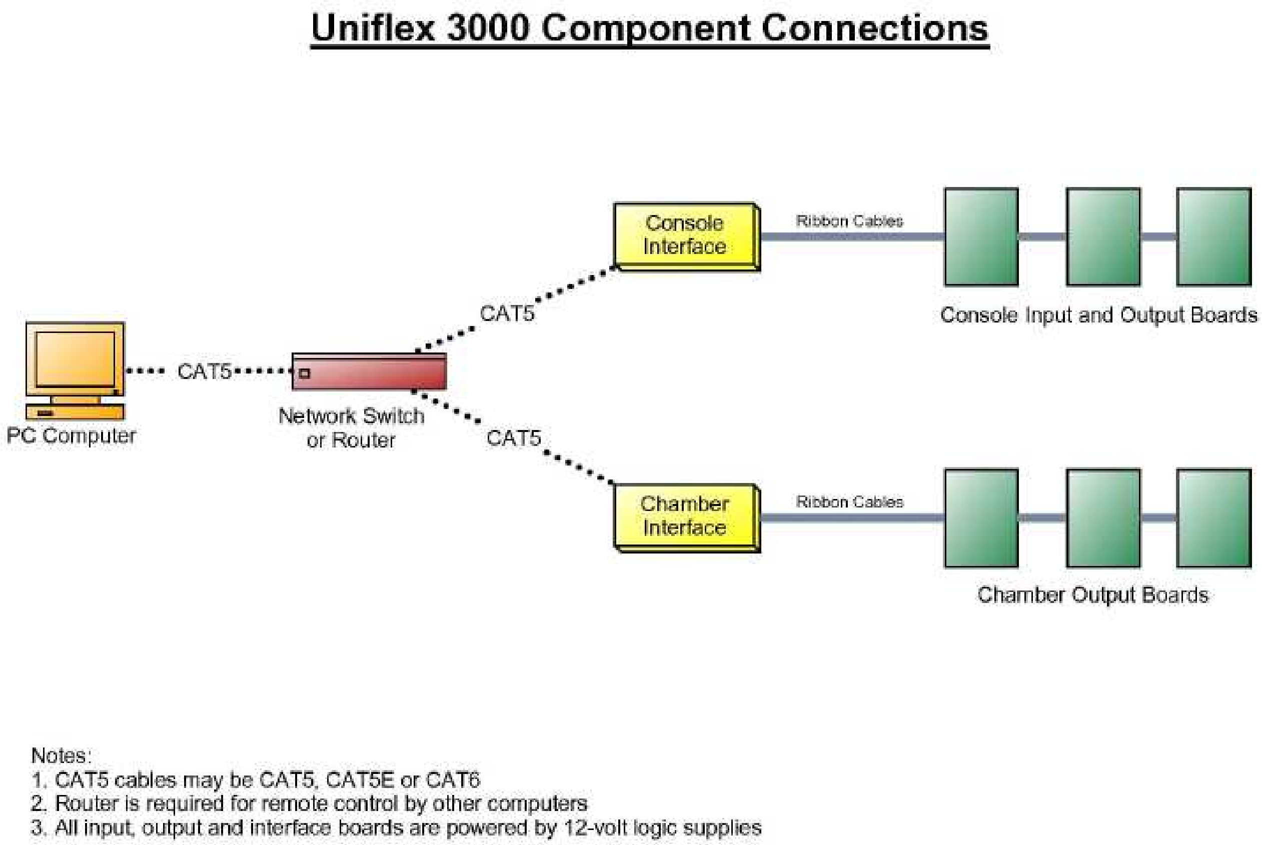
Installing and Wiring The Uniflex Hardware

Table of Contents

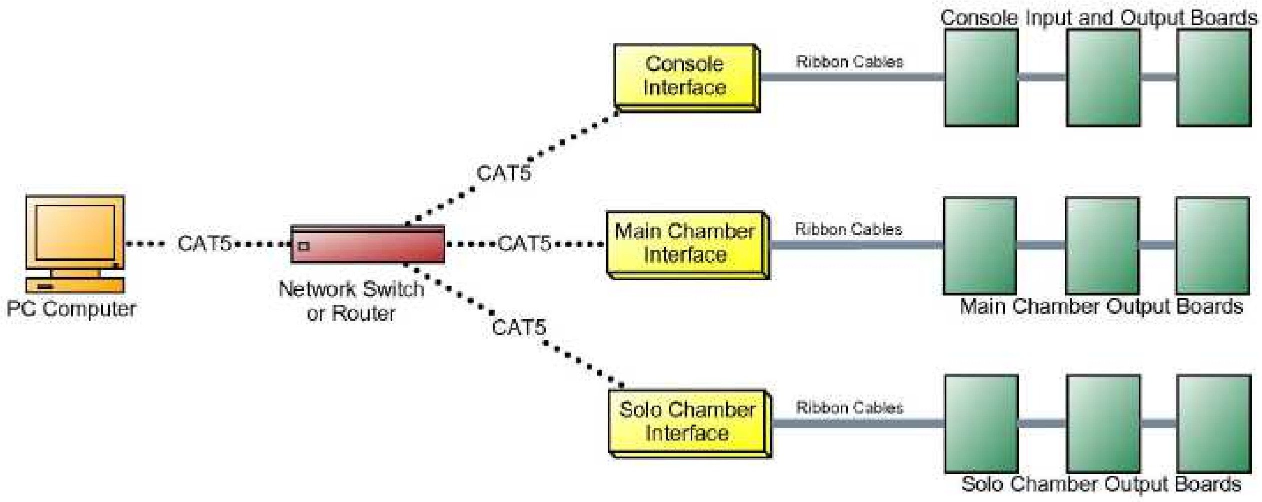
1. Component Block Diagrams

Basic block diagram for a single chamber interface board.



Basic block diagram for a two chamber interface boards.

Uniflex 3000 Component Connections



Notes:
1. CAT5 cables may be CAT5, CAT5E or CAT6
2. Router is required for remote control by other computers
3. All input, output and interface boards are powered by 12-volt logic supplies

---

2. General Wiring Instructions

Wiring a Uniflex Relay System involves wiring two types of power supplies and associated input and output data components. Logic power uses 18-gauge stranded or solid wire ind some 2-pin Pancon connectors. Magnet power uses 12-gauge or 10-gauge and spade connectors. Data connections use 24-gauge solid wire (commonly referred to as “telephone cable”) and 8-pin Pancon connectors. Inter-board data signals use standard 26-wire ribbon cable and 26-pin female dual in-line ribbon connectors. Uniflex can supply these connectors or you may purchase them yourself locally or online.

There are two wiring tools that you use for the Pancon connectors. The black Pancon tool is used to wire the 2-pin logic power connectors using 18-gauge stranded or solid wire. The red Pancon tool is used to wire the 8-pin input and output data connectors using 24-gauge solid wire. Uniflex can supply these simple wiring tools. Other more automatic tools are available from various manufacturers.

We can supply a crimping tool for connecting the ribbon cable connectors to the ribbon cable. There are also several commonly available tools and every installer has a different preference. I have used standard “duck-billed” vise grips to clamp the connectors onto the ribbon cables. I have also used a standard drill-press vise. Both of these tools are commonly available at Sears and other hardware stores for about $20. There are also several specialized tools to do this job ranging in price from about $25 to over $1,000. It is extremely important to align the connector at 90-degrees to the ribbon cable to prevent shorts.

You will note there are two ribbon connectors on each input and output board. These two connectors are connected in parallel to each other on the board itself. This allows multiple ways to connect all the boards together. It can be done with a single ribbon cable with several connectors on it or it could be done with several short cables with two connectors on each to tie the boards together. There is no specific requirement for how they are connected together just as long as all boards are eventually tied to the same interface board at some point. Never have more than one interface board on a ribbon cable string. There is no limit on the number of input and output boards that can be connected to a single interface board.

It is EXTREMELY important that the connectors are placed on the ribbon cable in the proper orientation or else board damage can result. If you look carefully at our console wiring picture you will notice that the red stripe on the cable is always on the right side when it enters the board’s connector. Thus the mantra that installers have come to use is “Red to the Right”. This includes the interface board as well. Of course, this assumes that the boards are oriented with the ribbon connectors at the bottom.

For the logic power, you could connect each input board, output board and interface board to the logic power supply (or a DC-to-DC converter output) using the 2-pin power connectors. However, since the ribbon cable carries the ground and logic power in the cable itself, you could just connect the logic power to one board (say the interface board) and let the remaining boards get their power from the ribbon connections. This is a personal choice. Carlton Smith Pipe Organ Restorations wired our Page console and you can see that he wired a power connector to each board. I wired the chambers, and chose to wire a power connector to the interface board only. Both methods are fine. The interface draws about 250 milliamps while each input and output board draws very little additional current. Looking again at our console wiring, you will see this connection at the bottom of each board between the two ribbon connectors.

The output boards need to be connected to the magnet supply with a 10-gauge or 12-gauge wire to supply the high-current magnet power. Input boards do not need this high-current power connection. Because of the high current drawn by a large piston change (such as a general cancel), we recommend that each board runs a separate wire to the magnet supply. On the picture, you can see these 4 red wires running up vertically on the right side of each output board (BA thru BD) and connecting at the top. Use a standard spade lug available at most electrical and auto supply stores.

The output boards draw minimal current (about 10-20 milliamps) from the logic power supply. Only control signals and logic supply power pass through the ribbon cable. The high-current magnet power enters the output board at the spade lug at the top of the board and exits through the 8-pin connectors next to each driver chip. This high current never enters the ribbon cable.

No damage will be done by connecting the input and output cards to the same ribbon cable as shown in the photograph of our Page console. These systems have been running this way in one form or another since the Devtronix days in the 1980's.

When you finally get everything wired and want to start checking things out, I suggest you leave the magnet supply off or disconnected from the output boards until you have checked out the system using diagnostic commands in the PcRelay program.

3. Tim Rickman's Uniflex 3000 Wiring Documentation

3.1. Introduction

This section is derived from Tim Rickman's original Uniflex 2000 wiring manual with changes to apply to the current Uniflex 3000 system. Please excuse some of the omissions that I may have missed. Dick Wilcox

Also note that some installers have overlooked the organ electrical rectifiers (Bulk Power Supplies). In order for the organ to work as designed with a solid state switching system, the power supplies used on the organ must be regulated DC rectifiers. You must not use old Selenium Rectifiers! When looking inside the rectifier, a selenium rectifier is about 5" X 5" Square and will have a number of cooling fins. They resemble the old fashioned "Bread Slicers" found in Bread Shops. These will NOT provide good regulated and clean DC the solid state components of this system depend on.

If your organ has rectifiers from the 50's and 60's they must be replaced with high quality regulated DC supplies. Astron Regulated Supplies are the most popular here in the US. They are high quality and very well regulated. Astron makes many different sized rectifiers from 20 Amps to 75 Amps will full regulation at the rated current.

If your organ is equipped with a solid state organ rectifier, when looking inside you will usually see two aluminum sheets with 4 rather large "stud" diodes attached. There should be 4 large diodes. This is called a full-bridge rectifier.

The addresses listed on our wiring forms may differ from the illustrations shown in the wiring manual. Many installers were getting confused on the addressing scheme we previously used.

In the console, the INPUT boards are addressed first starting at board address AA. Example if you had 5 input boards for your console, the board addresses would be AA through AE. Input boards contain BLUE labels which will run from AA-AP as your console requires.

The OUTPUT board address for the console start with board BA and will possibly run through BP as your consoles requires. Output boards contain RED labels.

