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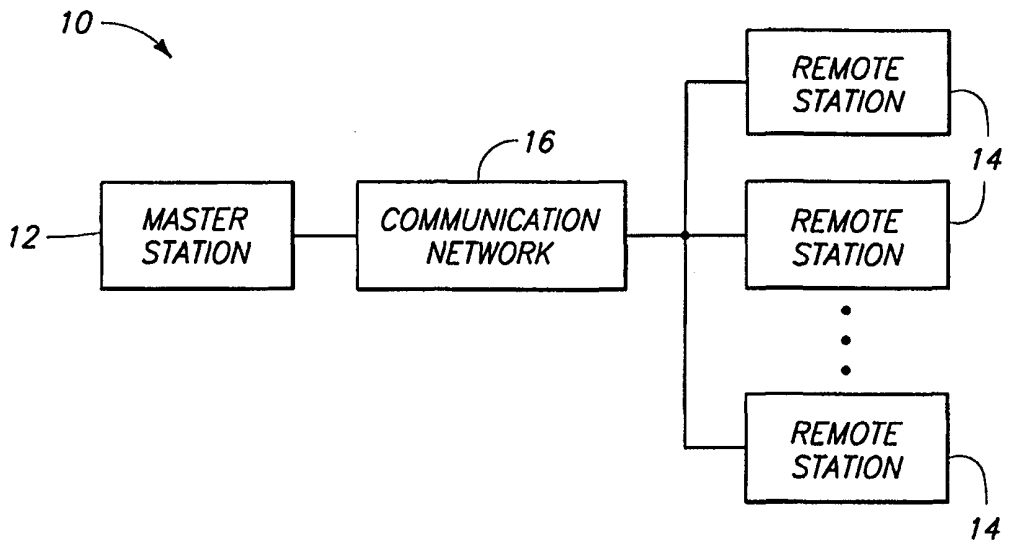

(57) Abstract

The present invention relates to an uninterruptible power supply, systems and methods of monitoring an uninterruptible power supply. One aspect of the present invention provides a system including a master station (12) including a communication device; and a remote station (14) including: a battery; a controller configured to monitor at least one condition of the battery; and a communication device coupled with the controller and configured to communicate the at least one condition to the master station communication device. Another aspect provides a method including providing a master station; providing a remote station (14) including a battery; monitoring at least one condition of the battery; and communicating the at least one condition from the remote station (14) to the master station (12) following the monitoring.

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DESCRIPTION

UNINTERRUPTIBLE POWER SUPPLY, SYSTEMS AND METHODS OF MONITORING AN UNINTERRUPTIBLE POWER SUPPLY

Technical Field

The present invention includes an uninterruptible power supply, systems, and methods of monitoring an uninterruptible power supply.

Background Art

Numerous electronic devices require continuous power to ensure proper operation. These devices typically do not operate during power outages resulting in periods of downtime. Further, the devices may require utilization of a specialized reboot procedure following an unexpected loss of power. Unexpected power losses are typically uncommon, however they do occur from time to time. Accordingly, devices such as uninterruptible power supplies (UPSs) have been developed to supply reserve power to electronic devices during power outages or shortages.

Conventional uninterruptible power supply configurations typically receive AC line voltage from a utility power source line. The uninterruptible power supplies also include one or more on-board storage devices (e.g., batteries) to supply reserve power during periods in time when there is a shortage or outage on the power source line. When there is a such shortage of power, the uninterruptible power supplies are configured to automatically switch to the batteries to supply reserve power to the accessory device requiring uninterrupted power. Following restoration of appropriate power upon the power source line, the uninterruptible power supplies supply power to the accessory device using power received from the utility. Additionally, the uninterruptible power supplies can be configured to recharge and maintain the batteries in a fully-charged condition for a subsequent line disturbance or power shortage.

The reserve power battery systems utilized in uninterruptible power supplies typically have a fixed life. For example, the life of a battery in a conventional configuration can range from three to eight years. Further, the batteries may be sensitive to environmental operating conditions inasmuch as the battery backup

systems can be damaged from a variety of sources. More specifically, an overcharging condition or an extreme temperature fluctuation can result in either battery damage or failure. Further, exposure to surges (e.g., lightning) and battery charger failure can also permanently damage a battery.

If battery failure occurs within an uninterruptible power supply, the backup capability of the uninterruptible power supply is either compromised or lost entirely. Such failure of batteries within uninterruptible power supplies may not be discovered until there is a disturbance or failure upon the power supply line and the backup operation of the uninterruptible power supply fails and the supply of power is interrupted. This may necessitate service of the uninterruptible power supply at an unscheduled time resulting in increased service charges. More importantly, failure of the uninterruptible power supply results in downtime of the associated accessory device.

Therefore, there exists a need in the art to provide a system for monitoring reserve power sources.

Brief Description of the Drawings

Preferred embodiments of the invention are described below with reference to the following accompanying drawings.

Fig. 1 is a high level functional block diagram of a power monitoring system in accordance with the present invention.

Fig. 2 is an illustrative representation of one remote station coupled with a master station of the system of Fig. 1.

Fig. 3 is a functional block diagram of a remote station coupled with an accessory device.

Fig. 4 is a functional block diagram of one embodiment of a remote station of the system.

Fig. 5 is a functional block diagram of one embodiment of a master station of the system.

Fig. 6 is a flow chart of an exemplary methodology for implementing communications from a remote station to a master station.

Fig. 7 is a flow chart of exemplary operations within a master station.

Best Modes for Carrying Out the Invention and Disclosure of Invention

According to one aspect of the invention, a system comprises: a master station including a communication device; and a remote station including: a battery; a controller configured to monitor at least one condition of the battery; and a communication device coupled with the controller and configured to communicate the at least one condition to the master station communication device.

According to a second aspect, a system comprises: a master station; and a plurality of remote stations individually including a battery adapted to supply power to a respective accessory device, the remote stations being individually configured to communicate at least one condition regarding the respective battery to the master station.

Another aspect of the present invention includes an uninterruptible power supply comprising: a battery adapted to supply power to an accessory device; a controller configured to monitor at least one condition of the battery; and a communication device coupled with the controller and configured to communicate the at least one condition.

Another aspect of the present invention includes a system comprising: a master station including: a communication device; a data base; and a processor configured to selectively store a plurality of status reports within the data base; a plurality of remote stations individually comprising an uninterruptible power supply and including: a battery adapted to supply power to an accessory device coupled with the uninterruptible power supply; a controller configured to monitor at least one condition of the battery; and a communication device coupled with the controller and configured to communicate the at least one condition to the master station communication device via a telephone line.

