

SPECIFICATIONCONNECTOR HAVING GUIDE BUSH WITH
ENHANCED GROUND CONTACT

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Background of the Invention

5 The present invention relates to an electrical connector having guide bushes, and more particularly to a connector having guide bushes with enhanced ground contacts.

 It is well known that particular electrical connectors, particularly input/output ("I/O") connectors,
10 may be fitted with guide bushes on their application surfaces (front faces) for receiving corresponding guide pins of a complementary electrical connector. By providing guide holes in the guide bushes for the corresponding pins, proper alignment is more easily achieved between the mating
15 connectors. An example of such an input/output electrical connector is disclosed in Japanese Patent Application Laid-Open No. 6-140096.

 A typical I/O electrical connector includes a dielectric housing having a front face and a mating portion
20 projecting forwardly from the front face, a plurality of terminals mounted in a complementary mating portion of the housing for engaging complementary terminals in the mating connector during mating, and a conductive shield on the front face of the housing, the shield generally including a
25 shroud encircling the mating portion and linear arrangement of the terminals and a flange integrally formed with the shroud for overlying much or all of the front face of the connector. The shields of the mating connectors preferably engage and maintain electrical contact upon mating, and will
30 thereby be kept at ground or at least the same potential.

 Typically, an internally threaded cylindrical bore extends through the flange and front face on either side of

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the shroud to provide a pair of recesses into which externally threaded guide bushes may be mounted. Generally, guide bushes have a relatively narrow externally threaded tail sections for screwing into the internally threaded
5 recesses as well as a relatively wider head section for mounting flush to the front face and projecting forwardly from the front face to provide enhanced mating capability, as described above, with a corresponding electrical connector or other electronic device.

10 Because of the structure of the shield and the manner in which it is mounted on the housing, significant wearing and/or deformation may occur, thereby weakening or inhibiting the electrical contact between the opposing shields and making the ground potential unstable.

15 Summary of the Invention

The present invention provides an electrical connector having guide bushes with an enhanced grounding capability.

20 Disclosed herein is an electrical connector and a guide bush for mounting upon a front face of the electrical connector wherein the front face has an aperture therein and a shield mounted thereon. The guide bush is adapted for mounting into the aperture on the front face and for receiving therein a guide pin from a mating electronic
25 component. The guide bush includes an integral body having a head portion and a tail portion, the tail portion being inserted into the aperture, and the head portion having a bore therein for receiving the guide pin from the mating electronic component. A resilient contact member protrudes
30 into the bore for contacting the guide pin of the mating component when the guide pin is received in the guide bush in order to establish a ground circuit therethrough.



5 In this manner, the maintenance of the ground potential is assured, even if wearing or deformation causes the contact between mating shields to be unreliable for this purpose. Other advantages of the present invention will be more clearly understood from the following description of the preferred embodiment(s) of the invention.

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Brief Description of the Drawings

5 FIGURE 1 is a cross-sectional view of an electrical connector and guide bush in accordance with the invention wherein the guide bush is shown mated with a guide pin from a mating connector;

FIGURE 2 is a side elevational view of one of the guide bushes of the electrical connector of FIGURE 1;

FIGURE 3 is a front elevational view of the guide bush of FIGURE 2;

10 FIGURE 4 is a rear elevational view of the guide bush of FIGURE 2;

FIGURE 5 is a top plan view of the guide bush of FIGURE 2;

15 FIGURE 6 is a cross-sectional view of the guide bush of FIGURE 3 taken along the line A-A;

FIGURE 7 is a cross-sectional view of the guide bush taken along the line B-B of FIGURE 6;

FIGURE 8 is an enlarged view of the encircled area in FIGURE 6;

20 FIGURE 9 is a side elevational view of a contact member for enhancing the ground contact;

FIGURE 10 is a front elevational view of the contact member of FIGURE 9;

25 FIGURE 11 is a rear elevational view of the contact member of FIGURE 9;

FIGURE 12 is a top plan view of the contact member of FIGURE 9;

FIGURE 13 is a cross-sectional view of the guide bush of FIGURE 2 prior to attaching a contact member;

30 FIGURE 14 is a fragmented front view of a prior art electrical connector having a guide bush; and

FIGURE 15 is a fragmented front view of an electrical connector having an enhanced ground contact guide bush in accordance with the present invention.



