

PROTECTIVE CIRCUIT AND PROTECTIVE MODULE FOR TELECOMMUNICATION DEVICES

The present invention relates to a protective circuit for the protection of a user from overvoltage and overcurrent, in particular for telecommunication devices, according to the preamble of claim 1.

From FR-A-2 455 381, a protective circuit for the protection of a user from overvoltage and overcurrent is known in the art. This protective device comprises a cross path between two parallel lines, said cross path including an overvoltage protection element and a heat-sensitive protection device acting on the overvoltage protection element. In the one line is further disposed a fuse element ahead of the cross path. The disadvantage of this arrangement is that by the disposal of the fuse ahead of the cross path, the fuse will be destroyed by surge currents since these will pass over the fuse. The surge currents are not carried away to earth, since the arrester cannot trip.

From DE-A-38 31 935, there is known in the art a protective circuit also comprising a fuse in the cable conductor and a cross path between cable conductor and earth conductor connected behind said fuse, said cross path being composed of a surge arrester and a heat-sensitive protection device thermally coupled therewith. An excessive thermal load on the surge arrester will lead to a response from the heat-sensitive device disconnecting the cross path. With permanent current load, the fuse will disconnect the current conduction. Thus, the system side is not protected anymore from short overvoltages, if the fuse does not disconnect, it will therefore be loaded with the overcurrent until disconnection occurs. The fuse has therefore to be resistant against surge currents which requires a large volume. After a response from the heat-sensitive protection device and of the subsequent disconnection of

the fuse, if any, the input of the system side will no longer be on a defined potential, so that the destruction of sensitive components cannot be excluded.

From EP-A-0 327 359, there is known in the art a protective circuit comprising an overvoltage cross path with a heat-sensitive protection device and a fuse disposed behind said cross path. This fuse has, however, the function of a fine protection only (protects system side), since in case of a short-circuit the fuse will not respond and the high currents can flow off over the short-circuit bridge only. There is therefore the risk of a fire on the line side.

It is therefore the object of the present invention to provide a protective circuit for the protection from overvoltage and overcurrent, which protects the surge arrester from excessive thermal loads and which disconnects current conduction in case of excessive current loads in a way that is safe for the system side, and will prevent the risk of fires.

The solution of this object is achieved by the characterizing features of claim 1. An additional solution is defined by the characterizing features of the coordinated claim 2. The protective circuit comprises a fuse connected in series with the current line, a short-circuit cross path connected between the current line and the earth line, provided with a heat-sensitive protection device and located, relative to the direction line side/system side, behind the fuse, said cross path being open in the operating condition. When overvoltages exist for an excessive period of time, the surge arrester will heat up, and will thereby operate the heat-sensitive protection device. The latter disconnects the cross path of the surge arrester and simultaneously closes the short-circuit cross path behind the fuse, so that the current line can then be disconnected by the fuse. Due to the short-circuit cross path, the input of the system side is then on a defined potential, namely earth.

With an inadmissibly high current loading, which may occur, e.g., with an overvoltage on the current line without the surge arrester being tripped, the current line is disconnected. Since in this case the heat-sensitive protection device does not respond, the

short-circuit cross path is not closed, so that here, too, no risk of fire exists due to excessive currents in the short-circuit line.

Since the branch of the cross path of the surge arrester is arranged before the fuse, relative to the direction line side-system side, the fuse is not loaded by current surges and may be kept small. When the heat-sensitive protection device is operated, the short-circuit cross path behind the fuse is closed, so that the latter will open the current line for correspondingly high currents. Since tripping of the heat-sensitive protection device causes opening of the cross path of the surge arrester, another operation of the surge arrester is prevented.

