

TERMINATION FOR COAXIAL CABLES

The present invention relates to a termination for multiple coaxial cables and relates particularly to a
5 termination for holding small coaxial conductor pairs in a closely-spaced array ready for connection to a corresponding array of closely spaced terminal pads.

One way to hold several conductors of a multiconductor cable arranged in the required order and
10 at the required pitch for connection to an array of terminals in a circuit to which such a cable is to be connected is shown in Wheatcraft et al. U.S. Patent No. 5,347,711. The central conductors of coaxial pairs are individually connected electrically to a transfer
15 frame disclosed by Wheatcraft et al., as by soldering each conductor to a respective contact which is part of the transfer frame. Attachment of such a transfer frame to a cable is a time-consuming part of the manufacture and preparation of a cable.

20 It is desirable to disconnect and reconnect the many conductors or conductor pairs of a multiconductor cable, repeatedly if necessary, without each time having to spend a great deal of time to connect a transfer frame. It is also preferred to connect or disconnect
25 such an array of conductors or conductor pairs to and from an array of terminal pads by mass reflow soldering and unsoldering techniques.

In use of the Wheatcraft et al. transfer frame, cutting the outer conductor, or shield conductor of a
30 coaxial pair allows the ends of the several tiny wires

comprising the shield conductor to splay out from the dielectric layer causing difficulties in connecting the shield by simultaneous mass solder reflow termination of the shield conductors to circuits to which the cable is
5 being connected. This is even a more serious problem if unsoldering is required since melting the solder to disconnect a shield conductor frees its wires to splay, even if they had been tinned previously.

According to the invention, a shield, known as a
10 shield conductor, of a coaxial cable is held in a short length of a jacket of the cable, thereby resisting wires of the shield from splaying outwardly when the shield has been exposed for the purpose, for example, of heating solder on the exposed shield. The advantage of
15 the invention makes it practical to heat solder for connection or disconnection of all the shields simultaneously such as by the heating of solder on the shields.

According to an embodiment, a holder, on which are
20 aligned and held multiple coaxial cables, supports a corresponding short length of jacket on each of the cables, and the exposed shield on each of the cables extends over an aperture in the holder to facilitate heating of solder on the exposed shield.

25 According to a further embodiment, the holder supports exposed portions of center conductors of the cables, and according to yet a further embodiment, the exposed portions of the center conductors extend across a second aperture in the holder to facilitate heating of
30 solder on the exposed center conductors.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, according to which;

Figure 1 is a plan view of a portion of a
5 multiconductor electrical cable including many individual coaxial conductor pairs, arranged in three modular arrays, with two of the modular arrays connected to respective arrays of terminal pads on a circuit board;

10 Figure 2 is a partially cut-away plan view of one of the modular coaxial conductor arrays shown in Figure 1, at an enlarged scale;

Figure 3 is a sectional view of a modular array of coaxial conductor pairs such as the one shown in
15 Figure 2, taken in the direction indicated by line 3-3, at an enlarged scale;

Figures 4-7 show successive steps of preparation of a coaxial conductor pair for inclusion in a modular array; Figure 4 shows a coaxial conductor pair of which
20 a short terminal portion of a tubular outer jacket and an outer, or shield conductor have been cut;

Figure 5 shows the coaxial conductor pair shown in Figure 4 after the terminal portions of the jacket and shield have been moved a short distance;

25 Figure 6 shows the coaxial conductor pair shown in Figure 5 after the dielectric layer has also been cut and separated portions of the tubular jacket, shield conductor, and dielectric layer have been moved longitudinally along the central conductor; and

Figure 7 shows the coaxial conductor pair with a short length of the tubular jacket moved to expose a portion of the shield conductor.

Referring now to the drawings which form a part of the disclosure herein, as shown in Figure 1 a multiconductor cable 10 includes a tubular cover 12 surrounding a large number of coaxial conductor pairs which extend from the end of the cover 12 in the form of three bundles 14. Each bundle 14 includes several coaxial conductor pairs 16, and the bundles 14 may, if desired, be bound at spaced intervals to keep the several conductor pairs 16 of each bundle 14 grouped together conveniently.

