KineMic™
Video Inspection "KMR" Series Systems
User Manual

Starrett Kinemetric Engineering

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1. Preface

1.1 Welcome

Thank you for purchasing a KineMic™ Video Inspection System. We are pleased that your search has led you to Starrett Kinemetric Engineering, a subsidiary of the L.S. Starrett Company. This manual is intended to maximize your satisfaction with your system and ensure the most in operating performance. Feel free to contact Starrett Kinemetric Engineering at any time. We value your feedback and your satisfaction as a customer.

1.2 Safety Symbols & Terminology

The following symbols and terms are used in this manual to call attention to important safety issues. Heed these notices carefully in order to avoid personal injury or damage to the system.

Symbol or Term	Meaning
	**CAUTION:** Failure to heed the message may result in personal injury or equipment damage.
	**WARNING:** Dangerous voltage. Risk of electrical shock. Failure to observe this warning may result in equipment damage, personal injury or death.
	**WARNING:** Disconnect equipment from power source. Failure to observe this warning may result in equipment damage, personal injury or death.
	**CAUTION:** Pinch Point - Keep hands clear. Failure to observe this warning may result in minor to severe personal injury or equipment damage.
DANGER	Immediate hazard which could result in severe personal injury or death.
WARNING	Hazard or unsafe practice which could result in personal injury.
CAUTION	Hazard or unsafe practice which could result in equipment damage or minor injury.
NOTE	Information that is helpful in properly operating the equipment.

1.3 Warranty

Starrett Kinemetric Engineering (SKE) products carry a one-year warranty from date of purchase against defects in material or workmanship (parts and labor), subject to factory inspection. SKE will repair or replace, at its option, any part or parts found to be defective in material or workmanship. Starrett warrants repaired or replaced parts for the balance of the original warranty period or 90 days, whichever is longer. Parts returned to the factory under warranty will be repaired at no charge. Freight charges to the factory will be paid by the customer. Return freight charges to the customer will be paid by Starrett.

This warranty does not cover damages from such causes as abuse, accident, neglect, fire or freight damage. It does not apply to defects resulting from modifications made by the customer or improper use of the system or its components.

1.4 Regulatory Compliance

KineMic Video Inspection Systems have been designed to comply with Council Directives 2006/42/EC - Machinery and 2002/95/EC RoHS (by exemption) when installed and operated

in accordance with this manual. As of the end of 2013, the systems remained to be inspected, tested, and evaluated by an independent test laboratory.

EMC Test Standards

EN 61326-1:2013 CISPR 11:2003+A1:2004 +A2:2006	Radiated and Conducted Emissions
IEC 61000-4-2:2009	Electrostatic Discharge Immunity
IEC 61000-4-5:2006	Power Line Surge Immunity
IEC 61000-4-4:2012	Electrical Fast Transients Burst Immunity
EN 61000-4-6:2009	RF Common Mode Immunity
IEC 61000-4-3:2006 +A2:2010	Radio Frequency Immunity
IEC 61000-4-8:2010	Power Frequency Magnetic Field Immunity
IEC 61000-4-11:2004	Voltage Dips and Short Interruptions Immunity

Safety Standards

EN 60204-1:2006+A1:2009	Safety of Machinery, Electrical Equipment of Machines
EN 12100	Safety of Machinery, Principles for Risk Assessment

1.5 Environmental Considerations

KineMic metrology systems are factory calibrated under the standard laboratory environmental conditions shown below:

Specification	Requirement
Ambient Temperature	20°C ± 0.5°C (68°F ± 1°F)
Humidity	40-60% RH
Temperature rate of change	0.5°C (1°F) per hour

If the systems are to take measurements under environmental conditions that are substantially different from those shown above, the systems should be recalibrated under the expected conditions. Users should also consider the material characteristics of the parts under inspection, in particular coefficients of thermal expansion. Numerical compensation may be required when measuring parts under conditions different from those controlling the stated dimensional specifications for these parts.

1.6 Safety Considerations

General Safety 	KineMic vision metrology systems are designed for safety and proper ergonomics during normal use. Exercise caution when lifting, handling or moving the systems to maintain calibration and measurement performance. Disconnect all power sources prior to moving or working on the equipment. Consult SKE if you have any question regarding transporting, using or maintaining the systems.
Electrical Safety 	KineMic vision metrology systems do not contain hazardous AC line voltages, as these are contained on the input side of the system's AC adapters, which are UL listed. Even at these low voltages, there is the potential of electrical component damage caused by accidental short circuits. For maximum electrical safety and minimal risk to the equipment, follow the guidelines below: • Ensure that the power receptacles for the AC adapters are properly grounded 3-prong polarized 120V AC types for use in North America or appropriate safety-rated receptacles for use outside of North America. • Do not operate the systems with housings open except for service by a factory trained technician. • Keep liquids away from the systems, and do not operate the equipment in excessively humid conditions, as water can cause short circuits. • Keep metal filings away from the systems, as such debris can cause short circuits. • Do not operate the equipment around volatile or flammable solvents, as local electrical heating could cause ignition. • Disconnect power, or do not plug in the power cord, if hazardous conditions exist such as a damaged or frayed power cord, a damaged or improperly grounded power receptacle, equipment exposure to liquid spills or excessive moisture, or impact damage. Have the system inspected by authorized personnel before operating. • There are no fuses or user-serviceable items in the systems. System should only be opened by a factory-trained service technician.

1.7 Disclaimer of Liabilities

The L.S. Starrett Company shall have no liability or responsibility to the customer or any other person or entity with respect to any liability, loss or damage caused or alleged to be caused directly or indirectly by this documentation, or the hardware and software described in it. This includes, but is not limited to, any interruption of service, loss of business or anticipatory profits, or consequential damages resulting from the use or operation of hardware or equipment.

1.8 Copyright & Trademark Information

2. KineMic Product Line Overview

SKE's KineMic video microscopes are a family of seven modular, versatile and affordable inspection and vision metrology systems. These are intended for receiving inspection, quality assurance, training, manufacturing assembly, research, and documentation – wherever easy setup and a range of magnifications are required. Each of the systems is described in a separate section of this manual. The seven systems are summarized below:

2.1 KineMic Zoom XGA Basic, P/N KMR-XGA

This a basic video microscope inspection system, where the part to be inspected is placed on an illuminated base, and a highly magnified image of the part is rendered on a 19" video monitor using a color XGA video camera and 6.5:1 magnifying zoom optics. No need to squint into a microscope eyepiece. The video camera is connected directly to the monitor – no need for a computer or programming. An optional boom stand can provide a stable mount for hard-to-reach places.

2.2 KineMic Zoom with D1 Software, P/N KMR-D1

This affordable and very easy to use computer-based video inspection system features 6.5:1 magnifying zoom optics with six detents and a 21.5" all-in-one touch-screen PC with MetLogix D1 software. This Windows based software allows image markup and archiving on disk, as well as printout and emailing. It also provides basic measurement capabilities for points, lines, circles, angles and distances. To make measurements, crosshairs are positioned manually on the screen by using a mouse or pressing the computer touch-screen directly.

2.3 KineMic Zoom XGA with 50 mm Micrometer Stage, P/N KMR-50-XGA

This is a video toolmaker's microscope which combines the XGA video camera and 6.5:1 magnifying zoom optics of the XGA basic model with a 50 x 50 mm (2" x 2") X-Y stage with X and Y micrometers. The micrometers move the stage in the X and Y directions and also display the stage position digitally with a resolution of 0.001 mm or 0.00005". Accurate measurements are taken as the magnified image is moved under crosshairs generated by the camera. Pushbuttons select mm or inches, zero the display, and can add a zero point offset if desired. The XGA camera is connected directly to the monitor – no need for a computer or programming. The measurement of small parts has never been easier or more direct.

2.4 KineMic with 50 mm Micrometer Stage & D1 Software, P/N KMR-50-D1

In this affordable yet versatile video inspection system, X and Y micrometers move a 50 x 50 mm (2” x 2”) stage in the X and Y directions and also display the stage position digitally with a resolution of 0.001 mm or 0.00005”. Additional capabilities are provided by a 21.5” all-in-one touch-screen PC with MetLogix D1 software. This software allows image markup and archiving on disk, as well as printout and emailing. It also provides basic measurement capabilities within the field of view for points, lines, circles, angles and distances. To make measurements, crosshairs are positioned manually on the screen by using a mouse or pressing the computer touch-screen directly.

2.5 KineMic Zoom with 200 mm Encoder Stage & M3 Software, P/N KMR-200-M3

This powerful yet affordable vision metrology system features 6.5:1 magnifying zoom optics with six detents, a manual 100 x 200 mm (4” x 8”) X-Y stage with digital encoders, a 21.5” all-in-one touch-screen PC, and MetLogix M3 vision metrology software. System features include video edge detection, computer controlled LED lighting, field-of-view (FOV) measurements, 2D geometric functions, tolerancing, image archiving, and data import/export under Windows® 7 Professional. FOV measurements are seamlessly integrated with stage motion to measure parts up to 200 mm (8”). These capabilities are normally only found in larger, more expensive vision metrology systems.

2.6 KineMic Zoom FOV with M3 Software, P/N KMR-ZFOV-M3

This vision metrology system features 6.5:1 magnifying zoom optics with six detents, a 21.5” all-in-one touch-screen PC, and MetLogix M3 vision metrology software. It is ideal for high-speed electronic measurements of small part parts that fit within the field of view (FOV) of the camera, which can range from 1.4 to 9 mm in the X direction depending on the zoom setting. Optical non-linearity errors are mapped at the factory and are corrected in software for each zoom detent position. The M3 software is also great for image archiving and annotation. The result is an accurate and versatile FOV zoom metrology microscope for different magnifications and fields of view.

