Thomas Vox Guitars - The On-board Effects

Jon Curl & R.G. Keen

Version 1, Revision 0

Contributors:

Steed Taranto

Table of Contents

Introduction

Thomas Organ went into the guitar pop music world in a big way in the mid and late 60s. Their amplifiers – the Beatle, Royal Guardsman, Buckingham, Viscount, and others, were notable presences in the rock music scene in the USA then. They also sold some novel guitars, notably the trapezoidal-body Phantom and Invader, and the teardrop versions, as well as the Mando-guitars, mandolin scaled electric versions.

It's not widely appreciated, but Thomas sold a large number of different guitar models – 87 of them by count in the service literature, though perhaps not many were sold of each model – eighteen of which had on-board electronics for effects. If you own or know of one of these rare birds, this may be useful to you.

Let me preface this with the fact that there is a very limited fund of knowledge on these guitars. Unfortunately, the service literature has no information whatsoever about what the circuits were on those effects boards, only the outboard wiring. There are huge gaps in the information. If you find mistakes or additional info, please send it and it will get sifted into the pile, with thanks for the help! I expect to update this write-up as more information becomes available.

Guitars With Effects

The on-board effects were slightly modified versions of their plug-into-the-guitar effects and on-the-floor pedals. It's not clear at this point which came first, or if they were semi-simultaneous.

Typical of Thomas Vox amps, they used a mix-and-match set of modules to produce a plethora of models with slightly different features with only modest inputs of design work. This is probably a leftover of the design approaches Thomas brought with them from the electric organ world, where modularity was a fundamental concept.

There were five on-board effects: distortion, treble-bass boost, repeat percussion, wah and a tuner, which came as either an E or G, depending on whether it was for a six-string guitar (E) or bass (G). These were actually implemented as stone-age version of “integrated circuit”, with the effect circuit built cordwood-style with the components on end between two postage-stamp-sized printed circuit boards. Each board had a unique set of leads on one side that let it be soldered into a “motherboard” that took the input, output, control wires and power/ground contacts out to where wires could connect these up to the controls and signal wiring.

Appendix A has a list of all the guitar models that are in the available service literature. The following is a table of just guitar the Vox guitar models with on-board effects, and the part numbers Thomas listed for the assemblies and PCBs. The effects listed were cross referenced back to the wiring diagrams in the service literature (which is all the service literature has on these modules) to make a sanity check on which went with what. The table is sorted in order of fewest effects first – that is, the smallest motherboard.

Model	Distn	T-B	Rpt	Wah	Tuner	MB PCB # (PCB only)	Asm #
Constellation IV V274	X	X			X(G)	09-3709-0	09-3706-0
Astro IV	X	X			X(G)	09-3709-0	09-3706-0
Sidewinder IV V272	X	X			X(G)	09-3709-0	09-3706-0
Apollo IV V271	X	X			X(G)	09-3709-0	09-3706-0
Apollo V266	X	X			X	09-3709-0	09-3706-0
Bossman V265	X	X			X	09-3709-0	09-3706-0
Delta IV V264	X	X			X(G)	09-3709-0	09-3706-0
Hawk IV V263	X	X			X(G)	09-3709-0	09-3706-0
Thunderjet V260	X	X			X	09-3709-0	09-3706-0
Cheetah V267 (1)	X	X	X		X	09-3756-0 (1)	09-3754-0 (1)
Delta V261 (1)	X	X	X		X	09-3756-0 (1)	09-3754-0 (1)
Viper V289 (1)	X	X	X		X	09-3756-0 (1)	09-3754-0 (1)
Starstream V269	X	X	X	X	X	09-3756-0 (1)	09-3754-0
Invader V262	X	X	X	X	X	09-3756-0 (1)	09-3754-0
Grand Prix V286	X	X	X	X	X	09-3903-0	09-3902-0
Ultrasonic V275	X	X	X	X	X	09-3903-0	09-3902-0
Ultrasonic V268	X	X	X	X	X	09-3903-0	09-3902-0
Starstream XII V270	X	X	X	X	X	09-3950-0	09-3949-0

Table 1: Vox Guitars With Effects

(1) Probably these contain an error in the parts list. Most Thomas Vox products have errors in their service literature.

The Motherboards

Thomas used the concept of a motherboard and a number of plug-in modules to do their effects. There are four unique MBs shown in the service literature: 3709, 3756, 3903, and 3950; likewise there are four top assembly numbers. In only two instances does a guitar's MB assembly part number have a different mix of modules claimed in the literature and wiring diagrams.

Easy and neat, eh? Well, not quite. In this, like so much of the Thomas Vox service literature, what they actually built and shipped does not always match the service literature. The service literature contains both obvious and subtle mistakes, and the suppliers of the actual guitars tended to build with what they had on hand if there was a shortage, by all reports.

The Invader and Starstream parts lists have a wah module listed, but say they use the 3756 MB; the Delta v261 and Cheetah V267 part list also says they use the 3756 MB, but there is no wah module listed in the part list, nor shown in the wiring diagram. This is highly suspicious, based on a scan of what is probably a Delta or Cheetah MB. There are not enough pins or space there to put a Wah module on-board, and the assembly diagrams show no separate wah module on any guitar, although the tuner is shown.

Here's what might have happened. The wiring diagrams are probably right, as they match the advertised features for the guitars, but the part list for the Invader V262 and Starstream V269 list an incorrect part number for the MB. It's likely that the V262 and V269 probably used the four-effect 3903 motherboard – mostly. Some guitars have been found with a two- or three-effects motherboard, with no space for the wah module, but with a modified wah module mounted separately inside the guitar, similar to the way the tuners always were. So it is possible that V262 and V269 were made with either the 3756 or 3903 motherboard, the 3756 models having a separately mounted wah module.

To further confuse things, the tuner module was never put put onto an effects motherboard, but was always mounted separately inside the guitar. And in addition, it is always possible to put in a motherboard with extra spaces and not use some of the spaces.

Of course this is speculation, based on part number lists and reasoning about corporate accountants, so it may be wildly in error, but it seems to make sense based on what it seen in the guitars that turn up.

From the techie perspective, the motherboards are primarily simple wiring vehicles to hold the effects modules in place physically, and then route the modules' leads to convenient places for wiring to

controls. The motherboards do have a couple of electrolytic capacitors on them, for power supply filtering and in one instance to complete the distortion adjustment circuit.

The circuits of the motherboards were primarily traces to re-sort the module pins to convenient wiring terminals on the edge of the motherboard. The functional parts of the effects circuits were all contained on the effects modules, with only one notable exception, one capacitor for the distortion module.

The Effects Modules

There are five unique boards or board sets for the effects modules, listed in Table 2. There was a distortion module, a treble-bass boost, a tuner module, a repeat percussion and a wah module.

Modules	Assy p/n	PCB p/n	Notes
Distortion	09-3708-0		
Treble-Bass Boost	09-3707-0		
Repeat	09-3755-0		
Wah	09-3786-0		Wah modules were sometimes placed inside the guitars off a motherboard, and sometimes assembled “upside down”
E-tuner	09-3703-0	09-3705-0	09-3904-0 coil
G-Tuner	09-3802-0	09-3705-0	09-3904-0 coil

Table 2: Effects Modules

From examining the parts lists in the service literature, the tuner modules were the same, and only tuned the coil differently. There MAY have been a different capacitor for tuning on E versus G modules, but the coil and boards were the same part number. More research is needed on this point to find out exactly what is in there.

The tuners represent some issues to people who want to repair their guitars. The original tunable coils are both not available any more and trickier to wind than a simple inductor. Getting adjustable coil forms is vastly harder than it once was. Beyond that, inductor-capacitor coils are not all that stable anyway. It is likely that the whole tuner assembly was the same for an E tuner as for a G tuner, the difference maybe being one capacitor value, and maybe just the setting on the inductor.

It's worth wondering what an on-board LC tuner is good for these days. Yes, sure, the “originality” thing. But if you really want it as a tuner, there is an alternative.

