HEXAGON
MANUFACTURING INTELLIGENCE

LEITZ REFERENCE Xe / Rotary Table

VERSION 2017-6

TECHNICAL DATA

Description	Accurate and fast universal measuring machines in moving bridge design. Suitable for quality departments and production lines.

Applications

Coordinate measurements	Inspection of any kind of parts and geometries for manufacturing as well as for R&D. For quality control centres and inline shop floor inspection.
Gear inspection	For gear diameters of up to 850 mm. Capable of measuring any type of gear, gear segments and gear racks. No rotary table required for gear inspection.
Form testing	Quality control of industrial form tolerances: roundness, cylindricity, flatness, straightness and profile.

Design

Frame	Moving bridge design with patented TRICISION™ technology.
Guide ways	Granite table with integrated dove tail guide. Pre-loaded air bearings in all axes.
Drives	Servo motors and steel-enforced belt drives.
Length measuring system	High resolution steel scales with incremental, electro-optical transducers.
Resolution	5 nm (0.005 µm)
Temperature compensation	Automatic temperature compensation for scales and work piece.
Damping system	Elastomere damping (optional: active pneumatic damping).

Electronics and Safety

Control cabinet B5	Modern microprocessor controller in a service-friendly, modular design with integrated monitoring. Remote diagnostics through Hexagon service via internet available (optional).
Collision protection	For styli, in setup mode.
Safety standards	CE-certificate; CE-conform with machine directive (2006/42/EG), EMC directive (2014/30/EU).

Supply Specifications

Protection class	IP 54
Operating voltage	230 V, ±10%; 50 - 60 Hz; P, N, PE
Power requirement	1.4 KVA
Power consumption	0.6 KVA
Rated current	6 A
Recommended main fuse	16 A

Air Supply

Pressure	≥ 0.55 MPa (5.5 bar)
Consumption	approx. 79 Nl / min plus 35 Nl / min oRT2 / oRT4
Quality	According to ISO 8573-1: 2010 [4:4:4]

Options

- Automatic styli changer, TravelRack
- Manual and automated part loading systems
- Automatic workpiece temperature sensor
- Active pneumatic damping

SPECIFICATIONS REFERENCE Xe / RT - FIXED HEAD

Max. permissible Errors MPE [µm] acc. to:		Temperature range	15.9.7	22.12.9
ISO 10360-2 (2010)				
Volumetric length measuring error [1],[2]	E_0 / E_{150}	18-22° C	1.4 + L / 350	1.9 + L / 350
Repeatability range [1],[2]	R_0		0.9	1.0
ISO 10360-4 (2000)				
Single stylus Form error, scanning [3]	THP		2.4 / 50s	2.6 / 50s
ISO 10360-5 (2011)				
Single stylus form error [2]	PFTU		1.4	1.8
Multi styli form error [4]	PFTM		3.0	3.2
Multi styli size error [4]	PSTM		1.5	1.6
Multi styli location error [4]	PLTM		2.3	2.4
ISO 12181				
Form measurement error [5]	RONt		1.6	1.9

SPECIFICATIONS REFERENCE Xe - ARTICULATING HEAD

Max. permissible Errors MPE [µm] acc. to		Temperature range	15.9.7	22.12.10
ISO 10360-2 (2010)				
Volumetric length measuring error [1],[6]	E_0 / E_{200}	18-22° C	1.7 + L / 350	2.1 + L / 350
Repeatability range [1],[6]	R_0		1.2	1.3
ISO 10360-4 (2000)				
Single stylus Form error, scanning [3]	THP		2.5 / 45s	3.0 / 45s
ISO 10360-5 (2011)				
Single stylus form error [6]	PFTU		1.7	1.9
Multi styli form error [6]	PFTM		5.1	5.4
Multi styli size error [6]	PSTM		2.9	3.0
Multi styli location error [6]	PLTM		3.9	4.0
ISO 12181				
Form measurement error [5]	RONt		1.8	2.0

Permitted Environmental Conditions	
Temperature gradients (hour/day/meter)	18-22° C: 1 / 2 / 1 K
Relative air humidity	30% – 70%, non condensing

Throughput	
Probing frequency	35/min
Max. positioning speed	520 mm/s
Max. acceleration	4000 mm/s²

[1] E_0, E_{150} and R_0 are valid — for a length gauge with an uncertainty of calibration of ≤ 0.08 + 0.3 x L / 1000 and a CTE between 8 x 10^{-6}/K and 13 x 10^{-6}/K. For measuring lengths of more than 1000 mm the availability of adequate gauges has to be confirmed with the manufacturer.

