Hauptwerk Hardware

System One

Full Organ Rebuild Solution

SYSTEM ONE
Hauptwerk Hardware

Control Board Installation & User Manual

Bob Howlett

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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 USB 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 USB Midi as their input.

The System ONE Control Board.

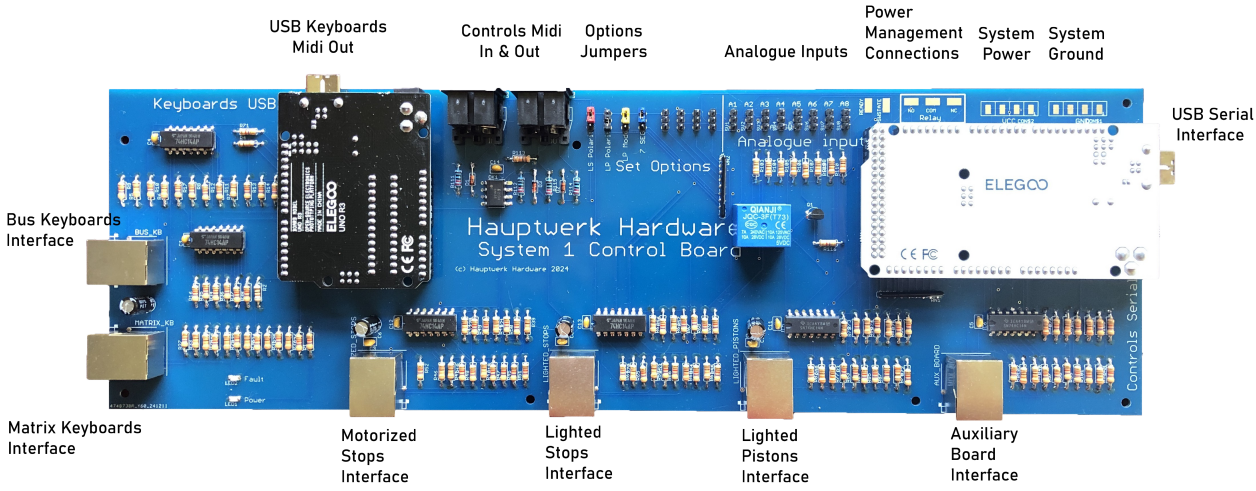
The System ONE Control Board is really the heart of the entire System ONE concept. It is from this board that you will connect your console to the computer which runs your virtual organ software. The control board is the main hub of your console system. It has a selection of connectors where you connect the different interfaces that you use with the system. Connections between the various interface boards and the control board are made using standard cat5 Ethernet type cables. These are readily available in custom lengths and as well as being very reliable are relatively cheap. One would usually mount the interface board physically close to the relevant controls and then use the appropriate length cat5 cable to connect it to the main control board.

The connections on the control board are as follows:-

- USB type B interface for the midi events generated by your manuals and pedals.
- 5 Pin DIN Midi interface for the midi events used to control the console and virtual organ software.
- RJ45 interface for a chain of Matrix type keyboards or pedals interfaces.
- RJ45 interface for a chain of Bus type keyboards or pedals interfaces.
- RJ45 interface for a chain of Motorized stop interfaces.
- RJ45 interface for a chain of Lighted stop interfaces.
- RJ45 interface for a chain of Lighted piston interfaces.
- RJ45 interface for an auxiliary interface board.
- USB type B interface for connection of a serial terminal.
- 8 x 3 pin header interfaces for analogue controls i.e. Swell pedal, Crescendo pedal etc.
- Solder pads for power (+5v) and GND.
- Built in LED indicators for power and fault condition.

System ONE can accommodate any or all of the above interfaces with the following maximum limitations.

- Matrix Key/pedal boards 7
- Bus Key/pedal boards 7
- **Maximum TOTAL key/pedal boards of both types 7**
- Motorized stops 120
- Lighted stops 128
- Lighted pistons 128
- Miscellaneous 5v Bus inputs – via Auxiliary board 8
- Miscellaneous LED outputs – via Auxiliary board 40*
- Two digit 7 segment LED display – via Auxiliary board 1



Above is a picture of the System ONE control board showing the different interfaces and other connections.

In a typical installation only some of these connections would be used.

Keyboards & Pedalboard

There would usually be one or more keyboard interfaces. These can be a mixture of Bus and Matrix type keyboard interfaces. Both types can be used at the same time and they can also be daisy chained together. You can have a maximum of 7 keyboards in total and this can be made up of any number of both types.

