Model LP-1 & LP-1A SHIELDED LOOP ANTENNA

Guide to Operations

10/03

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WARRANTY AND ASSISTANCE

All Belar products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, FOB factory or, in the case of certain major components listed in the instruction manual, for the specified period. Belar will repair or replace products which prove to be defective during the warranty period provided that they are returned to Belar prepaid. No other warranty is expressed or implied. Belar is not liable for consequential damages.

For any assistance, contact your Belar Sales Representative or Customer Engineering Service at the Belar factory.

APPLICATION NOTE

BELAR LP-1 AND LP-1A AM LOOP RECEIVING ANTENNA

REMOTE MONITORING:

Generally, the most reliable modulation indication is obtained with a modulation monitor located at the transmitter, fed with an RF sample from the output circuit of the transmitter.

When the monitor location is remote from the transmitter site, and it is impractical to send the required modulation indication to the operating point (studio) via remote control circuits or sub-audible telemetering, it is necessary to make the modulation measurement from an off-air signal. This measurement is made by using an RF amplifier (Belar RFA-2), which selectively amplifies the desired signal (picked up by a receiving antenna) to a level sufficient to drive a modulation monitor (Belar AMM-2, AMM-3, or AMMA-1).

RECEIVING ANTENNA:

AM stations radiate a signal in which the electric component (E Field) of the wave is perpendicular to the ground, therefore it is classified as vertically polarized. The two receiving antennas appropriate for the reception of this signal are the vertical whip and the loop. (Horizontal wire antennas greatly attenuate the signal over a vertical antenna, but not the ambient electrical noise, and have undesirable directional characteristics)

Vertical whips have a non-directional receiving characteristic responding to the impinging E Field wave, while loop antennas respond to the perpendicular magnetic component (H Field) of radio waves and exhibit a figure-eight directional characteristic when viewed from above.

For proper orientation of a loop, the imaginary plane in which the loop rests should be vertical to the ground and should, if extended, pass through the transmitting antenna. The loop characteristic sensitivity pattern results in a null 90° to each side of the receiving plane described.

The null in the sensitivity pattern of the loop antenna may be used to minimize pick-up of off-axis interfering stations. The loop may be rotated so that the null occurs in the direction of the interfering source. This is not recommended, however, if the angle between the desired station and the interfering station is less than 45°.

SHIELDED LOOP ANTENNA:

Two commonly encountered situations dictate the use of a shielded loop antenna: Excessive man-made electrical interference and the presence of an interfering station off the axis between the transmitter and receiving antenna.

Symptoms of excessive noise are a crackling sound from the aural output of the modulation monitor, or occasional, seemingly inappropriate pinning of the modulation meter while reading positive modulation.

A shielded loop antenna acquires noise immunity from the electrostatic shielding of the loop afforded by the grounded metallic conduit enclosing the wire coils.

Loop antennas, however, have a much smaller output voltage compared to the actual measured field strength of the desired signal. Belar can provide active loops (LP-1A) with an amplifier mounted in the loop frame to compensate for the loss.

Power for this amplifier is derived from a modification to the Belar RFA-2 RF amplifier (kit shipped with each LP-1A loop antenna when required) which sends the required 15 VDC phantom power through the coaxial lead-in (it is important that the input is not inadvertently grounded, otherwise damage to the RF amplifier will result).

When the LP-1A is being used with an AMDA-1 AM RF Distribution Amp, the phantom power is obtained by moving the phantom power jumper (P1) in the AMDA-1 to the "ON" position.

The signal level delivered to the RF amplifier by the amplified loop antenna will be approximately equal to the measured field strength at the antenna. The amplified loop is tuned to the station's operating frequency only to provide overload protection for the loop amplifier, and improves the selectivity of the overall system only slightly.

If the lead-in is properly terminated, the amplified loop will drive several hundred feet of coaxial cable.

In cases when the field strength at the receiving location exceeds 30 or 40 mV at the lowest transmitter power employed, an unamplified loop (LP-1) may be used. This loop is essentially untuned, but the number of turns is selected according to frequency. The output voltage of the LP-1 is approximately 1/30 field strength.

Since no isolation exists between the LP-1 and lead-in, it is recommended that the lead-in be limited to less than 100 feet to minimize tuning effects introduced by the cable.

