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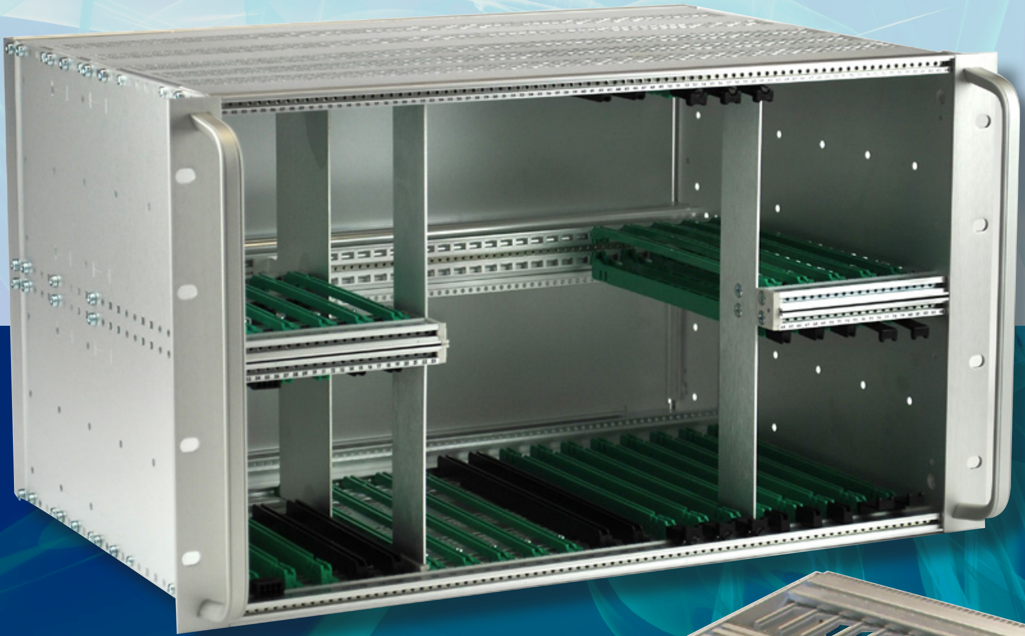

KM6 Subracks

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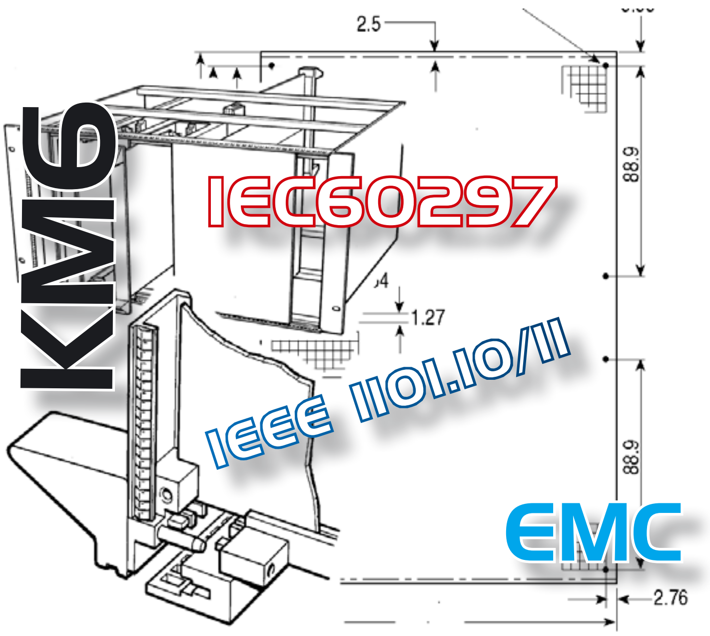
KM6 SUBRACKS



KM6-II Subrack System

KM6-HD Subrack System

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INTRODUCTION

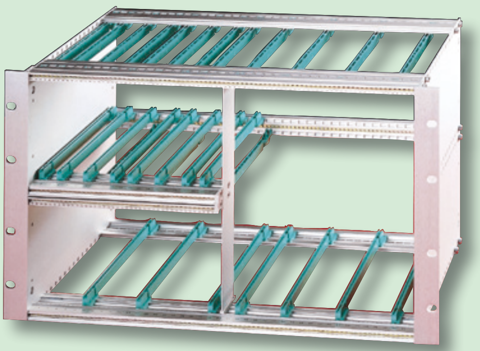
In order to meet the diverse mechanical, electrical and environmental requirements that today's markets & applications demand, Verotec offer two distinct subrack ranges. KM6 subracks are recognised worldwide as one of the leading products in its field having evolved around a number of international standards and in response to a number of trends. Principal among these trends are increased component densities, higher speed bus systems, greater connector contact counts, a greater range of operating environments, EMC and electrical safety regulations and, of course, economic pressures. Both are designed around a number of dimensional standards that aim to provide a basic level of interchange ability between different versions and between manufactures of similar systems.

KM6-II SUBRACK SYSTEM

Fully compatible with DIN 41494 part 5 and IEC 60297-3, KM6-II subracks are strong, versatile and easy to assemble. All tiebars have two screw fixing positions making the construction robust yet accurate and well suited to light and medium duty applications. The range is extensive, offering 3U, 4U, 6U and 9U heights in width of 24, 42, 60 & 84HP and depths of 160, 240, 300, 360 & 420mm. KM6-II Subracks are supplied either in kit form or individual component parts and are complimented by a wide range of accessories, including EMC conversion kits, guides, front panels and plug-in modules.

KM6-HD SUBRACK SYSTEM

The KM6-HD subrack range meets the requirements of IEEE 1101.10 & 11, which expands on IEC60297 to add functionality required for modern industrial computing applications. This includes RFI shielding, a rear transition area, front panel ESD / coding and handles with an injector / extractor operating feature. KM6-HD is therefore well suited to VME64x, CompactPCI applications, serving typical markets such as Telecoms, Medical and Instrumentation. In addition, KM6-HD would suit any rugged application where a resistance to shock and vibration is required. Built to meet MIL-STD-167, its features include positive guide retention, heavy two screw fixing tiebars, 3mm thick side plates & rack angles and a conductive finish throughout. The KM6-HD subrack accepts standard Eurocards in 3U, 6U & 9U heights and depths of up to 400mm in both the IEC 297 and IEEE 1101.10 standards. They are supplied fully assembled and complimented by the standard range of KM6 accessories.



▲ Extrusion based subrack

▼ RFI protected subrack

THE SUBRACK PRINCIPLE

Why would you choose to use an extrusion based subrack ?

In a word, accuracy. The need to provide a precise framework in which PCBs are supported and guided into connector positions is most efficiently achieved using accurate extrusion technology and hard-tooled end plate design. The subrack function now extends far beyond the pure support role and covers such areas as **RFI** protection, **Shock and vibration** protection, **ESD** protection and Fire enclosure safety to name but a few. Let's examine a number of the functional aspects of the subrack and look at the alternative solutions available

RFI PROTECTION

This is achieved by the use of covers, EMC contact fingers and conductively finished mating parts. The Faraday cage achieved with subracks can give very high levels of signal attenuation across a wide band of frequencies. The nature of the construction also allows the user to define a balance between EMC and ventilation. Selective RFI protection is another option, with the use of plug in screened modules. There are a couple of alternatives, either the problem can be designed out at board level (there is some doubt, however, that susceptibility problems can be designed out through tracking and layout changes), or the problem areas can be 'canned', but again there are some doubts regarding susceptibility.

