

# Metrology Automotive Seating

**FARO**



**FARO**® Edge ScanArm

Complete Seat Measurement

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D-70825 Korntal-Münchingen, Tel: +49 7150 9797-0, Fax: +49 7150 9797-44,  
info@faro-europe.com, www.faro.com

**Design by:** Vanessa Sevil Kizilelma,

**Edited by:** Antonio Ballester

**Graphics and layout by:** Vanessa Sevil Kizilelma,

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# Automotive Seating

## Quality Control in the Automotive Seating Market

The FaroArm® and FARO® Laser ScanArm® are two of the most used portable coordinate measurement systems in the automotive seating industry.

The car seating industry includes not only the whole car seats as we know them, but also headrests, frames, structures, mechanisms, foam and much more.

Since delivering high quality and reliable products it's linked with departments such as Research & Development, production or quality control, FARO helps and adds value with its portable cmm's to every step where measuring, testing or scanning parts is required.

# Complete Seat Measurement

The seat surface in particular is of great interest to developers of car seats

A wide variety of different seat positions, as well as areas which are difficult to access, are recorded without difficulty and in no time at all. The FARO Edge ScanArm is perfectly suited for CAD comparison and reverse engineering.

From the measurement data acquired in this way it is possible to calculate a wide variety of dimensions, such as the angle of incidence between the seat cushion and the backrest, for example, the height and width of the seat, as well as many other dimensions. Our FARO Edge ScanArm is an outstanding measuring tool for the non-contact recording of seat geometry.



## Benefits

Precise. Built-in smart sensors warn against excessive external loads, correct for thermal variations, and detect possible setup problems.

FARO's Laser Line Probe (LLP) is the first scanning attachment which fully integrates with the 7-axes Edge measurement arm system, transforming it into the Edge ScanArm. Unlike other systems, measurements can be carried out with or without direct contact with the object ensuring uninterrupted workflow - eliminating the need for software or hardware adjustments.

The following workflow shows a complete seat measurement using the FARO Edge ScanArm and the software CAM2 Measure 10.

**Step 1.** The FaroArm tactile probe is used to digitize the seat mounting positions on the seat fixture. These mounting positions are then aligned to the car line geometry co-ordinates values within CAM2 Measure 10.

**Step 2.** Affix seat to fixture and set seat slide to neutral position. A digital readout dialog box can then be switched on to aid the positioning of the seat front back to the recliner neutral position.

**Step 3.** Measure high points on front cushion wings on left hand and right hand side of seat, the high point command allows the digitizing of multiple points but only storing the highest point recorded thus eliminating operator influence. Report the 'Z' value and compare to drawing nominal.

**Step 4.** Measure high point on center of front back in between the headrest. Report the 'Z' value and compare to drawing nominal. Measure high points on top surface of headrest at two positions, (Headrest in uppermost and lowermost positions). Report the 'Z' value and compare to drawing nominal.

**Step 5.** Measure low point on front edge of the front cushion. Report the 'Y' value and compare to drawing nominal this confirms the position of the front cushion in car.

**Step 6.** Measure high point on rear edge of front back. Report the 'Y' value and compare to drawing nominal this confirms the position of the front back in car.

**Step 7.** Measure a high point on the inboard side of the front cushion, and a low point on the outboard side of the front cushion and report 'X' values and compare to drawing; this confirms clearance to car center console and door pad. A length can be constructed between these two points giving the overall width of the cushion.

**Step 8.** Measure a high point on the inboard side of the front back, and a low point on the outboard side of the front back and report 'X' values and compare to drawing, this confirms clearance to car center console and door pad. A length can be constructed between these two points giving the overall width of the front back.

**Step 9.** Generate report; the report can be saved in PDF, Excel, CSV, MHTML, RTF, Text and XML file formats.



## FaroArm Temperature compensation

Reduces fluctuations in measurement accuracies – commonly referred to as “measurement drift” – by actively responding to changes in temperature. This patented feature provides a consistent baseline of measurements, regardless of environment. FARO measurement arms are the only ones on the market with temperature sensors embedded throughout the Measurement Arm to monitor temperature and compensate automatically.

# Hip Point Check

## Test if the Hip Point location is within tolerance

When developing car seats, manikins are used to simulate the human sitting position. In this context the position of the hip point is of particular interest to the developers.

Our FARO EdgeArm is an outstanding, flexible and mobile measuring tool for determining this position.

First of all, known points are measured in order to establish the basis for the coordinate system. Once this basis is established, the coordinate of the hip point is also defined in the system.

