

TVM-250

TV SAP/PRO

Modulation Monitor

Guide to Operations

11/99

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TVM-250 TV SAP/PRO Modulation Monitor

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TVM-250 TV SAP/PRO Modulation Monitor

1 General Information

1-1 General Description

The Belar TVM-250 SAP/PRO monitor is a dual modulation monitor system for television stations broadcasting the MTS Second Audio Program (SAP) and/or PROfessional channels. Operated in conjunction with the Belar TVM-100, TVM-101, or other wideband aural demodulator, the Belar TVM-250 combines simultaneous audio demodulation and peak modulation measurement of both SAP and PRO subcarriers. An internal RMS metering system indicates injection of both subcarriers and provides direct RMS readings of audio crosstalk and signal-to-noise ratios.

Accurate decoding of the demodulated SAP signal is assured by an on-board professional dbx^{*} expander card. A crystal-controlled calibration system provides precise references for SAP and PRO carrier deviations, injection levels, and dbx expander performance. SAP and PRO rear-panel audio outputs are active-balanced and drive 600 Ω lines at +10 dBm.

The Belar TVM-250 SAP/PRO Monitor combines all its functions in a single chassis only one rack unit high. Two large LED displays simultaneously indicate peak modulation percentage of the SAP and PRO channels. Four LED's indicate modulation peaks and presence of the SAP and PRO subcarriers, with user-adjustable thresholds. All operational and metering functions can be controlled via the front-panel menu system. One set of UP/DOWN keys provides menu control, another set of keys adjusts operating parameters. Adjustable parameters include peak flasher settings and muting thresholds for SAP and PRO. To facilitate broadcast performance measurements, the menus offer the capability to bypass the subcarrier bandpass filters, to change the SAP detector bandwidth, and to substitute 75 μsecond de-emphasis for dbx companding.

The Belar TVM-250 SAP/PRO Monitor has an RS-232 interface, which provides capability to perform all front panel operations and readouts under computer control. With the addition of a modem and the supplied Wizard software, computer control may be extended to any off-site location via a standard telephone line. The TVM-250 may also be used in conjunction with other Belar monitors via the Wizard interface. The Wizard system turns an ordinary PC into a powerful tool for display and logging of SAP and PRO modulation parameters.

1-2 Specifications

Input	.....	Wide-band demodulated aural composite
Input Level	400 mV to 4 Vrms for 73 kHz peak deviation, in two overlapping ranges

*dbx is a registered trademark of THAT Corporation.

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Audio Outputs

Balanced Outputs	+10 dBm, 600 Ω active-balanced, XLR-type connectors
SAP & PRO Test Outputs	5 Vrms, unbalanced, BNC connectors (75 Ω source)

Audio Test 1.2 Vrms @ 100%, 30 dB gain inserted at —50 dB, unbalanced, BNC connector
(75 Ω source)

Serial Interface RS-232

Unit Interface Wizard Standard Interface

Remote Meter Outputs:

- SAP Analog Modulation Meter
- PRO Analog Modulation Meter
- Open collector and relay closures for SAP and PRO PEAK modulation and CARRIER presence indicators
- Data Out - direct coupled PRO demodulator output.
0.9 Vrms at 3 kHz peak deviation (for loads of 5 kΩ or more).

SAP Specifications (20 Hz - 10 kHz):

Subcarrier Peak Modulation ±5%

Injection (15 kHz) ±0.2 kHz

Frequency response:

Bandpass Filter In

Flat	± 0.4 dB
De-emphasized	± 0.5 dB
BTSC	±1.5 dB

Bandpass Filter Out

Flat	± 0.1 dB
De-emphasized	±0.25 dB
BTSC	±1.0 dB

Distortion (THD+N), 10 kHz bandwidth

BPF In, de-emphasized	≤1.2%
BPF Out, de-emphasized	≤0.3% (residual distortion ≤0.1%)

Signal-to-Noise Ratio, de-emphasized 65 dB

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PRO Specifications (30 Hz - 3.5 kHz):

Subcarrier Peak Modulation ±5%
Injection (3 kHz) ± 0.2 kHz
Frequency response:	
BPF In, de-emphasized .....	..... ±0.5 dB
BPF Out, de-emphasized .....	..... ±0.25 dB
Distortion (THD+N), 3.5 kHz bandwidth	
BPF In, de-emphasized .....	..... ≤1.5%
BPF Out, de-emphasized .....	..... ≤0.3% (residual distortion ≤0.2%)
Signal-to-Noise Ratio, de-emphasized .....	..... 65 dB
Dimensions .....	..... 1.75" H x 16.5" D x 19" W (1 EIA Rack Unit)
Power requirements .....	..... 20 Watts, 100-240 VAC, 50-60 Hz
Shipping Weight .....	..... 13 lbs (5.9 kgs)

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 Section 2-2 for the recommended claim procedure. Keep all packing material for proof of claim or for possible future use.

The TVM-250 is shipped with a Guide to Operations, 4 black rack-mount screws, a BNC jumper, and a three-wire line cord.

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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 so that the repair or replacement of the unit can be initiated without waiting for a claim to be settled with the carrier.

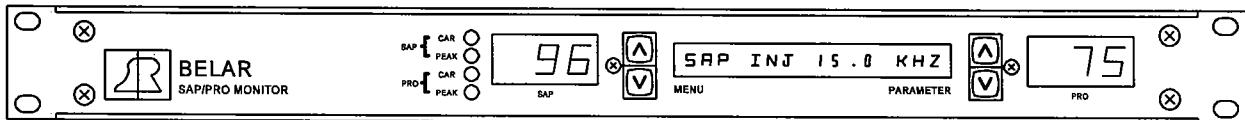
2-3 Repacking for Shipment

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.
- 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.

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3 Front Panel Operation



The SAP display window shows modulation of the SAP subcarrier in percent, with 100% representing 10 kHz peak deviation of the subcarrier.

The PRO display window shows modulation of the PRO subcarrier in percent, with 100% representing 3 kHz peak deviation of the subcarrier.

The MENU/PARAMETER window is a 16 character alpha-numeric display that shows the menu selections and associated parameters or measurement readings.

Located to the left of the MENU/PARAMETER window, the UP MENU(\wedge) and DOWN MENU(\vee) buttons are used to scroll through the various menu selections of the TVM-250. Either the UP(\wedge) or DOWN(\vee) button will lead to the desired menu choice—but usually one direction will reach the desired selection more quickly.

Located to the right of the MENU/PARAMETER window, the UP PARAMETER(\wedge) and DOWN PARAMETER(\vee) buttons are used to scroll through the available settings for a given menu selection, where applicable.

The menu selections are arranged in two tiers of loops. The main loop, or upper tier, consists of all the measurements the TVM-250 makes. The display in the MENU/PARAMETER window in the figure above is from the main loop. Three main loop entries—MODIFY SAP, MODIFY PRO, and MODIFY SETTINGS—are gateways to the lower tier menus. When one of these three gateway selections is displayed, the corresponding lower tier menu is accessed by pressing the UP PARAMETER (\wedge) button to the right of the MENU/PARAMETER window. All parameters that can be adjusted from the front-panel, such as mute and flasher thresholds, hold times, etc., are accessed through these gateway selections. (All of the adjustable parameters are explained in *Section 3-1 Menu Selections*, following.)

Four status LED's are immediately left of the SAP modulation display. Each LED has a corresponding relay closure and open-collector output available through rear-panel connections. (See *Section 4* for more information about the rear panel.) The LED's are grouped in pairs, duplicating indications for the SAP and PRO subcarriers. The green CARRIER LED's light when the respective subcarriers exceed the injection levels set by the user. The red PEAK LED's light when peak modulation of the respective subcarrier exceeds the threshold set by the user.

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3-1 Main Menu Selections

The Belar TVM-250 is essentially two modulation monitors in a single chassis. Both the SAP and PRO sections of the TVM-250 may be manually muted by the user from the front panel. Accordingly, the modulation percentage windows and some of the menu entries described below may not be active in the MENU/PARAMETER window when the TVM-250 is being used to monitor only one subcarrier.

- | | |
|-------------------------|--|
| TOTAL XXX% | Displays total peak FM deviation of the BTSC composite aural carrier—in percent—relative to 73 kHz peak deviation. Maximum displayed value is 127%. |
| SAP INJ XX.X KHZ | Displays the modulation (FM frequency deviation) of the aural carrier due to the presence of the Second Audio Program (SAP) subcarrier—in kilohertz deviation. Maximum displayed value is 25.0 kHz deviation.

When SAP injection exceeds 25.0 kHz, the text *HIGH SAP INJ* is displayed in the MENU/PARAMETER window as an alarm, alternating with the previously selected menu item. |
| PRO INJ X.X KHZ | Displays the modulation (FM frequency deviation) of the aural carrier due to the presence of the Professional Audio Channel (PRO) subcarrier—in kilohertz deviation. Maximum displayed value is 6.3 kHz.

When PRO injection exceeds 6.3 kHz, the text *HIGH PRO INJ* is displayed in the MENU/PARAMETER window as an alarm, alternating with the previously selected menu item. Note that the PRO discriminator is muted at injections exceeding 6.3 kHz. This blanks out the modulation display. |
| SAP XX.X DB | Displays the RMS level of the SAP audio output relative to 100% modulation of the SAP subcarrier (10.0 kHz peak deviation). The reading reflects any audio processing that is applied to the signal—whether it be de-emphasis or dbx expansion. Range is from –90.0 dB to +3.5 dB in 0.5 dB increments. |

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PRO XX.X DB	Displays the RMS level of the PRO audio output relative to 100% modulation of the PRO subcarrier (3.0 kHz peak deviation). The reading includes the effects of de-emphasis, if it has been selected. Range is from -90.0 dB to +3.5 dB in 0.5 dB increments.
MODIFY SAP	This is a gateway to the MODIFY SAP menu. It is activated by pressing the right UP PARAMETER (\wedge) button. The MODIFY SAP menu permits the user to configure operation of the SAP monitor functions. These parameter settings are described in <i>Section 3-2 MODIFY SAP Menu Selections</i> .
MODIFY PRO	This is a gateway to the MODIFY PRO menu. It is activated by pressing the right UP PARAMETER (\wedge) button. The MODIFY PRO menu permits the user to configure operation of the PRO monitor functions. These parameter settings are described in <i>Section 3-3 MODIFY PRO Menu Selections</i> .
MODIFY SETTINGS	This is a gateway to the MODIFY SETTINGS menu. It is activated by pressing the right UP PARAMETER (\wedge) button. The MODIFY SETTINGS menu permits the user to configure aspects of monitor operation common to the SAP and PRO sections of the monitor. These parameter settings are described in <i>Section 3-4 MODIFY SETTINGS Menu Selections</i> .

3-2 MODIFY SAP Menu Selections

MODIFY SAP	The SAP Menu loop is accessed by pressing the right UP PARAMETER(\wedge) button when MODIFY SAP is displayed in the MENU/PARAMETER window. Once accessed, the parameters described below are accessed by successively pushing the UP MENU (\wedge) and DOWN MENU(\vee) buttons to the left of the window. The UP PARAMETER (\wedge) and DOWN PARAMETER (\vee) buttons to the right of the window are used to step through the available operating choices or to set numerical values. Holding the PARAMETER button down will scroll through the full numerical range. The MODIFY SAP menu is exited by pressing the UP PARAMETER (\wedge) button while the EXIT ? option is displayed in the window.
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PEAK MOD XXX%	Adjusts the SAP modulation threshold above which the SAP PEAK LED lights. The range is 1% to 127%.
MUTE	Controls operation of the SAP muting system.
ON	ON mutes the SAP demodulator, no matter what the injection level of the SAP subcarrier.
AUTO	AUTO enables automatic muting of the SAP demodulator when injection of the SAP subcarrier falls below the threshold set by the user.
OFF	OFF disables the muting, turning on the SAP demodulator and display.
MUTE XX.X KHZ	Sets the injection level of the SAP subcarrier (modulation of the aural carrier due to the SAP subcarrier), in kilohertz, below which audio muting occurs and the SAP CARRIER presence LED is extinguished. Injection levels above this setting will activate the audio output circuits and light the front-panel SAP CARRIER presence LED light.
SAP BPF IN OUT	Selecting IN places the SAP bandpass filter in the signal path ahead of the SAP discriminator. The filter is required under normal broadcast conditions to suppress other interfering signals present in the demodulated aural composite signal. The filter is bypassed (OUT) only for performing tests.
DET BW 10 KHZ 20 KHZ	This sets the DETector BandWidth of the SAP demodulator system. This is the cut-off frequency of the audio low-pass filter at the output of the SAP discriminator. Under normal operating conditions the 10 KHZ mode is selected. The 20 KHZ bandwidth is used for testing only, as recommended in the BTSC System Recommended Practices.
SAP RESPONSE DBX 75US FLAT	This sets the type of processing the SAP output audio receives. BTSC broadcast operations require dbx companding for the audio (which requires dbx expansion at the receiver). Noise and distortion checks normally require 75 μ s de-emphasis. The FLAT position does not alter the frequency response of the discriminator output. Note that these choices do not affect the SAP subcarrier modulation readings.

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SAP CAL	This entry permits selection among four modes of SAP CALibration. In OFF, the SAP discriminator receives its input from the demodulated aural composite signal supplied to the TVM-250. When any of the other 4 choices are selected, the output of the calibrator is fed to the SAP demodulator system. The demodulated calibration signals appear at all SAP audio outputs.
ZERO	ZERO provides a quiet SAP carrier at 78,671 Hz for checking of the SAP discriminator noise floor.
DEV	DEViation supplies a SAP carrier FM modulated by a 715.2-Hz audio tone to exactly 10.0 kHz peak deviation (100%). This is used for checking the accuracy of SAP modulation indications and the audio output levels.
LF DBX	LF DBX is a SAP carrier FM modulated by a 357.6-Hz audio tone at 1.6345 kHz deviation (16.3% modulation). This is used to check the low-frequency behavior of the dbx expander card. (At this frequency and level, the dbx card will theoretically pass the demodulator signal without gain or loss.)
HF DBX	HF DBX is a SAP carrier FM modulated by a 5006.4-Hz audio tone at 8.929 kHz deviation (89.3% modulation). This is used to check the high-frequency behavior of the dbx expander card. (At this frequency and level, the dbx card will theoretically pass the demodulator signal without gain or loss.)
EXIT ?	This is the gateway to return to the main loop. The lower tier menu is exited by pressing the UP PARAMETER (\wedge) button while the EXIT ? option is displayed in the window. The user then arrives back at the MODIFY SAP entry in the main loop.

3-3 MODIFY PRO Menu Selections

MODIFY PRO	This menu is accessed by pressing the right UP PARAMETER (\wedge) button when MODIFY PRO is displayed in the MENU/PARAMETER window. Stepping through the menu entries, setting operating parameters, and exiting the menu is handled in the same manner as described under the MODIFY SAP Menu.
PEAK MOD XXX%	Adjusts the PRO modulation threshold above which the PRO PEAK LED lights. The range is 1% to 127%.

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MUTE	Controls operation of the PRO muting system.
ON	ON mutes the PRO demodulator, no matter what the injection level of the PRO subcarrier.
AUTO	AUTO enables automatic muting of the PRO demodulator when injection of the PRO subcarrier falls below the threshold set by the user.
OFF	OFF disables the muting, turning on the PRO demodulator and display. Muting still occurs in the event that PRO injection exceeds 6.3 kHz.
MUTE X.X KHZ	Sets the injection level of the PRO subcarrier (modulation of the aural carrier due to the PRO subcarrier), in kilohertz, below which audio muting occurs and the PRO CARRIER presence LED is extinguished. Injection levels above this setting will activate the audio output circuits and light the front-panel PRO CARRIER presence LED light.
PRO BPF	Selecting IN places the PRO bandpass filter in the signal path ahead of the PRO discriminator. The filter is required under normal broadcast conditions to suppress other interfering signals present in the demodulated aural composite signal. The filter is bypassed (OUT) only for performing tests.
IN	
OUT	
PRO CAL	This entry permits selection between two modes of PRO CALibration. In OFF, the PRO discriminator receives its input from the demodulated aural composite signal supplied to the TVM-250. When ZERO or DEV is selected, the output of the calibrator is fed to the PRO demodulator system. The demodulated calibration signals appear at all PRO audio outputs.
OFF	
ZERO	ZERO provides a quiet carrier at 102,273 Hz for checking the PRO discriminator noise floor.
DEV	DEVIation supplies a PRO carrier, FM modulated by a 357.6-Hz audio tone to exactly 3.0 kHz peak deviation (100%). This is used for checking the accuracy of PRO modulation indications and audio output levels.

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EXIT ?

This is the gateway to return to the main loop. The lower tier menu is exited by pressing the UP PARAMETER (\wedge) button while the EXIT ? option is displayed in the window. The user then arrives back at the MODIFY PRO entry in the main loop.

3-4 MODIFY SETTINGS Menu selections

MODIFY SETTINGS

The MODIFY SETTINGS menu loop is accessed by pressing the right UP PARAMETER (\wedge) button when MODIFY SETTINGS is displayed in the MENU/PARAMETER window. Stepping through the menu entries, setting operating parameters, and exiting the menu is handled in the same manner as described under the MODIFY SAP menu.

HOLD XX.X SEC -EXT

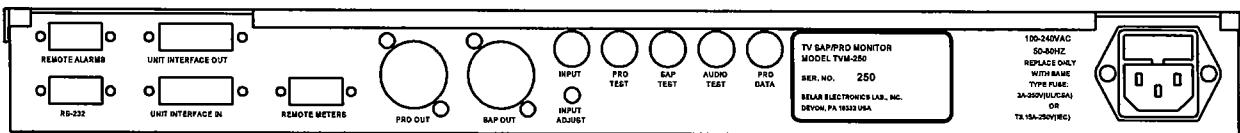
Sets the maximum time interval between updates of displayed peak modulation readings. In REAL TIME MODE, described below, anytime an increase in peak modulation occurs, the larger value is immediately displayed and the HOLD time display clock is restarted. The new value is displayed until either a larger peak occurs, or the HOLD time display clock expires. In PAST TIME MODE, the HOLD time is the duration that peak modulation values are held in the display. The largest modulation peak occurring during the display interval becomes the next displayed peak value at the end of the HOLD time. The range of possible HOLD times settings is from 0.5 second to 10.0 seconds. (Note: The range is from 1.0 second to 10.0 seconds for the 1200 bps modem data transmission rate.) When the TVM-250 is used in conjunction with another unit on the Wizard Interface, the option -EXT permits the hold time to be set by the controlling (MASTER) unit on the Wizard bus. (See INTERFACE under MODIFY OPTIONS in Section 6.)

