

PRISMO® navigator HTG

PRISMO® navigator S-ACC

Specifications and Performance Features



With Navigator
Scanning Technology

PRISMO® navigator –
Highest productivity

- HTG: temperature resistant
- S-ACC: high accuracy
- Multisensor ability
- Upgradeable with rotary table
- Close to production
with Accept-cabine

The PRISMO® navigator machine technology

Design:

All mechanical components have been designed for high accuracy, dynamics and resistance to ambient influences. Making the PRISMO® navigator fast, accurate and also suitable for use in production environment.

- Bridge-type CMM with stationary machine table
- Machine table in granite with clamping area acc. DIN 876
- Isolating table covers with storage compartment
- Highly rigid lateral bridge in lightweight construction in a thermally insensitive material combination (composite material and ceramics)
- All axes have Zeiss wrap-around (all four sides) air bearings. Highly dynamic and torsionally rigid.
- Fully enclosed X-axis and Y-driving axis
- Computer aided error correction of all 21 motion axes (CAA: Computer Aided Accuracy)
- Computer aided static (S-CAA) and dynamic (D-CAA) bending correction for highest accuracy and measuring speed (Navigator-function).
- Precision glass ceramics scales from Carl Zeiss
- Patented thermally insensitive scale mounting (clamp-unclamp bearing)
- Highly effective passive anti-vibration system due to elastomer/viscous support elements
- Computer aided compensation of thermal workpiece expansion
- Pre-wired for touch (single point probes, active/passive scanning) and optical probes (s. PRISMO® navigator Sensor Technology)

Control, operation: ISC (Intelligent Scanning Controller)

Its high reliability and optimum control behavior are the key features of Zeiss control technology:

- PC-based control with highly integrated control technology
- Service-friendly due to modular design
- Supports single-point and scanning probes from Carl Zeiss and other manufacturers
- "Active Scanning" for deflection-independent control of probing forces of VAST® XT and VAST® Gold
- Control unit with active and passive scanning algorithms
- Future upgrade capability
- Protective class: IP54 for controller in separate control cabinet
- Pre-activated centrifugal force for deviation reduction at high measuring speeds (Navigator function)

Usage:

- Standard control panel for manual, off-site control using joysticks
- Overdrive for speed control in the CNC mode
- Dynalog control panel for machine operation away from the computer (optional)

The PRISMO® navigator sensor technology

Standard Equipment:

VAST® Gold with Navigator

Active measuring probe for contacting scanning and single-point measurement

- VAST® Gold with wide measuring area for smallest probe sphere diameters and large, heavy stylus configurations
- Active interface for workpiece temperature sensor RST-T
- Navigator for high result quality with short measuring times
- S-CAA and D-CAA bending correction
- Optimization function for probe head movement (eg.: optimized travel path, tangential approach)
- pre-activated centrifugal force
- Software assistant for the automatic determination of highest possible scanning speed

Option RDS-CAA select

Articulating rotary dynamic sensor holder for touch and optical probes

- Lateral swivel axis offering the following advantages or articulated joints with a stacked tilt/swivel axis
- Tilt/swivel range +/- 180°
- Minimum loss in measuring range

- 2,5° increments of swivel axes
- CAA correction for automatic calibration of all 20736 possible angular positions with few measuring positions for touch single-point probes
- with
 - RST-P, TP6, TP20, TP200 (Touch trigger probes for single point measurement)
 - XXT, SP25 (passive measuring probes)
 - ViScan (Optical 2D camera sensor with image analysis function and autofocus for measuring normal to the image plane)
 - DTS (Optical 1D Probe for single point measurement)

Stylus changing magazines (Option)

MSR (Multi Sensor Rack) for all sensors with

- VAST magazines for VAST® XT / VAST® gold
- RDS magazines
- FCR 25

On request magazines for Renishaw sensors

Option MPS (Multiple Probe System)

Allows probe changing of standard configuration (VAST® XT/ VAST® gold and RDS)

The PRISMO® navigator measuring ranges

- With the wide range of overall sizes, PRISMO® navigator covers your measuring volume, too
- Large variations in Z measuring range between the 5, 7, 10 and 14 models (see measuring ranges and dimensions)
- Measuring range position, working surface, large bridge clearance and the permissible probe extensions enable optimum utilization of the measuring range (see machine sketches).

