

TVM-230

Precision Digital BTSC TV Stereo Modulation Monitor/Analyzer

The Wizard™ System

Guide to Operations

11/99

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TVM-230 Digital BTSC TV Stereo Monitor/Analyzer

1 General Information

1-1 General Description

The Belar TVM-230 Digital BTSC TV Stereo Modulation Monitor and Analyzer is a DSP based precision stereo monitor designed to operate in conjunction with the Belar TVM-100 or TVM-101 Precision Aural Monitor or other source of wideband aural composite.

The TVM-230 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 TVM-230 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 TVM-230 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 a personal computer. The ability to display measurements remotely will make a remote proof possible when the TVM-230 is combined with a distortion analyzer such as the Audio Precision.

1-2 Specifications

Inputs Two wide-band demodulated aural composite, selectable from front panel
Input Level 1.0V to 2.0Vrms for 73 kHz peak deviation
Input Impedance 100 k Ω , unbalanced BNC connector

Outputs

Left and Right
Audio Active 50 Ω Balanced Output
Level: +10 dBm into 600 Ω , XLR connector
Test 2.5 Vrms, 75 Ω , unbalanced, BNC connectors
Scope(auto-ranged) 1.3 Vrms, 75 Ω , unbalanced, BNC connectors
Pilot Output 2V P-P, 500 Ω , unbalanced, BNC connector
dbx Level 3.5355 Vrms for 50 kHz L-R deviation, BNC connector

Interface:

Serial Interface RS-232, DB-9 connector
Unit Interface Wizard Standard Interface

Remote Meter Outputs:

For interface to optional Model MP-230 Analog Remote Meter Panel
Analog Meter Outputs for Left, Right, L+R and L-R channels
Open Collector outputs for Stereo Peaks Per Minute (PPM), L+R PPM and Pilot
Relay closures for Stereo PPM, L+R PPM and Pilot

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Separation + Noise

Equivalent Mode	70 dB, 50 to 14 kHz
BTSC	Exceeds EIA MTS recommended practices for monitoring equipment. Typical separation at 100% 75 μ second equivalent input modulation:
50 kHz to 8 kHz	greater than 40 dB
8 kHz to 12 kHz	greater than 35 dB
12 kHz to 14 kHz	greater than 30 dB

Crosstalk + Noise:

L+R to L-R	75 dB (50 Hz to 14 kHz)
L-R to L+R	75 dB (50 Hz to 14 kHz)
SAP to L+R	75 dB
SAP to L-R	75 dB
PRO to L+R	75 dB
PRO to L-R	75 dB

Frequency Response (Left and Right channels)

Equivalent Mode	± 0.05 dB (50 Hz to 14 kHz)
BTSC:	
Typical at 100% 75 μ second equivalent input modulation	within ± 0.1 dB (50 Hz to 14 kHz)
Typical between 10% and 100% 75 μ second equivalent input modulation:	
50 Hz to 8 kHz	within + 0.05 dB to -0.02 dB
8 kHz to 14 kHz	within + 0.05 dB to -0.35 dB

Signal to Noise Ratio:

(L, R equivalent mode, pilot on)	
No de-emphasis	75 dB
De-emphasized, 75 μ second	85 dB

Distortion + Noise

Harmonic Distortion: (50 Hz to 14 kHz, measured across 30 kHz bandwidth)	
Equivalent Mode	0.025%
BTSC	0.1%

Signal Input-to Output Delay 5 milliseconds

Dimensions 1 EIA Rack Unit 1.75" H x 17" D x 19" W

Power Requirements 30 watts, 100-240 VAC, 50 to 60 Hz

Shipping Weight 13 lbs (5.9 kgs)

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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 TVM-230 is shipped with a Guide to Operations, 4 black rack-mount screws, a BNC jumper, 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.

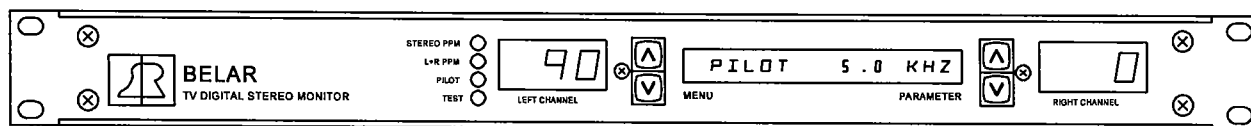
2-3 Repacking for Shipment

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.
- 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 yellow **TEST** LED is illuminated when the unit is EQUIValent mode (instead of MTS mode) or if the dbx¹ expander is switched out, or both.

The green **PILOT** LED is illuminated when the unit detects the 15.734 kHz pilot. At least 3 kHz injection is required to illuminate this light. If the TVM-230 has the optional Pilot Sync detector circuit installed and enabled, then this LED will blink if a loss of frequency lock between the pilot and horizontal sync is detected.

The red **L+R PPM** LED is illuminated when the number of L+R Peaks-per-minute exceeds the user-defined threshold as described below.

The red **STEREO PPM** LED is illuminated when the number of Stereo composite Peaks-per-minute exceeds the user-defined threshold as described below.

The **LEFT CHANNEL** window displays the left channel modulation, expressed in percent modulation.

The **RIGHT CHANNEL** window displays the right channel modulation, expressed in percent modulation.

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 TVM-230. 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 TVM-230 can make, as well as the displays MODIFY PPM and MODIFY SETTINGS. Two other two loops (accessed by pressing the UP PARAMETER button at the MODIFY PPM and MODIFY SETTINGS windows, respectively) consist of all the setable parameters in the unit, such as hold time, time mode, etc. These parameters are all explained in *Section 3-2 MODIFY PPM Menu Selections* or *Section 3-3 MODIFY SETTINGS Menu Selections*, following.

¹dbx is a registered trademark of THAT Corporation.

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3-1 Main Menu Selections

Below is a summary of all the menu selections available on the TVM-230.

TOTAL XXX %	Displays total peak modulation expressed in percent. The range is 0-127%.
STEREO XXX%	Measures the modulation level of the stereo composite (main plus stereo subchannel) with pilot. A 100% reading corresponds to 55 kHz deviation. This measurement is derived from the total measurement by subtracting out any SAP/PRO subcarriers which may be present. In order for the readings to be accurate, the SAP and PRO functions (described below) must be set correctly.
STEREO PPM	Displays the number of peaks per minute (PPM) of the stereo composite using a one minute sliding window. The level and duration of the peaks that will be counted can be set by the user, as described below under "MODIFY PPM".
L + R XXX %	Displays L + R peak modulation in percent. The range is 0-127%.
L + R PPM	Displays the number of peaks per minute (PPM) of the L + R using a one minute sliding window. The level and duration of the peaks that will be counted can be set by the user, as described below under "MODIFY PPM".
L - R XXX %	Displays L - R peak modulation in percent. The range is 0-127%.
PILOT X.X KHZ	Displays the Pilot Injection in kiloHertz deviation. The standard for setting pilot injection is 5 kHz.

IMPORTANT NOTE: The following dB measurements are referenced to 0 dB = 100% modulation. 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.

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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.
TOTAL -XX.X DB*	Measures total modulation in dB (0 dB = 73 kHz).
PILOT -XX.X DB*	Measures pilot injection in dB (0 dB = 73 kHz).
SUB -XX.X DB*	Measures the 31.5 kHz subcarrier suppression in dB (0 dB = 73 kHz).
MODIFY PPM	Press the UP PARAMETER arrow to enter the MODIFY PPM settings menu section. In this section are found a number of parameters that control the PPM indications and other settings, as described in <i>Section 3-2 Modify PPM Menu Selections</i> .
MODIFY SETTINGS	Press the UP PARAMETER arrow to exit the measurement section of the TVM-230 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 in <i>Section 3-3 Modify Settings Menu Selections</i> .

3-2 MODIFY PPM Menu Selections

SAP - ON/OFF/AUTO	This setting determines what offset is subtracted in order to correctly normalize the STEREO modulation reading. In the OFF mode, no offset is subtracted (the monitor assumes no SAP is present). In the ON mode a 15 kHz offset is subtracted (assumes 15 kHz SAP injection). In the AUTO mode, which requires a Belar TVM-250 SAP/PRO Monitor, the unit dynamically subtracts the actual SAP injection as measured by the TVM-250.
PRO - ON/OFF/AUTO	This setting determines what offset is subtracted in order to correctly normalize the STEREO modulation reading. In the OFF mode, no offset is subtracted (the monitor assumes no PRO is present). In the ON mode a 3 kHz offset is subtracted (assumes 3 kHz PRO injection). In the AUTO mode, which requires a Belar TVM-250 SAP/PRO Monitor, the unit dynamically subtracts the actual PRO injection as measured by the TVM-250.
ST PEAK XXX%	Sets the level of stereo composite that will be counted as a peak. A setting of 100% is equivalent to 55 kHz deviation.
ST THRES XX	Sets the threshold number of peaks-per-minute (PPM) required to activate the "STEREO PPM" LED and relay. If the Stereo PPM count exceeds this number, the LED lights and the relay is activated.
ST DUR XXX MS/TRACK	Determines the duration of what will be counted as one peak. No matter how many peaks exceed the threshold in the PPM DURATION time, only one will be counted. This is user selectable from 10 ms to 500 ms, plus TRACK. In the TRACK mode the duration is set to the same as the HOLD time.

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L+R PEAK XXX%	Sets the level of L+R that will be counted as a peak. A setting of 100% is equivalent to 25 kHz deviation.
L+R THRES XX	Sets the threshold number of peaks-per-minute (PPM) required to activate the "L+R PPM" LED and relay. If the L+R PPM count exceeds this number, the LED lights and the relay is activated.
L+R DUR XXX MS/TRACK	Determines the duration of what will be counted as one peak. No matter how many peaks exceed the threshold in the PPM DURATION time, only one will be counted. This is user selectable from 10 ms to 500 ms, plus TRACK. In the TRACK mode the duration is set to the same as the HOLD time.
EXIT ?	Press the UP PARAMETER arrow to exit the parameter setting section of the TVM-230 and enter the measurement section of the unit. The measurement section is where the unit displays most of its measurements (pilot injection, etc.).

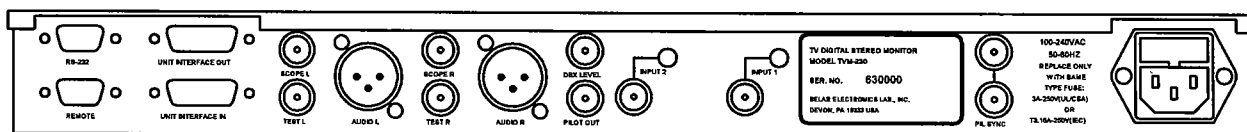
3-3 MODIFY SETTINGS Menu Selections

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 another unit in The Wizard System and it is desired that the other unit be the "master" or controlling unit. In this case the hold time is controlled by the other unit. When multiple units are connected together through the Wizard Interface, one unit should be considered the "master" unit and the other units should be considered "slave" units, and have their HOLD time set to EXT.
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 the user to save all parameters to internal EEPROM so that the unit configuration is preserved when power is removed. Press the UP PARAM to save the configuration.

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LOAD CONFIG	Loads 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.
MODE - MTS/EQUIV	Sets the stereo mode of the monitor. In MTS mode (normal operation), a 100% L-R reading corresponds to a 50 kHz deviation of the aural carrier. This is the proper mode of operation for the demodulation of BTSC stereo signals. In EQUIV mode, a 100% L-R reading corresponds to a 25 kHz deviation. This mode is used to demodulate a stereo composite signal similar to a conventional flat baseline FM signal. The TEST LED is illuminated in EQUIV mode.
DBX - IN/OUT	Switches the dbx expander and the de-emphasis and sum channel compensator for the L+R channel in or out. For proper demodulation of the BTSC signal the dbx function should be in. The TEST LED is illuminated when the dbx function is bypassed.
INPUT SEL - #1/#2	Selects the input source (jack 1 or jack 2). This can be used to easily and quickly switch the unit between 2 input sources, such as between a stereo generator and the TV aural demodulator.
SYNC DET - ON/OFF	This enables or disables the pilot sync detection circuit if this option is present (this is a factory-installed option). When enabled, a loss of frequency lock between the pilot and horizontal sync results in a blinking of the pilot LED.
EXIT ?	Press the UP PARAMETER arrow to exit the parameter setting section of the TVM-230 and enter the measurement section of the unit. The measurement section is where the unit displays most of its measurements (pilot injection, etc.).

4 Rear Panel



Input #1	Wideband aural composite, 100 k Ω , unbalanced, BNC Connector, 1.0 - 2.0 Vrms (2.8V - 5.7 V P-P).
Input #2	Wideband aural composite, 100 k Ω , unbalanced, BNC Connector, 1.0 - 2.0 Vrms (2.8V - 5.7 V P-P).
DBX Out	dbx input voltage. This is a sample of the L-R input to the dbx expander board. When the monitor is properly normalized, this voltage is 10 V P-P (3.5355 Vrms) for 50 kHz deviation (53.5 kHz deviation including pilot). 75 Ω source resistance.

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

Audio L Audio outputs (left and right), 600 Ω , balanced, +10 dBm, XLR-type
Audio R connector. Pin 1 is ground, pin 2 is +, pin 3 is -. These outputs are de-
emphasized when dbx is in operation and flat otherwise.



Test L Test outputs (left and right), 2.5 Vrms, 75 Ω , unbalanced, BNC
Test R connector. These outputs are de-emphasized when dbx is in operation
and flat otherwise.

Scope L Scope outputs, 1.3 Vrms, 75 Ω , unbalanced, BNC connector. When the respective
Scope R 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 P1
(Scope L) and P2 (Scope R) on the A1 board. For the location of these jumpers, see
the *TVM-230 A1 Board Connections and Adjustments* drawing in Section 8.

These outputs depend on which dB measurement the TVM-230 is displaying. A
table of the dB measurements (as shown in the front panel MENU/PARAMETER
window) and the respective scope outputs is shown below.

MENU	SCOPE L	SCOPE R
LEFT -XX.X DB	Left	Right
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	31.5 kHz
SUB KHZ -XX.X DB	Pilot	31.5 kHz

Unit Interface In This interface is used to connect to other units in The Wizard System for unified
remote operation. Note that when the TVM-230 is connected to another Wizard
System unit, such as the Belar TVM-250 SAP/PRO monitor, the HOLD TIME on all
but one of the units in the chain should be set to EXT to all the units will be
synchronized.

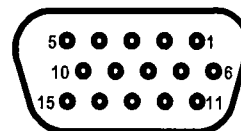
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Unit Interface Out

This interface is used to connect other Wizard-interface-equipped equipment, such as the Belar TVM-250 SAP/PRO Monitor to the TVM-230 for combined remote operation. The interface works in a daisy-chain configuration, with the first unit (say, the TVM-230) at the start of the chain, with its Unit Interface Out connected to the Unit Interface In on the next unit (say, the TVM-250). The Unit Interface Out of the TVM-250 is then connected to the Unit Interface In jack of the next unit.

Remote Meters

This connector is used to connect the optional MP-230 Analog Meter panel to the TVM-230, or for other remote metering or monitoring applications. The meter panel displays Left Channel or L+R, Right Channel or L-R, and Pilot, Stereo PPM and L+R PPM LEDs. See *Section 5-1* for the MP-230 installation instructions.



Remote Meters

The pinout of this connector is as follows (The MP-230 does not use all of the following pins):

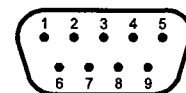
Pin 1	Stereo PPM relay (when the LED is lit, Pin 1 and 2 are closed)
Pin 2	Stereo PPM relay
Pin 3	L+R Relay (when the LED is lit, Pin 3 and 4 are closed)
Pin 4	L+R Relay
Pin 5	Pilot Relay (when the LED is lit, Pin 5 and 6 are closed)
Pin 6	Pilot Relay

(Note: relays are rated at 10 W max, 0.5 A max, 200 VDC max)

Pin 7	Stereo PPM (open collector)
Pin 8	L+R PPM (open collector)
Pin 9	Pilot PPM (open collector)
Pin 10	Left Remote Meter Out (+)
Pin 11	Right Remote Meter Out (+)
Pin 12	L+R Remote Meter Out (+)
Pin 13	L-R Remote Meter Out (+)
Pin 14	+5 V (25 mA max)
Pin 15	Ground

RS-232

The RS-232 connector is provided for direct computer communications with the TVM-230 for use with The Wizard Software. If you intend to write software to directly communicate with the TVM-230 using this port, refer to the *TVM-230 ASCII RS-232 Interface Commands* in *Section 7*.



RS-232
connector

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

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PL Sync (2 jacks) (OPTIONAL)

These jacks are provided as a video loop-through, so the TVM-230 can determine whether your pilot is properly synchronized to your horizontal sync. If it is desired to have the TVM-230 monitor the frequency lock of the 15,734 Hz stereo pilot to the horizontal sync frequency, connect either a 1 V P-P composite video signal or a 4 V P-P horizontal sync signal to either of these jacks using a 75 Ω coaxial cable (RG-59). Since these two jacks are a bridging loop-thru input, the video (sync) line may be either looped to another destination or terminated at the TVM-230 with an external line termination.

5 Installation and Setup

The TVM-230 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.

Connect the output of your TVM-100/101 or other wideband aural demodulator to the desired input jack (#1 or #2). Since each input jack has its own level adjustment, this procedure should be followed for each input.

The presence of level dependent companding in the L-R channel of the BTSC system makes stereo separation performance directly dependent on the level match between the compressor output in the stereo generator and expander input in the stereo demodulator. For optimum operation of the TVM-230 stereo demodulator, and for best separation, it is important that the dbx expander in the unit be driven at an input level as close to that prescribed as possible. In the TVM-230 this is achieved by finely adjusting the input sensitivity to obtain the correct relationship between aural carrier deviation due to the L-R and L-R signal level at the input to the dbx expander.

Listed below, in order of preference (most preferable first), are the reference conditions for setting the input sensitivity and the reading required to confirm proper adjustment for each case.

	Reference	Reading
A.	50 kHz deviation L-R (pilot not included)	3.5355 Vrms at DBX jack measured with high accuracy AC voltmeter
B.	50 kHz deviation L-R (pilot not included)	100% on L-R display
C.	25 kHz deviation L+R (sine wave)	100% on L+R display
D.	73 kHz deviation L+R (sine wave)	100% on Total display

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Using the internal calibrator, check the calibration of the discriminator and metering of the companion TVM-100 or TVM-101 aural monitor. If necessary, perform the adjustment procedure described in the TVM-100/101 manual.

To fine adjust monitor sensitivity, establish one of the reference conditions above. For cases A and B, apply a low distortion 1 kHz sine wave to the stereo generator with pilot turned off. Place stereo generator in test mode to produce an L-R signal (subchannel only). Adjust the audio level to the stereo generator to produce exactly 50 kHz deviation as indicated on the digital deviation indicator on the TVM-100. Turn on the pilot. (Because the pilot and the subcarrier do not reach their maximum values simultaneously, the peak deviation will now be approximately 53.6 kHz.) For method A, use a voltmeter whose input impedance is at least 1 Meg Ω and whose AC accuracy is better than 0.5% at 1 kHz. For method B, the L-R meter should be in the PEAK mode. Adjust R1 at the rear panel for the specified reading.

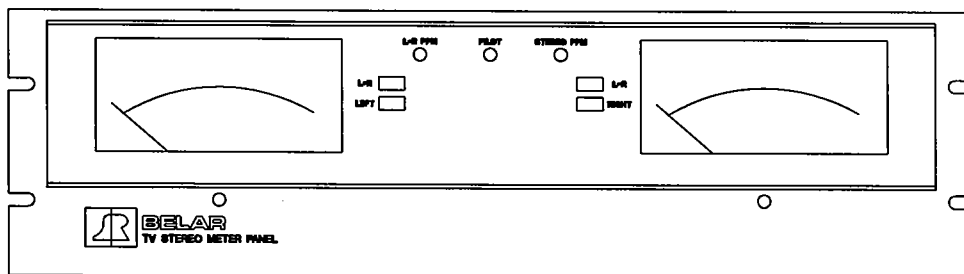
For methods C and D, apply a low distortion 1 kHz sine wave to the aural exciter. After checking the calibration of the TVM-100 as described above, adjust the level of the sine wave to achieve the prescribed deviation as indicated on the digital deviation indicator on the TVM-100. Read the appropriate display on the TVM-230 and adjust the appropriate input level adjustment at the rear panel for the specified reading.

