CHOIR EXTENSIONS (2')

GENERATORS

	Section A (C-F)			Section B (F#-B)			
C1	120 pf			C1	120 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	10K	R3	100K	R4	10K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS /GATES

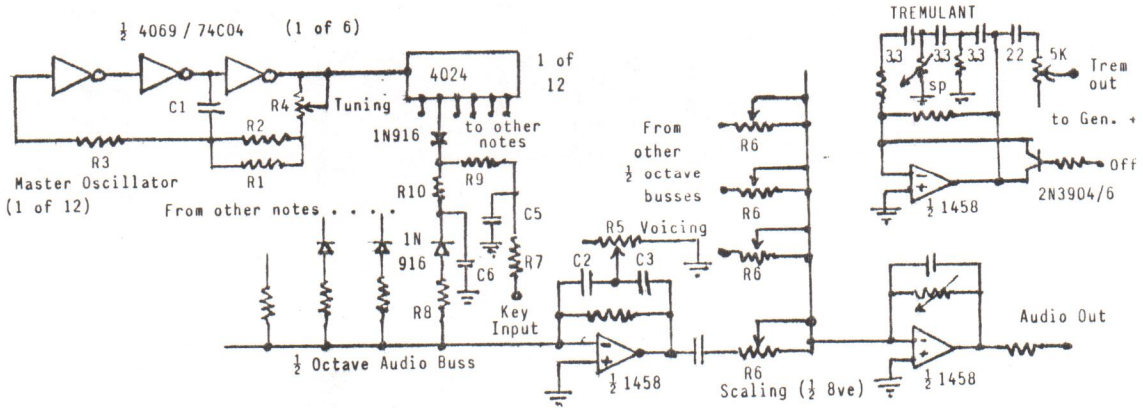
	Section A (C-F)			Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K
C5	-	-	-	1uf	.47uf	-	-	-	1uf	.47uf
C6	-	-	-	-	-	-	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-
C8	-	-	-	-	-	-	-	-	-	-

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	-	-	-	.033uf	.015uf	-	-	-	.022uf	.01uf
C3	-	-	-	.033uf	.015uf	-	-	-	.022uf	.01uf
C4	-	-	-	.022uf	.01uf	-	-	-	.015uf	.0068uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



SWELL CHIFF 1 3/5'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	120 pf			C1	120 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	10K	R3	100K	R4	10K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

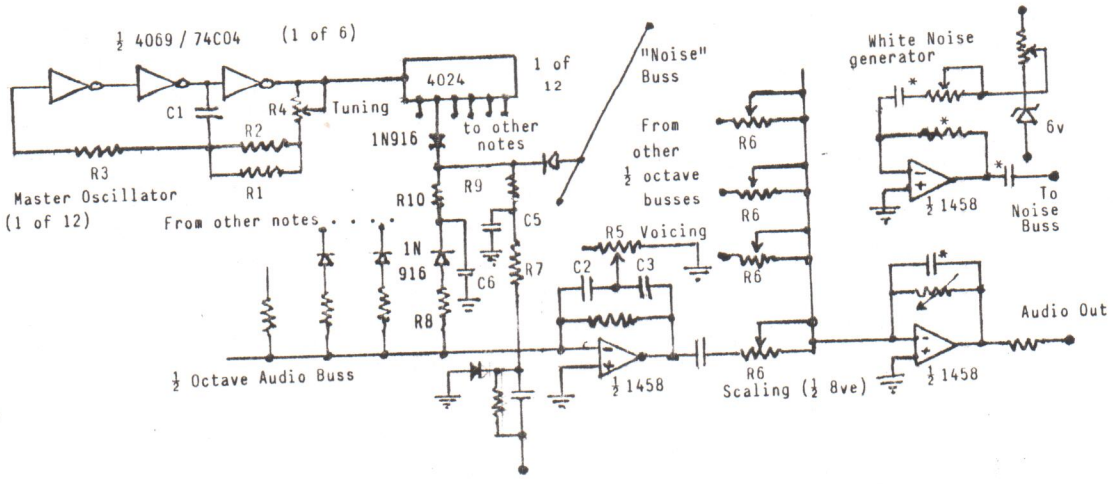
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	1.5K	1.5K	1.5K	1.5K	1.5K	1K	1K	1K	1K	1K
C5	4.7uf	2.2uf	1uf	.47uf	-	4.7uf	2.2uf	1uf	.47uf	-
C6	-	-	-	-	-	-	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-
C8	10uf	10uf	4.7uf	2.2uf	1uf	10uf	10uf	47uf	22uf	1uf

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	.1uf	.047uf	.022uf	.01uf	.0056uf	.1uf	.033uf	.015uf	.0082uf	.0033uf
C3	.1uf	.047uf	.022uf	.01uf	.0056uf	.047uf	.033uf	.015uf	.0082uf	.0033uf
C4	.1uf	.047uf	.022uf	.01uf	.0056uf	.1uf	.033uf	.015uf	.0082uf	.0033uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



SWELL GAMBA 16'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	50K	R3	100K	R4	50K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

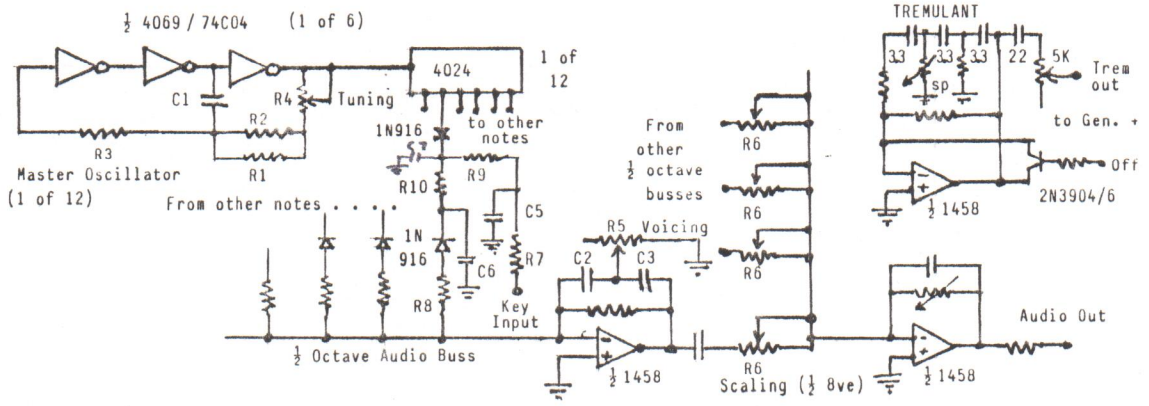
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	1.5K	1.5K	1.5K	1.5K	1.5K	1k	1K	1K	1K	1K
C5	33uf	22uf	10uf	4.7uf	2.2uf	33uf	22uf	10uf	4.7uf	2.2uf
C6	-	-	-	-	-	-	-	-	-	-
C7	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.033uf
C8	-	-	-	-	-	-	-	-	-	-

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	-	-	-	-	-	-	-	-	-	-
C3	-	-	-	-	-	-	-	-	-	-
C4	.47uf	.22uf	.1uf	.047uf	.022uf	.47uf	.22uf	.1uf	.022uf	.015uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



SWELL REED 16'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	50K	R3	100K	R4	50K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

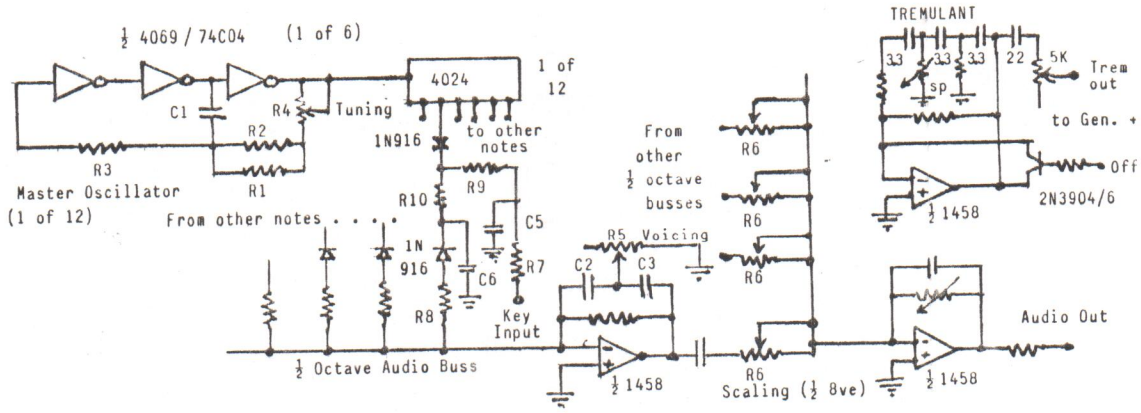
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	3.3K	1.5K	1.5K	1.5K	1.5K	2.2K	1K	1K	1K	1K
C5	33uf	33uf	22uf	10uf	4.7uf	33uf	33uf	22uf	10uf	4.7uf
C6	-	-	-	-	-	-	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-
C8	.047uf	.033uf	.022uf	.015uf	.01uf	.047uf	.033uf	.022uf	.15uf	.01uf

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
C3	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
C4	.47uf	.22uf	.1uf	.047uf	.022uf	.47uf	.22uf	.1uf	.033uf	.015uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



GREAT GAMBA 16'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	50K	R3	100K	R4	50K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

