RVS-8 Repeater Voting System

Assembly Manual Ver 2.1

LDG Electronics
1445 Parran Road St. Leonard MD 20685
Phone: 410-586-2177 Fax: 410-586-8475
e-mail: ldg@radix.net Web site: www://radix.net/~ldg

Introduction: The RVS-8 is a full featured repeater voting system designed to work with today's amateur and commercial repeaters. The voter features 8 channel capacity, menu driven display system, programmable logic states, on screen "signal to noise meter", site activity logging and more.

Once installed, the RVS-8 provides signal to noise based, "real time" automatic audio switching for up to eight sites. Multiple RVS-8s can be cascaded to provide up to 64 channels of voting.

Building the Kit: The RVS-8 is a medium to large sized project (not for beginners). It may take the average builder several evenings to build, check out and align the voter (we averaged about 3 hours for assembling just the PC board). Besides the normal building tools needed (small soldering iron or soldering pencil, wire cutters, screw drivers, etc.), the only test equipment needed is a voltmeter or oscilloscope.

Kit Assembly: Before starting, you may want to get a copy of the QST article where the RVS-8 first appeared. Although not needed for construction of the kit and written for an earlier version, it contains a little more general information about the RVS-8 and how it works. If you don't have or can't find the article, a reprint may be available from QST, 225 Main St., Newington CT 06111. We've included the updated charts, tables and information from the article in this manual.

Changes from the Article: A few changes were made since the article. The PC board size was increased to 6 by 9 inches. After building several prototypes (including the one shown in the QST article), it became apparent that component spacing was too tight and the PC board was expanded for ease of construction and use.

A larger LCD module is now provided. We were able to find a source of larger, back lit LCD modules with connectors that fit in the same vertical space. The new module is more readable and easier to connect. The 78L05 was also upgraded to a 7805 with heatsink to handle the extra current required of the back lighting.

The control circuitry has also been changed slightly. A new schematic is provided in this manual. An LM339 was added in place of the transistor for the COR and DIS Select line. This provides smoother selection of the multiplexed input bus and a driver for the output selector. A current limiting resistor was also added to the +12 line of J6 to prevent resets in case of shorting.

All of the LM324s were upgraded to TL084s. The new chips are a direct replacement and offer much less crossover distortion than the 324s.

U7 was changed from a CD4051 to a MAX 4051. The change provides an extra 20 db of cross talk isolation. The chip is a direct replacement.

J3 (Disable input) was upgraded from a header to a screw type connector. There was extra room on the board.

Be sure to use the schematic, parts placement, and connector pinouts provided in this manual. It matches the latest PC Board layout. Those items in the QST article are now outdated.

The software changed somewhat from what was described in the article. All references to db have been eliminated. We found it was possible for users to properly calibrate their system, but still not get accurate db measurements on the LCD module. All references made to signal strength, hysteresis, and S/N ratio are now relative references (shown as numbers, instead of db).

Getting Started: Before getting the soldering iron out, go through all of the parts in the kit and familiarize yourself with each component and its placement. Most of the parts are common, but a few of them may be new to some builders. There are just over 200 parts and 850 solder connections, so take your time.

Once familiar with the parts, use the parts placement sheet in this manual for identifying parts locations on the PC Board. Installation is done in order of vertical height. That is, the parts with low profiles (like resistors) are put in first and you work your way to the tallest parts (like the relay).

With the PC board blank, it is easiest to install all of the individual resistors first (not the SIPs). Be sure to check the values with the parts list. We provide 1/8 watt resistors with the kit, but you may use 1/4 watt if you wish (you may have to reshape the leads of the 1/4 watt resistors to make them fit). You can install the resistors in groups (like R25-32, R33-40 and R49-56) to better keep track of your progress. There are 34 total.

Diode 1 and 2 are next. D1 (the larger 1N4001) goes near the 12 volt input. The smaller 1N4148 goes near where the relay K1 will go. Be sure to match the polarity.

Now the 0.1 uf caps. There are ten that are randomly scattered on the board and another eight in a nice row at J5 (Audio In).

Now the Resistor SIPs. There are seven of them and two different values. Be sure to note the polarity of these. While looking at the SIP package and the markings are facing you, pin 1 is on the left side. It may also have a dot or line to mark pin 1. Note that the Resistor SIPs are called RS1-7 and the Resistor DIPs are called RP1-5. For markings, 103 means 10K and 104 means 100K.

Then the crystal. Use a left over piece of resistor lead to tie it down with holes provided on either side of the crystal. This will keep it from getting moved around too much and possibly breaking the leads.

The DIP sockets go in next. Note that all DIP sockets have pin 1 toward the top or to the right of the board. Both PLCC sockets have a small arrow in the middle area of the socket that points to pin 1. The arrow for the 52 pin PLCC should face toward the top of the board (flattened corner will be toward the crystal). The arrow for the 44 pin PLCC should face toward the right side of the board (flattened corner will be toward U6).

The 18 pots snap into the board. Be sure not to fold any of the pins underneath (and out of site) of the pot. All the values are the same, 100K (marked 104).

There are two transistor looking devices (TO-92 package) that go next. One is a 34064 power supervisory chip (U4) and the other one is actually a 2N3904 transistor (Q1). Both of the TO-92 devices face (the flat side) toward the left side of the board.

More capacitors are next. Install the twenty four .0047 uf disk capacitors and the two 22 pf (C51 and 52) near the crystal (the actual value can be anything between 10 and 33 pf). Install the 1.0 and 10 uFs (the electrolytics) in groups (C9-16, C41-48) to help keep track of them. Be sure to note polarity of the electrolytics, the long lead is the positive.

Use a nut and bolt to tie down the 7805 and heat sink in place. Configure the bolt so that the head is on the bottom of the PC board and the nut is on the component side. Form fit it before soldering in place. You may want to use a small amount silicon ”heat grease” to help the heat transfer, but it is not required.

The remaining components are connectors, headers, the relay and mounting hardware. Install the relay

last. The screw terminal connectors are made by sliding a several connectors together. J1 and J2 is made up of two 2-position and one 3-position connector. J3, J4 and J5 is made up of three 3-position connectors. Be sure to install the screw terminals so that the wire will enter from the back of the PC board and not over the components (they *will* go in backwards). There is no connector for J7 (the six pin User Interface). You can either solder the wires directly to the PC board or use your own SIP style connector.

The circuit should be “power on” tested once all components are soldered in and before any chips are placed in the sockets. Do not connect the LCD module yet. Apply 11-15 volts DC to the power input, J1. Current draw to the unit should be around 40 mA. The relay should energize.

There are voltage test points marked for +5, +6 and +12 volts just above U1. The test point for +12 will read 0.7 volts lower than the power input voltage applied at J1 because of the blocking diode D1. This diode prevents damaging chips if you accidentally connect input power backwards. The +6 test point will read half of the +12 test point (it doesn’t have to be exact, +/- 10% is ok). The +5 test point should read very near 5.0 volts (4.9 to 5.1 is ok).

Now install all chips except U1 and U2. Be sure to note orientation. Note that some of the chips are CMOS types. Although today’s CMOS chips are well protected, some care should be taken to be sure the chips are not damaged by static when they are handled (Don’t wear a wool sweater, brush your feet across the carpet, pet a cat, then try to install the chips). Reapply power. The voltage check should stay the same and the current draw should be around 80 to 90 mA. The relay will still be energized.

If the volts and amps still look good, you can proceed to install U1 and U2 into the sockets. Notice that U1 and U2 has a flattened corner that should match the socket. Also, U1 and U2 have a small dot denoting pin one that should match the arrow inside the socket.

Connect the LCD module using the supplied cable. Orient the LCD module so that the display is facing you and the 14 pin connector is on the left. The red stripe on the ribbon cable should line up to the left side of the PC board (closest to U2 and the Contrast pot) and to the bottom of the LCD module. On power up, the RVS-8 will display the startup screens on the LCD to show that the microprocessor is running and everything has initialized successfully. Current draw should be around 250 to 300 mA.

The display will show two startup screens in succession. The first will be the unit identification. The second will be the software version number and version date.

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Repeater Voting
 System  RVS-8

  Version 2.1
   March 1997
```

After two seconds, the display will switch to the Current Voted menu, which is the default display. If you are successful in getting the LCD to display the menu system, you can proceed with mounting the unit in an enclosure and connecting to the user interface.

The RVS-8 fits nicely into a rack mount box (one rack unit in height), but just about any metal enclosure that will accommodate the PC board and front panel items will work. Custom enclosures (pre-drilled

and punched, painted and silk screeened) manufactured by Ten-Tec Inc are available from LDG for $65 (plus shipping) .

Switches 1-4 and LEDs 1-2 mount on the front panel. The toggle power switch, SW4 is the only switch that will have 12 volts on it. The LEDs just push through holes. Note the polarity of the LEDs, the flat side should go to ground. You may want to use some silicon RTV or glue to help hold in the LEDs.

Use the stand offs to mount the PC board in the box. Use the six mounting holes provided on the PC board. If you are worried about RF getting into the system, you may want to connect an additional ground wire from one of the mounting bolts to the chassis.

Once everything is mounted and wired, apply power again to make sure everything is still working. Press the menu button and scroll through the LCD displays to verify the user interface is working.

Menu Functions:

This section will provide an overview of each menu and an explanation of the data presented on the LCD module.

Current Voted:

The Current Voted menu displays which site is currently selected by the voter. The LCD will show only one of the eight numbers in its position when selected (site one is in position one, site two is in position two, ect.). On power up, site one will be chosen for the default. The display is updated when a new site is chosen as the current voted. A site can not be selected as the current voted site if it has been disabled by either hardware or software.

There are no user inputs for this menu.

