MultiSystem
Installation Guide

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Contents

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 fibers 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 worksurface. 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.

Returning Parts to SSOS

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, which is the result of 25 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 SSOS'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.

Opening the Box

The MultiSystem 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 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 black 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.

The Parts

The system will contain a packing list, which will be completed by hand 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:

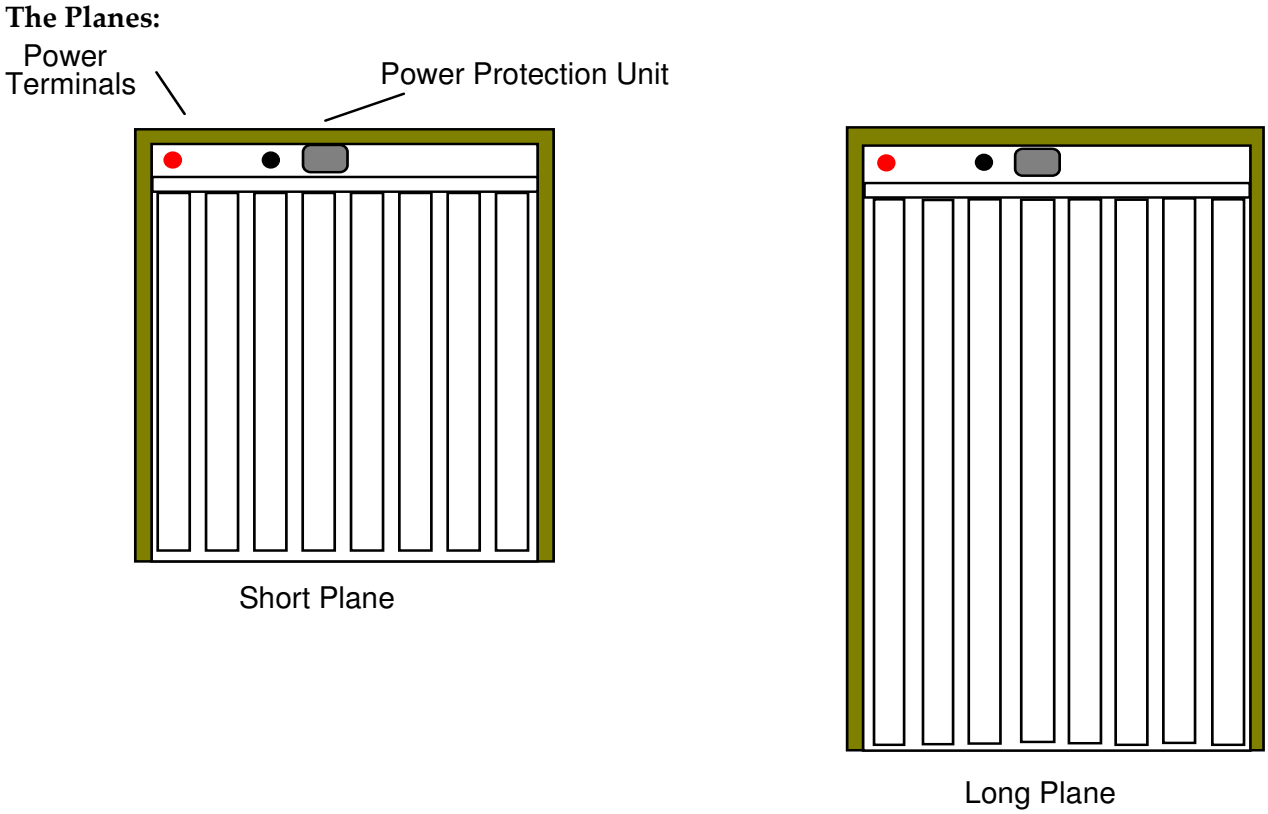


Figure **1***: Long and Short Planes*

Figure 2: The Processor

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.

Inside the box is a small EPROM chip that we call the cartridge. This cartridge contains all the information about this particular organ and is how the processor knows where to switch on the outputs.

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.

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.

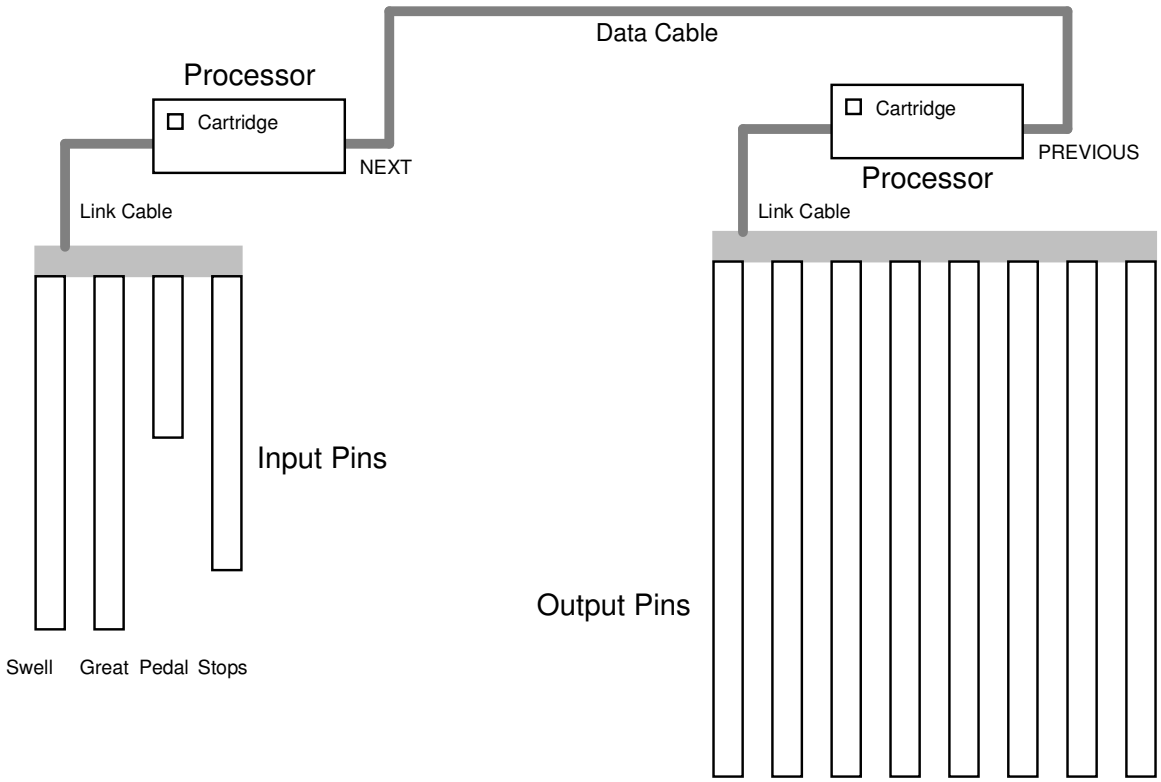


Figure **3***: A typical installation structure*

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.

Wiring to the Planes

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

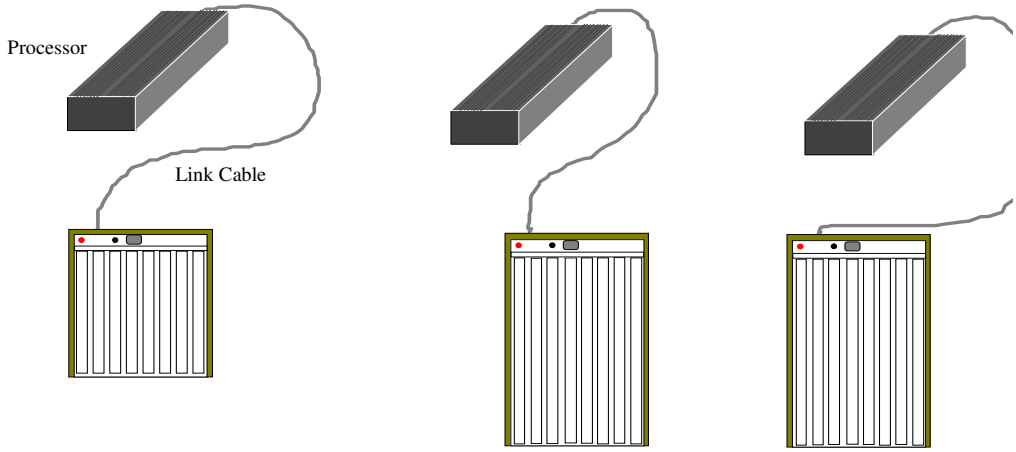


Figure **4***: The system*

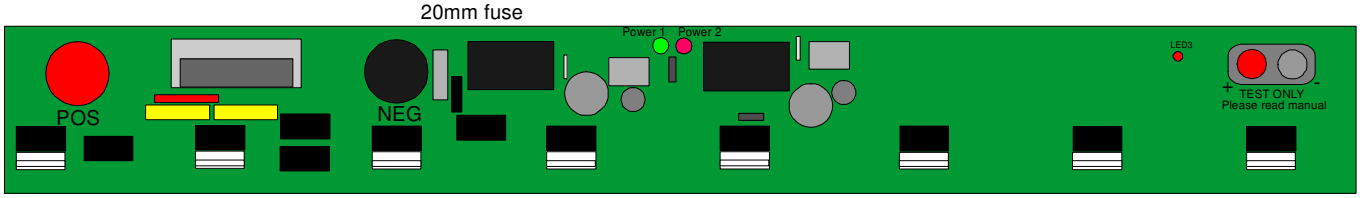
fixed to a vertical surface with the power terminals at the top, although it will work happily in any position. Wiring to the boards should be taken off the Plane in such a way that it does not restrict the service access to the SSOS parts. We suggest cables enter from the bottom of the plane (the opposite 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.

