Hauptwerk Hardware

System One

Full Organ Rebuild Solution

SYSTEM ONE
Hauptwerk Hardware

Lighted Rocker Tab-Stops Interfaces Installation & User Manual

Covers both 16 & 48 stop versions

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This manual should be read in conjunction with the System ONE Control Board user manual which is available from the downloads page of the website. See link below.

https://www.hauptwerkhardware.com/downloads_page/

A brief introduction to System ONE.

What is System ONE?

System One is an electronic system which comprises a main control board and a number of separate interface boards which connect to the various controls of an organ console. It is very versatile and can be used in the smallest organ right up to the largest. It copes with pretty much any type and combination of organ controls, including:-

- Matrix Keyboards
- Bus Keyboards
- **Lighted Stops/Rocker Tabs**
- Motorized Stops
- Lighted Pistons
- Basic Unlit Stops & Pistons
- Memory Level Display
- Swell & Other Pedal Controls
- Crescendo Indicators
- On Demand Re-scan of static controls (Transpose, Tuning etc.)

The system requires only two Midi connections to the computer running the Virtual Pipe Organ software and it works with Windows, MacOS and Linux operating systems. There is no programming required and it is simple to set up with your virtual pipe organ of choice.

It has been designed to meet the specific needs of the organ enthusiast as well as the professional, in that it addresses the unique requirements of the organ as opposed to the many other products already used in this field which are really just generic Midi devices which the builder then has to connect together to form their own 'system'. For more information on System ONE please refer to the Overview Document available from the downloads page of the Hauptwerk Hardware website.

Who is it for?

Hauptwerk Hardware System One is designed for both enthusiasts and professional users.

If you are planning an organ console build from scratch it is the ideal solution as you can plan each feature you want in your console and be certain that System One will cope with it easily. If you are rebuilding or 'Midifying' an existing console, System One will provide you with the easiest way to connect all the controls of your console and generate the required Midi signals to work with your computer without the need to perform any programming, only a few jumpers need to be set in order to tell the system what options you want to select.

It is ideal for use with Hauptwerk, Grand Orgue and any of the many other virtual organ software solutions available which use Midi as their input.

The Lighted Rocker Tab Stops Interfaces.

How Lighted Rocker Tab-stops work.

Below is a picture of a typical lighted rocker-tab circuit board as found in many commercial organs.

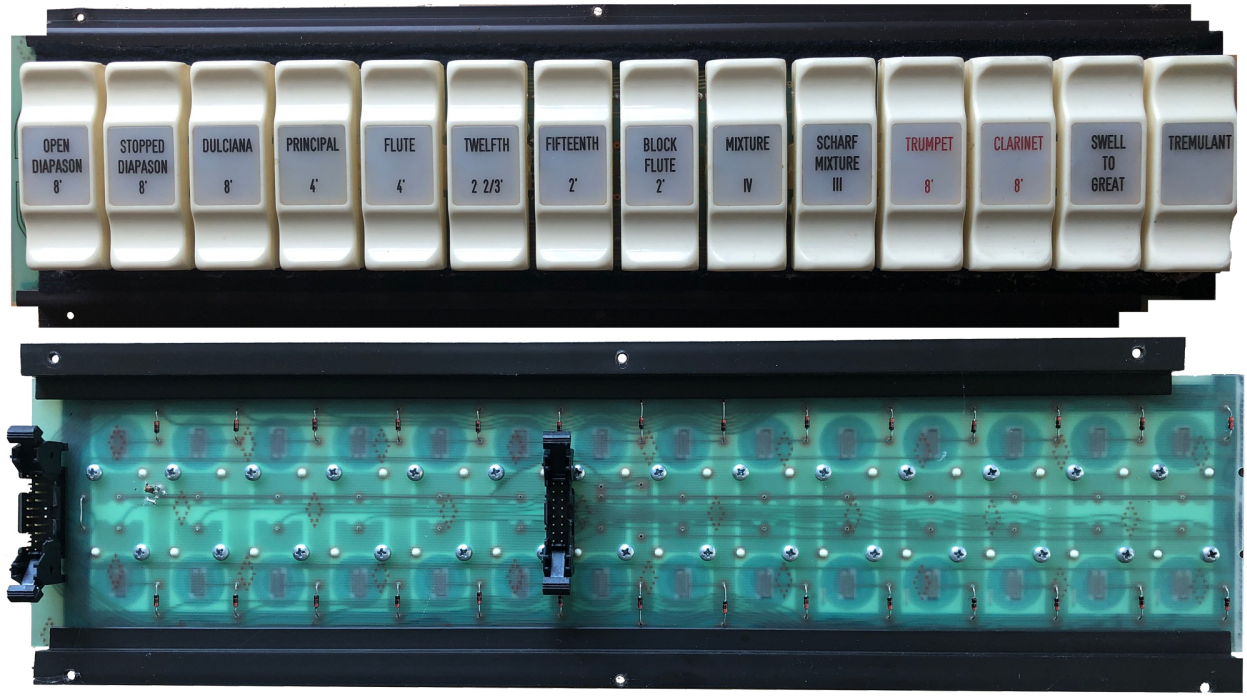


Illustration 1: A Lighted Rocker Tab PCB as used in many organs

How the 'Stop Controller' works.

I use the term 'stop controller' in this context to mean the functions of the System ONE main board and the lighted rocker tab-stops interface board combined.

The job of the stop controller is to control the power to the rocker tab LEDs and to communicate, via MIDI, with the computer. The controller continuously scans all the rocker switches to see which, if any, are pressed. Internally it remembers the status of each stop and will change their state only if the user operates the opposite button to the current state. In other words if the stop is 'on' and the user operates the 'off' end of that rocker then the controller will see that as a change of state and send the appropriate MIDI message to the computer to say that stop has been turned off, it will also extinguish the light for that stop. The reverse is also true when a currently 'off' stop is turned 'on' by the user pressing the 'on' end of the rocker.

As well as this the controller is constantly listening out for any incoming MIDI messages from the computer. If a MIDI message arrives requesting a change of state for any particular stop, the controller first looks at the current state of that stop, and if it already matches the requested condition it will do nothing. However if the requested state is different to the current state it will illuminate or extinguish that stop's LED as necessary and update the state of that stop in it's internal memory.

Interface Variants.

There are two variants of the lighted rocker-tab stop interface available. One is for up to 16 stops

and the other is for up to 48 stops. System ONE supports a total of 128 lighted rocker-tab stops which can be made up of any combination of the two board sizes.

The reason for choosing this multiple of 16 stops is due to the fact that the ubiquitous rocker tab PCB's like the one shown above always come in multiples of 16 stops. Their design is quite clever as they can be easily be cut down between stops if less than the maximum of 16 are required on any single board.

Connections.

As can be seen from Illustration 1 above the rear of these boards have two IDC type connectors. One is placed toward the centre of the board and is for the connections to the actual lamps. This is usually a 16 pin type. The other, usually a 20 pin type, is placed at the end of the board, and this is for the matrix connections. As can be seen from the picture the PCB contains the diodes that form the actual matrix. There are two diodes per rocker, one for 'on' and one for 'off'.

Below is a picture of the System ONE 16 rocker tab stop Interface.