IMPORTANT NOTE: Methods B, C, and D rely on initial factory set-up procedures and voltmeter stability to be effective. For this reason, method A is far superior to the other methods and is likely to result in a level normalization that is much more precise.

This procedure is not recommended if you have a Belar TVM-101 instead of a TVM-100. The TVM-101 does not have a digital deviation indicator.

5-1 Accessories

The optional MP-230 Analog Meter Panel, which consists of two large back-lit analog meters and two two-position switches, provides continuous analog metering of Left or L+R Modulation and Right or L-R Modulation as explained in *Section 4* under "Remote Meters"



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Before connecting the MP-230 to the TVM-230, 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 (J1B) on the TVM-230. The other end of the cable should be connected to the terminal strip (TB1) on the back of the MP-230 as follows:

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

MP-230 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-230 uses line power only to illuminate the meters. It is not required for proper operation of the meters.

MP-230 Calibration:

1. Feed a 1 kHz audio signal into the TVM-230 Composite Input.
2. Adjust the level of the audio so that the Left and Right Channel displays on the TVM-230 read 100%.
3. Depress the "Left" and "Right" meter panel pushbuttons.
4. Adjust potentiometers R1 and R7 on the rear of the MP-230 so the remote meters also read 100%.

The Wizard System

6 Running the Setup Program

To run the setup program, plug in the TVM-230 and press any of the keys located on the front panel while the INITIALIZATION message is being displayed. After a few seconds the TVM-230 will display a flashing RUNNING SETUP message as it enters the program.

6-1 Main Setup Menu Selections

RESET DEFAULTS ? Resets the TVM-230 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
ST PEAK 100%
ST THRES 10
ST DUR 10MS
L+R PEAK 100%
L+R THRES 10
L+R DUR 10MS
SAP - OFF
PRO - OFF
TIME MODE - PAST
INFINITE - OFF
REMOTE - OFF
DBX - IN
INPUT SEL - #1
SYNC DET - OFF
MODE - MTS

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

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 unit's serial number and EPROM version.

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

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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.

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 TVM-230 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 TVM-230 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.

**INTERFACE:
MASTER/SLAVE** Selects the configuration of the Unit Interface. The Unit Interface is used to connect to other units in The Wizard System for unified remote operation. Only one unit may have its Unit Interface set to MASTER. The MASTER unit controls the Unit Interface activity.

**CMD TYPE:
ASCII/BELAR** 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 *TVM-230 ASCII RS-232 Interface Commands* in Section 7, 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):XXXXX
XXXXX** 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 "..TVM-230.." 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.

The Wizard System

6-4 UNIT INFO SubMenu Selections

VERSION X.XX	Indicates the EPROM version installed in the unit.
SERIAL# 63XXXX	Indicates the units factory serial number.
EXIT ?	Pressing the UP PARAMETER button exits the UNIT INFO submenu and returns to the Main Setup Menu.

6-5 TEST RELAY/LED SubMenu Selections

RELAY#X - OPEN/CLOSE	Allows the relays and their associated LEDs to be tested. The relay number being tested is displayed along with the its state , either open or closed. The unit is configured so that when a 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 corresponding LED. To change the relay/LED being tested press the UP or DOWN PARAMETER button.
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 FAILED X	
EXIT ?	Pressing the UP PARAMETER button exits the RS-232 TEST Submenu and returns to the Main Setup Menu.

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7 TVM-230 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 TVM-230 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' - Stereo Peak Max
'C' - Stereo PPM Count
'D' - L+R Peak Max
'E' - L+R PPM Count
'F' - L-R Peak Max
'G' - Pilot Injection
'H' - Left dB
'I' - Right dB
'J' - SEP dB
'K' - L+R dB
'L' - L-R dB
'M' - XTALK dB
'N' - Total dB
'O' - Pilot dB
'P' - SUB dB
'Q' - Left Peak Max
'R' - Right Peak Max
'S' - Stereo PPM LED
'T' - L + R PPM LED
'U' - Pilot LED
'V' - Test 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

The Wizard System

Data Returned(assume total peak = 100%): '0100' + CR
ASCII Value : \$30 \$31 \$30 \$30 \$0D

'C' - Send Unit Configuration : Instructs TVM-230 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' - Mode
'E' - dbx
'F' - Input Select
'G' - Sync Detect
'H' - De-Emphasis
'I' - SAP
'J' - PRO
'K' - Stereo PPM Peak
'L' - Stereo PPM Threshold
'M' - Stereo PPM Duration
'N' - L + R PPM Peak
'O' - L + R PPM Threshold
'P' - L + R PPM Duration

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

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'A' - Alter Unit Configuration : Instructs TVM-230 to change the value 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' - Mode
'E' - dbx
'F' - Input Select
'G' - Sync Detect
'H' - De-Emphasis
'I' - SAP
'J' - PRO
'K' - Stereo PPM Peak
'L' - Stereo PPM Threshold
'M' - Stereo PPM Duration
'N' - L + R PPM Peak
'O' - L + R PPM Threshold
'P' - L + R PPM Duration

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.

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

The Wizard System

UNIT DATA DEFINITIONS:

Data	High	Low	Increments
Total Peak Max	127	0	1%
Stereo Peak Max	127	0	1%
Stereo PPM Count	6000	0	1
L+R Peak Max	127	0	1%
L+R PPM Count	6000	0	1
L-R Peak Max	127	0	1
Pilot Injection	12.7	0	0.1 kHz
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%
Stereo PPM LED	1	0	toggle
L+R PPM LED	1	0	toggle
Pilot LED	1	0	toggle
Test LED	1	0	toggle

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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)
Mode	1	0	toggle (MTS=1, EQUIV=0)
dbx	1	0	toggle (ON=1, OFF=0)
Input Select	1	0	toggle (#2=1, #1=0)
Sync Detect	1	0	toggle (ON=1, OFF=0)
De-Emphasis	1	0	toggle (ON=1, OFF=0)
SAP	2	0	2-AUTO; 1-ON; 0-OFF
PRO	2	0	2-AUTO; 1-ON; 0-OFF
Stereo PPM Threshold	100	1	1
Stereo PPM Duration	6	0	(0-5: 10, 20, 50, 100, 250, 500 ms); 6: TRACK
Stereo PPM Peak	127	1	1%
L + R PPM Threshold	100	1	1
L + R PPM Duration	6	0	(0-5: 10, 20, 50, 100, 250, 500 ms); 6: TRACK
L + R PPM Peak	127	1	1%

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. 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 converter	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>	$\longleftrightarrow$	<u>Belar Unit</u>
3 - Rx	$\longleftarrow$	3 - Tx
2 - Tx	$\longrightarrow$	2 - Rx
7 - GND	$\longleftrightarrow$	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.

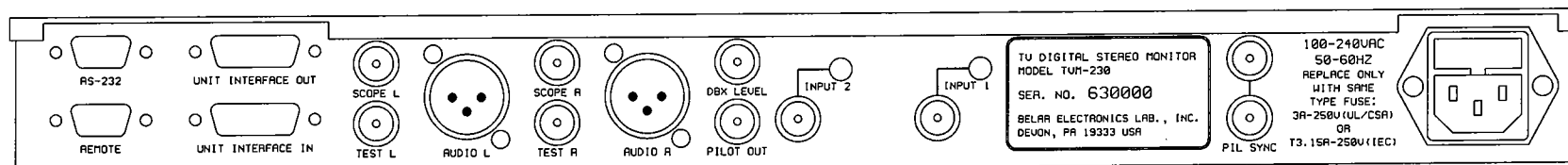
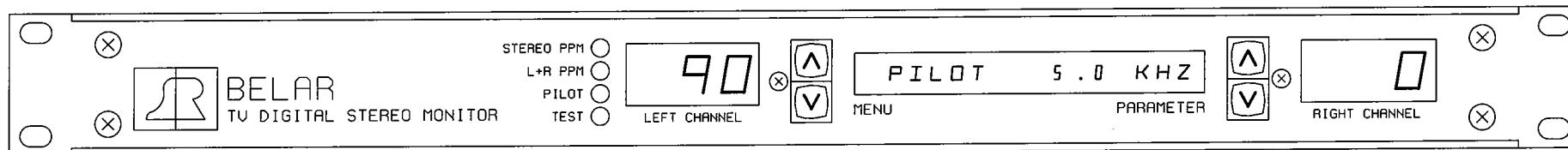
Some modems have various data compression schemes to increase the apparent speed under certain circumstances. Be sure to configure your modem to disable such compression schemes. Refer to your modem and communication software manuals if you encounter problems.

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**.

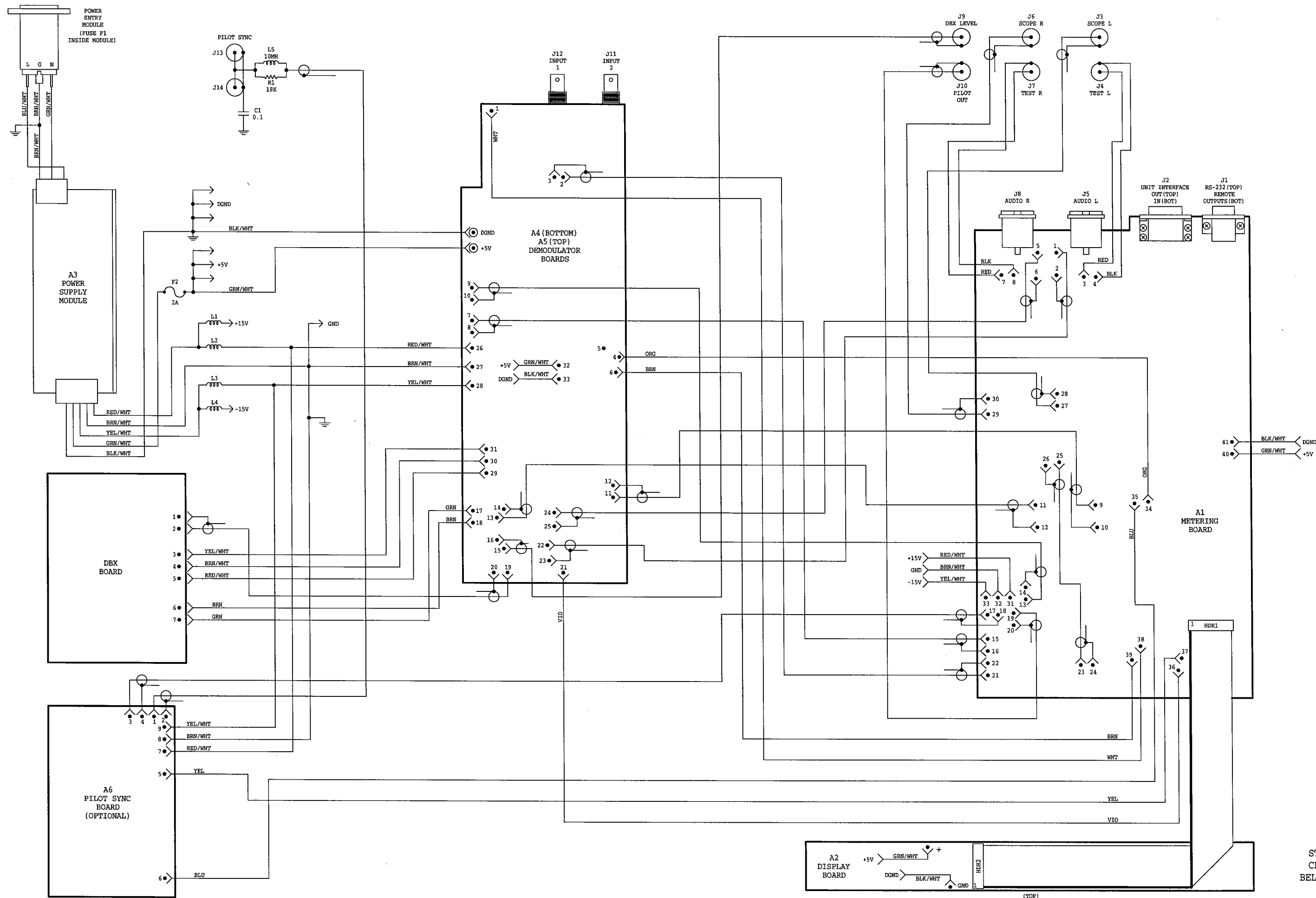


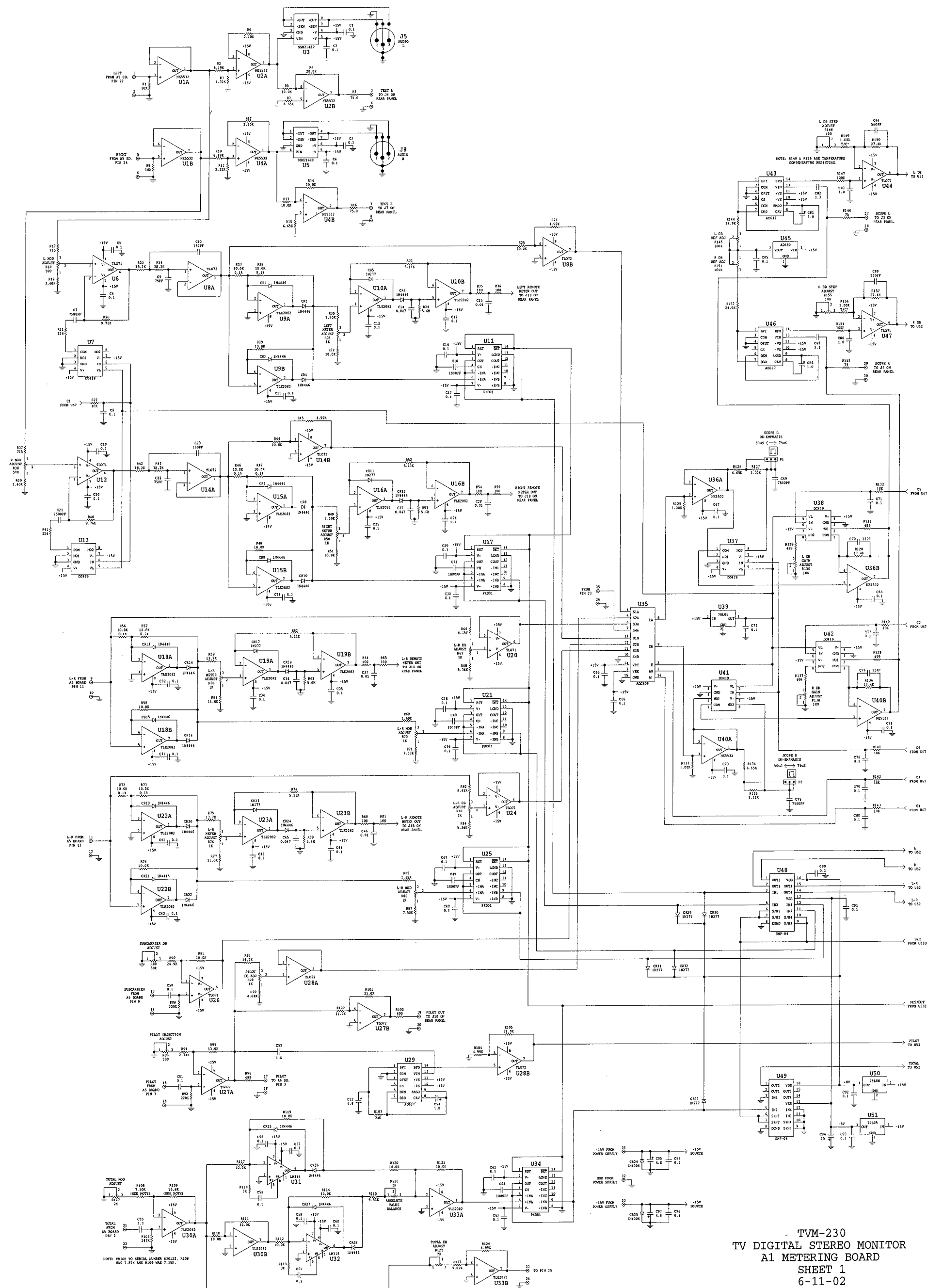
TUM-230 FRONT & REAR VIEW
BELAR ELECTRONICS

TVM-230 PARTS LISTS

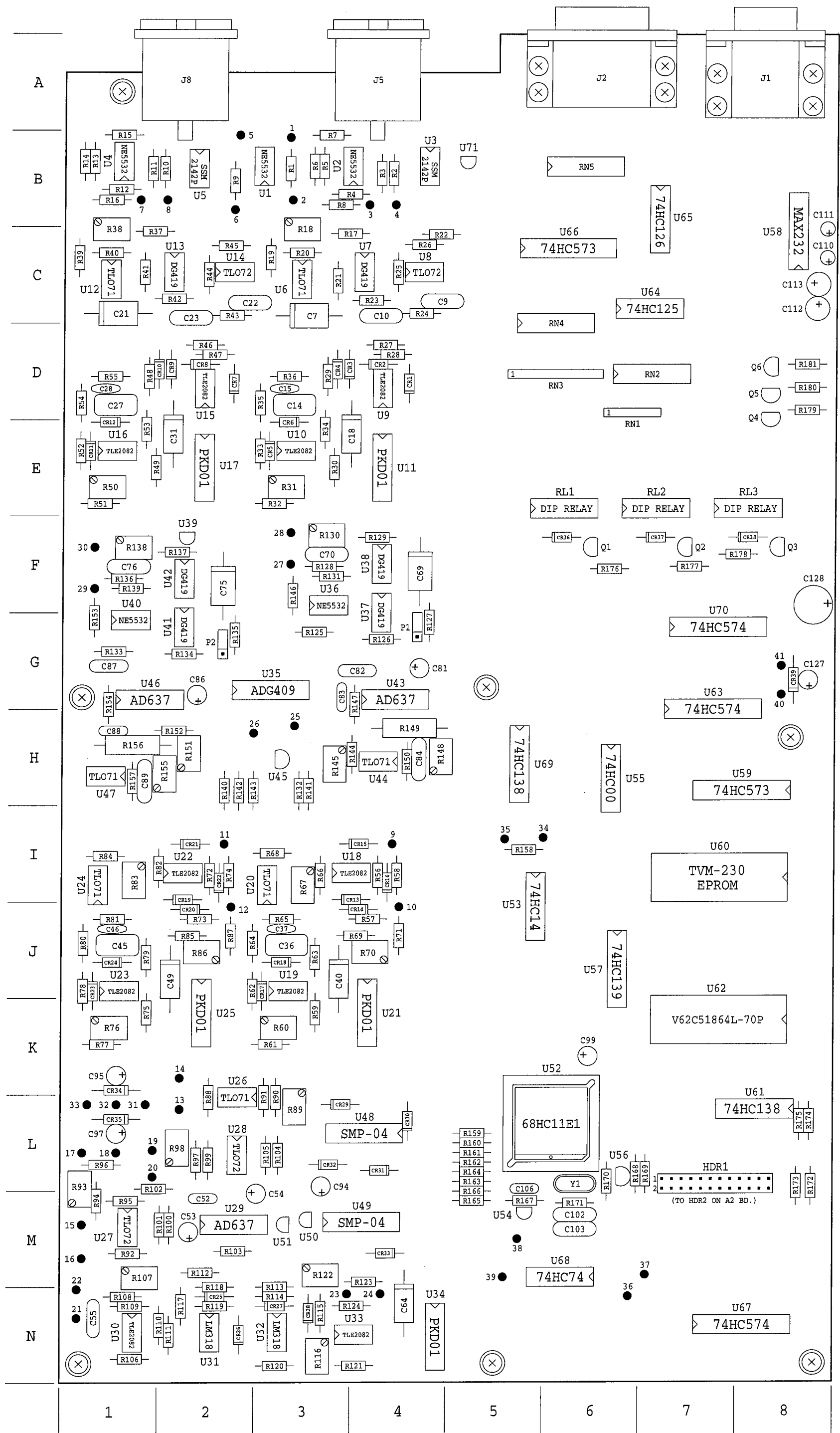
MAIN CHASSIS:

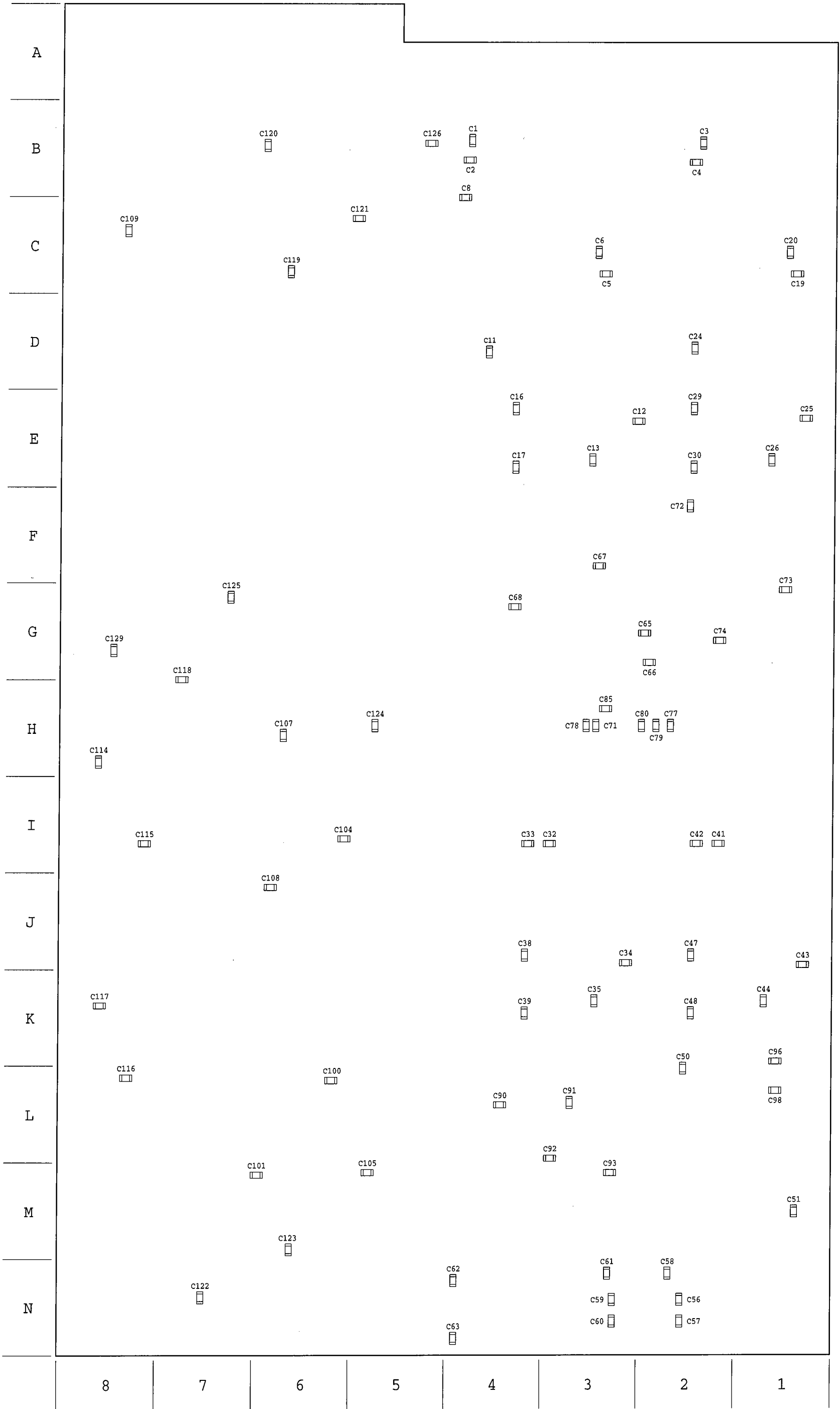
Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE:	4005-0020A
C1	C: FIXED CERAMIC 0.1uF 50V	0151-0015
--	POWER ENTRY MODULE: 6EGG1-1	0360-0021
F1	FUSE: GMA-3A 250V(UL/CSA)	2110-0009
--	or T3.15A-250V(IEC)	
--	FUSE HOLDER: CHASSIS MOUNT	2110-0010
F2	FUSE: AGC-2A 250V	2110-0006
J3, J4	JACK: BNC	0360-0006
J6, J7	JACK: BNC	0360-0006
J9, J10	JACK: BNC	0360-0006
J13, J14	JACK: BNC	0360-0006
L1 thru L4	CHOKE: RF	9140-0011
L5	CHOKE: 10mH	9143-0010
R1	R: METAL FILM 18k 2% 1/4W	0751-1832
--	FLAT CABLE ASSEMBLY: 24 CONDUCTOR	8900-0018
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004











TVM-230 A1 BOARD
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS

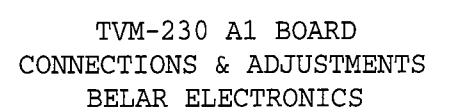
TVM-230 A1 BOARD
PART LOCATIONS

<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>	
C1	B4*	C51	M1*	C101	M6*	CR21	I2	R14	B1	R64	J2
C2	B4*	C52	M2	C102	M6	CR22	I2	R15	B1	R65	J3
C3	B2*	C53	M2	C103	M6	CR23	J1	R16	B1	R66	I3
C4	B2*	C54	M3	C104	I6*	CR24	J1	R17	C3	R67	I3
C5	C3*	C55	N1	C105	M5*	CR25	N2	R18	C3	R68	I3
C6	C3*	C56	N2*	C106	L5	CR26	N2	R19	C3	R69	J4
C7	C3	C57	N2*	C107	H6*	CR27	N3	R20	C3	R70	J4
C8	C4*	C58	N2*	C108	J6*	CR28	N3	R21	C3	R71	J4
C9	C4	C59	N3*	C109	C8*	CR29	L3	R22	C4	R72	I2
C10	C4	C60	N3*	C110	C8	CR30	L4	R23	C4	R73	J2
C11	D4*	C61	N3*	C111	C8	CR31	L4	R24	C4	R74	I2
C12	E3*	C62	N4*	C112	C8	CR32	L3	R25	C4	R75	K1
C13	E3*	C63	N4*	C113	C8	CR33	M4	R26	C4	R76	K1
C14	D3	C64	N4	C114	H8*	CR34	K1	R27	D4	R77	K1
C15	D3	C65	G2*	C115	I8*	CR35	L1	R28	D4	R78	J1
C16	E4*	C66	G2*	C116	L8*	CR36	F6	R29	D3	R79	J1
C17	E4*	C67	F3*	C117	K8*	CR37	F7	R30	E3	R80	J1
C18	E3	C68	G4*	C118	G7*	CR38	F8	R31	E3	R81	J1
C19	C1*	C69	F4	C119	C6*	CR39	G8	R32	E3	R82	I1
C20	C1*	C70	F3	C120	B6*			R33	E3	R83	I1
C21	C1	C71	H3*	C121	C5*	HDR1	L7	R34	E3	R84	I1
C22	C2	C72	F2*	C122	N7*			R35	D3	R85	J2
C23	C2	C73	G1*	C123	M6*	J1	A8	R36	D3	R86	J2
C24	D2*	C74	G2*	C124	H5*	J2	A6	R37	C1	R87	J2
C25	E1*	C75	F2	C125	G7*	J5	A4	R38	C1	R88	L2
C26	E1*	C76	F1	C126	B5*	J8	A2	R39	C1	R89	L3
C27	D1	C77	H2*	C127	G8			R40	C1	R90	L3
C28	D1	C78	H3*	C128	F8	P1	G4	R41	C1	R91	L3
C29	E2*	C79	H2*	C129	G8*	P2	G2	R42	C2	R92	M1
C30	E2*	C80	H2*					R43	C2	R93	L1
C31	E2	C81	G4	CR1	D4	Q1	F6	R44	C2	R94	M1
C32	I3*	C82	G4	CR2	D4	Q2	F7	R45	C2	R95	M1
C33	I4*	C83	G3	CR3	D3	Q3	F8	R46	D2	R96	L1
C34	J3*	C84	H4	CR4	D3	Q4	D8	R47	D2	R97	L2
C35	K3*	C85	H3*	CR5	E3	Q5	D8	R48	D1	R98	L2
C36	J3	C86	G2	CR6	E3	Q6	D8	R49	E1	R99	L2
C37	J3	C87	G1	CR7	D2			R50	E1	R100	M2
C38	J4*	C88	H1	CR8	D2	R1	B3	R51	E1	R101	M2
C39	K4*	C89	H1	CR9	D2	R2	B4	R52	E1	R102	L1
C40	J3	C90	L4*	CR10	D1	R3	B4	R53	E1	R103	M2
C41	I2*	C91	L3*	CR11	E1	R4	B3	R54	D1	R104	L3
C42	I2*	C92	L3*	CR12	E1	R5	B3	R55	D1	R105	L3
C43	J1*	C93	M3*	CR13	I4	R6	B3	R56	I4	R106	N1
C44	K1*	C94	L3	CR14	J4	R7	B3	R57	J4	R107	M1
C45	J1	C95	K1	CR15	I4	R8	B3	R58	I4	R108	N1
C46	J1	C96	K1*	CR16	I4	R9	B2	R59	K3	R109	N1
C47	J2*	C97	L1	CR17	J3	R10	B2	R60	K3	R110	N2
C48	K2*	C98	L1*	CR18	J3	R11	B1	R61	K3	R111	N2
C49	J2	C99	K6	CR19	I2	R12	B1	R62	J2	R112	M2
C50	L2*	C100	L6*	CR20	J2	R13	B1	R63	J3	R113	M3

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

TVM-230 A1 BOARD
PART LOCATIONS
cont.

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
R114	N3	R165	M5	U24	I1
R115	N3	R166	L5	U25	K2
R116	N3	R167	M5	U26	L2
R117	N2	R168	L6	U27	M1
R118	M2	R169	L7	U28	L2
R119	N2	R170	L6	U29	M2
R120	N3	R171	M6	U30	N1
R121	N4	R172	L8	U31	N2
R122	M3	R173	L8	U32	N3
R123	M4	R174	L8	U33	N4
R124	N4	R175	L8	U34	N4
R125	G3	R176	F6	U35	G3
R126	G4	R177	F7	U36	F3
R127	G4	R178	F8	U37	F4
R128	F3	R179	D8	U38	F4
R129	F4	R180	D8	U39	F2
R130	F3	R181	D8	U40	G1
R131	F3			U41	G2
R132	H3	RL1	E6	U42	F2
R133	G1	RL2	E7	U43	G4
R134	G2	RL3	E8	U44	H4
R135	G2			U45	H3
R136	F1	RN1	D6	U46	G1
R137	F2	RN2	D7	U47	H1
R138	F1	RN3	D6	U48	L4
R139	F1	RN4	C6	U49	M4
R140	H2	RN5	B6	U50	M3
R141	H3			U51	M3
R142	H2	U1	B3	U52	L6
R143	H2	U2	B3	U53	J5
R144	H3	U3	B4	U54	M5
R145	H3	U4	B1	U55	H6
R146	F3	U5	B2	U56	L6
R147	G4	U6	C3	U57	J6
R148	H4	U7	C4	U58	C8
R149	H4	U8	C4	U59	H8
R150	H4	U9	D4	U60	I7
R151	H2	U10	E3	U61	L8
R152	H2	U11	E4	U62	K7
R153	G1	U12	C1	U63	G7
R154	G1	U13	C2	U64	C7
R155	H2	U14	C2	U65	B7
R156	H1	U15	D2	U66	C6
R157	H1	U16	E1	U67	N8
R158	I5	U17	E2	U68	M6
R159	L5	U18	I4	U69	H5
R160	L5	U19	J3	U70	G7
R161	L5	U20	I3	U71	B5
R162	L5	U21	K4		
R163	L5	U22	I2	Y1	L6
R164	L5	U23	J1		



A1 BOARD TVM-230

Reference Designation	Description	Part Number
C1 thru C6	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C7	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C8	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C9	C: FIXED MICA 75pF 5%	0140-7505
C10	C: FIXED MICA 160pF 5%	0140-1615
C11 thru C13	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C14	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C15	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C16, C17	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C18	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C19, C20	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C21	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C22	C: FIXED MICA 75pF 5%	0140-7505
C23	C: FIXED MICA 160pF 5%	0140-1615
C24 thru C26	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C27	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C28	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C29, C30	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C31	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C32 thru C35	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C36	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C37	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C38, C39	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C40	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C41 thru C44	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C45	C: FIXED FILM 0.047uF 10% 100V	0122-4731
C46	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C47, C48	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C49	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C50, C51	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C52	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C53	C: FIXED TANT 6.8uF 25V	0185-0002
C54	C: FIXED TANT 1.0uF 35V	0185-0006
C55	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C56 thru C63	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C64	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C65 thru C68	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C69	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C70	C: FIXED MICA 12pF 5%	0140-1205
C71 thru C74	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C75	C: FIXED POLY 7500pF 2.5% 160V	0130-7522
C76	C: FIXED MICA 12pF 5%	0140-1205
C77 thru C80	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
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 CHIP 0.1uF 50V	C1206 0151-0014
C86	C: FIXED TANT 1.0uF 35V	0185-0006
C87	C: FIXED CERAMIC 3.3uF 50V	0151-0011

A1 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
C88	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C89	C: FIXED MICA 560pF 5%	0140-5615
C90 thru C93	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C94	C: FIXED TANT 15uF 16V	0185-0003
C95	C: FIXED TANT 6.8uF 25V	0185-0002
C96	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C97	C: FIXED TANT 6.8uF 25V	0185-0002
C98	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C99	C: FIXED TANT 6.8uF 25V	0185-0002
C100	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C101	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C102,C103	C: FIXED MICA 24pF 5%	0140-2405
C104	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C105	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C106	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C107 thru C109	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C110,C111	C: FIXED TANT 4.7uF 10V	0185-0001
C112,C113	C: FIXED TANT 10uF 16V	0185-0007
C114 thru C125	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C126	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C127	C: FIXED TANT 6.8uF 25V	0185-0002
C128	C: FIXED ELEC 100uF 35V	0180-0018
C129	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
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 CR16	DIODE: 1N4446	1900-0002
CR17	DIODE: 1N277 GERMANIUM	1900-0001
CR18 thru CR22	DIODE: 1N4446	1900-0002
CR23	DIODE: 1N277 GERMANIUM	1900-0001
CR24 thru CR28	DIODE: 1N4446	1900-0002
CR29 thru CR33	DIODE: 1N277 GERMANIUM	1900-0001
CR34,CR35	DIODE: 1N4006	1900-0016
CR36 thru CR38	DIODE: 1N4446	1900-0002
CR39	DIODE: 1N4006	1900-0016
HDR1	HEADER: 24 PIN	0361-0024
J1	CONNECTOR: "D" DUAL 9 PIN, 15 PIN	0360-0039
J2	CONNECTOR: "D" DUAL 15 PIN	0360-0033
J5,J8	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 Q6	TRANSISTOR: 2N4401	1850-0028

A1 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
R1	R: METAL FILM 10k 2% 1/4W	0751-1032
R2	R: METAL FILM 6.19k 1%	0721-6191
R3	R: METAL FILM 3.32k 1%	0721-3321
R4	R: METAL FILM 2.10k 1%	0721-2101
R5	R: METAL FILM 10.0k 1%	0721-1002
R6	R: METAL FILM 20.0k 1%	0721-2002
R7	R: METAL FILM 6.65k 1%	0721-6651
R8	R: METAL FILM 75.0 1%	0721-75R0
R9	R: METAL FILM 10k 2% 1/4W	0751-1032
R10	R: METAL FILM 6.19k 1%	0721-6191
R11	R: METAL FILM 3.32k 1%	0721-3321
R12	R: METAL FILM 2.10k 1%	0721-2101
R13	R: METAL FILM 10.0k 1%	0721-1002
R14	R: METAL FILM 20.0k 1%	0721-2002
R15	R: METAL FILM 6.65k 1%	0721-6651
R16	R: METAL FILM 75.0 1%	0721-75R0
R17	R: METAL FILM 715 1%	0721-7150
R18	R: VAR COMP 500, 10 TURN	2100-0027
R19	R: METAL FILM 3.40k 1%	0721-3401
R20	R: METAL FILM 9.76k 1%	0721-9761
R21	R: METAL FILM 226 1%	0721-2260
R22	R: METAL FILM 10k 2% 1/4W	0751-1032
R23, R24	R: METAL FILM 38.3k 1%	0721-3832
R25	R: METAL FILM 10.0k 1%	0721-1002
R26	R: METAL FILM 4.99k 1%	0721-4991
R27, R28	R: METAL FILM 10.0k 0.1%	0711-1002
R29	R: METAL FILM 10.0k 1%	0721-1002
R30	R: METAL FILM 7.50k 1%	0721-7501
R31	R: VAR COMP 1k, 10 TURN	2100-0021
R32	R: METAL FILM 10.0k 1%	0721-1002
R33	R: METAL FILM 5.11k 1%	0721-5111
R34	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R35, R36	R: METAL FILM 100 2% 1/4W	0751-1012
R37	R: METAL FILM 715 1%	0721-7150
R38	R: VAR COMP 500, 10 TURN	2100-0027
R39	R: METAL FILM 3.40k 1%	0721-3401
R40	R: METAL FILM 9.76k 1%	0721-9761
R41	R: METAL FILM 226 1%	0721-2260
R42, R43	R: METAL FILM 38.3k 1%	0721-3832
R44	R: METAL FILM 10.0k 1%	0721-1002
R45	R: METAL FILM 4.99k 1%	0721-4991
R46, R47	R: METAL FILM 10.0k 0.1%	0711-1002
R48	R: METAL FILM 10.0k 1%	0721-1002
R49	R: METAL FILM 7.50k 1%	0721-7501
R50	R: VAR COMP 1k, 10 TURN	2100-0021
R51	R: METAL FILM 10.0k 1%	0721-1002
R52	R: METAL FILM 5.11k 1%	0721-5111
R53	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R54, R55	R: METAL FILM 100 2% 1/4W	0751-1012
R56, R57	R: METAL FILM 10.0k 0.1%	0711-1002

A1 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
R58	R: METAL FILM 10.0k 1%	0721-1002
R59	R: METAL FILM 13.7k 1%	0721-1372
R60	R: VAR COMP 1k, 10 TURN	2100-0021
R61	R: METAL FILM 11.0k 1%	0721-1102
R62	R: METAL FILM 5.11k 1%	0721-5111
R63	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R64, R65	R: METAL FILM 100 2% 1/4W	0751-1012
R66	R: METAL FILM 8.45k 1%	0721-8451
R67	R: VAR COMP 1k, 10 TURN	2100-0021
R68	R: METAL FILM 5.36k 1%	0721-5361
R69	R: METAL FILM 1.69k 1%	0721-1691
R70	R: VAR COMP 1k, 10 TURN	2100-0021
R71	R: METAL FILM 7.50k 1%	0721-7501
R72, R73	R: METAL FILM 10.0k 0.1%	0711-1002
R74	R: METAL FILM 10.0k 1%	0721-1002
R75	R: METAL FILM 13.7k 1%	0721-1372
R76	R: VAR COMP 1k, 10 TURN	2100-0021
R77	R: METAL FILM 11.0k 1%	0721-1102
R78	R: METAL FILM 5.11k 1%	0721-5111
R79	R: FIXED CARBON 5.6M 5% 1/4W	0683-5655
R80, R81	R: METAL FILM 100 2% 1/4W	0751-1012
R82	R: METAL FILM 8.45k 1%	0721-8451
R83	R: VAR COMP 1k, 10 TURN	2100-0021
R84	R: METAL FILM 5.36k 1%	0721-5361
R85	R: METAL FILM 1.69k 1%	0721-1691
R86	R: VAR COMP 1k, 10 TURN	2100-0021
R87	R: METAL FILM 7.50k 1%	0721-7501
R88	R: METAL FILM 220k 2% 1/4W	0751-2242
R89	R: VAR COMP 50k, 10 TURN	2100-0025
R90	R: METAL FILM 24.9k 1%	0721-2492
R91	R: METAL FILM 10.0k 1%	0721-1002
R92	R: METAL FILM 220k 2% 1/4W	0751-2242
R93	R: VAR COMP 500, 10 TURN	2100-0027
R94	R: METAL FILM 2.74k 1%	0721-2741
R95	R: METAL FILM 13.0k 1%	0721-1302
R96	R: METAL FILM 499 1%	0721-4990
R97	R: METAL FILM 14.7k 1%	0721-1472
R98	R: VAR COMP 1k, 10 TURN	2100-0021
R99	R: METAL FILM 4.64k 1%	0721-4641
R100	R: METAL FILM 11.0k 1%	0721-1102
R101	R: METAL FILM 21.0k 1%	0721-2102
R102	R: METAL FILM 499 1%	0721-4990
R103	R: METAL FILM 24k 2% 1/4W	0751-2432
R104	R: METAL FILM 4.99k 1%	0721-4991
R105	R: METAL FILM 21.0k 1%	0721-2102
R106	R: METAL FILM 243k 1%	0721-2433
R107	R: VAR COMP 2k, 10 TURN	2100-0031
R108	R: METAL FILM 7.50k 1%	0721-7501
	(prior to serial number 630122 R108 was a 7.87k)	
R109	R: METAL FILM 15.8k 1%	0721-1582
	(prior to serial number 630122 R109 was a 7.15k)	

A1 BOARD TVM-230 cont.