2.7 KineMic Telecentric FOV with M3 Software, P/N KMR-TFOV-M3

No other optics can match the accuracy and freedom from optical distortion of telecentric lenses, where the light from the object stays parallel to the optical axis across the entire field of view. KineMic M3 FOV Telecentric models are available with a choice of six fixed-focus telecentric lenses for fields of view ranging from 1.8 mm to 24 mm in the X direction. System components include a 21.5” all-in-one touch-screen PC and MetLogix M3 vision metrology software – but no X-Y stage. These simple yet high performance metrology systems are ideal for high accuracy, high throughput measurements of small parts, with automatic comparison to CAD files and electronic record keeping.

3. System Specifications

Product Feature	**KineMic XGA Zoom Basic** KMR-XGA	**KineMic XGA Zoom 2x2 Stage** KMR-50-XGA	**KineMic D1 Zoom 2x2 Stage** KMR-50-D1	**KineMic M3 Zoom 4x8 Stage** KMR-200-M3	**KineMic D1 Zoom FOV** KMR-ZFOV-D1	**KineMic M3 Zoom FOV** KMR-ZFOV-M3	**KineMic M3 Telecentric FOV** KMR-TFOV-M3
Optics	6.5:1 zoom	6.5:1 zoom	6.5:1 zoom	6.5:1 zoom	6.5:1 zoom	6.5:1 zoom	6 telecentric lenses
CCD sensor	0.83 MPixel	0.83 MPixel	1.33 MPixel	1.33 MPixel	1.33 MPixel	1.33 MPixel	2.02 MPixel
Camera interface	VGA cable	VGA cable	USB cable	USB cable	USB cable	USB cable	USB cable
Computer	N/A	N/A	All-in-one PC	All-in-one PC	All-in-one PC	All-in-one PC	All-in-one PC
Software	N/A	N/A	MetLogix D1	MetLogix M3	MetLogix D1	MetLogix M3	MetLogix M3
Video screen	19" XGA monitor	19" XGA monitor	21.5" all-in-one PC	21.5" all-in-one PC	21.5" all-in-one PC	21.5" all-in-one PC	21.5" all-in-one PC
Screen resolution	1024 x 768	1024 x 768	1920 x 1080	1920 x 1080	1920 x 1080	1920 x 1080	1920 x 1080
Lens magnification	0.7X to 4.5X	0.7X to 4.5X	0.7X to 4.5X	0.7X to 4.5X	0.7X to 4.5X	0.7X to 4.5X	.30X,.50X,.80X, 1.0X,2.0X,4.0X
Screen magnification	31X to 200X	31X to 200X	31X to 200X	31X to 200X	31X to 200X	31X to 200X	13X to 178X
Auxiliary lenses	0.5, 0.75, 1.5, 2X	0.5, 0.75, 1.5, 2X	0.5, 0.75, 1.5, 2X	0.5, 0.75, 1.5, 2X	0.5, 0.75, 1.5, 2X	0.5, 0.75, 1.5, 2X	N/A
Field of view (along X-axis)	1.4 to 9.0 mm	1.4 to 9.0 mm	1.4 to 9.0 mm	1.4 to 9.0 mm	1.4 to 9.0 mm	1.4 to 9.0 mm	1.8 to 24 mm
X-Y stage motion	None	50 x 50 mm	50 x 50 mm	200 x 100 mm	None	None	None
Metrology means	None	Micrometers	D1 software**	X&Y encoders	D1 software**	M3 FOV software	M3 FOV software
Measurement resolution	N/A	1 µm (0.00005")	1 µm (0.00005")	0.5 µm (0.00002")	Up to 2 µm*	Up to 2 µm*	Up to 2 µm*
Measurement accuracy	N/A	3 µm per 25 mm	3 µm per 25 mm	2.5 µm + 5L/1000	Up to ±2.5 µm*	Up to ±2.5 µm*	Up to ±2.5 µm*
Basic stand	Std	Std	Std	Std	Std	Std	Std
Boom stand	Optional	N/A	N/A	N/A	Optional	Optional	N/A
LED back light	Std	Std	Std	Std	Std	Std	Std
LED ring light	Std	Std	Std	Std	Std	Std	Std
Lighting control	Via adjustment knobs	Via adjustment knobs	Via adjustment knobs	Via M3 software	Via adjustment knobs	Via M3 software	Via M3 software
Power consumpt.	W	W	W	W	W	W	W

Applications

Video inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dimensioning	No	Manual	Manual	VED	Manual	VED	VED
Geometric constructs	No	No	Yes	Yes	Yes	Yes	Yes
Image annotation	No	No	Yes	Yes	Yes	Yes	Yes
Image archiving	No	No	Yes	Yes	Yes	Yes	Yes

* These are best values. Actual values will depend on the zoom lens setting or the selected telecentric lens.

** Measurements with D1 software are made by manually positioning a crosshair on the screen.

Disclaimer: Due to continual product improvements, specifications may change without notice.

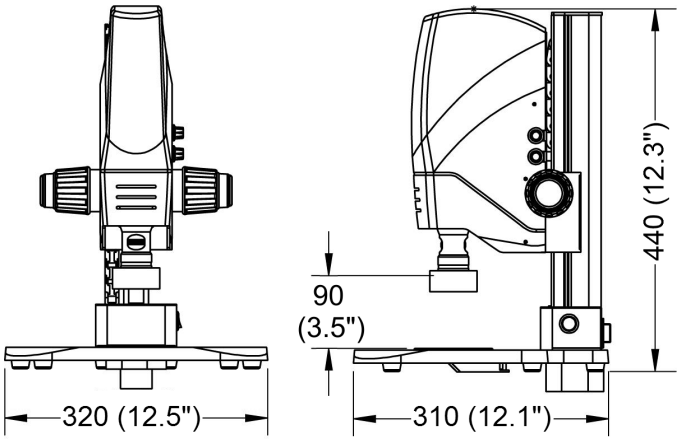
4. Product Details by Model

4.1 KineMic XGA Zoom Basic, P/N KMR-XGA

4.1.1 System Description

The KineMic XGA Zoom Basic is a microscope inspection system where the part to be inspected is placed on a base, and a highly magnified image of the part shows on a 19” video monitor using a color XGA video camera and 6.5:1 magnifying zoom optics. No need to squint into a microscope eyepiece. The video camera is connected directly to the monitor – no need for a computer or programming. Intensities of an LED top ring light and an LED backlight in the base are controlled by two knobs. An optional boom stand provides a stable mount for hard-to-reach places.

4.1.2 Metrology Unit Dimensions



Brightness adjustment knobs (top) and height adjustment knobs (bottom)

Knurled rotary control for zoom adjustment

4.1.3 Getting Started

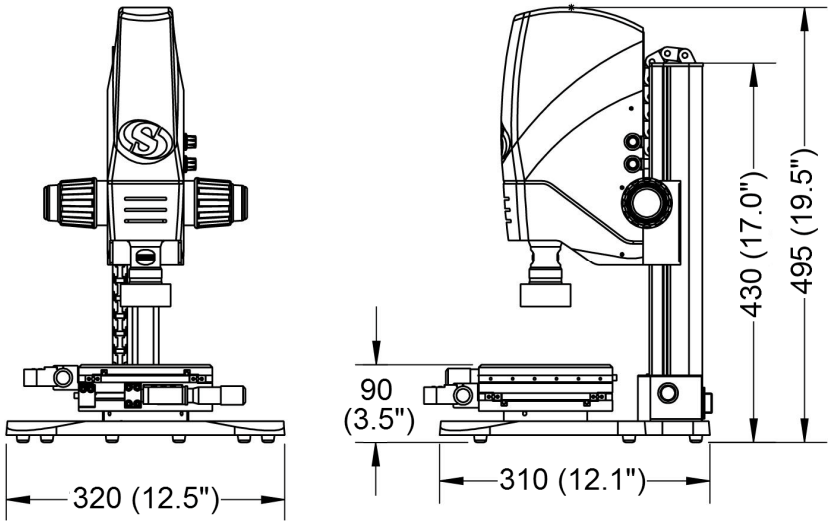
- Unpack the two boxes which contain the microscope unit and XGA monitor.
- Place the microscope unit and XGA monitor on a desktop or workbench. Provide a minimum width of 75 cm (30”) for the video monitor and microscope unit, and a minimum depth of 45 cm (18”). Additional work space to place parts and paperwork is recommended. Orient the monitor so that it does not face a bright light source, which would cause glare. A clean and dust-free environment is recommended to maintain cleanliness of the zoom mechanism and optical surfaces.
- Connect the microscope unit and XGA monitor via the supplied VGA cable. Plug the microscope unit and XGA monitor into an AC power outlet, and turn on both units. A highly magnified image of an object placed on the base will appear on the monitor screen.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment. Focusing is most sensitive at the highest magnification.
- Set top and bottom illumination using the two small knobs above the height adjustment knobs. The best illumination is where image detail is not lost in overly dark areas and is not washed out in overly bright areas.
- Set magnification by turning the knurled adjustment in front of the zoom optics. With parfocal zoom optics as used by KineMic, the image will stay in focus regardless of magnification. You may wish to set focus at highest magnification, then reduce magnification and increase the field of view.

