

RIGHT-ANGLE CONNECTOR HAVING A SHIELDING AND METHOD FOR
PRODUCING THE SHIELDING OF THE RIGHT-ANGLE CONNECTOR

The invention relates to a right-angle connector having a shielding and a method for producing the shielding of the right-angle connector.

Prior art

The utility model according to DE 201 14 581 U1 discloses a connector for a data cable according to US Telecommunications Standard FCC 68 500 which is designated as RJ 45 connector. In the central and rear region of the connectors, the contact elements are surrounded by a shielding which is open at the back which is made from a sheet metal part, for example, by bending. The shielding covering the side surfaces and the upper and lower side of the connector housing can be simply fabricated since the connector is implemented as a straight connector.

DE 692 21 560 T2 describes a connector which can form the corresponding connector to the connector described previously according to DE 201 14 581 U1. A shielding plate is provided which is bent around the connector housing in the upper region and in the rear region. No shielding is provided on the lower side of the contact elements.

DE 603 14 140 T2 describes an impedance-tuned connector which has a two-part shielding, where a first shielding element completely encloses the contact elements in the front region of the connector. The entire connector including the front shielding element is surrounded by an outer shielding plate which has embossings and recesses. In the rear region of the contact elements which is provided for soldering to conductors of a printed circuit board, the shielding element has recesses which allow the contact elements to be guided out from the shielding region.

DE 602 08 885 T2 describes a connector containing a shielding housing which encloses the side surfaces and the upper side. A shielding is also provided on the underside which in a first connector is disposed directly on the printed circuit board and in a corresponding connector is disposed on the underside of the plastic connector housing. On the rear side of the connector the shielding element has recesses through which the contact elements are guided from the shielding region.

On page 81 of the Catalogue E 074482 of the applicant Erni, 08/06, Edition 4, which can be viewed at www.erni.com, a right-angle connector in accordance with IEC 61076-4-101 is described in which shieldings are provided both on the upper side and on the underside, in which recesses are cut out in the front connector-side region both on the upper side and on the underside and the remaining bridges are curved out to form springs. The lower shielding encloses the underside of the end pieces of the contact elements provided for soldering to conductors of the printed circuit board so that the known connector can only be pushed

laterally onto the printed circuit board because in the mounted state of the connector the lower shielding is positioned on the underside of the printed circuit board and completely covers the contact region there.

DE 695 24 935 T2 discloses a shielded connector arrangement which provides for welding of shielding elements to one another. A straight connector forms the basis. The welded connection is provided between the shielding elements which are freely accessible on the outer side of the connector so that a soldered, a glued or another type of fixing possibility are proposed alternatively to the welded connection. The connection can also be completely omitted and held simply in its position by the stability of the completely assembled connector arrangement.

It is the object of the invention to provide a right-angle connector having a shielding which is easy to manufacture and a method for manufacturing the shielding of the right-angle connector which make it possible to achieve an effective shielding up to high frequencies of the signals conducted via the right-angle connector.

The objects are achieved in each case by the features specified in the equivalent claims.

Disclosure of the invention

The right-angle connector according to the invention comprises a plurality of contact elements which are arranged next to one another and provided at the back of

the right-angle connector for soldering to conductors of a printed circuit board, comprising an upper shielding arranged at least on the upper side of the right-angle connector and a lower shielding arranged on the lower side is characterised in that the lower shielding contains a lower shielding element on the connector side, the shielding surface of said element being oriented in the connecting direction, the lower shielding furthermore contains a separate, rear lower shielding element, and the lower shielding elements are electrically connected to each other.

The right-angle connector according to the invention makes it possible to achieve a high-quality shielding. In particular, a homogeneous inductance layer is achieved inside the connector. The right-angle connector according to the invention is particularly suitable for conducting high-frequency signals. For example, a digital signal can be conducted with high quality at a data rate up to 10 Gigabit, a high signal integrity being ensured at the same time. The right-angle connector according to the invention is therefore especially suitable for signal-processing arrangements in which for example, printed circuit boards are to be connected to a backplane.