SHOCK AND VIBRATION

This is achieved with the use of secure card guides (screwed in), two point extrusion to endplate fixing and additional mounting at the rear of the frame. It should be remembered that the effectiveness of the mounting is only as good as the rack/system into which the frame is mounted.

There are only custom solutions for securely mounting PCBs without using a subrack and these are normally loosely based around the subrack principle.

ESD PROTECTION

This is achieved using grounding clips in the card guide system to discharge Electrostatic build up from the PCB either during insertion or during the course of normal operation in situ. Additional grounding at the front panel is now seen as good ESD practise and this is achieved either with the use of metal inserts or through the grounding pin in IEEE1101.10 Injector/Ejector mechanisms.

Alternative methods of ESD are hard to define. Some claim that good production methods ie .operators fitted with discharge clips and product storage in anti-static packaging are helpful. Others claim sufficient discharge through an allocated pin(s) in the connector.

VERSATILITY

The Subrack concept allows the user to configure the usable space to suit the application, thus removing the necessity to 'tool' each configuration as a custom solution.

Divider kits for the front and rear allow a variety of heights, widths and depths within a single envelope size. Even the orientation of the PCBs can be readily changed from vertical to horizontal, or indeed a combination of the two within the same frame.

The alternative to this is to produce a custom based solution, which may well produce a high tooling investment requirement. Verotec have made a significant investment in tooling to produce good quality, versatile subrack products.

Eurocard dimensional criteria for KM6 subrack systems

INTRODUCTION

KM6 Subracks are designed around a number of dimensional standards that aim to provide a basic level of interchangeability between different versions and between manufacturers of similar systems. **The basis is the DIN41494 Eurocard standard.** The dimensions for the housing of Eurocards are described in IEC60297 section 3 SC48D. Plug-in units are modular in concept and are based on the first card position being 3,27mm from the left hand datum line of the working aperture; subsequent card positions are on multiples of 5,08mm (1HP) from this first card position.

To allow for a uniform working clearance between front panels, when used, the overall width of a front panel is 0,4mm less than the nominal HP x 5,08 dimensions generally quoted.

Heights are nominally quoted in U's (multiples of 44,45mm) but it should be borne in mind that a device quoted as nU high will not be n x 44,45mm in overall height.

KM6- subracks can accommodate connectors to IEC130-4, DIN41612 and VG95324 specifications or motherboards to the IEC60297-3 specification

In addition, reference will be found to the IEEE1101.1, .10 and .11 which expand on the above specifications and for which **KM6-HD** provides suitable product. These describe a number of features particularly relevant to VME64x, CompactPCI® and PXI bus structures.

EUROCARDS - CRITICAL DIMENSIONS

As with the rest of the system the printed circuit board sizes are standardised. All PCBs should be of the Eurocard size and conform to the layout shown.

A 2,50mm wide border is necessary at the top and bottom of printed circuit boards to allow clearance for fitting into card guides and for mounting into plug-in unit guide rails.

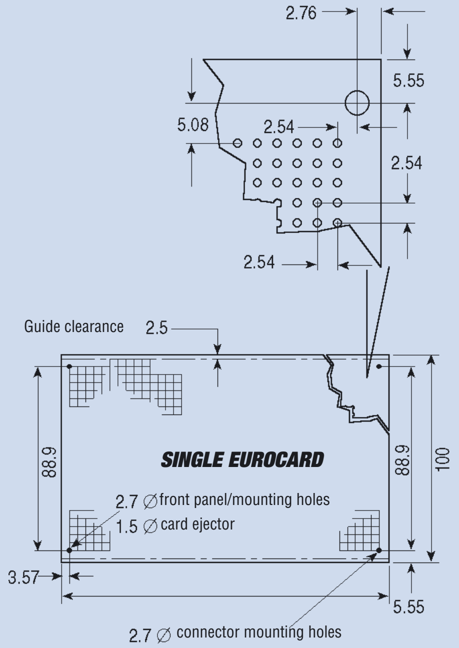
On the double height Eurocard, owing to the overall size and position of the connectors, it is recommended that when fitting components to the front panels the grid as laid out here is adopted. This will allow consistency between 3U and 6U height front panels if mixed configurations are utilised.

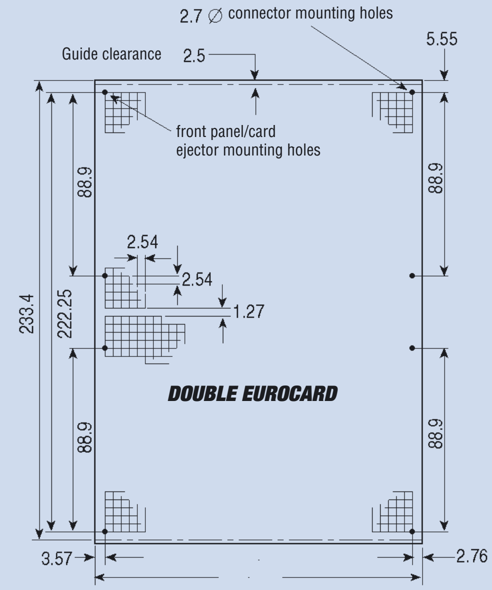
USEFUL FRONT PANEL AND CIRCUIT BOARD DIMENSIONS

These dimensions are useful when a Eurocard is to be attached to a KM6 front panel using card mounting brackets.

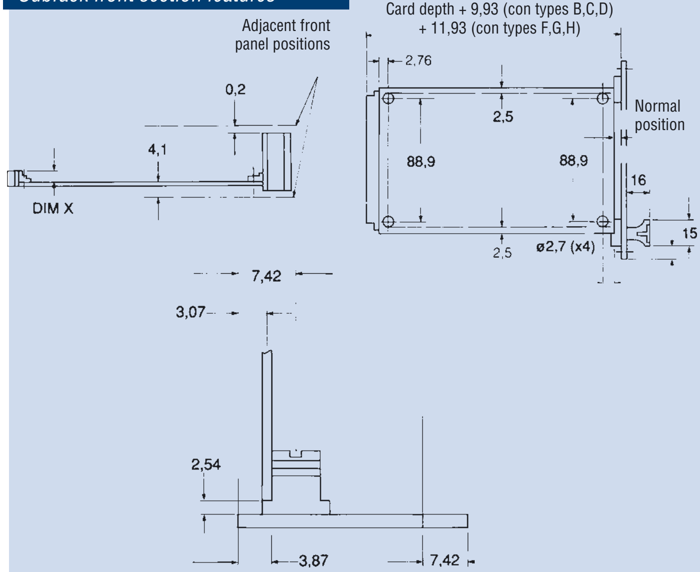
Connector type (DIN 41612)	B	C	D	E	F	G	H
DIM X	7,6	9,4	9,4	14,4	11,3	16,3	11,3

Please note: Certain plastics can be adversely affected by organic solvents. Care should be taken to avoid contamination by some cleaning agents, for instance. With modified PPO's and PPE's such as Luranyl we recommend that when using thread locking compounds they should be cyanoacrylate based, not anaerobic.



