

ELECTRICAL CONNECTOR

The invention relates to an electrical connector having a plug part and a socket part, which socket part has at least one outer housing and an inner part which can be rotated relative to said outer housing, wherein the inner part can be rotated by means of a plug part inserted into the socket part.

Such electrical connectors are known from EP 1 344 286 B1 or EP 1 208 619 B1, for example.

The previously known inner part is borne in the socket part so as to be rotatable between an off position and an on position. An essentially pin-shaped locking part is borne so as to be displaceable between an indented blocking position and a release position projecting from the inner part. In the release position of the locking device, the inner part can be rotated between off position and on position. This rotation takes place via the inserted plug part.

In the aforementioned publications, corresponding to the connector, before detachment the plug part is connected so as to be currentless, since a removal of the plug part may then only take place if it has been rotated into the off position beforehand.

However, in this prior art the current inside the electrical connector is interrupted, whereas no direct connection or disconnection of the load associated with the connector takes place. This means that, in the electrical connector, the properties of plugging in and switching on/off are combined.

The invention is based on the object of improving an electrical connector of the aforementioned type to the effect that this simply enables a direct deactivation of the associated load, and different loads can possibly also be connected with other possibilities for connection and disconnection via the same connector.

This object is achieved by the features of claim 1. According to the invention, the inner part is designed as an adapter part. On an outside facing away from the plug part, this adapter part has an adapter opening for the rotationally fixed reception of a switching element for connecting/disconnecting a load. This means that, with corresponding relative rotation of plug part and socket part, the switching element is also moved by means of the adapter part in such a way that the load is connected or, respectively, disconnected. The adapter part has the adapter opening for this purpose. This is adapted to the switching element of the load. If other loads with other switching elements are used, the adapter part may be replaced in a simple manner. The adapter part is of similar design in each instance except for the corresponding adapter opening, so that it can always be arranged as an inner part in the outer housing of the socket part.

The possibility thereby likewise exists that this adapter part is used in the electrical connectors according to EP 1 344 286 B1 or EP 1 208 619 B1.

According to the invention, a direct connection and disconnection of the load takes place in this way, wherein this may take place in addition to switching the electrical connector into a currentless state according to the aforementioned European patent documents. For example, this may take place with a time offset, so that a connection and disconnection of the load take place, and then a switching of the electrical connector into a currentless state.

In order to be able to adapt the switching element and adapter opening to one another in a simple manner, these may be designed to be complementary to one another. In one exemplary embodiment, for example, the switching element is a switch shaft with in particular an angular cross section, wherein the adapter opening has a complementary angular opening cross section. Such an angular cross section may be triangular, rectangular, or polygonal. Elliptical or oval cross sections which enable a corresponding rotationally fixed reception of the switching element in the adapter opening sections are likewise conceivable.

In order to be able to connect the adapter opening with the switching element in a simple manner during the assembly of the connector, or during arrangement of the socket part at the load or in proximity to the load, the switching element as an on/off switch may project from a rear switch part in the direction of the adapter part. This also relates in particular to the switch shaft, which protrudes as a switching element and engages with the adapter opening when socket part and rear switch part are assembled.

For arranging and exchanging the adapter part, this can be arranged so as to be detachable on or in the outer housing of the socket part.

It is possible for the adapter part to be arranged in the socket part, independently of corresponding plug contacts of the plug part, so that the adapter part is, for example, only part of the inner part, wherein the inner part further has corresponding receivers for the plug contacts. A co-rotation of the inner part, and thus of the adapter part, is thereby possible upon rotation of the plug relative to the socket part. However, in order to simplify the design, the adapter part may have through-openings for essentially pin-shaped plug contacts of the plug part. When the plug part is mounted on the socket part, these through-openings receive the plug contacts and, when the plug part is rotated relative to the socket part, the adapter part is directly rotated as well.

