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(54) **EMERGENCY ILLUMINATION SYSTEM AND VISUAL ALARM THEREFOR**

(57) An addressable fire system comprising a control section 10 and at least one visual alarm device 14a-d, wherein the control section 10 is operable to send power to the at least one visual alarm device 14a-d, is operable

to control illumination of the at least one visual alarm device 14a-d and is operable to program lighting parameters of the at least one visual alarm device 14a-d.

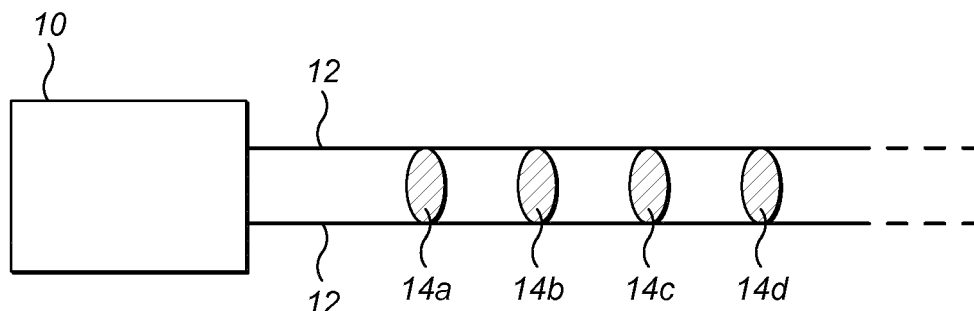


FIG. 4

Description

[0001] The present invention relates to an addressable emergency illumination system and an addressable fire detection system using visual alarm devices.

[0002] For many years visual alarm devices, in the form of beacons or combined sounder/beacons, have been part of fire alarm systems, mainly to satisfy the needs of the Equality Act. They assist the hard of hearing or staff working in noisy environments to recognise when a fire alarm has been raised.

[0003] Now a new product standard, EN 54-23:2010 (Fire detection and fire alarm systems. Part 23: Fire alarm devices - Visual alarm devices), has been introduced to standardise the requirements, test methods and performance of VADs and ensure light output is measured in a uniform manner. The need for VADs will be identified as part of the fire risk assessment. As with any fire alarm system, there are numerous challenges that must be considered in the design and installation of VADs.

[0004] One such challenge is the illumination of the entire volume of the open space where the alarm must be visible. VADs must produce sufficiently intense light, so that an individual located anywhere in the space, looking either towards or away from the VAD, would be alerted in the event of an emergency.

[0005] The performance of VADs is assessed against a minimum required illumination of 0.4 lux on surfaces perpendicular to the direction of the light emitted from the device.

[0006] Conventional addressable alarm systems typically comprise a number of detectors, such as smoke or heat detectors, a number of alarm sirens, and/or a number of visual alarm devices. Each device forms part of an electrical circuit commonly known as a loop, the ends of the loop being connected to a central control panel. The devices each have a unique address code which is known to the control panel and, using these address codes, bi-directional communication between a control panel and individual devices on the loop is possible.

[0007] An advantage with this kind of system over less sophisticated systems in which each device stands alone or is only addressable as part of a group of devices having the same address, is that when a particular device is activated the control panel is able to identify exactly which device has activated, and therefore where in the building the activation has taken place. In addition, whilst the device has previously been activated when the value of a detected parameter has exceeded a predetermined threshold value stored in its own memory, the intelligent addressable system allows the control panel to compare the detected parameter with information stored in its memory, whilst taking into account the values of that parameter or other parameters detected by other devices in the vicinity of the activated device.

[0008] The control panel is thus able to better assess the likelihood that the device has activated needlessly,

thus reducing the incidence of unwanted activation of sirens, water sprinklers and other emergency apparatus.

[0009] EP 575,175 describes a method of communication between a control panel and a beacon using Quaternary Mark Space (QMS) coding to deliver messages using modulation of a voltage waveform to encode the messages.

[0010] The use of an addressable system therefore allows a degree of control to be built into an alarm system.

[0011] According to the present invention there is provided an apparatus and method as set forth in the appended claims. Other features of the invention will be apparent from the dependent claims, and the description which follows.

[0012] According to an aspect of the present invention, an addressable emergency illumination system or addressable fire detection system comprises a control section and at least one emergency light or visual alarm device, wherein the control section is operable to send power to the at least one emergency light or visual alarm device, is operable to control illumination of the at least one emergency light or visual alarm device and is operable to program lighting parameters of the at least one emergency light or visual alarm device.

