Artisan Application Note
Allen Stop and Draw Knob Modification
for use with Artisan Input & Stop Driver Boards

1.0 Purpose

Many older Allen consoles have Stops (SAMs) and Draw Knobs that have onboard driver electronics that are designed to work with the Allen Capture Electronics. As originally configured, they will not work with Artisan Input & Stop Driver boards. However, they can be modified to operate quite well by modifying them to industry standard electrical configuration. The modification to the stops themselves require less than 10 minutes each after relocation to the work bench.

These procedures were developed during conversion of an Allen 632-3 to the Artisan Control System and Artisan Sound Engine. This conversion was done before the new type surface mount boards were available, but the new surface mount boards should make the task easier. The new Input & Stop Driver boards are smaller and have push-down --- insert wire --- release, connectors that make the wire connections very easy.

2.0 Applicability

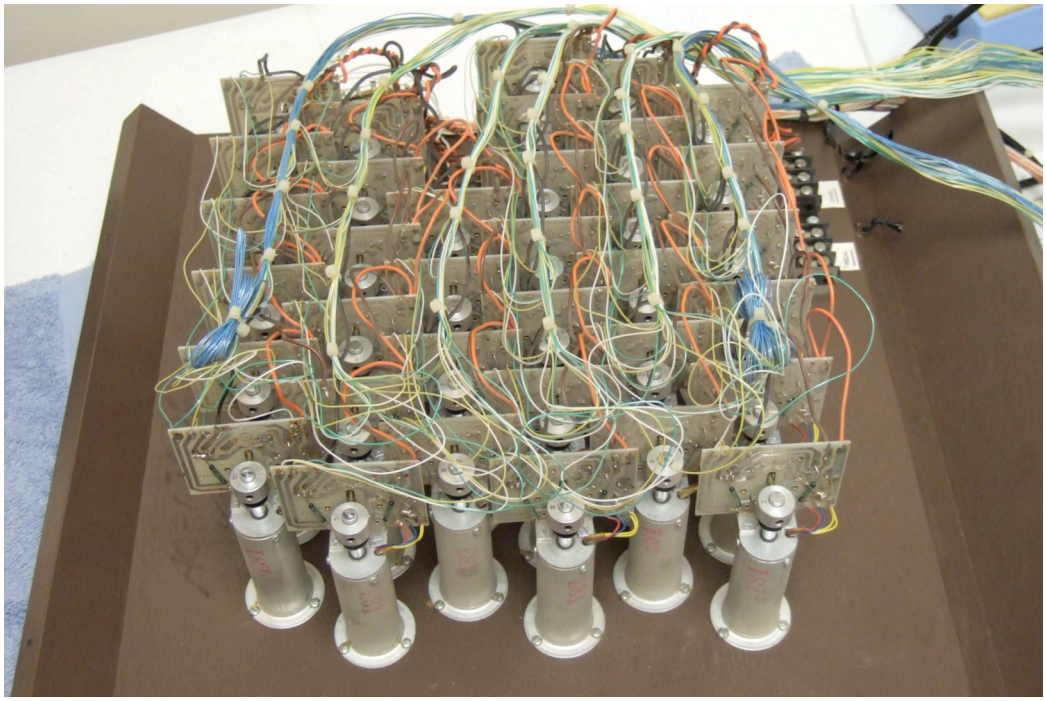
These procedures are applicable to all Allen Organs that use similar stops and draw knobs. While the Allen 632-3 is shown, these procedures have also been successfully used on an Allen 305 Classical Organ and an Allen 920 Theater Organ.

Allen 632-3 “C” Console Before Conversion

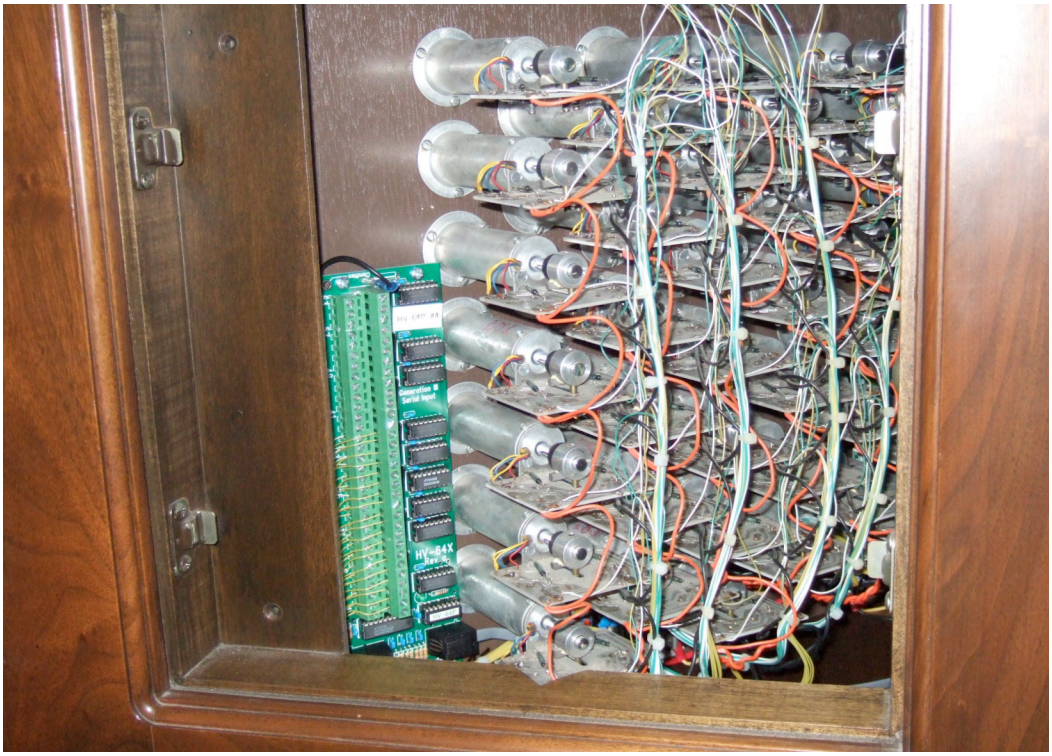
The 632-3 has both Draw Knobs and Rocker type SAMs. Both will require modification