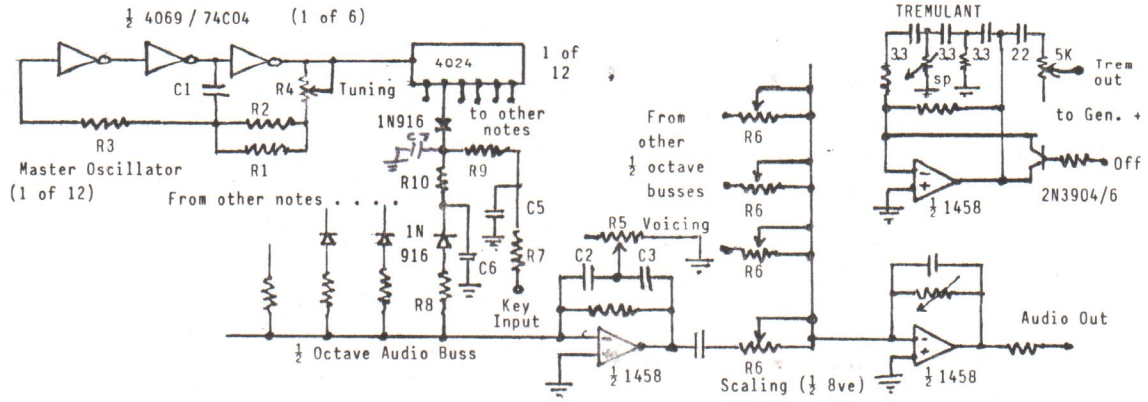
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	8.2K	R9	10K	R10	8.2K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	3.3K	1.5K	1.5K	1.5K	1.5K	2.2K	1K	1K	1K	1K
C5	22uf	22uf	10uf	4.7uf	2.2uf	22uf	22uf	10uf	4.7uf	2.2uf
C6	-	-	-	-	-	-	-	-	-	-
C7	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
C8	-	-	-	-	-	-	-	-	-	-

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	-	-	-	-	-	-	-	-	-	-
C3	-	-	-	-	-	-	-	-	-	-
C4	.47uf	.22uf	.1uf	.047uf	.022uf	.47uf	.22uf	.1uf	.022uf	.015uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



GREAT EXTENSION (2')

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	120 pf			C1	120 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	47K	R4	10K	R3	47K	R4	10K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

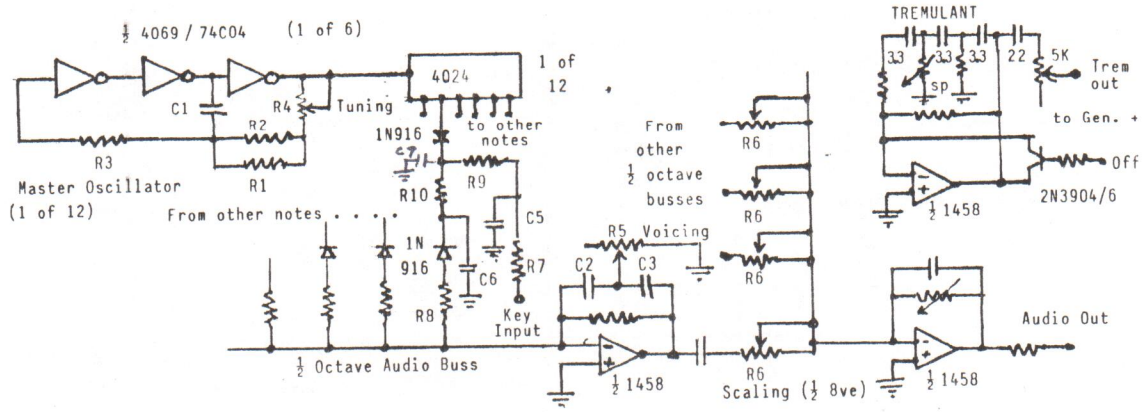
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K
C5	1uf	.47uf	1uf	.47uf	.47uf	1uf	.47uf	1uf	.47uf	.47uf
C6	.0047uf	.0033uf	-	-	-	.0047uf	.0022uf	-	-	-
C7	-	-	.033uf	.015uf	.0082uf	-	-	.022uf	.01uf	.0047uf
C8	-	-	-	-	-	-	-	-	-	-

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	.02uf	.01uf	-	-	-	.015uf	.0082uf	-	-	-
C3	.02uf	.01uf	-	-	-	.015uf	.0082uf		-	-
C4	.0015uf	.0082uf	.01uf	.0047uf	.0022uf	.01uf	.0047uf	.0082uf	.0033uf	.0018uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



GREAT / PEDAL PRINCIPAL 32' (with 1 oct. Clarinet)

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	220K	R4	100K	R3	220K	R4	100K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

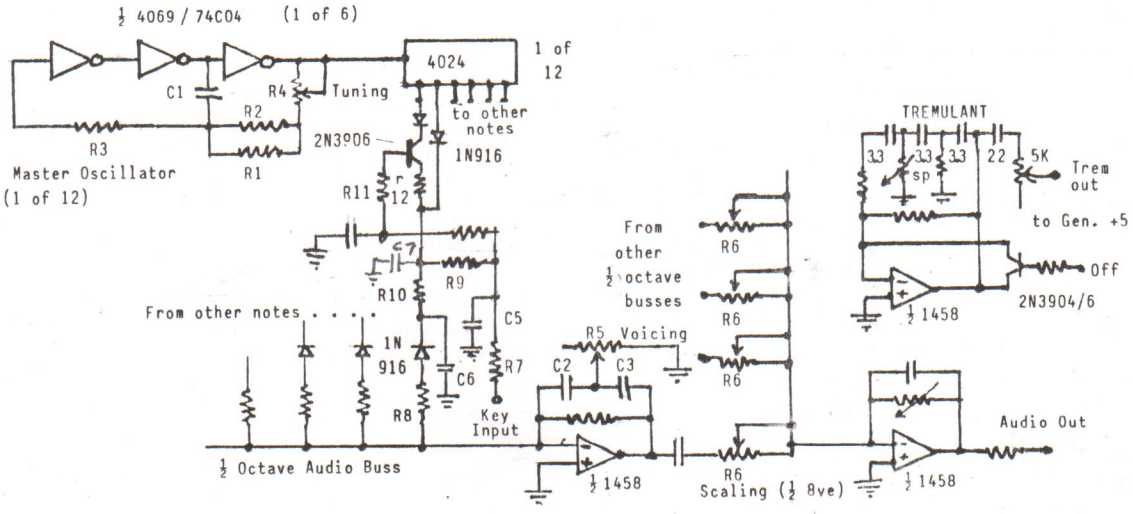
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.2K	R9	10K	R10	6.2K
R11	1M	R12	1K	R11	1M	R12	1K

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	3.3K	3.3K	2.2K	2.2K	2.2K	3.3K	2.2K	1.5K	1.5K	1.5K
C5	33uf	33uf	22uf	10uf	4.7uf	33uf	33uf	22uf	10uf	4.7uf
C6	-	-	-	-	-	-	-	-	-	-
C7	.22uf	.1uf	.047uf	.022uf	.01uf	.1uf	.047uf	.022uf	.01uf	.0047uf
C8	4.7uf	2.2uf	1uf	.47uf	.47uf	3.3uf	2.2uf	1uf	.47uf	-

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	DIv F#2	Div F#3	Div F#4	Div F#5
C2	2.2uf	1uf	.47uf	.22uf	.0068uf	2.2uf	1uf	.47uf	.22uf	.0047uf
C3	2.2uf	1uf	.47uf	.22uf	.0068uf	2.2uf	1uf	.47uf	.22uf	.0047uf
C4	1uf	.47uf	.47uf	.22uf	.1uf	4.7uf	2.2uf	1uf	.47uf	.22uf
R5	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



PEDAL / GREAT REED 32'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	220K	R4	100K	R3	220K	R4	100K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS /GATES

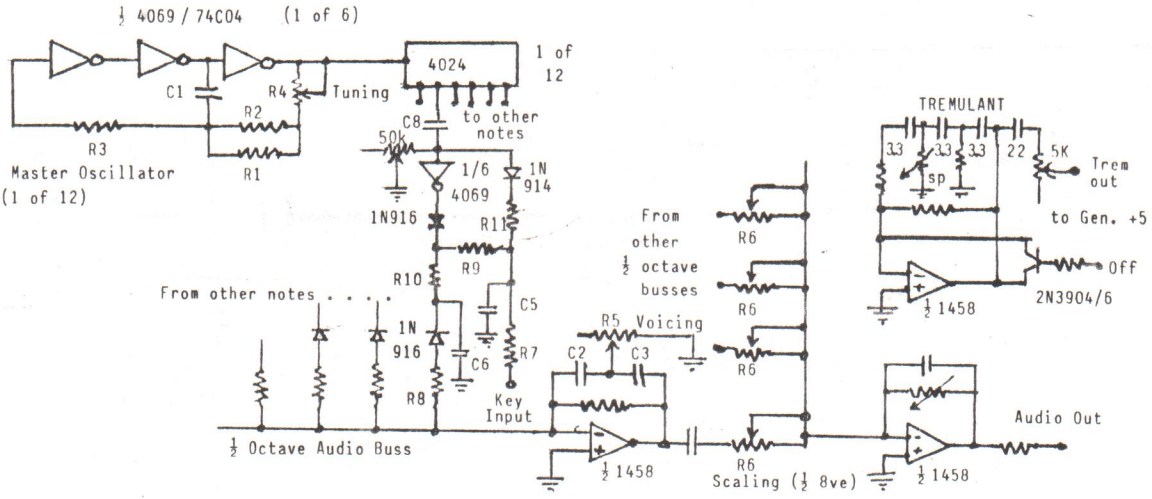
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	6.8K	R9	10K	R10	6.8K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	5.6K	3.3K	1.5K	1.5K	1.5K	5.1K	2.2K	1K	1K	1K
C5	33uf	33uf	22uf	10uf	4.7uf	33uf	33uf	22uf	10uf	4.7uf
C6	-	-	-	-	-	-	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-
C8	.1uf	.047uf	.033uf	.022uf	.015uf	.47uf	.047uf	.033uf	.022uf	.01uf