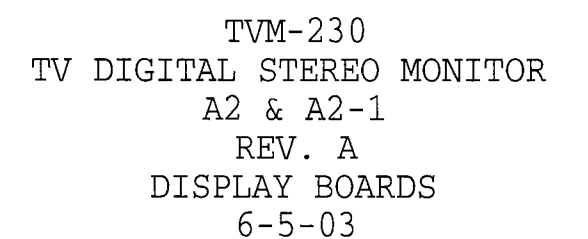
Reference Designation	Description	Part Number
R110 thru R112	R: METAL FILM 10.0k 1%	0721-1002
R113	R: METAL FILM 3k 2% 1/4W	0751-3022
R114	R: METAL FILM 10.0k 1%	0721-1002
R115	R: METAL FILM 9.53k 1%	0721-9531
R116	R: VAR COMP 1k, 10 TURN	2100-0021
R117	R: METAL FILM 10.0k 1%	0721-1002
R118	R: METAL FILM 3k 2% 1/4W	0751-3022
R119 thru R121	R: METAL FILM 10.0k 1%	0721-1002
R122	R: VAR COMP 2k, 10 TURN	2100-0031
R123	R: METAL FILM 9.09k 1%	0721-9091
R124	R: METAL FILM 4.99k 1%	0721-4991
R125	R: METAL FILM 1.00k 1%	0721-1001
R126	R: METAL FILM 6.65k 1%	0721-6651
R127	R: METAL FILM 3.32k 1%	0721-3321
R128	R: METAL FILM 17.4k 1%	0721-1742
R129	R: METAL FILM 499 1%	0721-4990
R130	R: VAR COMP 100, 10 TURN	2100-0022
R131	R: METAL FILM 499 1%	0721-4990
R132	R: METAL FILM 10k 2% 1/4W	0751-1032
R133	R: METAL FILM 1.00k 1%	0721-1001
R134	R: METAL FILM 6.65k 1%	0721-6651
R135	R: METAL FILM 3.32k 1%	0721-3321
R136	R: METAL FILM 17.4k 1%	0721-1742
R137	R: METAL FILM 499 1%	0721-4990
R138	R: VAR COMP 100, 10 TURN	2100-0022
R139	R: METAL FILM 499 1%	0721-4990
R140 thru R143	R: METAL FILM 10k 2% 1/4W	0751-1032
R144	R: METAL FILM 24.9k 1%	0721-2492
R145	R: VAR COMP 100k, 10 TURN	2100-0030
R146	R: METAL FILM 75 2% 1/4W	0751-7502
R147	R: METAL FILM 100k 1%	0721-1003
R148	R: VAR COMP 100, 10 TURN	2100-0022
R149	R: TEMP COMPENSATING 1.00k 1%	0791-1001
R150	R: METAL FILM 27.4k 1%	0721-2742
R151	R: VAR COMP 100k, 10 TURN	2100-0030
R152	R: METAL FILM 24.9k 1%	0721-2492
R153	R: METAL FILM 75 2% 1/4W	0751-7502
R154	R: METAL FILM 100k 1%	0721-1003
R155	R: VAR COMP 100, 10 TURN	2100-0022
R156	R: TEMP COMPENSATING 1.00k 1%	0791-1001
R157	R: METAL FILM 27.4k 1%	0721-2742
R158	R: METAL FILM 10k 2% 1/4W	0751-1032
R159 thru R167	R: METAL FILM 1k 2% 1/4W	0751-1022
R168 thru R170	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R171	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R172 thru R175	R: METAL FILM 470 2% 1/4W	0751-4712
R176 thru R181	R: METAL FILM 4.7k 2% 1/4W	0751-4722
RL1 thru RL3	RELAY: JWD-107-1 (or HE721A6341)	1600-0007

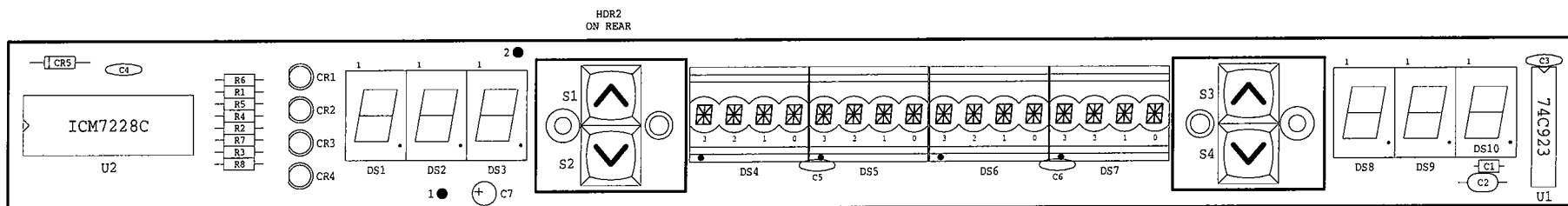
A1 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
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, U2	IC: NE5532	1826-0037
U3	IC: SSM2142P	1827-0005
U4	IC: NE5532	1826-0037
U5	IC: SSM2142P	1827-0005
U6	IC: TLO71	1826-0004
U7	IC: DG419	1827-0011
U8	IC: TLO72	1826-0038
U9, U10	IC: TLE2082	1826-0069
U11	IC: PKD01	1827-0001
U12	IC: TLO71	1826-0004
U13	IC: DG419	1827-0011
U14	IC: TLO72	1826-0038
U15, U16	IC: TLE2082	1826-0069
U17	IC: PKD01	1827-0001
U18, U19	IC: TLE2082	1826-0069
U20	IC: TLO71	1826-0004
U21	IC: PKD01	1827-0001
U22, U23	IC: TLE2082	1826-0069
U24	IC: TLO71	1826-0004
U25	IC: PKD01	1827-0001
U26	IC: TLO71	1826-0004
U27, U28	IC: TLO72	1826-0038
U29	IC: AD637	1827-0003
U30	IC: TLE2082	1826-0069
U31, U32	IC: LM318	1826-0010
U33	IC: TLE2082	1826-0069
U34	IC: PKD01	1827-0001
U35	IC: ADG409	1827-0010
U36	IC: NE5532	1826-0037
U37, U38	IC: DG419	1827-0011
U39	IC: 78L05CP	1826-0012
U40	IC: NE5532	1826-0037
U41, U42	IC: DG419	1827-0011
U43	IC: AD637	1827-0003
U44	IC: TLO71	1826-0004
U45	IC: AD680	1826-0051
U46	IC: AD637	1827-0003
U47	IC: TLO71	1826-0004
U48, U49	IC: SMP04	1827-0004
U50	IC: 78L08CP	1826-0058
U51	IC: 79L05CP	1826-0017
U52	IC: MC68HC11E1	1840-0010
U53	IC: 74HC14A	1822-0042
U54	IC: 78L05ACP	1826-0012

A1 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
U55	IC: 74HC00	1822-0039
U56	IC: MC34064	1826-0048
U57	IC: 74HC139A	1822-0048
U58	IC: MAX232	1823-0001
U59	IC: 74HC573	1822-0052
U60	IC: TVM-230 EPROM	1840-0011E
U61	IC: 74HC138	1822-0047
U62	IC: V62C51864L-70P	1840-0005
U63	IC: 74HC574	1822-0053
U64	IC: 74HC125	1822-0045
U65	IC: 74HC126A	1822-0046
U66	IC: 74HC573	1822-0052
U67	IC: 74HC574	1822-0053
U68	IC: 74HC74	1822-0067
U69	IC: 74HC138	1822-0047
U70	IC: 74HC574	1822-0053
U71	IC: 78L05CP	1826-0012
Y1	XTAL: 8 MHz	0411-0005

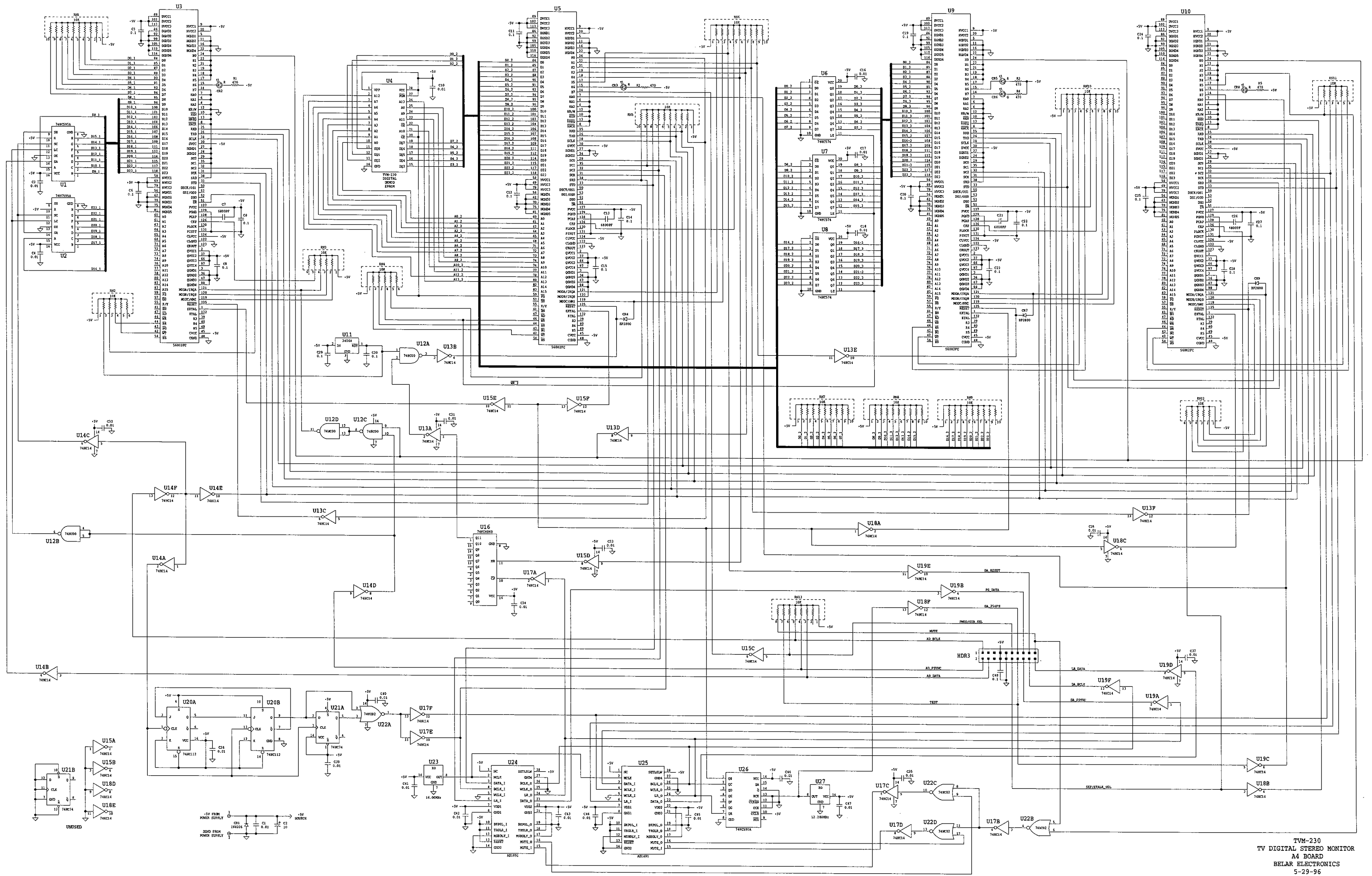


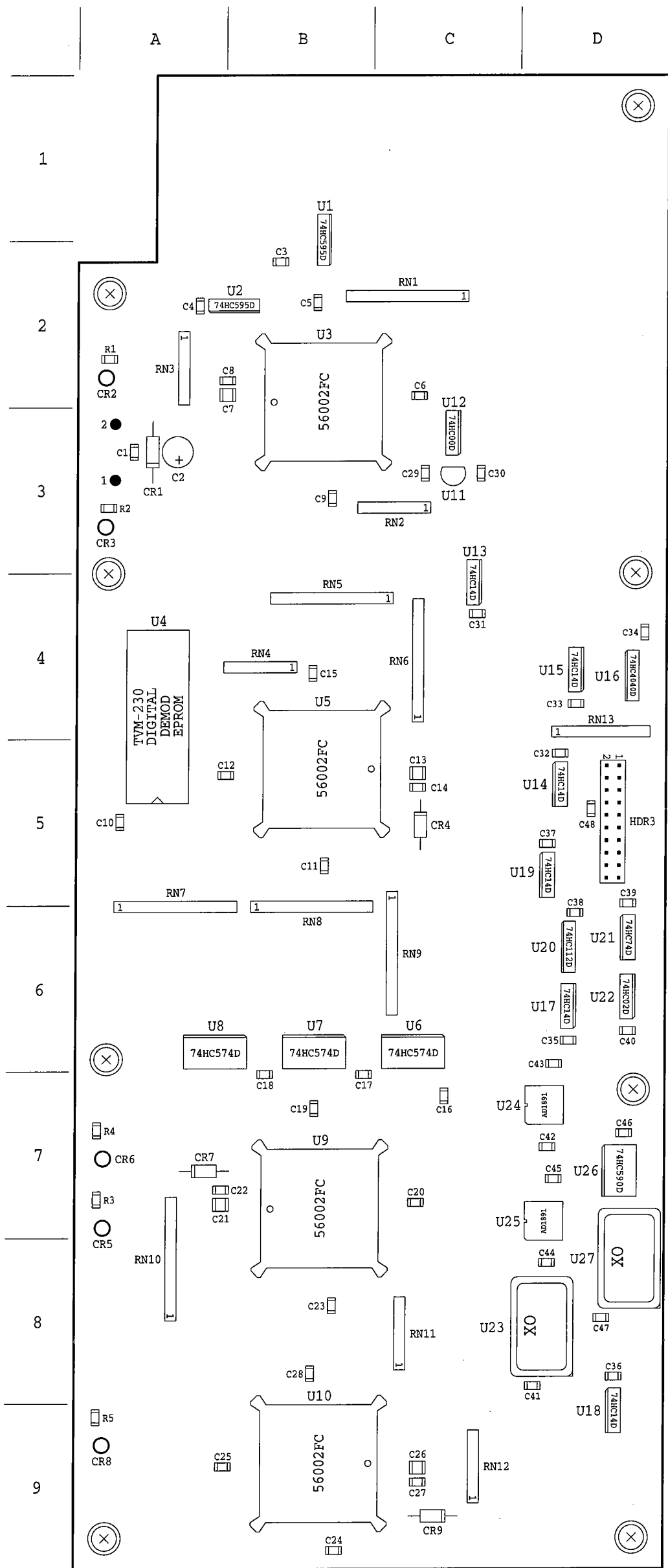


TVM-230 A2
REV. A
DISPLAY BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

A2 BOARD TVM-230, REV. A
 (Note: pc board is marked "TVM-250 A2")

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,CR2	LED: RED MV5053	1910-0001
CR3	LED: GREEN CMD5453	1910-0003
CR4	LED: YELLOW CMD5353	1910-0002
CR5	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





TVM-230 A4 BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS

TVM-230 A4 BOARD
PART LOCATIONS

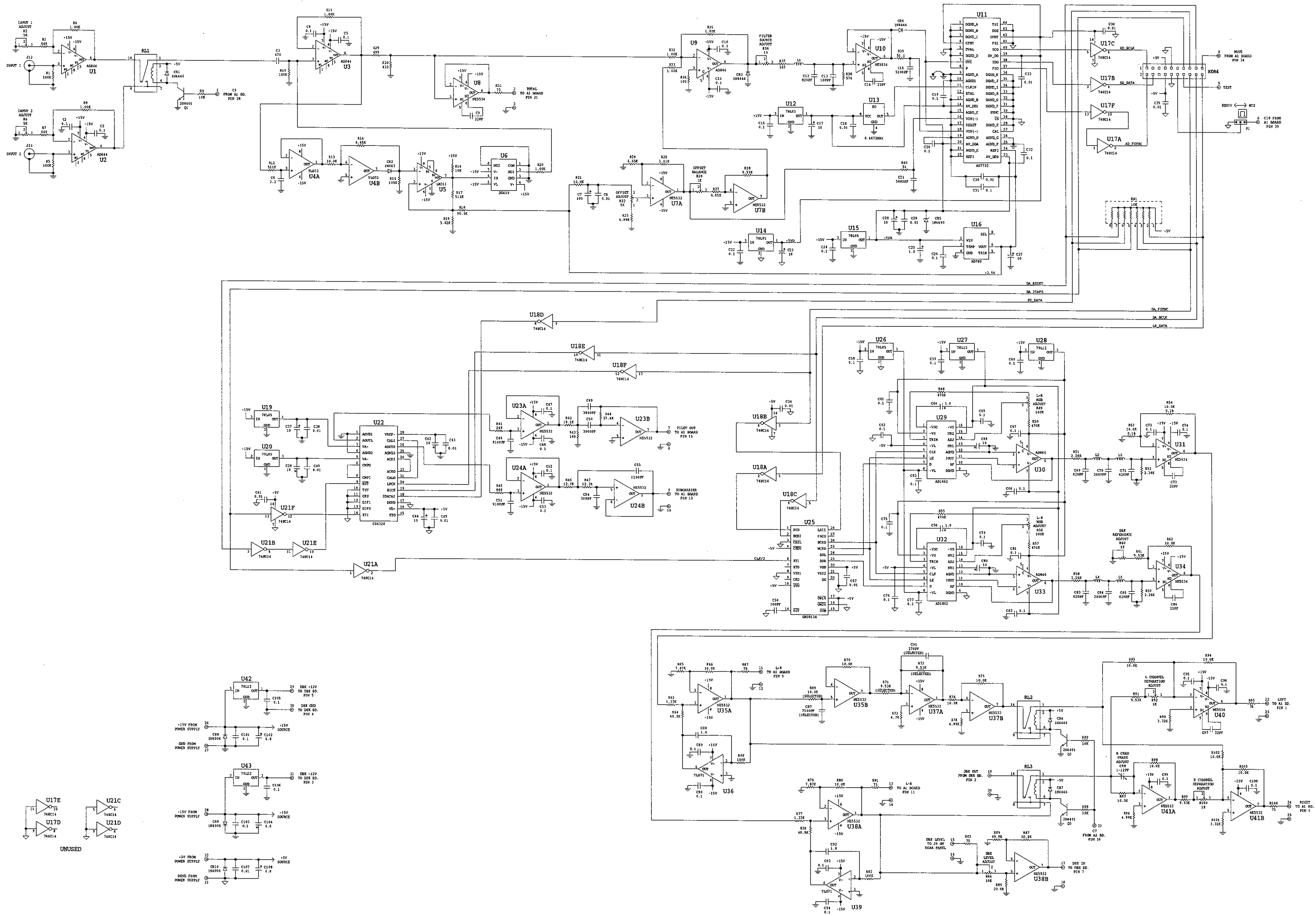
<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 A3	C20 C7	C39 D5	CR9 C9	RN10 A8	U15 D4						
C2 A3	C21 A7	C40 D6		RN11 C8	U16 D4						
C3 B2	C22 A7	C41 D8	HDR3 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							

