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Description:

Keypad for Input of Control Commands



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- 5 The invention relates to a keypad for the input of control commands, particularly as used for the call input in elevators.

From US 5,664,667 a keypad for the input of control commands has become known in which a switch carrier is equipped with pushbutton switches and is laid on a printed circuit board  
10 which has switching contacts and switching circuits. The pushbutton switches have switching plungers with contacts which, when a key is pressed, act directly on the corresponding contacts of the printed circuit board and can  
15 thereby initiate a control command.

In the keypad described above, the contact is created by the contact surface on the switching plunger of the pushbutton switch directly touching the printed circuit board or, more  
20 specifically, the contact surface on the printed circuit board. Due to the open construction of this keypad, moisture can penetrate between the switch carrier and the printed circuit board with its printed conductors and switching contacts. This leads to rapid corrosion and/or oxidation of  
25 the switching contacts and printed conductors and can lead as a result to short circuits and thereby to an unsatisfactorily short service life of the keypad. Furthermore, the force used when operating the keys is transferred directly to the contact surface of the printed circuit board and, if the force is too  
30 great, can intentionally or unintentionally lead to destruction of the keypad.

The objective of the invention is to propose a keypad for the input of control commands of the type mentioned at the outset  
35 which does not have the disadvantages mentioned above. This objective is met by the invention described in Patent Claim 1.



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The advantages resulting from the invention relate mainly to the fact that the switching operation to be initiated by keys which are pressed takes place within a closed unit taking the form of a carrier, which contains a keypad base and a membrane keypad, the switching contacts being located inside the membrane keypad which is sealed against moisture, or more specifically, initiation of a command takes place within the membrane keypad which is sealed against moisture, and the switching plungers of the keypad base have only a triggering function. The closed unit in the form of the carrier also makes installation considerably easier, since the keypad base and the membrane keypad can already be assembled in the carrier at the factory and only a key module has to be placed over them on site.

By means of the measures stated in the subclaims, advantageous further developments and improvements of the keypad for the input of control commands specified in Claim 1 are possible. By means of foil hinges, the keys placed over the closed unit are integrated into a key module, and each key has a stop which acts on the carrier in such a way that the travel of the key is limited by the stop even when the force applied to the key is excessive.

A more detailed description of an embodiment of the invention which is illustrated in the drawing follows below. The drawings show:

Fig. 1                    A front view of a membrane keypad;

Figs 2 a,b,c            A front view and a side view of a keypad base together with an enlarged detail view of a switching plunger;

Figs 3 a,b              A front view and a side view of a carrier;

Figs 4 a,b            A side view and a front view of a key module;  
and

Fig. 5                A perspective view of the complete keypad.

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Fig. 1 shows a front view of a membrane keypad 1. This membrane keypad is sealed against the effects of moisture and has, for example, fifteen contacts 2. Depending on the size of the keypad and/or the desired number of signals to be  
10 triggered by the keypad the number of contacts 2 can be chosen without restriction. Furthermore, the contacts 2 each have two contact surfaces 3 which are separated from each other by a cushion of air or gas and which form a so-called contact chamber in which this cushion of air or gas is the switching  
15 travel. If mechanical pressure is applied on a contact 2 the cushion of air or gas is compressed until the two contact surfaces 3 touch and the desired signal is triggered. When the application of pressure on the contact 2 ceases, the cushion of air or gas expands again to its starting position and the  
20 contact 2 is reopened. The contacts 2 or, more specifically, the contact chambers are linked together into groups of, for example, three by linking passages not shown in the drawing so that the pressure is equalized, thereby improving the switching action. The outstanding feature of this membrane  
25 keypad 1 or, more specifically, the contacts 2 which are separated by a cushion of air or gas, is the long service life (several million switching operations) and the low cost of manufacture. Moreover, embedded in the membrane keypad 1 in Fig. 1 but not illustrated, are printed conductors which are  
30 led out from the contacts 2 via a tongue 4 so that the signals can be processed in an electronic or control unit. By being sealed against moisture, and triggering of the contact being insulated, the contacts 2 and the electrical connections taking the form of, for example, printed conductors or  
35 circuits are protected against contamination by dirt, and against corrosion or oxidation.

