(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 745 920 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.12.1996 Bulletin 1996/49

(51) Int Cl.[6]: **G05D 25/02**, G08B 25/04

(21) Application number: **96201356.1**

(22) Date of filing: **18.05.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **29.05.1995 IT MI951113**

(71) Applicant: **BEGHELLI S.r.l.**
40050 Monteveglio, Bologna (IT)

(72) Inventor: **Beghelli, Gian Pietro**
40050 Monteveglio (Bologna) (IT)

(74) Representative: **Fusina, Gerolamo et al**
Ing. Barzanò & Zanardo Milano S.p.A,
Via Borgonuovo, 10
20121 Milano (IT)

(54) Centralized system for monitoring the functioning of peripheral appliances, in particular for emergency lighting lamps

(57) A centralized monitoring system is described, used for checking the functioning, in particular, of emergency lighting lamps, comprising an electronic control unit (10) connected to the electrical supply mains (30) and a series of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F), such as emergency lighting lamps, electronic processors, chronothermostats and televisions, which are connected electrically together and receive information and data from said electronic control unit (10).

The main characteristic of the system of the invention is that communication between the electronic control unit (10) and the peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) takes place using carrier digital transmission along the electrical line (90) of the supply mains (30).

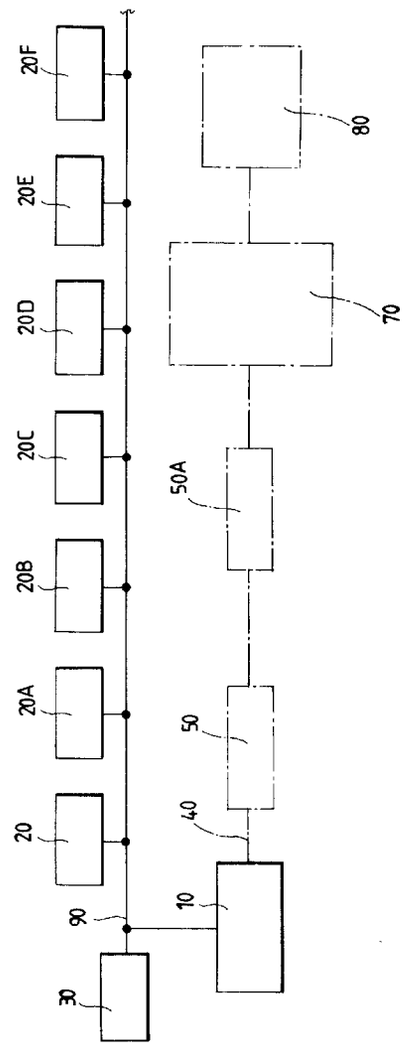


Fig.1

EP 0 745 920 A1

Description

This invention relates to a centralized system for monitoring the functioning of peripheral appliances, used in particular for emergency lighting lamps.

Telematic systems are becoming increasingly widespread in domestic and office environments for feeding control codes, data and information to a plurality of peripheral appliances (lamps, televisions, chronothermostats, electronic processors), the operation of which is programmed on the basis of instructions previously imparted by the user, or which are switched on when particular events occur.

In this respect, procedures are known for activating emergency lamps on failure of the supply voltage, and for programming chronothermostats, lighting systems, electronic processors and radio and television receivers.

Systems are also known for the diagnosis or self-diagnosis of the operation of such installations (by means of microprocessors able to carry out verification tests on peripheral appliances and handle the connection, with visual display of the information obtained), as are methods for monitoring and power supply centralization, systems for enabling and disenabling the operation of peripheral appliances, and procedures for remote switch-on, switch-off and programming.

All these operations can be carried out on the entire installation, on a given group of peripheral appliances or on each appliance individually, in order to have knowledge of their reliability at every moment and ensure their effectiveness at the moment of need. The results of these checks can then be printed on paper or fed along the telephone line by accessory devices, which can be added to the electronic control unit (printer, processor, modem).

Under normal system operating conditions, an electronic control unit can communicate with each peripheral appliance by periodically executed interrogation operations. If one or more appliances of the installation cannot be reached, this abnormality is signalled by displaying an error message on the control unit monitor.

