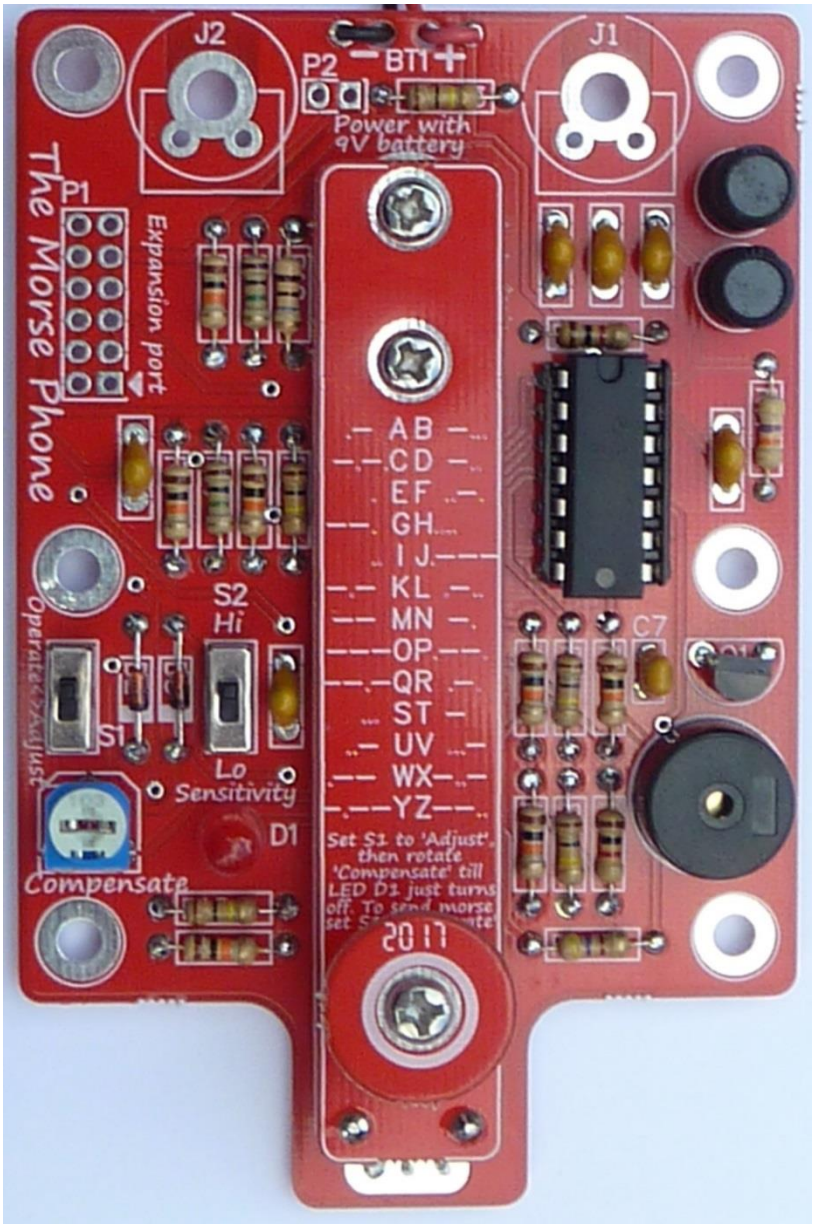
The Morse Phone

Manual Morse Phone Kit



A project of the Service Kring JOTA-JOTI.

Liking the Morse Phone, you have great ideas?
Let us know how, read on the last page.

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Remarks:
All the documentation around our kitbuilding kit is included in one big document. It includes, beside the building instruction, also all the background information and other things combined in the one doc.
To the instructors: we want to advise you to read this entire document beforehand carefully. It is sufficient to print only pages 6 and 7 for the purpose of building it..
TIP: To build one kit yourself before the JOTA-JOTI is besides fun also educational.

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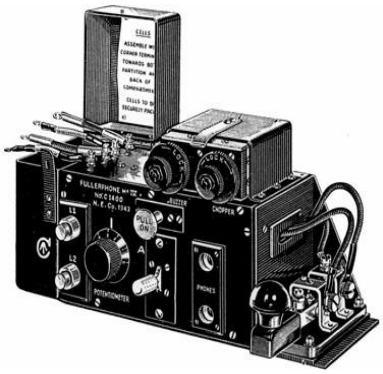
Introduction

For this year is "The Morse Phone" developed. It is a Morse beep that can be used standalone but also can be linked with other Morse Phones, after all, you communicate together! The Morse Phone is inspired by the Fuller phone, now this device will not be known by everyone, so first a bit of history.

