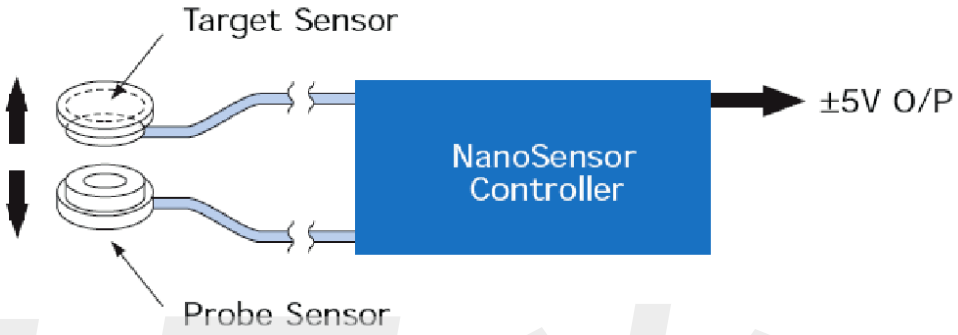
纳米级电容位移传感器

电容传感器的原理是利用力学变化使电容器中其中的一个参数发生变化的方法实现信号的变化的。电容位移传感器由目标和探针两个传感板组成电容器。当电容器之间的距离发生改变时，电容器的电容量就会发生改变，使用适当的控制器就会测出两个传感板距离的变化。



电容传感器因具有结构简单、功耗低、精度高、动态性能好、频带宽、高稳定性和非接触测量等优点，在工业生产和科学研究领域得到广泛的应用。

上海昊量光电设备有限公司推出的电容位移传感器主要包括以下几款产品：

①**AU-NX 系列位移传感器**是基于电容测微原理的非接触式的位移测量系统。该电容位移传感器由目标和探针两个传感板组成电容器。利用合适的控制器可测量两个电容板之间的距离，在 1.25mm 的行程中，分辨率可高达 7pm。此外该位移传感器具有很高的频带宽，可达到 10KHz，拥有优越的线性度可达到 0.02%。由于该电容传感器为非接触式精密测量系统，因此具有零迟滞、低功耗等优点。此外该系列的位移传感器可有铝合金和不胀钢两种材质。

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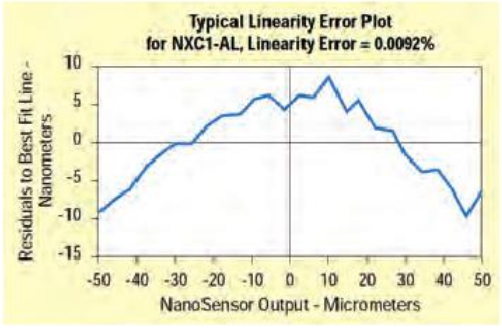
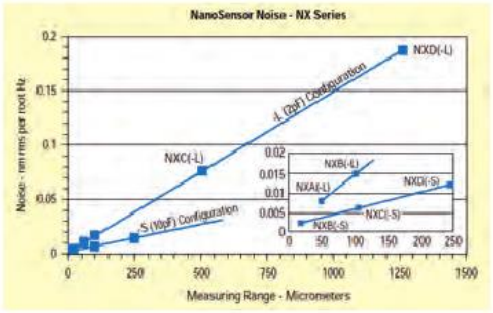
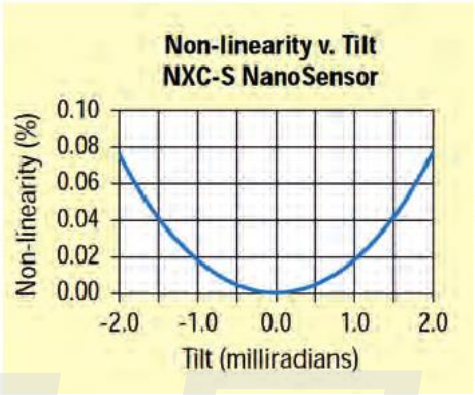
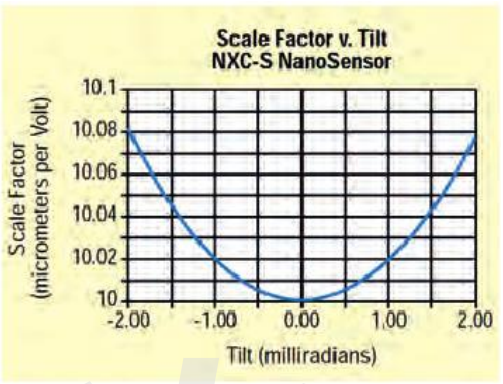
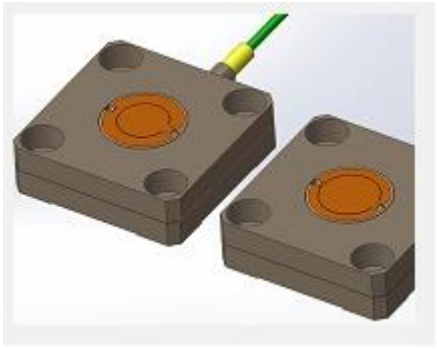








②AU-NZ 系列位移传感器的工作原理与 AU-NZ 系列的完全相同。它们的主要区别在工艺和材质上不同。AU-NZ 电容位移传感器采用微晶陶瓷和张胀钢材质，并且没有粘合剂。这使其拥有极好的热稳定性，非常适合低温使用。



