

Model RFA-4 Frequency Agile FM RF Amplifier

Guide to Operations

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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.

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1 General Information

1-1 General Description

The Belar RFA-4 Frequency Agile FM RF Amplifier is a microprocessor controlled, tunable RF amplifier designed for use with Belar's complete line of FM monitors, including the FMM-1 series, the FMM-2 series, and The Wizard. It features 10 memory locations for one-button access to 10 stations with call letters. Direct dial of any standard FM frequency is also possible, and UP/DOWN buttons are included. The station's call letters can be programmed into the display with the frequency for quick and easy reference. A sophisticated, multistage filter ensures the highest possible performance.

When used with The Wizard Precision Digital FM Modulation Analyzer (Model FMMA-1), the RFA-4 can be operated completely remotely, via an IBM-compatible PC and a pair of 2400-baud modems. Any preset can be accessed, and any station can be dialed in directly.

Local Oscillator and 10.7 MHz outputs are provided for use with the Belar FMM-4A Frequency Monitor for easy and convenient off-air frequency measurement.

1-2 Physical Description

The RFA-4 is constructed on a standard EIA 1 $\frac{3}{4}$ x 19 inch rack mount panel (one EIA rack unit). Operational controls are front panel mounted. Factory adjustments are located within the unit. The RF input, IF (650 kHz) output, L.O. output, and 10.7 MHz output are BNC connectors located on the rear of the unit. Two input attenuation switches and a mute disable switch are also located on the rear of the unit.

If the optional interface is installed, two interface D-shell connectors are also located on the back of the unit. The interface is used with The Wizard FM Digital Modulation Analyzer for unified remote operation.

1-3 Electrical Description

The RFA-4 is a solid state RF amplifier designed to accurately receive FM signals for measurement and monitoring purposes. It features a proprietary multi-stage filter and digitally-synthesized PLL tuner for maximum performance. Presets and other settings are stored in non-volatile memory in the unit so that no settings are lost in the event of power failure.

1-4 Electrical and Mechanical Specifications

RF Input Sensitivity	100 μ v
Signal-to-Noise Ratio:	
100 μ v input	75 dB
500 μ v input	85 dB
RF Input Impedance	75 Ω , BNC Connector
Input Attenuator	0, 6, 12, 18 dB
RF Frequency Range	87.75 - 107.95 MHz in 50 kHz increments
Outputs	650 kHz IF 10.7 MHz IF 98.45 MHz to 118.65 MHz LO
Capture Ratio	1.5 dB
Selectivity:	
Alternate Channel	27 dB
3rd Adjacent Channel	46 dB
Harmonic Distortion	< 0.03%
@ 1 kHz, 75 kHz deviation	
Separation with FMM-2 or Wizard Demod	
1 kHz	65 dB
15 kHz	55 dB
Dimensions	1 EIA Rack Unit 1.75"H x 10.5"D x 19"W
Power Requirements	100-240 VAC, 50/60 Hz
Power Consumption	16 VA
Shipping Weight	11 lbs

1-5 Accessories

An optional interface module (Option 01) is available for the RFA-4. The interface is required to operate the Belar RFA-4 remotely when used in conjunction with the Belar FMMA-1 The Wizard FM Modulation Analyzer.

2 Installation

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 RFA-4 is shipped with an instruction book, three wire line cord, four black rack mount screws, and a coaxial cable patch cord. When ordered with the optional interface, an interface cable is also provided.

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.

2-4 Preparation for Use

The RFA-4 Digital FM RF Amplifier is designed to be mounted in a standard 19-inch rack. 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 RFA-4. In no instance should the ambient chassis temperature be allowed to rise above 45°C (113°F).

Units prior to serial number 310320

These units can be operated from either a 105 to 125 Vac or 210 to 250 Vac single phase, 50 to 60 Hz power source. Make sure the unit is set for the proper voltage as follows:

Unplug the line cord. Open the fuse compartment door and pull lever to remove fuse. Using needlenose pliers, pull the voltage select board straight out of the power entry module. While facing the rear of the unit, orient the voltage select board so the desired line voltage is face up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation. The "100" and "220" positions on the bottom of the board are not used.) Reinsert the board into the power entry module, install the proper fuse (½A 250V for 115Vac, ¼A 250V for 230Vac), close the fuse door, and plug the line cord back in.

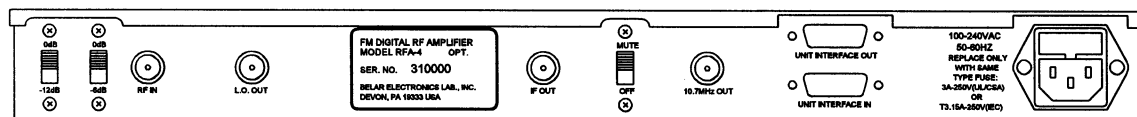
Units beginning with serial number 310320

These units can be operated from 100 to 240 VAC single phase, 50-60 Hz power source, with no user adjustments. The fuse should be a 5mm x 20mm GMA-3 3 AMP-250V (UL/CSA) or T3.15A-250V (IEC) fuse only. A spare fuse is stored in the in the removable fuse compartment.

Connect the three-wire grounded line cord provided. If a substitute line cord is used, be sure that the ground lead is connected to "G" on the line cord receptacle.

2-5 Interconnections & Controls

RFA-4 Rear Panel Jacks and Switches



RF IN RF Input: connect your receiving antenna to this input.

0dB-6dB These attenuation switches reduce the RF input level by 6 dB, 12 dB, or 18
0dB-12dB dB. These switches may be used in high signal strength areas to prevent overload and for optimum signal-to-noise ratio.

IF Out IF output (650 kHz) for connection to the IF Input jack of Belar FMM-2 FM Modulation Monitor, or IF Input jack of The Wizard (with demod). Note that when operating the Belar FMM-2 with the RFA-4, the IF Jack on the FMM-2 must be used and the RF/IF slide switch on the back of the FMM-2 must be set in the IF position.

L.O. Out Local Oscillator and 10.7 MHz outputs for connection to the Belar FMM-4A
10.7 MHz FM Frequency Monitor.

Mute When mute is on, the output level of *The Wizard's demod* will be muted when no RF level bars are lit.

(Optional)

Unit Interface

In: Used for connecting the RFA-4 with The Wizard for unified remote operation.

Unit Interface

Out: Used for connecting other units to The Wizard when the RFA-4 is also connected to The Wizard.

3 Operation

3-1 Initial Operation

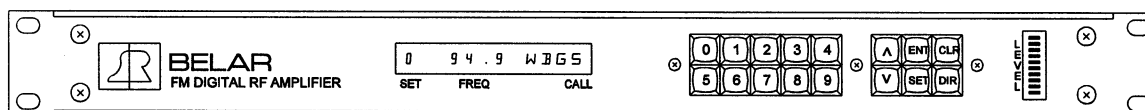
1. Connect your receiving antenna cable to the RF Input Jack on the back of the unit.
2. Connect the IF Output jack to the Belar FMM-2 FM Modulation Monitor IF Input jack, or The Wizard (with demod) IF Input jack.

Note: If you are using the Belar FMM-2, also move the RF/IF slide switch on the back of the FMM-2 to the IF position.

Note: If you are using the Belar FMM-1 (or RCA BW-75A), your FMM-1 will need modifications to accept IF input. See *Section 4*.

3. If using the RFA-4 with the Belar FMM-4A Digital Frequency Monitor, connect the L.O. and 10.7 MHz output jacks to the respective input jacks of the FMM-4A.
4. Ensure that units prior to serial number 310320 are set for the proper line voltage (see *Section 2-4*) and plug in the line cord.

3-2 Front Panel Indicators and Controls



The Belar RFA-4 has 10 preset memory locations for one-touch access. In addition, direct entry of frequencies is possible, as is manually scaling up or down the band. The display shows the currently selected preset, frequency and call letters (when programmed).

The RF Level indicator shows the relative strength of the RF Input. At least 1 indicator bar should be lit in order to make most accurate modulation measurements.

3-3 Setting or Changing the preset

Press **SET**. The unit will flash **ENTER PRESET** and blank out. Press the desired memory location (**0-9**). The unit will flash **ENTER FREQ** and blank out. Using the numeric keypad, enter the desired frequency. If you press the trailing **0** (e.g. you enter **88.10**) the frequency will be automatically entered; if you omit the trailing **0** (e.g. **88.1**) you must press **ENT** to select the frequency. The unit will then flash **ENTER CALL** and display **W** (the suggested first letter). Use the **^** and **v** keys to run through the alphabet for the first character of the call letter display. Then press **ENT** to move to the next character position. When all the call letters are entered, press **ENT** a final time to store the frequency and call letters in the memory location you selected.

3-4 Preset Selection

Press the desired preset number (**0-9**). The programmed station will be tuned in and the display will indicate the frequency and call letters (if programmed). If the preset has never been programmed, the unit will display **NO PROGRAM**.

3-5 Direct Dial (for non-programmed stations)

Press **DIR**. The unit will prompt **ENTER FREQ.** and blank out. Using the numeric keypad, enter the desired frequency. If you press the trailing **0** (e.g. you enter **88.10**) the frequency will be automatically entered; if you omit the trailing **0** (e.g. **88.1**) you must press **ENT** to select the frequency.

3-6 Manual Scanning

Use the **^** and **v** keys to manually step up or down the FM band, in 50 kHz increments. The tuning range of the RFA-4 is from 87.7 MHz to 108.0 MHz.

4 Use with the Belar FMM-1 or RCA BW-75A

In order to use the Belar RFA-4 with the Belar FMM-1 (or RCA BW-75A), the RF input of the monitor must be modified to accept the 650 kHz output of the RFA-4.

The purpose of this modification is to provide a direct connection to the IF input on the A2 card of the monitor.

Note: This modification disables the AM and incidental AM noise functions as well as the direct RF input function. No RF or OSCillator levels will be indicated on the modulation meter. No frequency deviation will be indicated.

1. Remove bottom cover.
2. Remove power to A1 card by unplugging the red lead to pin 1 on A1 and taping the end of the red lead to prevent shorts.
3. Remove the two orange leads from the INC. AM Noise Jack J5 and tape the ends.
4. Unplug the coax lead from pin 2 on A1 card and solder the lead to the center of J5. Do not solder the end of the clip, so you can restore original operation.
5. Remove one lead from the frequency meter M1 to make it inoperative. Tape the lead.
6. Replace bottom cover.
7. Remove the oven fuse F2 to disable the crystal oven.
8. Label J5 **650 kHz IF Input**.
9. Label the frequency meter M1 **NOT OPERATING**.

Reverse the steps to restore original operation.