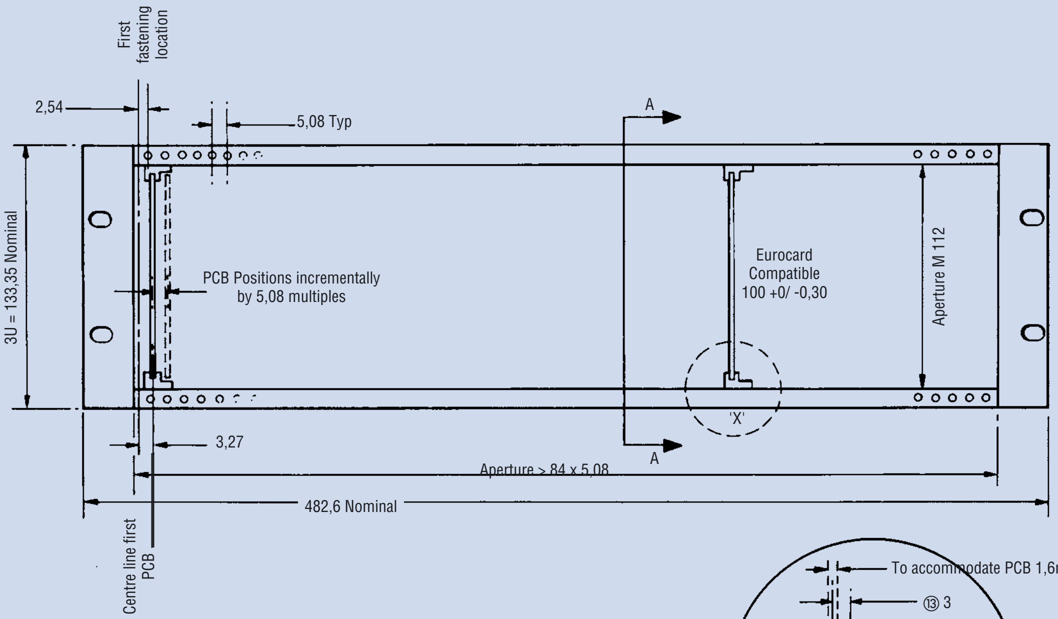


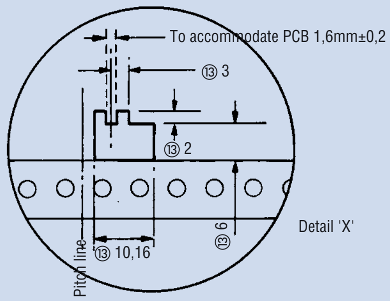
Subrack front section features

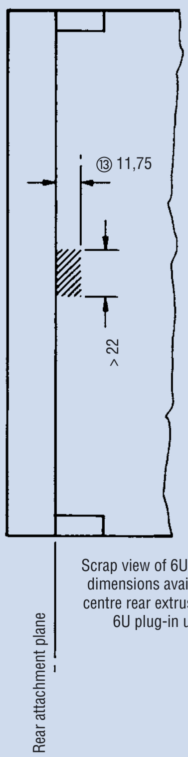


IEC 60297-3 dimensional criteria

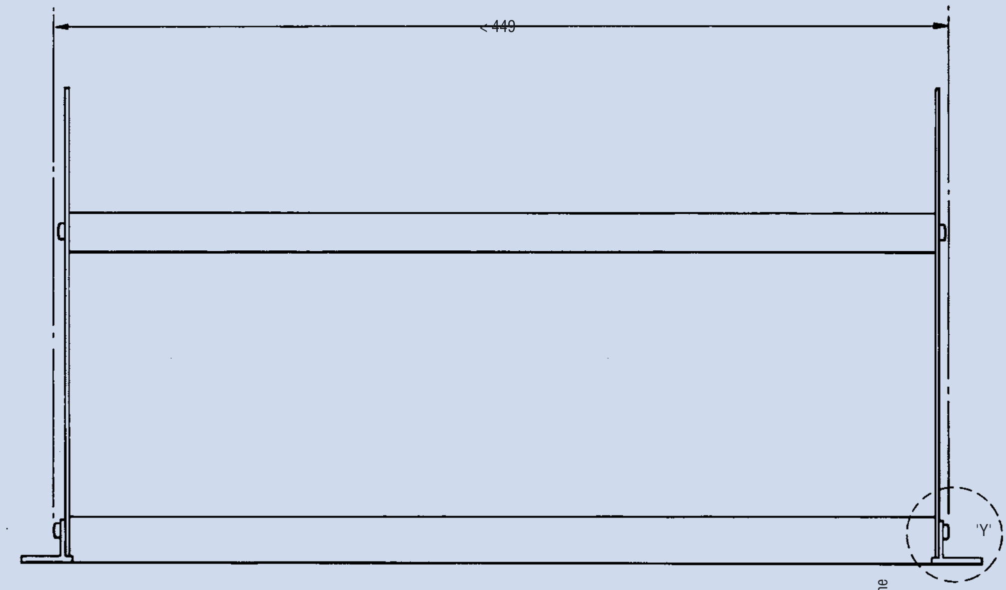
These illustrations show dimensions extracted from IEC 60297-3.
They are not comprehensive, but should prove generally informative



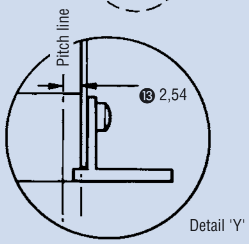




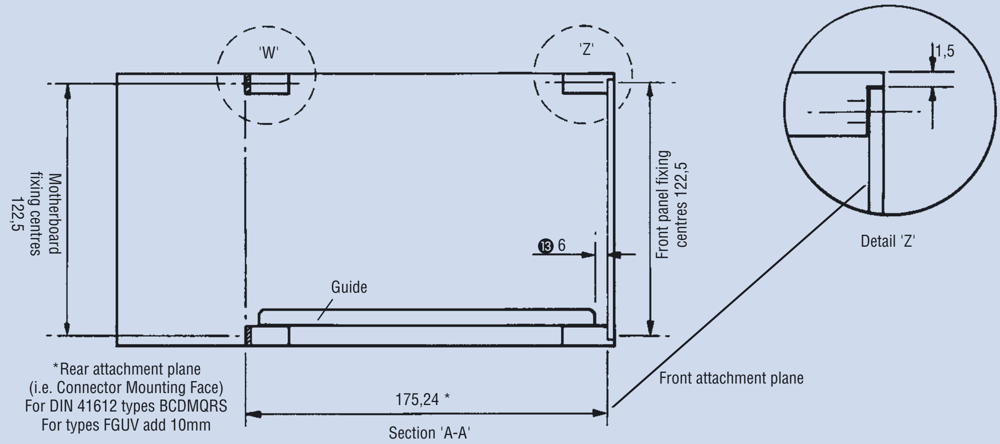
Scrap view of 6U showing dimensions available for centre rear extrusion with 6U plug-in u

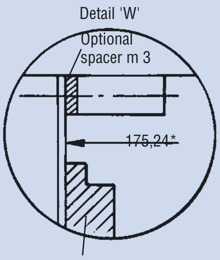


Subrack dimensions shown are for 3U x 84HP and single Eurocards
Heights increment by 44,45mm (1U)
Widths increment by 5,08mm (1HP)