As a result of the at least two-part design of the lower shielding, the shielding of the right-angle connector according to the invention can be assembled particularly easily. At least the rear lower shielding element can be positioned at least partially in a connector housing before making the electrical connection during the assembly. Despite its high-quality design, the right-angle connector

according to the invention can be manufactured cost-effectively. The right-angle connector according to the invention is therefore particularly suitable for cost-sensitive series production.

Advantageous further developments and embodiments of the right-angle connector according to the invention are obtained from dependent claims.

A first embodiment provides that the shielding surface of the rear lower shielding element is oriented perpendicular to the connecting direction. This embodiment is particularly suitable for a 90° right-angle connector.

Another embodiment provides that the shielding surface of the rear lower shielding element is oriented at least in sections parallel to the contact elements. With this measure, a high quality of the right-angle connector with respect to the homogeneous inductance profile inside the right-angle connector is achieved even for angles not equal to 90°.

One embodiment provides that the rear lower shielding element is guided at least approximately as far as the soldering connection of the contact elements. Therefore a complete shielding of the contact elements as far as the printed circuit board is achieved on the one hand. On the other hand, the printed circuit board can be fitted from above with the right-angle connector according to the invention.

A particularly advantageous embodiment provides that the lower shielding elements each have connecting surfaces which are welded together for the electrical connection of the lower shielding elements. A particularly easy assembly of the right-angle connector according to the invention is possible with this measure.

One embodiment provides the implementation of the connecting surfaces as flat connecting surfaces. It is preferably provided that the connector-side lower shielding element has a homogeneous connecting surface without recesses or cutouts, which extends over a plurality of contact elements, preferably over all the contact elements. This measure also helps to achieve the completest possible shielding of the contact elements.

As already mentioned, at least one lower shielding element can be disposed at least partially inside a connector housing. One embodiment provides that the rear lower shielding element is disposed at least in the area of the connection to the connector-side lower shielding element inside the connector housing.

A further development of this element provides that the rear lower shielding element has a plurality of separately formed connecting surfaces and that the connector housing has separate recesses corresponding to said connecting surfaces for guiding and at least partially accommodating the rear lower shielding element.

Another embodiment provides that the upper shielding contains a connector-side upper and rear upper shielding

element which are electrically connected to one another. The at least two-part configuration enables a simple realisation of the shielding, where for example the connector-side upper shielding element can be disposed at least partially inside the connector housing.

An advantageous further development of this embodiment provides that the upper shielding elements have connecting surfaces which are welded together for the electrical connection of said upper shielding elements. As a result, both the lower and the upper shielding elements can be processed with the same technology.

A further embodiment provides that at least one connector-side shielding element has an expansion offset and that the upper and/or lower connector-side shielding element has spring tongues for clamping a corresponding shielding element of a corresponding right-angle connector. The at least one expansion offset allows one connector to dip into the corresponding connector. The spring tongues on the one hand improve the electrical contact between the two connectors and on the other hand provide a clamping force in the connected state of the connector

The method according to the invention for producing the right-angle connector provides that the weld connection of at least the lower shielding elements is made by means of laser welding. Laser welding offers the possibility of making electrical contact between the lower shielding elements even in barely accessible places inside the connector housing. If the connecting surfaces of the lower shieldings lie inside the connector housing, the laser beam

can be guided up to the connection point through an opening provided in the connector housing.

According to one embodiment of the method according to the invention, the use of an in particular pulsed neodymium YAG laser is provided.

An advantageous embodiment of the right-angle connector according to the invention which is provided in particular in conjunction with the method of manufacture according to the invention by means of laser welding provides at least one opening in at least one connecting surface of the lower and/or upper rear shielding element, which is preferably designed as a hole. The openings enable a precise focusing of the laser beam. In particular, optimal welding with a minimal amount of heat is achieved whereby not only the welded shielding elements but in particular the connector housing made of plastic are protected during the welding.

Other advantageous further developments and embodiments of the right-angle connector according to the invention and the method are obtained from the following description. Exemplary embodiments of the invention are shown in the drawings and described in detail in the following description.

