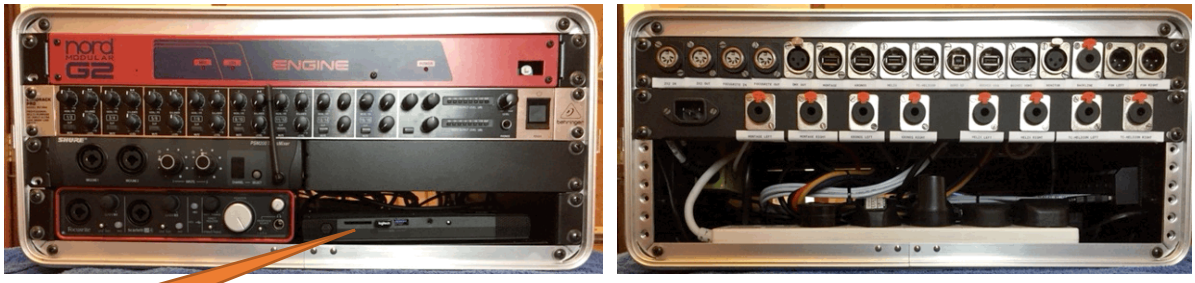
Building a Gig Rack

Derek Cook © 2018

Building a Computer Based Gig Rack

This Guide shows how I built my new gig rack, which will hopefully be an inspiration for others, going from this rats' nest (the new gig computer on the desk being tested) …

To this, as viewed from the front and rear, with the computer visible in the bottom right of the front view…



Gig PC for running Cantabile

This guide covers the hardware aspects of my gig rack. Please see my companion Cantabile Guide to cover the software aspects, and specifically how I am using the Cantabile Software as a live VSTi host.

Obviously, what goes into your specific rack will vary according to need, but the principles are the same.

What I needed in the rack was:

- A computer powerful enough to run my collection of VST synths, backing tracks, etc. (with Top Ten Software's Cantabile program as the live host);
- The four channel USB sound module for the computer (two channels for Front of House and two channels for click/monitor);
- The Transmitter for my wireless In Ear Monitor (IEM) system, picking up the click feed from the USB sound module;

- Line Mixer for on stage mixing of the hardware devices (synths, guitar boards) I have in use and mixed with the USB sound module output;
- A home for my Nord G2 Engine (virtual modular synth in a 1U rack!);
- MIDI interfaces;
- A USB Hub (not in view);
- My USB DMX interface (not in view).

With everything designed for ease of connection on stage, so there is no fumbling about inside the rack trying to find connections on a darkened stage!

The parts that I used to build this rack and sources of supply are listed in the Annex.

Choice of Computer and Monitor

Before diving into the build details, I thought it worth briefly explaining my buying choices for the computer and monitor.

For years I have gigged with a similar rack system to the one described here, but with the computer being an external laptop for running my backing tracks and driving a DMX light rig, which was synchronised to the backing track. The laptop was powerful enough to run this, but it was not powerful enough to run high spec VSTi synths as well. And it was always problematic to get the laptop close to the keyboards to keep an eye on things, and if you needed to access the laptop HMI for any reason then you are battling with a keyboard and trackpad.

So, I wanted a powerful computer in a small form factor (the best I could afford) and a remote monitor, preferably a touch panel, that could be mounted on my keyboard rig. My preference was to have the computer and as much wiring as possible integrated inside the rack, with only the external connections to worry about.

A Windows Tablet PC could have been an option, but the ones I looked at were not as powerful or easy to expand/upgrade as a more general computer form factor, and they had limited IO. Basically, they are designed for hand held use whilst running off internal batteries. And when you look at the cost (I was looking at Surface Pros) you could easily end up paying the cost I ended up paying (see below) for a lower spec system compared to the one that I created. The tablets usually had just one micro USB port, so limited connectivity, which is problematic for my needs. Basically, I wanted the most powerful processor in my budget range, 32GB of memory (to help eliminate memory paging) and at least a 512GB SSD for sample streaming to allow me to run VSTis like Omnisphere.

Following discussions with other Cantabile users on the Cantabile Forums, the ideal solution appeared to be an Intel (or equivalent) “Next Unit of Computing” (NUC) small form factor PC with a touch monitor.

