

# Deep-Flat Connectors

Version 1.0

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## Header

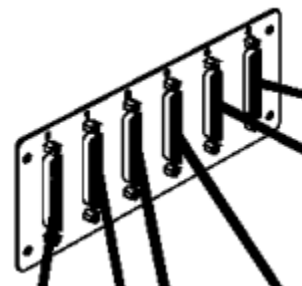
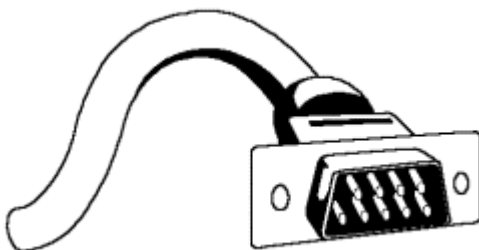
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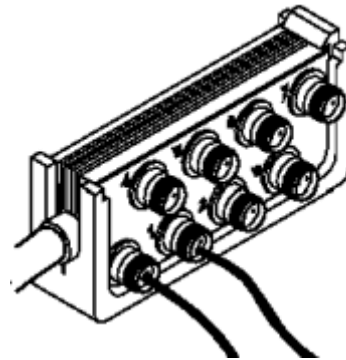
## Purpose of invention

The purpose of this invention is to provide an highly flexible and configurable design for electronic connectors which can be packed on a very little surface when space is a critical resources.

## Addressed problems

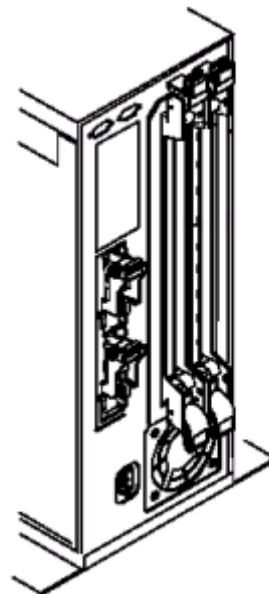
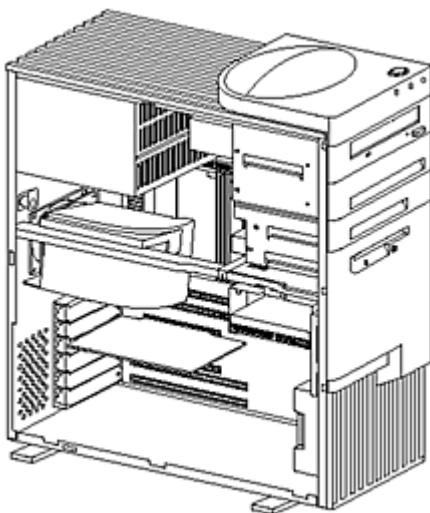
Just imagine you have to build a hub, or to connect several serial cables on a small panel on a wall, or simply have a server which should be connected to many different peripherals which support different communication protocols and cable configurations. If you consider most of existing connectors, they take a mostly rectangular or circular connection surface whose sides are from one to five centimetres of width times half to two centimetres of height.

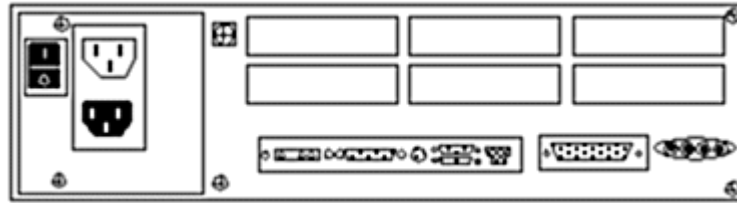




Today we have also small connectors which provide users with cascade connection availability, as USB for instance, but of course your peripheral should support such a standard. There are a lot of old peripherals that do not support USB, and in any case, not always it is possible to substitute some standard with a USB cable.

