

Terminal device

The invention relates to a terminal device as claimed in the preamble of claim 1.

One such terminal device is already known from DE-195 04 013 C1 (see especially Figures 13-16). The subject matter of this device is mainly a reusable tap to continuous multiwire lines, preferably on two-wire profiled flat ribbon cables (ASI lines) with current-carrying flexible leads, for example for measurement purposes at different points of the ASI lines. To connect the ASI line to a branching line the latter is inserted through a connecting sleeve into the housing in which then the correspondingly shaped contacts (Figure 17) connect the wires of the ASI line to the pertinent wires of the branch line.

In particular, as a result of the different terminals of continuous and branching lines the structure of the terminal device for a connection device is complex. Moreover the contact elements which are to be equipped with penetration spikes as well as with an insulation piercing connecting device are complex parts which moreover need be guided very accurately in order to enable simultaneous contact-making of the wires of ASI and branch line.

But also under this assumption secure installation and function are not guaranteed because the wires of the branch line are not reliably guided and their location can be checked when the contact carrier is being inserted when using transparent material, but can easily deviate from the desired position.

In addition, the required supports represent additional cost for support of the wires of the branch line. Furthermore, the known device is neither intended nor suitable for accommodating electrical means such as plug-in connectors or branch connecting sleeves.

Finally, the terminal device which had been published previously is not suited for building connecting structures by joining several identical devices, but in any case for connecting two ASI lines if the branch line on the free end does not have an actuator or sensor as provided in column 6, lines 13-14 of the patent, but via another PG gland is inserted in the threaded connecting sleeve of a second terminal device as shown in Figures 13-16 and is electrically connected therein to an ASI line.

The object of the invention is therefore to devise a terminal device of the initially mentioned type as simple and economical as possible, which enables reliable mechanical and electrical connection of the wires of at least two cables to be connected and of cable wires to contacts of plug-in connectors which are located in the threaded connecting sleeves of the terminal device and to other terminal devices.

This object is achieved as claimed in the invention by the characterizing features of claim 1.

The conductor holder enables simple, economical and mainly stable positioning of the conductors in the terminal device for absolutely reliable contact-making with the contact elements which are inserted transversely thereto and thus enables prompt and reliable installation. To do this first of all the

conductors must be inserted into the holes of the conductor holder and this unit inserted into the intended threaded connecting sleeve and then the contact elements are pressed through the recesses which run transversely to the holes. A visual inspection is unnecessary since the conductors and the contact elements are guided on all sides.

The conductors can advantageously be both conductor wires and also metal parts matched to the requirements of the respective application. Since to connect cables their end parts must be stripped to be able to insert the wires into the holes of the conductor holder, the terminal device is suitable both for round and flat cables.

Since the terminal device is intended solely for conductor connections and not for taps, the contact elements can be made simple, and when penetrating spikes are omitted, can be made both for contact-making of flexible lead and also of solid conductors.

The housing of the terminal device can also be made and produced more simply because supports as the rests of the conductors which are to make contact with one another are unnecessary. The uniform use of conductor holders for each connection moreover dictates a structure of the terminal device which is simpler and more economical than in the described prior art.

Furthermore, with a terminal device a larger number of connections is possible and depends on the number of threaded connecting sleeves provided. In practice this number is limited by the allowable maximum dimensions of the terminal device, for

which for a structure which is suitable for many applications four threaded connecting sleeves are possible, a favorable compromise being achieved between the size of the device and the number of possible connections.

One special advantage of the terminal device as claimed in the invention lies ultimately in that it is suitable as a module for building any connecting structures. To do this only the terminals of at least one threaded connecting sleeve each of several terminal devices need be connected to one another. Together with the internal connections of each terminal device, complex connecting networks which can be optimally matched to the circumstances of each individual case can thus be built and they moreover can be modified and expanded at any time.

Advantageous embodiments of the terminal device as claimed in the invention are described in the dependent claims.

The arrangement of one conductor holder per threaded connecting sleeve as claimed in the invention very easily makes it possible to provide different means for connection which can be easily joined via the conductors to be inserted into the channels of the conductor holder.

Claim 2 cites three essential means which can be attached alternatively in the threaded connecting sleeve, by which a large diversity of possible terminal devices which thus have high utility can be achieved.

