MultiSystem II
Installation Guide

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Important Precautions to Ensure Long Term Reliability

Like all modern electronic systems our products use components that can be damaged with static electricity. If you wish this system to remain in good working order for a long life you MUST follow these instructions. Failure to work to these standards will damage the system's vital components and cause premature failure.

Whenever you work on the system:

- ⊗ Keep away from any man-made fibres except those known to be antistatic material. Normal untreated plastic, Styrofoam, expanded polystyrene, etc. must be eliminated from the environment.
- ⊗ It is also not recommended to work on a metal work-surface. Untreated wood is the best alternative to an antistatic work bench or mat.
- ⊗ Always use the grounding wrist strap supplied, free replacements are available from SSOS on request.
- ⊗ The most important precaution is to ensure that you are at the same static charge as the processor before you touch it.
- ⊗ If you can feel static it is already 100 times greater charge than that required to destroy the sensitive components in this or any other modern electronic system.
- ⊗ Remember! The damage may not become apparent until long after you have left the site.

Always be sure to return any spare parts to SSOS in the packing supplied.

Static sensitive parts not returned in the correct antistatic bags and sealed at the end may not be accepted for credit as they are damaged goods and cannot be reused by us.

The System

Thank you for ordering the Solid State MultiSystem II, which is the result of over 40 years' experience in designing electronics for Organ Builders. It is the most advanced system of its kind available and is designed to be as easy as possible to install and to give many years of trouble-free life. Above all, the system is backed by Solid State's worldwide network of Organ Builders and Engineers who will be happy to answer any questions you may have.

If at any stage in the future the organ specification is altered, the system can be easily adapted with a kit of parts or maybe just a new software update emailed direct to you.

Opening the Box

The MultiSystem II is packed as follows:
Each box contains a plane (active pinboard). The label on the outside of the box explains where this part fits in the organ. However, to reduce shipping costs, if the box contains a short plane the extra space is used to contain the processors and cables.

The MultiSystem II Planes are packed in anti-static bags to protect the electronics from damage during transit. The planes must never be inserted into the packing boxes without first placing them in the bags and closing them. Severe damage to the system can result if you ignore this.

Please do not open the boxes and leave the planes in the corner of the workshop where they can be damaged. There have been several occurrences of this over the years and it will cause delays later in the installation.

The anti-static bags should be used for storing the planes whenever possible. However, it is important to remember that the bags conduct electricity and will interfere with operation of the system if they come into contact with the circuit boards when they are powered.

Things to know if you are an experienced Multisystem I installer

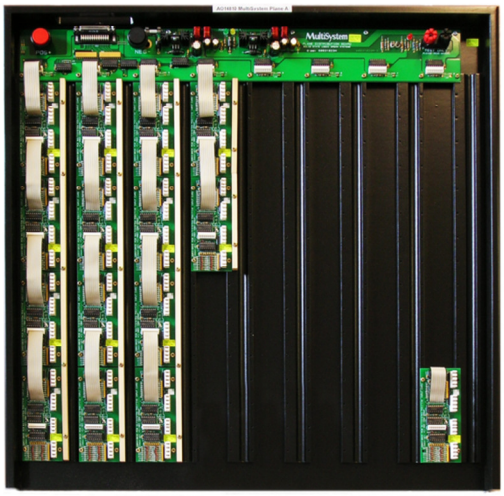
MultiSystem II has been carefully designed to be a logical step from the previous version and also to provide an upgrade path for existing systems. There are a few things you should know before proceeding with the installation.

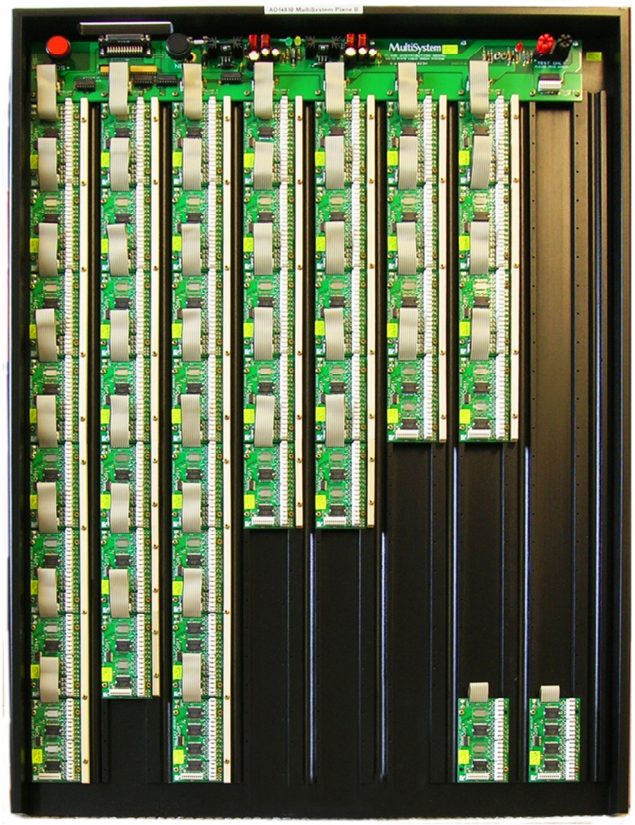
1. The processor has changed completely.
2. The network connection uses standard Cat5 cabling and a star connection. This means the layout of the cables between different sections of the organ is different. See page 21 for more details.
3. Cat5 networking is limited to 100 metres (300ft) on any cable run. Beyond this length fibre optic links are available. See page 25 for more information.
4. The planes are the same and connect to the processor in the same way.
5. Updating the system layout is now carried out with an SD memory card.

The Parts

The system will contain a packing list, which will be completed at the time of packing. To help you identify the individual parts the next section contains a pictorial view of the key items.

The Planes:



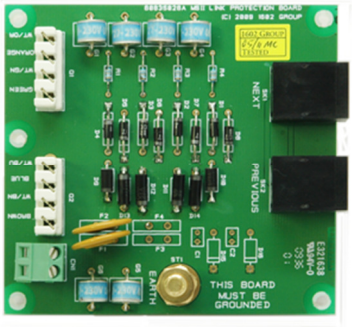


The Processor: The processor reads information from the planes and transfers this information to the relevant outputs, either on the same plane or via the data cable to another processor.

The Link Cable: Each plane must have a cable to link it to the processor. This is a 2m cable with a 25-way plug at one end and a 25-way socket at the other.

Network Switch: For systems with more than two processors. The network switch connects the processors together. Where there are only two processors these connect together without a switch.

Link Protection Board: These allow easy termination of network cabling and also provide a simple way to connect two processors together.



Network Patch Cable: These are used to link processors to Link Protection Boards or the network switch.

Spares Bag: The spares bag contains the special tools you will require, along with a selection of useful spare parts. Please keep this bag, together with a copy of the handbook, with the organ.

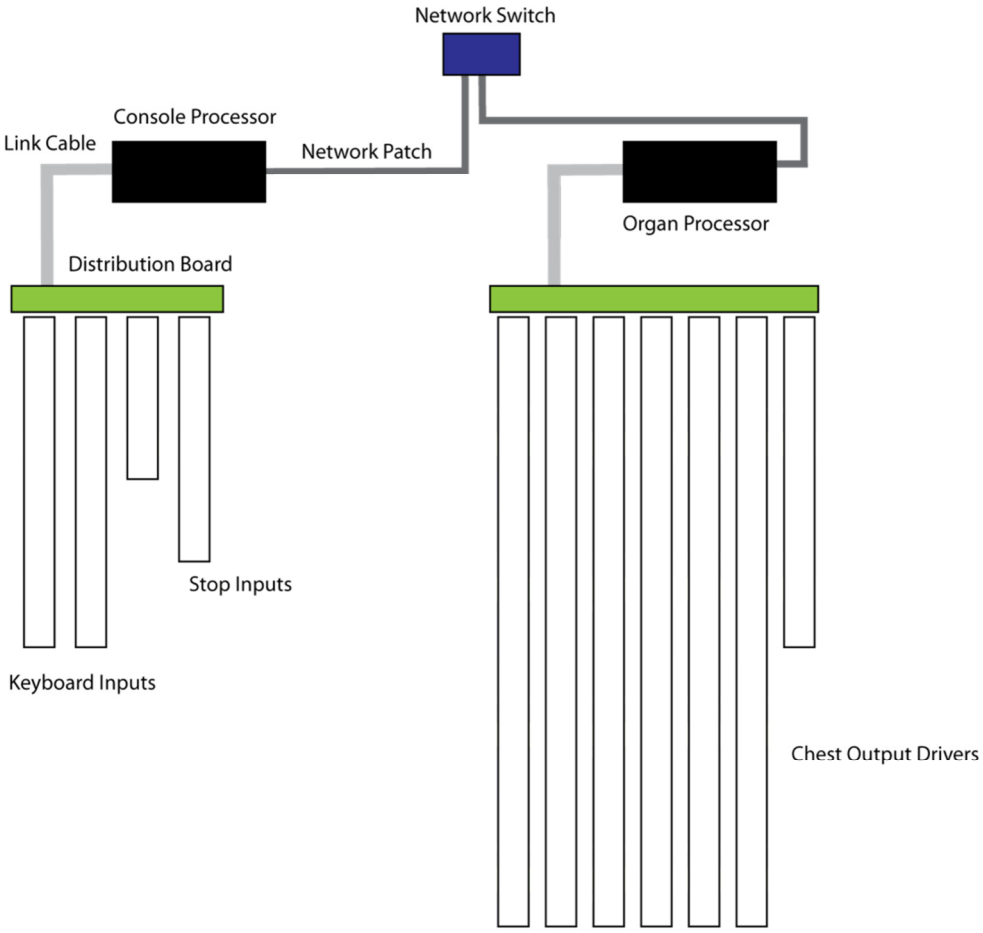


Figure 1: A typical installation structure

The Planes are where the Organ Builder wires the system to the organ or console. These planes replace traditional pinboards but still include columns of wiring pins and cable registers with which you are familiar. There are eight columns on each plane. The short plane has only 64 input pins or 80 output pins in each column and is normally used where space is a problem. The long plane can accommodate up to the full 128 pins in each column and is normally used in the organ.

There is a wiring list for this organ at the end of this book or in a separate section if a ring binder is used.

A system can have as many planes as necessary in as many locations as required.

A plane must have a processor box to run it and a cable to link from the processor box to the plane. These three parts are all that are required to make a system operate.

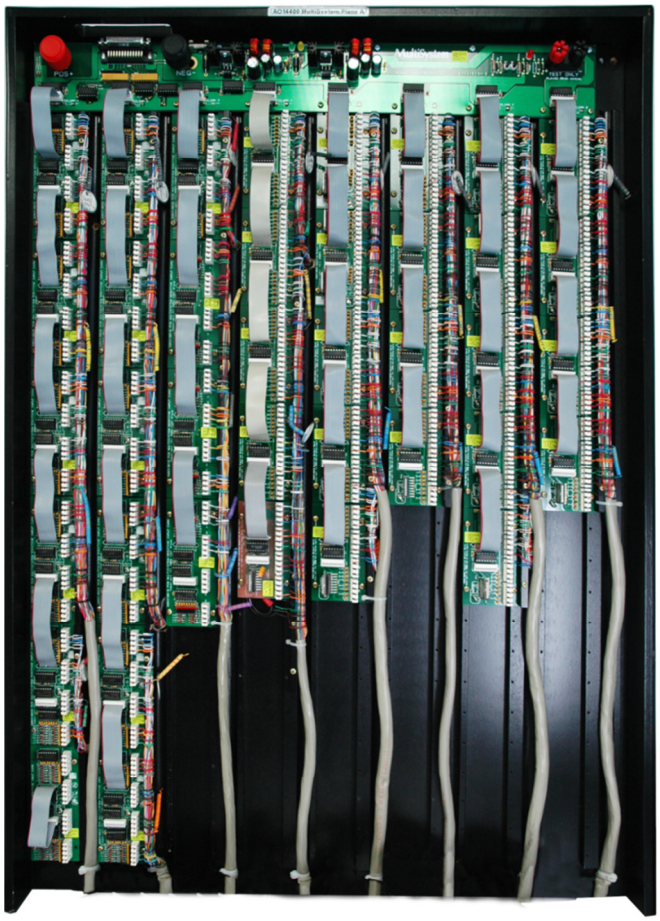


Figure 2: A wired Long Plane

Each column of circuit boards has a space to the right to accommodate the cables. Cable registers are fitted to guide the cables and these may be removed for cabling if required. The Plane is normally fixed to a vertical surface with the power terminals at the top, although it will work happily in any position. Wiring to the boards should be taken off the Plane in such a way that it does not restrict the service access to the SSOS parts. We suggest cables enter from the bottom of the plane (the opposite end to the distribution board).

