

# Control Unit Circuit Description

## I .Summary:

Control Unit is composed of Main Control Board, Ultrasonic Detector & Voltage Indicator, RF Radio and Storage Battery, Where Main Control Board controls all work status of the unit, Ultrasonic Detector & Voltage Indicator detects the objects in front of the ultrasonic sensor and indicates the battery voltage of the unit as well, and the RF Radio is responsible for wireless communication. The principle is shown in Fig.1.

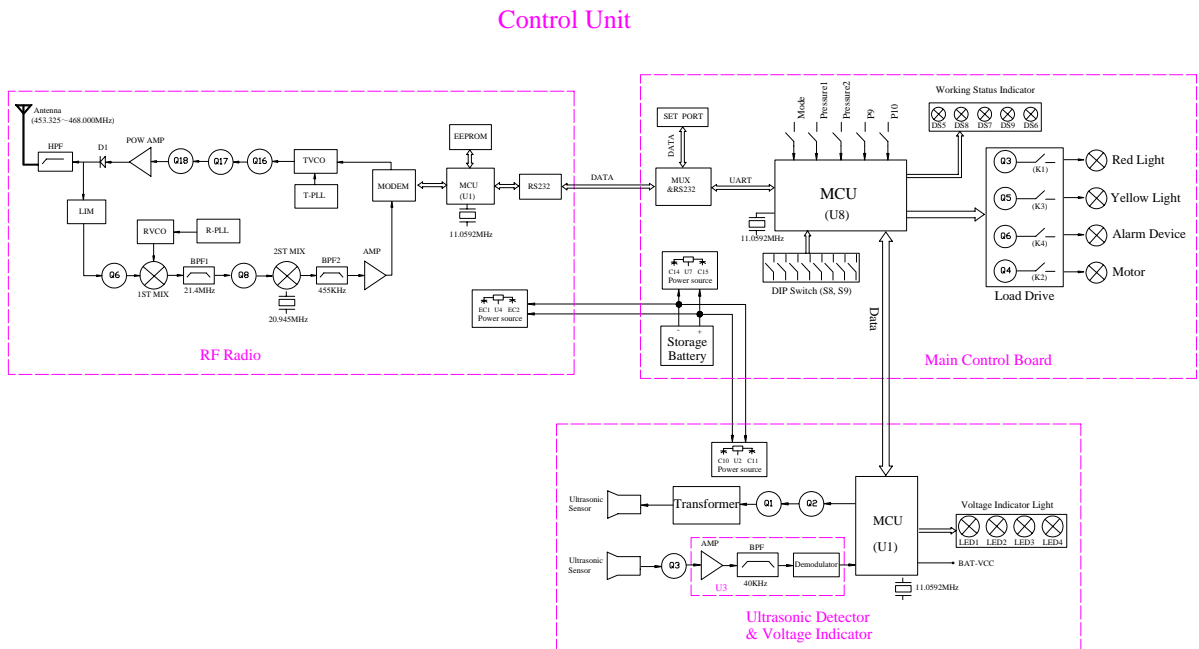
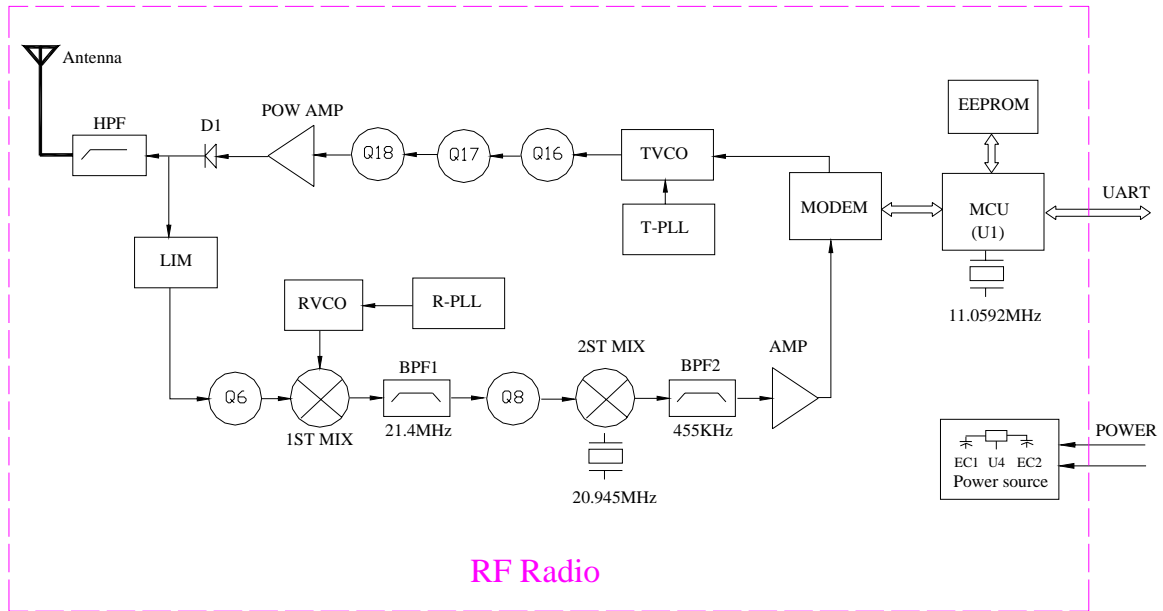


