Hauptwerk Hardware®

Table top Organ Controller

Installation & User Manual

Bob Howlett

January 2026

© Hauptwerk Hardware 2026

Table of Contents

Introduction....3
What is a Table Top Organ?....3
What does a Table-top Organ Controller actually do?....3
Who is it for?....4
The Table-top Organ Controller....4
Keyboards & Pedal-board....5
Console Controls....6
Options Jumpers....6
Analogue Inputs....6
Power Options....7
USB Serial Comms....7
Mounting....10
Our Hardware Ethos....10
Legal Information:....10
Warranty....11
Further Information....11
Contact Details....11

Introduction.

What is a Table Top Organ?

Table top organ is the name I use to describe a small console consisting only of two or three manuals and a number of lighted thumb pistons, with the option for a pedal-board and up to three swell or expression pedals which can be plugged into the main instrument as desired.

These instruments are popular for practice use, as well as providing a manageable solution for home use when controlling virtual pipe organ software such as Hauptwerk. Their main advantage being that they are small, light and portable, and therefore suitable for use in an environment with limited space.

Such an instrument does not usually have any stops because since it is envisioned that the instrument will be used with a virtual organ setup, such as Hauptwerk or Grand Orgue, the user is able to set the required registrations via the computer screen before starting to play, and then recall them as required, by pressing the appropriate pistons. By working like this, stops become redundant and much physical space can be saved thus making a more manageably sized instrument.

Illustration 1: A Table top organ

What does a Table-top Organ Controller actually do?

A Table-top organ controller is actually two controllers built on a single board, which is designed to be the right size to fit into a keyboard stack behind the lowest, usually designated the Great, keyboard. It contains a midi encoder as well as a Lighted Piston Controller. The midi encoder part generates the appropriate midi as the keys and pistons are pressed, and the lighted piston controller

part illuminates and extinguishes the piston LEDs, as the midi received from the virtual organ directs.

At this juncture it is helpful to understand the difference between a stop controller and a piston controller. A stop controller responds to a stop being physically activated, by first illuminating the stop's LED, and then sending the appropriate midi to the virtual organ. Similarly when the organist physically deactivates a stop, the controller extinguishes the stop's LED, and then sends the appropriate midi to the virtual organ. The stop controller also reacts to midi received from the virtual organ by illuminating or extinguishing the stop's LED, as the virtual organ commands, for instance when General Cancel is pressed, the virtual organ will send the necessary midi to extinguish all the stops' LEDs.

In contrast, a piston controller works like this: When the organist presses & releases a piston, the controller does not illuminate that piston. It simply sends the midi to the virtual organ to inform it that the piston has been pressed. It is then down to the virtual organ software to send the appropriate midi back to the piston controller, commanding it to illuminate the piston. Generally speaking only one piston per division would be illuminated, and so if a single piston controller spans several divisions, it would be impossible for that controller to 'know' which pistons can be on at any one time, without being specially programmed for each use case in which it may be installed. This is obviously undesirable and inflexible, so we leave control of the piston's LEDs to the virtual organ exclusively.

Who is it for?

The Hauptwerk Hardware Table top organ controller has been designed for use by anyone with a desire to create their own table-top organ who has a reasonable level of DIY skills and would see themselves capable of constructing the simple woodwork depicted in the picture above and who is confident of their ability to understand and follow these instructions.

Successful completion of such a project will also require the ability to solder to a reasonable standard. If you are new to soldering we suggest you check out the Hauptwerk Hardware Solder Practice Kit available from the web shop.

A table-top organ built with a Hauptwerk Hardware Table-top organ controller is ideal for use with Hauptwerk, Grand Orgue or any of the many other virtual organ software solutions available which use Midi as their input.

The Table-top Organ Controller.

The Table-top organ controller, or TTO controller for short, is a single board which has a number of input and output connectors and solder pads which connect to the controls of the TTO. It has a pair of 5 pin DIN Midi sockets which connect to the computer running the virtual organ software, and there is also a USB type B socket, which is used for powering the unit and which is also used as a serial data interface when setting up the unit. The board allows for direct connection to two matrix keyboards and 32 Lighted pistons via an 8 x 4 matrix.