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TIME MODE	Determines the mode in which peaks are displayed. In REAL time mode the display is updated immediately when a peak greater than the previously displayed value is detected. If no higher peak occurs in the time interval set by the HOLD time parameter, the instantaneous modulation peak detected at the moment the hold time interval ends becomes the newly displayed value. In the PAST time mode the unit displays the previously measured peak for the duration of the HOLD time. At the end of the HOLD time, the highest peak that occurred during that display interval becomes the next displayed peak.
INFINITE	Enables or disables a peak modulation storage facility that displays the highest modulation peak detected since the function was activated. If set to ON, the display acts as a "high-water mark" and will "stick" at the highest peak reading (since INFINITE was turned ON).
SAVE CONFIG	Stores all parameters set from the front-panel in internal non-volatile memory. The present operating configuration of the TVM-250 is thus preserved in the event of power failure. Press the UP PARAMETER (\wedge) button to save the present operating configuration.
RECALL CONFIG	Recalls the entire set of operating parameters stored by the previous SAVE CONFIG command. This allows the user to easily restore any operating configuration after making alterations to perform tests or special signal evaluations.
EXIT ?	This is the gateway to return to the main menu loop. The lower tier menu is exited by pressing the UP PARAMETER (\wedge) button while the EXIT ? option is displayed in the window. The user then arrives back at the MODIFY SETTINGS entry in the main menu loop.

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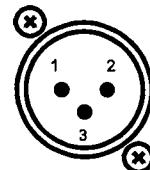
4 Rear Panel



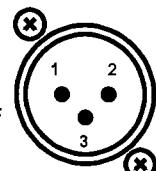
Input (J6) Accepts a wideband, demodulated television aural composite signal. BNC connector. Input impedance is 50 kΩ. Nominal input voltage: 1.46 Vrms (4.13 V p-p) for 73 kHz aural carrier peak deviation. Input voltage range 400 mVrms to 4 Vrms in two overlapping ranges.

Input Adjust (A1R4) Multi-turn input voltage adjustment potentiometer. Provides adjustment across full input sensitivity range when used in conjunction with internal gain jumper P1 on the A1 board.

PRO Out (J4) PRO audio output, 600Ω, active-balanced, +10 dBm, XLR-type chassis mounted plug. Pin 1 is ground, pin 2 is + output polarity (corresponding to an increase in the instantaneous frequency of the PRO subcarrier). Pin 3 is the – polarity output. This is the standard audio output for listening. Its frequency response characteristic is set by the internal 150µS DE-EMPHASIS SELECT jumper P2 on the A1 board. (Output is either de-emphasized or flat—the factory setting is de-emphasized.) To change the de-emphasis, see the TVM-250 A1 Board De-emphasis Settings drawing in Section 8. Note: if this output is used in unbalanced mode, be sure to ground the unused output pin at the TVM-250 chassis.

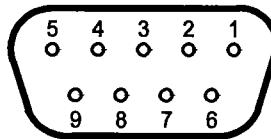


SAP Out (J5) SAP audio output, 600Ω, active-balanced, +10 dBm, XLR-type chassis mounted plug. Pin 1 is ground, pin 2 is + output polarity (corresponding to an increase in the instantaneous frequency of the SAP subcarrier). Pin 3 is the – polarity output. This is the standard audio output for listening. Its frequency response characteristic is set by the SAP RESPONSE Menu/Parameter setting, and can be set to FLAT, DBX, or 75US (75-microsecond) de-emphasis. Note: if this output is used in unbalanced mode, be sure to ground the unused output pin at the TVM-250 chassis.



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- PRO Test (J7)** An unbalanced PRO audio output for general use. This BNC connector supplies 5 Vrms open-circuit. (Source resistance is 75 Ω.) Audio response follows setting of P2 jumper on A1 board, as discussed above under PRO OUT.
- SAP Test (J8)** An unbalanced SAP audio output for general use. This BNC connector supplies 5 Vrms open-circuit. (Source resistance is 75 Ω.) Audio response follows setting of SAP RESPONSE parameter as described above under SAP OUT.
- Audio Test (J9)** An unbalanced audio output which follows the SAP/PRO audio voltmeter. Output is about 1.2 Vrms, open-circuit, for a "0.0 DB" voltmeter indication. (Source resistance is 75 Ω.) The audio signal source is determined by Menu selection. When the signal, as indicated by the front-panel voltmeter reaches -50 DB, 30 decibels of fixed gain is inserted into the path ahead of the output to improve observation. Audio de-emphasis follows the mode currently active for the appropriate channel. Once activated, the source remains the voltmeter reading most recently selected.
- PRO Data (J10)** An unbalanced, direct-coupled output of the PRO discriminator. Output voltage is approximately 900 mVrms, open-circuit, at 3 kHz peak deviation. Source resistance is 1000 Ω. This high-impedance output is provided to feed data demodulators that require DC signal paths. It will only drive loads of 5 kΩ load impedance or greater.
- Remote Alarms (J1A,
top connector)** A 9-pin D-type jack used to connect remote CARRIER presence and PEAK modulation alarms to the TVM-250. The relays close when injections or peak modulation readings exceed the thresholds set by the user as discussed in Section 3. Four internal relays provide isolated contact closures that coincide with the four front panel LED indications. The relays are rated at 10 W max, 0.5 A max, 200 VDC max. The connector wiring is as follows:



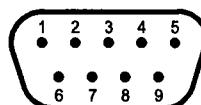
Remote Alarms

SAP CARRIER PRESENCE	1,2
SAP PEAK MODULATION	3,4
PRO CARRIER PRESENCE	5,6
PRO PEAK MODULATION	7,8

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Remote Meters
(J3)

This 9-pin D-type plug is used to connect the optional MP-250 Remote Analog Meter Panel to the TVM-250. The meter panel displays modulation of the SAP and PRO subcarriers on separate standard analog modulation meters. Four LED's provide indications of SAP and PRO PEAK modulation, and presence of CARRIER for both SAP and PRO subcarriers. The connections are pins 1 and 3 (ground) for the SAP meter, and pins 2 and 3 (ground) for the PRO meter. Note that if the Belar MP-250 Analog Meter Panel is not used and remote meters are connected, appropriate meter damping resistors must be placed in series with the remote meters for proper ballistics. Open collectors for the SAP CARRIER and SAP PEAK LED's are at pins 4 and 5 of the connector, respectively. Open collectors for the PRO CARRIER and PRO PEAK LED's appear at pins 6 and 7 of J3, respectively. The output of an internal voltage regulator capable of supplying about 40 millamps at +5V DC for LED operation appears at pin 8, with pin 9 the ground return for the regulator and the open collectors. Summary of pin-out:



Remote Meters

SAP remote modulation meter	1
PRO remote modulation meter	2
REMOTE modulation meter return (SAP, PRO)	3
SAP CARRIER open-collector	4
SAP PEAK open-collector	5
PRO CARRIER open-collector	6
PRO PEAK open-collector	7
+5VDC (40 mA limit)	8
Ground return to open collectors	9

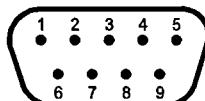
Unit Interface Out
(J2A, top connector)
Unit Interface In
(J2B, bottom connector)

These 15-pin D-type mating jacks are used to connect to other Belar monitors equipped with Wizard Interface jacks, such as the TVM-230 Digital BTSC TV Stereo Monitor/Analyzer, for unified local or remote operation.

RS-232
(J1B, bottom connector)

The standard RS-232 jack is provided for direct computer communications with the TVM-250. If you intend to write software to communicate directly with the TVM-250 using this port, please contact Belar for more information.

<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

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5 Installation and Setup

The TVM-250 is designed to be mounted in a standard 19-inch rack. The unit can be operated from a 100 to 240 VAC single phase, 50-60 Hz power source, with no user adjustments. The fuse should be a 5mm x 20mm type GMA-3 3AMP-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. If a substitute line cord is used, be sure that the ground lead is connected to "G" on the line cord receptacle.

INPUT Determine the output level of the wideband aural baseband output signal supplied by your aural demodulator. The TVM-250 will accommodate input levels ranging from 400 mVrms to 4 Vrms (0.566 to 5.66 volts-peak) for sinewaves modulating the aural carrier to 73 kHz peak deviation. One of two overlapping input ranges is selected by the position of an internal circuit board jumper. The TVM-250 is normally shipped with its input range set for 400 mVrms to 1.9 Vrms for 73 kHz peak deviation. This range accommodates the output of the Belar TVM-100 and TVM-101 aural modulation monitors, which is 1.46 Vrms for 73 kHz peak deviation. (This is 20 mVrms per kHz deviation). Other monitors, such as the Tektronix 1450-1 or Tektronix 1350, which supply 10 mV-peak per kHz peak deviation into 75 Ω (516 mVrms for 73 kHz deviation) also fall into this lower input level range. The input range must be changed only if the input level is above 1.7 Vrms.

To change the input range for higher input levels, remove the cover of the TVM-250. Facing the unit from the front, locate the large A1 metering board on the right side of the unit. (There is a drawing of this board with the jumper locations in *Section 8*.) At the left side of the A1 board, near the back of the unit, is jumper P1. Move jumper P1 from the rear position to the front position (towards the front of the unit). This reduces the input sensitivity. Replace the cover.

Connect the wideband aural output of your modulation monitor (TVM-100/101), or aural demodulator to the INPUT jack (J6) of the TVM-250 using the coaxial connecting cable supplied with the TVM-250. (The TVM-250 input is high-impedance. If it is desired to operate with other demodulators into terminated cables, through-line terminations must be added external to the TVM-250.) The input may be adjusted in one of two ways—either using the 73-kHz deviation calibration signal on the TVM-100/101, or by modulating the aural transmitter to exactly 73 kHz peak deviation. Once the calibration or test level signal has been established, adjust the INPUT ADJUST potentiometer (A1R4) on the rear panel with a small common screwdriver to obtain a **100% TOTAL** reading in the PARAMETER window.

(For demodulators providing calibration signals for other FM modulation levels, or when modulating the aural transmitter with a test signal to other FM deviations, adjust the potentiometer to obtain the corresponding percentage reading in TOTAL. For example, if the aural transmitter is deviated to 25 kHz peak deviation, TOTAL on the TVM-250 should read $(25 \text{ kHz}/73 \text{ kHz}) \times 100 = 34.25\% \approx 34\%$.)

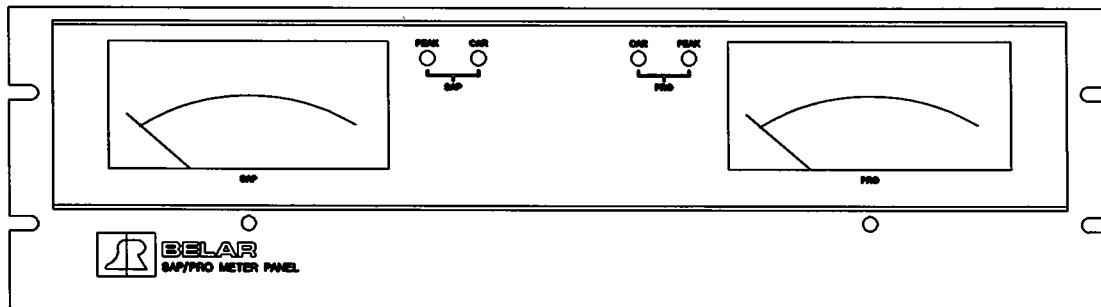
Readings of total aural peak modulation, and readings of the injection levels of the SAP and PRO subcarriers will now be accurate. The TVM-250 is now ready for normal operation.

Connections of related equipment to the TVM-250 are made via rear-panel connectors. Descriptions of the connections are listed in *Section 4 Rear Panel*.

TVM-250 TV SAP/PRO Modulation Monitor

5-1 Accessories

The optional MP-250 Analog Meter Panel consists of two large analog meters, with backlighting, and 4 LED's duplicating the front-panel LED's appearing on the TVM-250 front panel. The analog meters display peak modulation of the SAP and PRO subcarriers with conventional semi-peak ballistics. Function descriptions of the meter panel LED's may be found under "Front Panel Operation" (see Section 3).



Before connecting the MP-250 to the TVM-250, 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 (J3 on the TVM-250. The other end of the cable should be connected to the terminal strip (TB1) on the back of the MP-250 as follows:

Terminal Number	Wire Color
1	Black
2	Red
3	Orange
4	Green
5	Blue
6	White
7	Orange/Black
8	Black/White

MP-250 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.

The Wizard System

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 115 Vac operation, "240" for 230 Vac 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-250 uses line power only to illuminate the meters. It is not required for proper operation of the meters.

MP-250 Calibration:

Remote SAP Meter-

1. Go to "MODIFY SAP" on the TVM-250 Main Menu and enter the loop.
2. Go to "SAP CAL" and select "DEV".
3. Wait until the TVM-250 SAP reading settles, then adjust R1 on the rear of the MP-250 so the Remote SAP Meter reads the same as the SAP indication on the TVM-250.

Remote PRO Meter-

1. Go to "MODIFY PRO" on the TVM-250 Main Menu and enter the loop.
2. Go to "PRO CAL" and select "DEV".
3. Wait until the TVM-250 PRO reading settles, then adjust R8 on the rear of the MP-250 so the Remote PRO Meter reads the same as the PRO indication on the TVM-250.

TVM-250 TV SAP/PRO Modulation Monitor

6 Running the Setup Program

A setup program in the TVM-250 SAP/PRO Monitor is used to configure the unit for special operational characteristics. External communications attributes are set via the setup program. Additionally, certain factory calibration procedures also employ the setup program.

To run the setup program, plug in the TVM-250 (if it is already plugged in, unplug it first) and momentarily press any front panel key while the INITIALIZATION message is being displayed. After a few seconds, the TVM-250 will flash a "RUNNING SETUP" message in the MENU/PARAMETER window before it enters the SETUP menu. The following MENUs and PARAMETER choices will then appear as selected by use of the front panel keys.

For the following prompts, the front panel key responses are:

UP MENU,DN MENU Advances to the next prompt without altering the current setting.

UP PARAM (Λ) Indicates a YES/ON response or changes a parameter.
DN PARAM (V) Indicates a NO/OFF response or changes a parameter.

RESET DEFAULTS ? Resets the TVM-250 to default factory settings including the passwords. Pressing the UP PARAM (Λ) key when this message is displayed will reset the unit to default settings. Pressing any other key will advance to the next menu selection.

The default settings are as follows:

OPTIONS:

BAUD RATE	2400
PASSWORDS	ON
EXT SYNC	ON
INTERFACE	SLAVE

GLOBAL PARAMETERS:

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

The Wizard System

SAP PARAMETERS

SAP PEAK MOD 100%
SAP MUTE AUTO
SAP MUTE 7.5 KHZ
SAP BPF IN
SAP DET BW 10KHZ
SAP AUDIO DBX
SAP CAL OFF

PRO PARAMETERS

PRO PEAK MOD 100%
PRO BPF IN
PRO CAL OFF

MODIFY OPTIONS ?

This menu permits settings of attributes relevant to remote communications with the TVM-250. Pressing the UP PARAM key will allow these options to be modified. Pressing any other key will advance to the next SETUP menu.

BAUD RATE 1200 2400 4800 9600

Selects the communication speed of the RS-232 port. A speed of at least 2400 bps is preferred due to the large amount of real-time data the TVM-250 provides. Setting the TVM-250 to 1200 bps will change the minimum hold time to 1 second (instead of 0.5 seconds). There is no advantage at this time to speeds greater than 2400.

PASSWORDS ON OFF

Enables/Disables password protection of the TVM-250 when it is accessed remotely.

EXT SYNC ON OFF

Enables/Disables the use of the external sync signal the remote computer sends when the TVM-250 is being accessed remotely via the RS-232 port. If the EXT SYNC is on, the TVM-250 will synchronize its timebase to the remote computer to ensure time consistency for logfiles, graphs, and other computer functions. When the external sync is off, the TVM-250 will only use its own internal timeclock for time functions (Hold Time, PPM counts, etc).

TVM-250 TV SAP/PRO Modulation Monitor

**INTERFACE
SLAVE
MASTER** Selects the unit dominance when the TVM-250 is interconnected to other Belar monitors via the Wizard Interface. One, and only one unit on the interface bus may be designated MASTER—all others must be SLAVES. Remote communication would then be done through the RS-232 port of the unit designated MASTER.

EXIT ? Exits the MODIFY OPTIONS ? submenu.

MODIFY ID? Allows changing the ID which is displayed in the Wizard Software when the unit is accessed remotely. Pressing the UP PARAM key enters the modification mode. The display will then read (before the factory default has been altered):

ID<0>=..TVM-250.

This indicates that the current ID is "..TVM-250.", and that the first (0-th) digit is set for modification. To change the ID, use the UP/DOWN PARAM keys. The UP PARAM key scrolls through the 64 ASCII characters which can be represented by the 16-segment LED displays. The DOWN PARAM key steps (or scrolls) through each of the ten digits in the unit ID, so that all digits may be modified. Once editing the ID is complete, pressing either the UP or DOWN MENU key returns to "EXIT ?". Then pressing the UP PARAM key returns the user to the MODIFY ID ? menu entry.

UNIT INFO ? Displays information about the unit. Pressing the UP PARAM key will display information about the unit. The information you will see:

VERSION X.XX	EPROM Version in unit (press the UP MENU key to continue)
SERIAL #25XXXX	Unit Serial Number (press the UP MENU key to continue)

Then press the UP PARAMETER key to return to the UNIT INFO ? menu entry.

The Wizard System

UNIT SETUP?	This menu steps through a calibration procedure to check adjustment of unit in manufacture. The steps and their associated adjustment points are listed below:
TOTAL	A1R20 for peak balance at A1U9, pin 6 A4R22 for 100%
SAP INJ	A5R13 for 15.0 KHZ
SAP DEV	A1R29 for 100%
0 RMS	A1R71 for 0.0 DB
-40 RMS	A1R74 for -40 DB
Note: The previous two adjustments interact. Both potentiometers may require more than one adjustment.	
-50 RMS	A1R67 for -50 DB
PRO INJ	A5R97 so DC voltage at A5U26 pin 11 = voltage at A5U27 pin 6. A5R60 for 3.0 KHZ
PRO DEV	A1R79 for 100%
LF DBX	Modulation should read 16%. Check dbx card for unity gain at this level.
HF DBX	Modulation should read 89%. Check dbx card for unity gain at this level.
EXIT ?	Press UP PARAM key to exit.
TEST RELAY/LED?	Allows the four LED's, open collector remote LED drivers, and remote alarm relays all to be tested. When entered, the display reads and alternates between "RELAY #0 -OPEN" and "RELAY #0 -CLOSE". The appropriate individual front-panel LED, remote LED open-collector driver and remote alarm relay are alternately activated and de-activated. Pressing the UP/DOWN PARAM keys cycles through sets "0" through "3", corresponding to the SAP CARRIER, SAP PEAK modulation, PRO CARRIER, and PRO PEAK modulation indications. Pressing either MENU key takes the user to EXIT?, where pressing the UP PARAM returns the user to the MENU entry.
TEST RS-232 ?	Allows RS-232 port to be tested. Pressing the UP PARAM button once will start the test. The test consists of alternately Tx \$55 and Tx \$AA. The alphanumeric display shows the byte being transmitted and then the byte being received. In addition to the Tx and Rx lines, the DTR line is toggled on the Tx and the CD line status is displayed on the Rx.

