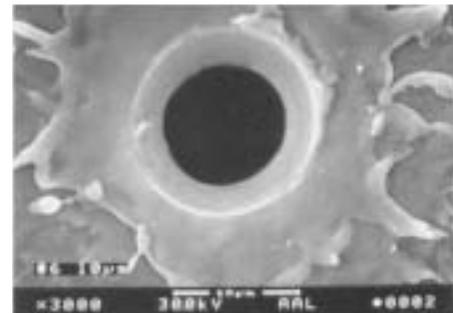
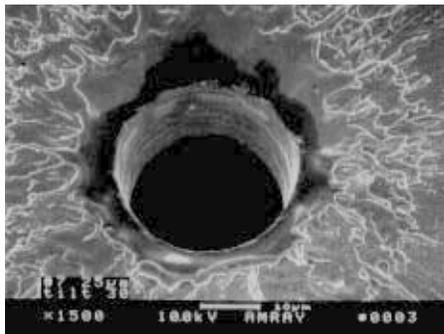
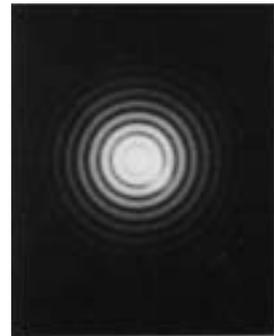
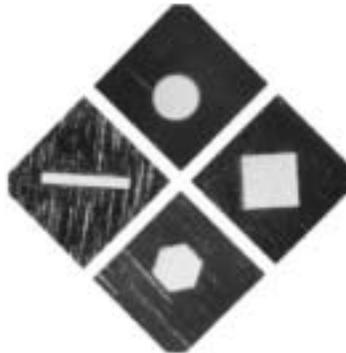
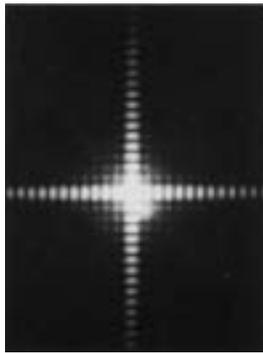




National Aperture, Inc.

Micro Precision Apertures



Product Guide

Precision apertures, targets and patterns, including round, slit, square, etc., for universal and high power applications

株式会社キーストンインターナショナル

227-0042千葉県柏市逆井13-27 黒沢ビル3F

電話(0471)75-8810 FAX(0471)75-5669 Email: key@keystone-intl.co.jp



Precision Apertures

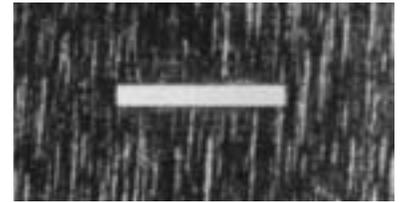
National Aperture is the leading manufacturer of precision micro-apertures. Our specialty is primarily in the 0.5µm to 1000µm range for round holes, with sizes up to 8,500µm. Slits and patterns range up to 25mm square.

All aperture edges are carefully fabricated employing proprietary computerized micro-drilling, micro-slitting and micro-finishing techniques. All finished components are rigidly quality controlled before shipping. Standards are traceable to NIST.

For special needs, we have provided a choice of options at an additional cost. However, the standards as listed are suitable for most research and industrial applications.

Some typical applications of our apertures include:

- Spatial filtering
- High power laser light control
- Microscope calibration
- Gas/liquid flow control
- Spectrophotometry
- Fiber optics
- Astronomy, etc.

