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Description

The invention relates to a connector for connecting individual conductors of a first planar array of conductors to preselected alternative individual conductors of a second, parallel, planar array, at least some of the individual conductors of the second array being laterally spaced from individual conductors of the first array. In particular, the invention relates to a kit for making such connector.

It is known from US—A—3 189 863 to provide apparatus for interconnecting conductors in a first planar array to conductors in a second planar array of parallel conductors and comprising a plate like insulating body formed with contact locating means for locating a plurality of first and second contact parts on first and second opposite faces of the body for respective alignment with conductors of the first and second arrays; the contact locating means including through sockets extending between the first and second opposite faces of the body, the first contact parts having necks receivable in the through sockets. In this apparatus the first and second contact parts are integrally formed in aligned pairs and the apparatus is adapted to interconnect predetermined conductors of the arrays at locations aligned with the sockets.

As a result of the increasing demand for complex electrical wiring, there is frequently a requirement to interconnect individual conductors of planar arrays of conductors, for example, of two flat cables, which conductors are in parallel planes but displaced laterally from each other. In the interests of minimising inventories and capital expenditure, it is also desirable to avoid a requirement for a different connector for each different combination of interconnections. At the same time, the connector should desirably be designed to facilitate fabrication by mass production techniques and relatively simple to assemble and use in the field, minimising applied costs. In addition, the connector should be of relatively small size consistent with a requirement for compact and unobtrusive equipment, particularly in undercarpet cable applications where a low profile is important.

According to the present invention apparatus for interconnecting conductors in a first planar array to conductors in a second planar array of parallel conductors and comprising a plate like insulating body formed with contact locating means for locating a plurality of first and second contact parts on first and second opposite faces of the body for respective alignment with conductors of the first and second arrays, the contact locating means including through sockets extending between the first and second opposite faces of the body, the first contact parts having necks receivable in the through sockets is characterised by comprising a kit of parts assemblable in different ways to enable conductors of the first array to be interconnected with laterally spaced preselected alternative conductors of the second

array, the body being formed with bus receiving channels extending laterally between the sockets and locating means for the second contact parts laterally spaced from the sockets, second contact parts for location in selected ones of the locating means therefore and bus portions for location in the channels for interconnecting second contact parts in said selected locating means and neck portions of respective first contact parts at said sockets.

Thus, a single kit is suitable for establishing alternative interconnections.

The connector may constitute an adaptor for use, for example, with a connector of the kind disclosed in European Patent Application EP—A—90494 filed 23 February 1983, the disclosure of which is incorporated herein by reference in which conductor engaging contact elements are located on a cable engaging face of an insulating housing body at the same pitch as the conductors of a flat cable so that clamping the face against the cable effects connection between the aligned contact elements and the cable conductors. In use, the adaptor is inserted between the cable engaging face and the cable with the first and second contact parts aligned with the contact elements and cable conductors, respectively and one or more bus portions located in preselected channels to interconnect individual connecting elements of the flat cable connector with chosen conductors of the cable.

The contact elements of the flat cable connector comprise tabs having surfaces formed with outstanding knife edges adapted to penetrate conductor insulation of the cable and establish electrical connection with the core. The first contact parts may be tabs with recesses complementary to the knife edges and the second contact parts may comprise tabs having insulation penetrating knife edges.

In a convenient more specific form, a contact part is integrally formed with means to grip a bus portion which is integrally joined to the contact part by a body portion receivable in a through socket with the bus gripping portion in a bus receiving channel on one face and the contact part on the opposite face.

This facilitates the provision of a compact and stable structure that can readily be assembled in various combinations.

The kit may be designed particularly to enable the contact elements of a connector constructed for a single phase wiring array to be connected to preselected, alternative conductors of a three phase wiring array. In such case, there are three laterally spaced first and second aligned contact part locating means each including common through sockets and two further second contact part locating means respectively laterally spaced to opposite sides of the second contact part locating means, the further second contact part locating means including through sockets common to locating means for bus gripping portions on the first face, the bus receiving channels respectively extending between the bus

gripping portion locating means and distal and adjacent first contact part locating means, third bus receiving channels also extending between a bus gripping portion locating means and the central first contact part locating means.

