

Cable connector for a ribbon cable

The present invention relates to a cable connector for a ribbon cable, comprising a housing of electrically insulating material with a plurality of contact elements, each contact element having a connecting portion formed as a plug-on contact for connection to a conductor of the ribbon cable, said housing having an opening extending from a first side to a second opposing side for receiving said ribbon cable.

Such a cable connector is known from United States patent 4,410,222 which discloses a connector assembly comprising a female connector connected to the ribbon cable and a male connector connected to a circuit member. The female connector comprises a first housing comprising plug-on contact members for connection to conductors of the ribbon cable and a second housing, the ribbon cable in use being clamped between the first and second housing.

A connector module generally comprises a housing of electrically insulative material which accommodates a plurality of contact elements or terminals arranged in rows and columns. The contact elements have a base section and a contact end and connecting end extending from opposite ends of the base section. The connecting ends project outside one side of the housing and are connected to a printed circuit board.

There have long been attempts to accommodate electronic circuits in as modular a design as possible on printed circuit boards of standard dimensions. The interconnections between the individual modules and components, such as recorders, playback devices, etc., are preferably made via electronic connectors. As a consequence of miniaturization and due to the high density of present day integrated circuits, a large number of electronic components can be mounted on a printed circuit board so that a large number of functions can be carried out by a module of this type. The number of terminals needed for connection to other modules has, likewise, increased.

As a result, there is a great need for connectors with a high contact element density, i.e., with a large number of electrical contacts or terminals per unit of volume. The need for connectors with high contact element density has become even greater as a

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result of the advent of surface mounting technology whereby electronic components are surface mounted to the printed circuit board. Surface mounted devices (SMD) are not mounted on a printed circuit board via the usual pinhole connection but are connected directly to the surface of the printed circuit itself. By surface mounting techniques, it is possible to mount electronic components readily on either surface of a board without interfering with connecting pins which project through the board. This results in a component density which is even higher than that achieved with conventional pinhole connections and a further increase in the number of terminals.

The object of the invention is to provide a cable connector which is designed in such a way that identical cable connectors may be mounted to a printed circuit board adjacent to each other without loss of space for one or more contact elements.

A further object of the invention is to provide a cable connector which is designed in such a way that undesired electrical contact between conductors of the ribbon cable within the cable connector, in the assembled state, is prevented.

A still further object is to provide a cable connector designed in such a way that when two identical cable connectors in the assembled state are mounted opposite each other conductors within one cable conductor will not touch conductors within the other cable connector.

Therefore, the cable connector according to the invention is characterized in that said contact elements are arranged in rows and columns, said opening comprises a series of open channels extending in the column direction of the contact elements and being enclosed by said housing, only one plug-on contact being located in each channel, the contact elements disposed adjacent to the second side of the housing being arranged in a manner such that, if two of said cable connectors are positioned with said second sides entirely situated opposite each other, the respective contact elements in both cable connectors within one and the same column are separated from each other by a distance of at least one column.

The through channels make easy assembly of the ribbon cable possible. In the case of two cable connectors located opposite each other and connected to, for example, a four row connector according

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to the invention, the displaced sitting of the contact elements achieves the result that, the ends, lying opposite each other, of the individual cores of the ribbon cables connected to the respective cable connectors always have a mutual distance equal to the width of one row. Accordingly, there is no danger of the conductors situated opposite each other being able to make electrical contact with each other, assuming that the end to be connected of each ribbon cable is finished in accordance with the position of the contact elements.

In a first embodiment of the invention the cable connector is characterized in that said cable connector comprises two rows and an even number of columns, the plug-on contacts disposed in adjacent channels each being arranged in another row.

Preferably, the pitch distance between adjacent contact elements is 2 mm.

Moreover, it is preferred that the housing of said cable connector has external dimensions such that two or more of said cable connectors can be positioned adjacent to each other without loss of space for one or more contact elements.

By using contact elements with a flat base section, the external dimensions of the cable connector are such that no space is lost for one or more of the contact elements. As a result, two or more cable connectors may be connected directly adjoining, for example, a four-row connector according to the invention.

In this application, the term "printed circuit board", which is also commonly referred to as "printing wiring board", is understood as meaning, in general, substrates with conducting tracks and thus, for example, also substrates of liquid crystal displays.