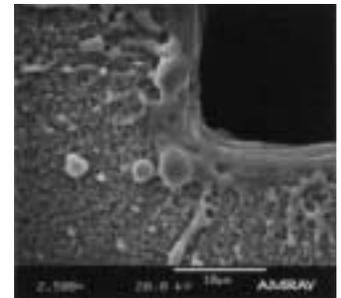


Basic types:

- Standard precision round apertures
- Standard precision air slit apertures
- High power precision round apertures
- High power precision air slit apertures
- Patterns on dielectric laser coatings

Typical materials:

- | | | |
|--------------------|--------------|------------|
| • Stainless steel | • Nickel | • Brass |
| • Tantalum | • Copper | • Tungsten |
| • Beryllium copper | • Molybdenum | • Gold |
| • Titanium | • Platinum | • etc. |



General Quality Standards:

Round Apertures:

- Roundness: Major axis - minor axis, max.
 0.5µm on holes 1-15µm
 1µm on holes 20-50µm
 2µm on holes 100µm and up
- Finish: Optical research quality,
 (no burrs on interior of aperture)
 <10µ-inch, on holes up to 250µm
 <80µ-inch, on holes over 250µm

Slit Apertures:

- Edge finish: 20µ-inch under 20µm
 60µ-inch 20µm and up
- Straightness: <0.5µm per mm, <2µm total

Certification and SEM photos available

Pinhole positioners: See MM-1 Accessories Data sheet

Delivery: 2 weeks/ standard holes

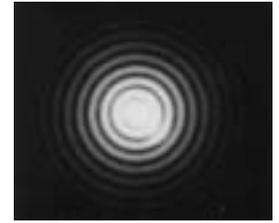
Customer satisfaction UNCONDITIONALLY GUARANTEED on all standard apertures.



Standard Precision ROUND Apertures "Pinholes"

Specifications:

Material:	302 stainless steel, non-magnetic
Finish:	Unblackened (see options)
Diameter:	3/8 inch (0.375 inch max) 9.53mm.
Positional tolerance:	ø.006 inch (0.1524mm)
Thickness:	0.0005 inch (12.7µm) 3µm and up (0.5 - 2.5µm are on 0.0001 inch - 0.0002 inch foil patch on 3-6 mil backing)

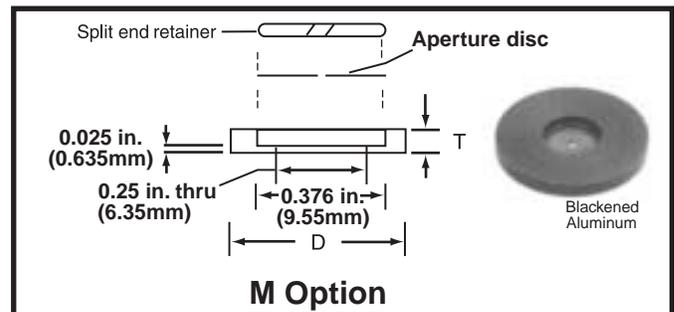
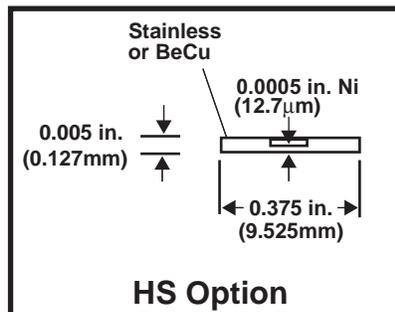


Catalog #	Size	Catalog #	Size
1 - 0.5	0.5µm +0.3µm, -0	1 - 65	65µm ±3µm
1 - 1.0	1.0µm +0.5µm, -0	1 - 75	75µm ±3µm
1 - 2.0	2.0µm ±0.5µm	1 - 100	100µm ±4µm
1 - 3.0	3.0µm ±0.5µm	1 - 150	150µm ±6µm
1 - 5.0	5.0µm ±1µm	1 - 200	200µm ±6µm
1 - 7.5	7.5µm ±1µm	1 - 300	300µm ±8µm
1 - 10	10µm ±1µm	1 - 400	400µm ±10µm
1 - 15	15µm ±1.5µm	1 - 500	500µm ±10µm
1 - 20	20µm ±2µm	1 - 600	600µm ±10µm
1 - 25	25µm ±2µm	1 - 700	700µm ±10µm
1 - 30	30µm ±2µm	1 - 800	800µm ±10µm
1 - 35	35µm ±2µm	1 - 900	900µm ±10µm
1 - 40	40µm ±3µm	1 - 1000	1000µm ±10µm
1 - 50	50µm ±3µm	1 - "size"	up to 7000µm

Unlisted hole size: one time setup charge, plus price of nearest listed size.
Non-Standard substrate diameter, thickness, material or tolerances: per quote.