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EXIT SETUP ? Press the UP PARAM button to exit the setup program and return the unit to normal operation.

7 Remote Communications with the TVM-250

The TVM-250 is designed to interface with other Belar monitors equipped with the Wizard Interface, including the TVM-230 BTSC TV Stereo Monitor/Analyzer. This permits combined remote operation with The Wizard Software. For details on how to configure your TVM-250 and The Wizard Software, please refer to the on-line help available in the software.

The TVM-250 can also be accessed directly through its RS-232 serial connector, using either The Wizard Software or user-written software. If you plan to write software to access the TVM-250 directly, please contact Belar for more information.

The Wizard System

8 Diagrams, Schematics and Parts Lists

Replaceable Parts. This page contains information for ordering replaceable parts for the monitor. 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. Please have the above information handy when you call.

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

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):

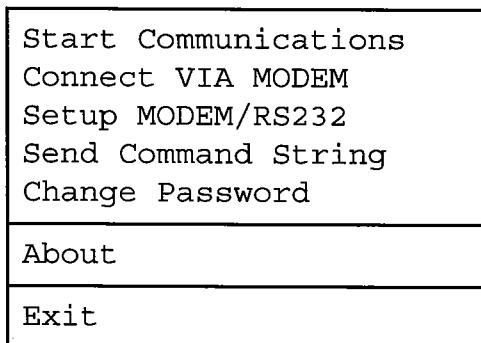
<u>PC</u>	<==>	<u>Belar Unit</u>
2 - Rx	<==	3 - Tx
3 - Tx	==>	2 - Rx
5 - GND	<==>	5 - GND

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:



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	<==	3 - Tx
3 - Tx	==>	2 - Rx
7 - GND	<==>	5 - GND
8 - CD	==>	1 - CD
20 - DTR	<==	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

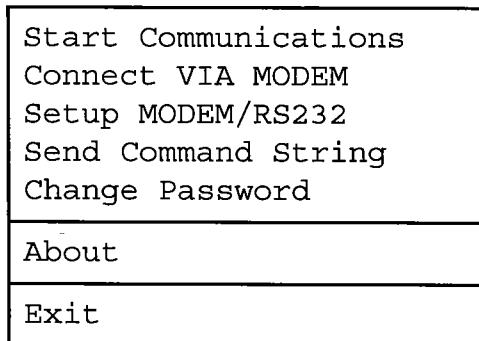
ATS0=n Puts modem in Auto-Answer mode, where "n" is the number of rings desired before the call will be answered. Note: "n" cannot equal 0 (we suggest n=1).

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.

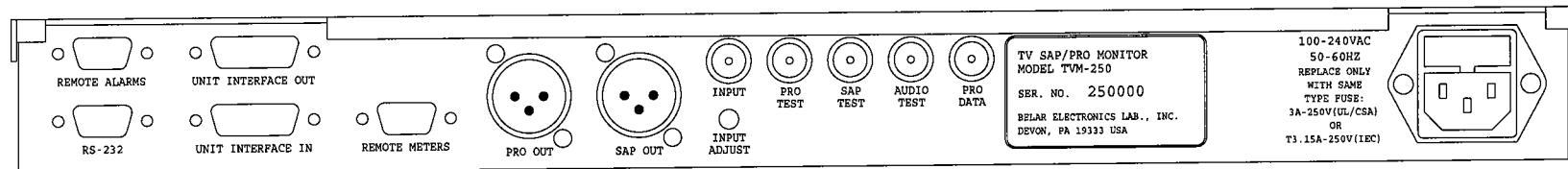
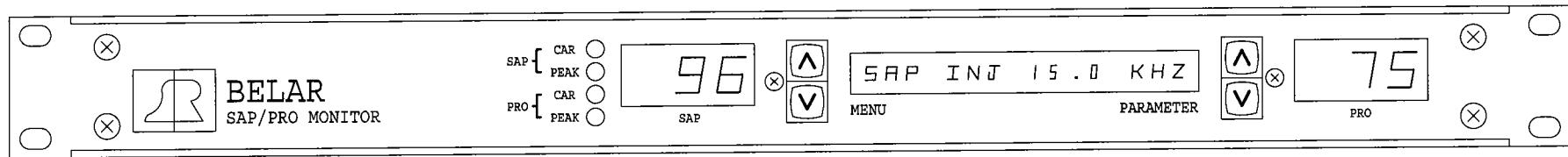
Some modems have various data compression schemes to increase the apparent speed under certain circumstances. Be sure to configure your modem to disable such compression schemes. Refer to your modem and communication software manuals if you encounter problems.

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:



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**.

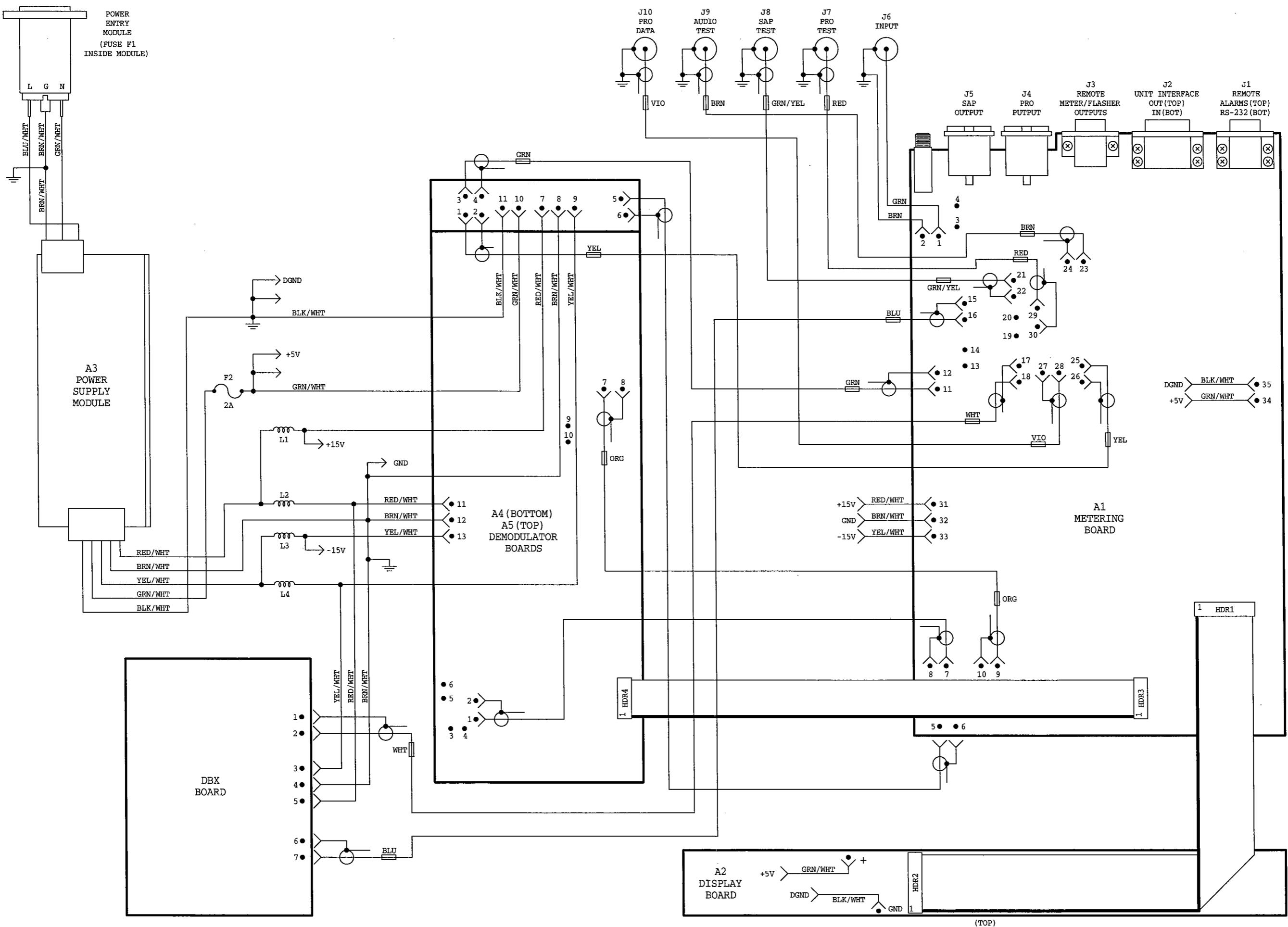


TVM-250 FRONT & REAR VIEW
BELAR ELECTRONICS

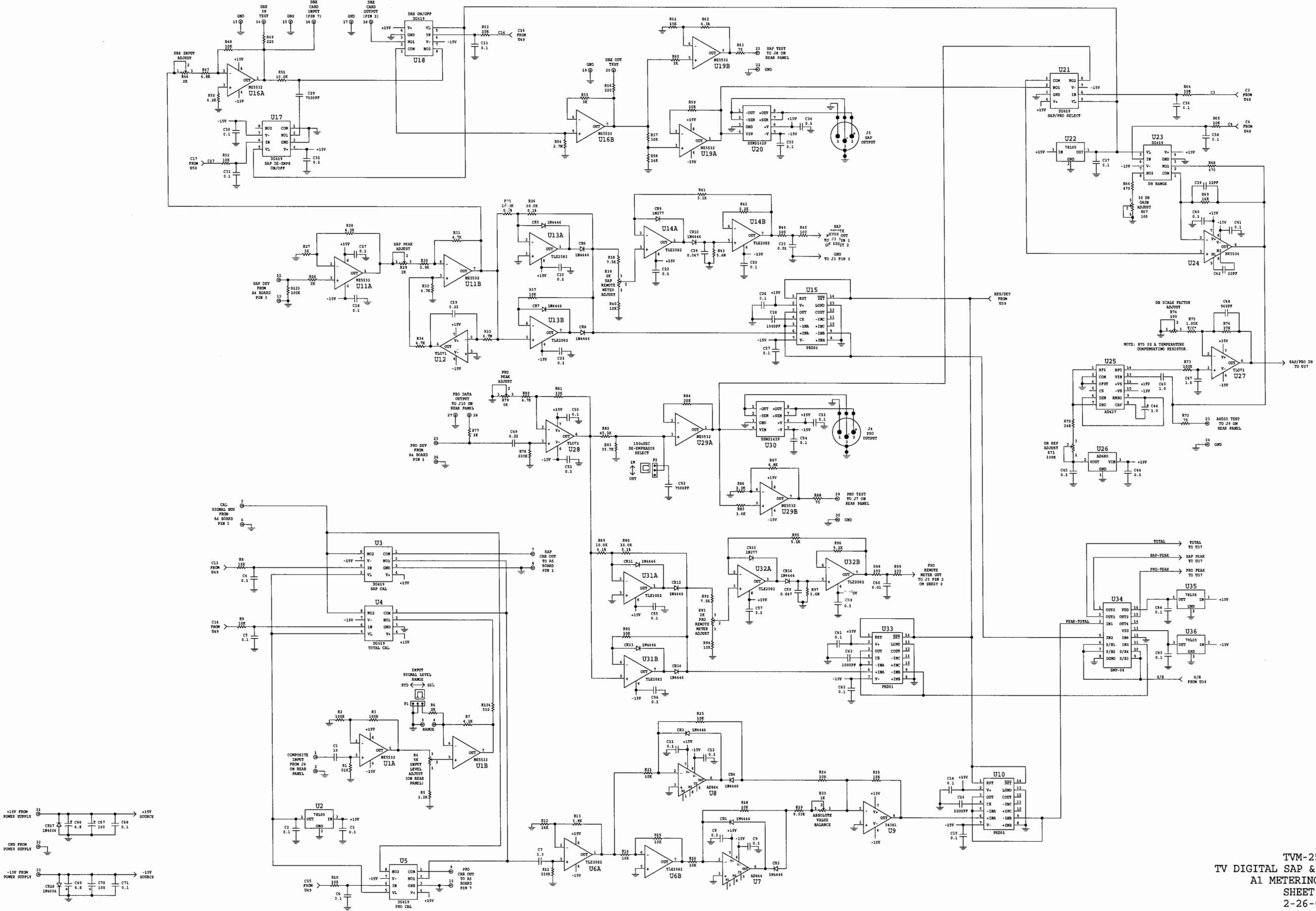
TVM-250 PARTS LISTS

MAIN CHASSIS

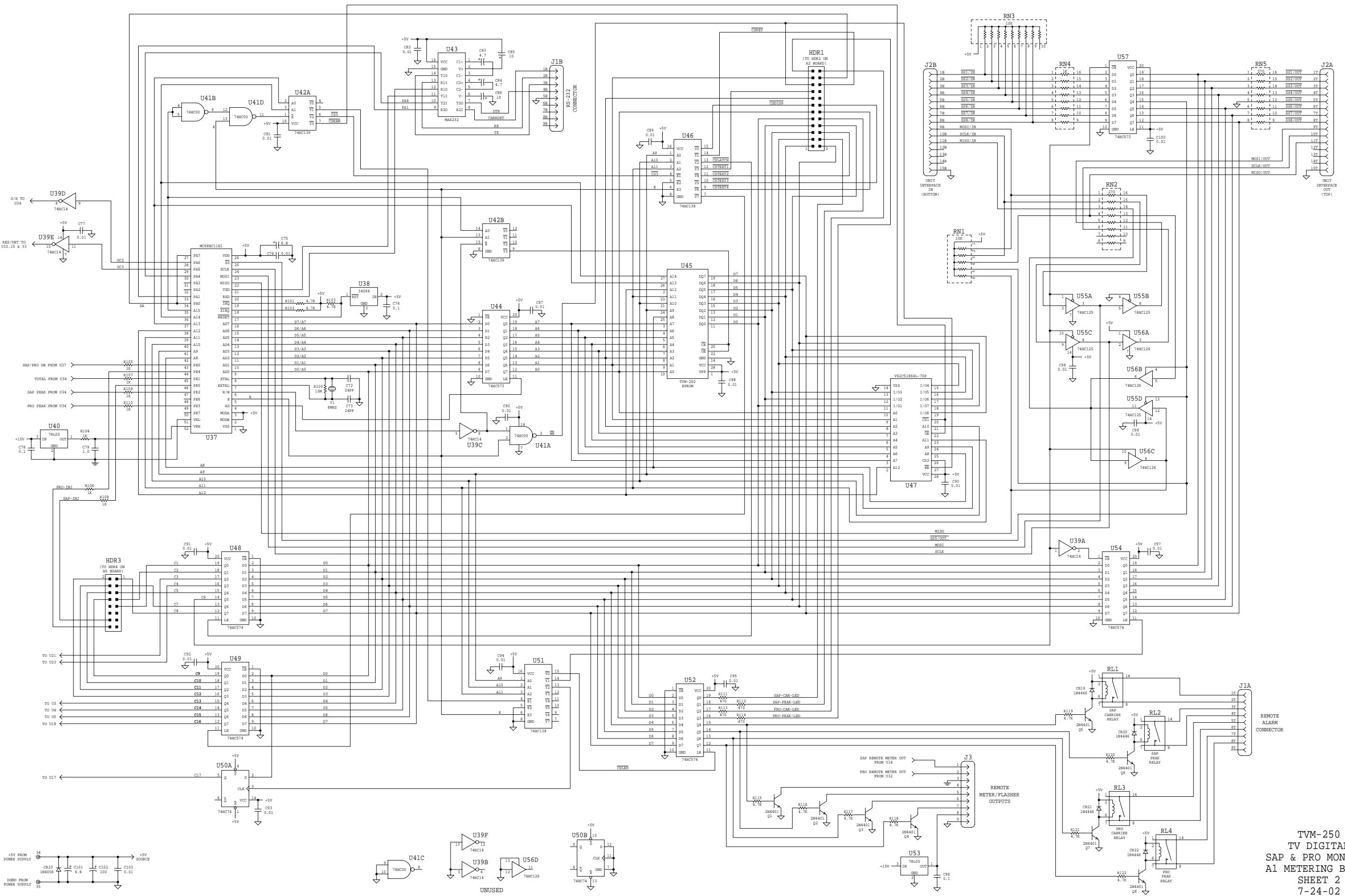
Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE: 30W	4005-0020A
-- F1	POWER ENTRY MODULE: 6EGG1-1 FUSE: GMA-3A 250V(UL/CSA) or T3.15A-250V(IEC)	0360-0021 2110-0009
-- F2	FUSE HOLDER: CHASSIS MOUNT FUSE: AGC-2A 250V	2110-0010 2110-0006
J6 thru J10	JACK: BNC	0360-0005
L1 thru L4	CHOKE: RF	9140-0011
-- --	FLAT CABLE ASSEMBLY: 24 CONDUCTOR FLAT CABLE ASSEMBLY: 16 CONDUCTOR	8900-0010 8900-0011
--	LINE CORD	8120-0002



