WIRING OUTLINE - CPU SYSTEM
January, 2013

www.pipeorgancontrol.com

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I. REQUIRED TOOLS

1SMALL WATTAGE SOLERING IRON WITH PENCIL TIP

A 40 watt thermostatically controlled pencil tip iron with 60% tin rosin core solder with a diameter of .031" is ideal. Copper solder wick is handy for cleaning up messy solder joints. For soldering red single nyleze wire to connectors, an 800 degree tip for the soldering iron is recommended.

WIRE WRAP PENCIL

This can be purchased from us, and is used to make neat and tight wraps of single nyleze wire on the connectors. Extra spools for the wire wrap pencil are available. The wire spools can be rewound as needed.

MULTIMETER

This is needed to measure AC and DC voltages, and check continuity of input circuits. A meter that beeps for continuity is recommended.

JUMPER CLIP LEAD

One is needed of small size, tips less than .1" wide and at least 2 feet long.

PHONE

A hands free land line phone is recommended when calling for trouble shooting advice, as it is necessary to make meter readings with both hands while being able to talk on the phone. This is better than a cell phone because the base station can be plugged into the church's phone line, thus making the calls on their nickel, and cell reception is sometimes not clear.

OSCILLOSCOPE

Since the logic voltage is regulated from the power supply to the magnets, the burden of maintaining a regulated voltage output at the rectifier is on you the customer. The only way to measure this is with an oscilloscope.

II. PHYSICAL COMPONENTS

CPU Circuit Card or CPx Circuit Card
  This Card is mounted in the console with four (4) screws thru plastic standoffs. It needs to be accessible from all sides for the attachment of cables. See the sample console layout schematic.

INPUT Circuit Cards - 2 x 64 = 128 inputs on each card
  These cards are mounted in the console with four (4) screws thru plastic standoffs. They need to be accessible from all sides for the attachment of cables. These should be located nearest the inputs they will be reading. See the sample console layout schematic.

INPUT Reflective LED Key Contact Rail
  A version of the Input card using reflective LED sensors to read keyboards is either mounted under the keys for long pivot keyboards or behind the keys for center pivot keyboards. Using either a white paint or shiny metal surface fixed to the keys with .050" clearance to this rail, the reflective surface directs light from the LED back to the phototransistor to detect key movement. Also included on this rail is the base address+1 for piston inputs. Only power cables and fiber optics are needed to 'wire' a keyboard. More details are provided in IV. INPUTS below.

OUTPUT Circuit Cards - 2 x 64 = 128 outputs on each card
  These cards are mounted in the console and pipe chambers with four (4) screws thru plastic standoffs. They need to be accessible from all sides for the attachment of cables. These cards should be mounted nearest the magnets they will be controlling.

A to D Circuit Card and Potentiometers
  These are used in conjunction with each other to read the swell and crescendo pedal positions.

LCD
  This is mounted (see LCD drawing) in clear line of sight of organist.

MIDI IN/THRU/OUT Connector Card
  This card is installed on the console with four (4) screws thru plastic standoffs in a convenient place for the organist to attach the MIDI cables.

RIBBON CABLE
  This cable connects the LCD, MIDI connector card, and any console indicator lights to the CPU circuit card.

FIBER OPTIC CABLES
  These connect all of the circuit cards together. See the sample console layout schematic.

FIBER OPTIC Retransmitter/Translator
  This is a small card that can be used to join/split/retransmit the fiber optic signal between console and chamber. Also it is used to translate between plastic fiber and glass fiber when cable lengths exceed 100'.

