Hauptwerk Hardware

Pedal Board Encoder

Installation & User Manual

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Introduction

What is it?

The Hauptwerk Hardware Pedal Board Encoder is a device designed to connect to your pedal board. It works with any 8 by 4 diode matrix, which is the type most often used on commercial pedal boards. In addition to the pedal inputs it has one input for a single analogue control such as a swell or effects pedal. A single midi out socket provides the midi to control your virtual organ setup. It works with Hauptwerk, Grand Orgue and other virtual organ software.

What does it do?

It generates the necessary Midi signals as your pedal board and swell pedal are operated, and transmits these to the computer or synth via the legacy industry standard 5 pin DIN connection. It is powered by a USB connector. NOTE the USB connector is for power only – it does NOT carry the midi signal.

Who is it for?

The Hauptwerk Hardware Pedal Board Encoder is designed as an add on for virtual organ setups which require a pedal board that can send midi as a stand-alone unit. i.e. one which is not currently connected, or intended to be connected as part of a console which already sends midi to a virtual organ.

It is easy to use and suitable for anyone with a basic knowledge of electronics and capable of soldering to a reasonable standard.

Product Features.

- **Supports up to 32 pedals and one analogue control.**
- **Uses legacy MIDI 5 pin DIN connection.**
- **Powered by USB - No other power source required.**
- **Standard solder pads for connection to pedal board.**
- **No programming required, simply connect your pedals and Midi lead - Done!**
- **Works with Hauptwerk, Grand Orgue and other Virtual Organ Software.**

Board dimensions (WxLxH): 80 x 60 x 30mm (3.15" x 2.36" x 1.18”).

Operation.

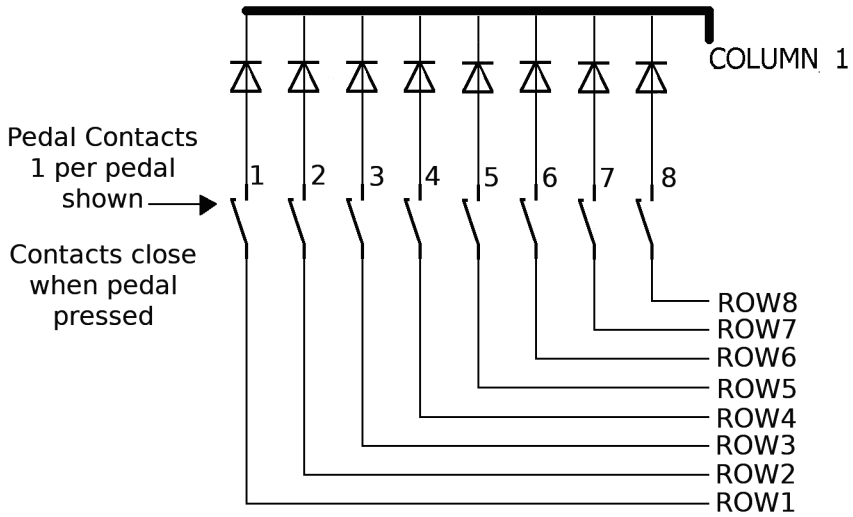
The 8 by 4 matrix.

This encoder works by sequentially scanning your pedals, which need to be arranged as an 8 by 4 matrix. This is the most common method of wiring a pedal board, and the one almost universally used by manufacturers in digital organs. Digital organs were introduced in the 1980s, so it is very likely that any organ, including it's pedal board, manufactured during or after this period will have been designed to work with digital circuits and thus will be wired as an 8 by 4 matrix.

For the sake of completeness, and so you can understand and identify the wiring from your pedal board I will quickly describe the matrix arrangement.

Firstly; if your pedal board has 12 wires coming from it (sometimes there can be 15, but only 12 are used), then it will use a matrix and thus be compatible with this encoder. If it has as many wires as pedals plus 1, then it is likely to be a single bus arrangement and NOT compatible with this encoder.

Secondly; once we have found how many wires come from the pedals we need to identify what each one does. A matrix is comprised of rows and columns. In the case of the pedals here there will be 8 rows and 4 columns. This is how we know there are 12 wires used, because 8 x 4 = 32 notes and 8 + 4 = 12 wires, one for each row (8) and one for each column (4). Below is a diagram representing one column and 8 rows of the matrix.



This arrangement is repeated four times along your pedal board.