The midi output generated by these keyboards has a dedicated USB midi connection. This is in order to avoid any latency when other controls are being operated whilst the user is playing a musical passage as may be the case when a thumb piston is pressed and the registration is updated. The amount of midi events sent back and forth between the console and the virtual organ could interrupt the flow of midi events sent from the keyboards if they both shared an interface. By keeping both streams of midi separate this eventuality is avoided.

Console Controls

Looking along the bottom of the board you will notice the other connections for the different types of interface. Only the interfaces required for the physical controls on the console would be used. The remaining ones simply left disconnected. As can be seen in the picture there are sockets for the connection of interface boards to control motorized stops, lighted stops, lighted pistons and an auxiliary board. Details of these different interface boards are given in their respective installation and user manuals which can be found on the website downloads page.

Along the top of the control board there are further connectors. The 'Controls Midi In & Out' is a 5 Pin DIN Midi interface which carries all the midi events generated by the console 'controls', i.e. everything **except** the events generated by the keyboards. This includes the analogue events as well as all the other controls connected to the various interfaces named above. One would usually use a USB to DIN midi adaptor to connect this interface to the virtual organ computer. Please note that it is important to use a good quality branded adaptor for this as many of the cheaper ones do not play well with anything but simple note on/off events in slow succession. You have been warned!

Options Jumpers

Continuing along the top of the board there is a segment containing the jumpers which are used to select the various modes of operation for some of the interface boards. You do not need to change any of these jumper positions unless you have connected their associated interface boards. If you have not connected and are not using Lighted stops, lighted pistons or the 7 segment display it is important to keep these jumpers in their original positions, that is fitted in the position closest to the back of the board. If they are changed to the front most position without the appropriate interface connected the control board will continuously send note on/off events which are not required and will be likely to slow the operation of, not only the control system but your virtual organ software as well. Again; you have been warned!

Analogue Inputs

After the options jumpers comes the analogue inputs, of which there are eight. These consist of sets of three header pins each onto which you can plug your analogue controls such as Swell pedal, master volume control, and so on. These connectors follow the same pattern electrically as those on our other products such as the Swell Pedal Encoder and the Tutti Encoder. This makes it easy to migrate from one system to another should that be desired. These connectors have the analogue input in the centre and are flanked by the +5v and GND connections. This makes it easy to simply connect a three core cable to a potentiometer. It is strongly advised to use the +5v pin on the relevant analogue input as the power source to your control potentiometer as opposed to any other voltage source. There are two reasons for this; first these +5v pins are protected against short circuit by the inclusion of a 330 ohm resistor for each one. Second; by using this 5v source it becomes impossible for the voltage applied to the actual analogue input, the centre pin, to ever exceed 5v. If this pin is ever subjected to any voltage higher than 5v instant and irreparable damage will be caused to the analogue to digital converters on the control board.

Power Management

The next connections are for power management and are used in conjunction with the System ONE Power Management Board. The first pad, marked 'Ready' is used to indicate to the power management board when the computer system running the virtual organ software has completed booting and the virtual organ is loaded and ready to play. This is arranged by configuring the virtual organ software to send a midi event to the control board when it is ready. When the control board receives that signal it forces the 'Ready' pad high and this, in turn causes the power management board to turn the LED from red to green. The next pad is marked 'swstate' and is to be connected to the console's on/off switch. This switch does NOT carry any mains power but is simply a low voltage switch which connects to the power management board. When the 'swstate' pad is set to a logic HIGH the control board will send a midi note 126 off on channel 10. This is used by the virtual organ software to trigger a save and shutdown event. As well as sending the midi event the controller will also set the 'Ready' pad back to LOW which causes the power management board to change the LED back to red. Once the computer has completed it's shutdown procedure the LED will be turned off.

This power management arrangement is useful for a headless system where it is desired to use the console/organ in exactly the same way as one would a dedicated organ. i.e. one which does not use a virtual organ computer. This is helpful to some organists that prefer to have a simple on/off control and no need for any computer screen, keyboard & mouse.

Amplifier Control

Continuing to the right we next have the NO, COM, NC pads marked as Relay. These are 'dry' contacts and are changed over when the 'Ready' pad is active. Their main purpose is to control a 'remote switching control signal' to external amplifiers. This ensures that the system amplifiers are not powered until the virtual organ has booted and is ready to play. The reason for this is to suppress the irritating pops and bangs that issue from the computers sound interface as the drivers are loaded during boot.