According to the features of claim 3, the cross path of the surge arrester and the short-circuit cross path are disposed behind the fuse being bridged by a short-circuit, which is separated when disconnecting the cross path of the surge arrester. Herein, the surge current load is also kept away from the fuse. The latter is disposed before the branch of the surge arrester and of the open short-circuit cross path, and is parallelly bridged with a short-circuit switch, so that, in operating condition, only the smaller portion of the current flows through it. Tripping of the heat-sensitive protection device will lead to an opening of the short-circuit, bridging the fuse, and to a closing of the short-circuit cross path between current line and earth line, so that the fuse is activated.

According to the preamble of claim 4, the protective circuit is symmetrically doubled for protecting two current lines of a double conductor, wherein, upon operation of a heat-sensitive protection device, both surge arresters are disconnected from the earth line over a common change-over switch, and both short-circuit cross paths are closed. Herein, the protective circuit is mounted into a double conductor as it is commonly done in the telecommunication sector. Between each of the two current lines and the common earth line, the protective function is achieved such that, upon tripping of only one heat-sensitive protection device, the common safety function is activated, both surge arresters are disconnected from the earth line,

and both short-circuit cross paths are closed. Instead of two separate surge arresters, a three-pole surge arrester can also be employed.

According to the preamble of claim 5, the protective circuit is further provided with a fine protection, so that according to VDE 0845, part 1, October 1987, a stage-type protection by coarse and fine protection is obtained. The fine protection comprises, according to the features of claim 6, a PTC resistor and a varistor being thermally closely coupled. Such devices are known in the art from DE-OS 32 31 066. Such a fine protection permits the protection from quick transient events and from overvoltages and overcurrents, where the coarse protection does not respond. The voltage-dependent resistor (varistor) guarantees limiting the voltage to the desired maximum level, and operates very quickly with response times in the order nanoseconds. The temperature-dependent PTC resistor (PTC = positive temperature coefficient) in the longitudinal branch serves for decoupling between the voltage limits in the coarse protection from those in the fine protection. Further, the PTC resistor serves for limiting currents in time, which are larger than the common and admissible operating currents by the heating-up of the PTC resistor due to the current flowing. Finally, the PTC resistor serves for overload protection of the voltage limiting in the fine protection (varistor), on one hand, by self-heating of the PTC resistor by the current flowing, with the increase of the resistance resulting therefrom, and, on the other hand, by the increase of the resistance due to the heating-up of the PTC resistor by the thermal coupling of the PTC resistor with the varistor.

Providing a measuring and disconnecting position behind the stage protection according to the features of claim 7, permits a partial testing of the functions of the protective circuit and of the current line with incorporated protective circuit. In the telecommunication sector, it is particularly advantageous to adapt such protective circuits as protective modules.

Further advantageous embodiments of the invention, in particular of the structure of the protective

circuit as a protective module, can be found in the subclaims.

In the following, the invention is described in more detail, based on several embodiments represented in the drawings of protective circuits, and on an embodiment represented in the drawings of a protective module. There are:

- Fig. 1 the circuit diagram of the first embodiment of the protective circuit provided with a fuse arranged therebehind for application in double conductors, in the operating condition,
- Fig. 2 the protective circuit according to Fig. 1 in the tripped condition,
- Fig. 3 the circuit diagram of the second embodiment of the protective circuit with bridged fuse arranged therebefore,
- Fig. 4 the circuit diagram of the third embodiment of the protective circuit as stage protection with measuring and disconnecting position,
- Fig. 5 the circuit diagram of the stage protection,
- Fig. 5a the circuit diagram of the fourth embodiment of the protective circuit,
- Fig. 6 a longitudinal section through the protective module,
- Fig. 7 the top view of the circuit board of the protective module,
- Fig. 8 a cross section through the protective module along line A-B in Fig. 6,
- Fig. 9 a cross section through the protective module along line C-D in Fig. 6,
- Fig. 10 the bottom view of the protective module with removed circuit board,
- Fig. 11 a top view of the protective module,
- Fig. 12 the side view of a connector bank of the telecommunication sector with five inserted protective modules, with a mounted earth rail and a set-up signal bracket to be operated by the signalling lugs of the protective modules,
- Fig. 13 a front view of the connector bank with inserted protective modules and signal bracket in not folded-down condition, and

Fig. 14 a front view according to Fig. 13 with folded-down signal bracket.

