Model "D"

Field Service Manual

by

Schantz Organ Company

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PREFACE

The purpose of this manual is to provide the service man in the field with enough information so that he may effectively trouble shoot any problem he might encounter that relates to the model D combination action. Nearly every problem will be resolved by exchanging one or more of the circuit boards located in the memory box.

It is not the intention of this manual to deal with circuit board repair, nor is it the policy of the company to authorize such repair. Field service should deal with the exchanging of circuit boards and the repair of any items that are wired in to the memory box itself. The circuit boards can then be replaced on an exchange basis with the factory.

The model D memory box is almost entirely modular. That is to say that nearly every active component is located on one of the circuit boards that simply plug into the memory box. Perhaps ninety percent of the problems you might encounter will be solved by replacing the circuit boards.

This manual deals with the procedures to find faulty circuit boards. It also includes information regarding how the equipment is wired into the organ and how to make adjustments to voltage settings and timing circuits.

Before attempting any repairs, you should read this manual entirely. Study the console and familiarize yourself with the entire system. You should know that the memory of combinations set, requires that power to the memory boards be on at all times, and that there is a battery pack that backs up the memory power supply to maintain power to the memory boards during power failures.

You should also be aware of the fact that the model D memory system uses CMOS technology, and that there is a risk of damaging the components with static electricity. Circuit boards should NEVER be changed with the power on. Any time you handle any part of the solid state equipment you should first ground yourself by touching the memory box chassis. This will reduce the hazard of static discharge that could damage components within the system. Further details regarding this are given in the section of the manual that covers circuit board replacement.

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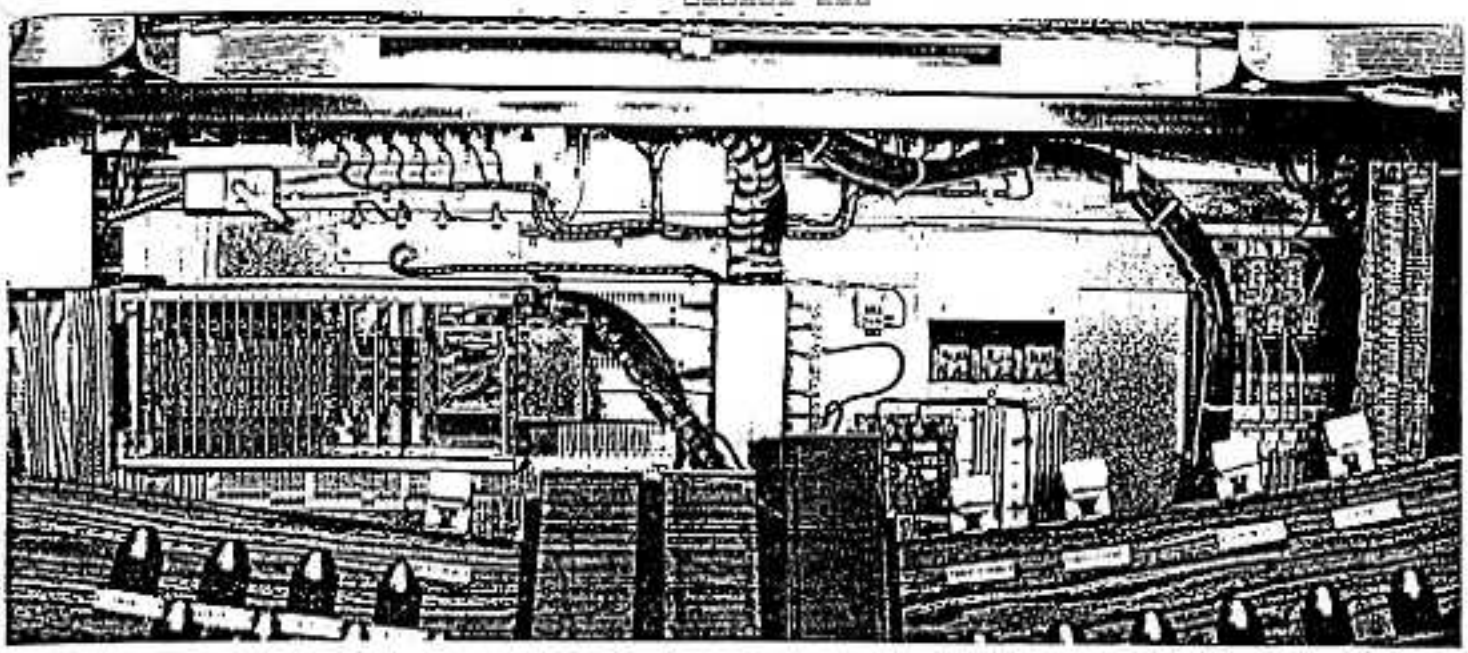
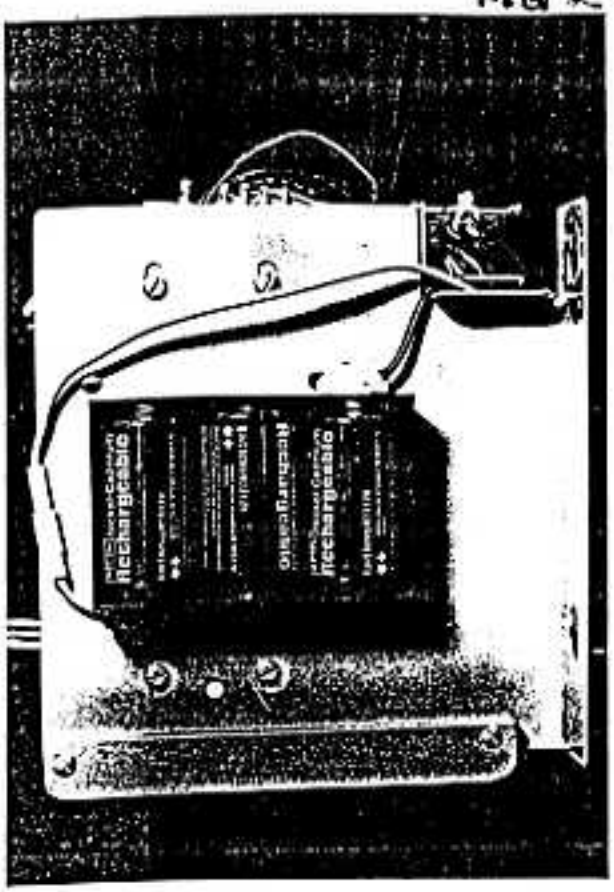
Part One

MEMORY BOX



The memory box consists of a back panel or "mother board" as it is sometimes called, attached to a rack which contains slots to guide the removable circuit boards into their respective sockets on the back panel. This box is generally located underneath the action frame or key desk of the console, behind the knee panel. Circuit boards can usually be replaced by removing the knee panel to gain access to the memory box.

The memory box is attached to the console with four screws that pass through keyhole slots in the box itself, then into iron brackets in the console. The box can be removed by simply loosening these four screws, lifting the box up, and passing the large opening of the keyhole slots over the screw heads. You will find about eight feet of cable connecting the memory box to the console. This cable is long enough to allow you to remove the box from the console and give you access to the wiring side of the back panel should the need arise.

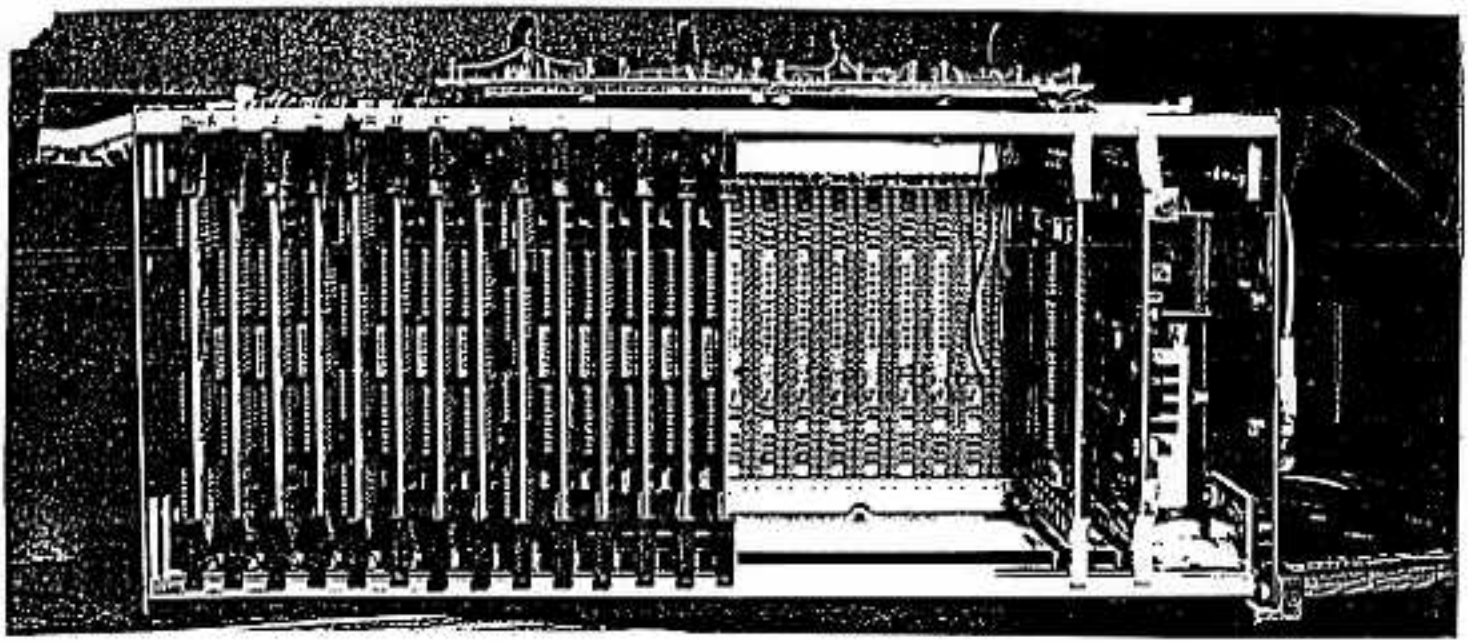


Strapped to the outside of the memory box cable is a power cord that plugs into an outlet somewhere inside the console. This cord provides the power to run the memory system, and must be plugged in at all times except when the system is shut down for service. Any time this cord is unplugged the batteries will provide the memory box with power. The batteries, therefore, must also be disconnected any time the equipment is shut down for service (fig.[2]).

Whenever the power is completely removed from the system, memory is going to be lost. Any time you must shut the equipment down for service you should either record the organist's piston settings on paper, or get permission to destroy the settings.

