

Model AS-1 AUDIO SENTRY

Guide to Operations

10/01

©



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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.

1	General Information	1
	1-1 General Description	1
	1-2 Physical Description	1
	1-3 Electrical Description	1
	1-4 Electrical Specifications	1
	1-5 Mechanical Specifications	2
	1-6 Instrument Identification	2
2	Unpacking	2
	2-1 Initial Inspection	2
	2-2 Claims	2
	2-3 Repacking for Shipment	2
3	Installation and Setup	3
	3-1 General	3
	3-2 Power Connection	3
	3-3 Audio Input Connection	4
	3-4 Initial Setup	4
4	Principles of Operation	5
	4-1 Schematic Diagram Description	5
5	Maintenance	5
	5-1 Signal Detector U1 Operational Test	5
	5-2 Time Delay and Alarm Control Test	6
	5-3 Alarm Control	6
	5-4 Power Supply	7
	5-5 Alarm Driver	7
6	Diagrams, Schematics and Parts Lists	8

1 General Information

1-1 General Description

The Belar AS-1 Audio Sentry is an all solid state audio modulation sensor designed to alert the operator to the lack of modulation in a communications system. The AS-1 also may be connected to indicate a carrier- off condition with no time delay before alarm initiation. The AS-1 is intended to complement existing modulation monitoring systems in AM, FM and TV facilities as well as in recording studios, public address and storecasting installations.

1-2 Physical Description

The AS-1 is constructed on a standard 3.5 x 19 inch EIA rack mount panel, occupying 5 inches of depth. All components are located within the shielded compartment of the unit. The aural alarm, AURAL RESET and visual alarm are located on the front panel. The AC power input, audio input, control points, SENSITIVITY adjust and the TIME DELAY adjust are located on the rear panel of the chassis.

The AS-1 is completely solid state, utilizing all silicon transistors and integrated circuits for long trouble-free life. The individual circuits are constructed on a military grade, glass epoxy, plated printed circuit board. High reliability industrial and military grade components are used throughout.

1-3 Electrical Description

The AS-1 is a solid state instrument designed to detect the lack of audio modulation within a preset period of time. The lack of modulation activity is indicated by a visual alarm as well as an aural alarm. In the case of AM modulation monitors with a "carrier off" switch, the AS-1 can instantly alert operators to the lack of carrier. An aural reset button mutes the aural alarm, but does not affect the visual indicator.

1-4 Electrical Specifications

Input Sensitivity	Adjustable from 0.1 volts to 20 volts
Input Impedance	1000 Ω
Frequency Range	30 Hz to 15,000 Hz
Time Delay	Adjustable from 3 to 60 seconds
Aural Alarm Frequency	2900 Hz
Aural Alarm Level	+70dB

Remote Alarms External alarms may be connected to Audio Sentry.
Total drive current not to exceed 50 mA.

Carrier-Off Alarm External contact required

Power Requirements 115/230 Vac, 50/60 Hz, 0.25 A

1-5 Mechanical Specifications

Dimensions	3.5"H x 5.25"D x 19"W (EIA Rack Mount)
Net Weight	4 lbs. (1.8 kg)
Shipping Weight	6 lbs. (2.7 kg)

1-6 Instrument Identification

The instrument is identified by the model number and a six digit serial number. The model number and serial number appear on a plate located on the rear panel of the unit. All communications with your Belar representative or the Belar factory in regard to the instrument should reference the model number and complete serial number.

2 Unpacking

2-1 Initial Inspection

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.) ask the carrier's agent to be present when the unit is unpacked. Carefully unpack the unit to avoid damaging the equipment through use of careless procedures. Inspect all equipment for physical damage immediately after unpacking. Bent or broken parts, dents and scratches should be noted. If damage is found, refer to Paragraph 2-2 for the recommended claim procedure. Keep all packing material for proof of damage claim or for possible future use.

The AS-1 is shipped with an instruction book and four beige rack mount screws.

2-2 Claims

If the unit has been damaged, notify the carrier immediately. File a claim with the carrier or transportation company and advise Belar of such action to arrange the repair or replacement of the unit without waiting for a claim to be settled with the carrier.

2-3 Repacking for Shipment

If the unit is to be returned to Belar, attach a tag to it showing owner and owner's address. A description of the service required should be included on the tag. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reusable, the unit should be repackaged in the following manner:

- a. Use a double-walled carton with a minimum test strength of 275 pounds.
- b. Use heavy paper or sheets of cardboard to protect all surfaces.

