	10		13
Frequency response (-3dB Hz)	50		
Sensitivity @ 10VDC (mV/V/mm)	75		54

DC: The specifications provided are for a transducer energised with 10 VDC and a calibration load of 20 kΩ at 20˚C.
Variation of these parameters will result in changes in performance.
Please refer to manuals for electrical connections.



Extension cables

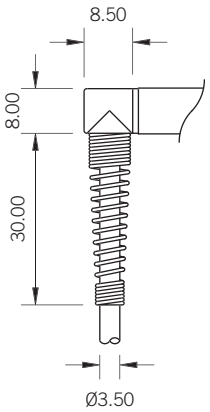
Analogue extension cables	
LVDT (m)	1, 2, 5, 10
Half bridge (m)	1, 2, 5, 10
Digital data cable and screwlock kits	
Standard (m)	2, 5
Enhanced (m)	0.3, 2, 5, 10, 15

Plug view into pins

Standard extension cables are fitted with a 5 pin 270° DIN socket and a 5 pin 270° plug, and are designed to be used with Solartron Metrology standard product

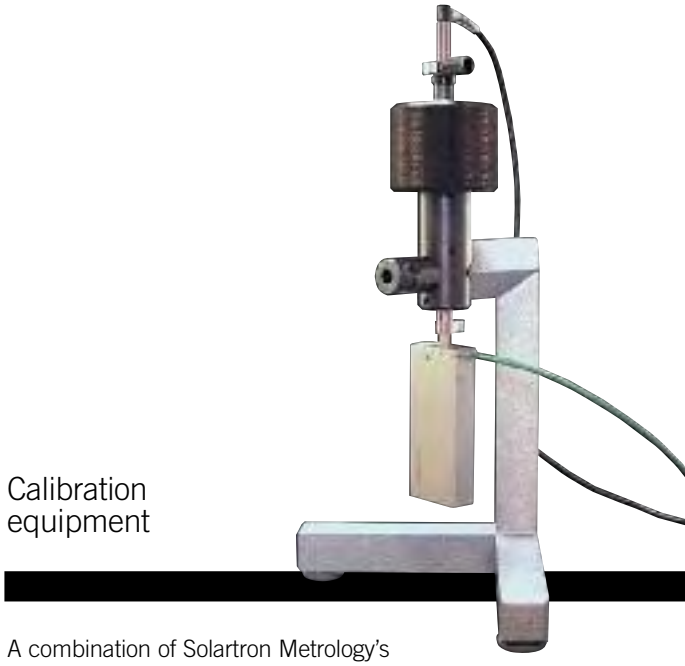
Radial outlet

To convert cable outlet from axial to radial on analogue and digital gauging probes



Springs

Replacement springs for analogue gauging probes

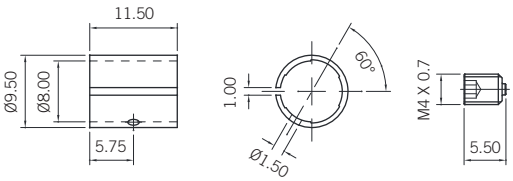


Calibration equipment

A combination of Solartron Metrology's successful linear encoder LE/25/S, the DR600 digital readout and a precision micrometer, provides a comprehensive kit for checking and inspection of readings from a linear transducer.

Handy and easy-to-use, Solartron calibration equipment will rapidly and precisely test any linear transducer with a stroke from ±0.25mm to ±10mm.

The kit includes an adaptor for testing smaller range transducers and comes with a comprehensive user manual.

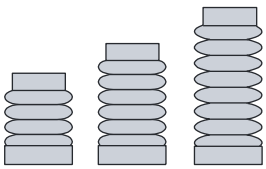


Clamping collet

For mounting 8mm analogue and digital gauging probes

Adjusting spanner

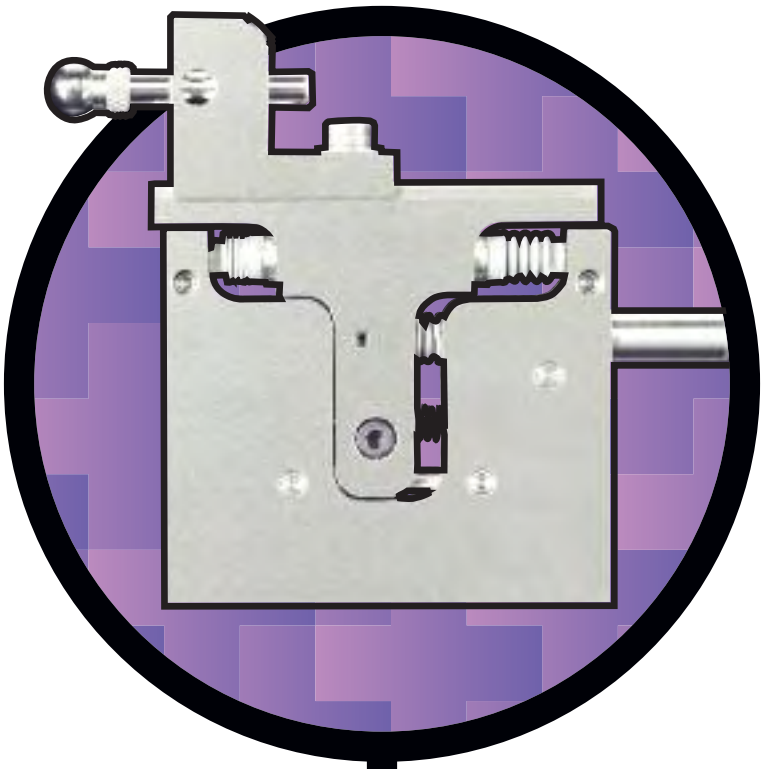
For adjusting the pre-travel on gauging probes



Gaiters

Replacement gaiters for analogue and digital gauging probes and linear encoders

Block gauges

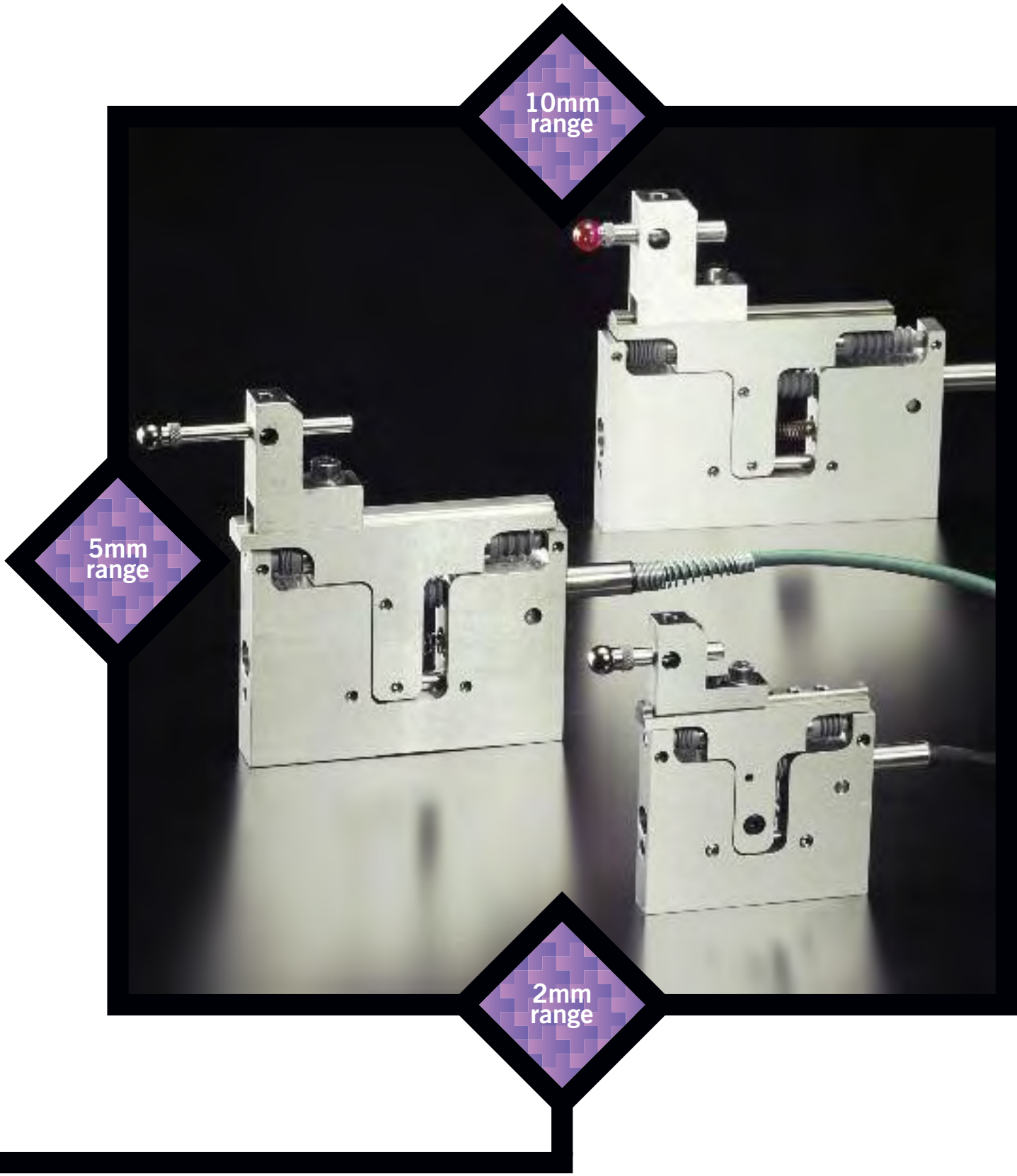


Solartron's new family of Block Gauges makes precision measurements of bores and cavities a simple and reliable process.

Generally, the use of these devices is recommended in applications where space is limited and where the use of axial probes is not possible.

- > 2mm, 5mm and 10mm total measuring range
- > Resolution better than 0.1µm
- > Repeatability: < 0.25µm
- > IP65 protection
- > Digital, LVDT and half bridge
- > Pneumatic or spring actuation
- > Compact size 2mm unit
- > Adjustable anti-rotation guide
- > Range of changeable tips

Meet the family...



The family of universal gauges includes 2 mm, 5 mm and 10 mm measurement ranges. The 5 mm product is used in most gauging applications and the 10 mm unit is designed for applications requiring a longer range. The 2 mm unit is a miniaturised version in length, height and thickness and is recommended for applications where space is very restricted.

The Block Gauges are available as LVDT, half bridge and digital variants. Each of these are extremely versatile and rugged gauging interfaces with good accuracy and repeatability. The block gauge family has been designed to provide simple installation and the fully adjustable tool holder combined with a range of tips allows easy set up for precision gauging applications.

A pneumatic kit allows the Block Gauge to be used with pneumatic actuation which can be combined with a range of springs to control the tip force. Pneumatic actuation simplifies the gauge design allowing quick and simple loading of the components to be measured.

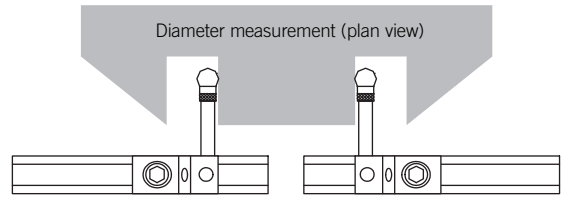
A range of springs is available to ensure that the Block Gauge can be used in any attitude. IP65 protection helps to extend the life of the gauge in dirty environments.

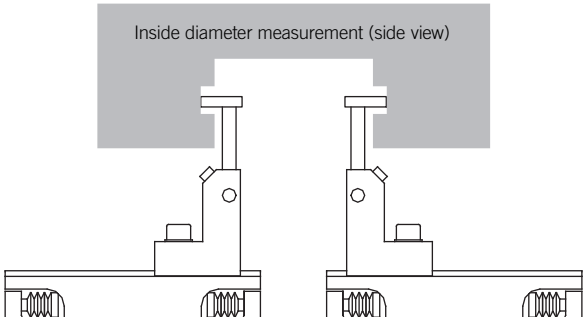
As many Block Gauges as required can be banked close together. The compact configuration and the ability to gauge off the centreline is useful when tightly packed points need to be measured.

The industry standard dovetail fitting of the tool holder on the 5 mm and 10 mm Block Gauges ensures that the gauge is rigid yet easy to adjust. The tip carriers have an M2.5 fitting that accepts all standard tips. Due to its size, the 2 mm gauge has a modified adjustment system that provides equal rigidity and ease of adjustment.

All units are able to measure with the tip offset and the position of the tool holder can be adjusted along the frame helping to reduce the footprint of the gauge.

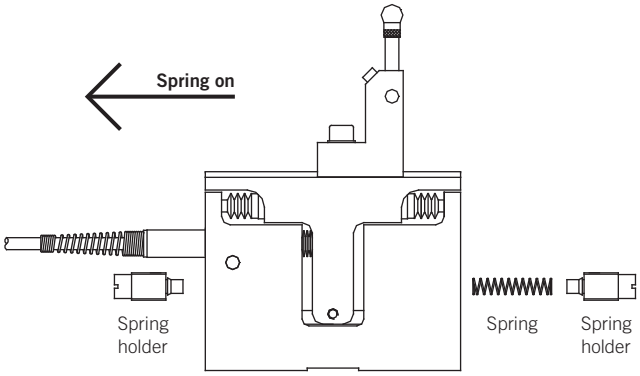
Applications

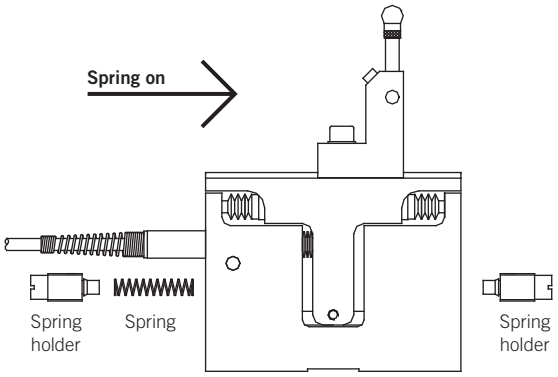




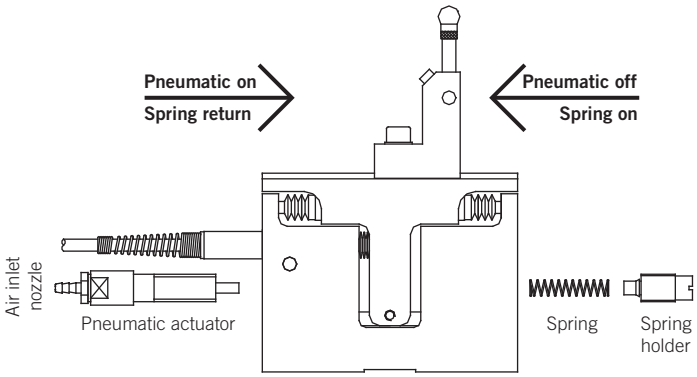
Configurations

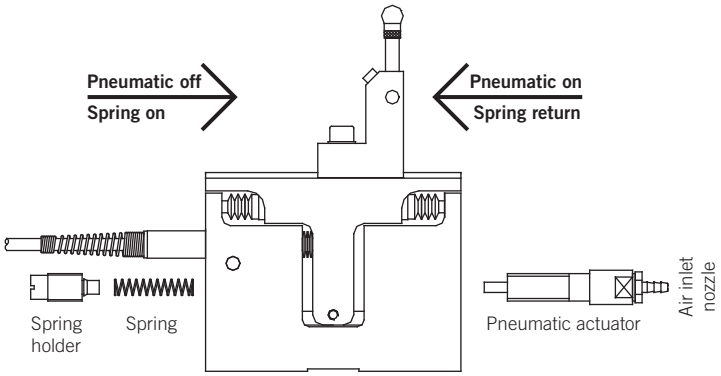
Spring actuation



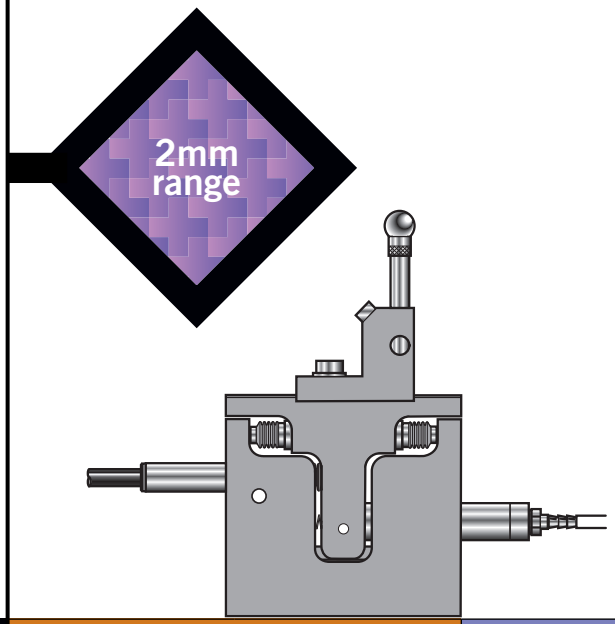


Pneumatic actuation





32 Specification



Product type	Analogue		Digital
	LVDT	H/B	
Axial cable outlet	BG/1	BG/1/H	DK/2
Radical cable outlet	BGR/1	BGR/1/H	DKR/2
Measurement			
Measurement Range (mm)	**±1**		**2**
Mechanical Travel (mm)	3		
Accuracy[1] (% of reading or µm)	0.5, 1µm		0.1
Resolution	Analogue: Dependent on electronics		Digital: User selectable to <0.1µm
Repeatability (on-axis at 0.7 N tip force) (µm)	0.25		
Null Position	Adjustable		-
Tip Force[2] in horizontal attitude ±20% (N)	1.5 @ mid position		
Temperature Coefficient %FS/°C	0.01		
Mechanical			
Mass (less tool holder) (g)	160		
Mass of moving parts (less tool holder) (g)	35		
Electrical Interface[3, 6]			
Sensitivity (mV/V/mm)	200	73.5	-
Energising Current ±5%	3mA/V @ 5kHz	2mA/V @ 10kHz	55mA @ 5VDC

1 Gauge Accuracy
The accuracy of the LVDT and Half Bridge Block Gauge range is quoted as % of reading or µm, whichever is greater.
The accuracy of the Digital Block Gauge range is quoted as [(resolution) + (accuracy %) x D] where D is the distance from the setting master. *(Please refer to the Glossary for definitions)*

2 Tip Force
Maximum Tip Force is 3.5 N. A selection of springs is supplied for attitude and dead weight compensation. Care should be taken as the gauge performance (accuracy and repeatability) may degrade at high tip forces.

3 LVDT and Half Bridge Block Gauge Performance
Accuracy, sensitivity, energising current and phase shift are valid for the following calibration conditions: LVDT gauges calibrated at 3 V, 5 kHz frequency into a 10kΩ load. Half Bridge gauges calibrated at 3 V, 10 kHz frequency into a 2kΩ load. The gauges will operate with energising voltages in the range 1 V to 10 V and with frequencies in the range 2 kHz to 20 kHz but the performance is not specified. Unplugged (free lead) and other specifications are available on request.

4 Viton is a trademark of DuPont Dow Elastomers.

5 Cables
All gauges are supplied with 2 m of PUR cable as standard. Other lengths and options are available on request.

6 Digital Block Gauge Termination
Digital Block Gauges are terminated with Solartron's Probe Interface Electronics (PIE) module. Please refer to the Orbit Network for details on this module and methods of integration for Digital Block Gauges.

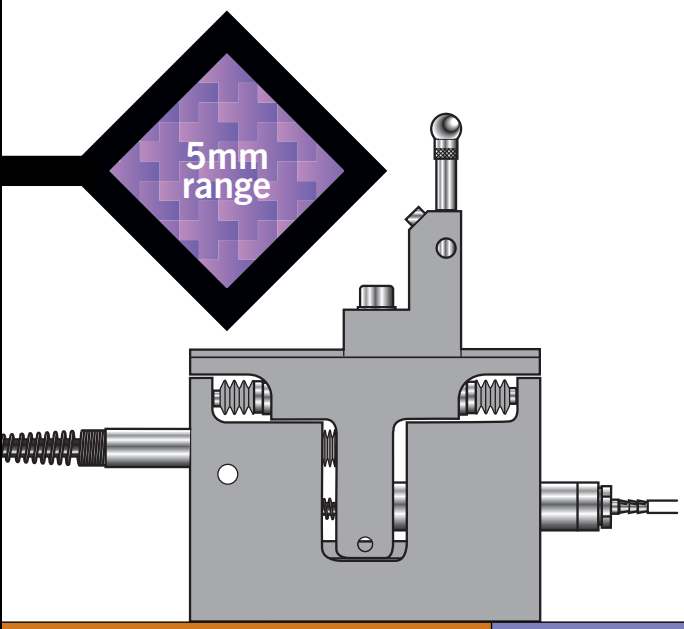
Environmental		LVDT and H/B	Digital
Storage Temp. (°C)		-40 to +85	-20 to +70
Operating Temp. (°C)		+5 to +85	+5 to +65
IP rating	Block Gauge	IP65	IP65
	Electronics	-	IP43

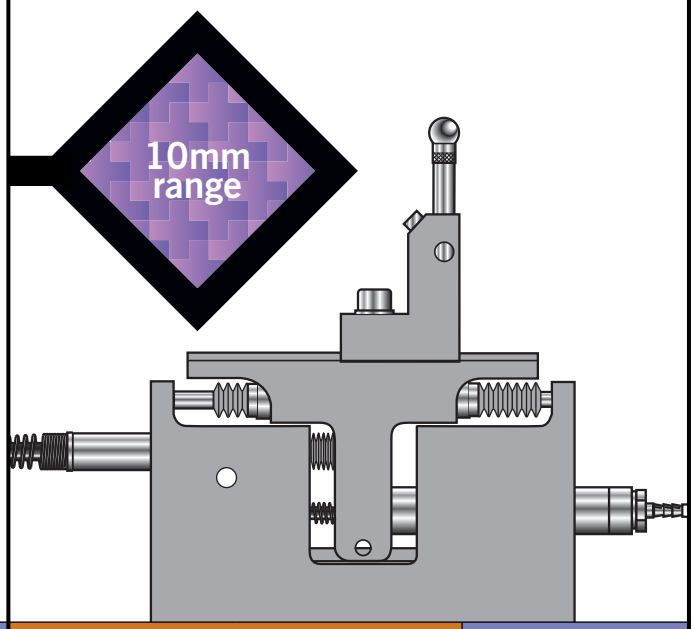
Shock: To maintain best performance the Block Gauge should be protected from excessive shock loads and dropping

Operating Pressure Range	
Pneumatic Operation:	1 to 3 Bar relative

To maximise working life of the probe head when pneumatic actuation is chosen, the air supply should be both clean and dry for continual reliable operation. Maximum relative humidity of 60% and filtered to better than 5µm particle size.

Materials	
Frame:	Stainless Steel
Gaiter[4]:	Viton®
Cable[5]:	PUR



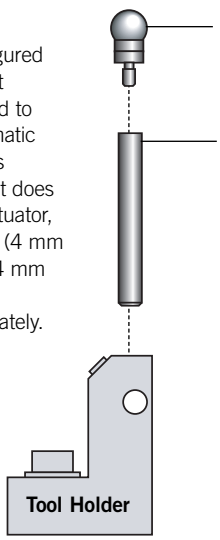


Analogue		Digital
LVDT	H/B	
BG/2.5	BG/2.5/H	DK/5
BGR/2.5	BGR/2.5/H	DKR/5
±2.5		**5**
6		
0.5, 2.5µm		0.2
Analogue: Dependent on electronics		Digital: User selectable to <0.1µm
0.25		
Adjustable		-
1.5 @ mid position		
0.01		
310		
90		
80	29.4	-
2mA/V @ 5kHz	1mA/V @ 10kHz	55mA @ 5VDC

Analogue		Digital
LVDT	H/B	
BG/5	BG/5/H	DK/10
BGR/5	BGR/5/H	DKR/10
±5		**10**
11		
0.5, 5µm		0.2
Analogue: Dependent on electronics		Digital: User selectable to <0.1µm
0.5		
Adjustable		-
1.5 @ mid position		
0.01		
350		
95		
40	14.5	-
2mA/V @ 5kHz	1mA/V @ 10kHz	55mA @ 5VDC

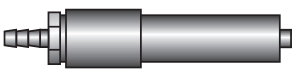
Accessories

All gauges are supplied configured as spring push. A customer fit pneumatic actuator is required to convert spring push to pneumatic operation. The Block Gauge is inclusive of integral sensor but does not include the pneumatic actuator, additional springs, tool holder (4 mm and 6 mm bore), tip carrier (4 mm and 6 mm diameter) or tips. These must be ordered separately.



Tips
With industry standard M2.5 thread. Download the Tips PDF from www.solartronmetrology.com

Tips Carrier
4 mm diameter with a choice of 20, 30 or 40 mm length for all Block Gauges.
6 mm diameter with a choice of 30, 40 or 50 mm length for 5 mm & 10 mm Block Gauges only.

