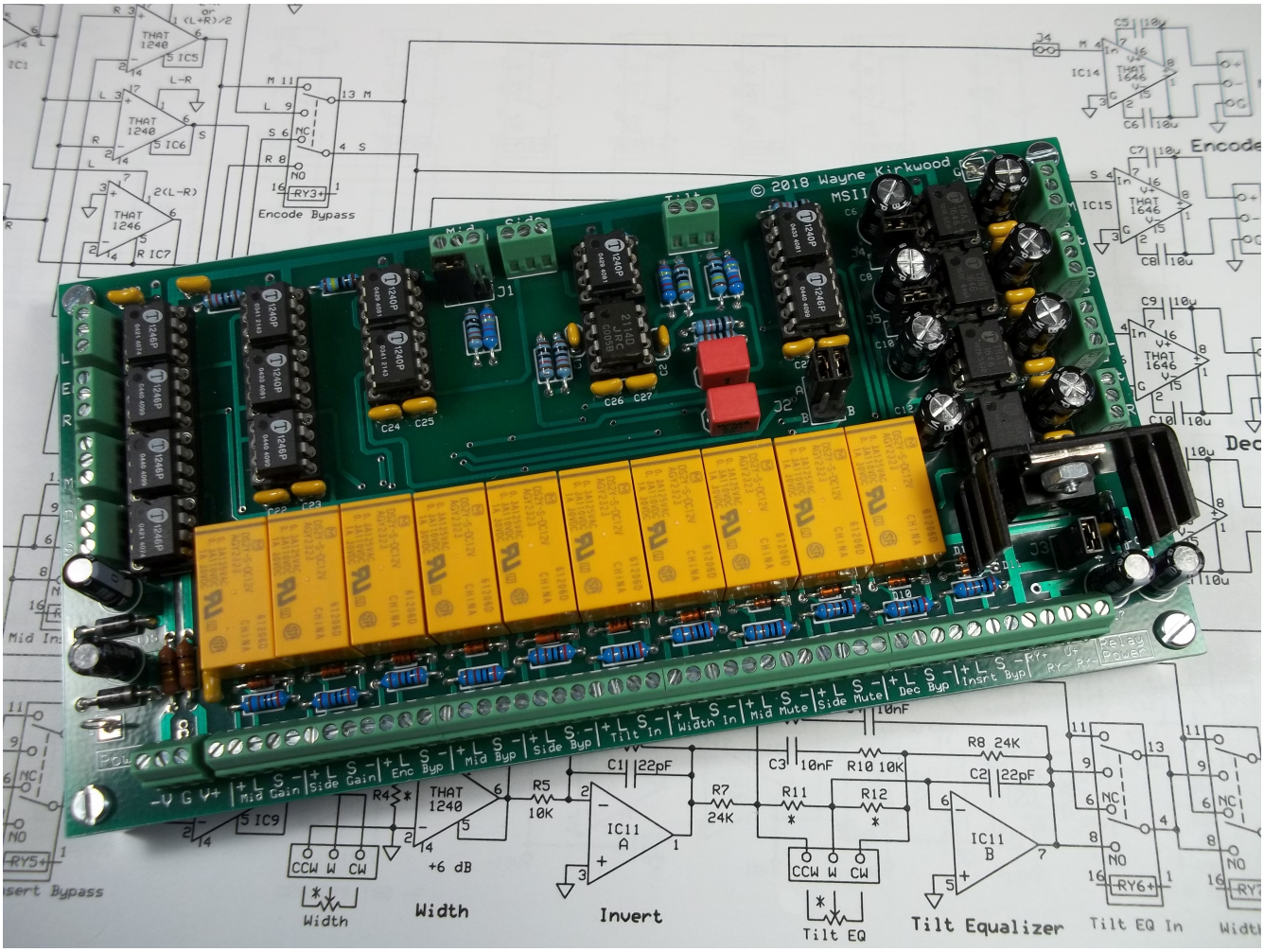
Assembly Instructions for the KA Electronics MS-II Precision MS Matrix

2.23.23



MS-II MS Matrix PC Board

Install IC sockets

Place the PC Board on the work bench silkscreen side face up.

Place (**17)** 8 pin IC sockets into their respective locations. Observe orientation of the notch. Make sure that you do not place the sockets in the bypass capacitor holes.

Tip: Lift the board up and place a piece of cardboard on top of the board to form a sandwich of PC board, sockets and cardboard. The cardboard is used to hold the sockets in place so the board can be turned over without the sockets dropping out. Flip the board over.

Tack Solder only two of the corner IC pins. Put downward pressure on the PC board to make certain the sockets are seated on the board as you solder.

Once all the IC sockets are tack soldered, flip the board over.

Make certain that each socket is correctly oriented, fully seated on the board and square.

If you're satisfied with the placement of the sockets, solder all of the remaining pins. Do not overfill the connection with solder because it can run underneath the socket and form a short between pins.

Visually check each pin's connection particularly those to the ground plane. Reheat any pins if needed. Do not trim the IC socket leads.

Install resistors and diodes

Install **(7)** 10KΩ 1% resistors at R1, R2, R5, R6, R9, R10 and R13.

Install **(1)** 24K3Ω 1% resistors at R3.

Install **(4)** 100KΩ 1% resistors at R4, R11, R12 and R14.

Install **(2)** 24K9Ω 1% resistors at R7 and R8.

R15-R19 are not used.

Install **(2)** 1Ω 1W fusible resistors at R20 and R21.

Install **(11)** LED current limiting resistors R22–R32. The value of these resistors depends on the desired LED brightness. If the LEDs are internally-ballasted and rated at 24V install bus wire links using resistor leads trimmed in previous steps. If the LED requires an external series resistor test the brightness at whatever operating current is desired. For approximately 5 mA install 4K99Ω 1/4W at R30-R32. For 10 mA use 2K21Ω.

Check the area around R22-R32 for solder bridges between the ends of the resistors.

Install diodes in the following locations.

Install **(12)** 1N4148 diodes at D1-D12. Observe polarity.

D13-D14 are not used.

Install **(4)** 1N4004 diodes at D15-D18. Observe polarity.

Install ceramic capacitors

Install **(2)** 22 pF at C1 and C2.

Install **(20)** 100 nF (0.1uF) at C20-C39.

Note: Designation C19 is not used.

Install jumper headers

Install the jumper shunts onto the header pins before you solder them. (The shunts serve as insulators that allow you to position them while soldering without burning your fingers.)

You will need **(6)** shunts. The shunts are positioned during installation in the locations that will be used in final test.

The shunts should be installed with small openings on the bottom. The shunts also have openings on the sides which also require that they be pointed outward on J2.

When installing the headers, tack solder only one pin and reheat it to adjust the position of the header so that it's square and flush with the board. Once you're satisfied with the orientation of the headers solder the remaining pins.

Install **(1)** 3 pin header at J1. The shunt on J1 should be in the left-hand position.