De Fuller phone

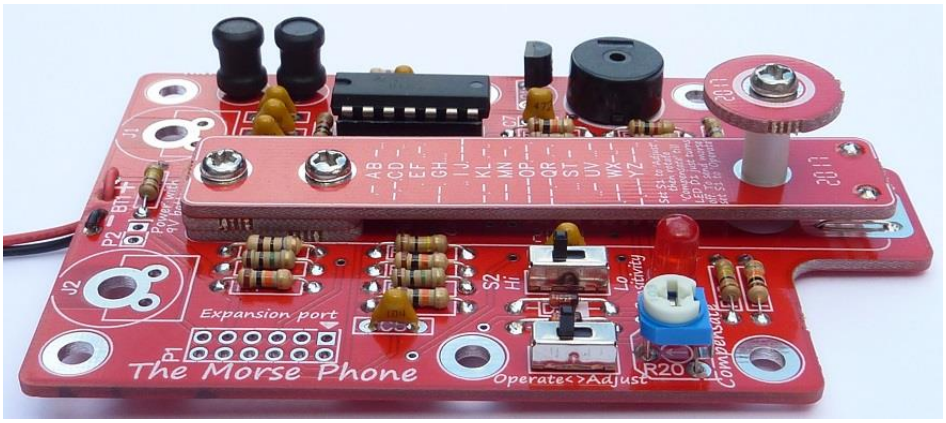


The Fuller phone is a Morse telegraphy device that has been developed during the first world war by major A.C. Fuller. In the years after that, the Fuller phone is further developed and remained in use until after the second world war. The ideas of A.C. Fuller were not new but he has managed to make a device that could be applied in war situations and harder to eavesdrop than the already existing telegraphy equipment.

Features

- The Morse Phone can be used in several ways:
- Independent, as Morse sounder, the Morse Phone will give a beep if the key is pressed.
- Linked to one or more other Morse Phones (or a real Fuller phone).
- In combination with the optional radio interface, its use is described in the manual of the radio interface. This is available separately.

Have fun with the construction and use of the Morse Phone!



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Contents of the Package

The table below can be used to check the contents of the kit. Soldering tin, and a 9 volt battery must be added by yourselves.

Component	Value	QTY	Position on board	Remarks
Resistor	470 Ω	1	R1	yellow, purple, brown, gold
Resistor	1 KΩ	2	R2, R3	brown, black, rood, gold
Resistor	10 KΩ	7	R4, R5, R6, R7, R8, R9, R10	brown, black, orange gold
Resistor	47 KΩ	1	R11	yellow, purple, orange, gold
Resistor	100 KΩ	5	R12, R13, R14, R15, R16	brown, black, yellow, gold
Resistor	1 MΩ	2	R17, R18	brown, black, green, gold
Resistor	10 MΩ	1	R19	brown, black, blue, gold
Pot meter	10 KΩ	1	R20	Pot meter
Capacitor	4,7 nF	1	C7	yellow, inscription 472
Capacitor	100 nF	6	C1, C2, C3, C4, C5, C6	yellow, inscription 104
Choke	10 mH	2	L1, L2	black “barrel” met 2 pins
LED	rood, 5 mm	1	D1	mind for polarity
Diode	1N4148	2	D2, D3	mind for polarity
Transistor	2N3904	1	Q1	mind for direction
IC socket	14 pins	1	U1	mind for direction
IC	TLC274N	1	U1	Mind the notch
Speaker	PKM13EPYH4002-B0	1	LS1	
Switch	2 way	2	S1, S2	
Battery clip	9 Volt	1		See description
Bolt	M3x10	2		
Bolt	M3x16	1		
Nut	M3	3		
Bush	10mm	1		
PCB		1		

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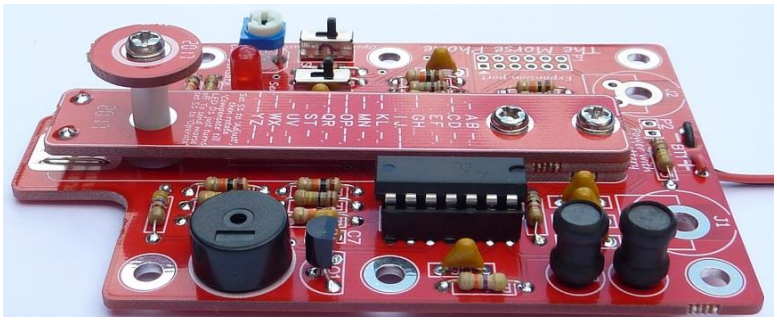
Component Numbering and Component Values

Print Imprint	Component	Print Imprint	Component
R1	470 Ω	C1	100 nF
R2	1 KΩ	C2	100 nF
R3	1 KΩ	C3	100 nF
R4	10 KΩ	C4	100 nF
R5	10 KΩ	C5	100 nF
R6	10 KΩ	C6	100 nF
R7	10 KΩ	C7	4,7 nF
R8	10 KΩ		
R9	10 KΩ	D1	LED red 5 mm
R10	10 KΩ		
R11	47 KΩ	D2	1N4148
R12	100 KΩ	D3	1N4148
R13	100 KΩ		
R14	100 KΩ	Q1	2N3904
R15	100 KΩ		
R16	100 KΩ	U1	IC socket 14 pins
R17	1 MΩ	U1	TLC274N
R18	1 MΩ		
R19	10 MΩ	LS1	speaker
R20	10 KΩ potmeter		
		S1	switch
L1	Chokel 10 mH	S2	switch
L2	Choke 10 mH		



