Metal detector pulse metal detector (FPI) - version 3.3.

resistors

1K	**R1, R17, R21**
47 ohms	**R2, R16**
10K	**R3**
4.7K	**R4, R14, R20**
2.2K	**R5, R18**
10 ohms	**R6, R15**
1.5K	**R7**
1.8K	**R8**
(one megaohm) 100	**R9**
ohm 1M	**R10**
Carbon or metal film with low thermal error - (2 watts) 390 ohm - 2W	**R11, R12**
18K	**R13**
22K	**R19**

* All resistors except resistors 11 and 12 are 5323 watt type (1/4 or a quarter watt)3

* All resistors should preferably be selected with an error of 1% or less 3

* The accuracy of resistors 7, 8, 1, 14, 11, and 25 is more important3

* Low thermal error of resistances 11 and 12 is important3

capacitors

Electrolyte	**10uF-16v**	**C1**
lens	**18pF**	**C2, C3**
small lens	) or code 154 (100nF	**C18, C20, C21, C23, C26**
small lens	) or code 154 (100nF	**C4, C5, C7, C8, C9, C14,**
Tantalum	(or code 157) 100uF-16v	**C6, C12**
lens**high quality**	) or 437 or 335 picofarad (5pF	**C10**
High quality tantalum	(or code 223) 470uF-16v	**C11**
Electrolyte	2.2uF-16v	**C13, C17, C25**
Electrolyte	**4700uF-16v**	**C15, C16**
Electrolyte	**1000uF-16v**	**C19, C22**
Electrolyte	**2200uF-25v**	**C24**

* The voltage of capacitors that are not mentioned is not important 3

* The use of a capacitor with a working voltage higher than the mentioned value is fine, but a capacitor with a lower voltage should not be used under any circumstances3.

* If using a capacitor with a higher voltage or 155 nano capacitors that are not small; There may be a problem in assembly 3

* The accuracy of 155 nanometer capacitors is not important, but these capacitors must be lens type (ceramic) or at least multi-layer 3 if MKT or polyester capacitors are used as lens capacitors; Their role in the circuit will be almost ineffective 3

* The accuracy of capacitors 15, 11 and 12 is important and up to 15% error is acceptable3

* Tantalum capacitors, unlike electrolytic capacitors, instead of having a negative pole; Usually, their positive pole is marked as +3, if you don't see the + sign in these capacitors; The colored bar next to the base (only for tantalum type) indicates the positive base, and usually in all capacitors with polarity; The length of the positive base is longer than the negative 3

* in case of using a battery with a voltage of more than 24 volts; Capacitor 24 should be considered 3. Volt type

* The use of solid or SMD capacitors is unimpeded if they are properly placed on the fiber.3

T1	(no extension) BS170	be original
T2	(MOSFET - without extension) IRF840	be original
T3	BC337	

ICs

U1	(Microcontroller) ATmega328P-PU	28 pin dip type
U2	LF357N	Not fake	(Metallic LF357H, LF157, LF257)
U3	L7805CV	High quality 3 volt regulator
U4	L7812CV	High quality 12 volt 133 amp regulator + small and strong heat sink

Other parts

X	20MHz	(20.000000 or 20.0000 or 20.000) 25 MHz crystal
D1, D2	1N4148	Diode
D3	1N5819	Diode
LCD	15x2	15 x 2 character LCD with backlight - preferably green
SP		Two-wire piezoelectric speaker with frame or headphones
BAT		Rechargeable battery 18 to 24 volts - 2 amps
LOOP		Probe loop (recommended) spider - 35uH - 1 ohm.
S		3 high-quality push switches that can be installed on the box (normal off mode and on pressed mode)
PCB		Suitable fiber for ironing - preferably high quality fiberglass - cm 7.9 x 7.3

8-pin and 28-pin (narrow) military sockets for ICs 1 and 2, small and strong heat sinks for the 7812 regulator and, if necessary, MOSFET

High-quality coaxial cable without foil to connect the loop to the circuit

Circuit breaker

High quality non-metallic wire and connector for connecting loop and pin header and flat cable for connecting LCD and 333

Headphone jack, if using a suitable headphone

box, preferably non-metallic and non-metallic skeleton

Explanation about some parts

* **Construction cost:** The cost of the circuit part of this device (apart from the battery, loop, box and skeleton) is not more than 25 dollars! All the used parts have been tried to be of the best common parts in the market, which can be found at least in several parts shops. Therefore, it does not impose any cost or trouble on anyone, and those who might be planning to make it by their friends should pay attention to this point. Be so as not to be taken advantage of 3

* **Resistors 11 and 12:** The thermal stability of these resistors will have an effect on the stability of the device, especially when the ground setting is inactive, because they gradually heat up during operation. Any resistance between 85. and 455 ohms 2 watts, provided that the thermal error is less; It works better than 15. 3% ohm which is common in the market. 3The exact primary ohm of these resistors is not important and simple testing with an ohmmeter is not a criterion for the resistance's thermal stability! According to the conducted tests, the 85. or 15. 1% Ohm type available in the market has no noticeable difference from the 3% type in terms of thermal stability, and only if you have access to more accurate types such as 531% 2W, you can get noticeably better results. 3 These types of resistors They usually have 5 color rings and their thermal stability is higher than other resistors. 3 If this type of resistor is not available; The use of 15. Ohm type 3% common in the market does not cause much problem 3, as well as the use of resistance. Watt is unimpeded 3 However, brick or wire resistors should not be used for these two parts and the material of these resistors should be carbon or metal film type 3

* **IC 1:** The microcontroller selected for this circuit is considered among the best in its class, which uses higher program memory and RAM, stronger processing power, and better ADC than lower-end microcontrollers. Other available digital designs are superior3, but this micro cannot be properly programmed by all programs, and in the relevant section, how to program with the proposed program that makes the work of the program easier will be explained in detail3, also due to the possibility of frequent updates for the software of this design And also the possibility of resetting the limit on the number of times the device is turned on and off; Friends, you should definitely use an AVR programmer with a USB interface, preferably USBasp type, and do the program yourself. 3 The Multi AVR programmer produced by ECA Iran is a cheap and good example.

It has been tested and works well with the eXtreme Burner - AVR program that will be introduced 3

The microcontroller used in this circuit is a 28-pin DIP type, so the SMD type of this micro, which has 2. pins, cannot be used.

* IC 2: op-amp for amplifying the signal of the receiver for this circuit, a good and common op-amp was selected from many numbers in the market and gave the best results in all tests. 3 Therefore, friends should not change this number because the software calculations, especially for the separation part Based on this number and other numbers, not only will it not work correctly; It may also lead to the failure of the microcontroller! Of course, unfortunately, there are many fake LF357 ICs available in the market, which will not give the correct answer, and the signs of that will be low range and incorrect separation and removal of iron. Fortunately, if this IC is fake, it will not damage the micro; But only the original type does not work well 3

Instead of plastic LF357N, you can use LF357H, which is a metal type, which in addition to having more stability; It is less likely to be fake! Considering that the thermal stability of this IC has an effect on the working stability of the whole device; You can also use LF157 or LF257, which are similar military and industrial models from 37. and achieve better stability, especially in cold weather.3 In any case, this IC must be of the original type, otherwise you cannot expect proper operation from a fake and unknown IC3. IC MAC157 can also be used, although its performance quality is not as good as the original LF1573

In case of using the metal type of these ICs, it should be noted that the appearance of the metal ICs is different and therefore one should pay attention to the correct placement method. 3, so when we look at the metallic IC from above, the left leg is leg 8; The number will be 1 and 2 and , respectively. to 7 are located 3, so it is enough to separate the 4 pins on the left side of the metal appendage and leave a little distance from the remaining 4 pins, and in this way the shape of the pins will be similar to the DIP type, which pins 1 and 8 are clear. We place it on the socket so that the metal appendage is towards the notch marked on the socket (towards capacitor 15). It should fit well on the socket and have better performance 3

* MOSFET: Transistor 2, which is the MOSFET of this circuit, was selected after checking several common numbers in the market. 3 IRF840 has a maximum voltage of 355 volts, and its maximum voltage is also used in this circuit, so it is slightly superior to IRF745, which is 455 volts. It is possible to achieve high power with MOSFET 845 easily by reducing the ohm loop or increasing the pulse width adjustment in this device. 3 Among other numbers that have given a good answer and are compatible with the separation section; 1555V MOSFET is 11NK100, but the result is not much different in terms of range. 3 Also, some types of IGB can be used. 3 Due to the presence of high voltage, you should not touch the output of the loop or even 2 watt resistors during operation, otherwise there may be an electric shock. which can be dangerous 3

The MOSFET in this circuit only heats up a little under normal conditions and therefore does not need a heat sink3, especially since the metal blade of the MOSFET itself is prone to absorb noise and by placing a heat sink it can absorb more noise from the surrounding environment3 Of course, the more frequency and pulse width settings and Especially if both are higher at the same time; MOSFET heats up more! But for normal settings that are conventional in exploration; The heating rate of the MOSFET is not high at all3, so only if using high frequency conditions or especially high pulse width; It is recommended to use heat sink for MOSFET both for better performance of MOSFET and to have better thermal stability 3

If the MOSFET is defective or on the contrary, the device may appear to work properly and only have a very small range!

* Regulators: because the accuracy and stability of 3 and 12 volts in this circuit plays a fundamental and decisive role; High-quality regulators must be used. 3 The 7853 regulator does not need a heat sink, but on the contrary, for the 7812 regulator, a small, multi-branched and strong heat sink must be considered because it produces considerable heat under normal conditions. and only a small, strong heatsink is enough, and if the regulator is of good quality, it will not suffer a voltage drop even if it gets hot. However, due to the variety of heat sinks available in the market, it is better to prepare several samples of heat sinks so that at the end of the assembly it can be determined which one fits better on the circuit.

* Loudspeaker: The design of the audio output in this circuit is such that it works with all kinds of speakers with high power3. Therefore, if you use a small 8 ohm speaker, the power of the speaker must be at least 532 watts, or the volume setting of the device should not be set too high, otherwise the speaker may be damaged. exists! However, because the piezoelectric speaker also responds strongly and requires less current, which will cause better and more stable circuit performance and lower battery consumption; It is recommended to use a two-wire piezo speaker with a frame.3 In addition, it is also possible to use headphones.3 Naturally, if you use headphones, you should consider the headphone jack on the box and preferably use headphones with volume, and if you feel that the sound is louder with headphones. It is too strong, you can put a resistor, for example 155 ohms, in series in the path of one of the headphone jack wires.

The subtle point about the location of the speaker, especially the normal type, is that it is much better to avoid the possibility of creating noise and interference; Do not place the speaker close to the output of the loop 3

Due to the presence of sound modes 1, 15, 11, and 12, which are VCO type and do not have digital volume adjustment; It is strongly recommended to use a piezo speaker when using these audio modes, and if necessary, reduce the sound by connecting a resistor in series. 15 and transistor. And the speaker itself will be subjected to a lot of pressure. Therefore, in case of using a normal speaker in this situation, a resistor of for example 155 ohms should be connected to one of the speaker wires. There is 3

* Battery: this circuit works well with a voltage between 13 and 24 volts, and there is no difference in the operation of the circuit in this voltage range3, but if the voltage is lower than 13 volts, it will not function properly, and a voltage higher than 24 can damage the capacitor 24 or 7812 regulator leads to 3 considering that the actual voltage of all types of rechargeable batteries gradually decreases after discharge; The best choice is an 18-volt battery, if you use a dry or sealed acid battery; can be from The number of 5V batteries in series or a 12V battery in series with a 5V battery with the same amperage, or using 3 lithium batteries in series, which is much lighter and smaller. It is better to have more work security than ordinary lithium ion. 3 If you use lithium types, there must be at least 3 cells and a maximum of 5 cells connected in series. 35 percent; Practically half of the charging capacity of these batteries will not be usable! However, if you need to constantly use a high frequency or pulse width due to the significant increase in battery consumption; It is recommended to use a battery up to 433 amps. 3 Also, the higher the voltage of the battery, the higher the heating rate of the 7812 regulator will be, and the energy loss will actually increase. and therefore, in this case, the capacitor 24 of the 3. volt type should be considered

If the battery voltage drops below 1433 volts; Because the circuit will no longer function properly; While displaying the Battery Low message, the sound reaction of the metal detector will be cut off for the metal sense. 3 In this case, if the operator is busy exploring; Device with horns. Tai will alert the operator every few seconds 3

Also diode. In this circuit, it is considered to protect against the possible reverse connection of the battery by the operator, and because it is in series in the circuit; If this diode is healthy, there is absolutely no way to damage any part, including this diode itself, by connecting the battery in reverse!