So this works out that the leftmost pedal labelled as '1' is connected to ROW 1. This would be low C on the pedal board. The pedal connected to row 2 would be C# and so on up to pedal 8 which would be G. So you can see that when you press one of these pedals it connects it's row to the wire at the top which represents Column 1. Since all the row lines are connected to the encoder it is easy to see when and which pedal has been pressed.

As I said above this is repeated 4 times along the pedal-board. So in the next section (Column 2), the notes continue Row 1 represents G#, so the encoder knows that when ROW1 is connected to Column2 it has to send a G#.

In Column 3, Row 1 represents E and in Column 4 Row 1 represents C again but in the next octave.

You can either remove the covers from your pedal board and identify each row and column wire by visual inspection or you can use a multimeter and figure it out logically as I show in this part of this video https://youtu.be/0TROySTzBOM?si=9YzThZBLUcbaHN9g&t=4888.

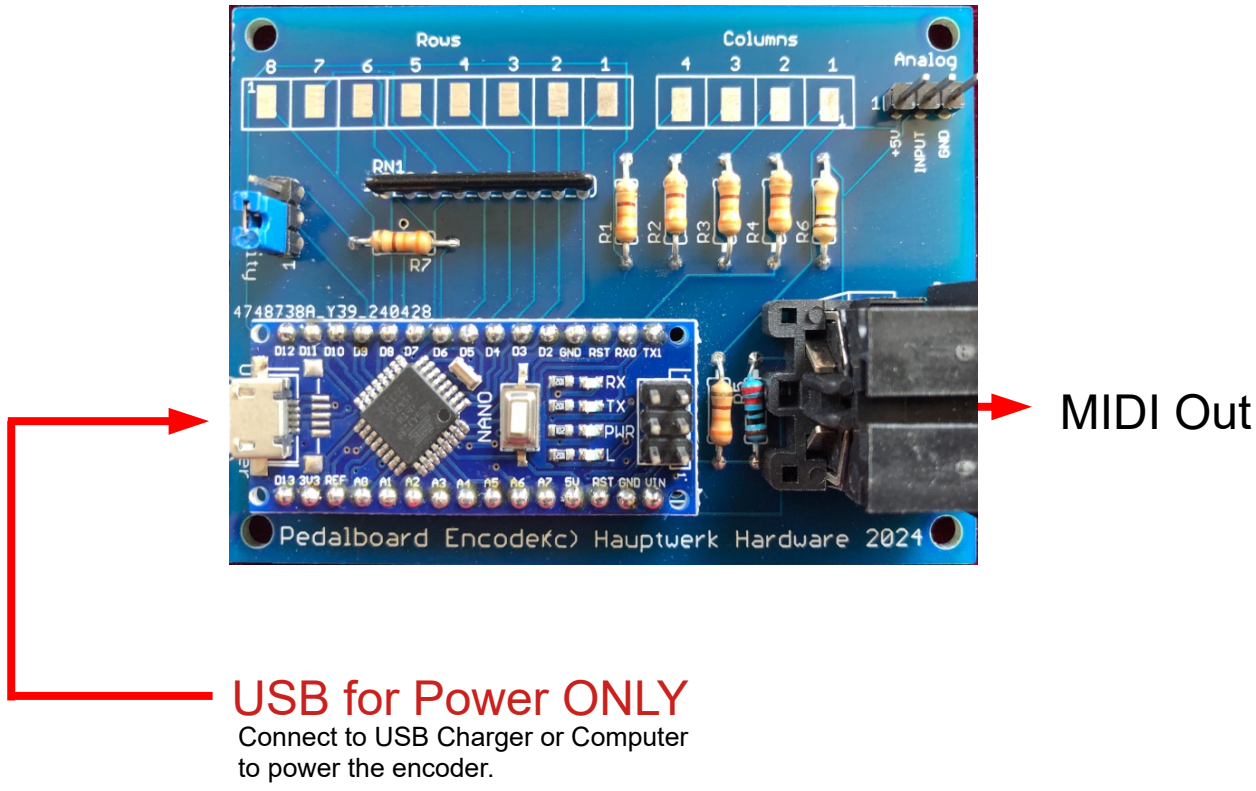
As discussed above this encoder is designed to work with a pedal board of up to 32 notes arranged as an 8 by 4 diode matrix, in addition it supports a single analogue control such as a swell pedal or volume control connected to the connector marked 'Analog'

Analogue controls produce an output whose voltage changes between 0v at the controls minimum position, and 5v at the controls maximum position. The 5 volt supply and the 0 volt ground connection are both provided from the pedal board encoder. As the control is advanced the voltage it produces rises, and falls again as the control is backed off. The encoder reads this voltage and produces Midi Control Change events as the control is operated. The computer running your virtual organ maps these events to whatever virtual control you choose.