Modern guitar tuners, which cost so little they're practically disposable, are controlled by crystal resonators for accuracies down in the 10-30 parts-per-million range. That's 0.001 to 0.003 percent. It would be good if you were using a tuner to use an accurate one. For repair purposes, that adjustable coil on the tuner modules is nearly irreplaceable.

So – what were those effects circuits? The service literature gives no hint. No service manual uncovered so far goes any deeper into the assembled motherboards than the order of wires at the edge of the motherboard, and no information at all on the circuits on the effects boards. That's all been collected the hard way, taking the (rare!) modules themselves, and carefully ferreting out what is where and what values were used.

From the view of 50 years later, you would never use a similar design. It is possible to produce a four-effects motherboard on a bit of PCB stock the same size as the original four-effects motherboard, no baby-boards or cordwood needed, and without going to surface-mount parts.

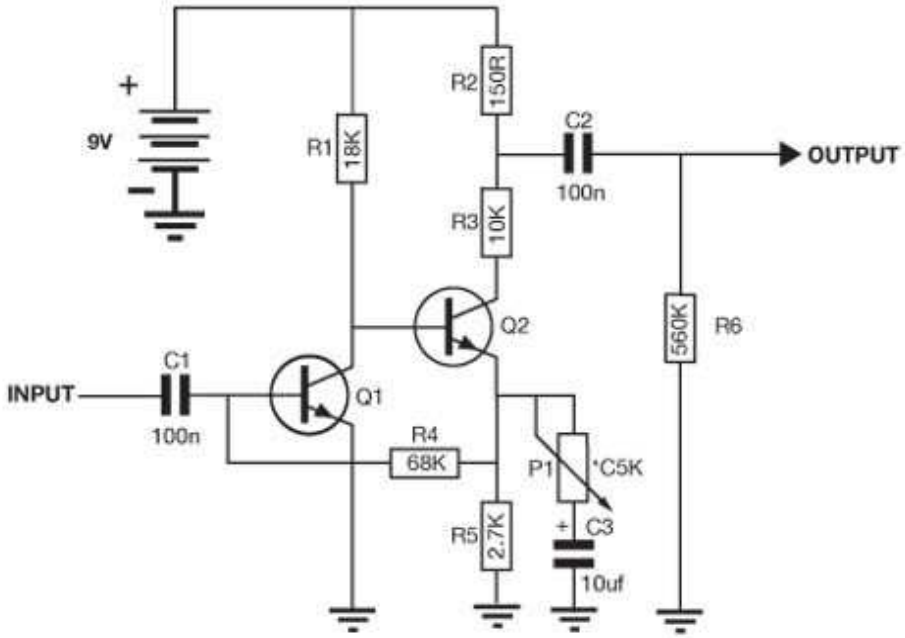
The big issue in putting electronics on guitars is the controls. Putting lots of knobs and switches onto the guitar is not currently in favor in guitar circles, as the guitar is viewed as worth more – and less likely to need changes! - than the effects behind the knobs and switches. Thomas allowed for one knob and one switch per effect on its guitars. There were no six-knob effects here!

The switches were DPDT slide switches, mounted on a panel on the front of the guitar, or on the guitar top in the case of some hollow bodies, alongside the knob for the effect. The wah, where fitted, was hooked to a triangular metal level which sat over the bridge.

So all of the on-board effects necessarily had limited controls, not least because there was not a lot of room on the front of the guitar to put them.

The following pages list the modules, their schematics, and some notes on the original parts. The information was gathered by Jon Curl from actual modules inside guitars. And special thanks to Steed Taranto, without whose help with information and encouragement I'd never have gotten this far.

VOX DISTORTION MODULE 1348B

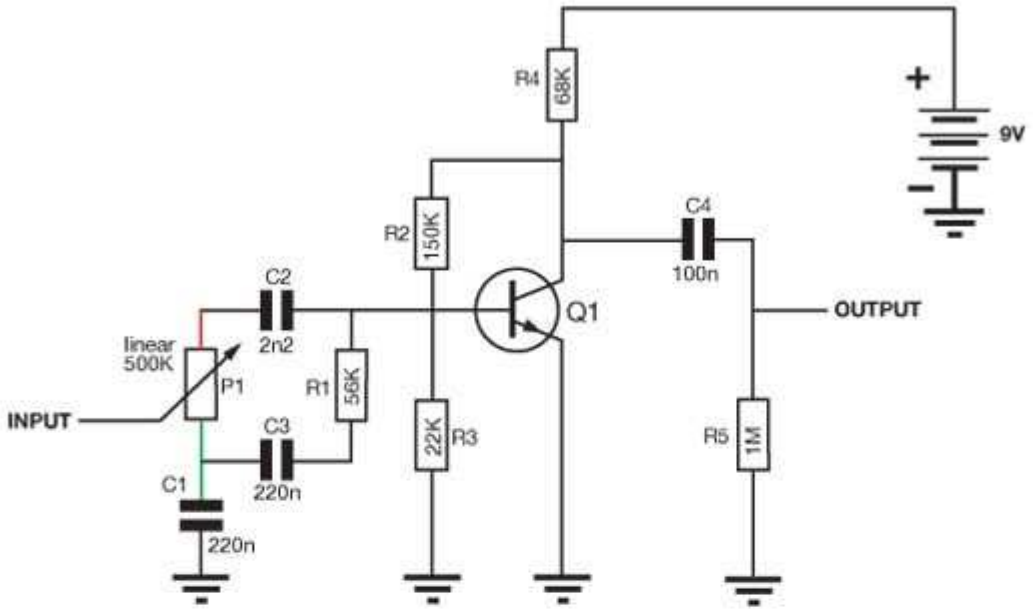


DRAWN BY JON CURL / ACID FUZZ
ACIDFUZZ.COM

REPLACEMENT PARTS LIST

Location	Description
CAPACITIORS	
C1-C2	These are usually Philips/Mullard "Tropical Fish" 200V radial film, or "ARCO" brand 200V radial film.
C3	**Ducati 10uf/15V** *BIPOLAR* Radial Electrolytic. (Typically measure around 15-18uf)
RESISTORS	
R1-R6	These are typically all 1/4 watt carbon film.
Transistors	
Q1	**BC108A**
Q2	**BC108A**
P1	**5K REVERSE Audio Taper** *This pot is labeled as a 5K R (reverse Audio), but typically ranges in actual value from 1.3 to 5K. It is important to use a reverse audio taper to spread the fuzz evenly over the pots travel.