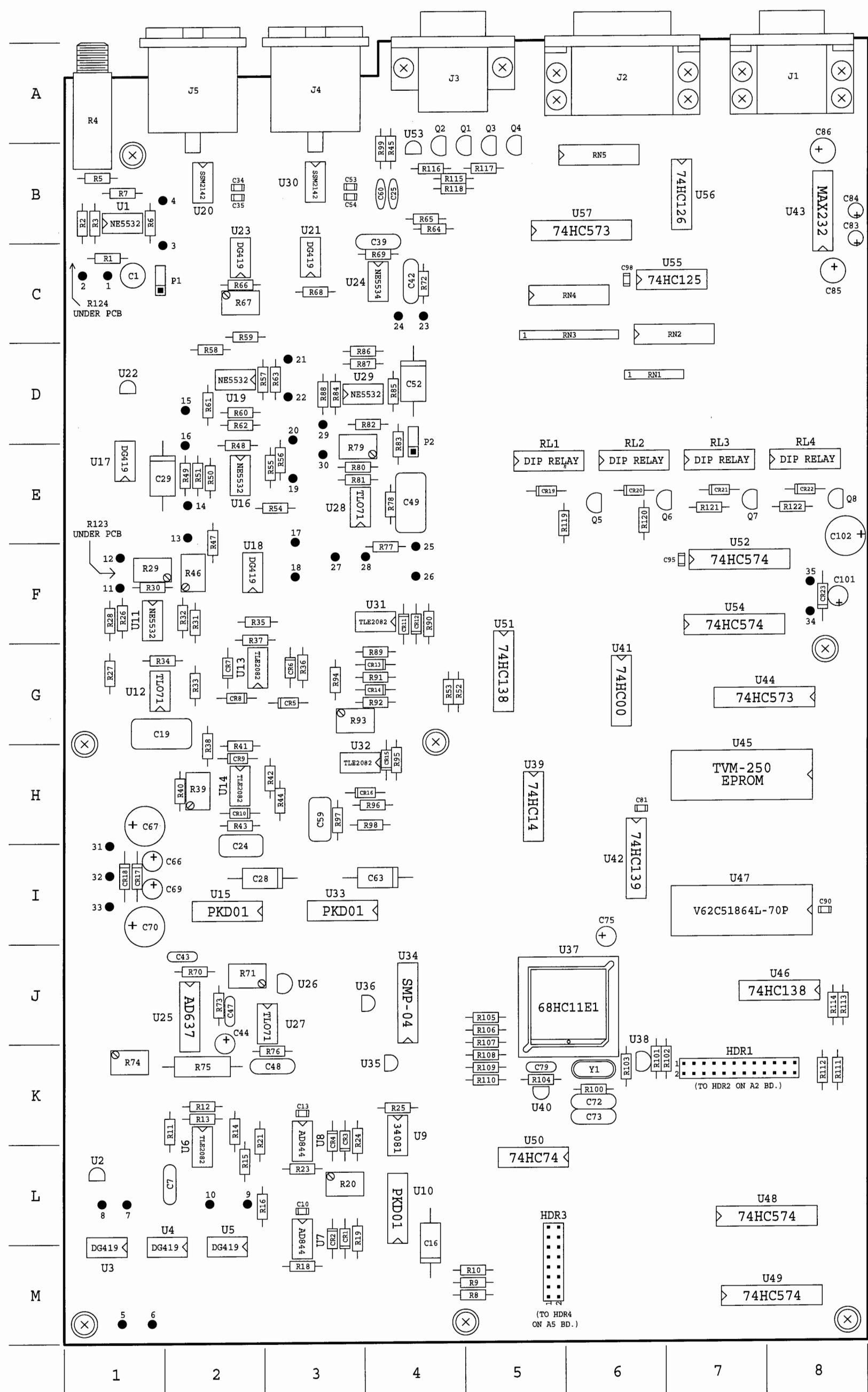
TVM-250
TV DIGITAL
SAP/PRO MONITOR
CHASSIS WIRING
BELAR ELECTRONICS
7-17-00



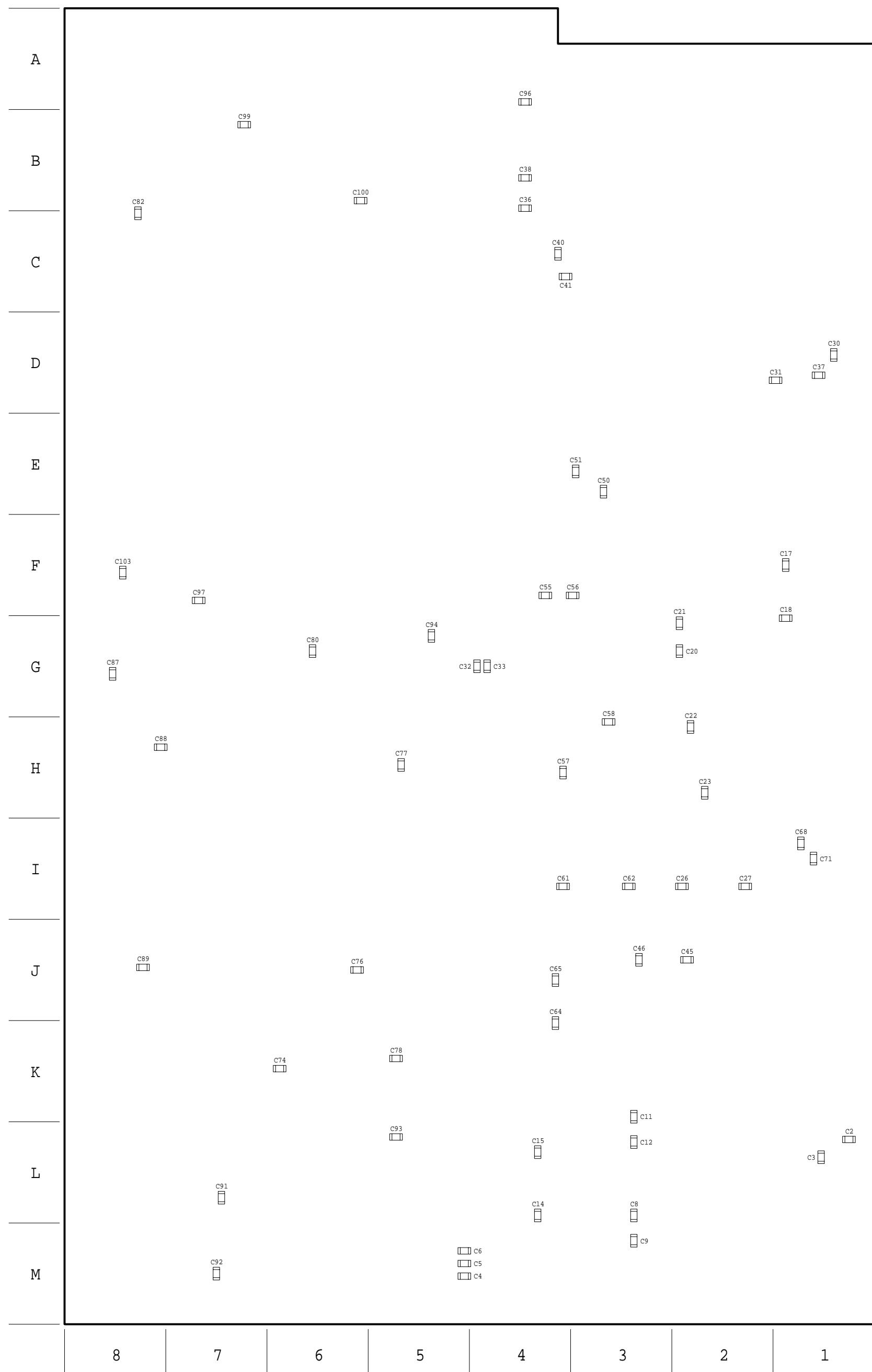
TVM-250
TV DIGITAL SAP & PRO MONITOR
A1 METERING BOARD
SHEET 1
2-26-04



TVM-250
TV DIGITAL
P & PRO MONITOR
METERING BOARD
SHEET 2
7-24-02



TVM-250 A1 BOARD
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS



TVM-250 A1 BOARD
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS

TVM-250 A1 BOARD
PART LOCATIONS
cont.

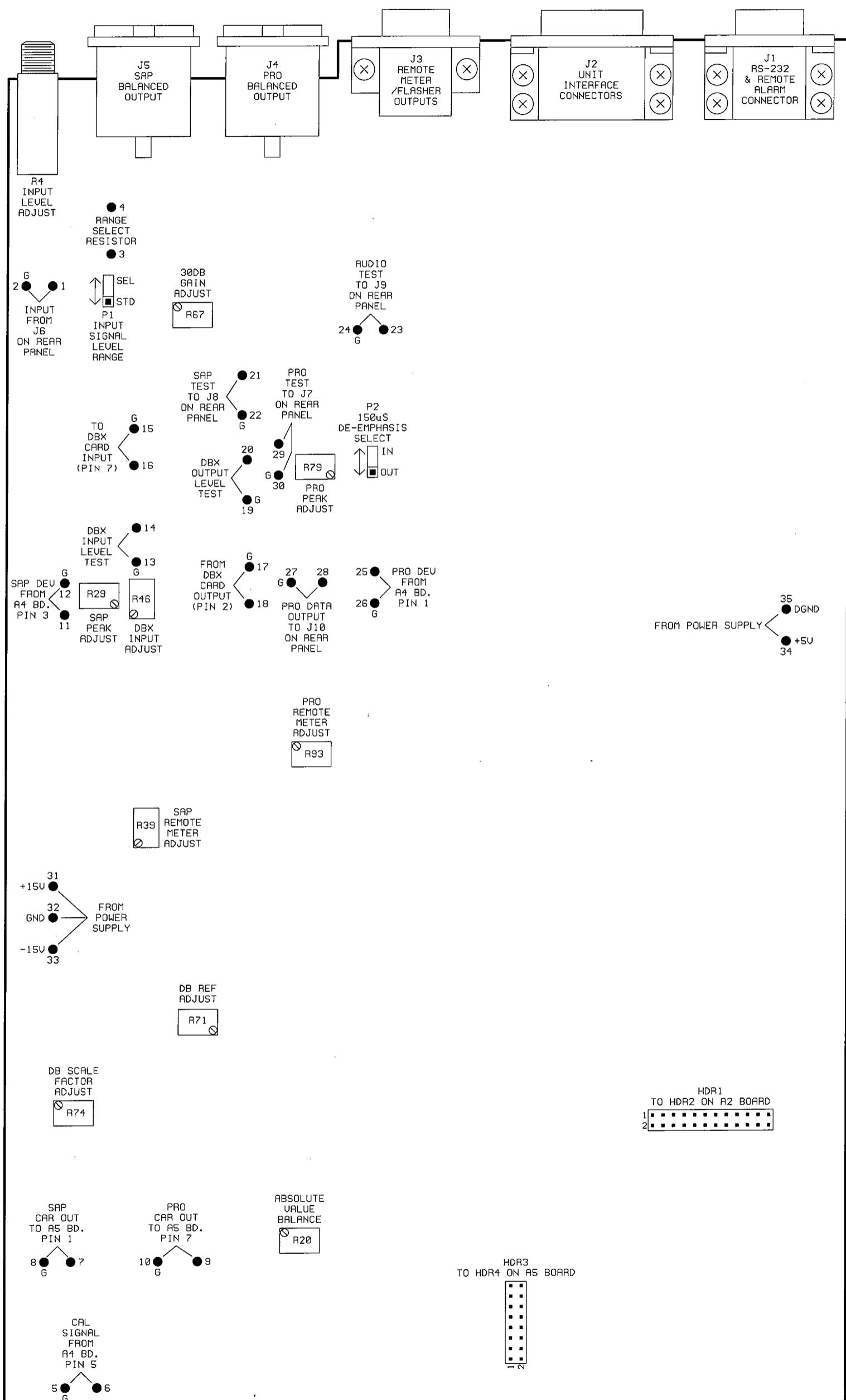
Desig/Loc Desig/Loc

C1	C1	C50	E3*	C99	B7*	Q8	E8	R48	E2	R97	H3
C2	L1*	C51	E3*	C100	B6*			R49	E2	R98	H4
C3	L1*	C52	D4	C101	F8	R1	C1	R50	E2	R99	B4
C4	M5*	C53	B3	C102	E8	R2	B1	R51	E2	R100	K6
C5	M5*	C54	B3	C103	F8*	R3	B1	R52	G4	R101	K6
C6	M5*	C55	F4*			R4	A1	R53	G4	R102	K6
C7	L2	C56	F3*	CR1	L3	R5	B1	R54	E3	R103	K6
C8	L3*	C57	H4*	CR2	L3	R6	B1	R55	E3	R104	K5
C9	M3	C58	H3*	CR3	K3	R7	B1	R56	E3	R105	J5
C10	L3*	C59	H3	CR4	K3	R8	M5	R57	D2	R106	J5
C11	K3*	C60	B4	CR5	G3	R9	M5	R58	D2	R107	J5
C12	L3*	C61	I4*	CR6	G3	R10	M5	R59	C2	R108	K5
C13	K3	C62	I3*	CR7	G2	R11	K2	R60	D2	R109	K5
C14	L4*	C63	I4	CR8	G2	R12	K2	R61	D2	R110	K5
C15	L4*	C64	K4*	CR9	H2	R13	K2	R62	D2	R111	K8
C16	L4	C65	J4*	CR10	H2	R14	K2	R63	D3	R112	K8
C17	F1*	C66	I1	CR11	F4	R15	L2	R64	B4	R113	J8
C18	G1*	C67	H1	CR12	F4	R16	L2	R65	B4	R114	J8
C19	G1	C68	I1*	CR13	G4	R17	L3	R66	C2	R115	B4
C20	G2*	C69	I1	CR14	G4	R18	M3	R67	C2	R116	B4
C21	G2*	C70	I1	CR15	H4	R19	L3	R68	C3	R117	B5
C22	H2*	C71	I1*	CR16	H3	R20	L3	R69	C4	R118	B4
C23	H2*	C72	K6	CR17	I1	R21	K2	R70	J2	R119	E5
C24	I2	C73	K6	CR18	I1	R22	K3	R71	J2	R120	E6
C25	B4	C74	K6*	CR19	E5	R23	L3	R72	C4	R121	E7
C26	I2*	C75	I6	CR20	E6	R24	K3	R73	J2	R122	E8
C27	I2*	C76	J6*	CR21	E7	R25	K4	R74	K1	R123	F1*
C28	I2	C77	H5*	CR22	E8	R26	F1	R75	K2	R124	C1*
C29	E1	C78	K5*	CR23	F8	R27	G1	R76	K3		
C30	D1*	C79	K5			R28	F1	R77	F4	RL1	E5
C31	D1*	C80	G6*	HDR1	K7	R29	F1	R78	E4	RL2	E6
C32	G4*	C81	H6	HDR3	M5	R30	F1	R79	E3	RL3	E7
C33	G4*	C82	C8*			R31	F2	R80	E3	RL4	E8
C34	B2	C83	C8	J1	A8	R32	F2	R81	E3		
C35	B2	C84	B8	J2	A6	R33	G2	R82	D4	RN1	D6
C36	B4*	C85	C8	J3	A4	R34	G1	R83	E4	RN2	C7
C37	D1*	C86	B8	J4	A3	R35	F2	R84	D3	RN3	C5
C38	B4*	C87	G8*	J5	A2	R36	G3	R85	D4	RN4	C6
C39	B4	C88	H8*			R37	F2	R86	D3	RN5	B6
C40	C4*	C89	J8*	P1	C1	R38	H2	R87	D3		
C41	C4*	C90	I8	P2	D4	R39	H2	R88	D3	U1	B1
C42	C4	C91	L7*			R40	H2	R89	G4	U2	L1
C43	J2	C92	M7*	Q1	B4	R41	H2	R90	F4	U3	M1
C44	J2	C93	L5*	Q2	B4	R42	H3	R91	G4	U4	M2
C45	J2*	C94	G5*	Q3	B5	R43	H2	R92	G4	U5	M2
C46	J3*	C95	F7	Q4	B5	R44	H3	R93	G3	U6	L2
C47	J2	C96	A4*	Q5	E6	R45	B4	R94	G3	U7	L3
C48	K3	C97	F7*	Q6	E6	R46	F2	R95	H4	U8	K3
C49	E4	C98	C6	Q7	E7	R47	E2	R96	H4	U9	K4

TVM-250 A1 BOARD
PART LOCATIONS
cont.

Desig/Loc Desig/Loc

U10	L4	Y1	K6
U11	F1		
U12	G1	<u>pins</u>	
U13	G2	1	C1
U14	H2	2	C1
U15	I2	3	C1
U16	E2	4	B1
U17	E1	5	M1
U18	F2	6	M1
U19	D2	7	L1
U20	B2	8	L1
U21	C3	9	L2
U22	D1	10	L2
U23	C2	11	F1
U24	C4	12	F1
U25	J2	13	E2
U26	J3	14	E2
U27	J3	15	D2
U28	E3	16	E2
U29	D3	17	E3
U30	B3	18	F3
U31	F4	19	E3
U32	H3	20	D3
U33	I3	21	D3
U34	J4	22	D3
U35	K4	23	D3
U36	J4	24	C4
U37	J6	25	F4
U38	K6	26	F4
U39	H5	27	F3
U40	K5	28	F3
U41	G6	29	D3
U42	I6	30	E3
U43	B8	31	I1
U44	G7	32	I1
U45	H7	33	I1
U46	J8	34	F8
U47	I7	35	F8
U48	L7		
U49	M8		
U50	L5		
U51	G5		
U52	F7		
U53	B4		
U54	F7		
U55	C7		
U56	B7		
U57	B6		



TUM-250 A1 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

Reference Designation	Description	Part Number
C1	C: FIXED ELEC 10uF 35V NON-POLAR	0180-0029
C2 thru C6	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C7	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C8 thru C15	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C16	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C17,C18	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C19	C: FIXED FILM 0.22uF 10% 100V	0122-2241
C20 thru C23	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C24	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C25	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C26,C27	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C28	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C29	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C30 thru C38	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C39	C: FIXED MICA 12pF 5%	0140-1205
C40,C41	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C42	C: FIXED MICA 22pF 5%	0140-2205
C43	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C44	C: FIXED TANT 1.0uF 35V	0185-0006
C45,C46	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C47	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C48	C: FIXED MICA 560pF 5%	0140-5615
C49	C: FIXED FILM 0.22uF 10% 100V	0122-2241
C50,C51	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C52	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C53 thru C58	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C59	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C60	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C61,C62	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C63	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C64,C65	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C66	C: FIXED TANT 6.8uF 25V	0185-0002
C67	C: FIXED ELEC 100uF 35V	0180-0018
C68	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C69	C: FIXED TANT 6.8uF 25V	0185-0002
C70	C: FIXED ELEC 100uF 35V	0180-0018
C71	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C72,C73	C: FIXED MICA 24pF 5%	0140-2405
C74	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C75	C: FIXED TANT 6.8uF 25V	0185-0002
C76,C77	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C78	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C79	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C80 thru C82	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C83,C84	C: FIXED TANT 4.7uF 10V	0185-0001
C85,C86	C: FIXED TANT 10uF 16V	0185-0007
C87 thru C95	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C96	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C97 thru C100	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C101	C: FIXED TANT 6.8uF 25V	0185-0002

A1 BOARD TVM-250 cont.