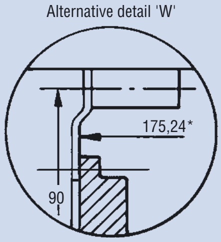


IEC 60297-3 dimensional criteria

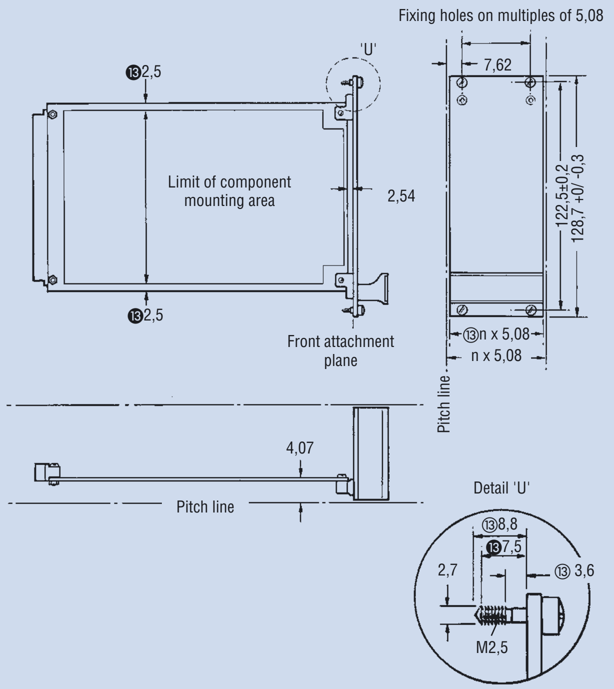


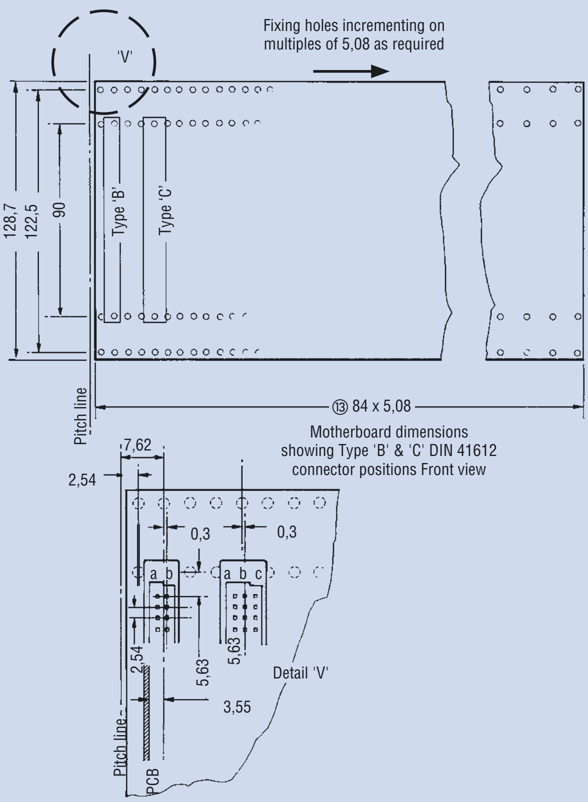


DIN 41612 connector mounted on motherboard



Alternative for direct mounting of DIN 41612 connectors





INTRODUCTION

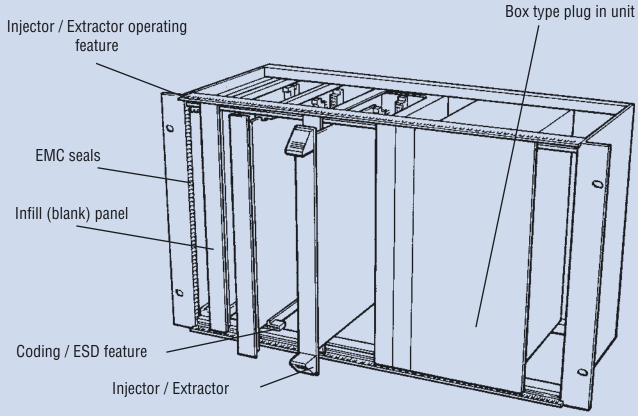
IEEE1101.1 is largely a reiteration of the basic IEC60297-3 standard, with some changes to reflect .10 and .11

IEEE110.10 was driven by a number of requirements:
The standardisation of EMC front panel geometry to ensure compatibility between various manufacturers' products.

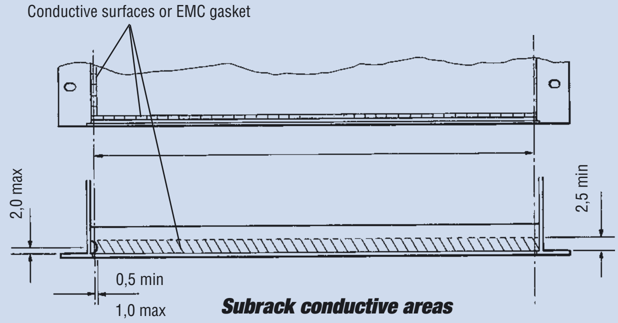
The introduction of the five-row DIN41612 connector into VME and the incorporation of Metric standard connectors. Both have very high pin counts and resultant high insertion / withdrawal forces that require a standard injector/ extractor handle geometry.

The standard also addresses the problems of electrostatic protection and a need to code plug-in units to prevent incorrect plug-up, where such actions could have catastrophic results (in particular in live insertion situations).

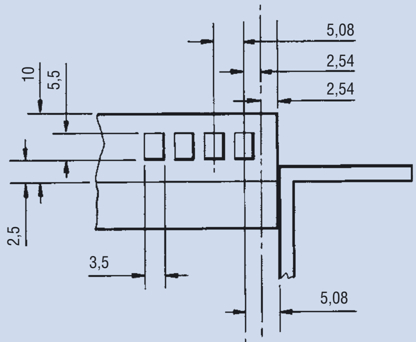
IEEE1101.11 standardises the geometry of rear plug-up (transition) modules where no previous standard existed.
Rear plug-up - or transition - is used and required within the core specifications of major open-architecture bus structures where a midplane is used to provide a rear I/O interface.



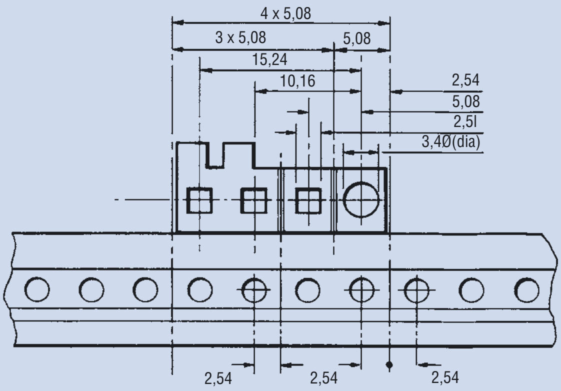
Typical arrangement of 1101.10 subrack



Subrack conductive areas

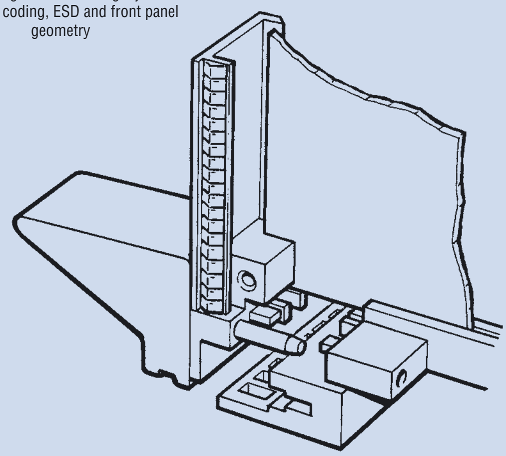


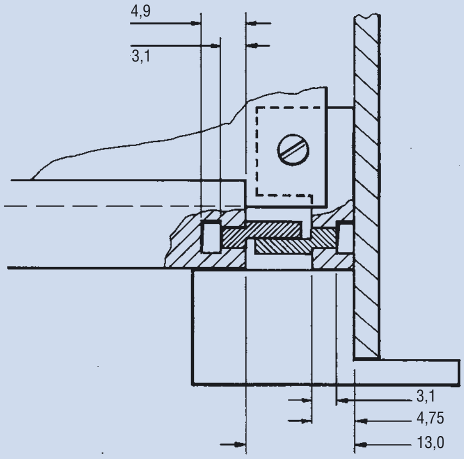
Subrack Injector / extractor operating feature