The conductor pairs 16 of each of the bundles 14 end together in a respective modular array holder 18 in which a terminal portion 20, Fig. 3 of each of the conductor pairs 16 is aligned and held in a desired position with respect to each of the other terminal portions 20 in the particular modular array 18. Thus, in each of the modular arrays 18 each of the terminal portions 20 is held in the proper position for connection to the corresponding one of an array of signal conductor terminal pads 24, Fig. 2, and a shield conductor terminal pad 26, Fig. 2, in a terminal array 28 located on a circuit board 30 forming part of a circuit to which the cable 10 is connected electrically.

Referring now also to Figures 2 and 3, it will be seen that the modular array 18 includes a holder comprising pair of support bodies of strong flexible dielectric sheet material such as a polyimide sheet

material available from the Allied Signal Corporation of
Hoosick, New York. An upper support body 32 may be of
thicker sheet material than the lower support body 34,
which is preferably thinner in order to facilitate
5 soldering the individual conductors of the conductor
pairs 16 to the terminal pads 24 and 26 as will be
explained below. For example, the upper support body 32
may be of polyimide having a thickness 33 of 5 mils,
while the lower support body 34 may have a thickness 35
10 of 1.5 mils, in an array of coaxial conductor pairs 16
each having a diameter 37 of 0.051 cm., spaced at a
pitch 78 of 0.064 cm. The upper and lower support
bodies 32, 34 are of similar shape and are mated
together aligned with each other. As shown in Fig. 2,
15 they define a pair of registration holes 36 extending
through both to be aligned with corresponding locating
devices such as registration holes 38 defined in the
circuit board 30 to receive locating pins, not shown,
temporarily during attachment of a modular array 18 to a
20 terminal array 28.

A layer 40 of adhesive 40 is provided on the lower
side of the upper support body 32 and a similar layer 42
of adhesive material is present on the upper surface of
the lower support body 34, attaching the upper and lower
25 support bodies 32, 34 to each other and to each of the
coaxial conductor pairs 16 which is a part of the
modular array 18. The adhesive material of the layers
40 and 42 is preferably a pressure-sensitive polymeric
silicone adhesive able to withstand temperatures
30 exceeding those encountered in soldering and

unsoldering. For example, a satisfactory silicone adhesive is available, pre-applied as a thin layer to the previously described polyimide sheet material available from Allied Signal Corporation of Hoosick, New York.

Each of the coaxial conductor pairs 16 of a modular array 18 includes a main portion leading from the array 18 as a part of the respective bundle 14 and thence into the main body of the cable 10. Thus, there is a main jacket portion 44 of an outer insulating jacket 45 of tubular material, and the terminal portion 20 of each of the conductor pairs 16 extends distally away from the main jacket portion 44. The terminal portion 20 includes a short exposed length 46 of an outer or a shield conductor 47, Fig. 3 extending from the main jacket portion 44 of the jacket 45. A short length 48 of the tubular jacket material surrounds a distal portion 50, Fig. 3 of the short exposed length 46 of the shield conductor 47. A dielectric layer 52 extends further from the main body portion 44 of the jacket, beyond the distal portion 50 of the short length 46 of the shield conductor 47 and within the short length 48 of tubular jacket material. An exposed portion of a central conductor 54 extends beyond a distal end 56 of the dielectric layer 52. An annular air gap 58 thus remains between the short length 48 of tubular jacket material and the portion of the dielectric layer 52 extending beyond the distal portion 50 of the shield conductor 46. The shield conductor 46 is thus kept

spaced apart from and insulated from electrical contact with the central conductor 54.

Since the shield conductor 47 is a layer of several small wires 60 that are served, that is, wrapped
5 helically side by side on the dielectric layer 52, the short length 48 of jacket material surrounding the distal portion 50 of the shield 47 keeps the wires 60 close together and tightly arranged about the dielectric layer 52, preventing them from splaying apart.