Thus, the terminal device can be made for example as a pure cable connector of three or four cables, for which in each threaded connecting sleeve there is one cable gland and the wires

of each stripped cable end are placed in the pertinent conductor holder.

But it is also possible to install in a threaded connecting sleeve a plug-in connector for connecting a mating connector, for example a cable set. In doing so the plug-in contact elements can be connected via individual conductors such as flexible leads, solid wires or tailor-made metal parts, but also via the conductors of cable pieces stripped on the ends or via conductors which are permanently connected to the plug-in contacts and which on the other end can be inserted into the channels of the conductor holders provided for this purpose.

Another especially feasible means consists finally in the indicated connecting piece which is simple to build and install and enables prompt joining of the terminal devices as claimed in the invention into mechanically stable units.

Making the conductive connection of the two conductor holders of the connecting piece as claimed in claim 3 results in a mechanically durable connection which can be easily produced and installed by machine which moreover ensures not only a permanently reliable connection between the connected terminal devices, but also high quality contact-making with the contact elements adjoined by the metal part under spring pressure.

To do this the contact elements can be selectively made as pins or spikes which can be inserted between the sheets or as legs for example of the contacts of the insulation piercing connecting device surrounding the sheets. Also a mixed execution of the contact elements is of course possible.

Making the contact elements as claimed in claim 4 is especially advantageous since the reliable contact-making is thus largely independent of the type of conductor. As mentioned, insulated and uninsulated flexible leads, solid wires or other metal parts which are rigid or elastic in the contact area are equally well suited.

Especially fast and uncomplicated installation of the terminal device is achieved as claimed in claim 5 in that the conductor holder, regardless of the means to be connected, are identical. This obviates not only the necessity of assignment to the different means, but also making available and storing different conductor holders are unnecessary.

In terminal devices with two conductors holders which are not located opposite one another or for more than two conductor holders, execution as claimed in claim 6 offers the advantage of small dimensions of the housing due to shorter threaded connecting pieces and in addition of the cross section of the terminal plug since the contact elements can be located in a narrow space. The possibility of overlapping is dependent on the number of conductor holders and contacts per conductor holder. With reasonable cost this execution can be easily accomplished for up to four threaded connecting sleeves with two-pin terminals.

Greatly simplified installation, especially in an embodiment of the conductor holder as claimed in claim 6, is achieved as claimed in claim 7 by coding of the conductor holders and threaded connecting sleeves which allows insertion of the

conductor holders into the threaded connecting sleeves in only a single position which can also be found "blind".

One possible embodiment of this coding is given in claim 8. In an execution as claimed in claim 9 it has the additional advantage that a projection is formed without added costs, which can be used as a stop in the insertion of the conductor holder into the threaded connecting sleeve. Moreover the flattened areas also cause effective locking.

A funnel-shaped insertion opening of the channels which is provided as claimed in claim 10 enables easy insertion of the conductors.

A quite significant facilitation of installation is achieved by a clamping element which is active in each channel as claimed in claim 11. When connecting for example one cable first the cable wires can be inserted into the channels and this unit can then be inserted into the pertinent threaded connecting sleeve in any sloped position without the fear of the conductor holder sliding out of the conductor ends or without special aids being necessary to prevent this sliding out. Rather as a result of the light clamping of the cable wires the indicated unit is premounted and then can be easily inserted in the threaded connecting sleeve when this takes place from top to bottom.

A spring tongue which is produced integrally together with the conductor holder in an injection molding process for example as claimed in claims 12 and 13 is economical and has sufficient spring action even for relatively thick and inelastic plastic.

In practical application a shielded version of terminal devices is often necessary, as is given in claim 14.

In the cable gland the conductive connection of the cable shield to the metal housing takes place via an annular metal spring which adjoins the cable shield and via a metallic thrust collar which adjoins the metal housing and which is conductively connected to the spring.

In a connected plug-in connector with an outside sleeve of conductive material this and/or a plug-in contact at ground potential is connected to the metal housing via a metal piece.

A connecting piece as claimed in the invention for this purpose has an annular metal piece on the periphery which when union nuts are screwed to the two metal threaded connecting sleeves to be joined adjoins the latter.

Feasibly these conductive connections are made such that they are also effective in a plastic-spray coated metal housing as claimed in claim 15.