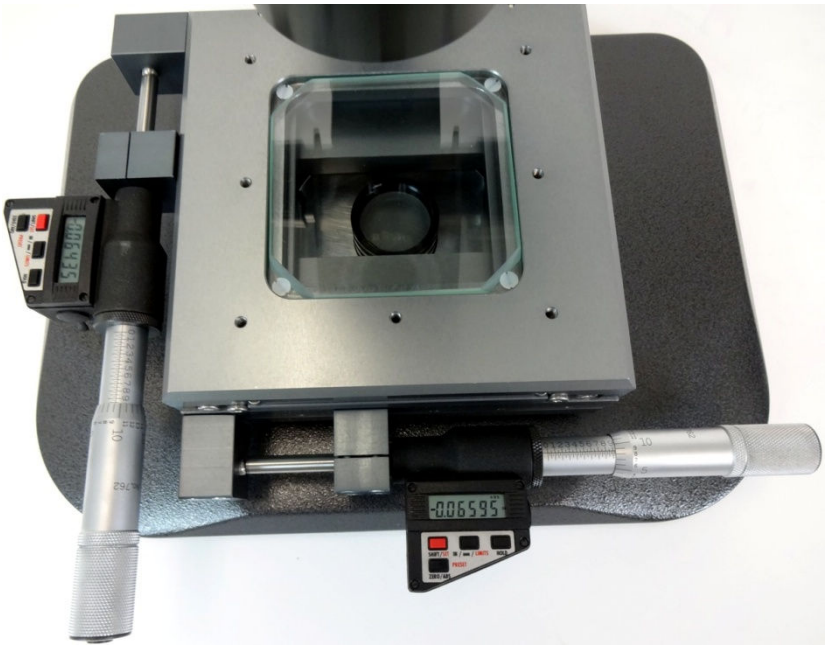
4.2 KineMic XGA Zoom, 50 mm Stage, P/N KMR-50-XGA

4.2.1 System Description

This is a video toolmaker's microscope which combines the XGA video camera and 6.5:1 magnifying zoom optics of the XGA Basic model with a 50 x 50 mm (2" x 2") X-Y stage with X and Y micrometers. The micrometers move the stage in the X and Y directions and also display the stage position digitally with a resolution of 0.001 mm or 0.00005". Accurate measurements are taken as the magnified image is moved under crosshairs generated by the camera. Push-buttons select mm or inches, zero the display, and can add a zero point offset. Intensities of the system's LED top ring light and LED backlight in the base are controlled by two knobs. The measurement of small parts has never been easier or more direct.

4.2.2 Metrology Unit Dimensions





Micrometer interface

4.2.3 Getting Started

- Unpack the two boxes which contain the microscope unit and XGA monitor.
- Remove any red shipping tabs that have been installed to protect the X-Y stage for shipment.
- Refer to the Getting Started of the previously described KineMic XGA Zoom Basic for system placement, electrical connections, focus control, lighting control, and zoom control.
- Familiarize yourself with the X-Y stage and its digital micrometer controls. Please refer to the separate manual which is shipped with Starrett 762 Mic Head. Highlights are as follows:
  - The micrometer display will go blank after 30 minutes of no spindle movement. Any movement of the spindle will activate the display with no loss of position reading.
  - One push of the HOLD button will freeze the display and the word HOLD will appear. A second push will update the display to the current position reading.
  - One push of the SHIFT/SET button changes the function of this button to SET, changes the function of the ZERO/ABS button to PRESET, and changes the function of the IN/mm button to LIMITS.
  - One short push (less than 1 sec) of this button zeroes the display at any point, thereby providing an incremental mode. A long push (more than 1 sec) returns the display to the original absolute reading mode, and the word ABS will appear.
  - The PRESET button allows a starting value other than 0 to be entered. Please refer to the separate 762 Mic Head manual.
  - In normal mode, one push of the IN/mm/LIMITS button changes readings from inches to millimeters and back. In the LIMITS mode, as selected by the SHIFT/SET button, minimum and maximum tolerance limits can be entered. Please refer to the separate 762 Mic Head manual.

4.2.4 Micrometer Battery Replacement

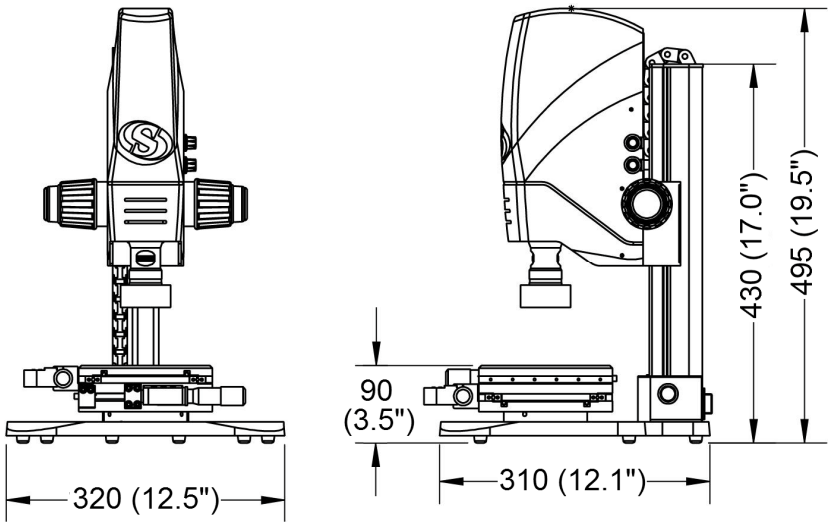
If a micrometer display loses its contrast, this is a sign of the micrometer battery getting weak. Remove the old battery from each micrometer and install a new one with the + side down, as marked on the cover of the battery compartment. Use a CR2450 button cell 3V lithium battery. Batteries can be obtained from Starrett by ordering PT61120.

4.3 KineMic D1 Zoom, 50 mm Stage, P/N KMR-50-D1

4.3.1 System Description

As in the KineMic XGA Zoom system, X and Y micrometers move a 50 x 50 mm (2” x 2”) stage in the X and Y directions and also display the stage position digitally with a resolution of 0.001 mm or 0.00005”. Additional capabilities are provided by a 21.5” all-in-one touch-screen PC with MetLogix D1 software. This software allows image markup and archiving on disk, as well as printout and emailing. It also provides basic video measurement capabilities within the field of view for points, lines, circles, angles and distances. To make measurements, crosshairs are positioned manually on the screen by using a mouse or by pressing the computer touch-screen directly. With this KineMic system, operators can measure dimensions up to 50 mm (2”) using the system’s micrometers, or make more complex measurements on small features within the field of view using by the crosshairs and the system’s D1 software.

4.3.2 Metrology Unit Dimensions



Micrometer control interface

4.3.3 Getting Started

- Unpack the two boxes which contain the microscope unit and all-in-one PC.
- Place both units on the intended desktop or benchtop.
- Remove any red shipping tabs that have been installed to protect the X-Y stage for shipment.
- Connect the microscope unit and all-in-one PC via the supplied USB cable. Plug the microscope unit and all-in-one PC in an AC power outlet, and turn on both units.
- Launch MetLogix D1 software by clicking on the “Run D1” shortcut on the computer desktop, and a highly magnified image of an object placed on the base will appear on the computer screen. Please refer to the supplied D1 software manual on the use and capabilities of D1 software.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment. Focusing is most sensitive at the highest magnification.
- Set top and bottom illumination with the two small knobs above the height adjustment knobs. The best illumination is where image detail is not lost in overly dark areas and is not washed out in overly bright areas.
- Set magnification by turning the knurled adjustment in front of the zoom optics to any of its six detent positions. With parfocal zoom optics as used by KineMic, the image will stay in focus regardless of magnification. You may wish to set focus at highest magnification, then reduce magnification and increase the field of view.
- Use the system’s micrometers to take measurements over the 50 x 50 mm (2 x 2”) travel range of the X-Y stage.
- Use D1 software for geometrical constructs and measurements within the field of view, also for image annotation and archiving. Note that the system is calibrated for all six zoom detent positions, which can be selected via a pull-down menu. Please refer to the D1 software manual.

4.3.4 Micrometer Battery Replacement

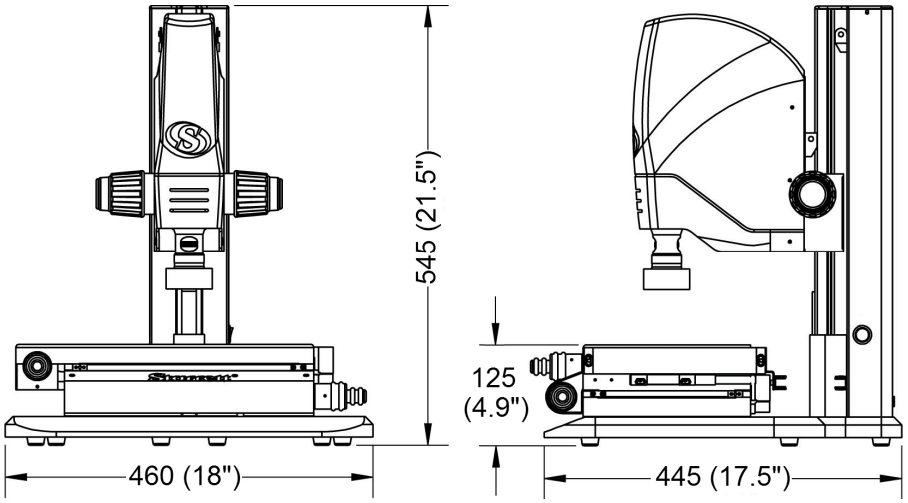
If a micrometer display loses its contrast, this is a sign of the micrometer battery getting weak. Remove the old battery from each micrometer and install a new one with the + side down, as marked on the cover of the battery compartment. Use a CR2450 3V button cell lithium battery. Batteries can be obtained from Starrett by ordering PT61120.

