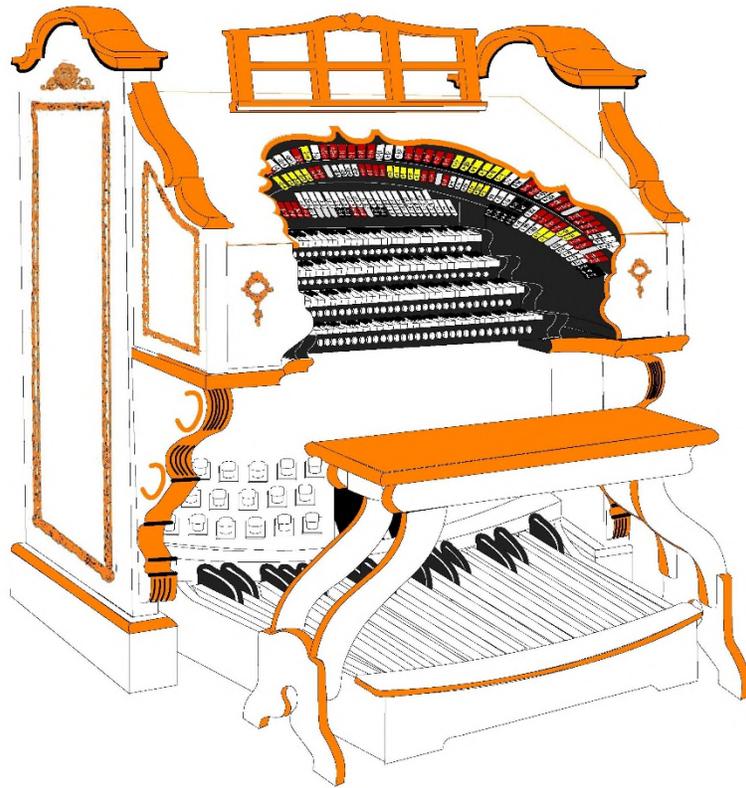


# DEVTRONIX CONSOLE WIRING



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# Overview

In an effort to follow previous documents used in wiring the organ, this attempts to provide instructions for planning and wiring the four manual Devtronix console. Careful consideration was given to the placement of components to accomplish the following goals.

1. Heavy items were placed in the bottom to lower the center of gravity.
2. Functional items were grouped. Power supplies, power switching, and Input/Output Cards.
3. Reduce the length of wires to reduce interference.
4. Simple layout for ease of maintenance of the wiring in the console.

# Layout

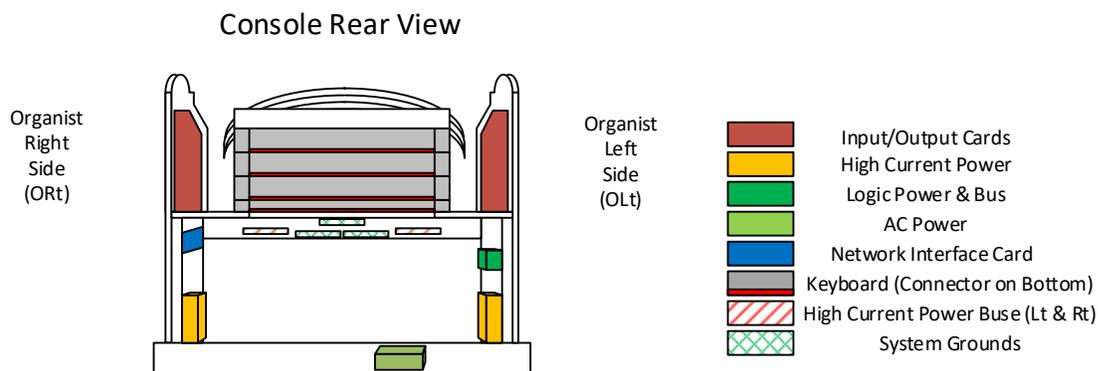


FIGURE 1 REAR VIEW

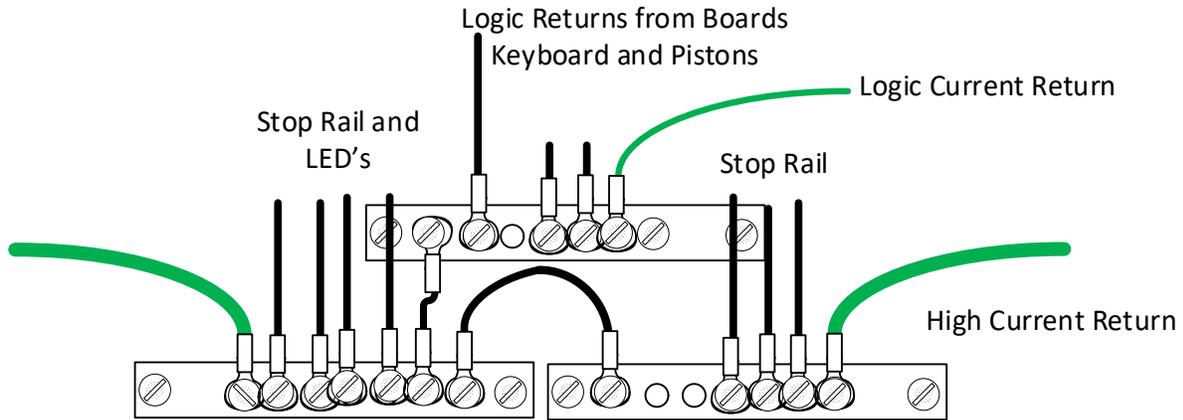
## AC Power

Power is introduced into the console thru a round three pin male inset connector, left of center (rear view). It is split between two outlet boxes in the bottom right (rear view) of the console. Two outlets are not switched and four are switched. One of the two unswitched lines feeds the two outlets in the top of the console.

The larger outlet box is controlled by a relay which is switched from the bottom left (rear view) of the console. Power from the box feeds the two high current power supplies and the logic power supply.

## DC Power

The High Current and Logic Power Supplies are energized from the switched portion of the AC distribution system. They are tied to a single ground reference point in the center of the console on large copper ground bus bars. This triple bar is the ground point for the entire console. The three bars are strapped together. The logic supply is tied to the center upper bar at the end with the grounds from the boards attached. The two high current supplies are attached at the ends of the two bars and the bars tied together. This arrangement keeps all the supplies at a common referenced ground while no currents from any supply flows thru the other supply's ground section. ***(This section is subject to change as it appears that more ground points may be needed.)***

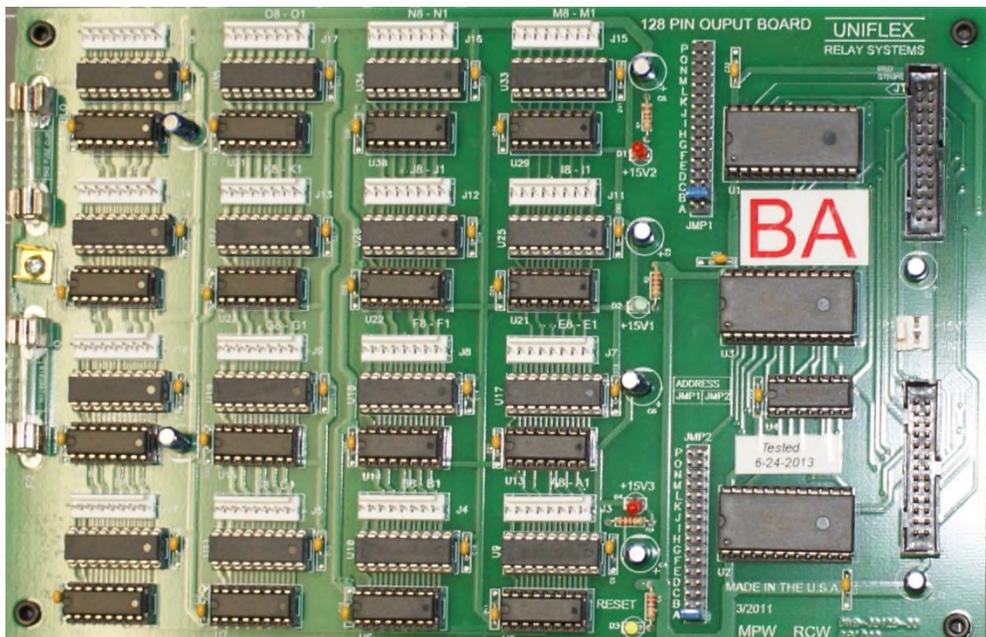


**FIGURE 2 GROUND BUS BAR ARRANGEMENT**

### High Current Power

Two military grade power supplies are installed in the console at the left and right sides. These are switching supplies. They are rated to supply 12Vdc at 65 amps continuous power. Peaks may well exceed that. The cooling fans have been altered to run at a slower speed to reduce noise. As there is only a high demand on the supply during combination changes this change is not significant.

The supplies provide the power to the driver cards located in the right and left upper section of the console. Each card has a direct line to a bus bar for the left and right supply. A female spade lug is used to attach to the driver card. Located on the left side of the pictured card the input is split thru two 5-amp slow blow fuses supplying 64 outputs each.



**FIGURE 3 OUTPUT CARD**

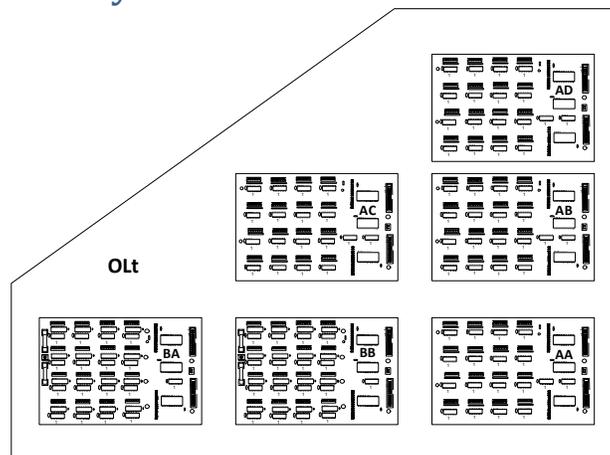
*Note: If one fuse is removed then this side can be feed from thru an external fuse so half the board could be feed from a different supply and voltage level.*

## Logic Power

A small dual voltage power supply is located below the key desk on the right side of the console as viewed from the rear. A small bus bar with a heavy copper loop serves as the plus (+) side of the supply's distribution. The ground (-) side is carried to the center of the console below the key desk by a single heavy green wire. (See the figure on Ground Bus Bar Arrangement.) The supply provides 12Vdc at 4 amps. This is a linear supply.

Two wires from each bus strings together three boards (six total) on the left side of the console (AE – AF – AG and BD – BE – BC) and another two pair for the right (AA – AB – AD and BB – AC – BA). 18 AWG wire is used for this purpose and with a current rating of 8 amps.

## Addressing & Board Layout



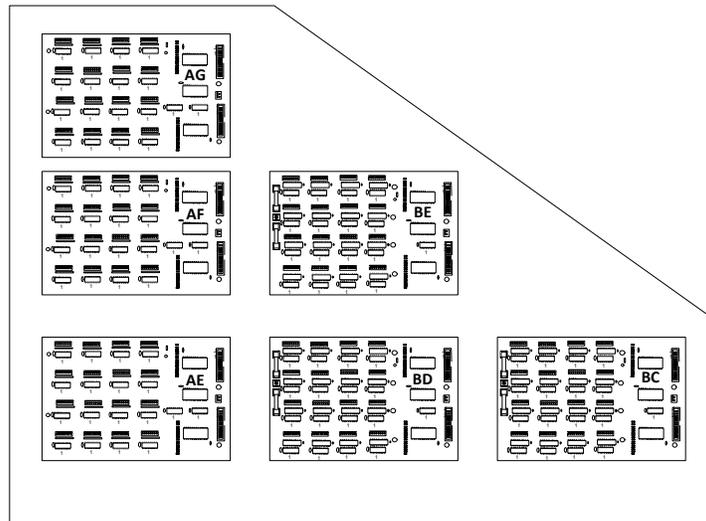
**FIGURE 4 ORGANIST LEFT SIDE BOARD LAYOUT**

Organist		AD		AG		Organist
Left	AC	AB		AF	BE	Right
BA	BB	AA		AE	BD	BC

**TABLE 1 I/O BOARD LAYOUT**

Twelve cards make up the console input and output cards. Red or “B” series cards are driver boards to move stops, and light pistons, displays, and LED’s. These are marked with a red sticker as seen in Figure 3.

The Blue or “A” series are input cards and are marked with a blue sticker like in Figure 3. These receive signals from all the switches, buttons, keys, and swell/crescendo shoes in the console.



**FIGURE 5 ORGANIST RIGHT SIDE BOARD LAYOUT**

## Board Address

Boards are positioned as indicated in the figures and tables above. There are two types of boards, input and output cards. They may be addressed in one of two ways. The first is in a sequential method as in AA, AB, AC, AD, AE,..... The next is to address them as to their function and location. Inputs are AX, Console outputs are BX, Solo Chamber Outputs are CX, and Main Chamber Outputs are DX. In the older Uniflex systems because of differences in the system the cards could have duplicate addressing. That method is not recommended in the Uniflex 4000 system. Address run from AA to AP (16), BA to BP, and on to PP or 256 cards (32,768 pins).

Next to the three large IC's, about 1/3<sup>rd</sup> of the way from the left are 16 two pin sets of jumpers representing the characters "A" thru "P". The lower jumper is for the first character in the address and the upper is for the second character. This provides the Board Address.

## Pin Address

Each card has 128 input or output pins. These are in sixteen groups of eight. The sixteen groups are identified with a letter designator like the board: A, B, C.... The eight pins are 1 thru 8. Starting on the bottom row at the right is A1. Moving one to the left is A2 and so on to A8. At the next block is B1.

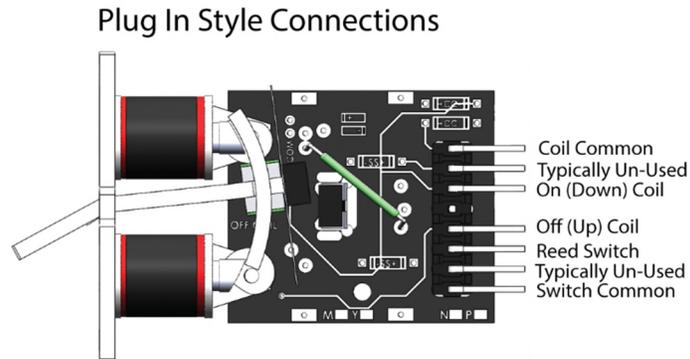
A typical pin address would be APB5. This pin address format would be the same for an input or output board.

## Stop Rail Wiring

The placement of the I/O cards was selected to reduce the length of the cable needed to wire the Stop Rail. A secondary consideration was to be able to group all the pins associated with the group together. The Horseshoe stop tabs are split at about the halfway point for the left and right side of the console. There is not enough room to of feed all the stops on one side or the other. The Back Rail stops are wired

all to one side. While not part of the Stop Rail, as an example, the 1<sup>st</sup> and 2<sup>nd</sup> touch for a keyboard along with the buttons on the key cheek are all kept together on the same side of the console.

## Stop Action Motor (SAM) Wiring



**FIGURE 6 STOP TAB PIN OUT**

Tabs are wired with a plug which fits on the pins as shown. Wires connecting to the relay should be 24 AWG to properly fit in the board displacement connectors. The commons or grounds may be of the same wire gage as the output/input wires. They are carrying no more current than the feed wires. Two independent commons (Logic and High Current) are necessary to prevent a “rising” ground due to the large current flow during a combination change. The color of these wires is not critical but they should be long enough to allow the easy removal of the plug should the SAM need to be removed.

The Stop Rails are organized into 7 sections or groups with all the wires from that section going to the same side. All the wires (input and output) from a stop tab will all go to the same side. All wires in each section should be the same length. That length being from the SAM the furthest away from the cards with the wire reaching the first identified pin for that group. Then moving to the next SAM, the connection is made to the next pin. The distance between SAM’s is greater than the distance between pin. Any excess wire to be coiled at the SAM. The wires break down as follows:

There are two full “horseshoe” rails wrapping around the console. They are split about half way around the semi-circle making efficient use of the relay cards. The split in the rail is indicated by the red and green stripped tabs.

There are two short sections located under the far left and right of the “horseshoe”. These Are wired to the boards on their side.

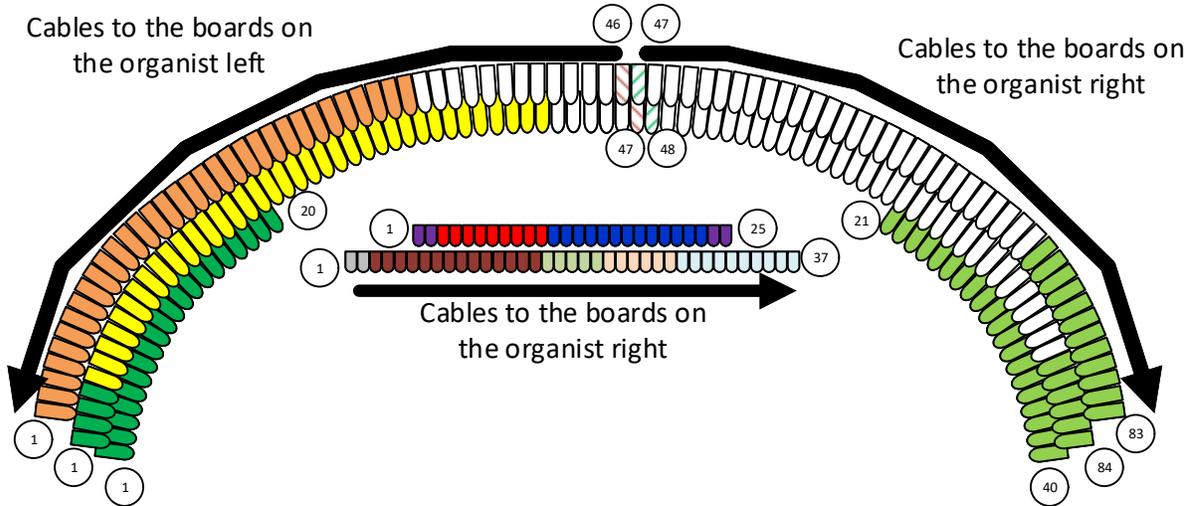
There are two rows on the section above the keyboards and underneath the stop rail. These are wired to the boards on the Organist Right

SAM numbers start on the left and increase as you move to the right. These are shown in Figure 7 and are used in the Stop Wiring Sheets.

An overall numbering system starts on the lower left and increases as you go to the right. It then picks up again on the middle rail at the left and increases as you go to the right. For

the back rail starting at the lower left and increasing as you move to the right. The count ends with the right tab on the upper row of the back rail.

A third system is present in the software where a number is given to a SAM as it is entered into the program.



**FIGURE 7 STOP RAIL SPLIT**

The wires from the SAM's going to the relay cards should be bundled into two groups. The reed switch output should form into one cable and the coil inputs should form into another. The separation of these two groups prevents noise from being introduced into the input lines when a large change is made to the stop rail.

Pin Out on the SAM's are as follows from the top down.

1. Coil Common
2. N/A
3. On or Down Coil
4. Blank or Key
5. Off or Up Coil
6. Reed Switch Output
7. N/A
8. Reed Switch Common

### Stop Action Motor Grounds

There are two grounds coming from each action. The Coil common is on the top pin and the reed common is on the bottom pin. These wires should be 16" in length and have 1" stripped to bare copper at each end. This should be of solid core and 24 AWG. It can be of the same wire used to make up the cable to the I/O cards.



**FIGURE 8 GROUND WIRE**

The excess wire between the SAM and the Ground BUS will be coiled as pictured above. The same for the Reed and Stop Coil wires.

### Ground Bus

The two Ground Buses could be solid core or stranded wire. They may both be 12 AWG or the reed common could be of a smaller 18 AWG as very little current flows here. There should be a connection between the Coil Common and the high current bus ground of 12 AWG wire. There should be one connection per 25 stops. The bus may be a single piece or a section for each cable group. The upper and lower horseshoe may share the same set of grounds along with the short rail or up to three sets for each half.

The two buses should be separated by about a half inch. Fiber board or some other insulator may be used to space them.

