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TRANSLATION FROM GERMAN

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Ribbon Cable With Shielded Connection

The invention concerns a ribbon cable with a series of electrical cable conductors embedded next to each other in an insulation material and with an electrical cable shield on at least one flat surface of the insulation material. The invention also concerns a ribbon cable plug-in connector for plug-in connection of a ribbon cable with a housing of the plug-in connector.

An ordinary ribbon cable 11 of the cited type is shown in Figure 19 and possesses a series of cable conductors 13s and 13m arranged next to each other and embedded in an insulation material 15 on one flat side of which (upper side in Figure 19) an upper shielding sheet 17 is arranged and on the other flat side of which a lower shielding sheet 19 is arranged. The cable conductors 13s form signal conductors and the cable conductor 13m serves as ground conductor. The insulation material 15 is removed far enough in the region of ground conductor 13m so that part of the ground conductor 13m protrudes from the insulation material 15. The two shielding sheets 17 and 19 in this region are bent onto the ground conductor 13m and are electrically connected to ground conductor 13m there. The insulation material can be two sheets between which the cable conductors are situated and which are glued together and to the cable conductors by means of an adhesive. The insulation material 15 can be polyester. The shielding sheets 17, 19 can be copper-coated

polyester sheets.

This ribbon cable design has some problems. On the one hand, electrical connection between the ground conductor 13m and the shielding sheets 17, 19 can exhibit relatively high contact resistance, since this connection is only produced by mechanical pressure. Moreover, the connection between shielding sheets 17, 19 and a plug-in connector housing that receives this ribbon cable 11 only occurs by means of an additional ground wire. Inclusion of this ground wire complicates the production process for the cable and for the ribbon cable plug-in connector and makes it expensive.

Automated mass production of this type of ribbon cable is demanding and expensive. The relatively high contact resistance between shielding sheets 17, 19 and ground conductor 13m adversely affects the quality of shield attenuation. Since the shielding sheets 17, 19 are not supported by insulation material 15 in the region connected to ground conductor 13m, they are mechanically quite sensitive there. The shielding sheets can be deformed in this area and hamper insertion of the ribbon cable into a plug-in connector. Use of an additional grounding wire requires space that might be available for signal conduction without the requirement for this wire.

Such problems can be overcome with a ribbon cable according to the invention according to Claim 1, which has at least one contact element made of an electrically conducting material that is secured on the outside of the ribbon cable with electrical contacting of the cable shield and is suitable for electrical contacting by means of a contact spring of a plug-in connector that accepts the ribbon cable or contact surface of an EMV housing that accepts the ribbon cable.

EMV housing refers to a housing made of an electrically conducting material that shields against electromagnetic interference radiation.

None of the cable conductors in the ribbon cable according to the invention need be sacrificed as ground conductor, but instead contacting of the cable shield is accomplished by means of at least one contact element secured on the outside of the ribbon cable. Mechanical weakening of the shielding sheets because of partial removal of the insulation material no longer occurs in the ribbon cable according to the invention either. In contrast, an increase in mechanical stability of the ribbon cable at the shielding contact site or shielding contact

sites occurs from inclusion of the contact element or several contact elements on the outside of the ribbon cable.

A ribbon cable plug-in connector according to the invention for plug-in connection of this ribbon cable, as stated in Claim 21, possesses a housing, on which at least one contact spring is arranged with a contacting zone for electrical contacting of at least one contact element secured on the ribbon cable. Electrical connection between the cable shield connected to the contact element and a shield potential conductor, especially ground potential conductor, of a mating connector or printed circuit board is produced via the contact springs. The contact spring can engage on the longitudinal side edge of the contact element situated on the longitudinal side edge of the ribbon cable or contact a main surface of the contact element.

If a ribbon cable according to the invention is accommodated in an EMV housing, this can be assembled from two housing parts that can be assembled with inclusion of the region of the ribbon cable provided with at least one contact element between it and the EMV housing, in which at least one contacting surface can be arranged on at least one of the two housing parts that is pressed against at least one contact element in the installed EMV housing and thus comes into electrical contact with the contact element. Preferably the at least one contact element is squeezed between opposite contact surfaces of the two EMV housing parts.

