

Description

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a connector for a transmission cable and, in particular, to a connector having a contoured shell locating the cable relating to contacts.

Description of the Prior Art

A transmission cable connector is an electrical connector component adapted to interconnect each electrical conductor of a cable to a respective complementary contact. The structure of the cable is meticulously designed and fabricated so that the electrical characteristics of the cable (including impedance and crosstalk) may be precisely controlled.

Such cables, which may be in round or flat form, are typically interconnected to other circuit components using a transmission cable connector. In the case of a round cable the interconnection is usually made by first fanning the extending ends of the cable into a generally planar array and securing each of the wires of the individual conductors to the respective contacts provided in the connector. The interconnection between the extending conductors and the contacts may be directly made, as a solder.

In some instances the center-to-center spacing of adjacent conductors in the planar array of conductors is different than the center-to-center spacing of the contacts in the connector. In such a case a transition circuit board is provided. The transition circuit board is a generally planar substrate having an array of conductive tracings with termination pads formed at each end of each tracing. Such tracings and pads may be disposed on one or both of the surfaces of the substrate. The individual conductors of the cable are suitably secured to the input pads along one edge of the transition board while the contacts of the connector are soldered into contact with output pads provided along other of the edges of the substrate. Typically the entire connector assembly is surrounded by a plastic tracing.

In the typical case little if any consideration is given to the electrical characteristics of the transition region between the ends of the cable and the contacts in the connector, whether or not an intermediate transition board is provided. It is often assumed that the electrical length of the transition region is electrically too short to cause problems with data transmission. However, this is not always true. At higher frequencies the signal transmission

benefits, particularly the impedance and crosstalk considerations resulting from precise design of the cable, are lost when one neglects the electrical characteristics of the conductors, contacts and board in the transition region.

Accordingly, in view of the foregoing, it is believed advantageous to provide a transmission cable connector which includes an impedance control arrangement in the transition region between the cable and the connector.

EP-A-0090539 discloses an electrical connector having a plurality of contacts which is provided with a moulded cover of insulative material selectively plated with conductive material, which is grounded in use to form an EMI shield.

US-A-3634806 discloses a matched impedance connector for the connection of a printed circuit board to a multi-conductor flat cable. The connector comprises a moulded block containing a plurality of cavities. Two rows of connecting pins are inserted into respective cavities and a metallic plate is disposed in between the two rows. The plate is grounded and serves to prevent the interruption of impedance when a connection is made.

SUMMARY OF THE INVENTION

In accordance with the invention, there is provided a connector having a predetermined electrical impedance, comprising connecting means, a plurality of contacts connectable via said connecting means to individual conductor wires of a cable having an electrical impedance closely matching said predetermined electrical impedance, and a shell having at least a conductive inner layer and covering at least the connecting means characterised in that the conductive inner layer is spaced from the connecting means at a predetermined clearance distance such that, in use, when the inner layer is connected to an appropriate electrical potential said predetermined electrical impedance is imparted to the connecting means.

The connecting means between the conductor wires of the cable to the contacts may be typically a planar substrate with an array of tracings on at least one surface or may simply consist of extended wires of the cable.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more fully understood from the following detailed description thereof taken in connection with the accompanying drawing which forms a part of this application and in which:

Figure 1 is a plan view of a connector in accordance with the present invention adapted for use with a transition circuit board, with portions of

the shell broken away for clarity;

Figure 2 is a side elevational view entirely in section of the transmission cable connector of Figure 1 taken along section lines 2-2 thereof; and

Figure 3 is a view similar to Figure 2 of a connector in accordance with the present invention adapted for use when the conductors of the cable are directly connected to the contacts of the connector.

DETAILED DESCRIPTION OF THE INVENTION

Throughout the following detailed description similar reference numerals refer to similar elements in all figures of the drawings.