The PRISMO® navigator concept

- Wide sensor spectrum from universal DT single point sensor to scanning with VAST XT or contacting and optical sensors on the RDS
- In the metrology room or on the shopfloor
- Flexibility provided by contacting and optical sensors
- Future proof, as all sensor can be retrofitted
- Open for growing metrology requirements

The PRISMO® navigator equipment package

HTG version (High Temperature Gradient)

When conditions become worse and the accuracy has to be better:

- More closely-knit CAA point grid
- Adapted probe corrections
- Additional probe corrections for remaining machine system error compensation
- Sensor for automatic workpiece temperature measurement
- "Thermal Drift Compensation" at control

S-ACC version (Super Accuracy)

for high-precision measurement:

- More closely-knit CAA point grid
- Additional probe corrections
- Special mechanical and electronic finishing and optimization
- Enhanced acceptance procedures
- Manual workpiece-temperature sensors

The PRISMO® navigator analysis systems

User-friendly operation and functionality of the overall system are our benchmark. Therefore, our software systems for CMM is the most successful and the most frequently used worldwide. With these systems operations can be programmed, which allow fully automatic measurements with the PRISMO® navigator

The Zeiss software library covers a wide variety of application requirements with its basic package and options:

- Prismatic workpieces
- Curves and free-form surfaces
- Special geometries, i.e. gears, turbine blades, etc.

All our systems are able to use CAD data for creating measuring programs. They are also capable of handling off-line programming. Measuring results can be displayed with custom-designed protocols for statistical evaluation.

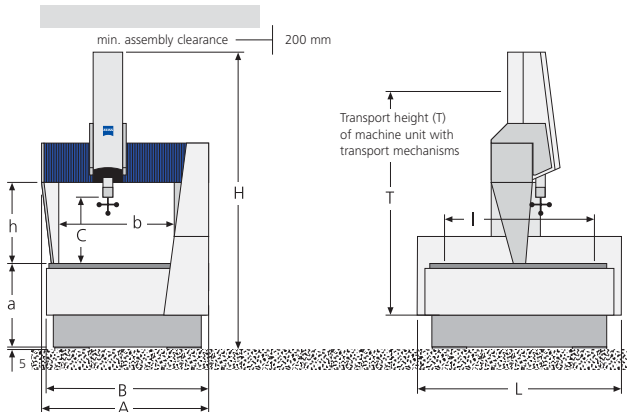
PRISMO® navigator 5+7

Measuring ranges, Dimensions

The PRISMO® navigator 5+7 measuring range diversity

		PRISMO® navigator 5	PRISMO® navigator 7				
Machine		7/9/5	7/9/7	9/12/7	9/15/7	9/18/7	9/24/7
Measuring ranges	X (mm)	700	700	900	900	900	900
	Y (mm)	900	900	1200	1500	1800	2400
	Z (mm)	500	650	650	650	650	650
CMM weight (approx.)	(ca. kg)	1650	1720	2250	2900	3410	4740
Permissible workpiece weight	(kg)	1200	1200	1500	1500	1500	2000

The PRISMO® navigator dimensions



Machine	7/9/5	7/9/7	9/12/7	9/15/7	9/18/7	9/24/7	
L		1740	1740	2040	2340	2640	3240
I		1220	1220	1520	1820	2120	2720
H		2930			3030		
a					850		
A		1525		1700			
B		1495		1670			
b		873		1073			
h		720		820			
C-RDS		602		712			
C-VAST Gold		595		705			
T		2000	2100	2100	2150	2150	2200

Dimensions in mm (in.)

