The ultimate CMM laser scanner combining productivity and accuracy
It’s a Nikon ...

The L100 CMM laser scanner offers the best possible combination of speed, accuracy and ease-of-use. Suited for both surface and feature measurement, the L100 quickly delivers accurate data and insightful part-to-CAD comparison reports even on shiny or multi-material surfaces.

The L100 builds on 20 years of experience in optical metrology. With the L100, Nikon Metrology confirms their technology leadership in the field of CMM laser scanning.
L100
Higher productivity
Better understanding
Faster decisions
Superior product quality
8 REASONS TO CHOOSE NIKON NON-CONTACT METRO

BETTER INSIGHTS IN DEVIATIONS
- Colorful part-to-CAD surface / profile / feature reports provide in a visual way detailed information on product conformity
- Leads to faster decision-making and corrective actions
- Results in fewer and shorter design iterations and faster time-to-market
- Shortens production downtime through faster troubleshooting

FACILITATE COMMUNICATION
- A picture is worth a thousand numbers
- Easy-to-interpret graphical reports
- Exchange unambiguous results with internal or external colleagues or suppliers

INCREASE INSPECTION PRODUCTIVITY
- Laser scanners collect more information in less time
- Faster feature measurement due to fewer CMM movements
- Easy off-line CAD-based programming saves on preparation and modification of measurement programs

ENHANCE THE CAPABILITY OF YOUR CURRENT CMM
- Upgrade to a versatile multi-sensor CMM offering both non-contact and touch probe inspection
- Retrofit existing CMMs controller hardware and software

Retrofit kits are available for most leading CMM controller brands
MEASURE SOFT AND FRAGILE COMPONENTS

- Measure delicate surfaces that cannot be touched
- No deformation of soft materials like foams, rubber, membranes, etc
- Scan any material - No special treatment required for dark or shiny parts

IMPROVED DATA QUALITY

- Overcomes errors inherent to tactile probing
  - No errors due to probe tip compensation
  - Uses large numbers of measuring points to extract features or reference planes compared to just a few points in case of tactile probing
- Measures complex surfaces with fine detail

REDO ANY ANALYSIS AT ANY TIME

- Perform additional analyses on existing measuring data even when the physical part isn’t available anymore
- Easily compare samples from different measuring sessions
- Re-use existing data to accelerate development of new models
- Reverse-engineer older or modified parts to obtain actual CAD models

REDUCE COSTS

- Less physical prototype iterations by virtual assembly of individually measured parts
- Laser scanning avoids the need for expensive checking fixtures
- Reduce (online) programming and maximize measuring time
ULTRAFAST DATA COLLECTION
The L100 is ideal to inspect larger components where productivity is key but without having to compromise on accuracy. The 100 mm wide Field-of-View combined with the increased measurement speed results in measurement productivity that wasn’t achievable with CMM scanning before.

CAPTURE THE FINEST DETAILS
The L100 is equipped with a high quality glass Nikon lens optimized for laser scanning. Combined with the high definition camera this results in a point resolution of 42 µm and a data quality that is the best on the market, enabling fine detail capture and measurement of sharper edges. The L100 has an exceptionally small probing error of 6.5 μm, which is a measure of the scanner’s noise level, enabling delivery of smooth meshes and high levels of detail.

ACCURATE FEATURE MEASUREMENT
The L100 is perfectly suited for combined surface and feature measurements. Thanks to the low measurement noise and high point resolution, feature measurement accuracy approaches the accuracy of a touch probe.

COPE WITH CHANGES IN SURFACE COLOR
The 4th generation of Enhanced Sensor Performance (ESP4) adapts the laser intensity for each point in the scan line to varying colors or materials faster than ever. This makes the scanner even more robust for digitizing multi-material assemblies or shiny surfaces without the need for cumbersome surface treatment.
NO COMPROMISES ON ACCURACY AND SPEED

Up to 105° A-angle PH10 rotation
Built-in rotation adapter
Instant ready
Firmware upgrade via USB
High quality Nikon lens
Full FOV indicator

200,000 points/s scan speed
Excellent for scanning details
Best-in-class probing error of 6.5 µm
100 mm wide Field-of-View

EASY TO USE

The new Field-of-View (FOV) projection provides a clear indication for the user whether the scanner is optimally positioned. This facilitates scanner programming and provides better feedback during actual scanning.

EXTEND THE MEASUREMENT REACH

The patent-pending integrated mount rotation allows the scanner to rotate around its autojoint axis in 30° increments up to 90°. This is particularly interesting to measure turbine blades or parts with vertically oriented features and edges.