In another embodiment of the invention as claimed in claim 16 in the threaded plug there is a circuit board on which not only economical conductive connection of the contact elements intended for this purpose by simple printed conductors can be effected, but in addition also the connection of electrical components, for example a terminating resistor, is easily enabled (claim 17).

The threaded plug is opened for inserting, connecting and wiring of the printed boards and as claimed in claim 18 can be closed by means of a screw-on cover.

The invention is detailed below using two embodiments of a terminal device as claimed in the invention and a connecting structure formed from two terminal devices.

Figure 1 shows a partially exposed perspective exploded view of a first terminal device for a pure cable connection,

Figure 2 shows a perspective view of a second terminal device equipped with three different terminal means,

Figure 3 shows a partially cutaway overhead view of the second terminal device with one assembled terminal,

Figure 4 shows a conductor holder in one view (Figure 4a) and as a section AB (Figure 4b),

Figure 5 shows a partially cutaway side view (Figure 5a) and an overhead view (Figure 5b) of a connecting piece and

Figure 6 shows a perspective view of a connecting structure composed of two terminal devices.

The same parts in the two embodiments are provided with the same numbers.

The terminal device 1 shown in Figure 1 has a T-shaped metal housing 2 with a terminal plug 3 and three threaded connecting sleeves 4 for holding one conductor holder 5 produced from insulating material at a time, and a cable gland which consists of a threaded sleeve 6 which can be screwed onto the threaded connecting sleeve 4, a gasket 7 and a helical spring 9 which is bent in a ring shape, which is located between two thrust collars 8 and which when the cable gland is tightened is pressed on the conical inner surfaces of the thrust collars radially inside against the shield of a shielded two-wire cable which is not

shown and in doing so on the one hand causes tension relief of the cable and on the other hand establishes a conductive connection of the cable shield via a metallic thrust collar 8 to the metal housing 2.

A contact carrier 10 of insulating material which can be attached by means of a screw-on union nut 11 is inserted into the terminal plug and bears the contact elements made as the contacts 12 of an insulation piercing connecting device for conductive connection of the pertinent cable wires.

On the other end the contacts 12 of an insulation piercing connecting device are soldered to the terminal points of a printed circuit board 46 which are linked by printed conductors 47 and in this way effect the desired conductive connections of the pertinent contacts 12 of an insulation piercing connecting device.

The terminal plug 3 is closed with a screw-on cover 48 which can be screwed off for access to the board for soldering or connecting electrical components, for example a terminating resistor, or also for measurement purposes.

For the sake of clarity the threads of the terminal plug 3 and the threaded connecting sleeve 4 are not shown.

The three conductor holders 5 each have two channels 13 for holding two cable wires and two slotted recesses 14 located perpendicular thereto for insertion of the contacts 12 of an insulation piercing connecting device and for making contact of the cable wires in the crossing area 32 of the channels 13 and the recesses 14.

The end parts of the cylindrical conductor holders 5 facing one another are semicylindrical and made such that they join one another overlapping and toothed in the connecting or contact-making area of the terminal device 1, the two conductor holders 5 which are located axially flush conversely being inserted in the same angular position and the conductor holder 5 which is located perpendicular thereto conversely being inserted turned by 180°. In this way a minimum space requirement for the connecting area and the terminal plug 3 is formed and a small housing size is achieved.

For quick insertion into the threaded connecting sleeves 4 in the desired angular position the conductor holders 5 each have a flattened area 15 which interacts with the corresponding surface of the inner wall of the threaded connecting sleeve 4. The flattened area 15 is not routed entirely to the cable-side end so that a projection 16 remains which for the conductor holders 5 which have been inserted into the desired position strikes an annular shoulder 17 of the threaded connecting sleeve 4.

The flattened area moreover forms an effective anti-rotation element.

In the second embodiment as shown in Figure 2 the terminal device 20 is equipped with a cable gland 6-9 for tension relief of a two-wire cable 21, a four-pin plug-in connector 22 and a connecting piece 23 which has two conductor holders 5 securely joined to one another with one threaded sleeve 6 each.

Each of the identically made conductor holders 5 has a cylindrical section 30 and a semicylindrical section 31 which projects into the connecting area of the terminal device 1, 20.