Reference Designation	Description	Part Number
C102	C: FIXED ELEC 100uF 35V	0180-0018
C103	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
CR1 thru CR8	DIODE: 1N4446	1900-0002
CR9	DIODE: 1N277 GERMANIUM	1900-0001
CR10 thru CR14	DIODE: 1N4446	1900-0002
CR15	DIODE: 1N277 GERMANIUM	1900-0001
CR16	DIODE: 1N4446	1900-0002
CR17, CR18	DIODE: 1N4006	1900-0016
CR19 thru CR22	DIODE: 1N4446	1900-0002
CR23	DIODE: 1N4006	1900-0016
HDR1	HEADER: 24 PIN	0361-0024
HDR3	HEADER: 16 PIN	0361-0016
J1	CONNECTOR: "D" DUAL 9 PIN	0360-0034
J2	CONNECTOR: "D" DUAL 15 PIN	0360-0033
J3	CONNECTOR: "D" SINGLE 9 PIN	0360-0036
J4, J5	CONNECTOR: "XLR" MALE	0360-0046
P1, P2	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 PIN (USED WITH P1 & P2)	0365-0028
Q1 thru Q8	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 51k 2% 1/4W	0751-5132
R2, R3	R: METAL FILM 100k 2% 1/4W	0751-1042
R4	R: VAR COMP 5k, 10 TURN	2100-0026
R5	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R6	R: METAL FILM 2k 2% 1/4W	0751-2022
R7	R: METAL FILM 4.3k 2% 1/4W	0751-4322
R8 thru R10	R: METAL FILM 10k 2% 1/4W	0751-1032
R11	R: METAL FILM 220k 2% 1/4W	0751-2242
R12	R: METAL FILM 24k 2% 1/4W	0751-2432
R13	R: METAL FILM 3.9k 2% 1/4W	0751-3922
R14 thru R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17*	R: METAL FILM 3k 2% 1/4W	0751-3022
*R17 not used when U7 is an AD844 IC.		
R18	R: METAL FILM 10k 2% 1/4W	0751-1032
R19	R: METAL FILM 9.53k 1%	0721-9531
R20	R: VAR COMP 1k, 10 TURN	2100-0021
R21	R: METAL FILM 10k 2% 1/4W	0751-1032
R22*	R: METAL FILM 3k 2% 1/4W	0751-3022
*R22 not used when U8 is an AD844 IC.		
R23 thru R25	R: METAL FILM 10k 2% 1/4W	0751-1032
R26	R: METAL FILM 2k 2% 1/4W	0751-2022
R27	R: METAL FILM 3k 2% 1/4W	0751-3022
R28	R: METAL FILM 6.2k 2% 1/4W	0751-6222
R29	R: VAR COMP 2k, 10 TURN	2100-0031
R30	R: METAL FILM 3.9k 2% 1/4W	0751-3922

A1 BOARD TVM-250 cont.

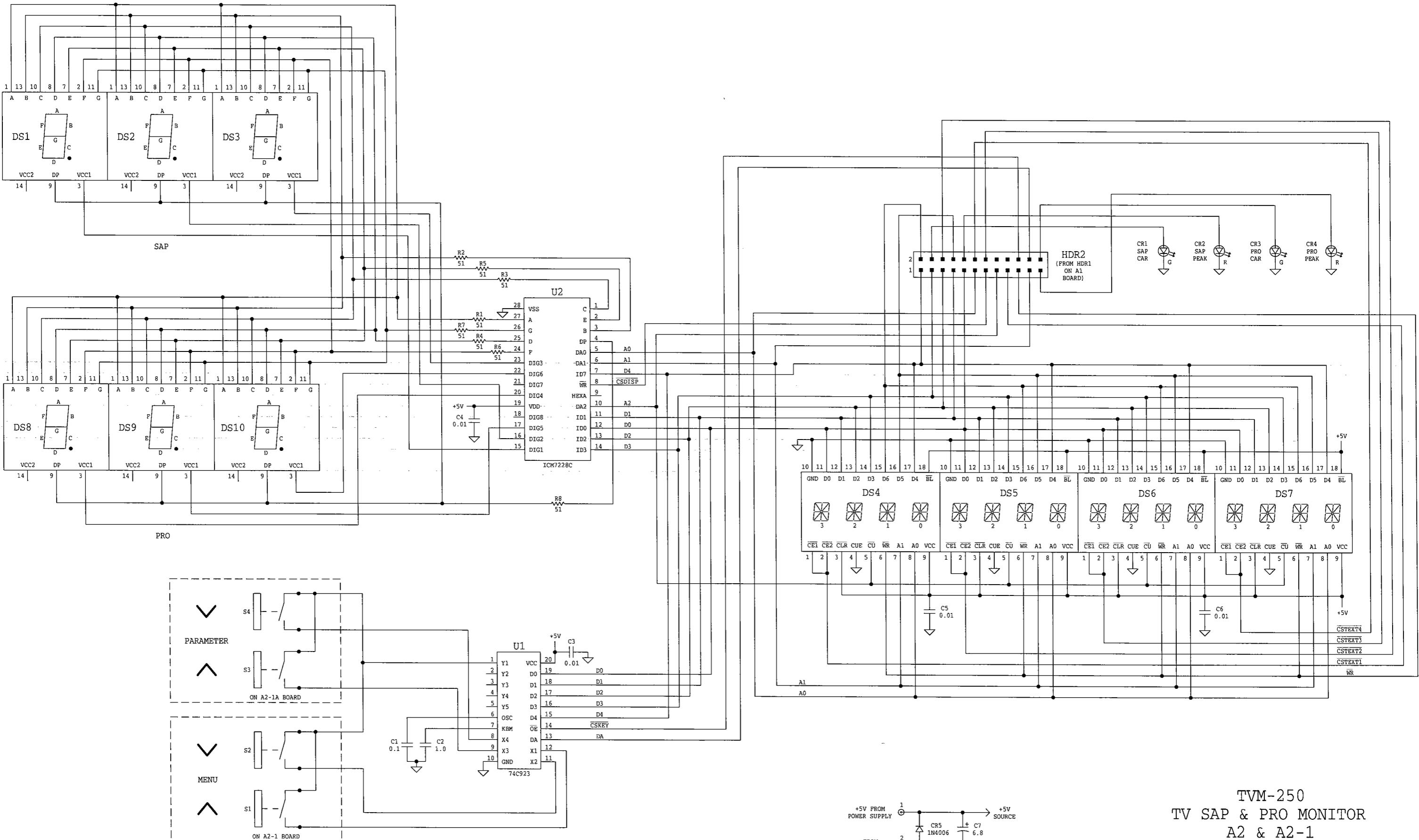
Reference Designation	Description	Part Number
R31, R32	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R33	R: FIXED CARBON 4.7M 5% 1/4W	0683-4755
R34	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R35, R36	R: METAL FILM 10.0k 0.1%	0711-1002
R37	R: METAL FILM 10k 2% 1/4W	0751-1032
R38	R: METAL FILM 7.5k 2% 1/4W	0751-7522
R39	R: VAR COMP 2k, 10 TURN	2100-0031
R40	R: METAL FILM 10k 2% 1/4W	0751-1032
R41, R42	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R43	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R44, R45	R: METAL FILM 100 2% 1/4W	0751-1012
R46	R: VAR COMP 2k, 10 TURN	2100-0031
R47	R: METAL FILM 6.8k 2% 1/4W	0751-6822
R48	R: METAL FILM 10k 2% 1/4W	0751-1032
R49	R: METAL FILM 220 2% 1/4W	0751-2212
R50	R: METAL FILM 4.3k 2% 1/4W	0751-4322
R51	R: METAL FILM 10.0k 1%	0721-1002
R52, R53	R: METAL FILM 10k 2% 1/4W	0751-1032
R54	R: FIXED CARBON 2.7M 5% 1/4W	0683-2755
R55	R: METAL FILM 3k 2% 1/4W	0751-3022
R56	R: METAL FILM 220 2% 1/4W	0751-2212
R57	R: METAL FILM 30k 2% 1/4W	0751-3032
R58	R: METAL FILM 16k 2% 1/4W	0751-1632
R59	R: METAL FILM 10k 2% 1/4W	0751-1032
R60	R: METAL FILM 3k 2% 1/4W	0751-3022
R61	R: METAL FILM 10k 2% 1/4W	0751-1032
R62	R: METAL FILM 4.3k 2% 1/4W	0751-4322
R63	R: METAL FILM 75 2% 1/4W	0751-7502
R64, R65	R: METAL FILM 10k 2% 1/4W	0751-1032
R66	R: METAL FILM 470 2% 1/4W	0751-4712
R67	R: VAR COMP 100, 10 TURN	2100-0022
R68	R: METAL FILM 470 2% 1/4W	0751-4712
R69	R: METAL FILM 16k 2% 1/4W	0751-1632
R70	R: METAL FILM 24k 2% 1/4W	0751-2432
R71	R: VAR COMP 100k, 10 TURN	2100-0030
R72	R: METAL FILM 75 2% 1/4W	0751-7502
R73	R: METAL FILM 100k 1%	0721-1003
R74	R: VAR COMP 100, 10 TURN	2100-0022
R75	R: TEMP COMPENSATING 1.00k 1%	0791-1001
R76	R: METAL FILM 27k 2% 1/4W	0751-2732
R77	R: METAL FILM 1k 2% 1/4W	0751-1022
R78	R: METAL FILM 220k 2% 1/4W	0751-2242
R79	R: VAR COMP 5k, 10 TURN	2100-0020
R80	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R81	R: METAL FILM 13k 2% 1/4W	0751-1332
R82	R: METAL FILM 45.3k 1%	0721-4532
R83	R: METAL FILM 35.7k 1%	0721-3572
R84	R: METAL FILM 20k 2% 1/4W	0751-2032
R85	R: METAL FILM 1.6k 2% 1/4W	0751-1622
R86	R: METAL FILM 2.2k 2% 1/4W	0751-2222

A1 BOARD TVM-250 cont.

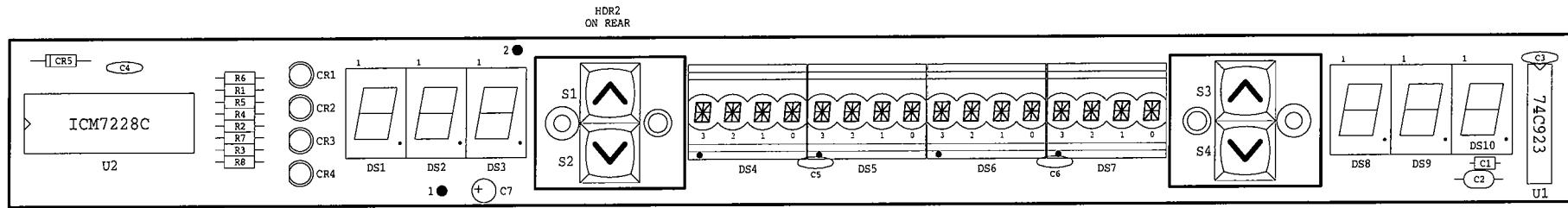
Reference Designation	Description	Part Number
R87	R: METAL FILM 6.8k 2% 1/4W	0751-6822
R88	R: METAL FILM 75 2% 1/4W	0751-7502
R89, R90	R: METAL FILM 10.0k 0.1%	0711-1002
R91	R: METAL FILM 10k 2% 1/4W	0751-1032
R92	R: METAL FILM 7.5k 2% 1/4W	0751-7522
R93	R: VAR COMP 2k, 10 TURN	2100-0031
R94	R: METAL FILM 10k 2% 1/4W	0751-1032
R95, R96	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R97	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R98, R99	R: METAL FILM 100 2% 1/4W	0751-1012
R100	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R101 thru R103	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R104 thru R110	R: METAL FILM 1k 2% 1/4W	0751-1022
R111 thru R114	R: METAL FILM 470 2% 1/4W	0751-4712
R115 thru R122	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R123*	R: METAL FILM 100k 2% 1/4W	0751-1042
R124*	R: METAL FILM 510 2% 1/4W *R123 & R124 are under PCB	0751-5112
RL1 thru RL4	RELAY: JWD-107-1 (or HE721A6341)	1600-0007
RN1	R: NETWORK 6 PIN 10k	0906-1032
RN2	R: NETWORK 16 PIN DIP 270	0908-2712
RN3	R: NETWORK 10 PIN 10k	0910-1032
RN4	R: NETWORK 16 PIN DIP 1k	0908-1022
RN5	R: NETWORK 16 PIN DIP 270	0908-2712
U1	IC: NE5532	1826-0037
U2	IC: 78LO5CP	1826-0012
U3 thru U5	IC: DG419	1827-0011
U6	IC: TLE2082	1826-0069
U7, U8*	IC: AD844 *prior to Feb, 2004 U7 & U8 were the LM318 IC.	1826-0052
U9	IC: MC34081	1826-0041
U10	IC: PKD01	1827-0001
U11	IC: NE5532	1826-0037
U12	IC: TLO71	1826-0004
U13, U14	IC: TLE2082	1826-0069
U15	IC: PKD01	1827-0001
U16	IC: NE5532	1826-0037
U17, U18	IC: DG419	1827-0011
U19	IC: NE5532	1826-0037
U20	IC: SSM2142P	1827-0005
U21	IC: DG419	1827-0011
U22	IC: 78LO5CP	1826-0012
U23	IC: DG419	1827-0011
U24	IC: NE5534	1826-0025
U25	IC: AD637	1827-0003
U26	IC: AD680	1826-0051
U27, U28	IC: TLO71	1826-0004

A1 BOARD TVM-250 cont.

Reference Designation	Description	Part Number
U29	IC: NE5532	1826-0037
U30	IC: SSM2142P	1827-0005
U31, U32	IC: TLE2082	1826-0069
U33	IC: PKD01	1827-0001
U34	IC: SMP04	1827-0004
U35	IC: 78L08CP	1826-0058
U36	IC: 79L05CP	1826-0017
U37	IC: MC68HC11E1	1840-0010
U38	IC: MC34064	1826-0048
U39	IC: 74HC14A	1822-0042
U40	IC: 78L05ACP	1826-0012
U41	IC: 74HC00	1822-0039
U42	IC: 74HC139A	1822-0048
U43	IC: MAX232	1823-0001
U44	IC: 74HC573	1822-0052
U45	IC: TVM-250 EPROM	1840-0011D
U46	IC: 74HC138	1822-0047
U47	IC: V62C51864L-70P	1840-0005
U48, U49	IC: 74HC574	1822-0053
U50	IC: 74HC74	1822-0067
U51	IC: 74HC138	1822-0047
U52	IC: 74HC574	1822-0053
U53	IC: 78L05CP	1826-0012
U54	IC: 74HC574	1822-0053
U55	IC: 74HC125	1822-0045
U56	IC: 74HC126A	1822-0046
U57	IC: 74HC573	1822-0052
Y1	XTAL: 8 MHz	0411-0005