All Diodes type 1N916 All Transistors type 2N3906

FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

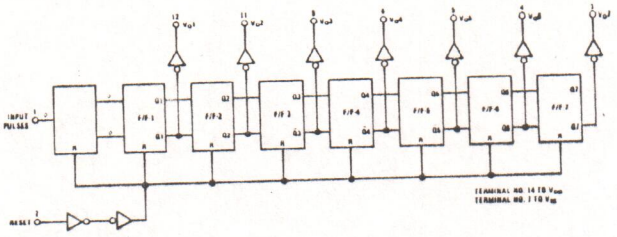
	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	1uf	1uf	.47uf	.22uf	.1uf	1uf	1uf	.47uf	.22uf	.1uf
C3	1uf	1uf	.47uf	.22uf	.1uf	2.2uf	1uf	.47uf	.22uf	.1uf
C4	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
R5	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K

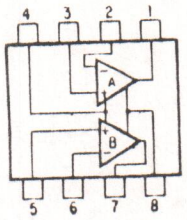


PINOUTS FOR INTEGRATED CIRCUITS

I.C.s Used in TONE GENERATORS

logic diagram

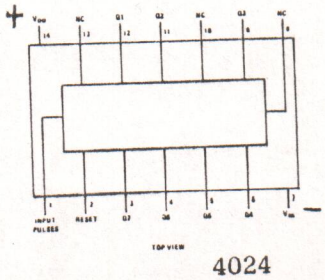




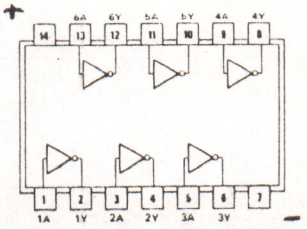
1. Output A
2. Inverting Input A
3. Noninverting Input A
4. V^-
5. Noninverting Input B
6. Inverting Input B
7. Output B
8. V^+

1458 CS

connection diagram

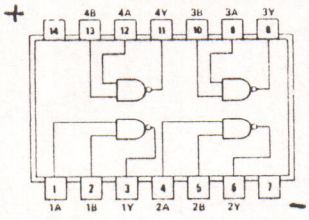


4024



4069

I.C.s Used in TTL SWITCHING



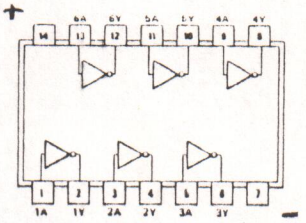
7400

7403

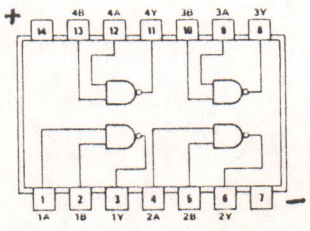
7404

7405

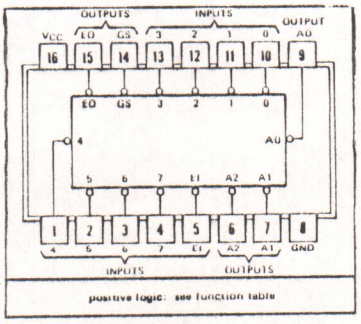
7407



I.C.s used in MEMORY BOARDS



4011



74148

CAPTURE MEMORY SYSTEM

Parallel input/output system using type 6116 CMOS static RAM chips, each chip having 8 input/output pins reading and writing eight stops, with sufficient number of chips to supply all stops on the organ at the same time, eliminating the need for multiplexing. During read or write operations, all stops are read or driven from memory board whether from full organ presets or individual department presets. All stops are memorized, but in the case of departmentals, only the desired set of stops have power sent to solonoids or coils.

The main board has two sets of power driver circuits made up of two or three stage transistor circuits. The first set of drivers supplies power to the individual current amplifiers for each coil. This provides control enabling only the desired group of coils be energized e.g. GREAT, SWELL etc. The second supplies power to the medium "holding voltage" which is delivered to each coil through a diode, supplying enough pull to hold the tab "ON" when pressed manually, but not enough to pull it on from its OFF position. When a preset is called, the holding voltage is removed, allowing all tabs to fall to the OFF position except those which are addressed ON. Also any tabs which were OFF and are called ON will be pulled ON by the much higher voltage deliverd individually through the switching transistors, supplied by the first set of drivers. Stops in other departments will remain unchanged, as their holding voltage will go uninterupted, and no higher ON voltage will be delivered to their drivers. On calling a preset, therefore, the first drivers turn on the higher voltage while the second ones turn off the hold voltage.

Data is selected from some two thousand locations by pressing one of forty preset buttons which activate the appropriate address lines. There are eleven lines in all, eight are controled by the preset buttons. Each set of eight buttons is connected, through schmidt trigger buffers, to its own eight to three line encoder chip. The three outputs connect to three 7407 non inverting open collector buffers (six per chip) which are used to wire-and all outputs to the same three lines, as only one division is used at a time. A chip output from each of the five 8 to 3 encoder chips drives its own individual address line, so that each button can call its own set of data. These five address lines also are connected to the hold and driver voltage switchers to limit the output action to the appropriate stop coils through the 7400 gates near the driver circuits. The five lines continue to the 5 diodes next to the 7407 chip which then connect to the 4011 pulse generator, providing a properly timed pulse on the write enable line when enabled by the SET relay, in order to write new data to the memory.

Normally, the first four sets of encoder chips (74148 type) are used for individual department presets and the fifth is used for General presets in which all stops on the organ are affected at once. This is accomplished using the second set of inputs in the two 7400 gates, which are all connected to the address line from the chip output of the General encoder chip. This line also connects to a third 7400 chip which controls a fifth set of set and hold driver circuits which are available for any stops which are not required to be included in any of the Departmentals such as inter manual couplers. Stops driven by these will only be activated when General buttons are pressed, along with all the other stops from the departments.

The WRITE or SET operation works as follows. When the SET button is pressed, energizing the set relay, the Output Enable line from the memory chips is disabled (high) placing the memory outputs go into high impedance state so that tab settings will not be changed when a button is pressed. This line (from the common of the relay contacts) also connects to the second input of the last cmos gate in the 4011 pulse generator, enabling the pulse to be output to the write enable inputs of the memory chips. When an individual button is pressed while the set relay is energized, first the appropriate address is set up by the encoder chip involved, after which a short pulse is output from the 4011 chip momentarily enabling the memory write inputs. The memory input/output terminals, now high impedance, contain data from the stop tab contacts, through the isolating resistors near the in/out terminals, and the appropriate levels are retained in the selected memory location. The data from the stop switches is otherwise shunted by the normally active outputs of the memory chips. Note that during the SET cycle, the Holding voltage is still cancelled when the selected button is pressed, but stops whech are on will not drop out due to the self holding effect caused by the switch data appearing at the memory input/output terminals driving the ON coils as they normally would during normal read cycle.

All five division address lines terminate at the 7407 chip near the "ON" drivers. The open collector outputs of the five buffers are connected to the chip enable line of the memory chips with a pullup resistor, so that any button pushed will cause the line to go negative, activating the memory chips which are normally in the "idling", low current state.

Power supply to memory chips is isolated from the rest of the circuit so that power can be supplied to the memory only while the organ is turned off. With the "CHIP ENABLE" inputs disabled, the memory only draws microamps, and can retain data with as low as 2 volts, so the electrlytic capacitors can support memory retention for hours in the event of a power failure, with a set of small batteries connected through diode as a further backup, able to hold memory for weeks or months.

MEMORY EXPANSION

The main board holds up to eight 6116 chips, each having eight input/outputs which provide for a maximum of 64 stops. If the organ has more than this, an expansion socket is provided for addition of a second board which is connected using a 16 pin DIP jumper cable. All data and power supply lines are included, so the expansion board requires only the memory chip section with input and output sockets.

The preset button input and encoding system can handle up to 40 buttons. While this number cannot be increased it is possible to use any unused department inputs to provide more general presets. In such a case, the extra inputs are connecte through diodes to a common line used to energize a small 5 volt relay with SPDT contacts wired in such a way as to interupt the generals data line between the 74148 section and the driver circuit section, leaving the 74148 section of the line open and connecting the driver section of the line to -5 volts. Energizing the relay from any source will then cause all stops to be driven. All stop settings are memorized during write operations whether Generals or Departmental.

The system described so far has used eight of the eleven data lines into the memory chips: three button address lines and five division address lines. The three remaining lines are connected to a sixth 74148 encoder providing another eight inputs. These are used to add seven more complete sets of memory if a selector switch is connected, bringing one input at a time to -5 volts.

