Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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Table I. Mean Sunspot Numbers for January

Day	N	Raw	s.d.	K-corrected	s.d.	s.e.
1	30	115	4.9	90	2.9	0.53
2	29	133	4.4	106	3.3	0.61
3	30	118	5.0	94	3.3	0.60
4	33	137	6.0	109	3.4	0.59
5	29	149	6.0	118	3.2	0.59
6	30	167	6.5	130	4.0	0.73
7	27	159	7.2	126	4.3	0.83
8	22	152	7.3	116	3.9	0.83
9	23	143	9.5	109	5.6	1.17
10	27	134	8.1	105	4.9	0.94
11	25	155	9.3	119	4.3	0.86
12	29	168	9.7	125	4.7	0.87
13	23	174	14.5	122	6.7	1.40
14	24	146	10.8	115	5.4	1.10
15	21	141	10.7	104	5.1	1.11
16	22	107	7.6	88	4.5	0.96
17	24	73	3.6	58	2.1	0.43
18	19	81	4.6	66	2.4	0.55
19	20	96	5.8	73	3.5	0.78
20	26	84	4.8	66	2.9	0.57
21	31	108	6.3	82	3.9	0.70
22	22	137	9.8	106	4.3	0.92
23	29	156	9.1	122	5.5	1.02
24	31	165	8.2	129	4.4	0.79
25	29	136	6.6	109	3.9	0.72
26	25	123	5.7	99	3.4	0.68
27	21	145	8.3	109	4.9	1.07
28	32	125	9.4	103	5.4	0.95
29	24	117	9.4	95	6.5	1.33
30	17	127	10.0	97	5.8	1.41
31	26	115	5.6	91	3.3	0.65

Means: 131.8 102.6

No. of Observations: 800

No. of Observers: 61

Table II. January Observers

15	AAP	P.Abbott
4	ATON	A.Attanasio
17	BARH	H.Barnes
4	BATR	R.Battaiola
3	BLAJ	J.Blackwell
31	BOSB	B.Bose
27	BRAB	B.Branchett
7	BRAD	D.Branchett
21	BRAR	R.Branch
19	BROB	R.Brown
9	CAMP	P.Campbell
21	CARJ	J.Carlson
22	CHAG	G.Morales
18	CKB	B.Cudnik
1	CLZ	L.Corp
27	CR	T.Cragg
5	DEMF	F.Dempsey
14	DRAJ	J.Dragesco
21	DUBF	F.Dubois
21	ELR	E.Reed
10	FEEC	C.Feehrer
12	FERJ	J.Fernandez
16	FLET	T.Fleming
20	FUJK	K.Fujimori
3	GALM	M.Gallo
19	GIOR	R.Giovannoni
15	GOTS	S.Gottschalk
2	HALB	B.Halls
3	HAYK	K.Hay
6	HRUT	T.Hrutkay
19	JAMD	D.James
8	JEFT	T. Jeffrey
10	KAPJ	J.Kaplan
22	KNJS	J&S Knight
7	LERM	M.Lerman
17	LEVM	M.Leventhal
13	MALK	K.Malde
3	MARE	E.Mariani
21	MARJ	J.Maranon
23	MCE	E.Mochizuki
8	MILJ	J.Miller
14	MMI	M.Moeller
1	MUDG	G.Mudry
18	OBSO	IPS Obs.
12	PENG	G.Pennington
12	RICE	E.Richardson
21	RITA	A.Ritchie
13	SCGL	G.Schott
11	SCHG	G.Scholl
6	SIMC	C.Simpson
1	STEF	G.Stefanopoulis
16	STEM	G.Stemmler
8	STQ	N.Stoikidis
21	SUZM	M.Suzuki
11	TESD	D.Teske
6	THR	R.Thompson
9	URBP	P.Urbanksi
9	VALD	D.del Valle
12	WILW	W.Wilson
17	WITL	L.Witkowski
18	YESH	H.Yesilyaprak

Reporting Addresses

Sunspot Reports -- **email:** solar@aavso.org
postal mail: AAVSO, 25 Birch St. Cambridge, MA 02138
FAX *(AAVSO)*: (617) 354-0665

