Hauptwerk Hardware®

Keyboard Matrix Analyser

User manual

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Table of Contents

Who is it for?....2
What does it do?....2
How do I use it?....2
Source Code....8
Mounting....8
Legal Disclaimer:....8
Warranty....9
Further Information....9
Contact Details....9

Who is it for?

The Keyboard Matrix Analyser is for anyone with a diode matrix circuit which they want to connect to an encoder. It doesn't only work with keyboards but also with pedal-boards, stops and pistons. In fact anything with a matrix configuration. It can recognize any matrix with up to 16 wires and detect the schema used from 14 x 2 up to the ubiquitous 8 x 8 used in the majority of commercial organs.

What does it do?

The purpose of the analyser is to remove the need to electrically test the keyboard using a multimeter and a logical approach. I have done a number of videos on how to do this and still receive a plentiful supply of emails asking whether a certain organ's keyboards will simply plug into one of the Hauptwerk Hardware encoders. Sadly that is not an easy question to answer for certain BUT given the myriad ways that 8 column wires and 8 row wires can be attached to a 16 way plug – well you get the idea...

This is where the Keyboard Matrix Analyser comes in. Simply connect the 16 wires from your matrix, in any order, to any of the analyser's pads and it will do all the hard work for you and figure out which function, i.e. Row or Column number, each wire performs. Once you know this it is simple to connect these wires to the right pins or pads on your encoder.

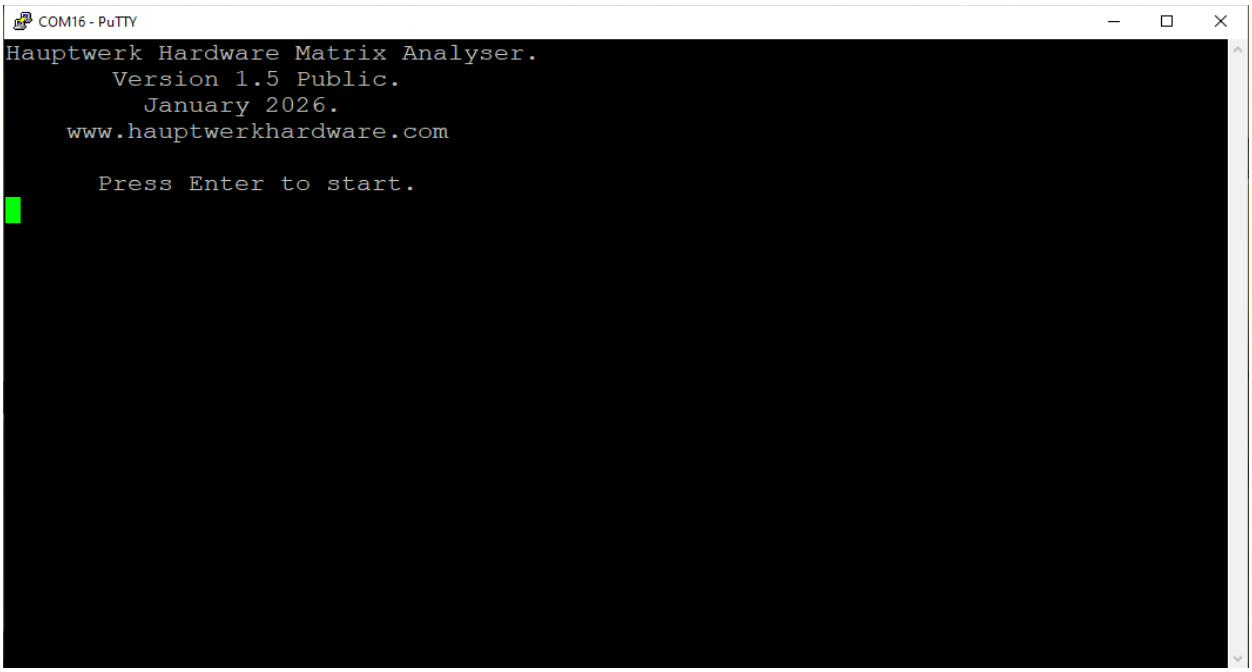
How do I use it?

