

FMSA-1 Precision Digital FM Stereo Modulation Monitor/Analyzer

Guide to Operations

2/99

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BELAR ELECTRONICS LABORATORY, INC.

119 LANCASTER AVENUE • P.O. BOX 76 • DEVON, PA 19333-0076 USA

VOICE (610) 687-5550 • FAX (610) 687-2686

WEB: <http://www.belar.com/> • E-mail: sales@belar.com • service@belar.com • parts@belar.com

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FMSA-1 Digital FM Stereo Monitor/Analyzer

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FMSA-1 Digital FM Stereo Monitor/Analyzer

1 General Information

1-1 General Description

The Belar FMSA-1 Stereo Modulation Monitor and Analyzer is a DSP based precision stereo monitor designed to operate in conjunction with the Belar FMMA-1 "The Wizard" baseband modulation monitor/analyzer.

The FMSA-1 digitizes the composite and decodes the stereo multiplex signal using digital signal processing techniques. Unlike an analog design, a DSP based design is not subject to variations due to temperature, component aging, or component tolerances. The resulting circuit requires virtually no adjustments, but can achieve extremely tight tolerances. In addition, the DSP design allows the use of FIR linear phase filters which eliminate phase distortion. The elimination of phase distortion allows the FMSA-1 to measure modulation peaks on the left, Right, L+R and L-R more accurately than with traditional techniques. All of these advances are possible because a design implemented using DSP is strictly a matter of software.

The FMSA-1 also digitizes all measurements. By digitizing the measurements the user can display modulation peaks, injections, and dB readings directly. As an added benefit, all readings can be viewed remotely using the FMMA-1 or the RS-232 port and a personal computer. The ability to display measurements remotely will make a remote proof possible when the FMSA-1 is combined with a distortion analyzer such as the Audio Precision.

1-2 Specifications

Metering Total, Left, Right, L + R, L - R, Pilot, Pilot Modulation, 38 kHz Suppression

Modulation Display Range 0-127% in 1% increments, accuracy $\pm 0.5\%$

Pilot Injection Range 0-12.7% in 0.1% increments

Input Composite, 100 k Ω , unbalanced, BNC Connector, 1.0 - 2.0 Vrms (2.8 V - 5.7 V P-P).

Outputs:

Left and Right Audio (Program) +10 dBm, 600 Ω balanced

Left and Right Test 2.5 Vrms, 75 Ω unbalanced

Left and Right Scope 1.3 Vrms, 75 Ω unbalanced

Pilot 2 VP-P, 499 Ω unbalanced

Left and Right Digital AES/EBU, 48 kHz

Separation:

Left to Right 80 dB, 10 Hz to 15 kHz

Right to Left 80 dB, 10 Hz to 15 kHz

Crosstalk:

L + R to L - R, L - R to L + R (matrix) 80 dB min

L + R to L - R, L - R to L + R (direct) 90 dB min

SCA to L + R 90 dB min

SCA to L - R 90 dB min

SCA Interference 90 dB min

The Wizard System

Audio Output Specifications:

Frequency Response, Left and Right	± 0.05 dB flat, 50 to 15 kHz, ± 0.25 dB de-emphasized
SNR, with de-emphasis, Left and Right	90 dB
Harmonic Distortion	0.01% max, 50 to 15 kHz
Intermodulation Distortion	0.01% max (SMPTE)

Serial Interface RS-232

Unit Interface Wizard Standard Interface

Remote Meter Outputs:

Left Channel Analog Meter, Right Channel Analog Meter, Pilot LED, Pilot Relay (for interface to Model MP-15 Analog Meter Panel - optional)

Dimensions 1 EIA Rack Unit, 1.75"H x 14"D x 19"W

Power Requirements 25 watts, 100-240 VAC, 50-60 Hz

Shipping Weight 12 lbs

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 and 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 claim or for possible future use.

The FMSA-1 is shipped with a Guide to Operations, 4 black rack-mount screws with cup washers, a BNC jumper, a Wizard ribbon interface cable, and a three-wire line cord.

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

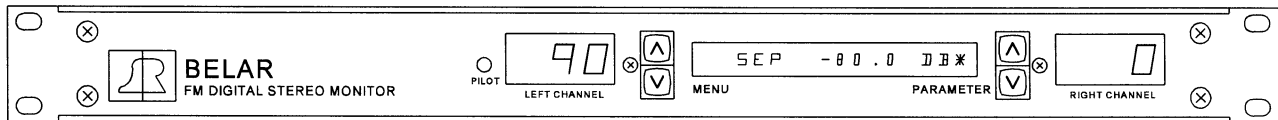
If the unit is to be returned to Belar, attach a tag to it showing owner and owner's address. A description of the service required should be included on the tag. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reusable, Belar can provide a replacement box and packaging at a nominal cost. Alternatively, 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.

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- 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 Front Panel Operation



The green **PILOT** LED is illuminated when the unit detects the 19 kHz pilot. At least 6% injection is required to illuminate this light.

The **LEFT CHANNEL** display usually displays the left channel modulation, expressed in percent modulation. When the unit is measuring crosstalk (XTALK displayed in the menu/parameter window), this display shows L+R.

The **RIGHT CHANNEL** display usually displays the right channel modulation, expressed in percent modulation. When the unit is measuring crosstalk (XTALK displayed in the menu/parameter window), this display shows L-R.

The **MENU/PARAMETER WINDOW** is a 16 character alphanumeric display that displays menu selections and associated parameters or measurements.

To the left of the Menu/Parameter Window, the **UP** and **DOWN MENU** buttons are used to scroll through the various menu selections of the FMSA-1. The menu selections are arranged in two loops, one for measurements and one for settings. Either the UP or DOWN button will get you to your menu choice -- but usually one direction will get you there quicker than the other.

To the right of the Menu/Parameter Window, the **UP** and **DOWN PARAMETER** buttons are used to scroll through the available settings for a given menu selection, where applicable. One loop, which includes the display shown in the figure above (your measured separation may be different, of course), consists of all of the measurements the FMSA-1 can make, as well as the display MODIFY SETTINGS. The other loop (accessed by pressing the UP PARAMETER button at the MODIFY SETTINGS window) consists of all the setable parameters in the unit, such as hold time, time mode, etc. These parameters are all explained in *Section 3-1 & 3-2 Menu Selections*, following.

The Wizard System

3-1 Menu Selections: Measurements

Below is a summary of all the menu selections available on the FMSA-1.

TOTAL XXX %	Displays total peak modulation expressed in percent. The range is 0-127%.
L + R XXX %	Displays L + R peak modulation in percent. The range is 0-127%.
L - R XXX %	Displays L - R peak modulation in percent. The range is 0-127%.
PILOT INJ XX.X %	Displays the Pilot Injection in percent. The range is from 0% to 12.7% in 0.1% increments.
PILOT MOD XXX %	Displays the Pilot Modulation (AM Modulation of the pilot) in percent. The range is 0-127%. This measurement is a good indication of multipath when the unit is used for off-air monitoring. This measurement will also increase when composite clipping is used.

IMPORTANT NOTE: The following dB measurements are referenced to 0 dB = 100% modulation, and are true rms readings. DB measurements can be measured with or without de-emphasis. When the measurement is *with* de-emphasis, an asterisk (*) will appear after the DB in the menu/parameter window. Pressing the UP PARAMETER button lights the * to the right of the DB and shows the de-emphasized measurement. Pressing the down arrow turns off the * and the de-emphasis.

LEFT -XX.X DB*	Displays left channel modulation in dB.
RIGHT -XX.X DB*	Displays right channel modulation in dB.
SEP -XX.X DB*	Displays separation in dB. Note that this measurement is designed for use with test tones during a proof. It is not possible to determine separation while the unit is measuring program material.
L + R -XX.X DB*	Displays the L+R (mono) component of the stereo signal in dB.
L - R -XX.X DB*	Displays the L-R (stereo) component of the stereo signal in dB.
XTALK -XX.X DB*	Displays crosstalk in dB. Note that this measurement is designed for use with test tones during a proof. It is not possible to determine crosstalk while the unit is measuring program material. When this menu is displayed, the LEFT CHANNEL window is showing L + R, and the RIGHT CHANNEL menu is showing L - R.
TOTAL -XX.X DB*	Measures total modulation in dB (0 dB = 100%).
PILOT -XX.X DB*	Measures pilot injection in dB.
38 KHZ -XX.X DB*	Measures the 38 kHz subcarrier suppression in dB.

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MODIFY SETTINGS

Press the UP PARAMETER arrow to exit the measurement section of the FMSA-1 and enter the parameter settings section of the unit. The parameter section is where you configure the unit to your preferences. The parameter settings are described below.

3-2 Menu Selections: Parameters

HOLD XX.X SEC HOLD - EXT

Determines the interval that readings are updated on the display when in past time. Also selects the length of time that the display is held when in real time. This is user selectable in 0.5 second increments from 0.5 to 10.0 seconds, plus EXT. HOLD - EXT is an external sync and should be used when the unit is interfaced with the FMMA-1. In this case the hold time is set to that of the FMMA-1.

TIME MODE - REAL/PAST

Determines the mode in which peaks are displayed. In REAL time mode the display is updated immediately as soon as a new peak is detected. In PAST time mode the unit waits the HOLD time and displays the highest peak which occurred in that interval.

INFINITE - ON/OFF

Enables or disables infinite hold of display. If infinite hold is enabled, the display acts as a "high water mark" and will "stick" at the highest modulation (until infinite hold is turned off).

REMOTE - ON/OFF

Enables or disables the RS-232 port. This allows users to enable or block remote access to the unit. Remote cannot be turned off while the unit is in remote mode (someone is communicating remotely). Remote also cannot be turned off remotely.

SAVE CONFIG

Allows user to save all parameters to internal EEPROM so that the unit configuration is preserved when power is removed. Press the UP PARAMETER to save the configuration.

XTALK - DIRECT/MATRIX

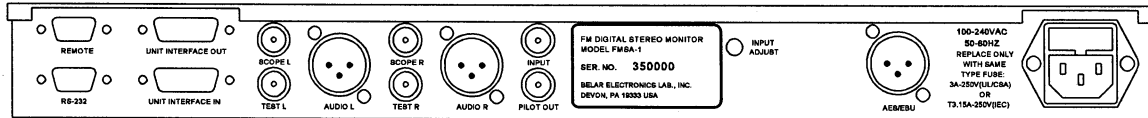
Toggles the way crosstalk measurements are made. In the DIRECT mode, crosstalk measurements are made directly on the L+R and L-R; however, the DIRECT mode will cause the Left Audio Output to switch to L+R and the Right Audio Output to switch to L-R when measuring XTALK, L+R, and L-R. (This can be disconcerting if you are using the audio outputs to drive house monitors.) In the MATRIX mode, the measurements are derived by matrixing the left and right outputs, which does not affect the audio outputs.

EXIT ?

Press the UP PARAMETER arrow to exit the parameter setting section of the FMSA-1 and enter the measurement section of the unit. The measurement section is where the unit displays most of its measurements (pilot injection, etc.).

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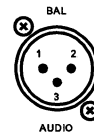
4 Rear Panel



Input Composite, 100 k Ω , unbalanced, BNC Connector, 1.0 - 2.0 Vrms (2.8 V - 5.7 VP-P).

Pilot Out Pilot output, 2 VP-P, 499 Ω source.

Audio L
Audio R Audio outputs (left and right), 600 Ω , balanced, +10 dBm, XLR-type connector. Pin 1 is ground, pin 2 is +, pin 3 is -. These outputs have internally selectable de-emphasis, and have been set for 75 μ sec de-emphasis unless 50 μ sec was specified when ordered. The de-emphasis can be changed by moving jumpers P1 (Audio L) and P3 (Audio R) on the A1 board (the large board). For the locations of these jumpers see the *FMSA-1 A1 Board De-emphasis Settings* drawing in Section 9.



Test L
Test R Test outputs (left and right), 2.5 Vrms, 75 Ω , unbalanced, BNC connector. These outputs are flat (no de-emphasis) as shipped from the factory but can be configured to have the same de-emphasis as the Audio outputs described above. The de-emphasis can be changed by moving jumpers P2 (Test L) and P4 (Test R) on the A1 board (the large board). For adding de-emphasis, see the *FMSA-1 A1 Board De-emphasis Settings* drawing in Section 9.

Scope L
Scope R Scope outputs, 1.3 Vrms, 75 Ω , unbalanced, BNC connector. When the respective dB measurement is below -50 dB, 30 dB of gain is automatically inserted for better resolution. The de-emphasis of these outputs follows the de-emphasis of the measurement. If the DB measurement is flat (no * to the right of the DB display on the front panel), the scope outputs are flat. If the DB measurement is de-emphasized (a * to the right of the DB on the display), the outputs are de-emphasized. The de-emphasis is set for 75 μ sec de-emphasis unless 50 μ sec was specified when ordered. The de-emphasis can be changed by moving jumpers P5 (Scope L) and P6 (Scope R) on the A1 board. For the location of these jumpers, see the *FMSA-1 A1 Board De-emphasis Settings* drawing in Section 9.

These outputs depend on which measurement the FMSA-1 is displaying. A table of the dB measurements (as shown in the front panel MENU/PARAMETER window) and the respective scope outputs is shown on the next page.

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Scope L	<u>MENU</u>	<u>SCOPE L</u>	<u>SCOPE R</u>
Scope R	LEFT -XX.X DB	Left	Right
(continued)	RIGHT -XX.X DB	Left	Right
	SEP -XX.X DB	Left	Right
	L+R -XX.X DB	L + R	L - R
	L-R -XX.X DB	L + R	L - R
	XTALK -XX.X DB	L + R	L - R
	TOTAL -XX.X DB	Total	(grounded)
	PILOT -XX.X DB	Pilot	38 kHz
	38 KHZ -XX.X DB	Pilot	38 kHz

Unit Interface In This interface is used to connect to The Wizard (FMMA-1) for unified remote operation. It can also connect to a jack labeled Unit Interface Out on other interface-equipped Belar equipment, such as the Belar RFA-4 Frequency Agile FM RF Amplifier.

Note that when the FMSA-1 is connected to the FMMA-1, the HOLD TIME on the FMSA-1 should be set to EXT, to synchronize the FMSA-1 to the FMMA-1.

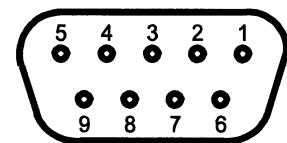
Unit Interface Out This interface is used to connect other Wizard-interface-equipped equipment, such as the Belar RFA-4 Frequency Agile FM RF Amplifier, to The Wizard (FMMA-1) for combined remote operation. The interface works in a daisy-chain configuration, with the FMMA-1 at the start of the chain, connected to the Unit Interface In on the FMSA-1. The Unit Interface Out of the FMSA-1 is then connected to the Unit Interface In jack of the next unit (the RFA-4, for example), and so forth.

Remote Meters This connector is used to connect the optional MP-15 Analog Meter panel to the FMSA-1. The meter panel displays Left Channel, Right Channel, and Pilot (LED). Note that the Left and Right Analog displays follow the audio output, so if the FMSA-1 is in DIRECT mode and XTALK is selected, for example, the Left meter shows L + R and the right meter shows L - R. Pins 1 and 2 are for the left meter; pins 3 and 4 are for the right meter; 5 and 6 are for the Pilot LED; and 7 and 8 are a relay closure for the pilot. Refer to the MP-15 installation instructions in *Section 5-1*. For use other than with the MP-15, contact Belar for more information.

The pinout of this connector is as follows:

Pin 1	Left Remote Meter Out
Pin 2	Left Remote Meter Gnd
Pin 3	Right Remote Meter Out
Pin 4	Right Remote Meter Gnd
Pin 5	+5 V for Pilot LED
Pin 6	Pilot LED (open collector)
Pin 7	Pilot Relay
Pin 8	Pilot Relay (when the LED is lit, Pin 7 and 8 are closed)

(Note: relay is rated at 10 W max, 0.5 A max, 200 VDC max)



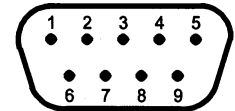
Remote
Connector

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RS-232

The RS-232 connector is provided for direct computer communications with the FMSA-1 for use with The Wizard Software. If you intend to write software to directly communicate with the FMSA-1 using this port, refer to the *FMSA-1 ASCII RS-232 Interface Commands* in *Section 8*.

<u>Pin</u>	<u>Type</u>	<u>Description</u>
1	input CD	Carrier detect from Modem
2	input Rx	Receive data
3	output Tx	Transmit data
4	output DTR	Data terminal ready
5	ground GND	signal ground
6-9		not used



RS-232 Connector

5 Installation and Setup

The FMSA-1 is designed to be mounted in a standard 19-inch rack. The unit can be operated from an 100 to 240 VAC single phase, 50-60 Hz power source, with no user adjustments. The fuse should be a 3A-250V (UL/CSA) or T3.15A-250V (IEC) fuse only. A spare fuse is stored in the removable fuse compartment.

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

Make the rear panel connections and adjustments as follows:

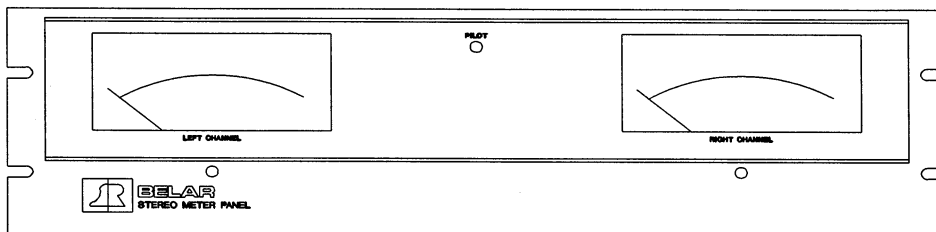
COMPOSITE INPUT

While applying the appropriate calibration signal to the composite input (for example, a Belar FMM-2 or FMMA-1 with the calibrator turned on), adjust the potentiometer labeled "INPUT ADJUST" located on the back panel until the **TOTAL** display on the front panel (in the MENU/PARAMETER window) reads 100%.

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5-1 Accessories

The optional MP-15 Analog Meter Panel, which consists of two large back-lit analog meters, provides continuous analog metering of Left and Right Modulation (or L+R and L-R modulation) as explained in *Section 4* under Remote Meters.



Before connecting the MP-15 to the FMSA-1, ensure that the meters are at mechanical zero.

Using the interconnect cable (provided), connect the D-connector end of the plug to the remote meter connector (J1) on the FMSA-1. The other end of the cable should be connected to the terminal strip (TB1) on the back of the MP-15 as follows:

<i>Terminal Number</i>	<i>Wire Color</i>
1	Brown
2	Red
3	Orange
4	White
5	Green
6	Blue

MP-15 Line Voltage Selection Procedure:

1. Unplug line cord.
2. Open fuse compartment door.
3. Move fuse pull lever to left to remove fuse. Leave fuse pull lever in the leftmost position.
4. Using needle nose pliers, pull the voltage select board straight out of the power entry module.
5. While facing the rear of the unit, orient the voltage select board so the desired line voltage is up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation).

Note: The "100" and "220" positions on the opposite side of the board are not used.

6. Plug the voltage select board into the power entry module.
7. Install the fuse (F1).
8. Close fuse compartment door.
9. Plug line cord in.

Note: The MP-15 uses line power only to illuminate the meters. It is not required for proper operation of the meters.

MP-15 Calibration:

1. Go to "TOTAL" on the FMSA-1 main menu.
2. Feed a 1 kHz audio signal into the FMSA-1 Composite Input.
3. Adjust the level of the audio so that the Left and Right Channel displays on the FMSA-1 read 100%.
4. Adjust potentiometers R3 and R4 on the rear of the MP-15 so the remote meters also read 100%.

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6 Running the Setup Program

To run the setup program, plug in the FMSA-1 and press any of the keys located on the front panel while the INITIALIZATION message is being displayed. After a few seconds the FMSA-1 will display a flashing RUNNING SETUP message as it enters the program.