The CHAMBER OUTPUT boards now start with the board addresses beginning at

OUTPUT board address CA and continuing through all the chamber output boards. Example if you had 12 OUTPUT boards for the chamber, the board addresses would be from CA through CL.

We like to start each chamber with a different group address. For instance, the main chamber may have boards CA-CL. The solo chamber may then have boards addressed as DA-DG while a percussion or echo chamber may have boards addressed as EA-EF.

Uniflex Relay Systems

(765) 232-4674

3.2. Fuses and Circuit Breakers

According to the National Electric Code, each output board should be fused with fuses rated at 6 amps or less. Our standard negative-common output boards come with two 5-amp slo-blo fuses with each fuse protecting half of the board. Our feeling is the $230.00 output board will always protect the 30 cent fuse, as a short circuit will destroy an IC, or the board long before the fuse ever will. However, if you do have a board failure, once the fuse has blown, the current path will be interrupted and will prevent any further damage.

Please note that Tim's original document refers to external fuses which you must wire yourself. You can ignore these instructions since our output boards now contain two onboard fuses.

Because the output board will deliver varying amounts of intermittent current and in some cases continuous current (trems and swell shades), you must use a "SLOW BLOW' fuse in all fusing applications or you will constantly be replacing fast blow fuses. The wiring drawings included in Appendix 1 of this wiring manual provide examples of fuse installation in connection with the I/O boards.

The console presents a very different problem when it comes to fusing. When using the electromagnetic (Syndyne type) of stop action, each coil will draw approx.. 1/2 Amp when energized. This means that if every output on the board were energized, the board would deliver about 48 amps of current to the 96 magnets it controls. A five Amp fuse would immediately blow. Fortunately, the Combination Action system "pulses" the stop action magnets for a very short period of time, approx. 75 to 100 milliseconds.

This short period of time does not give the slow-blow fuse enough time or enough of a sustained load to blow. A fast blow fuse, on the other hand, may blow immediately. The other nice thing about the combination action of this system is that only the stops required to move are energized, not all of the stop actions wired to the board.

The N.E.C. "interpreters" say you must wire in a 5 Amp fuse, between the magnet commons (neg.) of every 5 stop actions (1/2 Amp X 10 stop action magnets X 2 magnets per stop action). This would mean you would have to run dozens of common ground wires to a fuse panel some distance away from the stop rails. A 200 action stop rail for example, would require 40 fuses! Try finding a blown fuse among 39 others in the dark recesses of console.

A more sensible approach is to install a current sensing magnet circuit breaker. This device was devised in the early, unpredictable days of solid-state electronic combination actions, and was called the "no-faith" box, as many organ builders had no faith in the reliability or operation of these new black box systems. Rightfully so, as many of them would blow up, burn up wiring, stop actions, and make a total mess of the console if the combination action "hung-up". The heat generated by a stuck magnet coil can destroy the coil and may result in damage to the console and to the magnet drive electronics.

One might think, Oh! I'll just put in a circuit breaker rather than fuses. Wrong! A traditional circuit breaker senses the amount of current flowing in the circuit and interrupts that current flow when the total amount of current flowing exceeds a predetermined level. The traditional circuit breaker offers no protection in the case of a small number of magnets being driven for a sustained period of time, because the total current flowing is small relative to the maximum current that may flow (well under the rating of the circuit breaker) for a short period of time in normal operation.

The "No-Faith" circuit breaker, on the other hand was designed to allow any amount of current to flow, but interrupt the current (trip until manually reset) if any current, even a small amount, continues to flow for more than 2 seconds. This provides a very sensible answer to varying current flows that fuses cannot respond to, and it protects and trips at the slightest amount of current, should a magnet circuit hang on for longer than 2 seconds. The No-Faith circuit breaker is pre-set to activate when it senses more than 112 Amp flowing from the combination action power supply to the stop actions.

During normal operation, the current sense indicator on the front panel will glow whenever one or all magnets on the stop rail are activated. Should 1/2 Amp of current or more remain on for longer than 2 seconds, the internal sensing circuit trips and the current path is opened, taking the power supply off the output boards. If manually reset, the circuit continues to trip until the source of the problem is located and the load is removed from the circuit. The circuit breaker box is also equipped with a toggle switch that opens the circuit manually if you need to disable the combination action. A reset button will reactivate the circuit breaker once the switch is turned back on. The circuit breaker is also Tine powered, so it goes off and opens the circuit to the combination action power supply , if batteries are used as the combination action power source, when the organ is turned off. This keeps the batteries off the boards when the system is not in use.

While we have no tie to the manufacturer of this device, we do endorse it, and we have used many of these devices in console work we have done in the past. Its cost will more than pay for itself when factoring in the labor cost of installing and wiring around 40 to 50 fuses for the stop rail, and the No-Faith time delay circuit breaker provides infinitely more protection. It really is cheap insurance.

The No-Faith time delay circuit breaker is manufactured and sold by

The Crome Organ Co.
1210 Mile Circle Drive
Reno, NV 89511
(702) 852-1080

Input Board Fusing

An extra fuse and fuse holder has been included (optionally) to fuse the logic power (+) to the input and output boards. The logic supply that we furnish for your system has a built in "crow-bar" short circuit and over voltage protection circuit built in, as well as being equipped with its own fuse for extra protection. You may install the fuse between the logic supply and the main logic power bus as shown in the wiring pictorials in Appendix 1, pages 2 and 3 if you want further protection. There is no need to fuse the logic power to each I/O board individually.

If you require any assistance in figuring out your fusing needs, or would like us to supply you with a No-Faith Time delay circuit breaker, please give us a call.

---

uniflex relay systems

3.3. Tools You Will Need

Anyone who works with solid state electronic equipment MUST have as a minimum the following equipment at his disposal. The following is a checklist for your toolbox, or a shopping list to take to your local electronic supply and tool supply house if your tool box is inadequately equipped. It has been said that an organ man with inadequate resources in the "tool" department is a sad sight indeed

1) A Volt/Ohm meter is a MUST! Here, an analog meter works best. It does not have to be an expensive precision instrument either. Buy Radio Shack Analog Meters when they go on sale (about $25.00). You might want to keep two or three of them around, as they usually get dropped, burned with the soldering iron, stepped on, etc. You will want to leave a meter with the organ, so it is handy if you have left your tool box at home, and you need to check a coil or check a voltage.

The generic "Radio Shack" meters will tell you within 5% to 10% what voltages you are working with. They will also measure the resistance (Ohms) of a coil, and they will indicate up to 10 Amps of current flow. Analog Meters are easier to read, and will in my opinion give you a better "view" of what you are testing than a digital meter. Digital meters have to sample the media it is testing before it will give you a reading. This sometimes takes a while before you get a stable reading. Also, Digital meters are sometimes very confusing with all the different scales. Analog meters react right away, and generally have a rotary switch type of scale selector.   If you don't have a meter, you will need to get one before you begin the checkout of this system. A basic guide on how to use a meter is given in the system wiring guide installation instructions.

NOTE!: You must not attempt to turn on this system without a meter to verify voltages.

2) A Soldering Iron. If you plan to do any work on solid state equipment, you are going to have to invest in a good soldering iron. Here, Radio Shack's cheapest iron will not do. I strongly recommend you spend $35.00 and buy a battery operated rechargeable soldering iron. or $20.00 for a Weller (propane) "Portasol". Both are well worth the money for two reasons. 1, you don't have to drag around a power cord and 2) they are safe to use with electronic circuitry. The typical 110V 18-24 Watt soldering "pencil" will have a certain amount of AC leakage on the soldering tip. Solid State devices do not like AC, especially hi voltage AC. Some cheap "Pencil" type irons are terrible when it comes to AC leakage and these cheap soldering iron can do extensive damage to electronic equipment if you are not careful. If you apply a soldering iron tip with a AC leakage to your circuit boards, and if part of the circuit you are soldering to is tied to earth ground, you will be putting that AC component on line with your system. This is guaranteed to cause erratic system operation and possible board and IC damage. As a general rule, you should NEVER use a cheap pencil iron to solder a connection while any solid state system is ON. Many electronic "soldering stations" are equipped with isolation transformers and sufficient grounding to eliminate this possible hazard. A battery powered or propane gas soldering iron is the least expensive insurance you can get to avoid board damage when soldering wires onto solid state systems. Buy one! An 18 to 35 Watt soldering iron is fine for general use.

We shouldn't have to say this, but don't use one of those big soldering "guns" on electronic devices, and please, never use one of those heavy duty 250 Watt soldering irons used for pipe repair on electronic devices. If you have to ask why, stick to pipe repair and let someone else install the system.

3) SOLDER Never, Never use acid core solder when working with electronics. Acid core solder and acid paste is fine for wind lines and some pipe repair, but an absolute NO NO with electronic components. Always use ROSIN core (flux) and a minimum 60-40 lead-tin composition solder. Radio Shack again comes to the rescue if you are in a bind, but you should always buy the best quality solder from an electronics supply house. It will cost about $ 8.00 to $12.00 per one-pound spool. Solder comes in various gauges. There is no magic gauge that is best for all applications, but as a general rule get the smallest gauge the supply house caries. Anything around 28-30 gauge is fine for anything you will have to do with our system. Also, thinner solder means less working time to flow than the heavier gauges of solder.

WIRE STRIPPERS/CUTTERS You will need a decent pair of wire cutters and a good quality wire insulation stripper. Many combination tools provide a cutter and pre-sized wire gauge stripping all in one inexpensive tool. What you want to avoid when stripping the insulation from the wire is nicking the wire. A slight nick in a solid wire will cause the wire to break if it is flexed at the point of the nick.

IC REMOVAL TOOL. An IC puller is a U-Shaped tool that costs about $3.00. It has two right angled teeth that grab the IC (length wise) and allow you to pull the IC from the socket. The use of pliers and screwdrivers to wedge the IC out of the socket can damage the plastic case of the IC, and worse yet, a slip can bend or even break off the pins of the IC.

I'm not going to tell you that you will never have to pull an IC from a board in this system, (that's why they are in sockets!), but if you do, you will want to have an IC puller handy. It makes removing an IC a very easy and simple task.

---

uniflex relay systems

3.4. Preface to the General Instructions

Before you begin installation of your system interface boards, there are some points that must be brought to your attention pertaining to general organ wiring practices when dealing with solid state electronic systems.

We are assuming that you have had no previous experience in working with or installing solid state equipment.

You must remember that ANY manufacturers electronic control system for organs must be treated with respect and care when compared to the old electro-pneumatic devices of fifty years ago. Solid state equipment is sensitive to and may be damaged by static discharge. Keep the boards in the static protective wrappings until you are ready to install them. Before handling the boards, discharge any static charge your body may be holding by touching any unpainted metal grounded surface. If you feel a slight zap, or see a spark when you touch a metal surface, you know you are in a high static area you must be extra cautious when handling the boards.

The diagrams and pictorials furnished with these instructions are your guidelines and MUST be followed. References throughout the text are made to the different wiring pictorials. When a reference is made to a pictorial page or item number, you should leave the text and study the example provided.

All wiring diagram information is contained in SECTION 1 of the Appendix.

If you do not understand an instruction, let us know. We expect that for many of you, this will be your first encounter with electronic equipment. Where necessary, we will educate you with the fundamentals of basic electricity (Ohm's law) to assist you in determining the proper sizes of wire to use, etc.

When an instruction requires a specific wire size, or piece of equipment, we expect that you will meet or exceed the requirement. If you ignore the requirements, you cannot expect the system to operate as intended.

PRECAUTIONS

The organ rectifier used with this system MUST be of organ requirements design, and IT MUST be regulated. DO NOT attempt to use a rectifier that is under rated for the installation. If you do not know how to determine the size of rectifier you need, see SECTION 2 of the Appendix.