The Keyboard Matrix Analyser has a 16-Way IDC socket as well as 16 discrete solder pads for the connection of your keyboard. If it has a plug you can simply plug it into the 16-Way socket, if it does not have a plug, or it's plug is incompatible with the 16-Way socket, then remove the plug and connect the 16 wires to the solder pads. It does not matter which wire you connect to which pad, that is the point of the device. It will figure out what each wire does for you.

Once you have your keyboard, or other, matrix connected to the unit you simply plug it into a PC using it's USB port and open a terminal program. I use PuTTY which can be downloaded free and is easily found by searching 'Putty download' in Google. If you are using another operating system then you can find the relevant tty or serial terminal program for that.

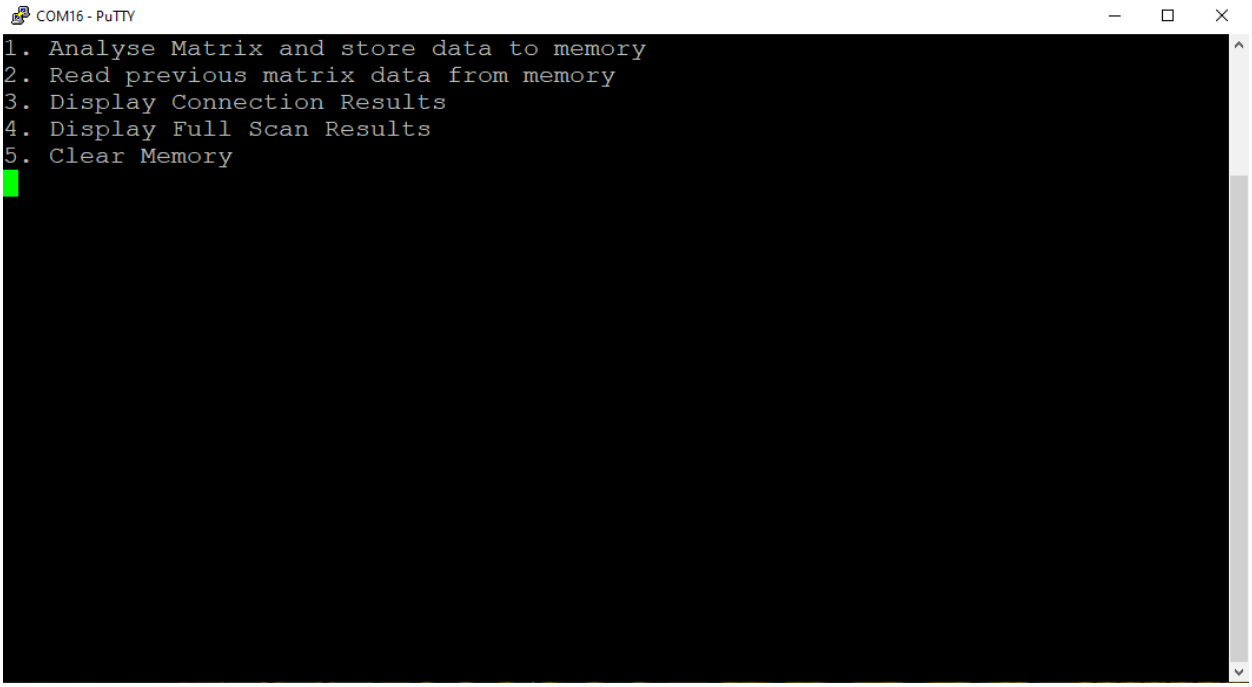
Once you have the serial program open you need to set the correct parameters for the analyser. You will need to know which COM port your computer assigned to the analyser, and you can find this from the Device Manager. It will appear in the Ports (COM & LPT) section and is usually listed as

CH340 Serial Device followed by it's assigned COM port number. Once you have ascertained the port number you can insert this into the PuTTY settings window. First select Serial as the connection type then set the Speed to be 115200. That should be enough as the remaining default settings should work. Once you have completed this you can click Open and you should get a screen like the one in the following picture.