C: Distance between table top and lower edge of probe

PRISMO® navigator 10 x = 1200

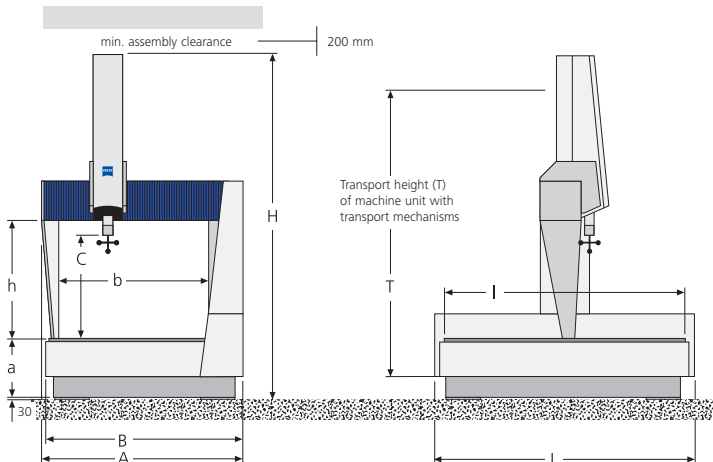
Measuring ranges, Dimensions

The PRISMO® navigator 10 measuring range diversity

Machine		12/18/10	12/24/10	12/30/10	12/42/10
Measuring ranges	X (mm)	1200	1200	1200	1200
	Y (mm)	1800	2400	3000	4200
	Z (mm)	1000	1000	1000	1000
CMM weight (approx.) ¹⁾	(ca. kg)	5820 (5910)	7080 (7150)	9500 (9600)	12500
Permissible workpiece weight ¹⁾	(kg)	2000 (5000)	2000 (5000)	3500 (5000)	3500

1) values in brackets for layout with increased workpiece weight (option)

The PRISMO® navigator 10 dimensions



Machine	12/18/10	1012/24/10	12/30/10	12/42/10	
L		2940	3540	4140	5340
I		2420	3020	3620	4820
H		3540*	3770**	3590	
a		590*	820**	640	
A		2050			
B		2020			
b		1373			
h		1220			
C-RDS		1086			
C-VAST Gold		1079			
T		2900			

* without base frame

** with base frame

Dimensions in mm (in.)

C: Distance between table top and lower edge of probe

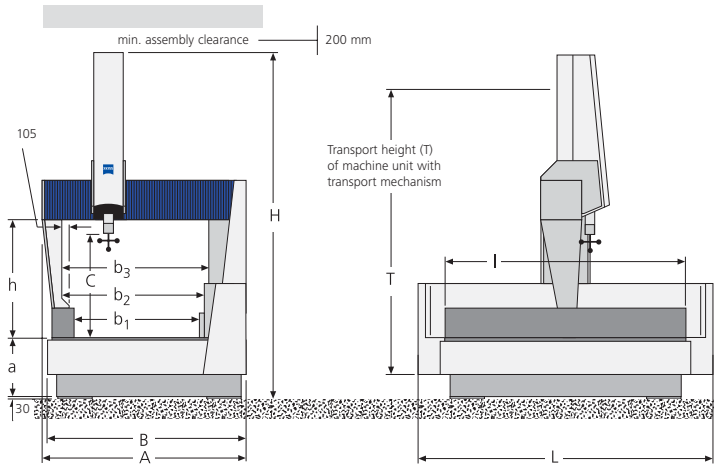
PRISMO® navigator 10 X = 1600

Measuring ranges, Dimensions

The PRISMO® navigator 10 measuring range diversity

Machine		16/24/10	16/30/10	16/42/10
Measuring ranges	X (mm)	1600	1600	1600
	Y (mm)	2400	3000	4200
	Z (mm)	1000	1000	1000
CMM weight (approx.)	(ca. kg)	11000	13000	17000
Zulässige Werkstückmasse	(kg)	3500	3500	3500

The PRISMO® navigator 10 dimensions



Machine	16/24/10	16/30/10	16/42/10
L	3540	4140	5340
I	3020	3620	4820
H	3800		
a	640		
A	2450		
B	2430		
b ₁ / b ₂ / b ₃	1673 / 1778 / 1910		
h	1530		
C-RDS	1386		
C-VAST Gold	1379		
T	3200		

Dimensions in mm (in.)