You should use a rectifier that is powered by 220 V or 115 VAC Single Phase or Three Phase. The rectifier MUST BE COMMERCIALLY MADE. Do not use home made diode rectifiers, battery chargers, old fashioned selenium (FINNED) rectifiers, or car batteries!

We must emphasize that the organ rectifier is a very critical piece of equipment in this system. IT MUST BE REGULATED so the magnets have full voltage on them regardless of the load.

DO NOT USE the original pipe organ DC GENERATOR to supply chest or console power as they produce tremendous amounts of high frequency "noise" on the magnet line which may falsely trigger the logic circuits.

The proper sized wiring from the rectifier to the console and chambers must be large enough to handle the current demand of the instrument. Be sure your installation is NOT under wired.

If you don't know how to determine the proper sized wire to use, see SECTION 2 of the Appendix for the instructions and formulas to use. More attention is given to the rectifier wiring at the end of this booklet.

If you do not own a Volt/Ohm meter, you must obtain one. You will need it to verify voltages, check continuity, and read resistance. Radio Shack sells them (often on sale). If you do not know how to use your meter, see SECTION 2 Appendix.

ENVIRONMENTAL PRECAUTIONS

In many sections of the country severe lightning strikes are quite common. These strikes can cause damage to your computer as well other electronic equipment if a strike should hit a power line serving the installation, or the building itself

If a storm is anticipated, it is always best to remove the computer power plug from the outlet or install a good commercial lightning protection device on the computer AC power line. If long interface cable runs are needed from the computer to the chambers, it is advisable to run the portion of the cable that is elevated above the ground in an earth grounded conduit if the building does not have a steel frame-work.,

GENERAL COMMENTS

There should be a MAIN POWER SWITCH at the CONSOLE to turn the system and related organ components ON and OFF with ease. You must not depend on having to throw several switches and fuse box levers or plug in two or three extension cords to get the system up and running. You may chuckle at this, but we wouldn't mention this if we hadn't seen it.

Do not be in a hurry to complete the wiring job. Take your time and plan to do it right the first time. Also, READ ALL THE INSTRUCTIONS! It is very easy to miss an important connection or comment about a connection by just looking at the pictorials. The system is not difficult to install if you follow the directions. When an instruction is completed, it will be helpful for you to check it off with your pencil so you know it has been completed. Having someone else check your work may be helpful to you as well.

It is suggested that you read through this entire booklet and study all the wiring pictorials very carefully before you begin the installation and wiring of the interface boards. As you read through the instructions, make notes for yourself, especially on things you do not understand.

The first part of the instruction will deal with the SITE requirements and interface board installation and wiring. The second part of the instructions will deal with the assignment of your wiring to the wiring forms.

uniflex
relay systems

3.5. Wiring Specs and Sizes

WIRING AND SPECIFICATION DOCUMENTS

General guidelines will instruct you on how to correct any "wiring errors", set up the combination action, assign or rearrange the crescendo pedal order, and how to use the recording and playback features of the system.

THE ORGAN RECTIFIER WIRING

We have saved the rectifier wiring to last. It must be checked in the existing organ and must be calculated for the organ being installed for the first time. Note! We have noticed that most organs in general tend to be UNDER wired in this department.

WIRE SIZES

The wire sizes from the organ rectifier positive and negative (Item 1) to the console and chamber bus bars (Items 7, 8,12 and 13 respectively) in the SECTION 1 Appendix are not given as they are different for each installation and must be considered individually. We have provided you with Rectifier WIRING DATA (located in SECTION 2 of the Appendix) showing you how to select the proper wire sizes. Voltage drops corresponding to ampere load are also given in relation to the actual distances from the rectifier to the chambers and console.

From these charts and instructions, you should be able to calculate the proper wire sizes that are needed from the rectifier to the console and from the rectifier to each chamber. DO NOT GUESS! CAREFULLY DETERMINE THE TOTAL CURRENT UNDER WORST CASE CONDITIONS. Take into consideration that the length of a wire you are running is a COMBINED TOTAL OF THE Positive WIRE AND THE NEGATIVE WIRE ADDED TOGETHER, i.e. a 10 foot run would require a total distance of 20 feet (up and back). The way a wire size is determined is not as simple as saying a #4 wire will handle 50 Amps. YOU MUST CALCULATE THE TOTAL Combined SERIES RESISTANCE OF THE TWO WIRES MEASURED IN OHMS PER FOOT, IN ADDITION TO ALLOWING FOR VOLTAGE DROPS, ETC. The chart at the bottom of Page 4 of SECTION 2 Appendix gives you a good reference without having to do all the math. If you would like to know how to figure them yourself see the three additional charts in SECTION 2 (See conclusion).

If a 220 VAC single phase rectifier is used, make sure it does not go out of regulation if it must share the same AC line with heavy changing loads. Motors or high current thermostatic controlled heating elements like those used in electric water and baseboard heaters can cause momentary drops in the line voltage which may cause the rectifier to go out of regulation. It may be necessary to run the rectifier on a circuit of its own.

Think of your electrical requirements in the same way as wind lines and blowers such as the blower being the rectifier, and the wind line being your wire. You may gain some insight. You would not expect satisfactory operation from 20 ranks of pipes winded with a three inch wind line. And you would not expect 20 ranks to play from a one-half horse power blower without a regulator either. Yet, many are willing to wire an organ this way. You can't blame the pips. They are only capable of producing sound with what is available from the wind source. If you starve the pipes of wind, they will not play properly. Single notes may play, but when you put on ALL the stops-nothing! The same applies with electricity and any manufacturers solid state, multiplex, or microprocessor relay and combination action system.

Uniflex Relay Systems will not be responsible for system anomalies resulting from under rated equipment, under sized wiring, or failure to follow our wiring instructions and guidelines.

3.6. Conclusion

Even though the basic electrical wiring procedures covered in these instructions have been given some fairly strict guidelines and warnings, remember that they are nothing more than good wiring practices which would be applied to wiring any electronic circuitry to a pipe organ. The emphasis on detail is for those of you who have never worked with electronics before, or for those who are not familiar with good wiring practices. Many of you will understandably have a few questions about specific applications of hardware of software needed for your installation. If there is an area or subject that has not been given enough detail, please do not hesitate to call.

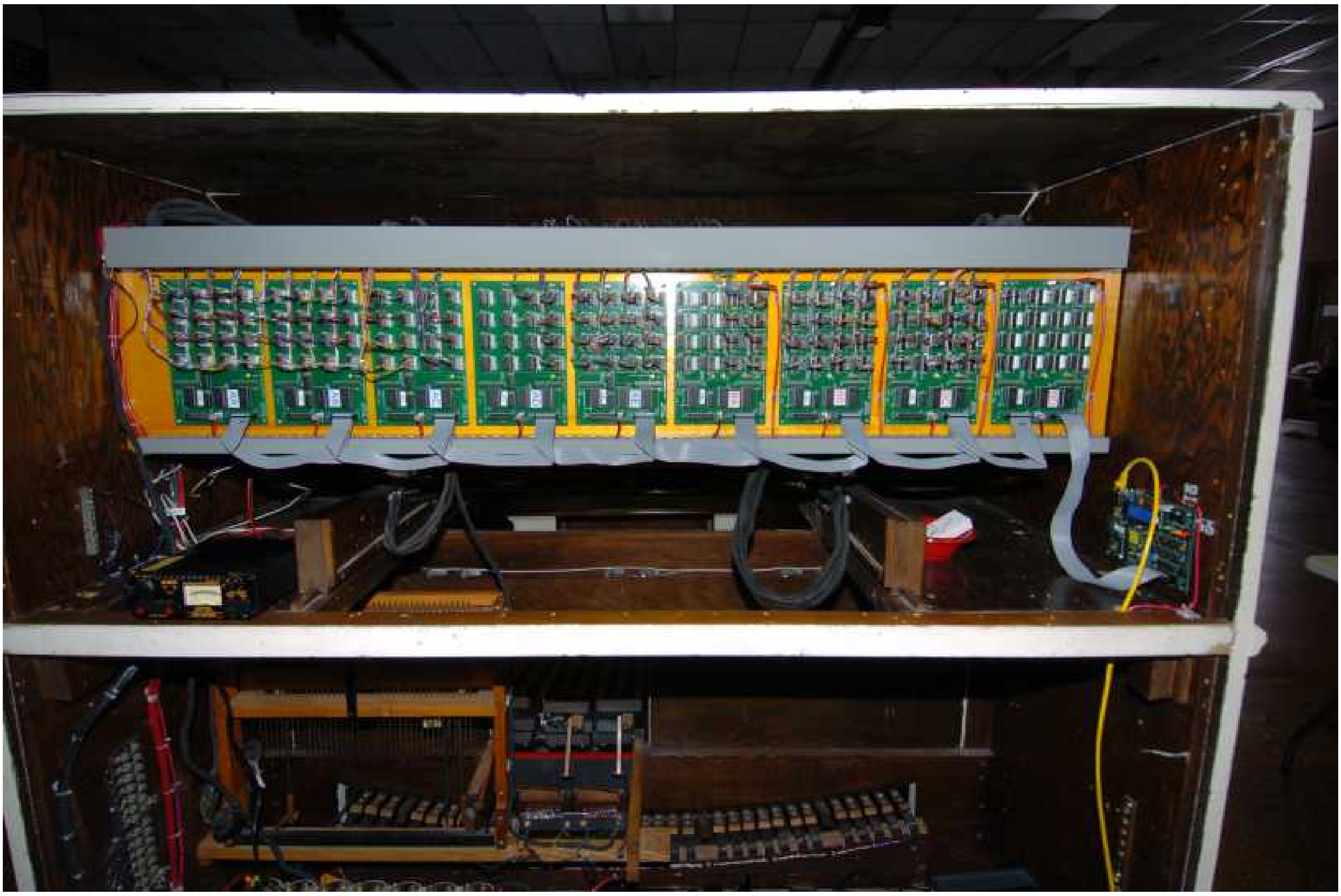
We want to help you in every way we can. Please don't hesitate to phone us if you have any questions and especially if you do not understand any of the specific diagrams or instructions.

