

## Description

This invention relates to electrical connector blocks for a flat ribbon cable having a plurality of conductors lying side by side in an insulating ribbon.

The proper grounding of electrical equipment is important, since transients may be generated internally or externally of the equipment which must find a pathway to ground or else damage may occur to the equipment or injury may occur to persons handling the equipment.

Transient protectors absorb this energy and minimise damage or prevent excessive voltage from leaving the equipment. Typically, the transient protectors are soldered onto a circuit board or to a connector. High density boards, however, have little room for such transient protectors. Moreover, standard insulation displacement connectors do not have exposed metal where the transient protectors can be added.

A particular danger may exist in cathode ray tubes (CRTs) in that high voltage in CRTs could propagate outside the enclosure of the devices via signal lines connected to the devices. Such propagation can cause fire, shock and/or equipment damage. Another concern is that the high voltage in the signal wires can arc over to other circuits or bare metal. If these wires are connected to equipment in a hazardous location, such as in the proximity of flammable or explosive material, this arc can cause ignition of this material.

It is desirable that any voltage on any signal leading out of a CRT be less than 250 volts ac with respect to ground (earth). The anode voltage in a CRT could be 14,000 to 35,000 volts. The capacitance of the anode could be 500 to 2,500 pF.

Transient protectors for lines leaving a CRT would thus be desirable, particularly in view of the small amount of space which is generally available on circuit boards of such devices.

Electrical connector blocks having insulation-piercing bifurcated contacts or tines for the formation of electrical connections have been described in US-A-3 012 219 and US-A-3 820 058. These connector blocks include one or more rows of insulation-piercing contacts for piercing the insulation of a multi-conductor ribbon cable or other insulated conductors. Also, a number of connector blocks are known in the prior art for common or ground termination of alternate drain conductors or a ground plane in a multi-conductor flat ribbon cable. Such connector blocks are disclosed in US-A-3 634 806, US-A-3 731 251, US-A-3 864 011 and US-A-3 912 354.

EP-A-0 043 627 discloses an electrical connector block in which terminal contacts having insulation-piercing ends for connection with conductors of a flat ribbon cable are arranged in two staggered rows.

The prior art does not teach the placement of components such as signal conducting resistors or surge suppression devices in shunt or parallel with two or more conductors in a ribbon cable.

According to the invention there is provided an electrical connector block for a flat ribbon cable having a plurality of conductors lying side-by-side in an insulating ribbon, the block comprising:

a base member capable of lying over a portion of the ribbon cable;

a plurality of terminal contacts, at least some of which extend through the base member each having an upper connection end and a lower insulation-piercing end and being disposed in the base member in a pattern such that the terminal contacts lie in a pair of spaced-apart rows, the terminal contacts in one row being spaced by an amount to engage via the insulation-piercing ends thereof alternate ones of the conductors in the ribbon cable, and the terminal contacts in the other row being staggered with respect to said one row to engage via the insulation-piercing ends thereof the conductors not contacted by the terminal contacts of said one row;

a bottom cover engageable on an opposite side of the ribbon cable from the base member; and mounting means connected between the base member and the bottom cover for urging the base member and bottom cover together with the ribbon cable therebetween;

characterised in that at least one component is connected between a respective pair of the plurality of terminal contacts for connection to at least one conductor of the ribbon cable, said one component being thereby connected between said one conductor of the ribbon cable and either another conductor of the ribbon cable or a separate wire connected to a respective terminal contact.

Preferred embodiments of the present invention described in detail hereinbelow provide a connector block which is particularly suited for a ribbon cable and provides contact to conductors in the cable as well as locations for mounting components on the block, which components are connected between conductors in the cable or between a conductor and a ground connection. The preferred connector blocks are provided on the ribbon itself so that there is no need for access to or space on a circuit board to which the ribbon may be connected. This also facilitates retrofitting of pre-existing assemblies.

The preferred electrical connector blocks are simple in design, rugged in construction and economical to manufacture.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective, exploded view of an electrical connector block embodying the invention;

Figure 2 is an exploded sectional view of the connector block of Figure 1;

Figure 3 is a side elevational view of the connector block in an engaged position on a ribbon;

Figure 4 is a top plan view of a base of the connector block of Figure 1.

Figure 5 is a top plan view of a base of another electrical connector block embodying the invention;

Figure 6 is a side elevational view of the base of Figure 5, shown without components; and

Figure 7 is a side elevational view of a circuit board with ribbon connector outfitted with an electrical connector block embodying the invention.

