Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

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July 1999

Daily Mean Sunspot Numbers, R_a for July 1999

(computational analysis performed by Joseph Lawrence)

simple average / k-corrected

Day	R_a avg	Std. Dev.		R_a k	Std. Dev.
1	178	10.4		148	6.3
2	180	7.8		158	5.0
3	167	7.6		148	5.7
4	175	8.9		155	6.4
5	156	6.1		137	4.6
6	145	7.0		131	5.2
7	147	6.1		127	4.1
8	130	6.8		115	4.6
9	145	6.6		128	4.0
10	137	5.5		117	3.7
11	157	5.6		134	3.8
12	158	6.7		137	4.9
13	123	4.8		105	2.9
14	111	4.9		94	3.3
15	102	3.9		89	2.9
16	98	3.8		85	2.7
17	104	5.0		89	3.8
18	104	5.8		95	4.6
19	84	4.0		70	3.6
20	100	4.4		86	3.7
21	104	4.0		90	3.0
22	117	5.1		96	3.4
23	123	4.7		107	3.5
24	141	6.4		118	4.1
25	145	6.8		121	4.0
26	133	9.7		114	4.9
27	149	5.4		133	4.7
28	181	7.4		156	5.6
29	207	8.0		180	5.2
30	208	11.4		180	8.6
31	187	11.0		166	5.7

Monthly Mean R_a avg = 141.8

Monthly Mean R_a k = 122.9

Observer	Code	Country	Days Obs.
Abbott, P	AAP	Canada	12
Anderson, E	ANDE	USA, NY	4
Attanasio, A	ATON	Italy	21
Barnes, H	BARH	New Zealand	16
Battaiola, R	BATR	Italy	21
Berg, R	BEB	USA, IN	6
Berdejo, J	BERJ	Spain	30
Blackwell, J	BLAJ	USA, NH	7
Boschat, M	BMF	Canada	24
Bose, B	BOSB	India	12
Branchett, B	BRAB	USA, FL	29
Branch, R	BRAR	USA, CA	30
Carlson, J	CARJ	USA, MA	23
Morales, G	CHAG	Bolivia	27
Cudnik, B	CKB	USA, TX	29
Clemens, C	CLEC	USA, PA	14
Laurent, C	CLZ	France	5
Collins, B	COLB	USA, OH	14
Compton, T	COMT	USA, MI	23
Conlin, G	CONG	USA, WA	8
Dempsey, F	DEMF	Canada	16
Dubois, F	DUBF	Belgium	29
Reed, E	ELR	USA, TX	30
Feehrer, C	FEEC	USA. MA	26
Ruiz, J	FERJ	Spain	16
Fleming, T	FLET	USA, TX	26
Gallo, M	GALM	Argentina	7
Giovanoni, R	GIOR	USA. MD	28
Gottschalk, S	GOTS	USA, IA	17
Halls, B	HALB	England	8
Hay, K	HAYK	Canada	15
Hrutkay, T	HRUT	USA, PA	21
Imperi, R	IMPR	USA, OH	5
Iskum, J	ISKJ	Hungary	10
Janssens, J	JANJ	USA, TX	3
Jenkins, J	JENJ	USA, IL	13
Jenner, S	JENS	England	4
Kaplan, J	KAPJ	USA, MN	19
Knight, J	KNJS	South Africa	25
Lerman, M	LERM	Canada	8
Leventhal, M	LEVM	Australia	19
Lizak, T	LIZT	USA, RI	22
Lubbers, T	LUBT	USA, MN	24
Malde, K	MALK	Norway	23
Mariani, E	MARE	Italy	14
Mochizuki, E	MCE	Japan	21
McHenry, L	MCHL	USA, PA	4
Miller, J	MILJ	USA	8
Moeller, M	MMI	Germany	28
Mudry, G	MUDG	Canada	10
Prestage, N	OBSO	Australia	9
Randall, T	RANT	USA,NY	2
Richardson, E	RICE	England	25
Ritchie, A	RITA	USA, MA	28
Ramsey, J	RMAJ	USA, AR	2
Ramsey, S	RMAS	USA, AR	2
Schott, G	SCGL	Germany	30
Simpson, C	SIMC	USA, OH	11
Gordon-States, B	STAB	England	28
Stoikidis, N	STQ	Greece	28
Suzuki, M	SUZM	Japan	22
Teske, D	TESD	USA, MS	31
Thompson, R	THR	Canada	15
Vargas, G	VARG	Bolivia	26
Wilson, W	WILW	USA, TN	14
Witkowski, L	WITL	USA, FL	25
Wydra, K	WYDK	Poland	18
Yesilyaprak, H	YESH	Turkey	31

Sudden Ionospheric Disturbance Report

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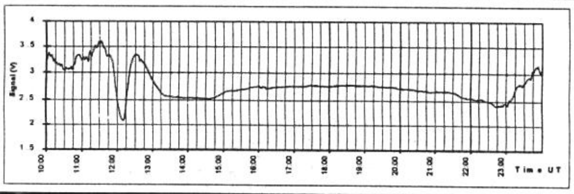

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Sudden Ionospheric Disturbances (SID) Recorded During July 1999

(correlation analysis performed by Joseph Lawrence, SID Analyst)

