

Multiple plug connection unit

The invention concerns a multiple plug connection unit with the features given in the preamble of Claim 1.

Multiple plug connection units are known whose main component consists of a base strip, for the supply of electricity to one or more parallel consumer units, particularly in telephone installations. This base strip is manufactured from insulating material and carries mutually parallel bus-bars for the phase, neutral and earth connection of several consumer units. An overload contact-breaker can be placed on the upper surface of this base strip for each consumer unit and this is used to conduct the supply current from the phase bus-bar to a connecting element of the base strip for the phase distributor lead of the particular consumer unit. The consumer unit itself is protected by this at the phase end against overload and short-circuit.

The electricity supply to the consumer units takes place via respective distributor leads for phase, neutral and earth connection. These can be electrically connected to the respective bus-bars by means of individual plug connectors. This connection takes place, for example, by plugging individual connection terminals of the distributor leads onto plug pins, of the base strip, protruding above the rear of the base strip.

The bus-bars of such base strips generally have separate contact, by means of main supply leads, for the phase, neutral and earth connection respectively. In the case of relatively large electricity supply units - such as switch boxes and the like - even the main connection for the base strips is found to be labour-intensive and the design is found to be complicated. The same disadvantage applies to the contact arrangements for the individual consumer units

because these have to be individually connected, by means of the connecting terminals of their distributor leads, to the rear plug pins of the base strip. It is precisely this rear lead-out of these plug pins which often makes the connecting work very awkward because access to the rear of the base strip is generally only possible with difficulty.

The main disadvantage of the previously known plug connectors concerns safety. In the case of state-of-the-art base strips, there is no provision to ensure that all their live parts are completely covered over from the outside. The associated risk of accident to a user due to contact with live components is obvious, particularly since work to correct faults often takes place under pressure of time.

An electricity distributor insert for frames in communications technology operating stations and having automatic safety equipment units which can be arranged adjacent to one another in a row is known from DE-A-34 17 422. Plug bases fastened adjacent to one another in the distributor insert carry, on their lower surface, connecting devices for connecting to the supply leads. An intermediate base with laterally arranged connecting devices is plugged into this plug base. The intermediate base carries the plug-in automatic safety units.

A disadvantage of this electricity distributor insert is the fact that each of the plug bases has electrical connecting elements which have to be individually connected to the associated supply leads. There are no bus-bars for phase, neutral and earth connection. One plug base in the distributor insert has to be fastened and connected for each consumer unit. Although the electricity distributor insert quoted satisfies safety requirements with respect to contact protection and the possibility of connecting consumer-unit leads without switching off the main current supply leads, the connecting work for

setting up the electricity supply unit, in a telephone installation for example, remains complicated and time-consuming.

5 A strip-type electricity supply unit is given in US-A-2 666 907, in which bus-bars which are covered for contact protection are used. The subject-matter of this publication, however, deals essentially merely with a multiple plug socket which can be installed in a wall and is supplied with electricity via a connecting
10 lead to a wall plug socket. No overload contact-breakers for safety purposes are, for example, provided.

BE-A-677 804 gives an arrangement with several bus-bars for electrical units in which the bus-
15 bars are each designed as punched and drilled sheet metal strips. Their connecting tabs, however, protrude uninsulated from the bus-bar holder and they therefore represent a safety risk which is not insubstantial when the electricity supply is not switched off.

20 On the basis of the disadvantages of state-of-the-art base strips, the object of the invention is to create a multiple plug connection unit of the type mentioned at the beginning which is comprehensively improved from the point of view of safety and by means
25 of which the connecting work is substantially rationalised both for the main connections and for the consumer-unit connections.

This object is achieved in accordance with the characterising features of Claim 1. By enclosing
30 the bus-bars in the casing of the base strip, these live parts are covered over. In contrast to conventional base strips, the bus-bars are now accessible via insertion openings. No live plug pins and the like protrude, therefore, on any side of the
35 base strip. This ensures substantial protection against contact with the live parts.

The rationalisation effect is achieved because the distributor lead connections for each

consumer unit are collected into one separate connection block in each case. Before the actual insertion of the multiple plug connection unit, the distributor leads of the consumer unit are therefore, for example, already connected to the connection block at the connection end when it is assembled. This connection block is an easily handled component of which a plurality can be placed one after the other along the base strip, making direct contact with the neutral and earth bus-bars. It is therefore no longer necessary as before to make the awkward individual consumer-unit electrical connections, of which there have been at least three, between the distributor leads and the base strip.

A further advantage is the fact that the connection blocks can only be put in place when there is direct contact with the neutral and earth bus-bars. The connection with the phase bus-bar is still interrupted in this assembly stage, i.e. no voltage is applied to the consumer unit. This connection is only made by placing an overload contact-breaker for one particular consumer unit on the casing of the base strip. For this purpose, the overload contact-breaker connects the phase bus-bar, by making contact with the latter, to the phase connection of the connection block enclosed between the base strip and the overload contact-breaker. The electricity supply unit for a particular consumer unit only becomes live when the overload contact-breaker is closed after the complete assembly of this electricity supply unit. It may be seen that the connection of the distributor leads, and hence the consumer units, to the multiple plug connection unit according to the invention is particularly free from danger and can be carried out in a rational manner. The subject-matter of the invention is, to a certain extent, built up in a modular fashion, each individual module and the whole of the plug connection unit both being designed to protect against

contact with the live parts. In addition, the connection of a consumer unit can be carried out in such a simple and rational manner because no manipulations are necessary on the rear of the base strip. Connection blocks and overload contact-breakers can be placed on the base strip, i.e. these components always approach from above and therefore from the front of the base strip.