6-1 Main Setup Menu Selections

RESET DEFAULTS ? Resets the FMSA-1 to default factory settings including the passwords. Pressing the UP PARAMETER button will reset the unit to default settings. The default settings are as follows:

HOLD 1.0 SEC
TIME MODE - PAST
INFINITE - OFF
REMOTE - OFF
XTALK - MATRIX

PASSWORDS

OBSERVER: BELAR1
OPERATOR: BELAR2
SUPERVISOR: BELAR3

MODIFY OPTIONS? Press the UP PARAMETER button to enter the MODIFY OPTIONS submenu section. This submenu contains the settings related to the RS-232.

MODIFY ID ? Press the UP PARAMETER button to enter the MODIFY ID submenu section. This submenu allows the user to edit the units identification string.

UNIT INFO ? Press the UP PARAMETER button to enter the UNIT INFO submenu. This submenu displays the units serial number and EPROM version.

TEST RELAY /LED ? This submenu allows the relay to be tested. Press the UP PARAMETER button to enter the TEST RELAY/LED submenu

TEST RS-232 ? This submenu allows the RS-232 port to be tested. Press the UP PARAMETER button to enter the TEST RS-232 submenu.

EXIT SETUP ? Exits the SETUP MENU and returns the unit to normal operation. Press the UP PARAMETER button to exit the setup program.

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6-2 MODIFY OPTIONS SubMenu Selections

BAUD RATE - 1200/2400/4800/9600	Selects the baud rate for the RS-232 Port. This baud rate should be set to the same baud rate as the device the FMSA-1 is being interfaced with.
PASSWORDS - ON/OFF	Enables/Disables password protection of the unit when it is accessed with The Wizard Software. If passwords are disabled the user will not be prompted to enter a password when establishing a connection with the unit. If the FMSA-1 is connected to a external MODEM the passwords should be enabled to protect the unit from unauthorized users, if a direct or hard wired connection is used then the password protection may not be needed.
EXT SYNC - ON/OFF	Determines whether or not the unit synchronizes its data collection to the PC's internal time of day clock. When using The Wizard Software the EXT SYNC should be enabled. This guarantees that the PC and remote unit are locked to the same time reference.
CMD TYPE: - BELAR/ASCII	Determines the RS-232 Command type. For normal operation, with the Wizard Software, the command type should be set to "BELAR". For use with the <i>FMSA-1 ASCII RS-232 Interface Commands</i> in Section 8, set the command type to "ASCII".
EXIT ?	Pressing the UP PARAMETER button exits the MODIFY OPTIONS submenu and returns the Main Setup Menu.

6-3 MODIFY ID SubMenu Selections

ID(X):XXXXXXXXXX	The unit ID is a 10 character string used to uniquely identify a unit when it is accessed remotely. The string is set by default to "..FMSA-1.." when the unit is shipped. This string may be altered by using the UP PARAMETER button to scroll through the available ASCII characters at the current cursor position. The current cursor position is indicated in parentheses. The cursor position is changed by using the DOWN PARAMETER button.
EXIT ?	Pressing the UP PARAMETER button exits the MODIFY ID submenu and returns to the Main Setup Menu.

6-4 UNIT INFO SubMenu Selections

VERSION X.XX	Indicates the EPROM version installed in the unit.
SERIAL# 35XXXX	Indicates the units factory serial number.
EXIT ?	Pressing the UP PARAMETER button exits the UNIT INFO submenu and returns to the Main Setup Menu.

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6-5 TEST RELAY/LED SubMenu Selections

- RELAY#0 -
OPEN/CLOSE** Allows the relay to be tested. The unit is configured so that when the Pilot LED is illuminated the relay is closed. The test program will continually cycle the chosen relay open and closed while it turns on and off the Pilot LED.
- EXIT ?** Pressing the UP PARAMETER button exits the RELAY/LED TEST submenu and returns to the Main Setup Menu.

6-6 TEST RS-232 SubMenu Selections

- TRANSMIT \$XX X** The RS-232 test alternately transmits a \$55 and \$AA over the interface. The display shows the byte being transmitted followed by the byte received. If no byte is received a "RECEIVE FAILED" message is displayed. In addition to testing the Rx and Tx lines the test also toggles the DTR on the Tx and reads the CD line on the Rx. The "0" or "1" displayed after the data byte is the current logic state of the DTR or CD line.
- RECEIVE \$XX X**
- RECEIVE FAILEDX**
- EXIT ?** Pressing the UP PARAMETER button exits the RS-232 TEST submenu and returns to the Main Setup Menu.

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7 Checkout and Verification of Operation

1. Apply the output of an ideal stereo generator to the input of the FMSA-1 and adjust the output to read 9% PILOT on the FMSA-1.
2. Apply a 400 Hertz single tone (no sweep) to the left channel of the stereo generator and adjust the level of the tone to read 90% on the LEFT CHANNEL display on the FMSA-1.
 - The LEFT CHANNEL should read 90%. The RIGHT CHANNEL should read 0%.
 - The rear LEFT test BNC jack should read 2.5 Vrms.
 - The rear RIGHT test BNC jack should read less than 1 mVrms.
3. Scrolling up through the MENU:
 - TOTAL = 96-97%
 - L+R = 45%
 - L-R = 45%
 - PILOT INJ = 9%
 - PILOT MOD = 0%
 - LEFT = -1dB
 - RIGHT = -80dB
 - SEP = -79dB
 - L+R = -7dB
 - L-R = -7dB
 - XTALK = 0dB
 - TOTAL = -5dB
 - PILOT = -21dB
 - 38 kHz = -23dB
4. The above may be repeated for the single tone applied to right channel of the stereo generator and the LEFT and RIGHT readings will be interchanged.
5. Note that the outputs of the rear XLR connectors in this mode are the left and right outputs.
6. To change the XLR connectors and the L and R test jacks from left out and right out to L+R out and L-R out, do the following:
 - Scroll down through the MENU to MODIFY SETTINGS.
 - Depress the upper PARAMETER button.
 - Scroll down the MENU to XTALK - MATRIX.
 - Depress the upper PARAMETER button once to read XTALK - DIRECT.
 - Scroll up the MENU to EXIT ?.
 - Depress the upper PARAMETER button and the MENU displays TOTAL.
7. Scroll down through the MENU to XTALK. It will read 0 dB since the input is a left only or right only signal.
8. Apply an L+R signal to the FMSA-1 so that both the LEFT CHANNEL and RIGHT CHANNEL displays read 90%.
 - The L TEST jack should read 2.5 Vrms.
 - The R TEST jack should read less than 1 mVrms, indicating very little crosstalk from L+R into L-R.

The Wizard System

9. Scroll down one position in the MENU.
The L-R should read -80 dB or better.
10. Scroll down one more in the MENU.
The L+R should read -1 dB. Thus steps 9 and 10 indicate very little crosstalk from L+R into L-R.
11. Scroll down one more position in the MENU to SEP, -0.0 dB indicating equal L and R and no separation. The L CHANNEL and R CHANNEL indicators both read 90%. Note that the outputs of the L and R TEST jacks will be equal and 2.5 Vrms.
12. Apply an L-R signal to the FMSA-1 so that both the L and R CHANNEL displays indicate 90%.
The SEP still reads -0.0 dB and both the L and R CHANNELS still read 90%.
The outputs of the L and R TEST jacks will be equal to 2.5 Vrms.
13. Scroll up one position in the MENU to L+R. It should read -80 dB or more.
The output of the L TEST jack should be less than 1 mVrms.
The output of the R TEST jack should be 2.5 Vrms.
14. Scroll up one more position in the MENU to L-R. It should read -1.0 dB.
15. Scroll up one more in the MENU to XTALK. It should read -80 dB or better.
Note that when the MENU is set to SEP, the outputs of the L and R TEST jacks and XLR connectors will be set to left and right outputs, but when the MENU is scrolled to L+R, L-R or XTALK, the L Test jack and L XLR will be the L+R output and the R TEST jack and R XLR will be the L-R output. This occurs only when the XTALK in the submenu MODIFY SETTINGS is set to XTALK - DIRECT. To return to the original setting where the L and R TEST jacks and XLR connector outputs are always on left and right, go to step number 6 above - and change the XTALK - DIRECT back to XTALK - MATRIX.

Note that the above outputs are normally de-emphasized. To change them, the top cover must be removed and the pin plugs on the A1 board must be changed - see the *FMSA-1 A1 Board De-emphasis Settings* drawing in *Section 9* of this manual. P2 and P4 will bypass the de-emphasis on only the test jacks. Turning the plugs sideways on P1 and P3 will remove the de-emphasis on both the test jacks and XLR connectors.

Note that if a less than ideal stereo generator is used, the readings of separation and crosstalk will be somewhat poorer than the readings given above. Input levels exceeding 127% can cause overloads in the FMSA-1 and can cause faulty results.

FMSA-1 Digital FM Stereo Monitor/Analyzer

8 FMSA-1 ASCII RS-232 Interface Commands

In order for the ASCII command set to be active, the CMD TYPE - ASCII option must be selected. This option is found in the MODIFY OPTIONS section of the SETUP PROGRAM.

'D' - Send Unit Data: Instructs FMSA-1 to send back the current value of the specified data. Use the tables below to determine the second character of the command string.

Data Available

'A' - Total Peak Max
'B' - L+R Peak Max
'C' - L-R Peak Max
'D' - Pilot Injection
'E' - Pilot Modulation
'F' - Left dB
'G' - Right dB
'H' - SEP dB
'I' - L+R dB
'J' - L-R dB
'K' - XTALK dB
'L' - Total dB
'M' - Pilot dB
'N' - SUB dB
'O' - Left Peak Max
'P' - Right Peak Max
'Q' - Pilot LED

The command syntax is:

'D' + X: (ASCII character data specifier) + CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the data, terminated with a carriage return.

Note: If the data requested is a dB reading the first digit returned determines the sign. A leading '1' indicates a positive value, while a leading '0' implies a negative value.

Example: Send Total Peak Modulation

Command Sent: 'D' + 'A' + CR: (carriage return)

ASCII Value: \$44 \$41 \$0D

Data Returned (assume total peak = 100%): '0100' + CR

ASCII Value: \$30 \$31 \$30 \$30 \$0D

The Wizard System

'C' - Send Unit Configuration: Instructs FMSA-1 to send back the current setting of the specified parameter. Use the tables below to determine the second character of the command string.

Parameters Available

'A' - Hold Time
'B' - Time Mode
'C' - Infinite
'D' - XTALK Mode
'E' - De-Emphasis

The command syntax is:

'C' + X: (ASCII character parameter specifier) + CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the parameter, terminated with a carriage return.

Example: Send Time Mode

Command Sent: 'C' + 'B' + CR: (carriage return)

ASCII Value: \$43 \$42 \$0D

Data Returned (assume Time Mode = Past): '0001' + CR

ASCII Value: \$30 \$30 \$30 \$31 \$0D

'A' - Alter Unit Configuration: Instructs FMSA-1 to change the value of the specified parameter. Use the tables below to determine the second character of the command string.

Parameters Available

'A' - Hold Time
'B' - Time Mode
'C' - Infinite
'D' - XTALK Mode
'E' - De-Emphasis

The command syntax is:

'A' + X: (ASCII character parameter specifier)

+ XXXX: (ASCII parameter data 1st digit = thousands

2nd digit = hundreds

3rd digit = tens

4th digit = ones)

+ CR: (carriage return)

The unit will send back four ASCII characters, representing the decimal value of the updated parameter, terminated with a carriage return.

FMSA-1 Digital FM Stereo Monitor/Analyzer

Example: Alter Time Mode

Command Sent: 'A' + 'B' + '0001' + CR: (carriage return)

ASCII Value: \$41 \$42 \$30 \$30 \$30 \$31 \$0D

Data Returned (assume Time Mode = Past): '0001' + CR

ASCII Value: \$30 \$30 \$30 \$31 \$0D

UNIT DATA DEFINITIONS

Data	High	Low	Increments
Total Peak Max	127	0	1%
L+R Peak Max	127	0	1%
L-R Peak Max	127	0	1%
Pilot Injection	12.7	0	0.1%
Pilot Modulation	127	0	1%
Left dB	+3.5	-90.0	0.5 dB
Right dB	+3.5	-90.0	0.5 dB
SEP dB	0.0	-93.5	0.5 dB
L+R dB	+3.5	-90.0	0.5 dB
L-R dB	+3.5	-90.0	0.5 dB
XTALK dB	0.0	-93.5	0.5 dB
Total dB	+3.5	-90.0	0.5 dB
Pilot dB	+3.5	-90.0	0.5 dB
SUB dB	+3.5	-90.0	0.5 dB
Left Peak Max	127	0	1%
Right Peak Max	127	0	1%
Pilot LED	1	0	toggle

The Wizard System

UNIT PARAMETER DEFINITIONS

Parameter	High	Low	Increments
Hold Time	20	0	0-EXT; (1-20: multiples of 0.5 sec)
Time Mode	1	0	toggle (PAST=1, REAL=0)
Infinite	1	0	toggle (ON=1, OFF=0)
XTALK Mode	1	0	toggle (DIRECT=1, MATRIX=0)
De-Emphasis	1	0	toggle (ON=1, OFF=0)

FMSA-1 Digital FM Stereo Monitor/Analyzer

9 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 provide 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

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
DAC	= digital-to-analog convertor	SI	= silicon
DPM	= digital panel meter	TANT	= tantalum
ELEC	= electrolytic	μ F	= microfarads
GE	= germanium	V	= volt
IC	= integrated circuit	VAR	= variable
k	= kilo = 1,000	VDCW	= dc working volts
M	= meg = 1,000,000	W	= watts
MOD	= modulation	WW	= wirewound
MY	= Mylar		
PC	= printed circuit		
pF	= picofarads		

Appendix A: Using The Wizard Software

Getting Started

Using The Wizard Software any Belar Monitor equipped with an RS-232 Port can be operated from any IBM-compatible personal computer, either through a direct connection (on-site) or from any distance via telephone/modem connection. It can also control other Belar units connected to it using The Wizard Interface. With The Wizard Interface multiple units in a series can be accessed remotely using a single RS-232 port.

Direct Connection

Equipment Required:

- The Wizard Software.
- An IBM compatible PC with an RS-232C serial (COM) port.
- An RS-232 cable with a 9 pin female D-connector at one end (for the Belar unit) and the appropriate connector for your computer (generally either a 9 or 25 pin female D-connector). For direct connection to a PC, only a three wire connection is actually needed: Rx, TX and GND. The various cable pinouts are below; your computer manual may also offer helpful information.

Generally, the RS-232 cable for direct connection is referred to as a "null modem" cable. For your convenience, the proper pin-out follows:

Pinout for Direct Connection (if your computer has a 9-pin D connector serial port):

<u>PC</u>	<u><==></u>	<u>Belar Unit</u>
2 - Rx	<u><==</u>	3 - Tx
3 - Tx	<u>==></u>	2 - Rx
5 - GND	<u><==></u>	5 - GND

Pinout for Direct Connection (if your computer has a 25-pin D connector serial port):

<u>PC</u>	<u><====></u>	<u>Belar Unit</u>
3 - Rx	<u><===</u>	3 - Tx
2 - Tx	<u>===></u>	2 - Rx
7 - GND	<u><====></u>	5 - GND

Procedure:

1. Connect one end of your RS-232 cable to the port on the back of the unit labeled "RS232", and connect the other end to the RS-232 (COM) port of your personal computer.
2. For safety's sake, if you plan to run The Wizard Software directly from the floppy disk, make a backup copy first and store the original in a safe place. Alternatively, copy The Wizard software to your hard disk, preferably in its own subdirectory (we suggest C:\WIZ).
3. From the A> or C:\WIZ> prompt, type **WIZ** and press **Enter**. Once the software has been started, pressing **F1** will bring up context-sensitive help.
4. Using the mouse, select the **Communications** menu from the top of the screen. If you do not have a mouse, press Alt-C. A drop-down menu will appear:

Start Communications
Connect VIA MODEM
Setup MODEM/RS232
Send Command String
Change Password
About
Exit

Select **Setup Modem/RS232** (using the arrow keys) and press **Enter**. Using the arrow and tab keys, configure your computer to the proper COM port, IRQ, and speed. Press **F1** in this screen for more information on any of these selections. Once you have made the selections, select Start Communications to establish a connection to the unit. The unit comes configured from the factory with a Supervisor password of **BELAR3**.

Connection via Modem

Equipment Required:

- The Wizard Software.
- An IBM compatible computer with at least a 1200 baud (preferably 2400 baud or greater) Hayes-compatible modem, internal or external.
- An external 1200 or 2400 baud external modem (for connection to the unit), set up as described below.
- An RS-232 cable with a 9 pin female D-connector at one end (for the unit) and the appropriate connector for your external modem (generally either a 9 or 25 pin female D-connector). For reliable external modem operation all five lines from the unit's RS-232C connector should be used. The pinout of this cable follows.
- A telephone line for connecting the two modems.

Pinout for Modem connection (25-pin D connector serial port at modem):

<u>PC</u>	<u><==></u>	<u>Belar Unit</u>
2 - Rx	<u><==</u>	3 - Tx
3 - Tx	<u>==></u>	2 - Rx
7 - GND	<u><==></u>	5 - GND
8 - CD	<u>==></u>	1 - CD
20 - DTR	<u><==</u>	4 - DTR

External Modem Setup:

Most external modems have non-volatile memory for storing configuration information. In order to configure the modem to work with the unit you must have a computer with a RS-232 port and some kind of communications software or other way of communicating with your modem. Connect the external modem to the computer using the appropriate cable and access it using your communications software. Using the appropriate AT commands set up the modem to do the following:

AT command Description

ATS0=n Puts modem in Auto-Answer mode, where "n" is the number of rings desired before the call will be answered. Note: "n" cannot equal 0 (we suggest n=1).

- AT&C1 Carrier Detect (CD) active during connect.
- AT&D3 Data Terminal Ready (DTR) disconnect and reset.
- AT&W0 Writes user configuration to non-volatile memory.

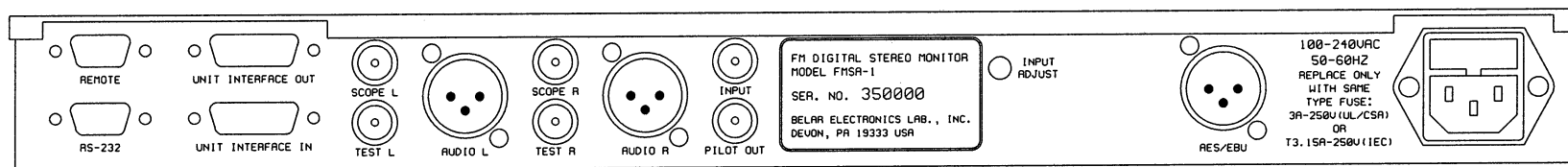
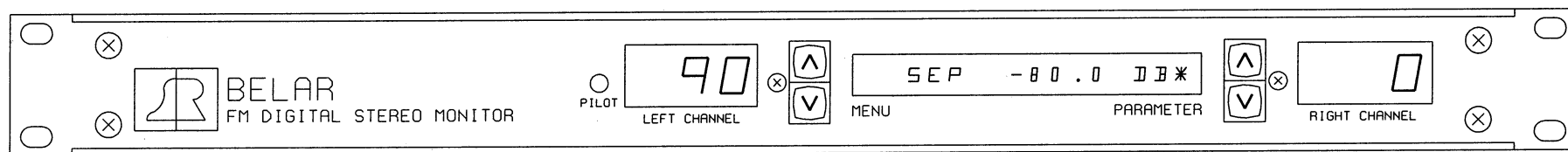
Some modems have various data compression schemes to increase the apparent speed under certain circumstances. Be sure to configure your modem to disable such compression schemes. Refer to your modem and communication software manuals if you encounter problems.

