
WIRELESS SYSTEMS INC.

ECO Lite Wireless Keypad

Circuit Description

Revision 1.0

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953-00001-000

1. Document Purpose

The purpose of this document is to describe Wireless Keypad circuitry for the Low Cost CPM.

2. Introduction

This document provides basic description of the Wireless Keypad circuits from the hardware point of view. The firmware overview can be find in the document 940-000002-000. The primary goal of this project was to develop a low cost battery operated Wireless Keypad for ECO Lite system. To achieve these goals we have used mostly discrete components for this design and the microcontroller is powered up when external interrupt is generated or a message transmission is needed only.
The Keypad circuitry can be divided into blocks for description purpose as well as for easy troubleshooting.

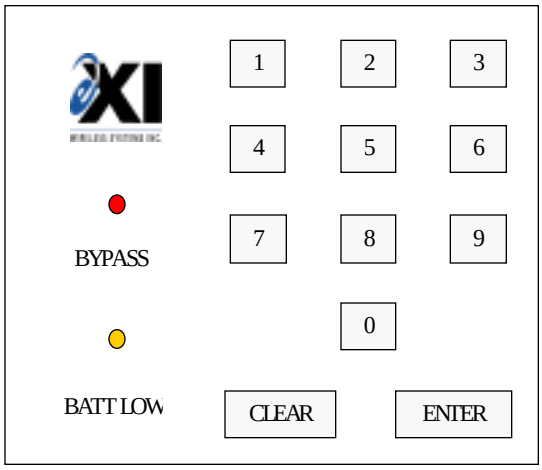

Fig. 1 Keypad Layout

3. Circuit Description

3.1 Timing circuit

The keypad timing is based on simple RC charge circuit. We can use this very simple configuration because timing is not critical for any of the keypad functions. This used configuration generates approximately 8 second cycle. This circuit is running all the time, so a high value resistor is used for Vcc connection to decrease a power consumption of this circuit.

3.2 Battery check circuit

The battery check circuit is based on two differential circuits and inverter to control the LED indicating low battery voltage. This battery check is activated at time base interval. A single LED is used as reference for comparing battery voltage. A set point for low battery indication is 2.75V. Another simple RC circuit is

used for the low battery voltage warning to be sent to the controller. The configuration used here gives us time base approximately 30 minutes.

3.3 Keypad circuit

The keypad is organized in 3x4 matrix. All three columns are connected through inverters to PIC inputs able to generate interrupt. When any key is pressed the analog switch is activated to connect power to PIC microcontroller. Then interrupt recognition process starts to find out source of the interrupt (keypad, low battery voltage, or tamper switch). The proper message is transmitted to the controller.

3.4 Tamper switch circuit

The keypad mounted in the bezel is protected against unauthorized removing by a tamper switch circuit. The circuit uses a magnetic reed switch (normally closed) and a small magnet glued to the bezel. If keypad is removed from the bezel the magnetic field holding the reed switch open is lost and voltage from a simple RC circuit generates an interrupt similar to the keypad interrupt. Because none of the keys is pressed the microcontroller decodes this situation as a tamper switch interrupt and alarm message is sent to the controller. To disable the alarm (controller is beeping) the proper password must be entered on the keypad. When the keypad is placed back to the bezel it takes approximately 20 seconds before the tamper switch circuit is ready to protect the keypad again.

3.5 Transmitter circuit

The keypad transmitter is using 433.92 MHz frequency to communicate with the controller. The antenna is a small surface mount inductor. The microcontroller output controlling the transmitter normally maintains high-level signal to keep RF transistor disable.

3.6 Microcontroller and memory circuits

The PIC16LC505 microcontroller is used for controlling all keypad’s activities. The both Master and User customized passwords are stored into an external serial EEPROM. The eight position rotary switch with a serial shift register is used for the ID number selection. This allows selecting specific communication path between the keypad and controller. An internal delay timer is used to power down microcontroller after each task is finished.