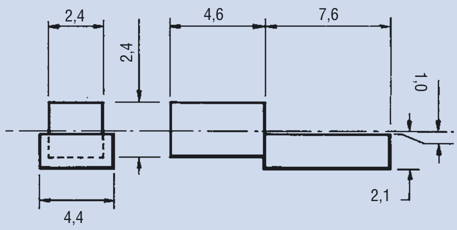
Subrack mounted coding / ESD feature

Typical plug-in unit showing injector / extractor coding, ESD and front panel geometry

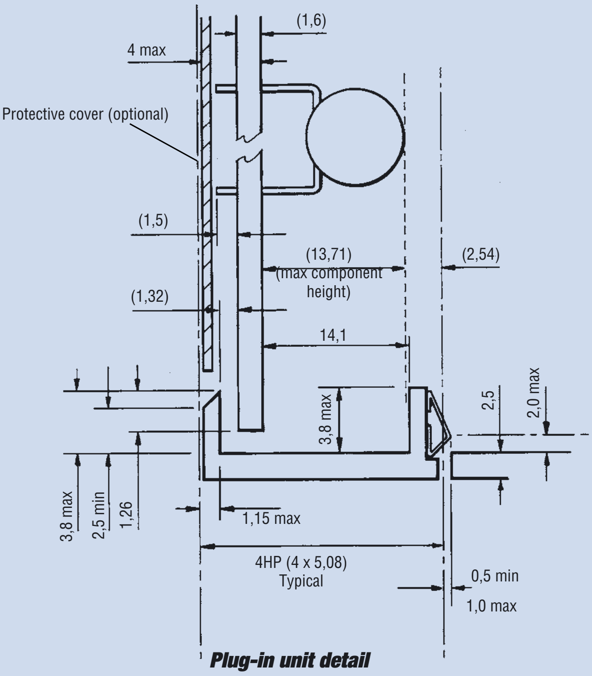




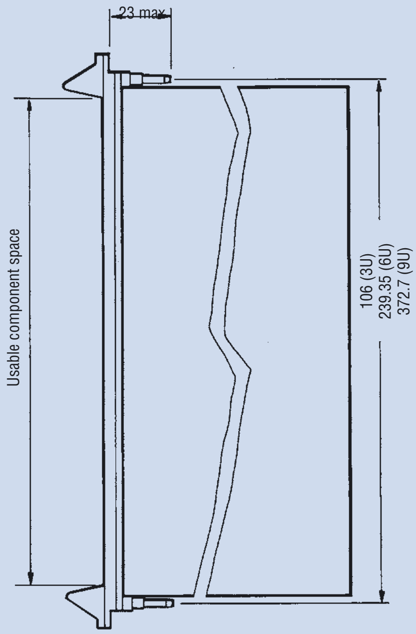
Interaction of coding key



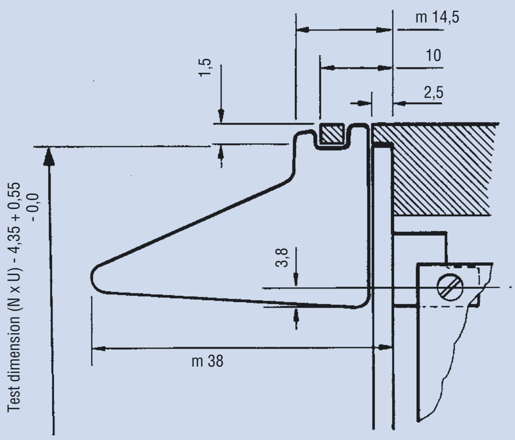
Coding key



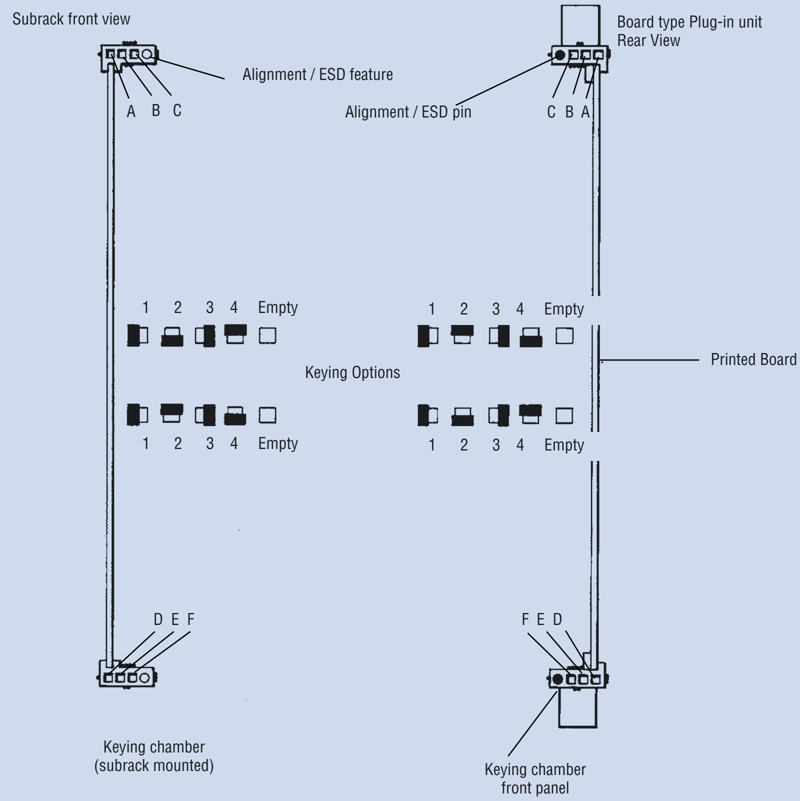
Plug-in unit detail

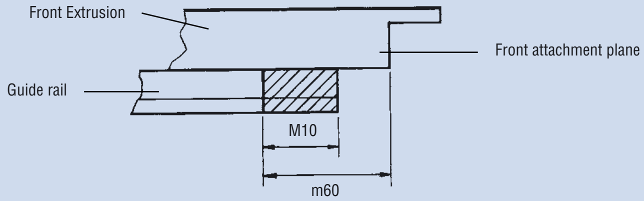


Location ESD detail

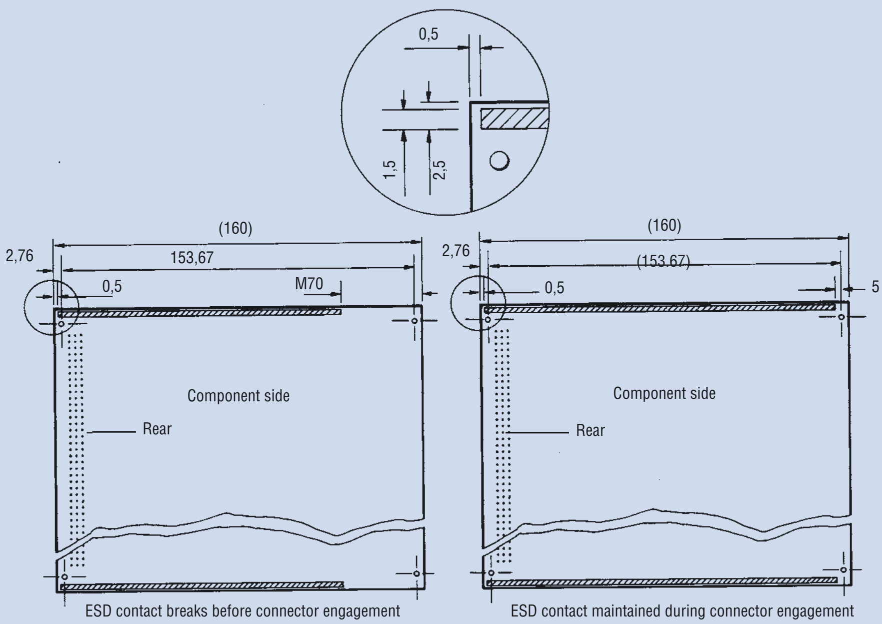


Detail for extractor



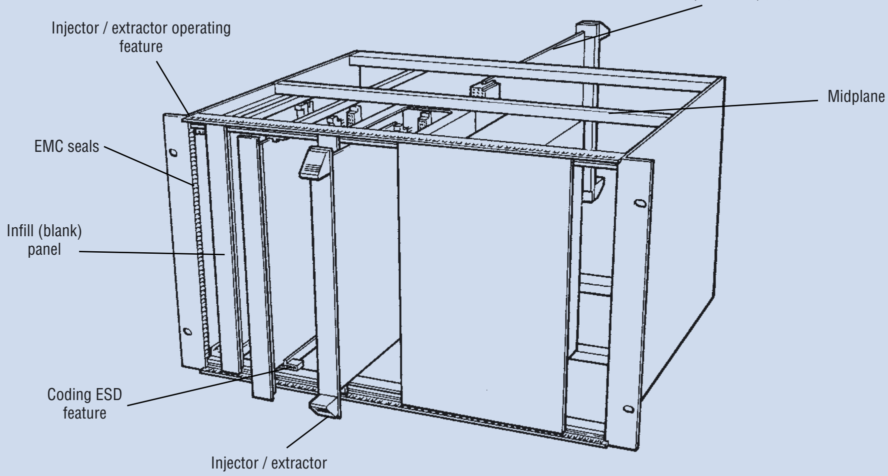


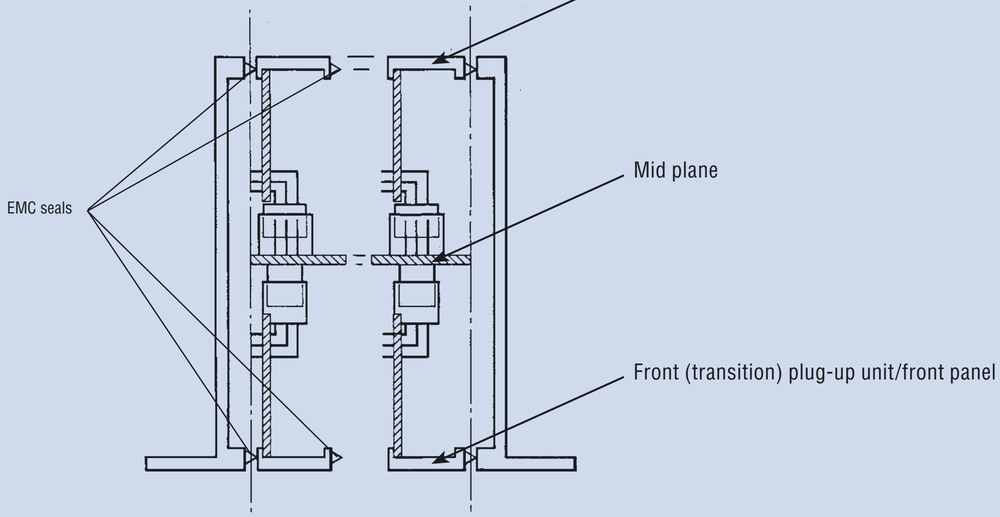
Guide rail ESD contact area



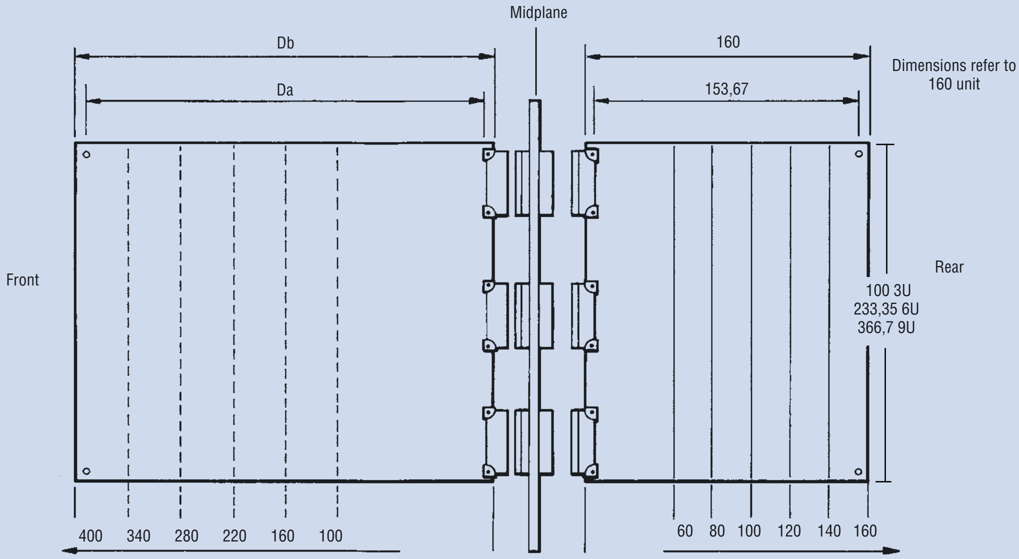
PCB ESD Contact strips top / bottom

Typical arrangement of 1101.11 subrack with rear plug-up



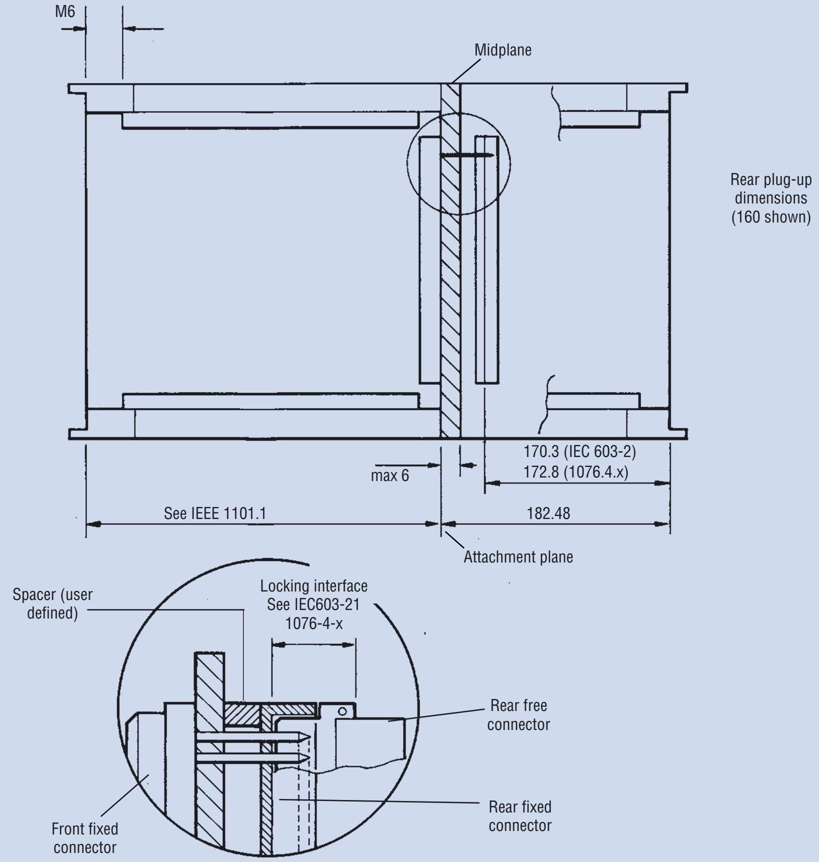


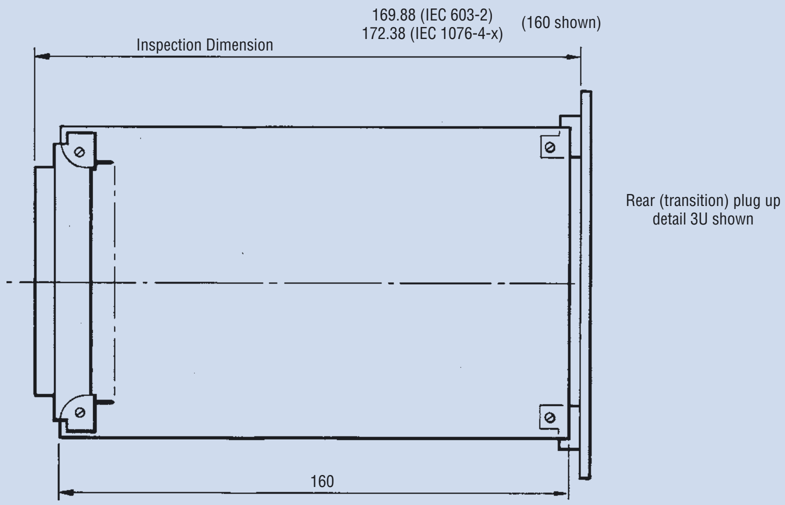
In line configuration for rear (transition) plug-up EMC panels.

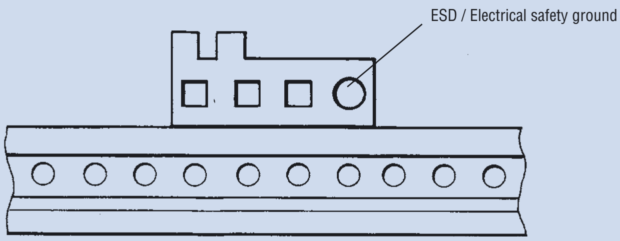


Front rear plug-up options

IEEE 1101.10/11 dimensional criteria







Frame mounted coding / ESD / location / electrical safety ground feature

A GUIDE TO THE EMC SCREENING SUBRACKS

Please note that any reference in this section to attenuation figures is theoretical, and examples have been obtained under laboratory conditions only.