For the display, whilst not a cheap option, the recommended option was the GeCHIC 1303i Touch Monitor, or similar, which is a 1080P resolution monitor with a Touch Interface.

On the basis that I will be gigging this for at least five years, I wanted the best I could afford. In total, the PC and Monitor alone cost about £2,000. You could buy a very good keyboard for that! But that would not allow me to run my soft synths, which is one of my design aims. But the way I look at it is to amortise the cost over time. £2,000 over five years is £400 per year. If I get paid £50 a gig (typical pub gig pay that you get if you are in a four piece band, not considering solo/duo gigs or door takes, where you can get much more), I need to do 8 gigs a year at this rate to get the cost back, which is not a tall order!

Your choice of computer will of course need to match budget and what you need the computer to do in terms of the software synths and their resource needs, so do think carefully about it to get the optimum solution.

However, the other consideration is that software resource requirements only ever go up over time, so I always get the best I can afford with plenty of headroom.

Just to give you a benchmark example. My 2014 era basic spec laptop (about £400 new) could not run a VSTi like UH-E DIVA without glitching unless you really pushed buffer sizes up to the point where latency was an issue. With the new system, I can run DIVA in its DIVINE mode for most patches and in Cantabile (my live host) the audio load (how much of the audio buffer is needed for the audio processing cycle) is less than 40% for a 10ms buffer.

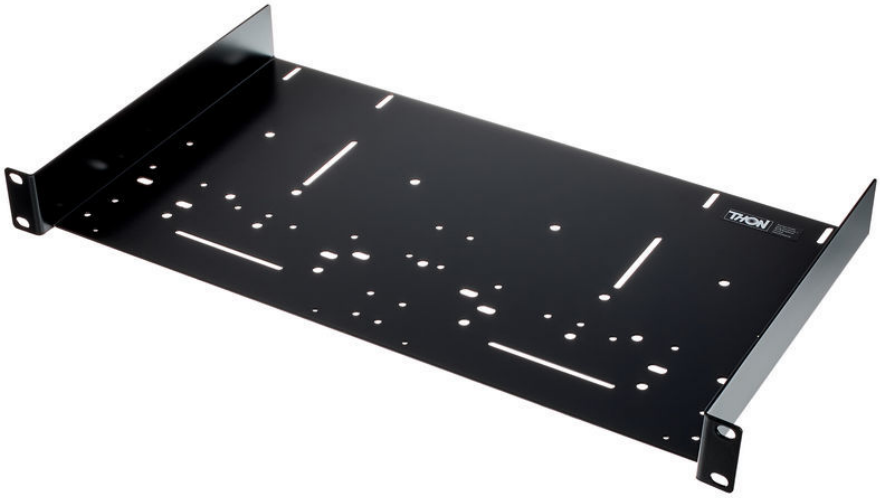
The following picture shows a shot of my rig, with the gig rack to the side (usually it will be behind me, and the monitor mounted to my keyboard stand. The stand is a Quick-Lok stand, and I have used their tablet mounting accessory to achieve this. It is nice and sturdy, easy to setup and of course gives me the computer HMI in easy reach for control, and it can also provide me with song cues, lyric prompts, etc. for some of the more demanding stuff.

Building the Rack

The starting point is a bare 4U 19” rack case, purchased from Thomann. Obviously, you can chose the height to suit what you need to fit in. You may need more or less rack space.

Hint: 1U is equal to 1.75” or 4.45cm. The Nord G2 in my rack takes up 1U of rack space. The history of Racks and their dimensioning can be found on Wikipedia if you are curious why we talk in Us!

It is quite easy to mount the items designed for rack mounting into the rack, via the tapped strips on the sides of the rack using M6 scews. However, a number of items are not rack mountable, so to mount things sturdily, I have put a “rack tray” in the base of the rack case.



You can see that it has plenty of holes that (if you are lucky) will line up with the gear that you wish to fit and any mounting system they use, or you could drill more holes as required. But what I do for ease of maintenance and removal is fix the items mounted to the tray (computer, USB module, DMX interface, etc.) using heavy duty, self-adhesive Velcro strips.
I find this to be just as secure as bolting items down! And the benefit is they are much easier to remove if needed without any tools or having to take the rack tray out (I do carry spares of items, where I can, in case anything fails).