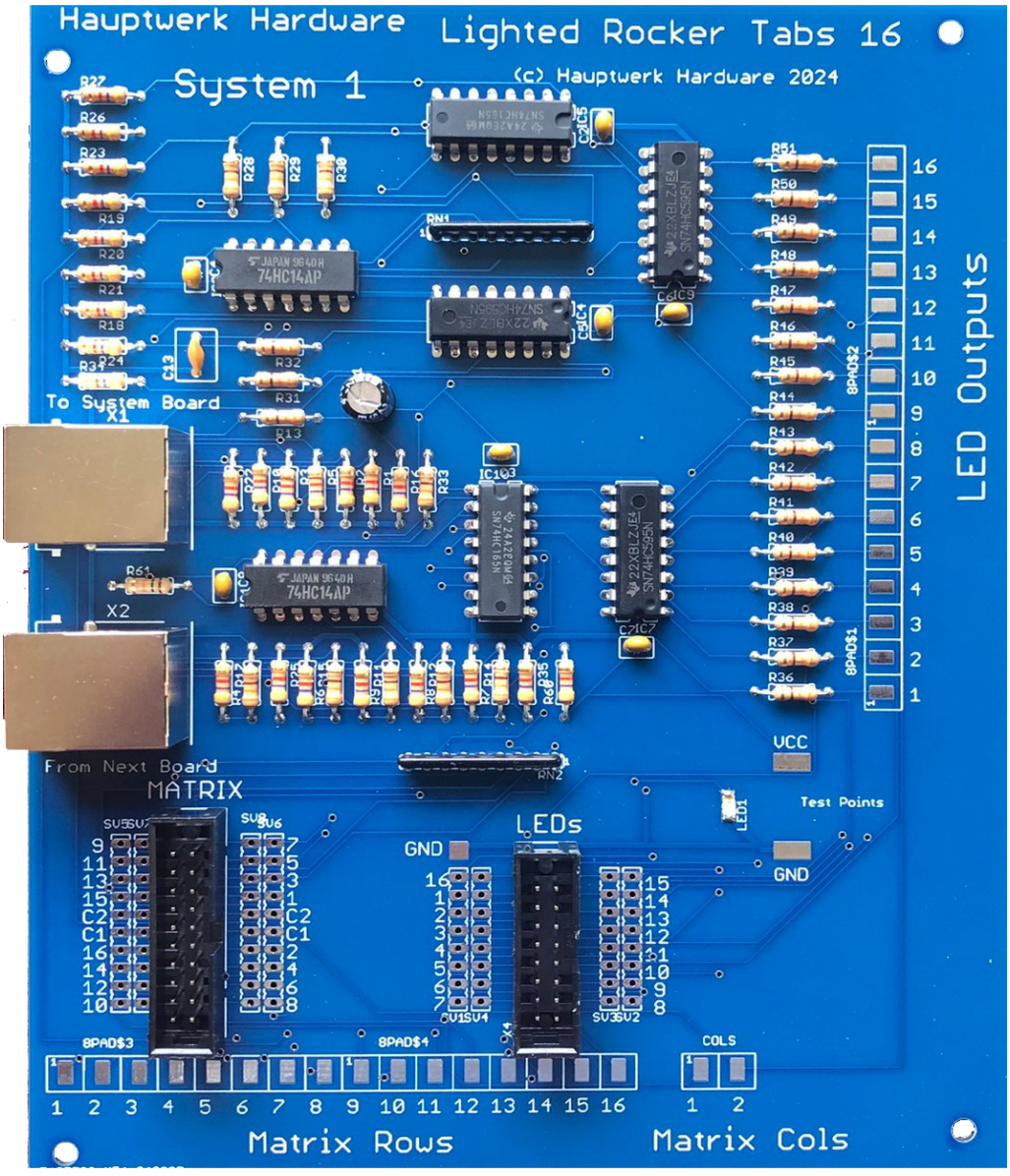


Illustration 2: The System ONE Lighted Rocker Tabs 16 Interface

As can be seen from Illustration 2, the System One Lighted Rocker Tabs 16 interface has two IDC type connectors similar to the ones used on the actual Rocker Tabs board. These can be connected to the rocker tabs board using ribbon cable and IDC connectors. Since these rocker tab boards are made by various different manufacturers they inevitably have some differences to the way each one is wired. Whilst it is very likely that one board will use the same 16 way connector for the LEDs as a board from another manufacturer it does not necessarily follow that both boards will use the same connection layout within that plug. For example one manufacturer may use pin 14 as GND but another may use that same pin 14 for the supply to the LED on the 14th rocker-tab.

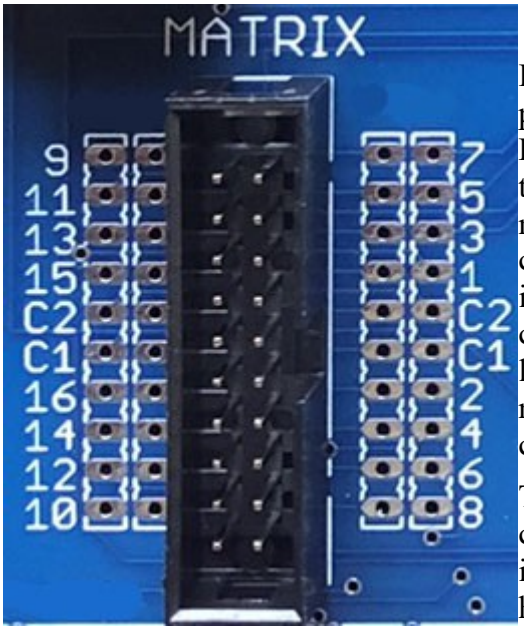


Illustration 3: Solder pads for each connector

It is for this reason that there are two groups of solder pads to each side of each connector on the Lighted Rocker Tabs Interface. See Illustration 3. The idea is that the pad nearest the connector is connected to it's matching pin on that socket and the one furthest from the connector is connected to the actual LED outputs on the interface board. The same is true for the matrix connector, where the matrix inputs within the board are labelled 1 through 16 along with C1 & C2. These numbers represent the matrix rows and the two matrix columns are represented by C1 and C2.

The thinking behind having two rows of pads by each connector is that if your rocker tab board happens to be internally wired with the same connections as the ones I have used previously, and which seem to be prolific, then all you have to do is connect a link between each connection of these two rows of solder pads, such that the pins in the connector will then be connected to the labelled matrix/LED connections in their natural order as per the labelling on the board.

If, however, your rocker tab board uses a different layout for it's connections then you can simply solder wires between the solder pads in the order necessary to make the right connections to the correct pins. This solves the age old problem of having to cut the ribbon cable and solder it's individual cores to the correct solder pads. By linking the correct pads you can keep the ribbon cable intact, making everything easier to install.

