C600 Theatre Organ Project
Part-1

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Introduction

This article, in several parts, describes the building of a theatre organ using Hauptwerk virtual organ software. It covers the entire project from obtaining a suitable console, how it was built, and how to set up the Hauptwerk software. While it describes one particular organ, the principles can be applied to other organ projects. Hopefully, some of the problems encountered can be avoided by other builders. The organ described is eventually intended to be installed in a home so has only a moderate audio capability, but for the first part of its existence has been used as a test bed for Classic Organ Works while exploring the problems associated with Hauptwerk software. As this is an on-going project, some of the latest information may not have been included and some information may be questionable. If the reader notices any errors, I would be pleased to know about them.

Acquiring the Beast

Some time during 2001, Classic Organ Works was offered a Devtronix theatre organ by a private individual in Etobicoke, Toronto. Devtronix organs had been supplied as kits and Jim Anderson, then a member of the Toronto Theatre Organ Society, had built one around 1979. Unfortunately, he had died during 1999 and his widow died two years later. The family then wanted to sell the house but lurking in the basement was this humongous white organ console. It appeared to be worth a lot of money so they tried offering it for sale to several churches but none wanted it. Finally, they found out about Classic Organ Works and their technician Arie Vandenberg went along to assess it. It was not in good shape, being barely playable and with obvious signs of damage to the speaker cone surrounds which had disintegrated with age. He reported back to Classic and informed me about it, knowing that I had long been looking out for a secondhand theatre organ console. So I went with him for a look and listen, and, as he had said, the sound was pretty awful and half of it did not work at all. The keyboards had seen better days and were uneven and noisy. There was also a lot of other stuff with it in the form of speaker cabinets and a huge mobile cabinet with all the electronics connected to the console via an enormous umbilical cord of multicore cables.

However, the console was just the kind of thing for which I had been looking for several years. It was a Devtronix French-style, three-manual, Paramount console in white with gold trimmings and a double-row of tabs in a horseshoe. This model was a 90% scale of a WurliTzer console. It had been nicely made although it was showing signs of wear and tear. I was not interested in the electronics parts of it or the speakers as I could acquire those kinds of things myself, but a properly-built horseshoe console with all those tabs was worth having and would save an enormous amount of work for which I did not have facilities. Concealing my excitement, I discussed the possibilities of removing it with the family and made them an offer that was quite a bit lower than their asking price, but, as they had not had any interest from elsewhere, they had lowered their expectations. After some haggling, a deal was agreed upon for the whole lot and a deposit paid. We would return with a van in a day or two and pay the balance at the time of removal.

Removal was easier said than done due to a very narrow flight of carpeted steps (with an iron railing) from the basement complicated by the exit being at right angles through a door at the top. Fortunately, the console came apart with the top simply being sat on pegs in the base unit. Luckily it had not been completely built in situ! All of the electronic equipment was in a separate wheeled cabinet some four feet wide by four feet high by two feet deep that comprised about ten wooden shelves with boards mounted on them in clips. There were masses of transistors and literally miles of wire. Several large-diameter multi-core cables led into the console and there were ten speaker cabinets in various sizes, including a Leslie cabinet and a high-frequency horn, as well as several power amplifiers.

Arie and I set about dismantling the system and carefully took the console apart, disconnecting cables that went between the upper and lower halves. It was extremely heavy with all the electronics inside so we disconnected and removed whatever we could. We could have gone through some double doors via the back garden but the route was tortuous and there was a narrow gate en route, so we elected to go via the stairs and out through the front door. We tipped the top part on its end and shunted it up the stairs one at a time to the top, being careful not to damage the trim. There, we spun it round ninety degrees on the carpet and shuffled it sideways through the basement doorway (having taken off the door). It just made it! The trip to the van was relatively easy. The base gave no trouble but the electronics cabinet suffered by being tipped on its end — the frame collapsed and all the boards ended up in a mess at one end, breaking off many wires. Undaunted, we carried it up the stairs, spun it round, and carted it off to the van. The speakers, pedalboard and bench followed with no trouble. The red-carpeted platform was a problem as it was too large to get into the van although it would easily pass through the basement doorway. It was agreed that the family would deliver it to Classic by open truck on a fine day.

Having got the organ into the van, I paid the balance and was informed that there were several other 'organy' items which I might as well take as they would only be thrown away if I didn't. These included some Wurlitzer posters, about twenty organ LPs, old theatre organ magazines, several useful reference books and all the schematics, invoices, notes and other details about the organ, including original Devtronix information and console plans. Some of these things were collectors' items and I accepted them gratefully.

What to Do With It?

Back at Classic, the system was thoroughly inspected and it was decided that there was little point in trying to resurrect the electronics as, not only was it a dated system, but also most of it was in bad shape anyway and had suffered in the move. It would have taken an awful lot of work to put it back together and the tonal results would not have been all that good when it was done. In its day, however, the Devtronix organ was among the best electronic theatre organs. Modern organs, with sampled tones, and computer controls, easily outclass the technology of twenty-odd years ago.

