

Felzjo pulse metal detector (FPI) - version 3.3

Resist it

R1, R17, R21	1K
R2, R16	47 ohm
R3	10K
R4, R14, R20	4.7K
R5, R18	2.2K
R6, R15	10 ohm
R7	1.5K
R8	1.8K
9R	(one megaohm) M1
R1	100 ohm
12R 11,R	Carbon or metal film with low thermal error - (2 watts) W2 - ohm
R13	390 18K
R19	22K

* All resistors except resistors 11 and 12 are of 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

* The low thermal error of resistances 11 and 12 is important3

capacitors

C1 10uF-16v	Electrolyte
C2, C3 18pF	lens
C4, C5, C7, C8, C9, C14, 100nF (154 codes or (small lens	
C18, C20, C21, C23, C26 100nF (154 codes or (small lens	
C6, C12	100uF-16v (157 code or (tantalum
10C	High quality lens (or 437 or 335 picofarad) pF5
11C	(or code 223) v-16uF2.2 High quality tantalum
C13, C17, C25	470uF-16v electrolyte
C15, C16	4700uF-16v electrolyte
C19, C22	1000uF-16v Electrolyte
C24	2200uF-25v electrolyte

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

* It is forbidden to use a capacitor with a working voltage higher than the mentioned value, but a capacitor with a lower voltage should not be used in any v

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-

layer3. If MKT or polyester capacitors are used as lens capacitors, their role in the circuit will be alm

* 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 specific negative pole; Usually, their positive pole is marked as +3,

if you don't see the + sign in these capacitors; The solid color bar next to the base (only for tantalum type) indicates the positive base and

also usually in all capacitors with polarity; the length of the positive base is

If using a battery with a voltage of more than 24 volts; Capacitor 24 should be considered 3.3 V type

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

Transistors

1T	(no extension) 170BS be be original
2T	original (MOSFET - no extension) 840IRF
T3	BC337

ICs

1 U	(microcontroller) PU-P328ATmega 28-pin dip type, not fake
U2	LF357N LF357H metal , LF157 , LF257(
3U	High quality 3 volt regulator CV7805L 12 volt 133
4U	amp high quality regulator + small and strong heat sink CV7812L

Other parts

X	MHz20 (20.000000 or 20.0000 or 20.000) 25 MHz crystal
D1, D2	1N4148 diode
D3	1N5819 diode
LCD	LCD character 15 x 2 with backlight - preferably green color 2x15
SP	piezoelectric speaker with two wire frames or
ONE	headphones rechargeable battery 18 to 24
LOOP	volts - 2 amps probe loop (recommended) spider - ohm 1 -
S	uH.35 3 keys High-quality push-button that can be installed on the box (normal disconnection mode
PCB	and push-on mode) fiber suitable for ironing - preferably made of high-quality fiberglass - 7.9 x 7.3 cm

8-pin and 28-pin (narrow) military sockets for ICs 1 and 2

Small and powerful heatsink for 7812 regulator and MOSFET if necessary

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 headphones

A suitable box preferably non-metallic and non-metallic frame

Explanation about some parts

* Manufacturing cost: The cost of the circuit part of this device (apart from the battery, loop, box, and skeleton) is not more than 25 dollars! We have tried to make all the parts used to be the best common parts in the market that can be found at least in several parts stores. It doesn't impose any cost or trouble on anyone, and those who might be planning to build it with their friends should pay attention to this point so as not to make

Do not place 3

* Resistors 11 and 12: The thermal stability of these resistors, because they gradually heat up during operation, it will affect the stability of the device, especially when the ground setting is inactive. 3 Therefore, any resistor between 85 and 455 ohms is 2 watts, provided it has a thermal error . **fewer ; It works better than 15 ohms 3% which is common in the market.** The exact initial 3 ohms of these resistors is not important and simple testing with an ohmmeter does not have the thermal stability of the resistor! According to the conducted tests, the 1% .85 or .15 ohm type available in the market in terms of thermal stability is not significantly different from the 3% type, and only if you have access to more accurate types such as 531% 2 watts, you can get noticeably better results. 3 These types of resistors They usually have 5 color rings and their thermal stability The use of the 15 ohm 3% common type in the market does not cause much problem, 3 as well as the use of resistance. wattage is a hindrance.

However, brick or wire resistors should not be used for these two parts, and the material of these resistors should be carbon or

* IC: 1 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 compared to lower-end microcontrollers. Other existing 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 must have an AVR programmer with a USB interface and preferably of the Use USBasp and do the program by yourself. 3 AVR Multi programmer produced by ECA Iran is a cheap and good example

It has been tested and works well with the AVR-Burner eXtreme 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-amps for amplifying the receiver signal for this circuit have been selected among many numbers of good and common op-amps in the market and have given the best results in all tests. 3 Therefore, friends should not change this number because the software calculations, especially for the separation section 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 will be a lot of incorrect iron removal. There is a fake 357LF IC in the market that will not give the correct answer, and its symptoms are low range and resolution. Fortunately, if this IC is fake, it will not damage the micro. But only the Instead of plastic N357LF, H357LF, which is a metal type, can also be used, 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 157LF or 257LF, 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 a fake and unknown IC to work properly. IC 157MAC can also be used, although its performance quality is not as high as the original 157LF3

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 metal IC from above, the left leg of 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 (toward 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. 840IRF has a maximum voltage of 355 volts, and its maximum voltage is also used in this circuit, so it is slightly superior to number 745IRF, 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 setting in this device. 3 Among other numbers that give a good answer and are compatible with the separation section; 1555V MOSFET is 100NK11, but the result is not much different in terms of range. Also, some types of IGB can also be used. Due to the presence of high voltage, the output of the loop or even 2W resistors should not be touched 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 amount of MOSFET heating is not high at all3, so only if high frequency conditions or especially high pulse width are used; It is recommended to use heat sink for MOSFET both for better performance and very small range! If the MOSFET is defective or vice versa, the device may appear to work properly and only have a

And the stability of 3 and 12 volts in this circuit plays a fundamental and decisive role; It is necessary to use high-quality regulators * Regulators: because it is used carefully, the 7853 regulator does not need a heat sink, but on the contrary, for the 7812 regulator, a small, multi-pronged and strong heat sink must be considered, because it produces appreciable heat even in normal conditions. Of course, this regulator can withstand high temperature. 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 high-powered speakers3, so if you use a speaker 8 small ohms, the power of the speaker should be at least 532 watts, or the volume setting of the device should not be set too high, otherwise there is a possibility of damage to the speaker! 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 frame3, in addition to this, the use of headphones is also prohibited. It is too strong, you can put a 155 Ohm resistor 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 VCO. Due to the presence of tone 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 under a lot of pressure. Therefore, if you use a normal speaker in this situation, you should connect a resistor of 155 ohms 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 normal lithium-ion. 3 If you use lithium types, at least 3 cells and at most 5 cells in series are required, and if 4 cells are used, due to the voltage dropping below the limit required for the circuit to work on the charge, it is less than 35 percent; Half of the charging capacity of these batteries will not be usable! If any type of battery is used, it is better to use its own automatic charger so that the batteries are charged properly and the problem of battery failure does not occur later. It is directly dependent on these two settings 3 to the extent that by reducing these two settings, the current consumption of the device will reach 35 milliamps, and by increasing these two settings, the battery consumption will be several hundreds of milliamps! In general, it is recommended to use 2 amp batteries, because with this amp battery and the default settings of the circuit, it works well for about 13 hours, which seems quite appropriate. There is no problem in using a higher amp battery, but there is no advantage except that the device lasts for a longer period of time. It works and has no role in stability because the power supply of the circuit is completely regulated³, but a stronger battery imposes the problem of volume, weight and more cost, which, especially considering the smallness and cheapness of the circuit itself, may destroy these advantages to some extent! However, if you need to constantly use a high frequency or pulse width due to the noticeable increase in battery consumption; It is recommended to use a battery up to 433 amps. Also, the higher the voltage of the battery, the higher the heating rate of the 7812 regulator will be and the more energy losses will occur. and therefore, in this case, the capacitor 24 of the 3.V type should be considered

If the battery voltage drops below 1433 volts; Because the circuit will no longer function properly; While displaying the Low message Battery, 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 no way to damage any part, including this diode itself, by connecting the battery in reverse!