Example of Console Card Layout with Fiber Optic Cable Routing

Fiber Optic Cables

To Pipe Chamber

CPU
CPU Card Size:
5" x 4"

A to D
Optional
A to D Card Size:
3.5" x 3.5"

NOTE: If the A to D card is not being used, return to the CPU card from the last Output Card.

| Base Address 1-64 | Base Address + 1 1-64 |
Great Keys

INPUT
Address = 0

Input Card Size:
6" x 4"

| Base Address 1-64 | Base Address + 1 1-64 |

INPUT
Address=2

INPUT Definitions
Pedal Keys & Crescendo
Divison 3-9
Stops 1-5
Pistons 1-2

| Base Address 1-64 | Base Address + 1 1-64 |

INPUT---
Addresses: 4-12

| Base Address 1-64 | Base Address + 1 1-64 |

INPUT
Address=14

| SAMs 1-32 PINS 1-32, ON COILS PINS 33-64, OFF COILS | SAMs 33-64 PINS 65-96, ON COILS PINS 97-128, OFF COILS |

OUTPUT
Addresses: from 1-15

Output Card Size:
7.25" x 5.25"

OUTPUT Definitions
Stops 1-5

| SAMs 1-32 PINS 1-32, ON COILS PINS 33-64, OFF COILS | SAMs 33-64 PINS 65-96, ON COILS PINS 97-128, OFF COILS |

OUTPUT
Addresses: from 1-15

| SAMs 1-32 PINS 1-32, ON COILS PINS 33-64, OFF COILS | SAMs 33-64 PINS 65-96, ON COILS PINS 97-128, OFF COILS |

OUTPUT
Addresses: from 1-15

| SAMs 1-32 PINS 1-32, ON COILS PINS 33-64, OFF COILS | SAMs 33-64 PINS 65-96, ON COILS PINS 97-128, OFF COILS |

OUTPUT
Addresses: from 1-15

Example of Chamber Card Layout

From Console CPU Tx or FO4x4

Rx | Tx

| Outputs 1-64 | Outputs 65-128 |

OUTPUT

Addresses: from 0-255

Output Card Size:
7.25" x 5.25"

Rx | Tx

| Outputs 1-64 | Outputs 65-128 |

OUTPUT

Addresses: from 0-255

Rx | Tx

| Outputs 1-64 | Outputs 65-128 |

OUTPUT

Addresses: from 0-255

To Next Chamber or FO4x4

Rx | Tx

| Outputs 1-64 | Outputs 65-128 |

OUTPUT

Addresses: from 0-255
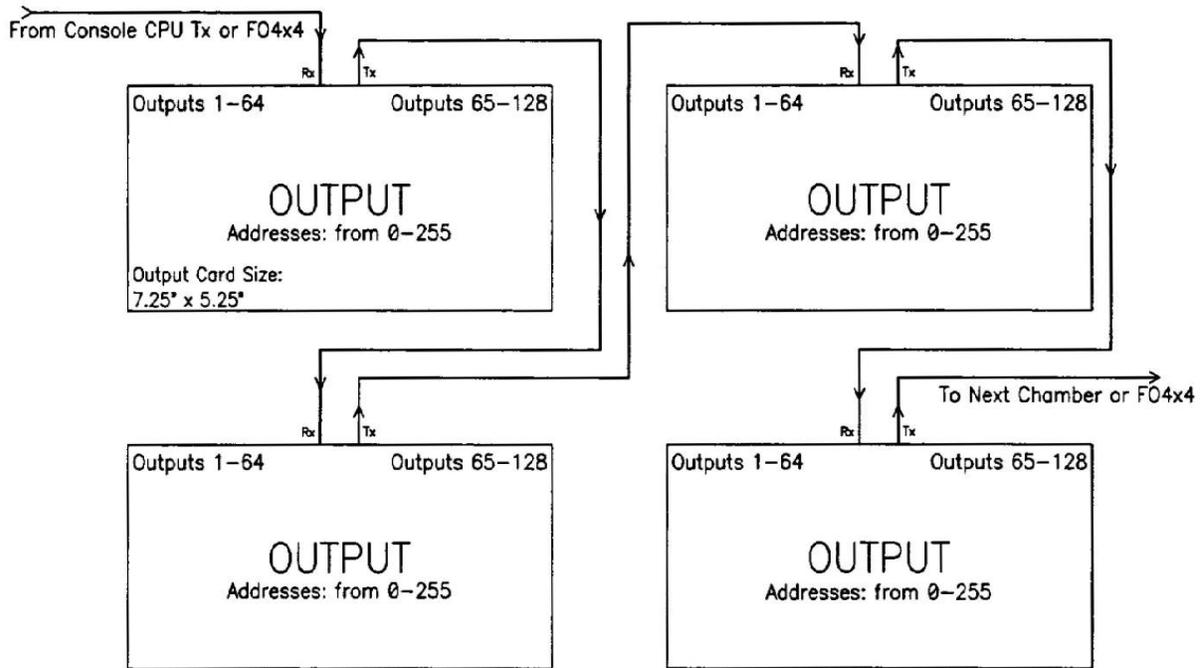
LCD MOUNTING INSTRUCTIONS