C: Distance between table top and lower edge of probe

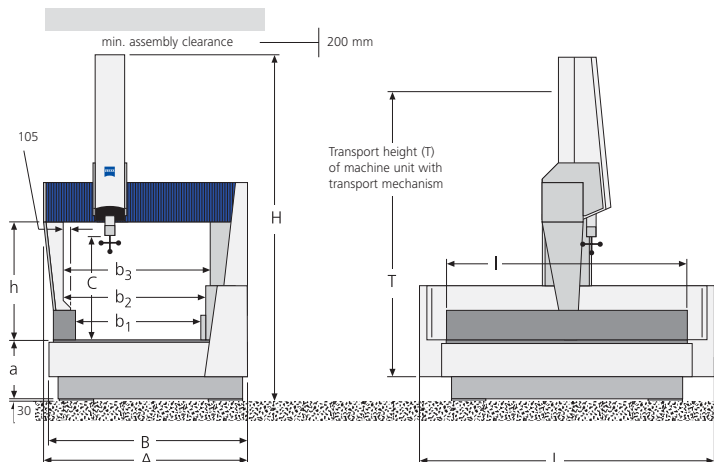
PRISMO® navigator 14

Measuring ranges, Dimensions

The PRISMO® navigator 14 measuring range diversity

Machine (U-Stone layout)		16/24/14	16/30/14	16/42/14
Measuring ranges	X (mm)	1600	1600	1600
	Y (mm)	2400	3000	4200
	Z (mm)	1300	1300	1300
CMM weight (approx.)	(ca. kg)	10500	12500	17000
Permissible workpiece weight	(kg)	3500	3500	3500

The PRISMO® navigator 14 dimensions



Machine	16/24/14	16/30/14	16/42/14
L	3540	4140	5340
I	3020	3620	4820
H	4290		
a	640		
A	2450		
B	2430		
b ₁ / b ₂ / b ₃	1673 / 1778 / 1910		
h	1530		
C-RDS	1386		
C-VAST Gold	1379		
T	3200		

Dimensions in mm (in.)

C: Distance between table top and lower edge of probe

PRISMO® navigator

Accuracy

The PRISMO® navigator Accuracy

PRISMO 5+7

PRISMO 10 x = 1200

PRISMO 10 x = 1600

PRISMO 14



VAST® Gold ¹⁾

HTG

Length (size) measuring error ²⁾

MPE acc. EN ISO 10360-2 for E (µm) at 18-22 °C
at 15-30 °C (PRISMO 5+7); 18-28 °C (PRISMO 10+14)

1.4 + L/333
1.9 + L/300

1.8 + L/300 ¹¹⁾
2.4 + L/300

2.9 + L/300
3.4 + L/270

3.2 + L/300
3.7 + L/270

Probing error

MPE acc. EN ISO 10360-2

for P (µm)

1.4

1.7

2.9

3.2

Scanning probig error with Navigator

MPE acc. EN ISO 10360-4

for THP (µm)

2.4; 3.0 ¹²⁾

3.0; 3.5 ¹³⁾

3.5

3.8

required measuring time with Calypso®

τ (sec)

29

29

29

29

required measuring time with UMESS® UX

τ (sec)

50

50

50

50

Form measurement error ³⁾

MPE for roundness

RON_t (MZCI) (µm)

1.4

1.7

2.9

3.2

acc. EN ISO 12181 (VDI/VDE 2617 Part 2.2)

VAST® Gold ¹⁾

S-ACC

Length (size) measuring error ²⁾

MPE acc. EN ISO 10360-2 for E (µm)
at 19-21 °C (PRISMO 5+7); 18-22 °C (PRISMO 10+14)

0.9 + L/350 ¹⁴⁾

1.5 + L/350 ¹⁵⁾

2.5 + L/300

3.0 + L/300

Probing error

MPE acc. EN ISO 10360-2

for P (µm)

1.0 ¹⁴⁾

1.5

2.7

3.0

Scanning probig error (with Navigator: as HTG)

MPE acc. EN ISO 10360-4

for THP (µm)

1.9

2.1

3.3

3.6

required measuring time

τ (sec)

50

50

50

50

Form measurement error ³⁾

MPE for roundness

RON_t (MZCI) (µm)

1.0 ¹⁴⁾

1.5

2.7

3.0

acc. EN ISO 12181 (VDI/VDE 2617 Part 2.2)

RDS

with contacting probes ¹⁷⁾

HTG + S-ACC



Length (size) measuring error ²⁾

MPE acc. EN ISO 10360-2 for E (µm) at 18-22 °C
at 18-24 °C

2.2 + L/333
2.2 + L/300

2.9 + L/300 ⁵⁾
2.9 + L/250 ⁵⁾

3.9 + L/250 ⁵⁾
3.9 + L/200 ⁵⁾

4.5 + L/250 ⁵⁾
4.5 + L/200 ⁵⁾

Probing error

MPE acc. EN ISO 10360-2

for P (µm) at 18-22 °C

2.0

3.0

4.0

5.0

at 18-24 °C

2.3

3.3

4.0

5.0

RST-P ^{6) 7)}

Standard

-

-

-

TP2, TP6 ⁸⁾, TP20 ⁹⁾, TP200 ⁹⁾

Optional

Standard

Standard

Standard

VAST XXT, SP25

Optional

Optional

Optional

Optional

Scanning probig error

MPE acc. EN ISO 10360-4

for THP (µm) at 18-22 °C

2,9

3,5

4,0

4,5

required measuring time with Calypso®

τ (sec) at 18-22 °C

72 (SP25: 80)