* Loop: The probe loop, which was the working criterion in the tests, is of the spider type with a capacity of about 35 microhenries and a resistance of about 1 ohm. However, due to the possibility of adjusting the pulse width and delay; It is practically possible to use a wide range of loops3, therefore, the exact capacity or resistance of the loop is not very important for this design3 It is recommended to use a spider or flat loop to get a stronger result and the separation and removal of iron has a better performance3 Explanation about How to wind these loops and calculate their capacity is beyond the scope of this article and has already been discussed many times in the metallurgical forum. Also, some corporate loops, especially the 18-inch mono loop of Commander GPX Minlab series devices (only mono type) can be used for this device and the answer is very good. It's also good 3

The less number the automatic delay device finds for the loop; That loop will be more suitable especially for small gold sense, and at the same time, the stability of that loop will decrease against particles. Daily automatic is important around 25 and if the daily loop is much higher than this, the separation part may not work well. Also, if the daily automatic loop is below 15, it is a sign of low capacitance and high sensitivity of the loop, which is not very suitable especially for large loops and causes The stability and even the difficulty is separated for the part. 3 Therefore, a slightly higher automatic daily loop is better in terms of stability for exploring on the ground. How much the daily loop is depends entirely on the quality and type and thickness of the wire and the way the loop is wound, as well as the type of connecting cable and loop connector. 3. Of course, in the case of balance in the situation where the loop is close to the metal, the correct result will not be obtained at all, and you must first of all be sure when balancing the metal close to the metal.

The loop connection cable is also very important. 3 One of the ways to connect the loop of this circuit is to use a high-quality stereo shield cable that has two cores and one shield. It should be connected to the two ends of the loop and the shield of the cable is connected to the Shield point on the circuit, the tip of the pot is not connected anywhere unless a thin conductive cover or graphite is used for the shield loop, in which case the cable shield can be connected to the shield loop. 3. Another way to connect this type of stereo shield cable to the circuit is that two cores inside the cable are connected at the beginning and end and connect to the 2nd loop point, and the cable shield is connected to the 1st loop point.

The best way to connect the loop is to use a high-quality coaxial cable such as Kerman or Mazandaran antenna cable or RG59 or RG58 with a core and copper shield and without.

There is a foil, in which case the core of the cable must be connected to the 2nd loop point and the cable shield must be connected to the 1st loop point. In fact, in this method, the shield point on the fiber is not used. This method gives a better answer and is more recommended.

The subtle point for connecting the cable to the spider loop or flat is that if you use the cable shield to connect one of the loop wires; In order to have more stability and less effect of noise, it is better to connect the wire coming from the inner part of the loop to the core of the cable and the wire coming from the outer part of the loop to the shield of the cable 3.

The important thing about connecting the cable shield to the graphite coating or the conductive coating of the shield loop is that this connection must be done correctly and firmly 3 otherwise, if this connection is loose, it will produce instability!

Also, this test should be done whether by bringing the metal close to the cable itself or shaking the cable (without touching the hand); Does the device react as a metal sense or negative meter or not? If this reaction is significant, the cable is not suitable, or the connection of the cable and the corresponding connector is not strong and there is a problem! Naturally, in terms of high sensitivity in this sector; Loop connections must be made firmly and soldered. Also, cables with aluminum foil often do not work well. Also, the connection between the output of the loop circuit on the fiber and the loop connector on the box if the distance is more than. cm is fine It should be done by the relevant cable and normal wire should not be used for this, otherwise even a few centimeters of normal wire can cause noise to enter the circuit receiver! In case of using connector and type plug.

The next point is that if a large loop, for example 55 cm, is used; The distance between the device box and the loop must be large enough and the angle between the loop and the skeleton during exploration should be such that it does not stand in front of the device box. There will be mutual interference between the loop and the box containing the circuit and the battery, and the metal detector's performance will be disturbed 3

To check the strength of the skeleton, loop and connections, before exploring on the ground and in a completely open environment, first hold the device and the loop towards the sky and shake it a little to make sure there is no instability! If the device is unstable due to the movement of the device and without the effect of the ground, show a negative sense or meter; It is clear that the internal connections of the device, especially the skeleton and loop parts, have problems, and in this case, the device is still not suitable for exploration, and the problem must be solved first.

* Shield of the whole circuit: according to the high-pass and low-pass filters for removing noise and software methods for dealing with noise beyond most existing pulse circuits, as well as the compact and special design of the fiber with a strong ground; There is practically no need to shield the whole circuit3, especially since, as mentioned, more than 85% of the noise received in all metal detector circuits enters the circuit through the loop and its connection cable and is amplified3, but if the loop shield is installed correctly; In order to remove the little noises that affect the circuit itself, the whole circuit can be placed in a case of aluminum foil and this foil is connected to the shield point 3. In this case, care must be taken that no part of the circuit other than the ground or the shield point Aluminum foil should be connected 3, especially the MOSFET body! If the loop is not shielded; The shield of the circuit itself will not have a noticeable effect and therefore it is better not to do it!

Another way to shield the entire circuit is to use a metal box and connect it to the ground of the circuit or the point of the shield3. so that the skeleton of the device and the distance and angle of the box with respect to the loop should be such that the metal box is not in front of and within the range of the sense loop, otherwise the metal detection performance of the device will be impaired3, therefore, the use of a metal box is not recommended despite the positive effect it has on noise removal3

Specifications of the proposed coils

Loop 25 cm flat: 2. round of lacquered wire 533 mil with an inner diameter of 1333 cm3 (4. round for spider mode) loop 5.

flat centimeter: 23 turns of lacquered wire 535 mil with an inner diameter of 25 cm3 (25 turns for spider mode) loop Flat 43

cm: 11 turns of lacquered wire 537 mil with an inner diameter of 4133 cm3 (25 turns for spider mode) Loop 55 cm flat: 15

turns of lacquered wire 537 mil with an inner diameter of 37 cm3 (17 turns for spider mode)

1 x 1 meter frame: 15 rounds of wiring with 1 mil3 core 133

x 133 meter frame: 8 rounds of 132 mil3 core wire 2 x 2

meter frame: 7 rounds of 132 mil3 core wire

For small loops, it is better to use lacquered wire, and for large frames, there is no other choice but to use coated wire3, but for the proper functioning of the separating part in large frames, you must use a type of wire that has a thick coating3, this creates a gap. It is between the cores of the wires and reduces the capacitance inside the coil, which is necessary for the correct operation of the separation.3 By carefully following the range of debug numbers 2 (A, B, C), you can understand this and it will be explained in the next sections.

In choosing the right coil for the desired purpose, it should be noted that basically every coil can be metal with a size of at least one twentieth of its own dimensions.

Feel it well! For example, for the sense of a metal, 3 centimeters; The 1 meter frame is the largest coil that can be used, and larger coils cannot properly sense such a small metal at least in their center3, so using large coils only for purposes that are larger than one-twentieth of the coil size increases the range.3

In examining the results of coils of the same size with different capacitance or resistance coordinates, it is important to consider that two settings of pulse width and delay, one of which is related to the transmitter and the other to the receiver of the device; Each coil has a different meaning! Therefore, changing the coordinates of the coil without changing these two settings may lead to a wrong conclusion about the suitability of that coil. 3 In fact, each coil with different capacitance and ohm coordinates and even a different capacitance state needs a special pulse width and delay setting in order to get the maximum gain or He expected the best stability from him 3

Circuit assembly and initial setup

The fiber circuit is designed in a miniature form, which makes it easier to box the circuit, and due to its small size, it has a stronger ground and absorbs less noise than larger circuits, and it basically answers much closer to the theory of the circuit's operation3, however, the smallness of the circuit requires It increases the delicacy of the assembly a little bit, and it is also necessary to be careful in choosing the size of the parts, especially some capacitors, which are also mentioned in the parts list and should be paid attention to. Also, it is much better to use fiberglass because it will give a better answer.

After completing the initial steps of fiber preparation with ironing and acid work method; In the fiber drilling phase, you should be careful and use two drills with size 537 and 1 mm. 3 resistors and ICs 1 and 2, small transistors, small capacitors, crystals and 4148 diodes should only be drilled with a 537 drill and for drilling Instead of the bases of regulators, MOSFETs, large capacitors, 2 watt resistors and 5819 diodes, as well as the connection of the wires to the circuit, a 1-mil drill was used. In fact, most of the fiber drilling should be done with a 537 drill. The fiber circuit faces a serious problem during the assembly stage!

Placement of the parts does not need a special explanation. 3 Just be careful, there are 4 jumpers in the circuit. 2 The jumper close to the LCD also applies 3, but for the jumper that is placed between the capacitors 13 and 15 above the fiber, a piece of thick wire should be used 3 For example, the additional base cut from the 3811 diode or 2 watt resistors are suitable for this jumper 3

It is necessary to pay attention to the fact that the closer the parts are assembled to the fiber, the better the final response of the circuit will be. 3

To assemble the 7812 regulator, pay attention that it is much better to first calculate what heatsink fits on the circuit and then screw the heatsink well and firmly on the regulator and then place the regulator on the fiber and assemble it so that the work is easier 3.

Also, in the installation of regulators and MOSFETs, pay attention to the hatched part on the image of the fiber showing the location of the metal blade of these parts 3 Considering that the main power supply of the circuit is 12 volts and the voltage of some capacitors is selected accordingly; It is recommended before the initial setup of the circuit and placement of 15 volt capacitors; Check the correctness of the 12 V voltage 3, otherwise there will be a possibility of damage to these capacitors 3

At the same time, do not turn on the micro circuit without placing a single resistor! There are several resistors in the circuit, which if not placed or the wrong value will lead to micro burn! Therefore, great care must be taken in the correct placement of all resistors 3

In any case, after assembly, first, avoid placing ICs 1 and 2 in the socket and check the correctness of the specified voltages on the fiber 3, noting that the voltage measurement must be done by a multimeter on the DC voltage range and between the negative of the battery or The same shield point should be done in relation to the points that are mentioned:

* 12 volt voltage: the jumper between capacitors 13 and 15 as well as point 1 LOOP have a voltage of 12, which is indicated as 12v on the fiber. The maximum error for this voltage is 532 volts, that is, between 11,385 and 12,325 volts is acceptable. In tests with about 15 regulators, 12 Volt (7812) done; The voltage of all of them was between 12315 and 12325 volts, and in this case there is no problem 3, but if the measured voltage is more than these errors, the 7812 regulator must be replaced! If there is no voltage at all, the correctness of the circuit wiring should be checked 3 If the voltage of 12 is more than 1.V, there will definitely be a possibility of damage to the micro IC!

* Voltage 133 volts: This voltage is related to the common end of resistors 1 and 14, which is specified as 9.5v and is considered an important voltage. The error rate of this voltage should be almost the same as voltage 12. For example, the higher the voltage of 12 is than the actual 12. Yes, 133 volts should be almost the same. Therefore, the acceptable range for this voltage will be between 13.5 and 1375 volts. The condition of resistors 1 and 14 should be checked. Also, the defective capacitor 12 can lead to problems in the voltage of 133 volts.

* 3 volt voltage: this voltage has a significant effect on the performance of micro and LCD, and therefore it must be correct with a maximum error of 531 volts3, so between 4315 and 3315 volts is acceptable3, otherwise the 7853 regulator must be replaced!

If the MOSFET circuit becomes hot at this stage, it indicates that there is probably a problem with the BS170 transistor or its connections, and it causes the MOSFET to be permanently on.