The circuit boards on the plane may be fitted with either solder pins or Krone connectors for connection. This will have been specified at the time of ordering. If the system is fitted with solder pins, great care must be taken when soldering not to damage surrounding components. Space is deliberately kept tight in order to reduce the overall size of the system.

If the system is fitted with Krone connectors, you will find a special tool in the kit that will allow you to quickly and reliably wire the system. There is further information on using the Krone connectors later in the handbook.

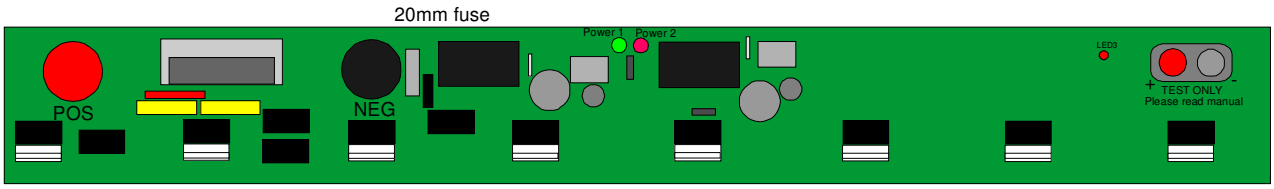


Figure 3: The Distribution board

At the top of the plane is the distribution board. As this part contains serviceable parts, do not run cables over the top of the plane. The power terminals are to the left and the power cables will feed through the hole in the top of plane to them. The remaining cables to the individual boards must be wired from the bottom of the plane. If it is more convenient the plane can be mounted sideways or upside down.

The distribution board, shown in Figure 3, contains all the power regulation and filtered data control in one board. There is an input fuse for the power rated at 5 Amps and is a 20mm type. Each of the two power supplies has an LED indicator to show that it is producing power. The odd numbered columns are run by Power 1 (Green LED), the even numbered columns and the processor are run by Power 2 (Orange).

This board is also fitted with a test circuit that can be used to test the system and wiring see page 36.

Electrical Interference

The electrical noise from unsuppressed magnets may cause erratic behaviour of the system. It is important that all magnets that are not directly connected to the system are suppressed with diodes. Typical examples are tremulants, swell motors, off-notes switched outside the Solid State system. Magnets driven directly from the system are suppressed by the Solid State circuitry.

Power Wiring

The plane is fitted with a pair of terminals to connect to the organ DC supply. This supply must be stable and free from electrical noise; most commercially available units are suitable.

The supply must be able to provide enough power on full load so that the supply to the MultiSystem II never falls below 9 Volts.

The system will not operate satisfactorily from DC supplies that are provided by a rotary generator, as the noise level is far too high and can confuse the system.

Regulated Power Supplies: Generally it's preferable to use a regulated supply, however there is a potential pitfall. All regulated power supplies regulate to provide a fixed voltage up to the capacity of the unit. Beyond this capacity the way to deal with the situation varies.

Certain types of supplies will trip, causing a complete loss of power; others will reduce the voltage, which limits the current. If Astron power supplies are installed they must be adequately sized since they will shut down when the current drawn approaches the limit. This shut down will occur for a split second, during which time the MultiSystem II switches off, removing the load. Power is reinstated and the MultiSystem II takes some 2-3 seconds to reboot. This type of power failure will normally occur as a large chord is being played and so the silence can be deafening! If you have questions on power supply sizing please call us. The MultiSystem II draws about 1 Amp per Plane for its own use; the remaining current is purely for the organ.

SSOS PowerLight supplies are available in different formats to suit input voltage and current requirements. These units are available in 30, 55 and 75 Amp capacity, they are regulated and do not shut down on overload. The output voltage will be steadily reduced to limit the current and are hence ideally suited to use with the MultiSystem II.

Power Indicator

At the top of each plane the distribution board takes the organ power and regulates it down to 5 Volts for the system. There are two power units that do this and each one has an LED to indicate the voltage is on.

The odd numbered columns are run by Power 1 (Green LED), the even numbered columns and the processor are run by Power 2 (Orange).

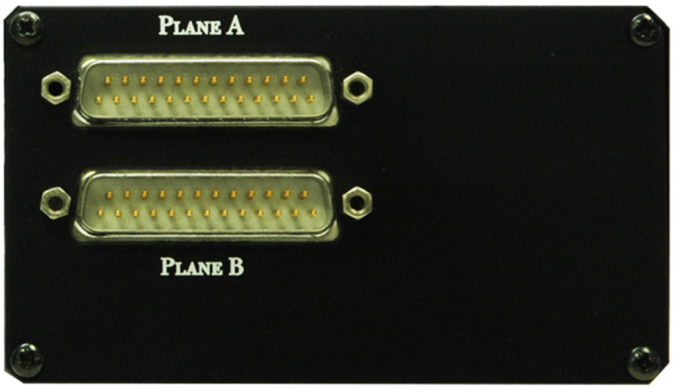


Figure 4: Plane connections on the processor

The drawing in Figure 4 shows one end of the processor box. There are two multi-way connectors called 25 way "D" Type connectors, because of the D shape of the casing. This D shape ensures that the plug can be inserted only one way round. The connectors are labelled **Plane A** and **Plane B** and are fitted with covers to prevent dust and stray electrostatic discharges entering the unused connector.

If the system has only one plane for the processor, then this must be connected to the Plane A connector. If a second plane is supplied it will be marked "Plane B" and connects to the connector marked Plane B.

In the box of parts you should find a cable with a 25-way "D" type connector at each end. The end with pins plugs into the top of the plane and the other into the processor box. This cable carries all the information and power that the processor requires.

MIDI Connections

MultiSystem II also offers MIDI connections at each location, this can be used to connect Keyboards, recorders, or digital effects such as MIDI chimes units. If the MIDI processing is fitted to a location the connector panel will have extra connections as shown in Figure 5.

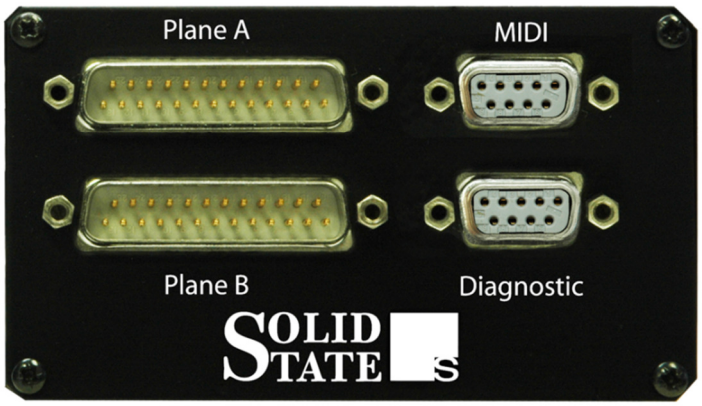


Figure 5: MIDI Connection

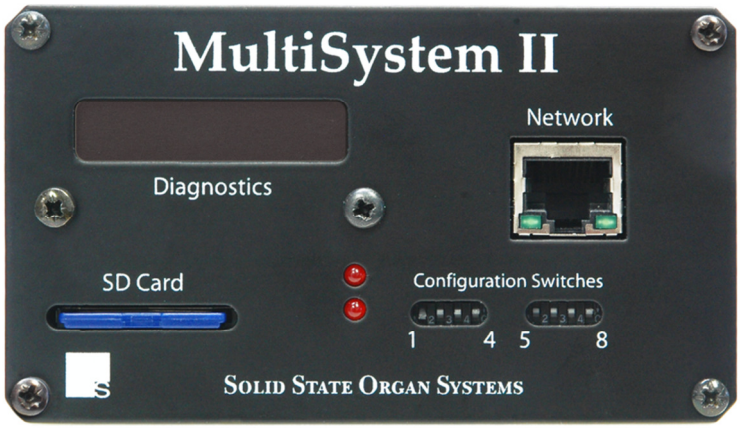


Figure 6: The processor Network Connector

At the other end of the processor box is an Ethernet Network connector with built in LED indicators. This connector is used to connect the processors together into a network.

MultiSystem II uses a "Star" network structure where every processor connects to a central connection point known as a "Network Switch". On systems with only two processors, if there is only one cable route between the processors , this network switch is not necessary.

Link Protection Board

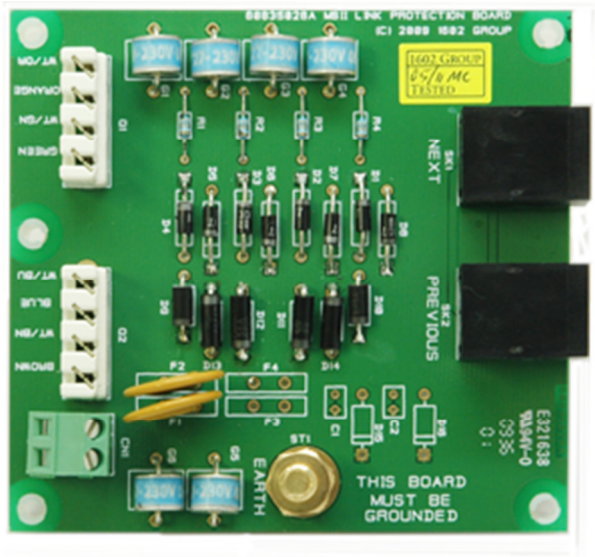


Figure 7: The Link Protection board

The link protection board is used to link one part of the system to another.

In some situations a single link protection board can be used with just patch cables connected to Next and Previous.

When the link protection board is used with data cable, because it protects the system components from damage either from miss-wiring or lightning strikes, it is very important to connect the earth terminal on each board to a suitable earthing point. If this is not done, the protection will not operate and a lightning strike may cause damage to the system.

Earth/Grounding Rod Requirements

It's very important that the energy in a lighting strike is taken away from the system. Any restriction or resistance in the ground wire will cause a dangerous voltage build up. A typical strike will need to find a path to ground for about 6,000 Amps!

To maximise protection to the system the following precautions are advised, although it is never possible to completely protect against lightning, the closer to this ideal the more protected the system will be. Most of all if the brass grounding stud is not connected there will be no protection.

The ground connection to the link protection board must be fed directly to main building ground. We recommend that this is not the cable used by the electrical earth system particularly when using 220V or greater systems. The electrical earth feeding the organ can have electrical noise on it from faulty equipment and cause the organ to be unreliable. If you are unsure about the quality of the electrical earth it is better not to use it.

To prevent unnecessary voltage build up, the grounding connection must be made through a cable of not less than 2.5mm^2, 12 AWG.

Mobile consoles should be provided with a separate grounding cable through a suitable connector if the area is prone to lightning strikes and the data cable runs are long.

For more information on protecting the installation from lightning damage please refer to publications on our website at www.ssosystems.com/downloads

Network Switches

The MultiSystem II network shares the same technology as a home or office network but because of the critical nature of the organ installation and the longevity required we use industrial components which are designed for a longer life and to work in an environment that has higher amounts of electrical interference.

Figure 8: The Network Switch

The device that links the network cables together is called a Network Switch, if the connection was to be linked to another network we would use a router which as the name suggests routes signals and in this case we simply need to connect them. The switch takes packets of data from each processor and switches them to connect to other cables and hence other processors. In this configuration all the processors are able to talk to each other simultaneously.