In this instance, it is likewise possible that the adapter part has insertion openings for electrically contacting the plug contacts. These insertion openings are aligned with the through-openings, wherein the through-openings may also be ends of the insertion openings. Corresponding numbers of insertion openings are arranged depending on the connector used; see for example two-, three-, five-, or multipole connectors. This means that an insertion opening with through-opening in the adapter part is correspondingly designed for each plug contact.

Given such an embodiment, further electrical contacts are also not necessary for contacting the plug contacts, since this contacting already takes place via the insertion openings of the adapter part.

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The rear switch part is associated with a corresponding load and serves to connect and disconnect the load. For this purpose, the rear switch part may have a switching device, wherein this may be associated with the switching element for shifting the switching device between on position and off position.

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The relative rotation of plug part and socket part for switching on and off may have different angles of rotation as required. For example, rotation angles of from 0° to 120°, preferably from 0° to 100°, and particularly preferably from 0° to 60° or 0° to 90°, are preferred for shifting the switching element. This means that, if the plug part is rotated by the corresponding rotation angle relative to the socket part, a connection or, respectively, disconnection of the load takes place via switch axle or switching element, and accordingly via switching device of the rear switch part.

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20 In at least the off position of the plug part relative to the socket part, a locking of both should preferably take place, which may take place via a corresponding locking device, for example. An example of such a locking device between plug part and socket part is a bayonet catch.

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In order to moreover be able to recognize the corresponding position of plug part relative to socket part, and if applicable also to give an indication of the connection or disconnection of the load, plug part and/or socket part may have rotational adjustment markings. These indicate, for example, that the plug part is still loosely inserted into the socket part without a connection of the load having already taken place. In another position of plug part and socket part, an indication of the corresponding locking of plug part relative to socket part, and of the connection of the load, takes place via the rotational adjustment marking.

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Further rotational adjustment markings can be used. For example, on the one hand the connection/disconnection of the load and on the other hand the switching of the connector into the currentless state may be indicated by such a rotational adjustment marking; see in this context again EP 1 344 286 B1 or EP 1 208 619 B1.

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40 In order to determine in a simple manner in which relative rotational position of plug part and socket part a connection of the load takes place, at least one rotational adjustment marking may be designed as an end stop. It is of course also possible that the disconnection position is characterized by such an end stop, wherein then the plug part can be removed from the socket part in this off position.

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It has already been pointed out above that the adapter part has corresponding insertion openings for electrically contacting the plug contacts. Since the adapter part is rotated relative to the rear switch part and thus to the switching element, in this context it proves to be advantageous if electrical connection lines are formed between insertion openings and switching device for length compensation while plug part and socket part are being rotated relative to one another. For example, this may take place via a corresponding length of the electrical connection lines that compensate for the corresponding rotary movements. The electrical connection lines may be flexible cables made up of fine wires, wherein a corresponding connection technology between electrical connection lines and switching element on the one hand and insertion openings on the other hand ensures a durable connection with corresponding functionality.

The corresponding socket part may be composed of a plurality of individual parts. For example, a spacer may be provided that in particular extends essentially between mounting flange and rear switch part. The adapter is at least partially inserted into this spacer. The spacer may serve in particular for detachable fastening of the rear switch part. For this purpose, corresponding fastening channels that, for example, serve for screwing down rear switch part and spacer may be provided along the periphery of the spacer or also in the material of the spacer. This means that the spacer on the one hand fixes the adapter in the direction of the rear switch part and simultaneously serves as a connector between attachment flange and rear switch part. At a front end opposite the rear switch part, the spacer may moreover have a guide sleeve which guides a rotation of the adapter part.

Furthermore, the possibility also exists that a fixing piece is arranged in the rear end of the adapter part, said rear end facing toward the rear switch part. This serves to fix the insertion sockets introduced there and corresponding lines in the adapter part. In order to hold the fixing piece accordingly in the adapter part, said fixing piece may have spacers that extend radially outward. In order to correspondingly allow insertion of the switch shaft into the adapter part, the fixing piece may have a longitudinal switch shaft opening through which the switch shaft can be introduced up to the corresponding adapter opening.