The way to connect the LCD is according to all such circuits and it is enough to connect the pins marked on the fiber from numbers 1 to 5 and also 11 to 15 to the same numbers that are written next to the pins of the LCD itself. 3 If only pin 1 is specified It is the sign of the beginning of the bases and respectively the bases 2 and . It will be until 15.3

In this device, only 3 push buttons are used for all kinds of settings, which should be located on the box and accessible to the operator in the form of 3 buttons, and they should be wired to the circuit. The wiring method is very simple, so that one wire from each key goes to the corresponding point in the device. The place of the S connector is connected to the fiber and another wire of each key is connected to the GND point 3, so we have 3 wires for 3 keys, and the sixth wire, which is GND or ground, is connected to the other end of each 3 keys. The heads of all 3 keys can be connected from the back and finally connected to GND 3, so for wiring from the fiber circuit to the part where the keys are on the box; We need a total of 5 wires

Ok: This key is for entering or exiting the menu or OK values, which should be placed in the middle of the remaining 4 keys.

Left: The left key is for reducing the values   in the menu or reducing the sensitivity in the exploration mode. This key should be installed on the left side of OK (number 1 in the password mode).

U.P: The upper key is to move between the options in the menu or debug mode in exploration mode 3 This key should be above OK 3 (number 2 in password mode)

Right: The right key is for increasing the values   of the settings in the menu or increasing the sensitivity in the exploration mode. 3 This key must be installed on the right side of OK. 3 (No. in the password mode)

Down: The down key is to go down to the options in the menu or automatic balance in the search mode 3. This key should also be placed at the bottom of OK 3 (number 4 in the password mode).

Therefore, in terms of the ideal placement of the keys on the box; The OK key is placed in the middle and 4 keys are installed on the sides of this key according to their names for simplicity 3 as shown in the picture below:

<div align="center">

2
Up
|
1 Left---OK---Right.
|
Down
4

</div>
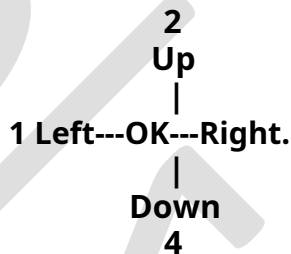
It is recommended because of the function that each key has; The layout of the keys on the box should be as above, and especially the Down key should be as easily accessible to the operator as possible in terms of the balance function during exploration.3

Programming IC microcontroller

Programming this micro is not very different from other microcontrollers of the AVR family and can be done with most types of programmers, but because this micro is a bit new; Some programs do not have the possibility to program it or have various problems during the program and especially the setting of fuse bit mission 3, for example, the common TNM programmer or programs like progisp, which have been tested many times and do not have good and reliable results! Therefore, my strong recommendation is to prepare a Multi AVR programmer with a USB interface and a ZIF socket to insert the micro and use the eXtreme Burner - AVR program, which is a very good, simple and fast program for programming this micro. 3 If you learn how to program with this program; The whole process of the program does not even take 1 minute! Of course, if 54-bit Windows is used, the relevant USBasp driver must be installed, otherwise the program will not be able to communicate with the programmer3, so for simplicity, it is better to run the program on a Windows 2.

Unfortunately, the original version of this program does not support the micro we are looking for3, therefore, a modified version has been provided that provides the possibility of programming the ATmega328P micro without any problems3 Of course, to use this program, the programmer used must be of the USBasp type, like the suggested example3 First, how We will check the installation and manipulation of this program:

We connect the programmer to the USB port of the computer and then the file**extreme_burner_avr_v1.4.2_setup**open it and install this program in the Windows environment. To the installation location of the program, for example**Files\eXtreme Burner – AVR C: \Program**Go and enter the folder**Data**We will get 3 two files**chips.xml**And**fuselayout.xml**The file that is zipped separately contains the existing program; In this folder, we will copy and replace two old files 3. By doing this, the micro program we want will recognize us correctly and we can follow the steps of the program 3

Now open the program and enter the menu**Chip**Go to the top of the program and select the ATmega328P option from the list of micros 3, then the yellow button**Open**Click on the top of the program and select the hex file related to this device from your computer. 3. If an error is found in this step; You can first copy the hex file on the Windows desktop and then open it from within the program 3. Then go to Tab **Fuse Bits/Settings**We are going to set the fuse bits 3. We can have two modes of setting the fuse bits! One is related to the normal mode in which we intend to save the settings we made before in the device, and the other mode is the bit fuse setting, which after each program load; The internal settings of the device will return to the default state, and it is mostly for when friends reset the limit of turning on and off the device. In addition to returning the setting values   to the default state; The limit of turning on and off will also be reset 3. Also, if for any reason the micro EEPROM memory has a problem or runs out

Limitation of frequency of use; When the device is turned on, only the words !!! Show the DEMO; It is necessary to reprogram the micro with the fuse bit reset settings. 3 In the micro program for the first time, it does not matter which of the following modes is used:

	Extended Fuse:	High Fuse:	Low Fuse:
To keep the settings saved inside the micro	**FC**	**D1**	**F7**
To reset the saved settings and reset the usage limit	**FC**	**D9**	**F7**

Then the Write checkbox next to each of these. We tick the option 3. Be careful, otherwise. Do not tick anything else on this page! Well, the fusebit settings work is finished and the hex file that we entered into the program before is enough, now the green button is enough **Write All** Click on the top of the program so that both the hex file and the fuse bits are programmed. 3 If the programmer is properly installed and supported by the program and the micro is properly placed on the programmer socket; There shouldn't be any problem. 3 Also, if the programmer is not recognized by the computer, it may be necessary to use the driver installation CD that comes with the programmer. 3 Also, sometimes the problem is solved by disconnecting and reconnecting the programmer from the USB port. There is, and it is better for friends to refer to the catalog of the programmer's guide they are buying. 3

Any type of USBasp type programmer can easily program our micro with the aforementioned program. Therefore, considering the many problems observed in the program of this micro with other programmers and programs; It is strongly recommended to prepare a USBasp type programmer3. This point can be seen carefully in the technical descriptions of the programmers3.

In the way of programming with Multi AVR programmer, ECA product of Iran, which is of USBasp type, it should be noted that the location of the microcontroller in the ZIF socket on the programmer is indicated by an inscription next to the socket based on the number of bases of each microcontroller. Therefore, for our microcontroller, which is of 28 type There is a pin; Pin 1 of micro IC should be placed in the place marked with 28P next to the ZIF socket.

Also, the way to program the micro with this programmer for the first time when the micro is raw is a little different from the next time! For the first time the micro program, the LS jumper must be closed (connected) on the programmer, and for the second time, in addition to leaving the LS jumper open, a crystal number between 8 and 25 MHz must also be placed in the specified place for the crystal next to the ZIF socket. The micro program should be done correctly and at a high speed. Of course, in the new examples of this type of programmer, the LS jumper is apparently removed, and in this case it is not necessary to touch the jumper on the programmer. ; **If other programs are used for the micro program**; Setting the fuses in detail will be as follows:

Description				Value	Fuse
	]	or Unprogrammed	or Disable	1	CKSEL0
(External Full Swing Crystal)	|	or Unprogrammed	or Disable	1	CKSEL1
	> =	or Unprogrammed	or Disable	1	CKSEL2
(Startup Time: 16K CK/14 CK + 65ms)	|	or Programmed	or Enable	0	CKSEL3
	|	or Unprogrammed	or Disable	1	SUT0
	]	or Unprogrammed	or Disable	1	SUT1
(Clock Output)		or Unprogrammed	or Disable	1	CKOUT
(Divide Clock by 8)		or Unprogrammed	or Disable	1	CKDIV8
(Reset vector)		or Unprogrammed	or Disable	1	BOOTRST
Boot Flash Section Size=2048 words	>-	or Programmed	or Enable	0	BOOTSZ0
"	>-	or Programmed	or Enable	0	BOOTSZ1
Preserve saved settings (Preserve EEPROM) Reset		or Programmed	or Enable	0	EESAVE
settings and restrictions (Preserve EEPROM)		or Unprogrammed	or Disable	1	EESAVE
(Watchdog Timer)		or Unprogrammed	or Disable	1	WDTON
(Serial programming)		or Programmed	or Enable	0	SPIEN
(Debug Wire)		or Unprogrammed	or Disable	1	DWEN
(Reset Disable)		or Unprogrammed	or Disable	1	RSTDISBL
	]	or Programmed	or Enable		BODLEVEL0 0
(Brown Out Detection Level = 4.3v)	> =	or Programmed	or Enable		BODLEVEL1 0
	]	or Unprogrammed	or Disable		BODLEVEL2 1

If a program with Farsi language is used, Disable means inactive and Enable means active. In the above list, the value 5 means that that option must have a tick and 1 means that the checkbox is not ticked for that fuse bit. 3 If there are other options than the above; No changes should be made on them. 3 If you use the eXtreme Burner-AVR program or any program that supports the fuse bit setting model in the form of Extended Low, High, there is no need to set these fuses one by one. The code that was mentioned in the first part alone will include the setting of all 11 fuse bits that we want, so it is much better in terms of simplicity and possibility of error.

If the fuse bits are not set correctly, the device will not work properly and the sign of that will be slow operation and very low delay loop (usually 5)3, but if the fuse bits related to the crystal and clock are set correctly; It should take about 4 seconds for the device to rise up to the moment of initial balance. 3 Also, if the BODLEVEL bits fuse is not set correctly, which can be seen in some other programs; It is quite possible that the device only after a few times of use!!! DEMO goes and doesn't work anymore! In this case, the only way to reprogram with a bit reset fuse will be 3. In this situation, sometimes it is even necessary to first erase the micro EEPROM memory by the programmer program separately (ERASE).

After fully assembling the circuit and checking the voltages and installing the keys, LCD and micro program; Then you can insert ICs 1 and 2 in their own sockets and turn on the circuit for the first time. In this situation, a short beep will be heard from the speaker, which indicates that the micro is programmed and the audio circuit is healthy. The only difference is that turning on the circuit. For the first time, it is in LCD contrast setting! Because the LCD contrast adjustment of this device is done digitally; Therefore, for the first time, a special process has been considered 3 in such a way that after the circuit is initially turned on; written**Press OK!**It is written in the first line and a counter starts counting in the bottom line 3. At the same time as this counting, the contrast level of the page changes! As soon as these writings are seen on the screen, you must press the OK button! In this way, the initial setting of the contrast is done and saved, and you can adjust the contrast later through the menu. Just wait a few seconds for the counter to start counting from the beginning, or turn the device off and on again. 3 However, be careful not to press the OK button until you see a text on the screen! Otherwise, it is assumed that the adjusted contrast is acceptable to you and if you cannot see anything on the screen, you cannot work with the device and even if the problem is from another part of the circuit and will be fixed later; You have to first reprogram the micro with the fuse bit related to the reset settings and then do the initial power on. 3 Actually, whenever the micro is programmed with the fuse bit reset the settings; The initial contrast adjustment process will be repeated 3

Device settings and menu

By pressing the OK key, you can enter the menu section 3. This menu uses a unique design method between similar circuits; It is possible to increase and decrease the values using the left and right keys at the same time as displaying the name of the desired setting 3. Also, the rollback mode and keeping the last option set by the operator is one of the special features of this menu for maximum convenience and simplicity. and the speed should be in the settings of the device. 3 The option selected by the arrow indicator can be adjusted at any moment, and by pressing the up or down keys, the option to be adjusted can be changed. and turn on the device to save the settings.

Frequency: This setting specifies the amount of pulse frequency (PPS) in this pulse metal detector and it is considered as 3. to 111 Hz with the possibility of 1 Hz change. No 3. Lower frequencies have a little more penetration in the soil and less sensitivity to the type of soil, but less sensitivity to smaller metals, and at the same time, they have a lower sensing speed. 3 If the high frequencies are the opposite, 3. At the same time, the battery consumption increases with increasing frequency. 3. I recommend It is possible to use frequencies between 155 and 55 to get a good answer in different conditions. 3. Another interesting point that frequency adjustment provides us; It is possible to remove noise in this way! Because the noise in the environment, depending on its frequency, can have a lesser effect on some of the set frequencies of the metal detector3, so by testing and checking this issue in different conditions, it is possible to use frequencies that are least sensitive to the noise in the environment3 in most conditions Changing the frequency by one or more hertz can eliminate the existing noise interference to a great extent.3 Due to the existence of 35 Hz city electricity noise in many places, it is recommended not to use frequencies that are odd multiples of 35! On the contrary, the frequencies that are even multiples of 35 have the least interference with the noise generated by the city's electricity. According to this, the frequency of 35 is the worst and the frequency of 155 or 255 is one of the best frequencies that can be used.