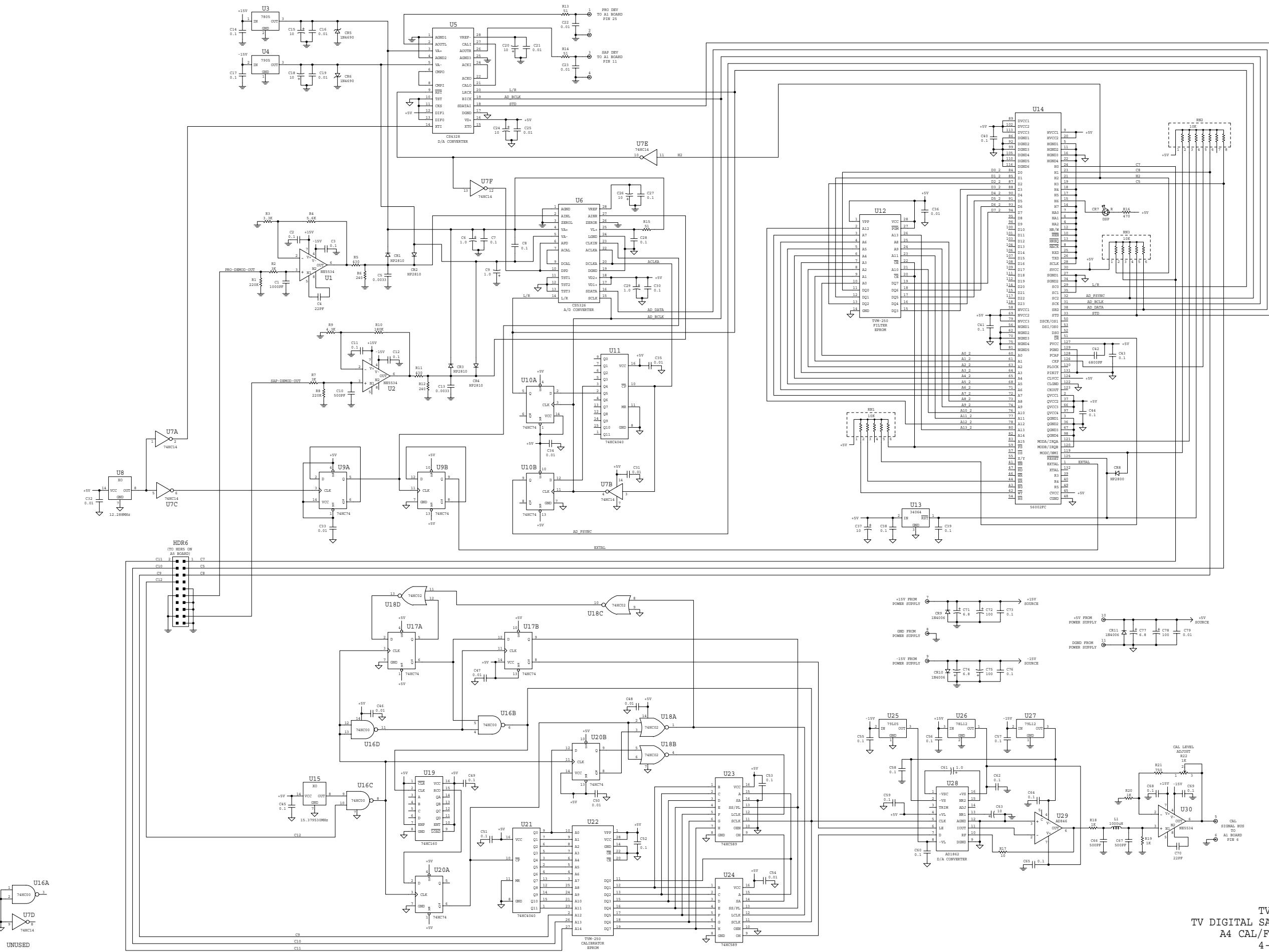
TVM-250
TV SAP & PRO MONITOR
A2 & A2-1
REV. A
DISPLAY BOARDS
6-5-03



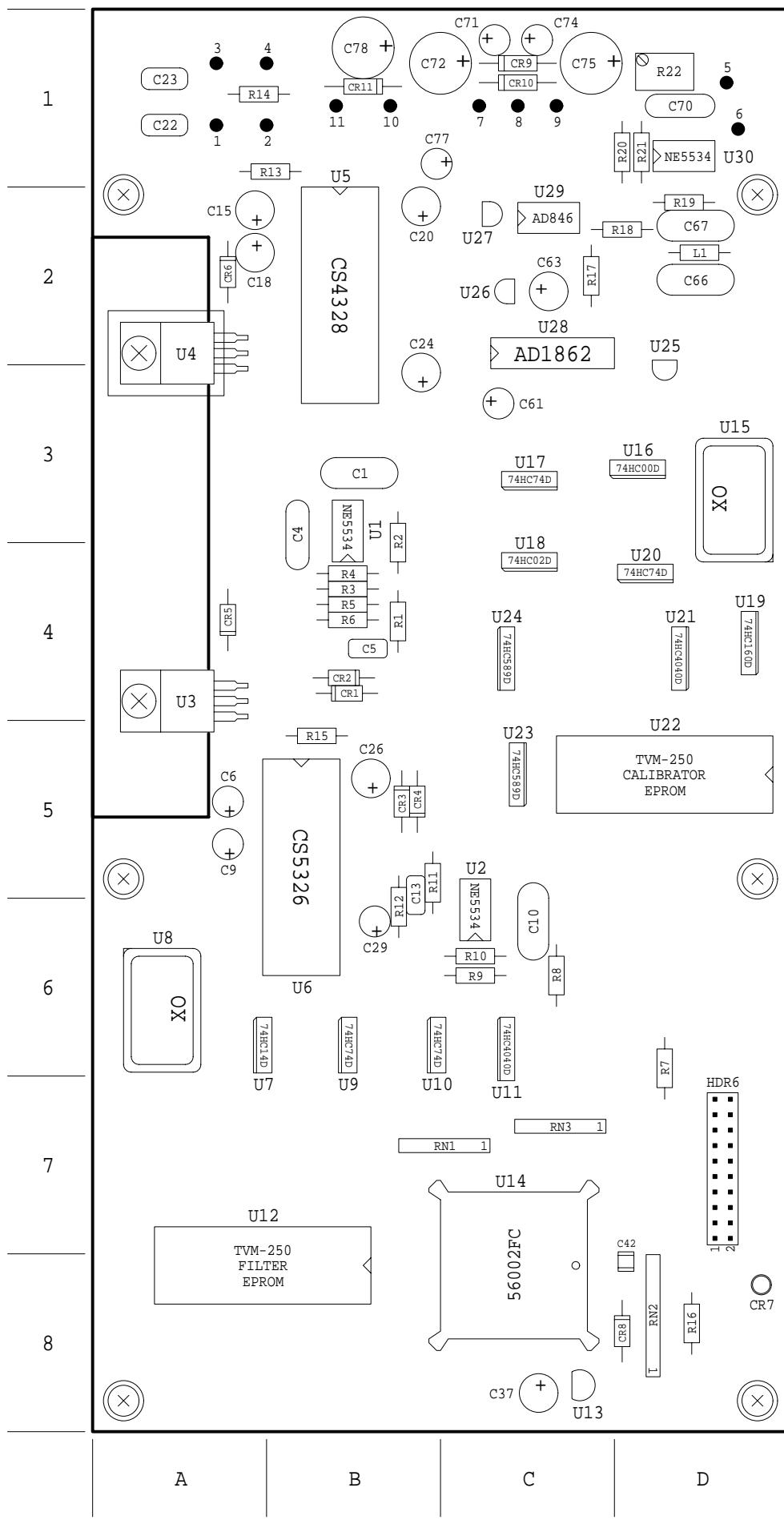
TVM-250 A2
REV. A
DISPLAY BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

A2 BOARD TVM-250, REV. A

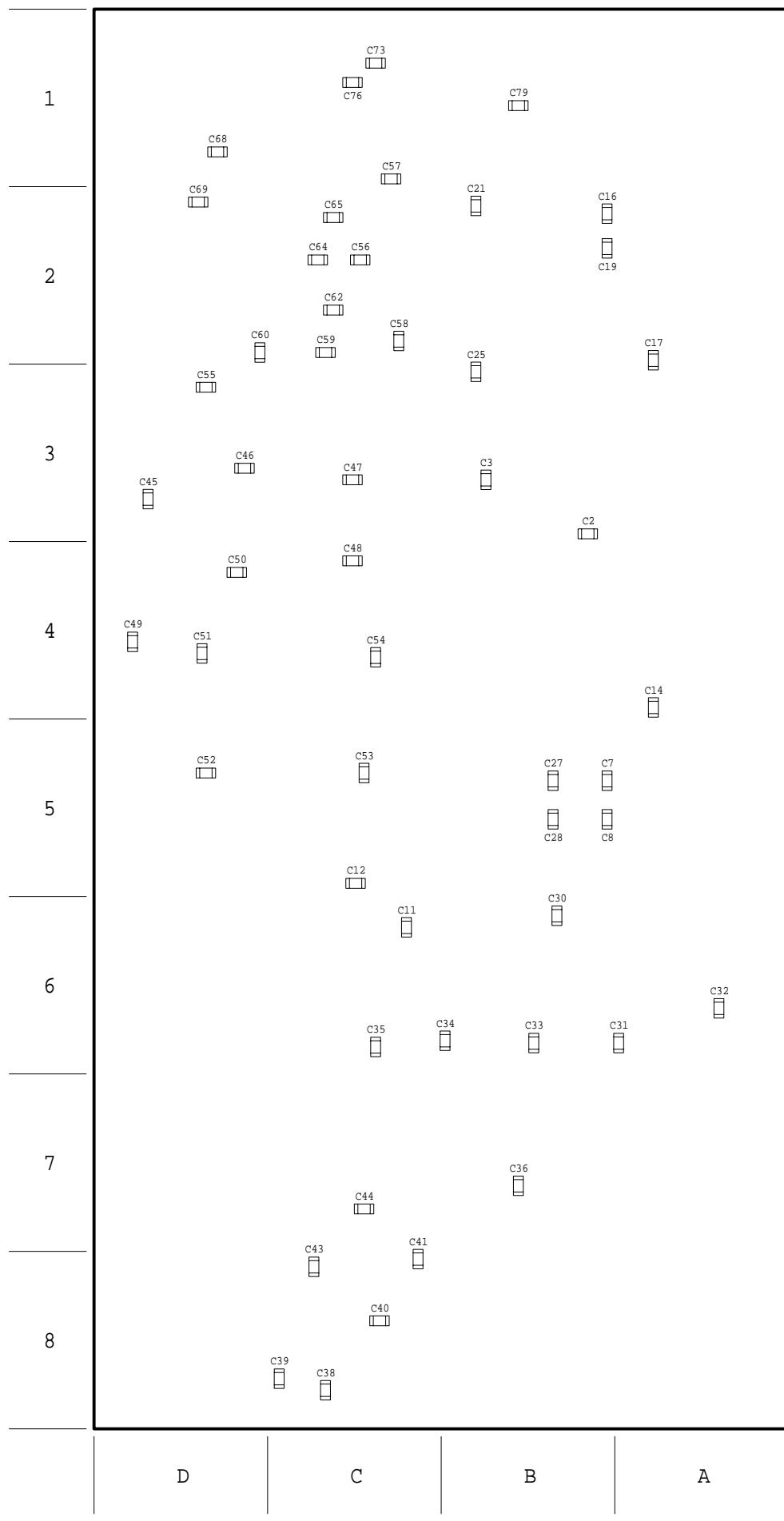
Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C2	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C3 thru C6	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C7	C: FIXED TANT 6.8uF 25V	0185-0002
CR1, CR3	LED: GREEN CMD5453	1910-0003
CR2, CR4	LED: RED MV5053	1910-0001
CR5	DIODE: 1N4006	1900-0016
DS1 thru DS3	DISPLAY: HP5082-7651	1930-0007
DS4 thru DS7*	DISPLAY: HDLO-2416 (prior to rev. A, DS4 thru DS7 were the HPDL2416 display, Belar P/N 1930-0005. These parts are not interchangeable.)	1930-0008
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



TVM-250
TV DIGITAL SAP & PRO MONITOR
A4 CAL/FILTER BOARD
4-21-98



TVM-250 A4 BOARD
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS

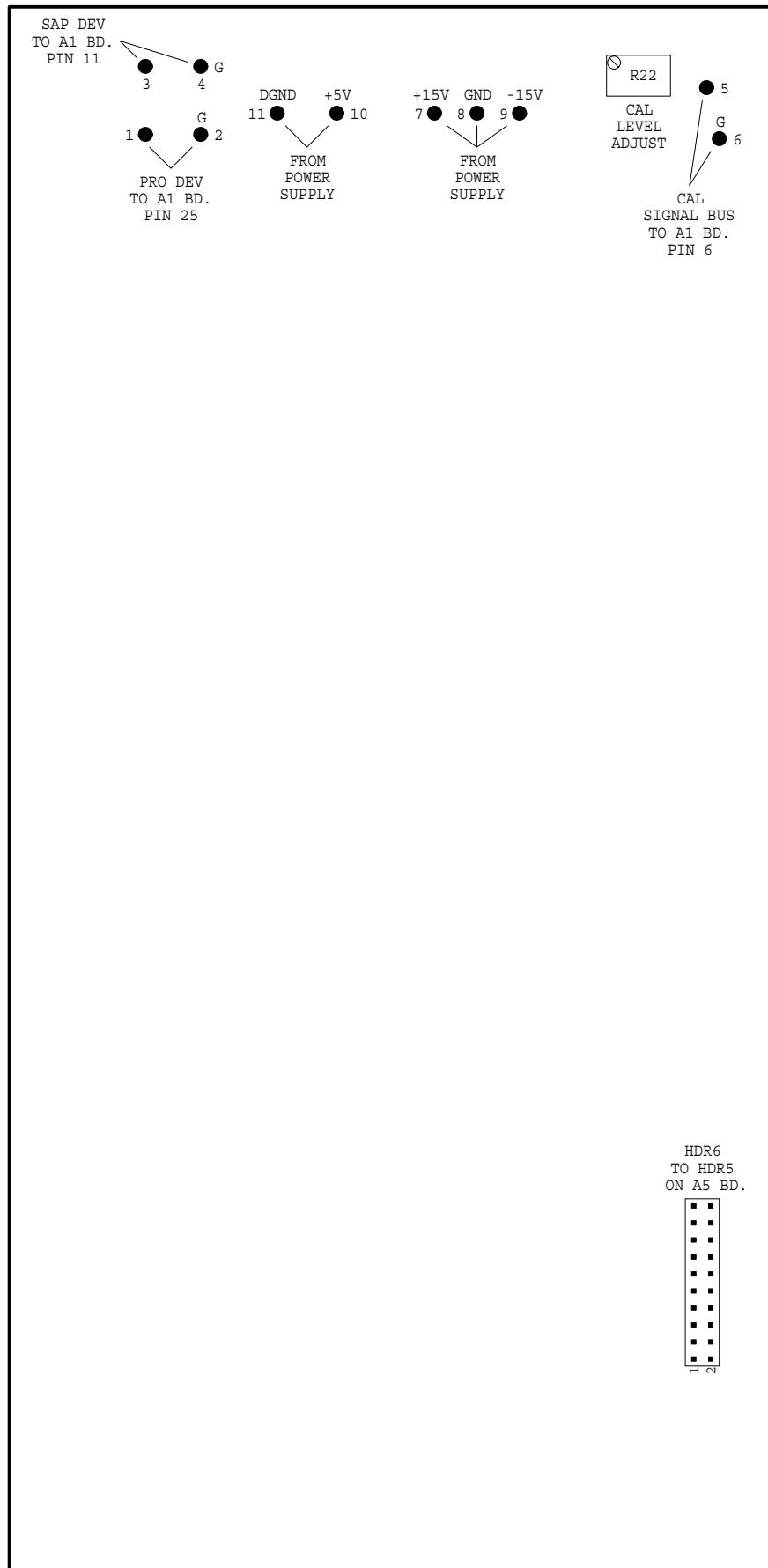


TVM-250 A4 BOARD
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS

TVM-250 A4 BOARD
PART LOCATIONS

| Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | <u>Desig/Loc</u> |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| C1 B3 | C29 B6 | C57 C1* | CR5 A4 | R17 C2 | U18 C4 | |
| C2 B3* | C30 B6* | C58 C2* | CR6 A2 | R18 D2 | U19 D4 | |
| C3 B3* | C31 A6* | C59 C2* | CR7 D8 | R19 D2 | U20 D4 | |
| C4 B3 | C32 A6* | C60 D2* | CR8 D8 | R20 D1 | U21 D4 | |
| C5 B4 | C33 B6* | C61 C3 | CR9 C1 | R21 D1 | U22 D5 | |
| C6 A5 | C34 B6* | C62 C2* | CR10 C1 | R22 D1 | U23 C5 | |
| C7 B5* | C35 C6* | C63 C2 | CR11 B1 | | U24 C4 | |
| C8 B5* | C36 B7* | C64 C2* | | RN1 C7 | U25 D3 | |
| C9 A5 | C37 C8 | C65 C2* | HDR6 D7 | RN2 D8 | U26 C2 | |
| C10 C6 | C38 C8* | C66 D2 | | RN3 C7 | U27 C2 | |
| C11 C6* | C39 C8* | C67 D2 | L1 D2 | | U28 C2 | |
| C12 C5* | C40 C8* | C68 D1* | | U1 B3 | U29 C2 | |
| C13 B5 | C41 C8* | C69 D2* | R1 B4 | U2 C6 | U30 D1 | |
| C14 A4* | C42 D8 | C70 D1 | R2 B3 | U3 A4 | | |
| C15 A2 | C43 C8* | C71 C1 | R3 B4 | U4 A2 | <u>pins</u> | |
| C16 B2* | C44 C7* | C72 B1 | R4 B4 | U5 B2 | 1 A1 | |
| C17 A2* | C45 D3* | C73 C1* | R5 B4 | U6 B5 | 2 A1 | |
| C18 A2 | C46 D3* | C74 C1 | R6 B4 | U7 A6 | 3 A1 | |
| C19 B2* | C47 C3* | C75 C1 | R7 D6 | U8 A6 | 4 A1 | |
| C20 B2 | C48 C4* | C76 C1* | R8 C6 | U9 B6 | 5 D1 | |
| C21 B2* | C49 D4* | C77 B1 | R9 C6 | U10 B6 | 6 D1 | |
| C22 A1 | C50 D4* | C78 B1 | R10 C6 | U11 C6 | 7 C1 | |
| C23 A1 | C51 D4* | C79 B1* | R11 B5 | U12 A8 | 8 C1 | |
| C24 B3 | C52 D5* | | R12 B6 | U13 C8 | 9 C1 | |
| C25 B3* | C53 C5* | CR1 B4 | R13 B1 | U14 C8 | 10 B1 | |
| C26 B5 | C54 C4* | CR2 B4 | R14 A1 | U15 D3 | 11 B1 | |
| C27 B5* | C55 D3* | CR3 B5 | R15 B5 | U16 D3 | | |
| C28 B5* | C56 C2* | CR4 B5 | R16 D8 | U17 C3 | | |

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



TVM-250 A4 BOARD
 CONNECTIONS & ADJUSTMENTS
 BELAR ELECTRONICS

A4 BOARD TVM-250

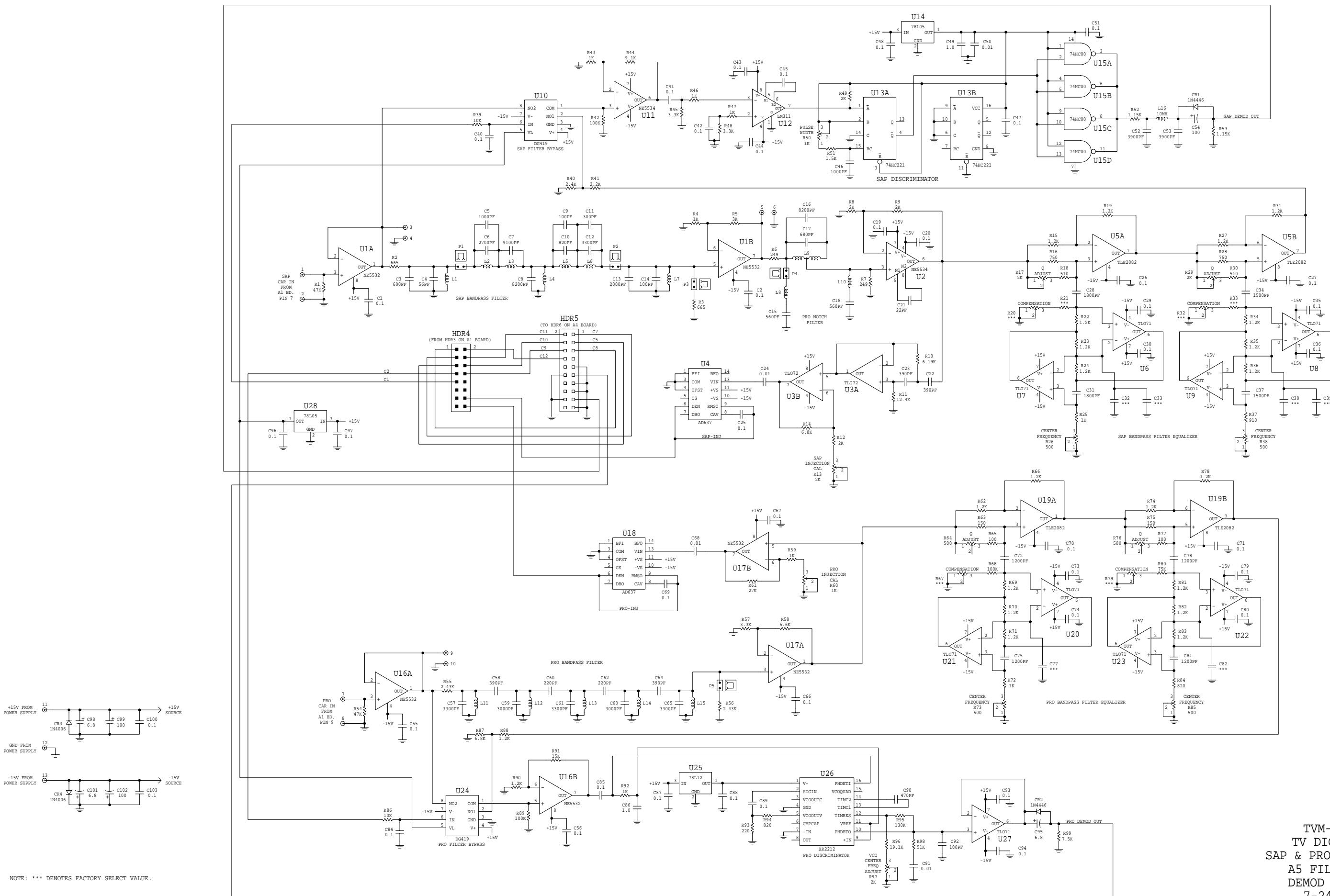
Reference Designation	Description	Part Number
C1	C: FIXED MICA 1000pF 5%	0140-1025
C2,C3	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C4	C: FIXED MICA 22pF 5%	0140-2205
C5	C: FIXED FILM 0.0033uF 10% 100V	0122-3321
C6	C: FIXED TANT 1.0uF 35V	0185-0006
C7,C8	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C9	C: FIXED TANT 1.0uF 35V	0185-0006
C10	C: FIXED MICA 500pF 5%	0140-5015
C11,C12	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C13	C: FIXED FILM 0.0033uF 10% 100V	0122-3321
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	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C18	C: FIXED TANT 10uF 16V	0185-0007
C19	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C20	C: FIXED TANT 10uF 16V	0185-0007
C21	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C22,C23	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C24	C: FIXED TANT 10uF 16V	0185-0007
C25	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C26	C: FIXED TANT 10uF 16V	0185-0007
C27,C28	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C29	C: FIXED TANT 1.0uF 35V	0185-0006
C30	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C31 thru C36	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C37	C: FIXED TANT 10uF 16V	0185-0007
C38 thru C41	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C42	C: FIXED CERAMIC CHIP 6800pF 50V	C1210 0151-0022
C43 thru C45	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C46 thru C48	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C49	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C50	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C51 thru C53	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C54	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C55 thru C60	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C61	C: FIXED TANT 1.0uF 35V	0185-0006
C62	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C63	C: FIXED TANT 10uF 16V	0185-0007
C64,C65	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C66,C67	C: FIXED MICA 500pF 5%	0140-5015
C68,C69	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C70	C: FIXED MICA 22pF 5%	0140-2205
C71	C: FIXED TANT 6.8uF 25V	0185-0002
C72	C: FIXED ELEC 100uF 35V	0180-0018
C73	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C74	C: FIXED TANT 6.8uF 25V	0185-0002
C75	C: FIXED ELEC 100uF 35V	0180-0018
C76	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C77	C: FIXED TANT 6.8uF 25V	0185-0002
C78	C: FIXED ELEC 100uF 35V	0180-0018
C79	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021

A4 BOARD TVM-250 cont.