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 SSOS system. Magnets driven directly from the system are suppressed by the SSOS circuitry.

Figure **5***: The distribution board*



Since 1998 most MultiSystems have been supplied with a new dual power distribution board. As this part contains serviceable parts, do not run cables over the top of the plane. The power terminals remain in their existing position 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 upside down.

The new distribution board, shown in Figure 5, contains all the power regulation and new filtered data control in one board. There is an input fuse on 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 29.

Power

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 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 as if the current drain approaches the limit the output will shut down. This shut down will occur for a split second, during which time the MultiSystem switches off, removing the load. Power is reinstated and the MultiSystem 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 call SSOS. The MultiSystem draws about 1 Amp per Plane for its own use; the remaining current is purely for the organ.

SSOS Power Light supplies are available for installations in North America and Canada. 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.

Connecting the Processor to the Plane

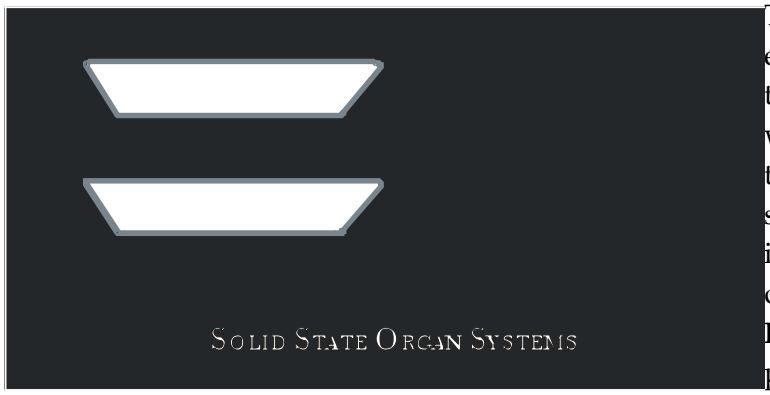


Figure **6***: The processor connections to the plane*

The drawing in Figure 6 shows one end of the processor box. There are two multiway 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.

Linking Two Processors Together to Make A Multi-Location System

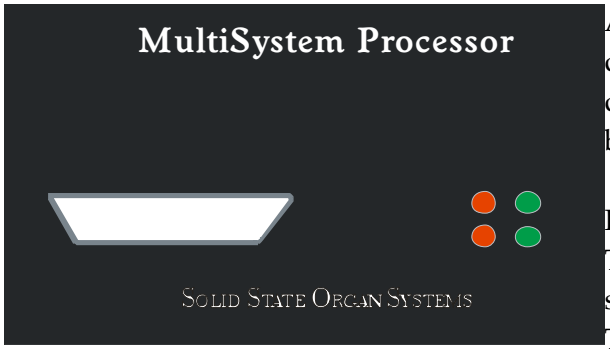


Figure 7: The processor connections to the link boards

At the other end of the processor box is another D connector and a group of LED indicators. This D connector is used to connect to the link protection boards.

It's then necessary to connect the systems together. This is normally done with a cable fixed out of sight, supplied by SSOS 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 19. 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 link protection board is used to link one part of the system to another and because it protects the system components from damage either from mis-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.
Your system will come complete with the necessary link protection boards and cables. The assembly will look similar to the system shown in Figure 8.

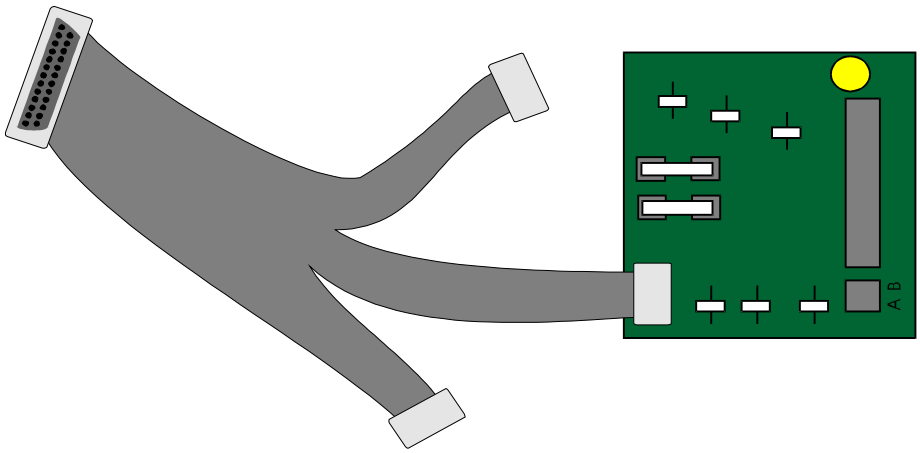


Figure **8***: The coloured ribbon cable*

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. It is preferable that this is not the cable used by the electrical earth system particularly when using 220V or greater systems.

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

Data Cable

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.

We recommend the use of a Belden cable, type number 1624R or 1633A LAN Data Cable Category Level 5 FTP with overall shield. However a number of alternatives are available and these are detailed in the table below, the cable must have a shield, as this is an integral part of the circuit. Suitable cables are available from our offices or from reputable computer cable dealers. For suppliers see the listing in the back of this book.

MultiSystem Data Cable - Alternative Types					
	Belden	Alpha	Farnell/ Newark	RS Components	SSOS Partcode
Level 5 (Preferred)	1624R or 1633A	9504FS	473-261	369-832 419-5477	31L08368
Level 5 (Flexible for mobile consoles)			296-788	369-854	31L08468

Connecting the Processor Box to 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 Board
3. The Coloured Ribbon Cable (SSOS Part Number 66D10260)

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 another connector used to connect the processor to the link protection board via the ribbon cable.

First plug the D connector of the ribbon cable into the processor then mount the Link Protection boards to the organ/console structure at a point where the ribbon cable will easily reach.

How many Link Protection Boards do you need?

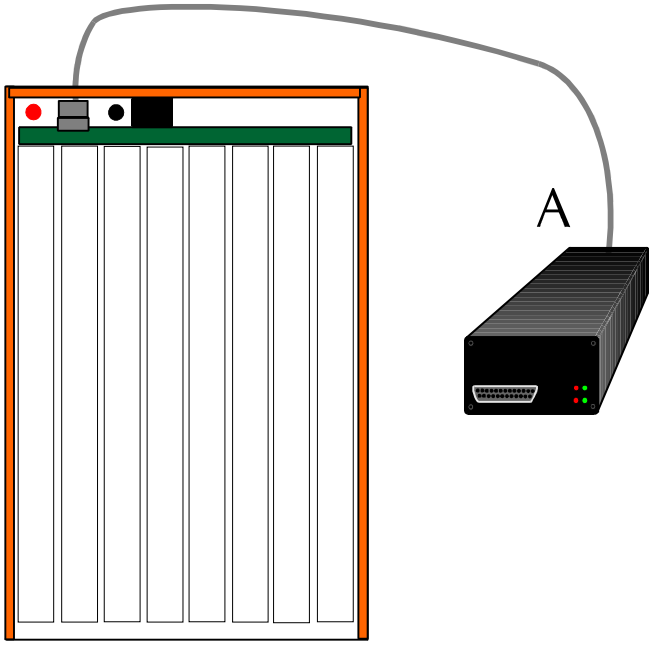


Figure **9***: A single location system*

Single Location Coupling System:

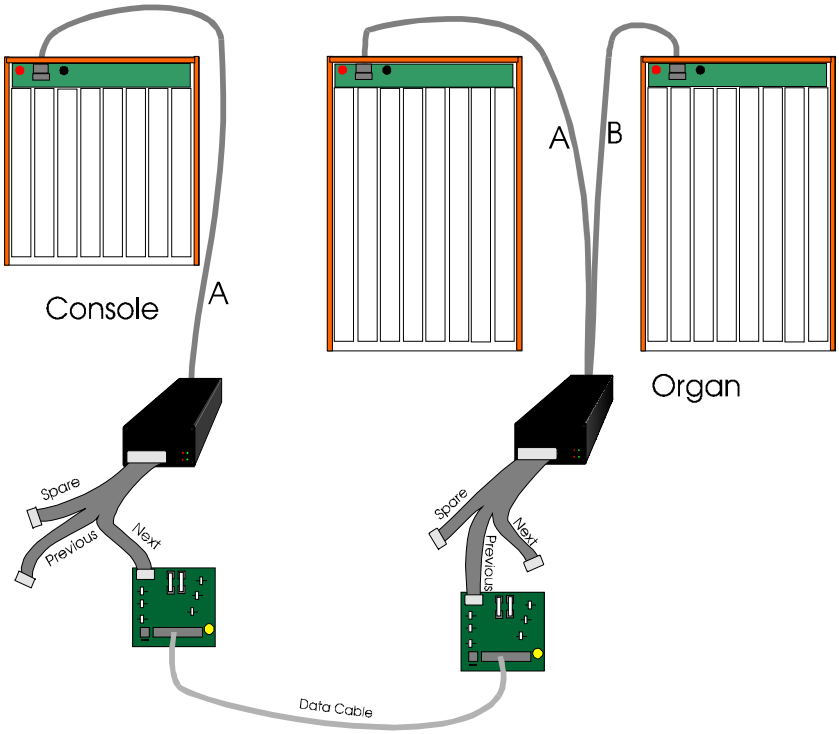
With a fixed position coupling option the system will normally have only one processor, although this might operate two planes. If this is the case, then your system will look similar to Figure 9 and you will not require link protection boards. There is no need to read any further in this section.