4.4 KineMic M3 Zoom, 200 mm Encoder Stage, P/N KMR-200-M3

4.4.1 System Description

This powerful yet affordable vision metrology system provides 6.5:1 magnifying zoom optics with six detents, a manual 100 x 200 mm (4” x 8”) X-Y stage with digital encoders, a 21.5” all-in-one touch-screen PC, and MetLogix M3 vision metrology software. Metrology features include video edge detection, computer controlled LED lighting, field-of-view (FOV) measurements, 2D geometric functions, tolerancing, image archiving, and data import/export under Windows 7 Professional. FOV measurements are seamlessly integrated with stage motion to measure parts up to 200 mm (8”). These capabilities are normally only found in larger, more expensive vision metrology systems.

4.4.2 Metrology Unit Dimensions



200 x 100 mm (8” x 4”) encoder stage with X and Y handwheels

4.4.3 Getting Started

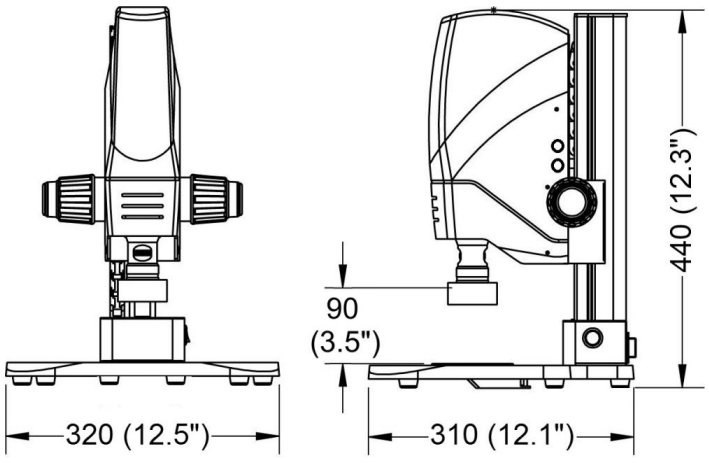
- KineMic KMR-200-M3 systems are shipped in a single wooden crate. Use a power screwdriver to remove 8 Phillips screws from the lid and 6 Phillips screws from the front side. The 14 screw locations are marked in red. Remove the lid and front side of the crate, then carefully remove the contents of the crate from the open side. For photos, please see the Unpacking & Installation section of this manual.
- Place the metrology unit and all-in-one PC on the intended benchtop or desktop.
- Remove any red shipping tabs that have been installed to protect the X-Y stage for shipment.
- Connect the metrology unit to all-in-one PC via two supplied USB cables. One is for the camera signal, the other for data. Either set of USB ports can be used for either function.
- Plug the metrology unit and all-in-one PC into a power outlet, and turn on both units.
- Launch MetLogix M3 software by clicking on the “Run M3” shortcut on the computer desktop, and a highly magnified image of an object placed on the base will appear on the monitor screen. Please refer to the supplied M3 software manual on the use and extensive capabilities of M3 software.
- Move the stage in the X and Y directions by using handwheels. Use the smaller handwheels for fast motion, the larger handwheels for fine control.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment. Focusing is most sensitive at the highest magnification.
- Set magnification by turning the knurled adjustment in front of the zoom optics to one of its six detent positions. With parfocal zoom optics as used by KineMic, the image will stay in focus regardless of magnification. You may wish to set focus at highest magnification, then reduce magnification and increase the field of view. Note that the system is calibrated for all six zoom detent positions, which can be selected via a pull-down menu. Please refer to the M3 software manual.
- With M3 software, top and bottom illumination are adjusted via sliders on the computer screen. Illumination settings can also be saved and be recalled under program control for more repeatable video edge detection.

4.5 KineMic D1 Zoom FOV, P/N KMR-ZFOV-D1

4.5.1 System Description

This vision metrology system features 6.5:1 magnifying zoom optics with six detents, a 21.5” all-in-one touch-screen PC, and MetLogix M3 vision metrology software. It is ideal for high-speed electronic measurements of small part parts that fit within the field of view (FOV) of the camera, which can range from 1.4 to 9 mm in the X direction depending on the zoom setting. Optical non-linearity errors are mapped at the factory and are corrected in software for each zoom detent position. The M3 software is also suitable for image archiving and annotation. The result is an accurate and versatile FOV zoom metrology microscope for different magnifications and fields of view.

4.5.2 Metrology Unit Dimensions



LED top illumination, controlled by knob at top of photo.

4.5.3 Getting Started

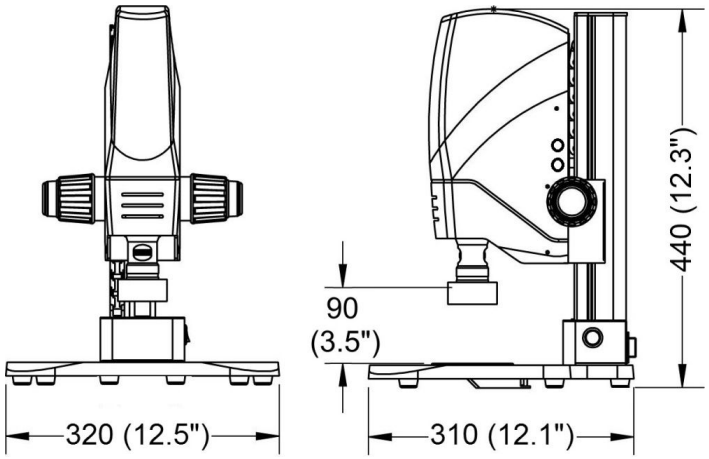
- Unpack the two cartons which contain the metrology unit and all-in-one PC.
- Place both units on the intended desktop or benchtop.
- Connect the microscope unit and all-in-one PC via the supplied USB cable. Plug the metrology unit and all-in-one PC into an AC power outlet, and turn on both units.
- Launch MetLogix D1 software by clicking on the “Run D1” shortcut on the computer desktop, and a highly magnified image of an object placed on the base will appear on the computer screen. Please refer to the supplied D1 software manual on the use and capabilities of D1 software.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment. Focusing is most sensitive at the highest magnification.
- Set top and bottom illumination with the two small knobs above the height adjustment knobs. The best illumination is where image detail is not lost in overly dark areas and is not washed out in overly bright areas.
- Set magnification by turning the knurled adjustment in front of the zoom optics to any of its six detent positions. With parfocal zoom optics as used by KineMic, the image will stay in focus regardless of magnification. You may wish to set focus at highest magnification, then reduce magnification and increase the field of view.
- Use the computer mouse or press directly on the computer screen to position crosshairs for measurement.
- Use D1 software for geometrical constructs and make measurements within the field of view, also for image annotation and archiving. Note that the system is calibrated for all six zoom detent positions, which can be selected via a pull-down menu. Please refer to the D1 software manual.

4.6 KineMic M3 Zoom FOV, P/N KMR-ZFOV-M3

4.6.1 System Description

This vision metrology system provides 6.5:1 magnifying zoom optics with six detents, a 21.5” all-in-one touch-screen PC, and MetLogix M3 vision metrology software – but no X-Y stage. It is ideal for high-speed electronic measurements of small parts that fit within the field of view (FOV) of the camera, which can range from 1.4 to 9 mm in the X direction depending on the zoom setting. Optical non-linearity errors are mapped at the factory and are corrected in software for each zoom detent position. The M3 software is also great for image archiving and annotation. The result is an accurate and versatile FOV zoom metrology microscope for measurement of small parts.

4.6.2 Metrology Unit Dimensions



4.6.3 Getting Started

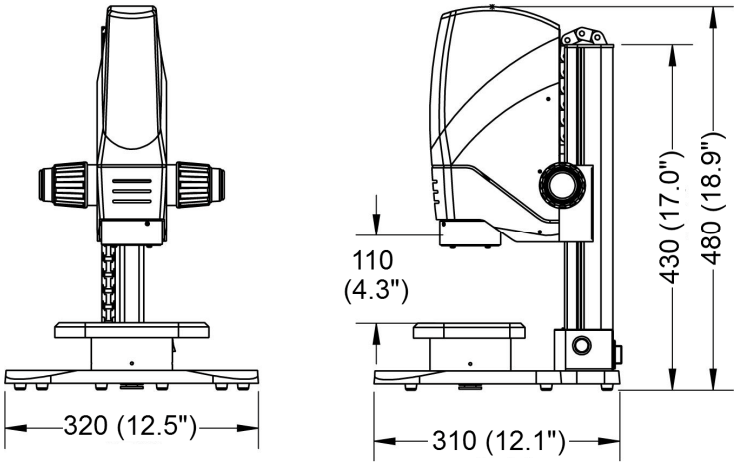
- Unpack the two cartons which contain the metrology unit and all-in-one PC.
- Place both units on the intended desktop or benchtop.
- Connect the metrology unit to the all-in-one PC via two supplied USB cables. One is for the camera signal, the other for data. Either set of USB ports can be used for either function.
- Plug the metrology unit and all-in-one PC into a power outlet, and turn on both units.
- Launch MetLogix M3 software by clicking on the “Run M3” shortcut on the computer desktop, and a highly magnified image of an object placed on the base will appear on the monitor screen. Please refer to the supplied M3 software manual on the use and extensive capabilities of M3 software.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment. Focusing is most sensitive at the highest magnification.
- Set magnification by turning the knurled adjustment in front of the zoom optics to one of its six detent positions. With parfocal zoom optics as used by KineMic, the image will stay in focus regardless of magnification. You may wish to set focus at highest magnification, then reduce magnification and increase the field of view. Note that the system is calibrated for all six zoom detent positions, which can be selected via a pull-down menu. Please refer to the M3 software manual.
- Set top and bottom illumination under computer control via sliders on the computer screen. Illumination settings can also be saved and be recalled under program control for more repeatable video edge detection.
- Features to be measured can be selected at the click of a mouse or by pressing directly on parts features shown on the computer screen. Please refer to the M3 software manual.