The subsidiary claims characterise advantageous further developments of the subject-matter of the invention. A form-fit and particularly strong connection between each connection block and the base strip is achieved by means of the characterising part of Claim 2. In addition, contact surfaces of the connection block on the upper surface of the base strip are created by the step-shaped, mutually form-fitted recesses, these contact surfaces being located at right angles to the insertion direction. These contact surfaces define unambiguous end stops for the insertion motion of the connection block on the base strip.

The multiple plug connection unit according to the invention is particularly compact due to the formation of an assembly unit, of the base strip and the connection blocks when the latter are placed in position, which is provided with a substantially rectangular cross-section (Claim 3). An electricity supply installation equipped with such a unit has a particularly clear layout and is therefore easier to service because of its orderly appearance.

The characterising features of Claims 4 to 7 describe measures by means of which the labour requirement for the installation of the electricity supply installation is reduced and safety is further improved. By means of the characterising feature of Claim 4, for example, a uniform assembly direction - i.e. the insertion direction from above - is ensured for all parts of the installation. As is described in Claim 5, the connection blocks have contact prongs

extending in the insertion direction for making contact between the neutral and earth distributor leads and the neutral bus-bar and earth bus-bar of the base strip. It may be seen that placing the connection block in position does not as yet involve connection of the consumer unit to the phase bus-bar. This only occurs on introduction of a contact prong into at least one insertion opening on the surface of the connection block confronting the direction of insertion (Claim 6). The final assembly operation for connecting the consumer unit to the phase bus-bar is advantageously carried out simply by placing an overload contact-breaker for a particular consumer unit on the assembly unit formed by the base strip and the particular connection blocks.

Advantageous further developments of the connection block of the multiple plug connection unit according to the invention are given in Claims 8 to 11. Thus, an embodiment according to Claim 8 ensures that - in the case of the connection blocks also - no live parts protrude freely towards the outside. Each connection-block casing encloses internal clamps which are used for the connection of the distributor leads which can be led in by means of lead-in openings arranged in the lower surface of the connection blocks. This also ensures that the distributor leads can be brought to the plug connection unit from the rear. There are, therefore, no interfering leads or cable lines in the assembly region of the multiple plug connection unit. In view of the high number of distributor leads - three distributor leads are required per consumer unit and sixteen consumer units can, for example, be connected per base strip - this nevertheless ensures that the electricity supply installation is clearly laid out.

The clamps are in direct electrical contact with the contact prongs of the connection block and (in the assembled position) with the contact prongs of an

overload contact-breaker which can be inserted into the insertion openings on the upper surface of the connection block. This ensures a high level of reliability of electrical connections and this is further improved by a configuration of the subject-matter of the invention in accordance with the characterising part of Claim 10. According to this, each connection block can be fixed on the base strip by means of a fixing screw extending in the insertion direction and axially located on the connection block in the stepped surface region. The free end of this fixing screw engages in one of the nuts or threaded eyes arranged in a row in the stepped surface region of the base strip and rotationally fixed in the casing. Each connection block is therefore fixed on its plug location when placed in position and can only be removed by releasing the fixing screw. The latter is in turn connected to the connection-block casing so that it cannot be lost and this avoids further disturbance to orderly procedure in the assembly of the electricity supply installation. This measure is also particularly advantageous for safety because in the case of an electrical supply installation, it is absolutely essential to avoid metal parts falling into the installation in an uncontrolled manner and, for example, causing short circuits.

In accordance with Claim 11, each of the heads of the fixing screws is accessible from the upper surface of the connection blocks. In consequence, the fixing of the connection blocks takes place from above and can be carried out merely by means of a screwdriver and when separated from the overload contact-breaker. This also ensures a uniform main assembly direction. The characterising features of Claims 12 to 15 concern measures which reduce the overall resistance of the assembly plug connection unit according to the invention and ensure a high level of contact reliability between the individual plug connections.

Main features which should be mentioned are that the bus-bars are integral with their contact tabs and struts and that contact compression springs enclosing the contact prongs and contact tabs are included.

5 Distribution installations equipped with the multiple plug connection unit according to the invention are therefore particularly suitable for a high-power electricity supply.

10 The advantageous further developments of the subject-matter of the invention according to the characterising features of Claims 16 to 20 concern the main connection of the base strip itself. It may be observed from the claims that the concept of contact protection covering of all the live parts is effected
15 in the case of the main connection as well. In addition, the fixing of the main supply leads fed in at the ends via lead-in openings in the connection boxes takes place by means of clamping screws on the connection clamps which are accessible from above by
20 means of openings inserted in the upper surface of the connection boxes. This again means that they can be dealt with from above - i.e. from the main assembly direction.