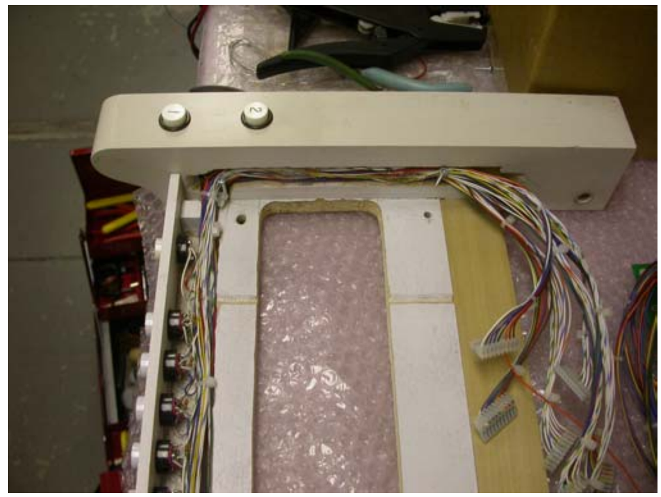
Accordingly, the decision was made to gut it completely, leaving only the keys, tabs and pedalboard. A state-of-the-art Classic combination-action control system would be used that would provide many desirable features hitherto almost impossible to implement. Whatever tonal system might be used could be thought about later

The Beast, having been gutted, resides at Classic Organ Works. Keyboards are missing. The pedal lamp uses an old aerosol tin.

when the console had been made to work as all would use the same kind of serial data stream. The various boards were removed, all inter-connecting wiring cut, and the boards sorted out according to function. When that had been done, they were cleaned up and offered for sale via the Internet to several organ-enthusiasts' lists where there were bound to be previous owners of Devtronix systems requiring spares or extra boards to expand their organs. After a while, all the boards had been disposed of except the reverberation unit and power amplifiers that could probably be used in a new system. The monetary return from the sold boards compensated for most of the original outlay.

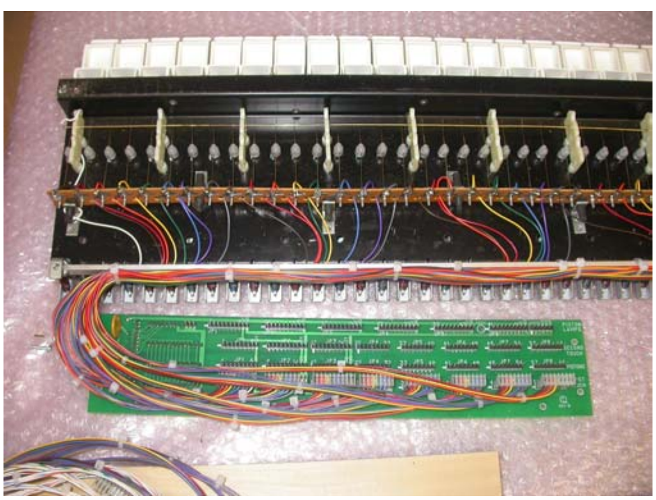
Keyboards

The console was cleaned up and all wiring scrapped — it amounted to quite a pile! Most of the inter-connecting wiring was old Post Office 26-gauge solid copper wire as used in telephone systems and would not be suitable for use on the crimped connecters that were going to be used. The keyboards were inspected and found to be plastic Pratt-Reed types in rather rough shape with many rubber bushes perished. These limited the travel of the keys at both up and down limits and had gone hard, causing the keys to 'clank'. Because these bushes had perished at different rates, the keys looked uneven and were noisy. However, the second-touch buffers were mostly quite good, which was a relief as they were obviously a special shape and would be hard to replace. New rubber bushes were located at Organ Supply Industries in the US and enough ordered to rebush all the keys, together with the special silicone lubricant that would prolong their life. As it happened, only the lowest keyboard (Accompaniment) was bad enough to require all its bushes changing. The other two keyboards were usable as they were, which was a relief as to change the bushes require removal of all the key tops and springs so that the rubber bushes could be individually pushed onto their pegs — quite a tricky job when they had been lubricated as the pegs had a U-bend in them. It was decided to leave the rebushing of the other two keyboards to a future date after the console had been made to work again, when the shortcomings of the keys would be better apparent.