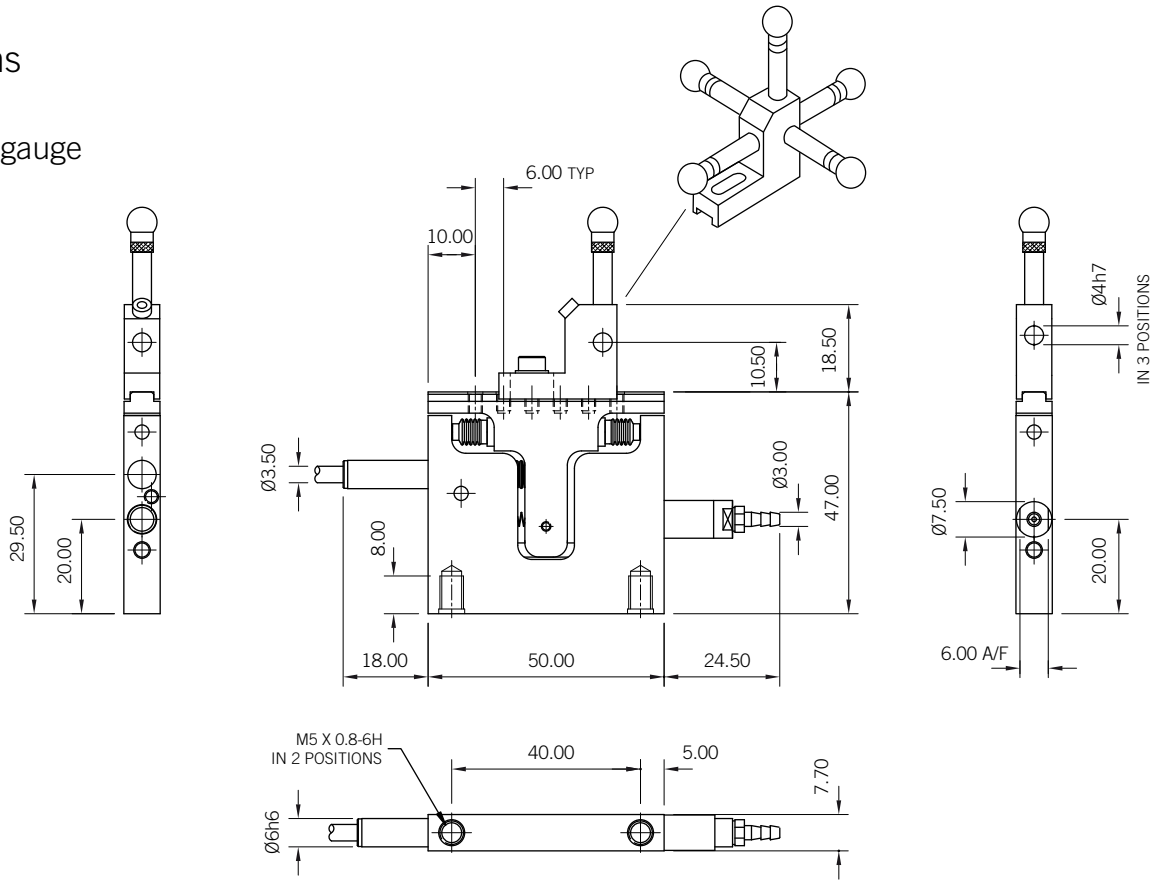


Pneumatic Actuator

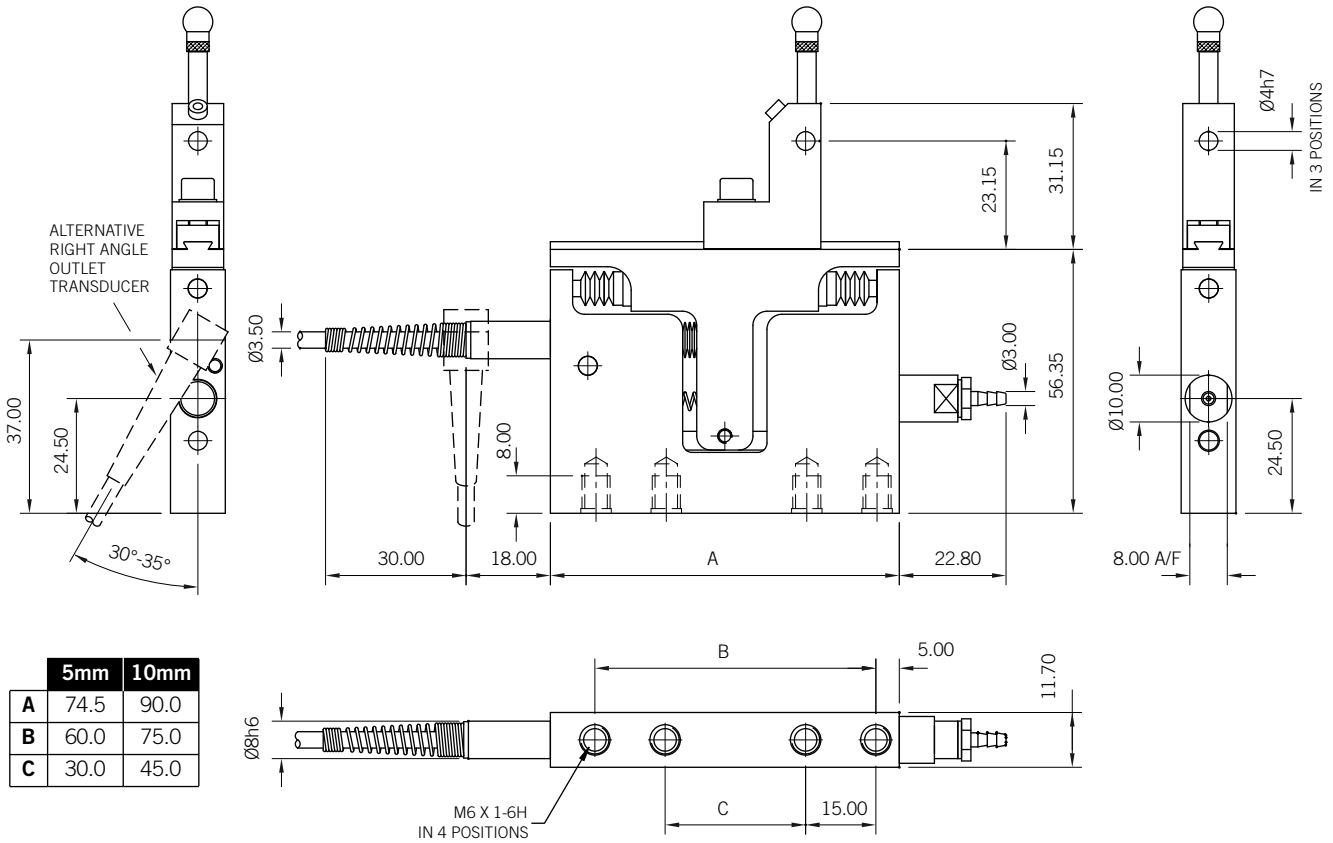
Alternative Springs
A set of customer fit springs (for different measurement forces) is included with each gauge. Replacement springs can be ordered individually or as sets.

34 Dimensions

2mm block gauge

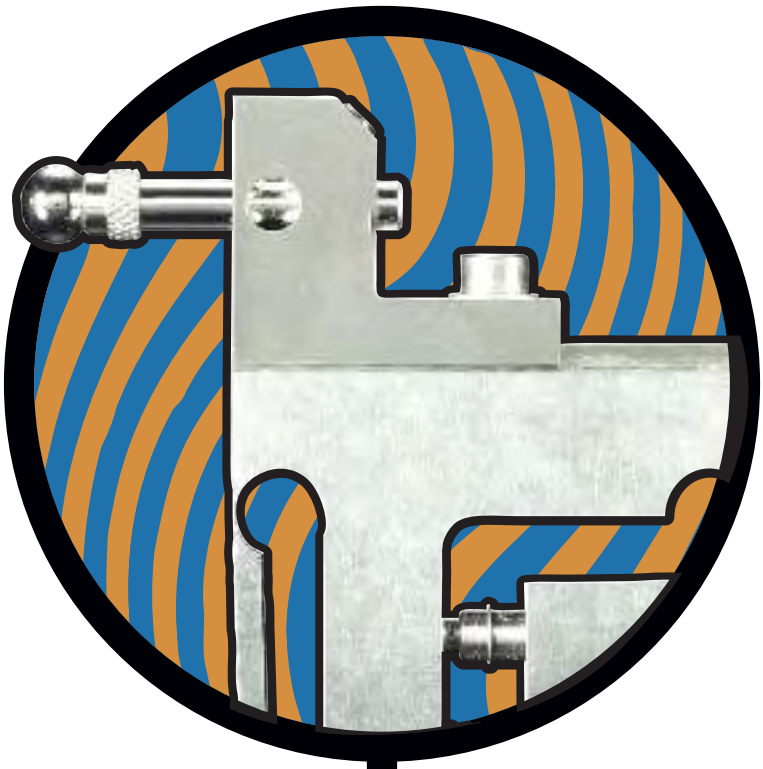


5mm and 10mm block gauges



	5mm	10mm
A	74.5	90.0
B	60.0	75.0
C	30.0	45.0

Flexure gauges



The Solartron Flexure Gauge is a compact measuring device, which is based on a parallelogram for the ultimate in precision and long life.

Motion is achieved without any friction parts, resulting in exceptional repeatability and minimal hysterisis.
Under normal operating conditions the gauge has an expected life in excess of 25 million cycles.

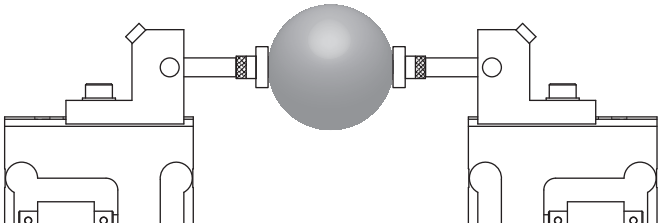
- > 2mm total measuring range
- > Excellent repeatability: < 0.10 µm
- > Extended operating life: 25 Million Cycles
- > IP65 Protection
- > Digital, LVDT and Half Bridge versions
- > Pneumatic or Spring Operation
- > All Stainless Steel construction
- > Range of changeable tips

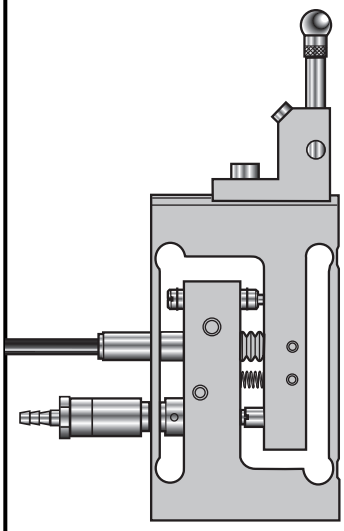
The Flexure Gauge is available with both forward and reverse spring action.
A pneumatically actuated version is available.

Range stops are provided to prevent over stressing the flexure and the high stiffness in the plane normal to the measurement axis means that repeatability and life are maintained in the presence of side loads.

The integral transducer is fitted with a Viton® gaiter, to achieve IP65 rating and the absence of bearings makes the Flexure Gauge naturally immune from contamination and humidity.

LVDT and Half Bridge analogue versions are available for plugging into most standard amplifiers. Digital versions allow the non-linearity of the flexure motion to be corrected during the calibration process, so that the output is a linear function of displacement. The networking capability of these products allows Solartron Flexure Gauges to be mixed with other digital transducers in a single measurement system.





Product type		Analogue		Digital
		LVDT	H/B	
Axial cable outlet:	Forward Spring	AU/1/S	AU/1/SH	DU/2/S
	Reverse Spring	AU/1/R	AU/1/RH	DU/2/R
	Reverse Spring Pneumatic	AU/1/P	AU/1/PH	DU/2/P
Radial cable outlet:	Forward Spring	AUR/1/S	AUR/1/SH	DUR/2/S
	Reverse Spring	AUR/1/R	AUR/1/RH	DUR/2/R
	Reverse Spring Pneumatic	AUR/1/P	AUR/1/PH	DUR/2/P
Measurement				
Measurement Range (mm)		**±1**		**2**
Maximum Mechanical travel (mm)		2.5		
Accuracy[1] (% of reading or µm)		0.5, 1µm		0.1
Resolution		Analogue: Dependent on electronics Digital: User selectable to <0.05µm		
Repeatability (on-axis at 0.7N tip force) (µm)		0.1		
Null Position		Adjustable		-
Tip Force (Spring Actuation) ±20% (N)		1.5 @ mid position		
Tip Force (Pneumatic Actuation) ±20% (N)		1 @ mid position @ 2 Bar		
Temperature Coefficient %FS/°C		0.01		
Mechanical				
Mass (less tool holder) (g)		120		
Mass of tool holder (g)		12		
Electrical Interface[2,5]				
Sensitivity (mV/V/mm)		200	73.5	-
Energising Current		3 mA/V @ 5kHz	1.2mA/V @ 10kHz	55 mA @ 5 VDC

1 Gauge Accuracy
The accuracy of the LVDT and Half Bridge Flexure Gauge is quoted as % of reading or µm whichever is greater. The accuracy of the Digital Flexure Gauge is quoted as [(resolution) + (accuracy %) x D] where D is the distance from the setting master. *(Please refer to the Glossary for definitions)*

2 LVDT and Half Bridge Flexure Gauge Performance
Accuracy, sensitivity, energising current and phase shift are valid for the following calibration conditions: LVDT gauge calibrated at 3 V, 5 kHz frequency into a 10 kΩ load.
Half Bridge gauge calibrated at 3 V, 10 kHz frequency into a 2 kΩ load.
The gauge will operate with energising voltages in the range 1 V to 10 V and with frequencies in the range 2 kHz to 20 kHz but the performance is not specified.
Unplugged (free load) and other specifications are available on request

3 Viton is a trademark of DuPont Dow Elastomers.

4 Cables
All gauges are supplied with 2 m of PUR cable as standard.
Other lengths and options are available on request.

5 Digital Flexure Gauge Termination
Digital Flexure Gauges are terminated with Solartron's Probe Interface Electronics (PIE) module.
Please refer to the Orbit Network for details on this module and methods of integration for Digital Flexure Gauges.

Environmental			
		LVDT and H/B	Digital
Storage Temp. (°C)		-40 to +85	-20 to +70
Operating Temp. (°C)		+5 to +85	+5 to +65
IP rating	Flexure Gauge	IP65	IP65
	Electronics	-	IP43

Shock: To maintain best performance the Flexure Gauge should be protected from excessive shock loads and dropping

Operating Pressure Range

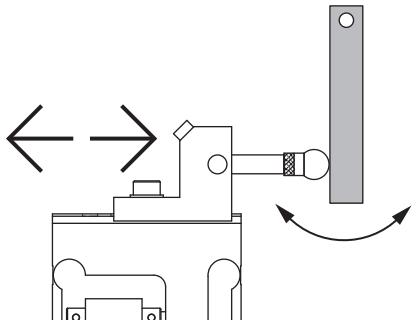
Pneumatic Operation: 1 to 3 Bar relative

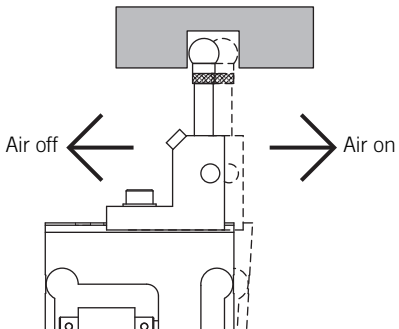
To maximise working life of the probe head when pneumatic actuation is chosen, the air supply should be both clean and dry for continual reliable operation. Maximum relative humidity of 60% and filtered to better than 5µm particle size.

Materials	
Frame	Stainless Steel
Gaiter[3]	Viton®
Cable[4]	PUR

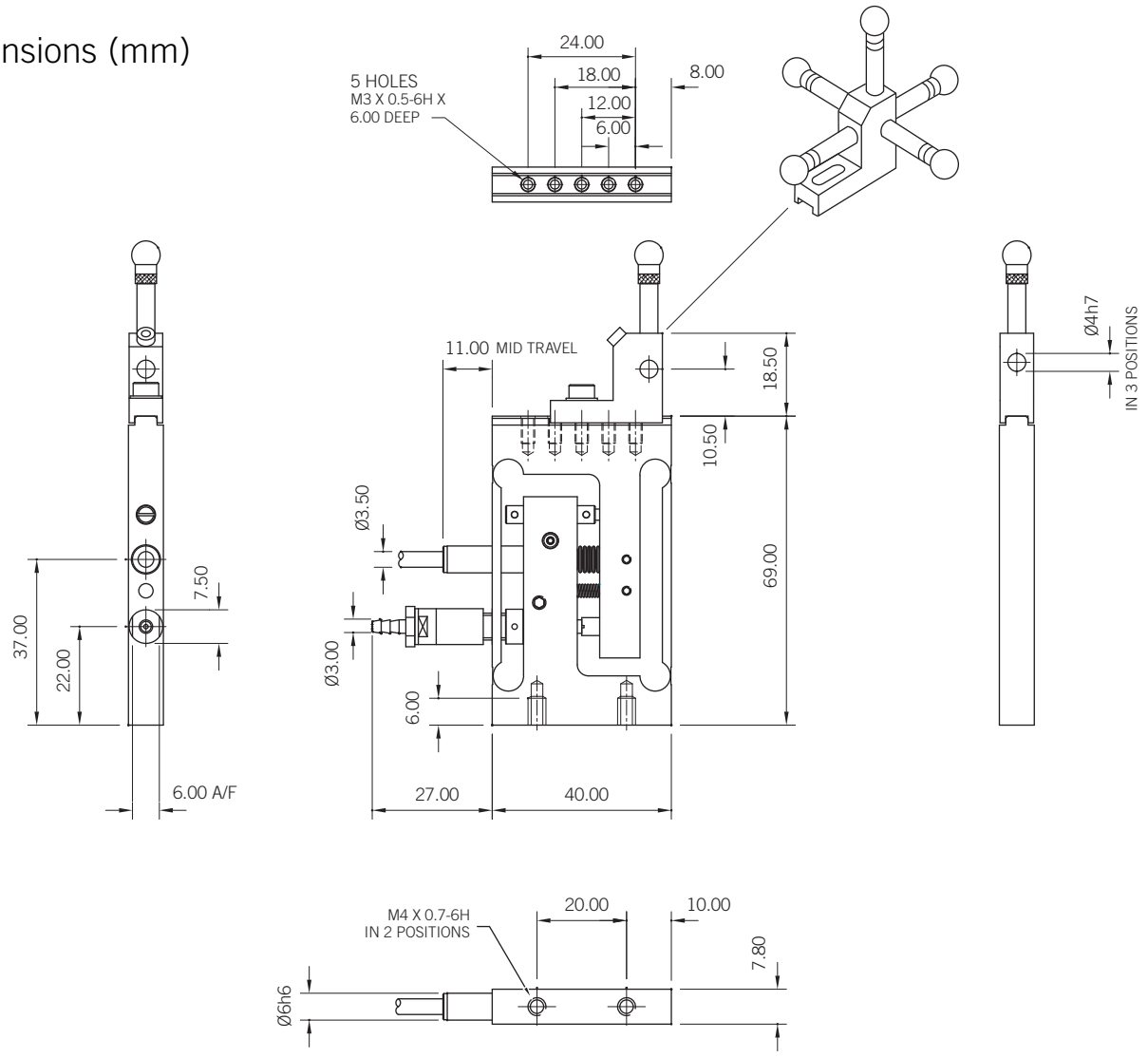
Life

Better than 25 million measuring cycles (dependant on application)



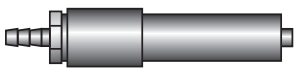


38 Dimensions (mm)

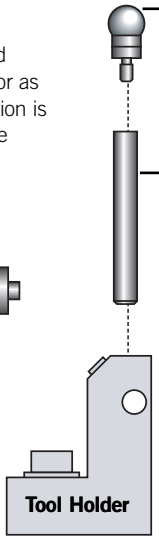


Accessories

The Flexure Gauge is supplied without the pneumatic actuator as standard. If pneumatic operation is required, the actuator must be ordered separately.



Pneumatic Actuator



Tips
With industry standard M2.5 thread. See page 92 or download the PDF file from www.solartronmetrology.com

Tips Carrier
A choice of 20, 30 or 40 mm length.

DZ series compact digital gauging probes

A novel approach to High Performance yet Compact Gauge Probes.

The lack of space to fit a gauge probe is often a problem for gauge builders and test engineers alike. Very short pencil style gauge probes have usually meant a reduction in performance and/or life expectancy, but that has now changed.

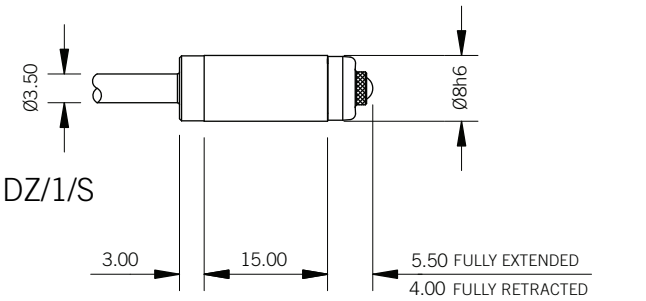
Solartron Metrology has taken a novel but practical route to solving the problem of miniaturisation with strength to produce the DZ range of compact Gauge Probes.

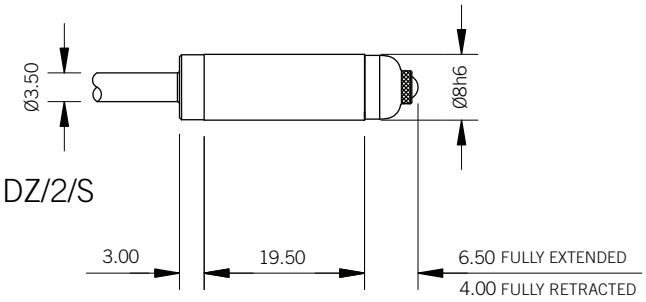
Up to 50% reduction in length over conventional 1mm and 2mm gauge probes has been achieved yet performance and life expectancy has been maintained. due to a completely new approach to the construction of gauge probes.

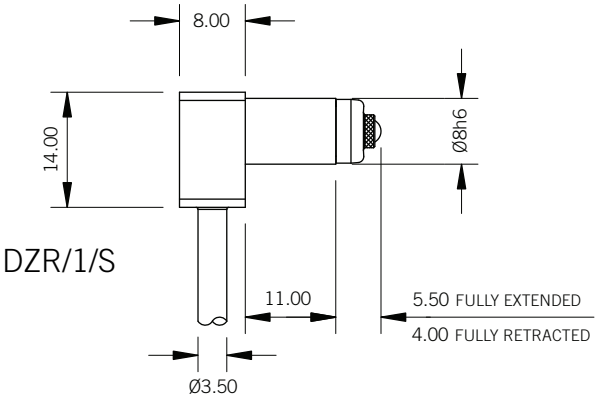
The sensor in a gauge probe normally sits behind the bearing. A reduction in overall length of a gauge probe is normally achieved by reducing the size of the bearing, which in turn affects the life or accuracy of the probe. Solartron's novel approach of fitting a specially designed sensor inside a Ball Sleeve Bearing enables the gauge builder to install extremely compact probes without compromising on performance.

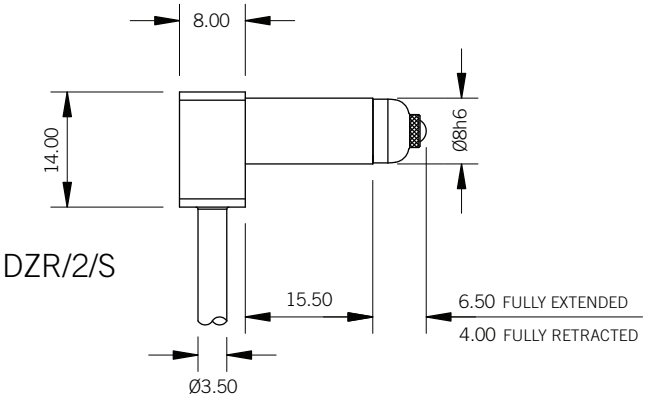
40 Specification and dimensions (mm)

Product type	DZ Digital Probe
Axial cable outlet	DZ/1/S DZ/2/S
Radial cable outlet	DZR/1/S DZR/2/S
Measurement	
Measurement range	1.0 mm 2.0mm
Accuracy	< 0.1%
Resolution	Down to 0.01um (user selectable)
Repeatability (um)	0.15
Pre-travel (mm)	0.15
Post-travel (mm)	0.35
Tip force (N) (mid position)	0.7
Temperature coefficient %FS/°C	0.01
Mechanical	
Body diameter	8h6
Body material	Stainless Steel
Tip Material	Tungsten Carbide
Gaiter	Viton®
Cable	PUR
Environmental (Probe only)	
Operating temperature (°C)	+5 to + 80
Storage temperature (°C)	-20 - + 70
IP rating	65
Interface electronics	
Reading rate	Up to 3906 readings per second
Bandwith	Up to 460 Hz
Output	Solartron Orbit Serial communication
Power	5.0 VDC +/- 0.25 @0.06A
Storage temperature (°C)	-20 to + 70
Operating temperature (°C)	0 to + 60
IP rating	43









Mini probes

The Solartron Digital Mini Probe is a compact, low profile transducer intended for measurements in confined spaces such as bores. The tip of the probe is adjustable to enable ease of installation.

- > Measurement range 0.5mm
- > Resolution programmable to < 0.05µm
- > Excellent repeatability and robustness in two planes
- > IP65 protection
- > Simple installation and sensor change
- > Suitable for operation in bores with key slot
- > Very compact size
- > Range of changeable tips
- > Up to 3,906 readings/second
- > Traceable calibration

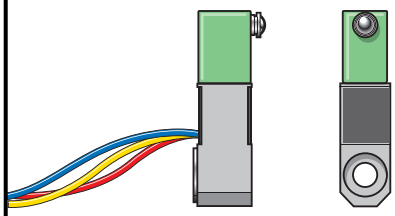
The Solartron Digital Mini Probe is based on a parallel spring structure that is significantly more robust than a single leaf arrangement. This greatly improves the reliability of the sensor, extending its working life and allowing it to be used in more demanding applications, such as automatic gages.

The parallel spring also ensures a high level of repeatability, both on axis and across axis, so that it can be used in dynamic applications where profiling is required.

The centreline of the tip is accurately aligned to one side of the transducer to provide a reference datum surface. Installation is simply a matter of positioning the device, and securing it via a single M3 screw. This requires accurate machining of the pocket in which the transducer is housed, with the resultant benefit of reduced installation and changeover time.

The digital nature of the Mini Probe provides an unprecedented ease of setup, especially since the electrical zero does not need to be set. The probe forms part of Solartron's range of digital products sharing the same Orbit Network interface. Mini Probes and other digital transducers can be connected via a single cable to a PC, PLC or Solartron's own Digital Readout.

The transducer is sealed using a Viton® boot to achieve IP65 requirements.
Tips with an M2 thread are available to suit different applications, these can be replaced in the field without the need to return the product to Solartron.