Additionally there are two RJ45 sockets which are compatible with Hauptwerk Hardware System ONE Keyboard Interfaces, thus providing the option of connecting two further keyboards or one keyboard and a pedal-board. The System ONE Interfaces are sold separately from the web shop.

The TTO Controller can accommodate up to four keyboards in total, along with a maximum of 32 lighted pistons and three swell pedals.

The connections on the TTO control board are as follows:-

- USB type B interface for powering the unit as well as monitoring midi and control events.
- 5 Pin DIN Midi interface for monitoring midi events to and from the virtual organ software.
- RJ45 socket for a chain of System ONE Matrix type keyboard or pedals interfaces.
- RJ45 socket for a chain of System ONE Bus type keyboard or pedals interfaces.
- 3 x 3 pin header interfaces and solder pads for analogue controls i.e. Swell pedal etc.
- Solder pads for 32 LED's
- Two System ONE Compatible Incandescent Lamp Driver sockets.
- Tutti Compatible sockets for inputs to both keyboard matrices the pistons matrix.
- Solder pads for two keyboard matrices and the piston matrix inputs.

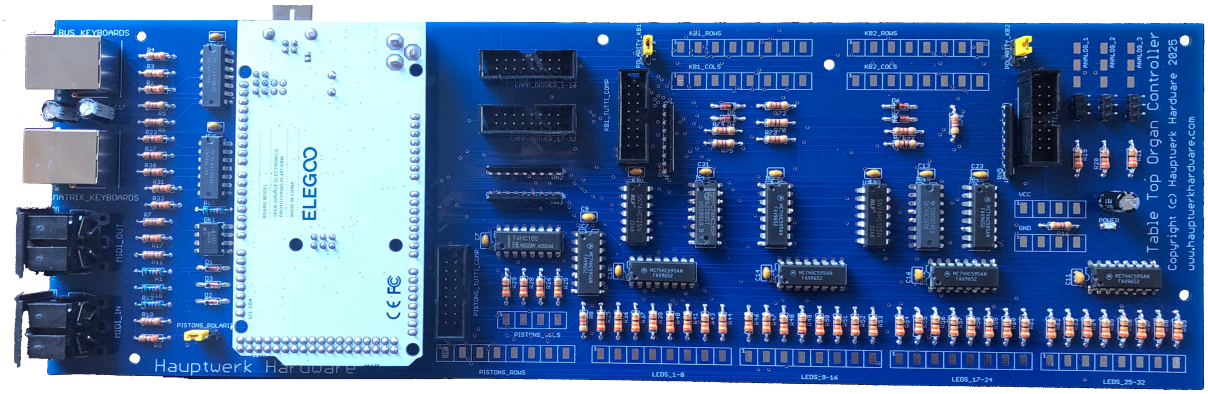


Illustration 2: The Table-top Organ Controller board

Above is a picture of the TTO Control board showing the different interfaces and other connections.

Keyboards & Pedal-board

The TTO Controller supports up to four keyboards. This allows for three manuals and a pedal-board. There are inputs for two matrix type keyboards on board as well as RJ45 input sockets for System ONE Keyboard Interfaces. You have the option to add two more keyboards using these sockets and these can be either two Bus type interfaces daisy-chained together, two Matrix type interfaces daisy-chained together or one of each. Using System ONE Interfaces allows for a simple single connection using a CAT 5 type computer Ethernet cable to the pedal-board or additional manual(s).

Each of the on-board keyboard matrices has a 16-way IDC socket which is Tutti compatible. This means that you can simply plug in Tutti accessories such as the Fatar Keyboard Splits* for use with Fatar keyboards making their installation as simple as plugging them into the Fatar Keyboard Split and then plugging the keyboard split into the TTO Controller. The same is true of the Tutti Connection Strips* should you wish to use those as an easy way of connecting a bare keyboard. The matrix for the pistons also has a Tutti compatible input socket.

* Sold separately via our web shop.