It is likewise conceivable that the longitudinal switch shaft opening has at least two different cross-sectional areas. For example, this may serve to adapt different shaft geometries with the fixing piece both on the front side and on the back side.

The invention furthermore relates to a socket part of an electrical connector according to the preceding embodiments; see for example a socket part with an outer housing, adapter part as inner part, adapter opening etc.

In the following, an advantageous exemplary embodiment of the invention will be explained in more detail with reference to Figures attached in the drawing.

Shown are:

- Fig. 1 a perspective view of an exemplary embodiment of an electrical connector according to the invention, obliquely from the front;
- 5 Fig. 2 a socket part as part of the electrical connector according to Fig. 1, with a rear switch part separate therefrom;
- Fig. 3 a longitudinal section through the electrical connector according to Figure 1, without rear switch part;
- 10 Fig. 4 a front view of an adapter part;
- Fig. 5 a view of socket part with rear switch part, obliquely from the rear;
- 15 Fig. 6 an exploded, perspective, oblique view of socket part and adapter part,
- Fig. 7 an enlarged view of a spacer, obliquely from the front, and
- 20 Fig. 8 an enlarged view of a fixing piece, obliquely from the side.

Shown in Figure 1 is a perspective view of an exemplary embodiment of an electrical connector 1, obliquely from the front. This comprises a plug part 2 and a socket part 3. These are shown in Figure 1 in an interconnected arrangement. The plug part 2 has at its front end an opening for a cable (not shown). This is inserted into the plug part 2 and is connected there to corresponding, in particular pin-shaped plug contacts 13; see also Figure 3 in this regard. A locking of plug part 2 and socket part 3 takes place via a corresponding fastening means that, in the illustrated exemplary embodiment, is executed as a bayonet catch 17; see again Figure 3.

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A relative rotation of the plug part and socket part by a rotation angle 16 takes place both to fasten the plug part 2 to the socket part 3 and for corresponding switching of a rear switch part 11 visible at the rear end of the socket part 3. This rotation angle is between 20° and 120°, preferably between 40° and 100°, and particularly preferably between 60° and 90°, for example. A rotational adjustment marking 18 may be formed at a front end of the socket part 3, or also at the plug part 2, to correspondingly establish the rotation angle 16. This may in particular have an end stop 19 which fixes the locking position and the connection position of plug part 2 relative to socket part 3, for example. A corresponding additional end stop may be formed at the other end of the rotation angle 16.

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According to Figure 1, the socket part 3 is open at its front end, wherein a corresponding cover 21 is arranged laterally next to the socket part 3. To fasten the socket part 3 to a switch box, a device, or the like, it has a fastening flange 22 which projects radially between socket part 3 and rear switch part 11. The rear switch part 11 is essentially part of the switch box,

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the device, or the like, and here is shown together with the electrical connector 1. The rear switch part 11 includes a corresponding switching device 15 which, by being switched on/off by means of rotation of the plug part 2, produces an activation/deactivation of a corresponding device in the switch box, the device, or the like. An example of such a device is a motor which is not only supplied with energy via the electrical connector 1 but which can also be switched on and off by the electrical connector 1.

In Figure 2, socket part 3 and rear switch part 11 from Figure 1 are shown individually and separate from one another. In this instance, the socket part 3 is closed at its front end by means of the fitted and locked cover 21. This is mounted on the socket part 3 so as to be able to pivot laterally. In particular, the socket part 3 has an outer housing 4 at whose rear end is formed the corresponding fastening flange 22. Arranged inside the outer housing 4 is an inner part 5 (see Figure 3) which is mounted in the outer housing 4 so as to be able to rotate. The rear switch part 11 has corresponding electrical connections for electrical connection lines of the socket part 3, and a switch shaft 10 as a switching element 9 at its front end pointing in the direction of socket part 3. This switch shaft 10 projects in the direction of socket part 3; see also Figure 3, in which this switch shaft 10 is depicted alone and without rear switch part 11.