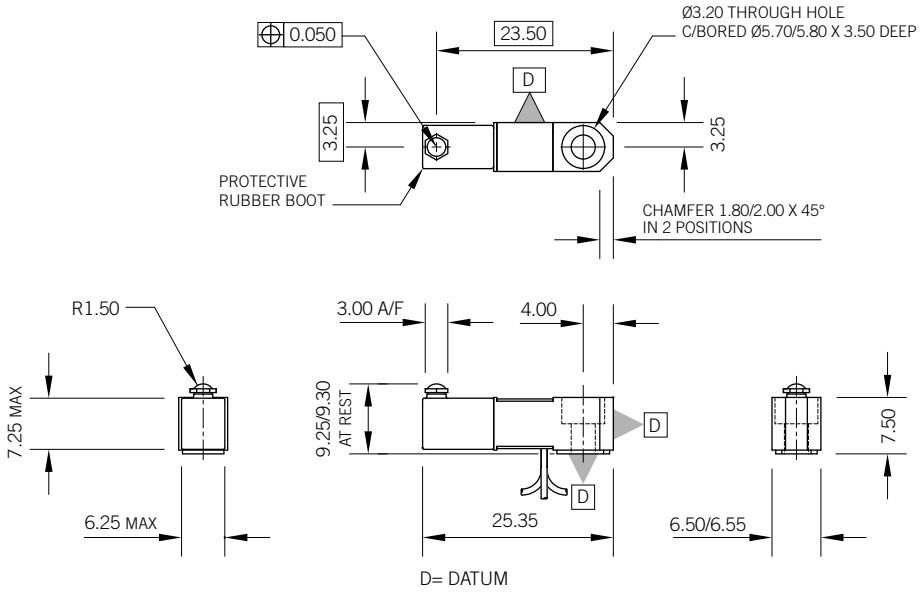


Product type: DM/0.5/S

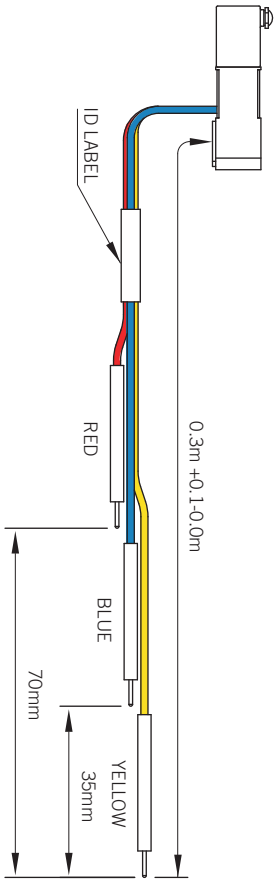
Measurement		
Measurement Range (mm)	**0.5**	
Mechanical Travel (mm)	0.6	
Start of Measuring Range	20 µm to 30 µm from limit stop	
Accuracy (nominal to axis of stylus)	±0.1 µm ± D x 0.2% (D= distance from setting master)	
Operational Repeatability[1] (µm)	On axis	On cross axis
at position 100 µm from limit stop	0.1	0.1
at position 250 µm from limit stop	0.25	0.15
at position 500 µm from limit stop	0.5	0.25
Resolution (µm)	0.05	
Measurement Bandwidth	Programmable from 6 Hz to 460 Hz	
Reading Speed	Up to 3906 readings/second (Dynamic Measurement Mode)	
Tip Force (N ± 25%)	0.7 (centre measurement range)	
Temperature Coefficient (µm/°C)	0.08	
Mechanical		
Mass (g)	< 15	
Recommended tip adjustment (mm)	±0.25 from the factory position (refer to manual)	
Material		
Mini Probe frame	Chromium Steel	
Frame Gaiter	Viton®	
Mounting	Retain using 1 x M3 screw (supplied with transducer)	
Environment		
Storage Temperature (°C)	-20 to +85	
Operating Temperature (°C)	0 to +60	
IP Rating Transducer	IP65	
Electronics	IP43	
Electrical Interface		
Energising Voltage	5 V ±0.25 VDC (Powered by Orbit Network)	
Energising Current	55 mA at 5 VDC (Powered by Orbit Network)	
Interface	Orbit Network	

1 Obtained by step gauging. Repeatability pushing the probe against the edge of the intended target prior to recording the measurement. This replicates the actual mini probe operation in the field.

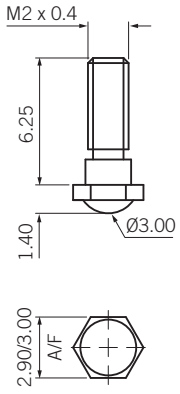
44 Dimensions (mm)



Cable assembly

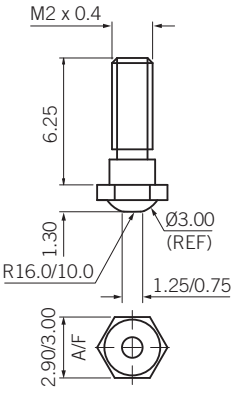


Probe tips



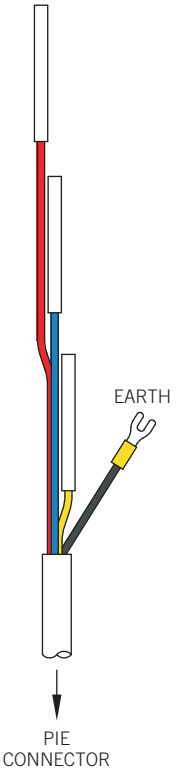
Ø3.00mm Ball

Tip material	Part no.
T.Carbide	804847
Ruby	804582
Silicon Nitride	804982



R12.70mm Ball

Tip material	Part no.
T.Carbide	804857



Lever Probe

The Solartron Digital Lever Probe is ideally suited to applications where the use of axial measuring probes is not possible, and where a low tip force and a high number of probing points are required.

> Measuring Range 0.5 mm
> Resolution Programmable to < 0.05 µm
> Tip Forces down to 5 g
> Excellent Repeatability
> Up to 3906 Readings/Second
> Industry Standard Styli
> Compact Size
> Direct Reading in mm/inch

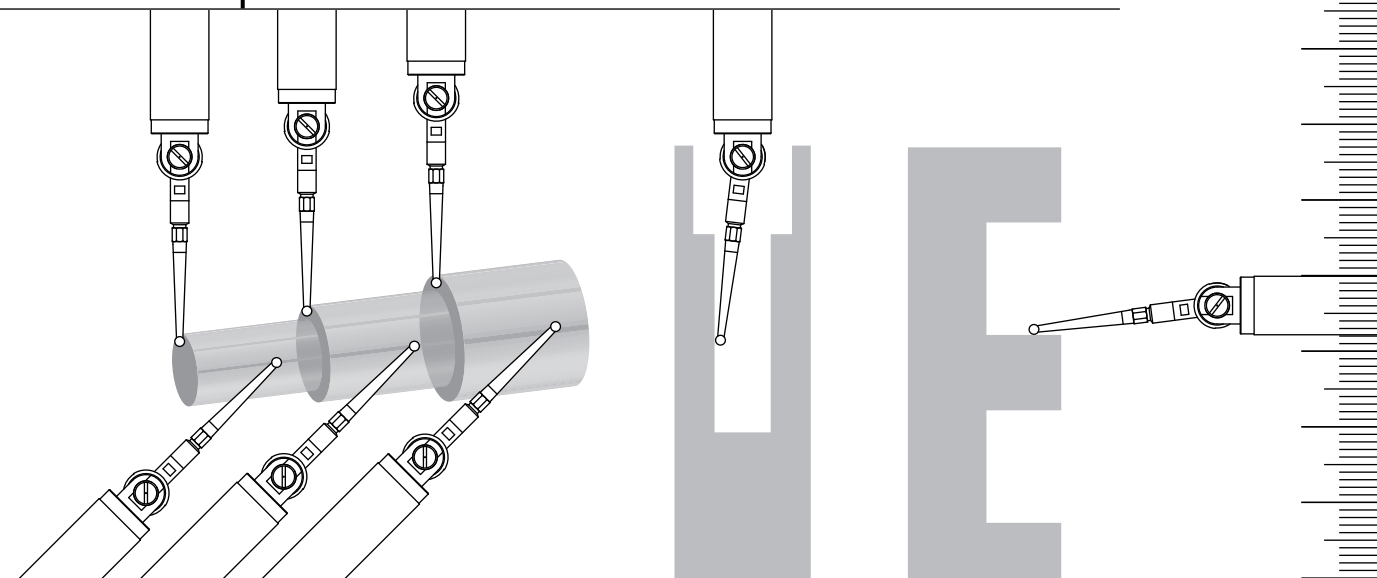
Solartron's Digital Lever Probe has been conceived for the precision measurement market. Its simple design and exceptional reliability result in a reduced cost of ownership without any reduction in performance.

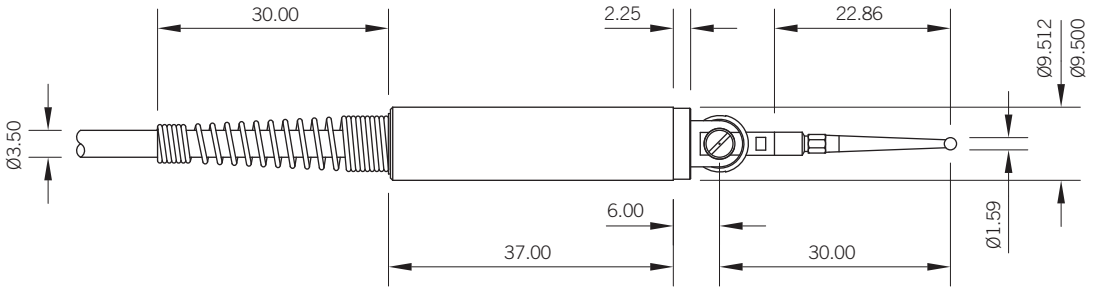
Due to its cylindrical housing geometry, the Lever Probe can be mounted in any attitude relative to the intended target. It can be mounted via the use of 8 mm peg or industry standard dovetail mounting blocks, or clamped directly into a 9.52 mm mounting hole.

With a measurement range of 500 µm and repeatability below 0.15 µm, the Digital Lever Probe can be easily integrated into measurement systems using Solartron's Orbit Network.

Product type: DL/0.5/S

Measurement	
Measurement Range (mm)	**0.5**
Mechanical Travel (mm)	0.6
Start of Measuring Range	20 µm to 30 µm from limit stop
Stylus Adjustment	180˚
Accuracy (nominal to axis of stylus)	±0.1 µm ± D x 0.08% (D= distance from setting master)
Repeatability (µm)	< 0.15
Hysteresis (µm)	< 0.25
Resolution (µm)	User selectable to < 0.01
Measurement Bandwidth	Programmable from 6 Hz to 460 Hz
Reading Speed	Up tp 3906 readings/second (Dynamic Measurement Mode)
Tip Force (N ±20%)	Options for 0.05 to 0.3 in 0.05N increments
Temperature Coefficient (µm/˚C)	0.1
Life (dependant on application)	Better than 5 million measuring cycles
Mechanical	
Mass (g)	< 15
Material of Frame	Stainless Steel
Mounting	Direct clamping into 9.52 mm hole Mounting blocks for 8 mm peg Industry standard dovetail available as accessories
Stylus (available in ball diameters) (mm)	2.54, 1.59, 0.79, 0.39 Mounting thread 1.72 UNF
Environment	
Storage Temperature (˚C)	-20 to +85
Operating Temperature (˚C)	0 to +60
Shock	To maintain best performance the Lever Probe should be protected from shock
Electrical Interface	
Energising Voltage	5 V ±0.25 VDC (Powered from Orbit Network)
Energising Current	55 mA at 5 VDC (Powered by Orbit Network)
Interface	Orbit Network

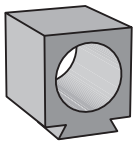




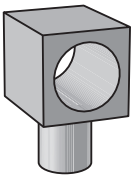
Accessories

Mounting blocks

The Digital Lever Probe can be clamped directly into a 9.52 mm mounting hole. Alternatively the following mounting blocks are available;



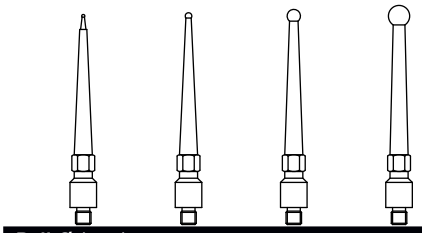
Industry standard dovetail mounting block



8 mm peg mounting block

Ball tipped styli

A range of styli are available with different ball diameters



Ball Ø (mm)			
0.38	0.79	1.59	2.54

Mounting threads are all 1-75 UNF

Displacement transducers

Regardless of whether a miniature displacement sensor is used within a semiconductor manufacturing process or a submersible transducer is monitoring the deformation of a structure in sea water, the need for reliability over long periods remains the same.

- > S-Series
- > Optimum series
- > MD micro series
- > SM series
- > DC miniature
- > Submersible

S series

50 Displacement transducers

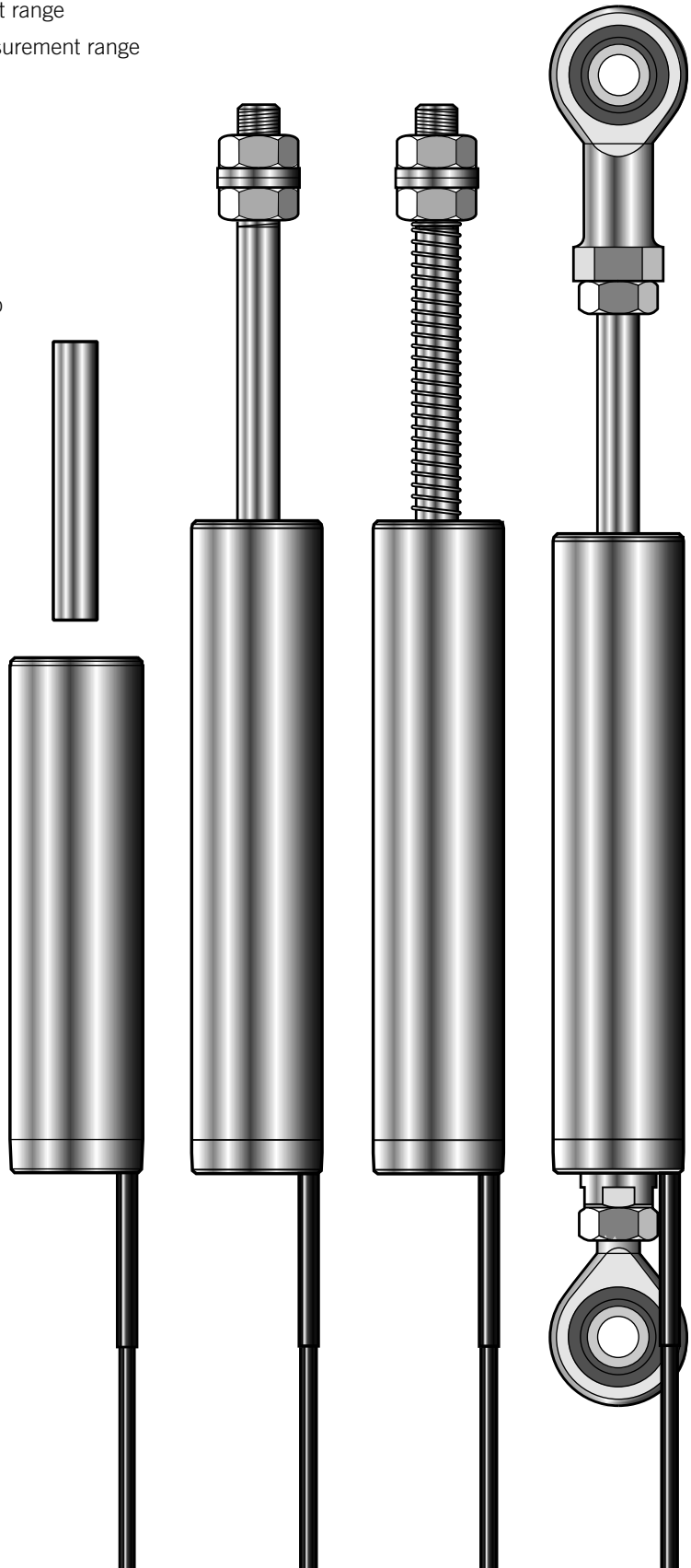
> Digital options with 5mm to 150mm measurement range
> Analogue options with ±2.5 mm to ±75 mm measurement range
> DC and 4-20mA versions with integral electronics
> <0.2% Linearity FRO
> Hermetically sealed and submersible on request
> IP67 protection
> Rugged 19mm diameter stainless steel body
> Rigid stainless steel carriers
> Improved measurement range to body length ratio
> Large bore to core clearance
> Wide range of accessories

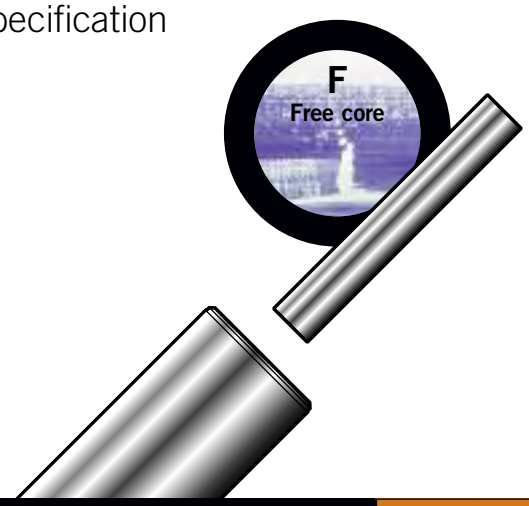
The S Series of Displacement Transducers is the culmination of many years' experience gained from Solartron Metrology's highly successful Mach One range plus careful note of market feedback. The result is a totally new range of transducers that is better able to satisfy today's demanding manufacturing and research applications.

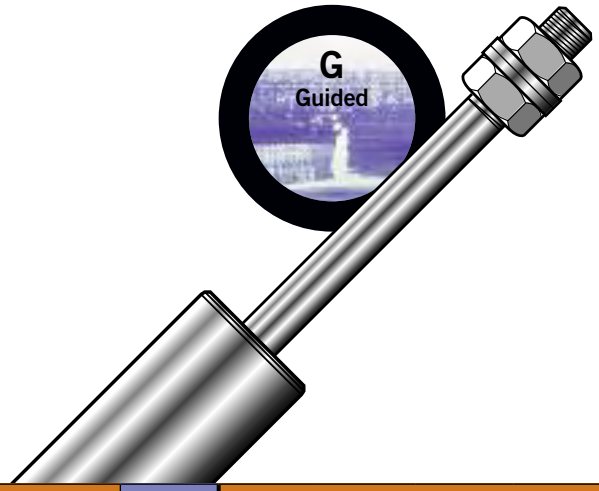
The need to transfer signals from the transducer to data acquisition and control systems reliably, quickly and cost effectively has been catered for with a complete new range of onboard or external analogue signal conditioning units and Orbit compatible modules for digital versions.

The Stainless Steel body with improved sealing to IP67 coupled with new polymer guides with rigid carriers, ensure that the transducers keep working accurately and reliably, especially in wet and corrosive conditions.

An unusually large bore to core clearance is maintained throughout the range, even on transducers fitted with onboard signal conditioning, enabling easier installation and making the assembly more forgiving of misalignment.







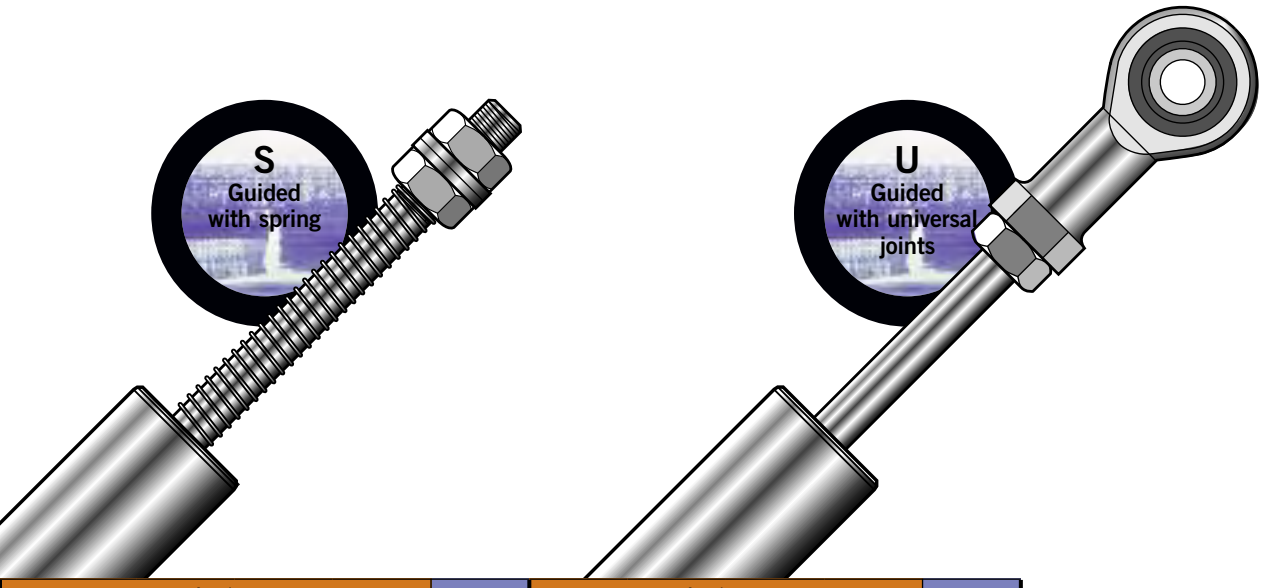
Product type	Analogue				Digital	Analogue				Digital
	LVDT	±5 V	0-10 V	4-20 mA		LVDT	±5 V	0-10 V	4-20 mA	
Free Core (F)	AS/2.5/F	VS/2.5/FB	VS/5/FU	IS/5/F	-	AS/5/F	VS/5/FB	VS/10/FU	IS/10/F	-
Guided (G)	AS/2.5/G	VS/2.5/GB	VS/5/GU	IS/5/G	DS/5/G	AS/5/G	VS/5/GB	VS/10/GU	IS/10/G	DS/10/G
Guided with Spring (S)	AS/2.5/S	VS/2.5/SB	VS/5/SU	IS/5/S	DS/5/S	AS/5/S	VS/5/SB	VS/10/SU	IS/10/S	DS/10/S
Guided with Universal Joints (U)	AS/2.5/U	VS/2.5/UB	VS/5/UU	IS/5/U	DS/5/U	AS/5/U	VS/5/UB	VS/10/UU	IS/10/U	DS/10/U
Measurement										
Measurement Range (mm)	**±2.5**		**5**			**±5**		**10**		
Linearity[1] (%FRO)	±0.2					±0.2				
Resolution (µm)	see note[2]				<0.1	see note[2]				<0.1
Pre-travel[3] ±0.5 (mm)	1.25					2.25				
Post-travel[3] ±0.5 (mm)	1.60					2.60				
Tip Force ±20% (horiz. at mid position) (N)	1.00					1.00				
Spring Rate ±20% (N/mm)	0.090					0.076				
Temperature Coefficient (%FRO/°C)	<0.02					<0.01				
Mechanical										
Body length ±0.5 (mm free core)	33.5	72.5			33.5	53	92			53
Body length ±0.5 (mm guided)	55	94			55	74.5	113.5			74.5
Body Diameter (mm)	19.00 (+0, -0.2)									
Weight[4] ±5g (g)	58	72				66	80			
Core weight[4] ±1g (g)	2.6					5.0				
Electrical Interface -LVDT										
Sensitivity ±5% (mV/V/mm)	144	-	-	-	-	178	-	-	-	-
Energising current ±5% (mA/V)	1.0	-	-	-	-	2.6	-	-	-	-
Residual Voltage at Null Position (%FRO)	<0.5	-	-	-	-	<0.5	-	-	-	-

Environmental	
Storage Temp: (°C)	LVDT:-40 to +120 DC, 4-20mA & Digital: -20 to +85
Operating Temp: (°C)	LVDT:-40 to +120 DC, 4-20mA: 0°C to 65°C Digital: -40 to +120 (transducer only)
IP Rating:	LVDT, DC, 4-20mA, Digital (transducer only): IP67
Vibration: Sinusoidal Amplitude	10 to 50 Hz. 50Hz to 1 kHz 1 to 10 g rms linear. 10 g rms
Shock:	Drop testing 1m onto a hard surface Topple testing 10 times from each end onto hard surface

Digital Probe Interface Electronics (PIE)	
Reading Rate:	Up to 3906 readings/second
Bandwidth:	Up to 460Hz dependent on noise performance required
Output:	Serial communication-RS485 signal level (Solartron Orbit Protocol)
Storage Temp: (°C)	-20 to +85
Operating Temp: (°C)	0 to +60
IP Rating:	IP43

Electrical Interface-DC & 4-20mA	
Input Voltage (VDC)	10 to 30
Output Ripple (%FRO)	0.02
Bandwidth	500Hz (-3 dB)

Materials	
Case	300 series Stainless Steel
Cable	FEP
Core	Nickel/Iron



Analogue				Digital
LVDT	±5 V	0-10 V	4-20 mA	
AS/7.5/F	VS/7.5/FB	VS/15/FU	IS/15/F	-
AS/7.5/G	VS/7.5/GB	VS/15/GU	IS/15/G	DS/15/G
AS/7.5/S	VS/7.5/SB	VS/15/SU	IS/15/S	DS/15/S
AS/7.5/U	VS/7.5/UB	VS/15/UU	IS/15/U	DS/15/U
±7.5		**15**		
±0.2				
see note[2]				<0.2
0.85				
1.20				
1.05				
0.057				
<0.01				
60.2	99.2			60.2
81.7	120.7			81.7
19.00 (+0, -0.2)				
67	81			
5.8				
121	-	-	-	-
2.2	-	-	-	-
<0.5	-	-	-	-

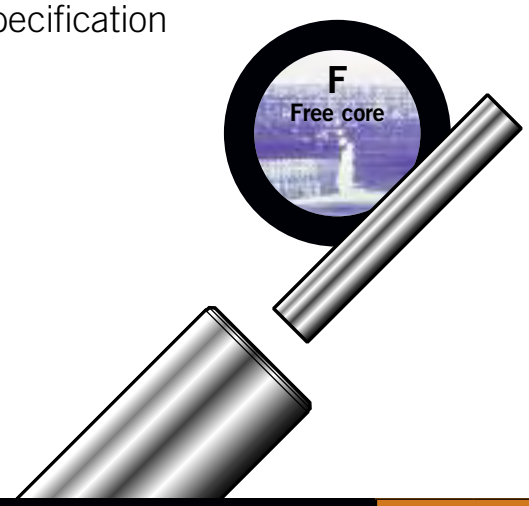
Analogue				Digital
LVDT	±5 V	0-10 V	4-20 mA	
AS/10/F	VS/10/FB	VS/20/FU	IS/20/F	-
AS/10/G	VS/10/GB	VS/20/GU	IS/20/G	DS/20/G
AS/10/S	VS/10/SB	VS/20/SU	IS/20/S	DS/20/S
AS/10/U	VS/10/UB	VS/20/UU	IS/20/U	DS/20/U
±10		**20**		
±0.2				
see note[2]				<0.2
2.45				
2.90				
1.10				
0.048				
<0.01				
74.5	113.5			74.5
96	135.0			96
80	94			
7.2				
76	-	-	-	-
0.6	-	-	-	-
<0.5	-	-	-	-

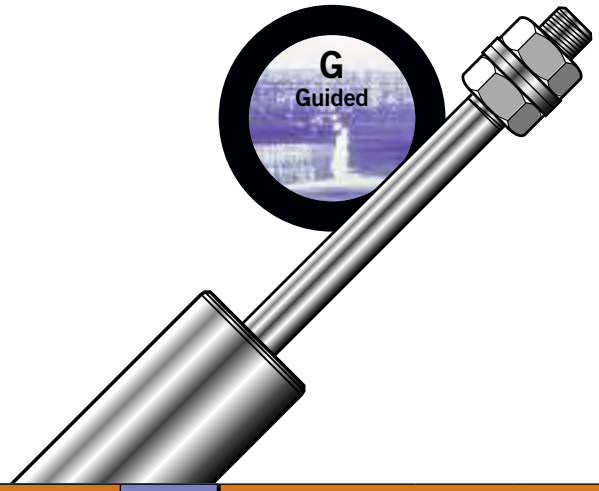
1 The linearity and electrical specification of the LVDT version is valid for the following conditions: energised at 3 V ±3mV r ms into a 100 kΩ load resistance configured with the centre ground at an excitation frequency of 5 kHz.