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
990701	0710	2	990708	0928	1	990723	1244	2	990729	1915	1
990701	0810	1+	990709	1800	1	990723	1400	2	990729	1935	2+
990701	1257	2+	990709	1856	1+	990723	1600	2	990729	2345	2
990701	1350	2	990709	1959	1	990723	2000	3	990730	0114	1+
990701	1457	2+	990709	2019	1-	990723	2106	2	990730	0600	1-
990701	1534	1+	990709	2341	2+	990723	2300	2	990730	0720	1
990701	1658	1-	990711	1317	1	990724	0403	1+	990730	0855	1+
990701	1743	2+	990711	1551	1+	990724	0753	2+	990730	1421	2
990701	2143	2+	990712	0730	1-	990724	1125	2	990730	1520	2+
990702	0719	2	990715	1436	1+	990724	1448	2	990730	1606	1+
990702	1521	2+	990715	1558	1-	990724	1619	2+	990730	1706	1-
990703	1507	1+	990716	0846	2+	990724	2045	2+	990730	1732	2
990703	1854	1+	990716	1549	2+	990724	2245	2	990730	1820	3
990703	1903	2+	990716	1746	2+	990725	0104	1-	990730	1852	1
990703	2022	2	990717	1404	1+	990725	0132	1+	990730	1915	2
990703	2048	2	990717	1627	2	990725	0513	1	990730	1946	3
990703	2123	2	990717	1746	2+	990725	1335	3	990730	2021	2
990704	0826	2+	990717	2207	1	990725	1842	2	990730	2157	2
990704	1617	2+	990718	0745	2	990727	1827	2	990730	2335	2+
990704	1859	2	990718	1754	2+	990727	1901	1	990731	1030	1
990704	2026	1+	990718	1852	2+	990728	0810	2+	990731	1400	1+
990704	2045	1+	990719	0835	3	990728	1807	3	990731	1614	2
990704	2328	2+	990719	1948	1+	990728	1936	2+	990731	1800	2
990705	0131	2	990720	0607	1	990728	2041	1+	990731	1837	2
990705	1202	2	990720	0823	1-	990728	2236	2+	990731	2359	1+
990705	1718	2+	990721	0812	1	990729	1253	2			
990705	1846	2+	990721	1845	2	990729	1447	1+			
990705	1902	1+	990722	2107	2+	990729	1515	2			
990707	1530	2	990723	0504	1+	990729	1648	2			
990708	0657	2+	990723	0912	1	990729	1730	2			

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

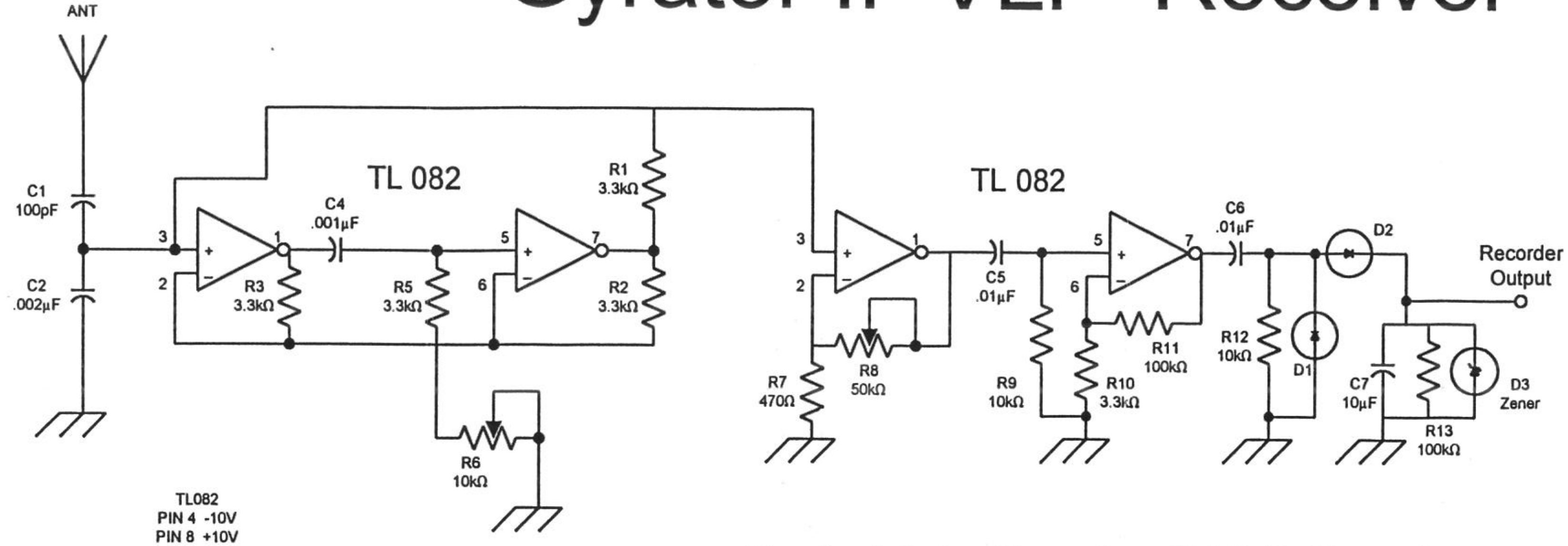
1) reported in at least two observers' reports.
2) visually analyzed with definiteness rating = 5 on submitted charts
3) reported by overseas observers with high definiteness rating