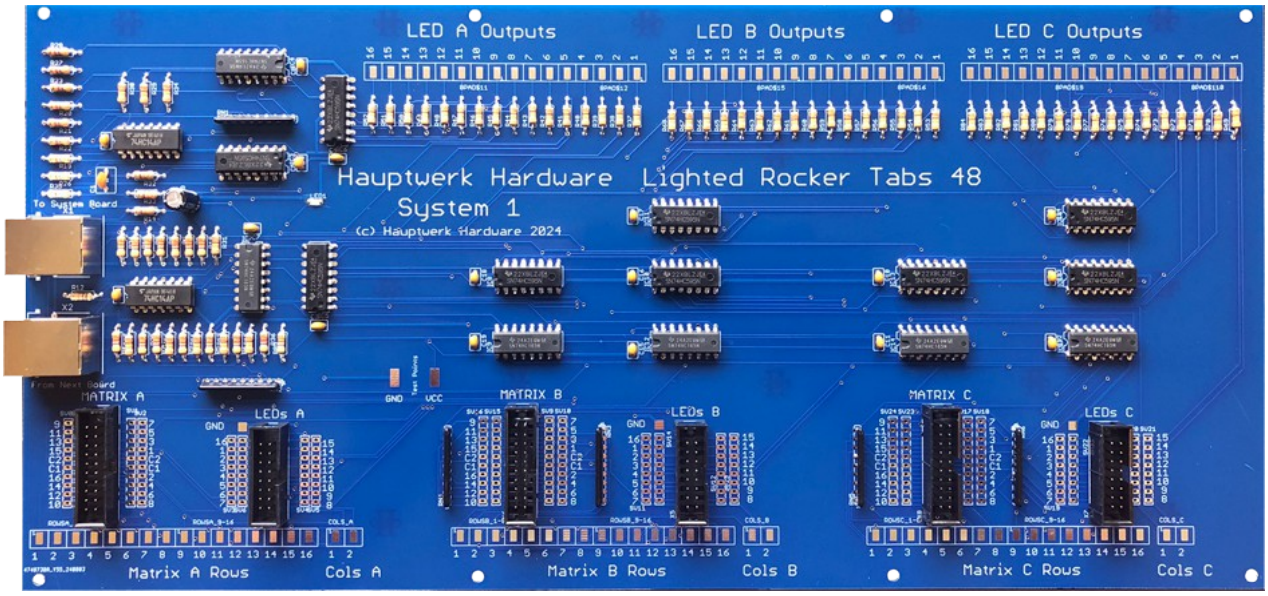
From the illustration above you will see that in addition to the IDC connectors there are solder pads allowing you to solder directly to the row and column connections as well as the LED outputs. These are there so that you can easily make connections to lighted rocker tabs or lighted pull stops that may be mounted in some other way which does not make use of a PCB of the type previously described. So long as these are wired in s 16x2 matrix everything will work just fine.

Why use a 16 x 2 matrix?

When I originally designed these boards it seemed logical to make them so that they would easily interface directly with the rocker tab boards I came across most. These boards, as discussed above and shown in illustration 1 use a 16 x 2 matrix. Each rocker tab has two 'switches', one to turn the tab 'on' and one to turn it 'off'. These are usually wired such that alternate input numbers operate the 'on' and 'off' functions. In other words the odd input numbers will all be connected to the 'on' switches and the even numbers will all be connected to the 'off' switches. Therefore the operation would work such that momentarily connecting row 1 to column 1 would turn on stop 1.

Momentarily connecting row 2 to column 1 would turn it off again. The same applies to the rest of the stops. Connecting row3 to column 1 would turn on stop 2, connecting row 5 to column 1 would turn on stop 3 and so on. The same is obviously true of the Even rows turning the respective stops off.

Below is a picture of the System ONE Lighted Rocker Tabs 48 interface.



The 48 stop variant.

Above is a picture of the Lighted Rocker-tab stops 48 interface. The reason that I chose 16 and 48 for the board sizes is that a great many organs use three of the lighted rocker tab circuit boards. Often each board is cut down so that there may be, say 10 pedal stops on a single board along with 15 on a separate board for the Great and 12 on a third board for the swell for example. Because these are simply three of the previously discussed stop boards but without all stops attached or used we can simply plug in, or otherwise connect these three boards to a 40 way System ONE Lighted Rocker Tabs 48 board and everything will work happily with the missing stops obviously not operating. It should be noted that the lighted rocker tabs 48 interface is simply three lighted rocker tabs 16 interfaces on a single board and operates in exactly the same way so far as stop numbering is concerned, so in the above example the numbering would run from 1 through 10 for the pedal followed by 17 through 31 for the Great and 33 through 44 for the Swell. Whilst the physically missing stops are missing in terms of their operation their numbers do not get concatenated to form a contiguous range.

Daisy-Chaining.

Lighted rocker tab stop interfaces, like most all other System ONE interfaces are able to be daisy-chained together Lighted rocker tab stop interfaces can be daisy-chained together up to a maximum of 128 lighted stops and stop 1 on the first board in the chain, that is the one nearest the controller, is designated as stop 1 by the stop controller. Likewise the first stop on the next board, if fitted will be assigned the number stop 17 or stop 49 depending on whether the first interface is a 16 stop or 48 stop one. This is easily done by simply plugging each board's 'To Encoder' socket into the previous boards 'From Next Board' socket. There is no programming required, the system will automatically

'see' all you interfaces and configure itself accordingly at boot time.

Configuration.

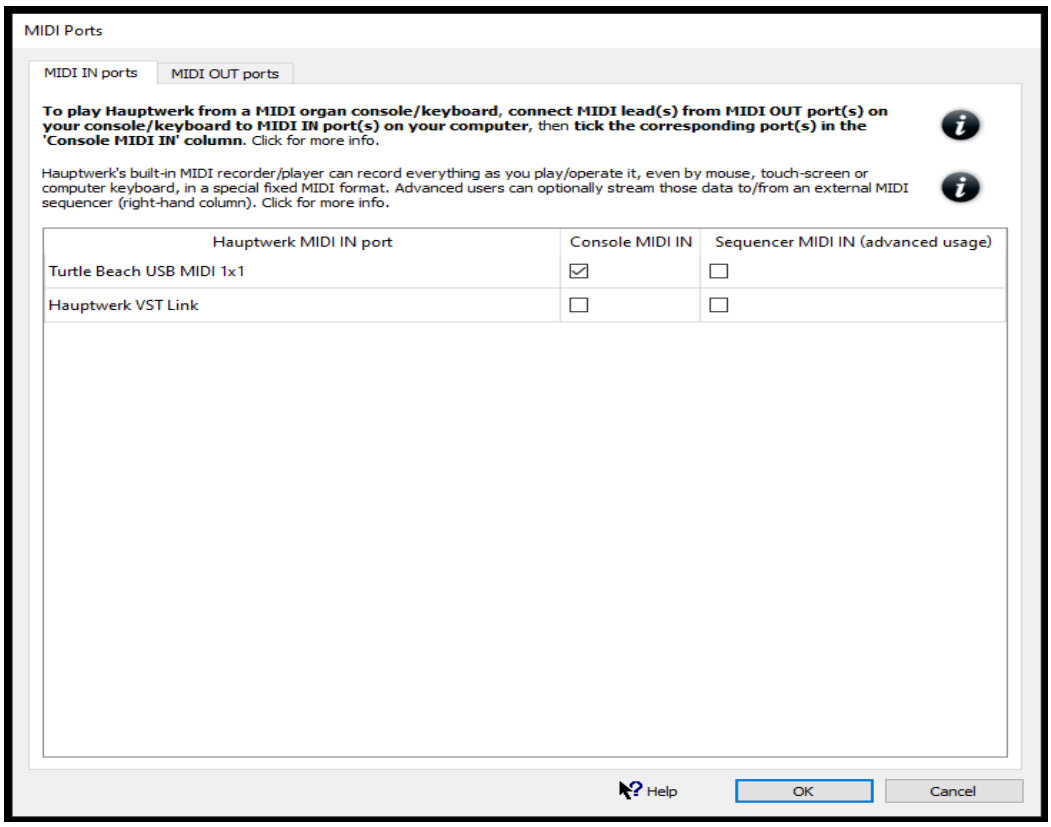
The System ONE Control Board uses midi channel 8 for lighted stops. There is no configuration required on the part of the installer or end user so far as the System ONE hardware is concerned and the operation of the lighted stops is straightforward. Basically when the controller senses that a stop is operated it will **send** a midi note on or off event on channel 8 with the note number being equal to the stop number in the chain as discussed above. When the controller **receives** a midi event on channel 8 it will determine the current state of the stop that matches the note number of that event and if the stop state differs the controller will illuminate or extinguish the relevant LED to match the received midi event. There is no other configuration required and it will work straight out of the box in the manner just described.

Configuring your stops in Hauptwerk.

In the following examples I have used a 'Turtle Beach USB Midi 1x1' 5 pin DIN to USB adaptor.