2 Dependent on associated electronics.

3 Guided versions and spring versions only.

4 Free core versions only. Weight for digital version is for probe only and excludes PIE.





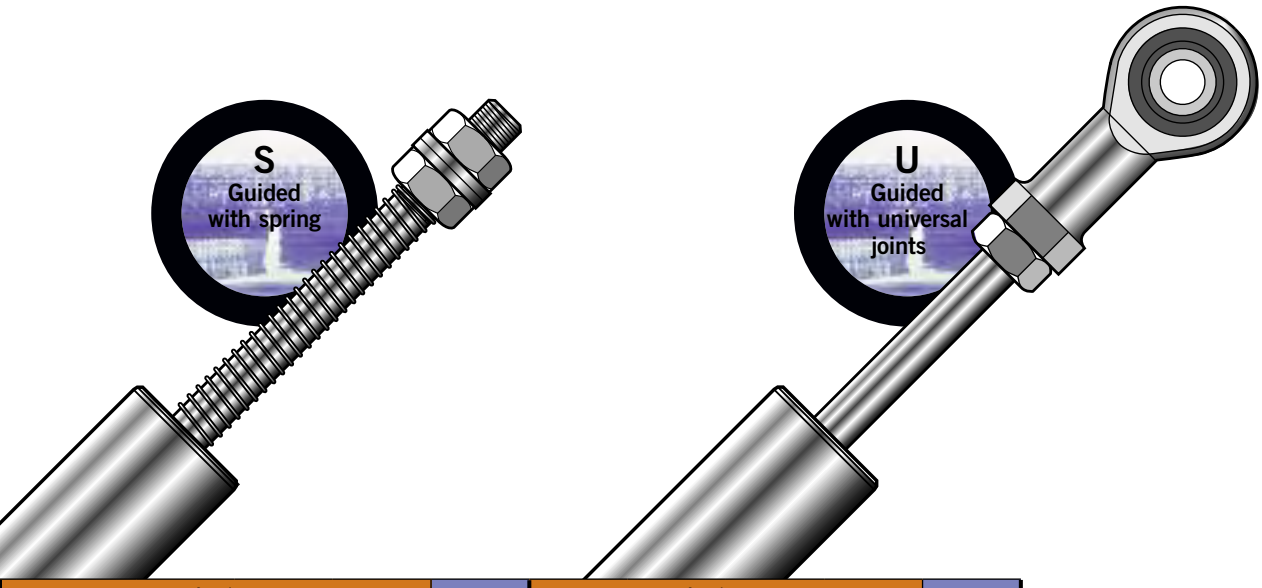
Product type	Analogue				Digital	Analogue				Digital
	LVDT	±5 V	0-10 V	4-20 mA		LVDT	±5 V	0-10 V	4-20 mA	
Free Core (F)	AS/15/F	VS/15/FB	VS/30/FU	IS/30/F	-	AS/25/F	VS/25/FB	VS/50/FU	IS/50/F	
Guided (G)	AS/15/G	VS/15/GB	VS/30/GU	IS/30/G	DS/30/G	AS/25/G	VS/25/GB	VS/50/GU	IS/50/G	DS/50/G
Guided with Spring (S)	AS/15/S	VS/15/SB	VS/30/SU	IS/30/S	DS/30/S	AS/25/S	VS/25/SB	VS/50/SU	IS/50/S	DS/50/S
Guided with Universal Joints (U)	AS/15/U	VS/15/UB	VS/30/UU	IS/30/U	DS/30/U	AS/25/U	VS/25/UB	VS/50/UU	IS/50/U	DS/50/U
Measurement										
Measurement Range (mm)	**±15**		**30**			**±25**		**50**		
Linearity[1] (%FRO)	±0.2					±0.2				
Resolution (µm)	see note[2]				<0.3	see note[2]				<0.5
Pre-travel[3] ±0.5 (mm)	5.95					6.15				
Post-travel[3] ±0.5 (mm)	6.30					6.60				
Tip Force ±20% (horiz. at mid position) (N)	1.25					1.50				
Spring Rate ±20% (N/mm)	0.035					0.031				
Temperature Coefficient (%FRO/°C)	<0.01					<0.01				
Mechanical										
Body length ±0.5 (mm free core)	88.9	127.9			88.9	110.4	149.4			110.4
Body length ±0.5 (mm guided)	110.4	149.4			110.4	131.9	170.9			131.9
Body Diameter (mm)	19.00 (+0, -0.2)									
Weight[4] ±5g (g)	92	106				110	124			
Core weight[4] ±1g (g)	6.4					6.6				
Electrical Interface -LVDT										
Sensitivity ±5% (mV/V/mm)	60	-	-	-	-	21	-	-	-	-
Energising current ±5% (mA/V)	1.5	-	-	-	-	0.5	-	-	-	-
Residual Voltage at Null Position (%FRO)	<0.5	-	-	-	-	<0.5	-	-	-	-

Environmental	
Storage Temp: (°C)	LVDT:-40 to +120 DC, 4-20mA & Digital: -20 to +85
Operating Temp: (°C)	LVDT:-40 to +120 DC, 4-20mA: 0°C to 65°C Digital: -40 to +120 (transducer only)
IP Rating:	LVDT, DC, 4-20mA, Digital (transducer only): IP67
Vibration: Sinusoidal Amplitude	10 to 50 Hz. 50Hz to 1 kHz 1 to 10 g rms linear. 10 g rms
Shock:	Drop testing 1m onto a hard surface Topple testing 10 times from each end onto hard surface

Digital Probe Interface Electronics (PIE)	
Reading Rate:	Up to 3906 readings/second
Bandwidth:	Up to 460Hz dependent on noise performance required
Output:	Serial communication-RS485 signal level (Solartron Orbit Protocol)
Storage Temp: (°C)	-20 to +85
Operating Temp: (°C)	0 to +60
IP Rating:	IP43

Electrical Interface-DC & 4-20mA	
Input Voltage (VDC)	10 to 30
Output Ripple (%FRO)	0.02
Bandwidth	500Hz (-3 dB)

Materials	
Case	300 series Stainless Steel
Cable	FEP
Core	Nickel/Iron



Analogue				Digital
LVDT	±5 V	0-10 V	4-20 mA	
AS/50/F	VS/50/FB	VS/100/FU	IS/100/F	
AS/50/G	VS/50/GB	VS/100/GU	IS/100/G	DS/100/G
AS/50/S	VS/50/SB	VS/100/SU	IS/100/S	DS/100/S
AS/50/U	VS/50/UB	VS/100/UU	IS/100/U	DS/100/U
±50		**100**		
±0.2				
see note[2]			<1	
4.25				
4.60				
1.75				
0.021				
<0.01				
168	207		168	
189.5	228.5		189.5	
19.00 (+0, -0.2)				
153	167			
9.0				
15	-	-	-	-
0.6	-	-	-	-
<0.5	-	-	-	-

Analogue				Digital
LVDT	±5 V	0-10 V	4-20 mA	
AS/75/F	VS/75/FB	VS/150/FU	IS/150/F	
AS/75/G	VS/75/GB	VS/150/GU	IS/150/G	DS/150/G
AS/75/S	VS/75/SB	VS/150/SU	IS/150/S	DS/150/S
AS/75/U	VS/75/UB	VS/150/UU	IS/150/U	DS/150/U
±75		**150**		
±0.2				
see note[2]			<2	
4.35				
4.70				
1.60				
0.012				
<0.015				
218.2	257.2		218.2	
239.7	278.7		239.7	
167	181			
9.0				
10	-	-	-	-
2.5	-	-	-	-
<0.5	-	-	-	-

1 The linearity and electrical specification of the LVDT version is valid for the following conditions: energised at 3 V ±3mV r ms into a 100 kΩ load resistance configured with the centre ground at an excitation frequency of 5 kHz.

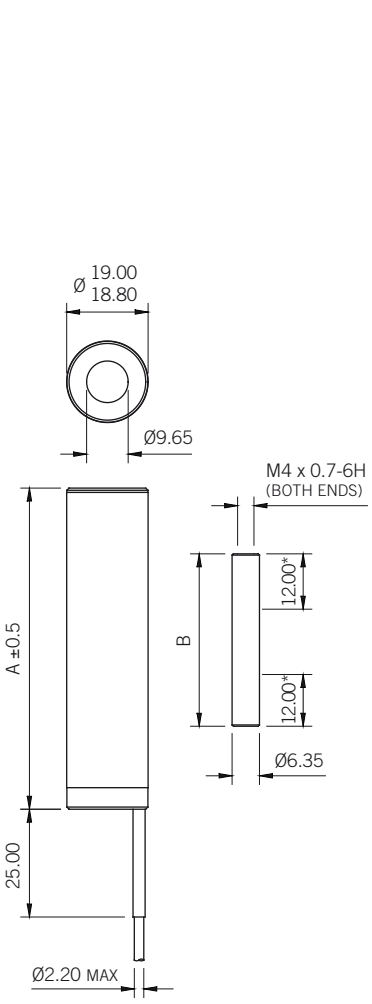
2 Dependent on associated electronics.

3 Guided versions and spring versions only.

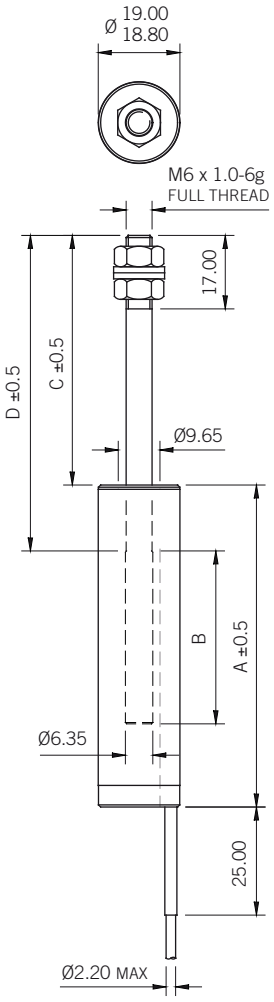
4 Free core versions only.

Dimensions (mm)

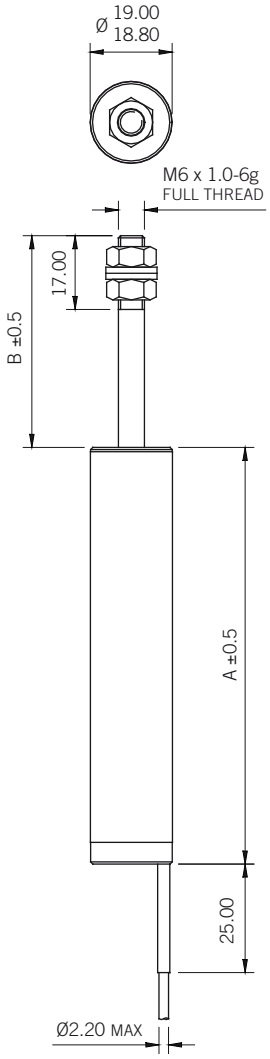
Free Core



Free Core with Carrier



Guided

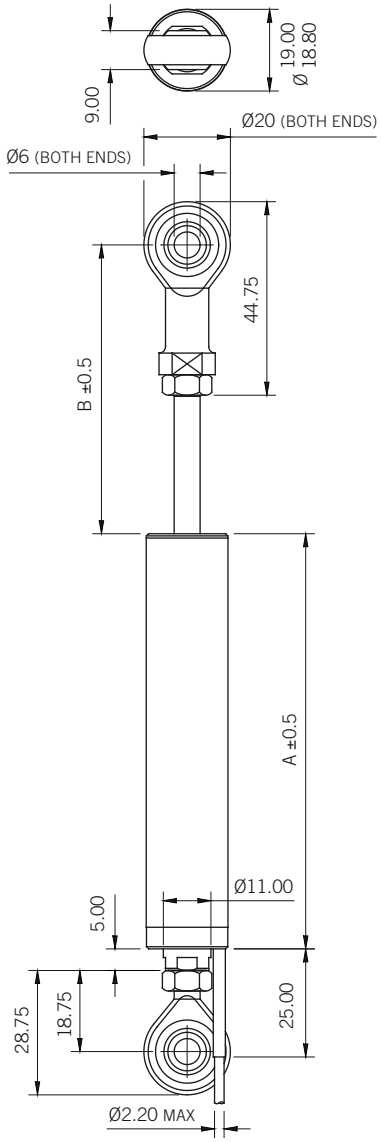


Free Core Free Core with Carrier	'A' body length	'B' core length	'C' at null	'D'
AS/2.5/F	35.5	16.5	40.5	47.0
AS/5/F	53.0	29.0	48.0	58.0
AS/7.5/F	60.2	34.0	50.9	62.0
AS/10/F	74.5	40.0	57.75	73.0
AS/15/F	88.9	37.5	67.3	91.0
AS/25/F	110.4	38.5	80.05	114.0
AS/50/F	168.0	50.0	115.0	172.0
AS/75/F	218.2	50.0	160.9	243.0
VS/2.5/FB, VS/5/FU, IS/5/F	72.5	16.5	40.5	47.0
VS/5/FB, VS/10/FU, IS/10/F	92.0	29.0	48.0	58.0
VS/7.5/FB, VS/15/FU, IS/15/F	99.2	34.0	50.9	62.0
VS/10/FB, VS/20/FU, IS/20/F	113.5	40.0	57.75	73.0
VS/15/FB, VS/30/FU, IS/30/F	127.9	37.5	67.3	91.0
VS/25/FB, VS/50/FU, IS/50/F	149.4	38.5	80.05	114.0
VS/50/FB, VS/100/FU, IS/100/F	207.0	50.0	115.0	172.
VS/7.5/FB, VS/150/FU, IS/150/F	257.2	50.0	160.9	243.0

Guided	'A' body length	'B1' fully extended	'B2' at null	'B3' fully retracted
AS/2.5/G, DS/5/G	55.0	35.25	31.5	27.4
AS/5/G, DS/10/G	74.5	46.25	39.0	31.4
AS/7.5/G, DS/15/G	81.7	20.25	41.9	33.2
AS/10/G, DS/20/G	96.0	61.25	48.8	35.9
AS/15/G, DS/30/G	110.4	79.25	58.3	37.0
AS/25/G, DS/50/G	131.9	102.25	71.1	39.5
AS/50/G, DS/100/G	189.5	160.25	106.0	51.4
AS/75/G, DS/150/G	239.7	231.25	151.9	72.2
VS/2.5/GB, VS/5/GU, IS/5/G	94.0	35.25	31.5	27.4
VS/5/GB, VS/10/GU, IS/10/G	113.5	46.25	39.0	31.4
VS/7.5/GB, VS/15/GU, IS/15/G	120.7	50.25	41.9	33.2
VS/10/GB, VS/20/GU, IS/20/G	135.0	61.25	48.8	35.9
VS/15/GB, VS/30/GU, IS/30/G	149.4	79.25	58.3	37.0
VS/25/GB, VS/50/GU, IS/50/G	170.9	102.25	71.1	39.5
VS/50/GB, VS/100/GU, IS/100/G	228.5	160.25	106.0	51.4
VS/7.5/GB, VS/150/GU, IS/150/G	278.7	231.25	151.9	72.2

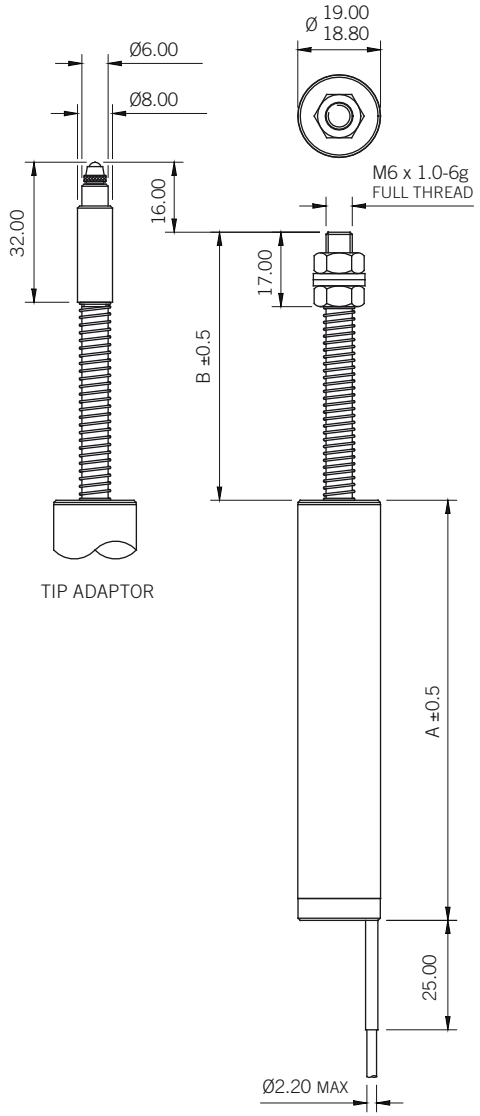
* 12 mm dimensions not applicable for AS/2.5/F, VS/2.5/F, VS/5/FU and IS/5/F

Guided with Universal Joints



Universal joints	'A' body length	'B1' fully extended	'B2' at null	'B3' fully retracted
AS/2.5/U, DS/5/U	55.0	53.25	49.5	45.4
AS/5/U, DS/10/U	74.5	64.25	57.0	49.4
AS/7.5/U, DS/15/U	81.7	68.25	59.9	51.2
AS/10/U, DS/20/U	96.0	79.25	66.8	53.9
AS/15/U, DS/30/U	110.4	97.25	76.3	55.0
AS/25/U, DS/50/U	131.9	120.25	89.1	57.5
AS/50/U. DS/100/U	189.5	178.25	124.0	69.4
AS/75/U, DS/150/U	239.7	249.25	169.9	90.2
VS/2.5/UB, VS/5/UU, IS/5/U	94.0	53.25	49.5	45.4
VS/5/UB, VS/10/UU, IS/10/U	113.5	64.25	57.0	49.4
VS/7.5/UB, VS/15/UU, IS/15/U	120.7	68.25	59.9	51.2
VS/10/UB, VS/20/UU, IS/20/U	135.0	79.25	66.8	53.9
VS/15/UB, VS/30/UU, IS/30/U	149.4	97.25	76.3	55.0
VS/25/UB, VS/50/UU, IS/50/U	170.9	120.25	89.1	57.5
VS/50/UB, VS/100/UU, IS/100/U	228.5	178.25	124.0	69.4
VS/7.5/UB, VS/150/UU, IS/150/U	278.7	249.25	169.9	90.2

Guided Spring Push



Guided Spring Push	'A' body length	'B1' fully extended	'B2' at null	'B3' fully retracted
AS/2.5/S, DS/5/S	55.0	35.25	31.5	27.4
AS/5/S, DS/10/S	74.5	46.25	39.0	31.4
AS/7.5/S, DS/15/S	81.7	20.25	41.9	33.2
AS/10/S, DS/20/S	96.0	61.25	48.8	35.9
AS/15/S, DS/30/S	110.4	79.25	58.3	37.0
AS/25/S, DS/50/S	131.9	102.25	71.1	39.5
AS/50/S. DS/100/S	189.5	160.25	106.0	51.4
AS/75/S, DS/150/S	239.7	231.25	151.9	72.2
VS/2.5/SB, VS/5/SU, IS/5/S	94.0	35.25	31.5	27.4
VS/5/SB, VS/10/SU, IS/10/S	113.5	46.25	39.0	31.4
VS/7.5/SB, VS/15/SU, IS/15/S	120.7	50.25	41.9	33.2
VS/10/SB, VS/20/SU, IS/20/S	135.0	61.25	48.8	35.9
VS/15/SB, VS/30/SU, IS/30/S	149.4	79.25	58.3	37.0
VS/25/SB, VS/50/SU, IS/50/S	170.9	102.25	71.1	39.5
VS/50/SB, VS/100/SU, IS/100/S	228.5	160.25	106.0	51.4
VS/7.5/SB, VS/150/SU, IS/150/S	278.7	231.25	151.9	72.2

* for spring push with tip add 16.0mm

Optimum series

58 AC miniature LVDT displacement transducers

- > Good measurement range to length ratio
- > Small body diameter
- > Large radial core to bore clearance
- > Rugged construction
- > High performance

The Optimum Series of LVDT transducers 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 light weight 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 1.9mm 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 posible to mount the core and carrier on the moving part.

Note: the Optimum can be wired as either differential output or ratiometric

Product type	Analogue	Digital
Guided	OP1.5	DO3
Free		
Measurement		
Measurement Range (mm)	**±1.5**	**3**
Pre-travel (mm)	1.78	
Total mechanical travel (mm)	6.72	
Linearity (%FRO)	0.25	
Resolution (µm)	see note 1	<0.1
Min Upward force[1] (g)	69	
Horizontal Force at mid point (g)	66	
Mechanical		
Material	400 Series stainless steel	
Standard cable length (m)	0.5 (PTFE)	
Length of carrier (protruding at 0 position)[2]	15.42	
Transducer weight ±0.5 (g)	7	
Mass of moving components ±0.2 (g)	1.5	
Spring rate (g/mm)	14.2	
Environmental		
Storage Temperature (°C)	-40 to +150	
Operating Temperature (°C)	-40 to +150	
IP rating	IP65	
Electrical Interface (LVDT)		
Wiring configuration	LVDT	
Energising Voltage (Vrms)	1 to 10	
Sensitivity at 5 kHz (±5% mV/V/mm)	108	-
Energising Current at 5 kHz (mA/V)	6	-
Zero Phase Frequency (kHz)	13.1	-

1 Dependent on electronics

2 Only guided with spring

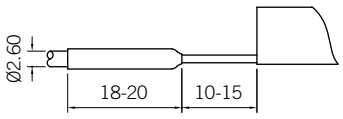
3 For guided versions only

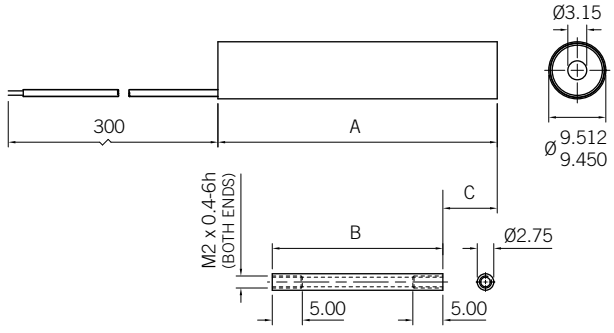
All analogue LVDT transducers calibrated at 3V, 5kHz frequency into a 100kΩ load.

