REAL WORLD INTERFACES

User Manual for Modified TR-606

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Quicksilver 606 from SocialEntropy.com

This TR-606 has the QS-606 installed – which replaces the TR-606's original CPU and memory. The QS-606 stores all its data in its own non-volatile memory, so there is no need for any internal lithium battery or for C-cells to retain its data.

The QS-606 cannot work with the 32 Bank Memory system which is one of the mods we do for the TR-606.

Please see the separate user manual and other documentation for how to operate the QS-606, which replaces all the internal sequencer functions, including receiving DIN Sync. Sending DIN Sync is unaffected by the QS-606, since this is done by the TR-606 hardware (rather than its now-removed CPU) when the Sync switch is set to Out.

Ordinarily the QS-606 has its MIDI In and Out connections via adaptor leads which plug into mini-DIN sockets. In this machine, MIDI In is via the Sync socket and MIDI Out is via an adaptor lead which connects to a 3.5mm stereo socket near the Sync socket. The connections for this are:

DIN pin 2 (centre) = Ground = Ground of the 3.5mm plug.
DIN pin 4 = 220 ohm pullup to +5V = Tip o the 3.5mm plug.
DIN pin 5 = 220 ohm active low data drive = Ring o the 3.5mm plug.

Ordinarily the MIDI out signal comes directly from the QS-606's CPU chip. It is theoretically possible that excessive voltages on the MIDI Out lead could damage the CPU chip. In this machine the MIDI Out signals is driven by a transistor buffer, which is highly resistant to such voltages. The transistor is driven by a logic gate buffer, so the QS-606 CPU is entirely protected from excessive voltages.

In accordance with the MIDI Standard the MIDI In connection of the QS-303 is isolated from the CPU and from the ground of the TR-606 by a LED to phototransistor opto-isolator. This protects the CPU from excessive voltages.

Normally a MIDI In socket uses only the signal pins 4 and 5, while the MIDI out socket also has a ground connection on pin 2, the middle pin. In this TR-606, since the Sync socket is used for MIDI In, and since the Sync socket's pin 2 is connected to the TR-606's ground by a 22 ohm resistor, the ground of the TR-606 is not isolated from the ground of the MIDI device which is driving the MIDI In cable. This could, in principle, lead to ground noise being imposed on either device. However, the 22 ohm resistor is likely to reduce the impact of any such ground noise problems.

Ground noise problems can be complex and hard to diagnose. If you have any such problems, please experiment, such as be removing power adaptors and using batteries instead, or by trying alternative power adaptors, audio leads and connection arrangements. If the problems persist, please take notes of all the details and let me know by email.

The QS-606 has a USB port for firmware updates and USB MIDI. Ordinarily this is available via a socket on a lead which is tucked inside the battery compartment, meaning that C-cell batteries cannot be used. The MIDI In and Out functionality of this USB interface is selected in the QS-606's Config mode.

In this machine, the USB connection is available via a Mini-USB socket located on the rear of the machine, between the Headphone and Audio Out sockets. Furthermore, this connection is electrically isolated from the QS-606 itself, using a remarkable device: the Analog Devices ADUM4160, which integrates two chips coupled by five tiny 1GHz transformers. This should protect the QS-606 from damage due to static electricity and excessive voltages due to capacitive coupling from power adaptors. It should also eliminate noise due to ground loop problems which would otherwise be caused by a USB connection.

It is possible that noise could be generated by this arrangement, if, for instance the computer to which the USB cable connects has a significantly different ground voltage from the TR-606's ground voltage. For instance if the computer was grounded but the TR-606 was not and the TR-606 was free-floating (running from batteries) or being driven by a mains adaptor which capacitively couples mains voltage and/or switch-mode power supply high frequency noise to the ground of the TR-606. Another example would be the TR-606 grounded, such as by connection to an audio system which was grounded, and the computer not being grounded. Normally a laptop computer will not be grounded, since it is running from its own batteries or from a non-grounded power adaptor. Alternatively neither the computer or the TR-606 could be grounded and there may be some significant difference between their ground levels.

Any significant difference between the ground voltage of the USB driving device and the ground voltage of the TR-606 could couple noise capacitively inside the TR-606. The solution is to ground both devices by some means, or if this is not possible for one or both of them, to disconnect them from the most likely source of capacitively coupled noise which is their mains power adaptor.

Normally, the TR-606 would be connected to other audio equipment, such as a mixer or amplifier, in which the audio leads cause there to be a common ground voltage for all connected devices. A laptop computer may not be amenable to such grounding, but if you take a 3.5mm lead from its headphone or microphone socket and plug that into your audio system, even without using the signal at all, this should be a good way of grounding the laptop. Unfortunately laptops and desktop PCs are electrically very noisy and such connections *might* cause problems in the entire audio system.