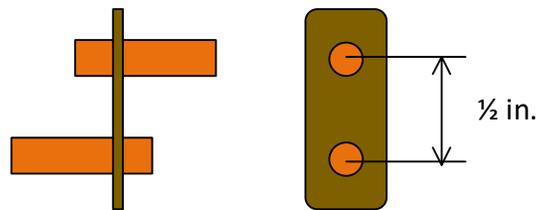


FIGURE 9 BUS SPACER

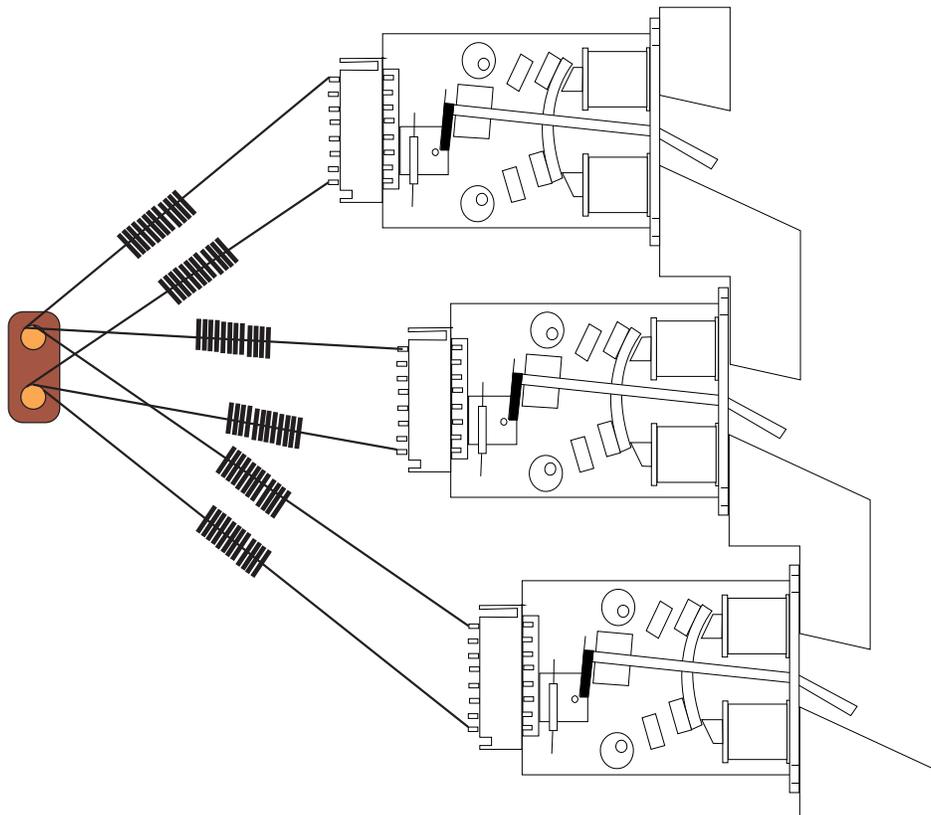


FIGURE 10 GROUND BUS WIRING

High Current Ground Bus – Left or Right Bar

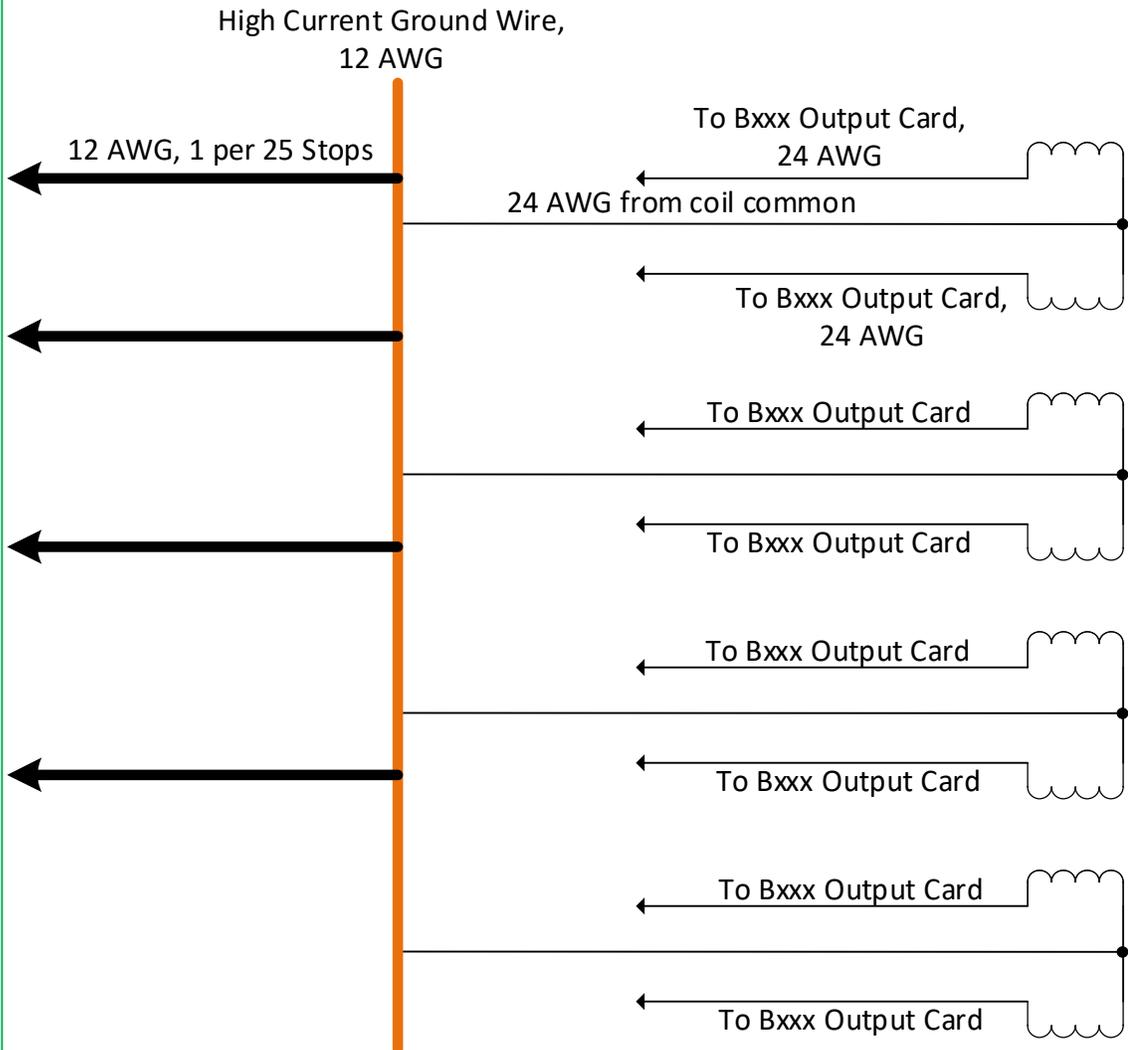
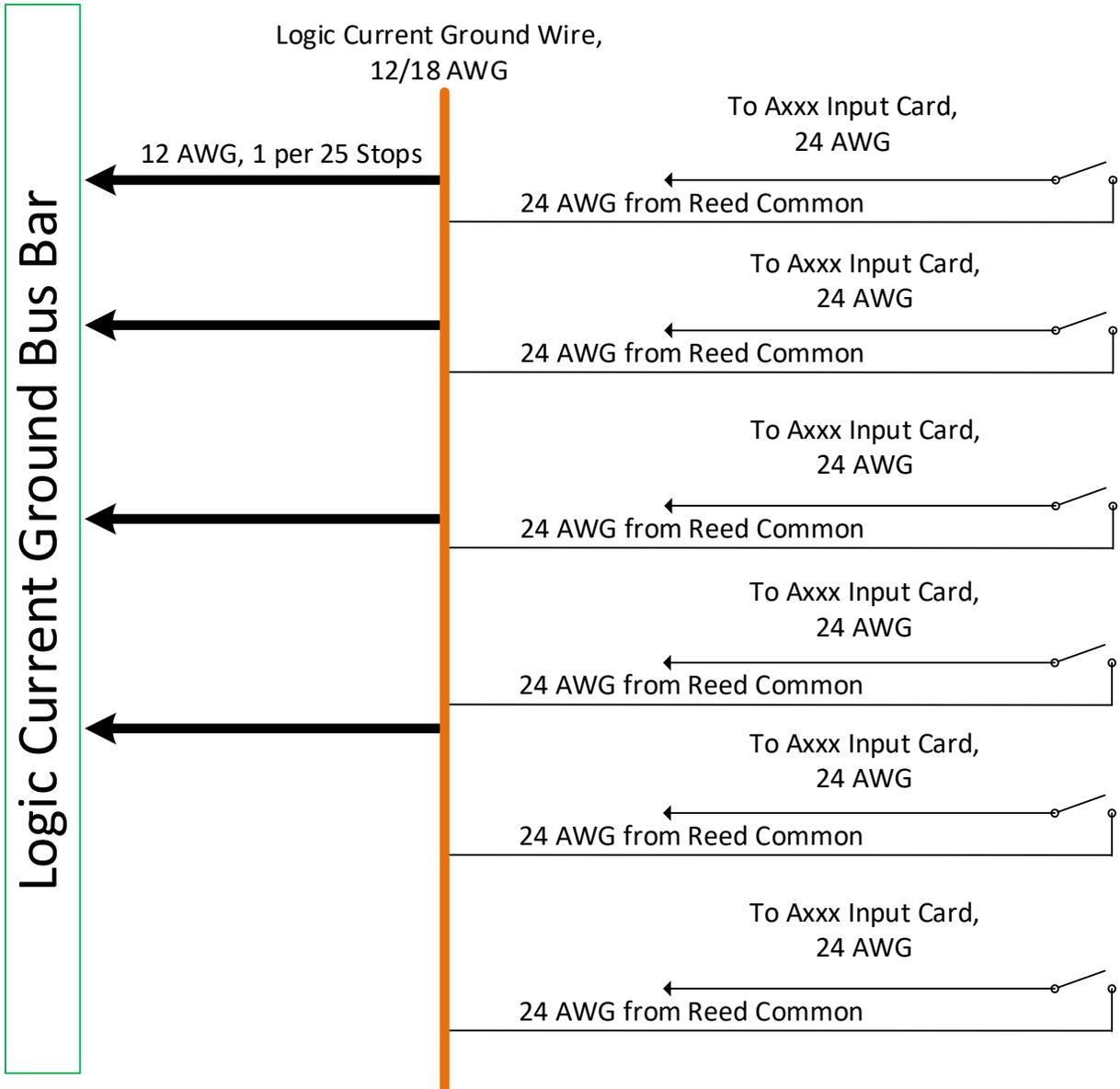


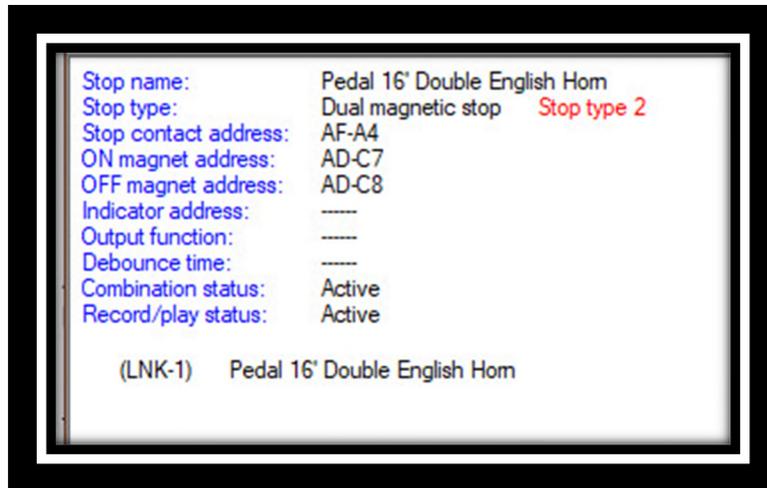
FIGURE 11 COIL COMMON (HIGH CURRENT)



**FIGURE 12 REED COMMON (LOGIC CURRENT)**

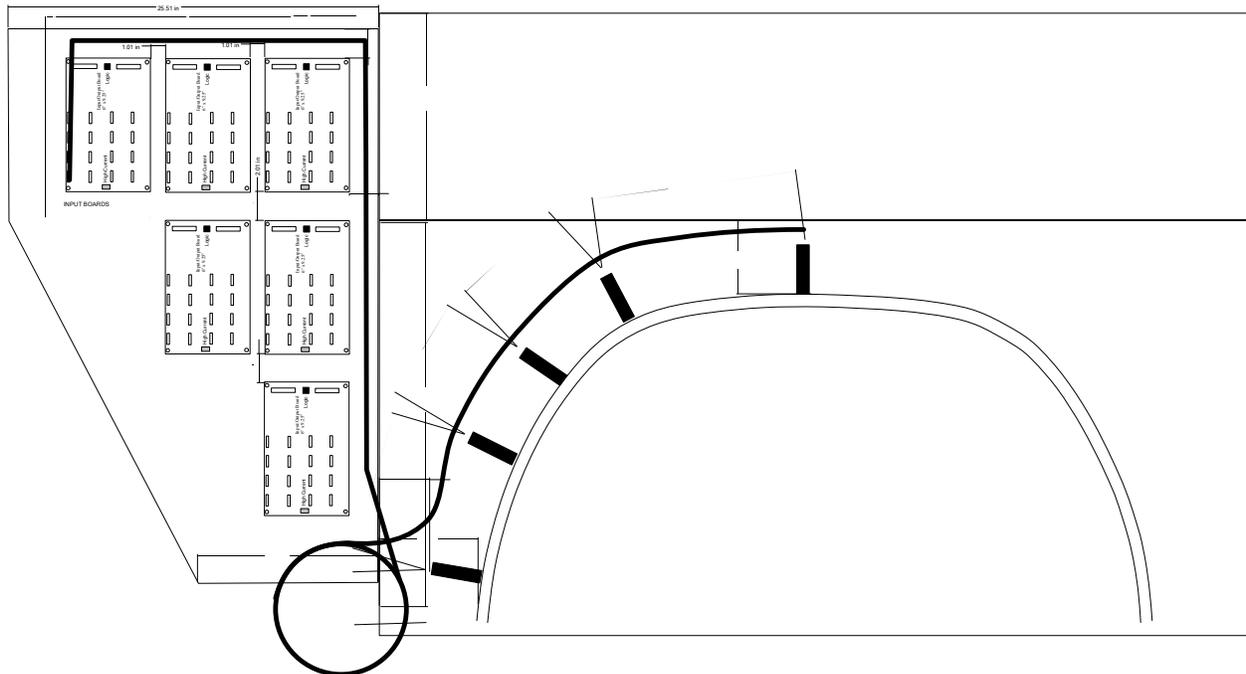
### Cable Routing

The order of pinning the “ON” and “OFF” coils is the same as in a top-down pattern matching the software definition and construction of the SAM to make the data entry simpler and follows the pin pattern on the SAM’s.



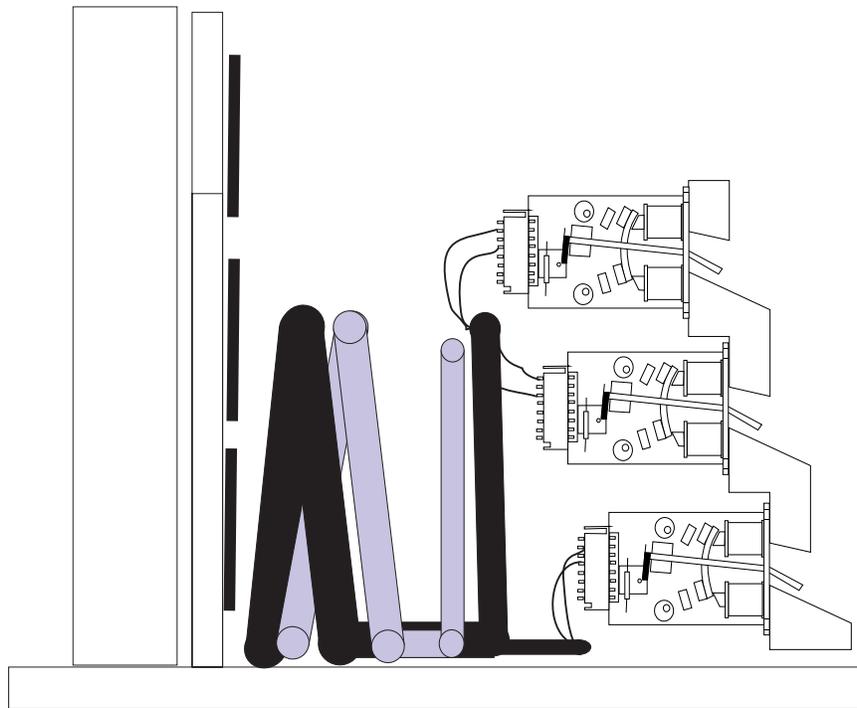
**FIGURE 13 UNIFLEX STOP DEFINITION**

Shown is the stop rail with the Organist Left I/O card board laying on the side. The cables come around the rail to the end of the rail and goes down to the Key Desk. It transits over to the side of the console where it forms a 360 deg loop with a 10" diameter. Exiting the loop, it runs along the key desk towards the rear of the console and then up onto the boards.



**FIGURE 14 STOP RAIL CABLE**

The next figure shows the cable coming off the end of the rail and being routed to the I/O boards. The cable support system and two common returns are not shown.



**FIGURE 15 CABLE VIEW**

### Stop Rail Cable

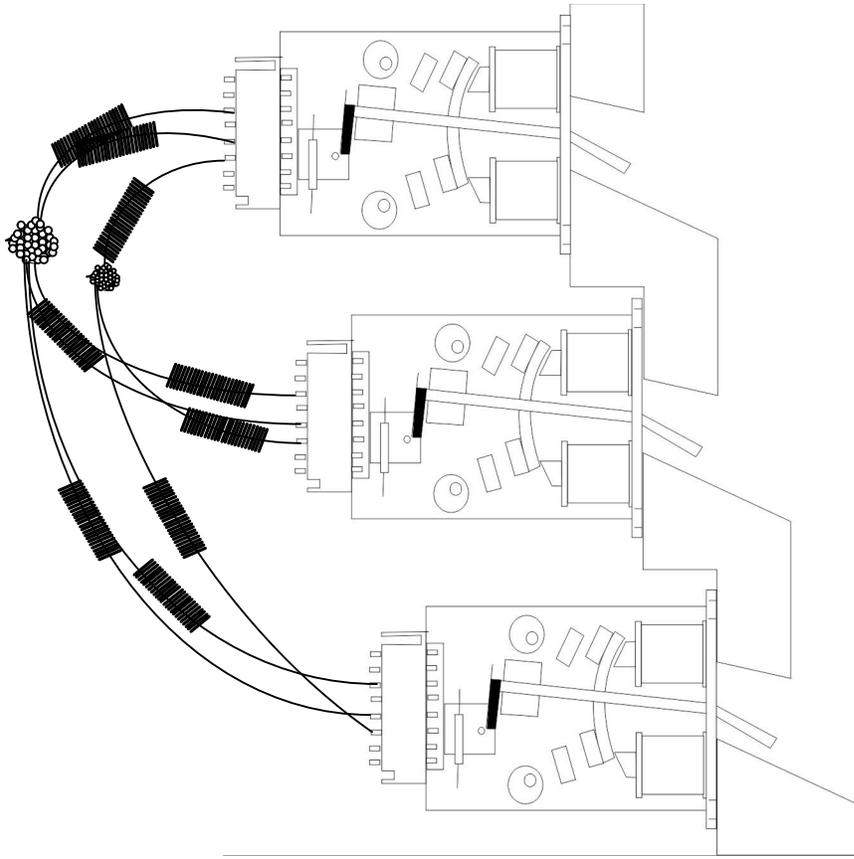
As described, the stop rail is divided into seven sections.

1. Top rail on the organist left.
2. Middle rail on the organist left.
3. Partial rail on the organist left.
4. Top rail on the organist right.
5. Middle rail on the organist right.
6. Partial rail on the organist right.
7. Two rows of stops above the key boards.

The wires from the SAM's will be made into two cables. One has the drive signal for the ON/OFF coils. The other is the output from the reed switch. All the wires in each cable as identified above will be of the same length. The length of the two cables (Coil & Reed) will be different as they will terminate on different types of boards (Input/Output) in different areas of each side of the console. Any excess will be taken up in a coil of wire at the plug on the SAM.

There may be separate cable bundles for each section as listed above or all the wires of each type may be bundled into one cable as shown in the example pictured below. But the wire length for the Top Rail (#1) will be a different length as those from the Middle Rail (#2).

The Sam's are wired to the Uniflex I/O Boards using 24 AWG wire. The length of wire between the SAM Plug and the cable bundle should be similar to the ground wire length, 16 inches from the wire bundle with about 1 inch stripped for connection to the Plug. The excess wire may be coiled as shown.



**FIGURE 16 SAM WIRES TO CABLE BUNDLE**

The cable bundle at the center, or split, between the two sides will be small but will grow in size as it moves around the rail to the sides of the console. As it moves off center it can be supported from the key desk between the sides and the key boards. It should rest on the support being able to lift up as the horseshoe is raised for maintenance.

Once it reaches the end of the stop rail the cable forms a loop with about a 10-inch diameter. The wires then run along the key desk toward the rear of the console to a point about 6-inches down the side of the card. It then turns upward passing over the "Board Select Jumpers". It then turns left to horizontal row of I/O Pins.

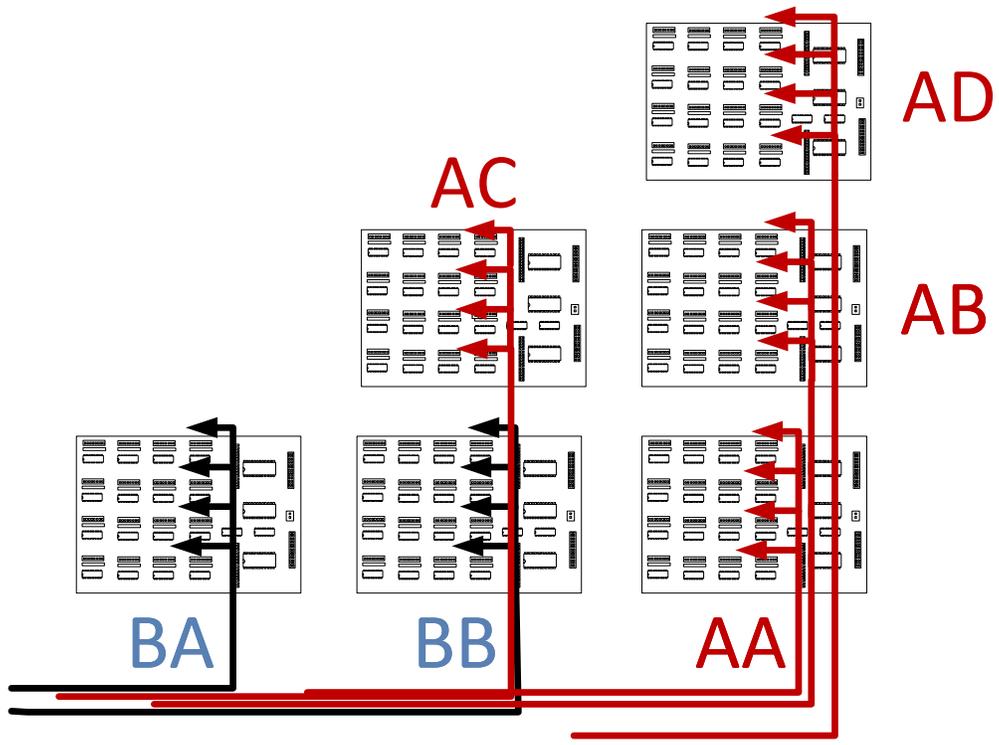


FIGURE 17 CABLE FEED TO BOARDS

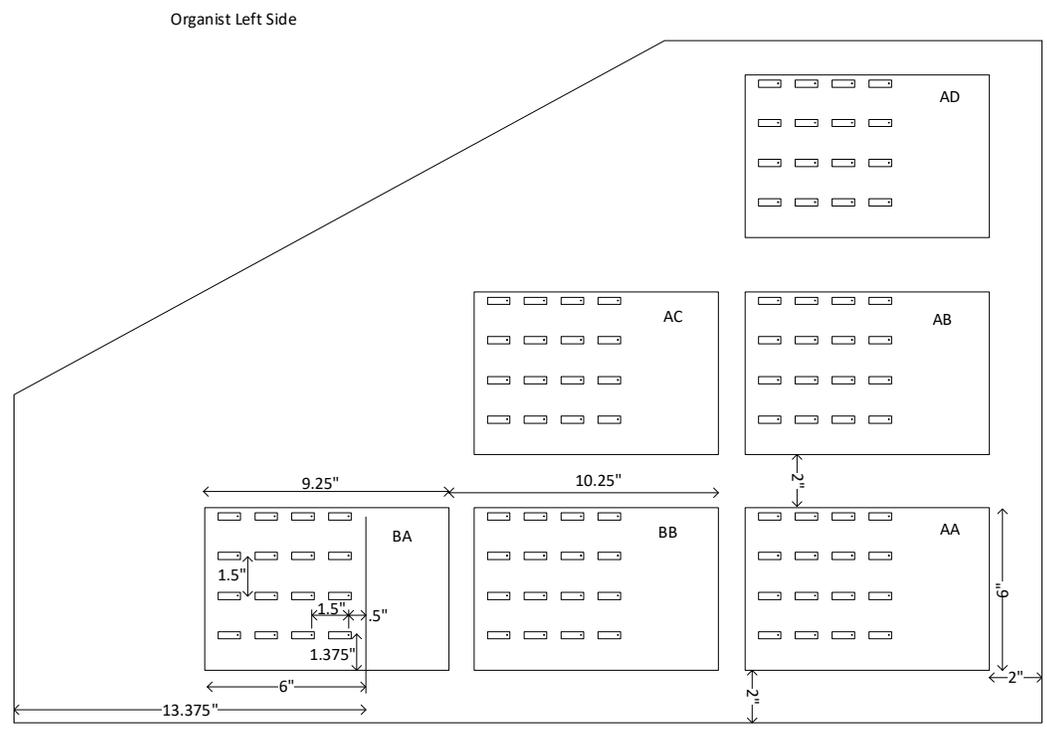


FIGURE 18 MEASUREMENTS FOR SPACING

## Cable Lengths

The length of each reed input or coil drive wire in a section are the same length. The length is calculated as the distance from the ON COIL PIN of the SAM farthest from the Uniflex I/O cards to the nearest pin on the I/O cards.

The next coil pin is 0.35-inches closer while the next I/O pin is 0.10-inch away. The next SAM is over 0.84-inches away. Each connection on the I/O cards results in a greater excess in length which can be absorbed at the SAM.

## Length Calculation

The top stop rail has a diameter of approximately 56 inches. Add another 7 inches to include the SAM's. That gives 198 inches for the circumference. **100 inches** is used for the overall length of the stop rail.

The Top Rail is made up of 83 stop tabs. The section split is made between stop #46 and #47 or about 56% of the stop rail. The length used for the Organist Left side of the Stop Rail is **56 inches**.

The loop at the end of the rail is based on a 10-inch diameter for a circumference of **32 inches**.

The distance from the edge of the I/O Card Board to the first output pin BAA1 is calculated to be about **17.25 inches**.

SAM to cable bundle	16.00
Horseshoe Length	56,00
Loop addition	32.00
Distance to first pin	17.25
Total	<b>121.25</b>

**TABLE 2 WIRE LENGTH CALCULATION**

Using the information given above the following calculations were made for the other groups.