If you shut the system down to replace a circuit board, you will, of course, need to reset the organist's original piston settings. Before doing so, try setting up some pistons with patterns of stops that are easy to see such as all on... all off... odd on... even on... etc. Try different settings on each piston. Reset the pistons with something else. Work the pistons. When you are satisfied that everything is working, then reset the pistons as they were before you began.

CIRCUIT BOARD IDENTIFICATION AND REPLACEMENT



There are four types of circuit boards in the memory box. Each type of circuit board is interchangeable with any other board of the same type. There are spare replacement boards provided for the three most common types in the box. These spares will allow you to replace virtually any faulty board with a spare, thus solving your immediate problem. The defective board can then be sent back to SCHANTZ ORGAN COMPANY for repair. Upon repair, the board will be returned to you to become your new spare circuit board, and should be put back in the console.

Refer to figure [3]. You can see a white identification strip that runs across the top of the memory box. This strip contains information to help you to identify each of the circuit boards in the memory box. Each division contains a board that is called a "CONTROL" board. This board is the interpreter for the pistons and the memory board for that division. The abbreviations

on the identification strip such as: "CPLR"..."GT"..."SW", etc. refer to a control board for that particular division. The first control board at the left end of the box, usually labeled "CPLR" not only operates the coupler tab section of the console, but also handles the general pistons. The numbers on the strip refer to the memory boards. Each memory board has a unique number rather than starting the number count over at "one" in each division. This approach is less error prone than numbering by division when it comes to communicating with us about your problem. The label on the strip marked "REV" refers to the reversible board. This board takes care of the reversible functions such as "Gt to Ped Rev", "Sfz", etc. There is generally only one reversible board, however, on large organs there may be more depending on the number of reversibles. The final marking on the identification strip is "PWR" which stands for the power supply.

Each type of circuit board has its own color coded identification. The nylon pull-tabs which are used to remove the circuit boards from the box are colored. Control boards have BLUE pull-tabs. Memory boards have GREEN pull-tabs. The reversible boards have YELLOW pull-tabs, and the power supply board has WHITE. In addition, each type of board has its own unique key. This means that a control board will not fit into a socket designated for a memory board.

Do not, however, attempt to install any circuit board into any socket other than the proper type. Do not force any board in, or attempt to install any board that does not go in straight. Be

sure when you install a board that the color of the pull-tabs match that which you just removed, and that the board goes freely and fully into the socket.

INDEX CARD

BIRMINGHAM, AL ST. MARY'S ON THE HIGHLANDS

BD. #		CKT #1	CKT #2	CKT #3	CKT #4	CKT #5	CKT #6	CKT #7	CKT #8
1	CPL	GT-PD 8	GT-PD 4	SW-PD 8	SW-PD 4	CH-PD 8	CH-PD 4	SW-GT 16	SW-GT 8
2	CPL	SW-GT 4	CH-GT 16	CH-GT 8	CH-GT 4	SW-CH 16	SW-CH 8	SW-CH 4	———
3	GT	Quint 16	Diap 8	Bour 8	Oct 4	H. Flt 4	Twf 2 2/3	Fif 2	Mix IV
4	GT	Chime	Trem	GT 16	GT 4	Unison	———	———	———
5	SW	Viola 8	Rohr 8	V Cel 8	Fl Con 8	Fl Cel 8	Prin 4	Hohl 4	Spitz 2
6	SW	PJ III	Fag 16	Trom 8	Fag 8	Clar	Trem	SW 16	SW 4
7	SW	Unison	———	———	———	XXXXXX	XXXXXXX	XXXXXXXX	XXXXXXX
7	CH	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	Nason 8	Dulc 8	Unda 8	Kopp 4
8	CH	Naz 2 2/3	Bloc 2	Terz 1 3/5	Krum 8	Trem	CH 16	CH 4	Unison
9	PD	Cont 16	Bour 16	Quin 16	Prin 8	Bour 8	Quin 8	CB 4	Flt 4
10	PD	Mix III	Trom 16	Fag 16	Trom 8	Clar	———	———	———
		REVERSIBLES							
		GT-PED	SW-PED	CH-PED	SFZ				

Refer to figure [4]. The index is a chart that will assist you in locating the proper circuit board when a malfunction occurs. It contains all the information necessary for you to locate the proper memory board if that failure relates to some stop or coupler. The index is on a card located in the box.

The first vertical column is labeled "BD#". This column is further divided into two columns. The column on the left contains the memory board numbers which correspond with the numbers written on the marker strip that runs across the top of the memory box (fig.[3]). The column on the right contains the

abbreviation of the division in which the board is used. Note that in our example, board #7 is listed twice... once for the Swell division, and once for the Choir. Under certain circumstances, memory boards can be split and used in two divisions. It will not be unusual to find this occurrence in any organ you might service.

The remaining columns labeled "CKT #1", "CKT #2", etc. identify the various circuits within the board, as to which circuit is used by which stop. This circuit number has no real bearing as to which board needs to be replaced, but does help us to pinpoint a problem once we receive a board for repair. The bottom line of the index contains the circuit numbers for the reversible board. If there were more than one reversible board in this memory box, the index would also reflect the reversible board numbers just the same as it does the memory board numbers.

Now let's suppose that you are trying to locate a defective memory board. Let's say that the Swell 8' Viole Celeste continues to come on even though you set it off again and again. This problem relates to a particular stop rather than some certain piston or something within a division, etc. Problems that relate to specific stops or couplers are generally associated with memory board failures. In this case you look at the index (FIG.[4]) and find that the Swell Viole Celeste is located on board #5, circuit #3. Replace the memory board #5 with the spare memory board and check out the combination action to see if the problem is fixed. (see page [2] last paragraph)

BOARD EXCHANGING PROCEDURES

There are a couple of precautions that you need to observe before you attempt to exchange any circuit board, or to do any work on the memory box. Exchanging circuit boards is very simple to do, and there is very little chance that static electricity will cause any damage to the equipment. There is some risk, however, so in order to prevent that "one little chance" we recommend that you handle the equipment as follows:

It should be pointed out here that earlier versions of our solid state combination action such as Model A, Model B, Model C & CA did not use CMOS chips, and therefore, did not require to have the power turned off to change circuit boards.

Model D requires that no circuit board may be removed or inserted while the power is on. This is going to force you to make some consideration for the organist's current piston settings... if they still exist. Before disconnecting the power you should either write down all existing piston settings, or get permission from the organist to destroy these settings. As soon as you remove all power from the memory box, all memory will be lost.

Did you ever walk across a room and get a shock when you touched the doorknob? Well that shock could cause us some harm, and that's what we are going to get rid of. Once you have the console opened up and are in a position to reach & exchange circuit boards, take a firm grip on the metal frame of the memory box and hang on for a second or two. The memory box is grounded

and "holding on" will allow any electrical charge in your body to escape to ground. Now that you are "safe"... stay still. Shuffling your feet or clothing builds those electrical charges back up. If you think that you are in a situation in which you might be building up static charges, keep periodically touching the memory box frame to keep yourself discharged.

Once you are discharged, you are ready to exchange a board. The next thing you need to do is to turn off the power to the memory system. Never remove or insert any board while the power is turned on. This means that both the power supply and the batteries must be shut down. The power supply is the last circuit board at the right end of the memory box. It has a red pilot lamp on it indicating whether or not the power is on. It also has a toggle switch on the front edge near the top. Turn the switch "off" (DOWN). The pilot lamp will go out. Now look at the right end of the memory box and pull the plug on the red wire that goes to the batteries. The memory box is now dead and it is safe to exchange circuit boards.

The power switch on the power supply board has AC Line voltage going to it (110 V). This can be hazardous and care should be exercised not to touch the circuit board on either side in the area of this switch. If you have any doubt as to where this is, unplug the power cord for the memory box. This will render the entire area safe to handle. If you are not certain just where this cord is located, you will find it strapped to the outside of the large cable which connects the memory box to the console. Simply follow this cord until you find the receptacle

where it is plugged in. This will most likely be under the action frame (key desk) of the console. When this cord is unplugged, the indicator lamp of the power supply board will be out no matter which way the little toggle switch on the power supply is set.

When exchanging circuit boards, you will find a rubber or plastic strip across the contact fingers of the spare board. This is there to protect the board from static discharge and removing this strip should be the last thing you do before inserting the spare into the memory box. As soon as the board has been inserted, the strip should be then placed onto the contact fingers of the board that was just removed.

When the board exchange is complete, turn the power back on and try out the system. The batteries may be left unplugged until you are finished with your work. That way they will not have to be unplugged again if you should have to shut down once more to exchange another board. (see page [2] last paragraph)

ELEMENTRY DIAGNOSTICS

If something should go wrong with your combination action, the problem can most likely be resolved by exchanging a circuit board. This can be done by anyone who is willing to take a few minutes to study the problem and perform the swap. No particular knowledge of electronics is necessary. Just simply follow the instructions that have been outlined in this manual.

Control boards (blue tabs) operate a group of memory boards for some division of the organ. If, for instance, you cannot get

Swell piston #3 to work, the problem probably relates to the control board for the Swell. Other similar control board problems would relate to any kind of thing that would affect an entire division, or even the entire organ as in the case of problems relating to the General pistons.

Memory boards (green tabs) manage piston settings. Each memory board is responsible for as many as eight stops. The stop controls that are operated by any particular memory board are usually in one certain division of the organ, however, these boards can be split up to operate not more than four stops in each of two different divisions. Memory board problems usually refer to "stop related" problems rather than "division related" problems. It was pointed out earlier in the section regarding how to read the index card that a certain stop was giving trouble. This kind of problem where some stop will not set on or off, or some stop won't cancel, etc. will most likely be fixed by replacing the memory board for that stop.

The reversible board controls the reversible pistons. If you have a dead reversible, or perhaps, one that will go on but not off, you should try to exchange the reversible board. Remember that the reversible board also operates stops that are run by the combination action. For instance, the Great to Pedal coupler tab has a memory board assigned to it as well as the reversible board. One board failure can affect the other. Do not overlook this fact when changing boards. If, for instance, you replace the reversible board because the Great to Pedal doesn't work right,

and that does not solve your problem, try replacing the memory board for the Great to Pedal also.

There are times when some problem doesn't follow any logic. You replace board after board, and the problem is still there. It may then be necessary to swap every board in the entire system in order to locate your problem. This technique is called "board substitution". If you should find that you must perform a complete board substitution, be systematic. Start at one end of the memory box and replace each board with its appropriate spare one at a time. After every exchange, check the system out to see if the problem has been solved. If not, remove the spare board and put the original board back in. Go on to the next board, and do the same thing. Repeat this process until you have either worked your way through the entire box, or until the problem has been found. This may take a little patience, but generally will locate a problem if the obvious attempts did not.