The switch shaft 11 according to Figure 2 has a rectangular cross section. In the assembled state according to Figure 1, this switch shaft is received so as to be rotationally fixed in a corresponding opening inside the socket part 3. Other cross sections of the switch shaft 10 or of the switching element 9 are possible, for example triangular cross section, pentagonal cross section, polygonal cross section, or also other cross sections in which a rotationally fixed arrangement in a corresponding complementary opening in the socket part 3 is possible.

An activation/deactivation of the switching device 15 inside the rear switch part 11 takes place by rotating the switching element 9 clockwise or counterclockwise.

Figure 3 shows a longitudinal section through the electrical connector 1 according to Figure 1, wherein for simplification the rear switch part 11 (see Figures 1 and 2) is not shown, and only its switch shaft 10 is visible as a switching element 9.

The plug part 2 is typically designed so that only the parts which are required in the context of the socket part 3 and the actuation of the corresponding switching element 9 are referenced. For example, this relates to a rotating sleeve 23 which is mounted on the rear end of the plug part 2 so as to be rotatable and can be fastened to the socket part 3 by means of the closure device, in particular bayonet catch 17, so as to be detachable. This is possible in an inserted position of the plug part 2 in the socket part 3; see Figure 3. In this position, corresponding pin-shaped plug contacts 13 of the plug part are inserted into insertion openings 14 in the inner part 5 of the socket part 3. The

- insertion openings 14 have through-openings 12 on their side facing toward the plug part 2. The inner part 5 is designed as an adapter part 6 which is selected depending on the switching element 9 that is used. The adapter part 6 is fastened so as to be detachable as an inner part 5 in the outer housing 4 of the socket part 3. The corresponding insertion openings 14 and through-openings 12 are likewise formed in the adapter part 6. This moreover has an adapter opening 8 on its outside 7 which faces away from the plug part 2, into which adapter opening the switching shaft 10 is inserted so as to be rotationally fixed.
- Other possibilities for the rotationally fixed connection between adapter part 6 and switching element 9 are conceivable, for example a projection on the outside 7 of the socket part which engages in a corresponding depression on the front end of the rear switch part 11, a driver, or the like which produces a corresponding rotation of a switching element 9 of the rear switch part 11 upon rotation of the adapter part 6.

The adapter part 6 serves in particular for this rotationally fixed connection between adapter part 6 and corresponding switching element 9 of the rear switch part 11, wherein it likewise serves, however, for the electrical connection of electrical connector 1 and rear switch part 11; see in this regard through-openings 12 and insertion openings 14. The insertion holes 14 are connected to the rear switch part 11 via electrical connection lines 20. The electrical connection lines are designed in such a way that corresponding length compensations are possible if adapter part 6 is rotated relative to rear switch part 11 to switch the switching device 15 on and off. For example, the electrical connection line may be designed as a flexible cable made up of fine wires, which cable ensures a durable connection and functionality between socket part 3 and switching device 15 by means of corresponding connection techniques. The driving of the adapter part 6 upon rotation of the plug part 2 essentially follows the pin-shaped plug contacts 13 and their contact with the insertion openings 14.

However, it is also conceivable that another driver is arranged between plug part 2 and adapter part 6, which ensures a driving of the adapter part 6 in both directions of rotation given rotation of the plug part 2.

A front view of the adapter part 6 according to Figure 3 is shown in Figure 4. In particular, the insertion openings 14 with through-openings 12 are visible at their open ends. In the illustrated example, five such insertion holes 14 are visible, so that in this instance a five-pole connection can be established between plug part and socket part. Other numbers of poles are possible, for example two poles, three poles, or even another number. The adapter opening 8 is arranged essentially centrally in the adapter part 6, which adapter opening is designed to receive a switching element 9 of complementary shape; see the switch shaft 10 according to Figure 3.

