



# Handheld Probe Coordinate Measuring Machine

**NEW** XM Series

## Portable, Benchtop CMM

**NEW**

New probe for even greater accuracy



NEW

## Easier and More Accurate

---

Easy measurement from any position

**Free-angle probe**

Thermal expansion coefficient calculation

**Temperature compensation function**

Probe tracing

**Free-form 3D CAD export**

Minimal training time

**Tutorial function**

Hole diameter:  
 $\varnothing 0.7880''$

Hole diameter:  
 $\varnothing 0.7881''$





KEYENCE

Hole diameter:  
 $\varnothing 0.7881''$

Hole diameter:  
 $\varnothing 0.7880''$

Hole distance  
 $6.6931''$



# Your Personal Coordinate Measuring Machine

Sometimes, hand tools just can't handle the job, but a CMM is too much. KEYENCE developed the XM Series Handheld Probe Coordinate Measuring Machine to fill that gap. With the same ease of use as calipers, the XM Series enables complex measurements with high accuracy.

Handheld Probe Coordinate Measuring Machine  
**NEW** XM Series



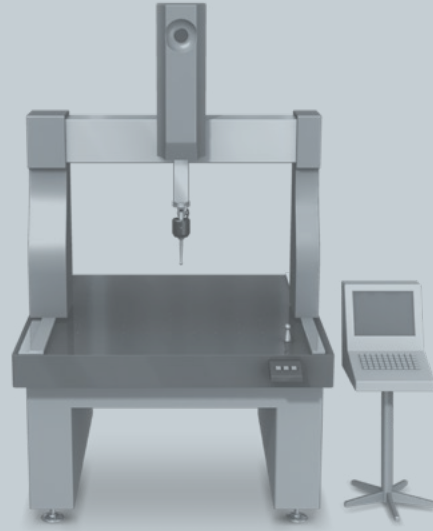


# Easy-to-Use and Highly Accurate Coordinate Measuring Machine

Caliper/micrometer



Bridge coordinate measuring machine



## Advantages

- Easy to use by anyone
- Can be used anywhere

## Advantages

- Measure complex shapes
- GD&T measurement
- High-accuracy

## Disadvantages

- Unable to measure complex shapes
- Unable to measure GD&T
- Measurement results vary between operators

## Disadvantages

- Difficult to operate
- Usable only in a specialized measuring room
- Ongoing costs



## The XM Series Designed with advantages in mind

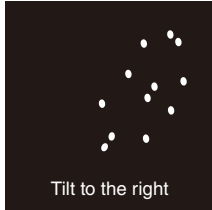
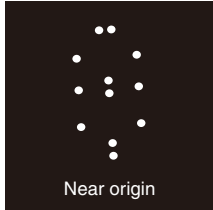
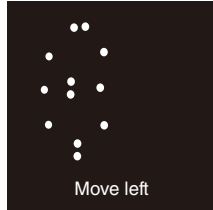
- As easy to use as calipers
- Can be used anywhere
- Can perform complicated measurement anywhere
- High-accuracy measurement by anyone

# Probe marker tracking enables high-precision measurements

## Unrestricted movement with a repeatability of $\pm 3 \mu\text{m}$

The XM Series uses a camera to capture the near-infrared light emitted from 12 different markers to ensure high-accuracy measurement.

The nearly 100 LEDs and nano-order surface processing enables a repeatability of  $\pm 3 \mu\text{m}$ .



[Probe information captured by the ultra-robust camera]  
Using the coordinate data from each marker, the machine is able to determine the position and orientation of the probe.

Free-angle probe

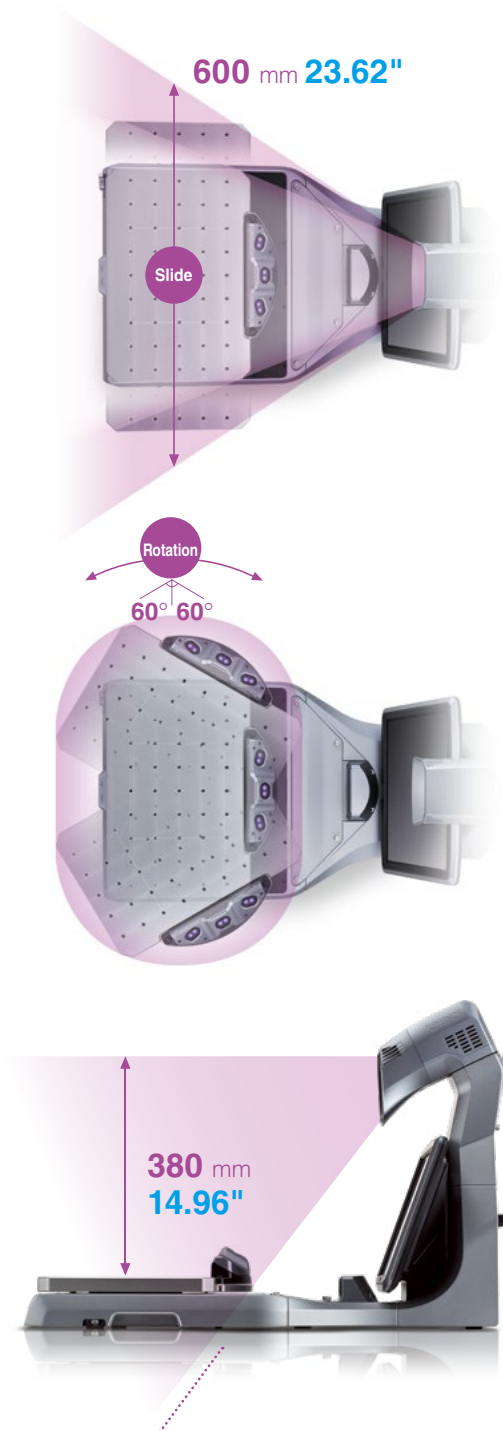
Stylus



## Wide 600 mm **23.62"** wide and 380 mm **14.96"** tall measurement area

The camera on the XM Series is tasked only with capturing the near-infrared light emitted from the markers.  
This means that, as long as the probe is within the camera's field of view, the position and orientation can be detected.

Ultra-robust camera



# Easier to use and more accurate

## Detection status confirmation LED

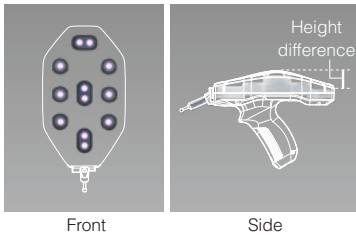


Green means you can measure

Measurement with even greater stability

## Probe marker position

KEYENCE achieved greater stability in measurement accuracy by placing the markers into three rows at three different heights along the probe.



Front

Side



Prevents measurement errors due to contact pressure

## All-in-one rigid structure

The integrated construction reduces measurement errors caused by contact pressure. The structures rigidity also makes it possible to ensure contact with the target for measurement.