72 (SP25: 80)

72 (SP25: 80)

72 (SP25: 80)

mit ViScan ¹⁰⁾

Probing error

Two-dimensional probing uncertainty

R₂ (µm) at 18-22 °C

10

10

10

10

acc VDI/VDE 2617 Part 6

One-dimensional probing uncertainty

R₁ (µm) at 18-22 °C

50

50

50

50

of autofocus acc. VDI/VDE 2617 Part 6

with DTS ¹⁰⁾

Probing error

One-dimensional probing uncertainty ¹⁶⁾

R_{1 uni} (µm) at 18-22 °C

25

25

25

25

Scales

Glass ceramic; from Y >2400 mm steel scales and automatic
Temperature measurement are used.

Resolution

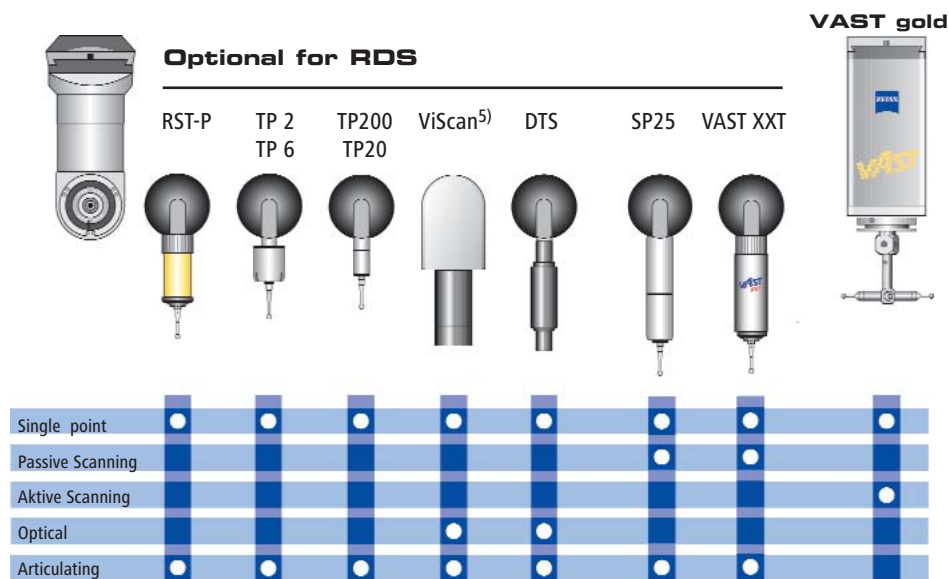
0.04 µm (0.000 008 in.)

- 1) VAST® Gold: Acceptance with stylus length 60 mm (2.4 in.) and tip diameter 8 mm (0.3 in.)
- 2) Measured length L in mm
- 3) Roundness in scanning mode with v_{scan} = 5mm/sec (0.2 in./sec), filter 50 UPR, gage calibration
- 5) With TP200
- 6) RST: acceptance with stylus length 40 mm (1.6 in.) and tip diameter 3 mm (0.12 in.)
- 7) The probe can be operated at an acoustic pressure of max. 75 dB (A) for single frequencies and max. 80 dB (A) for combination frequencies in the range 50-2000 Hz.
- 8) TP6: acceptance with stylus length 21 mm (0.83 in.) and tip diameter 3 mm (0.12 in.)
- 9) TP20/ TP200: acceptance with stylus length 10 mm (0.4 in.) and tip diameter 3 mm (0.12 in.). Module change with TP20/TP200 only by using RDS magazine
- 10) The use of optical probes is only recommended in conjunction with a contacting sensor (RST-P or TP6/20/200), temperature range 18 - 22°C (64 - 72 °F)