As has already been stated further above, additional cross sections for the adapter opening 8 are possible as long as these are suitable for the rotationally fixed reception of the corresponding switching element 9.

- 5 Shown in Figure 5 is a perspective view of socket part 3 with rear switch part 11, obliquely from the rear. In this instance, the socket part 3 is fastened to the rear switch part so as to be detachable. The closure cover 21 is furthermore fitted onto the socket part 3. In this way, the socket part 3 is fastened on a corresponding switch box, a device, or the like, for example,
10 and after insertion of a corresponding plug part 2 serves both for electrical supply to this device and switching on/off by means of the interaction of adapter part 6 and switching element 9.

- 15 The corresponding fastening flange 22 serves to fasten the plug part 2 to an outside of a housing or the like of the corresponding device.

- The electrical contacting takes place directly from the plug part 2 to the rear switch part 11 and is not visible in Figure 5, since this takes place in the interior between socket part and rear switch part 11. Only corresponding terminal contacts that, for example, may establish the electrical connection to
20 other devices of the apparatus, such as a motor or the like, are visible on the back side of the rear switch part 11.

- Furthermore, a spacer 24 as part of the socket part 3 is visible in Figure 5. This extends substantially between mounting flange 22 and rear switch part 11. The spacer 24 has laterally projecting fastening channels 26 which serve to fasten the rear switch part 11 in a releasable manner to the socket part 3; see also Figure 7. At its front end situated opposite the rear switch part, the spacer 24 has a guide sleeve 27 which has a smaller diameter in comparison to the remainder of the spacer, and which serves to support the adapter part 6 during its rotation.
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The corresponding parts of the spacer 24 are shown enlarged in Figure 7 and in a side view obliquely from the front.

- 35 Figure 6 shows socket part 3 in an exploded view without a rear switch part. Inner part 5 or adapter part 6 is withdrawn from the spacer 24 in particular, and corresponding insertion sockets 3 with connected electrical connection lines 20 are likewise shown separately at the rear end of adapter part 6.

- 40 In Figure 7, it can also be seen that the spacer 24 has a rotation slot 31 which partly extends in the circumferential direction of the spacer 24. A carrying element of the socket part can be inserted into this rotation slot 31.

- Shown in Figure 8 is a perspective view of fixing piece 25, obliquely from the front. This can be used in the adapter part 6, on its rear side facing toward the rear switch part 11. The fixing piece 25 serves to fix the corresponding insertion sockets 30 with connected electrical connection lines 20 in the adapter part 6.
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The fixing piece has spacers projecting radially outward 28, as well as centrally a longitudinal switch shaft opening 29. The switch shaft 10 can be guided through this and can be inserted into the corresponding adapter opening 8.

- 5 As has already been stated above, in particular the spacer 24 serves to fix the corresponding rear part in the longitudinal direction via the detachable connection between spacer and rear switch part. Upon rotation of the plug part 2 (see Figure 1), pins of the plug part (see plug contacts 13 according to Figure 3) transmit a corresponding force via the adapter part 6 to the
10 switch shaft 10 of the rear switch part 11.

- According to the invention, by using the adapter part an activation/deactivation of a corresponding device may take place in a simple manner by means of rotation of the plug part relative to the socket part. This is shown in particular in Figure 1 by means of the associated rotation angle 16. In a first position of the plug
15 part 2, an insertion into the socket part takes place with engagement of the plug contacts 13 in the corresponding insertion openings 14. The plug part 2 is subsequently rotated relative to the socket part 3, whereby a co-rotation of the adapter part 6 occurs. The adapter part 6 is in rotationally fixed engagement
20 with the switching element 9 of the rear switch part 11, so that this is likewise co-rotated and can be adjusted via the rotation of plug part 2 or adapter part 6 between on position and off position. This means that a direct activation and deactivation of a corresponding electrical device, such as a motor or the like, via switch shaft or switching element and switching device of the rear switch parts
25 takes place via the electrical connector according to the invention.

