

# HAND DOPPLER

JOHN WILLISCROFT - ZS6EF

## The ultimate direction finder.

- Simple to Build.
- High accuracy.
- Works with any receiver.
- Does not need attenuators
- Takes you right to the transmitter.

One gadget that has been developed for the fox hunting each month at the Johannesburg Branch is the hand doppler.

This piece of equipment is very close to the ideal direction finding tool.

The unit works with any hand held transmitter or receiver and does not require an S meter or connections to be made inside your set.

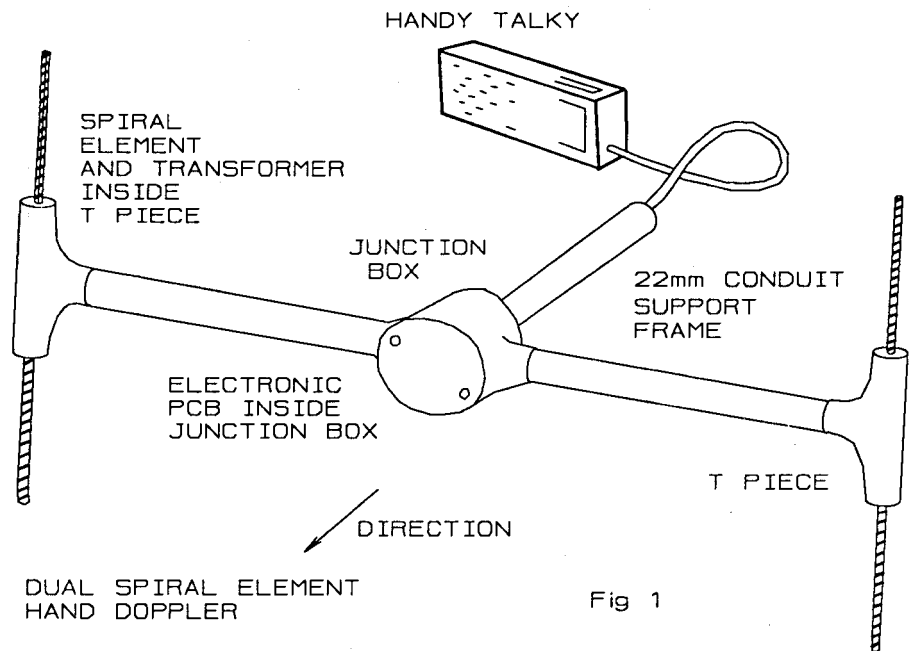
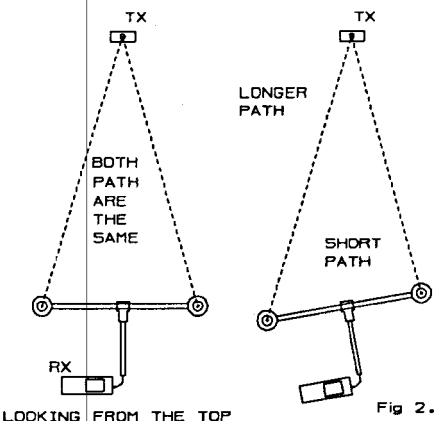
You can use the hand doppler in the dark with ease without lights, and no adjustments have to be made while hunting.

While this hand doppler is the most accurate direction finding piece of equipment seen to date, it is also the most simple of equipment to build.

## HOW IT WORKS

Look at the diagram Fig 2. When the doppler is pointing directly at the transmitter the distance from the transmitter to each element of the doppler is the same.

Switching from one element to the other at a rate of 500 Hz. the receiver connected to the doppler will receive the signal unaltered, as if only one element was used.



DUAL SPIRAL ELEMENT HAND DOPPLER

Fig 1

If one element is closer to the transmitter than the other only by a fraction of a mm. then the signal will arrive later at one element than at the other.

A very small movement of either element will present to the receiver a wave front that is delayed and advanced every 500 Hz. FM modulating the incoming signal at the switching frequency of 500Hz. Of course this will be heard as a tone in the loud speaker of the receiver.

The null in the 500 Hz. tone will only be heard when both elements are exactly the same distance from the transmitter. As soon as the elements are turned fractionally to one side or the other a tone is heard in the loud speaker.

Fig 3. circuit consists of two fet amplifiers that connect each element in turn to the coax line leading to the receiver. The amplifier is switched on when gate 2 of the fet is positive.

Gate 2 of each fet is driven from the 4001 circuit, one fet is switched on at a time.

Adjustment of the mark space ratio of the circuit can be made with the 20k trim pot. This test is best done with an oscilloscope, but if you don't have one you can adjust it by transmitting on your car rig and adjusting the trim pot for the clearest tone and best null.

## CONSTRUCTION

The body of the unit is made from standard electrical fittings found in your supermarket. The list of fittings is seen in the parts list.