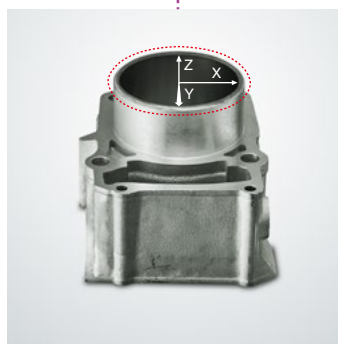
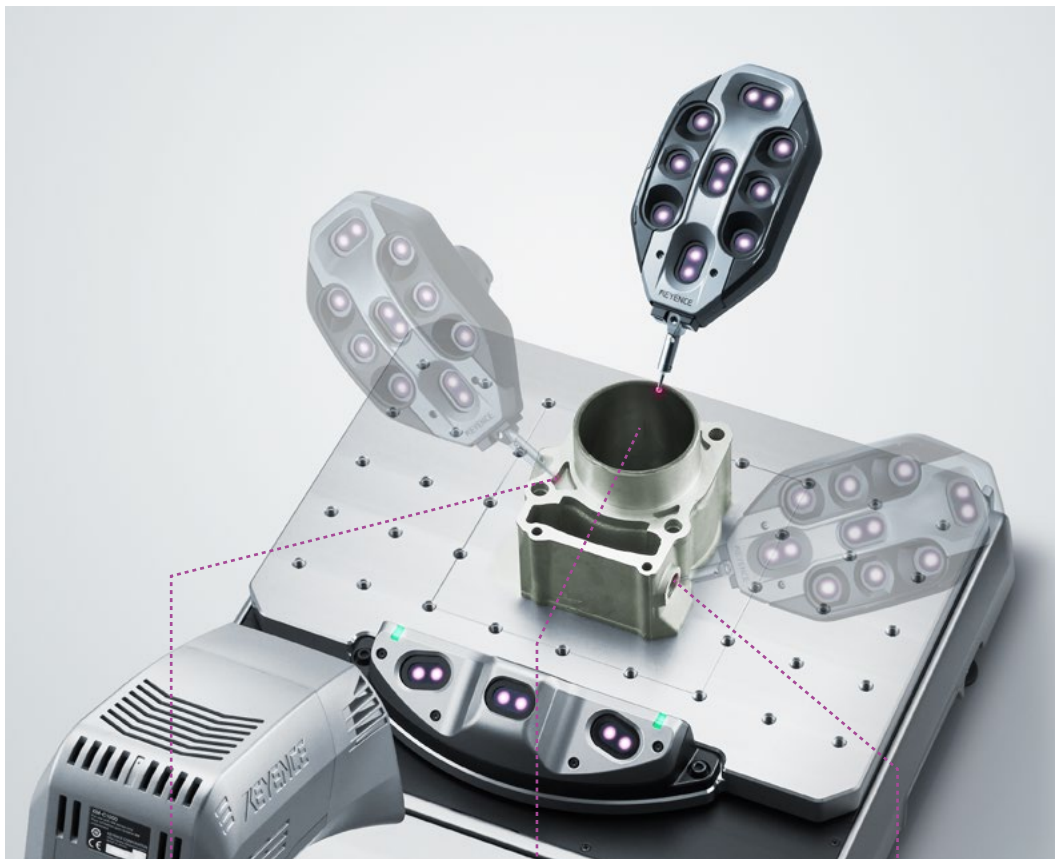
Probe design ensures optimal positioning

## Ergonomically designed grip

The probe is designed to directly face the camera when the stylus is facing directly downward for optimal detection of the infrared light emitted from the markers. Additionally, the probe itself is made of oil-resistant PBT plastic, which allows measurements to be performed in a variety of environments.

## Optical technology enables freedom of approach with touch-to-measure operability

So long as the probe is within the camera's field of view, measurement locations can be approached from any angle.



Easily approach horizontal holes without changing the position of the target being measured.

Anyone

Small probe camera

# See what you measure

The XM Series overlays the 3D image and probe-mounted camera image, simultaneously displaying measurement information right on a live image of the part.

Even users with no previous CMM experience can intuitively understand what is being measured.





## On-screen visual guidance

Anyone can measure the features the same way it was originally measured. Simply place the probe against the location displayed on the composite image.

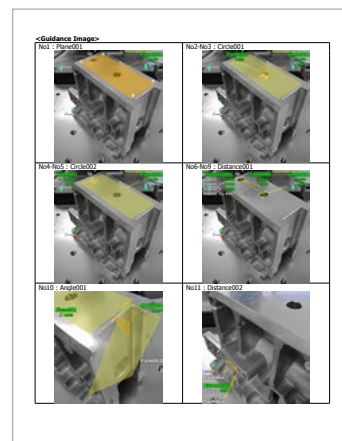
The XM Series reduces subjectivity by automatically detecting if measurements were taken correctly.



## Automatically created inspection reports with images for easy comprehension

The XM Series comes standard with a function for automatically creating inspection reports and work procedures that include camera images. Measurement points and items are laid out automatically, resulting in significant reductions in inspection report and operating instruction preparation time.

Part Report		Name					
	Measurement Date/Time	6/10/2018 11:20:53 AM					
	Lot Number						
	Serial Number	001					
	Name						
	Product Name						
	Storage Destination						
	Figure Number						
	Process						
	Measurement Device	M1702C-30 Series/3M-3000S/31103					
	Overall Result	OK					
Remarks							
-Measurement Result-							
No.	Element Name/Output Item	Meas. Value	Unit	Design Value	Upper Limit	Lower Limit	Pass
1	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
2	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
3	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
4	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
5	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
6	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
7	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
8	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
9	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
10	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK
11	Circle Distance	18.015	mm	18.000	1.000	-1.000	OK



# Minimal training time

Coordinate measuring machine interfaces are often a mess of complex and unfamiliar commands. The XM Series, however, uses images, icons, and animations to help anyone easily understand how to operate the system.

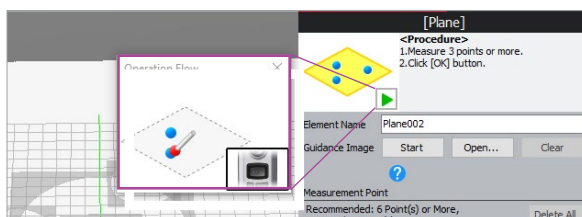
## ■ Sortable elements tree

Elements to measure can be created in the desired order directly on the tree. Intuitively correct measurements and change the order in which they are displayed.