VOX TREBLE/BASS BOOSTER MODULE 1351A

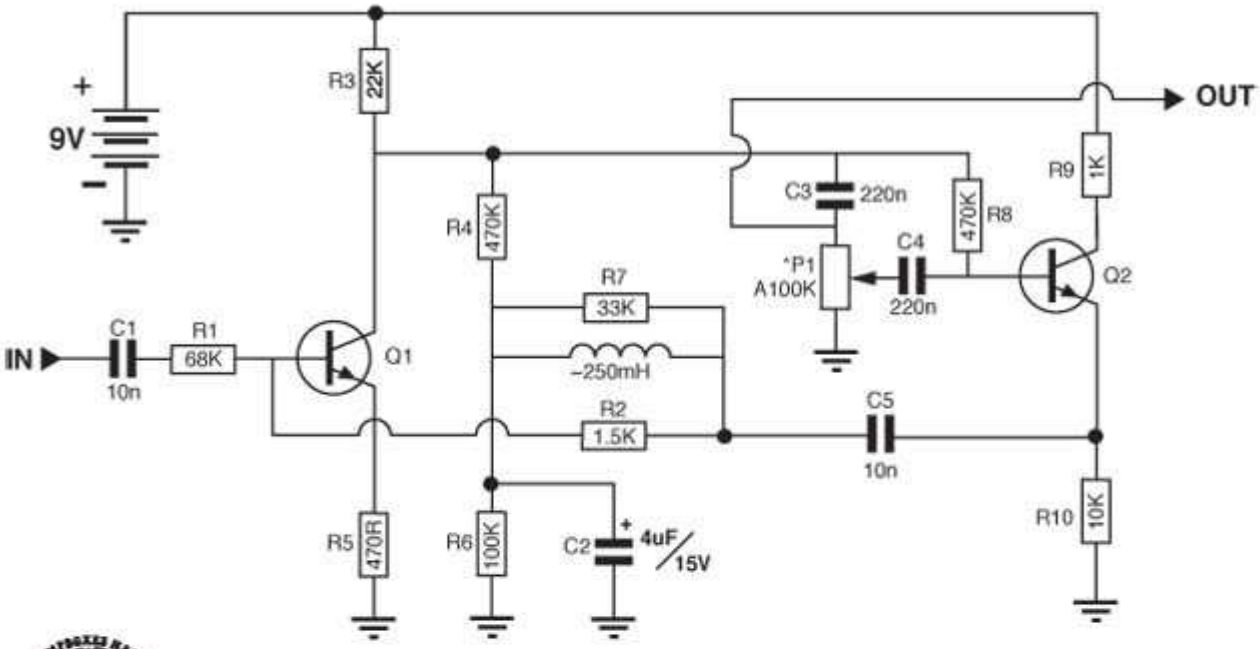


DRAWN BY JON CURL / ACID FUZZ
ACIDFUZZ.COM

REPLACEMENT PARTS LIST

Location	Description
CAPACITIORS	
C1-C4	These are usually Philips/Mullard "Tropical Fish" 200V radial film, "ARCO" brand 200V radial film, or an unknown brand of brown colored 200V AXIAL film capacitor. *Sometimes C2 is a Ceramic Disc or an ARCO 100v AXIALI film.
RESISTORS	
R1-R5	These are typically all 1/4 watt carbon film.
Transistor	
Q1	**BC109B** Collector voltage = 4.5 V, Base = 0.464 V, Emitter = 0 V
P1	**500K LINEAR** This pot is labeled as a 500K B (linear), but typically ranges in actual value from 380-500K. Vox should have used a **50K** linear pot here. Replace the original pot with a 50K or use tapering resistors to get your MIDRANGE back! GREEN signal wire to LUG 3. RED to LUG 1.

VOX PALM WAH MODULE 1361A

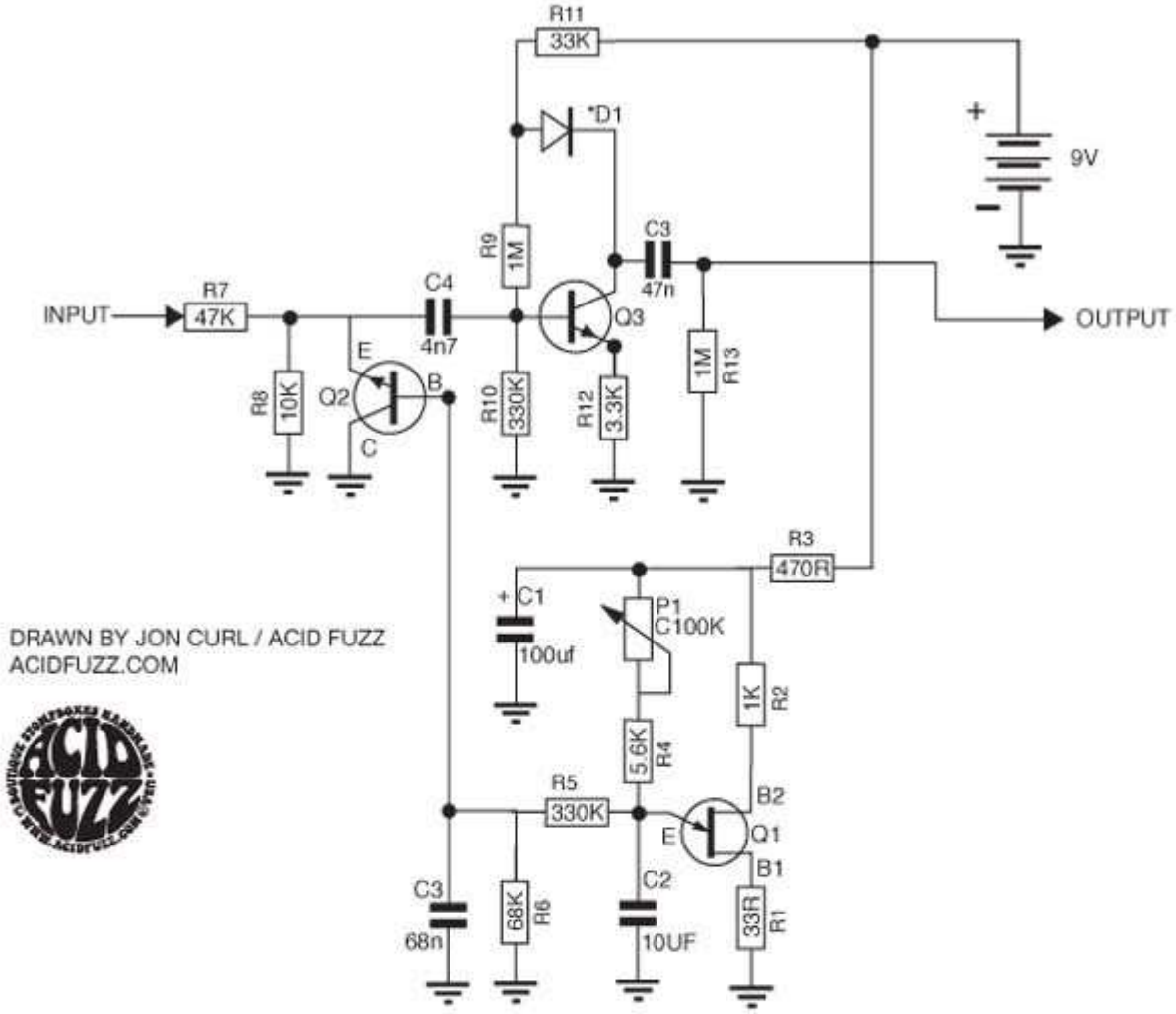


DRAWN BY JON CURL / ACID FUZZ
ACIDFUZZ.COM

REPLACEMENT PARTS LIST

Location	Description
CAPACITIORS	
C1 + C5	These are usually ARCO .01/20% tolerance, 400V radial film, or equivalent "tropical fish".
C3, C4	These are usually ARCO .22/10% 200V radial film, or "tropical fish" 200V radial film.
C2	**Ducati 4uf/15V** Bipolar Radial Electrolytic. (Labeled as 4uf, but typically measure between 5-7uf)
RESISTORS	
R1-R	These are typically all 1/4 watt carbon film, except R4 and R5 which are usually **1/2W** carbon film.
Transistors	
Q1	**BC109B**
Q2	**BC109B**
P1	**100K Audio Taper *SLIDE* POT** *This pot is labeled as "STACKPOLE" but was most likely cusomized for or by the EKO company in Italy with a hinged aluminum mounting bracket. Pot typically ranges in actual value from 70K to 125K. If scratchy or worn out, see "Tips and Tricks for Vox Guitars" at www.acidfuzz.com.