OPTIONS, STANDARD ROUND

- B-1** Poly black, one side, ultra-high (98%) emissivity (on holes 3µm and up only)
- B-2** Oxide, dull black, both sides (cannot be combined with B-1 or HS, except as custom order) 3µm and up
- HS** Extra Heavy Substrate, 0.005 inch (0.127mm) thick, thinned down to 0.0005 inch (12.7µm) Ni at center, (see drawing)
- M** 25mm mount D= 24.95mm T= 2.54mm blackened aluminum
- M-1** 1 inch mount D= 0.996 inch T= 0.100 inch blackened aluminum
- M-18** 18mm mount D= 18mm T= 2.54mm blackened aluminum
- M-0.5** 1/2 inch mount D= 0.496 inch T= 0.05 inch blackened aluminum
- C** Calibrated; actual size, ±0.5µm or 1%, 5µm and up
- CT** Closer Tolerance; half of listed tolerance, 5µm and up



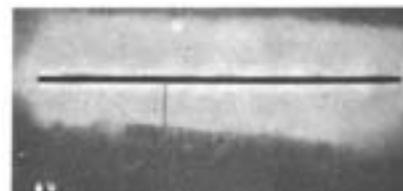
Ordering information: Example; 25µm round, black 2 sides, mounted on 25mm disc. Cat no.: 1-25+B-2+M
SEM photos: per aperture, per additional shot/angle (not to be used for calibration)



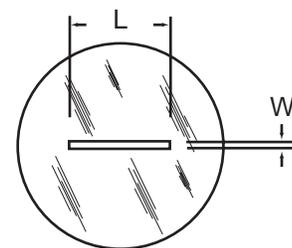
Standard Precision AIR SLIT Apertures

Specifications:

Material:	302 stainless steel, non-magnetic
Finish:	Unblacked (see options)
Diameter:	3/8 inch (0.375 inch max) 9.53mm.
Positional tolerance:	ø.006 inch (0.1524mm)
Thickness:	0.0005 inch (12.7 μm) except 2.5μm (2μm and under are on 0.006mm Ni foil)



Catalog #	Slit Width (W)	L = 1mm	L = 2mm	*L = 3mm
2 - 1	1.0μm +0.5μm, -0.0			
2 - 2.5	2.5μm ±1μm, -0.5μm			
2 - 5	5μm ±1μm			
2 - 10	10μm ±1μm			
2 - 25	25μm ±2μm			
2 - 50	50μm ±2μm			
2 - 100	100μm ±4μm			
2 - 150	150μm ±4μm			
2 - 200	200μm ±4μm			



Unlisted slit width: 6μm - 35μm one time setup charge, plus price of nearest listed size.
36μm - 750μm one time setup charge, plus price of nearest listed size.

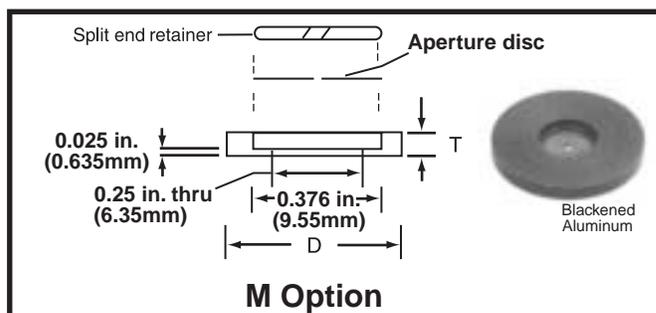
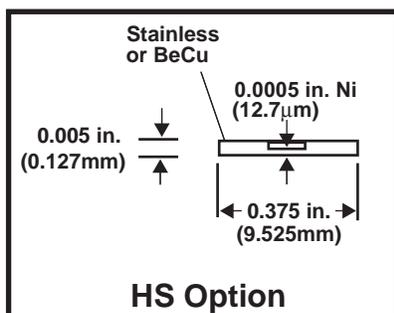
Longer lengths up to 25mm: per quote

Non-Standard substrate diameter, thickness, or material: per quote.