Another aspect provides a method comprising: providing a master station; providing a remote station including a battery; monitoring at least one condition of the battery; and communicating the at least one condition from the remote station to the master station following the monitoring.

According to another aspect, the present invention provides a method of monitoring an uninterruptible power supply comprising: providing an

uninterruptible power supply including a battery; selectively coupling the battery with an accessory device; monitoring at least one condition of the battery using the uninterruptible power supply; and indicating the at least one condition following the monitoring.

Referring to Fig. 1, a system 10 including a master station 12 coupled with a plurality of remote stations 14 is illustrated. Master station 12 and individual remote stations 14 are connected via a communication network 16. Bi-directional communications are preferably provided intermediate master station 12 and individual remote stations 14 via communication network 16.

Exemplary communication protocols utilize wireless (e.g., radio frequency) communications, or a dedicated or nondedicated telephone line of a public switched telephone network (PSTN). In a preferred aspect, "polite communications" are provided intermediate master station 12 and individual remote stations 14 enabling the use of nondedicated phone lines within remote stations 14. Such communications are described in detail below.

Referring to Fig. 2, a single remote station 14 is depicted coupled with master station 12. The depicted remote station 14 is configured as an uninterruptible power supply (UPS) in the illustrated embodiment. Other implementations or configurations of remote station 14 are possible.

Remote station 14 comprising the uninterruptible power supply is configured to provide continuous power to a coupled accessory device 18. Accessory device 18 typically comprises a device which requires continuous power for proper operation. For example, accessory device 18 can comprise a channel bank configured to link a slow-speed voice or data connection with a high-speed link. Alternatively, accessory device 18 comprises a computer system, alarm system, etc. Although not specifically identified in Fig. 2, master station 12 and remote station 14 individually include respective communications devices which are configured to communicate with one another via communication network 16.

As described in detail below, remote station 14 configured as an uninterruptible power supply includes a battery operable to supply reserve power to accessory device 18 when power from the local power line connection fails.

Remote station 14 is configured to monitor at least one condition of the battery and communicate the at least one condition to master station 12. The depicted master station 12 includes a computer 40 coupled with a data base 20 operable to store the forwarded conditions from one or more remote stations 14. The stored information may be retrieved from data base 20 and utilized to schedule servicing of remote stations 14 to avoid costly downtime of accessory device 18.

Remote stations 14 can be implemented as customer premises equipment (CPE) distributed throughout a geographical area. For example, in configurations wherein accessory device 18 comprises a channel bank, master station 12 can comprise a Networks Operations Center (NOC) of a service provider such as a competitive local exchange carrier (CLEC). The present invention enables monitoring plural remotely located stations 14 from a centralized master station 12.

Referring to Fig. 3, remote station 14 comprising an uninterruptible power supply is operable to provide continuous power to accessory device 18 even in times of failure of supplied power from a local utility, represented as power supply 28. The depicted embodiment of system 10 according to the present invention enables master station 12, comprising a Networks Operations Center, to monitor the status of individual remote stations 14 individually comprising an uninterruptible power supply.

Inasmuch as the internal batteries of remote station 14 can periodically fail or differ in state of readiness, it is important to know the potential failure of the batteries prior to the occurrence of a backup condition (e.g., failure of power from local utility power supply 28). In particular, batteries are sensitive to environmental conditions, over charging, exposure to electrical surges, battery charger failure, etc. A service call upon remote station 14 can be performed at a convenient point in time and prior to a power outage if the status of the batteries is known.

Remote station 14 can also be configured to detect and report predefined battery over and under voltage events. For example, remote stations 14 can report voltages in the battery which exceed a specified level (e.g., 106-110 percent) or drop below one or more specified levels (e.g., 70-95 percent). Such

can indicate conditions which result in battery failure caused by outside events, or normal degradation. In addition, remote station 14 can provide real time reporting of lightning suppression (i.e., status of a TVSS device described below), system electronics failure, a battery-on condition, a low-battery condition, and an overall system fault condition.

Remote station 14 can be configured to periodically or continually monitor the condition of the associated battery and communicate the information to master station 12. Alternatively, master station 12 can issue a command via communication network 16 to remote station 14 to initiate such monitoring and/or testing of the associated battery. For example, master station 12 can issue a command to initiate monitoring of the operability of the battery while remote station 14 operates in a backup test mode. In addition, master station 12 can issue a command to test the capacity of the battery. Such operations are described in further detail below.

Referring to Fig. 4, a block diagram illustrates internal components of remote station 14 according to one embodiment and configured as an uninterruptible power supply. The depicted uninterruptible power supply remote station 14 includes a communication device 22, controller 24 and battery 26. The depicted remote station additionally includes a transient voltage surge suppression (TVSS) device 30, a converter/charger 32, memory device 34, and switch 36.

Communication device 22 is coupled with the communication network and is configured to communicate with master station 12. In one embodiment, communication device 22 comprises a Sentry 4.3 available from Design Concepts International.

Transient voltage surge suppression device (TVSS) 30 is coupled with an AC power supply which can comprise a power line from the local utility. An exemplary TVSS device 30 comprises a TCS HWR available from Northern Technologies, Inc. Battery 26 can refer to one or more internal batteries as well as optional external batteries (not shown) which may be coupled with individual remote stations 14 when desired. An exemplary battery 26 comprises a direct current DC battery configured to output -48 Volts. Other battery configurations are possible.

TVSS device 30 and battery 26 are individually coupled with switch 36. Switch 36 is operable to receive power from the local utility via TVSS device 30 as well as power from battery 26. Responsive to control from controller 24, switch 36 is operable to selectively output power from the local utility or reserve power from battery 26.

Switch 36 is coupled with converter/charger 32. Converter/charger 32 can comprise an inverter and rectifier configured to selectively convert direct current (DC) power into alternating current (AC) power and vice-versa. In addition, during periods when the utility is on-line and power is received from the AC power supply via TVSS device 30, converter/charger 32 can provide a maintenance charge to battery 26 to maintain battery 26 in a ready-state of operation. Converter/charger 32 is operable to output either AC or DC power to the accessory device depending upon the particular configuration of the accessory device.

Controller 24 is configured to control and monitor various functions of remote station 14. Controller 24 can comprise a programmable device having designation P-80C52WFN-L16 available from Intel Corporation and configured to execute DCI Sentry 4.XA firmware available from Design Concepts International.

