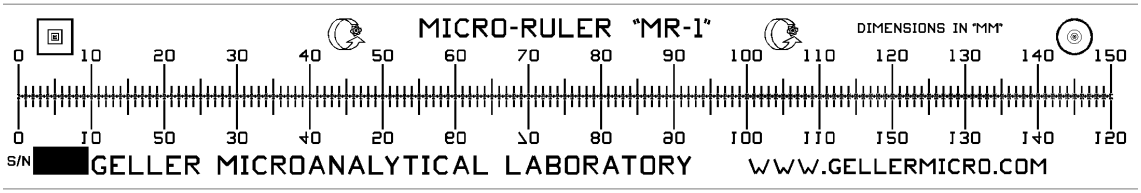
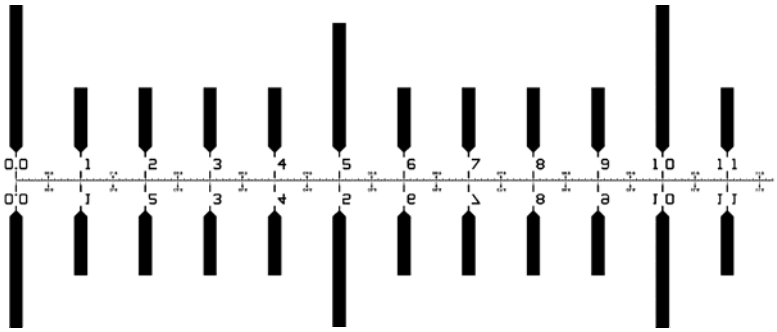
Ladd Catalog Number: LMR-1

Micro-Ruler MR-1

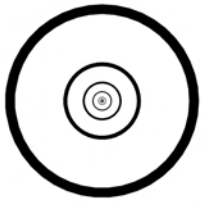
A NPL (NIST counterpart in the U.K.) traceable
Certified Reference Material.
A traceable “Micro-Ruler”



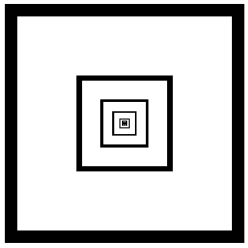


Markings are all on one side. Mirror image markings are provided so right reading numbers are always seen.

The minimum increment is 0.01 mm.



The circles (diameter) and square boxes (side length) are 0.02, 0.05, 0.10, 0.50, 1.00, 2.00 and 5.00 mm.



150 MM OVERALL LENGTH
150 mm uncertainty: ± 0.0025mm, 0 – 10 mm: ±0.0005 mm)
0.01 MM INCREMENTS, SQUARES & CIRCLES UP TO 5 MM

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Does the world need a traceable ruler?

According to ISO, traceable measurements shall be made when products require the dimensions to be known to a specified uncertainty. These measurements shall be made with a traceable ruler or micrometer. For magnification to be traceable the image and object size must be measured with calibration standards that have traceable dimensions.

E1951-98 STANDARD GUIDE FOR CALIBRATING RETICLES AND LIGHT MICROSCOPE MAGNIFICATIONS

This guide covers methods for calculating and calibrating light microscope magnifications, photographic magnifications, video monitor magnifications, grain size comparison reticles, and other measuring reticles. Reflected light microscopes are used to characterize material microstructures. Many materials engineering decisions may be based on qualitative and quantitative analyses of a microstructure. It is essential that microscope magnifications and reticle dimensions be accurate.

The calibration using these methods is only as precise as the measuring devices used. It is recommended that the stage micrometer or scale used in the calibration should be traceable to the National Institute of Standards and Technology (NIST) or a similar organization.

INTRODUCTION

Traceable rulers are required under ISO and QS-9000 and ISO-17025 quality programs. Geller MicroÅnalytical Laboratory introduces the Micro-Ruler MR-1, a metric dimensional calibration product that follows our very successful MRS-3 and MRS-4 magnification reference standards. These provide traceable pitch patterns as small as ½µm for magnification determination up to 200,000X. One significant use of the MR-1 is to measure magnified images to determine absolute magnification. We offer the MR-1 only as a certified reference material (a traceable standard) and recommend recertification in 5 year intervals.

PATTERN DESIGN

The MR-1 is fabricated by using highly accurate semiconductor fabrication equipment. The pattern is anti reflective chromium (30nm of CrO_2 over 70nm of Cr) over soda-lime glass. The overall size is ≅25mm X 180mm X 3 mm thick. The linear expansion coefficient is 9 X 10-6 PPM/°C. Over its full 150 mm length the ruler will predictably change dimensions by 1.35µm/°C.