Power Options

The last two connections on the top edge of the board are +5v and GND. There are 4 pads for each of these functions. You can power the board from these and you can take power from them if the board is powered by another source such as USB. When one connects a USB lead between the control board and a computer it will supply power to the control board. This can be used to advantage as it minimises the requirement for external power. If the board is powered in this way one must take steps to ensure that any controls connected via the various interface boards do not exceed a current draw of 500mA in total. Also it is inadvisable to connect two USB cables at the same time, as may be the case when monitoring the Serial Comms data with a USB cable connected for the keyboards. This is because of the way that USB controls power fed to the computer's USB ports. There are devices which plug in line with a USB type A plug and break the power connection whilst maintaining the data and ground connections. I strongly recommend using one of these whenever there is a possibility of feeding power 'back' up a USB connection. In other words if you power the board via the +5v and GND pads then please ensure you fit a USB Power Blocker when connecting any USB cable, also if you connect more than a single USB cable that powers the board.

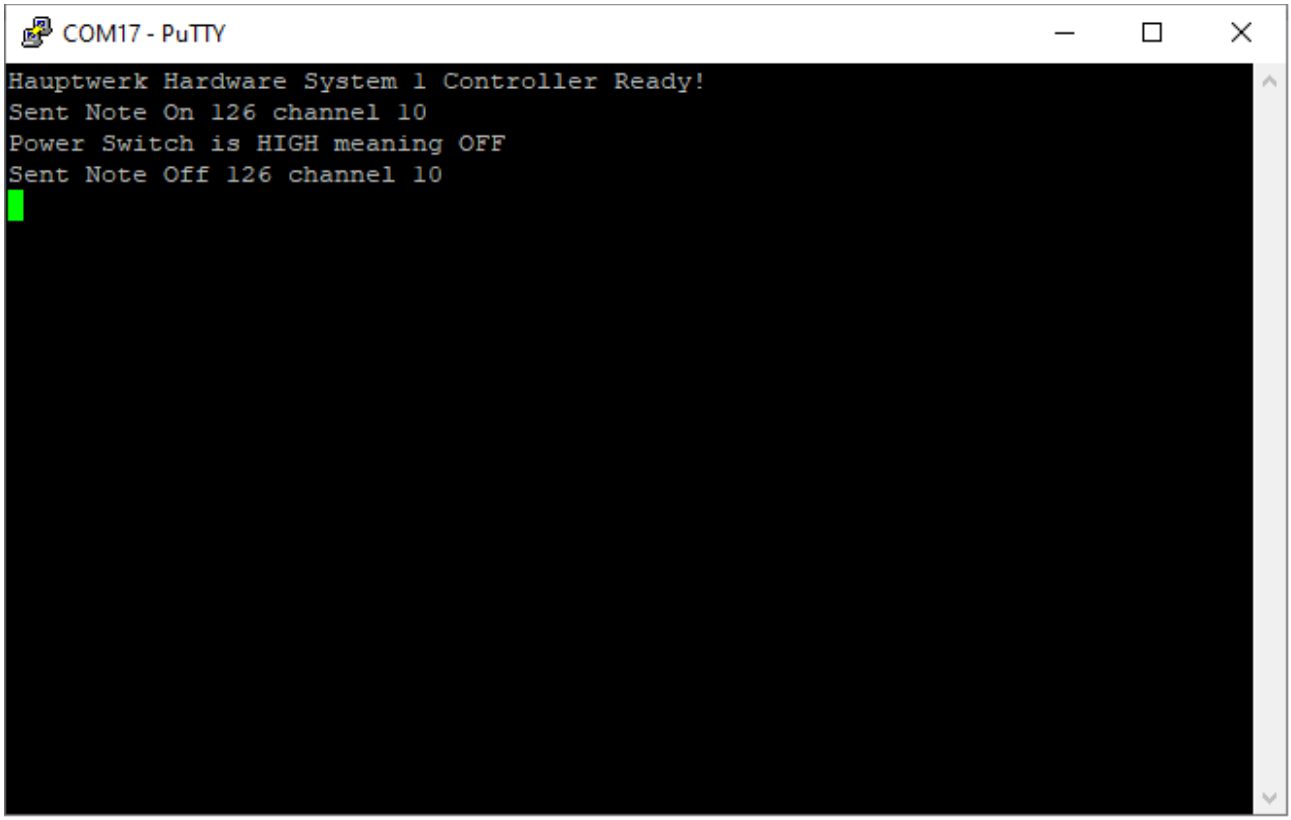
Below is a picture of a USB Power Blocker of the type readily available from Amazon.com

USB Serial Comms.