Memory device 34 is operable to store operational code for execution by controller 24. Memory device 34 comprises read-only memory (ROM) and random-access memory (RAM) in exemplary embodiments. Operational code downloaded from communication network and master station 12 can be stored within RAM portions of memory device 34. Preprogrammed operational code (firmware) is typically stored within ROM portions of memory device 34.

Controller 24 is configured to monitor at least one condition of battery 26. In some configurations, controller 24 is configured to monitor the status conditions when battery 26 is not coupled with associated accessory device. Such is preferred to provide status information of battery 26 which is utilized to maintain remote station 14 configured as an uninterruptible power supply in a constant ready-state in the event of loss of power from the local utility.

In exemplary configurations, controller 24 is programmed to monitor the occurrence of at least one of a battery-on condition, a low-battery voltage

condition and a system fault condition. The battery-on condition typically occurs when there is a loss or shortage of utility power from the power supply and inputted to TVSS device 30. However, reserve battery power may also be utilized when the supplied power from the utility is unclean or is experiencing brownout conditions.

A low-battery voltage condition can be monitored while battery 26 is in a reserve operational state not supplying reserve power to the associated accessory device. Such an alarm or indication can be utilized to schedule maintenance\replacement of battery 26 prior to a situation wherein usage of battery 26 is needed. Alternatively, this condition can be monitored when battery 26 is on-line. If such an alarm is indicated when battery 26 supplies reserve power, battery 26 can be disconnected from the accessory device to prevent damage to battery 26 or the accessory device.

Controller 24 is also operable to monitor the occurrence of a system fault condition which permits monitoring of components in addition to battery 26. Such a condition can occur when battery 26 is switched on-line but an internal component of remote station 14 is defective (e.g., converter/charger 32 or switch 36 is inoperable). An alarm can be indicated for the system fault. Preferably, system fault conditions are identified during periodic checks of remote station 14.

System 10 is also preferably configured to enable master station 12 to initiate monitoring and or testing functions within the plural remote stations 14. For example, master station 12 can be programmed to periodically output a command to all or selected ones of coupled remote stations 14. Alternatively, an operator of master station 12 can issue a command at a desired time to initiate an instantaneous monitoring function in remote stations 14. Master station 12 is configured to output the command via communication network 16 to the desired remote stations 14. Remote stations 14 are configured to monitor the at least one condition responsive to the received command and may output results from the monitoring to master station 12.

For example, remote device 14 can be instructed to test or monitor the operability and/or the capacity of battery 26. Thereafter, controller 24 of remote device 14 can instruct switch 36 to provide battery 26 in an on-line operational

mode to supply reserve power to an associated accessory device. Such can provide operability information wherein controller 24 monitors whether all connections of battery 26 are successfully provided to the accessory device. Responsive to proper connection, the operability test can be completed. If a fault is detected, controller 24 can indicate an alarm condition which typically specifies a system fault condition.

In addition, controller 24 can be configured to couple battery 26 with the associated accessory device via switch 36 to provide a capacity test. Such may be referred to as "exercising" battery 26. During such an operation, battery 26 is coupled with the accessory device and permitted to drain to a low voltage condition wherein power from the utility line is brought on-line to charge battery 26 and for application to the accessory device. Such a test provides information regarding the capacity of battery 26 to deliver reserve power. A capacity test may be performed at predefined intervals, such as once or twice a year.

In one configuration, a base value is measured following initial hook-up of remote device 14 to the desired accessory device and an initial capacity test is performed. The base value provides a value for subsequent comparisons. More specifically, test values from subsequent exercising capacity operations can be compared with the base value to determine the degree of degradation of battery 26.

Individual remote stations 14 preferably include a clock (not shown) for enabling controller 24 to provide such monitoring operations at predefined times. Such is preferred to enable the monitoring or testing operations during evenings or during periods of time when the accessory device is typically not in use to minimize disruption in operation of remote station 14 and the accessory device. Further, remote stations 14 can specify the timing of the occurrence of events or alarms in a status report to master station 12.

Referring to Fig. 5, one exemplary configuration for master station 12 is illustrated. The depicted master station 12 includes a computer 40 coupled with a data base 42 and communication network 16. The illustrated computer 40 includes a processor 44, memory device 46, hard disk 47, user interface 48, and communication device 50.

In one implementation, computer 40 comprises a personal computer and processor 44 comprises a Pentium II processor available from Intel Corporation. Memory device 46 can include a ROM memory device which stores boot code for configuring computer 40 and a RAM memory device usable by processor 44. Hard disk 47 is configured to store operational code as well as status report data received from remote stations 14 coupled with communication network 16. Further, status report data from remote stations 14 can be applied to data base 42 for storage.

User interface 48 of computer 40 can include a CRT display and keyboard or other input device. An operator can monitor the operations of master station 12 and remote stations 14 via the CRT display. Further, an operator can input commands using interface 48 for running various tests and implementing monitoring functions within remote stations 14 as previously described. In addition, a user can download operational code to individual remote stations 14 to provide new programming configurations for such remote stations 14.

As previously stated, status reports received from remote stations 14 can be stored within data base 42. Exemplary status reports identify the particular remote station 14 reporting, the result of the monitoring functions, elapsed time of the downtime of the utility, percentage of power remaining in the battery at a given time as determined from the capacity test operations, as well as time and date information. The status reports can be modified to include more or less information depending upon the particular application. Responsive to receiving such information, computer 40 may display alarm conditions via user interface 48 for predefined conditions indicated from remote stations 14 (e.g., current remaining energy information of battery 26 during an on-battery event, system fault indication, etc.).

Communication device 50 of computer 40 is configured to couple with a plurality of dedicated lines of communication network 16. Communication device 50 is configured to couple with 24 lines in an exemplary embodiment. Typical communications intermediate remote station 14 and master station 12 can occur within 7 seconds or less. Thus, utilizing 24 dedicated lines, master station 12 can access approximately 10,000 communications per hour in an exemplary

application. An exemplary communication device 50 comprises a Proline/2V available from Dialogic Corporation.

Communication device 50 is preferably configured to provide bi-directional communications with communication devices 22 of remote stations 14. Communication devices 22, 50 are configured to communicate utilizing Dual Tone Multiple Frequency (DTMF) strings in the described embodiment. Other configurations of communication devices 22, 50 are possible.