In the figures:

Figure 1 shows a sectional view through a right-angle connector known from the prior art,

Figure 2 shows a first view of the front and upper side of a right-angle connector according to the invention,

Figure 3 shown an exploded view of the right-angle connector shown in Figure 2,

Figure 4 shows a second view of the lower and rear side of the right-angle connector,

Figure 5 shows an exploded view of the right-angle connector shown in Figure 4,

Figure 6 shows a simplified sectional view through the right-angle connector,

Figure 7 shows a first view of the rear and upper side of a corresponding right-angle connector,

Figure 8 shows an exploded view of the corresponding right-angle connector shown in Figure 7,

Figure 9 shows a second view of the rear and lower side of the corresponding right-angle connector,

Figure 10 shows an exploded view of the corresponding right-angle connector shown in Figure 9,

Figure 11 shows a simplified sectional view through the corresponding right-angle connector shown in Figure 7,

Figure 12 shows an isometric view of shielding elements of the corresponding right-angle connector shown in Figure 7 which shows a special configuration of connecting surfaces,

Figure 13 shows a simplified sectional view through the right-angle connector corresponding to Figure 6 which shows a corresponding configuration of connecting surfaces shown in Figure 12 and

Figure 14 shows an isometric view of a right-angle connector in the connected state with a corresponding right-angle connector.

Figure 1 shows a sectional view through a right-angle connector 1 described in the catalogue E 074482 of the

Figure 1 shows a sectional view through a right-angle connector 1 described in the catalogue E 074482 of the applicant specified initially, in which a plurality of superposed contact elements 2 is provided, these being provided on the rear lower side 3 of the right-angle connector 1 for soldering to conductors of a printed circuit board 4 which are not visible.

The contact elements 2 are accommodated in an insulating connector housing 5 that is shielded by a shielding 6, 7 which is shown simplified. The shielding is composed of an upper shielding 6 and a lower shielding 7. In the front connector-side region, recesses are cut out from the shielding 6, 7 both on the upper side and on the underside and the remaining bridges are curved outwards to form spring tongues 8, 9 which enable a reliable contacting and clamping of the shielding of a corresponding connector. The lower shielding 7 encloses the underside of the end pieces 10 of the contact elements 2 provided for soldering to the conductors of the printed circuit board 4, not shown, and in the mounted state of the right-angle connector 1 covers the entire contacting region on the underside of the printed circuit board 4.

Figure 2 shows a right-angle connector 20a according to the invention which contains a plurality of adjacently disposed non-visible contact elements where in the exemplary embodiment shown, two superposed rows of contact elements are further provided. The right-angle connector 20a according to the invention contains an upper shielding 22a which in the exemplary embodiment shown is composed of a

connector-side upper shielding element 24a with a shielding surface 25a and a rear upper shielding element 26a.

In the exemplary embodiment shown, the transition between the upper shielding elements 24a, 26a lies approximately at the centre of the surface relative to the connecting direction 28.

According to one exemplary embodiment, it is provided that the rear upper shielding element 26a in connecting direction 28 has separately formed connecting surfaces 30a which make the electrical connection to the connector-side upper shielding element 24a in the mounted state of the right-angle connector 20a. Optionally, separately formed connecting surfaces 32a can also be provided on the connector-side upper shielding element 24a, which correspond to the connecting surfaces 30a of the rear upper shielding element 26a.

The right-angle connector 20a according to the invention further contains a lower shielding 34a which is composed of a connector-side lower shielding element 36a with a shielding surface 37a and a rear lower shielding element 38a, the shielding surface 37a of the connector-side lower shielding element 36a being oriented at least approximately in connecting direction 28.

The lower shielding 34a can only be seen in outline in the view of the front and upper side of the right-angle connector 20a according to the invention shown in Figure 2. For illustration an exploded view of the right-angle connector 20a shown in Figure 2 is therefore shown in

Figure 3. Those parts shown in Figure 3 which agree with the parts shown in Figure 2 are each designated with the same reference numbers. This agreement also applies to the following figures.

Figure 3 illustrates in particular the two-part configuration of the lower shielding 34a with the connector-side lower shielding element 36a and the rear lower shielding element 38a.