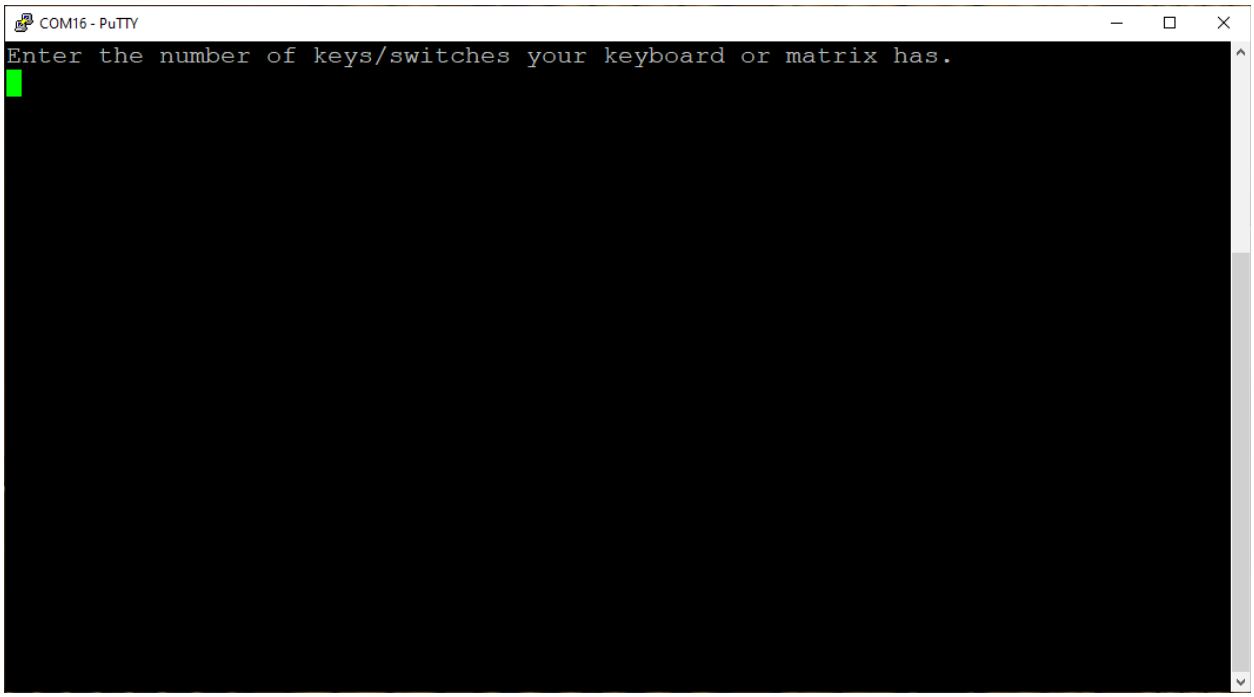


From here on in it's just a matter of following the instructions presented in the serial window.

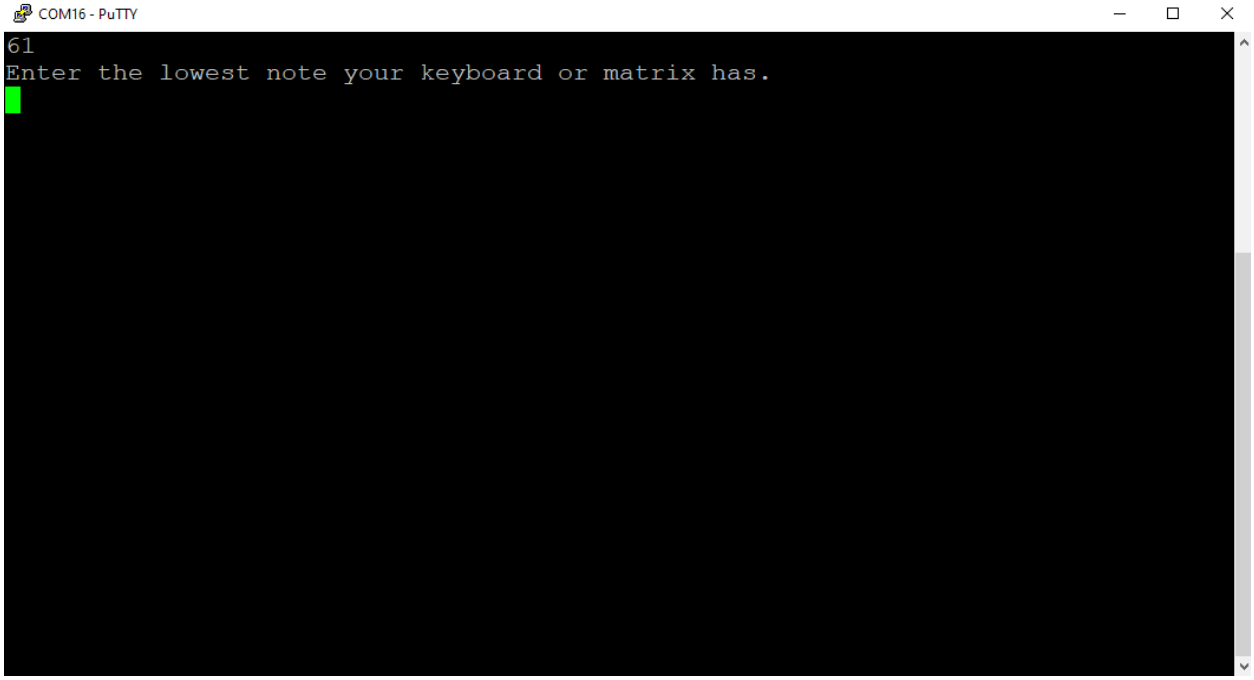
So; press Enter and you will see the main menu screen as shown below.