With reference to the Figures 1 and 2 a transmission cable connector generally indicated by reference character 10 embodying the teachings of this invention is shown. The connector 10 is adapted to interconnect the individual conductor wires 12 of a cable 14 to associated user circuitry (not shown) which is attached to the connector 10. In the embodiment of the invention shown in Figures 1 and 2 a transition board 16 is used to effect the transition.

The connector 10 includes a header portion 18 formed of a suitable dielectric material, such as molded plastic. A metal shroud 20 is disposed on the header 18. Prongs 20P (Figure 2) project from the shroud 20 through apertures 22 provided in the header 18. Tabs 20T project from the prongs 20P, for a purpose to be described.

The header 18 carries a predetermined plurality of electrical contacts 24 thereon. It should be understood that any suitable form of contacts 24 may be used in the connector 10. The contacts 24 are engaged in soldered contact, as shown by the solder beads 25, with individual contact pads 26, 28 respectively disposed on the upper and lower surfaces 30, 32 of the transition circuit board 16. As noted the board 16 is arranged to form a transition in the region between the ends of the individual wires 12 of the cable 14 and the contacts 24.

The surfaces 30, 32 of the circuit board 16 carry a predetermined pattern of tracings 36, 38 respectively which extend from the contact pads 40, 42 along one edge of the board 16. The pads 40, 42 respectively correspond to the pads 26, 28 provided along the opposite edge of the board 16.

The cable 14 may be either a planar (flat) cable or a round cable having a spirally wound array of conductors therein. Each form of cable 14 includes an insulation jacket 14J (Figures 2, 3). To effect the interconnection of the individual conductors 12 of the cable 14 the jacket 14J is removed and, in the case of a round cable, the conductor

wires 12 in the cable fanned out in a generally planar configuration. The extending, individual conductor wires 12 are stripped of their jackets 14J. The wires 12 are soldered or otherwise suitably attached to the pads 40, 42, as the case may be, as shown by the solder beads 43.

The wires 12 of the cable 14 are held in place in the vicinity of the pads 40, 42 by a shell 44. The shell 44 is comprised of upper and lower members 44A, 44B, typically formed of a plastic material. The members 44A, 44B are secured together by screws 46. Serrations 48A, 48B (Figures 2, 3), respectively provided on the shell members 44A, 44B, grasp the insulation jacket 14J of the cable to assist in securing the cable in place. The shell members 44A, 44B are held in the vicinity of the header 18 by the interengagement of the tabs 20T of the shroud 20 with notches 49 provided in the shell members 44. It should be understood that any suitable expedient may be used to secure the cable to the shell 44 and the shell 44 to the header 18. It should also be understood that suitable bus bars (not shown) may also be provided on the surface of the board to provide suitable terminations for any ground signals disposed within the cable 14.

The cable 14 is constructed so as to exhibit a predetermined electrical impedance. In particular the impedance of the cable 14 as well as the effects on a given conductor due to the presence of one or more adjacent conductors is minimized. In accordance with the present invention the connector 10 is provided with an impedance control arrangement 50 whereby the electrical impedance of the elements in the transition region between the end of the cable 14 and the contacts 24 of the connector 10 is generally matched to the impedance of the cable 14. The impedance control arrangement is implemented by conductive layers 52, 54 on the inner surfaces of the upper and lower shell members 44A, 44B, respectively. Of course, if the shell members 44A, 44B are themselves formed of a conductive material, no additional inner conductive layers need be provided.

The shell members 44A, 44B are contoured to dispose the inner conductive layers 52, 54 on the inner surfaces of the shell members into predetermined close distances 58, 60 from the respective proximal surfaces 30, 32 of the transition board 16. Preferably, the layers 52, 54 are generally parallel to the surfaces 30, 32, respectively of the board 16. The spacings 58, 60 are selected such that the tracing patterns 36, 38 on the respective surfaces 30, 32 of the transition board 16, in conjunction with the metallic layers 52, 54 of the shell 44, and are arranged so that, in use, with the conductive layers 52, 54 connected to a predetermined potential (typically ground potential), the layers 52, 54

act as impedance control surfaces or ground planes. Thus, the layers 52, 54 of the shell members 44A, 44B lying the respective predetermined distances 58, 60 from the surfaces 30, 32 of the board 16, taken in conjunction with the spacing, density, and pattern of the respective tracings 36, 38 on those surfaces of the board, impart to the tracings 36, 38 an electrical impedance that substantially matches the electrical impedance of the cable 14.