Console Controls

The role of the TTO Controller is to provide manuals and lighted pistons, however since a keyboard is simply a bunch of switches it is equally possible to use one of the matrices which would usually be used with a keyboard, as a collection of separate switches, effectively giving you 64 digital inputs. These could be used as stop switches or for any other purpose which you may desire for 'other' console controls. If you decide you want to use this method it is probably easier to use a System ONE Bus Keyboard Interface and plug that into the relevant socket on the TTO Controller board. The Bus Interface simply has 64 inputs to which you can apply a voltage to operate each input whereas the System ONE Matrix type Interface, as it's name suggests, requires you to create a diode matrix from your switches or controls.

Options Jumpers

Each of the three on-board matrices have a jumper marked 'Polarity'. These jumpers are used to select the polarity of the diodes used in the keyboard matrix. Each keyboard can have a different polarity but it is imperative that all the diodes face the same way on any single keyboard.

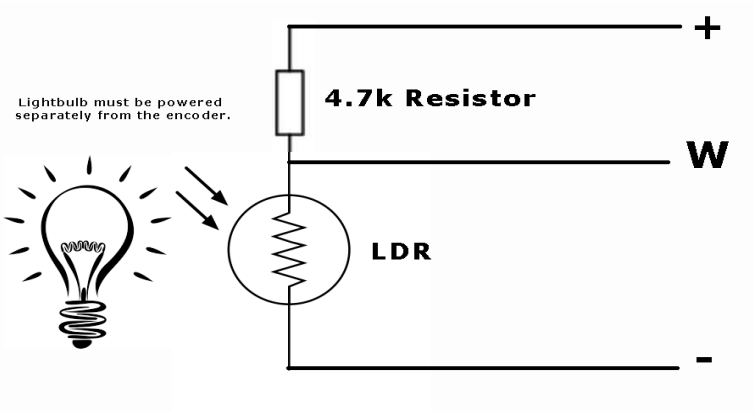
Analogue Inputs

There are three analogue inputs on-board and these consist of sets of solder pads as well as 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, thus allowing the use of our M-Audio adaptor (see web shop) if that is required. 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.

There are other possibilities for connecting analogue inputs. Many older swell pedals have an optical arrangement containing a light bulb and a light dependant resistor (LDR) 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 TTO Controller but you need to add a resistor and ensure that the power supply for the light bulb is ***completely separated*** from the controller wiring.

The diagram below shows how to wire it up.



There are some pedals which work in a different way and these have a rotating contact which contacts more connections as the pedal is advanced. Usually there are 10 or more, 17 seems to be a common amount, of connections. These pedals are usually used as crescendo pedals and ***are not suitable for use with the TTO Controller.***