In the interests of simplicity of structure and body strength, the third channel includes a portion common with an adjacent channel.

Desirably, a first contact part is integrally formed with a bus strip of sufficient length to provide the precursor of any of the bus portions, and the bus gripping portion includes a tab formed to extend transversely of the body portion and provided at a free end with spaced bus gripping fingers returned for receipt in the bus receiving channel.

Excess lengths of the bus portions may quickly be removed in the field and the bus portion bent to the desired configuration. Each contact part and the bus gripping parts may be stamped and formed from blanks of identical size minimizing capital equipment costs. The small structural differences readily being made by substituting alternative die inserts.

An example of a kit according to the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view of a flat cable connector assembly incorporating a connector adaptor erected from the kit;

Figure 2 is an exploded perspective showing, in particular, the adaptor body and base plate;

Figures 3A and 3B are perspective views of the connector body partly in cross-section before and after assembly with contacts.

Figures 4A to 4F are perspective views of the individual contacts; and

Figures 5A to 5E are perspective views of alternative connector and contact combinations to provide alternative interconnections between conductors located for single and three-phase suppliers.

Referring to Figures 1 to 4, the kit comprises a plate-like insulating body 11 formed with laterally spaced contact locating means 12a—e and a series of contacts 13a—f (Figures 4A to 4F) partly formed for assembly with the body by location in pre-selected of the locating means.

The body 11 is molded in one piece of suitable plastic material and the contact locating means 12a—e comprise first and second pairs of recesses 14a—e and 15a—e respectively on first and second opposite faces 16 and 17 of the body respectively, the recesses of respective pairs intercommunicating by through sockets 19a—e respectively extending between the faces. The three central recesses 14b, c and d on the first face 16 and each of the recesses 15a—e on the second face 17 have flat base walls for reception of contact parts, but the two outer recesses 14a and e communicate at ends remote from the through sockets with bus receiving channels 22 and 24 which extend laterally across the first face 16 and communicate with contact receiving recesses 14d and 14c respectively. A third bus receiving channel 25 extends between recess 14d and the approximate

mid-point of channel 24. Locating posts 26a and 26b upstand from diagonally opposite corners of the second face 17 and a series of sockets 28 for the receipt of self-tapping clamping screws 29 (Figure 1) extend in symmetrically spaced relation across the centerline of the body. Locating sockets 30 are formed in the first, upper face 16 adjacent opposite edges of the body on respective opposite sides of the centerline. Two further sockets 31 for the receipt of clamping screws 32 extend through the body on opposite sides of the centerline. Cavities 20, 20' are formed adjacent opposite edges of the body in the interests of economy of material.

As shown more particularly in Figures 4A to 4F, the kit includes six different stamped and formed contacts 13a—f. The contact 13a comprises first contact part or tab 33a and second contact part or tab 34a joined by a neck 35a from respective opposite sides of which extend locating flanges 36a. The tabs 33a and 34a each constitute conductor engaging contact parts, a pair of locating recesses 37a being stamped in tab 33a on each side of a screw receiving aperture 38a. Insulation penetrating teeth 39a are pushed out of the tab 34a. For the convenience of the user to facilitate assembly with the body, the tab 33a may be bent to extend transversely of the neck 35a and tab 34a and the flange 36a bent out of the plane of the neck as shown.

Referring to Figures 3A and 3B, the contact 13a is assembled with the body 11 by insertion from the first face 16 of the body 11, second tab 34a leading into the central through socket 19c so that the first tab 33a is received in a recess 14c on the first face of the body and the neck 35a is received as an interference in the through socket 19c. The second tab 34a is then bent to extend transversely of the neck under the first tab so that its inherent resiliency causes it to remain spaced from the body defining an obtuse angle with the neck 35a as shown in Figure 3B. Subsequent engagement with a cable will enable sufficient resilient flexure of the tab towards the body with the teeth 39a remaining proud of the surface 17 to provide a permanent connection to the cable conductor.