- c. Use at least 4 inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam or rubberized hair. **NEWSPAPER IS NOT SUFFICIENT FOR CUSHIONING MATERIAL.**
- d. Use heavy duty shipping tape to secure the outside of the carton.
- e. Use large FRAGILE labels on each surface.
- f. Return the unit, freight prepaid. Be sure to insure the unit for full value.

3 Installation and Setup

3-1 General

The AS-1 is designed to be mounted in a standard 19 inch rack. The unit should be mounted either immediately below or above the unit from which it is receiving audio.

When the amplifier is mounted above high heat generation equipment such as power amplifiers, consideration should be given to cooling requirements which allow a free movement of cooler air around the AS-1. In no instance should the ambient chassis temperature be allowed to rise above 50°C (122°F). Mount the AS-1 in the rack using the four non-marring rack mount screws provided.

3-2 Power Connection

Newer AS-1s can be operated from either a 105 to 125 Vac or 210 to 250 Vac, single phase, 50 to 60 Hz power source. Older AS-1s are not field selectable for line voltage. Be sure the unit is set up for the proper voltage as follows:

Older units:

These units are not field selectable and are factory wired for 115 Vac or 230 Vac, single phase, 50 to 60 Hz power source operation only. Check the rear panel of the unit for a label which shows the line voltage that the unit is wired to operate with.

Newer field selectable units:

These units can be operated from either a 105 to 125 Vac or 210 to 250 Vac single phase, 50-60 Hz power source. Make sure the unit is set for the proper voltage as follows: Unplug the line cord. Slide the line voltage selector switch (S2) to the 115 V or 230 V position. Ensure that the fuse (F1) is the proper current rating for the selected voltage ($\frac{1}{4}$ A 250 V for 115 Vac, $\frac{1}{8}$ A 250 V for 230 Vac).

3-3 Audio Input Connection

CAUTION: DO NOT APPLY MORE THAN 20 VOLTS TO TB1-2 ON THE AUDIO SENTRY OR THE INPUT MAY BE DAMAGED.

Use TB1-6 to drive remote alarm devices. The external alarm current must be kept to less than 50 mA. If greater, then an external relay should be used. TB1-6 is a transistor switch to ground. The external alarms require their own power source.

3-4 Initial Setup

The following procedures should be followed for placing the unit into initial operation. The operator has varied alternate methods of installation:

1. The alarms may be held in a muted mode until the transmitter is ready. An external contact closure between TB1-3 and TB1-4 activated by the transmitter plate-on control circuit, will set the alarms.
2. Alarms may be activated immediately upon application of primary power by installing a jumper between terminals 3 and 4 on TB1.
3. If neither of the two installation methods are chosen then the unit will automatically be armed upon the application of audio, and any loss of audio that exceeds the preset dropout time will initiate the alarm functions. If the monitor is equipped with a carrier-off switch it can be connected to the remote alarm terminal (TB1-5) on the Audio Sentry, giving station personnel instant notification of loss of carrier by a steady light and constant tone. However, if only the audio is lost, then a flashing light and a pulsating tone will be activated, notifying station personnel of audio trouble.
4. DIRECT ALARM ACTIVATE The front panel alarms of the Audio Sentry may be activated by a contact closure between TB1-5 and TB1-1 (ground), i.e., carrier-off alarm.
5. REMOTE ALARM DRIVER Remote alarm devices may be driven from the Audio Sentry by connecting the external alarm to TB1-6. The external alarm current must be less than 50 mA. If drive currents are greater than 50 mA, an external relay should be used. TB1-6 is a pulsed transistor switch to ground. Any external alarms require their own power source and will not be turned off by the front panel Aural Reset pushbutton switch if an alarm condition exists.
For a continuous alarm condition (non-pulsed) at TB1-6, move the jumper at R26 (510 Ω) on the A1 board from pin 9 of U2 to pin 12 of U2.
6. SENSITIVITY ADJUST Apply audio to TB1-2 at what would be considered the normal non-alarm level. Turn the SENSITIVITY adjust pot (R8) counterclockwise (less gain) until the alarm timeout sequence is triggered. Turn the pot in the other direction until the alarm ceases and leave the adjustment at that point. Any audio level lower than this initial setting will trigger the alarm timeout sequence.
7. TIME DELAY ADJUST Set the AS-1 up so it is in the non-alarm condition. Remove the audio input and the time delay sequence will begin before the alarms trigger. Turn the TIME DELAY adjust pot (R12) clockwise for a longer delay or counter-clockwise for a shorter delay. A short delay would only be recommended for highly processed audio or false triggering may occur during normal program pauses.