Referring to Fig. 6, an exemplary method for communicating data, such as a status report, from an individual remote station 14 to a master station 12 is illustrated. Firmware to implement the following procedure is stored within memory device 34 of remote station 14 in an exemplary configuration. Initially at step S10, controller 24 monitors the condition of battery 26. Such can be responsive to a command from master station 12 or a periodic check of the state of battery 26.

At step S12, controller 24 determines whether an alarm condition is present. Such can include comparing the present voltage of battery 26 to an acceptable predefined range, a system fault or other condition requiring attention. If an alarm condition is detected at step S12, controller 24 proceeds to step S14 to determine whether immediate remedial action is necessary. Such may include disconnecting battery 26 from an accessory device or other predefined operation at step S16.

If no remedial action is required at step S14, or if no alarm is detected at step S12, controller 24 proceeds to step S18. At step S18, controller 24 formats a status report to be forwarded to master station 12 via communication network 16. The status report can indicate an alarm condition, or alternatively a pass condition if the monitoring of battery 26 indicates satisfactory operation or condition. An exemplary status report can identify the particular remote station 14, time and date information, location information and a particular alarm condition, if any.

Following preparation of the status report, controller 24 proceeds to step S20 to determine whether a communication line (e.g., T-1 line) to network 16 is open. Such provides polite communications which permits communications of

remote station 14 with master station 12 via a nondedicated line. Controller 24 idles at step S20 if no communication line is open. Otherwise, controller 24 proceeds to step S22 to initiate communication of the status report via communication network 16 to master station 12.

During communications, controller 24 monitors for the presence of an interrupt at step S24. Such can include an individual telephone going off-hook (e.g., a telephone has been picked up to place an outgoing call using the nondedicated line or an incoming call has been received upon the nondedicated line). If an interrupt occurs at step S24, controller 24 proceeds to step S20 to monitor for an opening of the communication line wherein the communication is repeated. If no interrupt occurs, controller 24 proceeds to step S26 to continue communication of the status report to master station 12.

Following completion of the communication of the status report as determined at step S28, controller 24 returns to step S10 to monitor another condition of battery 26. Alternatively, the indicated process can end following the creation of the status report.

Referring to Fig. 7, exemplary operations within master station 12 are illustrated in a flow chart. Operational code for implementing the depicted operations can be stored within memory 46 or hard drive 47. Initially, processor 44 receives a communication from one of remote stations 14 at step S40. Remote stations 14 call following installation. Thereafter, remote stations 14 periodically call master station 12. Alternatively, remote stations 14 may call responsive to an alarm condition being detected as described with reference to Fig. 6. Such calls following an alarm may be randomly delayed to avoid the presence of numerous simultaneous calls responsive to one event. The status report is communicated from remote station 14 to master station 12 during step S40 and can include one or more events or alarms.

At step S42, processor 44 determines whether an immediate alarm condition should be issued via user interface 48. If no alarm condition is indicated, processor 44 proceeds to step S46 to store the status report in data base 42. The stored status report can indicate whether maintenance should be scheduled to service remote station 14.

If an alarm condition is indicated at step S42, processor 44 can trigger the desired alarm at step S44 which may indicate that an immediate response is needed. Such an alarm indication can be indicated at master station 12 (e.g., Networks Operations Center) or alternatively transferred to another station (e.g., a regional alarm computer via an Ethernet connection). Following the triggering of the alarm, processor 44 proceeds to step S46 and stores the status report within data base 42 and identifies the particular communicating remote station 14.

Thereafter, processor 44 determines whether programming is present at step S48. A user of master station 12 may indicate programming is to be downloaded to remote stations 14. Exemplary programming can include updates to the operational code of one or more remote stations 14 (e.g., specifying the time remote devices 14 report to master station 12), or commands to initiate a monitoring or test function within remote stations 14. Responsive to programming being present at step S48, processor 44 proceeds to step S50 to download the appropriate programming to the respective remote station 14 at step S50.

Alternatively, if no programming is present at step S48, the communication interaction with the current remote station 14 can be terminated. Thereafter, master station 12 awaits another communication from one of remote stations 14.

The present invention described herein enables a user at a centralized location (e.g., a single master station 12) to monitor a plurality of remote stations 14. For example, the Networks Operations Center (NOC) of a service provider, such as a competitive local exchange carrier (CLEC), can remotely monitor and/or test a plurality of remotely located devices in the field. Such remote devices can comprise uninterruptible power supplies as described herein and configured to provide reserve power to associated channel banks or other appropriate devices. Alternatively, remote devices 14 can comprise other devices.

CLAIMS

1. A system comprising:

a master station including a communication device; and

a remote station including:

a battery;

a controller configured to monitor at least one condition of the battery; and

a communication device coupled with the controller and configured to communicate the at least one condition to the master station communication device.

2. The system according to claim 1 wherein the remote station comprises an uninterruptible power supply and the battery is adapted to supply power to an accessory device coupled with the uninterruptible power supply.

3. The system according to claim 2 wherein the controller is configured to monitor the at least one condition when the battery is not coupled with the accessory device.

4. The system according to claim 2 wherein the controller is configured to monitor the operability and the capacity of the battery when the battery is coupled with the accessory device.

5. The system according to claim 1 wherein the remote station is configured to receive a command from the master station.

6. The system according to claim 5 wherein the controller is configured monitor the at least one condition responsive to the command.

7. The system according to claim 1 wherein the controller is configured to monitor the occurrence of at least one of a battery-on condition, a low-battery voltage condition, and a system fault condition.

8. The system according to claim 1 wherein the master station communication device and remote station communication device communicate using a telephone line.

9. A system comprising:

a master station; and

a plurality of remote stations individually including a battery adapted to supply power to a respective accessory device, the remote stations being individually configured to communicate at least one condition regarding the respective battery to the master station.

10. The system according to claim 9 wherein the remote stations individually comprise an uninterruptible power supply.

11. The system according to claim 9 wherein the remote stations are individually configured to monitor the at least one condition.

12. The system according to claim 9 wherein the remote stations are individually configured to monitor the at least one condition when the battery is not coupled with the accessory device.

13. The system according to claim 9 wherein the remote stations are individually configured to receive data from the master station.

14. The system according to claim 13 wherein the data comprises a command and the remote stations are individually configured to monitor the at least one condition responsive to the data.

15. The system according to claim 13 wherein the data comprises programming information.

16. The system according to claim 9 wherein the remote stations individually include a controller configured to control the coupling of the battery and the accessory device and to monitor the operability and the capacity of the battery when the battery is coupled with the accessory device.