```
1
 Current Voted
```

Current CORs:

The Current COR shows which sites have active CORs. The LCD will show all site numbers in their position when active. The LCD will update the display in real time. That is, if the COR for site one becomes active, the display will show site one. If the COR becomes inactive, the display will immediately (within 50 mSec.) remove site one. A site will not be shown if it has been disabled by either hardware or software. The display is updated when any COR input has changed.

There are no user inputs for this menu.

```
1 2
 Current CORs
```

Channel S/N:

The Channel S/N menu will display the signal to noise ratio of the selected channel. There are two modes of displaying the S/N ratio. The first is the internal number (0 to 255) used to represent the S/N ratio of each channel (a higher number represents a higher signal). The second is a bar graph that approximates an “S-meter” reading according to the S/N ratio. The select switch can be used in either mode to cycle through each site. The data switch is used to toggle between number and bar graph mode.

The mode is not stored in Serial EEPROM and defaults to number mode on power up. The display is updated every second for either mode.

Note: The Channel signal to noise ratio display can produce false readings if the input modulation exceeds about 4 kHz bandwidth. If you are using the Channel S/N ratio for comparisons, take the reading with no modulation.

```
 Value = 255
Signal / Noise
```

or

```
 Value = xxxxxxxxxx
Signal / Noise
```

Hits per Chan:

The Hits per Chan menu shows the number of times a channel has been voted out of the last 100 COR cycles. A COR cycle is the time from when any site becomes active to the time no sites are active. The hits for a site is incremented if that site has been selected the most during a COR cycle (a site can be temporarily voted during a COR cycle, but the hits for that site will not be incremented unless it has been voted the most during that COR cycle).

The maximum number of hits on any channel is 100. Sites that are not selected at the end of a COR cycle are decremented by one. For example, if the current hits are: site one - 57, site two - 28, site three - 12, and site two is voted for the next COR cycle, the result is: site one - 56, site two - 29, site three - 11.

The Sel switch is used to cycle through each site. The LCD will display the channel number and the number of hits.

The Hits per Channel is not stored in Serial EEPROM and all channels default to zero hits on power up.

```
Chan 01 Hits 64
 Hits per Chan
```

Most Active:

The Most Active menu keep tracks of the hits per channel for each channel and displays the site with the most votes out of the last 100 CORs. An internal count is kept on each site for the number of times it has been voted. The site that has the most votes in the last 100 COR cycles is chose. If more than one site has the most votes, the first site with the most counts encountered by the software will be chosen.

Sites that are disabled are not eligible to be selected as the Most Active site.

There are no user inputs for this menu.

```
1
 Most Active
```

Least Active:

The Least Active menu is similar to the Most Active, except it keeps track of the site with the least number of hits. If more than one site has the least COR counts, the first site with the least number of hits encountered by the software will be chosen.

Sites that are disabled are not eligible to be selected as the Least Active site.

There are no user inputs for this menu.

```
 2
Least Active
```

Hysteresis:

The Hysteresis menu display the currently selected hysteresis level (0 to 8). The hysteresis level is the amount of signal to noise ratio improvement needed over the currently voted site before a new site will be voted. The lower the hysteresis level selected, the smaller the amount noise improvement needed for a new selection. Some amount of hysteresis should be used with all systems. Not enough hysteresis will result in constant switching that may sound annoying. Too much hysteresis may result in large, noticeable changes in audio when switching from noisy to quite site (or vice versa). A typical value used may be between 3 and 6.

In the RVS-8, the signal to noise ratio for each channel is represented internally by a number that has a value between 0 and 255, with a higher number meaning higher signal (better signal/noise ratio). This number can be viewed with the Channel S/N menu.

Each step of the hysteresis level is equal to 6 counts of the internal number. A hysteresis value of 5 means that a new signal must be 30 counts (5 times 6) higher than the currently voted signal before it will become the newly voted channel.

The Sel or Data switch can be used to cycle the Hysteresis through the selections. When the selection reaches 8, the next selection is 0. The Hysteresis data is stored in serial EEPROM.

Note: The 0 selection is recommended for testing purposes only. Since the software can update at 30 times per second, the 0 selection will allow sites to switch at that same rate and an audible 30 Hz buzz can sometimes be heard.

```
Value = 4
Hysteresis
```

Disabled Chans:

The Disabled Channels menu show which channels are currently disabled. There are two ways to disable a channel, by hardware or software. To disable the channels by software, press the Menu switch until “Disabled Channels” is displayed on line two of the LCD module. Then press the Select switch until the desired channel has the cursor, then press the Data switch to toggle between on or off. If the number is showing on the display, the channel is disabled. If the number is not showing, it is not disabled by software or hardware.

To disable channels by hardware, an external connection must be made to the RVS-8 via J3. Depending on how the Disable Active State is programmed for each channel, the voltage on each corresponding pin

determines if the channel is disabled or not (see menu section on Dis Active State).

The two disable systems are “ORed” together. That means that if the software “or” the hardware has a channel disabled, the RVS-8 will disable that channel. Note that if the hardware has a channel disabled, the software can not enable that channel. The reverse is also true, if the software has a channel disabled, the hardware can not enable that channel. Pay close attention to this if you plan on having your repeater controller handle site disabling.

The software disable data is stored in Serial EEPROM. Each time data is changed on the Disabled Chan menu, data is written into the EEPROM. This data is non-volatile. If power is removed, the data will stay intact.

Data that has been programmed into the EEPROM is read into the Voter upon power up.

```
    3 4 5 6 7 8
Disabled Chans
```

Dis Active State:

Each DIS (disable) input is programmable to be active high or active low. Active Hi means the external control will produce a positive going voltage (6.5 to 20 volts) when the channel is to be disabled and a low going voltage (0.0 to 4.5 volts) when the channel is to enabled. Active Lo means that your controller (or other disabling device) will provide a low going voltage (0.0 to 4.5 volts) when the channel is to be disabled and a high going voltage (6.5 to 20 volts) when the channel is to be enabled.

The DIS Active State menu shows the current selections for each external disable input. The Sel switch is used to cycle through each input. The LCD will display the channel number and if the DIS is active Hi or Lo. The Data switch is used to toggle the active state between Hi and Lo.

The DIS Active State data is stored in Serial EEPROM.

```
Chan 1 Active Hi
Dis Active State
```

COR Active State:

Each COR input is programmable to be active high or active low. Active Hi means that your receiver (or link receiver) will produce a positive going voltage (6.5 to 20 volts) when the squelch is open (receiving a signal) and a low going voltage (0.0 to 4.5 volts) when the squelch is closed (no signal). Active Lo means that your receiver will provide a low going voltage (0.0 to 4.5 volts) when the squelch is open and a high going voltage (6.5 to 20 volts) when the squelch is closed.

The COR Active State menu shows the current selections for each COR input. The Sel switch is used to cycle through each site. The LCD will display the channel number and if the COR is active Hi or Lo. The Data switch is used to toggle the active state between Hi and Lo.

The COR Active State data is stored in Serial EEPROM.