An EMV housing can be configured so that it has a receiving opening for a disk made of electrically conducting material that serves as contact element of the ribbon cable, in which the disk has a cable feed-through opening by means of which the cable is passed through the disk during electrical contact between the disk and cable shield so that an electrical connection can be made between the cable shield and the EMV housing.

However, this type of EMV housing can also be provided with one or more contact springs instead of this contact surface or disk receiving opening or in addition to it, this spring or these springs coming into contact with at least one contact element in the installed EMV housing.

On the other hand, a plug-in connector housing can also be provided with at least one disk receiving opening and/or with at least one contact surface that can be pressed against at

least one contact element of the ribbon cable section inserted into the plug-in connector in the installed plug-in connector housing instead of one or more contact springs or in addition to these.

Since the shielding potential in these solutions is not guided via a cable conductor used as ground conductor with a comparatively small conducting cross section, but rather via at least one contact spring and/or a contact surface that can have a much greater conducting cross section than the ground conductor of the ordinary ribbon cable, particularly good shield connection occurs in the case according to the invention. The limited and safe electrical contact resistance that exists between the cable shield of the ribbon cable and, on the one hand, the at least one contact element and, on the other hand, between the at least one contact element and the at least one contact spring and/or contact surface of the connector housing or EMV housing also contributes to this.

The contact element can be designed as a roughly U-shaped folding contact that lies against a longitudinal side edge of the ribbon cable with its U-bridge and whose U-arms are each connected to one of the two flat sides of the ribbon cable. This folding contact can be designed in the form of a contact strip extending essentially over the entire width of the ribbon cable or in the form of a contact claw extending only over a small part of the width of the ribbon cable.

The contact element can also be designed as a contact strip with a base strip whose length is essentially equal to the width of the flat side of the ribbon cable and with two arms that can be folded from each longitudinal end of the base strip and at a distance from it.

The contact element can also be a contact plate that is mounted on one flat side of the ribbon cable or a disk with a cable feed-through opening that accepts the ribbon cable.

If the cable shield forms the outside of the ribbon cable, preferably in the form of a shielding sheet, the contact element can be fastened directly to the cable shield. If an insulation sheath is situated above the cable shield, the cable shield is exposed at the fastening point for the contact element so that, despite the insulation sheath, electrical contact can be produced between the contact element and the cable shield.

If the contact element is formed from a metal strip, it can be electrically connected to the cable shield by mere pressing or by soldering. If the contact element is constructed from

electrically conducting plastic, it can be brought into electrical contact with the shielding sheet by means of an electrically conducting glue.

The part of the ribbon cable provided with at least one contact element and intended for insertion into a plug-in connector housing or an EMV housing can be a ribbon cable end that is sealed with a plug-in connector or a region of the ribbon cable between the two ribbon cable ends in which a branch connection is made.

Further embodiments of the ribbon cable according to the invention and the ribbon cable plug-in connector according to the invention can be gathered from the additional claims.

The invention is now further explained with reference to practical examples.

In the drawings:

Figure 1 shows a schematic top view of a ribbon cable according to the invention;

Figure 2 shows a contact element in the form of a contact claw;

Figure 3a shows a contact element in the form of a contact strip of a first variant;

Figure 3b shows a contact element in the form of a contact strip of a second variant;

Figure 4 shows a contact element in the form of a contact plate;

Figure 5 shows a cross-sectional view of a ribbon cable according to the invention along line 5-5 in Figure 1;

Figure 6 shows a narrow side view of a ribbon cable according to the invention;

Figure 7 shows a schematized top view, partially in cross section of a ribbon cable plug-in connector according to the invention with a ribbon cable according to the invention and a plug-in connector housing with contact springs according to the invention;

Figure 8 shows an end view of a plug-in connector housing according to the invention on the cable insertion side;

Figure 9 shows a side view of a plug-in connector housing according to the invention provided with contact springs;

Figure 10 shows a cross-sectional view of the plug-in connector housing depicted in Figure 9 with the inserted ribbon cable;

Figure 11 shows a top view of a contact spring according to the invention;

Figure 12 shows a side view of the contact spring depicted in Figure 11;

Figure 13 schematically depicts contact springs acting in different directions;

Figure 14 shows a top view of a housing half of an EMV housing to accept to a ribbon cable according to the invention;

Figure 15 shows a narrow side view of the EMV housing half;

Figure 16 shows a broad side view of the EMV housing half;

Figure 17 shows a perspective view of a ribbon cable provided with a contact element in the form of a disk;

Figure 18 shows a narrow side view of the arrangement depicted in Figure 17 in a disk receiving opening of an EMV wall; and

Figure 19 shows a cross section through the already mentioned ribbon cable of known design.

