

WIRING OUTLINE

I. PHYSICAL COMPONENTS

Console Box
LCD
Pipe Boxes
Power, Ground, and Fiber Optic Cables
RS232, Midi IN, Midi Out, and Midi Thru Connector

II. POWERS AND GROUNDS

110VAC circuit for power supply/rectifier
110VAC circuit for blower
On/Off switch
DC output power and ground cables

III. INPUTS

Circuit definitions
Wiring hints

I

IV. OUTPUTS

Circuit definitions
Wiring hints

V. TESTING OF WIRING FOR POWER UP

Testing of AC voltages
Testing of DC voltages
Testing of input circuits
Testing of output circuits
Installation of LCD Logic Cable, RS232/MIDI Cable
Installation of Circuit Cards
Power up
Testing of Voltages with an Oscilloscope

VI. FIBER OPTICS

Hook up of fiber optic cables

VII. TROUBLE SHOOTING

Systematic Approach
Fuses

I. PHYSICAL COMPONENTS

CONSOLE BOX

This box is mounted by screws through the four small (1/4") holes on the long side of the box with the rows of pins on the backplane in the vertical position. Access for the fiber optic cable(s) is through the four 3/8" holes on the other long side of the box opposite the mounting holes. The box can be mounted with fiber optic cable access on the top or bottom, the bottom being preferred due to less stress on connectors. Location of the box should be central behind the keyboards for the shortest cable lengths. It shall be easily accessible from the cover side for card access/testing and from the back side for wiring.

LCD

Mounted (see LCD drawing) in clear line of sight of organist.

PIPE BOXES

Pipe boxes are mounted by screws through the four small (1/4") holes (on the side of the box opposite the power supply connectors) with the rows of pins on the backplane in the vertical position. The fiber optic access will be from the side through the 3/8" holes located with the power supply connectors. It shall be easily accessible from the cover side for card access/testing and from the back side for wiring, at the same time. Boxes should be located nearest the largest number of magnets wired to each box to minimize cable lengths.

POWER, GROUND, AND FIBER OPTIC CABLES

These can be furnished by us with the proper wire gauges, colors, and connector terminations. If so, it is necessary for us to have the location of these physical components and the distances between them to make up the cables.

RS232, MIDI IN, MIDI OUT, and MIDI THRU CONNECTOR

This circuit card is installed on the console in a convenient place for the organist to attach a cable from a PC and midi devices.

II. POWERS AND GROUNDS

110VAC CIRCUIT FOR POWER SUPPLY/RECTIFIER

An independent circuit shall be provided for the power supply/rectifier, in metal conduit, with a green wire ground terminating at the water meter or a ground rod. This is called a green wire ground circuit, or computer grade circuit.

110VAC CIRCUIT FOR BLOWER

The circuit for the blower must be independent from the above circuit for the power supply/rectifier.

ON/OFF SWITCH

A 24VAC transformer has to be supplied with the 110VAC disconnect, as shown in power source drawing, to energize a relay which turns on the power supply/rectifier and blower motor starter.

POWER SUPPLY CABLES

Power and ground DC cables as shown in the power source drawing (between copper boxes and power supply/rectifier) are connected according to color and size of ring terminals. See console box drawing and pipe box drawing, side views.

Color Code: yellow = +12VDC
black = GND

NOTE: Ground and Minus are not equivalent terms in DC terminology. Ground means zero potential, minus is below zero, and plus or positive is above zero.

III. INPUTS: keyboards, pedalboard, crescendo and swell box rollers, stop switches, pistons, and coupler switches.

CHOIR, SWELL, AND GREAT KEYS

each wired to one connector from 1-61

PEDALBOARD

wired to one connector from 1-32

CRESCENDO AND SWELL BOX(ES)

wired to one 32 pin connector as follows: Crescendo (16 stages) contacts 1-16 wired to pins 1-16 respectively, Swell Box(es) contacts 1-16 wired on pins 17-32 respectively, which can be divided between more than one swell roller providing that the total of the contacts does not exceed 16.

CHOIR, SWELL, GREAT, AND PEDAL STOP SWITCHES

wired, one connector for each stop jamb. Connector size equals the number of stops on the jamb. The sum of these connectors cannot exceed 64. There is a maximum of 64 stops. The pin number is determined by where the connector is plugged on the stops row.