Analogue	Digital	Analogue	Digital
OP6	DO12	OP12.5	DO25
±6.0	**12**	**±12.5**	**25**
1.53		2.33	
15.22		29.82	
0.25		0.25	
see note 1	<0.1	see note 1	<0.2
82		73	
94		93	
400 Series stainless steel		400 Series stainless steel	
0.5 (PTFE)		0.5 (PTFE)	
26.77		43.97	
12		20	
2.5		3.5	
6.6		5.2	
-40 to +150		-40 to +150	
-40 to +150		-40 to +150	
IP65		IP65	
LVDT		LVDT	
1 to 10		1 to 10	
78	-	69	-
4.5	-	5.7	-
24.1	-	24.8	-

Free Core

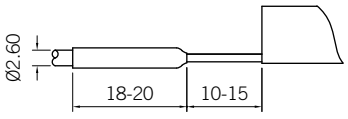
Type	'A' Body Length	'B' Core Length	'C' At Null
OP1.5	20.60	11.00	4.80
OP6.0	46.50	28.40	9.05
OP12.5	83.50	50.80	16.35

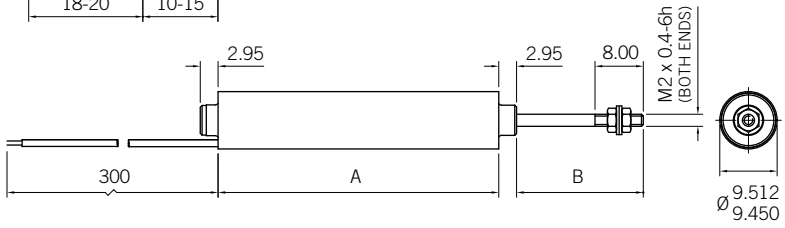




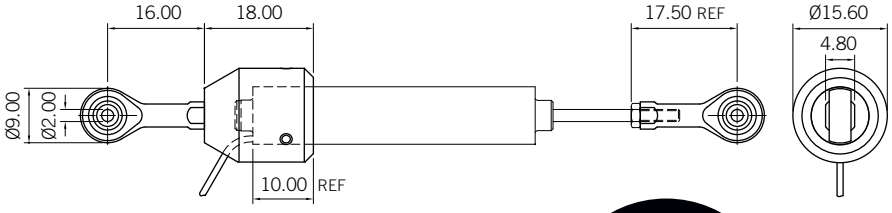
Guided Core

Type	'A' Body Length	'B' At Null
OP1.5	20.60	14.10
OP6.0	46.50	21.00
OP12.5	83.50	31.70



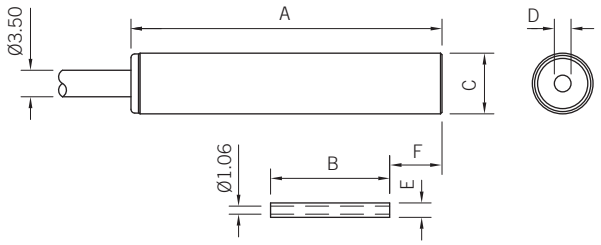


Universal Joints



MD micro series

60 AC miniature displacement transducers



Type	'A' Body Length	'B' Core Length LVDT	'B' Core Length H/B	'C' Body O/D (fit)	'D' Body I/M	'E' Core O/D	'F' At Null
M6D1 / M6DH1	28.00	11.00	10.30	Ø6h6	Ø1.95	Ø1.60	2.00
MD1 / MD1H	28.00	11.00	8.85	Ø8h6	Ø2.20	Ø1.90	3.00
MD2.5 / MD2.5H	41.00	15.70	15.00	Ø8h6	Ø2.20	Ø1.90	6.90
MD5 / MD5H	49.00	21.20	18.40	Ø8h6	Ø2.20	Ø1.90	8.40
MD10 / MD10H	68.00	24.40	29.00	Ø8h6	Ø2.20	Ø1.90	16.40

> Small diameter
> Right angle outlet available
> Low core weight
> Uses screened cable
> Spring relief

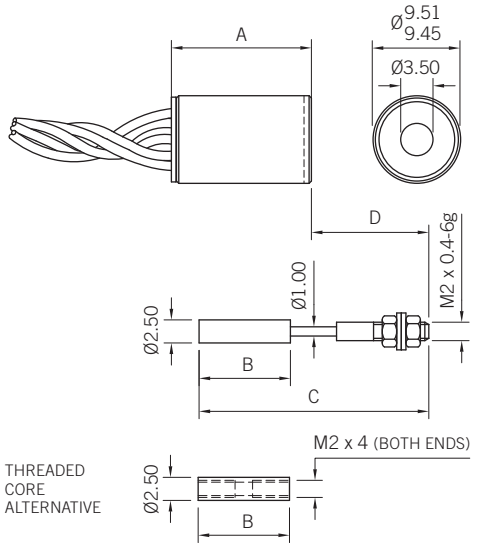
The small case diameter (6mm and 8mm) allows for easy installation in confined spaces. A right angle output facility is available as a retrofit for the 8mm version.
The low core weight makes this range ideal for use in low inertia systems. Cross talk is prevented by the screened cable, which also allows for multiple use of these transducers in close proximity.

Product type	MD Micro Series				
LVDT	M6D1	MD1	MD2.5	MD5	MD10
Half Bridge	M6DH1	MD1H	MD2.5H	MD5H	MD10H
Measurement					
Measurement Range (mm)	**±1**	**±1**	**±2.5**	**±5**	**±10**
Linearity[1] (% Reading)	0.5				
Temperature Coefficient (%FRO/°C)	<0.01%				
Mechanical					
Material	400 Series stainless steel				
Standard cable length (m) Null	2 (PU)				
Length of carrier (protruding at Null)	Free core				
Transducer weight ±0.5 (g)	2.6	5.0	7.6	8.5	13.0
Mass of moving components nominal (g)	0.1	0.2	0.2	0.3	0.7
Environmental					
Storage Temperature (°C)	-40 to +105				
Operating Temperature (°C)	-10 to +80				
IP rating	None				
Electrical Interface (LVDT)					
Energising Voltage (Vrms)	1 to 10V				
Sensitivity at 10 kHz (±5% mV/V/mm)	269	210	150	105	33
Energising Current at 5 kHz (mA/V)	3	1.8	2.0	1.0	0.6
Zero Phase Frequency (kHz)	13	10	13	10	14
Electrical Interface (Half bridge)					
Energising Voltage (Vrms)	1-10				
Sensitivity at 10 kHz (±5% mV/V/mm)	83		82	51	33
Energising Current at 10 kHz (mA/V)	1.2	1		1.2	

1 All analogue LVDT probes calibrated at 3V, 5kHz frequency into a 10kΩ load. 100kΩ for the unplugged versions. All analogue Half Bridge transducers calibrated at 3V, 5kHz frequency into a 2kΩ load. 1kΩ for the unplugged versions. Right angle outlet is not available with model M6D1.

SM series

AC miniature displacement transducers



1.72 UNF threaded core also available

Type	'A' Body Length	'B'Core Length	'C' Core + Carrier	'D' At Null
SM1	15.10/15.25	9.90	24.90	12.70
SM3	34.90/35.05	20.60	42.60	15.30

> Rugged construction
> Short body length
> Good performance

SM transducers cover two standard linear ranges from ±1mm to ±3mm. They are designed for measuring displacement in applications where infinite resolution and repeatability are 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 or oily environments and in applications with high levels of mechanical stress.

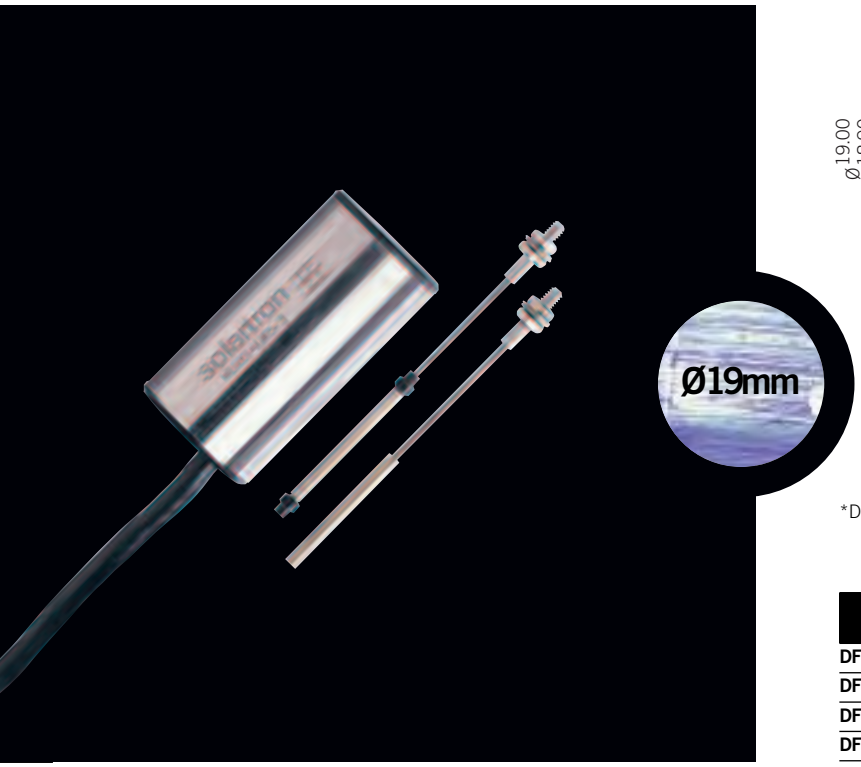
The core and push rod assembly moves friction-free within the sensor, an alternative design is available where only the core, threaded at both ends, is provided. Recommended push rod material is titanium. Other materials can be used, but with varying effects on the electrical characteristics.

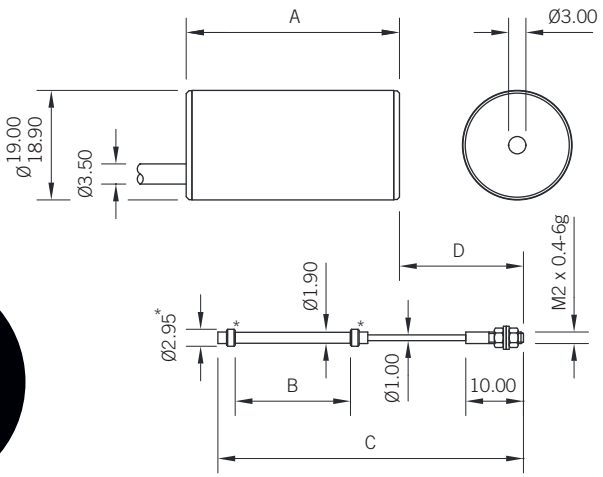
Product type	Analogue SM series	
Free	SM1	SM3
Measurement		
Measurement Range (mm)	**±1**	**±3**
Linearity[1] (% FRO)	0.25%	
Mechanical		
Material	400 Series stainless steel	
Standard cable length (m)	0.5 (PU)	
Length of carrier (protruding at 0 position)	12.7	15.3
Transducer weight ±0.5 (g)	6	8
Mass of moving components ±0.2 (g)	0.5	1.5
Environmental		
Storage Temperature (°C)	-40 to +100	
Operating Temperature (°C)	-40 to +85	
IP rating	None	
Electrical Interface (LVDT)		
Energising Voltage (Vrms)	1 to 10	
Sensitivity at 10 kHz (mV/V/mm ±15%)	142	136
Energising Current at 5 kHz (mA/V)	3.8	1.8
Zero Phase Frequency (kHz)	14	3.9

1 All analogue LVDT transducers calibrated at 3V, 5kHz frequency into a 100kΩ load. 100kΩ for the unplugged versions.

DF(g) series

62 DC miniature displacement transducers





*Delrin bearings fitted to DFg Series only

Type	'A' Body Length	'B' Core Length	'C' Core + Carrier	'D' At Null
DF1.0/DF2.5	37.00	20.00	50.00	21.50
DFg1/DFg2.5	37.00	20.00	53.00	21.50
DF5	43.00	24.30	54.30	20.50
DFg5	43.00	24.30	57.30	20.50

- > Measurement range to 10mm
- > High output
- > Two types
- > Infinite resolution
- > Excellent repeatability

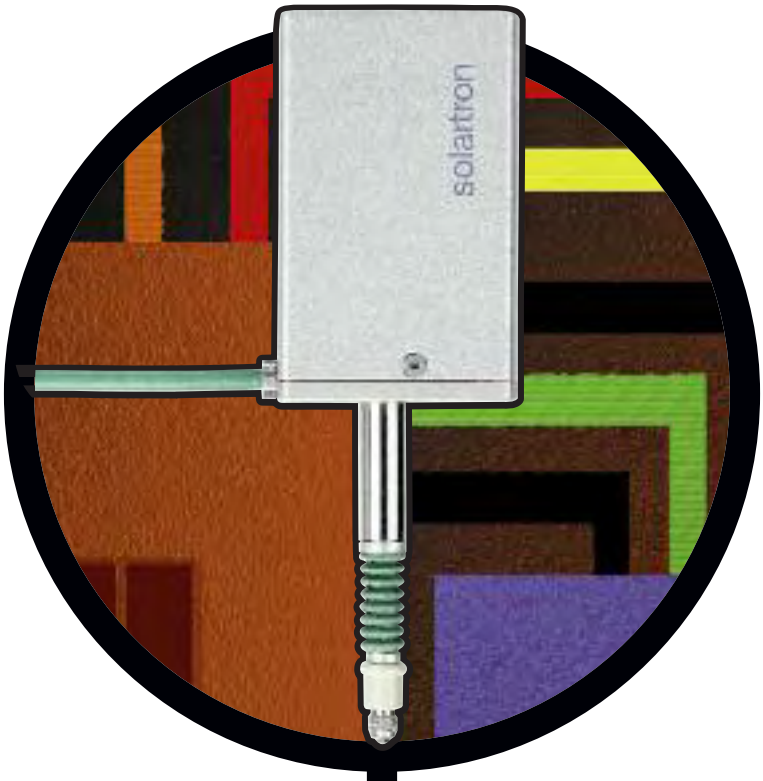
The DF dc miniature displacement transducer has a friction-free core and the DFg has a free guided core incorporating Delrin bearings. All types incorporate a linear variable differential transformer (LVDT) as the measuring source together with oscillator, demodulator and filter providing a self-contained 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.

Product type	DC miniature		
Free	DF1	DF2.5	DF5
Guided	DFg1	DFg2.5	DFg5
Measurement			
Measurement Range (mm)	**±1**	**±2.5**	**±5**
Linearity [1]	0.3%		
Temperature Coefficient % FS/°C Zero	<0.02	<0.01	
Sensitivity	<0.025		
Mechanical			
Material	400 stainless steel		
Standard cable length (m)	3		
Length of carrier (protruding at 0 position)	21.5		20.5
Transducer weight (g)	26		30
Mass of moving components (g)	1		1.2
Environmental			
Storage Temperature (°C)	-10 to +80		
Operating Temperature (°C)	-5 to +70		
IP rating	IP65		
Electrical Interface			
Energising Voltage (VDC)	10 to 24		
Energising Current at 10 VDC (mA)	10		13
Frequency response (-3dB Hz)	50		
Sensitivity at 10 VDC ±10% (mV/V/mm)	75		54

1 Specification or a transducer at 10VDC and a calibration load of 20kΩ

Linear encoders



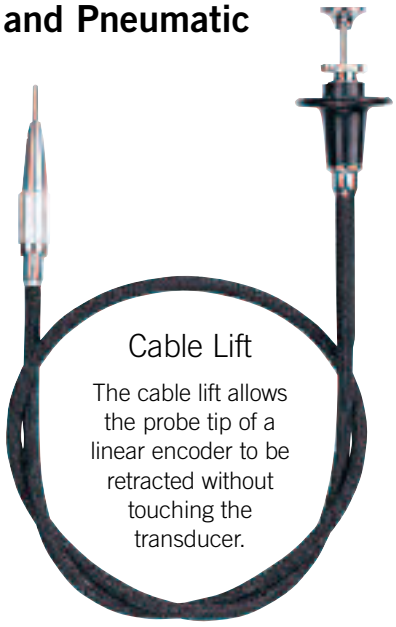
The Linear Encoder range of gauges consists of high accuracy optical probes designed for use in applications where consistent sub micron measurement accuracy is required. In contrast to traditional gauging probes, the accuracy is maintained along the entire measurement range.

The linear encoders also serve many displacement and positioning applications due to the high purity of their optically generated sine wave electrical output, which enables a high level of electronic interpolation. Also, their proven high repeatability is a testament to the excellent mechanics and bearings used in the range.

A probe consists of the probe head (including guidance mechanism), cable and connector. The connector type depends on the probe's electrical output, but is compatible with industry standards such as 1Vpp and 11 µA and TTL. In the case of the Digital Linear Encoder, the standard Probe Interface Electronics (PIE) is used which can be connected directly to a Solartron Digital Readout, a PC or a PLC via Solartron's Orbit Network System.

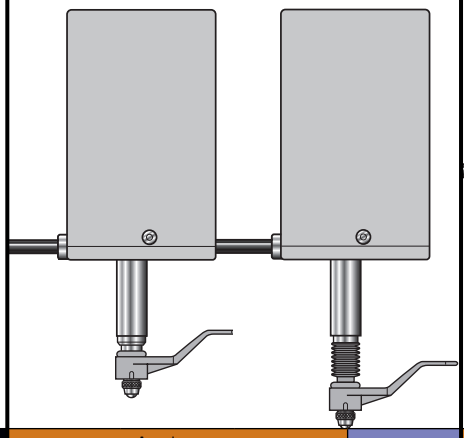
- A choice of 12 mm or 25 mm measurement ranges
- Spring, free, pneumatic, cable release
- Up to 0.4 µm accuracy
- Up to 0.0125 µm resolution
- Outputs: Sinewave Voltage 1 Vpp
  Sinewave Current 11 µA
  TTL
  Digital (Orbit®)
- CE approved
- Verification / calibration Traceable to NPL (National Physical Laboratory)

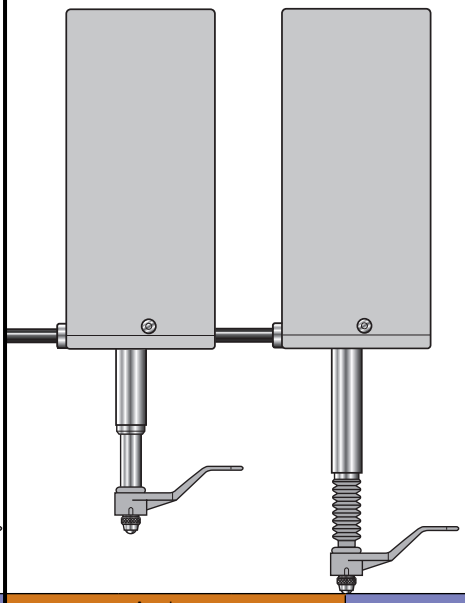
Spring Actuation and Pneumatic



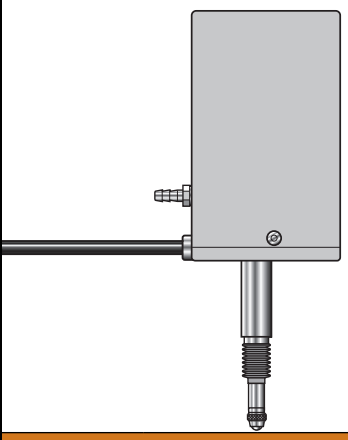
Cable Lift

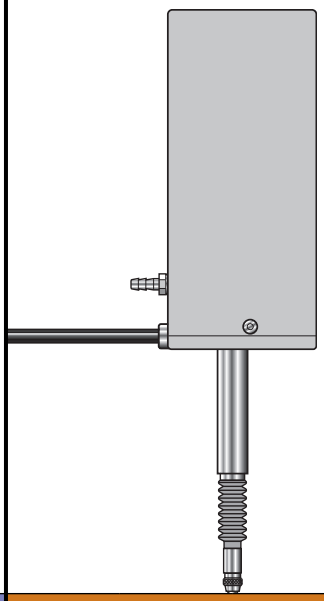
The cable lift allows the probe tip of a linear encoder to be retracted without touching the transducer.

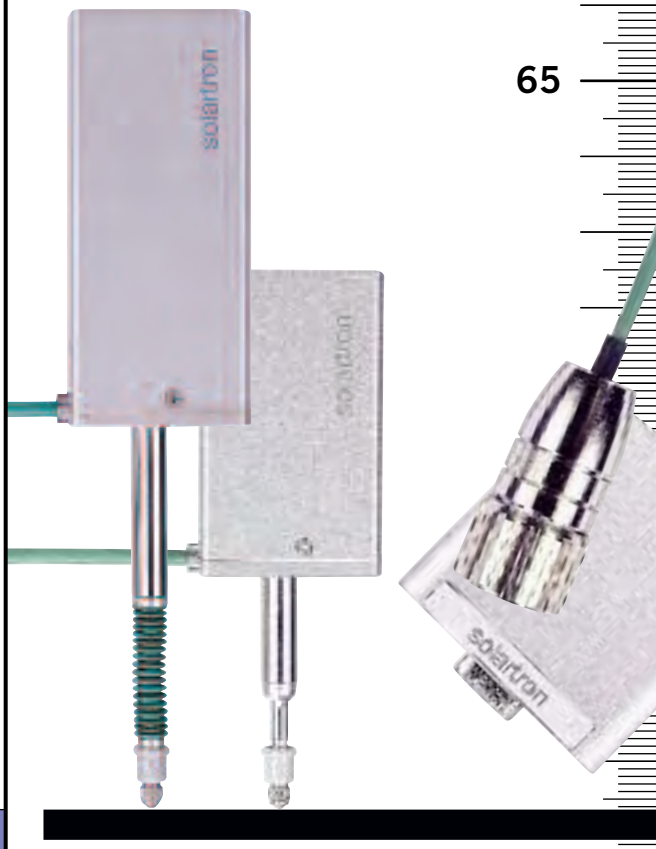




Product type	Analogue			Digital	Analogue			Digital
	TTL[1]	Voltage	Current		TTL[1]	Voltage	Current	
Standard Spring	LE/12/S	LE/12/SV	LE/12/SC	LE/12/S	LE/25/S	LE/25/SV	LE/25/SC	LE/25/S
Pneumatic								
Measurement								
Measurement Range (mm)	**12**				**25**			
Travel Range (mm)	13				26			
Accuracy (µm)	±0.5			±0.4	±0.5			±0.4
Repeatability (µm)	0.1				0.1			
Resolution (µm)	Dependent on Electronics[2]			0.05	Dependent on Electronics[2]			0.05
Reference mark position (mm)	3 approximately (from the end stop)				3 approximately (from the end stop)			
Max gauging speed (m/s)	Dependent on Electronics[5]			0.5	Dependent on Electronics[2]			0.5
Tip Force (N) Up Down Horizontal	0.1 0.6 0.5				0.1 0.6 0.5			
Temperature Coefficient (µm/°C)	-0.35 to -0.5				-0.4 to -0.7			
Mechanical								
Material Scale Shaft Gaiter	Quartz Hardened stainless steel Viton® (IP65 only)				Quartz Hardened stainless steel Viton® (IP65 only)			
Mounting (mm)	Ø8h6				Ø8h6			
Environmental								
Storage Temperature (°C)	-20 to +70				-20 to +70			
Operating Temperature (°C)	+10 to +50				+10 to +50			
IP Rating (probe only)	Choice of IP50 or IP65				Choice of IP50 or IP65			
Electrical Interface								
Power supply (VDC ±5%)	5				5			
Output signal type	TTL	1 V_{pp}	11 μA_{pp}	Orbit	TTL	1 V_{pp}	11 μA_{pp}	Orbit
Output signal period (µm)	see note[2]	10	10	0.05	see note[2]	10	10	0.05
Cable length[4] (m)	2	2	2	-	2	2	2	-
Connector	for options contact sales office			Orbit PIE	for options contact sales office			Orbit PIE







Analogue			Digital	Analogue			Digital
TTL[1]	Voltage	Current		TTL[1]	Voltage	Current	
LE/12/P	LE/12/PV	LE/12/PC	LE/12/P	LE/25/P	LE/25/PV	LE/25/PC	LE/25/P
12				**25**			
13				26			
±0.5			±0.4	±0.5			±0.4
0.1				0.1			
Dependent on Electronics[2]			0.05	Dependent on Electronics[2]			0.05
3 approximately (from the end stop)				3 approximately (from the end stop)			
Dependent on Electronics[5]			0.5	Dependent on Electronics[5]			0.5
0.1 0.6 0.5				0.1 0.6 0.5			
-0.35 to -0.5				-0.4 to -0.7			
Quartz Hardened stainless steel Viton® (IP65 only)				Quartz Hardened stainless steel Viton® (IP65 only)			
Ø8h6				Ø8h6			
-20 to +70				-20 to +70			
10 to +50				+10 to +50			
IP65				IP65			
5				5			
TTL	1 V_{pp}	11 μA_{pp}	Orbit	TTL	1 V_{pp}	11 μA_{pp}	Orbit
see note[2]	10	10	0.05	see note[2]	10	10	0.05
2	2	2	-	2	2	2	-
for options contact sales office			Orbit PIE	for options contact sales office			Orbit PIE

1 TTL probes supplied with inline interpolation circuitry (iBox).

2 TTL resolution is dependent on the user's counter electronics.

3 A special version of the Linear Encoder has been developed to allow the Linear Encoder to be used as part of an Orbit network dynamic measurement system. This allows synchronisation of the probe reading to another data acquisition or control event. This special linear encoder integrates an encoder, interpolation module and Encoder Input Module. However since the Encoder Input Module has a maximum input frequency of 1.2MHz, this limits the gauging speed to 0.24ms^{-1}. For more information on this device and ordering information, please refer to the website.