Figure 1 shows a top view of a ribbon cable 21 equipped according to the invention with contact claws 23, one of which is shown in a perspective view in Figure 2. Each of the contact claws 23 is formed by a folding contact in the form of a roughly U-shaped folded material strip that lies with its U-bridge 35 against a longitudinal side edge of ribbon cable 21 and whose U-arms 37 are connected to the two flat sides of ribbon cable 21. The two U-arms 37 are short in comparison with the width of the flat side of ribbon cable 21.

It is assumed in conjunction with Figure 1 that the outsides of the two flat sides of ribbon cable 21 are each formed by a cable shield, preferably in the form of a shielding strip and that the two U-arms 37 of the two contact claws 23 are positioned on the lower 17 and upper 19 shielding sheets (Figure 5). If the contact claws 23 consist of solid metal, they are preferably pressed onto ribbon cable 21 and additionally soldered to shielding sheets 17, 19. If the contact claws 23 consist of plastic, which is made conducting by incorporation of electrically conducting particles, the contact claws 23 can be attached to the shielding sheets 17, 19 by means of an electrically conducting glue.

In order to be able to connect the cable conductors to the conductor contacts of a plug-in connector that accepts ribbon cable end 25, the cable conductors are exposed in the region of cable end 25 on a flat side of ribbon cable 21. Because of the mechanical weakening of the ribbon cable end 25 caused by this a reinforcement layer, preferably in the form of a stiffening sheet 27, is provided on the flat side of ribbon cable end 25 on which the

cable conductors are not exposed. A locking rib 29 is set back relative to ribbon cable end 25 and extends over part of the flat side width of ribbon cable 21 and cooperates in locking fashion with a locking shoulder 59 (Figure 7) in a plug-in connector housing 43 into which ribbon cable end 25 can be inserted. In this fashion the ribbon cable 21 is securely held in plug-in connector housing 43.

The locking rib 29 is displaced relative to the longitudinal center line of ribbon cable 21 in order to ensure proper insertion of ribbon cable end 25 into a cable insertion opening 45 of plug-in connector housing 43 displaced in complementary fashion (Figure 8).

Since the contact claws 23 are arranged at the level of the locking rib 29 when viewed in the longitudinal direction of ribbon cable 21, the locking rib 29 has a rib recess 31 on its right side in Figure 1 in which the right contact claw 23 in Figure 1 is accommodated.

In the depicted variant the two arms 37 of each contact claw 23 are each provided with a through-hole 33, which can serve as visual control of the soldered connection between shielding sheets 17, 19 and contact claw 23 and can also form a locking device that can snap into a complementary locking element of the plug-in connector housing or EMV housing when ribbon cable 21 is inserted into a plug-in connector housing or an EMV housing. The locking element can serve as (additional) contacting element for a (additional) ground connection between the contact claw and the plug-in connector or EMV housing.

One of the contact claws 23 is shown in Figure 2 in a perspective oblique view in which the U-bridge 35 and the two U-arms 37 can be seen.

Figure 3a shows a contact strip 39a in a perspective oblique view that coincides in the length of its U-arms 37 with the contact claw 23. The U-arms 37 of contact strip 39 have a length essentially equal to the width of the flat side of ribbon cable 21. Only a single contact strip 39a is therefore required even if one intends to engage one contact spring 47 on each of the two longitudinal side edges of ribbon cable 21 (Figure 7). If a locking rib 29 is arranged on the ribbon cable 21 in a case when a contact strip 39a is also provided, the fastening side of the contact strip 29 on ribbon cable 21 is displaced in the longitudinal direction of the ribbon cable relative to the fastening sites shown in Figure 1 for the two contact claws 23. The arms 37 of the contact strip 39a can also each be provided with a through-hole 33.