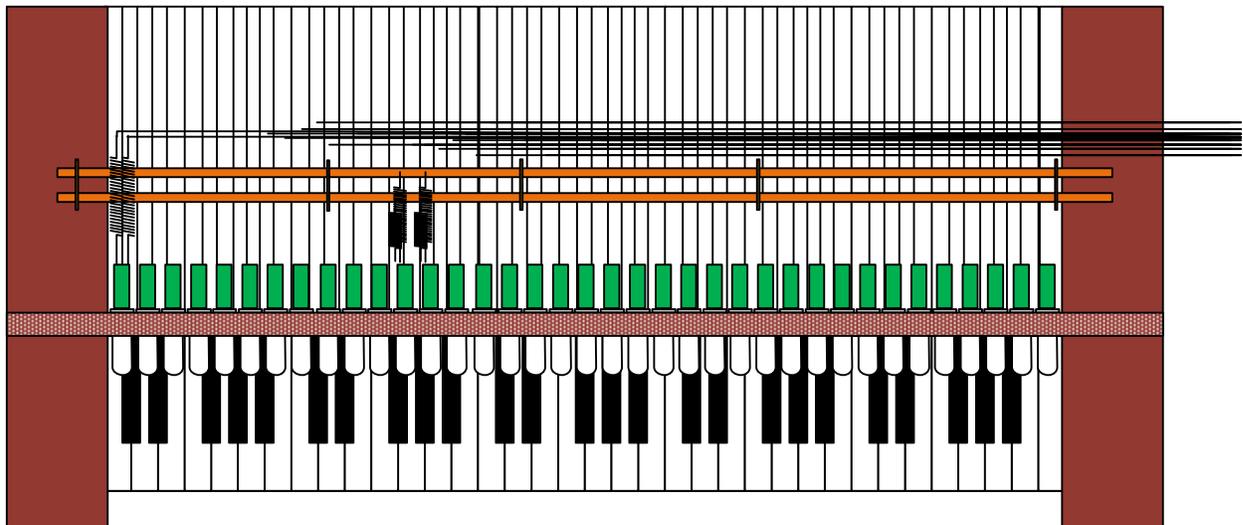
**TABLE 3 WIRE LENGTHS**

	On/Off Coil Pair	Reed Switch
1. Top rail on the organist left.	121.25	141.75
2. Middle rail on the organist left.	129.25	145.45
3. Partial rail on the organist left.	104.25	149.35
4. Top rail on the organist right.	115.25	135.75
5. Middle rail on the organist right	120.00	137.75
6. Partial rail on the organist right.	129.00	140.50
7. Two rows of stops above the key boards.	135.00	148,00
	147,00	160,00

### Back Rail Calculation

The construction of the Cable for the stops above the keyboards is the same as for the horseshoe. That is a length of wire between the SAM and the Ground Bus or Cable bundle. These are separate from the ones for the Horseshoe as they can be moved independent of each other. This section is not split and all of the cables go to the Organist Right.

These Ground Bars follow the same convention as the horseshoe grounds but should be tied to the Organist Right Hand High Current Supply ground.



**FIGURE 19 BACK RAIL CABLES & GROUNDS**

### Construction Process

The logical progression is to wire the plugs on the I/O cards. The wires may be formed into small groups to make bending to fit the situation simpler. Any excess or short fall can be taken up in the section between the cable bundle and the SAM where the wire is coiled to adjust for the excess.

Note: Some of the following text is taken from the Uniflex 2000 Wiring Manual but applies to the 4000 system.

## Wiring the I/O Cards

A special **PUNDIT** wiring tool has been furnished for this job. The wiring shells are designed to accept PVC covered (phone) wire from 24 to 26 Gauge. Before you start your wiring, you should experiment with inserting wires into the shells to establish a technique. Experimentation is the best way to establish a technique. The wires you insert during your experimentation may be removed by carefully pulling the wire out of the jaws of the connector.

[Home](#) > [Connectors](#) > [Connector Tools & Accessories](#) > [Crimp Tools](#)

### MMIT-100F

Crimp Tool, Hand, Pancon Mas-Con CE & CT Connectors, MMIT Series



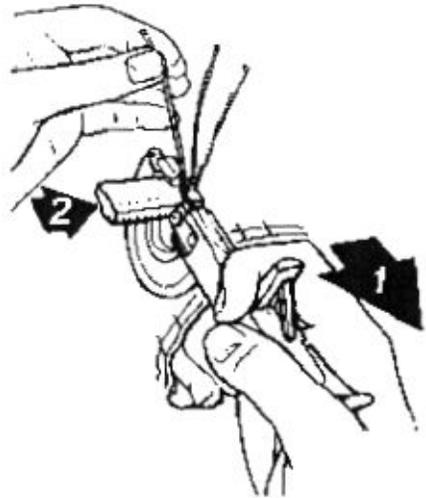
Manufacturer:	PANCON CONNECTORS
Manufacturer Part No:	MMIT-100F
Order Code:	1653500
Product Range 	MMIT Series

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Image is for illustrative purposes only. Please refer to product description.

**FIGURE 20 PANCON PUNCH DOWN TOOL**

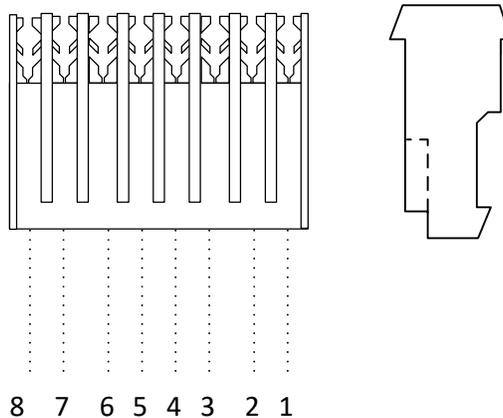
Notice how the shell inserts into the tool and how the indexing "V" holds the shell in place. (The "V" is shown clearer in the Mechanical Drawing, Figure 23.) The wires in Figure 21 are being inserted into cell 6, 7, and 8 of the shell. Cell 1 is at the far left of the shell as shown in this pictorial.



**FIGURE 21 PANCON TOOL WITH PLUG INSERTED**

The connector shell will fit properly in only one direction. If you examine a shell, you will notice that one side has shiny metal tabs visible. This is the back side of the connector. The other side has some black paint stripes on raised extrusions. This is the indexing side. This side faces up. Insert the shells with the black paint marks and indexing extrusions facing up. If you look closely, each cell of the shell is numbered from 1 to 8. These numbers appear on the black paint marked side of the shell. These numbers will correspond with the pin positions of the header on the PC board.

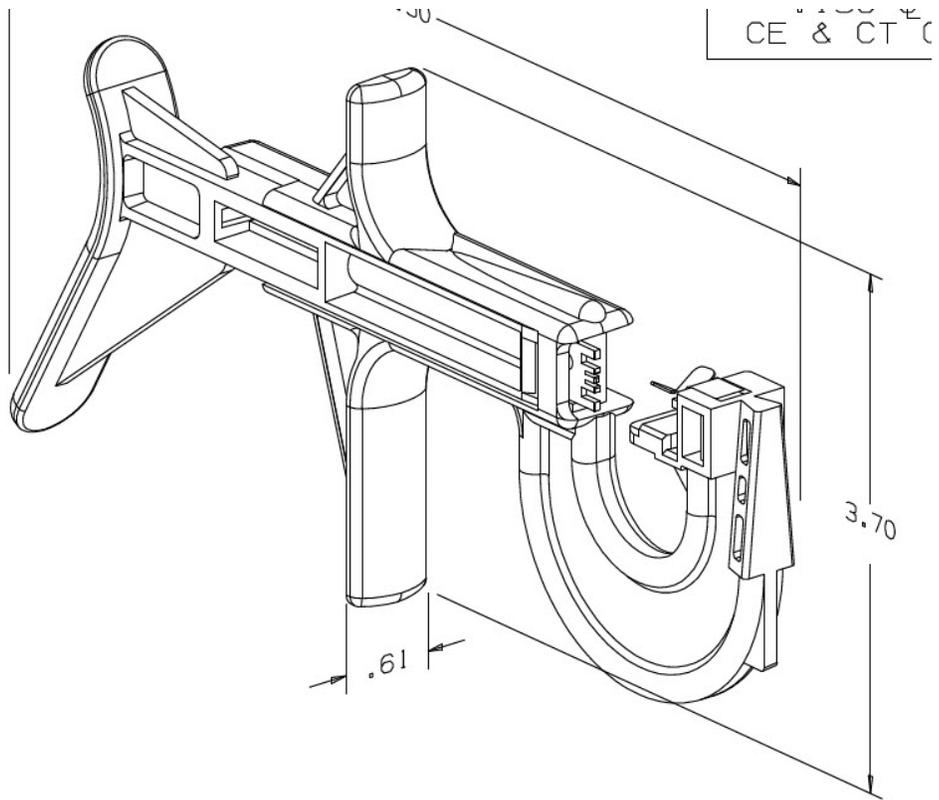
A “Toe Tag” can be used to mark the shell with the position on the I/O Card. IE ACD or BAD.



**FIGURE 22 CONNECTOR SHELL/PLUG**

The shell will only fit properly on an interface board in one direction. The black markings will face away from the PC board header lock and face the IC to the left of the header. Please note these orientations.

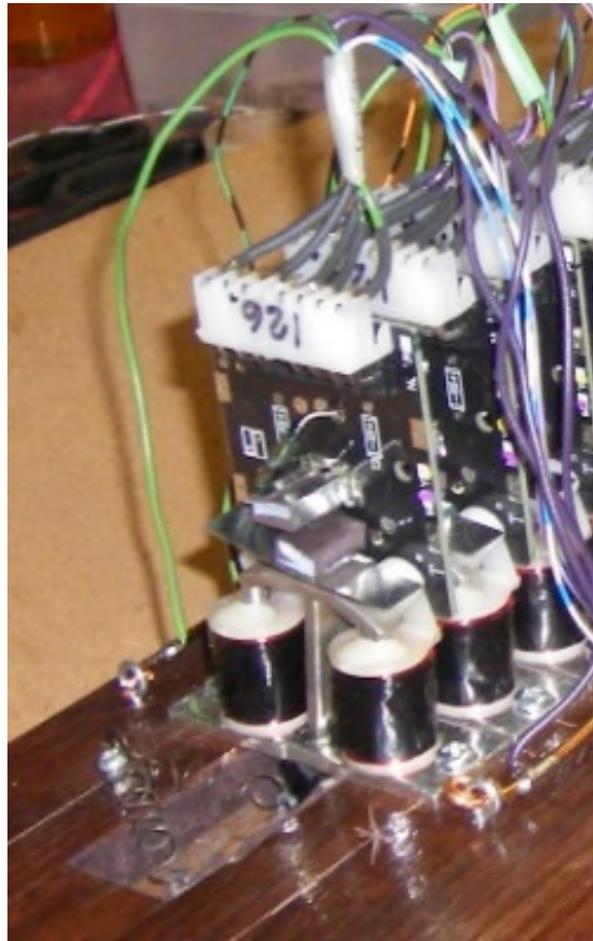
When doing the wiring, it is easiest to pull your wires in rows and tie them in groups of 8 wires.



**FIGURE 23 PANCON TOOL MECHANICAL DRAWING**

## Wiring the Stop Action Motor

Wires are attached to a plug on the SAM. Small amounts of Heat Shrink is used to reduce strain on the connector and to bundle the group of wires. A “Laundry Marker” or felt tip permanent marker can be used to mark the connector plug with the SAM number from the wiring charts.



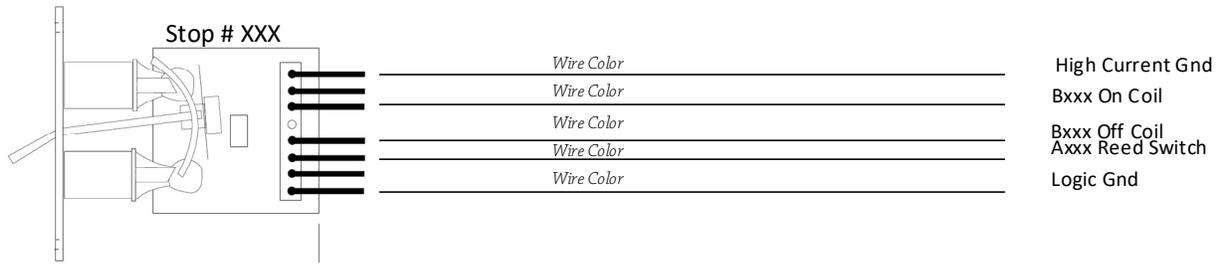
**FIGURE 24** NUMBERING THE SAM'S

## Wire Tracking Chart

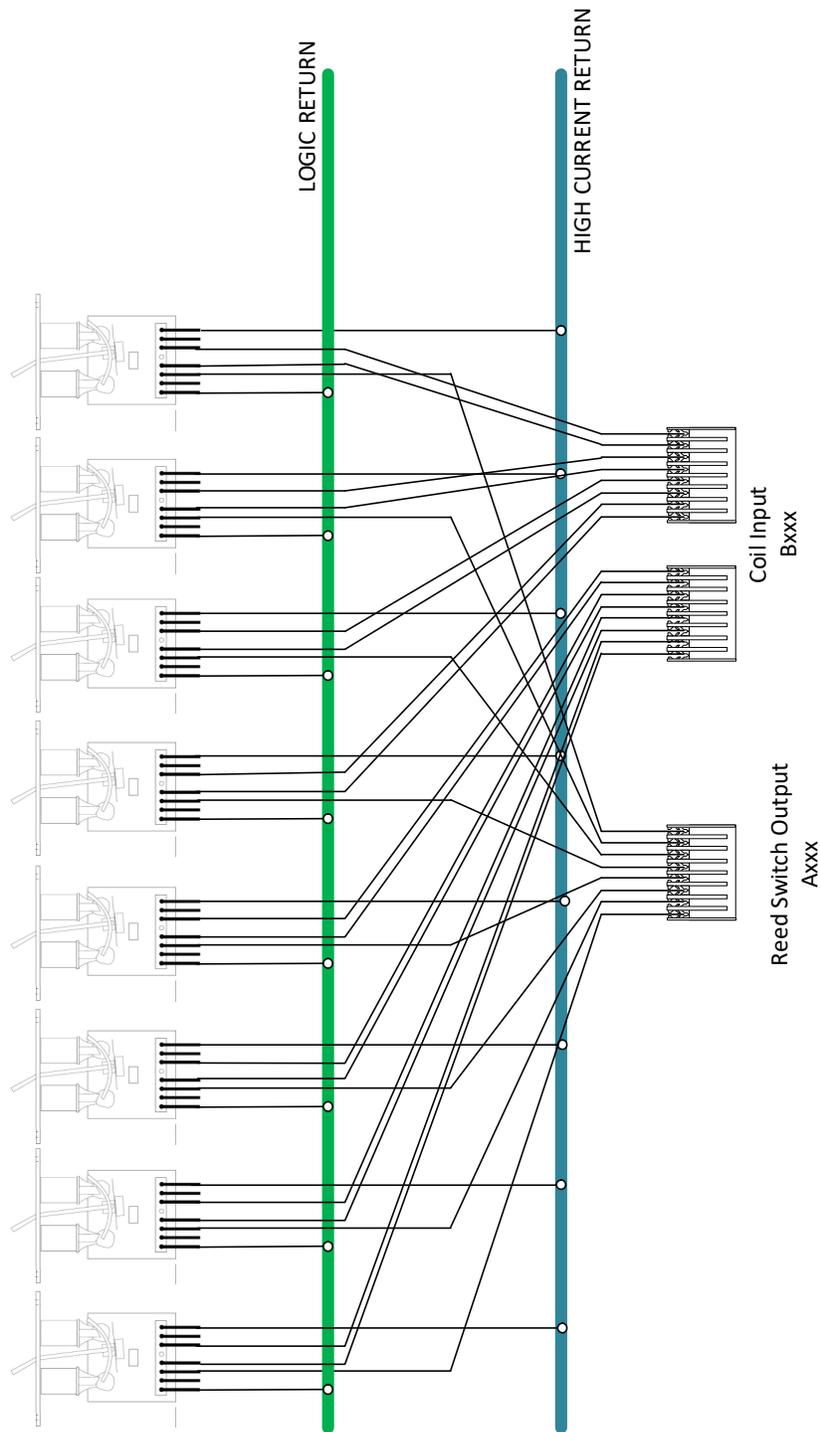
This chart is provided to be filled in at the time the wires are attached to the SAM plugs to track the color wire used for each connection. Rather than identify the wire and force a condition, it is simpler to fill in the color at the time and allow for any errors that may happen. The chart is made to conform to groups of eight SAM's running sequential for the left and right half of the stop rail. Where the row ends in the middle of a connector to an I/O card, the next cable will start with the next position. These are indicated in the chart.

The charts are created in Microsoft's VISIO, but will be available as a PDF file for each group. This process will be repeated for all I/O connections in the console.

The chart is laid out for eight stop actions. Four actions on the front of the page and four on the back of the page. This means that one plug for the coil drives will be populated on the front with half of a plug for the reed inputs. The back of the page finishes out this input plug and fills another plug for the output board for a total for three plugs as shown in the schematic in Figure 26.

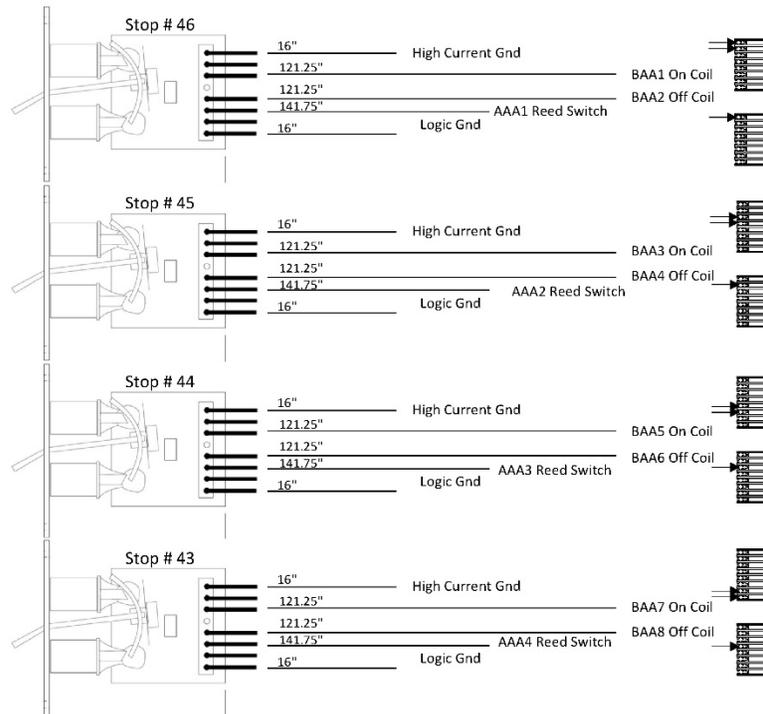


**FIGURE 25 SAM WIRE LAYOUT**



**FIGURE 26 EIGHT SAM SCHEMATIC**

This schematic shows eight SAM's and how they are wired to the console. Two ground bus strips are shown and three I/O card plugs (one for eight reed switch inputs and two for the sixteen on/off coils). SAM #1 in this group is at the top of the page. Pin #1 on the I/O Plug is at the top or right end of the connector as pictured in the shell drawing.



NOTES:

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**FIGURE 27 SAMPLE PAGE FROM THE WIRING CHART**

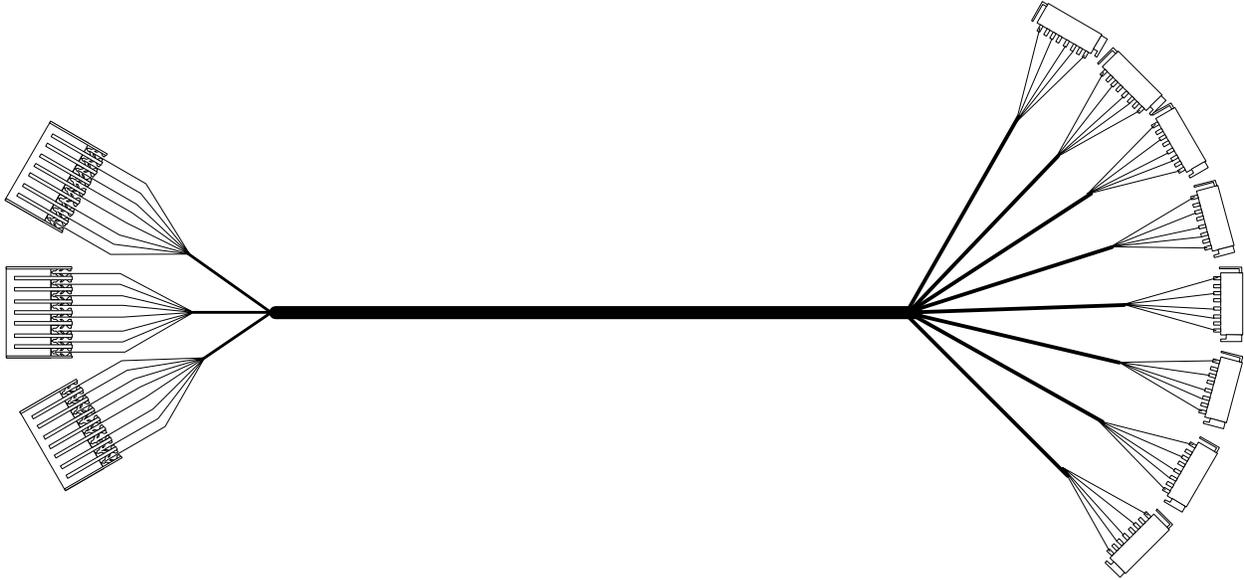
## Construction Process (Continued)

The easiest method might be to start with eight SAM Plugs. Wire them as indicated with the length of wire as detailed in the WIRING CHART documenting the wire colors as you go on the chart. Using three I/O Card plugs (two for the Coil drive wires and one for the Reed Switch output) wire the long wires as indicated in the chart and shown in the Figure 26, the Eight Sam Schematic.

Using scraps of wire, loosely bundle the cables and set them aside. These ties will be removed when the cables are formed up and the plugs are attached to the boards and SAMs.

In an effort to conserve I/O pins to the maximum, some groups will end and start in the middle of an I/O plug. Something to keep track of and will be easy with numbering the SAM plugs.

How these wires will be laced together will be covered in a later section. This is just to manage the cables before final lacing of the wire.

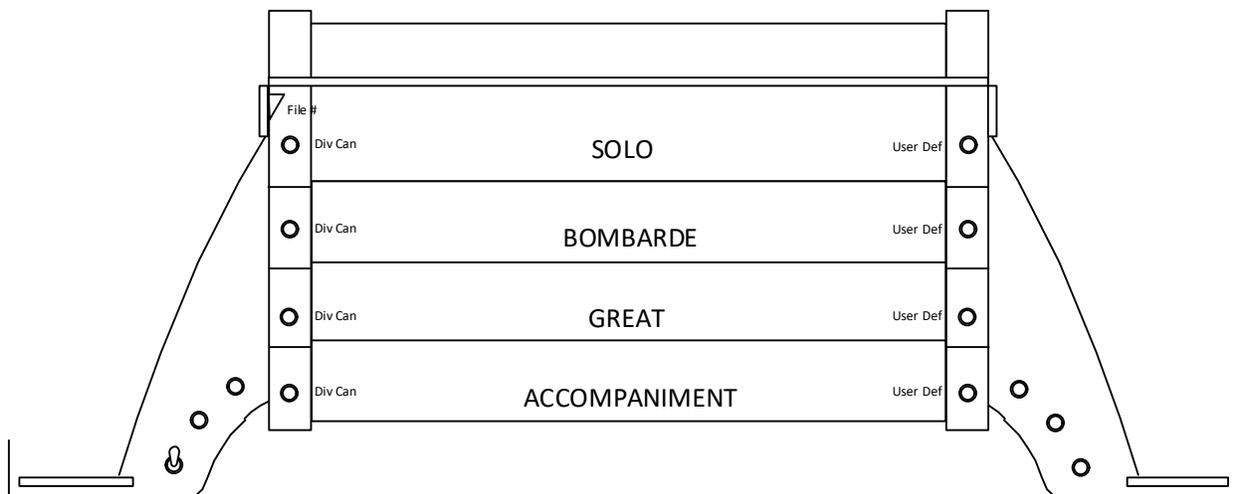


**TABLE 4 EIGHT SAM PLUG GROUP (MECHANICAL)**

## Key Desk

The Key Desk includes the items under the Stop Rail or installed on in the Key Desk. The list includes:

1. Keyboards
2. Piston Rails
3. Key Cheek Buttons
4. Key Desk Buttons
5. 2 Digit File Display



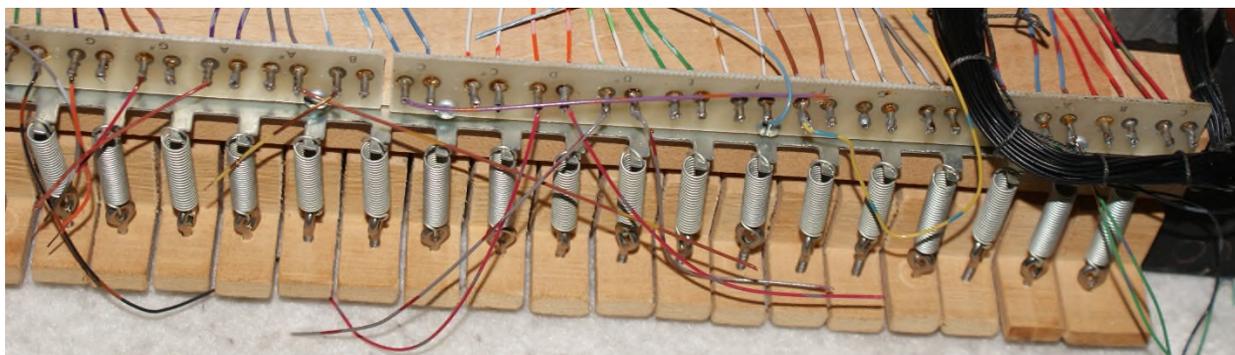
**FIGURE 28 KEY DESK LAYOUT**

## Keyboards

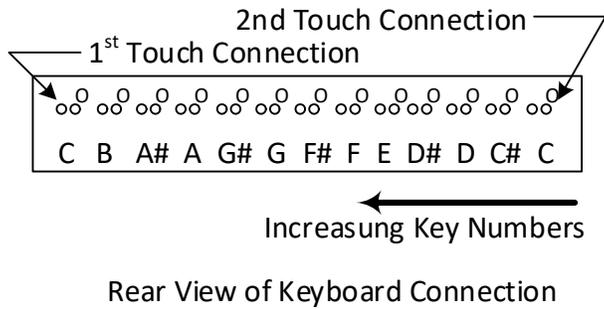
This section covers just the Keyboards and no other inputs or outputs. The keyboards stack up from bottom to top as: Accompaniment, Accompaniment 2<sup>nd</sup> Touch, Great, Great 2<sup>nd</sup> Touch, Bombarde, and Solo. These are all wired to the I/O cards on the Organist Left Side.