5 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.*

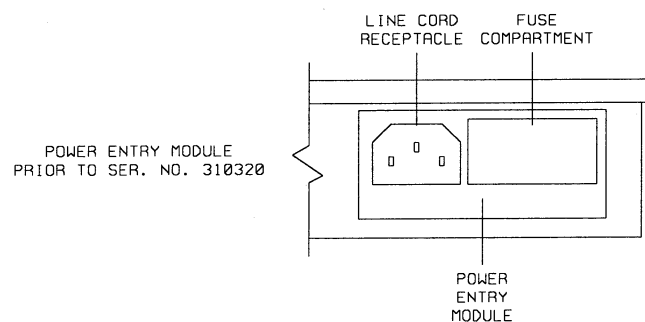
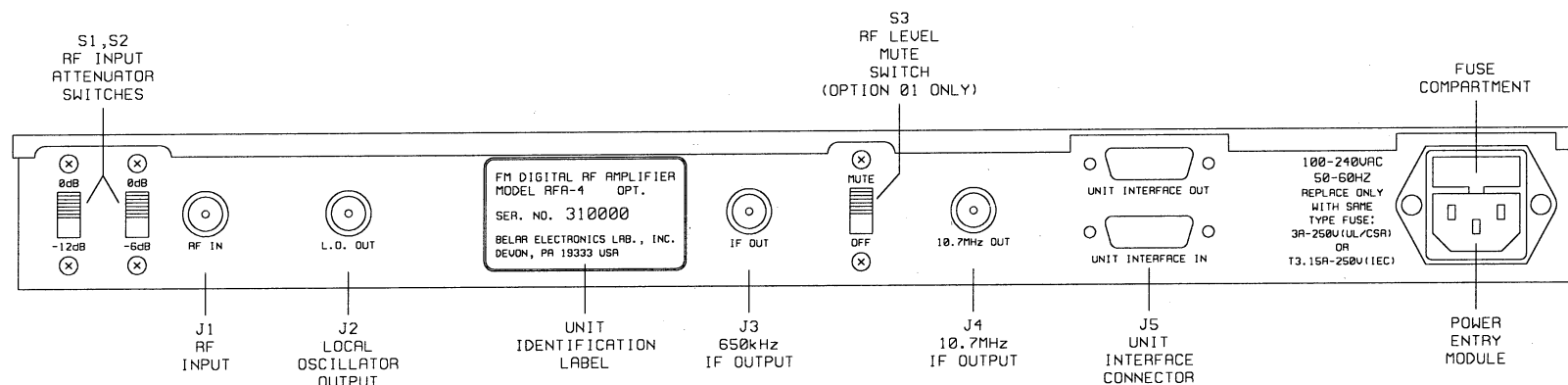
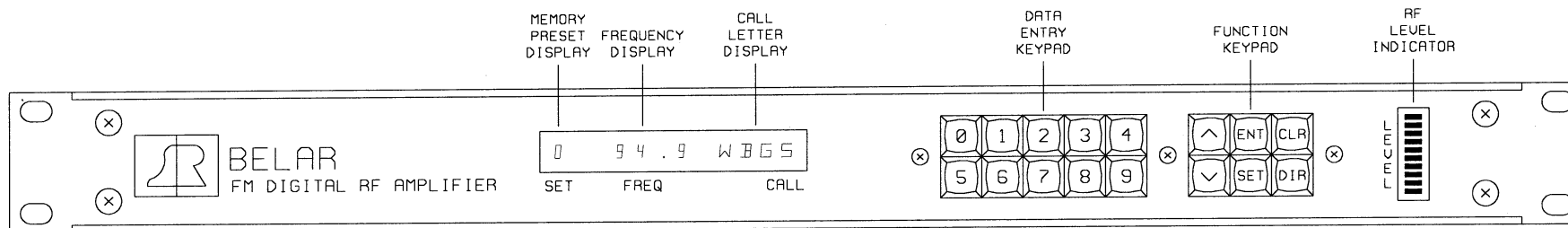
Orders may also be taken over the telephone. Parts orders can be put on your VISA, MasterCard, or American Express card, or we can ship them COD.

REFERENCE DESIGNATORS

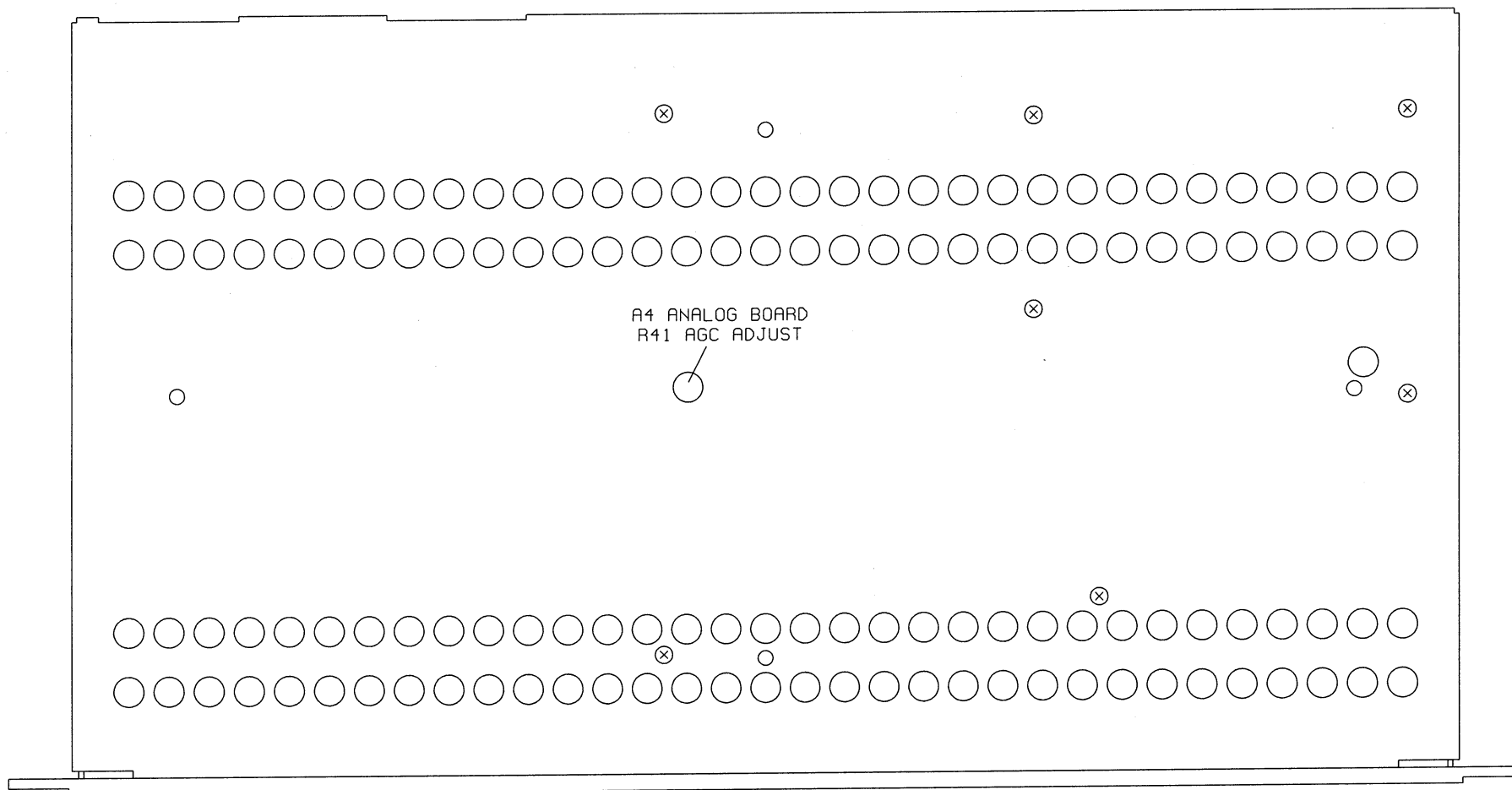
A	= assembly	J	= jack	S	= switch
BR	= diode bridge	L	= inductor	T	= transformer
C	= capacitor	M	= meter	TB	= terminal block
CR	= diode or LED	P	= plug	U	= integrated circuit
DS	= display or lamp	Q	= transistor	W	= cable
F	= fuse	R	= resistor	X	= socket
FL	= filter	RL	= relay	Y	= crystal
HDR	= header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

ABBREVIATIONS

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



RFA-4 FRONT & REAR VIEW
BELAR ELECTRONICS



RFA-4
TOP COVER ADJUSTMENT HOLE LOCATIONS
BELAR ELECTRONICS

RFA-4 PARTS LISTS

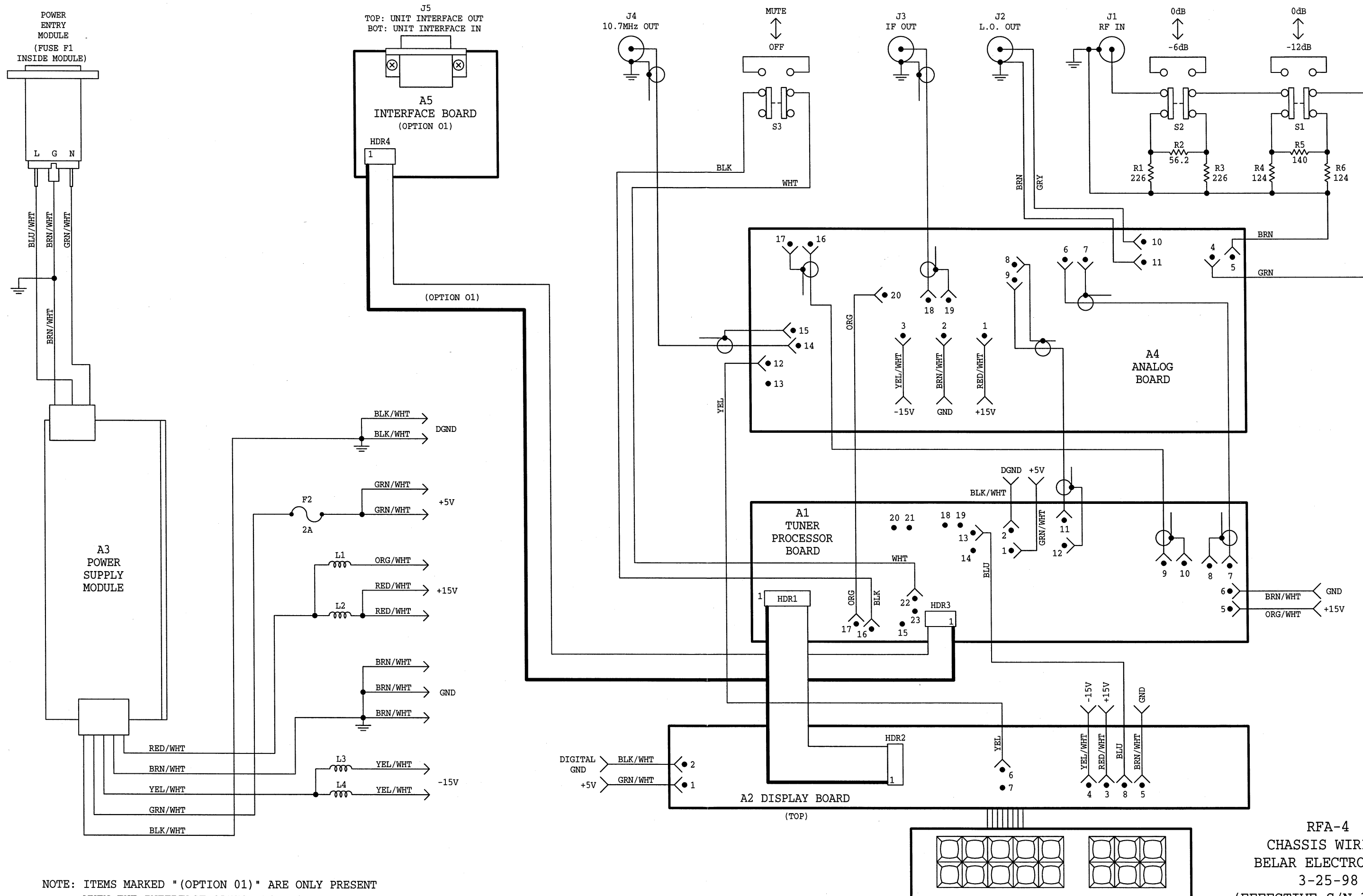
MAIN CHASSIS:

Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE: 15V, 15W (note 2)	4005-0019A
--	POWER ENTRY MODULE: 6EGG1-1 (note 2)	0360-0021
F1	FUSE: GMA-3A 250V(UL/CSA) (note 2)	2110-0009
	or T3.15A-250V(IEC)	
--	FUSE HOLDER: CHASSIS MOUNT (note 2)	2110-0010
F2	FUSE: AGC-2A 250V (note 2)	2110-0006
--	POWER ENTRY MODULE: 6J4 (note 1)	0360-0020
	FUSE: AGC 1/2A 250V (note 1)	2110-0001
	AGC 1/4A 250V (230 Vac) (note 1)	2110-0002
J1 thru J4	JACK: BNC	0360-0005
L1 thru L4	CHOKE: RF (note 2)	9140-0011
R1	R: METAL FILM 226 1%	0721-2260
R2	R: METAL FILM 56.2 1%	0721-56R2
R3	R: METAL FILM 226 1%	0721-2260
R4	R: METAL FILM 124 1%	0721-1240
R5	R: METAL FILM 140 1%	0721-1400
R6	R: METAL FILM 124 1%	0721-1240
S1 thru S3	SWITCH: SLIDE, DPDT	3102-0003
T1	TRANSFORMER: POWER, DPC-34-700 (note 1)	9100-0022
T2	TRANSFORMER: POWER, DPC-16-1500 (note 1)	9100-0011
--	FLAT CABLE ASSEMBLY: 10 CONDUCTOR (note 3)	8900-0015
--	FLAT CABLE ASSEMBLY: 16 CONDUCTOR	8900-0016
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

note 1: USED PRIOR TO SERIAL NUMBER 310320.