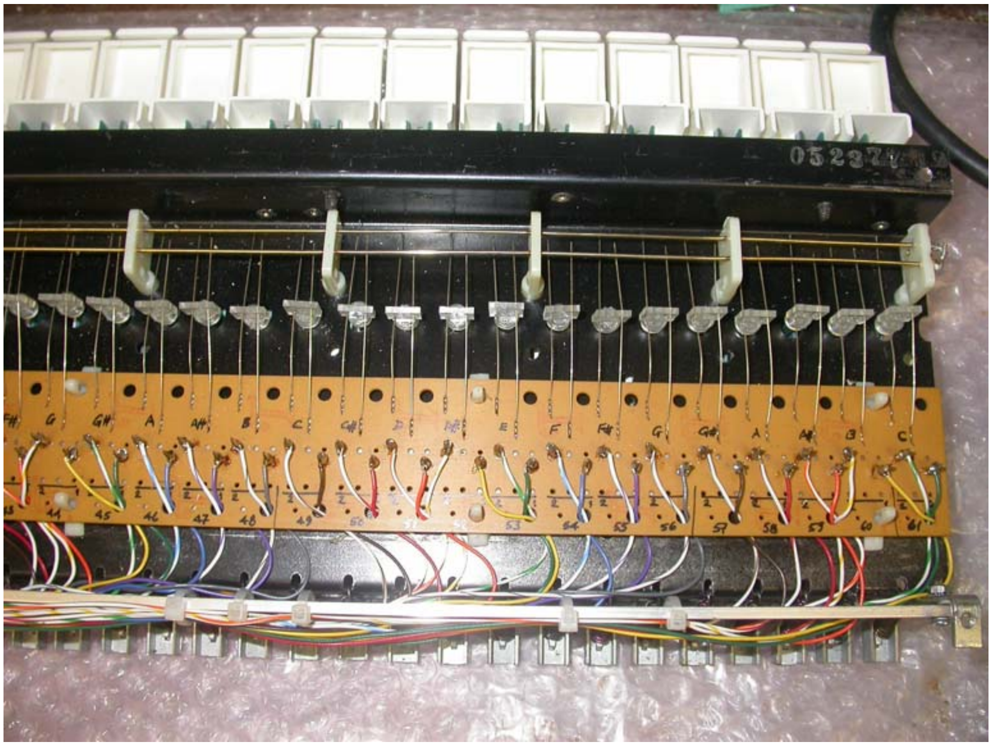


The Accompaniment keyboard base and pistons.

Two of the keyboards had second-touch contacts and extra bushes to give the extra pressure at the bottom of the key travel. Each keyboard used springy wire contacts that pressed against silver-plated rods running the length of the keyboard — two sets for second touch keyboards. The silver-plated rods were in a very oxidized condition and obviously had not been cleaned in years. A preliminary cleaning of one showed that the contacts were usable although inclined to be intermittent. As built, that would have been a major problem since the contacts switched very low-level signals at relatively low impedances where contact resistance was a major factor, but with the Classic sys-



The Solo keyboard



Underside of the Accompaniment keyboard showing the two sets of contacts for first and second touch and how the wiring was laced to the aluminum strip at the rear.

tem, a small amount of d.c. current was switched by the contacts and this would help to keep them clean. Not only that, but the system contains anti-bounce software that eliminates all but the worst contact-bounce problems.

It was apparent that there was little room under the keys. There would be no easy way to install diodes so that the keys could be matrix-wired. That would also require the rods to be separated into twelve-note (octave) lengths and there were insufficient supporting pillars for these shorter pieces. It was very probable that such pillars would not be obtainable some twenty-five years after they had been manufactured so it was decided to use wire-per-contact wiring with some small Classic Switch Input Boards and design an interface system that would mount on the back of the keyboard to save having masses of wire to the control system.

Accordingly, an interface mother board was designed that would use the same switching boards (type SIB-4) that were used in their 'Grey-Box' (CCU) control systems. The new interface board would be fitted vertically at the rear of the keyboard but set back on a wooden spacer and could be no taller that 2.5 inches (the height of a keyboard). Three 64-input SIB-4 boards would be used — one for First Touch, one for Second Touch and one for Piston switches. In addition, an output driver board (OUTN-1) would be used to drive piston lamps. All control pistons would be fitted on the piston rails rather than on a panel, so piston lamps were a necessity.

With this capability, it was decided that all general and divisional pistons might as well be illuminated types and new piston rails were planned. Since the switch-input boards had 64 inputs, there could be up to 32 double-touch pistons and suitable piston layouts were derived. All these input boards provided multiplexed 8-bit data outputs and had a common binary addressing scheme so that the connections to the control system would be shared and therefore minimal. The four boards on each manual would plug in from the rear. The top (Solo) manual did not have second touch so one board could be omitted. The same system could be used for the pedalboard that currently did not have second touch either. In this case, the pedal interface would be mounted away from the pedals on the back of the knee panel for better access. Lamps were allowed for on the pedals in case illuminated toe pistons were ever fitted. The use of an OUTN-1 board, although not principally a lamp driver, was so that it would be the same type as those used to drive stop magnets. It did mean, though, that each piston lamp had to have its own series resistor to limit in-rush current (to prolong its life) because there were no such resistors on the board. An OUTL-1 might have been a better choice as it has these resistors.

The keyboards were not a good design as they were mounted on half-inch particle board used as a base under all the contacts. Consequently, there was no way to adjust the contacts once it had been assembled. Therefore, a large aperture the length of the keyboard was cut in each base for access from beneath. The three keyboards assembled into a single unit with the use of triangular wooden brackets at the sides that allowed each keyboard to be pivoted upwards for adjustments. However, there was a snag with these brackets because the aperture through the front of the console was no wider than the key cheeks and the brackets would not go through as well. Accordingly, the brackets were replaced by custom-made metal ones mounted inside the cheeks. All seemed well and the set of keyboards was installed temporarily to see what problems there might be. It was immediately apparent that the keyboards could not be raised individually because of the proximity of the stop tabs immediately above the top keyboard unless the entire assembly was pulled forward — and it would have to be pulled so far forward that it would be off the keybed. It was decided to leave that particular problem until later and continue with wiring. The keyboards could at least be removed and, if the cables were long enough, as a working entity so that adjustments would be possible. Failing that, extension cables could always be employed.