In addition, the conductive layers 52, 54 are respectively spaced predetermined distances 70, 72 from the area of interconnection 43, between the extending wires 12 of the cable 14 and the pads 40, 42 on their respective surfaces of the board 16. Further, the layers 52, 54 are respectively spaced predetermined distances 74, 76 between tracings 36, 38 and the interconnections between the tracings, pads 26, 28 and the contacts 24. These spacings 70-76 are arranged to impart an electrical impedance to these areas of interconnection which matches the electrical impedance of the cable. The layers 52, 54 may be appropriately contoured in the respective regions 78, 80 where the contacts 24 extend from the pads 26, 28 toward the header 18.

The interconnection between the layers 52, 54 and the appropriate ground potential is effected by contact between the layers 52, 54 and the tabs 20T which are attached to the prongs 20P projecting from the shroud 20. Of course, any other suitable means of connection with the layers 52, 54 may be used.

As seen in Figure 3 the teachings of this invention are applicable to arrangements wherein the extending wires 12 of the cables are directly joined to the contacts 24. Typically, the jointure is soldered, as shown by the bead 82. In this embodiment the ends of the cable are clamped between a central plank 18P extending from the header 18 and the shell members 44A, 44B. In this Figure 3, the reference characters 58', 60', 70', 72', and 74', 76' respectively represent the clearance distances between the area of interconnection between the wires 12 and the contacts 24; the extending portion of the wires 12; and the contacts 24. The layers 52, 54 may also be appropriately contoured in the regions 78', 80'. Note that in Figure 2 the exterior of the shells 44A, 44B are recessed, while in the embodiment of Figure 3, the exterior of the shells are planar.

From the foregoing it may be appreciated that, when connected to the appropriate electrical potential, the ground planes provided by the conductive layers 52, 54 of the shell 44 maintain the signal integrity of the signals carried on the individual wires 12 through the transition region between the end of the cable 14 and the contacts 24. By

appropriately contouring the metallic conductive layers of the shell and spacing them the predetermined distances from the extending conductor wires, the tracings on the board surface, the contact pads and/or the contacts, the electrical impedance of these elements in the transition region may be made to closely match the electrical impedance of the cable.

Those skilled in the art, having the benefit of the teachings as hereinabove set forth, may affect numerous modifications thereto. For example, although the invention has been illustrated in connection with a double-sided (i.e., tracings on both surfaces) transition circuit board, single-sided boards may be used. Moreover, although a female connector is illustrated, it is also possible to use a male connector configuration. Furthermore, the layers need not be contoured over the entire transition region. Thus, in Figures 1 and 2, beneficial advantages would obtain were the parallel spacings 58, 60 in the region overlying only the surface of the board maintained. However, the more precise the contours and the spacings between the conductive layers 52, 54 and the various elements in the transition region, the more closely matched is the electrical impedance of the elements in this region to the impedance of the cable.

Claims

1. A connector having a predetermined electrical impedance, comprising connecting means (16,36,38,82), a plurality of contacts (24) connectable via said connecting means (16,36,38,82) to individual conductor wires (12) of a cable (14) having an electrical impedance closely matching said predetermined electrical impedance, and a shell (44) having at least a conductive inner layer (52,54) and covering at least the connecting means; characterised in that the conductive inner layer (52,54) is spaced from the connecting means (16,36,38,82) at a predetermined clearance distance such that, in use, when said inner layer (52,54) is connected to an appropriate electrical potential said predetermined electrical impedance is imparted to the connecting means.
2. A connector according to claim 1 wherein the connecting means are formed by a planar substrate (16) which engages the contacts (24) and possesses an array of tracings (36,38) on at least one surface thereof, the individual tracings (36,38) being connectable to a respective one of the contacts (24) as well as to a respective one of the individual conductor wires (12) of the cable (14).