Description of the Preferred Embodiment

Referring to FIGURE 1, an electrical connector 1 having a metal conductive guide bush 3 according to the present invention is shown mated with an electrical
5 connector 2 having a metal conductive guide pin 4. The guide-bushed electrical connector 1 has guide bushes 3 on opposite ends of its application or front surfaces 7 for accommodating the guide pins 4 projecting from the opposite ends of the application surface of the guide-pinned
10 electrical connector 2, thereby guiding the mating of the correspondingly fitting electrical connector 2 by guiding pins 4 into the guide bushes 3 of the guide-bushed electrical connector 1. The dielectric housing 5 of the guide-bushed electrical connector 1 has a mating portion 34
15 (FIGURE 5) having a plurality of terminals 6 arranged and fixed in parallel lines therein, the terminals being directed toward the application surface 7 of the dielectric housing 5 (only their tails are shown in FIGURE 1). Two guide bushes 3 are arranged at opposite ends of the mating
20 portion.

Likewise, the dielectric housing 8 of the guide-pinned electrical connector 2 has a mating portion having a plurality of terminals 9 arranged and fixed in parallel lines therein, these terminals being directed to the
25 application surface 10 of the dielectric housing 8 (again, only their tails are shown in FIGURE 1). Two guide pins 4 are arranged at opposite ends of the parallel terminal arrangement so that these guide pins 4 may be aligned with the guide bushes 3 of the guide-bushed electrical connector
30 1 upon mating.

A metal shield 7a is applied to the front face (application surface 7 of the dielectric housing 5 excluding the mating portion/ terminal arrangement) of the guide-bushed electrical connector 1, and a metal shield 10a is



applied to the front face of the dielectric housing 8
excluding the terminal arrangement of the guide-pinned
electrical connector 2. The shields 7a and 10a have
forwardly protruding shroud sections surrounding the mating
portions, and the protruding shroud sections of the shields
7a and 10a telescope one another when the connectors 1 and 2
are mated.

Referring to FIGURES 2-8, each guide bush 3 is
preferably metal, and comprises a fixing part 12 having
threads 11 on its outer circumference and a hollow
cylindrical part 14 having a guide hole 13 along its central
axis for accommodating a guide pin 4 of the electrical
connector 2. The hollow cylindrical part 14 has a pair of
diametrically opposed slots 15 formed in the circumferential
wall of the hollow cylindrical part 14, and contact members
16 are fixed to the guide bush adjacent the fixing part 12
so that their resilient contact legs 17 protrude into the
guide hole 13.

Referring to FIGURES 9-12, the contact member 16
is preferably stamped of sheet metal and comprises a
generally annular base 18 having a pair of resilient contact
legs 17 integrally connected thereto standing diametrically
opposed with one another. The circular hole 19 of the
annular base 18 is sized to allow the fixing part 12 to pass
therethrough. As seen from FIGURE 13, a step-like
transition 20 from the fixing part 12 to the cylindrical
part 14 has projections 21 formed on the cylindrical
circumference of the cylindrical part 14. After inserting
the fixing part 12 of the guide bush 3 into the circular
hole 19 of the annular base 18 of the resilient contact 16,
the projections 21 are bent or otherwise deformed on the
annular base 18 as seen from FIGURE 8. This bending
positively fixes the contact member 16 to the fixing part 12
of the guide bush 3, allowing its contact legs 17 to pass

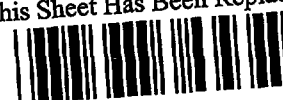


through the slots 15 and partly protrude into the guide hole 13.

As best seen from FIGURE 1, the dielectric housing 5 of the connector 1 preferably has grounding members 22 fixed therein. Each grounding member 22 has a tapped or threaded receptacle 23. The guide bush 3 can be fixed to the dielectric housing 5 by threadedly engaging its fixing part 12 in the tapped receptacle 23, with the diverging inlet 13a opening on the side of the application surface 7 of the dielectric housing 5.

As best seen in Figures 2 and 5, the hollow cylindrical part 14 has a step-like transition from the relatively larger head 24 to the relatively smaller trunk 25. In use, the connector 1 will be mounted adjacent a metal panel 27 having holes for the guide bushes 3 and the mating portion 34 and then the guide bushes are screwed into the tapped receptacle. As such, the panel 27 is sandwiched between the step-like transition and the front surface 7 of the shield 7a. Thus, the guide-bushed electrical connector 1 is fixed to the panel 27, and the grounding receptacle 22 is soldered to the ground circuit of the printed circuit board 35 at 36. Likewise, the guide-pinned electrical connector 2 preferably has grounding members 22a fixed therein, and the guide pins 4 are threadedly engaged with the grounding members 22a, which are, in turn, soldered to the ground circuit of the printed circuit board 37 at 38.