Observer	Code	Station(s) Monitored
Winkler, J	A-50	NAA, NPM
Overbeek, D	A-52	NAA, NSW, NPM
Toldo, D	A-52	NAA, NSW, NPM
Stokes, A	A-62	NAA
Witkowski, L	A-72	NAA
Landry, A	A-81	NAA
Panzer, A	A-83	NAA
Moos, W	A-84	FTA, GBZ, ICV
Hill, M	A-87	NAA
Mandaville, J	A-90	NAA, NPM

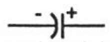
Importance	Duration (min)
1-	< 19
1	19 - 25
1+	26 - 32
2	33 - 45
2+	46 - 85
3	86 - 125
3+	> 125

Editor's Note: SID Technical Bulletin Volume 10 No. 1 described the new gyrator II receiver developed by Art Stokes (A62). The schematic published in the report contained errors which have subsequently been identified by Leonard Witkowski (A72). Errors in the diagram wiring and parts list were attributed to oversights by the editor. The corrected page is provided in this Bulletin. Also, the printed circuit board was expected to cost $7.00, but FAR Circuits will provide the boards for $7.50 postpaid.

Gyrator II VLF Receiver

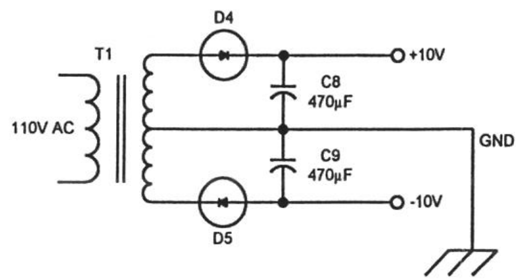


TL082
PIN 4 -10V
PIN 8 +10V



capacitor polarity

Bipolar Power Supply



Design By Arthur J. Stokes, 1999

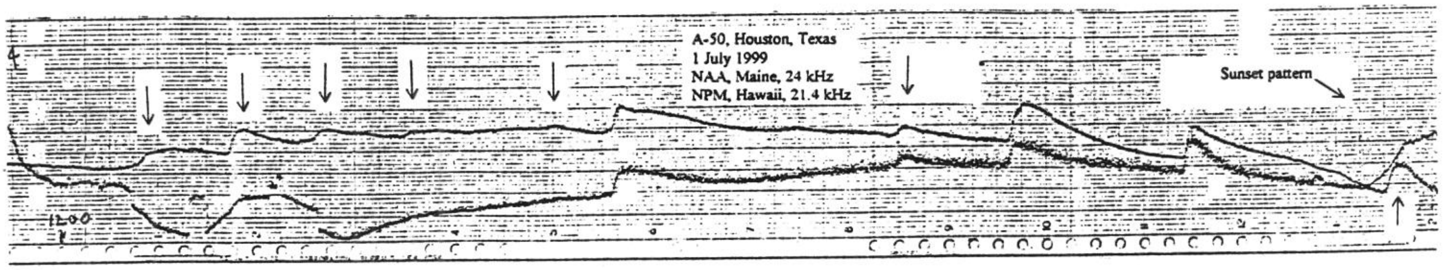
Parts List: Gyrator II VLF Receiver

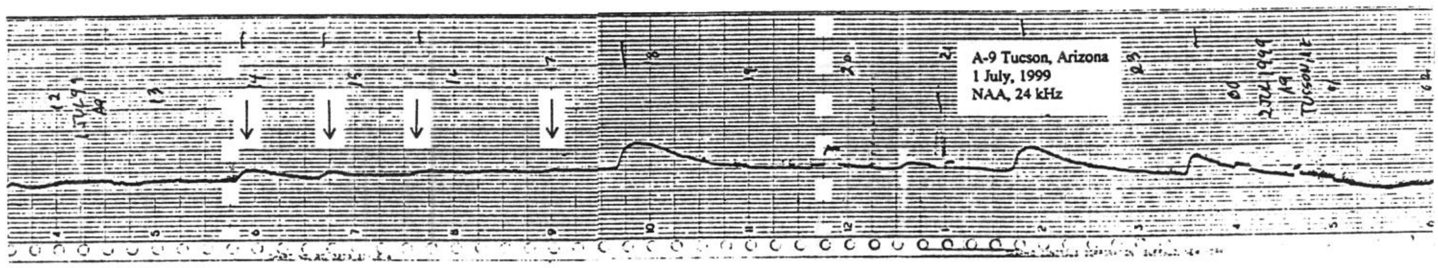
Schematic Label	Component	Radio Shack Part Number
R1,R2,R3,R5,R10	3.3kΩ, 1/4W	271-1328
R9,R12	10kΩ, 1/4W	271-1335
R11,R13	100kΩ, 1/4W	271-1347
R7	470Ω, 1/4W	271-1317
R6	10kΩ linear pot	271-1715
R8	50kΩ linear pot	271-1716
C1	100pF polypropylene cap	(see Mouser Electronics)
C2	Two parallel .001 µF polypropylene capacitors	-
		-
C4	.001µF polpypropylene cap	-
C5,C6	.01µF ceramic capacitors	272-131
C7	10µF electrolytic capacitor	272-1013
C8,C9	470µF electrolytic capacitor	272-1030
D1,D2	1N34 diode	276-1123
D3	5.1V Zener diode	276-565
D4,D5	1N4001 silicon diodes	276-1101
TL082	Dual biFET op-amp	276-1715
T1	12 Volt center-tapped transformer	273-1365
	Metal cabinet, BNC connector, 1/8 inch audio connector, knobs, power cord and misc. hardware	