1. Cut out rectangle in stop jamb B wide by E high.
2. Bevel front side of opening at 45 degres.
3. Relieve back side using dimensions A, C, D, & F.
4. Insert glass first, then LCD with connector at top.
   Attach with 4 – #4 x 3/8" screws.

	4x20	2x40
A	.290"	.675"
B	3.060	6.100"
C	.400"	.425"
A+B+C	3.750"	7.200"
D	.225"	.325"
E	1.100"	.750"
F	.175"	.325"
D+E+F	1.500	1.400
Glass	3.5" x 1.375"	6.25" x 1.125"

Stop Jamb (front view)

D

D+E+F

E

A | B | C

F

A+B+C

Stop Jamb (side view)

Glass

LCD

Ribbon
Connector

3/16" 7/16"

4
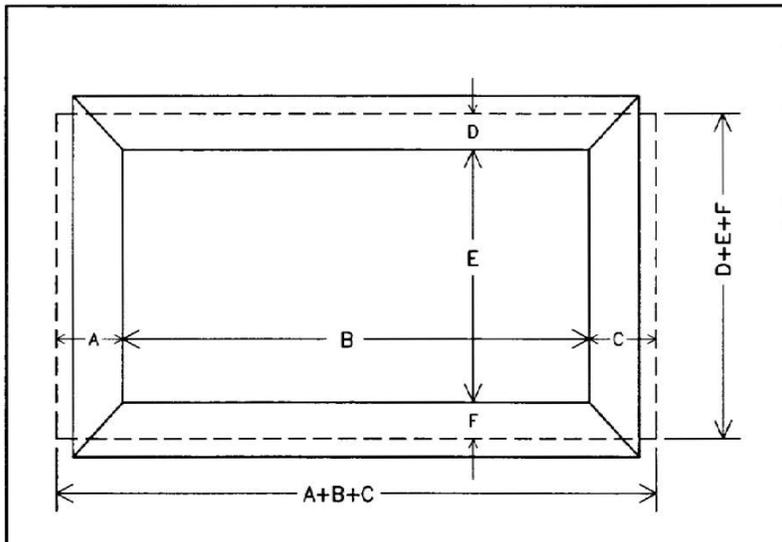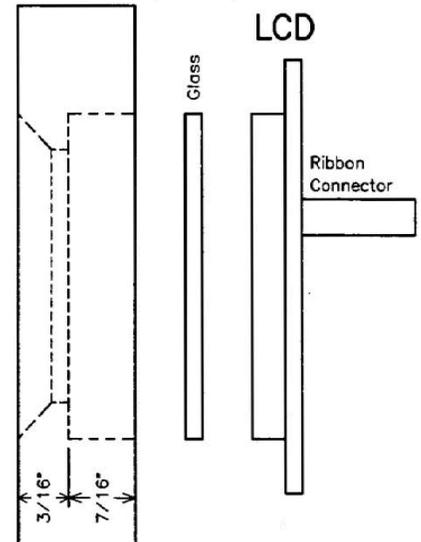
III. POWERS AND GROUNDS

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 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.