Referring now to Fig. 1, there is a protective circuit shown, arranged between the terminals a-a' and b-b' of line side L and system side S, resp., a common earth conductor E being provided for carrying overcurrents off, which are generated by overvoltages referenced to the earth potential. The protective module comprises two surge arresters 1, 2, being connected as cross paths between the terminals a and E or b and E, resp., and fuses 3, 4, being connected in the connection lines between the terminals a, a' or b, b', behind the branches 12 of the surge arresters 1, 2. The surge arresters 1, 2 are thermally controlled by heat-sensitive protection devices 5, 6. Fig. 1 shows the protective circuit in operating condition, i.e. the surge arresters 1, 2 contact a change-over switch 9, which is connected over a base 10 with the earth line E. The short-circuit cross paths 7, 8 are opened, and are, in operating condition, not connected with the change-over switch 9. Occurring overvoltages, the duration of time of which is sufficient to trip the surge arrester 1 or 2, are carried off to earth E over said surge arresters with the resulting overcurrent. The fuses 3, 4 are, therefore, not loaded with the surge currents.

In Fig. 2, the protective circuit according to Fig. 1 is represented with tripped fuse operation. An excessive thermal load of one of the two surge arresters 1, 2, i.e. an excessive current load, will operate the corresponding heat-sensitive protection device 5 or 6, resp., and causes an operation of the common change-over switch 9. This is shown here by the displacement thereof toward the right. Thereby, the short-circuit cross paths 7, 8 are connected to the earth line, and are closed. The cross paths of the surge arresters 1, 2 are disconnected. The fuses 3, 4 are activated now, and can disconnect the current lines between the terminals a, a' and b, b'. The terminals a', b' of the system side S are now on a defined potential, namely the earth potential, so that protection of personnel and of sensitive electronic cir-

cuitry on the system side S is guaranteed. A risk of fire, as otherwise possibly being caused by the protective circuit, is also prevented.

Fig. 3 shows another embodiment of the protective circuit with a modified arrangement of the fuses 3', 4'. A fuse 3' is arranged in the line connection between the terminals a, a' before the cross path of the surge arrester 1. The short-circuit cross path 7 arranged behind thereof is open in operating condition, whereas the cross path of the surge arrester 1 contacts the change-over switch 9, which is connected with the earth line E. The fuse 3' is short-circuited, in this short-circuit a closed switch 11 being incorporated. The heat-sensitive protection device 5 acts upon the change-over switch 9 and the switch 11 such that tripping of the heat-sensitive protection device 5 will cause opening of the cross path of the surge arrester 1 and closing of the short-circuit cross path 7. Simultaneously, the switch 11 in the short-circuit of the fuse 3' is opened, so that the fuse 3' is activated over the short-circuit cross path 7.

The partitioning of the protective circuit into a coarse protection 20 and a fine protection 21 in the form of a stage-type protection is shown by the protective circuit according to Fig. 4. This stage-type protection is extended by a measuring and disconnecting position 22 connected behind thereof.

Fig. 5 shows another embodiment of the stage-type protection with measuring and disconnecting position 22. Into the double conductor of the line connection between the terminals a, a' and b, b' with the earth conductor E, the coarse protection 20, the subsequent fine protection 21 and the subsequent measuring and disconnecting positions 22 existing in each line connection are disposed. The coarse protection 20 is formed of the cross paths with the surge arresters 1, 2, the subsequent fuses 3, 4 provided in the line connections, the short-circuit cross paths 7, 8, the heat-sensitive protection devices 5, 6 and the common change-over switch 9. The subsequent fine protection 21 is composed of the PTC resistors 30, 31 provided in the respective line connection, and of the varistors 32, 33 following thereupon, said varistors being con-

ected in parallel between the respective line connection between the terminals a, a' and b, b' and the earth conductor E. The earth potential is lead outside as another measuring position 35, so that potential measurements between the measuring and disconnecting positions 34 and the measuring position 35 for the earth potential are possible.