A configuration of the plug connection unit
25 in accordance with the characterising features of Claim 21 permits simple and rapid connection, on assembly, of several such base strips in series. This takes place by means of axially aligned assembly in the longitudinal direction using two base strips with end
30 surfaces facing one another and at a slight distance apart. Metallic connecting pins, one in contact with the phase bus-bar and one with the neutral bus-bar are mounted on the end surface of the first base strip, facing the second base strip, so that they can be
35 axially displaced in the longitudinal direction. The said pin is enclosed, so as to protect against contact, by the casing of the base strip in the inactive position. In its active position, in which it is

pushed out endways from the casing of the base strip, its external free end engages in the corresponding lead-in openings for the connection of the phase bus-bar and the neutral bus-bar of the second base strip and can be connected to the corresponding connection clamps there. The connecting pin is then advantageously mounted in the connection clamps for the contact struts on the end surface of the first base strip opposite the main connection. Simple and reliable location of the connecting pins is possible by fixing the clamping screws of the connection clamps which are connected by means of the connecting pins.

Reliable covering of the connecting pins, even in the case where two or more base strips are placed one after the other, is ensured by means of the characterising features of Claim 23. The covered length can be adapted automatically and individually to the assembly distance between two base strips by using a spring-loaded, longitudinally telescoping telescopic sleeve. This again facilitates assembly and improves the covering safety. These advantages are also achieved by means of an embodiment of the subject-matter of the invention in accordance with Claims 24 and 25.

A further advantage which should be mentioned of the multiple plug connection units which are connected together by means of the connecting pins is the very simple possibility of subsequently removing a base strip when it is no longer required for electricity supply purposes. It is important that all the live parts should again be covered to provide protection against contact during the dismantling procedure.

According to Claim 26, a signal bus-bar is fitted parallel to the phase bus-bar, neutral bus-bar and earth bus-bar, which signal bus-bar can be connected by means of the signal contact connections of the overload contact-breaker to the neutral connection

in the connection block for the purpose of monitoring the overload contact-breaker. This provides the possibility of monitoring efficiently, and, if necessary, externally, electricity distributor installations, particularly relatively complex ones installed in relatively large switch boxes. If the signal bus-bar is part of a signal circuit which is provided separately for each multiple plug connection unit, it is possible, for example, to indicate the response of an overload contact-breaker in a certain plug connection unit by means of a signal light. The monitoring personnel only need to carry out an inspection at the corresponding plug connection unit which has released the overload contact-breaker and in whose consumer unit a fault has therefore occurred.

The characterising features of Claims 27 to 30 give measures by means of which the necessary electrical connections are made between the individual contact prongs and tabs within a connection block by means of a simple design. As many contact elements as possible are then combined as components manufactured integrally in order, by this means, to reduce transfer resistances, etc.

The characterising feature of Claim 30 describes a simple connection possibility for the earth bus-bar of the plug connection unit according to the invention.

In summary, reference is again made to the main advantages of the subject-matter of the invention:

- 30 - Essential design features of the multiple plug connection unit according to the invention have been aimed at covering the live parts so as to prevent them being touched.
- All the assembly steps for the installation of an electricity supply installation equipped with the multiple plug connection units according to the invention can be carried out rationally and simply. This also applies in the event of

subsequent addition or removal of connection units.

- 5 - The reliability of the multiple plug connection unit according to the invention is further increased by the integral design of, for example, the bus-bars and connecting elements in the connection blocks. Another advantage is the reduced transfer resistances in the live components, as a result of which the loss power within the electricity distribution installation is reduced.
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 The invention is explained in more detail in an illustrative example by means of the enclosed figures, in which:

- 15 Fig. 1 shows a perspective view of the multiple plug connection unit,
- Fig. 2 shows, in a partially sectioned representation, a perspective view of the base strip with connection blocks placed on it,
- 20 Fig. 3 shows a perspective exploded view of the base strip,
- Fig. 4 shows a perspective view of a connection block from underneath,
- 25 Fig. 5 shows a perspective exploded view of a connection block,
- Fig. 6 shows a partial cross-section along the straight line VI-VI of Fig. 2,
- Fig. 7 shows a cross-section through the base strip along the straight line VII-VII of Fig. 2,
- 30 and
- Fig. 8 shows a longitudinal section through a telescopic sleeve for covering the connecting pins.

- 35 The multiple plug connection unit according to the invention is shown with its main components in Fig. 1. These main components are the base strip 1, the connection blocks 2 and the overload

contact-breakers 3. The plug connection unit is used for the supply of electricity to one or more parallel consumer units (not shown), particularly in telephone installations. They contain a plurality - 16 in the particular example - of plug-in positions 4.

Each consumer unit (not shown) generally requires three distributor leads 5, i.e. one each for phase, neutral and earth connection. At the supply end, these distributor leads 5 are respectively collected into the separate connection block 2 which can be placed on one of the plug-in positions 4 on the base strip 1 and can therefore make an electrical and mechanical connection with the base strip 1. The electrical connection to a consumer unit is completed, by means of the multiple plug connection unit according to the invention, by placing an overload contact-breaker 3 on the sub-assembly made up of the base strip 1 and the connection block 2. In the illustrated example, the overload contact-breakers 3 are designed as double switches so that increased breaking capacities can be achieved. After they have been closed by means of a handle 6 located on the upper surface of the overload contact-breaker 3, the consumer unit is completely connected by means of the distributor leads 5 and the multiple plug connection unit.

