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

(11) Publication number: **0 136 800**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **84305740.7**

(22) Date of filing: **22.08.84**

(51) Int. Cl.⁴: **G 08 B 25/00**

(30) Priority: **24.08.83 US 525967**

(43) Date of publication of application:
10.04.85 Bulletin 85/15

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **PITTWAY CORPORATION**
165 Eileen Way
Syosset New York(US)

(72) Inventor: **Fradin, Roger B.**
Seven Ibesen Court
Dix Hills New York 11746(US)

(74) Representative: **Cross, Rupert Edward Blount et al,**
BOULT, WADE & TENNANT 27 Furnival Street
London EC4A 1PQ(GB)

(54) **Signal transmission system.**

(57) A signal transmission system includes a transmitter (Figure 1) which transmits a particular pulse train signal at a selected one of a plurality of possible baud rates, and a receiver (Figure 3) tunable to receiver selectively signals at any one of the possible transmission baud rates. Such a system enables a plurality of satellite transmitters to communicated unambiguously with a common receiver.

./...

FIG 1

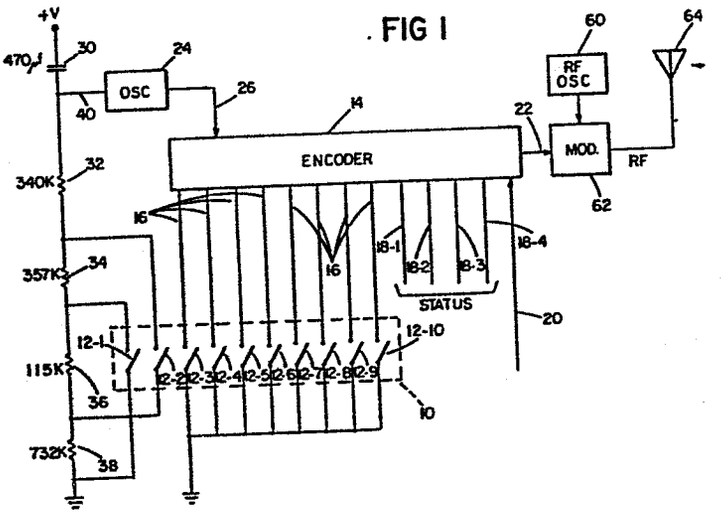
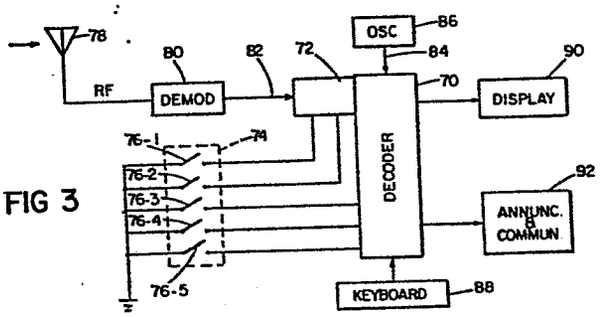

+V
470
30
24
OSC
40
26
14
ENCODER
60
RF OSC
64
22
MOD.
RF
62
340K
32
16
18-1
18-2
18-3
18-4
357K
34
STATUS
20
12-1
12-10
115K
36
12-2 12-3 12-4 12-5 12-6 12-7 12-8 12-9
10
732K
38

FIG 3


78
RF
80
DEMOD
82
72
OSC
86
84
70
DISPLAY
90
76-1
74
76-2
76-3
76-4
76-5
DECODER
92
ANNUNC. & COMMUN.
KEYBOARD
88

SIGNAL TRANSMISSION SYSTEM

This invention relates to a signal transmission system of the type that provides communication between a common device (e.g., a transmitter or a receiver) and a plurality of cooperating satellite devices over a common communications link.

In security systems, for example, it is frequently desirable to transmit signals warning against impending danger from satellite sensors to a central monitor. For example, a house system may monitor a plurality of sensors which can generate signals indicating alarm conditions (for example, smoke, fire, unauthorized entry through a door or window, loss of power). A satellite transmitter actuated by a change of state of its associated sensor produces an output signal identifying the sensor and the type of condition producing the trigger signal. The receiver station of the system decodes the signal transmitted from the satellite sensor-transmitter to identify the triggered sensor and its condition. It is desirable to verify such transmissions, and relatively short transmission times are also desirable

to avoid conflict between other monitored sensor-transmitters of the security system. The receiver may alert the system operator to the occurrance of an alarm condition by displaying information which identifies the remote sensor signalling the alarm condition and the type of alarm condition detected by that remote sensor. Other similar communication systems employ a common transmitter and a plurality of satellite receivers for controlling remote devices such as appliances.