The L100 also allows the use of an extended 105° PH10 A-angle allowing better access to measure underneath or behind parts.
## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probing error (MPE&lt;sub&gt;p&lt;/sub&gt;)</td>
<td>6.5 µm (0.00026&quot;)</td>
</tr>
<tr>
<td>Ball bar length (MPE&lt;sub&gt;e&lt;/sub&gt;)</td>
<td>6 µm +L/250 mm (0.00024&quot; +L/13.8&quot;)</td>
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<tr>
<td>Multi-stylus test (MPE&lt;sub&gt;AL&lt;/sub&gt;)</td>
<td>6 µm (0.00024&quot;)</td>
</tr>
<tr>
<td>ISO Probing form error</td>
<td>15 µm (0.00059&quot;)</td>
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<tr>
<td>ISO Probing size error all</td>
<td>20 µm (0.00079&quot;)</td>
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<td>ISO Probing dispersion value</td>
<td>26 µm (0.00102&quot;)</td>
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<td>ISO Cone angle</td>
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<td>Scanning speed</td>
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<tr>
<td>Resolution</td>
<td>Max. 42 µm (0.0017&quot;)</td>
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<tr>
<td>Max. Field-of-View width</td>
<td>110 mm (4.3&quot;)</td>
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<tr>
<td>Field-of-View depth</td>
<td>60 mm (2.4&quot;)</td>
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<tr>
<td>Stand-off distance</td>
<td>105 mm (4.1&quot;)</td>
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<tr>
<td>Laser safety</td>
<td>Class 2</td>
</tr>
<tr>
<td>Enhanced Scanner Performance</td>
<td>ESP4</td>
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<tr>
<td>Daylight filter</td>
<td>Yes</td>
</tr>
<tr>
<td>Probe head compatibility</td>
<td>PH10M, PH10MQ, CW43, PHS</td>
</tr>
</tbody>
</table>

**Accuracy specifications according to ISO 10360-8:2013:**

1. Nikon Metrology test comparable to ENISO 10360-2 MPE, using 1σ sphere fit.
2. Nikon Metrology test comparable to ENISO 10360-2 MPE<sub>AL</sub>.
3. Nikon Metrology test comparable to ENISO 10360-5 MPE<sub>AL</sub>.
4. *Maximum probing form error* using 25 representative points in translatory scanning mode
5. *Maximum probing size error* using All measured points in translatory scanning mode
6. *Maximum probing dispersion value* using 95% of the measured points in translatory scanning mode
7. Cone angle: Region of sphere on which the measured points are selected

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**L100**

Laser scanning beyond expectations
LC15Dx
High accuracy with high resolution
New possibilities
without compromise
The LC15Dx is a viable alternative to a tactile probe for an increasing number of high precision CMM applications. Manufacturers gain a better appreciation of the dimensional quality of their products without compromising on cycle times. A wider variety of parts, geometry and materials can be measured more effectively, including many parts too small or fragile for a touch probe.

**BENEFITS**

**Closing the accuracy gap**
Thanks to the latest laser scanner technology the LC15Dx is closing the gap between laser scanner and tactile probe accuracy. In tests comparable to ISO 10360-2 MPE and ISO 10360-5 MPEAL the LC15Dx achieved the accuracy associated with using a CMM and tactile probe. However, unlike a tactile probe, the LC15Dx uses non-contact 3D laser triangulation to measure the surface directly and eliminate probe compensation errors. The uncertainty and delay caused when a laser scanner is used before it has reached operating temperature, has been eliminated by a thermal stabilizer mounted inside the scanner body.

**Versatile scanning without the hassle**
Nikon’s unique ESP3 technology intelligently adapts the laser settings for each measured point in real-time. A wider range and mix of surface materials, finishes, colors and transitions can be measured more efficiently without user interaction, manual tuning and part spraying, including small and fragile parts. Unwanted reflections are neutralised by an advanced software filter while changes in ambient light are absorbed by a high grade daylight filter.

**Better appreciation of product quality**
Global Compare provides a complete 3D visualization of dimensional quality. The entire part is checked to the CAD model and any areas of concern are immediately highlighted using Color Mapping. Further investigation and analysis is possible using fly-outs, sections and a library of Geometric Dimensioning and Tolerancing (GD&T). Inspection reports can be as simple or complex as required with follow-on reports fully automated.
**SOFTWARE**

**Intuitive software for every application**

A selection of popular software packages for part-to-CAD and feature inspection are available for the LC15Dx, including FOCUS and CAMIO.

Key features include:

- CAD programming
- Best-fit alignment
- Part to CAD comparison
- Feature inspection
- Blade analysis
- Color reporting
- Multi-sensor CMM
- Offline programming
- Point cloud management
- GD&T library
- Teach & Learn programming
- Full simulation

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**High quality Nikon lens**

Improves accuracy and data quality

**Eye safe laser**

Class 2 visible light laser

**Feature inspection**

Feature measurement and GD&T library

**Sections and profiles**

2D section and profile analysis

**CAD comparison**

Direct comparison of measured part to CAD

**Best-fit alignment**

Best-Fit alignment of measured part to CAD

**Point cloud management**

Trim and filter point clouds

**CAD export**

Reverse Engineering and data storage

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**CLOSING THE GAP WITH TACTILE PROBE ACCURACY**
Enhance the capability of your current CMM

Retrofitting your current CMM with an LC15Dx is a cost effective solution. The retrofit integrates with the existing CMM controller hardware and compatible probe system to provide a versatile multi-sensor CMM offering both non-contact and touch probe inspection.

LC15Dx retrofit kits are available for the following CMM controller systems.

- Aberlink
- Deva
- Coord3
- Dukin
- LK
- Hexagon DEA
- Hexagon Brown & Sharpe
- Hexagon Sheffield
- Mitutoyo
- Mora
- Renishaw
- Wenzel
- Werth
- Zeiss

Contact Nikon for details on exact versions of the controllers

Combine laser scanning with a tactile probe

In some cases a single sensor technology is insufficient for measuring all of the features. The LC15Dx can be combined with an optional tactile probe to create a versatile multi-sensor CMM. Depending on the application both technologies can be used independently or together in the same inspection program. Fully automatic sensor changing is possible with the addition of an optional change and storage rack which is mounted on the table of the CMM.

