REAL WORLD INTERFACES

MIDI Sync In for the TR-808

Robin Whittle 22 February 2019 www.firstpr.com.au/rwi/tr-808/

1 - Receiving MIDI Sync and driving Roland/DIN Sync

This TR-808 is equipped with a microcontroller which receives MIDI Sync and uses it to generate Roland/DIN Sync. The two Roland/DIN Sync signals (Run/Stop and Clock) drive the TR-808's Internal Sequencer – and with the optional Sync Lead, up to three other devices which also receive Roland/DIN Sync.

MIDI is a one-directional serial data communications system whereby a MIDI Out socket uses two wires to drive the LED of an opto-isolator the MIDI In circuit of another device. The LED shines infrared light onto a phototransistor inside the opto-isolator, enabling a pattern of on and off to be received without a direct electrical connection. This optical isolation prevents many problems with ground noise which would arise if the signal was sent by a direct electrical connection.

Using patterns of on and off at 31,250 bits per second, up to 3,125 8 bit bytes of data can be sent every second. Most MIDI messages such as those for note on and off are composed of two or three bytes, but the messages for MIDI Sync are one byte. Below, "song" means whatever piece of music is being played by all the equipment. The three we are interested in are:

1 - Start.

2 - Stop.

3 - Clock, representing 1/24th of a quarter note. These are sent when the song is playing (after a Start byte) and may be sent when no song is playing (after a Stop byte).

MIDI uses the two intermediate pins of a 5 pin DIN socket, those between the middle pin and the outside pins. Since these were added in the 1950s to an earlier three pin arrangement, their numbers are 4 and 5. The pin numbers, in order, are 1, 4, 2, 5 and 3

These three messages correspond to three events which are conveyed by Roland/DIN Sync, which predates MIDI. There are two simple positive voltage signals for Roland/DIN sync. Both are active high, with 0 volts meaning "off" and +5 to +15 volts meaning "on".

1 - Run/Stop.

When this goes high, this signals that the song has started to play. The receiving device waits for a positive Clock signal transition, which represents the first 1/24 note of the song.

When this signal goes low, this signals that the song has ended.

2 - Clock. This carries a square wave, where the positive-going edge denotes 1/24th of a quarter note.

It is relatively easy to receive these three MIDI messages and generate the appropriate signals for Roland/DIN sync. However, special care is required with the first Clock byte received after the Start byte. This can arrive 0.32 milliseconds after the Start byte. If this results in a positive edge on the Clock signal so soon after the positive edge of the Run/Stop signal, then many or most Roland/DIN Sync slave devices, such as TB-303s, TR-808s and TR-606s, will not see that first clock pulse, and so will play the rest of the song 1/24th of a quarter note late.

The MIDI Sync In system uses appropriate delays to queue the first one or several MIDI In Clock messages so that they result in Clock pulses which are suitably delayed from each other and from the rising edge of the Run/Stop signal.

Since the pins used by MIDI are not used in a Roland/DIN Sync socket, it is possible to make a socket which works with both types of signalling.

One MIDI Output can drive only one MIDI Input.

One Roland/DIN Sync output can drive multiple Roland/DIN Sync inputs. There is no formal specification for Roland/DIN sync. However, assuming that the output drive is reasonably strong, and the load resistance on the input socket is modest, such as 10k ohms, then there should be no trouble with one Roland/DIN Sync output driving 5, 10 or perhaps more inputs.

There are two ways of using the Sync In system: with and without the Sync Lead, which is described at:

http://www.firstpr.com.au/rwi/dfish/sync-lead/

Here it is assumed that the Sync Lead has three Roland/DIN Sync output plugs, but we can make such cables with more such plugs.

2 - The TR-808's Internal Sync Generator system

The outside pins of the Sync socket are used to drive the Internal Sequencer.

When the Sync switch (next to the Sync socket) is **INPUT** the only way these pins can be driven is by a lead driving these pins from a Sync Master, such as another TR-808 or TR-606 with its Sync switch set to OUTPUT.

When the Sync switch is set to **OUTPUT**, these pins are driven by the Internal Sync Generator, which responds to the TEMPO pot, the FINE pots and the START / STOP switch.

3 - Use without the Sync Lead

Set the TR-808's Sync switch to **INPUT**.

Plug the lead from the Sync Master into the TR-808's Sync socket.

The TR-808's Internal Sequencer should now start, play and stop in time with the master.

4 - Use with the Sync Lead

Set the TR-808's Sync switch to **INPUT**.

Identify the Sync Lead's first 5 Pin DIN plug: the one which has two thicker wires going to the 5 pin DIN socket.

Plug this into the TR-808's Sync socket.

Use the other 5 pin DIN plugs to drive one or more Sync slave devices.