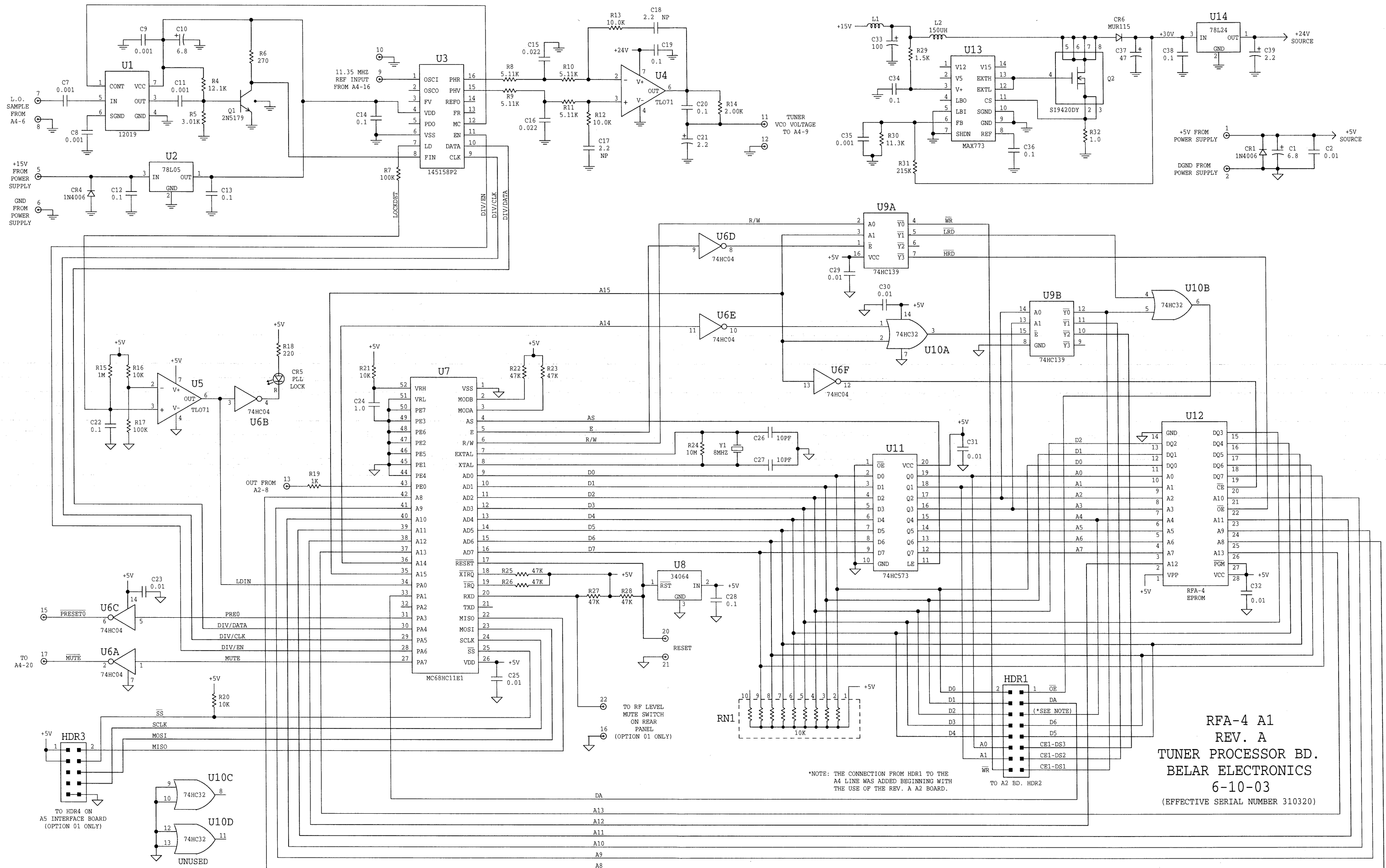
note 2: USED BEGINNING SERIAL NUMBER 310320.

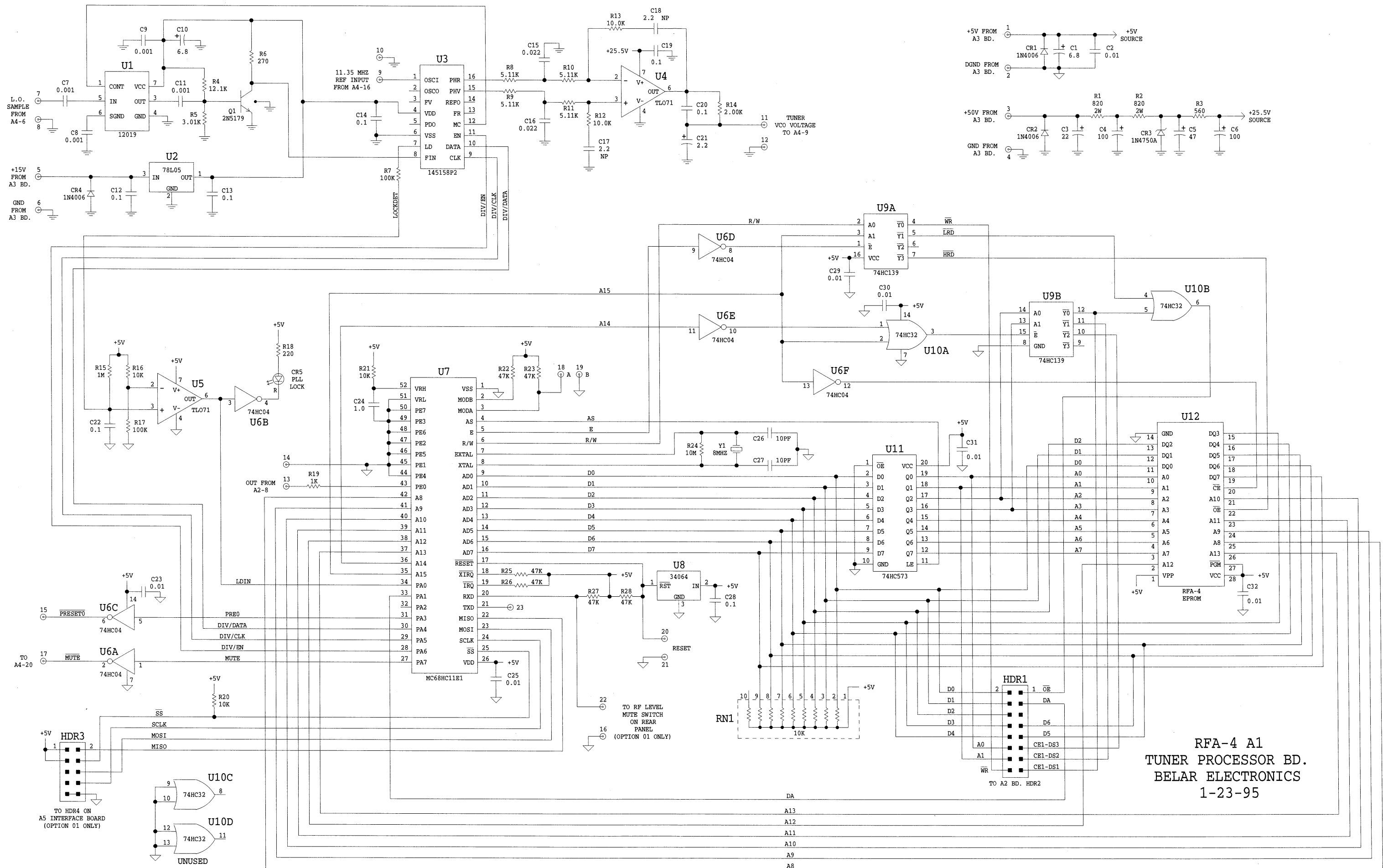
note 3: THE 10 CONDUCTOR FLAT CABLE ASSEMBLY IS ONLY INSTALLED WITH OPTION 01.



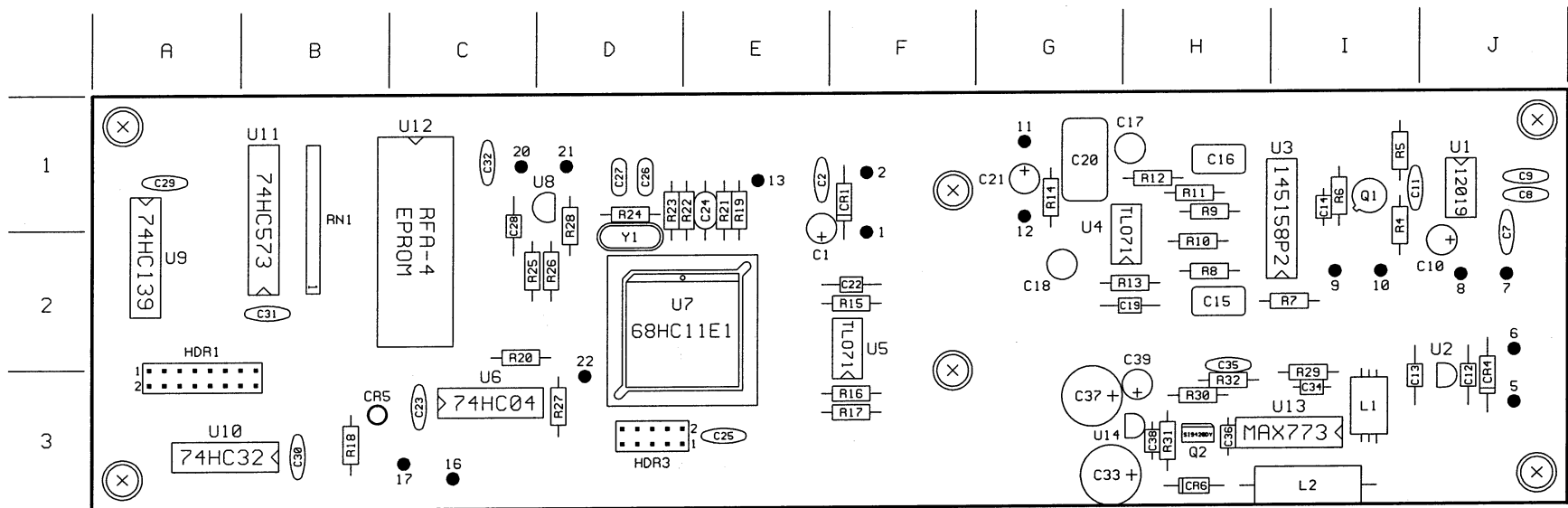
NOTE: ITEMS MARKED "(OPTION 01)" ARE ONLY PRESENT WHEN THE INTERFACE OPTION IS INSTALLED.