The last connector is the USB Serial connection mounted on the Elegoo daughter board. This is used to monitor what is being sent and received by the control board. You can access the data sent from this port by connecting to it using a Serial Terminal program such as PuTTy. When connecting to the control board, in the PuTTy connection screen you would choose 'Serial' as the connection type, 115200 as the Speed and whatever your computer enumerates the COM port number to be as the Serial Line. You can find this number from the Ports (COM & LPT) in your computer's Device Manager.

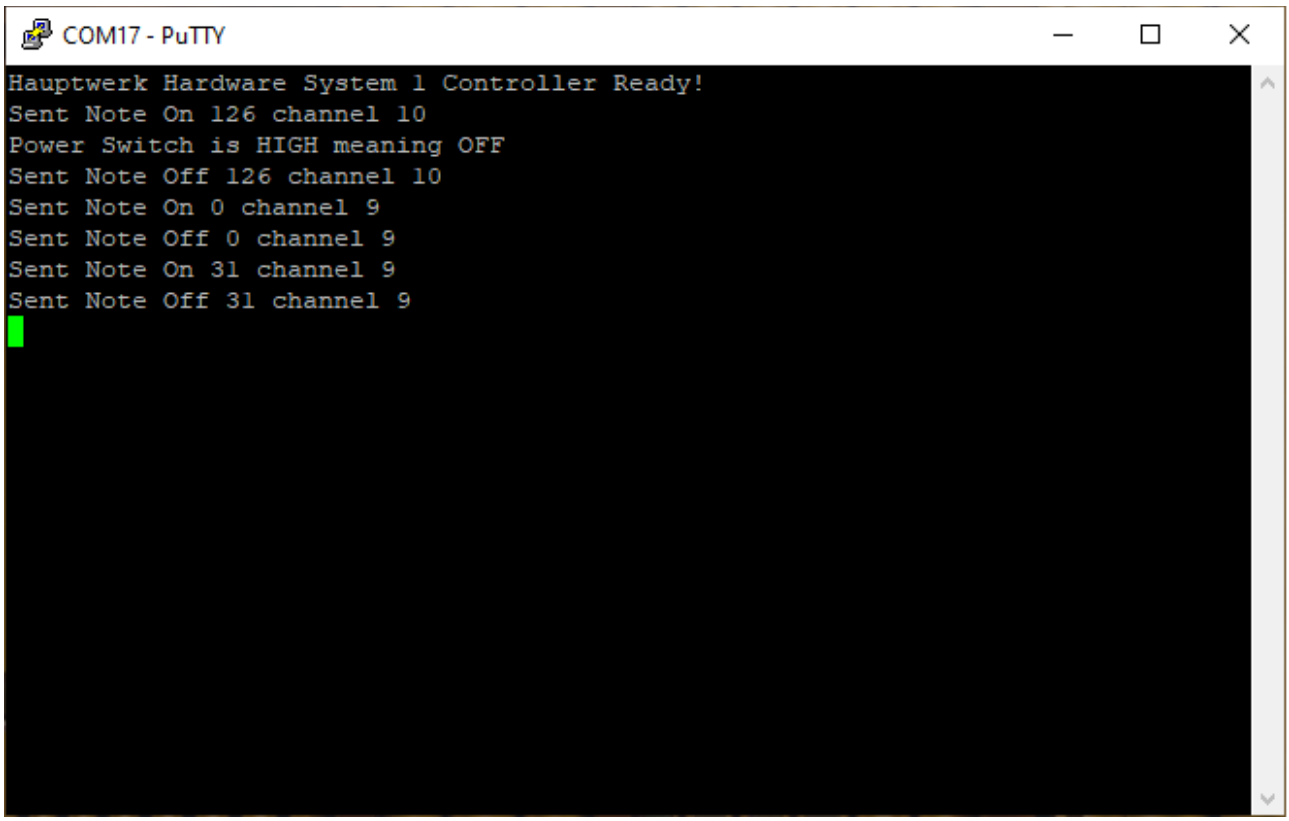
Once connected you will see the following displayed in the PuTTy window.

This is the initial data sent when the system is initialized. The events sent on channel 10 are power management events as is the note about the power switch being HIGH.