Install **(1)** 6 pin header at J2. Install **(2)** shunts vertically on J2 at the bottom "B" position. The openings in the sides of the shunts should point outward. (If they are not the two sections can short together.)

Install **(1)** 2 pin header at J3. Link the header with a shunt.

Install **(2)** headers at J4 and J5. On MSII_34 PC boards these are 2 pin headers. On later boards these are 3 pin. Link the headers with shunts. On 3 pin headers link the lower two pins.

Install Phoenix connectors

When installing the Phoenix connectors make sure the openings for the wires point outward to the edge of the board. When installing the connectors, tack solder only one pin and reheat it to adjust the position of the connector so that it's square and flush with the board. Once you're satisfied with the orientation of the connector, solder the remaining pins.

Boards above the MSII_33 revision do not require customization of the 12 pin Phoenix connectors.

On early MSII_33 version boards the 12 pin Phoenix connectors require their ends to be filed (or sanded) to allow proper clearance when multiple 12 pin connectors are stacked end-to-end. These connectors should be "dry fitted" (not soldered) to make sure all four can be installed without force-fitting them.

The best way to file down the 12 pin Phoenix connectors is to use a flat file or sand paper laid on a workbench. Drag the ends of the connector across the file. The two inner connectors require both ends to be filed. The two outer connectors only need the inside ends filed. Remove enough material so the connectors can be inserted without force-fitting. If the board bows slightly when all four are installed more material needs to be removed. Once the 12 pin connectors can be installed mechanically without physical interference the phoenix connectors may be soldered.

Prior to MSII_37: Install **(12)** 3 pin Phoenix connectors at the Encode and Decode Inputs, the Power Connector, the Mid, Side and Tilt controls, and finally the Encode and Decode outputs.

MSII_37 PC Boards: Install **(10)** 3 pin Phoenix connectors at the Encode and Decode Inputs, the Power Connector, the Side control, and finally the Encode and Decode outputs.

MSII_37 PC Boards: Install **(2)** 4 pin Phoenix connectors at the Mgain and Tilt controls.

Install **(4)** 12 pin Phoenix connectors end-to-end for the Relay and Relay Power connections at the lower edge of the PC board.

Install electrolytic capacitors

Note: The + (positive) terminals for the electrolytic capacitors have a square pad. Where space permits there is also a "+" silkscreen marking. The longer capacitor lead is the positive lead.

Bipolar capacitors, which do not have a polarity, will also be installed in eight locations. Make certain that you have the right type of capacitor before soldering it.

Install **(8)** 10uF 35V (or 50V) bipolar electrolytic capacitors at C5-C12.

Install **(2)** 47uF 35V polarized electrolytic capacitors at C15 and C16. The polarity of these capacitors are critical.

Install **(2)** 10uF 50V polarized electrolytic capacitors at C17 and C18. The polarity of these capacitors are critical.

C13 and C14 are not used.

Note: Film capacitors C3 and C4 will be installed in a later step.

Install the relays

The relay coils are usually 24V DC. (The Mouser BOM specifies 24V coils.) An optional 7824 regulator can be installed, in a later step, at IC18 for use with the +/-15V bipolar audio or external 24V supplies.

Tip: This step eases relay installation and makes soldering easier. Place all ten relays on the PC board and adjust them so they visually line up. Attach a long strip of adhesive masking tape to bridge the tops of the relays. The tape helps hold them together to allow soldering them as a group. Once the tape is attached, make certain the relays are still square and even relative to each other. At this point the corner pins of each relay may be tack-soldered in the following step.

When soldering the relays tack-solder the corner pins on each relay first. This will allow you to adjust the relays so they line up correctly. When you are certain that each relay is flush with the PC board and aligned with its neighbors solder the remaining pins. Each relay has 8 pins. Mentally count each pin as you solder it on each relay to make certain no pin is missed.

Install **(10)** relays at RY1-RY10.

Install optional relay voltage regulator

Install an LM7824 regulator.

Mount a small TO-220 heat sink onto the LM7812 (or 7824) before installing it with a 1/4" 4-40 screw, #4 fiber washer and 4-40 nut. Thermal grease is not required.

Insert the regulator and heat sink assembly onto the circuit board making sure that the lower edge of the lead, where it flares, is flush with the PC board. Depending on the regulator leads the bottom of the heat sink should clear the top of the PC board by about 0.2".

Solder only the center pin of IC18 making certain that the regulator is mounted square. If you are satisfied with the orientation of the regulator solder the remaining pins. If it is not square re-heat the pin and adjust it.

J3 must be linked for the regulator to supply power to the relay coils. Open J3 if an external 24V relay supply is used and the on-board regulator is not needed.

Install film capacitors

Install (2) 10 nF (0.01uF) 1% film capacitors at C3, C4.

Note: Do not install the ICs at this time.

Check all solder connections and reheat or re-flow them if necessary

When component leads are trimmed after soldering the solder joint becomes fractured. It is always a good idea to reflow all solder connections after lead trimming while checking for bridges or pins which may have missed being soldered.

If you add solder during this step do so sparingly particularly under IC sockets. Solder can flow through the PC board vias to the underside of the IC socket and cause shorts between pins.

If you prefer to remove the solder flux residue from the PC board now is a very good time to do it.

When you're finished cleaning the PC board inspect every joint under magnification.

Install spacers

Install **four** 4-40 threaded hex spacers at the board mounting holes. Place the **four** fiber washers between the PC board and the hex spacer and secure using four 4-40 1/4" screws. Four additional screws and fiber washers are in the bill-of-materials for securing the PC board to the chassis.

Initial Tests

The board should be tested on a power supply before installing the ICs.

Initial DC Tests

Connect a source of bipolar DC power.

If a variable power supply is used, slowly raise the voltage to about +/-15V.

There should be no measurable current draw. If excess current is drawn check the board for solder bridges and correct polarity of D15 and D16 and all the electrolytic capacitors.

Check the voltages at pin 7 of IC1-IC10 and IC12-IC13. It should be +15V. The voltages at pin 4 of the aforementioned ICs should be -15V.

Check the voltage at pin 8 of IC11. It should be +15V. The voltage at pin 4 should be -15V.

Check the voltage at pin 6 of IC14-IC17. It should be +15V. The voltages at pin 5 should be -15V.

Check the relay power supply if it is installed. Connect the +15V supply to Phoenix connector terminal "U+." Connect the -15V supply to Phoenix terminal "RY-." J3 should be linked. Measure the voltage between "Relay -" and "Relay

+." It should measure approximately 12V or 24V depending on the voltage regulator installed.

If any of the voltages are out of range look for solder bridges or an un-soldered pin or component lead.

Remove power.

Install the ICS

Install **(6)** THAT1246 at IC1-IC4, IC7 and IC13.

Install **(6)** THAT1240 at IC5, IC6, IC8-IC10 and IC12.

Install **(1)** OPA2134 at IC11.

Install **(4)** THAT1646 at IC14-IC17.

