

REMOTE MONITORING SYSTEM FOR CONTAINERS

The present invention relates to a remote monitoring system for containers which transmits information for example a control command and operation data by a serial communication system using power lines, and is applicable to marine freezing containers.

In general, a remote monitoring system for containers comprises a central monitoring device and a plurality of sub terminal stations. In such a system, connections between the central monitor and the sub stations are made and broken due to, for example, the maintenance or the movement of a container.

In general, the central station is installed in an office in a container yard or in a monitoring place in an operations room of a ship and the sub stations are installed in the container in combination therewith.

In a general communication system, since a network address is settled upon the configuration of the system, it can not be applied to the automatic address registration of the terminals in a communication system for the remote monitoring system of containers.

In general, in known systems the registration (log-on) of many and unspecified terminals on the same network into a central computer is made in accordance with a communication sequence shown in Fig. 8. In Fig. 8, when the central computer issues a log-on request permission signal E, terminals 1 to n issue log-on request signals R1 to Rn simultaneously. The log-on signals interfere with one another on the network. In order to avoid this interference in many cases, delay times T1 to Tn are set in the terminals at random. This method is not efficient since useless time t1 occurs for each communication.

The freezing container is basically moved between owners of goods, the container yard and the container ships. In the remote monitoring in the container yard and the container ships, it is always required to monitor containers which are newly connected to the communication network or disconnected therefrom. Further, it is difficult to leave the operator of the container to effect logging on or logging off of the container.

It is an object of the present invention to provide a remote monitoring system for containers capable of automatically logging-on addresses of terminals in a communication network.

The present invention resides in a remote monitoring system for containers, including a central monitoring device having a computer , and a communication device housed in each container, such that the transmission of signals between the said devices can be carried out by serial communication using a power line, characterized in that logging-on and logging-off to said central monitoring device, according to the connection and disconnection of a said container to said power line, can be accomplished by the use of a peculiar number (terminal address) of said container for the purpose of avoiding interference due to signals from other containers, and in which the central monitoring device is adapted to detect non-communication with individual containers and to log-off a container for which detected non-communication has continued for a predetermined period.

More particularly, the communication network using the power line data carrier technique is structured and a main power plug of the freezing container is connected to a receptacle to perform the communication with the central monitoring device. The automatic logging-on function by the identification of the container using an

identification number of the ISO standard peculiar to the container and the automatic logging-off function by continuation of the communication disabling state formed by disconnecting the power plug of the freezing container are added.

With such a configuration, an AC 200 V or 400 V line, for example, is used as a data communication line by the power line data carrier technique and mutual communication can be made by means of a master modem device and a slave modem device each including a power line data carrier interface.

A central computer system issues a monitoring command of a designated container to the master modem device and the master modem device takes up monitoring data from a freezer controller in accordance with a communication protocol previously set with the slave modem device on the basis of the command to transmit the data to the central computer. The computer processes the data and supplies it to an output device. The central computer sequentially receives the monitoring data for other containers and processes the data.

In addition, the container makes connection and disconnection with AC lines in response to movement of

cargoes in the container yard or the container ship and the logging-on and off processes can be made to the central computer system automatically and efficiently by utilizing the peculiar identification numbers of the containers.

By means of the present invention, unskillful computer operation by the container operator is removed and the operation for the remote monitoring in the connection and disconnection of the freezing container is also removed so that mistakes by the operator can be eliminated and the logging-on and off processes to the remote monitoring system can be made exactly.

Fig. 1 is a block diagram showing the configuration of a remote monitoring system for freezing containers according to the present invention;

Fig. 2 is a block diagram showing the internal configuration of a modem in a communication interface of Fig. 1;

Fig. 3 is a logging-on sequence chart in the case of a single unregistered container;

Fig. 4 is a logging-on sequence chart in the case of two unregistered containers;

Fig. 5 is a diagram showing communication data in Figs. 3 and 4;

Fig. 6 is a flow chart showing the program of a microcomputer included in a master modem device of Fig. 1;

Fig. 7 is a diagram showing a peculiar number of a container; and

Fig. 8 is a conventional communication sequence chart.

Fig. 1 is a block diagram showing the configuration of a remote monitoring system for marine freezing containers according to the present invention.

The system uses AC 200 V or 400 V power line 109 as a data communication line by the power line data carrier technique, and mutual communication can be made by means of a master modem device 103 and a slave modem device 106 each including a power line data carrier interface.

A central computer 102 issues a monitoring command for a designated container 105 to the master modem device 103. The master device 103 takes monitoring data from a

freezing controller 107 in accordance with a communication protocol established with the slave modem device 106 on the basis of the command and transmits the data to the central computer system 102. The central computer system 102 processes the data and supplies the processed data to an output device 104. The central computer system 102 can receive the monitoring data of other containers 105a' and 105b' successively and process the data.

Containers are connected to or disconnected from AC line due to movement of cargoes in the container yard or the container ship.

In the present system, identification numbers peculiar to the containers are used in the connection and the disconnection to perform the logging-on process and the logging-off process for the central computer system 102 automatically and efficiently.

