VERSION 1

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SHED / LOG CABIN INTRUDER ALARM

PROJECT MANUAL

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PREFACE

First of all thank you for downloading this project, I hope that you find it useful, educational or just a good read. Like most of my projects, they are designed and written such that most hobbyist electronics enthusiasts can build the designs using common components and materials.

Where best possible, low cost, easily obtainable components are used within the design. For more information, please visit my website at;

www.rkelectronics.org

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DESIGN BRIEF

To design and build an alarm unit which will sound a siren in the event of an unexpected intrusion into a shed or log cabin. The alarm arming will be made by key switch. There will be a ten second delay between key activation and the alarm arming. A ten second delay will also be present between intruder detection and the siren sounding to allow for a suitable time for genuine alarm deactivation. Intruder detection will be via two methods; magnetic door switch and an infrared motion detector.

The alarm will consist of two units; the internal control unit (with key activation for the alarm) and a second for the outside which will contain the siren, siren control circuit and backup battery.

Both the alarm control box and the outside bell box will have a tamper detection switch will activate the siren upon the enclosures being opened.

The alarm system (internal control unit) will display the alarm status and the current time (clock). There will be an electronic menu for setting the time, testing the siren and setting up a maintenance mode which will allow the enclosures to be opened. The menu will only be available when the alarm is deactivated.

ASSUMPTIONS

This project assumes that you have basic knowledge of electronics. This report also assumes that you have some experience with using PIC microcontrollers.

SAFETY

Please note that I do not take any responsibility for any loss, damage or harm caused by the building of this project. This project book comes 'as is'. I have built this project and can confirm it works, and to the best of my ability is safe to use.

PRICIPLE OF OPERATION

MAIN CONTROL UNIT

The main control unit is the heart of the intruder alarm. This unit is responsible for controlling the siren and interfacing with the user. At the centre of the circuit is a PIC microcontroller which is responsible for the alarm control and user interface. The microcontroller checks the status of the key switch to determine if the alarm should be armed or disarmed. During armed mode the controller will check for changes in the infrared and door sensors and sound the alarm if an intruder is detected.

As part as an anti-intruder function there is a tamper loop present. This is a wire loop which is powered by the main control unit. The supplied voltage is 5 volts. This voltage is sent around each enclosure and sensor as a loop and then is returned back to the main control unit's microcontroller. If any wire is cut, or tamper switch opened this loop is broken and detected by the main controller and the bell box control circuitry.

If the tamper loop is broken an alarm signal is sent to the bell box and tamper alert is shown to the user. The bell box also detects for loss of voltage in the tamper loop and will sound the alarm regardless if the alarm signal is present or not.

The main unit also allows the user to start the maintenance mode. This is a feature which allows the user to open either of the enclosures for maintenance. During this mode the main controller will activate a maintenance signal from low to high. The maintenance signal tells the bell box controller to ignore both the tamper loop voltage and any alarm signals that might be present. The maintenance mode will not work if the wire between the main controller and bell box is cut or disconnected.

The microcontroller will also display the alarm conditions and the time via a local 16x2 alphanumeric LCD display.

The control functions performed by the microcontroller is shown in table 1.

BELL BOX UNIT

The bell box unit contains the siren, the backup battery and the siren control circuitry. The battery is provided to power both units in the event of a power cut and to provide local power to the siren in the event of the bell box connecting cable being cut. The bell box is also designed to sound the alarm if the control cable linking the two units is cut. This is achieved by detecting a drop in tamper loop voltage usually to zero volts. The siren circuitry is also designed to sound if either of the two control units are opened. This is achieved as discussed earlier by the use of a tamper loop which links the two units

The siren electronics is also designed to sound the siren only for short periods of time. If the alarm is triggered the siren will only sound for three to four minutes. This is to comply with various local laws regarding home alarms.

The bell box circuit is powered by a PIC microcontroller. The full control functions is provided in table 1.