Uniflex Relay Systems
526 West Division Street
Union City, Indiana 47390-1007
Voice: (765) 232-4674
Email: dick@uniflex.com
Website: www.uniflex.com

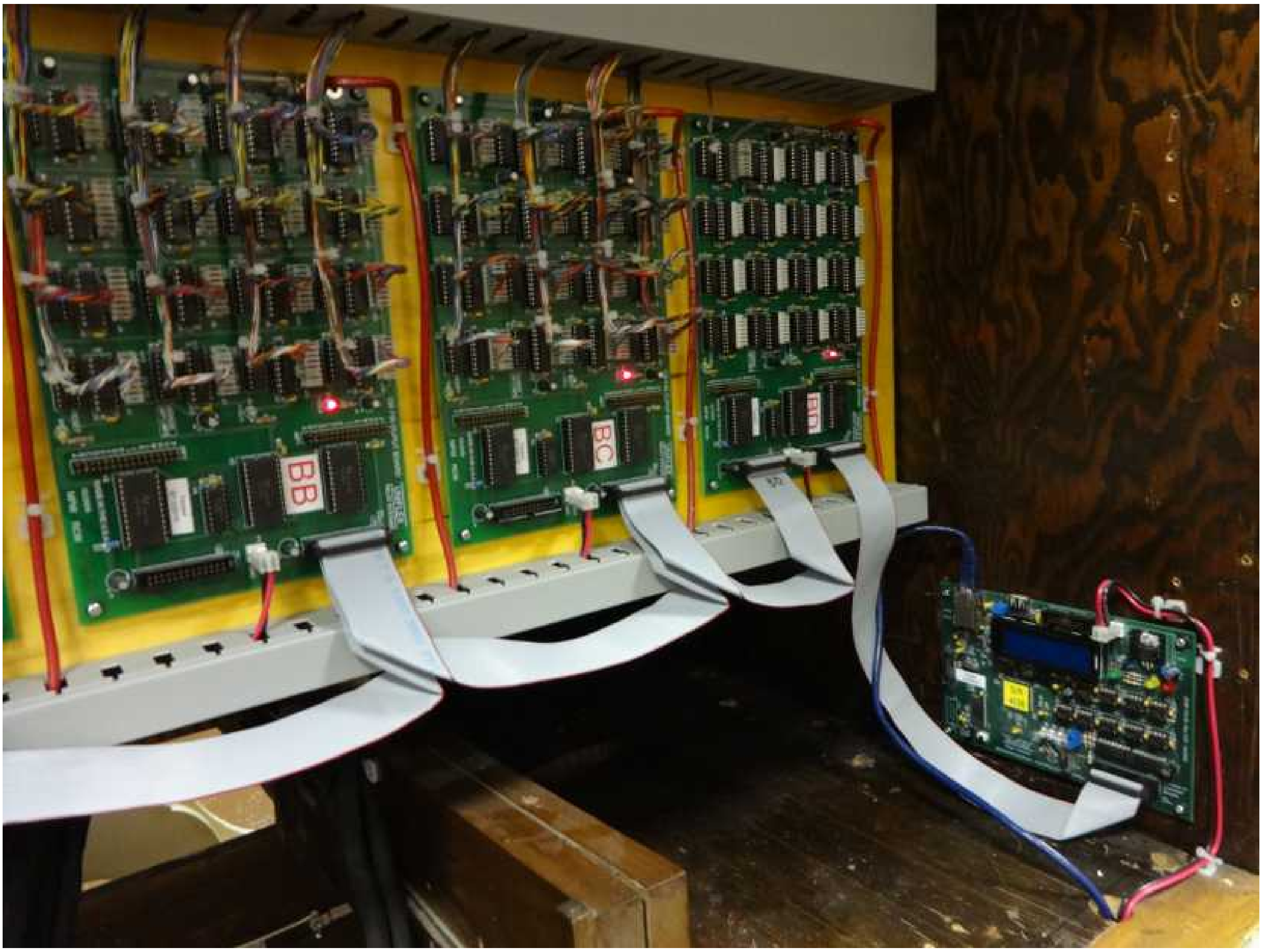
4. Wiring the Console

Front view of our Page 3/12 console used in this documentation.

Rear view of our Page 3/12 console used in this documentation.



Rear view showing the various connections between the boards and organ components.

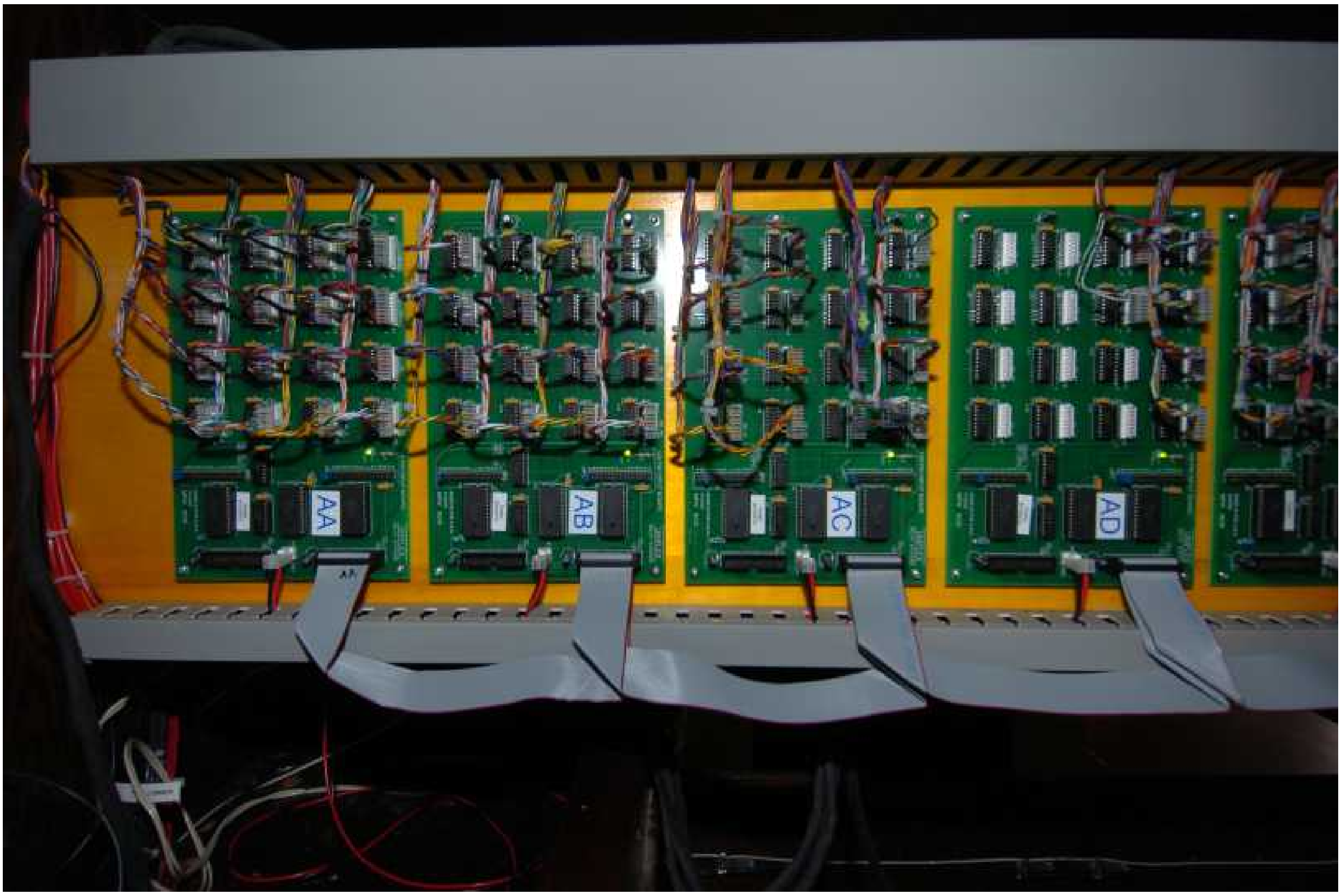


Note the ribbon cable connecting the console interface on the console side panel with the input and output boards mounted vertically on the wood backplane (added by Carlton Smith). Logic power is fed to the interface and to each input and output board with a red/black pair of 18-gauge and a 2-pin Pancon connector. Also note the blue CAT5 cable feeding the interface board at the top left-side.

A clearer picture of the interface card:

The USB connector and the 20-pin connector above the display are currently not used. The yellow label in the center of the board designates the unique serial number of the interface board.

Close view of input boards AA-AD (AE is off screen). Blue labels designate input boards.



Wires exiting from the top of the input boards connect to the keyboards, stops and pistons. They are 24-gauge solid telephone cable wires.

Close view of output boards BA-BD. Red labels designate output boards.

Wires exiting from the top of the output boards connect to the stop magnets and indicators. They are also 24-gauge solid telephone cable wires.

4.1. Tim Rickman's Uniflex 3000 Console Guidlines

CONSOLE INPUT AND OUTPUT BOARD WIRING GUIDELINES

We have prepared several wiring pictorial examples to help illustrate the various points covered in the text For clarity, ITEM numbers have been included in the pictorials and referenced to the text.

An appendix located in the back of this guide contains all the various examples and pictorials. When a reference to a pictorial page or item number is made, note the SECTION and PAGE NUMBER of the example. Leave the text for a moment and study the appendix example carefully.

By now, you should have received the interface board order for your instrument. Each board has been pre-addressed and thoroughly tested for you. Before you unwrap them and begin to mount them, please take the time to discharge any static charge you may be holding.
Included with the interface boards you should find the following:

1) A Logic Power Supply. (usually mounted in the console)

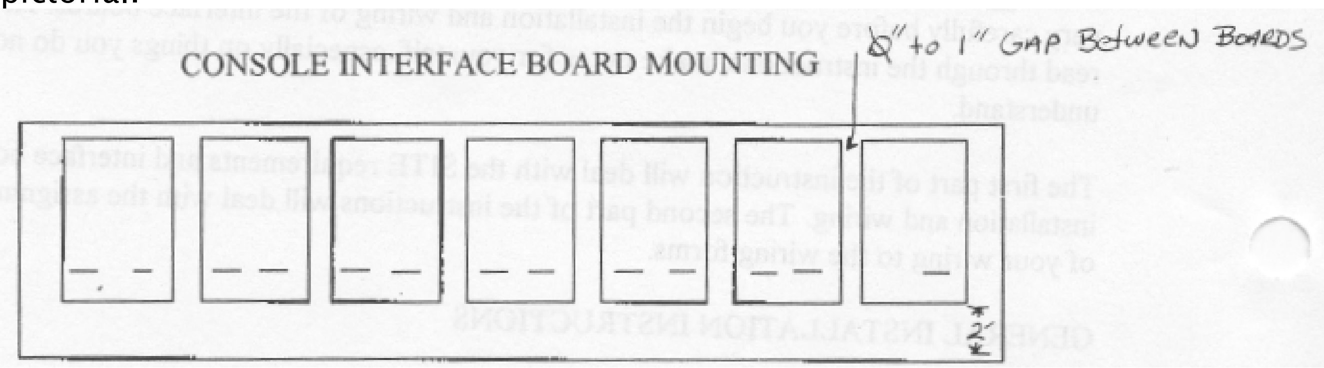
2) Four #4 x 5/8" pan head sheet metal mounting screws for each interface board.

3) A pre-determined number of insulation displacement connector shells for solderless wiring connections.

4) An insulation displacement wiring tool for punching the wire into the connector shells.

MOUNTING THE CONSOLE INPUT AND OUTPUT BOARDS

You should plan to install your console input and output boards in an easy to get to location. It is most convenient to mount the boards butted side by side on a finished piece of 5/8 or 1/2 inch plywood. Use appropriately sized wood screws to mount each board. When mounting the boards, all that matters is to keep the boards in address order for quick identification. It is preferable to install them as shown here and in the wiring pictorial.



Leave about 2 inches below the boards to accommodate a 26 wire ribbon cable that will be sent with your system and program disks once you have completed and documented your wiring.

WIRING BUS CONNECTOR STRIP

Once you have installed the logic power supply and AC electrical requirements, you must install a wiring bus connector strip (ITEM 9 and 10 located on Page 2 of the appendix) with at least six terminals or screws for the distribution of logic power, positive and negative, to the CONSOLE and CHAMBERS. (Chamber wiring will be covered after the console wiring)

If your console does not have a POSITIVE and NEGATIVE rectifier bus bars already installed, you must install them as shown in the pictorial on Page 2 of the Appendix (ITEMS 7 and 8). Each bus bar for the rectifier POSITIVE and NEGATIVE should be fairly heavy stock. It should have at least 12 to I5 tapped screws and lock washers for all the various wires that must be attached to them.

DO NOT TRY TO USE A SINGLE STUD AND WRAP ALL THE WIRES AROUND IT. This is a very unreliable type junction.