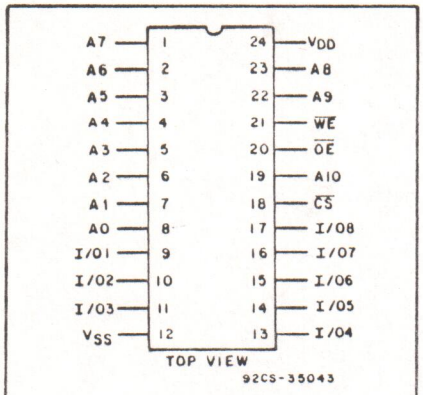
PRESET INPUT PROCESSING

A set of input buffers has been provided to prevent unintentional writing of data to other memory locations caused by intermittent loss of button contact during the Write Pulse, and also to provide a slight hold on the preset action to allow mechanical stabilization of stop movement before power is removed. A capacitor from the switch contact to ground charges when the button is pressed and discharges through the resistor in parallel. This voltage is input to a HCMOS Schmitt Trigger inverter and then through a standard TTL inverter to return correct polarity and provide sufficient current sink for the 74148 inputs. One such ciruit is provided for each button, and is located on a separate board inserted between the keyboard rail and the main Preset board.

RCA
Solid State Division

Memory/Microprocessor Products
CDM6116 Types

Preliminary Data



TERMINAL ASSIGNMENT

CMOS 2048-Word by 8-Bit LSI Static RAM

Features:

- *Fully static operation*
- *Single power supply - 4.5 V to 5.5 V*
- *All inputs and outputs directly TTL compatible*
- *3-state outputs*
- *Industry standard 24 pin configuration*
- *Input address buffers gated off with chip deselect*
- *Fast access time*
- *Low standby and operating power - I_{DDS1} = 1 μA typical, I_{OPER} = 35 mA maximum*
- *Data retention voltage - 2 V min.*
- *Operating temperature range (Max. Rating) - 0° to 70°C*

The RCA-CDM6116 is a 2048-word by 8-bit static random-access memory. It is designed for use in memory systems where high-speed, low power and simplicity in use are desirable. This type has common data input and data output and utilizes a single power supply of 4.5 V to 5.5 V.

The input address buffers are gated off with chip deselect for minimum standby power with inputs toggling.

The CDM6116 is supplied in 24-lead, hermetic, dual-in-line side-brazed ceramic (D suffix) and in 24-lead dual-in-line plastic packages (E suffix).

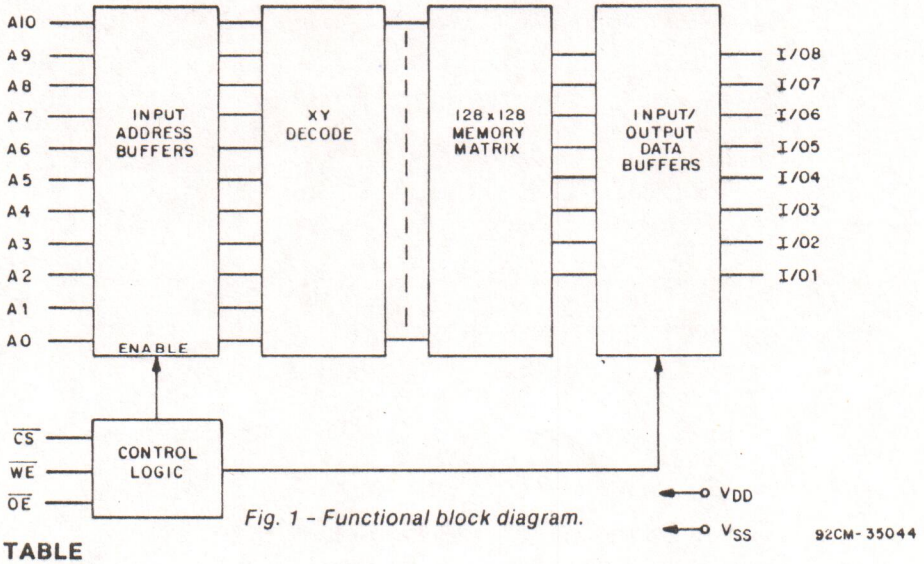


Fig. 1 - Functional block diagram.

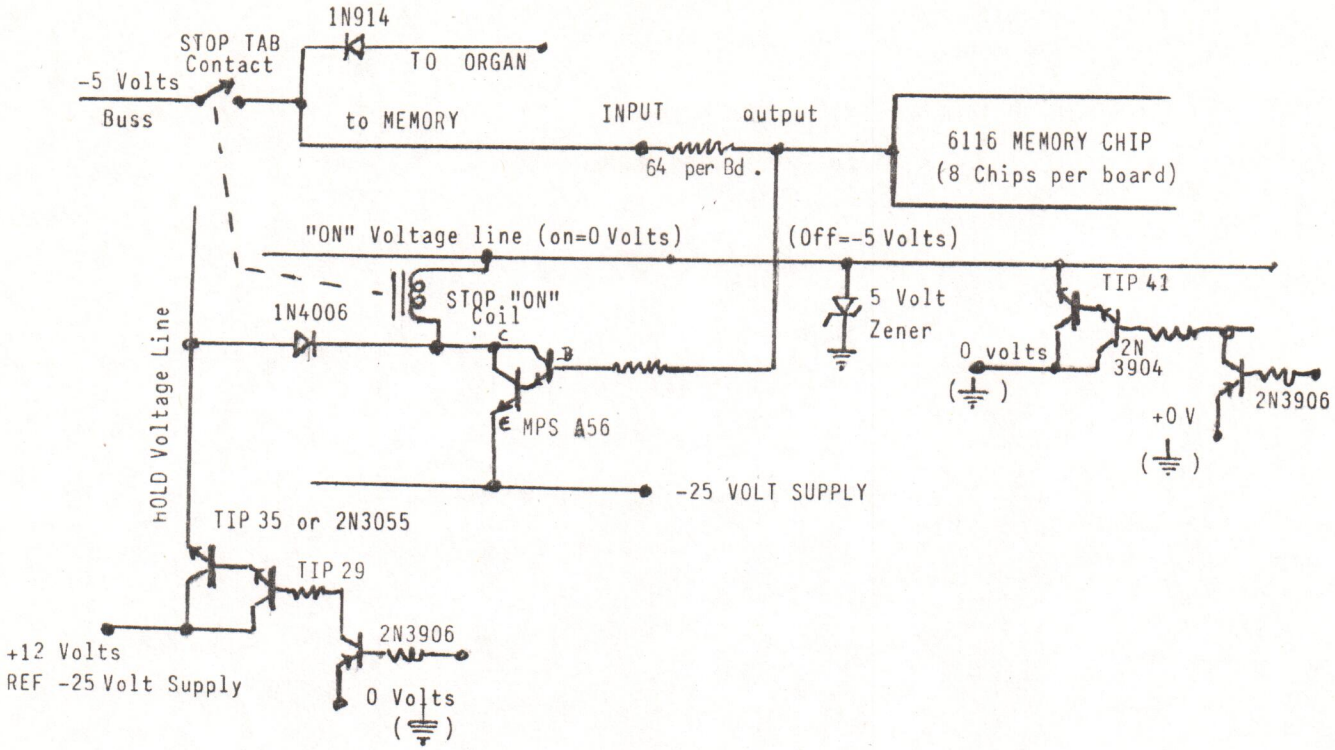
TRUTH TABLE

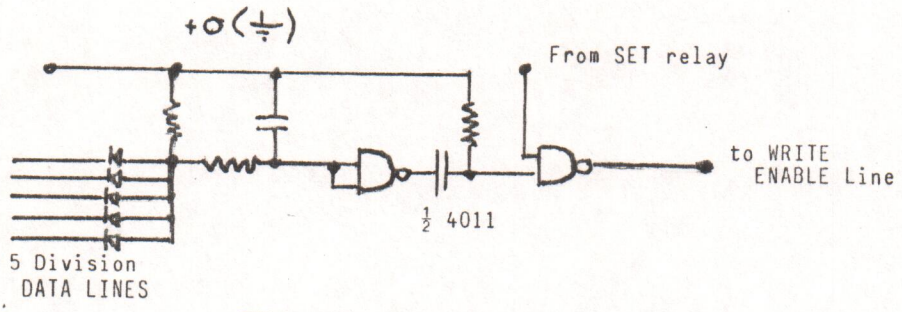
$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	AO TO AIO	MODE	DATA I/O
H	X	X	X	STANDBY	HIGH Z
L	L	H	STABLE	READ	DATA OUT
L	H	L	STABLE	WRITE	DATA IN
L	L	L	STABLE	WRITE	DATA IN