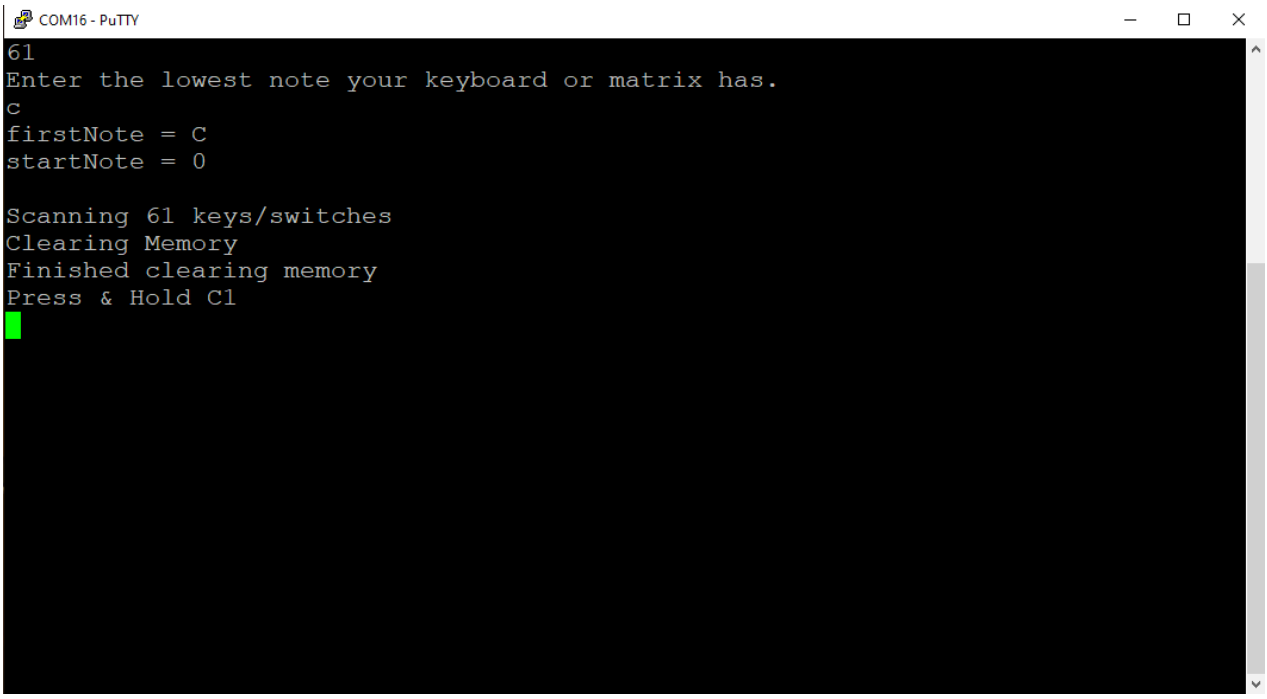
From here you can follow the options in order. Firstly press 1 to initiate the analytic scan of the keyboard. It will ask you for the number of keys on your keyboard. It is important to enter the correct number for your keyboard.