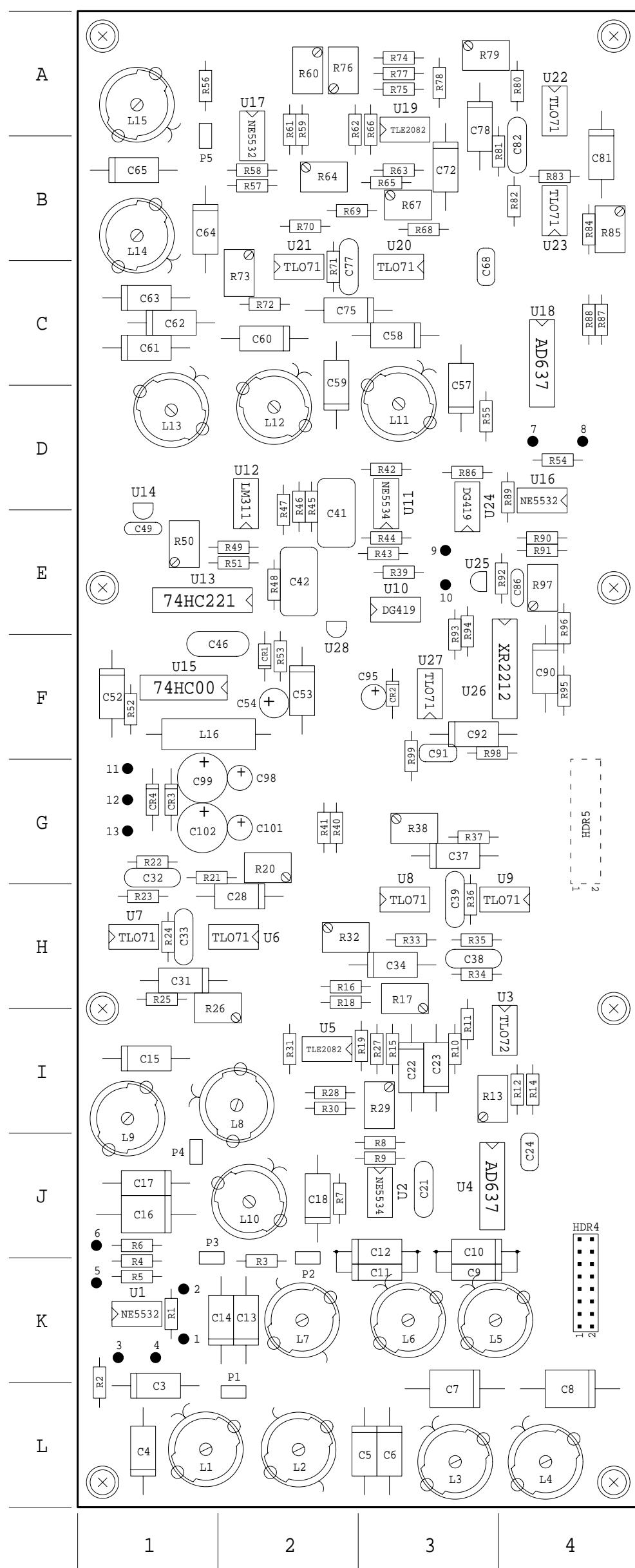
Reference Designation	Description	Part Number
CR1 thru CR4	DIODE: HP5082-2810	1900-0032
CR5,CR6	DIODE: 1N4690	1900-0031
CR7	LED: RED T-1	1910-0004
CR8	DIODE: HP5082-2800	1900-0026
CR9 thru CR11	DIODE: 1N4006	1900-0016
HDR6	HEADER: 20 PIN	0361-0020
L1	CHOKE: 1000uH	9141-0100
R1	R: METAL FILM 220k 2% 1/4W	0751-2242
R2	R: METAL FILM 3k 2% 1/4W	0751-3022
R3	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R4	R: METAL FILM 5.6k 2% 1/4W	0751-5622
R5	R: METAL FILM 430 2% 1/4W	0751-4312
R6	R: METAL FILM 240 2% 1/4W	0751-2412
R7	R: METAL FILM 3k 2% 1/4W	0751-3022
R8	R: METAL FILM 220k 2% 1/4W	0751-2242
R9	R: METAL FILM 4.3k 2% 1/4W	0751-4322
R10	R: METAL FILM 180k 2% 1/4W	0751-1842
R11	R: METAL FILM 430 2% 1/4W	0751-4312
R12	R: METAL FILM 240 2% 1/4W	0751-2412
R13 thru R15	R: METAL FILM 51 2% 1/4W	0751-5102
R16	R: METAL FILM 470 2% 1/4W	0751-4712
R17	R: METAL FILM 10 2% 1/4W	0751-1002
R18 thru R20	R: METAL FILM 1k 2% 1/4W	0751-1022
R21	R: METAL FILM 750 2% 1/4W	0751-7512
R22	R: VAR COMP 1k, 10 TURN	2100-0021
RN1	R: NETWORK 6 PIN 10k	0906-1032
RN2	R: NETWORK 8 PIN 10k	0908-1032
RN3	R: NETWORK 6 PIN 10k	0906-1032
U1,U2	IC: NE5534	1826-0025
U3	IC: 7805CT	1826-0014
U4	IC: 7905CT	1826-0056
U5	IC: CS4328	1830-0004
U6	IC: CS5326 (or CS5327)	1830-0008
U7	IC: 74HC14AD	1872-0010
U8	IC: XO, 12.288MHz	0415-1228
U9,U10	IC: 74HC74AD	1872-0003
U11	IC: 74HC4040D	1872-0013
U12	IC: TVM-250 FILTER EPROM	1840-0003E
U13	IC: MC34064	1826-0048
U14	IC: 56002FC	1890-0002
U15	IC: XO, 15.379530MHz	0415-1537
U16	IC: 74HC00D	1872-0001
U17	IC: 74HC74AD	1872-0003
U18	IC: 74HC02D	1872-0002
U19	IC: 74HC160D	1872-0015

A4 BOARD TVM-250 cont.

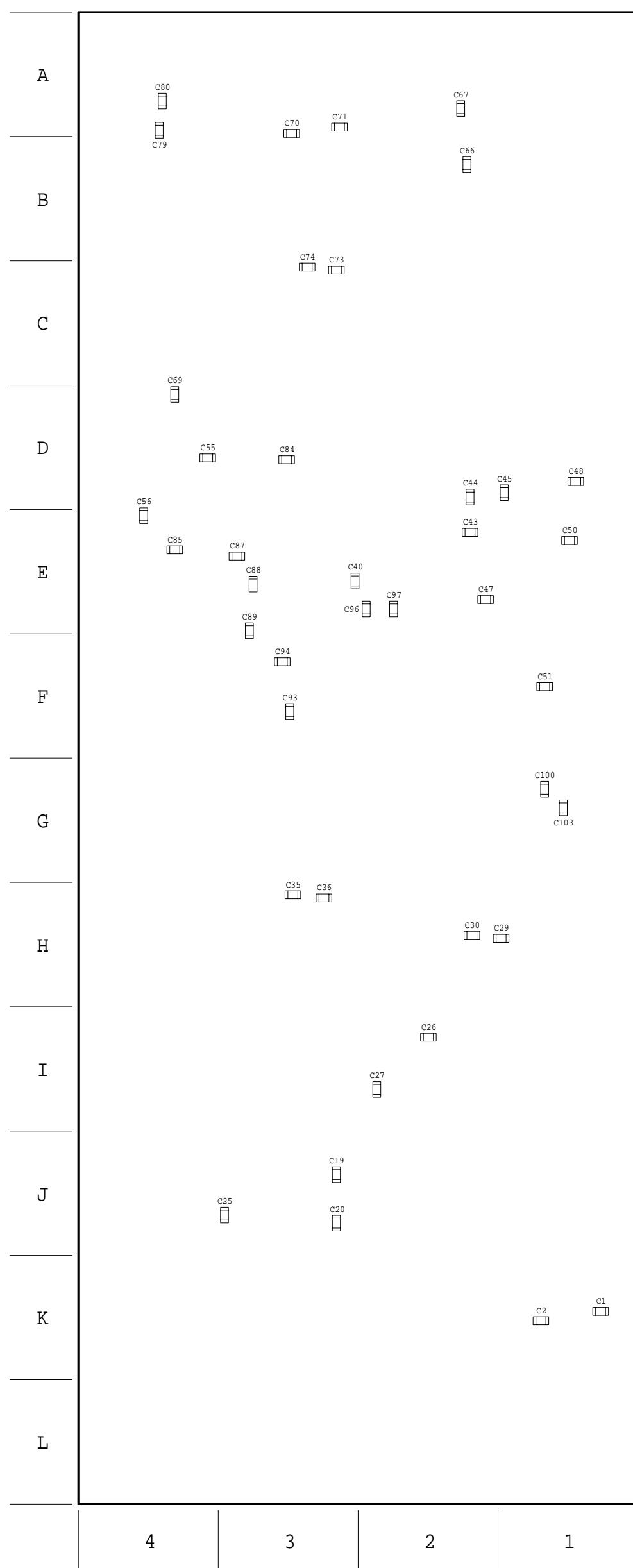
Reference	Description	Part Number
Designation		
U20	IC: 74HC74AD	1872-0003
U21	IC: 74HC4040D	1872-0013
U22	IC: TVM-250 CALIBRATOR EPROM	1840-0011C
U23, U24	IC: 74HC589D	1872-0014
U25	IC: 79L05CP	1826-0017
U26	IC: 78L12CP	1826-0015
U27	IC: 79L12CP	1826-0019
U28	IC: AD1862	1830-0006
U29	IC: AD846A	1827-0008
U30	IC: NE5534	1826-0025



TVM-250
TV DIGITAL
SAP & PRO MONITOR
A5 FILTER &
DEMOD BOARD
7-24-02



TVM-250 A5 BOARD
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS

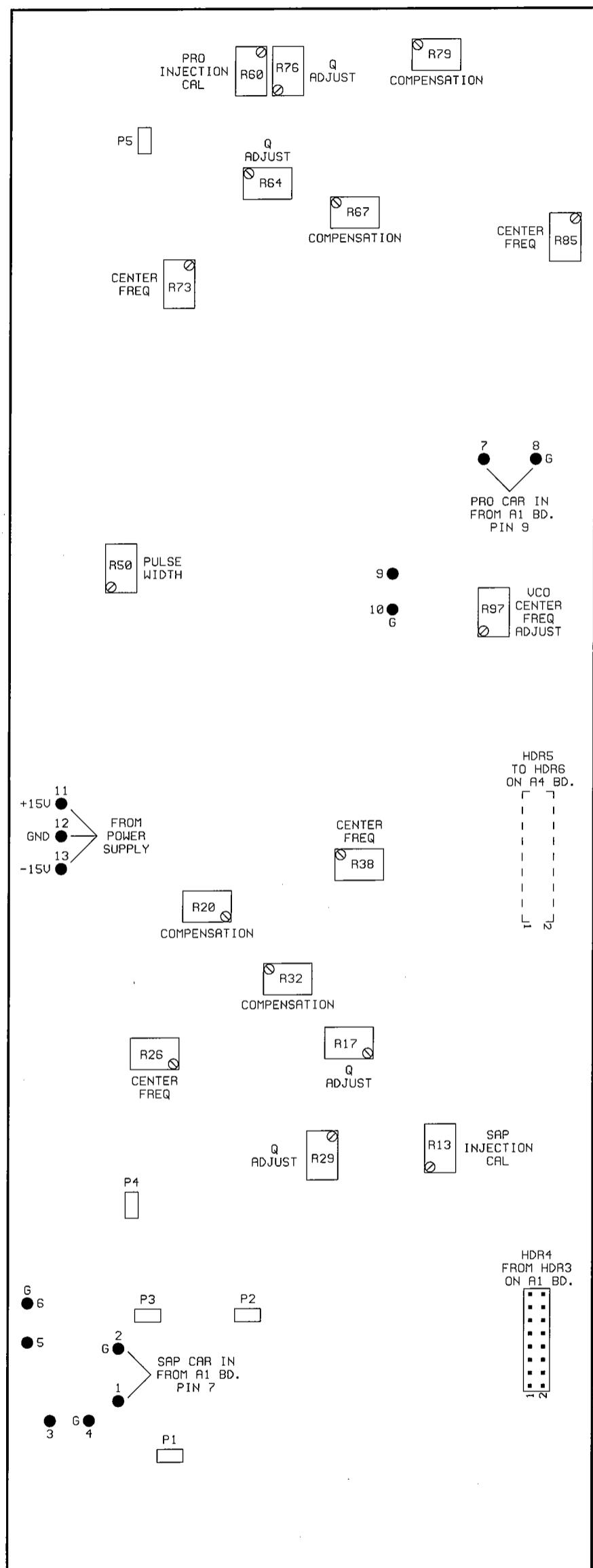


TVM-250 A5 BOARD
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS

TVM-250 A5 BOARD
PART LOCATIONS

| Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | Desig/Loc | <u>Desig/Loc</u> |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| C1 K1* | C49 E1 | C97 E2* | R10 I3 | R58 B2 | U6 H2 | |
| C2 K1* | C50 E1* | C98 G2 | R11 I3 | R59 A2 | U7 H1 | |
| C3 L1 | C51 F1* | C99 G1 | R12 I4 | R60 A2 | U8 H3 | |
| C4 L1 | C52 F1 | C100 G1* | R13 I3 | R61 A2 | U9 H4 | |
| C5 L3 | C53 F2 | C101 G2 | R14 I4 | R62 A2 | U10 E3 | |
| C6 L3 | C54 F2 | C102 G1 | R15 I3 | R63 B3 | U11 D3 | |
| C7 L3 | C55 D4* | C103 G1* | R16 H2 | R64 B2 | U12 D2 | |
| C8 L4 | C56 E4* | | R17 H3 | R65 B3 | U13 E1 | |
| C9 K3 | C57 D3 | CR1 F2 | R18 H2 | R66 A3 | U14 D1 | |
| C10 J3 | C58 C3 | CR2 F3 | R19 I3 | R67 B3 | U15 F1 | |
| C11 K3 | C59 C2 | CR3 G1 | R20 G2 | R68 B3 | U16 D4 | |
| C12 J3 | C60 C2 | CR4 G1 | R21 G1 | R69 B2 | U17 A1 | |
| C13 K2 | C61 C1 | | R22 G1 | R70 B2 | U18 C4 | |
| C14 K2 | C62 C1 | HDR4 K4 | R23 H1 | R71 C2 | U19 A3 | |
| C15 I1 | C63 C1 | HDR5 G4 | R24 H1 | R72 C2 | U20 C3 | |
| C16 J1 | C64 B1 | | R25 H1 | R73 C2 | U21 C2 | |
| C17 J1 | C65 B1 | L1 L1 | R26 H1 | R74 A3 | U22 A4 | |
| C18 J2 | C66 B2* | L2 L2 | R27 I3 | R75 A3 | U23 B4 | |
| C19 J3* | C67 A2* | L3 L3 | R28 I2 | R76 A2 | U24 D3 | |
| C20 J3* | C68 C3 | L4 L4 | R29 I3 | R77 A3 | U25 E3 | |
| C21 J3 | C69 D4* | L5 K3 | R30 I2 | R78 A3 | U26 F4 | |
| C22 I3 | C70 A3* | L6 E3 | R31 I2 | R79 A3 | U27 F3 | |
| C23 I3 | C71 A3* | L7 K2 | R32 H2 | R80 A4 | U28 E2 | |
| C24 J4 | C72 B3 | L8 I2 | R33 H3 | R81 B4 | | |
| C25 J3* | C73 C3* | L9 I1 | R34 H3 | R82 B4 | <u>pins</u> | |
| C26 I2* | C74 C3* | L10 J2 | R35 H3 | R83 B4 | 1 K1 | |
| C27 I2* | C75 C2 | L11 D3 | R36 H3 | R84 B4 | 2 K1 | |
| C28 H2 | C76 -- | L12 D2 | R37 G3 | R85 B4 | 3 K1 | |
| C29 H1* | C77 C2 | L13 D1 | R38 G3 | R86 D3 | 4 K1 | |
| C30 H2* | C78 A3 | L14 B1 | R39 E3 | R87 C4 | 5 K1 | |
| C31 H1 | C79 A4* | L15 A1 | R40 G2 | R88 C4 | 6 J1 | |
| C32 G1 | C80 A4* | L16 F1 | R41 G2 | R89 D4 | 7 D4 | |
| C33 H1 | C81 B4 | | R42 D3 | R90 E4 | 8 D4 | |
| C34 H3 | C82 B4 | P1 L2 | R43 E3 | R91 E4 | 9 E3 | |
| C35 H3* | C83 -- | P2 J2 | R44 E3 | R92 E4 | 10 E3 | |
| C36 H3* | C84 D3* | P3 J1 | R45 D2 | R93 E3 | 11 G1 | |
| C37 G3 | C85 E4* | P4 J1 | R46 D2 | R94 E3 | 12 G1 | |
| C38 H3 | C86 E4 | P5 A1 | R47 D2 | R95 F4 | 13 G1 | |
| C39 H3 | C87 E3* | | R48 E2 | R96 E4 | | |
| C40 E3* | C88 E3* | R1 K1 | R49 E2 | R97 E4 | | |
| C41 E2 | C89 E3* | R2 K1 | R50 E1 | R98 F3 | | |
| C42 E2 | C90 F4 | R3 K2 | R51 E2 | R99 F3 | | |
| C43 E2* | C91 F3 | R4 K1 | R52 F1 | | | |
| C44 D2* | C92 F3 | R5 K1 | R53 F2 | U1 K1 | | |
| C45 D1* | C93 F3* | R6 J1 | R54 D4 | U2 J3 | | |
| C46 F1 | C94 F3* | R7 J2 | R55 D3 | U3 I4 | | |
| C47 E2* | C95 F3 | R8 J3 | R56 A1 | U4 J3 | | |
| C48 D1* | C96 E2* | R9 J3 | R57 B2 | U5 I2 | | |