Pulse Width: This setting is based on the concept of pulse width (pulse width) and is based on microseconds, which directly plays a role in the power of the transmitted waves, and it is considered as 155 to 355 microseconds with the possibility of changing it by 3 microseconds. Frequency adjustment are two settings that determine the condition of the pulse sent by the device's transmitter, and so far there is no digital pulse metal detector in this way! By adjusting the pulse width, it is possible to get better results from special loops, even with large sizes, and also to adjust the conditions of the pulse power in relation to the Ohm ratio, the loop capacity, and the soil type of the area. He has experience. 3 Higher pulse width means more current or amperage in the loop. 3 But this high ampere may be problematic for smaller loops and small targets. 3 For example, very small amounts of gold cannot be sensed well by high pulse width! If larger targets respond better to a larger pulse width3, especially silver metal in large dimensions can be sensed significantly stronger with a high pulse width3 Generally, a setting between 135 and 235 gives a good response for this device in different conditions3 It is necessary to explain that most Existing circuits, which are often designed for coin detection, have a constant pulse width of 155 microseconds! At the same time values higher than 55. In this plan, it is mostly for testing and it may give a good answer only under some special conditions and with some loops. The pulse width increases greatly 3. In order to use the maximum breakdown voltage of 355 V MOSFET IRF840, it is better not to set the pulse width less than about 135 V, otherwise the final voltage of the pulse in the loop will also decrease in the same proportion. There are more Rds; A higher pulse width of about 235 is necessary to use all the capabilities of this MOSFET. Of course, this issue also depends on the capacity and resistance of the loop used, so it is better to adjust the appropriate pulse width for each loop.

To protect the pressurized parts of the circuit in case of high frequency or pulse width setting and to limit the maximum current consumption of the circuit; A system is considered to prevent possible damage to the circuit 3. Therefore, if according to the internal calculation of the device, the battery consumption exceeds a limit;

After setting above the limit of each of the frequency and pulse width settings; The message "High Power" is displayed and the device returns to the menu and does not allow saving the settings 3. In this case, at least one of the frequency or pulse width settings must be reduced to some extent so that the device allows saving the settings and returns to normal exploration mode 3. Of course It is possible to use the final numbers of both mentioned settings, provided that it is not accompanied by an increase of the other limit.3

Another important point is that if the frequency or pulse width is changed a lot; Considering that the thermal condition of the 2 watt resistors and the MOSFET and the 7812 regulator changes slightly; After the initial balance, the device will become unstable until the mentioned parts reach thermal equilibrium3, therefore, in such a situation, you should usually wait for about 1 minute and then balance the device again3 This happens when these two settings are greatly reduced, and the mentioned parts To achieve thermal stability in their new state, they need time. 3. Instability at the beginning of turning on the device is also related to the same issue, and of course, in the initial working conditions of the device, the time required for the LF357 IC to heat up is also added to this set. It depends on these parts, and in order to improve it, you should choose 2 watt resistors of the thermally stable type, and at the same time, while using the original and high-quality type of MOSFET and the 7812 regulator, you should consider them as a suitable heat sink3.

DelayThe manual daily setting in the menu means that from the moment the automatic daily starts, which is equal to the value of 5; How much additional delay should we have in microseconds?3 So any number that is set actually means automatic delay plus that additional delay after the end of the sent pulse.3 The importance of this setting is because metals like small gold actually need less delay for They have a good sense, but at the same time, in this state, the metal detector will be more sensitive to the effect of earth, particles, some salts, stones, and pottery! So, depending on the conditions and type of soil, it is better to raise the dili manually3, therefore, a manual dili of 20+ to +60 can have a favorable result in most conditions3, but in higher dili, the sensitivity to smaller metals, especially the gold type, is less! Therefore, especially for smaller loops that are used for the sense of small metals; Setting the high delay is not useful3, so how to adjust the delay is experimental and depends on the purpose of the operator and the loop used and the type of soil in the area.3 My recommendation for small loops is to set the delay around 25+, and for relatively large loops, the delay should be set higher, which can In addition to reducing the effect of soil and salts; It helps to have a stronger sense and more range for bigger targets. The sensitivity to the ground decreases, but the range of the metal detector is also reduced. There is a daily setting 3 It can also help for bigger goals. 3. If you set manual daily with high value The sensitivity to the ground will decrease, but the range of the metal detector will also decrease. There is a daily setting 3 It can also help for bigger goals. 3. If you set manual daily with high value The sensitivity to the ground decreases, but the range of the metal detector is also reduced. There is a daily setting 3

If you feel the need for a delay higher than the mentioned limits, you should first lower the integral interval setting so that the device allows more delay setting.3

: Integ.Wbe on 44; Integral calculation will be done in the time interval of 55 to 154 microseconds after the transmitter pulse is cut off. 3 This setting, along with the daily setting, is effective in the sense of different metals and sensitivity to some solvents and to some extent the effect of noise. 3 Too much reduction of this setting leads to The range decreases, and with its increase, although it may appear that the range of the metal detector is slightly increased; But at the same time, the probability of sensitivity to some ground effects also increases 3 in some pulse metal detector circuits that are used exclusively for the sense of small gold; A number around 25 microseconds is considered for this setting3, but because this figure will cause a decrease in range for other metals and especially large targets; It is better to have a higher value for this setting in general metal detection or for larger purposes. Therefore, working with this setting requires a lot of experience and it is recommended to use the default setting (44) if you are not familiar with its exact function. 3 Integ. They also learn W3. In fact, the exact interval of integration starts from the moment of daily automatic plus manual daily and continues until the value set for this setting. Setting RX Width This setting is considered one of the unique and professional settings compared to other existing designs; It indicates that the integration process of the metal sense criterion which is taken from the return signal; How long will it continue in microseconds after the delay 3. The start of this setting is 15 microseconds and with a change of 2 microseconds, the final adjustable value depends on the delay setting. 3 In some analog circuits, this setting is as) or integration interval (Integration Width) Automatic Loop 25 should be announced and Manual Daily should be set to +45 and RX Width setting, this setting is considered one of the unique and professional settings compared to other existing plans; It indicates that the integration process of the metal sense criterion which is taken from the return signal; How long will it continue in microseconds after the delay 3. The start of this setting is 15 microseconds and with a change of 2 microseconds, the final adjustable value depends on the delay setting. 3 In some analog circuits, this setting is as) or integration interval (Integration Width) Automatic Loop 25 should be announced and Manual Daily should be set to +45 and RX Width setting, this setting is considered one of the unique and professional settings compared to other existing plans; It indicates that the integration process of the metal sense criterion which is taken from the return signal; How long will it continue in microseconds after the delay 3. The start of this setting is 15 microseconds and with a change of 2 microseconds, the final adjustable value depends on the

If you feel the need for an integral interval that is too much in the menu, you must first reduce the delay setting so that the device allows you to set a longer integral interval.

Ground: (Automatic adaptation to the ground) This setting is similar to the (Self Adjusting Threshold) SAT function in advanced pulse metal detectors, which of course has improvements compared to this standard function and works more like the Tracking function in Minlab GPX series devices3. Also this The setting is similar to the AUTO setting in Lorenz metal detectors.3 This setting is very important during long exploration; It is considered a big difference between this design and many simple metal detector designs, and it makes the operator's work easier during the exploration of a large area because it eliminates the need for successive balancing3, so that if sudden changes do not occur during exploration and the device be left alone for hours; Unlike most circuits, this metal detector will remain at the maximum range and sensitivity set!

3, for example, lower values are better for lands with diverse and bad conditions, but of course, the range of metal detection will be slightly lower and a higher movement speed is needed to sense the metal with power, but for lands with better conditions, higher ground numbers are more suitable and lead to It will also increase the range. 3 In case of sudden changes in the exploration conditions, it may be necessary to press the balance button. 3. Also, if the ground setting is inactive, the device is facing a hole or out of balance; It produces a warning horn faster3, of course, the function of the ground system is more useful on setting the high sensitivity level, and if you use a low sensitivity level, it is better to turn off the ground, otherwise there may be a significant loss of range.3

It should also be noted that if this option is active; How to test the range of metals in the air is a little different! Because this feature causes the gradual and automatic adaptation of the metal detector to the environment; Approaching the metal slowly and from a distance to the loop will not be a correct method, and it may seem that the range of the metal detector is constantly increasing and decreasing! Although appropriate arrangements have been made for such a situation; But for the maximum sense point, which is the border between sense and non-sense state of the metal, nothing can be done, and therefore the final range cannot be measured correctly with this test method. It is possible to approach the metal with enough speed from the side of the loop!

SpeedIn case of using lower numbers for this setting and considering more stability and establishing complete silence; It is possible to set the device's sensitivity level a little higher and achieve a greater range. 3

Although the speed setting is almost independent from the frequency setting; But if speed 15 is used and a higher sense speed is still needed, the frequency should be increased so that the metal detector's sense speed increases again3, but on speed 1 or less, adjusting the frequency will not have much effect on the device's sense speed3

At the same time, this setting has a similar effect on the speed of the device's reaction to the hole or going out of balance3, which means that the higher the number of this setting, the sooner the device will produce a warning horn when it hits the hole3.

: Iron Reject(Iron removal) This setting is similar to Minlab's GPX series devices and is implemented by complex iron detection formulas in Minlab's metal detectors3, with the difference that in Minlab and Lorenz pulse systems, the iron removal system works only with double loops and therefore with large loops. which are mono, there is practically no iron removal, but in this design, the iron removal system can be used with any size of mono loop. There are 3 adjustable values for this option from 5 or OFF to 5. while activating this feature; The degree of iron removal is determined 3, the higher the number of this setting; The removal is done with more power and will gradually lead to the removal of other metals as well! If this setting is active and iron is detected during sensing; The output sound of the device will be cut off, but the sense graph and meter, as well as the separation number and the FE text on the LCD screen will still show the sense of the iron target. It has important points that will be explained in detail in another section 3

BackLight: This setting, which may be seen for the first time in such circuits, is related to the digital adjustment of the LCD brightness level! The adjustable values for this option are from 5 or OFF to 15. The OFF value means the light is off and 15 means the maximum light of the LCD screen. 3 Some types of LCD have different light systems, in which case manipulation of the jumper It is behind the LCD so that the light works properly. 3 In such a situation, and if that jumper cannot be changed, it is better to use another brand of LCD. Also, the battery consumption will not increase significantly, so there is no need to worry about this.3

Contrast: This setting is similar to the previous setting, but it is used to control the contrast or actually the blackness of the writing on the LCD. 3 The adjustable values for this option are from 5 to 35. The writings are lighter in color3 due to the difference between the LCDs and also related to the operator's viewing angle compared to the LCD, which depends on the location of the LCD on the box and the state of the device's skeleton and how to hold it; The operator can make this adjustment in such a way that the writings are in the best readability for the eyes 3

Volume: This setting is related to the audio output power of the circuit, the value OFF means the complete cut off of the sound and the value 15 means the maximum sound power. Of course, if you choose the sound tone 1, 15, 11 or 12, this setting will not affect the sound response of the device. and only the OFF mode will lead to a complete cut off of the sound. 3. Considering the high sound power of this device, it is recommended not to use a high volume setting, especially for a regular speaker; because it will result in a decrease in stability and an increase in battery consumption.3 In the sound system of this design, a kind of increasing mode is considered for the sound in tone modes 1 to 8.3 so that when the metal is closer to the loop, the sound becomes a little stronger.3 for more effective use of In this mode, it is recommended that the volume of the sound be lower than 3 degrees, if the volume level is more than 7, the increasing function of the sound will not have a noticeable effect. It works better with a normal speaker than a piezo speaker 3

