

ELEVATOR CONTROL SYSTEM

This invention relates to improvements in an elevator control system employing an electronic computer.

The electronic computer is recently getting to be used to control elevator cars. Elevator control systems employing an electronic computer include a read only memory (which is abbreviated hereinafter to an "ROM") device having stored therein data used with a program for controlling an associated elevator system. However the ROM devices included in conventional elevator control systems have been required to store data peculiar to a mating elevator car because a building served by that elevator car may be different from other buildings in both number of floors at which elevator cars stop and vertical distance between each pair of adjacent floors. This has not only resulted in an expensive ROM device but also in the disadvantage that, upon the occurrence of a failure in the ROM device, an associated elevator car can not be again operated unless the failed ROM device is exchanged for a new ROM device having stored therein data peculiar to that elevator system.

Alternatively, the required data may be rewritten in the ROM device at the spot where the elevator car is installed. However, this measure is uneconomical only because the required writing and screening devices are expensive and is also time consuming. Therefore time elapses until the operation of the elevator system can

be restored. Further if a new ROM device is produced in an associated factory, a considerable period of time must be anticipated for the necessary procedure, the transportation of the components etc. As a result,
5 the operation of the elevator car can not be expected to be quickly restored.

Accordingly it is an object of the present invention to eliminate the disadvantages of the prior art practice as described above by the provision of a
10 new and improved elevator control system in which, upon the occurrence of a failure on an ROM device involved, the down time is as short as possible and which can be more cheaply constructed than conventional elevator control system with the electronic computers.

15 The present invention provides an elevator control system for controlling an elevator car and having an electronic computer, said system comprising a ROM device having stored therein first control data common to all elevator cars, and a setting device
20 disposed separately from said ROM device and including a plurality of control elements, each of said control elements selectively providing one of either an ON or an OFF signal, said setting device setting second control data peculiar to said elevator car and
25 concerning the serial number of a served floor by combining said ON and OFF signals from said plurality of control elements.

The present invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

Figure 1 is a block diagram of one embodiment of the elevator control system of the present invention;

Figure 2 is a circuit diagram of one embodiment of the converter shown in Figure 1, and

Figure 3 is a circuit diagram of the one embodiment of the setting device shown in Figure 1.

Referring now to Figure 1 of the drawing, there is illustrated one embodiment of the elevator control system of the present invention. The arrangement illustrated comprises a central processing unit 10 which may comprise a single chip 8-bit microprocessor commercially available under TYPE 8085A from Intel and a signal lead 12 extending from the central processing unit 10 and representing a group of signal lines such as address buses, data buses, control buses etc. The arrangement comprises further a first ROM device 14, a second ROM device 16, a random

access memory (which is abbreviated hereinafter to an "RAM") device 18, a converter 20 and a setting device 22 each connected to the lead 12 to receive and transmit data from and to the lead 12. The converter 20 is connected to a controlled object 24 or elevator's appliances disposed in an associated elevator car and on floors of a building served by that car so as to transmit and receive data to and from the latter although the elevator car and floors are not illustrated.

The first ROM device 14 has stored therein a program for controlling the elevator car and may comprise a 16K UV erasable P ROM device commercially available under TYPE 2716 from Intel firm. According to the present invention control data used with the program are divided into first data common to general elevator cars and second data peculiar to the associated elevator car. The second ROM device 16 has stored therein the first control data common to all the elevator cars as described above and may also comprise a 16K UV erasable P ROM device commercially available under TYPE 2716 from Intel firm. The second control data peculiar to the elevator car are set by the setting device 22 as will be described later.

Only when the RAM device 18 is maintained energized from an associated electric source, data is stored and held therein. The RAM device 18 may comprise a static MOS RAM device commercially available under TYPE 2114 from Intel firm.

The converter 20 is operative to convert data from one of the central processing unit 10 and the elevator's

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appliances 24 to data suitable for use with the other of the two and to supply the converted data to the latter. The converter 20 may convert a voltage level to another voltage level, an analog signal to a corresponding digital signal or a serial signal to a parallel signal as the case may be.