- 11) Y >2400: MPE_E = 2,0 + L/300
- 12) At 15-30 °C
- 13) At 18-28 °C
- 14) Y >1500: MPE_E = 1,3 + L/350; MPE_P = 1,3; MPE for RON_t = 1,3
- 15) Y >2400: MPE_E = 1,7 + L/350
- 16) Probing error on plane, dull areas acc. VDI/VDE 2617 Part 6
- 17) Specifications for VAST XXT, TL1 and SP25, module 2

PRISMO® navigator Sensor System, Speed, Environment

The PRISMO® navigator sensor system



The PRISMO® navigator sensor variety

		Basic equipment VAST® gold	VAST® XXT	Optional on RDS ¹⁾		
Probing method		universal aktive scanning probe	passive scanning probe	RST-P touch trigger single point probe	ViScan optical 2D image sensor with autofocus	DTS optical 1D single point sensor
Min. probing force		50 mN		10 mN	-	-
Meas. rate	Single points HTG Single points S-ACC Scanning	up to 2 sec/point up to 2,5 sec/point max. 200 points/sec	up to 2,5 sec/point up to 2,5 sec/point max. 200 points/sec	up to 1,7 sec/point -	-	-
Stylus length ²⁾	max.	800 mm	Stylus: 30-250 mm Extensions: 100 mm	Stylus: 90 mm Extensions: 300 mm	working space dependent on objective 75-90mm	Trigger distance 43mm
Stylus mass ²⁾	max.	600 g (incl. adapter plate)	10 g	10 g	-	-
Min. tip diameter ²⁾		0,3 mm	1 mm	0,5 mm	-	-

The PRISMO® navigator dynamics			PRISMO® 5+7	PRISMO 10 X = 1200	PRISMO® 10+14 X = 1600
Travel speeds	Setup mode:		0 to 70 mm/s	0 to 70 mm/s	0 to 70 mm/s
	Series measurement mode:	Axis	max. 300 mm/s	max. 300 mm/s	max. 300 mm/s
		Vector	max. 520 mm/s	max. 520 mm/s	max. 520 mm/s
	Acceleration:	Axis	max. 1.4 m/s ²	max. 0.8 m/s ²	max. 0.6 m/s ²
		Vector	max. 2.4 m/s ²	max. 1.4 m/s ²	max. 1.0 m/s ²
Scanning speed (dependent on sensor):			max. 100 mm/s	max. 100 mm/s	max. 100 mm/s

The PRISMO® navigator Temperature reserves		HTG		S-ACC	
		PRISMO 5+7	PRISMO 10+14	PRISMO 5+7	PRISMO 10+14
Temperature conditions for guaranteeing the specified length-measuring error	Ambient temperature ³⁾ Temperature gradients	15-30 °C 2.0 K/h 5.0 K/d 1.0 K/m	18-28 °C ⁴⁾ 2.0 K/h 5.0 K/d 1.0 K/m	19-21 °C 1.0 K/h 2.0 K/d 1.0 K/m	18-22 °C 1.0 K/h 2.0 K/d 1.0 K/m
Ambient temperature for ready-to operate status		10 - 35 °C			
Relative air humidity		40 to 70%			
Floor vibrations		The PRISMO® navigator is equipped with an elastomer /viscous damping system and therefore very vibration resistant (limit curves on request). On request, we perform a vibration analysis.			

- 1) TP6/TP20/TP200/SP25 (Renishaw) see manufacturer's documentation
- 2) Depending of application, a restriction of stylus system characteristic data may be advised
- 3) The sensor-related restrictions are described in the part "PRISMO® navigator accuracy" (P. 5)
- 4) For PRISMO 10+14 with Y >2400: 18-24 °C and temperature gradient from S-ACC
- 5) Optical Scanning by multiple point collection in one position

The PRISMO® navigator link to Your Network/Production

Power requirements	1/N/PE 100/110/115/120/125/230/240 V (±10%); 50-60 Hz (±3,5%). Total power consumption: max. 1000 VA
Compressed-air supply	Supply pressure 6 to 10 bar (87 to 145 psi), pre-filtered. Consumption approx. 10 l/min (0.35 cfm) at 5.0 bar (73 psi) operating pressure. Air quality acc. to ISO 8573 Part 1: Class 4
Data technology	The PRISMO® navigator product line can be equipped with workstations or with high quality PC systems. On request the systems can be equipped with components for connecting to your network.