[0013] In the following, the terms emergency light and visual alarm device can be used interchangeably, so a reference to one can be used as a reference to the other.

[0014] The control section may be operable to control illumination or coverage volume of the at least one emergency light or visual alarm device.

[0015] The lighting parameters may include output level, or brightness, of the at least one emergency light, illumination characteristics, such as illumination period, of the at least one emergency light, action on presence detection in the vicinity of the at least one emergency light. The lighting parameters may include a setting of the ambient light level or illumination volume for at least one emergency light.

[0016] The configuration parameters may include output level, output power setting, and scene selection setting of the at least one emergency light. The control parameters may include action on presence detection in the vicinity of the at least one emergency light.

[0017] The configuration parameters may include coverage volume of the at least one visual alarm device.

[0018] The at least one emergency light may be addressable, preferably individually, by the control section.

[0019] The at least one emergency light may include at least one energy storage means (i.e. battery or capacitor) for powering functions of the at least one emergency light.

[0020] The at least one emergency light may include an energy storage means, which may be a capacitor, a super-capacitor or a battery for storing charge supplied to the at least one emergency light by the control section.

[0021] The control section may be operable to control the at least one emergency light to return status information to the control section. The status information may

include a current charge status of a battery of the at least one emergency light and/or a light output level of the at least one emergency light, action on presence detection in the vicinity of the at least one emergency light and /or a current operating state, e.g. normal or emergency, of the at least one emergency light.

[0022] According to another aspect of the present invention there is provided an emergency light or visual alarm device comprising lighting means and power storage means, wherein the emergency light or visual alarm device is operable to receive power from a control section of an associated emergency illumination system or fire system and wherein the emergency light is operable to receive illumination control commands and lighting parameter commands from the control section.

[0023] The at least one emergency light or visual alarm device may include a battery for powering functions of the at least one emergency light.

[0024] For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

Figure 1 is an example graph of a Mark/Space type of voltage signal;

Figure 2 is a graph showing a waveform for communication between an emergency control panel and an emergency beacon;

Figure 3 is a graph of a communications protocol for communication between an emergency control panel and an emergency beacon;

Figure 4 is a schematic diagram of a control panel and a set of emergency beacons attached thereto; and

Figure 5 is a schematic diagram of an emergency beacon.

[0025] A multiplexed communications system for an emergency signalling system is shown in Figure 4. The system comprises a control panel 10 with a two-wire signalling link 12 supplying power to and communicating data with multiple devices 14a-d connected to it.

[0026] The system has been fundamentally designed to be implemented in an Analogue Addressable Fire Alarm system. It can, however, be used for other two-wire communications systems where there is a control panel which powers and communicates bi-directionally to a number of devices (an addressable emergency lighting system, for example).

[0027] Devices 14a-d are connected to the control panel 10 in circuits called loops 12. The maximum number of devices 14a-d on a loop is defined by factors such as current consumption, length and characteristics of trans-

mission line, and data polling rate.

Loop Transmission Data Encoding Principle

[0028] The control panel 10 communicates with devices 14a-d by applying time encoded voltage pulses to the loop circuit(s) 12. Each device 14a-d decodes these signals and acts on the information contained therein. Devices 14a-d communicate in response by applying time encoded current pulses to the loop circuit 12 which the control panel 10 decodes.

[0029] Devices 14a-d are programmed with a unique serial number at the stage of manufacture. This serial number is the means by which the control panel 10 can individually communicate with each device 14a-d.

[0030] The control panel 10 transmits data to all devices 14a-d simultaneously by switching the loop 12 voltage between two levels at accurately defined intervals. Information is efficiently time encoded using QMS signalling.

[0031] Data from a specific device 14a-d is communicated to the control panel 10 by means of a series of current pulses. These current pulses are returned both synchronously and asynchronously, depending on the mode of communication.

Loop QMC transmit signalling

[0032] The control panel 10 TRANSMITS data on the loop 12 as time encoded voltage pulses switched between two levels V_m (Mark voltage) and V_s (Space voltage) as shown in Figure 1.

[0033] There are four combinations 00, 01, 10, 11 each of which can be encoded in either a Mark or a Space. This method has two advantages over previous methods in that the data rate is significantly increased and the baseband carrier frequency is significantly reduced.