Sudden Ionospheric Disturbances Recorded During July

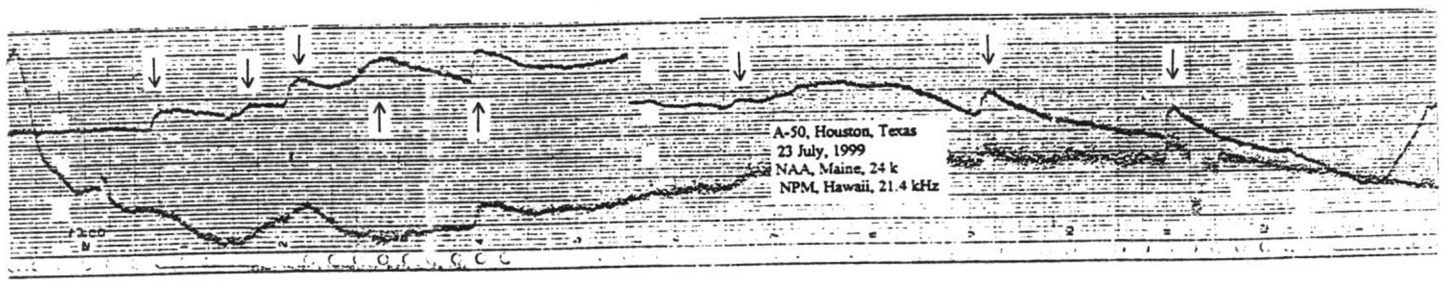
Prepared by
Casper H. Hossfield

July started off with lots of solar activity. Charts are reproduced below for 1 July that shows 10 solar flares recorded as Sudden Ionospheric Disturbances, SIDs. The first chart, a multiplexed recording of NAA and NPM by Jerry Winkler, A-50, shows four small SIDs between 1200 UT and 1600 UT. Although they are small they are nevertheless quite definite because Jerry's chart is interference free all that day. There is also a tiny hardly noticeable flare at 1700 UT that I didn't count until I saw that it was also recorded as a tiny even less noticeable SID on the chart below by Werner Scharlach, A-9, whose chart is also interference free all morning. These charts show how easy it is to detect even the very tiny SIDs when there are two or more interference free charts that can be compared. A-50's 10[th] SID is recorded on NPM at 0130 UT the next day after NAA's Sunset pattern shows the Maine to Houston, Texas propagation path was no longer sunlit. By multiplexing NPM in Hawaii Jerry extends the time he can record SIDs by about 4 hours.

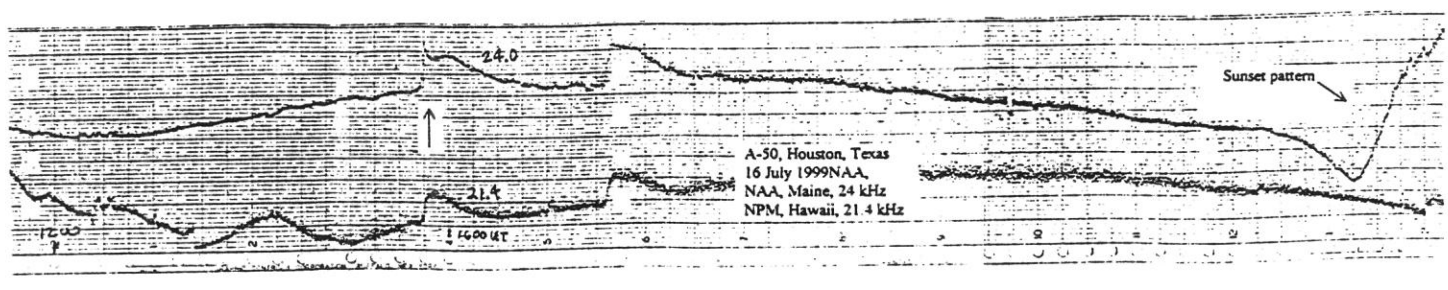




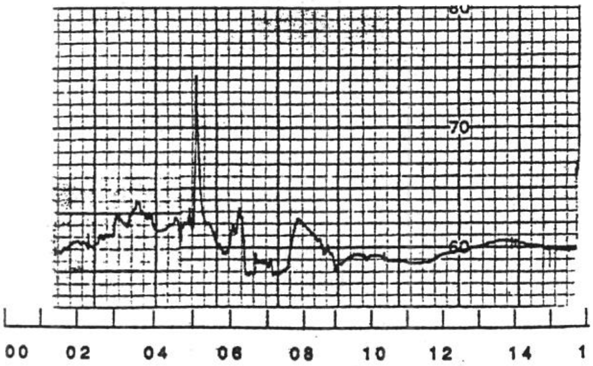
The 23[rd] of July was another high activity day. The chart below shows 5 SIDs between 1200 UT and 1700 UT. The 4[th] and 5[th] SIDs shows clearly how much the rise time to maximum can vary. The 4[th] SID takes more than 15 minutes to rise to maximum while the 5[th] one gets there in about 3 minutes.



The chart below shows an interesting inversion in the rise to maximum of an SID at 1545 UT. NPM's SID shows the normal shape, as does the following NAA SID starting at 1736 UT. It is a mystery why the first is inverted and followed less than two hours later by a normal rise to maximum.



