Principle of Operation of the EON/CALT Fireplace Remote Control

The micro-controller on the Remote Transmitter reads the resistance of the temperature sensor (thermistor) every 16 second. It then converts the resistance reading into temperature reading and display the temperature on the LCD.

When the user press the auto button on the Remote Transmitter, the micro-controller will compare the preset temperature with the room temperature. If the room temperature is above/below the preset temperature, it will send a series of on/off code words to turn on/off the RF oscillator which in turn will transmit an ASK RF signal to the Remote Receiver.

When the user press the manual on the Remote Transmitter, the micro-controller on the Remote Transmitter will send a series of on code words (if the Remote Transmitter is at off state) or off code words (if the Remote Transmitter is at on state) to the RF oscillator. The RF oscillator will in turn transmit an ASK RF signal to the Remote Receiver.

The Receiver consists of 2 modules. These modules are: the Basic Unit (BU) and the Fan Speed and Fan Height Control Unit (FFU). The BU consists of a RF receiver, a micro-controller, a temperature sensor, a cooling fan and a driver circuit to turn on or off a gas valve. The FFU consists of a micro-controller, a blower driver circuit and a flame height control circuit. The BU is the master unit it can work alone or with the FFU. It controls the operation of the FFU.

The super-regenerative circuit on the BU receives the RF signal from the Remote Transmitter, converts it into code words (CMOS logic level) and feed the received code words to micro-controller. The micro-controller will then turn on or off the gas fireplace accordingly. When the BU receives a blower speed or flame height control signal from the Remote Transmitter the micro-controller in the BU will send a signal to the micro-controller in the FFU that will in turn controls the speed of the blower and the flame height of the fireplace according to the signal transmitted by the Remote Transmitter. The temperature sensor on the BU will read the temperature at the BU. If the temperature is above a pre-set temperature, the micro-controller will turn on a cooling fan that will cool down the modular Receiver. The BU will turn off the cooling fan if the

temperature falls below another pre-set temperature. If the temperature at the BU rises above yet another pre-set temperature, the BU will automatically turn off the fireplace, signal the FFU unit to turn off the blower. The BU will not turn the fireplace and the blower back on until the temperature at the BU falls below a fourth pre-set temperature.

The FFU detects the phase of the supply line and feeds a signal to the micro-controller when the phase of the supply line crosses zero. The micro-controller in the FFU triggers the Triac at different phase angle in order to control the speed of the blower. The flame height of the fireplace is controlled by the current fed through the gas valve's solenoid. The micro-controller in the FFU responds to the control signal from the BU and output a 4 bit digital signal to control the flame height. The digital signal from the micro-controller is converted to an analog control signal via a R-2R resistor network. This control signal is used to control the output current, that is the current fed through the gas valve's solenoid, of a current mode PWM driver hence control the flame height of the fireplace.

All timing on the BU is derived from the 32768Hz crystal oscillator and 455kHz ceramic resonator oscillator. The timing of the FFU is derived from a 455kHz ceramic resonator. All the timing of the Transmitter is derived from a 32768Hz crystal oscillator.

Timing and Signal Format of the Transmission

The Transmission signal composed of a train of code words separated by 12.1ms and last for 1.5 seconds. The timing of the transmission signal is shown in Figure 1.

Each code word consists of 13 bits. It always start with a start bit and follow by 12 bits (A_{11} to A_0) as shown in figure 2. A_{11} to A_0 are a combination of '0' and '1'. The timing of the start bit, '0' and '1' are shown in Figure 3, 4 and 5 respectively.

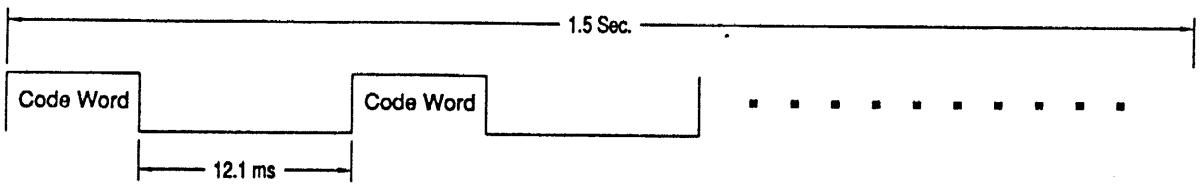

Figure 1 : Timing of Transmission

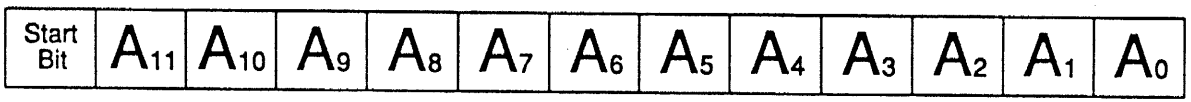

Figure 2 : Code Word Format

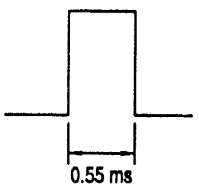

Figure 3 : Timing of Start Bit

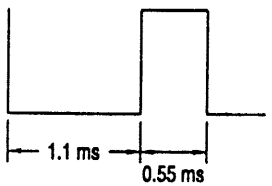

Figure 4 : Timing of '1'

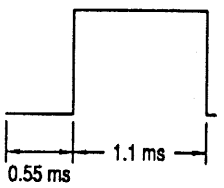

Figure 5 : Timing of '0'