Fig. 5a shows another embodiment of the protective circuit with a signalling device. The protective device comprises a three-pole surge arrester 1' between the line connections of the terminals a, a' and b, b', the central electrode 13 being connected over a slide contact 14 with the change-over switch 9 adapted as a slider 45 and being at earth potential. The fuses 3, 4 are provided in the line connections behind the cross path of the three-pole surge arrester 1'. The heat-sensitive protection devices 5, 6 and the short-circuit cross paths 7, 8 are provided in the same construction as in the previous embodiments. The earth conductor E contacts the change-over switch 9 over a slide contact 15. The measuring and disconnecting positions 34 in the line connections between the terminals a, a' and b, b' are provided as well.

At the end of the change-over switch 9, there is mounted a contact maker 16, the connection line 17 of which may be connected with further protective modules 99 and leads to an electronic signal transducer 18 connected over a resistor 19 to a line 24, wherein a signal transducer 25 for a central signal and an exchange battery 26 is provided. The protective circuit permits a central signallization, whether or not a protective module 99 has been tripped in a protected field, e.g. of a main distribution frame of the communication. The free end of the change-over switch 9 serves, herein, as a signalling lug 56, which will, with tripped protective module 99, come into contact with the contact maker 26 and will also accept the earth potential. If, thereby, the circuit is closed over the local signalling transducer 18, then the tripping condition of the protective module 99 can be indicated at the main distribution frame or in a field, and, if applicable, also at a connector block, by a lamp, LED, buzzer or by another signalling de-

vice. Contact making needs not be permanent, but may have a type of trigger function. If applicable, power supply of the signalling device has to be performed over a DC/DC converter, since protective earth may accept a high potential. Over interfaces to counting mechanisms, heavily loaded current lines, e.g. with frequent tripping, can be found out.

Fig. 6 shows a central longitudinal section through a protective module 99 adapted as a miniature module provided with a protective circuit, being adapted as a stage-type protection with measuring and disconnecting position 22. The miniature switch finds its applications particularly in the telecommunication sector.

An external housing 40, the lower section of which is formed of a circuit board 41, includes a three-pole surge arrester 42, the central electrode of which contacts a sheet-metal part 43. Such a three-pole surge arrester 42 comprises a left-hand and a right-hand external electrode 27, 28 and a common central electrode 13, so that two spark gaps are formed between the external electrodes 27, 28 and the central electrode 13. The sheet-metal part 43 is conductively connected, over a solder position 44, with a metal slider 45 at a lug 46 showing downwardly, said lug being guided in a guide slot 81 at the circuit board 41. The slider rests with contact projections 47, 48, one of which only is visible in Fig. 6, on the circuit board 41, and is spring-loaded at its side directed toward the surge arrester 42 by means of a spring 88 mounted on a guide pin 49. The spring 88 is supported, on the other side, on an internal housing wall 50, forming, together with an internal housing top wall 51 and the left-hand transverse wall 52 of the housing in Fig. 6, a cavity 107 for receiving the surge arrester 42, being surrounded by the walls 50, 52 and the top wall 51. The slider 45 is contacted, at its top, by an earth plate 53 adapted as a resilient member. The latter is located in a hollow section 55 being formed by the internal top wall 51 and the external top wall 29 of the housing 40, said external top wall being open toward the external transverse wall 52 of the housing 40 and serving for receiving an earth module or an

earth rail 98, resp. For safely contacting, the earth plate 53 is provided, in the hollow section 55, with a spring tongue 54.