High precision parts and small geometry

The LC15Dx provides significant benefits for a wide variety of high precision parts and geometry, including small details, semi-rigid parts and the more demanding materials:

- Turbine blades
- Eliminate probe tip compensation errors
- Medical implants
- Inspect complex freeform geometry
- Precision moulding
- Measure small, soft and fragile parts
- High precision parts
- Small geometry

PROCESS
METHOD
MACHINED - MOULDED - STAMPED - CAST - FORGED

MATERIAL
METAL - PLASTIC - RUBBER - CLAY - CERAMIC - COMPOSITES

FINISH
MACHINE - POLISHED - PLATED - PAINT - MIXED COLORS

STRUCTURE
RIDGED - SOFT - FLEXIBLE - FRAGILE

FEATURE
SURFACE - GEOMETRIC FEATURE - PROFILE - SECTION

MULTI-SENSOR APPLICATIONS
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probing error (MPE)</td>
<td>1.9 µm (0.000075”)</td>
</tr>
<tr>
<td>Ball bar length (MPEE)</td>
<td>A+4 µm +L/350 mm (A+0.00016 +L/13.78”)</td>
</tr>
<tr>
<td>Multi-stylus test (MPEAL)</td>
<td>3.9 µm (0.00015”)</td>
</tr>
<tr>
<td>ISO Probing form error</td>
<td>7 µm (0.00027”)</td>
</tr>
<tr>
<td>ISO Probing size error all</td>
<td>15 µm (0.000591”)</td>
</tr>
<tr>
<td>ISO Probing dispersion value</td>
<td>7.6 µm (0.000299”)</td>
</tr>
<tr>
<td>ISO Cone angle</td>
<td>100°</td>
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<tr>
<td>Scanning speed (approx.)</td>
<td>70,000 points/sec</td>
</tr>
<tr>
<td>Resolution (point spacing)</td>
<td>22 µm (0.00087”)</td>
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<td>Points per line (approx.)</td>
<td>900</td>
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<td>Measuring temperature range</td>
<td>18-22°C (64.4-71.6° F)</td>
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<td>Operating temperature range</td>
<td>10-40°C (50-104° F)</td>
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<td>370 g (0.82 lbs)</td>
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<td>IP30</td>
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<td>Laser safety</td>
<td>Class 2</td>
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<td>Enhanced Scanner Performance</td>
<td>ESP3</td>
</tr>
<tr>
<td>Daylight filter</td>
<td>Yes</td>
</tr>
<tr>
<td>Probe head compatibility</td>
<td>PH10M, PH10MQ, CW43, PHS</td>
</tr>
</tbody>
</table>

All accuracy specifications valid for a CMM with an accuracy of 2µm + L/350 or better using manufacturer supplied test sphere.

1 Nikon Metrology test comparable to EN/ISO 10360-2 MPE using 1σ sphere fit.
2 Nikon Metrology test comparable to EN/ISO 10360-2 MPEE where A is equal to the CMM MPEE first term value.
3 Nikon Metrology test comparable to EN/ISO 10360-5 MPEAL.

Accuracy specifications according ISO 10360-8:2013:

4 $P_{\text{Form.Sph.1x25:Tr:ODS,MPE}}$ : “Maximum probing form error” using 25 representative points in translatory scanning mode.
5 $P_{\text{Size.Sph.All:Tr:ODS,MPE}}$ : “Maximum probing size error using All” measured points in translatory scanning mode.
6 $P_{\text{Form.Sph.D95%:Tr:ODS,MPL}}$ : “Maximum probing dispersion value” using 95% of the measured points in translatory scanning mode.
7 Cone angle : Region of sphere on which the measured points are selected.

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**LASER RADIATION**

Do not stare into the beam or view directly with optical instruments.

Class 2 Laser Product

Max output = 4.8 mW & 8.0 µJ

660 & 635nm

IEC 60825-1 Edition 2.0 2007-03

Read instruction manual before use

Complies with 21 CFR 1040.10 and 1040.11, Laser Notice No. 50, dated June 24, 2007

Due to the diverging beam, viewing the laser output with optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.
LC15Dx
Closing the gap with touch probe accuracy
Ultra-fast high-definition 3D scanning

More than two decades since the inception of the ModelMaker product line, the cutting-edge ModelMaker H120 firmly pushes the ever-exacting boundaries of handheld laser scanning. Incorporating blue laser technology, ultra-fast frame rate, specially developed Nikon optics and the ability to measure the most challenging materials this represents the next generation of portable laser scanning. The H120 makes no compromises in addressing the market needs by efficiently delivering the most detailed and accurate data in a fraction of the time of competing technologies.
UNCOMPROMISING PERFORMANCE

By combining a frame rate of 450 Hz, a stripe width of 120 mm and a resolution of 35 μm, users benefit from high productivity and detailed measurements with a single sensor. Without relying on interpolation techniques to artificially boost data density, the ModelMaker H120 guarantees fast data collection over a large area without compromising on small details – offering great flexibility in a single solution even when cycle time is critical, no matter the type of parts measured. Furthermore, the superior accuracy of the ModelMaker H120 ensures it stands far apart from similar technology, further pushing the traditionally accepted boundaries of handheld laser scanners.