*Note: L = 3mm if not otherwise specified (except 2.5μm)

OPTIONS, STANDARD AIR SLIT

- B-1** Poly black, one side, ultra-high (98%) emissivity
- B-2** Oxide, dull black, both sides (cannot be combined with B-1 or HS, except as custom order) Not for 2μm slit
- HS** Extra Heavy Substrate, 0.005 inch (0.127mm) thick, thinned down to 0.0005 inch (12.7μm) Ni at center, (see drawing)
- M** 25mm mount D= 24.95mm T= 2.54mm blackened aluminum
- M-1** 1 inch mount D= 0.996 inch T= 0.100 inch blackened aluminum
- M-18** 18mm mount D= 18mm T= 2.54mm blackened aluminum
- M-0.5** 1/2 inch mount D= 0.496 inch T= 0.05 inch blackened aluminum
- C** Calibrated; actual size, ±1μm or 1%, 25μm and up
- CT** Closer Tolerance; half of listed tolerance, 100μm and up



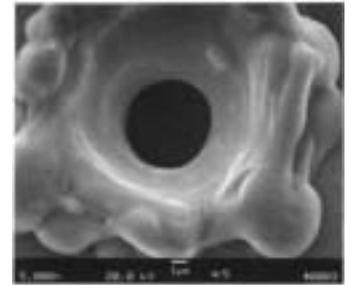
Ordering information: Example; 25μm round, black 2 sides, mounted on 25mm disc. Cat no.: 1-25+B-2+M
SEM photos: per aperture, per additional shot/angle (not to be used for calibration)



High Power Precision Round Apertures

Specifications:

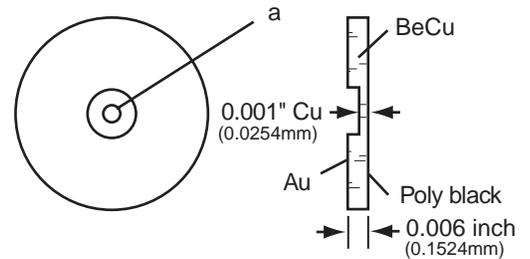
Material:	Copper
Finish:	Gold plated one side, flat poly black (98% emissivity) on reverse side
Diameter:	3/8 inch (0.3755 inch max.) 9.525mm
Positional tolerance:	ø.006 inch (0.1524mm)
Thickness:	1 mil, with 5 mil support (bi-metal) (Electroplated; no bonding material)



5µm

Catalog #	Size
-----------	------

3 - 5	5µm ±1µm
3 - 10	10µm ±1µm
3 - 15	15µm ±1.5µm
3 - 25	25µm ±2µm
3 - 50	50µm ±3µm
3 - 100	100µm ±4µm
3 - 200	200µm ±6µm
3 - size	up to 7000µm



Unlisted hole size 6µm to 1000µm:

Non-standard substrate diameter, thickness, material or special tolerances: per quote

OPTIONS, HIGH POWER ROUND

- M 25mm mount D= 24.95mm T= 2.54mm blackened aluminum
- M-1 1 inch mount D= 0.996 inch T= 0.100 inch blackened aluminum
- M-18 18mm mount D= 18mm T= 2.54mm blackened aluminum
- M-0.5 1/2 inch mount D= 0.496 inch T= 0.05 inch blackened aluminum
- C Calibrated; actual size, ±0.5µm or 1%, 5µm and up
- CT Closer Tolerance; half of listed tolerance, 10µm and up
- G2 Gold plated, both sides

SEM photos:

per aperture,
per additional shot/angle
(not to be used for calibration or measurement)