```
Chan 2 Active Lo
COR Active State
```

Other Inputs and Outputs:

Power Input: +12 volt power is supplied to the RVS-8 through J1. The actual voltage can be between +11 and +15 and should be regulated. Total current consumption is less than 300 mA. If voltage drops below 11 volts, the voter will still function, but the relay may not energize.

Audio / COR Output: J2 provides the audio and COR output. The audio output also has a separate ground connection. The output adjustment for audio on J2 is provided by R125.

The COR output is supplied through relay K1 and J2. The relay can handle up to 5 amps at 250 volts. The mechanical service life of the relay is 10 million operations (about 2500 operations per day for 10 years). The relay is a single pole, double throw type that can be configured for a normally open or normally closed configuration. All switch contacts are floating with respect to the PC board (not tied to +12 or ground) to allow for use with other than 12 volt systems.

User Interface: The User Interface (J7) provides connections to the front panel LEDs and pushbutton switches. Refer to the diagrams near the end of the manual for specific pin connections.

Output Selection: The Output Selection header (J6) provides the user with an output that follows which site is currently selected. The output pin (1 through 8) for the corresponding voted channel (1 through 8) goes to +12 volts. All other channels will float to zero volts.

The software provides a special counting function that keeps track of the voted sites during a COR cycle. Just before the COR cycle ends (about 1 mSec) the output selection will switch to the site that was voted most during the cycle. This provides the user an opportunity to connect the output selection header to a controller that will sense the selected site and take action (possibly change the tail beep or make a voice announcement). Without this sensing software, the voter would constantly select the site with the longest tail squelch when the COR cycle ends (not desireable).

The Selected / Continuous jumper JP1 changes the output to either continuously follow the voted channel or only provide an output when a COR is active. In most cases, the jumper will be in the Continuous position.

Pin 9 provides a ground and pin 10 provides +12 through a 1K resistor. These signals are provided in case the Output Selection or other back panel connections need to be tied high or low for the equipment it is connected to. The +12 pin is limited to 10mA.

Installation and Alignment: After the unit is in its case and properly turns on, you can run some audio through a few of the channels to see how it operates. The alignment is pretty much the same as described in the QST article. A voltmeter (as a minimum) can be used, but you may want to use an audio signal generator and an oscilloscope for the audio path checks.

While on the bench, set up each channel to match your COR and Disable Active State. Also set all controls

in the center position. This will ensure that at least something gets through the audio circuits and something is seen on the LCD module.