Referring to FIGURES 6 and 7, the guide hole 13 of the guide bush includes a hexagonal hole 28 and a substantially aligned round hole 29 generally contiguous to the hexagonal hole 28. As best seen in FIGURE 3, the circular perimeter of the round hole 29 is inscribed within the hexagonal hole 28 when viewed along the central axis of the guide hole 13. The inscribed circle has substantially the same width as does the guide pin 4 of the mating



connector 2, thereby permitting the guide pin 4 to be inserted into the hollow cylindrical part 14 and be guided along the center axis of the hollow cylindrical part 14 thereby.

5 As seen from FIGURE 1, the guide-bushed electrical connector 1 can be mated with the guide-pinned electrical connector 2 by inserting the guide pins 4 into the guide holes 13 of the guide bushes 3 until the tips of the guide pins 4 are generally adjacent the bottoms of the round hole sections 29. At that point, the resilient contact legs 17 of the contact member 16 make contact with the guide pins 4, thereby establishing electrical connection between the guide bushes 3 and the guide pins 4. As a result, the shield 7a covering the application surface 7 of the dielectric housing 5 is conductively connected to the shield 10a covering the application surface 10 of the dielectric housing 8 of the complementary electrical connector 2. Thus, the ground circuit includes both shields 7a and 10a as well as the printed circuit board 35. The use of the ground contact members 16 contacting the guide pins 4 provides a more reliable contact than just establishing the ground circuit between shields 7a and 10a. This provides the enhanced grounding effect.

25 The guide pins 4 are insertable and removable freely in the hexagonal and round hollow space of the guide hole 13 and are not therefore subject to significant deformation. When the invading pins 4 meet the resilient contact legs 17, the legs resiliently flex against the insertion force but maintain contact with the guide pin 4 under a biased force. Repeated mating of the guide pin and guide bush will have no significant adverse effect on the ground circuit due to the resilience of the contact legs 17, thereby assuring a stable ground interconnection each time the connectors are mated.



Two or more contact members 16 may be used, and individual contact members 16 may have more than two contact legs 17 thereon. The contact legs 17 may preferably be arranged symmetrically with respect to the center axis of the guide hole 13. Of course, the slots 15 are made in the cylindrical wall 14 of the guide bush 3 to provide the proper spacing for the contact legs 17 around the center of the guide hole 13. Preferably, the slots 15 are also arranged symmetrically with respect to the center of the guide hole 13.

The hexagonal hole shape 28 of the inlet section of the guide bush 3 helps reduce the width of the electrical connector 1. As seen in FIGURE 14, a conventional guide bush 30 has an inlet outer perimeter of hexagonal shape 31. Affixing such a guide bush 30 to the dielectric housing 32 typically employs a wrench or box-like driver applied to the outer perimeter of the hexagonal head 31 of the bush 30 to rotate the head 31 onto the housing 32. In order to apply the circumscribing tool there must be a gap G between the bush 30 and the end of the linear terminal contact arrangement 33 or mating portion (often a protruding shield shroud), wherein gap G is sufficiently large to allow the insertion of at least a portion of the wrench or other circumscribing tool therebetween. Accordingly, the lateral sides of the electrical connector must be increased in order to account for the additional width of the circumscribing tool.

For the described embodiment, the guide bush structure avoids such a problem by allowing insertion of a hexagonal rod-like tool or shaft into the guide hole 13 for rotationally engaging the guide bush 3 with the ground peg 22. Thus, the additional space required for the circumferential tool in the conventional connector is not required. As seen in FIGURE 15, the guide bush 3 may be



located very closely to the end of the mating portion, thus permitting a reduction in the lateral size of the electrical connector. Of course, the inlet to the guide hole may take triangular, rectangular, pentagonal, or many other possible shapes. The hexagonal shape is preferable due to its availability as an insertion tool.

The invention, as appreciable from the foregoing description of the various embodiments, provides significant advantages over conventional connectors, particularly with regard to enhancing the ground contact between the mating connectors. The invention is not limited to the preferred embodiment described herein, or to any particular embodiment. Specific examples of alternative embodiments considered to be within the scope of the invention, without limitation, include embodiments wherein there are fewer or more contact legs to enhance the ground contact, wherein such contact legs are spaced alternatively from the described embodiments, even in asymmetrical patterns, wherein the hexagonal inlet opening 28 is not present, wherein the shield shroud surrounding the linear terminal contact arrangement is substantially rectangular, trapezoidal, or of any other shape, and wherein the outer perimeter of the guide bush is round, hexagonal, or any other shape. Other modifications to the described embodiments may also be made within the scope of the invention. The invention is defined by the following claims.