Figures 1, 2 and 3 show an electrical connector block 10 for a flat ribbon cable 12 having a plurality of side-by-side conductors 14 to 17 which are enclosed within an insulating ribbon 22.

The block 10 comprises a top cover 30 which covers components connected to a base member or base 32. The top cover 30 includes arms 34 with hooks or shoulders 36 which engage under a bottom cover 38. The arms 34 have the dual purpose of holding the cover 30 on the base 32 as well as holding the bottom cover 38 up into engagement with the ribbon 12. Spring metal clips 40 are provided on both ends of the block 10 and on either side of the arms 34 for holding the base 32 to the bottom cover 38.

The base 32, as shown best in Figure 2, includes a plurality of terminals or contacts 42 to 46. Each contact 42 to 46 extends through the base 32 and includes a lower insulation piercing end. The lower insulation piercing end can be bifurcated (not shown) or tine-shaped. It is important the insulation piercing end of each of the terminals or contacts 42 to 46 be sufficiently long to pierce the insulation of the ribbon 22 and come into contact with one of the conductors 14 to 17 in the ribbon.

To further facilitate this contact, the bottom cover 38 is provided with a plurality of cavities or recess slots 50 which are disposed under each conductor to accommodate any displacement of the ribbon 22 after it has been pierced by the insulation-piercing ends of the terminals or contacts 42 to 46.

The terminals or contacts 42 to 46 automatically pierce the insulation and come into contact with the conductors 14 to 17 when the block 10 is assembled.

As shown in Figure 4, a plurality of components 52, 53 and 54 can be connected, for example by soldering, between terminals in a first row of terminals containing the contacts 42, 43 and 44 and a second row of terminals containing the contacts 45 and 46. These components may, for example, be resistors or diodes. In Figure 4, the component 52 is shown connected between adjacent conductors 14 and 15 by virtue of its being connected to the terminals 42 and 45. In a similar fashion, the component 53 is shown connected between terminals 43 and 46 and thus interconnects adjacent conductors 16 and 17. Components can be arranged in other manners, however, to connect any one conductor with any other conductor and also to provide this connection with a selected component, such as a resistor or diode.

Figures 5 and 6 illustrate an embodiment of the

invention used as a transient protector. In this case, the base 72 includes a first row of terminals or contacts at 74 and a second row at 76. A bus line 78 having slots 80 is fixed near the centre of the base 72. Transient protection for each conductor including conductors 19, 20 and 21 is provided by a ground wire 82 which has one end fixed, for example by clamping or soldering, to the bus line 78.

Figure 7 shows a ribbon cable 12 connected between a circuit board 90 and a standard displacement connector 92. At some point along the ribbon cable 12, the connector block or box 10 is engaged and is shown with the ground wire 82 connected by a nut and bolt combination to a chassis 94 which supports the circuit board 90.

#### Claims

1. An electrical connector block (10) for a flat ribbon cable (12) having a plurality of conductors (14 to 17) lying side-by-side in an insulating ribbon (22), the block (10) comprising:

a base member (32; 72) capable of lying over a portion of the ribbon cable (12);

a plurality of terminal contacts (42 to 46; 74, 76, 78), at least some of which extend through the base member (32; 72) each having an upper connection end and a lower insulation-piercing end and being disposed in the base member (32; 72) in a pattern such that the terminal contacts lie in a pair of spaced-apart rows, the terminal contacts in one row (42 to 44; 74) being spaced by an amount to engage via the insulation-piercing ends thereof alternate ones of the conductors (e.g. 15, 17) in the ribbon cable (12), and the terminal contacts in the other row (45, 46; 76) being staggered with respect to said one row to engage via the insulation-piercing ends thereof the conductors (e.g. 14, 16) not contacted by the terminal contacts of said one row;

a bottom cover (38) engageable on an opposite side of the ribbon cable (12) from the base member (32; 72); and

mounting means (40) connected between the base member (32; 72) and the bottom cover (38) for urging the base member and bottom cover together with the ribbon cable (12) therebetween;

characterised in that at least one component (e.g. 52) is connected between a respective pair of the plurality of terminal contacts (42 to 46; 74, 76, 78) for connection to at least one conductor (14 to 17) of the ribbon cable (12), said one component being thereby connected between said one conductor of the ribbon cable (12) and either another conductor of the ribbon cable (12) or a separate wire (82) connected to a respective terminal contact (78).