The slider 45 forming the change-over switch 9 comprises, at its side turned away from the spring 88, a signalling lug 56, which, with tripped safety function, passes through an opening 87 of the right-hand transverse wall 57 of the housing. Therein, another opening 58 is provided, said opening being limited by the circuit board 41. This opening 58 serves for receiving a non shown measuring and disconnecting module, and comprises spring tongues 59, 60 contacting the circuit board 41 in normal condition, i.e. without a measuring and disconnecting module being introduced.

Fig. 7 shows the circuit board 41 being part of the housing 40 of the protective module 99, and being adapted, at its left-hand end, as a contact tongue 61. On the shown side of the circuit board 41, contact areas 62, 64 are provided for contacting the line-side terminals a, b, and which are followed by external circuit tracks 63, 65. On the opposed side of the circuit board 41, identical contact areas for contacting the system-side terminals a', b' are provided. These are connected, over through-contacts 66, 68, with the circuit tracks 67, 69 extending internally in parallel to the circuit tracks 63, 65. In the incoming circuit tracks 63, 65, there are narrow sections 70, 71 forming the fuses 3, 4.

The circuit tracks 63, 65, 67, 69 terminate on the side of the circuit board 41 opposed to the contact tongue 61 each in rectangular, oblong contact zones 72, 73, 74, 75. In the contact zones 72, 75, there are provided two bores 76, 77 or 78, 79 each. Such bores 76 to 79 serve for receiving vertically mounted contact plates 96, 97. Approximately in the middle of the circuit board, there is provided a recess 80 for receiving the sheet-metal part 43. Further, a guide slot 81 is provided, which shows from the recess 80 to the side of the circuit board 41 turned away from the contact tongue 61, and which serves for receiving the lug 46 of the slider 45. The support positions 82, 83 mark the positions, where the contact projections 47, 48 of the slider are placed,

in operating condition. These are arranged in the area of the narrow sections 70, 71 of the circuit tracks 63, 65 serving as fuses 3, 4. Therefore, in operating condition, the contact projections 47, 48 will not have contact with the circuit tracks 63, 65. The contact positions 84, 85 provided on the contact zones 72, 75, mark the position of the contact projections 47, 48 with tripped function of the fuses 3, 4.

The safety function of the protective circuit is tripped by the melting of the solder position 44, so connecting the slider 45 with the contact plate 43 of the surge arrester 42. The contact plate 43 provides for a close thermal contact. Melting of the solder position 44 effects, due to the pre-tensioned spring 88, a movement of the slider 45. The latter moves away from the surge arrester 42, and disconnects the contact of the surge arrester 42 with the earth plate 53. The contact projections 47, 48 leave their non-contacting support positions 82, 83, and rest, after such movement, on the contact positions 84, 85. Therefore, a direct short-circuit between the earth plate 53 and the circuit tracks 63, 65 is established, behind the narrow sections 70, 71 forming the fuses 3, 4. The signalling lug 56 projects from the opening 87 in the transverse wall 57. Its function will be described in detail hereinbelow.

Fig. 8 shows a section through the protective module 99 along the sectional plane A-B in Fig. 6. The protective module 99 is surrounded by the housing 40 and the circuit board 41. The slider 45 comprises two L-shaped metal slider portions 90, 91, which are combined to a T-piece, such that the long legs 90', 91' forming the crosspiece of the T-piece, are tensioned relative to each other, and form an acute-angled V-shaped spring. At the respective ends of the short legs 90'', 91'' forming the flange of the T-piece, are the contact projections 47, 48 resting on the circuit board 41. The slider 45 forming the change-over switch 9 is contacted, at its top, by means of the spring force of the earth plate 53.