4.7 KineMic M3 Telecentric, FOV – P/N KMR-TFOV-M3

4.7.1 System Description

No other optics can match the accuracy and freedom from optical distortion of telecentric lenses, where the light from the object stays parallel to the optical axis across the entire field of view. KineMic M3 FOV Telecentric models are available with a choice of six fixed-focus telecentric lenses for fields of view ranging from 1.8 mm to 24 mm in the X direction. Each system is factory calibrated for a specific lens. System components include a 21.5” all-in-one touch-screen PC and MetLogix M3 vision metrology software – but no X-Y stage. These simple yet high performance metrology systems are ideal for high accuracy, high throughput measurements of small parts, with automatic comparison to CAD files and electronic record keeping.

4.7.2 Metrology Unit Dimensions



4.7.3 Getting Started

- Unpack the two cartons which contain the metrology unit and all-in-one PC.
- Place both units on the intended desktop or benchtop.
- Connect the metrology unit to the all-in-one PC via two supplied USB cables. One is for the camera signal, the other for data. Either set of USB ports can be used for either function.
- Plug the telecentric microscope unit and all-in-one PC into a power outlet, and turn on both units.
- Launch MetLogix M3 software by clicking on the “Run M3” shortcut on the computer desktop, and a highly magnified image of an object placed on the base will appear on the monitor screen. Please refer to the supplied M3 software manual on the use and extensive capabilities of M3 software.
- Set focus by raising and lowering the optical head. The object to be viewed will be in best focus at a specific height. Use the two large inner knobs on the side of the Z-column for coarse height adjustment, then use the two smaller outer knobs for fine height adjustment.
- Set top and bottom illumination under computer control via sliders on the computer screen. Illumination settings can also be saved and be recalled under program control for more repeatable video edge detection.
- Features to be measured can be selected at the click of a mouse or by pressing directly on parts features shown on the computer screen. Please refer to the M3 software manual.

5. Camera Features

5.1 XGA Features

The XGA camera can be connected directly to a video monitor using the XGA format, without use of a computer. Four horizontal and four vertical lines can be found in the Overlay Graphic. Each line can be changed manually to 6 different colors and to full screen. Each line is in one pixel wide, making it precise for alignment. The XGA provides 60 fps with progressive scan and RGB 8:8:8.

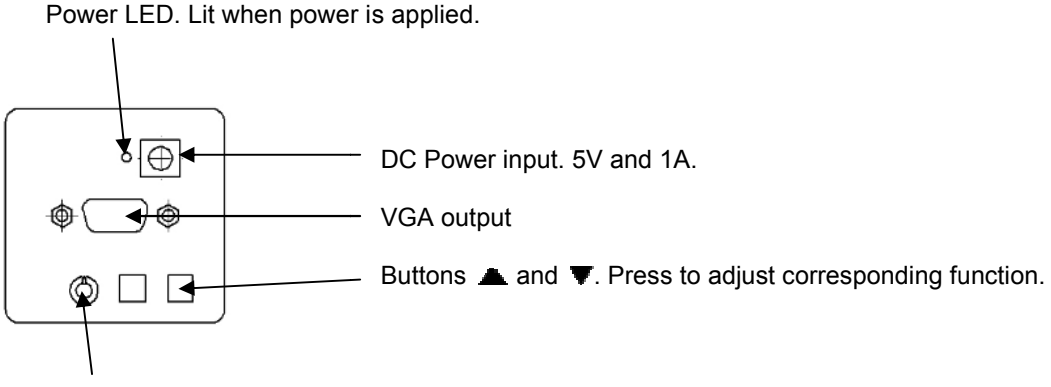
5.2 Applications

XGA cameras can be used for PCB inspection, semiconductor manufacturing, medical applications, microscope imaging, and more.

5.3 Product Specifications

Model Number	XGA-130 VM
Resolution	1280 x 720, 1280 x 1024, 1024 x 768 pixels
Frame Rate	60 fps
Color Depth	24 bit
Pixel Size	4.4 µm X 4.4 µm
Optical Size	1 / 2.5”
Output	VESA standard, PC graphic output, D-sub 15 pin interface
Overlay Graphic	8 crosshairs (4V & 4H, 8V & 8H), adjustable. Central crosshair (1V & 1H), fixed.
Lens Mount	C-mount
Power In	DC, 5-12V, 450 mA
Dimensions	70 x 52 x 51 mm
Operating Temperature	0-60°C, 20%-80% relative humidity

5.4 Selections



Switch	Function	Press ▲	Press ▼	Press ▲ & ▼ Buttons	Notes
1	1 Line1	Rise/Left	Down/Right	● Press both ▲ and ▼ buttons. Color of selected crosshair will change in sequence: black, gray, white, red, green, blue, disable.	 1. Not in this position. 2. Each single line is one pixel wide. Each line can be changed manually to 6 different colors and be shifted over the screen.
2	2 Line 2	Rise/Left	Down/Right		
3	3 Line 3	Rise/Left	Down/Right		
4	4 Line 4	Rise/Left	Down/Right		
5	5 Line 5	Rise/Left	Down/Right		
6	6 Line 6	Rise/Left	Down/Right		
7	7 Line 7	Rise/Left	Down/Right		
8	8 Line 8	Rise/Left	Down/Right		
9	Line type	□ Disable graphic + Central crosshair # 4H +4V = 8V II 8H		When selecting central crosshair, press ▲ + ▼ to change line color.	Select different crosshair types as needed.
A	Exposure	+	-	AE Auto exposure	Automatically quit after adjusting.
B	White Balance	+	-	R R G G B B	Note 1
				For Automatic White Balance, press the ▲ button three times. AWB will start and automatically stop after adjusting.	

C	Image	Color	- Normal - Mirrored - Inverted	- Positive - Negative	
D	Display	1280 x 1024 1280 x 720 1024 x 768	**50** 50 Hz **60** 60 Hz	- Normal - Freeze the image	Note 2
E	Wide dynamic range	**+**	**-**	- WDR/Normal	Note 3
F	Factory setting recovery	Press 3 times (image reset)	Press 3 times (line reset)	- Neutral	
G		Neutral		Reserved	

Notes:

1. **White Balance.** Adjust white balance to adjust the color of the image. Under different lighting conditions, the color of the object will have a slight difference. This can be corrected by adjusting the value of the R/G/B, in order to display the real color. This camera has two white balance adjustment modes: manual and automatic.

   In the manual mode, press ▲ and ▼ buttons to select R/G/B, then press ▲ and ▼ buttons to increase or decrease the contrast value, respectively.

   Press ▲ and ▼ buttons to turn white balance mode on/off. In this state, press ▲ three times. The camera will start automatic white balance adjusting. It will automatically exit after adjusting. When the camera enters the automatic white balance mode, power on the lighting device and prepare a white paper as the reference subject. Place the white paper under the entire lens view. Only in this way can we get the best image. After automatic white balance adjusting, the brightness of the screen may vary, so it is best to re-do the exposure adjustment.

2. **Display:** Press the ▲ button to select a different resolution. This camera offers three resolutions to achieve the best effects with different displays on the market: 1280 x 720 to match 16:9 HD TV; 1280 x 1024 to match 5:4 17” and 19” monitors; and 1024 x 768 to match 4:3 15” and 8” monitors. Press ▼ to select a 50 HZ or 60 HZ model. Press the ▲ and ▼ buttons to freeze and restore the current image.

3. **Wide dynamic mode:** Some highly reflective objects, such as metal or solder, may result in bright spots on the screen. First reduce brightness of the light source or shorten the exposure time to eliminate these bright spots. Then press the ▲ and ▼ buttons to enter the “wide dynamic mode.” You will find that the original dark image portion becomes brighter. Next, press the ▲ and ▼ buttons to fine-tune the image effects and achieve a larger dynamic range. Note that setting a wide dynamic mode may cause the signal to noise ratio to decrease, so that the image may appear slightly noisy.

6. KineMic Options

6.1 Optional Boom Stand

The boom stand, P/N 3623, can be used with all KineMic models that do not use an X-Y stage. It allows the KineMic optical head to be used for inspection and field-of-view measurements of features of large parts which would not fit on the standard stand. It is normally ordered with new KineMic systems, since special provisions have to be made for electrical cabling.

Key features of the stand are a heavy metal base measuring 26 x 36 x 2.5 cm (9 ¼" x 14 ¼" x 1"), a vertical post measuring 39 cm (15 ½") above the base, a horizontal boom measuring 54 cm (21 ¼") long, and an adjustable mount for the KineMic optical head. The mount provides knobs for 55 mm (2.2") of height adjustment and is hinged vertically so that the optical head can swing out sideways. A separate clamp ring around the vertical post prevents the horizontal boom from dropping.

At its maximum extension, the boom stand can provide a horizontal clearance of 65 cm (25 ½") between the vertical post and the optical axis, compared to only 11.5 cm (4 ½") for the standard KineMic mount. Additional clearance is provided by swinging out the optical head.