Offset and Current Draw Tests

Reconnect power.

Connect a wire between the Phoenix connector Width "CW" (clockwise) and "W" (wiper) connections. (A component lead trimmed during construction makes a good link.)

Connect wires between the Tilt Phoenix connector CW, W and CCW terminals so that they are shorted together.

If a variable power supply is used slowly raise the voltage to about +/-15V.

Measure the voltages across R20 and R21, the 1Ω resistors. The voltages should typically be less than 60 mV indicating a current draw of less than 60 mA.

Measure the DC voltages of the IC pins listed below. No input or output should be pinned to a supply rail. Typical offsets will be +/- 15 mV or less.

IC1-IC10 and IC12-IC13 pin 6 output.

IC11 pins 1 and 7.

(IC11 and IC12 will show large DC offsets in the range of 1-3V if the Side and Tilt links are not connected.)

IC14-IC17 pins 1 and 8.

Remove power.

Signal Tests

The MS-II board has numerous operational and jumper options.

On-board relays allow the MS-II to switch Mid/Side Encode Gain, bypass the Encode/Decode functions, bypass the Mid/Side inserts, insert Width and Tilt EQ in Side, And Mute Mid/Side.

The first group of tests are made with the relays un-powered. When the MS-II relays are in the un-powered "normally-closed" state, the Left and Right Encode inputs

flow to the Encode output as Mid and Side. The Mid Side Decode inputs flow to the Decode outputs as Left and Right. When the Encoder outputs are wired to the Decoder inputs for test, Left and Right flow through the entire unit but undergo full Mid/Side Encode/Decode internally. In this "default" mode about 80% of the MS-II's active circuitry is tested.

The second group of tests checks operation of the various relays, the Width (Side Gain) adjustment and the Side Tilt Equalizer.

A signal generator (or DAC output) and level meter (or A/D inputs) are required. The instrument connections may be balanced, un-balanced or a combination of both.

The relay supply for the board should be connected to the +/-15V rails as described in the section "Initial Tests."

Jumper Positions for Test

The jumpers should have been installed in the proper location during assembly. Please confirm in the following steps they are in the correct position.

J1 in the left-most position. (No Mid attenuation.)

J2M J2S two links in the vertical "B" position. (Decode bypass post-Width/Tilt)

J3 installed. (Internal relay supply.)

J4 and J5 installed in bottom position A. (Optional encode mute/insert.)

Test the Input-Output and Mid-Side Encoder-Decoder Circuitry

The level measurements performed here check the board for unity gain signal passage and correct operation of the MS Encoder-Decoder.

Tip: It is important to note that when testing an MS Encoder-Decoder that mono test signals do not, by definition, produce a Side signal. Put simply two things cannot be different if they are the same. Test signals in only one channel produce the Side or difference signal needed for internal tests. For this reason pay particular attention when instructed to feed tone into only one channel.

When making level measurements on THAT1646 outputs use a high impedance or "bridging" (approx. 10KΩ or greater) loading. A THAT1646 loaded in 600Ω will read approximately -0.7 dB less. If a 600Ω load is anticipated in final use, take this into account.

Unless specified all AC and DC measurements are made relative to ground.

Connect the MS-II's Mid Side Encode outputs into the Decoder input. These connections pass signal through the Mid Side Inserts for testing. A short length of two 2-conductor twisted pairs looped from the right-hand side of the board to the encode inputs will suffice. Be careful to observe signal polarity.

Tip: Reversing the polarity of Mid or Side with respect to one another can produce some surprising results. Reversing the polarity of Side for example will swap the Left and Right outputs on decode. When looping the Encode Outputs into the Encode inputs pay close attention to polarity.

Apply power.

Check the full Mid-Side Encode-Decode Path

Feed a 0 dBu (775 mV RMS) 1 kHz tone into the Left and Right Inputs. The generator can be either balanced or unbalanced. If unbalanced, ground both the G and "-" inputs.

Measure the output level at the Decode Left and Right Outputs. If a single-ended unbalanced instrument is used, ground the "-" output. The output levels for both channels should measure 0 dBu.

Remove the tone feeding the Left Channel. Continue feeding tone into the right channel. The Right channel output should continue to read 0 dBu. The Left output should read below -50 dBu typically -60 dBu.

Reconnect tone to the Left channel input and remove tone from the right channel input. The Left channel output should continue to read 0 dBu. The Right output should read below -50 dBu typically -60 dBu.

If the steps above provide correct results then proceed to check operation of the relays. If one or more measurements don't seem correct then check the following test points.

Feed a 0 dBu 1 kHz tone into the Left and Right Inputs.

Measure the levels at the outputs (pin 6) of IC1 and IC2. They should read -6 dBu.

Feed tone to the Left channel input and remove tone from the right channel input.

Measure the signal level at the following points:

IC5 output pin 6: -6 dBu
IC6 output pin 6: -6 dBu
IC7 output pin 6: 0 dBu
IC14 input pin 4: -6 dBu
IC15 input pin 4: -6 dBu

Encode Mid Out +/- -6dBu relative to ground; 0 dBu balanced/differential
Encode Side Out +/- -6dBu relative to ground; 0 dBu balanced/differential
Decode Mid In +/- -6dBu relative to ground; 0 dBu balanced/differential
Decode Side In +/- -6dBu relative to ground; 0 dBu balanced/differential

IC3 output pin 6: -6 dBu
IC4 output pin 6: -6 dBu
IC8 output pin 6: -6 dBu
IC9 output pin 6: -6 dBu
IC12 output pin 6: -6 dBu
IC13 output pin 6: >-50 dBu

Feed a 0 dBu 1 kHz tone into both the Left and Right Inputs.

Measure the signal level at the following points:

IC13 output pin 6: -6 dBu

IC16 input pin 4: -6 dBu
IC17 input pin 4: -6 dBu

Decode Left Out +/- -6dBu relative to ground; 0 dBu balanced/differential
Decode Right Out +/- -6dBu relative to ground; 0 dBu balanced/differential

Check operation of the Relays

The next steps check operation of the relays. The first group of tests verify operation of the Gain, Mute and Bypass relays.

A second group of tests check the active circuitry of the variable Width and Tilt equalizer and their bypass relays.

Make certain the relay supply is connected to the bipolar audio supply as described in "Initial Tests."

Each relay has four connections. Two connections, "+" and "L" are for the current-limited LED anode and cathode connections. The "L" and "S" terminals are connected to each other. When the "L" terminal is connected to relay common the LED illuminates.

To engage a relay, connect the "S" and "-" terminals to each other. The "S" terminal is the relay coil; the "-" terminal is connected to the relay supply common "RY-." When the relays are powered from the bipolar supplies for test, the "RY-" or "-" is at -15V. The relay positive supply will be either 12V greater (or 24V if a 7824 is used) than -15V.

Check the Gain, Mute and Bypass relays

Feed a 0 dBu 1 kHz tone into the Left and Right **Inputs**.