The overall mechanical construction of the base strip 1 and the connection blocks 2 can be explained by means of Fig. 2. In cross-section, the two components each have a mutually facing stepped profile which forms the stepped contact surfaces 7, 8 of the base strip 1 and the connection block 2. The stepped contact surface 7 of the base strip 1 confronts the insertion direction 9 of the connection blocks 2 and overload contact-breaker 3. Correspondingly directed in the opposite direction is the stepped contact surface 8 of the connection block 2.

Insertion openings 12, 12', 12'', 12''' located

one after the other in the longitudinal direction and on the upper surface 10 or one of the stepped partial surface [sic] 11 confronting the insertion direction 9 make the internal space of the casing of the base strip 1 accessible for the contact prongs 13 of the overload contact-breakers 3 and the connection blocks 2.

The base strip 1 and the connection blocks 2 form, in the position in which one is placed on the other, a sub-assembly, approximately rectangular in cross-section, with upper surfaces 10, 14 extending in the same plane.

At its two ends 15, 16, the casing 17 of the base strip 1 opens into the two connection boxes 18, 19. The main connection to the base strip 1 is undertaken by means of main supply leads (not shown) for the phase, neutral and earth connection in the connection box 18 located on the left-hand side of Fig. 2. As is clear from Fig. 2 and 3, connection clamps 20, 21, 22 located parallel and adjacent to one another are present in the connection box 18 protruding above the upper surfaces 10, 14 in a direction transverse to them. These connection clamps 20, 21, 22 are so-called jacket clamps and are each provided with a clamping screw 23. The longitudinal direction of these terminal screws 23 is parallel to the insertion direction 9. They can be actuated from above by means of access openings 24 in the top wall 25 of the connection box 18. Lead-in openings 26 for the main supply leads (not shown) are provided on the end surface of the connection box 18. These main supply leads end at the respective connection clamps 20, 21, 22.

The precise construction of the base strip 1 is shown by means of an exploded view in Fig. 3. The casing 17 is manufactured from insulating material and is composed of a casing lower part 27 and a casing upper part 28. The upper part arches like a cover over the lower part 27 and is connected to the latter in the final assembled position by means of rivets 29 which

engage in sleeve protrusions 30 formed in the insertion direction 9 on the bottom of the casing lower part 27. The phase bus-bar 31, the signal bus-bar 32, the neutral bus-bar 33 and the earth bus-bar 34 are located parallel and adjacent to one another in the longitudinal direction of the base strip 1 between the casing lower part 27 and the casing upper part 28.

The phase bus-bar 31 located at the back in the viewing direction of Fig. 3 is designed as a stamping of flat rectangular cross-section directed parallel to the insertion direction 9. Integral contact struts 36 of approximately square cross-section are formed in the longitudinal direction at its two free ends. One contact strut 36 at the connection box 18 end engages in the connection clamp 20. The phase bus-bar 31 is solidly connected, electrically and mechanically, to the phase main connection lead (not shown) by tightening the associated clamping screw 23. Integral contact tabs 38 are formed on the edge 37 of the phase bus-bar 31 confronting the insertion direction 9. These contact tabs 38 are counter to the insertion direction 9 and are substantially aligned with every second insertion opening 12 of the insertion opening row 39 at the back, viewed in the direction of Fig. 3. In the case of a 16-fold connection unit, there are 16 such contact tabs 38 whereas the insertion opening row 39 has thirty-two insertion openings 12. One plug-in position 4 of the multiple plug connection unit therefore includes, inter alia, a contact tab 38 and two adjacent insertion openings of the insertion opening row 39. When an overload contact-breaker 3 is placed on such a plug-in position 4, its phase inlet contact prong 40 comes into surface contact with the contact tab 38 so that an electrical connection is made. The contact pressure between the tab and the prong is reinforced in each case by contact pressure springs 41 enclosing both components and pushed onto each contact tab 38.

The signal bus-bar 32 is located alongside the phase bus-bar 31 and is parallel to it and the contact tabs 38' of this signal bus-bar 32 are aligned, in the transverse direction of the base strip, with the contact tabs 38 of the phase bus-bar 31. The contact struts 36' are welded in the longitudinal direction onto the free ends 35' of the signal bus-bar 32. Integral connection is not necessary in this case because it is not important to achieve the smallest possible transfer resistances in the signal circuit. In the insertion direction 9, the contact tabs 38' of the signal bus-bar 32 are aligned with the insertion openings 12' of the row 39' located in front of the insertion opening row 39. The signal input contact prongs 42 of the overload contact-breaker 3 engage in the respective insertion openings 12' and, when placed in position, are in contact with the contact prongs 38'. Contact pressure springs 41 are again present to increase the contact pressure. The contact strut 36' of the signal bus-bar 32 located at the end of the connection box 18 engages in the connection clamp 21 of smaller dimensions and is there connected, electrically and mechanically, to the main signal connection (not shown).