SES Reports -- **email:** noatak@aol.com
postal mail: Mike Hill
114 Prospect St. Marlboro, MA 01752

Magnetometer Reports -- **email:** capaavso@aol.com
postal mail: Casper Hossfield
PO Box 23, New Milford, NY 10959
FAX: (973) 853-2588 or (407) 482-3963

Table III. Means of Raw Group Counts for January 2001

Day	Mn.	Day	Mn.	Day	Mn.	Day	Mn.
1	6.5	9	9.8	17	4.6	25	8.0
2	8.3	10	8.4	18	5.3	26	6.7
3	7.7	11	8.7	19	6.4	27	7.6
4	8.9	12	8.6	20	5.4	28	7.1
5	10.1	13	7.8	21	6.6	29	7.0
6	11.4	14	6.8	22	7.0	30	7.4
7	11.0	15	6.5	23	8.7	31	6.8
8	10.1	16	6.0	24	8.6	Mn.	7.75

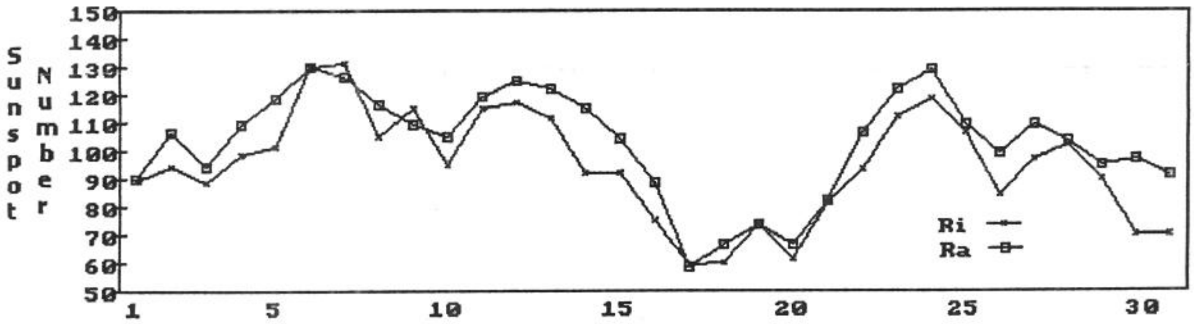

Fig. 1. Comparison of Ri (provisional) and Ra estimates for January.
(Ri Source: www.oma.be/KSB-ORB/SIDC/index.html)

Smoothed Mean Sunspot Number (Rsm) for July 2000: 123.9

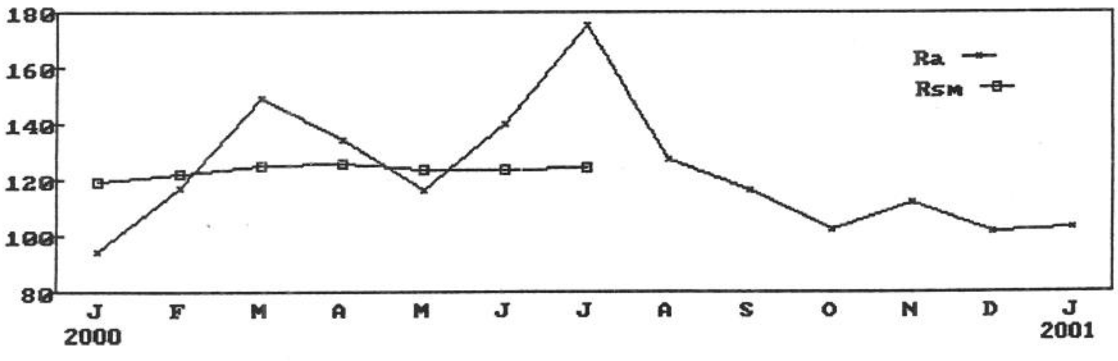

Fig. 2. Monthly Ra and Smoothed Mean Sunspot Numbers (Waldmeier method).