However, centralized function monitoring systems of the known art occupy a working space which it would be advantageous to reduce because of complexity of the cabling, which includes wires carrying the supply to the various devices and bus connection lines for transferring information and data between system circuit blocks and the microprocessor.

In addition, the installation complexity and the considerable quantity of connection wires which have to be run between the supply mains, the control unit and the peripheral devices make such a circuit arrangement costly, complicated and lengthy (in terms of working time).

An object of the present invention is therefore to provide a centralized system for monitoring the functioning of peripheral appliances which obviates the aforesaid drawbacks, ie which enables an installation to be assembled within a smaller working area than the known art by virtue of being able to use a smaller volume of cabling, while at the same time ensuring the functions, the connections, the technical performance and the facility for expansion of the system, and complying with current electrical regulations, these being typical characteristics of known centralized systems.

A further object of the present invention is to be able to install said centralized system on existing electrical installations, without having to modify either the system or the existing installation.

A further object of the invention is to provide a centralized system for monitoring the functioning of peripheral appliances which is of simple and economical construction without having to use complicated or costly procedures, achieved by using standard circuit arrangements and known electrical and electronic components.

These and further objects are attained by a centralized system for monitoring the functioning of peripheral appliances in accordance with claim 1.

Advantageously, the centralized system of the present invention comprises an electronic control unit which supervises the operation of a plurality of peripheral appliances of electrical and electronic type (lamps, chronothermostats, televisions, electronic processors) to check their state of operation, to check the charge level of the storage batteries present internally and to command the enabling or disenabling of their functions (switching-on, programming, switching-off).

Communication between the electronic control unit and the peripheral appliances is achieved using digital information and data transmission of carrier type along the (220 Volt) line of the supply mains of the centralized system.

This characteristic enables the system to be installed by simply plugging the peripheral appliances into appropriate current sockets without having to add any communication line or dedicated digital buses.

Moreover, the electronic control unit comprises within itself all the system control functions and is able to recognize the appliances installed, so extremely simplifying the configuration of the system during installation. In this respect, each appliance is identified unambiguously. This enables separate installations and systems to share the same line of the supply mains.

Finally, the fact of being able to use for transferring the digital signals (information and data) the actual wires of the line carrying the electricity supply to the system, by using the known method of carrier transmission, makes the cabling of the entire system simple and the installation of the peripheral appliances economical.

Further objects and advantages of the present invention will be apparent from the ensuing description and the accompanying drawing, which is provided by way of non-limiting example and on which Figure 1 represents a block diagram of the centralized system for monitoring the functioning of peripheral appliances, in

accordance with the present invention.

In said figure, the reference numeral 10 indicates the electronic control unit, which is connected via the electrical line 90 of the supply mains 30 to a series of peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F, which can be chronothermostats, lighting lamps, electronic processors, or electronic transmitting or receiving devices. The number of said appliances 20, 20A, 20B, 20C, 20D, 20E, 20F can vary according to user requirements. However, in consideration of the effective constraints represented by the physical construction of the system and the performance/price ratio, the maximum number of appliances 20, 20A, 20B, 20C, 20D, 20E, 20F which can be connected is fixed at 255 (this figure is linked to the fact of forming, together with the control unit 10, a number which is a power of 2, within the framework of a digital signal transmission in bits per second).

The electronic control unit 10 is advantageously provided with a liquid crystal display screen, a printer and a keyboard usable by the user for keying-in commands. The entire centralized system can be integrated within another system with more extended functions, to provide remote monitoring of the peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F via the telephone line 40, which is connected to the control unit 10. The connection is made by two connectors per serial line (of standard RS232 type) positioned on the rear of the electronic control unit 10, which in this manner can communicate with electronic processors 70 and printers 80 via the modem 50, 50A.

The electronic control unit 10 is also equipped with a rechargeable Nickel-Cadmium storage battery providing 3 hours of self-sufficiency in the absence of voltage at the supply mains 30.

It should be noted that, in the particular case of a centralized system for monitoring emergency lighting lamps, each lamp is able to provide emergency lighting even if communication with the control unit 10 is interrupted or voltage is absent at the supply mains 30 (provided said lamp has not been previously disenabled by the control unit 10 following a command imparted by the user via the keyboard).