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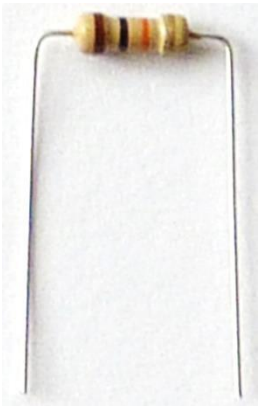
Building description of the Morse Phone



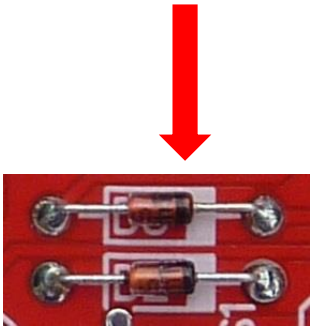
First of all we separate the smaller pieces from the large circuit board. To do this break loos the pieces and the edges can be smootned with a file. It is the easiest to assemble the parts from low to high. All resistors are mounted lying down. To do this, bend both threads at an angle of 90 degrees taking into account the distance between the holes on the PCB. Insert the resistance through the print back and bend the wires at the bottom of the print careful slightly apart. The print can now be turned around to soldering without resisters fall out of the board. Cut after soldering the legs just above the soldering, do the same for all other components with longer legs like the LEDs and capacitors.

Tip 1: the polka dot at the beginning of the line can be coloured to indicate which parts are already mounted.
Tip 2: look when in doubt about the installation of a component to the picture of the PCB, once soldered wrong can sometimes be very tricky repair.
Tip 3: for the resisters a bending mold can be a useful components.

Assembly order

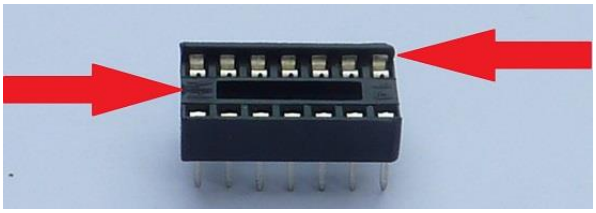
Mount the following resisters:

- R1: 470 Ω (yellow, purple, brown, gold)
- R2, R3: 1 KΩ (brown, black, rood, gold)
- R4, R5, R6, R7, R8, R9, R10: 10 KΩ (brown, black, orange gold)
- R11: 47 KΩ (yellow, purple, orange, gold)
- R12, R13, R14, R15, R16: 100 KΩ (brown, black, yellow, gold)
- R17, R18: 1 MΩ (brown, black, green, gold)
- R19: 10 MΩ (brown, black, blue, gold)
- Mount diode D2 en D3.



Please note that these can be mounted only one way, see drawing on the PCB. The black stripe on the diodes must match the stripe on the print.
NOTE: save the severed legs of the diodes, which we still needed.

- Mount IC-foot U1. Make sure this well flat against the print.
- **PLEASE NOTE**: in one of the ends of the IC-foot is a notch, it must match the drawing on the PCB. Make sure all the pins by the print back stitches before you go to all connections soldering, at the top level and in line.



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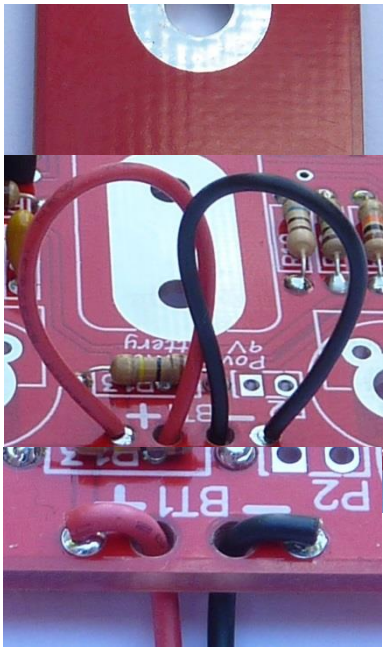
- Mount the following capacitor.
- C1, C2, C3, C4, C5, C6: 100 nF (yellow, inscription 104)
- C7: 4.7 nF (yellow, inscription 472)

Mount switch, S1 en S2.

- Mount transistor Q1.
- Mount the speaker LS1.
- Mount the pot meter, R20.
- Mount LED D1.
- **Please note** that LEDs have a short and a long leg. The long leg is on the side of the slide switches..
- Mount the Chokes L1 en L2.



Of the cutting wires of the diodes we go the signal key contacts.

- o Mount 3 wire bridges on the large print.
- o Mount 1 wire bridge on the arm of the key.

NOTE: Make sure the wire bridges well flat on the print are, see pictures. A little bit of solder on the side of the wire bridge is not really as long as it's not above the wire comes out.

- mount the battery connection.