All keyboards were originally fitted with two contacts for 1<sup>st</sup> and 2<sup>nd</sup> touch. Because of this each key on all the keyboards will have two wire connections. In this configuration only the Accompaniment and Great keyboards will use Both connection points. These keyboards will have two connections for a total of 122 wires each while the other keyboards will only have 61 wires each or connections to only half of the connections.

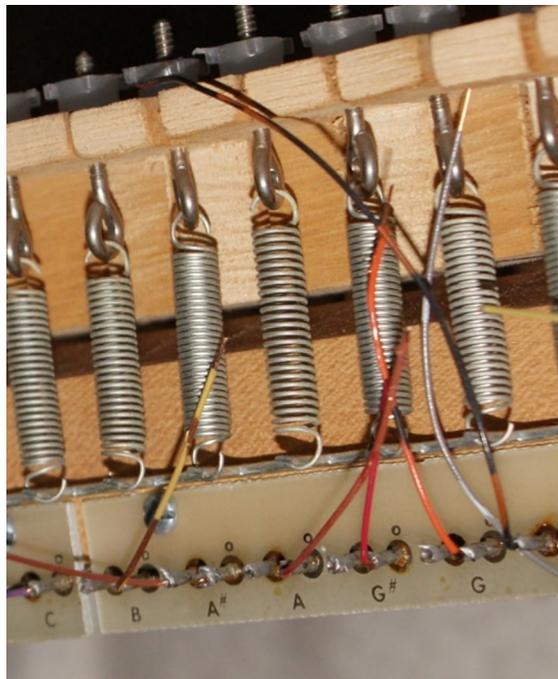
Visible on the rear of the keyboard is a green PC board running the length of the keyboard. These are marked with the note designation between the two connection points for each key.



**FIGURE 29 REAR VIEW KEYBOARD CONNECTION (UPSIDE DOWN)**



**FIGURE 30 DRAWING OF NOTE CONNECTION**

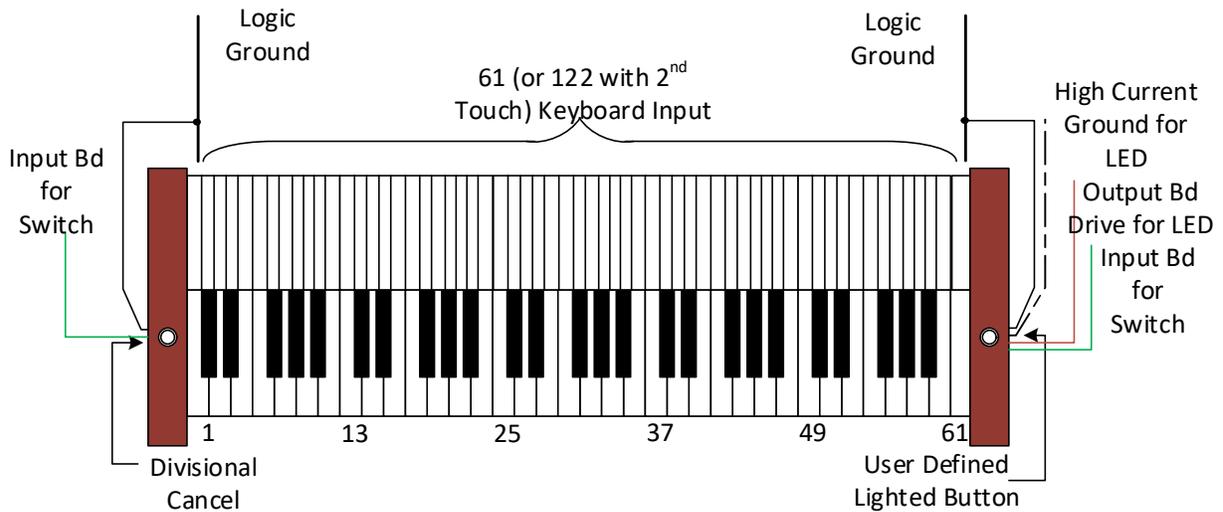


**FIGURE 31 CLOSE UP SHOWING CONNECTION IDENTIFICATION**

A “Zero” is above one connection point to designate the 2<sup>nd</sup> touch connection point.

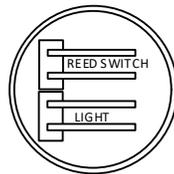
No connection point exists for the Logic Ground needed for the Key contacts. A black wire is tied to the high note end of the Key Contact Ground (a bare copper wire running under the front of the keys). This wire may be used if extended along with a second wire connected at the other end of the keyboard as indicated in Figure 32.

With Each Keyboard are two Key Cheeks or Key Slips. The Organist Left Hand Slip has a single button (or Piston) used as a “Divisional Cancel Piston” for this keyboard. The Organist Right Hand Slip has a Lighted Button which may be programmed for the individual Organist. These buttons will need to have their Reed common connected to the keyboard common and the LED connected to the high current common.



**FIGURE 32 KEYBOARD WIRE REQUIREMENTS**

The Reed Switch has no polarity so the Input and Common can be connected to either pin. The LED common is the lowest pin.

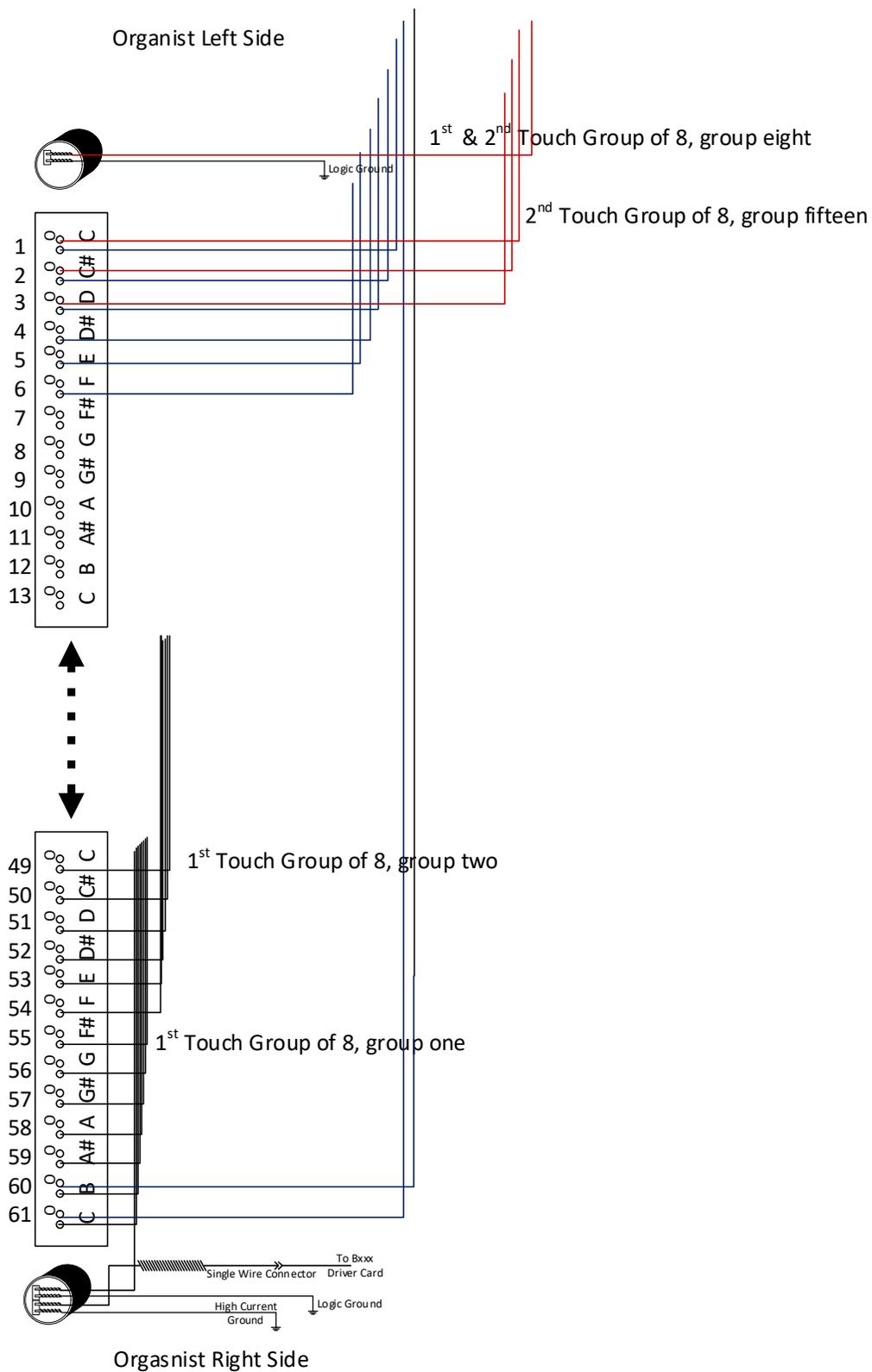


**FIGURE 33 PISTON WIRING**

The single wire for the LED output should have a disconnect inserted in it between the keyboard stack and the I/O board.

## Keyboards with Second Touch

Viewing the keyboard from the rear, the wiring starts with the Organist Right Side (left side from this view). The lighted button in the key cheek gets wired to the High Current Ground, Logic Ground, and an Output Driver thru a disconnect as indicated. The Reed Switch is the first wire for the Keyboard Input wires. This is formed in with seven other wires from the 1<sup>st</sup> touch key contacts starting with note #61. These wires (notes C thru F#) will populate the first Input Board Plug, "P". The wires continue on to the end of the 61 contacts, ending in the middle of a plug. The next position of the plug goes back to note #61 and starts with the 2<sup>nd</sup> Touch connection.



**FIGURE 34 KEYBOARD WIRING PLAN**

A Wiring sheet like those used for the SAM's is used to document the connections and to allow the write-in of the wire colors used to make the connections.

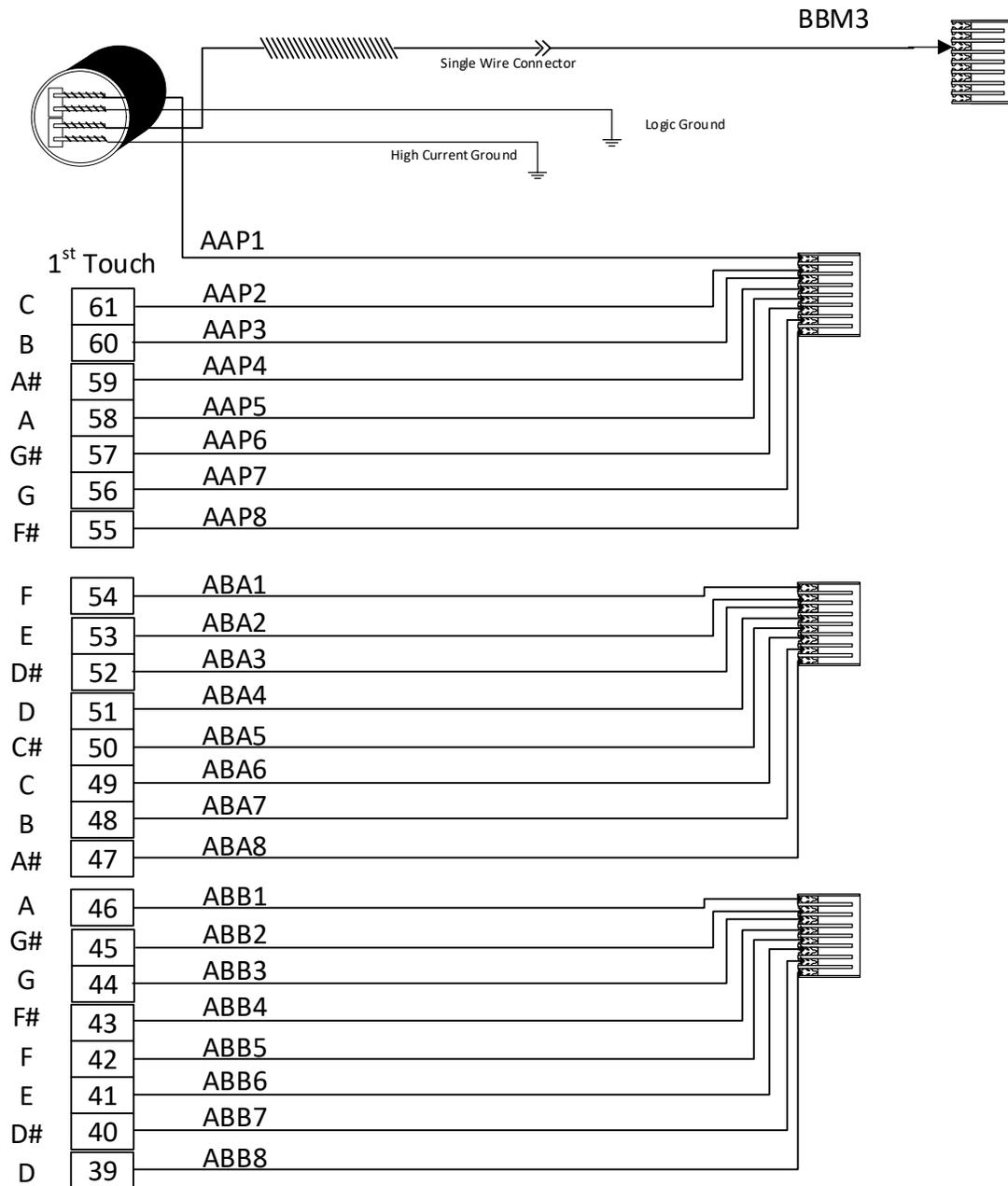


FIGURE 35 WIRING SHEET

This same format is used for the Great Keyboard.

## Keyboards without 2<sup>nd</sup> Touch (Bombarde and Solo)

These two keyboards are being treated like one keyboard with first and second touch with a minor modification for the key cheek buttons. This chart is four pages (two pages printed front and back). With each keyboard being covered as a single set. The wiring for the plugs does break between the keyboards so that they can be separated.

### Piston Rails

Located on the front of each keyboard is the Piston Rail. This is a mix of simple pistons, lighted pistons, and LED lamps. While the LED Pistons have their bias resistor built into them the LED Bulbs do not and will need a resistor installed in the line. All of the wiring for these will be to the Organist Right Side.

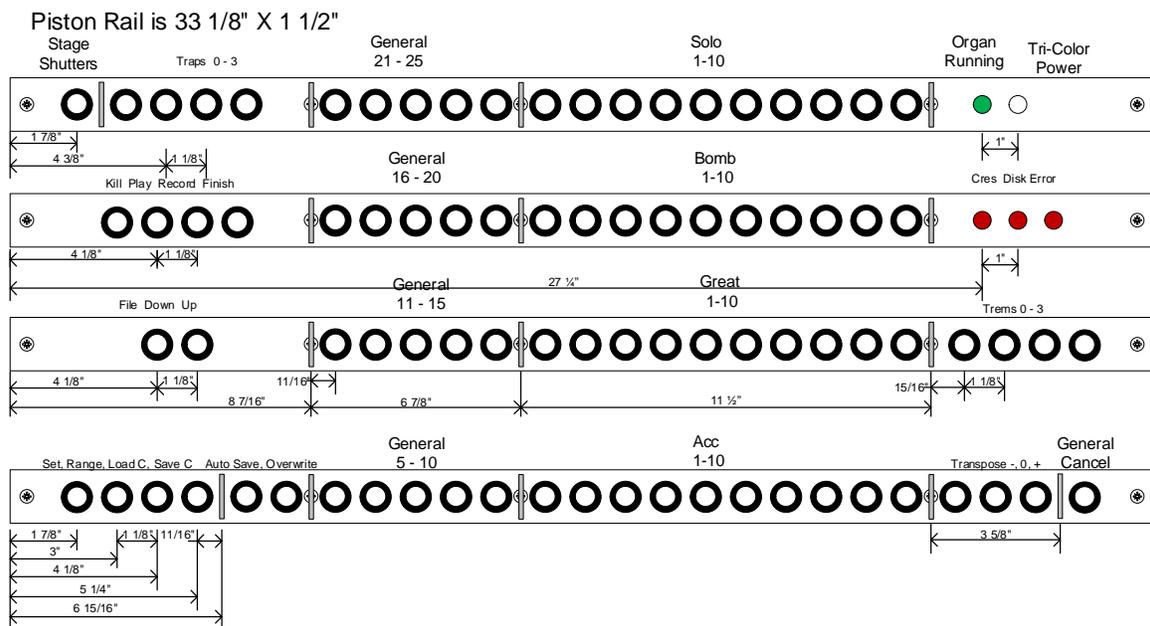
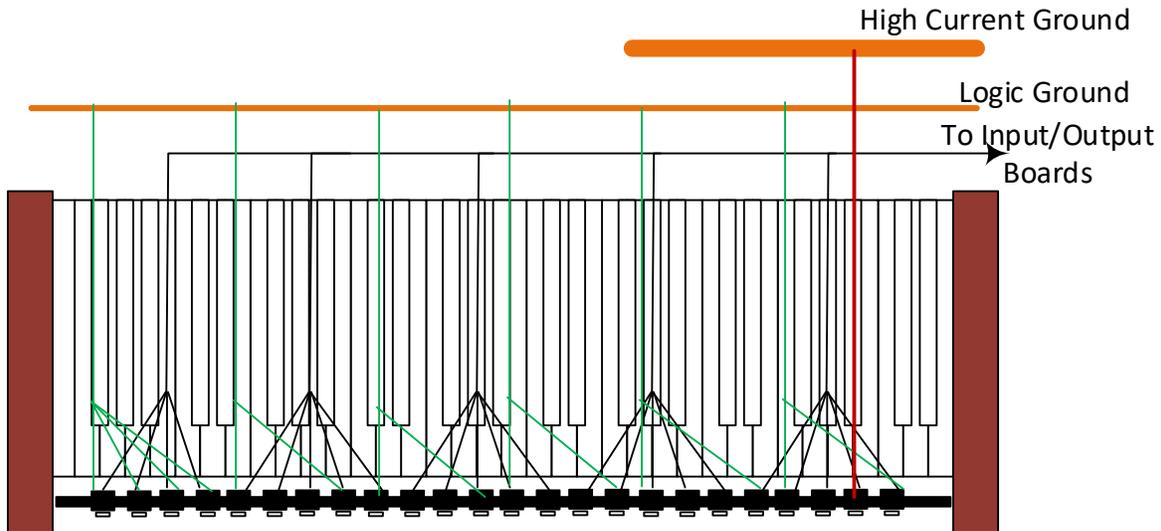


FIGURE 36 PISTON RAILS

While many connections could be combined to make the system simpler, they are repeated for each Piston rail so that one rail can be removed from the keyboard stack.



The space available is limited and the increase in the number of buttons makes doing this as a single bundle with grounds makes it almost impossible. Because of the space below the bottom keyboard and the space between keyboards because of the inclination of the keyboards, there is space between the keyboards to pass the wires like the key contacts. Because of the low current values flowing in these lines the chance of any cross talk is minimum for small bundles of wires.



**FIGURE 39 BOTTOM VIEW OF PISTON WIRING**

Poster board should be laid between the wires and the keys underneath to prevent entanglement of the wires between the keys.

The High Current Grounds are so few that they can be tied directly to the Ground bus. There needs to be a logic bus wire run like with the stop tabs. This will be an 18 AWG Logic Ground wire about 30" from the Piston Rail. This should be strapped to the Logic Ground with 24 AWG wire from the ends and about every 12" over the length of the bar.

As with the SAM's, the ground wires on the pistons may be of the same gage/type wire as the plugs.

Excess wire will be formed in a coil around a pencil in the space behind the keyboards and being formed into a wire bundle.

The wiring chart looks like this:

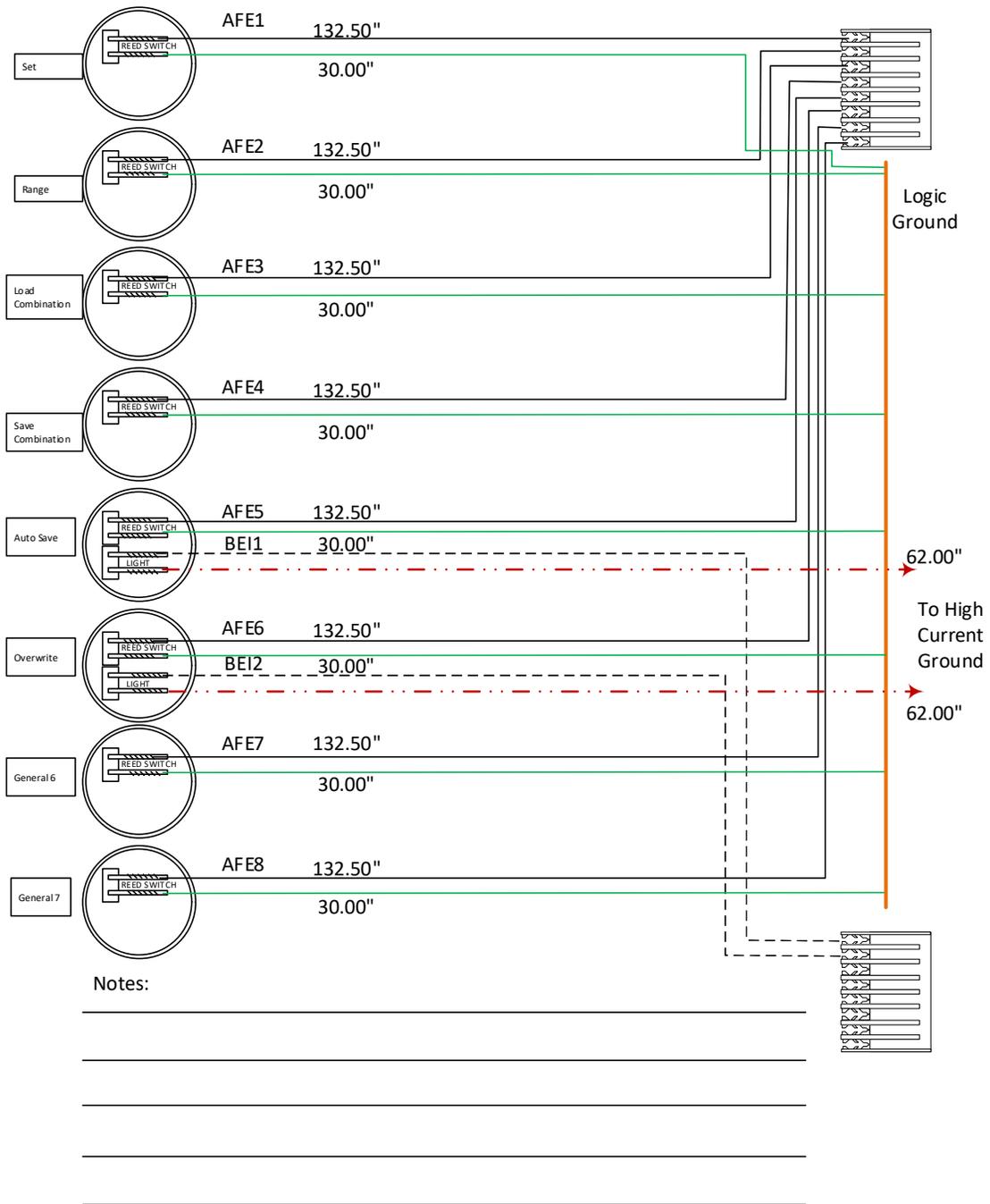


FIGURE 40 PISTON RAIL CHART EXAMPLE

## Great (Second) Manual

The Great Manual Piston Rail is all unlit buttons and so only needs an 18 AWG Logic Ground wire about 30" from the Piston Rail. This should be strapped to the Logic Ground with 24 AWG wire from the ends and about every 12" over the length of the bar.

