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(54) **Mono-bidirectional control system with a number of actuations in electrical networks via en-decoders connected by a single wire to one or more other en-decoders**

(57) In a MONO-BIDIRECTIONAL system for remote activation and deactivation of relays or LEDs connected to various branches and/or various users of an electrical and/or electronic system, comprising actuation units acting on primary electronic devices (9) which send and receive signals to one or more secondary electronic devices (9a) which depending on what these signals are, in preset ways activate or deactivate these relays (11i) or LEDs (12i), the connection between these primary and secondary electronic devices and vice versa is made digitally in the baseband in inverse form without interface on a line with the lowest impedance composed of a single wire with positive voltage between 7 and 30 volts with reference to ground or with interface if these primary and secondary electronic devices are connected via a power network by means of a carrier frequency (directive wave); this connection correlates the actuation units to activation or deactivation of relays or LEDs in preset ways, in that between these electronic devices and the actuation units or relays and LEDs, electronic circuits are inserted which are composed of a number of separable elements (1, 3, 4, 5, 8) so as to obtain a different correlation between an actuation datum and the method of activation/deactivation by replacing at least one of these elements with another which is interchangeable with it.

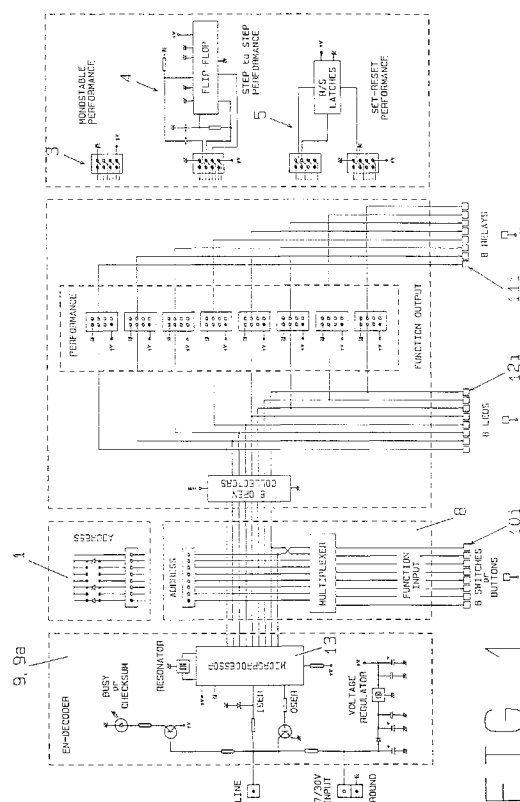


FIG. 1

Description

This invention relates to the field of electrical and electronic systems engineering, in particular electronic systems for remote activation of relays and LEDs connected to various branches and/or various users of an electrical and/or electronic system in preset ways.

Currently there are various communications systems in which elements of electrical devices interact with reception/ transmission of data on a single two-wire line, to which all are connected in parallel. These systems are composed of an assembly of devices of electrical systems for both work and home and work stations, in which a plurality of control, signalling and actuation devices are connected to one line in order to selectively activate an electronic or electrical unit. In particular, each device and each unit of the system are associated with an address which identifies its location, function and operating mode. The appropriate actuation units, for example, push buttons or sensors, and the units to be activated, for example, relays or electronic switches for lamps, are interconnected with more or less identical circuits including specific identification components for identifying the devices associated therewith, as well as their functions, using numerical values. Moreover, they can convert their numerical value into a sequence of pulses, transmit this sequence on the line, receive similar sequences, recognize and process signals received, and transmit commands and authorization signals. These circuits, as mentioned above, are all located in parallel on the two-wire line using appropriate interfaces.

First, this type of connection makes a system very sensitive to disturbances caused for example by sudden and abrupt variations of electrical characteristics due to microinterruptions or to remote connections of high loads or due to random or atmospheric factors.

Second, in a system according to the described state of the art, specific actuation of one of these push buttons or sensors corresponds to a specific result of activation or deactivation of a relay, in a fixed manner alterable only by modification of various circuits.

Third, in a system such as this, it is always necessary to interpose an appropriate interface circuit between the electronic devices designed to transmit a signal and those designed to receive the signal.