So that the membrane keypad 1 can be precisely positioned in a carrier or case 5 as shown in Fig. 3a and Fig. 3b, openings 6 are provided. These openings 6 are positioned so that they fit over the pins located on the case 5 and the membrane keypad 1 is thereby fastened in place.

Fig. 2a shows the front view and Fig. 2b the side view of a keypad base 10, which preferably consists of silicone rubber or a material with similar characteristics. The keypad base 10 has switching plungers 11 whose number and position corresponds with the contacts 2 of the membrane keypad 1. There are also openings 12 in the keypad base 10 so that the keypad base 10 is positioned over the pins of the carrier 5 and the switching plungers 11 lie over the contacts 2 of the membrane keypad 1.

Fig. 2c shows an enlarged cross-section of a switching plunger 11 according to Figs 2a and 2b. The switching plunger 11 consists in essence of a switching element 13 and a dome 14. The domes 14 of the switching plungers 11 are each constructed in such a manner that there is a defined switching point for the switching element 13. That is to say, the dome 14 has a precisely defined point at which it "snaps" or "clicks" which is overcome with a specified application of force on the switching plunger 11. The switching element 13 is then pressed onto the underlying contact 2 or, more specifically, the contact surface 3 of the membrane keypad 1 and thereby causes a signal to be triggered. So that the switching element 13 can trigger a signal, the keypad base 10 has openings 17 in the area of the switching plungers 11 or, more specifically, the domes 14. This makes it possible for the switching element 13 to be pressed onto the underlying contact 2 of the membrane keypad 1.

By comparison with conventional keypads, the basic difference with this construction is that the switching element 13 has no

contact surface or contact pill but has only the function of causing the signal to be triggered. The actual registration of the command takes place within the sealed membrane keypad 1 by means of pressing the two contact surfaces 3 together.

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Fig. 3a shows a front view and Fig. 3b a side view of a carrier or case 5. The purpose of this carrier 5 is to contain the membrane keypad 1 and the keypad base 10 and hold them in place. The carrier 5 consists of an upper part 20 and a lower part 21 which are joined together by means of a foil hinge 22. The upper part 20 and the lower part 21 consist of one piece so that the entire case 5 can be manufactured in an injection molding tool as a single piece. The lower part 21 has ribbing 28 taking the form of fins extending to the rear wall which serve to stiffen the carrier 5 as well as to distribute the force if there is excessive pressure on the keys. The upper part 20 contains pins 23 whose spacing matrix corresponds to that of the openings 6 in the membrane keypad and to that of the openings 12 in the keypad base 10. There are also openings 24 in the upper part 20 whose spacing matrix corresponds to that of the switching plungers 11 of the keypad base 10. These openings 24 serve to create the connection between the switching plungers 11 and the keys of the key module 16.

When first the keypad base 10 with the switching plungers 11 facing down, and then the membrane keypad 1, have been inserted in the carrier or case 5 and each of the openings 6, 12 guided over the pins 23 and thereby fastened into place, the carrier 5 can be closed. As indicated in Fig. 3b by an arrow, the carrier 5 is closed by the lower part 21 being folded over at the foil hinge 22 onto the upper part 20. To hold the carrier 5 in the closed state and to lock it, there is a lock which can be closed only once, or else a lock can be used which can be reopened for maintenance. For example, pegs 25 with conically shaped tips can be positioned on the upper part 20 which fit into holes 26 in the lower part 21, the

diameter of the holes 26 being slightly smaller than the maximum diameter of the conical tip of the peg 25.

5 The closed carrier or case 5 forms a complete, protected, and functioning unit and thereby considerably eases installation, since the keypad base 10 and the membrane keypad 1 can already be installed in the carrier 5 at the factory and on site it is only necessary to place over them a key module 16 as illustrated in Figs 4a and b. For the purpose of clicking the  
10 key module 16 onto the carrier 5 there are fastening holes 27 in the upper part 20 and the lower part 21 which lie over each other when the carrier 5 is in the closed state.