Power Options

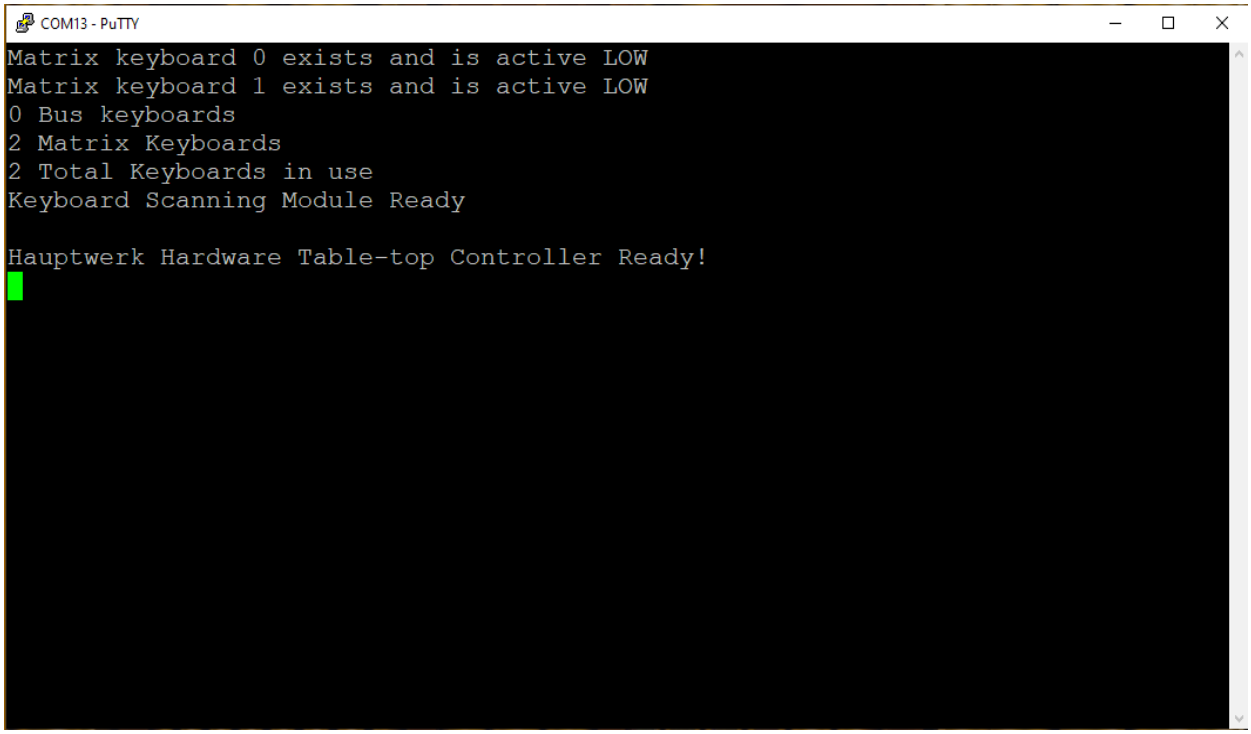
Generally the board is powered by it's USB socket, but that does not have to be the case. There are four solder pads for both VCC and GND on the board and any stable 5V supply connected to these pads will suffice.

USB Serial Comms.

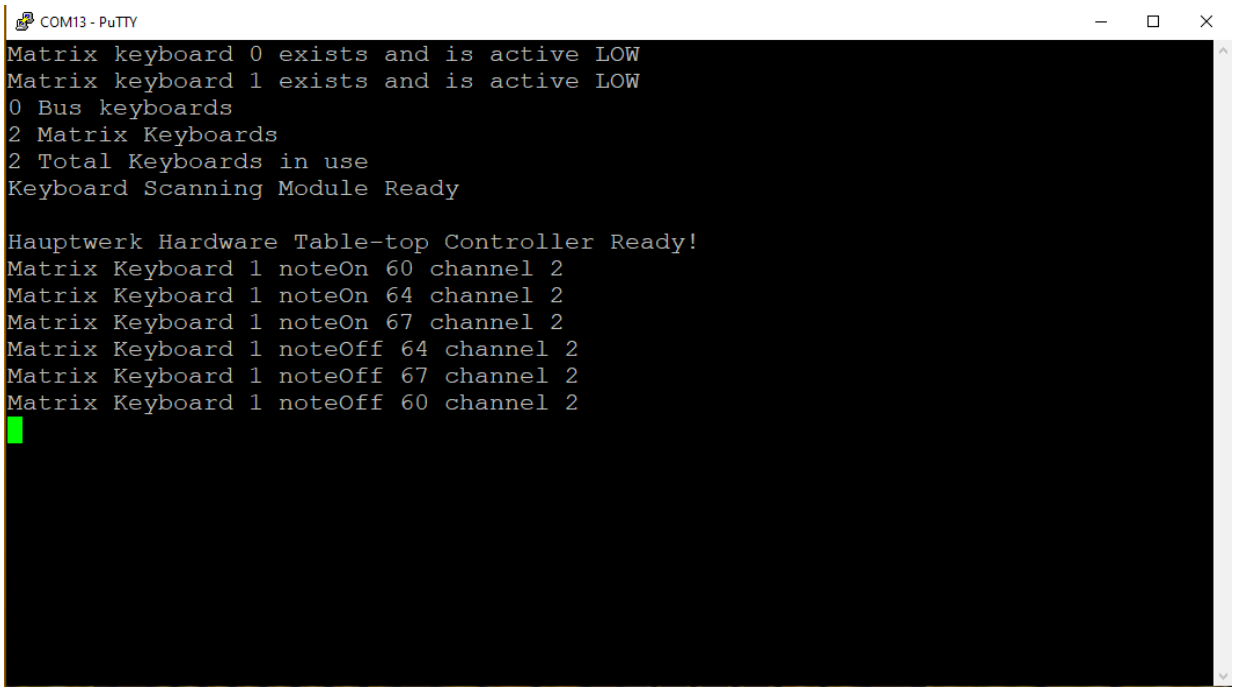
The USB Serial connector is mounted on the Elegoo daughter board. This can be used to monitor what is being sent and received by the TTO controller. You can access the data sent from this port by connecting to it using a Serial Terminal program such as PuTTy. When connecting to the TTO controller, in 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.