4 Principles of Operation

4-1 Schematic Diagram Description

The purpose of the Belar AS-1 Audio Sentry is to alert personnel of the lack of audio occurring over any preselected period of time between 3 and 60 seconds. The following describes the signal processing within the unit.

Audio from TB1-2 is applied to input resistor R1. Diodes CR1 and CR2 prevent excess signal from damaging the operational amplifier.

U1 is a conventional operational amplifier using negative feedback, whose output is adjusted by the sensitivity control, R8. The output of U1 is detected by diodes CR3 and CR4 and filtered by capacitor C4. The rectified output of U1 is applied to the base of Q1, causing it to conduct and hold the time delay, Q2, off. The rectified output is also applied to the gate of CR7, causing it to conduct and set the aural alarm into a ready mode.

In the event of a signal loss, the time delay, Q2, which is adjusted by R12 will conduct. The output pulse of Q2 is applied to the first flip-flop of U2. This causes its output to go low, and the collector of Q3 to go high, thereby turning oscillator Q4 on. The output of Q4 is applied to the second flip-flop of U2 which divides the pulse by two. The output of the second flip-flop of U2 then drives the alarm switch, Q5.

The aural alarm may be reset by front panel switch, S1. When S1 is depressed, the conduction of CR7 is momentarily interrupted, causing CR7 to reset.

Upon return of an incoming signal, the conduction of Q1 and CR6 resets U2. The dc output of CR4 returns CR7 to its ready state.

5 Maintenance

5-1 Signal Detector U1 Operational Test

Adjust the sensitivity control, R8, located on the rear of the unit, to its minimum position. Apply power to the unit and disconnect any input to TB1-2 on the rear of the unit. With a voltmeter, measure the following points.

<u>U1, pin #</u>	<u>Voltage</u>
2	5.8 V
3	5.8 V
4	0 V
6	5.8 V
7	12.0 V
Junction CR4 & R9	0 V

If the proper voltages are obtained, then connect an audio source to TB1-2 and adjust the output frequency for 400 Hz and the output level for 0.15 volts peak-to-peak. Adjust the sensitivity control to half-range and measure the voltage at the junction of CR4, C4 and R9.

A reading of 2.2 volts dc should be obtained.

5-2 Time Delay and Alarm Control Test

The time delay consists of transistors Q1 and Q2 and their associated components. With the 400 Hz tone applied to TB1-2 and 2.2 volts found at the junction of CR4, C4 and R9, measure the collector of Q1. A reading of 0.125 volts should be obtained. Set the Time Delay Adjust R12, on the rear of the unit, to its minimum position. Disconnect the audio signal from TB1-2 and attach an oscilloscope to the junction of R14 and C6. An 8 V pk-pk pulse should be observed, approximately every 2 seconds.

5-3 Alarm Control

The alarm control consists of U2, Q3, Q4 and their associated circuitry. Apply a 400 Hz audio signal to TB1-2. With a voltmeter, measure the following points.

<u>U2, PIN #</u>	<u>DC VOLTAGE</u>
1	1.1
2,6	0.75
3,11	0.0
4	4.6
5	0.75
10,7	4.6
9	0.2
14	4.6
13	3.5
Collector Q3	0.07

Disconnect the audio signal from TB1-2. After the initial time delay, the output pulse from Q2 (approximately 8 V pk-pk) is applied to the clock input (pin 1) of U2. This input pulse sets the flip-flop and causes pin 13 to change to logic 0. A voltmeter applied to pin 13 should read near 0 volts.

Q4 is a unijunction transistor operating as a relaxation oscillator. The output of Q4 is applied to pin 5 of U2. With an oscilloscope attached to pin 5 U2, a frequency of approximately 5.5 Hz should be observed. Check the level at pin 5, U2, to ensure that the second flip-flop will toggle. The voltage must go below 0.8 V at its minimum and exceed 2.0 V at its maximum.

Attach the probe of the oscilloscope to terminal 9. A frequency of one-half that of pin 5 should appear. The output should range from about 0.2 V at its lowest point and 3.5 V at its highest.

Apply a 400 Hz signal to TB1-2 and re-check that pins 2 and 6 of U2 are 0.75 volts. These are the clear terminals of U2 and are reset by the conduction of Q1, through steering diode CR6.