According to this invention there is provided a signal transmission system comprising a transmitter type component and a receiver type component, said transmitter type component including means for encoding a message having a system identification portion, a device identification portion, and an information portion, and means for converting said message into a serial train of data pulses as a function of said encoded system identification, device identification, and information portions of said message; and said receiver type component including means for decoding a serial pulse train received from said transmitter type component, characterized in that said transmitter type component includes a generator that has a plurality of pulse interval modes, and baud rate selector means for selecting one of said plurality of pulse interval modes at which said signal

pulse train is transmitted; and said receiver type component includes selector means for selecting one of a plurality of pulse intervals, and means responsive to said pulse interval selector for selecting signal trains received by said receiver type component that have a baud rate corresponding to said selected pulse interval for decoding.

In a particular embodiment, the transmitter type component includes an output transducer, modulating means coupled to feed the transducer, signal producing means having a data input to produce a pulse width modulated signal representing the signal data as a multibit digitally encoded word and said baud rate selector means includes an oscillator with an RC network for controlling the frequency of output signals from said oscillator, and selectable switch means for adjusting the component values of said RC network.

The receiver type component can include an input transducer, demodulating means coupled to the input transducer for converting the received signal into a serial pulse train, said receiver selector means being coupled to said demodulating means.

Said receiver selector means can include pulse leading edge detector means, interval counter means, a store for a selected system baud rate, comparator means

for comparing the baud rate of the received signal with the selected baud rate, signal decoding means responsive to said comparator means, and an output device coupled to said decoding means.

When the baud rate selector detects an incoming signal within the selected baud rate range (indicating that the transmission is from an associated transmitter), the pulse train signal is decoded and appropriate output devices activated to indicate the security sensor and its condition that generates the signal transmission. A variety of data, and other types of signals such as control, interrogation or verification, may be transmitted with sytems in accordance with the invention.

The preferred transmitter/modulator and receiver/demodulator units are adapted for transmitting data signals over communication links subject to interference from adjacent similar systems such as common power distribution lines of a building or high frequency radio.

This invention will now be described by way of example with reference to the drawing, in which:-

Figure 1 is a block diagram of transmitter apparatus employed in a security system in accordance with the invention;

Figure 2 is a diagram illustrating an alarm signal transmission sequence produced by the transmitter

of Figure 1; and

Figure 3 is a block diagram of receiver apparatus for receiving a signal transmission from the transmitter shown in Figure 1.

The security system includes a plurality of satellite transmitters of the type shown in Figure 1 and a common receiver of the type shown in Figure 3, the transmitters and receivers being interconnected by a radio link. Associated with each transmitter is a security device (a door or window monitor, an intrusion sensor or the like) that is uniquely identified by a five bit device code. In addition, the security system employs a five bit "house" code to distinguish between signal transmissions from other monitoring systems. Thus, each signal transmission system may monitor up to thirty-two security devices in an area where there are up to thirty-one similar security systems.

A ten stage DIP switch unit 10 is associated with each transmitter, as shown in Figure 1. Switch unit 10 has ten switches 12-1 - 12-10, switches 12-1 - 12-5 being set to the "house" or system code; and switches 12-6 - 12-10 being set to the "device" or sensor code of the particular security device associated with that transmitter. Switches 12-3 - 10 are connected to encoder 14 via input lines 16 and signals from the associated

security device, that are applied to encoder 14 over lines 18-1 - 18-4, indicate the current status of that security device (for example whether a monitored contact is opened or closed). Also connected to encoder 14 is line 20 over which a trigger signal is transmitted whenever a signal transmission is desired, for example in periodic response to a timer to provide a check on the status of the monitored device and the transmitter circuitry; and also in response to a changed state of the monitored device (for example, a change of state of a door monitor device indicating that the monitored door has been opened or a change of state of an area monitor device indicating the presence of an intruder in the monitored area).