You will remember from the 'System ONE Control Board' user manual that there are two midi connectors on the board. One is USB midi which carries midi from the manuals only, and the other is a legacy 5 pin DIN interface which carries the midi for everything else. This is the one to use for the lighted stops.

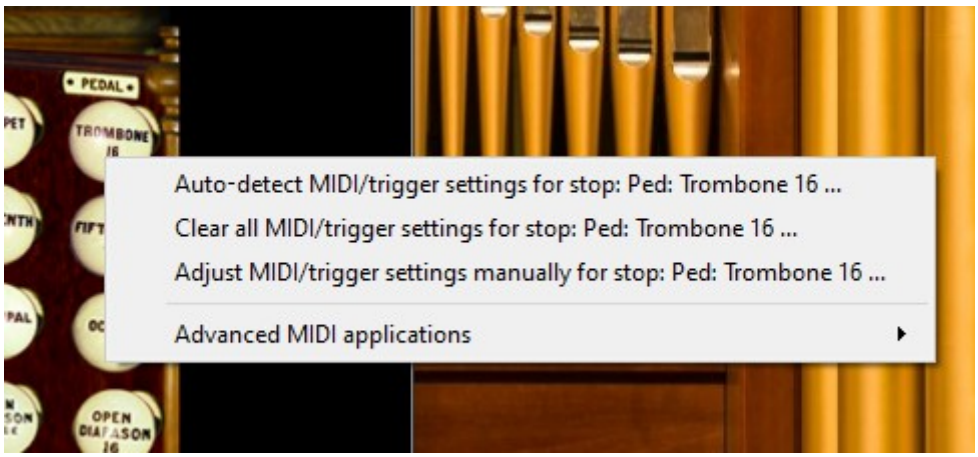
Once you have your midi interface connected, the first thing to do is to tell Hauptwerk that you want to use the midi from your System ONE Control Board to control the virtual controls on your computer. Open Hauptwerk and from the 'General Settings' menu select 'Midi Ports'. That will open a window that looks like the one below.



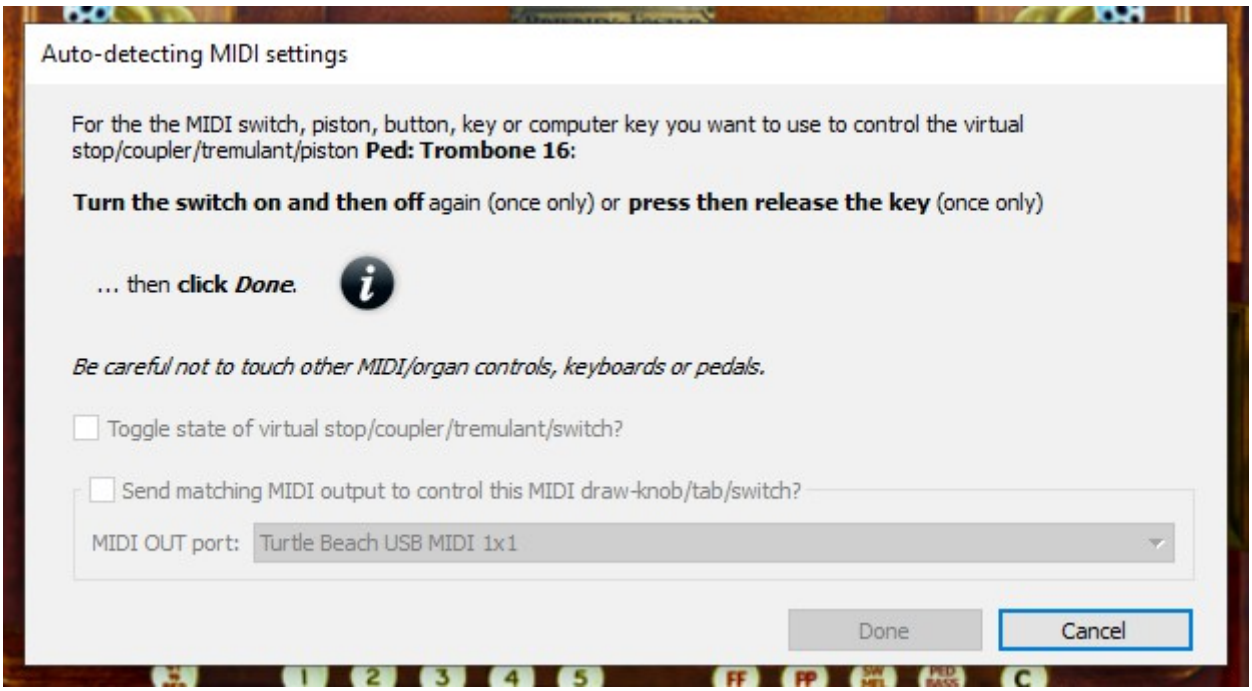
Tick the box for 'Console MIDI IN' for your USB Midi adaptor, as shown above. Then click the second tab at the top of the window labelled 'MIDI OUT ports'. This will reveal an almost identical screen but this time click the 'Console MIDI OUT' box. Once done click the 'OK' button.

You have now told Hauptwerk that you want to use your USB Midi adaptor for both incoming and outgoing midi commands. Everything is ready to proceed, so now load an organ – I have used the 'St Annes Moseley' organ that is bundled with the Hauptwerk software. Once the organ has loaded continue as below.

For this example I am going to use the Trombone 16 from the Pedal Division. First right click the Trombone stop and you will be presented with a menu as shown in the picture below.

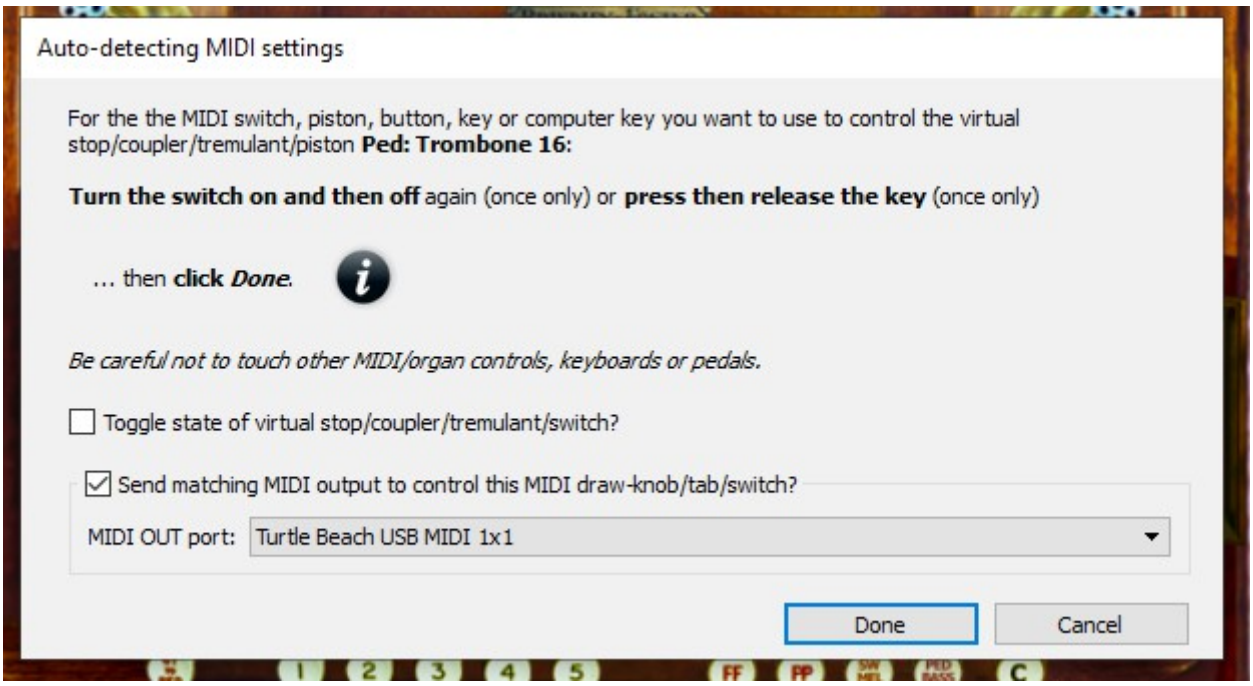


Select the first option 'Auto-detect...' This will open a new dialogue box as in the next picture.

