Direct image transmission

FOP

Fiber Optic Plates

HAMAMATSU

PHOTON IS OUR BUSINESS

FOP

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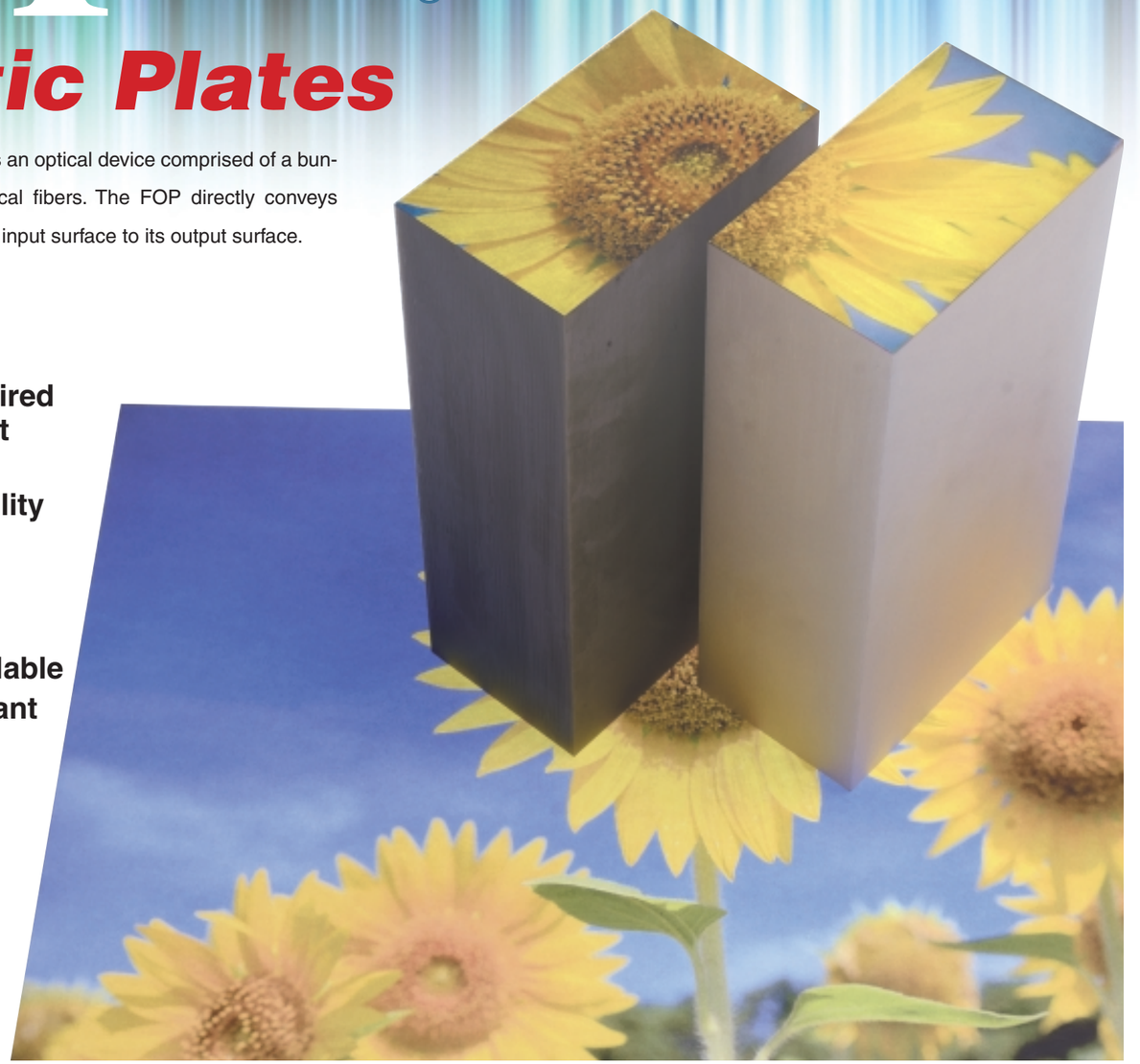
OVERVIEW

The FOP (fiber optic plate) is an optical device comprised of a bundle of micron-diameter optical fibers. The FOP directly conveys light or image incident on its input surface to its output surface.