Figure 3 shows an advantageous embodiment of the rear lower shielding element 38a with a shielding surface 39a which has separately formed connecting surfaces 40a which are provided to make the electrical connection with the connector-side lower shielding element 36a. For this purpose, the connector-side lower shielding element 36a has at least one corresponding connecting surface 42a wherein in the exemplary embodiment shown a homogeneous surface without cutouts or recesses is provided, extending over the entire rear end of the connector lower shielding element 36a. According to one embodiment it can be provided that the connector-side lower shielding element 36a also has separately formed connecting surfaces corresponding to the separately formed connecting surfaces 40a of the rear lower shielding element 38a.

Figure 3 gives a complete view of the connector housing 44a in which the non-visible contact elements are accommodated.

The two-part configuration of the lower shielding 34a enables both the connector-side lower shielding element 36a and also in particular the rear lower shielding element 38a

to be arranged at least partially inside the connector housing 44a, where the electrical connection between the two lower shielding elements 36a, 38a can only be made after insertion into the connector housing 44a.

Figure 4 shows a second view of the lower and rear side of the right-angle connector 20a according to the invention. Figure 4 shows in particular the positioning of the connecting surfaces 40a of the rear lower shielding element 38a which in the mounted state of the rear lower shielding element 38a are positioned in recesses 46a of the connector housing 44a. The second view shown in Figure 4 gives a view of the solder connections 48a of the contact elements 50a accommodated in the connector housing 44a.

To illustrate the assembly in particular of the rear lower shielding element 38a, Figure 5 shows an exploded view of the right-angle connector 20a shown in Figure 4. Figure 5 illustrates in particular the arrangement of the recesses 46a in the connector housing 44a.

The right-angle connector 20a according to the invention in particular makes it possible to achieve a high-quality shielding 22a, 34a. In particular a homogeneous inductance layer is achieved inside the right-angle connector 20a. As a result, the right-angle connector 20a according to the invention is particularly suitable for conducting high-frequency signals. The right-angle connector 20a according to the invention is particularly suitable for connections between signal processing arrangements where digital signals can be conducted via the connection at data rates up to 10 Gigabits with high signal integrity. The

frequency-dependent signal damping only occurs at very high frequencies. In particular a position-dependent constant wave impedance can be achieved inside the right-angle connector 20a according to the invention as a result of the high quality shielding 22a, 34a due in particular to the two-part configuration of the lower shielding 34a which particularly contributes to minimising position-dependent signal reflections and signal falsifications caused thereby.

Furthermore, as a result of the two-part design of the lower shielding 34a, easy assembly of the lower shielding 34a is possible, particularly when the connector-side lower shielding element 36a and in particular the rear lower shielding element 38a are disposed at least partially inside the connector housing 44a.

According to an advantageous embodiment forming the basis of Figures 2-5, it is provided that the shielding surface 39a of the rear lower shielding element 38a is oriented at least approximately perpendicular to the connecting direction 28. This embodiment is therefore particularly suitable for a 90° right-angle connector 20a.

Another embodiment provides that the shielding surface 39a of the rear lower shielding element 38a is oriented parallel to the contact elements 50a at least in sections. As a result, a high quality of the right-angle connector 20a with regard to the homogeneous inductance profile inside the right-angle connector 20a is even achieved at angles not equal to 90° provided that an angle of not equal to 90° is provided.

In the exemplary embodiment of the right-angle connector 20a according to the invention shown, it is assumed that the rear lower shielding element 38a is guided at least approximately as far as the solder connection 48a of the contact elements 50a. As a result, a complete shielding of the contact elements 50a is achieved as far as the printed circuit board not shown in detail. Furthermore, as a result of this embodiment the printed circuit board with the right-angle connector 20a according to the invention can be fitted from above.

A quite particularly advantageous embodiment provides that the connecting surface 40a of the rear lower shielding element 38a or the connecting surface 42a of the connector-side lower shielding element 36a are welded together to make the electrical connection of the shielding elements 36a, 38a.