Procedure:

1. For safety's sake, if you plan to run The Wizard software directly from the floppy disk, make a backup copy first and store the original in a safe place. Alternatively, copy The Wizard software to your hard disk, preferably in its own subdirectory (we suggest C:\WIZ).
2. From the A> or C:\WIZ> prompt, type **WIZ** and press **Enter**. The Wizard front panel will appear in the lower half of your screen.
3. Using the mouse, select the **Communications** menu from the top of the screen. If you do not have a mouse, press Alt-C. A drop-down menu will appear:

Start Communications
Connect VIA MODEM
Setup MODEM/RS232
Send Command String
Change Password
About
Exit

Select **Setup Modem/RS232** (using the arrow keys) and press **Enter**. Using the arrow and tab keys, configure your computer to the proper COM port, IRQ, speed, and telephone number(s). Press **F1** in this screen for more information on any of these selections. Once you have made the selections, select **Connect VIA MODEM** to instruct your modem to dial up the modem at the remote unit and established a connection. The unit comes configured from the factory with a Supervisor password of **BELAR3**.

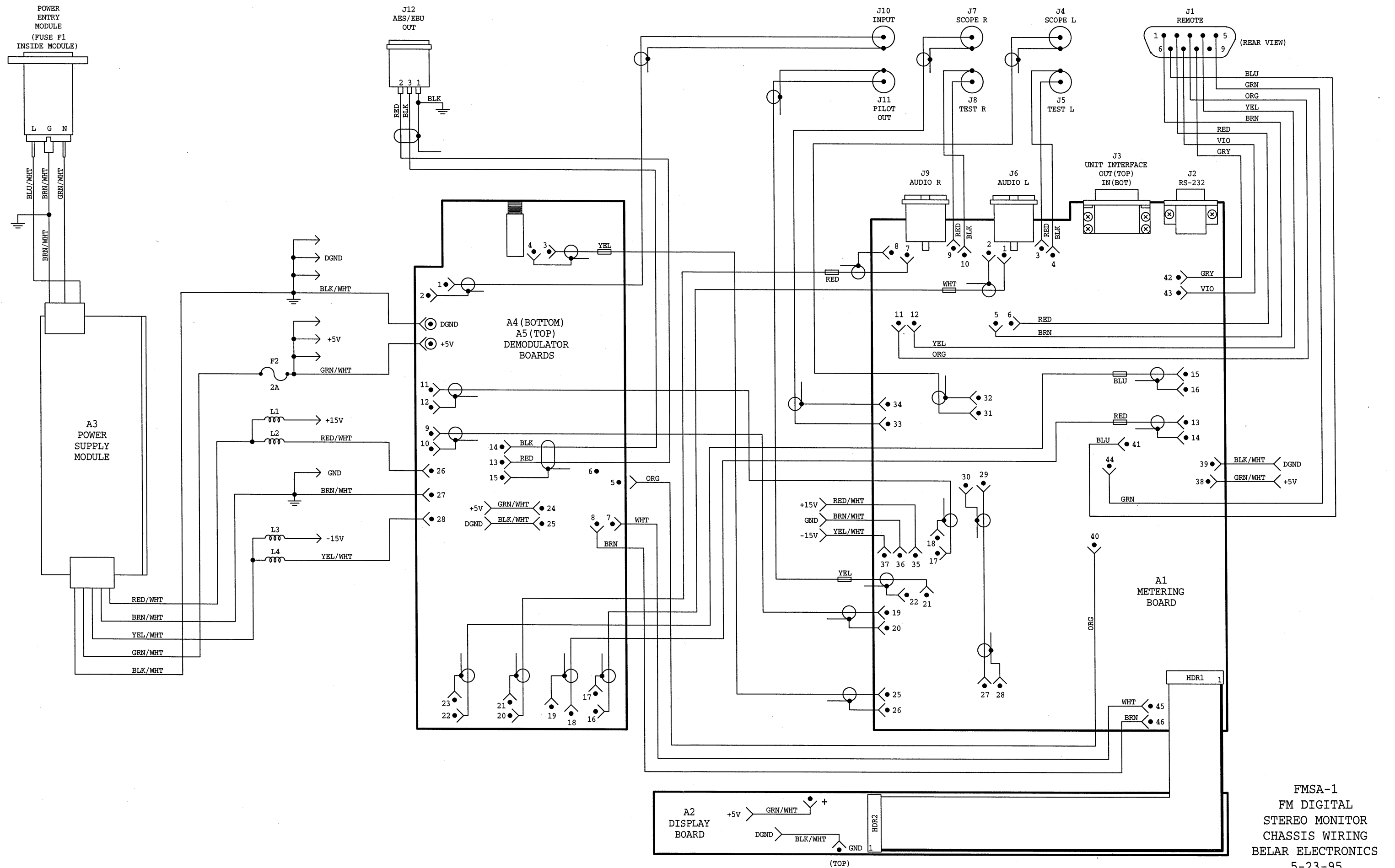


FMSA-1 FRONT & REAR VIEW
BELAR ELECTRONICS

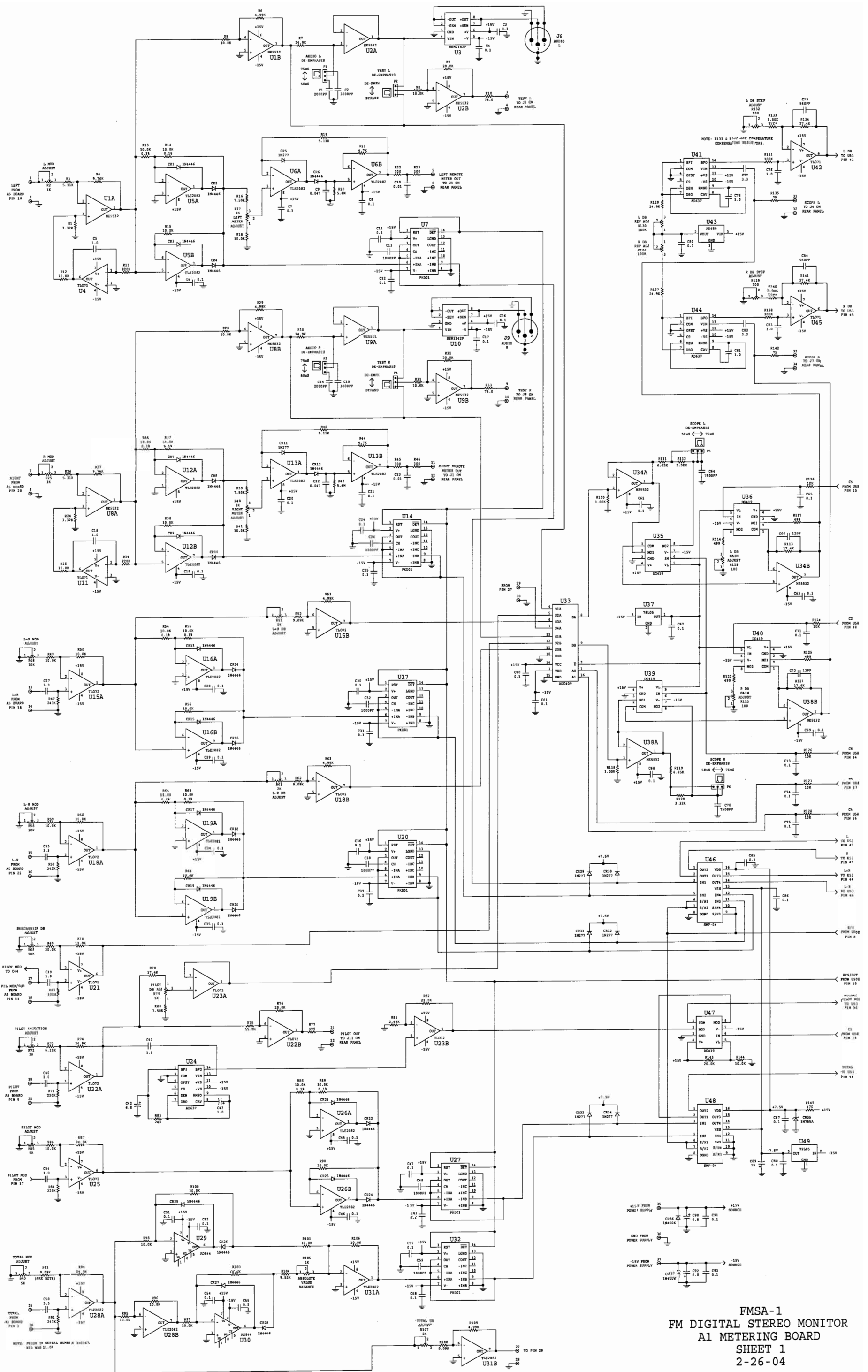
FMSA-1 PARTS LISTS

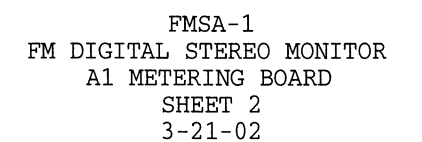
MAIN CHASSIS

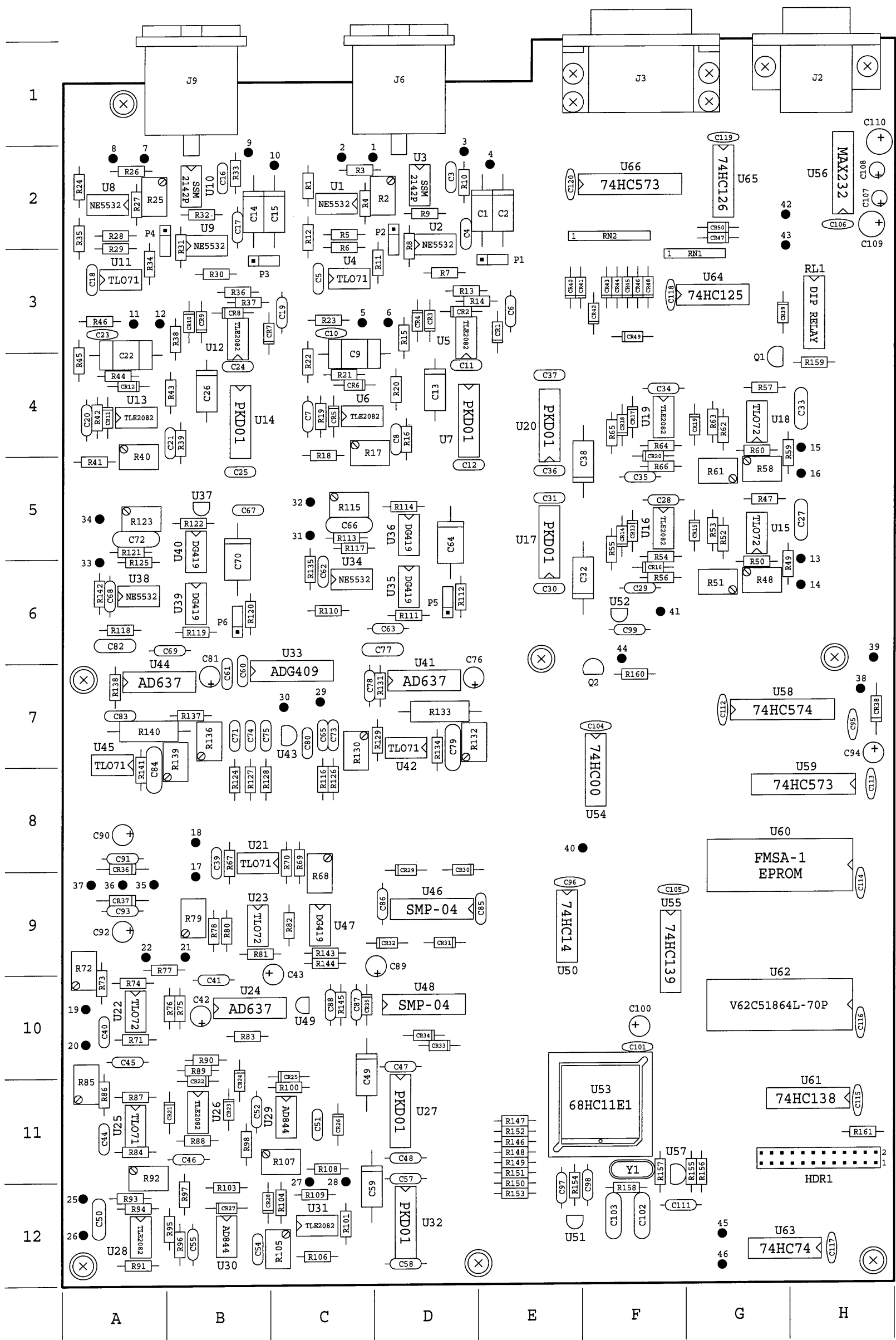
Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE: 30W	4005-0020A
--	POWER ENTRY MODULE: 6EGG1-1	0360-0021
F1	FUSE: GMA-3A 250V(UL/CSA)	2110-0009
	or T3.15A-250V(IEC)	
--	FUSE HOLDER: CHASSIS MOUNT	2110-0010
F2	FUSE: AGC-2A 250V	2110-0006
J1	CONNECTOR: 9 PIN D, FEMALE	0360-0037
J4, J5	JACK: BNC, ISOLATED	0360-0006
J7, J8	JACK: BNC, ISOLATED	0360-0006
J10, J11	JACK: BNC, ISOLATED	0360-0006
J12	JACK: XLR MALE	0360-0047
L1 thru L4	CHOKE: RF	9140-0011
--	FLAT CABLE ASSEMBLY: 24 CONDUCTOR	8900-0017
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004



FMSA-1
FM DIGITAL
STEREO MONITOR
CHASSIS WIRING
BELAR ELECTRONICS
5-23-95







FMSA-1 A1 BOARD
PART LOCATIONS

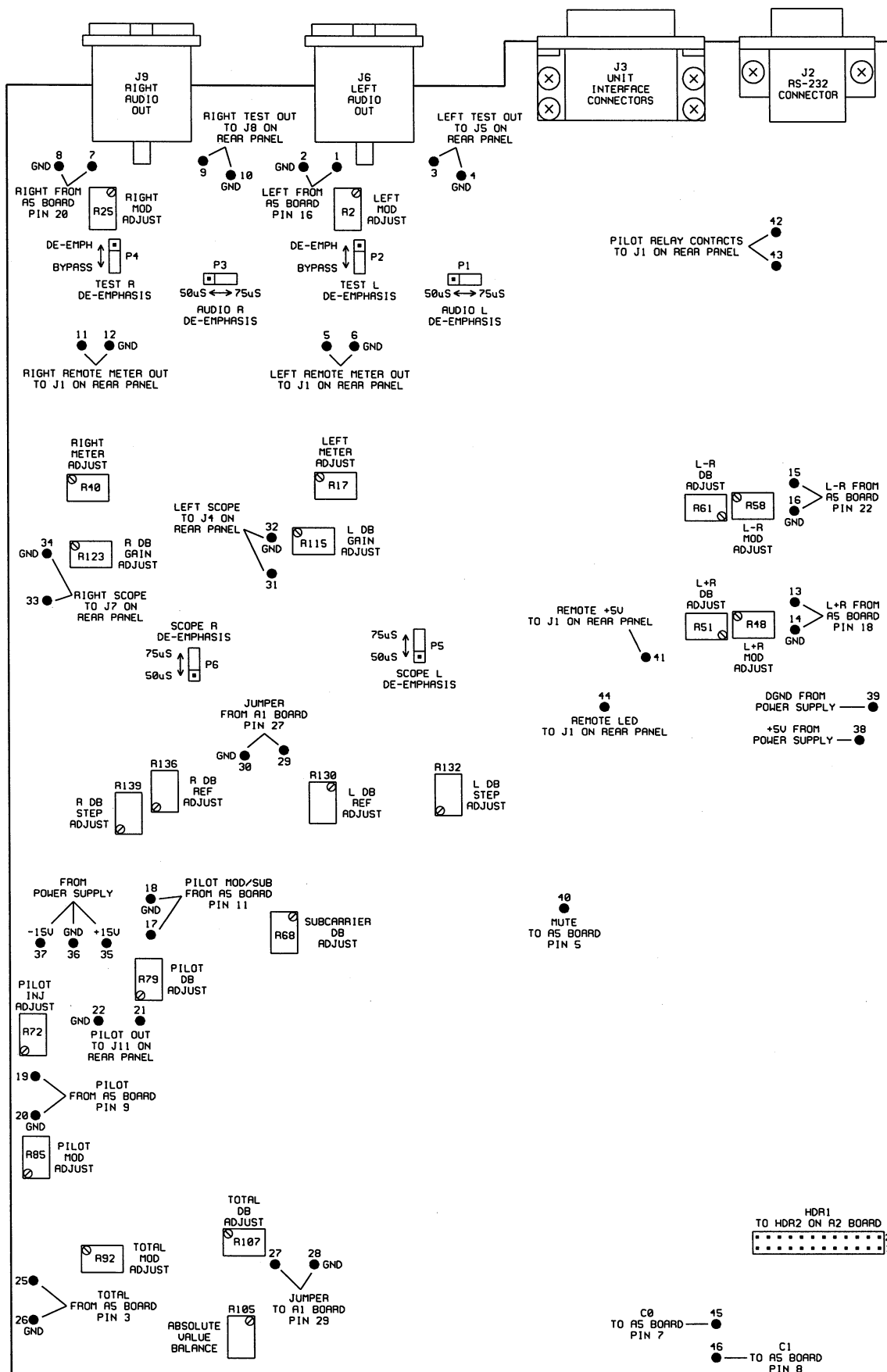
<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1	E2	C50	A12	C99	F6	CR27	B12	R8	D2	R57	G4
C2	E2	C51	C11	C100	F10	CR28	B12	R9	D2	R58	G5
C3	D2	C52	B11	C101	F10	CR29	D9	R10	D2	R59	G5
C4	D2	C53	C11	C102	F12	CR30	D9	R11	D3	R60	G4
C5	C3	C54	B12	C103	F12	CR31	D9	R12	C2	R61	G5
C6	E3	C55	B12	C104	F7	CR32	D9	R13	D3	R62	G4
C7	C4	C56	B12	C105	F9	CR33	D10	R14	D3	R63	G4
C8	D4	C57	D11	C106	H2	CR34	D10	R15	D3	R64	F4
C9	C4	C58	D12	C107	H2	CR35	C10	R16	D4	R65	F4
C10	C3	C59	C12	C108	H2	CR36	A8	R17	C4	R66	F5
C11	D4	C60	B7	C109	H2	CR37	A9	R18	C4	R67	B8
C12	D5	C61	B7	C110	H1	CR38	H7	R19	C4	R68	C9
C13	D4	C62	C6	C111	F12	CR39	G3	R20	D4	R69	C8
C14	B2	C63	D6	C112	G7	CR40	E3	R21	C4	R70	C8
C15	C2	C64	D5	C113	H8	CR41	E3	R22	C4	R71	A10
C16	B2	C65	C7	C114	H9	CR42	F3	R23	C3	R72	A9
C17	B2	C66	C5	C115	H11	CR43	F3	R24	A2	R73	A10
C18	A3	C67	B5	C116	H10	CR44	F3	R25	A2	R74	A10
C19	C3	C68	A6	C117	H12	CR45	F3	R26	A2	R75	B10
C20	A4	C69	B6	C118	F3	CR46	F3	R27	A2	R76	B10
C21	B4	C70	B5	C119	G1	CR47	G2	R28	A2	R77	A9
C22	A4	C71	B7	C120	E2	CR48	F3	R29	A2	R78	B9
C23	A3	C72	A5			CR49	F3	R30	B3	R79	B9
C24	B4	C73	C7	CR1	E3	CR50	G2	R31	B2	R80	B9
C25	B5	C74	B7	CR2	D3			R32	B2	R81	B9
C26	B4	C75	B7	CR3	D3	HDR1	H11	R33	B2	R82	C9
C27	H5	C76	D7	CR4	D3			R34	A3	R83	B10
C28	F5	C77	D6	CR5	C4	J2	H1	R35	A2	R84	A11
C29	F6	C78	C7	CR6	C4	J3	F1	R36	B3	R85	A11
C30	E6	C79	D7	CR7	B3	J6	D1	R37	B3	R86	A11
C31	E5	C80	C7	CR8	B3	J9	B1	R38	B3	R87	A11
C32	E6	C81	B7	CR9	B3			R39	B4	R88	B11
C33	H4	C82	A6	CR10	B3	P1	E3	R40	A4	R89	B10
C34	F4	C83	A7	CR11	A4	P2	D2	R41	A5	R90	B10
C35	F5	C84	A8	CR12	A4	P3	B3	R42	A4	R91	A12
C36	E5	C85	E9	CR13	F5	P4	A2	R43	B4	R92	A11
C37	E4	C86	D9	CR14	F5	P5	D6	R44	A4	R93	A12
C38	E5	C87	C10	CR15	G5	P6	B6	R45	A4	R94	A12
C39	B8	C88	C10	CR16	F6			R46	A3	R95	B12
C40	A10	C89	D9	CR17	F4	Q1	G4	R47	G5	R96	B12
C41	B10	C90	A8	CR18	F4	Q2	F7	R48	G6	R97	B12
C42	B10	C91	A8	CR19	G4			R49	G6	R98	B11
C43	C9	C92	A9	CR20	F5	R1	C2	R50	G6	R99	C10
C44	A11	C93	A9	CR21	B11	R2	D2	R51	G6	R100	C11
C45	A10	C94	H7	CR22	B11	R3	C2	R52	G5	R101	C12
C46	B11	C95	H7	CR23	B11	R4	C2	R53	G5	R102	B12
C47	D10	C96	E9	CR24	B11	R5	C2	R54	F5	R103	B12
C48	D11	C97	E12	CR25	C10	R6	C2	R55	F5	R104	C12
C49	C10	C98	F12	CR26	C11	R7	D3	R56	F6	R105	C12