5-4 Power Supply

The power supply is a conventional full wave design. Q6 and VR1 form a series pass regulator.

5-5 Alarm Driver

Apply a 400 Hz signal to TB1-2. With a voltmeter, measure the following points.

<u>Test Point</u>	<u>Voltage</u>
Junction CR5,R23	20.0V
Junction R25,DSI	19.4V

Disconnect the signal from TB1-2 and attach a voltmeter to the junction of R25 and DS1. Depress S1. The voltage on R25 should now be 0 volts.

The alarm driver is controlled by the output pulse from pin 9 U2. A 20 V pk-pk pulse should appear at the collector of Q5.

6 Diagrams, Schematics and Parts Lists

Replaceable Parts. This page contains information for ordering replaceable parts for the unit. The tables that follow list the parts in alphanumeric order by reference designation and provides a description of the part with the Belar part number.

Ordering Information. To order a replacement part from Belar, address the order or inquiry to Belar and supply the following information:

- a. Model number and serial number of unit.
- b. Description of part, *including the reference designation and location.*

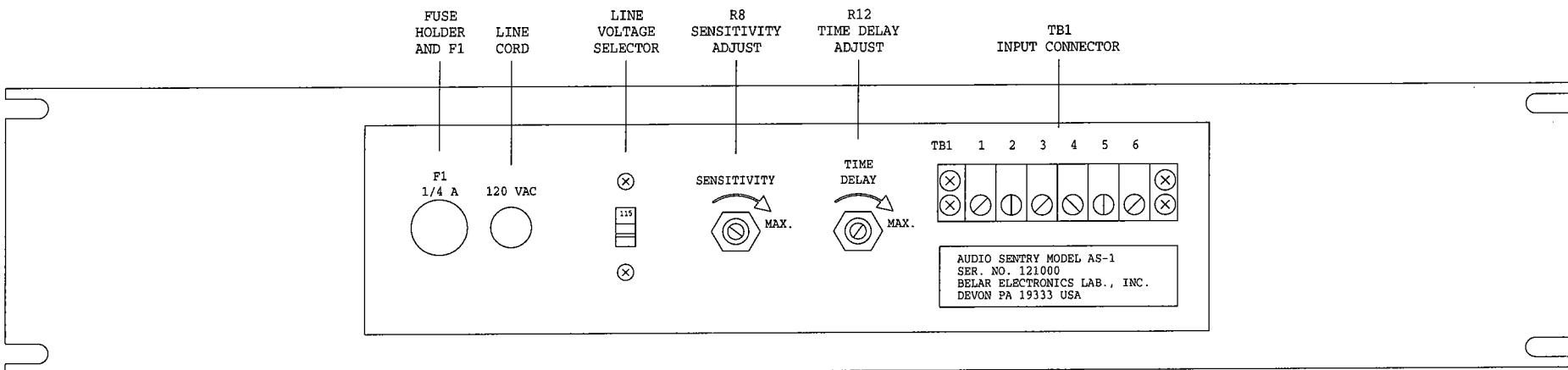
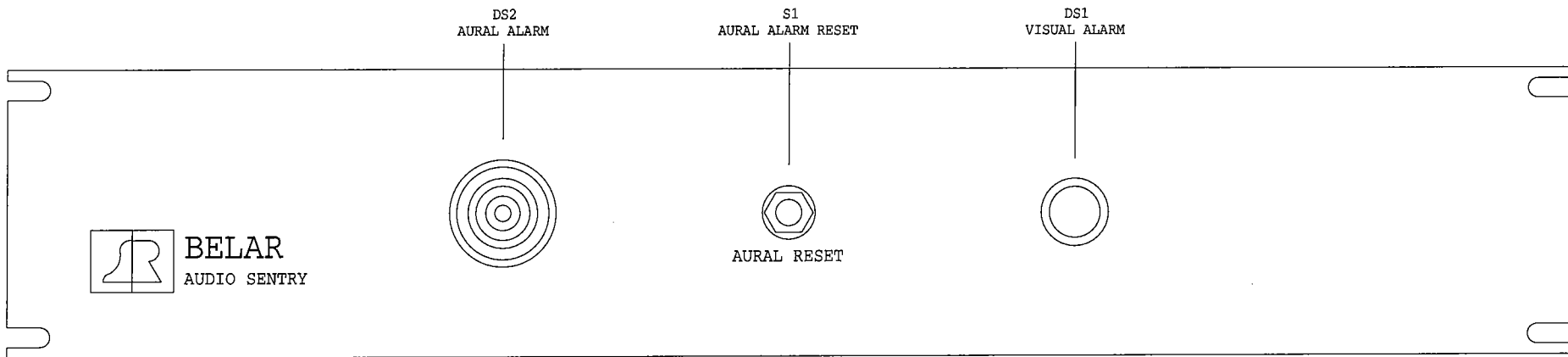
Orders may also be taken over the telephone. Parts orders can be put on your VISA, MasterCard, or American Express card, or we can ship them COD.