17. The system according to claim 9 wherein the remote stations are individually configured to monitor the occurrence of at least one of a battery-on condition, a low-battery voltage condition, and a system fault condition.

18. The system according to claim 9 wherein the master station and remote station communicate using a telephone line.

19. An uninterruptible power supply comprising:

a battery adapted to supply power to an accessory device;

a controller configured to monitor at least one condition of the battery; and

a communication device coupled with the controller and configured to communicate the at least one condition.

20. The uninterruptible power supply according to claim 19 wherein the controller is configured to monitor the at least one condition when the battery is not coupled with the accessory device.

21. The uninterruptible power supply according to claim 19 wherein the communication device is adapted to receive a command and the controller is configured monitor the at least one condition responsive to the command.

22. The uninterruptible power supply according to claim 19 wherein the controller is configured to control the coupling of the battery and the accessory device and to monitor the operability and the capacity of the battery when the battery is coupled with the accessory device.

23. The uninterruptible power supply according to claim 19 wherein the controller is configured to monitor the occurrence of at least one of a battery-on condition, a low-battery voltage condition, and a system fault condition.

24. A system comprising:

a master station including:

a communication device;

a data base; and

a processor configured to selectively store a plurality of status reports within the data base; and

a plurality of remote stations individually comprising an uninterruptible power supply and including:

a battery adapted to supply power to an accessory device coupled with the remote station;

a controller configured to monitor at least one condition of the battery; and

a communication device coupled with the controller and configured to communicate the at least one condition to the master station communication device via a telephone line.

25. A method comprising:

providing a master station;

providing a remote station including a battery;

monitoring at least one condition of the battery; and

communicating the at least one condition from the remote station to the master station following the monitoring.

26. The method according to claim 25 further comprising:

providing a remote station comprising an uninterruptible power supply; and

supplying power to an accessory device using the battery.

27. The method according to claim 26 wherein the monitoring comprises monitoring when the battery is not coupled with the accessory device.

28. The method according to claim 25 further comprising receiving a command within the remote station from the master station and the monitoring is responsive to the receiving the command.

29. The method according to claim 25 wherein the monitoring comprises:

coupling the battery with an accessory device; and

testing at least one of the operability and capacity of the battery following the coupling.

30. The method according to claim 25 wherein the monitoring comprises monitoring the occurrence of at least one of a battery-on condition, a low-battery voltage condition, and a system fault condition.

31. The method according to claim 25 wherein the communicating comprises communicating using a telephone line.

32. A method of monitoring an uninterruptible power supply comprising:

providing an uninterruptible power supply including a battery;

selectively coupling the battery with an accessory device;

monitoring at least one condition of the battery using the uninterruptible power supply; and

indicating the at least one condition following the monitoring.

33. The method according to claim 32 wherein the monitoring comprises monitoring when the battery is not coupled with the accessory device.

34. The method according to claim 32 further comprising receiving a command within the uninterruptible power supply from the master station and the monitoring is responsive to the receiving the command.

35. The method according to claim 32 wherein the monitoring comprises testing at least one of the operability and capacity of the battery during the coupling of the battery with an accessory device.

36. The method according to claim 32 wherein the monitoring comprises monitoring the occurrence of at least one of a battery-on condition, a low-battery voltage condition, and a system fault condition.