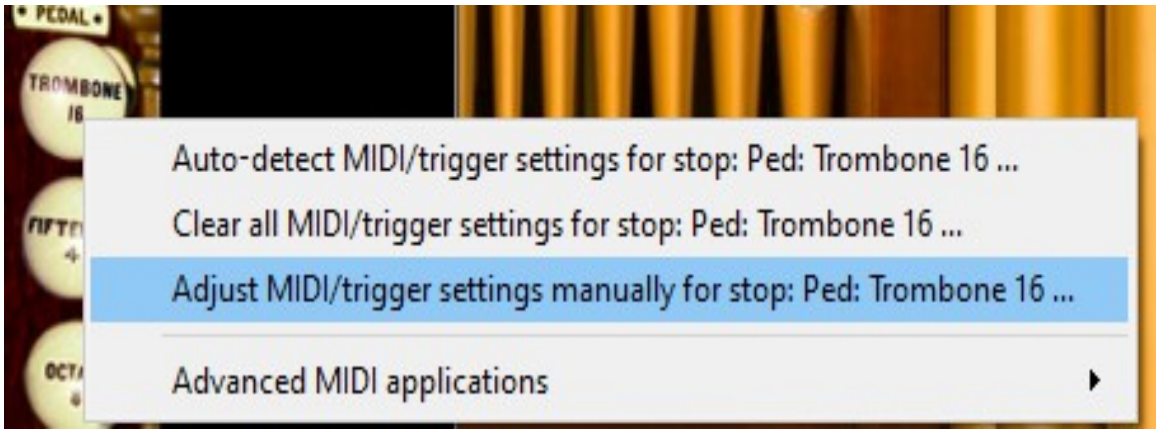


Once you see this box you will notice that the 'Done' option is greyed out, along with other options. This is because Hauptwerk is waiting for you to operate the stop. Put the lighted stop into the on

state and you will see that the 'Done' button becomes available, i.e. no longer greyed out. Now put the stop back into it's off state and you will see that all the options in the box are now active. Notice the last option 'Send matching MIDI output...' Make sure that this is ticked and select the 'MIDI OUT port' to be your USB to Midi adaptor. Once you have done this your screen should look like the next picture.

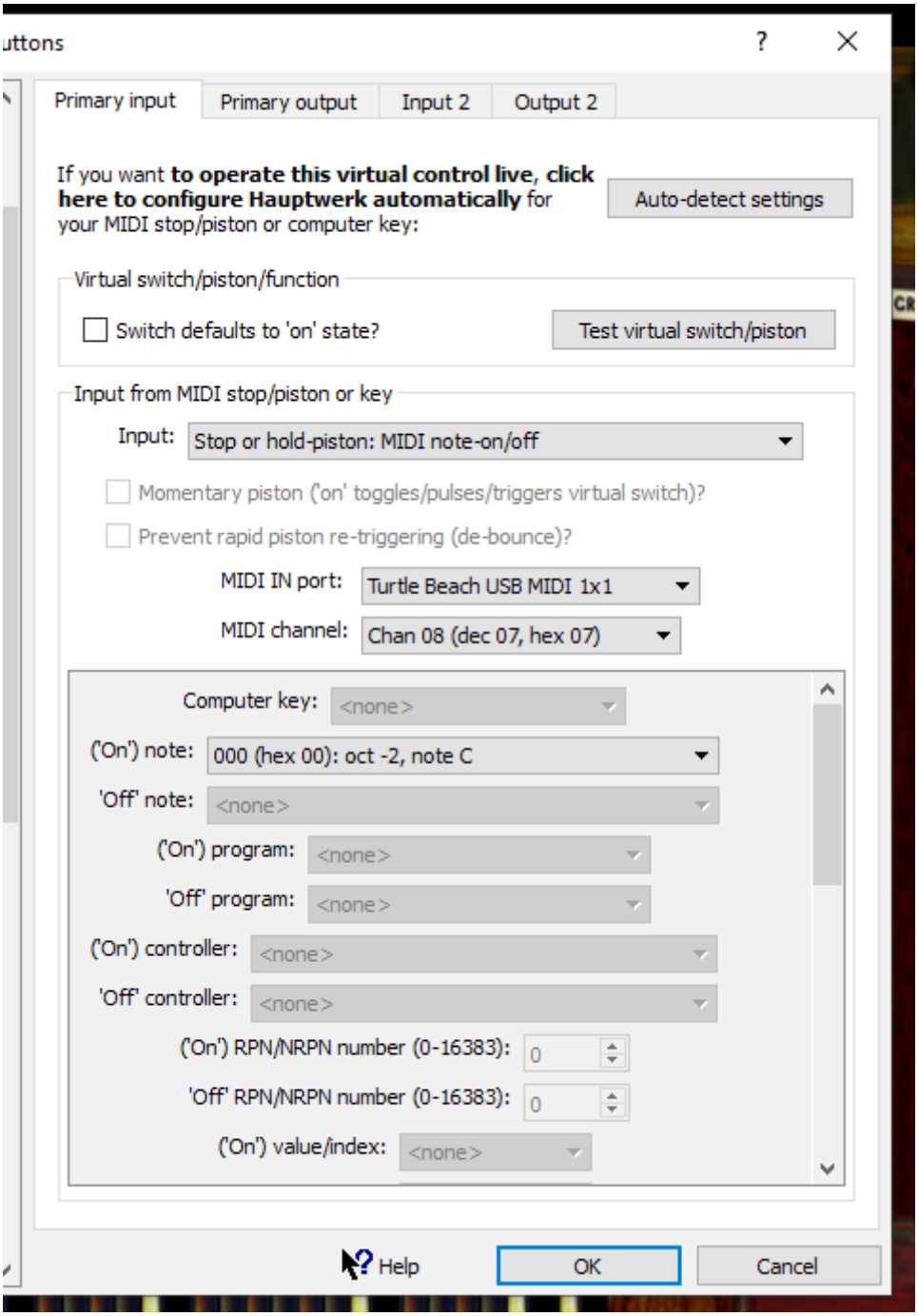


Click the 'Done' button and then, once again right click the Trombone stop. This time select the third option – 'Adjust MIDI/trigger settings manually for stop: ped:Trombone 16...'

