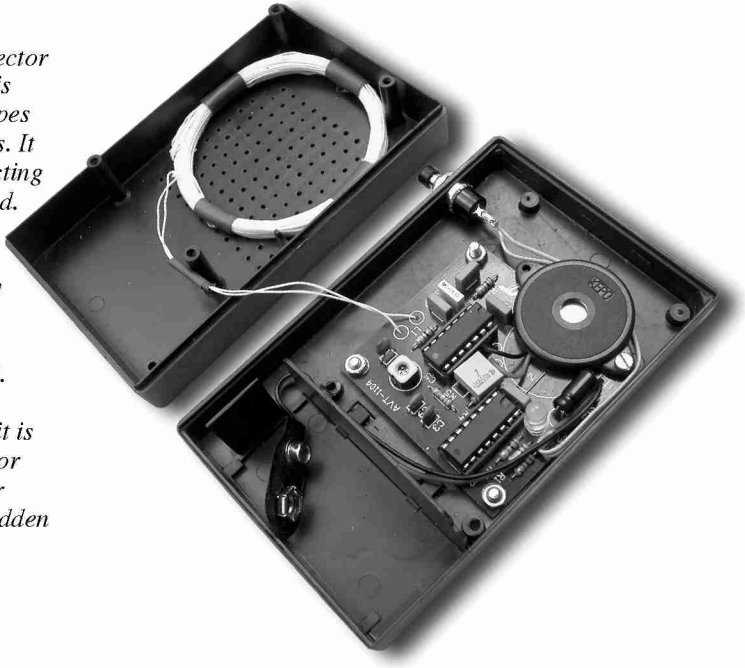
AVT 1104 Simple metal detector

The easy to use metal detector is very useful at home. It is ideal for searching out pipes and electric wires in walls. It can also be used for detecting metal hidden in the ground. The only drawback it has is its short range. The metal detector is only responsive to objects that are 2-20 centimetres away from the sensor coil.

Recommendations: *the kit is recommended for indoor or outdoor use. It is ideal for detecting metal objects hidden in grass, earth or plaster.*



Electrical characteristics

- metal sensor - a single, easy to make coil
- metal-triggered acoustic signalling
- LED diode as power indicator
- low component count; easily assembled
- enclosure provided
- 9V power supply (6F22 battery)

Description

The schematic of the metal detector is shown in figure 1. Using a piezoceramic resonator, the reference oscillator is mounted on the U2C NAND gate. It works in the frequency range of about 450 kHz. The second generator with the L1 adjustable coil is mounted on the U2B gate. In the normal state, both generators work at the same frequency. The additional, variable C5 capacitor helps in

frequency calibration. The measurement oscillator output (with the L1 coil) drives the mono-stable oscillator on the U2, C8 and R7 components. It is triggered by any signal slope from the U2B gate. The U2D gate is driven by both signals. Depending on the frequency difference, an acoustic frequency product appears at the U2D output and the BZ1 loudspeaker. A circuit composed of the U1D, E, F gates is a typical trigger working as the U2 power supply switch (CMOS4011). Successively pressing the S1 pushbutton causes the device to be turn on and off alternatively. The additional diode indicates the generators have been turned on. The CMOS4049 high load buffers are used as inverters. While in the standby mode the circuit is characterized by very low quiescent current which practically does not affect the battery charge. After connecting the U2 (the 14 pin connected to the U1F output) the circuit starts to operate with current consumption of about 30mA.