At each side of the long legs 90', 91' of the slider portions 90, 91, a disc-shaped varistor 32, 33, a separating contact plate 94, 95, a PTC resistor 30,

31, and an external contact plate 65, 97 are provided, the contact projections 92, 93 pressing, by the spring action of the long legs 90', 91' of the slider 45, on the varistors 32, 33, and thus contact them electrically. The contact projections 92, 93 are disposed on the inner side of the long legs 90', 91' of the L-shaped slider portions 90, 91. The PTC resistors 30, 31 have a rectangular shape, and the varistors 32, 33 have a cylindrical shape, their heights being smaller than their diameters. One varistor 32, 33 each and one PTC resistor 30, 31 each are electrically connected at their base surfaces by means of a separating contact plate 94, 95. Due to the large contact areas, the thermal contact is also very good.

The cross-section shown in Fig. 9 through the protective module 99 along line C-D in Fig. 6 shows the housing 40 with the circuit board 41. To the internal side walls of the housing 40 are adapted in their shape the contact plates 96, 97, extending wherefrom the contact plate 96 is soldered vertically into the circuit board 41, by means of the bores 76, 77, and the contact plate 97 is soldered vertically into the bores 78, 79. Inwardly follow the hollow sections 100, 101, receiving the left-hand and the right-hand PTC resistors 30, 31. Then, inwardly, follow the separating contact plates 94, 95, electrically connecting the PTC resistors 30, 31 with the varistors 32, 33. Subsequently, the receiving spaces 102, 103 for receiving the varistors 32, 33 follow. Centrally is shown the signalling lug 56 of the slider 45. Between the receiving spaces 102, 103 for the varistors 32, 33 and the circuit board 41, the spring tongues 59, 60 of the measuring and disconnecting contacts are provided. The hollow spaces 100, 101 for receiving the PTC resistors 30, 31 and the receiving spaces 102, 103 for receiving the varistors 32, 33, of the separating contact plates 94, 95, and of the spring contact tongues 59, 60 are formed in a corresponding moulded body 104, having at its front another opening 105 for passing the signalling lug 56 of the slider 45 through.

In Fig. 10, a bottom view of the protective module 99 with removed circuit board 41 is shown. The

contact spring tongues 59, 60 serving for contacting on the contact zones 73, 74 of the circuit board, are rigidly connected each with one of the separating contact plates 94, 95. Thereby, the connections between the line-side terminals a, b and the system-side terminals a', b' are established over the PTC resistors 30, 31, without employing a measuring and disconnecting module. Fig. 10 shows, further, the hollow spaces 100, 101 and the receiving spaces 102, 103 for receiving the PTC resistors 30, 31 or of the varistors 32, 33, resp. Centrally, the slider 45 with the contact projections 92, 93 is provided, the flange side of which is formed of the short legs 90'', 91'', At the ends thereof, the contact projections 47, 48 are attached, at bottom. The guide lug 49 of the compression spring 88 projects through the internal housing wall 50. On the other side of the housing wall 50, there is the receiving space 107 for receiving the three-pole surge arrester 42.

Fig. 11 shows a top view of the protective module 99. There are shown the contact plates 96, 97, the separating contact plates 94, 95 with the pertinent hollow spaces 100, 101 and the receiving spaces 102, 103 for receiving the PTC resistors 30, 31 or the varistors 32, 33, resp. The earth plate 53 partially projects over the hollow and receiving spaces 100 to 103, and over the receiving space 107 of the surge arrester 42 with the spring tongue 54. The latter serves for contacting with the earth rail 98, as will be described hereinbelow.

Instead of the varistors 32, 33, voltage-limiting semiconductor elements are employed. The varistors, the diodes and the other components can be used for modifications of the basic models in the production (modular design).