* Loop: The probe loop that worked in the tests is of the spider type with a capacity of about 35 micro-Henries and a resistance of about 1 Ohm. However, due to the possibility of adjusting the pulse width and delay; It is possible to use a wide range of loops, so the exact capacity or resistance of the loop for this The removal of iron is not very important in the part of separation and design. 3 It is recommended to use a spider loop or a flat one to get a stronger result and have a better performance. 3 An 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 forum. Fellezjo has been discussed. Also, some corporate loops, especially the 18-inch mono loop of the commander of Minlab GPX series devices (mono type only) can be used for this device and it has given a very good answer.

The lower the number the automatic delay device finds for the loop; That loop is especially suitable for small gold sense to remove iron; It will be daily, and at the same time, the stability of that loop against particles will also decrease³, but for the proper functioning of the separation and automatic part, it is important to be around 25 and if the daily loop is much higher than this, the separation part may not work well.

If the 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 it causes instability and even a problem for the separation section. 3 Therefore, a slightly higher automatic daily loop is better for exploring on the ground in terms of stability. How much depends on the quality, 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, if 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. There should be no metal near the loop. 3. It is recommended to use sieve wire as much as possible to make the loop.

Naturally, the shielding of the loop is important considering that 85% of the noise enters the circuit through the loop itself, and in this context, covering the loop with a screen coated with graphite spray or high-grade graphite pencil ingot will have a positive effect³, but shielding the loop with aluminum foil It doesn't give a good answer and it reduces the range of the metal detector 3 unless a kind of very thin conductive coating is used, which itself as a metal is almost The metal detector cannot be sensed! There is something like this in the form of sandwich paper or some gift paper or kitchen labels in the market that can be used 3 Of course, the conductivity of at least one side of these paper sheets is necessary and should be tested with an ohmmeter on these paper sheets, and if it shows a small ohm, it indicates that it can be used. Otherwise, it has no effect. 3 In the case of the graphite shield, this test must be done with an ohmmeter, so that the graphite-coated plate has a resistance of less than 1 kilo ohm per centimeter. 3 If the resistance is higher than this, the graphite shield will not have a noticeable effect. The effect of this type of shield is to reduce ground effects³, therefore, the existence of a shield for the loop, although it may not show a positive effect in air tests, but it will definitely have a positive effect for working on the ground³, for this reason, most of the reliable corporate loops use graphite shields³

The cable connecting the loop is also very important. One of the ways to connect the loop of this circuit is to use a high-quality stereo shielded cable that connects two cores and LOOP1 to the two cores of the cable and has a shield on both ends on the other side. LOOP2 loop points must be connected and the shield of the cable is connected to the shield point on the circuit, which 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 cover. Find 3 other ways to connect this

The type of stereo shield cable is connected to the circuit in such a way that the two cores inside the cable are connected at the beginning and end and are connected to the LOOP2 point, and the cable shield is connected to the LOOP1 po

The best way to connect the loop is to use a high-quality coaxial cable, such as Kerman or Mazandaran antenna cable or 59RG or 58RG with a core and copper shield and wit

There is a foil, in which case the core of the cable must be connected to the LOOP2 point and the cable shield must be connected to the LOOP1 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 impact of noise, it is better to connect the wire that comes from the inner part of the loop to the core of the cable and the wire that comes from the outer part of the loop. Connect to the cable shield 3

The important thing about connecting the cable shield to the graphite cover or the conductive cover 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!

It should also be tested whether the device reacts as a metal sense or a negative meter by bringing the metal close to the cable itself or shaking the cable (without touching the hand). If this reaction is noticeable, the cable is not suitable or Cable connections and related connectors

It 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. A high-quality plastic pin is recommended. 3 One of the best connectors tested is the waterproof plastic military connector. 3 Type 2 pin of these connectors can also be used. It should be brass. 3 If the metal connector is made of iron, it will have a negative effect on the range and separation. It applies and you should not use metal accessories to connect the loop to the main skeleton. 3. Only non-metallic connections such as bolts and nuts.

Plastic or polyethylene and the like are allowed to be used near the loop. 3

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

environment, the device and In order to check the strength of the skeleton, loop and connections, before exploring on the ground and in a completely open the loop should be held towards the sky without the effect of the ground and shaken a little to make sure that there is no instability. ! If due to the movement of the of the device, especially the skeleton and loop parts, have device, it shows instability in the form of sense or negative meter; It is clear that the internal connections problems, and in this case, the device is 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 of the existing pulse circuits, as well as the compact and special design of the fiber with a strong ground; It is not necessary to apply the shield of the entire circuit³, especially as it was mentioned that 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 connect 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, the and Distance angle of the box with respect to the loop is such that the metal box is not in front of and in the range of the sense loop, otherwise the metal detection function of the device will be disturbed. It is not recommended to eliminate noise.

3. Therefore, the use of a metal box despite the positive effect on

Specifications of the proposed coils

Flat 25 cm loop: 2 rounds of 533 mil mesh wire with an inner diameter of 1333 cm³. 4 rounds for spider mode.

Flat 5 cm loop: 23 turns of 535 mil mesh wire with an inner diameter of 25 cm³ (25 turns for spider mode)

Flat 43 cm loop: 11 turns of 537 mil sieve wire with an inner diameter of 4133 cm³ (25 turns for spider mode)

Flat 55 cm loop: 15 turns of 537 mil sieve wire with an inner diameter of 37 cm³ (17 turns for spider mode)

1 x 1 meter frame: 15 turns of wire with 1 mil³ core

Frame 133 x 133 meters: 8 rounds of wire with a core of 132 mil³

Frame 2 x 2 meters: 7 rounds of wire with a core of 132 mil³

For small loops, it is better to use wire mesh, and for large frames, there is no other choice but to use coated wire³, but for the proper functioning of the separation part in large frames, you must use a type of wire that has a thick coating³, this creates a gap. between the cores of the wires and it reduces the capacitance inside the coil, which is necessary for correct operation, separation 3 carefully according to the range of debug numbers 2 (C), in choosing the right coil for the desired purpose, it

A (This matter can be understood and will be explained in the next sections 3 , B should be noted

that the principles of each 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 3 cm metal; 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, therefore, 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 capacity 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 wrong conclusions about the suitability of that coil. ³ In fact, each coil with different capacitance and ohm coordinates and even a different capacitor state needs a special pulse width and delay setting in order to get the maximum gain or He expected th

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 the principles are much closer to the theory of circuit operation³. 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 mentioned in the list of parts and should be paid attention to. ³