Table 1 – Operating Modes

Operating Mode	User Operation	Main Controller	Bell Box	Other Notes
Alarm activated	Key switch turned to armed	Await change in infrared sensor or door switch Check for key switch change	Await either alarm or maintenance signal Check tamper loop	
Alarm activated	Key switch turned to armed Infrared sensor change state or door sensor change state	Begin ten second count down Check for key switch change	Await either alarm or maintenance signal Check tamper loop	
Alarm activated	Key switch turned to armed Infrared or door sensor changed state Ten second countdown over	Alarm signal to bell box is changed from low to high Check for key switch change	Activate siren Begin three minute timer Await alarm signal change Check for maintenance signal	Siren activation is limited to three minutes then regardless of alarm signal condition the siren will no longer sound until the alarm signal changes back to low then high again.
Alarm activated	Key switch turned to armed Tamper switch on either units have been activated or any interconnecting cables have been cut	Send alarm signal Indicate tamper switch detection	Activate siren	To deactivate siren the key switch must be turned in the following sequence to deactivate a tamper switch; deactivate – activate - deactivate
Alarm deactivated	Key switch turned to disarmed	Check key switch Check tamper loop voltage	Siren off await alarm signal, maintenance signal. Check tamper loop voltage	
Alarm deactivated	Key switch turned to disarmed Tamper switch on either units have been activated or interconnecting cables are cut	Send alarm signal Indicate tamper switch detection	Activate siren	To deactivate siren the key switch must be turned in the following sequence to deactivate a tamper switch; deactivate – activate - deactivate
Alarm deactivated	Key switch turned to disarmed Maintenance mode has been activated	Maintenance signal is changed from low to high	Alarm signal and tamper loop signal is ignored	Maintenance mode allows the enclosures to be opened to perform maintenance if required.

HOW TO USE

To activate the alarm the user should turn the key to the arm position. A ten second countdown will commence. Each second will be sounded by the buzzer. At the point of the alarm being armed, the buzzer will make a continuous sound for one second, at that point the alarm is armed.

Upon entering, either the door or infrared motion sensor will change state. This state change will trigger the ten second count down to alarm. During this time, the user should turn the key switch to the disarm position, disarming the alarm. Should the alarm remain armed and after ten seconds, the alarm will activate.

On first time use the main unit will ask for the sensors to be set up. The main unit will detect if a high or low state is present from the door and infrared motion sensors during a detected event i.e. Door opening or person moving. The main unit will ask for the door to be opened and then for the user to press the enter button. The switch state is then recorded in the microcontrollers EEPROM. The same routine is requested for the infrared motion sensor. This allows for either a normally open or normally closed type sensor to be used.

To adjust the time press enter and select the onscreen options.

To test the bell box press and hold the up button while the alarm is deactivated.

To enter maintenance mode press and hold the down button while the alarm is deactivated.

The first time use setup can also be accessed at any time by pressing the enter button and selecting the setup option.