The neutral bus-bar 33 is located in front of the phase bus-bar 31 and the signal bus-bar 32, parallel to them in the longitudinal direction but different in shape. An approximately square metal rod 43 forms the support structure for the neutral bus-bar 33. L-shaped contact tabs 38" are integrally applied by cold working to its front edge, which is parallel to the insertion direction 9. Each of the vertical legs of the L aligns with each second insertion opening 12" of the insertion opening row 39" located on the upper surface 10 of the stepped partial surface 11. The free end 35" of the contact strut 36" on the end of the neutral bus-bar 33 pointing towards the connection box 18 engages in the connection clamp 22. The connection

end of the neutral main connection lead (not shown) is also located there. A reliable electrical connection for the neutral bus-bar 33 is created by tightening the clamping screw 23".

5 The neutral bus-bar 33 is flanked by the earth bus-bar 34 which is designed as a stamping with a flat rectangular cross-section and contact tabs 38" formed integrally on it. The earth bus-bar 34 is located under the neutral bus-bar 33 in a plane at right angles to the insertion direction (on this point, see also Fig. 7). The contact tabs 38" are bent at right angles to it counter to the insertion direction 9. Relative to the longitudinal direction of the base strip 1, the contact tabs 38" of the neutral bus-bar 33 and the contact tabs 38" of the earth bus-bar 34 are located on one line and alternate with one another. The contact tabs 38" of the earth bus-bar 34 are aligned with the insertion openings 12" of the insertion opening row 39". On its free ends 35", the earth bus-bar 34 has an annular collar 45 formed integrally on it, the internal opening of this annular collar 45 being penetrated in the extension direction 9 by a riveted bush 46. The latter is connected to an earth pin 48 protruding from the lower surface 47 of the casing lower part 27 in the insertion direction 9. This earthing pin 48 is used to earth the earth bus-bar 34.

Placing a plurality of base strips 1, 1' one after the other is explained by viewing Fig. 2 and 3 together. In the connection box 19 on the end of the base strip 1 opposite the main connection end, there are two further connection clamps 20', 22' in which the second [sic] free ends 35, 35" of the phase bus-bar 31 and the neutral bus-bar 33 engage. A metallic connecting pin 49, 49' is at the same time mounted in these connection clamps 20', 22', respectively so that it can be displaced longitudinally. The connecting pins 49 and the free ends 35, 35" of the bus-bars can

be fixed relative to one another by tightening the clamping screws 23' of the connection clamps 20', 22'. When a single base strip 1 is used, the full length of the connecting pins 49, 49' is located within the casing 17. If a further base strip 1' is to be added to the row, the connecting pins 49, 49' are pushed out of the casing 17 in the longitudinal direction. The outer ends 50, 50' of the connecting pins 49, 49' then pass, during the outward motion, through openings 51 located in the end surface of the connection box 19, extend over the assembly distance 52 between the two base strips 1, 1' and engage in the lead-in openings 26' of the second base strip 1'. There they are connected, in the connection box 18', to the free ends 35, 35" of the phase bus-bar 31' and the neutral bus-bar 33'. The connection box 18', and its connection clamps 20', 21' and 22', is constructed in a similar manner to that of the base strip 1. The base strip 1' can therefore be connected to the phase main connection and the neutral main connection via the base strip 1. To make the connecting pins 49, 49' easier to push out, they have, on their inner ends 53, 53', pusher pins 54, 54', of insulating material, protruding upwards counter to the insertion direction 9. These pusher pins penetrate through guide slots 55, 55' located in the upper surface 10 of the base strip 1 and extending in the longitudinal direction. The guide slots 55, 55' are located in the extrapolation of the insertion opening row 39 in an intermediate piece 56 between the latter and the connection box 19.

In order to cover the connecting pins 49, 49' between the two base strips 1, 1', the pins are provided with in each case telescopic sleeve 57 which can be telescoped in the longitudinal direction and is acted upon by a compression spring 58 (Fig. 8). The engagement end 59 of the partial sleeve 60 pointing in the direction of the base strip 1 has an annular engagement protrusion 61 which can be engaged in the

opening 51 and can therefore be firmly connected to the base strip 1. The second partial sleeve 63 is provided with a cover 64 on its contact end 62, which cover is only cut out when a second base strip 1' has to be added to the row on an existing base strip 1. By this means, the connecting pins 49 are always covered so as to prevent them being touched. The cover 65, which can be placed on the access openings 24 on the upper surface 10 of the connection boxes 18, 19, serves the same purpose.