Figure 3b shows a contact strip 39b in a perspective oblique view that has a base strip 36 with a length corresponding to the width of the flat side of ribbon cable 21 and two arms 38, one of which can be folded from one end and the other from the other end of base strip 36 with spacing relative to base strip 36. The arms 38 of contact strip 39b have a length essentially equal to half the width of the flat side of ribbon cable 21 or also shorter. Only a single contact strip 39b is therefore required in this contact strip 39b even if one intends to engage a contact spring 47 on each of the two longitudinal side edges of ribbon cable 21 (Figure 7). If a locking rib 29 is also arranged on ribbon cable 21 when a contact strip 39b is provided, the fastening side of contact strip 39b on ribbon cable 31 is displaced in the ribbon cable longitudinal direction relative to the fastening sites for the two contact claws 23 shown in Figure 1. The arms of the contact strip 39b can also each be provided with through-hole 33.

Figure 4 shows a contact plate 41 that can be fastened to ribbon cable 21 instead of a contact claw 23 by soldering or gluing, depending on whether the material of the contact plate 41 is metal or conducting plastic. Preferably a contact plate 41 is fastened to each longitudinal side edge of ribbon cable 21 in similar fashion to the variant shown in Figure 1. If one shielding sheet 17, 19 is situated on each of the two flat sides of ribbon cable 21, a contact plate 41 is preferably attached to each longitudinal side edge and on each flat side of ribbon cable 21. The contact plate 41 is also preferably provided with a through-hole 33.

Figure 5 shows a cross-sectional view along line 5-5 in Figure 1, but with a modification to the extent that the rib recess 31 is situated on the other longitudinal side edge of ribbon cable 21 in contrast to the variant shown in Figure 1.

The ribbon cable 21 depicted in Figure 5, like the known ribbon cable 11 shown in Figure 19, has a series of signal conductors 13s arranged next to each other, which are embedded in insulation material 15, on both flat sides of which shielding sheets 17 and 19 are situated. However, unlike the known cable design according to Figure 19, all cable conductors are fully embedded in the insulation material and all have the function of a signal conductor 13s. A contact claw 23, by means of which both shielding sheets 17, 19 are electrically contacted, is attached on each longitudinal side edge of ribbon cable 21.

The stiffening sheet 27 and locking rib 29 are designed in one piece in the variant shown in Figure 5, but could also be separate components.

It is apparent in the narrow side view of ribbon cable 21 shown in Figure 6 that the cable conductors are exposed on ribbon cable end 25 on the flat side pointing downward in Figure 6 so that they can be brought into electrical contact with conductor contacts of a plug-in connector that accepts the ribbon cable end 25.

Figure 7 shows a top view and partial cross section of a ribbon cable plug-in connector arrangement with a plug-in connector housing 43 and the ribbon cable 21, in which the ribbon cable end 25 is inserted into a cable insertion opening 45 (better visible in Figures 8 and 10). The ribbon cable 21 depicted in Figure 7 is provided according to Figure 1 with a contact claw 23 on each of the two longitudinal side edges. A contact spring 47 is fastened to the sides of connector housing 43 adjoining the longitudinal side edges of ribbon cable 21, these springs having a contact spring arm 49 facing the corresponding contact claw 23 on whose free end facing the corresponding contact claw 23 a convex contact zone 51 is provided. Contact tabs 55 protrude above connector housing 43 on the front side 53 facing away from cable insertion opening 45. Electrical contact to the shielded conductors of a mating connector (not shown) or a printed circuit board (also not shown) can be made by means of these contact tabs 55. The contact springs 47 are formed, secured on plug-in connector housing 43 and made of a material so that their contact zones 51 lie against the U-bridge 35 of the corresponding contact claw 23 under spring tension in ribbon cable end 25 inserted into cable insertion opening 45 and thus produce electrical connection to shielding sheets 17 and 19 via contact claws 23. The contact spring arms 49 with contact zones 51 pass through the side wall openings 57 of plug-in connector housing 43.

The locking rib 29 of ribbon cable end 25 and a locking shoulder 59 that cooperates with locking rib 29 are shown with a dashed line in Figure 7 on an elastic locking arm 61 of plug-in connector housing 43. During insertion of ribbon cable end 25 into cable insertion opening 45 the locking arm 61 widens elastically when the locking rib 29 is moved past it until the locking shoulder 59 is situated beneath locking rib 29 in Figure 7 and can return the locking arm 61 elastically into its locking position.