Only a few simple adjustments are needed to calibrate the input buffers, signal to noise converters and the TX audio output. If on the test bench, the items needed for alignment are a receiver and a DC voltmeter. If at the repeater site, only a voltmeter is needed since the receivers are already there. Variable resistors R17-24 control the amplitude of the audio for the input buffer of each input. Moving the control clockwise increases the signal. It is important to match this as close as possible first to keep from having to compensate for differences in the noise adjustments. Variable resistors R41-48 control the amplitude of the noise seen by the microprocessor for each channel. Moving these controls clockwise increases the amount of noise. Variable resistor R125 is the Audio output adjustment. This is the overall audio adjust that that will go to your transmitter or controller. R136 is the contrast pot for the LCD module. It should initially be set in the center position, then adjust for best contrast.

When calibrating the channels, you may want to disable all channels except the one you are working on. This will prevent any channel from accidentally being selected while calibrating.

Ideally, you would transmit (over the air) different audio tones to all remote receiver and calibrate the link receivers to have identical signals (in amplitude and frequency content) going to the voter. In the real world, this may not be possible. Differences in radio equipment may change the audio response for each site. The calibration procedure described here will give you good performance while maintaining a minimum amount of time and test equipment required.

First, transmit a 1000 Hz tone at 2.5 KHz deviation to your link receiver. Be sure the link receiver has a full quieting signal. A touch-tone signal from your handheld radio will work if you don't have a tone generator to connect to your transmitter. Adjust the receiver's volume control and the Audio pot to read 2.0 volts AC on the meter at the audio test point for the channel. The audio test points are next to each corresponding pot for that channel (they are marked AUD1, AUD2, ect). Check the Silk Screen layout sheet for help locating these.

Next, with the squelch open and no RF signal on the receiver, adjust the noise test point to read 3.5 volts DC. The noise test points are located between C41-48 and RS-1 and are marked A/D1, A/D2, ect. Repeat the audio and noise adjustments for the other seven channels.

Once at the repeater site, the adjustments should be close, but you may have to readjust to compensate for receiver differences. You may want to temporarily connect toggle switches to the disable lines and set the hysteresis to zero so you can quickly switch back and forth between sites to check for any audible differences in audio.