The converter 20 may be commercially available under TYPE SN 7407 from Texas Instrument firm and is preferably of a circuit configuration as shown in Figure 2. The arrangement illustrated comprises a buffer 20a including an input connected to an input terminal V_{in} and an output connected to an output terminal V_{out} and also through a resistor R_p to a positive terminal of a DC source having a voltage of 12 volts thereacross.

When the input terminal V_{in} is put at a high level having, for example, 5 volts, the output terminal V_{out} is put at a voltage of 12 volts. On the other hand, the input terminal V_{in} at a low level of a null volt puts the output terminal V_{out} at a null voltage.

In this way, an ON-OFF signal at 5 volts is voltage-converted to an ON-OFF signal at 12 volts.

From the foregoing it is seen that the central processing unit 10 controls normally the elevator's appliances 24 according to the program stored in the first ROM device 14 through the converter 20 while at the same time calculating data read out from the second ROM device 16 by utilizing data read out from the RAM device 18 and controlling the elevator's appliances 24 in accordance with the result of the calculation and through the converter 20.

The setting device 22 is preferably of a circuit configuration as shown in Figure 3. In the arrangement illustrated, a plurality of normally open switches, in this case, four switches S_1 , S_2 , S_3 and S_4 are disposed in parallel circuit relationship and include one of two stationary contacts connected to ground and the other stationary contacts connected to respective output terminals $22a$, $22b$, $22c$ and $22d$ and also connected together to a positive terminal E of a DC source through individual resistors R_1 , R_2 , R_3 and R_4 respectively.

In the arrangement of Figure 3, the switches S_1 , S_2 , S_3 and S_4 form respective bits of a binary number having four bit positions and can be selectively closed and opened to form predetermined data. Assuming that a building served by an associated elevator car includes ten floors, the switches S_1 and S_3 may be put in their closed position while the switches S_2 and S_4 are put in their open position. Under these circumstances, a null voltage is developed at each of the output terminals $22a$ and $22c$ while voltages as determined by the resistors R_2 and R_4 are developed at the output terminals $22b$ and $22d$. In other words, an L, an H, an L and an H levels are imparted to signals developed at the output terminals $22a$, $22b$, $22c$ and $22d$ respectively.

Then those signals are entered into the central processing unit 10 to form a binary number [1010] or a decimal number 10. That binary or decimal number designates the tenth floor.

Similarly the ordinal numbers of the remaining floors can be designated by binary numbers formed of different

combinations of the closed switch or switches and the open switch or switches.

