

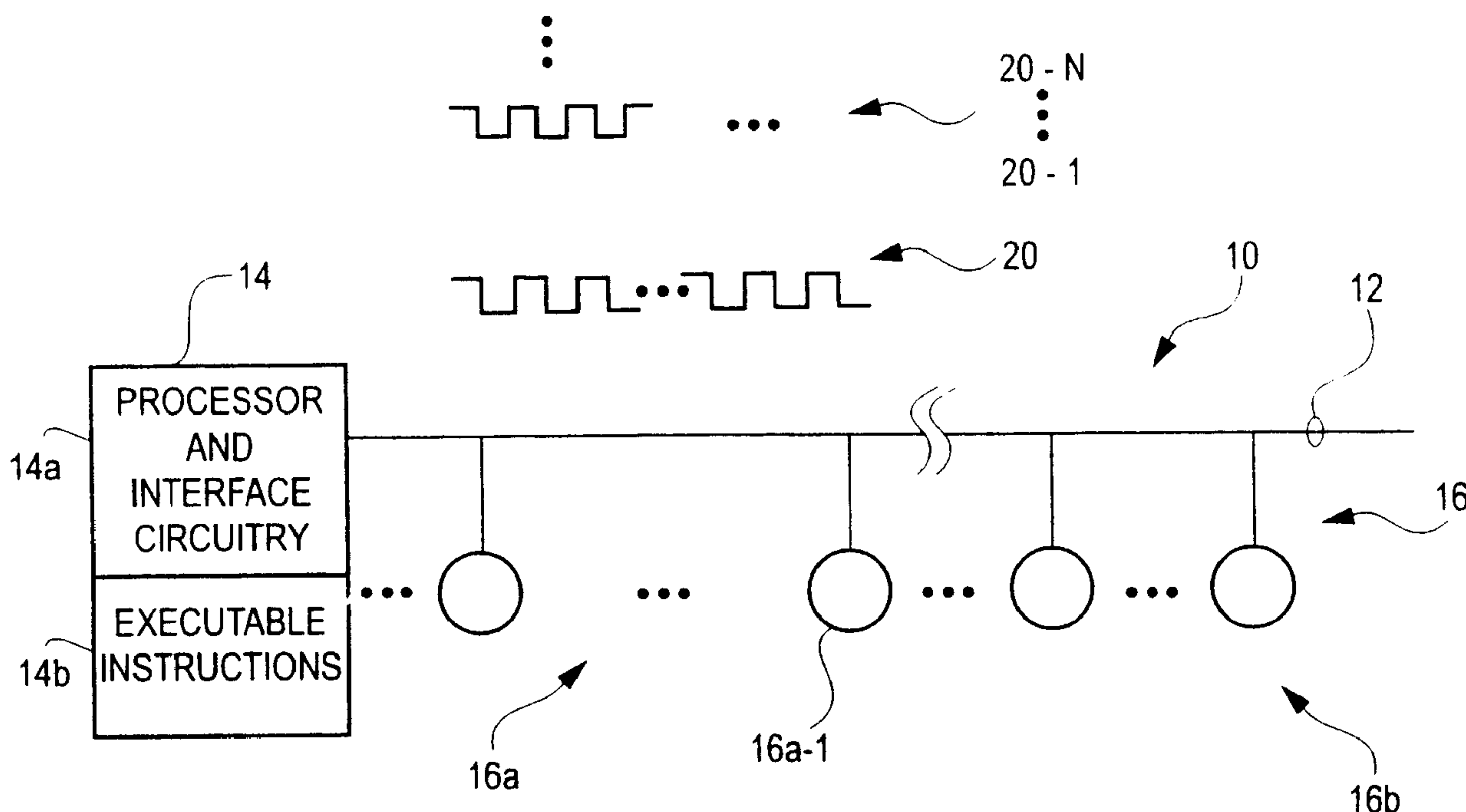


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(54) Titre : COMMUNICATION BIDIRECTIONNELLE ENTRE UN ELEMENT DE CONTROLE ET DES DISPOSITIFS ELECTRIQUES