act as impedance control surfaces or ground planes. Thus, the layers 52, 54 of the shell members 44A, 44B lying the respective predetermined distances 58, 60 from the surfaces 30, 32 of the board 16, taken in conjunction with the spacing, density, and pattern of the respective tracings 36, 38 on those surfaces of the board, impart to the tracings 36, 38 an electrical impedance that substantially matches the electrical impedance of the cable 14.

In addition, the conductive layers 52, 54 are respectively spaced predetermined distances 70, 72 from the area of interconnection 43, between the extending wires 12 of the cable 14 and the pads 40, 42 on their respective surfaces of the board 16. Further, the layers 52, 54 are respectively spaced predetermined distances 74, 76 between tracings 36, 38 and the interconnections between the tracings, pads 26, 28 and the contacts 24. These spacings 70-76 are arranged to impart an electrical impedance to these areas of interconnection which matches the electrical impedance of the cable. The layers 52, 54 may be appropriately contoured in the respective regions 78, 80 where the contacts 24 extend from the pads 26, 28 toward the header 18.

The interconnection between the layers 52, 54 and the appropriate ground potential is effected by contact between the layers 52, 54 and the tabs 20T which are attached to the prongs 20P projecting from the shroud 20. Of course, any other suitable means of connection with the layers 52, 54 may be used.

As seen in Figure 3 the teachings of this invention are applicable to arrangements wherein the extending wires 12 of the cables are directly joined to the contacts 24. Typically, the jointure is soldered, as shown by the bead 82. In this embodiment the ends of the cable are clamped between a central plank 18P extending from the header 18 and the shell members 44A, 44B. In this Figure 3, the reference characters 58', 60', 70', 72', and 74', 76' respectively represent the clearance distances between the area of interconnection between the wires 12 and the contacts 24; the extending portion of the wires 12; and the contacts 24. The layers 52, 54 may also be appropriately contoured in the regions 78', 80'. Note that in Figure 2 the exterior of the shells 44A, 44B are recessed, while in the embodiment of Figure 3, the exterior of the shells are planar.

From the foregoing it may be appreciated that, when connected to the appropriate electrical potential, the ground planes provided by the conductive layers 52, 54 of the shell 44 maintain the signal integrity of the signals carried on the individual wires 12 through the transition region between the end of the cable 14 and the contacts 24. By

appropriately contouring the metallic conductive layers of the shell and spacing them the predetermined distances from the extending conductor wires, the tracings on the board surface, the contact pads and/or the contacts, the electrical impedance of these elements in the transition region may be made to closely match the electrical impedance of the cable.

Those skilled in the art, having the benefit of the teachings as hereinabove set forth, may affect numerous modifications thereto. For example, although the invention has been illustrated in connection with a double-sided (i.e., tracings on both surfaces) transition circuit board, single-sided boards may be used. Moreover, although a female connector is illustrated, it is also possible to use a male connector configuration. Furthermore, the layers need not be contoured over the entire transition region. Thus, in Figures 1 and 2, beneficial advantages would obtain were the parallel spacings 58, 60 in the region overlying only the surface of the board maintained. However, the more precise the contours and the spacings between the conductive layers 52, 54 and the various elements in the transition region, the more closely matched is the electrical impedance of the elements in this region to the impedance of the cable.