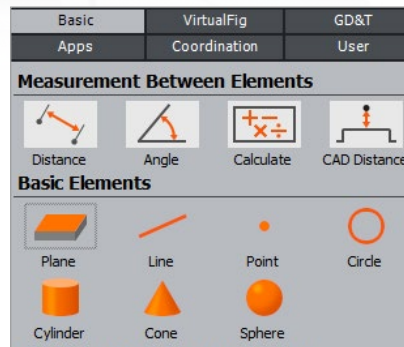


## ■ Easy-to-understand tool menu

Frequently used basic measurement elements such as planes, lines, points, circles, cylinders, cones, and spheres are consolidated into a single tab. Each tool also comes with video instructions.



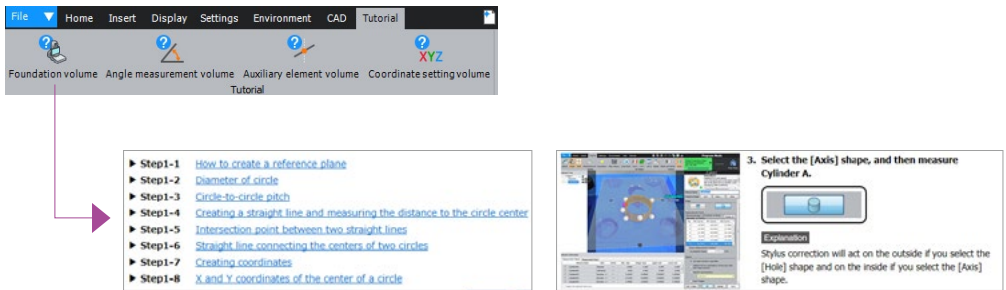
Clicking the "▶" button on the screen will bring up a window showing video instructions.



**NEW FUNCTION**

## Tutorial function

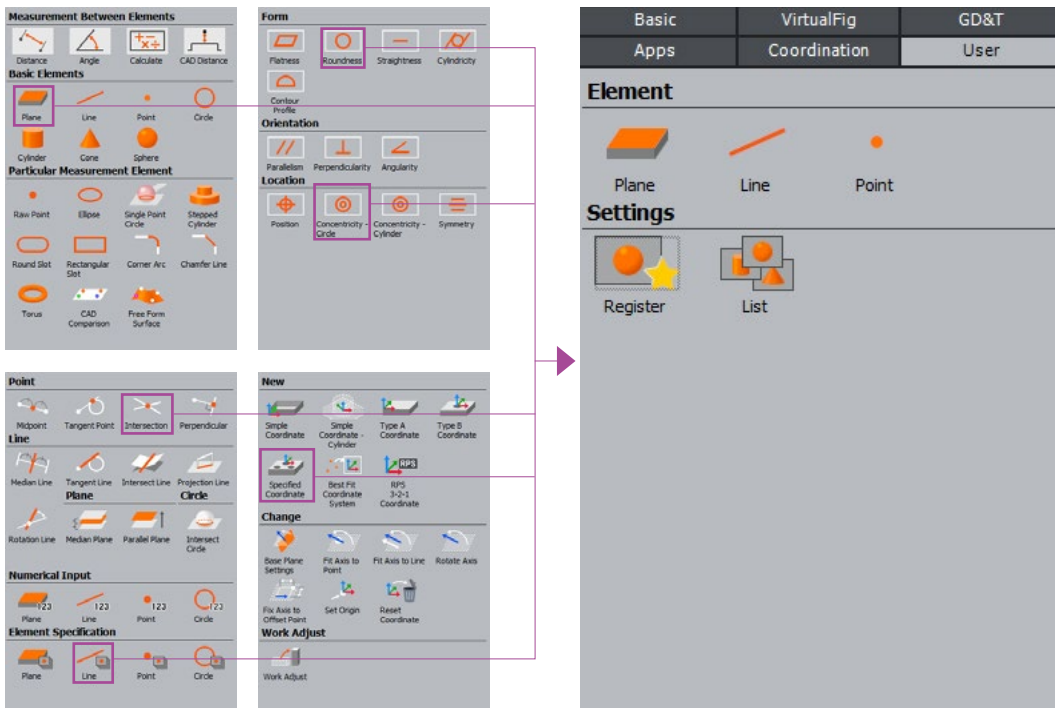
The tutorial function provides easy-to-understand measurement instructions with images. This allows even first-time users to check measurement methods without having to look at the manual.



**NEW FUNCTION**

## Customizable interface function

Register only the most frequently used measurement elements to quickly select the desired tool. This ensures smooth measurement operations even for first-time users.



Anywhere

High-accuracy 3D measurement

All-in-one design that allows for measurement in any location





**NEW FUNCTION**

## Accurate measurement even with temperature changes

The XM Series includes a temperature compensation function that ensures measurement targets are measured under the same conditions, just like a climate-controlled measuring room, even if the ambient temperature is not constant.

Simply select the current temperature and the material, and the XM Series will automatically compensate for the standard temperature dimensions.



Shop floor work in summer



Shop floor work in winter

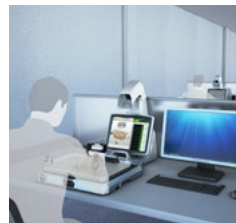


## Compact, benchtop design for shop floor measurement

Thanks to its all-in-one compact design, the XM Series fits not only next to measurement tables and machines in the workplace but also in offices. That means no more carrying parts to a quality lab to be measured, and no more waiting around on any current backlog. The XM Series can also be placed on a cart.



Shop floor work



Office work



## No need for a specialized measuring room (Operating environment: 10 to 35°C 50 to 95°F, 20 to 80% RH)

KEYENCE wanted to make a CMM that can be used anywhere. The components of the XM Series were meticulously designed and built with only the best materials.



Probe internals (quartz glass)



Unique lens and lens tube design

## Compare with 3D CAD data

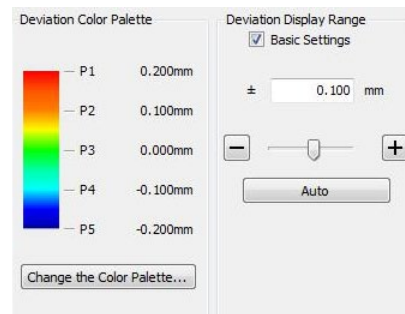
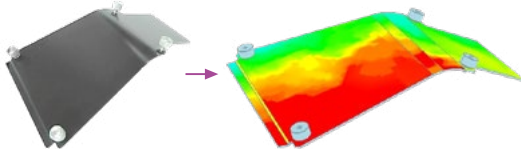
Optional accessory: **XM-H1C**

The XM Series can import 3D CAD files. To perform comparative measurement, simply place the probe against the target. The XM Series will display the differences between the part and the imported 3D CAD data. Profile GD&T measurements are also possible.



### Comparison — Color map function

Comparative measurement of parts is possible using the shapes from imported 3D CAD files. The points of difference between the target and the 3D CAD data can also be displayed as a color map.



### Profile measurement

A surface profile tool has been added to GD&T measurement elements. This tool makes it possible to measure curved surface shapes.