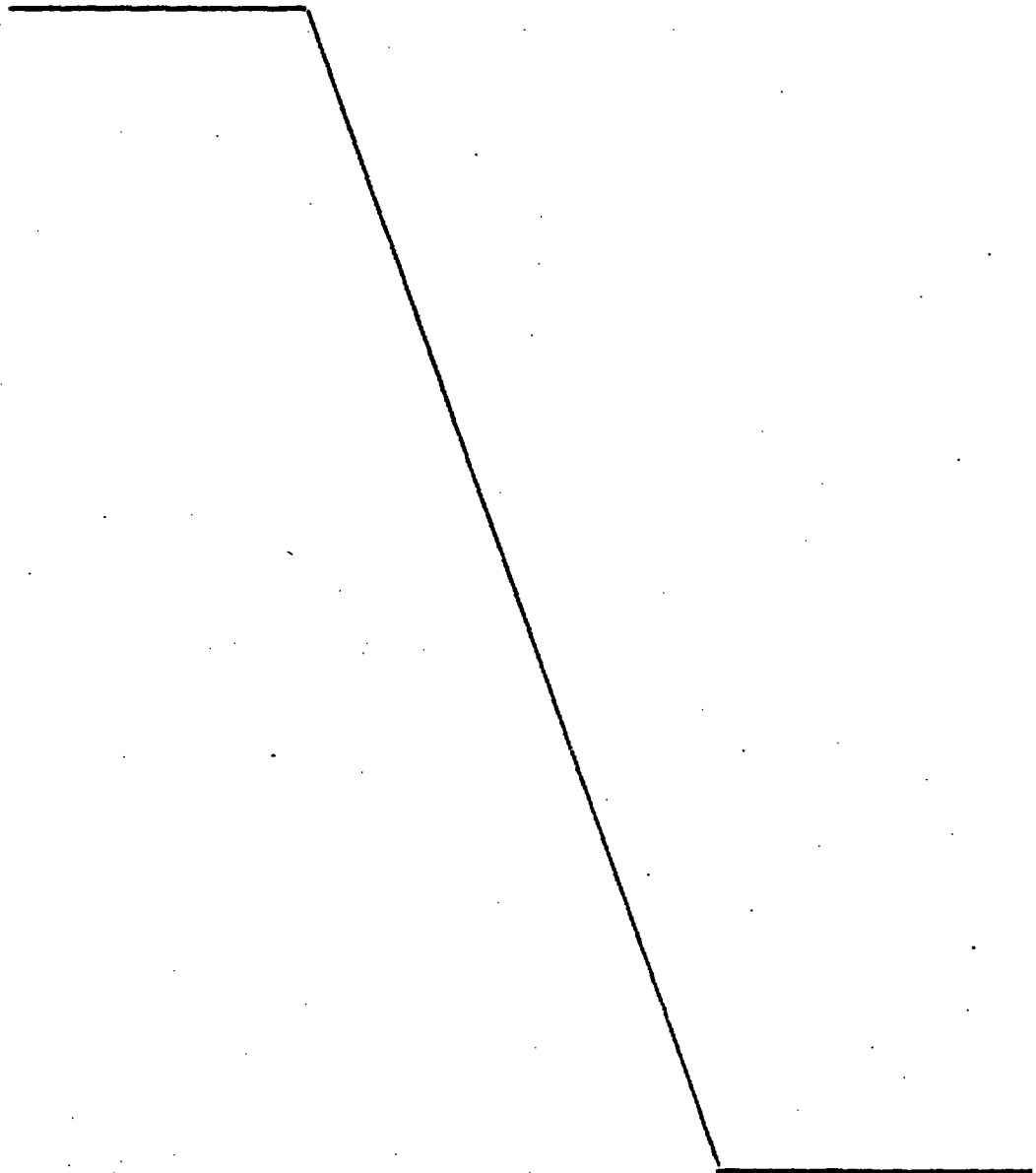
1 If desired, a length of jumper wire may be
substituted for each switch S_1 , S_2 , S_3 or S_4 . In the
s 5 latter case, the lengths of jumper wire are selectively
connected to and disconnected from an associated common
DC source in predetermined manners to designate the
ordinal numbers of the floors. In short, it is required
only to combine ON and OFF signals from a plurality of
10 control elements such as the switches or lengths of
jumper wire in predetermined manners.

 In the normal mode of the operation the arrange-
ment of Figure 1 controls the elevator's appliances 24
in the same manner as conventional elevator control
15 systems excepting that data previously stored in a
single ROM device are divided into those stored in the
ROM device 16 and those set by the setting device 22.

 Upon the occurrence of a failure on the second
ROM device 16, a spare can readily replace the failed
20 ROM device 16 because it is common to elevator cars.
This results, as a matter of course, in a far shorter
time out of service of the elevator car and according-
ly in small inconvenience to persons utilizing that
elevator car.

25 In the arrangement of Figure 1, however, the
occurrence of a failure on the setting device 22 comes

in question but the setting device 22 has a far smaller probability of occurrence of failures as compared with the second ROM device 16 because the same is formed of a plurality of simple control
5 elements, such as ON/OFF switches or lengths of jumper wire connected to or disconnected



from the associated DC source in order to provide ON or OFF signals, and therefore small in information quantity.