Note: The following measurements of the Encode and Decode outputs are for a balanced connection. If using a unbalanced meter and measuring relative to ground subtract 6 dB.

Measure the Encode Mid Out level. It should be +6 dBu (balanced) when read across the +/- outputs.

Engage the Mid Gain relay.

Measure the Encode Mid Out level. It should decrease by 6 dB to 0 dBu.

Measure the Left and Right Decode Outputs. They should continue to read 0 dBu indicating that RY1 is decreasing Encode Mid gain by -6 dB while at the same time increasing Decode Mid gain by +6 dB.

Disengage the Mid Gain relay.

Measure the Mid and Side Encode outputs. The Mid output should read +6 dBu. The Side output should read <-50 dBu.

Move J1 from the left-hand to the right-hand position. The Left and Right Decode outputs should decrease from 0 dBu to -3 dBu. Move J1 back to the left-hand position.

Engage the Encode Bypass relay RY3.

Measure the Mid and Side Encode outputs. The Mid output should read +0 dBu. The Side output should read 0 dBu.

Disengage the Encode Bypass relay.

Feed tone to the Left channel input and remove tone from the right channel input.

Engage the Side Gain relay RY2.

Measure the Encode Side Out level. It should increase by 6 dB to measure +6 dBu when read across the +/- outputs.

Measure the Left and Right Decode Outputs. The Left Decode output should continue to read 0 dBu and the right channel <-50dBu indicating that RY2 is increasing Encode Side gain by +6 dB while at the same time decreasing Side Decode gain by -6 dB.

Disengage the Side Gain relay.

Engage the Mid Mute relay RY8.

Measure the Left and Right Decode Outputs. The Left and Right Decode outputs should both read -6 dBu indicating that RY8 is muting the Mid input to the Decoder.

Disengage the Mid Mute relay.

Engage the Side Mute relay RY9.

Measure the Left and Right Decode Outputs. The Left and Right Decode outputs should both read -6 dBu indicating that RY9 is muting the Side input to the Decoder.

Disengage the Side Mute relay.

Engage the Decode Bypass relay RY10.

Measure the Left and Right Decode Outputs. The Left and Right Decode outputs should both read 0 dBu indicating that RY10 is bypassing the Decoder.
Disengage the Decode Bypass relay.

Disengage the Decode Bypass relay RY10.

Remove the jumper wires which connect the Encode Mid and Side outputs to the Decoder Mid and Side inputs.

Measure the output levels of the Left and Right Decode outputs. They should be in the noise floor.

Engage the Mid Bypass relay RY4.

Measure the Left and Right Decode output levels. They should read -6 dBu.

Disengage the Mid bypass relay.

Engage the Side Bypass relay RY5.

Measure the Left and Right Decode output levels. They should read -6 dBu.

Disengage the Side bypass relay.

Engage the Insert bypass mode which engages both RY4 and RY5.

Measure the Left and Right Decode output levels. The Left Decode output should read 0 dBu (balanced). The Right Decode output should be <-50 dBu.

Leave the Insert bypass relay engaged for the remaining tests.

Check the Width and Tilt Equalizer

This section checks both the active circuitry of the Width and Tilt equalizer as well as the relays which bypass them.

Remove the wire jumpers installed at the Side and Tilt Phoenix connectors and replace them two 10KΩ linear potentiometers. Set both pots to their approximate mid position.

Make certain that J2M J2S are linked in the vertical "B" position. (Decode bypass post-Width/Tilt)

Feed 1 kHz 0 dBu tone to the Left channel input and remove tone from the right channel input.

Engage the Decode Bypass relay RY10. (The insert bypass relay should already be engaged.)

The Decode Right Channel output is now Side Out.

Measure the Side output level forwarded to the Right Channel Decode output. The level should measure 0 dBu.

Engage the Width relay RY7. Adjust the 10KΩ potentiometer from the clockwise (CW) to counter-clockwise (CCW) position. The level should range from +6 dBu to -∞. (Typically >-60 dBu.)

Return the potentiometer to the mid position and adjust the level at the Right Decode output for 0 dBu.

With the Insert bypass relays (RY4 and RY5)Decode Bypass (RY10) and Width relay (RY7) engaged continue testing.

Note: RY7 Width has to also be engaged for the Tilt EQ to function.

In the following tests we will use generator frequencies of 10 kHz and 100 Hz.

Increase the generator frequency to 10 kHz while feeding only the Right channel Encode Input.

Set the Tilt EQ pot to full CW.

Engage the Tilt EQ relay RY6.

The Side level, measured at the Decode Right channel output, should increase by approximately 3 dB.

Rotate the Tilt Pot to its CCW position. The Side level, measured at the

Decode Right channel output, should decrease by approximately -3 dB.

Decrease the generator frequency to 100 Hz.

The Side level, measured at the Decode Right channel output, should read about +3 dB.

Rotate the Tilt EQ control to full CW rotation.

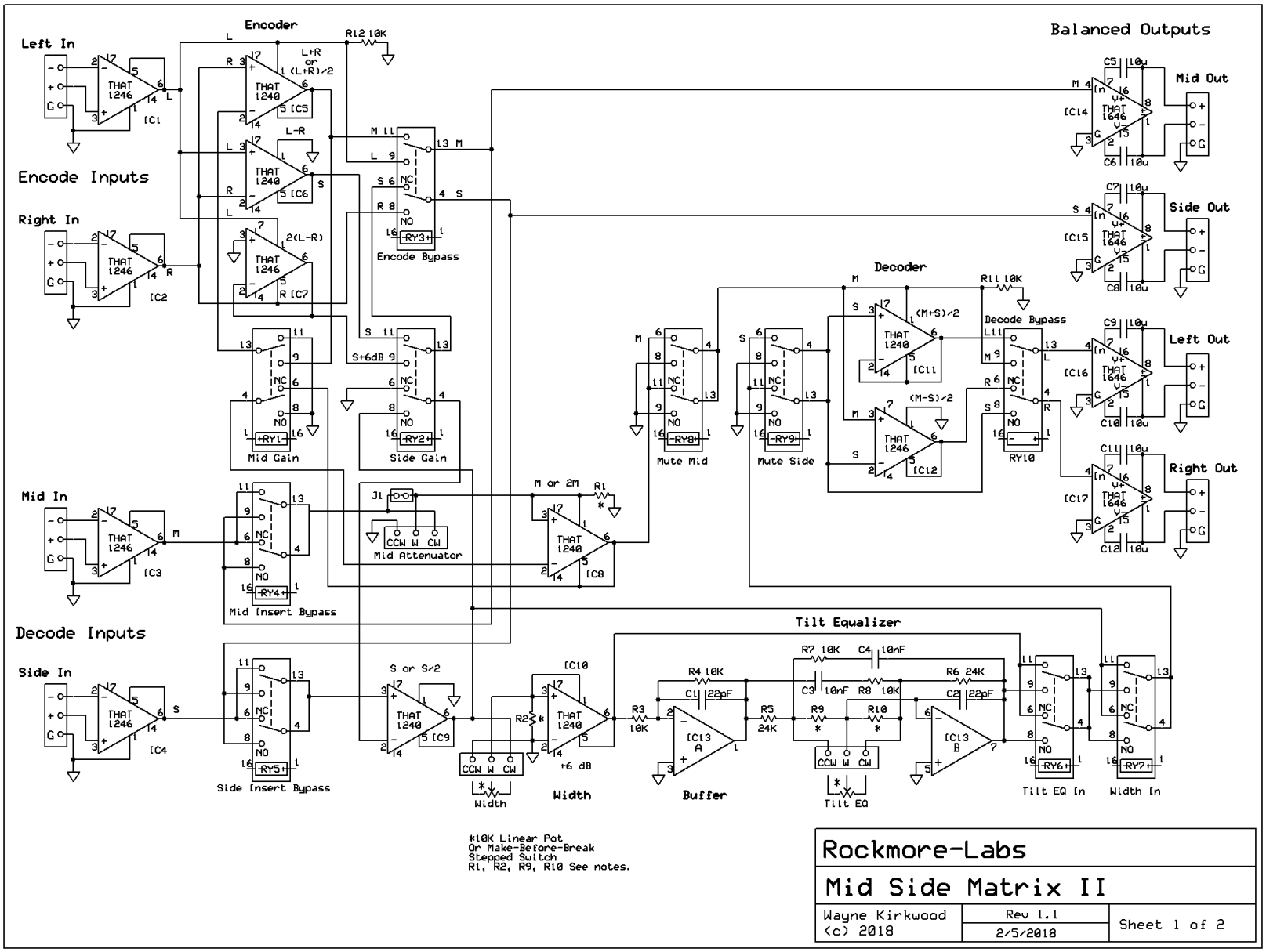
The Side level, measured at the Decode Right channel output, should decrease by approximately -3 dB.