6.2 Auxiliary Lenses for Zoom Optics

Two auxiliary lenses can be added to the KineMic 6.5:1 zoom optics:

- A 0.5X auxiliary lens, P/N 4828, cuts magnification in half but doubles the field of view.
- A 2.0X auxiliary lens, P/N 4829, doubles magnification but cuts the field of view in half.

7. Unpacking & Installation

7.1 Shipped Components

Product Feature	KineMic XGA Zoom, Basic KMR-XGA	KineMic XGA Zoom, 2x2 Stage KMR-50-XGA	KineMic D1 Zoom, 2x2 Stage KMR-50-D1	KineMic M3 Zoom, 4x8 Stage KMR-200-M3	KineMic D1 Zoom, FOV KMR-ZFOV-D1	KineMic M3 Zoom, FOV KMR-ZFOV-M3	KineMic M3 Telecentric, FOV KMR-TFOV-M3
Metrology unit with basic stage	√				√	√	√
Metrology unit with X-Y stage		√	√	√			
19" VGA monitor	√	√					
VGA cable for camera signal	√	√					
AC power cable to monitor	√	√					
21.5" all-in-one PC			√	√	√	√	√
USB cable for camera signal			√	√	√	√	√
USB cable for image data				√		√	√
Brick power supply for met. unit	√	√	√	√	√	√	√
Brick power supply for PC			√	√	√	√	√

7.2 Unpacking Shipping Boxes

KineMic systems other than the KineMic KMR-200-M3 (with a 200 mm encoder stage) are shipped in two cardboard boxes with foam inserts: one box for the metrology unit and another box for the system's XGA monitor or all-in-one PC. Unpack carefully so as not to miss cables, documentation, or software CDs. KineMic systems are shipped to users with all software installed. Verify that your system is complete as listed in the above table.

KMR-200-M3 crate with screw locations in red

KMR-200-M3 crate with lid and front removed

The KineMic KMR-200-M3 (with a 200 mm encoder stage) is shipped in a single wooden crate. Use a power screwdriver to remove 8 Phillips screws from the lid and 6 Phillips screws from the front side. The 14 screw locations are marked in red. Remove the lid and front side of the crate, then carefully remove the contents of the crate from the open side.

7.3 Removing Red Shipping Tabs

Starrett Kinemetric X-Y stages use metal tabs to prevent movement during shipment. Painted red for easy identification, these are intended to be removed once the equipment has been placed in its final position. Look for red tabs and remove them before attempting to move the stage. You may wish to store the tabs and their mounting screws for a possible later move of the equipment.

7.4 Placing the Equipment

A clean working environment free from dust and fumes is recommended to keep the equipment clean and prolong its life. Place the equipment on a benchtop or a desktop at a convenient working height. Allow enough room to allow for stage motion, to store the parts to be inspected and measured, and for paperwork. Do not place brick type AC power adapters directly on the floor if the floor can be flooded for wash-down.

7.5 Electrical Connections

Brick type AC power adapters for PC (top) and metrology unit (bottom)

- Power to the metrology unit is via a brick type AC adapter with 100/240 Vac input and 24 Vdc, 5A output.
- Power to the all-in-one PC is via via a brick type AC adapter with 100/240 Vac input and 19.5 Vdc, 7.9A output.
- Power to the XGA monitor is directly via an AC cable.
- XGA systems use a VGA cable from the metrology unit to the video monitor.
- PC-based systems with D1 software use a USB cable from the camera of the metrology unit to the all-in-one PC.
- PC-based systems with D3 software use a USB cable from the camera and a second USB cable for digital data between the metrology unit and all-in-one PC.

7.6 On-Site Functional Test, Calibration and Training

All SKE vision metrology systems and optical comparators are calibrated at the factory prior to shipment; however, it is possible that components may have moved during shipment. A complete functional test and calibration are recommended following physical installation.

Professional system installation is available for all KineMic systems and is quoted as a separate line item. It is highly recommended for all systems with M3 software and is purchased by most users. As part of its setup services, SKE oversees the equipment's in-plant transportation to its permanent location and uncrating. SKE then performs the physical setup and electrical connection, followed by a completed functional checkout. This typically takes 1/2 day for a KineMic system. The system is then allowed to temperature stabilize overnight.

On-site calibration normally takes place on the day following setup. Calibration uses NIST-traceable glass grids and gage blocks. Calibration typically takes 1/2 to 1 day for a KineMic system.

On-site basic operator training is provided following calibration. This typically takes 1/2 day for a KineMic system. Many customers choose to augment basic training with additional hands-on training, where new operators program parts of the type on which they will be working. Training is with the new equipment and is limited to 1 to 3 people, so that these can all get hands-on time. SKE's objective is to create "power users," who can then train other users when needed.

Installation services in North America (USA, Canada and Mexico) are provided by professional service technicians operating out of the Laguna Hills, CA, headquarters of Starrett Kinemetric and its regional sales offices. Outside of North America, installation services are provided by Starrett subsidiaries in Brazil (for South America), Scotland (for Europe and Africa), China (for Mainland China), and Singapore (for Southeast Asia), and Australia.

8. Measurement Strategy

KineMic systems are available with either 6.5:1 zoom optics with adjustable magnification from 0.47X to 3.0X, with 12:1 zoom optics with adjustable magnification from 0.4X to 4.7X, or with any of six telecentric lenses with a fixed magnification of 0.30X, 0.50X, 0.80X, 1.0X, 2.0X or 4.0X. As used here, magnification is the image size at the camera CCD detector place divided by the object size. Since the CCD size is fixed, each magnification has a corresponding field of view (FOV), which is the CCD size divided by magnification. The higher the magnification, the higher the resolution, but also the smaller the field of view.

8.1 Zoom Optics Measurement Strategy

While the zoom optics can provide the same field of view (FOV) as four of the telecentric lenses, they do not offer the ultra-low optical distortion that is required for purely optical measurements across the entire FOV. However, they can be more accurate than telecentric lenses when used at high magnification in combination with stage motion, where reading accuracy is based on the system's calibrated linear encoders.

Select zoom optics to measure large parts which would not fit into a single FOV, also to measure smaller parts where extremely high magnification is required. The lowest zoom magnification setting accommodates parts up to 11.2 x 9.4 mm (0.44" x 0.37") in the FOV. To measure large parts, locate the edge of interest at minimum magnification, then take the actual measurement at maximum magnification using the system's crosshairs. The zoom optics' parcentricity feature ensures that a feature will remain at the optical center of the video image throughout the magnification range.

In general, higher magnification provides greater resolution and accuracy; however, not all features should be inspected at the highest available magnification. Too high a magnification may make it difficult to discern edges by exaggerating edge defects such as burrs or chips. Try decreasing the magnification until the edge is more clearly identifiable. Also consider factors such as tolerance requirements, manufacturing processes, functional requirements and optical characteristics of the part. Features with loose tolerances may not need to be inspected at high magnification. Select the magnification best suited for the requirements.

8.2 Telecentric Lens Measurement Strategy

Select telecentric optics to perform high accuracy, high throughput field-of-view (FOV) measurements. If all measurements are to be in the FOV, select the highest magnification lens whose FOV encompasses the entire part. The 0.30X lens accommodates parts up to 24 x 18 mm (2.0" x 1.5"). If the entire part cannot fit into the FOV, no problem. Simply move the stage by up to 200 mm (4") for the KineMic200 or 300 mm (12") for the KineMic300, and the M3 software will seamlessly integrate FOV measurements with encoder readings from stage motion.

8.3 Illumination Strategy

Once the image has been properly focused and magnification has been set, adjust light levels as necessary using your systems manual adjustment knobs or the slider controls in M3 software. The right lighting is paramount to accurate measurement with any video-based measurement system. Lighting that is too dim will result in a dark, low-contrast image with indiscernible features. Lighting that is too bright may result in a washed-out image and blooming, or oversaturated bright regions that distort features.

When adjusting lighting, start with light that is lower than desired, and then increase lighting while viewing the image on the monitor. Maintain constant lighting for consistent results. Always use the same light level while sampling points for a single feature – do not to change light levels during a measurement run.

Depending on the part characteristics and the feature being viewed, the right combination of lighting may aid in bringing out a particular feature. Take time to experiment by balancing the available light sources.

8.4 Magnification and Focus Strategy

Accurate measurement requires proper focus of the image. With a zoom lens, focusing is most sensitive at highest magnification. A good strategy is to first focus the image at the highest magnification, and then decrease magnification to the desired level.

In general, high magnification (or zoom) helps with accurate measurements. However, while high magnification provides high resolution, it does not always provide the highest accuracy, and not all features should be inspected at the highest available magnification. Too high a magnification may make it difficult to discern the edge of a feature by exaggerating edge defects such as burrs and chips. Try decreasing the magnification until the edge is more clearly definable. Also, there is an inverse relationship between magnification and field of view, and using a lower magnification may be more convenient.

Also consider factors such as tolerance requirements, functional requirements, manufacturing processes, and optical characteristics of the part. Features with loose tolerances may not need to be inspected at high magnification. Experiment to select the magnification that is most suitable for the feature being inspected or measured.

8.5 Parts Fixturing and Skew Control

The part must be fixtured securely to prevent part movement during measurements. Also, the feature being measured must be aligned with the measurement axis or with the X-Y stage if stage's X-Y encoders are used to make measurements. If the part is off angle, a condition known as skew will introduce measurement errors. Aligning the part with the measurement axis or with the X-Y stage will result in more accurate measurements. With M3 software, skew errors can be removed by creating a reference frame based on the part before taking measurements. Please see the M3 software manual for details.

