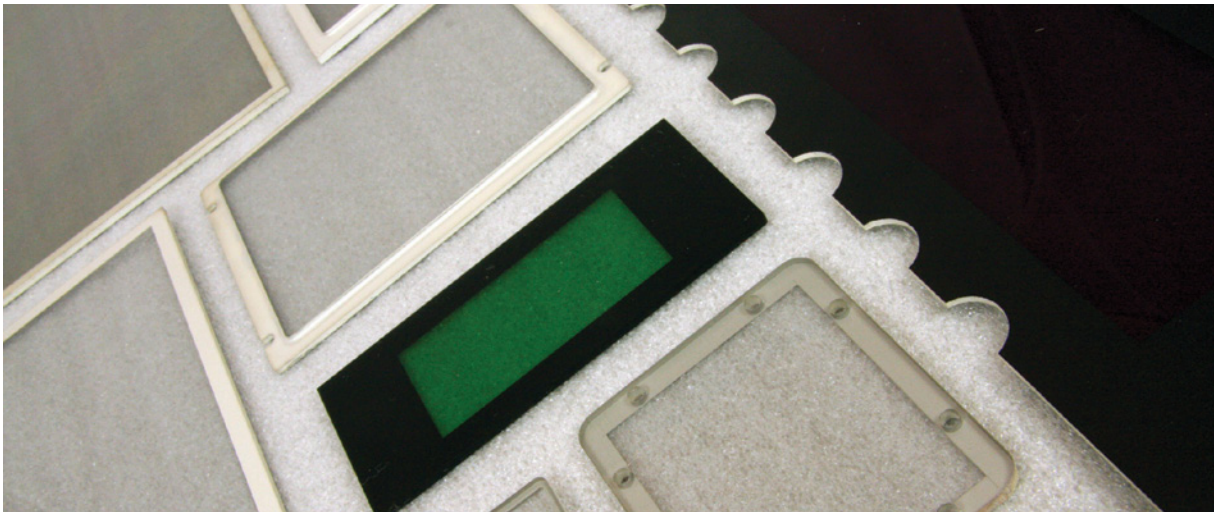
Kemtron
Proven EMC Shielding Performance

EMI Shielded Windows



Product Overview

Shielded windows provide a high performance EMI shield while maintaining optimum optical transparency.

Screening or shielding of optical windows is achieved by using either:

- A very fine woven wire mesh trapped between or embedded in a clear optical substrate such as acrylic, polycarbonate or glass, or
- A transparent vapour deposited conductive coating such as Indium Tin Oxide or Gold applied to the surface of the clear optical substrate.

Termination of the window to the enclosure is achieved with a continuous low resistance conductive edge around the window, either a conductive buss bar and conductive gasket, or extended wire mesh (see window mounting)

Application

EMI shielded windows provide an EMI screen as part of a shielded enclosure which will provide protection against radiated emissions and susceptibility. Shielded windows provide good transparency for viewing display devices such as LED, LCD, vacuum fluorescent, plasma etc and they can also form the front panel of an enclosure to provide impact protection, contrast enhancement of displays, display colour matching, anti reflection and an anti glare surfaces. Large windows can provide transparent EMI shielding for architectural use such as computer rooms, shielded rooms, MRI rooms and secure communication cabins.

Availability

EMI shielded windows are made to customer specification. Sizes can range from 1cm² up to 1x2 metres for architectural use. Windows can be silk screened or printed with logos, information etc. Termination can be by mechanical clamping using a conductive gasket or by bonding into the enclosure with a conductive adhesive.

Product Overview (Continued)

Design Considerations

Optical Substrates

Acrylic is a versatile substrate available in a range of colours to match display outputs to improve contrast enhancement including clear, which exhibits 92% light transmission, through to infra-red transmitting opaque materials. Acrylic is easily machined and formed making it suitable for front panels needing cut outs, holes, steps etc. Multiple layers can be fully laminated with fine wire meshes together with different colour combinations and the inclusion of circular polarizers. Acrylic has a UL94HB flammability rating and hard anti scratch, chemical resistant coatings can be applied to the surface as an optical flat or as anti-glare.

Polycarbonate has very high impact resistance, more than 16 times that of Acrylic and 200 times more than glass making it most suitable for rugged applications. Whilst its light transmission is not as good as other substrates at 85%, it has the advantage of having UL94VO flammability rating over 2.4mm thickness. Hard anti scratch, chemical resistant coatings can be applied to the surface as an optical flat or as anti-glare. Fine wire meshes can be fully laminated between two layers.