REFERENCE DESIGNATORS

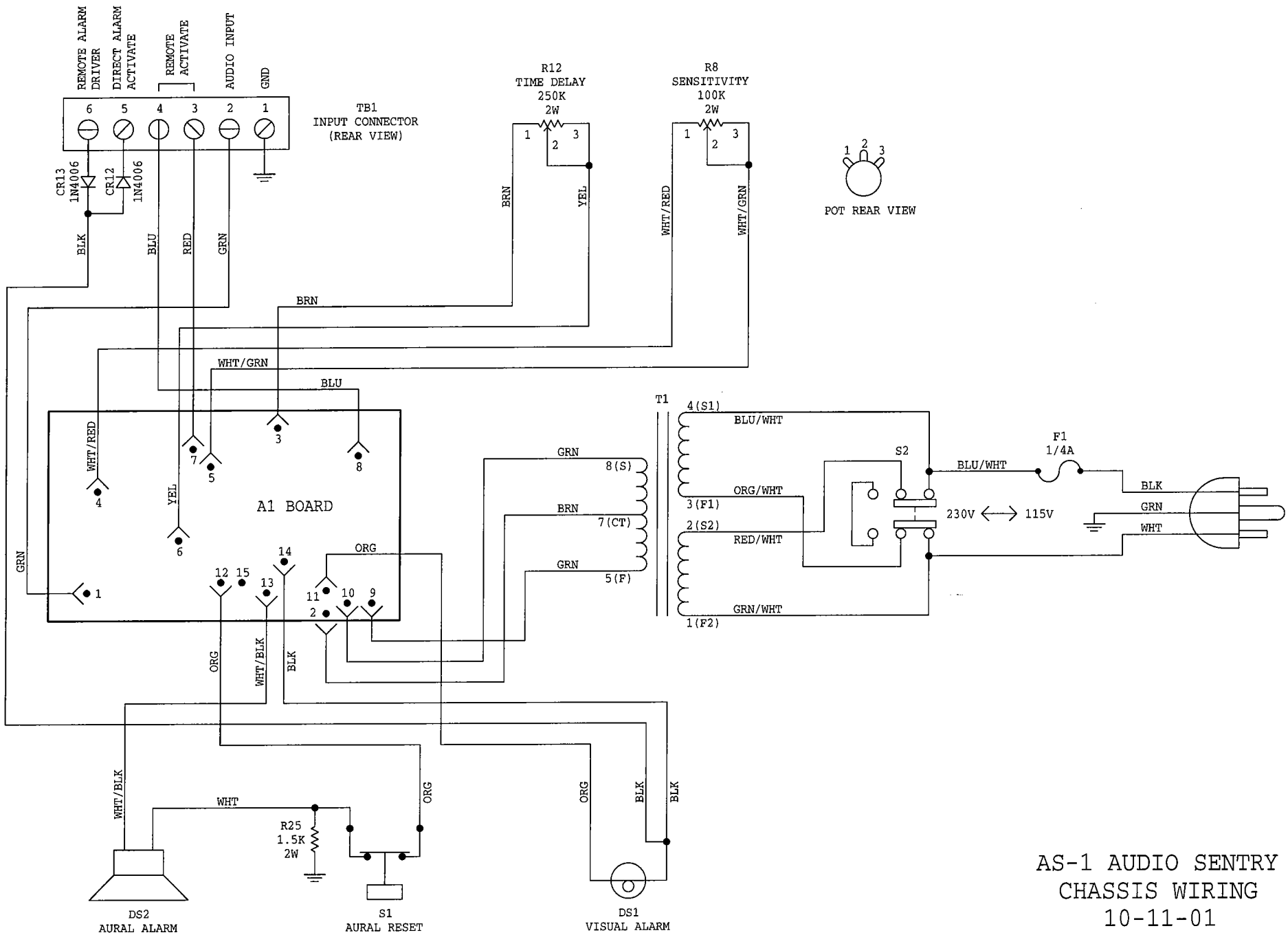
A	= assembly	J	= jack	S	= switch
BR	= diode bridge	L	= inductor	T	= transformer
C	= capacitor	M	= meter	TB	= terminal block
CR	= diode or LED	P	= plug	U	= integrated circuit
DS	= display or lamp	Q	= transistor	VR	= voltage regulator
F	= fuse	R	= resistor	W	= cable
FL	= filter	RL	= relay	X	= socket
HDR	= header connector	RN	= resistor network	Y	= crystal