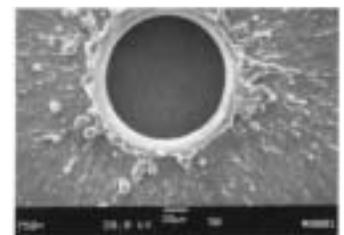
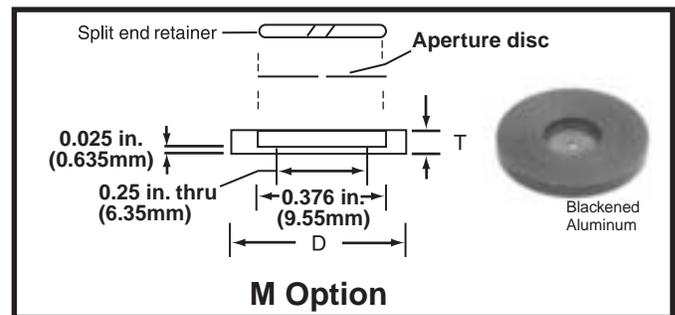
Power resistance, examples:

- 0.5 - 1 megawatt/mm²,
- 75 nanosecond duration, 700nm
- 1 - 2 megawatts/mm²,
- 10 nanosecond duration, 700nm

Note: Because of the numerous power density conditions, a test on 1 mil copper in your direct operating environment is recommended.

Ordering information example:

50µm high power round, mounted on 18mm disc, close tolerance
Catalog number: 3-50+M-18+CT



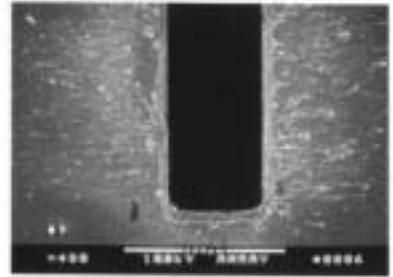
50µm



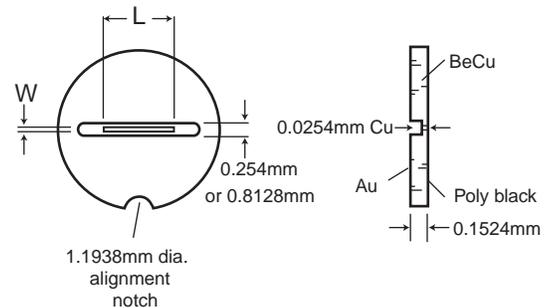
High Power Precision AIR SLIT Apertures

Specifications:

Material:	Copper
Finish:	Gold plated one side, flat poly black (98% emissivity) on reverse side.
Diameter:	3/8 inch (0.3755 inch max), 9.5377mm
Positional tolerance:	ø.006 inch (0.1524mm)
Thickness:	1 mil, with 5 mil support (bi-metal)



Catalog #	Slit Width (W)	Length
4 - 5	5µm ±1µm	3mm
4 - 10	10µm ±1µm	3mm
4 - 15	15µm ±1.5µm	3mm
4 - 25	25µm ±2µm	3mm
4 - 50	50µm ±3µm	3mm
4 - 100	100µm ±4µm	3mm
4 - 200	200µm ±4µm	3mm



Unlisted slit width:

6µm - 35µm one time setup charge, plus price of nearest listed size.

36µm - 750µm one time setup charge, plus price of nearest listed size.

Longer lengths up to 25mm: per quote

Non-Standard substrate diameter, thickness, or material: per quote.

OPTIONS, HIGH POWER SLIT

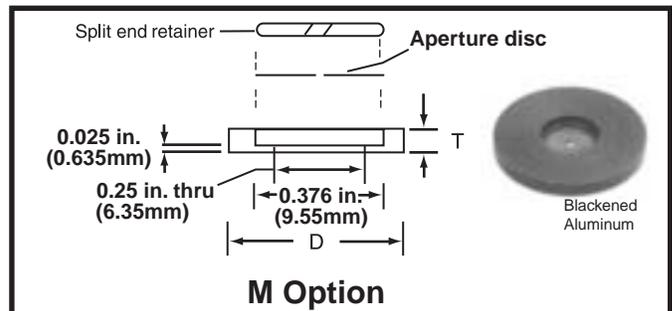
- M 25mm mount D= 24.95mm T= 2.54mm blackened aluminum
- M-1 1 inch mount D= 0.996 inch T= 0.100 inch blackened aluminum
- M-18 18mm mount D= 18mm T= 2.54mm blackened aluminum
- M-0.5 1/2 inch mount D= 0.496 inch T= 0.05 inch blackened aluminum
- C Calibrated; actual size, ±1µm or 1%, 25µm and up
- CT Closer Tolerance; half of listed tolerance, 100µm and up
- G2 Gold plated, both sides