"Common Ground" or "Ground" refers to an electrical connection which serves as a common reference point for ALL CIRCUITS. Most power supplies including the organ rectifier and the logic supply have two wiring terminals on them. One is the POSITIVE (+) terminal, sometimes referred to as the "Feed" and the other terminal is the NEGATIVE (-), sometimes referred to as the "Return". We will refer to the NEGATIVE (-) (or "Return" terminal as COMMON, COMMON GROUND, or GROUND. All three terms mean the same thing here. Page 2 of the Appendix shows the COMMON GROUND connections.

WIRING THE LOGIC POWER TO THE CONSOLE BOARDS

Logic power should be supplied to each console input, output board and interface board using #18 stranded wire and the supplied 2-pin logic power plugs. These plugs are at the bottom of the boards and are labeled "+15V1". Actually the logic power voltage may be from +12 volts to +16 volts. These should be run to the logic power buss bar. Logic power for the console is typically supplied by a single 3-amp well regulated digital power supply typically called a 12-volt DC supply that actually puts out 13.8 volts.

At this time, you should run a #18 stranded wire from the logic power NEGATIVE bus to the rectifier NEGATIVE bus. (See ITEM 9 to ITEM 7 as shown in the pictorial on Page 3 of the Appendix. The separate # 18 wire from logic power supply NEGATIVE to the rectifier NEGATIVE provides a COMMON GROUND reference between the two separate supplies. The system will not function normally if this wire is left off.

NOTE: This is the most overlooked connection in the system.

Once the logic power supply and COMMON GROUND reference wiring has been completed, study the wiring pictorial on Page 3 of the Appendix showing the wiring of the heavy current stop magnet lines from the POSITIVE rectifier bus strip to the magnet output interface boards. There must be one #10 or #12 stranded wire run from the rectifier POSITIVE (+) junction to the spade lug between the two fuses. This terminal is labeled "Magnet Power" in teeny-tiny little white letters on EACH magnet OUTPUT board in the console. (See ITEM 8). Use commonly available spade lugs to make this connection.

DO NOT WRAP THE #12 WIRE AROUND OR SOLDER TO THIS LUG. Simply strip about I/8" of the #12 wire, and crimp or solder the wire to the female lug.

STOP ACTION CONNECTIONS

If you have not already done so, you must prepare for the wiring of the stop actions (stop switch and on and off magnets) in the console. (Study Page 4 and 5 of the Appendix.) If you are using the original electro-pneumatic (air actions) the heavy GROUND wire from the air action boxes is probably already in place. If this is a new or rebuilt console converted to dual electric stop actions, you must do some extra heavy wiring.
The most common error installers have made is not providing enough GROUND "RETURN" wires when dual electric stop action/drawknobs are used. (See ITEM 7, Page 4). Each electro-magnet of the typical stop action (Syndyne, Kimber Allen, Reisner, Peterson, etc.) draws about one-half Amp when energized. If you have 200 dual electric actions, a GENERAL CANCEL will require 100 Amps. The GROUND "RETURN" wires must be large enough to handle this much current. You cannot get by with a single #12 wire to the rectifier COMMON GROUND junction strip.

As an example, a console with a maximum of 200 dual electric actions will require at least eight # 12 stranded wires to be distributed around the stop rail COMMON from the rectifier GROUND bus. The pictorial on Page 3, 4, and 5 of the Appendix shows this wiring.

NOTE! The SWITCH and ON and OFF magnet wiring to the interface boards will be covered later on in this booklet.

Be sure your GROUND "RETURN" lines are large enough to handle the intended load. If you are not sure, give us a call.

While on the subject of dual electric actions, it must be pointed out that your rectifier must be capable of supplying the requirements of the dual electric stop actions on a GENERAL CANCEL if every stop in the organ is down. You must insure that the equipment you are using with this system is capable of handling the load placed upon it. Your pipe chests may require only 40 Amps, but the console with 200 stop actions will require a rectifier capable of delivering 100 Amps even if only momentarily when every stop is on.

If your rectifier is under powered for the load, dependable operation of all stops cannot be assured. There are, however, alternatives available.

ALTERNATIVES FOR UNDER POWERED RECTIFIERS

1). A separate power source for the stop action magnets with short duty cycles (75-100 Milliseconds) may use a capacitor discharge system. This (control) system pulses the magnets for 75 Milliseconds and may be increased to 300 Milliseconds, cautiously.

2). Consider, in a practical sense, that this system provides power ONLY to those stops which must move on a GENERAL CANCEL or any other combination action function. In normal playing conditions it is not likely that every stop on the console will be on. If you can accept this fact, then decide how many stops would require a GENERAL CANCEL pulse and provide enough power capacity to handle what you feel is practical.

3). Another alternative is the rechargeable GEL CELL (a sealed lead acid battery which can supply very high currents for a short period of time) battery pack for the console stop actions.

All of these alternatives are in use in the organ industry.
This completes the general mounting and power supply wiring of the console. Review your work and when you are satisfied that everything has been properly wired, go on to the chamber interface board wiring requirements.

WIRING THE CONTACTS TO THE CONSOLE INPUT BOARDS

NOTE! Serious damage can be done to the interface boards by applying power to input and output plug connections when logic power is not present. This includes continuity tests and magnet coil resistance measurements with an ohm meter, etc. Be careful not to damage your boards by doing tests and measurements once your wiring has begun. If you need to test your hardware and wiring, do so before you attach the plugs to the boards and isolate all common grounds from the interface boards.

INPUT BOARDS ARE USED ONLY IN THE CONSOLE. The switch contacts of the keyboards, pedalboard, stop switches, thumb and toe pistons, single contact toggle switches, roller or shorting bar expression and crescendo actions, etc. all wire to the INPUT boards. The COMMON side of all these switches (including keyboards) must be wired to the console COMMON GROUND bus. Use #20 solid or stranded wire for these ground lines. (A wiring pictorial appears on Page 7 of the Appendix). Also, reference the COMMON GROUND connection on Page 3 of the Appendix.

NOTE! The STOP MAGNET and STOP SWITCH COMMON GROUNDS should have been run and terminated at the console COMMON GROUND junction when the interface boards were installed (See Pages 4 and 5 of the Appendix).

Once the COMMON ground lines have been run and terminated, plan time to attach the solderless insulation displacement connectors to all the switch contact wiring in the console. These 8-pin insulation-displacement connectors require the use of #24 solid telephone cable. Wire the SWITCHED side of each key contact, piston, stop switch, roller type expression and crescendo actions to the INPUT board connector plugs as described in the following paragraphs. The wiring pictorials (Pages 5, 7, 8 and 9) should be studied and referenced against the wiring listings in Section 3 of the Appendix.

A special Pancon wiring tool has been furnished for this job. The wiring shells furnished with your order are designed to accept PVC covered (phone) wire of 24 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. Extra shells have been included with your order in case you happen to damage a shell while learning to use the tool, but this is pretty hard to do.

Each INPUT board has sixteen 8 pin male connectors, four to a row and four rows wide. Each connector has been assigned a letter, A through P. Note that only the first of the eight pins on each connector is numbered by a one (1) to preclude a row of small numbers from becoming confusing. (See special pictorial Page I of the Appendix Section 3 for INPUT board layout architecture and Page 3 for START and END wiring information).
[DW] Note that the following instructions direct you to use blank wiring sheets and write down your own wiring pin addresses. This is the way Tim did things where he always wrote the definition file for the customer. You may want to use a different procedure, especially if you are writing your own definition file.

STEP ONE -- STOP SWITCH CONTACT WIRING PROCEDURES

A). Sit at the console with your blank CONSOLE INPUT wiring sheets and copy down the name and pitch of each stop tab on the console as shown in Section 3 of the Appendix (P.12 and P.13).

Begin with the pedal division and work in order from left to right, lowest row stops to highest row stops, all the way through the console ending with the back rail (name board) stops BEFORE you begin the wiring.

Once you have listed all the stops to an address on the forms, you can use the form as your wiring guide. When you begin your wiring, start the stop switch wiring on board AA with the first stop in the pedal division wired to connector A, pin 1 (AA-Al). Now work upwards through the rows of alphabetically listed connectors as shown on

the
BOARD WIRING LAYOUT wiring sheet in the Appendix.

B). If you plan to add more stop hardware to a division at a later time, you need not leave spare pins. Stop switches, pistons, and other control switches can be added at any time to any available INPUT board in the system. Additional INPUT boards may be purchased at any time for future expansion.

C). Be sure you write in the interface board addresses on ALL your wiring work sheets.

STEP TWO -- KEYBOARD WIRING

Keyboard wiring should be listed on the INPUT wiring forms as shown in the Appendix wiring listings. All keyboards should be wired in note order from low to high, division by division beginning with the pedal. List your wiring as shown on pages 7, 8 and 9 in the Appendix.

Your keyboard wiring should start as shown in the wiring sheet examples, directly following the stop switch wiring.

STEP THREE -- PISTON/SWITCH WIRING

All piston and switch names and addresses must be listed on the INPUT wiring sheets (as shown in Appendix on Page 9). Pistons are treated like any other INPUT contact. Each piston and switch is wired to the interface boards after the last keyboard note as shown in the wiring example.

STEP FOUR -- EXPRESSION AND CRESCENDO WIRING

If you are installing the computer control system on an instrument using potentiometer-controlled expression and crescendo shoes, an example located on the POTENTIOMETER EXPRESSION WIRING DIAGRAM on Page 8 in Section 1 of the Appendix will show how the potentiometers are wired between GROUND and the input board.

The center leg (rotor) of the potentiometer will be the interface board wiring connection, and one of the outer (stator) legs of the potentiometer will be wired to ground. If the pedal operation is reversed when you get the organ playing, move the ground wire on the other potentiometer outer solder leg.

Potentiometers can be wired to any input of the board. You do not have to wire certain things to certain sections of the interface boards. As long as you document what each wire goes to or does, we can take it from there. All we really ask is that you keep things in order and please try not to jump around or intermix things like wiring two octaves of a keyboard followed by 20 combination action pistons and then the final three octaves of the keyboard. This makes programming very difficult and prone to error.

If you are installing the system on a pipe organ using roller or shorting bar contacts, each contact will be wired to an input board pin in the order of closure. The crescendo roller must also have one wire used as the shorting contact on the roller wired to common ground. (Pages 9, 21 and 22 of the Appendix show the wiring listings of roller type expression and crescendo actions, and the wiring of these controls is shown on Page 8 in Section 1 of the Appendix.

CONSIDERATIONS AND SYSTEM REQUIREMENTS

The system requires the installation of a few controls you may not be familiar with.

1). COMBINATION ACTION: Those organs which have not previously had a "capture" type combination action installed will need to add or designate a SET piston. This piston is used to set the stops into memory for the combination action. It is wired as an INPUT pin just like any other INPUT.

2). A RANGE TOGGLE SWITCH must also be included in the system. This can be single pole single throw (SPST) toggle or slide on-off switch. It may be mounted anywhere, even under the key desk in a hidden area. The RANGE SWITCH is used when assigning the combination action to the computer. It is not a general use switch, and need not be mounted for general public use. Complete instructions for the use of the RANGE SWITCH will come with your system disk and owners manual.

3). GENERAL AND DIVISION CANCELS. The system supports a General Cancel and individual Divisional Cancels for each division on the organ.
4). GENERAL AND DIVISION PISTONS. The system is not limited by the number of combination action divisional and general thumb and toes pistons. You may install as many as you feel you need.

5). SEMI-BLIND (no movement) CONTROL SWITCHES WITH INDICATORS. The system also supports AUXILIARY type control panels. Many organs outgrow their original stop switch allocations with this type of open ended system. The system will support single contact momentary buttons with indicator lamps rated at the same voltage as your stop magnets (12-15V) or momentary buttons equipped with LEDs (light emitting diodes). These auxiliary controls may be assigned to operate under control of the combination action or will function as neutrals in relation to the combination action, or any variation in between.