The contact 13d shown in Figure 4D is similar to the contact 13a of Figure 4A except that the aperture 38a is omitted, locating recesses 37d are more closely spaced, and the flanges 36d are bent to extend under the tab 33d. Assembly of contact 13d is similar to that of contact 13a except that tab 34d is bent to extend away from the tab 33d. Contact 13d is intended for location by either contact locating means 12b or 12d (Figure 2). Contacts 13b, c and e (Figures 4B, C and D) have tabs 33b, c and e constituting conductor engaging contact parts joined by short necks 41b, c and e to bus bars 42b, c and e, which are bent, as necessary, to enable receipt in channels 25 and 24 (Figure 5C), channel 24 (Figure 5D), channel 22 (Figure 5B), or channels 22 and 24 (Figure 5E). It is envisaged that only contacts with straight busses need be supplied, the busses being cut to length and severed in the field.

As shown in Figures 4F, 3A and 3B, tab 33f is

bent to extend transversely of neck 41f and trifurcated at a free end to form bus gripping spring fingers 43 returned towards the tab 34f. Assembly of the contact with the base 11 and a bus bar is by inserting the contact 13f in locating means 12a (or 12e), tab 34f leading, with bus 42e preloaded in channel 22 so that the fingers 43 grip the bus 42e between them. The tab 34f is then bent towards the base 11 to the position shown in Figure 3B.

As stated above, the adaptor kit is designed to enable various combinations of connection between cable engaging contacts 63c, d and e of a known single phase duplex outlet 64 connector described in European Patent Application EP—A—90494, and the individual conductors 66a of a triple phase flat cable 67. The conductors 66a—e correspond respectively to the secondary, neutral, ground, primary and tertiary lines. When the three phase supply is not connected to the cable, the conductor 66e may be used as an alternative ground.

Referring again to Figure 1, to assemble the cable 67 with the base plate 45, an upper metal shield 71 of the cable is turned back and secured by U-form clips 72 to the flanges 46 so that an exposed insulated cable portion extends across the cable receiving portion of the base plate. The base 11 assembled with a chosen combination of contacts is covered with fish paper 18 on surface 16 and surface 17 is clamped against the cable 67 which overlies a layer of fish paper 73 by screws 29 so that the contacts establish connection to the individual conductors as required. The duplex outlet 64 is then clamped by screws 32 against the body so that conductors 63c, d and e engage tabs of contacts 12b, c and d. The cover is then clamped to the base plate by screws 60.

The combinations of interconnections that can be obtained using the kit are illustrated in Figures 5A to 5E.

In Figure 5A, a standard ground primary phase connection is obtained by using contacts 13d in locating means 12a and 12d and contacts 13a in 12c.

In Figure 5B, a standard ground secondary phase connection is obtained by the use of contacts 13a in locating means 12c as above, contacts 13d in 12b, spring contact 13f in 12a, and contact 13e in 12d.

In Figure 5C, a standard ground tertiary connection is obtained by locating contacts 13a and 13d as above, spring contact 13f in 12e, and bus contact 13b in locating means 12d.

In Figure 5D, an isolated ground primary phase connection is obtained by locating contacts 13d in locating means 12b and 12d, bus contact 13c in 12c, and spring contact 13f in 12e.

In Figure 5E, an isolated ground secondary phase connection is obtained by locating contact 13d in locating means 12b, respective bus contacts 13c and 13e in 12c and 12d, and spring contacts 13f in 12a and 12e.

The isolated ground requirement is necessary to prevent a surge (spike) possibility when the

usual ground is connected to other equipment and is particularly sought in data applications.

It should be noted that in some other applications, only three different contacts may be required to obtain all of the above combinations of interconnection, namely contacts 13b, d and e, the apertures 38a, c for grounding screws not being required. Each tab may be of the same size minimizing die alterations when a series of different contacts are to be stamped and enabling the same press to be used.