SEM photos:

per aperture,
per additional shot/angle
(not to be used for calibration or measurement)

Power resistance, examples:

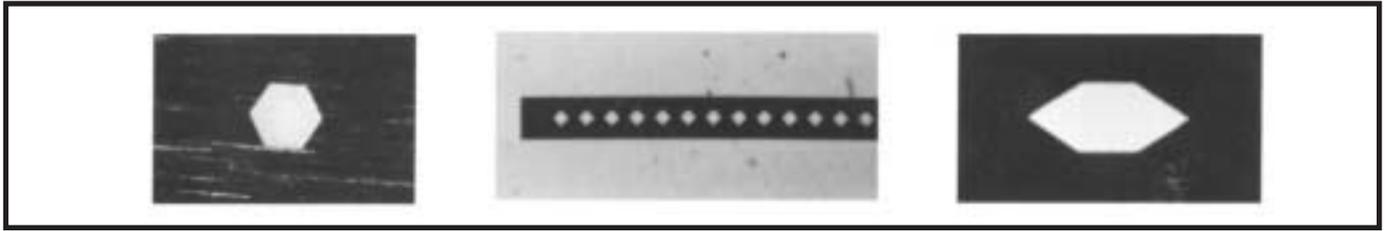
- 0.5 - 1 megawatt/mm²,
- 75 nanosecond duration, 700nm
- 1 - 2 megawatts/mm²,
- 10 nanosecond duration, 700nm



Note: Because of the numerous power density conditions, a test on 1 mil copper in your direct operating environment is recommended.

Ordering information example:

50µm high power round, mounted on 18mm disc, close tolerance
Catalog number: 4-50+M-18+CT



Typical materials:

- | | |
|-------------------|-------------|
| •Stainless steel | •Tantalum |
| •Brass | •Tungsten |
| •Copper | •Molybdenum |
| •Beryllium copper | •Titanium |
| •Gold | •Platinum |
| •Nickel | •etc. |



Suggested materials (unless otherwise required):

For best quality and cost; 300 series stainless steel 0.001 inch (0.0254mm) thick or under.

Gas, Liquid, Material FLOW Oriented:

Leak test grade;

The emphasis normally on roundness is replaced by orifice area specification to improve cost effectiveness. To optimize quality, materials should be kept as thin as allowable. 302 stainless steel is suggested unless otherwise required.

Metered Flow;

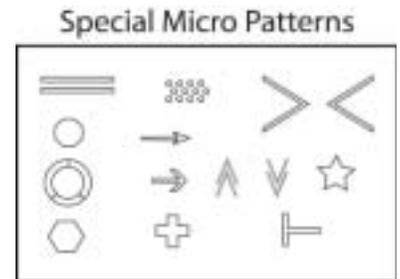
Same as Leak Test above

Dies (wire polymer), Jets (liquid or gas);

Up to 0.010 inch (0.254mm) diameter x 0.010 inch (0.254mm) deep

Special Micro Patterns:

Round, square, rectangular, slit, arc, hexagon, octagon, annular, etc. and combinations of patterns or arrays



X-ray shielding, selective:

Typical materials are tantalum, tungsten and platinum

Four-Bar Patterns:

Standard on 302 stainless steel 0.0005 inch x 0.375 inch, or copper 0.001 inch. Up to 5mm square; not including applicable air slit options
Up to 0.750 inch, any workable material

4-Bar Patterns



SEM photos:

- per feature
- per additional shot/angle
- (Not to be used for calibration or measurement.)

Quality projection samples are available at minimal or no cost.

Custom Air Apertures on Reflective Surfaces to Optical Tolerances

Flatness:

to 1/4 wave per inch (25.4mm), with consideration for thickness requirements at immediate aperture area

Reflectivity:

Optical metal mirror quality

Materials:

- Copper
- Stavex (stainless steel)
- etc.