Disengage the Tilt EQ.

Move J2M and J2S to the "A" position. (Decode bypass forwards Decode M and S Inputs to Left and Right Outputs)

This completes functional checkout of the MTC MS-II circuitry.

For those that wish to do so we recommend also performing noise and distortion measurements using software-based tools and audio converters. Extended tests should be performed when the unit is installed in a shielded enclosure due to the possibility of fields being picked up by the board's film capacitors and potentiometer wiring.


Encoder
Balanced Outputs
Left In
Encode Inputs
Right In
Mid In
Decode Inputs
Side In
Mid Out
Side Out
Left Out
Right Out
Encode Bypass
Mid Gain
Side Gain
Mid Attenuator
Mid Insert Bypass
Side Insert Bypass
Mute Mid
Mute Side
Decoder
Decode Bypass
Tilt Equalizer
Buffer
Width
Tilt EQ
Tilt EQ In
Width In
*10K Linear Pot
Or Make-Before-Break
Stepped Switch
R1, R2, R9, R10 See notes.
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Mid Side Matrix II
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Rev 1.1
2/5/2018
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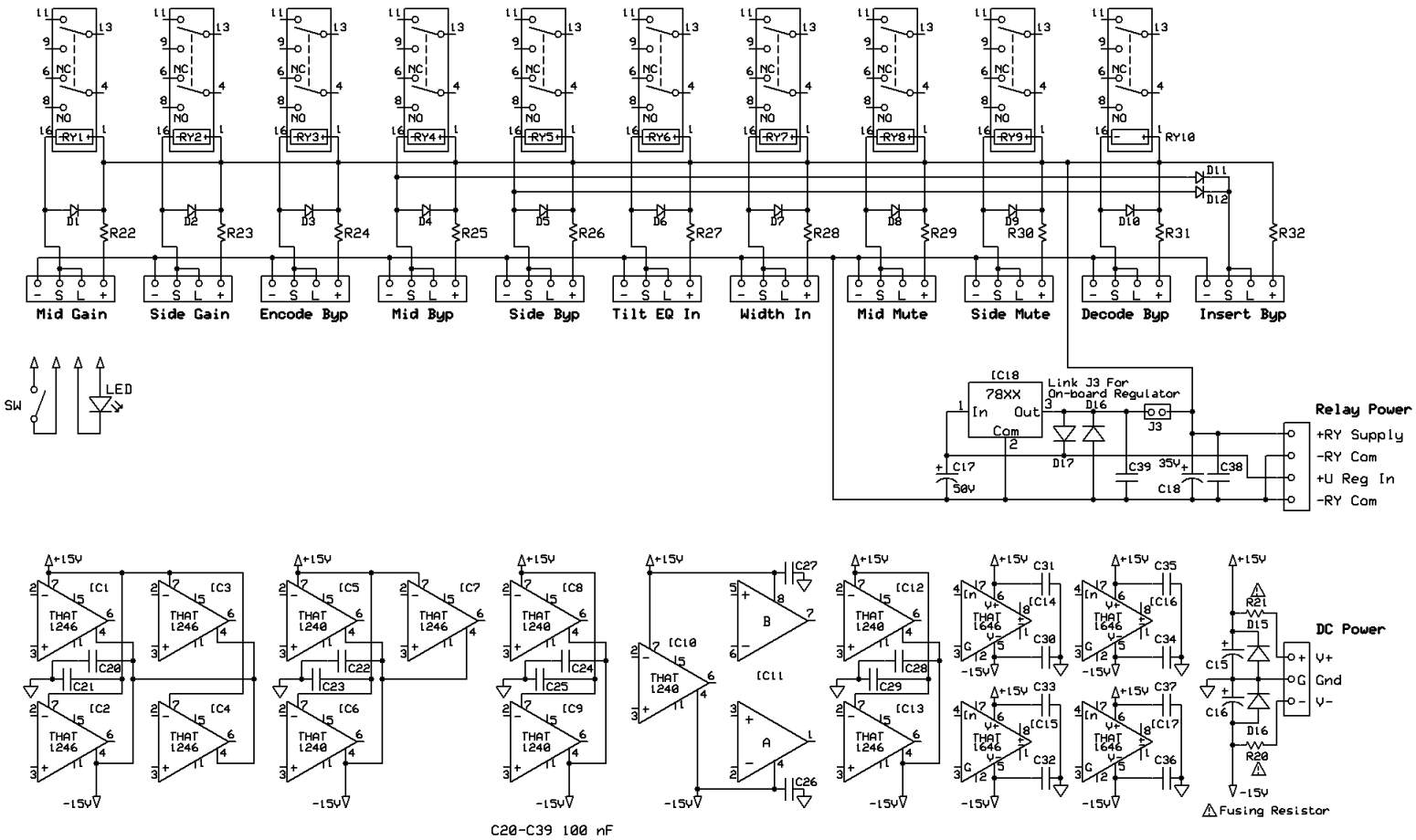