Place the MIDI lead from the output of the master device into the 5 pin DIN socket of the Sync lead.

The TR-808's Internal Sequencer should now start, play and stop in time with the MIDI master, as should the slave devices.

5 - Being stuck in Run mode

The Sync In system drives the Run/Stop and Clock pins via diodes with 1k ohm series resistors. If an external Sync master is driving the Sync socket via a cable and/or if the TR-808's Internal Sync Generator is driving it (with the Sync switch set to OUTPUT), then the Sync In system is still capable of driving these pins active high even if these other signal sources are not.

The only scenario in which this is likely to be a problem is if the Sync In system is driving Run/Stop high (meaning Run) when you don't want it to. This will happen if, for instance, you were running the TR-808 via MIDI sync, the Sync In system has received the Run message and so is driving the Run signal high, and you unplug the MIDI lead, or turn off the MIDI master device.

Without the MIDI In lead, the Sync In system cannot receive a Stop command, and so will continue to drive the Run pin high. There are two ways of recovering from this:

1 - Turn the TR-808 off for a second or two and then on.

2 - Plug the MIDI cable back into the TR-808 and do whatever is required to make the device which is driving it output a Stop command.

6 - Potential ground noise problems when not using the Sync Lead

The MIDI Specification requires that MIDI leads be shielded cables, with the two data signals being carried by inner conductors and the shield connected to the middle pin (2) at both ends of the lead.

It also requires that pin 2 of Out and Thru sockets be grounded. This arrangement protects the signals from capacitively coupled noise, since for the whole length of the cable, the grounded shield surrounds them.

The MIDI Specification further requires that pin 2 of a MIDI In socket not be electrically connected to anything. This ensures that there is no electrical connection between the master and slave device, so there can be no ground noise problems.

The TR-808's Sync socket does not comply with this pin 2 isolation requirement. Pin 2 is connected to the TR-808's ground via a 22 ohm resistor. If you are using the Sync lead, then the requirement is met, because the Sync lead's 5 pin DIN socket has only two wires, for pins 3 and 5, connecting to the 5 in DIN plug which connects to the Sync socket.

So when not using the Sync lead, there is a potential for ground noise problems.

This is not the place for a treatise on all possible ground noise problems, however the following guidance will hopefully be sufficient. Please let me know if you have any difficulties not covered by the following.

The TR-808 would work fine with no resistance (0 ohms) between its ground and pin 2. It seems that the 22 ohm resistor and some other circuitry is part of an arrangement for loading patterns and tracks into memory in the factory.

22 ohms is low enough that pin 2 behaves like a ground pin for Sync In or Out purposes, in the event that the connected device has no other ground connection to the TR-808. Generally their grounds will be connected, via the ground lines of audio cables driving a common mixer and/or by any ground pin in the mains leads these devices have.

22 ohms is high enough that some common ground noise problems will either not occur, or will occur only to a slight extent. This is when the other device has a low voltage noise on its ground with respect to the local machine's (the TR-808's) ground. Assuming the two devices are connected to a common ground point (mixer and/or mains sockets) with a total resistance of an ohm at most (typically the resistance would be 0.2 ohms or similar), then the 22 ohm linkage via the MIDI lead and Sync socket will not significantly add to whatever ground noise problems are already present without this lead.

It is possible that you will still have ground noise problems with a MIDI lead being plugged into the Sync socket. The scenario which comes to mind is that the MIDI Out socket driving the cable is part of a device which has no audio grounding, and which is driven by a mains power adaptor which itself has no ground. Such switch mode power supplies have capacitors from their ground to the mains Active and Neutral signal. These can impose hum, buzz and potentially high frequency switch-mode power supply noise onto any connected devices. Likely suspects for this scenario are laptops and any USB interface connected to them, or some other such device which is not already connected to a common audio mixer.

If you do have any trouble with MIDI In to the TR-808 causing audio noise, you can take one of these steps to solve the problem, all of which break the connection between the MIDI Out device's pin 2 and the TR-808's pin 2.

1- Use the Sync Lead.

2 - Modify one end of your MIDI cable so that it has no pin 2. This is the centre pin. You can probably achieve this via a robust intervention with some pointy nose pliers: wiggling the pin at its base back and forth, bending it each time, until metal fatigue sets in and the pin breaks off.

This MIDI lead will still work fine for all MIDI applications, as long as the plug which lacks pin 2 is used at the MIDI In end of the link. It will probably work OK the other way around, but it will certainly work this way, since pin 2 of normal MIDI In sockets have no electrical connection.

3 - Make up a special socket and plug adaptor lead in which only the intermediate pins, 4 and 5, are connected.

Document history

- 2019-02-22 New document.