Encoder 14 is of the parallel to serial converter type, of the type shown in US Patent No. 4,200,862 or European Patent Publication No. 0069470 published January 12, 1983, for example and, in response to a trigger signal on line 20, supplies to output line 22 a serial train of pulses indicating the status of the signals on lines 16 and 18. The serial pulse train on line 22 is generated at a baud rate determined by the rate of clock pulses provided by oscillator 24 on line 26. Connected to oscillator 24 is an RC network that includes capacitor 30 and resistors 32, 34, 36, 38. The

RC network provides a time base signal over line 40 to oscillator 24, the effective resistance value of the RC network being determined by house code switches 12-1 and 12-2. The baud rate (pulse interval) at which encoder 14 transmits pulses on line 22 depends on the setting of house code switches 12-1 and 12-2, as indicated in the following table:

House Code Switch		Pulse Interval (line 26)
12-1	12-2	(Microseconds)
C	C	(about 440)
C	O	(about 680)
O	C	(about 1025)
O	O	(about 1470)

An example of the serial train of signals generated by encoder 14 is shown in Figure 2. That serial train includes a sync pulse 40, three house code pulses 42-1 - 42-3; five device code pulses 44-1 - 44-5; and four status pulses 46-1 - 46-4. The interval 48 between leading edges 50 of the pulses is established by the setting of house code switches 12-1 and 12-2 of switch unit 10. The specific pulse train indicated in Figure 2, is generated by closed house code switches 12-3 and 12-4; closed device switches 12-7, 12-9 and 12-10; 'zero' status signals on lines 18-1 and 18-2 and 'one' status signals on status lines 18-3 and 18-4. Similar

to the system disclosed in the above-mentioned European Patent Publication No. 0069470, the width of sync pulse 40 is 3/4 of that of pulse interval 48 (the interval between successive pulse leading edges 50); a binary one is represented by a pulse that is half the width of pulse interval 48 (for example bit 42-1); and a binary zero is represented by a pulse that is 1/4 width of pulse interval 48 (for example house bit 42-3).

The data stream on line 22 is combined with an RF signal from 345 megahertz RF oscillator 60 in modulator 62, and the resulting pulse-width modulated RF signal output is applied to transmitter antenna 64.

A block diagram of the cooperating receiver is shown in Figure 3. That receiver includes decoder 70 and baud rate selector 72 to which a house code is applied from switch unit 74 that contains five switches 76-1 - 76-5, switches 76-1 and 76-2 being set to the same house code as switches 12-1 - 12-5 of the transmitter shown in Figure 1. The receiver includes an antenna 78 via which the received RF signal is transmitted to the demodulator 80 where that signal is demodulated to provide a pulse train on line 82. Decoder 70 supplied with clock pulses over line 84 from oscillator 86 at a conventional microprocessor clock frequency. Coupled to decoder 70 are peripheral devices including keyboard 88, display 90

and annunciator and communication panel 92.

The demodulated incoming signal on line 82 (a train of square wave pulses as indicated in Figure 2) is applied to baud rate selector 72 and checked for the pulse interval 48 specified by the setting of switches 76-1 and 76-2, as indicated in the following table:

House Code Switch		Pulse Interval Range
76-1	76-2	(Microseconds)
C	C	375 - 540
C	O	562 - 810
O	C	855 - 1222
O	O	1290 - 1752

Selector 72 may be implemented in hardware or software and effectively includes a detector responsive to pulse leading edges 50, a counter that is cleared in response to each detected leading edge 50 and stepped by decoder clock pulses, a storage that stores a count range as a function of the settings of switches 76-1 and 76-2 (as indicated above), and a comparator that compares the baud rate count of the received signal with the baud rate selected by the settings of switches 76-1 and 76-2. When selector 72 detects and incoming signal within the selected baud rate range (indicating that the transmission is from an associated transmitter), the pulse train signal is passed to decoder 70 to decode the pulse train as a

function of the width of each of the pulse signals, similar to the system disclosed in the above-mentioned European Patent Publication No. 0069470. To further insure error-free operation of the system, the transmitter/modulator of Figure 1 is programmed to transmit each message eight times, and the receiver/modulator of Figure 3 is programmed to accept a message only after reception of two consecutive identical message words that have the house code specified by switches 76-1 - 76-5. The verified decoded data word provides indications of the monitored device (bits 44) and the status of that monitored device (bits 46), which indications are applied to output devices 90 and 92. Control signals, including alarm acknowledgement and reset signals are generated from the control keyboard 88.