If the OFF mode is selected, the sound of the device is completely cut off, and if the BackLight setting is not turned off, all the reactions of the sensors and warning beeps will be in the form of flashing the light of the LCD screen, which is more suitable for using the device at night3. removing iron and detecting the iron content of the target; Instead of the sound being cut off, the screen light will stop flashing 3

:Tone This setting is related to the selection of the tone mode of the output sound to react against the sense of metal. 3 The adjustable values for this option are 1 to 12. 3 Values 1 and 2 and . Each of them has a lower or lower or lower sound in monotone, and values 4, 3, and 5 are two-tone, and value 7 is three-tone, but mode 8 is It has a sound depending on the proximity to the metal and the strength of the sense3, in such a way that when the sense is weaker, the sound below is heard, and as it gets closer to the metal, this sound becomes stronger until it becomes a low sound, and finally when the sense Metal reaches its strongest state; The lowest sound is produced 3

The sound modes 1, 15, 11 and 12 are considered as VCO or voltage-controlled oscillator, and therefore the frequency of the produced sound is completely variable. In these 4 modes, no volume levels will be used, and it is recommended to use a piezo speaker for these sound modes. It should be used as explained in the section related to the speaker. The sound is low and gradually as the sense becomes stronger or the metal gets closer, the sound will become lower. 3 This is the tone of the 15th photo, and at first the sound is low, and as the sense becomes stronger, the sound gradually becomes lower, which is similar to the sound model of some devices. It is closer to a professional. These situations, in general, contribute a lot to a more accurate sense of the center of the target

Tone 11 is a sound that corresponds to the separation 3 in such a way that in the case where the target has not yet given a clear separation; The sound is very low and after the separation part is activated; The frequency of the sound will be proportional to the separation number. 3 The lower the target separation number, the lower the sound and the higher the separation number, the lower the sound will be produced. 3 Tone 12 is also related to the separation sound with the reverse mode, 3, that is, in a situation where the separation of the metal is still clear. is not ; The sound is very low and if the separation of the metal is detected by the device, it produces a louder sound for lower separation numbers and a lower sound for higher separation numbers. 3 Tone 12 is closer to the sound separation system of professional metal detectors.

Multi-voice combinations effectively help distinguish real targets from false ones or random noise, and the center of the target can be better recognized3, although the choice of sound tone depends on the operator's taste; But it is recommended to use tone 153. The sound response of some metal detectors, such as Lorenz, is more similar to tone 15. In addition, in multi-tone modes 4, 3, and 5, the speed of changing the pitch naturally depends on the working frequency of the metal detector, but in three modes There is no connection between the working frequency of the metal detector and the sound

:Password In order to personalize the use of the device and prevent unauthorized access by others, as well as create security under special conditions; The password option is perhaps considered for the first time for such a design. 3 It should first be noted that there is no full keyboard in this device; For simplicity, a password between 1 and 15 digits, including numbers 1 to 4, is considered3 so that when the device is in password receiving mode; The left key equals the number 1; The top key is equal to the number 2; The right key is equivalent to a number. And the bottom key will be equal to number 4. In this case, the entered numbers will be displayed as passwords. After entering the password, it is enough to press the OK key so that the device evaluates the password. The device box should be written so that it is easier to use the password function. 3 This option is slightly different from other menu options. If you press any of the left or right keys, another screen will be shown. 3 If the device already has a password; First, the Old Password message is displayed and the operator must enter the previous password. 3. If the entered password is incorrect; After displaying the Wrong Password message, the device returns to the menu screen and does not allow changing the password without entering the previous password3, but if the previous password is entered correctly, the message Password New is displayed and the device receives the new password. It can be from 1 digit to 15 digits depending on the operator's taste, and whenever we enter the right password, we have to press the OK button3, then on the next page, the Confirm Password message will be displayed, which means that the new password has been reconfirmed by the operator3, if the new password is loaded The second time is different from the first time; Similar to the wrong password mode, the device returns to the main menu and the password is not changed.3 But if the password was the same as the first time in the confirmation mode; While displaying Password Changed, the device saves the entered password and returns to the main menu. 3 If there is a password and it is not empty, the value ON will be displayed in front of the Password option in the menu. and OFF is displayed in front of this option 3 It is given that it means reconfirmation of the new password by the operator 3 if the new password is different from the first time the second time; Similar to the wrong password mode, the device returns to the main menu and the password is not changed.3 But if the password was the same as the first time in the confirmation mode; While displaying Password Changed, the device saves the entered password and returns to the main menu. 3 If there is a password and it is not empty, the value ON will be displayed in front of the Password option in the menu. and OFF is displayed in front of this option 3 It is given that it means reconfirming the new password by the operator 3 if the new password is different from the first time the second time; Similar to the wrong password mode, the device returns to the main menu and the password is not changed.3 But if the password was the same as the first time in the confirmation mode; While displaying Password Changed, the device saves the entered password and returns to the main menu. 3 If there is a password and it is not empty, the value ON will be displayed in front of the Password option in the menu. and OFF is displayed in front of this option 3

If the device has a password; The next time it turns on, first of all, by showing the sign? Password from the operator

asks 3. In this case, we must enter the password and press the OK button. 3 If the password is correct, the device will start working as usual. To remove the password from the device, it is enough to go to the Password option in the menu and after entering the previous password; In the step of giving a new password, without entering any number, simply press the OK button or, in fact, enter an empty password and repeat this task in the step of confirming the new password. OFF value appears 3

It is recommended to be careful when choosing a password and to use a suitable combination as a password that, while providing adequate security; Don't forget it 3. Otherwise, if you forget the password, there will be no way to reset the settings except the micro program with fusebit.

AboutThis option is only intended to display device and designer information and has no other function. 3 Therefore, it is enough to view this information when the flash menu is placed in front of this option; Press one of the right or left keys to find the information related to the device name and program version number, and then display the designer. 3 After displaying this information, which takes a few seconds; The device returns to the main page of the menu 3

* **Adjust the sensitivity**It cannot be done from inside the menu and it will be explained in the Sensitivity section!

* The final point about the menu settings is that after making the relevant settings, which can be on one or more options; It is enough to press the OK button to exit the menu; Save all settings made 3. If any of the frequency settings; pulse width; Daily or integration intervals that are effective in the balance have been changed; After exiting the menu, the balance process is automatically executed once.3

* In response to common questions such as whether this metal detector is sensitive to salts or clay or not, or how sensitive it is to gold, or how it works with a large loop, or what kind of loop is used in this circuit; It must be said that basically these questions about this particular plan are almost meaningless! Because according to the existence of all the possible settings mentioned; Practically, there is no special factor that is common in pulse metal detectors that cannot be changed by the digital settings of this device. 3 It should be noted that the total settings of this device, if it wanted to exist in an analog circuit, would need at least 15 volumes, and more than this number, it should have IC and no The digital system did not respond well either! But in this plan, practically with any set of simple digital settings; We have a new metal detector that has a different capability.3 With a series of settings, the sensitivity to solutes is greatly reduced, and with other settings, the sensitivity to small gold increases.3 Also, the maximum sensitivity to large metals or the problem of penetration into the soil are all changed by changing the settings. Therefore, this design It is completely flexible and a complete alternative to thousands of metal detector designs, each of which has a special feature, so that it can get a good answer depending on the conditions and needs of the operator.

* Regarding facing the noise problem, it should be mentioned that the frequency settings; Speed   and Grand all have an effect on noise! With a little testing in the desired environment and just slightly increasing and decreasing the number of these settings, the noise can be interestingly removed to the point where the high sensitivity of this metal detector can be used. Test should be done 3 according to the type of possible noise that is different in different environments; If it is felt on the high sensitivity level, additional beeps caused by noise will be heard; With a little patience, you can find the appropriate setting to remove the existing noise and use it to continue exploring. 3. It is better to test the effect of noise, first set the Speed   setting to the maximum value, then set the sensitivity level to high values, and the amount of extra horn and especially the meter sense number. Or the fluctuation of the debug number 1 should be evaluated for different settings. 3 When the mentioned settings are changed, especially the frequency, the meter sense fluctuates on smaller numbers, or the debug number 1 has less fluctuations; It means that on those settings

Now we will explain the settings in normal exploration conditions:

Automatic balance: By pressing the down key in normal exploration mode; The steps of automatic balancing are done 3, of course, this is done automatically after the device is turned on. 3 When this mechanism is activated, first the automatic timer related to the loop is found and displayed on the screen in microseconds, and then the final balance is done until the silent mode is established. Be careful 3. In the first step, the automatic daily number of the loop will be found; A number of about 25 indicates that the loop and its connecting cable are in a near ideal state, and the higher the value displayed is more than 25, the higher the capacitance and the lower quality of the loop and cable, especially for normal loops, this number is higher. It also goes to 3, although the automatic delay a little more than 25 can help stability, but it should be noted that if the condition of the loop and cable is such that the automatic delay is displayed from the range of 5. Go higher; There won't be a good chance for the small gold sense, and at the same time, the iron separation and removal may not perform well.3

After pressing the balance button, if the loop is disconnected from the device or has a connection, or due to the conditions of the circuit, it does not match at least; message**Coil error!**(loop error) is displayed and the operation of the device stops 3. In this situation, to continue working, it is necessary to solve the possible problem in the loop or even the circuit and then press the balance button again 3. Because the device performs automatic balancing after turning on; If the loop has a problem, the device will not work, and in this way, the possibility of damage to the circuit and the unnecessary consumption of the battery will be avoided. The circuit including the LF357 IC and its surrounding parts and the BS170 transistor and MOSFET and even the wrong program of the micro fuse bits. **Any basic defect in the circuit can lead to an error message! Coil Error 3**

Naturally, if the loop is close to the metal during the balancing, the delay may be higher or even the loop error will be announced3, so you should be careful not to place the device near the metal while balancing the loop3

It should be noted that if the loop device is changed while it is on; The device must be rebalanced by pressing the bottom button3, although it is recommended that the device be turned off or at least in the menu display mode when changing the loop.

Sensitivity: (Sensitivity) This setting, which actually determines the sensitivity of the device's receiver for Sense, is done by the left and right keys during exploration. 3 By pressing the left key, the sensitivity decreases, and by pressing the right key, the sensitivity increases, and at the same time, the degree of sensitivity appears on the screen. 3 values It can be adjusted for the degree of sensitivity from 1 to 25. 3. Lower values mean less sensitivity and range, and higher values mean higher sensitivity and more range. 3. The final value set may not be usable in that way; Because it needs zero noise and ideality of everything, which is never possible! But no matter how much the device and the environment are in better conditions; It is possible to adjust more sensitivity and get more range 3 otherwise the conventional range of pulsed metal detectors is obtained in the same degrees near the end of the sensitivity adjustment and also with good stability 3 Therefore, the maximum degree of sensitivity is not only in terms of the possibility of testing but also because it shows the range. Metal detection of this device is not limited in any way! It is necessary to mention that by changing the effective parameters in metal detection such as frequency and pulse width, delay and integral interval; In practice, the degree of sensitivity has a new meaning, and for this reason, it is necessary to adjust the sensitivity to a different degree, so that the metal detector works well3. For example, by increasing the pulse width or the integration interval, it may be necessary to decrease the sensitivity level in order to obtain a good result. The sensitivity setting of this device depends on other settings and is relative 3 It is necessary to mention that by changing the effective parameters in metal detection such as frequency and pulse width, delay and integral interval; Practically, the level of sensitivity has a new meaning, and for this reason, it is necessary to adjust the sensitivity to a different level, so that the metal detector works well3. For example, by increasing the pulse width or the integration interval, it may be necessary to decrease the level of sensitivity to get a good result. The sensitivity setting of this device depends on other settings and is relative 3 It is necessary to mention that by changing the effective parameters in metal detection such as frequency and pulse width, delay and integral interval; In

The important thing about the degrees of sensitivity adjustment is that, apart from the final degree; The difference in the range of the metal detector between each level of adjustment and the next level is not more than -2%! For this reason, even on sensitivity level 1, we will have approximately 35% of the final range of the metal detector, and this range will reach approximately 75% on sensitivity level 15. On the other hand, because the signal amplification in the internal receiver of this circuit is significantly higher. Most of the considered standard pulse circuits; In many environmental conditions and depending on the condition of the ground, the final few degrees of sensitivity may not be usable at all, and with a slight change in the distance of the loop to the ground, we may see an additional horn or a negative meter3. Therefore, keeping this example in mind, even a weak and suspicious target A fake that has a meter sense of 15 and may not reach the separation threshold will be able to be sensed on a sensitivity level of 12; There should be no insistence on using high degrees of sensitivity3. Therefore, if the goal of exploring a wide area and the sense is a definite goal with separation; The degree of sensitivity between 15 and 13 is more recommended, and high sensitivity levels should be used more for exploring special areas with

At the same time, increasing and decreasing the sensitivity of the device only affects the overall range of the metal detector (All Metal) and will not affect the range of the device.