3.0 Stop Jamb Modification

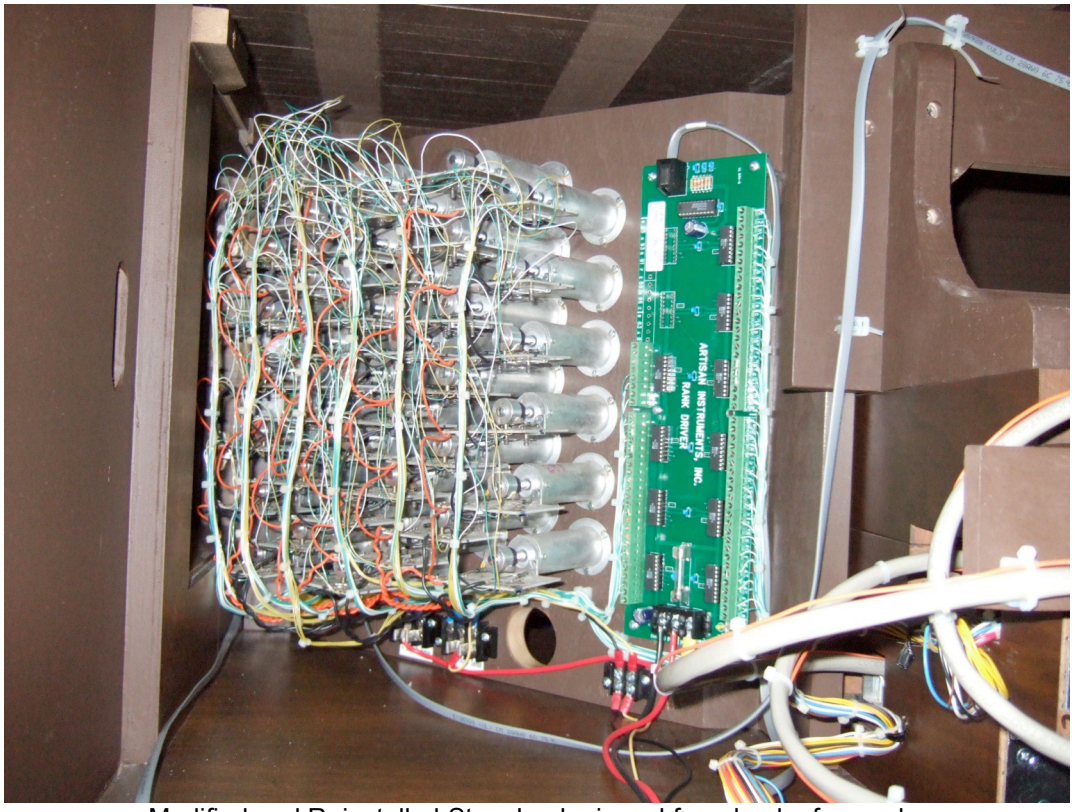
The Stop Jambs can be removed, and Back Rail can be removed from the C console as a complete assembly, and modified on the work bench. The next three pictures will give you an idea of before and possible after modification configurations.



Allen 632-3 Stop Jamb Before Modification



Modified and Reinstalled Stop Jamb viewed through side access panel.
Note the HV-64 Stop Sense Input Board Installed on Jamb

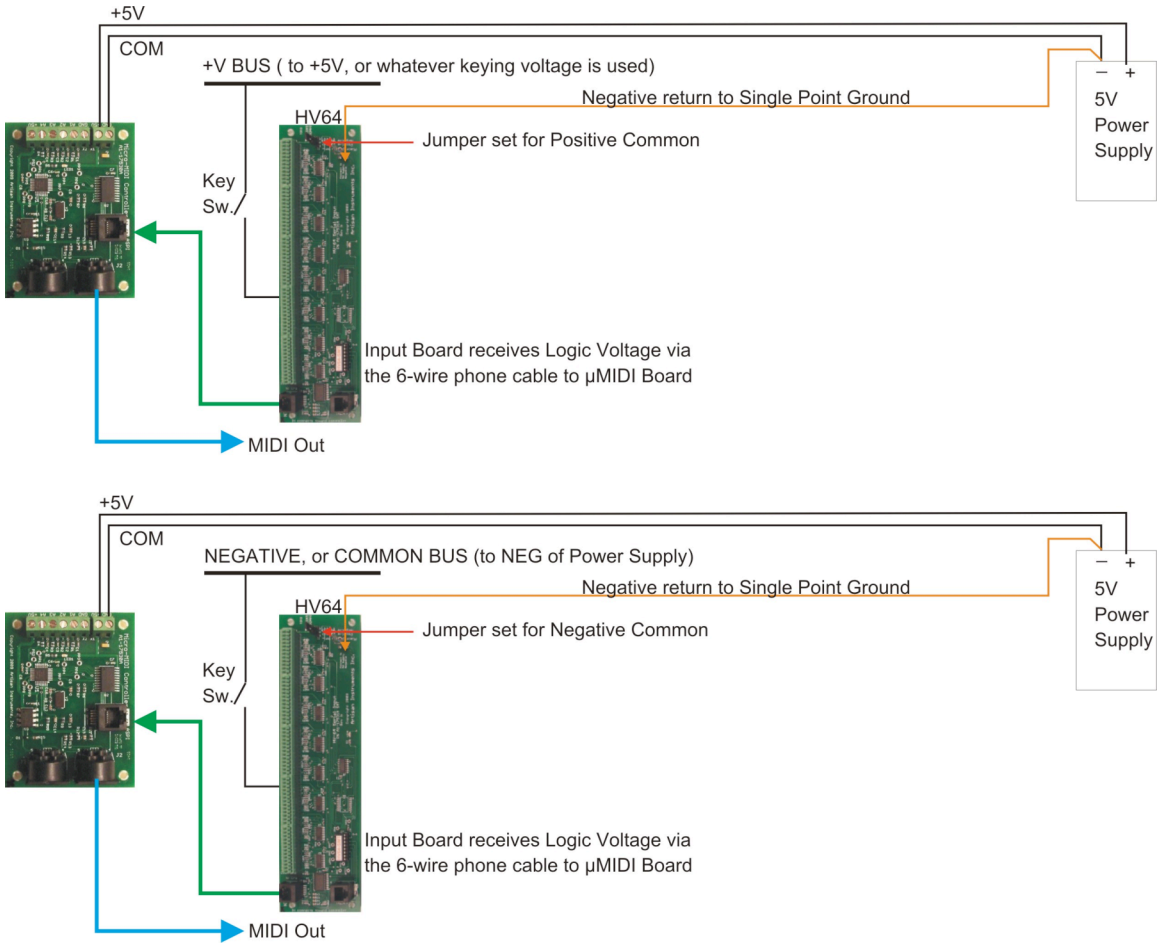


Modified and Reinstalled Stop Jamb viewed from back of console.
Note Stop Driver Board Installed on Jamb. The hole is for the Memory Level Select Potentiometer and Knob.