The hardware of the master modem device 103 and the slave modem device 106 for use in communication are the same and have the following function. In Fig. 2, transmission and receipt of data with the central computer system 102 or the freezing controller 107 are made through an RS232C interface by one-chip

microcomputer 111. Communication between the master modem device 103 and the slave modem device 106 is made by frequency modulating serial data produced from a TxD terminal of the one-chip microcomputer 111 by a high-frequency modulator 112 and supplying the modulated signal from the modulator 112 through a transmission amplifier 113, a high-frequency transformer 114, a high-frequency bypass condenser 115 and a power connector 108 of the freezing container to the power line 109 of AC power supply. This signal is transmitted to all of the slave modem devices 106 connected to the power line 109 and is further transmitted through the power connector 108 of the slave modem device 106, the high-frequency bypass condenser 115, the high-frequency transformer 114 and a received signal amplifier 116 to a demodulator 117 to be converted into the original serial data and be supplied to receive terminal RxD of the one-chip microcomputer 111. The demodulator 117 can detect a data modulation signal from the power line 109 separately from the received data and the detected signal is supplied to the one-chip microcomputer 111. A master modem control program 119 is incorporated into a modem to form the master modem device 103 and a slave modem control program 120 is incorporated into a modem to form the slave modem device 106. The modulator 112 and the demodulator 117 can utilize various modulation and demodulation methods.

Figs. 3 and 4 show the logging-on sequence using the modem. Fig. 5 shows operation codes and transfer data formats between the modems. Fig. 6 is a program flow chart of the master modem device.

Fig. 3 shows the logging-on sequence in the case where only one container is connected to AC power source. The central computer system 102 periodically transmits to the master modem device 203 a logging command LC for detecting containers 105, 105a and 105b connected newly to AC line. The master modem device 103 receive this command and transmits a logging-on request inquiry command E to AC line constituting the communication network. The slave modem device 106 for an unregistered container which has received the command E returns a response signal R. The container number is added in the signal R and the master modem device 103 can detect the container number. The master modem device 103 transmits the logging-on request LR to the central computer system 102 and the central computer system 102 transmits a log-on permission response DN to the modem. The master modem device 103 transmits a logging on completion notification LP to the slave modem device 106 and consequently the slave modem device 106 confirms that the logging-on has been made in the central computer

system 102. Subsequently, the slave modem device 106 transmits the data peculiar to the container through the master modem device 103 to the central computer system 102 by means of the container I.D. data transmission ID to complete a series of logging-on sequence. Thereafter the logged on container makes communication for monitoring periodically by the central computer system 102.

Fig. 4 is a diagram showing the logging-on sequence in the case where a plurality of new containers are connected to AC line. In this case, there is a problem as follows. The containers 1 and 2 transmit the logging-on request R in response to the logging-on request inquiry E of the master modem simultaneously and consequently the container number can not be detected because of interference of the data. The interference of data can be detected by the received state of a start code STx, an end code ETx, a bit error detection check code or the like shown in the data format of Fig. 5. Even when data can not be received exactly, the one-chip microcomputer 111 of the master modem device 103 can detect the high-frequency signal on the AC line and detect that at least one or more new containers have transmitted the logging-on request response R. The master modem device 103 enters into a search sequence immediately after the detection. The search sequence is

performed on the basis of the peculiar number of the container. The peculiar number of the container is specified by ISO 6346 as shown in Fig. 7.

The code of a company owning the container, and an individual container serial number, can be used to recognize the individual containers. The present invention aims to make the search sequence efficiently. As shown in Fig. 4, after detection of the interference, the master modem device 103 first inquires by a first search command S_{11} whether a container having in its serial number a first digit equal to "1" exists or not. If there is no response, the device 103 inquires by a search command S_{12} whether there is a container with a serial number of which the first digit is "2". Fig. 4 shows the case where two containers have "2" in the first digit and since the logging-on request responses R are issued simultaneously, interference is again detected by the master modem device 103. When the interference is detected, the container number for search is carried and a search command S_{21} having the first digit "2" and the second digit "1" and so on, is issued. In the example of Fig. 4, when the second digit is "5", the slave modem 106 of the container serial number includes "25" will first transmit the logging-on request response

R alone and the master modem device 103 can then receive exactly. Thus, the master modem 103 can recognize the peculiar number of the container included in the response R. The subsequent sequence is the same as that in the previously-described case where a single container is connected.

The search sequence is continued until the response R from the slave modem 106 is exactly received by carrying the container number while detecting the response from the slave modem 106. If two or more containers with identical serial numbers are detected, the search is continued using the company code portion of the container numbers. The search of the code for each company of the peculiar number of the container is made by one previously registered character of alphabetic letter.

As described above, in the present system the peculiar number of the container is not used as data for the container search but is used for avoidance of interference upon request of the logging-on. The logged on container enters into the ordinary interval monitoring mode.

When the container is disconnected from the AC power source, the communication for the monitoring is normally

impossible (no response) and when this state is continued for a fixed time, the central computer system 102 cancels the registered container number. This operation is named logging-off.

The present system can be used even for automatic logging-on of the terminals of the system having a dedicated communication line without use of the modem device.



CLAIMS:

1. A remote monitoring system for containers, including a central monitoring device having a computer, and a communication device housed in each container, such that the transmission of signals between the said devices can be carried out by serial communication using a power line, characterized in that logging-on and logging-off to said central monitoring device, according to the connection and disconnection of a said container to said power line, can be accomplished by the use of a peculiar number (terminal address) of said container for the purpose of avoiding interference due to signals from other containers, and in which the central monitoring device is adapted to detect non-communication with individual containers and to log-off a container for which detected non-communication has continued for a predetermined period.

2. The system claimed in claim 1, in which the central monitoring device is adapted to detect interference between signals from two or more containers in a log-on procedure, on detection of such interference to interrogate the containers on the basis of possible addresses thereof, and to log-on the containers individually on detection of different actual addresses thereof, resulting from such interrogation.



3. The system claimed in claim 1, or 2 in which the communication device comprises a modem.

4. A remote monitoring system for containers, substantially as herein described with reference to figures 1 to 7 of the accompanying drawings.