Normally, a repeater system should use identical remote receivers and link equipment. This would ensure that the audio characteristics are nearly the same for each site. If different equipment is used, it may be necessary to place audio shaping components (such as a 1K resistor in series and .01 uf capacitor to ground to filter out higher frequencies) in the audio lines to properly match the different audio characteristics.

Performance:

The performance from the RVS-8 is excellent. As the QST article stated, when the system is set up and

working right, you can't tell the voter is there. We usually have the output selector connected to our repeater controller (all CAT-300s and 500s) to change the tail beep to different tones for identification of different site selections because we can't tell which site is selected by audio alone.

Since the audio actually only passes through one op amp and one analog gate, there is very little distortion compared to the original signal (much less than 1db). Cross talk between channels is typically less than -60 db. The passband is 30 to 20,000 Hertz. All subaudiable tone are passed.

Once the audio characteristics are matched properly, you can use the noise adjustments (R41-48) to tailor your particular installation. In a system with a receiver at the repeater site, you may want to increase the noise for that site slightly to force selection of the remote sites.

Trouble Shooting:

In case of trouble, start with the basics. Look at the solder connections and check for bridges. Be sure all the parts are in the proper place and polarity is correct. Use the voltage test points to check for specific voltages.

There are a few things that can go wrong with building the kit, but the kits are very reproducible. Our first ten assemblies of the V2.0 PC boards yielded ten voters that worked first time and provided identical performance.

If your unit is not working at all, but you have good voltage and amps checks, look at the crystal clock on the 68HC11 with a scope coupled through a 10 pf capacitor. If you don't have a scope, tune an HF radio to 8.0 MHz and listen for the clock. If there is no clock, this may also indicates that the code is not executing. Look around the sockets and connections between U1 and U2 for problems.

If there is still no LCD data, look at the data lines going to the module. You should be able to see data being sent with and O-scope. Check the Contrast voltage, it should be near 0.1 volts.

For audio problems, diagram 1 shows typical audio voltage and signal readings taken with a signal generator and oscilloscope a various stages of the voter for channel 1. These readings are meant to be used for trouble shooting and initial calibration. Once set up in your system, the actual readings may vary somewhat depending on how customized the installation is.

Most voting problems result from mismatched audio levels or characteristics. To check for those types of problems, move a misbehaving channel to another input. If the problem follows, it's probably the audio from the receiver. Also, be sure there is no distortion before connecting to the Voter.

