

ELECTRICAL CONNECTOR

This invention relates to an electrical connector having first terminals at a front thereof, and to which external electrical conductors may be secured to make electrical connections between
5 the conductors and the first terminals, the connector being adapted to receive over-voltage protection devices so that the over-voltage protection devices are then coupled electrically to the first terminals for providing over-voltage protection to electrical circuits in use coupling to the first terminals via the external conductors, and releasable mounting means for releasable connection of the connector to support structure for the connector, characterised
10 in that the connector has mounting assembly positioned at the rear of the connector for receiving the over-voltage protection devices.

Electrical connectors having terminals, such as for making releasable electrical connection to electrical conductors of a communications network, may be arranged to receive over-voltage
15 protection devices which, in the event of an over-voltage condition on a conductor, act to provide a conductive path to earth. Such devices may be connected across respective pairs of conductors associated with respective communications circuits. Each over-voltage device may comprise a three terminal device, first and third terminals of which are in use connected to respective conductors of the pair with which it is associated. The second terminal is connected
20 to earth. Under the condition of normal voltage across such a device, the device presents a high impedance as between all terminals, but under over-voltage conditions on either the first or second terminals, breakdown occurs to provide a conductive path from the terminal exhibiting the over-voltage to earth. The provision of devices of this type is important in practical communications systems to prevent over-voltage conditions, arising for example
25 from lightning strikes, from causing serious damage to the system.

Practically, in for example a telephone exchange, the connectors which releasably connect to the network conductors are arranged on suitable support structure with the terminals facing outwardly for ease of access, bearing in mind that alterations to the connections from the
30 connector terminals to the conductors may need to be frequently made, to accommodate the

needs of network users. In such a construction, the over-voltage protection devices may then be mounted to the fronts of the connectors. This mounting arrangement is convenient from the point of view of ease of access, since the over-voltage devices themselves may need to be accessed for replacement. However, mounting these in this fashion is also inconvenient in that
5 the devices are then adjacent the connector terminals and inhibit convenient access to the connector terminals.

It is an object of the invention to provide an electrical connector which may be arranged for receiving over-voltage such as to permit ready access to the connector terminals, and to
10 permit access to the over-voltage devices in a simple manner.

In one aspect, the invention is characterised in that the connector (8) has mounting assembly (14) positioned at the rear of the connector (8) for receiving the over-voltage protection devices (18).
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The releasable mounting means (20) may at least in part be formed by a conductive earth element (50), which in use of the connector makes releasable electrical connection to the support structure (22) such that an electrical earth path is formed from the connector to an earthed conductive portion of the support structure (22).
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The first terminals may be carried by an insulative body (10) of the connector, the mounting assembly (14) having second terminals (16) electrically connected to ones of the first terminals (12), the mounting assembly (14) being adapted to receive the over-voltage protection devices (18) so that these connect to the second terminals (16) such that the over-
25 voltage protection devices (18) are coupled to the first terminals (12) via the second terminals (16).

The mounting assembly (14) may have an insulative structure (24) and a circuit board (26), the second terminals (26) being carried by the insulative structure (24) and being electrically
30 coupled to conductive tracks (88) of the circuit board (26) which are electrically coupled to

the first terminals (12).

An electrically conductive earth element (50) may be provided, in use of the connector forming part of or otherwise electrically coupling to the releasable mounting means (20), to
5 provide an earth connection to the over-voltage protection devices (18). In one form, the earth element (50) is arranged to releasably connect to the insulative body (10) of the connector. Also in a particular form, the earth element (50) may have gripping portions (68) which are adapted to releasably grip the support structure (22) to effect the releasable connection of the connector to the support structure (22). In the latter case, the gripping
10 portions (68) may be resilient and positioned adjacent to respective opposed portions (70) of the connector, such that parts of the support structure may be resiliently gripped between the gripping portions (68) and the opposed portions (70) of the connector. The opposed portions (70) may be formed on the earth element (50) so that each gripping portion (68) and its opposed portion (70) define therebetween a respective rearwardly facing opening for receiving
15 a respective part of the support structure (22). There may be a said gripping portion (68) and an associated said opposed portion (70) of the earth element (50) at each end of the earth element (50).

A cover (30) may be provided, covering the rear of the connector. This may be releasably
20 attached to the insulative body (10) of the connector.