Both the amplified and unamplified Belar shielded loop antennas may be ordered for use with other than Belar RF amplifiers. An optional outboard power supply is available for this purpose. (Option-01)

OFF-AIR MONITORING PROBLEMS:

In a few situations, off-air modulation monitoring may be impossible. The RF amplifier cannot eliminate co-channel interference (generally occurring at night) and adjacent channel interference. If the interfering signal is sufficiently far off-axis, it may be minimized by a loop antenna, as previously discussed.

Some RF amplifiers have been constructed with narrow IF bandwidths to suppress adjacent and second adjacent channel pickup. This is not generally recommended, because the modulation indication then becomes inaccurate due to the lack of high frequency components in the detected signal.

When an RF amplifier is operated in close proximity to a transmitter on another AM frequency, input overload may become a problem. If you suspect an overload problem, watch the RF level indicator when your carrier is turned off. The indicator should drop to the same point on the scale as with the antenna disconnected. If it does not, try reducing the input level, and if necessary insert a pad.

Directional antennas generally introduce inaccuracies in the field-measured modulation indications. When the monitoring system is operating in the major lobes of a directional pattern, these errors are generally acceptable.

If one wishes to operate an off-air monitor near the null of a directional array, a theoretical investigation of inaccuracies introduced in modulation may be warranted for the particular array.

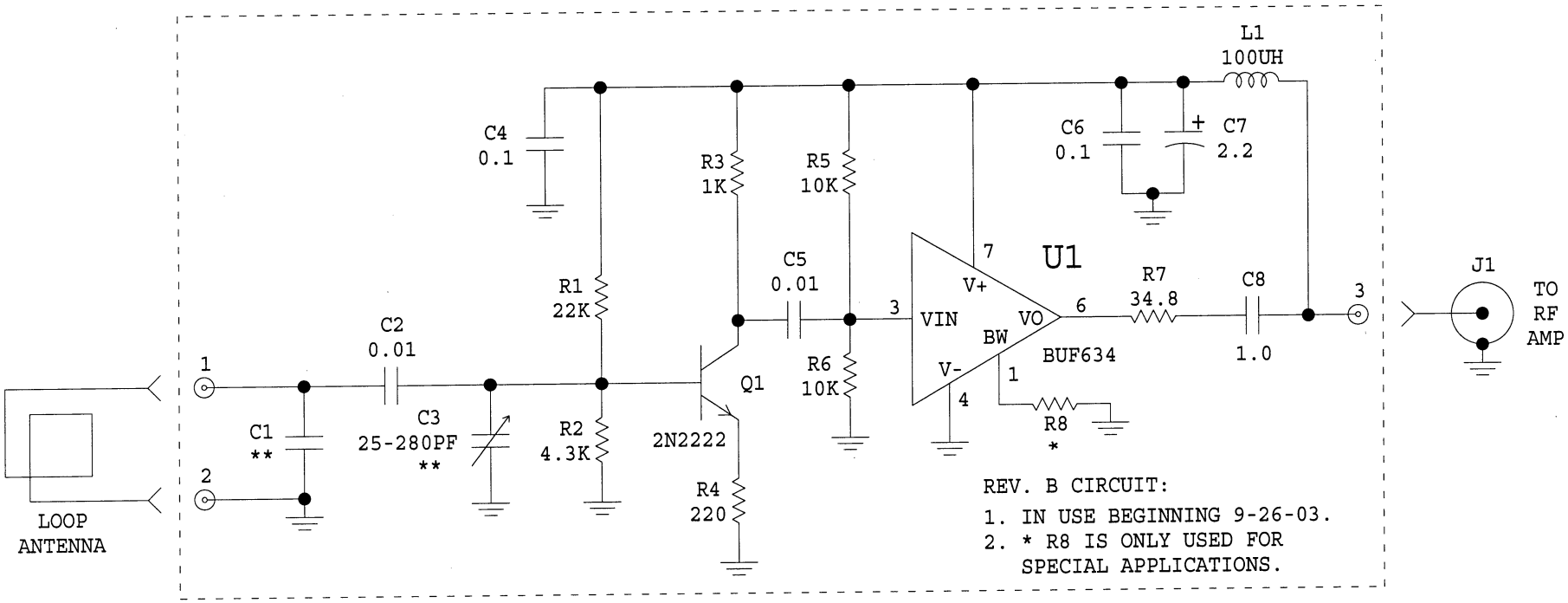
Belar does not recommend introducing filters between the antenna and the RF amplifier, to attenuate adjacent frequency interference. To obtain accurate modulation indications, any external filter must have symmetric amplitude and asymmetric phase response about the carrier frequency, while providing the proper measurement bandwidth.