Debug: By pressing the upper key while exploring, instead of the first line of writing on the screen, which is actually a summary of the device's settings; The first time the top button is pressed (debug 1) while displaying the integral sign; The amount of the total integral of the return signal that is being calculated is simultaneously displayed on the first line of the LCD! If the top button is pressed again in this mode, the second debug mode (debug 2) will be activated, which displays information related to The separation channel is A, B, C. 3 By pressing the upper key for the third time, the information related to the device settings will be displayed again in the first line. If the iron removal setting is active and touching ferrous metal, the sense sound will be interrupted3, so to have visual information related to separation during sense, the debug mode must not be active3

The display of the above values in the debug mode has no effect on the quality of metal detection and is mostly for testing purposes and bug detection 3. For example, the operator can check the amount of noise through the amount of fluctuations of the integral number, which is the main criterion of the sense, in the debug mode 1. 3 Setting a higher sensitivity depends on this. This number has more stability and less fluctuations. Therefore, friends can even check the various changes regarding the way the device is made and the issue of the shield and settings by monitoring this number to see what methods they can use to reduce the amount of integral fluctuations or noise. Minimize it 3 because it should not be forgotten that getting the final range from a metal detector depends on maximum removal of noise 3 Also by checking the numbers related to separation channels in debug mode 2, it is possible to understand to a large extent the correctness of the function of the separation part and the whole device, which in the section Another will be explained 3

The value of the number displayed only in debug mode 1 depends on the delay setting and the integration interval. Therefore, there is no specific numerical range for the debug number 1, and it is mostly the degree of stability and low fluctuation that indicates the optimal situation in terms of noise effect. Debug 2 communication between numbers. This setting is not unique and only the frequency and pulse width are slightly influential. 3

Explanation of the information on the LCD in exploration mode

In exploration mode, as long as the metal is not sensed or the sense is weak; On the first line, we see a summary of the main settings, which helps us to know what settings the device is working with. 3 Due to the limitation of display space, abbreviations are used for this purpose. S stands for sensitivity, D for daily, F for frequency, and P for pulse width. There are 3 numbers on the right side of these letters indicating the adjustment made for each of them

When the sense of metal is strong enough that the separation information reaches the initial level of validity; The first line has completely changed and instead of displaying the settings; The information related to the separation of the target is displayed 3. In this regard, first the ID text appears on the left side of the first line and then the separation number

3 If iron removal is active, the iron or non-ferrous target is indicated as FE or NON-FE, and on the right side of it, the level of the iron meter is displayed. 3 If iron removal is disabled, the word FERRO is displayed instead. And the degree of iron meter is displayed based on a fixed basis. 3 The content of the first line returns to the settings summary display mode moments after the metal sense is cut off. 3 Detailed explanations in this field will be provided in the relevant section.

If the top button is pressed during exploration; Instead of this information, the calculated integral figure or the information related to the separation channels (A, B, C) is displayed on the first line, which was explained in the previous section 3.

In the right part of the second line, the battery voltage is displayed, the accuracy of which is 531 volts. Errors exceeding this value depend on the error of resistors 11 and 25, and the voltage accuracy is 3 volts. He checked the two resistors and also the jumper under the micro. 3 By checking the displayed voltage of the battery, depending on the type of battery, you can find out how full and empty it is. 3 For example, for 3 series lithium-ion or polymer cells; The value of 21 volts means fully charged and 15 volts means the battery is completely empty. 3 If the battery voltage is less than 13, the circuit performance is not predictable and the stability and range will decrease. 3 If the battery voltage is less than 1433 volts; While displaying the message**Low Battery**on the left side of the bottom line; The sound reaction of the metal detector for Sense 3 will be disabled if the device is turned off in the left part of the second line of the message**Power Off**will be displayed and after hearing the special sound of the device, it will turn off 3

A number will indicate the strength of the sense of the metal. 3 The stronger the sense is, or in fact the metal is bigger or closer to the loop, this number will increase. reach a rough estimate about the possible depth of the metal and even the possibility of it being wrong 3. For example, if the meter number changes a lot by moving the loop up and down on the target point, it indicates a low target depth. The depth is greater. 3 Similarly, if a target is sensed in a wide area with a low meter, it can be a large metal indicator at a great depth. On the contrary, if the target's sense area is small and changes in the meter sense happen quickly, it shows that the target is small and shallow. At the same time, if in the area sense of purpose; meter sense does not have any special changes and does not reach its maximum number in the center of the target; It can mean an error and some kind of scattered particles in that area. 3 Another important feature that meter sense gives to the operator; It is possible to detect the target point more precisely, because especially in situations where the distance between the metal and the loop is quite large; Usually, when the metal is directly in front of the center of the loop, it is sensed more strongly, and in this situation, the meter sense will have the highest value3, but in the situation where the target is small and shallow, it may have a stronger sense near the sides of the loop than the center. Okay, so with this digital meter, you can pinpoint the center point of the target much more accurately and even estimate the dimensions of the metal better.

If the device encounters a hole or the loop is too far from the ground, and also sometimes after the metal sense is cut off; The sense meter shows negative numbers, which can mean that the device is momentarily out of balance or hole sense3. In this case, the device announces this issue with warning beeps every few seconds3. In this situation, if the ground setting is active, after a short period of time Again, the balance will be established automatically and the negative meter sense will disappear. 3 Although the meter sense scale is related to most of the settings, setting the sensitivity level will not have any effect on the meter sense number for a specific purpose. Sameness becomes sense 3

In the normal mode of exploration and in conditions where we do not have any sense of metal or holes depending on the total settings; On the left side of the bottom line, there are two signs (_) and (!) 3. In the normal state of the loop movement on the ground, it is normal to switch between these two symbols, especially on high sensitivity levels, 3 but in the condition that the loop is stable; Switching between these two signs will be a sign of noise! If the loop moves away from the ground or the device is close to the hole sense mode, before the negative meter is displayed, the sign (!) will be shown permanently 3.

Separation and removal of iron

Iron separation and removal system in this device by The channel is separate from the SENSE channel and was designed and implemented based on the technical information of Minlab and Lorenz metal detectors. Therefore, the most important point that may be relevant for most explorers is that the iron separation and removal part has nothing to do with the SENSE and the final range of this metal detector. And unlike many devices and circuits with separation; In this separation plan, the final range of the metal detector is not over, and whether the iron removal part is active or inactive has no effect on the range of the metal detector!

In this device, when metal is sensed; If it is close enough to the loop that the separation calculations leading to the result make sense and the device is not in debug mode; In the first line of the display, a 2-digit number between 5 and 11, which in fact**Target ID**Or there is a classification number in front of the text: ID is displayed 3. This classification number is based on Conductivity and is considered almost the same as Lorenz devices, so friends can refer to the subject of Target Classification in the Lorenz Deep Max X3 or X5 or Z1 booklet. and refer to the relevant table to evaluate the meaning of resolution numbers. 3 The resolution numbers in this design are usually displayed a little higher than the similar scale in Lorenz devices. Or the thickness of the metal has an effect on this number, and the type of metal affects it to a lesser extent. In fact, the bigger and thicker the non-ferrous metal is, the higher the separation number is. So, for example, we do not have a fixed and specific separation number for gold metal! But for large and solid gold, there is an expectation of a separation number above 75.3 Regarding iron, usually depending on the dimensions of the iron metal, a separation number between 5 is possible.

Unlike VLF systems, pulsed systems are not affected by the specific effects of sine waves on the target; Even very large ferrous metals will usually not have a separation number higher than 75 (depending on the device's construction) and therefore the separation and iron removal system for large metals in this device is more reliable than VLF systems.

The iron removal system works when the Iron Reject setting is active in the menu and based on a separate calculation formula simultaneously with the display of the separation number and if iron is detected; The sense sound of the device will be cut off at the same time after the word separation number**FE**3 is written to mean that the target is ferrous, but if the non-ferrous target is detected, the sense sound will continue and after the separation number, the phrase**FE NON**-It means that the target is non-ferrous. 3 In both cases, a two-digit negative or positive numerical meter is considered, which shows that depending on the setting of the degree of iron removal; To what extent is the sensed target located in the iron or non-ferrous area 3, so in the case of ferrous (FE) a negative number is shown on the right side, the more negative it is, the more metal is in the iron area 3 in the non-ferrous state Iron (NON-FE) is also displayed as a positive number with a + prefix, and the more positive this number is, it means that the metal is more in the non-ferrous region3, unlike the segregation number, which under different conditions is approximately shows the same number for each specific target; The iron meter is completely dependent on the setting of the degree of iron removal.3 Therefore, with several tests on different ferrous and non-ferrous targets and checking the condition of the iron meter, the desired iron removal degree can be set more precisely in the menu.3 In the iron detection mode, sometimes the iron meter may show a negative number. give But the device will announce that it is non-ferrous metal by displaying NON-FE and not interrupting the sound! In fact, the complete detection of the iron content of the target has other conditions other than the iron meter number, which is possible by other methods available in the device program, and therefore the most accurate result is what the FE or NON-FE display simultaneously announces to the operator and the iron meter It is placed only for more detailed examination and more assurance. Of course, at the beginning of the strong sense and with the separation of ferrous metal, a short beep is heard, which is completely normal. The sound is completely cut off and the word FE is also displayed. 3 If the removal of iron is inactive or OFF; We will not have the display of iron or non-iron and cut off the sound for iron, but instead after the word separation number In fact, the complete detection of the iron content of the target has other conditions besides the iron meter number, which is possible by other methods available in the device program, and therefore the most accurate result is what the FE or NON-FE display simultaneously announces to the operator and the iron meter It is placed only for more detailed examination and more assurance. Of course, at the beginning of the strong sense and with the separation of ferrous metal, a short beep is heard, which is completely normal. The sound is completely cut off and the word FE is also displayed. 3 If iron removal is inactive or OFF; We will not have the display of iron or non-iron and cut off the sound for iron, but instead after the word separation number In fact, the complete detection of the iron content of the target has other conditions besides the iron meter number, which is possible by other methods available in the device program, and therefore the most accurate result is what the FE or NON-FE display simultaneously announces to the operator and the iron meter It is placed only for more detailed examination and more assurance. Of course, at the beginning of the strong sense and with the separation of ferrous metal, a short beep is heard, which is completely normal. The sound is completely cut off and the word FE is also displayed. 3 If iron removal is inactive or OFF; We will not have the display of iron or non-iron and cut off the sound for iron, but instead after the word separation num

The separation range is about 85% of the final range of the metal detector for each target, which, of course, depends on the type of target, and the device itself determines whether the calculations are sufficient to announce the separation and removal of iron. Any metal that is outside the target's separation range and has a weak sense; The function of the metal detector will be All Metal, and the information of separation and iron removal will not appear, and only the diagram and sense meter and beep will show the unknown metal sense.