(54) Title: BIDIRECTIONAL COMMUNICATION BETWEEN CONTROL ELEMENT AND ELECTRICAL DEVICES



(57) Abrégé/Abstract:

A software driven monitoring system includes a common control element coupled to a plurality of monitoring devices. The devices can indicate to the control element that a predetermined condition has been detected. Where the control element transmits a status inquiry command to the devices, those devices exhibiting the status provide the same indication to the control element as is indicative of the predetermined condition. One indication is a shunt or a short circuit of a medium between the common control element and the devices. An existing system can be upgraded by installing the control element, or upgrading an existing control program. Alternately, the devices can be installed in a system wherein the control element does not issue the status inquiry command. In those installations, the monitoring devices never issue a status reply as the required command is never received.

ABSTRACT OF THE DISCLOSURE

A software driven monitoring system includes a common control element coupled to a plurality of monitoring devices. The devices can indicate to the control element that a predetermined condition has been detected. Where the control element transmits a status inquiry command to the devices, those devices exhibiting the status provide the same indication to the control element as is indicative of the predetermined condition. One indication is a shunt or a short circuit of a medium between the common control element and the devices. An existing system can be upgraded by installing the control element, or upgrading an existing control program. Alternately, the devices can be installed in a system wherein the control element does not issue the status inquiry command. In those installations, the monitoring devices never issue a status reply as the required command is never received.

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TITLE: Bidirectional Communication between Control Element and Electrical Devices

This application is a division of application number 2,343,527 filed in Canada on April 6, 2001.

FIELD OF THE INVENTION

- 5 **[0001]** The invention pertains to monitoring systems. More particularly, the invention pertains to ambient condition monitoring systems such as fire alarm systems.

BACKGROUND OF THE INVENTION

- 10 **[0002]** Region monitoring systems have been found to be useful when installed in buildings to monitor various on-going conditions in one or more regions of the building. Examples of these include fire alarm systems and burglar alarm systems. In addition to such systems which are usable in commercial or industrial establishments, it has been recognized that such
15 systems, in an appropriate form, can be usefully installed in residences or small non-residential buildings.

- [0003]** Known residential alarm systems, in one form, include a common control element coupled by a hardwire communications link to a plurality of spaced-apart electrical units. The electrical units can include, for
20 example, smoke detectors, intrusion detectors or the like. The electrical units can also include, if desired, output circuitry to energize alarms or to generate outgoing messages for the purpose of seeking assistance such as from a remote monitoring center or the like.

- [0004]** Many of the known, installed, types of residential systems have
25 exhibited relatively limited types of communication between the common control element and the detectors or other electrical units which are coupled to the cable or communications medium. For example, systems are known wherein detectors monitoring an ambient condition, exhibit an output indicative of that condition by causing a particular current or voltage to appear

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on or in the communications medium. In the case where the detectors are coupled to a common control element by an electrical cable, a detector exhibiting a selected state, such as an alarm state, could cause a current to flow in the cable. The control element, upon detecting that current flow is able
5 to establish that at least one of the detectors in the system is exhibiting an alarm state.

[0005] Typically such detectors latch into an alarm state until the control element produces a reset signal. One known way of establishing a reset is to interrupt power to the communications medium which in turn
10 causes all of the detectors and/or electrical units coupled thereto to reset themselves.

[0006] Some of the known systems utilized established two-wire communications mediums and compatible two-wire devices. Other known systems use four-wire communications mediums with compatible four-wire
15 devices. Known systems very often have been evaluated by a certification organization for purposes of performance and reliability under predetermined conditions. Maintaining such certification limits changes that can be made to the control element as well as to the detectors or other electrical units coupled to the system.

20 **[0007]** There continues to be a need to be able to introduce additional flexibility into existing types of residential alarm systems. Preferably, such flexibility could be introduced without requiring recertification and without introducing additional installation complexity or limiting the number of devices coupled to the system. In addition, it would be preferable if any devices
25 responsive to such expanded capabilities were also downward compatible and functioned appropriately in known installed systems.