The inventor of this invention has devised a MONO-BIDIRECTIONAL system which, due to its characteristics, overcomes the aforementioned limitations.

The object of the invention is in fact a MONO-BIDIRECTIONAL system for remote activation and deactivation of a plurality of relays or LEDs connected to various branches and/or to various users of an electrical and/or electronic system, comprising actuation elements such as switches, push buttons and sensors acting on primary electronic devices capable of sending and receiving signals to one or more secondary devices which, depending on what these signals are, activate or

deactivate these relays or LEDs in preset ways, wherein the connection between the primary and secondary electronic devices is made digitally in the baseband in inverse form without the use of interfaces over a line at the lowest impedance, comprising a single wire with positive voltage between 7 and 30 volts relative to ground, or with the use of interface circuits only if these primary and secondary electronic devices are connected via power networks by the carrier frequency "directive wave", or with other carriers, such as radio or telephone channels or the like; this connection correlates the actuation of these units to activation and deactivation of these relays or LEDs in preset ways, by the fact that in between these primary and secondary electronic devices and these actuation units, pushbuttons, switches or sensors -- respectively relays and LEDs -- electronic circuits are inserted which are obtained by combining a number of separable elements in such a way as to obtain a different correlation between the same actuation of these units and the methods of activation and/or deactivation of these relays and LEDs by substitution of at least one of their elements with another which is interchangeable with it.

A more detailed description of one embodiment of the MONO-BIDIRECTIONAL system according to the invention follows, with reference to the attached figures which show the following:

- Fig. 1 is the basic circuit diagram of an embodiment of the MONO-BIDIRECTIONAL system according to the invention;
- Fig. 2 is a diagram showing the connection between the TX part of an EN-DECODER, several INPUT/OUTPUT function cards and address diode boards;
- Fig. 3 is a diagram of the RX part of an EN-DECODER with attached customizing cards shown in the margins;
- Fig. 4 shows a system according to the invention made with six EN-DECODERS in the RX part for activation and deactivation of relays and with four EN-DECODERS in the TX part with INPUT/OUTPUT function cards interposed between the actuation units and these TX EN-DECODERS.

First, the system requires an interface only if these primary and secondary electronic devices, of the EN-DECODER type, must be connected via power networks by the carrier frequency (directive wave), or with other possible carriers, such as radio or telephone channels or the like. This elimination of the interface is made possible by transmitting signals with the EN-DECODER in the inverse digital form, that is, where the positive value of the voltage present on the line which comprises a single wire, in the presence of signals which characterize the transmission of data, is carried at 0 volts. The signals are in this case sent and received on a line with lowest impedance comprising a single wire with a voltage between 7 and 30 volts which is positive relative to

ground. Obviously, in a network operating with this method, the signal will be rather long, and will be less subject to influences of random fluctuations, for example, in the network voltage generated by random and/or atmospheric events or other similar disturbances.

Second, in all possible embodiments, the flexibility and versatility of the system can be increased by inserting -- between the TX part of an EN-DECODER (9 in Figs. 1-4) and the RX part of another EN-DECODER 9a and respective actuation units 10i or relays 11i and LEDs 12i -- electronic circuits obtained by combining a number of separable parts 1, 2, 3, 4, 5, 6, 7, 8, such that replacing only one of them with another, different but interchangeable part will subsequently result in the fact that the same actuation of this unit 10i (pushbutton, sensor or switch) will produce different ways (as desired) of activating or deactivating relay(s) 11i and LEDs 12i controlled by that same unit.

By appropriately designing the various parts which comprise these electronic circuits it is in fact possible, by substituting only one, to modify the output signal of an EN-DECODER 9 in such a way as to alter the action of respective EN-DECODER 9a, consequently altering the connections between the various branches of the circuits in such a way as to activate or deactivate one or more relays 11i or LEDs 12i in the desired way. To increase the number of possible combinations which would engender different final results of activation and/or deactivation of relays 11i or LEDs 12i, similar electronic circuits obtained by combining a number of elements are also inserted between each RX EN-DECODER and the relays controlled by it.