[2] E_0, R_0 and PFTU are valid — for Leitz styli from ø 3 x 35 mm up to ø 8 x 130 mm, without extension; anywhere in the measuring volume.

[3] THP is valid — for a Leitz stylus ø 5 x 80mm.

[4] PFTM, PSTM, PLTM are valid — for 5 Leitz styli ø 5 x 80mm. To be tested near the reference sphere.

[5] RONt (MZCI) is valid — for a Leitz stylus ø 5 x 80mm, filter 50 UPR, with precision calibration. Verification with QUINDOS only. Form measurement error (roundness) at a ø 50 mm ring gauge, in scanning mode, acc. to EN ISO 12 181 (VDI/VDE 2617, part 2.2)

[6] E_0, R_0 and PFTU are valid — for HH-A-T7.5 with Leitz stylus ø 3 x 50mm, without extension; anywhere in the measuring volume.

Specifications for acceptance test with ball plates on request.
Specifications are valid only with original Leitz accessories.

TECHNICAL DATA – PROBE HEADS

Leitz Probe Heads Reference Xe / RT	HP-S-X5	HH-A-T7.5 / HP-S-X1H
Measuring methods	3D-self-centring, Scanning, variable High Speed Scanning VHSS, Tag-Scan, Scan Catch	
Max. data rate	1000 points/s	1000 points/s
Probing force	0.1 to 1.2 N	0.1 to 0.6 N
Max. stylus lenght	500 mm	225 mm, cranked styli ≤ 100 mm
Max. stylus weight (incl. stylus clamping)	500 g	33 g
Smallest tip diameter	0.3 mm	0.3 mm

TECHNICAL DATA - ROTARY TABLE

Description High precision rotary tables for Leitz measuring machines.

Types oRT: "On top" versions, removable from the machine table

Specifications

	oRT 2	oRT 4
Maximum table load - Mass placed central	50 kg	250 kg
Resolution	0.035 arc sec	0.035 arc sec
Max. rotating speed	12 rpm	12 rpm
Permissible moment of inertia	1 kgm²	15 kgm²

Design

Bearings High accuracy, pre-stressed air bearings

Drive High performance servo motor, with zero backlash Harmonic-Drive transmission

Belt drive system with minimized shear force

Measuring system High resolution electro-optical rotary encoder

Measuring Modes 4-Axis scanning (with QUINDOS)

SPECIFICATIONS

Four-axis measuring errors MPE according to ISO 10360-3 (2000) in µm[1][2]		FR radial	FT tangential	FA axial
oRT 2				
Reference Xe / RT	15.9.7 / 22.12.9/10	4.5 / 4.7	4.2 / 4.7	3.3 / 3.5
oRT 4 [3]				
Reference Xe / RT	15.9.7 / 22.12.9/10	4.7 / 5.1	4.5 / 5.8	3.6 / 4.2

[1] FR, FT and FA are valid for a Leitz stylus ø 5 mm, L = 80 mm; the RT in upright position
[2] Specifications are valid for central positioning in XY
[3] FR, FT and FA are valid for Δh = 200 mm and r = 200 mm

The max. table load of a Leitz CMM with oRT 2 / oRT 4 is reduced by the weight of the rotary table.

DIMENSIONS

Model	Diameter [mm]	Length [mm]	Height [mm]	Weight [kg]
oRT 2	185	340	153	25
oRT 4	415	560	230	125

CMM CAPABILITY CHARTS AND ISO 10360

CMM Capability Charts - Distances and Diameters

Tolerance [mm]	Distance or diameter [mm] 50	100	200	400	600	1000
± 0.010	0.9 + L / 400	0.8 + L / 500	0.6 + L / 500	0.5 + L / 800	0.4 + L / 1000	
± 0.015	1.3 + L / 300	1.2 + L / 350	0.9 + L / 350	0.7 + L / 500	0.6 + L / 700	0.4 + L / 900
± 0.020	1.8 + L / 250	1.6 + L / 250	1.3 + L / 300	0.9 + L / 350	0.8 + L / 500	0.6 + L / 700
± 0.030	2.8 + L / 200	2.6 + L / 250	2.2 + L / 250	1.7 + L / 300	1.5 + L / 400	1.0 + L / 500
± 0.050	4.7 + L / 150	4.3 + L / 150	4.0 + L / 200	3.0 + L / 200	2.6 + L / 400	1.7 + L / 300
± 0.070	6.7 + L / 200	6.7 + L / 350	6.3 + L / 300	5.4 + L / 250	5.0 + L / 300	4.5 + L / 400

Example: A diameter of 100 mm has a tolerance of ± 0.020 mm.
For the inspection of this feature a CMM with a length measuring error E_0 = 1.6 + L / 250 [µm] is required.