10 With each of the coaxial conductor pairs 16 held similarly aligned and parallel with each other at the required pitch 78 to correspond with the spacing of the terminal pads 24, the upper and lower support bodies 32 and 34 are attached to all of the conductor pairs 16 by
15 the adhesive layers 40 and 42, thus defining a top side 72, Fig. 3, and a bottom side 74 of the modular array 18.

The upper and lower support bodies 32 and 34 each include a first or rear support member in the form of a
20 transversely extending strip 62, a second or front support member in the form of a transversely extending strip 64, and a third or central support member in the form of a transversely extending strip 66. The transversely extending strips 62, 64 and 66 are all held
25 at the required distances from each other and are interconnected with each other by a pair of spacer members in the form of side portions 68 which define the locator holes 36. A transverse aperture 70 is defined between the rear transverse support strip 62 and the
30 central transverse support strip 66, exposing a

respective termination portion 71 of each of the short lengths 46 of the shield conductor on both the top side 72 and the bottom side 74 of the modular array 18. A transverse aperture 76 defined between the front

5 transverse support strip 64 and the central transverse support strip 66 similarly exposes a termination portion 79 of each of the central conductors 54 at both the top side 72 and the bottom side 74 of the modular array 18.

The portions of the adhesive layers 40, 42 on the
10 transverse front support member strips 64 of the upper and lower support bodies 32 and 34 engage each of the central conductors 54 and also adhere to each other between the central conductors 54, keeping the central conductors 54 properly spaced apart from one another at
15 the required pitch 78. Similarly, the adhesive layers 40, 42 of the transverse rear support member strips 62 hold the main body portions 44 of the insulating jackets of the conductor pairs 16 closely spaced at the same pitch 78, and the transverse central support member
20 strips 66 are adhered to the short lengths 48 of tubular jacket material and similarly maintain their positions at the same pitch 78. The upper and lower support bodies 32 and 34 thus keep the terminal portions 20 of all of the conductor pairs 16 aligned with one another
25 and spaced apart from one another at the required pitch 78.

In connecting the cable 10 to the circuit board 30, each of the modular arrays 18 is aligned properly with its respective terminal array 28, by the use of the
30 registration holes 36 in the support bodies 32 and 34

and the registration holes 38 at each terminal array 28, thereby aligning each of the central conductors 54 with the appropriate terminal pad 24 and aligning an exposed portion of the short length 46 of each shield conductor 47 with the common terminal pad 26, or with the appropriate individual shield terminal pad (not shown) of a terminal array which has individual shield terminal pads. With the parts which are to be connected thus being aligned properly, appropriate heater bars and solder preforms may be used to solder the termination portions 79 of all of the central conductors simultaneously as at 75 and to solder all of the exposed termination portions 71 of the shield conductors 47 simultaneously as at 77 to make all of the required electrical interconnections; because of its small thickness, the lower support body 34 offers no significant interference to use of such mass solder reflow termination methods to connect the conductor pairs 16 of the modular array 18.

If it should become necessary to disconnect the modular array 18 from a terminal array 28, all of the connections can be heated simultaneously in a similar manner to release each of the central conductors 54 and shield conductors 47 from the respective terminal pads 24 or 26, and the upper and lower support bodies 32 and 34 of the modular array 18 will continue to maintain the alignment and pitch among all of the conductor pairs 16 of the modular array 18. The cable 10 can thus be disconnected from a defective circuit and can be connected to a replacement circuit without having to

verify or re-establish the arrangement and spacing of the many coaxial conductor pairs 16 as part of the task of connecting the cable 10 to a circuit.

In order to facilitate solder connection of the conductor pairs 16 to a terminal array 28, it may be desirable to tin the exposed portions of each of the central conductors 54 and of the short lengths 46 of the shield conductors 47 of the modular array 18. This can be accomplished simply by dipping the modular array 18, including the support bodies 32 and 34 into molten solder of the appropriate composition. Tinning the exposed conductor portions of the modular array 18 has the additional benefit that solder adhered to the exposed portion of the short length 46 of shield conductor 47 tends to reinforce the action of the short length 48 of tubular jacket material encircling the distal end portion 50 of each of the shield conductors 47. That is, the adhered tinning solder bridges any small gaps between the individual wires 60 of the shield conductor 47. This enhances the ability of the exposed portions of the shield conductors 47 to conduct heat from a heater bar to the terminal pad 26 and away from the dielectric layer 52 during the process of soldering the modular array 18 to the terminal array 28 and helps to protect the dielectric layer 52 from being damaged.