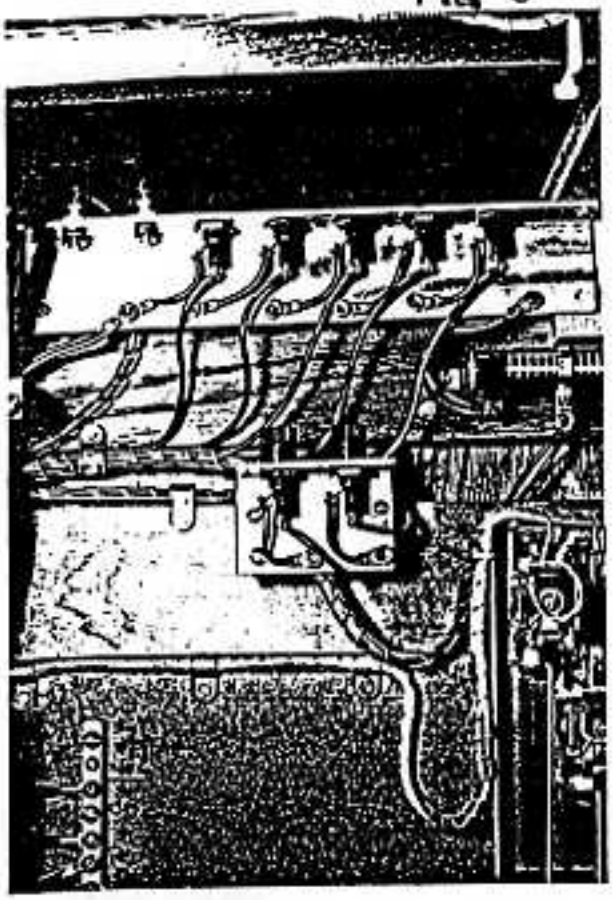
KICKER FUSES

All electric consoles have fuses installed to protect the circuitry that operate the devices which move the drawknobs and coupler tabs. The size of each fuse is determined by the number of controls that operate through it, and is set to a value that will cause the fuse to blow if there is continuous current through the fuse. These fuses are slow-blow type, and under normal operating conditions, will not fail. Rapidly changing from

one piston to another for extended periods of time can cause fuses to fail. Blown fuses will cause sections of drawknobs and rocking tablets to quit working through the combination action. That is, if you hit a piston or the General Cancel, and some of the controls do not move, you may have a blown fuse. The fuses are arranged so that entire vertical rows of drawknobs will be fed from one fuse. This will cause vertical rows of drawknobs to quit moving when the fuse for that particular row fails. Memory boards, on the other hand, are not usually assigned to some vertical row of controls. This means that if you have a single vertical row of controls, or even several rows that are dead, you probably have a blown fuse instead of circuit board problems.

The fuses for the coupler tabs are not arranged the same because they are all in a single row unless the console is extremely large. The fuses are generally divided up to feed the odd-numbered coupler tabs with one fuse, and the even-numbered tabs with the other. There are exceptions to this arrangement for consoles that require more than two fuses to operate the coupler tabs. Generally speaking, if

FIG 6



you have a group of rocking tabs in which every other tab is dead, you most likely have a blown fuse.

The fuses are located underneath the action frame (key desk), behind the knee panel, at the rear of the console. (see figure [5]) There is a row of fuse holders on each side of the console. You will find that these groups of fuses contain the same number of fuses as the number of vertical rows of drawknobs on each side of the console.

The fuse for the outermost row of drawknobs on the left side is located in the row of fuses on the left side of the console, and is the fuse at the extreme left end of that group. The fuse for the third row in from the outside on the right jamb, will be found in the right hand group of fuses, third fuse in from the right. As you can see, the fuses are arranged exactly as the rows of drawknobs are arranged on the jambs.

There is another fuse group for the coupler tabs, and this group is usually located on the right side below the group for the right jamb. This fuse group will most likely have only two fuses because of the smaller number of coupler tabs as compared with the number of controls that occupy an entire jamb of drawknobs. The arrangement as to which fuse operates which group of coupler tabs is somewhat more complex than the setup for the drawknobs. The solenoids that operate the coupler tabs are built in two rows even though there is only one row of coupler tabs. With the exception of very large consoles, each fuse will operate one row of kicker solenoids. Since the coupler tabs are connected to the kickers in an alternating pattern (ie: front,

back, front, back, etc.), a blown fuse will reveal itself with every other tab unable to be moved by the pistons or the cancel. You will probably need to check each fuse in this group to determine which one might be blown.

LIST OF FUSE VALUES FOR EACH VERTICAL ROW OF DRAWKNOBS (FROM LEFT TO RIGHT) FIG 6

2¼ AMP	2 AMP	2 AMP	½ AMP	½ AMP
PED 1	PED 2	SW 1	SW 2	SW 3

FIRST BAPTIST BROWNWOOD, TEXAS

½ AMP	½ AMP	¼ AMP	¼ AMP	¼ AMP
GT 1	GT 2	CH 1	CH 2	CH 3

CPLS FRONT 2½ AMP.	CPLS BACK 2½ AMP

There is a chart posted in the back of the console that will help you to determine what size fuse to replace should you find one that has failed. (see fig.[6]) Lets suppose that the third row of drawknobs in from the outside on the left jamb are dead. that is they will not move when pistons that should move them are operated, nor will the cancel bring them off. This happens to be the first row of knobs in the Swell division. Look at the chart. It is arranged in groups much in the same way that the fuse

groups are arranged in the console. The third row of knobs in from the outside on the left jamb is the first row of Swell knobs. The chart shows the group of fuses for the Pedal & Swell (left jamb) at the top. The first row of Swell knobs (Sw 1) is also the third block in from the left end of the chart. The chart indicates that this row uses a 2 amp fuse.

There are spare fuses located in pouches somewhere inside the console, usually at the back under the action frame. There will be a variety of sizes from which you should be able to find the correct value for any fuse that needs to be replaced.

POWER FAILURE ALARM

Because of the fact that the power must always be on in order to maintain memory, the console has been fitted with an alarm system to alert the organist of that fact should a power failure occur. Any interruption of electrical power to the memory system will trigger the power failure alarm (PFA). This does not mean that the memory has been lost, but only that there has been an interruption of power and that the pistons should be checked out. You will find a signal lamp and reset push-button on the console labeled "CHECK COMBINATIONS". If when you turn the organ on and find this lamp lit, try your pistons to see if they are still valid. Chances are that memory will not have been lost because most power failures will not be long enough to run the back up batteries down. Extinguish the alarm light by pressing the reset button under the indicator lamp, and reset your pistons only if necessary.

SUMMARY OF PART ONE

The material covered in this writing should enable anyone not familiar with electronics or the solid state combination to make a simple diagnosis of the most common problems that may occur and fix the equipment by either exchanging circuit boards or replacing fuses. This manual was written for the benefit of the organist or any other person who might be in a position to fix problems, should they occur, without the inconvenience of calling in an outside service person. It does not, in any way, reflect that there should be an ongoing need to continually replace circuit boards, fuses, or provide any recurring service.

The Model D solid state combination action should provide you with many years of virtually trouble free service. If you have any questions please feel free to call on us.

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FIG 7

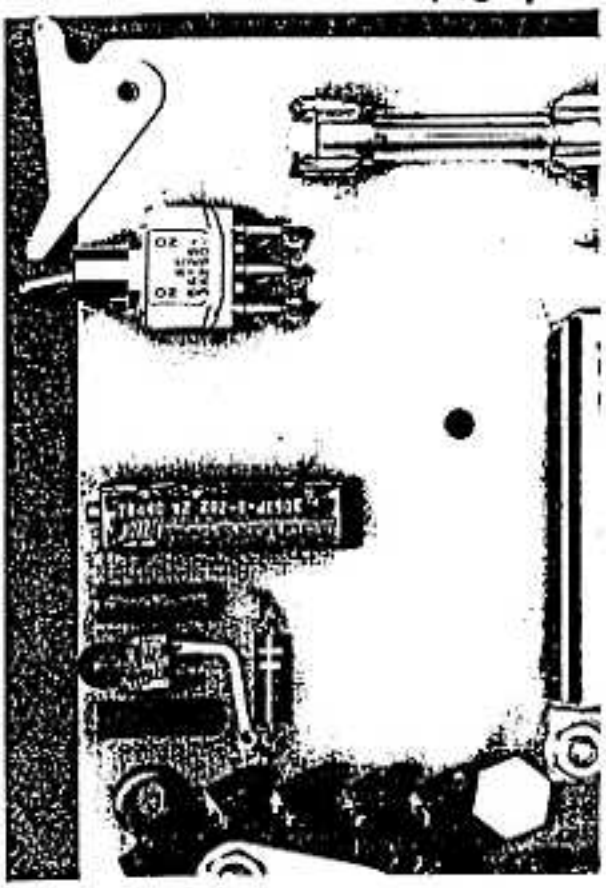
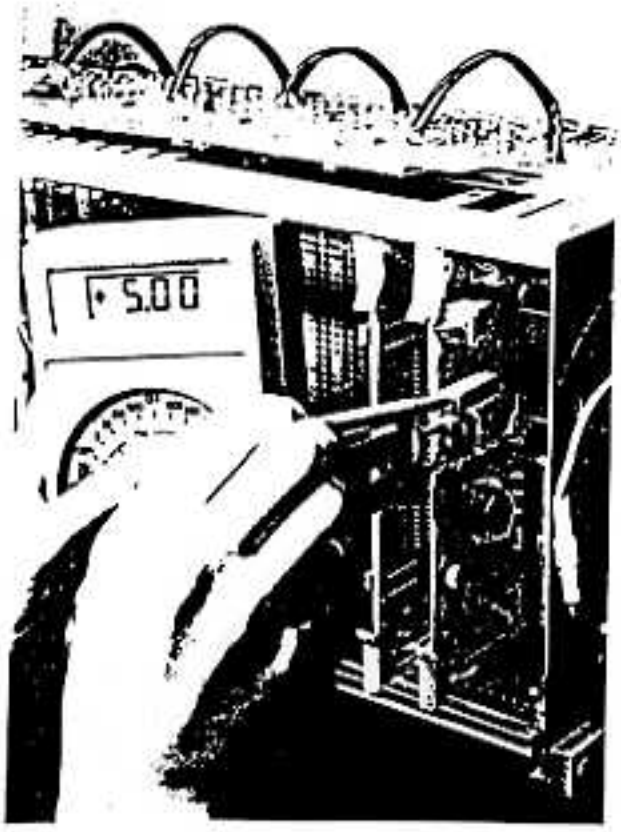


FIG 8



VOLTAGE SETTING PROCEDURE

The Model D memory box is designed to operate from its own power supply at 5 volts D.C. This voltage is adjusted by a trimpot located on the power supply board. (see figure [8]). Test jacks are provided for your convenience to connect a voltmeter.