By its nature, an empty enclosure does not fall within the scope of any EMC performance regulation, since all the existing standards are applicable solely to electrical/electronic equipment; any modification to either the enclosure or its contents will have an effect upon its EMC performance.

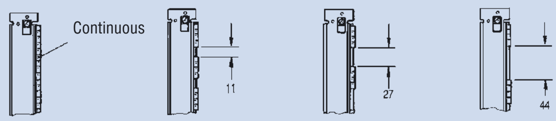
Whilst KM6-HD is designed / supplied with full line capability as standard, KM6-II subracks can be retrospectively screened by the addition of covers, gaskets, front panels and associated components – as detailed in the relevant section of this catalogue.

The key to good screening performance in the E (electrical) field is to limit the size of any holes and the real-estate between them, and to reduce the length of slots, on the basis that the shorter the slot, the better the performance at higher frequencies. The H (magnetic) field performance is more a function of material and thickness - hence a steel cover would offer some improvement in this area.

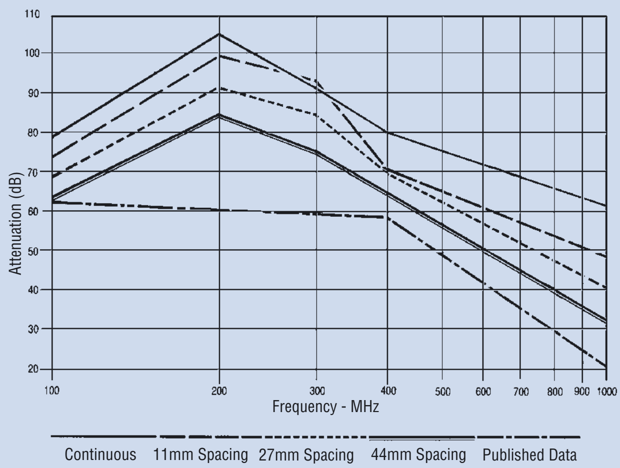
The cover kits are available in ventilated and unventilated form and their typical performance can be fairly accurately forecast, assuming that they are fitted in the recommended way. The obvious difference is that the unventilated version offers a higher level of attenuation. Despite the fact that aluminium has good thermal properties, however, it must be accepted that you may have heat dissipation problems. The choice of ventilation holes is necessarily a compromise between EMC, thermal and manufacturing considerations. We have chosen with these in mind. Apart from this, the only means that can easily be used to further enhance the standard screening performance in this area is to apply an appropriate EMC gasket around all edges, thus reducing slots to the minimum; under laboratory conditions we achieved an improvement of approximately 15dB using seals in this manner. For this sort of application there are self-adhesive stainless steel or copper alloy gasket strips readily available from EMC seal suppliers.

The area of EMC shielding which is most open to variables is in the sealing of the front and rear panels. Here, adjusting the spacing of the RFI fingers can produce significantly different performances and whilst this guide is not all encompassing in this matter, it will assist you. Hence, all other factors being equal, maximum performance can be achieved by using full width front panels, thus reducing the number of potential leakage points.