CMM Capability Charts - Form Tolerances

Tolerance	0.005 mm	0.007 mm	0.010 mm	0.015 mm	0.020 mm	0.030 mm	0.050 mm
PFTU [µm]	0.5	0.7	1.0	1.5	2.0	3.0	
THP [µm]				1.5	2.0	3.0	5.0

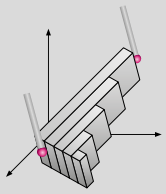
Example: For inspection of a roundness tolerance of 0.020 mm a CMM with a single stylus form error of PFTU= 2.0 µm respectively with a single stylus form error, scanning THP = 2.0 µm is required.

Note: PFTU and THP are specified for small areas only (up to 30 mm).

CMM capability charts are applicable only, if the feature can be measured with a stylus for which the accuracy of the CMM is specified.

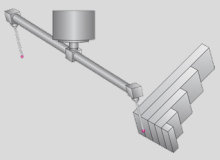
ISO 10360

ISO 10360-2
Volumetric length measuring error
E_0



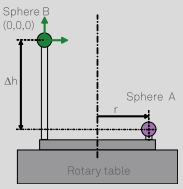
5 gauges have to be measured 3 times with one probing each end, in 7 different directions. All measuring results must be within »E_{100}«

ISO 10360-2
Volumetric length measuring error
E_{150}



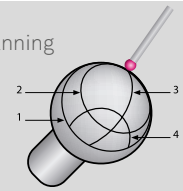
5 length gauges have to be measured 3 times in the YZ- or XZ plane with opposite styli, mounted 150 mm off the Z spindle axis.

ISO 10360-3
Four axis measuring errors
FR radial
FT tangential
FA axial



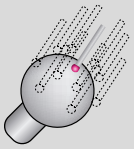
Sphere A and B have to be measured in 29 defined positions. FR, FT and FA are the max. range of the centre coordinates for either A or B in X, Y or Z direction.

ISO 10360-4
Single stylus form error scanning
THP



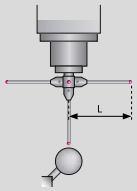
A precision sphere has to be scanned with 4 defined lines. THP is the range of all radii.
THP = R_{max} - R_{min} = sphere form, scanning.

ISO 10360-5
Single stylus form error
PFTU



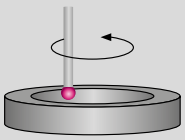
A precision sphere has to be measured with 25 probings. PFTU is the range of all radii.
PFTU = R_{max} - R_{min} = sphere form.

ISO 10360-5
Multi styli error
form **PFTM**
size **PSTM**
location **PLTM**



A sphere is measured with 5 styli (fixed PH) or with 1 stylus in 5 orientations (articulating PH) with 5 x 25 probings. Form, size and location error over 125 points.

ISO 12181
Form measurement error
RONt (MZCI)



A ring gauge, ø 50 mm, is scanned with high point density. The range of radial distances is then evaluated on a calculated Tschebyscheff-circle.

GEAR INSPECTION

Gear Measuring Capability

Cylindrical gears	Spur, helical, double helical, splines (internal and external)
Clutch gears	Internal and external
Gear segments	Minimum No. of teeth: 1
Gear racks	Constant ratio, variable ratio
Bevel gears	Straight bevel, spiral bevel, hypoid bevel, crown gears
Couplings	Curvic, Hirth
Gear cutting tool	Hob cutter, indexable insert hob, broach, shaper cutter, shaving gears, form cutter
Evaluation standards	DIN, ISO, AGMA, ANSI, JIS, CNOMO, CAT
Available interfaces	Gleason GAGE 4/WIN, Klingelnberg KIMOS, DMG Mori, Depo
Measuring principle	3-Axes, gear fixed anywhere in the measuring volume. No rotary table required. Profile and flank inspection with Variable High-Speed-Scanning with involute path control.
Alignment of the gear axis	Vertical or horizontal
Max. No. of gears on pallet	Not limited, depending on gear diameter and machine measuring range.