Claims

1. Apparatus for interconnecting conductor (63) in a first planar array to conductor (66) in a second planar array of parallel conductor (66) and comprising a plate like insulating body (11) formed with contact locating means (12a—e) for locating a plurality of first (34a, d, f) and second (33a—f) contact parts on first and second opposite faces (16, 17) of the body (11) for respective alignment with conductor (63c, d, e and 66a—e) of the first and second arrays, the contact locating means (12b, c, d) including through sockets (19b, c, d) extending between the first and second opposite faces (16; 17) of the body (11), the first contact parts (34a, d, f) having necks (35a, d, f) receivable in the through sockets (19b, c, d) characterised by comprising a kit of parts assemblable in different ways to enable conductors (63c, d, e) of the first array to be interconnected with laterally spaced preselected alternative conductors (66a—e) of the second array, the body (11) being formed with bus receiving channels (22, 24, 25) extending laterally between the sockets (19b, c, d) and locating means (12a—f) for the second contact parts (33a, f) laterally spaced from the sockets (19b, c, d), second contact parts (33a—f) for location in selected ones of the locating means therefore and bus portions (42b, c, e) for location in the channels (22, 24, 25) for interconnecting second contact parts (33a—f) in said selected locating means and neck portions (35a, d, f) of respective first contact parts (34a, d, f) at said sockets (19b, c, d).

2. A kit according to claim 1 in which a contact part (33f) is integrally formed with means (43) to grip a bus portion (42b, c, e).

3. A kit according to claim 2 in which the bus gripping means (43) is integrally joined to the contact part (34f) by a body portion (35f) receivable in a through socket (19a, e) with the bus gripping means (43) in a bus receiving channel (22, 24, 25) on one face (17) and the contact part (34f) on the opposite face (17).

4. A kit according to claim 3 in which the through socket (19a, e) for receiving the body portion (35f) is laterally spaced from the contact locating means (12c, d) on the first face (16) across which the bus receiving channels (22, 24, 25) extend.

5. A kit according to claim 4 in which there are three laterally spaced, first contact part locating means (14b, c, d) and second contact part locating

means (15b, c, d) each including common through sockets (19b, c, d) and two further second contact part locating means (15a, e) laterally spaced to respective opposite sides of the three second contact part locating means (15b, c, d), the further second contact part locating means (15a, e) including through sockets (19a, e) common to locating means (14a, e) for a bus gripping portion (43) on the first face (16), the bus receiving channels (22, 25) respectively extending between the bus gripping portion locating means (14a, e) and an adjacent first contact part locating means (14d) respectively, a third bus receiving channel (24) also extending between a bus gripping portion locating means (14e) and the central first contact part locating means (14a).

6. A kit according to claim 5 in which the third channel (24) includes a portion common with an adjacent channel (25).

7. A kit according to claim 3 in which the bus gripping portion includes a tap (33f) formed to extend transversely of the body portion (35f) and provided at a free end with spaced bus gripping fingers (43) returned for receipt in the bus receiving channel (22, 24).

Patentansprüche

1. Gerät zur Verbindung von Leitern (63) in einer ersten planaren Anordnung mit Leitern (66) in einer zweiten planaren Anordnung von parallelen Leitern (66), mit einem plattenförmigen isolierenden Körper (11), der mit Kontaktpositioniereinrichtungen (12a—e) zur Positionierung einer Vielzahl von ersten (34a, d, f) und zweiten (33a—f) Kontaktteilen auf ersten und zweiten gegenüberliegenden Flächen (16, 17) des Körpers (11) geformt ist, und zwar zur jeweiligen Ausrichtung mit Leitern (63c, d, e und 66a—e) der ersten und zweiten Anordnungen, wobei die Kontaktpositioniereinrichtungen (12b, c, d) Durchgangssockel (19b, c, d) umfassen, die sich zwischen der ersten und zweiten gegenüberliegenden Fläche (16, 17) des Körpers (11) erstrecken, wobei ferner die ersten Kontaktteile (34a, d, f) Hälse (35a, d, f) aufweisen, die in den Durchgangssockeln (19b, c, d) aufnehmbar sind, dadurch gekennzeichnet, daß ein Bausatz von Teilen vorgesehen ist, die in unterschiedlicher Weise zusammengebaut werden können, damit Leiter (63c, d, e) der ersten Anordnung mit seitlich beabstandeten vorgeählten alternativen Leitern (66a—e) der zweiten Anordnung verbunden werden können, daß der Körper (11) mit SammelschienenaufnahmeKanälen (22, 24, 25) versehen ist, die sich seitlich zwischen den Sockeln (19b, c, d) erstrecken und mit Positioniereinrichtungen (12a—f) für die zweiten Kontaktteile (33a, f), die seitlich im Abstand zu den Sockeln (19b, c, d) liegen, daß zweite Kontaktteile (33a—f) zur Positionierung in Ausgewählten der Positioniereinrichtungen für diese vorgesehen sind, sowie Sammelschienenabschnitte (42b, c, e) zur Positionierung in den Kanälen (22, 24, 25) zur Verbindung mit zweiten Kontaktteilen (33a—f) in den ausgewählten Positioniereinrichtungen