L = LOW H = HIGH X = DON'T CARE

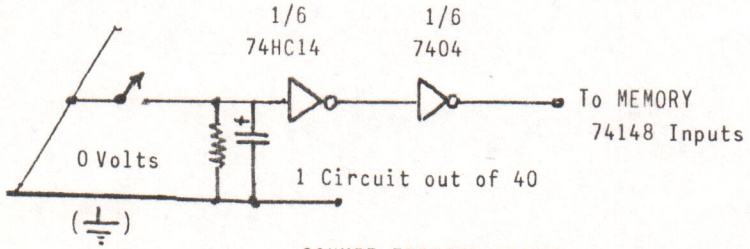
Printed in USA/8-82

STOP TABSWITCH AND COIL DRIVER CIRCUITS

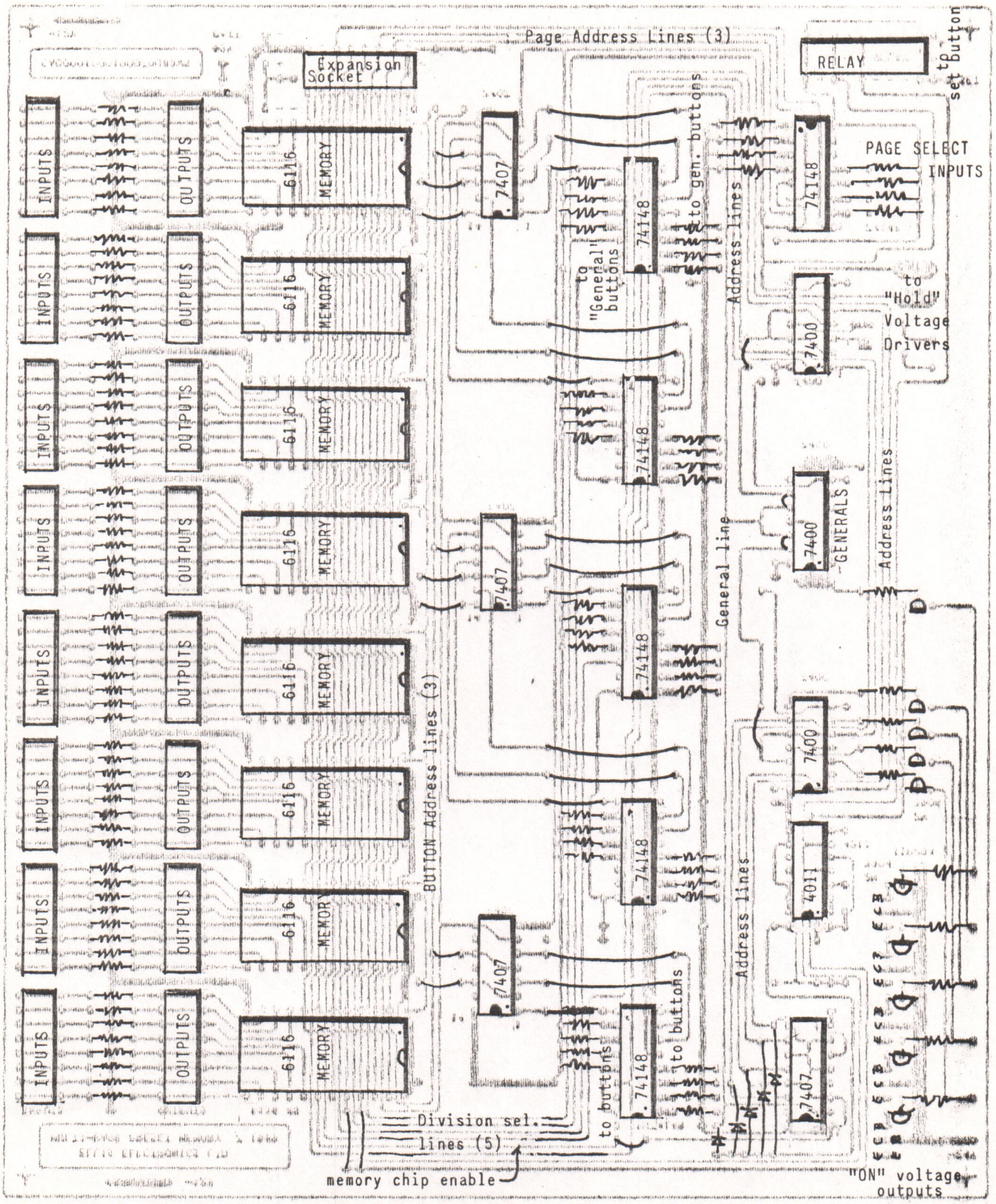




PULSE GENERATOR AND TIMER for WRITE CYCLE

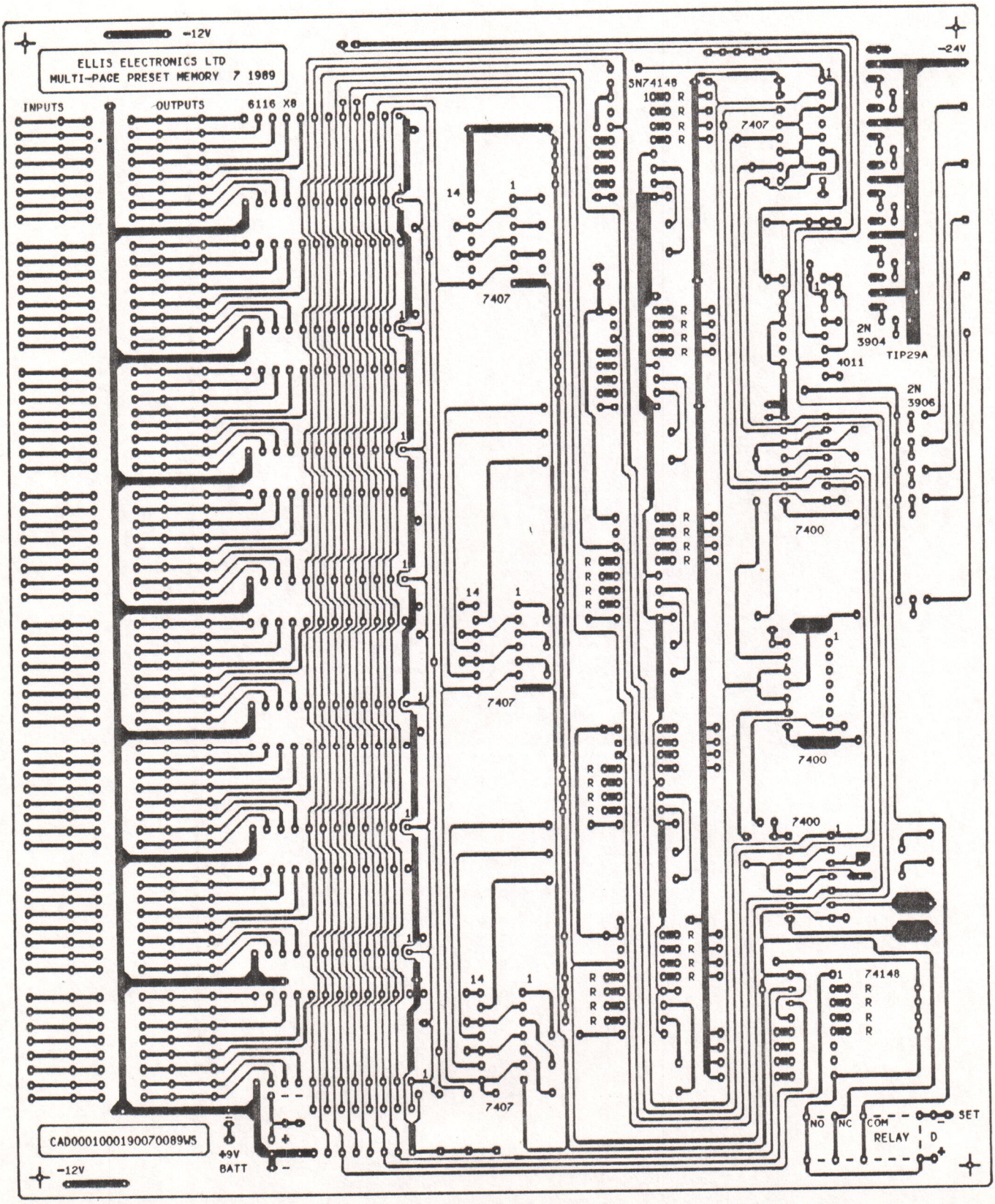


SCHMIT TRIGGER INTERFACE

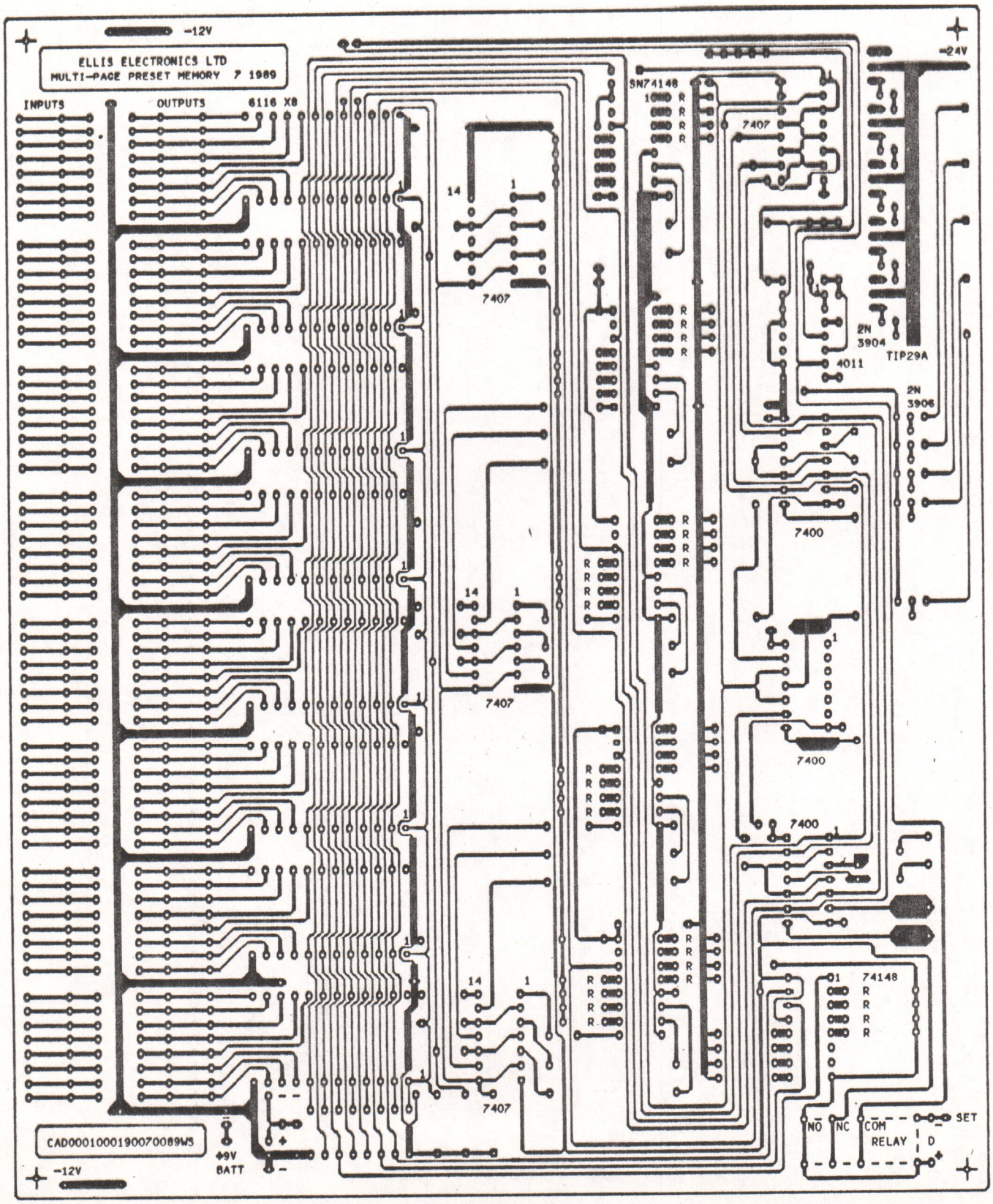


PRESET MEMORY BOARD - COMPONENT SIDE

PRESET MEMORY BOARD - FOIL SIDE



PRESET MEMORY BOARD - COMPONENT SIDE



COLOUR CODES

Much of the wiring used in this organ is multi-coloured. It should be understood that the colour codes were used as an aid in assembly only, and therefore do not necessarily represent any particular order or sequence, either musically or electrically. The colours are useful, however, for the purpose of identifying the two ends of individual wires. It may actually be found in many cases that the colours in a cable do follow some sequence, and this can be used as an aid in trouble shooting, as long as it is realized that the sequence may not be consistent.

Two different codes may be found within the system. Wherever possible or practical, the standard EIA code is used, with the number zero being considered the first in a sequence. Where Amphenol telephone type connectors are used in cables the pin numbers will not follow the sequence used at the wired ends of the cable, instead the standard telephone colour code is used, so that the wiring at the connectors will follow the usual sequence for that type of connector. The wires at the equipment ends of the cables will, of course be in sequence with each other.

Both codes are listed below page for reference, but again, use colours only as a guide to tracing.

E.I.A. COLOUR CODE

BLACK	0	BROWN	1	RED	2	ORANGE	3
YELLOW	4	GREEN	5	BLUE	6	VIOLET	7
GREY	8	WHITE	9				

TELEPHONE COLOUR CODE

BE/WE	1	OE/WE	2	GN/WE	3	BN/WE	4	GY/WE	5
BE/RD	6	OE/RD	7	GN/RD	8	BN/RD	9	GY/RD	10
BE/BK	11	OE/BK	12	GN/BK	13	BN/BK	14	GY/BK	15
BE/YW	16	OE/YW	17	GN/YW	18	BN/YW	19	GY/YW	20
BE/VT	21	OE/VT	22	GN/VT	23	BN/VT	24	GY/VT	25
WE/BE	26	WE/OE	27	WE/GN	28	WE/BN	29	WE/GY	30
RD/BE	31	RD/OE	32	RD/GN	33	RD/BN	34	RD/GY	35
BK/BE	36	BK/OE	37	BK/GN	38	BK/BN	39	BK/GY	40
YW/BE	41	YW/OE	42	YW/GN	43	YW/BN	44	YW/GY	45
VT/BE	46	VT/OE	47	VT/GN	48	VT/BN	49	VT/GY	50

ADDED DATA

IMPORTANT - PLEASE READ

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This manual has been loaned to you as an exception, because we believe that the information will be safe in your hands, and we respectfully request that the following conditions be met.

1. The manual will be securely stored.

2. No part of the manual will be copied or reproduced in any way.

3. The manual will not be loaned or made available to anyone.

We take this perhaps over-cautious attitude only for our protection against the possibility of losing the right to market our own products and designs, and your co-operation is greatly appreciated.

ELLIS ELECTRONICS LIMITED

THEORY OF OPERATION - TTL Switching

The centre of any ELLIS organ system is the data switching network made up of a number of circuit boards containing the data routing equipment using TTL technology.