Pistons

The old piston rails had been removed and new ones were to be made with many more pistons that could be incorporated into the Classic control system to use its additional facilities. This involved rebating out the particle board base along the front edge to clear where the new pistons would go. At the same time, the key cheeks had their wiring grooves considerably enlarged to accept more piston wires because there were more pistons, many of which would also have lamps (none of the original pistons were lighted types). While that was being done, additional holes were bored in the top of the key cheeks to allow for two effects pistons on each one. Thus, there was the maximum capability of 28 pistons on each rail. The positions of the five mounting screws dictated that the piston layout be in four groups of seven at one-inch intervals after the outermost screws had been moved closer to the cheeks. This is one-eighth of an inch less than the usual standard for piston spacing but was deemed to be acceptable. Again, there was little room to rewire the pistons as a matrix so they would have to be wired wire-per-switch

fashion. The lamps would have to be done that way in any case as there was no place to put lamp-driving circuitry under the keys. New pistons were ordered from Syndyne and engraved at Classic. Plans were made to include the second-touch capability of these Syndyne pistons. The old pistons were reused where possible to save costs although their colour and engraving style did not quite match the new ones.

An aluminum lacing bar was installed along the rear of the each keyboard behind the springs, to accommodate all the new wiring. The wiring would plug into the motherboards using single-in-line insulation-displacement connectors that did not need the wires to be stripped or soldered. These were MASCON through-type connectors where the wires could be installed one at a time with a special tool and looped on to another connector if necessary. One keyboard was started upon.

At this point, work slowed to a crawl due to other demands on my time and the console languished in the workshop at Classic until one day they decided that they needed the space. It was shipped back home and put into the garage — there being no room in the basement. There it sat, gathering dust and mouse droppings, for about three years. There was another consideration in this delay, though, which was that the then-current Classic computer control board (CCC) lacked a few outputs thought to be necessary for such a large console. Although even larger church organs had been made, they did not need as many odd outputs such as extra strobes for things like second-touch keyboards. The CCC was about to be redesigned and would then accommodate all the requirements for a large theatre organ.

Virtual Organ Software

Meanwhile, technology marched relentlessly on and MidiTzer™ came on the scene. This was investigated and seemed to be of interest, especially as it was a free program. It worked on a standard PC and comprised a two-manual, eight-rank, virtual WurliTzer theatre organ modeled entirely in software, and using sound fonts to regenerate the sampled sounds of pipes. There was a screen display of the console and it was controlled entirely by MIDI signals from whatever keyboards and stops, pistons, etc, could be supplied. It was definitely a possibility. This system had been demonstrated at the American Theatre Organ Society's Fiftieth-anniversary Convention in Pasadena during July 2005. Classic Organ Works supplied the keyboards and pedalboard and I attended. The MidiTzer system was very much a possibility for my organ. There were some limitations as to what it could do, such as not being able to voice each note, but that would not matter at this stage.

Somewhat earlier, though, Hauptwerk™ had arrived and been tried out by Classic as being more professional — one had to buy the program but it offered much more by being able to completely emulate a large church organ. It used digital sampled pipe sounds with long samples. This would seem to be a better system but it was only for church organs. Then, early in 2006, Hauptwerk announced that they had a two-manual, eight-rank, virtual Wurlitzer theatre organ in the works with samples provided by Brett Milan Audio from the Virginia Theatre WurliTzer. Furthermore, a nineteen-rank, three-manual virtual WurliTzer was being planned. Hauptwerk also had the possibility that one could use one's own sample sets and therefore make any kind of an organ.

This news galvanized Classic into thinking anew about how to incorporate it into an organ as the existing sampling technology was becoming obsolete. It seemed possible to use Hauptwerk to entirely replace professional sound generation equipment in a small organ for a far lower cost. There was a theatre organ console doing nothing in my garage, so why not redeem it and breathe some life into it once more?

A deal was reached whereby I would build this organ at Classic using Classic parts and buy them at cost price, working on the organ in my own time in the evenings and weekends. In return, Classic would use the console for development and possibly demonstrate it at shows in order to generate enthusiasm for the Hauptwerk approach. After a suitable period of time, I would take the organ back home and it would be all mine. One such show was looming and that was a company Open House. As the date approached far too rapidly, it became necessary to work on the console during working hours as well and it became possible to play it, with limitations, only a day or two before that deadline.

Some time after the console had been built, Hauptwerk announced the imminent availability of a 31-rank, three-manual, theatre organ. This was going to be just what we wanted! But, until then, the organ had to be made to work and much had to be learned about Hauptwerk.