ABBREVIATIONS

ADC	= analog-to-digital converter	PIV	= peak inverse voltage
BCD	= binary coded decimal	POLY	= polystyrene
CER	= ceramic	PORC	= porcelain
COMP	= composition	POT	= potentiometer
CONN	= connector	SEMICON	= semiconductor
DPM	= digital panel meter	SI	= silicon
ELEC	= electrolytic	TANT	= tantalum
GE	= germanium	μ F	= microfarads
IC	= integrated circuit	V	= volt
k	= kilo = 1,000	VAR	= variable
M	= meg = 1,000,000	VDCW	= dc working volts
MOD	= modulation	W	= watts
MY	= Mylar	WW	= wirewound
PC	= printed circuit		
pF	= picofarads		



AS-1 FRONT & REAR VIEW
BELAR ELECTRONICS

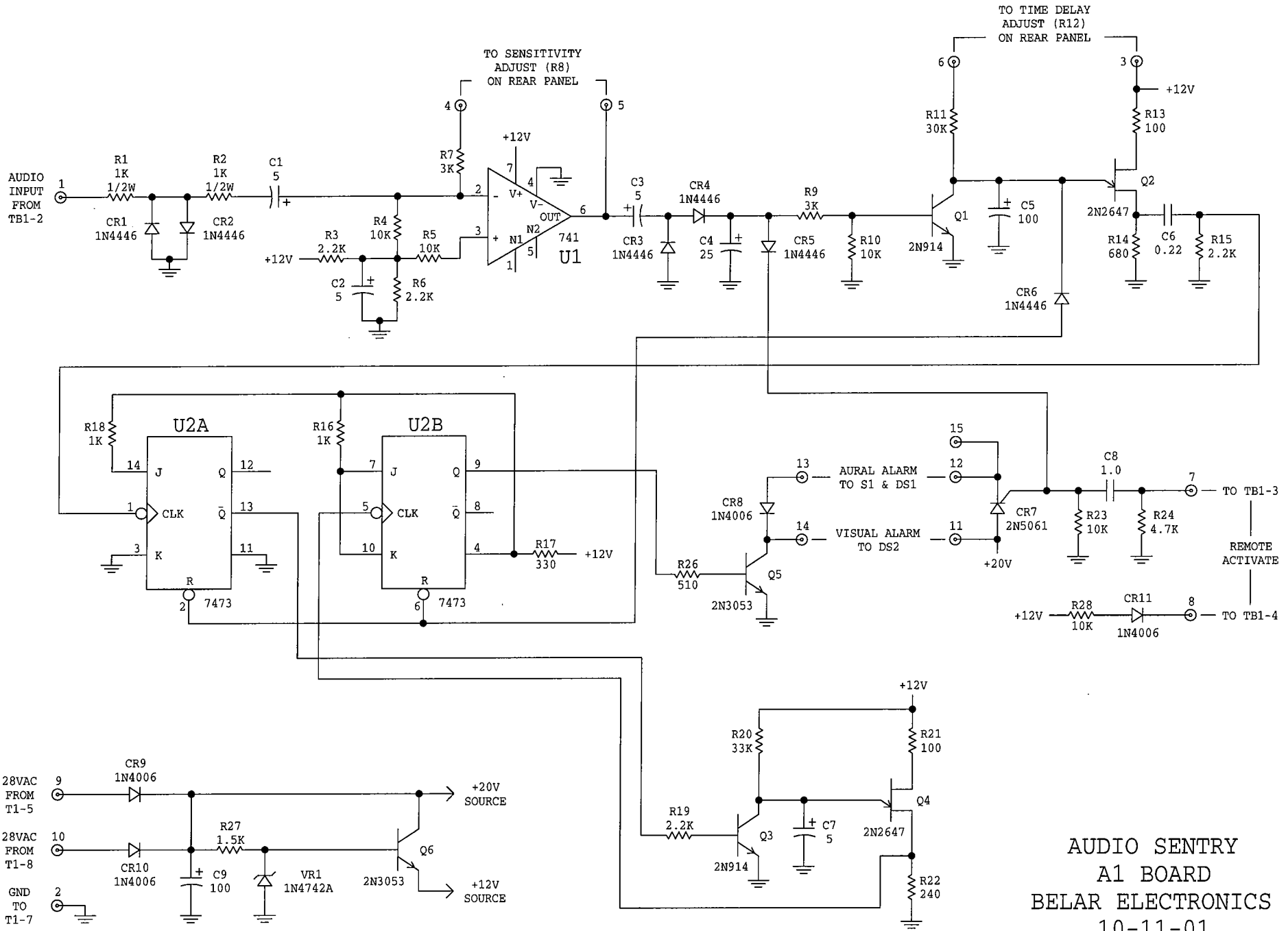


AS-1 AUDIO SENTRY
 CHASSIS WIRING
 10-11-01

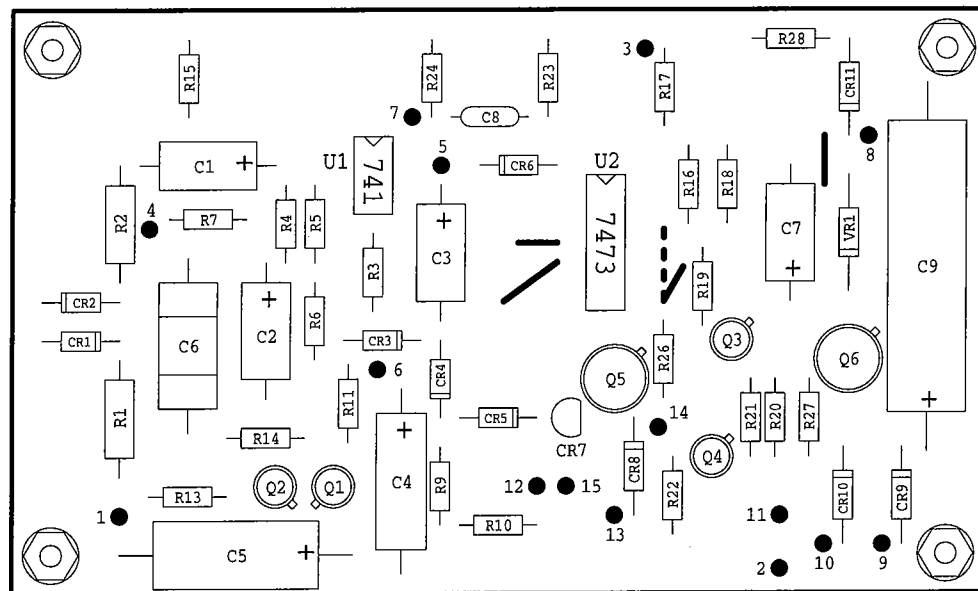
AS-1 PARTS LISTS

MAIN CHASSIS

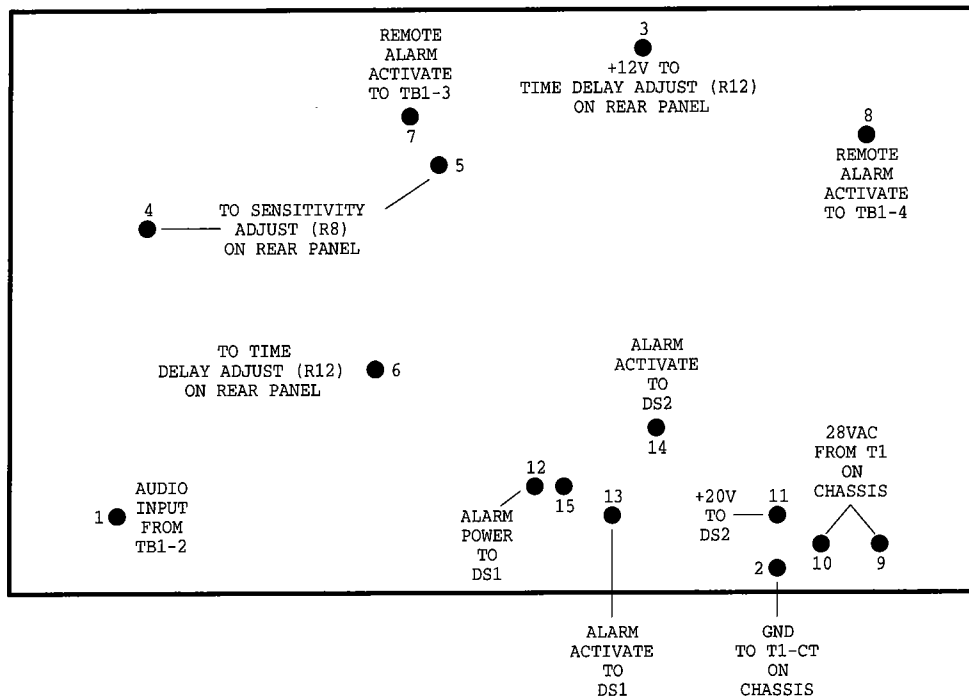
Reference Designation	Description	Part Number
CR12,CR13	DIODE: 1N4006	1900-0016
DS1	HORN: SONALERT	0365-0018
DS2	LAMP: 1829S	2140-0001
F1	FUSE: AGC 1/4A 250V	2110-0002
R8	R: VAR COMP 100k 10% 2W	2100-0006
R12	R: VAR COMP 250k 10% 2W	2100-0016
R25*	R: WIREWOUND 1.5k 5% 2W	0811-0008