The Network switch has 5 Cat5 connections which are all identical and can be used in any order. The switch also has a DC power connector that must be connected to normal organ or console power. Remember to use a source that is always on when the organ is.

Mounting options for the Network Switch are explained in the manual supplied with the network switch.

Make the right connection

When making network connections the following rules should be observed:

Processor to Processor	Use one Next connector and one Previous connector
(2 Processor systems only)	If the two processors are close together (e.g. a single location coupling system and an RFM) then the Next and Previous connections of one link protection board can be used. Otherwise use Next on one link protection board and Previous on the other and link them with a data cable.
Processor to Network Switch	Use a patch cable to make a direct connection or use the Next connectors on two link protection boards.
Network Switch to Network Switch	Use one Next and one Previous connector as for processor to processor connections.

It is not possible to connect two processors together using just a standard patch cable. You must use a Next and Previous connection on a single link protection board or a pair of link protection boards connected by data cable. You may also connect two processors together using a commercially available Ethernet cross-over cable.

Data Cable

Connecting the systems together is normally done with a cable fixed out of sight, supplied by Solid State in lengths that you specify. This cable does not come with connectors fitted, as the cable will often have to be pushed through narrow gaps.

Connectors can be supplied to suit your installation. For multiple location of console wiring see page 30. The simplest installation, where the console does not need to be moved, will not require connectors or wall plates. The cable is wired directly to the terminal blocks on the link protection board.

The cable used to wire the systems together is critical to its operation.

Although the cable appears to be a telephone type cable, it is actually a very high performance computer data cable and no guarantees of system performance can be made if this specific type of cable is not used.

The cable should be LAN Data Cable Category Level 5 or above (e.g. Cat5e or Cat6). Solid cored cable should be used for fixed installation wiring. If you are running between sections of a building in the air space this cable may need to be plenum grade. Plenum grade can always be used in place of riser grade but not the inverse. Consult your local electrical contractor who will be able to advise. Flexible cable is suitable for mobile console connections and should ideally have a double skinned jacket to protect it from damage in a public area.

Suitable cable is available direct from Solid State cut to your requirements.

Some Rules for installing data cable:

1. Data cable is sensitive to sharp bends and being crushed. Do not attach the cable to the building using cable fixings that are tight enough to distort the jacket of the cable. Use pre-formed fixings if possible that don't crush the cable. When using cable ties do not over tighten them.

2. Each MultiSystem II cable can only be used to connect from one point to another. Cables must not be chained or "Tee" jointed. If this is done, reflections of the data will echo around the system and may cause interference problems. In much the same way as the wind in a pipe oscillates, electricity in a wire will do the same, except at a much higher frequency.
3. The cable may be joined if cut too short. Be careful to keep each connection separate and ensure the screen/shield is connected as well if screened cable is used.

We do not recommend the use of screened (shielded) cable for the network connections but we understand that in some situations this cable may already be in place (e.g. if upgrading from MultiSystem 1). The screen is not used but if it is left disconnected it can make the network vulnerable to interference. We recommend connecting the screen to the earth terminal at only one end of the cable.

How many Link Protection Boards do you need?

The number of link protection boards required depends on the number of processors, including CFM II (Capture for MultiSystem II) and RFM II (Recorder for MultiSystem II) and the layout of the organ.

The following examples should enable you to work out where all the network components go and how they will be connected.

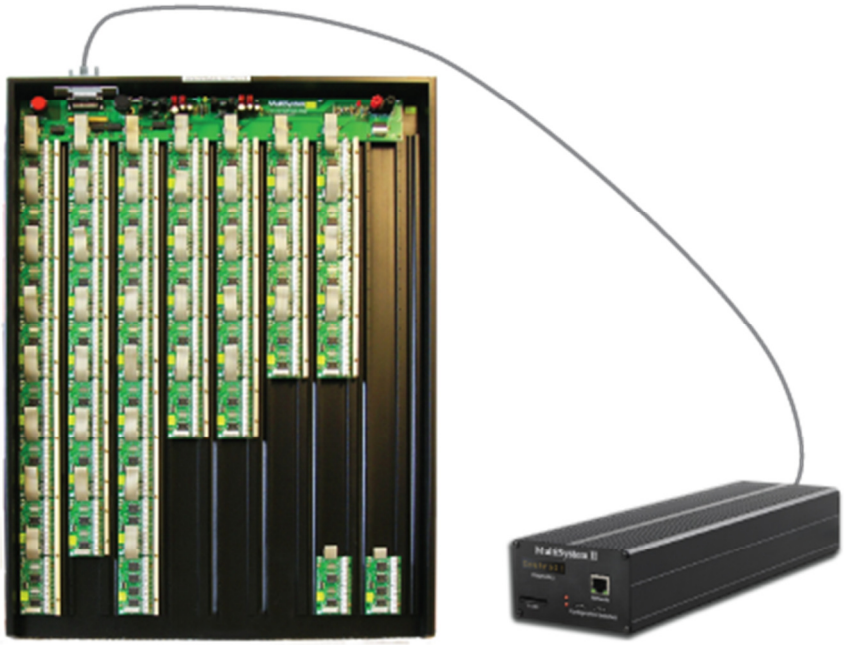


Figure 9: A single location system

With a fixed position coupling option the system will normally have only one processor, although this might operate two planes. If this is the case, then your system will look similar to Figure 9 and you will not require link protection boards. There is no need to read any further in this section.

If, however, you have more than one processor, please read on.

Multiple Processor setup

MultiSystem is a very flexible control system and adapts to a wide variety of organ layouts, because of this the manual has many options which may prove confusing. Once you have familiarised yourself with some of the basic options available you are very welcome to call your local office and talk through the options specifically related to your installation. As always we are happy to help.

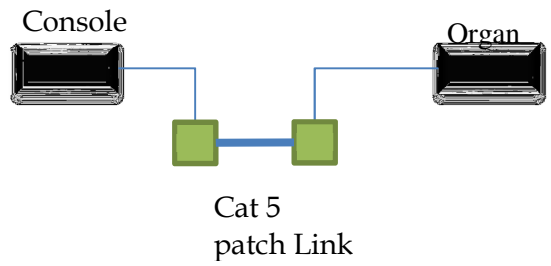


Figure 10: A Direct Network Link

Figure 10 shows a direct connection between two processors using two link protection boards. The processors are connected to the link protection boards with short Cat5 pre-made cables we call patch cords. One into the Next connection and one to Previous as was done with MultiSystem 1.

When more than two processors are required a network switch must be used to split the cables. A typical setup is shown in Figure 11 where each patch cable is connected to the switch in a "star" format. This setup is different to the MultiSystem I as now all wires lead to a common point.

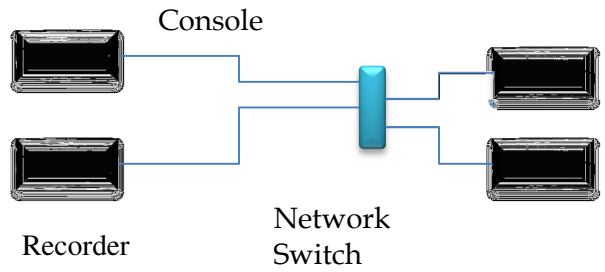


Figure 11: The Network Switch

The block diagram in Figure 12 shows a typical structure with two processors in the console and three in the organ. The network switch in the console takes the two cables and reduces them to one longer cable which is terminated using link protection boards which allow easy termination of the cable if the console is mobile and add to the lightning protection. The third organ location is connected using Link Protection boards as the cable run is too long for patch cables.

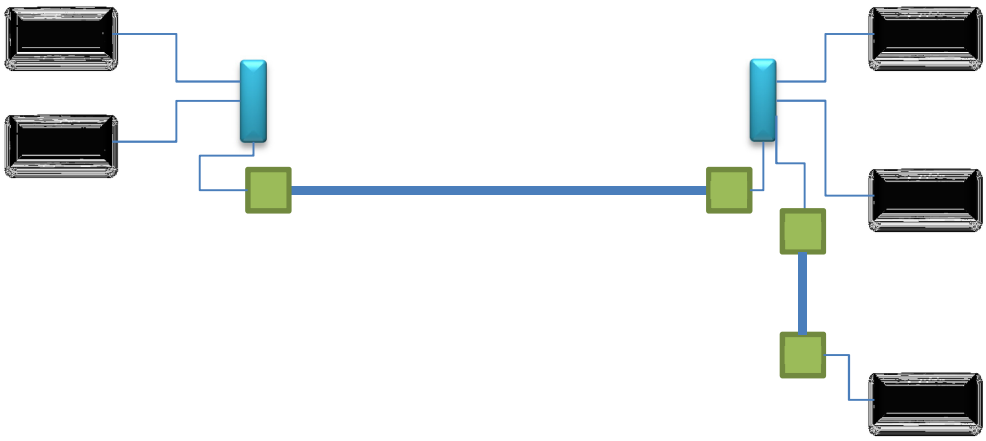


Figure 12: Multiple processor arrangement

Specific Network Layout Examples

Single Location System with CFM or RFM

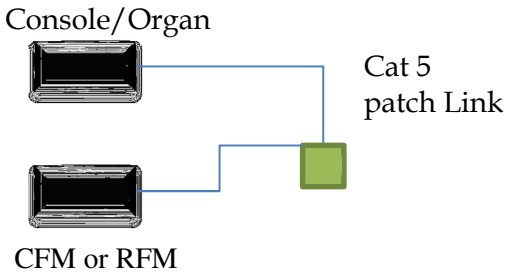
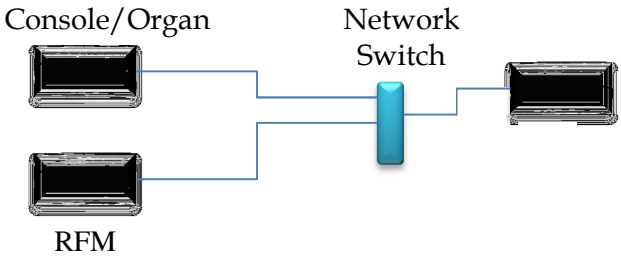


Figure 13: A single location with CFM or RFM

If there are two processors which will be installed in the same location (e.g. a MultiSystem II processor and an RFM II processor) these can be connected together with two patch cables and a single link protection board. One processor should connect to the Next connector and the other to the Previous connector.

Single Location System with CFM and RFM



If there are three or more processors installed in the same location (e.g. a MultiSystem II processor and a CFM II and an RFM II) there will also be a network switch. No link protection boards are required. Each processor should be connected to the network switch with a patch cable.

Figure 14: An example of a three location system

If the system has three or more processors it will be supplied with a network switch. Each processor must connect to the network switch either directly with a patch cable or through data cable and two link protection boards. As an example, a system for three locations would be supplied with five patch cables, four link protection boards and the network switch.

The network switch should be mounted close to one of the processors. This processor should be connected to the network switch using one of the patch cables.

The other processors should be connected to the network switch using link protection boards and data cable. Patch cables should be used to connect the processors and the network switch to the link protection boards. These patch cables should only connect to the Next connector on the link protection boards.

Multi-Location System with CFM or RFM

The CFM and RFM processors must connect to the network switch like the other processors.

The controls for CFM all connect through the console plane, so the CFM processor can be physically located anywhere providing it is connected to the network and has power when the console is in use.