Each peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F is provided with two LEDs, which indicate the state of operation of the system. The first LED (green light) indicates the presence of voltage at the supply mains 30, and the second LED (two-colour) indicates correct operation of each peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F, recording of errors during functioning checks on the system (provided by the electronic control unit 10), and communication difficulties between the peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F and the control unit 10. The centralized system operates as follows:

The user installs the appliances 20, 20A, 20B, 20C, 20D, 20E, 20F and the control unit 10 in their final positions and, using the keyboard of the control unit 10, initiates the recognition process.

In this respect, the control unit 10 assists the user in executing the required functions by displaying on the display screen selection menus representing a logical association between the commands which can be executed and the keys to be pressed. In this respect, on the screen in correspondence with the key to be pressed there is displayed a name which identifies the function with which it is linked. Access to the keyboard of the electronic control unit 10 can be prohibited to an unauthorized person by using an appropriate combination key present on the rear of the casing. Within the control unit 10 there is a clock which maintains the time set by the user for a period exceeding 12 months, the configuration data remaining indefinitely in a permanent memory.

On termination of the recognition process (based on the transfer of digital signals by carrier transmission along the line 90 of the 220 Volt supply mains 30), the execution time of which depends on the size of the system, the electronic control unit 10 displays on the screen the number of peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F identified and a list of the relative identification codes. The recognition process does not interfere with the operation of any installations already installed on the same line 90 of the supply mains 30, and the operations involved in replacing, removing or adding appliances 20, 20A, 20B, 20C, 20D, 20E, 20F to an installation already installed and operating can be executed by simple commands keyed-in by the user via the keyboard of the control unit 10.

The information and data successively exchanged between the electronic control unit 10 and the peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F (again using carrier transmission of digital signals along the line 90 of the 220 Volt supply mains 30) are dedicated to the implementation of the following functions:

- verification of the state of operation of the peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F;
- verification of the state of charge of the storage battery associated with each peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F;
- unconditional switching-on of lamps (in the case of an emergency lighting installation);
- enabling or disenabling emergency lamp operation (in the case of an emergency lighting installation). It should be noted that in this case, emergency lamp operation is independent and is implemented even if communication with the control unit 10 is interrupted, as the carrier transmission of digital signals relates only to the management of the emergency lighting installation.

The state of operation of the peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F is checked by the electronic control unit 10 either automatically or at the specific request of the user (by keyboard commands).

The period between two automatic verification tests and the time at which said test is carried out are parameters which are set by the user via the keyboard of the control unit 10.

In setting these parameters, account must be taken of current national and international regulations regarding the environment in which the system is used.

During checking, the peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F is made to operate for about one minute. The electronic control unit 10 senses any error indications and signals these to the user either on the display screen or by paper print-out. The document produced by the control unit 10 indicates both the day and time at which the check was made, the type of fault and the identification of the appliances 20, 20A, 20B, 20C, 20D, 20E, 20F in which the abnormality was encountered (each appliance 20, 20A, 20B, 20C, 20D, 20E, 20F is identified by an unambiguous address, which identifies its position relative to a reference point within an overall graph of the installation). The same peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F provides a local indication of the error by causing a red LED to blink.

The state-of-charge check on the storage battery associated with each peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F is similar in execution to the check on its operating state, but requires a longer execution time because it is required to verify that the installed appliances 20, 20A, 20B, 20C, 20D, 20E, 20F have a self-sufficiency in terms of electrical energy which conforms to the rating plate.

During this test the appliance 20, 20A, 20B, 20C, 20D, 20E, 20F is in operation, and an associated microprocessor checks the state of the storage battery, recording any abnormality. On termination of the test, the electronic control unit 10 obtains the results from each peripheral appliance 20, 20A, 20B, 20C, 20D, 20E, 20F and displays them on the screen. It is also possible to produce a paper print-out showing the date and time of the check, the errors found and an identification of the appliances 20, 20A, 20B, 20C, 20D, 20E, 20F which have produced them. A further visual identification of the defective peripheral appliances 20, 20A, 20B, 20C, 20D, 20E, 20F is provided by the appliances 20, 20A, 20B, 20C, 20D, 20E, 20F themselves by the blinking of the red LED. The user is able to set the frequency of the automatic checks (from 1 to 99 weeks) and the time of their execution, or to require their immediate execution by means of an appropriate command to be fed to the electronic control unit 10.