MEASURE THE MOST CHALLENGING MATERIALS

The 4th generation of Nikon’s patented Enhanced Sensor Performance (ESP4) provides faster-than-ever real-time dynamic adjustment of the laser intensity for every point. Users can confidently scan across parts with strong colour transitions and varying reflectivity from any direction with no loss in scanner speed and no need for prior part preparation. ModelMaker scanners also benefit from intelligent reflection control which allows users to measure very shiny or polished materials while unwanted reflections are filtered out.

IMMEDIATE PRODUCTIVITY

Simple system set-up, immediate boot-up and no need for scanner warm-up combined with the structural rigidity, thermal stability and absolute encoder technology of the MCAx arms allows users to switch on and start confidently collecting accurate data straightaway.

EXTREMELY LOW NOISE DATA

By combining specially-developed Nikon optics and low-speckle blue laser technology, the ModelMaker H120 achieves super low-noise measurements and can cleanly resolve details such as sharp edges and even surface scratches and abrasions which other scanners simply cannot.

ENHANCED USER EXPERIENCE

Innovative features such as thermal compensation, an integrated locking connector, contrasting full field of view projector, excellent touch probe clearance and a compact size give the user all the feedback and assurance he needs to concentrate purely on the measurement task.
MODELMAKER MMDx

Scanning technology optimized for your application

The ModelMaker MMDx range of handheld laser scanners is ideally suited for portable 3D inspection and reverse engineering applications. With choices of scanner models for high detail, all-round scanning or high productivity, users can select the best hardware for their needs.

MMDx incorporates 3rd generation Enhanced Sensor Performance (ESP3) to scan almost any sample materials and surface finishes without user interaction.

The digital camera technology offers a measuring accuracy down to 7 microns and benefits from a true non-interpolated resolution of more than a thousand points per stripe, allowing freeform surfaces and features to be scanned accurately and efficiently.

Featuring high frame rates and laser stripes up to 200 mm, the MMDx range provides the ultimate in scanning productivity. The scanner’s digital cameras benefit from a true (non-interpolated) resolution of over 1000 points per stripe, providing optimum resolution for scanning freeform surfaces and features efficiently.

Weighing around 400 g and featuring an angled laser plane for comfort while scanning, MMDx scanners are optimized for ergonomic use. Set-up time and portability is optimized through the use of isolated thermal zones, temperature compensation and on-board processing – which means no external controller or extraneous cabling.

<table>
<thead>
<tr>
<th>Model</th>
<th>Scan rate</th>
<th>Productivity</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>H120</td>
<td>• • • • • ••</td>
<td>• • • • • ••</td>
<td>• • • • • • •</td>
<td>• • • • • • •</td>
</tr>
<tr>
<td>MMDx50</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
</tr>
<tr>
<td>MMDx100</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
</tr>
<tr>
<td>MMDx200</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
<td>• • • • •</td>
</tr>
</tbody>
</table>

ModelMaker scanners and MCAx arms seamlessly interact with Focus software for scan and tactile probe data acquisition and inspection processing. It is a total solution that tightly integrates hardware and software to guarantee smooth and error-free operation.

Focus software is specifically designed to easily control data flows with minimal user interaction. Users can complete handheld data acquisition and inspection jobs in Focus without compromising performance.

Alternatively, through the Nikon Metrology API, the ModelMaker scanners and MCAx arms can be used directly in many 3rd party inspection and reverse engineering software applications, including PolyWorks® and Geomagic®.
APPLICATIONS

The combined solution of ModelMaker scanners and MCAx arms delivers high-productivity and precise non-contact and contact metrology. Used to optimise production workflow through rapid, reliable and accurate analysis of product dimensions — both freeform and geometric — it has proven to be an invaluable tool across many industries and workplaces from the shop floor to the metrology lab.

Able to robustly measure almost any material and with the flexibility to inspect parts of sizes ranging from a few millimetres to several metres and more allows the solution to span many industries including Automotive, Aerospace, Power Generation and Consumer products, and well as Universities, Research Institutes and scanning service providers – especially for components such as tools and dies, body-in-white / sheet metal parts, castings, injection moulded, soft or fragile materials and additive manufactured parts.

The ModelMaker handheld laser scanners paired with MCAx portable articulated co-ordinate measuring arms and Focus software allow you to reduce measurement times by rapidly diagnosing production issues in all areas of manufacture. This enables delivery of your products faster and with greater confidence by meeting the highest quality standards.

Key benefits for your application
- High accuracy and fast data throughput saves time and money
- Optimized for hard-to-scan surfaces
- Designed for use under all shop floor or field conditions
- Extreme temperature stability and zero warm-up time
- Quick and easy plug-and-play setup
- Enhanced ergonomics for stress-free usage
- Short learning curve
- Seamless transition between scanning and touch-probing
- Compatible with all major brands of point cloud software

Uses within your process
- Fast & accurate multi-sensor 3D inspection
- Part-to-CAD inspection: First article inspection against CAD model
- Inspection of geometric features
- Gap-and-flush inspection
- Reverse engineering: from concept studio clay to class A surfaces
- Digitizing for additive manufacturing
Accurate and portable multi-sensor measurement

The MCAX Manual Coordinate measuring Arm is a precise, reliable and easy-to-use portable 7-axis measuring arm. It is the perfect partner for the ModelMaker H120 and MMDx laser scanners and Focus Handheld scanning and inspection software due to its high precision, repeatability and stability. This total solution’s accuracy, capability and portability make it feel perfectly at home in the metrology lab, on the shop floor and in-the-field.