Planning is the key to a smooth and trouble free Artisan Organ Conversion. We suggest planning the conversion so that the organ is as mechanically and electrically modular as possible. Each module assembly should be as self contained as possible. The pictures above show a conversion using earlier versions of the Input & Stop Driver Boards. The latest version of the Stop Driver Board is smaller (same form factor as the HV-64 Input Board) and much easier and faster to locate, mount, and wire. +27V Power and separate 27V Grounds are connected to a terminal strip on one end of the Stop Driver board. The +27 V Magnet/Chest common is supplied from and fused on the Stop Driver Board. It is connected to a terminal strip to distribute the +27V Magnet Common to the columns of stops. **It is very important that the +27V Magnet Common from a driver board is connected to ONLY those stops connected to THIS Stop Driver Board.** Planning in terms of modules makes this almost automatic. The driver chips on the board have internal snubbing diodes to absorb any spikes generated during operation. Failure to observe this rule will likely result in the destruction of the moderately expensive 5841 driver chips and cause the on board fuse to blow. Fortunately the chips are in sockets and easily replaced if you need to. The control information for the Stop Driver Board is transmitted from its µMIDI board to the Stop Driver board via a 6 conductor RJ-11 (telephone type) cable with modular connectors.

By mounting the HV-64 Stop Sense Input Board on the Stop Jamb, the connection to the rest of the organ is by one or two RJ-11 cables - depending on how the stop and piston sense HV-64s are configured. The HV-64 is ultimately connected to the piston/stop sense µMIDI via the RJ-11 cables, which also supply +5 V logic power and ground to the HV-

64s. A reference ground wire is also carried back from the HV-64 to the sense common ground terminal strip, which is independently carried back to the common tie point for all power supply grounds.



Pictorial Diagram of Input Wiring when using either a Positive Common, or a Negative Common Bus

You might wonder why all the separate grounds carried back to a single common point. Two reasons: It minimizes noise pick-up and by separating the 27 V Ground from the others it avoids “Ground Bounce”. Ground Bounce occurs in this situation because the 27 V Ground carries a significant burst of current when the stops operate (approx 0.6 amps per stop). The resistance of the wire causes a voltage difference to momentarily exist at the +27 Ground terminal on the Driver Board and the and the ground terminal on the 27 V Power Supply. If the Sense Common and the 5 V Ground were connected together on the stop jamb, the ground bounce might be detected by the HV-64 and send a false signal to the µMIDI board and cause erratic operation of the stops.

3.1 Stop Modifications

Note that the Draw Knob stops are wired in vertical columns. Document the locations and unscrew the stop knobs, and remove the spacers, washers, and springs from the front. To make re-assembly easy and minimize the need for regulation and adjustment, It is a good idea to use a small plastic bag for each set of parts so they can be replaced as

a group on the proper stop. With care, a vertical column of stops can be removed as a complete column and taken to a work bench, modified and re-installed. We suggest a long (200 mm or about 8") common (-) screw driver with a small tip (4 mm or about 3/16") that is slightly magnetized for removing and replacing the three screws that hold the stops in place.

The slightly magnetized tip will facilitate fishing the screws out and replacing them after modification.

Before modification, there are 6 wires connected to each stop. After modification, there will be 5 wires connected to each stop. Their functions are as follows.

Original Wiring	
Orange #20 stranded	+27V Magnet Common (wired stop to stop)
Brown #20 stranded	27V Ground (wired stop to stop)**
Black #20 stranded	Stop Sense Common Ground (wired stop to stop)
White #26 solid	Function
Green #26 solid	Control
Yellow #26 solid	Information

Modified Wiring	
Orange #20 stranded	+27V Magnet Common (wired stop to stop)
Black #20 stranded	Stop Sense Common Ground (wired stop to stop)
White #26 solid	Stop ON to Stop Driver Board
Green #26 solid	Stop OFF to Stop Driver Board
Yellow #26 solid	Stop Sense to HV-64 Input Board

Note: The Brown #20 27V Ground is not required by the Artisan Stop Driver Board and should be disconnected from the stops and removed.

The Blue #26 solid wires are spares. Be sure the #26 solid wires are long enough to be neatly routed to their respective boards. We suggest not cutting them off very short until you are ready to connect them. When you are ready to connect the White and Green wires to the Stop Driver Board, connect them in ON-OFF pairs and in columnar groups and they will be easy to keep identified and connected to the correct terminal pairs. Using the same procedure connect the Yellow Stop Sense wires to the terminals on the HV-64. Careful planning and creation of wire lists will be very helpful references when you are ready to write the µMIDI configuration file (.ucf) and program the µMIDI boards.