If your problem is surface space, you might realise that you may have enough space if you consider the direction that is orthogonal to that surface. For example, most computer chassis are mostly empty. The back face of a server is relatively small, but the volume is mostly available to hardware.

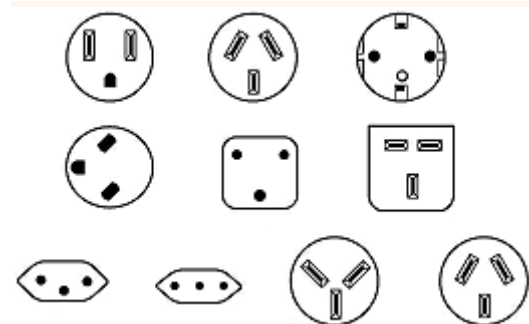
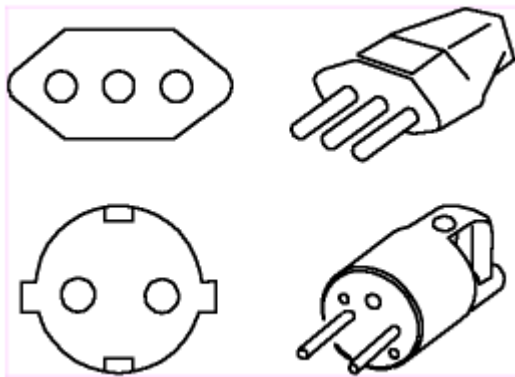




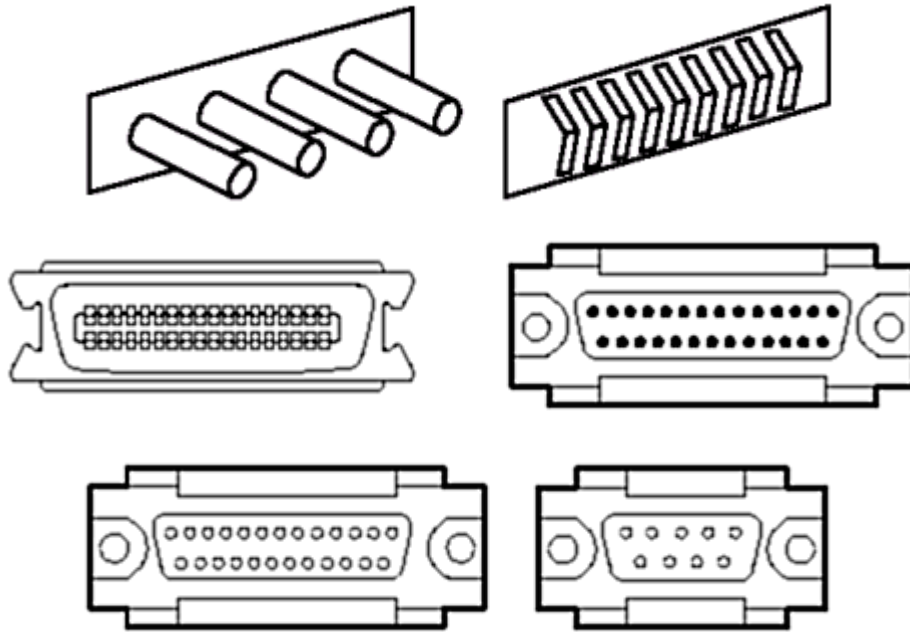
The foundation of this invention is to use that space to pack several connectors in a small surface. In addition, this invention shows also how to take advantage of the new design to allow to use the same plug for different connectors, to merge two different connection configurations in a single connector, to combine two connectors in a single connection mechanism, to dynamically recognise the connector configuration by using an optical or mechanical code.