Thickness:

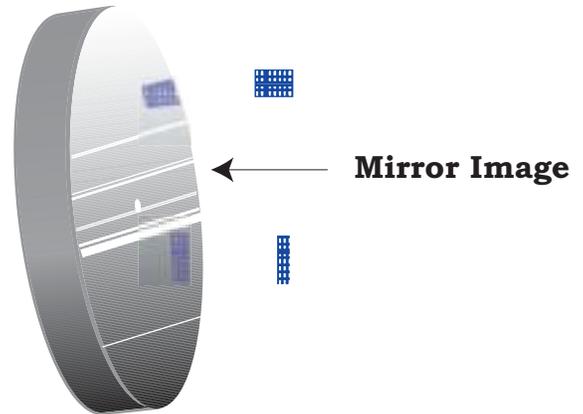
as required for flatness, minimum

Coatings:

- Gold
- Silver
- Dichroic
- SiO
- etc.

Applications:

- Astronomy; ground based and space applications
- Imaging
- etc.



Clear Patterns, Reticles, Apertures on high power dielectric laser reflector coatings

For applications requiring transparency and/or power resistance greater than achievable with opaque (metallic, etc.) surfaces this process creates patterns on dichroic reflectors with selective transparency.

Wavelength: Per standard high power dielectric coating, visible and near visible

Pattern generation: Per customer or National Aperture, Inc. via AutoCad™

Pattern definition: $1\mu\text{m}$ (semiconductor pattern quality)

Dimensions: Up to 6 inch (152.4mm); thickness, 0.04 inch - 0.09 inch [1.016 - 2.286(mm)]

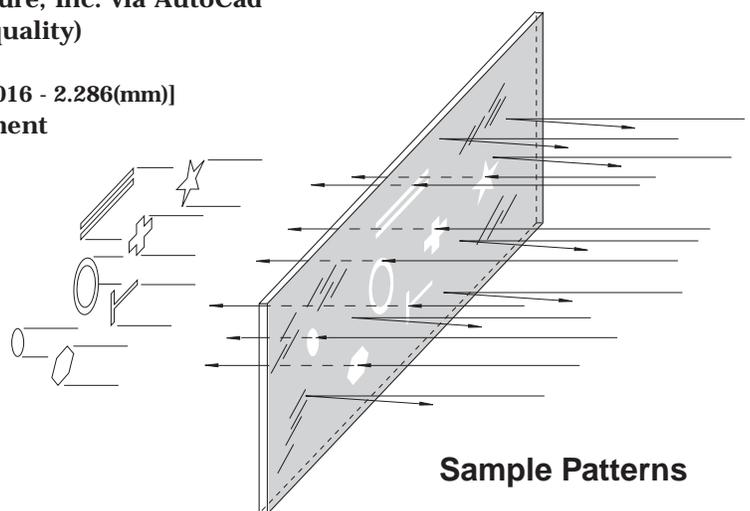
Reflectivity: 20% to 98%, based on requirement