6). TRANSPOSER. If a transposer is desired on the instrument, three types are available. You may wire in one or all three types of transposers on your instrument:

A). ABSOLUTE: The rotary switch type. This is usually six half-steps down, six halfsteps up and a standard pitch reference "C" at the 12:00 o'clock position. This would require a 13 position SINGLE POLE NON-SHORTING rotary switch. The common of this rotary switch would wire to ground. Any number of up and down steps may be wired to this type of transposer with appropriate switching.

B). RELATIVE: This is the three-piston type transposer. Piston one raises the pitch in half steps each time it is pressed. Piston two (center) is standard "C" pitch. Piston three lowers the pitch in half steps each time it is pressed.

C). KEY SENSING: This is a one piston transposer. The piston is pressed in and held. While holding the piston is, press any key on any keyboard and the computer will transpose you into the key and pitch range of the note you pressed. Pressing C3 (middle "C") will bring you back to standard pitch.

NOTE! Transposer methods in B and C may be thumb pistons, toe pistons, or both.

CONSOLE OUTPUT BOARDS

Console MAGNET OUTPUT boards provide power to the stop key UP (on) and DOWN (off) coils for the combination action. MAGNET OUTPUT boards may also be used to control suitable indicator lamps or LEDs (light emitting diodes). Some current limitations apply when using incandescent indicators with MAGNET OUTPUT boards.

The OUTPUT board outputs the POSITIVE (source) side of the rectifier or stop magnet power supply. One side of each coil of the console stop actions are wired to an output pin plug and the other side of each console stop action is wired to COMMON GROUND. (See pages 4 and 5 of Section 1 in the Appendix).

If you are using SYNDYNE or PETERSON, or HARRIS stop actions, you should have specified NEGATIVE COMMON sensing. If you are using POSITIVE COMMON devices, you may experience false setting of the reed switches when using the combination action.

Each console OUTPUT board consists of 128 separate high current outputs. Each OUTPUT board has four rows of 8-pin male connectors, four connectors to a row. The 8-pin connectors have been assigned letters from A through P. These letters appear in silver just to the right of the red male connector as were the INPUT boards, (See page 10 of the Section 3 in the Appendix).

CONSIDERATIONS WHEN WIRING THE MAGNET OUTPUT BOARDS

The OUTPUT boards for your console should begin with board address BA. This means you will not have duplicate board address in the console, as input boards begin with board address AA. One group of addresses (AA-AP) is for INPUT boards and the second set of addresses (BA-BP) are OUTPUT boards, Don't confuse the two because the computer knows the difference.

We advise that you wire the stop magnets to the OUTPUT boards as the examples show on Pages 11 and 12 listings in the Appendix. Wiring examples in Section 1 refer to these examples.

If you began your stop switch wiring as advised, you can see by the OUTPUT board example your magnet wiring will follow the stop order. Doing this will allow easy linkage of the stop switches to the magnets. You should begin the magnet wiring with the ON magnet of stop switch number 1 as the first pin of the OUTPUT board BA, 'The second pin would be the OFF magnet of stop switch number 1 and so on. You must continue consistently in an ON-OFF manner throughout the wiring. You will have a total of four stop mechanisms (each having two coils) wired to each 8-pin connector.

NOTE! Magnet wiring MUST follow the stop order.

IMPORTANT NOTICE

DO NOT WIRE ALL THE ON MAGNETS TO ONE BOARD AND ALL THE OFF MAGNETS TO ANOTHER BOARD. Doing so may put an excessive load on the magnet driver IC. Always alternate the magnets in the DOWN/UP or ON/OFF manner explained above so no more than four of the eight sections of the magnet driver will be energized at one time.

There are a few NEVERS when working with the magnet OUTPUT boards once they are installed.

NEVER TRY TO PRE-TEST A BOARD YOURSELF. This means removing ICs, probing around with a scope, etc. Each board was completely tested before it was shipped.

DO NOT APPLY LOGIC OR MAGNET POWER TO ANY BOARD until you are instructed to do so by the general system operating manual that will be sent with your system . A complete testing and checkout procedure will be shipped to you with your system package.

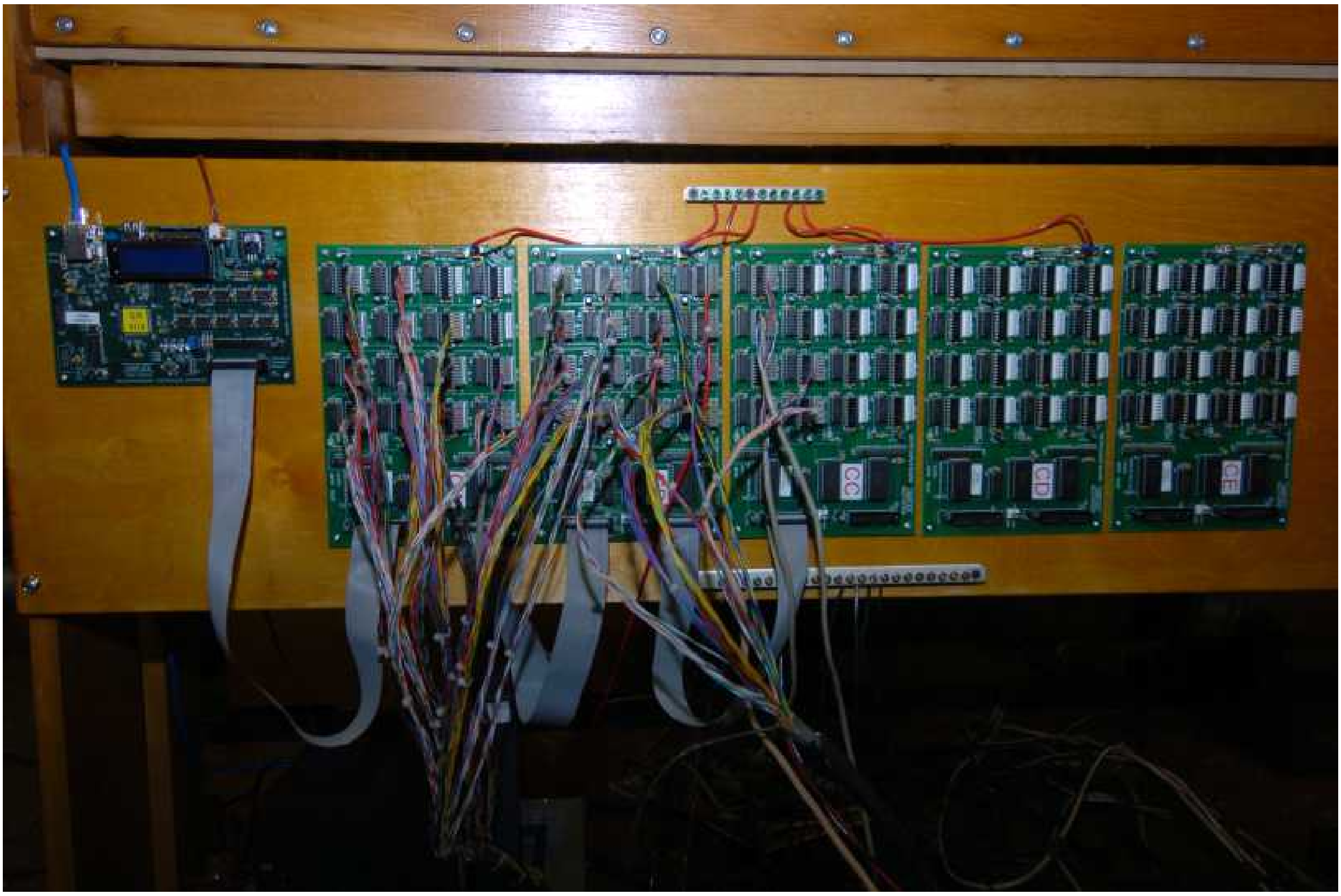
NEVER CHECK YOUR WIRING WITH A "HOT WIRE" while the magnets are plugged into the interface board. You should perform all such "Hot Wire" tests BEFORE you install the computer interface. The system has its own sophisticated diagnostic testing routines built in that will enable you to determine any wiring errors or abnormalities.

---

uniflex relay systems

5. Wiring the Chambers

This is a view of our main chamber wiring. It is only partially finished with only 2-1/2 boards wired up to chest magnets. Since this is my test system, the wiring is not tied down properly in order to allow me to make changes quickly during testing of various configurations.



Note the ribbon cable connecting the main chamber interface on the left with the first three output boards mounted vertically on the wood backplane. In this instance I am feeding logic power to the interface and allowing the ribbon cable to carry the logic power to the output boards. Note the red/black pair of 18-gauge wire and the 2-pin Pancon connector feeding the logic power to the interface at the top left or the board. Also note the blue CAT5 network cable feeding the interface board at the top left-side.

The red wires connected to the top buss-bar are 12-gauge stranded wires which feed the magnet power to the output boards. Please note that these boards have only one fuse while the newer boards have two fuses, one for each half of the board. Either type of board will work fine in the chambers or low-current consoles.

The bottom buss-bar is magnet power ground for the chest returns which are usually

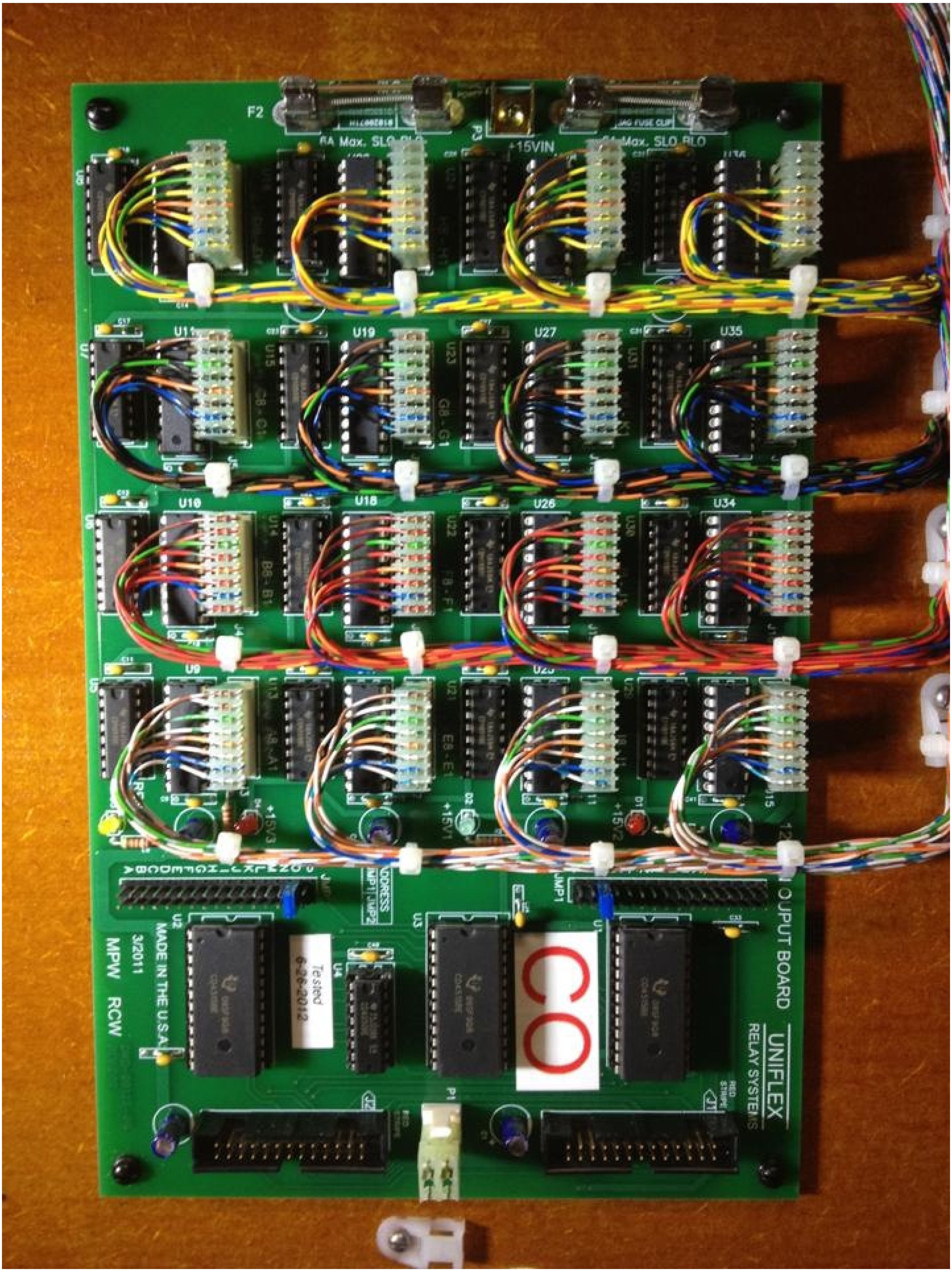
10 or 12-gauge stranded or solid wire.