The 5 volt supply and the 0 volt ground connections are both provided from the pedal board encoder. It is important that you use these 'reference voltage' connections on the encoder board to provide power to your analogue controls. This is because if you were to use another power supply, say one already installed as part of the organ, the voltage that it supplies may be greater than the reference voltage that is expected on the encoder input. ***This would be bad and very likely to damage the encoder.*** If the voltage supply to the analogue control is too low the control will not provide the full travel range of the virtual control, worse still if the supply voltage is not stable the virtual control will waver and behave in unexpected ways, that is why the voltage outputs are provided on the encoder!

Installation and use.

General.



The Pedal board Encoder has 12 solder pads, one for each row 1 through 8 and one for each column 1 through 4, and one 3 pin connector for the analogue input.

These solder pads are where you will connect your pedal's wires. As you can see from the above picture there are also two other connections to the board; the USB connection ***which is only used to power the encoder. No MIDI data is available from this port***, and the 5 Pin DIN socket which is the MIDI output from the board and is connected to either a synthesiser via a standard 5 pin Midi cable or to a computer via a USB to MIDI adaptor.

The Polarity Jumper.

Below the solder pad for Row8 there is a jumper labelled 'Polarity'. This is to select the polarity of the diodes in the matrix. Since there is no standard as to which way round the diodes should be connected, some manufacturers may connect their diodes one way round and others connect them in reverse. If none of your pedals appear to work and no midi is sent from the encoder then try putting this jumper in the other position. You cannot cause any harm to the encoder or the pedals if this jumper is in the wrong position, it simply means that no midi will be sent until it is set correctly for your particular pedal board. Note that you need to reboot the encoder whenever you change the polarity setting by removing the power to the encoder, waiting a second or so and then restoring power in order for the new setting to take effect.

Connecting the Pedal Wiring.

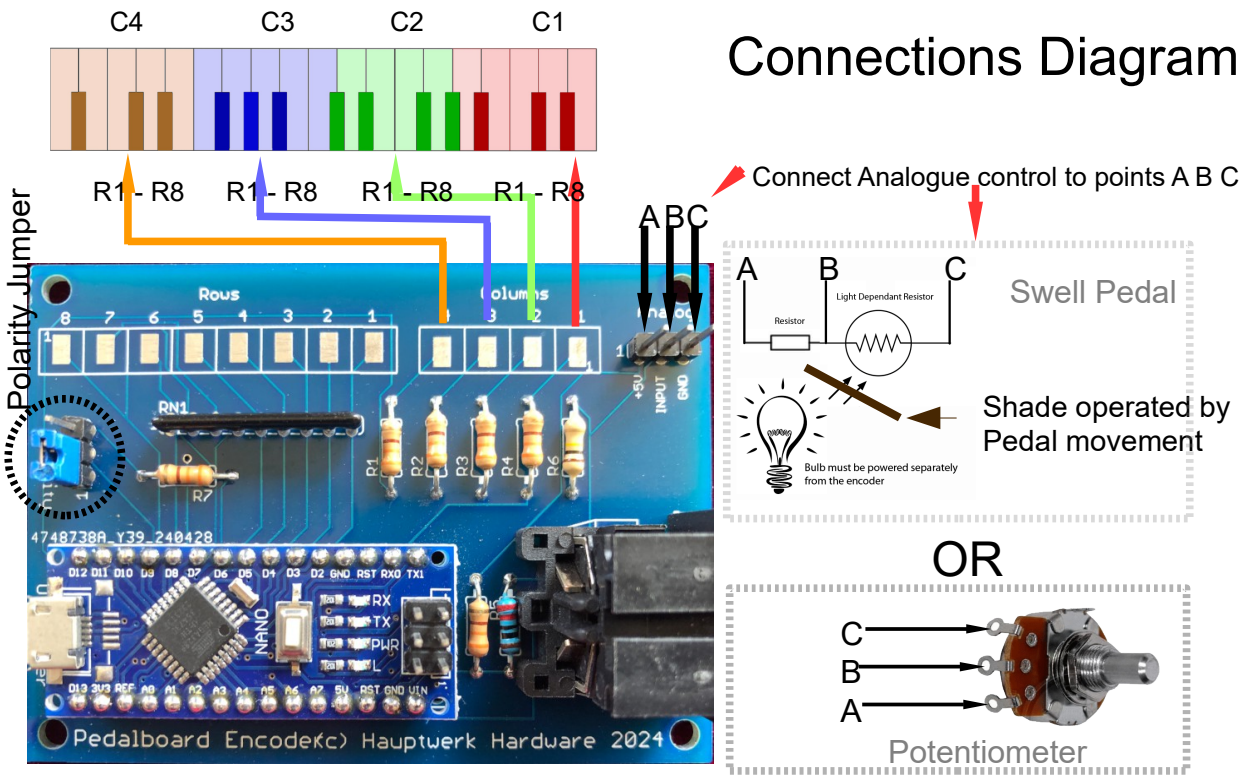
Once you have identified what each of your pedal wires does in terms of row1 etc. as discussed above it is time to connect them to the encoder. The matrix diagram above shows a single column (consisting of 8 pedals) and I said this is repeated four times along the pedal board. **This does not mean that there are four sets of row wires.** The row wires are simply connected to ***ALL*** rows along the keyboard. In other words row1 column 1 is connected to row 1 column 2 and row 1 column 3 etc. and the same applies to all the other rows. **Therefore the wiring to the external world only consists of 8 row wires and 4 column wires**. You would simply solder these wires to their appropriate solder pads as marked on the encoder board.