Incidence: 0° - 90°, per specification

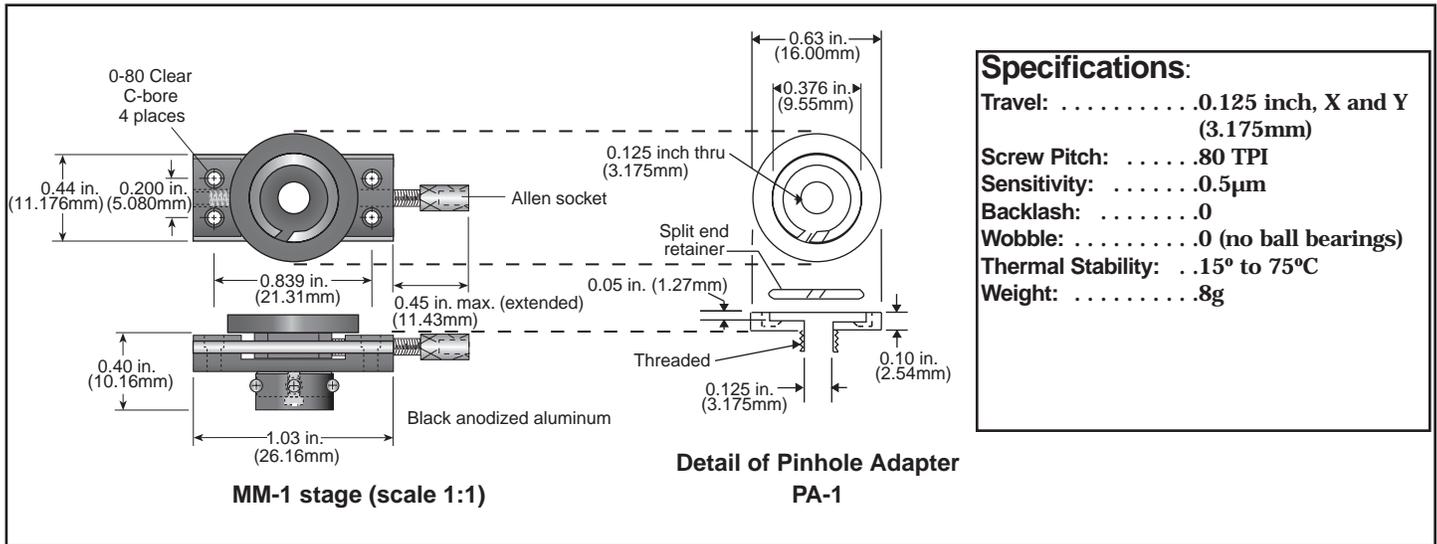
Power resistance: 2 - 8 megawatts/mm², pulsed

Material: Glass, fused silica, etc.

Pricing: Per quote

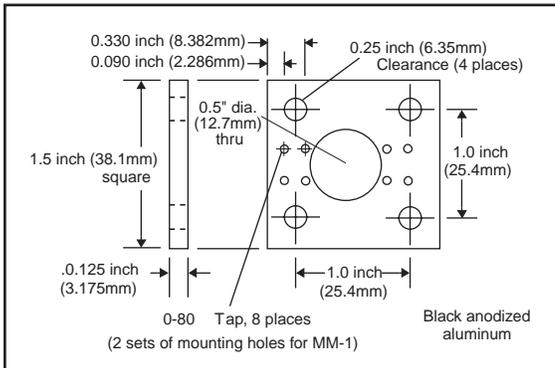


Model MM-1XY/PA



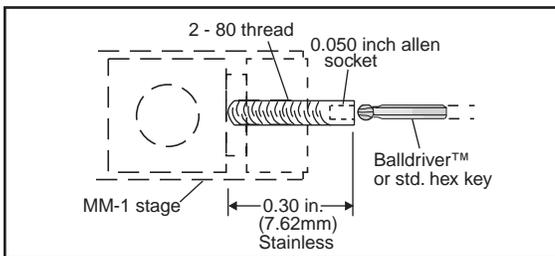
The pinhole (aperture) positioner is a composite of the MM-1 MicroMini™ stage and the PA-1 pinhole adapter. A similar pinhole positioner can also employ the MM-3 stage [0.5 inch(12.7mm) travel] where needed (see Stage Catalog).

Accessories



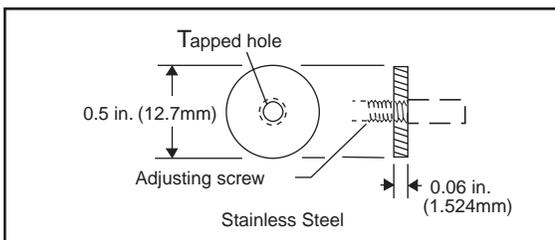
AP4-1 Adapter Plate

A multi-position mounting plate to interface with standard optical tables and accessories, or to stabilize free-standing stages.



SS-1 Headless Adjusting Screw

This custom designed lead screw replaces the standard thumb screw. It provides full linear travel, while reducing the overall length of the stage by 0.4 inches (10.16mm).



TG-1 Thumb Grip

This knurled 1/2 inch (12.7mm) diameter adjustment ring provides increased sensitivity. The TG-1 can be added to the standard MM-1 adjusting screw and may alternately be used as a locking nut.