To do this, insert the wires from under by the print back and then in the holes. Solder the threads. Then pull the threads tight, the Red wire to the + the black wire to-. See pictures.

- mount the signal arm key on the PCB.
  The two rectangular pieces of circuit board between the arm of the key and the print. Look at the picture for the right fitting way.

- Mount the signal arm key on the PCB.

The two rectangular pieces of circuit board between the arm of the key and the print. Look at the picture for the right fitting way.

- Place U1 in the socket.
  1. **Note:** in one of the ends of the IC is a notch (slit), it must match the drawing on the print and the notch in the previously-mounted IC-foot.

In principle, the Morse Phone now ready for use!

Take a look at the practical tips on page 12.

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The use and adjustment of the Morse Phone

Use as a Morse sounder

- When using as "beep", the setting and adjustment of the sensitivity as follows:
- • Set switch S2 to position "Hi" (high sensitivity).
- • Set switch S1 in position "Adjust".
- • Turn the adjustment knob "Compensate" until the Morse Phone is beeping.
- • Now turn the adjustment knob as far back that the beeping just stops.
- • Set the switch S1 in position "Operate", the Morse Phone can now be used.

Use as Morse Phone

If there are multiple Morse Phones be linked together, then there are two ways this can be done.

Morse Phones connecting with 2 threads

This possibility is the simplest. Each Morse Phone line as is described under "use as sounder". Connect to connect all Morse Phones the J1 connections with each other, do the same with the J2 connectors (makes a change in principle not matter).

Below are the Morse Phones ready for use. If the Morse Phones give a show if no key is pressed, then put switch S2 in position "Lo" (low sensitivity.

Morse Phones connecting with one wire and a ground rod

This method is slightly more complex. Connect all Morse Phones one connector (J1 or J2) with a ground rod (e.g. a herring) and the other connected via a wire to the other Morse Phones.

The metal pin in the ground will generate an electric voltage, this voltage can cause the Morse Phone is beeping, even if the key is not pressed. The likelihood of this situation is Morse at the different Phones the largest as different types of metal pens be used or if the soil composition is different (sand/clay, dry/wet, etc.). This tension can be compensated by turning to "compensate". Set switch S1 in position "Adjust" again, turn the dial until the beeping stops. Also tried the sensitivity can vary between "Hi" and "Lo".
In principle, the downward adjustment procedure be done but at one Morse Phone..

Some experimentation with different metals, the depth of the ground rod, can also influence in this situation. Also while using may need to have the button "compensate" to twist (the electric potential of the ground rod in the ground can change). This way of using the Morse Phone is more for the experimenters!!

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Interrupting the leak-resistance

Between J1 and J2 is a resistor posted by 100kOhm (R13). This resistance causes the Morse Phone independently, as sounder, may be used.

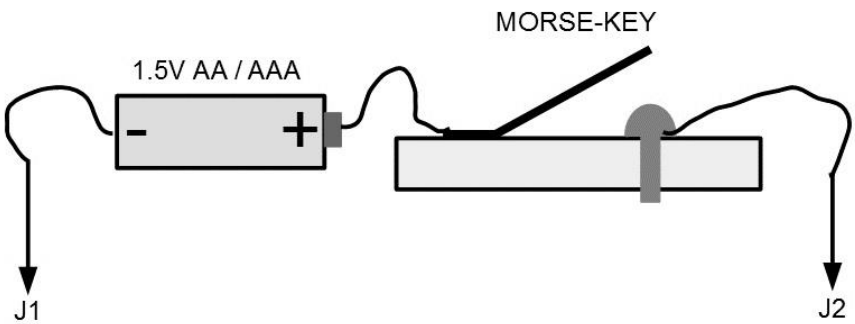
A real Fullerphone, the inspiration for the Morse Phone, could only be used if this was connected to another Fullerphone. The connection was interrupted, then also heard somewhere the sending station not show out of his Fullerphone (a handy indication that something was wrong). For the downward adjustment was necessary to the terminals of the Fullerphone (at the Morse Phone J1 and J2) with a piece of electrical wire. The Morse Phone can also work the same way as a real Fullerphone.

On the bottom of the print, at P2, runs a very thin trace. If you this gently scratched out, is resistance R13 is no longer active. The Morse Phone now has a short circuit wire between J1 and J2 to pieper. Or, with linked Phones, the own Morse Phone will only beep if there is actually another Morse Phone connected. With a drop of solder or a jumper above change can be undone

Build your own Morse key

It is also possible to build additional Morse keys to make a counter station which connects with wires to your Morse Phone.
There are two possibilities:
• Use one Morse Phone, there is then no additional battery needed.
You have than one Morse Phone and an external key.
• Create a foreign key in series with a battery (1 .5V AA or AAA).
This may be combined with multiple Morse Phones be used.

