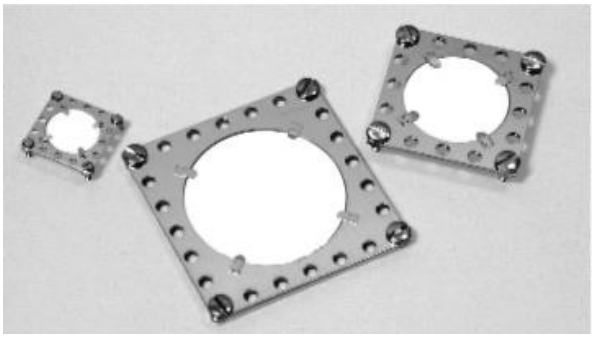
UHV Phosphor Standard Screens

APPLICATIONS:

- Beam Detection
- Beam Alignment
- Lens Testing
- Uniformity Testing
- Surface Physics
- **RHEED** (Reflection High-Energy Electron Diffraction) techniques for surface characterization
- UHV Experiments

FEATURES / OPTIONS:

- High luminosity Phosphor (P-22 Blue)
- UHV Compatible
- Input 1W/cm^2 max
- Bakeable to 350°C
- SS304 or glass backing
- Standard sizes up to 1.5" screen diameter



Examples of various sized Standard Phosphor Screens (0.7", 1.4" and 2.0" Edge length) with conductive glass (0.5", 1.0", 1.5" diameter) screens mounted in the central aperture of two adjacent square eV Part® plates. Tabs present to secure screens and conduct away charge.

UHV Phosphor Screens

Kimball Physics Phosphor Screens are made of a high luminosity phosphor (Blue P22- ZnS: Ag). Interestingly, phosphor does not contain phosphorus.

The screens are sensitive to electrons and will emit photons (luminescence) starting at approximately 500 eV with a threshold of 1 x 10^{-7} A/cm^2 at 500 eV. The maximum recommended input beam power density is 1 Watt/cm^2. Two general types of phosphor screens are made by Kimball Physics: Rugged Phosphor Screens and UHV Phosphor Screens.

This document will focus on Rugged Phosphor Screens.

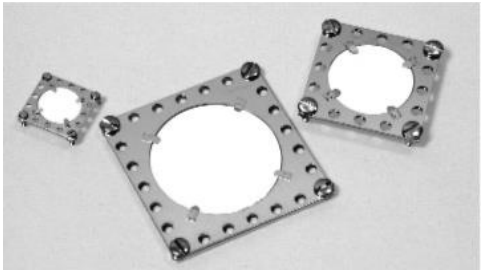
UHV Phosphor Screens (Kimball Physics ***PHOS-UP22***), with no binder, are compatible with ultra-high vacuums (UHV) better than 1 x 10^{-8} torr. Although these screens do well in an UHV environment, they are more fragile and require greater care when handling. Since the phosphor coating is delicate, it can be easily damaged from touching the UHV phosphor coating. Also, shock from knocking or dropping the screen may cause the phosphor coating to flake off. Standard UHV screens are shipped with a stainless-steel protective cover. The thickness of the UHV phosphor ranges from 50 µm to 70 µm.

The UHV screens are fabricated from high luminosity blue phosphor (P-22). They are bakeable to 350°C and are available in phosphor screen diameters of 0.50", 0.75", 1.00" and 1.50" for eV Part Plate Mounts (see figure above) and as 1.43", 2.83" and 4.20" for Thin Flange Mounts (2.75", 4.50", 6.00" CF respectively) for RHEED Thin Flange Mount Screens covered in another document.

Please also refer to our Phosphor Screen Overview for more details about both UHV and Rugged Standard Screens, with the various available mounting options including *eV Part®* Plates and RHEED Thin Flange Mounted Phosphor Screens.

UHV Phosphor Screens

- High luminosity Phosphor (P-22 Blue)
- Delicate coating
- Vacuum better than 10^{-8} torr
- Input 1W/cm^2 max
- Bakeable to 350°C
- SS 304 and Glass Backing
- Standard sizes up to 1.5" screen diameter