To prepare each of the conductor pairs 16 to be included in a modular array 18, as shown in Figure 4, a first step is to cut through the tubular jacket 45 and the shield conductor 47 at a position such as the one indicated by broken line 80, close enough to the end 82

of the conductor pair 16 so that it is possible to slide the separate portions of the jacket 45 and shield 47 along the dielectric layer 52 to the position shown in Figure 5.

5 With the jacket 45 and shield 47 thus moved axially in the direction indicated by the arrow 84 in Figure 5, the dielectric layer 52 is then cut at a distance 86 from the distal end 50 of the cut-back shield conductor 46. Conveniently, the dielectric layer 52 can be cut at
10 the position indicated by the broken line 88 adjacent the moved portions of the jacket 45 and shield 47. The separate portions of the jacket 45, shield 47, and dielectric layer 52 are then all moved axially a further distance in the same direction along the central
15 conductor 54 to expose the termination portion 79 of the central conductor 54 which will ultimately span the aperture 76 defined by the support bodies 32, 34.

Thereafter, the tubular jacket 45 is cut at the position indicated by the transverse broken line 90 in
20 Figure 6, without cutting through the shield conductor 47 at that location, and the short length 48 of tubular jacket material thus cut free is also moved axially in the direction of the arrow 91, through a distance 94, for example, that is less than the length 96 of the
25 short length 48 of tubular jacket material so that a part of the short length 48 of tubular jacket material continues to surround the distal portion 50 of the shield conductor 46 as described above.

The moved portions of the jacket 45, shield 47, and
30 dielectric layer 52 still surrounding the central

conductor 54 can thereafter be placed in a suitable jig (not shown), if desired, to hold the terminal portion 20 of each coaxial conductor pair 16 in a respective required location while the upper support body 32 is
5 attached to the coaxial conductor pairs and thereafter the lower support body 34 is mated to it to complete the modular array 18. Finally, when convenient, the central conductors 54 can be clipped close to the outer margin 98 of the front transverse support member 64 to complete
10 preparation of the modular array 18.

Advantageously, the invention allows for holding multiple coaxial cables during soldering, wherein a short length of a jacket on each of the cables is moved forward to hold a shield of the cable from
15 splaying, unraveling.

CLAIMS:

1. A termination for coaxial cables comprises, a holder on which are aligned and held multiple coaxial cables, and wherein exposed portions of central
5 conductors of the cables extend from dielectric layers of the cables, conducting shields surround the dielectric layers of the cables, exposed portions of the shields extend from a jacket of the cable, and the exposed portions of the shields extend over an aperture
10 through the holder to facilitate heating of solder on the exposed portions of the shields, characterised by;
short lengths (48) of the jackets (45) separated from remainders of the jackets (45), the short lengths (48) of the jackets (45) surrounding respective distal
15 portions (50) on the exposed portions (46) of the shields (47), and the short lengths (48) of the jackets (45) being supported on the holder.

2. A termination as recited in claim 1, further characterised by; the exposed portions of the central
20 conductors (54) extending from the short lengths (48) of the jackets (45) and extending over a second aperture (76) through the holder to facilitate heating of solder on the exposed portions of the central conductors (54).

3. A termination as recited in claim 1, further
25 characterised by; portions of the dielectric layers (52) being separate from remainders of the dielectric layers (52) and extending over respective distal portions on the exposed portions of the central conductors (54).

4. A termination as recited in claim 1 or 2 or 3,
30 further characterised by; the exposed portions of the



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central conductors (54) extending from the short lengths (48) of the jackets (45) and being held by the holder.

5. A termination as recited in claim 1 or 3, further characterised by; the holder comprising, a pair of support bodies (32, 34), and the pair of support bodies (32, 34) holding therebetween the cables and the short lengths (48) of the jackets (45).