VOX REPEATER MODULE 1353

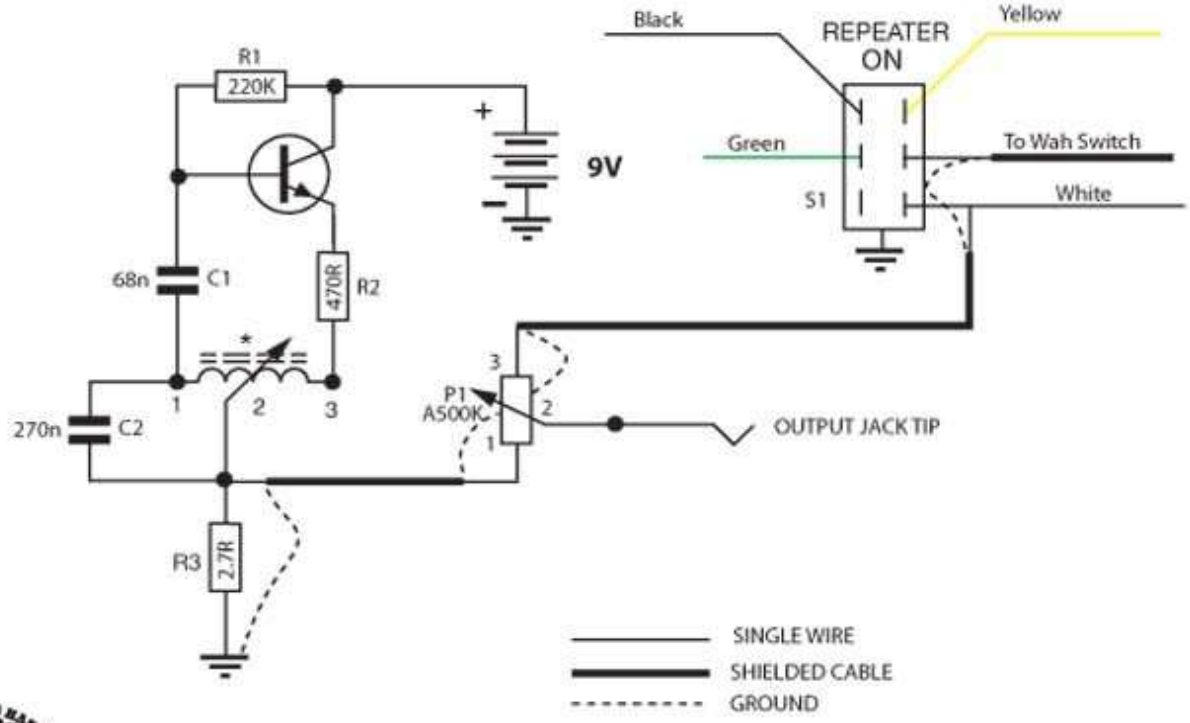


DRAWN BY JON CURL / ACID FUZZ
ACIDFUZZ.COM

REPLACEMENT PARTS LIST

Location	Description
CAPACITIORS	
C1	Ducati 12V radial electrolytic.
C2	Ducati 15V *bipolar* radial electrolytic.
C3	ARCO 200V radial film, or Tropical Fish 200V radial film.
C4	ARCO 200V radial film, or Tropical Fish 200V radial film.
C5	Axial film or radial ceramic disc.
RESISTORS	
R1-R13	These are typically all 1/4 watt carbon film. Sometimes R3 is 1/2W carbon comosition, sometimes R13 is 1/2W carbon film.
Transistors	
Q1	**2N2646** (General Electric)
Q2	**BC109B**
Q3	**BC109B**
P1	**100K REVERSE Audio Taper** (It is important to use a reverse audio taper to spread the rate evenly.)
D1	Germanium diode. *This part is not necessary and has little to no effect. It can be omitted by connecting the R10/R12 junction to the Q3 collector/C3 junction.