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

Systems with Two Processors:

If your system is supplied with two processors, it will also have two link protection boards and two ribbon cables. The system must be assembled as shown in Figure 10. It is important to note that on one processor the connector labelled "NEXT" is used, where on the other processor the connector labelled "PREVIOUS" is used.

Figure **10***: An Example of a two location system*



Systems with Three Processors:

If the system has three processors, it will be supplied with three ribbon cables and four link protection boards. The system will appear similar to Figure 11 below. Please pay special attention to the way the small ribbon connectors are plugged in.

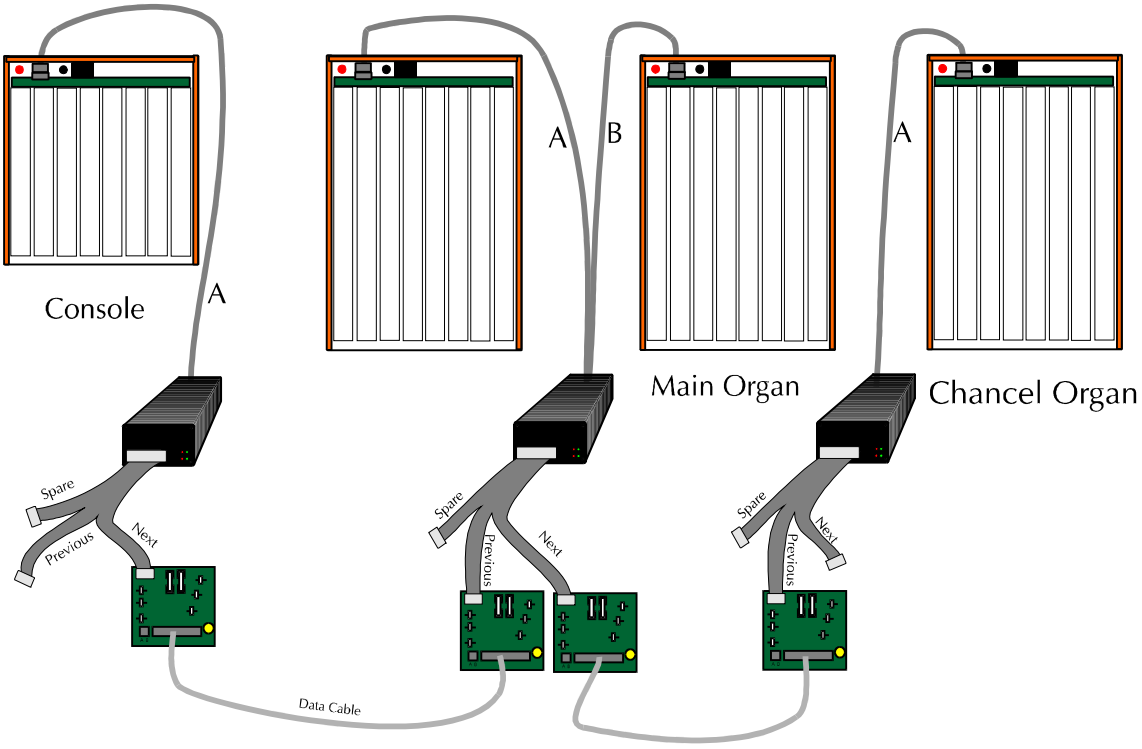


Figure **11***: An Example of a three-location system*

Connecting the Systems Together

Earlier in the instructions we mentioned the use of the cable that links the systems together. This cable should be placed in position and the ends connected to the link protection boards.

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 systems as shown in Figure 11. It is now necessary to link them together.

Some Rules:

1. Each MultiSystem 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.

2. The cable may be joined if cut too short, but be careful to connect the screen/shield as well.

3. Each system has "Inputs" and "Outputs".

The small plugs on the end of the coloured ribbon cable are labelled NEXT, PREVIOUS & SPARE. In Figure 11, you will note that the link protection boards are arranged so that these connectors are arranged in a particular order.

Please follow the chart on page 16 when connecting the system. A simple rule of thumb is that the "NEXT" and "PREVIOUS" connectors are normally used. The third connector is reserved for special functions. Never connect two plugs marked NEXT or two plugs marked PREVIOUS to the same data cable. The system will not normally be damaged, it just won't work.

Systems with Two Processors	Cable One
Console	NEXT
Organ	PREVIOUS

Systems with Three Processors Option One, Console at one end.	Cable One	Cable Two
Console	NEXT	
Organ One	PREVIOUS	NEXT
Organ Two		PREVIOUS

Systems with Three Processors Option Two, Console in the centre.	Cable One	Cable Two
Organ One	NEXT	
Console	PREVIOUS	NEXT
Organ Two		PREVIOUS

Systems with CFM or MFM

This MultiSystem may include additional processors with no planes, these will be for Midi for MultiSystem (MFM) and/or Capture for MultiSystem (CFM). 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.

These processors are linked in the same way as the MultiSystem processors. Because they are not required to operate at a distance from each other, a simple linking device known as an NP linker is provided for connection.

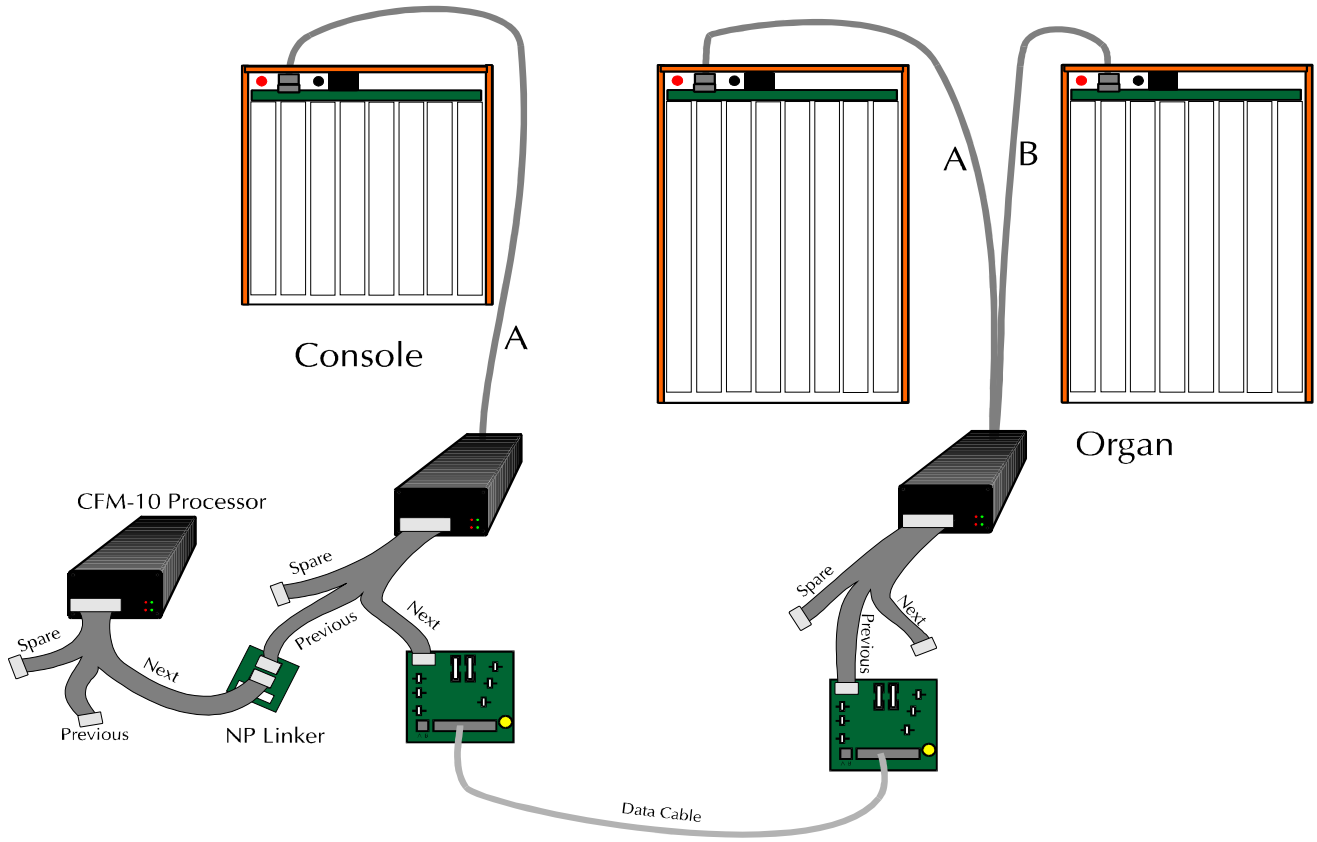


Figure **12***: A CFM system*

Link Protection Board – Data Cable Connection

MultiSystems are now supplied with Krone connectors on the link protection board for terminating the data cable. See Page 41 for more information on wiring with Krone connectors. Carefully strip the data cable about 100mm (4") removing the foil shield but leaving the bare metal drain wire intact. Keep the twisted pairs of the data cable twisted as much as possible and insulate the drain wire. Punch the wires into the Krone blocks being careful to observe the correct colour coding. The bare drain wire is for the shield connection but it without a plastic coating it does not securely hold in the Krone block. Please attach the wire to a short length of insulated wired which is to be punched into the block.