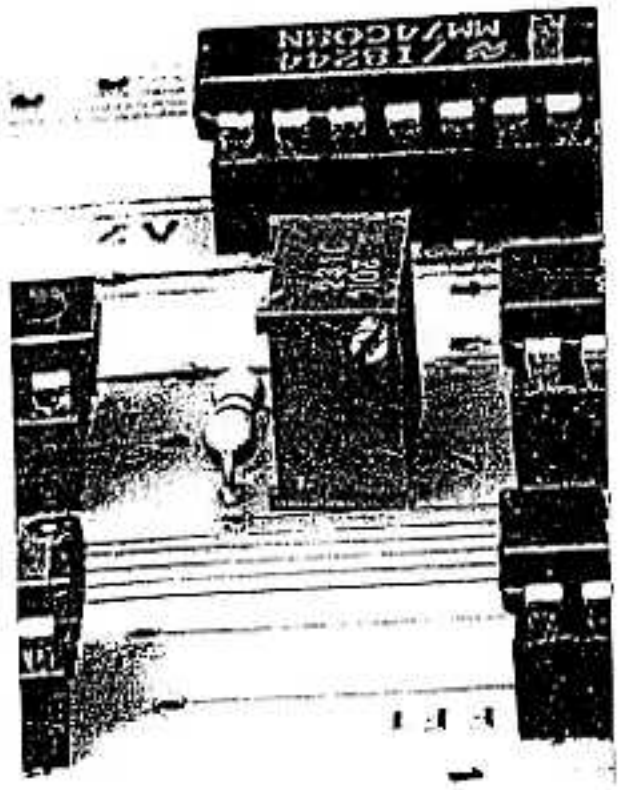
With all circuit boards installed, and the system up and running, insert the probes of your voltmeter into the test jacks on the power supply board. (Make sure that your meter has been set up to measure 5 volts D.C.) If necessary, adjust the trimpot on the power supply board to obtain a reading of 5 volts. Make this setting as accurately as possible. This is the only adjustment required to set voltage on this system.

BATTERIES AND CHARGING EQUIPMENT

The batteries that provide back up power during power failures are located at the right end of the memory box. There are three standard "D" cell NI CAD rechargable batteries installed in a plastic battery holder. This type of battery is available locally should they ever need to be replaced.

Battery replacement can be done while the power is on. Disconnect the plug that connects the batteries to the memory box. Release the VELCRO (tm) strip that secures the batteries in place. Now the old batteries can be removed and the new ones installed. Make sure that you point each battery the correct direction when you put them in the holder. Plus (+) and minus (-) symbols are imprinted both inside the battery holder and on the batteries themselves.

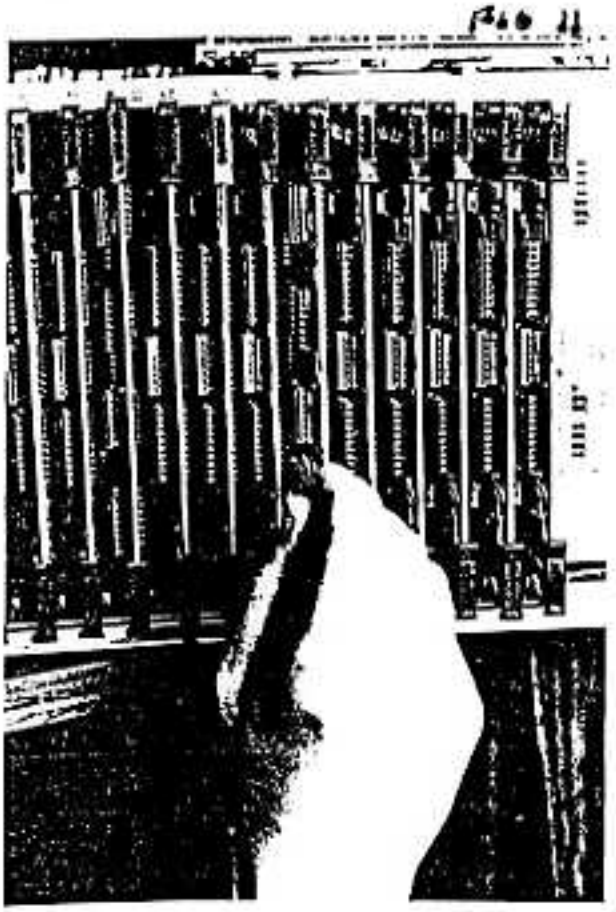
CONTROL BOARD TIMING ADJUSTMENT



When any piston is pressed, the output of the memory boards is turned on and then off for a predetermined time period. This timing is set by a trimpot located on the General control board. The period is called the "HOLD" period, and this timing pulse serves two purposes:

First, this pulse locks the system up on the last piston pressed, and continues execution of that piston even if it should be released before the end of the timing period. This insures that any piston pressed will remain "on" long enough to guarantee that all drawknobs, etc. will be able to move completely to their new assigned position, no matter how quickly the piston was struck and released.

Second, the HOLD period guarantees that the piston will release at the end of the time period even if it is still pressed. This protects the output driver transistors on the memory boards from overheating, and keeps the kicker fuses from blowing. Because of this, we can select fuse values for the kickers with very close tolerances that will insure protection from a "hung output" should it ever occur.



The actual length of the HOLD is set using an insulated screwdriver, or an insulated alignment tool to adjust the trimpot that is located on the General control board. Insulated tools are extremely important here, because there is a high risk of shorting things out between the circuit boards if you should use a metal screwdriver, or something like that. Should you need such a tool, and cannot find one locally, you can obtain one from us.

The hold time period should be set as short as possible, but long enough to guarantee complete movement of the controls. If the hold period is too long, then rapid changing from one piston to another will not be possible. If the hold period is too short, some of the controls may not move to their full on, or full off position.

Fig 12.

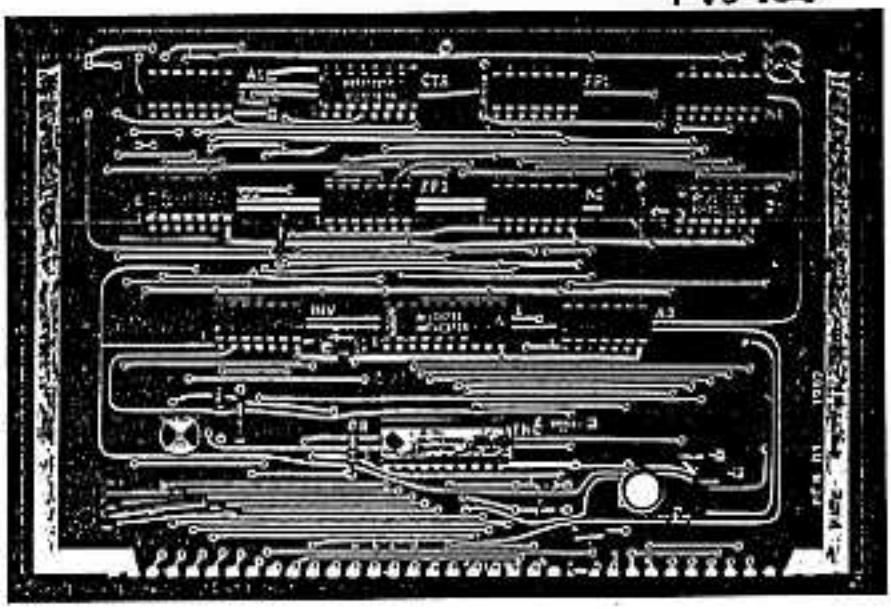


FIGURE 13 HERE

CONTROL BOARD DESCRIPTION

As mentioned before, the Model D combination action utilizes one control board for each division. This allows the user to operate pistons from different divisions simultaneously because each division its own independent section within the system. The control boards are wired to the thumb and toe pistons at the console. They are then wired out to their own group of memory boards and output the various signals that tell the memory boards whether or not they are operating a piston, or setting one. They tell the memory boards exactly which location in memory to access for any given piston that is pressed, and whether or not to "write" (set) to that location, or to "read" (operate) that piston.

The nucleus of the control board is the method used to read which piston has been pressed. This is accomplished with a CMOS keyboard encoder chip that can read any one of twenty pistons through a matrix of four "X" and five "Y" lines. The pistons are wired in such a way that each one has a unique combination of one "X" line and one "Y" line connected to it. Since each piston is connected to a different pair, there can be a total of twenty different pistons available for each division. The output of this decoder generates a five bit binary number that is sent to the memory boards via address lines A through E.

There are a total of six address lines that each control board outputs to the memory boards for that division. Address lines A through E have just been mentioned. Address line F is

used to select between Divisional and General pistons. This line is normally low, and goes high when any General piston is pressed. This causes the General control board to output a signal to all divisional control boards which sets the address line F high in each division. Address line F in the coupler division will always remain low unless independent coupler pistons are fitted.

Address lines G and H, when used, are wired directly to a select switch that allows each piston to be used over four different times through a feature we call "A-B-C-D Select".

One other switch that may be connected to the control boards is a switch that operates an optional feature we call "DUAL SET". This switch, when installed, turns the "set" mode on at the control boards after the HOLD period has ended and the drawknobs have assumed the position called for by the piston just pressed. If you should then continue to hold that piston in, the the "DUAL SET" switch is on, the system will then function as if it were a hold-set machine. That is to say, that pressing any piston will cause the knobs to move according to the command from the piston. If you keep the piston pressed in, you can now reach out and manually change the position of any of the stops in that division, and as long as you keep the piston in, you can continue to make changes manually. Upon release of the piston the combination action will assume the setting of the last valid position of the knobs.