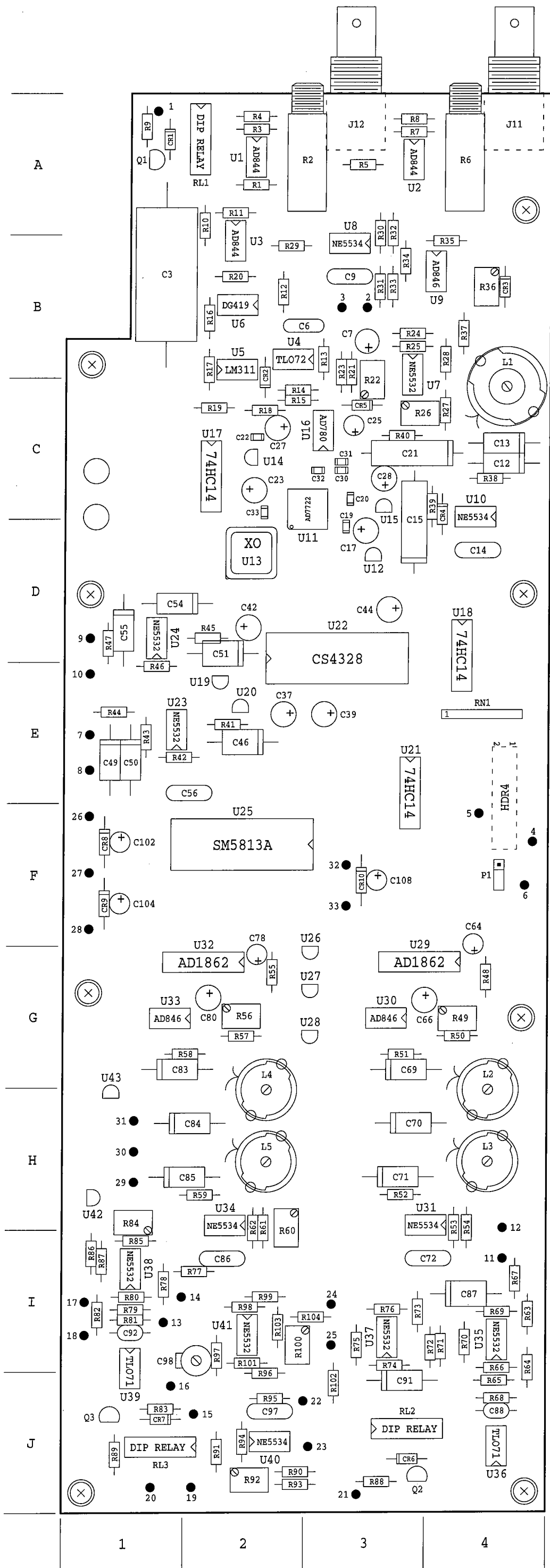
A4. BOARD TVM-230

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: TVM-230 DIGITAL DEMOD EPROM *(used beginning serial number 630122)	1840-0003I
U4**	IC: TVM-230 DIGITAL DEMOD EPROM **(used prior to serial number 630122)	1840-0003F
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

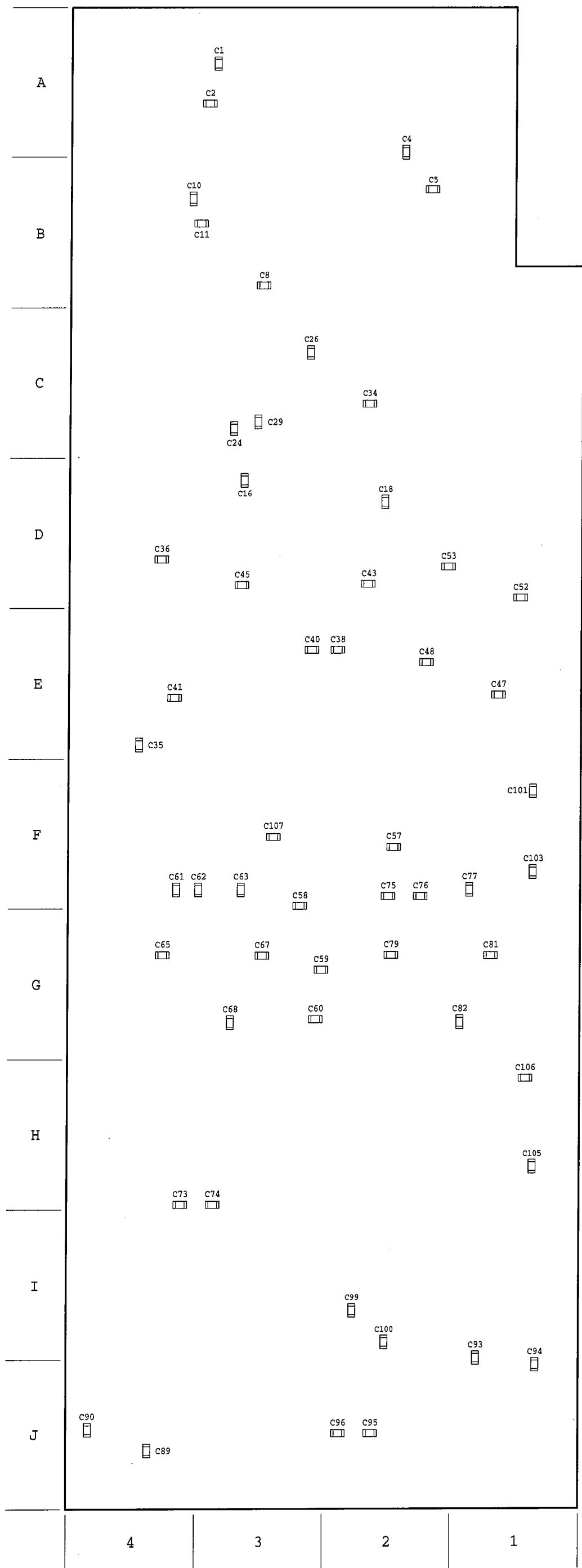
A4 BOARD TVM-230 cont.

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





TVM-230 A5 BOARD
REV. A
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS
(EFFECTIVE SERIAL NUMBER 630122)

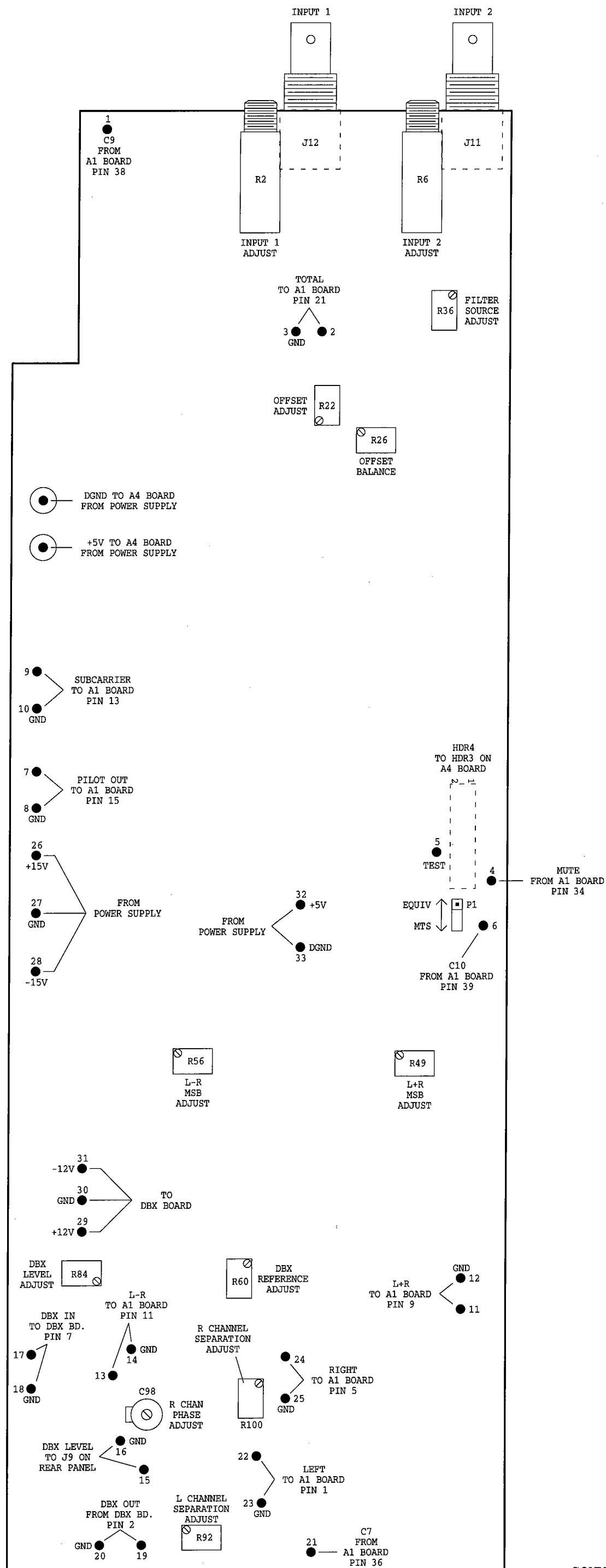


TVM-230 A5 BOARD
REV. A
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS
(EFFECTIVE SERIAL NUMBER 630122)

TVM-230 A5 BOARD REV. A
PART LOCATIONS
(effective serial number 630122)

<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*	C56 E2	CR1 A1	R28 B4	R83 J1	U27 G3
C2 A3*	C57 F2*	CR2 B2	R29 B2	R84 H1	U28 G3
C3 B1	C58 F3*	CR3 B4	R30 A3	R85 I1	U29 G3
C4 A2*	C59 G3*	CR4 C4	R31 B3	R86 I1	U30 G3
C5 B2*	C60 G3*	CR5 C3	R32 A3	R87 I1	U31 H4
C6 B2	C61 F4*	CR6 J3	R33 B3	R88 J3	U32 G2
C7 B3	C62 F3*	CR7 J1	R34 B3	R89 J1	U33 G1
C8 B3*	C63 F3*	CR8 F1	R35 B4	R90 J2	U34 H2
C9 B3	C64 F4	CR9 F1	R36 B4	R91 J2	U35 I4
C10 B4*	C65 G4*	CR10 F3	R37 B4	R92 J2	U36 J4
C11 B3*	C66 G3		R38 C4	R93 J2	U37 I3
C12 C4	C67 G3*	HDR4 E4	R39 C4	R94 J2	U38 I1
C13 C4	C68 G3*		R40 C3	R95 J2	U39 I1
C14 D4	C69 G3	J11 A4	R41 E2	R96 J2	U40 J2
C15 D3	C70 H3	J12 A3	R42 E1	R97 I2	U41 I2
C16 D3*	C71 H3		R43 E1	R98 I2	U42 H1
C17 D3	C72 I4	L1 C4	R44 E1	R99 I2	U43 H1
C18 D2*	C73 H4*	L2 H4	R45 D2	R100 I2	
C19 D3	C74 H3*	L3 H4	R46 E1	R101 I2	<u>pins</u>
C20 C3	C75 F2*	L4 H2	R47 D1	R102 J3	1 A1
C21 C3	C76 F2*	L5 H2	R48 G4	R103 I2	2 B3
C22 C2	C77 F1*		R49 G4	R104 I3	3 B3
C23 C2	C78 G2	P1 F4	R50 G4		4 F4
C24 C3*	C79 G2*		R51 G3	RL1 A2	5 F4
C25 C3	C80 G2	Q1 A1	R52 H3	RL2 J3	6 F4
C26 C3*	C81 G1*	Q2 J3	R53 H4	RL3 J1	7 E1
C27 C2	C82 G1*	Q3 J1	R54 H4		8 E1
C28 C3	C83 G1		R55 G2	RN1 E4	9 D1
C29 C3*	C84 H2	R1 A2	R56 G2		10 E1
C30 C3	C85 H2	R2 A2	R57 G2	U1 A2	11 I4
C31 C3	C86 I2	R3 A2	R58 G2	U2 A3	12 H4
C32 C3	C87 I4	R4 A2	R59 H2	U3 B2	13 I1
C33 C2	C88 J4	R5 A3	R60 H2	U4 B2	14 I1
C34 C2*	C89 J4*	R6 A4	R61 H2	U5 B2	15 J2
C35 E4*	C90 J4*	R7 A3	R62 H2	U6 B2	16 J1
C36 D4*	C91 J3	R8 A3	R63 I4	U7 B3	17 I1
C37 E2	C92 I1	R9 A1	R64 I4	U8 B3	18 I1
C38 E2*	C93 I1*	R10 A2	R65 J4	U9 B4	19 J2
C39 E3	C94 J1*	R11 A2	R66 I4	U10 C4	20 J1
C40 E3*	C95 J2*	R12 B2	R67 I4	U11 C2	21 J3
C41 E4*	C96 J2*	R13 B3	R68 J4	U12 D3	22 J3
C42 D2	C97 J2	R14 C2	R69 I4	U13 D2	23 J3
C43 D2*	C98 I2	R15 C2	R70 I4	U14 C2	24 I3
C44 D3	C99 I2*	R16 B2	R71 I4	U15 C3	25 I3
C45 D3*	C100 I2*	R17 B2	R72 I4	U16 C3	26 F1
C46 E2	C101 F1*	R18 C2	R73 I3	U17 C2	27 F1
C47 E1*	C102 F1	R19 C2	R74 I3	U18 D4	28 F1
C48 E2*	C103 F1*	R20 B2	R75 I3	U19 E2	29 H1
C49 E1	C104 F1	R21 B3	R76 I3	U20 E2	30 H1
C50 E1	C105 H1*	R22 C3	R77 I2	U21 E3	31 H1
C51 D2	C106 H1*	R23 B3	R78 I1	U22 D3	32 F3
C52 D1*	C107 F3*	R24 B3	R79 I1	U23 E1	33 F3
C53 D2*	C108 F3	R25 B3	R80 I1	U24 D1	
C54 D1		R26 C3	R81 I1	U25 F2	
C55 D1		R27 C4	R82 I1	U26 G3	

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



TVM-230 A5 BOARD
REV. A
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS
(EFFECTIVE SERIAL NUMBER 630122)

A5 BOARD TVM-230 Rev. A
(effective serial number 630122)

Reference Designation	Description	Part Number
C1,C2	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C3	C: FIXED ELEC 470uF 25V NON-POLAR	0180-0037
C4,C5	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C6	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C7	C: FIXED TANT 100uF 6.3V	0185-0010
C8	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C9	C: FIXED MICA 22pF 5%	0140-2205
C10,C11	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C12	C: FIXED POLY 820pF 2.5% 160V	0130-8212
C13	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C14	C: FIXED MICA 22pF 5%	0140-2205
C15	C: FIXED POLY 5100pF 1% 160V (C15 is selected for 1%)	0130-5122
C16	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C17	C: FIXED TANT 10uF 16V	0185-0007
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 POLY 5600pF 2.5% 160V	0130-5622
C22	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C23	C: FIXED TANT 10uF 16V	0185-0007
C24	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C25	C: FIXED TANT 1.0uF 35V	0185-0006
C26	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C27,C28	C: FIXED TANT 10uF 16V	0185-0007
C29,C30	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C31,C32	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C33 thru C36	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C37	C: FIXED TANT 10uF 16V	0185-0007
C38	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C39	C: FIXED TANT 10uF 16V	0185-0007
C40,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 TANT 10uF 16V	0185-0007
C45	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C46	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C47,C48	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C49,C50	C: FIXED POLY 3900pF 2.5% 160V	0130-3922
C51	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C52,C53	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C54	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C55	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C56	C: FIXED MICA 100pF 5%	0140-1015
C57	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C58 thru C63	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C64	C: FIXED TANT 1.0uF 35V	0185-0006
C65	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C66	C: FIXED TANT 10uF 16V	0185-0007
C67,C68	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014

A5 BOARD TVM-230 Rev. A, cont.
(effective serial number 630122)

Reference Designation	Description	Part Number
C69	C: FIXED POLY 620pF 2.5% 160V (C69 is matched with C83)	0130-6212
C70	C: FIXED POLY 2000pF 2.5% 160V (C70 is matched with C84)	0130-2022
C71	C: FIXED POLY 620pF 2.5% 160V (C71 is matched with C85)	0130-6212
C72	C: FIXED MICA 22pF 5%	0140-2205
C73 thru C77	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C78	C: FIXED TANT 1.0uF 35V	0185-0006
C79	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C80	C: FIXED TANT 10uF 16V	0185-0007
C81, C82	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C83	C: FIXED POLY 620pF 2.5% 160V (C83 is matched with C69)	0130-6212
C84	C: FIXED POLY 2000pF 2.5% 160V (C84 is matched with C70)	0130-2022
C85	C: FIXED POLY 620pF 2.5% 160V (C85 is matched with C71)	0130-6212
C86	C: FIXED MICA 22pF 5%	0140-2205
C87	C: FIXED POLY 7500pF 2.5% 160V (C87 is selected for value)	0130-7522
C88	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C89, C90	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C91	C: FIXED POLY 270pF 2.5% 160V (C91 is selected for value)	0130-2712
C92	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C93 thru C96	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C97	C: FIXED MICA 22pF 5%	0140-2205
C98	C: VARIABLE MICA 1-12pF	0121-0005
C99 thru C101	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C102	C: FIXED TANT 6.8uF 25V	0185-0002
C103	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C104	C: FIXED TANT 6.8uF 25V	0185-0002
C105, C106	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C107	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C108	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	DIODE: 1N4446	1900-0002
CR2	DIODE: 1N643	1900-0017
CR3, CR4	DIODE: 1N4446	1900-0002
CR5	DIODE: 1N4690	1900-0031
CR6, CR7	DIODE: 1N4446	1900-0002
CR8 thru CR10	DIODE: 1N4006	1900-0016
HDR4	HEADER RECEPTACLE: 20 PIN	0361-2020
J11, J12	CONNECTOR: BNC PC MOUNT	0360-0014
L1 thru L5	INDUCTOR: BELAR	

A5 BOARD TVM-230 Rev. A, cont.
(effective serial number 630122)