8.6 Metlogix D1 and M3 Software Operation

KineMic systems with an all-in-one PC come with either MetLogix M3 or MetLogix D1 software, as ordered.

M3 software is full-featured 2D metrology software with video edge detection (VED) and lighting control. By using VED, features and geometries to be measured can be selected by using the mouse or simply by tapping the touch screen. Measurements can be within the field of view or be automatically integrated with encoder readings from an X-Y stage (KMR-200-M3 system).

D1 software offers many of the same real time image display, markup, and archiving capabilities as M3 software, as well as basic geometrical constructs like points, lines, circles, distances, and angles. However, edges are selected manually using crosshairs on the screen, not automatically via VED, and lighting control is via knobs, not software. D1 software is suitable for measurements within the field of view and for measurement using crosshairs and a micrometer stage (KMR-50-D1 system).

M1 or M3 software operation is outside the scope of this hardware-oriented user manual. Please refer to the separate MetLogix D1 or M3 software manual.

9. System Maintenance

KineMic inspection and metrology systems have been designed for years of superior service. Periodic maintenance as outlined in this section should be performed to maintain the system in peak operating condition.

- Perform a daily inspection to ensure that the system is operating correctly and that proper safety guidelines are being followed.
- Periodically verify basic optical performance.
- Periodically perform cleaning.
- For metrology systems, schedule regular factory-authorized calibration and maintenance service to preserve proper function and accuracy.

9.1 Daily Inspections

On a daily basis, inspect your system for general safety and basic functionality:

- Verify that the work area is clean, dry and free of debris. Remove any debris or loose items from around the system and metrology stage.
- Verify that the electrical power cords are plugged into a grounded power source and are unobstructed.
- Verify that temperature and humidity are within recommended ranges.
- Allow the system to warm up to normal operating temperature before performing critical parts measurements.

9.2 Weekly or Monthly Maintenance

On a weekly or monthly basis (based on experience), do the following:

- Inspect the system for cleanliness. If dirty, follow cleaning instructions as stated below under "Cleaning."
- Verify that the stage control mechanisms move freely. If it binds, call for service. KineMic lead screws use with plastic nuts. Do not apply any grease or other lubricant.
- Check the system for calibration against a certified chrome-on-glass standard if critical dimensions are to be measured.

9.3 Zoom Optics Alignment Verification

The performance of zoom optics (in zoom systems) should be verified regularly to ensure accurate measurements. Parfocality, parcentricity and squareness verifications are straight-forward and may be performed as often as desired. Focus is set during normal operation by changing the distance between the lens and the surface being viewed.

CAUTION: While optical alignment verification may be performed by an operator, optical alignment correction should only be performed by an authorized service technician. If alignment discrepancies are found, contact SKE or your local SKE representative to schedule authorized service.

9.3.1 Zoom Optics Parfocality & Focus

Parfocality is the optical property which allows the video image to remain in focus as magnification is adjusted from highest to lowest. SKE zoom optics are designed to maintain parfocality throughout their magnification range. To check parfocality, always reference a flat, sharp edge. Do not select a rough or sloping feature. The MAG checker available from Starrett Kinemetric is an ideal tool to check parfocality.

Steps to check parfocality:

1. Place the MAG checker or other suitable inspection part on the stage and secure properly.
2. Backlight the image as necessary. Set light levels as needed to avoid blooming.
3. At low magnification, select a flat, sharp edge in the center of the field of view (FOV).
4. Select highest magnification, and carefully refocus the image by physically changing the viewing distance.
5. While observing the feature, slowly adjust the magnification lower. Verify that the feature remains focused as the magnification is lowered.
6. Report any observed discrepancy. If the error is verified, contact your SKE representative for authorized service.

9.3.2 Zoom Optics Parcentricity

Parcentricity is the optical property which allows a feature to remain at the optical center of the video image throughout the magnification range. Like parfocality, parcentricity requires that the feature be first located at highest magnification.

Steps to check parcentricity:

1. Place the MAG checker or other suitable inspection part on the stage and secure properly.
2. Select the crosshair image tool and verify that it is at its defined center position. Please refer to the M3 manual for details on centering the crosshair. The crosshair is to remain at this position during the parcentricity test.
3. Zoom to low magnification, and adjust the stage position so that the crosshair is centered on the X-Y axis of the calibration standard (or another suitable feature if the standard is not used).
4. Change to high magnification and refocus the image.
5. Adjust the stage position as needed to re-center the crosshair on the feature.
6. While observing the feature, slowly adjust the magnification lower. Verify that the feature remains at the center of the crosshair as the magnification is lowered.
7. Report any observed discrepancy. If the error is verified, contact your SKE representative for authorized service.

9.3.3 Zoom Optics Squareness

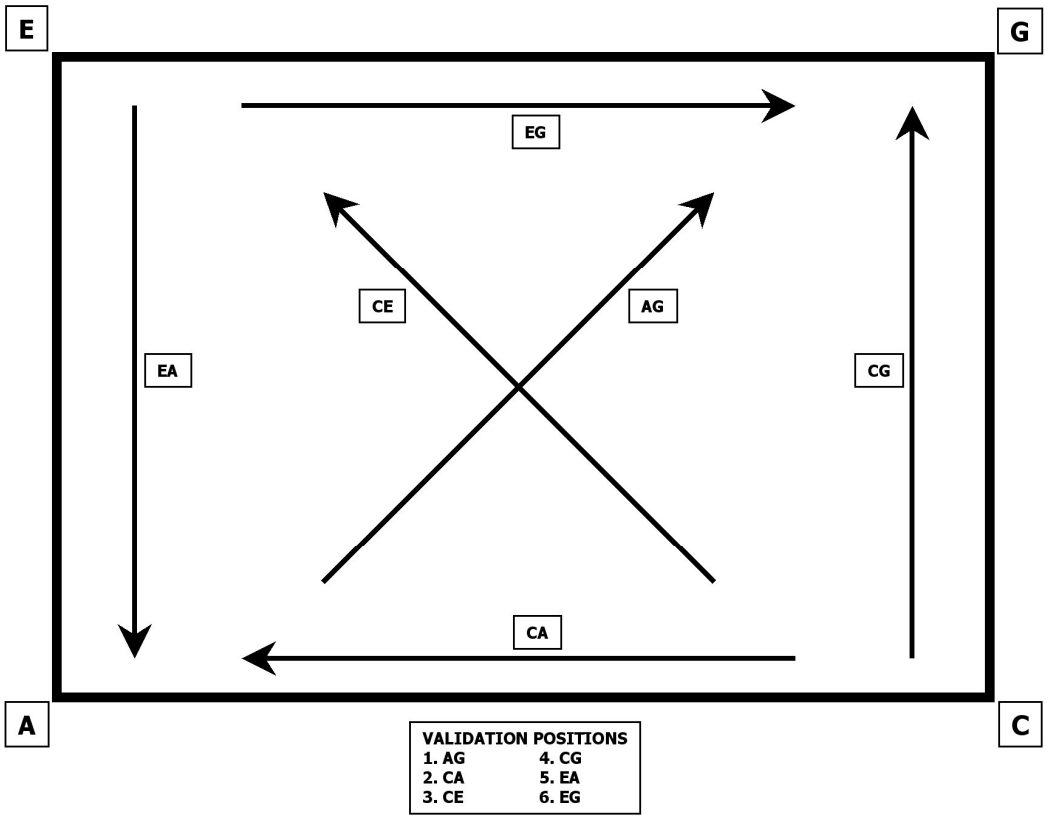
Squareness refers to the alignment of the camera relative to the motion of the metrology stage. If the camera is misaligned (out of square), an image will appear to drift diagonally across the video image as the stage position is moved along one axis.

Steps to check squareness:

1. Place the MAG checker or other suitable inspection part on the stage and secure properly.
2. Select the crosshair image tool in software and verify that it is at its defined center position. Please refer to the M3 software manual for details.
3. At low mag, select a point-like feature such as a corner or the standard's X-Y origin. Using the stage, position it to the center of the crosshair.
4. Zoom to high magnification, then refocus and re-center the point as needed.
5. While observing the feature, slowly move the stage X axis ONLY. (Do not move the stage Y axis.) Verify that the point remains aligned on the X axis of the crosshair as the feature is moved to the left and right within the field of view
6. Report any observed discrepancy. If the error is verified, contact your SKE representative for authorized service.

