ANNULAR APERTURE OBSTRUCTION TARGETS

► **Obstruction Diameters Ranging from 50 µm to 1700 µm**
► **Pinhole Diameters Ranging from 300 µm to 2000 µm**
► **Blocking Region with Optical Density ≥ 6**
► **0.5 mm Thick Quartz Substrate in Ø1" Aluminum Housing**

Application Idea
R1CA2000 Obstruction
Target Mounted in
CXY1Q Translation Mount
with Quick-Release Plate

R1DF100
Annular Aperture Target
Obstruction Diameter = 100 µm
Pinhole Diameter = 1000 µm

OVERVIEW

Features

- Increase Contrast when Imaging Biological Systems
- Filter Out Lower Order Spatial Modes
- 0.5 mm Thick Quartz Substrate
- Blocking Region (OD ≥ 6) Created Using a Chrome Mask
- AR Coating Over Chrome Mask to Minimize Back Reflections
- Aluminum Housing with a 1" Outer Diameter

Thorlabs' Annular Aperture Obstruction Targets (AAOTs) are ideal for increasing the contrast when imaging biological systems or filtering out lower order modes. Each AAOT is characterized by the ratio (ε) between the obstruction diameter (OD) and the pinhole diameter (PD). Thorlabs offers Annulus Aperture targets that are designed with either a constant 1 mm pinhole diameter for high-pass spatial filtering applications, or a constant ε ratio for confocal microscopy applications.

They are fabricated from 0.5 mm thick quartz glass substrate that has high transmission in the 400 - 2200 nm wavelength range. The clear aperture annulus is created using a chrome mask with an optical density ≥ 6 that blocks light from being transmitted though the inner obstruction target and outer obstruction region. The AAOT is then mounted within a housing that has a 1" outer diameter for mounting within our translation mounts for Ø1" optics, as shown in the image above. The glass substrate is mounted with the chrome mask facing towards the engraved side of the housing. To minimize back reflections, we recommend having the AR-coated chrome mask facing the light source when used.

Apertures Selection Guide
Single Precision Pinholes
Circular in Stainless Steel Foils
Circular in Tungsten Foils
Circular in Gold-Plated Copper Foils
Square in Stainless Steel Foils
Pinhole Wheels
Manual
Motorized
Pinhole Spatial Filter
Slits
Annular Apertures
Alignment Tools

APERTURES SELECTION GUIDE

| Apertures Selection Guide			
Aperture Type	**Representative Image (Click to Enlarge)**	**Description**	**Aperture Sizes Available from Stock[a]**
Single Precision Pinholes[a]		Circular Pinholes in Stainless Steel Foils	Ø1 µm to Ø2 mm
		Circular Pinholes in Tungsten Foils	Ø5 µm to Ø2 mm

		Ø10 to Ø50 µm
	Circular Pinholes in Gold-Plated Copper Foils	
	Square Pinholes in Stainless Steel Foils	100 to 1000 µm Square
Slits[a]	3 mm Long Slits in Stainless Steel Foils	Slit Widths: 5 to 200 µm
Annular Apertures	Annular Aperture Obstruction Targets on Quartz Substrates with Chrome Masks	Ø300 µm or Ø2 mm Pinholes with ε Ratios[b] of 0.85, Ø1 mm Pinholes with ε Ratios[b] of 0.05 0.1, or 0.85
Pinhole Wheels	Manual, Mounted or Unmounted, Chrome-Plated Fused Silica Disks with Lithographically Etched Pinholes	Each Disk has 16 Pinholes from Ø25 µm to Ø2 mm and Four Annular Apertures (Ø100 µm Hole, 50 µm Obstruction)
	Motorized Pinhole Wheels with Chrome-Plated Glass Disks with Lithographically Etched Pinholes	Each Disk has 16 Pinholes from Ø25 µm to Ø2 mm and Four Annular Apertures (Ø100 µm Hole, 50 µm Obstruction)

- a. Single precision pinholes and slits can be special ordered with different aperture sizes, foil materials, shapes, and hole distributions than those offered from stock. Please contact Tech Support with inquiries.
- b. Ratio of the Obstruction Diameter to the Pinhole Diameter

Obstruction Targets: Annular Aperture, 0.05 or 0.10 Ratio

- ▶ Constant Pinhole Diameter of 1 mm
- ▶ Obstruction Diameters of 50 µm or 100 µm
- ▶ Ø1" Housing can be Mounted in Many of our Translation Mounts for Fine Alignment
- ▶ Ideal for High-Pass Spatial Filtering Applications
- ▶ Can be Used in Our Pre-Assembled Spatial Filter System

$$\varepsilon = \frac{Obstruction\ Diameter}{Pinhole\ Diameter}$$
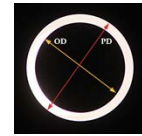
Click to Enlarge
Close-Up Photo of an Obstruction Pinhole
OD: Obstruction Diameter
PD: Pinhole Diameter

