Hauptwerk Hardware

System One

Full Organ Rebuild Solution

SYSTEM ONE
Hauptwerk Hardware

Bus Keyboard Interface
Installation & User Manual

Bob Howlett

June 2025

© Hauptwerk Hardware 2025

Table of Contents

A brief introduction to System ONE....3
What is System ONE?....3
Who is it for?....3
The System ONE Bus Interface Board....4
Advantages....4
High Voltage!....4
Reversed Key Operation....4
Polarity....5
Connections....5
Daisy-Chaining....5
Mounting....6
Our Hardware Ethos....6
Legal Disclaimer:....6
Warranty....6
Further Information....7
Contact Details....7

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 USB Midi as their input.

The System ONE Bus Interface Board.

The System ONE Bus Keyboard Interface is for use with keyboards which are wired in a 'bus' configuration. That is they have one side of each key connected to a common point, often via a single wire called a bus. The other side of each key has it's own wire which then connects to the electronics within the organ. This, necessarily creates a set of 62 wires for a “Five Octave plus Top C” keyboard. This type of configuration is often found in pipe organ consoles and many early electronic organs. It is easily recognisable by the thick bundle of wires coming from each keyboard as opposed to the 16 wires usually found in keyboards which are wired in a matrix configuration.

Advantages.

The advantage of a bus wired keyboard is that it is simple to connect to the midi equipment because it just requires each key's wire to be connected to it's named solder pad on the interface board. The remaining single 'bus' wire is connected to a power source, originally that would be the one provided by the pipe organ's 'electric action' but in the case of a re-worked or stand alone console it would be from the power supply feeding the rest of the console's new electronics.

In the original organ it would be the case that the power supplied to the keyboard's bus would be sufficient to drive the solenoids or 'pallet magnets' that are electrically opened to allow wind to pass into their respective pipes. Usually the voltage of this supply would be anything between 18 and 100 volts depending on the age and design of the organ. Modern digital electronics almost always runs on just 5 volts, and this is the voltage used in all modern organs, most of which use a matrix configuration for their keyboards.

The consequence of using an older or pre-used bus keyboard is that often the actual key contacts are dirty and showing signs of age. This is not too much of a problem when used at higher voltages but it can make them most unreliable when used with 5 volts, as this is not sufficient to overcome the contact resistance and results in keys which either do not sound at all or sound intermittently.

High Voltage!

The System ONE Bus Interface is designed to work with input voltages from the keys of up to 100v and can withstand even higher voltages than that. This means that if we have a keyboard which is unreliable with a bus voltage of 5 volts we can easily increase that voltage to, say 50 volts, and oftentimes this solves the problem. Obviously the bus voltage cannot be changed if it is still in use in a pipe organ, as would be the case when building a hybrid instrument, i.e. one which both sends midi whilst continuing to operate the pipes as it always has.

Reversed Key Operation.

Some organs have keys that are electrically always on! There are cases where the keys are designed to turn off, or 'break' the circuit when pressed, rather than 'make' or turn on the circuit when pressed.

The usual arrangement is for a key to 'make' when it is pressed. This makes sense when we consider that the 'circuit' consists of a power supply, the key, and a pallet magnet in the wind chest. When the key is pressed the contact makes and the pallet magnet opens allowing the wind into the pipe.

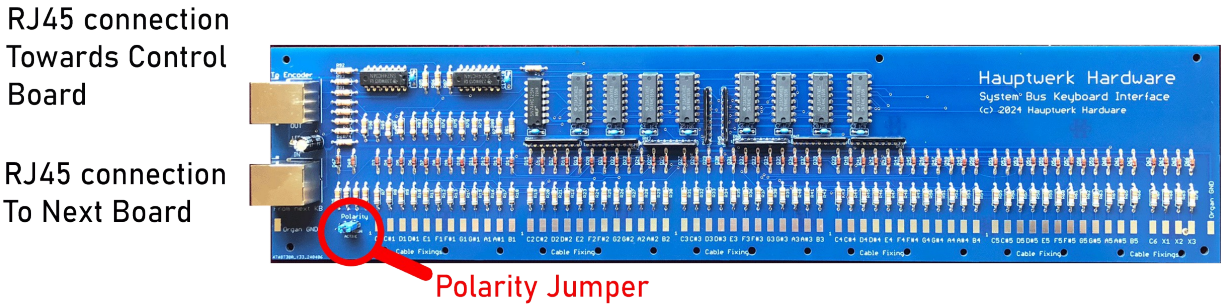
Some organs have another electrical arrangement where there are more complex things going on between the keys and the pallet magnets and sometimes this results in a requirement for the keys to always be 'on' or supplying voltage from the bus to their wires ***except*** when they are pressed.

This arrangement results in all the key wires being powered except when a key is pressed. If we simply connect these key wires to the Bus Keyboard Interface in the usual way the result would be

that from a midi perspective every not would be sounding except those which were actually pressed. This would be very loud but likely not sound very good!

Polarity.

In order to accommodate this scenario there is a jumper on the interface board which is labelled 'Polarity'. Putting this into one position will tell the control board to reverse all the notes from this keyboard so that everything works as expected. The other position will make the control board treat the notes as usual, i.e. sounding only when a voltage is present on the key wire.



Connections.

Along the bottom of the Bus Keyboard Interface you will see 64 solder pads which are labelled with the relevant note names. These are where you connect the key wires from each key to. On the right hand side you will notice three additional solder pads labelled X1, X2 &X3. These can be used for any other switch type controls that you may have, for example three pistons or similar. These are not usually used but exist for your convenience should you desire to use them.

At each end of the note inputs there is a solder pad labelled 'Organ GND'. These are for a connection to the ground side of the key power supply, be that the organ power supply ground side or the ground of whatever power supply you are using in the case of a reworked or new console.

Each System ONE Bus Interface Board has two RJ45 sockets. These are what is used to connect the boards to the System ONE Control Board.

In the above picture the top RJ45 socket would be connected to the control board using a regular Cat 5 Ethernet cable. Clearly the protocol in use here is NOT Ethernet, but this type of cable is eminently suitable for this use case being cheap, readily available in any length, and above all reliable.

The bottom RJ45 socket is used to connect the next Bus Interface board in the chain to this one.

Daisy-Chaining.

Bus Keyboard interfaces can be daisy-chained together up to a maximum of 7. 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.

The maximum number of keyboards allowed for the entire system is 7. This can be made up of any number of both Bus and Matrix keyboards.

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

0333 577 2393

contact@hauptwerkhardware.com

www.hauptwerkhardware.com