Classic Software

Much thought was given to writing the console software program. It was based on work recently done by myself for several theatre organs, including the 3/30 WurliTzer in the Grand Rapids Museum and Canada's largest theatre pipe organ in Kingston — a 3-manual, 28-rank Kimball. These all used a recently-revised program with far more capability than there had been when my organ had first been contemplated. As a result, some more pistons had to be ordered and engraved for extra controls. After much sweat and head-scratching a simplified test version of the software was produced.

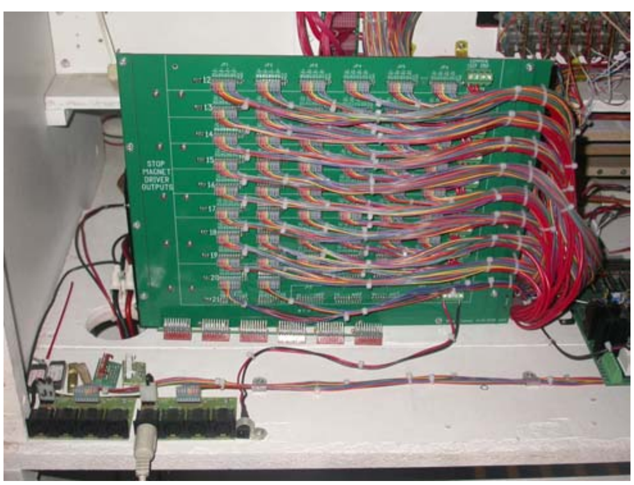
At this point, the logical thing to do was to make the keyboards work. The fronts of their bases had already been rebated out so that many more pistons could be fitted. Then, the grooves inside the key-cheeks had been enlarged to accommodate more wires. It took a long time before they were usable because the keyboard base and cheeks were glued together meaning that most of the work had to be done with a chisel because it was not possible to get a router near the ends.

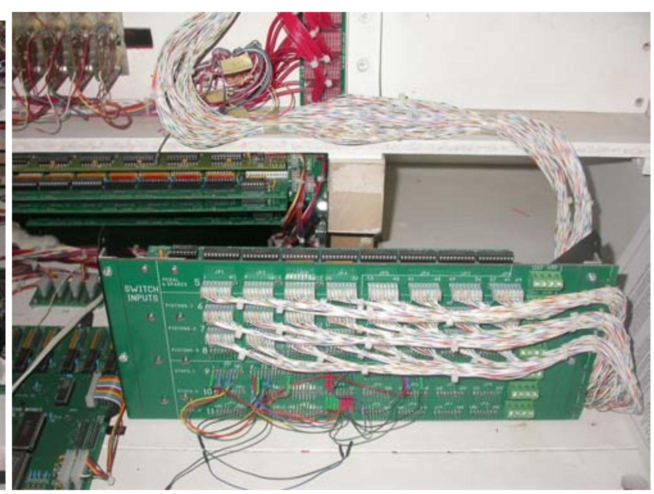
I set about wiring the keyboards in such a way that they could be removed from the wooden base if necessary without unplugging any connectors. The contact springs and rails were cleaned up. Next, the piston rails were wired with their wiring placed in the key cheek grooves. Care was taken to ensure that no wires would get in the way of keys by hot-gluing them in place. It soon became apparent that there was no room for all the piston wires if the Syndyne second-touch pistons with lamps were to be fully used, despite all that chiselling. It was a shame, as I had already had them engraved and installed, but the second-touch capability had to be dropped. As each keyboard was completed, the wiring was tied to the lacing bar that had been added at the back. The keyboard was then tested.

Eventually, the complete set of three was able to be hooked up to the test facility using shared cables looped from one to another. Some problems then became immediately apparent that had not been noticed when a single keyboard had been tested. The keys were intermittent and their interface outputs depended on how many other keys were being pressed at the same time. It did not matter on which keyboard these notes were being pressed. The pistons were similarly afflicted and their identifying numbers were completely wrong in some cases. More contact cleaning improved matters slightly but the only way to improve matters seemed to be to unplug extra keyboards or shorten all the cables to the test set. This was going to be a major problem unless a cure could be found as they could not be any shorter in the console. This problem looked like being due to excess capacitance on the cables but that could not be the case since other organs had worked fine with longer cables. How were these keyboards any different? After some thought, it was realised that all the interface boards were being driven simultaneously by the addressing signals and that they had pull-down resistors which, when paralleled, were comparable in value to the pull-up resistors in the CCC outputs. As the signals emanated from open-drain CMOS devices, their outputs could never rise to the supply rail voltage and the effect would be worse with more boards (eventually up to eleven on this organ, causing the highest level to be little more than half the voltage rail). All the organs that had used this system before had used only a few such boards in parallel with little effect on the voltage levels. Such a low voltage swing would never operate the CMOS input devices in the control board as it would be nowhere near great enough to exceed the input voltage threshold. This was indeed the case so the pull-up resistors on the CCC board were reduced in value to give a greater voltage and that solved all these keyboard problems.