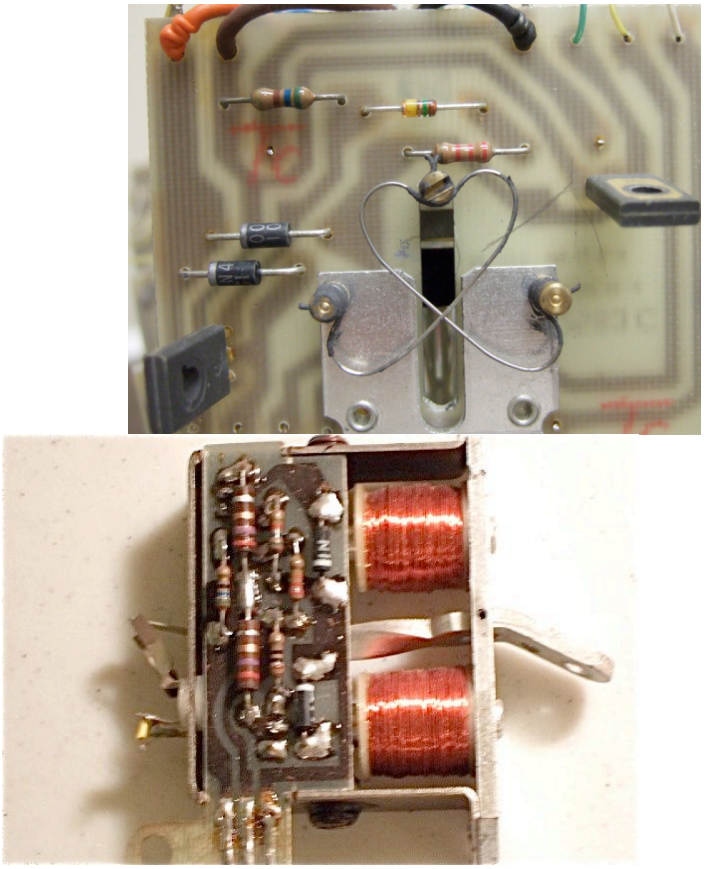
The Stop Driver board provides the momentary ground to operate the ON or OFF magnets. The Stop Sense wire performs two functions. The µMIDI that reads the HV-64s for the pistons and stops is the first µMIDI in the chain and the stop sense wire tells the µMIDIs driving the stops their current position (ON or OFF) and also ultimately tells the Sound Engine (or other µMIDIs in pipe organs) which ranks are ON or OFF by generating MIDI codes.

3.1.1 Stop Circuit Board Modifications

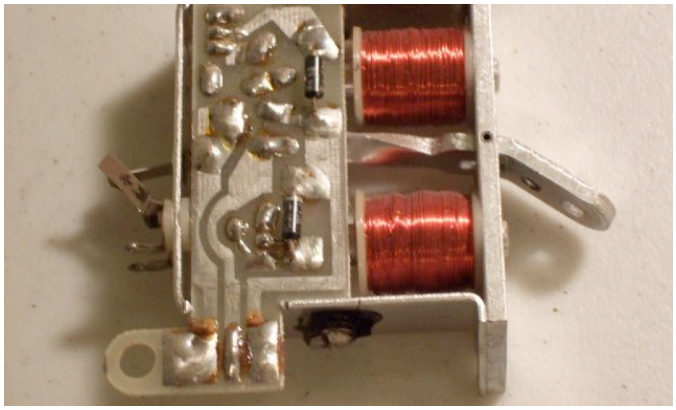
These vintage Allen organs used stops with onboard driver electronics. There are several different stop configurations; Draw Knobs, Tab type stops, and Rocker type stops, that use different circuit boards. However, all follow a similar functional theme and

have to work with standard Allen Capture Boards of that vintage. The stops have the magnet driver electronics on board and are supplied as listed in the table above.

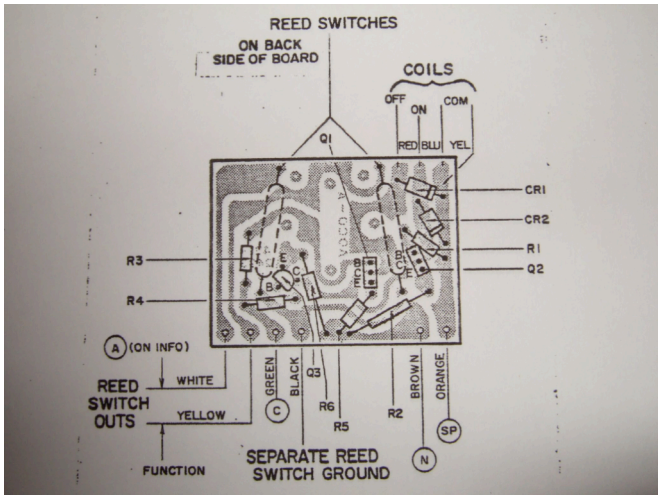
Here are some pictures of different stops and circuit boards that you may encounter.



Allen Draw Knob and Allen Tab Type Stop with Resistors
On Solder Side of the Circuit Board