Editor's Note

Beginning with this issue, the monthly Solar Bulletin will be posted routinely to the AAVSO website. Visitors to the website who wish to contribute sunspot and/or Sudden Ionospheric Disturbance (SID) observations to the Solar Division on a regular basis are encouraged to contact the editor at either of the following addresses:

Postal Mail: AAVSO Solar Coordinator, 25 Birch St., Cambridge, MA 02138
Email: cfeehrer@hotmail.com

Sudden Ionospheric Disturbance Report

Michael Hill, SID Analyst
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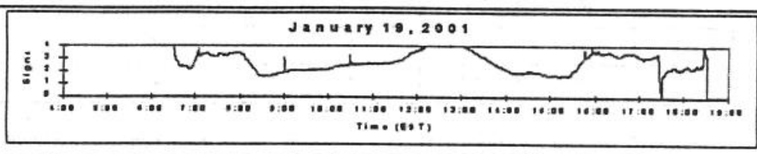
noatak@aol.com



Sudden Ionospheric Disturbances (SID) Recorded During January 2001

(Analysis performed by Michael Hill, SID Analyst)

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
010102	0800	3	010121	1925	2			
010102	1712	2	010123	1802	2+			
010103	0622	2+	010123	2045	2+			
010103	1045	2	010124	0533	1+			
010103	1807	2	010124	0725	1			
010104	0900	2+	010124	1103	2			
010104	2008	2	010124	1449	2			
010105	0711	2	010124	1555	2			
010105	1833	2	010124	1836	2+			
010107	1225	1-	010125	0711	2			
010109	0650	2	010125	0820	1+			
010109	0859	2	010125	0855	1			
010109	1604	1+	010125	1028	1			
010110	1017	2	010126	0605	1+			
010114	1030	1	010126	2014	2			
010115	1140	1	010128	0500	1-			
010115	1314	2	010128	1553	3			
010115	1603	2+	010128	1850	1+			
010115	1854	2+	010129	1540	1-			
010116	0610	1+	010130	1510	2			
010116	1531	2+						
010117	0605	3						
010119	1700	3+						
010120	1847	2+						
010120	2117	2+						

The events listed above meet at least one of the following criteria

1) Reported in at least two observer reports
2) Visually analyzed with definiteness rating = 5
3) Reported by overseas observers with high definiteness rating

Observer	Code	Station(s) monitored
A Clerkin	A29	NAA
J Winkler	A50	NAA, NPM
D Overbeek	A52	XXX, NAA, NSW
D Toldo	A52	XXX, NAA, NSW
A Stokes	A62	NAA
J Ellerbe	A63	ICV
P King	A80	FTA
A Panzer	A83	NAA
W Moos	A84	FTA
Hill, M	A87	NAA
G DiFillipo	A93	GBZ

Importance	Duration (min)
1-	< 19
1	19 – 25
1+	26-32
2	33-45
2+	46-85
3	86-125
3+	> 125

Solar Events

Once again the past month featured many lower C-Class flares punctuated with a smaller number of large M-Class flares. The most active periods were centered around the 15th and the 20th of January. Of the 191 X-Ray flares registered by the Goes-8 spacecraft, only 10 of them were M-Class and there were in fact no X-Class flares all month. Our observers monitored 8 of these large flares. A total of 45 events were reported for the month. The 15th was a noteable day for it consisted of two very large events, generated from a C9.4 at 1600 UT and a C4.9 at 1845 UT, both relatively small flares. On the 19th there was an M1 flare at 1625 and this resulted in a very long duration event that lasted most of the rest of the day. This was most curious, especially since not only was it a long slow event but it was followed by an abnormally low dip of signal strength afterwards. Unfortunately my signal was cut off by the sunset effect before it could show how the signal might have recovered. What we need here is an observer in Hawaii ☺ (We have Europe, eastern North America, and even South Africa, but no one farther west than Jerry Winkler in Houston, Texas.)

The 20th was another active day including the strongest flare of the month: an M7.7 that once again was cut off for me by the sunset pattern. The SID event was on a very steep rise when it abruptly stopped and leveled off, followed by a very sharp decline. I was struck by how very dependent the propagation of the signal is to the Ionosphere and how sensitive our receivers are - not just to the flares occurring on the sun, but also to the composition of a vital part of our atmosphere. It is always this sense of being able to measure the environment around me that makes SID monitoring so interesting. I'm sure many of our observers feel the same.