VOX E TUNER / G TUNER



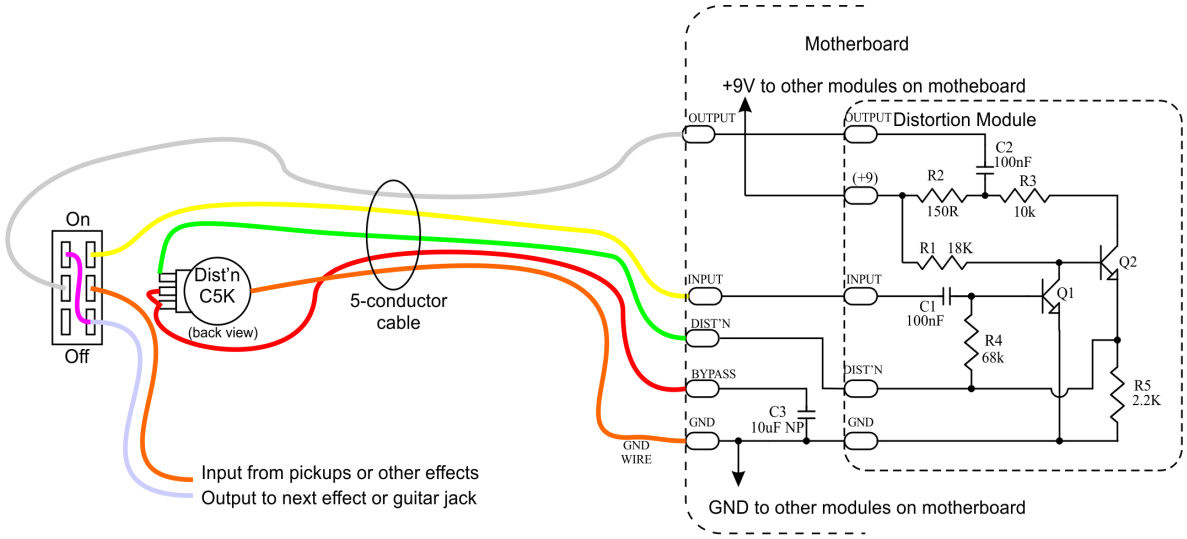
DRAWN BY JON CURL / ACID FUZZ
ACIDFUZZ.COM

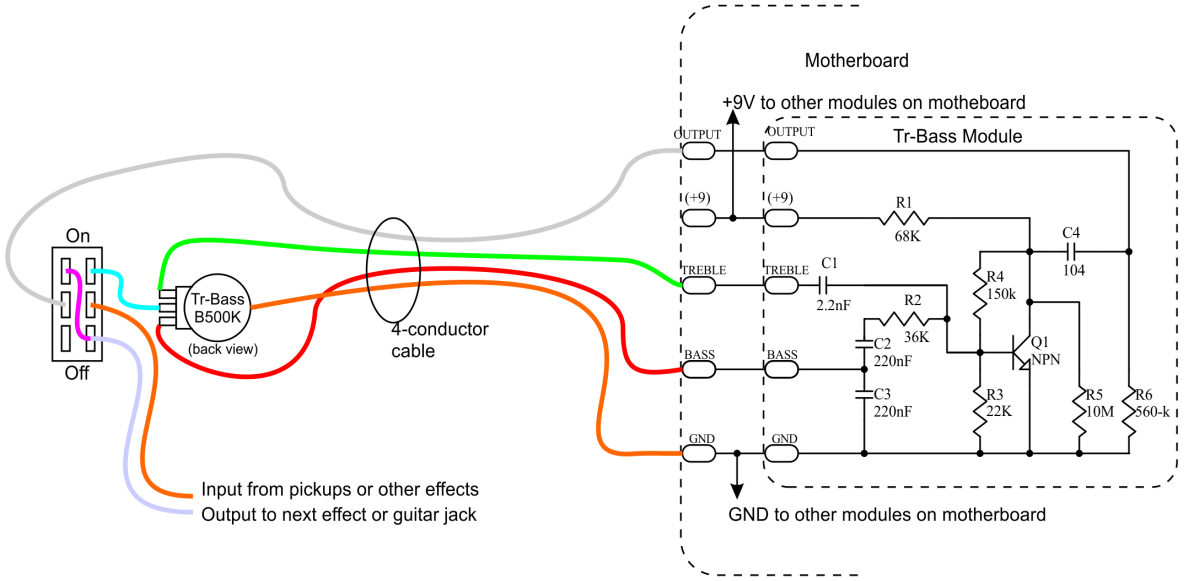
REPLACEMENT PARTS LIST

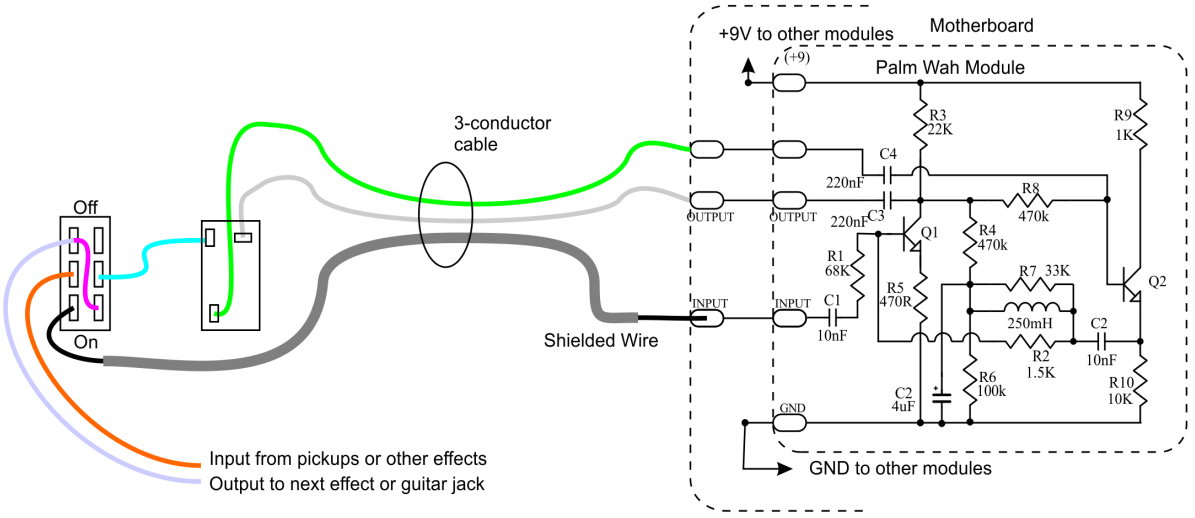
Location	Description
CAPACITIORS	
C1	ARCO or "tropical fish" 200V radial 10% tolerance
C2	ARCO or "tropical fish" 200V radial 10% tolerance, sometiemes ARCO axial 160V/20%
RESISTORS	
R1-R3	These are typically all 1/4 watt carbon film. Shielded cable ground is also ground point for R3.
Transistors	
Q1	**BC108A** hFE~200 Collector V= 9V, Base = 1.64V, Emitter = 2V
P1	**500K Audio Taper** Shielded signal wires ground to pot case.
S1	DPDT slide-switch.
INDUCTOR	Variable ferrite core inductor.

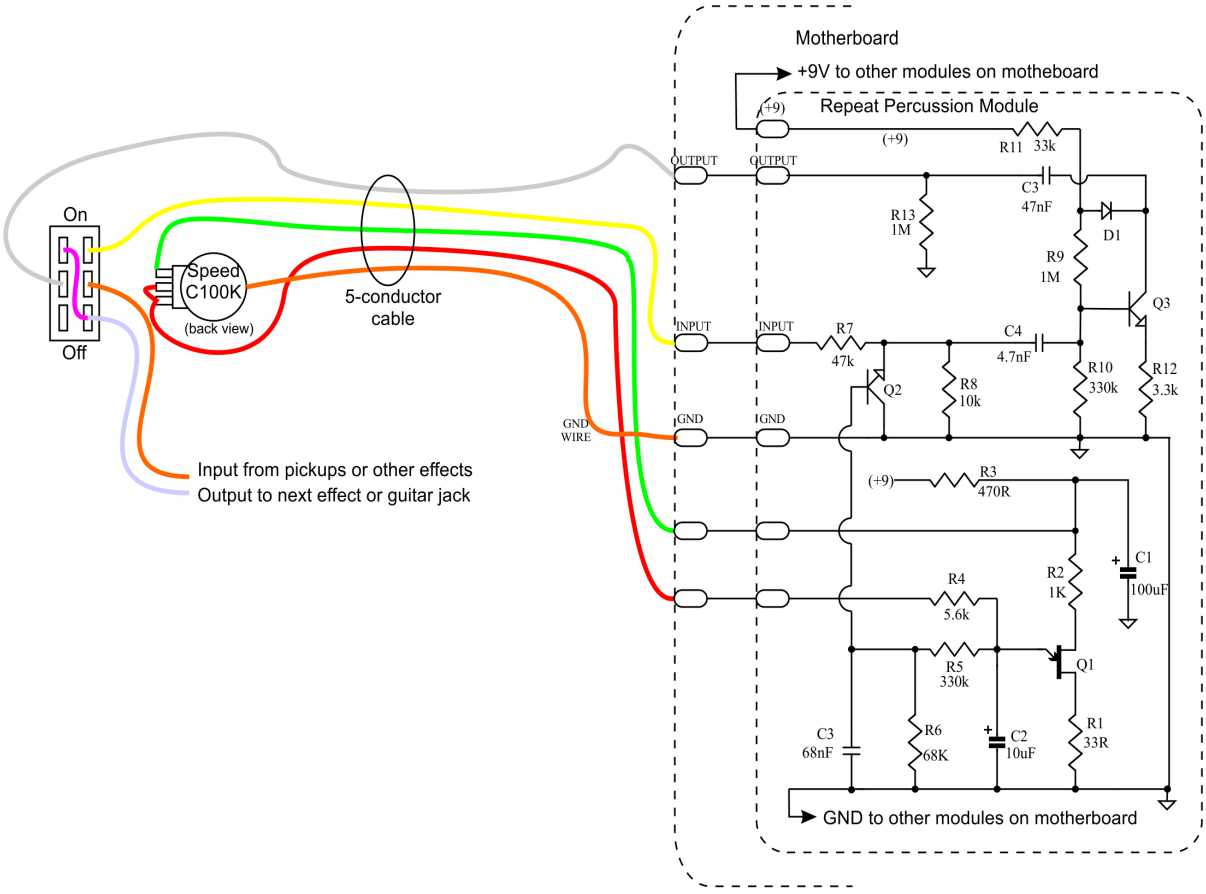
Inductor pin out:
(side view)

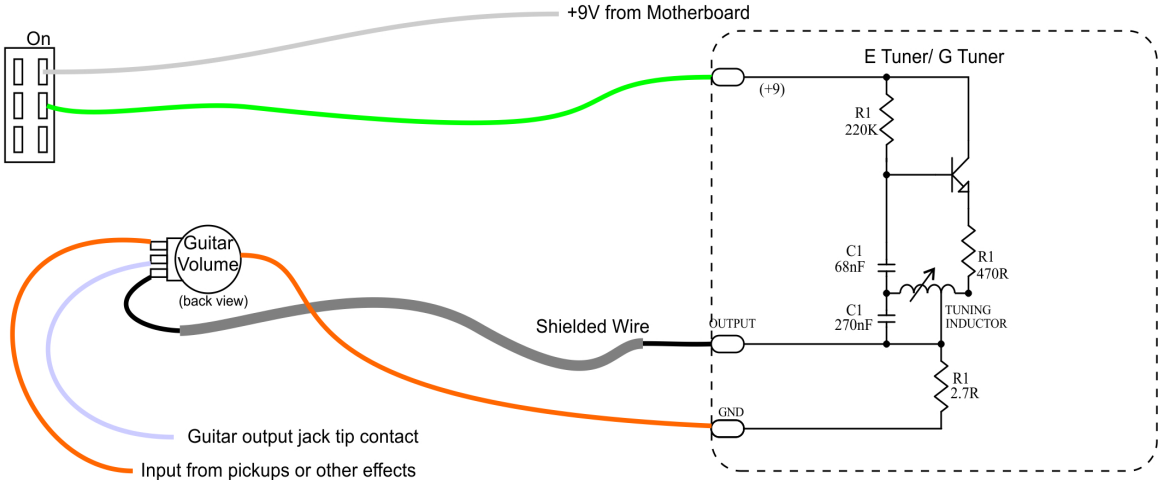
Effects Schematics – Modules on Motherboards











Repairing Modules and Motherboards

One of the biggest purposes of this document is to gather and preserve the information on these guitars and their on-board electronics so they can be kept going for a longer time. Too many of them have been lost, or discarded for lack of knowledge when some fault was found.

From the technologist's perspective, there are some obvious places where the modules will fail, and all repair attempts should start by checking these out. First, anything that moves or is adjusted is at a bigger risk of failure than things that don't. So the switches and pots connected to the modules are more prone to failure than the circuits themselves, as any amp-tech will tell you. Another obvious failure point is any electrolytic capacitors.