Two Noise Reduction Mods

As part of the basic work on this machine I have made changes which entirely or almost entirely eliminate two sources of noise:

1. An interfering buzz in the Cymbal and Hi Hat circuits caused by front panel LED current. The more LEDs which are on, the worse this noise was.

2. A clicking sound in the main mix output due to crosstalk from the two Trigger Out signals, which are driven by the Hi Tom and Low Tom channels. These are not audible if the Tom sounds are in the main mix, and they may not be audible if there are many other drum sounds at the same time. However, if the Toms are triggered while the Toms Volume pot is turned down, then these clicks may be audible in the main mix output.

Of course there are still other background noises in the machine if the Volume pot and/or the external mixer's gain are turned up high.

LEDs

The LEDs are now Blue except for the Run/Stop which is Red.

New Tact Switches

All tact switches have been replaced with Omron sealed tact switches. These are sealed against dust and liquids. Since dust seems to be the primary or sole cause of the original unsealed ALPS switches becoming erratic, we believe the Omron switches will probably last for a very long time - ideally decades.

Accent Button

A red pushbutton on the right of the machine activates Accent. This does not affect the state of MIDI Out events sent by the QS-303.

Individual Outputs

There is a 3.5mm socket for each volume control: BD, SD, Toms, CY and HH. When a plug is inserted, that signal does not go to the mixing bus, but comes out of the plug pure and unmixed with anything else.

CY/HH External Audio Input

This is a 3.5 mm socket near the LT and HT trigger outputs. The Cymbal and HiHat circuits normally operate by filtering/distorting/gating/filtering a mix of six square-wave signals which are produced internally. This is what happens when nothing is plugged into this socket. When a plug is inserted, this socket becomes an audio input which takes the place of those six oscillators. Therefore, Cymbal and HiHat sounds will be made from whatever signal is put in through this socket. A good start is a continuous, bright, high chord. Be sure to vary the signal level, since this greatly affects the sound which results. Use line-level signals, not the outputs of a microphone. You can't really overload this, so try sticking all sorts of signals into it!

This is *not* a means of triggering the CY or HH circuits. They still must be triggered by the Sequencer or external inputs (on the AS Box) – this is simply an input for an audio signal for the circuits to process.

Due to crosstalk inside the machine (it would be impossible to shield everything in an instrument of this small size) when you put an external signal into this socket, the standard six oscillator mix seems to go to a higher level (probably due to not being loaded). This may cause some cross-talk into the main output. High input signals to this socket may also cross-talk into the main output.

Noise Source Level Trimpot

The TR-606 contains a white noise source, based on a noisy reverse-biased transistor. This is used for the Snappy noise component of the snare and for a low rumble with the Toms. There is a single rumble circuit which is triggered by either Tom circuit.

There is a trimpot which controls the level of this noise source. I have altered the range of this trimpot to enable much higher than normal noise levels when turned clockwise. The trimpot is now mounted on the bottom of the main circuit board and can be adjusted with a small flat-blade screwdriver via a new hole in the bottom of the machine.

Switchable Snare Modifications

The Snare circuit consists of a Twin-T resonator circuit which is made to oscillate with a naturally (exponentially) decaying sine wave, due to the energy it receives from the Trigger pulse. That pulse is 1ms long and is normally about +5V. On an accented beat, the voltage can be between +5V and about +14V. On accented beats, according to the higher voltage of the Trigger pulse, the Twin-T circuit resonates at a greater amplitude initially, and so resonates for longer.

The Trigger pulse also drives a noise gating circuit. There is an approximately "white" (flat spectrum) noise source inside the machine for the Snare and Tom circuits, based on a noisy reverse-biased transistor emitter-base junction. The gating circuit has a high-pass filter to make the "snappy" noise pulse from the broad-spectrum internal noise signal.

This modification involves two three-position toggle-switches which are mounted at the left of the machine. The left switch controls the noise part of sound and the right switch controls the resonant sine-tone part. These two switches are just to the right of the row of 4 memory switches – adjacent to the Sync socket.

These switches control four changes to the Snare sound:

- Lower the frequency of the Twin-T resonator somewhat.
- Increase the mix level of the Twin-T resonator.
- Lower the filter frequency for the noise pulse, to give it more mid-frequency oomph.
- Further lower the filter frequency of the noise pulse, making it significantly louder.

	Noise switch	**Tone switch**
Up	Normal.	Normal.
Centre	Noise pulse contains more mid and low frequencies and so is somewhat louder.	Tone has lower frequency.
Down	Noise pulse contains still more mid and lower frequencies and so is significantly louder.	Tone is louder and has lower frequency