Recordings of two magnetic storms are shown below. Jim mandaville, A90, made the first magnetogram that shows a sharp 160 nanotesla spike at 0500 UT. The same spike shows on Danie Overbeek's magnetogram made in South Africa although not as pronounced. The 3rd and 4th magnetograms are of the 30 July magnetic storm. All four magnetograms were made with McWilliams Torsion variometers.

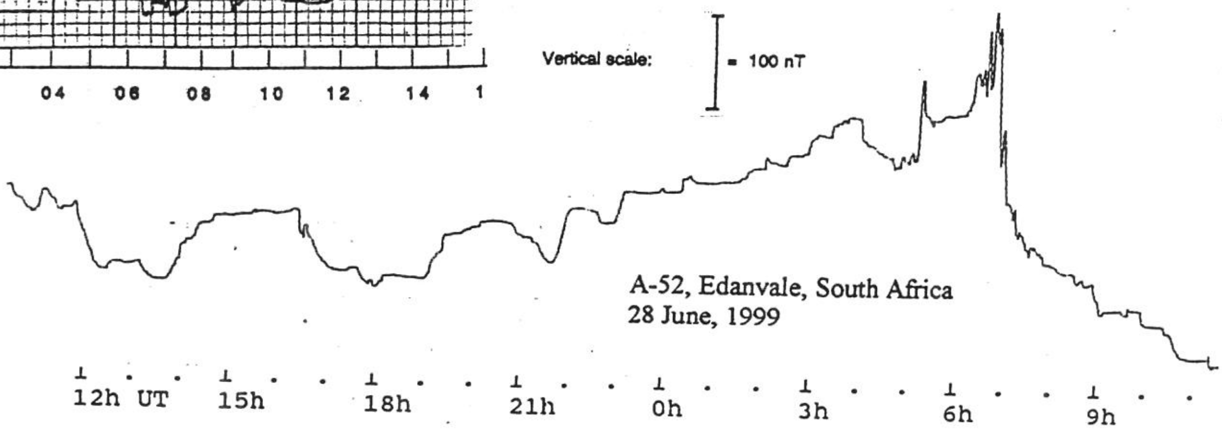


Horizontal component (H) at Oro Valley, Arizona (geographic 32° 23.4'N, 110° 56.8'W; magnetic latitude 40° N), 28 June 1999. Torsion variometer; observer J. Mandaville. Time scale in hours UTC.

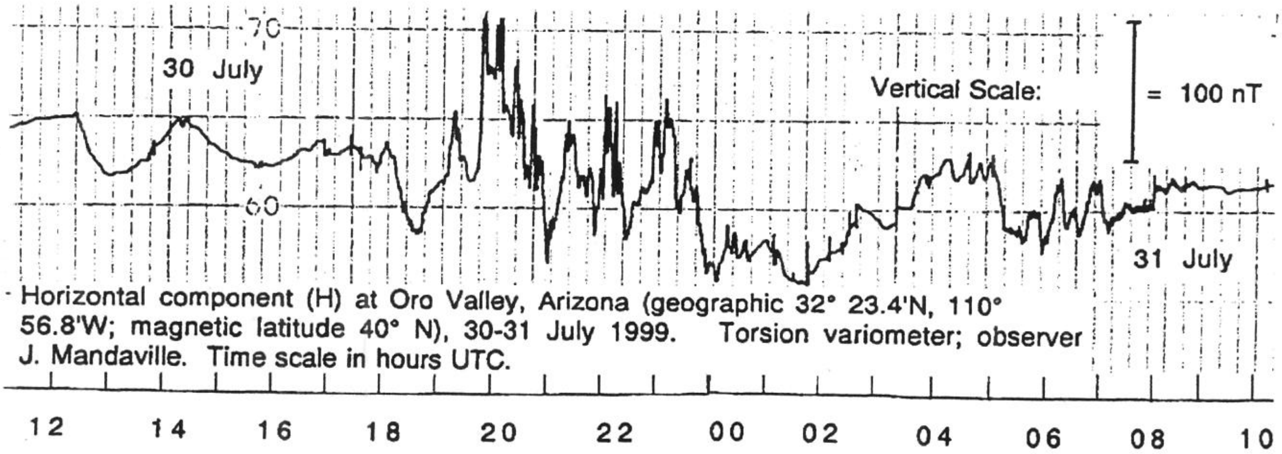
Note unusual, sharp positive spike, beginning at 0500 UTC. Its amplitude is 160 nT.

Original vertical scale: 1 mm = 5 nT.

This trace shows the final part of a disturbance that had been proceeding through the previous day (27 June 1999).