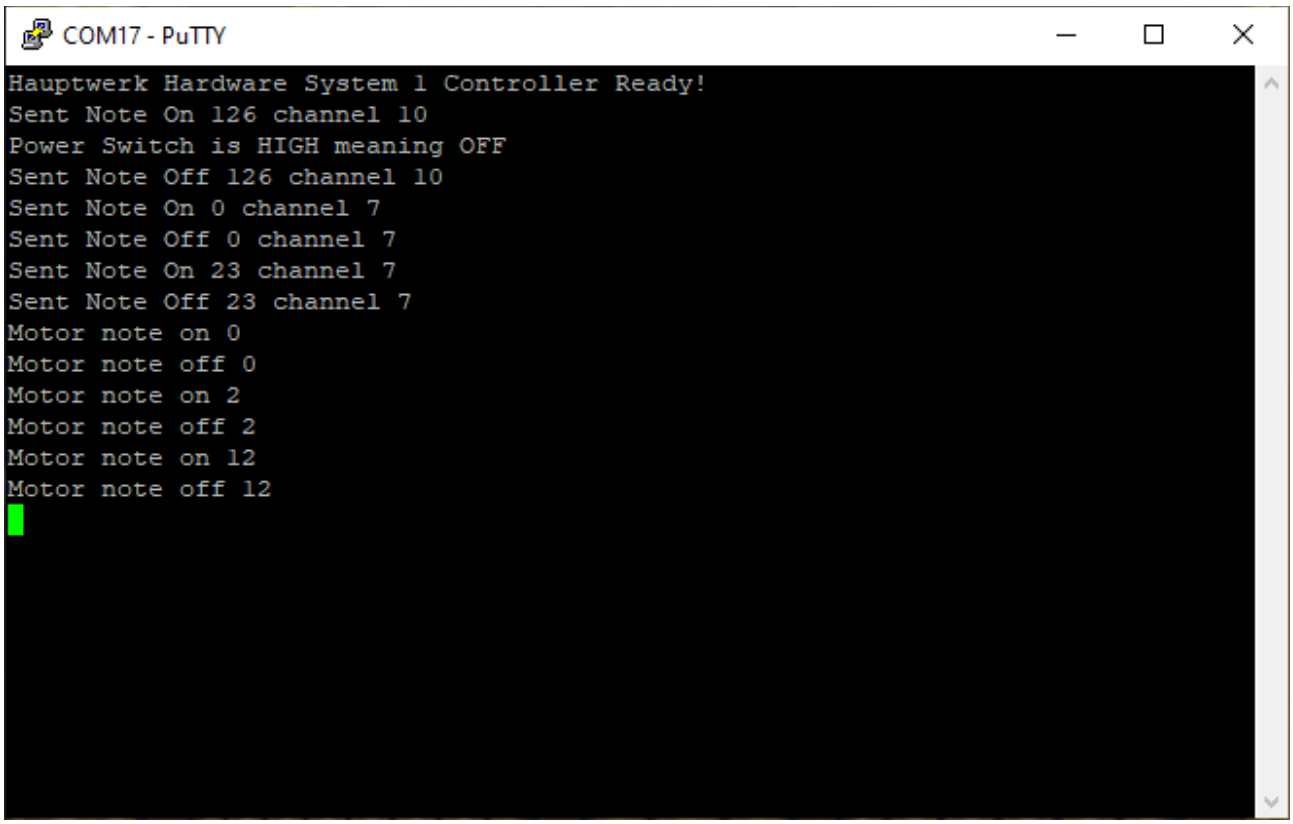


As you operate controls on your console and the control board generated the midi signals which it sends to the computer it displays them in the PuTTy window.

The picture below shows the data sent to the terminal when Lighted stop number 0 is operated on and off followed by Lighted stop number 31.



Below is a picture showing the data sent to the terminal when motorized stops number 0 and 23 are operated followed by the data which the control board has received via midi from the virtual organ to move motorized stops 0, 2 and 12 on, then off again.



As you can see this data is very helpful in setting up and troubleshooting your console installation as it shows what is being sent to the computer in the form of midi as you operate the various console controls as well as the data received from the computer which controls the console controls, so you can check that the relevant lighted stops or pistons respond to the received midi commands as well as making sure the motorized stops move. Without this data you would not know for certain what midi the control board was receiving, if anything at all!

Mounting

The System ONE Control Board has 7 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. 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 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.

Hauptwerk Hardware

0333 577 2393

contact@hauptwerkhardware.com

www.hauptwerkhardware.com

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