2. An electrical connector block according to claim 1, wherein said one component (e.g. 52) is connected between a terminal contact of said one row and a terminal contact of said other row for connection between respective conductors of the ribbon cable (12).

3. An electrical connector block according to

Figure 5 is a top plan view of a base of another electrical connector block embodying the invention;

Figure 6 is a side elevational view of the base of Figure 5, shown without components; and

Figure 7 is a side elevational view of a circuit board with ribbon connector outfitted with an electrical connector block embodying the invention.

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To further facilitate this contact, the bottom cover 38 is provided with a plurality of cavities or recess slots 50 which are disposed under each conductor to accommodate any displacement of the ribbon 22 after it has been pierced by the insulation-piercing ends of the terminals or contacts 42 to 46.

The terminals or contacts 42 to 46 automatically pierce the insulation and come into contact with the conductors 14 to 17 when the block 10 is assembled.

As shown in Figure 4, a plurality of components 52, 53 and 54 can be connected, for example by soldering, between terminals in a first row of terminals containing the contacts 42, 43 and 44 and a second row of terminals containing the contacts 45 and 46. These components may, for example, be resistors or diodes. In Figure 4, the component 52 is shown connected between adjacent conductors 14 and 15 by virtue of its being connected to the terminals 42 and 45. In a similar fashion, the component 53 is shown connected between terminals 43 and 46 and thus interconnects adjacent conductors 16 and 17. Components can be arranged in other manners, however, to connect any one conductor with any other conductor and also to provide this connection with a selected component, such as a resistor or diode.

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Figure 7 shows a ribbon cable 12 connected between a circuit board 90 and a standard displacement connector 92. At some point along the ribbon cable 12, the connector block or box 10 is engaged and is shown with the ground wire 82 connected by a nut and bolt combination to a chassis 94 which supports the circuit board 90.

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a base member (32; 72) capable of lying over a portion of the ribbon cable (12);

a plurality of terminal contacts (42 to 46; 74, 76, 78), at least some of which extend through the base member (32; 72) each having an upper connection end and a lower insulation-piercing end and being disposed in the base member (32; 72) in a pattern such that the terminal contacts lie in a pair of spaced-apart rows, the terminal contacts in one row (42 to 44; 74) being spaced by an amount to engage via the insulation-piercing ends thereof alternate ones of the conductors (e.g. 15, 17) in the ribbon cable (12), and the terminal contacts in the other row (45, 46; 76) being staggered with respect to said one row to engage via the insulation-piercing ends thereof the conductors (e.g. 14, 16) not contacted by the terminal contacts of said one row;

a bottom cover (38) engageable on an opposite side of the ribbon cable (12) from the base member (32; 72); and

mounting means (40) connected between the base member (32; 72) and the bottom cover (38) for urging the base member and bottom cover together with the ribbon cable (12) therebetween;

characterised in that at least one component (e.g. 52) is connected between a respective pair of the plurality of terminal contacts (42 to 46; 74, 76, 78) for connection to at least one conductor (14 to 17) of the ribbon cable (12), said one component being thereby connected between said one conductor of the ribbon cable (12) and either another conductor of the ribbon cable (12) or a separate wire (82) connected to a respective terminal contact (78).

2. An electrical connector block according to claim 1, wherein said one component (e.g. 52) is connected between a terminal contact of said one row and a terminal contact of said other row for connection between respective conductors of the ribbon cable (12).

3. An electrical connector block according to



claim 1, wherein one of the terminal contacts comprises a bus line (78) to which the separate wire (82) is connected, and said one component is connected between said one conductor of the ribbon cable (12) and the bus line (78).

4. An electrical connector block according to claim 1, claim 2 or claim 3, including a top cover (30) having a recess and engaged over the base member (32; 72) for covering the at least one component (e.g. 52) and the terminal contacts (42 to 46).

5. An electrical connector block according to claim 4, wherein the top cover (30) includes a pair of arms (34) extending towards and engaged or engageable with the bottom cover (38) on opposite sides of the bottom cover.

6. An electrical connector block according to claim 5, wherein the mounting means includes a plurality of clips (40) engaged or engageable between the base member (32; 72) and the bottom cover (38) for holding the base member and the bottom cover together.

7. An electrical connector block according to claim 4, wherein the mounting means includes a plurality of clips (40) engaged or engageable on opposite sides of the base member (32; 72) and bottom cover (38), and between the base member and bottom cover, the mounting means also including the top cover (30) having a pair of arms (34) extending towards and into engagement with the bottom cover (38) for holding the top cover (30) to the bottom cover and the base member (32; 72) and the ribbon cable (12) between the top cover and bottom cover.