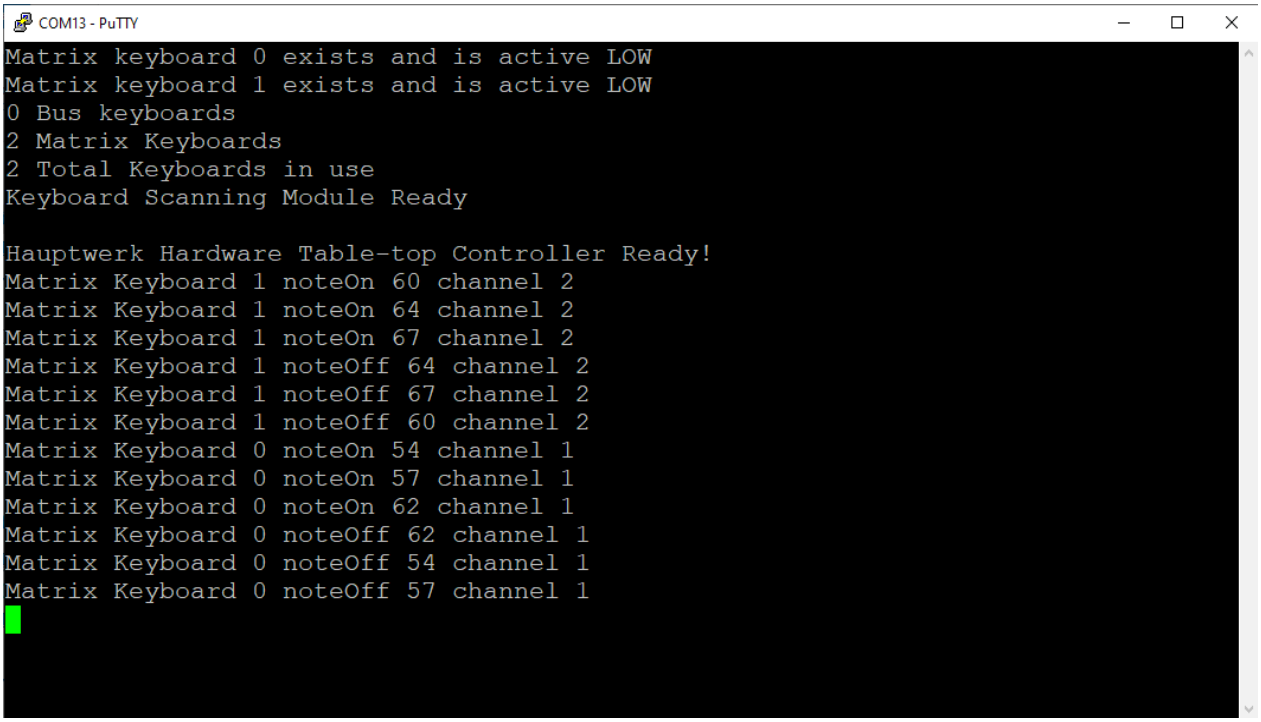
This is the data sent when the system is initialized.