Electrolytic capacitors have a built-in decay mechanism. When unused – that is, no DC voltage across them in the correct polarity – they will become unusable in between five and twenty years. Using them (by putting a DC voltage across them with the circuits in use) helps preserve them. These boards have capacitors that are nearly 50 years old. The smart thing to do is to simply replace them. Pick the nearest modern electrolytic capacitor in value and as much or more DC voltage rating, and solder them in, taking care to get the polarities right. This will mean you won't have to worry about this again for 10-20 years.

With one exception, the actual modules do not have electrolytic capacitors on them, so they're not subject to this slow decay. The exception to this is the Repeat Percussion module, which has two. This module is the most complex one, and is also the most likely to need those caps replaced.

The transistors may be noisy. Transistor-making was not as well understood 50 years ago, and they may never have been as good as modern ones. Also, bipolar transistors can have “creeping hiss” where they get noisier over years and decades from the way the circuit works and get noisier with time. If noise and hiss was why you opened it up, think about just obtaining replacement transistors ahead of time and replacing them all while the module is open.

In restoring all geriatric effects, it's a good idea to re-melt all the solder joints. Just use a freshly-tinned soldering iron and a touch of rosin-core solder (not lead-free!) primarily for the flux cores. Use a hot enough iron to melt the joint quickly, then get the iron off the joint so long term heating doesn't damage the copper traces' hold to the board. Lead-free solder is a danger to the PCBs, because it only melts at a higher temperature than tin-lead solders, and this endangers the adhesion of the copper to the board.

For restoring individual modules, you have the problem that the components are not accessible. If the module itself doesn't work, you're probably going to have to take it apart; worse, you're going to have to take it apart in such a manner that you don't damage it in the process. The most effective way is usually to obtain some solder wick (Chem-Wick brand is good) and some liquid flux. Paint the joints with liquid flux with a Q-tip, clean your soldering iron tip and touch some rosin-core solder to it to get a layer of solder on the tip, and press the solder wick onto the joint with the tip of the iron. In a couple of seconds, you'll see the solder begin to flow up into the wick. If this doesn't happen by three seconds, your iron is not hot enough, and you're likely to damage the adhesion of the copper to the underlying board. If this happens, stop and turn up your soldering iron's heat or get another iron. The iron is replaceable, the PCB it damages may not be.

When the solder has flowed up into the wick, remove the wick and iron. These boards are single-sided, so it's easy to remove all the solder from a joint.

When all the joints are un-soldered, wiggle each lead with needle-nosed pliers to check that they're really free, then gently work the board off the ends of the wires.

Before removing a board, it's best to eagle-eye the leads between the boards. Some of the leads are from wires or components with one lead on each board. But some, mostly transistors, are only attached to one of the PCBs, generally the top one. These leads don't have to be unsoldered to get the boards apart. Only remove the solder from the places that hold the boards clamped together.

When you get the boards apart, it is smart to take some good digital pictures of what they look like so you can put them back together right.

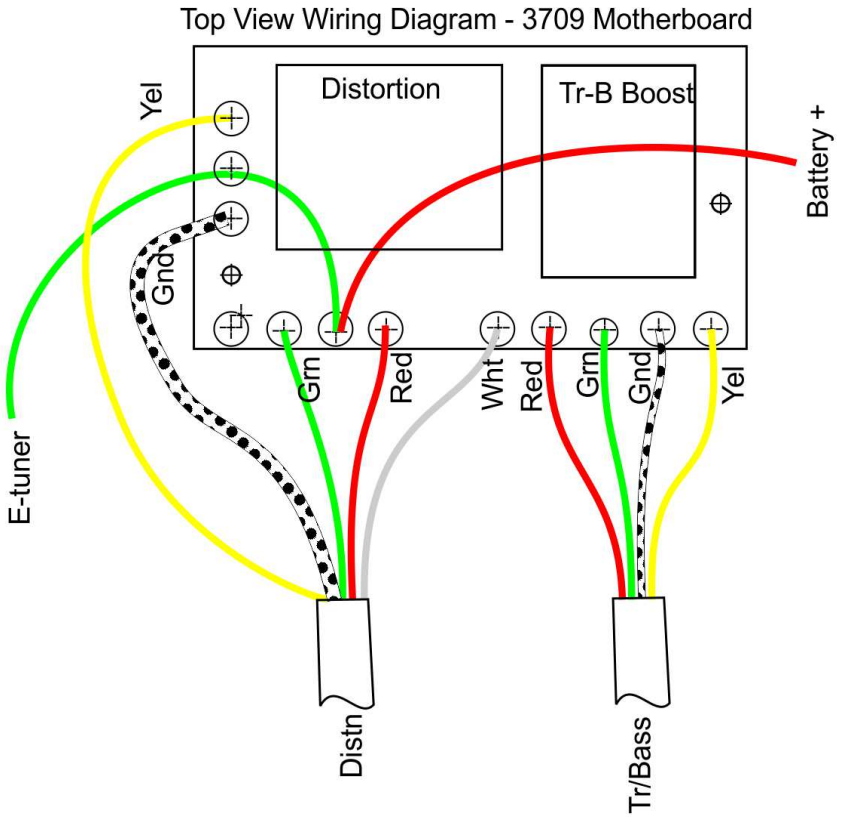
With the boards separated, do yourself a favor and check every part for value, and being open or shorted. Chances are low that any of them are damaged, but it's possible. And after all, you pulled the boards apart for some reason, right?

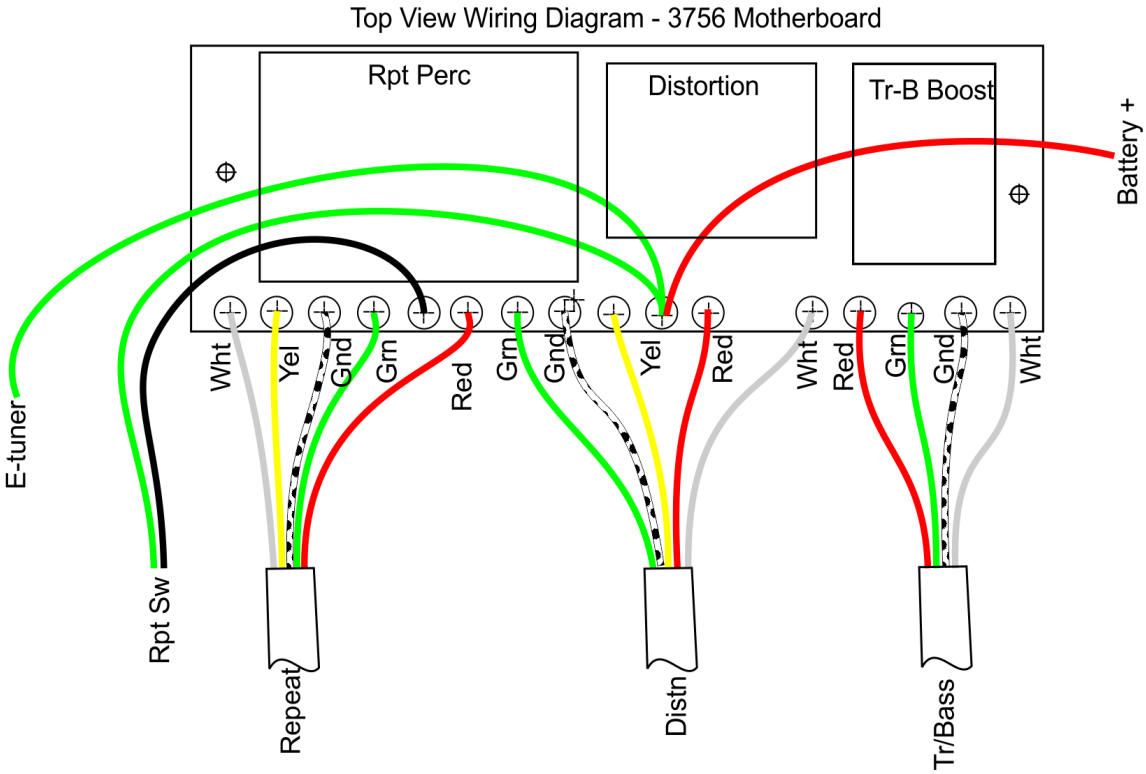
In the process of gathering this information, with Jon and Steed's help I was able to produce PCB layouts for reproducing the original PCBs.