Fig.1

## II . Description of all parts

### 1. RF Radio

It includes the following parts shown in Fig.2.

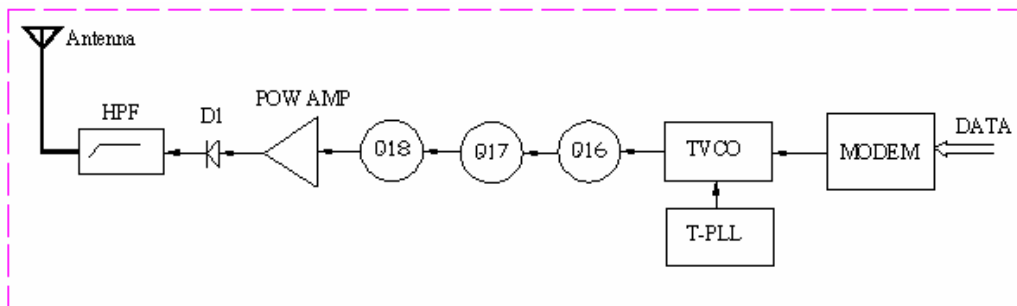


**Fig. 2**

**1) Power Circuit**

The RF radio is powered by battery. The power source is stabilized via IC U4 and filtered by EC1 and EC2 to supply to the RF radio circuit.

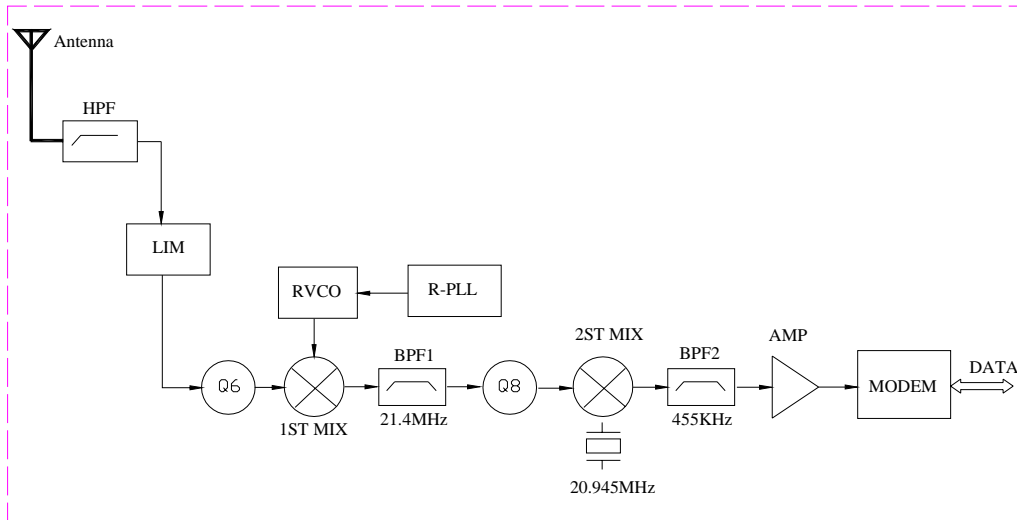
**2) Transmitting system is shown in Fig.3**



**Fig.3**

The digital data from MCU is modulated to analog signal by MODEM. The analog signal enters into TVCO and T-PLL for carrier-modulating. The modulated signal will be amplified by audion Q16, Q17, Q18. The amplified signal will enter into POW AMP for power amplifying. The output of AMP passes diode D1 and be filtered by high-pass filter HPF. The filtered signal will be feed-in the antenna and sent out to air.