At the first possibility you rule the Morse Phone, as you would for use as a beeper. After adjusting, rotate the button compensate a little. The Morse Phone now gives no abeep, you now connect a wire with J1 and J2, the Morse Phone gives a beep. Your homemade signal key you can than between J1 and J2.
At the second possibility you rule the Morse Phone (s) off for use as beep, release the button adjust. The remote station now consists of a 1 .5V battery and signalling key. Connect the external drive to J1 and J2
TIP: look on internet to Morse keys based on clothespins and paper clips.



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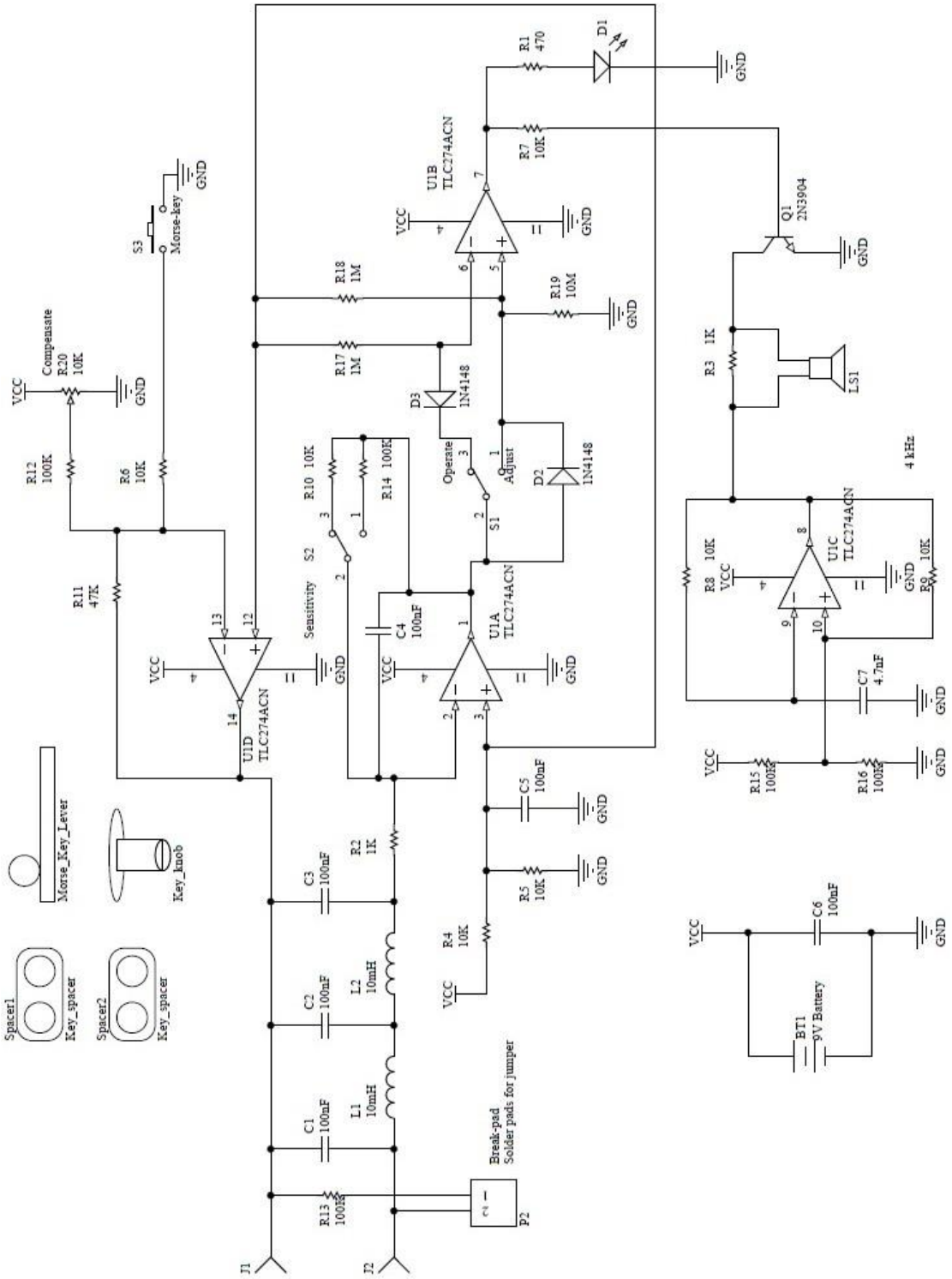
Schedule



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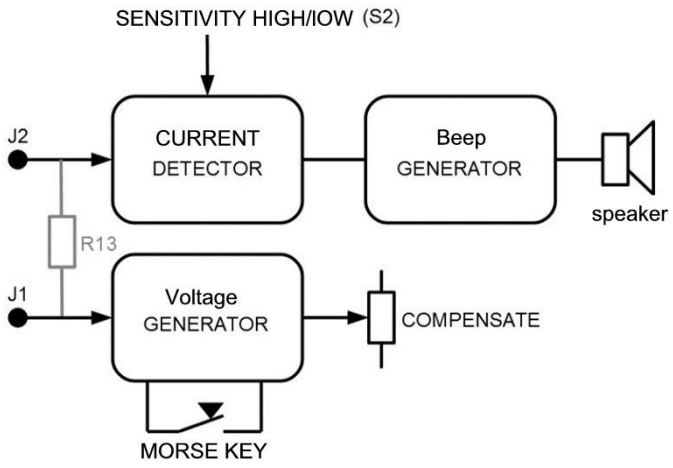
Electronic operation