The link protection boards are designed to route the high voltages in the data cable to ground via the stud. The fuses are primarily designed to protect the system from shorts in the data cable wiring as fuses are normally about 1000 times too slow to protect against lightning damage.

Using the Cable Connector Blocks (Older Systems)

There are two connector blocks on each link protection board. One is reserved for the remote start option, which is explained later; the other is for the main link cable. These connectors are specially chosen to be vibration resistant. The contacts are spring loaded so the wires are under a constant tightening pressure. Any vibration causes the connector to settle and clamp the cable tighter, rather than becoming loose.

To attach the cable you will need a small flatblade/slotted electrical screwdriver. One is supplied in your spares kit for convenience, but any flat-blade that fits will do.

- Insert the screwdriver into the slot above the cable entry and this will force the jaws open
- Push the correct colour wire into the lower slot
- Remove the screwdriver

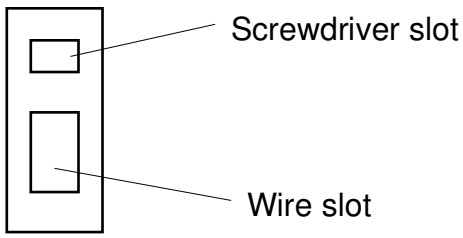


Figure 13: Using connector blocks

The insulation must be stripped between 1/8 and ¼ inch before insertion into the terminal block. Do not overstrip as the bare wires can touch and stop the organ playing.

The twisted colour pairs should remain twisted or be retwisted before connecting to maximise performance of the system.

Removal of the cables is accomplished by following the same procedure.

When this process is complete use one of the cable ties in the spares kit to attach the main cable to the link protection board by passing it through the two holes provided.

Consoles With More than One Connection Point

If one or more of the consoles are mobile they may require more than one connection point each. In this case the wiring must be planned differently and some further parts will be required.

Planning the wiring:
Although each processor may be connected anywhere in the system if the console is to be moveable it is preferable to arrange for it to be at the end of the line. This simplifies the wiring, as only one data cable has to be fed to the console instead of two if it is positioned in the centre of the chain.

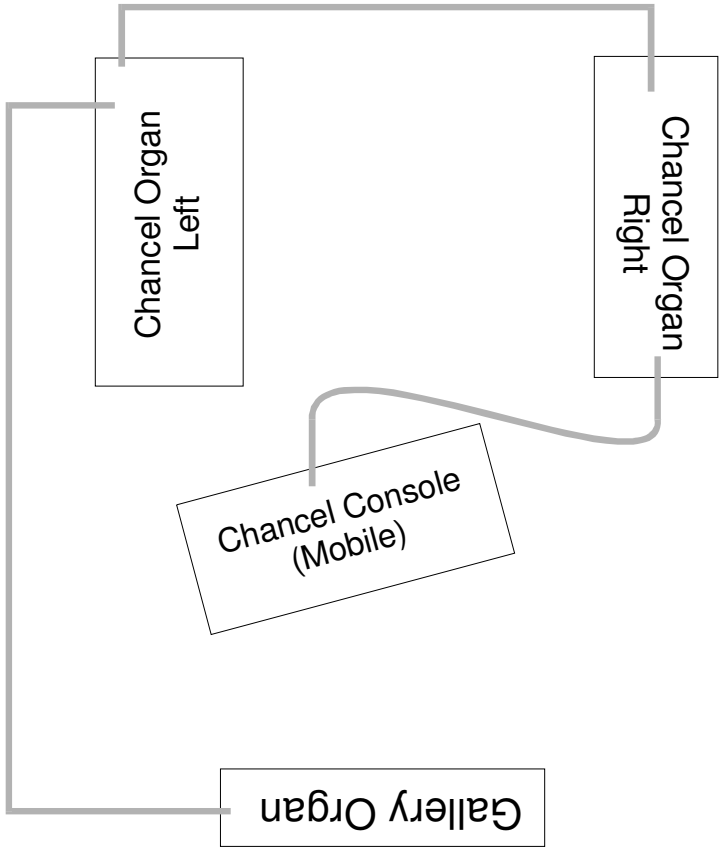


Figure **14***: A plan for data cable wiring*

Figure 14 above shows a typical installation and the best way the plan the wiring.

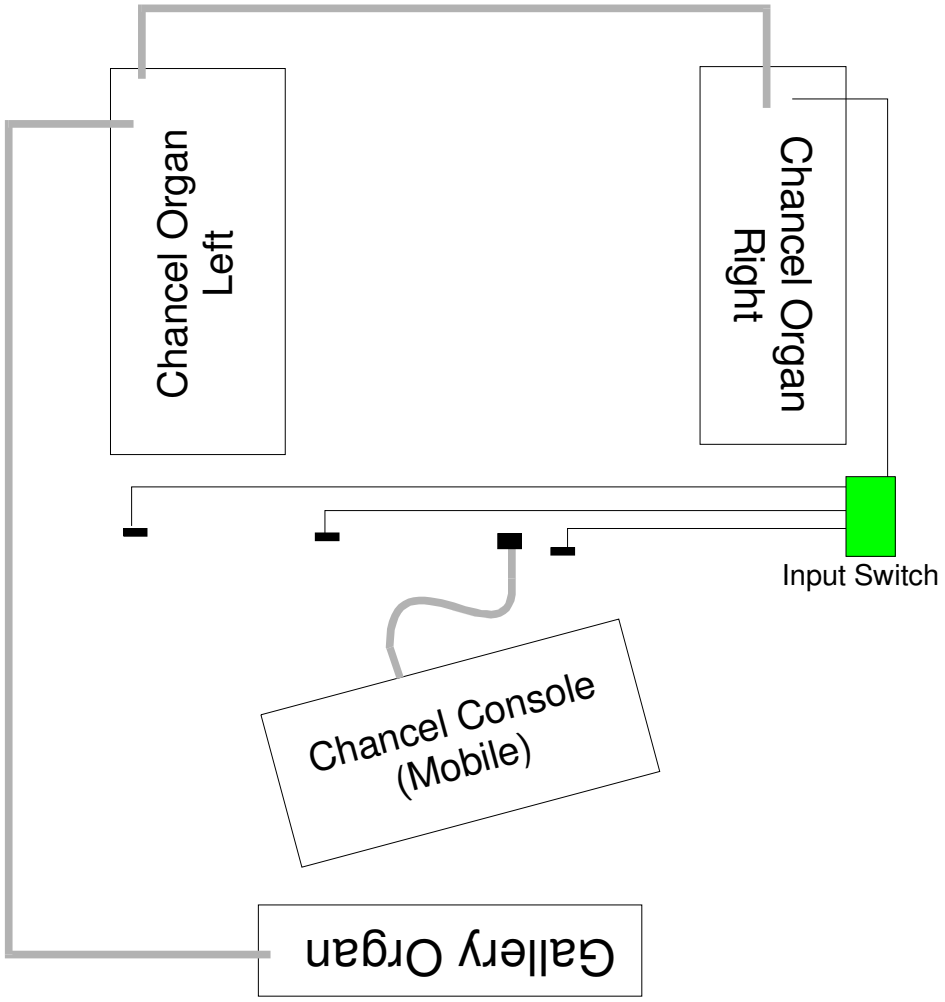


Figure **15***: A multiple location system layout*

If the console needs to have more than one point to plug in the data then the wiring must be planned to do this. Do not chain the cable from one plug to another as this will not work reliably due to echoes caused by the open end of the cable. Please wire the connectors as follows. Each connection position for the console must be wired back to an input selector, available from SSOS. There must never be a junction in the cable where the cable splits; it must go through the selector.

Connecting Plugs for Movable Consoles

It is often desirable to fit connectors to the cable for moveable consoles. If the console has only one connection point it may be best not to fit a cable, as this is one less link in the chain to have a problem.

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. Suitable plugs and sockets are available from SSOS or other suppliers. We recommend professional video connectors manufactured by Hirose and available from RS Components, Newark Electronics and Farnell. The addresses of these suppliers around the world can be found at the end of this manual.