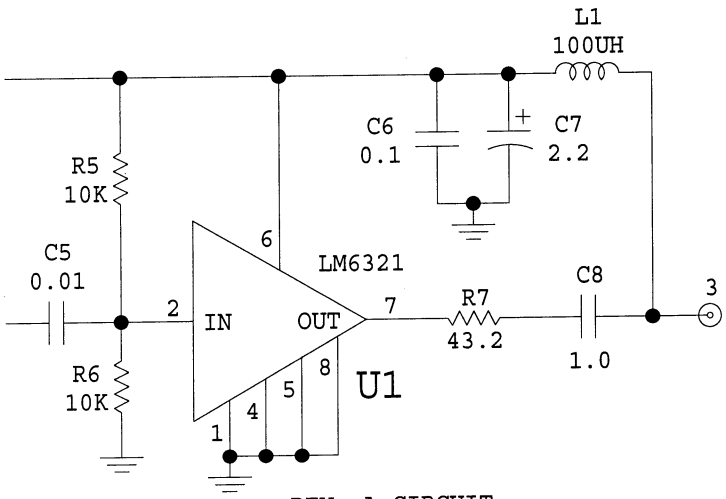
For further information, contact the Belar Customer Service Department.

ANTENNA SPECIFICATIONS

LP-1, LP-1A

Frequency Range	530 kHz to 1610 kHz
Dimensions	36" DIA.
Mounting	½" NPT
Connector	BNC
Attenuation	30 dB (LP-1)

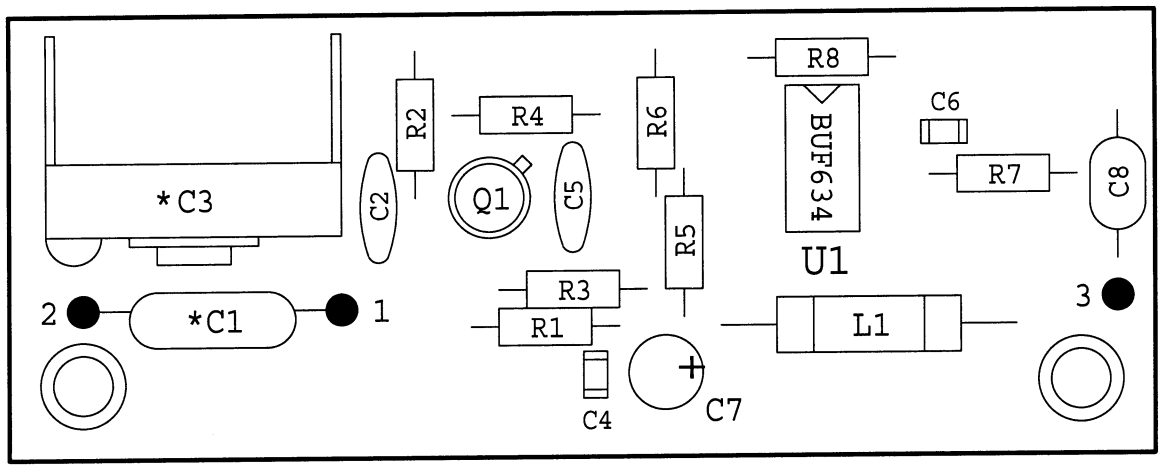




LP-1A A1
REV. A & REV. B
AMPLIFIER BOARD
BELAR ELECTRONICS
9-26-03

GENERAL NOTES:

1. ** C1 AND C3 ARE FREQUENCY DETERMINING COMPONENTS AND ARE NOT USED IN THE WIDE-BAND LP-1A.
2. CAPACITANCE VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.
3. VALUES SHOWN ARE FOR AMPLIFIER GAIN OF 12 DB. FOR UNITY GAIN R1=8.2K, R2=8.2K AND R4=1K.