(*Note: Prior to serial number 121559, R25 was a 1.3K 1/2W)		
S1	SWITCH: SPST MOMENTARY	3104-0001
S2	SWITCH: SLIDE 115/230V SELECTOR	3102-0002
T1	TRANSFORMER: POWER	9100-0004
TB1	TERMINAL BLOCK: 6 SCREW	0360-0003
XDS2	SOCKET: LAMP W/CAP	1450-0001
XF1	FUSEHOLDER:	2110-0003
--	LINE CORD	8120-0002



AUDIO SENTRY
A1 BOARD
BELAR ELECTRONICS
10-11-01



AS-1
 AUDIO SENTRY
 A1 BOARD
 COMPONENT LAYOUT
 BELAR ELECTRONICS



AS-1
 AUDIO SENTRY
 A1 BOARD
 CONNECTIONS
 BELAR ELECTRONICS

A1 BOARD AS-1

Reference Designation	Description	Part Number
C1 thru C3	C: FIXED ELEC 5.0uF 25V	0180-0007
C4	C: FIXED ELEC 25uF 16V	0180-0009
C5	C: FIXED ELEC 100uF 16V	0180-0006
C6	C: FIXED FILM 0.22uF 10% 80V	0120-2241
C7	C: FIXED ELEC 5.0uF 25V	0180-0007
C8	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C9	C: FIXED ELEC 100uF 50V	0180-0010
CR1 thru CR6	DIODE: 1N4446	1900-0002
CR7	SCR: 2N5061	1850-0013
CR8 thru CR11	DIODE: 1N4006	1900-0016
Q1	TRANSISTOR: 2N914	1850-0006
Q2	TRANSISTOR: 2N2647	1850-0012
Q3	TRANSISTOR: 2N914	1850-0006
Q4	TRANSISTOR: 2N2647	1850-0012
Q5, Q6	TRANSISTOR: 2N3053	1850-0008