Such a welded connection can advantageously be provided for welding the upper shielding elements 24a, 26a provided that the upper shielding 22a is configured to be multi-part. In this case, the welded connection will be made between the optionally provided connecting surfaces 30a of the rear upper shielding element 26a with the corresponding connecting surface 32a of the connector-side upper shielding element 24a.

The method according to the invention for producing the right-angle connector 20a according to the invention provides for making the welded connection of the lower shielding elements 36a, 38a and optionally the upper

shielding elements 24a, 26a by means of laser welding. Laser welding in particular makes it possible to make the welded connection if, during assembly, the lower shielding elements 36a, 38a are already located inside the connector housing 44a to make the electrical connection.

In this case the welding can be carried out through the recesses 46a in the connector housing 44a.

If there is a visible connection from the front side of the right-angle connector 20a in connecting direction 28 onto the upper side of the connecting surface 42a of the connector-side lower shielding element 36a, the welding of the shielding elements 36a, 38a of the lower shielding 34a can be made through the contact chambers from the front side of the right-angle connector 20a. In particular a neodymium YAG laser is provided for producing the welding. Such a laser has the advantage of a good energy meterability. Pulsed operation with pulse durations which can extend down into the femtosecond range is particularly advantageous. This laser is also suitable for the surface treatment of the shielding elements 24a, 26a, 36a, 38a.

The simplified sectional view shown in Figure 6 through the right-angle connector 20a according to the invention illustrates the positioning in particular of the two shielding elements 36a, 38a of the lower shielding 34a.

The at least one connecting surface 40a of the rear lower shielding element 38a abuts against the corresponding connecting surface 42a of the connector-side lower shielding element 36a. The two connecting surfaces 40a, 42a

can be curved corresponding to one another. In the exemplary embodiment shown, a flat surface is assumed. The specific configuration of the connecting surfaces 40a, 42a can be specified depending on the predefined distance from the contact elements 50a which is shown in simplified form in Figure 6. In order to achieve a homogeneous position-dependent induction profile inside the right-angle connector 20a according to the invention, the lower shielding elements 36a, 38a are preferably guided parallel to at least one contact element 50a, at least in sections.

Figure 6 furthermore illustrates the electrical connection between the upper shielding elements 24a, 26a if the upper shielding 22a is configured to be multi-part. The connecting surfaces 30a of the rear upper shielding element 26a are preferably welded together with the at least one shielding surface 25a of the connector-side upper shielding element 24a. Naturally, the method according to the invention for laser welding can also be used at this position.

In the exemplary embodiment shown according to Figure 6, the contact elements 50a have contact springs 52 on the connector-side front end.

Figures 7-11 shows a corresponding right-angle connector 20b according to the invention which has components the same as the right-angle connectors 20a according to the invention, shown initially, the corresponding components being provided with the index "b" instead of the index "a" in the reference numbers.

The right-angle connector 20b according to the invention according to Figure 7 also has a connector housing 44b which is surrounded by an upper shielding 22b and by a lower shielding 34b. The upper shielding 22b contains a connector-side front shielding element 24b and a rear upper shielding element 26b, where the rear upper shielding element 26b should have separately formed connecting surfaces 30b for electrical contact to the connector-side upper shielding element 24b.

To illustrate the individual components of the right-angle connector 20b according to the invention, Figure 8 shows an exploded view of the right-angle connector 20b reproduced in Figure 7. In contrast to the configuration in the first right-angle connector 20a according to the invention, in the corresponding right-angle connector 20b, instead of a homogeneous connecting surface 42a, separately formed connecting surfaces 42b are provided on the connector-side front shielding element 36b which correspond to the separately formed connecting surfaces 40b of the rear lower shielding element 38b. Furthermore, recesses from which spring tongues 60 are bent out are provided at the connector-side end of the connector-side upper shielding element 24b.

Figure 9 shows a view of the rear and lower side of the corresponding right-angle connector 20b in the mounted state. In the corresponding right-angle connector 20b, the connecting surfaces 40b of the rear lower shielding element 38b are also positioned in recesses 46b of the connector housing 44b.

To illustrate the individual components, Figure 10 again shows an exploded view of the corresponding right-angle connector 20b reproduced in Figure 9.