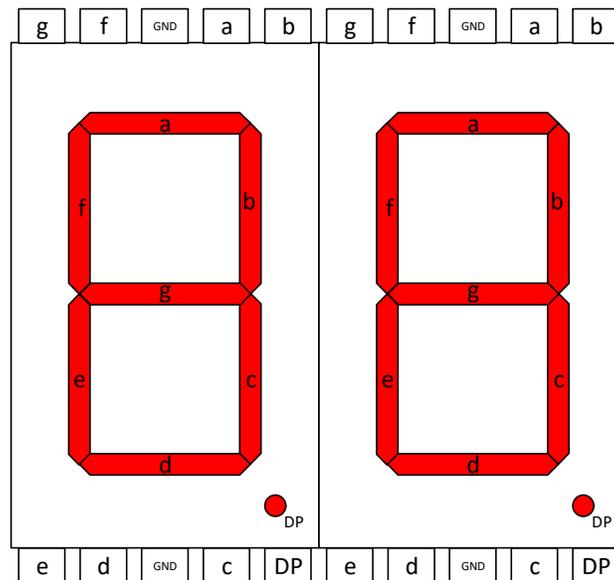
## Bombarde (Third) Manual

This rail while not having as many buttons as the Accompaniment Rail has every type of connection. LED's, LED Pistons, and regular pistons. This will have every type of connection to be found. The logic bus will be the same as the other two rails. A short High Current bar is used to connect the LED's and then a single wire goes to the High Current Bus.

## Solo (Top) Manual

This manual is similar to the Bombarde Manual. It has regular push buttons, lighted buttons, an LED driven from the relay, and a TRI-COLOR LED connected to each of the three power supplies. If the LED is white, then all three supplies are working.

## File Number Display



**FIGURE 41 FILE NUMBER DISPLAY**

On the Organist Left Side above the top keyboard is a two-digit LED seven segment display. The display is wired to the Organist Left Side driver card.

**TABLE 5 7 SEGMENT DISPLAY**

2 Digit Display (7 Segment)	
1'S	a      BBN1
	b      BBN2
	c      BBN3
	d      BBN4
	e      BBN5
	f      BBN6

	g	BBN7
10'S	a	BBN8
	b	BBO1
	c	BBO2
	d	BBO3
	e	BBO4
	f	BBO5
	g	BBO6

The two “DP’ (decimal point) indicators are not used at this time. There is no driver assigned at this time although the plug has open spots for them. No definition in the relay has been created for them. They could be used to indicate some status such as when the Sostenuito is engaged or if it is operating as some other state like a sustain. Or if it operating on the Great, Bombarde, or Solo manual. This chart is similar to wiring LED’s on the piston rails. See Wiring Chart for wire length.

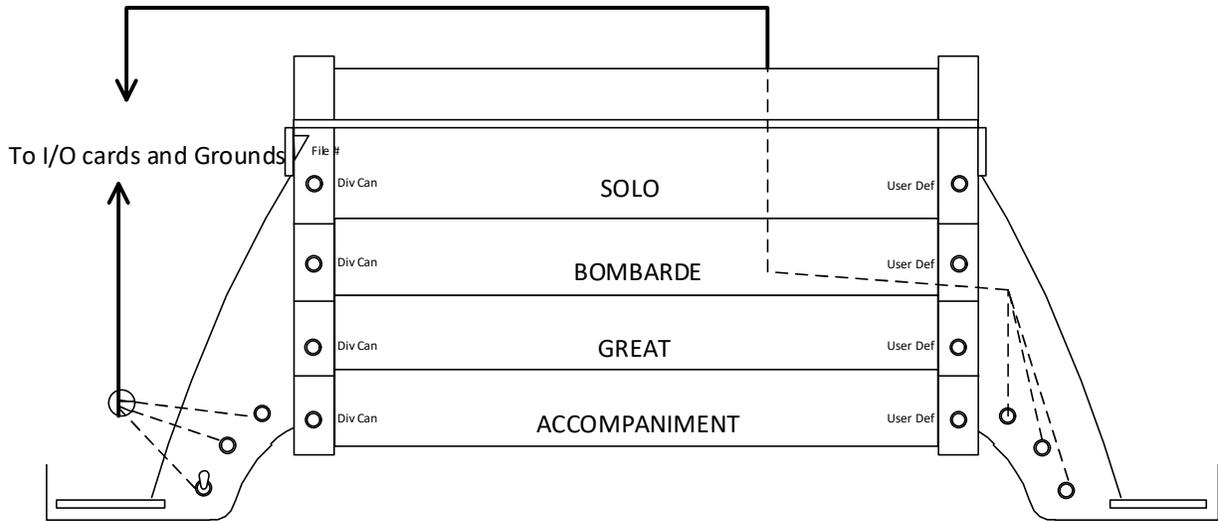
## Key Desk Surface

There are five LED buttons and one three position switch. The five buttons are all left for the Organist to define as buttons or reversible actions. The three-position switch is of the ON-OFF-ON type and is used to select the Wurlitzer – Both – Robert Morton Chrysoglotts. The logic for this being handled by the relay Link. All electrical connections are on the organist left side of the console. [Figure 28](#) shows the location of these items.

**TABLE 6 KEY DESK BUTTONS AND SWITCH**

Key Desk		
User Button 1	ADP1	BBP1
User Button 2	ADP2	BBP2
User Button 3	ADP3	BBP3
User Button 4	ADP4	BBP4
User Button 5	ADP5	BBP5
Harp Select	ADP6 & P7	

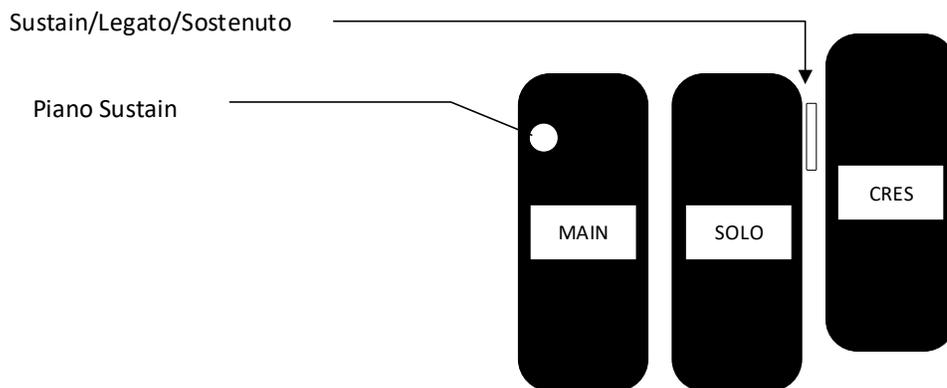
Wiring from these items can be routed in one of two ways. As shown on the left side of the picture, a hole could be drilled thru the key desk and the wires passed up thru the hole. This gives a short exposure to the wires under the key desk. The second is to route the wires under the manuals and pass thru to the rear of the console in the large gap under the keyboards as pictured to the right. This takes on modification to the console but does expose the wires. One action would be to place a sheet of poster board under the keyboards.



**FIGURE 42 KEY DESK WIRING**

## Swell and Crescendo Shoes

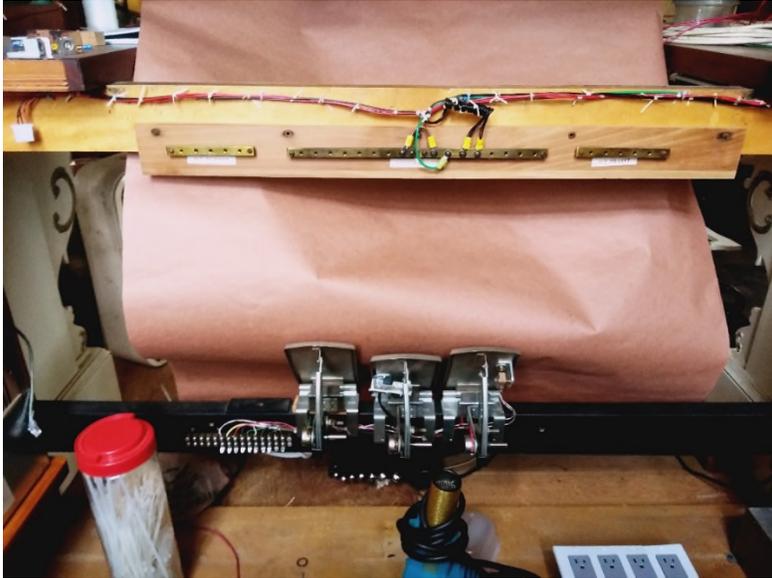
Located in the center of the console above the Pedal Board are three Shoes. Their functions (from left to right) are: Main Chamber Swell, Solo Chamber Swell, and Crescendo Pedal. The two Chamber shoes control both the front facing and stage facing shutters. The Main Chamber Swell has a round button in the upper left for controlling the Piano Sustain Pedal. The Solo Chamber Swell has a side kick switch which controls the Great Keyboard sustaining functions. There is a junction strip associated with these connections.



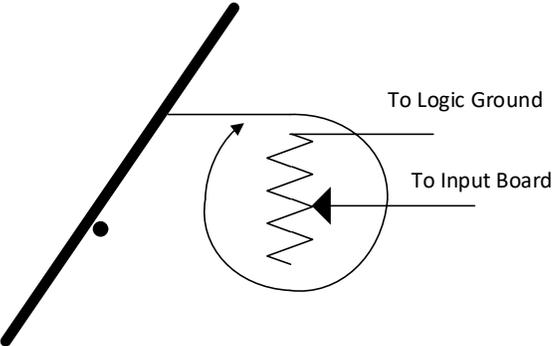
**FIGURE 43 SHOE CONFIGURATION**

The two switches are simple normally open contacts. The three shoes are connected to 10k Ohm linear potentiometers. These are wired to ground on one connection and the wiper are to the other. They are connected so that when the shoes are closed or in the up position the reading on the pot should be

close to zero. The slight offset from zero is to keep from jamming the action into the stop point of the device and using it to control the travel limit. The error is then removed in the relay software.



**FIGURE 44 SHOES REAR VIEW**



**FIGURE 45 SCHEMATIC CONNECTIONS**

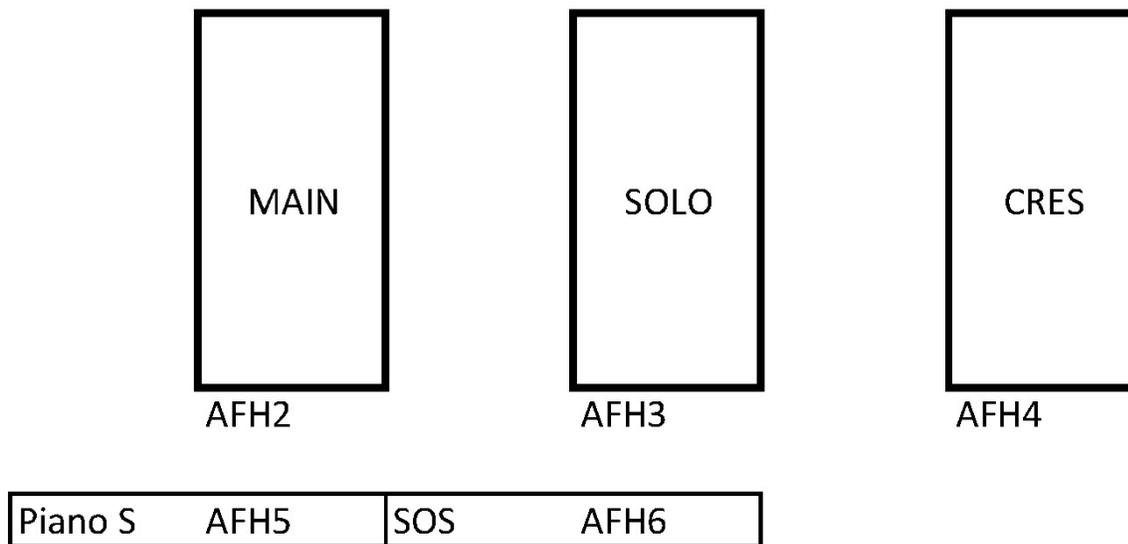


FIGURE 46 SHOE CONNECTIONS

## Toe Studs (Kick Panel)

Surrounding the Swell Shoes is the Kick Panel. Installed here are Toe Studs which control various effects and the first five General Pistons and Pedal Division Pistons.

This image is of the original layout. The new console will have one less swell shoe with wider spacing of the toe studs.



FIGURE 47 ORIGINAL DEVTRONIX KICK PANEL

The toe studs are constructed with two contacts attached to the outer frame. A copper disk is attached to the center plunger and completes the connection when pressed.

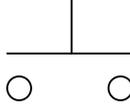


FIGURE 48 TOE STUD SCHEMATIC

TABLE 7 TOE STUD MAP

Toe Studs							
Left							
	Auto Horn	Ahooga	Sub Dive Alarm	Police Siren	Programmable	Grand Crash	
	AGJ1	AGJ2	AGJ3	AGJ4	AGJ5	AGJ6	
Wood Block	Wind	PED 1	PED 2	PED 3	PED 4	PED 5	Pedal Cancel
AGJ7	AGJ8	AGK1	AGK2	AGK3	AGK4	AGK5	AGK6
Programmable	Surf	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	General Cancel
AGL5	AGL6	AGK7	AGK8	AGL1	AGL2	AGL3	AGL4
Right							
	Fire Gong	Boat Whistle	Train Whistle (Build)	Bird (Build extra)			
	AGN3	AGN4	AGN5	AGN6			
	Roll Cymbal (Build)	Gong	Splash Cymbal	Machine Gun	Door Bell		
	AGM6	AGM7	AGM8	AGN1	AGN2		
	Crash Cymbal	Drum Roll	Triangle	Horse Hooves	Airplane		
	AGM1	AGM2	AGM3	AGM4	AGM5		

The grounds all go to the Logic Supply Ground. All of the inputs to the relay go to the panel on the Organist Right Side. The “Programable” Stud on the bottom row of the left side is the furthest away from the relay. The wiring is grouped as to function. That is the “General Pistons” are wired as a block and the “Pedal Pistons” are also wired as a block.

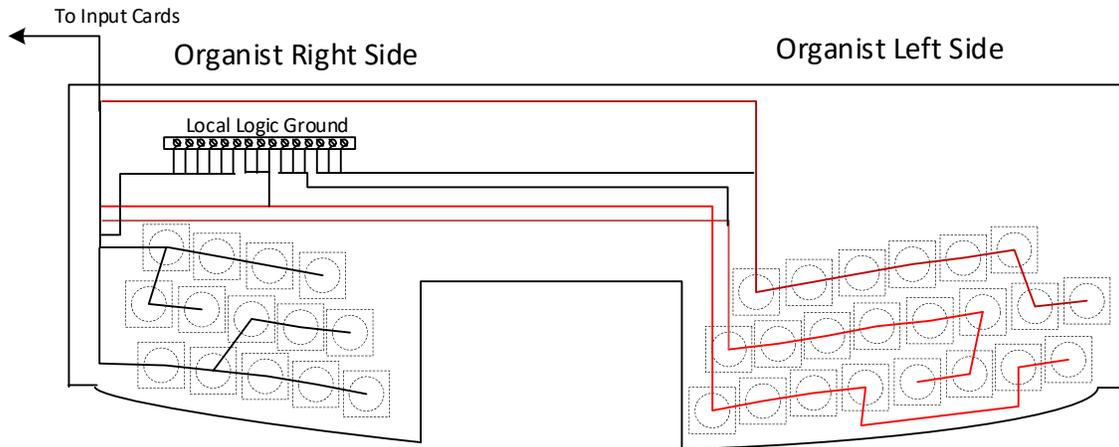
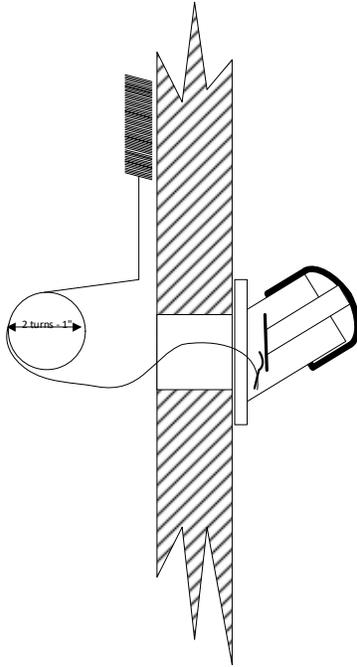
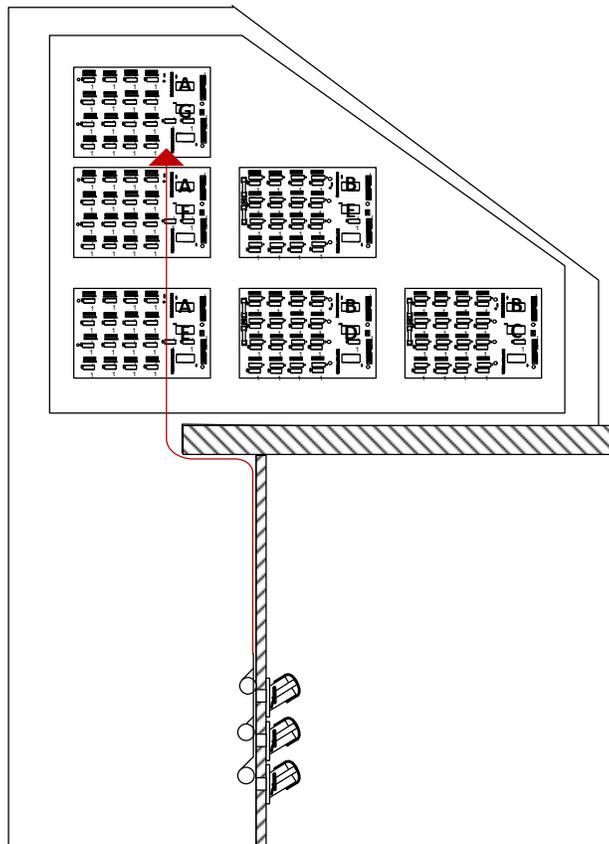


FIGURE 49 KICK PANEL REAR VIEW

Wires from the Toe Studs will pass through the kick board. On the back side of the board the wire will form into a two-turn coil of about one-inch diameter (slack wire) of a little over six inches. A smaller coil like in Figure 8 can be used to take up additional slack.

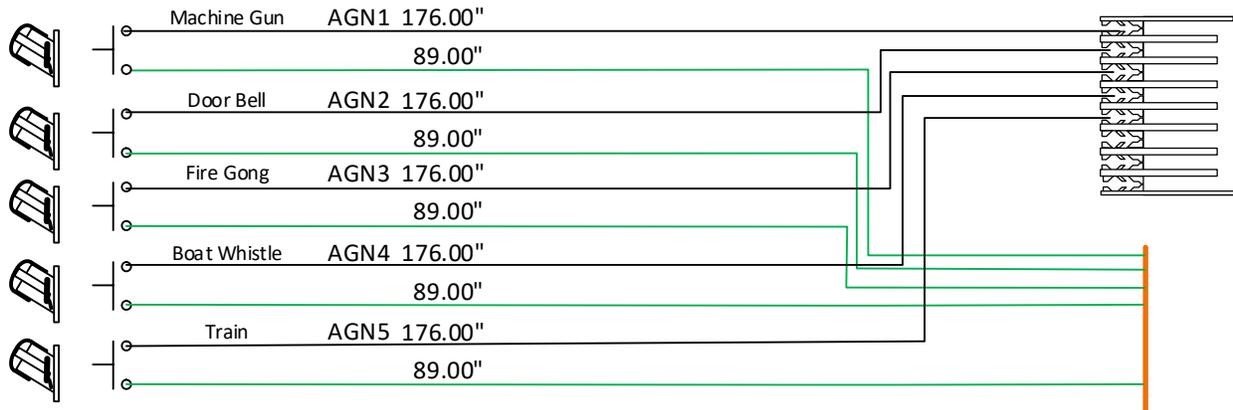


**FIGURE 50 TOE STUD WIRING**



**FIGURE 51 CABLE PATH TO I/O CARDS**

### Rear View, Left



Notes:

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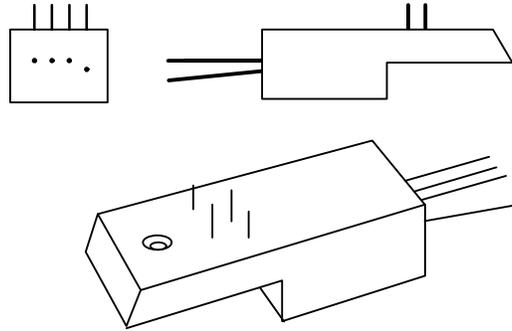


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**FIGURE 52 TOE STUD WIRING CHART EXAMPLE**

## Pedal Board

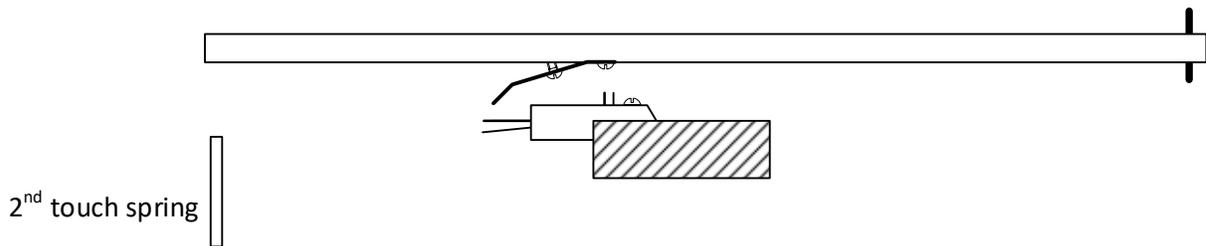
This Pedal Board is simpler than most Wurlitzer Pedal Boards. The Swell Shoes are attached to the console. There are no Toe Studs installed on the Pedal Board. There is 1<sup>st</sup> and 2<sup>nd</sup> touch on the Pedal Board for a total of 64 input. 96 pins wired with 32 for the Ground on each note and the two key contacts. The lower contact is for the second touch. A four-wire contact block is used. The amount of dip in the second touch wire will need to be computed after the rail is installed. A small piece of proto type board attached to the front of the contact block will position this wire correctly.



**FIGURE 53 PEDAL CONTACT BLOCK**

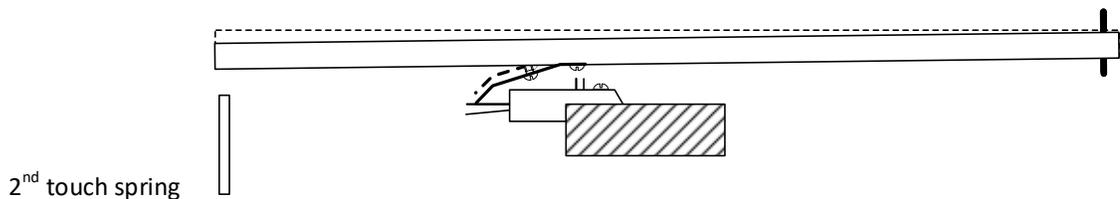
This is the basic pedal key configuration. The pivot point is at the rear and there is another spring, not shown, that provides the basic return pressure. For this discussion, assume that the key contact (in the center of the picture) will travel one inch for the total key travel (1<sup>st</sup> & 2<sup>nd</sup> touch).