### Invention description

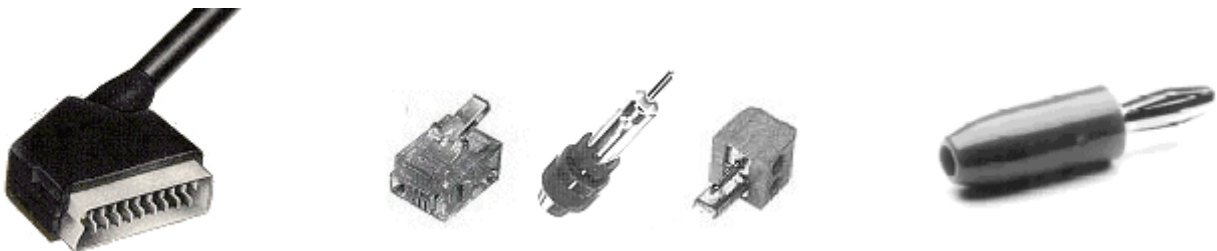
A connector is a piece of hardware consisting of a plug and a mechanism to fix that plug to a socket. The plug is usually made of a frame and a set of pin positioned according to some scheme. In some cases, i.e. electrical plugs, there are few big pins, which provide the plug with a natural fixing mechanism simply by entering the holes of a socket.



In some other cases, as in electronic plugs (e.g. computers, cellular phones, hi-fi) there are many little pins which require an external mechanism to fix the plug in the sockets. Pins used in electronic plugs are usually implemented as small needles (as in serial and parallel cables), or little metallic lamellas (as in cellular phones or IBM Workpad™).



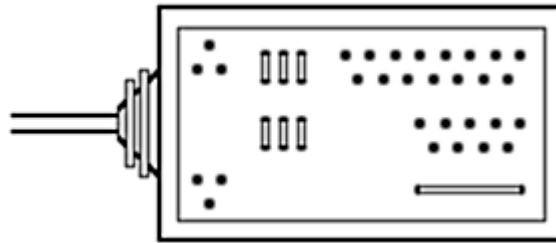
The common characteristic that is typical of all those plugs is that pins are inserted in the corresponding socket holes orthogonal to the socket surface. This approach reduces the friction of pins and hole container and therefore limits the wear. On the other hand, it forces the designer to dispose the pins on a surface which is parallel to the "wall" where the sockets is mounted. In electronics, where space is a critical resources, plugs became smaller and smaller, so that now the USB and the new SCSI ports are quite small and allow cascade connections. However, it is still necessary to maintain older standards, as for example parallel and RS-232 ports, mouse and game ports, video and audio ports. But sockets are available also on other devices. For example, SCART sockets on televisions, phone connectors, jacks for microphones, headphones, and other audio devices in hi-fi or VCRs.



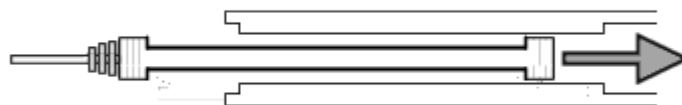
This approach is not only used by plugs connected to cables, but also for small devices that are directly plugged in another device. For example, PMCPIC cards

In this invention, the orthogonal direction is used to insert the connector, that is, the contacts are not disposed on the socket surface, but inside the socket. The socket itself is a small and thin slot very similar to those used for PCMCIA cards. Differently from those cards, anyway, contacts are not on the bottom of slot, but on one or both sides.

The plug, called hereinafter *deep-flat connector* (DFC), is represented by a small flat plastic rectangular framed support. The cable is connected to the support at one of the smaller side.

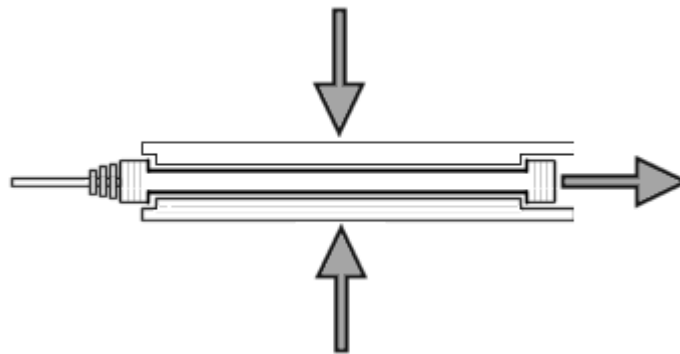


The connector is inserted into the slot from the opposite one. When the connector is fully inserted, a little additional pressure activate a mechanism to fix it without any need for external fixing mechanisms.