The insulative body (10) of the connector and the first terminals (12) may form parts of a disconnection module (40), the first terminals (12) being arranged in two parallel rows so that pairs of the first terminals (12), each comprising a first terminal (12) in one row and an
25 opposed first terminal (12) in the other row, are defined, the first terminals (12) having respective resilient contact portions (12c), the resilient contact portions (12c) of the first terminals (12) in each pair thereof being arranged so that in a first condition thereof they are resiliently biased into electrical contact with each other but, in a second condition thereof, are displaced out of direct electrical contact, by insertion of, for example, a test plug or an
30 electrically insulative element therebetween so that they are forced apart against the resilient

bias. In this arrangement, the resilient contact portions (12c) of each pair are electrically coupled in the first condition of these, and disconnected in the second condition. In arrangements of this kind, only the first terminals (12) in one row of the first terminals may be arranged to be coupled to the over-voltage devices (18).

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There may for example, be two spaced parallel rows of the second terminals (16), with an elongate portion (52) of the earth element (50) being positioned to extend parallel to and between the rows. The elongate portion (50) of the earth element may be generally planar and arranged to form an outstanding barrier between ones of the over-voltage devices (18) positioned at either face thereof. The elongate portion (52) may have projections (54) which connect to conductive tracks (88) on the circuit board (26) and thence via those tracks to ones of the second terminals (16).

The invention is further described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a exploded perspective view of an electrical connector constructed in accordance with the invention, and support structure with which the connector is used;

20 Figure 2 is a rear perspective view of the connector and support structure of Figure 1:

Figure 3 is a view somewhat like Figure 2, but with one component of the connector removed to show connections to an earth element, within the connector; and

25 Figure 4 is a diagram illustrating electrical connections within the connector of Figure 1.

The electrical connector 8 shown is designed to be releasably secured to a support structure 22, in this case, formed by spaced parallel rails 72.

30 Connector 8 has an electrically insulative body 10 on a front face of which are positioned first

terminals 12 to which, in use of the connector, insulated wire conductors of communications circuits are connected. The terminals 12 are of the insulation displacement type, having bifurcated outer ends defining opposed resilient arms between which an insulated wire conductor can be pressed, so that inner edges of the arms cut the insulation and are resiliently urged into contact with the conductor, so that the conductor is gripped by the arms which then make electrical connection to the conductor.

The front face of the body 10 is of elongate rectangular form and the terminals 12 are arranged at this in two spaced parallel rows which extend parallel to the longer sides of the front face. The bifurcated ends of the terminals 12 are accommodated in forwardly open cavities 74 at the front face of the body 12, so as to permit wire conductors to easily be connected to these.

At the rear face of the body 10, the connector 10 is fitted with a mounting assembly 14 having a printed circuit board 26 and, mounted on this, an insulative structure 24 formed of the insulative bodies 38 of two over-voltage device connectors 28. As described later, certain of the terminals 12 are soldered or otherwise electrically connected to tracks on the printed circuit board 26. Tracks on the printed circuit board 26 are also connected, such as by soldering, to second terminals 16 carried by the insulative bodies 38 forming parts of the connectors 28.

The terminals 16 are of a kind permitting the making of electrical connection to wires insertable into them, by clamping action as an end of the wire is pressed into the terminal. Over-voltage protection devices 18 are electrically connected to the connectors 28, by so inserting wires 44, 46, 48 of each device 18 into respective ones of the terminals 16, so that the then-gripped wires make electrical connection via the tracks on the printed circuit board 26 to the terminals 12. The devices 18 are in this instance gas arresters, these being gas-filled devices having a central terminal to which wire 46 is connected and outer end terminals to which the respective wires 44, 48 are connected.

An earth conductor in the form of an earth element 50 is formed by stamping and bending from metal plate. This has a planar central generally planar strip-like portion 52, with projections 54 extending outwardly from one edge. These projections 54 are received in openings in the printed circuit board 26, at locations between the two connectors 28, and
5 soldered or otherwise electrically connected to tracks on the printed circuit board 26, so that the portion 52 extends outwardly from the rear face of the printed circuit board 26, in outstanding relationship to the printed circuit board 26 and between the connectors 28.

At its ends, the element 50 has transversely bent-out somewhat planar portions 60, these
10 having at one free end of each a tongue-like mounting portion 62 with an aperture 64. These portions 62 are inserted into slots 66 at the rear of the body 10, and at each end of the body 10, so that the mounting portions 62 cooperate with internal retaining elements (not shown) in the slots 66 to retain the mounting portions 62 and securely but releasably mount the element 50 to the body 10. For example, the slots 66 may have internal latching projections
15 which snap fit into the apertures 64 for this purpose.