The illustrated system is capable of monitoring up to thirty-two security devices such as fire, panic. door and window sensors in a particular dwelling unit. Each security device has a corresponding transmitter/modulator and the several transmitter/modulators are coordinated with the system receiver/demodulator by both the baud transmission rate and specific transmitted data bits 42. Decoder 70 includes verification circuitry which counts the number of pulses between sync pulses 40 to insure that the received data word includes the

correct number of bits; and validates data word reception by comparing two successive decoded data words. The eight successive data words generated by encoder 14 are transmitted within an interval of less than 1/4 second so that the likelihood of clash between two system transmitters is minimized. Potential conflict between adjacent transmitter-receiver systems is minimized by the use of different baud rate transmissions.

CLAIMS:

1. A signal transmission system comprising a transmitter type component and a receiver type component,

said transmitter type component including means for encoding a message having a system identification portion, a device identification portion, and an information portion, and means for converting said message into a serial train of data pulses as a function of said encoded system identification, device identification, and information portions of said message; and

said receiver type component including means for decoding a serial pulse train received from said transmitter type component,

characterized in that said transmitter type component includes a generator that has a plurality of pulse interval modes, and baud rate selector means for selecting one of said plurality of pulse interval modes at which said signal pulse train is transmitted; and said receiver type component includes selectro means for selecting one of a plurality of pulse intervals, and means responsive to said pulse interval selector for selecting signal trains received by said receiver type component that have a baud rate corresponding to said selected pulse interval for decoding.

2. A system as claimed in Claim 1, characterized in that said system includes

a common first component and a plurality of satellite second components, said plurality of satellite components being interconnected with said common component by a communication link subject to interference from similar adjacent communication systems,

one of said first and second components being of said transmitter type and the other of said first and second components being of said receiver type.

3. A system as claimed in Claim 2, characterized in that said common component is a receiver, and each said satellite component is a transmitter.

4. A system as claimed in any preceding claim, characterized in that said transmitter type component includes radio frequency transmission means.

5. A system as claimed in Claim 4, characterized in that the transmission frequency of said transmitter type component unit is above 100 mHz.

6. A system as claimed in any preceding claim, characterized in that said transmitter type component

includes an output transducer, modulating means coupled to feed said transducer, signal producing means having a data input to produce a pulse width modulated signal representing the signal data as a multibit digitally encoded word and said baud rate selector means includes an oscillator with and RC network for controlling the frequency of output signals from said oscillator, and selectable switch means for adjusting the component values of said RC network.

7. A system as claimed in any preceding claim, characterized in that said receiver type component includes an input transducer, demodulating means coupled to the input transducer for converting the received signal into a serial pulse train, and said receiver selector means is coupled to said demodulating means.

8. A system as claimed in any preceding claim, characterized in that said receiver selector means includes pulse leading edge detector means, interval counter means, a store for a selected system baud rate, comparator means for comparing the baud rate of the received signal with the selected baud rate, signal deconding means responsive to said comparator means, and an output device coupled to said decoding means.