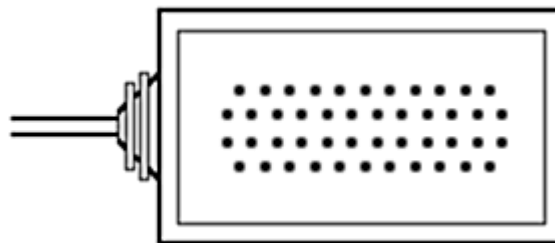
It is out of the scope of this invention to show the various mechanisms to fix inside and to free the plug from the socket. There is plenty of them. Most are based on elastic lamellas and other mechanisms. The only recommendations is to select small ones, flat and thin. The plug should be freed by pressing again it inside the socket, to avoid to have fixing pieces outside the socket hole, which would increase the room needed for the socket on the socket panel.

At the same time, if available, the connector configuration markers are read to set up dynamic linking, and the connection is activated. This plug uses printed electrical surface schemes similar to those used for printed circuits. Practically the plug is really the female connector, whereas the sockets is the male one. In fact, when the plug is inserted and fixed, the socket closes around the plug pushing the contacts against the plug surfaces.

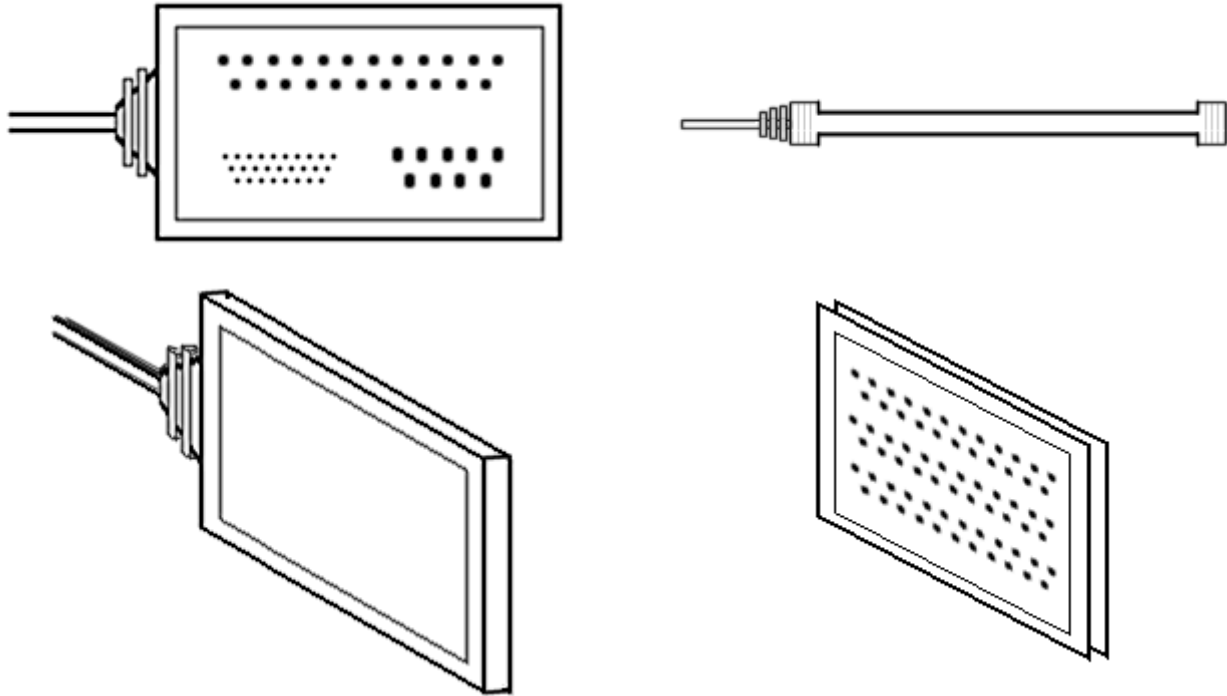