The precise construction of the connection blocks 2 and their fixing to the base strip 1 may be explained by means of Fig. 4 to 6. The connection blocks 2 consist essentially of a casing 66 manufactured from an insulating material and having an upside-down stepped profile in cross-section. When the connection blocks 2 are placed in position, the stepped contact surfaces 8 face the stepped contact surfaces 7 of the base strip and are located on the latter as a form fit. Three lead-in openings 68 are formed, adjacent to one another in the longitudinal direction, onto the side of the stepped profile in the lower surface 67 for the distributor leads 5 for the phase, neutral and earth connection of the consumer unit. The connection ends of the distributor lead 5 end in horizontally arranged connection clamps 69. Their clamping screws 70 can be actuated by means of access openings 71 which pass through the side walls 72, parallel to the longitudinal direction, of the connection blocks 2. Two contact prongs 74, 74' on the same plane emerge downwards in the insertion direction 9 from the stepped partial surface 73 of the connection blocks 2 flush with the insertion opening row 39" of the base strip 1 and, when the connection blocks are in position, these contact prongs 74, 74' respectively engage in the insertion openings 12" and 12"' of the base strip 1 and make surface contact with one of the contact tabs 38" of the neutral bus-bar 33 or one of

the contact tab [sic] 38'' of the earth bus-bar 34. The contact pressure between the contact prongs 74, 74' and the contact tab [sic] 38'' and 38'' is again increased by means of contact pressure springs 41. The internal, further course of the contact prongs 74, 74' is shown in Fig. 5. The contact prong 74 forms one U-leg of a U-shaped contact piece 75 whose second U-leg is formed by a contact tab 76. This engages in the connection clamp 69 for the connection of the earth distributor lead 5. By this means, the latter is electrically connected to the earth bus-bar 34. The second contact prong 74' is the U-leg of a second U-shaped contact piece 75' whose second U-leg is again formed by a contact tab 76'. The latter engages in the connection clamp 69' for the neutral distributor lead 5 of the consumer unit. By this means, this distributor lead is also connected to the associated bus-bar (neutral bus-bar 33). A further contact tab 78 pointing upwards counter to the insertion direction 9 is formed on the U-base 77 of this contact piece 75'. The contact tab 78 is aligned with the insertion opening 79 in the upper surface 14 of the connection block casing 66. The insertion opening 79 is used for accepting the signal output contact prong 80 of the overload contact-breaker which, when placed in position, comes into surface contact with the contact tab 78. By this means, a continuous signal circuit is created between (sic) the signal bus-bar 32 via the overload contact-breaker 3 to the neutral bus-bar 33 and this ensures condition monitoring of the overload contact-breaker 3 of a base strip 1.

In the casing 66 of the connection block, there is also a longitudinally extended contact piece 75'' whose lower end engages in the connection clamp 69'' for the phase distributor lead. The upper end designed in the form of a contact tab is flush with a further insertion opening 79' in the upper surface 14 of the connection blocks 2 and is acted upon by the phase output contact

prong 81 of the overload circuit-breaker 3 when the latter is in position. By this means, the phase distributor lead of the consumer unit is also electrically connected to the phase bus-bar 31 and, at the same time, is protected in the case of a short-circuit or overload by the overload circuit-breaker 3. The remaining contact prongs of the overload contact-breaker 3 are idle contact prongs 82 which only carry out the task of an improved mechanical fastening by means of their insertion in corresponding insertion openings in the connection blocks 2 and the base strip 1 but are irrelevant with respect to electrical connection.

The fixing device for the connection blocks 2 on the base strip 1 is shown particularly clearly in Fig. 6. A fixing screw 83 passes through the connection blocks 2 in the insertion direction 9 and emerges downwards from one of their stepped partial surfaces 73'. The fixing screw 83 is located in the longitudinal axial direction by means of the shim washer 84 fastened to the casing 66. In the central stepped partial surface 11' of the base strip 1, holes 85 are located in rows, with which holes nuts 86 enclosed in a rotationally fixed manner between the casing upper part 28 and the casing lower part 27 of the base strip 1 are aligned. If a connection block should be placed on a plug-in position 4, the free end 87 of the fixing screw 83 engages first in the holes 85 until it comes in contact with the threaded hole of the nut 86. From this position, the connection block must be brought into its final assembled position by rotation of the fixing screw 83. For this purpose, a circular cut-out 88 is introduced on the upper surface 14 of each of the connection blocks 2 and the respective heads 89 of the fixing screws 83 are accessible by means of these. The fixing design according to the invention ensures that the correct connection sequence is always maintained. The

connection block must always be screwed separately onto the base strip before all the electrical connections are made when the overload contact-breaker is placed in position. Similarly, the consumer unit is first
5 separated at the phase end by withdrawing the overload contact-breaker before the connection block can be unscrewed.

In summary, it is clear from the above description that, in the case of the multiple plug
10 connection unit, particular attention has been paid to contact safety by covering all the live parts and to the creation of a plug connector which substantially rationalises and simplifies the connecting work and permits low transfer resistances in the case of an
15 electrical distribution installation.