The most active day was on the 24th, a day on which observers monitored many significant events. Interestingly, in a similar manner with which the high flare activity for the month consisted mainly of a lot of smaller flares, all of the flares that day were lesser class flares. The average was only at a level of C4.5. Neverthless they all produced strong signal enhancements easily visible on my daily chart recording. Hopefully most of you check your charts or recorders every day. It is much easier to log the data for one day than for 7 days or worse yet 30 days. The side benefit, of course, is first hand knowledge of the days activity on the sun and in the Ionosphere. Good observing and of course Happy New Year and Happy New Millennium.

SUDDEN IONOSPHERIC DISTURBANCES SUPPLEMENT

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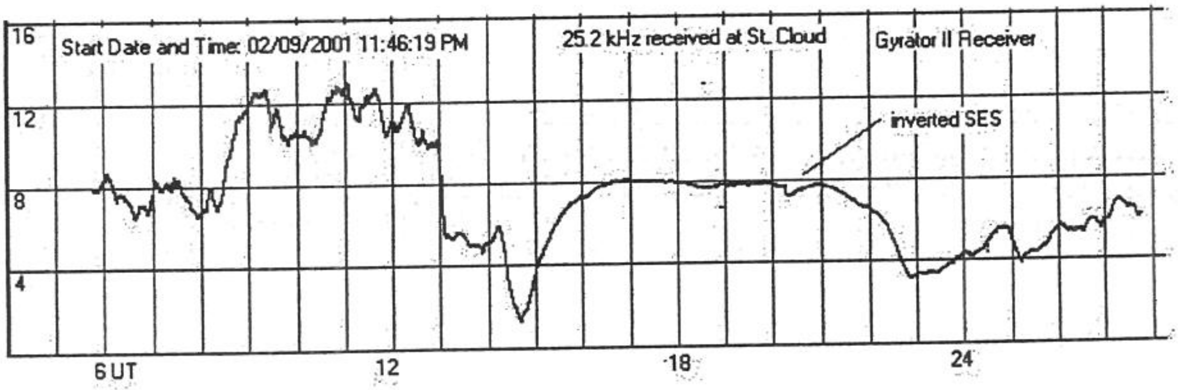
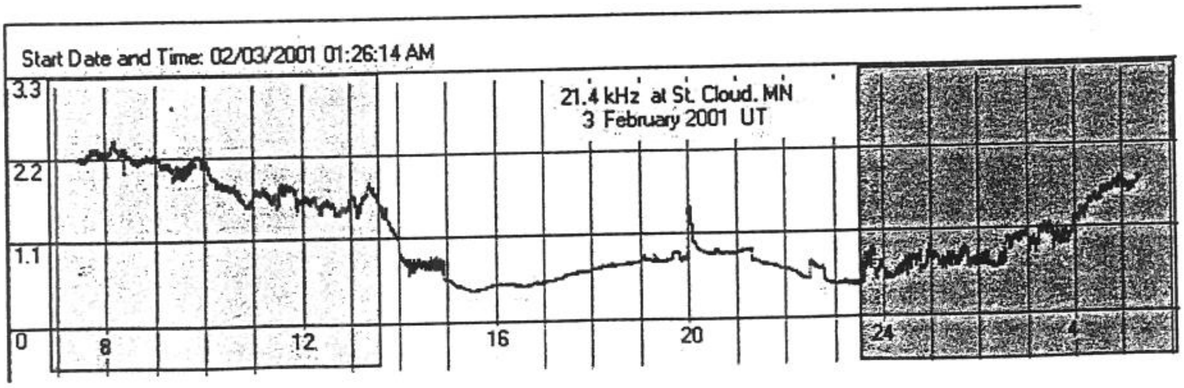
SUDDEN IONOSPHERIC DISTURBANCES RECORDED DURING JANUARY, 2001