### Possible implementations

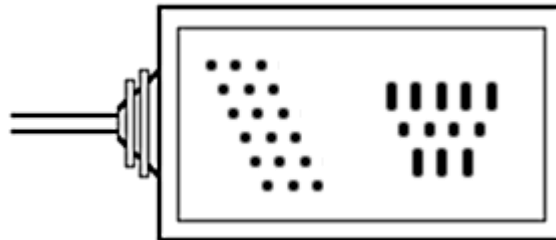
It is possible to design several different kinds of deep-flat connectors. The simplest one has the contacts only on one face, no configuration markers, and pin-like layout.



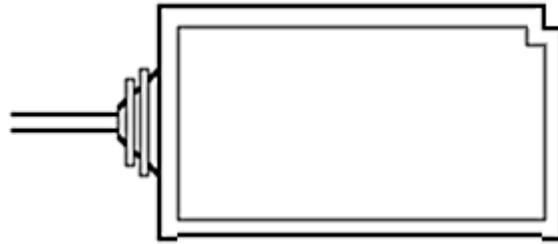
Based on that, we can define several variants. The first one is related to the usage of surfaces. In fact, it is possible to use both surfaces, and /or to use more than one layout on each surface.



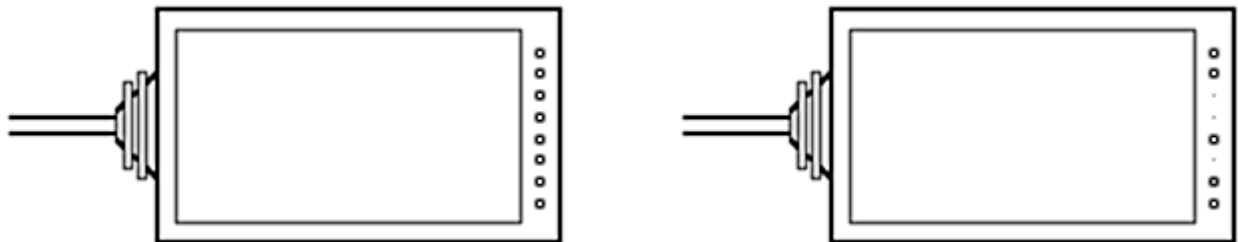
The second one is related to layouts. In addition to the classic pin-like layout, it is possible to use different schemes changing both point positions and contact shapes.



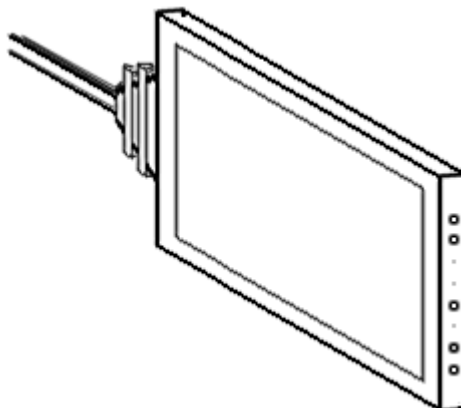
The third one is related to configuration markers. Some marker can be used to guarantee a correct insertion of plug, as corner cuts or track cuts. Others can be used to identify the type of plug and to prevent using a certain plug in the wrong sockets.