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 phase of fiber drilling, you should be careful and use two drills with size 5. 3mm should be used, 3 bases of resistors and ICs 1 and 2, small transistors, small capacitors, crystal and diodes 4148 should be drilled only by drill 537 and for drilling the bases of regulators, MOSFETs, large capacitors, 2 watt resistors and diode 5819 And also the place where the wires are connected 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 is 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 heat sink fits on the circuit and then screw the heat sink well and firmly on the regulator and then place the regulator on the fiber and assemble it so that the work is easier ³.

blade of these parts. Also, pay attention to the installation of regulators and MOSFETs, the hatched part on the image of the fiber shows the placement of the metal 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

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 and also the LOOP1 point have a voltage of 12, which is marked as v12 on the fiber. The maximum error for this voltage is 532 volts, that is, between 11385 and 12325 volts is acceptable. volt (7812) was done; their voltage 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, the wiring of the circuit must be correct. ³. **If the voltage of 12 volts is more than 1. volt, there will definitely be a possibility of damage to the micro IC!**

* Voltage 133 V: This voltage corresponds to the common end of resistors 1. and 14, which is specified as v9.5 and is considered an important voltage ³. The error rate of this voltage should be almost the same as voltage 12. For example, the higher the voltage 12 is than 12 It is true, 133 volts should be almost the same ³, so the acceptable range for this voltage will be between 13.5 and 1375 volts ³ If the voltage 12 is correct but this voltage has problems; The condition of resistors 1. and 14 should be checked. Also, the defectiveness of capacitor 12 can lead to problems in the voltage of 133 volts.

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

If the MOSFET circuit becomes hot at this stage, it indicates that the 170BS transistor or its connections are probably faulty 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 use the specified bases on the fiber from numbers 1 to 5 and also 11 to 15. Connect to the same numbers that are written next to the bases of the LCD itself. ³ If only the 1st base is specified, it is the beginning of the bases, and the 2nd and 2nd bases respectively. It will be until 15.3

How to connect and function keys

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. S connector located on 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 connected to the GND or ground, it is connected to the other end of all 3 keys in a shared way. In fact, one of the heads of all 3 keys can be connected from the back and finally connected to GND. So, for wiring from the fiber circuit to the part where the keys are on the box. ; We need 5 wires in total 3

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.

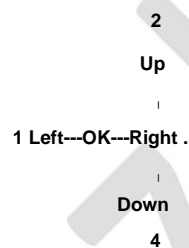
Left: The left key is for reducing the values in the menu or reducing the sensitivity in exploration mode. This key must be installed on the left side of OK (number 1 in password mode).

UP: The up key is used to go up between the options in the menu or debug mode in exploration mode 3 This key must 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 (number). in password mode (

Down: The down key is used to go down to the options in the menu or automatic balance in exploration mode3. This key must also be located at the bottom of OK3 (number 4 in 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



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 balance performance during exploration.3

Programming IC microcontroller

Programming this micro is not very different from other AVR family microcontrollers, and it can be done with most types of programmers3, but because this micro is considered a bit new; Some programs do not have the possibility to program it, or have various problems during the program, 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 an AVR Multi programmer with a USB interface and a ZIF socket to insert the micro and use the AVR-Burner eXtreme program, which is a very good, simple and fast program to program 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 corresponding USBasp driver must be installed, otherwise the program will not be able to communicate with the programmer3. Therefore, for simplicity, it is better to run the program on a Windows 2.

bit to be installed 3

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 P328ATmega 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 open the [setup_1.4.2v_avr_burner_extreme](#) file and install this program in the Windows environment. To the installation location of the program, for example, [Program\C](#)

Go to [AVR - Burner eXtreme\Files](#) and enter the [Data](#) folder. 3 The two files [xml.chips](#) and [xml.fuselayout](#) which are zipped separately in the file contain the existing program; In this folder, we will copy and replace two old files. By doing this, the micro program will recognize us correctly and we can follow the steps of the program.

Now open the program and enter the [Chip](#) menu at the top of the program and select P328ATmega from the list of micros 3. Then click the yellow [Open](#) button at there is an error in this step was observed ; You can first copy the the top of the program and select the hex file related to this device from your computer 3. If hex file on the Windows desktop and then open it from within the program 3. Then go to Tab

Settings/Bits Fuse We go 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 that we have already made in the device, and the other mode is to set the fuse bit, which after each program load; The internal settings of the device will Face return to the default state and it is mostly for the time when friends read the limit of the number of times the device is turned on and off. 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 mod

Low Fuse: **F7** High Fuse:D1 Extended Fuse:FC
FC:Fuse Extended 9D:Fuse High **7F** :Fuse Low

Built-in micro save save settings for
To reset the saved settings and reset the usage limit

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 earlier is enough to press the green **All Write** button at the top of the program so that both the hex file and the fuse bits are programmed, if the programmer is installed correctly and is supported by the program. 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 by disconnecting and reconnecting the programmer, the problem will be solved. 3. More explanation in this regard is beyond the scope of this article. Friends, it is better to refer to the guide catalog of the programmer you are buying.

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 programmer. This point can be seen carefully in the technical descriptions of the programmers.

In the way of programming with the AVR Multi programmer, an ECA product of Iran, which is of the 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 the micro. Our micro is of 28 pin type; Pin 1 of micro IC should be placed in the place marked with P28 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 on the programmer must be closed (connected) and for the second time after that, in addition to leaving the LS jumper open, a crystal between 8 and 25 MHz must also be placed in the specified place for the crystal next to the ZIF socket to The micro program should be done correctly and at a high speed. Of course, in the new examples of this type of programmer, apparently the LS jumper has been removed, and in this case it is not necessary. Despite the strong recommendation to use the programmer and the program that was explained; **If other programs are used for the micro program**; Setting the fuses in detail will be as follows:

CKSEL0 1	or Disable or Unprogrammed or Disable	}	
CKSEL1 1	or Unprogrammed or Disable or	}	(External Full Swing Crystal)
CKSEL2 1	Unprogrammed or Enable or	=>	
CKSEL3 0	Programmed or Disable or	}	(Startup Time: 16K CK/14 CK + 65ms)
SUT0 1	Unprogrammed or Disable or	}	
SUT1 1	Unprogrammed or Disable or	}	
CKOUT 1	Unprogrammed or Disable or	}	(Clock Output)
CKDIV8 1	Unprogrammed or Disable or	}	(Divide Clock by 8)
BOOTSZ0 0	Unprogrammed or Enable or	}	(Reset Vector)
BOOTSZ1 0	Programmed or Enable or	->	Boot Flash Section Size=2048 words
EESAVE 0	Programmed Retention of saved	->	
EESAVE 1	settings (EEPROM) Preserve (Programmed or Enable or reset settings and restrictions (EEPROM) Preserve (Unprogrammed or Disable or Disable or Unprogrammed		
WDTON 1			(Watchdog Timer)
SPIE 0 1	Either Enabled or Programmed		(Serial Programming)
DWEN	Either Disable or Unprogrammed		(Debug Wire)
RSTDISBL 1	Either Disable or Unprogrammed		(Reset Disable)
BODLEVEL0 0	or Enable or Programmed or Enable	}	
BODLEVEL1 0	or Programmed or Disable or	=>	(Brown Out Detection Level = 4.3v)
BODLEVEL2 1	Unprogrammed	}	

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 change should be made on them 3

, High, If you use the AVR-Burner eXtreme program or any program that uses the model to set the fuse bits to Low Extended support, there is no need for these one-by-one fuse settings. 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 in any way, and the sign of that will be slow operation and very low delay loop (usually 5), but if the fuse bits related to the crystal and calc are set correctly, the device will rise up to the moment of the initial balance. It should take about 4 seconds.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 will go to DEMO mode!!! The only way is to reprogram with the fuse bit reset settings 3. In this situation, sometimes it is even necessary to erase the micro EEPROM memory separately by the programmer program.