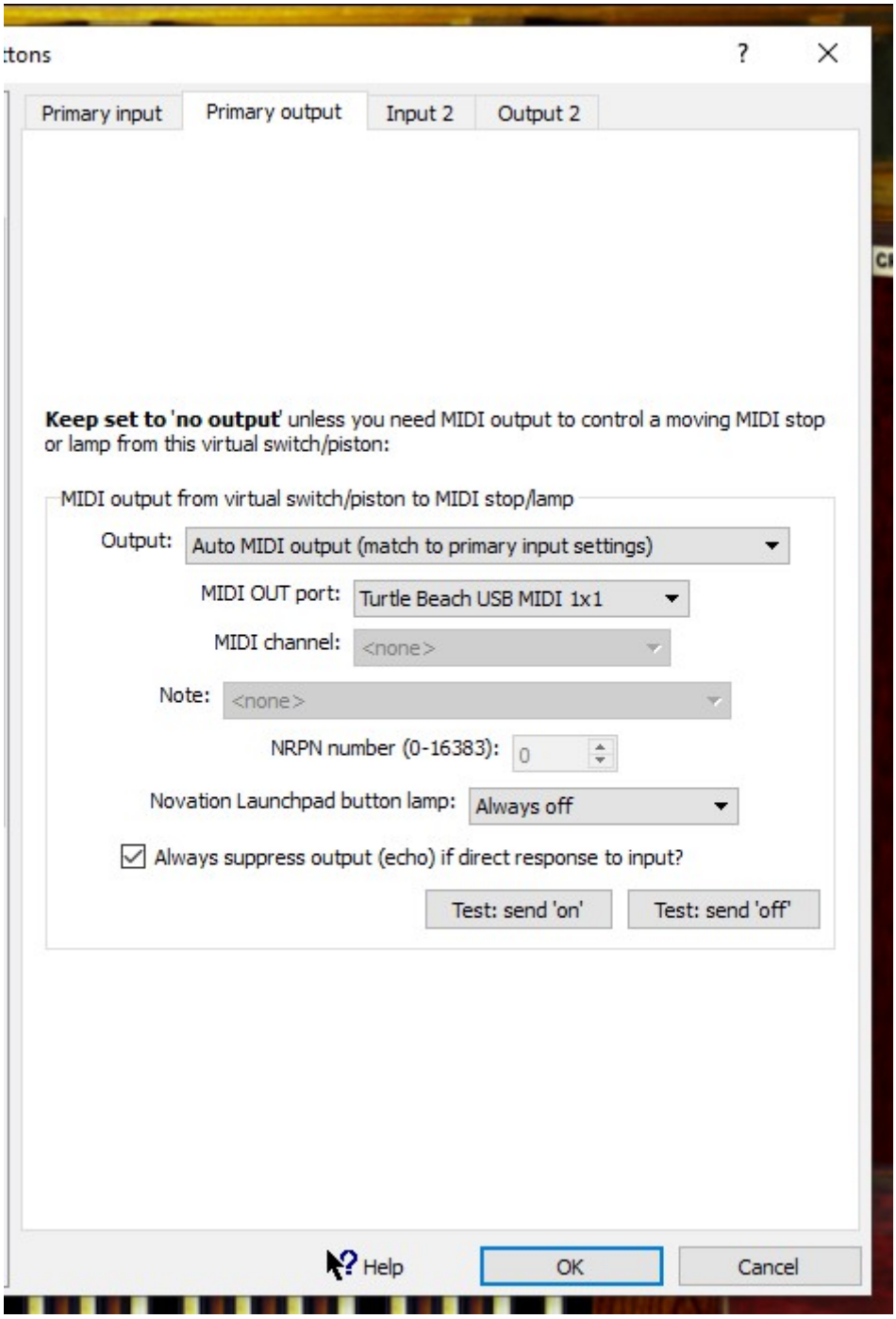


This will open a window like the one below. Only the right half of the window is shown in the picture simply for the sake of saving space and making the relevant part big enough to read. From this window you can see what settings Hauptwerk has chosen and make sure they look correct.

There are two tabs at the top of the window. First check the info on the 'Primary input' tab. The important bits are: 'Input' should read 'Stop or hold-piston: MIDI note-on/off'. MIDI IN port: should read 'The name of your USB Midi adaptor'.



Once you have satisfied yourself that the information on the 'Primary input' tab is correct click the 'Primary output' tab. This will display a screen like the one in the next picture.


:tons
Primary input
Primary output
Input 2
Output 2
Keep set to 'no output' unless you need MIDI output to control a moving MIDI stop or lamp from this virtual switch/piston:
MIDI output from virtual switch/piston to MIDI stop/lamp
Output:
Auto MIDI output (match to primary input settings)
MIDI OUT port:
Turtle Beach USB MIDI 1x1
MIDI channel:
<none>
Note:
<none>
NRPN number (0-16383):
0
Novation Launchpad button lamp:
Always off
Always suppress output (echo) if direct response to input?
Test: send 'on'
Test: send 'off'
Help
OK
Cancel

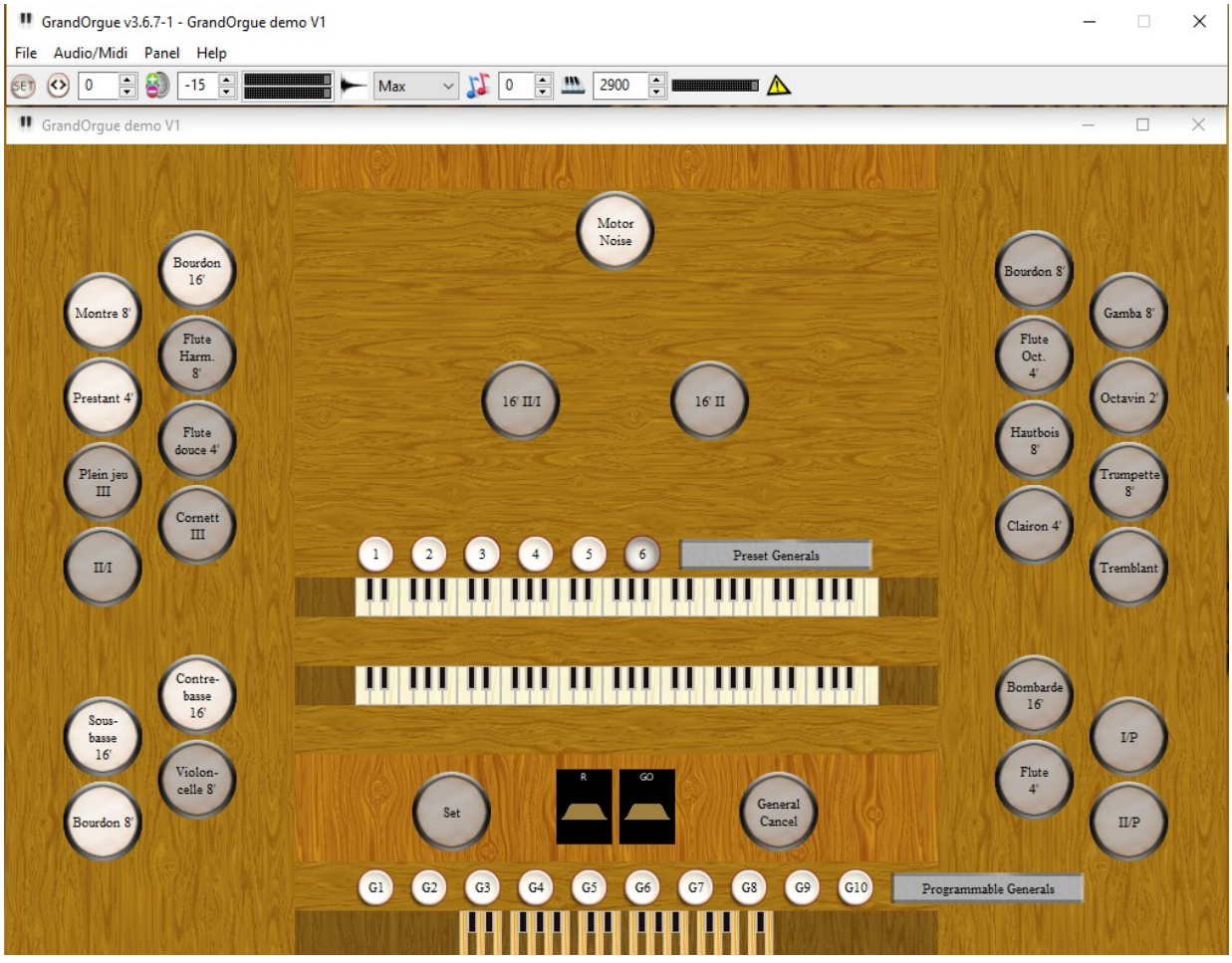
It is important to make sure that the box labelled 'Always suppress output (echo) if direct response to input?' is ticked. If this box is left unticked it can cause the stop to keep flipping between on and off in certain circumstances AND according to Murphy's law those circumstances will be during a recital!