Available QUINDOS Software Modules for Gear Inspection

Gears and Worms	• Gear	• Gear Gauges	• Unknown Gear	• Straight Bevel Gear
	• Spiral Bevel Gear	• Cylindrical Worm	• Worm Wheel	• Globoid Worm
	• Sprocket	• Curvic Couplings	• CAT Gear	• Hirth Gear
	• Rack, constant	• Rack, variable		
Cutting Tools	• Hob Cutter	• Shaper Cutter	• Shaving Gear	• Broach
	• Form Cutter			

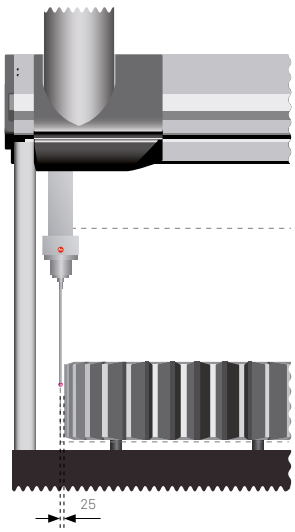
Gear related Specifications

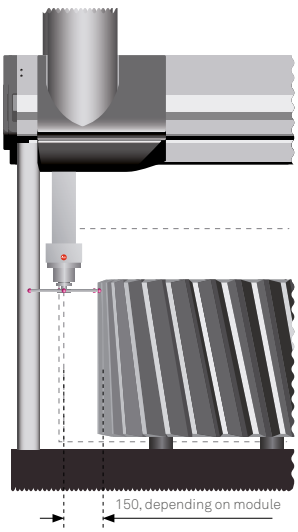
Module range	0.5 - 100 mm
Max. gear width	= Z-range of the Reference Xe (vertical orientation), e. g. 700 mm for a 15.9.7
Max. shaft length	= X-range of the Reference Xe (horizontal orientation), e. g. 1500 mm for a 15.9.7
Spiral angle	0° - 90°
Machine accuracy	Group 1 according to VDI/VDE 2612/2613, page 1 and 2
Min. Gear ø	not limited

Max. Gear ø, external [mm]

	15.9.7	22.12.9/10
Spur gear	850	1150
Helical gear [1]	600	900

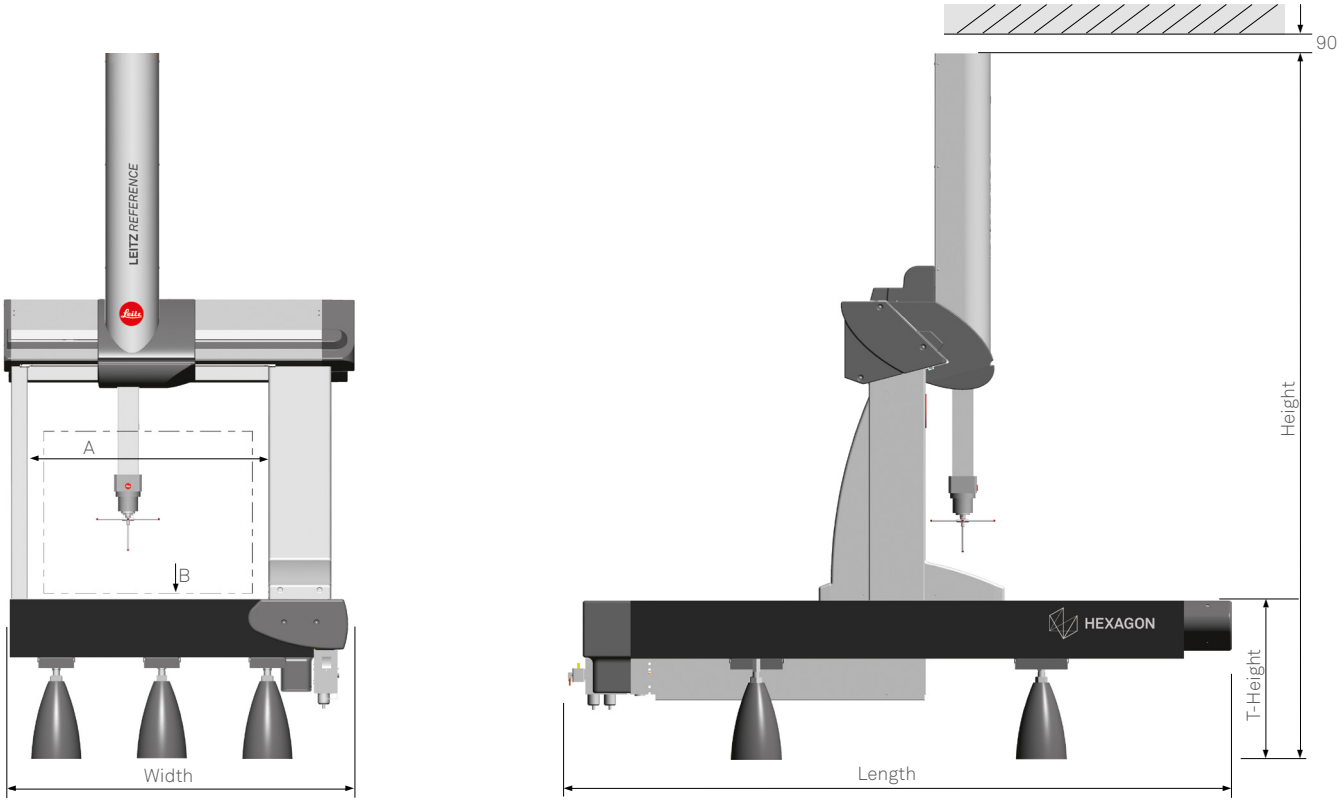
[1] depending on module and styli configuration