- The circuit of the Morse is to divide into 3 blocks.
- • a tone generator
- • a power detector with switchable sensitivity
- • a power-generator with adjustable open-circuit voltage



The tone generator is controlled by the flow detector. If the power detector a stream, on connection J2, detects high enough it will turn on the tone generator, then sounds a tone from the speaker. The power, power-detector switches can be set with switch S2, the high/low button. The voltage generator is normally turned off and is turned on by pressing the key. In that case the voltage generator put a strain on J1. There can be a flow through an external Morse Phone go running, or if it is not connected, there will be at least a (small) flow through R13. On this current will flow-detector at the own Morse Phone and the external Morse Phone respond.

When using the Morse Phone with a ground rod and one wire, there will be by the contact of the metal pen with the ground a voltage be resurrected, this tension can induce an (unwanted) flow when the flow detector reacts (the Morse Phone remains always beeping). This can be solved by this tension to road (to compensate). That can be done with the button "compensate". To set the compensation voltage put your S1 in the stand "Adjust".

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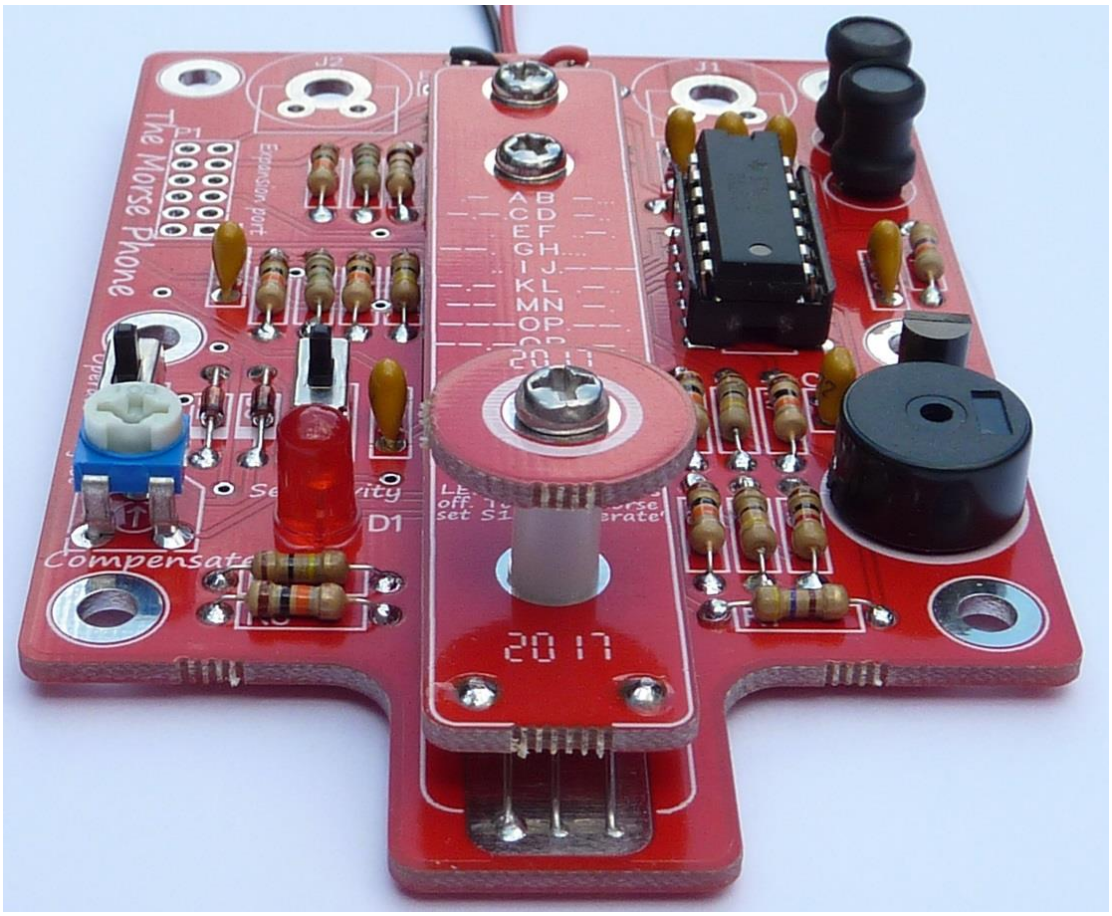
Practical tips

- • Under the print may 4 small feet (hardware store) are pasted. The key is a lot more stable and works finer.
-
- • The connecting wires of the diodes are Sometimes used as contacts for signalling key some thin. Then it may be nice to instead of 2 but 1 piece of print to use as a remote signal key holder of the arm.
-
- • To the threads on J1 and J2 to connect there are different possibilities. For example, you can solder the wires to the PCB, 4 mm banana buses, alligator clips, print Crown stones or drumsticks with a wing nut. The facilities for this are already present on the print..