Connecting the Swell Pedal.

The analogue input can be used for a swell or expression pedal as well as any other variable control such as a rotary volume control or a drawbar. If you have a pedal that is fitted with a potentiometer you simply have to run three wires from the pot' to the Swell Pedal input. This input has three pins and they simply connect to the pot' in the way shown below. In other words the centre pin of the input connects to the centre pin of the pot and the outer pins of the input connect to the outer connections of the pot', it does not matter which outer pin connects to which side of the pot' so long as the centre goes to the centre of the pot'. If the swell pedal operates 'backwards' then simply reverse the outer two wires!

There are other possibilities for connecting a swell pedal. Many older swell pedals have an optical arrangement containing a light bulb and a light dependant resistor separated by a shade which moves with the action of the pedal.

This is arranged so that more light is allowed to fall onto the LDR as the pedal is advanced. It is possible to use this type of pedal with the pedal board encoder but you need to add a resistor and ensure that the power supply for the light bulb is completely separated from the encoder wiring. The diagram below shows how to wire everything up.



The diagram above shows two types of analogue controls.

The first, shown on the left of the diagram is a simple potentiometer. These are very common and can be found used as rotary controls for functions such as master volume, tuning, etc. as well as fitted to effects pedals. They usually have a value marked on them which is their resistance in ohms. Any potentiometer with a value of between 500 to 50,000 (often shown as 50K, or especially on new ones 503, where it decodes as 50 plus 3 more zeros giving 50,000) ohms will work.

The second type as shown on the right in the picture is comprised of a lightbulb and a Light Dependant Resistor (LDR), with a shade between them which moves to expose more of the LDR to the light as the pedal is advanced. Many manufacturers use this method and originally there would be only four wires coming from the pedal to the existing internal electronics of the organ. That is two for the bulb, and two for the LDR. Some manufacturers such as Allen organs used two LDR's on their pedals and so there were more wires. A simple visual inspection with the control disassembled will reveal how the wires are connected.

For our purposes we need to add a resistor as in the diagram. The value of the resistor will be determined by initial measurement and a bit of trial and error. Basically the required value of the additional resistor, marked 'Resistor' above should be somewhere close to the dark resistance of the LDR. If you don't have a meter that can measure resistance then I would suggest trying a 4.7K resistor and then substituting that with a 10K resistor and see which works best for you. The lowest value you should try would be around 1K, below that you stand a chance of damaging the LDR.

Wiring

It is important to keep the wiring as neat as possible and to secure the resulting wiring loom carefully using zip ties or some similar cable restraint system. Do not create a birds nest of wiring or you will have a terrible time sorting it out if there is any problem after you're done installing it, also untidy wiring that is longer than it needs to be can act like an antenna and allow all sorts of interference to have an effect on the operation of your controls..!

Mounting

The Pedal Board Encoder has 4 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 both the board and the encoder itself. 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.

Notes.

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.