RFA-4
CHASSIS WIRING
BELAR ELECTRONICS
3-25-98
(EFFECTIVE S/N 310320)

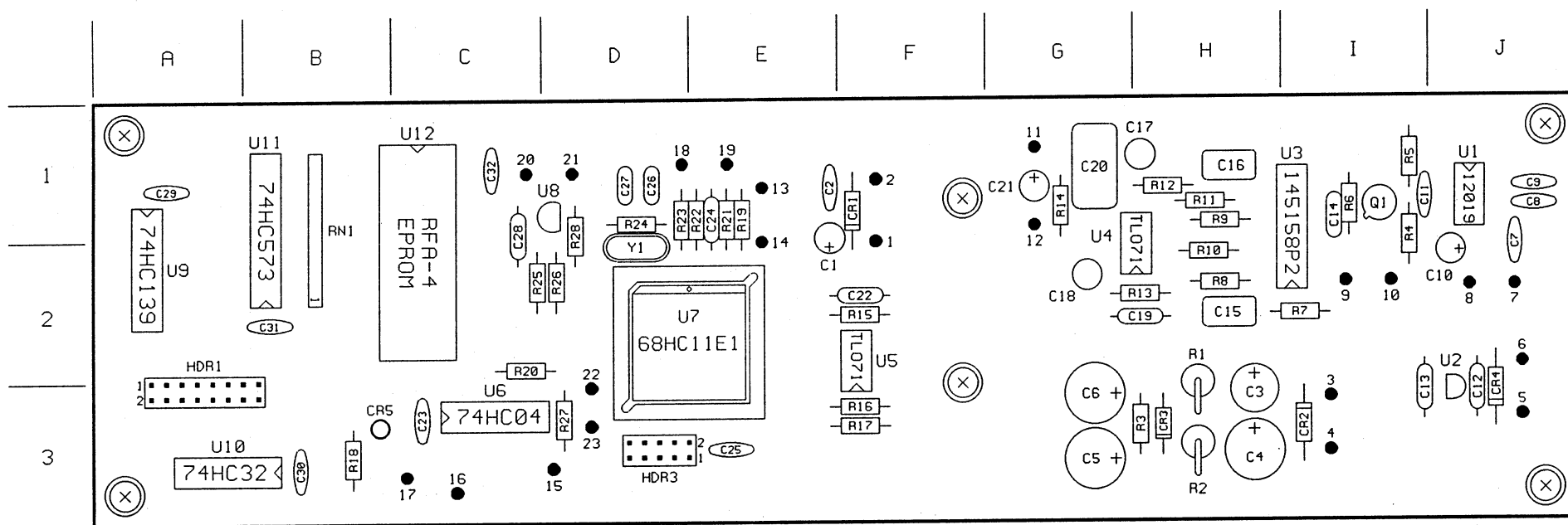




RFA-4 A1
 TUNER PROCESSOR BD.
 BELAR ELECTRONICS
 1-23-95



RFA-4 A1
REV. A
TUNER PROCESSOR BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS
(EFFECTIVE SERIAL NUMBER 310320)



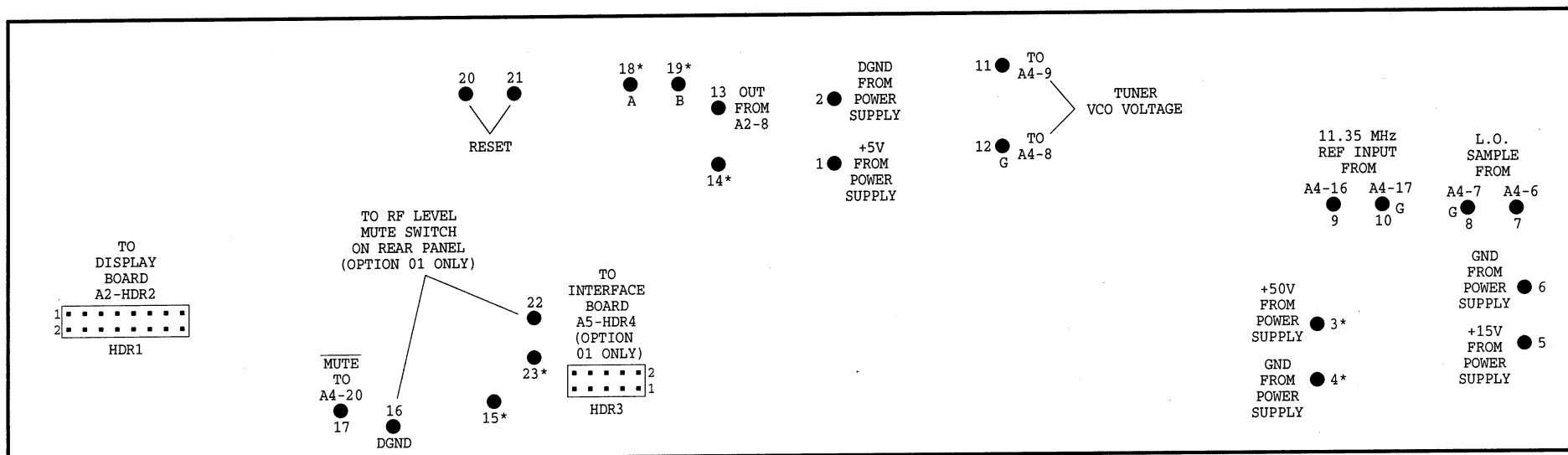
RFA-4 A1
TUNER PROCESSOR BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

RFA-4 A1 BOARD
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 E2	C23 C3	CR5 B3	R11 H1	RN1 B1	3* I3	
C2 E1	C24 E1	CR6# H3	R12 H1		4* I3	
C3* H3	C25 E3		R13 H2	U1 J1	5 J3	
C4* H3	C26 D1	HDR1 A3	R14 G1	U2 J3	6 J2	
C5* G3	C27 D1	HDR3 D3	R15 F2	U3 I1	7 J2	
C6* G3	C28 C1		R16 F3	U4 H2	8 J2	
C7 J2	C29 A1	L1# I3	R17 F3	U5 F2	9 I2	
C8 J1	C30 B3	L2# I3	R18 B3	U6 C3	10 I2	
C9 J1	C31 B2		R19 E1	U7 D2	11 G1	
C10 J2	C32 C1	Q1 I1	R20 C2	U8 D1	12 G1	
C11 I1	C33# G3	Q2# H3	R21 E1	U9 A2	13 E1	
C12 J3	C34# I3		R22 E1	U10 A3	14* E2	
C13 I3	C35# H3	R1* H3	R23 D1	U11 B1	15* D3	
C14 I1	C36# H3	R2* H3	R24 D1	U12 C2	16 C3	
C15 H2	C37# G3	R3* H3	R25 C2	U13# I3	17 C3	
C16 H1	C38# H3	R4 I2	R26 D2	U14# I3	18* D1	
C17 H1	C39# H3	R5 I1	R27 D3		19* E1	
C18 G2		R6 I1	R28 D1	Y1 D2	20 C1	
C19 H2	CR1 F1	R7 I2	R29# I3		21 D1	
C20 G1	CR2* I3	R8 H2	R30# H3	<u>pins</u>	22 D3	
C21 G1	CR3* H3	R9 H1	R31# H3	1 F2	23* D3	
C22 F2	CR4 J3	R10 H2	R32# H3	2 F1		

*NOTE: USED PRIOR TO SERIAL NUMBER 310320.

#NOTE: USED BEGINNING SERIAL NUMBER 310320.



RFA-4 A1
TUNER PROCESSOR BOARD
CONNECTION DRAWING
BELAR ELECTRONICS

*NOTE: GOLD PINS 3,4,14,15,18,19 AND 23 ARE NOT USED BEGINNING SERIAL NUMBER 310320.

A1 BOARD RFA-4

Reference Designation	Description	Part Number
C1	C: FIXED TANT 6.8uF 25V	0185-0002
C2	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C3 (note 1)	C: FIXED ELEC 22uF 100V	0180-0031
C4 (note 1)	C: FIXED ELEC 100uF 63V	0180-0032
C5 (note 1)	C: FIXED ELEC 47uF 50V	0180-0017
C6 (note 1)	C: FIXED ELEC 100uF 35V	0180-0018
C7 thru C9	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C10	C: FIXED TANT 6.8uF 25V	0185-0002
C11	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C12 thru C14	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C15,C16	C: FIXED POLY 0.022uF 10% 100V	0122-2231
C17,C18	C: FIXED ELEC 2.2uF 50V NON-POLAR	0180-0030
C19	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C20	C: FIXED POLY 0.1uF 10% 100V	0122-1041
C21	C: FIXED TANT 2.2uF 35V	0185-0009
C22	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C23	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C24	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C25	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C26,C27	C: FIXED MICA 10pF 5%	0142-1005
C28	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C29 thru C32	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C33 (note 2)	C: FIXED ELEC 100uF 35V	0180-0018
C34 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C35 (note 2)	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C36 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C37 (note 2)	C: FIXED ELEC 47uF 50V	0180-0017
C38 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C39 (note 2)	C: FIXED TANT 2.2uF 35V	0185-0009
CR1	DIODE: 1N4006	1900-0016
CR2 (note 1)	DIODE: 1N4006	1900-0016
CR3 (note 1)	DIODE: 1N4750A	1900-0004
CR4	DIODE: 1N4006	1900-0016
CR5	LED: RED	1910-0004
CR6 (note 2)	DIODE: MUR115	1900-0034
HDR1	HEADER: 16 PIN	0361-0016
HDR3	HEADER: 10 PIN	0361-0010
L1 (note 2)	CHOKE: RF	9140-0011
L2 (note 2)	CHOKE: 150 uH	9140-0150
Q1	TRANSISTOR: 2N5179	1850-0023
Q2 (note 2)	TRANSISTOR: SI9420DY	1850-0035

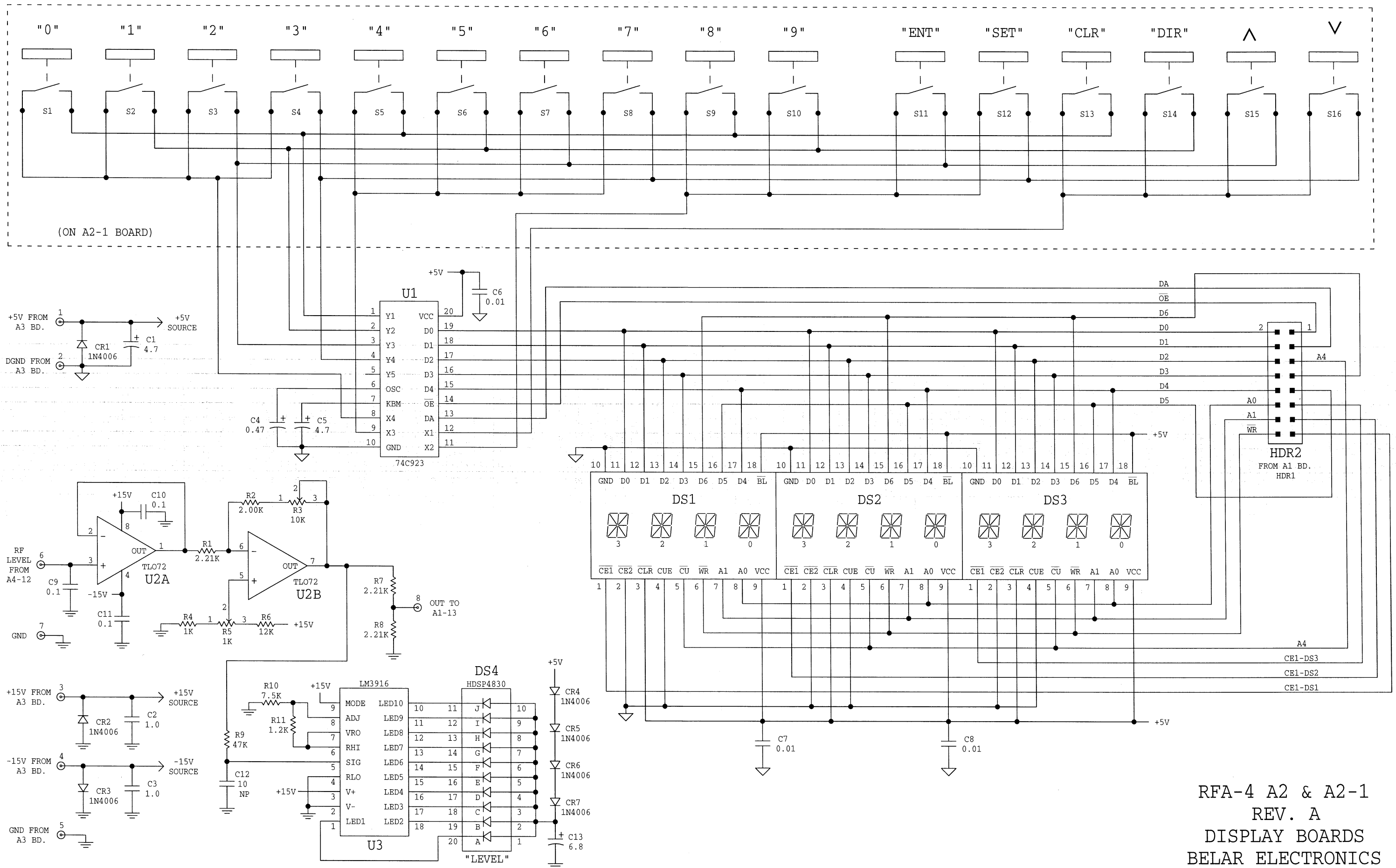
note 1: Used prior to serial number 310320.

note 2: Used beginning serial number 310320.