PISTONS

wired, one connector for each piston slip and toe stud keyboard. Connector size equals the number of pistons or toe studs on slip or keyboard. The sum of these 4 connectors cannot exceed 64. Available pistons defined are: Programmable Pistons 1-36, Programmable Reversibles 1-8, Cancel, Set, Memory Level Up, Memory Level Down, Transpose Up, Transpose Down, Pedal to Great, French, Crescendo/Fortissimo Indicate, Fortissimo, Player, Piston Sequencer On/Off, Piston Sequencer Up, Piston Sequencer Dn.

COUPLERS

wired, one connector for each group of couplers. Connector size equals the number of couplers in each group. The sum of these connectors cannot exceed 24. Available couplers defined are: Swell Great Choir to Pedal 8&4, Swell Choir to Great 16&8&4, Swell to Choir 16&8&4, Great to Great 16&8 unison off&4, Swell to Swell 16&8 unison off&4, Choir to Choir 16&8 unison off&4, Pedal to Great 8.

MIDI STOPS

Midi Stops 1-8 are wired on an 8 pin connector and are plugged into the console box on the coupler pins 25 through 32.

CIRCUIT DEFINITION - INPUT

Inputs are wired as a simple switch circuit with one side of the switch being common (attached to GND), and the opposite side of the switch being wired to the connector. These inputs are wired and laced into cables with connectors which plug onto the backplane of the console box at the labeled position.

NOTE: These input cables must be physically separated from all output cables.

WIRING HINTS

Commons - 22 gauge wire is acceptable,
- should not be laced with corresponding cables

- are tied to power supply GROUND
Pistons - order of piston wiring is not important as piston definitions are programmed.
Couplers - order of coupler wiring is not important as coupler definitions are programmed
Connector Pin Order - input connectors are wired in ascending number order. When holding connector in horizontal position with pin 1 in lower left position: pin 2 is above pin 1 in upper row, pin 3 is in lower row to the right of pin 1, pin 4 is above pin 3 in upper row and so on.
Note: pin number ordering is different from output connectors - see following pages.

Pin List - Keep a written list of the pin numbers that the stop inputs are wired to for straight chest programming.
- Keep a written list of the pin numbers of the swell roller inputs that will be used for Midi volume.

PISTON LABELING FOR CONSOLE CONSTRUCTION

General Pistons 1 to XX

Divisional Pistons 1 to XX

Note: The sum of these pistons (Generals and Divisionals) cannot exceed 36. Only five Great and Choir divisionals will exchange with the French manual interchange.

Builder Defined Reversibles 1 to 6 (labeled for their specific purpose.

FFF - Fortissimo Piston

CANCEL - General Cancel Piston

ML UP - Memory Level Up Piston

ML DN - Memory Level Down Piston

TR UP - Transpose Up Piston

TR DOWN - Transpose Down Piston

P/G - Pd/Gt Piston

IND - Fortissimo/Crescendo Indicate Piston

FRENCH - Great and Choir Manual Interchange Piston

SET - Setter Piston

PLAYER - Player Piston

R1 - Organist programmable reversible

R2 - Organist programmable reversible

PS On/Off - Piston Sequencer On/Off

PS UP - Piston Sequencer Up

PS DN - Piston Sequencer Down

IV. **OUTPUTS: stop on/off coils, pipe magnet coils in pipe boxes**

CONSOLE BOX OUTPUTS

STOP ACTION MAGNETS - CHOIR, SWELL, GREAT, AND PEDAL ON/OFF COILS wired to two 64 pin connectors, with stops 1-32 being wired to the first 64 pin connector and stops 33-64 being wired to the second 64 pin connector. Each 64 pin connector has parallel rows of 32 pins, one row being ON coils and the opposite row being OFF coils. These output connector pin numbers must match the input connector pin numbers for each division.

STOP ACTION MAGNETS - COUPLER ON/OFF COILS AND MIDI STOPS wired to a 64 pin connector with parallel rows of 32 pins, one row being ON coils and the opposite row being OFF coils. These output connector pin numbers must match the input connector pin number for couplers and MIDI stops.