The planar portions 60 also define, at ends opposite the mounting portions 62, resilient gripping portions 68 which extend outwardly and rearwardly on the connector 8. These gripping portions 68 cooperate with respective adjacent but spaced edge portions 70 of the
20 element 50, formed by cut-outs at the ends of the portion 52, to enable releasable resilient gripping of the parallel rails 72 of the support structure 22, as shown in Figures 2 and 3. Thus, each gripping portion 68 and its adjacent opposed edge portion 70 constitutes a respective releasable mounting means 20 for releasably mounting the connector 8 to the structure 22.

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A rear cover 30 is provided, which is positionable over the planar portion 52 of the element 50, the printed circuit board 26, the connectors 28 and devices 18. Cover 30 rests against the rear of the body 10 and is held in position, when the connector is coupled to the rails 72 of the support structure 22, by clamping of end extensions 32 of the cover between the rear of
30 the body 10 and the rails. The cover 30 has end slots 34 at which the edge portions 70 of the

planar portion 52 of the element 50 are exposed, so that these can engage the rails 72 for gripping in conjunction with the gripping portions 68.

The electrical interconnections within and to and from the connector 8 when in use are diagrammatically represented in Figure 4, which shows wire conductors 82, 86 of an incoming circuit pair connected to adjacent "incoming" terminals 12 in one row of the terminals 12 on body 10, and wire conductors 80, 84, of an "outgoing" circuit pair connected to adjacent "outgoing" terminals 12 in the other row of the terminals 12 on body 10. The connections to the conductors 80, 82, 84, 86 are made at insulation displacement contact portions 12a of the terminals 12. The circuit board tracks, on circuit board 26, are represented diagrammatically by reference numerals 88. Certain of these tracks interconnect from body portions 12b of contacts 12 in the "incoming" row thereof to the terminals 16 and thus with the wires 44, 48 of the devices 18 as shown. Also, the wires 46 of the devices 18 connect via further printed circuit board tracks 88 to the element 50 and thence to the rails 72 of the support structure 22.

In use, electrical interconnections may be made between wires connected to the terminals 12 as may be needed to suit the set up of required communications circuits. This may be easily accomplished at the front of the connector without interference or inconvenience as may occur if the over-voltage protection devices were to be positioned at the front of the connector. On the other hand, access to the devices 18 can be readily gained, when required, by unclipping the connector 8 from the rails 72 and removal of the cover. The devices 18 may be readily removed from the connectors 28 by applying manual force to pull the wires from the terminals 16.

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The illustrated body 10 and terminals 12 constitute a so-called "disconnection module" 40, the terminals in each row of these being releasably electrically coupled to respective associated opposite terminals 12 in the other row. This coupling is effected by resilient engagement of resilient contact portions 12c (Figure 4) of the terminals 12 in one row with corresponding spring portions 12c of the terminals in the other row. The portions 12c are

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positioned in a lengthwise extending trough in the front of the connector body, to be accessible to enable selective disconnection of the electric coupling between each of the terminals of one row from the respective associated terminals 12 in the other row, by positioning, for example, insulative plugs or test plugs between the portions 12c, so that the
5 portions 12c are forced apart against natural resilient bias of these. The test plugs and/or insulative plugs can be readily inserted and removed, as required by virtue of the over-voltage protection devices being positioned at the back of the connector. Further, it should be appreciated that any other type of terminal device may be employed for connection with the terminals 12 of the connector, in place of the insulative or test plugs.

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The described arrangement has been advanced merely by way of explanation any many modifications may be made thereto without departing from the spirit and scope of the invention which includes every novel feature and combination of features herein disclosed.

List of reference symbols

8	Electrical connector
10	Insulative body
5 12	First terminals
12a	Insulation displacement contact portions (of contacts 12)
12b	Body portions (of contacts 12)
12c	Spring portions (of contacts 12)
14	Mounting assembly
10 16	Second terminals
18	Over-voltage protection devices
20	Releasable mounting means
22	Support structure
24	Insulative structure
15 26	Printed circuit board
28	Over-voltage device connectors
30	Cover
32	End extensions (of cover 30)
34	Slots 34 (in cover 30)
20 38	Insulative bodies (of connector 30)
40	Disconnection module
44	Wire (of the over-voltage protection devices)
46	Wire (of the over-voltage protection devices)
48	Wire (of the over-voltage protection devices)
25 50	Earth element
52	Planar portion (of element 50)
54	Projections (on element 50)
60	Transversely bent out planar portions (on element 50)
62	Mounting portions (on element 50)
30 64	Aperture (on element 50)

	66	Slots (on body 10)
	68	Gripping portions (on element 50)
	70	Edge portion (on element 50)
	72	Rails
5	74	Cavities (on body 10)
	80	Wire conductor (outgoing)
	82	Wire conductor (incoming)
	84	Wire conductor (outgoing)
	86	Wire conductor (incoming)
10	88	Tracks (on circuit board 26)