Switching operation is based on the Two-Input inverted AND (NAND) gate. The condition required to produce a logic 0 at the output is that both inputs be held to logic 1. The board is wired so that one gate receives data from a key and the other receives data from a stop. When both conditions are met, i.e. a key pressed with a stop ON, the appropriate gate output will switch to logic 0. The system is wired common positive, so the output will read -5 volts when ON. Tone generators and pipe drivers are designed to respond to an input of -5 volts.

All gate outputs which are to drive the same generator or pipe are diagonally tied on the face of the circuit board. The switching gates are of the Open Collector type, and only drive in the (-) direction. A resistor on each set of outputs common to a note pulls the line to (+) when no gate is ON (-).

Keyboard outputs are normally (+) when off, switching to (-5) when keys are pressed. Each switching board, therefore has a row of gates at the keyboard inputs for the purpose of inverting the keyboard data so that a key ON will produce the required (+) at the input of the NAND gates. Each key inverter is tied to all gate inputs in vertical line with it. STOP inputs are tied together in horizontal lines on the board. Usually, a transistor inverter / shunt circuit keeps all stop inputs in a common horizontal row in the logic 0 condition when its stop is turned off.

A variation has bee used in several models where the stop inputs of the gates are either left open or tied to the key input gates next to them. Stop control is effected by wiring all VCC (+5 volt) pins of the IC's together and applying the 5 volts via the stop control. No output is possible anywhere in the row unless voltage is provided by turning ON the stop. Switching action is the same in either method.

IT SHOULD BE NOTED that both types of output devices driven by these switching systems contain other voltages considerably higher than the 5 volts used by the TTL components. *APPLYING VOLTAGES HIGHER THAN THE SUPPLY VOLTAGE TO EITHER THE INPUTS OR THE OUTPUTS AS WELL AS THE COMMON POWER SUPPLY WILL BURN OUT TTL DEVICES.* As many as 10 or 12 common gate outputs may be connected to any given output line, so *ACCIDENTAL SHORTING to OTHER SUPPLY VOLTAGES could cause EXTENSIVE DAMAGE.*

BE CAREFUL

UNIT SWITCHING

Unit switching is used in pipe organs in order to make greater use of the available pipes, based on the fact that many stops on the organ are identical except for the pitch of the pipes, usually one being an octave above or below the other. It is possible through some type of switching arrangement to use one set of pipes for as many as three or four such stops. This organ uses the TTL switching system described in this manual to make the necessary switching arrangements. The same method is used with the electronic ranks, as it is possible at some time in the future to replace any electronic rank with a set of pipes. A specification sheet is included in this manual to show which ranks the various stops are derived from.