POWER SUPPLY CABLES

   LOGIC VOLTAGE: Each circuit card must be supplied with voltage for the logic. This logic voltage is attached at the green barrier block on the CPU card, the green barrier block on the Input cards, and at the center green barrier block on the Output cards. The +VDC must be fused as follows: based on ½ amp per circuit board with a maximum fuse size of 3 amps.

   MAGNET COIL VOLTAGE: This only applies to the OUTPUT cards and is covered in V. Outputs.

$$\begin{array}{lll} \text{Color Code:} & \text{yellow} & = +12\text{vdc or} + \text{power supply voltage} \\ & \text{Black} & = \text{GND or - minus} \\ & \text{Red} & = +5\text{vcc} \\ & \text{Orange} & = +3.3\text{vdc} \end{array}$$

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

POWER SOURCE

Power Sources should be centrally located to their loads, optimizing wire lengths vs. wire gauges.

FROM CIRCUIT BOX

Computer Grade Circuit in metal conduit with green wire connected to ground rod or water main. NOTE: This is to be an independant circuit, not combined with the blower circuit.

24VAC Transformer

24VAC to Console ON/OFF Switch

120 VAC DISCONNECT
with Relay to turn on Power Supply

INPUT (VAC)

DC POWER SUPPLY
with
REGULATED OUTPUT

DC OUTPUT +

DC OUTPUT −

+ DC (Yellow) wire gauge large enough to handle power supply rated output.

− DC (Black) wire gauge large enough to handle power supply rated output.

+Terminal Block

To + DC fuse blocks

ATO Fuse Block

To Logic +VDC terminals, six (6) cards per three (3) amp fuse.

To Magnet +Vx terminals Output Cards in console for Combination Action. Five (5) amp fuse.

To Magnet +Vx terminals Output Cards in chamber for chest magnets. Three (3) amp fuse.

ATO Fuse Block

−Terminal Block

− (GND) terminals on circuit cards. Chest commons. Input commons.

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IV. INPUTS

DEFINITION

Inputs are keyboards, pedalboard, crescendo and swell box rollers, stop switches, pistons, and coupler switches. These inputs are 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 to the Input circuit card. These inputs are wired and laced into cables with connectors which plug onto the Input cards. **Please note** that the input cables must be physically separated from all output cables to minimize crosstalk.

These inputs are wired to pins in groups of 64, each group being assigned a definition according to the following table at the time of power up programming.

KEYBOARDS

Maximum of nine, each wired to one connector from 1-61.

PEDALBOARD and CRESCENDO

The Pedalboard is wired on pins 1-32 and the Crescendo is wired to the same connector on pins 33-64. If the AtoD function is being used for the Swell Box Pedals and Crescendo Pedal, then pins 33-64 are piston inputs.

STOPS 1

Stops, Couplers, Pistons, MIDI Stops, and Swell Box Rollers. The Swell Box Roller Pins that are to be used for MIDI Volume must be wired in the range of 1-16. All the rest of the input pins in this group can be in any order.

STOPS 2

Stops, Couplers, and Pistons.   If CPx Upgrade, then also MIDI Stops.

STOPS 3

Stops.   If CPX Upgrade, then also Couplers and MIDI Stops.

STOPS 4

Stops.   If CPx Upgrade, then also Pistons.

STOPS 5

Stops.   If CPx Upgrade, then also Pistons.

PISTONS 1

Pistons

PISTONS 2

Pistons

WIRING HINTS

Commons - are tied to power supply GROUND or - minus.

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. Please note that this numbering order is different from output connectors.

Pin List - Keep a written list of all of the Input wiring on the furnished spreadsheets.

Input Card Addresses - Each Input Card has to be given an unique even number address starting with zero (0) so the correct data will be transmitted to the CPU circuit card. This address (in binary number form) is set with a dip switch on each Input circuit card, the base address side being the even number dipswitch, and the base plus one (base+1) address side being the odd number address above the base address.