The simplified sectional view shown in Figure 11 through the corresponding right-angle connector 20b according to the invention again illustrates the positioning in particular of the two shielding elements 36b, 38b of the lower shielding 34b.

Instead of the contact springs 52, the corresponding plug connector 20b has contact blades 54.

The electrical connection of the connecting surfaces 40b, 42b of the lower shielding 34b and optionally the connecting surfaces 30b, 32b of the upper shielding 22b are again advantageously made using the laser welding method according to the invention.

The plane of intersection forming the basis of Figure 11 is selected in such a manner that one of the spring tongues 60 of the connector-side lower shielding element 36b can be seen. Furthermore, Figure 11 shows an embodiment of the connector-side upper shielding element 24b and/or the connector-side lower shielding element 36a, 36b according to which at least one lower shielding element 24b has an offset 62, 64 which makes it possible to accommodate the initially described right-angle connector 20a according to the invention.

Figure 12 shows an isometric view of an advantageous embodiment of the rear shielding elements 26a, 26b, 38a, 38b, where in the exemplary embodiment shown in Figure 12 as an example, the upper shielding 22b of the corresponding right-angle connector 20b shown in Figures 7-11 is depicted. The embodiment relates to recesses 61b provided in the connecting surfaces 30b of the rear upper shielding element 26b. In the exemplary embodiment shown two recesses 61b are provided as an example in each connecting surface 30b. The recesses 61b are preferably designed as holes so that a simple and inexpensive implementation is possible.

The recesses 61b allow a precise focussing when laser welding. As a result, an optimal welding of the rear upper shielding element 26a with the front upper shielding element 24b is achieved, where only a minimal amount of heat needs to be supplied. As a result, not only the shielding elements 26b, 24b to be welded together but in particular the connector housing 44b shown in Figure 12 are subjected to very little thermal loading.

Advantageously such recesses 61b are also provided in the connecting surfaces 40b of the rear lower shielding element 38b shown in Figure 8.

A corresponding opening in the rear lower shielding element 38a, 38b is shown as an example in Figure 13 for the example of the right-angle connector 20a, where Figure 13 at least partially corresponds to the sectional view shown in Figure 6. Figure 13 shows an opening 61a cut in the rear upper shielding element 26a of the upper shielding 22a of the right-angle connector 20a. Figure 6 further shows a cut

opening 62a provided in the connecting surface 40a of the rear lower shielding element 38a.

Corresponding openings 62b, not shown in detail, can advantageously also be provided in the connecting surfaces 40b of the rear lower shielding element 28b of the corresponding right-angle connector 20b.

Figure 13 illustrates that the laser beam produced during the laser welding passes through the openings 61a, 61b, 62a, 62b, impinges upon the connecting surfaces 32a, 32b, 42a, 42b of the front shielding elements 24a, 24b, 36a, 36b and can perform the welding.

Figure 14 shows an isometric view of a right-angle connector 20a according to the invention in the connected state with a corresponding right-angle connector 20b according to the invention. In the exemplary embodiment shown, openings 61a are provided in the connecting surfaces 30a of the rear upper shielding element 26a of the right-angle connector 20a and openings 61b are provided in each of the connecting surfaces 30b of the rear upper shielding element 26b of the corresponding right-angle connector 20b. Preferably the openings 62a, 62b described are also provided in each of the connecting surfaces 40a, 40b of the rear lower shielding element 38a, 38b not visible in Figure 14.

Not only the openings 61b in the connecting surfaces 30b of the rear upper shielding element 26b shown as an example in Figure 12 but all the openings 61a, 61b, 62a, 62b of the rear upper and lower shielding elements 26a, 26b, 38a, 38b

are expediently designed as holes with a view to the particularly simple and therefore cost-effective implementation. The hole diameter can, for example, be 0.2 mm.