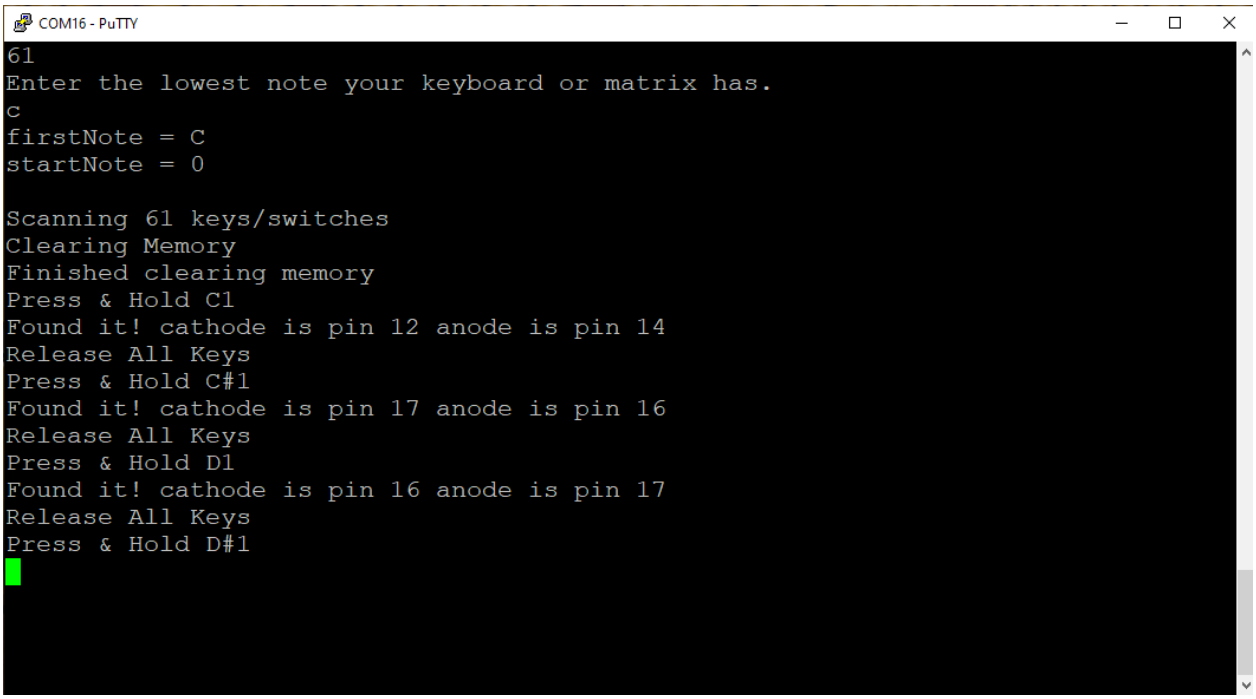


Next it will ask for the name of the note your keyboard starts on, this is usually C but some keyboards differ.

