OPTICAL DEVICE TO REPLACE LENS

FIBER OPTIC PLATES

LOW DISTORTION

HIGH TRANSMITTANCE

SIMPLE AND COMPACT OPTICAL DESIGN

HAMAMATSU

TRANSFER THE OPTICAL IMAGE WITHOUT DISTORTION AND OPTICAL LOSS

OPTICAL DEVICE TO REPLACE LENS

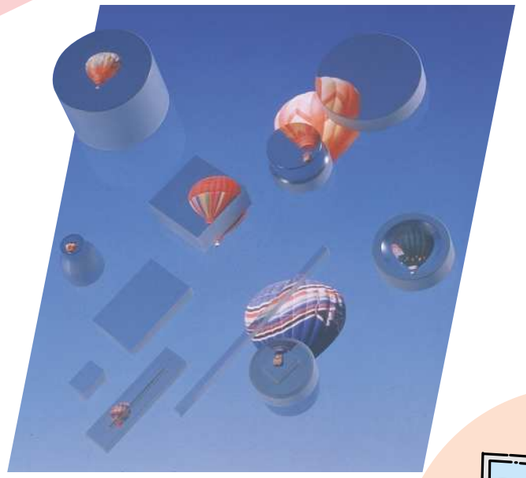
FIBER OPTIC PLATES (FOP)

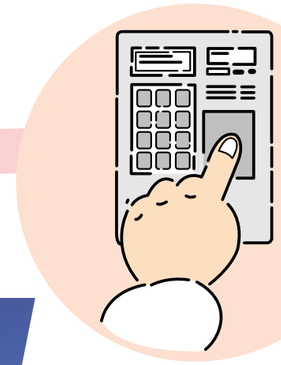
Fiber optic plate (FOP) is optical device bundling optical fibers having several micro-meters in diameter. It will transfer the light and image with high efficiency and low distortion, which allows it as the better replacement of optical lens.
In addition, it has no necessity to consider the focal point like optical lens, which can make the optical design simple and compact.
Hamamatsu will offer the variation in the high definition type having minimum fiber size of 3 micro-meters and in the magnification size of 3: 1 maximum for tapered type.

High spatial resolution
High transfer efficiency
Low image distortion
Enable compact optical design
Enable magnification/ reduction of image

- BANK NOTE SORTER
- etc.

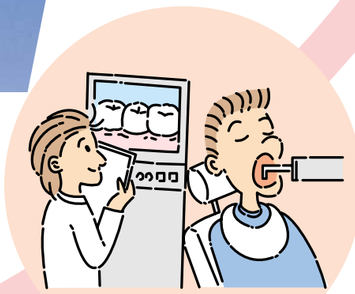
▼COUPLED TO LINEAR/TWO DIMENSIONAL MOS LINEAR IMAGE SENSOR





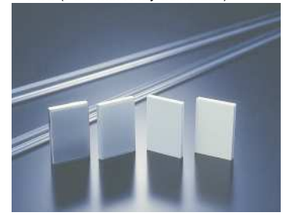
▲COUPLED TO CCD AS INPUT WINDOW

- SECURITY CHECK (FINGER PRINT IDENTIFICATION)
- HIGH RESOLUTION VIDEO CAMERA
- SURVEILLANCE CAMERA
- MEDICAL X-RAY CAMERA
- etc.



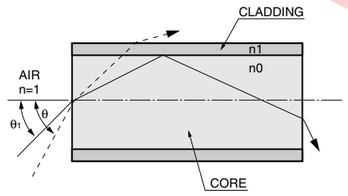
- MEDICAL X-RAY CAMERA
- DENTAL X-RAY CAMERA
- INDUSTRIAL X-RAY INSPECTION SYSTEM
- etc.

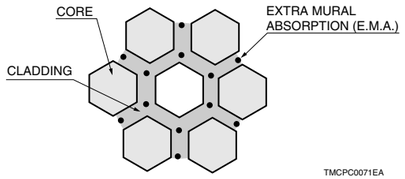
▼FOS (FOP with X-ray Scintillator)



OPTICAL PRINCIPLE AND CONSTRUCTION

A fiber optic plate has a multi fiber construction that bundles single fiber of several micro-meters in diameter. Each single fiber consists of a core glass conveying light, a clad glass covering the core glass and an E.M.A. that absorbs light leakage from the core glass. (Refer to the picture.)
A single fiber conveys light with reflection at the border caused by difference in the refractive indexies between the core and the clad glass.
As shown in the right picture when light enters at over the max. acceptance angle θ_I (dotted line θ), it does not get internally reflected and thus passes out of the fiber. However, it is absorbed by the E.M.A. and it does not reach the next single fiber. Therefore the resolution is not degraded and optical images can be conveyed without cross talk.
In addition, as tapered fiber optics consist of many tapered single fibers, reduced (magnified) input image can be conveyed with the same ratio.