Art Stokes has redesigned his Gyrator II receiver so it requires fewer parts and is easier to build. The new minimal design and Art's description of its advantages is shown below. Recently Al McWilliams of torsion magnetometer fame built a gyrator II receiver and ran some tests on it. He very loosely coupled the output of a precision function generator to the input of the gyrator II and stepped the frequency up and down 10 Hz and obtained a very well defined curve. At the center frequency (24000 Hz) the DC output was 13 volts. At about 70% of this voltage the frequency width is close to 160 Hz. Therefore the overall "Q" of the gyrator II is calculated to equal 150. I.e., the "bandwidth" is 160 Hz when tuned to 24000 Hz. The gyrator II was then tuned to 25.2 kHz to produce an output of 13 volts. When the receiver was tuned back to 24 kHz the signal voltage dropped to 0.8 volts, a factor of 16 from the 13 volts at 25.2 kHz. This seems to indicate an additional narrow bandpass filter would be required to receive the 24 kHz from Cutler, Maine in St. Cloud. The 25.2 kHz transmitter in La Moure, SD is only about 200 miles from St. Cloud, MN where Al lives. He measured drift over time and found it to be less than 5 Hz. A recording of an inverted SES on the 25. 2 signal is shown below. Another recording below shows Gyrator II has no problem, however, recording the much weaker 21.4 kHz signal from NPM in Hawaii. I do not know of anyone else who has successfully recorded NPM in Hawaii from the USA with a gyrator II receiver. Al uses a long wire antenna rather than the small indoor loop antenna others use. This may account for his success. These tests show that despite its simplicity Gyrator II is an excellent little receiver that is easy to build and set up to record solar flares. Its 160 Hz passband provides excellent selectivity that will separate the stations and with a good antenna it can pull in the weak signals like NPM in Hawaii.



The chart above records an inverted SES on the 25.2 kHz signal. Its transmitter distance from S. Cloud, MS is only 200 miles. For a nearby signal inverted SESs are not unusual and often provide excellent sensitivity to ionospheric disturbances.



The shaded areas in the chart above are the nightime part of the recording. Notice how the sunset rise of NPM on 21.4 kHz does not occur until about 4-hours after sunset in St. Cloud, MN. The signal still responds to flares after local sunset giving extra hours of coverage when recording a far westerly signal like NPM.

A Minimal Gyrator II VLF Receiver

Arthur J. Stokes N8BN

A more simple version of the Gyrator II receiver can be built with an absolute minimum number of parts. This version eliminates the metal cabinet as well as the need the drill mounting holes in the cabinet. All parts are mounted on the circuit board. The only modification to the circuit board is the need to drill four holes to mount two connectors and two potentiometers.

Construction:
The first 1/4 inch hole is made 1 inch from the left side of the board and 1 and 1/8 inch from the back edge. The second 1/4 inch hole is made 5/8 inch from the right side and 5/8 inch from the back edge. The third hole is made with a 3/8 inch drill 2 1/2 inches from the left edge and 1 and 1/4 inches from the front of the board. The second 3/8 inch hole is made 7/8 inch from the right edge and 3/4 inch from the front edge of the board. The shafts on the potentiometers are usually long and should be cut off with a hacksaw to about 3/4 of an inch. Some small washers should be placed on the shafts to lift the pots slightly off the PC board to prevent shorting to the copper foil. All parts should be mounted on the PC board and soldered carefully before the pots are put in place. The pots should be rotated to position the tabs close to the corresponding points on the circuit board where the connections are to be made. Short pieces of bare copper wire are used to connect the pots. There is no need to use shielded wire since the connections are short. There are no feedback problems with these short connections. The four corner mounting holes on the PC board were enlarged slightly and used make legs that would allow the receiver to sit on a flat surface. Four one inch 6-32 screws and double nuts made up the legs.

The previous version of the Gyrator II used a center tapped 12 volt transformer mounted in the cabinet. Since Radio Shack does not carry suitable wall plug transformer, the circuit has been modified to use a 9 volt DC wall transformer. This modification uses two 1 K resistors in series with the common point used as the center tap to ground. The 1 K resistors are mounted in place of the two rectifier diodes in the original circuit. The circuit works well with 5 1/2 volts to the IC's. All parts, except the PC board are available from Radio Shack

This version uses ceramic capacitors available from Radio Shack Although the Q of these capacitors is not as high as the polypropylene capacitors, they still provide sufficient selectivity for good tuning.