The bundled wires are 24-gauge solid telephone cables which run to the chest magnets. They are not as well organized as the console wires are because I wired them myself and need to be able to quickly change them for testing purposes. In other words, that's my excuse for messy wires in the chambers. Your mileage WILL vary.

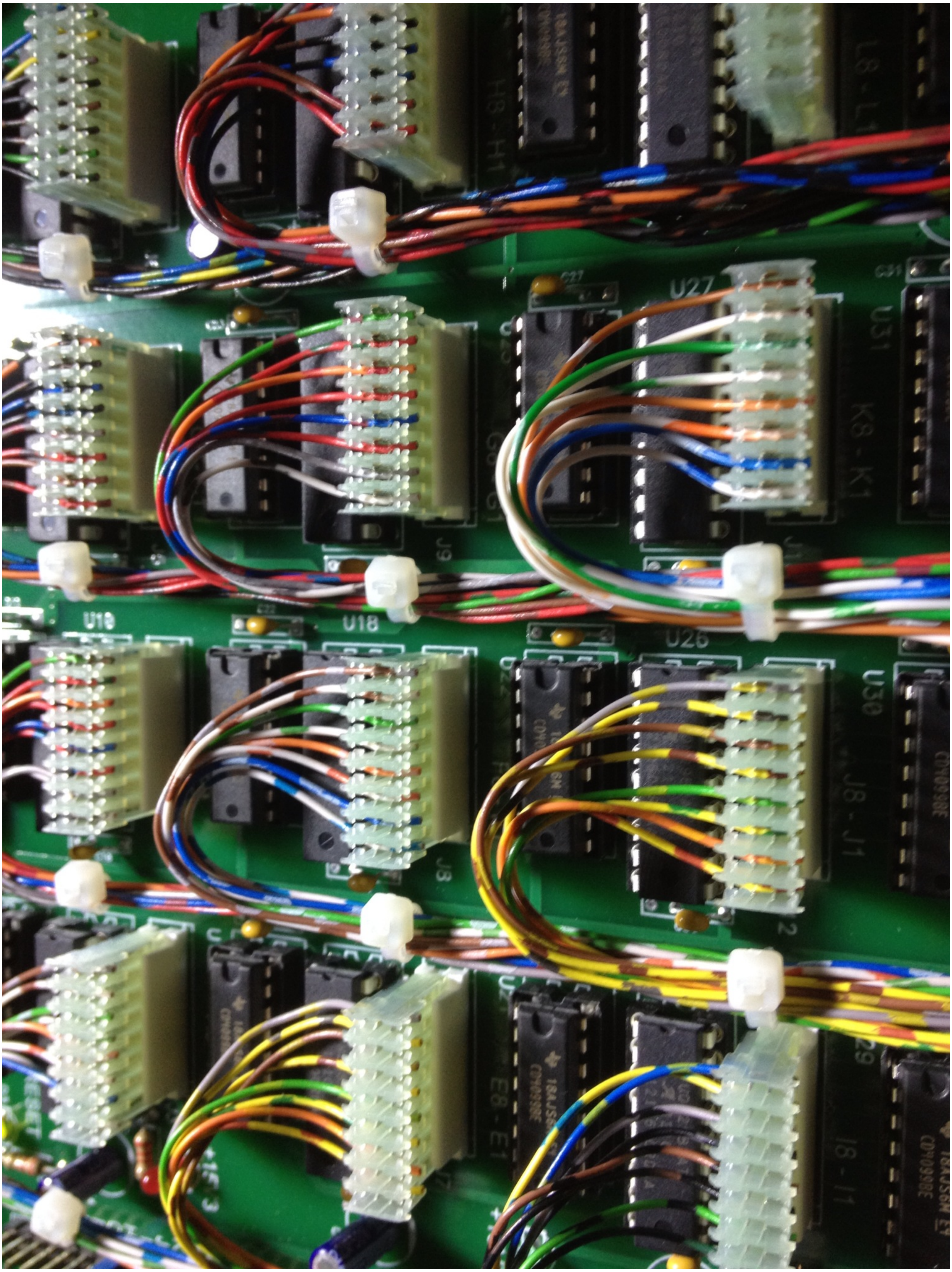
==

The following views were supplied to us by Kevin Grunill, our European distributor. They are photos of his beautiful Astoria installation and show one way that a professional chamber installation can be set up.

This view shows the output pin wiring using 16 of the the 8-pin insulation-displacement connectors and standard 24-gauge telephone wiring cables. The power cables and ribbon cables have not been connected yet.



This view shows a close-up of wiring the connectors.


U27
U31
U18
U26
U30
K8 - K1
J8 - J1
I8 - I1
E8 - E1
J9

5.1. Tim Rickman's Uniflex 3000 Chamber Guidelines

CHAMBER BOARD MOUNTING AND LAYOUT

Mounting the chamber OUTPUT boards on the larger pipe organs requires some planning, especially if several separate chambers are involved. If the computer control system is replacing an electro-mechanical or wind relay, it is best to plan to wire the OUTPUT interface boards in the same location as the old relay(s). The wires can be cut from the old relay spreaders and once the crimp-on pins are attached, they can be inserted into the connector shells and the job will be much easier.
The chamber interface boards should be mounted basically the same as the console interface boards were, on a finished panel in-line and in address order.

Look at the chamber wiring pictorial on Page 6 of the Appendix. A two wire cable (POSITIVE and NEGATIVE) consisting of #18 wire must be run to EACH chamber separately from the logic power supply (located in the console) to provide power to the chamber interface logic boards. One wire (+) connects to the logic +I5 Volt pin to ALL of the interface OUTPUT boards in EACH chamber. The second wire (ground) connects to the GROUND pin of EACH interface board in EACH chamber. The ground wire connection on the interface is also the diode common (flyback diode) for the magnet driver IC's. The flyback diodes clamp any back EMF from damaging the solid state drivers, and must be tied to the rectifier negative as described next.

A single #18 stranded jumper wire must be run from the rectifier NEGATIVE bus over to the GROUND pin of one logic OUTPUT board in EACH chamber. This connection (shown on Page 6, from ITEM l2 to the GND (ground) pin on board AB of the MAIN chamber) will assure a COMMON reference point even if there is a small voltage drop in the long logic power lines. This connection is also the diode common for the magnet driver ICs and prevents back EMF generated by the magnet coils from appearing in the system.

There MUST be a separate heavy line run from each chest in the chamber over to the rectifier GROUND bus This line is the chest magnet COMMON (Chest "Return"). If each chamber has four chests, there must be four heavy ground wires terminating at the rectifier GROUND bus. This wire must be large enough to handle the number of magnets in each chest under worst case conditions. Generally, a #10 stranded wire will be adequate for pipe chest commons provided the length is less than 20 feet. Section 2 of the Appendix (rectifier wiring data chart) will be helpful.
As was done in the console, a separate #10 or #12 stranded wire MUST be run from the rectifier POSITIVE bus to EACH of the MAGNET OUTPUT boards in EACH chamber (See Page 6 wiring pictorial for detail).

WIRING THE OUTPUT CHAMBER BOARDS

Each OUTPUT board is capable of controlling 96 outputs, or in this case up to 96 pipes. We have included as work sheets for your documentation one copy of form 0.1 for each OUTPUT board in your order and a Chamber Rank Listing sheet (form CRL.I Page 14 in Appendix).

To begin planning your chamber wiring you should first list each rank on form CRL. I Following the ranks, list all the tuned percussions. In planning your wiring always start the rank on its lowest note and wire the notes in ascending chromatic order. If any rank or tuned percussion begins on a note other than "C", be sure to note this on form CRL.I as the example indicates.

Example: Harp, 49 notes starts on Note G, octave 1 of the keyboard.

All the examples of rank listings reference octave 1 as the first octave of the KEYBOARD. Therefore; C-I would be 8' C as referenced to the manual keyboards. C-0 would be 16' C, C-00 would be 32' C. This may be confusing to those used to identifying pipes as CCCC, CCC or CC, etc. but please follow our guidelines when listing rank octaves, especially the starting note octave of the rank.

TYPICAL INSTALLATION WIRING EXAMPLE

The overall Appendix will give you a good idea of instrument wiring and listing requirements. Many of the wiring diagrams also reference to the wiring sheet listings. You should spend some time studying these reference diagrams and listings before you begin to layout and wire your system.

RANKS VS. TUNED PERCUSSIONS

All tuned percussions should be listed in the same manner as ranks.

Tuned percussions should be listed on form CRL.1 just as you did the ranks. If reiteration is desired on any or all of the tuned percussions (Xylophone, Glockenspiel, etc., individually programmable reiteration controllers will be provided in the system software. You must provided a stop switch called PERCUSSION REIT for general reiteration of ALL tuned percussions, or individual REIT tabs for the instruments you wish REIT to control. Each note may be individually controlled for rate and duty cycle. This means you will have a different controller for each tuned percussion in the instrument. If you desire this feature, you need not leave the instruments original mechanical reiteration contacts in the circuit. Wire the primary magnet directly to the OUTPUT board bypassing the REIT contacts.

NON-TUNED PERCUSSION REITERATION

Non-tuned percussions (toy counter traps) should be wired with the original mechanical reiteration contacts intact.

TREMULANT, TRAP, AND EXPRESSION SHUTTER WIRING

TREMULANT stop controls may be wired to the OUTPUT boards individually. If several trems are wired together in parallel, one connection may be wired to the Output board controlling them providing the total sum of current drawn by the parallel primary valve coils does not exceed 500 mA (l/2 Amp), the total current handling capacity of the magnet driver IC. If the sum of current is close to 500 mA, the remaining seven pins of the connector MUST NOT be used because this current is continuous while the stop is on. Traps are wired in a similar manner. If one OUTPUT board control line activates several traps, you must insure that the current will not exceed 500 mA. Low current (less than 500 mA) relays may be wired to the OUTPUT board to control heavier loads.

Remember, you must not exceed 500 mA total per 8-pin connector.

Expression swell shades are wired to the OUTPUT boards one by one in order. On the form provided, you should indicate any special progression of the shades as the pedal is advanced.

Example: The first pedal contact should open shade #1. The second pedal contact keeps shade #1 open and adds shades #2 and #3. The third pedal contact keeps shades #1, #2 and #3 open and adds shades #4, #5 and #6, etc.