Once all the adjustments have been made you can click the 'OK' button which will return you to the usual organ console view in Hauptwerk. At this point you should be able to operate the physical stop and see the virtual on screen stop change in sympathy with the real one. The reverse should also happen, operate the virtual on-screen stop and the physical stop should light up or go out in sync with it.

You can now repeat this procedure for the remaining connected stops.

Configuring your stops in Grand Orgue.

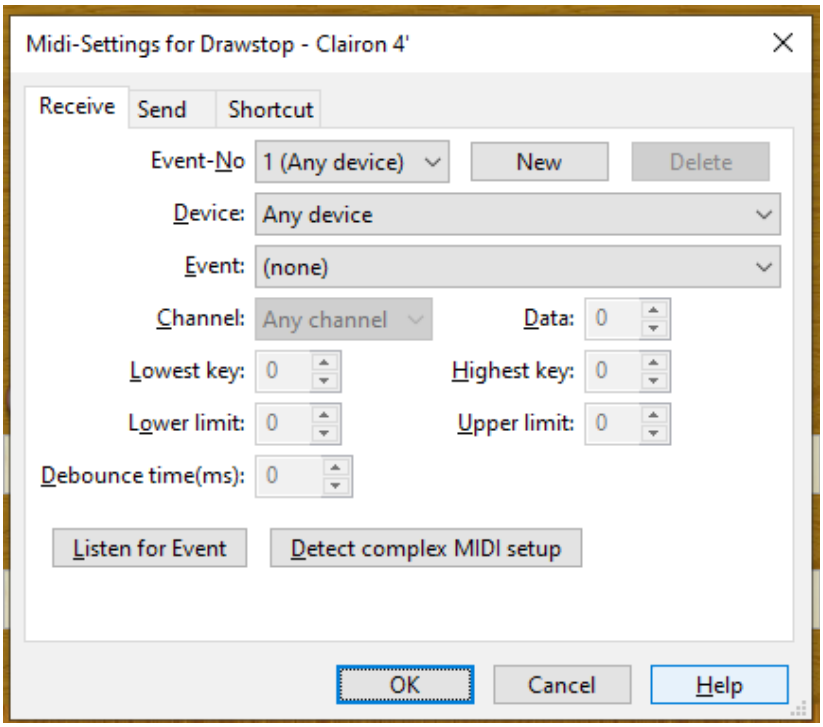
Start by opening Grand Orgue and loading your desired organ. In this example I am going to use the default organ that is downloaded with the Grand Orgue windows installer. Once you have it installed and working you should see a window similar to the one below.



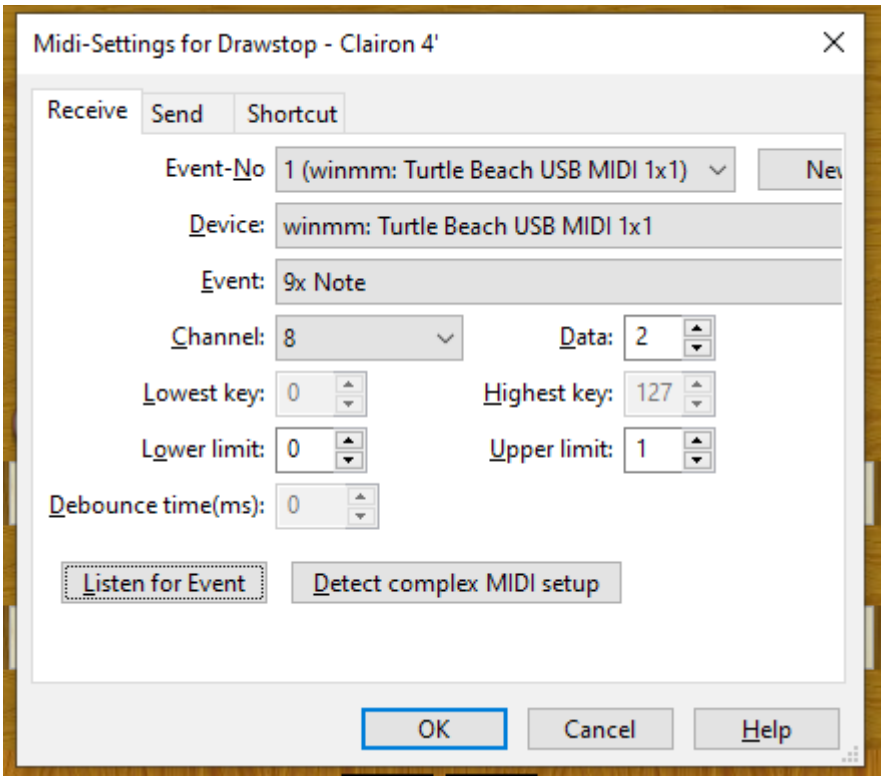
For this example I am going to use the Clarion 4' stop.

Right click the desired stop and immediately you should see a dialogue box like the one below. The important part here is the button marked as 'Listen for Event'. Click this and you will see the

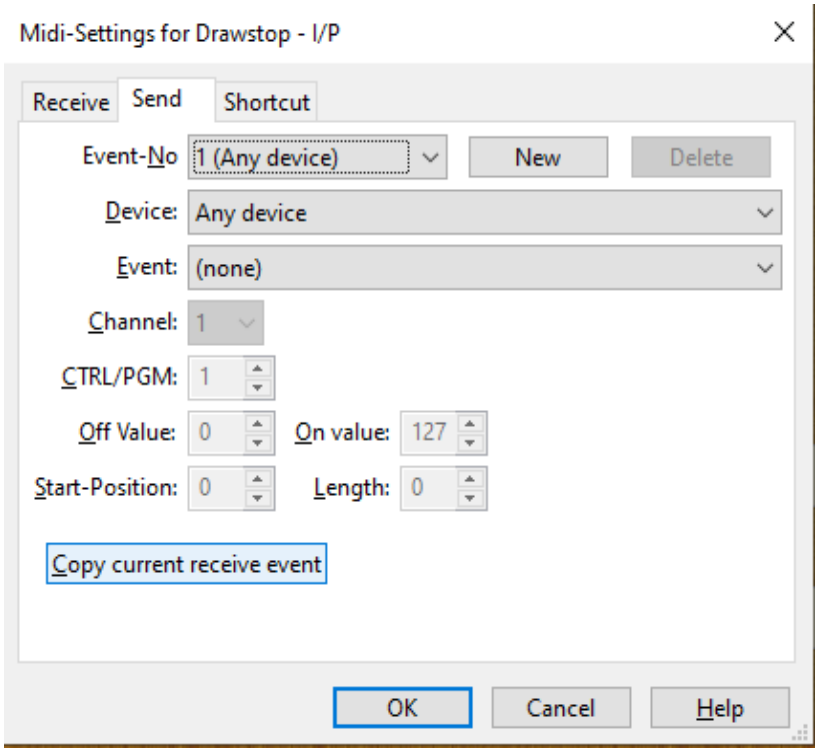
instruction 'Please press the MIDI element' appear underneath the button.