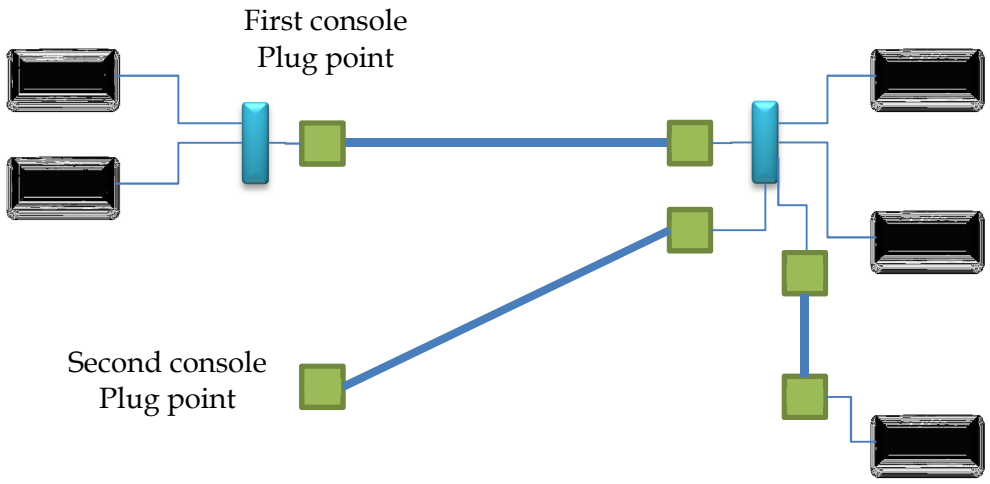
RFM has controls which connect directly to the RFM processor. Therefore the RFM processor must be physically located in the console. As there will be more than two connections in the console (console processor, RFM, connection to organ) the network switch will be required in the console. The console processor, RFM and CFM should connect to the network switch using patch cables. Each organ processor should connect to the network switch in the console using link protection boards and data cable. Patch cables should be used to connect the processors and the network switch to the link protection boards. These patch cables should only connect to the Next connector on the link protection boards.

Systems with moveable consoles

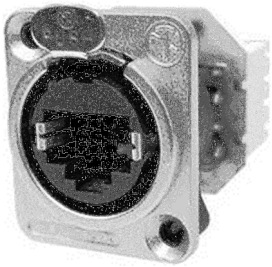
Where there is a mobile console, the cable may have to pass through wall plates and connectors.

If more than one connection point is required each wall point will require a separate cable to the network switch

If a network switch is required in the console (e.g. because there is an RFM) then a second switch will be required to merge the connections from the various plug-in points for the console.



Connecting Plugs for Movable Consoles



Solid State can supply surface mounting connectors, mounting plates and ready-made flexible cables. We use professional grade metal connectors and the wall connectors can have Krone connectors fitted for easy termination. We can also supply internal console data cables with data connectors to fit to the outside of the console saving you wiring time and uncertainty of cable wiring.

It is often desirable to fit connectors to the cable for moveable consoles. In this case it is recommended that both the console and the wall have connectors, this allows a spare cable to made and left with the organ in case of damage. It can be helpful to have long and short cables for different locations as well.

The cable from the console to the wall can suffer greatly in use. As the console is heavy it is easy to forget that the data cable is still attached to the console when pushing it across the chancel. The data cable must be terminated in a strong and reliable plug if it is to provide a reliable service.

Connections with the MIDI Option

If the system was ordered with MIDI on some locations then the processors will be fitted with a 9 Pin D connector which connects to the Solid State MIDI connector panel. The wiring identical to the MFM system for MultiSystem I and so upgrades can be plugged straight in.

In the console the MIDI connection supports MIDI in and MIDI Out and can be used to record and play the organ.

In the organ chamber the MIDI connection only outputs MIDI and to do this requires MIDI stops to be configured on the console. This is typically used for MIDI chimes or other electronic voices. Sometimes it is necessary to add a new processor depending on the requirement and the number of MIDI ranks required in addition to the pipes.

The Recorder for MultiSystem (RFM) offers built in recording and more sophisticated MIDI inputs and outputs plus it can record and play the organ at the same time.

Fibre Optic Connections

When a single data run exceeds 100 metres or 300 feet it is necessary to use fibre optics as the copper cable is not able to reliably pass the data over this length.

Advantages of Fibre:

Although fibre links offer greater capacity, fast speeds and extremely long cable runs very little of this is actually realised in an organ system. However immunity from electrical storm damage and longer than 100m (300 feet) cable runs is very helpful. There is no speed gain using fibre in this system.

Disadvantages of Fibre:

1. Dust is a major problem as the fibre is less than the thickness of a hair a speck of dust can easily block the signal. Once the cable is installed it is sealed and problems are prevented.
2. Fibre is difficult to terminate properly and should be done by an expert or purchase pre-made cables.
3. Remote start is not supported directly at this time.

What you need to know about Fibre for Organs:

Fibre is obviously more difficult to use in organ building than copper wiring and requires special tools and procedures. It does, however, increase the length of a single data run beyond 100m (300ft) and reduces vulnerability to storm damage.

The fibre link is a direct one to one connection, you need a fibre transceiver at each end. Normally there is one fibre cable for each direction, a transmit and a receive cable. As MultiSystem is bi-directional we need to communicate in both directions.

There are many different cable choices and connectors. Principally the fibre itself comes as multi-mode and single-mode. Confusing as it is the multi-mode fibre is lower spec and covers distances up to about 2Km, single mode covers distances up to hundreds of Km. There are also multiple connector choices.

We have specified the use of multi-mode fibre and industrial grade ST connectors for our fibre system.

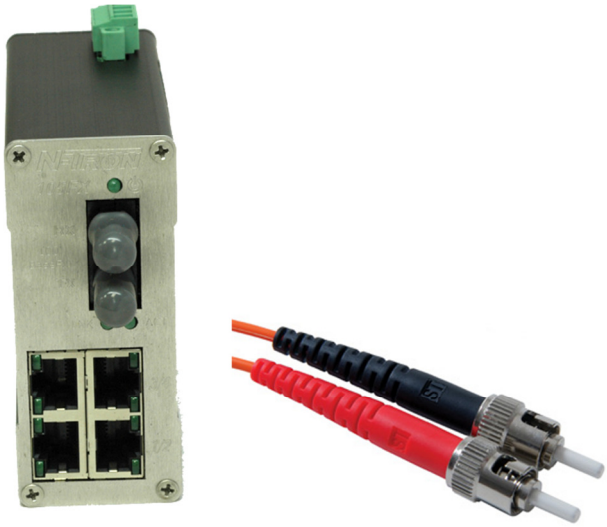
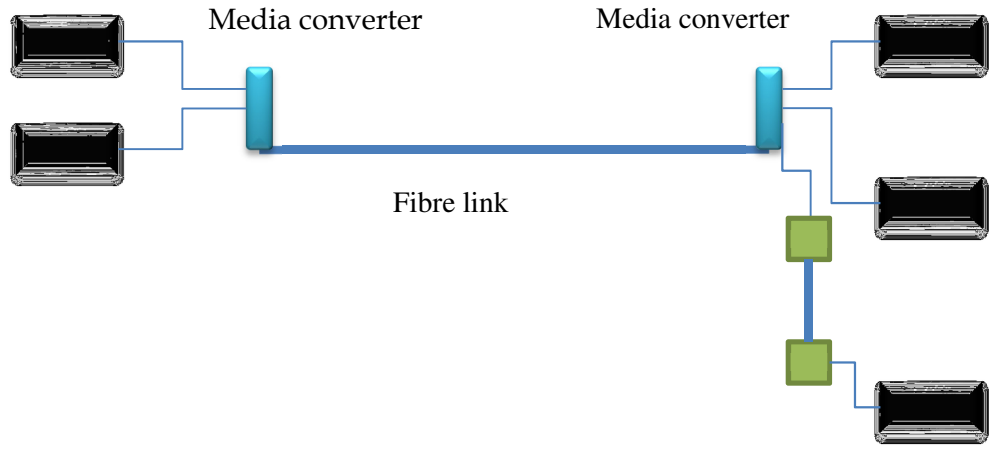


Figure 15: A Fibre Media Converter and cables

What parts do I need?

A fibre link replaces one piece of data cable and is made up of two media converters and two lengths of fibre with connectors. A media converter converts the data system from copper (Cat5) to fibre and also has a built in network switch.



Installing the Fibre

The fibre link can either be supplied with connectors and be factory tested or it can be run and terminated on site. We do not recommend terminating your own fibre, to do the job properly requires skill and practice and also expensive special tools including test equipment to be sure the job has been done correctly. If the fibre link is poor quality the communications will fail and the organ will suffer. Your electrical contractor will be able to recommend a local company to do this but ask for a test result to ensure the link has been installed properly.

Precautions:

1. Do not crush the fibre or kink it.
2. Make sure the fibre is in a place where it will not be stood on or heavy objects placed on it.
3. Do not remove the dust caps on the connectors until you are about to connect them.
4. Do not twist the fibre when coiling it or when removing from the drum.
5. When pulling the fibre do not pull on the jacket, for a long run the fibre will be supplied with kevlar pull tags by the manufacturer.

Connecting up the Fibre

Each fibre link has a dust cap which must be kept in place until the last moment. There is a cap on the connector on the media converter and also a smaller one on the cable connector.

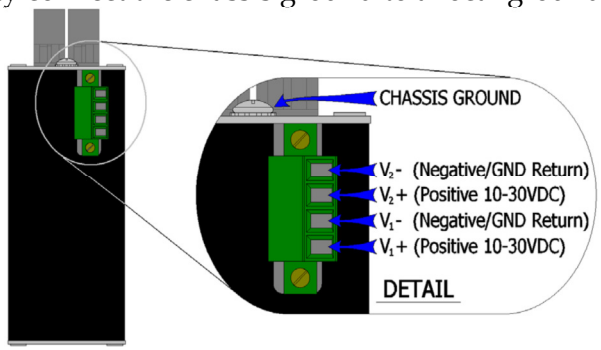
The media converter has two connections, marked Tx and Rx for transmit and receive. The Tx connector on one converter must be connected to the Rx on the other. **However**, the fibre cable is marked A and B which is already crossed over. Connect A to Tx and B to Rx at both ends.

The cable connector slides over the protruding part on the media converter and must be pushed in against the spring and twisted to latch in place as shown in Figure 16: Connecting up the fibre below.

Figure 16: Connecting up the fibre

Connecting Power to the Media Converter

The media converter, like the network switch is powered from the organ or console power supply. It is set to have dual power inputs and will operate from either V1 or V2 circuits. You can connect two separate power supplies to it if you wish.
To improve noise immunity connect the chassis ground to a local ground point.



LED Status on Media Converter

From Top to Bottom:
SPD Speed LED
LNK/ACT Link/Activity LED
RJ45 Ports Auto sensing 10/100BaseT Connection

LED	Colour	Description
	ON	Power is on
	OFF	Power is off
LNK/ACT	On	Link established, no activity on cable
	Blinking	Link established, activity on cable
	Off	No link activity on cable
SPD	On	Link is 100Mbps (normal)
	Off	Link is 10Mbps. (Slow, indicates problem)

Connecting the Systems Together

There are a number of ways of connecting the system depending on the type of organ. If there is a mobile console, the cable may have to pass through wall plates and connectors. Let us first consider the fixed console installation, as the same basic rules apply to more complicated installations as well.

If all is well, by now you will have assembled the planes and processors. It is now necessary to link them together.

1. Fix the link protection boards
2. Lay the data cable
3. Connect the data cable to the link protection boards

Positioning the Link Protection Boards

At this point in the assembly you will have the following parts available:

1. The Processor Box
2. The Link Protection Boards
3. The Network Patch Cables (SSOS Part Number 32SKT018)

The processor box should by now be connected to the plane or planes, for the system. At the opposite end of the processor box is the connector used to connect the processor to the link protection board using the Patch Cable.

First plug one end of the patch cable into the processor Network connector then mount the Link Protection board to the organ/console structure at a point where the patch cable will easily reach.

Systems with RFM, CFM or MFM

This MultiSystem II may include additional processors with no planes, these will be for MIDI (MFM), Piston Capture (CFM), Record/Playback (RFM) etc. In which case these processors will also need to be installed.

A more detailed instruction is provided in the relevant installation manual provided with the system or in another section of this manual if a ring binder version has been provided.

If there is only one MultiSystem II Processor then a single Link Protection Board will have been provided. In this case connect one processor to the NEXT connector and the other processor to the PREVIOUS connector. IMPORTANT: If NEXT and PREVIOUS on one link protection board are both used then data cable must not be connected to the terminal blocks.