The PRISMO® navigator safety

Safety regulations	PRISMO® navigator fulfills the EC machinery-directive 98/37/EC including the low voltage-directive 73/23/ECC and the EMC-directive 89/336/ECC.
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DIN EN ISO 9001

The PRISMO® navigator:

The following options on request:

- Rotary table as integrated 4th axis
- Different control panels (Dynalog P)
- Pallet and feed systems
- Accept Cabin for the production environment up to 35 °C (PRISMO 7)
up to 32 °C (PRISMO 10 X=1200)
- Extensive computer and peripheral options
- Software options
- Training, CNC programming, Service

The Zeiss experience and Zeiss Service

- Zeiss - is inventor and leader in innovative CNC coordinate metrology
- Zeiss - is the largest manufacturer of CNC coordinate measuring machines worldwide
- Zeiss - offers machine service, software service and hotline
- Zeiss - invests a high amount of sales volume in research and technology
- Zeiss - and Zeiss measuring machines are future-oriented
- Zeiss - with Carl Zeiss 3D Metrology GmbH is the largest contractor of metrology services

Explanations to PRISMO® navigator accuracy

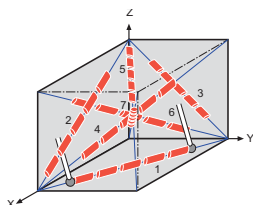
MPE = Maximum Permissible Error

As defined in the EN ISO 10360, every specification for accuracy will be noted with "Maximum Permissible error (MPE)". MPE defines a maximum value that a measuring deviation is not allowed to exceed. Accuracy results are represented as an index number. MPE_E describes the length measuring error and MPE_P describes the probing error.

Maximum Permissible Error for length measurement

MPE_E

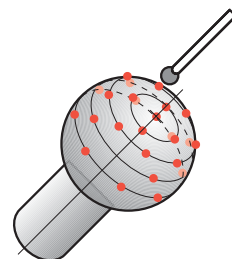
To determine length measuring error, calibrated gage blocks or step gage blocks are measured. With every measurement, 5 different lengths in 7 different positions within the measuring range of the CMM will be determined. Every length will be measured 3 times. None of the measurements are allowed to deviate from the calibrated value by more than the specified amount. The specification is in most cases dependent on the length, written in the form $MPE_E = A + L/K$, whereby L represents the length. Sometimes the formula will be written as $MPE_E = A + F \cdot L/K$, in which case the formula must be converted in order to compare it to the first variation. For example, the values $MPE_E = 2.5 + 1.5 \cdot L/333$ and $MPE_E = 2.5 + L/220$ are the same.



Maximum Permissible Error for probing

MPE_P

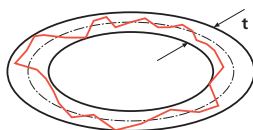
To determine the probing error, a sphere (diameter 10 to 50 mm) with negligible form error will be probed on 25 recommended positions (from ISO 10360-2). From the measurement results, a so called Gaussian least squares sphere is calculated. The range of radial distances from their associated is not allowed to exceed the specification.



Maximum Permissible Error for form measurement (roundness)

$MPE_{RONT(MZCI)}$

The application of CMMs for form measurement is discussed in VDI 2617, sheet 2.2. Parameters for roundness measurements are defined in EN ISO 12181. For testing, a 50 mm ring gage with negligible form error is measured with high point density (with Zeiss: scanning mode). From the measurement results, a so called Tschebyscheff-circle (MZCI = minimum zone circle) is calculated. The outcome of the form deviation results in the range of radial distances of this circle. It is not allowed to exceed the specification.

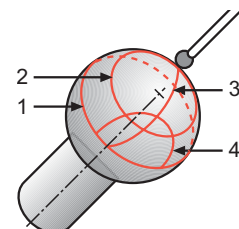


Maximum Permissible Error for scanning probing

MPE_{THP} und MPE_{τ}

To determine the scanning probing error, a sphere (diameter of 25 mm) with negligible form error will be scanned along 4 recommended scanning lines (from ISO 10360-4). When comparing the measurements with the MPE_{THP} specifications, there are two conditions that must be met. First, the range that is determined from radial distances from the associated sphere is not allowed to exceed the specification (see MPE_P). Second, the deviation between the radial distances and the calibrated sphere diameter is not allowed to exceed the specification. Additionally, the time required (τ) for the test must be specified, as speed has an enormous influence on the results.

When the accuracy and time needed is indicated, the specification of the scanning probing error is an important indicator of the productivity of a CMM.



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