Description	Manufacturer's part number	SSOS Part Number	Newark/Farnell	RS Components
Cable Plug	RM15TPD 10P	32PN10KF	147-054	464-987
Panel Socket	RM15TPD 10S	32PN10GF	147-056	464-993
Rectangular flange	RM15TR-F		211-977	
Allen Key		80C67EEX	441-661	609-590

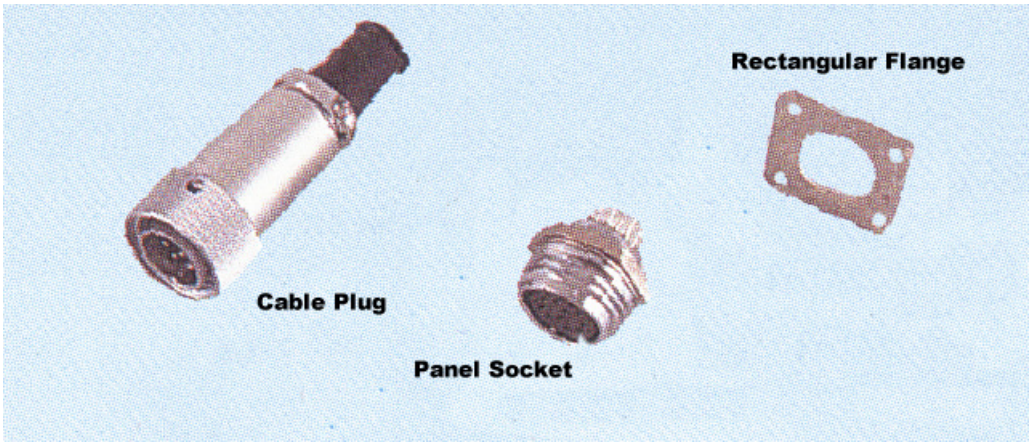


Figure **16***: Data cable connectors*

The connectors shown in Figure 16 are 10 way connectors; the data cable has eight individual conductors and an overall shield. The connector should be wired to the following layout. This will maintain a standard for the system and aid fault finding.

The cable plug is assembled using the small hex key provided in the kit. The collar on the connector must be rotated in position to allow the key to be inserted to release the assembly.

A mounting flange is available to assist in mounting the panel socket if required.

Neatness when wiring these connectors is vital. Each conductor must be stripped to allow soldering.

If the cable end has been exposed to the air for more than a few hours strip back until the copper is clean and bright.

Remove the outer casing, being careful to not cut any of the internal wires.

Remove the foil cover for ¾" (20mm) and expose eight insulated wires and a bare drain wire from the shield. Strip each individual conductor for 7/32" (5mm).

Tin each bare end with a small amount of solder, take care not to melt the insulation. Feed the prepared cable through the casing of the plug when wiring the plug and solder to the pins as shown below. Take great care to minimise shorts and avoid melting the connector insulation with excessive heat.

We cannot stress enough how important it is to make a good an reliable connection. If this connection fails, the link from the console to the organ will be lost. SSOS is happy to supply ready-made cables on request.

Connector Pin	Cable Colour
1	Blue
2	White/Blue
3	Orange
4	White/Orange
5	Green
6	White/Green
7	Brown
8	White/Brown
9	Shield/Screen
10	Not used

The Input Selector

The input selector will switch up to three positions into one. If more console positions are required then more selectors can be added. The console remote start must be wired according to the instructions on page 26 of this manual.

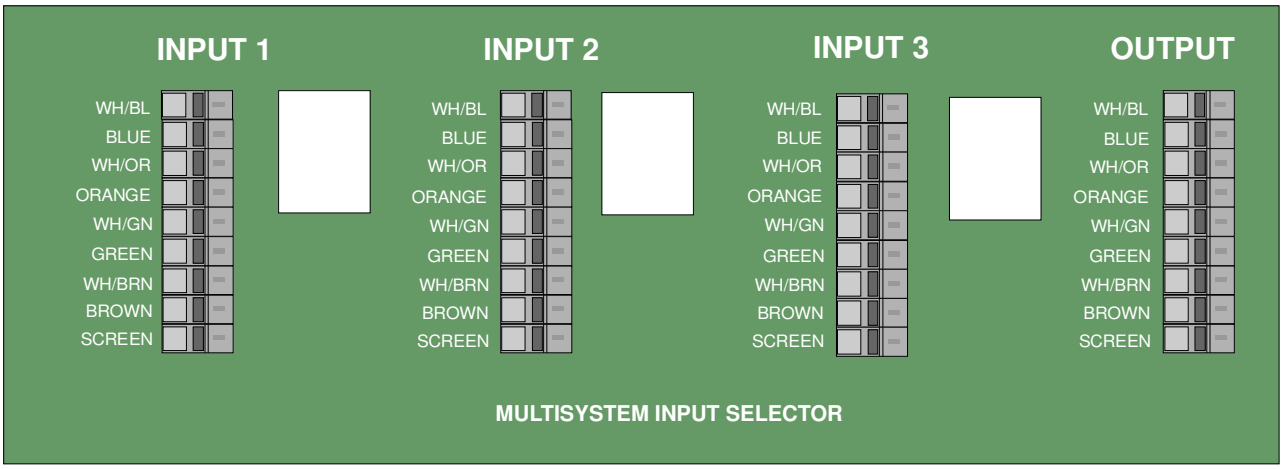


Figure **17***: The console input switcher*

Each section of the input selector is arranged exactly the same as the link protection board, (see page 15 for wiring details). Be sure to connect the screen or shield of the cable securely and that it cannot short on the bare ends of the other cables.

The selector may be positioned anywhere in the cable run that is convenient, although it is important to document this with the installation to aid fault finding in the future.

How does the selector operate?

The selector senses the remote start voltage in the data cable. A positive voltage on the BROWN cable with a return on the WHITE/BROWN cable will close the relay contact for that circuit enabling data to flow between the processors.

Expression Inputs

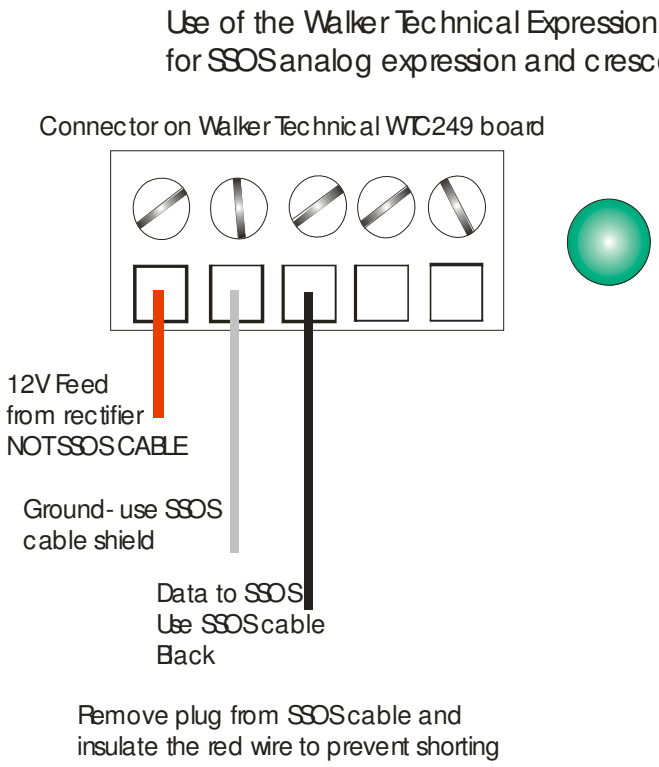
Historically the expression shoe was fitted with a roller wired to a common positive which feeds into the MultiSystem through a positive input module. It is important to note that the pins are defined with an open and a closed position. As the MultiSystem allows different numbers of shoe contacts and 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 because of this 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 sliders to match our crescendo shoe to do this and 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 analogue inputs as follows:



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.

To calibrate the MultiSystem 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:

- Rotary selector switch
- Engraved brass or black cast bezel plate
- Black collet knob
- 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:

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.

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.

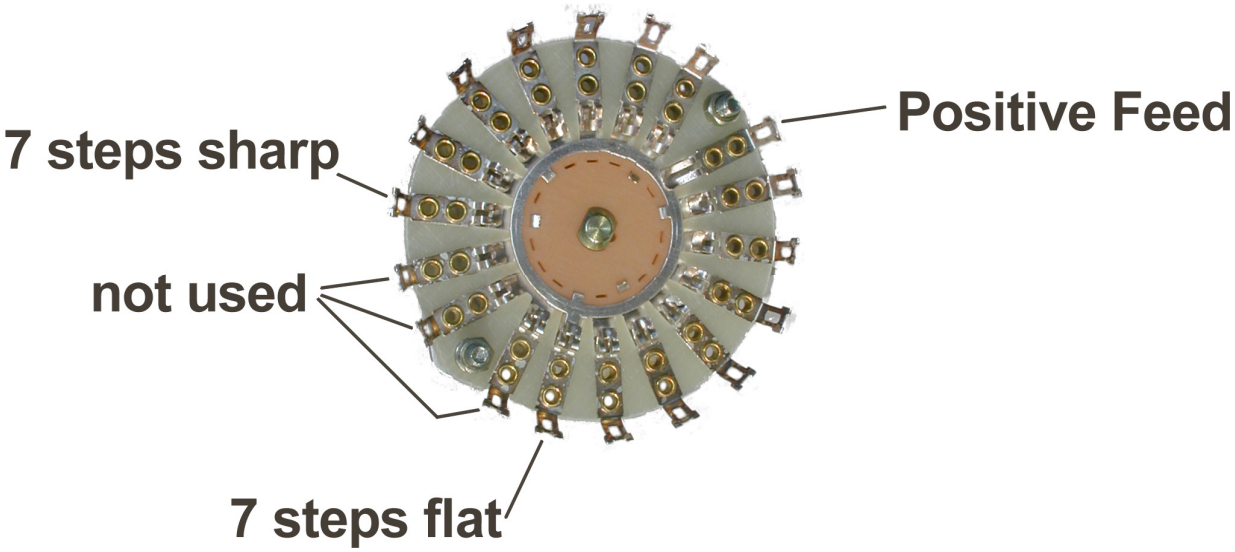
The knob mounts to the shaft via a collet, which is tightened by the brass nut seen in the end of the knob. Use a pair of pliers and rotate the shaft to its farthest left hand (counter clockwise) position. Place the knob on the shaft, point the line at the left-hand "7" on the plate, and hold the knob 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 input pin board assembly. Continue to identify and wire each switch contact in turn until all are wired. Refer to the MultiSystem 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.