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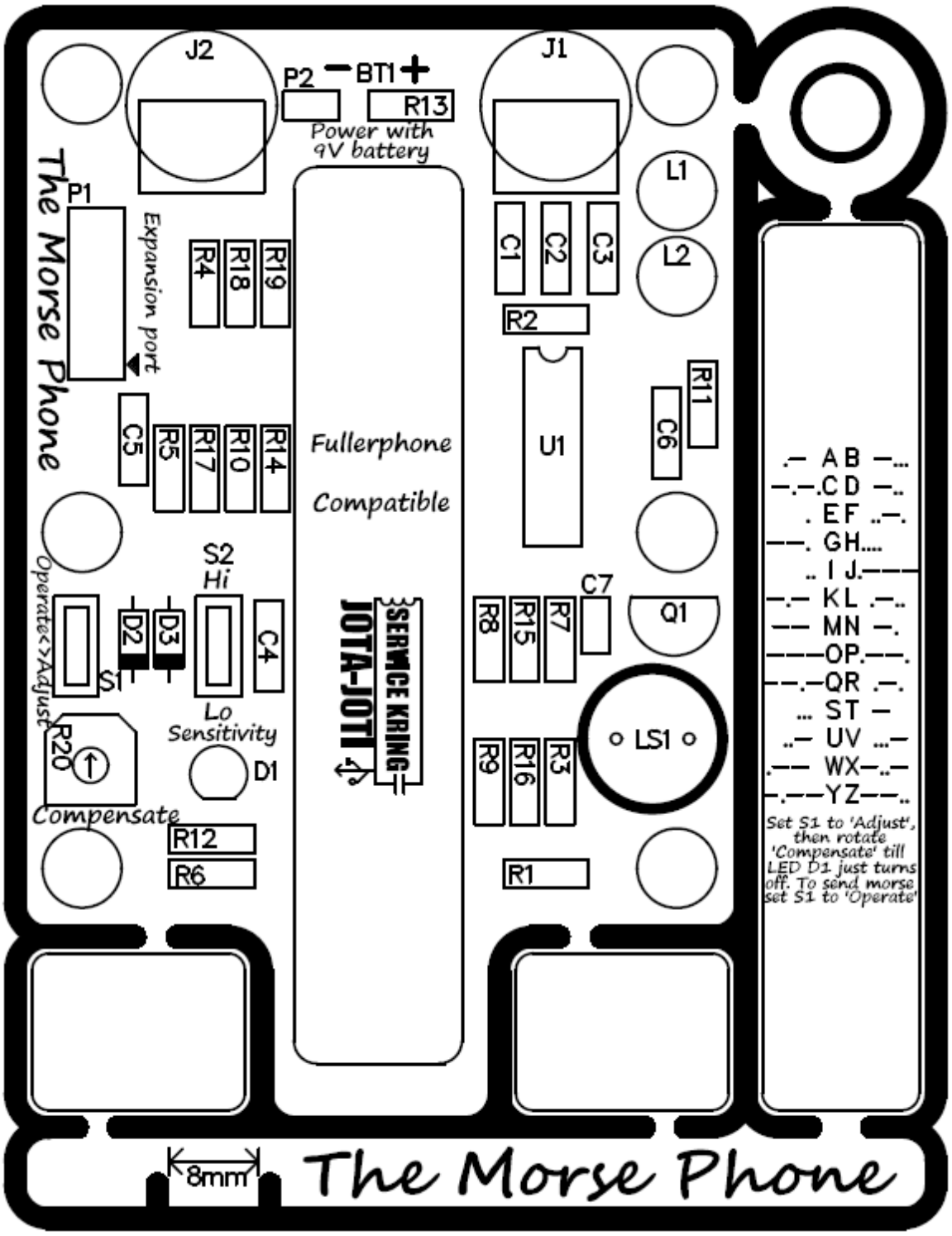
Component layout