MIDI Stops – If using the CPx upgrade, then these MIDI stops can be wired on Stops1, 2, & 3, such that when looked at as a group, each MIDI Stop is wired to a unique pin number.

Dip Switch Addresses for Input Cards

Addr 0   Addr 2   Addr 4   Addr 6   Addr 8   Addr 10   Addr 12   Addr 14
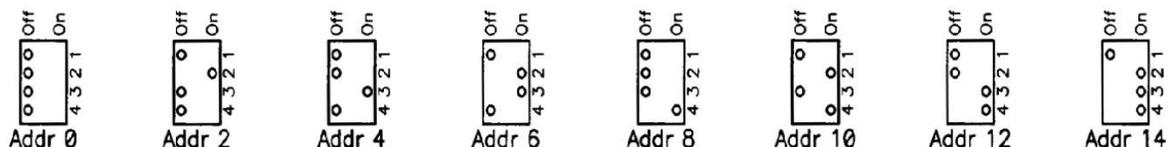
PISTON LABELING FOR CONSOLE CONSTRUCTION

General Pistons 1 to XX

Divisional Pistons 1 to XX

Please note that the sum total of these pistons (Generals and Divisionals) cannot exceed 128. Only 8 pistons defined as Great Divisionals will exchange with 8 pistons defined as Choir divisionals when using the French manual interchange piston and the Piston Coupler pistons.

16 Builder Defined Reversible Pistons, which are labeled for their specific purpose.

8 Programmable Cancel Pistons

8 User Settable Reversible Pistons 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 DN - Transpose Down Piston

P/G - Pd/Gt Piston or Coupler

IND - Fortissimo/Crescendo Indicate Piston

FRENCH - Great(Div0) and Choir(Div4) Manual Interchange Piston or Coupler - cannot be both

SET - Setter Piston

MENU/PLAYER - Menu Piston for access to Play/Record/Delete, Save/Load, MIDI, Copy, and Piston Seq. Type

PS On/Off - Piston Sequencer On/Off

PS UP - Piston Sequencer Up

PS DN - Piston Sequencer Down

REFLECTIVE LED Key Contact Rail

This Input card version fixed to an aluminum rail is mounted either under the keys for long pivot keyboards or behind the keys for center pivot keyboards using a screw on each end of the rail to attach to the key frame or cheek. Using a reflective surface fixed to the keys, leave a .050" clearance gap to the LED/phototransistors mounted along the edge of the circuit card. The firing point can be adjusted either by shimming the aluminum rail or by adjusting individual reflectors. Also included on this rail is the base address+1 for 38 piston inputs, using two (2) 20 pin connectors in the center of the Rail. These two connectors are 2 rows of 10 pins equaling 20 pins each, the center pin of each row is the common, and the outer 9 of each row are for piston inputs. If the pistons are wired to the connectors, then the only wiring to the keyboard is power and fiber optics.

NOTE: The early versions of this rail use a separate +3.3VDC power supply to feed the rail in addition to the usual +12V/Gnd fed to each Input card, the cards are clearly labeled if this is the case. Remember to tie the negatives of all power supplies together at the power supply output terminals.

V. OUTPUTS

DEFINITION
These are either magnet coils or indicator lights, either in the console or pipe chamber(s).

CONSOLE INDICATOR LIGHTS
There are four (4) indicator light controls available, Fortissimo, Crescendo, Set, and Player. These are wired as positive common, current sinking circuits with the switched side of the light connected to the ribbon cable from the CPU card which is described in section VI.

STOP ON/OFF COILS
For each input group Stops 1-5 that is used for stops and couplers, there will have to be two (2) groups of 64 outputs. The first group corresponds with Inputs 1-32, and the second group of 64 corresponds with Inputs 33-64. Each 64 pin connector grouping has parallel rows of 32 pins, one row (starting with the number 1 or 65) being ON coils and the opposite row (starting with the number 33 or 97) being OFF coils. These output connector pin numbers must match the input connector pin numbers. For example, if some input pins are skipped, the same number of pins in the order will have to be skipped on the corresponding output connectors.