Planning the Console Wiring

Having got the keyboards to work reasonably well, the next job was to decide where and how to place in the console all the printed-circuit boards that were necessary. An over-riding consideration was that the console had been built in two pieces — top and bottom — so that it could be dismantled to pass through standard doorways. Consequently, there was a shelf formed by the keydesk that extended all the way to the back and became the base of the upper section. Unfortunately, the ‘Grey Box’ control system (CCU) would not fit above this shelf, being too tall, neither could it go sideways behind the keyboards, and it would not be convenient in the lower section, but it used small boards that plugged onto the rear of its front panel (a CCIO-3). Normal discrete boards were large and would be untidy, being all different shapes and sizes. The solution was to use the CCU front panel and bus-strips from the ‘Grey Box’, chop the panel in two and not use the metalwork. Then all inputs would be on one half of the panel and all outputs on the other. The outputs needed a high-current feed as they had to drive all the stop tab magnets so would have to be near the power supply and wired with very thick wire for their power so as to minimize voltage drops. The output panel would be placed at the right side of the console because there was a shelf for audio stuff in the way on the lower left side where the power unit could have gone. Power wiring for the input section need not be so thick so that could be installed on the left side. The shelf could be used to support the computer necessary to run Hauptwerk. As several other parts of the system required low-current feeds, a low-voltage distribution system was included for the left side. Thus the main power supply feed was as short as possible and had only one set of terminals enroute to the magnet drivers for minimum voltage drop. Some old keyboard mounting brackets were modified to hold the two pieces of CCIO-3 panel board yet allow them to be hinged down for access to the plug-in boards behind. All wiring would be to the front of the two panels (facing the rear of the console), except for the power and common control signals that would go behind. The console computer board (CCC) could fit between these two panels so that its wiring would be as short as possible to all boards. There was little else required in the upper section of the console — look inside and you will wonder where all the money went to!





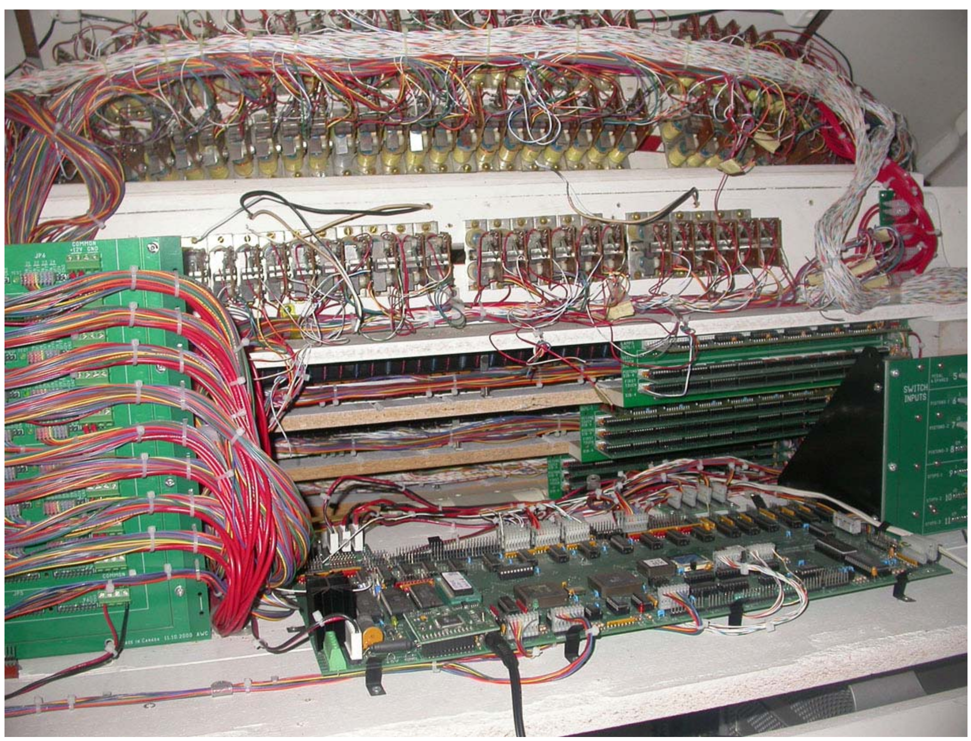
The Left picture shows the Stop Magnet Driver Panel and the MIDI In/Out interface.
The Right picture shows the Stop Switch Panel with the MIDI patch-panel at the bottom.

Wiring the Console

Having sorted out the keyboards, main power distribution and board positions, the next task was to wire up the tabs. On past jobs it had sometimes been noticed that some general and divisional piston combinations would unexpectedly turn on the odd stop tab switch input — most annoying if it happened to be something like a Wood Block or Chimes! This was thought to be due to the high-current pulses during stop-magnet activation directly affecting the magnetically-operated reed switches in the tabs. The heavy currents in the common wires generated magnetic fields strong enough to trip the nearby switches directly and their slight hysteresis would not be enough to deactivate them because there were steady magnetic fields present from nearby magnets used to give the tabs their latching action. In other words, they were always on the point of operating due to the presence of magnets so that it would not take much extra magnetic influence to make them close their contacts. Removal of that extra influence might not be quite enough to let them turn off again. The cure was to separate the switch wiring from the magnet wiring and not to have a large common feed going up to many stops. Instead, the 12-volt feed was split via junction boards close to the supply so that each stop tab would have its own supply wire at a modest current (about a half-Amp only as they were 26-ohm magnets).