SUMMARY OF THE INVENTION

[0008] In accordance with the invention, a control element of a
30 monitoring system can determine if any of the devices coupled to the system

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are in a predefined state. This determination uses the same voltage/current characteristics that a comparable system would exhibit without this expanded functionality.

[0009] In accordance herewith, the control element includes a
5 programmed processor as well as interface circuits for communicating, via a communication medium such as electrical or optical cable with the devices. The control element includes executable instructions for forming a status command and transmitting same to the devices in the system.

[0010] In one embodiment, the status command can take the form of a
10 sequence of voltage pulses. Other types of status commands can be sent without departing from the spirit and scope of the present invention. The status commands only need to be compatible with the devices coupled to the medium.

[0011] In response to receiving a predetermined status command from
15 the control element, each of the devices which is exhibiting the respective status replies substantially immediately to the control element via the medium. The form of the reply corresponds to the same signal sent by the respective device or devices to indicate another predetermined state, such as an alarm condition. Hence, if some of the devices correspond to smoke detectors, for
20 example, the reply to the status command from the control element, from those detectors exhibiting the appropriate status, would be the same electrical signal as would be sent by the respective detector or detectors to indicate the presence of a predetermined ambient condition.

[0012] In one aspect of the invention, the reply from the device or
25 devices exhibiting the requested status could be in the form of one or more electrical currents caused by the respective device or devices to flow in the communication medium. For example, in an alarm state, the detector or detectors that have gone into alarm might shunt the medium. Since the responding device or devices each cause a respective current to flow in the
30 medium, the control element can detect the presence of a cumulative current

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reply indicative of one or more devices which is responding to the status command.

[0013] Instructions in the control element, upon detection of the cumulative reply current in the medium, determine that one or more of the
5 devices is exhibiting the respective status. The magnitude of the reply current is indicative of the number of devices exhibiting the status.

[0014] Alternately, instead of current, other forms of cumulative electrical or optical signals could be used. Any signal which a device exhibits in response to a predetermined condition can be used as a reply signal to a
10 status request.

[0015] In yet another aspect, the control element can include executable instructions for forming a plurality of different commands which can be transmitted, via the medium, to the devices coupled to the system. The commands can be addressed to different conditions or states which might be
15 present at one or more of the devices in the system. The devices need only be capable of replying with the same electrical or optical signal normally used for informing the control element of the presence of a predetermined state or condition.

[0016] The present system is particularly advantageous in that the
20 devices are downward compatible with respect to existing previously installed, systems. Additionally, no hardware changes need be made to any of the devices nor to the control element. The control element incorporates executable instructions which provide the commands to be transmitted to the devices seeking status replies.

25 **[0017]** The devices can include executable instructions for responding to received commands with hardware which can also be used to communicate to the control element the presence of a selected predetermined condition such as fire or intrusion. The devices could also incorporate an ASIC for control.

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[0018] Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is an over-all block diagram of a system in accordance with the present invention; and

[0020] FIG. 2 is an over-all block diagram of a device usable with the
10 system of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0021] While this invention is susceptible of embodiment in many different forms, there are shown in the drawing and will be described herein in
15 detail specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

[0022] FIG. 1 illustrates a system 10 which incorporates a
20 communications medium generally indicated at 12. The medium 12 could be, for example, a wired medium such as electrical or optical cable. Alternately, the medium 12 could be a wireless medium such as RF or infrared.

[0023] Wired media could include two or four wire cables. In four-wire systems, two wires can be for device commands. Two can be for device
25 feedback.

[0024] Coupled to the medium 12 are a control element 14 and a plurality of devices 16. The control element 14 includes a programmed processor and interface circuitry 14a and executable instructions 14b. The instructions 14b can be stored either permanently or temporarily in any

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conventional form of storage device such as read-only memory, programmable read-only memory or read/write memory.