MAGNET COILS IN THE PIPE CHAMBERS
There are 128 outputs (pins) per Output circuit card using two 64 pin connectors arranged in 2 rows of 32. The wiring from the first 64 pin connector can continue to the second 64 pin connector which then is considered to be pins 65 through 128.

Unit magnets: These are wired in ascending consecutive order with one rank or partial 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 can be wired in the same ascending consecutive order as the stop inputs were wired in the console. The tremolos, zimbelsterns, are included with this group.
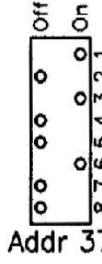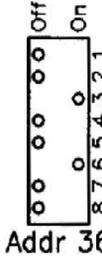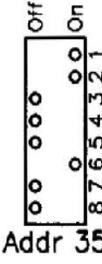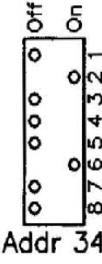
Swell Box(es): These are wired in ascending consecutive order - the same order as the inputs were wired.

WIRING HINTS

Pin List - Keep a written list of all of the Output wiring on the furnished spreadsheets.
Output Card Addresses - Each Output Card has to be given an unique address so that the correct data coming from the CPU circuit card will be recognized. This address (in binary number form) is set with a DIP Switch on each Output circuit card.

Dip Switch Addresses for Output Cards

Addr 0   Addr 1   Addr 2   Addr 3   Addr 4   Addr 5   Addr 6   Addr 7

Addr 8   Addr 9   Addr 10   Addr 11   Addr 12   Addr 13   Addr 14   Addr 15

Addr 16   Addr 17   Addr 18   Addr 19   Addr 20   Addr 21   Addr 22   Addr 23

Addr 24   Addr 25   Addr 26   Addr 27   Addr 28   Addr 29   Addr 30   Addr 31

Addr 32   Addr 33   Addr 34   Addr 35   Addr 36   Addr 37   etc. etc. etc.   Addr 256

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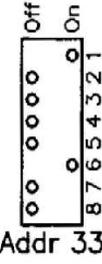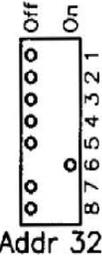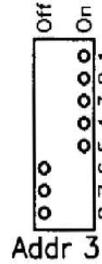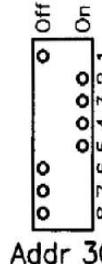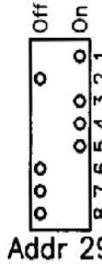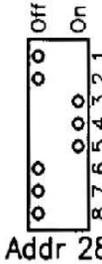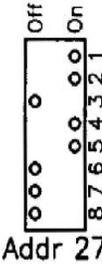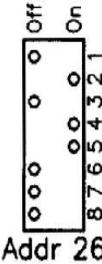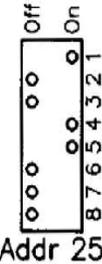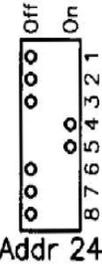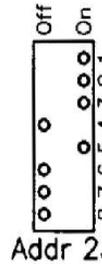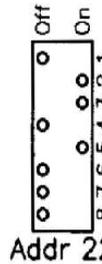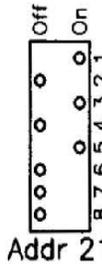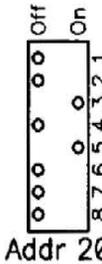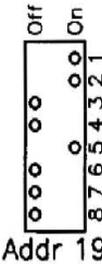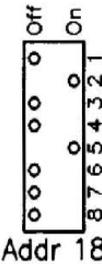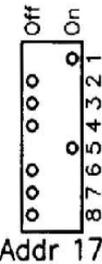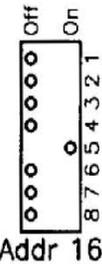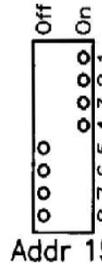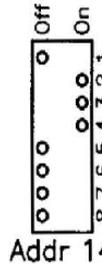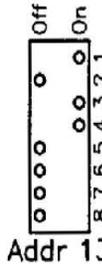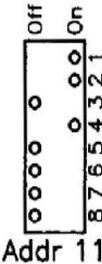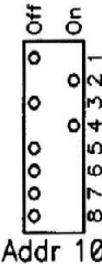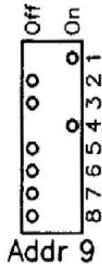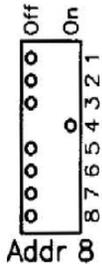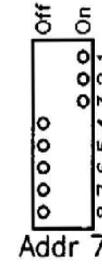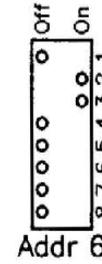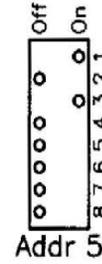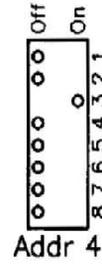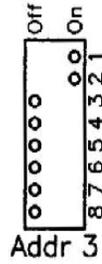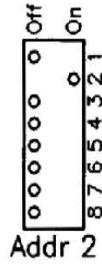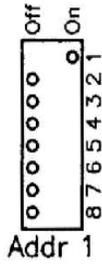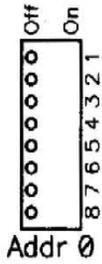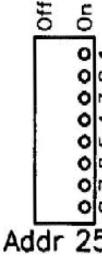
OUTPUT CIRCUIT CARD TYPE –   **SMT+** (Positive Common)