Current Pulse Reply Signalling

[0034] Devices 14a-d connected across a two-wire loop 12 communicate data to the control panel 10 by switching in a current source directly across the loop 12 to generate a current pulse for a period of $200\mu s$. This current pulse is sensed by the control panel 10 and decoded as a logical '1' by its presence and as a logical '0' by its absence, as shown in figure 2. In Figure 2 the length of a tr pulse is typically $400\mu s$, but may vary between $370\mu s$ and $560\mu s$. After the tr pulse is the Start pulse of $200\mu s$. Bits D7 to D0, followed by Parity and Stop are then applied to the loop 12, each of which is $200\mu s$ in duration.

Communication Protocol

[0035] The system uses a defined protocol for construction of all loop transmissions, detailed in figure 3.

[0036] The phases of transmission common to all communications are the Start Frame, with a length of typically

2000 μ s and minimum and maximum of 1800 μ s and 2400 μ s respectively. The vectored priority interrupt (VPI) slot has a typical length of 750 μ s with a minimum and maximum of 655 μ s and 845 μ s respectively, and the control message, followed by the checksum.

[0037] The start frame is used to allow loop outstations (devices 14a-d) to detect the start of a new message, the VPI slot is used to allow devices 14a-d to asynchronously interrupt a standard loop polling sequence and the message number is used to define what data is being sent, or requested from the loop device.

[0038] The data following the message number is dependent upon the meaning inherent in the message itself, some message are then followed by a checksum byte.

Amendments to the protocol for use on addressable emergency lighting systems or addressable fire systems for use with visual alarm systems

[0039] The protocol system has been further developed for use in an addressable emergency lighting system, which controls luminaires/beacons 14a-d.

[0040] This system uses multiple lighting luminaires/beacons 14a-d which are communicated to individually using the above protocol. To maintain backward compatibility extra control messages have been allocated to communicate with lighting devices 14a-d only. At the moment the following messages have been devised, but further messages will be required:

Program Luminaire brightness - Used to setup the brightness level of the individual luminaire or beacon 14;

Program Luminaire Scene Settings - Used to program a set of predefined scene settings, which are triggered from the control panel 10;

Return luminaire status - The luminaire/beacon 14a-d returns its current battery charge and lamp level; and

Program luminaire operational state - Instruction from control panel 10 to tell the luminaire/beacon 14a-d what operating state it is currently in (i.e, normal or emergency).

[0041] An example emergency beacon 14a is shown in Figure 5. The beacon 14a is programmable using the protocol outlined above, including the commands mentioned in the amendment above. In addition the emergency lighting beacon includes high capacity energy storage device e.g. a super capacitor 16, i.e. a capacitor with a high capacitance for storing charge supplied by the control panel 10. This high capacity energy storage device e.g. capacitor 16 has been found to address the problem of pulsing power to an emergency beacon when an alarm condition require the beacon to flash.

[0042] The capacitor allows a low voltage system to slowly charge the capacitor 16 when the alarm condition is not present and to discharge the amount of power required to illuminate the beacon 14a to a required output.

5 These features avoid the voltage drop that would typically occur along long runs of cabling that extend from the panel to the emergency beacons. The lengths can extend to kilometres of cable. Also, without the high capacity energy storage it would be very difficult to provide a pulsed light, or strobe, that is sometimes required, because of the long cable lengths.

10 [0043] The European Standard EN54 Part 23 requires a specified lumen output of an emergency beacon for a given volume that it covers. The system and beacons disclosed herein provide a use application in the standard.

15 [0044] The low voltage charging and the ability to control the required output of the beacon 14a is advantageous, because the required output of a beacon can be outside the scope of existing systems in terms of the power they can supply. In addition the required output of a beacon can be dictated by the environment, such as a ceiling height when the beacon 14a is attached to a ceiling. Therefore the ability to program the beacon 14a from the control panel 10 is very beneficial, especially in view of the number of beacons that may be controlled by the panel 10.

20 [0045] It is possible to operate the control panel 10 to send details of a volume to be illuminated by the beacon 14a and use programmable circuitry (programmed at manufacture or during installation or when connected to the control panel) in the beacon 14a to determine a light output required. A level of ambient light detected by the beacon 14a may also be used to determine the output of the beacon 14a.