As an aside, if this document has been helpful, any information you can add to the pile of information would help you help the next guy with a similar problem. If you can, take good digital pictures of the information you find, especially parts values and locations, and make them available on the web, or email them to one of the authors for inclusion in future editions of this info.

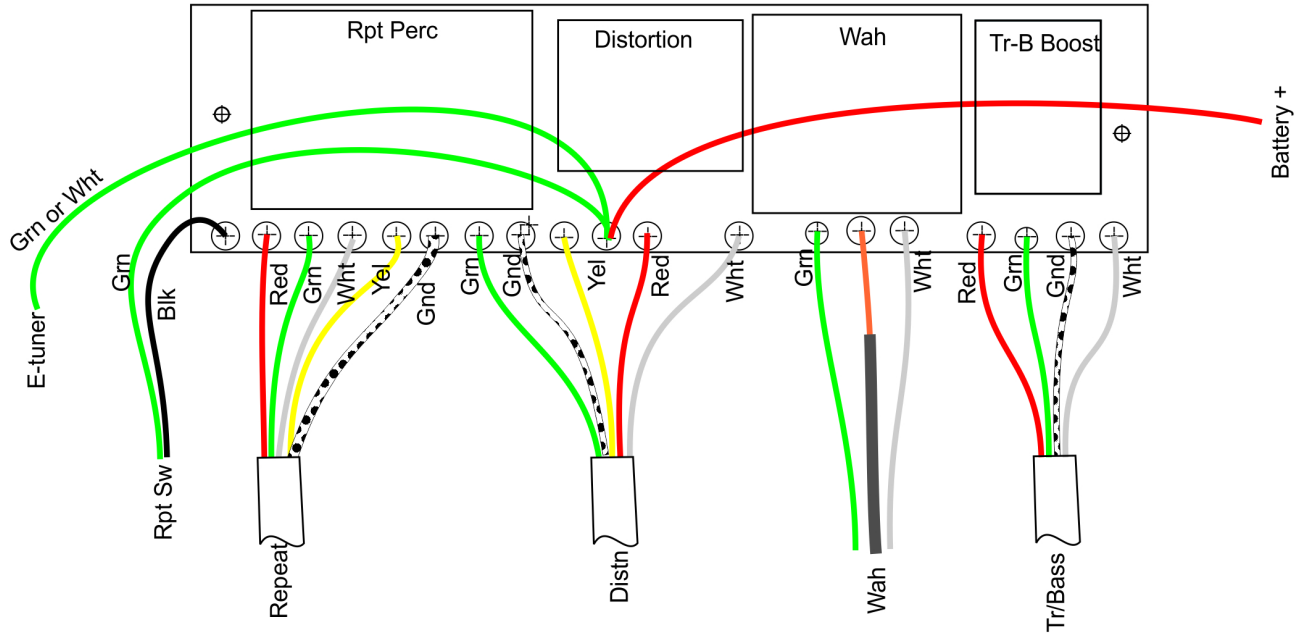
Motherboard Wiring Diagrams

The Thomas Vox service literature on the guitars contains the following diagrams on how the motherboards were wired to the effects.





Top View Wiring Diagram, 3903 Motheboard



Appendix A. Vox Guitar Models – info from service literature

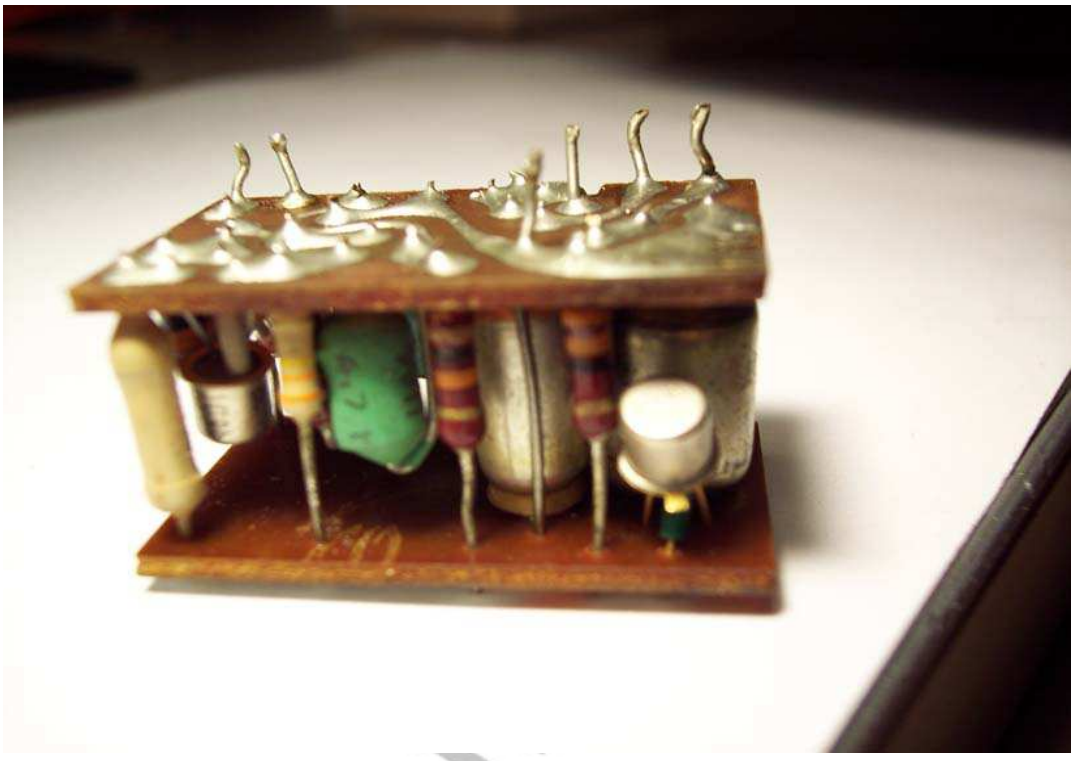
P/N	Alt P/N	Serv. Lit	Source	Model Name
V201	V-2-1	Rev 1966	J	Stroller
V202	V-2-2	Rev 1966	J	Clubman Bass
V203	V-2-3	Rev 1966	J	Clubman Bass
V204	V-2-4	Rev 1966	J	Bassmaster
V205	V-2-5	Rev 1966	J	Ace
V206	V-2-6	Rev 1966	J	Super Ace
V208	V-2-8	1966	J	Shadow
V209	V-2-9	1966	J	Phantom VI
V209	V-2-9	1966	J	Phantom VI
V210	V-2-10	1966	E	Phantom IV
V210	V-2-10	1966	J	Phantom IV
V211	V-2-11	1966	E	Soundcaster
V212	V-2-12	1966	J	Consort
V213	V-2-13	1966	J	Lynx
V214	V-2-14	1967	C	Cougar Bass
V215	V-2-15	1966	C	Challenger
V216	V-2-16	1966	C	Escort Bass
V217	V-2-17	1966	C	Jumbo Medium
V219	V-2-19	1966	E	Bobcat
V220	V-2-20	1966	E	Serenader
V221	V-2-21	1966	E	Phantom XII
V222	V-2-22	1966	E	Mark VI
V223	V-2-23	1966	E	Mark XII
V224	V-2-24	1966	E	Mark IV Bass
V229	V-2-29	1966	E	Student Prince
V230	V-2-30	1966	E	Tempest XII
V231	V-2-31	1966	E	Mark IX
V232	V-2-32	1966	E	Violin Bass
V233	V-2-33	1966	E	Meteor
V234	V-2-34	1966	E	Hurricane
V235	V-2-35	1966	E	Spitfire
V236	V-2-36	1966	E	Panther Bass
V237	V-2-37	1966	E	
V238	V-2-38	1966	E	Country Western
V239	V-2-39	1966	E	Folk Twelve
V240	V-2-40	1966	E	Folk Twelve Electro
V241	V-2-41	1966	E	Bulldog
V242	V-2-42	1966	E	Super Meteor
V243	V-2-43	1966	E	Super Lynx
V244		1966	E	Harlem
V245		1966	E	New Orleans
V246		1967	E	Phantom XII Stereo
V247		1966	E	Tornado
V248		1966	E	Wyman Bass