UHV Phosphor Screen	Phosphor Size (Ø)	Phosphor Backing	eV Plate Mount	Notes eV Plat Mount
PHOS_UP22SS-B5X5-R500	0.50”	SS	B5X5-R500	5 holes each side of 0.700” Square, with Centered Round Hole 0.500”
PHOS_UP22GL-B5X5-R500	0.50”	Glass	B5X5-R500	5 holes each side of 0.700” Square, with Centered Round Hole 0.500”
PHOS_UP22SS-B7X7-R750	0.75”	SS	B7X7-R750	7 holes each side of a 1.000” Square plate, with Centered Round Hole 0.750”
PHOS_UP22GL-B7X7-R750	0.75”	Glass	B7X7-R750	7 holes each side of a 1.000” Square plate, with Centered Round Hole 0.750”
PHOS_UP22SS-C5X5-R1000	1.00”	SS	C5X5-R1000	5 Holes each side of 1.400” Square plate, with Centered Round Hole 1.000”
PHOS_UP22GL-C5X5-R1000	1.00”	Glass	C5X5-R1000	5 Holes each side of 1.400” Square plate, with Centered Round Hole 1.000”
PHOS_UP22SS-C5X5-R1500	1.50”	SS	C7X7-R1500	7 Holes each side of 2.000” Square plate, with Centered Round Hole 1.500”
PHOS_UP22GL-C5X5-R1500	1.50”	Glass	C7X7-R1500	7 Holes each side of 2.000” Square plate, with Centered Round Hole 1.500”

Notes:
Plate Thickness:
B plates 0.012”,
C Plates 0.025”
B Plates Holes: Hole Size 0.062”, Hole spacing 0.150”
C Plates Holes: Hole Size 0.125”, Hole Spacing 0.300”
B Plate Size:
Square 5 Hole (B5x5) 0.700” x 0.700”,
Square 7 Hole (B7x7) 1.000” x 1.000”

C Plate Size:
Square 5 Hole (C5x5) 1.400” x 1.400”,
Square 7 Hole (C7x7) 2.000” x 2.000”,
Rectangular 3 x 5 Hole (C3x5) 0.750” x 1.400”
UP = UHV Phosphor Screen
RP = Rugged Phosphor Screen
SS= Stainless Steel Backing
GL= Glass Backing

UHV Phosphor Specifications	
Phosphor Type	ZnS: Ag Type 1330 (P-22 Blue)
Phosphor Screen Type	UHV
Phosphor Screen Backing	Stainless Steel 304, Conductive Glass
Saturation Threshold	3 x 10^{-2} Amps/cm^2
Peak Emitted Wavelength	450 nanometers
Maximum Input Power Density	1 Watt/cm^2
Minimum Power Density for Screen Response	5 x 10^{-5} Watts/cm^2
Max. Bakeout Temperature	350ºC
Notes: •Operating Vacuum Range; UHV Range, compatible with better than 10^{-8} torr	

Care and Handling Rugged, UHV and RHEED Phosphor Screens

Cautions	•Rugged •Rugged RHEED	**Handle with care.** Although the phosphor is bonded to SS or glass to resist mechanical shock or accidental touching of the screen, handle the ruggedized screen with reasonable care and do not scrape the phosphor.
	•UHV •UHV RHEED	**Handle with care.** Use caution when handling the phosphor screen as the coating is extremely delicate. Do not touch the Phosphor Coating or damage may result. Banging or knocking the screen or its mount on a hard surface could cause phosphor to flake off.
Shipping Protection	•RHEED	For protection of the RHEED Phosphor Screen, it is shipped with a Plexiglass cover and a steel base. The cover should be removed by a qualified technician wearing clean room gloves. Do not touch or knock the phosphor surface while removing the cover. • Remove the 12-point bolts • Carefully lift off the Plexiglas cover; it will expose the fragile phosphor surface • Holding the edge of the flange, remove phosphor screen with its flange from the steel base. Save the cover and base for shipping or storage.
Grounding	•All phosphor screens	After installation, ensure that the screen is properly grounded.
Maximum Input Power Density	•Rugged •UHV •RHEED	1 Watt/cm^2 Caution: Exceeding 1 Watt/cm^2 input power may damage the phosphor coating. To preserve screen brightness, it is advisable to use the lowest power density that provides a clear spot. Input Power Density = $\frac{\text{Beam Current x Beam Energy}}{\text{Spot Size (area)}}$

Phosphor Screen Notes

1) Using the phosphor screens at electron energies below the first unity-secondary-emission crossover point may cause the screen to charge up to electron cathode potential, at which point the screen temporarily goes out.

2) When using the phosphor screen, input power density should not exceed 1 Watt/cm^2, or the phosphor coating may be damaged. To preserve screen brightness, it is advisable to use the lowest beam power density that provides a clear spot. Normal usage will result in gradual browning of the screen.

3) Ruggedized screens are bakeable up to 200°C; UHV screens are bakeable up to 350°C.

4) Larger screens, mounted in either six- or eight-inch viewports are also available as an option. The diameter of a screen for a six-inch viewport would be 4.2 inch and the diameter of a screen for a eight inch viewport would be 6.2 inch. These larger phosphor screens can be deposited on leaded glass if required.

5) Rugged screens on stainless steel can, as an option, be deposited directly on the eV square plate.