4 Longer cable available on request

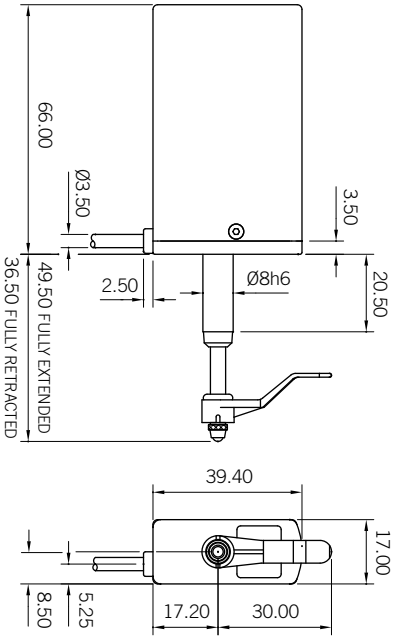
5 For TTL, see table below

Probe signal period (µm)	Configurator interpolation	Quad edge period (µm)	Max Gauging speed (m/s)
0.4	A (x25)	0.1 (x100)	0.5
0.2	B (x50)	0.05 (x200)	0.5
0.1	C (x100)	0.025 (x400)	0.4
0.05	D (x200)	0.0125 (x800)	0.2

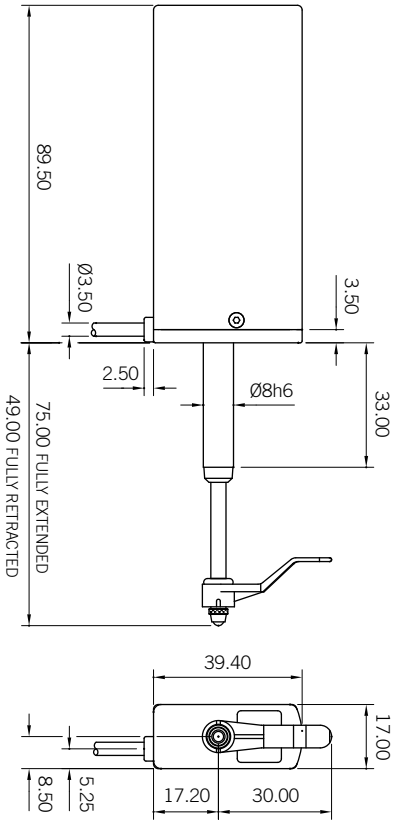
The counter electronics is required to have sufficient bandwidth for the gauging speed, the following formula can be used to calculate the encoder signal frequency and the suitability of the end electronics.
Output Frequency (kHz) = gauging speed (ms^{-1}) x 100
x (Configurator Interpolation Rate)/4

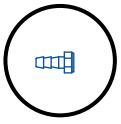
Viton is a registered trademark of Dupout Dow Elastomers

LE/12/S

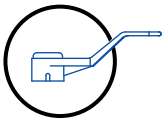


LE/25/S



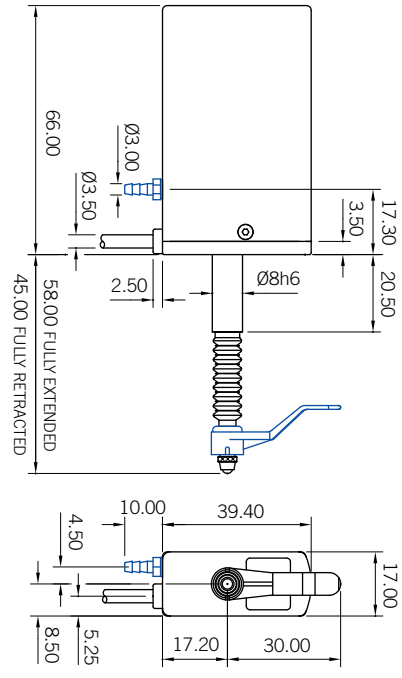


Air inlet nozzle on pneumatic (P) versions

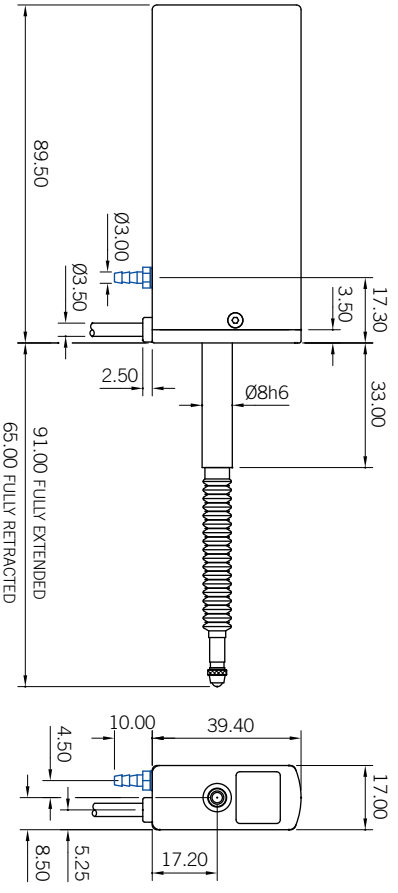


Lift for spring (S) versions

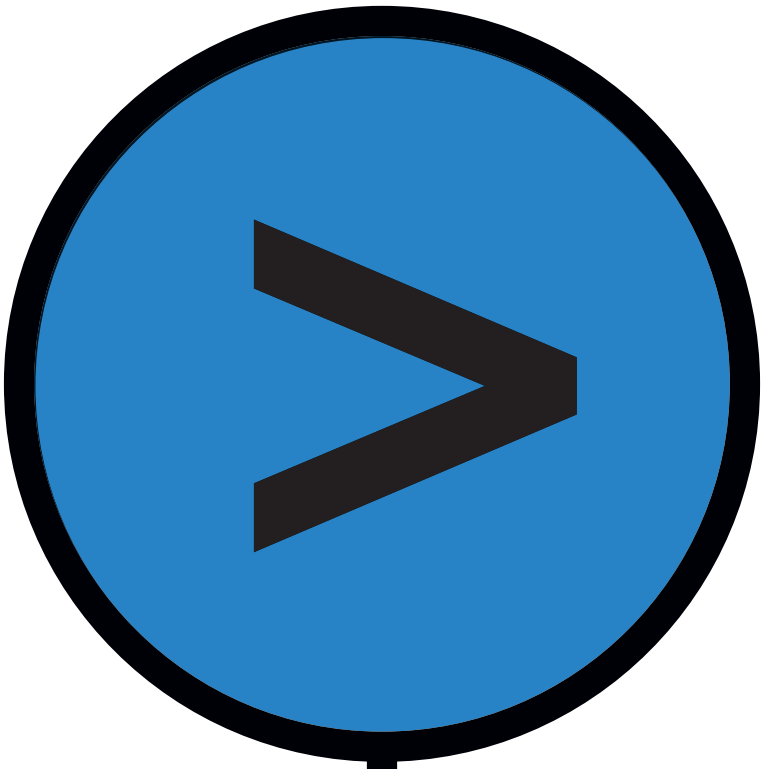
LE/12/S and LE/12/P



LE/25/S and LE/25/P



Orbit® system components



As well as many Orbit dimensional measurement devices, Solartron Metrology also offers a range of electrical interface modules for third party sensors and for general instrumentation tasks. The Orbit modules and controllers are presented in this section.

Controllers comprise a PCI card, USB and RS232 interfaces and a digital readout DRO.

Modules comprise an Analogue Input Module for easy connection of third party transducers to the Orbit network (e.g. temperature, force, pressure), a Digital Input/ Output module for interfacing to switches or control lines and Encoder Input Modules allowing the interface of Rotary or Line Scale incremental type encoders (TTL).

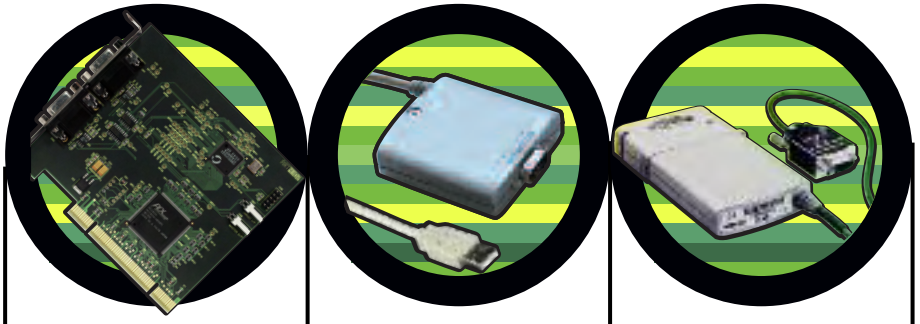
> PCI, USB, RS232 Controllers

> Modules for Analogue input, Digital input/output, TTL input

> Up to 31 modules per controller channel

> A variety of technologies (inductive, optical and third party sensors)

Orbit® Controllers



	Orbit® PCI Network card	Orbit® USB Interface Module (USBIM)	Orbit® R3232 Interface Module (RS232IM)
Computer Interface			
Bus	PCI	USB 2.0 full speed	RS232 (up to 115.2 kB)
Operating system	Microsoft Windows		
Network Interface			
Signal	RS485		
Protocol	Orbit		
Number of Orbit modules (with external PSIM)[1]	Up to 62	Up to 31	
Number of Orbit modules (without external PSIM)[2]	Up to 10 depending on module type	Up to 4 depending on module type	0
Baud Rate	187.5kB or 1.5MB		187.5 kB
Measurement Modes supported[3]	All modes	Standard/Buffered	
Environmental			
Operating Temp. Range (°C)	0 to +60		
Storage Temp. Range (°C)	-20 to +85		
IP Rating	-	IP43	
Mechanical & Connections			
Computer connections	PCI card slot	USB socket type A	RS232 port
Dimensions (mm)	-	65 x 61 x 18 excluding connector (refer to PIE drawings)	
Weight (g)	89	160	
Material	-	Die Cast Aluminium	

1 1 PSIM required per channel

2 The specifications quoted are dependant on the power available from the computer in use

3 Orbit Modes are explained in the Technologies section of this catalogue

Orbit® Modules

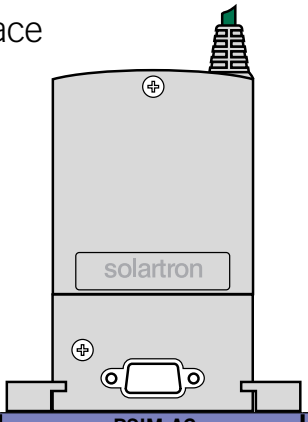
	Orbit® Analogue Input Module (AIM)	Orbit® Encoder Input Module (EIM)	Orbit® Digital input-output Module (DIOM)
Power Requirement			
Voltage Range (VDC)	5 ±0.25		
Current Consumption[1] (mA)	Up to 145 depending on input type	40	25 all outputs on
Single Input[2]			
Input Type	Analogue voltage or current	Incremental Encoder	8 channel Input/Output
Input Voltage (V)	0-24, 0-10, 0-5, ±10, ±5	30 max	0 to 30
Input Currents (mA)	4-20, ±20, 0-20	< 10	1/Channel
Options	Special PT100 module available	Single ended or differential, HTL	-
Single Output			
Voltage output	-		Open drain up to 30 V
Current Output	-		50 mA for each output
Reading Speed	Up to 3906readings/second		240 readings per second
Interpolation rate	-	x1, x2, x4 programmable	-
Measurements performance			
Warm-up	95% accuracy after 5 mins		
Linearity (%FSO)	0.05		
Bandwidth	460 Hz	1.2 MHz max in/out frequency	DC
Measurement Modes	Standard/Dynamic/Buffered		Standard
Environmental			
Operating Temp. Range (°C)	0 to +60		
Storage Temp. Range (°C)	-20 to +85		
IP Rating	IP43		
Mechanical & Connections			
Transducer	Various connector options		
Enclosure - Size (mm)	65 x 61 x 18 excluding connector (refer to PIE drawings)		
Weight (g)	160		
Material	Die cast Aluminium		

1 Excludes sensor consumption
2 Transducer interface

Orbit® Accessories

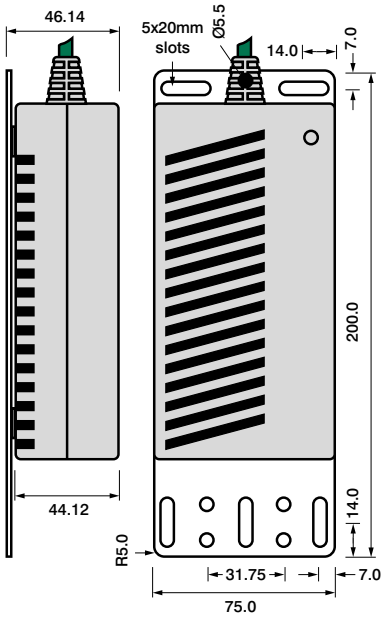
Power Supply Interface Module (PSIM)

For use with multi-channel systems needing more power than available from the computer. The power supply can also extend the network beyond the normal 10m per port limit up to 1Km



PSIM transformer

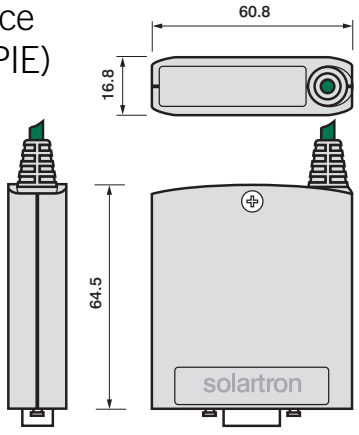
For use with Power Supply Interface Module versions PSIM-AC and PSIM-DC only.



Product type	PSIM-AC	PSIM-DC	PSIM-5V
Output voltage	5.1VDC @ 1.8A max.		
Operating Temp. Range (°C)	0 to +60		
Drive capability	Up to 31 Orbit modules dependent on type		
Supply voltage	90 to 264VAC @ 1 A max.	10 to 30VDC	+5VDC from regulated supply
Supply frequency (Hz)	47 to 440	-	-
Termination	IEC320 plug (supplied with 2m lead and local AC supply connector)	5m flying lead	5m flying lead (input directly to the module. There is no transformer)
Cable length (m)	2 (between module and power supply)		-
Dimensions	As PIE plus T-CON (see below). Module does not separate		

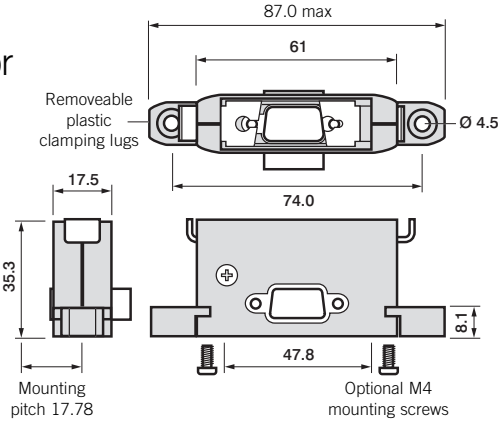
Probe Interface Electronics (PIE)

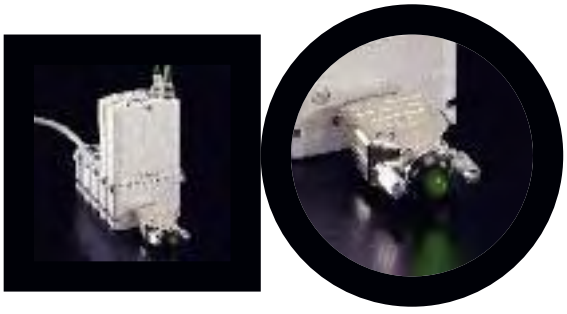
Fitted to all Solartron Metrology digital products



'T-CON' connector

The 'building block' of Orbit digital networks





Happy light

Connected on the last T-CON of the Orbit network the "happy light" plug will indicate green (on) when the power supply is within specification and flash when the network is active. It is highly recommended as an additional item to the Orbit network.
Nominal dimensions are 47mm x 31mm x 15mm.

Orbit® software

Orbit® support pack for Windows®

Solartron Metrology provides software support for Microsoft Windows. This software is supplied with the Orbit Network Card, the USB Interface Module and the RS232 Interface Module.
The Orbit Windows Support Pack software includes a COM Object Library for COM applications and Dynamic Link Libraries (DLLs) for lower level programming. Support is also provided for all major programming languages, such as VBA, VB, C++, Borland C Builder and Delphi. Example programs for these languages are available upon request.
Download the latest drivers from www.solartronmetrology.com

Orbit® support pack for Excel®

The Orbit Excel Support Pack enables the user to take readings from the Orbit Network and place values directly into cells of a Microsoft Excel spreadsheet.
Following installation of the Excel support pack, a toolbar becomes available to the user and enables commands such as "Take Readings", "Zero Readings", "Close Link", etc.,

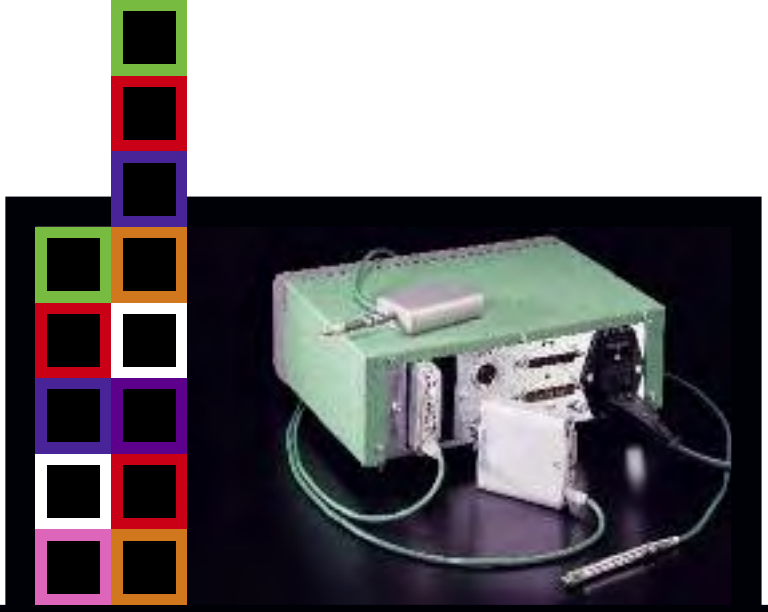
The Orbit Excel Support Pack disc contains examples to help you get started, each designed to show different aspects of the software.
Download the latest drivers from www.solartronmetrology.com

Orbit® examples for LabVIEW®

Solartron Metrology provides program examples to enable users to develop applications under the National Instruments LabVIEW environment. Examples are also provided to allow quick test application tests, such as taking measurement readings from Digital Probes or Linear Encoders into LabVIEW.

Digital readouts

72 DR600 and DR700



The purposeful ergonomic design of these digital readouts is intended for applications in various industrial environments. The 24 alphanumeric character information digital display guides the user through a series of menus from initial setup to gauging applications and arithmetic operations.

Solartron Metrology Digital Readouts operate with both Digital Linear Encoders and Solartron's range of Digital Probes. Following the success of the DR600 digital readout, Solartron Metrology introduced an even more sophisticated member of the Digital Readout family, the DR700. Whilst retaining all the features of the DR600 (Preset, alarms, RS232 output, Max, Min, Difference), the DR700 boasts a number of new functions; For example, the new "Scaling Factor" function can be used to compensate for angled or lever operated probes, or diameter when measured in a V block. It also enables measurement of angles or squares.

Other new functions include the "Gauging Mode" - allowing global pass/fail evaluation of up to 30 scan channels -and "Max A +Max B".

The DR700 can be used with multiple probe fixtures using Linear Encoders, Digital Probes or a combination of both - making it a truly versatile addition to the Solartron Orbit range.

Product type	DR600	DR700
Display Type	24 character alpha numeric display	
Display length	±999.9999mm or ±39.370078"	
Resolution	Down to 0.05µm or 0.000005"	
Range Lamps	Indicates Hi/OK/Lo for limited detection	
Input		
Signal Input	Orbit	
Number of Orbit modules (without external PSIM example)	Up to 10	
Number of Orbit modules (with external PSIM example)	Up to 30	
External input/output		
Single output	RS232 serial port (for printer or PC connection)	
Digital I/O	✓	✓
Motor drive	✓	✓
Measurement Configurations		
Individual Probe	✓	✓
Probe pair	✓	✓
Multiple Probes	✓	✓
Scan[1]	✓	✗
Gauging Mode	✗	✓
Electrical		
Power Supply (VAC)	96 to 244	
Line frequency (Hz)	47 to 440	
Environmental		
Storage Temperature range (°C)	-20 to + 60	
Operating Temperature range (°C)	0 to +40	
Humidity	0 to 95% non condensing	
Safety rating	EN61010-1	
EMC	Emission: EN50081-1 Immunity: EN50082-2	
IP Rating	Front panel: IP65 Unit: IP40	
Mechanical & Connections		
Dimensions (mm)	235 x 190 x 90	
Weight (kg)	2.25	

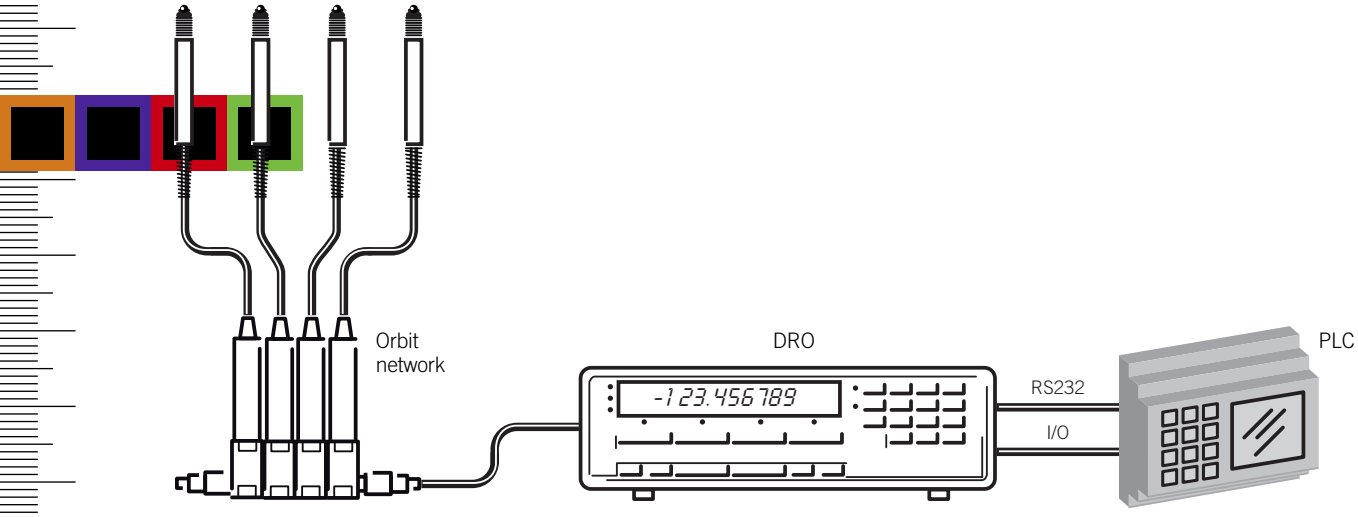
Keypad functions DR600 and DR700

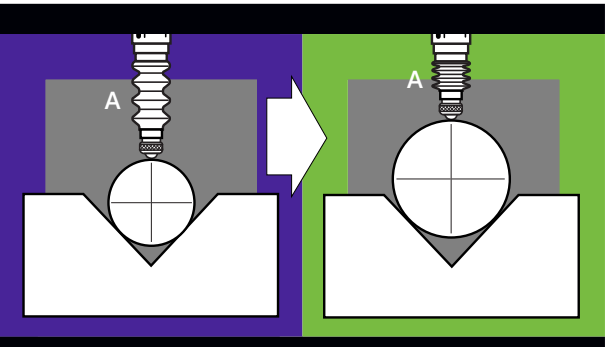
Zero	Single key operation to zero reading on display
Print	Reading sent to printer or PC via the RS232C interface (Baud rate selectable 300 to 57.6 Kbaud)
Motor Drive	Control of motor driven probes with 3 tip forces and 3 retraction speeds, for each orientation, (Tip down, up or horizontal) on Linear Encoders LE/50/M and LE/100/M
Program Select	10 different programs available. Each program may have its own preset, limits and probes, or pair of probes (A+B or A-B)
Units	Choice of mm or inches
Preset	10 memories enable 10 different preset values to be stored. Soft keys enable direct toggle between incremental and absolute datum
Maximum/Minimum	Stores maximum, minimum and difference values
Limits/Tolerance	High and Lo limit values, indication by range lamps. Outputs from the back panel permit control of relays for sorting components. 10 sets of limits can be stored
Multiple Probes	Up to 10 probes or pairs of probes (A+B or A-B) can be assigned different programs. Each probe can have its own Preset, Limits, Resolution and Direction
Probe Scan	Up to 30 probes, sharing the same preset limits etc. can be scanned
Mathematics	Two probes may be used in an A+B or A-B configuration
Resolution	Choice of 0.01µm, 0.1µm, 1µm, 10µm, 100µm or 1, 10, 100, 1000, 10,000 millionths inch Choice of 1, 2, 5 steps in least significant figure Note. Automatic inhibit of excessive resolution for probe in use
Count Direction	Increasing count can be assigned to retraction or extension of probe tip
Reference Mark	The reference mark enables a datum to be re-established - e.g. following a power down
Display Freeze	External initiation of measurement and display freeze
Lock	Password protection may be applied to any permutation of keys or features

Keypad functions DR700 only

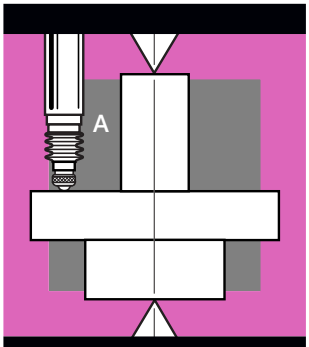
Scaling Factor	This function of the DR700 allows the user to apply a Scaling Factor (range ±0.01 to ±100.0) to any program. Typical uses: V-block measurement, display of angle from two probes at a fixed distance apart and correction of cosine error (for probe at small angle from 90°).
Max A + Max B	Displays the maximum deviation of probe B. A typical application for this mode is as a means of measuring the amount of squareness and bend of a shaft on a cutting tool.
Gauging Mode	Used in measuring against a master part, Gauging Mode provides a global Pass/Fail evaluation for up to 30 scan channels (using the range lamps). Each scan channel can have individual probe A+B or A -B measurement, with its own limits and presets. Gauging Mode can have a maximum of 30 probes using Digital Probes and Linear Encoders.
Autosense Mode	Autosense Mode is designed to enable the automatic selection of a program when the tool associated with that program is used. It is intended for applications where only one tool is in use at any one time. Each program must use a unique probe (or probes) with a number of tools ranging from 1 to 9, which will be associated with programs 1 to 9. Designed for hand tools using Digital Probes or Linear Encoders, the reading is automatically displayed on the DR700 when the tool is in its active measuring range.
Peak Mode	Peak Mode will take a number of readings (2 to 99) from a single Digital Probe or Linear Encoder, using a manual trigger to store each reading. The DR700 will then analyse and display a calculated result in any of the following ways: Maximum, Minimum Peak, Peak Range (max-min) and Average of the Peak readings.

Digital readouts

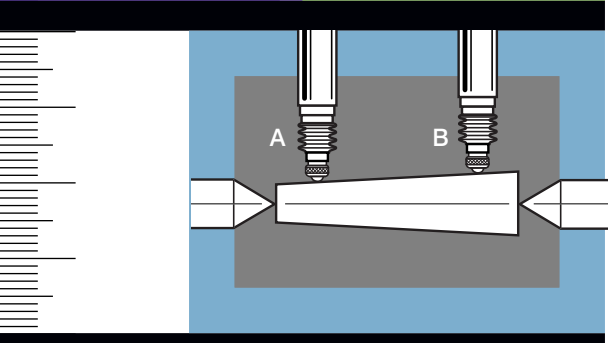




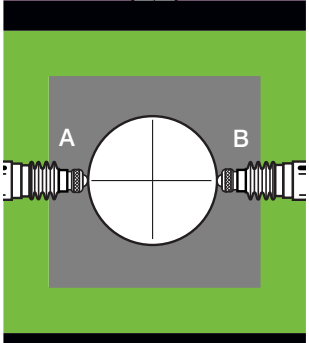
DR700
scaling
factor



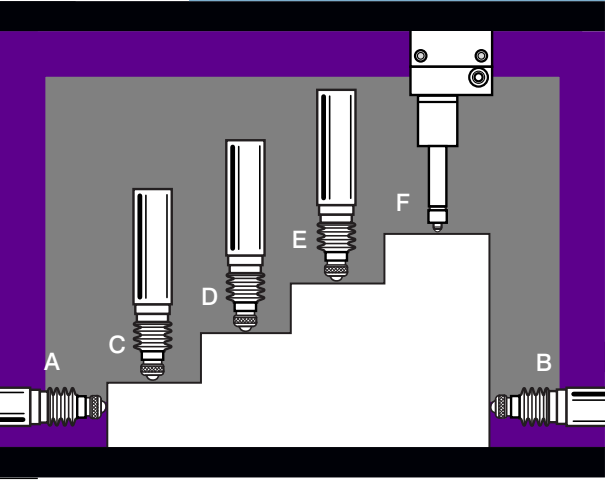
T.I.R.
MAX - MIN



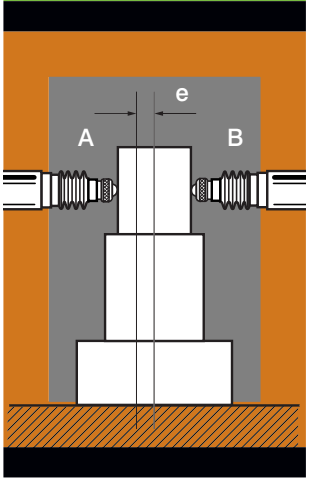
Taper
measurement
independent
of component
dimensions A-B



Diameter
measurement
independent of
eccentricity A+B



DR700 gauging mode
(up to 30 probes)
Enables global
pass/fail evaluation of
up to 30 scan
channels. Each
channel can be either
an individual probe,
A+B or A-B, and has
its own set of limit
and preset values.
C,D,E,F & A-B



DR700
scaling
mode

$e = \frac{A - B}{2}$

MAX - MIN

Analogue electronics and displays

The electrical performance of an analogue displacement transducer is only as good as the signal conditioning allows.