Figure 1

Prior art

CLAIMS

1. A right-angle connector comprising a plurality of contact elements (50a, 50b) which are arranged next to one another and provided at the back of the right-angle connector (20a, 20b) for soldering to conductors of a printed circuit board (5), comprising an upper shielding (22a, 22b) arranged at least on the upper side of the right-angle connector (20a, 20b) and a lower shielding (34a, 34b) arranged on the lower side, characterised in that the lower shielding (34a, 34b) contains a lower shielding element (36a, 36b) on the connector side, the shielding surface (37a, 37b) of said element being oriented in the connecting direction (28), the lower shielding (34a, 34b) furthermore contains a separate, rear lower shielding element (38a, 38b), and the lower shielding elements (36a, 36b, 38a, 38b) are electrically connected to each other.
2. The right-angle connector according to claim 1, characterised in that the shielding surface (39a) of the rear lower shielding element (38a) is oriented perpendicular to the connecting direction (28).
3. The right-angle connector according to claim 1, characterised in that the shielding surface (39a) of the rear lower shielding element (38a) is oriented at least in sections parallel to the contact elements (50a, 50b).

4. The right-angle connector according to claim 1, characterised in that the rear lower shielding element (38a) is guided at least approximately as far as the soldering connection (48a, 48b) of the contact elements (50a, 50b).
5. The right-angle connector according to claim 1, characterised in that the lower shielding elements (36a, 38a, 36b, 38b) have connecting surfaces (40a, 42a, 40b, 42b) which are welded together for the electrical connection of the lower shielding elements (36a, 36b, 38a, 38b).
6. The right-angle connector according to claim 5, characterised in that the connecting surfaces (40a, 42a, 40b, 42b) are flat connecting surfaces (40a, 42a, 40b, 42b).
7. The right-angle connector according to claim 5, characterised in that at least one opening (62a, 62b) is provided in at least one connecting surface (40a, 40b) of the rear lower shielding element (38a, 38b).
8. The right-angle connector according to claim 1, characterised in that the lower shielding element (36a, 36b) on the connector side has a homogeneous connecting surface (42a, 42b) without recesses which extends over a plurality of contact elements (50a, 50b).

9. The right-angle connector according to claim 1, characterised in that the rear lower shielding element (38a, 38b) is disposed at least in the area of the connection to the connector-side lower shielding element (36a, 36b) inside a connector housing (44a, 44b) which at least partially accommodates the contact elements (50a, 50b) of the right-angle connector (20a, 20b).
10. The right-angle connector according to claim 9, characterised in that the rear lower shielding element (38a, 38b) has a plurality of separately formed connecting surfaces (40a, 40b) and that the connector housing (44a, 44b) has separate recesses (46a, 46b) corresponding to said connecting surfaces (40a, 40b) for guiding and at least partially accommodating the rear lower shielding element (38a, 38b).
11. The right-angle connector according to claim 1, characterised in that the upper shielding (22a, 22b) contains a connector-side upper and rear upper shielding element (24a, 26a, 24b, 26b) which are electrically connected to one another.
12. The right-angle connector according to claim 10, characterised in that the upper shielding elements (24a, 26a, 24b, 26b) have connecting surfaces (30a, 32a, 30b, 32b) which are welded together for the electrical connection of said upper shielding elements (24a, 26a, 24b, 26b).

13. The right-angle connector according to claim 12, characterised in that an opening (61a, 61b) is provided in at least one connecting surface (30a, 30b) of the rear upper shielding element (26a, 26b).
14. The right-angle connector according to claim 7 and 13, characterised in that the opening (61a, 61b, 62a, 62b) is designed as a hole.
15. The right-angle connector according to claim 1 or 10, characterised in that at least one connector-side shielding element (24a, 36a, 24b, 36b) has an expansion offset and that the upper and/or lower connector-side shielding element (24a, 36a, 24b, 36b) has spring tongues (60) for clamping a corresponding shielding element (24a, 36a, 24b, 36b) of a corresponding right-angle connector (20a, 20b).
16. A method for producing the right-angle connector according to any one of the preceding claims characterised in that the weld connection of at least the lower shielding elements (26a, 36a, 26b, 36b) is made by means of laser welding.
17. The method according to claim 13, characterised in that a neodymium YAG laser is used for the laser welding.
18. The method according to claim 14, characterised in that the neodymium YAG laser is operated in pulsed mode.