Let us describe selected embodiments of these circuits obtained by combining a number of separable parts. According to one preferred embodiment, the circuits inserted between actuation units 10i and an EN-DECODER in the TX part (Fig. 2) are comprised of cards 6-7-8 (of known type) called integrated circuit INPUT-OUTPUT function cards, all of which are interchangeable and allow insertion of one or more address diode boards 1 (which can also be of known type), which place the circuit in the desired mode. EN-DECODERS 9 used for this embodiment are of microprocessor type 13 with five FIRMWARE, two of which are for MONO and BIDIRECTIONAL communication, and three for control.

Each of the cards to which EN-DECODERS 9 are attached is capable of being connected to a number of INPUT/OUTPUT function cards 6, 7, 8 and one or more channels (up to eight in this embodiment) which can be joined to one another via connections.

Each INPUT/OUTPUT function card 6, 7, 8 with up to eight channels is also equipped with up to eight pre-setters 2 with eight positions and with up to eight connections for insertion of as many "address" diode boards 1, with the result that by adding other cards, up to one thousand and twenty four different INPUT channels and up to one thousand and twenty four different OUTPUT channels for a single EN-DECODER are obtained.

Of course, all these components can be made with dimensions which allow them to be accommodated within an electrical "switchbox" with embedding of known type and in which various actuation units, push buttons, switches and LEDs are mounted.

Similarly to the scheme envisioned for the TX part of the EN-DECODER, inserted between its RX part and the relays to be activated/deactivated there are one or more integrated circuit cards of known type 3, 4, 5 (Fig. 3) called "customizing" cards, which are interchangeable, and each of which is capable of configuring the circuit such as to determine preset ways of actuating controlled relays 11i.

For example, for one of these relays, by appropriately substituting the proper customizing card, it is possible to obtain performance of the monostable type (with card 3), step to step type (with card 4), or set-reset type (with card 5), with all the advantages of flexibility and reliability of system operation imaginable by those skilled in the art.

Figure 1 shows all the circuits of an embodiment of the system described above. Regarding the EN-DECODERS used both in the TX and RX parts described above (Figs. 2 and 3), they are built using microprocessors 13 which each contain five FIRMWARE, two of which are for MONO and BIDIRECTIONAL communication, and three for control.

With the MONO-DIDIRECTIONAL system according to the invention, it is also possible to use standard switches as actuation units, in contrast to state of the art models which cannot do so.

The system according to the invention can be used in the BIDIRECTIONAL direction for example when one needs to be able to read -- on the LEDs attached to the boards of various actuation units or in their proximity -- the ON/OFF state of various relays or of other types of users or services controlled by actuating these units 10i, so as to always be certain that the actuation has taken place in the desired direction. In this case, one or more EN-DECODERS 9a used in the RX part function as a TRANSPONDER, sending back to one or more EN-DECODERS of part TX, signals connected thereby to actuation units 10i, signals capable of displaying the state of devices such as thermostats, pressure control devices, hygrometers, flow control devices, humidity control devices, sensors, push buttons or switches via ON/OFF type signal LEDs and/or via up to one thousand and twenty four separate inputs.

In practice, in designing the system according to this invention, the inventor has devised an economical and functional MONO-BIDIRECTIONAL system equipped with a very large number of channels (one thousand and twenty-four INPUT and one thousand and twenty four OUTPUT in the described embodiment) which can be controlled in many cases as stated with a low voltage single wire network not affected by external factors in terms of the reliability of its operation. The system according to the invention, the overall block diagram

of which is shown in Fig. 4, can also be made using methods and components different from those in the example as described and represented in the diagrams.

Other different embodiments are possible which will remain within the scope of the protection granted by this patent if they correspond to the content of the attached claims.