If there is more than one MultiSystem II Processor then all processors must be connected to the Network Switch. Mount the CFM/MFM/RFM Processors close to the Network Switch and connect each one to the Network Switch using a patch cable.

Link Protection Board – Data Cable Connection

MultiSystem IIs are supplied with Krone connectors on the link protection board for terminating the data cable. See Page 50 for more information on wiring with Krone connectors. Carefully strip the data cable about 100mm (4″). Keep the twisted pairs of the data cable twisted as much as possible. Punch the wires into the Krone blocks being careful to observe the correct colour coding.

The link protection boards are designed to route the high voltages in the data cable to ground via the stud.

Network Switch Power Connections

The network switch is powered from the organ or console power supply. There is a removable screw terminal connector and the wiring information is printed on the label. Any DC voltage from 1- to 48V is suitable. It does not matter which source the DC power is taken from and it can be supplied by a separate DC supply if convenient. It does not need to be hooked in to the other power in any way.

Expression Inputs

Historically the expression shoe was fitted with a roller wired to a common positive which feeds into the MultiSystem II through a positive input module. It is important to note that the pins are defined with an open and a closed position. As the MultiSystem II allows different numbers of shoe contacts and swell engine output pins the control is converted in the software and sent as a 128 stage position. This information is also sent to MIDI if used.

Wiring the shoe backwards will not work and will create a two position swell output, either all off or all on. If a wire is connected to position 10 for example then all the output pins up to 10 or its equivalent will be on, this helps to prevent noise in the expression shades with intermittent shoe contacts.

Analogue Expression

More recently expression shades have been fitted with sliders that measure the position of the shoe and transmit it as a voltage. We can supply analogue sliders to read the shoe position and plug directly into the MultiSystem. Other manufactures such as Harris Precision Products can incorporate the slider into their shoe.

Walker Technical manufactures a magnetic expression shoe which can be wired directly to the MultiSystem II analogue inputs as follows:

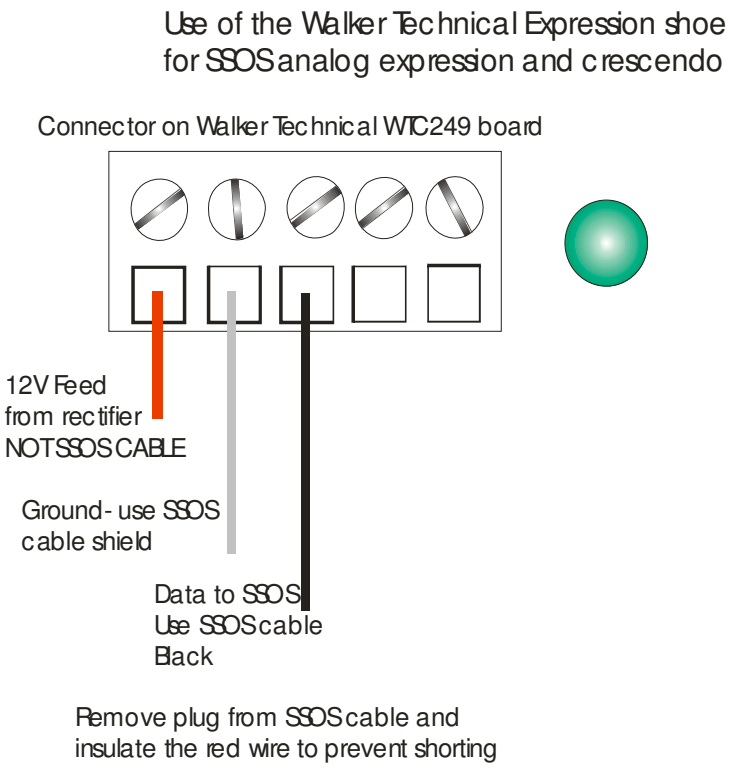


Figure 17: Wiring up a Walker shoe

You will need to remove the plug from one end of the SSOS analogue cable and only use the black and shield wires, making sure the red 5V power wire is insulated and out of the circuit. The Walker unit requires 12V from the console rectifier. Calibrate the Walker board before calibrating the input board on the MultiSystem II.

To calibrate the MultiSystem II analogue input board first turn the shoe completely closed. The green LED should light to show that the shoe is at the end of its travel. If it doesn't, unplug the analogue cable. If the light comes on suspect the calibration on the Walker shoe.

Once the green light is lit at the shoe closed position move the shoe to the fully open position. Now adjust the small preset control until the green LED just lights, close the shoe a little and the LED should go out and then light again when the shoe opens.

The red light will stay lit all the time to indicate good power.

Transposer Switch Wiring

For the digital transposer refer to "Console Clock and Digital Transposer Instruction Manual".

The Rotary assembly consists of four pieces:

1. Rotary selector switch
2. Engraved brass or black cast bezel plate
3. Black collet knob
4. Cap for the above knob

Mounting the Switch

The switch mounts to a thin panel by means of the threaded bushing surrounding the shaft. The switch is shipped with a nut and lock-washer already on the bushing. PLEASE NOTE that this nut is currently holding two locating fingers in the switch assembly; the holes through which these fingers are placed are marked with black in case the fingers are misplaced during handling prior to tightening the nut.

There are two suggested means of mounting the switch:

A. By counter-boring the rear of the wooden panel to about ¼" thickness remaining, and using the nut to draw the switch and brass plate together against the wood. It is wise to make a small indentation in the wood to catch the projecting anti-rotation finger on the face of the switch. It also may be helpful to drill holes in the corners of the brass plate to use small r.h. screws to keep the panel from rotating.

B. By drilling a suitable hole in a piece of scrap metal, drilling mounting screw holes in the corner, and drilling a counter-bore in the wood panel to clear the bushing and mounting hardware. It is recommended to drill a hole for the anti-rotation finger in your metal mounting plate. You mount the switch to the plate, mount the plate to the rear of the wood panel, and mount the brass plate to the face of the panel with four r.h. screws in holes you drill in the corners. This method is especially suited to mounting in thick panels where there may be adequate space on the panel rear for the oversize metal plate that will be necessary.

After switch mounting is resolved, the switch shaft must be cut, using a hacksaw. Be sure the shaft is cut square, and any burrs are filed off. The depth of the knob from the bottom of the skirt to the top of the shaft is exactly 3/8". About 1/8" of this depth is free of interference that projects from the surface, if mounting system "A" is used. Be careful not to have the knob drag on the plate; allow about 1/16" minimum between the knob skirt and the plate.

The knob mounts to the shaft via a collet, which is tightened by the brass nut seen in the end of the knob. Use a pair of pliers and rotate the shaft to its farthest left hand (counter clockwise) position. Place the knob on the shaft, point the line at the left-hand "7" on the plate, and hold the knob firmly while tightening the collet nut. Be sure the nut is as tight as possible, rotate the switch through its entire compass several times, and then re-tighten the collet. Finally, snap in the cap, lining up the white line with the knob.

Wiring the Switch

Positive organ current is fed to the pin marked in the picture below; this is the only pin on the switch that always contacts the rotating centre.

Rotate switch to the "7" flat position and note which contact is selected (touched by the moving finger in the centre of the switch). Wire this to the appropriate pin on the MultiSystem II input pin board assembly. Continue to identify and wire each switch contact in turn until all are wired. Refer to the MultiSystem II connector list for the appropriate pins; there will be 7 semitones flat and 7 semitones sharp making a total of 14 wires.

If you have any questions, please call and we'll do our best to talk you through the installation problem you are experiencing.

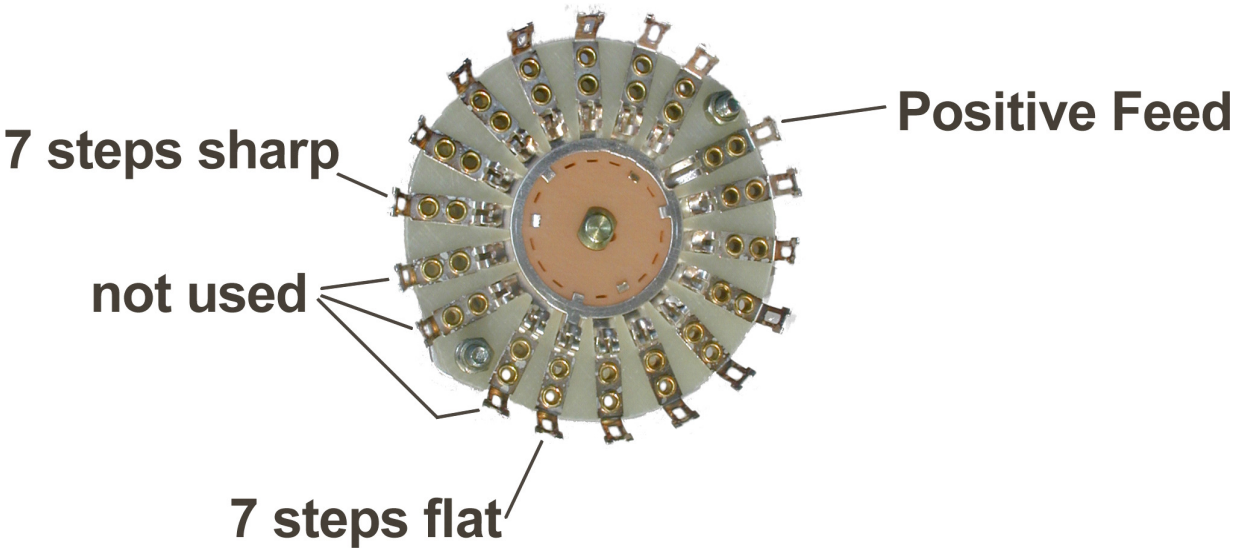


Figure 18: The mechanical transposer switch

Organ Remote Start

The cables in the system provide a spare circuit for the organ builder to use as required. This circuit is completely independent of the SSOS system and can be used to carry up to 36 Volts DC at 1 Amp. The circuit is available on two terminals on each link protection board. Previous version of the link protection board were marked A and B for these terminals, during the re-design A and B markings were missed, we apologise for the confusion, either terminal may be used for each circuit, remember to use the same one that the other end.

A typical use of this circuit would be to start the blowers when the console power is applied. The wiring would look like this:

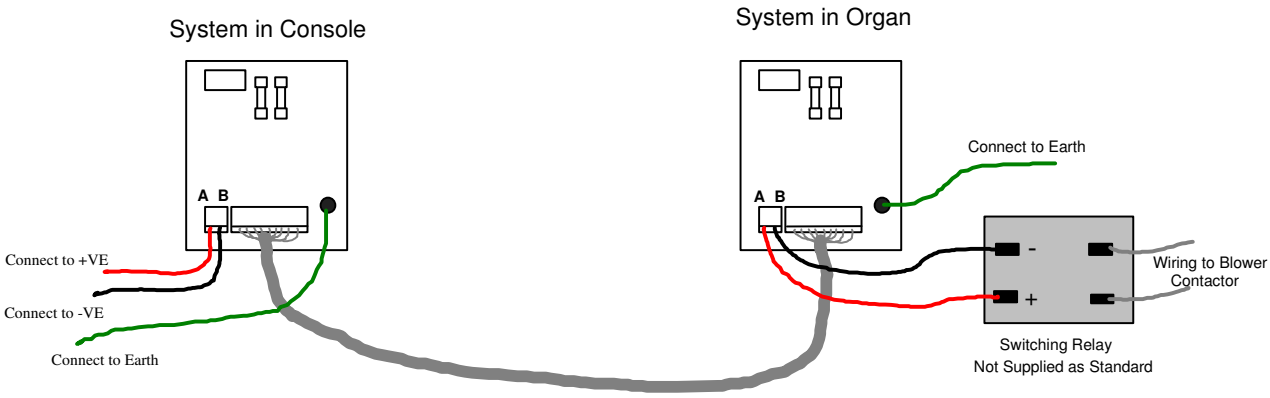
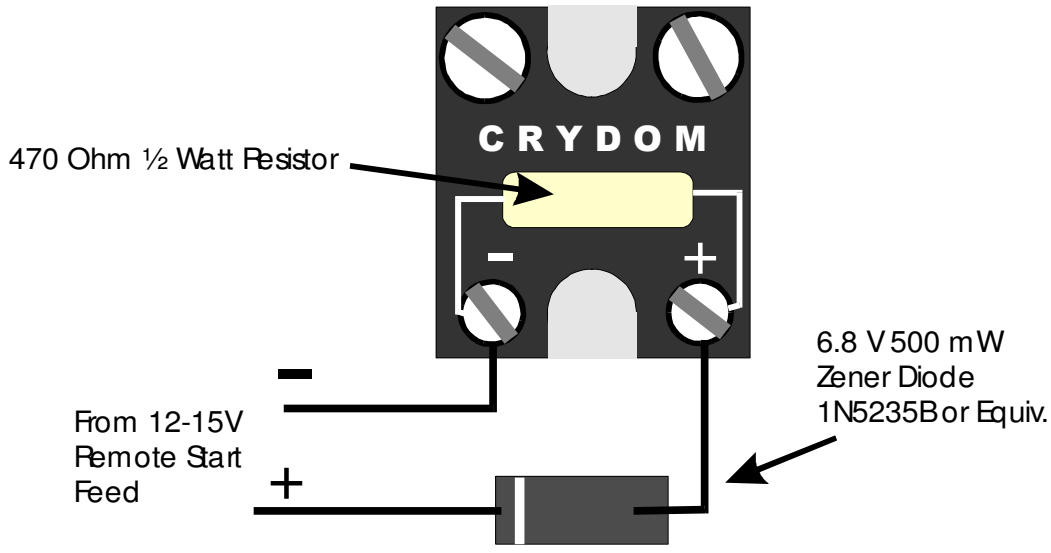