Contour Profile

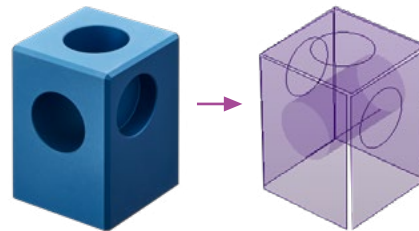
Item	OK/NG	Mes. Value
Max. Dev...	---	0.010
Min. Devi...	---	-0.020
Max. Dev...	---	0.020
Contour ...	---	0.040
Contour ...	---	0.030

# CAD data export

Measurement results can be exported as data files without any complicated operations. Simply click a button to convert the results to 3D CAD data, including STEP and IGES files. Elements projected onto a flat plane can also be output as 2D CAD data (DXF files). This feature is useful when measuring parts without drawings.

## 3D CAD export of measured elements

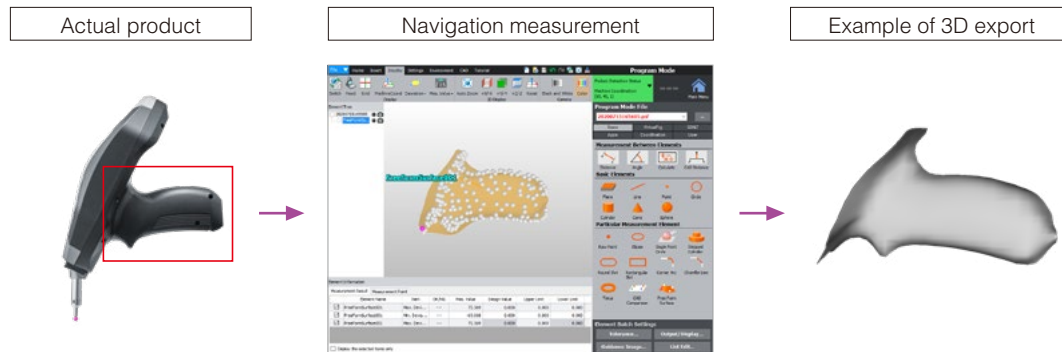
Measured elements such as planes, circles, and cylinders can be output accurately to 3D CAD files.



**NEW FUNCTION**

## 3D CAD export of free-form surfaces

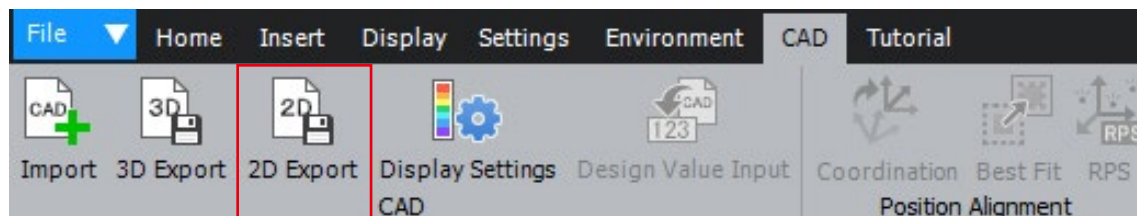
The XM Series can measure and output 3D CAD data even curved objects simply by touching the probe to the part.



**NEW FUNCTION**

## CAD export of 2D elements

Circles and straight lines projected on a flat plane and their dimensions can be output as 2D CAD data (DXF files).



## Statistical analysis function for summarizing data

Following run mode, measurement results will be saved and analyzed automatically using the system's built in SPC software.

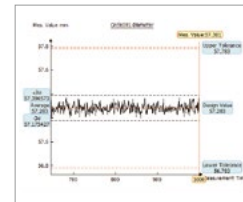
### Verification of statistics values

Key statistics values such as pass / fail count, max. value, min. value, average,  $\sigma$ ,  $3\sigma$ ,  $6\sigma$ , and Cpk for selected measurement items can be calculated automatically and displayed.

Input	Meas Item	Value
1	Max Measurement	0.0
2	Min Measurement	0.0
3	Average	0.0
4	Standard Deviation	0.0
5	Max Value	0.0000
6	Min Value	0.0000
7	Upper Tolerance	0.0000
8	Lower Tolerance	0.0000
9	Upper Spec	0.0000
10	Lower Spec	0.0000
11	Range (Max - Min)	0.0000
12	CP	0.0000
13	CPK	0.0000
14	PP	0.0000
15	PPK	0.0000
16	CPK (1.5)	0.0000
17	CPK (2)	0.0000
18	CPK (3)	0.0000
19	CPK (4)	0.0000
20	CPK (5)	0.0000
21	CPK (6)	0.0000
22	CPK (7)	0.0000
23	CPK (8)	0.0000
24	CPK (9)	0.0000
25	CPK (10)	0.0000
26	CPK (11)	0.0000
27	CPK (12)	0.0000
28	CPK (13)	0.0000
29	CPK (14)	0.0000
30	CPK (15)	0.0000
31	CPK (16)	0.0000
32	CPK (17)	0.0000
33	CPK (18)	0.0000
34	CPK (19)	0.0000
35	CPK (20)	0.0000
36	CPK (21)	0.0000
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38	CPK (23)	0.0000
39	CPK (24)	0.0000
40	CPK (25)	0.0000
41	CPK (26)	0.0000
42	CPK (27)	0.0000
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111	CPK (96)	0.0000
112	CPK (97)	0.0000
113	CPK (98)	0.0000
114	CPK (99)	0.0000
115	CPK (100)	0.0000

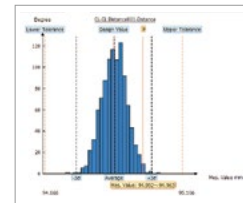
### Trend graph

With the XM Series, the trends for selected measurement items can be viewed in a graph. This allows for visualization of such trends as increased variation, upward / downward measurement trends, and periodic fluctuations.



### Histogram

The variations for each selected measurement item can be viewed in a graph. The graph, which shows the range of measurements as the horizontal axis and the frequency as the vertical axis, allows users to see whether the measurements are centering on any values in particular and how the measurements vary.



## Traceability system diagram

The reference step gauge used for inspection and calibration has been calibrated by a DAkkS accredited company for a traceability system that meets international standards.



Inspection report



Calibration certificate



## Follow up support

### Delivery

After the product arrives, your local system specialist will provide training and assist with system's implementation.



### Practice material

You can improve your proficiency by using the practice materials included with the system.



Practice material

### Technical support

Our office's employ dedicated staff who provide coordinate measuring machine support by phone or email.



## Calibration

With the XM Series, there is no need to worry about periodic calibration. Simply place the probes, camera, and stage markers in the dedicated case and send them to KEYENCE. KEYENCE will provide temporary replacement units (probes, camera, stage markers) while the original machine is being calibrated.