③大量程电容位移传感器，主要包括 AU-NCG-1-AL-UHV，该高分辨率位移传感器为严苛环境条件下设计，工作温度范围可以从-200℃到+150℃。采用镀金陶瓷电容板，行程可达到 11000 微米，且分辨率可达到 0.12 微米。在极大的行程中仍然可以保持较好测直线性，线性度可达到 0.4%。

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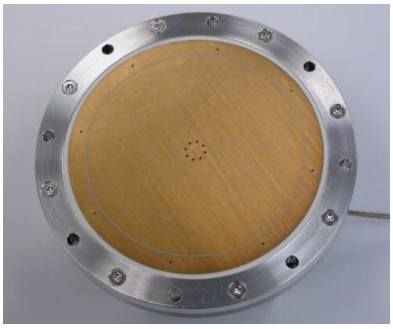

◆主要特点

- 大行程（11mm）
- 高分辨率（0.1nm）
- 高热稳定性
- 高直线性（0.02%）
- 零迟滞
- 高频带宽度（10KHz）
- 低功耗
- 操作温度范围大（-200~+150℃）

◆主要应用

精密制造、计量、形变测量、平台控制、材料测试、显微镜、能动光学、精密光束控制等。

◆主要参数

AU-NCG-1-AL-UHV Specification

Parameter	Value	Comments
Variant	AU-NCG-1-AL-UHV	
Materials	Aluminium housing with gold plated alumina (ceramic) sensors	
Depth	10mm	Note 1
Diameter	82mm	
UHV Kapton cable length	0.5m	Longer available on request
Kapton air cable length	1.5m	Note 2
Sensor gap	3.5 to 14.5mm (9 nominal)	Note 3
Sensor range	11mm	As standard
Position noise (rms)	120nm	Note 4
Uncompensated linearity	0.4%	Typical
Probe area	2500mm^2	Typical
Vacuum compatibility	10^{-10} Torr	Note 5
Operating temperature	-200 to +150ºC	
Relative humidity	0-95% (non-condensing)	
Radiation hardness	10^7 Gy	Note 6

Notes:

1. Per sensor half. Sensor mounting faces nominally should be 29mm apart parallel and concentric.
2. Radiation hard (Kapton) airside cable. Controller end should be shielded from radiation with the controller.
3. Sensor gap nominal (9mm) is taken from the sensor housing faces. Real sensor face gap will be 10mm at the nominal. Each recessed by 0.5mm.
4. Typical value measured with NS-2304 @ 100Hz bandwidth, with a total kapton cable length of 2m.
5. Sensors are made of low outgassing materials and ultrasonically cleaned. Prior to installation the NCG-1-AL-UHV sensors can be baked out for 1 day at 180°C.
6. Radiation levels beyond this will begin to degrade the Kapton cable. Greater levels of radiation can be tolerated but fall outside of the product warranty.

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AU-NX Specification

Parameter		Value						Units	Comments
Static physical									
Variant		AU-NXB		AU-NXC		AU-NXD			
Active area		22.5		113		282		mm^2	
Material		AL	SI	AL	SI	AL	SI		Note 1
Dynamic physical (Typical values)									
Thermal drift		230	3	230	3	230	3	nm K^{-1}	Note 2
Short range –S (10pF)	Range	20		100		250		µm	
	Nominal scale factor	2		10		25		µm/V	
	Noise	<0.001		<0.005		<0.013		nmrms $Hz^{-½}$	
	Linearity error	<0.08		<0.05		<0.06		%	Note 3
Long range –L (2pF)	Range	100		500		1,250		µm	
	Nominal scale factor	10		50		125		µm/V	
	Noise	<0.015		<0.075		<0.188		nmrms $Hz^{-½}$	
	Linearity error	<0.08		<0.03		<0.06		%	Note 3
Operating temperature	Controller	+10 to +50						°C	
	Sensor	-273 to +80						°C	
Storage temperature		0 to +70						°C	
Relative humidity		5 to 95 (non-condensing)						%	
Operating pressure	-UHV	10^{-9}						T	Note4

Notes

1. Aluminium (AL) and Super Invar (SI) material available on all variants. Alternative materials, e.g. Stainless Steel or Invar 36 can be used. Please consult Queensgate.
2. This is the thickness contribution only. It does not include the area effect.
3. Linearity error can be dominated by the parallelism of the sensor faces; particularly for short range sensors. Linearity for type 4 compact sensors will have an order of magnitude higher non-linearity.
4. Vacuum sensors should be baked out at 100 °C for two days prior to installation for best vacuum compatibility.

AU-NZ Specification

Parameter		Value			Units	Comments
Static physical						
Variant		AU-NZB	AU-NZC	AU-NZD		
Active area		22.5	113	282	mm^2	
Material		Zerodur/SI	Zerodur/SI	Zerodur/SI		Note 1
Dynamic physical (Typical values)						
Thermal drift		1.5	1.5	1.5	nm K^{-1}	Note 2
Operating temperature	Controller	+10 to +50			°C	
	Sensor	-273 to +100			°C	

Notes

1. This is the sensor thickness contribution only, it does not include any area effect.
2. Sensor head only can be used at cryogenic temperatures.

All other parameters are as per NX Series NanoSensors.

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