R1, R2	R: METAL FILM 1k 2% 1/2W	0771-1022
R3	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R4, R5	R: METAL FILM 10k 2% 1/4W	0751-1032
R6	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R7, R9	R: METAL FILM 3k 2% 1/4W	0751-3022
R10	R: METAL FILM 10k 2% 1/4W	0751-1032
R11	R: METAL FILM 30k 2% 1/4W	0751-3032
R13	R: METAL FILM 100 2% 1/4W	0751-1012
R14	R: METAL FILM 680 2% 1/4W	0751-6812
R15	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R16	R: METAL FILM 1k 2% 1/4W	0751-1022
R17	R: METAL FILM 330 2% 1/4W	0751-3312
R18	R: METAL FILM 1k 2% 1/4W	0751-1022
R19	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R20	R: METAL FILM 33k 2% 1/4W	0751-3332
R21	R: METAL FILM 100 2% 1/4W	0751-1012
R22	R: METAL FILM 240 2% 1/4W	0751-2412
R23	R: METAL FILM 10k 2% 1/4W	0751-1032
R24	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R26	R: METAL FILM 510 2% 1/4W	0751-5112
R27	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R28	R: METAL FILM 10k 2% 1/4W	0751-1032
U1	IC: 741	1826-0006
U2	IC: 7473	1821-0010
VR1	DIODE: 1N4742A (1N3022B)	1900-0008