Finally it is possible to check whether the position is within the prescribed tolerance range.





The following workflow shows a hip point measurement using the FARO Edge ScanArm and the software CAM2 Measure 10.

**Step 1.** The FaroArm is used to digitize the seat mounting positions on the hip point measurement fixture. These mounting positions are then aligned to in car co-ordinate values within CAM2 Measure 10.

**Step 2.** Affix seat to fixture and set seat slide to neutral position. A digital readout dialog box can then be switched on to aid the positioning of the seat front back to the recliner neutral position.

**Step 3.** The digital readout dialog box can also be used to aid the positioning of heel point. Place hip point calico on seat, (this is used as a common seat cover to eliminate effect of seat fabric types).

**Step 4.** Locate hip point manikin on seat and set T Bar to correct position. Locate legs onto T Bar and set to correct position.

**Step 5.** Load up the manikin with 2 x thigh weights and 2 x buttock weights. Slide the manikin forward on the seat, then allow to rest back into seat. Preload the seat using spring load on manikin base. Load the manikin with 8 x back weights (4 per site).

**Step 6.** Raise the manikins back plate from the seat back approximately 90 degrees, then pivot the Manikin from side to side, approximately 15 degrees, the movement from side to side to be repeated 3 times.

**Step 7.** Allow the manikin to sit back naturally in the seat, and then apply 15 Kg. preload to the manikins backplate.

**Step 8.** Using CAM2 Measure 10, digitize a projection plane on the Hip point location face, and then measure a circle on the Hip



point location bar. This process is repeated for RH and LH sides of the manikin.

**Step 9.** Using CAM2 Measure 10, create a point by best fit, between the two previously digitized LH and RH hip point locations. This command constructs a midpoint between the two, thus giving the hip point in X, Y & Z.

**Step 10.** Within CAM2 Measure 10 a nominal and tolerance can be keyed in against the actual position, thus indicating is the hip point location is within tolerance.

**Step 11.** Generate report; the report can be saved in PDF, Excel, CSV, MHTML, RTE, Text and XML file formats.

# Foam Testing

## Check tolerances in a 3D comparison using the FARO Edge ScanArm

To ensure consistent quality in the production of car seats it is also necessary to measure foam components. Thanks to its non-contact scanning function, the FARO Edge ScanArm is an outstanding measuring tool, because no pressure is exerted on the component.

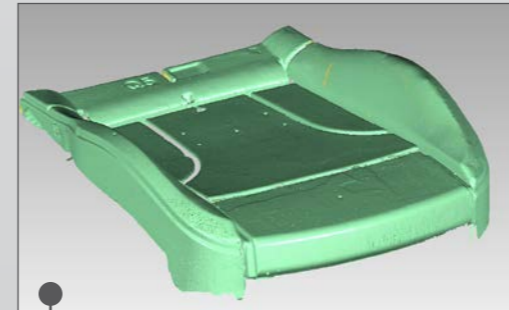
The displayed component can be easily recorded with minimal effort. The rear of the component can also be measured with no difficulty, simply by turning it round. The A and B surfaces can be scanned independently and registered together within the software.

The data acquired can be used, for example, for sections through the component or for variance comparisons relating to CAD.

## Internal Counter Balance

The FaroArm is the only measurement arm available with internal counterbalance in every model. As portable measurement arms are used more and more for repetitive part on-production line measurement, they must be fatigue free. Our patented internal counter balance provides neutral buoyancy (where the arm floats at horizontal) for fatigue free use and as well as unmatched probe control.



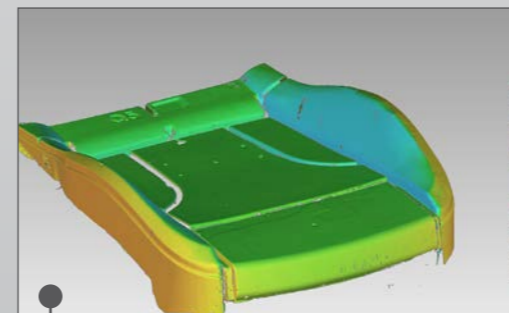


### Scan

Orientate the foam pad in a position where the 'A' surface can be scanned. Using the Laser Line Probe capture the 'A' surface as a point cloud and save.

Start a new scanning session, now orientate the foam pad in a position where the 'B' Surface can be scanned. Again using the Laser Line Probe capture the 'B' surface as a point cloud, now the 'A' surface point cloud can be imported and the software allows registration of the two files, resulting in a complete foam surface scan.

The CAD model can now be imported and will be displayed as reference file, the scanned point cloud file is now set as a test file.



