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PROTECTION PLUG

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The present invention relates to a protection plug, in particular a voltage-surge protection plug for telecommunication installations, according to the preamble of claim 1.

A protection plug of the type referred to hereinbefore is described in DE 40 26 004 C2, said plug being adapted as a stage protection with a measuring and disconnecting position. The protection plug comprises a housing, the lower side of which is formed by a printed-circuit board, a voltage-surge suppressor, a slider, a spring, an earth plate, a signalling lug, a solder position melting with an inadmissible heating-up of the voltage-surge suppressor and causing a movement of the slider, which in turn will move the signalling lug outwardly for indication.

Disadvantageous, in this prior art protection plug, are the large number of individual parts used, thus an economical manufacture being difficult, and the load on the solder position exerted by the helical spring being tensioned, which may cause flow of the solder material.

It is therefore the object of the invention to develop a protection plug for the reliable protection against voltage surges, wherein the solder position is loaded to a minimum extent only and which is composed of few parts only and further permits automated manufacture at low cost, and which clearly shows the tripped condition at the outside.

The solution of this object is achieved by the characterising features of claim 1.

The protection plug provided according to the invention meets with a few components only the following requirements:

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- coarse protection
- fail-safe with optical signalling,
- current protection.
- measuring position.

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Coarse protection is achieved in known manner by a voltage-surge suppressor. The fail-safe mechanism connected to the voltage-surge suppressor provides a thermal protection in case of overloading of the voltage-surge suppressor, by shorting the telephone wires a, b to earth. This short-circuit mechanism is achieved by a slider, and a red signalling element at the rear side thereof being clearly visibly is moved outwards of the plug, when a voltage surge occurs.

Tripping of the fail-safe contact is achieved by a shaped part of solder material. Heating-up of the voltage-surge suppressor causes, by a welded-on or clamped-on guide plate, melting of the shaped part of solder material. The shaped part of solder material is subject to a minimum, precisely balanced spring force (pressure force) exerted by the slider, said force being close to the limit of self-locking of the slider. By an inclined orientation of a support face of the slider, generally a decoupling of the shaped part of solder material and of the spring force of the slider is obtained. The slider held in the operating condition by an edge at the housing will be released because of the melting of the shaped part of solder material and of the spring travel from the edge thus becoming free. The slider moves backwards because of a compression spring mounted thereon, said spring being supported at an internal housing wall.

In the rear part of the plug is disposed at the slider a red plastic part as a signalling element, so that with a movement of the slider it will be swung outwards from the plug and clearly shows the tripping condition.

Current protection is achieved by a fuse or a temperature-dependent resistor.

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individual parts

The one-piece housing and a few individual parts only permit a low-cost, automated manufacture of the plug.

Further advantageous embodiments of the invention are defined in the further subclaims.

In the following, the invention will be described in more detail, with reference to an embodiment of the protection plug represented in the drawings. There are:

- Fig. 1 an exploded view of the basic components of the protection plug,
- Fig. 2 the perspective view of the slider,
- Fig. 3 the side view of the opened-up plug,
- Fig. 4 the top view of the opened-up bottom side of the plug (without printed-circuit board),
- Fig. 5 the top view of the printed-circuit board (top side), and
- Fig. 6 the top view of the printed-circuit board (bottom side).

The protection plug is particularly intended as a voltage-surge protection plug for telecommunication installations in conjunction with terminal blocks.

In Fig. 1 are shown in an exploded view the components of the protection plug. According to the representation in Fig. 1, the protection plug comprises an outer housing 1, the bottom side of which being closed by a printed-circuit board 2 with a voltage-surge suppressor 3 and with fuse elements 26, a slider 4 with a compression spring 8 and a shaped part 7 of solder material, a signalling element 5 and an earth plate 27. The protection plug is connected by the earth plate 27 to the earth rail 34 of a not shown connector block and thereby to the earth of the protection system (Fig. 3).