The control boards are responsible for the timing of the various signals, some of which were mentioned earlier. The

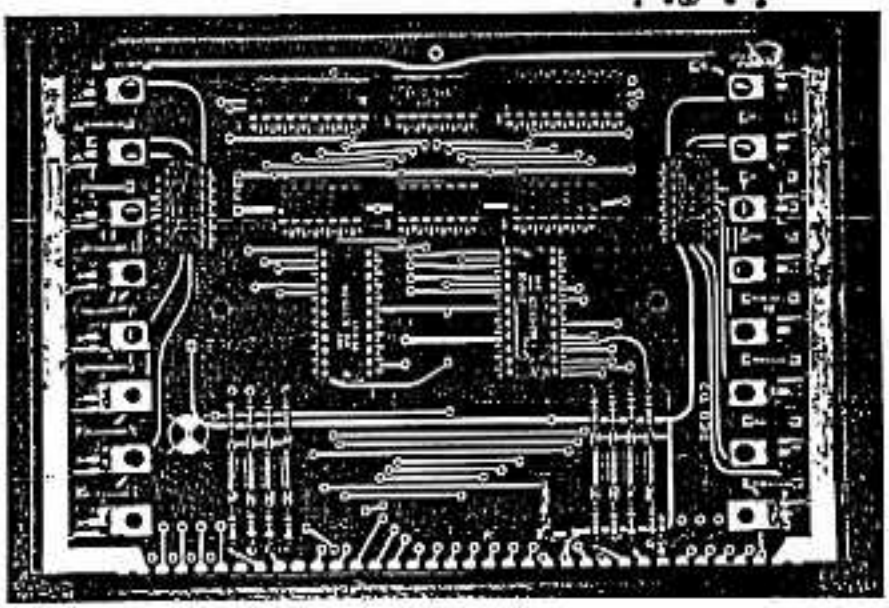
position of the "DUAL SET" switch if so equipped, is monitored by the control boards. They also monitor the "Set" piston, and the "Cancel" piston. And, in the case of the General board as compared with the Divisional boards, they share a signal that comes from the General control board and goes out to all of the Divisional control boards that tells the Divisional boards to stand by and receive instruction from the General board whenever a General piston has been pressed.

The control board that handles the General pistons will be the first control board at the left end of the memory box. If there is more than one memory box, there will still be only one General control board. This board will usually operate the memory boards that handle the coupler tabs and will be labeled "CPLR" unless the organ has independent pistons for the coupler tabs.

The memory boards that work the coupler tabs will be treated as a separate division and since they are operated via the General pistons, they can be tied directly to the General or "CPLR" control board. If, however, the console is fitted with independent Coupler pistons, the "CPLR" control board then must become a divisional board just like the rest. In that case an additional control board will be installed to operate the General pistons. This board would not have any memory boards associated with it.

MEMORY BOARD DESCRIPTION

FIG 14



The memory boards are centered around two CMOS 256 by 4 bit RAM chips. Each memory chip can, therefore, retain settings for 256 different pistons for four steps. This, at first might seem unreasonably large for practical applications, since no console is going to have 256 pistons per division. Each control board is capable of maintaining 20 pistons, and in the unlikely event that 32 pistons per divisions were required, a modification to the system could be performed that would allow 32 pistons per division. That figure plus 32 General pistons could make a total of 64 pistons that each and every memory chip would possibly have to access. Now multiply that figure by four to accommodate the A-B-C-D memory select. This gives you 256. It is doubtful that any organ would be fitted with 32 Divisional and 32 General pistons all at the same time, or perhaps even 20 pistons of each

type, but the potential is there to make the system serviceable for any application no matter how large.

The memory chips are tied through some logic gates to a series of driver transistors that are the switches which actually work the kicker actions in the console. The gates are managed by the control board.

Each memory board driver transistor has a diode associated with it. The purpose of this diode is to suppress the transient "spike" that is generated by the kicker magnet when it turns off. All electro magnets possess this property, and if not cared for, this voltage surge can cause memory chips top change their settings. If the "glitch", as it is sometimes called, is severe enough...damage to the components can occur.

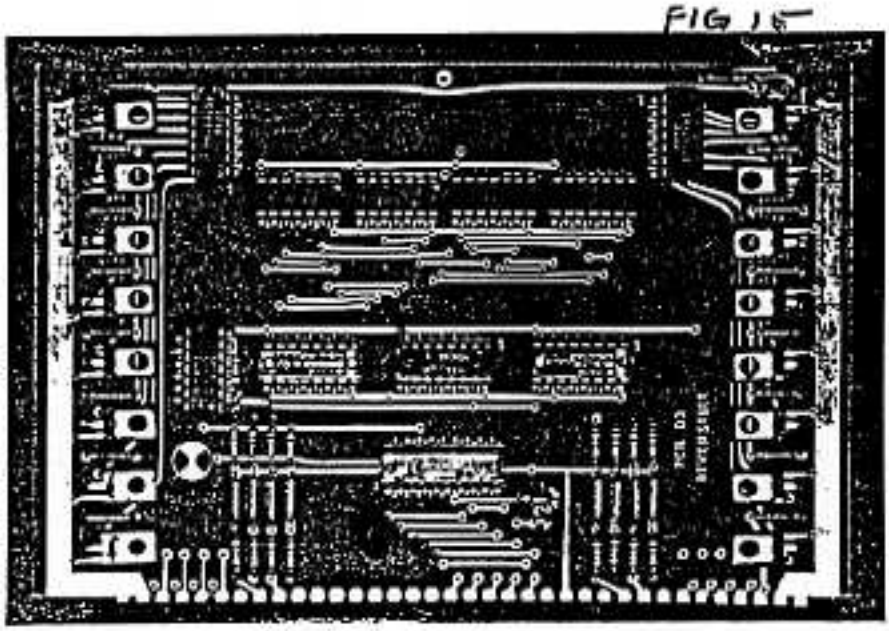
All of our solid state systems previous to the Model D had the kicker action surpressor diodes installed directly at the kicker magnets themselves. This arrangement made testing and replacement of these diodes a bit difficult. Model D design has overcome this problem by allowing the diodes to be replaced by exchanging the memory boards themselves.

As mentioned earlier, there are two memory chips on each memory board. Each memory chip is independently wired through its logic gates to a set of driver transistors along each side of the board. Each half of the board can handle four stops. Therefore the memory board is capable of operating eight stops maximum. These eight (or less) stops must be in the same division, unless the board is split. In which case, a maximum of four stops can be utilized for each half. The stops for each

half of the board must be together in the same division, thus allowing one memory board to be used in two divisions at the same time.

REVERSIBLE BOARD DESCRIPTION

FIG 15

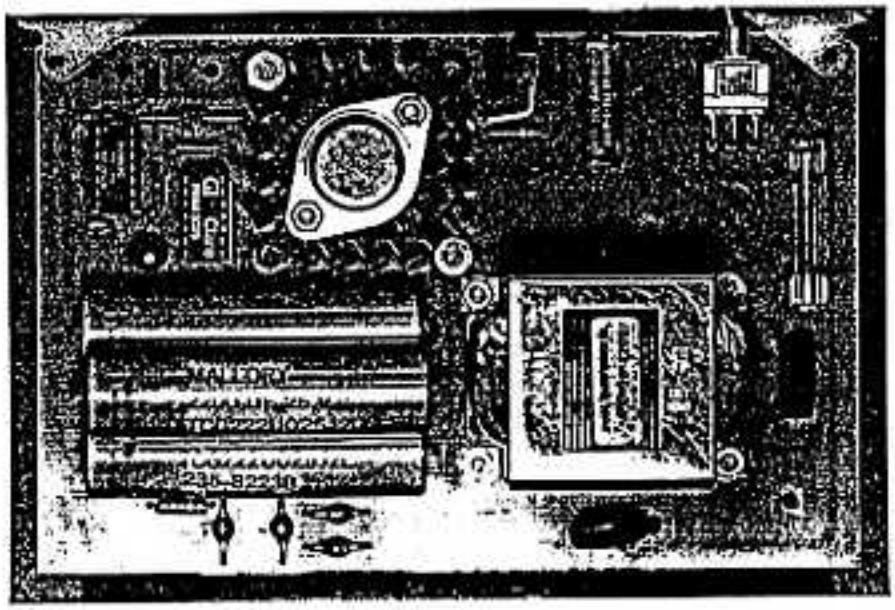


As the name implies, the reversible board takes care of the operation of the reversible actions such as Gt to Ped Rev...Sfz, etc. This unit operates independently from the rest of the system and that means that a reversible function may be accessed at the same time that the combination pistons are operated providing the two operations do not clash. That is to say, you cannot operate a piston that will be controlling the same stop that the reversible piston is going to change.

The reversible board uses the same decoder chip that is used by the control board to determine which reversible has been pressed, but it uses only eight of the twenty possible addresses

because there is room for only eight reversibles on the board. Like the memory boards, it too has the driver transistors mounted on it which operate the kicker actions to move the controls on the console.

POWER SUPPLY DESCRIPTION



The power supply board provides the 5 volt D.C. power that not only keeps the memory chips active, but also provides the power to operate the entire memory system. This board also contains the power failure alarm system which monitors the power line for interruptions.

Setting the correct output voltage, and getting the batteries to charge up properly, have both been mentioned in previous sections of this manual.

There is a red indicator on the front edge of this board that indicates whether the power is on or not. There also is a toggle switch just above this lamp (see fig. [7]). This switch

turns off the A.C. line current to the power supply and will shut the memory box down. Be aware, as mentioned before, that even though this switch may be turned off, there is still 110 volts A.C. present on the circuit board in the proximity of the switch. The board should never be handled unless it is removed from the memory box, or the memory box power cord has been disconnected. Serious injury could result from electrical shock if this caution is not observed.

If the combination action is dead, and the indicator lamp on the power supply is out. If the toggle switch on the board will not turn the indicator on, and you have established that the receptacle where the memory box is plugged into is hot, the fuse on the power supply may be out. While observing all precautions regarding electrical shock, turn off the power, remove the power supply, and replace the line fuse that is on the board with a similar type...1/2 AMP quick blow.

The power failure alarm warns the organist that there has been an interruption of the line current to the memory box at some time since the last time the organ has been used. It does not mean that the memory has been destroyed as it does not consider how long the power may have been off. Short duration (several hours or less) power failures will be covered by the back up batteries, and therefore, not cause memory failure. However, the alarm will still come on the next time the organ has been put to use, and the organist should check their settings to make sure nothing has been lost.

There is an indicator lamp and a reset button located in plain view on the console. If, when the organ is turned on, the red lamp is lit, the pistons should be checked and the reset button should be pressed to turn the indicator off.

The indicator lamp and the reset button are both wired from +12 volts D.C. (organ D.C. positive). The other side of each of these two devices then are wired down to the power supply edge connector on the back panel (see fig. [20]). This wiring, the lamp and push button are the only part of the alarm circuit that should be repaired in the field should the PFA (as we call it) ever need service. Any failure within the circuit board itself, should be fixed by exchanging the power supply with a new one.

Any failure of the power supply that cannot be repaired by replacing the fuse or adjusting the voltage, should also be replaced.