Claims

1. A connector having a predetermined electrical impedance, comprising connecting means (16,36,38,82), a plurality of contacts (24) connectable via said connecting means (16,36,38,82) to individual conductor wires (12) of a cable (14) having an electrical impedance closely matching said predetermined electrical impedance, and a shell (44) having at least a conductive inner layer (52,54) and covering at least the connecting means; characterised in that the conductive inner layer (52,54) is spaced from the connecting means (16,36,38,82) at a predetermined clearance distance such that, in use, when said inner layer (52,54) is connected to an appropriate electrical potential said predetermined electrical impedance is imparted to the connecting means.
2. A connector according to claim 1 wherein the connecting means are formed by a planar substrate (16) which engages the contacts (24) and possesses an array of tracings (36,38) on at least one surface thereof, the individual tracings (36,38) being connectable to a respective one of the contacts (24) as well as to a respective one of the individual conductor wires (12) of the cable (14).



3. A connector according to claim 2 wherein the conductive inner layer (52,54) is disposed parallel to the surface of the substrate (16).
4. A connector according to claim 2 or 3 wherein the shell (44) is contoured to space the conductive inner layer (52,54) a predetermined clearance distance from the interconnections between the tracings (36,38) and the wires (12) of the cable (14).
5. A connector according to claim 2,3 or 4 wherein the shell (44) is contoured to space the conductive inner layer (52,54) at a predetermined clearance distance from the interconnections between the tracings (36,38) and the contacts (24).
6. A connector according to claim 1 wherein the connecting means are formed by extended portions of the conductor wires (12) which engage the contacts (24) and the shell (44) is further contoured to space the conductive inner layer (52,54) at the predetermined clearance distance from the extended portions of the conductor wires (12) and the point of interconnection with the contacts (24).
7. A connector according to claim 6 wherein the shell (44) is contoured to space the conductive inner layer (52,54) at a second predetermined clearance distance from the contacts (24).
8. A connector according to any one of the preceding claims wherein the shell (44) is made wholly of a conductive material.

Patentansprüche

1. Verbinder, welcher eine vorbestimmte elektrische Impedanz hat, und Verbindungseinrichtungen (16, 36, 38, 82), eine Mehrzahl von Kontakten (24), welche über die Verbindungseinrichtungen (16, 36, 38, 82) mit einzelnen Leiterdrähten (12) eines Kabels (14) verbindbar sind, welches eine elektrische Impedanz hat, welche eng auf die vorbestimmte elektrische Impedanz abgestimmt ist, und eine Hülse (44) aufweist, die wenigstens eine leitende innere Schicht (52, 54) hat und wenigstens die Verbindungseinrichtung abdeckt, dadurch gekennzeichnet, daß die leitende innere Schicht (52, 54) von den Verbindungseinrichtungen (16, 36, 38, 82) einen vorbestimmten Zwischenabstand derart hat, daß, wenn im Gebrauchszustand die innere Schicht (52, 54) mit einem geeigneten elektrischen Potential verbunden ist, die vorbestimmte elektrische Impe-

danz den Verbindungseinrichtungen vermittelt wird.

2. Verbinder nach Anspruch 1, bei dem die Verbindungseinrichtungen von einem planaren Substrat (16) gebildet werden, welches mit den Kontakten (24) zusammenarbeitet und eine Gruppe von Bahnen (36, 38) auf wenigstens einer Oberfläche hiervon besitzt und die einzelnen Bahnen (36, 38) mit einem jeweils zugeordneten Kontakt (24) sowie mit einem jeweils zugeordneten, einzelnen Leiterdraht (12) des Kabels (14) verbindbar sind.
3. Verbinder nach Anspruch 2, bei dem die leitende innere Schicht (52, 54) parallel zur Oberfläche des Substrats (16) angeordnet ist.
4. Verbinder nach Anspruch 2 oder 3, bei dem die Hülse (44) profiliert ist, um die leitende innere Schicht (52, 54) in einem vorbestimmten Zwischenabstand von den Verbindungen zwischen den Bahnen (36, 38) und den Drähten (12) des Kabels (14) anzuordnen.
5. Verbinder nach Anspruch 2, 3 oder 4, bei dem die Hülse (44) profiliert ist, um die leitende innere Schicht (52, 54) in einem vorbestimmten Zwischenabstand von der Verbindung zwischen den Bahnen (36, 38) und den Kontakten (24) anzuordnen.
6. Verbinder nach Anspruch 1, bei dem die Verbindungseinrichtungen von verlängerten Teilen der Leiterdrähte (12) gebildet werden, welche mit den Kontakten (24) zusammenarbeiten und bei dem die Hülse (44) ferner profiliert ist, um die leitende innere Schicht (52, 54) in einem vorbestimmten Zwischenabstand von den verlängerten Teilen der Leiterdrähte (12) und der Verbindungsstelle mit den Kontakten (24) anzuordnen.
7. Verbinder nach Anspruch 6, bei dem die Hülse (14) profiliert ist, um die leitende innere Schicht (52, 54) in einem zweiten vorbestimmten Zwischenabstand von den Kontakten (24) anzuordnen.
8. Verbinder nach einem der vorangehenden Ansprüche, bei dem die Hülse (44) insgesamt aus einem leitenden Material hergestellt ist.