FMSA-1 A1 BOARD

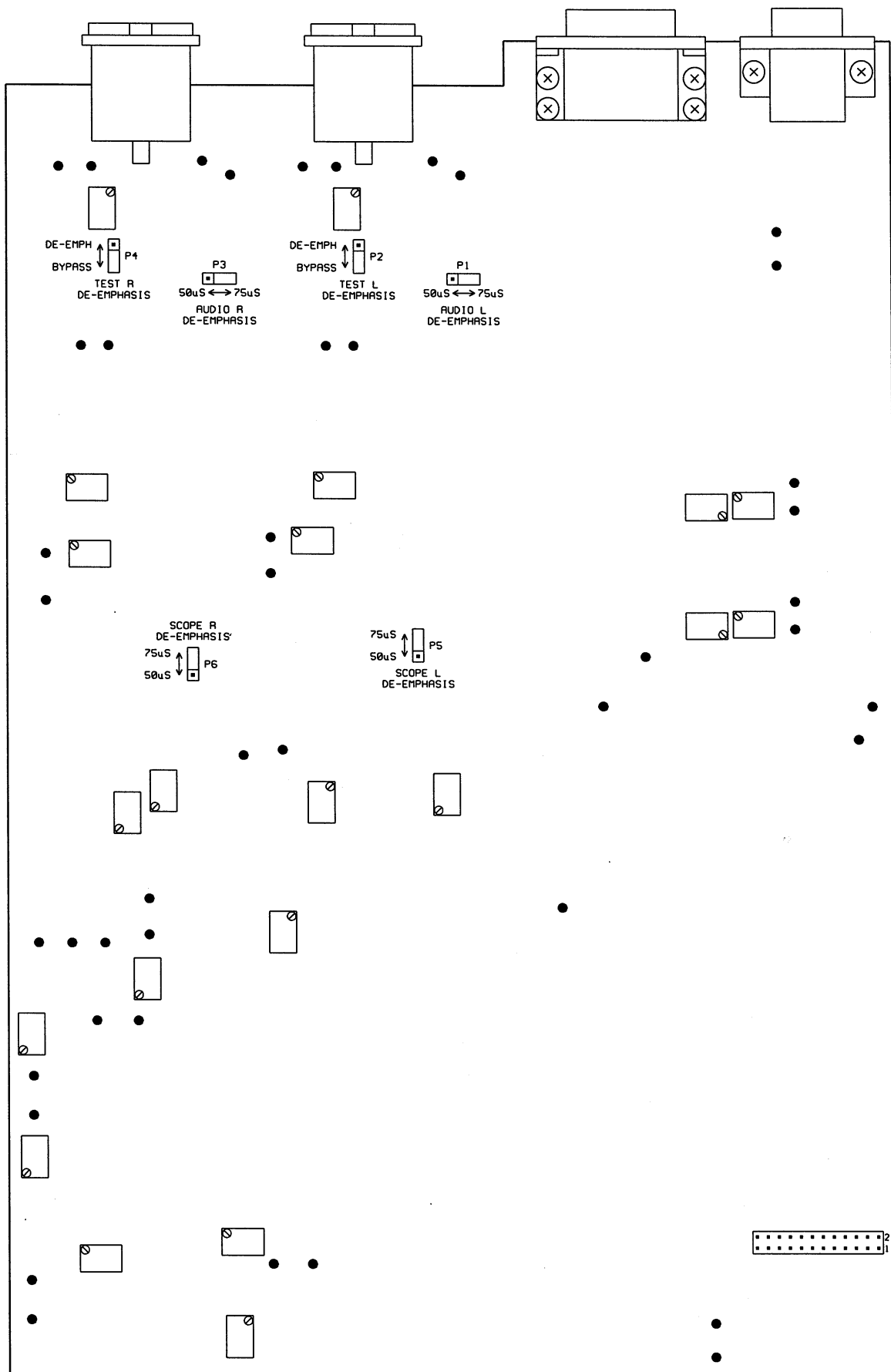
PART LOCATIONS

cont.

Desig/Loc		Desig/Loc		Desig/Loc		Desig/Loc	
R106	C12	R154	E12	U35	D6	13	H6
R107	C11	R155	G11	U36	D5	14	H6
R108	C11	R156	G11	U37	B5	15	H4
R109	C12	R157	F11	U38	A6	16	H5
R110	C6	R158	F12	U39	B6	17	B9
R111	D6	R159	H4	U40	B5	18	B8
R112	D6	R160	F7	U41	D7	19	A10
R113	C5	R161	H11	U42	D7	20	A10
R114	D5			U43	C7	21	B9
R115	C5	RL1	H3	U44	A7	22	A9
R116	C8			U45	A7	23	--
R117	C5	RN1	G3	U46	D9	24	--
R118	A6	RN2	F2	U47	C9	25	A12
R119	B6			U48	D10	26	A12
R120	B6	U1	C2	U49	C10	27	C11
R121	A5	U2	D2	U50	E9	28	C11
R122	B5	U3	D2	U51	E12	29	C7
R123	A5	U4	C3	U52	F6	30	C7
R124	B8	U5	D3	U53	F11	31	C5
R125	A6	U6	C4	U54	F8	32	C5
R126	C8	U7	D4	U55	F9	33	A6
R127	B8	U8	A2	U56	H2	34	A5
R128	B8	U9	B2	U57	F11	35	A9
R129	D7	U10	B2	U58	G7	36	A9
R130	C7	U11	A3	U59	H8	37	A9
R131	D7	U12	B3	U60	G8	38	H7
R132	D7	U13	A4	U61	H11	39	H6
R133	D7	U14	B4	U62	G10	40	E8
R134	D7	U15	G5	U63	G12	41	F6
R135	C6	U16	F5	U64	G3	42	G2
R136	B7	U17	E5	U65	G2	43	G2
R137	B7	U18	G4	U66	F2	44	F6
R138	A7	U19	F4			45	G12
R139	B7	U20	E4	Y1	F11	46	G12
R140	A7	U21	B8				
R141	A8	U22	A10		<u>pins</u>		
R142	A6	U23	B9	1	C2		
R143	C9	U24	B10	2	C2		
R144	C9	U25	A11	3	D2		
R145	C10	U26	B11	4	E2		
R146	E11	U27	D11	5	C3		
R147	E11	U28	A12	6	D3		
R148	E11	U29	C11	7	A2		
R149	E11	U30	B12	8	A2		
R150	E12	U31	C12	9	B2		
R151	E11	U32	D12	10	C2		
R152	E11	U33	C7	11	A3		
R153	E12	U34	C6	12	A3		



FMSA-1 A1 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS



FMSA-1 A1 BOARD
DE-EMPHASIS SETTINGS
BELAR ELECTRONICS

A1 BOARD FMSA-1

Reference Designation	Description	Part Number
C1	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C2	C: FIXED POLY 3000pF 2.5% 160V	0130-3022
C3	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C4	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C5	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C6,C7	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C8	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C9	C: FIXED FILM 0.047uF 10% 200V	0120-4731
C10	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C11,C12	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C13	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C14	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C15	C: FIXED POLY 3000pF 2.5% 160V	0130-3022
C16	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C17	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C18	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C19,C20	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C21	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C22	C: FIXED FILM 0.047uF 10% 200V	0120-4731
C23	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C24,C25	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C26	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C27	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C28,C29	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C30,C31	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C32	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C33	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C34,C35	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C36,C37	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C38	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C39,C40	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C41	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C42	C: FIXED TANT 6.8uF 25V	0185-0002
C43	C: FIXED TANT 1.0uF 35V	0185-0006
C44	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C45 thru C48	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C49	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C50	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C51	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C52,C53*	C: FIXED CERAMIC 0.1uF 50V	0151-0006
	*C53 is not used when U29 is an AD844 IC.	
C54	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C55	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C56*	C: FIXED CERAMIC 0.1uF 50V	0151-0015
	*C56 is not used when U30 is an AD844 IC.	
C57,C58	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C59	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C60 thru C62	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C63	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C64	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C65	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C66	C: FIXED MICA 12pF 5%	0140-1205
C67	C: FIXED CERAMIC 0.1uF 50V	0151-0015

A1 BOARD FMSA-1 cont.

Reference Designation	Description	Part Number
C68,C69	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C70	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C71	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C72	C: FIXED MICA 12pF 5%	0140-1205
C73 thru C75	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C76	C: FIXED TANT 1.0uF 35V	0185-0006
C77	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C78	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C79	C: FIXED MICA 560pF 5%	0140-5615
C80	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C81	C: FIXED TANT 1.0uF 35V	0185-0006
C82	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C83	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C84	C: FIXED MICA 560pF 5%	0140-5615
C85	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C86 thru C88	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C89	C: FIXED TANT 15uF 16V	0185-0003
C90	C: FIXED TANT 6.8uF 25V	0185-0002
C91	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C92	C: FIXED TANT 6.8uF 25V	0185-0002
C93	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C94	C: FIXED TANT 6.8uF 25V	0185-0002
C95,C96	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C97	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C98	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C99	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C100	C: FIXED TANT 6.8uF 25V	0185-0002
C101	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C102,C103	C: FIXED MICA 24pF 5%	0140-2405
C104 thru C106	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C107,C108	C: FIXED TANT 4.7uF 10V	0185-0001
C109,C110	C: FIXED TANT 10uF 16V	0185-0007
C111	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C112 thru C120	C: FIXED CERAMIC 0.01uF 100V	0151-0003
CR1 thru CR4	DIODE: 1N4446	1900-0002
CR5	DIODE: 1N277 GERMANIUM	1900-0001
CR6 thru CR10	DIODE: 1N4446	1900-0002
CR11	DIODE: 1N277 GERMANIUM	1900-0001
CR12 thru CR28	DIODE: 1N4446	1900-0002
CR29 thru CR34	DIODE: 1N277 GERMANIUM	1900-0001
CR35	DIODE: 1N755A	1900-0023
CR36 thru CR38	DIODE: 1N4006	1900-0016
CR39	DIODE: 1N4446	1900-0002
CR40 thru CR50	DIODE: 1N277 GERMANIUM	1900-0001
HDR1	HEADER: 24 PIN	0361-0024
J2	CONNECTOR: "D" SINGLE 9 PIN	0360-0036
J3	CONNECTOR: "D" DUAL 15 PIN	0360-0033
J6,J9	CONNECTOR: "XLR" MALE	0360-0046

A1 BOARD FMSA-1 cont.

Reference Designation	Description	Part Number
P1 thru P6	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 PIN (USED WITH P1 THRU P6)	0365-0028
Q1,Q2	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 3.32k 1%	0721-3321
R2	R: VAR COMP 1k, 10 TURN	2100-0021
R3	R: METAL FILM 5.11k 1%	0721-5111
R4	R: METAL FILM 9.76k 1%	0721-9761
R5	R: METAL FILM 10.0k 1%	0721-1002
R6	R: METAL FILM 4.99k 1%	0721-4991
R7	R: METAL FILM 24.9k 1%	0721-2492
R8	R: METAL FILM 10.0k 1%	0721-1002
R9	R: METAL FILM 20.0k 1%	0721-2002
R10	R: METAL FILM 75.0 1%	0721-75R0
R11	R: METAL FILM 820k 2% 1/4W	0751-8242
R12	R: METAL FILM 10.0k 1%	0721-1002
R13,R14	R: METAL FILM 10.0k 0.1%	0711-1002
R15	R: METAL FILM 10.0k 1%	0721-1002
R16	R: METAL FILM 7.50k 1%	0721-7501
R17	R: VAR COMP 1k, 10 TURN	2100-0021
R18	R: METAL FILM 10.0k 1%	0721-1002
R19	R: METAL FILM 5.11k 1%	0721-5111
R20	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R21	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R22,R23	R: METAL FILM 100 2% 1/4W	0751-1012
R24	R: METAL FILM 3.32k 1%	0721-3321
R25	R: VAR COMP 1k, 10 TURN	2100-0021
R26	R: METAL FILM 5.11k 1%	0721-5111
R27	R: METAL FILM 9.76k 1%	0721-9761
R28	R: METAL FILM 10.0k 1%	0721-1002
R29	R: METAL FILM 4.99k 1%	0721-4991
R30	R: METAL FILM 24.9k 1%	0721-2492
R31	R: METAL FILM 10.0k 1%	0721-1002
R32	R: METAL FILM 20.0k 1%	0721-2002
R33	R: METAL FILM 75.0 1%	0721-75R0
R34	R: METAL FILM 820k 2% 1/4W	0751-8242
R35	R: METAL FILM 10.0k 1%	0721-1002
R36,R37	R: METAL FILM 10.0k 0.1%	0711-1002
R38	R: METAL FILM 10.0k 1%	0721-1002
R39	R: METAL FILM 7.50k 1%	0721-7501
R40	R: VAR COMP 1k, 10 TURN	2100-0021
R41	R: METAL FILM 10.0k 1%	0721-1002
R42	R: METAL FILM 5.11k 1%	0721-5111
R43	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R44	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R45,R46	R: METAL FILM 100 2% 1/4W	0751-1012
R47	R: METAL FILM 243k 1%	0721-2433
R48	R: VAR COMP 10k, 10 TURN	2100-0024
R49,R50	R: METAL FILM 10.0k 1%	0721-1002
R51	R: VAR COMP 2k, 10 TURN	2100-0031
R52	R: METAL FILM 9.09k 1%	0721-9091

A1 BOARD FMSA-1 cont.

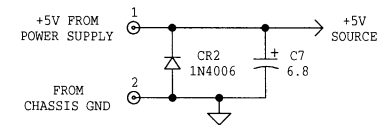
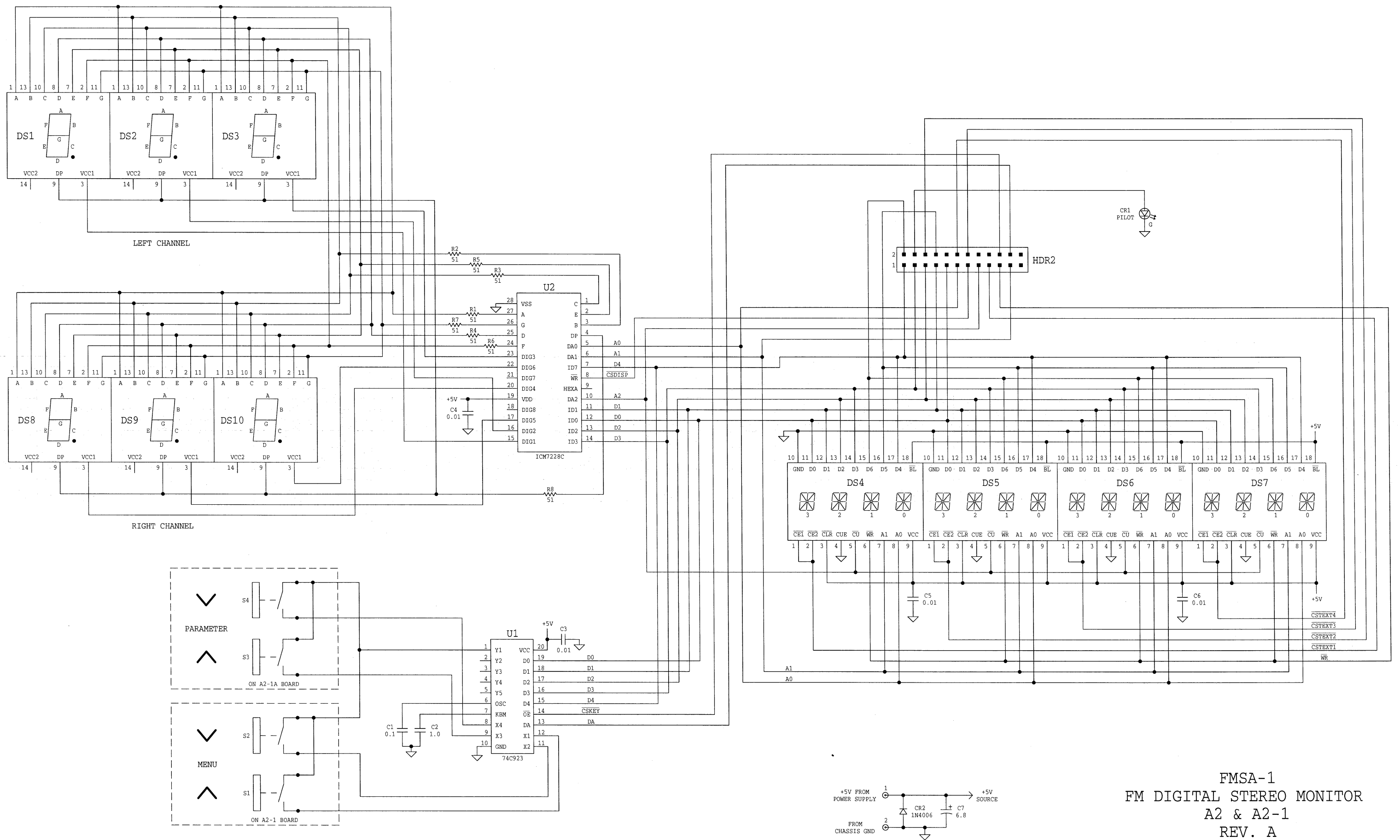
Reference Designation	Description	Part Number
R53	R: METAL FILM 4.99k 1%	0721-4991
R54,R55	R: METAL FILM 10.0k 0.1%	0711-1002
R56	R: METAL FILM 10.0k 1%	0721-1002
R57	R: METAL FILM 243k 1%	0721-2433
R58	R: VAR COMP 10k, 10 TURN	2100-0024
R59,R60	R: METAL FILM 10.0k 1%	0721-1002
R61	R: VAR COMP 2k, 10 TURN	2100-0031
R62	R: METAL FILM 9.09k 1%	0721-9091
R63	R: METAL FILM 4.99k 1%	0721-4991
R64,R65	R: METAL FILM 10.0k 0.1%	0711-1002
R66	R: METAL FILM 10.0k 1%	0721-1002
R67	R: METAL FILM 220k 2% 1/4W	0751-2242
R68	R: VAR COMP 50k, 10 TURN	2100-0025
R69	R: METAL FILM 20.0k 1%	0721-2002
R70	R: METAL FILM 11.0k 1%	0721-1102
R71	R: METAL FILM 220k 2% 1/4W	0751-2242
R72	R: VAR COMP 2k, 10 TURN	2100-0031
R73	R: METAL FILM 6.19k 1%	0721-6191
R74	R: METAL FILM 24.9k 1%	0721-2492
R75	R: METAL FILM 11.0k 1%	0721-1102
R76	R: METAL FILM 20.0k 1%	0721-2002
R77	R: METAL FILM 499 1%	0721-4990
R78	R: METAL FILM 17.4k 1%	0721-1742
R79	R: VAR COMP 5k, 10 TURN	2100-0020
R80	R: METAL FILM 7.50k 1%	0721-7501
R81	R: METAL FILM 2.49k 1%	0721-2491
R82	R: METAL FILM 21.0k 1%	0721-2102
R83	R: METAL FILM 24k 2% 1/4W	0751-2432
R84	R: METAL FILM 220k 2% 1/4W	0751-2242
R85	R: VAR COMP 5k, 10 TURN	2100-0020
R86	R: METAL FILM 10.0k 1%	0721-1002
R87	R: METAL FILM 24.9k 1%	0721-2492
R88,R89	R: METAL FILM 10.0k 0.1%	0711-1002
R90	R: METAL FILM 10.0k 1%	0721-1002
R91	R: METAL FILM 243k 1%	0721-2433
R92	R: VAR COMP 5k, 10 TURN	2100-0020
R93*	R: METAL FILM 9.09k 1%	0721-9091
	*(prior to serial number 350167, R93 was an 11.0k)	
R94	R: METAL FILM 24.9k 1%	0721-2492
R95 thru R98	R: METAL FILM 10.0k 1%	0721-1002
R99*	R: METAL FILM 3k 2% 1/4W	0751-3022
	*R99 is not used when U29 is an AD844 IC.	
R100,R101	R: METAL FILM 10.0k 1%	0721-1002
R102*	R: METAL FILM 3k 2% 1/4W	0751-3022
	*R102 is not used when U30 is an AD844 IC.	
R103	R: METAL FILM 10.0k 1%	0721-1002
R104	R: METAL FILM 9.53k 1%	0721-9531
R105	R: VAR COMP 1k, 10 TURN	2100-0021
R106	R: METAL FILM 10.0k 1%	0721-1002
R107	R: VAR COMP 2k, 10 TURN	2100-0031
R108	R: METAL FILM 9.09k 1%	0721-9091
R109	R: METAL FILM 4.99k 1%	0721-4991

A1 BOARD FMSA-1 cont.