[0025] The devices 16 can include a plurality 16a of ambient condition detectors. The detectors can include, without limitation, smoke or fire
5 detectors, intrusion detectors, position detectors, flow detectors, motion detectors, and the like. Such devices usually include at least one ambient condition sensor and processing circuitry whereby under predetermined conditions, signals are coupled to the communication medium 12 from the respective detectors which are indicative of the presence of one or more
10 predetermined conditions.

[0026] One of known predetermined conditions is detection of a sufficient indication of fire in a fire detector, which could be a flame, a smoke or a thermal detector, for example, which is indicative of the presence of a fire or an alarm condition. In such instances, a corresponding electrical signal
15 which could be a current signal, a voltage signal, or an optical intensity signal can be coupled to the medium 12 for communication to element 14. Alternately, the detector or detectors which have gone into alarm can shunt or short circuit the medium 12. Element 14 in turn, in response to receiving an alarm indicating signal, can be programmed or hardwired to take appropriate
20 action such as activation of an audible or visible alarm unit or the like.

[0027] A plurality of output devices 16b is coupled to medium 12. The devices 16b can, without limitation, include audible or visible output devices, solenoid actuating devices and the like for carrying out a predetermined function in the region in which the system 10 is installed. If desired, output
25 devices can also be incorporated into detectors 16a.

[0028] It will be understood that the exact details of the devices 16 are not limitations of the present invention. It will also be understood that the communications medium 12 could include a variety of two-wire or four-wire cable communications systems without departing from the spirit and scope of
30 the present invention.

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[0029] The system 10 is, in accordance with the present invention, particularly advantageous in that existing two-wire/four-wire communications cables 12 can be used with up-graded control elements 14 and upgraded detectors 16a to provide functionality beyond that heretofore known for such systems. In this regard, element 14 can form a status requesting command, generally indicated at 20 in FIG. 1 and transmit same by a medium 12 to devices 16.

[0030] Those devices which are exhibiting a status corresponding to command 20 can in turn reply to element 14 by coupling an electrical or optical signal to medium 12 of a predetermined magnitude which is indicative of the respective device, such as device 16a-1 exhibiting the requested status. In the event that multiple devices exhibit the requested status, the respective reply signals will be coupled to the medium 12 substantially simultaneously and cumulatively whereupon element 14 can detect the cumulative reply signal and in turn establish from its amplitude the number of status indicating devices. For example, responding devices could shunt appropriate wires of a wired medium causing a current to flow therein.

[0031] It will be understood that element 14 could issue a variety of commands 20-1, 20-2 . . . 20-n to the devices 16 requesting status or other information. In response to each of the commands 20-i, the respective replying devices can couple the same electrical or optical signal to the medium 12 as would be used to reply not only to other commands 20-1 . . . 20-n but also to indicate the presence of various conditions such as the presence of a predetermined ambient condition.

[0032] It will be understood by those of skill in the art that devices could receive commands via medium 12a, an electrical cable, and respond via medium 12b, a different electrical cable. Responses could include shunting or shorting a respective medium or coupling an electrical signal or multi-element message thereto.

[0033] FIG. 2 illustrates in block diagram form the detector 16a-1. The detector 16a-1 includes control circuitry 30, which could include a

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programmed processor. Coupled to the processor is a plurality of executable instructions 32. Also coupled to the processor 30 are interface circuits 34 which enable the detector 16a-1 to communicate via the medium 12 with the element 14. It will also be understood that some or all of the members of the plurality 16 could include an application specific integrated circuit, ASIC, instead of or in addition to a programmed processor.

[0034] Detector 16a-1 also incorporates an ambient condition sensor 36 which could, for example and without limitation, correspond to a flame sensor, a smoke sensor, a thermal sensor, a flow sensor, a position sensor, a motion sensor or the like without limitation. It will also be understood that multiple sensors can be incorporated into a detector or device 16 without departing from the spirit and scope of the present invention.

[0035] In the event that the device is to also carry out an output control function, output circuits 38 can be provided coupled to the control processor 30. In such instances, the respective device need not include the sensor 36.