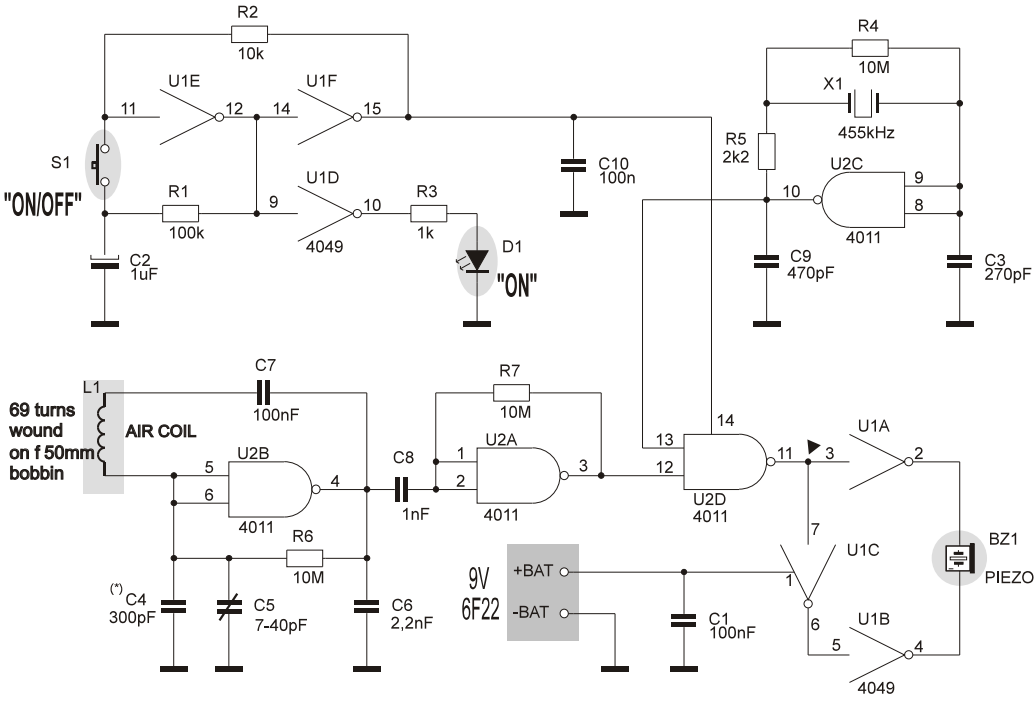


Figure 1. Electrical schematic

Assembly and test

The circuit is assembled on one side of the PCB. The layout of components is shown in figure 2. The Z wire jumpers, passives, resistors and capacitors should be soldered in first. It is worth using the IC sockets. Not forgetting to connect the leads, the BZ1 converter can be glued to the PCB too. The last component to be made is the L1 air coil. To do this 69 turns of insulated wire should be wound on a f 50mm bobbin. The diameter of the wire used is not critical. After that the air coil should be insulated. The previously prepared air coil along with the PCB should be attached inside the enclosure by means of hot glue gun, as shown in figure 3. The S1 pushbutton is advised to be placed

within easy reach. The suggested enclosure should easily hold the 6F22 9V battery. After connecting the battery and pushing S1 the loudspeaker should produce sound or remain soundless (if the difference in frequency of the generators is near zero) and the D1 LED diode should turn on. By simultaneously adjusting the C5 variable capacitor and moving any metal object for example, a fork over the L1 air coil the capacitor position should be established to make the acoustic signal more audible. After this has been done, the enclosure can be shut. Now the circuit is ready to operate. In case the circuit cannot be well adjusted the C4 capacitor value within the range of 150pF…470pF should either be increased or decreased.

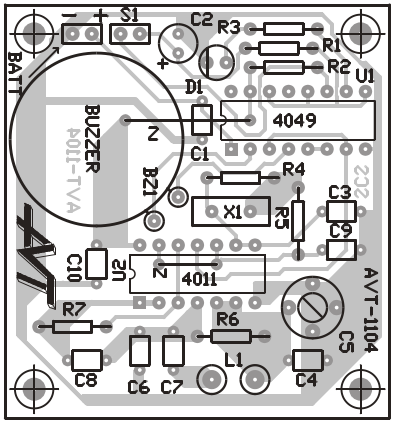


Figure 2. Component layout on the PCB

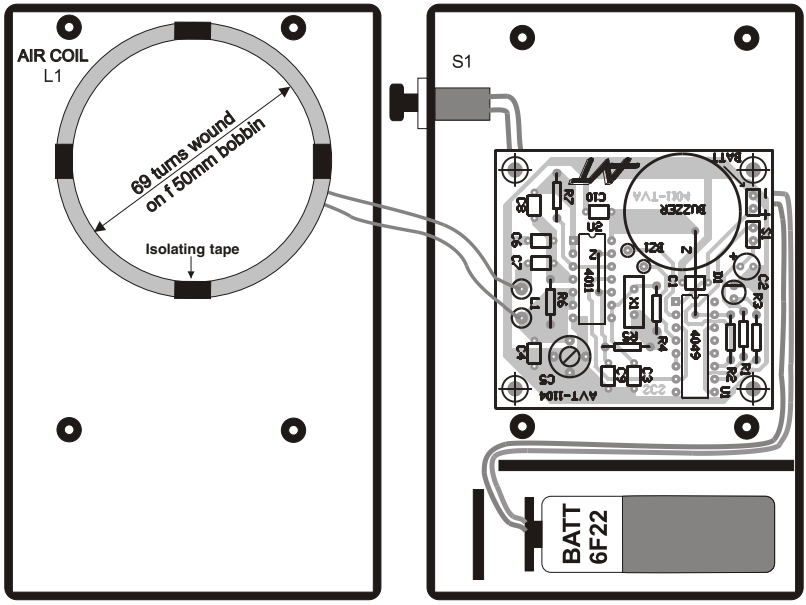


Figure. 3

Component list

In the order of soldering:

1	✓	Z: make two wire jumpers
2		R1: 100kW (brown-black-yellow-gold)
3		R2: 10kW (brown-black-orange-gold)
4		R3: 1kW (brown-black-red-gold)
5		R4, R6, R7: 10MW (brown-black-blue-gold)
6		R5: 2,2kW (red-red-red-gold)
7		C1, C7, C10: 100nF
8		C9: 470pF
9		C3: 270pF
10		C4: 220pF
11		C5: 7…35pF capacitor
12		C6: 2,2nF
13		C8: 1nF
14		C2: 1µF/16V
15		The US1 IC 16-pin socket
16		The US2 IC 14-pin socket
17		D1 LED diode
18		X1: 455 kHz (450…500 kHz)
19		BZ1: piezoelectric loudspeaker
20		S1: pushbutton switch
21		9V battery snap-in terminal
22		Air coil; see "Assembly and test" section (69 turns wound on f 50mm bobbin)
23		Insert the US1 CMOS 4049 in the socket
24		Insert the US2 CMOS 4011 in the socket

The kit was made on the basis of a project bearing the same trade name published in "Elektronika Praktyczna 10/96"

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