This normal-sized wiring (24 AWG) would be installed first and a feel established for how to install all the other wiring for the stops — bearing in mind that the various panels would need to hinge down so that the wiring would have to be in fairly loose bundles near the pivoting points to avoid undue stress. All possible spare stops would be wired in (and their wires tied back) so that 192 such feeds were required. The console actually has only some 164 stops installed but there is room for more in places between divisions. In planning the software, each division was arranged to end in some multiple of eight stops wherever possible in order to simplify the software. Hence the good number of 192 (=24x8). The system was split into two identical junction boards placed at the left and right sides of the console with 96 each spread over eight 12-pin connectors.

The first job was to clean up the tabs and remove all the old stubs of wiring. These had been made using quite thick stranded wire whose insulation melted at the slightest touch of a soldering iron and some of the wires were poked into hollow pins. This made clean removal very difficult, especially when bending over the horseshoe and poking down between tabs with a hot iron and long-nosed pliers for the wires had to come off sideways where one had the least control of the process.



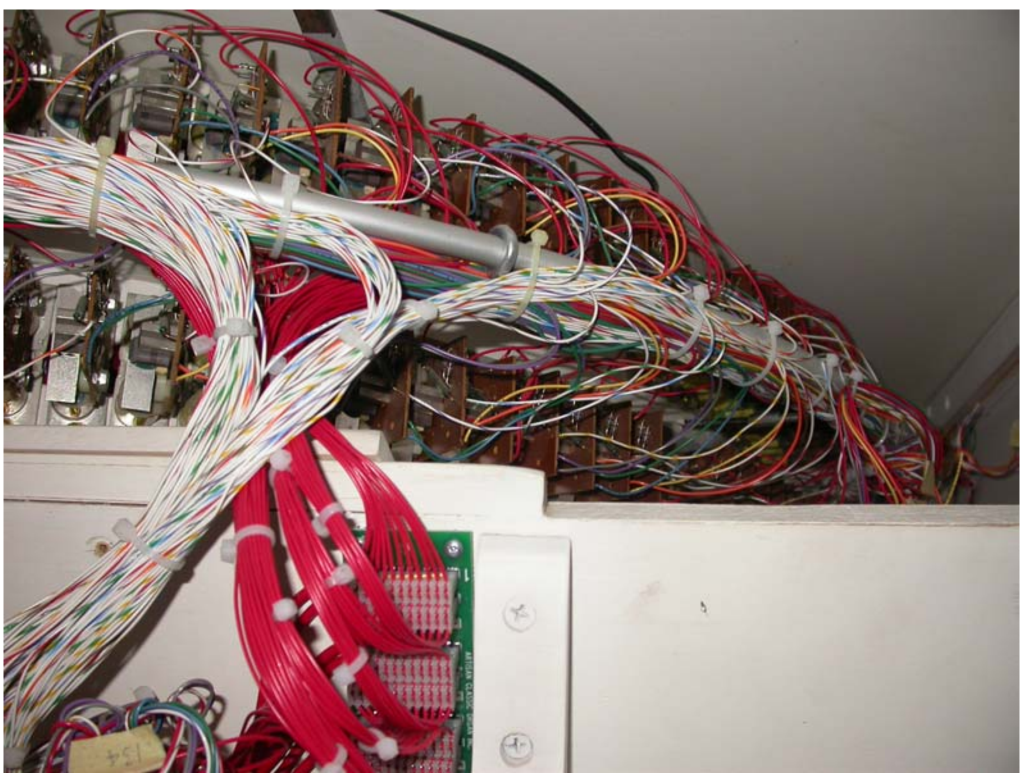
The Rear of the console. The Computer is in the centre with keyboard interfaces behind. The stop wiring support rail is hidden in the wiring. Dangling wires are for spare stops. Red wires are for 12V power. The tiny square board provides the MIDI effects.

Support Rail

After cleaning up the tabs and repairing the odd pin, all 192 common +12V feeds were wired first. Although all from the same source, they were still wired in order according to the stop list. As the wiring progressed, it was tied temporarily to the support rail by means of garbage bag twist ties as these could easily be undone and retied as wires were added. It soon became apparent that the existing support rail for the wiring behind the tabs would not be able to handle all the wiring necessary This flimsy rail had been made from some plastic-coated steel rod (curtain rail?) about one-eighth of an inch in diameter and was quite springy with insufficient mounting points.

A look in the local Home Depot hardware store revealed some 3/8-inch diameter aluminum rod in three and four-foot lengths. This could easily be bent (gradually, round one's knee) to fit the horseshoe shape and two rods joined together with a heat-shrink sleeve. The question of supporting the rods was solved by using eye-bolts that the rod would slip through and using extension threaded screws fastened into the woodwork between the two rows of tabs. All the eyebolts were installed first and the rods added afterwards. Maneuvering the rods into place through all these eyebolts on a curve was a bit tricky but was managed successfully although at times the bolts bent alarmingly.