25 [0046] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

30 [0047] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

35 [0048] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

40 [0049] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompa-

nying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. An addressable fire system comprising a control section and at least one visual alarm device, wherein the control section is operable to send power to the at least one visual alarm device, is operable to control illumination of the at least one visual alarm device and is operable to program lighting parameters of the at least one visual alarm device.
2. The addressable emergency fire system of claim 1, wherein the lighting parameters include at least one of output level of the at least one visual alarm device, and illumination characteristics of the at least one visual alarm device.
3. An addressable emergency illumination system comprises a control section and at least one emergency light, wherein the control section is operable to send power to the at least one emergency light, is operable to control illumination of the at least one emergency light and is operable to program lighting parameters of the at least one emergency light.
4. The addressable emergency illumination system of claim 3, wherein the lighting parameters include at least one of output level of the at least one emergency light, illumination characteristics of the at least one emergency light, and action on presence detection in the vicinity of the at least one emergency light.
5. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the control section is operable to control illumination or coverage volume of the at least one emergency light or visual alarm device.
6. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the lighting parameters include a setting of the ambient light level or illumination volume for at least one emergency light and/or visual alarm device.
7. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the at least one emergency light and/or visual alarm device is addressable by the control section.
8. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the at least one emergency light and/or vis-

ual alarm device includes an energy storage means for powering functions of the at least one emergency light and/or visual alarm device.

9. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the at least one emergency light and/or visual alarm device includes an energy storage means for storing charge supplied to the at least one emergency light and/or visual alarm device by the control section.
10. The addressable emergency illumination system or emergency fire system of any preceding claim, wherein the control section is operable to control the at least one emergency light and/or visual alarm device to return status information to the control section.
11. The addressable emergency illumination system or emergency fire system as claimed in claim 10, wherein the status information includes at least one of a current charge status of a battery of the at least one emergency light and/or visual alarm device and/or a light output level of the at least one emergency light and/or visual alarm device, action on presence detection in the vicinity of the at least one emergency light and/or visual alarm device and a current operating state, e.g. normal or emergency, of the at least one emergency light and/or visual alarm device.
12. An emergency light and/or visual alarm device comprises lighting means and energy storage means, wherein the emergency light and/or visual alarm device is operable to receive power from a control section of an associated emergency signalling system or emergency fire system and wherein the emergency light and/or visual alarm device is operable to receive illumination control commands and lighting parameter commands from the control section.
13. The emergency light and/or visual alarm device of claim 12, which includes an energy storage means for powering functions of the at least one emergency light and/or visual alarm device.
14. An addressable emergency illumination system or emergency fire system substantially as described herein with reference to the accompanying drawings.
15. An emergency light and/or visual alarm device substantially as described herein with reference to the accompanying drawings.