Claims

1. Electrical connector (1) and a rear switch part (11), the electrical connector (1) having a plug part (2) and a socket part (3), which socket part (3) has at least one outer housing (4) and an inner part (5) that can be rotated relative to said outer housing, wherein the inner part (5) can be rotated by the plug part (2) inserted into the socket part (3), **characterized in that** the inner part (5) is designed as an adapter part (6) which has an adapter opening (8) on an outside (7) facing away from the plug part (2) for rotationally fixed reception of a switching element (9) for connection/disconnection of a load, wherein the switching element (9), as an on/off switch, protrudes from the rear switch part (11) in the direction of the adaptor part (6).
2. Electrical connector according to claim 1, **characterized in that** the adapter opening (8) and the switching element (9) are designed to be complementary to one another.
3. Electrical connector according to claim 1 or 2, **characterized in that** the switching element (9) is a switch shaft (10) with in particular an angular cross section.
4. Electrical connector according to any one of the preceding claims, **characterized in that** the adapter part (6) is arranged on or in the outer housing (4) so as to be detachable.
5. Electrical connector according to any one of the preceding claims, **characterized in that** the adapter part (6) has through-openings (12) for essentially pin-shaped plug contacts (13) of the plug part (2).
6. Electrical connector according to any one of the preceding claims, **characterized in that** the adapter part (6) has insertion openings (14) for electrically contacting the plug contacts (13).
7. Electrical connector according to claim 6, **characterized in that** a switching device (15) of the rear switch part (11) for adjustment between on position and off position is associated with the switching element (9).
8. Electrical connector according to any one of the preceding claims, **characterized in that** a rotation angle (16) for the relative adjustment of the plug part (2) and the socket part (3) is 20° to 120°, preferably 40° to 100°, and in particular preferably 60° to 90°.
9. Electrical connector according to any one of the preceding claims, **characterized in that** a locking device, in particular a bayonet catch (17), is formed between the plug part (2) and the socket part (3).

10. Electrical connector according to any one of the preceding claims, **characterized in that** the adapter part (6) is arranged in a spacer (24) at the rear end of the socket part (3).
- 5 11. Electrical connector according to claim 10, **characterized in that** the spacer (24) is arranged between fastening flange (22) and the rear switch part (11) and is designed in particular for fastening of the rear switch part (11) so as to be detachable.
- 10 12. Electrical connector according to claim 10 or 11, **characterized in that** the spacer (24) has a guide sleeve (27) on its side facing away from the rear switch part (11).
- 15 13. Electrical connector according to any one of the preceding claims, **characterized in that** a fixing piece (25) in the adapter part (6) serves to fix insertion sockets (30).
- 20 14. Electrical connector according to claim 13, **characterized in that** the fixing piece (25) has radially outwardly projecting spacers (28) and, centrally, a longitudinal switch shaft opening (29).
- 25 15. Electrical connector according to any one of the preceding claims, **characterized in that** the plug part (2) and/or the socket part (3) have rotational adjustment markings (18).
- 30 16. Electrical connector according to claim 15, **characterized in that** at least one rotational adjustment marking (18) is formed as an end stop (19).
- 35 17. Electrical connector according to claim 7, **characterized in that** electrical connection lines (20) are formed between insertion opening (14) and switching device (15) for length compensation during the rotation of the plug parts (2) and the socket part (3) relative to one another.
18. Electrical connector according to claim 14, **characterized in that** the longitudinal switch shaft opening (29) has at least two different cross section areas.
19. Socket part (3) of an electrical connector (1) according to any one of the preceding claims.