DIMENSIONS AND TABLE LOAD

Dimensions in mm



Model	Probe Head	Length [mm]	Width [mm]	Height [mm]	T-Height [mm]	A [mm]	B [mm]	Weight [kg]
15.9.7	HP-S-X5 / X1H	2800	1560	3073	700	1030	32 / 72	3.400
22.12.9 / 10	HP-S-X5 / X1H	3650	1860	3422	610	1330	49 / 72	7.700

MEASURING RANGES (X x Y x Z)

			Z-range oRT2	Z-range oRT4
15.9.7	HP-S-X5	1500 x 900 x 690	x 537	x 460
15.9.7	X1H / HH-A-T7.5	1500 x 900 x 760	x 607	x 530
22.12.9	HP-S-X5	2200 x 1200 x 900	x 747	x 670
22.12.10	X1H / HH-A-T7.5	2200 x 1200 x 1000	x 847	x 770

Permitted Table Load	
Reference Xe / RT 15.9.7	1500 kg
Reference Xe / RT 22.12.9/10	2250 kg

HEXAGON
MANUFACTURING INTELLIGENCE

Hexagon Manufacturing Intelligence helps industrial manufacturers develop the disruptive technologies of today and the life-changing products of tomorrow. As a leading metrology and manufacturing solution specialist, our expertise in sensing, thinking and acting – the collection, analysis and active use of measurement data – gives our customers the confidence to increase production speed and accelerate productivity while enhancing product quality.

Through a network of local service centres, production facilities and commercial operations across five continents, we are shaping smart change in manufacturing to build a world where quality drives productivity. For more information, visit **HexagonMI.com**.

Hexagon Manufacturing Intelligence is part of Hexagon (Nasdaq Stockholm: HEXA B; **hexagon.com**), a leading global provider of information technologies that drive quality and productivity across geospatial and industrial enterprise applications.

- COORDINATE MEASURING MACHINES
- 3D LASER SCANNING
- SENSORS
- PORTABLE MEASURING ARMS
- SERVICES
- LASER TRACKERS & STATIONS
- MULTISENSOR & OPTICAL SYSTEMS
- WHITE LIGHT SCANNERS
- METROLOGY SOFTWARE SOLUTIONS
- CAD / CAM
- STATISTICAL PROCESS CONTROL
- AUTOMATED APPLICATIONS
- MICROMETERS, CALIPERS AND GAUGES
- DESIGN AND COSTING SOFTWARE

Full Bright® 福宮通商股份有限公司

總公司:新北市 235 中和區連城路 258 號 3F-3
（遠東世紀廣場 I 棟）
Tel: 02- 82271200 Fax: 02-82271266
Http:// www.fullbright.com.tw
E-mail : sales@fullbright.com.tw

台北 Tel: 02 - 82271227 Fax: 02 - 82271191
台中 Tel: 04 - 24736300 Fax: 04 - 24734733
高雄 Tel: 07 - 3430270 Fax: 07 - 3430296
昆山 Tel: 512 - 57751291 Fax: 512 - 57751293
東莞 Tel: 769 - 85847220 Fax: 769 - 85847229

www.fullbright.com.tw