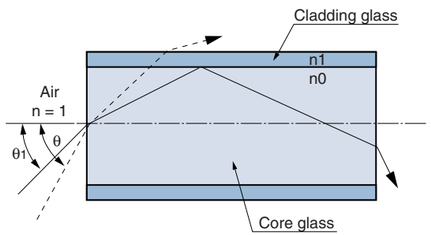


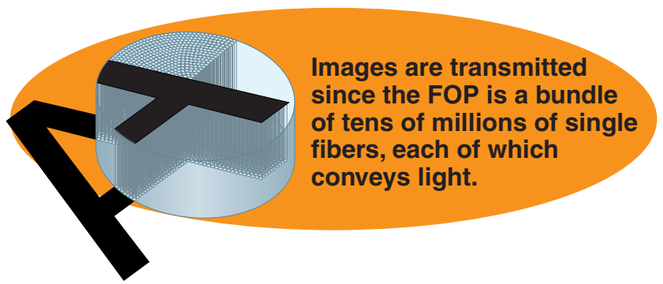
FEATURES

- ◆**No focusing distance required allows simple and compact optical design**
- ◆**Superb X-ray shielding ability**
  (X-ray shielding type)
- ◆**Image magnification and reduction**
  (tapered fiber optics)
- ◆**Customized products available**
- ◆**All products RoHS compliant**

CONSTRUCTION

The basic element of an FOP consists of a single fiber that conveys light and an absorber glass that absorbs light leaking from the fiber.
In each single fiber, light is conveyed by total reflection that occurs at the boundary between the core glass and the cladding glass due to the difference in their refractive index. As shown in the figure on the right, when light (shown by broken line) enters a fiber at an angle θ (theta) greater than the maximum acceptance angle θ1, it does not totally reflect and exits the fiber. However, that light is absorbed by the absorber glass so that it will not reach the next fibers. This feature allows optical images to transmit through each fiber without degrading the resolution.

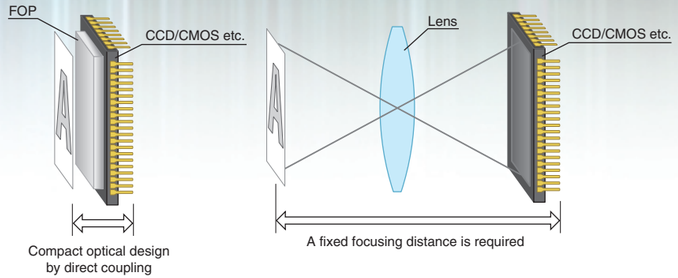




Images are transmitted since the FOP is a bundle of tens of millions of single fibers, each of which conveys light.

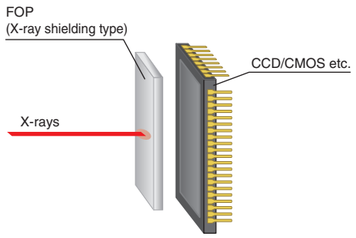
Allows compact optical design with high resolution

An FOP can be directly coupled to solid state imaging devices such as CCD and CMOS image sensors. Unlike a normal optical lens, FOP requires no space for focusing distance and so allows a flexible compact optical design.



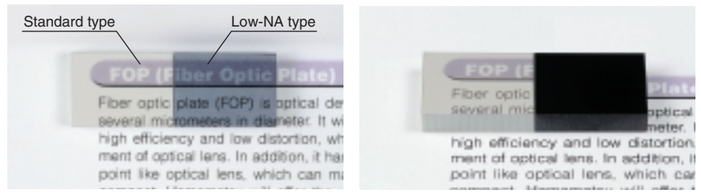
Effective for X-ray shielding

The X-ray shielding type FOP has a shielding capability about 5 times higher than a standard FOP when exposed to X-rays emitted from a 70 kV X-ray tube (comparison made using a 3 mm thick FOP). When an FOP is used as the light-receiving surface of a camera, it prevents the image sensor in the camera from deteriorating due to exposure to X-rays.