Reference Designation	Description	Part Number
R110	R: METAL FILM 1.00k 1%	0721-1001
R111	R: METAL FILM 6.65k 1%	0721-6651
R112	R: METAL FILM 3.32k 1%	0721-3321
R113	R: METAL FILM 17.4k 1%	0721-1742
R114	R: METAL FILM 499 1%	0721-4990
R115	R: VAR COMP 100, 10 TURN	2100-0022
R116	R: METAL FILM 10k 2% 1/4W	0751-1032
R117	R: METAL FILM 499 1%	0721-4990
R118	R: METAL FILM 1.00k 1%	0721-1001
R119	R: METAL FILM 6.65k 1%	0721-6651
R120	R: METAL FILM 3.32k 1%	0721-3321
R121	R: METAL FILM 17.4k 1%	0721-1742
R122	R: METAL FILM 499 1%	0721-4990
R123	R: VAR COMP 100, 10 TURN	2100-0022
R124	R: METAL FILM 10k 2% 1/4W	0751-1032
R125	R: METAL FILM 499 1%	0721-4990
R126 thru R128	R: METAL FILM 10k 2% 1/4W	0751-1032
R129	R: METAL FILM 24.9k 1%	0721-2492
R130	R: VAR COMP 100k, 10 TURN	2100-0030
R131	R: METAL FILM 100k 1%	0721-1003
R132	R: VAR COMP 100, 10 TURN	2100-0022
R133	R: TEMP COMPENSATING 1.00k 1%	0791-1001
R134	R: METAL FILM 27.4k 1%	0721-2742
R135	R: METAL FILM 75 2% 1/4W	0751-7502
R136	R: VAR COMP 100k, 10 TURN	2100-0030
R137	R: METAL FILM 24.9k 1%	0721-2492
R138	R: METAL FILM 100k 1%	0721-1003
R139	R: VAR COMP 100, 10 TURN	2100-0022
R140	R: TEMP COMPENSATING 1.00k 1%	0791-1001
R141	R: METAL FILM 27.4k 1%	0721-2742
R142	R: METAL FILM 75 2% 1/4W	0751-7502
R143	R: METAL FILM 20.0k 1%	0721-2002
R144	R: METAL FILM 10.0k 1%	0721-1002
R145	R: METAL FILM 470 2% 1/4W	0751-4712
R146 thru R154	R: METAL FILM 1k 2% 1/4W	0751-1022
R155 thru R157	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R158	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R159,R160	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R161	R: METAL FILM 470 2% 1/4W	0751-4712
RL1	RELAY: JWD-107-1 (or HE721A6341)	1600-0007
RN1	R: NETWORK 6 PIN 10k	0906-1032
RN2	R: NETWORK 8 PIN 10k	0908-1032
U1,U2	IC: NE5532	1826-0037
U3	IC: SSM2142P	1827-0005
U4	IC: TLO71	1826-0004
U5,U6	IC: TLE2082	1826-0069
U7	IC: PKD01	1827-0001
U8,U9	IC: NE5532	1826-0037
U10	IC: SSM2142P	1827-0005

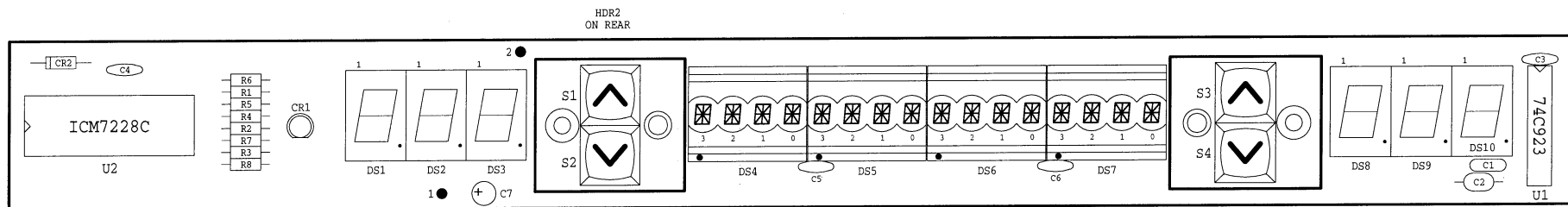
A1 BOARD FMSA-1 cont.

Reference Designation	Description	Part Number
U11	IC: TLO71	1826-0004
U12,U13	IC: TLE2082	1826-0069
U14	IC: PKD01	1827-0001
U15	IC: TLO72	1826-0038
U16	IC: TLE2082	1826-0069
U17	IC: PKD01	1827-0001
U18	IC: TLO72	1826-0038
U19	IC: TLE2082	1826-0069
U20	IC: PKD01	1827-0001
U21	IC: TLO71	1826-0004
U22,U23	IC: TLO72	1826-0038
U24	IC: AD637	1827-0003
U25	IC: TLO71	1826-0004
U26	IC: TLE2082	1826-0069
U27	IC: PKD01	1827-0001
U28	IC: TLE2082	1826-0069
U29,U30*	IC: AD844	1826-0052
*prior to Feb, 2004 U29 & U30 were the LM318 IC.		
U31	IC: TLE2082	1826-0069
U32	IC: PKD01	1827-0001
U33	IC: ADG409	1827-0010
U34	IC: NE5532	1826-0037
U35,U36	IC: DG419	1827-0011
U37	IC: 78L05CP	1826-0012
U38	IC: NE5532	1826-0037
U39,U40	IC: DG419	1827-0011
U41	IC: AD637	1827-0003
U42	IC: TLO71	1826-0004
U43	IC: AD680	1826-0051
U44	IC: AD637	1827-0003
U45	IC: TLO71	1826-0004
U46	IC: SMP04	1827-0004
U47	IC: DG419	1827-0011
U48	IC: SMP04	1827-0004
U49	IC: 79L05CP	1826-0017
U50	IC: 74HC14A	1822-0042
U51,U52	IC: 78L05CP	1826-0012
U53	IC: MC68HC11E1	1840-0010
U54	IC: 74HC00	1822-0039
U55	IC: 74HC139A	1822-0048
U56	IC: MAX232	1823-0001
U57	IC: MC34064	1826-0048
U58	IC: 74HC574	1822-0053
U59	IC: 74HC573	1822-0052
U60	IC: FMSA-1 EPROM	1840-0011A
U61	IC: 74HC138	1822-0047
U62	IC: V62C51864L-70P	1840-0005
U63	IC: 74HC74	1822-0067
U64	IC: 74HC125	1822-0045
U65	IC: 74HC126A	1822-0046
U66	IC: 74HC573	1822-0052
Y1	XTAL: 8 MHz	0411-0005



FMSA-1
FM DIGITAL STEREO MONITOR
A2 & A2-1
REV. A
DISPLAY BOARDS
6-3-03

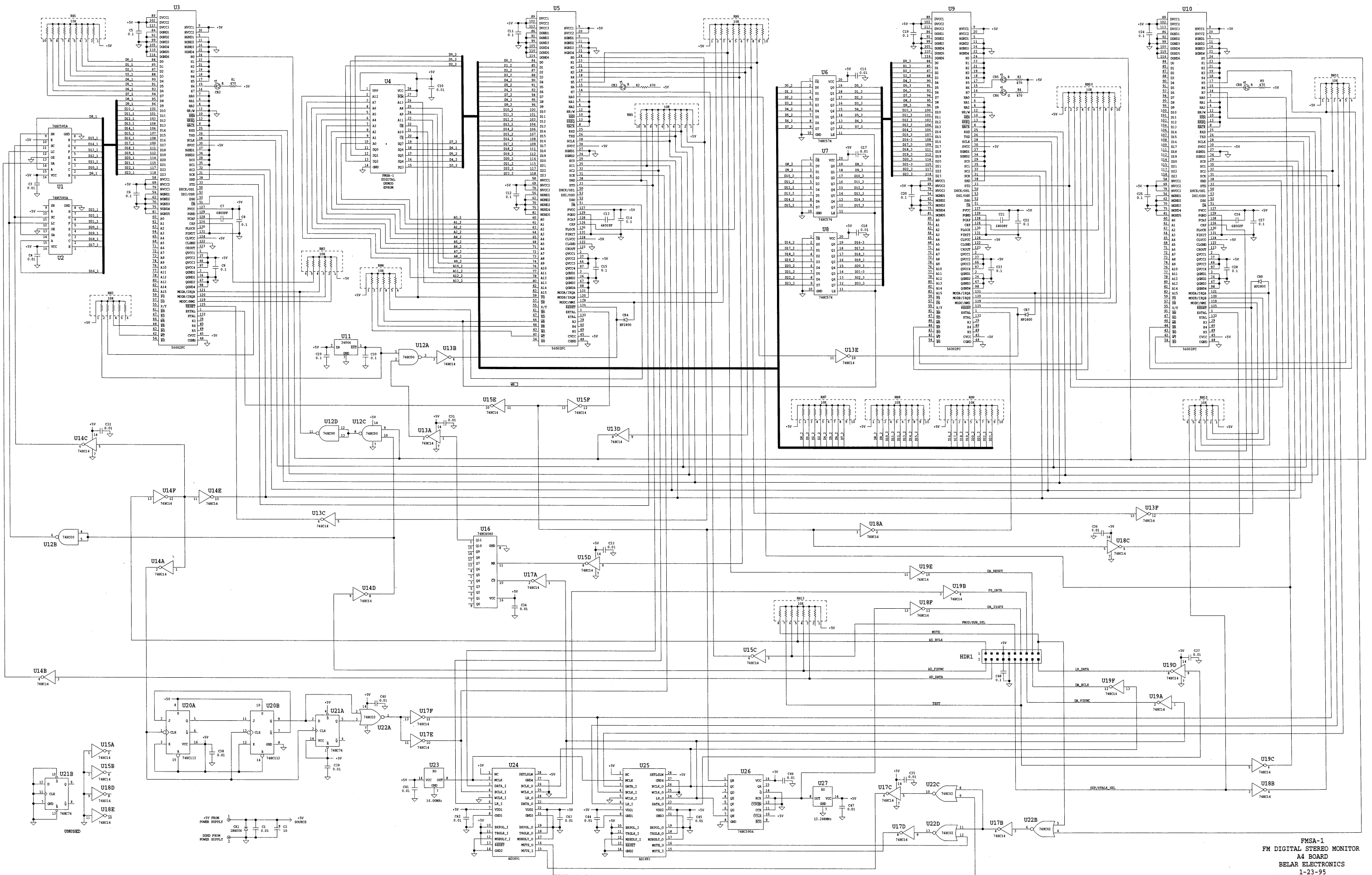
PRIOR TO REV. A OF THE A2 BOARD, PIN 5 OF DS4 THRU DS7 WAS CONNECTED TO +5V.

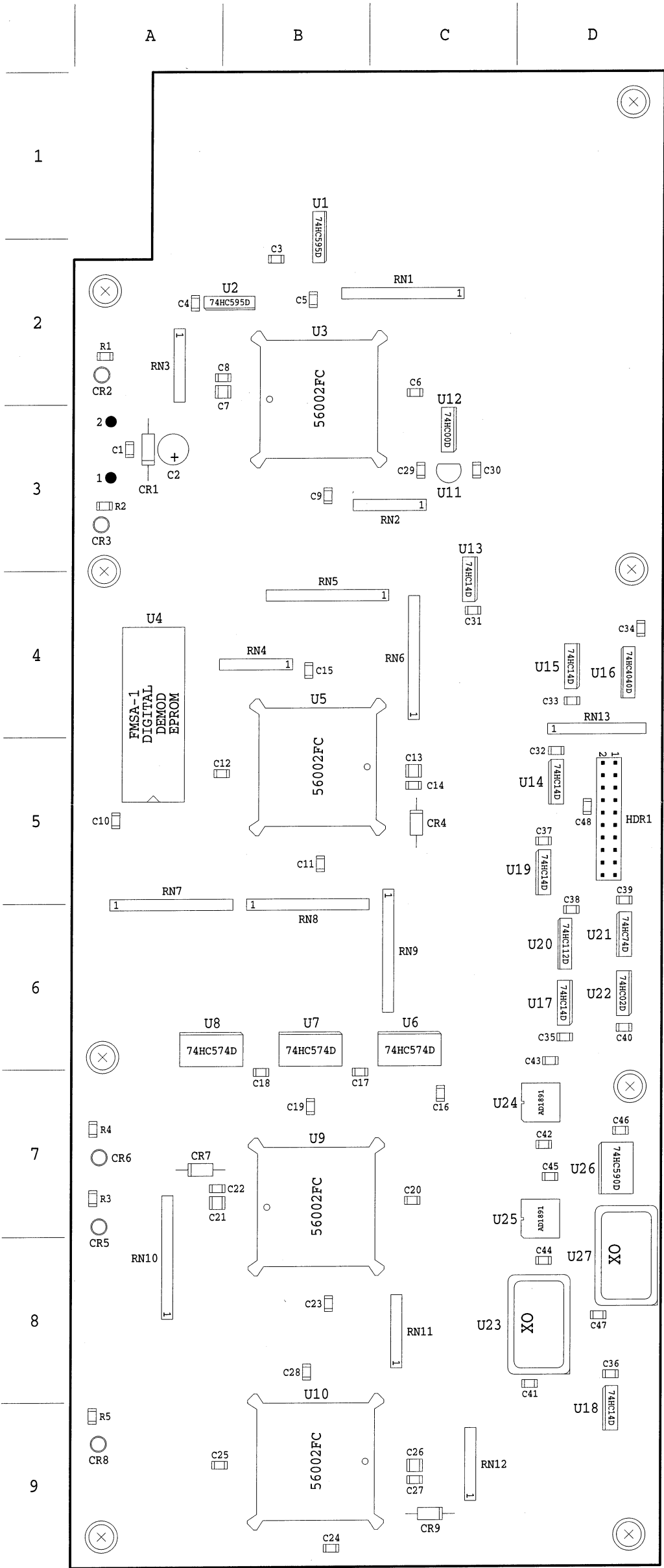


FMSA-1 A2
REV. A
DISPLAY BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

A2 BOARD FMSA-1, REV. A

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C2	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C3 thru C6	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C7	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	LED: GREEN CMD5453	1910-0003
CR2	DIODE: 1N4006	1900-0016
DS1 thru DS3	DISPLAY: HP5082-7651	1930-0007
DS4 thru DS7*	DISPLAY: HDLO-2416	1930-0008
(prior to rev. A, DS4 thru DS7 were the HPDL2416 display, Belar P/N 1930-0005. These parts are not interchangeable.)		
DS8 thru DS10	DISPLAY: HP5082-7651	1930-0007
HDR2	HEADER: 24 PIN	0361-0024
R1 thru R8	R: METAL FILM 51 2% 1/4W	0751-5102
S1 thru S4	SWITCH: PUSHBUTTON, MOMENTARY (ON A2-1 BOARDS)	3105-0001
U1	IC: 74C923	1823-0006
U2	IC: ICM7228C	1823-0002





FMSA-1 A4 BOARD
PART LOCATIONS

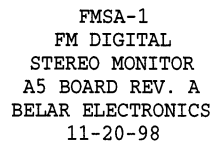
<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 A3	C20 C7	C39 D5	CR9 C9	RN10 A8	U15 D4						
C2 A3	C21 A7	C40 D6		RN11 C8	U16 D4						
C3 B2	C22 A7	C41 D8	HDR1 D5	RN12 C9	U17 D6						
C4 A2	C23 B8	C42 D7		RN13 D4	U18 D9						
C5 B2	C24 B9	C43 D6	R1 A2		U19 D5						
C6 C2	C25 B9	C44 D8	R2 A3	U1 B1	U20 D6						
C7 B2	C26 C9	C45 D7	R3 A7	U2 B2	U21 D6						
C8 B2	C27 C9	C46 D7	R4 A7	U3 B2	U22 D6						
C9 B3	C28 B8	C47 D8	R5 A9	U4 A4	U23 D8						
C10 A5	C29 C3	C48 D5		U5 B5	U24 D7						
C11 B5	C30 C3		RN1 C2	U6 C6	U25 D7						
C12 B5	C31 C4	CR1 A3	RN2 C3	U7 B6	U26 D7						
C13 C5	C32 D5	CR2 A2	RN3 A2	U8 A6	U27 D8						
C14 C5	C33 D4	CR3 A3	RN4 B4	U9 B7							
C15 B4	C34 D4	CR4 C5	RN5 B4	U10 B9							
C16 C7	C35 D6	CR5 A7	RN6 C4	U11 C3	<u>pins</u>						
C17 B7	C36 D8	CR6 A7	RN7 A6	U12 C3	1 A3						
C18 B7	C37 D5	CR7 A7	RN8 B6	U13 C4	2 A3						
C19 B7	C38 D6	CR8 A9	RN9 C6	U14 D5							