Dedicated case

## Simple stylus calibration

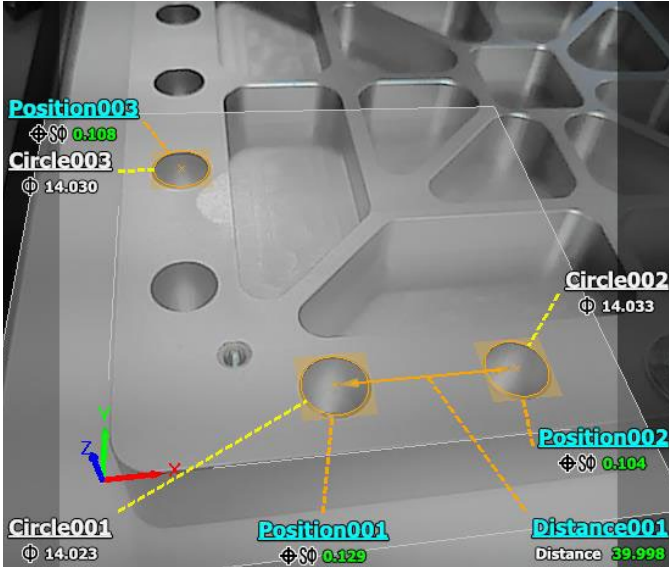
Simply place the stylus ball tip in the cone of the dedicated jig and measure at least 13 different orientations to complete calibration.



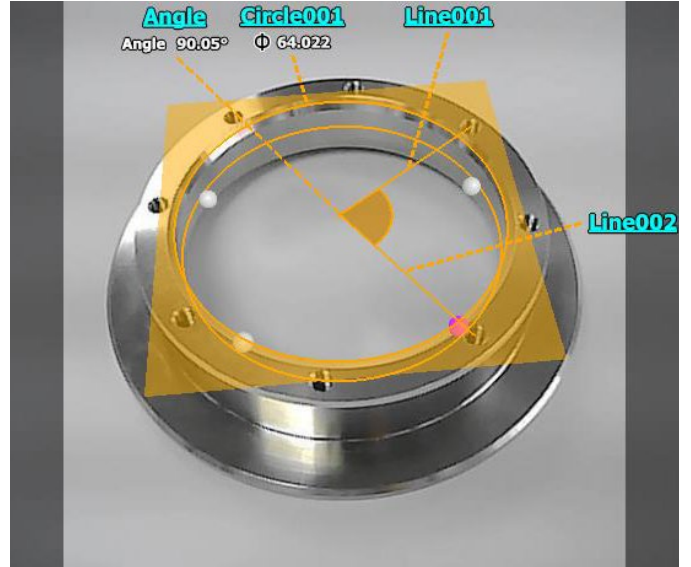
Easy calibration using the dedicated calibration jig

# Application examples

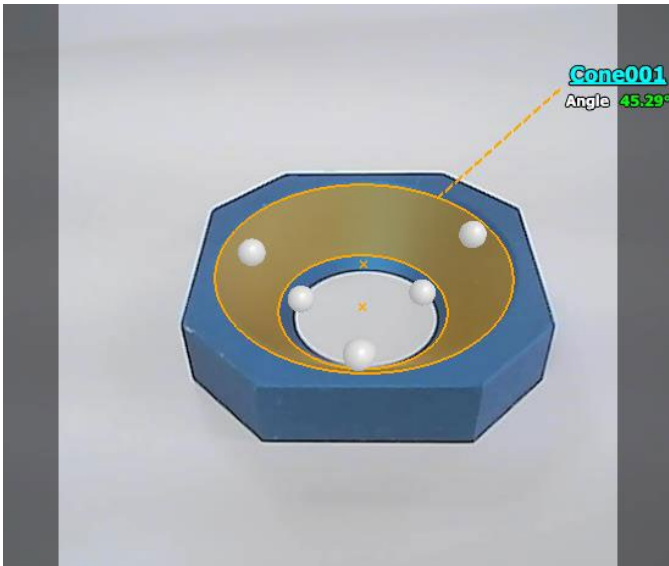
## Machined Parts



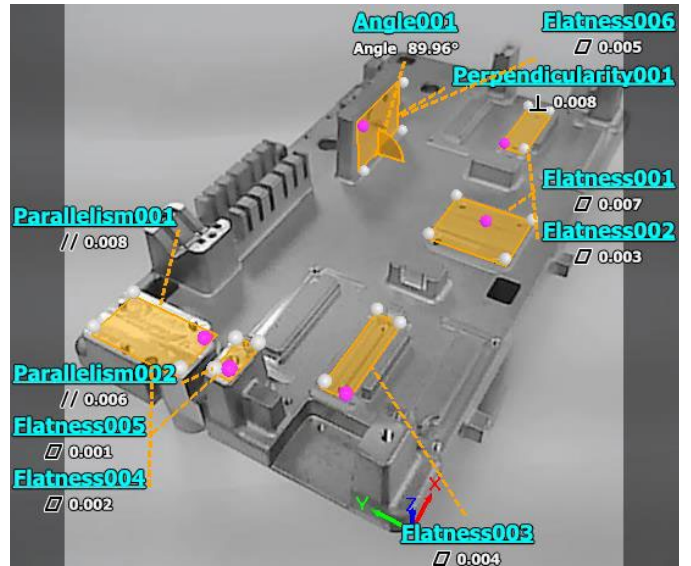
Hole distance, circularity, XY coordinates