CIRCUIT WIRING DIAGRAM

SCHEMATIC DIAGRAM

Figure 1 below details the circuit schematic diagram

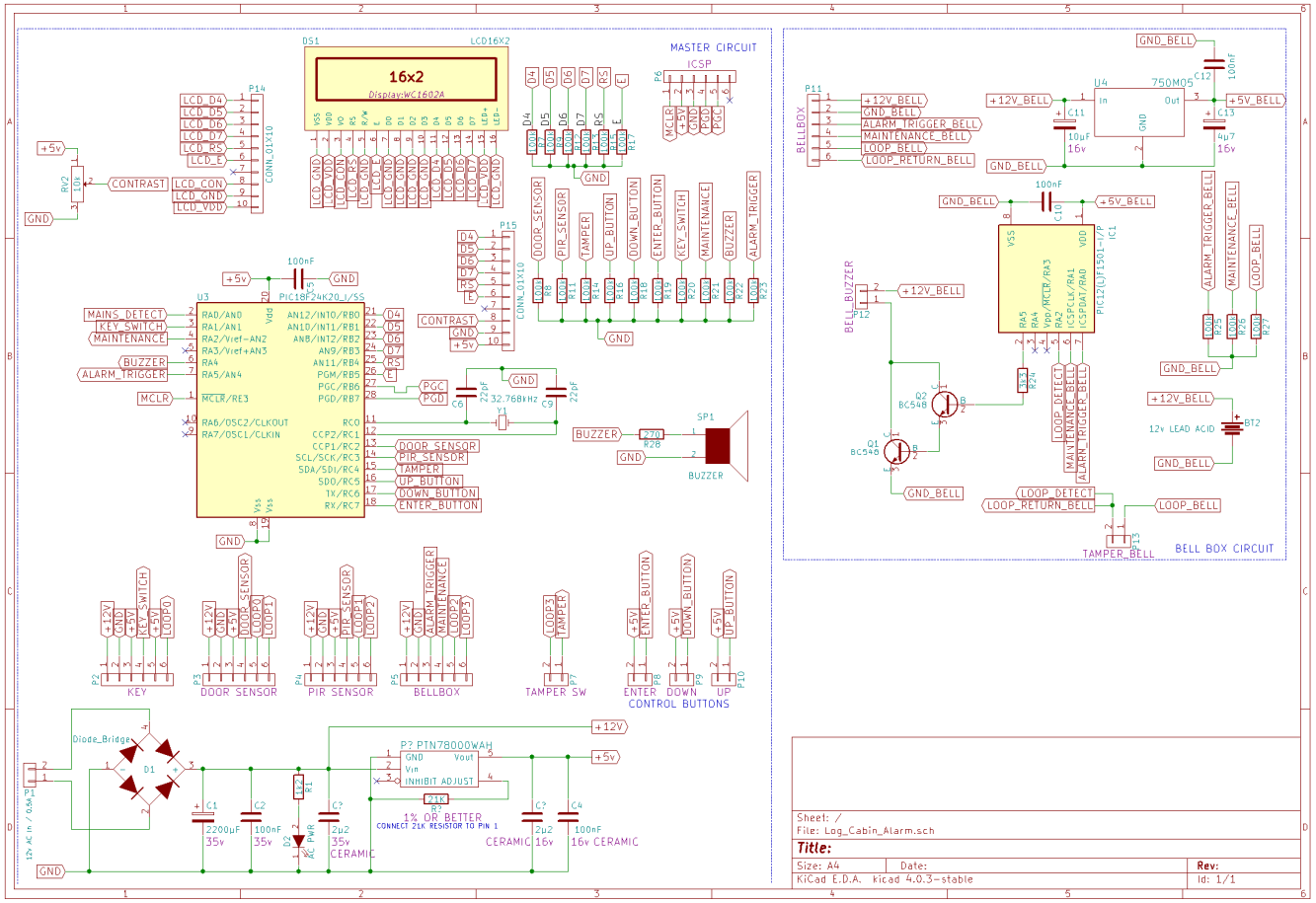

Figure 1 – Control Circuit Schematic Diagram

BILL OF MATERIALS

This section lists all the components used.

Table 4 – Bill of Materials

Reference	Value
P1	12v AC In / 0.5A
U3	PIC18F24K20_I/SS
C1	2200µF
C2	100nF
R1	1k2
D2	AC PWR
C4	100nF
DS1	LCD16X2
RV2	10k
D1	Diode_Bridge
C5	100nF
P6	CONN_01X06
R7	100k
R9	100k
R12	100k
R13	100k
R15	100k
R17	100k
Y1	32.768kHz
C6	22pF
C9	22pF
R8	100k
R11	100k
R14	100k
R16	100k
R18	100k
R19	100k
R20	100k

Reference	Value
R21	100k
R22	100k
R23	100k
P2	CONN_01X06
P3	CONN_01X06
P4	CONN_01X06
P5	CONN_01X06
P8	CONN_01X02
P9	CONN_01X02
P10	CONN_01X02
P7	CONN_01X02
IC1	PIC12(L)F1501-I/P
P11	CONN_01X06
U4	750M05
C10	100nF
C11	10µF
C13	4µ7
C12	100nF
R25	100k
R26	100k
R27	100k
Q2	BC548
Q1	BC548
R24	3k3
P12	CONN_01X02
BT2	12v LEAD ACID
P13	CONN_01X02
SP1	BUZZER
R28	270
P15	CONN_01X10
P14	CONN_01X10

Reference	Value
P16	PTN78000WAH
C3	2µ2
C7	2µ2
R2	21K