(ERASE) 3

Turn on the circuit for the first time

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 ! **OK Press** is written in the first line and a counter starts counting in the bottom line 3. At the same time as this count, the contrast level of the screen changes! As soon as these writings are seen on the screen, you must press the OK button! In this way, the initial contrast adjustment is done and saved, and you can adjust the contrast more precisely later through the menu. 3. If you fail to see a text on the screen within a few seconds Just wait a few seconds until the counter starts counting from the beginning or the device turn it off and turn it on again 3. 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 for you, and if you cannot see anything on the screen, you cannot use the device.

Work 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

and meDevice settings

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, as well as 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. It is not much. 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. In the case of high frequencies, it is the opposite. 3. At the same time, the battery consumption increases with increasing frequency. 3. My recommendation is more. It is recommended to use frequencies between 155 and .55 to get a good answer in different conditions. 3. Another interesting point that the frequency setting 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 large extent.3 Due to the presence of 35 Hz noise in city electricity in many places, it is recommended to use frequencies that are odd multiples of 35.

Do not use! 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.

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 is considered as 155 to 355 microseconds with the possibility of changing it by 3 microseconds. In fact, this setting Besides, they determine the setting, and until now, in circuits similar to pulse metal detectors, there are two settings in which there are no conditions for the pulse sent by the digital device transmitter! By adjusting the pulse width, better results can be obtained from special loops even with large sizes Also, he adjusted the conditions of the pulse power according to the ohm ratio and the capacity of the loop and the type of soil in the area, which in general requires testing and experience to achieve the desired result in this case. 3 A higher pulse width means more current or amperes in the loop. 3 But this amperage High may be problematic for smaller loops and small targets 3. For example, very small amounts of gold cannot be sensed well by the high pulse width! More pulses work better. 3. Especially silver metal in large dimensions can be sensed significantly stronger with a high pulse width. 3. Adjustment item. Between 135 and 235 gives a good answer for this device in different conditions. 3 It is necessary to explain that most of the existing circuits, which are often designed for coin detection, have a fixed pulse width of 155 microseconds! At the same time, values higher than .55 in this design are mostly for testing and may give a good answer only under some special conditions and with some loops, otherwise these high values can lead to a decrease in range or loss of stability or more sensitivity to the ground and salt. Yes, and the battery consumption of the device increases greatly with the increase of the pulse width.3 In order to use the maximum breakdown voltage of 355 V MOSFET 840 IRF, 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 decrease in the same proportion. A MOSFET like 100NK11, which is 1000 volts and has 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 pressure 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

The device returns to the menu and after setting higher than any of the frequency and pulse width settings; The message "Power High" is displayed 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 the normal scanning mode. 3 Of course, the possibility of using the final numbers of each There are two mentioned settings, provided that it is not accompanied

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 will be unstable until the mentioned parts reach thermal equilibrium³ and the 7812 regulator will change a little; After the initial balance of the device, he rebalanced the device 3. This happened in the high reduction mode of these two settings. Therefore, in such a situation, you usually have to wait for about 1 minute, and then the mentioned parts need time to reach thermal stability in their new state. 3. Instability in It also occurs at the beginning of turning on the device and it is related to the same issue, and of course, in the initial working conditions of the device, the time required to heat up the IC 357LF is also added to this set. He chose the watt from the thermally stable type, and at the same time, while using the original and high-quality type of MOSFET and the 7812 regulator, he considered it a suitable heat sink for them.

Delay: This important setting related to the receiver of the device determines how long in microseconds the sense calculations from the return damping wave should be done after the end of the pulse.³ This setting starts from 5 and can be adjusted to 2 microseconds, which is the value Finally, it depends on the setting of the integral interval 3. Of course, this device has a unique software method called Finder Delay, which can find the amount of delay for the start of the loop during balancing in a fraction of a second! The 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 amount after the end of the sent pulse.³ The importance of this setting is because metals like small gold require 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 manual dili +20 to +60 can have a good result in most conditions³, but in higher dili, the sensitivity to smaller metals, especially 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 the way 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 a longer range for larger targets. The sensitivity to the ground will decrease, but the range of the metal detector will also decrease. There is a daily setting 3

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

W.Integ: (Width Integration or integration interval) This setting, which is considered one of the unique and professional settings compared to other existing plans, indicates that the integration process of the owner of Sens Fells, which is taken from the return signal, until What time interval in microseconds should continue 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 called Width RX They also learn 3. 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. 3 For example, if the daily automatic loop is announced as 25 and the manual daily is set to +45 and the setting W.Integ should be set to 44; the integral calculation will be done in the time interval of 55 to 154 microseconds after the transmitter pulse is cut off. 3 This setting is effective in addition to the daily setting in the sense of different metals and sensitivity to some salts and to some extent the impact of noise. If the value of this setting is too high, it will lead to a decrease in the range, and by increasing it, although it may appear, the range of the metal detector will be 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 small gold sensors; 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 the sense of larger targets. Therefore, working with this setting requires a high level of experience and it is recommended to use the default setting (44) if you are not familiar with its exact function.

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

Ground: This setting is similar to the Threshold Adjusting Self (TAS) function in advanced pulse metal detectors, which of course has improvements compared to this standard function and is more similar to the Tracking function in GPX series devices.

Minelab works. 3 Also, this setting is similar to the AUTO setting in Lorenz metal detectors. 3 This setting is very important during long exploration; It is 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. It has not fallen and it should be left alone; Unlike most circuits, this metal detector will remain on the maximum range and sensitivity set! Also, the activation of this setting makes the device constantly adjust itself with the change of weather conditions that affect the stability of the circuit and always provide the expected range in metal detection with the same sensitivity that is set. 3 adjustable values for this option out of 5 or OFF to 15

There are 3 values OFF means that this function is inactive and the balance of the device will be fixed, in which case there will be a need for consecutive balances during exploration, but instead it provides a little range and more sensitivity. 3 other values mean that this function is active. 3 lower numbers indicate faster automatic adaptation and higher values mean slower and longer adaptation. 3 The set value depends on the speed of the operator's exploration and to some extent the size of the loop and the type of soil of the area to be explored, and the best value is always obtained according to experience.

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. OFF mode

3. Also, if the ground setting is inactive, the device faces a hole or is out of balance; It generates 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 noticeable 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! It is similar to the situation that happens during real exploration, and we actually put the loop on it from around the possible metal. 3 The ground setting is designed for such a situation and is suitable for real exploration. 3 Also, for a more accurate maximum range test, you can first place the metal under the loop. The audio should be cut off and then the distance between the cutoff point and the loop was measured as the maximum range. 3. When the ground is off, the way to perform the range test does not make sense.