BACK PANEL & WIRING

FIGURE 16 HERE

The back panel provides us with a place to mount the sockets which mate with the various circuit boards that operate the memory system. It also provides us with a place to tie in the wiring that connects the memory box with the outside world...the console kicker actions and pistons, etc. In addition, the back panel also provides us with all of the common busses that run between the various circuit boards. Some of these busses are common to the entire system, and others are common only to the circuit boards within each division.

Buss foils that are common only within the divisions do, in fact, run across the entire back panel, but they are cut between each division in order to keep them separated from one another.

Other foils run across the entire back panel but connect only to control boards. These foils are separated from the memory board sockets by drilling out tine jumper loops beside each socket pin on each and every memory board socket that comes in contact with these specific foils.

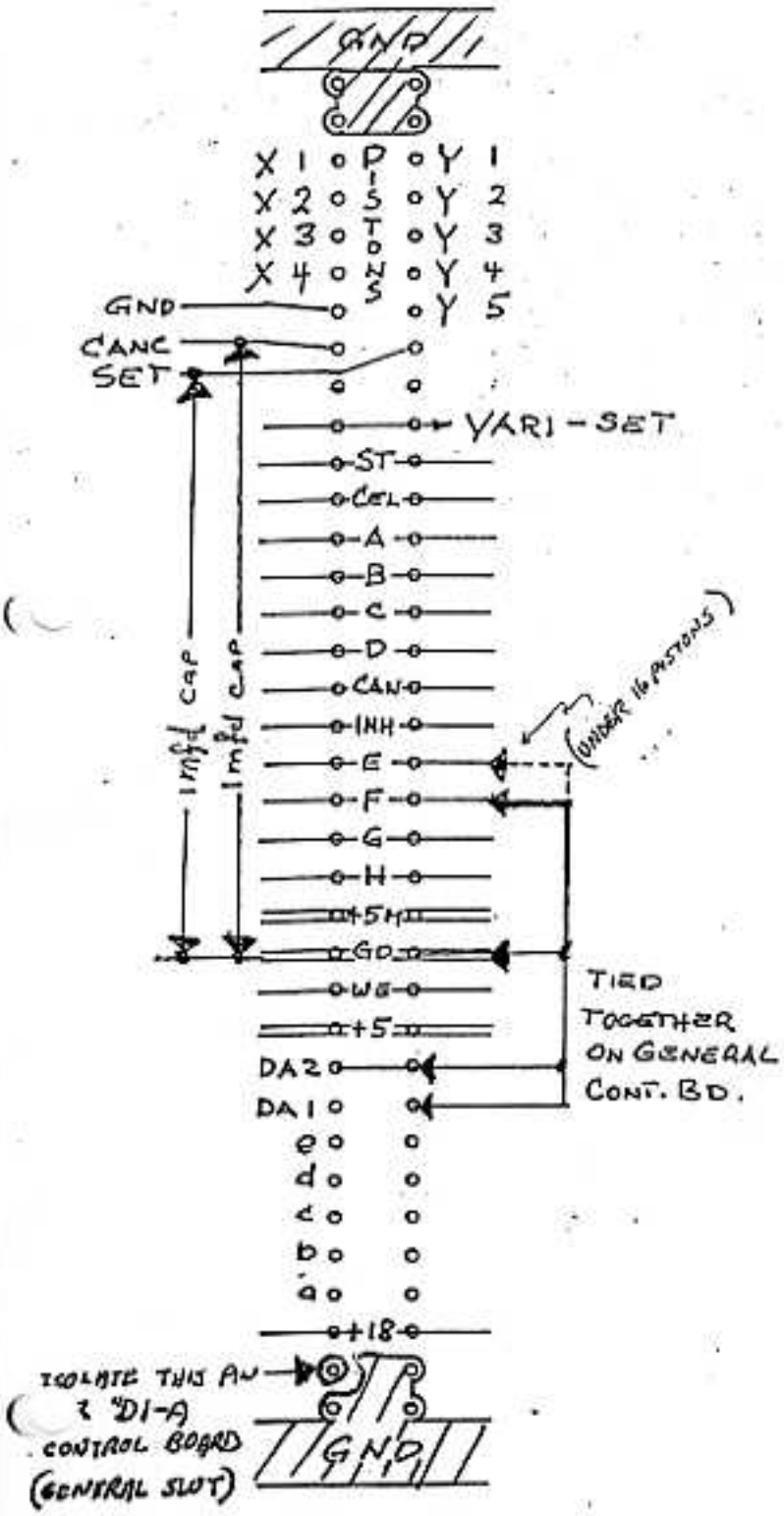
It is not likely that a problem regarding the cutting of the various back panel foils would ever escape the initial checkout at the factory, but you should be aware of just what is separated from what else in case you should encounter some difficulty relating to this subject. The spacing between some of the foils and related socket pins is extremely close and sometimes visual inspection alone is not sufficient. It may be necessary to test for shorts that might exist between common foils and supposedly segmented socket pins with an ohmmeter.

Study figures 17 through 20 on pages 36 through 39 respectively. These figures illustrate in detail exactly what is connected to each socket pin. You will notice that there are two pins side-by-side at each vertical location on the sockets. Some of these are connected together, others are not.

In order to simplify the identification of the various socket pins, we will establish a numbering system that will apply in all references made to these points with this manual. The drawings of the sockets show them as viewed from the back of the memory box as you would view the box when it is removed from the console with the plastic wiring trough facing you and at the top of the box. The cable will then be running off to your left. The top of each socket will be the end closest to the wiring trough. Each socket pin will be numbered in pairs (left and right) from top to bottom. That is to say that pin "14L" on some given socket would then be the 14th pin down from the top on the left side.

MOD. "D" CONTROL BOARD WIRING.

FIG 17



GEN. CONTROL BOARD

1. GROUND INPUT PIN DA 1
2. GROUND BOTH PINS DA 2
3. GROUND ADDRESS LINE F
4. IF NOT MORE THAN 16 PISTONS, GROUND ADDRESS LINE E.
5. INSTALL 1mfd CAPACITOR in CANCEL. AND SET LINES TO GROUND
6. GROUND UNUSED Y LINES

DIVISION CONTROL BOARDS.

1. GROUND ADDRESS LINE E IF NOT MORE THAN 16 PISTONS ON EITHER GEN. OR DIV.
2. GROUND UNUSED Y LINES

ADJUST CONTROL BOARD TRIMPOTS

DIV: TURN SCREW COUNTERCLOCKWISE UNTIL IT CLICKS, THEN TURN SCREW CLOCKWISE 10 TURNS.

GEN: TURN SCREW COUNTERCLOCKWISE UNTIL IT CLICKS, THEN TURN SCREW CLOCKWISE 15 TURNS. (DI-A 10 TURNS)

CLOCKWISE TURNS INCREASES HOLDTIME.

SELECT

IF SELECT FEATURE IS NOT UTILIZED, G AND H LINES HAVE TO BE GROUNDED. IF ONLY A-B IS USED - GROUND H-LINE.

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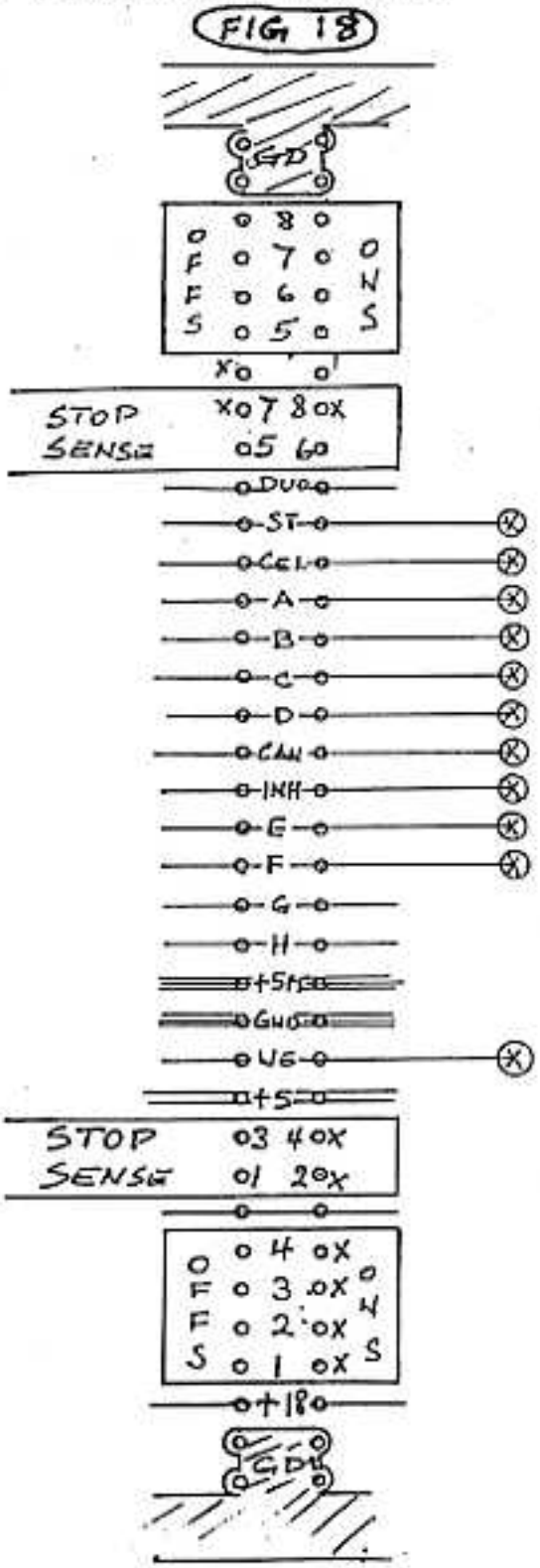
MOD. "D" MEMORY BOARD WIRING

INTER-MANUAL COUPLER BOARDS IN SLOTS NEXT TO GENERAL CONTROL BOARD.

FIG 18



X DESIGNATES CUTS TO BE MADE ON MEMORY BOARD POSITIONS ONLY.

⊗ ARE CUTS FOR SEGMENTING DIVISIONS

CANCEL PISTON LINE MAY BE SEGMENTED FOR DIVISIONAL CANCELS.