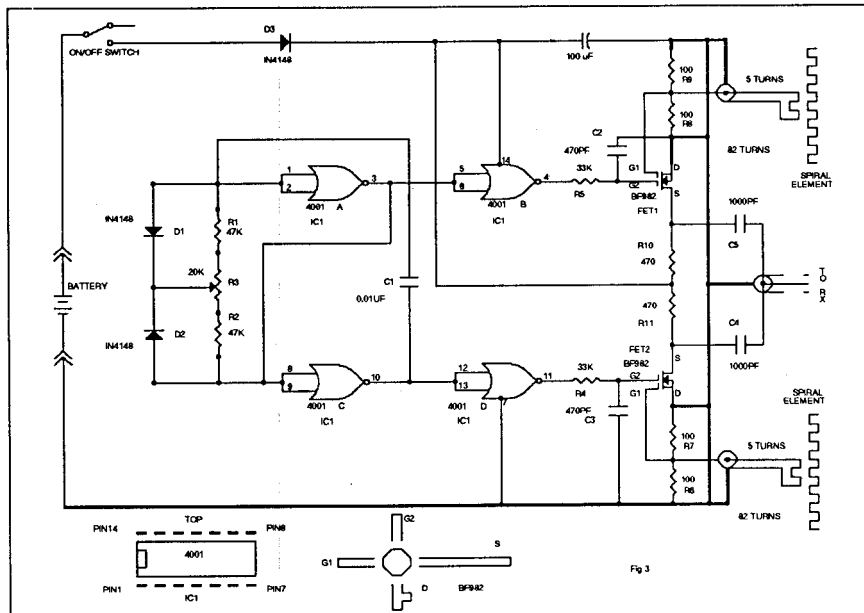
Elements are spiral wound on a 6 mm dowel in order to shorten the element from the 1000 mm normal length down to 450 mm so that it is easy to run through bushes and to store it in the car's boot.

Two elements are made by winding 82 turns of 0.8 or 1.1 mm wire onto a 6 mm wooden dowel 450 mm long evenly spaced.

Larger dowel will not resonate correctly as the ratio of interturn capacitance and the inductance must be correct.

Elements must be balanced, the spiral construction allows a transformer to be wound around the center with ease. The transformer consists of 5 turns around the exact center of the element. Take a look at Fig 4.

Exact tuning of the element to frequency is necessary in order for the spiral element to be efficient. This is accomplished by taking a grid dip meter exactly in the physical center of the element and adjusting the turns until the element is on 145.5 MHz.



If you do not place the coil of the grid dip exactly in the center of the element you will not get a true reflection of the elements frequency.

Antenna elements will cover the whole 2m band if dipped at the centre of the band.

Varnish is best used to cover the elements when the complete unit has been tested.

If you intend to cover the spiral elements with heat shrink it should be of a type normally used for high voltage and not a PVC based, or carbon filled type, otherwise your element will be deaf. Leave the covering off the elements until the element is complete and working, so that you can see the effect of the covering. You may also need to do some final adjustments.

Connect the coax to the 5 turns while assembling it into the electrical parts.

Keep the leads to the 5 turns as short as possible, and fix it into the conduit T piece with silicon rubber. Fig 4.

It is very important that both assemblies are identical and that the ends of the coax

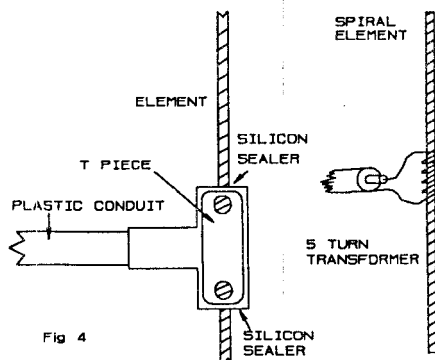


Fig 4

and the coil are connected the same way round.

The pcb assembly is straight forward and should create no problems.

Wire up the battery connector and switch to the PCB.

### TESTING

Connect the battery and switch on the PCB, place the probe on pin 4 of the 4001 and adjust the 20k trim pot so that the mark space ratio is balanced. Check that the amplitude of the mark is 8V.

Check on gate 2 of each fet for a square wave with a slightly rounded front edge.

Plug the coax into a receiver that is tuned to a local signal. Take care not to transmit into the hand doppler as you will destroy the fet's.

Place the doppler so that the elements are vertical, move the doppler side to side while listening to the tone. As you point both elements exactly towards the transmitter the tone should disappear.

If your elements do not point exactly straight ahead then you have not tuned up the spiral elements correctly. To overcome this slip the spirals up and down on one element at a time until the elements is pointing straight ahead.

### USING THE DOPPLER

If the antenna arrangement is made so that each half is identical then 1.5 degree of resolution is easily obtainable.

Listen to the station you wish to find with the doppler turned on.

With the elements vertical rotate the doppler around your body until the null in the tone is heard.

### PARTS LIST

2 x 20 mm conduit T pieces with inspection cover.

1 x 20 mm round junction box with a outlet each side and one on the bottom in the middle.

1 x 20 mm round junction box to be used as a lid.

3 x 20 mm conduit tube

300 mm long.

2 x lengths of 6 mm dowel

450 mm long.

1.5 m 50 ohm 6mm coax.

1 x BNC coax connector.