CLAIMS:-

1. An electrical connector (8) having first terminals (12) at a front thereof, and to which external electrical conductors may be secured to make electrical connections between the
5 conductors and the first terminals (12), the connector being adapted to receive over-voltage protection devices (18) so that the over-voltage protection devices are then coupled electrically to the first terminals (12) for providing over-voltage protection to electrical circuits in use coupling to the first terminals (12) via the external conductors, and releasable mounting means (20) for releasable connection of the connector (8) to support structure (22) for the
10 connector, characterised in that the connector (8) has mounting assembly (14) positioned at the rear of the connector (8) for receiving the over-voltage protection devices (18).

2. An electrical connector as claimed in claim 1, wherein the releasable mounting means (20) is at least in part formed by a conductive earth element (50), which in use of the
15 connector makes releasable electrical connection to the support structure (22) such that an electrical earth path is formed from the connector (8) to an earthed conductive portion of the support structure (22).

3. An electrical connector as claimed in claim 1, further characterised the first terminals
20 (12) are carried by an insulative body (10) of the connector, the mounting assembly (14) having second terminals (16) electrically connected to ones of the first terminals (12), the mounting assembly (14) being adapted to receive the over-voltage protection devices (18) so that these connect to the second terminals (16) such that the over-voltage protection devices (18) are coupled to the first terminals (12) via the second terminals (16).

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4. An electrical connector as claimed in claim 3, further characterised in that the mounting assembly (14) has an insulative structure (24) and a circuit board (26), the second terminals (16) being carried by the insulative structure (24) and being electrically coupled to conductive tracks (88) of the circuit board (26) which are electrically coupled to the first
30 terminals (12).



5. An electrical connector as claimed in claim 3 or claim 4, further characterised in that an electrically conductive earth element (5) is provided for electrically coupling to the releasable mounting means (20) to provide an earth connection to the over-voltage protection devices (18).

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6. An electrical connector as claimed in claim 5, further characterised in that the earth element (50) is arranged to releasably connect to the insulative body (10) of the connector.

7. An electrical connector as claimed in claim 6, further characterised in that the earth
10 element (50) has gripping portions (68) which are adapted to releasably grip the support structure (22) to effect the releasable connection of the connector to the support structure (22).

8. An electrical connector as claimed in claim 7, further characterised in that the gripping
15 portions (68) are resilient and positioned adjacent to respective opposed portions (70) of the connector, such that parts of the support structure may be resiliently gripped between the gripping portions (68) and the opposed portions (70) of the connector.

9. An electrical connector as claimed in claim 8, further characterised in that the opposed
20 portions (70) are formed on the earth element (50) so that each gripping portion (68) and its opposed portion (70) define therebetween a respective rearwardly facing opening for receiving a respective part of the support structure (22).

10. An electrical connector as claimed in any one of claims 7 to 9, further characterised
25 in that there is a said gripping portion (68) and an associated said opposed portion (70) of the earth element (50) at each end of the earth element (50).

11. An electrical connector as claimed in any one of claims 3 to 10, further characterised in that a cover (30) is provided for covering the rear of the connector.



12. An electrical connector as claimed in claim 11, further characterised in that the cover (30) is releasably attached to the insulative body (10) of the connector.

13. An electrical connector as claimed in any one of claims 3 to 12, further characterised
5 in that the insulative body (10) of the connector and the first terminals (12) form parts of a disconnection module (40), the first terminals (12) being arranged in two parallel rows so that pairs of the first terminals (12), each comprising a first terminal (12) in one row and an
opposed first terminal (12) in the other row, are defined, the first terminals (12) having
respective resilient contact portions (12c), the resilient contact portions of the first terminals
10 in each pair thereof being arranged so that in a first condition thereof they are resiliently
biased into electrical contact with each other but, in a second condition thereof, are displaced
out of direct electrical contact, by insertion of an electrically insulative element therebetween
so that they are forced apart against the resilient bias.

15 14. An electrical connector as claimed in claim 13, further characterised in that only the
first terminals (12) in one row of the first terminals (12) are arranged to be coupled to the
over-voltage devices (18).

15. An electrical connector as claimed in any one of claims 3 to 14, further characterised
20 in that there are two spaced parallel rows of the second terminals (16), with an elongate
portion (52) of the earth element (50) being positioned to extend parallel to and between the
rows.

16. An electrical connector as claimed in claim 15, further characterised in that the
25 elongate portion (52) has projections (54) which connect to conductive tracks (88) on the
circuit board (26) and thence via those tracks to ones of the second terminals (16).