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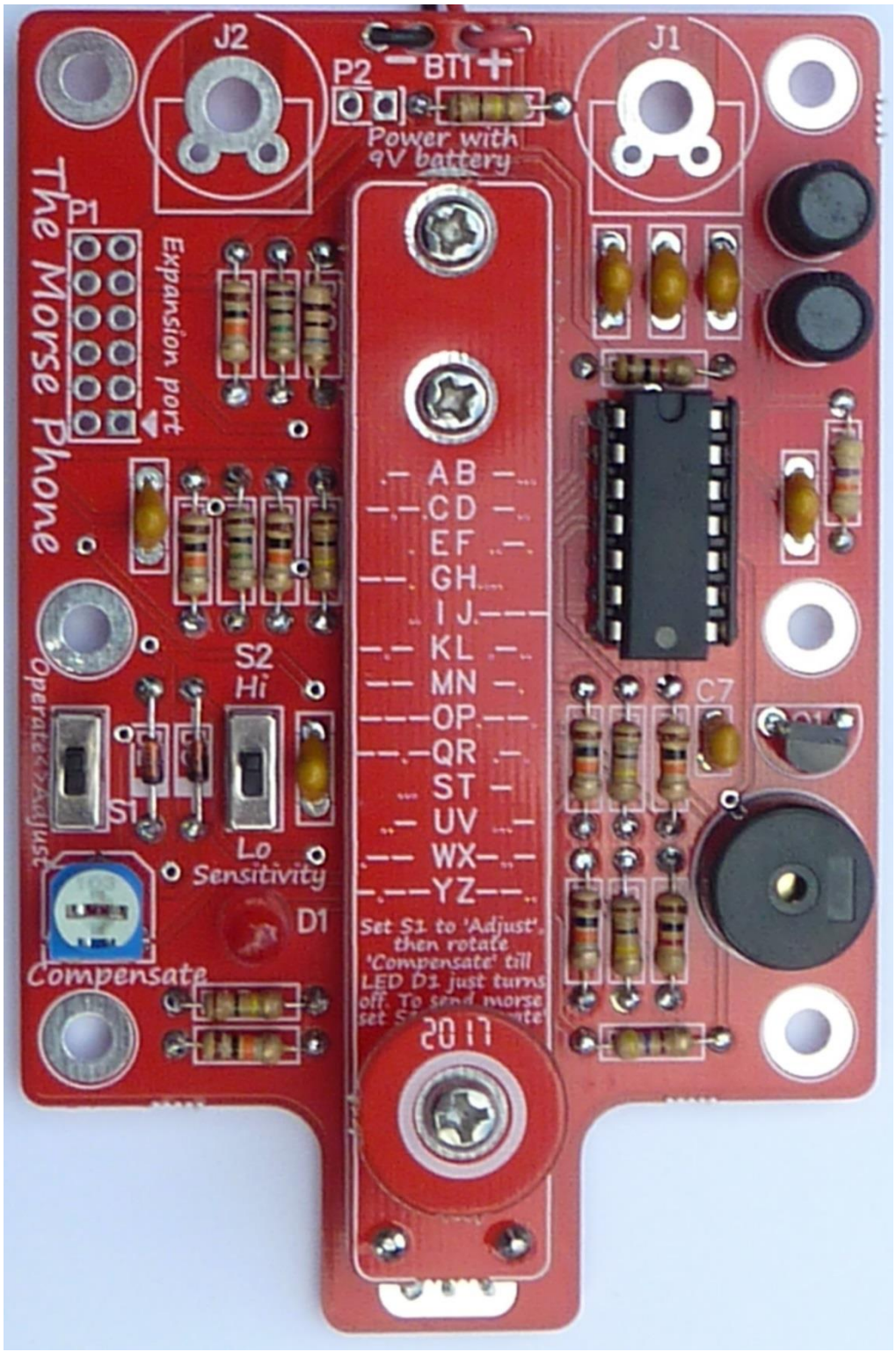
Complete PCB



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Soldering with children

- There are at soldering with children some pitfalls imaginable, by avoiding this, it is likely that the new little project is successfully completed.

- The following items we see in the field:
- • The making of the soldered connection takes (much) too long, A good soldered connection is made in about 3 seconds. Approximately 1.5 seconds for pre-heat (with a little solder to the tip for good heat conduction), attach solder, solder and remove the soldering iron. Children do not have this skill yet and the materials are heated for too long and thus too hot.
- • Children often tend to put solder on the soldering iron and then "stick" the solder on the board, the flux is already burning and poor soldering is the result. In an attempt to get it right, the solder connection heats up too long, causing component failures ed.
- • Temperature-controlled soldering irons are set at too high a temperature, for leaded solder around 320 ° C is a good temperature for soldering.
- • NON-controlled soldering irons often have to high power, and the pin temperature can reach 450-500 ° C. A iron with a power of about 15 to 20 W is for this purpose the most suitable.
- • The assistant has previously not read the manual and do not know exactly what to do.
- • There is too little guidance in relation to the number of participants. Certainly the youngest children, many need much guidance. A directive is to go aim for one attendant on one beaver, with cubs / gnomes one supervisor per soldering (2 scout members per soldering station). With older Scouts go for one supervisor on four members. As the members are more experienced this can be adjusted of course.
- • It is advisable to have besides the solder guidance, one supervisor who controls the PCB with components build on it and (if applicable) places the IC's ect. This trouble-shooter can also look at mail functional PCB that do not work right away.

Feedback

Do you have comments or do you want to give feedback on the Morse Phone?
Do you have comments or questions about the Service Kring JOTA-JOTI?
Please contact us via the contact form on the site www.kitbuilding.org.

On behalf of the Service Kring JOTA-JOTI, we wish everyone very happy building but also a lot of game fun with **the Morse Phone**!