The arm can be equipped with a wide range of probing systems aside from laser scanning, such as a large choice of probes for a variety of tasks including touch-trigger measurements and continuous scanning. Its flexibility makes this measurement arm the perfect solution for the widest range of measurement tasks. The MCAX range of 7-axis articulated arms is available in six different sizes and in two accuracy levels giving users the ability to specify the best system for their needs.

- Tactile probing performance from 0.023 mm and scanning system accuracy from 0.028 mm ensures the highest standard of measurement results
- Available in six lengths between 2.0 m and 4.5 m to suit small to large measurement tasks
- Absolute encoder technology means no referencing or warm-up period is required
- Advanced carbon fiber construction for strength and thermally stability in all environments
- Automatic probe recognition and repeatable probe and scanner mounting allows immediate switching between measurement tools
- The ergonomic wrist features haptic feedback whilst the arm provides audio and visual notifications
- Low friction handling positions for reduced user stress and fatigue
- Counterbalance for effortless control infinite rotation of all principle axes for unrestricted use
- Integrated lock secures the arm easily and safely
- Quickly and easily attaches to a variety of stands / tripods or vacuum mount
- Supports a wide variety of fixed and touch-trigger probes in many lengths and stylus configurations
- MCAX+ includes a certified length standard for performance verification in the field
- Certified performance according to ASME B89.4.22. VDI/VDE 2617-9 certification is also available
<table>
<thead>
<tr>
<th>Arm Model</th>
<th>Measuring range</th>
<th>Weight</th>
<th>With H120</th>
<th>With MMDx50</th>
<th>With MMDx100</th>
<th>With MMDx200</th>
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</thead>
<tbody>
<tr>
<td>MCAx20+</td>
<td>2.0 m</td>
<td>8.2 kg</td>
<td>0.028 mm</td>
<td>0.042 mm</td>
<td>0.048 mm</td>
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</tr>
<tr>
<td>MCAx25+</td>
<td>2.5 m</td>
<td>8.5 kg</td>
<td>0.032 mm</td>
<td>0.048 mm</td>
<td>0.054 mm</td>
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<td>MCAx30+</td>
<td>3.0 m</td>
<td>8.8 kg</td>
<td>0.038 mm</td>
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<td>0.060 mm</td>
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<td>MCAx35+</td>
<td>3.5 m</td>
<td>9.1 kg</td>
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<td>0.072 mm</td>
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<tr>
<td>MCAx40+</td>
<td>4.0 m</td>
<td>9.4 kg</td>
<td>0.060 mm</td>
<td>0.094 mm</td>
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<td>0.114 mm</td>
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<tr>
<td>MCAx45+</td>
<td>4.5 m</td>
<td>9.7 kg</td>
<td>0.080 mm</td>
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<td>MCAx20</td>
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<td>MCAx25</td>
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<td>0.040 mm</td>
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<td>0.062 mm</td>
<td>0.078 mm</td>
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<td>MCAx30</td>
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<td>0.082 mm</td>
<td>0.100 mm</td>
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<tr>
<td>MCAx35</td>
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<td>0.102 mm</td>
<td>0.106 mm</td>
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<tr>
<td>MCAx40</td>
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<td>0.070 mm</td>
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<td>0.136 mm</td>
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<tr>
<td>MCAx45</td>
<td>4.5 m</td>
<td>9.4 kg</td>
<td>0.122 mm</td>
<td>0.162 mm</td>
<td>0.168 mm</td>
<td>0.190 mm</td>
</tr>
</tbody>
</table>

1. Typical values are 30% better than published values.  
2. Laser scanner Accuracy is determined by scanning a plane from various directions, each time using the entire scanner field of view. The result is the maximum 1σ deviation of the scan data to fitted plane features.  
3. The Scanning Performance test indicates the performance of the laser scanner combined with a MCA arm. The test is performed by scanning a highly accurate reference plane in 5 different orientations of the articulated arm and laser scanner. The 5 resulting point clouds are merged together and a best-fit plane is constructed through this combined point cloud. For each of the points, the deviation distance to the best-fit plane is calculated. The result of the test is the average value of all of the deviations.  
4. The Point Repeatability test (or SPAT) is the reference test to determine measurement arm repeatability with a ball probe. The probe is placed in a conical socket and points are measured from multiple approach directions and is tested different zones of the arm measurement volume. The result is the maximum of the X, Y or Z range divided by two.  
5. The Volumetric Accuracy test most accurately represents the reasonable expectations for probing performance in practical measuring applications since it involves measuring a certified length standard many times in several locations and orientations and compares the resulting measurements to the actual length. It is the most appropriate test for determining machine accuracy and repeatability. The result is the maximum deviation of the measuring distance less the theoretical length.

Probing and scanning specifications are achieved under stable environmental conditions with the MCA arm mounted on a base plate or magnetic base. A 15 mm diameter, 50 mm long, steel ball probe connected to both probe ports is used for the probing performance tests. Probing specifications are based on a subset of ASME B89.4.22:2004. Probing certification to VDI/VDE 2617-9 is also available.
The MCAx Manual Coordinate measuring Arm, is a precise, reliable and easy-to-use portable 7-axis measuring system. It is the perfect partner for the ModelMaker MMDx digital handheld laser scanners and Focus 10 Handheld scanning and inspection software. This total solution’s accuracy, capability and portability makes it feel perfectly at home in the metrology lab, on the shop floor and in-the-field.