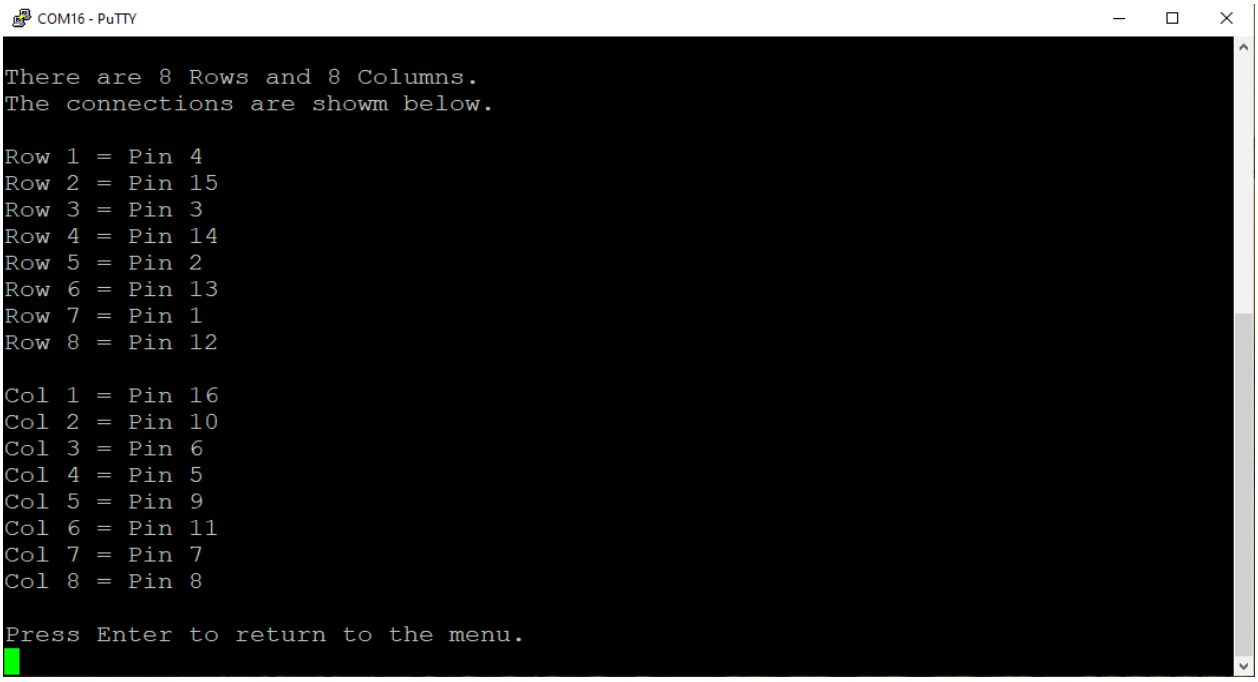


Next it will ask you to press & release each key in turn, letting you know when it has found the key you are pressing.





Once you have completed this part it will tell you that it is complete and invite you to press Enter to return to the menu. From there you would usually select option 3 which will display the results as in the next picture.



This is the information you have been waiting for as it tells you the role of each wire. So in the above picture the first row of the matrix, Row 1 is the wire connected to Pin (or pad) 4 of the analyser board, and so on for the rest of the wires.

If you want to look more deeply into the results of the analysis of the keyboard you can select option 4 from the menu, and that will give you a detailed display as per the following picture.