Solartron Metrology has used its considerable experience to produce signal conditioning, numerical displays and controllers that enhance the performance of its analogue transducers and ensure simple and reliable connection to instrumentation and control systems.

- > OD Family
- > DIN Rail Conditioning module
- > BICM (in line)
- > CAH
- > GPM
- > SI 7500 Series
- > SI 3000 series

OD2, OD4, OD5

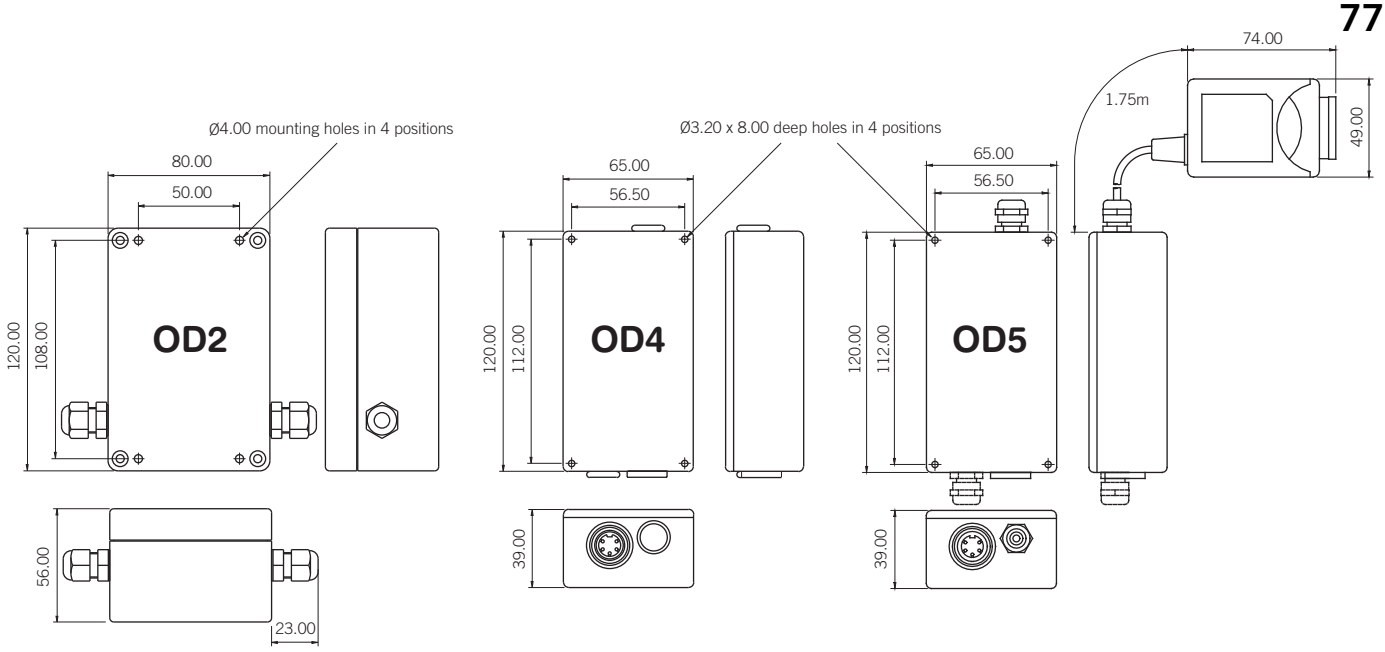
- > Range selectable to ±10 VDC
- > Range selectable to ±20 mA (example: 0-20 mA, 4-20 mA)
- > DC and AC powered versions
- > LVDT and Half Bridge variants
- > Suitable for harsh industrial environments
- > Robust construction
- > Good linearity

The OD (Oscillator / Demodulator) family of conditioning electronics is Solartron's solution for interfacing to its extended range of analogue inductive transducers. The OD family comprises the OD2, OD4 and OD5 units, each offering different functionality to suit the intended application.

The OD2 is a two wire 4 to 20 mA LVDT signal conditioner. It is designed for long signal transmission distances due to its low susceptibility to noise and cable resistance. Cable breakage results in a loss of current flow, which indicates a fault.

The OD4 is a compact signal-conditioning module for inductive transducers; it can be powered from a single 10 to 30 VDC power supply. The signal polarity, span and offset are fully adjustable providing ±20 mA current output or ±10 VDC voltage output. The OD4 is housed in a die cast zinc box resulting a substantial degree of mechanical protection for harsh environment applications.

The OD5 provides the same connectivity and output as the OD4 and is powered from a universal power supply module with an input voltage range of 90 VAC to 264 VAC.

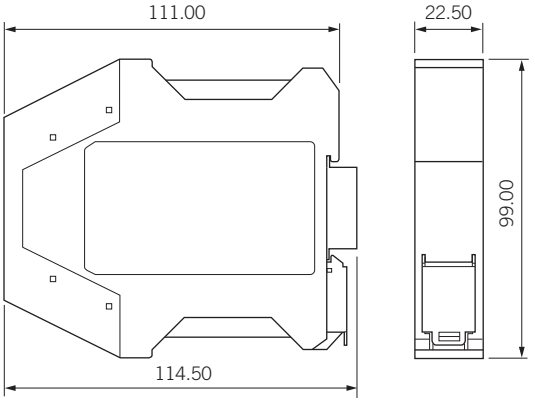


Product type	OD2	OD4	OD5
Power Requirement			
Voltage Range	13 to 42 VDC	10 to 30 VDC	90 VAC to 264 VAC
Current Range	Up to 30 mA	140 mA at 10 VDC to 50 mA at 30 VDC	250 mA at 120 VAC to 100 mA at 250 VAC
Frequency Range (Hz)	-	-	47 to 63
Transducer Excitation			
Primary Voltage (Vrms)	0 to 9 Vrms	3 Vrms nominal	
Primary Frequency (kHz)	5 or 13 nominal	2.5 or 5 nominal, 10 or 13 nominal (half bridge variant)	
Signal Input			
Input Range	30 to 530 mV/V[1]	55 mV to 5000 mV LVDT full range	
Input Load Resistance (kΩ)	2	2, 10, 100	
Options	-	Forward and Reverse polarity, half-bridge	
Signal Output			
Voltage Output (VDC)	-	Up to ±10	
Current Output	4-20 mA, 2 wire	Up to ±20 mA into 150 Ω load	
Output Ripple	< 38 µA rms	< 1 mV rms	
Output Offset	Up to 100% on maximum gain (coarse & fine adjustment)		
Temp. Coeff. Gain (%FRO/°C)	< 0.01	< 0.01	
Temp. Coeff. Offset (%FRO/°C)	< 0.01	< 0.01	
Warm Up (mins)	15 is recommended		
Linearity (%FRO)	< 0.02	< 0.1	
Bandwidth (-3dB)	25 Hz		
Environmental			
Operating Temp. Range (°C)	0 to +60	0 to +60	
Storage Temp. Range (°C)	-40 to +80	-20 to +85	
IP Rating	IP65	IP40	
Mechanical & Connections			
Transducer	Internal Terminal Block	5-pin Circular DIN	
Power Supply	Internal Terminal Block		IEC320 C14
Output Signal	Internal Terminal Block		
Weight (g)	223	300	
Material	Light Grey ABS	Die-cast Zinc Alloy (Painted)	

1 For transducers with a sensitivity greater than 530mV/V, an adjustable input attenuator is required. Contact your local sales office for further information

DIN rail conditioning module

78 Oscillator and Demodulator for inductive transducers



- > Range selectable to ±10 VDC
- > Range selectable to ±20 mA (example: 0-20 mA, 4-20 mA)
- > DC powered (10 to 30 VDC)
- > LVDT and Half Bridge variants

The DIN Rail Conditioning Module (DRC) is a DC powered conditioning module that can accept a wide range of analogue inductive transducer types due to its wide input gain. The signal polarity, span and offset are adjustable providing ±10 VDC voltage output or ±20 mA current output.

The module housing is a standard DIN rail enclosure which can clip directly to a 35 mm top hat rail (TS35 EN50022) as shown in the mechanical outline.

The transducers are connected using screw terminals to the front of the DRC. Set-up and adjustments are made using a combination of internal links and front panel mounted fine adjustment potentiometers.

By linking two DRC modules, users can also perform some analogue arithmetic on two signals such as; A+B, A-B, (A+B)/2 and (A-B)/2.

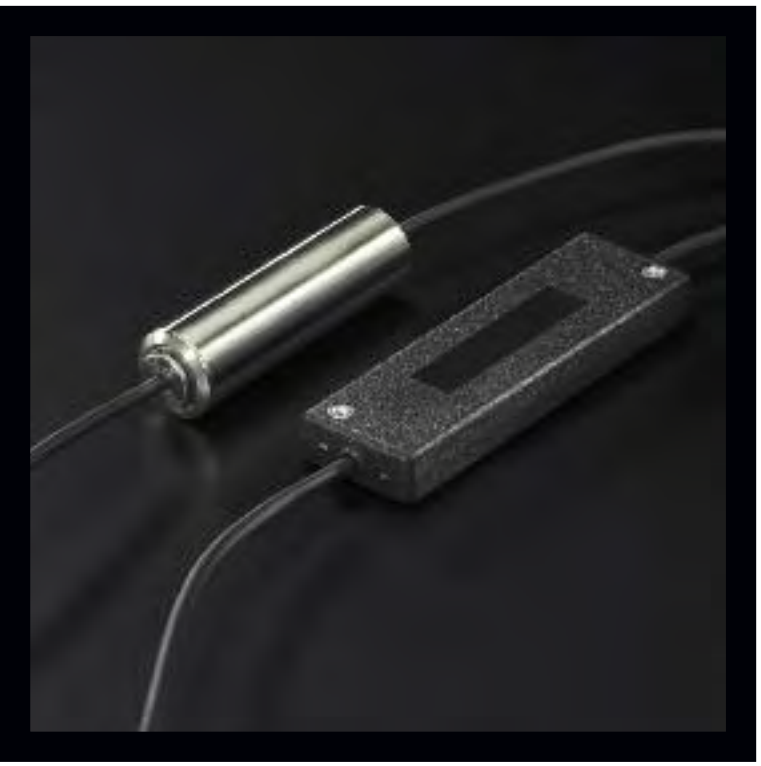
Power requirement	DRC
Voltage Range (VDC)	10 to 30
Current Range (mA)	160 at 10V to 70 at 30V
Transducer Excitation	
Primary Voltage (Vrms nom.)	3
Primary Frequency (kHz)	5, 10 or 13 link selectable
Signal Input	
Input Range (mV)	55 to 5000 LVDT full range
Input Load Resistance (kΩ)	100, 2
Options[1]	See note 1
Signal Output	
Voltage Output (VDC)[2]	Up to ±10
Current Output	Up to ±20 mA into 150 Ω load
Output Ripple (mVrms)	<1
Output Offset	Up to 100%[2]
Temp. Coefficient Gain (%FRO/°C)	<0.01
Temp. Coefficient Offset (%FRO/°C)	<0.01
Warm-up (mins)	15 is recommended
Linearity (%FRO)	<0.1
Bandwidth (-3 dB)	500 Hz, 1kHz link selectable
Environmental	
Operational Temp. Range (°C)	0 to +60
Storage Temp. Range (°C)	-20 to +85
Mechanical & Connections	
Transducer	Screw Terminals
Power Supply	Screw Terminals
Output Signal	Screw Terminals
Weight (g)	120
Material	Green polyamide

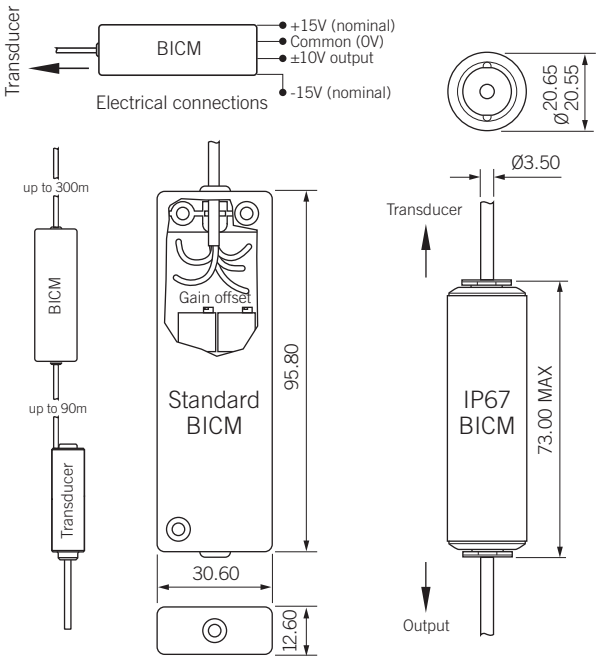
1 No input options are offered. As connection of transducer is by screw terminal, additional internal configuration methods are not required. By changing connections and use of external components, the user can perform: • Change input polarity • Half Bridge connection • Grounding one side of the input • Phase correction • Quad resistors

2 Fine adjustment via the front panel

BICM

Remote signal conditioning





- > Ease of use
- > No extra components required
- > In-line
- > Customer or factory fit
- > IP67 version available

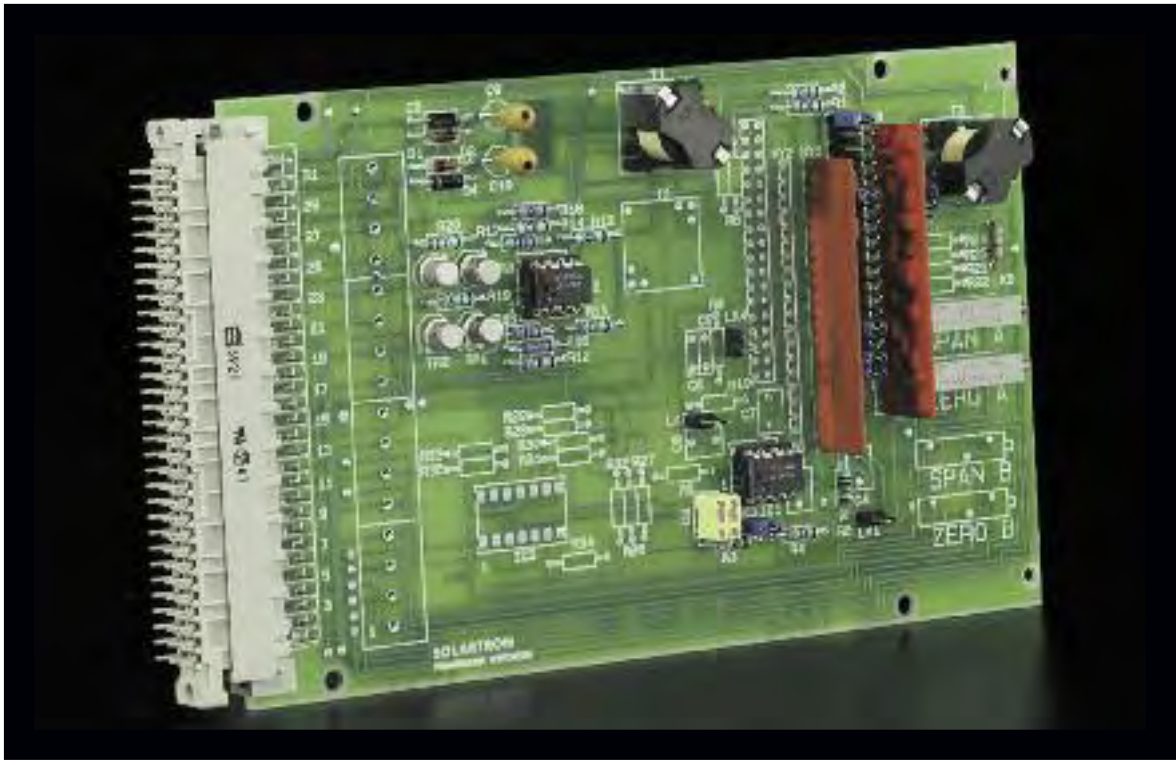
DC operation can be achieved by using a BICM in-line-conditioning module, this is recommended in harsh environments where the electronics may not be subjected to extreme temperatures for example. The cable length from the transducer to the BICM can be up to 10m (32 feet approx.) and up to 300 meters (1,000 feet approx.) from the BICM to the processing unit or display. In both cases the user must ensure the performance of the system is adequate and that any noise pickup on such long cables is not a problem.

When the BICM is supplied pre-wired to the transducer, Solartron Metrology fit gain setting components to achieve a nominal ±10 V output. A set of components suitable for most transducers is supplied with the BICM when it is ordered separately.

Note that specifications are quoted at 3 metres between transducer and BICM.

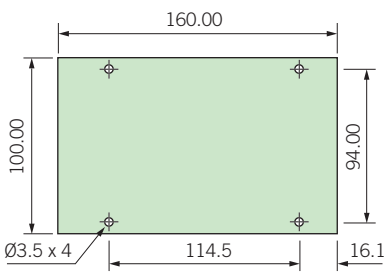
Power requirement	Standard BICM	IP67 BICM
Voltage Range (VDC)	±13.8 to ±18	
Current Range (mA)	±12 at 15 VDC	
Transducer Excitation		
Primary Voltage (Vrms)	1.2 to 21	
Primary Frequency (kHz)	5	
Single Input		
Input Voltage Range (Vrms)	Up to 3.5	
Input Load Resistance (kΩ)	100	
Signal Output		
Voltage Output (VDC)	Up to ±10	
Output Ripple (mVrms)	<14	
Output Offset	Up to 100%	
Temp. Coefficient Gain (%FRO/°C)	<0.03	
Temp. Coefficient Offset (%FRO/°C)	<0.025	
Warm-up (mins)	15 is recommended	
Linearity (%FRO)	<0.1	
Bandwidth (-3 dB)	250 Hz typical	
Environmental		
Operational Temp. Range (°C)	0 to +70	
IP Rating	IP40	IP67
Mechanical & Connections		
Connections	Solder pad /factory fit	Factory fit only
Weight (g)	25	75
Material	A.B.S.	40 series stainless steel

CAH Card



- **>** Dual LVDT input card
- **>** Eurocard dimensions
- **>** Voltage plus current outputs
- **>** Summation plus average option
- **>** DIN 41612 connection

Dimensions (mm)



The CAH series provides the OEM with flexible, low cost conditioning which can be packaged to suit individual requirements.

The cards are particularly suited to industrial and laboratory applications where it is necessary to take the output of an inductive or resistive transducer and calculate mathematical functions and/or interface with remote data loggers or displays.

The cards are available in two styles: Single Channel or Dual Channel with (A ± B)/2 facilities. Electrical connection is through a DIN connector type 41612. Each card provides both current and voltage output signals.

The (A ± B)/2 facility offers four outputs, based on two independent transducer signal inputs (A and B). These are A + B, A - B, (A + B)/2 and (A - B)/2. Span is adjustable in 9 coarse ranges which, together with the integral fine control, allows the use of transducers with sensitivities in the range of 0.5 mV/V to 750 mV/V for a full scale output of 5 VDC. Coarse and fine zero controls are provided to enable the transducers to be zeroed anywhere within their measuring ranges.

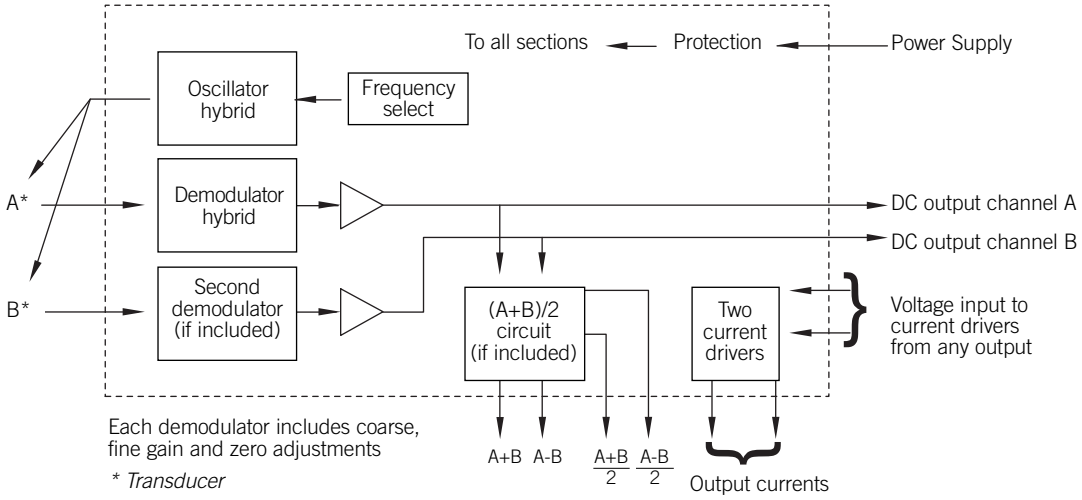
Two operating frequencies are provided, 5 kHz and 10 kHz and the output filter cut off frequency can be set to 500 Hz or 1 kHz, facilitating the optimum response time/output ripple compromise.

Product type		CAH Card
Power requirement		
Voltage Range (VDC)		±14 to ±16[1]
Current Range: (mA)	No Load Full Load	+40, -45 nominal +85 , -90 nominal
Supply Protection		Reverse polarity protection
Transducer Excitation		
Primary Voltage (Vrms)		5
Primary Frequency (kHz)		5 or 10 selectable
Single Input (transducer sensitivity range)		
Input Range (mV/V)		0.5 to 750
Input Load Resistance (kΩ)		1, 10 or 100 selectable
Signal Output		
Voltage Output (VDC)		Up to ±10[2]
Current Output (mA)		Up to ±20 into 500Ω load
Output Ripple (mVrms)		<4
Output Offset		Up to 100% (coarse & fine adjustment[2])
Temperature Coefficient Gain (%/°C)		<0.05[3]
Temperature Coefficient Offset (%/°C)		<0.05[3]
Warm-up (mins)		15 is recommended
Linearity (%)		<0.02
Bandwidth (-3 dB)		500 Hz, 1kHz selectable
Environmental		
Operational Temperature Range (°C)		0 to +60
Storage Temperature Range (°C)		-20 to +85
Mechanical & Connections		
Transducer, Power Supply, Output Signal		DIN 41612 connectors
Weight		Up to 120g

1 The power supply may be reduced to ±12 V if the output is not required to exceed ±7 V

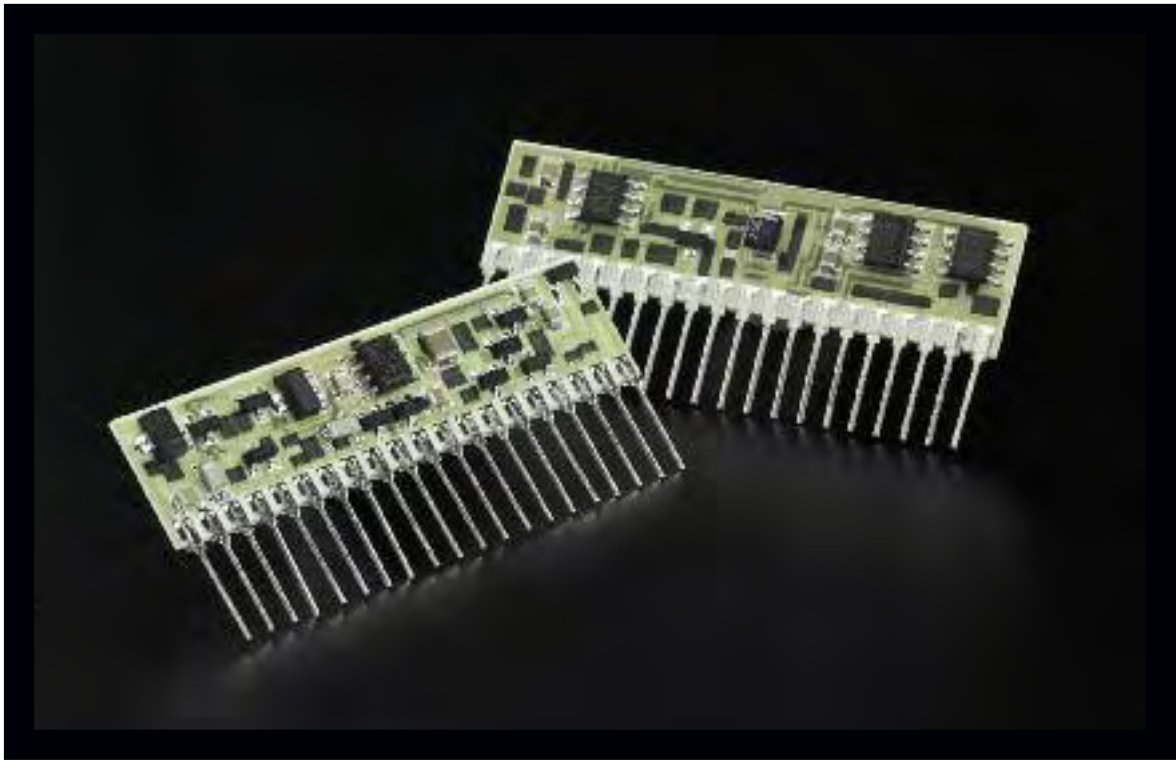
2 Fine adjustment via the front panel

3 Assumes ±5 V output



GPM

82 Configurable Hybrid Modules



- > Small size
- > Ease of use
- > Low cost
- > No extra components required
- > For assembly to OEM circuit boards

The GPM Oscillator and Demodulator Hybrid's are thick film hybrid sub-assemblies. They are designed as components for use by customers building their own support electronics. The Oscillator and Demodulator modules are miniaturised and encapsulated for minimum PCB space requirements.