The characteristics of the centralized system for monitoring the functioning of peripheral appliances according to the invention are apparent from the aforegoing description, as are its advantages.

These particularly include:

- flexibility, simplicity and speed of installation and cabling of the electrical and electronic appliances pertaining to the system;
- reduction of the number of connecting wires compared with the known art, as the digital signal is conducted along the same line which carries the electrical supply to the system;
- versatility of system use on existing installations without requiring modifications to the electrical installation;
- ease of integration with other electrical systems and reliability in terms of simplicity of use (because of the method of recognizing installed peripheral appliances and hence the fast configuration) and unambiguous identification of the faulty appliance, following diagnostic error messages;
- time saving in assembling the installation compared with the known art;
- time saving in the procedures involved in checking and monitoring the operation and self-sufficiency of the appliances connected to the installation, compared with the known art;
- compliance with current international and national electrical safety regulations;
- lower cost than the known art.

As already stated, the centralized system of the present invention can be integrated into a system with more extended functions or remote monitoring of the peripheral appliances can be achieved using a telephone line connected to the electronic control unit, to which electronic processors and printers are connected via modems.

Finally, numerous modifications can be made to the centralized system of the present invention without leaving the principles of novelty of the inventive idea, and it is apparent that in the practical implementation of the invention the materials, shapes and dimensions of the illustrated details can be chosen at will according to requirements and can be replaced by others technically equivalent.

Claims

1. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) comprising at least one electronic control unit (10) connected electrically to at least one electrical supply mains (30) and governing the operation of at least one peripheral appliance (20, 20A, 20B, 20C, 20D, 20E, 20F), and which may be connected via at least one telephone line (40) to a plurality of electronic devices (50, 50A, 70, 80), a plurality of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) being connected together and connected electrically to said supply mains (30), characterised in that the connections between said electronic control unit (10) and said supply mains (30) and between said supply mains (30) and said peripheral

appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) and the connections between at least two peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) are made via the line (90) of said supply mains (30), so that communication between said electronic control unit (10) and said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) is achieved using carrier digital transmission of information and/or data along said line (90).

2. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1, characterised in that said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) consist of emergency lighting lamps.

3. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1, characterised in that the number of said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) is variable and depends on user requirements, said number being less than or equal to 255.

4. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1, characterised in that said carrier digital transmission enables the electronic control unit (10) to check the operation of the peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) automatically or at the specific request of the user.

5. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 4, characterised in that said electronic control unit (10) receives information regarding maloperation of said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) and indicates it to the user by display on a screen and/or print-out.