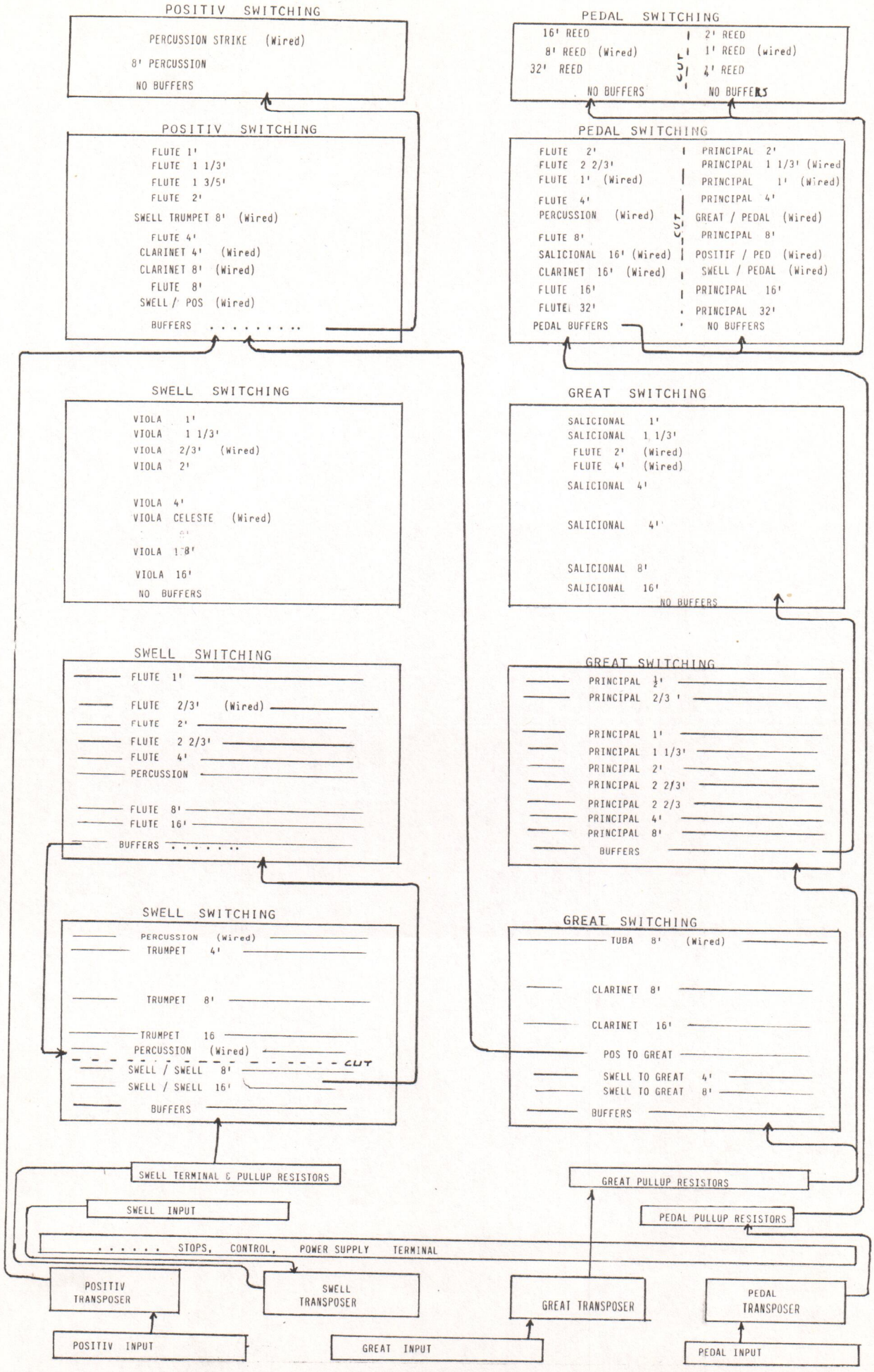
One additional variation is used in the case of some electronic voices when controled by TTL switching. By pulsing the stop input of any given pitch, a resulting LOWER input voltage appears at the generator. This makes possible two different stops of the SAME pitch. This is used in the Pedal system, with the FAGOTTO 16, which is a softer BOMBARDE, and the GEDECKT 16, a softer BOURDON. The pul are taken from a higher pitched tone generator at random. Generator square waves result in about half the normal input voltage when used to strobe the stop inupt.

Note that all PIPE stops use electronic notes for the lowest octave in 8' pitches, and in 4' pitch in Great Principal. Swell and Choir flutes also use high octave electronic extensions. These may be located on unused sections of other generator boards. In cases where Celeste board is used, Keying diodes are cabled to other generator boards for correct tuning.

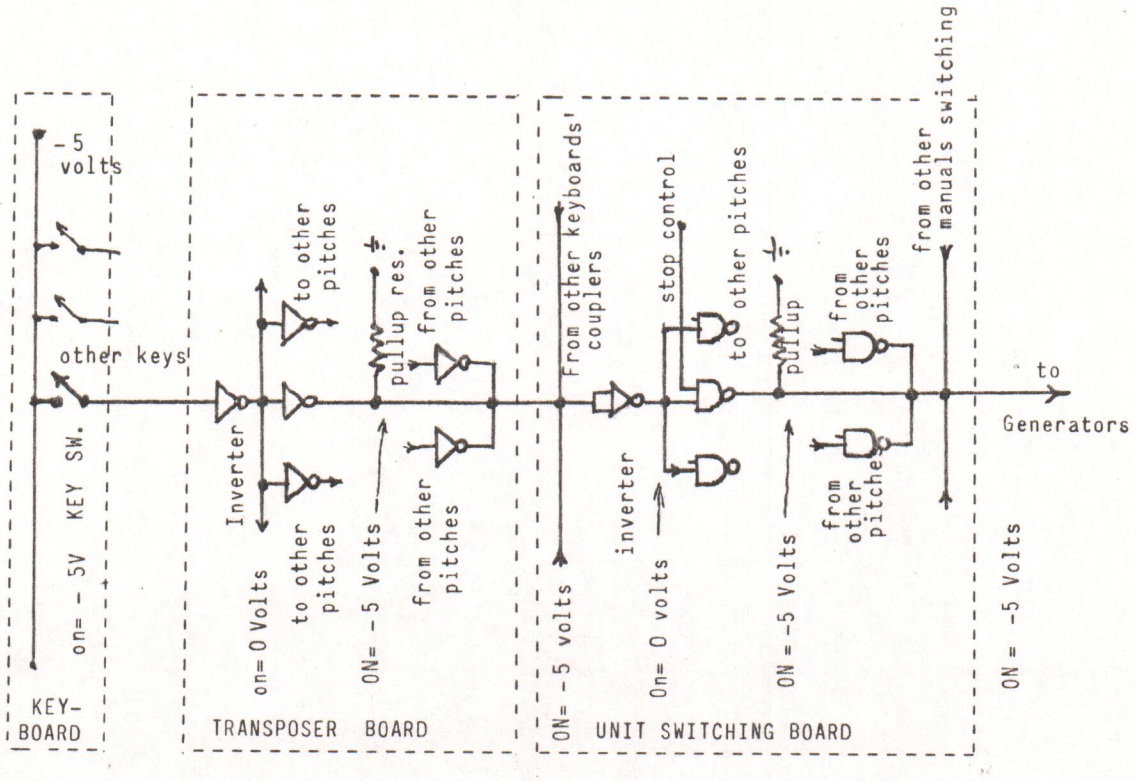
TRANSPOSER SYSTEM

The transposer used in this organ uses a TTL switching system similar to the TTL Unit Switch previously used, but more compact, using Hex Inverters instead of Quan Nand Gates, switching six notes per chip rather than the previous four. Without the second input in each gate, row switching is accomplished by applying the +5 volt supply only to the pitch required. Cross wiring is simple, each row is offset by one chromatic step, allowing change of one semitone per strip. Console control is wired so that only one pitch can be selected at a time, of course. As in the earlier unit switch system, a row of buffer hex inverters at the inputs changes the data from negative on to positive on in order to supply the required negative on condition at the outputs, which are of the open collector configuration, with all outputs of a common pitch tied together with a common pullup resistor. Only an active output will change the condition of the common line, ignoring all other outputs connected.

One circuit board is fitted for each keyboard, each board having one buffer row of 7404 inverters, plus a row of 7405 inverters for each pitch, including unison. All VCC terminals from all four boards for each pitch are tied, and serve as control input, with + being pitch ON.


POSITIV SWITCHING
PERCUSSION STRIKE (Wired)
8' PERCUSSION
NO BUFFERS
POSITIV SWITCHING
FLUTE 1'
FLUTE 1 1/3'
FLUTE 1 3/5'
FLUTE 2'
SWELL TRUMPET 8' (Wired)
FLUTE 4'
CLARINET 4' (Wired)
CLARINET 8' (Wired)
FLUTE 8'
SWELL / POS (Wired)
BUFFERS
PEDAL SWITCHING
16' REED
8' REED (Wired)
32' REED
NO BUFFERS
2' REED
1' REED (wired)
4' REED
NO BUFFERS
CUT
PEDAL SWITCHING
FLUTE 2'
FLUTE 2 2/3'
FLUTE 1' (Wired)
FLUTE 4'
PERCUSSION (Wired)
FLUTE 8'
SALICIONAL 16' (Wired)
CLARINET 16' (Wired)
FLUTE 16'
FLUTE 32'
PEDAL BUFFERS
PRINCIPAL 2'
PRINCIPAL 1 1/3' (Wired
PRINCIPAL 1' (Wired)
PRINCIPAL 4'
GREAT / PEDAL (Wired)
PRINCIPAL 8'
POSITIF / PED (Wired)
SWELL / PEDAL (Wired)
PRINCIPAL 16'
PRINCIPAL 32'
NO BUFFERS
CUT
SWELL SWITCHING
VIOLA 1'
VIOLA 1 1/3'
VIOLA 2/3' (Wired)
VIOLA 2'
VIOLA 4'
VIOLA CELESTE (Wired)
VIOLA 8'
VIOLA 16'
NO BUFFERS
GREAT SWITCHING
SALICIONAL 1'
SALICIONAL 1 1/3'
FLUTE 2' (Wired)
FLUTE 4' (Wired)
SALICIONAL 4'
SALICIONAL 4'
SALICIONAL 8'
SALICIONAL 16'
NO BUFFERS
SWELL SWITCHING
FLUTE 1'
FLUTE 2/3' (Wired)
FLUTE 2'
FLUTE 2 2/3'
FLUTE 4'
PERCUSSION
FLUTE 8'
FLUTE 16'
BUFFERS
GREAT SWITCHING
PRINCIPAL 1'
PRINCIPAL 1 1/3'
PRINCIPAL 2'
PRINCIPAL 2 2/3'
PRINCIPAL 2 2/3
PRINCIPAL 4'
PRINCIPAL 8'
BUFFERS
SWELL SWITCHING
PERCUSSION (Wired)
TRUMPET 4'
TRUMPET 8'
TRUMPET 16
PERCUSSION (Wired)
SWELL / SWELL 8'
SWELL / SWELL 16'
BUFFERS
CUT
GREAT SWITCHING
TUBA 8' (Wired)
CLARINET 8'
CLARINET 16'
POS TO GREAT
SWELL TO GREAT 4'
SWELL TO GREAT 8'
BUFFERS
SWELL TERMINAL & PULLUP RESISTORS
SWELL INPUT
GREAT PULLUP RESISTORS
PEDAL PULLUP RESISTORS
STOPS, CONTROL, POWER SUPPLY TERMINAL
POSITIV TRANSPOSER
SWELL TRANSPOSER
GREAT TRANSPOSER
PEDAL TRANSPOSER
POSITIV INPUT
GREAT INPUT
PEDAL INPUT

SWITCHING DATA ROUTING - ONE KEY TO ONE GENERATOR NOTE



TONE GENERATION AND KEYING

Tone generators are arranged in ranks of 61 notes each, usually of a common voice. Highest octaves are produced by twelve CMOS three-gate oscillators on each board. Type 4069 hex inverters provide two oscillators per chip, the outputs connected to the clock inputs of six 4024 7-stage dividers which provide all of the lower octaves.