und Halsabschnitten (35a, d, f) von jeweiligen ersten Kontaktteilen (34a, d, f) an den Sockeln (19b, c, d).

2. Bausatz nach Anspruch 1, bei dem ein Kontaktteil (33f) einstückig mit Mitteln (43) geformt ist, um einen Sammelschienenabschnitt (42b, c, e) zu greifen.

3. Bausatz nach Anspruch 2, bei dem die Sammelschienenengreifereinrichtung (43) einstückig mit dem Kontaktteil (34f) durch einen Körperabschnitt (35f) verbunden ist, welcher in einem Durchgangssockel (19a, e) derart aufnehmbar ist, daß die Sammelschienenengreifereinrichtung (43) in einem SammelschienenaufnahmeKanale (22, 24, 25) an einer Fläche (17) und der Kontaktteil (34f) auf der entgegengesetzten Fläche (17) liegt.

4. Bausatz nach Anspruch 3, bei dem der Durchgangssockel (19a, e) zur Aufnahme des Körperabschnitts (35f) seitlich im Abstand zu der Kontaktpositioniereinrichtung (12c, d) auf der ersten Fläche (16) liegt, über welche sich die SammelschienenaufnahmeKanäle (22, 24, 25) erstrecken.

5. Bausatz nach Anspruch 4, bei dem drei seitlich beabstandete erste Kontaktteilpositioniereinrichtungen (14b, c, d) vorgesehen sind, sowie zweite Kontaktteilpositioniereinrichtungen (15b, c, d), von denen jede gemeinsame Durchgangssockel (19b, c, d) umfaßt, sowie zwei weitere zweite Kontaktteilpositioniereinrichtungen (15a, e), die seitlich zu jeweiligen gegenüberliegenden Seiten von den drei zweiten Kontaktteilpositioniereinrichtungen (15b, c, d) beabstandet sind, wobei die weiteren zweiten Kontaktteilpositioniereinrichtungen (15a, e) Durchgangssockel (19a, e) umfassen, die gemeinsam mit Positioniereinrichtungen (14a, e) für einen Sammelschienenengreifabschnitt (43) auf der ersten Fläche (16) sind, wobei die SammelschienenaufnahmeKanäle (22, 25) sich jeweils zwischen der Sammelschienenengreifabschnittpositioniereinrichtung (14a, e) und einer benachbarten ersten Kontaktteilpositioniereinrichtung (14d) jeweils erstrecken, und wobei ein dritter SammelschienenaufnahmeKanale (24) sich ebenfalls zwischen einer Sammelschienenengreifabschnitt-Positioniereinrichtung (14e) und der zentralen ersten Kontaktteil-Positioniereinrichtung (14a) erstreckt.

6. Bausatz nach Anspruch 5, bei dem der dritte Kanal (24) einen Abschnitt aufweist, der mit einem benachbarten Kanal (25) gemeinsam ist.

7. Bausatz nach Anspruch 3, bei dem der Sammelschienenengreifabschnitt eine Lasche (33f) aufweist, die derart geformt ist, daß sie sich quer zum Körperabschnitt (35f) erstreckt und an einem freien Ende mit beabstandeten Sammelschienenengreifingern (43) versehen ist, die zur Aufnahme in dem SammelschienenaufnahmeKanale (22, 24) zurückgebogen sind.