[0036] In accordance with the present invention, the devices 16 are downward compatible with monitoring systems which do not include software or executable instructions to issue status commands such as the commands 20-1 . . . 20-n. In such instances, the respective devices monitor respective ambient conditions and couple signals indicative thereof to the medium 12.

[0037] The control element 14 also incorporates reset circuitry for interrupting electrical energy provided to the devices 16 for predetermined periods of time thereby resetting same in response to the devices replying either to the commands 20-1 . . . 20-n or going into an alarm state in response to a detected adjacent ambient condition. Other types of reset signals could also be used.

[0038] From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of

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course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

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What is claimed:

1. A dual mode fire detector usable in first and second different types of alarm systems, the first type of system having a control unit coupled by a cable to a plurality of detectors wherein the detectors, on detecting a fire
5 condition, exhibit a latched alarm indicating condition on the cable, producing a predetermined current flow on the cable, wherein the current flow is detectable by the control unit as an indication of an alarm condition and wherein the control unit interrupts the alarm indicating current flow thereby resetting all of the detectors substantially simultaneously, and, wherein the
10 second type of system has a different control element coupled to a second cable and alarm indicating fire detectors are coupled to the second cable, wherein the fire detectors each produce a current flow in the second cable in response to a fire and wherein the different control element includes circuitry for sending at least one status requesting message to the detectors via the
15 second cable wherein the detectors exhibiting the requested status respond to the different control element's status requesting message by each producing the same current flow on the second cable as the respective detector would produce thereon to indicate a fire, the dual mode detector comprising:

a fire sensor;

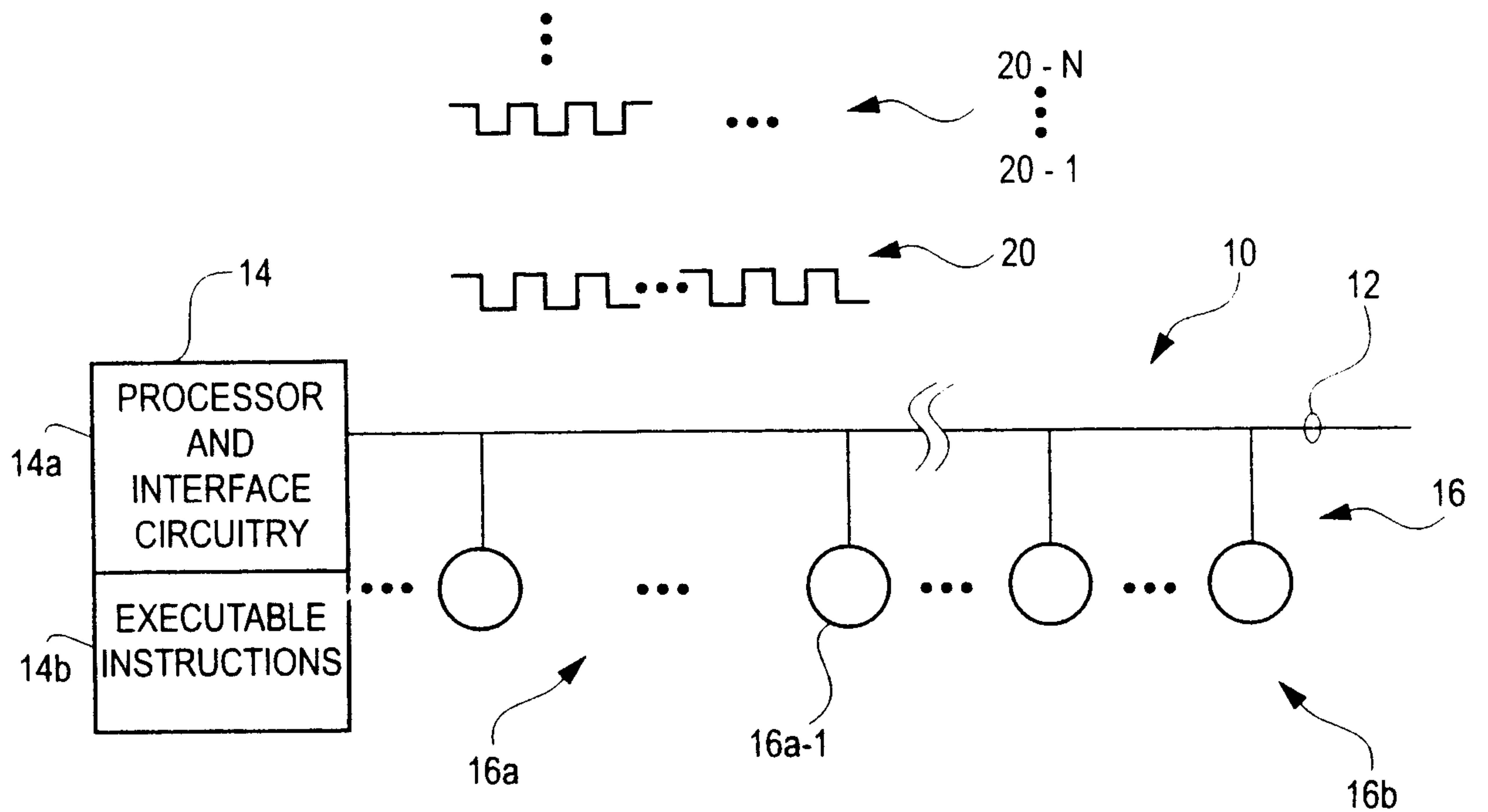
20 control circuits, coupled to the sensor and couplable to a communication cable, wherein the control circuits receive fire indicating signals from the sensor and status requesting signals from the cable, wherein the control circuits produce a current flow on the cable to indicate a fire condition and the same current flow is produced on the cable, in response to a received status
25 request, to indicate the existence of the requested status, and where in the absence of status requesting signals, only a fire, sensed by the fire sensor produces the current flow.