Speed: (Sense speed) This setting is considered similar to the Motion feature in Minlab GPX metal detectors, and it actually determines the speed of the sense or the device's reaction to the metal. Also, this setting is the opposite equivalent to the Filter option in Lorenz metal detectors. The low values of this option are equivalent to the higher values of the filter in Lorenz devices. This feature is present in normal metal detector designs. Noise removal should be created in a very good level and we have much less extra beeps during exploration. 3. There are no adjustable values, it causes stability and noise removal, and higher values mean the speed for this option is from 1 to 15. 3. Lower values mean slower sense speed. The maximum stability and sense is more, which is naturally less stable and more susceptible to noise. For example, setting 15 is equivalent to almost immediate target sense, and on the contrary, in setting mode 1, it takes a few seconds for the device to announce the metal sense! The selection of the level of this setting depends on the speed of exploration and the operator's goal and the size of the loop, and in any case, to achieve more stability, if needed, the speed of the sense should be set to a lower level. There will be weaker target misses.³ In fact, setting lower values for this option can automatically provide more removal for small targets and particles.³ Therefore, as a general rule, smaller loops with higher speed figures and larger loops with lower speed figures. They have better and more stable results. 3 It is necessary to explain that this system is intelligent and if the reaction of the possible target is stronger than a certain limit, this setting will not be taken into account and it will announce the metal sense as fast as possible! In case of using less numbers for this setting and due to more stability and setting it a little higher, complete silence; The sensitivity level of the device and a greater range can be achieved

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 speed of the metal detector's sense increases again³, but on speed levels of 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 a hole or going out of balance³, meaning that the higher the number of this setting, the sooner the device will produce a warning horn when it encounters a hole³.

Reject Iron : 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 only works with double loops and therefore With Large loops that are mono do not have an iron removal function, but in this plan, the iron removal system can be used with any size of mono loop. 3 The adjustable values for this option are from 5 or OFF to 5. 3 The OFF value means that the iron removal function is inactive. and other values while activating this feature; They determine the degree of iron removal 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 light 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, in fact, the amount of black text on the LCD. 3 adjustable values for this option are from 5 to 35. It means that 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 how to hold it depends; The operator can make this setting in such a way that the writings are in the best condition and the skeleton of the device is readable for the eyes.

Volume: This setting is related to the audio output power of the circuit, where the value OFF means the complete cut off of the sound and the value 15 means the maximum volume. Of course, if you choose the sound tone 1, 15, 11 or 12, this setting has an effect on the sound response of the Sens device. It will not have 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 normal speaker; because it will result in a loss of stability and an increase in battery consumption. In the audio system of this design, a kind of increasing mode is considered for the sound in tone modes 1 to 8, so that when the metal is closer to the loop, the sound becomes a little stronger. 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 will be 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 of the LCD screen light, 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 selecting the tone mode of the output sound to react to the metal sense. 3 adjustable values for this option 1 There are 3 values up to 12, 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. 3 In these 4 modes, the wing 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. A professional is closer³. These situations contribute a lot to a more accurate sense of the target center³

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 s 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

and preventing unauthorized access by others as well as creating security under **Password conditions:** to personalize the use of a specific device; 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 equivalent 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 box of the device should be written so that it is easier to use the password feature 3

This option is slightly different from other menu options 3 in this way that when the menu indicator is placed on this option; 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 Password Old message is displayed and the operator must enter the old password. 3. If the entered password is wrong; After the device displays the message Password Wrong

It returns to the menu page and does not allow changing the password without entering the previous password.³ But if the previous password is entered correctly, the message The device receives the new password. 3 The password can be from 1 digit to 15 digits depending on the operator's taste, and each password is shown, and when we have entered the correct password, we must press the OK button. 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 Changed Password, 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, with the display of your symptoms? 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.

The device is enough, go to the Password option in the menu and after entering the previous password; In the setting step, to remove the password from the new password, without entering any number, simply press the OK button or, in fact, enter an empty password and repeat this process in the new password confirmation step 3. In this situation, the device will be without a password. And for this setting, the OFF value appears in the menu. 3

It is recommended to be careful when choosing a password and to use a suitable combination as a password, which while creating proper 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.

And the designer is considered and has no other function. 3 Therefore, to view this information **About:** This option is only sufficient to display device information when the flash menu is placed in front of this option; Press one of the right or left keys to get information about the device name and number

Find the version of the program and then the display designer. 3 After displaying this information, which takes a few seconds; The device returns to the main page of the m

* **The sensitivity setting** is not 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; The button is enough

Press OK to exit the menu; Save all settings made 3. If any of the frequency settings; pulse width; The daily or integration interval that is effective in the balance has been changed; After exiting the menu once again, the balance process will be automatically done

It is executed 3

In response to common questions such as whether this metal detector is sensitive to salt or clay, or how sensitive it is to gold, for example, how does it work 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; There is no specific factor that is common in pulsed 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 would have IC and no The digital system did not respond well either! But in this plan, they work with any set of simple digital settings; We have a new metal detector that has a different function. 3. With a series of settings, the sensitivity to salts is greatly reduced and with Other settings increase the sensitivity to small gold 3, as well as the maximum sensitivity to large metals or the problem of penetration into the soil, all change by changing the settings 3, so this design is completely flexible and a complete alternative to thousands of metal detector designs, each of which has a special feature.

Depending on the conditions and needs of the operator, he got a good answer 3

Regarding 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 environment, just slightly increasing and decreasing the number of these settings, the noise can be interestingly removed to the point where the high levels of 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 by setting the Speed setting to the maximum value and then setting the sensitivity level to high values and the amount of extra horn and especially the meter number.

The sense 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 sense meter fluctuates on smaller numbers or the debug number 1 has less fluctuations; It means that there is less noise on that setting3, so you can confirm these settings and then set the Speed setting to a lower value to do the rest of the noise removal, and finally set the sensitivity level to the highest level, which will produce an additional beep. 3. In this way, maximum sensitivity and stability can be achieved. 3. Also, some of the problem of noise removal is related to the Ground setting, which should be active under the presence of noise. 3.

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 silence 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 connection cable are in a close to ideal condition, and how many days are displayed from 25 If it is more, it is a sign of higher capacitance and lower quality of the loop and cable, especially for normal loops, this number goes up. that the daily automatic displayed goes above the 5.5 range; 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 well3.

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 ! **Error Coil (loop error)** is displayed and the operation of the device stops 3. In this situation, in order to continue working, it is necessary to solve the device performs automatic balancing after turning on If possible problem in the loop or even the circuit, and then press the balance button again. 3 Because the 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 prevented. There may be a problem in the surrounding parts and the 170BS transistor and MOSFET, and even the wrong program of the micro fuse bits. In fact, the circuit, including the 357LF IC, and **any basic defect in the circuit can also lead to error messages! Error Coil.**

Naturally, if the loop is close to the metal during balancing, the delay may be higher or even a loop error will be reported³, 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 button ³, although it is recommended

When changing the loop, the device should be turned off or at least in menu display mode ³

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 with the right key, the sensitivity increases, and at the same time, the degree of sensitivity appears on the screen. The adjustable values for the degree of sensitivity are from 1 to 25. ³ Lower values mean less sensitivity and range, and higher values mean higher sensitivity and more range. Being ideal and the environment should be in better conditions; it is possible to adjust the sensitivity of everything, which is never possible! But the more the device is used, the more range it gets ³. Otherwise, the conventional range of pulsed metal detectors is at the same levels near the end of the sensitivity adjustment. It is obtained with good stability. Therefore, the maximum degree of sensitivity is set not only in terms of the possibility of testing, but also because it shows that the metal detection range 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 and Daily and integral interval: The sensitivity level has a new meaning, and for this reason, it is necessary to adjust the sensitivity with a different level in order for the metal detector to work well. For example, by increasing the pulse width or the integration interval, it may be necessary to decrease the sensitivity level to get a good result ³ Therefore, the sensitivity setting of this device depends on other settings and it is relative ³