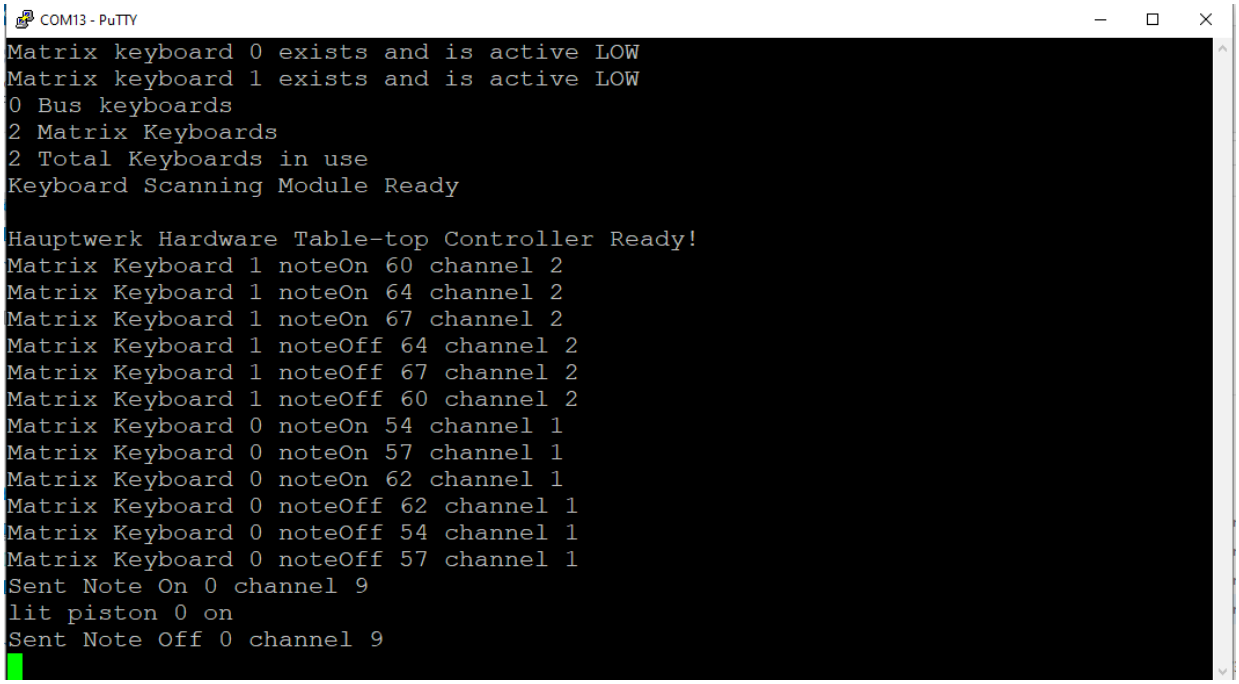
As you operate controls on your console and the controller generates the midi signals which it sends to the computer, it displays them in the PuTTy window. The picture below shows the midi sent when a C chord is played & released on the Swell manual.



This is the data sent when a D chord is played and released on the Great. As you can see each midi event is appended to the data shown as it happens in real time.



The next picture shows the 3 lines of data which are sent & received when a piston is pressed. In this case the unit has it's midi connected to Hauptwerk and the piston is programmed to light up in Hauptwerk.



What is actually happening here is that the TTO Controller sends a midi Note On as the piston is

pressed, Hauptwerk then receives this and responds by 'pressing' the virtual piston and sending a midi Note On back to the TTO Controller, which then illuminates the piston. Finally the TTO Controller sends a Note Off as the organist releases the piston This is ignored by Hauptwerk as it has no relevance in this scenario.

As you can imagine this data is very helpful in setting up and troubleshooting your installation as it shows what is being sent to the computer in the form of midi as you operate the various TTO controls, as well as the data received from the computer which controls the TTO piston LEDs, allowing you to check that the relevant pistons respond to the received midi commands, as well as making sure that the midi generated when you operate the keyboards and pistons is as expected. Without this data you would not know for certain what midi the controller was receiving, if anything at all!

Mounting

The TTO Controller has 6 mounting holes of 3mm diameter each. These are for mounting the board in a convenient place within your TTO. 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 within the board. 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 Information:

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.

The name Hauptwerk Hardware is a registered trademark.

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