PIPE BOX OUTPUTS - 320 outputs are wired in 5 dual rows 32 pins.

UNIT MAGNETS: These are wired in ascending consecutive order with one rank or offset rank following another with no need to skip pins in between. This order can be either chromatic or diatonic (C or C# side).

PRIMARY ACTIONS FOR STRAIGHT CHESTS: These are wired in ascending consecutive order, using either chromatic or diatonic (C or C# side) order.

STOP ACTIONS for STRAIGHT CHESTS: These are wired in ascending consecutive order - the same order as the input stop actions were wired. The tremolos are included with this group.

SWELL BOX(ES): These are wired in ascending consecutive order - the same order as the inputs were wired.

NOTE: These outputs can be in any pipe box with another box picking up where the previous box left off.

CIRCUIT DEFINITION - **OUTPUT**

Outputs are wired as a current sinking circuit with the common side of the coil wired to POSITIVE (+12VDC - 6 amp fuses on the end of the copper box) and the switched side of the coil wired to the connector. These outputs are wired and laced into cables with connectors that plug onto the backplanes of the console and pipe boxes. It is not necessary to attach diodes to each coil, as the driver chip has diodes internally.

NOTE: These output cables must be physically separated (1/4" minimum) from all input cables.

WIRING HINTS

Commons - one 14 gauge wire per rank, not laced into cable with connectors, brought in a group with other commons from chest to copper box, connected to a 6 amp fuse on copper box with the yellow feed wires.

Connector Pin Order - output connectors are wired in ascending order. When holding connector in horizontal position with pin 1 in lower left position: the lower row is 1 through 32 from left to right and the upper row is 33 thru 64 from left to right.

Note: this is different from input connectors.

Pin List - keep a written list of box and pin numbers for each rank of pipes, keyboard primaries, stop actions, swell motor stages, and tremolo actions wired to the pipe boxes. This pin list is used to calculate the programming levels.

Pipe Box Addresses - Each Pipe Box has to be given a unique address so that the data coming from the console box will be recognized. This address (in binary number form) is soldered across the jump pads (as shown on the pipe box address illustration) on the **PIPE CARD** which is then plugged onto the output driver cards inside the pipe box.

V. TESTING OF WIRING FOR POWER UP

TESTING OF AC VOLTAGES

Check 110VAC input in power disconnect/relay box

Leads of meter on black and white wires: read 110VAC

Leads of meter on black and green wires: read 110VAC

Leads of meter on white and green wires: read 0VAC

Check 24VAC transformer

Leads of meter on output of transformer: read 24VAC

If correct, turn the on/off switch on and check the output of the transformer again: read 24VAC or greater.

TESTING OF DC VOLTAGES

Measure voltages at the terminal block on the side of the console box and all pipe boxes (see console box drawing and pipe box drawing, side views). Remember the color code of power supply cables (III. POWER SUPPLY CABLES).

Measure voltages inside the console box and pipe boxes (see input circuit drawing and output circuit drawing) on the card edge connectors. Terminals with red dots are +5VDC, and terminals with yellow dots are +12VDC. GND is the two outside pairs of terminals as shown on drawings. The terminals with white dots are pin 1 of each connector group.

TESTING OF INPUT CIRCUITS

Testing of the input circuit wiring is done inside of the console box as shown on the input circuit drawing with the power turned off. This testing must be done inside of the box because this tests ALL of the wiring. Leads are attached as shown in the input circuit drawing. As input switches are closed by a person at the console, a beep or zero ohms has to be observed when the correct pin is touched on the card edge connector.

Note: the terminals with white dots are pin 1 of each connector.

TESTING OF OUTPUT CIRCUITS

Testing of the output circuit wiring is done inside of the console box and inside of the pipe boxes as shown on the output circuit drawing with the power turned on. This testing must be done inside of the boxes because this tests ALL of the wiring. The clip lead is attached to rectifier ground as shown on the drawing, and as pins are touched, the correct magnet must be energized. See V. OUTPUTS: Pin List - for the correct magnets

Note: the terminals with white dots are pin 1 of each connector.

INSTALLATION OF LCD LOGIC CABLE, RS232 CABLE, and MIDI CABLE

With the correct DC voltages obtained above, these cables are now attached according to the LCD wiring instructions drawing.