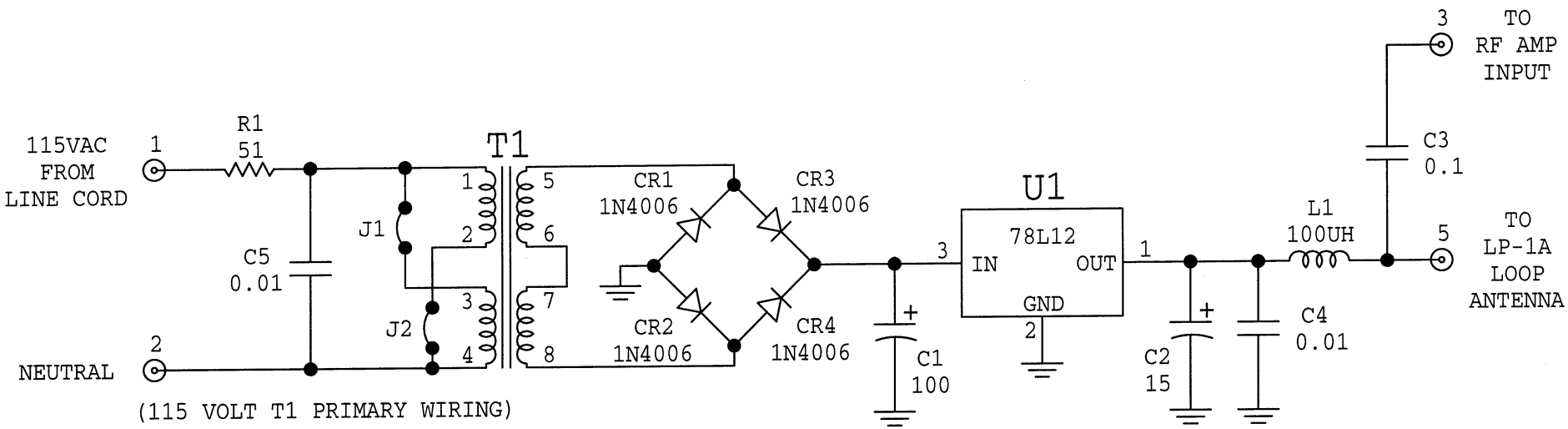


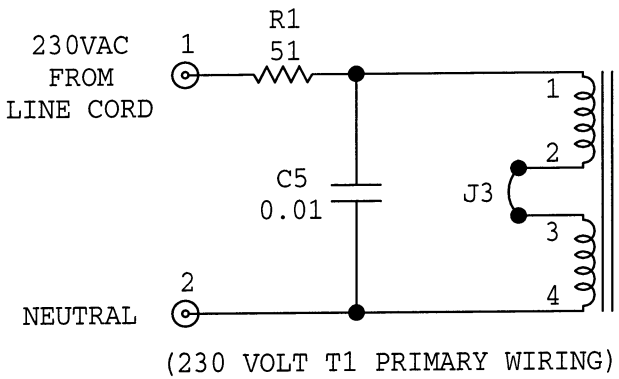
1. *C1 AND C3 ARE NOT USED IN THE WIDE-BAND VERSION OF THE LP-1A.
2. THE REV. B BOARD IN USE BEGINNING 9-26-03.
3. THE REV. A BOARD WAS USED PRIOR TO 9-26-03 AND HAD AN LM6321 IC FOR U1 AND DID NOT USE R8.

LP-1A A1 BOARD REV. A & REV. B COMPONENT LAYOUT BELAR ELECTRONICS

A1 BOARD LP-1A, REV. A & REV. B
(Rev. B was in use beginning 9-26-03)