Fig. 12 shows a connector block 89 of the telecommunication with five mounted protective modules 99 and one earth rail 98. At both front sides of the connector block 89, a U-shaped signal bracket 36 is supported over pivot bearings 37. The legs 38 of the signal bracket 36 are slightly longer than the height of the mounted protective modules 99 over the connector block 89. The connection piece 39 of the signal

bracket 36 is, therefore, in the active zone of the tripped signalling lugs 56 of the protective modules 99. On the internal side of the long connection piece 39 of the signal bracket 36, there is provided an electrically conductive contact strip 106, being connected over the connection line 17 shown in Fig. 5a to the central signalling system. Fig. 13 shows the front view of the connector block 89 with signal bracket 36 arranged thereupon in operating condition. Fig. 14 shows the front view according to Fig. 13 with folded-down signal bracket 36, so to be able to replace the protective modules 99 and to allow for an easy access to the measuring and disconnecting contact. Folding-down of the signal bracket 36 is necessary, since otherwise, the protective modules 99 could not be pulled out. Folding-down of the signal bracket 36 is also possible in the opposite sense from the one shown in Fig. 14, if further connector blocks 89 provided on the one side of the connector block 89 with mounted protective module 99 would obstruct folding-down.

In Fig. 12, there is shown a protective module 99 with projecting signalling lug 56. This means that due to an interference with subsequent heating, the solder position 44 has been desoldered, and the slider 45 has been pushed out from the housing 40, under the action of the spring 88. The optical signalling lug 56 touches now the contact strip 106, and closes the signal circuit, according to the circuit diagram shown in Fig. 5a, against the earth conductor E. An additional signalling is also imaginable by closing the signal circuit according to Fig. 5a, even when the signal bracket 36 is folded down according to Fig. 14. This would avoid an inadmissible switching-off of the signalling by a folded-down signal bracket 36, i.e. already during folding-down of the signal bracket 36, a signal is given by a non-shown contact. The signal bracket 36 itself may incorporate a signalling element, e.g. an LED, a lamp or the like, in order to facilitate tracing a fault.

Patent Claims

1. A protective circuit for the protection of a user from overvoltage and overcurrent, in particular for telecommunication devices, comprising a fuse (3, 4) connected into the line connection (a, a'; b, b') and a surge arrester (1, 2) protected by a heat-sensitive protection device (5, 6) and forming a cross path between the line connection (a, a'; b, b') and the earth conductor (E), a response of the heat-sensitive protection device (5, 6) causing disconnection of the cross path of the surge arrester (1, 2), characterized by that the cross path of the surge arrester (1, 2) is arranged before the fuse (3, 4), relative to the direction line side-system side (L-S), and that the response of the heat-sensitive protection device (5, 6) causes a closure of a short-circuit cross path (7, 8) behind the fuse (3, 4) between the line connection (a, a'; b, b') and the earth conductor (E).

2. A protective circuit for the protection of a user from overvoltage and overcurrent, in particular for telecommunication devices, comprising a fuse (3, 4) connected into the line connection (a, a'; b, b') and a surge arrester (1, 2) protected by a heat-sensitive protection device (5, 6) and forming a cross path between the line connection (a, a'; b, b') and the earth conductor (E), a response of the heat-sensitive protection device (5, 6) causing disconnection of the cross path of the surge arrester (1, 2), characterized by that the cross path of the surge arrester (1, 2) is arranged behind the fuse (3', 4'), relative to the direction line side-system side (L-S), and that the response of the heat-sensitive protection device (5, 6) causes a closure of a short-circuit cross path (7, 8) between the line connection (a, a'; b, b') and the earth conductor (E) behind the cross path of the surge arrester (1, 2), and that the fuse (3', 4') is bridged by a switch (11), which is disconnected when



disconnecting the cross path of the surge arrester (1, 2).

3. A protective circuit according to one of claims 1 to 2, characterized by that the protective circuit for protecting two line connections (a, a'; b, b') of a double conductor is symmetrically doubled, both surge arresters (1, 2) being disconnected, upon a response of a heat-sensitive protection device (5, 6), from the earth conductor (E) over a common change-over switch (9), and both short-circuit cross paths (7, 8) being closed.

4. A protective circuit according to one of claims 1 to 3, characterized by that a fine protection (21) for achieving a stage-type protection composed of coarse protection (20) and fine protection (21) is connected into the line connection (a, a'; b, b').