The contact springs 47 are attached in the variant depicted in Figure 7 by means of plastic buttons 63 arranged in one piece on connector housing 43. However, this fastening can also occur differently, for example, by gluing the contact spring 47 to the plug-in connector housing 43.

The cable insertion opening 45 and the locking arm 61 are readily apparent in the front view of the plug-in connector housing 43 shown in Figure 8. In addition, mounting seats 67 for the contact spring 47 can be seen there on the side wall 65 on the plug-in connector housing 43. The locking arm 61 widens downward elastically during introduction of ribbon cable end 25 into cable insertion opening 45 (in consideration of Figure 8). It is provided with an engagement recess 69 with whose help the locking arm 61 can be moved downward when the ribbon cable end 25 is to be withdrawn again from cable insertion opening 45.

Figure 9 shows a side view with the plug-in connector housing 43 and a contact spring 47 arranged on it. The corresponding side view with the inserted ribbon cable end 25 is shown in Figure 10. Figures 9 and 10 concern variants in which the plug-in connector housing itself is not provided with conductor contacts for contacting of signal conductors 13s of ribbon cable 21. In this variant the housing 43 forms an additional housing into which the actual plug-in connector is snapped with the conductor contacts that contact signal conductors 13s.

Such plug-in connector housings are the object of our older German Patent Application 195 12 788.9 (not published previously), the disclosure contents of which are expressly referred to here so that this patent application will be referred to with respect to additional details of such plug-in connectors.

In addition to the ribbon cable plug-in connector arrangement disclosed in this patent application, contact claws 23 (Figure 10) and contact spring 47 (Figure 9) are provided according to the invention. If the plug-in connector has not only a contact connection leg 71 running in the longitudinal direction of the cable, but also contact connection leg 73 running across the longitudinal direction of the cable, the contact springs 47 are preferably provided not only with contact tabs 55 extending in the longitudinal direction of the cable, but additionally with contact tabs 75 extending across the longitudinal direction of the cable.

Figures 11 and 12 show a top view and a side view of a contact spring 47 used according to the invention from which the special form of the contact springs 47 shown in Figure 7 follows even more clearly. Holes 77 serve for attachment by means of plastic buttons 63 on connector housing 43.

In the previously considered variants the contact springs 47 contact the contact element, for example, contact claws 23 from the side, i.e., on the longitudinal side edges of the ribbon cable, in elastic fashion. However, it is also just as possible to use contact springs whose contact spring arms contact the main surfaces of the contact elements, in the case of use of contact claws 23, they are U-arms, i.e., in a direction toward the flat sides of the ribbon cable in elastic fashion.

Both possibilities are schematically shown in Figure 13. In addition to a contact spring arm 49 that acts laterally on a contact claw 23, two contact plates 41 are shown there, which are situated on different flat sides of the ribbon cable 21 and are contacted by one contact spring arm 49 with spring tension acting toward the corresponding flat side of the ribbon cable.

The cable conductors of ribbon cable 21 can be round conductors or, as in the variant according to Figure 5, flat conductors, which consist, for example, of copper or aluminum. For example, flat conductors are applied to a polyester sheet or laminated between polyester sheets, for example, by means of an adhesive situated between the polyester sheets, in which the polyester sheet or polyester sheets form the insulation material 15. The insulation material 15 can also be other materials, like PVC or PTFE. The ribbon cable 21 can be constructed with one or more cable shields 17, 19, for example, in the form of one or more copper or aluminum sheets or polyester sheets coated with copper or aluminum. One or more layers of insulating material can be applied as outer sheath of the cable above the cable shield or cable shields 17, 19.

As already mentioned, the contact elements, for example, contact claws 23, can consist of metal or conducting plastic.

The contact springs 47 preferably consist of a metal that possesses both good electrical conductivity and good spring properties. Copper alloys with high spring constants are used, for example.

Another example of an EMV housing in which a ribbon cable according to the invention can be arranged is considered with reference to Figures 14 to 16. This EMV housing is assembled from two housing halves, only one of which is shown in Figures 14 to 16, namely, in a top view in Figure 14, in a narrow side view in Figure 15 and longitudinal side view in Figure 16.