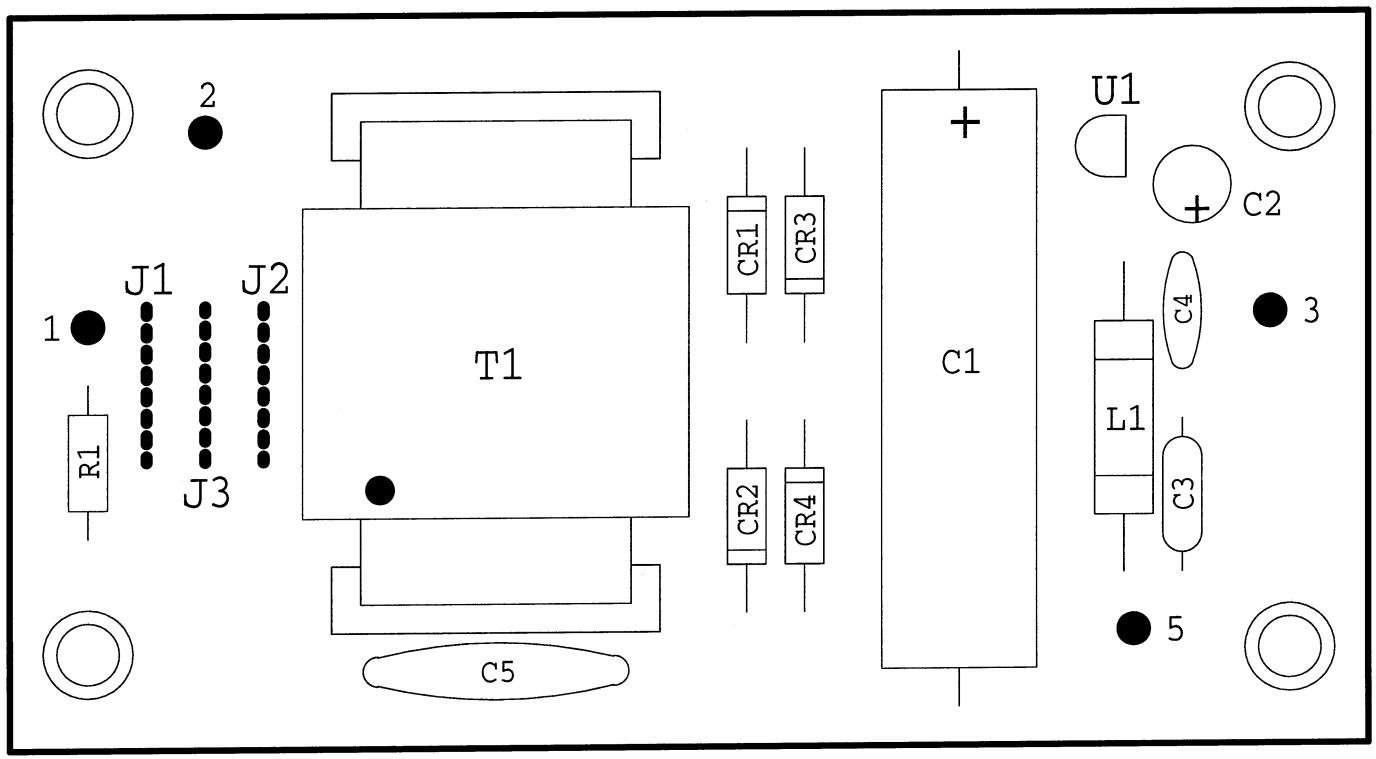
Reference Designation	Description		Part Number
C1*	C: FIXED MICA 5% (value depends on frequency)		
C2	C: FIXED CERAMIC 0.01uF 100V		0151-0003
C3*	C: VARIABLE MICA 25-280pF		0121-0009
C4	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206	0151-0014
C5	C: FIXED CERAMIC 0.01uF 100V		0151-0003
C6	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206	0151-0014
C7	C: FIXED TANT 2.2uF 35V		0185-0009
C8	C: FIXED CERAMIC 1.0uF 50V		0151-0008
	(*C1 and C3 are not used in the wide-band LP-1A.)		
L1	CHOKE: 100uH		9140-0005
Q1	TRANSISTOR: 2N2222		1850-0020
R1	R: METAL FILM 22k 2% 1/4W		0751-2232
R2	R: METAL FILM 4.3k 2% 1/4W		0751-4322
R3	R: METAL FILM 1k 2% 1/4W		0751-1022
R4	R: METAL FILM 220 2% 1/4W		0751-2212
R5,R6	R: METAL FILM 10k 2% 1/4W		0751-1032
R7	R: METAL FILM 34.8 1%		0721-34R8
	(R7 was 43.2 ohm before Rev. B.)		
R8	(R8 is only used for special applications and was not used before Rev. B.)		
U1	IC: BUF634		1826-0074
	(Before Rev. B, U1 was a LM6321 IC, 1826-0050. The IC'S are not interchangeable.)		