Revendications

1. Appareil pour interconnecter un conducteur (63) d'une première rangée plane à un conducteur (66) d'une seconde rangée plane de conducteurs parallèles (66) et comprenant un corps isolant (11)

analogue à une plaque formée de façon à comporter des moyens (12a—e) de positionnement de contact destinés à positionner plusieurs premières (34a, d, f) et secondes (33a—f) pièces de contact sur des première et seconde faces opposées (16, 17) du corps 11 pour les aligner respectivement avec des conducteurs (63c, d, e et 66a—e) des première et seconde rangées, les moyens (12b, c, d) de positionnement de contact comprenant des alvéoles débouchants (19b, c, d) s'étendant entre les première et seconde faces opposées (16, 17) du corps (11), les premières pièces de contact (34a, d, f) comportant des collets (35a, d, f) pouvant être logés dans les alvéoles débouchants (19b, c, d), caractérisé en ce qu'il comporte un ensemble de pièces pouvant être assemblées de différentes manières pour permettre à des conducteurs (63c, d, e) de la première rangée d'être interconnectés à des conducteurs alternés, préalablement choisis, espacés latéralement (66a—e) de la seconde rangée, le corps (11) étant formé de façon à présenter des rainures (22, 24, 25) de réception de bus s'étendant latéralement entre les alvéoles (19b, c, d) et les moyens de positionnement (12a—f) pour les secondes pièces de contact (33a, f), à distance latéralement des alvéoles (19b, c, d), des secondes pièces de contact (33a—f) à positionner dans certains, choisis, des moyens de positionnement qui leur sont destinés, et des parties de bus (42b, c, e) à positionner dans les rainures (22, 24, 25) pour interconnecter des secondes pièces de contact (33a, f) dans lesdits moyens choisis de positionnement et des parties de collet (35a, d, f) de premières pièces respectives de contact (34a, d, f) auxdits alvéoles (19b, c, d).

2. Ensemble selon la revendication 1, dans lequel une pièce de contact (33f) est réalisée d'une seule pièce avec un moyen (43) destiné à réaliser une prise sur une partie de bus (42b, c, e).

3. Ensemble selon la revendication 2, dans lequel les moyens (43) de prise de bus sont solidarifiés à la pièce de contact (34f) par une partie de corps (35f) pouvant être logée dans un alvéole débouchant (19a, e), les moyens (43) de

prise de bus étant disposés dans une rainure (22, 24, 25) de réception de bus sur une face (17) et la pièce de contact (34f) sur la face opposée (17).

4. Ensemble selon la revendication 3, dans lequel l'alvéole débouchant (19a, e) destiné à recevoir la partie de corps (35f) est espacé latéralement des moyens (12c, d) de positionnement de contact sur la première face (16) sur laquelle les rainures (22, 24, 25) de réception de bus s'étendent.

5. Ensemble selon la revendication 4, dans lequel il y a trois moyens de positionnement des premières pièces de contact (14b, c, d) et de positionnement des secondes pièces de contact (15b, c, d), espacés latéralement, comprenant chacun des alvéoles débouchants communs (19b, c, d) et deux autres moyens de positionnement des secondes pièces de contact (15a, e), espacés latéralement sur des côtés opposés respectifs des trois moyens (15b, c, d) de positionnement des secondes pièces de contact, les autres moyens (15a, e) de positionnement des secondes pièces de contact comprenant des alvéoles débouchants (19a, e) communs aux moyens de positionnement (14a, e) pour une partie (43) de prise de bus sur la première face (16), les rainures (22, 25) de réception de bus s'étendant respectivement entre les moyens (14a, e) de positionnement des parties de prise de bus et un moyen (14d), adjacent, de positionnement de premières pièces de contact, respectivement, une troisième rainure (24) de réception de bus s'étendant également entre un moyen (14e) de positionnement d'une partie de prise de bus et le moyen central (14a) de positionnement d'une première pièce de contact.

6. Ensemble selon la revendication 5, dans lequel la troisième rainure (24) comprend une partie commune à une rainure adjacente (25).

7. Ensemble selon la revendication 3, dans lequel la partie de prise de bus comprend une patte (33f) formée de façon à s'étendre transversalement à la partie de corps (35f) et munie à une extrémité libre de doigts espacés (43) de prise de bus retournés pour être reçus dans la rainure (22, 24) de réception de bus.

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