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CLAIMS:

1. A conductive guide bush (3) for mounting upon a front face (7) of an electrical connector (1) into an appropriately configured aperture (23) in said front face, said connection also including a conductive shield (7a) mounted onto said front face, said guide bush being adapted to receive therein a guide pin (4) from a mating electronic component (2), said guide bush comprising:

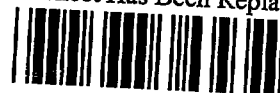
an integral body having a head portion (14) and a tail portion (12), said tail portion being adapted for retainable insertion into said aperture of said connector, said head portion having a bore (13) therein for receiving said guide pin from said mating electronic component; and

at least one resilient contact member (16) protruding into said bore for contacting said guide pin of said mating component when said guide pin is received in said guide bush.

2. A guide bush in accordance with claim 1 wherein said guide bush is adapted to be fixed to said electrical connector by driving said tail portion into a tapped aperture (23) of the connector.

3. A guide bush in accordance with claim 2 wherein said tail portion (12) is externally threaded and said guide bush is adapted to be fixed to said electrical connector by rotatingly driving said tail portion into said tapped aperture.

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4. A guide bush in accordance with claim 1 wherein said contact member includes at least one resilient contact leg (17) for biasing against said guide pin when said guide pin is received in said guide bush.

5 5. A guide bush in accordance with claim 1 wherein said contact member includes at least two contact legs for contacting said guide pin when said guide pin is received in said guide bush.

10 6. A guide bush in accordance with claim 5 wherein said at least two contact legs are arranged symmetrically with respect to the center of said bore.

15 7. A guide bush in accordance with claim 1 wherein said head portion (14) includes a head section (24) of relatively larger diameter and a trunk section (25) of relatively smaller diameter integrally connected to said head section to form a step-like transition, said step-like transition and said front face of said connector being adapted to sandwich a panel (27) therebetween.

20 8. A guide bush in accordance with claim 7 wherein said bore (13) includes an outer portion (28) of a first shape and an inner portion (29) of a second shape.

9. A guide bush in accordance with claim 8 wherein said outer portion includes a polygonal shape and said inner portion has a circular shape.



10. A guide bush in accordance with claim 9 wherein said polygonal outer portion is hexagonal in shape.

11. An electrical connector (1) comprising:

5 a front face (7), with a conductive shield (7a) mounted thereon, and a conductive guide bush (3) mounted in an aperture on said front face of said connector, said guide bush being adapted to receive therein a guide pin (4) from a mating electronic component (12),

10 said guide bush including an integral body having a head portion (14) and a tail portion (12), said tail portion being inserted into said aperture, said head portion having a bore (13) therein for receiving said guide pin from said mating electronic component, and at least one resilient contact member (16) protruding into said bore for contacting
15 said guide pin of said mating component when said guide pin is received in said guide bush.

12. An electrical connector in accordance with claim 11 wherein said guide bush is fixed to said electrical connector by driving said tail portion into a tapped
20 aperture (23) of a ground peg (22) of the connector.

13. An electrical connector in accordance with claim 12 wherein said tail portion (12) is externally threaded and said guide bush is fixed to said electrical connector by rotatingly driving said tail portion into said tapped
25 aperture.



14. An electrical connector in accordance with claim 11 wherein said contact member includes at least one resilient contact leg (17) for biasing against said guide pin when said guide pin is received in said guide bush.

5 15. An electrical connector in accordance with claim 11 wherein said contact member includes at least two contact legs for contacting said guide pin when said guide pin is received in said guide bush.

10 16. An electrical connector in accordance with claim 15 wherein said at least two contact legs are arranged symmetrically with respect to the center of said bore.

15 17. An electrical connector in accordance with claim 11 wherein said head portion (14) includes a head section (24) of relatively larger diameter and a trunk section (25) of relatively smaller diameter integrally connected to said head section to form a step-like transition, said step-like transition and said front face of said connector being adapted to sandwich a panel (27) therebetween.

20 18. An electrical connector in accordance with claim 11 wherein said bore (13) includes an outer portion (28) of a first shape and an inner portion (29) of a second shape.

19. An electrical connector in accordance with claim 18 wherein said outer portion includes a polygonal shape and said inner portion has a circular shape.

25 20. An electrical connector in accordance with claim 19 wherein said polygonal outer portion is hexagonal in shape.