#### Patentansprüche

1. Elektrischer Verbinderblock (10) für ein Flachbandkabel (12) mit einer Vielzahl von Leitern (14-17), die Seite an Seite in einem isolierenden Band (22) liegen, wobei der Block (10) aufweist:

ein Basisteil (32; 72), welches geeignet ist, über einem Teil des Bandkabels (12) zu liegen;

eine Vielzahl von Anschlußkontakten (42-46; 74, 76, 78), von denen sich mindestens einige durch das Basisteil (32; 72) erstrecken und jedes ein oberes Verbindungsende und ein unteres, die Isolierung durchdringendes Ende hat und im Basisteil (32; 72) in einem Muster derart angeordnet ist, daß die Anschlußkontakte in einem Paar von im Abstand voneinander angeordneten Reihen liegen, wobei die Anschlußkontakte in einer Reihe (42-44; 74) um einen Betrag im Abstand liegen, um über ihre die Isolierung durchdringenden Enden mit alternierenden Kontakten der Leiter (z.B. 15, 17) in dem Bandkabel (12) in Eingriff zu treten, wobei die Anschlußkontakte in der anderen Reihe (45, 46; 76) bezüglich der einen Reihe so versetzt sind, daß sie über ihre die Isolierung durchdringenden Enden mit den Leitern (z.B. 14, 16) in Eingriff treten, welche nicht von den Anschlußkontakten der einen Reihe kontaktiert sind;

eine Bodenabdeckung (38), die auf einer gegenüberliegenden Seite des Bandkabels (12) von dem Basisteil (32; 72) in Eingriff bringbar ist; und

Befestigungsmittel (40), die zwischen dem Basisteil (32; 72) und der Bodenabdeckung (38) verbunden sind, um das Basisteil und die Bodenabdeckung mit dem Bandkabel (12) dazwischen zusammenzudrücken;

dadurch gekennzeichnet, daß mindestens ein Bestandteil (z.B. 52) zwischen einem entsprechenden Paar der Vielzahl von Anschlußkontakten (42-46; 74, 76, 78) für die Verbindung mit mindestens einem Leiter (14-17) des Bandkabels (12) verbunden ist, wobei der eine Bestandteil dadurch zwischen dem einen Leiter des Bandkabels (12) und irgendeinem anderen Leiter des Bandkabels (12) oder einer separaten Leitung (82) verbunden ist, die mit einem entsprechenden Anschlußkontakt (78) verbunden ist.

2. Elektrischer Verbinderblock nach Anspruch 1, wobei ein Bestandteil (z.B. 52) zwischen einem Anschlußkontakt der einen Reihe und einem Anschlußkontakt der anderen Reihe für die Verbindung zwischen entsprechenden Leitungen des Bandkabels (12) verbunden ist.

3. Elektrischer Verbinderblock nach Anspruch 1, wobei einer der Anschlußkontakte eine Omnibusleitung (78) aufweist, mit welcher die separate Leitung (82) verbunden ist, und wobei ein Bestandteil zwischen dem einen Leiter des Bandkabels (12) und der Omnibusleitung (78) verbunden ist.

4. Elektrischer Verbinderblock nach Anspruch 1, Anspruch 2 oder Anspruch 3 mit einem Deckel (30) mit einer Ausnehmung, der über dem Basisteil (32; 72) für die Abdeckung mindestens des einen Bestandteils (z.B. 52) und der Anschlußkontakte (42-46) in Eingriff steht.

5. Elektrischer Verbinderblock nach Anspruch 4, wobei der Deckel (30) ein Paar von Armen (34) aufweist, die sich zur Bodenabdeckung (38) hin erstrecken und mit dieser auf gegenüberliegenden Seiten der Bodenabdeckung in Eingriff stehen oder mit dieser in Eingriff bringbar sind.

6. Elektrischer Verbinderblock nach Anspruch 5, wobei das Anbringmittel eine Vielzahl von Klammern (40) aufweist, die zwischen dem Basisteil (32; 72) und der Bodenabdeckung (38) zum Zusammenhalten des Basisteils und der Bodenabdeckung in Eingriff stehen oder dazwischen in Eingriff bringbar sind.