LP-1A LOOP ANTENNA
OPTION 01
REMOTE POWER SUPPLY
BELAR ELECTRONICS
9-4-96

THIS CIRCUIT IN USE EFFECTIVE 6-7-93

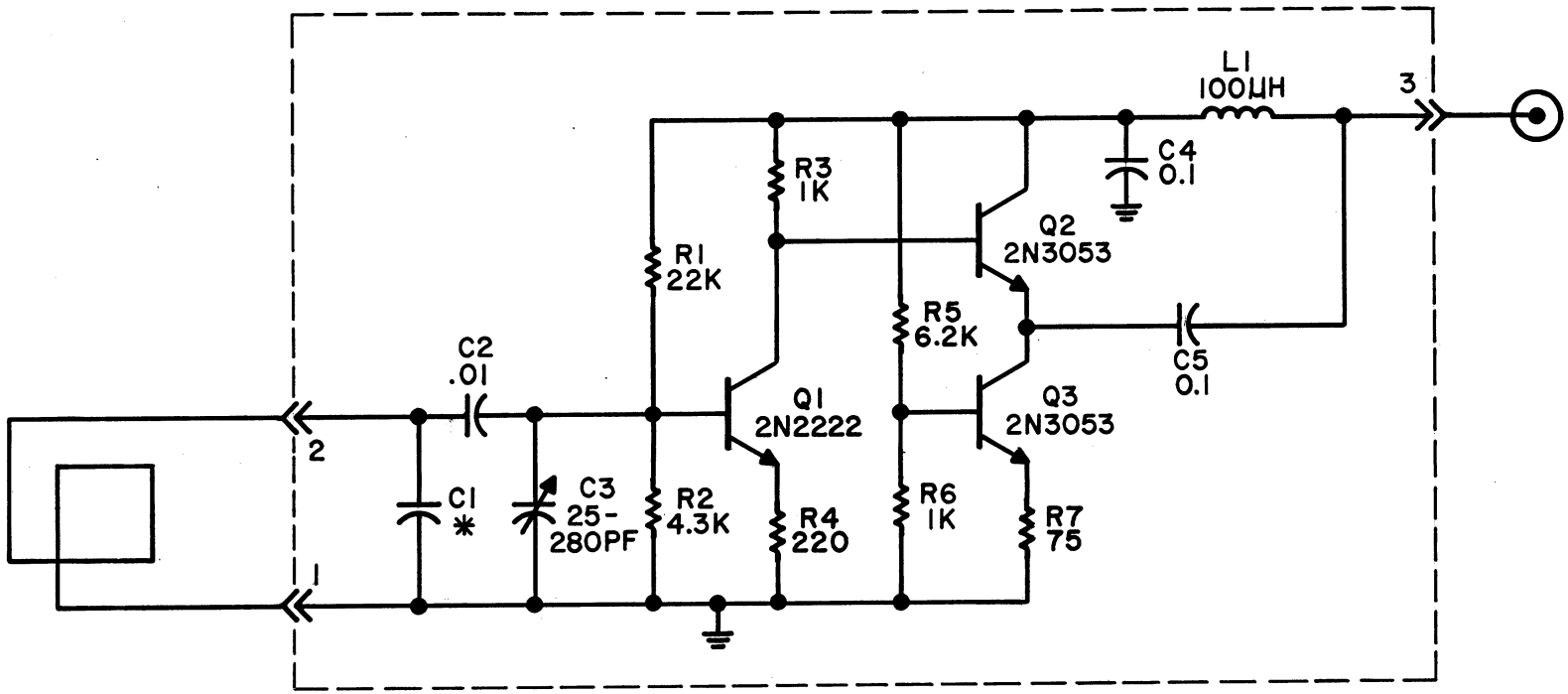


LP-1A
POWER SUPPLY BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

THIS BOARD IN USE 6-7-93

POWER SUPPLY BOARD LP-1A
(used beginning 6-7-93)