In the text which follows, the invention will be illustrated in detail by reference to a drawing in which:

figure 1 shows diagrammatically in perspective a printed wiring board, to which several connectors and ribbon cable connectors are connected;

figure 2 shows diagrammatically in perspective two cable connectors located opposite each other for a ribbon cable which can be connected to a four-row connector.

Figure 3 shows a printed circuit board 2 with connectors as described and claimed in parent European patent application

0,393,251 fitted on opposite sides. Several protective plates 27, 28 of different dimensions are mounted on the two flat sides of the printed wiring board 2. Openings 34 are formed in the protective plates 27 in a manner such that the protective plates can be mechanically connected to the printed circuit board 2 by means of, for example, screws and spacers. This results in the desired strong mechanical connection between the diverse connectors and the printed wiring board. At the position of the sidewalls 15, 16 of the connectors 13, the protective plates are provided with ribs 35 extending in the longitudinal direction of the connectors 13. This increases the mechanical stability of the protective plates and prevents the protective plates from being bent during rough contact of the connectors 13. It should be clear that ribs 35 extending in the transverse direction (not shown) across the protective plates may also be provided with the same object.

It may be necessary, particularly in elaborate systems, to connect parts of one connector with parts of another connector or with another printed circuit board. At the bottom left in figure 1, four adjoining cable connectors 36 of the type illustrated in figure 2 are shown mounted to the connector 13. The cable connectors 36 adjoin each other in figure 1 without loss of space for one or more contact elements.

In figure 2, two cable connector modules having a housing 36 with two rows of contact openings located opposite each other at a distance are shown diagrammatically in perspective on an enlarged scale. The ribbon cables 37 have conductors disposed opposite each other in the open channels 38 of the respective cable connectors. The channels extend in the column direction of the contact elements from one side of the housing to the other. To prevent these conductors making undesired electrical contact with each other, the contact elements of the cable connectors 36 are so arranged that only one connecting end of a contact element is situated in each channel 38 so that, if two ribbon cable connectors are positioned opposite each other, the respective contact elements in the same column are separated from each other over at least a distance of one position. By further providing that the end of a ribbon cable 37 to be received in a cable connector has a course corresponding to the sitting of the connecting ends of the contact elements so that

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after assembly of the ribbon cable, the conductors of the contacting extremities do not project beyond the housing 36, the ends of the contacted conductors will then not touch each other when the cable connectors are mounted opposite each other.

5 The contact elements can, of course, be arranged in different ways. For example, adjoining contact elements of a two-row cable connector with an even number of columns can each be located in a different row with the end of the ribbon cable 37 to be received in the cable connector having a castellated course. The contact
10 elements may have a flat base section from which contact fingers or a contact pin extend with the connecting end being designed as a plug-on contact (not shown). The pitch distance between the contact elements is preferably 2 mm. In figure 2 projections 39, which can be broken away, are attached to avoid erroneous contacting.

15 It will be clear that the invention is not limited to the preferred embodiments thereof described and shown in the drawings, but that other variations and modifications are possible. For example, the connector modules may include optoelectronic connectors connected to optical fiber cables, shielded connectors, to
20 locking means or so called polarity indicators to prevent incorrect connection of the connector modules, etc., all without deviating from the scope of the invention, which is defined by the claims.

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1. A cable connector for a ribbon cable (37), comprising a housing of electrically insulating material with a plurality of contact elements, each contact element having a connecting portion formed as a plug-on contact for connection to a conductor of the ribbon cable (37), said housing having an opening extending from a first side to a second opposing side for receiving said ribbon cable (37) characterized in that said contact elements are arranged in rows and columns, said opening comprises a series of open channels (38) extending in the column direction of the contact elements and being enclosed by said housing, only one plug-on contact being located in each channel (38), the contact elements disposed adjacent to the second side of the housing being arranged in a manner such that, if two of said cable connectors are positioned with said second sides entirely situated opposite each other, the respective contact elements in both cable connectors within one and the same column are separated from each other by a distance of at least one column.

2. A cable connector according to claim 1 characterized in that said cable connector comprises two rows and an even number of columns, the plug-on contacts disposed in adjacent channels (38) each being arranged in another row.

3. A cable connector according to claim 1 or 2 characterized in that the pitch distance between adjacent contact elements is 2 mm.

4. A cable connector according to any of the preceding claims characterized in that the housing of said cable connector has external dimensions such that two or more of said cable connectors can be positioned adjacent to each other without loss of space for one or more contact elements.

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