A1 BOARD RFA-4 CONT.

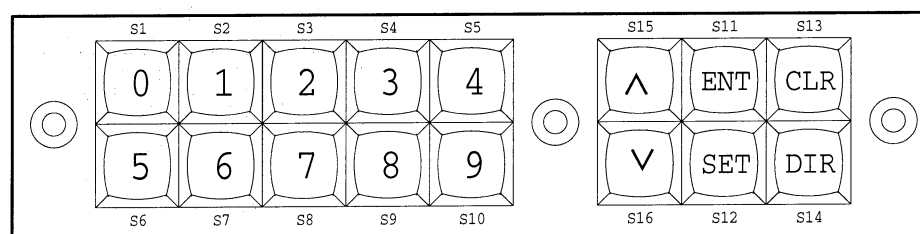
Reference Designation	Description	Part Number
R1,R2 (note 1)	R: WIREWOUND 820 5% 2W	0811-0020
R3 (note 1)	R: METAL FILM 560 2% 1/4W	0751-5612
R4	R: METAL FILM 12.1k 1%	0721-1212
R5	R: METAL FILM 3.01k 1%	0721-3011
R6	R: METAL FILM 270 2% 1/4W	0751-2712
R7	R: METAL FILM 100k 2% 1/4W	0751-1042
R8 thru R11	R: METAL FILM 5.11k 1%	0721-5111
R12,R13	R: METAL FILM 10.0k 1%	0721-1002
R14	R: METAL FILM 2.00k 1%	0721-2001
R15	R: METAL FILM 1M 2% 1/4W	0751-1052
R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17	R: METAL FILM 100k 2% 1/4W	0751-1042
R18	R: METAL FILM 220 2% 1/4W	0751-2212
R19	R: METAL FILM 1k 2% 1/4W	0751-1022
R20,R21	R: METAL FILM 10k 2% 1/4W	0751-1032
R22,R23	R: METAL FILM 47k 2% 1/4W	0751-4732
R24	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R25 thru R28	R: METAL FILM 47k 2% 1/4W	0751-4732
R29 (note 2)	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R30 (note 2)	R: METAL FILM 11.3k 1%	0721-1132
R31 (note 2)	R: METAL FILM 215k 1%	0721-2153
R32 (note 2)	R: METAL FILM 1.0 2% 1/4W	0751-1R02
RN1	R: NETWORK 10 PIN 10k	0910-1032
U1	IC: 12019	1822-0059
U2	IC: 78L05CP	1826-0012
U3	IC: 145158P2	1823-0003
U4,U5	IC: TLO71	1826-0004
U6	IC: 74HC04	1822-0041
U7	IC: MC68HC11E1	1840-0010
U8	IC: MC34064	1826-0048
U9	IC: 74HC139	1822-0048
U10	IC: 74HC32	1822-0043
U11	IC: 74HC573	1822-0052
U12	IC: RFA-4 EPROM	1840-0003C
U13 (note 2)	IC: MAX773	1826-0059
U14 (note 2)	IC: 78L24CP	1826-0012
Y1	XTAL: 8 MHz	0411-0005

note 1: Used prior to serial number 310320.
note 2: Used beginning serial number 310320.

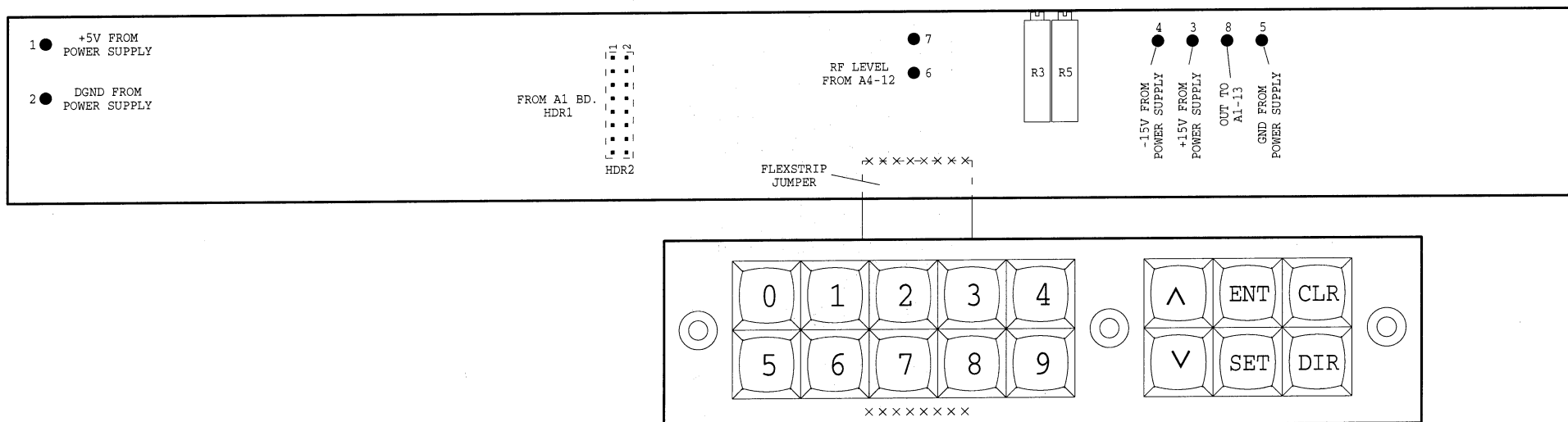


RFA-4 A2 & A2-1
REV. A
DISPLAY BOARDS
BELAR ELECTRONICS
6-10-03

PRIOR TO REV. A OF THE A2 BOARD, PIN 5 OF DS1 THRU DS3 WAS CONNECTED TO +5V.



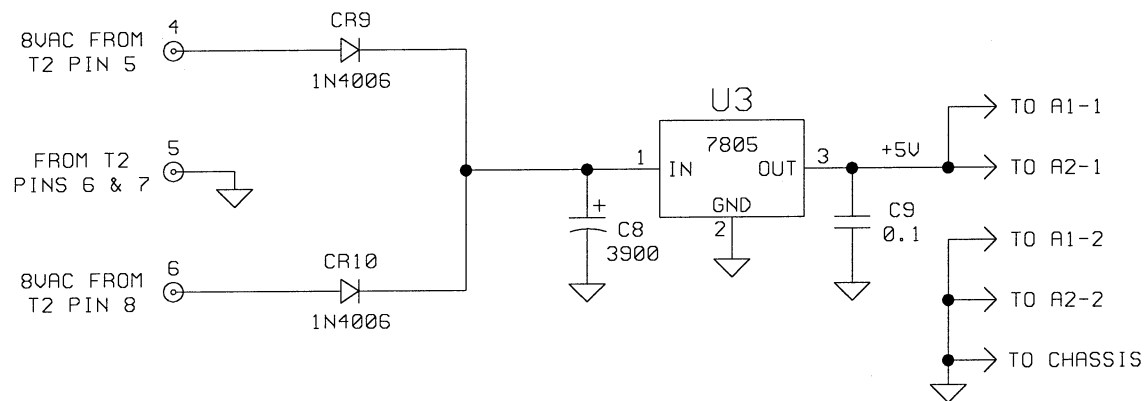
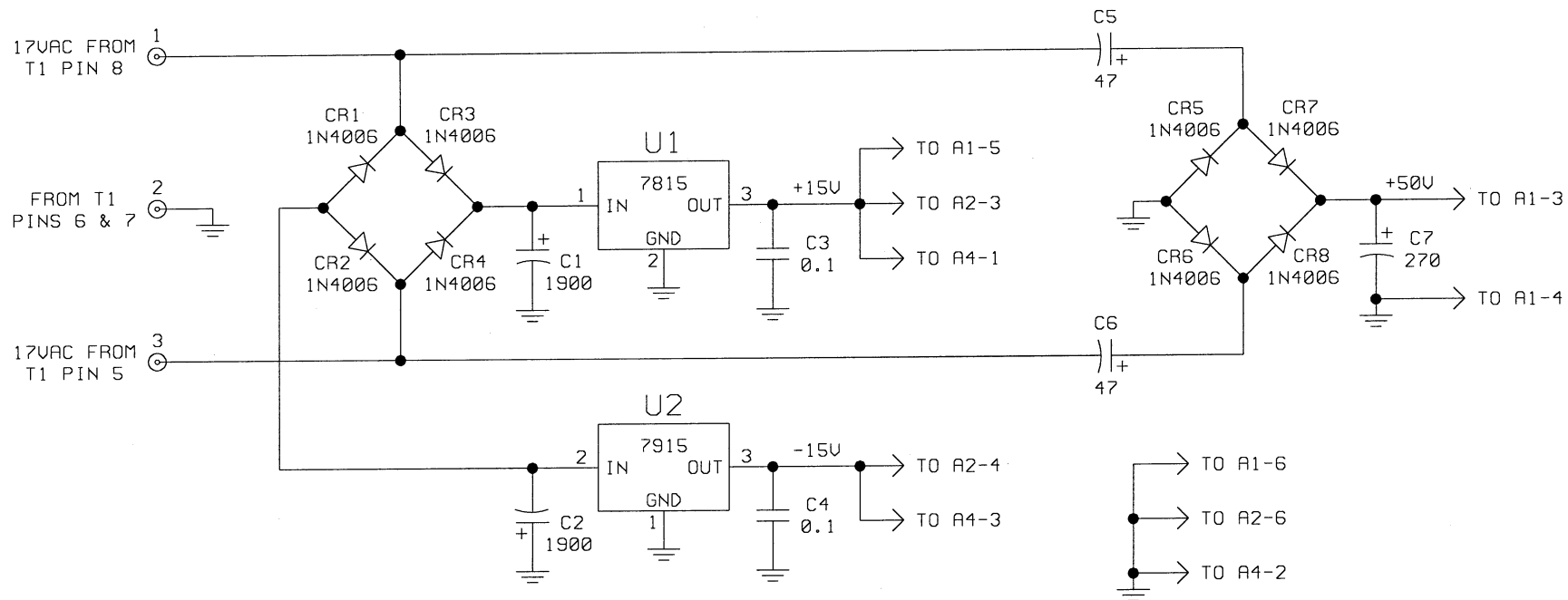
RFA-4 A2 & A2-1
REV. A
DISPLAY BOARDS
COMPONENT LAYOUT
BELAR ELECTRONICS