Fig 4a shows a side view and Fig. 4b a front view of a key  
15 module 16. This key module 16 in the specific form in which it can be used in an elevator installation, is for example a ten-digit keypad with additional optional functions such as a handicapped button etc., is made in one piece, and consists of keys 30 and a frame element 31. Foil hinges 32 serve as the  
20 means of connecting the keys 30 to the frame element 31 and also permit the switching movement of the keys 30. The key module 16 can be made completely from synthetic material, the keys 30 bearing symbols and/or figures of synthetic material injected from behind the keys. A further alternative is for  
25 the keys 30 themselves to be made of metal, for example die cast zinc, bearing figures and symbols of synthetic material injected from behind the keys, the remaining elements such as the frame element 31 and the film hinge 32 being made from synthetic material.

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On the back of the key module 16 there are fastening pins 33 which can be used to click the key module 16 onto the closed carrier 5 by pressing the fastening pins 33 into the corresponding fastening holes 27 in the carrier 5.

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There is a switching strip 34 on the back of each key 30

which, when a key is pressed, creates the connection to the corresponding switching plunger 11 of the keypad base 10, the plunger then causing the signal to be triggered by the contact 2 on the membrane keypad 1. A stop 35 serves the purpose of limiting the switching stroke onto the switching plunger 11 and, if excessive force is applied to the key 30, of also preventing destruction of the keypad base 10 or the membrane keypad 1 by the stop 35 acting on the external surface of the closed carrier 5.

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Fig. 5 shows a perspective view of the complete keypad. Following insertion of the membrane keypad 1 and the keypad base 10 into the open carrier 5 this is closed as indicated by the arrow and locked with the pegs 25. This closed unit can be preassembled and built into the terminal in a short space of time during production and can also be delivered directly to the jobsite as a spare part when required. This saves time during installation and, furthermore, the membrane keypad 1 and the keypad base 10 are protected from damage by the closed carrier 5. A further advantage is that no further fasteners are required to assemble the keypad. The key module 16 need finally only be clicked onto the carrier 5.

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## Patent Claims:

1. A keypad for input of commands for an elevator control system, comprising  
a membrane keypad (1) including a plurality of aligned contact pairs (2),  
means for providing tactile feedback to a user upon actuation of said contact pairs (2),  
a carrier (5) for said membrane keypad (1) and said tactile feedback providing means,  
and a plurality of activating keys (30) integrated in a key module (16) removably located on top of said carrier (5),  
characterized in that  
said membrane keypad (1) comprises a plurality of flexible air-tight chambers having upper and lower surfaces normally separated by gas cushions within the air-tight chambers, first contacts of the plurality of contact pairs (2) located on the upper surfaces and extending within the air-tight chambers and second contacts of the contact pairs (2) being located on the lower surfaces and extending within the air-tight chambers in a spaced relation to the first contacts, the gas cushions being compressible by the application of a force exerted via said activating keys (30) and said tactile feedback providing means to the exterior of the membrane keypad (1) at the location of a chosen aligned contact pair to allow the contacts of the chosen contact pair (2) to come into electrical contact, the contacts of the chosen contact pair (2) separating and returning to their spaced relation upon removal of said force, the spacing movement being supported by said gas cushion.
2. Keypad according to Claim 1,  
characterized in that  
the membrane keypad (1) is sealed against the effects of moisture.

3. Keypad according to Claim 1 or 2,  
characterized in that  
the switching plungers (11) of the keypad base (10) which  
are preferably made of silicone rubber each consist of a  
switching element (13) and a dome (14).
4. Keypad according to one of the Claims 1 to 3,  
characterized in that  
the carrier (5) consists of an upper part (20) and a lower  
part (21) which are joined together by a foil hinge (22).
5. Keypad according to one of the Claims 1 to 4,  
characterized in that  
the key module (16) consists of a frame element (31) and  
the keys (30) which are joined together by means of foil  
hinges (32).
6. Keypad according to one of the Claims 1 to 5,  
characterized in that  
the keys (30) are made of synthetic material or of metal  
with figures and symbols of synthetic material injected  
from behind the keys.
7. Keypad according to one of the Claims 1 to 6,  
characterized in that  
the keys (30) are provided with a stop (35).
8. Keypad according to one of the Claims 1 to 7,  
characterized in that  
the carrier (5) is locked in the closed state.
9. Keypad according to one of the Claims 1 to 8,  
characterized in that  
the lower part (21) of the carrier (5) has ribbing (28) in  
the form of fins extending to the rear wall.