The MCAx arm can be equipped with a wide range of probing systems for laser scanning, touch-trigger measurements and continuous scanning. Its flexibility makes this measurement arm the perfect solution for the widest range of measurement tasks.

**Measurement volume**
Available in six lengths between 2.0 m and 4.5 m

**Advanced construction**
Aerospace-grade carbon fiber arm tubes are strong, lightweight, thermally stable and feature a lifetime warranty

**Zero-G counterbalance**
Reduces operator fatigue delivering effortless control in all positions

**Lock**
Secures the arm easily and safely when not in use - Enables to fix the arm in any intermediate position

**Integrated carry handle**
Secure lifting point allows for easy carrying

**Feature packs**
Can provide additional capability such as Wireless (Wi-Fi) connectivity and Li-Ion battery power

**Universal mounting system**
Quickly and easily attaches to a variety of stands / tripods and bases including magnetic and vacuum mounts

**Rotating grips**
Low friction handling positions for better ergonomics while reducing stress and fatigue

**Infinite rotation**
Infinite rotation of all principle axes for unrestricted use

**Absolute encoders**
No referencing or warm-up time required

**In-the-field verification**
MCAx+ arms are supplied with a NIST-traceable length standard for accuracy and repeatability verification
**Multi-probe capability**
Simultaneous mounting of both tactile probe and non-contact laser scanner

**Integrated buttons**
Control at your fingertips

**Ergonomic pistol grip**
Increases operator comfort and productivity

**Automated probe recognition**
Switch between different probe types or between tactile probes and scanners any time - No re-calibration, no probe selection, no tools

**Uncompromised portability**
No external controller box provides "Plug and play" technology

**Zero warm-up time**
Isolated hot and cold zones and temperature compensation on MMDx scanner

**Enhanced sensor performance**
Measurement of unfriendly surfaces is simple due to fully automatic adjustment of laser settings

**Optimized scanner geometry**
Tilted laser plane and camera gives comfortable ergonomics and best quality image response

**Probe options**
MCAx supports a wide variety of tactile (straight and hook) and touch-trigger probes in many lengths and stylus configurations
THE DIGITAL HANDHELD SCANNER

The unmatched accuracy, usability and performance of the digital ModelMaker scanner make it the perfect tool for all inspection or reverse engineering applications.

The ModelMaker MMDx scanners are a leap forward in 3D digitizing, as they feature 3rd generation Enhanced Sensor Performance (ESP3) making them suitable for scanning almost any material.

SCAN ANY MATERIAL

Through Enhanced Scanning Performance, the ModelMaker scanner adapts its laser power to suit the surface characteristics of the object. During scanning, it automatically tracks changes in surface conditions — both color and reflectivity — and adapts laser power accordingly in real-time. As a result, ModelMaker is able to accurately and efficiently handle parts with any surface color and texture, without requiring re-scanning or spraying.

ModelMaker scanners also feature an intelligent anti-reflection filter to provide accurate measurements when scanning very shiny or polished materials. The functionality filters out all reflective laser light that is scattered in many directions.

BEST-IN-CLASS PRODUCTIVITY

Featuring high frame rates and laser stripes up to 200 mm, the digital MMDx provides the ultimate in scanning productivity. The scanners’ digital cameras benefit from a true (non-interpolated) resolution of over 1000 points per stripe, providing optimum resolution for scanning freeform surfaces and features efficiently.

EASE-OF-USE

Weighing around 400g and featuring a comfortable stand-off distance, ModelMaker scanners are optimized for ergonomic use. Set-up time and portability is optimized through the use of isolated thermal zones, temperature compensation and on-board processing — which means no external controller or extraneous cabling.

THE RIGHT TOOL FOR THE RIGHT JOB

The ModelMaker is available in two performance variants and three stripe widths to match your specific productivity and resolution needs.

<table>
<thead>
<tr>
<th></th>
<th>Scan rate</th>
<th>Productivity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMDx50</td>
<td>• • • • •</td>
<td>• •</td>
<td>• • • •</td>
</tr>
<tr>
<td>MMDx100</td>
<td>• • • • •</td>
<td>• • • •</td>
<td>• •</td>
</tr>
<tr>
<td>MMDx200</td>
<td>• • • • •</td>
<td>• • • •</td>
<td>• •</td>
</tr>
</tbody>
</table>

Thanks to ESP3, ModelMaker is able to scan the steep sides of convex surfaces, often a challenge due to poor light reflection.
TOTAL SOLUTION

ModelMaker MMDx scanners and MCAx arms seamlessly interact with Focus software for scan and tactile probe data acquisition and inspection processing. It is a total solution that tightly integrates hardware and software to guarantee smooth and error-free operation.

SCANNING AND APPLICATION SOFTWARE

Focus supports intuitive inspection using an articulated arm or Optical CMM with tactile and/or scanning probes. The software is specifically designed to easily control data flows with minimum user interaction. For the first time, customers can complete handheld data acquisition and inspection jobs from within Focus without compromising performance.

Alternatively, through the Nikon Metrology API, the MMDx handheld scanners and MCAx arms can be used directly in many 3rd party inspection software applications, including PolyWorks® and Geomagic®.

For reverse engineering applications users can select from a broad offering of 3rd party packages which tightly integrate all Nikon Metrology handheld scanners.