Low-NA-FOP

Hamamatsu also provides FOP with a low NA (numerical aperture). In this type of FOP, light incident at an angle exceeding the maximum acceptance angle is absorbed by the absorber material. So this FOP is ideal when extracting only light having a small incident angle.



Tapered fiber optics for image magnification or reduction

These are tapered FOPs fabricated by heat treatment to have a different size ratio between their input and output surfaces. This magnifies or reduces the input image at the desired ratio. The magnification/reduction ratio for a standard tapered FOP is 1:2 or 2:3 but can be varied up to a maximum of 1:5.

FOP Fiber Optic Plates

■SPECIFICATIONS

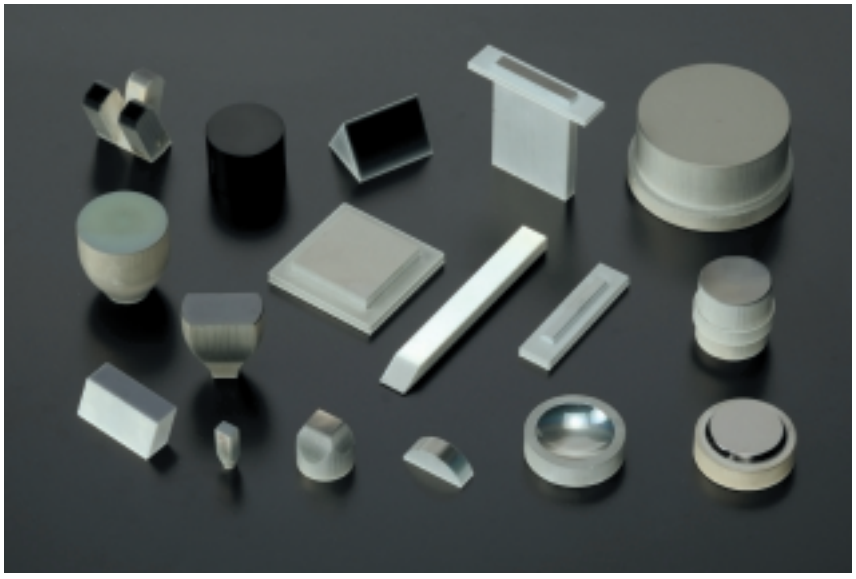
Item		Fiber optic plate					Tapered fiber optics	Unit
Type No.		J3182	J11181	J11057	J12221	J5734	J5743	
FOP type		Standard	Standard	X-ray shielding	Low-NA	High resolution	Taper (Ratio 2:1)	—
Numerical aperture (N.A.)		1.0			0.43	1.0	1.0	—
Maximum acceptance angle (full angle)		180			51	180	180	deg.
Fiber diameter		6			25	3	6 (large end)	μm
Resolution *1		102			28.5	161	102	Lp/mm
Transmittance*2	Collimated light	73	73	70	45	79	63	%
	Diffused light	63	63	66	6	60	15	%
Coefficient of thermal expansion *3		85	84	77	93	85	84	$\times 10^{-7}$/°C
Absorber		Yes						—

*1: Test target USAF1951 (reference values)
*2: at 550 nm wavelength
*3: at 100 °C to 300 °C

■OUTSIDE DIMENSIONS

Type No.	Suffix	Shape (mm)
J3182	-72	30.0 × 20.0 × 3.0 t
J11057	-73	50.0 × 50.0 × 3.0 t
J12221	-74	ϕ26.5 × 3.0 t
J11057 / J11181	-75	100.0 × 100.0 × 3.0 t
J5734	—	13.59 × 6.86 × 2.54 t
J5743	—	ϕ12.5- ϕ25.0 × 25.0 t

■CUSTOMIZED PRODUCTS



We welcome your requests for custom FOPs with different shapes and fiber diameters, etc. Please feel free to contact us.

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