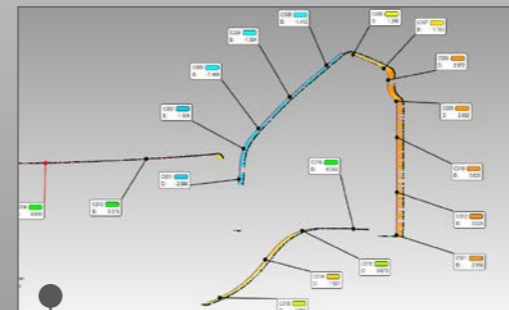
### Align

When we have a reference file and a test file, we can now perform an alignment, for this application we use the best fit method.

As the description indicates the software will best fit the point cloud against the CAD. A 3D comparison can now be performed, (This is one button click within the software).

Tolerances are now set up and the areas within specification are displayed as green. Any points below specification are displayed as blue whilst any points above specification are displayed as red (the various shades indicating the extent of the deviation, the deeper the color the bigger the deviation).

We can now either manually click and drag annotations at specific points which detail the deviation between the CAD and actual data sets, or create uniform grid on the data allowing us to analyze the change over a pre-defined distance.



### Compare

A 2D comparison can now be performed by keying in a value for the position where the section needs to be taken; the result is displayed showing the nominal CAD section and the points captured on that section, once again colored whiskers showing any deviation between the nominal and actual.

If 2D Dimensions are required, these can be generated on the section, distance, angular and radius checks can all be evaluated. A report can now be generated in various formats (PDF, Excel, Word), again one button click, a 3D PDF can also be generated allow the recipient options to interact with the report. I.e. zoom and rotation.

In most cases more than one sample needs to be analyzed, the software also has the ability to batch process, where multiple files are analyzed automatically in the same way as the first, trend analysis (SPC) is also a feature within the software.

# Lumbar Support Measurement

## The different lumbar support positions can be recorded with the FARO Edge ScanArm

One frequent application in the development of car seats is the portrayal of the position and the adjustment path of the lumbar support.

Offering the possibility of uncomplicated, non-contact and time-saving recording, our FARO Edge ScanArm is ideally suited to this task.

The lumbar support is scanned in several positions. The position can be displayed directly in the software, and the adjustment path is visualised by a pseudo-colour comparison.

## Stress Stop Warnings

Every FaroArm includes patented sensors within the arm that continually monitor the force and stresses applied to the arm. In the event that the arm is forced into a position that compromises the accuracy of a measurement, the user is instantly alerted with an on-screen display. This ensures that every measurement is an accurate one, even with the most inexperienced users.





The following workflow shows a lumbar support measurement using the FARO Edge ScanArm.

**Step 1.** The FaroArm tactile probe is used to digitize the seat mounting positions. These mounting positions are then aligned to the in car co-ordinate values. Set the lumbar position to OFF and using the Laser Line Probe scan over the face fabric to generate a point cloud of the front face of the seat front back.

**Step 2.** The point cloud is then polygon meshed in order to create a surface to check back to. The polygon mesh file is then saved as a master file, this file will be used to compare back to thus giving us a true representation of the seat foam movement when the lumbar device is operated.

**Step 3.** Set the lumbar position to ON at full extreme. To ensure an accurate measurement on lumbar movement, digitize the seat mounting positions with the tactile probe (we do this to eliminate any inaccuracies incurred on seat position when operating the lumbar mechanism).

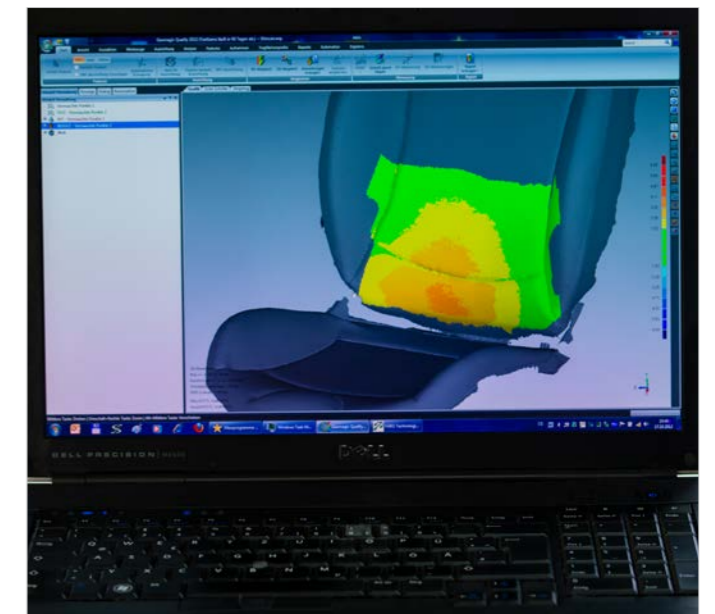
**Step 4.** Using the Laser Line Probe scan over the face fabric to generate a new point cloud now recording the surface with the lumbar activated. Import the previously saved polygon mesh file. You will now see both data sets on the screen and also the two files in the modal manager sequence tree.