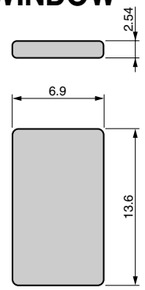




TMCPC0071EA

3μm FOP FOR 2/3 INCH CCD WINDOW

FOP developed for the window of CCD having higher spatial resolution. There is almost no image quality degradation while light transmission to CCD element because it has fiber diameter size of 3μm which is half of pixel size of CCD having best spatial resolution.
Maximum available size 100 mm × 100 mm.

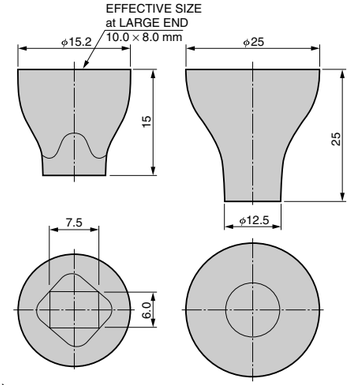


(Unit: mm)
J5734

TMCPA0047EA

TAPERED FIBER OPTICS

Transfered image can be magnified/reduced so that each fiber is tapered with same ratio.
It will allow to make the large size image condensed into CCD element, with using tapered fiber optics as the window material, which enables to support the magnification of CCD imaging area.
Maximum available size 30 mm at large end.



(Unit: mm)
J5735
J5743

TMCPA0048EA

OPTICAL DEVICE TO REPLACE LENS

FIBER OPTIC PLATES

FIBER OPTIC PLATES LINE UP

		FIBER OPTIC PLATES						TAPERED FIBER OPTICS		UNIT
Type No.		—	J5734	—	—	—	—	J5735	J5743	—
Fiber Diameter		3		6	25			6 ①		μm
Numerical Aperture (N. A.)		1.0		1.0	0.88	0.55	0.35	1.0		—
Resolution ②		161		102	28.5			102		Lp/mm
Extra Mural Absorption (E. M. A.)		NO	YES	YES	YES	YES	YES	YES		—
③ Transmittance	Collimated Light	85	79	73	74	70	60	60 ④	63 ⑤	%
	Lambertian Light	85	60	63	38	14	5	30 ④	15 ⑤	%
Maximum Useful Area		180		180	124	66	40	180		degree
Thermal Expansion Coefficient		85×10^{-7}		85×10^{-7}	96×10^{-7}			85×10^{-7}		/°C
Frit Type		Corning 7575		Corning 7576				Corning 7575		—
Sealing Metal		Carpenter 49 (Metal)		Corning 9008 (Glass)				Carpenter 49 (Metal)		—
Photocathode		YES		NO				YES		—
Phosphor Screen		YES		YES				YES		—
Vacuum Integrity		$< 1 \times 10^{-5}$								Pa·cc·He/s
Tapered Ratio ⑥		—		—	—			1.38: 1	2: 1	—
Application		· CCD · LCLV, CRT · Input/Output Window of I.I.			· CRT			· CCD · LCLV, CRT · Input/Output Window of I.I.		—

①Fiber size at large end ②Test chart USAF 1951 ③FOP: t = 3 mm, Wavelength = 550 nm
④Tapered Fiber Optics: t = 15 mm, Wavelength = 550 nm
⑤Tapered Fiber Optics: t = 25 mm, Wavelength = 550 nm
⑥Upto 3: 1 ratio upon request

PRECAUTION FOR USE

- **Keep the surface of FOP clean**
  Stains on effective area may be the reason of degradation in transparent ratio. Wipe out it with alcohol, if any.
- **Handle FOP carefully**
  FOP is made from glass material. Please don't give the scratch or shock to it.
- **Keep FOP in the storage under dry condition**
  Keep in the storage under the condition same as general optical device.
- **Use the coupling material when it is coupled each other**
  Direct coupling with another FOP's may generate the scratch on the surface of FOP. Please use the coupling material like silicon oil for it.

WARRANTY PERIOD

- This device is guaranteed for one year after delivery date from us. The warranty extends only to replacement of the products. The warranty does not cover damage due to misuse or natural calamity.

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