HALF-BOARD WIRING

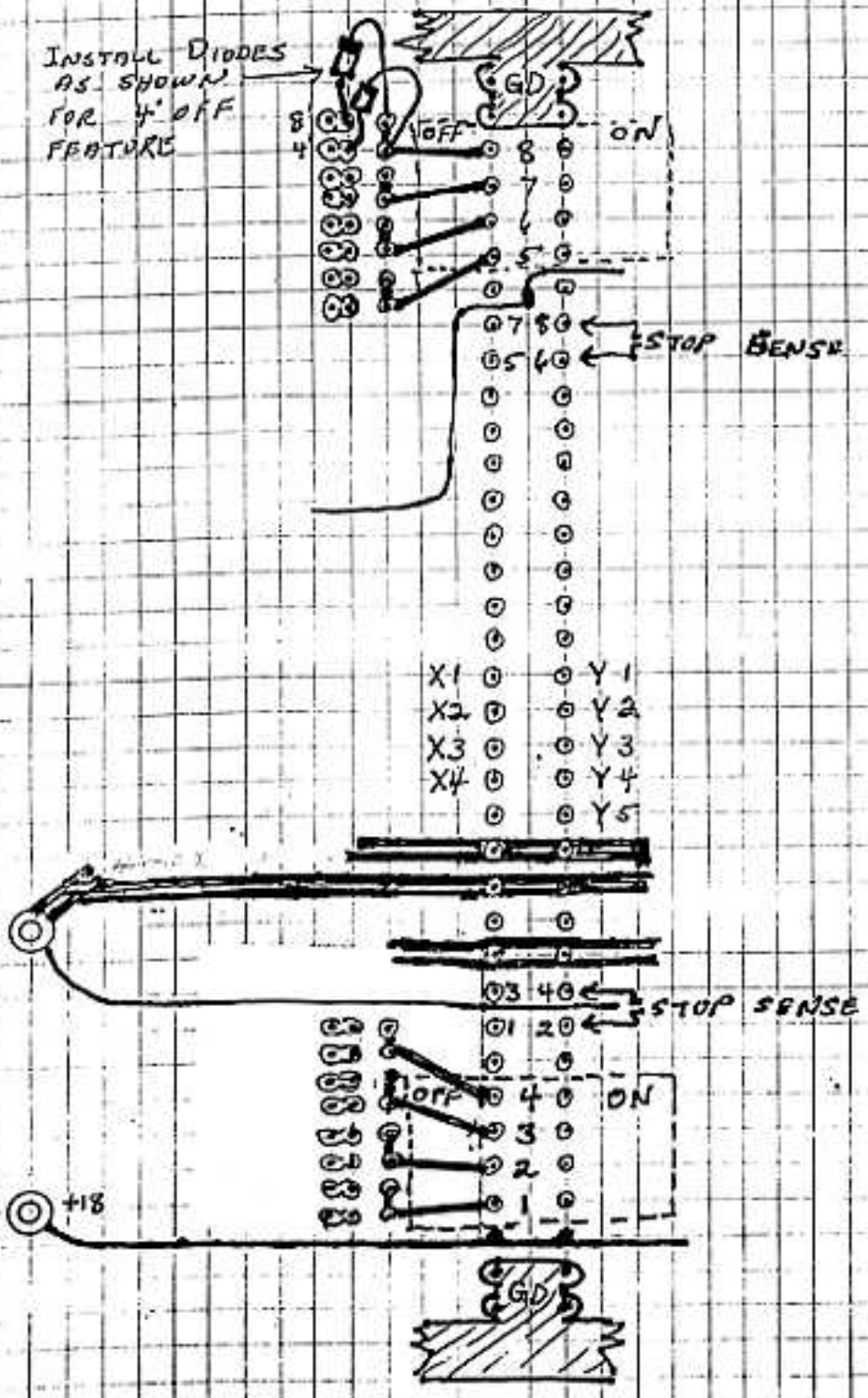
1 TO 4 GOES TO THE RIGHT.

5 TO 8 GOES TO THE LEFT.

IN THIS CASE CUTS TO SEGMENT DIVISIONS HAVE TO BE MADE BETWEEN PINS OF SOCKET INVOLVED. ⊗

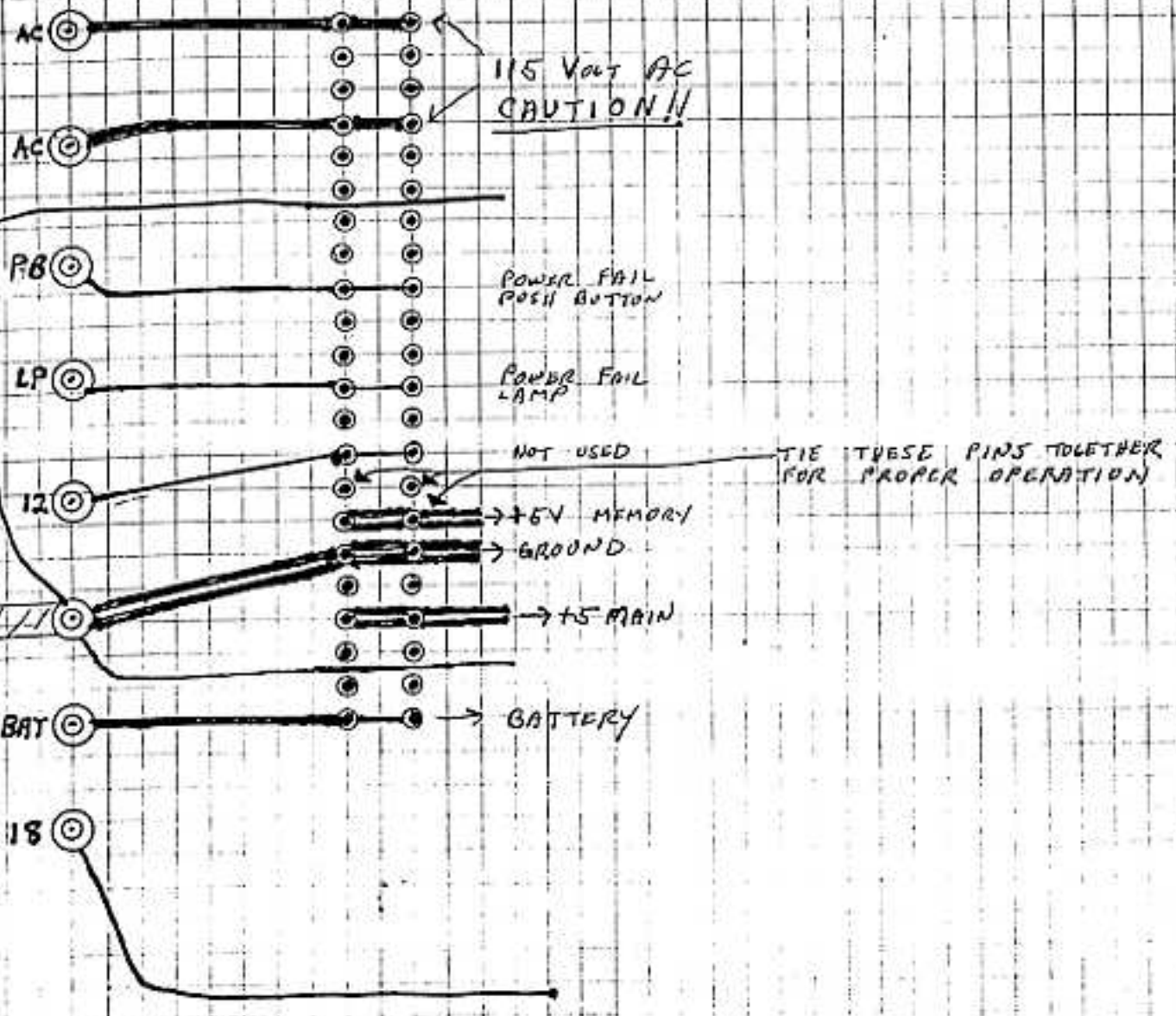
MODEL "D" REVERSIBLE BOARD WIRING

FIG 19



MODEL "D" POWER SUPPLY WIRING

FIG 20



CONTROL BOARD SOCKET

Pins 1 & 2, L & R are tied to ground.

Pins 3L, 4L, 5L and 6L are connected to lines X1 through X4 respectively from the pistons.

Pins 3R, 4R, 5R, 6R and 7R go to the Y1 through Y5 lines at the pistons. These may not all be connected.

The CANCEL and SET pistons are connected to pins 8L and 8R of the General control board socket.

Position 10 L and R is connected to the Dual Set function switch if so fitted, otherwise, tied to ground.

Positions 21 and 22 L and R are connected to lines G and H of the A-B-C-D select switch when fitted, otherwise, tied to ground.

The control board socket for any given division will be at the right end of that particular group of sockets (as viewed from the rear) if none of the memory boards are shared between that division and any other division. When a memory board is shared between two divisions, the memory boards for both divisions are placed side-by-side with one control board at each end of this group. The busses that are segmented between divisions in this situation are cut between the L and R pins of the memory board socket that is <u>shared between the two divisions.</u>

All segmenting to separate one division from another will be done immediately to the right of each control board socket, between the control board socket and the next socket over, except the one situation described above, where there will be a control board situated to the left of its associated memory boards.

The socket positions that are cut between divisions are from top to bottom as follows: Positions 11 through 20, and position 25. All other common foils that run across the back panel remain intact.

MEMORY BOARD SOCKET

Pins 1 and 2, L and R are tied to ground.

Pins 3L, 4L, 5L and 6L connect to the "OFF" kickers for circuits 8, 7, 6 and 5 respectively.

Pins 3R, 4R, 5R and 6R connect to the identical "ON" kickers as mentioned above.

The stop action sense lines connect to pins 8 and 9, L and R as follows: #8:8R...#7:8L...#6:9R...and #5:9L.

The stop action sense lines connect to pins 27 and 28, L and R as follows: #4:27R...#3:27L...#2:28R...#1:28L.

Pins 30L, 31L, 32L and 33L connect to the "OFF" kickers for circuits 4, 3, 2 and 1 respectively.

Pins 30R, 31R, 32R and 33R connect to the identical "ON" kickers as mentioned above.

The following memory board socket pins will always be separated from the common busses that run along side these pins. These busses connect to control board sockets only: 7L, 8L, 8R, 27R, 28R, 30R, 31R, 32R and 33R.

REVERSIBLE BOARD SOCKET

The top two positions are tied to ground.

The socket positions 3, 4, 5, 6, 8 and 9, L and R as well as the positions 27, 28, 30, 32, 32 and 33, L and R are identical in design to the same positions on the Memory board sockets. They are wired to the "ON" and "OFF" kickers as well as the stop actions for the various stops that are affected by the Reversible board. This is accomplished by installing jumpers between the reversible board socket pins and the respective socket pins on the appropriate Memory board sockets which the particular reversibles operate.

In addition, the "OFF" pins are fitted with a place to connect two diodes to each "OFF" (left) pin. This feature allows each "OFF" action of any reversible to operate two kickers together. This is used with pedal couplers that are operated with the reversibles. The "OFF" pin of each reversible that operates a pedal coupler will be connected through diodes to the "OFF" kicker for that particular coupler, and the "OFF" kicker for the respective 4' coupler also.