**Step 5.** Set the Polygon Mesh as a reference file and the new scanned point cloud as a test file. In order to eliminate any inaccuracies on alignment which may have been caused by seat movement whilst operating the lumbar mechanism, we perform a feature based alignment. This alignment allows us to align the seat mounting position to each other.

**Step 6.** A 3D compare is now performed (one software button click) this compares the point cloud to the polygon mesh, and is illustrated by a color map showing the level of movement incurred by the operation of the lumbar.

**Step 7.** We can now either manually click and drag annotations at specific points which detail the deviation between the two data sets, or create uniform grid on the data allowing us to analyze the change over a pre-defined distance.

**Step 8.** A report can now be generated in various formats (PDF, Excel, Word), again one button click, a 3D PDF can also be generated allow the recipient options to interact with the report. I.e. zoom and rotation.



# Technical information

## FARO Edge ScanArm®

- Using advanced CMOS technology, the FARO Laser Line Probe (LLP) produces over 45,000 points of three-dimensional data per second.
- The handle with the FARO Laser Line Probe attachment weighs in at 222.4g. The LLP only adds an amazing 76.6g.
- The FARO Laser Line Probe can be permanently attached without interfering with your regular workflow.
- With a laser stripe that is nearly 90mm wide to capture more data with fewer scan passes.
- No need for interface box or external wiring.
- The FARO Laser Line Probe is fully compatible with the Bluetooth®, WLAN, USB, and Ethernet ready technologies used in the FARO Edge.
- Laser Line Probe Accuracy:  $\pm 35\mu\text{m}$  ( $\pm 0.0014''$ )

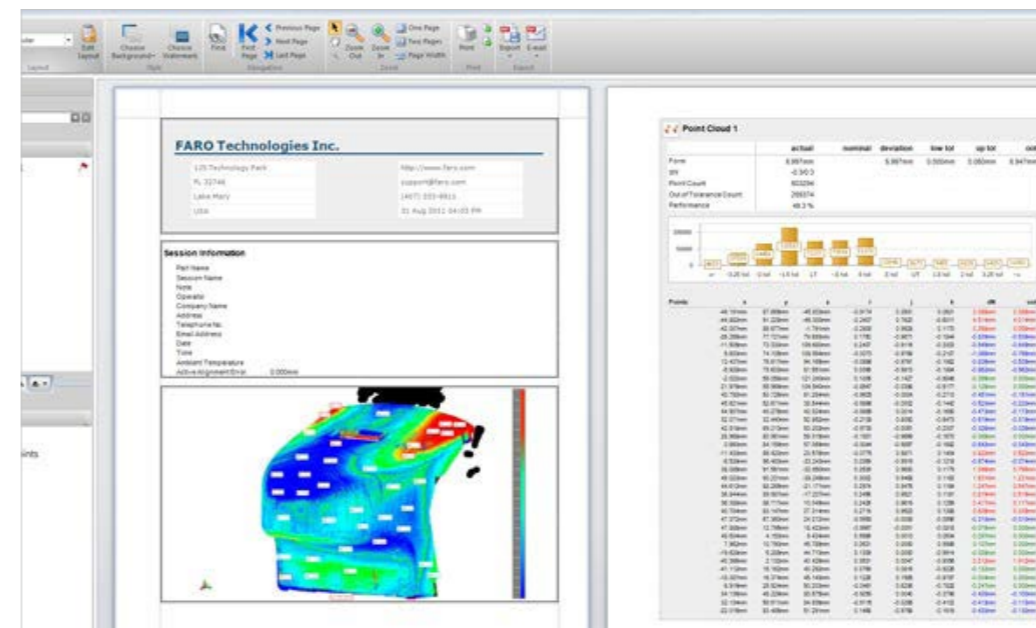
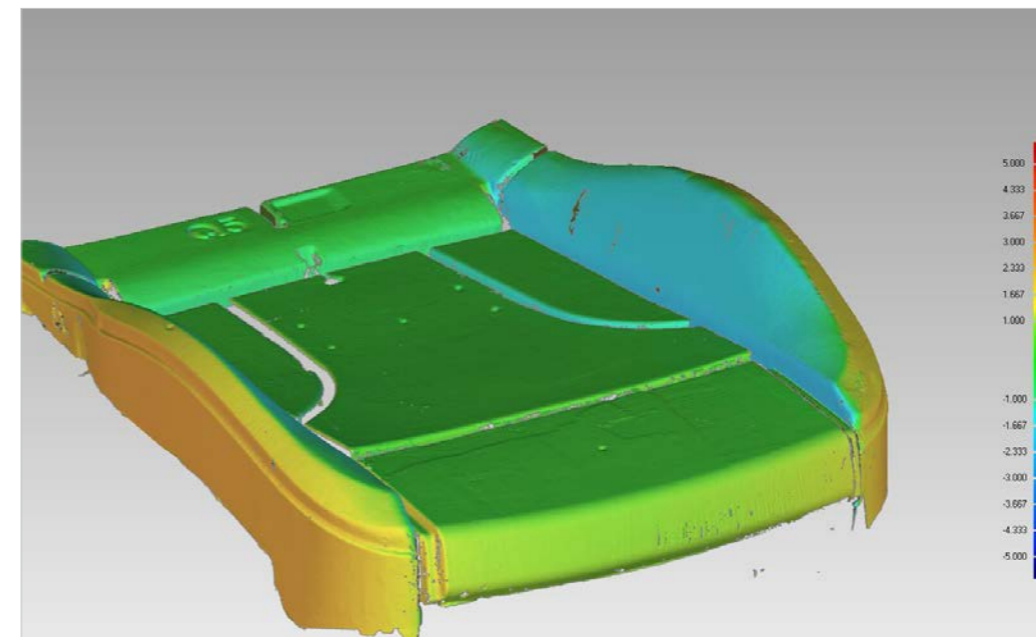