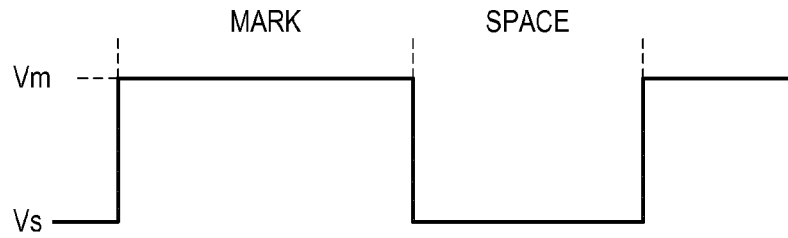


FIG. 1

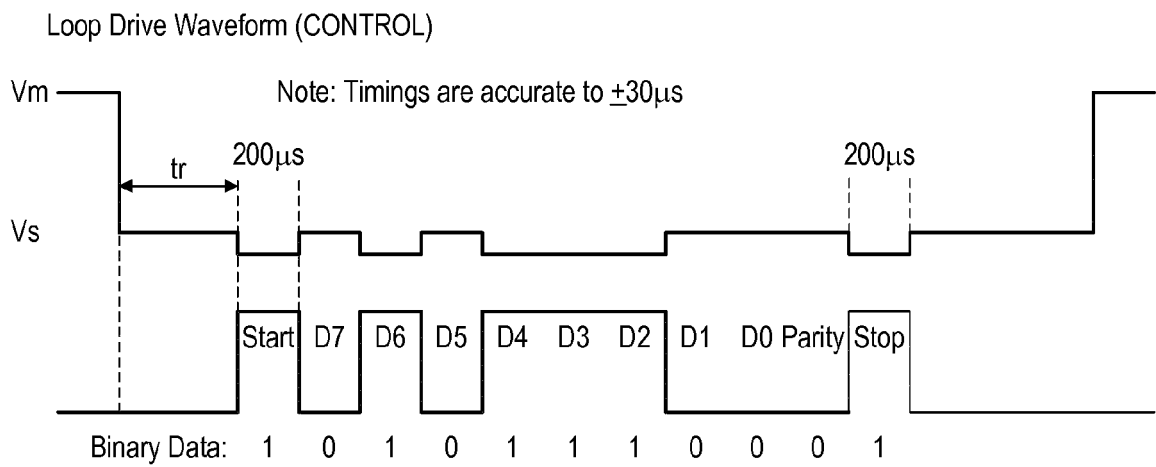


FIG. 2

TIME-ENCODED QUATERNARY MARK SPACE SIGNALLING

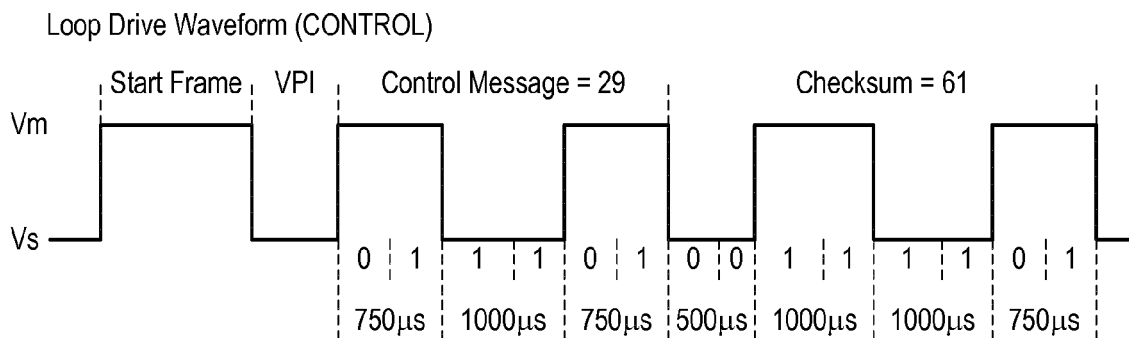


FIG. 3

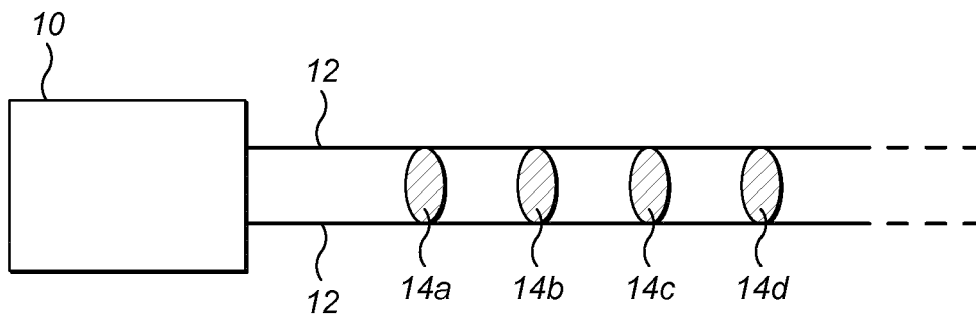


FIG. 4

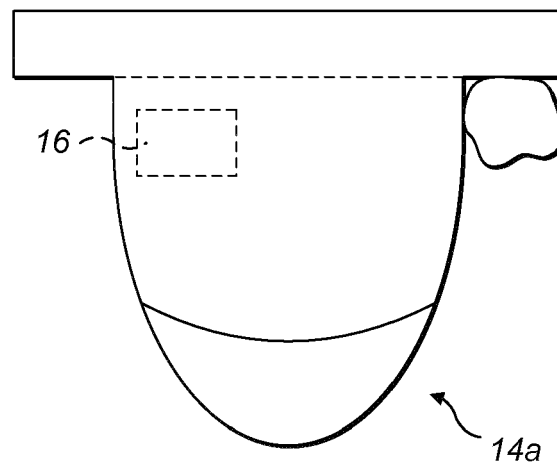


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 15 16 6663

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 404 474 A (COOPER LIGHTING AND SECURITY L [GB]) 2 February 2005 (2005-02-02) * page 14, lines 31-33 * * page 5, lines 17-23 * * page 8, lines 6-14 * * page 14, lines 3-6 * * page 29, lines 23-26 * * page 23, lines 24-33 * -----	1-15	INV. G08B7/06
			TECHNICAL FIELDS SEARCHED (IPC) G08B H02J
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 September 2015	Examiner Coffa, Andrew
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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Patent documents cited in the description

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