3. In this situation, the appropriate iron removal degree is equal to 155 minus the FERRO number divided by In addition, there are 2 and 3, for example, if ferro is 51 for iron; The appropriate iron removal degree will be approximately 13.3 If the iron removal degree is set more than 2 degrees higher than the desired level, other non-ferrous metals will be removed gradually! Therefore, one should be very careful in choosing the degree of iron removal.3 Of course, due to the possible difference between different loops, you should remember the degree of iron removal suitable for each loop and adjust the iron removal again after replacing the loop. The condition that the loop is located at the normal distance of the exploration to the ground should also be done so that the conditions of the ground are also taken into account and the result is more reliable3. In this case, it can be hoped that more than 85% of iron wastes will be removed with accuracy.3 Of course, other than removing iron. by device; At the same time, the separation number will also help 3 Therefore, one should be very careful in choosing the degree of iron removal.3 Of course, due to the possible difference between different loops, you should remember the degree of iron removal suitable for each loop and adjust the iron removal again after replacing the loop. The condition that the loop is located at the normal distance of the exploration to the ground should also be done so that the condition of the ground is also taken into account and the result is more reliable3. In this case, it is possible to hope that more than 85% of iron waste will be removed with accuracy.3 Of course, other than removing iron. by device; At the same time, the separation number will also help 3

Another way to detect iron is to set the option to remove iron to OFF and based on the number of FERRO, the operator can speculate about whether the target is ferrous3. OK, it can be concluded that the values   above 35 are close to iron and below 35 are non-ferrous. Of course, at the same time, one should also pay attention to the separation number or ID, because the separation number of ferrous metals is not less than about 5. or more than about 75. The values   mentioned as examples They are dependent on the coordinates of the device and loop used and must be evaluated before exploration. 3

Unfortunately, some metals that are not completely ferrous cannot be reliably removed3, for example, tin is undetectable due to its tin coating, and there is almost no chance to remove ordinary tin cans3, although the old and rusty types inside the soil can be removed with a good chance. There are detection and removal. 3 types of steel can be removed depending on the type and amount of iron, but some types of steel cannot be removed. Fortunately, most of the iron waste, including nails and chains and parts of agricultural tools, which are completely iron, can be easily removed by the iron removal system. detected and removed 3

In working with the separation and removal of iron, the correct operator has a great effect! For example, the fast movement of the loop on the target can cause the device to make an error in separation3. Therefore, after a target is sensed and the separation information shows that the metal is within the separation range; You should keep the loop slowly on the center of the target, i.e. where the meter sense shows the highest value, for a few seconds, so that the device reaches a fixed number as a separation number based on more calculations, and detect iron more reliably. The angle and the way the loop is positioned relative to the metal has a little effect on the result of separation; It is possible that the resolution information from different angles and on the sides of the target may be slightly different3, although this issue can lead to a better evaluation of the target, but the resolution information on the center point of the target is always more important3. Separation should not increase or decrease the distance of the loop from the ground!

3. On the other hand, the system of this device is designed as much as possible to detect separation information in the high range. 3 So if the metal suddenly gets too close to the loop or sticks; The resolution channels are loaded and there will be no correct information about the resolution number or detection of the iron target 3

In order to make a correct conclusion, especially for the iron removal part, the device itself must have the right conditions! In the main circuit part, the IC LF357 or other numbers that were mentioned is the most important issue, and also the health of the capacitors 3 pico and 232 micro and MOSFET are important.3 In the loop part, it is also very important that the daily automatic loop is around 25. An example of a loop that has a delay greater than 5. OK, it can't have a very favorable result for the separation.3 Therefore, it is recommended to follow the specifications of the proposed loop and also make sure to use the appropriate connection cable and connector for the loop.3 In the initial tests, you should pay great attention to choose a place in the home environment that really contains metals. Different types should be far away from the loop, otherwise the iron removal system will not work properly. 3 Although in almost most situations, you can get a good result with the iron removal degree option, but in the natural environment where there is no interfering metal; It is necessary to re-adjust the level of iron removal. 3 If the above issues are not met, the iron removal part may not remove any ferrous metals or, on the contrary, many non-ferrous metals may be removed as well!

If, for any reason, the iron removal section did not provide an acceptable answer on any of the levels specified in the menu; It is necessary to set the Iron Reject option to OFF to disable it. 3 Although in this case we will not have iron removal, the separation number can still help to speculate about the type of target to some extent, and at the same time, the meter in front of the FERRO term may also help. It will help 3, although in such a case, this meter will not help much by displaying very low or very high numbers. Therefore, it is strongly recommended to fix the problems in the circuit or loop in such a way that the iron separation and detection system works reliably.

The separation and adjustment system of iron removal depends a little on the frequency and pulse width adjustment! But the difference in the degree of iron removal will not be more than one degree.3 But the settings of Delay, Integ.W, Ground, and Speed have no effect on the separation or removal of iron because they are only related to the sense channel. Therefore, it is better to select the frequency and pulse width first. He decided depending on the exploration conditions and then tested the iron removal setting 3

To check the correctness of the separation system for each device; The second debug mode is considered 3 in such a way that by pressing the up key twice during exploration. The number is displayed next to the letters A, B, C, which contains the separation information. There are 3 channels according to the sample of the tested device**In case there is no metal near the loop**; These numbers should have approximate values of A300, B700, C800. 3 Exact numbers are not considered at all, and a slight change is made in these numbers by changing the frequency and pulse width. And if the difference is too big, it indicates the basic problems in the circuit and probably IC 37. or loop or even MOSFET3. For example, the number A must be between 255 and 455 and preferably between 235 and 35. so that the iron removal system can be on one of the levels Available in the menu, give a good answer. 3 Also, the number B should be about 2 times the number A or a little less or more.**The approximate correctness of the numbers mentioned next to Daily Automatic about 25 shows the correct operation of the whole device**It will have both IC 37 and MOSFET and loop, and there is no need to test the shape of the waves with an oscilloscope! If in the state of metal sense this. If the number is checked, they will naturally have lower values. Also, placing the loop on the floor of the house or near the wall that has metal materials will lead to a decrease in the mentioned numbers, especially the number A. Therefore, it is strongly recommended before placing the loop near any surface first from Make sure there is no metal behind that surface!

Naturally, the problem of noise also affects the quality of resolution! The better the normal stability of the device for SENS, the more accurate and stable the performance of the separation and removal of iron will be. 3 If there is noise in the environment, the separation may not have accurate results at long distances. 3 The sign of this problem is that the separation number changes frequently It can be done! The more stable the separation number is, the more reliable the result of separation and especially iron removal is. 3 Therefore, in a situation where the separation number constantly changes by more than 3 units; The removal of iron is not reliable and in this situation, it is not possible to be sure of the disconnection and connection of the horns, which is a sign that the device is hesitant to detect iron3.

Another problem is that reducing the sensitivity of the device on the separation board is not effective in any way! In fact, the sensitivity adjustment is only related to the metal sense channel3, so practically, on sensitivity levels of about 15 or less, the separation is expected to be done almost simultaneously with the metal sense, and in those conditions, the separation range can be equal to the metal detection range of the device.

Another point is the difference between the separation range and the final range for different purposes. The larger the metal and the higher the separation number, the faster the separation is activated, and on the meter sense, it is activated less and weaker. Therefore, for valuable burial purposes that have a high separation number, even the separation range is possible. He considered about 15% of the final win for that goal! On the contrary, for very small targets or thin metals that have a small separation number, the separation will be activated later and the separation range will be less.3 Therefore, when faced with a special situation where the meter sense shows a strong sense of a target, but unlike usual, the separation system has not been activated yet. ; You can easily guess that the goal cannot be something valuable! In contrast to the 85% accuracy of the iron removal system; The issue that goals with a separation number below 25 cannot be something valuable is a more definite issue3

The important issue regarding the trust in the iron removal system is that in certain situations where several different metals are present in the soil with specific placement conditions, there is always a possibility that the device will mistakenly announce the removal of iron3, so the level of trust and the possibility of accepting a 25% error It is expected that the iron removal system will be the responsibility of the operator in terms of the risk of not losing a valuable target.3 From this point of view, in this plan, the issue of iron removal has been tried to be considered a little stricter, and therefore, if iron removal is active in the menu, again We will always have a short beep at the moment of initial sense of iron, and the operator can pay attention to the separation information on the screen and make a decision.

However, regarding how to balance a metal detector depending on the conditions of the environment and loop and the method of exploration; The experience of the operator is the first word; However, I will explain the recommended method for balancing this device 3

In the case that the Ground setting is active, which means that automatic matching with the ground and environment is active; It is better to place the metal detector loop at the same distance from the ground where the exploration is to be done, and press the balance button and start the exploration after a few seconds.

But in the case that Ground has an OFF value and is actually inactive; Due to the lack of automatic adaptation to the ground; The balance with the ground has an experimental mode. 3. On the ground where some sense can be seen by bringing the loop closer to them, it is better for the ground mode to be turned off; The loop should be taken a little closer to the ground than the normal mode of exploration, and then the balance should be done, and then the loop should be taken a little higher and continue the exploration 3.

At the same time, always at the moment of balancing every metal detector, one should pay attention to the basic issue that the operator must balance the metal detector where he is sure that there is no metal! Otherwise, the balance was done incorrectly due to the presence of hidden metal in the soil, and therefore, after moving the loop on the ground, a negative meter is displayed and the device goes out of balance. And one should move away from the desired area a little and rebalance the device and then continue exploring 3

The important thing in exploring with any metal detector is the proper distance between the loop and the ground. Based on the research and tests, the minimum distance between the loop and the ground should be approximately 3 cm for every 5 cm of the loop size! For example, for a 5. cm loop, the minimum distance is 3 cm; For loop 55, a distance of 15 cm; A distance of about 25 cm for a 1-in-1 loop and about 45 cm for a 2-meter loop is required from the ground in order to minimize the effect of the ground on the metal detector sense and to have more stability and better separation3, especially in situations where the loop of the device is slightly shaken from The balance is withdrawn; It is necessary to observe this distance more. Naturally, considering the increase in stability, we will not have a loss in range, and the effective range of the device may even increase! Otherwise, taking the loop closer to the ground will cause many problems regarding instability; Noise and sensitivity to earth and salts will cause the separation accuracy to decrease, and the distance that is more than necessary will obviously lead to a loss of range.

Therefore, the operator should scan the desired area with the metal detector in such a way that the loop of the metal detector is always parallel to the ground and as much as possible by maintaining the appropriate distance from the ground. This method of moving the loop has 3. Naturally, when using large loops, the movement on the ground should be slower, and the up and down of the loop should be avoided as much as possible. And according to the size of the loop and even the physical characteristics and height of the operator, he does not have the necessary fit; It will be much more difficult to maintain the distance and keep the loop parallel to the ground3, so it is strongly recommended to take help from the images of reliable and famous metal detectors in making the skeleton of the device3

In order to reduce the sensitivity of the metal detector to the ground, humidity, and salts, there are certain points that must be taken into account3, apart from the problem of the proper distance of the loop from the ground and the maximum effort to maintain this distance, which was explained; In order to increase the stability while exploring, you should also pay attention to the settings. 3 In this regard, the most important setting is the Delay setting, usually the higher the sensitivity to the ground, the lower the sensitivity to the ground. If the Daily number is above a certain limit, it will gradually reduce the range, especially for smaller metals. 3 Also, the pulse width should be set to a minimum number that includes the maximum range for large metals! Therefore, the pulse width more than that limit is not appropriate and will only cause more sensitivity to the ground and an unnecessary increase in battery consumption. 3 Lower frequencies are naturally a little more suitable for less sensitivity to the ground and better penetration in the soil. However, the frequencies of 155 and 255 It is a very good result to bring along 3 also for lands that have very diverse and variable soil; If the Ground option is active, it is better to use lower values. Although lower values of ground will reduce the range a little, but it will be more stable. On the contrary, for lands with more suitable and uniform conditions, a higher range can be achieved without any problems. There should be stability. 3 Also, if due to the operator's reason, he cannot properly observe the distance between the loop and the ground; Decreasing the Speed setting helps the device to not have extra beeps during the up and down moments of the loop.

