

NAVINERTIA TECH*Precision Measurement Solutions*

V400LS

Chip Coplanarity Measuring System

I. Technical Specifications

1. Functional Principle

- A 3D line-scan laser displacement sensor performs fast, dense point-cloud scanning of the target product surface, capturing three-dimensional point-cloud coordinate data. The measurement software processes this data to generate a 3D color image of the product, then uses dedicated algorithms to extract target position coordinates from the 3D image — including but not limited to the highest point, lowest point, and average point. Based on the extracted coordinate data, the software further analyzes and calculates final target dimension results, including but not limited to flatness, coplanarity, warpage, height, depth, and step height.
- Supports feature matching and precise coordinate-system setup on 3D images, as well as fast array and macro-array measurement.
- Uses the imaging function module to establish a measurement reference coordinate system on the target product, and can extract and evaluate key planar form-and-position tolerance dimensions, including but not limited to point coordinates, distance, angle, diameter, circumference, area, position, parallelism, symmetry, concentricity, and coaxiality.

2. Main Structure

- The V400LS uses a fixed gantry-type, three-axis motion structure with a granite main frame, ensuring a stable mechanical structure. The workpiece (including tray) is placed on the glass worktable; through effective three-dimensional motion control combined with a high-precision 3D line-scan laser displacement sensor working alongside the imaging module, the system achieves comprehensive, efficient measurement of the target product's planar and height-direction dimensions.

3. Key Performance Specifications

V400LS Chip Coplanarity Measuring System	Item	Specification
Overall Dimensions	Instrument dimensions L×W×H (mm)	1100 × 1000 × 1800
	Net weight (kg)	900
Travel	3D Line-Scan Laser: X / Y / Z (mm)	X: 400 Y: 300 Z: 200
	Imaging: X / Y / Z (mm)	X: 300 Y: 300 Z: 200
Measurement Accuracy	3D Line-Scan Laser: Z-direction static linearity accuracy (μm)	±3.6
	Imaging: E UXY, MPE (μm)	±(3.0 + L/200)
<i>L = length of the measured object, in mm.</i>		
Motion Performance	X/Y-axis speed (mm/s)	200
	Z-axis speed (mm/s)	150
Imaging System	Camera type	HD industrial digital camera
	Resolution	2 megapixels
Optical System	Lens type	Continuous auto-zoom lens
	Optical magnification range	0.7X – 4.5X
	Image (display) magnification range	18X – 230X
	Max. object-space field of view (mm)	10.71 × 8 × 13.45
	Lens working distance (mm)	90 ± 2
<i>Magnification values are approximate; actual values depend on monitor size and resolution.</i>		
Illumination System	Surface light	LED cold light source, programmable brightness level
	Contour light	LED cold light source, programmable brightness level
	Coaxial light	LED cold light source, programmable brightness level
Encoder System	Linear glass scale resolution (μm)	0.1
3D Line-Scan Laser	Effective working distance (mm)	60
	Z-direction static effective range (mm)	18
	Laser-line reference width (mm)	31
	Z-direction static linearity accuracy (μm)	±3.6
	Laser-line point spacing (μm)	12
	Laser-line profile point count	3200
Motion Joystick	High-performance configuration	LCD display for real-time monitoring of machine status; one-touch emergency-stop button for safe operation; speed-adjustment knob for flexible motion control

V400LS Chip Coplanarity Measuring System	Item	Specification
Industrial Computer	High-performance configuration	Intel i7 processor • 16GB DDR4 RAM • 1024GB SSD • 27" HD LCD monitor • Windows 10 OS
Worktable Load	Load capacity (kg)	5
Power Requirements	Voltage	AC 200–240V, 50/60Hz
	Power consumption	≤2000W
	Grounding	Mandatory; ground resistance ≤ 4Ω
Operating Environment	Temperature range	20 ± 2 °C
	Temperature gradient	0.5 °C/h, 2 °C/24h
	Relative humidity	30%–80%
	Vibration level	< 0.002g, below 15Hz, away from vibration sources
Specifications are subject to change without prior notice due to continuous product improvement.		

II. Standard Configuration List

No.	Category	Item / Specification	Qty	Unit
1	Mechanical Body	Main frame — Granite full-body structure	1	set
		Motion control system — Dedicated full closed-loop CNC motion control	1	set
		Guidance system — Custom precision guideways	6	sets
		Drive system — Dedicated AC servo motor	3	sets
		Transmission system — Custom precision ball screw	3	sets
2	Encoder System	High-precision linear glass scale — 0.1μm resolution	3	sets
3	Sensing System	Imaging — 2-megapixel HD industrial digital camera	1	set
		3D line-scan laser — Micron-level measurement accuracy	1	set
4	Optical System	High-precision zoom lens — Continuous auto-zoom	1	set
5	Illumination System	Surface light — Custom-configured	1	set
		Contour light — Custom-configured	1	set
		Coaxial light — Custom-configured	1	set
6	Motion Joystick	High-performance configuration — With LCD display, emergency-stop button, and motion-speed adjustment knob	1	set
7	Industrial Computer	High-performance configuration — Intel i7 CPU / 32GB RAM / 1024GB SSD / 27" HD LCD monitor / keyboard & mouse set / computer desk	1	set
8	Measurement Software	3D Line-Scan Dedicated Software — Independently designed and developed; 100% proprietary IP	1	set
9	Technical Documentation	Certificate of Conformity — Factory quality inspection certificate	1	set
		Factory Accuracy Report — Measured accuracy data prior to shipment	1	set
		User Manual — Instrument operation and maintenance manual	1	set
		Measurement Software Manual — Software application manual	1	set
		Warranty Card — Proof of eligibility for in-warranty service	1	set
10	Other	Pixel calibration target — Complimentary	1	set
		Ceramic gauge block — 2 mm height	1	set
		Ceramic gauge block — 5 mm height	1	set
		Basic positioning fixture — Complimentary	1	set