An EMV housing half 79 shown in Figure 14 has a mounting space for a ribbon cable end (not shown) and a device connected to it, for example, a connector connected to the ribbon cable end, an electrical or electronic device or the like. The EMV housing half 79 on the right side in Figure 14 is provided with a cable insertion connector opened rightward. In the vicinity between the transition between the cable insertion connector 83 and the mounting space 81 the EMV housing half 79 is provided with two positioning protrusions 85 that are taken up in complementary positioning recesses during joining of the depicted EMV housing half 79 with the corresponding other EMV housing half. In this fashion a mated joining of the two EMV housing halves is ensured. However, a positioning protrusion and positioning recess can also be arranged in complementary fashion on each of the two EMV housing halves or a number other than two positioning protrusions and two complementary positioning recesses can be provided on each EMV housing half.

In addition, at least one of the two EMV housing halves is provided with at least one contact surface 87 that is pressed against at least one contact element 23 or 39a or 39b or 41 in the joined state of the two EMV housing halves so that electrical connection occurs between the EMV housing and the cable shield and the ribbon cable situated in it. Two contact surfaces 87 are provided in the variant depicted in Figure 14, which are situated on the inside of the positioning protrusion 85 and serve for electrical contacting of a contact claw 23 or a contact plate 41 or together cause contacting of a contact strip 39a or 39b.

Figures 17 and 18 show a ribbon cable 21 in an oblique view or in a narrow side top view, which is provided with a contact element in the form of an electrically conducting disk 89 that has a cable feed-through opening 91 for this purpose with a shape adapted to the outer contour of ribbon cable 21. According to Figure 18 the disk 89 is inserted into a disk receiving opening 93 of an electrically conducting wall 95, which can be a wall of an EMV housing, with electrical contacting of this wall 95. In this case the disk receiving opening 93

can be formed in a one-piece wall 95 or between two partial walls, for example, two housing parts. For better holding of disk 89 in disk receiving opening 93 the outside periphery of disk 89 can be provided with a groove 97.

Claims

1. Ribbon cable (21) with a series of electrical cable conductors (13s) embedded next to each other in an insulation material (15) with an electrical cable shield (17, 19) on at least one flat side of the insulation material (15) and with at least one contact element (23; 39a; 39b; 41) consisting of an electrically conducting material that is held on the outside of ribbon cable (21) during electrical contacting of cable shield (17, 19) and is suitable for electrical contacting by means of, for example, a contact spring (47) of a plug-in connector (43) that accepts the ribbon cable (21) or a contact surface of an EMV housing that accepts the ribbon cable (21).

2. Ribbon cable according to Claim 1, in which the contact element is formed by a folding contact (23; 29a) in the form of a roughly U-shaped folded material strip that lies with its U-bridge (35) on a longitudinal side edge of ribbon cable (21) and whose U-arms (37) are each connected to one of the two flat sides of ribbon cable (21).

3. Ribbon cable according to Claim 2, in which the folding contact is designed as a contact claw (23), both of whose U-arms (37) are short in comparison with the width of the flat side of ribbon cable (21).

4. Ribbon cable according to Claim 3, in which at least one contact claw (23) is arranged on each longitudinal side edge of ribbon cable (21).

5. Ribbon cable according to Claim 2, in which the folding contact is designed as a contact strip (39a) each of whose U-arms (37) have a length essentially equal to the flat side of ribbon cable (21).

6. Ribbon cable according to Claim 1, in which the contact element is designed as a contact strip (39b) with a base strip (36) whose length is essentially equal to the width of the flat side of ribbon cable (21) and with two arms (38) that can be folded with spacing from each long end of the base strip (36).



can be formed in a one-piece wall 95 or between two partial walls, for example, two housing parts. For better holding of disk 89 in disk receiving opening 93 the outside periphery of disk 89 can be provided with a groove 97.