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 degree of adjustment to the degree Next more than -2. Not a percentage! 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 land, there may be several

The final degree of sensitivity cannot be used at all, and with a slight change in the distance of the loop to the ground, we can see an additional horn or a negative meter³, so with Having this example that even a weak and suspicious target that has a sense meter of 15 and may not even reach the separation threshold can be sensed on a sensitivity level of 12; There should be no insistence on the use of high levels of sensitivity³, so if the goal of exploring a wide area and sense is a definite goal with separation; A sensitivity level between 15 and 13 is recommended, and high sensitivity levels should be used more for exploring specific areas with signs that even a weak sense is important. The mode should be set to OFF, otherwise there will be a double loss of range. In fact, the function of the ground system is more useful on high sensitivity levels.

It has an effect on the overall range of the metal detector (All Metal) and it will not affect the range of the device. At the same time, increasing and decreasing the sensitivity of the device only has

Debug: by pressing the up 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 up button is pressed (debug 1), while the integral sign is displayed, the total integral amount of the return signal that is being calculated is simultaneously displayed on the first line of the LCD! If in this case the up button is pressed again, the second debug mode (Debug 2) is activated, which is A. ³ By pressing the up key for the third time, the information related to the display of the information related to the separation channel will be displayed as C. The device settings will be displayed in the first line. The separation of information is no longer displayed, and only if the iron removal setting is active and it collides with ferrous metal, the sound of the sense is cut off. Therefore, in order to have visual information related to the separation during the sense, the debug mode must not be active.

The display of the above values in debug mode has no effect on the quality of metal detection and is mostly for testing purposes and fault diagnosis. ³ For example, the operator can check the amount of noise through the amount of fluctuations of the integral number that is the main owner of the sense in debug mode 1. ³ The setting of higher sensitivity depends on this. This number has more stability and less fluctuations, so friends can even make different changes regarding the method

And check the issue of the shield and the settings by monitoring this number to see what methods can be used to minimize the amount of fluctuations of the integral device, or the same noise³ because it should not be forgotten that getting the final range from a metal detector depends on the maximum removal of noise³ Also, by checking the numbers related to the separation channels in debug mode 2, it is possible to understand to a large extent the correctness of the function of the separation section and the whole device, which will be explained in another section³.

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

Only the frequency and pulse width are a little influential ³ And this is not a setting and a connection between numbers. Ganesh

Explanation of the information on the LCD in the 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.

Abbreviation for sensitivity, D is daily, F is frequency, and P is pulse width. ³ numbers on the right side of these letters indicate the adjustment made for each one.

There is 3

When the sense of metal is strong enough that the separation information reaches the initial level of validity; The first line has been 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 FE-NON, 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 setting 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 information related to separation channels (C, B, A) 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. The error of more than this value depends on the accuracy of the circuit voltage of 3 volts. Therefore, if there is a problem in the display of the battery voltage, the status of these two resistors, the error of resistors 11 and 25 and also checked the jumper under the micro. 3 By checking the displayed voltage of the battery and depending on the type of battery, you can find out how full and empty it is. 3 Example for 3 series cells of lithium ion or polymer; 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 14.33 volts; While displaying the **Battery Low** message on the left side of the bottom line; The sound response of the metal detector for Sense will be disabled. 3. If the device is turned off, the **Off Power** message will be displayed on the left side of the second line, and after hearing a special sound, the device will turn off.

In normal mode, we have the probe in the left part of the second line of the sense chart, which is activated at the same time as the sound reaction and indicates the strength of the metal sense³, but in this device, a sense degree number (sense meter) is also in the form of a digital meter on the right side of the sense chart. It is taken as a number. A digit will indicate the strength of the metal sense. 3 The stronger the sense is, or in fact the metal is bigger or closer to the loop, this number will increase. and checking meter sense; reach a rough estimate about the possible depth of the metal and even the possibility of it being an error 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 3, but if the meter changes little by moving the loop away from the ground 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, the condition of meter sense will have the highest value³, but in the condition that the target is small and shallow, it may have a stronger loop sense near the sides than the center³, so with this digital meter, you can pinpoint the center point of the target much more accurately (Pinpointing).) and even estimated the dimensions of the metal better 3

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.

The bar announces this with warning beeps. 3 In this situation, if the ground setting is active, after a short period of time, the balance will be restored automatically and the negative meter sense will disappear.

It will not have an effect on the meter sense number for a specific target. Therefore, a specific target will be sensed on different sensitivity levels with the same meter sense.

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, two signs (L) and (!) are considered.³ In the normal state of the loop movement on the ground, it is normal to switch between these two signs, especially on high sensitivity levels,³ but in the condition that the loop is fixed; The sign will be a sign of the effect of noise! In the condition that 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

Iron removal Separation and

iron removal in this device by The channel is separate from the SENS channel and based on the technical information of Minlab and Lorenz metal detectors, the design and iron separation and removal system has been implemented in any way. Therefore, the most important point that may be relevant for most explorers is that the separation part and the SENS and the final range of this It will not have a metal detector and, unlike many devices and circuits, it has 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

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 is actually the **ID Target** or the separation number, is written in front: ID 3 is displayed. This separation number is based on Conductivity and is considered almost the same as Lorenz devices. Therefore, friends can refer to Classification Target topic in Lorenz Deep Max 3X or 5X or 1Z booklet and the corresponding table to evaluate the meaning of classification numbers. 3 Classification numbers in this design are usually displayed a little higher than the similar scale in Lorenz devices. It is completely wrong to identify the type of metal and primarily the size and geometric shape and even the permeability

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 big and solid gold

There is an expectation of a separation number above 75.³ Regarding iron, usually depending on the dimensions of the ferrous metal, there is a possibility of a separation number between 5 and 55.³ However, this range of separation number can include many other purposes, and therefore the results of the iron removal section are for the detection of iron. Being the target is much more valid. 3 For very small or thin metals like foil, the separation number is usually displayed below 25. 3

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

The iron removal system works when the Reject Iron 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 interrupted, and at the same time, the word **FE** will be written after the separation number, meaning that the target is ferrous, but if the non-ferrous target is detected, the sense sound will continue, and after the separation number, the word **-NON** will be written.