The slotted recesses 14 for inserting the contacts 12 of an insulation piercing connecting device are perpendicular to the axis of each conductor holder 5, the channels 13 for inserting the conductors penetrate the cylindrical section 30 and the semicylindrical section 31 to shortly in front of its free end. The crossing areas 32 of the channels 13 and the recesses 14 form the contact-making points where the legs of the contacts of an insulation piercing connecting device are pressed against the conductors under pressure.

For easier insertion of the conductors into the channels 13 they are provided with funnel-shaped insertion openings 33.

Moreover, from the inside walls of the channels 13 one spring tongue 34 projects which has one free end, which is pre-arched to the inside and which is integral with them. These tongues clamp the conductors which are inserted into the conductor holder 5 during installation and which thus together with the conductor holder can be inserted easily and independently of the location of the terminal device 1, 20 into the pertinent threaded connecting sleeve 4.

The two conductor holders 5 of the connecting piece 23 are mechanically connected securely to one another by a metal ring 35. They have two annular collars 36 for holding the threaded sleeves 6 to be able to pivot axially-securely and moreover when the connecting piece 23 has been installed they form the metallic

connection of the screwed-together housing 2 of the two terminal devices 1, 20. Two gaskets 37 provide for a water-tight connection.

For electrical connection there are two metal parts 39 which each consists of two sheet metal parts 38 (shown by the broken line in the area which is not visible) and which are guided through the inner cavities of the connecting piece 23. At the crossing areas 32 the sheet metal parts 38 are spaced apart, the distance being somewhat greater than the clearance of the legs of the contacts 12 of an insulation piercing connecting device so that they adjoin the conductors which have been formed in this way under pressure.

In the case of a cable terminal the insulated individual wires 40 of the stripped cable 21 represent the parts which are generally called conductors.

When a shielded plug-in connector 22 is joined to a threaded connecting sleeve 4 (Figure 1 and 3) the shielding and the ground connection to the metal housing 2 are accomplished via a pot-shaped metal piece 41 which with the plug-in connector 22 installed adjoins under pressure the face shoulder 42 of the pertinent metal housing connecting sleeve and with a peg which is not shown is connected to the ground terminal of the four-pin plug-in connector 22. The conductors which are not visible for connecting the other three clamp terminals of the plug-in connector 22 to the pertinent contacts 12 of an insulation piercing connecting device are made here as insulated individual

wires which are inserted into the channels 13 of the conductor holder 5.

The metal housing 2 in the embodiment of the terminal device as shown in Figure 3 is provided with a sprayed-on plastic coating 43 which projects over the housing connecting sleeve and bears the thread 44 for screwing on a threaded sleeve 6 of the plug-in connector 22 and two other means which are not shown (connecting piece and/or cable gland).

In Figure 6 two terminal devices 20 with three threaded connecting sleeves 4 each are coupled together via a connecting piece 23 in the manner of a module to a connecting unit 45 in which the wires 40 of the two cables 21 are connected to the contacts of one plug-in connector 22 and which is prepared for further expansion into a connecting network of any degree of branching with different connected means by other connection pieces 23.

Reference number list

- 1 terminal device of the first embodiment
- 2 metal housing
- 3 terminal plug
- 4 threaded connecting sleeve
- 5 conductor holder
- 6 threaded sleeve
- 7 gasket
- 8 thrust collars
- 9 helical spring
- 10 contact carrier
- 11 union nut of 3
- 12 contacts of an insulation piercing connecting device
- 13 channels in 5
- 14 recesses in 5
- 15 flattened area of 5
- 16 projection on 5
- 17 annular shoulder of 4
- 20 terminal device of the second embodiment
- 21 cable
- 22 plug-in connector
- 23 connecting piece
- 30 cylindrical section of 5
- 31 semicylindrical section of 5
- 32 crossing areas of 13 and 14
- 33 funnel-shaped insertion opening of 13
- 34 spring tongues

- 35 metal ring of 23
- 36 annular shoulders of 23
- 37 gaskets on 23
- 38 sheet metal parts of 39
- 39 metal part of 23
- 40 wires of 21
- 41 metal piece of 22
- 42 end shoulder of 2
- 43 sprayed-on plastic coating of 2
- 44 thread of 43
- 45 connecting unit
- 46 printed circuit board
- 47 printed conductors on 46
- 48 screw-on cover of 3