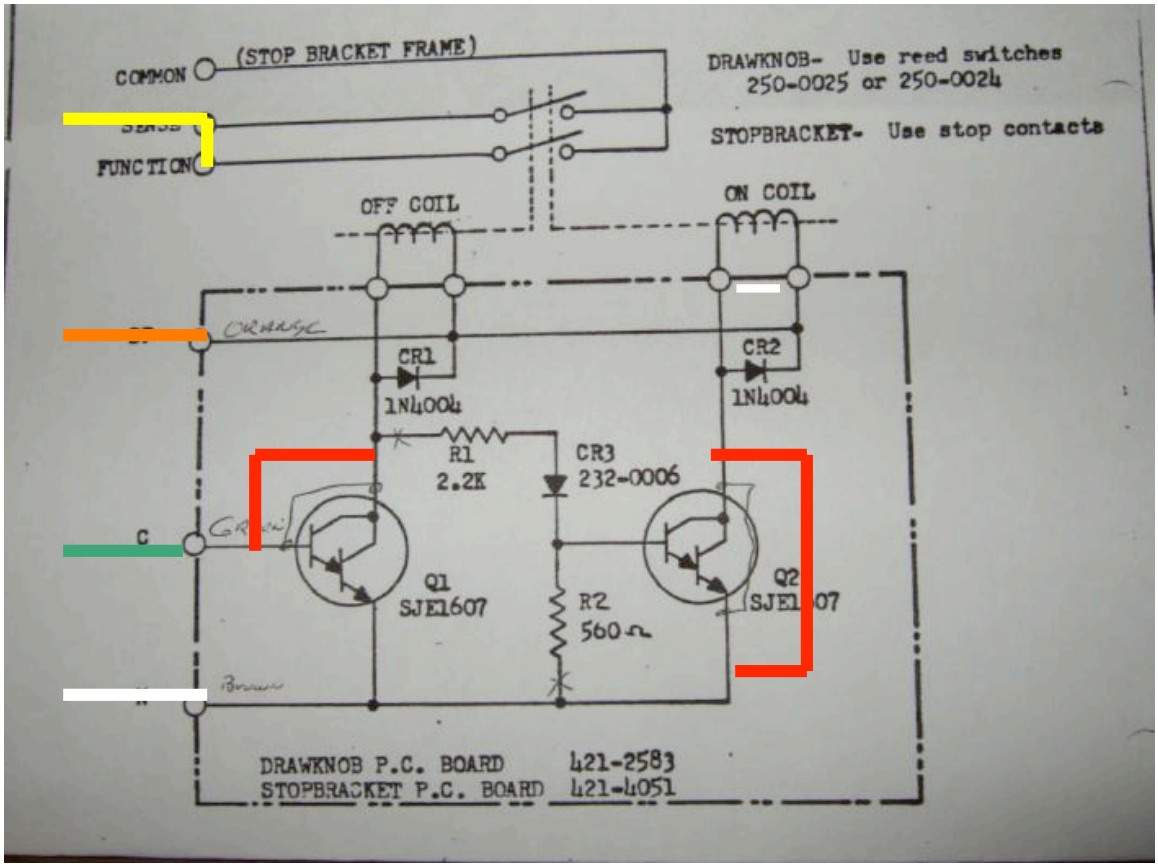


Allen Tab Type Stop with tinned circuit traces partially modified

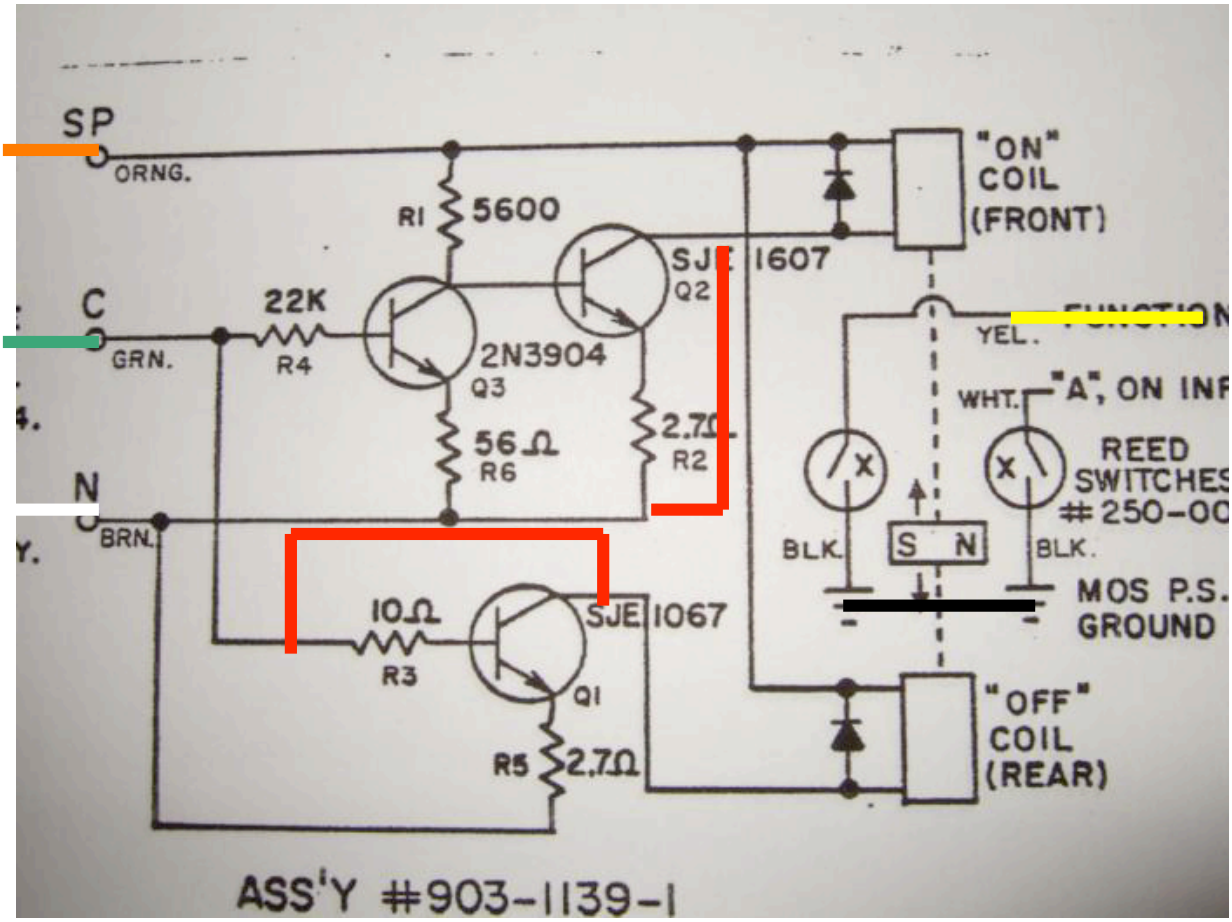


Allen Draw Knob CB with 3 Transistors

Here are two different board schematics that were used.



Two Driver Transistors



Two Drivers and a Signal Transistor

Two Driver Transistors, or Two Drivers and a Signal Transistor

There may be slight variations on schematics, but do not be concerned. All the stops require essentially the same modification procedure. You must remove all the components except the 1N4001 diodes and install two jumpers to complete the circuit from the Ground side of the two coils to their respective terminals. This will convert the stop for use with the Artisan Stop Driver Boards. The jumpers are shown in RED and the external connections are shown by colored bars that indicate the wire colors used. Here is how to do the modifications:

3.1.2 Stop Modification Details

Suggested Tools

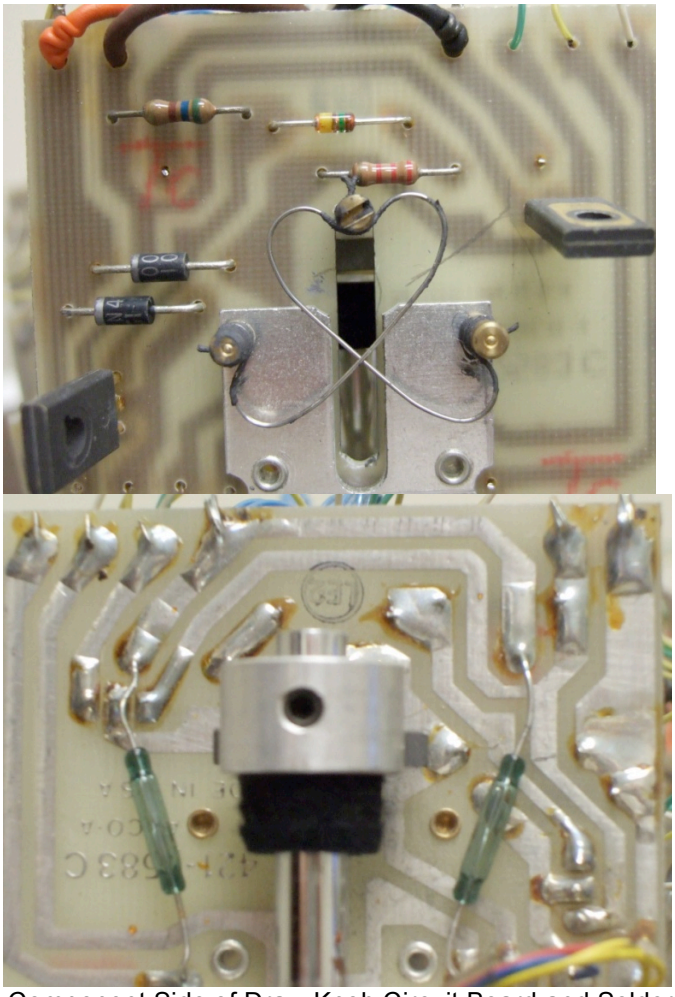
Flush Cutting Diagonal Pliers (Dikes) similar to Xcelite 170M
Low wattage Soldering Station similar to the Vellman VTS5 (Low cost, adjustable temperature, 50 watt)
Solder Removal Tool or solder removal braid used to open the holes in circuit board for connecting wires – not absolutely necessary.

Suggested Supplies

Small diameter electronic solder with No Clean flux, if available
Solder Removal Braid (optional)
#20 or #22 bare tinned solid copper wire. If it is not readily available, you can just strip the insulation from a piece of insulated wire. Stranded wire is not recommended. Two short jumpers are needed for each stop.

Procedure

As mentioned previously, the Allen 632-3 has two different types of physical stops that are almost electrically identical and the same general instructions are applicable to both types and other similar stops used on Allen organs of this vintage.



Component Side of Draw Knob Circuit Board and Solder Side of Draw Knob Circuit Board

This circuit board has only two SJE1607 Darlington type driver transistors. Other versions have the two Darlington drivers and a small signal transistor. It does not matter which type you have, all the electronic components must be removed EXCEPT the two black 1N4001 diodes on the component side. DO NOT remove, damage, or re-position the two magnetic reed switches on the solder side. They are encased in glass and are easily broken if you try to bend the leads using incorrect procedures. They have been carefully positioned to properly respond to the small magnet on the Draw Knob shaft. Only one reed switch is needed by the Artisan Control System for Stop Sense. The other switch

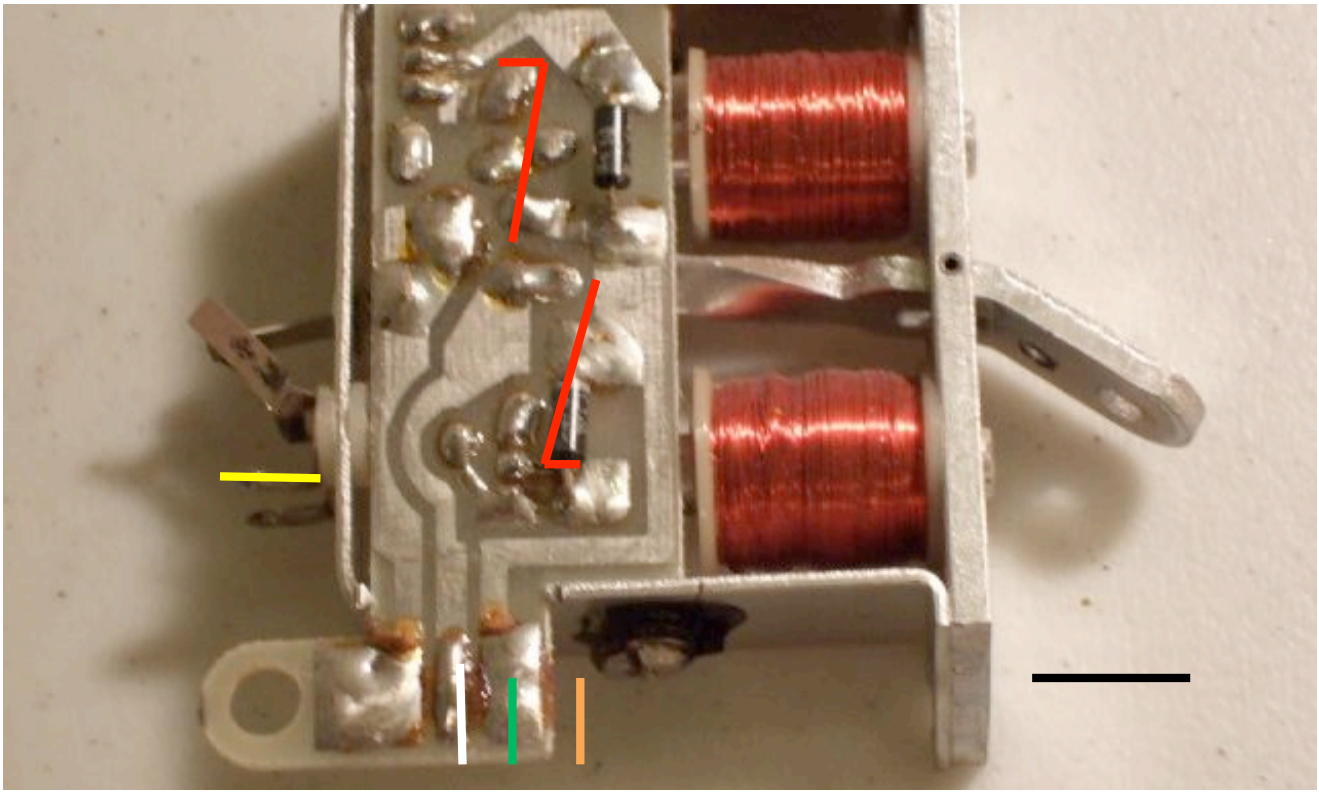
can be a spare in case the active switch gets damaged. If the active reed switch gets damaged all you have to do to activate the spare switch is move the Yellow Stop Sense wire on the stop to the other reed switch terminal. Removal of the two 1N4001 diodes is not necessary. There are internal spike snubbing diodes in the Stop Driver chips, but by using the design +27 VDC polarity and voltage for the Magnet Common (orange wire), the diodes are correctly oriented and will simply snub any spikes generated by the magnet coils before they have a chance to get back to the Stop Driver chips. If you leave them in place, you have two diodes making sure any spikes get absorbed and can do no damage to the electronics. Sort of like wearing both a belt and suspenders (braces) to absolutely, positively make sure your trousers stay up and making absolutely sure any spikes get absorbed before they can damage anything.