5. A protective circuit according to claim 4, characterized by that the fine protection (21) comprises a PTC resistor (30, 31) connected into the line connection (a, a'; b, b') and a varistor (32, 33) connected transversely thereto between the line connection (a, a'; b, b') and the earth conductor (E), said varistor being thermally closely coupled to the PTC resistor (30, 31).

6. A protective circuit according to claim 5, characterized by that in each line connection, a measuring and disconnecting position (34) is connected in series behind the stage-type protection.

7. A protective module comprising a protective circuit according to one or several of claims 3 to 6, characterized by that the change-over switch (9) is adapted as a slider (45) supported in a housing (40), the one end of said slider being connected over a solder position (44) with the earth plate (43) of a surge arrester (42) rigidly held in the housing (40), said surge arrester being spring-loaded in a direction showing away therefrom and slidably resting against an earth plate (53), and that the slider (45) comprises



contact projections (47, 48), which are contactless in the operating condition, and which contact the current lines after melting of the solder position (44) under heat influence and the thus effected displacement of the slider under spring action, and connect them to earth potential (E).

8. A protective module according to claim 7, characterized by that the slider (45) is formed of two slider portions (90, 91) having L-shaped cross sections, which are T-shapedly combined in such a manner that the two long legs (90', 91') forming the crosspiece are slightly pre-tensioned relative to each other, so that a V-shaped spring is formed, and that at the outside of the short legs (90'', 91'') forming the flange, one contact projection (47, 48) each is attached, and at the inside of the long legs (90', 91') forming the crosspiece, outwardly directed contact projections (92, 93) are attached.

9. A protective module according to claim 8, characterized by that the housing (40) is closed on one side by a circuit board (41), which is adapted at its one end as a contact tongue (61) projecting over the housing (40), said contact tongue comprising contact positions (62, 64) on either side, and circuit tracks (63, 65, 67, 69) on the side directed toward the inside of the housing (40).

10. A protective module according to claim 9, characterized by that the fuses (3, 4) on the circuit board (41) are adapted as narrow sections (70, 71) of the respective circuit tracks (63, 65).

11. A protective module according to one of claims 6 to 10, characterized by that the slider (45) comprises a signalling lug (56) showing in the direction of the transverse wall (57) of the housing (40), said signalling lug projecting, after tripping of the fuse, outwardly through an opening (87) of the housing (40), and providing a tripping signal.



12. A protective module according to one of claims 6 to 11, characterized by that on either side of the slider (45) centrally extending in the housing (40), one varistor (32, 33), one contact plate (94, 95), one PTC resistor (30, 31) and one external contact plate (96, 97) each are provided, which are all electrically connected with each other.

13. A protective module according to one of claims 6 to 12, characterized by that at the transverse wall (52) of the housing (40) directed towards the contact tongue (61), an opening (55) for introducing an earth rail (98) is provided, which can be contacted in the interior of the housing (40) by means of a spring (54).

14. A protective module according to one of the preceding claims, characterized by that at the housing wall (57) directed toward the signalling lug (56), an opening (58) for introducing a measuring and disconnecting module is provided, which lifts off, in the interior of the housing (40), a spring contact (59, 60) connecting the incoming circuit track (63, 65) behind a PTC resistor (30, 31) with the outgoing circuit track (67, 69), from the outgoing circuit track (67, 69).

15. A protective module according to one of the preceding claims, characterized by that a signal bracket (36) is provided, which is disposed in a small distance from the front-side transverse wall (57) of the protective module (99), and which can be contacted by the signalling lug (56) of the protective module (99), the signal bracket (36) being provided with a contact strip (104) for supplying a signal to a signalling device.

16. A protective module according to claim 15, characterized by that the signal bracket (36) is U-shaped, and can be folded down with its legs (38) over pivot bearings (37) at a connector block (89).