P/N	Serv. Lit	Source	Model Name	
V250	1966	E	Violin Bass Acoustic	
V251	1967	E	Guitar Organ	
V252	1966	E	Mark VI Acoustic	
V253	1966	E	Super Lynx Deluxe	
V254	1966	E	Wildcat	
V255	1966	E	Typhoon	
V257		E	Mando	
V258	1967	E	Mark XII Acoustic	
				Onbd Fx
V260	1969	R	Thunderjet	D, T
V261	1969	R	Delta	D, T, R
V262	1969	R	Invader	D, T, R, W
V263	1969	R	Hawk IV	D, T
V264	1968	R	Delta IV	D, T
V265	1968	R	Bossman	D, T
V266	1968	R	Apollo	D, T
V267	1968	R	Cheetah	D, T, R
V268	1968	R	Ultrasonic	D, T, R, W
V269	1968	R	Starstream	D, T, R, W
V270	1968	R	Starstream XII	D, T, R, W
V271	1968	R	Apollo IV	D, T
V272	1968	R	Sidewinder IV	D, T
V273	1968	R	Astro IV	D, T
V274	1968	R	Constellation IV	D, T
V275	1968	R	Ultrasonic XII	D, T, R, W
V278	1968	R	Rio Grande	
V279	1968	R	Shenandoah	
V280	1968	R	Silver Sage	
V281	1969	R	Saturn IV	
V282	1969	R	Skybolt IV	
V283	1969	R	Spyder IV	
V284	1969	R	Stinger IV	
V286	1969	R	Grand Prix	D, T, R, W
V287	1969	R	Saturn	
V288	1969	R	Aristocrat	
V289	1969	R	Viper	D, T, R
				Type
X201	1969		Voxton	Steel String
X202	1969		Voxton	Steel String
X203	1969		Voxton	Steel String
X205	1969		Voxton	Classical
X207	1969		Voxton	Classical
X209	1969		Voxton	F-hole Elec
X212	1969		Voxton	F-hole Elec ba
X214	1969		Voxton	Steel String 12

What the source letters C, J and E mean is unknown. Perhaps “E” is EKO.

Appendix B: Example Guitars

Appendix C: Cordwood Style Construction



Appendix D: Thinking outside the Vox [R.G,'s opinions – don't blame this on others 8-)]

With the perspective of another half-century since the Vox onboard effects were made available, it's tempting to second guess them. Thomas Organ was very much interested in the pop music culture as a business opportunity, and their decisions on what to market were, in fact, business decisions. We know more about the guitar and amplifier culture now; or properly, that culture has evolved. Some of the business decisions that Thomas made then look decidedly odd today.

One big example is the internal arrangement – architecture, if you will – of the Beatle amplifiers. These were set up with the idea that a lead, rhythm, and bass guitar would all plug into the single amplifier, and an entire band would use the one amp. This seems very strange to modern guitarists.

In this same vein, the circuits used in the onboard effects were chosen for business reasons from the circuits available at the time. A good guess is that they picked circuits that were simple, with small parts count (and cost!) from their external-effects line. They were limited to what effects were available then within those limits.

That led to choices that are, again, a bit odd to modern usage. Distortion is, of course, a practical necessity for most guitarists. It's not clear that a modern guitarist would limit himself to just one distortion, but an onboard one would be handy if it didn't muck up using the guitar otherwise. An active treble-bass boost is probably good, but this isn't necessarily the handiest place to have it. A wah is good, but having it hand-operated on the guitar is more than a bit clumsy, and the wah level on the guitars that had this seem clumsy, to me at least. Repeat percussion is something of a one-trick pony, and probably would not get much use in modern playing.

And that brings up the idea of what onboard effects would be useful if we rethought this concept today. What follows is my personal take on it.

Active treble-bass is nice; but I'd dearly love to have some kind of onboard compressor. Distortion – sure; love it. Maybe enough to only use the one with some tinkering and personalization.

Wah? No use for that on the guitar IMHO, but I might very much like to have a filter-based thing that could do selectable boosts, like the Vox Mid Range Boost effect, and maybe an auto/envelope wah setting.

As for Repeat Percussion – I'm a bit ambivalent. It's a fun effect, but an onboard tremolo or better yet,

and attack-delay would be more useful.

And the tuner is a nice touch, but today's tuners are so much better than the simple inductor based tuner that I personally would prefer something like integrating a tuner into the body of the guitar, perhaps with micro-small LEDs showing on the top edge of the guitar. Still, if I used the onboard tuner, I'd rework it to be crystal controlled, something we can do with trivial ease with today's ICs.

I would approach the idea of what I'd make from the Vox onboard effects from two different directions. One is for exact replacement/refurbishment, and the other is updating the onboard effects concept a bit.

As far as exactly replacement, PCB layouts are available for exactly replicating the originals. When executed in brown paper-phenolic PCB stock, reasonably exact facsimiles of the originals can be made.

But it interests me to think what else I could put on the existing “motherboards” if I wanted. It's an intellectual challenge to come up with replacement modules for the original motherboards that would let the original guitars do interesting new effects. I know this strikes some people with horror, but, well, that's me.

Doing this requires some technical thought. There are four different PCB layout sizes that fit into the holes on the Vox motherboards. Each is unique, as is the footprint of the pins and holes on the motherboard. This means that if you decide to replace the wah board, you have a fixed size and hole pattern that the replacement must fit. Likewise the treble-bass booster. A replacement meant for the treble-bass position won't fit in the wah position.

I parsed these into positions and the implied pin/hole patterns. Not surprisingly, I called these T, D, R and W, for treble-bass, distortion, repeat percussion and wah, remembering that this is a description of the size and pins, not the circuit. The idea is that if you're doing a replacement effect, you ought to pick which position it goes in, and design the circuit and its PCBs to fit the position on the motherboard.

As an example, I decided that it might be reasonable to trade the active treble-bass boost for a compressor. I took the circuit of the MXR Orange Squeezer and adapted it to a sandwich of two PCBs in the style of the original Vox boards that fits into the hole pattern/size of the treble-bass circuit. So it's possible to replace the treble-bass booster with a compressor on all of the existing Vox motherboards that use it.

As a second example, I decided that an onboard envelope wah would be more useful to me than an onboard wah circuit, so I adapted the Dr. Q effect circuit to fit the size/shape and pin positions of the

Wah board, so one of these could be fit into any motherboard, replacing the existing wah with a funk filter.

In the future, I'm going to look at what can be designed into the small module form factor. Some ideas are a much more sophisticated compressor; a different distortion, but still compatible with the same position/holes; a more normal tremolo than the repeat percussion. There are others.

With today's parts and PCB industry, it is possible (I've done it!) to lay out the circuits of the effects directly on the motherboard PCB. For instance, a single PCB the size of the 3903 “four-fx” can hold all the parts directly on the board, doing away with solderable modules entirely. This of course means you can't trade them out, and they're non original, but for replacing a completely broken motherboard or adding the Vox onboard effects to a different guitar, it might be useful.

And when I get to thinking about replacing the motherboards, I get to a quibble I have with how Vox did the designs themselves. These were a futuristic concept at the time, but the computer world has done a lot of work on motherboards and back planes, and there are better ways. Ideally, every effect pin-out would be identical, and the board sizes the same so that any module can go in any position. It's simple enough to do, but probably not something anyone other than me is interested in.

Sigh. So many circuits, so little time.