

# SmartScope SP

High Performance Multisensor Metrology Systems

# SmartScope® SP

## System Specifications

	SmartScope SP 332	SmartScope SP 463	SmartScope SP 663
XYZ travel (mm)	300 x 300 x 250	450 x 610 x 300	650 x 660 x 300
XYZ measuring range with standard lens (mm)	300 x 300 x 200	450 x 610 x 250	650 x 660 x 250
Machine dimensions (mm)	870 x 850 x 800	1650 x 1085 x 1900	1830 x 1560 x 1960
Drive system & controls	4-axis DC servo drive (X,Y,Z and zoom) with dual drive, air bearing Z axis	4-axis DC servo drives (X,Y,Z and zoom)	4-axis DC servo drive (X,Y,Z and zoom) with dual Y-axis drive
XYZ scale resolution (µm)	Standard: 0.1; Optional: 0.05	Standard: 0.1; Optional: 0.05	Standard: 0.1; Optional: 0.05
Machine weight (kg)	160	1400	1800
Shipping weight (kg)	220	1640	2300
Worktable	Hardcoat worksurface with tapped fixture holes and removable glass insert		
Worktable payload (kg)	30	75	130
Rotary axis	Optional Miniature Servo rotary, or MicroTheta rotary	Optional Miniature Servo rotary, MicroTheta rotary, HPR High Precision Rotary or Heavy Duty rotary and Dual Rotary indexers. Consult the factory for complete information about available rotary indexer combinations.	
Power requirements	100-120 VAC or 200-240 VAC, 50/60 Hz, 1 phase, 600 W	100-120 VAC or 200-240 VAC, 50/60 Hz, 1 phase, 800 W	100-120 VAC or 200-240 VAC, 50/60 Hz, 1 phase, 850 W
Compressed air requirements (332 model only)	Std: 120 liters/min @ 3.0 - 5.0 bar Opt: Air dryer kit		
Rated environment	Temperature: 18-22 °C, stable to ±1 °C; Maximum rate of temperature change: 1 °C / hour, maximum vertical thermal gradient: 1 °C / meter. Humidity: 30-80%; Vibration <0.001g below 15 Hz		
Operating environment, safe operation	Temperature: 15-30 °C		

## SmartScope SP Optics

SP optics are designed for maximum imaging performance and flexibility over a wide range of applications. The front objective lens offers the convenience of a larger field of view, while the 5.5X zoom lens offers a range of higher magnifications to handle small features. An optional high magnification objective is easily interchanged when feature sizes require it. A 5.0 megapixel metrology camera and dedicated monochromatic illuminators ensure sharp imaging at all zoom positions.

The telecentric lens system enables use of the optional TeleStar® Plus TTL interferometric laser. The TeleStar Plus offers extra long working distance and sub-micron resolution for high precision surface profile and depth measurements.

## SmartScope SP Optics & Sensor Specifications

	Standard	Optional
Optics	QVI® SP zoom optics with AccuCentric® auto-compensation, one standard front lens and 5.5x optical zoom offer up to 60:1 digital/optical magnification range with maximum 90 mm WD	High magnification lens
Illumination	All monochromatic LED: substage profile, coaxial surface, SmartRing™ ring light	LED focus grid illuminator
Camera	5 MP monochrome digital metrology camera	
Field of view size (mm)	<b>Standard objective lens:</b> 12.27 x 10.26 (16.0 diag.) 2.23 x 1.87 (2.91 diag.) 0.20 x 0.17 (0.27 diag.)	<b>High magnification lens:</b> 2.23 x 1.87 (2.91 diag.) 0.41 x 0.34 (0.53 diag.) 0.04 x 0.03 (0.05 diag.)
Image processing	256 level grayscale processing with 10:1 subpixel resolution	
Scanning sensors	Scanning probe controller, SP25 scanning probe body, SM25-2 module and 3 mm dia. x 21 mm stylus. 3 position change rack. Calibration kit including kinematic mount and certified 25mm sphere	Additional SM25-1, SM25-3, SM25-4, SM25-5, TM25 scanning and touch modules, stylus holders, and styli
Laser sensors		TeleStar® Plus interferometric TTL laser
Controller	Windows® based, with up-to-date processor, on board networking/communication ports and integral QVI scanning controller for laser and tactile scanning; multifunction handheld controller for operator control	
Controller accessory package	24" flat panel monitor, keyboard, 3-button mouse. Ergonomic sit-stand operator workstation for 463 and 663 models.	Dual 24" flat panel monitors, keyboard, 3-button mouse; granite / laminate operator workstation for benchtop 332 model.
Software	ZONE3® Express 3D coordinate metrology software, includes QVI Portal configuration and calibration utility	ZONE3 Prime, ZONE3 Pro and ZONE3 Offline editions SmartProfile®, SmartFit® 3D, SmartReport® Powered by QC-CALC, E-SPC