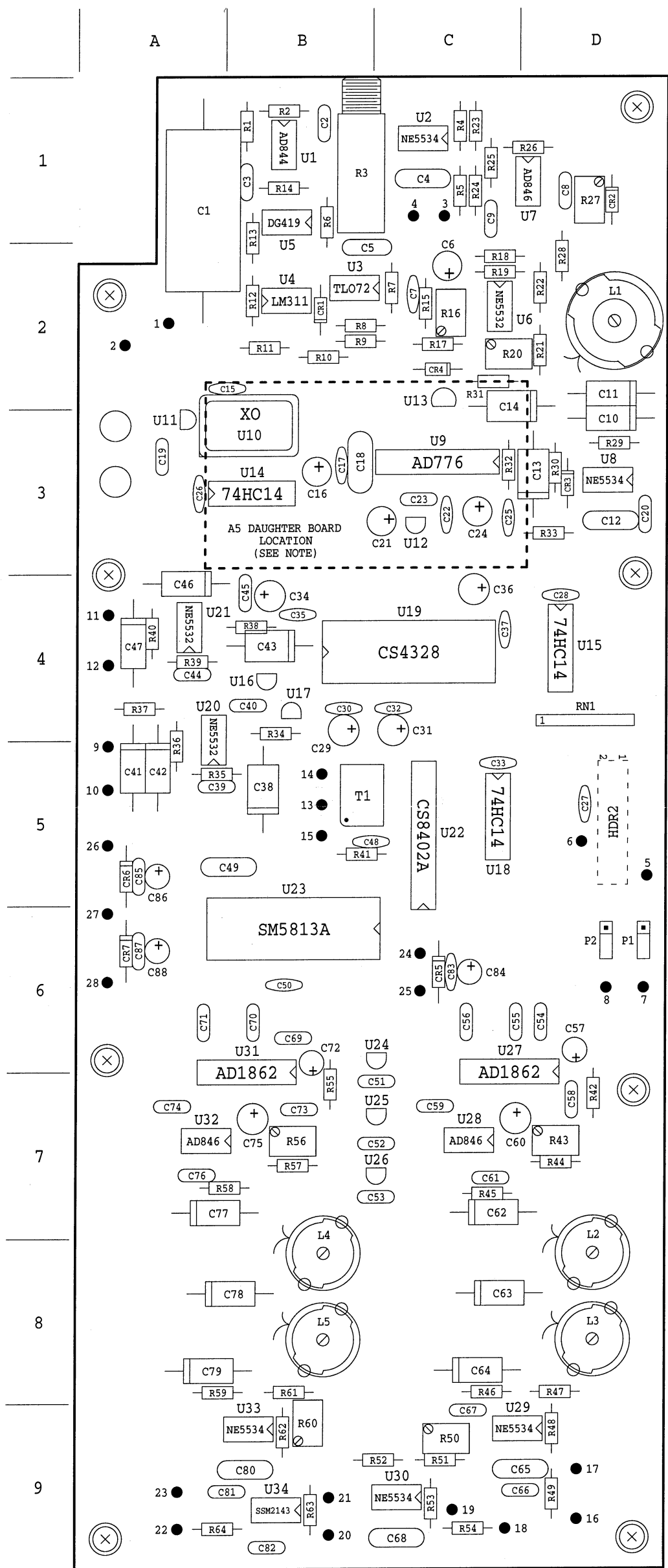
A4 BOARD FMSA-1

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C2	C: FIXED TANTALUM 10uF 16V	0185-0007
C3, C4	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C5, C6	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C7	C: FIXED CERAMIC CHIP 6800pF 50V C1210	0151-0022
C8, C9	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C10	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C11, C12	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C13	C: FIXED CERAMIC CHIP 6800pF 50V C1210	0151-0022
C14, C15	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C16 thru C18	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C19, C20	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C21	C: FIXED CERAMIC CHIP 6800pF 50V C1210	0151-0022
C22 thru C25	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C26	C: FIXED CERAMIC CHIP 6800pF 50V C1210	0151-0022
C27 thru C30	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C31 thru C47	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C48	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
CR1	DIODE: 1N4006	1900-0016
CR2, CR3	LED: RED T-1	1910-0004
CR4	DIODE: HP5082-2800	1900-0026
CR5	LED: RED T-1	1910-0004
CR6	LED: GREEN T-1	1910-0008
CR7	DIODE: HP5082-2800	1900-0026
CR8	LED: RED T-1	1910-0004
CR9	DIODE: HP5082-2800	1900-0026
HDR1	HEADER CONNECTOR: 20 PIN	0361-0020
R1 thru R5	R: FIXED CARBON CHIP 470 5% RC1206	0681-4715
RN1	R: NETWORK 10 PIN 10k	0910-1032
RN2 thru RN4	R: NETWORK 6 PIN 10k	0906-1032
RN5 thru RN10	R: NETWORK 10 PIN 10k	0910-1032
RN11, RN12	R: NETWORK 6 PIN 10k	0906-1032
RN13	R: NETWORK 8 PIN 10k	0908-1032
U1, U2	IC: 74HC595D	1872-0012
U3	IC: 56002FC	1890-0002
U4*	IC: FMSA-1 DIGITAL DEMOD EPROM *(used beginning serial number 350167)	1840-0003H
U4**	IC: FMSA-1 DIGITAL DEMOD EPROM **(used prior to serial number 350167)	1840-0003B
U5	IC: 56002FC	1890-0002
U6 thru U8	IC: 74HC574D	1872-0011
U9, U10	IC: 56002FC	1890-0002
U11	IC: MC34064	1826-0048
U12	IC: 74HC00D	1872-0001

A4 BOARD FMSA-1 cont.

Reference Designation	Description	Part Number
U13 thru U15	IC: 74HC14AD	1872-0010
U16	IC: 74HC4040D	1872-0013
U17 thru U19	IC: 74HC14AD	1872-0010
U20	IC: 74HC112D	1872-0004
U21	IC: 74HC74AD	1872-0003
U22	IC: 74HC02D	1872-0002
U23	IC: XO, 16.000MHz	0415-1600
U24, U25	IC: AD1891	1880-0001
U26	IC: 74HC590D	1872-0005
U27	IC: XO, 12.288MHz	0415-1228



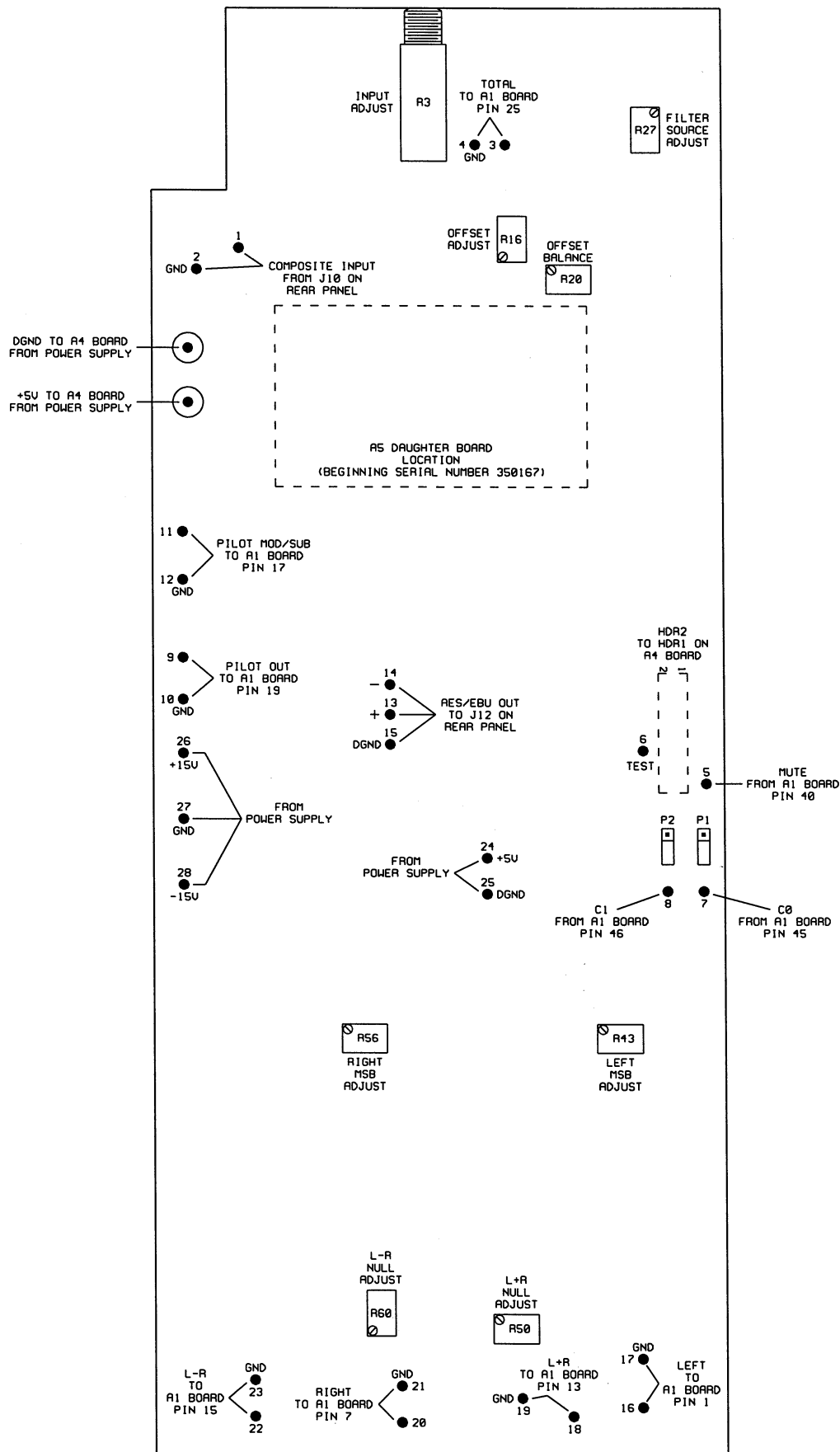


NOTE: BEGINNING SERIAL NUMBER 350167, U10 IS NOT USED AND
U9 (AD776) IS REPLACED BY THE A5 DAUGHTER BOARD.

FMSA-1 A5 BOARD
REV. A
COMPONENT LAYOUT
BELAR ELECTRONICS

FMSA-1 A5 BOARD REV. A
PART LOCATIONS

Desig/Loc		Desig/Loc		Desig/Loc		Desig/Loc		Desig/Loc		Desig/Loc	
C1	A1	C42	A5	C83	C6	R16	C2	R57	B7	U29	D9
C2	B1	C43	B4	C84	C6	R17	C2	R58	B7	U30	C9
C3	B1	C44	A4	C85	A5	R18	C2	R59	A8	U31	B6
C4	C1	C45	B4	C86	A5	R19	C2	R60	B9	U32	A7
C5	B2	C46	A4	C87	A6	R20	C2	R61	B8	U33	B9
C6	C2	C47	A4	C88	A6	R21	D2	R62	B9	U34	B9
C7	C2	C48	B5			R22	D2	R63	B9		
C8	D1	C49	B5	CR1	B2	R23	C1	R64	A9	pins	
C9	C1	C50	B6	CR2	D1	R24	C1			1	A2
C10	D3	C51	C7	CR3	D3	R25	C1	RN1	D4	2	A2
C11	D2	C52	C7	CR4	C2	R26	D1			3	C1
C12	D3	C53	C7	CR5	C6	R27	D1	T1	B5	4	C1
C13	D3	C54	D6	CR6	A5	R28	D2			5	D5
C14	C2	C55	C6	CR7	A6	R29	D3	U1	B1	6	D5
C15	B2	C56	C6			R30	D3	U2	C1	7	D6
C16	B3	C57	D6	HDR2	D5	R31	C2	U3	B2	8	D6
C17	B3	C58	D7			R32	C3	U4	B2	9	A5
C18	B3	C59	C7	L1	D2	R33	D3	U5	B1	10	A5
C19	A3	C60	C7	L2	D8	R34	B4	U6	C2	11	A4
C20	D3	C61	C7	L3	D8	R35	A5	U7	D1	12	A4
C21	C3	C62	C7	L4	B8	R36	A5	U8	D3	13	B5
C22	C3	C63	C8	L5	B8	R37	A4	U9	C3	14	B5
C23	C3	C64	C8			R38	B4	U10	B3	15	B5
C24	C3	C65	D9	P1	D6	R39	A4	U11	A3	16	D9
C25	C3	C66	D9	P2	D6	R40	A4	U12	C3	17	D9
C26	A3	C67	C9			R41	B5	U13	C2	18	C9
C27	D5	C68	C9	R1	B1	R42	D7	U14	B3	19	C9
C28	D4	C69	B6	R2	B1	R43	D7	U15	D4	20	B9
C29	B4	C70	B6	R3	B1	R44	D7	U16	B4	21	B9
C30	B4	C71	A6	R4	C1	R45	C7	U17	B4	22	A9
C31	C4	C72	B6	R5	C1	R46	C8	U18	C5	23	A9
C32	C4	C73	B7	R6	B1	R47	D8	U19	C4	24	C6
C33	C5	C74	A7	R7	C2	R48	D9	U20	A4	25	C6
C34	B4	C75	B7	R8	B2	R49	D9	U21	A4	26	A5
C35	B4	C76	A7	R9	B2	R50	C9	U22	C5	27	A6
C36	C4	C77	A7	R10	B2	R51	C9	U23	B6	28	A6
C37	C4	C78	B8	R11	B2	R52	C9	U24	C6		
C38	B5	C79	A8	R12	B2	R53	C9	U25	C7		
C39	A5	C80	B9	R13	B1	R54	C9	U26	C7		
C40	B4	C81	B9	R14	B1	R55	B7	U27	C6		
C41	A5	C82	B9	R15	C2	R56	B7	U28	C7		



FMSA-1 A5 BOARD
REV. A
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

A5 BOARD FMSA-1 (rev. A)

Reference Designation	Description	Part Number
C1	C: FIXED ELEC 470uF 25V NON-POLAR	0180-0037
C2, C3	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C4	C: FIXED MICA 22pF 5%	0140-2205
C5	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C6	C: FIXED TANT 100uF 6.3V	0185-0010
C7	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C8, C9	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C10	C: FIXED POLY 820pF 2.5% 160V	0130-8212
C11	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C12	C: FIXED MICA 22pF 5%	0140-2205
C13	C: FIXED POLY 5100pF 1% 160V (selected)	0130-5122
C14	C: FIXED POLY 5600pF 2.5% 160V	0130-5622
C15	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C16	C: FIXED TANT 100uF 6.3V	0185-0010
C17	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C18	C: FIXED MICA 1000pF 5%	0140-1025
C19, C20	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C21	C: FIXED TANT 100uF 6.3V	0185-0010
C22	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C23	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C24	C: FIXED TANT 100uF 6.3V	0185-0010
C25 thru C28	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C29	C: FIXED TANT 10uF 16V	0185-0007
C30	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C31	C: FIXED TANT 10uF 16V	0185-0007
C32, C33	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C34	C: FIXED TANT 10uF 16V	0185-0007
C35	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C36	C: FIXED TANT 10uF 16V	0185-0007
C37	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C38	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C39, C40	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C41, C42	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C43	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C44, C45	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C46	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C47	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C48	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C49	C: FIXED MICA 100pF 5%	0140-1015
C50	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C51 thru C56	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C57	C: FIXED TANT 1uF 35V	0185-0006
C58, C59	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C60	C: FIXED TANT 10uF 16V	0185-0007
C61	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C62	C: FIXED POLY 620pF 2.5% 160V (C62 is matched with C77)	0130-6212
C63	C: FIXED POLY 2000pF 2.5% 160V (C63 is matched with C78)	0130-2022

A5 BOARD FMSA-1 (rev. A) cont.

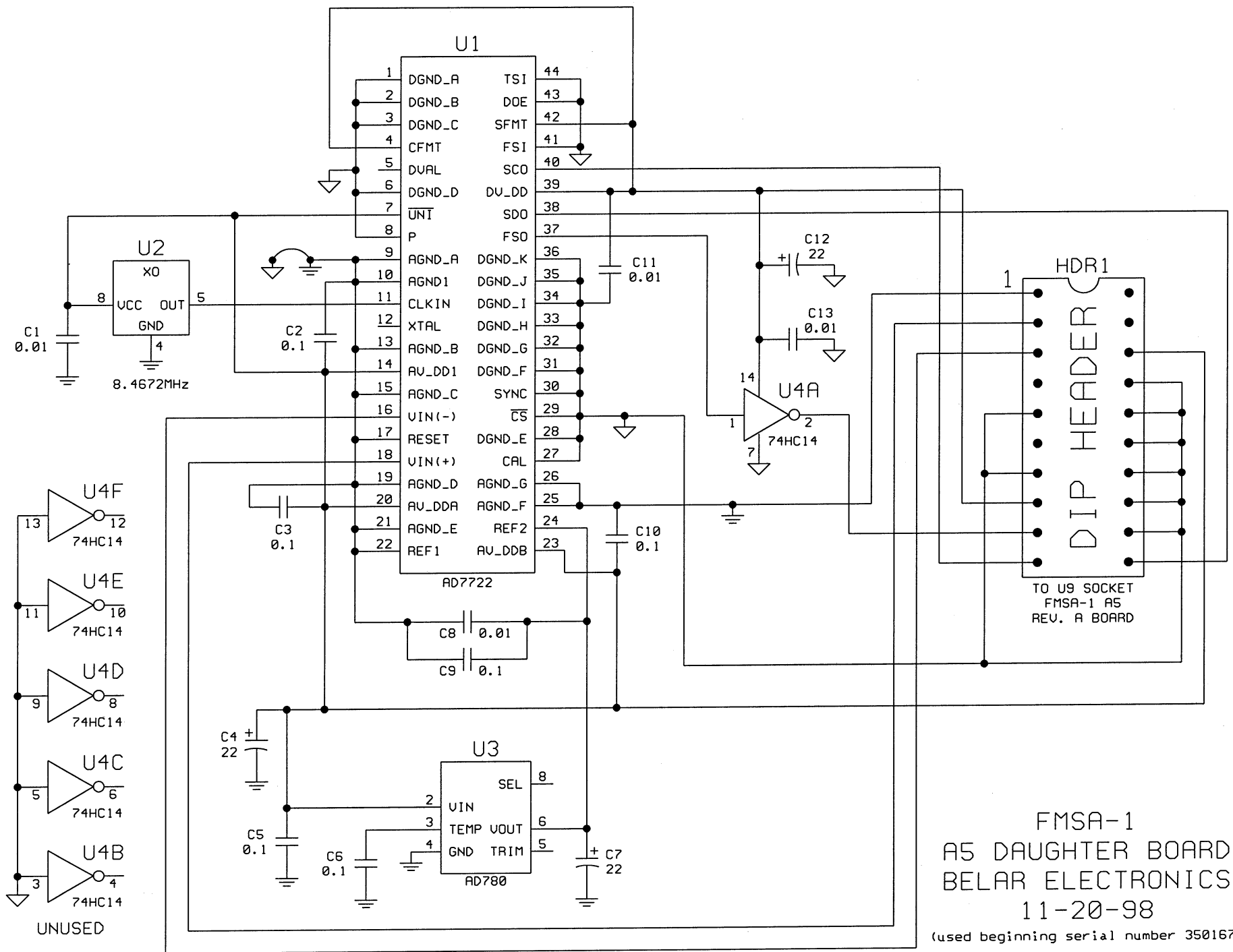
Reference Designation	Description	Part Number
C64	C: FIXED POLY 620pF 2.5% 160V (C64 is matched with C79)	0130-6212
C65	C: FIXED MICA 22pF 5%	0140-2205
C66, C67	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C68	C: FIXED MICA 22pF 5%	0140-2205
C69 thru C71	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C72	C: FIXED TANT 1uF 35V	0185-0006
C73, C74	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C75	C: FIXED TANT 10uF 16V	0185-0007
C76	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C77	C: FIXED POLY 620pF 2.5% 160V (C77 is matched with C62)	0130-6212
C78	C: FIXED POLY 2000pF 2.5% 160V (C78 is matched with C63)	0130-2022
C79	C: FIXED POLY 620pF 2.5% 160V (C79 is matched with C64)	0130-6212
C80	C: FIXED MICA 22pF 5%	0140-2205
C81, C82	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C83	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C84	C: FIXED TANT 6.8uF 25V	0185-0002
C85	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C86	C: FIXED TANT 6.8uF 25V	0185-0002
C87	C: FIXED CERAMIC 0.1uF 50V	0151-0015
C88	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	DIODE: 1N643	1900-0017
CR2, CR3	DIODE: 1N4446	1900-0002
CR4	DIODE: 1N4690	1900-0031
CR5 thru CR7	DIODE: 1N4006	1900-0016
HDR2	HEADER RECEPTACLE: 20 PIN	0361-2020
L1 thru L5	INDUCTOR: BELAR	
P1, P2	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 POSITION (USED WITH P1 & P2)	0365-0028
R1	R: METAL FILM 100k 1%	0721-1003
R2	R: METAL FILM 1.00k 1%	0721-1001
R3	R: VAR COMP 500, 10 TURN	2100-0028
R4*	R: METAL FILM 1.00k 1%	0721-1001
*Note: beginning serial number 350167, R4 is 316 1%, P/N 0721-3160		
R5	R: METAL FILM 75 2% 1/4W	0751-7502
R6	R: METAL FILM 511k 1%	0721-5113
R7	R: METAL FILM 10.0k 1%	0721-1002
R8	R: METAL FILM 8.45k 1%	0721-8451
R9	R: METAL FILM 100k 1%	0721-1003
R10	R: METAL FILM 90.9k 1%	0721-9092
R11	R: METAL FILM 5.62k 1%	0721-5621

A5 BOARD FMSA-1 (rev. A) cont.

