Elcombe Systems

Circuit Description Smoke Alarm RF Transmitter

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The following refers to the Smoke Alarm transmitter schematic 87-0633-01-S

1) General

1.1 The schematic is divided into two sheets the first contains the input and control sections, and the second the RF transmitter and modulation means.

1.2 This circuit has more than one function and the description contained here only refers to its use as a Smoke Detector Alarm Signaling Device. As such the PC board which the schematic describes is housed internally in a Sentrol Smoke Detector ESL560.

2) Controller and Input Circuit

2.1 Power Supply

Power is provided at J1 pins 1 and 2 by connections to the Smoke detector unit which contains 2 parallel 2/3AA Lithium cells. So for this function the regulator U2 is not used and isolated by D3.

2.2 Alarm inputs

J1 pins 3,4,5,and 6 are digital inputs indicating the state of the Smoke Detector such as 'Alarm','Battery Low', etc. . The first three of these pins are read directly by the processor U1, the fourth which is the battery low flag is read via Q3 which in this case acts as an inverter. Q3 is used as a battery sensor in other applications.

2.3 Programming

The reed switch SW1 is used as a program input for the processor (J2 is not used here) and can be driven by a special electromagnetic head which allows the board to be programmed whilst enclosed in the Smoke Detector Unit.

Programming includes telling the processor what type of functions to perform how to react to various inputs and also an ID code to be used in RF transmission of an alarm or trouble state.

2.4 RF Transmission

Transmission is controlled by U1 via the TRANS line which powers the RF circuits and the MOD/ line which modulates the RF circuit. In normal operation when an alarm occurs the ID code is transmitted which may be a 12 or 20 bit word at about 2 mSec per bit, repeated every 50 mSec for a total of 2.5 secs. This transmission is repeated every minute whilst the alarm continues.

Other transmissions may occur such as once every 8 hours under battery low condition.

2.5 Crowbar circuit

In case the processor causes the TRANS signal to be permanently high under a fault condition Q4 and Q5 act as a delayed crowbar which will close down transmission after 14 to 20 Secs and will remain until the processor is reset.

3) RF Circuitry

3.1 Modulator and Xtal Oscillator

Q1 and circuitry act as an accurate crystal oscillator at one third the transmission frequency and is powered up by the TRANS signal. Part of the tuning circuitry is provided by L1 and C4. When MOD/ is low the diode D1 is non-biased and in a high impedance state which effectively removes C4 from the circuit. When D1 is powered by MOD/ high, then D1 is in a low impedance state putting C4 in parallel with L1, this effectively changes the impedance of L1 and pulls the oscillator frequency. By this means the oscillator is frequency modulated without disturbing amplitudes etc.

Q1 oscillates in class 'C' conditions producing sharp current pulses to the tank circuit L2 C8 CV1. These are tuned to the third harmonic which is the transmission frequency about 173 MHz.

3.2 RF Output Circuit

Q2 is the output power amplifier. Under class 'C' conditions Q2 amplifies the oscillator signal and supplies pulses to the filter and antenna matching circuit.

The antenna is a fixed small printed copper loop on the PCB and emits power in the 1.8 uWatt range.