Fig. 2 shows in a perspective view the slider 4 comprising a support portion 9 and a blade-spring portion 14 which are connected to each other as one piece by a connecting portion 18. The support portion 9 has two oppositely bent-off contact wings 10 (Fig. 4), which in the operating condition (no voltage surge)

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lie on rest faces 28 of the printed-circuit board 2 (Fig. 5), said rest faces having no electrical contact to the signal path. In case of a voltage surge for a longer period of time (e.g. in case of power crossing), the contact wings 10 are displaced by the movement of the slider 4 onto the contact faces 29 of the printed-circuit board 2 included in the signal path (Fig. 5). By this movement, the line paths a, b (Figs. 1, 3, 5) are connected to earth, and the voltage surge is carried away.

The support portion 9 comprises a receiving portion 11 (Figs. 1, 4) for the helical spring 8 being supported at an inner housing wall 31 (Fig. 4) and against the spring force thereof the slider 4 being inserted into the housing 1 of the protection plug. By a contact face 12 of the support portion 9 is established an electrical connection between the slider 4 and the earth plate 27 and a guide plate 6 at the voltage-surge suppressor 3 (Fig. 3), so that the voltage surge can be carried away over the earth rail 34 of a not shown terminal block, and the voltage-surge suppressor 3 is permanently connected to earth.

The groove 13 at the rear end of the support portion 9 serves for receiving the signalling element 5 (Fig. 1, 4).

The blade spring portion 14 is formed of a long spring arm 30 at the resilient end 15 a web 16 being bent off, and of a bent-off stop portion 19 behind the connecting portion 18 of the blade-spring portion 14 to the support portion 9. The web 16 carries the shaped part 7 of solder material and is provided as one piece with a bent-off support face 17. The support face 17 of the slider 4 is supported at an edge 20 of the housing 1 (Fig. 3) such that in the operating condition the slider 4 will exert nearly any force on the shaped part 7 of solder material, due to the self-locking forces, said shaped part 7 of solder material supporting the spring arm 30. Only in case of a voltage surge, when the shaped part 7 of solder material melts, the support face 17 will slide from the edge 20 of the housing 1 and the slider 4 will move and cause

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the voltage to be carried away to earth and the signalisation of the voltage surge case.

For the proper operation of the slider 4, the dimensions of the spring travel of the blade-spring portion 14 and thus the contact force thereof for precisely loading the shaped part 7 of solder material as well as the dimensions of the inclined orientation of the support face 17 in conjunction with the edge 20 at the housing 1 are of enormous importance.

The groove 13 at the support portion 9 serves for swinging the signalling element 5 out of an opening 32 of the housing wall 33 (Fig. 4) when the slider 4 is moved backwards.

The slider 4 has to achieve, as the most important functional element of the protection plug, the short-circuit and the signalisation thereof.

Based on Figs. 3 to 6, the mode of operation of the protection plug will now be described.

The side view of the opened protection plug shows, according to Fig. 3, the functional elements of the protection plug in their constructional structure.

The housing 1 is downwardly closed by the printed-circuit board 2. The printed-circuit board 2 carries the voltage-surge suppressor 3 with the guide plate 6 attached thereat, which connects the voltage-surge suppressor 3 over the earth plate 27 in the upper part of the housing 1 and over the earth rail 34 of a not shown terminal block to earth.

The slider 4 is in connection to earth by its contact face 12 (Fig. 2) over the earth plate 27 and to the guide plate 6 of the voltage-surge suppressor 3 over the shaped part 7 of solder material. When the voltage-surge suppressor 3 heats up, heat will be conducted over the welded-on guide plate 6 to the shaped part 7 of solder material. The shaped part 7 of solder material is subject, as described above, to a slight, precisely balanced spring force (pressure force) of the slider 4. The slider 4 used as a fail-safe mechanism and for an optical signalisation of a voltage surge, is released by the spring travel of its posi-



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tion defined by the edge 20 at the housing 1 and by the support face 17 at the blade-spring portion 14 of the slider 4, when the shaped part 7 of solder material melts by heat influence. The slider 4 moves backwards, i.e. away from the position of the voltage-surge suppressor, because of the compression spring 8 attached thereon (as described above), said compression spring being supported at the inner housing wall 31 (Fig. 4). The two contact wings 10 provided at the slider 4 (Fig. 4) are displaced by the slider movement from the rest faces 28 onto two contact faces 29 (Fig. 5). The contact faces 29 are each contact points of the telephone wires a, b. By the contact wings 10 provided at the slider 4, the wires a, b are connected to earth.