Once you have planned the wiring locations of the expression shades, trems, and non-tuned percussion, be sure you indicate the final wiring on your listings.

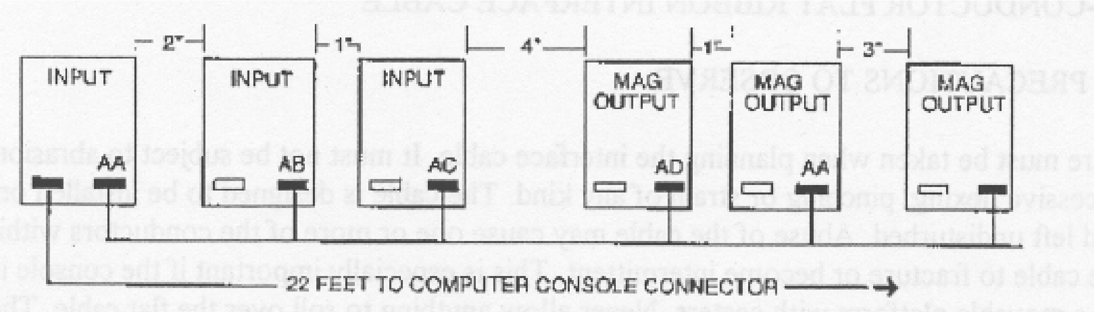
There are no OUTPUT board wiring requirements for the potentiometer or roller crescendo pedal as all crescendo operations are controlled and carried out internally by the computer. The only exception to this is if you wish to have indicator positioning lights or LEDs.

NOTE! If you have a particular crescendo order in mind, indicate the sequence on the form provided. You may always add to or modify the progression once the system is up and running. (See pages 21 and 22 in Appendix).

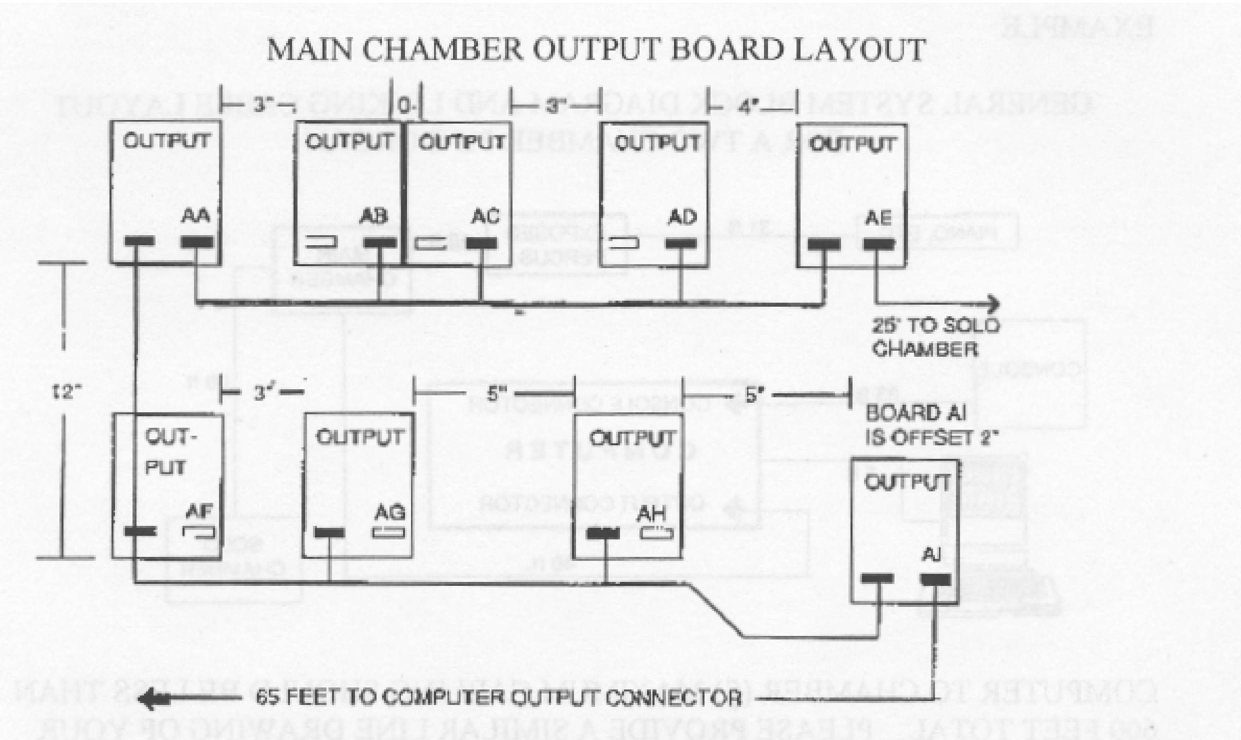
COMPUTER TO INTERFACE BOARD WIRING

Special "daisy-chain" flat ribbon cables and connectors must be made up for each system. Because we do not know the actual locations you have selected to mount your INPUT and OUTPUT interface boards, you must generate these ribbon cables yourself. The following pages provide examples and diagrams of these requirements. When you make these cables, you will need to check the continuity of the cable and also test for inter-pin shorts. We sell a special cable tester for this purpose along with two adapter cables to adapt the 26-pin connectors that we use to the 25-pin “D” style connectors that the cable-tester uses. Shorts within the cable can instantly blow the sensitive digital chips used in our boards.

CONSOLE INTERFACE BOARD LAYOUT AND MEASUREMENT EXAMPLES



The above example clearly indicates a proportional in-line layout of the CONSOLE INPUT and OUTPUT boards. Also indicated above the boards is an accurate measurement between boards for fabrication of the CONTINUOUS inter-connecting cable. When the cable is made up it will follow the route you provide in YOUR drawing.



The example clearly indicates a proportional IN-LINE and OFFSET layout of the MAIN CHAMBER OUTPUT boards in two rows. Indicated above each board is an accurate measurement between board and between rows (12") for fabrication of the single continuous "daisy-chain" inter connecting cable. When the cable is made up, it will follow the route you provide in your drawing,

NOTE! The example has indicated that board AI is offset two inches down from the other boards. Your drawing should also indicate anything out of line.

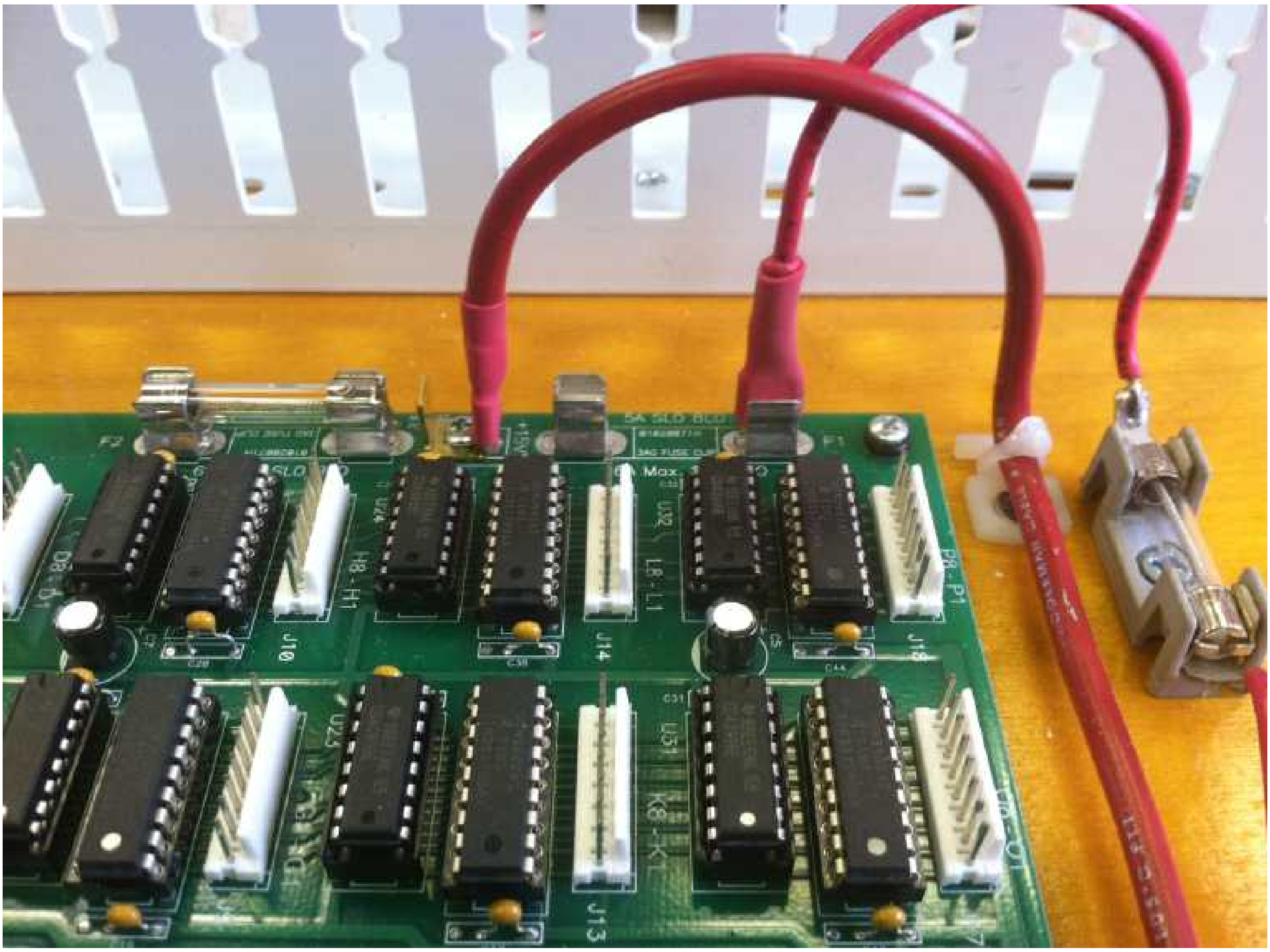
26-CONDUCTOR FLAT RIBBON INTERFACE CABLE PRECAUTIONS TO OBSERVE:

Care must be taken when planning the interface cable. It must not be subject to abrasion, excessive flexing, pinching or strain of any kind. The cable is designed to be installed once and left undisturbed. Abuse of the cable may cause one or more of the conductors within the cable to fracture or become intermittent. This is especially important if the console is on a movable platform with casters. Never allow anything to roll over the flat cable. The cable must not be run under carpets where heavy foot traffic will cause wear. This should go without saying, but never tack, nail or staple the interface cable to any surface. You may use tape to secure the cable down, but you MUST NOT tape the interface cable around long runs of metal conduit or to metal surfaces. The flat ribbon cable is not designed to be run or pulled through metal conduit.

6. Split Output Board Wiring

There are some situations where you may need to drive some output signals from a different source than the normal magnet supply. Perhaps a different voltage is required for some console indicators. Other times you may be using a Crome Organ Circuit Breaker for console magnets and using the same source (the circuit breaker) for indicator lights is not suitable because the steady current will trip the circuit breaker. Rather than using a whole board for these few signals, you may have an output board that is using only half of an output board or less.

Carlton Smith (Carlton Smith Pipe Organ Restorations) has come up with an easy way to split the output boards into two halves with each half being driven by a separate voltage source or controlled source. The following two photos show how this is accomplished without the need to physically modify the board.



Note the larger red wire on the left will power the two leftmost rows of 32 pins each. This corresponds to pin addresses A1 thru H8. The smaller red wire connected to the external off-board fuse holder will power the two rightmost rows of 32 pins each. This corresponds to pin addresses I1 thru P8. This allows separate power sources for each half of the board.