Claims

1. MONO-BIDIRECTIONAL system for remote activation and deactivation of relays or LEDs connected to various branches and/or various users of an electrical and/or electronic system, comprising actuation units such as switches, pushbuttons and sensors (10i) acting on primary electronic devices (9) which are capable of sending and receiving signals to secondary electronic device(s) (9a), which, depending on what these signals are, in preset ways activate or deactivate these relays (11i) or LEDs (12i), characterized in that the connection between these primary and secondary electronic devices is made digitally in the baseband in inverse form without use of interfaces on a line with the lowest impedance composed of a single wire with positive voltage between 7 and 30 volts with reference to ground or with the use of interface circuits in the case in which the primary and secondary electronic devices are connected via a power network by means of a "directive wave" carrier frequency, or with other carriers, such as radio or telephone channels or the like, this connection correlating the actuation of these units which activate or deactivate these relays or LEDs in preset ways, due to the fact that -- between these primary (9) and secondary (9a) electronic devices and these actuation units, push buttons, switches, sensors (10i), respectively relays (11i) or LEDs (12i) -- electronic circuits are inserted which are obtained by combining a number of separable elements (1, 2, 3, 4, 5, 6, 7, 8), in such a manner as to obtain a different correlation between the same actuation of these units (10i) and the methods of activation and/or deactivation of these relays (11i) or LEDs (12i) by replacement of at least one of their parts by another which is interchangeable with it.
2. MONO-BIDIRECTIONAL system according to claim 1, in which aforementioned actuation units (10) act on these primary electronic devices (9a) via one or more INPUT/OUTPUT function cards (6, 7, 8) inserted between them, these primary electronic devices being of the EN-DECODER type with microprocessor (13) and with INPUT/OUTPUT function cards (6, 7, 8) inserted between the EN-DECODERS and actuation units (10i) with the possibility of insertion of one or more "address" diode

boards (1), one per activation, each of which is different and interchangeable and made in such a way as to define, with its insertion, a particular desired correlation between its actuation unit (10i) and the method of activating and/or deactivating one or more relays (11i) and LEDs (12i) controlled by the INPUT/OUTPUT function card to which it is connected.

3. MONO-BIDIRECTIONAL system according to claim 2, in which the card of EN-DECODER (9) can connect, via connections with one or more INPUT/OUTPUT function cards (6, 7, 8), to one or more channels which can also be joined to one another by connections, up to a maximum of one thousand and twenty four different INPUT channels and up to one thousand and twenty four different OUTPUT channels.
4. MONO-BIDIRECTIONAL system according to claim 3, in which each INPUT/OUTPUT function card (6, 7, 8) is preset for a number of activations between one and eight.
5. MONO-BIDIRECTIONAL system according to claim 4, in which with one INPUT/OUTPUT function card with just one channel equipped with presetter (2) with eight positions and a connection for insertion of an address board (1), up to one thousand and twenty four different INPUT channels and up to one thousand and twenty four different OUTPUT channels, all different from one another, can be obtained.
6. MONO-BIDIRECTIONAL system according to claim 5, in which these address boards (1) which all differ from one another number up to a maximum of one hundred and twenty-eight.
7. MONO-BIDIRECTIONAL system according to any of the preceding claims, in which these secondary electronic devices which activate and/or deactivate relays (11i) or LEDs (12i) are of EN-DECODER type (9a) with microprocessor (13), connected to a plurality of relays (11i), and in which these electronic circuits inserted between them and these relays or LEDs are composed of one or more integrated circuit cards called "customizing" cards (3, 4, 5), each of which can determine preset ways of actuating relay(s) (11i) or LEDs (12i) controlled by it.
8. MONO-BIDIRECTIONAL system according to any of claims 2 through 7, in which EN-DECODER devices (9, 9a) are used which comprise microprocessors (13), each containing five FIRMWARE, two of which are for MONO and BIDIRECTIONAL communication, and three for control.

9. System according to any of the preceding claims, in which one or more EN-DECODERS (9a) used in the RX part function as a TRANSPONDER, sending back to one or more EN-DECODERS (9) of part TX signals connected to actuation units (10i), signals capable of displaying via indicator LEDs the ON/OFF state of up to one thousand and twenty four separate inputs, the state of thermostats, hygrometers, flow control devices, pressure control devices, humidity control devices, sensors, push buttons or switches, the resulting system thereby being bidirectional.