Claims

1. Ribbon cable (21) with a series of electrical cable conductors (13s) embedded next to each other in an insulation material (15) with an electrical cable shield (17, 19) on at least one flat side of the insulation material (15) and with at least one contact element (23; 39a; 39b; 41) consisting of an electrically conducting material that is held on the outside of ribbon cable (21) during electrical contacting of cable shield (17, 19) and is suitable for electrical contacting by means of, for example, a contact spring (47) of a plug-in connector (43) that accepts the ribbon cable (21) or a contact surface of an EMV housing that accepts the ribbon cable (21).

2. Ribbon cable according to Claim 1, in which the contact element is formed by a folding contact (23; 29a) in the form of a roughly U-shaped folded material strip that lies with its U-bridge (35) on a longitudinal side edge of ribbon cable (21) and whose U-arms (37) are each connected to one of the two flat sides of ribbon cable (21).

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5. Ribbon cable according to Claim 2, in which the folding contact is designed as a contact strip (39a) each of whose U-arms (37) have a length essentially equal to the flat side of ribbon cable (21).

6. Ribbon cable according to Claim 1, in which the contact element is designed as a contact strip (39b) with a base strip (36) whose length is essentially equal to the width of the flat side of ribbon cable (21) and with two arms (38) that can be folded with spacing from each long end of the base strip (36).

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7. Ribbon cable according to Claim 1, in which at least one contact element is designed as a contact plate (41) that can be arranged at any site on the outside of ribbon cable (21).

8. Ribbon cable according to Claim 7, in which at least one contact plate (41) is arranged in the region of each of the two longitudinal side edges of ribbon cable (21).

9. Ribbon cable according to Claim 1, in which the contact element is formed from a disk (89) in whose inner region a cable feed-through opening (91) corresponding to the outside dimensions of ribbon cable (21) is provided and whose outside periphery can be accepted in a disk receiving opening (93) of an electrically conducting wall (95), preferably of an EMV housing.

10. Ribbon cable according to one of the Claims 1 to 9, in which a cable shield (17, 19) is arranged on each flat side of ribbon cable (21).

11. Ribbon cable according to Claim 10, in which at least one contact plate (41) is arranged on each of the two longitudinal side edges of ribbon cable (21) on each flat side of ribbon cable (21).

12. Ribbon cable according to one of the Claims 1 to 11, in which the contact element (23; 39a; 39b; 41) is constructed with an electrically conducting metal.

13. Ribbon cable according to Claim 12, in which the contact element (23; 39a; 39b; 41) is attached by pressing, for example in the form of a crimp connection, to ribbon cable (21).

14. Ribbon cable according to one of the Claims 1 to 13, in which a soldered connection exists between contact element (23; 39a; 39b; 41) and the corresponding cable shield (17, 19).

15. Ribbon cable according to one of the Claims 1 to 14, in which the contact element (23; 39a; 39b; 41) is provided with a hole (33) that serves for visual control of the soldering site and/or can cooperate as a snap-in opening with a complementary snap-in element of a connector housing (43) in which (additional) electrical contacting of the contact element (23; 39a; 39b; 41) is possible via the locking element if it is designed electrically conducting.

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16. Ribbon cable according to one of the Claims 1 to 13 or 15, in which the contact element (23; 39a; 39b; 41; 89) is made of electrically conducting plastic and is glued to the corresponding cable shield (17, 19) by means of an electrically conducting glue.

17. Ribbon cable according to one of the Claims 1 to 16, in which the cable shield (17, 19) forms the outside of the ribbon cable.

18. Ribbon cable according to one of the Claims 1 to 17, in which an insulation sheath is situated above cable shield (17, 19) having a sheath opening that exposes the cable shield (17, 19) at the attachment site of the contact element or each contact element (23; 39a; 39b; 41; 89).

19. Ribbon cable according to one of the Claims 1 to 18, in which each cable shield (17, 19) is formed from a shielding sheet of electrically conducting metal or plastic spanning the corresponding flat side of ribbon cable (21).

20. Ribbon cable according to one of the Claims 1 to 19, in which the at least one contact element (23; 39a; 39b; 41; 89) is arranged in the region of a cable end (25) that can be inserted into a plug-in connector housing (43).

21. Ribbon cable according to one of the Claims 1 to 20, in which the cable conductors (13s) are exposed in the region of the cable end (25) on a flat side of ribbon cable (21) and a stiffening layer (27) is arranged on the other flat side of ribbon cable (21).