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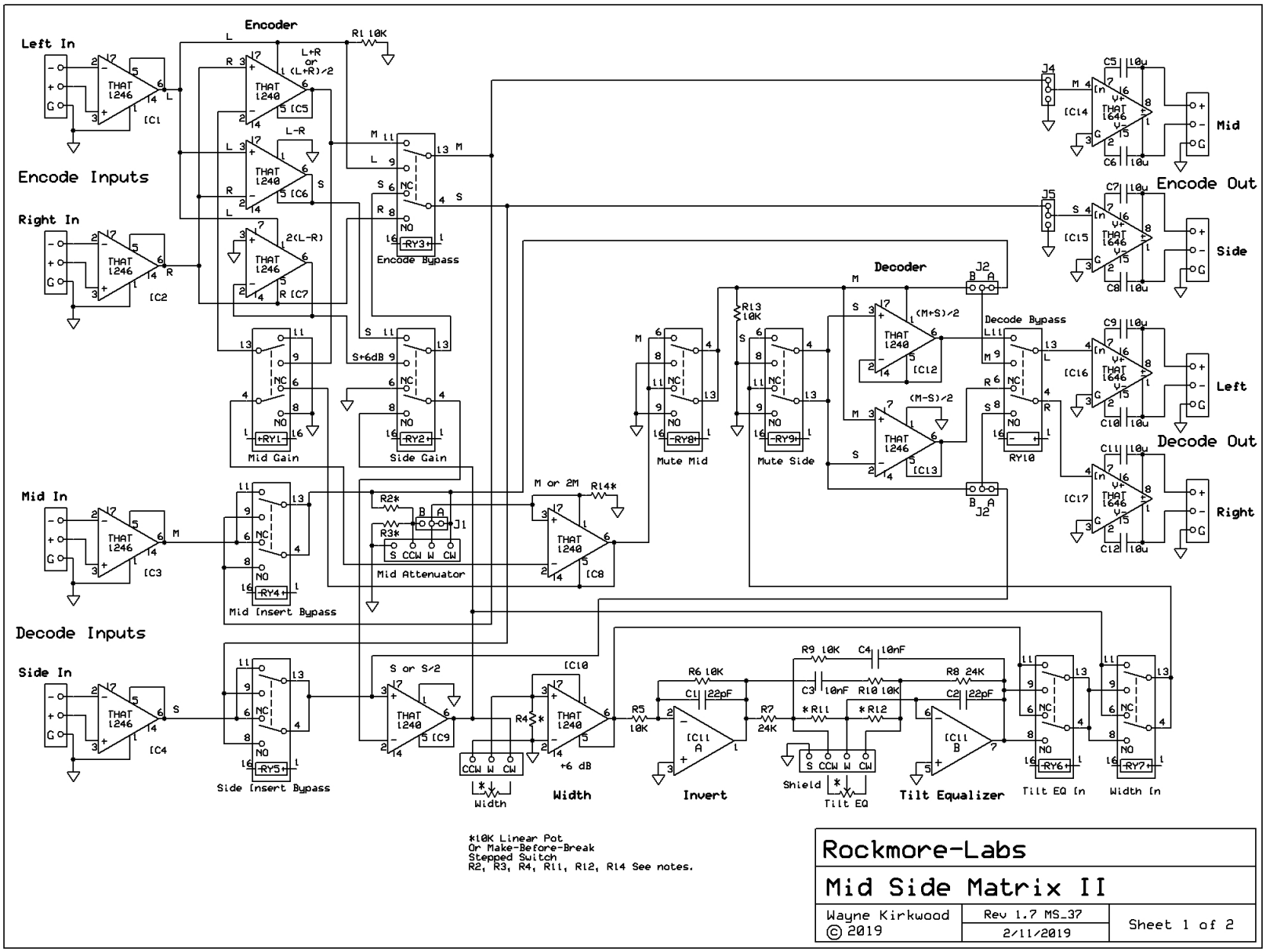
Encoder
Left In
Encode Inputs
Right In
Mid In
Decode Inputs
Side In
Encode Bypass
Mid Gain
Side Gain
Mid Insert Bypass
Side Insert Bypass
Mid Attenuator
Mute Mid
Mute Side
Decoder
Decode Bypass
RY10
Encode Out
Mid
Side
Decode Out
Left
Right
Width
Invert
Shield
Tilt EQ
Tilt Equalizer
Tilt EQ In
Width In
*10K Linear Pot
Or Make-Before-Break
Stepped Switch
R2, R3, R4, R11, R12, R14 See notes.
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2/11/2019
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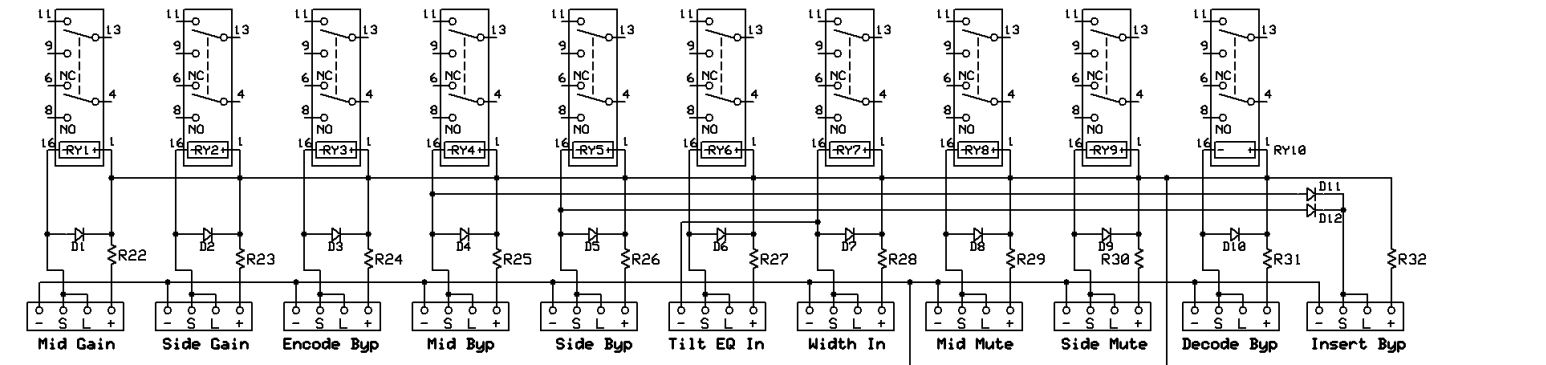