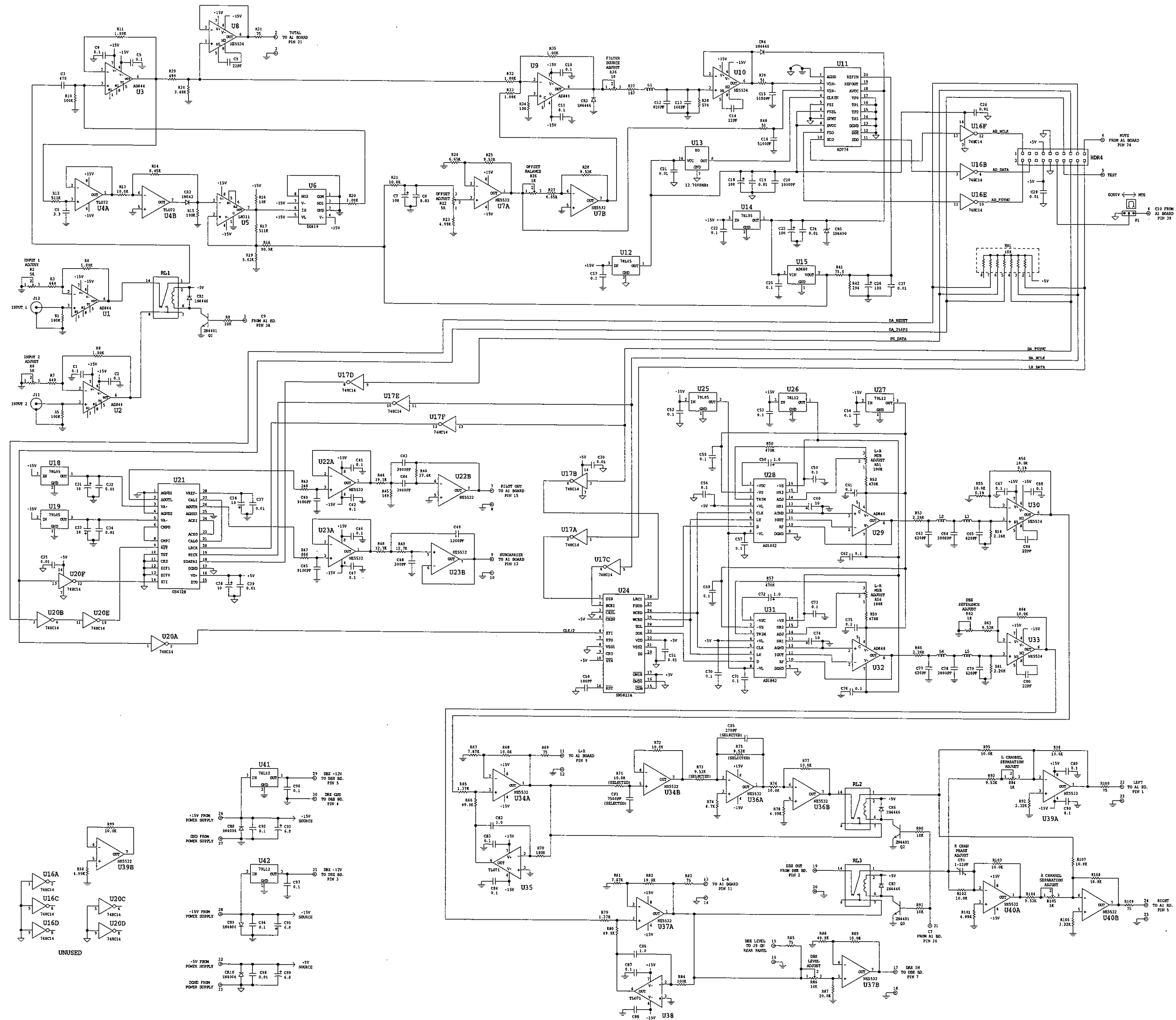
Reference Designation	Description	Part Number
P1	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 PIN (used with P1)	0365-0028
Q1 thru Q3	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 100k 2% 1/4W	0751-1042
R2	R: VAR COMP 5k, 10 TURN	2100-0026
R3	R: METAL FILM 649 1%	0721-6490
R4	R: METAL FILM 1.00k 1%	0721-1001
R5	R: METAL FILM 100k 2% 1/4W	0751-1042
R6	R: VAR COMP 5k, 10 TURN	2100-0026
R7	R: METAL FILM 649 1%	0721-6490
R8	R: METAL FILM 1.00k 1%	0721-1001
R9	R: METAL FILM 10k 2% 1/4W	0751-1032
R10	R: METAL FILM 100k 1%	0721-1003
R11	R: METAL FILM 1.00k 1%	0721-1001
R12	R: METAL FILM 511k 1%	0721-5113
R13	R: METAL FILM 10.0k 1%	0721-1002
R14	R: METAL FILM 8.45k 1%	0721-8451
R15	R: METAL FILM 100k 1%	0721-1003
R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17	R: METAL FILM 511k 1%	0721-5113
R18	R: METAL FILM 90.9k 1%	0721-9092
R19	R: METAL FILM 5.62k 1%	0721-5621
R20	R: METAL FILM 1.00k 1%	0721-1001
R21	R: METAL FILM 10.0k 1%	0721-1002
R22	R: VAR COMP 5k, 10 TURN	2100-0020
R23	R: METAL FILM 4.99k 1%	0721-4991
R24	R: METAL FILM 6.65k 1%	0721-6651
R25	R: METAL FILM 3.01k 1%	0721-3011
R26	R: VAR COMP 1k, 10 TURN	2100-0021
R27	R: METAL FILM 6.65k 1%	0721-6651
R28	R: METAL FILM 9.53k 1%	0721-9531
R29	R: METAL FILM 499 1%	0721-4990
R30	R: METAL FILM 432 1%	0721-4320
R31	R: METAL FILM 75 2% 1/4W	0751-7502
R32, R33	R: METAL FILM 1.00k 1%	0721-1001
R34	R: METAL FILM 100 2% 1/4W	0751-1012
R35	R: METAL FILM 1.00k 1%	0721-1001
R36	R: VAR COMP 10, 10 TURN	2100-0033
R37	R: METAL FILM 187 1%	0721-1870
R38	R: METAL FILM 576 1%	0721-5760
R39	R: METAL FILM 51.1 1%	0721-51R1
	(R39 is selected for value, nominal value shown)	
R40	R: METAL FILM 51 2% 1/4W	0751-5102
R41	R: METAL FILM 249 1%	0721-2490
R42	R: METAL FILM 19.1k 1%	0721-1912
R43	R: METAL FILM 169 1%	0721-1690
R44	R: METAL FILM 37.4k 1%	0721-3742
R45	R: METAL FILM 866 1%	0721-8660

A5 BOARD TVM-230 Rev. A, cont.
(effective serial number 630122)

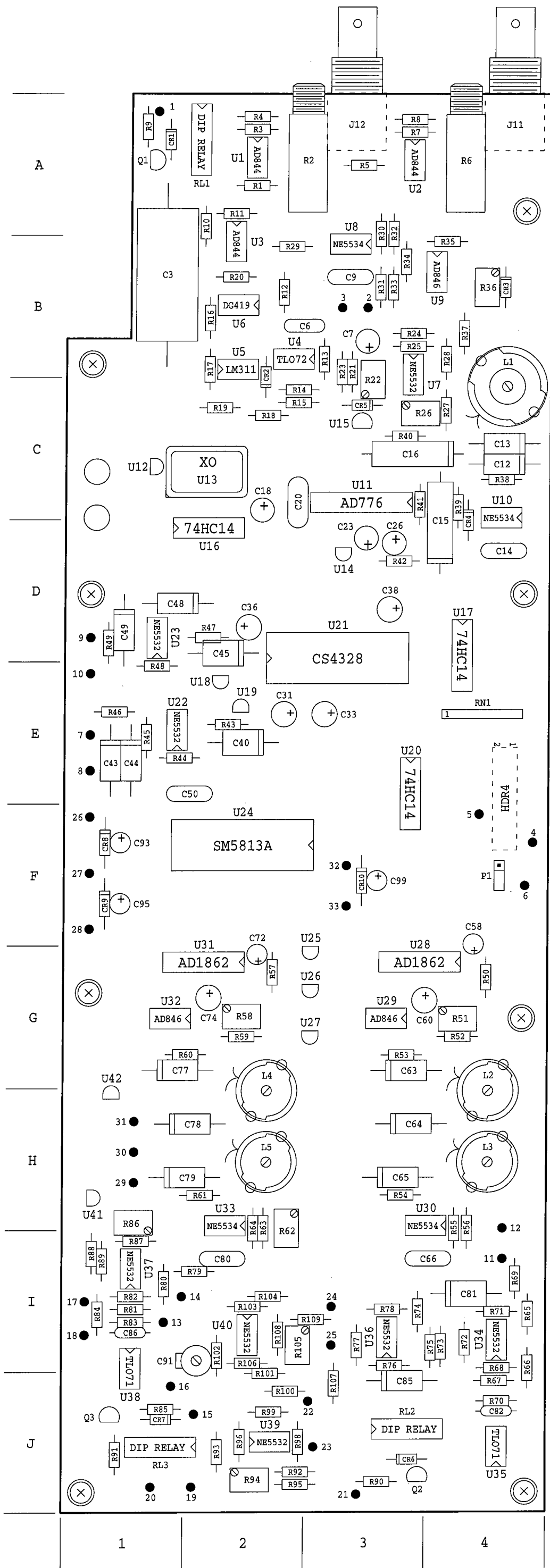
Reference Designation	Description	Part Number
R46,R47	R: METAL FILM 12.7k 1%	0721-1272
R48	R: METAL FILM 470k 2% 1/4W	0751-4742
R49	R: VAR COMP 100k, 10 TURN	2100-0030
R50	R: METAL FILM 470k 2% 1/4W	0751-4742
R51	R: METAL FILM 2.26k 1%	0721-2261
	(R51 is matched with R58)	
R52	R: METAL FILM 2.26k 1%	0721-2261
	(R52 is matched with R59)	
R53,R54	R: METAL FILM 10.0k 0.1%	0711-1002
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	R: METAL FILM 2.26k 1%	0721-2261
	(R58 is matched with R51)	
R59	R: METAL FILM 2.26k 1%	0721-2261
	(R59 is matched with R52)	
R60	R: VAR COMP 1k, 10 TURN	2100-0021
R61	R: METAL FILM 9.53k 1%	0721-9531
R62	R: METAL FILM 10.0k 1%	0721-1002
R63	R: METAL FILM 1.37k 1%	0721-1371
R64	R: METAL FILM 49.9k 1%	0721-4992
R65	R: METAL FILM 7.87k 1%	0721-7871
R66	R: METAL FILM 10.0k 1%	0721-1002
R67	R: METAL FILM 75 2% 1/4W	0751-7502
R68	R: METAL FILM 100k 2% 1/4W	0751-1042
R69	R: METAL FILM 10.0k 0.1%	0711-1002
R70	R: METAL FILM 10.0k 1%	0721-1002
R71	R: METAL FILM 9.53k 1%	0721-9531
	(R71 is matched with R72)	
R72	R: METAL FILM 9.53k 1%	0721-9531
	(R72 is matched with R71)	
R73	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R74,R75	R: METAL FILM 10.0k 1%	0721-1002
R76	R: METAL FILM 4.99k 1%	0721-4991
R77	R: METAL FILM 1.37k 1%	0721-1371
R78	R: METAL FILM 49.9k 1%	0721-4992
R79	R: METAL FILM 7.87k 1%	0721-7871
R80	R: METAL FILM 10.0k 1%	0721-1002
R81	R: METAL FILM 75 2% 1/4W	0751-7502
R82	R: METAL FILM 100k 2% 1/4W	0751-1042
R83	R: METAL FILM 75 2% 1/4W	0751-7502
R84	R: VAR COMP 10k, 10 TURN	2100-0024
R85	R: METAL FILM 20.0k 1%	0721-2002
R86	R: METAL FILM 49.9k 1%	0721-4992
R87	R: METAL FILM 10.0k 1%	0721-1002
R88,R89	R: METAL FILM 10k 2% 1/4W	0751-1032
R90	R: METAL FILM 3.32k 1%	0721-3321
R91	R: METAL FILM 9.53k 1%	0721-9531
R92	R: VAR COMP 1k, 10 TURN	2100-0021
R93,R94	R: METAL FILM 10.0k 1%	0721-1002

A5 BOARD TVM-230 Rev. A, cont.
(effective serial number 630122)

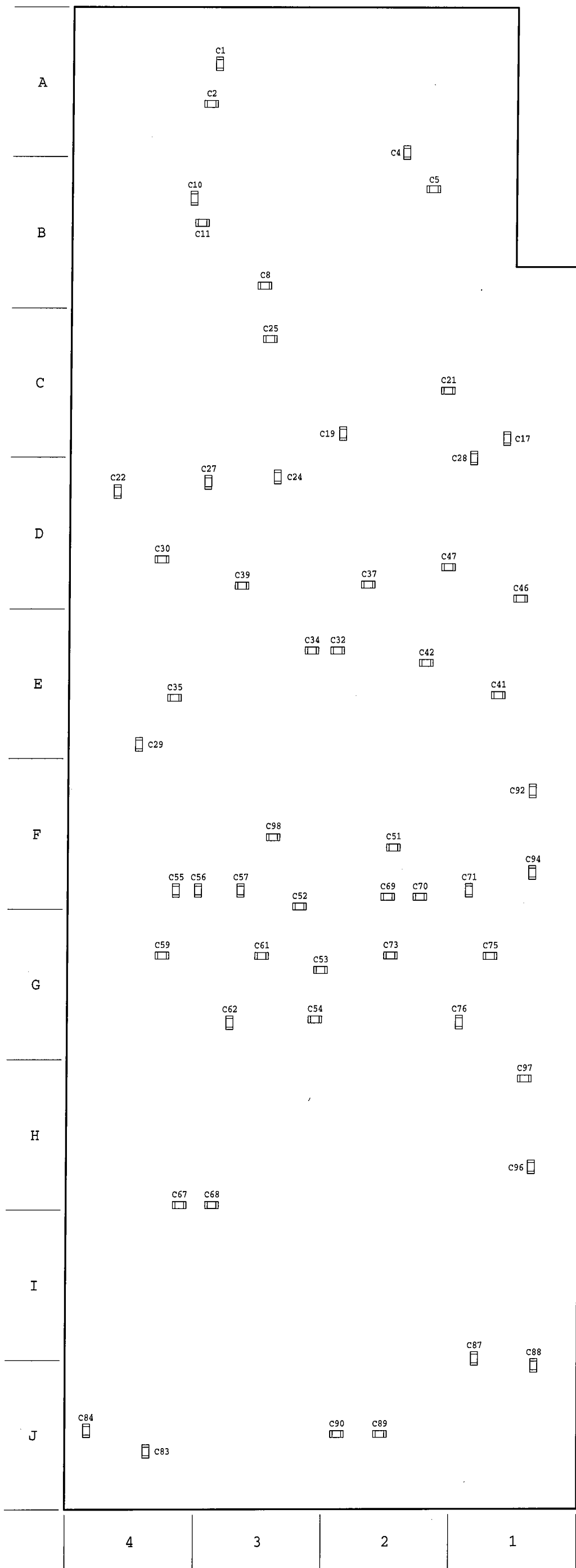
Reference Designation	Description	Part Number
R95	R: METAL FILM 75 2% 1/4W	0751-7502
R96	R: METAL FILM 4.99k 1%	0721-4991
R97,R98	R: METAL FILM 10.0k 1%	0721-1002
R99	R: METAL FILM 9.53k 1%	0721-9531
R100	R: VAR COMP 1k, 10 TURN	2100-0021
R101	R: METAL FILM 3.32k 1%	0721-3321
R102,R103	R: METAL FILM 10.0k 1%	0721-1002
R104	R: METAL FILM 75 2% 1/4W	0751-7502
RL1 thru RL3	RELAY: JWD-172-1	1600-0006
RN1	R: NETWORK 8 PIN 10k	0908-1032
U1 thru U3	IC: AD844A	1826-0052
U4	IC: TLO72	1826-0038
U5	IC: LM311	1826-0009
U6	IC: DG419	1827-0011
U7	IC: NE5532	1826-0037
U8	IC: NE5534	1826-0025
U9	IC: AD846A	1827-0008
U10	IC: NE5534	1826-0025
U11	IC: AD7722	1880-0003
U12	IC: 78L05CP	1826-0012
U13	IC: XO, 8.4672MHz	0416-8467
U14,U15	IC: 78L05CP	1826-0012
U16	IC: AD780	1826-0064
U17,U18	IC: 74HC14A	1822-0042
U19	IC: 78L05CP	1826-0012
U20	IC: 79L05CP	1826-0017
U21	IC: 74HC14A	1822-0042
U22	IC: CS4328	1830-0004
U23,U24	IC: NE5532	1826-0037
U25	IC: SM5813A	1830-0003
U26	IC: 79L05CP	1826-0017
U27	IC: 78L12CP	1826-0015
U28	IC: 79L12CP	1826-0019
U29	IC: AD1862	1830-0006
U30	IC: AD846A	1827-0008
U31	IC: NE5534	1826-0025
U32	IC: AD1862	1830-0006
U33	IC: AD846A	1827-0008
U34	IC: NE5534	1826-0025
U35	IC: NE5532	1826-0037
U36	IC: TLO71	1826-0004
U37,U38	IC: NE5532	1826-0037
U39	IC: TLO71	1826-0004
U40	IC: NE5534	1826-0025
U41	IC: NE5532	1826-0037
U42	IC: 78L12CP	1826-0015
U43	IC: 79L12CP	1826-0019



TVM-230
TV DIGITAL STEREO MONITOR
A5 BOARD
BELAR ELECTRONICS
11-16-98
(USED PRIOR TO SERIAL NUMBER 630122)



TVM-230 A5 BOARD
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS
(USED PRIOR TO SERIAL NUMBER 630122)

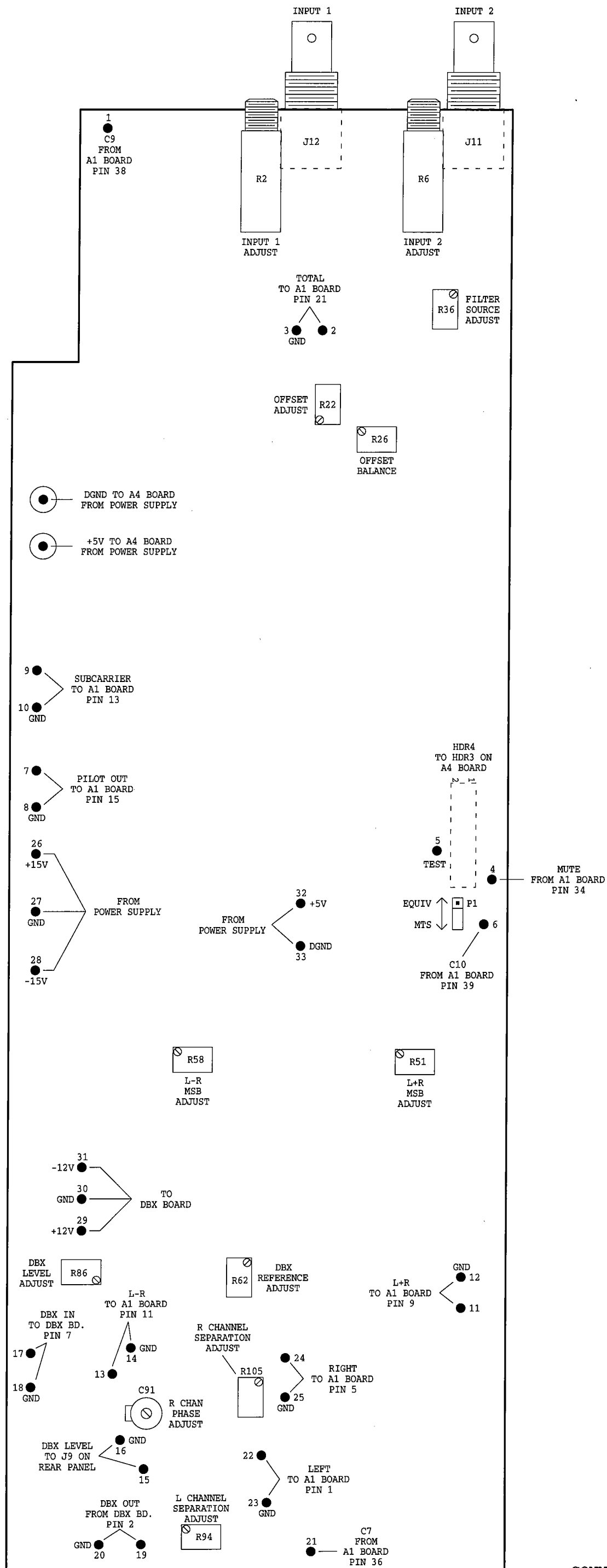


TVM-230 A5 BOARD
COMPONENT LAYOUT-BOTTOM
BELAR ELECTRONICS
(USED PRIOR TO SERIAL NUMBER 630122)

TVM-230 A5 BOARD
PART LOCATIONS
(used prior to serial number 630122)