RFA-4 A2 BOARD
REV. A
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

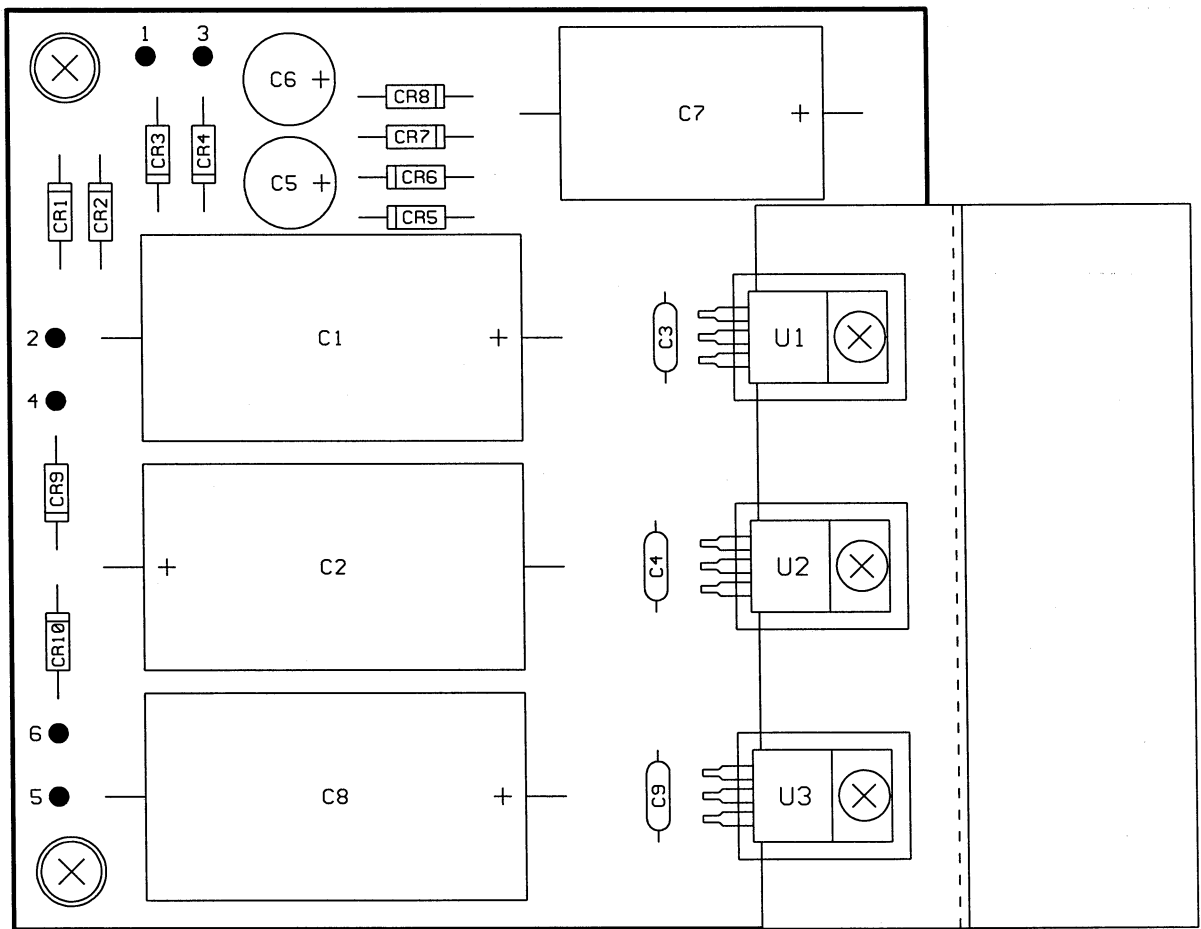
A2 BOARD RFA-4, REV. A

Reference Designation	Description	Part Number
C1	C: FIXED TANT 4.7uF 10V	0185-0001
C2,C3	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C4	C: FIXED TANT 0.47uF 35V	0185-0008
C5	C: FIXED TANT 4.7uF 10V	0185-0001
C6 thru C8	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C9 thru C11	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C12	C: FIXED ELEC 10uF 35V NON-POLAR	0180-0029
C13	C: FIXED TANT 6.8uF 25V	0185-0002
CR1 thru CR7	DIODE: 1N4006	1900-0016
DS1 thru DS3	DISPLAY: HDLO-2416 (prior to rev. A, DS1 thru DS3 were the HPDL2416 display, Belar P/N 1930-0005. These parts are not interchangeable.)	1930-0008
DS4	DISPLAY: HDSP-4830	1930-0006
HDR2	HEADER: 16 PIN	0361-0016
R1	R: METAL FILM 2.21k 1%	0721-2211
R2	R: METAL FILM 2.00k 1%	0721-2001
R3	R: VAR COMP 10k, 10 TURN	2100-0018
R4	R: METAL FILM 1k 2% 1/4W	0751-1022
R5	R: VAR COMP 1k, 10 TURN	2100-0023
R6	R: METAL FILM 12k 2% 1/4W	0751-1232
R7,R8	R: METAL FILM 2.21k 1%	0721-2211
R9	R: METAL FILM 47k 2% 1/4W	0751-4732
R10	R: METAL FILM 7.5k 2% 1/4W	0751-7522
R11	R: METAL FILM 1.2k 2% 1/4W	0751-1222
S1 thru S16	SWITCH: PUSHBUTTON, MOMENTARY (ON A2-1 BOARD)	3105-0001
U1	IC: 74C923	1823-0006
U2	IC: TLO72	1826-0038
U3	IC: LM3916	1826-0049



(ONLY USED PRIOR TO SERIAL NUMBER 310320)

RFA-4 A3
POWER SUPPLY BOARD
BELAR ELECTRONICS
5-11-92



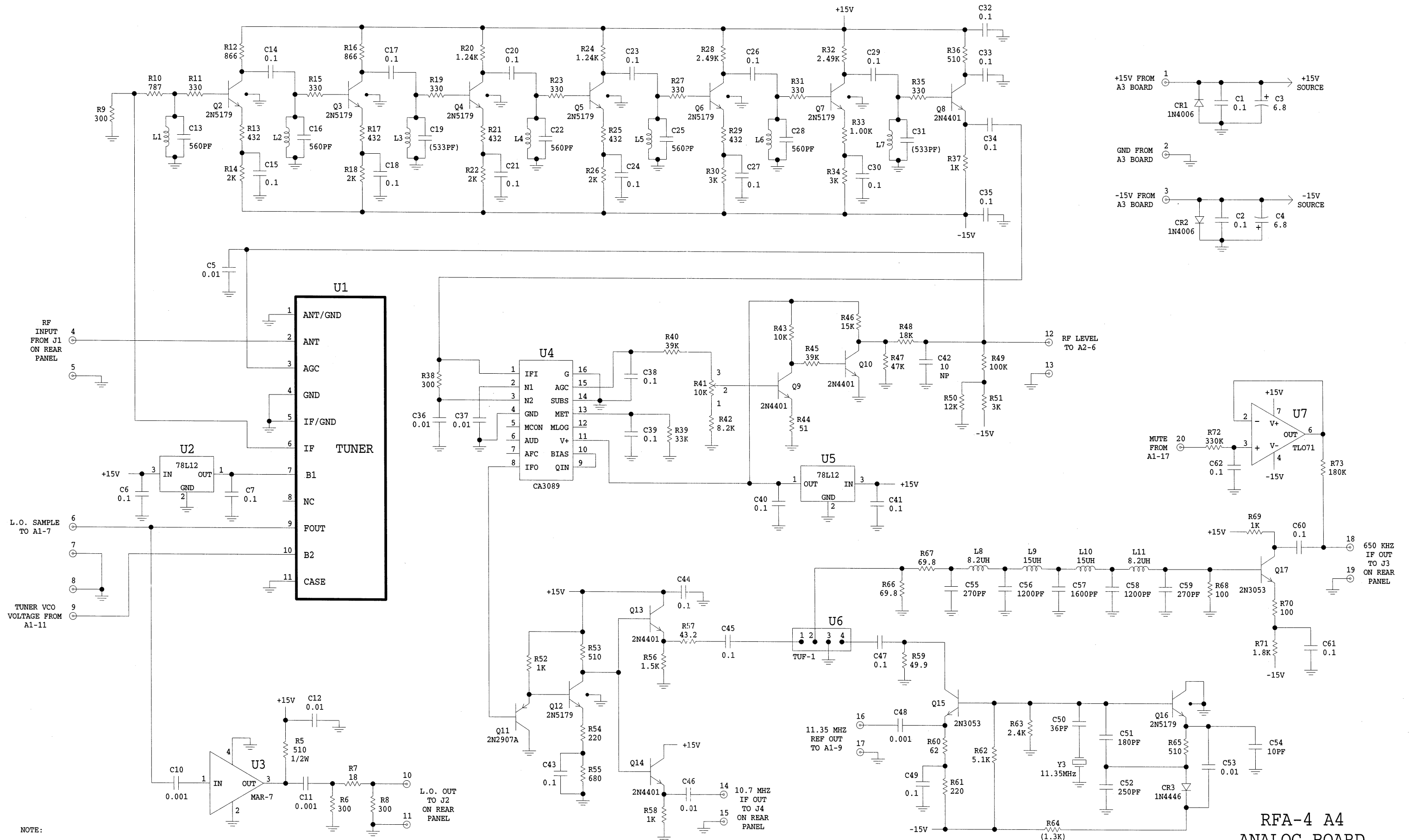
(ONLY USED PRIOR TO SERIAL NUMBER 310320)

RFA-4 A3 BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

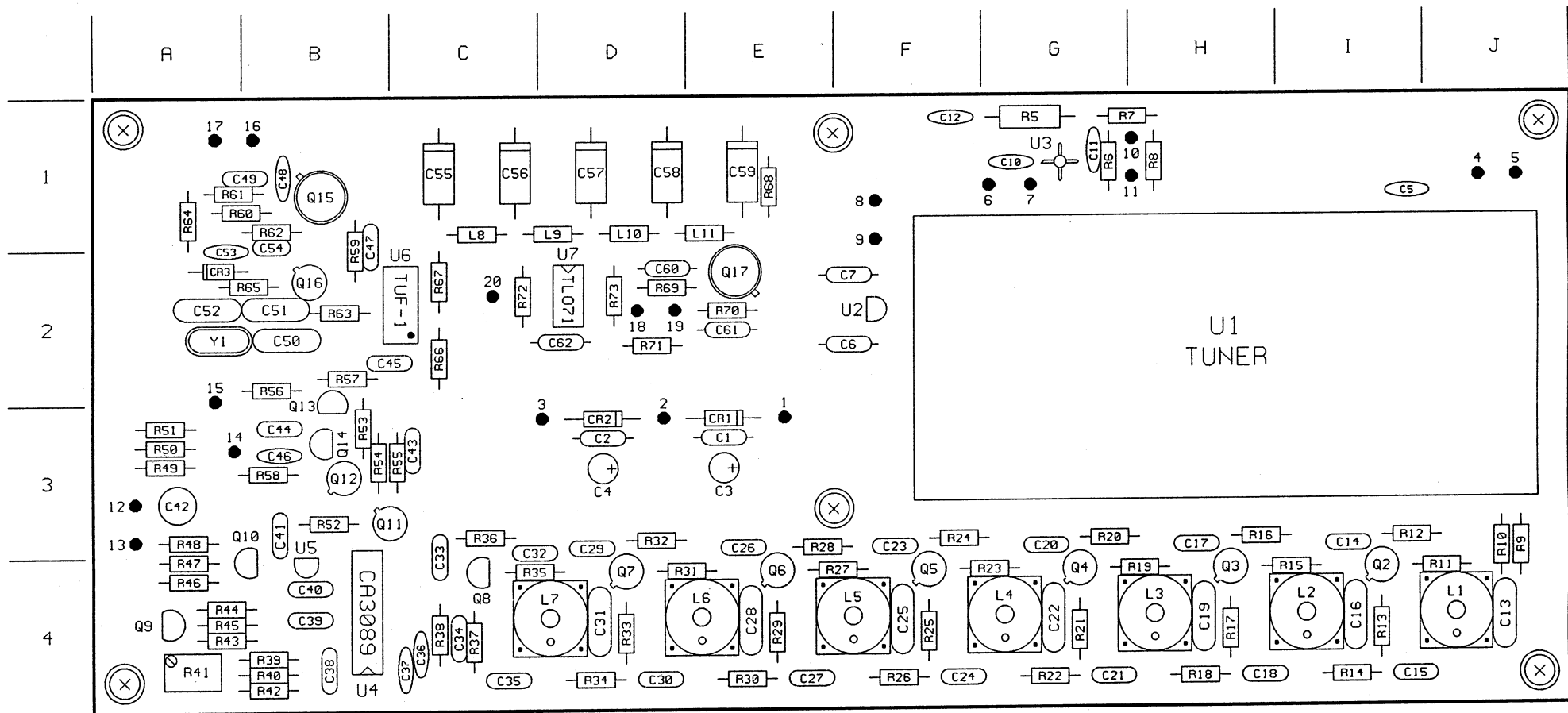
A3 BOARD RFA-4

(Only used prior to serial number 310320)