The resistors, small signal diode and the transistors need to be removed using the flush cutting pliers. The two large Darlington transistors can be removed with the flush cutters or if there is not enough space for the flush cutters, it is very easy to wiggle the large transistors back and forth until the leads break off. Note: In the rocker type SAMs, the transistors are located on the component side of the board, but the resistors and diodes are located on the solder side of the board. It is not necessary to remove any solder except some of that where the wires connect to expose the holes if you wish. Once installed, there is almost no mechanical stress on the connections and solder alone will provide adequate strength.

If you removed a column of stops as a group, you may leave the Orange and Black wires connected. The Brown wire should be removed completely by either cutting or de-soldering. That connection point will be used for the Green wire that will provide the ground connection for the OFF coil to the Stop Driver board.

After you have removed the specified components, study the circuit board to determine the best way to add the two jumpers to complete the circuits to the edge terminals. The jumpers are very easy to install on the two-transistor board. If you will carefully examine the Solder Side picture of the two-transistor Draw Knob Board on page 6, you will notice that I have drawn in two RED lines connecting two terminals on one of the transistors and all three terminals on the other. These terminals are very close together on the solder side of the board and generally have excess solder. If not, you can add a bit more. Using the tip of the soldering iron, you can create solder bridges between the two terminals on one transistor and all three terminals on the other. Be careful not to disturb the reed switch or its lead which passes over the former transistor connections. Normally solder bridges are to be avoided, but in this instance, all circuit traces except the ones we need to the edge of the circuit board have been disconnected. Do exercise caution when you are unsoldering or soldering the board edge connections that you do not inadvertently create any solder bridges or lift the traces by overheating. If the connections seem to have excess solder you can remove the excess with solder removal braid or solder removal tool (Solder Sucker). If it is not hurting anything, leave it alone.

The tab and rocker type stops generally have to be completely disconnected and removed from the organ for modification. The three-transistor board requires two bare jumper wires about 1 inch long. Make a ¼ inch bend on one end to make it easier to solder the wire to the center terminal of the former locations of the MJE1607 transistors.



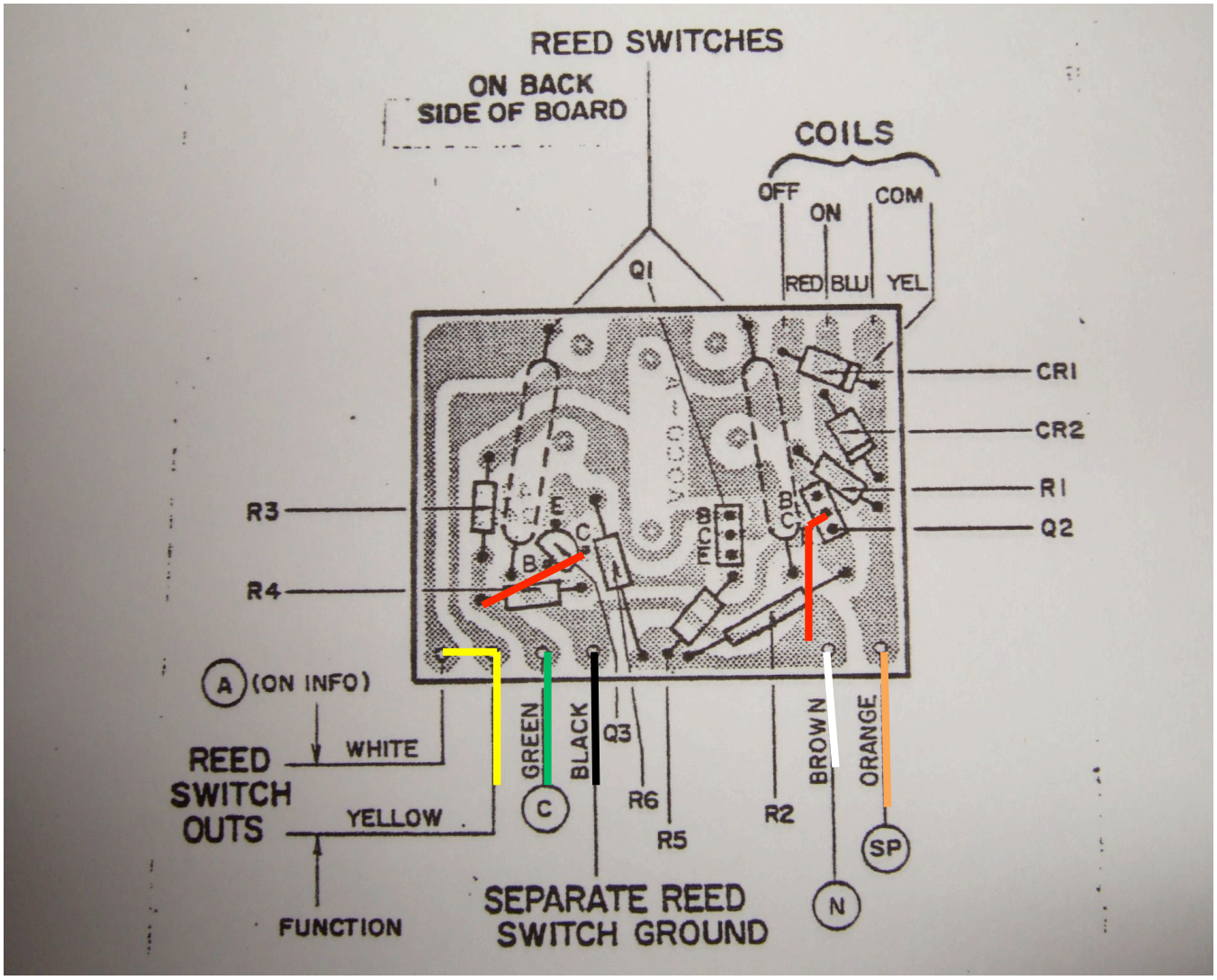
The routing shown is to take advantage of large blobs of solder and not need three hands to make the connection and feed solder at the same time. Most of the circuit traces are disconnected. Choose your route carefully to avoid undesired solder bridges and in advertent connection to active traces.