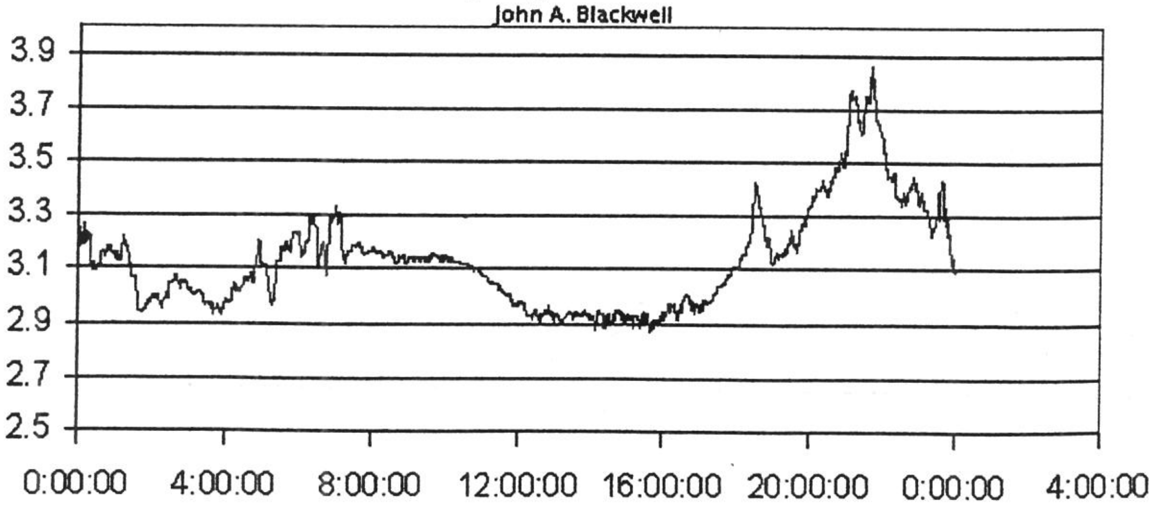


Magnetogram: "H" at Edenvale, South Africa. 1999 06 28



Horizontal component (H) at Oro Valley, Arizona (geographic 32° 23.4'N, 110° 56.8'W; magnetic latitude 40° N), 30-31 July 1999. Torsion variometer; observer J. Mandaville. Time scale in hours UTC.

Magnetogram 073199 UT
John A. Blackwell



Sudden Ionospheric Disturbance Technical Bulletin

AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

Volume 10 Number 1

July 1999

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The Solar Division is pleased to receive for publication a description of the improved gyrator II VLF receiver developed by SID Technical Coordinator Art Stokes (A-62). The original gyrator VLF receiver was described by Mr. Stokes in *Communications Quarterly* magazine in 1994. Further experimentation and comments from many SID observers who built the original gyrator have lead to the improved gyrator II design. Periodically as relevant article submissions are received, the Solar Division will publish these articles in special issue technical bulletins. All Solar Division observers are encouraged to submit articles pertaining to solar observing technique, equipment, and data analysis for consideration.

Gyrator II - An Improved Gyrator Tuned VLF Receiver

By Arthur J. Stokes, Sr.

The original gyrator tuned VLF receiver has been previously published[1,2]. Many of the receivers have been built and used successfully for monitoring SID's since 1994. Some users of that receiver have problems with the receiver going into oscillation when the gain was increased to a high level. It occurred to me that the problem could very well be a result of the gyrator tuning function of the circuit being too close in proximity to the amplifier function, inasmuch as both functions are on the same integrated circuit chip.

In this new circuit design, I have separated the two functions by using two dual op-amps in place of the original quad op-amp. The two op-amps are separated on the circuit board to minimize interaction. Another advantage here is that I have selected the TL082 dual biFET op-amps which are available from Radio Shack. The original 1436 quad op-amp was not easily available.

The amplifier function is quite different from the original precision rectifier arrangement. The new circuit uses the two amplifiers on the IC with capacitor coupling. The first amplifier is set up with a variable gain of zero to one hundred. The second amplifier has a fixed gain of about thirty. This gives a total gain of about three thousand which is generally enough for our purpose.

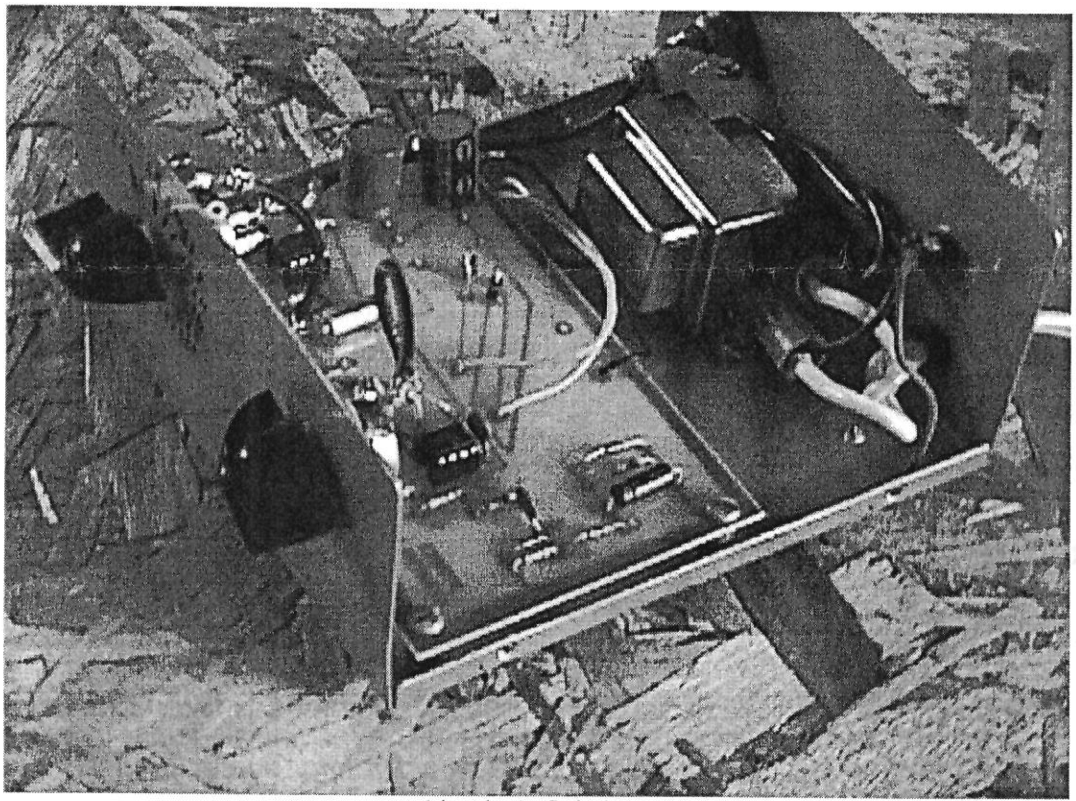
The rectifier-integrator has been changed to a straightforward two diode rectifier arrangement that has been used in previous receivers. This works well here. An optional 5 volt Zener diode may be placed across the recorder output to limit any voltage surge that could result from a high gain setting and strong signal input.