If during the exploration by bringing the loop closer to the ground, the sensor can be seen with separation; It shows that the ground conditions are not suitable3, especially for wet or saline soils, the higher the separation number (ID) related to the soil sense, it is a sign of higher conductivity of the soil and the ground is unsuitable for metal detection.3 In these conditions, it is better to first place the loop at a greater distance from the ground He took into account the points mentioned about the settings and then began to explore. 3 If possible, he chose a time for exploration when the land in the area in question is drier, and a better and stronger result is obtained. Using large loops works better 3

In a situation where digging is done on a pit or hole, special methods must be used that require more experience3. Therefore, it is recommended to dig a pit for a purpose before proceeding; The sense and separation information should be evaluated carefully and patiently, and then a decision should be made to dig 3. Otherwise, to explore inside the pit, you should use smaller loops than the hole, and first balance the loop on the wall, and then continue the search inside the hole. 3 ways There is another way to use a magnifying glass that is significantly larger than the hole itself. 3 Otherwise, due to the presence of a pit that has the form of a hole and the effect is a metal image; Depending on the type of soil, the range may be reduced or the metal detector may be out of balance3. Similarly, if the initial sense of the target is weak, not only the negative effect of the pit will show itself more; Rather, it is possible due to hitting and partial movement of the intended target during drilling; The effect of the aura that increases the power of the sense will be weakened, and after digging the hole, it will be practically nothing Do not see sensei! Therefore, for weak targets, more and more careful investigation should be done before digging.3 Based on experience, this is one of the special cases that cause the target not to be sensed after the preliminary digging, and explorers sometimes without knowing the subject; They raise the issue of changing the place of burial due to the presence of a special spell, while the main point of the matter was the point that was mentioned!

Allergy to gold

Usually, there is a common question for most explorers that how sensitive is the metal detector to gold?! Either they say that a certain circuit is not sensitive to gold, or on the contrary, it is very sensitive! It must be said that it is fundamentally not correct to state such a problem from a scientific and technical point of view, because first of all, it should be noted that the issue of small gold, which has a small conductivity and a short time constant, is completely different from large gold. No, 3, but small gold naturally has a weaker sense, and for a better sense, you need to observe special settings and also a suitable loop. 3 The main problem in the initial tests is that, due to the high price of gold, pieces are tested, even if they are of any gender, by a metal detector. They don't feel the pulse well!

But for the sense of small gold, there are some things to consider. 3. First of all, the type of loop is important. 3. The loop used for sense of small gold should have a low delay and be a so-called fast coil, so that small gold, which has a short time constant, can be sensed well. 3 types of flat or spider types of loops are suitable for this purpose, and naturally, for the sense of small metal, you should use a small loop size, such as 25 or 5 cm, otherwise it is normal not to sense a small metal with a large loop. Small golds help 3, for example, high frequency and pulse width of about 135 or even less, low manual delay and of course high speed are all things that cause a better sense of a target like small gold 3, so if the probe has such a goal, these points should be included. be observed and the situation will be completely different from the sense of big goals with big loops 3

There are two other subtle points in gold exploration. 3 First, gold has been a valuable metal since long ago; In the same proportion, the possibility of its presence in different places is less than other low-value metals! Although this issue is contrary to the desire and mentality of an explorer, it is completely consistent with reality. 3 The second point is that gold, in terms of its physical nature, is less ionized than many other buried metals, and therefore the aura that can cause its stronger sense It is not as strong as other metals! This is also one of the characteristics of gold metal and it is one of the factors that made gold metal valuable3, while it is expected for most of the buried old metals due to the presence of the halo effect; Their metal detection range is 133 and sometimes even up to 2 times higher than air tests, but you can't expect this for gold, and finally it may be sensed a little stronger than air tests. The halo effect increases the range and you can expect more range than usual 3

Allergy to clay and some non-metals

An important point that the explorer must pay attention to when working with any metal detector is that basically all types of metal detectors are used regardless of the type of technology used; Metal is sensed based on its electrical conductivity3, therefore, any technique or detail that is used in the structure of different metal detectors cannot go beyond the scope of this general rule, otherwise, naturally, it may not sense some specific metals or the range of the metal sense will be greatly reduced. arise! Therefore, advertisements that are often seen regarding the insensitivity of metal detector products to pottery and the like are not true in general.3 Some types of pottery are detected by all metal detectors and some are not detected by any metal detector. Metal detectors in the world can be found 3

According to the above explanations, this is the reason for the sense of the earth being wet and full of salts, which has electrical conductivity and can practically pass the electric current through itself. 3 This issue and how to deal with it was explained in the previous sections. 3 Also some types of pottery (not all types)) especially if they are located in wet soil, they may have a similar sense to a metal3, in fact, it depends on the materials that were used in making that clay, and of course, wet soil also strengthens its conductivity effect3, some clays that have Sens are strong, they may have a separation number between 35 and 55, which can help to speculate about the sens of clay3, although this separation number is also related to a large group of metal targets, and it cannot necessarily be concluded that the sensed target must be clay. 3 Therefore, recognizing the sense of pottery requires a high level of experience. It is possible to reduce the frequency and pulse width and increase the delay lead to a weaker sense and even eliminate it 3 also in places where there is scattered pottery unlike metal targets; Sens is not well centered! It means that it is possible despite the existence of Sens in a large and large area; The meter sense number does not increase gradually from the sides to the center of the target and it increases and decreases 3. This problem can be a sign of scattered particles such as crushed pottery.

Also, in some environments, there are stones with metal particles that are detected by a metal detector. Some types of these stones have relatively strong detection. Fortunately, if these particles are magnetic and the so-called iron ore is the target, the iron removal system will remove it well. It can be recognized and removed 3

Basically, one of the ways to detect errors while exploring an area is to pay attention to the repetition of the separation pattern3. For example, if a target is sensed in an area and after digging it is determined that it was an error; It is possible to remember the resolution number as well as the degree of iron meter and if the same resolution characteristics are observed in the sense of another target near that place; It can be concluded that there is probably a similar error and therefore additional digging is avoided 3

Cavitation

Although the main use of metal detectors is to sense metal, and they cannot detect metal well; But under certain conditions, this metal detector can also be used to sense holes! Therefore, in this device, meter sense is considered as a sign, and just as the positive numbers of the meter are a sign of metal sense; Negative numbers can also be a sign of the presence of a hole.3 The technical reason for the difference between a hole and metal is the problem of different conductivity compared to soil.3 Just as metal is much more conductive than soil; The hole also has photo mode3, so it is possible to recognize the hole in some conditions and depending on the type of soil and device settings3

For cavity detection, as opposed to metal detection, we need to make the metal detector sense the effect of soil more so that the difference in return waves for places where there is a cavity can be evaluated more.3 Therefore, using a lower delay and a higher frequency and pulse width will work better for cavity sensing.3 Also because that we intend to evaluate momentary changes with meters; It is better to deactivate the ground setting as well.3 In fact, the ground setting is useful for metal detection mode, especially on high sensitivity levels; It doesn't work well for the hole detection mode. 3 In such a situation, if the metal detector announces a sense when the loop approaches the ground and actually senses the presence of the ground well; There will be a good chance to sense the hole3, otherwise it is unlikely to sense the hole in that land, and such a land is much more suitable for metal detection than hole detection3

By considering the above and paying attention to the increase in the number of negative meters at a certain point of the ground, it is possible that there may be a hole in that part. The speed of warning horns increases 3

In some situations, the difference in the soil of an area compared to the surrounding area may cause a hole condition for the metal detector3, for example, places that have softer or looser soil than the surrounding area, or wells and holes that are filled later usually show a weak hole condition of their own3.

In cases where before the metal sense, the negative meter is first displayed, which is a sign of a hole, and then the device announces the metal sense; It is usually a sign that the metal may be inside a larger cavity! Therefore, in this situation, the device will first announce the existence of a hole and then the metal will be sensed 3

Final points

Since the basic issue for almost all metal detector enthusiasts is; In the design, this issue has been given a lot of attention3, by mentioning this important point that by reducing the effect of noise, you can achieve a greater range3, so the part related to removing noise in the form of two filters in the circuit and several filters and special software algorithms in the program of this design 3. Therefore, there is nothing left to discuss except the quality of parts and assembly, skeleton and loop. 3. In terms of range with a 25 cm spider loop in the home environment and without a shield; 355 Toman coin up to 3 cents and copper fiber 13 x 13 to 85 cents and one gram gold coin up to 17 cents and all spring coin up to 2 cents sensed! Also, with a 55 centimeter loop in open space, a 355 Toman coin can be sensed up to 55 centimeter and a 13 centimeter copper fiber up to about 135 centimeter. Loop 5. cm about 175 cm; Loop 43 cm, about 234 meters; Loop 55 cm maximum. Meter ; 1 in 1 loop, finally 433 meters; Loop 133 x 133 will be a maximum of 5 meters and loop 2 x 2 will be 8 meters at the end.3 Of course, the final range of each loop for metal is the same as the size of the loop or larger and is obtained at high levels of sensitivity. For the new metal buried in the soil, we may have a slight loss of range, but for the metals that have been buried in the soil for decades due to the halo effect, the result will be even 133 times higher than the air test! Little improvement in this result or constant achievement of such a range depends on the quality of the loop; appropriate settings; build quality; It also has a shield and noise reduction. Of course, in the natural environment, 35 Hz noise, which has the most destructive effect, is greatly reduced. But at home, the 35 Hz noise is strong, and the loop easily receives this noise, and despite the presence of the filter, it is still to some extent. It is strengthened by the circuit! The most interesting point is that if the loop is vertical, according to the information of the scope, the noise is at the limit of 35 Hz. decreases by !!! Of course, provided that there is no electrical device in front of it3, but if the loop is horizontal and actually parallel to the floor and ceiling of the house; We will have a stronger 35 Hz noise, which is normal due to the city's electrical wiring system in the building. 3. Another point is that naturally, the larger the loop, the more noise it absorbs! This issue is in addition to the fact that the range of larger loupes is greater and usually different metals are used in the construction materials of the floor, ceiling and walls, and there are also household items; It actually causes that no metal detector with a loop larger than 5. cm can be tested well in the indoor environment3, so for larger loops, real testing must be done outside the home environment3 Failure to pay attention to this point can reduce the apparent range for large loops in the home environment and also the separation part not working properly and even disrupting the balance of the device and encountering a loop error 3

Fortunately, unlike 35 Hz noise regarding high frequency noise and radio waves; In this design, the relevant filters work much better and unlike some other circuits, we will not have high frequency and radio noise here.3 Therefore, the most important problem in the field of low frequency noises, especially 35 Hz, is again in this circuit compared to most existing circuits. Most deleted 3

As you can see, the hex file of this metal detector has a relatively large volume and contains thousands of program lines; Moreover, the features of the device also speak for themselves. Therefore, there is a possibility of minor changes and modifications in almost all parts, which will be done over time and new features will be added. All this and the speed of progress of this project will depend on friends who are Cooperate and help the project to be in a higher position by making the device and giving opinions and expressing the results of exploration and suggestions and constructive criticism. Of course, the final result is something that they will benefit from. in the past ; Avoid interfering with the circuit part as much as possible, and if you think there is a real mistake somewhere in the circuit, let me know privately so that I can investigate the matter. 3 Therefore, this is one of the reasons for not publishing the schematic of the circuit! However, the circuit part of this design is simple and everything has been carefully calculated and tested until the best solution has been reached and there is no room for fundamental mistakes in the circuit.3 This is also true for the fiber circuit design and even some manipulations in this field. It may cause the device to malfunction! Those who may think that this plan is not good and want to start disrupting the project path as usual, either out of jealousy or enmity or competition and personal interests; This time, I will tell them that this is my personal design! You have something to do with your work and plan and project in any way you see fit. Otherwise, no other non-technical approach will be acceptable from my point of view. I wish success to all my friends. Those who may think that this plan is not good and want to start disrupting the project path as usual, either out of jealousy or enmity or competition and personal interests; This time, I will tell them that this is my personal design! You have something to do with your work and plan and project in any way you see fit. Otherwise, no other non-technical approach will be acceptable from my point of view. I wish success to all my friends. Those who may think that this plan is not good and want to start disrupting the project path as usual, either out of jealousy or enmity or competition and personal interests; This time, I will tell them that this is my personal design! You have something to do with your work and plan and project in any way you see fit. Otherwise, no other non-technical approach will be acceptable from my point of view. I wish success to all my friends.

December 1.1 - Mehr 1.13 - Specialized metal detector and tracer metallurgical association - Hamid

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