The following explanation on contact position is for explaining the position of the second touch contact. The pedal board we have may need to have all new blocks installed if the contact rail is not cannibalized from another console.



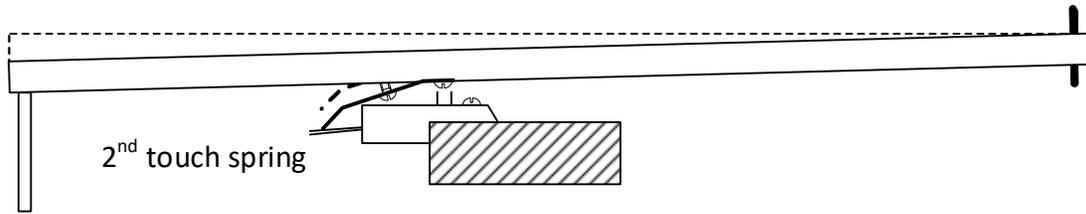
**FIGURE 54 PEDAL KEY AT REST**

As the key is depressed and the contact bar travels about ¼" it will make contact with the key common and the 1<sup>st</sup> touch contact.



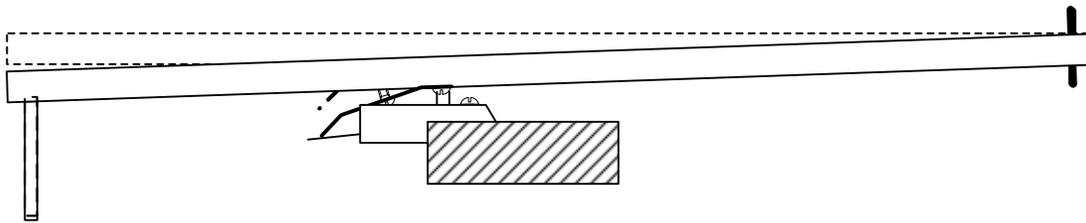
**FIGURE 55 PEDAL KEY @ 25% OF TRAVEL**

The key will continue to travel until the contact has move about ½" and has made contact with the second touch spring. It has yet to make contact with the 2<sup>nd</sup> touch contact but now requires additional pressure to move downward.



**FIGURE 56 PEDAL KEY AT 50% OR END OF 1ST TOUCH TRAVEL**

Going deeper, at 75% of the travel the contact bar makes touch with the second touch contact and continues to travel to the bottom of the stroke making good contact with the key contacts.

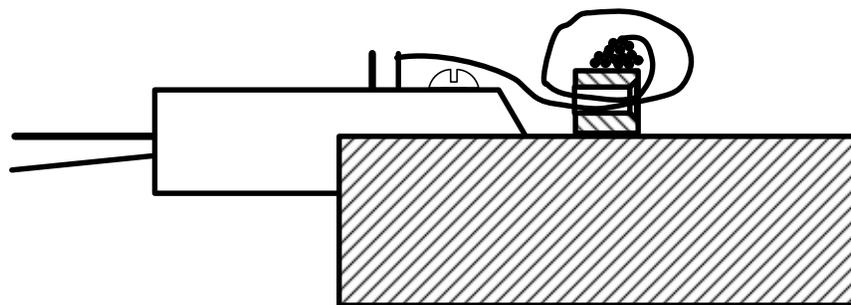


**FIGURE 57 KEY AT 75%**

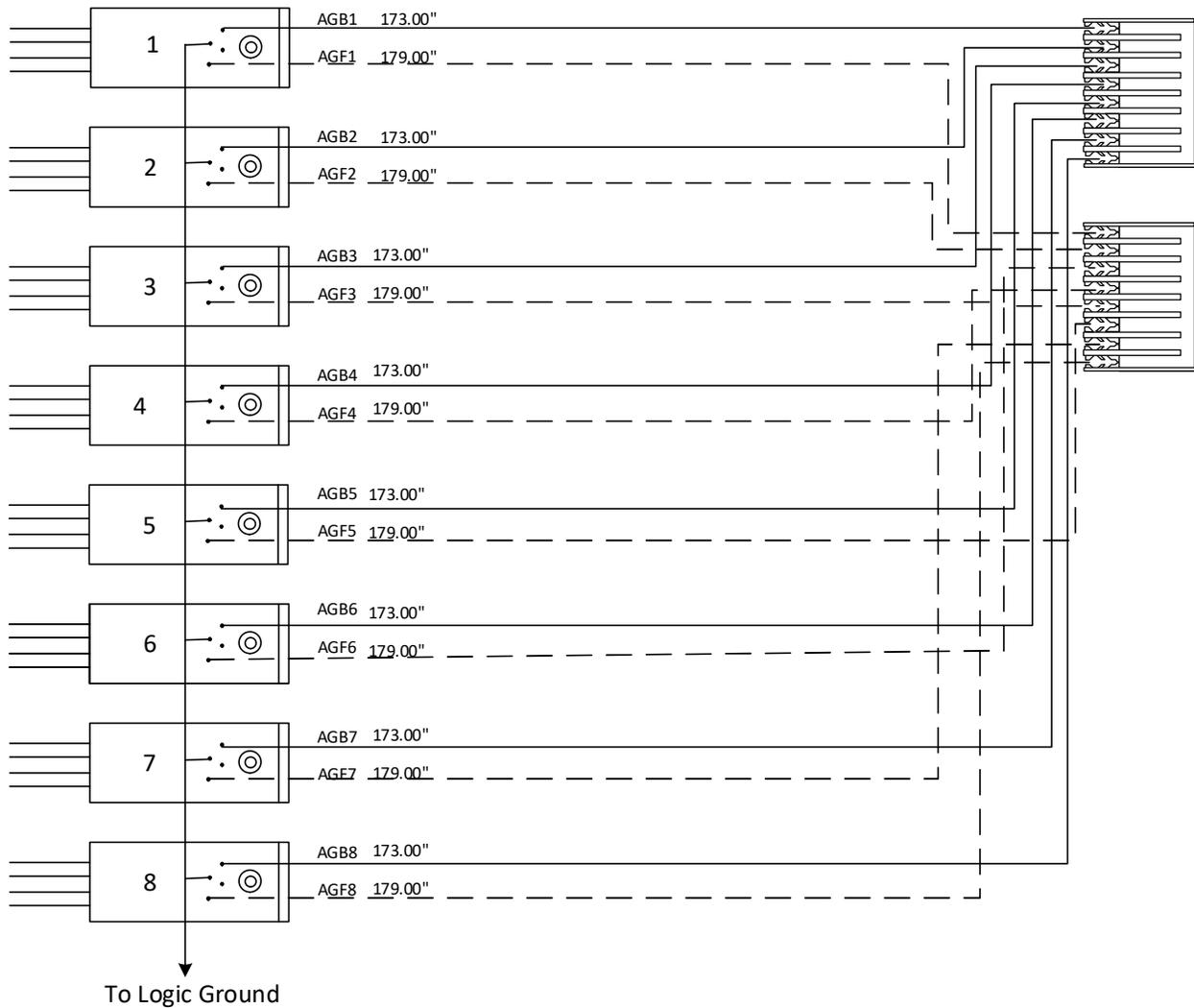
In review, at 25% of the travel contact is made with the 1<sup>st</sup> touch contact. It continues to travel to the 2<sup>nd</sup> touch spring at 50% and stops. With more pressure at 75% of the travel it makes contact with the second touch contact and continues to travel to the bottom. This is the same for the Keyboards as well.

The wire length calculated for the pedal board is measured from the low C note at the organist far left. The cable then runs the length of the contact rail to the organist right hand side. Then up the side of the pedal board. There is to be a loop of slack wire at this point in the console so the pedal board may slide away from the console for repair. The loop should be ~36" long or have an 11.50" diameter. The cable then proceeds up the side of the console in the same fashion as the cable from the Kick Panel.

The wiring should originate at the I/O board plug and then trimmed to length at the contact block. There is not the ability to coil up slack wire here as there is in all other cases. The contact rail will have a strip of wood with holes for the wire to pass through and to lace the cable bundle to the rail. The wire shown here before it is pulled tight.



**FIGURE 58 CONTACT RAIL AND BLOCK**



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FIGURE 59 PEDAL BOARD WIRING CHART

## Cable Lacing

There are many systems for wire management. Each with its advantages and problems. Wax Lacing Cord is best for this purpose. It binds tight, has a low profile, and can be cut out and replaced when required for maintenance.

The wiring charts are laid out for the eight wire plugs. This is an ideal size for small wire bundles and remains flexible enough to allow the wires to be tied up off site and then fitted into the console.

These small cables can then be joined together by a method known as “Cable Sewing”. This forms the cables into a flat ribbon which like the small cables can be shaped to the console.

### The Knot

Bundling the eight wires together, a “Clove Hitch” is the most useful knot. Along with the properties of the wax cord and the way it grabs, it makes for a tight knot. With the addition of an “Over Hand” knot on top it will not come lose.

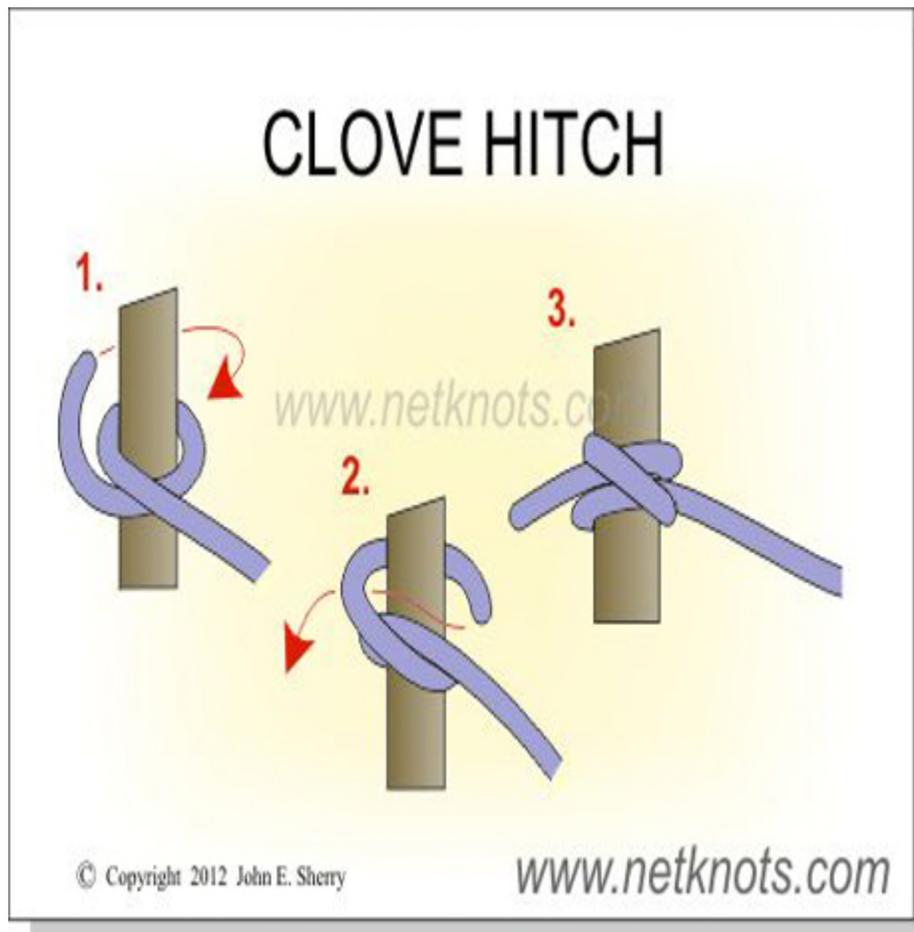
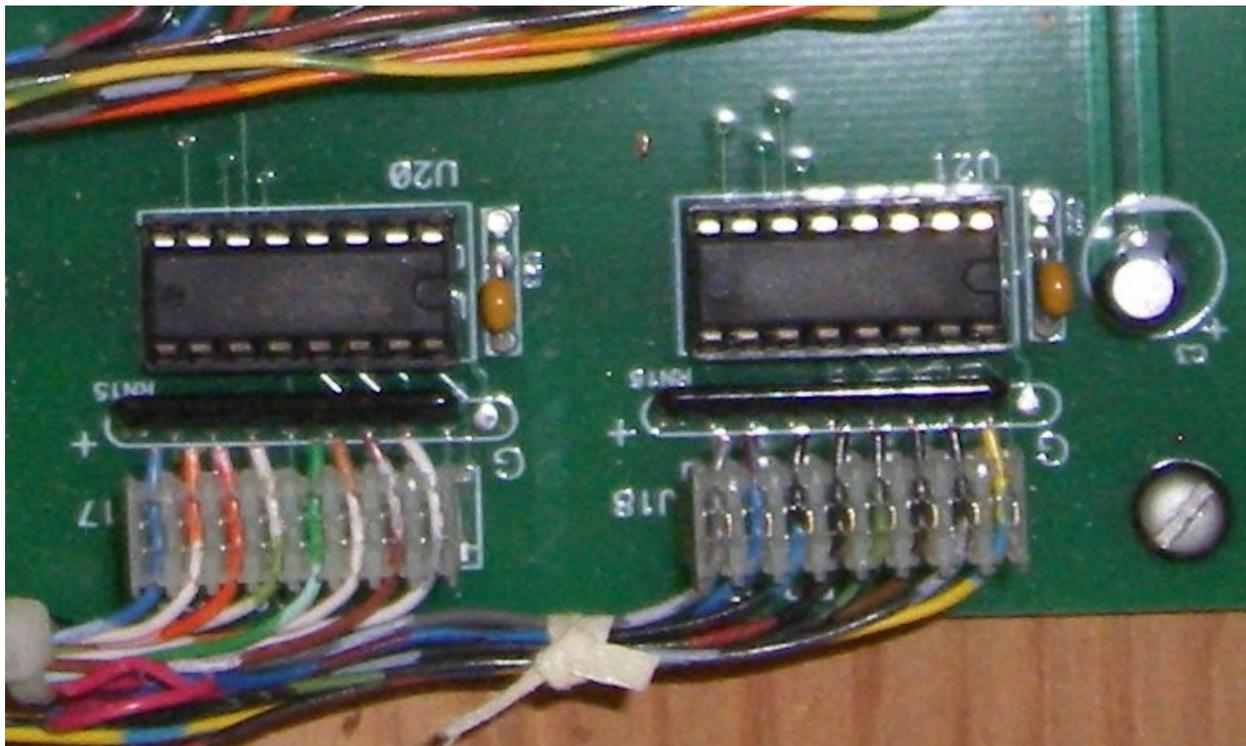


FIGURE 60 CLOVE HITCH

These knots should be placed between 8 to 12 inches along the main body of the cable and closer in turns. When cutting the excess cord away from the knot, leave between one eighth to one quarter inch to keep the knot from unraveling.

## The Plug

Figures 20 through 23 introduce the I/O board plug and the tools used to wire them. The plug fits into the punch down tool with circuit position 1 on the left-hand side. The wires may be feed into the plug from the front (away from the tool) or rear (from the tool), This second option is preferred as the boards are laid out with space between the connectors and chips on this side.



**FIGURE 61 PLUG WITH WIRE ATTACHED**

Wires exit the plug and form an immediate right angle and then tied into a bundle. The next tie to the left is 1.5" from the tie in the center of the picture here. That is also the spacing between pin one on each plug. If forming these into a single cable the four plugs should be spaced at that distance.

The plan is to bundle each 8 wires from a plug back to the connection point in the console (or within a few inches).

The cables may be marked with Toe Tags and could be cut down to not clutter the wiring.

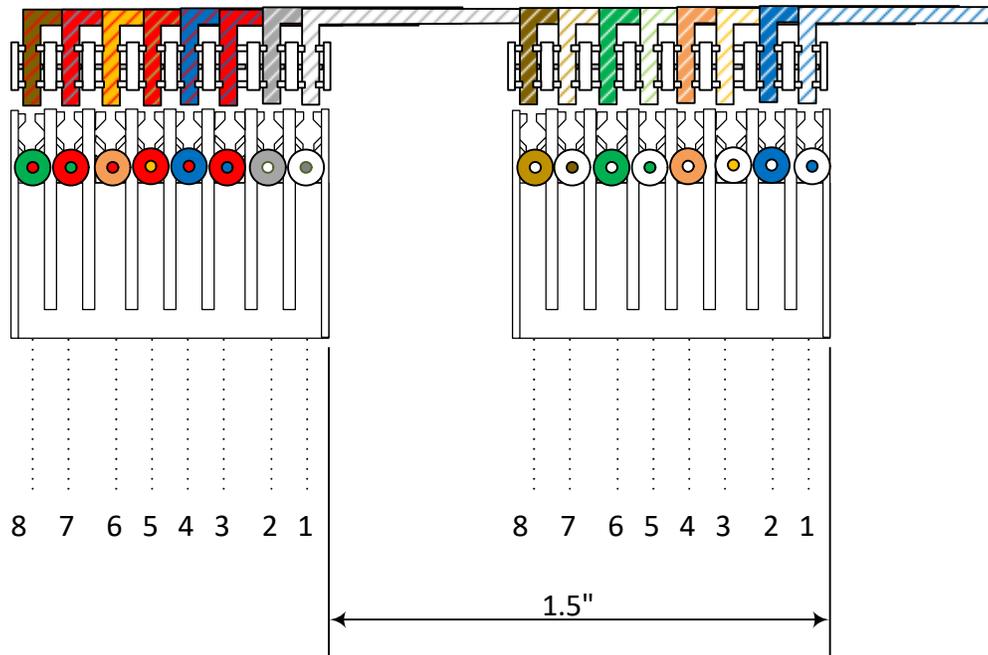


FIGURE 62 PLUG SPACING

Each Wiring chart will include a drawing showing the basic length of the different sections of the cable.

## Cable Sewing

Originally developed by the communications industry for management of RF cables and small wire bundles it is now found in all forms of electronics including military equipment. The intention is to secure the cables together not in a flat bundle. Each cable is tied to an adjacent cable such that it can be cut and the cables to the left and right remain together.

The term “sewing” comes from the use of a hook or needle to thread the lacing between adjacent cables.

## YouTube Videos

Here is the Mil-Spec method of doing this. It is very complicated. I will propose a simpler method.

Cable Sewing Frank - Part 1

<https://www.youtube.com/watch?v=La6LbgnZJco>

Cable Sewing Frank - Part 2

<https://www.youtube.com/watch?v=anpOLg5e3HM>

Cable Sewing Frank - Part 3

[https://www.youtube.com/watch?v=A7Qukw\\_OnSk](https://www.youtube.com/watch?v=A7Qukw_OnSk) 0:02 / 5:36

## Cable Sewing Modified

The videos use a heavy thread to tie the cables together. This results in a complicated knotting system to ensure a tight grip. Using wax cord makes the process simpler and faster.

Start with a piece of cord about 3 feet in length. Wrap it around the first wire bundle twice. Then tie a simple overhand knot with the two ends and pull it tight. Right over left is easy to remember and simple. Pull then ends tight. Put a second overhand knot in using the same right over left tie. This forms a square knot.

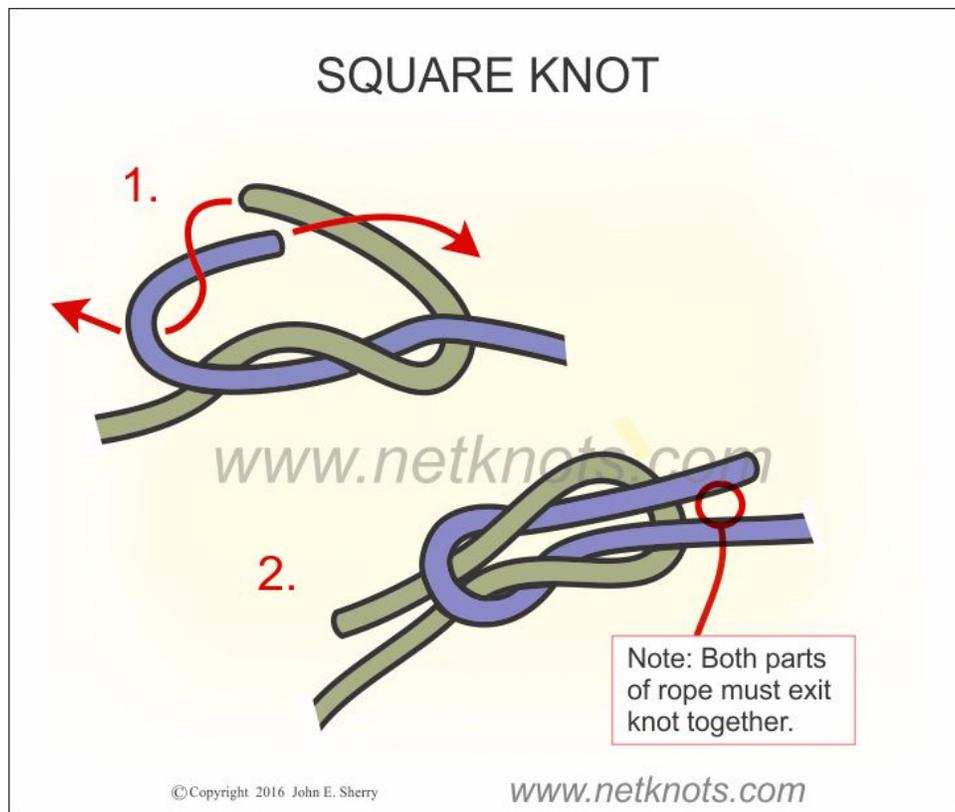


FIGURE 63 SQUARE KNOT

Lay the next cable bundle down next to this one. Pass each end of the cord around the bundle from the right and left. Tie another square knot and proceed with the next bundle.