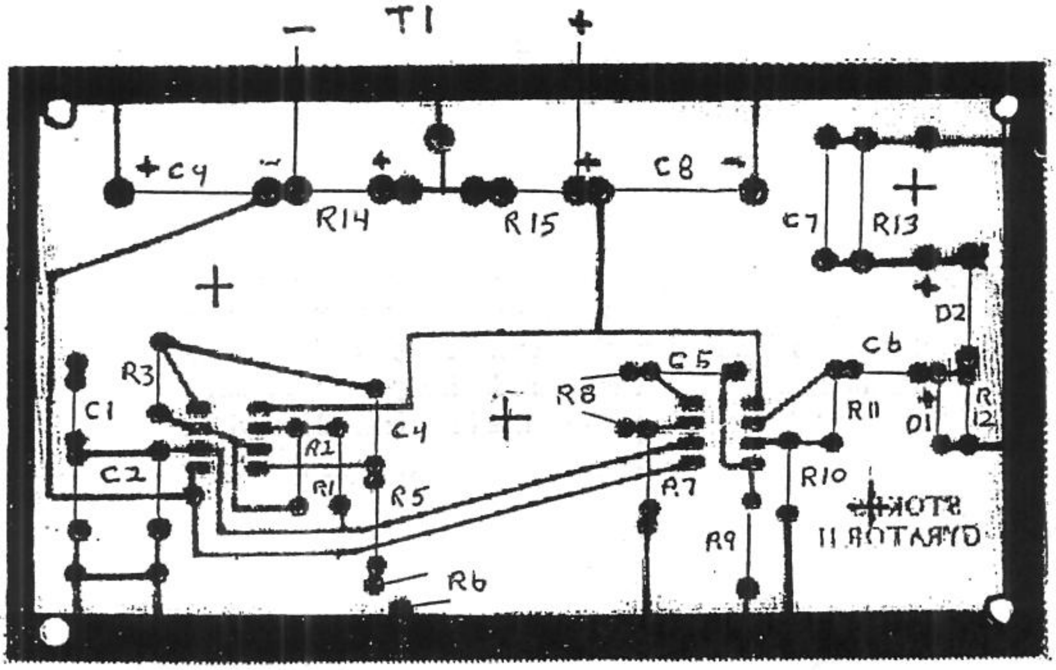
Performance:
This little receiver has worked very well. It has about the fewest number of parts that can make a workable VLF receiver.

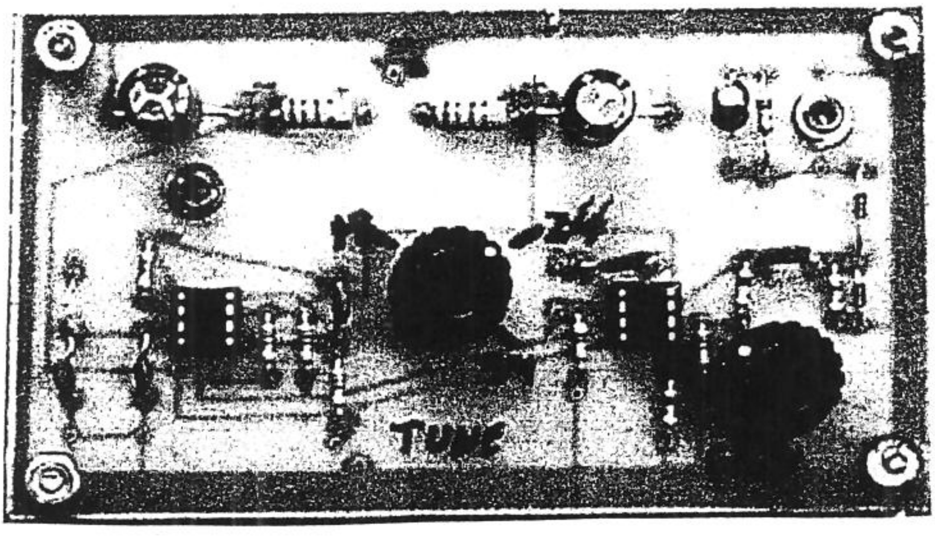
The Gyrator II circuit board may be purchased from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

References:

1. Arthur J. Stokes, "A Gyrator Tuned VLF Receiver", *Communications Quarterly,* Spring 1994, pgs 24-26
2. Arthur J. Stokes, "A Gyrator Tuned VLF Receiver", *SID Technical Bulletin, Vol.5,1*
3. Arthur J. Stokes, "Gyrator II - An Improved Gyrator Tuned VLF Receiver", *SID Technical Bulletin, Vol.10,1* Available at www.AAVSO.org

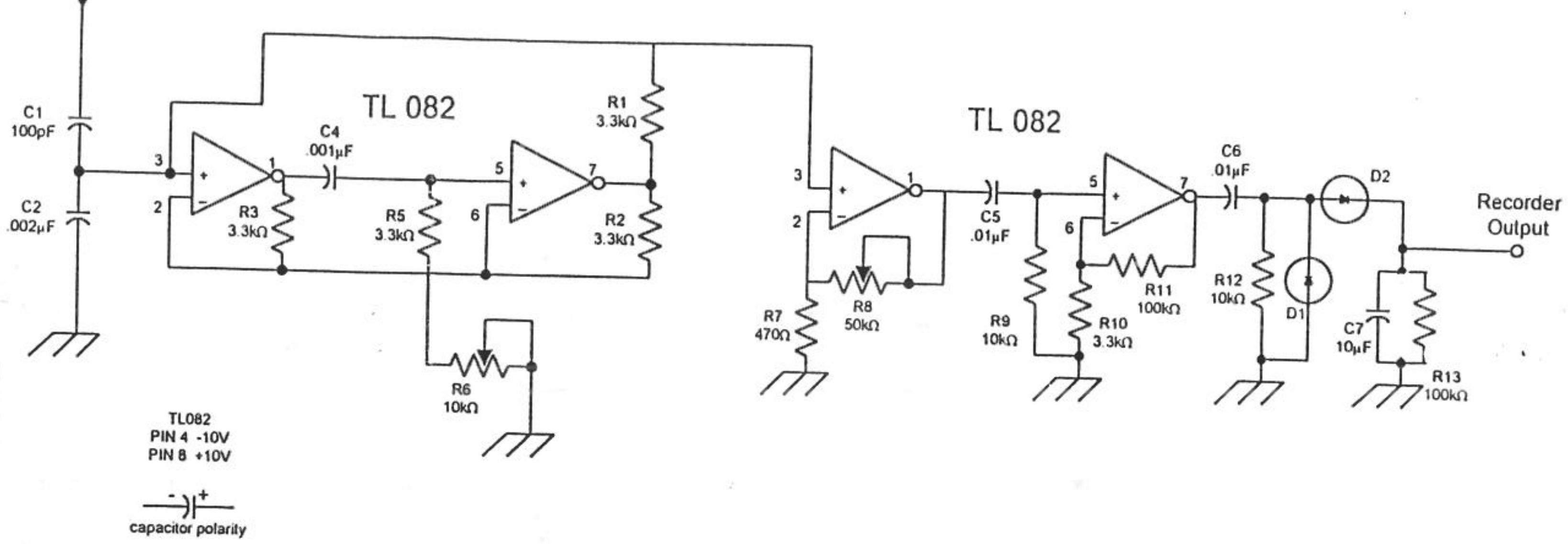
Parts Placement on Circuit Board





Gyrator II VLF Receiver

Minimal Version



Parts List: Minimal Gyrator II VLF Receiver

R1,R2,R3 R4,R10	3.3-k resistors 1/4 watt 271-1328
R9,R12	10-k resistors 1/4 watt 271-1335
R11,R13	100-k resistors 1/4 watt 271-1347
R7	470 ohm resistor 1/4 watt 271-1317
R6	10-k linear pot 271-1715
R8	50-k linear pot 271-1716
R14,R15	180 ohm resistors. ½ watt 271-1110
C1	100 pfd Hi-Q ceramic disc capacitor 272-123
C2	Two parallel .001 ufd Hi-Q caps 272-126
C4	.001 ufd Hi-Q cap 272-126
C5,C6	.01 ceramic caps 272-131
C7	10 ufd electrolytic capacitor 272-999
C8,C9	470 ufd electrolytic capacitors 272-957
TL082	Dual Bifet Opamps 276-1715
T1	9 V DC 300 mil wall transformer 273-1455
	Audio connectors 274-251
	Knobs 274-407
	IC sockets 276-1995