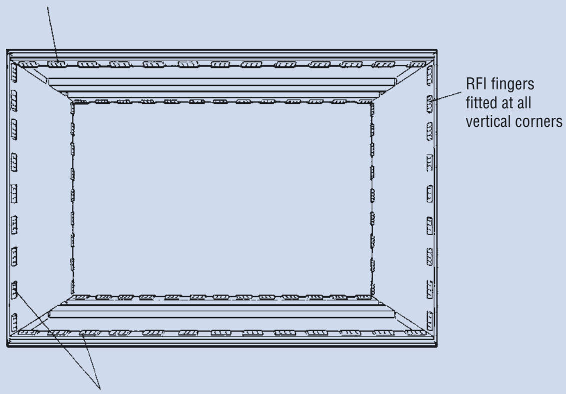
Shown here is a set of typical plots obtained under test conditions using various finger configurations, from small groups at varying intervals up to a full strip of fingers. The subrack was fitted with unventilated top and bottom covers throughout the test. The 11mm curve is anomalous at 300MHz which is due to a function of the geometry of the particular enclosure under test. Figures are averaged from front and rear. Ventilated covers reduce the attenuation by an average of 15% under test conditions. The lower attenuations at 100 MHz are a result of the measurement method, and do not reflect an inferior level of shielding. The effect of slot length is clearly shown at increasing frequencies. EMC fingers can add significant cost to the screening of a system and for this reason, we do not include fingers in some instances; instead, you should select the configuration most suitable for your particular application, after consideration of the variables detailed in this section. The EMC finger strips can be easily cut to length with a pair of sharp scissors, taking care to avoid crushing the raised fingers.



Effect of Be Cu Spacing on single front and rear panels solid top and bottom covers with dimples at 20mm spacing Be Cu IN 4-finger blocks



RFI fingers fitted on front and/or rear extrusions when using overall closing panels.



Spacing of fingers should be consistent throughout. They should be placed to coincide with those on the front and rear panels.

End plate angles omitted for clarity

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Shock and vibration

The increasing use of electronics in such applications as mobile, roadside, factory and earthquake environments has led to an increased awareness of the effects of shock and vibration on full systems.

The use of subracks in these conditions is generally limited by a number of factors.

1) The loading - both total weight and its distribution; increased height to some extent improves the vertical stability; increasing width adversely affects its resistance to vibration in the vertical axis and the deflection of horizontal components; increasing depth encourages 'parallelogramming' in sideways shock and vibration. Placing heavier components as close as possible to the major fixing points will also help in all axes.

2) The overall construction - a box structure (ie one which has securely fitted top and bottom, front and rear covers) will be much more rigid than a simple framework. Here, backplanes, front and rear panels with multiple fixings, offer considerable benefit.

3) Constraining the assembly at the rear, as well as the front, provides an extremely good return for the effort. Careful design here can prevent movement in sideways and vertical directions.

4) Positive retention of guides adds to the capability of the assembly. It is recommended for particularly heavy plug-ins such as power supplies, especially in transit, where it may be subjected to vibration and shock on stiffly suspended trucks or during handling.

5) The most difficult problem for the subrack manufacturer is to add as much material to extrusions whilst maintaining integrity with the dimensional standards such as IEEE1101.1, at as low a cost as possible and without restricting airflow too much.

6) Large PCBs will react badly to sideways vibration and may require the incorporation of stiffening devices securely fixed at close intervals to prevent 'snaking' or 'panting', both of which put considerable stress on component connections.

There are a large number of specifications and standards which can be invoked to express the testing requirements, some of which are very specific, some extremely widely drawn. Among the latter you may find military specifications which are intended to cover a wide range of environments from storage and transport, through ship-borne, to airborne and missile applications.

It is important to note that whilst, Verotec can meet most requirements, over specifying test analysis will inevitably can lead to unnecessary cost penalties, with little overall again at the end of the process.

In order to ensure that you select the right subrack, or request the correct test set before installing your systems, a discussion of your needs with one of our applications specialists may be beneficial.

For further details please contact our Applications Support Team

Subrack shock and vibration

Subrack materials and finishes

Although aluminium can be seen as a more expensive material than, for instance, steel, it offers several benefits in the design and construction of subracks which makes it highly suitable. The reduction in weight which it offers is particularly useful for 'one-man' handling in restricted space and less than ideal heights.
Additionally, it has excellent heat conduction properties.

In extruded form, it is possible to design-in a wide variety of features which would be difficult and expensive to incorporate into formed and machined materials. It also permits easy changes of length.

There are a number of ways of specifying the actual material - we use BS1474.6063 T6 extrusion.

In sheet form, aluminium can offer good rigidity for its weight and is relatively easy to punch and half shear accurately, with minimum tool wear. Our aluminium sheet is BS EN485-2 5251 (H12-H26).

Ideally, from the point of view of corrosion and scuff resistance and for a good decorative finish, anodising is excellent. Our anodising is to our own specification and we are rightly proud of the excellent appearance it produces.

Anodic film, which is electrolytically applied is an excellent insulator. It is therefore unsuitable in modern subrack systems which need to be electrically bonded due to problems from electrostatics; they also frequently have to be EMC screened by the application of covers and panels which must all be electrically continuous as far as possible.

For that reason, most of Verotec's subrack system components are now finished by means of a chromate conversion process (typical trade terms are Irridite, Alocrom, Alodine). This process ensures that the aluminium materials have a good degree of corrosion resistance, which in turn prevents 'self anodising' over time. Clear chromate has low surface resistivity (lower than the colour types) but because it is only a surface film can be affected by scuffing and finger-marking. For that reason, care should be taken during handling. However, it has a good appearance.
From a production point of view, the use of steel in KM6-RF covers offers benefits in that it provides stiffness at lower thicknesses.
We use mild steel sheet CR4 to BS EN10130

In common with most steel components and fixings throughout the Verotec subrack range, we use clear passivated zinc plating to provide corrosion resistance with an acceptable appearance - although the colour passivation used on tapped strips provides much greater protection against front panel fixing screws 'freezing' in prolonged use or harsh climatic environments.

Moulded plastics are used where complex shaped components are used in large volumes. There is a huge range of basic materials available, but in general we are looking for a cost effective plastic that has good moulding properties, is mechanically and dimensionally stable over a fairly wide range of temperatures and humidities, and conforms to modern requirements in fire resistance. The latter is usually expressed as UL94- V* (V0 is the highest level, V1 being generally as low as we would accept).
It is important to note that the UL94 test has a number of gradations in thickness and test application.

Subrack material and finishes

One of the major problems associated with plastics is their susceptibility to attack by chemical solvents and we make frequent reference to this. This kind of damage frequently only shows when the material is under stress (when it is screwed down, for instance) and is commonly caused by threadlock compounds or cleaning solvents. Where breakages occur, a sample of the item concerned can usually establish the nature of the problem.

It is important to note that most plastic components have fine 'knit lines' where the material flows join during the moulding process - they are not normally deleterious to performance although they are frequently mistaken for incipient cracks.

The addition of glass fibres adds to the strength of moulded components, and is typically used in applications like injector/ extractors. It is used judiciously because it tends to accelerate tool wear.

Most of our moulded subrack components are produced in modified PPO (Polyphenylene Oxide) - typically under the trade names Luranyl or Noryl, or Polycarbonates - Makrolon for instance. The latter is also supplied in sheet form for transparent panels.

In the area of EMC seals, there is a general trend to stainless steel, away from Beryllium Copper. The latter has excellent forming, spring, and conductive properties, but there is concern about its disposal at the end of equipment life cycles.

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