COM16 - PuTTY

```
note Number 1 note Name C anode = pin 4  cathode = 16
note Number 2 note Name C# anode = pin 15  cathode = 16
note Number 3 note Name D anode = pin 3  cathode = 16
note Number 4 note Name D# anode = pin 14  cathode = 16
note Number 5 note Name E anode = pin 2  cathode = 16
note Number 6 note Name F anode = pin 13  cathode = 16
note Number 7 note Name F# anode = pin 1  cathode = 16
note Number 8 note Name G anode = pin 12  cathode = 16
note Number 9 note Name G# anode = pin 4  cathode = 10
note Number 10 note Name A anode = pin 15  cathode = 10
note Number 11 note Name A# anode = pin 3  cathode = 10
note Number 12 note Name B anode = pin 14  cathode = 10
note Number 13 note Name C anode = pin 2  cathode = 10
note Number 14 note Name C# anode = pin 13  cathode = 10
note Number 15 note Name D anode = pin 1  cathode = 10
note Number 16 note Name D# anode = pin 12  cathode = 10
note Number 17 note Name E anode = pin 4  cathode = 6
note Number 18 note Name F anode = pin 15  cathode = 6
note Number 19 note Name F# anode = pin 3  cathode = 6
note Number 20 note Name G anode = pin 14  cathode = 6
note Number 21 note Name G# anode = pin 2  cathode = 6
note Number 22 note Name A anode = pin 13  cathode = 6
note Number 23 note Name A# anode = pin 1  cathode = 6
note Number 24 note Name B anode = pin 12  cathode = 6
note Number 25 note Name C anode = pin 4  cathode = 5
note Number 26 note Name C# anode = pin 15  cathode = 5
note Number 27 note Name D anode = pin 3  cathode = 5
note Number 28 note Name D# anode = pin 14  cathode = 5
note Number 29 note Name E anode = pin 2  cathode = 5
note Number 30 note Name F anode = pin 13  cathode = 5
note Number 31 note Name F# anode = pin 1  cathode = 5
note Number 32 note Name G anode = pin 12  cathode = 5
note Number 33 note Name G# anode = pin 4  cathode = 9
note Number 34 note Name A anode = pin 15  cathode = 9
note Number 35 note Name A# anode = pin 3  cathode = 9
note Number 36 note Name B anode = pin 14  cathode = 9
note Number 37 note Name C anode = pin 2  cathode = 9
note Number 38 note Name C# anode = pin 13  cathode = 9
note Number 39 note Name D anode = pin 1  cathode = 9
note Number 40 note Name D# anode = pin 12  cathode = 9
note Number 41 note Name E anode = pin 4  cathode = 11
note Number 42 note Name F anode = pin 15  cathode = 11
note Number 43 note Name F# anode = pin 3  cathode = 11
note Number 44 note Name G anode = pin 14  cathode = 11
note Number 45 note Name G# anode = pin 2  cathode = 11
note Number 46 note Name A anode = pin 13  cathode = 11
note Number 47 note Name A# anode = pin 1  cathode = 11
note Number 48 note Name B anode = pin 12  cathode = 11
note Number 49 note Name C anode = pin 4  cathode = 7
note Number 50 note Name C# anode = pin 15  cathode = 7
note Number 51 note Name D anode = pin 3  cathode = 7
note Number 52 note Name D# anode = pin 14  cathode = 7
note Number 53 note Name E anode = pin 2  cathode = 7
note Number 54 note Name F anode = pin 13  cathode = 7
note Number 55 note Name F# anode = pin 1  cathode = 7
note Number 56 note Name G anode = pin 12  cathode = 7
note Number 57 note Name G# anode = pin 4  cathode = 8
note Number 58 note Name A anode = pin 15  cathode = 8
note Number 59 note Name A# anode = pin 3  cathode = 8
note Number 60 note Name B anode = pin 14  cathode = 8
note Number 61 note Name C anode = pin 2  cathode = 8
note Number 62 note Name C# anode = pin 0  cathode = 0
note Number 63 note Name D anode = pin 0  cathode = 0
note Number 64 note Name D# anode = pin 0  cathode = 0
Press Enter to return to the menu.
```

This information may be of use if you are getting any odd or unexpected results from the matrix results display from option 3 above. It shows the connections for each diode used for each key and allows you to have a visual check as to what exactly is going on within your matrix.

Returning to the menu there are two options left that we haven't covered; those being option 2: Read Previous Matrix Data From Memory and option 5, Clear Memory.

Once the analyser has completed the analysis of the keyboard it stores the data in EEPROM memory. This type of memory does not lose it's data when the power is turned off or the unit reset. This saves you having to write down the result of what each wire does (and promptly losing the paper you wrote it on, which is always what happens to me!). You can disconnect the analyser from the keyboard and the computer and then at a later date, when required, you can connect the analyser to the computer again, and by pressing option 2 from the menu it will read the data back from the memory and you can then see the results by selecting option 3 as before. This means that you only need to connect the analyser to the computer and not have to connect the keyboard to the analyser this time.

Source Code

Because this device is likely to be used only a couple times during the build of your organ project I have made the source code available via the Hauptwerk Hardware web shop for a nominal fee. This is so that if you already have an Arduino board of your own you can simply plug the code into the Arduino IDE and upload it to your own device, thus saving the cost of having to purchase the unit ready-made. Of course you will not have the PCB, but if you are an enthusiast who already has the necessary Arduino board it should be easy for you to find a way to connect the wires from your keyboard to your Arduino.

Mounting

The Keyboard Matrix Analyser is not really expected to be mounted in any permanent way because it's mode of use is expected to be transient. Once you know what your keyboard wires all do there is no further need to use the analyser – until the next keyboard comes along :-)

That said though, the usual common sense rules still apply, and the board must be used in a position where it will not suffer condensing moisture, water, physical shock or any contact with moving parts, and it must be protected from any conductive items, parts or waste that may fall on it.

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 miss handling, 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.

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