Figure 19 The remote start relay wiring

When installing a Solid State relay for the remote start add the extra components shown below. This will ensure that the relay does not "hunt". A safety cover is available to protect the bare terminals.



More than two processors?

If there are more than two processors, the lines for remote start must be linked across from one link protection board to the next.

MultiSystem II includes a small test lamp system on the distribution board. The test area is on the right side of the distribution board.

The system is made up of two terminals and an LED indicator. The parts kit delivered with the system will also contain a test lead that plugs into the terminal. If this is not available, any regular wire will do. The test connectors also work as screw terminals. There is a small hole on the underside of the terminal and the coloured portion acts as the screw.

Test procedure

There are two terminals and one indicator. The red terminal supplies positive power for positive input cards and will light the indicator if connected to the plane negative (0 volts).

The black terminal supplies a negative return. It will feed negative input cards and will light the lamp when connected to plane positive.

There is only one test lead supplied, as it is not possible to test both positive and negative at the same time.

If the system you are testing is fitted with Krone connectors it is possible to temporarily punch a spare wire into the connector to apply a test input. This wire should be the same diameter as any existing wires in the connector and conform to the wire thickness chart on page 45.

Testing Negative Outputs
Use the red test terminal. If the output is on, the LED will light.

Testing Positive Outputs
Use the black test terminal. If the output is on (over 10 volts), the lamp will light.

Testing Positive Inputs
Use the red test terminal. Connecting to an input with the test lead will switch it on. The test system will only reliably drive one input. The current supplied is very small and will not damage any circuits. It is also short circuit protected.

Testing Negative Inputs
Use the black test terminal. Connecting to an input with the test lead will switch it on. Again the test system will only reliably drive one input. The current supplied is very small and will not damage any circuits. It is also short circuit protected.

Processor Indicators

The end of the processor box has an amber text display, two small red lamps or LEDs and two green LEDs (these are on the Network connector). These are provided to indicate what the system is doing.

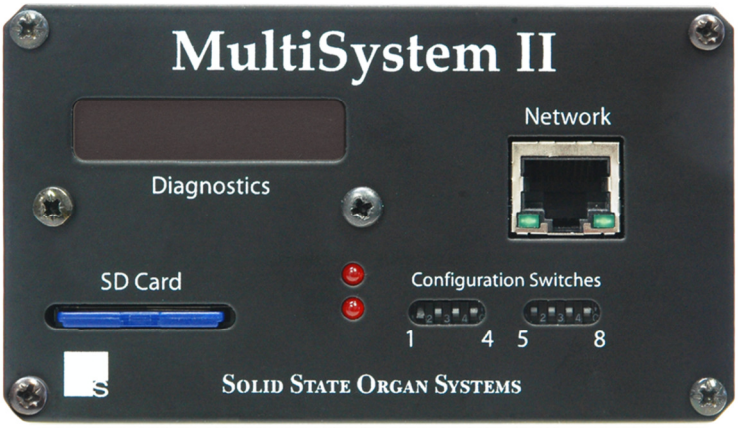


Figure 20: Indicators on the processor

Diagnostic display

The MSII processor includes a diagnostic display that normally indicates some core information about the location. If you jam your head in the console or chamber with your best reading glasses and watch the display above the SD card slot you will see a series of characters flash by. If you miss it the first time the display cycles so just wait.

The information is as follows:

1. `AO12345` or `CC12345:` This is the job number of the system program and will be the same as the connector list. Useful if you have more than one job in the shop and mix up the processors.
2. `24Apr13:` The date the configuration was last changed.
3. `10:04AM:` The time the configuration was last changed.
4. `Console:` The location the processor is programmed for. This is mainly to check that it is the correct one, the names are the same as the connector list, such as Console, Chancel L etc. If the name is not correct, although it is possible to change the switches to correct this, first check that there isn't another display elsewhere in the system showing the correct name for this location and then swap them.
5. `RECEIVED`
6. `00000001` Each digit of the number following 'RECEIVED' corresponds to a location with location 0 being on the far right. A 1 in a position is indicating that this location is seeing the data from that location. It is an indication of the current connection status, hence all zeros is not good unless it is a single location. Planes with input modules fitted show up here.
7. `Plane A`
8. `=========:` Next the status of the modules for Plane A are displayed. The length of the column is compared to the configuration and the eight characters display the result of columns 1-8. For example `====^^=v:` shows columns 1-4 and 7 are correct, columns 5 and 6 are shown as having more modules planned for in the configuration than detected and column 8 shows less modules. The system will always work with the wrong

number of modules but the display is indicating they are not communicating and that there is a possible fault.

9. The display then repeats the same data for plane B.

10. `MSII0105` The main version of the processor operating system.
11. `Build 41` The secondary version of the processor operating system
12. `Err 0000` This is an indication of damaged packets that were received by this location. It is a measure of the health of the network link from the location to the router or switch. If you have numbers here check the cable for damage, kinks, tight clamps and other distortion.
13. `00000001` Each two digits corresponds to the first 4 locations with location 0 on the right. It is a count of the number of times this location has established communication with that location. It is an indication of the overall long-term health of the network. Under proper conditions, the location numbers will 01 indicating that the locations established communication once at power up and there have been no intermittent losses of communication. In the above example, this location has established communication with location 0 once since power-up.

    NOTE: RFMII deliberately comes and goes on the network so, if it is configured as one of the first 4 locations, its number will increment each time RFMII plays something. This is perfectly normal.

Plane Data on the display

This information can help to quickly determine where the problem lies. For example, if the organ location is not functioning, check the diagnostic display for the link status. This will tell you if there is a cable problem.

Another example is to check the Plane A and Plane B status indication.
- If the displays show all '=' signs then the modules on the column are all functioning and match the configuration.
- If there is a '?' in the display, MSII cannot talk to the column and is indicating it can find no information. If TauNet is used then a '?' display is normal for the columns fitted with TauNet.
- If there is a '^' on the display, the column is shorter than the configuration.
- If there is a 'v' on the display, the column is longer than the configuration.

A long column will not be a problem for MSII and a short one may be indicating that the configuration has been prepared for future additions but the modules are not fitted at this time. A '?' indication is either a problem or an entire column prepared for but missing or a column with TauNet.

The network information is very helpful in establishing that the problem is either in the processor itself or due to a lack of communication over the network.

Enabling Advanced Diagnostics:

DIP switch 2 on the console processor enables the advanced diagnostics. When the switch is ON or down the diagnostics is enabled.

Whenever an input pin changes state, the Plane, Column and Pin number are displayed. This is very useful in confirming the input wiring before the organ is operational. It can also confirm whether or not the input wiring is sound without requiring a voltmeter. In the absence of pin

activity, the display reverts back to the normal diagnostic display.

Note that the system should not be left with the advanced diagnostics enabled as it slows the overall system down. This is because it takes much more time to display the information on the display than it does to process it to the output pin. If it is left on, there is no problem other than reduced performance.

Diagnostics using a computer

Further information is available via the diagnostic port. If debugging is enabled, changes in data output will be displayed on the terminal by plane, column, pin and status (on or off). This can be very helpful for confirming whether or not the pins are actually being energized by the configuration. For example, if the 32' resultant does not work as expected, you can enable the output diagnostics to see what pins are being energized.

If you wish to use this advanced feature you will either need a computer with a serial port or we can supply USB and Bluetooth converters.

NOTE: Terminal diagnostics slows the system down tremendously. If the system is power cycled, diagnostics are automatically disabled.

LEDs

- Both of the red LEDs indicate power, they must both be lit for the processor to run. If only one is lit the processor is receiving power but has an internal problem. They must never flicker as this indicates bad power.
- The right green LED indicates the network is connected at full speed.
- The left green LED flashes when data is sent.

Configuration Switches

There are 8 configuration switches on each processor, normally there is no need to change them as they will be set at the factory for you as part of the setup procedure. The technicians will sometimes refer to these as DIP switches.

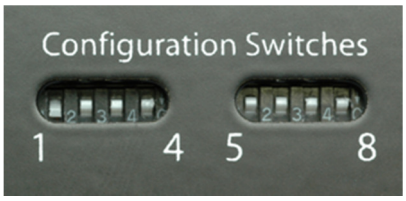


Figure 21: The configuration switches

The switches are numbered from left to right as printed on the panel. Switches 1 to 4 are used to setup boot up conditions and diagnostics. Switches 5 to 8 tell each processor which location it is in and define its unique position on the network.

Each processor contains all the configuration files necessary to operate any location of the organ and the position of the switches tells it which location to be. This allows processors to be moved around in the event of damage to the system so that a less critical processor may be moved and the switches changed.

The switches are OFF when UP, looking at the example above, switch 1 is ON and the rest are OFF.

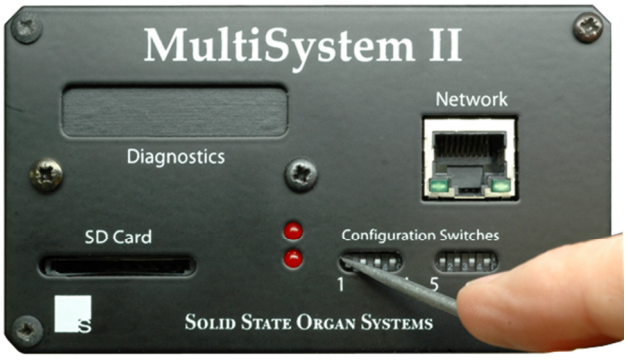


Figure 22: Setting the configuration switches

To change the switches requires a small screwdriver or similar tool. They are deeply recessed to avoid being accidently moved when the box is handled.

Technical note:

Switch 1 - Sets the system to boot up as a MultiSystem. Must be down for normal operation.
Switch 2 - Enable diagnostic display on alphanumeric panel on box (slows processing down a lot)
Switch 3 - Enable MIDI Output on OUT (always responds to MIDI in)
Switch 4 - not used

Switch 5 - Location bit 3
Switch 6 - Location bit 2
Switch 7 - Location bit 1
Switch 8 - Location bit 0

Location bits define the IP address of each location and there must never be two the same in any system. The console locations are usually the lowest numbers typically starting with 0000 or all off. The DIP switches configure the location in binary.

The location bits also map directly to the location names in the system. Location 0 loads AOxxxxxa.hex and location 0001 loads b etc.