External connections to this type stop are shown in their respective colors (see table on page 4). It is suggested that the Yellow wire to the sense terminal(s) be stripped about ½ inch and the two sense switch terminals be bridged to provide a more reliable sense switch operation. The frame of this stop is the Sense Common. These stops are mounted to metal rails that are grounded using slot head (-) #4 sheet metal screws or 4-40 machine screws. We suggest that you replace the screws with Phillips head (+) screws to facilitate re-installation. (+) head screws capture the tip of the screwdriver and keep it from slipping out of the head. Expect to have to adjust the contact fingers on the sense switch for proper operation. They are silver plated phosphor bronze (I think) and they easily get out of adjustment with handling. Otherwise they are pretty reliable and tend to stay in adjustment unless mechanically disturbed. Do not worry about silver tarnish, it is conductive. The switch action tends to be self cleaning if it is properly adjusted.

The only difference in rocker type stops is the mounting tab for the Rocker. Try to put the stops back in their original location if possible to avoid the need for rocker alignment. If not, you will wish you had. It is very time consuming.

A picture was not available for the following Draw Knob Stop. This view is from the component side of the board and the jumpers are soldered to the solder side of the board. The schematic is on page 6. Be sure you have the transistors identified and understand the orientation of the

terminals before installing the jumpers or connecting the wires. Do the first one as a prototype and test it. Then use this as a “go by” for the other stops. It will save a lot of time and anguish.



Note: If you have the means to remove the solder and remaining component lead in the jumper locations, you may want to consider installing the jumpers from the component side and soldering them on the solder side of the board.

Q1 controls the “OFF” coil and Q2 & Q3 control the “ON” coil.

4.0 Testing the Modified Stops

After the stop is modified, it is very important to test it before reinstalling it. I would urge you to strongly consider building a simple test rig. All you need is a 24 VDC 1 Amp power supply and some color coded clip leads. If you want to get fancy, a couple of pushbutton switches to momentarily individually ground the WHITE and GREEN wires and a low current 28 V indicator light connected between the +24 V and the YELLOW stop sense wire. Ideally, you should use a 2 ma LED, but be sure and size the series current limiting resistor to limit the current to the LED to stay within its ratings. Because the sense switches are isolated from the coil circuitry, you can use a 5V DC power supply of even a small battery to independently power the LED.

DO NOT use the 27 V power supply for the organ to power the test rig. It is capable of producing damaging currents in the event of an inadvertent short. We strongly suggest a 1 amp slow blow fuse in the 27 Volt supply line for safety.

To test operation of a stop, connect the +27 V lead from the power supply to the + common (Orange wire terminal) on the stop. Momentarily touch (or press the button) to ground the WHITE wire. The stop should turn ON and the indicator light (if connected) should light. Now, momentarily touch the ground to the GREEN wire, the stop should turn OFF and the indicator light should turn Off. Perform this test 2 or 3 times and if operation is satisfactory, the stop is ready to install.

DO NOT keep a stop coil grounded for more than just a touch. The coils draw approximately 0.6 amps and will quickly overheat and burn out if energized too long. If a coil gets damaged, the entire stop must be replaced, they cannot be repaired.

The Artisan Control System and the Stop Driver Board µMIDIs are default programmed to ground the appropriate stop coil wires for 100 milliseconds 1/10th second and the duty cycle is very low. The Stop Driver Board never energizes both coils on a stop simultaneously. Based on the stop sense signal, the µMIDI knows the position of every stop it is controlling. If you press a piston that commands a stop to turn ON or OFF, the µMIDIs will only energize the stops that are NOT in the commanded position. If the piston is programmed for the stop to be ON and it already ON, the µMIDI will not energize a coil on that stop.

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5.0 Summary

This procedure reflects lessons learned from converting 6 electronic organs to Virtual Pipe Organs. The most recent projects have been an Allen 632-3 and an Allen 305 classical organs, and an Allen 920 Theater Organ to Artisan Virtual Pipe Organs. Each one has been a learning experience and it is expected that future projects will improve on these techniques. Your project may require different techniques and methods. If you have any questions, please do not hesitate to contact Artisan for answers and guidance.

General Comment

More HV-64s and Stop Driver Boards than were absolutely necessary were used in this conversion. However, the convenience and ultimate serviceability offered by extensive modularization vastly simplified the overall wiring. Bundles of #26 solid wires running all over the console were eliminated and replaced by a few RJ-11 cables. The µMIDIs were all arranged in a central location in a row so short MIDI cables could connect them together in a daisy chain. The result is a very neat installation that is easy to trouble shoot and service.

Our experience has been that neat, easy-to-service conversions seem to require little troubleshooting and service. An Artisan Virtual Pipe Organ conversion can extend the useful life of a magnificent organ for many years and, at the same time offer the sounds of a real pipe organ at a fraction of the cost of a new organ.

Here is a picture of the nearly completed conversion project.

This picture was taken while the organ was set up for voicing. After voicing, the computer, monitor, keyboard and mouse are not required. The professional grade audio equipment in the rack will in a suitable location. Some decorative escutcheons are missing in this photo. The clear plastic music rack is protected from scratching by plastic sheeting.

All 8 channels of the Artisan Sound Engine are fed to a combination mixer/effects processor that provides reverb in addition to the mixing functions. The final audio mix is fed through an electronic crossover network to separate the very low frequencies which are separately amplified and reproduced by an 18 inch sub-woofer. Higher low, midrange and high frequencies are separately amplified and fed as a stereo pair to two large three way speaker systems. The result is a full tonal range capable of the softest string stops to chandelier rattling bass.