37. The method according to claim 32 wherein the indicating comprises communicating the at least one condition.

38. The method according to claim 37 wherein the communicating comprises communicating using a telephone line.

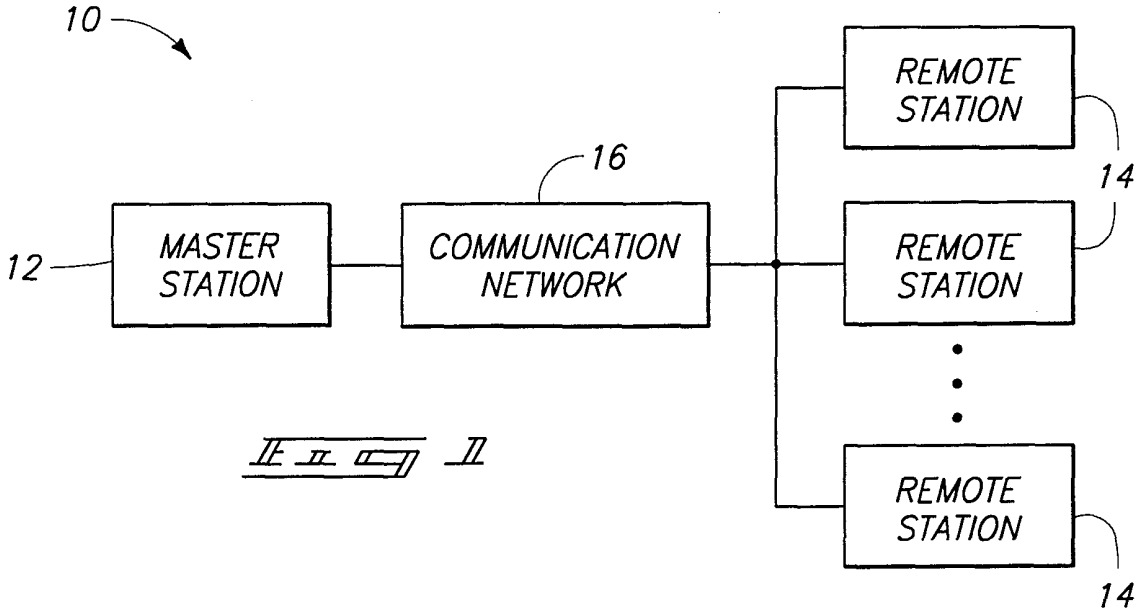


Fig 1

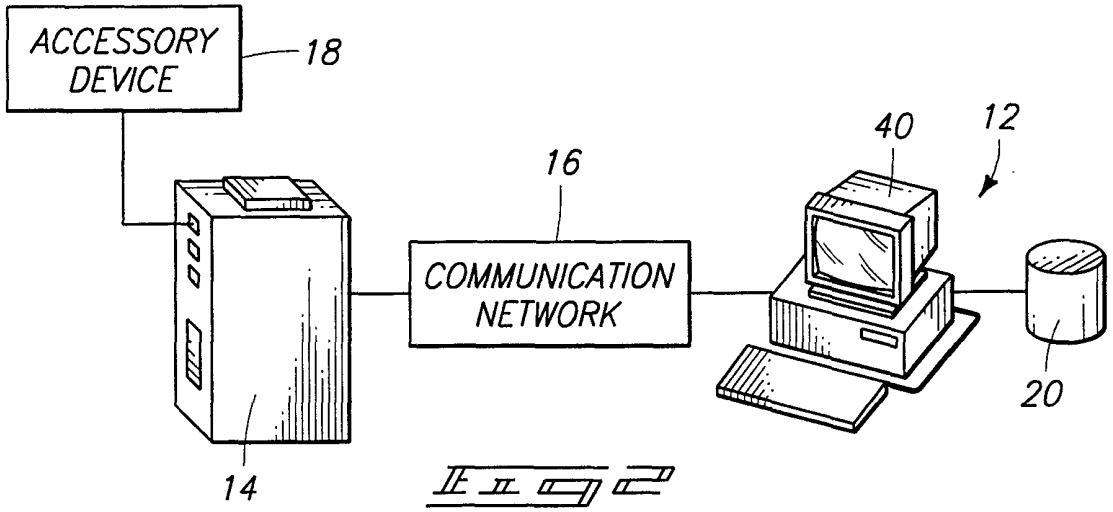


Fig 2

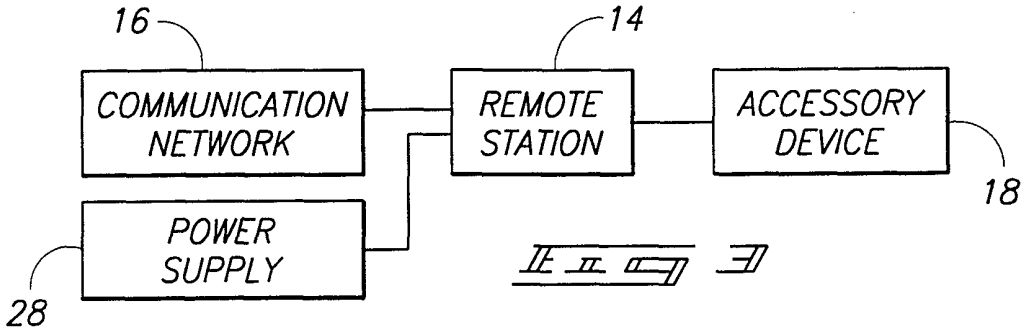


Fig 3

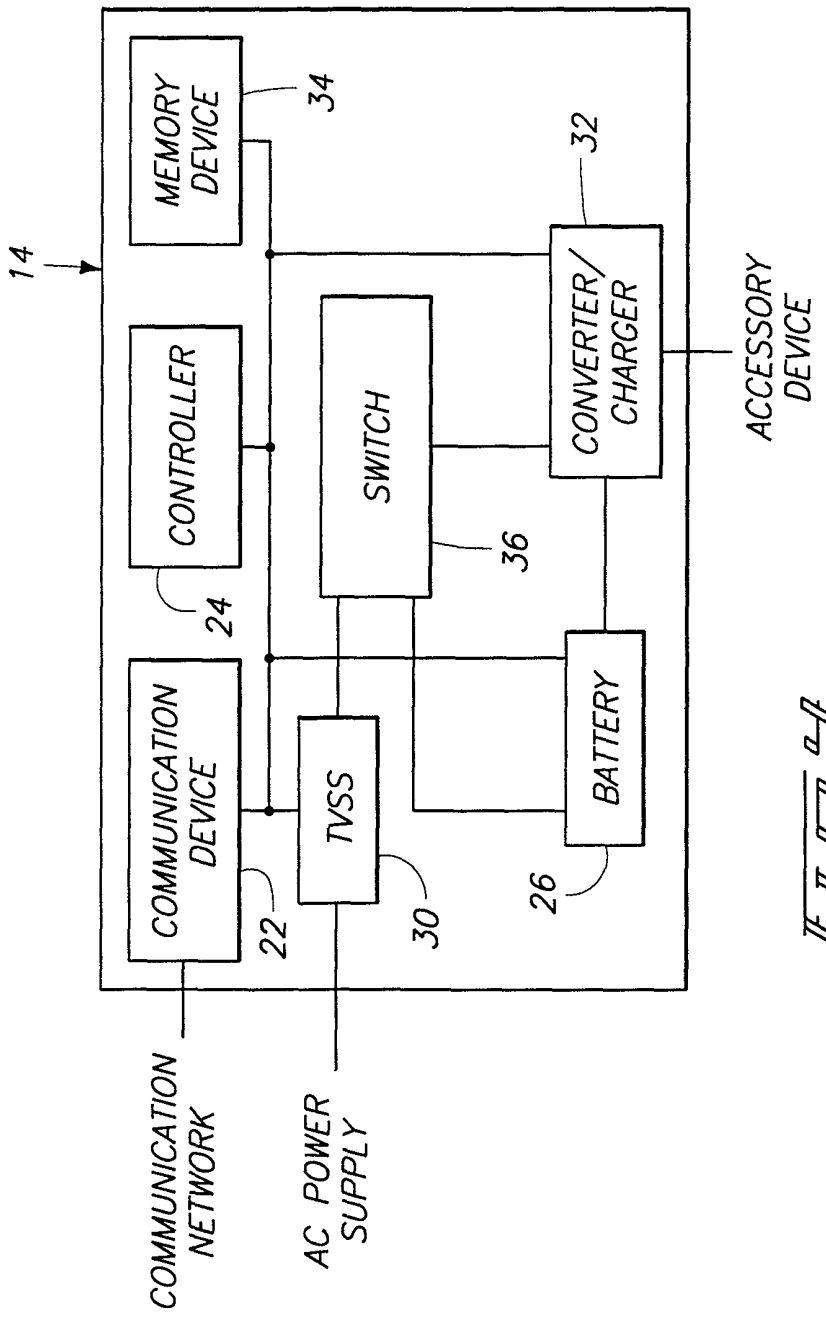

14
MEMORY DEVICE
34
CONTROLLER
24
SWITCH
36
CONVERTER/ CHARGER
32
ACCESSORY DEVICE
COMMUNICATION DEVICE
22
TVSS
30
BATTERY
26
COMMUNICATION NETWORK
AC POWER SUPPLY