The MR-1 is labeled in mm. Its overall scale extends over 150 mm with 0.01 mm increments. The ruler is designed to be viewed from either side as the markings are both right reading and mirror images. This allows the ruler marking to be placed in direct contact with the sample, avoiding parallax errors. Independent of the ruler orientation the scale can be read correctly. There is a common scale with the finest (0.01 mm) markings to read.

We measure and certify pitch (the distance between repeating parallel lines using center-to-center or edge–to-edge spacing. This is the only type of measurement that can be used to relate measurements from different microscopy techniques (see "Submicrometer Linewidth Metrology in Optical Microscopy", Nyysonen & Larrabee, Journal of the Research of the National Bureau of Standards, Vol. 92, No. 3, 1987). Linewidth measurements (the measurement of a single line or space width) can only be related if the same type of illumination is used as for the calibrating instrument since edge effects lead to uncertainty in the edge locations. Using pitch measurements, errors from edge-to-edge locations cancel as long as like positions are measured.

Square boxes and circles are used for measuring magnification simultaneously in the X and Y directions. This gives a measure of image skew, barreling, pincushion and other non-linearities, which have various origins.

WHAT IS THE MEASUREMENT UNCERTAINTY?

The MR-1 ruler uncertainty is ± 0.5µm over the 0 – 10 mm distance and ± 2.5µm over the entire 150 mm length, as measured by the National Physical Laboratory (the NIST counterpart in the United Kingdom). Our in-house measurements will slightly degrade the uncertainties listed above.

WHAT IS INCLUDED THE CERTIFICATION REPORT?

The Micro-Ruler is currently under consideration to be added to our ISO-17025 scope. The report issued follows the ISO-17025 guidelines for certification and traceability. Included is the unique serial number engraved on the standard, certification data, recertification due date (5 year suggested interval), operator, instrumentation used, and actual pattern measurements along with a measure of total uncertainty. This report has satisfied 100% of our customer audits.

Geller MicroÅnalytical Laboratory, certified to ISO-9001 and ISO-17025 (for the MRS-3 and MRS-4 traceable magnification reference standards) offers several unique products and services to the technical community. We have developed products out of the need to support our analytical services. Our staff takes pride in performing state-of-the-art analyses on difficult specimens and we do our utmost to go beyond just offering analytical data. We interpret the information, as well. As our satisfied repeat clients and publications reveal, we have developed several unique techniques for problem solving. We maintain your confidentiality with the utmost care as our small, but capable c.ompany, concentrates on providing you with answers.

ANALYTICAL SERVICES

- **Electron Probe microanalysis**: JEOL JXA-733 (fully automated) with 4 WDS and EDS.
  Scanning electron microscopy: JEOL 840, with x-ray, digital imaging and particle size counting.
- **Auger electron spectroscopy**: JEOL JAMP-10S and JEOL JAMP-7800 (with hemispherical analyszer), both fully automated.
- **Profilometry, metallography, microhardness**, **surface roughnes** and much more.

PRODUCTS

- **UHV-EL:** Chemical standards for microanalysis; choose from over 250 pure elements, compounds, minerals, glasses, and alloys. Some are NIST traceable. These standards are used for energy and wavelength dispersive x-ray analysis, surface analysis and macro & micro x-ray fluorescence. We also have a traceable aluminum/copper standard for EDS calibration.
- **Ion Sputtering Standards:** for ion sputter rate calibration. Thin films of Si_3N_4 and SiO_2 on Si and Ta_2O_5 on Ta. Various thicknesses.
- **Counter-Rota-Cutter™:** pat. #4949605) for low speed diamond saws (Buehler ISOMET™, LECO VC-50™ and Struer's Minitom™) allowing faster cutting, with smoother and thinner sections and less deformation.
- **Vacu-Storr™:** vacuum desiccators with holding times up to 5 years!. Developed to protect our analytical standards for storage and shipping. Various sizes are available.
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COMPUTER CONTROL SYSTEMS

- **dpict32**: PC based digital imaging for most SEMs. Active scan generator. Collect up to 9 images simultaneously. Industry compatibel formats.
- **dQant32**: Quantitative electron probe microanalysis program for WDS and EDS analysis.
- **dSspec**: Wavelength spectrometer, stage control, and beam current measurements for electron probes.
- **Auger-II:** PC based digital control for Auger electron data collection and reduction as well as Auger imaging.

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12/24/2001