INSTALLATION OF THE CIRCUIT CARDS

WARNING: CIRCUIT CARDS ARE INSTALLED ONLY WHEN THE CORRECT VOLTAGES HAVE BEEN OBTAINED ON THE CARD EDGE CONNECTORS INSIDE THE CONSOLE AND PIPE BOXES.

Input Card - in console box only, installed in accordance with input component side arrows at the ends of the card edge connectors on the backplane.

Output Card - in console box and pipe boxes, installed in accordance with output component side arrows at the ends of the card edge connectors on the backplane. This card can be plugged in one direction only due to an index key in the long connector near one end.

Console Card - in console box only, installed on the top of input and output cards. With cards installed correctly, the fiber optic cable(s) can be plugged into the console card through the 3/8" holes in the copper box (see console box drawing). Install LCD, RS232, and MIDI logic cable onto console card at connector labeled LCD, RS232, and MIDI with white dots aligned to indicate pin 1.

Pipe Card - in pipe boxes only, installed on the top of the output cards. With cards installed correctly the fiber optic cables can be plugged into the card through the 3/8" holes in the copper box (see pipe box drawing).

POWER UP

Turn on on/off switch and adjust LCD variable resistor on the Console circuit card adjacent to the LCD connector with a screwdriver for the optimum viewing of ML 1 in the lower left corner of the LCD.

TESTING OF VOLTAGES WITH OSCILLOSCOPE

The voltage of the power supply to the magnets must remain constant when worst case conditions are met - combination action use and slider motor movement. The scope is hooked to the voltage of the power supply on channel 1 and the logic voltage on channel 2. When worst case conditions are used, the voltage line of the logic must remain constant.

VI. FIBER OPTICS

HOOK UP OF FIBER OPTIC CABLE

The fiber optic cable furnished by us comes with proper termination to snap into place. These cables snap into the console and pipe cards through holes in the copper boxes (see console and pipe box drawings). The gray connector snaps into the gray transmitter labeled 'T' and the blue connector snaps into the blue receiver labeled 'R'. The data is transmitted from the console card (gray transmitter and connector) to the pipe card (blue receiver and connector). This data is then retransmitted by the pipe card (gray transmitter and connector) to the next pipe card (blue receiver and connector). This is repeated until all of the pipe cards are receiving the data.

VII. TROUBLE SHOOTING

SYSTEMATIC APPROACH

In order to solve a malfunction quickly and correctly, a systematic approach is required. The problem has to be isolated and then tested correctly. The steps in this approach are:

1. Turn off power
2. Remove circuit cards
3. Check for correct DC voltages
4. Test problem circuit
5. Repair
6. Installation of circuit cards

1. Turn off power before removing circuit cards.
2. Remove all of the circuit cards in the box.
3. Check for the correct DC voltages. This is done exactly as was done in VI. TESTING OF WIRING FOR POWER UP.
4. Test the problem circuit. This is done exactly as was done in VI. TESTING OF WIRING FOR POWER UP.
5. Repair. If the problem was found in step 2 then repair of the problem will be in the wiring. If not, then card swapping can be tried. Input cards, output cards, and pipe cards can be swapped to see if the problem moves.
6. Installation of circuit cards. This is done exactly as was done in VI. TESTING OF WIRING FOR POWER UP. Remember input cards and output cards have to be installed in accordance with component side arrows at the ends of the card edge connectors and index key near one end of the long connector.

FUSES

6 amp - Each output common (positive +12VDC) has a 6 amp fuse that is located on the side of the console box and the pipe box. There are five of these mounted in a row with the yellow wire being common. Do not use a fuse larger than 6 amps. If a larger fuse is necessary, then the common should be split for a smaller load and two 6 amp fuses employed.

3 amp - The logic voltage to each copper box is fused with a 3 amp fuse located adjacent to the output common fuses, with the yellow wires attached. It is the one which joins to the backplane (diode and voltage regulator).

NOTE: In the event of the need to call us for assistance, you must have your documentation, voltmeter, and a phone at the copper box so that we can help you.

NOTE: Most problems encountered are either voltage or wiring. A voltmeter measures quantity, an oscilloscope measures quality.