Apart from the problem of failures, however, 5 the setting device 22 includes the switches or lengths of jumper wire whose number is limited in view of its mounting.

Regarding the construction thereof, the setting device (22) will now be described.

10 It is now assumed that although most elevator systems must be arranged to be capable of serving buildings having at most fifty floors at which elevator cars involved stop the systems serve those having from three to ten floors. In the 15 assumed conditions, the setting device 22 is required to provide data including at least six bits to determine all the floors at which the elevator cars stop. This is because fifty indicating the number of the floors is greater than 20 2^5 and smaller than 2^6 . However, when the ordinal numbers of the floors are stored in the second ROM device 16 except for from the third to the tenth floors while only those of the latter floors are set by the setting device 22, the device 22 is 25 required only to provide 3-bit data.

Under these circumstances, the central processing unit 10 can first check if the ordinal

numbers of the floors are stored in the second ROM device 16. If so, the central processing unit 10 can read out from the second ROM device 16 that ordinal number of the floor at which the elevator car is required to stop. If the ROM device 16 does not have the ordinal number of the floor stored therein as determined by the central processing unit 10 then the setting device 22 is arranged to set the ordinal number of the floor at which the elevator car is required to stop. It is here noted that when the central processing unit 10 sees that the ROM device 16 has a cardinal number "0" for the floors entered thereinto, the same determines that the ordinal numbers of the floors are not stored in the ROM device 16. This is because the floor number "0" can not exist.

From the foregoing it is seen that the setting device 22 and the second ROM device 16 can be constructed so that, the setting device 22 sets data having values lying within a predetermined range and that the second ROM device 16 has stored therein data having values lying outside of the predetermined range.

This measure can decrease the number of the switches or lengths of jumper wire included in the setting device 22 and also standardize associated programs.

As described above, the present invention provides an elevator control system with an electronic computer comprising an ROM device for storing control data common to general elevator cars and a setting device including a plurality of control elements for providing ON and OFF signals and setting control data peculiar to a mating one of the elevator cars by different combinations of those ON and OFF signals.

10 The present invention has several advantages. For example, the ROM device can be standardized and therefore, upon the occurrence of a failure on the ROM device the out of service time of the elevator car can be very short. Also it is possible to manufacture the elevator control system more cheaply than conventional elevator control systems with the electronic computer.

While the present invention has been illustrated and described in conjunction with a single preferred embodiment thereof, it is to be understood that numerous changes and modifications may be resorted to without departing from the scope of the present invention.

Claims :



1. An elevator control system for controlling an elevator car and having an electronic computer, said system comprising a ROM device having stored therein first control data common to all elevator cars, and a
5 setting device disposed separately from said ROM device and including a plurality of control elements, each of said control elements selectively providing one of either an ON or an OFF signal, said setting device setting second control data peculiar to said
10 elevator car and concerning the serial number of a served floor by combining said ON and OFF signals from said plurality of control elements.
2. An elevator control system as claimed in Claim 1 comprising a replaceable ROM storing floor serial
15 numbers outside a predetermined range of numbers and in which said control elements are a plurality of independent manually operable on/off circuit elements preset providing in combination data signals representing floor serial numbers in the said predetermined
20 range.
3. An elevator control system as claimed in claim 1 or 2 wherein each of said control elements comprises a switch having closed and open positions to provide selectively ON and OFF signals.



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4. An elevator control system as claimed in claim 1
or 2 wherein each of said control elements comprises a
length of jumper wire selectively connected to or
disconnected from a common DC source to provide
5 selectively ON and OFF signals.

5. An elevator system substantially as hereinbefore
described with reference to the accompanying drawings.

The text of the specification has been reproduced by photocopying the applicants original
typescript. It may contain a few amendments which are difficult to read. The original
typescript containing these amendments may be inspected on the premises of the Patent Office