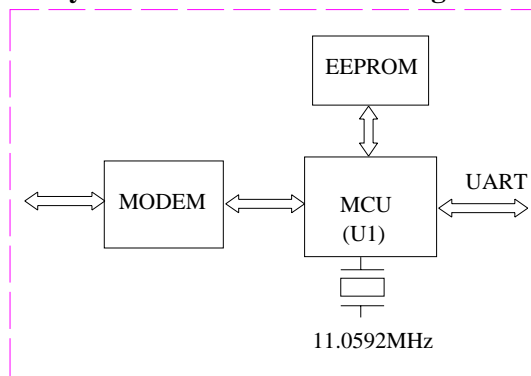
**3) Receiver system is shown in Fig.4.**



**Fig.4**

The signal from antenna will be filtered by a high-pass filter HPF to get rid of the undesired low frequency signal. The filtered signal will pass a limiter LIM and be amplified by an audio Q6. The output of Q6 will be mixed with the output frequency from RVCO and R-PLL in 1<sup>ST</sup> MIX. The output of 1<sup>ST</sup> MIX will be filtered by a 21.4MHz band-pass filter BPF1. The output of the BPF1 will be amplified by an audio Q8 and its output will be mixed with 20.945Mhz signal in 2<sup>nd</sup> MIX. The output of 2<sup>nd</sup> MIX will be filtered by a 455Khz band-pass filter BPF2 and amplified by the amplifier AMP. The output of AMP will be demodulated by MODEM to digital data and passed to MCU.

**4) MCU, memory and Modem is shown in Fig.5.**



**Fig.5**

MCU controls the operations of the RF radio. Its working clock is 11.0592MHz which is provided by an external crystal. It communicates with external devices via UART and store the work mode, channel and Tx frequency etc. parameters of the RF radio in EEPROM. At the same time it receives or sends data from/to MODEM via I/O port.

**2. Main Control Board**

It includes the following parts shown in Fig.6.