These Annular Aperture Obstruction Targets have an obstruction-to-pinhole ratio (ε) of either 0.05 or 0.10, making them ideal for use as high-pass or edge-enhancement filters. When the Fourier plane is imaged onto the filter, the center region, which contains Gaussian light (TEM_{00}), will become blocked by the center obstruction. This allows the higher order modes of the Fourier plane, which contain diffraction information, to pass through and form the image. This will cause an overall loss of light intensity and generalized, smooth features, but it will enhance any sharp lines or boundaries.

Shown to the right is a close up photo of an obstruction pinhole with the pinhole diameter (PD) and obstruction diameter (OD) labeled. The chrome-masked area appears black, and light is transmitted through the clear aperture.

| Item #	ε Ratio[a]	Obstruction Diameter	Pinhole Diameter	Annular Aperture Concentricity		Glass Thickness
				with Respect to Housing[b]	with Respect to Substrate[c]	
R1DF50	0.05	50 µm	1 mm	<0.41 mm	≤216 µm	0.5 mm
R1DF100	0.10	100 µm				

- a. Ratio of the Obstruction Diameter to the Pinhole Diameter (See Photo to the Above Right)
- b. Concentricity of the Annulus with Respect to the Outer Diameter of the Quartz Glass Substrate
- c. Concentricity of the Annulus with Respect to the Outer Diameter of the Aluminum Housing

Part Number	Description	Price	Availability
R1DF50	Customer Inspired! Annular Obstruction Target, ε = 0.05, Ø50 µm Obstruction	$165.56	Today
R1DF100	Customer Inspired! Annular Obstruction Target, ε = 0.10, Ø100 µm Obstruction	$165.56	Today

Obstruction Targets: Annular Aperture, 0.85 Ratio

- ▶ Constant ε Ratio of 0.85
- ▶ Ø1" Housing can be Mounted in Many of our Translation Mounts for Fine Alignment
- ▶ Ideal for Confocal Microscopy Applications
- ▶ Can be Used in Our Pre-Assembled Spatial Filter System

$$\varepsilon = \frac{Obstruction\ Diameter}{Pinhole\ Diameter}$$
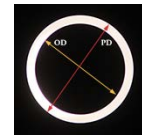
Click to Enlarge
Close-Up Photo of an Obstruction Pinhole
OD: Obstruction Diameter

These Annular Aperture Obstruction Targets have a constant obstruction-to-pinhole ratio (ε) of 0.85, making them ideal for increasing the lateral spatial resolution within confocal imaging systems. These filters are designed to be placed directly in front of the output of a light source such as a fiber-coupled laser. The system should be aligned so that the first bright diffraction spot of the light source is larger than

the pinhole diameter of the annular aperture.

PD: Pinhole Diameter

These annular apertures are often used in confocal and two-photon excitation microscopy to increase the lateral resolution of the imaging system or in confocal theta fluorescence microscopy to increase the lateral and axial resolution of the imaging system.

Shown to the right is a close up photo of an obstruction pinhole with the pinhole diameter (PD) and obstruction diameter (OD) labeled. The chrome-masked area appears black, and light is transmitted through the clear aperture.

| Item # | ε Ratio[a] | Obstruction Diameter | Pinhole Diameter | Concentricity | | Glass Thickness |
				with Respect to Housing[b]	with Respect to Substrate[c]	
R1CA300		255 µm	300 µm			
R1CA1000	0.85	850 µm	1000 µm	<0.41 mm	≤216 µm	0.5 mm
R1CA2000		1700 µm	2000 µm			

- a. Ratio of the Obstruction Diameter to the Pinhole Diameter (See Photo to the Above Right)
- b. Concentricity of the Annulus with Respect to the Outer Diameter of the Quartz Glass Substrate
- c. Concentricity of the Annulus with Respect to the Outer Diameter of the Aluminum Housing

Part Number	Description	Price	Availability
R1CA300	Customer Inspired! Annular Obstruction Target, ε = 0.85, Ø255 µm Obstruction	$165.56	Lead Time
R1CA1000	Customer Inspired! Annular Obstruction Target, ε = 0.85, Ø850 µm Obstruction	$165.56	Today
R1CA2000	Customer Inspired! Annular Obstruction Target, ε = 0.85, Ø1700 µm Obstruction	$165.56	Today