Each hybrid has been designed to include the most commonly required options, which can be selected by linking pins on the device. However, if unusual frequencies, etc, are required, these can be accommodated by the addition of a few external components.

These two hybrid's have been designed to contain all the most popular options, so application will normally be a simple matter.

A set of application notes is available to assist in designing with this his product.

Oscillator

The oscillator is designed to provide a sine wave carrier for driving the transducer and a square wave reference for the demodulator.

The nominal output is 5 V rms at 5 or 10 kHz, but the device can operate over 1 to 20 kHz, at 0.5 to 7 V rms. It can also provide an output voltage proportional to supply voltage, or an external reference.

If more than one oscillator is used, they can be synchronised to avoid interaction problems.

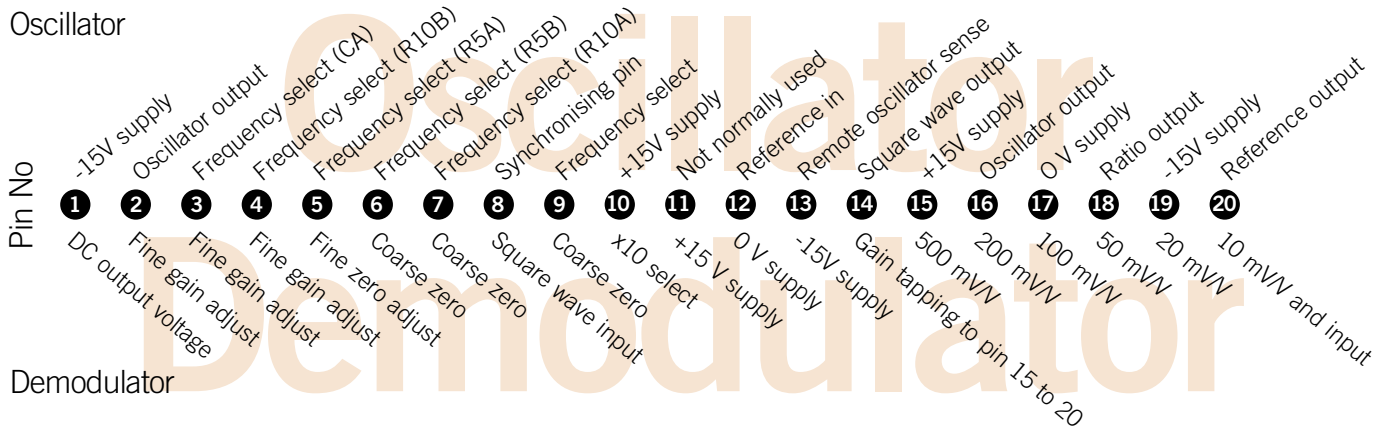
Product type	Oscillator
Power requirement	
Voltage Range (VDC)	±15 (7.5 to 18 acceptable)
Current Range (mA)	±39
Transducer[3]	
Primary Voltage	5 Vrms nominal, 0.5 V to 7 V variable[1]
Primary Frequency (kHz)	5, 10 or 15, 1 to 20 variable[1]
Primary Current (mArms)	50 max
Oscillator Protection	Open & short circuit protection
Gain control	Remote sense facility
Temp. Coeff. of Amplitude (%/°C)	±0.004
Temp. Coeff. of Frequency (%/°C)	±0.02
Warm-up (mins)	15 is recommended
Mechanical & Connections	
Weight (g)	3.5 approx.
Size (mm)	52 x 15 x 6 approx
Mounting	PCB mount conformal coated sil package
Connections	See pin diagram below

Demodulator

The demodulator is designed to amplify the output from the transducer and convert it to a DC voltage. It provides a nominal 5 VDC output (linear to 10 V) for inputs from 2.5 mV to 3.75 V rms (corresponding to 0.5 mV/V to 750 mV/V for 5 V energisation of transducer). 22 gain settings can be selected using links, and an external fine gain control can be added. Facilities also exist for adjusting zero anywhere in the range of the transducer, enabling end or centre zero. Again, a fine control can be added externally. The output filter characteristics can also be altered by addition of external components.

Product type	Demodulator
Power requirement	
Sensitivity	5 VDC output in 9 gain ranges for inputs from 2.5mV to 3.75Vrms. Fine gain control can be added[1]
Output Offset (%)	±30 Fine, ±100 Coarse
Voltage Output (V)	Up to ±10 (with ±15 power supply)
Bandwidth (-3 dB)	500 Hz, 2nd order may be altered
Output Ripple (mVrms)	1
Temp. Coefficient Gain (%/°C)	0.05[2]
Temp. Coefficient Offset (%/°C)	0.05[2]
Warm-up (mins)	15 is recommended
Linearity (%)	<0.02
Mechanical & Connections	
Weight (g)	3.5 approx.
Size (mm)	52 x 15 x 6 approx.
Mounting	PCB mount conformal coated sil package
Connections	See pin diagram below

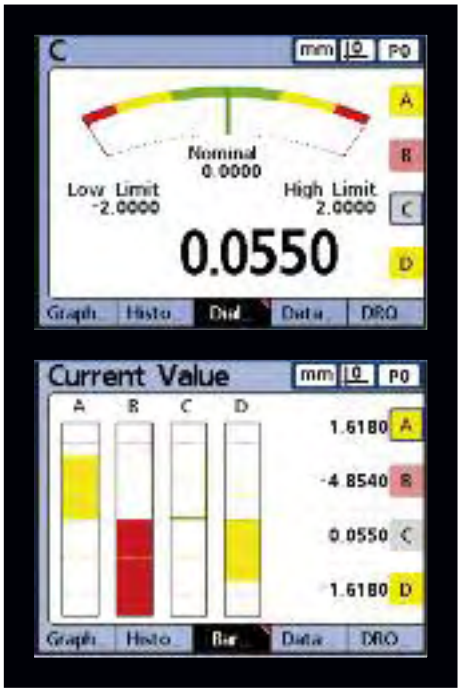
1 Requires additional resistors **2** Assumes ±5 V output **3** Transducer Modulation and Demodulation



SI 7500 series

- > Up to 16 Digital Probes or Modules
- > Up to 100 Parts storable
- > SPC support
- > Suite of Mathematical functions
- > Intuitive menu system
- > Clear graphical display

The SI 7500 is a multi axis metrology display that connects to a Solartron Metrology Orbit Network and accepts up to 16 Orbit Module inputs; such as Digital Probes, Linear Encoders and Analogue Input Modules.
It features intuitive displays, helpful audio cues and user defined formulas. The SI 7500 also reports dynamic Min/Max measurements, provides SPC analysis from an integrated database and offers connectivity to PC's and other peripherals.



Product type	SI 7500
Display type	6" Colour LCD
Resolution	0.0001mm or 0.000004"
Inputs	
Signal Input	Orbit
Connection type	Orbit Network Cable
Number of Orbit Modules	16
Additional Input/Outputs	Remote Switch, USB Port, Remote Keypad, Parallel Data Port, RS232C Serial Port, Relay Outputs x 2
Electrical Interface	
Power Supply (VAC)	85 to 264
Line Frequency (Hz)	43 to 63
Environmental	
Storage Temperature (°C)	-20 to +60
Operating Temperature (°C)	0 to +45
Humidity	0 to 95%, non condensing
Safety Rating	EN 61010-1
EMC	EN 55011:1998, EN50082-2:1995
Mechanical	
Enclosure WxHxD (mm)	292.1 x 190.5 x 69.85
Base WxHxD (mm)	254 x 50.8 x 190.5
Enclosure Weight (Kg)	1.59
Base Weight (Kg)	3.18

SI 3000 series

Single or dual channel controllers

> Simple Menu System
> 1 or 2 channel display (user selectable)
> 7 Digit Colour Display (user selectable)
> Auto course/fine resolution
> Auto display colour change for in/out range
> Peak hold facility
> Data logging facility
> Discrete I/O
> 4-20ma or DC voltage output
> RS232 output

The new SI 3000 range of Controllers are specifically designed to operate with Solartron's extensive range measurement transducers, and/or third party transducers, such as pressure and temperature.

One of the main features is an intuitive menu-driven 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 transducers.

Product type	SI Series
2 x LVDT input, single display	**SI 3100**
2 x DC or 4-20ma input, dual display	**SI 3300**
2 x Orbit Digital input, dual display	**SI 3500**
Power requirement	
Power supply (VDC)	+24 VDC ± 10%
Digital Display	
SI 3100	Single Colour LCD display, 40Hz update
SI 3300 & 3500	Dual Colour LCD display, 40Hz update
Display length (for mm)	± xx.xxxxx (user selectable)
Display length (for ins)	± x.xxxxxx (user selectable)
Resolution	Down to 0.05µm or 0.000005" (user selectable)
Analogue display	
SI 3100	Single coloured vertical bar
SI 3300 & 3500	2 coloured horizontal bars or 1 vertical
Keypad	
Membrane type with 9 keys	Print, Zero, Up, Down, Left, Right, Enter, Peak Hold/Track, Menu
Measurement type	
SI 3100	A, B, A+B, A-B, (A+B/2), (A-B/2), (B-A/a)
SI 3300 & 3500	A, B, A+B, A-B, (A+B/2), (A-B/2), (B-A/a) X and Y

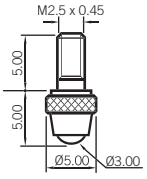
Product type	SI Series
2 x LVDT input, single display	**SI 3100**
2 x DC or 4-20ma input, dual display	**SI 3300**
2 x Orbit Digital input, dual display	**SI 3500**
Data Logging	
SI 3300 & 3500 only	10,000 readings via switch or 1ms to 24hr time interval
Indications	
	mm/inch, Lower & Upper Limits, Out of Range, Measurement Mode
External input/output	
Serial	RS232 serial port (for printer or PC)
Discrete Output	2 x 3 isolated discrete outputs
Analogue Output	2 channels either configured DC Voltage or 4-20ma
Mechanical and Environmental	
Mounting	Bench top or Panel Mount (user selectable)
Sealing	Front Panel IP65. Case IP51, Rear connection IP51
EMC	Immunity: EN6100-6-2:2001 Emissions: EN61000-6-3:2001
Storage Temperature (°C)	-20°C to +50
Operating Temperature (°C)	0°C to +50
Dimensions WxHxD (mm)	Excluding Bezel 134 x 65 160 Including Bezel 144 x 74 x 175

Probe tips

1 Type normally fitted to AX Series and tungsten carbide version of feather touch probes

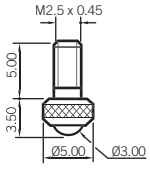
2 Shank of 041676 is narrower and longer than 802605. Tip normally used on linear encoders

3 Type fitted to nylon versions of feather touch probes



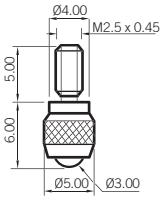
Ø3.00mm Ball

Tip material	Part no.
T.Carbide	804979
Ruby	804807
Nylon	805181
Silicon Nitride	804973



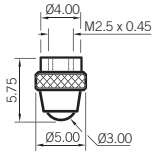
Ø3.00mm Ball

Tip material	Part no.
T.Carbide	802605[1]
Nylon	803246[3]



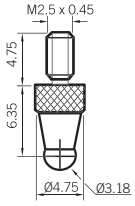
Ø3.00mm Ball

Tip material	Part no.
T.Carbide	041676[2]



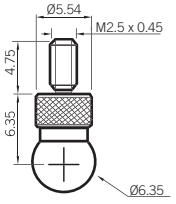
Ø3.00mm Ball

Tip material	Part no.
T.Carbide	804967
Ruby	804966
Nylon	804965
Silicon Nitride	805180



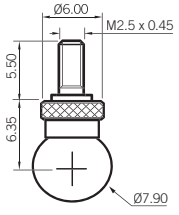
Ø3.18mm Ball

Tip material	Part no.
T.Carbide	008305-004



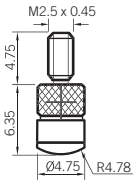
Ø6.35mm Ball

Tip material	Part no.
T.Carbide	008305-005



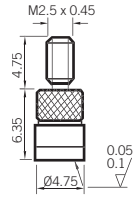
Ø7.90mm Ball

Tip material	Part no.
Ruby	804828



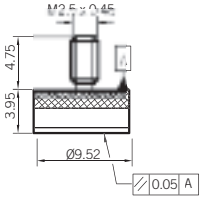
Ø4.75mm Dome

Tip material	Part no.
T.Carbide	008305-034



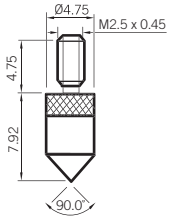
Ø4.75mm Flat

Tip material	Part no.
T.Carbide	008305-033



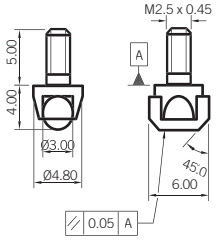
Ø9.52mm Flat

Tip material	Part no.
T.Carbide	008305-007



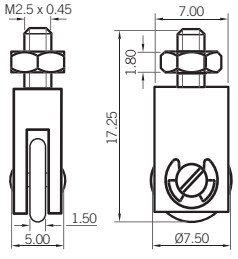
90° Tip

Tip material	Part no.
T.Carbide	008305-003



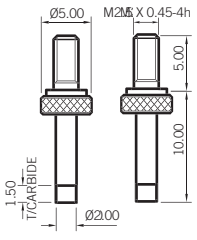
Ø7.90mm Roller

Tip material	Part no.
T.Carbide	008305-030



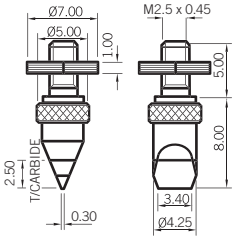
1.5 x Ø7.50mm Wheel

Tip material	Part no.
Steel	008305-027



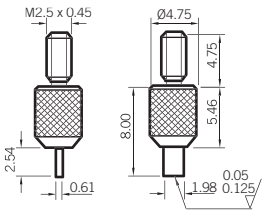
Ø2.00mm Pin

Tip material	Part no.
T.Carbide	206675



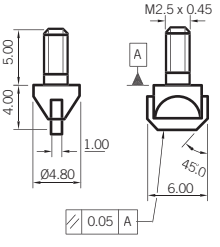
Knife Edge

Tip material	Part no.
T.Carbide	206674



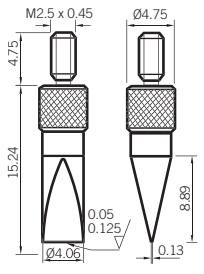
0.6 x 2mm Blade Edge

Tip material	Part no.
T.Carbide	008305-035



1 x 6mm Blade Edge

Tip material	Part no.
T.Carbide	008305-031



4 x 11mm Knife Edge

Tip material	Part no.
T.Carbide	008305-036

Glossary

Measurement definitions

Measurement Range

The range of displacement over which the measured values are within the maximum permissible errors of the transducer. For analogue products this is expressed as a displacement either side of the electrical zero or null position. For digital products, this is expressed as a single displacement from the start of the measurement range to the end position.

Example: An AX5 analogue transducer has a measurement range of ±5mm. This means it has a total measurement range of 10mm. A DP10 digital transducer has the same measurement range of 10mm.

Repeatability

Repeatability is defined as the ability of the transducer to provide measurements within a close distribution on the same measurand carried out in the same direction.

Solartron use a method of establishing repeatability where a defined side load is applied to the transducer under test which reflects how transducers are used in most real applications. Methods of measuring repeatability without applying side load usually give a better result but this may not be reflected in real life applications.

Hysteresis

Hysteresis is defined as the difference between measurements on the same measurand carried out where the transducer measures the measurand from opposite directions.

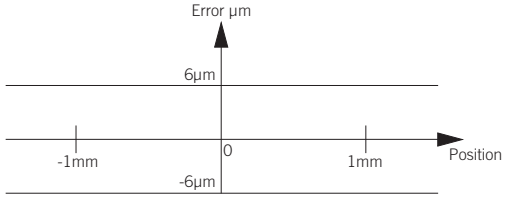
Linearity

Linearity is defined as the deviation of a transducer's response from a straight line.

Solartron use two definitions for linearity depending on the product type. These are % FRO or the more demanding % Reading (0.5% Reading approximately equals 0.25% FRO).

% Full Range Output (%FRO)

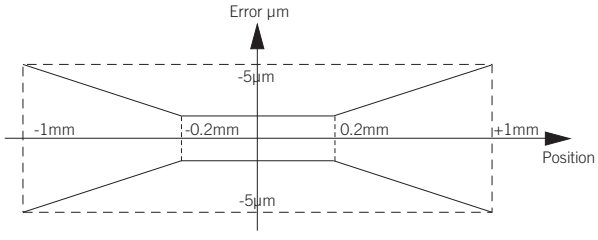
% Full Range output fits a straight line through zero to the measured characteristic which balances the positive and negative errors from this line. This is known as the "Best Fit Straight Line". The magnitude of this error is then expressed as % of full range and includes any error due to symmetry either side of zero but does not include any sensitivity error.



Example: ±1mm transducer with 0.5% FRO

% Reading

%Reading defines an error envelope within which the allowable error is proportional to the displacement. This is defined as a % of the displacement being measured with a minimum equivalent to 20% of the maximum displacement that the transducer can measure. This method results in a more stringent performance being required of the sensor operating around the electrical zero than is required with a % FRO.



Example: ±1mm transducer with 0.5% Reading

For standardised analogue transducers the error envelope is with respect to the nominal transducer sensitivity and therefore the total error includes both linearity and sensitivity errors. For non standardised transducers the error curve is with respect to the actual sensitivity and therefore any subsequent electronics will be required to adjust for the actual sensitivity of the transducer.

Measurement definitions *continued*

Accuracy

The accuracy is defined as the peak to peak variation of the measured error curve using a precision reference, usually a laser interferometer. This method is used for Digital Transducers and Linear Encoders.

Uncertainty of measurement

Uncertainty is an issue that is associated with any measurement. At Solartron Metrology, the GUM (Guide for the Expression of Uncertainties in Measurement) is used to specify the uncertainties of verification of its products. This section discusses uncertainty for the different product categories.

Analogue gauging products

The gauging products are verified using a variety of instruments such as an optical Linear Encoder, a barrel micrometer or a wedge comparator. The verification using an optical linear encoder results in an uncertainty of better than 0.5 µm.

Digital products and analogue and digital Linear encoder

The Digital probe, linear encoder and other digital products are verified using an optical interferometer, the wavelength of which is computed using Edlen's formula (B. Edlen, Metrologia Vol. 2, 71 (1966)) for operation under normal atmospheric conditions (not in vacuum).
The uncertainty of the measurement is usually less than 0.1 µm.
The user should refer to the verification or calibration sheets for actual values.

Electrical definitions

Electrical Zero

The position of the moving part of the transducer with respect to its body where the electrical output is zero. In practice, this is the transducer position where the output is minimised.
Note: Sometimes known as null.

Energising Voltage

The allowable range of voltages used to energise an LVDT or Half Bridge transducer. It is specified as a sinewave in Vrms. The energising voltage is the range over which the transducer will operate, however the transducer specification is guaranteed only at the calibration energising voltage. For DC operated transducers, the energising voltage is specified in VDC.

Energising Current

The current required to energise the transducer. It is dependent on the energising voltage and is expressed as mA/V. It also varies with the energising frequency.

Energising Frequency

The allowable range of frequencies used to energise an LVDT or Half Bridge transducer.
It is specified in kHz. The energising frequency is the range over which the transducer will operate, however the transducer specification is guaranteed only at the calibration energising frequency.

Sensitivity

This is specified as the magnitude of the output with respect to displacement (mm) and energising voltage (V) for an LVDT or Half Bridge Transducer. It is expressed in mV/V/mm.

Residual Voltage at Electrical Zero

The minimum voltage attained for the electrical zero position, i.e. the smallest output that can be detected.

Transducer and physical definitions

Total Mechanical Range

The distance over which the moving part of a transducer can be displaced between two physical end stops. Total mechanical range is always greater than measuring range.

Direction of displacement measurement

Outward travel is defined as displacement away from the body of the transducer and cable end. Inward travel is defined as displacement into the body of the transducer towards the cable end.

The conventional direction of signals for an LVDT is such that for an inward displacement from the electrical null the output signal is in phase with the excitation signal and for an outward displacement from electrical zero the output signal is in antiphase to the excitation signal.

For a digital transducer the output count increases for an inward movement.

Outward travel from Zero

This is the total mechanical movement outward from the electrical zero of an LVDT or HB transducer. It is generally greater than the measurement range from the electrical zero. (See also pre travel).

Inward travel from Zero

This is the total mechanical movement inward from the electrical zero of an LVDT or HB transducer. It is generally greater than the measurement range from the electrical zero. (Also see post travel)

Pre-travel

The mechanical movement from the fully outward position, where the moving element is against a mechanical limit stop, to the start of the measurement range.

Post Travel

The mechanical movement from the end of the measurement range to the fully inward position, where the moving element is against a mechanical limit stop.

Tip Force

The tip force of the transducer is defined as the force exerted on the sample at the electrical zero of the transducer or at the mid point of the measurement range for digital transducers and Linear Encoders. Tip force is defined in the horizontal position unless specified otherwise.

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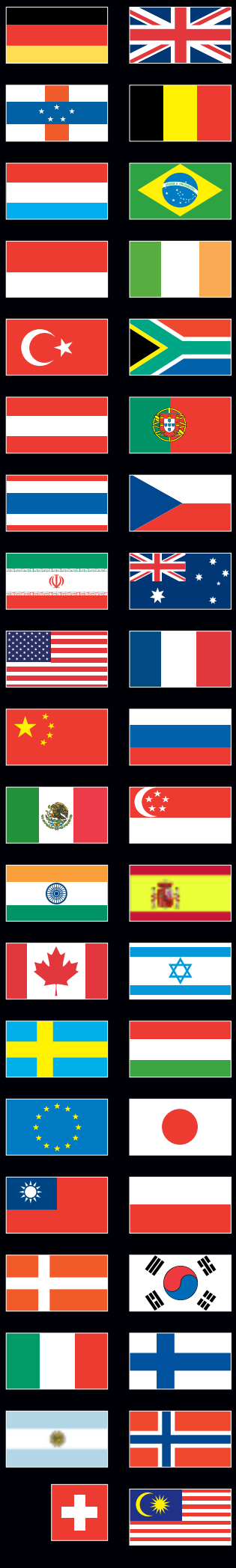

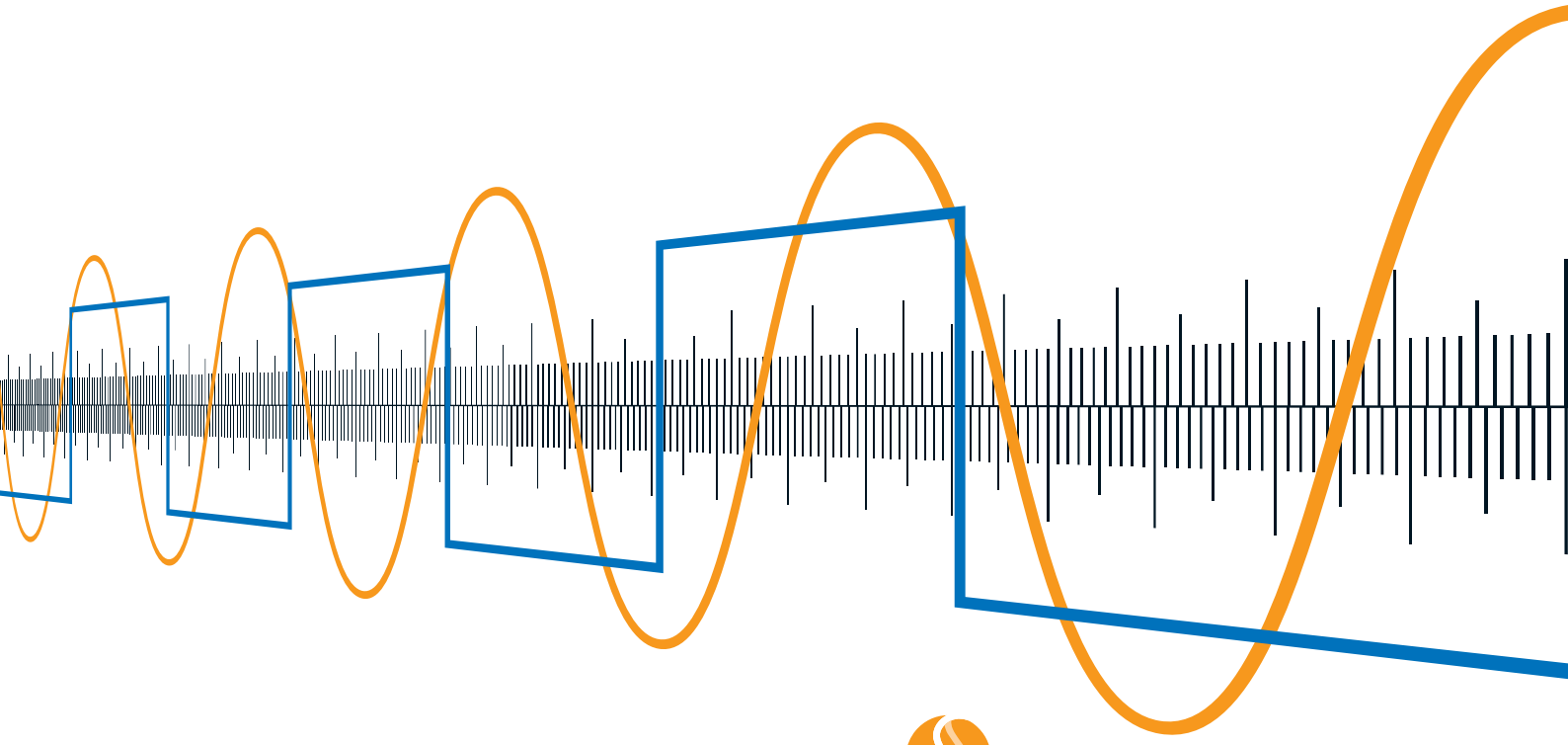

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Solartron Metrology pursues a policy of continuous development. Specifications in this document may therefore be changed without notice.

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