The power supply is designed around a twelve volt center-tapped transformer available from Radio Shack. Two diodes and two capacitors form a dual voltage power supply with approximately ten volts plus and minus. The small amount of ripple on the DC voltage does not affect the performance of the receiver.

Performance

The tuning of the gyrator is very sharp. The tuning dial must be turned very slowly to avoid missing a station signal. The half power bandwidth is a little over 200 Hz. This high Q is only obtained when using high Q polypropylene capacitors in the gyrator. Silver mica capacitors work fairly well also.

The recorder output is sufficient to drive a few milliamperes to various types of recorders and also enough voltage for A/D converters for computer recording.



(photo by Art Stokes)

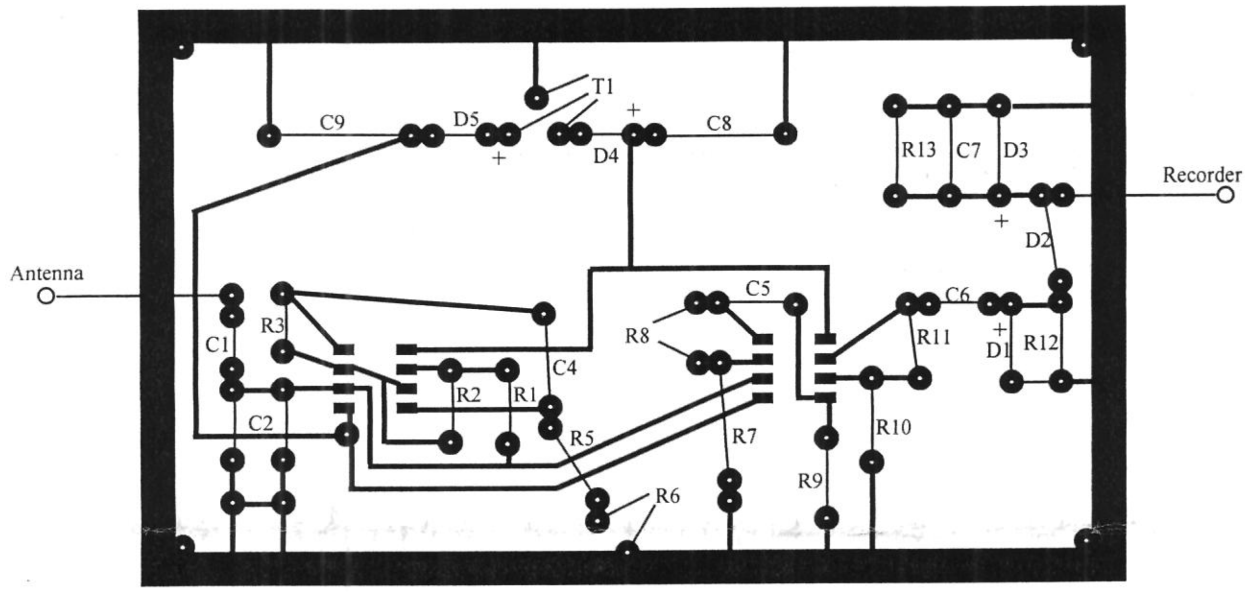
Construction

A printed circuit board is available from FAR Circuits. All parts are available from Radio Shack with the exception of the polypropylene capacitors. These capacitors can be obtained from Digi-Key and Mouser Electronics. I will also supply the capacitors for $3.00 post paid.

Wires to the two potentiometers and the recorder connector must be cut to length and soldered in place before mounting the circuit board in the cabinet on standoff supports. The antenna signal lead to the BNC connector must also be in place. Holes in the cabinet for the two potentiometers, the BNC connector, the recorder connector, and the power cord must be made before placing the circuit board. All the diodes must be mounted in the correct orientation with regard to polarity. The marked band is always to the plus direction. It is advisable to use shielded audio cable or small coax for the connections to the potentiometers and to the BNC antenna connector.

Summary

I have found the Gyrator II circuit to be very stable with the advantage of increased gain without oscillation. The increased output drive is sufficient for recorders that require a few milliamperes. A further benefit lies in the availability of most parts from Radio Shack.



Parts Placement on Circuit Board

Acknowledgement

My sincere thanks to Casper Hossfield (A-05) for many fruitful suggestions in the design of the final circuit. His assistance was very helpful in arriving at a much improved VLF receiver.