# Performance and Accuracy Specifications

SmartScope SP Model		332	463	663
<b>Optical (per ISO 10360-7:2011)</b>				
Unidirectional X or Y length measurement errors	$E_{UX(Y), MPE^*}$	$(1.5 + 5L/1000) \mu\text{m}^{1,2,3,4}$	$(1.5 + 5L/1000)\mu\text{m}^{1,2,3,4}$	$(2.0 + 5L/1000)\mu\text{m}^{1,2,3,4}$
Unidirectional XY length measurement errors	$E_{UXY, MPE^*}$	$(1.9 + 5L/1000) \mu\text{m}^{1,2,3,4}$	$(1.9 + 5L/1000)\mu\text{m}^{1,2,3,4}$	$(2.4 + 5L/1000)\mu\text{m}^{1,2,3,4}$
Unidirectional length measurement errors	$E_U, MPE^*$	$(3.9 + 5L/1000) \mu\text{m}^{1,2,4,6}$	$(3.4 + 5L/1000) \mu\text{m}^{1,2,4,6}$	$(4.4 + 5L/1000) \mu\text{m}^{1,2,4,6}$
Repeatability of XY length measurement errors	$R_{UXY, MPL^*}$	$1.5 \mu\text{m}^{2,3,4}$	$1.5 \mu\text{m}^{2,3,4}$	$2.0 \mu\text{m}^{2,3,4}$
Probing error (High zoom / low zoom)	$P_{F2D, MPE}$	$1.9 \mu\text{m} / 10 \mu\text{m}^{2,4}$	$1.9 \mu\text{m} / 10 \mu\text{m}^{2,4}$	$1.9 \mu\text{m} / 10 \mu\text{m}^{2,4}$
Probing error of imaging probe (High zoom / low zoom)	$P_{FV2D, MPE}$	$1.2 \mu\text{m} / 5 \mu\text{m}^{2,4}$	$1.2 \mu\text{m} / 5 \mu\text{m}^{2,4}$	$1.2 \mu\text{m} / 5 \mu\text{m}^{2,4}$

<b>Autofocus Performance (per QVI #790218)</b>				
Z-linear autofocus accuracy	$E_Z$	$(3.8 + 5L/1000) \mu\text{m}^{1,2,4}$	$(3.8 + 5L/1000) \mu\text{m}^{1,2,4}$	$(3.8 + 5L/1000) \mu\text{m}^{1,2,4}$

<b>SP25 Tactile Probe Performance (per ISO 10360-4:2000)</b>				
Scanning probe errors	$MPE_{THP}$	$4.9 \mu\text{m}^{2,5,7}$	$4.9 \mu\text{m}^{2,5,7}$	$4.9 \mu\text{m}^{2,5,7}$
Time for scanning probe errors	$MPL_{T_e}$	$70 \text{ sec}^{2,5,7}$	$70 \text{ sec}^{2,5,7}$	$75 \text{ sec}^{2,5,7}$

<b>SP25 Tactile Probe Performance (per ISO 10360-5:2010)</b>				
Single stylus form errors	$P_{FTU, MPE}$	$3.9 \mu\text{m}^{2,5}$	$3.9 \mu\text{m}^{2,5}$	$3.9 \mu\text{m}^{2,5}$

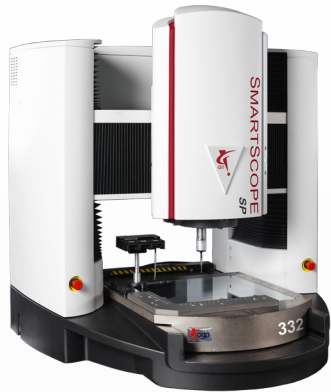
<b>TeleStar® Plus Laser Performance (per ISO 10360-8:2013)</b>				
Probing size error All	$P_{[Size, Sph, All, Tr, ODS], MPE}$	$3.5 \mu\text{m}^2$	$3.5 \mu\text{m}^2$	$3.5 \mu\text{m}^2$

<b>TeleStar® Plus Laser Accuracy</b>				
Z-axis laser measurement accuracy with optional 1X lens		$1.0 \mu\text{m}^{2,8}$	$1.0 \mu\text{m}^{2,8}$	$1.0 \mu\text{m}^{2,8}$

<b>NOTES</b>				
1. Where L = measuring length in mm				
2. Applies to a thermally stable system in the rated environment and in accordance with the operating manual. Maximum rate of temperature change: 1 °C / hour, maximum vertical thermal gradient: 1 °C / meter. With evenly distributed load of up to 5 kg. Depending on load distribution, accuracy at maximum rated load may be less than standard accuracy. The system shall be operated using the procedures given in the operating manual when conducting tests.				
3. Measured in the standard measuring plane, defined as a plane within 25 mm of the worktable surface				
4. All optical accuracy specifications at maximum optical magnification, unless otherwise stated				
5. Using SP25 with SM25-2 module with 3.0 mm x 21 mm A-5000-3553 stylus				
6. On-site verification optional				
7. Target tip deflection 0.35 mm				
8. Accuracy on horizontal specular surfaces within the measuring range				
*Artifact may be low expansion with a CTE no greater than $1 \times 10^{-6} / ^\circ\text{C}$ and with a CTE expanded uncertainty (k = 2) no greater than $1 \times 10^{-6} / ^\circ\text{C}$ , and will have calibrated values adjusted to the CTE of steel per ISO 10360-7:2011. Linear, area and volumetric accuracy standards are described in QVI publication number 790762.				

# SmartScope SP

## System Configurations



### SmartScope SP 332

**SmartScope SP 332** offers high performance in a convenient bench-top package. The patented elevating-bridge design provides machine-in squareness and a large work envelope that uses very little floor space. An air-bearing Z-axis motion system provides the friction free motion and stiffness necessary for excellent scanning probe performance.



### SmartScope SP 463

**SmartScope SP 463** is a rugged, floor model system of proven design to handle larger, heavier parts in a workshop environment. The fixed bridge design separates the primary axis motions so they are completely independent, with no influence on each other. Rigidity and stiffness give this transport superb volumetric accuracy.



### SmartScope SP 663

**SmartScope SP 663** offers a large measuring volume and high payload capacity in compact footprint. The moving bridge design provides an open work envelope allowing heavy parts to be loaded by a conveyor or overhead crane if needed. Granite base and granite bridge with heavy duty cast uprights ensure thermal stability and vibration isolation for excellent scanning performance, even under adverse conditions.