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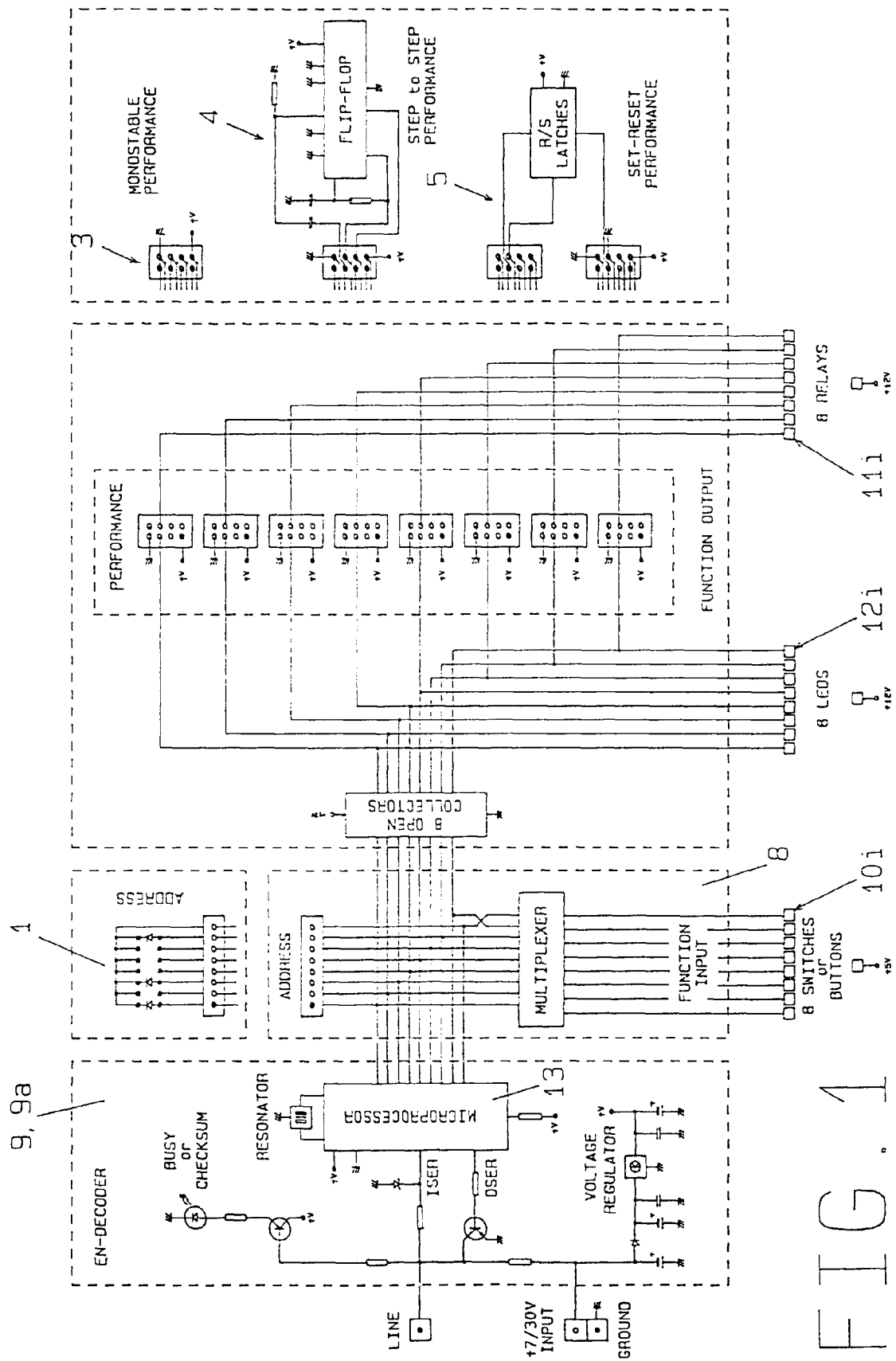