<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*	C55 F4*	CR9 F1	R35 B4	R89 I1	U27 G3
C2 A3*	C56 F3*	CR10 F3	R36 B4	R90 J3	U28 G3
C3 B1	C57 F3*		R37 B4	R91 J1	U29 G3
C4 A2*	C58 F4	HDR4 E4	R38 C4	R92 J2	U30 H4
C5 B2*	C59 G4*		R39 C4	R93 J2	U31 G2
C6 B2	C60 G3	J11 A4	R40 C3	R94 J2	U32 G1
C7 B3	C61 G3*	J12 A3	R41 C3	R95 J2	U33 H2
C8 B3*	C62 G3*		R42 D3	R96 J2	U34 I4
C9 B3	C63 G3	L1 C4	R43 E2	R97 --	U35 J4
C10 B4*	C64 H3	L2 H4	R44 E1	R98 J2	U36 I3
C11 B3*	C65 H3	L3 H4	R45 E1	R99 J2	U37 I1
C12 C4	C66 I4	L4 H2	R46 E1	R100 J2	U38 I1
C13 C4	C67 H4*	L5 H2	R47 D2	R101 J2	U39 J2
C14 D4	C68 H3*		R48 E1	R102 I2	U40 I2
C15 C4	C69 F2*	P1 F4	R49 D1	R103 I2	U41 H1
C16 C3	C70 F2*		R50 G4	R104 I2	U42 H1
C17 C1*	C71 F1*	Q1 A1	R51 G4	R105 I2	
C18 C2	C72 G2	Q2 J3	R52 G4	R106 I2	<u>pins</u>
C19 C2*	C73 G2*	Q3 J1	R53 G3	R107 J3	1 A1
C20 C2	C74 G2		R54 H3	R108 I2	2 B3
C21 C2*	C75 G1*	R1 A2	R55 H4	R109 I3	3 B3
C22 D4*	C76 G1*	R2 A2	R56 H4		4 F4
C23 D3	C77 G1	R3 A2	R57 G2	RL1 A2	5 F4
C24 D3*	C78 H2	R4 A2	R58 G2	RL2 J3	6 F4
C25 C3*	C79 H2	R5 A3	R59 G2	RL3 J1	7 E1
C26 D3	C80 I2	R6 A4	R60 G2		8 E1
C27 D3*	C81 I4	R7 A3	R61 H2	RN1 E4	9 D1
C28 D1*	C82 J4	R8 A3	R62 H2		10 E1
C29 E4*	C83 J4*	R9 A1	R63 H2	U1 A2	11 I4
C30 D4*	C84 J4*	R10 A2	R64 H2	U2 A3	12 H4
C31 E2	C85 J3	R11 A2	R65 I4	U3 B2	13 I1
C32 E2*	C86 I1	R12 B2	R66 I4	U4 B2	14 I1
C33 E3	C87 I1*	R13 B3	R67 J4	U5 B2	15 J2
C34 E3*	C88 J1*	R14 C2	R68 I4	U6 B2	16 J1
C35 E4*	C89 J2*	R15 C2	R69 I4	U7 B3	17 I1
C36 D2	C90 J2*	R16 B2	R70 J4	U8 B3	18 I1
C37 D2*	C91 I2	R17 B2	R71 I4	U9 B4	19 J2
C38 D3	C92 F1*	R18 C2	R72 I4	U10 C4	20 J1
C39 D3*	C93 F1	R19 C2	R73 I4	U11 C3	21 J3
C40 E2	C94 F1*	R20 B2	R74 I3	U12 C1	22 J3
C41 E1*	C95 F1	R21 B3	R75 I4	U13 C2	23 J3
C42 E2*	C96 H1*	R22 C3	R76 I3	U14 D3	24 I3
C43 E1	C97 H1*	R23 B3	R77 I3	U15 C3	25 I3
C44 E1	C98 F3*	R24 B3	R78 I3	U16 D2	26 F1
C45 D2	C99 F3	R25 B3	R79 I2	U17 D4	27 F1
C46 D1*		R26 C3	R80 I1	U18 E2	28 F1
C47 D2*	CR1 A1	R27 C4	R81 I1	U19 E2	29 H1
C48 D1	CR2 B2	R28 B4	R82 I1	U20 E3	30 H1
C49 D1	CR3 B4	R29 B2	R83 I1	U21 D3	31 H1
C50 E2	CR4 D4	R30 A3	R84 I1	U22 E1	32 F3
C51 F2*	CR5 C3	R31 B3	R85 J1	U23 D1	33 F3
C52 F3*	CR6 J3	R32 A3	R86 H1	U24 F2	
C53 G3*	CR7 J1	R33 B3	R87 I1	U25 G3	
C54 G3*	CR8 F1	R34 B3	R88 I1	U26 G3	

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



TVM-230 A5 BOARD
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS
(USED PRIOR TO SERIAL NUMBER 630122)

A5 BOARD TVM-230
(used prior to serial number 630122)

Reference Designation	Description	Part Number
C1,C2	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C3	C: FIXED ELEC 470uF 25V NON-POLAR	0180-0037
C4,C5	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C6	C: FIXED CERAMIC 3.3uF 50V	0151-0011
C7	C: FIXED TANT 100uF 6.3V	0185-0010
C8	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C9	C: FIXED MICA 22pF 5%	0140-2205
C10,C11	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C12	C: FIXED POLY 820pF 2.5% 160V	0130-8212
C13	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C14	C: FIXED MICA 22pF 5%	0140-2205
C15	C: FIXED POLY 5100pF 1% 160V (C15 is selected for 1%)	0130-5122
C16	C: FIXED POLY 5100pF 2.5% 160V (C16 is selected)	0130-5122
C17	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C18	C: FIXED TANT 100uF 6.3V	0185-0010
C19	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C20	C: FIXED MICA 1000pF 5%	0140-1025
C21	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C22	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C23	C: FIXED TANT 100uF 6.3V	0185-0010
C24	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C25	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C26	C: FIXED TANT 100uF 6.3V	0185-0010
C27 thru C30	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C31	C: FIXED TANT 10uF 16V	0185-0007
C32	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C33	C: FIXED TANT 10uF 16V	0185-0007
C34,C35	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C36	C: FIXED TANT 10uF 16V	0185-0007
C37	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C38	C: FIXED TANT 10uF 16V	0185-0007
C39	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C40	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C41,C42	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C43,C44	C: FIXED POLY 3900pF 2.5% 160V	0130-3922
C45	C: FIXED POLY 9100pF 2.5% 160V	0130-9122
C46,C47	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C48	C: FIXED POLY 300pF 2.5% 160V	0130-3012
C49	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C50	C: FIXED MICA 100pF 5%	0140-1015
C51	C: FIXED CERAMIC CHIP 0.01uF 50V C1206	0151-0021
C52 thru C57	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C58	C: FIXED TANT 1.0uF 35V	0185-0006
C59	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C60	C: FIXED TANT 10uF 16V	0185-0007
C61,C62	C: FIXED CERAMIC CHIP 0.1uF 50V C1206	0151-0014
C63	C: FIXED POLY 620pF 2.5% 160V (C63 is matched with C77)	0130-6212

A5 BOARD TVM-230 cont.
(used prior to serial number 630122)

Reference Designation	Description	Part Number
C64	C: FIXED POLY 2000pF 2.5% 160V (C64 is matched with C78)	0130-2022
C65	C: FIXED POLY 620pF 2.5% 160V (C65 is matched with C79)	0130-6212
C66	C: FIXED MICA 22pF 5%	0140-2205
C67 thru C71	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C72	C: FIXED TANT 1.0uF 35V	0185-0006
C73	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C74	C: FIXED TANT 10uF 16V	0185-0007
C75, C76	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C77	C: FIXED POLY 620pF 2.5% 160V (C77 is matched with C63)	0130-6212
C78	C: FIXED POLY 2000pF 2.5% 160V (C78 is matched with C64)	0130-2022
C79	C: FIXED POLY 620pF 2.5% 160V (C79 is matched with C65)	0130-6212
C80	C: FIXED MICA 22pF 5%	0140-2205
C81	C: FIXED POLY 7500pF 2.5% 160V (C81 is selected for value)	0130-7522
C82	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C83, C84	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C85	C: FIXED POLY 270pF 2.5% 160V (C85 is selected for value)	0130-2712
C86	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C87 thru C90	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C91	C: VARIABLE MICA 1-12pF	0121-0005
C92	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C93	C: FIXED TANT 6.8uF 25V	0185-0002
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 CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C99	C: FIXED TANT 6.8uF 25V	0185-0002
CR1	DIODE: 1N4446	1900-0002
CR2	DIODE: 1N643	1900-0017
CR3, CR4	DIODE: 1N4446	1900-0002
CR5	DIODE: 1N4690	1900-0031
CR6, CR7	DIODE: 1N4446	1900-0002
CR8 thru CR10	DIODE: 1N4006	1900-0016
HDR4	HEADER RECEPTACLE: 20 PIN	0361-2020
J11, J12	CONNECTOR: BNC PC MOUNT	0360-0014
L1 thru L5	INDUCTOR: BELAR	
P1	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 PIN (used with P1)	0365-0028

A5 BOARD TVM-230 cont.
(used prior to serial number 630122)

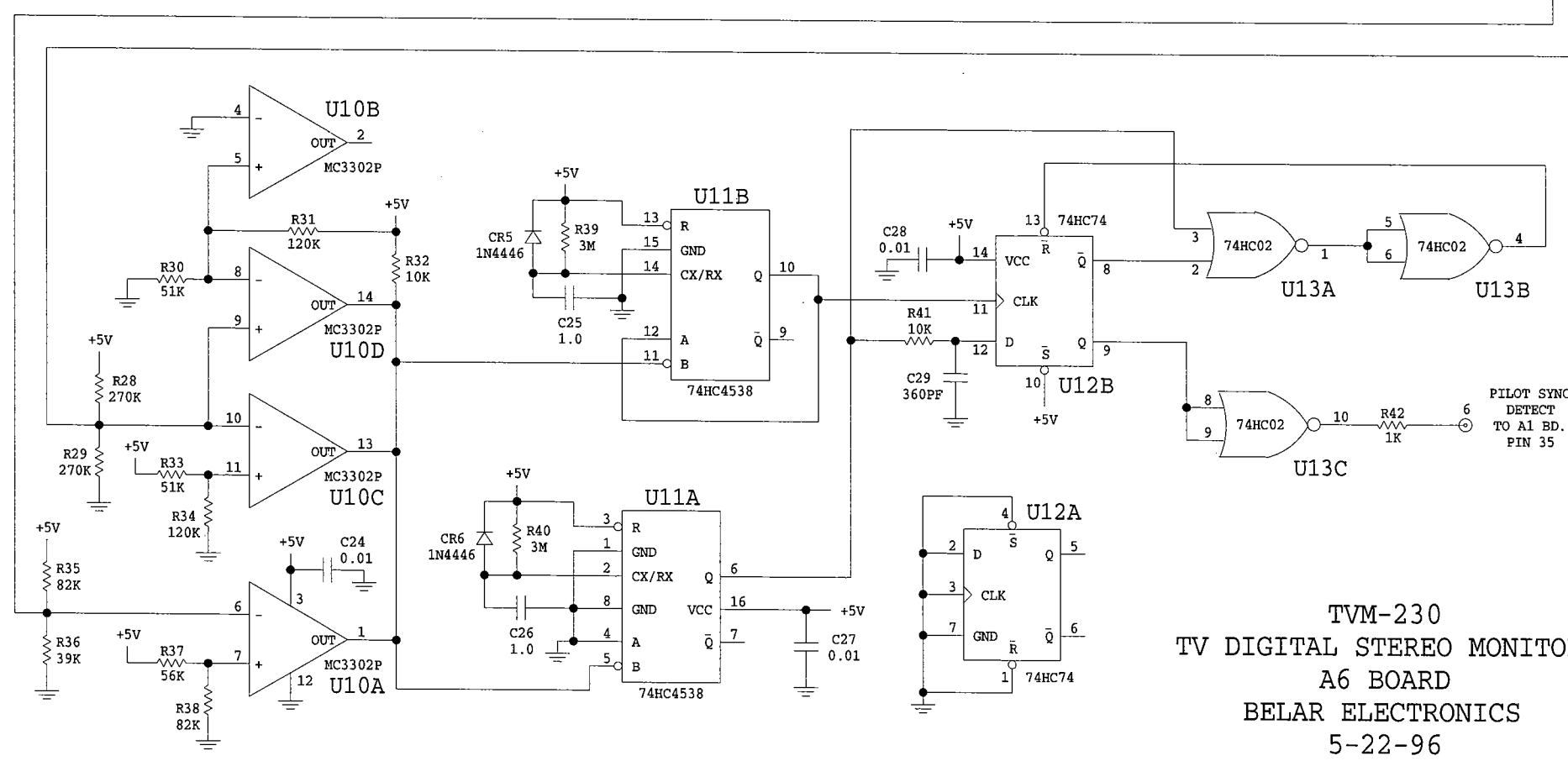
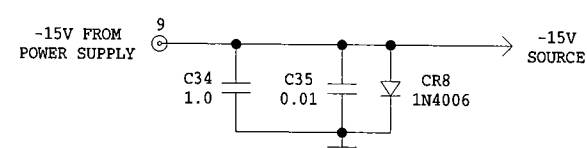
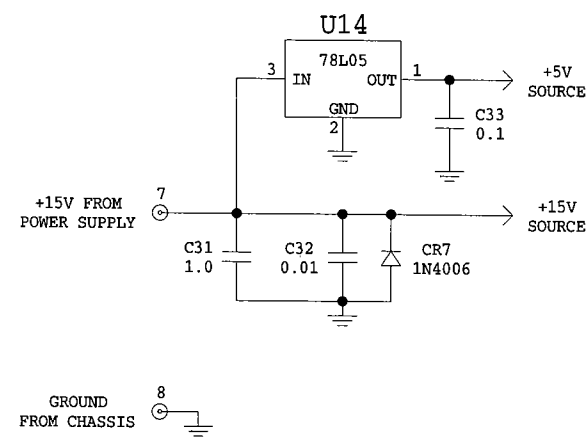
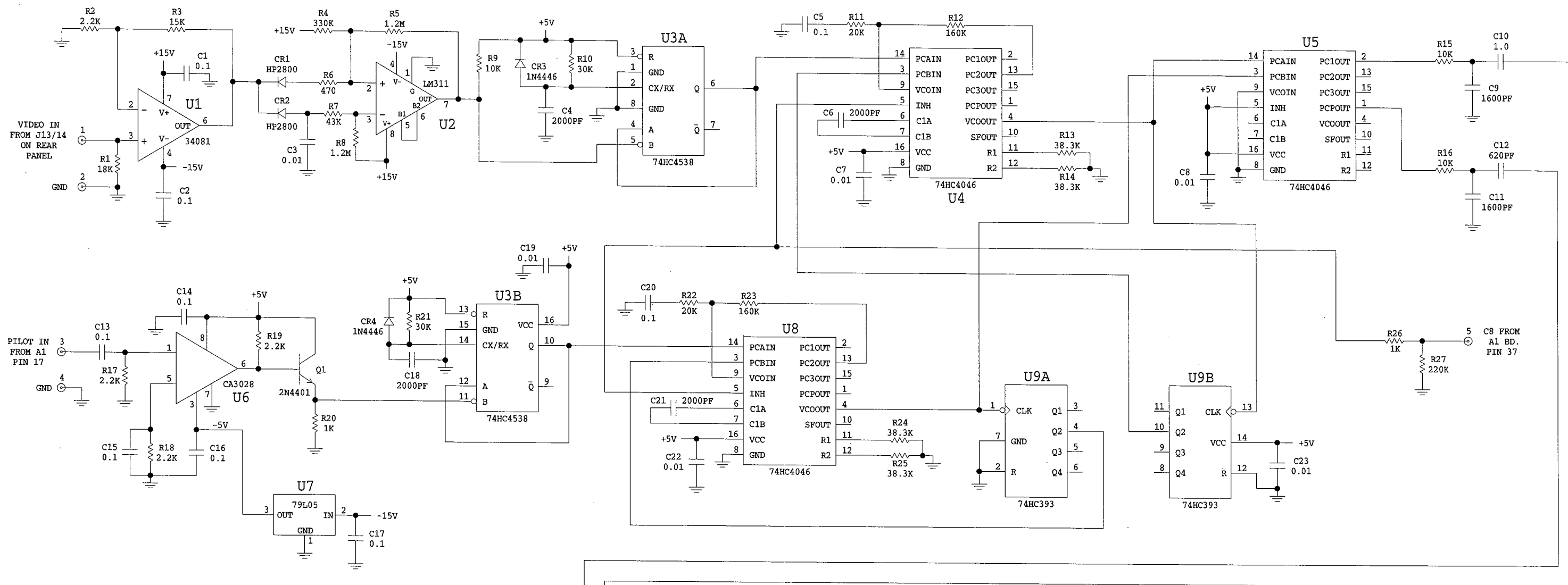
Reference Designation	Description	Part Number
Q1 thru Q3	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 100k 2% 1/4W	0751-1042
R2	R: VAR COMP 5k, 10 TURN	2100-0026
R3	R: METAL FILM 649 1%	0721-6490
R4	R: METAL FILM 1.00k 1%	0721-1001
R5	R: METAL FILM 100k 2% 1/4W	0751-1042
R6	R: VAR COMP 5k, 10 TURN	2100-0026
R7	R: METAL FILM 649 1%	0721-6490
R8	R: METAL FILM 1.00k 1%	0721-1001
R9	R: METAL FILM 10k 2% 1/4W	0751-1032
R10	R: METAL FILM 100k 1%	0721-1003
R11	R: METAL FILM 1.00k 1%	0721-1001
R12	R: METAL FILM 511k 1%	0721-5113
R13	R: METAL FILM 10.0k 1%	0721-1002
R14	R: METAL FILM 8.45k 1%	0721-8451
R15	R: METAL FILM 100k 1%	0721-1003
R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17	R: METAL FILM 511k 1%	0721-5113
R18	R: METAL FILM 90.9k 1%	0721-9092
R19	R: METAL FILM 5.62k 1%	0721-5621
R20	R: METAL FILM 1.00k 1%	0721-1001
R21	R: METAL FILM 10.0k 1%	0721-1002
R22	R: VAR COMP 5k, 10 TURN	2100-0020
R23	R: METAL FILM 4.99k 1%	0721-4991
R24	R: METAL FILM 6.65k 1%	0721-6651
R25	R: METAL FILM 9.53k 1%	0721-9531
R26	R: VAR COMP 1k, 10 TURN	2100-0021
R27	R: METAL FILM 6.65k 1%	0721-6651
R28	R: METAL FILM 9.53k 1%	0721-9531
R29	R: METAL FILM 499 1%	0721-4990
R30	R: METAL FILM 3.40k 1%	0721-3401
R31	R: METAL FILM 75 2% 1/4W	0751-7502
R32, R33	R: METAL FILM 1.00k 1%	0721-1001
R34	R: METAL FILM 100 2% 1/4W	0751-1012
R35	R: METAL FILM 1.00k 1%	0721-1001
R36	R: VAR COMP 10, 10 TURN	2100-0033
R37	R: METAL FILM 187 1%	0721-1870
R38	R: METAL FILM 576 1%	0721-5760
R39	R: METAL FILM 51.1 1%	0721-51R1
	(R39 is selected for value, nominal value shown)	
R40	R: METAL FILM 51 2% 1/4W	0751-5102
R41	R: METAL FILM 75.0 1%	0721-75R0
R42	R: METAL FILM 294 1%	0721-2940
R43	R: METAL FILM 249 1%	0721-2490
R44	R: METAL FILM 19.1k 1%	0721-1912
R45	R: METAL FILM 169 1%	0721-1690
R46	R: METAL FILM 37.4k 1%	0721-3742
R47	R: METAL FILM 866 1%	0721-8660
R48, R49	R: METAL FILM 12.7k 1%	0721-1272

A5 BOARD TVM-230 cont.
(used prior to serial number 630122)