If your receiver is expecting to see a low impedance load (8 to 600 ohms), you may have to place a loading resistor across the output of your receiver for proper impedance matching. Since the input to the voter is high impedance, it will not load down your receiver.

For COR problems, be sure to check the Disable and Disable States menus and the Disable hardware inputs (J3). If any of these have been set in a position that you do not expect, the result may seem like a COR malfunction.

If something should occur that would prevent one channel from having less than 3.5 volts DC on its noise test point, readjust all channels to read 3.0 volts DC. You can go as low as 2.5 volts for all channels for the noise test point voltage and still maintain good performance from the voter.

If you can not get at least 2.5 volts DC for the noise test voltage, then increase the Audio pot for each channel to 2.5 volts AC on your meter and repeat the noise adjustments. You can go as high as 3.0 volts for the audio test point voltage and still maintain good performance from the voter.

Tech Support:

Telephone technical support (410-586-2177) is available most days from 6 to 9 pm Eastern Standard Time. Replies by FAX (410-586-8475) and e-mail (ldg@radix.net) are also welcome and are promptly answered.

Last Resort:

As a last resort only, LDG Electronics will attempt to repair any problems. As much as we would like to do it for free, we just can't. We have a flat fee of $70 plus parts to repair an RVS-8 (most resistors and capacitors are included in that fee). The 68HC11 chip is $20, the X68C75 is $30, the 34064 is $3, and the X25040 is $5. Most of the other chips are around $1 each.

We will not attempt to repair any unit that has been soldered with acid core. We reserve the right to refuse repair due to excessive problems or damage due to construction.

Before any unit is sent to us, you must first call to get return authorization. All units returned must be prepaid, either by check, money order or Credit Card unless other arrangements are made. Package the unit carefully and keep in mind we will use your packaging to return the unit to you. Include a description of what problem you are having and a phone number you can be reached at in the evenings in case we have questions. Repairs average about 3 to 6 weeks, depending on the particular problem.

We are investigating the possibilities of providing loaner units to prevent significant down time while repairs are being made.

Upgrades:

We are continually trying to add more features in the software of the RVS-8. The original software was locked in with version 1.4 at the time of the QST article (with minor changes since) and contains the features described in this manual.

If you have an idea of how the unit can be made better (in software or hardware), please send a description of your idea. If we use it for the RVS-8, we'll send you the “beta” version of the upgrade for evaluation to see if it’s what you wanted. We’re currently looking at “auto failing” channels (like the GE voters) that automatically disables any channel that fails a timeout test. Since the software is planned to be enhanced, we will offer the first few upgrades for free. The planned upgrades will require only a X68C75 chip exchange.