Take this case for example: The reversible #2 operates the Swell to Pedal 8' coupler. Figure [4] on page [5] of this manual indicates that the Swell to Pedal 8' coupler is located at memory socket #1 circuit #3, and the Sw. to Ped. 4' is located at socket #1, circuit #4. The reversible socket jumpers are wired to the memory socket pins as follows:

REV PIN 32R (REV #2 ON)...to...MEM SKT #1, PIN 31R (MEM #3 ON)
REV PIN 32L (REV #2 OFF)..to...MEM SKT #1, PIN 31L (MEM #3 OFF) &
also through diodes at REV 32L:MEM SKT #1, PIN 30L (MEM #4 OFF)
REV PIN 28R (REV ST.ACT #2)to..MEM SKT #1, PIN 27L (MEM #3 S.A.)

POWER SUPPLY SOCKET

The power supply socket is wired as illustrated in figure [20]. L and R sides are all wired together, so no reference will be made to the left or right side of the socket.

Positions 4 and 7 are connected to "110V AC Line" (these terminals are hazardous and should be handled with care).

Position 12 connects to the "PFA Lamp".

Position 15 connects to the "PFA Push Button".

Position 18 connects to the "+5 Mem" buss on the back panel. (This buss is actually located at position 18, so therefore positions 17 and 18 must be jumpered together).

Position 20 connects to the "Logic Ground" buss on the back panel.

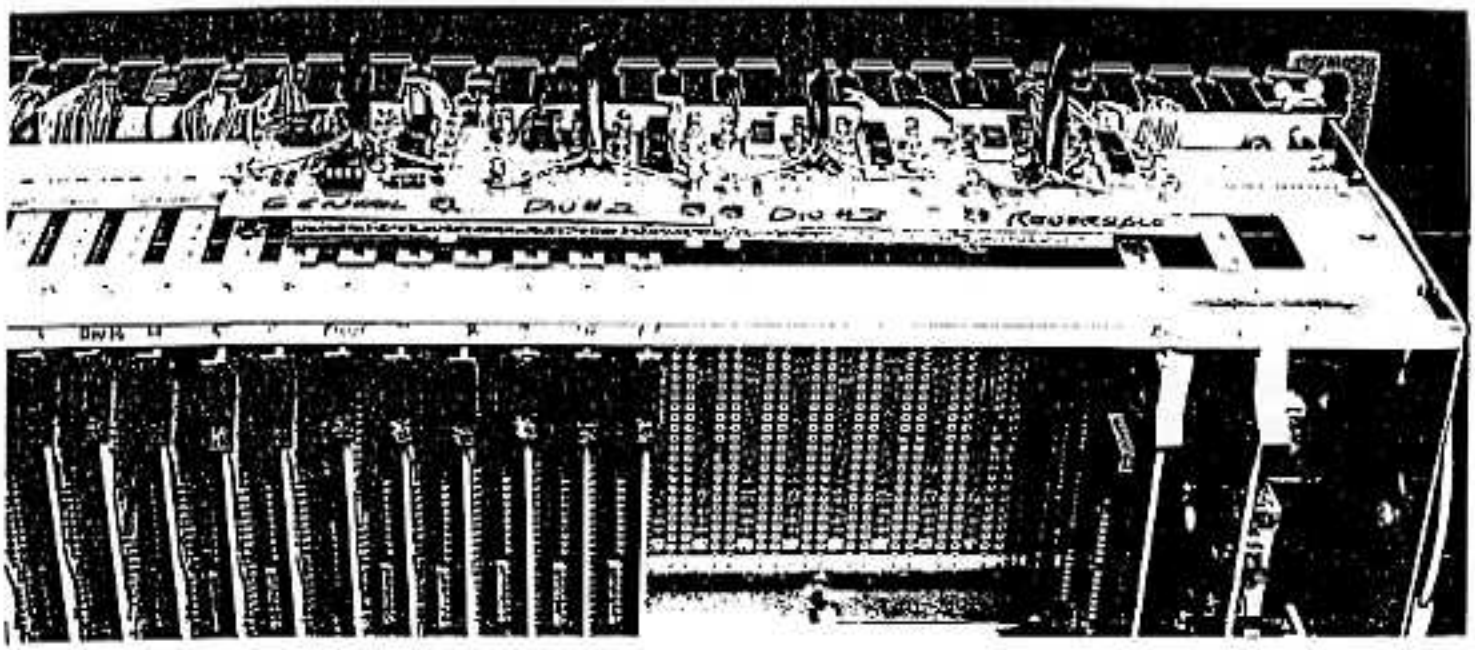
Position 22 connects to the "+5" buss on the back panel (The "+5" and "+5 Mem" busses are jumpered together on the back panel).

Position 25 connects to the battery.

All of the connections mentioned above that connect to the outside world are connected to the power supply socket through stud terminals located immediately to the left of the power supply socket. All of these terminals have been mentioned above except for one.

The only remaining terminal at the left end of the back panel is the one at the very bottom, and this is connected to the +18V DC that feeds the kicker actions in the console. (+ 12V DC in the case of an air console).

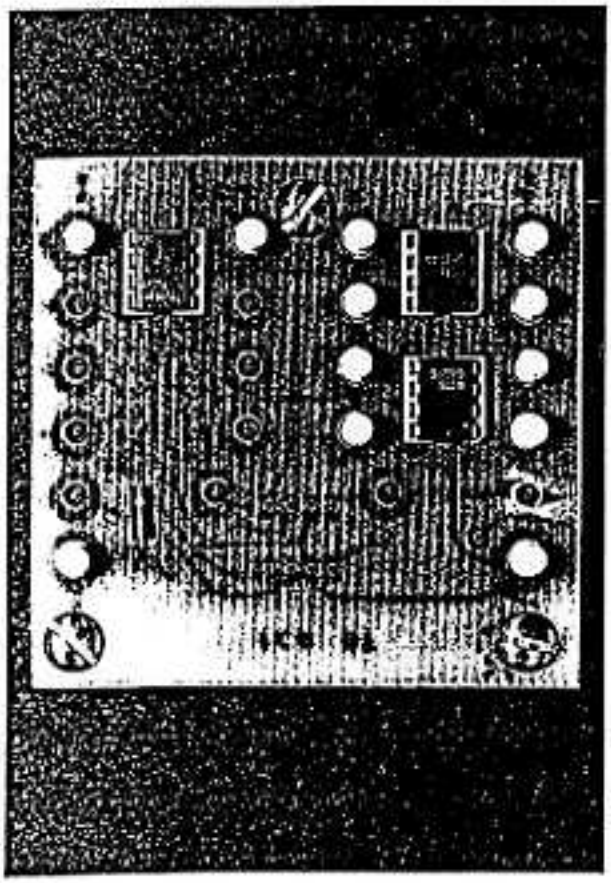
INTERFACE BOARDS



On some early Model D combination actions fitted with the series D1 control boards, interface boards utilizing opto-couplers have been installed. The purpose of this interface is to reduce the possibility of inputting electrical noise to the decoder chip on the control boards. Figure 21 shows such an installation. The interface boards are mounted across the top of the memory box. There is one interface board for each control board, and one for the reversible board as well.

The interface boards are hard-wired between the pistons and the "X & Y" inputs on the control boards. They are, therefore, not removable as are the other circuit boards. The opto-coupler chips are socketed, allowing replacement of these I.C.s without any particular difficulty.

Should piston failure occur that cannot be corrected by exchanging the control board for that particular division, try replacing the opto-coupler chips for that division on the



appropriate interface board. Each board has two divisions on it, and the divisions are arranged in the same order across the box that the control boards are arranged.

When you replace one of the I.C. packages on the Interface board, make certain that you note which direction that the notch on the chip faces before you remove it. Always install the new chip in the same direction. Be careful because the packages point in several different directions.

Replacement opto-coupler chips are available from us should the need arise. If immediate replacement is necessary, try exchanging the chips with the ones for the reversibles to make certain that "replacement" solves the problem. The parts are not likely to be available locally so, therefore, we will have to be notified about this problem. Exchanging parts with the reversible division should allow time for us to send to you the needed replacement items. The reversibles would then be temporarily out of operation.

Failure of the opto-coupler chips is not considered likely.

EARLY MODEL D TIMING ADJUSTMENT

Model D combination actions built before January 1, 1985 were fitted with control boards D1, and D1-A. All later consoles are fitted with control boards D1-B. The D1, and D1-A boards require that the hold circuit timing pulse be set for each division. The later revision D1-B operates with a master clock on the General control board with all of the divisional control boards slaved to it, and therefore, require that the timing be set on the General board only. The control board timing adjustment procedure as outlined on page 19 of this manual applies to the later (D1-B) version of this combination action.

On the early systems, it is necessary to set the length of the timing for the hold circuit on the General control board slightly longer than the time set for the divisional control boards. The default setting for these boards is done as follows.

Turn the timing trimpot on each control board counter clockwise at least 30 turns to guarantee that they are all turned down as far as they will go. Then turn the pot on the General control board back up (clockwise) fifteen turns. Turn the remaining pots on the divisional control boards up ten turns. This should give you a satisfactory setting. Check the combination action out examining for the responsiveness of the knobs as well as the action's ability to change rapidly from one piston to another. If the timing of the General control board is shorter that the time set on any of the divisional control boards, erratic operation of the knobs will occur when General

pistons are struck, and released quickly. Check to see that when a General piston is hit and quickly released, that the knobs do not try to move to a different setting as the piston is released. If this symptom appears, increase the time on the General control board by turning the trimpot up a turn or two. If this causes the system to not allow rapid operation while going from piston to piston, then go back and turn all of the trimpots back down a turn or two. Be sure to turn all of the pots down the same amount.

SUMMARY OF PART TWO

Part one of this manual was written with the customer in mind. It was intended to serve as a guide for non-technical people providing information on circuit board and fuse replacement. The material covered in the second part of this manual has been directed to the service man in the field. It is slightly more technical than part one, however, it should be understandable by anyone who is familiar with organ construction, wiring, and the basic use of test equipment.

We at SCHANTZ ORGAN COMPANY are standing by to offer assistance to anyone in the field who needs help with a specific problem. It is suggested that you call us from the church at the time you are working with the equipment so that we might best handle your needs.

We also urge that any time you service an organ outfitted with this combination action, that you bring this manual with you. You should also have an accurate multimeter and be familiar with its operation.

Our business hours are from 7:00 AM to 3:30 PM Eastern time Monday through Friday.

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