FOCUS HANDHELD SCANNING FEATURES

- Real-time point cloud rendering
- Point cloud filtering and polygon meshing tools
- Fuse command for intelligently and automatically processing point cloud data into an accurate, high quality polygon mesh
- Tactile measurements complement laser scanning, both of which can be performed directly in Focus
- Remote software interaction using articulated arm and K-Scan probe
- Automatic sensor intensity adaptation to scan surfaces with varying color or high reflectivity
- Import/export of all standard point, mesh and CAD formats, such as IGES, STL, CATIA, UG, Pro/E, STEP, VDA, etc
- Scripting support for scanning automation

APPLICATIONS

- Fast & accurate 3D scanning
- Part-to-CAD inspection: First article inspection against CAD model
- Inspection of geometric features
- Gap-and-flush inspection
- Reverse engineering: from concept studio clay to class A surfaces
- Input for rapid prototyping
MCAx CONFIGURATIONS AND ACCESSORIES

<table>
<thead>
<tr>
<th></th>
<th>MCAx+</th>
<th>MCAx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanner compatibility</td>
<td>Handheld scanners: MMDx</td>
<td></td>
</tr>
<tr>
<td>Feature pack</td>
<td>Scanning pack</td>
<td></td>
</tr>
<tr>
<td>Probes</td>
<td>15 mm diameter steel, 50 mm long</td>
<td>6 mm diameter ruby, 100 mm long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 mm diameter ruby, 100 mm long</td>
</tr>
<tr>
<td>TESA TKJ connectors</td>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Locking counterbalance</td>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Hard case</td>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Dust cover</td>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Probe calibration sphere</td>
<td>Standard</td>
<td>Standard</td>
</tr>
<tr>
<td>NIST traceable length standard</td>
<td>Standard</td>
<td>Optional</td>
</tr>
<tr>
<td>Rotating grips</td>
<td>Standard</td>
<td>Not available</td>
</tr>
<tr>
<td>Base</td>
<td>Magnetic</td>
<td>Bolt-down</td>
</tr>
</tbody>
</table>

1 Scanner not included with MCAx arms as standard

ACCESSORIES

A modular approach to base and probe connectivity as well as measurement volume extensions and datuming provides a multitude of accessories to enhance usage in the most demanding situations

SOLUTION BENEFITS

- High accuracy and fast data throughput saves time and money
- Optimized for hard-to-scan surfaces
- Designed for use under all shop floor or field conditions
- Extreme temperature stability and zero warm-up time
- Quick and easy plug-and-play setup
- Short learning curve
- On-board calibration storage
- Scanner compatible with all major brands of portable localizers and point cloud software
- No external controller
- Automatic probe recognition
- Enhanced ergonomics mean stress-free usage
- Seamless transition between scanning and touch-probing

The ModelMaker MMDx digital handheld scanners paired with MCAx portable articulated co-ordinate measuring arms allows you to reduce measurement times by rapidly diagnosing production issues in all areas of manufacture. This enables delivery of your products faster and with greater confidence by meeting the highest quality standards.
SPECIFICATIONS

MODELMAKER MMDx LASER SCANNER

<table>
<thead>
<tr>
<th></th>
<th>MMDx50</th>
<th>MMDx100</th>
<th>MMDx200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripe width (Y)</td>
<td>50 mm (2.0”)</td>
<td>100 mm (3.9”)</td>
<td>200 mm (7.9”)</td>
</tr>
<tr>
<td>Stand-off (to near FOV)</td>
<td>95 mm (3.7”)</td>
<td>100 mm (3.9”)</td>
<td>110 mm (4.3”)</td>
</tr>
<tr>
<td>Measuring range (Z)</td>
<td>50 mm (2.0”)</td>
<td>100 mm (3.9”)</td>
<td>150 mm (5.9”)</td>
</tr>
<tr>
<td>Accuracy (1σ)</td>
<td>7 μm (0.00028”)</td>
<td>10 μm (0.00039”)</td>
<td>16 μm (0.00063”)</td>
</tr>
<tr>
<td>Data rate at full FOV</td>
<td>50 Hz</td>
<td></td>
<td>60 Hz</td>
</tr>
<tr>
<td>Max. data rate</td>
<td></td>
<td>150 Hz</td>
<td></td>
</tr>
<tr>
<td>Points per stripe</td>
<td></td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Temperature compensation</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Laser power control</td>
<td>Fully automatic - per point (Enhanced sensor performance - ESP3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor weight</td>
<td></td>
<td>Approx. 400 g (14.1 oz.)</td>
<td></td>
</tr>
<tr>
<td>Laser power</td>
<td></td>
<td>Class 2</td>
<td></td>
</tr>
<tr>
<td>Localiser compatibility</td>
<td></td>
<td>Nikon Metrology MCAx / MCA II 7-axis / MCA 7-axis (v2.2 &amp; 2.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nikon Metrology K-Series K600 / K610</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Romer/CimCore Infinite 1.0SC 7-axis / Infinite 2.0SC 7-axis</td>
<td></td>
</tr>
</tbody>
</table>