Reference Designation	Description	Part Number
C1	C: FIXED ELEC 100uF 50V	0180-0010
C2	C: FIXED TANT 15uF 15V	0185-0003
C3	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C4	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C5	C: FIXED CERAMIC 0.01uF 2kV	0151-0010
CR1 thru CR4	DIODE: 1N4006	1900-0016
L1	CHOKE: 100uH	9140-0005
R1	R: METAL FILM 51 2% 1/4W	0751-5102
T1	TRANSFORMER: DPC-16-55	9100-0025
U1	IC: 78L12CP	1826-0015

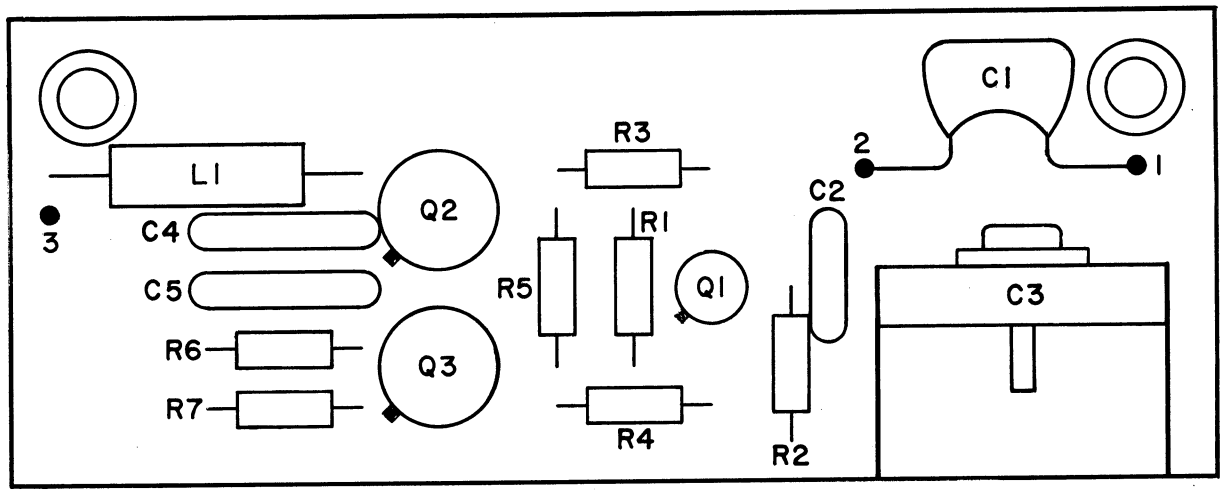


NOTES:

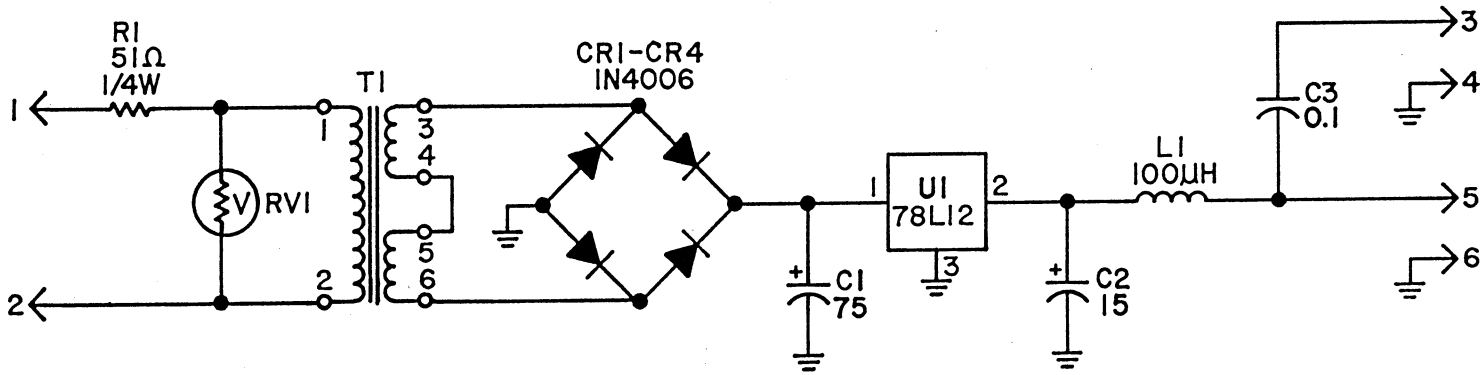
CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS SPECIFIED.
RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
* FREQUENCY DETERMINING PART.
VALUES SHOWN ARE FOR AMPLIFIER GAIN OF 12 DB.
FOR UNITY GAIN R1 = 8.2K, R2 = 8.2K & R4 = 1K.