FE means that the target is non-ferrous. 3 In both cases, a negative or positive two-digit 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 (FE-NON) this number is also shown as positive and prefixed with +, and the more positive this number is, it means that the metal is more in the non-ferrous region 3, 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. 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. In the iron detection mode, sometimes the iron meter may show a negative number. Let the device announce that it is a non-ferrous metal by displaying FE-NON and not interrupting the sound! 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 FE-NON display simultaneously informs the operator with the voice response and the iron meter. It is placed only for more detailed examination and more assurance. 3 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, and instead, after the separation number, the word **FERRO**

It is written and then a two-digit number without a sign, which is based on a fixed basis and depends on the coordinates of the circuit and loop, shows the level of iron content of the target. 3 In this case, the higher the FERRO number, the closer the target is to iron. 3

The device itself has a separation range of about 85% of the final range of the metal detector for each target, which, of course, depends on the type of target and whether iron removal is sufficient or not. Therefore, within the range of 25% of the final range of the metal detector for each metal, it detects whether the calculations for the announcement Separation, which is outside the range of separation of that goal, and there is a weak sense; The function of the metal detector will be Metal All, and the separation and removal of iron information will not appear, and only the diagram and sense meter and

The important thing for the iron removal part is to calibrate the device depending on the circuit and loop construction conditions as well as the exploration environment. 3 To calibrate the iron removal part, you must first make sure that the device loop is not close to any metal and even far away from large metals to get the results. The removal of iron will not be affected 3 Then by using metals such as iron tools such as pliers or a large screw or a key or a thick iron chain or a piece of iron beam, you can test the different levels of Reject Iron setting 3 If the level of iron removal is set correctly for most of the iron The instrument should show a meter of iron (FE) between -3 and -15, and for non-ferrous metals, often a meter of iron (FE-NON) between +3 and +15. For example, in the test of a ferrous metal, if the meter of iron is more than -15 It became clear that there is a need to reduce the degree of iron removal. 3 The easiest way to find the appropriate degree of iron removal is to first set this setting to OFF and then evaluate the FERRO number with a ferrous metal. 3 In this situation, the degree of removal Suitable iron is equal to 155 minus the FERRO number divided by . In addition, there are 2.3, 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 condition of the ground is also taken into account and the result is more reliable. 3 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 iron removal option to OFF, and based on the number of FERRO, the operator can speculate about the iron content of the target. 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 removed 3, for example, tin is undetectable due to its tin coating, and there is almost no chance to remove ordinary tin cans 3, although old and rusty types in the soil can be removed with a good chance. There are 3 types of steel, depending on the type and amount of iron, they can be removed, but some types of steel cannot be removed. 3. They can be identified and the parts of agricultural tools that are completely iron can be easily removed by the system. In any case, fortunately most of the iron waste, including nails and chains, can be removed.

Detected iron removal and correct

separation operator iron removal have a great effect! For example, the fast movement of the loop on the target can cause the device to have an error in while working with the separation part. 3 Therefore, after a target is sensed and the separation information shows that the metal is within the separation range; reaches a 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 fixed number as a separation number based on more calculations and detect iron more reliably 3 because 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 separation of information from different angles and on the sides of the target is slightly different 3, although this problem can lead to a better evaluation of the target, but the separation information on the center point of the target is always more important 3, at the same time, it is an important point that in order to get a more accurate result in Separation should not increase or decrease the distance of the loop. Calculations are based on the last distance of the loop from the ground before the sense of the target. 3 Therefore, the distance of the loop from the ground must be maintained on the center of the

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 Therefore, if the metal suddenly gets too close to the loop or sticks; The separation channels are loaded and there will be no correct information about the separation number or detection of the iron target. 3

In order to make a correct conclusion, especially for the iron removal part, it is necessary for the device itself to have the right conditions! In the main circuit section, the IC 357LF or other numbers that were mentioned is the most important issue, and the health of the 3 pico and 232 micro capacitors and the MOSFET are also important. 3 In the loop part, it is also very important that the automatic daily 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 be very careful to choose a place in the home environment. It is important that different metals are really 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 should be re-adjusted to remove the degree of iron removal, or on the contrary, many non-ferrous metals were removed. Another sign of the proper working of the resolution part is the resolution number 3. For example, for very small or thin non-ferrous targets, the resolution number should be below 25, and for metals such as large and thick aluminum, the resolution number is expected to be around 85. The same is true for most medium-sized coins. or coarse, the separation number should be in the range of 5 to 35. For example, the separation number of a 355 white Toman coin is about 45. For large and old buried targets, the separation number is usually above 75 and even 85, in which case there is a greater chance for the target to be valuable. It should be noted that the resolution number of 11 is usually an error. 3 If the resolution number is shown to be very high or very low for all purposes, it is clear that the problem is likely to be from IC 357LF or loop or MOSFET.

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 Reject Iron option to OFF so that it becomes inactive. 3 Even though we will not remove iron in this case, the resolution number can still help to speculate about the type of target, and at the same time, the meter in front of the term FERRO may also help. 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 so 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 Delay, W. Integ, Ground, and Speed settings have no effect on the separation or removal of iron because they are only related to the Sense channel. 3 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 contains the separation information. There are 3 channels according to the sample of the . B . exploration. The number is displayed next to the letters CA, which tested device and [in a state where there is no metal near the loop](#) ; These numbers should have approximate values of 800C, 700B, 300A. 3 Exact numbers are not intended at all, and even a slight change in the frequency and pulse width will occur in these numbers.

And the ratio between them should be similar to the mentioned numbers, and if the difference is too big, it indicates the basic problems in the circuit and possibly IC. 37 or loop or even MOSFET. 3. For example, the number A must be between 255 and 455 and preferably between 235 and . 35, so that the iron removal system can give a good answer on one of the levels in the menu. 3 Also, the B number should be about 2 times the A number or a little less or more. That's okay 3. Therefore, [the correctness of the numbers mentioned next to Daily Automatic about 25](#) will indicate the correct operation of the whole device, including IC 37, 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, removing 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 iron part 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 ! 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 iron. 3.

It does not affect the separation board! In fact, the sensitivity adjustment is only related to the channel, the other problem is that there is no way to reduce the sensitivity of the SenseFelz device. Therefore, for those operating on sensitivity levels of about 15 or less, the separation is expected to be done almost simultaneously with the SenseFelz device, and in those conditions, the separation range can be equal.

Another point is the difference between the separation range and the final range for different purposes. The bigger the metal and the higher the separation number, the faster the separation is activated, and on the meter sense, it is 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, in the face of a special situation where the meter sense shows a strong sense of a target, but unlike usual, the separation system has not yet been activated. ; You can easily guess that the goal cannot be something valuable! Kal, contrary 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

The important issue regarding the trust in the iron removal system is that in special cases where several different metals are present in the soil with special placement conditions, there is always a possibility that the device will mistakenly declare the removal of iron. 3, 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 Always one short beep at a time

We will have the basic sense of iron and the operator can pay attention to the separation information on the screen and make a decision 3

Balancing and exploring methods

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

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 have a metal detector at the same distance

It should be placed in relation to the ground where exploration is to be done, and the balance button should be pressed, and after a few seconds, the exploration will be

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 just a little closer to the ground than the normal exploration mode, and then the balance should be done, and then the loop should be taken a little higher and

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 is done incorrectly and due to the presence of hidden metal in the soil, and therefore, after moving the loop on the device, it is out of balance. This problem shows that at the point where the balance is done, the possibility of metal presence in the negative earth meter is and the device He rebalanced and then continued to explore 3 displayed. It should be a little far from the target area and the important

thing in any metal detector is the proper distance between the loop and the ground. According to 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 loop of 5 cm, the minimum distance is 3 cm; For loop 55 distance 15 cm For the 1-in-1 loop, a distance of about 25 cm and for a 2-meter loop about 45 cm from the ground is required to minimize the effect of the ground on the metal detector sense and to have more stability and better separation, especially in situations where the loop of the device is slightly shaken from The balance is withdrawn; It is more necessary to observe this distance. Naturally, due to the increase in stability, we will not have a drop in range by considering this point

The effective range of the device may even increase! Otherwise, taking the loop closer to the ground will cause many problems regarding instability; Excessive noise and distance sensitivity will obviously lead to loss of range 3

Going down to the ground will create the accuracy of separation and also in the way of scanning the ground with all metal detectors, this issue is very important that the distance of the loop and even the angle of the loop with respect to the ground should not change constantly! 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.