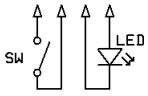

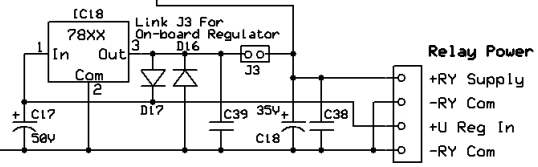

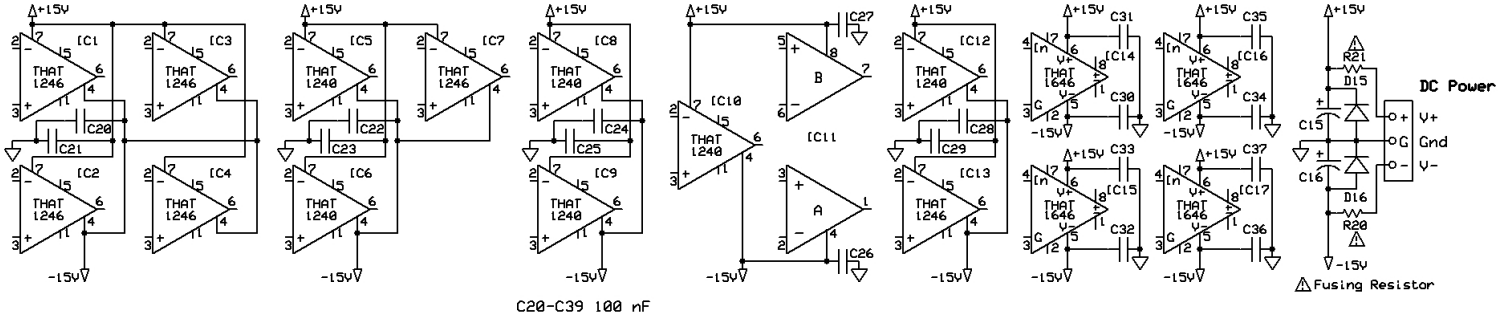

C20-C39 100 nF

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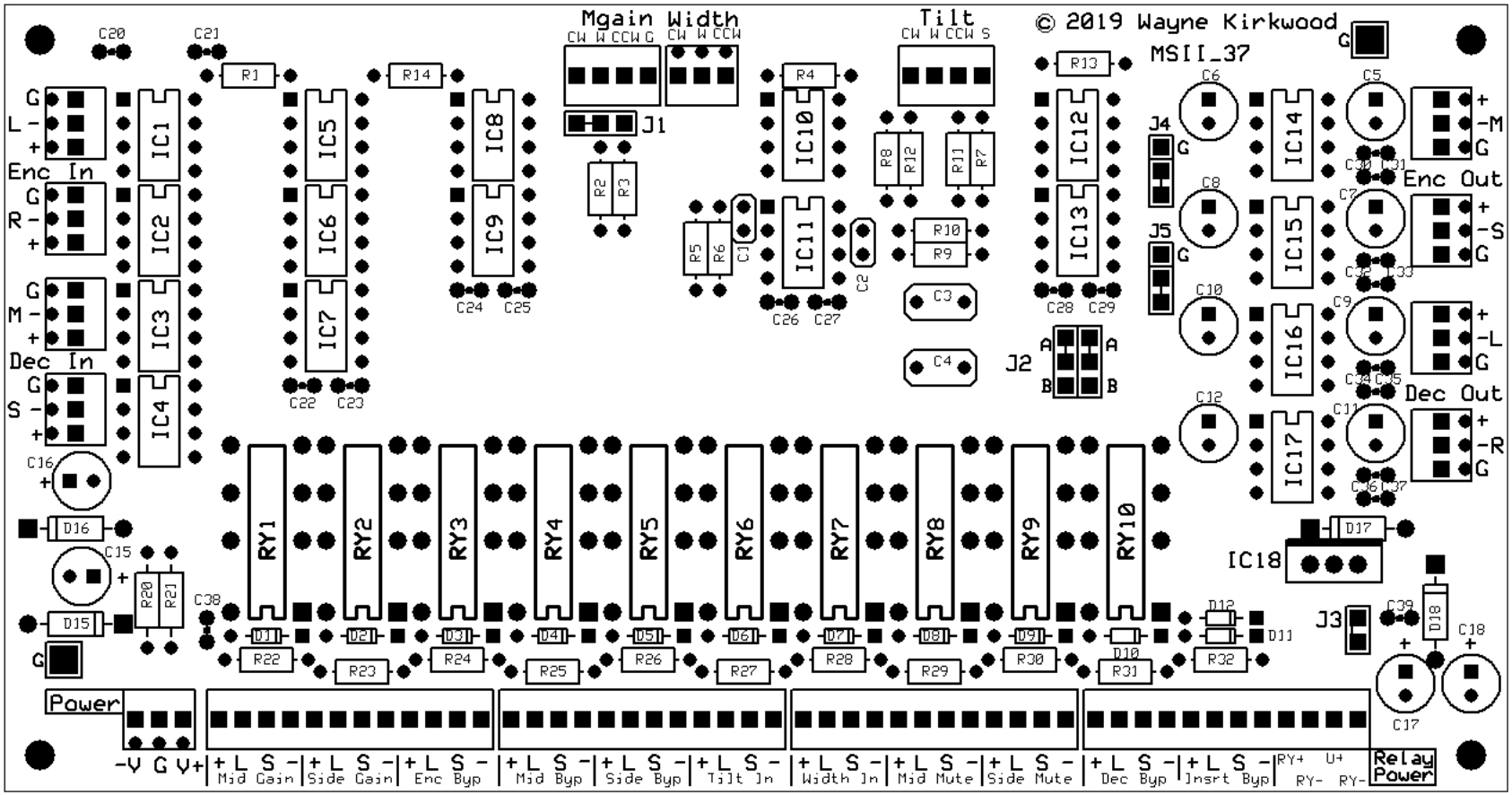
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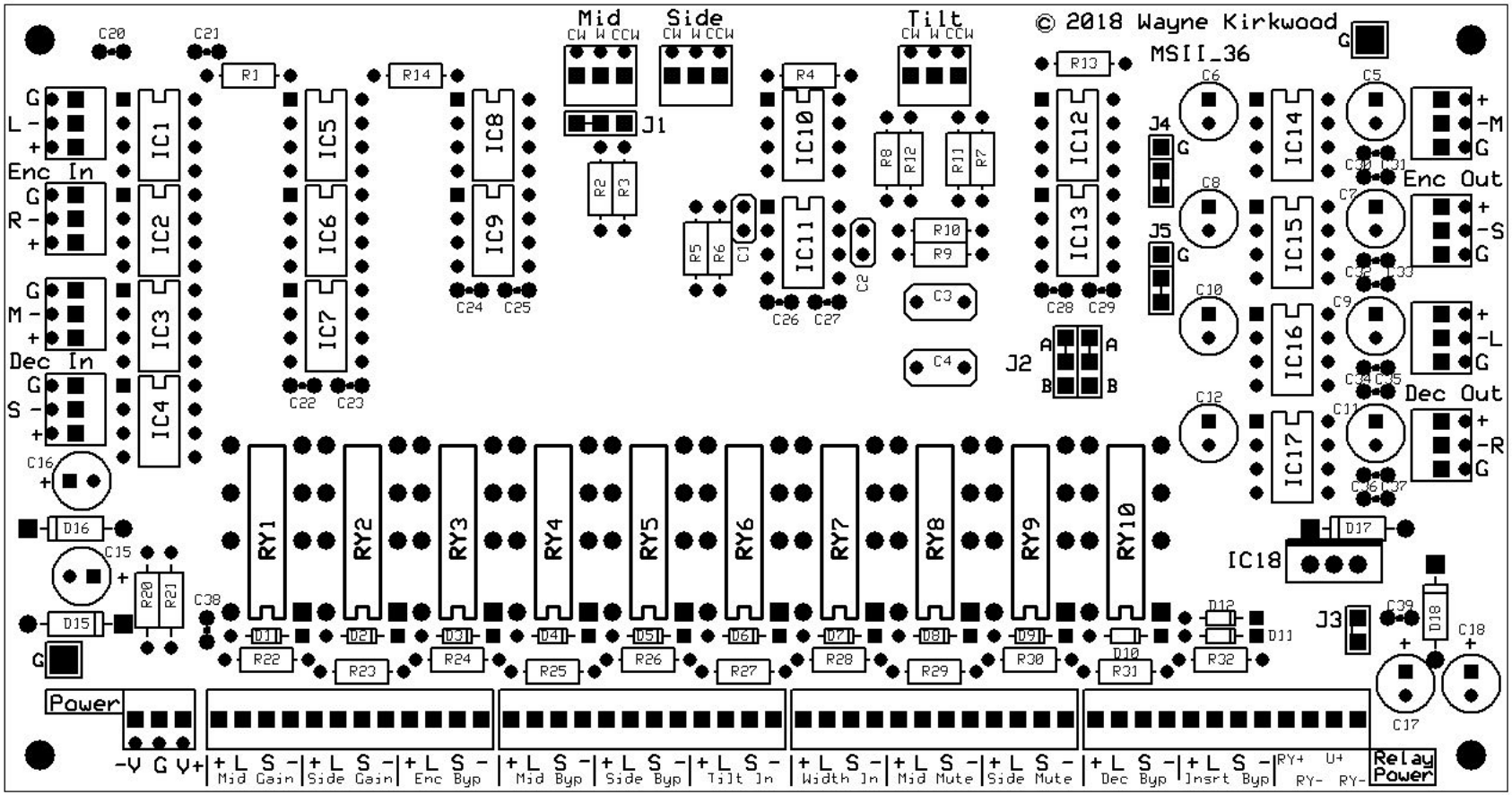
MSII_37
Mgain Width
CW W CCW G CW W CCW
Tilt
CW W CCW S
J1
J2
J3
J4
J5
Enc In
Dec In
Enc Out
Dec Out
IC18
Power
Relay Power
-V G V+
+ L S - Mid Gain
+ L S - Side Gain
+ L S - Enc Byp
+ L S - Mid Byp
+ L S - Side Byp
+ L S - Tilt In
+ L S - Width In
+ L S - Mid Mute
+ L S - Side Mute
+ L S - Dec Byp
+ L S - Insrt Byp
RY+ V+
RY- RY-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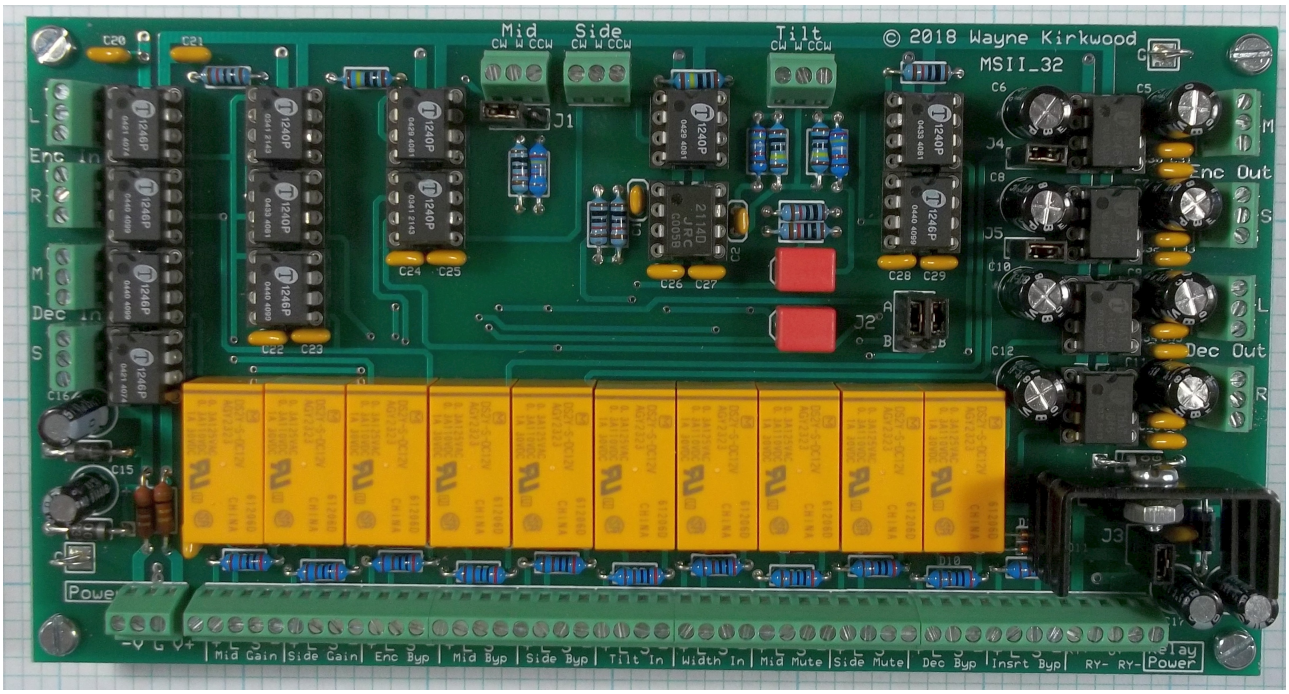
MSII_36
Mid
Side
Tilt
CW W CCW
L
Enc In
R
M
Dec In
S
G
Enc Out
Dec Out
-M
-S
-L
-R
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
IC13
IC14
IC15
IC16
IC17
IC18
J1
J2
J3
J4
J5
RY1
RY2
RY3
RY4
RY5
RY6
RY7
RY8
RY9
RY10
Power
-V G V+
Mid Gain
Side Gain
Enc Byp
Mid Byp
Side Byp
Tilt In
Width In
Mid Mute
Side Mute
Dec Byp
Insrt Byp
RY+
RY-
U+
Relay Power



Completed MS-II Board

Detailed Parts List

A complete bill of materials is available from Mouser Electronics:

MTC MS-II BOM V37 PCB with THAT and TI ICs and 24V Relays:
https://www.mouser.com/ProjectManager/ProjectDetail.aspx?AccessID=59fbdeac53

Other Resources

Pro Audio Design Forum MTC MS-II Build Thread:

https://www.proaudiodesignforum.com/forum/php/viewtopic.php?f=7&t=911

For more information contact: sales@ka-electronics.com