Revendications

1. Un connecteur ayant une impédance électrique prédéterminée, comprenant des moyens de raccordement (16, 36, 38, 82), une pluralité de



- contacts (24) susceptibles d'être raccordés via lesdits moyens de raccordement (16, 36, 38, 82) à des fils conducteurs individuels (12) d'un câble (14) dont l'impédance électrique correspond de près à ladite impédance électrique prédéterminée, et une enveloppe (44) ayant au moins une couche conductrice intérieure et recouvrant au moins les moyens de raccordement; caractérisé en ce que la couche conductrice intérieure (52, 54) est écartée et disposée à une distance prédéterminée des moyens de raccordement (16, 36, 38, 82) de manière à ce que, lors de l'utilisation, quand ladite couche interne (52, 54) est raccordée à un potentiel électrique adéquat, lesdits moyens de raccordement présentent ladite impédance électrique prédéterminée.
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45
- 50
- 55
2. Un connecteur selon la revendication 1, dans lequel les moyens de raccordement sont constitués par un substrat plan (16) qui vient en prise avec les contacts (24) et comporte un réseau de pistes conductrices (36, 38) sur au moins l'une de ses surfaces, les pistes individuelles (36, 38) étant susceptibles d'être raccordées respectivement à l'un des contact (24) ainsi qu'à l'un des fils conducteurs individuels (12) du câble (14).
 3. Un connecteur selon la revendication 2, dans lequel la couche conductrice interne (52, 54) est disposée parallèlement à la surface du substrat (16).
 4. Un connecteur selon la revendication 2 ou 3, dans lequel l'enveloppe (44) est profilée afin de séparer d'une distance prédéterminée la couche conductrice interne (52, 54) des interconnexions entre les pistes conductrices (36, 38) et les fils conducteurs (12) du câble (14).
 5. Un connecteur selon la revendication 2, 3 ou 4, dans lequel l'enveloppe (44) est profilée afin de séparer d'une distance prédéterminée la couche conductrice interne (52, 54) des interconnexions entre les pistes conductrices (36, 38) et les contacts (24).
 6. Un connecteur selon la revendication 1, dans lequel les moyens de raccordement sont constitués des parties des fils conducteurs (12) du câble et qui viennent en prise avec les contacts (24), et dans lequel l'enveloppe (44) est en outre profilée afin de séparer d'une distance prédéterminée la couche conductrice interne (52, 54) des parties des fils conducteurs (12) du câble et du point d'interconnexion avec les contacts (24).
 7. Un connecteur selon la revendication 6, dans lequel l'enveloppe (44) est profilée afin de séparer une deuxième distance prédéterminée, la couche conductrice interne (52, 54) des contacts (24).
 8. Un connecteur selon l'une quelconque des revendications précédentes, dans lequel l'enveloppe (44) est entièrement réalisée un matériau conducteur de l'électricité.