The voltage-surge suppressor 3 will remain connected to earth, in the short-circuited condition, after tripping of the fail-safe mechanism. Contact to the earth rail 34 (Fig. 3) of the terminal block (not shown) is achieved by the welded-on guide plate 6 and the earth plate 27. In the not tripped condition, earth is further connected over the shaped part 7 of solder material and the guide plate 6 to the voltage-surge suppressor 3.

In the rear part of the plug, the red signalling element 5 (Fig. 1) is disposed or supported, resp., at the slider 4 that it will be swung or rotated, resp., out of the plug upon movement of the slider 4. For this purpose, a stationary bearing portion 21 (semi-circular inner face as a bearing) is provided in the housing 1 as a fixed point of rotation for the circular outside surface 22 of the signalling element 5, a pin 23 being supported in the groove 13 of the slider 4 (Figs. 1, 4).

Current protection is achieved by the SMD fuse 26 being contacted by the solder pads 25 (Figs. 3, 5, 6). The solder pads 25 are through-plated towards the bottom side of the printed-circuit board 2 (Fig. 6).

The fuse caps (not shown) are accessible from outside to measuring tips and serve as measurement tapping positions for the individual wires.

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PATENT CLAIMS

1. A protection plug, in particular an over-voltage protection plug for telecommunication installations, generally comprising a housing with a printed-circuit board, a voltage-surge suppressor, a slider, a spring, an earth plate, a signalling element, characterised by that the slider (4) is pre-loaded over a support face (17) and over an edge (20) at the inner housing wall in the housing (1) by the spring (8), and that a shaped part (7) of solder material is loaded to a minimum extent only by the spring force (pressure force) of the slider (4).

2. A protection plug according to claim 1, characterised by that the slider (4) is formed as one piece of a support portion (9) having opposedly bent-off contact wings (10), a receiving portion (11) for the spring (8), a contact face (12) for the connection of the voltage-surge suppressor (3) to earth over an earth plate (27), a groove (13) for holding the signalling element (5), and of a blade-spring portion (14) having a long spring arm (30), the blade-spring portion (14) being bent off at its resilient end (15) to form a web (16) whereon the shaped part (7) of solder material is disposed and wherefrom the support face (17) is bent off.

3. A protection plug according to claims 1 and 2, characterised by that in the housing (1) is provided a stationary bearing portion (21) as a fixed point of rotation for a circular outside surface (22) of the signalling element (5), a pin (23) of the signalling element (5) being supported in the groove (13) of the slider (4).

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4. A protection plug according to claim 1, characterised by that the printed-circuit board (2) provided on either side with circuit tracks is through-plated in the section of the SMD solder pads (25), and that the printed-circuit board (2) comprises the voltage-surge suppressor (3) with the guide plate (6) and fuse elements (26).

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94-031

LIST OF REFERENCES

1	housing
2	printed-circuit board
3	voltage-surge suppressor
4	slider
5	signalling element
6	guide plate
7	shaped part of solder material
8	spring
9	support part
10	contact wing
11	receiving portion
12	contact face
13	groove
14	blade-spring part
15	end
16	web
17	support face
18	connecting portion
19	end stop
20	edge
21	bearing portion
22	circular outside surface
23	pin
24	
25	SMD solder pad
26	fuse element
27	earth plate
28	rest face
29	contact face
30	spring arm
31	inner housing wall
32	opening
33	housing wall
34	earth rail

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