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 and is marked Remote Start A & B. For compatibility with the input selector system for multiple consoles A must be wired to positive 9-16V and B to the negative return for this circuit.

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

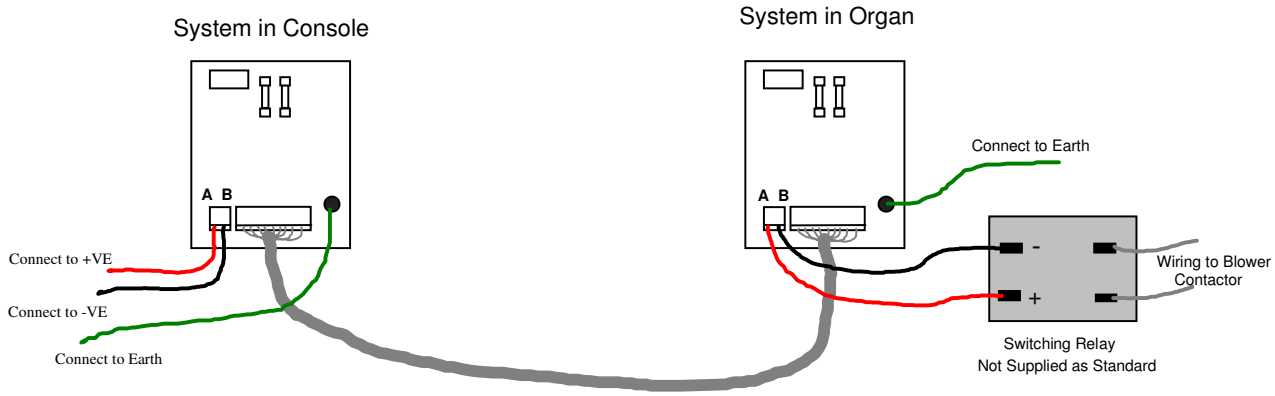


Figure **18***: Remote start wiring*

When installing a Solid State relay for the remote start add the extra components shown in Figure 19. This will ensure that the relay does not "hunt". A safety cover is available to protect the bare terminals.

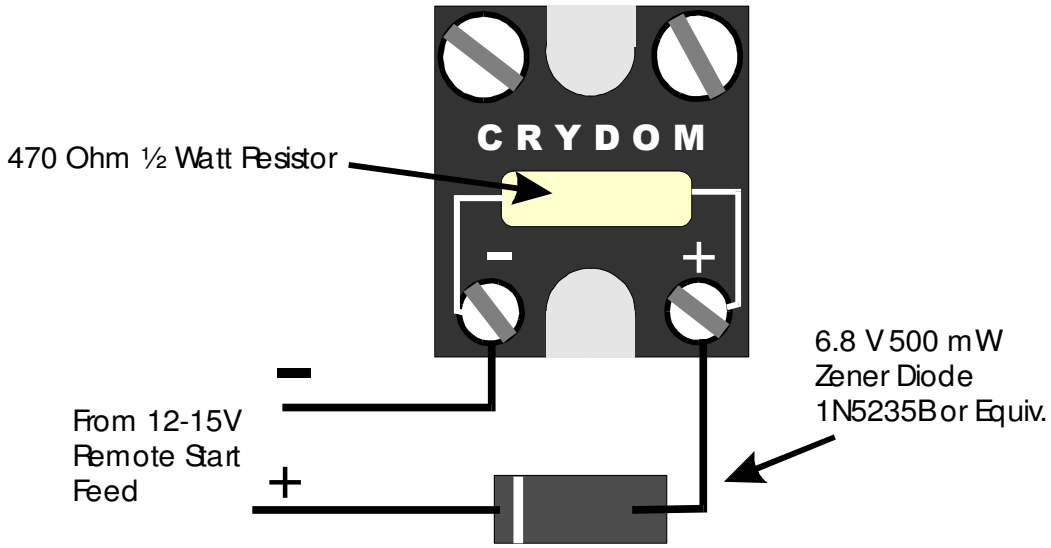


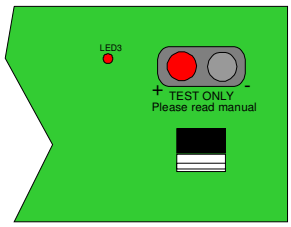
Figure **19***: The Crydom relay wiring*

More than two processors?

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

Test Lamps

New versions of the MultiSystem now include a small test lamp system on the distribution board. These systems started being shipped from our factory in the spring of 1998. The test area is on the right side of the distribution board and is shown in the drawing below.



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 33.

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 Indicator Lamps

There are four small lamps or LED's on the end of the processor box. These are provided to indicate what the system is doing.

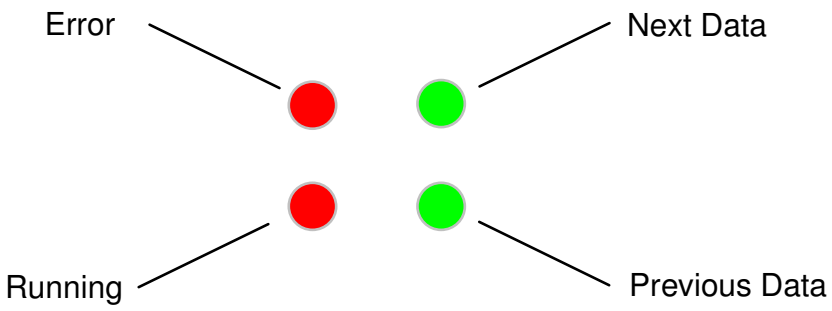


Figure **20***: Indicators on the processor*

Full details of the operation of these useful indicators are given in the accompanying tables. As a quick reference a normal system will have the Red "Running" LED lit and the two Green LEDs flashing. The Green LEDS will often flash at different speeds. This does not have any significance.

Power Indicator

Systems supplied prior to 1998 have a power system with a small Yellow LED on the power protection unit that lights when power is applied to the large power terminals on the plane. This indicates to you that the power is available to the system.

On later systems delivered from spring 1998 onward, two lamps provide power indication. 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).

Observation	Possible Problems	Suggested Action
Red Running LED ON Two Green LEDs Flashing at different speeds. In single processor systems the green lights will flash together slowly.	System OK	
No LEDs	No Power to Processor Processor is not booting due to a fault on the planes.	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? 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.
Red Running LED is ON Red Error LED is ON	The Processor has a problem. The system is fitted with an error detection device that will, in this unlikely event, automatically restart the processor. If there is a persistent fault these LEDs should flash.	This may be caused by inserting the replacement EPROM incorrectly. See section on EPROMS. If the two LEDs are on permanently, try switching off the power, allowing at least 10 seconds and restarting. If the fault remains call SSOS. Please call us anyway if this happens.

Red Running LED is flashing Red Error LED is flashing	The system is trying to restart itself to cure an error that has occurred.	If the system has recently been installed, the fault could be due to the way the system has been assembled. If the system has been in operation for some time, the processor may well be at fault. A power problem in the rectifier could also cause this, check the rectifier and the wiring. Adding a new EPROM for a system upgrade and fitting it backwards will also cause this.
Red Running LED is ON Red Error LED is OFF Both Green LEDs are flashing once per second in synchronisation	The processor is running, but unable to talk to the other end. Is this state displayed on both processors? Both of the processors are showing the same display.	If there is only one processor in the system this is OK. If one processor has any of the above faults, then the one connected to it along the data cable will display a slow flashing Green LED until it receives a communication from the other end. The fault is very likely to be in the data cable wiring. Check that the colours are correct on the link protection board and the correct choice of connectors (NEXT and PREVIOUS) on the coloured ribbon cable has been made. Try swapping the NEXT and PREVIOUS connections throughout the installation.