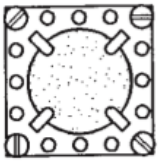
6) UHV screens on stainless steel are deposited on a round stainless steel plate that is affixed to the square mounting plate by four equally spaced tabs spot-welded to the square mounting plate and to the underside of the round (phosphor- coated) plate.

7) Standard phosphor screens deposited on conductive glass (both Rugged and UHV) are held between two stainless steel plates, within a center hole, by four equally spaced tabs on both sides of the screen. The tabs, which are spot-welded to the stainless steel plates, also serve to bleed off charge from the screens.

Examples of Phosphor Screens Mounted on Various eV Part® Plates

PHOS-RP22SS-B5x5-R500 (Rugged)
PHOS-UP22SS-B5x5-R500 (UHV)
0.50 inch phosphor on 0.700 inch square,
0.012 inch thick stainless steel B5x5 plate

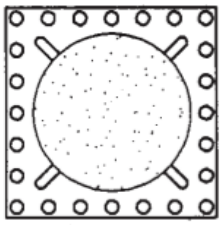
PHOS-RP22GL-B5x5-R500 (Rugged)
PHOS-UP22GL-B5x5-R500 (UHV)
0.50 inch phosphor on 0.030 inch thick
conductive glass fitting in a 0.700 inch square,
0.012 inch thick stainless steel B5x5 plate



PHOS-RP22GL-B5x5-R500

PHOS-RP22SS-B7x7-R750 (Rugged)
PHOS-UP22SS-B7x7-R750 (UHV)
0.75 inch phosphor on 1.000 inch square,
0.012 inch thick stainless steel B7x7 plate

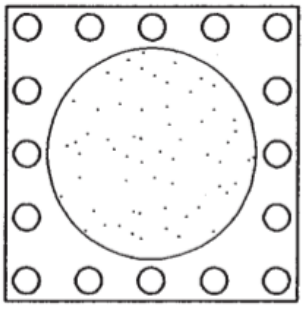
PHOS-RP22GL-B7x7-R750 (Rugged)
PHOS-UP22GL-B7x7-R750 (UHV)
0.75 inch phosphor on 0.030 inch thick
conductive glass fitting in a 1.000 inch square,
0.012 inch thick stainless steel B7x7 plate



PHOS-UP22SS-B7x7-R750

PHOS-RP22SS-C5x5-R1000 (Rugged)
PHOS-UP22SS-C5x5-R1000 (UHV)
1.00 inch phosphor on 1.400 inch square,
0.025 inch thick stainless steel C5x5 plate

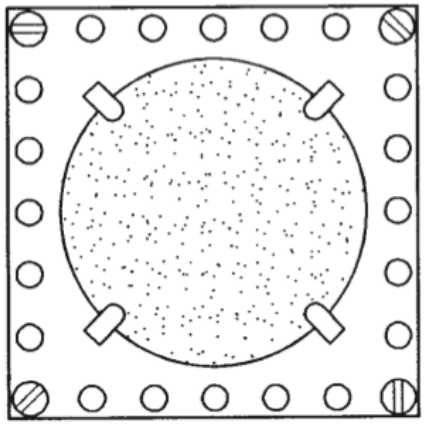
PHOS-RP22GL-C5x5-R1000 (Rugged)
PHOS-UP22GL-C5x5-R1000 (UHV)
1.00 inch phosphor on 0.030 inch thick
conductive glass fitting in a 1.400 inch square,
0.025 inch thick stainless steel C5x5 plate



PHOS-RP22SS-C5x5-R1000

PHOS-RP22SS-C7x7-R1500 (Rugged)
PHOS-UP22SS-C7x7-R1500 (UHV)
1.50 inch phosphor on 2.000 inch square,
0.025 inch thick stainless steel C7x7 plate

PHOS-RP22GL-C7x7-R1500 (Rugged)
PHOS-UP22GL-C7x7-R1500 (UHV)
1.50 inch phosphor on 0.030 inch thick
conductive glass fitting in a 2.000 inch square,
0.025 inch thick stainless steel C7x7 plate



PHOS-UP22GL-C7x7-R1500

References

For more information about Kimball Physics Detectors, please visit our website at:
Kimball Physics Detectors

Other References

Detectors Phosphor Screens Overview
Detectors RHEED Phosphor Screens
Detectors Rugged Phosphor Screens
Thin Mounting Flanges
eV Parts

Notes:

1. Cautions when directly attaching to MCF Chambers:
   - •Silver Plated Bolts or Equivalent Lubrication must be used
   - •Please measure the hole depth and other flange / copper ring /part thicknesses
   - •Choose a correct bolt length such that the bolt doesn't bottom in the tapped hole prior to tightening the structure.
2. Specifications Subject to Change Without Notice.
3. DE Altobelli, DT Taylor 1/25/2023

Document: Detectors_UHV_Phosphor_Screens_2023_0125