Claims

1. Terminal device (1) for electrical connection of at least two electrical conductors (39, 40) in a housing (2) which has a tubular terminal plug (3) in which by means of a union nut (11) which can be screwed onto it a contact carrier (10) with contact elements (12) located therein for making-contact between and connecting the conductors (³⁹~~29~~, ⁴⁰~~30~~) in a connecting area of the housing (2) can be axially pushed without the capacity to turn, characterized in that the housing (2) has at least two outwardly projecting tubular threaded connecting sleeves (4) for holding one conductor holder (15) at a time which is made of insulating material and which projects into the connecting area and in which there are axial channels (13) for inserting the conductors (39, 40) and recesses (14) which run transversely thereto and which cross at the contact-making sites (32) with the channels (13) for inserting the contact elements (12).

2. Terminal device as claimed in claim 1, wherein the conductors (39, 40) are optionally wires (40) of at least one cable (21) which is inserted into a threaded connecting sleeve (4) and is attached therein by a cable gland and/or connected to terminal clamps of at least one plug-in connector (22) which is inserted into a threaded connecting sleeve (4) and is attached therein and/or are internal connecting lines (39) of a connecting piece (23) which has two conductor holders (5) which are mechanically and electrically connected to one another with one



threaded sleeve (6) each for insertion and attachment in two threaded connecting sleeves (4) of the housing (2).

3. Terminal device as claimed in claim 2, wherein for electrical connecting of the terminals of the two conductor holders (5) of the connecting piece (23) there is one metal part (39) consisting of two spring-elastic sheets (38) which are spaced apart in the contact area and which adjoin one another over the remaining length.

4. Terminal device as claimed in one of claims 1 to 3, wherein the contact elements are made as insulation piercing connecting devices (12).

5. Terminal device as claimed in one of claims 1 to 4, wherein the conductor holders (5) are made identical.

6. Terminal device as claimed in one of claims 1 to 5, wherein the conductor holders (5) in the connecting area overlap with end parts (31) facing one another and in doing so form a common contact-making area.

7. Terminal device as claimed in one of claims 1 to 6, wherein the conductor holders have coding for correct-angle insertion into the threaded connecting sleeves and the latter have corresponding coding.

8. Terminal device as claimed in claim 7, wherein the coding is made as a flattened area (15) of the cylindrical surface of the conductor holder (5) and the corresponding coding consists in a connecting sleeve part which projects to the inside from the inner wall of the threaded connecting sleeve (4) and which is matched to the coding.



9. Terminal device as claimed in claim 8, wherein the flattened area (15) does not extend entirely to the cable-side end of each conductor holder (5) and the projection (16) formed thereby when the conductor holder (5) is in the desired position strikes one end surface (17) of the part of the threaded connecting sleeve which is used as the corresponding coding.

10. Terminal device as claimed in one of claims 1 to 9, wherein the channels of the conductor holder each have one funnel-shaped insertion opening (33).

11. Terminal device as claimed in one of claims 1 to 10, wherein the channels (13) of the conductor holders (5) each have at least one clamp element which projects to the inside from the channel wall.

12. Terminal device as claimed in claim 11, wherein the clamp element is a clamp spring (34) which has one free end and which is pre-arched to the inside.

13. Terminal device as claimed in claim 11 or 12, wherein the clamp elements (34) are integral with the conductor holder (5).

14. Terminal device as claimed in one of claims 1 to 13, wherein the housing (2) is a metal housing which optionally can be conductively connected via parts (8, 9) of the gland to the shield of at least one shielded cable and/or via a metal piece (41) to a grounded plug-in contact of a plug-in connector (22) which is located in a threaded connecting sleeve (4) and/or via one metal part (39) of a connecting piece (23) to another metallic housing.



15. Terminal device as claimed in claim 14, wherein the metal housing (2) has a sprayed-on plastic coating (43) on which the threads (44) of the threaded connecting sleeve (4) and the terminal plug (3) are attached.

16. Terminal device as claimed in one of claims 1 to 15, wherein in the terminal plug (3) there is a printed circuit board (46) on which the electrical connections of the contact elements (12) are made by printed conductors (47).

17. Terminal device as claimed in claim 16, wherein electrical components are connected between the terminal points of the contact elements (12) on the printed circuit board (46).

18. Terminal device as claimed in one of claims 16 or 17, wherein the threaded plug (3) is open on the board side and has a screw-on cover (48).