22. Ribbon cable according to one of the Claims 1 to 21, in which at least one locking rib (29) running across the longitudinal direction of the ribbon cable is arranged on one of the two flat sides of ribbon cable (21) in the region of the fastening site of at least one contact element (23; 39a; 39b; 41; 89) for locking engagement with a complementary locking element (59) of a connector housing (43) that accepts ribbon cable (21).

23. Ribbon cable plug-in connector arrangement for plug-in connection of an electrical ribbon cable (21) according to one of the Claims 1 to 22, with a housing (43) of the plug-in connector arrangement that has a cable insertion opening (45) for acceptance of ribbon cable (21) and is provided with at least one contact spring (47) with a contact zone (51) for electrical contacting of at least one contact element (23; 39a; 39b; 41) mounted on ribbon cable (21), in which electrical connection can be produced via contact spring (47) between the cable shield (17, 19) connected to the contact element (23; 39a; 39b; 41) and a

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shielding potential conductor, especially ground potential conductor of a mating connector, an EMV housing or a printed circuit board.

24. Ribbon cable plug-in connector arrangement according to Claim 23 for a ribbon cable (21) with a contact strip (39a; 39b) according to Claim 5 or 6, with contact jaws (23) according to Claim 4 with contact plates (41) according to Claim 8, in which a contact spring (47) is arranged in the vicinity of each of the two transverse ends of cable insertion opening (45) so that they engage for electrical contact in the ribbon cable (21) inserted into cable insertion opening (45) on a main surface or on an outer longitudinal side of the contact strip (39a; 39b) or the corresponding contact claw (23) or the corresponding contact plate (41).

25. Ribbon cable plug-in connector arrangement according to Claim 23 or 24 for ribbon cable (21) with contact jaws (23) according to Claim 4 and with a locking rib (29) according to Claim 21, in which the locking rib (29) only extends over part of the ribbon cable width, in which a locking arm (61) cooperating with locking rib (29) in elastic fashion is arranged on the plug-in connector housing (43) with a locking shoulder (59) that protrudes above locking rib (29) in the locking state, the contact jaws (23) lie at the level of the locking rib (29) in the cable longitudinal direction and the contact zones (51) of contact spring (47) lie at roughly the level of the locking shoulder (59) in the longitudinal direction of the cable insertion opening (45).

26. Ribbon cable plug-in connector arrangement according to one of the Claims 23 to 25, in which the housing (43) is designed as a plug-in connector housing and has conductor contact receiving chambers to accept conductor contacts extending into the cable insertion opening (45) for electrical contacting of the individual exposed cable conductors (13s).

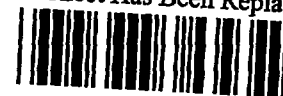
27. Ribbon cable plug-in connector arrangement according to one of the Claims 23 to 25, in which the housing (43) is an additional housing designed to accept a plug-in connector housing with conductor contact receiving chambers on which the locking shoulder (59) and at least one contact spring (47) are arranged.

28. EMV housing for a ribbon cable acceptable in it according to one of the Claims 1 to 22, in which the EMV housing is assembled from two housing parts (79) made



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of an electrically conducting material, at least one of which is provided with at least one contact surface (87) that is in electrical contact, preferably in press contact, with at least one contact element (23; 39a; 39b; 41) of ribbon cable (21) in the ribbon cable (21) situated between the two assembled EMV housing parts (79).

29. EMV housing for a ribbon cable acceptable in it according to Claim 9, in which the EMV housing is assembled from two housing parts (95) made of an electrically conducting material, between which a disk receiving opening (93) corresponding to the outside contour of disk (89) is formed in the assembled state so that an electrical connection can be produced via disk (89) between cable shield (17, 19) and the wall.

Summary

Ribbon cable (21) with cable conductors (13s) arranged next to each other in series with a cable shield (17, 19) and with at least one contact element (23) provided for electrical contacting of cable shield (17, 19) on the outside of ribbon cable (21) and for electrical contacting by means of a contact spring of a plug-in connector that accepts ribbon cable (21) or a contact surface of an EMV housing that accepts ribbon cable (21). Electrical connection between cable shield (17, 19) and a plug-in connector or EMV housing can be produced via the contact spring or the contact surface.

(Figure 5)