Glass has a very durable surface and will withstand high temperatures making it suitable for the application of vapour coatings such as ITO (indium tin oxide) for EMI shielding and/or anti reflection coatings that will reduce first surface reflections to less than 0.5%. Glass can be fully laminated with fine wire meshes and circular polarizers when required.

ADC (Allyl Diglycol Carbonate), trade name CR39, has a very hard surface hence its use as spectacle lenses. ADC is normally cast and has good impact resistance and is highly formable but is easily broken if scratched or notched. ADC meets UL94HB flammability rating but is the most expensive substrate.

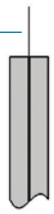
Shielding Media

Fine Wire Meshes provide the highest level of shielding while maintaining excellent optical properties. Wires used as the EMI shield are stainless steel or copper. The stainless steel mesh ranges from 50 wires per inch up to 250, copper mesh 70, 100 and 145. Wire diameters are 0.025mm or 0.056mm for stainless, 0.056mm for copper. The greater wire density gives better shielding performance but light transmission and optical clarity is degraded. The optimum wire count to achieve good shielding and optical characteristics is around 80-100 wires per inch. The wire is plated and blackened to fuse the wire crossovers ensuring consistent EMC performance and the blackening reduces specular reflection from the mesh, enhancing the optics. Wire meshes can cause moiré fringing on some displays. To eliminate this the wire is orientated in the substrate at an angle to be determined during the window design, this may from 11 to 45 degrees dependant on the display.

Transparent Vapour Deposited Conductive Coatings ITO (indium tin oxide) and Gold can be applied to the substrates but do not provide as effective shielding as the wire meshes. Their advantage is that optical clarity is maintained and there is no degradation in resolution or fringing that can be caused by fine wire meshes. The coating can be applied in various thicknesses to achieve a resistance of 5, 10 or 25 ohms/square.

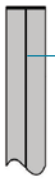
Design Considerations (Continued)

Extended wire

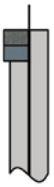


Conductive
'edge only' buss

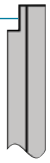
Wire mesh
extends to
edge of panel



Combination
conductive and
environmental gasket

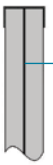


Conductive 'Z' buss

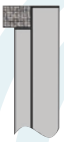


Conductive
'U' buss

Wire mesh
extends to
edge of panel



Conductive gasket



Conductive
'L' buss

Wire mesh
extends to
edge of panel

Technical Specifications

Shielding Effectiveness

Stainless Steel Wire Mesh

Stainless steel wire Silver plated (fusing the wire crossovers) and blackened with a black corrosion resistant plating

1 = 80 mesh type 304 stainless steel with a 0.001" wire diameter
2 = 100 mesh type 304 stainless steel with a 0.001" wire diameter
3 = 100 mesh type 316 stainless steel with a 0.001" wire diameter

Port size 20" x 24" test performed in accordance with NSA 65-6 and MIL-STD-285

H Field

Frequency	1	2	3
2KHz		2dB	
15KHz	6dB	6dB	13dB
100KHz	15dB	16dB	30dB
1MHz	32dB	32dB	49dB

E Field

Frequency	1	2	3
2KHz			>60dB
15KHz	82dB	86dB	89dB
100KHz	86dB	87dB	87dB
1MHz	81db	85dB	87dB
10MHz			88dB

E Field & Plane Wave

Frequency	1	2	3
18KHz			92dB

Plane Wave

Frequency	1	2	3
30MHz		73dB	80dB
60MHz	62dB		81dB
100MHz		74dB	84dB
150MHz			84dB
180MHz			90dB
300MHz		70dB	
400MHz			77dB
650MHz			
1GHz	58dB	59dB	62dB
3GHz		50dB	
5GHz	40dB	43dB	
7GHz		43dB	
10GHz	34dB		47dB
15GHz	30dB	38dB	44dB

Copper Wire Meshes

Plated (fusing the wire crossovers) and blackened with a black corrosion resistant plating

1 = 100 mesh type with a 0.0022" wire diameter

Port size 20" x 24" test performed in accordance with NSA 65-6 and MIL-STD-285

H Field

Frequency	1
15KHz	5dB
100KHz	21dB
1MHz	41dB

E Field

Frequency	1
1KHz	>60dB
15KHz	90dB
100KHz	89dB
1MHz	89dB
10MHz	90dB

Plane Wave

Frequency	1
30MHz	80dB
60MHz	82dB
100MHz	84dB
150MHz	92dB
180MHz	90dB
400MHz	77dB
1GHz	62dB
5GHz	51dB
10GHz	42dB
15GHz	43db

E Field & Plane Wave

Frequency	1
18MHz	88dB