Keying is accomplished through biased diodes. One diode per note is used in most voices except where a second diode is connected to the next octave higher for the purpose of introducing even numbered harmonics into the waveform. Input voltage of about 5 volts from switching logic outputs is processed through resistor-capacitor network in each note input circuit to provide the proper attack and decay characteristics of the note. Outputs are mixed through resistors in half octave groups (6 notes) and connected to filter inputs. Outputs of the filters are mixed through trimmer resistors to mixer/output stage.

Two variations will be found on principal and reed ganerators. Extra circuitry to provide the more complex attacks and waveforms of these voices is included on special generator boards which are somewhat larger than standard boards.

Separate tremulants are provided for most ranks, using the half 1455 chip corresponding to the output amplifier at the opposite end of the board. The tremulant is a phase shift oscillator set at about 6 Hz. Output is connected the the supply voltage line of the master generators, causing a slight fluctuation in pitch at the tremulant frequency. Stop control simply biases the shunt transistor connected across the negative feedback resistor, preventing oscillation.

SWELL GEDECKT 16'

GENERATORS

Section A (C-F)				Section B (F#-B)			
C1	240 pf			C1	240 pf		
R1,R2	Selected for tuning			R1,R2	Selected for tuning		
R3	100K	R4	50K	R3	100K	R4	50K

All master generator integrated circuits 4069 CMOS hex inverter
All divider integrated circuits 4024 CMOS seven stage divider

KEYERS/GATES

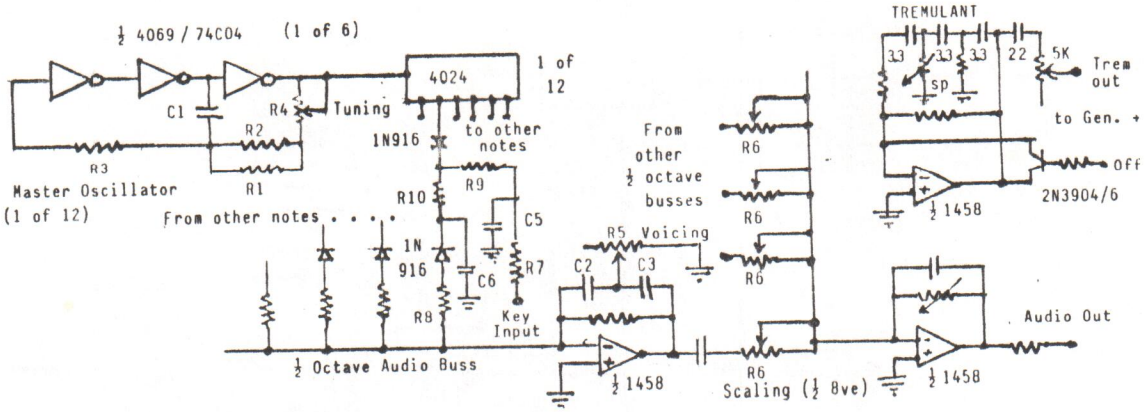
Section A (C-F)				Section B (F#-B)			
R8	10K			R8	10K		
R9	10K	R10	8.2K	R9	10K	R10	8.2K
R11	-	R12	-	R11	-	R12	-

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
R7	3.3K	1.5K	1.5K	1.5K	1.5K	2.2K	1K	1K	1K	1K
C5	33uf	33uf	22uf	10uf	4.7uf	33uf	33uf	22uf	10uf	4.7uf
C6	-	-	-	-	-	-	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-
C8	-	-	-	-	-	-	-	-	-	-

All Diodes type 1N916 All Transistors type 2N3906

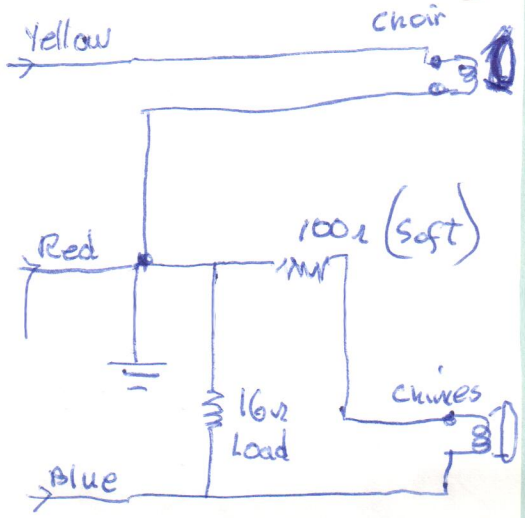
FILTERS / BUSS AMPLIFIERS All Integrated Circuits type 1458 Dual Operational Amplifiers

	Div C1	Div C2	Div C3	Div C4	Div C5	Div F#1	Div F#2	Div F#3	Div F#4	Div F#5
C2	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
C3	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
C4	1uf	.47uf	.22uf	.1uf	.047uf	1uf	.47uf	.22uf	.1uf	.047uf
R5	5k	5K	5K	5K	5K	5K	5K	5K	5K	5K
R6	100K	100K	100K	100K	100K	100K	100K	100K	100K	100K



ADDED DATA

Tower (Pantry) Chimes



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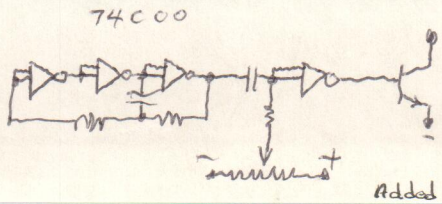
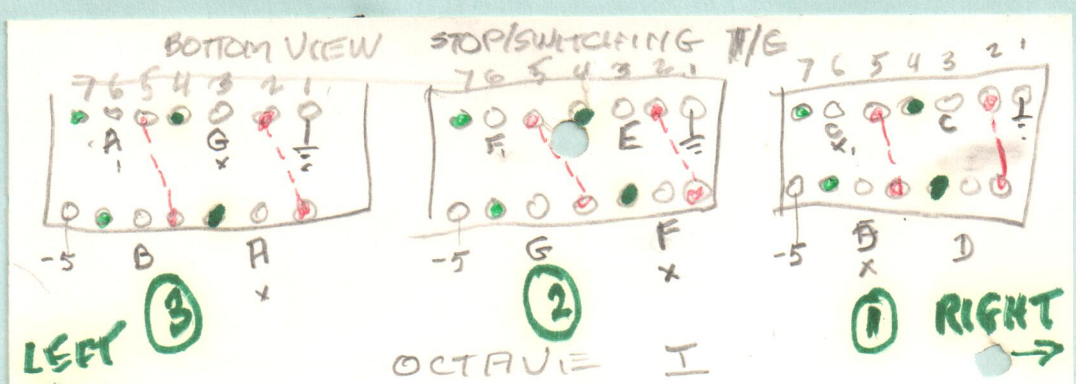
ELLIS SOFT VOLUME CONTROL



Added 8/21/92



* RED STOP ON/OFF COMMON LINE

• Nothing

HI LEFT

LO

TEST TO PLAY: USE ⏚ Right

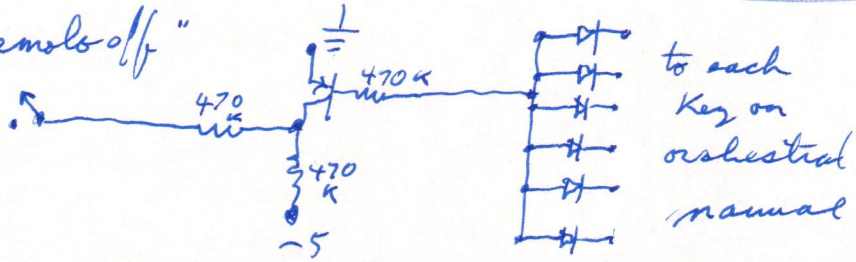
TRANSISTOR → SOFT ↓ SWITCHING NPN →

MODIFICATIONS or CHANGES

Oct 3 '91 - Dopp Flute 8 stop would not set On. Memory chip output open (last terminal, last chip on lower board) (Red with Blue wires) Rem. Cut red/blue wires at memory Connect to Unused GREAT output (white/Green). Orig. ECHO stops. Cut White/Green wires at buffer strip. Grey wires used as jumpers at Memory A.J.E.

Oct 10 '91

"Tremolo off"



" Delay Vibrato on Orchestral

Dec 20 '91 Krumhorn 4' choir - as above
Orange/white wires = connect in place of green/white wires

MODIFICATIONS and CHANGES

MODIFICATIONS and CHANGES

<. MODIFICATIONS or CHANGES

. MODIFICATIONS or CHANGES

MODIFICATIONS or CHANGES