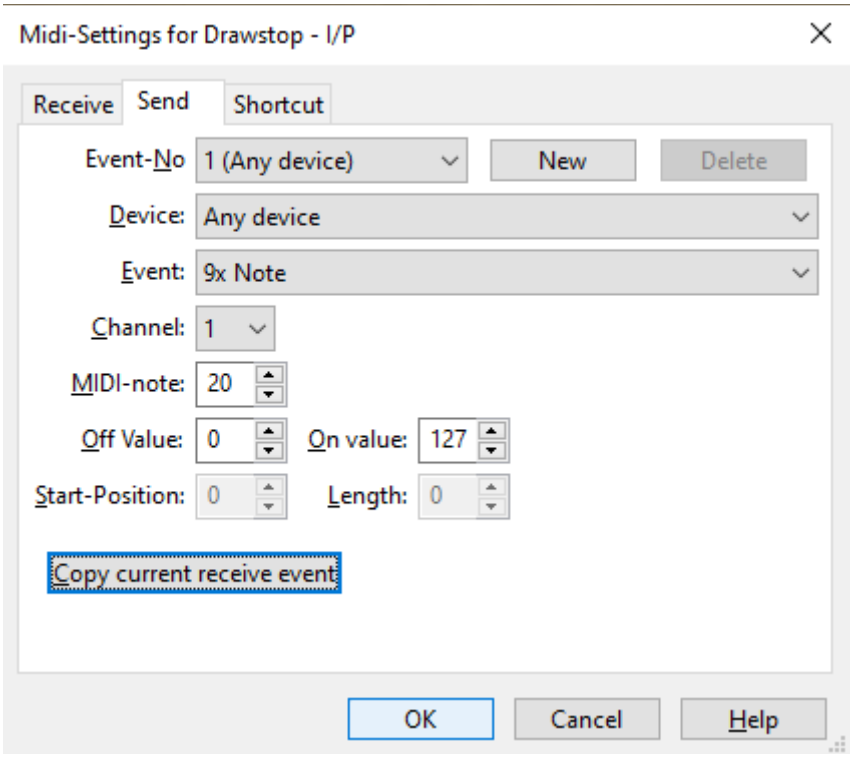
Now - operate the desired stop, set it to the 'ON' state, then back to the 'OFF' state. Once you have done this you will see that the information in the other fields is automatically populated with the MIDI information about the stop that you operated. This is shown in the picture below. At this point we have completed setting up the receive event. This means that, at this point, Grand Orgue will respond to the operation of that physical stop.



Next we have to complete the send setup of this stop. Click the 'Send' tab at the top of the dialogue box and you will see the 'Send' page as below.



Click the button marked 'Copy current receive event'. This will automatically populate the fields with the information required for Grand Orgue to send MIDI data to operate the physical stop, as shown in the picture below.



Now click the 'OK' button to complete the setup for that stop.

Now simply perform the above procedure for the rest of the stops you will be using. This completes the setup of the Grand Orgue software to work with your System ONE Motorized Stops Interface.

Configuring other virtual organ software.

The controller will work with any MIDI capable virtual organ software. Hauptwerk and Grand Orgue have the Midi Auto-detect feature which makes it easy to set them up. If you want to use the controller with software that does not have this feature you can easily input the information manually. The things that the software will require are:-

- Midi Device
- Midi Channel
- Midi Note On/off value

The Midi Device name will be 'USB MIDI Device', or whatever name your 5 pin MIDI to USB device enumerates as.

The Midi Channel will always be channel 8 for lighted stops.

The Midi Note On/Off value will be that of the stop you are using.

If you have a serial terminal connected to the USB Comms output from the System ONE Control board, then operating the desired stop will print on the screen the Midi Channel number along with the MIDI Note On/off number. It will also print the result of any received midi, so for example when you operate the stop on screen the System ONE Controller will print 'lighted stop x' on, and the same for when you return the on screen stop to the off position 'lighted stop x' off will be printed.

Now that you have this information you can simply enter it into the relevant spaces in your virtual organ software for each stop you are using.

Mounting

All System ONE boards have a number of mounting holes of 3mm diameter each. These are for mounting the board in a convenient place within your console. It is important to consider that the reverse of the board is made from copper and that parts of this copper surface carry the electrical signals to and from the encoder. It is therefore necessary to ensure that whatever mounting method you use does not allow the reverse of the board to come into contact with any conductive surface, as doing so may present a fire risk and or cause irreparable damage to the board. It is suggested that suitable insulating spacers be used in mounting the board leaving a gap of at least 5mm between the board and the mounting surface. The front surface of the board is also made from copper and the same advice applies.

The board is suitable for mounting at any angle in any plane. The board must be installed in a position where it will not suffer condensing moisture, water, physical shock or any contact with moving parts. It must be protected from any conductive items, parts or waste that may fall on it.

Our Hardware Ethos.

The hardware used in this controller is an Atmel AVR along with other components. Some of these

components are readily available as a ready assembled 'core' unit which can then be programmed with whatever firmware you wish. Hauptwerk Hardware buy these 'dev' boards and use them to build our products. These microprocessors exclusively use our own production firmware and contain no boot loaders or other third party code. This firmware remains our intellectual property. It is copyright and protected from being read from the AVR.

The logic behind using these 'dev' boards is that they are readily available and likely to remain so for some considerable time. Should any of our products ever fail in the future, it is easy to simply unplug the dev board and replace it with a new one, safe in the knowledge that one will still be available. This is in contrast to our competitors bespoke boards whose availability is entirely dependent on provisions made by that particular manufacturer at the time.

Legal Disclaimer:

It is the installers responsibility to ensure that they have familiarized themselves with this product and its documentation and have the necessary understanding and technical and practical competence to be able to install and use it correctly. Whilst every care has been taken in the design, testing and documentation of this product, Hauptwerk Hardware will accept no liability whatsoever for any physical or consequential damage or injury caused by the use of any of our products in any circumstances.

Warranty.

All equipment supplied by us will carry a 12 month warranty against faulty parts or workmanship. Extended warranties are available in some countries at an additional cost. Should any part of the new system fail within this period we will repair or replace it free of charge. It should be noted however that correct operation of the new system depends on the existing console controls such as keyboards, stops etc. continuing to work correctly, along with power supplies et al, especially in pipe organs. Any failure of these existing controls will obviously have an adverse effect on the operation of the new system, this type of issue will ***not*** be covered under the warranty.

Any faulty item must be returned to us for inspection & repair. Initially the customer will pay the shipping for any products returned. All returns from outside the UK **MUST BE CLEARLY MARKED AS "WARRANTY RETURN - ZERO COMMERCIAL VALUE"** as Hauptwerk Hardware will **NOT PAY** any import duty on returns and any packages not marked as above will be returned or destroyed by UK Customs **at their discretion**.

Once the return is received by Hauptwerk Hardware we will video it's unboxing and testing. If the product is found not to be faulty a testing charge* will be made and the customer will be invoiced for this as well as the return shipping. The testing video will be made available to the customer.

If the product is found to be faulty due to faulty manufacturing or premature component failure Hauptwerk Hardware will repair or replace it at our discretion. We will reimburse the customer for the shipping costs they incurred in returning it and we will send the replacement or repaired item to the customer with free shipping.

The same procedure applies to returns from within the UK save for need to mark the package as warranty return. The warranty does not cover damage caused by mishandling, inappropriate connection, incompetent or inappropriate installation.

Further Information.

If you require any further information or have any questions please feel free to call us on +44 (0)

333 577 2393 and we will be happy to clarify anything or provide any further information you may need. Business hours are 09:30 to 17:00 Monday – Friday UK Time.

Contact Details.

Hauptwerk Hardware

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www.hauptwerkhardware.com