We still work on the honor system (because most of our customers are very trustworthy). We will send you an upgraded chip first, so that your system will have the minimum amount of down time. Then, you just send the old chip back to us to be eligible for future upgrades at no cost. If you purchased the unit from LDG, we will notify you when upgrades are available.

Feedback:

We encourage everyone who builds the kit to drop us a note (card, letter or e-mail preferred) to let us know how well it works for you. This will ensure that we have provided everyone with the best kit possible. We plan to have a small RVS-8 Newsletter to coordinate hardware and software changes, modifications, and other items that would be of general interest to users.

RVS-8 Update Notes

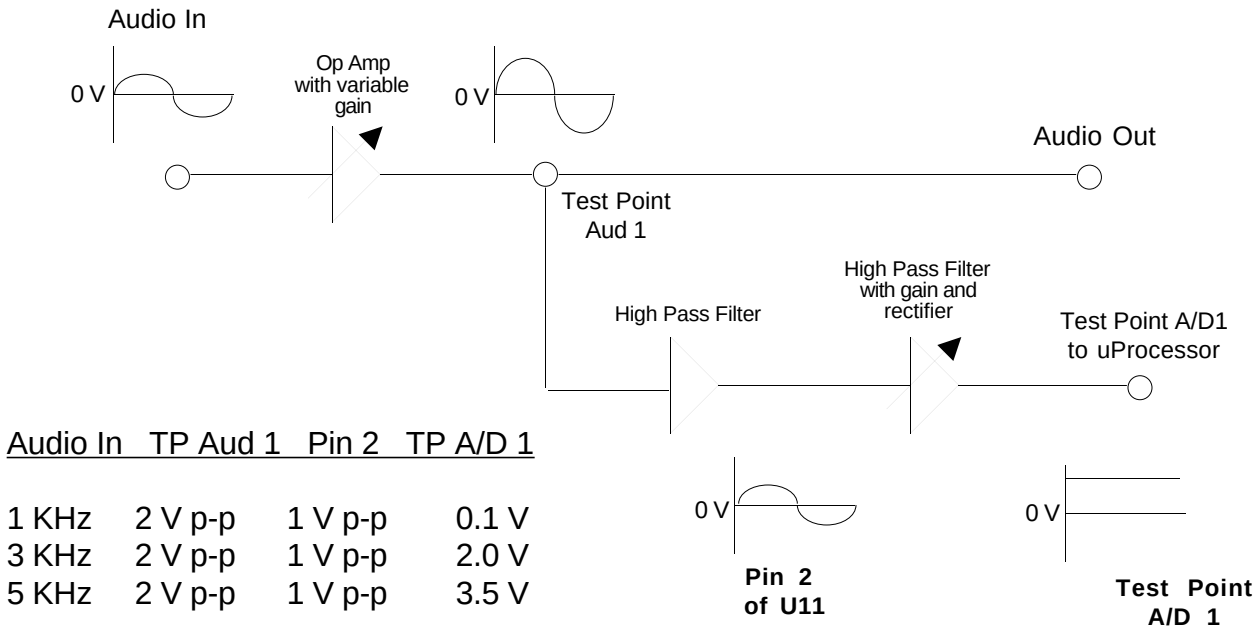
Version 2.0 PC Board
Version 2.1 Software

The RS-232 interface is not used with this version of the software. The MAX-232 chip, socket, or the 4 - 1.0 uF electrolytic caps are not provided. We had originally planned to add software for RS-232 control and reporting, but the effort was discontinued.

Another oops. There is also a mistake on the silk screen for RP2 and RP3. They should be labeled as 10K resistor DIPs.

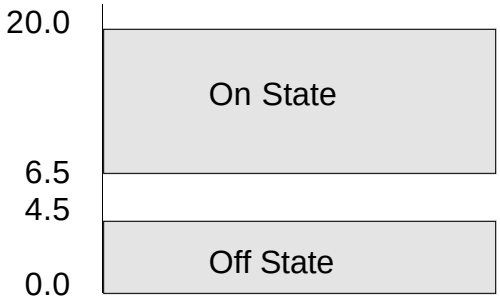
The COR output (N/O and N/C) from K1 is labled backwards. The manual shows the correct lables.

A note about component numbering. There are not 153 capacitors. C59-99 and C105-149 are not used. There are about 150 resistors, but most of them are in SIPs and DIPs.

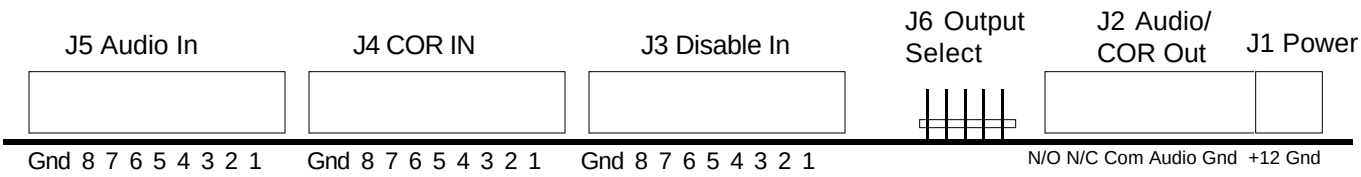


Audio In	TP Aud 1	Pin 2	TP A/D 1
1 KHz	2 V p-p	1 V p-p	0.1 V
3 KHz	2 V p-p	1 V p-p	2.0 V
5 KHz	2 V p-p	1 V p-p	3.5 V

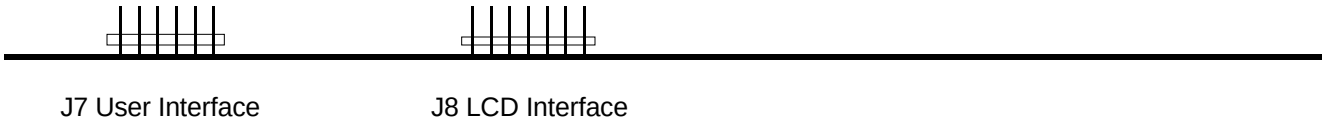
Figure 1. Sample Waveforms for Alignment



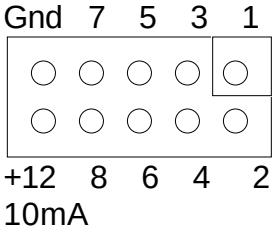
COR and Disable Input Range



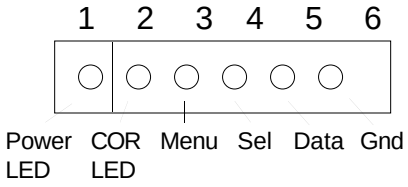
Back Panel Connections. Looking at Back.



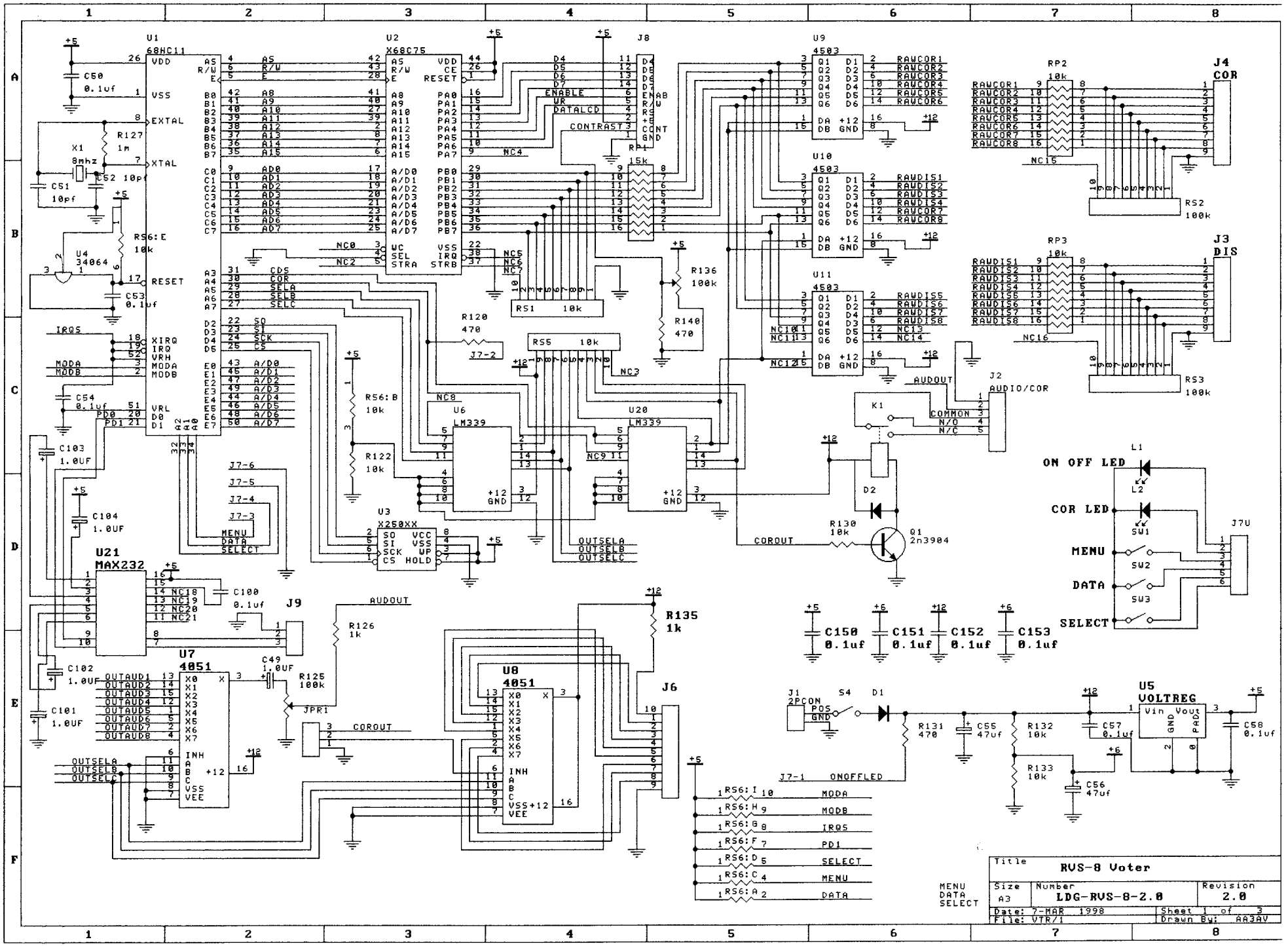
Front Panel Connections. Looking at Front.

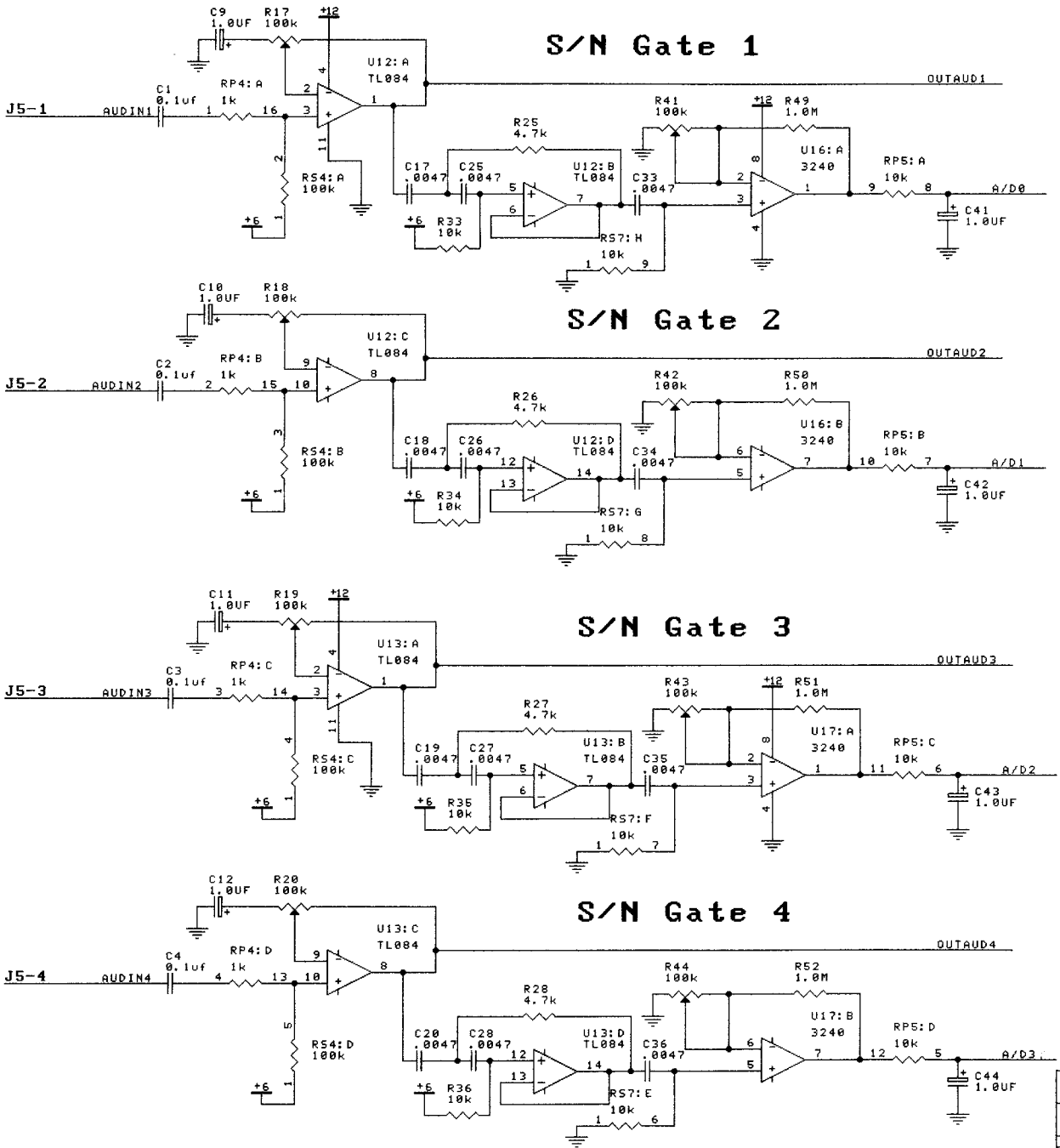


J6 Output Select

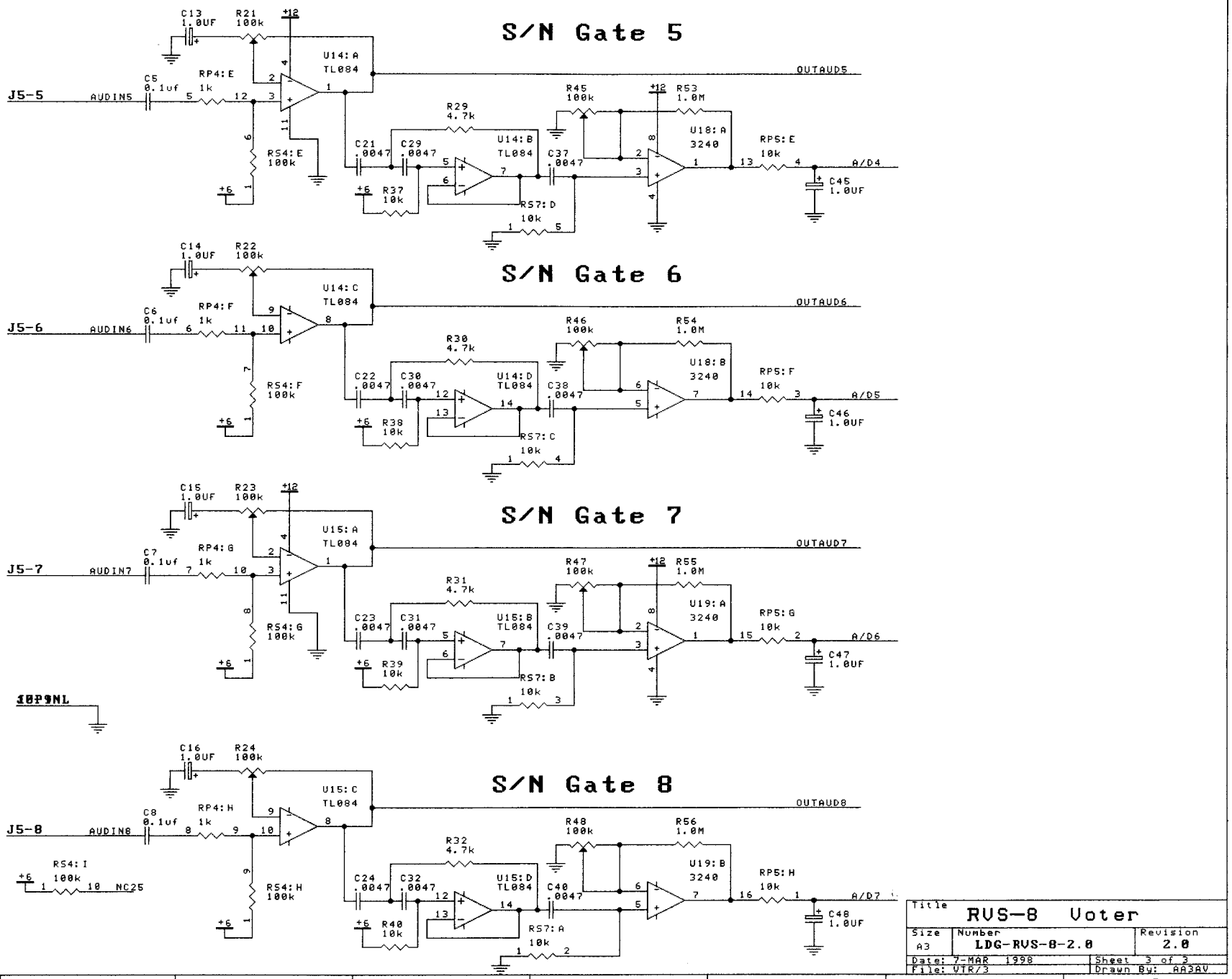


J7 User Interface


U1
68HC11
U2
X68C75
J8
U9
4503
U10
4503
U11
4503
RP2
10k
J4
COR
RP3
10k
J3
DIS
RP1
15k
RS1 10k
RS5 10k
RS2
100k
RS3
100k
U4
34064
X1
8mhz
C50
0.1uf
C51
10pf
C52 10pf
C53
0.1uf
C54
0.1uf
R127
1m
RS6:E
10k
R120
470
J7-2
R136
100k
R140
470
RS6:B
10k
R122
10k
U6
LM339
U20
LM339
U3
X250XX
J2
AUDIO/COR
K1
D2
R130
10k
Q1
2n3904
L1
ON OFF LED
L2
COR LED
SW1
MENU
SW2
DATA
SW3
SELECT
J7U
U21
MAX232
C103
1.0UF
C104
1.0UF
C100
0.1uf
C102
1.0UF
C101
1.0UF
C49
1.0UF
J9
R126
1k
R125
100k
JPR1
U7
4051
U8
4051
R135
1k
J6
C150
0.1uf
C151
0.1uf
C152
0.1uf
C153
0.1uf
J1
2PCON
S4
D1
R131
470
C55
47uf
R132
10k
R133
10k
C56
47uf
C57
0.1uf
U5
VOLTREG
C58
0.1uf
J7-1
ONOFFLED
RS6:I
RS6:H
RS6:G
RS6:F
RS6:D
RS6:C
RS6:A
MODA
MODB
IRQS
PD1
SELECT
MENU
DATA
MENU
DATA
SELECT
Title
RVS-8 Voter
Size
A3
Number
LDG-RVS-8-2.0