7. Elektrischer Verbinderblock nach Anspruch 4, wobei das Befestigungsmittel eine Vielzahl von Klammern oder Clips (40) aufweist, die auf gegenüberliegenden Seiten des Basisteils (32; 72) und der Bodenabdeckung (38) in Eingriff stehen oder in Eingriff bringbar sind sowie zwischen dem Basisteil und der Bodenabdeckung, wobei das Anbringmittel auch einen Deckel (30) aufweist mit einem Paar von Armen (34), die sich zur Bodenabdeckung (38) hin erstrecken und mit dieser in Eingriff erstrecken, um den Deckel (30) an der Bodenabdeckung zu halten und das Basisteil (32; 72) und das Bandkabel (12) zwischen dem Deckel und der Bodenabdeckung.

#### Revendications

1. Bloc de connexion électrique (10) pour câble-



ruban plat (12) comportant une série de conducteurs (14 à 17) s'étendant côte à côte dans un ruban isolant (22), le bloc (10) comprenant:

un socle (32; 72) susceptible de s'étendre pardessus une partie du câble-ruban (12);

une série de contacts-bornes (42 à 46; 74, 76, 78) dont certains au moins traversent le socle (32; 72) présentant chacun une extrémité supérieure de connexion et une extrémité inférieure de perforation d'isolant et disposés dans le socle (32; 72) en un motif tel que les contacts-bornes s'étendent sur deux rangées espacées l'une de l'autre, les contacts-bornes d'une première rangée (42 à 44; 74) ayant l'espacement voulu pour porter par leurs extrémités de perforation d'isolant contre des conducteurs alternés (par exemple 15, 17) du câble-ruban (12), et les contacts-bornes de l'autre rangée (45, 46; 76) étant décalés en quinconce par rapport à ladite première rangée pour porter par leurs extrémités de perforation d'isolant contre les conducteurs (par exemple 14, 16) non touchés par les contacts-bornes de ladite première rangée;

un couvercle de dessous (38) pouvant s'engager sur le côté du câble-ruban (12) opposé au socle (32; 72); et

un moyen de montage (40) posé entre le socle (32; 72) et le couvercle de dessous (38) pour presser le socle et le couvercle de dessous l'un vers l'autre avec interposition entre eux du câble-ruban (12);

caractérisé en ce qu'au moins un composant (par exemple 52) est monté entre deux, respectifs, de la série de contacts bornes (42 à 46; 74, 76, 78) pour connexion à au moins un conducteur (14 à 17) du câble-ruban (12), ledit composant se trouvant par là monté entre ledit conducteur du câble-ruban (12) et soit un autre conducteur du câble-ruban (12), soit un fil indépendant (82) relié au contact-borne (78) respectif.

2. Bloc de connexion électrique selon la revendication 1, dans lequel ledit composant (par

exemple 52) est monté entre un contact-borne de ladite première rangée et un contact-borne de ladite autre rangée pour relier entre eux des conducteurs respectifs du câble-ruban (12).

3. Bloc de connexion électrique selon la revendication 1, dans lequel un des contacts-bornes constitue une ligne omnibus (78) à laquelle est relié le fil indépendant (82) et le dit composant est monté entre ledit conducteur du câble-ruban (12) et la ligne omnibus (78).

4. Bloc de connexion électrique selon la revendication 1, la revendication 2 ou la revendication 3, comportant un couvercle de dessus (30) présentant un évidement et engagé pardessus le socle (32; 72) pour recouvrir le ou chaque susdit composant (par exemple 52) et les contacts-bornes (42 à 46).

5. Bloc de connexion électrique selon la revendication 4, dans lequel le couvercle de dessus (30) comporte deux bras (34) s'étendant vers, ou engagés ou pouvant être engagés sur, le couvercle de dessous (38) de part et d'autre de celui-ci.

6. Bloc de connexion électrique selon la revendication 5, dans lequel le moyen de montage comporte plusieurs étriers (40) engagés ou pouvant être engagés entre le socle (32; 72) et le couvercle de dessous (38) pour maintenir le socle et le couvercle de dessous assemblés.

7. Bloc de connexion électrique selon la revendication 4, dans lequel le moyen de montage comporte plusieurs étriers (40) engagés ou pouvant être engagés sur des côtés opposés du socle (32; 72) et du couvercle de dessous (38), et entre le socle et le couvercle de dessous, le moyen de montage comportant aussi la présence sur le couvercle de dessus (30) de deux bras (34) dirigés vers, et en contact avec, le couvercle de dessous (38) pour maintenir le couvercle de dessus (30) contre le couvercle de dessous et contre le socle (32; 72) et le câble-ruban (12) entre le couvercle de dessus et le couvercle de dessous.