2 x 5mm x 40mm brass machine screws.

4 x Meter of 0.8 or 1.1 mm copper wire.

1 x pcb.

1 x IC1 4001 IC.

3 x D1 D2 D3 IN4148 diode

2 x FET1 & 2 BF982 or similar fet.

2 x R1 R2 47k

2 x R4 R5 33k

4 x R6 R7 R8 R9 100 ohm

1 x R3 20k trimpot

2 x C2 C3 470 pf

2 x C4 C5 1000 pf

1 x C6 100 uF

1 x miniature on off switch.

1 x 9V battery.

Parts available from VIDIKITS

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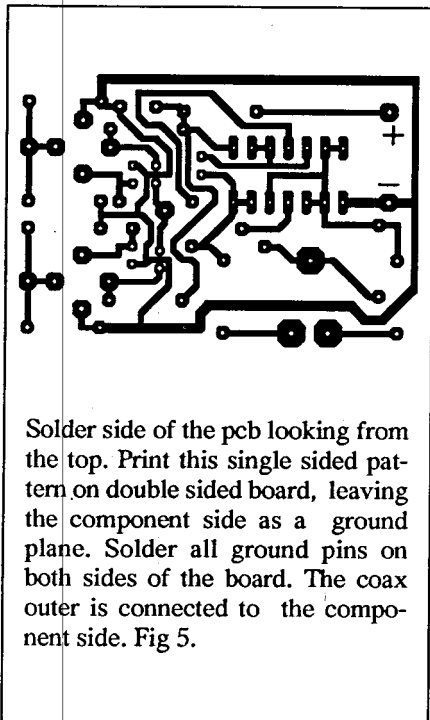
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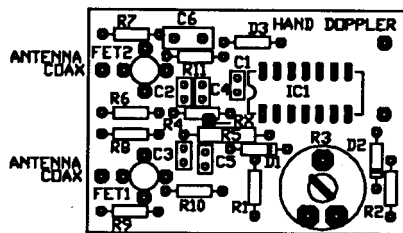
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Solder side of the pcb looking from the top. Print this single sided pattern on double sided board, leaving the component side as a ground plane. Solder all ground pins on both sides of the board. The coax outer is connected to the component side. Fig 5.



You now have a direct bearing on the station and you don't know if it is in front or behind you.

Take a few steps to the left or right of your first position and find the null again.

This new heading will be a little to the left or right of the first heading, this will indicate if the signal is ahead or behind you.

If you are a long way from the station say

40 km or so, you may have to walk sideways some 12 to 15 meters in order to see which direction the transmitter is in.

Once you know the general direction then you do not have to repeat this side walking exercise.

If you hear your tone is not completely clear, and contains a wobble, or you hear a high tone with the normal tone, then this is an indication that you are receiving multipath or a reflection.

To avoid this, take a few steps into a new position and find the direction again.

When you come very close to the transmitter, and you wish to know what antenna it is that is radiating, then you turn your doppler so that the elements are horizontal, move it up and down until you have a null and it will point directly at the antenna.

Good hunting from ZS6EF.

## ALGOA BAY C W MERIT AWARD

### SARL - PORT ELIZABETH

**A**lgoa Bay C W Merit Award, issued by the Port Elizabeth Branch of the South African Radio League.

This Award was originally inaugurated by the Algoa Branch in 1979 and was known as the Algoa Branch CW Merit Award. The Algoa Branch has now merged with the Port Elizabeth Branch and both branches use the name of Port Elizabeth Branch. To have some continuity with the original certificates, it was decided to change the name to Algoa Bay CW Merit Award.

The aims of the certificate are:

- to encourage the use of CW
- to encourage the new ZS licensee to actively operate on CW, rather than to wait out the first year until he/she is able to operate on Phone.
- to set a target for Amateurs to obtain a certificate which they could be proud to display in their shack.

The Rules are as follows:

- The award is available to licensed amateurs.
- Contacts on and after 1 January 1979 are valid.
- No QSL cards are necessary. Proof of contacts can be established by a log entry. Photostat copies of the log or a certificate signed by two licensed amateurs or the Secretary of

an Amateur Radio Club verifying the contacts are acceptable.

- The fee for the Award is: ZS stations R2. DX stations 2 dollars or 5 IRC's.
- The address for application is: The Awards Manager, Port Elizabeth Branch, SARL, P.O. Box 10402, PORT ELIZABETH, 6015, RSA

There are three classes of certificates as follows: Class 1: 250 x 2 CW contacts, of which 5 must be ZS contacts. Class 2: 500 x 2 CW contacts, of which 10 must be ZS contacts. Class 3: 1000 x 2

CW contacts, of which 20 must be ZS contacts

ZS contacts may be either with the same or different stations.

\* \* \* \* \*

To date 48 certificates have been awarded as follows: Alaska 1, Transkei 1, Great Britain 4, Switzerland 1, East Germany 2, Yugoslavia 2, United States of America 11, Republic of South Africa 12, West Germany 12, Canada 1, Denmark 1.

ALGOA BAY CW MERIT AWARD

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