Revision
2.0
Date: 7-MAR 1998
Sheet 1 of 3
File: VTR/1
Drawn By: AA3AV



Title	RVS-8 Voter	
Size: A3	Number: LDG-RVS-8-2.0	Revision: 2.0
Date: 7-MAR 1998		Sheet 2 of 3
File: VTR/2		Drawn By: AA3AV


S/N Gate 5
C13 1.0UF
R21 100k
+12
U14:A TL084
OUTAUD5
J5-5
AUDIN5
C5 0.1uf
RP4:E 1k
R29 4.7k
R45 100k
R53 1.0M
U18:A 3240
RP5:E 10k
A/D4
C45 1.0UF
C21 .0047
C29 .0047
U14:B TL084
C37 .0047
RS4:E 100k
R37 10k
RS7:D 10k
+6
S/N Gate 6
C14 1.0UF
R22 100k
U14:C TL084
OUTAUD6
J5-6
AUDIN6
C6 0.1uf
RP4:F 1k
R30 4.7k
R46 100k
R54 1.0M
U18:B 3240
RP5:F 10k
A/D5
C46 1.0UF
C22 .0047
C30 .0047
U14:D TL084
C38 .0047
RS4:F 100k
R38 10k
RS7:C 10k
S/N Gate 7
C15 1.0UF
R23 100k
U15:A TL084
OUTAUD7
J5-7
AUDIN7
C7 0.1uf
RP4:G 1k
R31 4.7k
R47 100k
R55 1.0M
U19:A 3240
RP5:G 10k
A/D6
C47 1.0UF
C23 .0047
C31 .0047
U15:B TL084
C39 .0047
RS4:G 100k
R39 10k
RS7:B 10k
10P9NL
S/N Gate 8
C16 1.0UF
R24 100k
U15:C TL084
OUTAUD8
J5-8
AUDIN8
C8 0.1uf
RP4:H 1k
R32 4.7k
R48 100k
R56 1.0M
U19:B 3240
RP5:H 10k
A/D7
C48 1.0UF
C24 .0047
C32 .0047
U15:D TL084
C40 .0047
RS4:I 100k
NC25
RS4:H 100k
R40 10k
RS7:A 10k
Title
RVS-8 Voter
Size A3
Number LDG-RVS-8-2.0
Revision 2.0
Date: 7-MAR 1998
Sheet 3 of 3
File: VTR/3
Drawn By: AA3AV

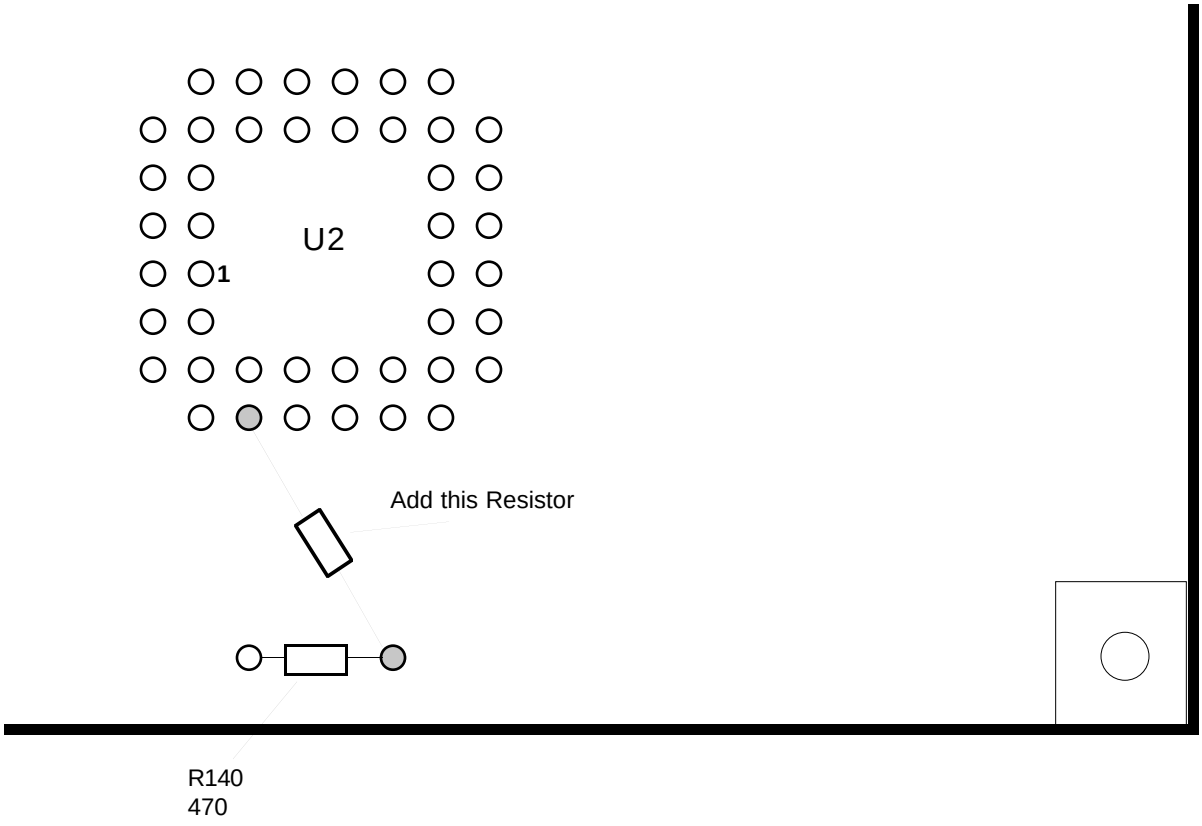
RVS-8 Parts List

Description	Quantity	Name
1N4148	1	D1
1N4001	1	D2
2N3904	1	Q1
SPDT Relay	1	K1
Red LED	2	L1-2
Pushbutton	3	SW1-3
Toggle	1	SW4
10 pf	2	C51, C52
.0047 uf	24	C17-40
.1 uf	18	C1-8, C50, C53-54, C57-58, C100
1.0 uf, 25 or 50v	9	C9-16, C49, C101-104
10 uf, 25 or 50v	8	C41-48
47 uf, 25 or 50v	2	C55, C56
470 1/8w	3	R120, R131, R140
1.0 K 1/8w	2	R126, R135
4.7 K 1/8w	8	R25-32
10 K 1/8w	12	R33-40, R122, R130, R132, R133
1.0 M 1/8w	9	R49-56, R127
10 K Sip	4	RS1, RS5, RS6, RS7 (103)
100 K Sip	3	RS2, RS3, RS4 (104)
1.0 K Dip	1	RP4 (102)
10 K Dip	3	RP2, RP3, RP5 (103)
15 K Dip	1	RP1 (153)
100K Pot	18	R17-24, R41-48, R125, R136
8MHz	1	X1
68HC11	1	U1
X68C75	1	U2
X25040	1	U3
34064	1	U4
7805	1	U5
LM399	2	U6, U20
4051	1	U8
MAX-4051	1	U7
4503	3	U9-11
TL084	4	U12-15
3240	4	U16-19
LCD	1	LCD Module
3 Pin header	2	J9, JP1
10 Pin header	1	J6
14 Pin header	1	J8
2 Pin Screw Conn.	2	J1-2
3 Pin Screw Conn.	10	J2-5
Heat Sink	1	-
Shunt	1	-
Ribbon Conn.	1	-
PC Board	1	-
Bolt	7	-
Nut	7	-
Spacer	6	-

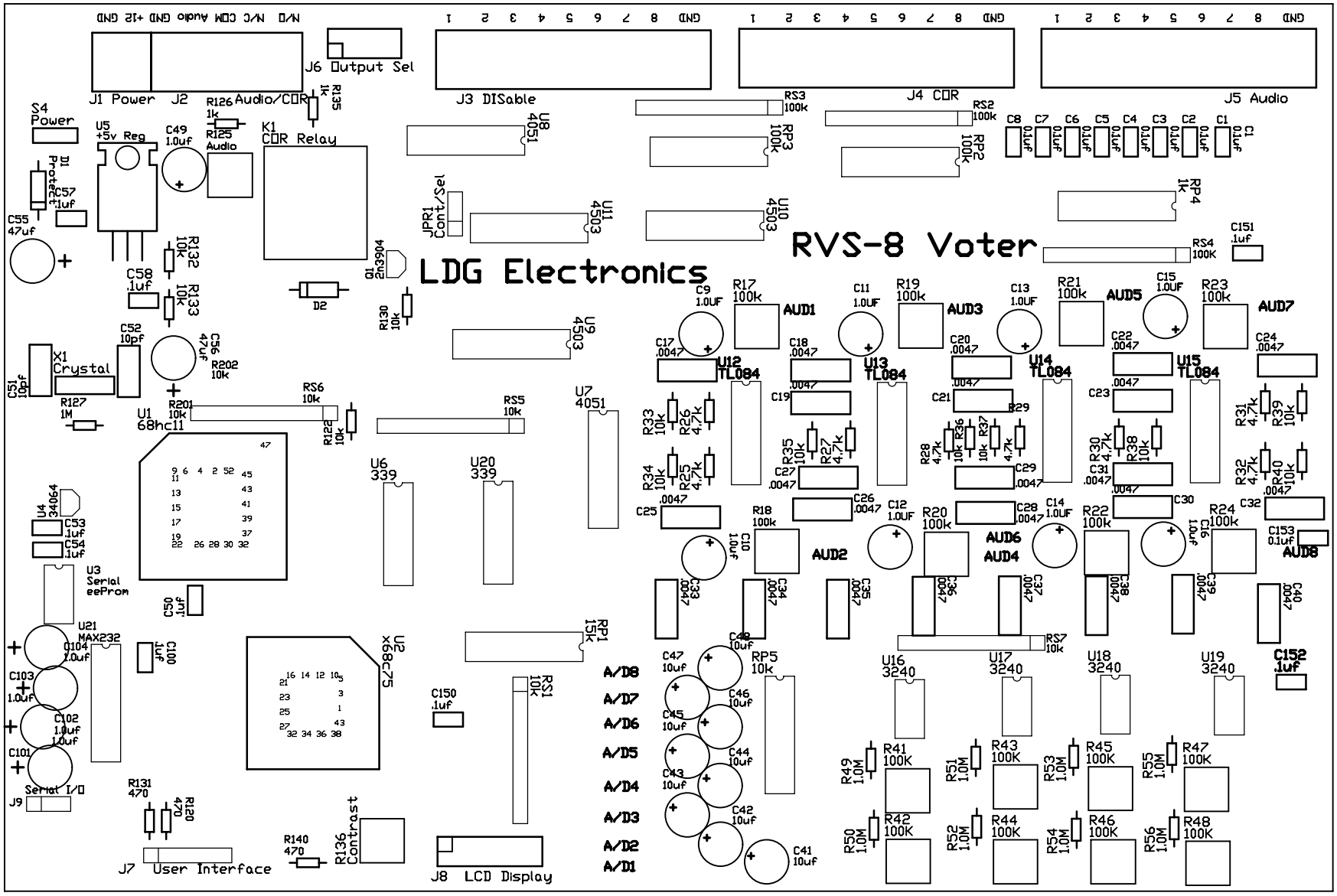
RVS-8 Update Notes

Version 2.0 PC Board
Version 2.1 Software

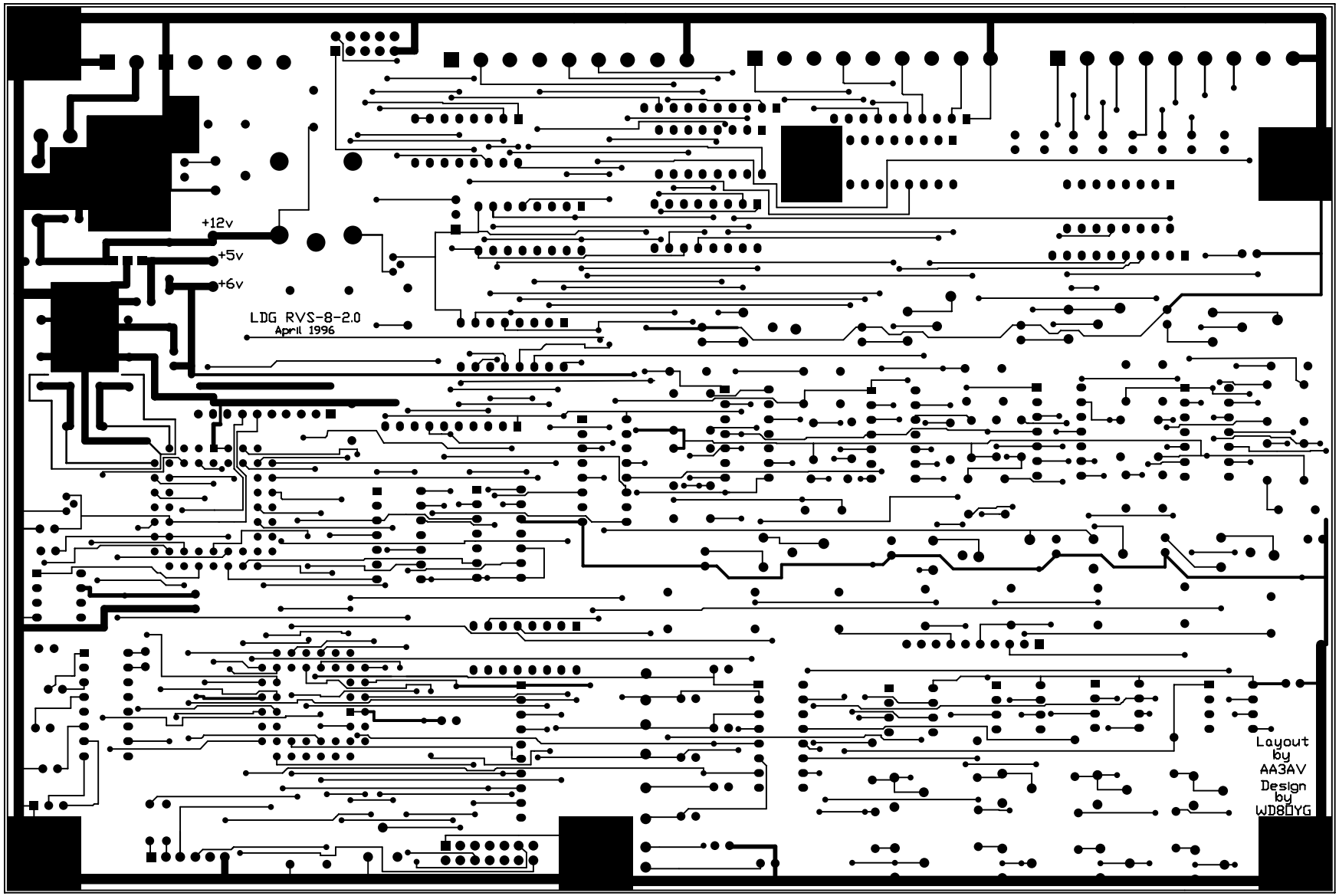
Ooops. We missed a pull down resistor on the STRB line of the X68C75 chip (U2). A 2.2K resistor is provided with the kit to be used here (any value between 1 K and 100K would work). The resistor goes between pin 37 of U2 to the grounded pin of R140. See diagram below.



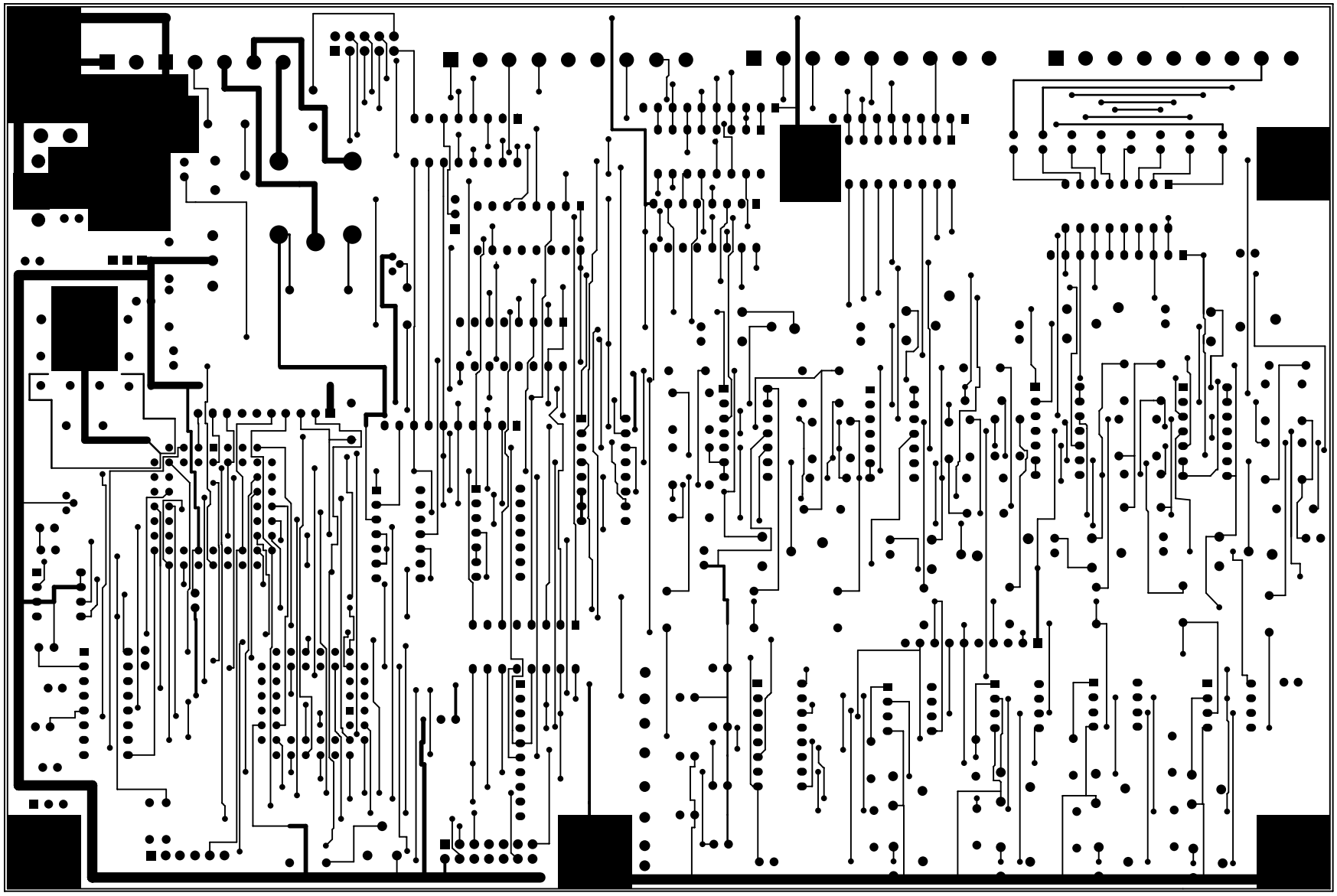
View From Bottom of Board (solder side)



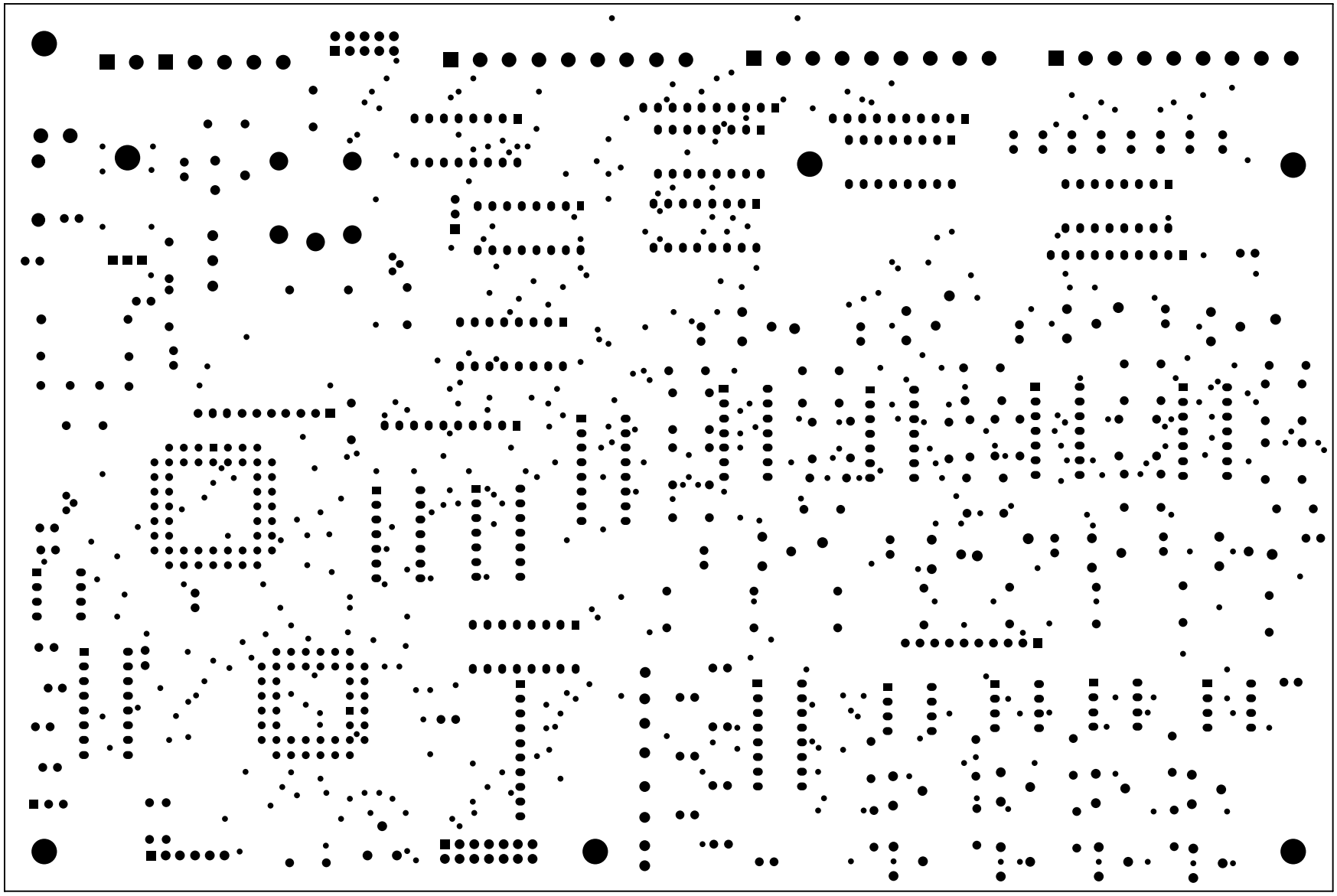
VOTER20 Top Overlay



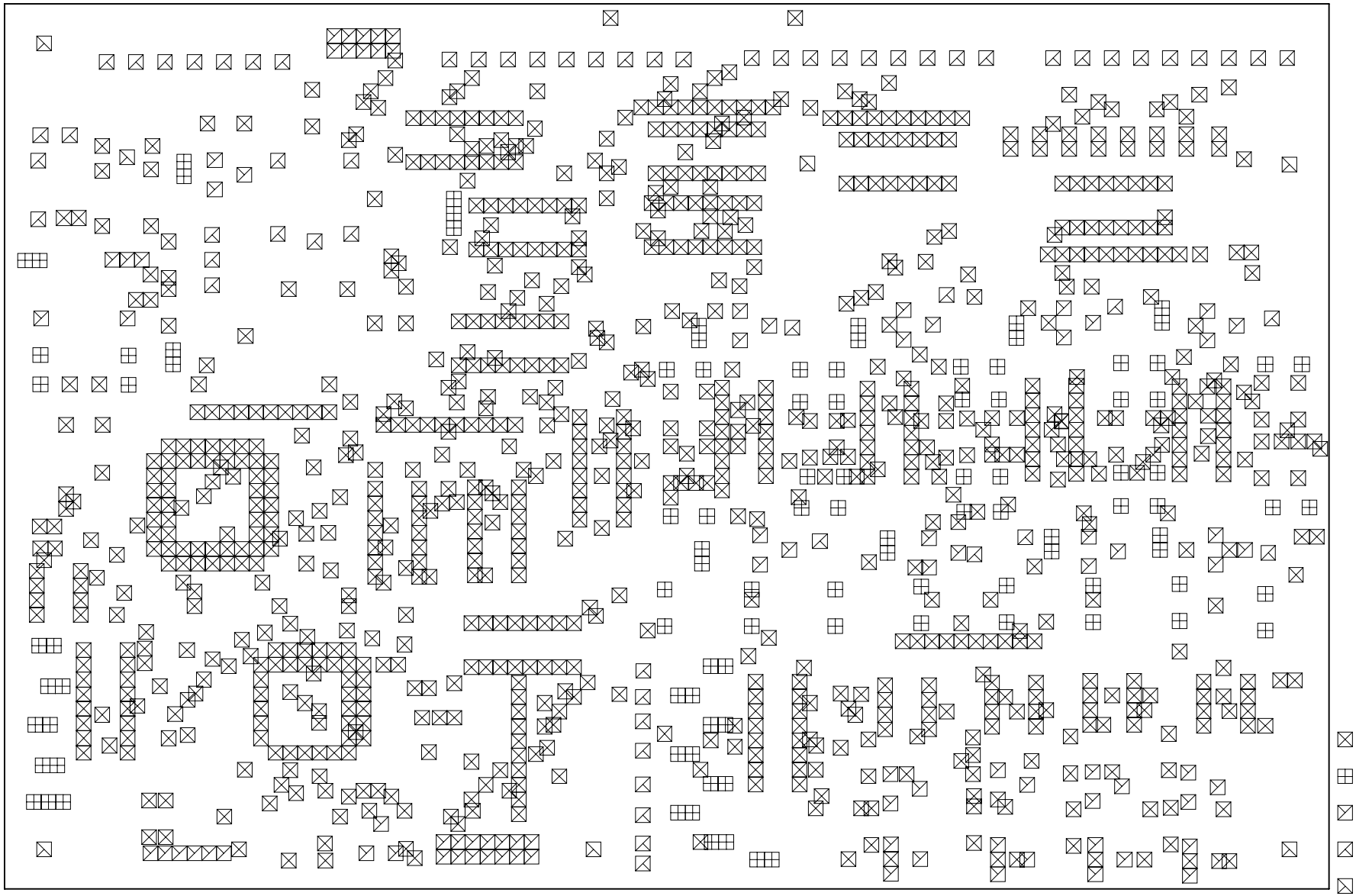
VOTER20 Top Layer



VOTER20 Bottom Layer

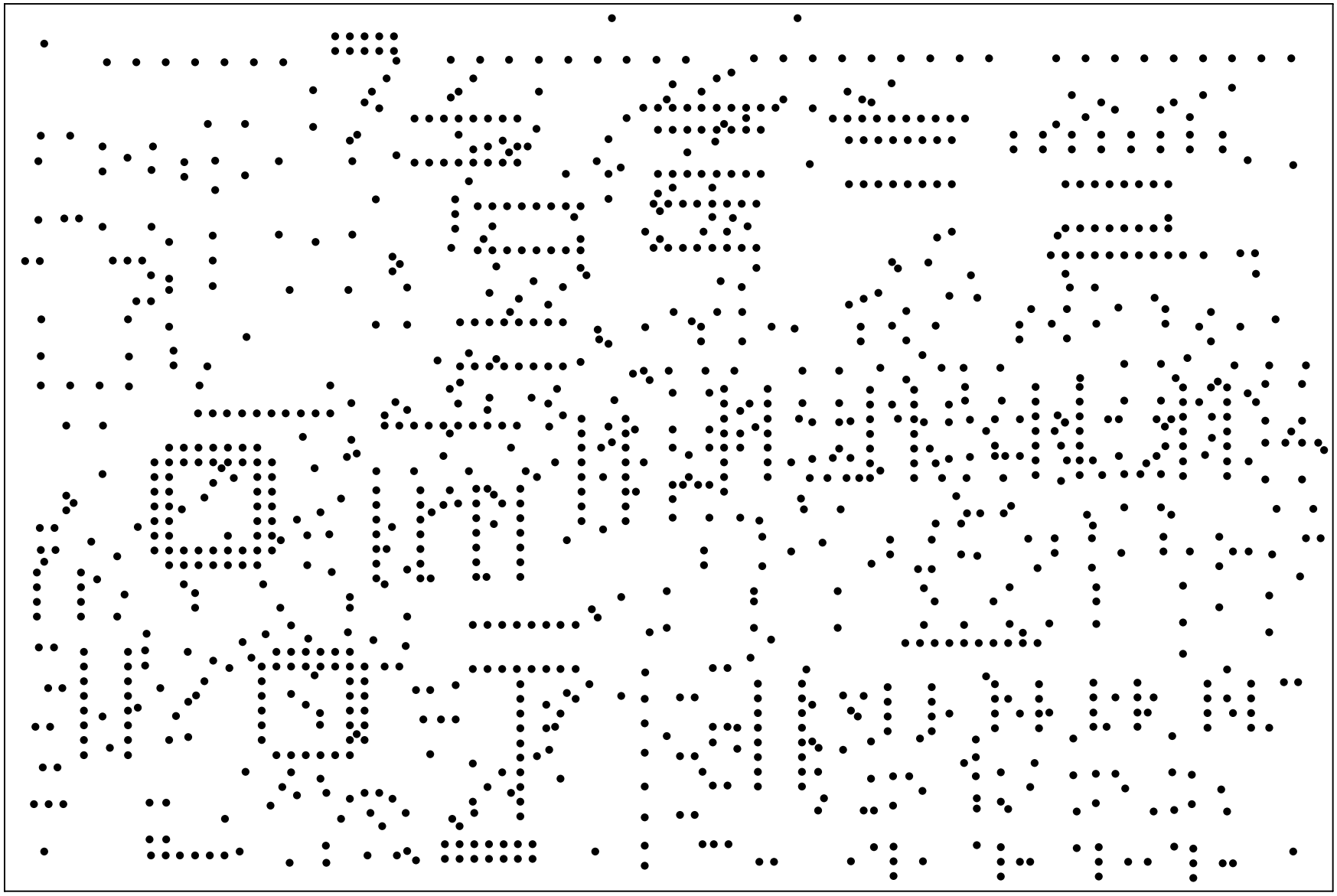


VOTER20 Top Solder Mask



VOTER20 Drill Drawing

	mils	Count
⊠	28	1004
⊞	35	104
⊠	42	89
⊠	52	62
⊠	125	7
	Total	1266



VOTER20 Drill Guide