Configuration Files

Each MultiSystem is built off identical processors that are configured with a small set of files that tell each processor how the organ is wired and the structure of the coupling etc.

Figure 23: Inserting the new layout

In the earlier MultiSystem these files were contained on an EPROM which plugged into the processor. Now there is no need to open the box, the files are stored inside the processor on flash memory which can be updated when a new layout is required.

Each system ships with a copy of the factory tested configuration files on an SD memory card fitted in the console processor. If you need an additional card it will need to be formatted correctly before the MultiSystem will recognise it.

To update a configuration

First, it is necessary to obtain the files. We can send the files to you on a suitable SD memory card or for fast service we can email them to you to copy onto a card. If you wish to copy them from an email you will need a computer that has an SD slot, many modern laptops including the Macbook Pro support this directly. You can also obtain a USB to SD converter from a computer store very cheaply.

To create an update SD card. The card must be a plain SD card, not SDHC or SDSX, size is not important as the files are very small. The card must be formatted in your computer with a FAT format, not FAT32 or any other type, this may reduce the size of the card.

The files we send you are known as hex files and the name ends in .hex. There will normally be one file for each organ processor except CFM and RFM which do not require configuration. The files need to be copied to the SD card and placed in the very top or root folder, do not place them in a sub folder/directory. If there are hex files already on the SD card, as there will be if you use the one from the processor then we suggest moving them to a folder called OLD.

The screen should look like this in Windows 7 and similarly in other operating systems.

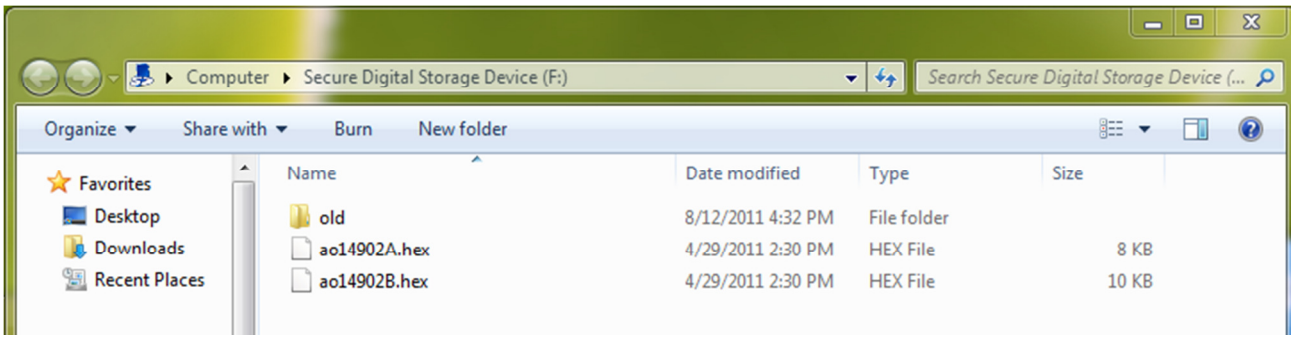


Figure 24: The SD card on a PC

Before removing the SD card from your computer make sure you eject it first using the software. This is important to make sure the files are closed properly.

Remove the card from your computer and insert it into the MultiSystemII processor as shown in Figure 23, you will need to do this for every processor unless instructed otherwise by our service team. This can be done with the processor on or off.

To start the upload first switch on the organ, as the processor boots up it checks to see if the files on the SD card are different and if so it copies them to its internal memory. This process happens in less than 5 seconds and so it is easy to think that the upload was not successful.

Now repeat this for the remaining processors in the system.

Observation	Possible Problems	Suggested Action
Both red LEDs ON Amber display cycling Both green LEDs OFF	Network not connected and not communicating	For a single processor system this is Normal
Both red LEDs ON Amber display cycling Right green LED ON Left green LED flashing	Network connected and communicating	For a multi-processor system this is Normal
No LEDs or displays	No Power to Processor	1. Are the two LED's (Green & Orange) lit on the power units which are at the top of the planes? 2. Are the 25 Way cables from the planes to the processor connected? 3. Is The Plane A cable connected to Plane A on the processor or Plane B?
"LinkNone" is displayed on the processor	The processor is running, but unable to talk to the other end. Is this state displayed on both processors?	Check Cat5 cables

No LEDs	No Power to Processor	1. Are the two LED's (Green & Orange) lit on the power units which are at the top of the planes? 2. Are the 25 Way cables from the planes to the processor connected?
	Processor is not booting due to a fault on the planes.	1. After first removing the power, try removing all ribbon jumper cables from the top distribution board. This is done by firstly pushing down the white plastic bar, and while holding it pressed, carefully removing the ribbon cable. The Red "Running" LED may now light when the power is reconnected. Plane B can be removed completely for this check. 2. If there are two planes try disconnecting Plane B and switching back on. 3. Measure the voltage at bottom of each column of the plane. Do this by probing into the white connector on the last board on pins 1 and 10. A good reading is between 4.6 and 5.2 Volts.

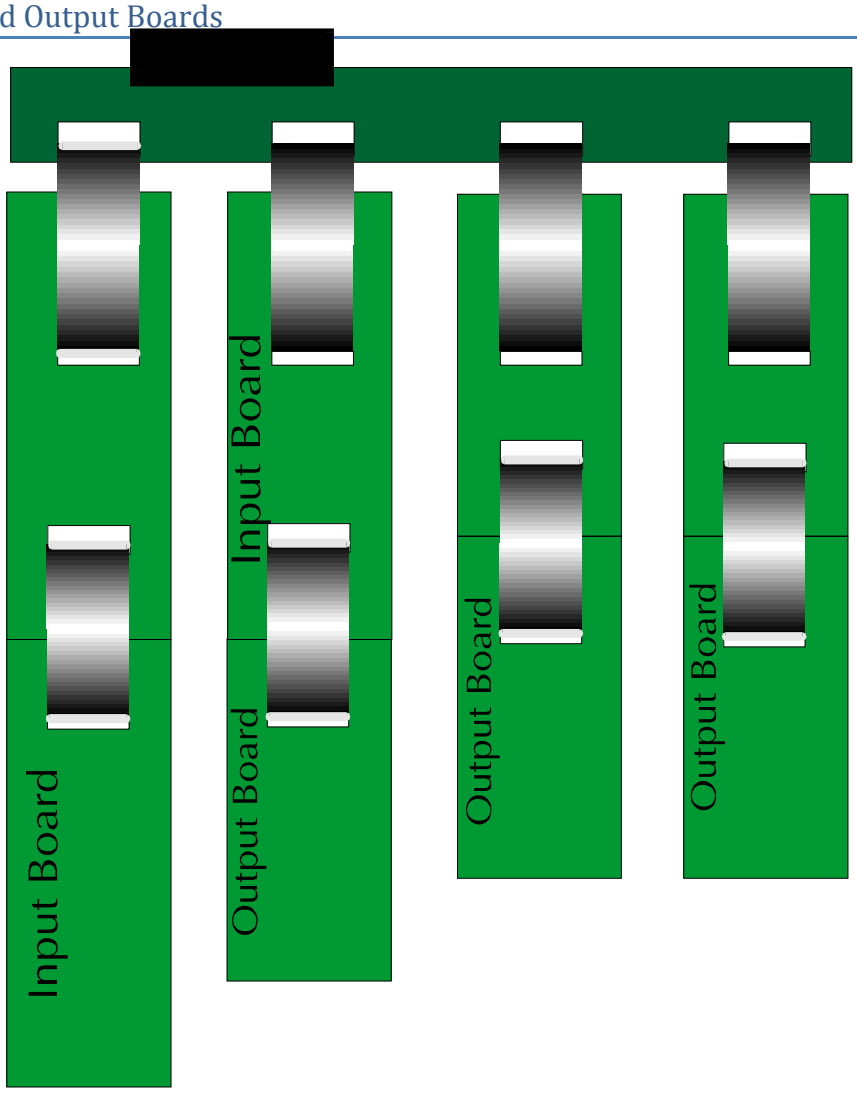


Figure 25: Input and Output boards:

There are six basic types of input and output boards:

1. Negative Input
2. Positive Input
3. Negative Output
4. Positive Output
5. Heavy Duty Negative Output
6. Heavy Duty Positive Output

Each board can be positioned in any column and in any mix of types.

There are also two options for each board and you may encounter either type. Some systems are wired with traditional solder pins but increasingly more are wired with the punch block connector that is used by quality telecommunication companies around the world.

The Krone connectors, are white blocks mounted on the boards and each block takes four circuits. You will need a special tool to add and remove wires from the Krone connectors. One will have been supplied with the system and should be available on site. Spare tools are available from Solid State offices and suitable suppliers. The Krone Tool Part number is 80CLAV6C.

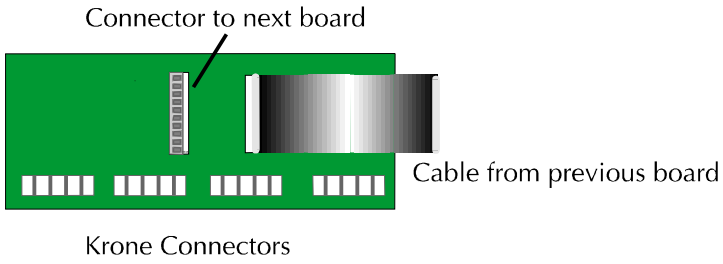


Figure 26: input or output board

Each board is attached to the plane with four screws. Some boards also have a power feed to the rear of the board that will unplug allowing a replacement board to be fitted.

Each system is supplied with at least one of every type of board attached to one of the planes; these are to be used as replacements when required.

There are two types of connectors in use for the grey flat cables which connect the boards together. These are called Wire-trap and Sherlock. Wire-trap connectors are fitted to systems supplied up until January 2013. Sherlock connectors are fitted to systems supplied after January 2013.

Wire-trap Connectors

The grey flat cable that joins the boards is attached to a board at one end as shown in Figure 27. The bare ends of the cable push into the connector on an adjacent board.

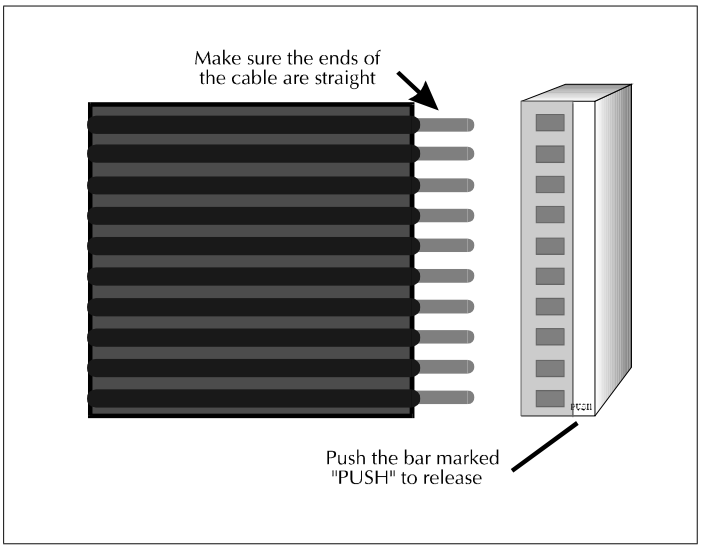


Figure 27: Removing the interconnecting cables

There are several things to be careful with inserting and removing the flat cable.

1. Make sure the individual wires are straight. Smoothing them gently with your finger and thumb can do this, or if the situation is bad try straightening the wires with needle nose pliers.
2. Make sure that two wires do not go in the same hole. This will cause all the boards below this one to stop working.

3. When removing the cable, be sure to push centre of the small white bar on the connector in toward the circuit board. It really does say PUSH on it! This will release the jaws and free the cable. It sometimes helps to do this when inserting the cable also.
4. The connector has "shark's tooth" contacts. Shaped like shark's teeth, they are self-tightening, so please remember to give each cable a small pull to tighten the jaws after installation. This will provide a reliable gas tight joint and give many years of trouble free service.