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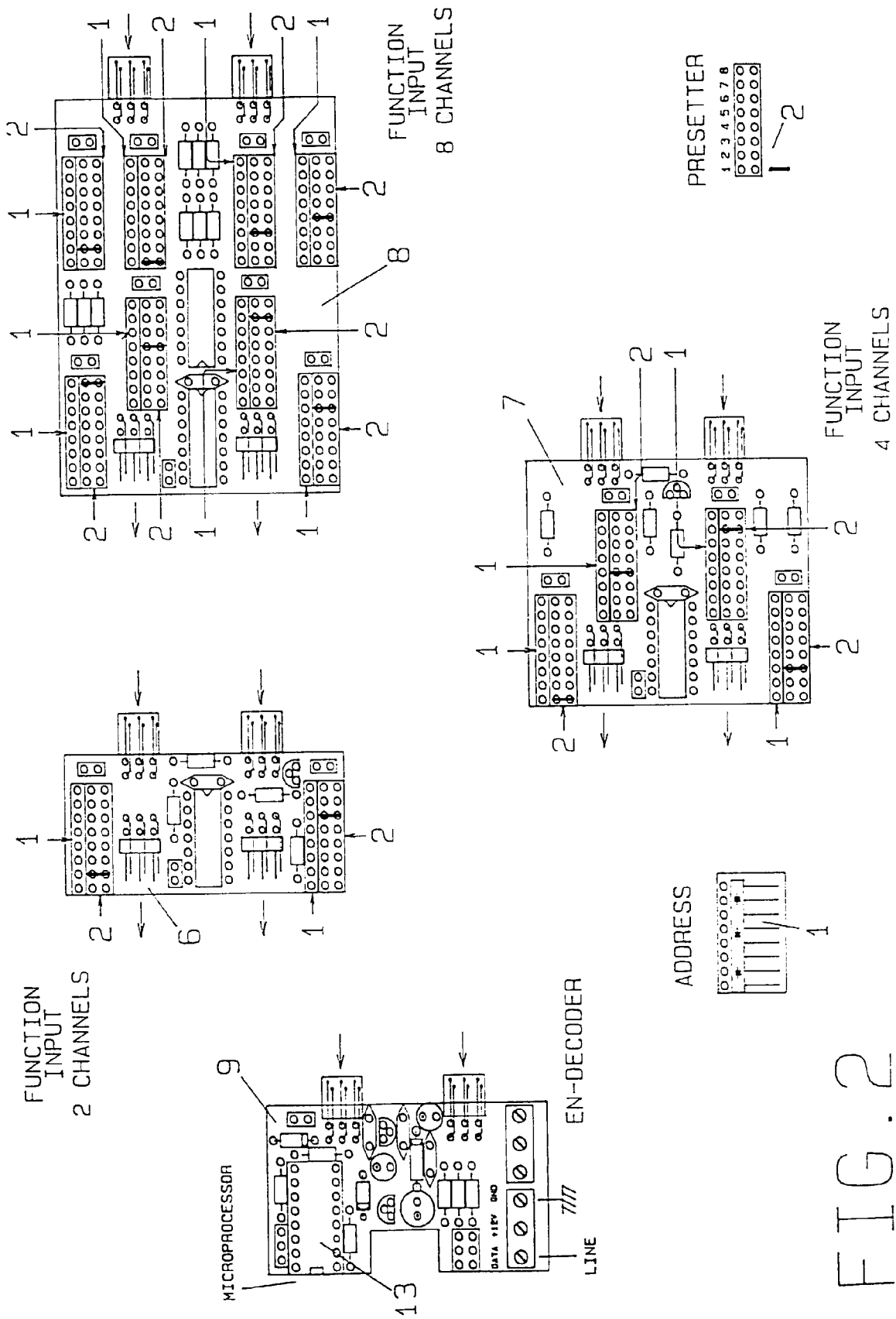