1 Typical values are 30% better than published accuracy.

MCAx ARTICULATED ARM

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Point repeatability 2</th>
<th>Volumetric accuracy 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCAx20+</td>
<td>2.0 m (6.6ft.)</td>
<td>0.023 mm (0.0009”)</td>
<td>±0.033 mm (±0.0013”)</td>
</tr>
<tr>
<td>MCAx25+</td>
<td>2.5 m (8.2ft.)</td>
<td>0.027 mm (0.0011”)</td>
<td>±0.038 mm (±0.0015”)</td>
</tr>
<tr>
<td>MCAx30+</td>
<td>3.0 m (9.8ft.)</td>
<td>0.042 mm (0.0017”)</td>
<td>±0.058 mm (±0.0023”)</td>
</tr>
<tr>
<td>MCAx35+</td>
<td>3.5 m (11.5ft.)</td>
<td>0.055 mm (0.0022”)</td>
<td>±0.081 mm (±0.0032”)</td>
</tr>
<tr>
<td>MCAx40+</td>
<td>4.0 m (13.1ft.)</td>
<td>0.067 mm (0.0026”)</td>
<td>±0.098 mm (±0.0039”)</td>
</tr>
<tr>
<td>MCAx45+</td>
<td>4.5 m (14.8ft.)</td>
<td>0.084 mm (0.0033”)</td>
<td>±0.119 mm (±0.0047”)</td>
</tr>
<tr>
<td>MCAx20</td>
<td>2.0 m (6.6ft.)</td>
<td>0.044 mm (0.0017”)</td>
<td>±0.061 mm (±0.0024”)</td>
</tr>
<tr>
<td>MCAx25</td>
<td>2.5 m (8.2ft.)</td>
<td>0.049 mm (0.0019”)</td>
<td>±0.069 mm (±0.0027”)</td>
</tr>
<tr>
<td>MCAx30</td>
<td>3.0 m (9.8ft.)</td>
<td>0.079 mm (0.0031”)</td>
<td>±0.100 mm (±0.0039”)</td>
</tr>
<tr>
<td>MCAx35</td>
<td>3.5 m (11.5ft.)</td>
<td>0.099 mm (0.0039”)</td>
<td>±0.125 mm (±0.0049”)</td>
</tr>
<tr>
<td>MCAx40</td>
<td>4.0 m (13.1ft.)</td>
<td>0.115 mm (0.0045”)</td>
<td>±0.151 mm (±0.0059”)</td>
</tr>
<tr>
<td>MCAx45</td>
<td>4.5 m (14.8ft.)</td>
<td>0.141 mm (0.0056”)</td>
<td>±0.179 mm (±0.0070”)</td>
</tr>
</tbody>
</table>

2 The Point Repeatability Test (or SPAT) is the reference test to determine measurement arm repeatability with ball probe. The cone is in front of the machine. Points are measured from multiple approach directions. The average point and the deviation of each point to the average center are calculated. The result is the maximum range divided by two.

The published value is the pass-off specification for ASME B89.4.22 SPAT and VDI/VDE 2617-9 Sphere form (MPEPF) & Sphere position (MPEPL)

3 The Volumetric Accuracy Test most accurately represents the reasonable expectations for machine performance in practical measuring applications since it involves measuring a certified length standard many times in several locations and orientations and compares the resultant measurements to the actual length. The Volumetric Length Accuracy Test is the most appropriate test for determining machine accuracy and repeatability. The result is the maximum deviation of the measuring distance less the theoretical length.

The published value is the pass-off specification for ASME B89.4.22 Volumetric Performance and VDI/VDE 2617-9 Sphere size (MPEPS) & Indication for size (MPEE)

Probing specifications are relevant to both the center and offset probe ports of the MCAx arm. The specifications are achieved under stable environmental conditions with the MCAx arm mounted on a base plate or magnetic base and using a 15 mm diameter, 50 mm long, steel ball probe connected to both probe ports.
## SYSTEM ACCURACIES FOR MCAx WITH SCANNER COMBINATIONS

<table>
<thead>
<tr>
<th>Arm type</th>
<th>Laser scanning system accuracy (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MMDx50</td>
</tr>
<tr>
<td>MCAx20+</td>
<td>42 µm (0.0017&quot;)</td>
</tr>
<tr>
<td>MCAx25+</td>
<td>48 µm (0.0019&quot;)</td>
</tr>
<tr>
<td>MCAx30+</td>
<td>54 µm (0.0021&quot;)</td>
</tr>
<tr>
<td>MCAx35+</td>
<td>72 µm (0.0028&quot;)</td>
</tr>
<tr>
<td>MCAx40+</td>
<td>94 µm (0.0037&quot;)</td>
</tr>
<tr>
<td>MCAx45+</td>
<td>116 µm (0.0046&quot;)</td>
</tr>
<tr>
<td>MCAx20</td>
<td>50 µm (0.002&quot;)</td>
</tr>
<tr>
<td>MCAx25</td>
<td>56 µm (0.0022&quot;)</td>
</tr>
<tr>
<td>MCAx30</td>
<td>78 µm (0.0031&quot;)</td>
</tr>
<tr>
<td>MCAx35</td>
<td>102 µm (0.004&quot;)</td>
</tr>
<tr>
<td>MCAx40</td>
<td>128 µm (0.005&quot;)</td>
</tr>
<tr>
<td>MCAx45</td>
<td>162 µm (0.0064&quot;)</td>
</tr>
</tbody>
</table>

**Laser scanning system accuracy**: the laser scanning system accuracy indicates the performance of the laser scanner combined with a handheld localizer. The test is performed by scanning a highly accurate reference plate in 5 different orientations of the articulated arm and laser scanner. The 5 resulting point clouds are merged together in one point cloud and a best-fit plane is constructed through this point cloud. For each of the points, the distance is calculated to the best-fit plane. The result of the test is the 2σ value on all of the calculated deviations.

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**MMDx with MCAx**

Premium portable metrology

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