Hole diameter, parting angle

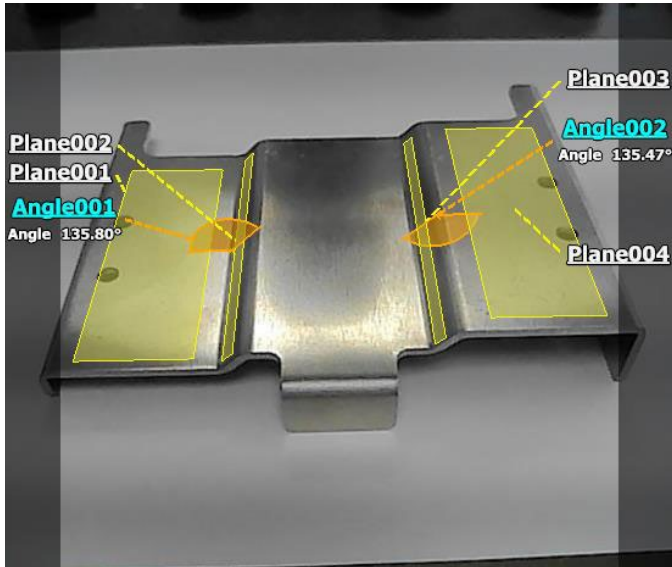


Taper

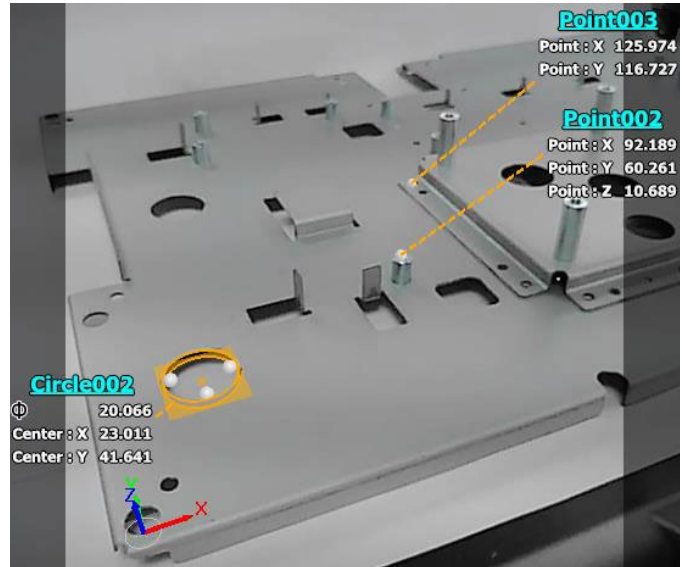


Flatness, perpendicularity, and parallelism

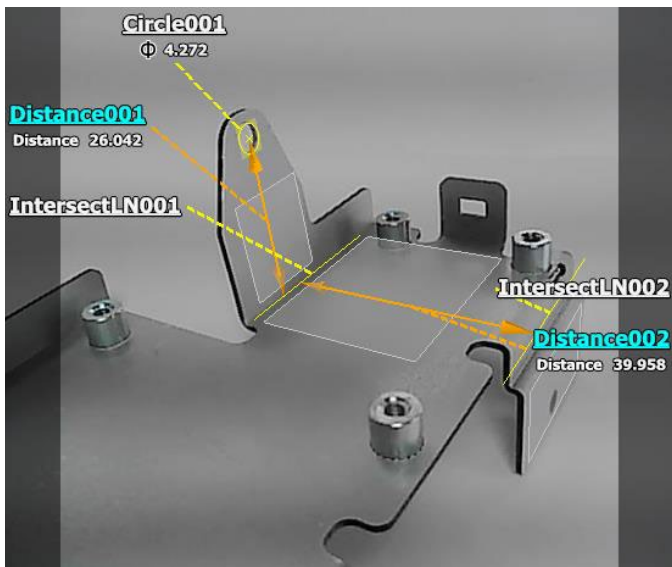
Stamped Metal Parts



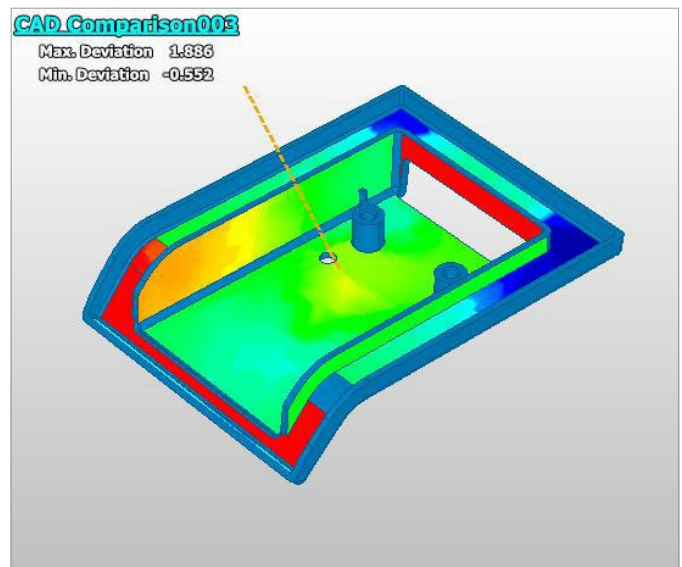
Bending angle



XYZ coordinates from origin



Distance from curved virtual line to hole center,  
distance between curved virtual lines



3D CAD comparison

## Advantages of the XM Series

A small coordinate measuring machine with the power to bring about big changes



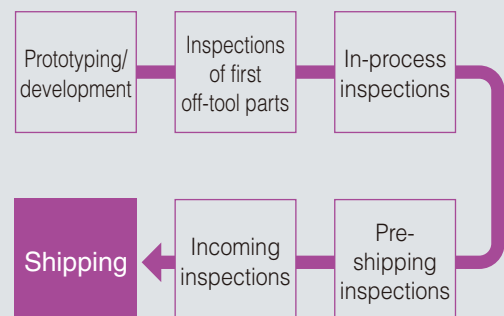
### Improving efficiency through quick and accurate inspections.

Significantly reduce inspection time by empowering any employee to measure anywhere. This allows for more time dedicated to other critical tasks, enabling shorter delivery times and overall improved work efficiency.



### Reducing costs through inspection process improvements

The ability to perform in-house inspection can help improve initial yield rates and reduce costs. Delays before shipping and inspection can also be eliminated by performing prompt inspections and quality evaluations during each process.







# System configuration

| With Xθ stage

**XM-2200/1600**

**XM-T2200/1600**



**XM-2200**  
Measuring unit  
(1 probe)

**XM-T2200**  
Measuring unit  
(2 probes)

**XM-1600**  
Controller

## | Main unit accessories



Probe  
**XM-P2000**



ø5 mm 0.20° stylus  
**OP-88421**



Stylus calibration jig  
**OP-87947**



Console  
**OP-87945**



Probe stand



Wired mouse /  
keyboard

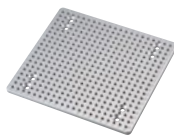
## | Optional accessories



ø2.5 mm 0.10° stylus  
**OP-88422**



Extension cable  
**OP-88186**



M6 base plate  
**OP-88080**



Sticky plate  
**OP-87946**



Auxiliary  
measurement tools  
**OP-88233**



Small-diameter stylus  
calibration jig  
**OP-88550**

Fixed stage

**XM-2000/1600**

**XM-T2000/1600**

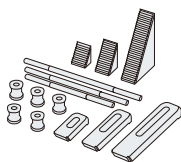
**XM-2000**  
Measuring unit  
(1 probe)

**XM-T2000**  
Measuring unit  
(2 probes)

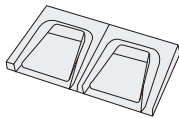
**XM-1600**  
Controller



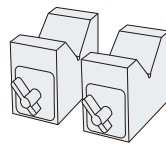
### Commercially available products



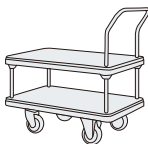
Clamps



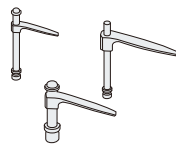
Foot switches



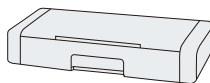
Magnetic V blocks



Cart



Tension clamps



Printer

### Interfaces

Front: USB port (2 ports)