The Input and Output Boards

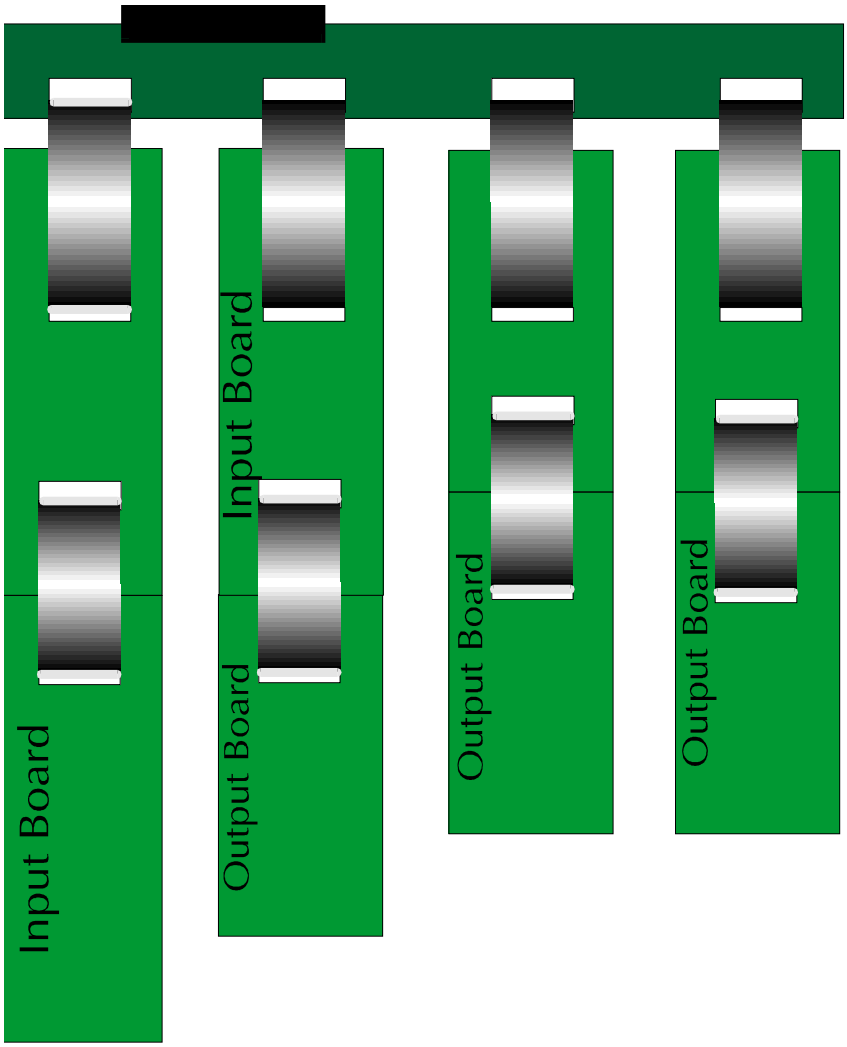


Figure **21***: Input and output boards*

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 SSOS offices and suitable suppliers. The Krone Tool Part number is 80CLAV6C.

Changing an Input or Output Board

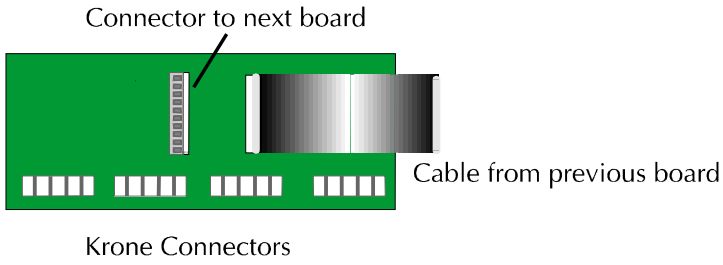


Figure 22: input or output board

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.

The grey flat cable that joins the boards is attached to a board at one end as shown in Figure 21. The bare ends of the cable push into the connector on an adjacent board.

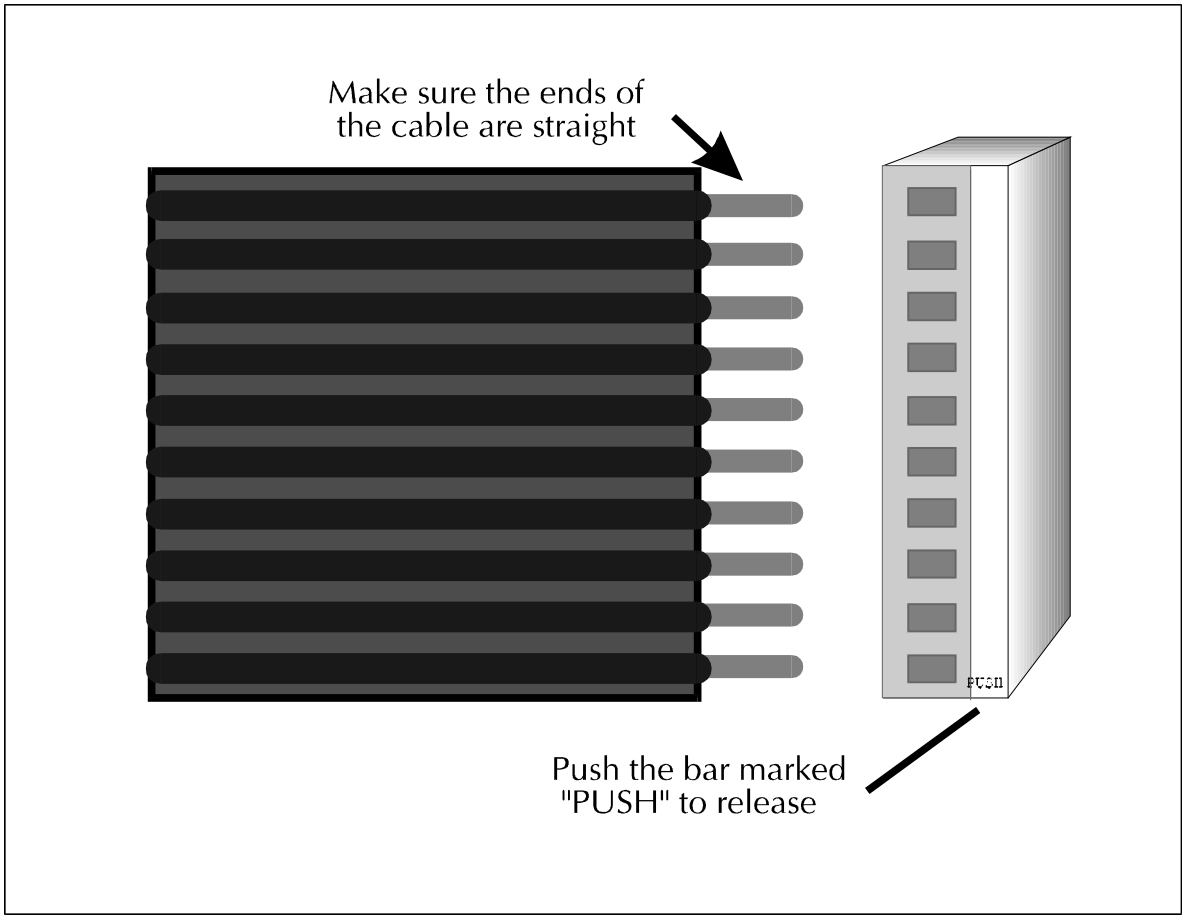


Figure **23***: Removal of interconnecting cables*

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 down the small white bar on the connector. 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.

Figure **24***: The processor box*

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, however it is possible to do so if the program that operates the MultiSystem needs to be changed. More about changing parts later.
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 three circuit boards. One contains the processor and one has the components that link it to the long data cable that links two processors together. Above these there may also be a board on a separate shelf. This is called the buffer board and is used to buffer the signals to the plane. 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.

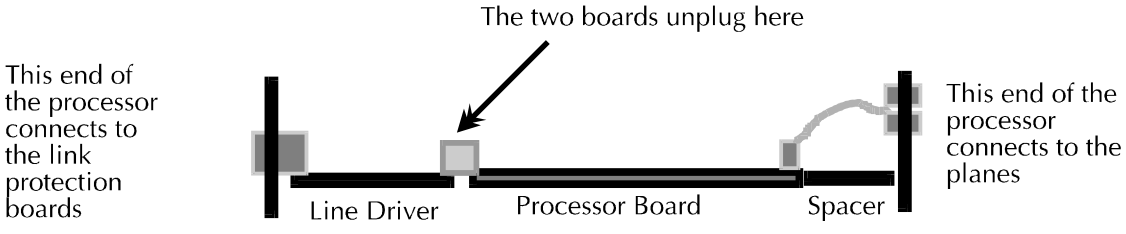


Figure **25** *The processor without buffer board*

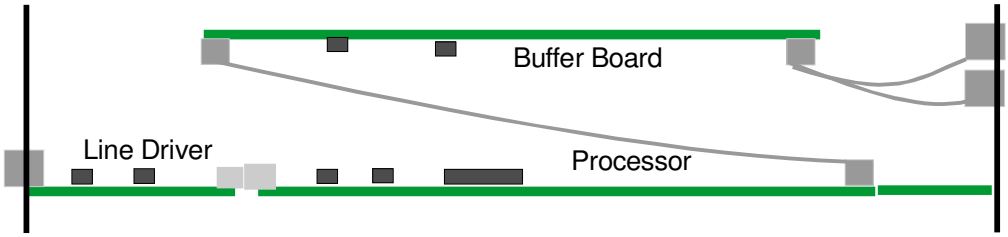


Figure **26***: The processor with buffer board*

Removing the Processor

Having taken adequate anti-static precautions:

Remove the two screws either side of the connector on the end where the LEDs are fitted. It is not necessary to remove the end plate.

Next 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.

Behind this cover you will find two ribbon cables linking it to the processor board and also a spacer that should be removed at this point.

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

If a buffer board is in the box, see Figure 26, it is necessary to remove this at the same time. It will slide out with the rest of the unit.

Avoid pulling the processor board by the ribbon cables! It will strain them and may cause unreliability.

Refitting the Processor

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

Now bring the buffer board (if fitted) up across the top of the processor assembly with the components facing the processor components and the back of the board facing upwards. Gently slide the whole assembly into the box and secure with the two screws either side of the connector.