Surface Mount Technology+. This is a positive common or low side switching card that has current sinking circuits with the common side of the coils wired to POSITIVE and the switched side of the coils wired to the connectors.

This card can switch 1.2 amps per pin @ 100% duty cycle, all outputs have built in thermal shutdown, linear current limitation and overvoltage clamping.

Fusing of the commons is left up to the installer and must be at least one 6 amp fuse per rank of pipes, with 6 amps being the maximum fuse value or size.

The VDC and GND for the logic are located on the center green barrier block, the VDC must be connected to a fused connection point from the power supply according to III. Powers and Grounds.

The Vdc and GND for the magnets are located on the two (2) 4 terminal outer barrier blocks labeled GND, +V1, +V2 and +V4, +V3, GND. Since this is a positive common board, the GND terminals are the return for all the magnets, you must have enough wire to match the fused positive common side of the circuit. The four (4) +V1-4 terminals are not connected and do not need any wires.

If separate power supplies are used for logic and magnet coils on an Output card, their grounds (-) must be tied together at the power supply output terminals.

OUTPUT CIRCUIT CARD TYPE –   **SMT-** (Negative Common)

Surface Mount Technology-. This is a negative common or high side switching card that has current sourcing circuits with the common side of the coils wired to NEGATIVE and the switched side of the coils wired to the connectors.

This card can switch 1.2 amps per pin @ 100% duty cycle, all outputs have built in thermal shutdown, linear current limitation and overvoltage clamping.

Fusing of the commons is left up to the installer and must be at least one 6 amp fuse per rank of pipes, with 6 amps being the maximum fuse value or size.

The VDC and GND for the logic are located on the center green barrier block, the VDC must be connected to a fused connection point from the power supply according to III. Powers and Grounds.

The Vdc and GND for the magnets are located on the two (2) 4 terminal barrier blocks labeled GND, +V1, +V2 and +V4, +V3, GND. The positive (+) terminal of power supply that is driving the magnet coils must be hooked to each of these +Vx terminals through a fuse with a maximum size of 3Amps (when driving a combination action in the console, this will have to be raised to a maximum of 5A). The GND (-) terminal of this power supply that is driving the magnets must be hooked to the GND terminals of the +Vx barrier blocks, these GND wires matching the +Vx terminal wires in gauge size and number.