# Appendix

## Data

### Pin Usage

#### Organist Left Side

Spare Pins	
AAO2	BBM7
AAO3	BBM8
AAO4	BBP6
AAO5	BBP7
AAO6	BBP8
AAO7	
AAO8	
ABO5	
ABO6	
ABO7	
ABO8	
ACO5	
ACO6	
ACO7	
ACO8	
ADO8	
ADP8	

	Stops
	Keyboards
	Display
	Key Desk
	Free

FIGURE 64 OLS GUIDE

BA

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P								O								N								M							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L								K								J								I							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H								G								F								E							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D								C								B								A							

FIGURE 65 OUTPUT BOARD BA

BB

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P					O					N					M																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L					K					J					I																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H					G					F					E																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D					C					B					A																

**FIGURE 66 OUTPUT BOARD BB**

AA

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P					O					N					M																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L					K					J					I																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H					G					F					E																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D					C					B					A																

**FIGURE 67 INPUT BOARD AA**

AB

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P					O					N					M																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L					K					J					I																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H					G					F					E																
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D					C					B					A																

**FIGURE 68 INPUT BOARD AB**

AC

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P								O								N								M							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L								K								J								I							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H								G								F								E							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D								C								B								A							

**FIGURE 69 INPUT BOARD AC**

AD

8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
P								O								N								M							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
L								K								J								I							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
H								G								F								E							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
D								C								B								A							

**FIGURE 70 INPUT BOARD AD**

Organist Right Side

Spare Pins	
AAO2	BBM7
AAO3	BBM8
AAO4	BBP6
AAO5	BBP7
AAO6	BBP8
AAO7	
AAO8	
ABO5	
ABO6	
ABO7	
ABO8	
ACO5	
ACO6	
ACO7	
ACO8	
ADO8	
ADP8	

Stops
Keyboards
Display
Key Desk
Free

FIGURE 71 ORS GUIDE

BC

8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1							
P								O								N								M							
8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1							
L								K								J								I							
8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1							
H								G								F								E							
8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1								8 7 6 5 4 3 2 1							
D								C								B								A							

FIGURE 72 OUTPUT BOARD BC

BD

8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
P		O		N		M
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
L		K		J		I
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
H		G		F		E
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
D		C		B		A

FIGURE 73 OUTPUT BOARD BD

BE

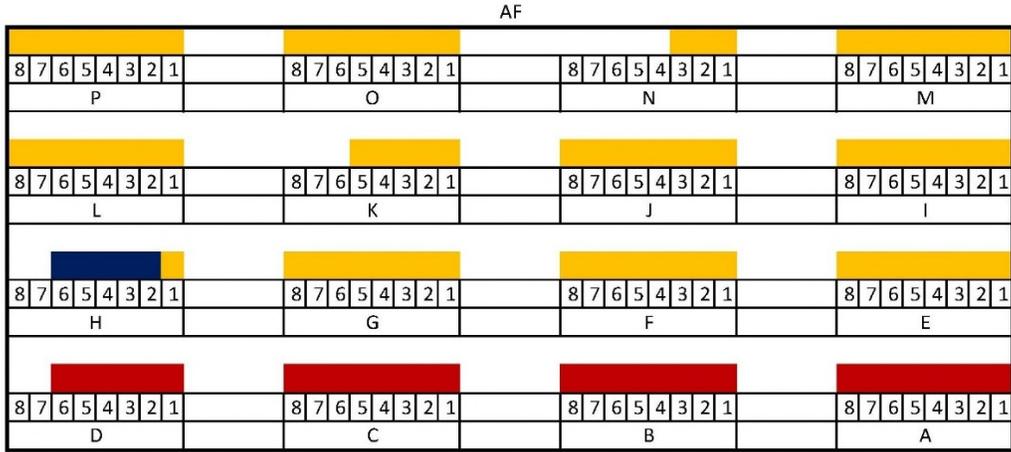
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
P		O		N		M
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
L		K		J		I
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
H		G		F		E
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
D		C		B		A

FIGURE 74 OUTPUT BOARD BE

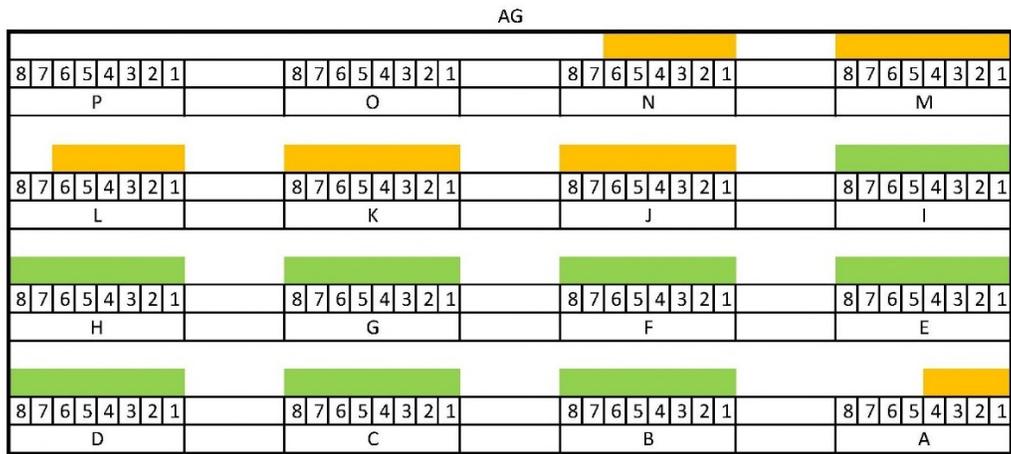
AE

8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
P		O		N		M
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
L		K		J		I
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
H		G		F		E
8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1		8 7 6 5 4 3 2 1
D		C		B		A

FIGURE 75 INPUT BOARD AE



**FIGURE 76 INPUT BOARD AF**



**FIGURE 77 INPUT BOARD AG**

## Keyboards

	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
KBD1:	Pedal		1									
32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AG-B1	AG-B2	AG-B3	AG-B4	AG-B5	AG-B6	AG-B7	AG-B8	AG-C1	AG-C2	AG-C3	AG-C4
8'	AG-C5	AG-C6	AG-C7	AG-C8	AG-D1	AG-D2	AG-D3	AG-D4	AG-D5	AG-D6	AG-D7	AG-D8
8'	AG-E1	AG-E2	AG-E3	AG-E4	AG-E5	AG-E6	AG-E7	AG-E8	----	----	----	----
8'	----	----	----	----	----	----	----	----	----	----	----	----
8'	----	----	----	----	----	----	----	----	----	----	----	----
4'	----	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											

KBD2:	Pedal 2nd	1										
32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AG-F1	AG-F2	AG-F3	AG-F4	AG-F5	AG-F6	AG-F7	AG-F8	AG-G1	AG-G2	AG-G3	AG-G4
8'	AG-G5	AG-G6	AG-G7	AG-G8	AG-H1	AG-H2	AG-H3	AG-H4	AG-H5	AG-H6	AG-H7	AG-H8
8'	AG-I1	AG-I2	AG-I3	AG-I4	AG-I5	AG-I6	AG-I7	AG-I8	----	----	----	----
8'	----	----	----	----	----	----	----	----	----	----	----	----
8'	----	----	----	----	----	----	----	----	----	----	----	----
4'	----	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											
KBD3:	Accomp	1										
32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AA-P2	AA-P3	AA-P4	AA-P5	AA-P6	AA-P7	AA-P8	AB-A1	AB-A2	AB-A3	AB-A4	AB-A5
8'	AB-A6	AB-A7	AB-A8	AB-B1	AB-B2	AB-B3	AB-B4	AB-B5	AB-B6	AB-B7	AB-B8	AB-C1
8'	AB-C2	AB-C3	AB-C4	AB-C5	AB-C6	AB-C7	AB-C8	AB-D1	AB-D2	AB-D3	AB-D4	AB-D5
8'	AB-D6	AB-D7	AB-D8	AB-E1	AB-E2	AB-E3	AB-E4	AB-E5	AB-E6	AB-E7	AB-E8	AB-F1
8'	AB-F2	AB-F3	AB-F4	AB-F5	AB-F6	AB-F7	AB-F8	AB-G1	AB-G2	AB-G3	AB-G4	AB-G5
4'	AB-G6	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											
KBD4:	Accomp 2nd	1										
32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AB-G7	AB-G8	AB-H1	AB-H2	AB-H3	AB-H4	AB-H5	AB-H6	AB-H7	AB-H8	AB-I1	AB-I2
8'	AB-I3	AB-I4	AB-I5	AB-I6	AB-I7	AB-I8	AB-J1	AB-J2	AB-J3	AB-J4	AB-J5	AB-J6
8'	AB-J7	AB-J8	AB-K1	AB-K2	AB-K3	AB-K4	AB-K5	AB-K6	AB-K7	AB-K8	AB-L1	AB-L2
8'	AB-L3	AB-L4	AB-L5	AB-L6	AB-L7	AB-L8	AB-M1	AB-M2	AB-M3	AB-M4	AB-M5	AB-M6
8'	AB-M7	AB-M8	AB-N1	AB-N2	AB-N3	AB-N4	AB-N5	AB-N6	AB-N7	AB-N8	AB-O1	AB-O2
4'	AB-O3	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											
KBD5:	Great	1										
32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AB-P2	AB-P3	AB-P4	AB-P5	AB-P6	AB-P7	AB-P8	AC-A1	AC-A2	AC-A3	AC-A4	AC-A5

8'	AC-A6	AC-A7	AC-A8	AC-B1	AC-B2	AC-B3	AC-B4	AC-B5	AC-B6	AC-B7	AC-B8	AC-C1
8'	AC-C2	AC-C3	AC-C4	AC-C5	AC-C6	AC-C7	AC-C8	AC-D1	AC-D2	AC-D3	AC-D4	AC-D5
8'	AC-D6	AC-D7	AC-D8	AC-E1	AC-E2	AC-E3	AC-E4	AC-E5	AC-E6	AC-E7	AC-E8	AC-F1
8'	AC-F2	AC-F3	AC-F4	AC-F5	AC-F6	AC-F7	AC-F8	AC-G1	AC-G2	AC-G3	AC-G4	AC-G5
4'	AC-G6	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											

KBD6: Great 2nd 1

32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AC-G7	AC-G8	AC-H1	AC-H2	AC-H3	AC-H4	AC-H5	AC-H6	AC-H7	AC-H8	AC-I1	AC-I2
8'	AC-I3	AC-I4	AC-I5	AC-I6	AC-I7	AC-I8	AC-J1	AC-J2	AC-J3	AC-J4	AC-J5	AC-J6
8'	AC-J7	AC-J8	AC-K1	AC-K2	AC-K3	AC-K4	AC-K5	AC-K6	AC-K7	AC-K8	AC-L1	AC-L2
8'	AC-L3	AC-L4	AC-L5	AC-L6	AC-L7	AC-L8	AC-M1	AC-M2	AC-M3	AC-M4	AC-M5	AC-M6
8'	AC-M7	AC-M8	AC-N1	AC-N2	AC-N3	AC-N4	AC-N5	AC-N6	AC-N7	AC-N8	AC-O1	AC-O2
4'	AC-O3	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											

KBD7: Bombarde 1

32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AC-P2	AC-P3	AC-P4	AC-P5	AC-P6	AC-P7	AC-P8	AD-A1	AD-A2	AD-A3	AD-A4	AD-A5
8'	AD-A6	AD-A7	AD-A8	AD-B1	AD-B2	AD-B3	AD-B4	AD-B5	AD-B6	AD-B7	AD-B8	AD-C1
8'	AD-C2	AD-C3	AD-C4	AD-C5	AD-C6	AD-C7	AD-C8	AD-D1	AD-D2	AD-D3	AD-D4	AD-D5
8'	AD-D6	AD-D7	AD-D8	AD-E1	AD-E2	AD-E3	AD-E4	AD-E5	AD-E6	AD-E7	AD-E8	AD-F1
8'	AD-F2	AD-F3	AD-F4	AD-F5	AD-F6	AD-F7	AD-F8	AD-G1	AD-G2	AD-G3	AD-G4	AD-G5
4'	AD-G6	----	----	----	----	----	----	----	----	----	----	----
2'	----	----	----	----	----	----	----	----	----	----	----	----
1'	----	----	----	----	----	----	----	----	----	----	----	----
1/2'	----											
	0,N,N											

KBD8: Solo 1

32'	----	----	----	----	----	----	----	----	----	----	----	----
16'	----	----	----	----	----	----	----	----	----	----	----	----
8'	AD-H2	AD-H3	AD-H4	AD-H5	AD-H6	AD-H7	AD-H8	AD-I1	AD-I2	AD-I3	AD-I4	AD-I5
8'	AD-I6	AD-I7	AD-I8	AD-J1	AD-J2	AD-J3	AD-J4	AD-J5	AD-J6	AD-J7	AD-J8	AD-K1
8'	AD-K2	AD-K3	AD-K4	AD-K5	AD-K6	AD-K7	AD-K8	AD-L1	AD-L2	AD-L3	AD-L4	AD-L5
8'	AD-L6	AD-L7	AD-L8	AD-M1	AD-M2	AD-M3	AD-M4	AD-M5	AD-M6	AD-M7	AD-M8	AD-N1
8'	AD-N2	AD-N3	AD-N4	AD-N5	AD-N6	AD-N7	AD-N8	AD-O1	AD-O2	AD-O3	AD-O4	AD-O5

4'	AD-O6	----	----	----	----	----	----	----	----	----	----	----
2'		----	----	----	----	----	----	----	----	----	----	----
1'		----	----	----	----	----	----	----	----	----	----	----
1/2'		----										
	0,N,N											

## Stops & Buttons

STP1:	16' PEDAL TUBA HORN	<2>	---	----	AA-O1	BB-M1	BB-M2	5	A	A
STP2:	16' PEDAL DIAPHONIC DIAPASON	<2>	---	----	AA-N8	BB-L7	BB-L8	5	A	A
STP3:	16' PEDAL TIBIA CLAUSA (SOLO)	<2>	---	----	AA-N7	BB-L5	BB-L6	5	A	A
STP4:	16' PEDAL COUNTRA VIOL	<2>	---	----	AA-N6	BB-L3	BB-L4	5	A	A
STP5:	16' PEDAL CONCERT FLUTE	<2>	---	----	AA-N5	BB-L1	BB-L2	5	A	A
STP6:	10-2/3' PEDAL CONCERT FLUTE	<2>	---	----	AA-N4	BB-K7	BB-K8	5	A	A
STP7:	8' PEDAL ENGLISH HORN	<2>	---	----	AA-N3	BB-K5	BB-K6	5	A	A
STP8:	8' PEDAL BRASS TRUMPET	<2>	---	----	AA-N2	BB-K3	BB-K4	5	A	A
STP9:	8' PEDAL TUBA HORN	<2>	---	----	AA-N1	BB-K1	BB-K2	5	A	A
STP10:	8' PEDAL DIAPHONIC DIAPASON	<2>	---	----	AA-M8	BB-J7	BB-J8	5	A	A
STP11:	8' PEDAL HORN DIAPASON	<2>	---	----	AA-M7	BB-J5	BB-J6	5	A	A
STP12:	8' PEDAL TIBIA CLAUSA (SOLO)	<2>	---	----	AA-M6	BB-J3	BB-J4	5	A	A
STP13:	8' PEDAL TIBIA CLAUSA (MAIN)	<2>	---	----	AA-M5	BB-J1	BB-J2	5	A	A
STP14:	8' PEDAL CLARINET	<2>	---	----	AA-M4	BB-I7	BB-I8	5	A	A
STP15:	8' PEDAL BRASS SAXAPHONE	<2>	---	----	AA-M3	BB-I5	BB-I6	5	A	A
STP16:	8' PEDAL ORCH REED	<2>	---	----	AA-M2	BB-I3	BB-I4	5	A	A
STP17:	8' PEDAL VIOL D' ORCHESTRE	<2>	---	----	AA-M1	BB-I1	BB-I2	5	A	A
STP18:	8' PEDAL SALICIONAL	<2>	---	----	AA-L8	BB-H7	BB-H8	5	A	A
STP19:	8' PEDAL CONCERT FLUTE	<2>	---	----	AA-L7	BB-H5	BB-H6	5	A	A
STP20:	4' PEDAL DIAPHONIC DIAPASON	<2>	---	----	AA-L6	BB-H3	BB-H4	5	A	A
STP21:	16' PEDAL PIANO	<2>	---	----	AA-L5	BB-H1	BB-H2	5	A	A
STP22:	8' PEDAL PIANO	<2>	---	----	AA-L4	BB-G7	BB-G8	5	A	A
STP23:	8' ACCOMP to PEDAL	<2>	---	----	AA-L3	BB-G5	BB-G6	5	A	A
STP24:	8' GREAT to PEDAL	<2>	---	----	AA-L2	BB-G3	BB-G4	5	A	A
STP25:	8' SOLO ENGLISH HORN	<2>	---	----	AA-L1	BB-G1	BB-G2	5	A	A
STP26:	8' SOLO BRASS TRUMPET	<2>	---	----	AA-K8	BB-F7	BB-F8	5	A	A
STP27:	8' SOLO TUBA HORN	<2>	---	----	AA-K7	BB-F5	BB-F6	5	A	A
STP28:	8' SOLO DIAPHONIC DIAPASON	<2>	---	----	AA-K6	BB-F3	BB-F4	5	A	A
STP29:	8' SOLO HORN DIAPASON	<2>	---	----	AA-K5	BB-F1	BB-F2	5	A	A
STP30:	8' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-K4	BB-E7	BB-E8	5	A	A
STP31:	8' SOLO TIBIA CLAUSA (MAIN)	<2>	---	----	AA-K3	BB-E5	BB-E6	5	A	A
STP32:	8' SOLO CLARINET	<2>	---	----	AA-K2	BB-E3	BB-E4	5	A	A
STP33:	8' SOLO KINURA	<2>	---	----	AA-K1	BB-E1	BB-E2	5	A	A
STP34:	8' SOLO ORCHESTRAL OBOE	<2>	---	----	AA-J8	BB-D7	BB-D8	5	A	A
STP35:	8' SOLO SOLO STRING	<2>	---	----	AA-J7	BB-D5	BB-D6	5	A	A

STP36:	8' SOLO VIOL D' ORCHESTRE	<2>	---	----	AA-J6	BB-D3	BB-D4	5	A	A
STP37:	8' SOLO SALICIONAL	<2>	---	----	AA-J5	BB-D1	BB-D2	5	A	A
STP38:	8' SOLO BRASS SAXAPHONE	<2>	---	----	AA-J4	BB-C7	BB-C8	5	A	A
STP39:	8' SOLO OBOE HORN	<2>	---	----	AA-J3	BB-C5	BB-C6	5	A	A
STP40:	8' SOLO CONCERT FLUTE	<2>	---	----	AA-J2	BB-C3	BB-C4	5	A	A
STP41:	8' SOLO VOX HUMANA (SOLO)	<2>	---	----	AA-J1	BB-C1	BB-C2	5	A	A
STP42:	4' SOLO TUBA HORN	<2>	---	----	AA-I8	BB-B7	BB-B8	5	A	A
STP43:	4' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-I7	BB-B5	BB-B6	5	A	A
STP44:	4' SOLO TIBIA CLAUSA (MAIN)	<2>	---	----	AA-I6	BB-B3	BB-B4	5	A	A
STP45:	2-2/3' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-I5	BB-B1	BB-B2	5	A	A
STP46:	2' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-I4	BB-A7	BB-A8	5	A	A
STP47:	1-3/5' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-I3	BB-A5	BB-A6	5	A	A
STP48:	1-1/3' SOLO TIBIA CLAUSA (SOLO)	<2>	---	----	AA-I2	BB-A3	BB-A4	5	A	A
STP49:	8' SOLO PIANO	<2>	---	----	AA-I1	BB-A1	BB-A2	5	A	A
STP50:	8' SOLO CATHEDRAL CHIMES	<2>	---	----	AA-H8	BA-P7	BA-P8	5	A	A
STP51:	16' SOLO MARIMBA	<2>	---	----	AA-H7	BA-P5	BA-P6	5	A	A
STP52:	16' SOLO CHRYSOGLOTT (WURL)	<2>	---	----	AA-H6	BA-P3	BA-P4	5	A	A
STP53:	8' SOLO SLEIGH BELLS	<2>	---	----	AA-H5	BA-P1	BA-P2	5	A	A
STP54:	8' SOLO XYLOPHONE	<2>	---	----	AA-H4	BA-O7	BA-O8	5	A	A
STP55:	8' SOLO GLOCKENSPIEL	<2>	---	----	AA-H3	BA-O5	BA-O6	5	A	A
STP56:	16' SOLO to SOLO	<2>	---	----	AA-H2	BA-O3	BA-O4	5	A	A
STP57:	8' SOLO unison off	<2>	---	----	AA-H1	BA-O1	BA-O2	5	A	A
STP58:	4' SOLO to SOLO	<2>	---	----	AA-G8	BA-N7	BA-N8	5	A	A
STP59:	6-2/5' SOLO to SOLO	<2>	---	----	AA-G7	BA-N5	BA-N6	5	A	A
STP60:	5-1/3' SOLO to SOLO	<2>	---	----	AA-G6	BA-N3	BA-N4	5	A	A
STP61:	4-4/7' SOLO to SOLO	<2>	---	----	AA-G5	BA-N1	BA-N2	5	A	A
STP62:	8' ACCOMP ENGLISH HORN	<2>	---	----	AA-F6	BA-L3	BA-L4	5	A	A
STP63:	8' ACCOMP BRASS TRUMPET	<2>	---	----	AA-F5	BA-L1	BA-L2	5	A	A
STP64:	8' ACCOMP TUBA HORN	<2>	---	----	AA-F4	BA-K7	BA-K8	5	A	A
STP65:	8' ACCOMP DIAPHONIC DIAPASON	<2>	---	----	AA-F3	BA-K5	BA-K6	5	A	A
STP66:	8' ACCOMP HORN DIAPASON	<2>	---	----	AA-F2	BA-K3	BA-K4	5	A	A
STP67:	8' ACCOMP TIBIA CLAUSA (MAIN)	<2>	---	----	AA-F1	BA-K1	BA-K2	5	A	A
STP68:	8' ACCOMP CLARINET	<2>	---	----	AA-E8	BA-J7	BA-J8	5	A	A
STP69:	8' ACCOMP SOLO STRING	<2>	---	----	AA-E7	BA-J5	BA-J6	5	A	A
STP70:	8' ACCOMP VIOL D' ORCHESTRE	<2>	---	----	AA-E6	BA-J3	BA-J4	5	A	A
STP71:	8' ACCOMP SALICIONAL	<2>	---	----	AA-E5	BA-J1	BA-J2	5	A	A
STP72:	8' ACCOMP BRASS SAXAPHONE	<2>	---	----	AA-E4	BA-I7	BA-I8	5	A	A
STP73:	8' ACCOMP OBOE HORN	<2>	---	----	AA-E3	BA-I5	BA-I6	5	A	A
STP74:	8' ACCOMP CONCERT FLUTE	<2>	---	----	AA-E2	BA-I3	BA-I4	5	A	A
STP75:	8' ACCOMP VOX HUMANA (SOLO)	<2>	---	----	AA-E1	BA-I1	BA-I2	5	A	A
STP76:	8' ACCOMP VOX HUMANA (MAIN)	<2>	---	----	AA-D8	BA-H7	BA-H8	5	A	A
STP77:	4' ACCOMP DIAPHONIC DIAPASON	<2>	---	----	AA-D7	BA-H5	BA-H6	5	A	A
STP78:	4' ACCOMP HORN DIAPASON	<2>	---	----	AA-D6	BA-H3	BA-H4	5	A	A

STP79:	4' ACCOMP TIBIA CLAUSA (MAIN)	<2>	---	----	AA-D5	BA-H1	BA-H2	5	A	A
STP80:	4' ACCOMP SOLO STRING	<2>	---	----	AA-D4	BA-G7	BA-G8	5	A	A
STP81:	4' ACCOMP VIOL D' ORCHESTRE	<2>	---	----	AA-D3	BA-G5	BA-G6	5	A	A
STP82:	4' ACCOMP SALICIONAL	<2>	---	----	AA-D2	BA-G3	BA-G4	5	A	A
STP83:	4' ACCOMP CONCERT FLUTE	<2>	---	----	AA-D1	BA-G1	BA-G2	5	A	A
STP84:	4' ACCOMP VOX HUMANA (SOLO)	<2>	---	----	AA-C8	BA-F7	BA-F8	5	A	A
STP85:	4' ACCOMP VOX HUMANA (MAIN)	<2>	---	----	AA-C7	BA-F5	BA-F6	5	A	A
STP86:	2-2/3' ACCOMP CONCERT FLUTE	<2>	---	----	AA-C6	BA-F3	BA-F4	5	A	A
STP87:	2' ACCOMP CONCERT FLUTE	<2>	---	----	AA-C5	BA-F1	BA-F2	5	A	A
STP88:	8' ACCOMP PIANO	<2>	---	----	AA-C4	BA-E7	BA-E8	5	A	A
STP89:	4' ACCOMP PIANO	<2>	---	----	AA-C3	BA-E5	BA-E6	5	A	A
STP90:	16' ACCOMP MARIMBA	<2>	---	----	AA-C2	BA-E3	BA-E4	5	A	A
STP91:	8' ACCOMP MARIMBA	<2>	---	----	AA-C1	BA-E1	BA-E2	5	A	A
STP92:	8' ACCOMP CHRYSOGLOTT (WURL)	<2>	---	----	AA-B8	BA-D7	BA-D8	5	A	A
STP93:	4' ACCOMP to ACCOMP	<2>	---	----	AA-B7	BA-D5	BA-D6	5	A	A
STP94:	8' SOLO to ACCOMP	<2>	---	----	AA-B6	BA-D3	BA-D4	5	A	A
STP95:	16' GREAT ENGLISH HORN	<2>	---	----	AA-G4	BA-M7	BM-M8	5	A	A
STP96:	16' GREAT BRASS TRUMPET	<2>	---	----	AA-G3	BA-M5	BM-M6	5	A	A
STP97:	16' GREAT HORN DIAPASON	<2>	---	----	AA-G2	BA-M3	BM-M4	5	A	A
STP98:	16' GREAT DIAPHONIC DIAPASON	<2>	---	----	AA-G1	BA-M1	BM-M2	5	A	A
STP99:	16' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AA-F8	BA-L7	BM-L8	5	A	A
STP100:	16' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AA-F7	BA-L5	BM-L6	5	A	A
STP101:	16' GREAT CLARINET	<2>	---	----	AE-E6	BC-J3	BC-J4	5	A	A
STP102:	16' GREAT ORCHESTRAL OBOE	<2>	---	----	AE-E7	BC-J5	BC-J6	5	A	A
STP103:	16' GREAT SOLO STRING	<2>	---	----	AE-E8	BC-J7	BC-J8	5	A	A
STP104:	16' GREAT VIOL D' ORCHESTRE	<2>	---	----	AE-F1	BC-K1	BC-K2	5	A	A
STP105:	16' GREAT SALICIONAL	<2>	---	----	AE-F2	BC-K3	BC-K4	5	A	A
STP106:	16' GREAT BRASS SAXAPHONE	<2>	---	----	AE-F3	BC-K5	BC-K6	5	A	A
STP107:	16' GREAT OBOE HORN	<2>	---	----	AE-F4	BC-K7	BC-K8	5	A	A
STP108:	16' GREAT VOX HUMANA (SOLO)	<2>	---	----	AE-F5	BC-L1	BC-L2	5	A	A
STP109:	16' GREAT VOX HUMANA (MAIN)	<2>	---	----	AE-F6	BC-L3	BC-L4	5	A	A
STP110:	16' GREAT CONCERT FLUTE	<2>	---	----	AE-F7	BC-L5	BC-L6	5	A	A
STP111:	8' GREAT ENGLISH HORN	<2>	---	----	AE-F8	BC-L7	BC-L8	5	A	A
STP112:	8' GREAT BRASS TRUMPET	<2>	---	----	AE-G1	BC-M1	BC-M2	5	A	A
STP113:	8' GREAT TUBA HORN	<2>	---	----	AE-G2	BC-M3	BC-M4	5	A	A
STP114:	8' GREAT DIAPHONIC DIAPASON	<2>	---	----	AE-G3	BC-M5	BC-M6	5	A	A
STP115:	8' GREAT HORN DIAPASON	<2>	---	----	AE-G4	BC-M7	BC-M8	5	A	A
STP116:	8' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-G5	BC-N1	BC-N2	5	A	A
STP117:	8' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AE-G6	BC-N3	BC-N4	5	A	A
STP118:	8' GREAT CLARINET	<2>	---	----	AE-G7	BC-N5	BC-N6	5	A	A
STP119:	8' GREAT KINURA	<2>	---	----	AE-G8	BC-N7	BC-N8	5	A	A