III. 3D Line-Scan Professional Measurement Software

1. Simple, Friendly User Interface

- The software places the main and frequently used functions as buttons on its main interface, making it easy to learn — users can complete nearly all routine measurement actions with simple mouse clicks and drags.

2. Intuitive, Convenient Parameter Setting

- The software's line-scan interface provides a dynamic, real-time graphical display of laser profile-line coordinates, making it especially easy to observe and select the optimal scan position. For workpieces of different sizes, simply set the start and end coordinate positions to enable fully automatic scan sampling.
- With a simple mouse click, users can obtain the coordinates of the highest point, lowest point, and average point within the target area.
- The 3D point-cloud display supports multiple formats — color, black-and-white, and brightness maps — for measurement personnel to use as needed.

3. Comprehensive Geometric Dimension Evaluation

- The software supports evaluation and measurement of basic geometric elements including point, line, circle, arc, rectangle, ellipse, keyway/slot, open curve, closed curve, and plane. Once a 3D line-scan laser displacement sensor is added to the Z-axis, the software can also evaluate and measure three-dimensional geometric elements, including but not limited to cylinders, cones, spheres, and surfaces. Depending on the actual characteristics of each element, different measurement methods can be applied; once measurement is complete, the software automatically generates key characteristic information for the element, including coordinate values, length, height, perimeter, area, angle, flatness, and volume.

4. Flexible Measurement Programs & Form-and-Position Tolerance Settings

- The software automatically generates a measurement program based on the programming sequence and supports saving it in a dedicated file format for direct recall when measuring the same product model again.
- The software supports common program operations such as run, pause, stop, and repeat run.
- Measurement personnel can edit, reorder, insert, and delete steps within the measurement program to accommodate complex and varied measurement scenarios.
- For large-batch workpiece measurement scenarios, only a single edge-finding measurement is needed to enable fully automatic batch measurement of the same product model — avoiding repeated operations and saving time and effort.
- The software provides comprehensive form-and-position tolerance setup and calculation functions, including but not limited to straightness, roundness, flatness, cylindricity, profile, position, parallelism, perpendicularity, concentricity, and circular runout. It also supports automatically determining a dimension's OK/NG status against the tolerance and automatically flagging and alerting on NG dimensions. A visual tolerance chart helps measurement personnel quickly identify specific out-of-tolerance dimensions and analyze the cause in a targeted way.

5. Array Measurement

When multiple identical workpieces are placed on the same fixture in a roughly evenly spaced arrangement, the operator can measure one workpiece first, then use the array function to measure all the remaining workpieces — reducing edge-finding time and simplifying the user's program. The process is as follows:

- Step 1: Establish a workpiece coordinate system on the starting workpiece in the fixture, measure the target elements (a workpiece coordinate system is optional depending on the specific case), and save this as a measurement program.
- Step 2: From the main menu, select “File > New” to create a new measurement program.
- Step 3: From the main menu, select “File > Open Array Measurement” to open the array program window, then select “Array > New Array” within that window.
- Step 4: In the New Array dialog, click “Select Default User Program” and choose the measurement program saved in Step 1, then set the number of rows and columns for the array and the horizontal and vertical spacing between workpieces. After configuring these settings, click “Confirm” at the top of the dialog to generate the array program, then click “OK” at the bottom to complete the array setup.
- Step 5: Because the position of the fixture relative to the machine table is not fixed, a coordinate system must be established so that the array direction aligns with the actual workpiece arrangement direction. In the array dialog’s menu bar, select “Coordinate System > Establish Coordinate System.” Extract a feature from one workpiece in the image area — for example, a circle — then select that circle in the element list and click the “Origin” button on the coordinate toolbar; the coordinate origin is then set at the circle’s center. Move the machine table as far away as practical, extract the same feature (the same circle) on another workpiece, select it in the element list, then click the “Align” button on the coordinate toolbar to level the coordinate system, and finally click “Save” to save the workpiece coordinate system — the array direction will now match the actual workpiece arrangement direction.
- Step 6: Save the array. In the array dialog’s menu bar, select “Array > Save Array”; the array file extension is *.fpg.
- Step 7: Run and edit the array. Click “Run” on the array toolbar to measure the workpieces on the fixture one by one. You can also right-click any workpiece position within the array to bring up a dropdown menu with options such as marking that position as “with/without workpiece” (so it is skipped during measurement) or resetting the spacing to adjust that workpiece’s specific position.