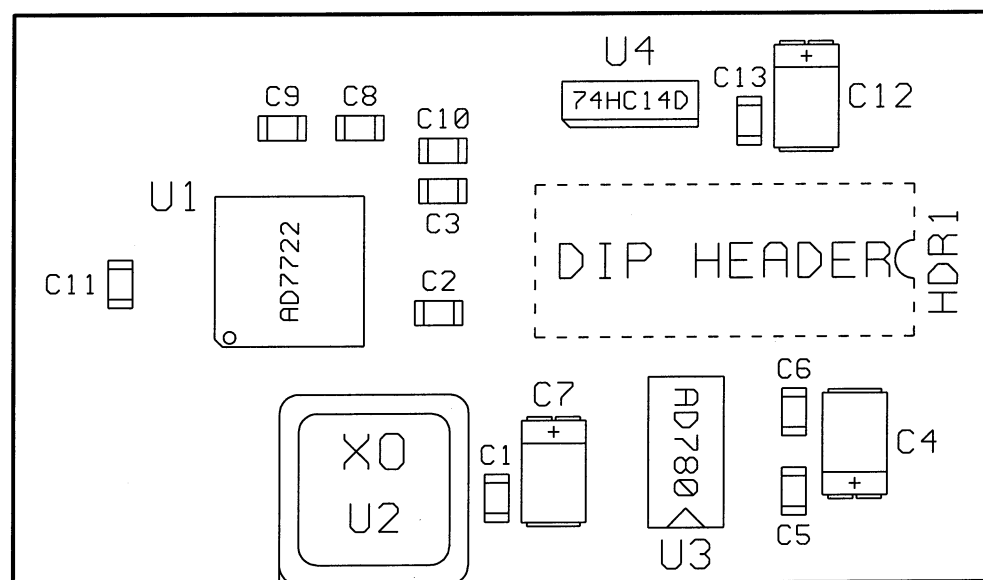
Reference Designation	Description	Part Number
R12	R: METAL FILM 511k 1%	0721-5113
R13	R: METAL FILM 10k 2% 1/4W	0751-1032
R14	R: METAL FILM 1.00k 1%	0721-1001
R15	R: METAL FILM 10.0k 1%	0721-1002
R16	R: VAR COMP 5k, 10 TURN	2100-0020
R17	R: METAL FILM 4.99k 1%	0721-4991
R18	R: METAL FILM 6.65k 1%	0721-6651
R19	R: METAL FILM 9.53k 1%	0721-9531
R20	R: VAR COMP 1k, 10 TURN	2100-0021
R21	R: METAL FILM 6.65k 1%	0721-6651
R22	R: METAL FILM 9.53k 1%	0721-9531
R23*	R: METAL FILM 715 1%	0721-7150
*Note: beginning serial number 350167, R23 is 1.00k 1%, P/N 0721-1001		
R24	R: METAL FILM 1.00k 1%	0721-1001
R25	R: METAL FILM 100 2% 1/4W	0751-1012
R26	R: METAL FILM 1.00k 1%	0721-1001
R27	R: VAR COMP 100, 10 TURN	2100-0022
R28	R: METAL FILM 140 1%	0721-1400
R29	R: METAL FILM 576 1%	0721-5760
R30	R: METAL FILM 51.1 1%	0721-51R1
(R30 is selected for value, nominal value shown)		
R31	R: METAL FILM 51 2% 1/4W	0751-5102
R32	R: METAL FILM 75.0 1%	0721-75R0
R33	R: METAL FILM 294 1%	0721-2940
R34	R: METAL FILM 249 1%	0721-2490
R35	R: METAL FILM 19.1k 1%	0721-1912
R36	R: METAL FILM 169 1%	0721-1690
R37	R: METAL FILM 37.4k 1%	0721-3742
R38	R: METAL FILM 1.69k 1%	0721-1691
R39, R40	R: METAL FILM 24.9k 1%	0721-2492
R41	R: METAL FILM 110 2% 1/4W	0751-1112
R42	R: METAL FILM 470k 2% 1/4W	0751-4742
R43	R: VAR COMP 100k, 10 TURN	2100-0030
R44	R: METAL FILM 470k 2% 1/4W	0751-4742
R45, R46	R: METAL FILM 2.26k 1%	0721-2261
(R45 is matched with R58, R46 is matched with R59)		
R47, R48	R: METAL FILM 10.0k 1%	0721-1002
R49	R: METAL FILM 75 2% 1/4W	0751-7502
R50	R: VAR COMP 1k, 10 TURN	2100-0021
R51	R: METAL FILM 9.53k 1%	0721-9531
R52	R: METAL FILM 10.0k 1%	0721-1002
R53	R: METAL FILM 4.99k 1%	0721-4991
R54	R: METAL FILM 75 2% 1/4W	0751-7502
R55	R: METAL FILM 470k 2% 1/4W	0751-4742
R56	R: VAR COMP 100k, 10 TURN	2100-0030
R57	R: METAL FILM 470k 2% 1/4W	0751-4742
R58, R59	R: METAL FILM 2.26k 1%	0721-2261
(R58 is matched with R45, R59 is matched with R46)		
R60	R: VAR COMP 1k, 10 TURN	2100-0021
R61	R: METAL FILM 9.53k 1%	0721-9531

A5 BOARD FMSA-1 (rev. A) cont.

Reference Designation	Description	Part Number
R62	R: METAL FILM 10.0k 1%	0721-1002
R63,R64	R: METAL FILM 75 2% 1/4W	0751-7502
RN1	R: NETWORK 8 PIN 10k	0908-1032
T1	TRANSFORMER: PULSE 602-12545	9100-0030
U1	IC: AD844A	1826-0052
U2	IC: NE5534	1826-0025
U3	IC: TLO72	1826-0038
U4	IC: LM311	1826-0009
U5	IC: DG419	1827-0011
U6	IC: NE5532	1826-0037
U7	IC: AD846A	1827-0008
U8	IC: NE5534	1826-0025
U9*	IC: AD776	1830-0005
*Note: beginning serial number 350167, U9 is replaced by the A5 Daughter Board		
U10**	IC: XO, 12.7008MHz	0415-1270
**Note: beginning serial number 350167, U10 is not used		
U11,U12	IC: 78L05CP	1826-0012
U13	IC: AD680	1826-0051
U14,U15	IC: 74HC14A	1822-0042
U16	IC: 78L05CP	1826-0012
U17	IC: 79L05CP	1826-0017
U18	IC: 74HC14A	1822-0042
U19	IC: CS4328	1830-0004
U20,U21	IC: NE5532	1826-0037
U22	IC: CS8402A	1823-0008
U23	IC: SM5813A	1830-0003
U24	IC: 79L05CP	1826-0017
U25	IC: 78L12CP	1826-0015
U26	IC: 79L12CP	1826-0019
U27	IC: AD1862	1830-0006
U28	IC: AD846A	1827-0008
U29,U30	IC: NE5534	1826-0025
U31	IC: AD1862	1830-0006
U32	IC: AD846A	1827-0008
U33	IC: NE5534	1826-0025
U34	IC: SSM2143P	1827-0006



FMSA-1
A5 DAUGHTER BOARD
BELAR ELECTRONICS
11-20-98
(used beginning serial number 350167)

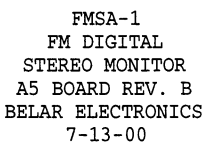


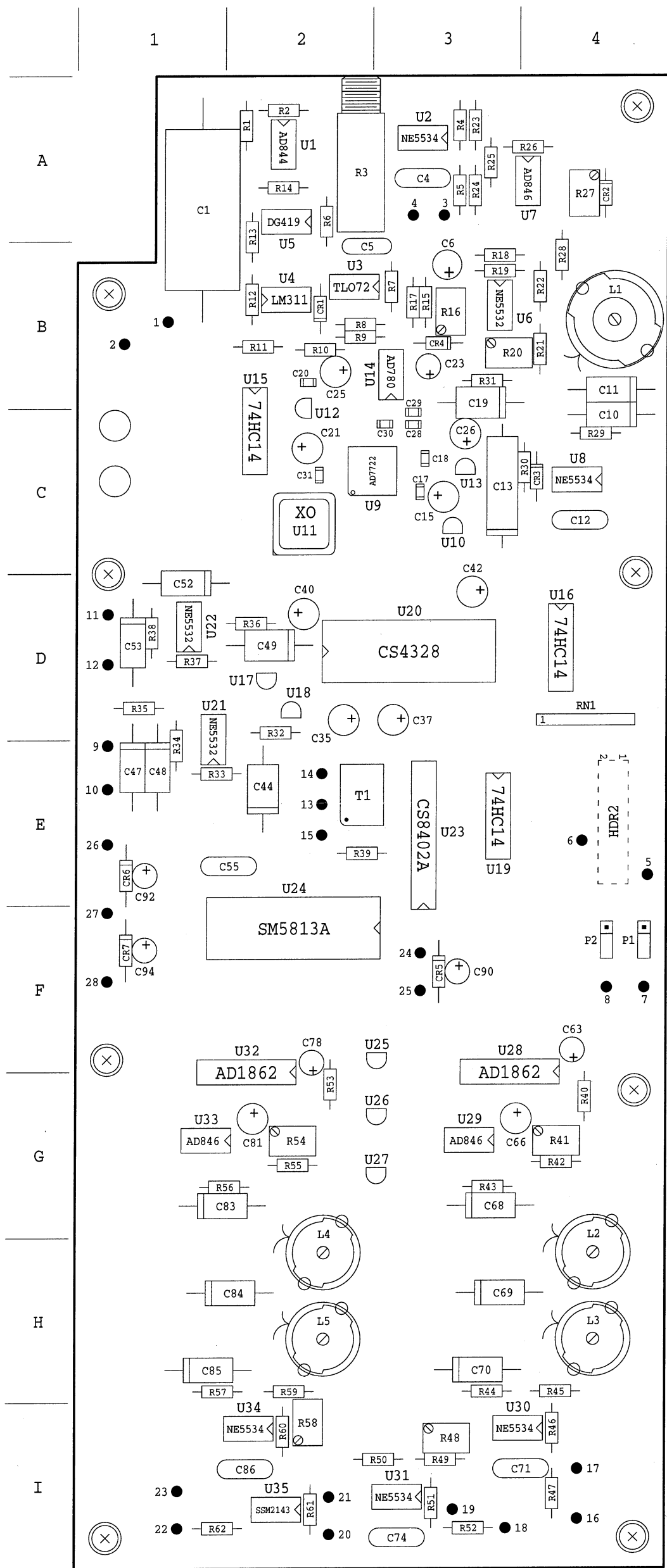
FMSA-1
A5 DAUGHTER BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS
(used beginning serial number 350167)

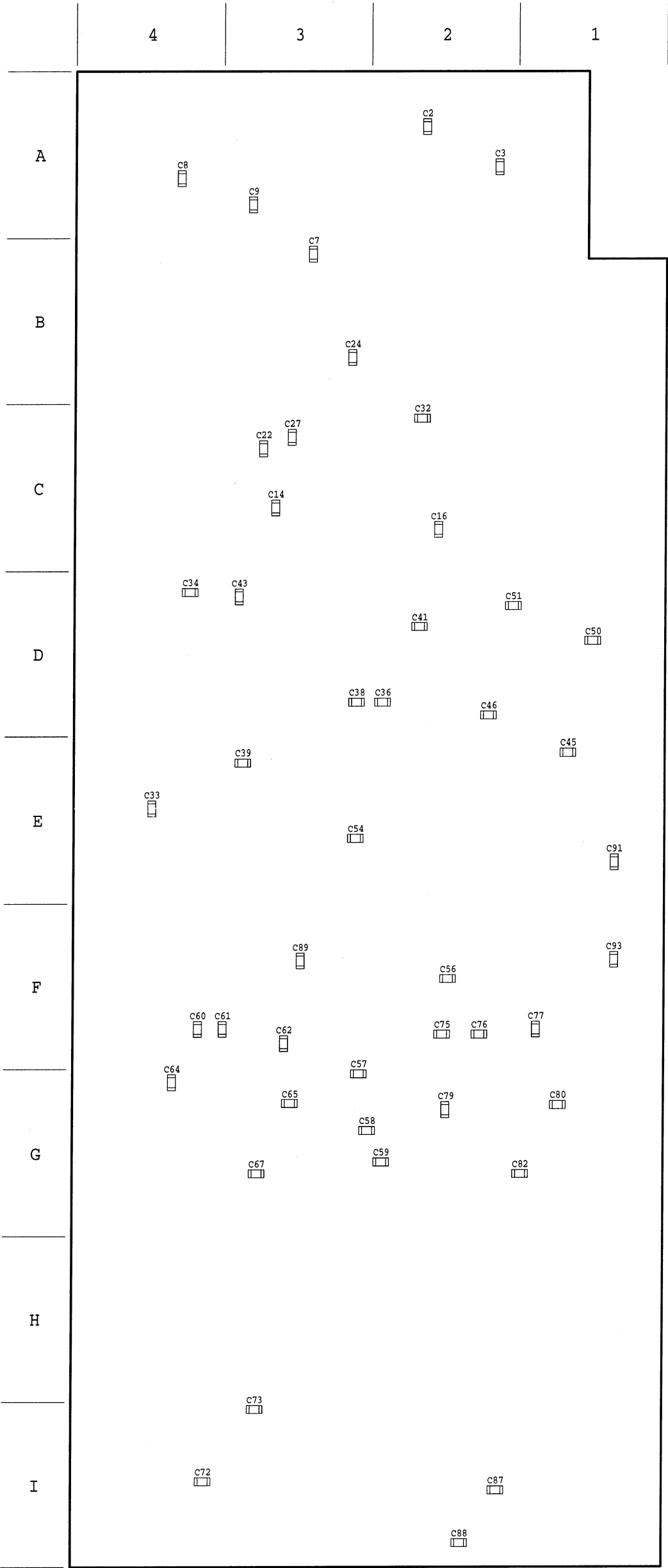
FMSA-1 A5 DAUGHTER BOARD

(used with the FMSA-1 A5 Rev. A Board beginning serial number 350167)

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C2, C3	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C4	C: FIXED TANTALUM CHIP 22uF 25V	0185-0032
C5, C6	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C7	C: FIXED TANTALUM CHIP 22uF 25V	0185-0032
C8	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C9, C10	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C11	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C12	C: FIXED TANTALUM CHIP 22uF 25V	0185-0032
C13	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
HDR1	DIP HEADER: 20 PIN	0363-0020
U1	IC: AD7722	1880-0003
U2	IC: XO, 8.4672MHz	0416-8467
U3	IC: AD780	1826-0064
U4	IC: 74HC14D	1872-0010



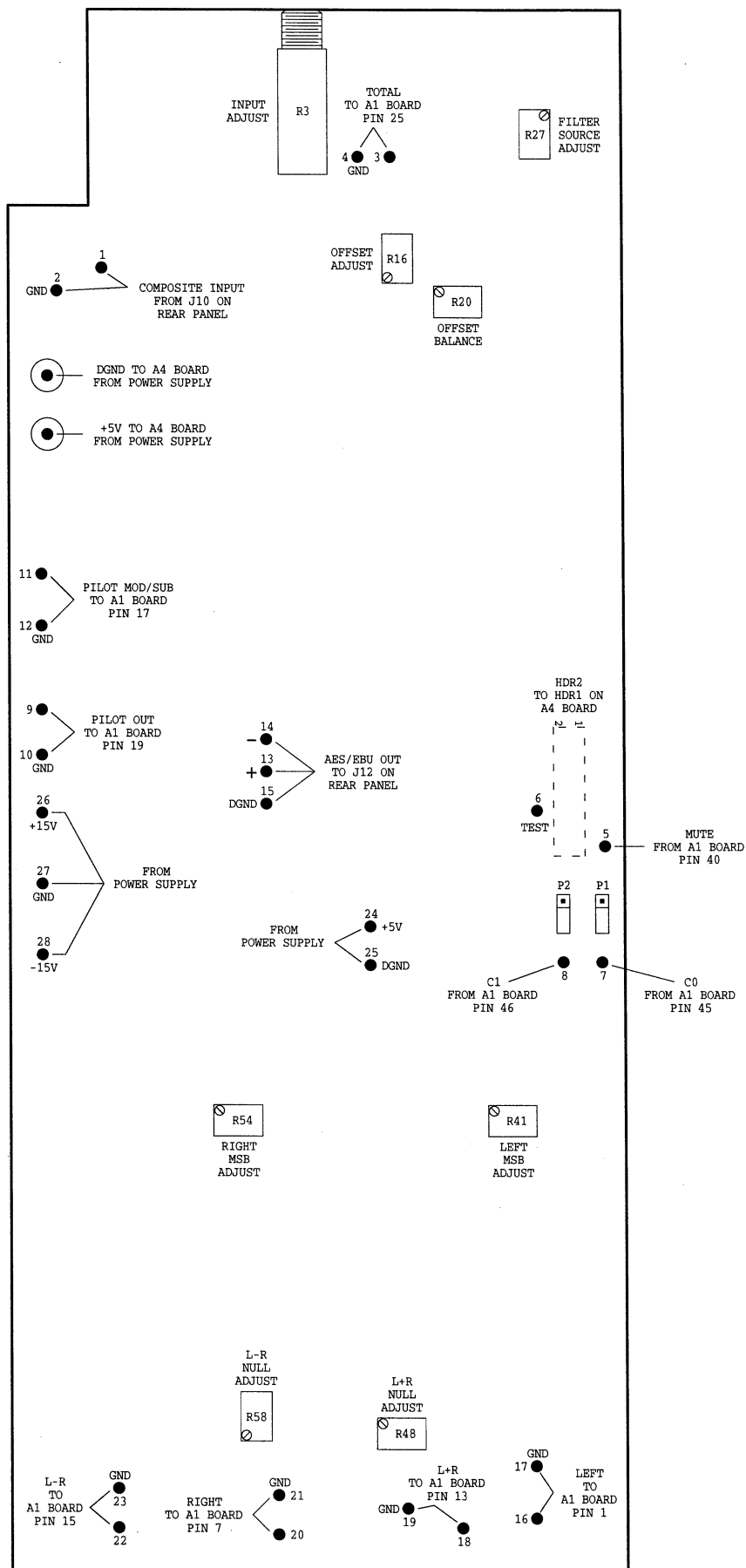




FMSA-1 A5 BOARD REV. B
PART LOCATIONS

<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>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1	A1	C42	D3	C83	G2	R10	B2	R51	I3	U25	F3
C2	A2*	C43	D3*	C84	H2	R11	B2	R52	I3	U26	G3
C3	A2*	C44	E2	C85	H1	R12	B2	R53	G2	U27	G3
C4	A3	C45	E1*	C86	I2	R13	A2	R54	G2	U28	F3
C5	B2	C46	D2*	C87	I2*	R14	A2	R55	G2	U29	G3
C6	B3	C47	E1	C88	I2*	R15	B3	R56	G2	U30	I4
C7	B3*	C48	E1	C89	F3*	R16	B3	R57	H1	U31	I3
C8	A4*	C49	D2	C90	F3	R17	B3	R58	I2	U32	F2
C9	A3*	C50	D1*	C91	E1*	R18	B3	R59	H2	U33	G1
C10	C4	C51	D2*	C92	E1	R19	B3	R60	I2	U34	I2
C11	B4	C52	D1	C93	F1*	R20	B3	R61	I2	U35	I2
C12	C4	C53	D1	C94	F1	R21	B4	R62	I1		
C13	C3	C54	E3*			R22	B4			<u>pins</u>	
C14	C3*	C55	E2	CR1	B2	R23	A3	RN1	D4	1	B1
C15	C3	C56	F2*	CR2	A4	R24	A3			2	B1
C16	C2*	C57	G3*	CR3	C4	R25	A3	T1	E2	3	A3
C17	C3	C58	G3*	CR4	B3	R26	A4			4	A3
C18	C3	C59	G2*	CR5	F3	R27	A4	U1	A2	5	E4
C19	B3	C60	F4*	CR6	E1	R28	B4	U2	A3	6	E4
C20	B2	C61	F3*	CR7	F1	R29	C4	U3	B2	7	F4
C21	C2	C62	F3*			R30	C4	U4	B2	8	F4
C22	C3*	C63	F4	HDR2	E4	R31	B3	U5	A2	9	E1
C23	B3	C64	G4*			R32	D2	U6	B3	10	E1
C24	B3*	C65	G3*	L1	B4	R33	E1	U7	A4	11	D1
C25	B2	C66	G3	L2	H4	R34	E1	U8	C4	12	D1
C26	C3	C67	G3*	L3	H4	R35	D1	U9	C2	13	E2
C27	C3*	C68	G3	L4	H2	R36	D2	U10	C3	14	E2
C28	C3	C69	H3	L5	H2	R37	D1	U11	C2	15	E2
C29	C3	C70	H3			R38	D1	U12	C2	16	I4
C30	C3	C71	I4	P1	F4	R39	E2	U13	C3	17	I4
C31	C2	C72	I4*	P2	F4	R40	G4	U14	B3	18	I3
C32	C2*	C73	I3*			R41	G4	U15	C2	19	I3
C33	E4*	C74	I3	R1	A2	R42	G4	U16	D4	20	I2
C34	D4*	C75	F2*	R2	A2	R43	G3	U17	D2	21	I2
C35	D2	C76	F2*	R3	A2	R44	H3	U18	D2	22	I1
C36	D2*	C77	F1*	R4	A3	R45	H4	U19	E3	23	I1
C37	D3	C78	F2	R5	A3	R46	I4	U20	D3	24	F3
C38	D3*	C79	G2*	R6	A2	R47	I4	U21	D1	25	F3
C39	E3*	C80	G1*	R7	B3	R48	I3	U22	D1	26	E1
C40	D2	C81	G2	R8	B2	R49	I3	U23	E3	27	F1
C41	D2*	C82	G1*	R9	B2	R50	I3	U24	F2	28	F1

*note: These locations are on bottom of pc board.