- (1) Serial output port
- (2) DVI connector
- (3) Monitor connector
- (4) Power connector
- (5) LAN port
- (6) USB ports (4 ports on rear)
- (7) Main power switch
- (8) AC power input connector
- (9) Camera control ports (2 ports)



# Specifications

## Measuring unit

Model	Measuring unit	XM-2000	XM-T2000	XM-2200	XM-T2200
Camera	Image pickup device	4 megapixel CMOS image sensor			
	Wavelength at light-receiving center	Near-infrared			
Measuring range		300 mm × 250 mm × 150 mm	11.81' × 9.84' × 5.91'	600 mm × 300 mm × 200 mm	23.62' × 11.81' × 7.87'
Min. display unit	Distance	1 μm			
	Angle	0.0001 degrees			
Measurement accuracy	Repeatability	Stage locked	±3 μm	±3 μm	
		Stage unlocked	-	±4 μm	
	Indication error	Stage locked	±8 μm* <sup>1</sup>	±8 μm* <sup>1</sup>	
		Stage unlocked	-	± (10 + L/100) μm* <sup>2</sup>	
Stage	Withstand load	25 kg			
	X-axis movable range	-	±100 mm 3.94'		
	Rotation range	-	±60°		
Probe	No. of probes	1	2	1	2
Stage marker	No. of markers	-	6		
	Marker light source	-	Near-infrared LED (870 nm)		
Probe connection port		2 inputs			
Console input		Dedicated console			
External remote input		Non-voltage input (contact/non-contact): 2 inputs			
Display	Built-in display	15" LCD monitor (1024 × 768)			
Interfaces	Communication (external communication)	USB 2.0 Series A: 3 ports			
Environmental resistance	Ambient temperature	+10 to +35°C 50 to 95°F			
	Ambient humidity	20 to 80% RH (no condensation)			
Power supply	Power supply voltage	Supplied from controller			
	Connector type	Dedicated connector			
Weight	Head	Approx. 28.2 kg (including camera and cable)		Approx. 39.6 kg (including camera and cable)	
	Console	Approx. 150 g (including cable)			

\*<sup>1</sup> In reference to ISO 10360-2 (within the range of 200 × 200 × 150 mm 7.87' × 7.87' × 5.91' at an operating ambient temperature of 23 ±1°C 73.4 ± 33.8°F)

\*<sup>2</sup> In reference to ISO 10360-2 (within the range of 500 × 200 × 150 mm 19.69' × 7.87' × 5.91' at an operating ambient temperature of 23 ±1°C 73.4 ± 33.8°F)

## Controller

Model	Controller	XM-1600
HDD		500 GB
Interfaces	Measuring unit	Dedicated cable
	Communication (external communication)	RS-232C
		USB 2.0 Series A: 6 ports (front: 2, rear: 4)
		LAN RJ45 (10BASE-T/100BASE-TX/1000BASE-T)
Display	External output	DVI-D
Power supply		100 to 240 VAC 50/60 Hz
Power consumption		250 VA max.
Weight		Approx. 7.7 kg
Environmental resistance	Ambient temperature	+10 to +35°C 50 to 95°F
	Ambient humidity	20 to 80% RH (no condensation)

## Probe

Model	Probe	XM-P2000* <sup>3</sup>
Marker	No. of markers	12
Housing material	Marker body	Quartz glass
	Probe housing	PBT plastic
Light source		Near-infrared LED (870 nm)
Applicable stylus		M5 (Commercially available styluses can be used)
Camera		Compact CMOS image sensor
Status LED		Green: Measurement possible Red: Measurement impossible Off: Not selected
Weight		Approx. 500 g (including cable)

\*<sup>3</sup> Included with XM-2000, XM-T2000, XM-2200, and XM-T2200 models.