6. Macro-Array Measurement

Macro-array measurement is designed for scenarios where multiple identical or different fixtures are placed on the worktable at the same time — the array on each fixture can be the same or different — or where multiple identical or different array units exist on the same fixture. The process is as follows:

- Step 1: Following the array-measurement steps above, establish two separate arrays on different fixtures or fixture regions, and save each.
- Step 2: Open the array dialog and select “Array > Array Macro”; in the dialog that appears, click “Add” and add the two array files saved in Step 1 to the list.
- Step 3: Once added, close the “Array Macro Settings” dialog and click “Run Macro” on the array toolbar; the program will then measure the workpieces on each fixture, macro by macro.

7. Diverse Data & Graphic Export

- The software supports exporting measurement data results in multiple report formats, including Excel, Word, and TXT. The Excel report supports numerous customizable output parameters, including but not limited to element name, nominal value, tolerance band, measured value, deviation value, maximum value, minimum value, average value, range value, Cp/Cpk, out-of-tolerance value, measurement time, OK/NG status, pass rate, background color, and font color.

8. Rich, Open External Interfaces

- The software supports connecting external devices such as contact probes, laser sensors, spectral confocal displacement sensors, and robotic arms, and can integrate these devices together for more precise measurement of a workpiece’s height and 3D dimensions.

9. Custom MES Integration

- The software supports secondary development to integrate with the customer's internal MES system, enabling key measurement data to be uploaded centrally to the MES server — making it easier for customers to filter and query data on the MES side, and to manage and trace measurement data history in a unified way. It supports optional handheld scanner and industrial code-reader modules to capture the target product's ID information, automatically link it with the measurement data, and upload both together.

IV. Installation, Acceptance & Service

1. Delivery, Installation & Commissioning

- The Buyer shall formally notify Navinertia Tech within 3 working days of the goods' arrival, so that qualified service engineers can be scheduled for an on-site visit.
- Before Navinertia Tech's service engineers arrive on site, the Buyer is responsible for properly storing the goods. Unauthorized unpacking is prohibited, as is storing the goods outdoors or in locations unsuitable for precision measuring instruments — including direct sunlight, high temperature, high humidity, dust, or highly corrosive environments.
- Navinertia Tech is responsible for unpacking, positioning, installation, and commissioning of the goods at the Buyer's site, and will actively support the Buyer in completing the final acceptance process. The Buyer shall assist by providing the necessary site access, forklifts, cranes, tools, and manpower.
- Given the demanding environmental requirements of precision measuring instruments, all packaging for the goods may only be opened under the on-site supervision and approval of Navinertia Tech's service engineers.

2. Acceptance Terms

- Final acceptance of the goods shall be based on applicable international, national, and industry standards.

3. Training Terms

- Navinertia Tech will provide the Buyer's operating personnel with timely, professional, and comprehensive on-site training, ensuring trained personnel are capable of day-to-day operation and maintenance. Training content includes, but is not limited to, an overview of key modules, standard operating procedures, software programming, and routine maintenance and precautions.
- For newly purchased goods, Navinertia Tech commits to a cumulative on-site training duration of, in principle, no less than 2 working days. For first-time customers, Navinertia Tech will give due consideration to reasonable requests to extend the training duration.
- The Buyer shall promptly designate suitable trainees and actively participate in training organized by Navinertia Tech. Trainees designated by the Buyer should have basic knowledge of precision metrology and basic computer operating skills.
- While conducting training at the Buyer's site, Navinertia Tech personnel shall comply with the Buyer's policies regarding information confidentiality, organizational discipline, and workplace safety.

4. In-Warranty Service

- During the warranty period, for any malfunction or damage to the goods attributable to Navinertia Tech, the company will repair or replace the affected components free of charge and restore the goods to normal working condition.
- As the goods are precision measuring instruments with strict installation and operating environment requirements, unauthorized software upgrades, in-plant relocation, or cross-site relocation are prohibited without Navinertia Tech's prior consent, in order to keep the goods in normal working condition. Note: such unauthorized actions will immediately void the remaining warranty period and may cause abnormal or damaged hardware/software conditions; any resulting consequences shall be borne entirely by the Buyer.
- Online service response: within 4 hours of receiving the Buyer's formal notification, via channels including but not limited to phone, online communication, and remote access.

- On-site service response: on-site arrival within 24 hours of receiving the Buyer's formal notification, applicable when the issue cannot be effectively resolved online.
- General technical consultation: flexible response available 7×24, including technical engineering consultation service.

5. Out-of-Warranty Service

- For goods outside the warranty period, Navinertia Tech commits to providing long-term paid technical support, and recommends that the Buyer discuss and sign a long-term maintenance agreement with Navinertia Tech to optimize the overall cost of use and maintenance throughout the product's life cycle.