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



TVM-250 A5 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS

A5 BOARD TVM-250

Reference Designation	Description	Part Number
C1, C2	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C3	C: FIXED POLY 680pF 2.5% 160V	0130-6812
C4	C: FIXED POLY 56pF 2.5% 160V	0130-5602
C5	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C6	C: FIXED POLY 2700pF 2.5% 160V	0130-2722
C7	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C8	C: FIXED POLY 8200pF 2.5% 160V	0130-8222
C9	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C10	C: FIXED POLY 820pF 2.5% 160V	0130-8212
C11	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C12	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C13	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C14	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C15	C: FIXED POLY 560pF 2.5% 160V	0130-5612
C16	C: FIXED POLY 8200pF 2.5% 160V	0130-8222
C17	C: FIXED POLY 680pF 2.5% 160V	0130-6812
C18	C: FIXED POLY 560pF 2.5% 160V	0130-5612
C19, C20	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C21	C: FIXED MICA 22pF 5%	0140-2205
C22, C23	C: FIXED POLY 390pF 2.5% 160V	0130-3912
C24	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C25 thru C27	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C28	C: FIXED POLY 1800pF 2.5% 160V	0130-1822
C29, C30	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C31	C: FIXED POLY 1800pF 2.5% 160V	0130-1822
C32, C33	C: FIXED MICA, FACTORY SELECT	
C34	C: FIXED POLY 1500pF 2.5% 160V	0130-1522
C35, C36	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C37	C: FIXED POLY 1500pF 2.5% 160V	0130-1522
C38, C39	C: FIXED MICA, FACTORY SELECT	
C40	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C41, C42	C: FIXED FILM 0.1uF 10% 100V	0122-1041
C43 thru C45	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C46	C: FIXED MICA 1000pF 5%	0140-1025
C47, C48	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C49	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C50	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C51	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C52, C53	C: FIXED POLY 3900pF 2.5% 160V	0130-3922
C54	C: FIXED TANT 100uF 6.3V	0185-0010
C55, C56	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C57	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C58	C: FIXED POLY 390pF 2.5% 160V	0130-3912
C59	C: FIXED POLY 3000pF 2.5% 160V	0130-3022
C60	C: FIXED POLY 220pF 2.5% 160V	0130-2212
C61	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C62	C: FIXED POLY 220pF 2.5% 160V	0130-2212
C63	C: FIXED POLY 3000pF 2.5% 160V	0130-3022
C64	C: FIXED POLY 390pF 2.5% 160V	0130-3912
C65	C: FIXED POLY 3300pF 2.5% 160V	0130-3322

A5 BOARD TVM-250 cont.

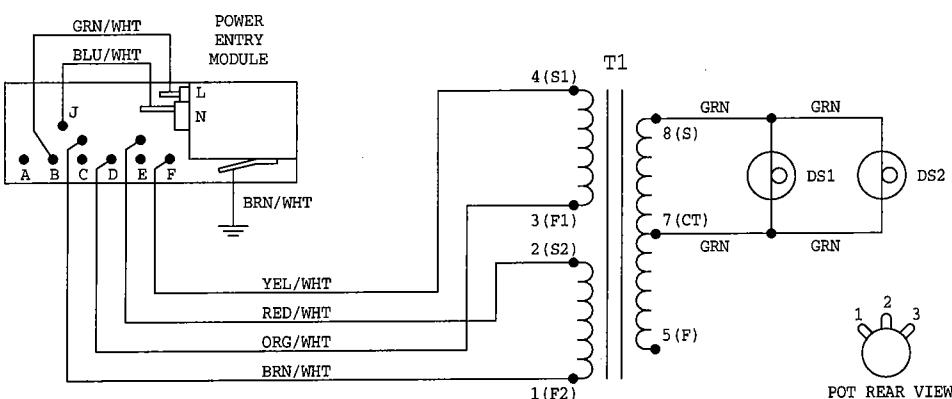
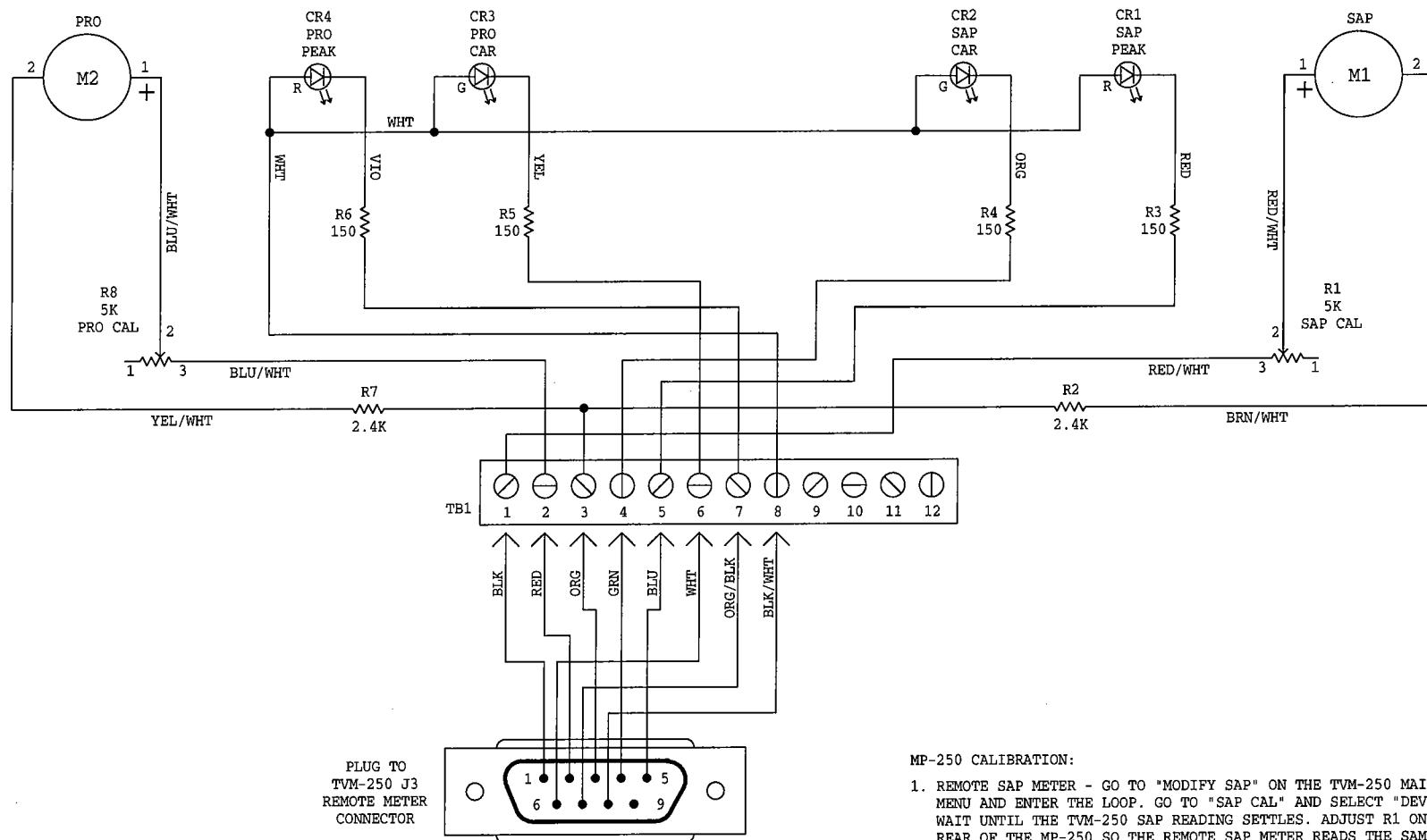
Reference Designation	Description	Part Number
C66 , C67	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C68	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C69 thru C71	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C72	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C73 ,C74	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C75	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C76	not used	
C77	C: FIXED MICA, FACTORY SELECT	
C78	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C79 ,C80	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C81	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C82	C: FIXED MICA, FACTORY SELECT	
C83	not used	
C84 ,C85	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C86	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C87 thru C89	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C90	C: FIXED POLY 470pF 2.5% 160V	0130-4712
C91	C: FIXED FILM 0.01uF 10% 100V	0122-1031
C92	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C93 ,C94	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C95	C: FIXED TANT 6.8uF 25V	0185-0002
C96 ,C97	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C98	C: FIXED TANT 6.8uF 25V	0185-0002
C99	C: FIXED ELEC 100uF 35V	0180-0018
C100	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C101	C: FIXED TANT 6.8uF 25V	0185-0002
C102	C: FIXED ELEC 100uF 35V	0180-0018
C103	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
CR1 , CR2	DIODE: 1N4446	1900-0002
CR3 , CR4	DIODE: 1N4006	1900-0016
HDR4	HEADER: 16 PIN	
HDR5	HEADER RECEPTACLE: 20 PIN	
L1 thru L15	INDUCTOR: BELAR	
L16	INDUCTOR: 10mH	9143-0010
P1 thru P5	PLUG: 2 PIN, PC MOUNT	0365-0029
--	JUMPER: 2 PIN (used with P1 thru P5)	0365-0028
R1	R: METAL FILM 47k 2% 1/4W	0751-4732
R2 ,R3	R: METAL FILM 665 1%	0721-6650
R4	R: METAL FILM 1k 2% 1/4W	0751-1022
R5	R: METAL FILM 3k 2% 1/4W	0751-3022
R6 ,R7	R: METAL FILM 249 1%	0721-2490
R8 ,R9	R: METAL FILM 2k 2% 1/4W	0751-2022
R10	R: METAL FILM 6.19k 1%	0721-6191
R11	R: METAL FILM 12.4k 1%	0721-1242
R12	R: METAL FILM 2k 2% 1/4W	0751-2022

A5 BOARD TVM-250 cont.

Reference Designation	Description	Part Number
R13	R: VAR COMP 2k, 10 TURN	2100-0031
R14	R: METAL FILM 6.8k 2% 1/4W	0751-6822
R15	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R16	R: METAL FILM 750 2% 1/4W	0751-7512
R17	R: VAR COMP 2k, 10 TURN	2100-0031
R18	R: METAL FILM 510 2% 1/4W	0751-5112
R19	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R20	R: VAR COMP, FACTORY SELECT	
R21	R: METAL FILM, FACTORY SELECT	
R22 thru R24	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R25	R: METAL FILM 1k 2% 1/4W	0751-1022
R26	R: VAR COMP 500, 10 TURN	2100-0027
R27	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R28	R: METAL FILM 750 2% 1/4W	0751-7512
R29	R: VAR COMP 2k, 10 TURN	2100-0031
R30	R: METAL FILM 510 2% 1/4W	0751-5112
R31	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R32	R: VAR COMP, FACTORY SELECT	
R33	R: METAL FILM, FACTORY SELECT	
R34 thru R36	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R37	R: METAL FILM 910 2% 1/4W	0751-9112
R38	R: VAR COMP 500, 10 TURN	2100-0027
R39	R: METAL FILM 10k 2% 1/4W	0751-1032
R40	R: METAL FILM 2.4k 2% 1/4W	0751-2422
R41	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R42	R: METAL FILM 100k 2% 1/4W	0751-1042
R43	R: METAL FILM 1k 2% 1/4W	0751-1022
R44	R: METAL FILM 9.1k 2% 1/4W	0751-9122
R45	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R46, R47	R: METAL FILM 1k 2% 1/4W	0751-1022
R48	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R49	R: METAL FILM 2k 2% 1/4W	0751-2022
R50	R: VAR COMP 1k, 10 TURN	2100-0021
R51	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R52, R53	R: METAL FILM 1.15k 1%	0721-1151
R54	R: METAL FILM 47k 2% 1/4W	0751-4732
R55, R56	R: METAL FILM 2.43k 1%	0721-2431
R57	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R58	R: METAL FILM 5.6k 2% 1/4W	0751-5622
R59	R: METAL FILM 1k 2% 1/4W	0751-1022
R60	R: VAR COMP 1k, 10 TURN	2100-0021
R61	R: METAL FILM 27k 2% 1/4W	0751-2732
R62	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R63	R: METAL FILM 150 2% 1/4W	0751-1512
R64	R: VAR COMP 500, 10 TURN	2100-0027
R65	R: METAL FILM 100 2% 1/4W	0751-1012
R66	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R67	R: VAR COMP, FACTORY SELECT	
R68	R: METAL FILM 100k 2% 1/4W	0751-1042
R69 thru R71	R: METAL FILM 1.2k 2% 1/4W	0751-1222

A5 BOARD TVM-250 cont.

Reference Designation	Description	Part Number
R72	R: METAL FILM 1k 2% 1/4W	0751-1022
R73	R: VAR COMP 500, 10 TURN	2100-0027
R74	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R75	R: METAL FILM 150 2% 1/4W	0751-1512
R76	R: VAR COMP 500, 10 TURN	2100-0027
R77	R: METAL FILM 100 2% 1/4W	0751-1012
R78	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R79	R: VAR COMP, FACTORY SELECT	
R80	R: METAL FILM 75k 2% 1/4W	0751-7532
R81 thru R83	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R84	R: METAL FILM 820 2% 1/4W	0751-8212
R85	R: VAR COMP 500, 10 TURN	2100-0027
R86	R: METAL FILM 10k 2% 1/4W	0751-1032
R87	R: METAL FILM 6.8k 2% 1/4W	0751-6822
R88	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R89	R: METAL FILM 100k 2% 1/4W	0751-1042
R90	R: METAL FILM 1.2k 2% 1/4W	0751-1222
R91	R: METAL FILM 15k 2% 1/4W	0751-1532
R92	R: METAL FILM 1k 2% 1/4W	0751-1022
R93	R: METAL FILM 220 2% 1/4W	0751-2212
R94	R: METAL FILM 820 2% 1/4W	0751-8212
R95	R: METAL FILM 130k 2% 1/4W	0751-1342
R96	R: METAL FILM 19.1k 1%	0721-1912
R97	R: VAR COMP 2k, 10 TURN	2100-0031
R98	R: METAL FILM 51k 2% 1/4W	0751-5132
R99	R: METAL FILM 7.5k 2% 1/4W	0751-7522
U1	IC: NE5532	1826-0037
U2	IC: NE5534	1826-0025
U3	IC: TLO72	1826-0038
U4	IC: AD637	1827-0003
U5	IC: TLE2082	1826-0069
U6 thru U9	IC: TLO71	1826-0004
U10	IC: DG419	1827-0011
U11	IC: NE5534	1826-0025
U12	IC: LM311	1826-0009
U13	IC: 74HC221	1822-0074
U14	IC: 78LO5CP	1826-0012
U15	IC: 74HC00	1822-0039
U16, U17	IC: NE5532	1826-0037
U18	IC: AD637	1827-0003
U19	IC: TLE2082	1826-0069
U20 thru U23	IC: TLO71	1826-0004
U24	IC: DG419	1827-0011
U25	IC: 78L12CP	1826-0015
U26	IC: XR2212	1826-0057
U27	IC: TLO71	1826-0004
U28	IC: 78LO5CP	1826-0012



MP-250 CALIBRATION:

1. REMOTE SAP METER - GO TO "MODIFY SAP" ON THE TVM-250 MAIN MENU AND ENTER THE LOOP. GO TO "SAP CAL" AND SELECT "DEV". WAIT UNTIL THE TVM-250 SAP READING SETTLES. ADJUST R1 ON THE REAR OF THE MP-250 SO THE REMOTE SAP METER READS THE SAME AS THE SAP INDICATION ON THE TVM-250.
2. REMOTE PRO METER - GO TO "MODIFY PRO" ON THE TVM-250 MAIN MENU AND ENTER THE LOOP. GO TO "PRO CAL" AND SELECT "DEV". WAIT UNTIL THE TVM-250 PRO READING SETTLES. ADJUST R8 ON THE REAR OF THE MP-250 SO THE REMOTE PRO METER READS THE SAME AS THE PRO INDICATION ON THE TVM-250.

NOTES:
 1. METERS ARE SHOWN FROM REAR.
 2. SCHEMATIC SHOWS MP-250 CABLE.

MP-250
 REMOTE METER PANEL
 FOR THE TVM-250
 TV DIGITAL SAP & PRO MONITOR
 BELAR ELECTRONICS
 6-24-99

MP-250 PARTS LIST

Reference Designation	Description	Part Number
CR1	LED: RED MV5053	1910-0001
CR2, CR3	LED: GREEN CMD5453	1910-0003
CR4	LED: RED MV5053	1910-0001
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	R: VAR COMP 5k	2100-0008
R2	R: METAL FILM 2.4k 2% 1/2W	0771-2422
R3 thru R6	R: METAL FILM 150 2% 1/2W	0771-1512
R7	R: METAL FILM 2.4k 2% 1/2W	0771-2422
R8	R: VAR COMP 5k	2100-0008
T1	TRANSFORMER: DP 241-4-10	9100-0024
TB1	TERMINAL BLOCK: 12 SCREW	0360-0002
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

MP-250 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.