0136800

FIG 1

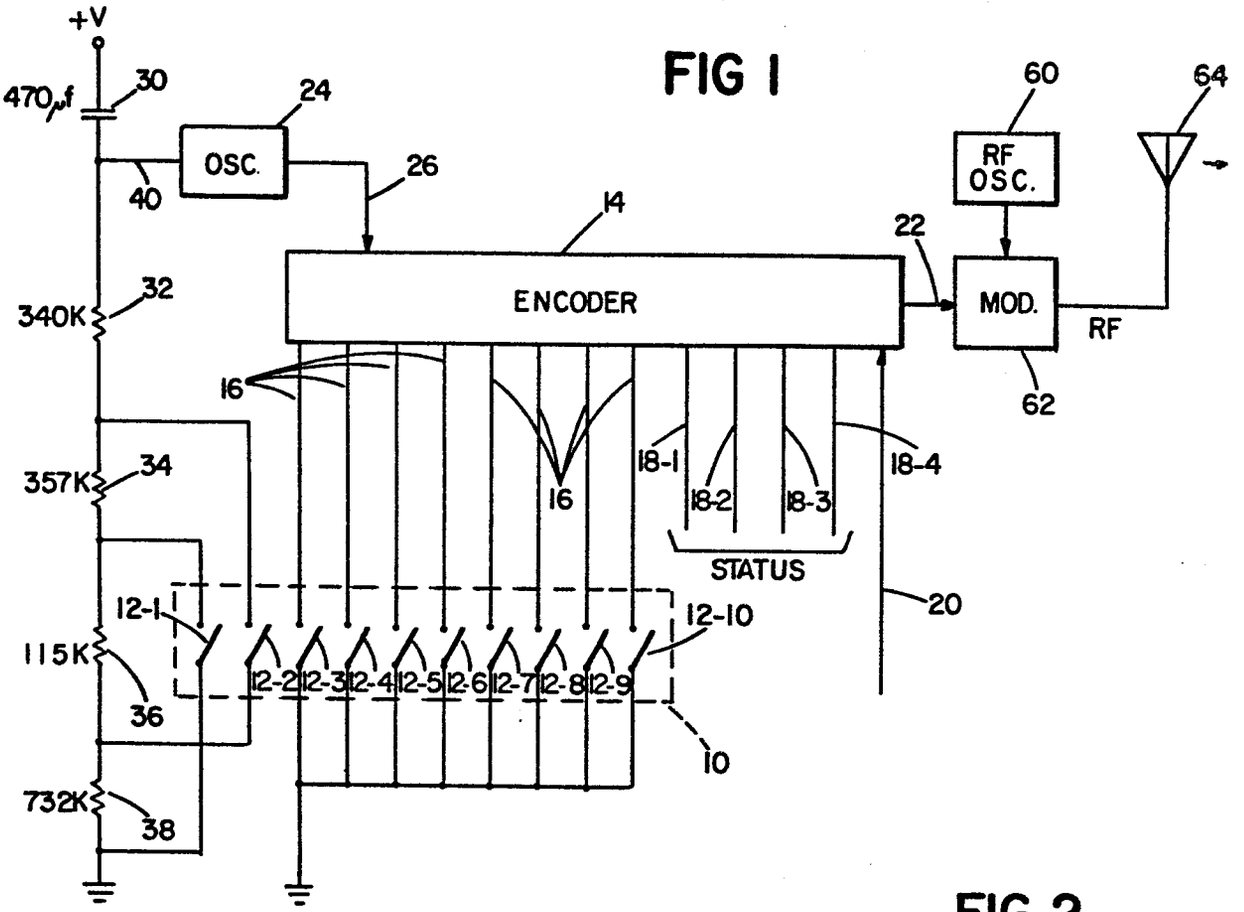


FIG 2

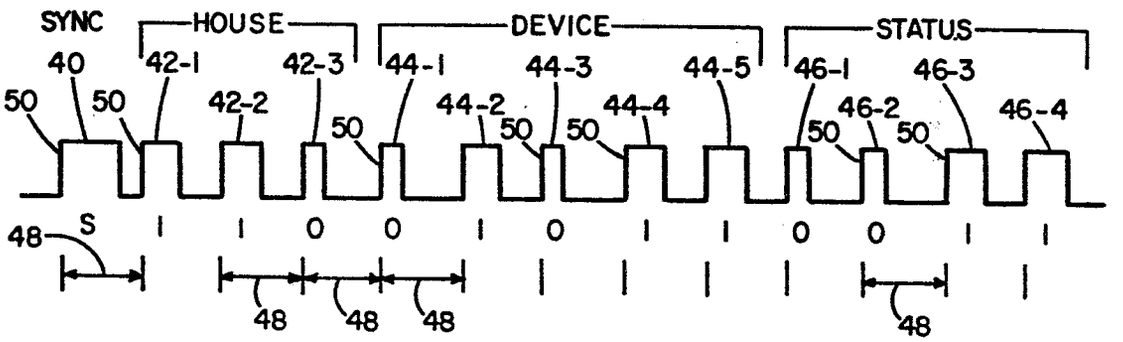


FIG 3