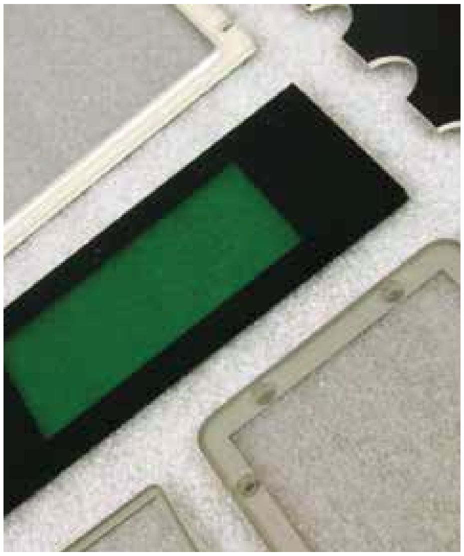
Kemtron
Proven EMC Shielding Solutions
Kemtron Ltd. is now part of
TE connectivity



EMI SHIELDED WINDOWS

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 termination).

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 $1cm^2$ up to 1 x 2 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.

DESIGN CONSIDERATIONS

Optical substrates

Acrylic

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 UL94 H-B flammability rating and hard anti scratch, chemical resistant coatings can be applied to the surface as an optical flat or as anti-glare.

Polycarbonate

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 UL94 V-0 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

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.

Allyl Diglycol Carbonate

ADC, 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 UL94 H-B flammability rating but is the most expensive substrate.

DESIGN CONSIDERATIONS

Shielding media

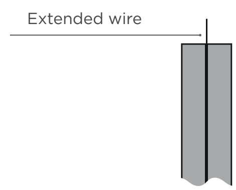
Fine Wire Mesh

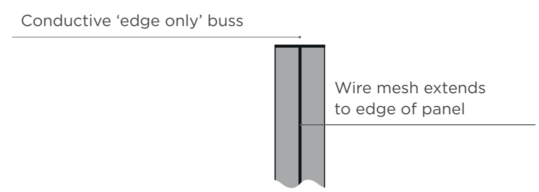
Fine Wire Meshes provide the highest level of shielding while maintaining excellent optical properties. Wires used as the EMI shield are stainless steel or copper. The stainless steel mesh ranges from 50 wires per inch up to 250, copper mesh 70, 100 and 145. Wire diameters are 0.025mm or 0.056mm for 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.

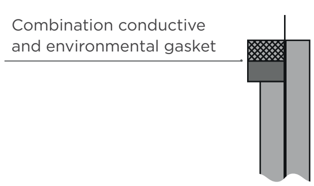
Transparent Vapour Deposited Conductive Coatings

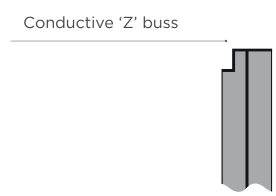
Transparent Vapour Deposited Conductive Coatings ITO (indium tin oxide) and Gold can be applied to the substrates but do not provide as effective shielding as the wire meshes. Their advantage is that optical clarity is maintained and there is no degradation in resolution or fringing that can be caused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

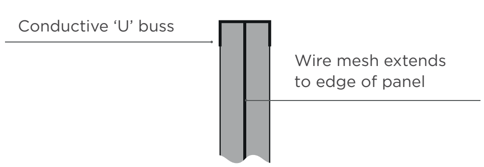
WINDOW TERMINATION

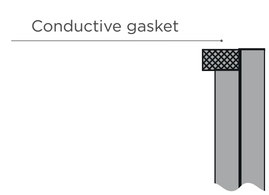


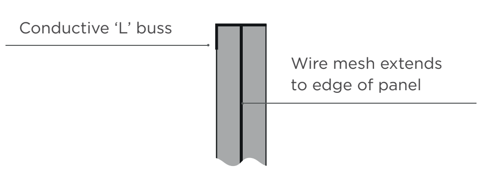












SHIELDING EFFECTIVENESS

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.

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

E Field

Frequency	1	2	3
2 KHz	-	-	>60 dB
15 KHz	82 dB	86 dB	98 dB
100 KHz	86 dB	87 dB	87 dB
1 MHz	81 dB	85 dB	87 dB
10 MHz	-	-	88 dB

H Field

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

E Field

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

E Field & Plane Wave

Frequency	1	2	3
18 KHz	-	-	92 dB

Plane Wave

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

Plane Wave

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

E Field & Plane Wave

Frequency	1
18 KHz	88 dB

Notice

Information supplied in these data sheets is based on independent and laboratory tests which Kemtron believes to be reliable. Kemtron has no control over the design of customer's product which incorporates Kemtron's products, therefore it is the responsibility of the user to determine the suitability for his particular application and we recommend that the user make his own test to determine suitability.

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