9.4 Calibration Verification for KMR-200-M3

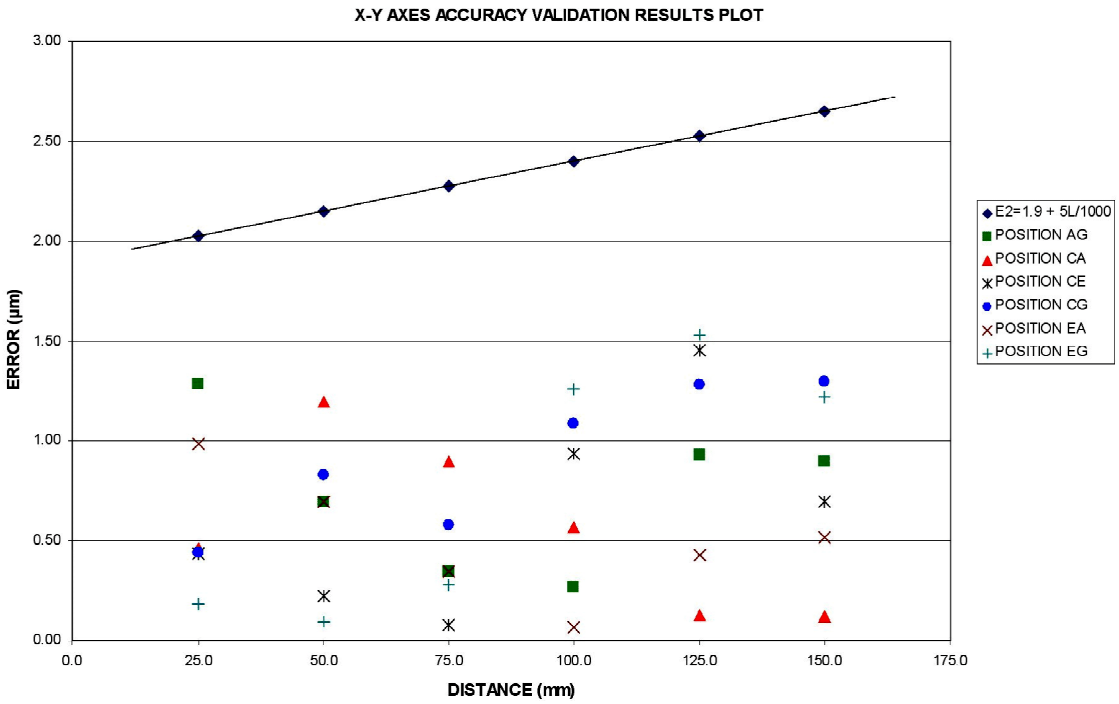
Calibration should be verified periodically depending on user requirements and systems usage, and should be at least monthly. A calibration verification standard artifact is available from SKE authorized distributors or directly from the SKE service department. Calibration should also be verified after the system has been serviced or moved. The following is a brief description of the steps recommended for the verification of your machine.



Verification Standard Placement

Steps to validate calibration:

1. Place the calibrated verification standard in one the six positions on the glass stage as shown above. Secure the standard with hot melt glue or other suitable retaining method so that stage translation cannot move the standard under any condition.
2. Skew the center of the two end circles. Please refer to the M3 software manual for proper alignment procedures.
3. Measure the distance between the 1st and 2nd, 1st and 3rd, 1st and 4th, 1st and 5th, and the 1st and 6th fiducials. Repeat these measurements 10 times.
4. Calculate the absolute average deviation for each of the 5 groups of distance measurements.
5. Repeat the measurements for all six locations shown in the illustration.
6. The absolute averages should be within factory system specifications, and be derated for the environment and calibration errors.



Calibration Error Chart Example

9.5 Cleaning

To the degree possible, KineMic systems should be kept in a clean environment, away from dirt, dust, oil and debris which could affect system performance or degrade the system's mechanical and electronic parts. If a clean environment is not available, the machine should be kept as clean and protected as is possible. In harsh environments, preventive maintenance and factory service should be scheduled to keep the system in top working order. Cover machine with plastic if not in use.

9.5.1 Cleaning External Surfaces

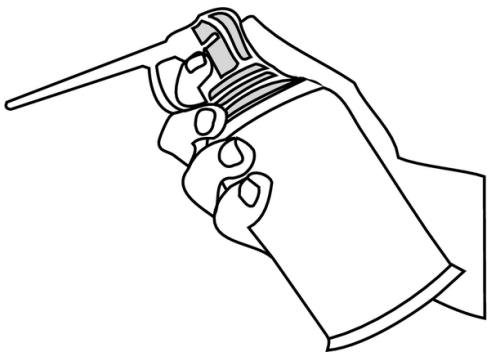
Wipe down with a clean, lint-free cloth moistened (not wet) with plain water or Simple Green®. Never wipe down with acetone or other harsh solvents, which may damage painted or plastic surfaces. Isopropyl alcohol may be used to clean surface contaminants where Simple Green proves ineffective.

⚠	**WARNING:** Never pour fluid on the system when cleaning. Do not over-wet cleaning cloth. Excessive moisture can seep into mechanical or electrical parts, damage the equipment and possibly cause an electrical short circuit and physical injury. As a precaution, unplug the system before cleaning. Always unplug the system before using any flammable cleaning fluid.

9.5.2 Cleaning Optics

	**WARNING:** Do not touch lens surfaces with your fingertips, since the resulting fingerprints will destroy optical coatings over time. Only clean optical surfaces with proper cleaning supplies, and then only when necessary.

If a lens is covered with loose dust, first try blowing off this dust using a can of optical grade (oil-free) canned compressed air. Be careful not to shake the can, or propellant may blow onto the lens. As alternative, use a lens brush to gently wipe off the dust.



Optical grade compressed air

If the lens is soiled with greasy deposits which cannot be blown or brushed off, use an alcohol-based commercial lens cleaner and a lens tissue or a lens cloth. These items are available from camera stores. Apply the lens cleaner generously to dissolve the grease, and then blot off the lens cleaner and dissolved grease using minimum motion. Avoid rubbing the lens, since hard particles from the deposit or the lens cloth could scratch the optical coatings.

If the greasy deposits do not come off with the lens cleaner, use a stronger solvent such as reagent-grade acetone as a last resort. Gently wipe the lens surface while moving the lens cloth to always present a clean surface to the lens. Wipe in a circular manner moving from the center of the lens toward the outer edge. Do not reuse the lens cloth to avoid redepositing contaminants.

9.5.3 Cleaning Mechanical Parts

To ensure a long, trouble-free service life, wipe down the system regularly to remove any dust or dirt from the system. Most critical components are covered and require no user service. Should the stage mechanics bind or require service, please contact your SKE representative. The lead screws used with KineMic use plastic nuts. Do not apply any grease or other lubricant, which would collect dirt and impair product performance.

10. GLOSSARY

The following terms may have additional meanings. The definitions that follow are in the context of the KineMic video metrology systems.

Accuracy The maximum error that the system will produce when measuring a true standard.

All-in-one PC A space saving personal computer where all electronics, disk drives and I/O connections are in the same enclosure as the video monitor, which is an LCD color touch-screen. A keyboard and mouse are also included.

Axis A direction which allows movement and along which dimensions can be measured. In KineMic systems, the X-axis is horizontal from left to right, and the Y-axis is from front to back, and the Z-axis is from bottom to top.

Boom Stand An alternative support mechanism for the optical head. It allows the head to swing out sideways to reach otherwise unreachable surfaces.

Blooming A condition where the parts of the video image are distorted by oversaturated bright regions, making illuminated regions appear larger than they really are.

CCD Charge Coupled Device. The solid-state image sensing element of the video camera.

Distortion Optical image distortion at the CCD sensor across the maximum field of view. Expressed in percent for the dimensional error along one axis divided by the true dimension.

DXF A computer aided design (CAD) data file format developed by Autodesk, Inc. and now also used by other companies for the export and import of CAD data.

Focus The condition which provides the sharpest image. Achieved by optimizing the distance between the object and imaging optics.

FOV Field of View. The region of the metrology stage being viewed by the camera and displayed on the video monitor.

FOV Measurement A video measurement performed in a single field of view without moving the stage or camera.

Illumination, Front Lighting applied to the object from the same side as the camera so that surface features can be viewed on the video monitor.

Illumination, Back Lighting applied from the back of the object so as to create a silhouette when the object is viewed by the camera.

Mag Abbreviation for magnification.

Magnification, Lens In a vision metrology system, the image size in the CCD plane divided by the corresponding object size.

Magnification, Image Magnification on monitor. Image size on the video monitor divided by the corresponding object size. Same as lens magnification in a properly adjusted optical comparator.

Parcentricity The condition where a feature remain at the optical center of the video image throughout the magnification range of zoom optics.

Parfocality The condition where the video image remains in focus as the magnification is adjusted from highest to lowest with zoom optics.

Pixel A picture element. Term used to describe the individual light detectors of the CCD sensor in the camera and also the individual light emitters of an LCD video monitor.

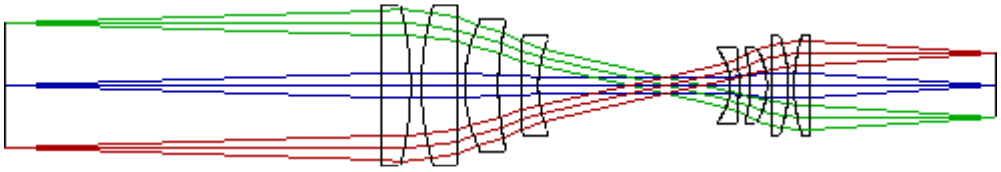
Resolution The least significant digit to which a physical quantity can be read. High resolution does not imply high accuracy.

Skew Misalignment of the part with respect to the X and Y axes. This will create measurement errors unless the part is repositioned or the de-skew feature of the metrology software redefines the measurement axes.

Squareness The alignment of the camera relative to the motion of the metrology stage. If the camera is misaligned (out of square), the image will drift diagonally as the stage position is moved along one axis.

Substage Lighting Illumination from below the stage glass. Used for profile or silhouette video edge measurements.

Telecentric A lens property where the light from the object stays parallel to the optical axis across the entire field of view, thereby eliminating optical distortion. This can only happen if the entrance aperture of the lens is larger than the field of view, requiring a large and expensive lens.



Object Telecentric lens CCD detector

TFE Tetrafluoroethylene, a self-lubricating polymer coating used on precision lead screws.

VED Video Edge Detection, a system where a video camera and digital image processing are used to detect edges or other features.

Zoom Optics Optics which can change magnification based on a user selection. Zoom control can be manual or motorized, depending on the metrology system.