Non-Contact Edge (7 Axes)			
Measurement Range	1.8m (6ft.)	2.7m (9ft.)	3.7m (12ft.)
Performance	0.069mm (0.0027in.)	0.076mm (0.0030in.)	0.126mm (0.0049in.)
Contact Edge (7 Axes)			
Repeatability <sup>1</sup>	0.024mm (0.0009in.)	0.029mm (0.0011in.)	0.064mm (0.0025in.)
Accuracy <sup>2</sup>	$\pm 0.034\text{mm}$ ( $\pm 0.0013\text{in.}$ )	$\pm 0.041\text{mm}$ ( $\pm 0.0016\text{in.}$ )	$\pm 0.091\text{mm}$ ( $\pm 0.0035\text{in.}$ )

<sup>1</sup> REPEATABILITY = SINGLE POINT ARTICULATION PERFORMANCE TEST. <sup>2</sup> ACCURACY = VOLUMETRIC MAXIMUM DEVIATION.

# CAM2 Measure10

## The first choice in portable measurement software



Engineered for maximum efficiency in computer-aided measurement and 3D inspection, FARO's CAM2 Measure 10 offers you the flexibility to measure the way your process or job requires.

The software is ideal for CAD and non-CAD-based inspection and Geometric Dimensioning and Tolerancing (GD&T).

CAM2 Measure 10 features image-guided measurement, automatic nominal association to various features, Quick-Tools and an elegant and intuitive user interface.

Moreover the software is delivered with a reliable CAD import tool which increases the ability to load a large amount of CAD data.



**GLOBAL HEADQUARTERS**

FARO Technologies Inc.  
250 Technology Park  
Lake Mary, FL 32746  
USA  
info@faro.com

[www.faro.com](http://www.faro.com)

**HEADQUARTERS EUROPE**

FARO EUROPE GmbH & Co. KG  
Lingwiesenstr. 11/2  
70825 Korntal-Münchingen  
Germany  
T: +49 7150 97 97 0  
F: +49 7150 97 97 44  
info@faro-europe.com

**FARO TECHNOLOGIES UK LTD**

9-10 The Cobalt Centre  
Siskin Parkway East  
Middlemarch Business Park  
Coventry, CV3 4PE  
T: +44 2476 21 76 90  
F: +44 2476 30 55 72  
uk@faro-europe.com

**ALL OTHER EMEA COUNTRIES**

FARO SWISS Holding GmbH  
Wiesengasse 20  
8222 Beringen, Schaffhausen  
T: +49 7150 97 97 0  
F: +49 7150 97 97 44  
distribution@faro-europe.com