STP120:	8' GREAT ORCHESTRAL OBOE	<2>	---	----	AE-H1	BC-O1	BC-O2	5	A	A
STP121:	8' GREAT SOLO STRING	<2>	---	----	AE-H2	BC-O3	BC-O4	5	A	A
STP122:	8' GREAT VIOL D' ORCHESTRE	<2>	---	----	AE-H3	BC-O5	BC-O6	5	A	A
STP123:	8' GREAT SALICIONAL	<2>	---	----	AE-H4	BC-O7	BC-O8	5	A	A
STP124:	8' GREAT BRASS SAXAPHONE	<2>	---	----	AE-H5	BC-P1	BC-P2	5	A	A
STP125:	8' GREAT OBOE HORN	<2>	---	----	AE-H6	BC-P3	BC-P4	5	A	A
STP126:	8' GREAT CONCERT FLUTE	<2>	---	----	AE-H7	BC-P5	BC-P6	5	A	A
STP127:	8' GREAT VOX HUMANA (SOLO)	<2>	---	----	AE-H8	BC-P7	BC-P8	5	A	A
STP128:	8' GREAT VOX HUMANA (MAIN)	<2>	---	----	AE-I1	BD-A1	BD-A2	5	A	A
STP129:	5-1/3' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-I2	BD-A3	BD-A4	5	A	A
STP130:	5-1/3' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AE-I3	BD-A5	BD-A6	5	A	A
STP131:	4' GREAT TUBA HORN	<2>	---	----	AE-I4	BD-A7	BD-A8	5	A	A
STP132:	4' GREAT DIAPHONIC DIAPASON	<2>	---	----	AA-B5	BA-D1	BA-D2	5	A	A
STP133:	4' GREAT HORN DIAPASON	<2>	---	----	AA-B4	BA-C7	BA-C8	5	A	A
STP134:	4' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AA-B3	BA-C5	BA-C6	5	A	A
STP135:	4' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AA-B2	BA-C3	BA-C4	5	A	A
STP136:	4' GREAT SOLO STRING	<2>	---	----	AA-B1	BA-C1	BA-C2	5	A	A
STP137:	4' GREAT VIOL D' ORCHESTRE	<2>	---	----	AA-A8	BA-B7	BA-B8	5	A	A
STP138:	4' GREAT SALICIONAL	<2>	---	----	AA-A7	BA-B5	BA-B6	5	A	A
STP139:	4' GREAT CONCERT FLUTE	<2>	---	----	AA-A6	BA-B3	BA-B4	5	A	A
STP140:	4' GREAT VOX HUMANA (SOLO)	<2>	---	----	AA-A5	BA-B1	BA-B2	5	A	A
STP141:	4' GREAT VOX HUMANA (MAIN)	<2>	---	----	AA-A4	BA-A7	BA-A8	5	A	A
STP142:	3-1/5' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AA-A3	BA-A5	BA-A6	5	A	A
STP143:	3-1/5' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AA-A2	BA-A3	BA-A4	5	A	A
STP144:	2-2/3' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AA-A1	BA-A1	BA-A2	5	A	A
STP145:	2-2/3' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AE-A1	BC-A1	BC-A2	5	A	A
STP146:	2-2/3' GREAT CONCERT FLUTE	<2>	---	----	AE-A2	BC-A3	BC-A4	5	A	A
STP147:	2' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-A3	BC-A5	BC-A6	5	A	A
STP148:	2' GREAT TIBIA CLAUSA (MAIN)	<2>	---	----	AE-A4	BC-A7	BC-A8	5	A	A
STP149:	2' GREAT VIOL D' ORCHESTRE	<2>	---	----	AE-A5	BC-B1	BC-B2	5	A	A
STP150:	2' GREAT CONCERT FLUTE	<2>	---	----	AE-A6	BC-B3	BC-B4	5	A	A
STP151:	1-3/5' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-A7	BC-B5	BC-B6	5	A	A
STP152:	1-1/3' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-A8	BC-B7	BC-B8	5	A	A
STP153:	1' GREAT TIBIA CLAUSA (SOLO)	<2>	---	----	AE-B1	BC-C1	BC-C2	5	A	A
STP154:	16' GREAT PIANO	<2>	---	----	AE-B2	BC-C3	BC-C4	5	A	A
STP155:	8' GREAT PIANO	<2>	---	----	AE-B3	BC-C5	BC-C6	5	A	A
STP156:	4' GREAT PIANO	<2>	---	----	AE-B4	BC-C7	BC-C8	5	A	A
STP157:	8' GREAT CATHEDRAL CHIMES	<2>	---	----	AE-B5	BC-D1	BC-D2	5	A	A
STP158:	8' GREAT MARIMBA	<2>	---	----	AE-B6	BC-D3	BC-D4	5	A	A
STP159:	8' GREAT MARIMBA	<2>	---	----	AE-B7	BC-D5	BC-D6	5	A	A
STP160:	8' GREAT CHRYSOGLOTT (WURL)	<2>	---	----	AE-B8	BC-D7	BC-D8	5	A	A
STP161:	8' GREAT XYLOPHONE	<2>	---	----	AE-C1	BC-E1	BC-E2	5	A	A
STP162:	8' GREAT GLOCKENSPIEL	<2>	---	----	AE-C2	BC-E3	BC-E4	5	A	A

STP163:	16' GREAT to GREAT	<2>	---	----	AE-C3	BC-E5	BC-E6	5	A	A
STP164:	8' GREAT unison off	<2>	---	----	AE-C4	BC-E7	BC-E8	5	A	A
STP165:	4' GREAT to GREAT	<2>	---	----	AE-C5	BC-F1	BC-F2	5	A	A
STP166:	16' SOLO to GREAT	<2>	---	----	AE-C6	BC-F3	BC-F4	5	A	A
STP167:	4' SOLO to GREAT	<2>	---	----	AE-C7	BC-F5	BC-F6	5	A	A
STP168:	16' SOLO to GREAT	<2>	---	----	AE-C8	BC-F7	BC-F8	5	A	A
STP169:	8' SOLO to GREAT	<2>	---	----	AE-D1	BC-G1	BC-G2	5	A	A
STP170:	16' BOMB ENGLISH HORN	<2>	---	----	AE-J3	BD-C5	BD-C6	5	A	A
STP171:	16' BOMB BRASS TRUMPET	<2>	---	----	AE-J4	BD-C7	BD-C8	5	A	A
STP172:	16' BOMB TUBA HORN	<2>	---	----	AE-J5	BD-D1	BD-D2	5	A	A
STP173:	16' BOMB DIAPHONIC DIAPASON	<2>	---	----	AE-J6	BD-D3	BD-D4	5	A	A
STP174:	16' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-J7	BD-D5	BD-D6	5	A	A
STP175:	16' BOMB TIBIA CLAUSA (MAIN)	<2>	---	----	AE-J8	BD-D7	BD-D8	5	A	A
STP176:	16' BOMB SOLO STRING	<2>	---	----	AE-K1	BD-E1	BD-E2	5	A	A
STP177:	16' BOMB BRASS SAXAPHONE	<2>	---	----	AE-K2	BD-E3	BD-E4	5	A	A
STP178:	16' BOMB VOX HUMANA (SOLO)	<2>	---	----	AE-K3	BD-E5	BD-E6	5	A	A
STP179:	8' BOMB ENGLISH HORN	<2>	---	----	AE-K4	BD-E7	BD-E8	5	A	A
STP180:	8' BOMB BRASS TRUMPET	<2>	---	----	AE-K5	BD-F1	BD-F2	5	A	A
STP181:	8' BOMB TUBA HORN	<2>	---	----	AE-K6	BD-F3	BD-F4	5	A	A
STP182:	8' BOMB DIAPHONIC DIAPASON	<2>	---	----	AE-K7	BD-F5	BD-F6	5	A	A
STP183:	8' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-K8	BD-F7	BD-F8	5	A	A
STP184:	8' BOMB TIBIA CLAUSA (MAIN)	<2>	---	----	AE-L1	BD-G1	BD-G2	5	A	A
STP185:	8' BOMB CLARINET	<2>	---	----	AE-L2	BD-G3	BD-G4	5	A	A
STP186:	8' BOMB BRASS SAXAPHONE	<2>	---	----	AE-L3	BD-G5	BD-G6	5	A	A
STP187:	8' BOMB OBOE HORN	<2>	---	----	AE-L4	BD-G7	BD-G8	5	A	A
STP188:	8' BOMB SOLO STRING	<2>	---	----	AE-L5	BD-H1	BD-H2	5	A	A
STP189:	8' BOMB VOX HUMANA (SOLO)	<2>	---	----	AE-L6	BD-H3	BD-H4	5	A	A
STP190:	4' BOMB TUBA HORN	<2>	---	----	AE-I5	BD-B1	BD-B2	5	A	A
STP191:	4' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-I6	BD-B3	BD-B4	5	A	A
STP192:	4' BOMB TIBIA CLAUSA (MAIN)	<2>	---	----	AE-I7	BD-B5	BD-B6	5	A	A
STP193:	4' BOMB SOLO STRING	<2>	---	----	AE-I8	BD-B7	BD-B8	5	A	A
STP194:	2-2/3' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-J1	BD-C1	BD-C2	5	A	A
STP195:	2-2/3' BOMB TIBIA CLAUSA (MAIN)	<2>	---	----	AE-J2	BD-C3	BD-C4	5	A	A
STP196:	2' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-D2	BC-G3	BC-G4	5	A	A
STP197:	2' BOMB TIBIA CLAUSA (MAIN)	<2>	---	----	AE-D3	BC-G5	BC-G6	5	A	A
STP198:	1' BOMB TIBIA CLAUSA (SOLO)	<2>	---	----	AE-D4	BC-G7	BC-G8	5	A	A
STP199:	8' BOMB PIANO	<2>	---	----	AE-D5	BC-H1	BC-H2	5	A	A
STP200:	8' BOMB MARIMBA	<2>	---	----	AE-D6	BC-H3	BC-H4	5	A	A
STP201:	8' BOMB CHRYSOGLOTT (WURL)	<2>	---	----	AE-D7	BC-H5	BC-H6	5	A	A
STP202:	8' BOMB XYLOPHONE	<2>	---	----	AE-D8	BC-H7	BC-H8	5	A	A
STP203:	8' BOMB GLOCKENSPIEL	<2>	---	----	AE-E1	BC-I1	BC-I2	5	A	A
STP204:	16' GREAT to BOMB	<2>	---	----	AE-E2	BC-I3	BC-I4	5	A	A
STP205:	8' GREAT to BOMB	<2>	---	----	AE-E3	BC-I5	BC-I6	5	A	A

STP206:	4' GREAT to BOMB	<2>	---	----	AE-E4	BC-I7	BC-I8	5	A	A
STP207:	16' SOLO to BOMB	<2>	---	----	AE-E5	BC-J1	BC-J2	5	A	A
STP208:	TRAPS TO PEDAL 2ND	<2>	---	----	AE-P2	BD-O3	BD-O4	5	A	A
STP209:	8' SOLO to PEDAL 2ND	<2>	---	----	AE-P3	BD-O5	BD-O6	5	A	A
STP210:	8' ACCOMP 2ND ENGLISH HORN	<2>	---	----	AE-P4	BD-O7	BD-O8	5	A	A
STP211:	8' ACCOMP 2ND BRASS TRUMPET	<2>	---	----	AE-P5	BD-P1	BD-P2	5	A	A
STP212:	8' ACCOMP 2ND TUBA HORN	<2>	---	----	AE-P6	BD-P3	BD-P4	5	A	A
STP213:	8' ACCOMP 2ND DIAPHONIC DIAPASON	<2>	---	----	AE-P7	BD-P5	BD-P6	5	A	A
STP214:	8' ACCOMP 2ND TIBIA CLAUSA (SOLO)	<2>	---	----	AE-P8	BD-P7	BD-P8	5	A	A
STP215:	8' ACCOMP 2ND CLARINET	<2>	---	----	AF-A1	BE-A1	BE-A2	5	A	A
STP216:	16' ACCOMP 2ND MARIMBA	<2>	---	----	AF-A2	BE-A3	BE-A4	5	A	A
STP217:	8' ACCOMP 2ND CATHEDRAL CHIMES	<2>	---	----	AF-A3	BE-A5	BE-A6	5	A	A
STP218:	8' ACCOMP 2ND GLOCKENSPIEL	<2>	---	----	AF-A4	BE-A7	BE-A8	5	A	A
STP219:	8' ACCOMP 2ND PIANO	<2>	---	----	AF-A5	BE-B1	BE-B2	5	A	A
STP220:	4' GREAT to ACCOMP 2ND	<2>	---	----	AF-A6	BE-B3	BE-B4	5	A	A
STP221:	8' BOMB to ACCOMP 2ND	<2>	---	----	AF-A7	BE-B5	BE-B6	5	A	A
STP222:	8' SOLO to ACCOMP 2ND	<2>	---	----	AF-A8	BE-B7	BE-B8	5	A	A
STP223:	TRAPS TO ACCOMP 2ND	<2>	---	----	AF-B1	BE-C1	BE-C2	5	A	A
STP224:	16' GREAT 2ND ENGLISH HORN	<2>	---	----	AF-B2	BE-C3	BE-C4	5	A	A
STP225:	8' GREAT 2ND ENGLISH HORN	<2>	---	----	AF-B3	BE-C5	BE-C6	5	A	A
STP226:	8' BOMB to GREAT 2ND	<2>	---	----	AF-B4	BE-C7	BE-C8	5	A	A
STP227:	8' SOLO to GREAT 2ND	<2>	---	----	AF-B5	BE-D1	BE-D2	5	A	A
STP228:	8' SOLO to GREAT 2ND	<2>	---	----	AF-B6	BE-D3	BE-D4	5	A	A
STP229:	MAIN TREM	<2>	---	----	AF-B7	BE-D5	BE-D6	5	A	A
STP230:	SOLO TREM	<2>	---	----	AF-B8	BE-D7	BE-D8	5	A	A
STP231:	TIBIA CLAUSA TREM (MAIN)	<2>	---	----	AF-C1	BE-E1	BE-E2	5	A	A
STP232:	VOX HUMANA TREM (MAIN)	<2>	---	----	AF-C2	BE-E3	BE-E4	5	A	A
STP233:	TUBA HORN TREM	<2>	---	----	AF-C3	BE-E5	BE-E6	5	A	A
STP234:	ENGLISH HORN TREM	<2>	---	----	AF-C4	BE-E7	BE-E8	5	A	A
STP235:	VIBRAPHONE	<2>	---	----	AF-C5	BE-F1	BE-F2	5	A	A
STP236:	GLOCKENSPIEL REIT	<2>	---	----	AF-C6	BE-F3	BE-F4	5	A	A
STP237:	MARIMBA REIT	<2>	---	----	AF-C7	BE-F5	BE-F6	5	A	A
STP238:	XYLOPHONE REIT	<2>	---	----	AF-C8	BE-F7	BE-F8	5	A	A
STP239:	GREAT sostenuto	<2>	---	----	AF-D1	BE-G1	BE-G2	5	A	A
STP240:	SWELL TO MASTER	<2>	---	----	AF-D2	BE-G3	BE-G4	5	A	A
STP241:	STRING CELESTE OFF	<2>	---	----	AF-D3	BE-G5	BE-G6	5	A	A
STP242:	TRAPS REIT OFF	<2>	---	----	AF-D4	BE-G7	BE-G8	5	A	A
STP243:	STAGE LIGHTS ON	<2>	---	----	AF-D5	BE-H1	BE-H2	5	A	A
STP244:	STAGE LIGHTS TRIGGER	<2>	---	----	AF-D6	BE-H3	BE-H4	5	A	A
STP245:	PEDAL RIDE CYMBAL	<2>	---	----	AE-M1	BD-I1	BD-I2	5	A	A
STP246:	PEDAL BASS DRUM	<2>	---	----	AE-M2	BD-I3	BD-I4	5	A	A
STP247:	PEDAL SNARE DRUM TAP	<2>	---	----	AE-M3	BD-I5	BD-I6	5	A	A
STP248:	CYMBAL X	<2>	---	----	AE-M4	BD-I7	BD-I8	5	A	A

STP249:	PEDAL CRASH CYMBAL	<2>	---	----	AE-M5	BD-J1	BD-J2	5	A	A
STP250:	PEDAL TAP CYMBAL	<2>	---	----	AE-M6	BD-J3	BD-J4	5	A	A
STP251:	PEDAL BRUSH CYMBAL	<2>	---	----	AE-M7	BD-J5	BD-J6	5	A	A
STP252:	PEDAL SIZZLE CYMBAL	<2>	---	----	AE-M8	BD-J7	BD-J8	5	A	A
STP253:	PEDAL TRIANGLE TAP	<2>	---	----	AE-N1	BD-K1	BD-K2	5	A	A
STP254:	PEDAL RIDE CYMBAL	<2>	---	----	AE-N2	BD-K3	BD-K4	5	A	A
STP255:	PEDAL COWBELL	<2>	---	----	AE-N3	BD-K5	BD-K6	5	A	A
STP256:	ACCOMP SNARE DRUM ROLL	<2>	---	----	AE-N4	BD-K7	BD-K8	5	A	A
STP257:	ACCOMP TOM TOM 1	<2>	---	----	AE-N5	BD-L1	BD-L2	5	A	A
STP258:	ACCOMP CYMBAL X	<2>	---	----	AE-N6	BD-L3	BD-L4	5	A	A
STP259:	ACCOMP TAP CYMBAL	<2>	---	----	AE-N7	BD-L5	BD-L6	5	A	A
STP260:	ACCOMP BRUSH CYMBAL	<2>	---	----	AE-N8	BD-L7	BD-L8	5	A	A
STP261:	ACCOMP SIZZLE CYMBAL	<2>	---	----	AE-O1	BD-M1	BD-M2	5	A	A
STP262:	ACCOMP SAND BLOCK	<2>	---	----	AE-O2	BD-M3	BD-M4	5	A	A
STP263:	ACCOMP MARACAS	<2>	---	----	AE-O3	BD-M5	BD-M6	5	A	A
STP264:	ACCOMP WOOD BLOCK I	<2>	---	----	AE-O4	BD-M7	BD-M8	5	A	A
STP265:	ACCOMP TAMBOURINE	<2>	---	----	AE-O5	BD-N1	BD-N2	5	A	A
STP266:	ACCOMP CASTANETS	<2>	---	----	AE-O6	BD-N3	BD-N4	5	A	A
STP267:	ACCOMP TRIANGLE TAP	<2>	---	----	AE-O7	BD-N5	BD-N6	5	A	A
STP268:	ACCOMP SLEIGH BELLS	<2>	---	----	AE-O8	BD-N7	BD-N8	5	A	A
STP269:	8' ACCOMP SOLO STRING	<2>	---	----	AE-P1	BD-O1	BD-O2	5	A	A
STP270:	Relative transposer -1	<1>	---	----	AF-G6	5	A	A		
STP271:	Absolute transposer +0	<1>	---	----	AF-G7	5	A	A		
STP272:	Relative transposer +1	<1>	---	----	AF-G8	5	A	A		
STP273:	Stage Shutters Off	<1>	---	BE-K1	AF-O1	5	A	A		
STP274:	SOLO RT CHEEK	<1>	---	BB-M6	AD-H1	5	A	A		
STP275:	BOMBARDE RT CHEEK	<1>	---	BB-M5	AC-P1	5	A	A		
STP276:	GREAT RT CHEEK	<1>	---	BB-M4	AB-P1	5	A	A		
STP277:	ACCOMP RT CHEEK	<1>	---	BB-M3	AA-P1	5	A	A		
STP278:	AUTOSAVE	<1>	FNC314	----	AF-E5	5	I	I		
STP279:	KILL	<1>	FNC317	----	AF-L1	5	A	A		
STP280:	Stop #280	<1>	---	----	10	A	A			
STP281:	RECORD	<1>	FNC319	----	AD-H3	10	A	A		
STP282:	WOOD BLOCK I	<1>	---	----	AG-J7	10	A	A		
STP283:	PROGRAM TOE 1	<1>	---	----	AG-L5	10	A	A		
STP284:	AUTO HORN	<1>	---	----	AG-J1	10	A	A		
STP285:	WIND	<1>	---	----	AG-J8	10	A	A		
STP286:	SURF	<1>	---	----	AG-L6	10	A	A		
STP287:	AHOOGA HORN	<1>	---	----	AG-J2	10	A	A		
STP288:	DIVE ALARM	<1>	---	----	AG-J3	10	A	A		
STP289:	POLICE SIREN	<1>	---	----	AG-J4	10	A	A		
STP290:	PROGRAM 2	<1>	---	----	AG-J5	10	A	A		
STP291:	-----	<1>	---	----	10	A	A			

STP292:	CRASH CYMBAL	<1>	---	----	AG-M1	10	A	A	
STP293:	BASS DRUM ROLL	<1>	---	----	AG-M2	10	A	A	
STP294:	TRIANGLE TAP	<1>	---	----	AG-M3	10	A	A	
STP295:	HORSE HOOVES	<1>	---	----	AG-M4	10	A	A	
STP296:	AIRPLANE	<1>	---	----	AG-M5	10	A	A	
STP297:	ROLL CYMBAL1	<1>	---	----	AG-M6	10	A	A	
STP298:	GONG	<1>	---	----	AG-M7	10	A	A	
STP299:	SPLASH CYMBAL	<1>	---	----	AG-M8	10	A	A	
STP300:	MACHINE GUN	<1>	---	----	AG-N1	10	A	A	
STP301:	DOOR BELL	<1>	---	----	AG-N2	10	A	A	
STP302:	FIRE GONG	<1>	---	----	AG-N3	10	A	A	
STP303:	BOAT WHISTLE	<1>	---	----	AG-N4	10	A	A	
STP304:	TRAIN WHISTTLE	<1>	---	----	AG-N5	10	A	A	
STP305:	BIRD 1	<1>	---	----	AG-N6	10	A	A	
STP306:	RT DESK 1	<1>	---	----	BB-P1	AD-P1	10	A	A
STP307:	RT DESK 2	<1>	---	----	BB-P2	AD-P2	10	A	A
STP308:	RT DESK 3	<1>	---	----	BB-P3	AD-P3	10	A	A
STP309:	LF DESK 1	<1>	---	----	BB-P4	AD-P4	10	A	A
STP310:	LF DESK 2	<1>	---	----	BB-P5	AD-P5	10	A	A
STP311:	MORTON HARP	<1>	---	----	AD-P6	10	A	A	
STP312:	WURLITZER HARP	<1>	---	----	AD-P7	10	A	A	
STP313:	-----	<0>							
STP314:	-----	<0>							
STP315:	Kick Switch	<1>	---	----	AF-H6	0	A	A	
STP316:	Piano Sustain	<1>	---	----	AF-H5	0	A	A	
STP317:	-----	<0>							
STP318:	-----	<0>							
STP319:	-----	<0>							
STP320:	-----	<0>							