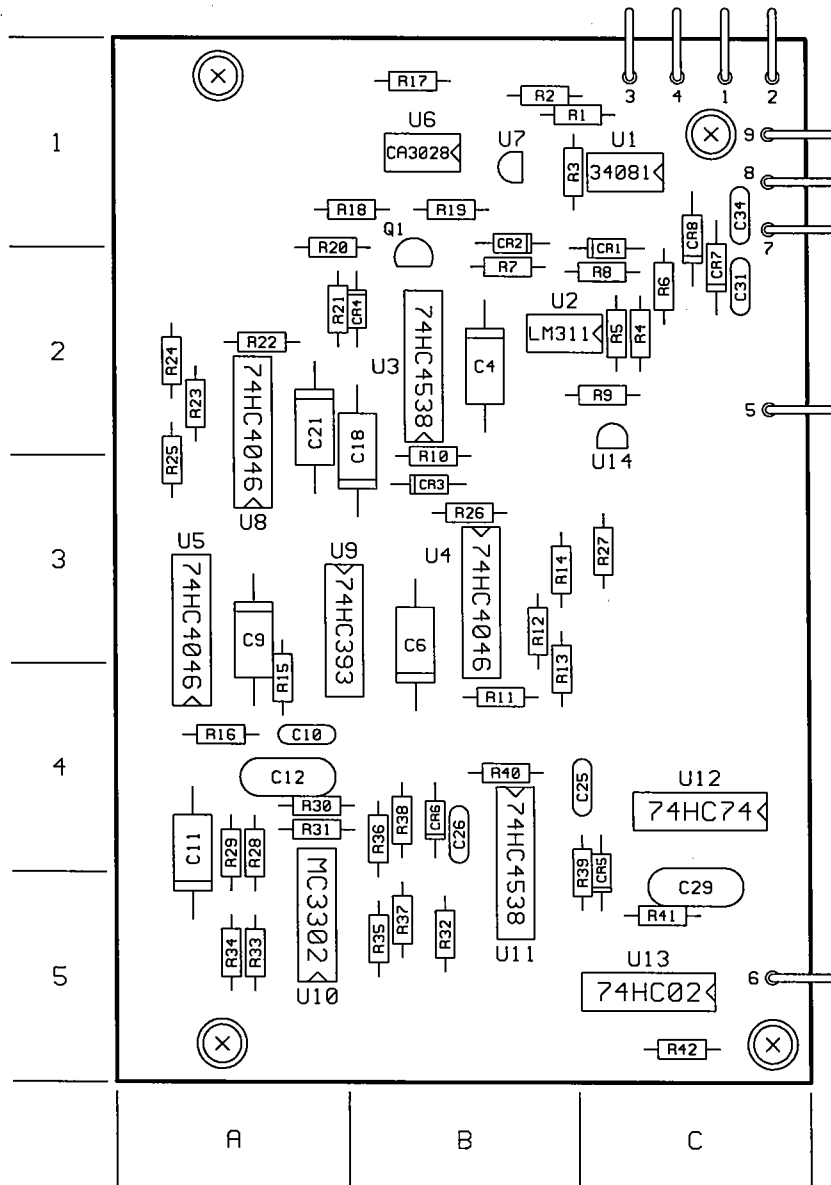
Reference Designation	Description	Part Number
R50	R: METAL FILM 470k 2% 1/4W	0751-4742
R51	R: VAR COMP 100k, 10 TURN	2100-0030
R52	R: METAL FILM 470k 2% 1/4W	0751-4742
R53	R: METAL FILM 2.26k 1% (R53 is matched with R60)	0721-2261
R54	R: METAL FILM 2.26k 1% (R54 is matched with R61)	0721-2261
R55, R56	R: METAL FILM 10.0k 0.1%	0711-1002
R57	R: METAL FILM 470k 2% 1/4W	0751-4742
R58	R: VAR COMP 100k, 10 TURN	2100-0030
R59	R: METAL FILM 470k 2% 1/4W	0751-4742
R60	R: METAL FILM 2.26k 1% (R60 is matched with R53)	0721-2261
R61	R: METAL FILM 2.26k 1% (R61 is matched with R54)	0721-2261
R62	R: VAR COMP 1k, 10 TURN	2100-0021
R63	R: METAL FILM 9.53k 1%	0721-9531
R64	R: METAL FILM 10.0k 1%	0721-1002
R65	R: METAL FILM 1.37k 1%	0721-1371
R66	R: METAL FILM 49.9k 1%	0721-4992
R67	R: METAL FILM 7.87k 1%	0721-7871
R68	R: METAL FILM 10.0k 1%	0721-1002
R69	R: METAL FILM 75 2% 1/4W	0751-7502
R70	R: METAL FILM 100k 2% 1/4W	0751-1042
R71	R: METAL FILM 10.0k 0.1%	0711-1002
R72	R: METAL FILM 10.0k 1%	0721-1002
R73	R: METAL FILM 9.53k 1% (R73 is matched with R75)	0721-9531
R74	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R75	R: METAL FILM 9.53k 1% (R75 is matched with R73)	0721-9531
R76, R77	R: METAL FILM 10.0k 1%	0721-1002
R78	R: METAL FILM 4.99k 1%	0721-4991
R79	R: METAL FILM 1.37k 1%	0721-1371
R80	R: METAL FILM 49.9k 1%	0721-4992
R81	R: METAL FILM 7.87k 1%	0721-7871
R82	R: METAL FILM 10.0k 1%	0721-1002
R83	R: METAL FILM 75 2% 1/4W	0751-7502
R84	R: METAL FILM 100k 2% 1/4W	0751-1042
R85	R: METAL FILM 75 2% 1/4W	0751-7502
R86	R: VAR COMP 10k, 10 TURN	2100-0024
R87	R: METAL FILM 20.0k 1%	0721-2002
R88	R: METAL FILM 49.9k 1%	0721-4992
R89	R: METAL FILM 10.0k 1%	0721-1002
R90, R91	R: METAL FILM 10k 2% 1/4W	0751-1032
R92	R: METAL FILM 3.32k 1%	0721-3321
R93	R: METAL FILM 9.53k 1%	0721-9531
R94	R: VAR COMP 1k, 10 TURN	2100-0021
R95, R96	R: METAL FILM 10.0k 1%	0721-1002
R97	(not used)	

A5 BOARD TVM-230 cont.
(used prior to serial number 630122)

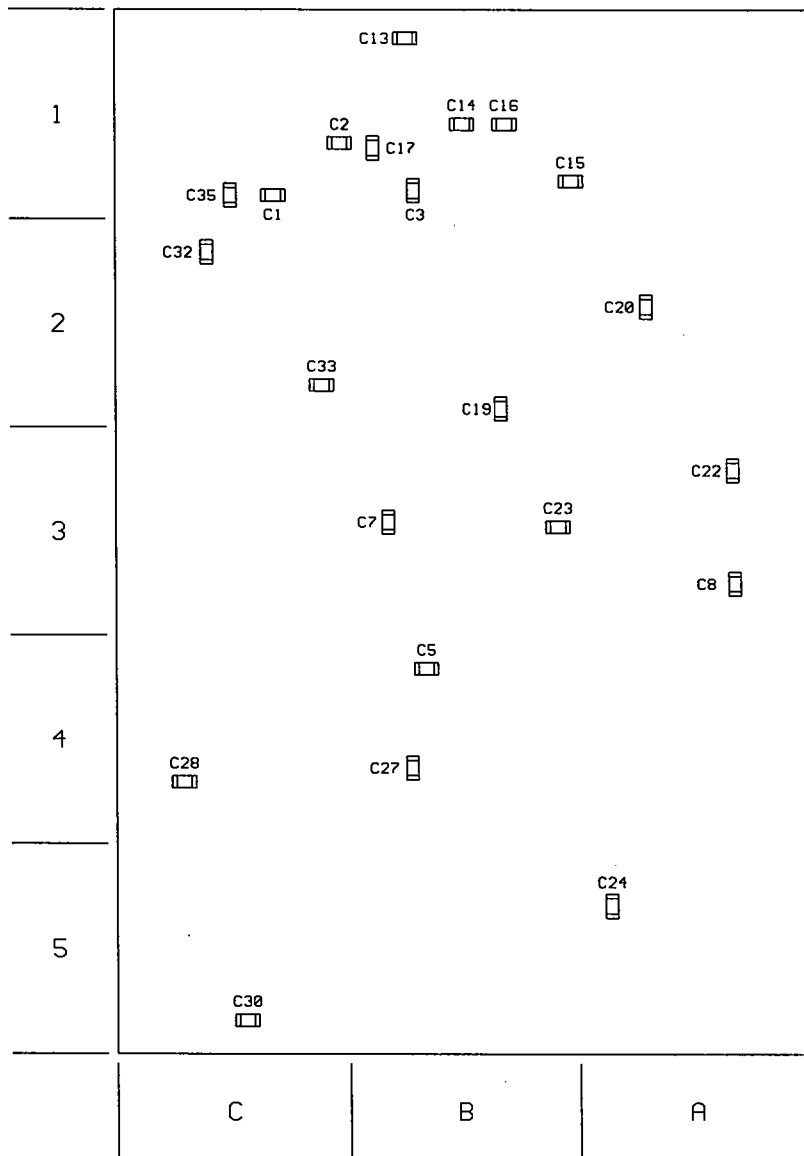
Reference Designation	Description	Part Number
R98	R: METAL FILM 4.99k 1%	0721-4991
R99	R: METAL FILM 10.0k 1%	0721-1002
R100	R: METAL FILM 75 2% 1/4W	0751-7502
R101	R: METAL FILM 4.99k 1%	0721-4991
R102,R103	R: METAL FILM 10.0k 1%	0721-1002
R104	R: METAL FILM 9.53k 1%	0721-9531
R105	R: VAR COMP 1k, 10 TURN	2100-0021
R106	R: METAL FILM 3.32k 1%	0721-3321
R107,R108	R: METAL FILM 10.0k 1%	0721-1002
R109	R: METAL FILM 75 2% 1/4W	0751-7502
RL1 thru RL3	RELAY: JWD-172-1	1600-0006
RN1	R: NETWORK 8 PIN 10k	0908-1032
U1 thru U3	IC: AD844A	1826-0052
U4	IC: TLO72	1826-0038
U5	IC: LM311	1826-0009
U6	IC: DG419	1827-0011
U7	IC: NE5532	1826-0037
U8	IC: NE5534	1826-0025
U9	IC: AD846A	1827-0008
U10	IC: NE5534	1826-0025
U11	IC: AD776	1830-0005
U12	IC: 78L05CP	1826-0012
U13	IC: XO, 12.7008MHz	0415-1270
U14	IC: 78L05CP	1826-0012
U15	IC: AD680	1826-0051
U16,U17	IC: 74HC14A	1822-0042
U18	IC: 78L05CP	1826-0012
U19	IC: 79L05CP	1826-0017
U20	IC: 74HC14A	1822-0042
U21	IC: CS4328	1830-0004
U22,U23	IC: NE5532	1826-0037
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	IC: NE5534	1826-0025
U31	IC: AD1862	1830-0006
U32	IC: AD846A	1827-0008
U33	IC: NE5534	1826-0025
U34	IC: NE5532	1826-0037
U35	IC: TLO71	1826-0004
U36,U37	IC: NE5532	1826-0037
U38	IC: TLO71	1826-0004
U39,U40	IC: NE5532	1826-0037
U41	IC: 78L12CP	1826-0015
U42	IC: 79L12CP	1826-0019



TVM-230
TV DIGITAL STEREO MONITOR
A6 BOARD
BELAR ELECTRONICS
5-22-96



TUM-230 A6 BOARD
COMPONENT LAYOUT-TOP
BELAR ELECTRONICS

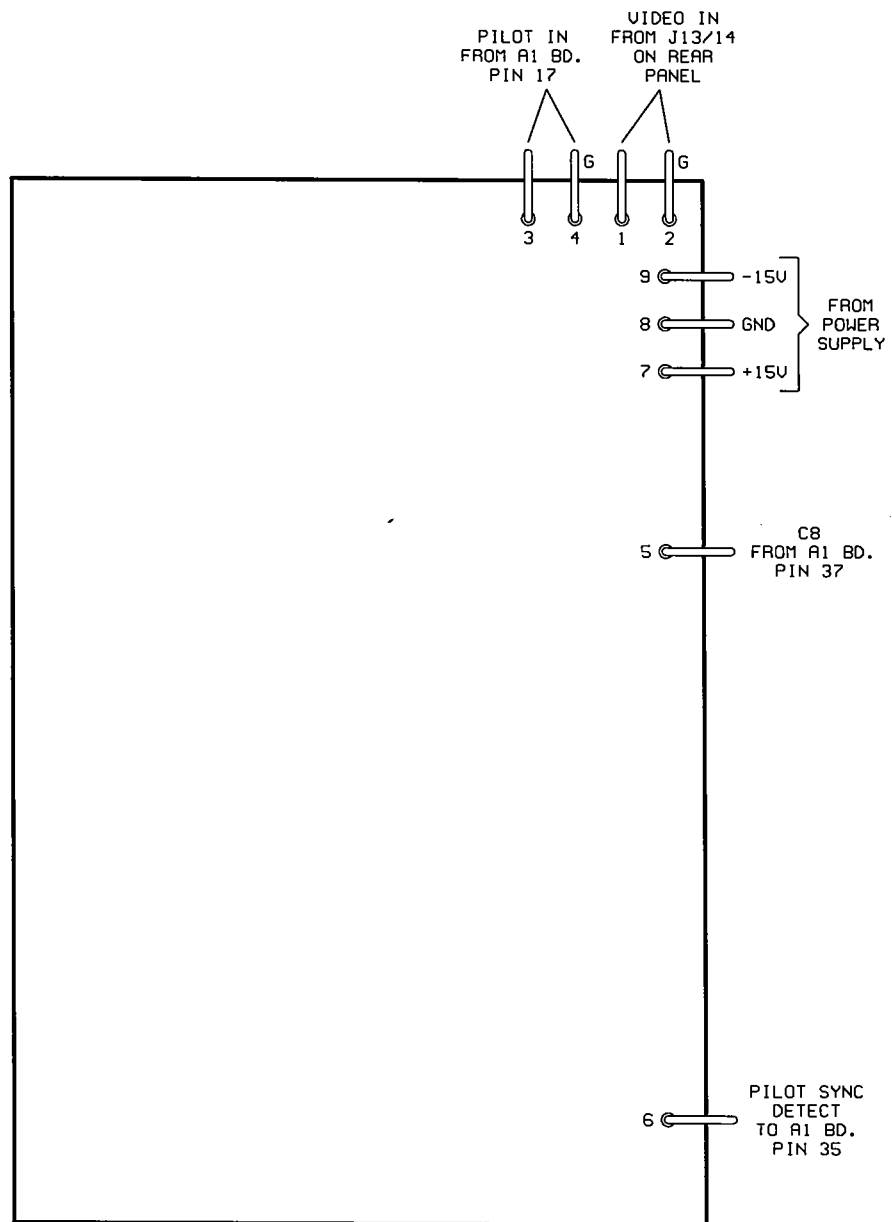


TUM-230 A6 BOARD
 COMPONENT LAYOUT-BOTTOM
 BELAR ELECTRONICS

TVM-230 A6 BOARD
PART LOCATIONS

<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>		<u>Desig/Loc</u>	
C1	C1*	C21	A2	CR5	C4	R14	B3	R34	A5	U11	B4
C2	C1*	C22	A3*	CR6	B4	R15	A4	R35	B5	U12	C4
C3	B1*	C23	B3*	CR7	C2	R16	A4	R36	B4	U13	C5
C4	B2	C24	A5*	CR8	C1	R17	B1	R37	B5	U14	C2
C5	B4*	C25	C4			R18	B1	R38	B4		
C6	B3	C26	B4	Q1	B2	R19	B1	R39	C4	<u>pins</u>	
C7	B3*	C27	B4*			R20	A1	R40	B4	1	C1
C8	A3*	C28	C4*	R1	C1	R21	A2	R41	C5	2	C1
C9	A3	C29	C5	R2	B1	R22	A2	R42	C5	3	C1
C10	A4	C30	C5*	R3	B1	R23	A2			4	C1
C11	A4	C31	C2	R4	C2	R24	A2	U1	C1	5	C2
C12	A4	C32	C2*	R5	C2	R25	A3	U2	B2	6	C5
C13	B1*	C33	C2*	R6	C2	R26	B3	U3	B2	7	C1
C14	B1*	C34	C1	R7	B2	R27	C3	U4	B3	8	C1
C15	B1*	C35	C1*	R8	C2	R28	A4	U5	A3	9	C1
C16	B1*			R9	C2	R29	A4	U6	B1		
C17	B1*	CR1	C1	R10	B2	R30	A4	U7	B1		
C18	B2	CR2	B1	R11	B4	R31	A4	U8	A2		
C19	B2*	CR3	B3	R12	B3	R32	B5	U9	A3		
C20	A2*	CR4	B2	R13	B4	R33	A5	U10	A5		

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



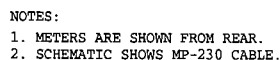
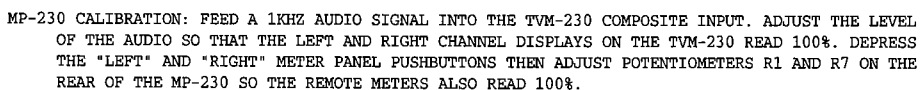
TUM-230 A6 BOARD
 CONNECTIONS
 BELAR ELECTRONICS

A6 BOARD TVM-230

Reference Designation	Description	Part Number
C1,C2	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C3	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C4	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C5	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C6	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C7,C8	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C9	C: FIXED POLY 1600pF 2.5% 160V	0130-1622
C10	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C11	C: FIXED POLY 1600pF 2.5% 160V	0130-1622
C12	C: FIXED MICA 620pF 5%	0140-6215
C13 thru C17	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C18	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C19	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C20	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C21	C: FIXED POLY 2000pF 2.5% 160V	0130-2022
C22 thru C24	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C25,C26	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C27,C28	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C29	C: FIXED MICA 360pF 5%	0140-3615
C30	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C31	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C32	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
C33	C: FIXED CERAMIC CHIP 0.1uF 50V	C1206 0151-0014
C34	C: FIXED CERAMIC 1.0uF 50V	0151-0016
C35	C: FIXED CERAMIC CHIP 0.01uF 50V	C1206 0151-0021
CR1,CR2	DIODE: HP5082-2800	1900-0026
CR3 thru CR6	DIODE: 1N4446	1900-0002
CR7,CR8	DIODE: 1N4006	1900-0016
Q1	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 18k 2% 1/4W	0751-1832
R2	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R3	R: METAL FILM 15k 2% 1/4W	0751-1532
R4	R: METAL FILM 330k 2% 1/4W	0751-3342
R5	R: FIXED CARBON 1.2M 5% 1/4W	0683-1255
R6	R: METAL FILM 470 2% 1/4W	0751-4712
R7	R: METAL FILM 43k 2% 1/4W	0751-4332
R8	R: FIXED CARBON 1.2M 5% 1/4W	0683-1255
R9	R: METAL FILM 10k 2% 1/4W	0751-1032
R10	R: METAL FILM 30k 2% 1/4W	0751-3032
R11	R: METAL FILM 20k 2% 1/4W	0751-2032
R12	R: METAL FILM 160k 2% 1/4W	0751-1642
R13,R14	R: METAL FILM 38.3k 1%	0721-3832
R15,R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17 thru R19	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R20	R: METAL FILM 1k 2% 1/4W	0751-1022
R21	R: METAL FILM 30k 2% 1/4W	0751-3032
R22	R: METAL FILM 20k 2% 1/4W	0751-2032

A6 BOARD TVM-230 cont.

Reference Designation	Description	Part Number
R23	R: METAL FILM 160k 2% 1/4W	0751-1642
R24, R25	R: METAL FILM 38.3k 1%	0721-3832
R26	R: METAL FILM 1k 2% 1/4W	0751-1022
R27	R: METAL FILM 220k 2% 1/4W	0751-2242
R28, R29	R: METAL FILM 270k 2% 1/4W	0751-2742
R30	R: METAL FILM 51k 2% 1/4W	0751-5132
R31	R: METAL FILM 120k 2% 1/4W	0751-1242
R32	R: METAL FILM 10k 2% 1/4W	0751-1032
R33	R: METAL FILM 51k 2% 1/4W	0751-5132
R34	R: METAL FILM 120k 2% 1/4W	0751-1242
R35	R: METAL FILM 82k 2% 1/4W	0751-8232
R36	R: METAL FILM 39k 2% 1/4W	0751-3932
R37	R: METAL FILM 56k 2% 1/4W	0751-5632
R38	R: METAL FILM 82k 2% 1/4W	0751-8232
R39, R40	R: FIXED CARBON 3M 5% 1/4W	0683-3055
R41	R: METAL FILM 10k 2% 1/4W	0751-1032
R42	R: METAL FILM 1k 2% 1/4W	0751-1022
U1	IC: MC34081	1826-0041
U2	IC: LM311	1826-0009
U3	IC: 74HC4538	1822-0076
U4, U5	IC: 74HC4046	1822-0049
U6	IC: CA3028	1826-0034
U7	IC: 79L05CP	1826-0017
U8	IC: 74HC4046	1822-0049
U9	IC: 74HC393	1822-0075
U10	IC: MC3302P	1826-0005
U11	IC: 74HC4538	1822-0076
U12	IC: 74HC74	1822-0067
U13	IC: 74HC02	1822-0040
U14	IC: 78L05CP	1826-0012



MP-230
REMOTE METER PANEL
FOR THE TVM-230
TV DIGITAL STEREO MONITOR
BELAR ELECTRONICS
6-24-99

MP-230 PARTS LIST

Reference Designation	Description	Part Number
CR1	LED: RED MV5053	1910-0001
CR2	LED: GREEN CMD5453	1910-0003
CR3	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 R5	R: METAL FILM 150 2% 1/2W	0771-1512
R6	R: METAL FILM 2.4k 2% 1/2W	0771-2422
R7	R: VAR COMP 5k	2100-0008
S1,S2	SWITCH: PUSHBUTTON (2 BUTTON)	3101-0033
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-230 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.