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2. A detector as in claim 1 wherein the current flow is produced by the control circuits exhibiting a change from a first impedance to a second impedance.
3. A detector as in claim 1 wherein the current flow produced in response
5 to a status requesting signal is produced until electrical energy flowing to the control circuits is interrupted.
4. An electrical device, usable in at least first and second communications systems which exhibit the same protocol wherein the first system has functional capability not present in the second system wherein the first system
10 issues at least one selected command not issued by the second system wherein the device comprises: circuitry for interfacing to a system communication medium; a control circuit which, responds to selected commands received via the interfacing circuitry and, in response to the at least one selected command, via the interfacing circuitry, couples a response
15 to a medium wherein that response is the same as is coupled to that medium to indicate the existence of a different predetermined condition at the detector.
5. A device as in claim 4 wherein the control circuit includes a programmed processor and executable instructions.
6. A device as in claim 5 which includes a condition sensor wherein the
20 processor causes a signal on that medium, in response to a selected condition indicated by the sensor, wherein the caused signal is substantially the same as is caused on that medium in response to the at least one selected command.
7. A device as in claim 6 wherein the same signal comprises a current of
25 a selected magnitude flowing on the medium.
8. A device as in claim 7 wherein the sensor comprises an ambient condition sensor selected from a class which includes a smoke sensor, a gas sensor, an intrusion sensor and a heat sensor.

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9. A device as in claim 6 wherein the instructions reply to at least two different selected commands received from the medium in the same way as is used to indicate the presence of the selected condition.
10. A device as in claim 9 wherein the medium is shunted to indicate the
5 presence of the selected condition.
11. A device as in claim 10 wherein the selected condition comprises an alarm state.
12. A device as in claim 5 wherein the system communication medium and the medium are different.
- 10 13. A device as in claim 12 wherein the system communication medium comprises two electrical wires.
14. A device as in claim 13 wherein the medium comprises two different electrical wires.
15. A device as in claim 4 wherein the control circuit comprises an
15 application specific integrated circuit.

FIG. 1**FIG. 2**