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

Attach the 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. Push the processor firmly into the line driver card. If it is correctly seated the spacer will be flush with the edge of the box.
3. Do not over tighten the self-tapping screws.
4. Check the processor for loose wire clippings, etc. on the back before re-assembling.
5. Don't forget to fit the spacer. It prevents the cards becoming separated by prolonged use of 32' pipes.

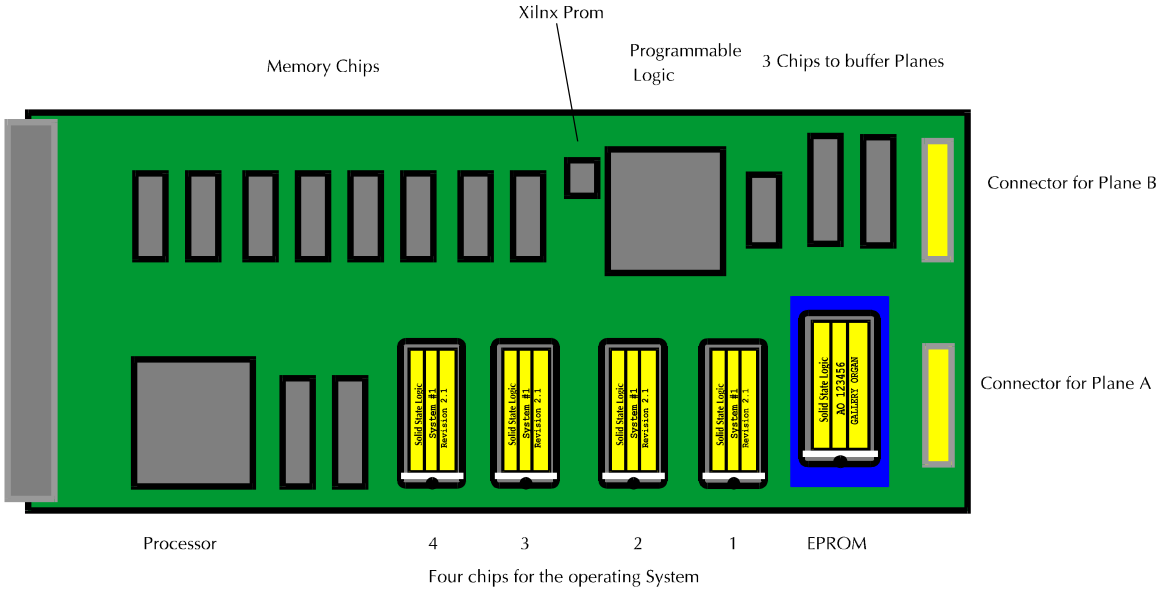


Figure **27***: The processor board*

It is unlikely that even a skilled electronics engineer is going to be able to repair the processor on site. However the processor contains an important device that you can change with care. The EPROM. The EPROM is a chip on the processor that contains all of the data for the part of the organ controlled by that particular processor.

An installation with, say, three processors will have three identical processors that can be interchanged except for the EPROM which customises the processor for each location in the organ. Two things can identify the EPROM.

1. It sits in a special socket equipped with ejectors on each end to allow you to remove it easily.
2. It has a yellow label attached telling you which part of the organ it is to be used for.

Line Driver Board

Also fitted inside the processor box is the small board with the D connector and LEDs which is the line driver. This board communicates data between processors. As it is connected to the data cable it can suffer damage in a lightning strike. Although the best policy is to replace this board if damaged, it is also possible to make some on-site repairs in an emergency.

The secondary protection against lightning strikes takes place inside the processor on the line driver board. There are a set of special fast response 10 Ohm resistors, spares of which should be in the SSO spares envelope. On this board are also two RS485 drivers a TI device DS8921N and two opto isolators, HP 6N137 which may be damaged. The rows of 1N4001 diodes route the strike to ground and are probably OK but check the P6KE protection devices in D8 D1 D15 D16 D23 and D30. These will blow dead short to protect the circuit and may be clipped out in an emergency to get the organ running, but then the next strike will cause more damage.

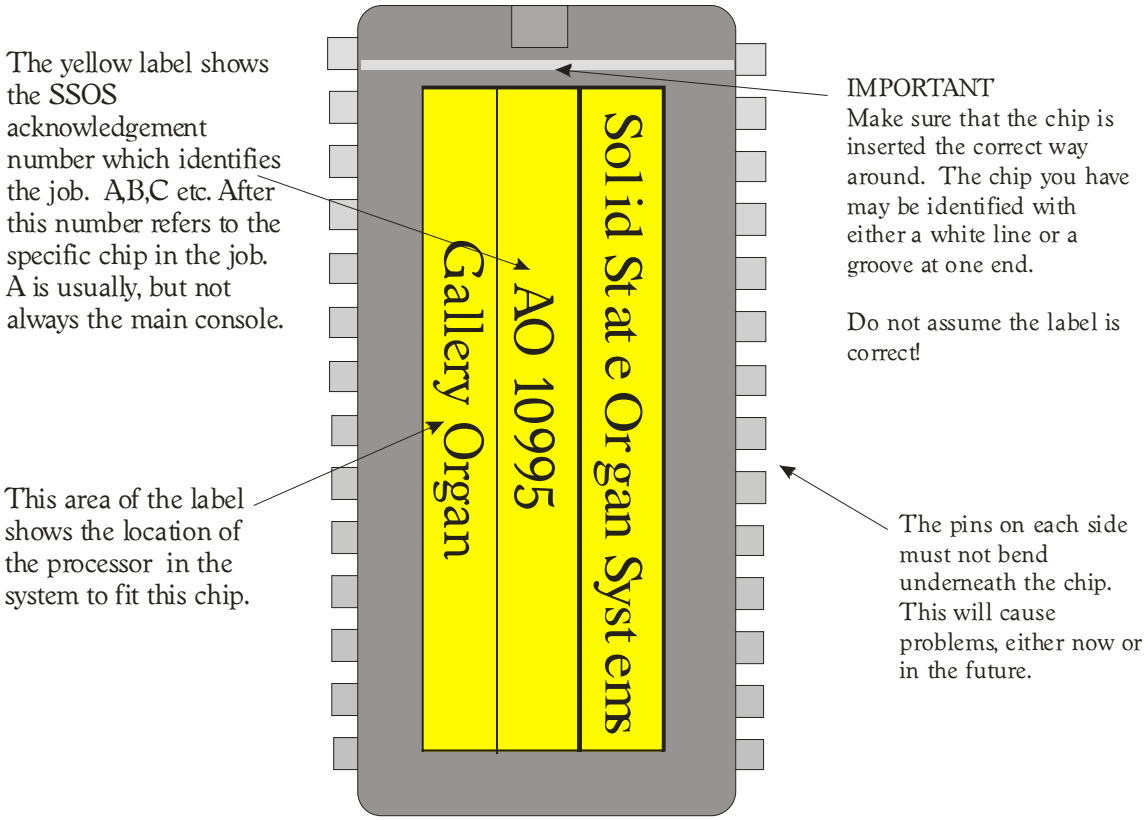


Figure **28***: The EPROM*

Wiring Information for Quick Connection (Krone) Blocks

The MultiSystem 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	0.40 - 0.65 mm
26 - 22 AWG	
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.

Use of the Special Tool

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 6089 2 030-21. 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.

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.

32PM25YX	CON D 25W LEAD M TO F	Grey cable from processor to plane
534102A1	MULTISYS CABLE REG 16W OUT	Cable register for 1 output board
534102A2	MULTISYS CABLE REG 64W OUT	Cable register for 4 output boards
534102A3	MULTISYS CABLE REG 64W IN	Cable register for 4 input boards
534102A4	MULTISYS CABLE REG 16W IN	Cable register for 1 input board
62310021	S/A MULTISYS 16 POS IN KRONE	Positive input board fitted with Krone connectors
62310022	S/A MULTISYS 16 POS IN PINS	Positive input board fitted with solder pins
62310131	S/A MULTISYS 16 NEG OUT KRONE	Negative output board fitted with Krone connectors
62310151	S/A MULTISYS 16 NEG OUT HD KRN	Heavy Duty Negative output board with crones
62310210	S/A MULTISYS PROCESSOR COUP	MultiSystem Processor board (no box or l. driver)
62310220	S/A MULTISYS LINK DRIVER	Link driver board for processor
62310230	S/A MULISYS SERIAL DIST	Distribution board simple type
62310234	S/A MULTISYS SER DIST BUF 5.2V	Distribution board with buffered drive
62310254	PHANTOM MULTISYS PROCESSOR BOX	Empty processor box with 2 end plates
62310260	S/A MULTISYSTEM PROTECTION I/F	Link protection board
62310282	S/A MULTISYS PROCESSOR BUFFER	Buffer board for processor
62312110	MS CNTRL PANEL I/F CARD STD	Interface for CFM
66D10260	MULTISYSTEM CABLE PROC-PROT	Coloured ribbon cable
723100M7	MULTISYS PLANE 8 COL LONG	Long Plane with dist board
723100M8	MULTISYS PLANE COMP SHORT	Short Plane with dist board
723100M5	MULTISYS PROCESSOR UNIT COMP	Complete MultiSystem processor in a box
723100S1	MULTISYSTEM SPARES BAG KRONE	Spares kit shipped with system
82S9FFRM	CASE WITH INSERTS-MULTISYSTEM	Packing for one plane (large or small)
82S9JSRC	POLY BAG ANTI-STATIC 30″X 36″	Antistatic bag for one plane

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