FIG. 2

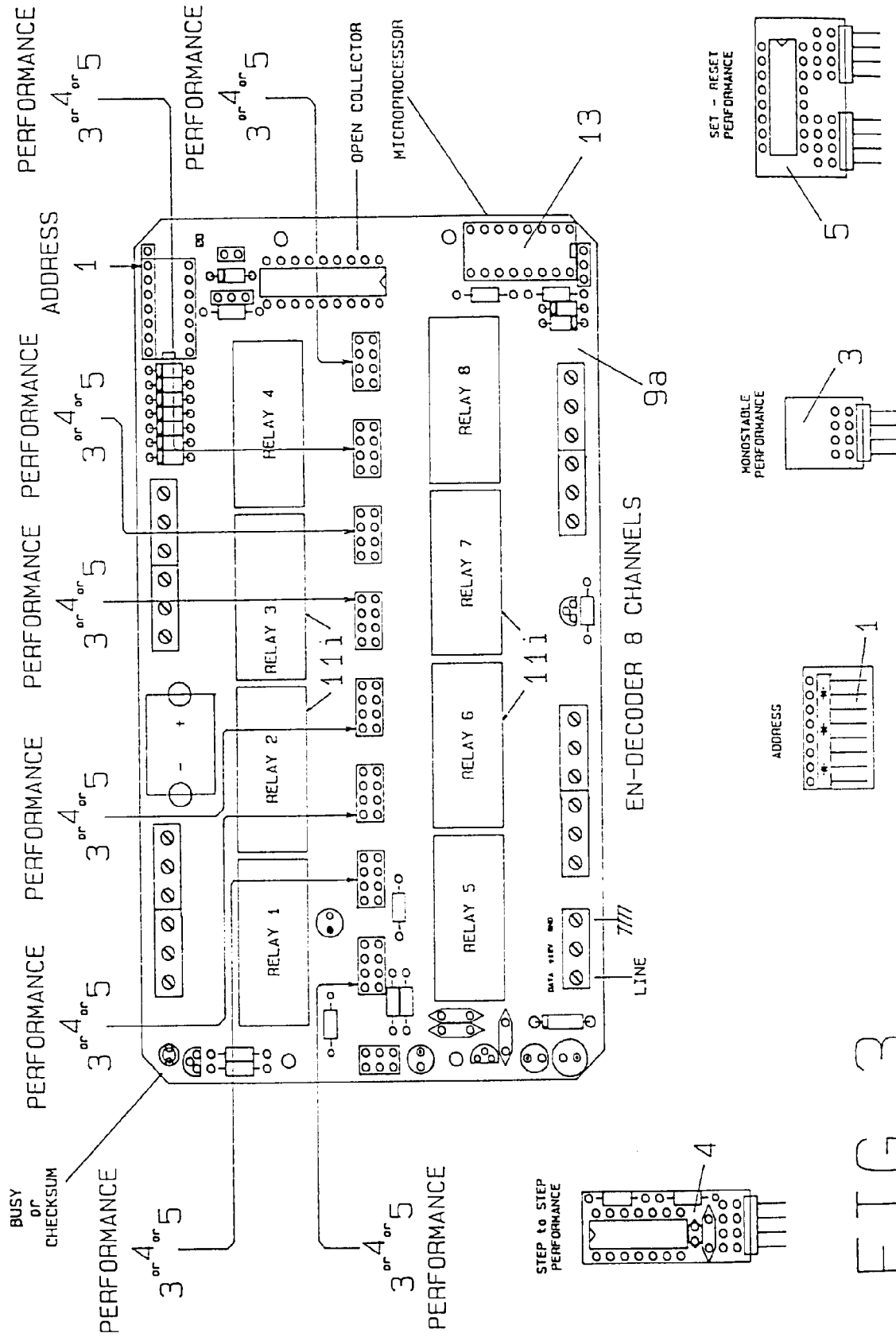


FIG. 3

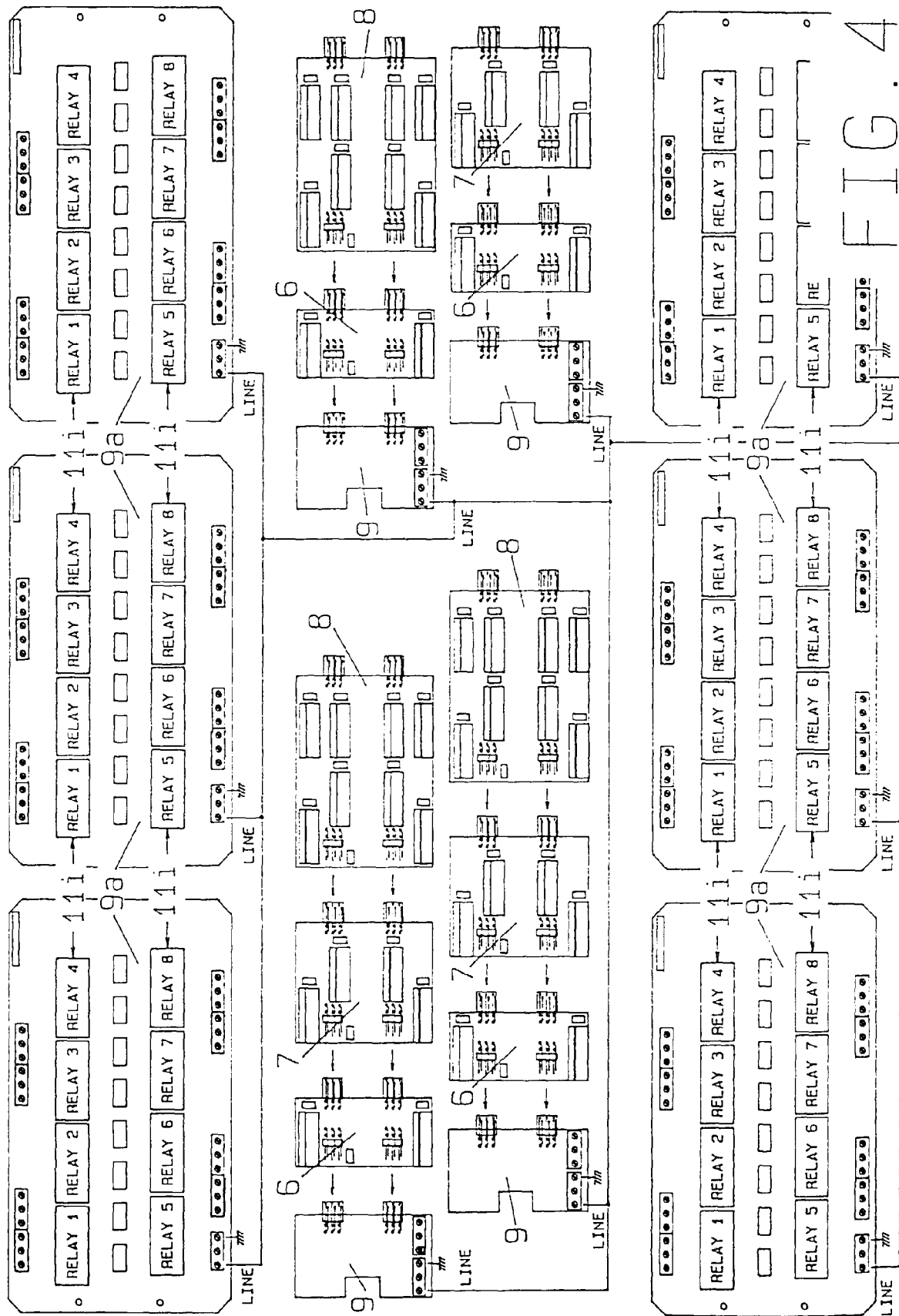


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 96 81 0619

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR-A-2 535 133 (PAGET JEAN) 27 April 1984 * page 4, line 31 - page 7, line 34; figures 1-4 *	1,2,7,9	G08C15/00
A	---	3-6,8	
Y	DE-U-91 06 677 (INCOS GMBH) 25 July 1991 * claims 1,4,5; figures 1-3 *	1,2,7,9	
Y	DE-A-38 26 895 (HEILAND BERND) 8 March 1990 * column 2, line 65 - column 6, line 26; figures 1-3 *	9	
A	FR-A-2 676 849 (AVE SPA) 27 November 1992 * the whole document *	1	
A	MACHINE DESIGN, vol. 59, no. 13, 11 June 1987, CLEVELAND US, pages 122-124, XP002019483 DAVID BABIN: "SIMPLIFIED REMOTE CONTROL CIRCUITS" * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G08C H04Q
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 November 1996	Examiner Wanzeele, R
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