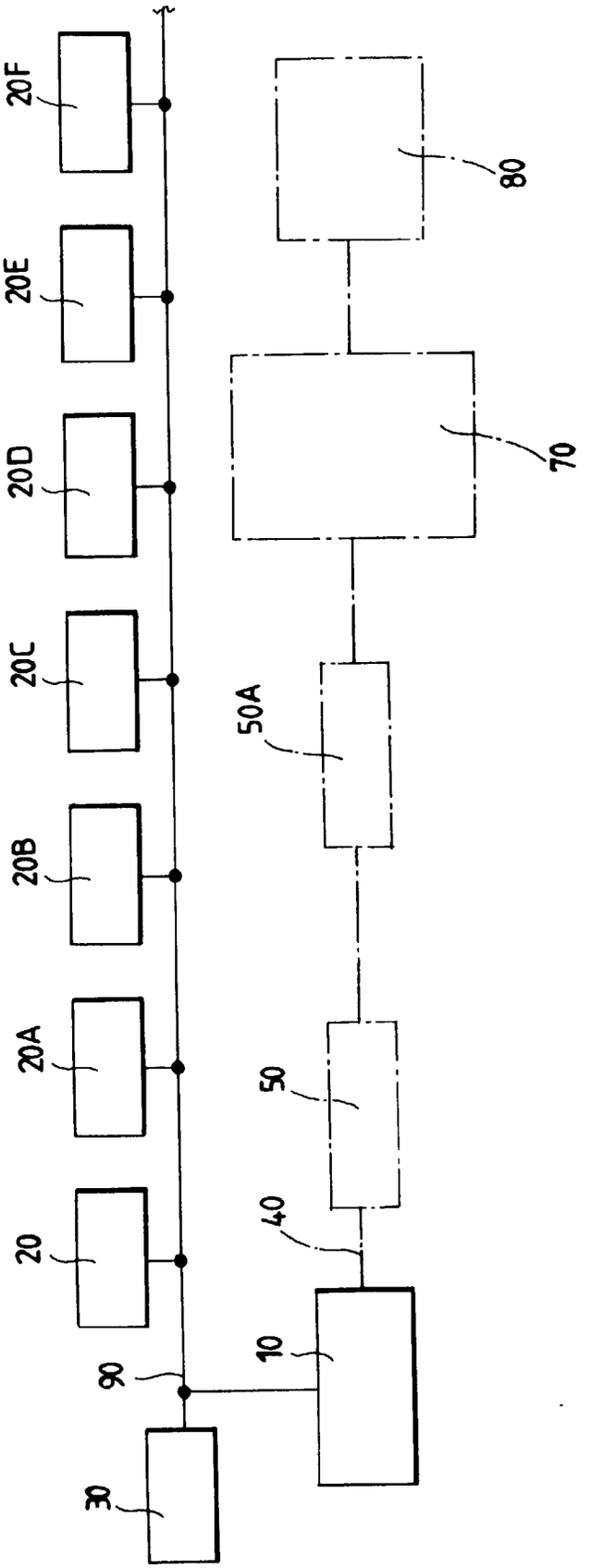
6. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1, characterised in that said carrier digital transmission enables the electronic control unit (10) to check the state of charge of the storage battery present in at least one of said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F), any abnormalities to be recorded and the result of the check to be displayed on screen and/or by print-out.

7. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1 or 2, characterised in that said carrier digital transmission allows said emergency lighting lamps to be unconditionally switched on.

8. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1 or 2, characterised in that said carrier digital transmission allows the emergency function of said emergency lighting lamps to be enabled or disenabled.

9. A centralized system for monitoring the functioning of peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) as claimed in claim 1, characterised in that said carrier digital transmission enables an installation of said peripheral appliances (20, 20A, 20B, 20C, 20D, 20E, 20F) to be installed on existing electrical installations without requiring modifications to said electrical installations, while complying with current national and international electrical regulations.

Fig.1



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1356

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)
X	US-A-4 755 792 (PEZZOLO DONALD E ET AL) 5 July 1988 * column 1, line 8 - column 3, line 68; figures 1,2 *	1,2,4, 6-9	G05D25/02 G08B25/04
X	US-A-5 051 720 (KITTIRUTSUNETORN KITTI) 24 September 1991 * column 3, line 21 - column 6, line 40; figure 1 *	1-5,7-9	
X	US-A-4 567 557 (BURNS MARTIN J) 28 January 1986 * column 5, line 47 - column 7, line 38; figures 1-6 *	1-3,7-9	
X	GB-A-2 182 791 (PCG DESIGNS LIMITED) 20 May 1987 * page 1, line 38 - page 7, line 41; figures 1-7 *	1-9	
A	EP-A-0 490 836 (BEGHELLI G P B SRL) 17 June 1992 * column 1, line 58 - column 3, line 15; claims 1,5-7; figure 4 *	1-9	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G05D G08B
A	ELEKTRONIK, vol. 43, no. 4, 22 February 1994, pages 102-105, XP000434651 FLUR M ET AL: "MIT LINWORKS: DATEN AUF DER NETZLEITUNG KOMMUNIKATION VON STECKDOSE ZU STECKDOSE" * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	9 September 1996	Tran-Tien, T

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

EPO FORM 1503 03.82 (P04C01)