The following shot shows the rear view of the rack, with items fixed to the tray, and the start of the USB wiring.

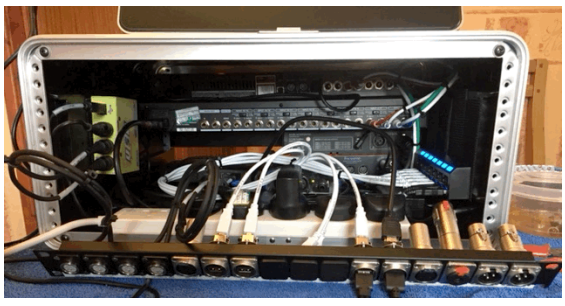
Inside the rack, not visible from the front I have (from left to right):

- MIDISPORT 2x2 interface to provide additional MIDI ports;
- DMXIS USB DMX interface (for connecting the computer to a DMX light rig);
- Seven port USB hub (even the four ports on the NUC PC were not enough for me. I'll provide a USB list later);

And in the foreground, you can see a mains strip.

The actual layout was revised several times as I built this, as I found that the vertical mounting of the USB hub (see on the far right) fouled with the jack couplers on the back panels once I fitted them, and I hadn't noticed whilst building the rear panels.

I also needed a space for the NUC PSU to be fitted on the rack tray, which meant moving the 2x2 MIDI interface. The following layout worked for me, and you can see a test fit of the topmost rear panel and connectors, including USB leads. You can see the MIDISPORT 2x2 has been vertically mounted on the side of the case (that heavy-duty VELCRO again!) and the USB hub (now powered and lit) is now horizontally mounted low down to avoid the two rear panels and their connectors when fitted. Lesson learnt" do plenty of test fittings with everything that needs to go in!



So, sorting out the mounting of items is relatively simply, the issue then is how to make a system to facilitate ease of connection on stage around the rear of the rack. I also wanted to minimise the number of soldered connections, again for ease of maintenance.

I found a company, ESR, that sells pre-punched 1U panels, and selected one with 16 cutouts for the top most panel.

And one with 8 cutouts and a cutout for an IEC Mains connector for the second panel (audio inputs for mixer).

The cutout dimensions are a standard size, and a number of “bulkhead” couplers are available, which are also known as “feed through” connectors, which can be simply bolted to the cutout panels.

Description	**Image**
¼” Stereo Jack (TRS) coupler	
Neutrik XLR Plug	
Neutrik XLR Socket	
Neutrik USB *(note these are reversible, so that either the Type A or Type B connector is outermost)*	
Neutrik HDMI	

The only coupler that I could not find was a five pin DIN coupler for the MIDI connections, so I just brought panel mount connectors, and had to cut and solder MIDI leads to make those, but that got me down from 24 soldering jobs down to four!

So, starting off with the MIDI connections, this was a case of purchasing a set of 1M leads, and cutting one end so that it could be soldered to the panel mount connectors, as shown below.

That was the hardest part of the job! This picture also shows that you can get blanking plugs for any unused cutouts to keep things neat (some connectors were on back order, so I just blanked them until I had them).

Here is the top most panel complete and ready for fitting with all leads in place, labelled (more on labelling later) and cable tied.

The picture above also shows the advantage of the feed through couplers where you can get them, as they simply provide a connector inside the rack that you can fit standard leads to, which makes for very easy and quick assembly and of course ease of maintenance.

This is not a cheap approach as the couplers are around the £5 mark each, but they do make the job so much easier. The budget conscious could of course continue with a soldering job for all connectors.

And then the lower panel of inputs (e.g. from my keyboards) for the line mixer. You can also see that I have labelled all of the connectors, and the mains block cable has been cut and terminated onto an IEC mains inlet (complete with safety shroud).

The mains cable was stripped back and terminated with standard crimp “spade” connectors for fitting onto the IEC mains inlet. I will of course say that you should only contemplate doing this work of mains wiring if you feel competent to do so. I did it as I was fed up with a dangling lead from the rack’s mains block that never quite reached the floor when the rack was on a stand!