Multiples of eight colour-coded wires fitted into 8-pin connectors made the wiring job easier. Care was taken to work in a logical order starting with the pedal department (the longest wire run) and complete one connector group at a time so that mistakes would not be made. All possible empty tab positions were wired with their wires being tied back near the stop rail in case those tabs were ever fitted. After all the +12V wires had been installed, then all the magnets were wired. Lastly, all the switches were wired and their wiring separated from that of the magnets to further avoid interaction. Only when the stop wiring was complete and tested were proper cable ties fitted. Later testing revealed that the problem of inadvertent stop operation had been eliminated — on this organ at least.



Stop wiring showing the lacing bar behind the Accompaniment tabs. Each stop has plenty of loose wire to allow it to be removed while operative. Unused stop wires are tied back. One eye bolt is visible. The red wires come from the +12V distribution. One wire per stop.

Pedalboard

This was a surprisingly good one made to AGO standards with springs under the key fronts. It was in good shape but there were no contacts on the pedalboard. Instead, the pedalboard screwed to the console in a specific place and each pedal had an adjustable magnet that moved near a reed switch mounted on the console base. The pedalboard could therefore be removed without unplugging anything but at the expense of some groveling to get at the mounting screws inside the console and that placed some restrictions on where things could be mounted inside the console. Actually, this system turned out to be not very good because the screws were difficult to align on an uneven floor and the weight of anything on the console baseboard caused the switches to move down — away from the magnets, there being no supports beneath the base. In fact, when the organ had been rewired and it came time to test the pedalboard, initially not one of the pedals worked! Much adjustment was necessary involving bending of the magnet mountings to reduce the horizontal gaps between magnets and the reed switches. These were a source of trouble too, because the magnets had been glued to little wooden blocks that, in turn, were glued to steel brackets on the ends of the pedals. Several years in the garage, as well as some twenty-five years in the house, had caused the wood-to-steel glue to come unstuck so that several magnets had fallen off. Fortunately, all but one had been found during sweeping up the garage after the console had been removed. A spare magnet was obtained and a replacement block fashioned and glued with Superglue. After this had been installed, the original was discovered under a box in the garage! It was retained as a spare in case some other magnet fell off.

So now we had workable pistons, keys, pedals and tabs. A proper vacuum-fluorescent display was made and installed beneath a bezel that covered a large hole in a sloping wooden panel alongside the keycheeks where some AC switches had been removed. It was a little difficult to see, being off to one side, but did not detract from the general appearance of the console.

Working at last! The 2/8 Virginia Wurlitzer is on the screen.

Next Time!

By the time that the stop wiring had been finished, some four thousand feet of 24 AWG stranded hook-up wire had been used and its weight is considerable. Incidentally, the connectors used were MAS-CON types in which each wire is connected with a tool that pushes it into the pin so that stripping or soldering were not necessary. Unfortunately, the tabs themselves, being old ones, required wires to be surface-soldered (no holes) and they were not easy to get at, especially the lower row as the rows were not independently mounted. This part of the organ was by far the most difficult and time-consuming.

Although wiring of only four wires for each of 192 stops does not sound particularly arduous, it took the better part of a month because the stop rail was left in the console. In hindsight it might have been better to have taken it out and wired everything on the bench. However, that would have meant wiring from the stops to the connectors with consequent guesswork on the lengths of the wires, resulting in an untidy installation. It would also mean sorting out the wires before terminating them back in the console — a great source of possible errors despite colour coding. It was deemed better to wire each connector fully, tie it in place and then solder the eight wires to the tabs where the lengths could be easily adjusted one by one. Several inches of spare wire was left behind each tab, principally to make it easier to take a tab out as a working entity, but also as it was easy to adjust the wire lengths and lose any excess at the support rail. Only when one connector was completed, would another one be started.

Only one wiring support rod was used — between the two rows and right round the horseshoe. It might have been better with two, one behind each row. Although the two rows are not separable on this organ, that would have helped if they had been. Either way, it would have reduced the thickness of the wiring bundles. Of course, if the rods had been behind the stops, you would not be able to remove the stops conveniently unless the rods were placed well back so perhaps the present way is not so bad after all.

Another wiring improvement might have been to design the control system with the stops wired in sequential order around the lower horseshoe rail first and then around all the upper one and sort it all out in software afterwards. The actual stop functions would still be in their proper places but this would have made the wiring somewhat easier to do. In this organ the stops had been allocated in order by divisions so that all the pedal wiring on both rails would be completed first, then each manual in turn, with the backboard stops last. It was more logical from the software point of view and easier to understand in the wiring lists, as well as making each division in a single chunk on one, or perhaps two, boards. But it makes no difference to the computer operation except that it might be trickier to identify where the various divisions stop and start if they are split into several groups of stops. It might also make things more difficult when assigning console stops to the virtual organ stops.

If you would like to know more about this project, contact Classic Organ Works at 905-475-1275 or 1-888-812-9717 and ask for me. Alternatively, and preferably, e-mail me at AWC@organworks.com or organawc@sympatico.ca