A5 BOARD FMSA-1 (REV. B)

Reference Designation	Description	Part Number
C1	C: FIXED ELEC 470uF 25V NON-POLAR	0180-0037
C2, C3	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C4	C: FIXED MICA 22pF 5%	0140-2205
C5	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C6	C: FIXED TANT 100uF 6.3V	0185-0010
C7	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C8, C9	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C10	C: FIXED POLY 820pF 2.5% 160V	0130-8212
C11	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C12	C: FIXED MICA 22pF 5%	0140-2205
C13	C: FIXED POLY 5100pF 1% 160V (SELECTED)	0130-5122
C14	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C15	C: FIXED TANT 10uF 16V	0185-0007
C16	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C17, C18	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C19	C: FIXED POLY 5600pF 2.5% 160V	0130-5622
C20	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C21	C: FIXED TANT 10uF 16V	0185-0007
C22	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C23	C: FIXED TANT 1uF 35V	0185-0006
C24	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C25, C26	C: FIXED TANT 10uF 16V	0185-0007
C27, C28	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C29, C30	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C31 thru C34	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C35	C: FIXED TANT 10uF 16V	0185-0007
C36	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C37	C: FIXED TANT 10uF 16V	0185-0007
C38, C39	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C40	C: FIXED TANT 10uF 16V	0185-0007
C41	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C42	C: FIXED TANT 10uF 16V	0185-0007
C43	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C44	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C45, C46	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C47, C48	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C49	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C50, C51	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C52	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C53	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C54	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C55	C: FIXED MICA 100pF 5%	0140-1015
C56	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C57 thru C62	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C63	C: FIXED TANT 1uF 35V	0185-0006
C64, C65	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C66	C: FIXED TANT 10uF 16V	0185-0007
C67	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C68	C: FIXED POLY 620pF 2.5% 160V (C68 is matched with C83)	0130-6212

A5 BOARD FMSA-1 (REV. B) cont.

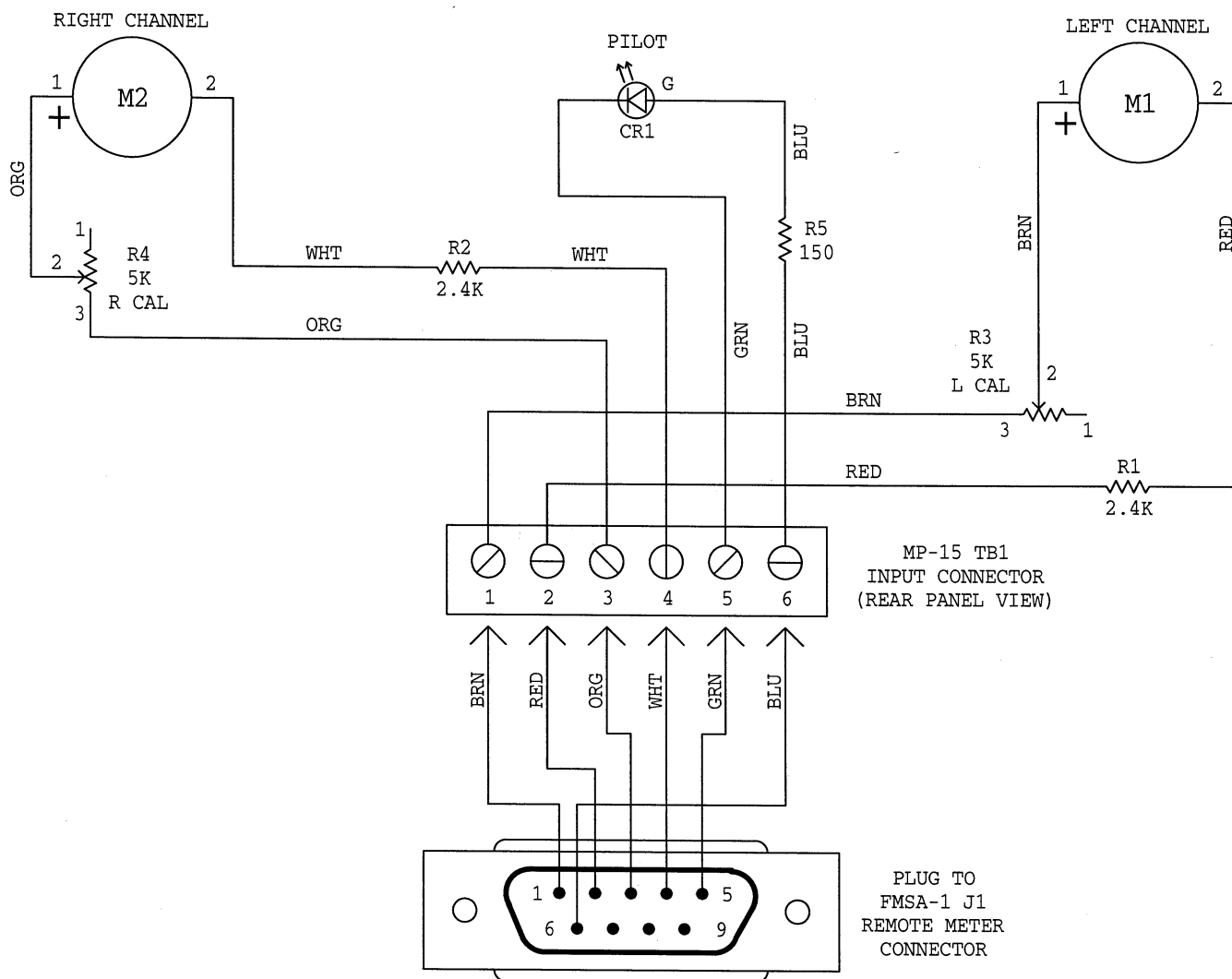
Reference Designation	Description	Part Number
C69	C: FIXED POLY 2000pF 2.5% 160V (C69 is matched with C84)	0130-2022
C70	C: FIXED POLY 620pF 2.5% 160V (C70 is matched with C85)	0130-6212
C71	C: FIXED MICA 22pF 5%	0140-2205
C72, C73	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C74	C: FIXED MICA 22pF 5%	0140-2205
C75 thru C77	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C78	C: FIXED TANT 1uF 35V	0185-0006
C79, C80	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C81	C: FIXED TANT 10uF 16V	0185-0007
C82	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C83	C: FIXED POLY 620pF 2.5% 160V (C83 is matched with C68)	0130-6212
C84	C: FIXED POLY 2000pF 2.5% 160V (C84 is matched with C69)	0130-2022
C85	C: FIXED POLY 620pF 2.5% 160V (C85 is matched with C70)	0130-6212
C86	C: FIXED MICA 22pF 5%	0140-2205
C87, C88	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C89	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C90	C: FIXED TANT 6.8uF 25V	0185-0002
C91	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C92	C: FIXED TANT 6.8uF 25V	0185-0002
C93	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C94	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	DIODE: 1N643	1900-0017
CR2, CR3	DIODE: 1N4446	1900-0002
CR4	DIODE: 1N4690	1900-0031
CR5 thru CR7	DIODE: 1N4006	1900-0016
HDR2	HEADER RECEPTACLE: 20 PIN	0361-2020
L1 thru L5	INDUCTOR: BELAR	
P1, P2	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 POSITION (USED WITH P1 & P2)	0365-0028
R1	R: METAL FILM 100k 1%	0721-1003
R2	R: METAL FILM 1.00k 1%	0721-1001
R3	R: VAR COMP 500, 10 TURN	2100-0028
R4	R: METAL FILM 316 1%	0721-3610
R5	R: METAL FILM 75 2% 1/4W	0751-7502
R6	R: METAL FILM 511k 1%	0721-5113
R7	R: METAL FILM 10.0k 1%	0721-1002
R8	R: METAL FILM 8.45k 1%	0721-8451
R9	R: METAL FILM 100k 1%	0721-1003
R10	R: METAL FILM 90.9k 1%	0721-9092

A5 BOARD FMSA-1 (REV. B) cont.

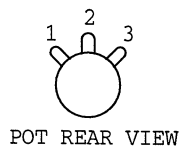
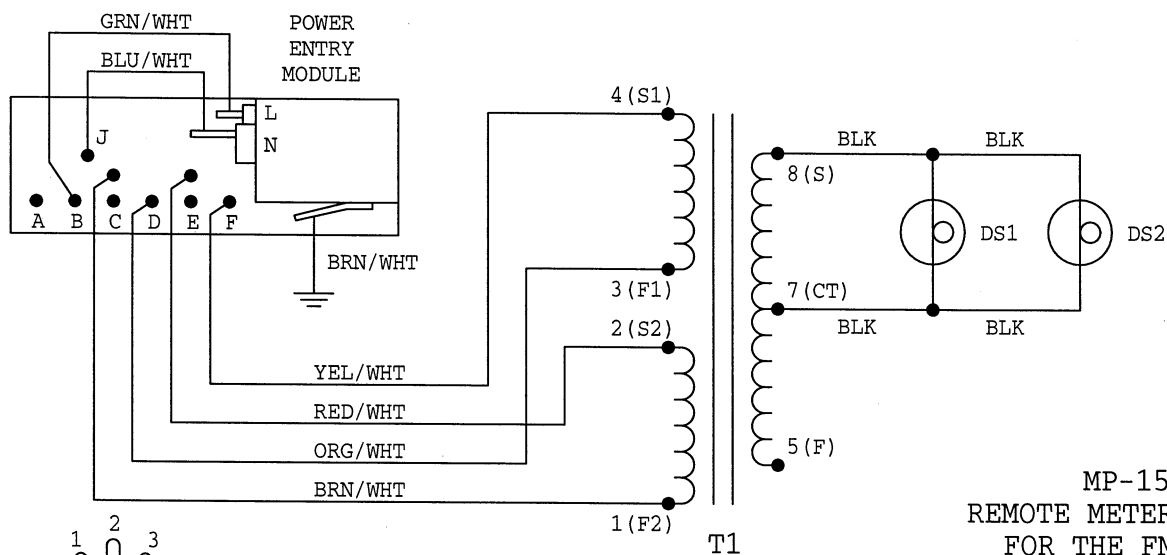
Reference Designation	Description	Part Number
R11	R: METAL FILM 5.62k 1%	0721-5621
R12	R: METAL FILM 511k 1%	0721-5113
R13	R: METAL FILM 10k 2% 1/4W	0751-1032
R14	R: METAL FILM 1.00k 1%	0721-1001
R15	R: METAL FILM 10.0k 1%	0721-1002
R16	R: VAR COMP 5k, 10 TURN	2100-0020
R17	R: METAL FILM 4.99k 1%	0721-4991
R18	R: METAL FILM 6.65k 1%	0721-6651
R19	R: METAL FILM 3.01k 1%	0721-3011
R20	R: VAR COMP 1k, 10 TURN	2100-0021
R21	R: METAL FILM 6.65k 1%	0721-6651
R22	R: METAL FILM 9.53k 1%	0721-9531
R23, R24	R: METAL FILM 1.00K 1%	0721-1001
R25	R: METAL FILM 100 2% 1/4W	0751-1012
R26	R: METAL FILM 1.00k 1%	0721-1001
R27	R: VAR COMP 100, 10 TURN	2100-0022
R28	R: METAL FILM 140 1%	0721-1400
R29	R: METAL FILM 576 1%	0721-5760
R30	R: METAL FILM 51.1 1%	0721-51R1
	(R30 is selected for value, nominal value shown)	
R31	R: METAL FILM 51 2% 1/4W	0751-5102
R32	R: METAL FILM 249 1%	0721-2490
R33	R: METAL FILM 19.1k 1%	0721-1912
R34	R: METAL FILM 169 1%	0721-1690
R35	R: METAL FILM 37.4k 1%	0721-3742
R36	R: METAL FILM 1.69k 1%	0721-1691
R37, R38	R: METAL FILM 24.9k 1%	0721-2492
R39	R: METAL FILM 110 2% 1/4W	0751-1112
R40	R: METAL FILM 470k 2% 1/4W	0751-4742
R41	R: VAR COMP 100k, 10 TURN	2100-0030
R42	R: METAL FILM 470k 2% 1/4W	0751-4742
R43, R44	R: METAL FILM 2.26k 1%	0721-2261
	(R43 is matched with R56, R44 is matched with R57)	
R45, R46	R: METAL FILM 10.0k 1%	0721-1002
R47	R: METAL FILM 75 2% 1/4W	0751-7502
R48	R: VAR COMP 1k, 10 TURN	2100-0021
R49	R: METAL FILM 9.53k 1%	0721-9531
R50	R: METAL FILM 10.0k 1%	0721-1002
R51	R: METAL FILM 4.99k 1%	0721-4991
R52	R: METAL FILM 75 2% 1/4W	0751-7502
R53	R: METAL FILM 470k 2% 1/4W	0751-4742
R54	R: VAR COMP 100k, 10 TURN	2100-0030
R55	R: METAL FILM 470k 2% 1/4W	0751-4742
R56, R57	R: METAL FILM 2.26k 1%	0721-2261
	(R56 is matched with R43, R57 is matched with R44)	
R58	R: VAR COMP 1k, 10 TURN	2100-0021
R59	R: METAL FILM 9.53k 1%	0721-9531
R60	R: METAL FILM 10.0k 1%	0721-1002
R61, R62	R: METAL FILM 75 2% 1/4W	0751-7502

A5 BOARD FMSA-1 (REV. B) cont.

Reference Designation	Description	Part Number
RN1	R: NETWORK 8 PIN 10k	0908-1032
T1	TRANSFORMER: PULSE 602-12545	9100-0030
U1	IC: AD844A	1826-0052
U2	IC: NE5534	1826-0025
U3	IC: TLO72	1826-0038
U4	IC: LM311	1826-0009
U5	IC: DG419	1827-0011
U6	IC: NE5532	1826-0037
U7	IC: AD846A	1827-0008
U8	IC: NE5534	1826-0025
U9	IC: AD7722	1880-0003
U10	IC: 78L05CP	1826-0012
U11	IC: XO, 8.4672MHz	0416-8467
U12, U13	IC: 78L05CP	1826-0012
U14	IC: AD780	1826-0064
U15, U16	IC: 74HC14A	1822-0042
U17	IC: 78L05CP	1826-0012
U18	IC: 79L05CP	1826-0017
U19	IC: 74HC14A	1822-0042
U20	IC: CS4328	1830-0004
U21, U22	IC: NE5532	1826-0037
U23	IC: CS8402A	1823-0008
U24	IC: SM5813A	1830-0003
U25	IC: 79L05CP	1826-0017
U26	IC: 78L12CP	1826-0015
U27	IC: 79L12CP	1826-0019
U28	IC: AD1862	1830-0006
U29	IC: AD846A	1827-0008
U30, U31	IC: NE5534	1826-0025
U32	IC: AD1862	1830-0006
U33	IC: AD846A	1827-0008
U34	IC: NE5534	1826-0025
U35	IC: SSM2143P	1827-0006



MP-15 CALIBRATION: GO TO "TOTAL" ON THE FMSA-1 MAIN MENU. FEED A 1 KHZ AUDIO SIGNAL INTO THE FMSA-1 COMPOSITE INPUT. ADJUST THE LEVEL OF THE AUDIO SO THAT THE LEFT AND RIGHT CHANNEL DISPLAYS ON THE FMSA-1 READ 100%. ADJUST POTENTIOMETERS R3 AND R4 ON THE REAR OF THE MP-15 SO THE REMOTE METERS ALSO READ 100%.



- NOTES:
1. METERS ARE SHOWN FROM REAR.
 2. SCHEMATIC SHOWS MP-15 CABLE.

MP-15
REMOTE METER PANEL
FOR THE FMSA-1
FM DIGITAL STEREO MONITOR
BELAR ELECTRONICS
6-24-99

MP-15 PARTS LIST

Reference Designation	Description	Part Number
CR1	LED: GREEN CMD5453	1910-0003
DS1, DS2	LAMP: 755	2140-0005
--	SOCKET: LAMP	1450-0012
--	POWER ENTRY MODULE: 6J4	0360-0020
F1	FUSE: AGC 1/4A 250V	2110-0002
M1, M2	METER: MOD 0-133%	1120-0012
R1,R2	R: METAL FILM 2.4k 2% 1/2W	0771-2422
R3,R4	R: VAR COMP 5k	2100-0008
R5	R: METAL FILM 150 2% 1/2W	0771-1512
T1	TRANSFORMER: DP 241-4-10	9100-0024
TB1	TERMINAL BLOCK: 6 SCREW	0360-0003
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

MP-15 LINE VOLTAGE SELECTION PROCEDURE

1. Unplug line cord.
2. Open fuse compartment door.
3. Move fuse pull lever to left to remove fuse. Leave fuse pull lever in the leftmost position.
4. Using needle nose pliers, pull the voltage select board straight out of the power entry module.
5. While facing the rear of the unit, orient the voltage select board so the desired line voltage is up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation).
Note: The "100" and "220" positions on the opposite side of the board are not used.
6. Plug the voltage select board into the power entry module.
7. Install the fuse (F1).
8. Close fuse compartment door.
9. Plug line cord in.