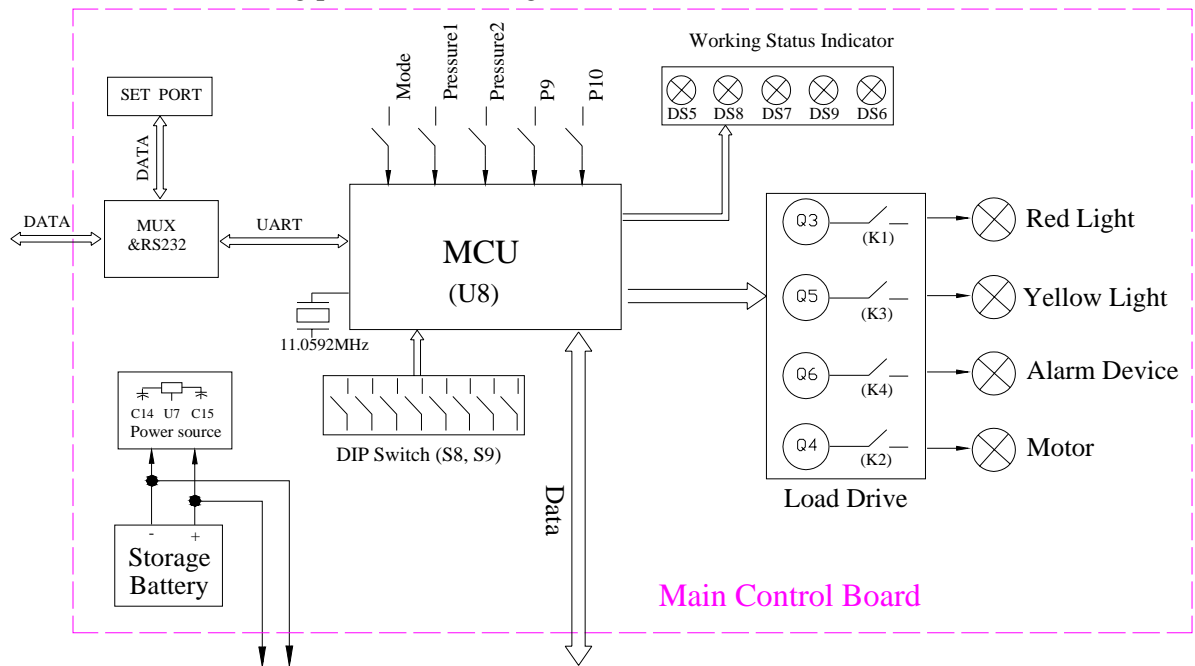


Fig.6

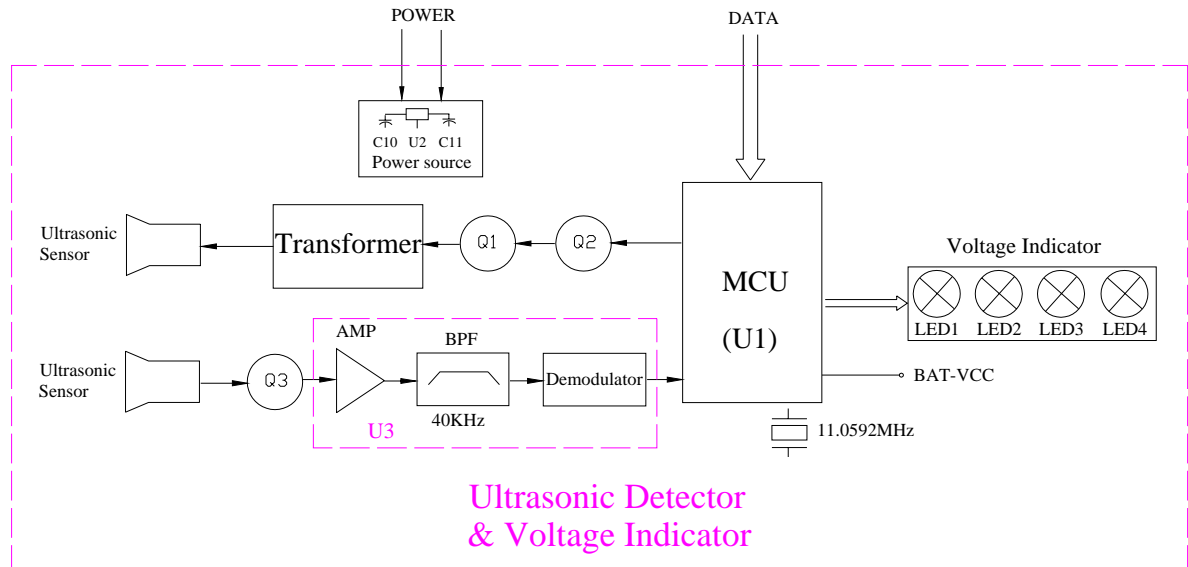
### 1) Power Circuit

The Main control Board is powered by battery. The power source is stabilized via IC U7 and filtered by C14 and C15 to supply to the Main Control Board.

### 2) MCU Control circuit

MCU (U8) is a control IC. It is connected with input signals including Mode Switch, Hose Sensor (Pressure1, Pressure2), Proximity Switch (P9, P10) and DIP Switch (S8, S9). It will export signals to control status indicator (DS5-DS9) and to drive the relays to control the external devices including Red Light, Yellow Light, Motor and Alarm) via Q3-Q6. MCU starts ultrasonic detect function via I/O port and communicate with RF radio or other external interfaces through MUX and RS232 as well.

### 3. Ultrasonic Detector & Voltage Indicator



#### 1) Power Circuit

The Ultrasonic Detector & Voltage Indicator circuit is powered by storage battery. The power source is stabilized via IC U2 and filtered by C10 and C11 to supply to the circuit.

#### 2) MCU Control part

MCU communicates with Main Control Board via I/O port. It control ultrasonic transmitter with audion Q2 and receive ultrasonic signal via IC U3. MCU samples the voltage value of storage battery with A/D convertor of MCU and indicates its value with 4 LED. The number of the light LED indicates the different voltage values.

#### 3) Ultrasonic transmitting circuit:

The output of ultrasonic frequency signal from MCU is amplified by Q2 and Q1 to drive IF transformer. The output of IF transformer connected to ultrasonic sensor will transmit the ultrasonic signal.

#### 4) Ultrasonic receiving circuit:

The ultrasonic signal is received by sensor and amplified by Q3 and inputted to demodulation IC U3. The demodulated signal is inputted to MCU. The IC U3 includes prepositive amplifier AMP, a 40KHz band-pass filter BPF and a demodulator.