LAST C5
L1
Q3
R7

SCHEMATIC DIAGRAM, LOOP ANTENNA PREAMP CARD



LOOP ANTENNA PREAMP CARD COMPONENTS



NOTE:
CAPACITANCE VALUES ARE IN MICROFARADS.

LAST USED
C3
CR4
L1
R1
RV1
T1
U1
PIN 6

REMOTE POWER SUPPLY - LOOP ANTENNA
(PRIOR TO 6-93)

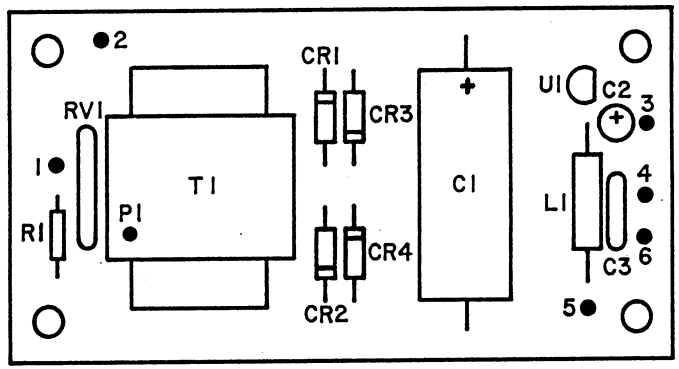
LP-1A SHIELDED LOOP ANTENNA WITH BUILT-IN PREAMPLIFIER CARD

Reference Designation	Description	Part Number
C1	C: FXD MICA (FREQUENCY DETERMINING)	Belar
C2	C: FXD CER 0.01uF 100V	0151-0003
C3	C: VAR MICA 25-280pF	0121-0009
C4,C5	C: FXD CER 0.1uF 50V	0151-0006
L1	INDUCTOR: RF 100uH	9140-0005
Q1	TRANSISTOR: 2N2222	1850-0020
Q2,Q3	TRANSISTOR: 2N3053	1850-0008
R1	R: FXD COMP 22k 5% ¼W	0683-2235
R2	R: FXD COMP 4.3k 5% ¼W	0683-4325
R3	R: FXD COMP 1k 5% ¼W	0683-1025
R4	R: FXD COMP 220 5% ¼W	0683-2215
R5	R: FXD COMP 6.2k 5% ¼W	0683-6225
R6	R: FXD COMP 1k 5% ¼W	0683-1025
R7	R: FXD COMP 75 5% ¼W	0683-7505

OPTION 01: EXTERNAL POWER SUPPLY FOR LP-1A (PC BOARD)

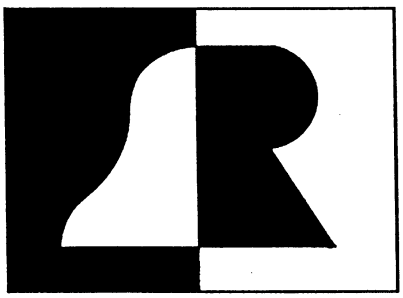
(used prior to 6-93)

Reference Designation	Description	Part Number
C1	C: FIXED ELEC 75uF 40V	0180-0013
C2	C: FIXED TANT 15uF 15V	0185-0003
C3	C: FIXED CERAMIC 0.01uF 100V	0151-0003
CR1 thru CR4	DIODE: 1N4006	1900-0016
L1	CHOKE: 100uH	9140-0005
R1	R: FIXED CARB 51 5% 1/4W	0683-5105
RV1	not used	
T1	TRANSFORMER: DPC-16-55	9100-0025
U1	IC: 78L12CP	1826-0015



REMOTE POWER SUPPLY CARD COMPONENTS

(PRIOR TO 6-93)



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