Sherlock Connectors

The grey cables are fitted with Sherlock connectors at both ends. The connectors have a latch to keep the connection secure.

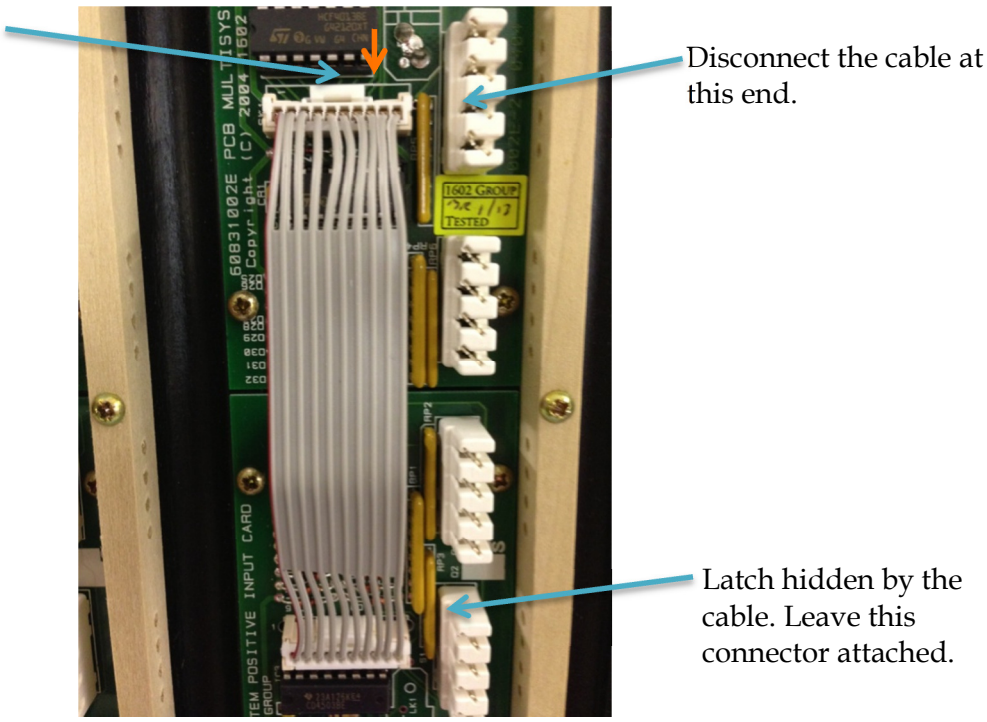


Figure 28: Sherlock Connecting System

When disconnecting boards only disconnect the connector at the board above (the end of the cable nearest the distribution board). Leave the cable attached to the board where the cable covers the latch.

When disconnecting boards squeeze the top of the latch until the latch releases, then pull the connector away from the board.

When connecting boards carefully line up the connector then push it in until the latch clicks.

Figure 29: The processor

The processor is sealed in a black metal case. This is where all the thinking is done. Under normal circumstances it is not necessary to open this box.

The processor box contains a fast microprocessor designed by SSOS specifically for this task. Its energies are concentrated on moving information from one position to another as fast as possible. It is not necessary to understand how the microprocessor works in detail, but knowledge of what it does will help.

Q. Does every Plane require access to a Processor to operate?

A. Yes, the plane is helpless without the processor.

Q. Can a processor operate more than one Plane?

A. Yes, each processor may operate up to two planes.

First let us look inside the processor.

ALWAYS USE A GROUNDED WRIST STRAP BEFORE OPENING THE BOX.
FAILURE TO DO SO WILL DAMAGE THE PROCESSOR AND MAY INVALIDATE YOUR WARRANTY.

Dismantling the box can be a little bit tricky. But most important of all, when the chips are exposed the processor is vulnerable to electro-static damage, which may not reveal itself for years to come.

Inside the box are two circuit boards plugged together but these never need to be unplugged from each other except in the factory. There is also a small spacer, which prevents the boards moving inside the box.

The circuit boards slide in and out of the box. There are grooves moulded into the box for this purpose. The boards fits one slot from the bottom. The top of the box has cooling fins and the bottom of the box is smooth.

Removing the Processor

Having taken adequate anti-static precautions:

Remove the four self-tapping screws at the end of the processor that connects to Plane A and Plane B. This is printed on the cover. Leave the panel loose and turn to the other end of the box.

Remove the four self-tapping screws at the end of the processor.

Turn the panel at an angle so it can be passed through the processor tube and all of the electronics will come out.

Carefully slide the entire system out of the box. Be careful to avoid all contact with static damaging materials, such as white plastic.

Avoid pulling the processor board by the small ribbon cable as it may be pulled out of the connector.

Refitting the Processor

Tilt the end panel and slide back through the box in the reverse way that you removed it. The box is the same at both ends. Remember that the top of the box has cooling fins and lines up with the top of the panels (writing the right way up).

Position the processor assembly so it begins to slide into the box on the guides one slot from the bottom.

If you have inserted the processor correctly the spacer should fit flush with the end of the box.

Attach each end of the box with the four self-tapping screws being careful not to trap the ribbon cables.

Take the following precautions when re-assembling:

1. Avoid trapping the ribbon cables between the panel and the box.
2. Check the processor for loose wire clippings, etc. on the back before re-assembling.
3. Don't forget to fit the spacer. It prevents the cards becoming separated by prolonged use of 32' pipes.
4. Do not over tighten the self-tapping screws.

The MultiSystem II can be supplied with either standard solder pins or with quick connection blocks. It is important to make this decision at the time of ordering, as it is difficult to alter this once the system is assembled.

The quick connection blocks supplied are of the highest quality available and should not be confused with cheaper alternatives available from other sources. This design has been in use with telecommunications systems throughout the world for over 50 years.

The blocks are arranged in groups of four circuits with slots in the top where the wires are inserted. Cable registers are supplied to arrange the cables prior to assembly. They can be removed from the system and discarded if not required.

The quick connection blocks will provide a very fast and extremely reliable connection if a few simple rules are used.

1. There is a limit to the range of wire size that can be used
2. The special insertion/removal tool supplied must be used
3. It is not necessary to remove the insulation from each wire

It is possible to make 61 connections with this system in a little over one minute with very little previous experience.

Technical Data

Strands / Dia. (mm)	Overall Dia. (mm) Including insulation
7/0.15	1.10
7/0.20	1.20
7/0.25	1.20

Copper conductor 26 - 22 AWG	0.40 - 0.65 mm
Over Insulation	0.7 - 1.40 mm

It is possible to use cables outside this specification but this must be checked with the SSO sales office. Two cables may be inserted into each slot for making parallel connections if required. The two wires should, however, be identical. The connection blocks will accept up to 100 re-terminations without damage.

These connectors comply with European and tropical climate tests to 40/92 DIN 50015 and in corrosive industrial or salt laden air to reliability test DIN 40046. They are also suitable for high vibration environments.

In order to terminate the system correctly you will require a special insertion/removal tool. The tool supplied is a professional quality tool and should last a lifetime. Spare tools are obtainable directly from SSOS or other suppliers. They are manufactured by a European Company called Krone and the part number is 6537 1 500-00. Tools are also available from SSOS as part number 80CLAV6C.

Use only the special tool to insert wires.
Any other tool will damage the blocks and cause unreliability.

The tool has a number of functions. It can be used to insert wires or remove them from the blocks. It is also capable of cutting off excess wire if required.

If you wish to cut off the excess wire, remove the clip at the bottom of the tool and allow it to hang free on the string. If you wish to link the wire onto another point, make sure the clip is in place and this will prevent the cutters operating. Please be very careful not to allow the wire clippings to fall into the electronics where they may cause damage.

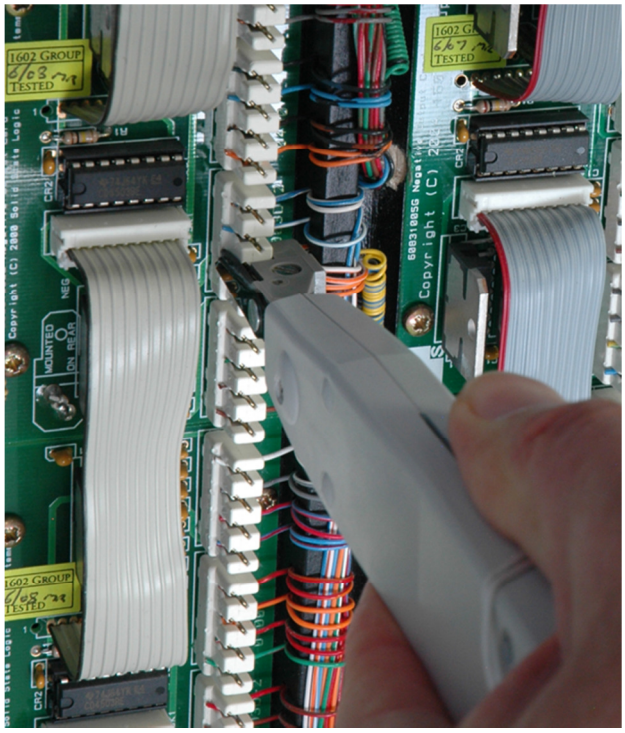


Figure 30: Punching wires with the Krone tool

To insert a wire, place the wire over the top of the connection block. Insert the tool into the block with the grey plastic part closest to the cable register and the cutters nearest the components. The small groove in the bottom of the tool should rest on the wire. Push the tool firmly into the block. If the cutters are enabled you will feel and hear a click as the excess wire is trimmed.

Removing wires is done with the other end of the tool. At the side is a black metal clip. Pulling this out in the same way as a penknife will reveal the removal tool.

Hook the wire between the block and the cable register and pull the wire out.

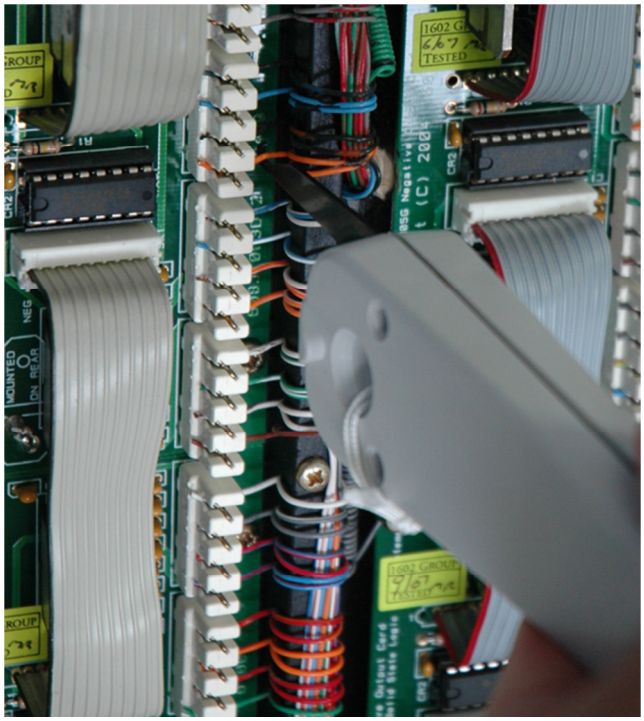


Figure 31: Removing wires with the Krone tool

32PM25YX	Grey cable from processor to plane
534102A1	Cable register for 1 output board
534102A2	Cable register for 4 output boards
534102A3	Cable register for 4 input boards
534102A4	Cable register for 1 input board
62310015	Negative input board fitted with Krone connectors
62310025	Positive input board fitted with Krone connectors
62310026	Positive input board fitted with solder pins
62310135	Negative output board fitted with Krone connectors
62310065	Positive output board fitted with Krone connectors
62310155	Heavy Duty Negative output board with Krone connectors
62312115/6	Interface for CFM Control Panels
62310235	Distribution board for the top of the plane
723500M1	MultiSystem II processor
723500M2	MultiSystem II processor with MIDI
62350221	MultiSystem II Processor board (no box or software)
62350260	Link protection board
32SKT018	Network patch-cable 1 metre
45UNC050	5 Port Network Switch
723100S1	Spares kit shipped with system