Claims

1. Multiple plug connection unit for the supply of electricity to one or more parallel consumer units, particularly in telephone installations,

- 5 - having, in a base strip (1) of an insulating material, bus-bars (31, 33, 34) arranged parallel to one another for phase, neutral and earth connection, and
- having in each case one overload contact-breaker (3)
- 10 which can be inserted between each consumer unit and the phase bus-bar (31),
- the consumer unit or consumer units being each connected via distributor leads (5) for phase, neutral and earth connection, which leads can be electrically
- 15 connected to the particular bus-bars (31, 33, 34) by means of the multiple plug connection unit, characterised by the following features:

- a) the bus-bars (31, 33, 34) are enclosed on all sides by the casing (17) of the base strip (1) and are
- 20 accessible by means of insertion openings (12, 12, 12", 12"'), for contact prongs (13), the openings being arranged in a casing wall and each opening being substantially aligned with the bus-bars (31, 33, 34);
- b) the distributor lead connections for each
- 25 particular consumer unit are combined in a separate connection block (2) in each case;
- c) the connection blocks (2) can be placed one after the other along the base strip (1), making direct contact with the neutral (33) and earth (34) bus-bars;
- 30 and
- d) the overload contact-breakers (3) can be placed on the casing (17) of the base strip (1), making contact with the phase bus-bar (31) and, when placed in position, each simultaneously makes contact with the
- 35 phase connections of the connection blocks (2), which are enclosed between the base strip (1) and the overload contact-breaker (3).

2. Plug connection unit according to Claim 1,



characterised in that the base strip (1) and the connection blocks (2) exhibit a step-shaped recess, mutually matching in cross-section, in their side wall regions which face one another when they are placed in position.

3. Plug connection unit according to Claim 2, characterised in that when placed in position, the base strip (1) and the connection blocks (2) form an assembly unit with a substantially rectangular cross-section whose mutual contact surfaces (7, 8) are formed by the recess as stepped surfaces extending between the lower surface (47) and the upper surface (10, 14) of the assembly unit.

4. Plug connection unit according to one of the preceding claims, characterised in that the insertion openings (12, 12', 12'', 12''') in the base strip (1) are located on its upper surface (10) and stepped partial surface (11) confronting the insertion direction (9) of the connection blocks (2).

5. Plug connection unit according to one of the preceding claims, characterised in that the connection blocks (2) are each provided, in the region of their stepped partial surface (73) pointing downwards, with two contact prongs (74, 74') extending in the insertion direction (9) for making contact between the neutral and earth distributor leads and the neutral bus-bar (33) and the earth bus-bar (34) of the base strip (1).

6. Plug connection unit according to Claim 5, characterised in that the connection blocks (2) are each provided, on their surface (14) confronting the insertion direction (9), with at least one insertion opening (79, 79') through which a contact prong can be introduced to make contact with the phase distributor lead (5).

7. Plug connection unit according to one of the preceding claims, characterised in that the overload contact-breakers (3) can be inserted by means of their contact prongs (40, 42, 80, 81), each extending from



their lower surface in the insertion direction, into the insertion openings (12, 12', 79, 79'), on the substantially plane upper surface (10, 14) of the assembly unit consisting of the base strip (1) and the connection blocks (2).

8. Plug connection unit according to one of the preceding claims, characterised in that the connection blocks (2), by means of their casing, (66) enclose internal clamps (69, 69', 69'') which are used for the connection of the distributor leads (5) which can be led in by means of lead-in openings (68) arranged in the lower surface (67) of the connection blocks (2).

9. Plug connection unit according to Claim 8, characterised in that the clamps (69, 69', 69'') can be contacted by means of the two contact prongs (74, 74'), arranged in the insertion direction (9), of the connection block (2) and by means of an insertable contact prong (80, 81) of the overload contact-breaker (3).

10 Plug connection unit according to one of Claims 3 to 9, characterised in that each connection block (2) can be fixed on the base strip (1) by means of a fixing screw (83) extending in the insertion direction (9) and axially located on the connection block (2) in the region of a stepped partial surface (73), each of which fixing screws (83) engages by means of its free end (87) in one of the nuts (86) or threaded sleeves arranged in a row in the region of the stepped partial surface (11) of the base strip (1) and rotationally fixed in the casing (17).

11. Plug connection unit according to Claim 10, characterised in that each of the heads (89) of the fixing screws (83) is accessible from the upper surface (14) of the connection blocks (2).

12. Plug connection units according to one of the preceding claims, characterised in that the bus-bars (31, 32, 33, 34) are designed as integral, punched and/or cold-worked, strip-type shaped metal parts.



13. Plug connection unit according to Claim 12, characterised in that contact tabs (38, 38', 38", 38"') are formed integrally on the bus-bars (31, 32, 33, 34), counter to the insertion direction and in line in the installed position with the insertion openings (12, 12', 12", 12"'), which contact tabs are subjected to the contact prongs (13) of the connection block (2) and overload contact-breakers (3) when the connection blocks (2) and overload contact-breakers (3) are placed in position.
14. Plug connection unit according to Claim 13. characterised in that the contact prongs (13) of the connection blocks (2) and the overload contact-breakers (3) and the contact tabs (38, 38', 38", 38"') are surrounded by contact pressure springs (41) in order to increase the contact pressure when the connection blocks (2) and overload contact-breakers (3) are placed in position.
15. Plug connection unit according to one of Claims 12 to 14, characterised in that contact struts (36, 36', 36") are integrally formed on the free ends (35, 35") of the bus-bars (31, 32, 33) and extend in the longitudinal direction of the latter.
16. Plug connection unit according to one of Claims 12 to 15, characterised in that each of the end surfaces (15, 16) of the base strip (1) enters a connection box (18, 19) in which the connection clamps (20, 21, 22) for the bus-bars (31, 32, 33) are located so as to be covered over from the outside.
17. Plug connection unit according to Claims 15 and 16, characterised in that the contact struts (36, 36', 36") of the bus-bars (31, 32, 33) engaged by means of their free ends (35, 35', 35") in the connection clamps (20, 21, 22) in the connection boxes (18, 19).
18. Plug connection unit according to Claim 16 or 17, characterised in that the clamping screws (23) of the connection clamps (20, 21, 22) located adjacent to one another in the transverse direction are accessible



from above by means of access openings (24) inserted in the top wall (25) of the connection boxes (18, 19).