It depends on this method of moving the loop. Naturally, when using large loops, the movement on the ground should be slower and the raising and lowering of the loop should be avoided as much as possible. An important point in this context is the shape of the metal detector skeleton. the construction angles and parallel keeping of the height of the operator does not have the necessary proportion; It will be much more difficult to maintain the distance according to the size of the loop and even the physical characteristics of the loop compared to the ground, so it is strongly recommended to take help from the images of reliable and famous metal detectors in making the skeleton of the device.

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 account. 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 during exploration, you should also pay attention to the settings. In this regard, the most important setting is the Delay setting, usually the higher it is, the lower the sensitivity to the ground

At least +25 or more should be considered for working on the ground, even if the Delay number is higher than a certain limit, it will gradually reduce the range, especially for smaller metals. Also, the pulse width should be set to a minimum number that almost gives the maximum range for metals. It will only cause more sensitivity to the earth and an unnecessary increase in consumption! Therefore, the pulse width is not suitable for more than that limit and it will drain the battery. 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 bring very good results. Also for lands that They 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. 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. Only at the end of following all these points, you should lower the sensitivity level of the device to a certain extent so that no instability is observed during the exploration.

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 suitable, especially for wet or highly saline soils, the higher the ID number (related to the sense of the ground) is, it is a sign of higher conductivity of the soil and the ground is unsuitable for metal detection. He took into account the points that were mentioned about the settings and then proceeded to explore. 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

In a situation where digging is done on a pit or hole, special methods need to be used that require more experience, so it is recommended to evaluate the effort first and then make a decision to dig. In addition to digging a pit for a purpose; Sensing and distinguishing information with accuracy, in order to explore inside the pit, one should use smaller loops than the hole and first balance the loop on the wall and then continue the search inside the hole. Another way is to use a loupe that is noticeable from the hole itself. It should be bigger. Otherwise, due to the presence of a pit that has the shape of a hole and the effect of that is the image of the metal; Depending on the type of soil, the range may decrease or the metal detector may be out of balance

Similarly, if the initial sense of the target is weak, not only the negative effect of the pit shows itself more; Rather, it is possible due to hitting and partial movement of the intended target during drilling; The aura effect that increases the power of the sense should be weakened and after digging the hole, no more sense and more and more detailed investigation should be done. Therefore, for weak targets, before digging, there must be certain things that cause the target not to be sensed after 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

There is usually a common question for most explorers that how sensitive is the metal detector to gold?! Either they say that this particular circuit is not sensitive to gold, or on the contrary, it is very sensitive! It must be said that basically stating such a problem is not scientifically and technically correct, 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, it needs 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, which basically, if they are of any gender Even if they are not detected well by the pulse metal detector! For example, a finely woven chain, which is considered a porous and permeable metal, whether it is made of gold or not, will not be properly detected by a pulsed metal detector³, but gold pieces such as coins, bangles, and rings can be easily detected by pulse

They are senseless, so this issue should be paid attention to when testing gold metal

But for the small-type gold sense, there are some things to consider. 3. First of all, the type of loop is important. 3. The loop used for the small gold sense must have a low delay and so-called coil fast, so that the small gold, which has a short time constant, can be well sensed. 3 types of flat or spider are suitable types of loop for this purpose, and naturally, for the sense of small metal, you should use a small loop size like 25 or .5 cm, otherwise it is normal not to sense small metal with a large loop. 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, so in the case that the probe has such a target, these points should also 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 the exploration of gold. 3 First, gold has been a valuable metal for a long time; 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 in line with reality. 3 The second point is that, in terms of its physical nature, gold 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, if 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 that for gold, and in the end it may be a little stronger than 3. Of course, if there is another metal next to gold like in many cases; 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 the principles of all types of metal detectors 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, the advertisements that are often seen regarding the insensitivity of metal detector products to pottery and the like are by no means true in general. Some types of pottery can be detected by all metal detectors and some cannot be 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 wet and salty earth, which has electrical conductivity and can pass 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 noticeable sense similar to a metal³, in fact, it depends on the materials that were used to make 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, detecting the sense of pottery requires a high level of experience. In cases where the pottery is of a type that has a weak sense, reducing the frequency and pulse width and increasing the delay can lead to a weaker sense and even eliminate it. Also, in places where there is scattered pottery. Unlike metal targets, SENS does not have a good centrality! That is, it is possible despite the presence of SENS in a large and dense 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 the metal detector. Some types of these stones have a relatively strong sense. Fortunately, if these particles are magnetic and are meant to be iron ore, they are removed by the system.

The removal of iron can be easily detected, and one of the ways to detect errors while exploring an area is to pay attention to the repetition of the separation pattern. 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 feel the effect of soil more than the difference in return waves for places where there are cavities. It is becoming more evaluable³, so using less delay and more frequency and pulse width works better for cavity sense³, also because we intend to evaluate momentary changes with the meter; It is better to deactivate the ground setting. ³ Actually, 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 detects when the loop approaches the ground, and actually feels the presence of the ground well; There will be a good chance to sense the hole³, otherwise it is unlikely that you can sense the hole in that land, and such a land is much more suitable for metal detection than hole detection³

Paying attention to the increase in the number of negative meters at a certain point of the ground, it can be assumed that there may be a hole in that part, taking into account the above, ³ devices will announce this issue in the form of warning beeps, and if it is inactive, it will be set to ground. The speed of warning horns increases ³

In some situations, it is possible that 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 condition³.

The Sens metal alarm device; Usually, in cases where before metal detection, a negative meter is displayed, which is a sign of a hole, and then it is possible that the metal is inside a bigger hole! Therefore, in this condition, the device will first report the existence of a hole and then the metal will be sensed ³

Final points

Since the basic problem 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 reach a greater range³, so the part related to noise removal is in the form of two filters in the circuit and several the quality of parts and assembly, skeleton and The special software filter and algorithm have been implemented in the program of this plan³, so there is nothing left except in terms of range with a 25 cm spider loop in the home environment and without a shield; 355 Toman coin up to .3 cm and copper fiber 13 x 13 to 85 cm and one gram gold coin up to 17 cm and all spring coin up to .2 cm! 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. ³ This is almost the strongest result that can be obtained from pulse circuits. 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 problem is in addition to the fact that the range of larger loops is greater and usually different metals are used in floor, ceiling and wall construction materials and in household items. Amal causes that no metal detector with a loop larger than 5.5 cm can be properly tested indoors ³, so for larger loops, real testing must be done outside the home ³ Failure to pay attention to this point can reduce the apparent range for large loops in The home environment and also the correct operation and facing the loop error ³

Not separating and even disrupting the balance of the device, fortunately, unlike 35 Hz noise, regarding high frequency noises 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 noise, 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 slight 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 creating and giving opinions and expressing the results of research and suggestions and constructive criticism. Of course, the final result of the device is something that they themselves will benefit from. in the past ; Avoid interfering with the circuit part as much as possible, and if you think that 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 project is not good and want to start disrupting the project as usual, either out of jealousy, enmity, competition, or personal interests; This time, I will tell them that this is my personal design! You have a say, you I wish success to all my friends 3

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

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