Reference Designation	Description	Part Number
C1,C2	C: FIXED ELEC 1900uF 50V	0180-0027
C3,C4	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C5,C6	C: FIXED ELEC 47uF 50V	0180-0017
C7	C: FIXED ELEC 270uF 100V	0180-0034
C8	C: FIXED ELEC 3900uF 25V	0180-0035
C9	C: FIXED CERAMIC 0.1uF 50V	0151-0006
CR1 thru CR10	DIODE: 1N4006	1900-0016
U1	IC: 7815C	1826-0031
U2	IC: 7915C	1826-0033
U3	IC: 7805C	1826-0014



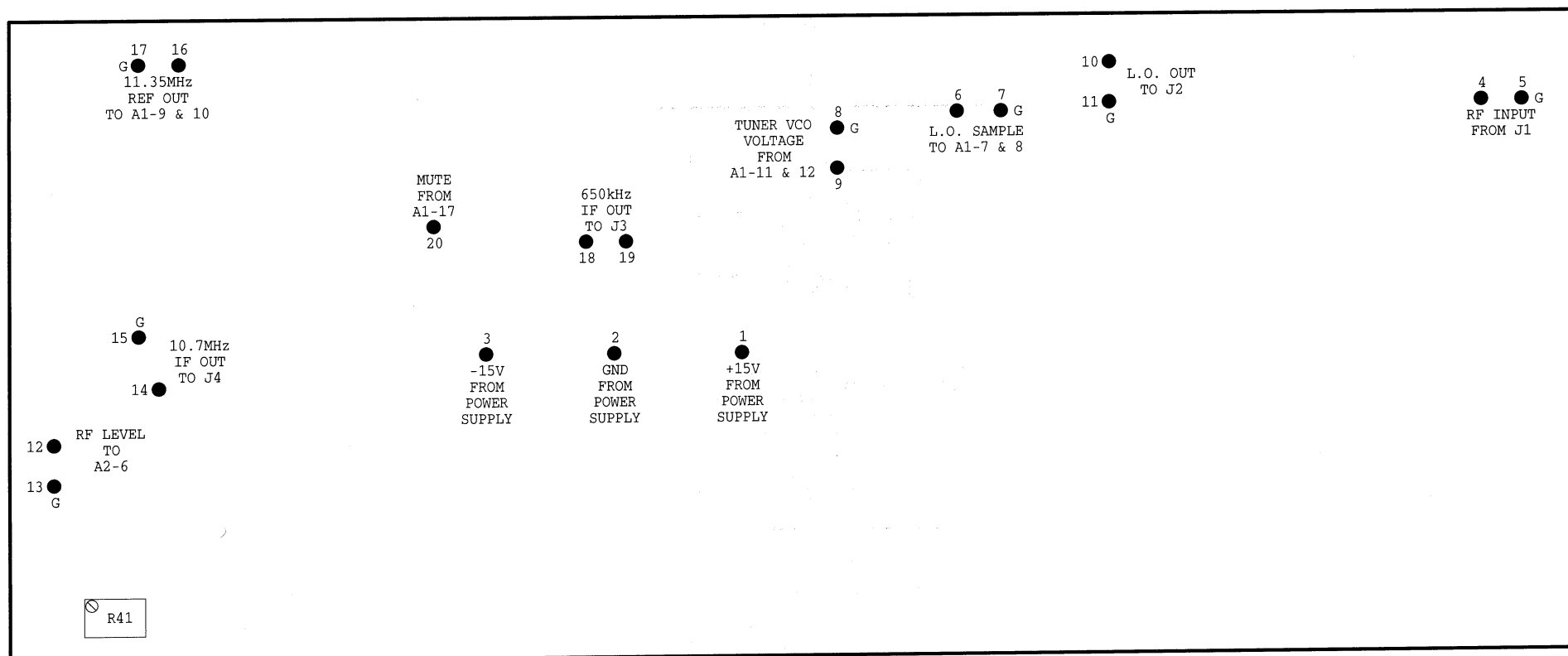
RFA-4 A4
ANALOG BOARD
BELAR ELECTRONICS
12-19-97



RFA-4 A4 BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

RFA-4 A4 BOARD
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 E3	C43 C3	Q5 F4	R31 D4	R71 D2	
C2 D3	C44 B3	Q6 E4	R32 D3	R72 C2	
C3 E3	C45 B2	Q7 D4	R33 D4	R73 D2	
C4 D3	C46 B3	Q8 C4	R34 D4		
C5 I1	C47 B1	Q9 A4	R35 C4	U1 H2	
C6 F2	C48 B1	Q10 B4	R36 C3	U2 F2	
C7 F2	C49 B1	Q11 B3	R37 C4	U3 G1	
C10 G1	C50 B2	Q12 B3	R38 C4	U4 B4	
C11 G1	C51 B2	Q13 B2	R39 B4	U5 B4	
C12 F1	C52 A2	Q14 B3	R40 B4	U6 C2	
C13 J4	C53 A1	Q15 B1	R41 A4	U7 D2	
C14 I3	C54 B1	Q16 B2	R42 B4		
C15 I4	C55 C1	Q17 E2	R43 A4	Y1 A2	
C16 I4	C56 C1		R44 A4		
C17 H3	C57 D1	R5 G1	R45 A4	<u>pins</u>	
C18 H4	C58 D1	R6 G1	R46 A4	1 E3	
C19 H4	C59 E1	R7 G1	R47 A4	2 D3	
C20 G3	C60 D2	R8 H1	R48 A3	3 D3	
C21 G4	C61 E2	R9 J3	R49 A3	4 J1	
C22 G4	C62 D2	R10 J3	R50 A3	5 J1	
C23 F3		R11 J4	R51 A3	6 G1	
C24 F4	CR1 E3	R12 I3	R52 B3	7 G1	
C25 F4	CR2 D3	R13 I4	R53 B3	8 F1	
C26 E3	CR3 A2	R14 I4	R54 B3	9 F1	
C27 E4		R15 I4	R55 C3	10 H1	
C28 E4	L1 J4	R16 H3	R56 B2	11 H1	
C29 D3	L2 I4	R17 H4	R57 B2	12 A3	
C30 D4	L3 H4	R18 H4	R58 B3	13 A3	
C31 D4	L4 G4	R19 H4	R59 B1	14 A3	
C32 C3	L5 F4	R20 G3	R60 A1	15 A2	
C33 C3	L6 E4	R21 G4	R61 A1	16 B1	
C34 C4	L7 D4	R22 G4	R62 B1	17 A1	
C35 C4	L8 C1	R23 G4	R63 B2	18 D2	
C36 C4	L9 D1	R24 F3	R64 A1	19 D2	
C37 C4	L10 D1	R25 F4	R65 B2	20 C2	
C38 B4	L11 E1	R26 F4	R66 C2		
C39 B4		R27 F4	R67 C2		
C40 B4	Q2 I4	R28 E3	R68 E1		
C41 B3	Q3 H4	R29 E4	R69 D2		
C42 A3	Q4 G4	R30 E4	R70 E2		



RFA-4 A4 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

A4 BOARD RFA-4

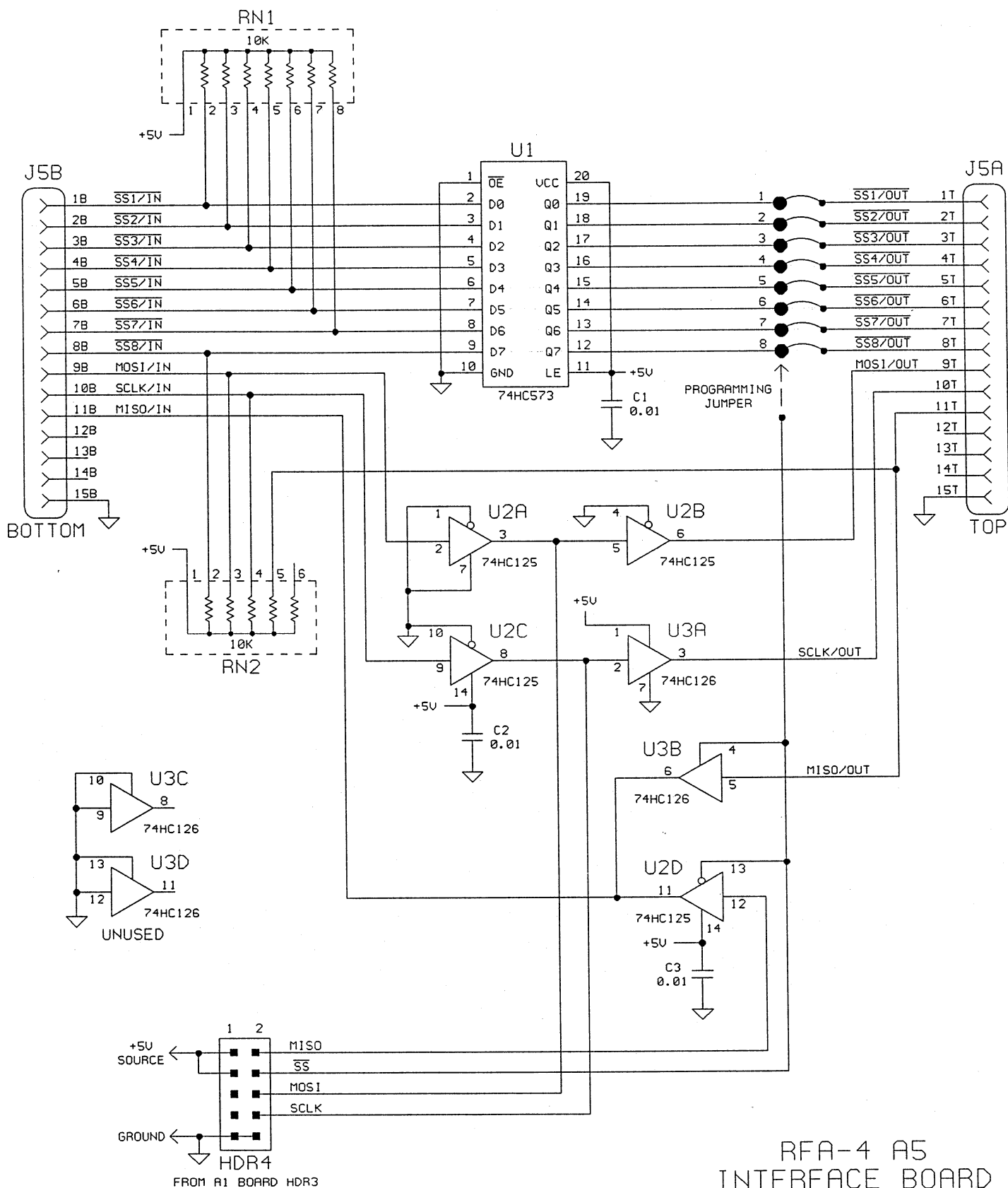
Reference Designation	Description	Part Number
C1,C2	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C3,C4	C: FIXED TANT 6.8uF 25V	0185-0002
C5	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C6,C7	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C8,C9	not used	
C10,C11	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C12	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C13	C: FIXED MICA 560pF 2%	0140-5612
C14,C15	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C16	C: FIXED MICA 560pF 2%	0140-5612
C17,C18	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C19	C: FIXED MICA 500pF 2%	0140-5012
	(C19 selected for value, nominal value shown)	
C20,C21	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C22	C: FIXED MICA 560pF 2%	0140-5612
C23,C24	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C25	C: FIXED MICA 560pF 2%	0140-5612
C26,C27	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C28	C: FIXED MICA 560pF 2%	0140-5612
C29,C30	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C31	C: FIXED MICA 500pF 2%	0140-5012
	(C31 selected for value, nominal value shown)	
C32 thru C35	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C36,C37	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C38 thru C41	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C42	C: FIXED ELEC 10uF 35V NON-POLAR	0180-0029
C43 thru C45	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C46	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C47	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C48	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C49	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C50	C: FIXED MICA 36pF 5%	0140-3605
C51	C: FIXED MICA 180pF 5%	0140-1815
C52	C: FIXED MICA 250pF 5%	0140-2515
C53	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C54	C: FIXED MICA 10pF 5%	0142-1005
C55	C: FIXED POLY 270pF 2.5% 160V	0130-2712
C56	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C57	C: FIXED POLY 1600pF 2.5% 160V	0130-1622
C58	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C59	C: FIXED POLY 270pF 2.5% 160V	0130-2712
C60 thru C62	C: FIXED CERAMIC 0.1uF 50V	0151-0006
CR1,CR2	DIODE: 1N4006	1900-0016
CR3	DIODE: 1N4446	1900-0002
L1 thru L7	COIL:	Belar
L8	CHOKE: 8.2uH	9141-0015
L9,L10	CHOKE: 15uH	9141-0025
L11	CHOKE: 8.2uH	9141-0015