19. Plug connection unit according to Claim 18, characterised in that the access openings (24) can be closed by means of a cover (65).

20. Plug connection unit according to one of Claims 16 to 19, characterised in that one of the two connection boxes (18) has, as the main connection, lead-in openings (26) in its end surface, which are aligned with the connection clamps (20, 21, 22), through which the main supply leads for the connection of the phase bus-bar (31) and the neutral bus-bar (33) enter the base strip (1).

21. Plug connection unit according to one of Claims 16 to 20, characterised in that connecting pins (49, 49') manufactured from metallic material and in contact, one with the phase bus-bar (31) and one with the neutral bus-bar (33), are mounted on the end surface of the base strip (1) opposite the main connection so that they can be axially displaced in the longitudinal direction, each of which connection pins (49, 49')

- is enclosed by the casing (17) of the base strip (1) in the inactive position and

- in the active position, in which it is pushed out endways from the casing (17) of the base strip (1), it can be inserted by means of its external free end (50, 50') into the corresponding lead-in openings (26) for the connection of the phase bus-bar (31) and the neutral bus-bar (33) of a second base strip (1') located in series with the first base strip (1) in the longitudinal direction and it can be connected to the to correspond [sic] connection clamps (20, 22).

22. Plug connection unit according to Claim 21, characterised in that each of the connection pins (49, 49') penetrate through the connection clamps (20', 22') for the contact struts (36, 36') on the end surface opposite the main connection.



23. Plug connection unit according to Claim 21 or 22, characterised in that each connection pin (49, 49') is surrounded by a spring-loaded, longitudinally telescoping telescopic sleeve (57) on its free connection length between the two base strips, which telescopic sleeve (57) is fastened by means of its fastening end (engagement end 59) to the end surface of the base strip casing (17) opposite the main connection.
- 10 24. Plug connection unit according to one of Claims 21 to 23, characterised in that each connection pin (49, 49') is provided on its inner end (53, 53') with a rectangular pusher pin (54, 54') protruding upwards and manufactured from insulating material.
- 15 25. Plug connection unit according to Claim 24, characterised in that the pusher pin (54, 54') penetrates with its free end through a guide slot (55, 55') located in the upper surface (10) of the base strip (1) and extending in the longitudinal direction.
- 20 26. Plug connection unit according to one of the preceding claims, characterised in that a signal bus-bar (32) is fitted in the base strip (1) and parallel to the phase bus-bar (31), the neutral bus-bar (33) and the earth bus-bar (34), which signal bus-bar (32) can be connected by means of the signal contact connections (42, 80) of the overload contact-breaker (3) to the neutral connection (69') in the connection block (2) for the purpose of monitoring the overload contact-breaker (3).
- 25 27. Plug connection unit according to Claim 26, characterised in that the contact prong (74') of the connection block (2) forms, for the neutral connection, the U-leg of a U-shaped contact piece (75') open in the insertion direction (9),
- 30 - whose second U-leg (contact tab 76') protrudes into the corresponding connection clamp (69') for the neutral distributor lead (5) and
- 35 - on whose U-base (77) a contact tab (78) is formed



counter to the insertion direction (9), which contact tab (78)

- is aligned with a further insertion openings (79) on the upper surface (14) of the connection block (2) and
- 5 - is subjected to the signal output contact prong (80) of the overload contact-breaker (3) in the inserted position of the latter.

28. Plug connection unit according to Claim 27, characterised in that the contact prong (74) of the connection block (2) forms, for the earth connection, the U-leg of a further contact piece (75), U-shaped in the insertion direction, the second U-leg (contact tab 10 76) of the contact piece (75) protrudes, offset to the first U-leg in the U-plane, into the corresponding connection clamp (69) for the earth distributor lead. 15

29. Plug connection unit according to Claim 27 or 28, characterised in that in the connection block (2), a further contact piece (75") extends in the insertion direction (9),

- 20 - whose end pointing counter to this direction is subjected to the phase output contact prong (81) of the overload contact-breaker in the inserted position of the latter, and
- whose end pointing in the insertion direction (9) 25 protrudes into the connection clamp (69") for the phase distributor lead (5).

30. Plug connection unit according to one of the preceding claims, characterised in that the earth bus-bar (34) carries a ring extension (collar 45), located at right angles to the insertion direction, on each of its free ends (35''), which ring extension is penetrated, in the final assembled position, by a riveted bush (46) connected to an earth pin (48) emerging downwards in the insertion direction (9) from 35 the base strip (1).