Fig 4

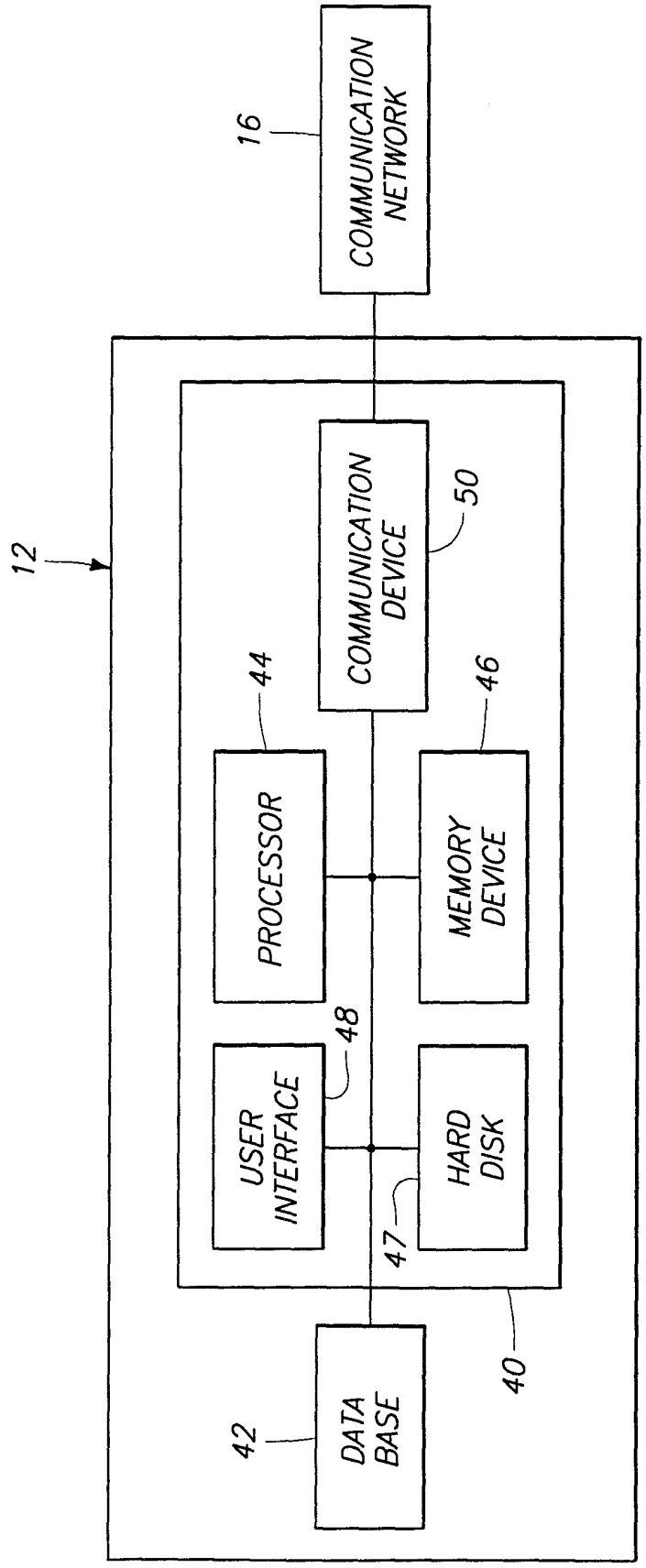
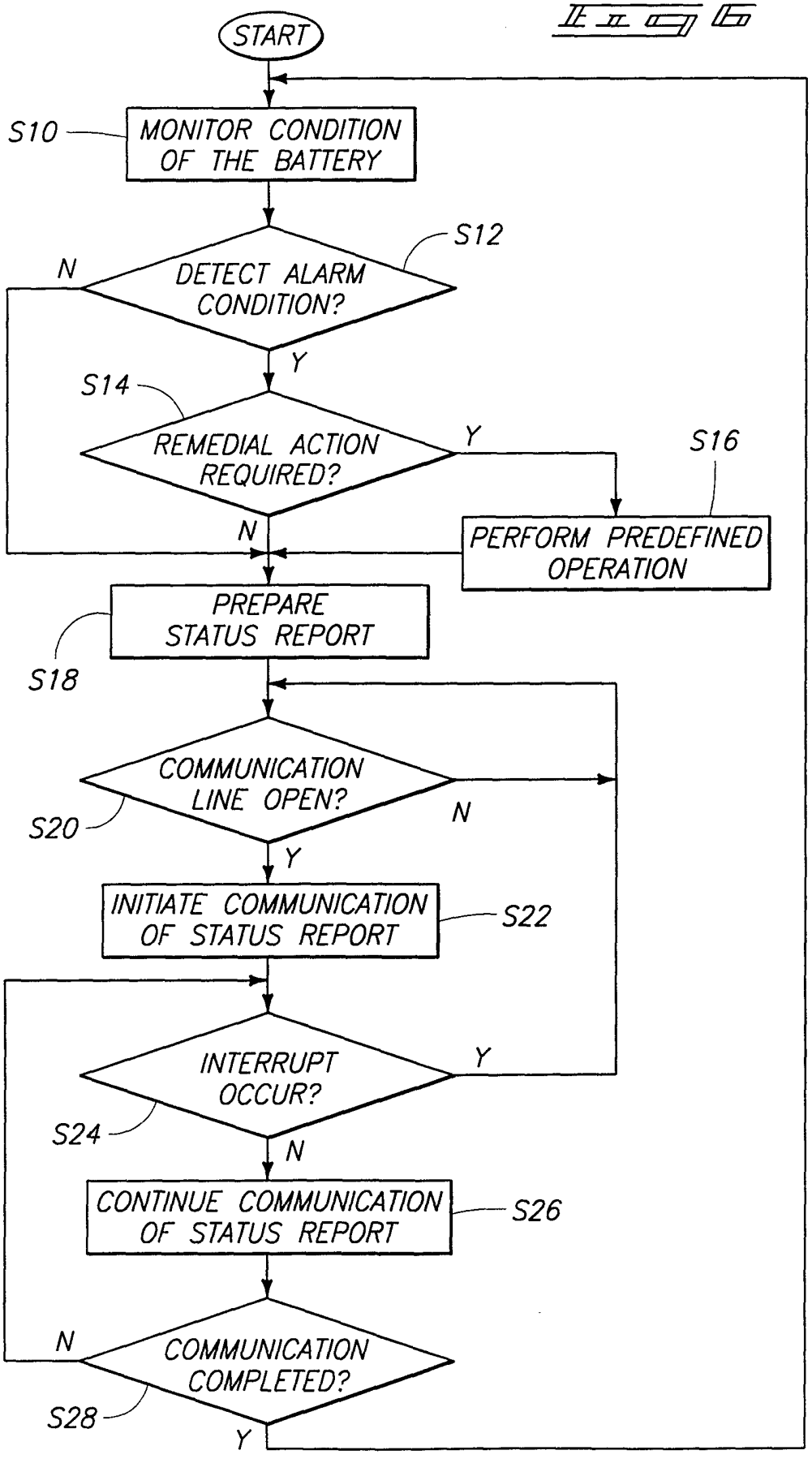