Those who wish may purchase the gyrator II circuit board for $7.00 from FAR Circuits, 18N640 Field Court, Dundee IL 60118, USA. Make certain to request the gyrator II circuit board to avoid confusion with the previous design. Polypropylene capacitors are available from Mouser Electronics: http://www.mouser.com or (800)346-6873.

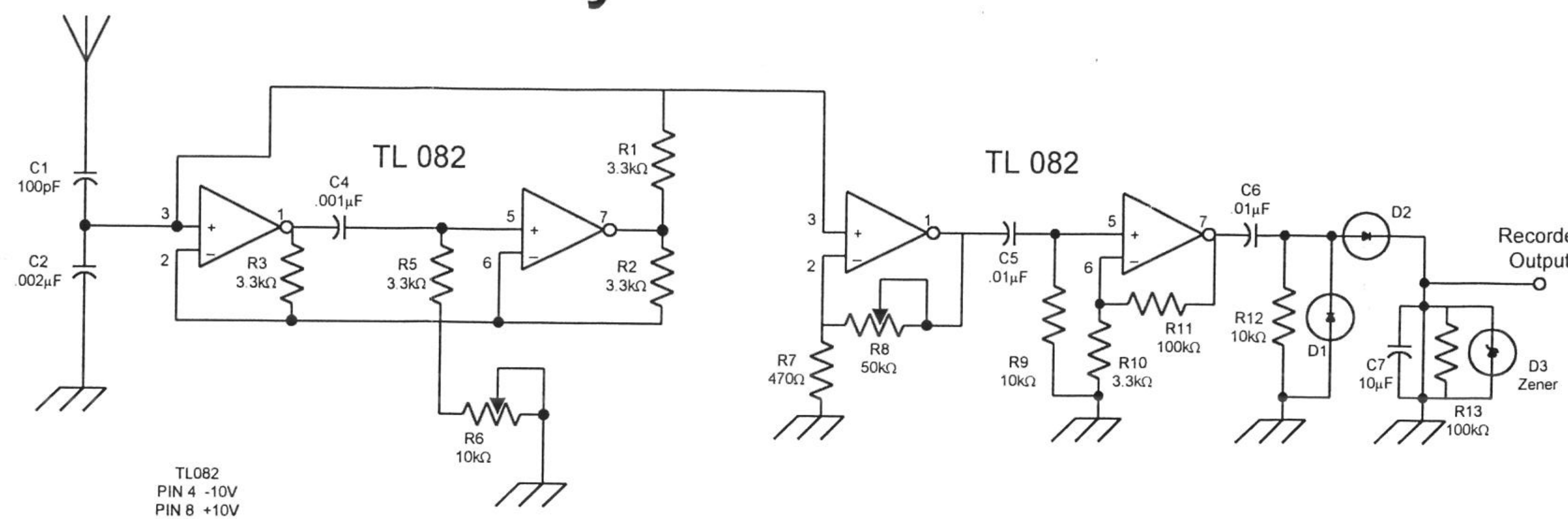
Arthur J. Stokes, N8BN
astokes@gwis.com

References:
1. Arthur J. Stokes, "A Gyrator Tuned VLF Receiver", *Communications Quarterly*, Spring 1994, pg 24-26.

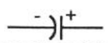
2. Arthur J. Stokes, "A Gyrator Tuned VLF Receiver"' *SID Technical Bulletin*, Vol.5, 1.

Editor's Note: Mr. Stokes ran tests to verify the necessity of using shielded wire to connect the potentiometers. His results indicate that parasitic oscillations limit the useful gain to only half the full range if unshielded wire is used to connect the potentiometers and signal connectors. The amplifier improvements described in this article are only achieved with the use of shielded wire.

Gyrator II VLF Receiver

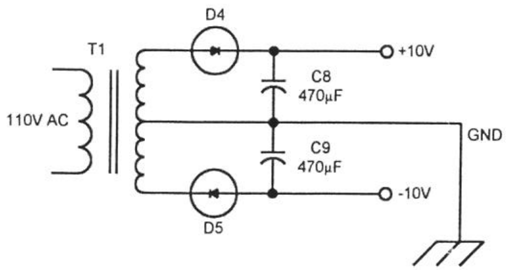


TL082
PIN 4 -10V
PIN 8 +10V



capacitor polarity

Bipolar Power Supply



Design By Arthur J. Stokes, 1999

Parts List: Gyrator II VLF Receiver

Schematic Label	Component	Radio Shack Part Number
R1,R2,R3,R4,R10	3.3kΩ, 1/4W	271-1328
R9,R12	10kΩ, 1/4W	271-1335
R11,R13	100kΩ, 1/4W	271-1347
R7	470Ω, 1/4W	271-1317
R6	10kΩ linear pot	271-1715
R8	50kΩ linear pot	271-1716
C1	100pF polypropylene cap	(see Mouser Electronics)
C2	Two parallel .001 µF polypropylene capacitors	-
		-
C4	.001µF polpypropylene cap	-
C5,C6	.01µF ceramic capacitors	272-131
C7	10µF electrolytic capacitor	272-1013
C8,C9	470µF electrolytic capacitor	272-1030
D1,D2	1N34 diode	276-1123
D3	5.1V Zener diode	276-565
D4,D5	1N4001 silicon diodes	276-1101
TL082	Dual biFET op-amp	276-1715
T1	12 Volt center-tapped transformer	273-1365
	Metal cabinet, BNC connector, 1/8 inch audio connector, knobs, power cord and misc. hardware	