A4 BOARD RFA-4 CONT.

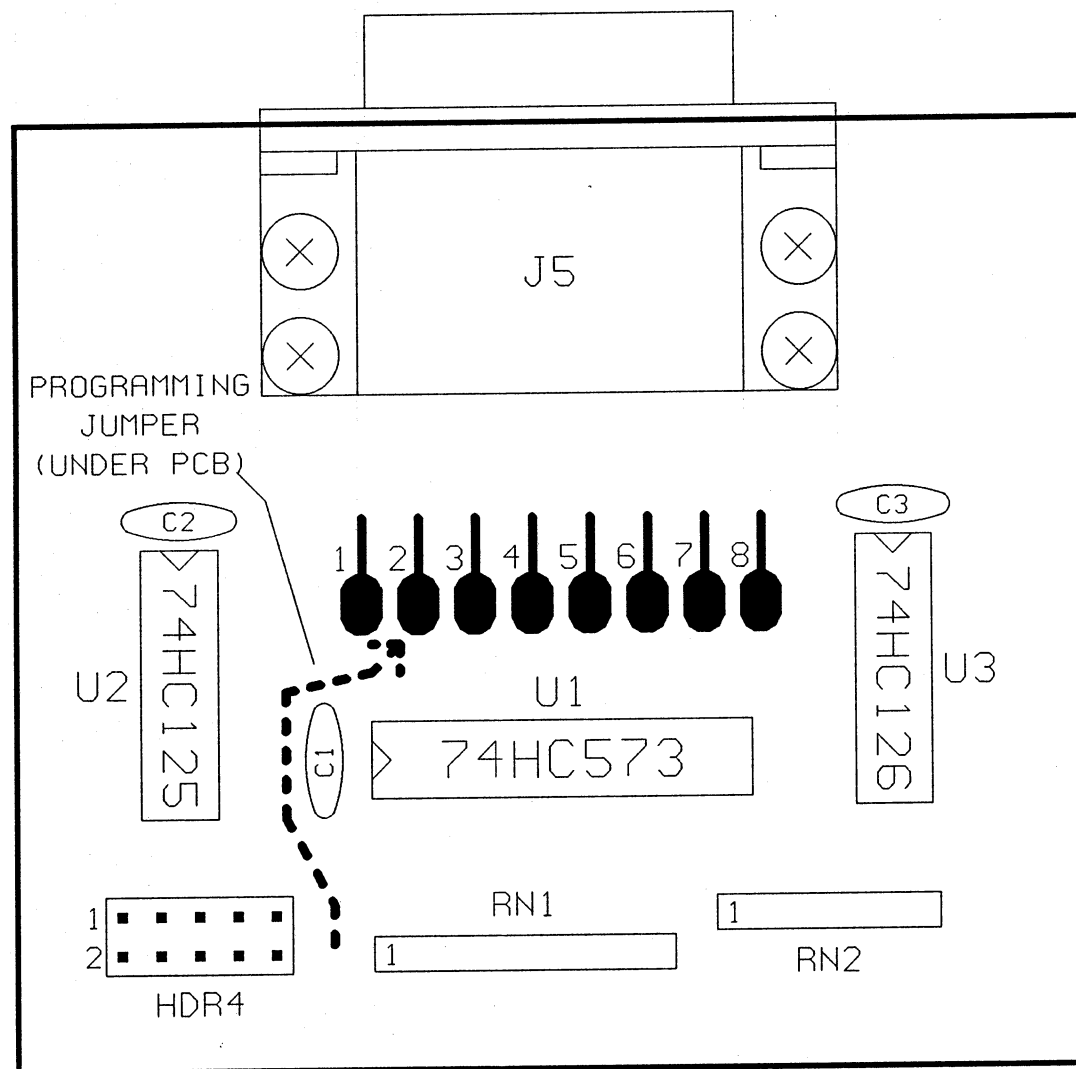
Reference Designation	Description	Part Number
Q1	not used	
Q2 thru Q7	TRANSISTOR: 2N5179	1850-0023
Q8 thru Q10	TRANSISTOR: 2N4401	1850-0028
Q11	TRANSISTOR: 2N2907A	1850-0027
Q12	TRANSISTOR: 2N5179	1850-0023
Q13, Q14	TRANSISTOR: 2N4401	1850-0028
Q15	TRANSISTOR: 2N3053	1850-0008
Q16	TRANSISTOR: 2N5179	1850-0023
Q17	TRANSISTOR: 2N3053	1850-0008
R1 thru R4	not used	
R5	R: METAL FILM 510 2% 1/2W	0771-5112
R6	R: METAL FILM 300 2% 1/4W	0751-3012
R7	R: METAL FILM 18 2% 1/4W	0751-1802
R8, R9	R: METAL FILM 300 2% 1/4W	0751-3012
R10	R: METAL FILM 787 1%	0721-7870
R11	R: METAL FILM 330 2% 1/4W	0751-3312
R12	R: METAL FILM 866 1%	0721-8660
R13	R: METAL FILM 432 1%	0721-4320
R14	R: METAL FILM 2k 2% 1/4W	0751-2022
R15	R: METAL FILM 330 2% 1/4W	0751-3312
R16	R: METAL FILM 866 1%	0721-8660
R17	R: METAL FILM 432 1%	0721-4320
R18	R: METAL FILM 2k 2% 1/4W	0751-2022
R19	R: METAL FILM 330 2% 1/4W	0751-3312
R20	R: METAL FILM 1.24k 1%	0721-1241
R21	R: METAL FILM 432 1%	0721-4320
R22	R: METAL FILM 2k 2% 1/4W	0751-2022
R23	R: METAL FILM 330 2% 1/4W	0751-3312
R24	R: METAL FILM 1.24k 1%	0721-1241
R25	R: METAL FILM 432 1%	0721-4320
R26	R: METAL FILM 2k 2% 1/4W	0751-2022
R27	R: METAL FILM 330 2% 1/4W	0751-3312
R28	R: METAL FILM 2.49k 1%	0721-2491
R29	R: METAL FILM 432 1%	0721-4320
R30	R: METAL FILM 3k 2% 1/4W	0751-3022
R31	R: METAL FILM 330 2% 1/4W	0751-3312
R32	R: METAL FILM 2.49k 1%	0721-2491
R33	R: METAL FILM 1.00k 1%	0721-1001
R34	R: METAL FILM 3k 2% 1/4W	0751-3022
R35	R: METAL FILM 330 2% 1/4W	0751-3312
R36	R: METAL FILM 510 2% 1/4W	0751-5112
R37	R: METAL FILM 1k 2% 1/4W	0751-1022
R38	R: METAL FILM 300 2% 1/4W	0751-3012
R39	R: METAL FILM 33k 2% 1/4W	0751-3332
R40	R: METAL FILM 39k 2% 1/4W	0751-3932
R41	R: VAR COMP 10k, 10 TURN	2100-0024
R42	R: METAL FILM 8.2k 2% 1/4W	0751-8222

A4 BOARD RFA-4 CONT.

Reference Designation	Description	Part Number
R43	R: METAL FILM 10k 2% 1/4W	0751-1032
R44	R: METAL FILM 51 2% 1/4W	0751-5102
R45	R: METAL FILM 39k 2% 1/4W	0751-3932
R46	R: METAL FILM 15k 2% 1/4W	0751-1532
R47	R: METAL FILM 47k 2% 1/4W	0751-4732
R48	R: METAL FILM 18k 2% 1/4W	0751-1832
R49	R: METAL FILM 100k 2% 1/4W	0751-1042
R50	R: METAL FILM 12k 2% 1/4W	0751-1232
R51	R: METAL FILM 3k 2% 1/4W	0751-3022
R52	R: METAL FILM 1k 2% 1/4W	0751-1022
R53	R: METAL FILM 510 2% 1/4W	0751-5112
R54	R: METAL FILM 220 2% 1/4W	0751-2212
R55	R: METAL FILM 680 2% 1/4W	0751-6812
R56	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R57	R: METAL FILM 43.2 1%	0721-43R2
R58	R: METAL FILM 1k 2% 1/4W	0751-1022
R59	R: METAL FILM 49.9 1%	0721-49R9
R60	R: METAL FILM 62 2% 1/4W	0751-6202
R61	R: METAL FILM 220 2% 1/4W	0751-2212
R62	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R63	R: METAL FILM 2.4k 2% 1/4W	0751-2422
R64	R: METAL FILM 1.3k 2% 1/4W	0751-1322
	(R64 selected for value, nominal value shown)	
R65	R: METAL FILM 510 2% 1/4W	0751-5112
R66, R67	R: METAL FILM 69.8 1%	0721-69R8
R68	R: METAL FILM 100 1%	0721-1000
R69	R: METAL FILM 1k 2% 1/4W	0751-1022
R70	R: METAL FILM 100 2% 1/4W	0751-1012
R71	R: METAL FILM 1.8k 2% 1/4W	0751-1822
R72	R: METAL FILM 330k 2% 1/4W	0751-3342
R73	R: METAL FILM 180k 2% 1/4W	0751-1842
U1	TUNER ASSEMBLY	0412-0001
U2	IC: 78L12CP	1826-0015
U3	IC: MAR-7	1845-0027
U4	IC: CA3089	1826-0046
U5	IC: 78L12CP	1826-0015
U6	IC: TUF-1	1845-0011
U7	IC: TLO71	1826-0004
Y1	XTAL: 11.35MHz	0413-1135



RFA-4 A5
INTERFACE BOARD
(OPTION 01)
BELAR ELECTRONICS
5-13-92



RFA-4 A5 BOARD
(OPTION 01)
COMPONENT LAYOUT
BELAR ELECTRONICS

A5 BOARD RFA-4 (OPTION 01)

Reference Designation	Description	Part Number
C1 thru C3	C: FIXED CERAMIC 0.01uF 100V	0151-0003
HDR4	HEADER: 10 PIN	0361-0010
J5	CONNECTOR: "D" DUAL 15 PIN	0360-0033
RN1	R: RES NETWORK 6 PIN 10k	0906-1032
RN2	R: RES NETWORK 8 PIN 10k	0908-1032
U1	IC: 74HC573	1822-0052
U2	IC: 74HC125	1822-0045
U3	IC: 74HC126A	1822-0046