16
COMMUNICATION NETWORK
12
COMMUNICATION DEVICE
50
44
PROCESSOR
46
MEMORY DEVICE
48
USER INTERFACE
HARD DISK
47
40
42
DATA BASE

FIG 5

Fig 6


START
S10
MONITOR CONDITION OF THE BATTERY
S12
DETECT ALARM CONDITION?
N
Y
S14
REMEDIAL ACTION REQUIRED?
Y
S16
PERFORM PREDEFINED OPERATION
N
PREPARE STATUS REPORT
S18
COMMUNICATION LINE OPEN?
S20
N
Y
INITIATE COMMUNICATION OF STATUS REPORT
S22
INTERRUPT OCCUR?
Y
S24
N
CONTINUE COMMUNICATION OF STATUS REPORT
S26
COMMUNICATION COMPLETED?
N
S28
Y

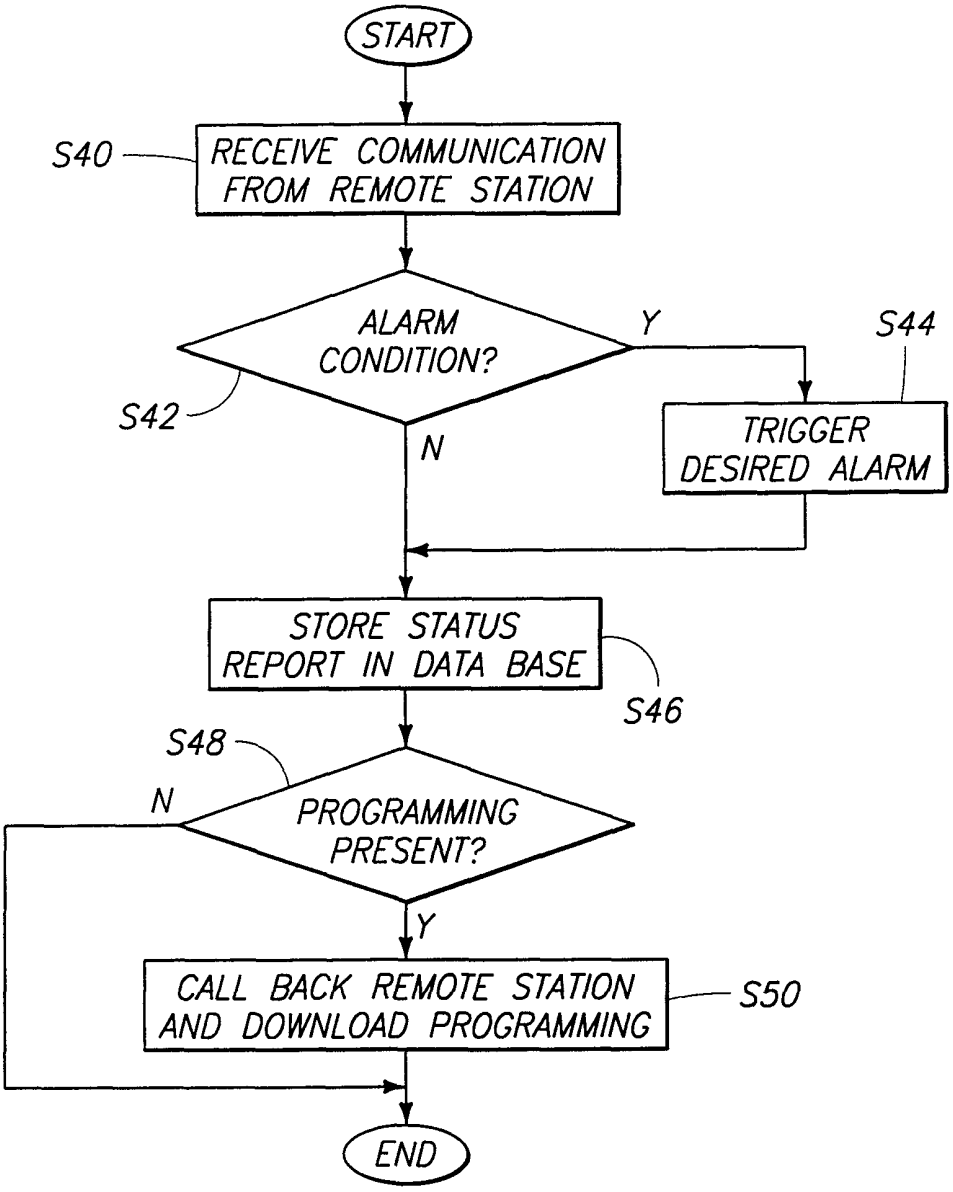

START
S40
RECEIVE COMMUNICATION FROM REMOTE STATION
ALARM CONDITION?
Y
S44
S42
N
TRIGGER DESIRED ALARM
STORE STATUS REPORT IN DATA BASE
S46
S48
N
PROGRAMMING PRESENT?
Y
CALL BACK REMOTE STATION AND DOWNLOAD PROGRAMMING
S50
END

FIG 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/28278

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01R 31/36; G06F 19/00
US CL : 702/63

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 702/62,188; 340/455,636,657; 320/134,136

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
None

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO APS EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,281,955 A (REICH et al) 25 January 1994 (25.01.1994), column 16 and Fig. 25.	1-8, 19-23, 25-31, 32-38 --- 9-15,24
X --- Y	US 5,381,554 A (LANGER et al) 10 January 1995 (10.01.1995), Figs. 1-2.	1-8, 19-23, 25-31, 32-38 --- 9-15,24
X --- Y	US 5,666,040 A (BOURBEAU) 09 September 1997 (09.09.1997), Fig. 1.	1-8, 19-23,25-31,32-38 --- 9-15,24

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
	31 March 2000 (31.03.00)
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Patrick J Assouad Telephone No. 703-308-0956

Form PCT/ISA/210 (second sheet) (July 1998)