So, to recap, here is what the completed job looks like front and rear. I hope you will agree it looks pretty neat, and I achieved my goal of ease of setup. Not shown here, but I also loomed all of the cables between the keyboards and rack, rack and amplifier, rack and guitar pedal and rack and vocal pedal. The effort to do that was about half a day in total of labelling and cable tying, but it means that instead of laying and recovering and storing around 20 cables it has been reduced to working with four cable looms. I can setup and tear down in about 20 minutes now, whilst keeping the stage tidy and free from “cable spaghetti”.

Connector Allocations

Here is my allocation for the connectors

ID		For	Comments
Internal			
---	MIDI 2x2 A IN	Unused	
---	MIDI 2x2 A OUT	Nord G2	Internal
First Panel			
1	MIDI 2x2 B IN	FC300 IN	
2	MIDI 2x2 B OUT		
3	Focusrite MIDI IN	Helix	
4	Focusrite MIDI OUT		
5	DMXIS	DMX OUT	
6	USB 4.1	Montage	
7	USB 4.2	Kronos	
8	USB 4.3	Helix	
9	USB 4.4	TC-Helicon	
10	Nord G2	Nord G2	Direct coupled to G2
11	USB 4.5	GeChic 1303i	For power and the touch interface
12	HDMI Coupler	GeChic 1303i	
13	Shure Monitor B	Monitor In	
14	Mixer Monitor	Backline Out	
15	Mixer Left	FOH Left	
16	Mixer Right	FOH Right	
Second Panel			

1	Helix Left		
2	Helix Right		
3	TC-Helicon Left		
4	TC-Helicon Right		
5	Montage Left		
6	Montage Right		
7	Kronos Left		
8	Kronos Right		

USB Port Allocation

These are the ports on the NIC computer. Port 4 goes to the USB hub to expand the number of ports.

Port	Use	Comment
1	General for USB Devices	E.g. hard drive for backup.
2	Wireless Keyboard and Mouse	
3	Focusrite	
4.1	Montage	
4.2	Kronos	
4.3	Helix	
4.4	TC-Helicon	
4.5	GeChic 1303i	
4.6	DMXIS	
4.7	MIDISPORT 2x2	

Labelling

This is a bit extravagant, but well worth it in the long run.

I used a cable labeller like this. I was lucky in that I was able to borrow the labeller machine from work, and so I just had to purchase a “self-laminating” cable label cassette for the cables and a self-adhesive label cassette for labelling the back panel. They are not cheap, but there is no substitute for well labelled cables and connectors!

If you don’t have this as an option, I would still recommend you identify the ends of the cables in some way. When I first wired my studio (many years ago), I used self-adhesive alpha/numeric labels from Maplin, which you can use to make up identifier codes.

Annex – Parts List

Item	Supplier	Stock Number
Thomann Rack Case 4U	Thomann	
Thon Rack Adapter 1U 25	Thomann	
C14 Panel Mount IEC Plug	RS	488-191
IEC Insulating Boot	RS	526-0724
Pre-Punched 1U Panel for 16 D-Type XLR Connectors	ESR	406-736
Pre-Punched 1U Panel for 8 D-Type XLR Connectors and 1 x IEC Inlet	ESR	406-734
Neutrik MFD M3 Mounting Frame for D-Type Connectors	ESR	406-885
6.35mm Stereo Bulkhead Socket - Socket	ESR	075-525
Neutrik NA3FDM Fe-Ma Feedthrough Chassis XLR	Studio Spares	511200
Neutrik XLR Feedthrough Male-Female Chassis panel	Studio Spares	511210
Neutrik USB Feedthrough	Studio Spares	581510
Neutrik HDMI Feedthrough Chassis Panel Connector	Studio Spares	511010
DIN / MIDI Panel	Studio Spares	440390
Patch Leads Straight Stereo Jacks ×6	Studio Spares	589150
USB 1M leads		
MIDI 1M Lead		
HDMI 1M Lead		
BMP21 Brady Cable Labeller	RS	819-9808
Brady Cable Label Refill Labels – Self Laminating	RS	694-9138
Brady Nylon Cloth Cartridge Labels	RS	694-9100
Self Adhesive Cable Labels	Maplin	SJ19V
Heavy Duty Velco	Amazon	
Cable Ties Bulk Pack	Amazon	
Intel NUC6i7KYK skull canyon Core i 7 fully assembled PC	Ambros	
Gechic On-Lap 1303I | Full HD Portable Display Monitor	Amazon	