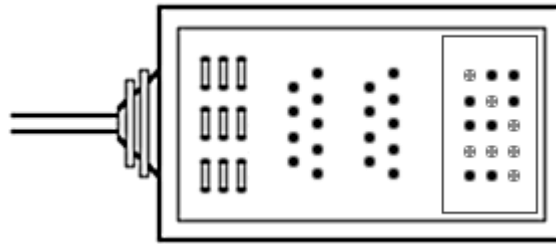
Dynamic configuration of socket can be obtained by reading the markers on the plug. We might have optical or mechanical reading. Optical reading is similar to the mechanism used for floppy diskettes, where holes are used to specify the diskette storage size. We may think of holes in the frame surrounding the contacts layout.



Mechanical markers can be, for examples, closed holes on the bottom of plug, just on the short side of plug opposite to the cable, corresponding to pins on the bottom of the socket, or vice versa. The pins can be pressed. In correspondence of a hole, the pin is not pushed, whereas a pin corresponding to the plug bottom surface is pushed in. If we define a eight-holes design, we have up to 256 different positions corresponding to 256 different configurations. If we reserve the 00000000 and 11111111 values to specific meanings, we have 254 configurations.

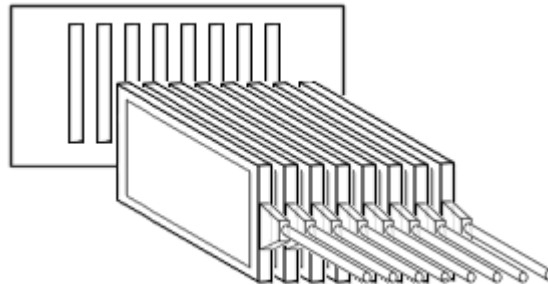


Of course, more sophisticated electronics might accept different depth for holes, but the quality of plug frame should be higher and therefore more expensive. Another way to implement markers is to use electronic markers. That is, it is possible a part of layout to specify the layout configuration of the rest of plug surface. The electronic markers might take, let us say, a third of surface (header), whereas the rest of surface can be used for data signals.

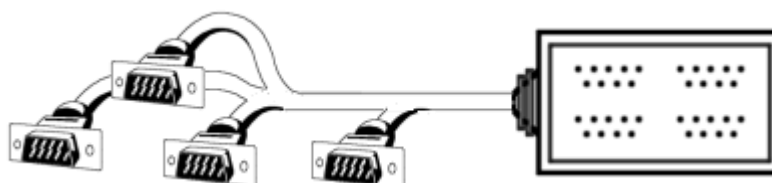


### Possible utilisation

DFCs can be used where there is more room in terms of depth than in terms of surface. For example, to pack a lot of sockets on the rear side of a PC, or to connect a lot of peripheral on a wall panel of small size.



Of course, it is possible to build adapters consisting of a cable with a DFC on one end, and one or more classic connector of the same or different kinds on the other end.



## Advantages

There are several advantages in using this invention: practical, technical, and economical.

The economical advantages are related to have a simple standard plug frame for every kind of connections. You have only to print different pin configurations to manage all the different kind of layouts. The plug shape itself is not affected. Also the socket is simplified, since it is just a rectangular thin slot similar to those used for PCMCIA card, but smaller. Of course, the contacts in the sockets corresponding to plug pins are different, but even in this case the layout can be implemented by a printed circuit-like approach. Other economical advantages are related to the reduced size of socket panels.

Technical advantages are related to the possibility to pack in a single connectors many different layouts, and to shape those layouts according to various criteria. Contacts can be of any possible shape, and the connector surface is enough large to contains a lot of them. On the other hand, the socket takes little room, so that many of them can be packed together. Also the socket faces can be tightly packed, since they can be implemented by the same technique of plug surfaces.



Practical advantages are related to the possibility to connect several classical connectors to a single DFC, the possibility to pack many sockets on a relatively small wall or deck panel, and the possibility to use both DCF sides and various DCF sizes. For example, if you have enough room in depth, you can design very long DFCs.