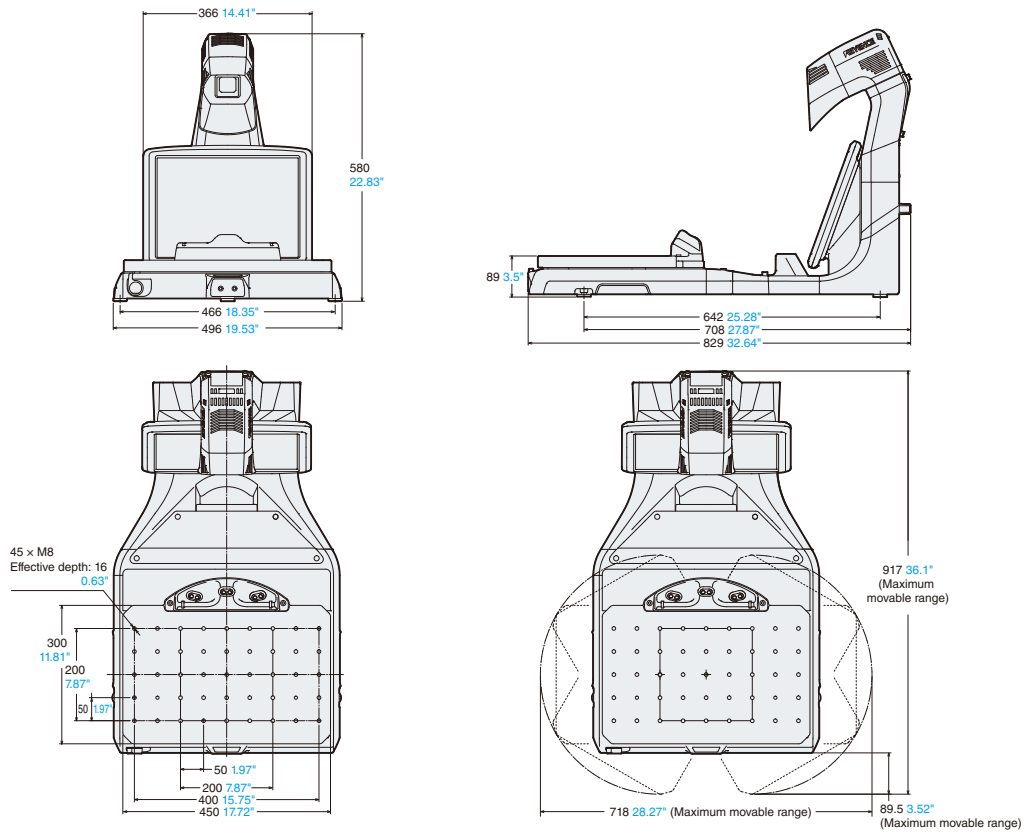


## Functions

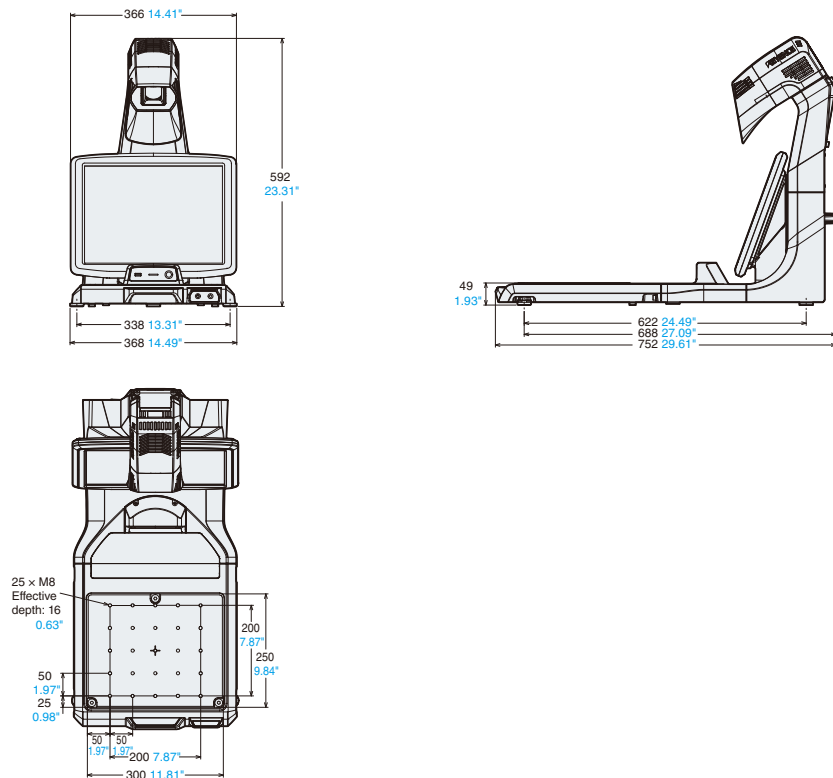
Item	Subitem	Specifications
Measuring mode		Program mode / Run mode / Statistic analysis / Single measurement
No. of configurable elements		500 (excluding comment elements)
Maximum measurement points		200 points (per element)
Basic	Measurement between elements	Distance / Angle / Calculate / CAD distance
	Basic elements	Plane / Line / Point / Circle / Cylinder / Cone / Sphere
	Particular measurement element	Raw point / Ellipse / Single Point Circle / Stepped Cylinder / Round Slot / Corner Arc / Chamfer Line / Torus / CAD Comparison / Free-Form Surface
Virtual figures	Point	Midpoint / Contact point / Intersection / Perpendicular / Numerical input / Element specification
	Line	Median line / Tangent line / Intersect line / Projection line / Rotation line / Numerical input / Element specification
	Plane	Median plane / Parallel plane / Numerical input / Element specification
	Circle	Intersect circle / Numerical input / Element specification
GD&T	Form	Flatness / Circularity / Straightness / Cylindricity / Profile
	Orientation	Parallelism / Perpendicularity / Angularity
	Location	Position / Concentricity / Coaxiality / Symmetry
Coordination	New	Simple coordinate system / Type A coordinate system / Type B coordinate system / Specified element coordinate system / RPS 3-2-1 coordinate system / Best-fit coordinate system
	Change	Base plane settings / Fit axis to point / Fit axis to line / Rotate axis / Fix axis to offset point / Set origin / Reset coordinate
	Work adjust	Work adjust
Simple measurement	Distance	Plane-to-point height / Plane-to-plane distance / Hole distance
	Angle	Dihedral angle / Edge-to-edge angle
	Diameter	Diameter / Pitch circle diameter / Lower diameter / Upper diameter
	Position	Hole position / V groove
Batch settings		Batch tolerance settings / Batch settings for output / Display Items / Guidance image batch settings / List edit
No. of measurement macro settings		100
No. of probe settings		32
Average times of measurement		1 / 2 / 4 / 8 / 16
Check measurement position		Available
Print / file output		Inspection specifications / Single object report / Single object report (with guidance image) / Screen image / Graphic display image / Probe camera image / CSV output
Import / export		Move / Copy / Delete
Other		Comment / Other measurement results

# Dimensions

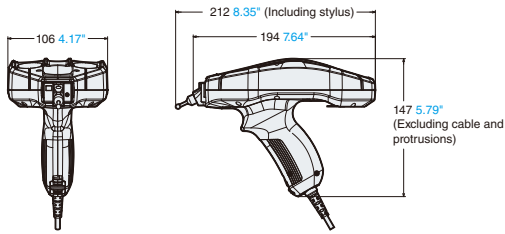
## Measuring unit XM-2200/XM-T2200



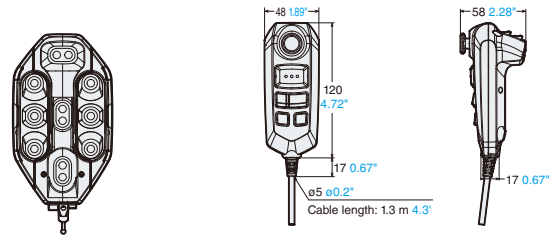
## Measuring unit XM-2000/XM-T2000



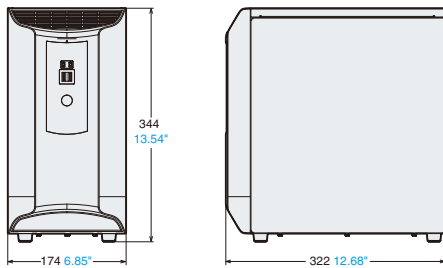
Probe **XM-P2000**



Console **OP-87945**

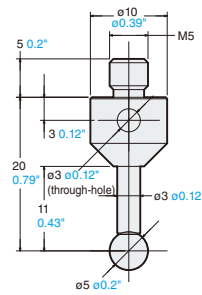


Controller **XM-1600**

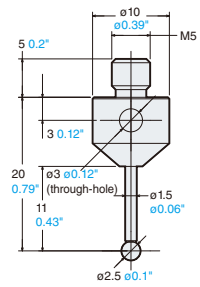


Stylus

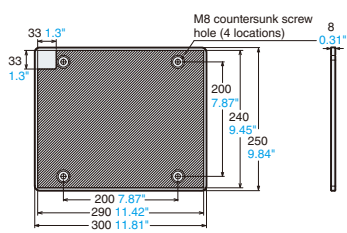
**OP-88421**



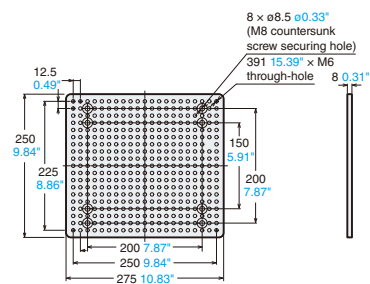
**OP-88422**



Sticky plate **OP-87946**



M6 base plate **OP-88080**





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