If separate power supplies are used for logic and magnet coils on an Output card, their grounds (-) must be tied together at the power supply output terminals.

OUTPUT CIRCUIT CARD TYPE - Positive Common - 2803A

Outputs are wired as a current sinking circuit with the common side of the coil wired to POSITIVE and the switched side of the coil wired to the connector. All magnet coils must have a unique diode associated with them. In order to use the diode internal to the driver chip, you must hook up the wiring exactly as stated here, otherwise you must locate a diode right at the terminals of the coil. This Positive Common circuit board takes care of all the diodes, fusing, and voltage polarities if you hook it up according to these directions. The commons are split into 8 pin or magnet groups. These are to be hooked up at the green barrier blocks labeled C1 thru C16.

The groupings are as follows:

Pins	Common	Fuse	+VDx
1-4 and 33-36	C1	Fuse 1	1
5-8 and 37-40	C2	Fuse 2	1
9-12 and 41-44	C3	Fuse 3	1
13-16 and 45-48	C4	Fuse 4	1
17-20 and 49-52	C5	Fuse 5	2
21-24 and 53-56	C6	Fuse 6	2
25-28 and 57-60	C7	Fuse 7	2
29-32 and 61-64	C8	Fuse 8	2
65-68 and 97-100	C9	Fuse 9	3
69-72 and 101-104	C10	Fuse 10	3
73-76 and 105-108	C11	Fuse 11	3
77-80 and 109-112	C12	Fuse 12	3
81-84 and 113-116	C13	Fuse 13	4
85-88 and 117-120	C14	Fuse 14	4
89-92 and 121-124	C15	Fuse 15	4
93-96 and 125-128	C16	Fuse 16	4

Each of these groups of 8 has a fuse associated with it above the barrier block. These fuses are not labeled but lay in respective order with the commons. The fuses are 2AG, quick blow glass, with a 2amp rating matching the load of the magnets, with a maximum size of 2 amps.

You must wire your commons in these groups. To test the wiring for correct grouping of commons and fuses, remove all but one fuse and test the 8 pins of the corresponding group. There are no exceptions to this wiring layout.

The VDC and GND for the logic are located on the center green barrier block.

The +Vdc and GND for the magnets are located on the large green barrier blocks between the commons. These +Vx terminals are unique and separate, labeled +V1, +V2, + V3, and +V4, with each of the four feeding the 4 commons nearest to it. These +VDC terminals must be fused externally at the power supply, with a fuse not to exceed 5 amps. The GND terminal of the magnet coil power supply must be hooked to the GND terminals with gauge size and number matching the +V1, +V2, +V3, and +V4 wires.

If separate power supplies are used for logic and magnet coils on an Output card, their grounds (-) must be tied together.

OUTPUT CIRCUIT CARD TYPE -   Ground Common - 2981A - .5a per pin max.

Outputs are wired as a current sourcing circuit with the common side of the coil wired to GROUND (-) and the switched side of the coil wired to the connector. All magnet coils must have a unique diode associated with them. In order to use the diode internal to the driver chip, you must hook up the wiring exactly as stated here, otherwise you must locate a diode right at the terminals of the coil. This Ground Common circuit board takes care of all the diodes, fusing, and voltage polarities if you hook it up according to these directions:

Pins	Fuse	+VDx
1-4 and 33-36	F1	1
5-8 and 37-40	F2	1
9-12 and 41-44	F3	1
13-16 and 45-48	F4	1
17-20 and 49-52	F5	2
21-24 and 53-56	F6	2
25-28 and 57-60	F7	2
29-32 and 61-64	F8	2
65-68 and 97-100	F9	3
69-72 and 101-104	F10	3
73-76 and 105-108	F11	3
77-80 and 109-112	F12	3
81-84 and 113-116	F13	4
85-88 and 117-120	F14	4
89-92 and 121-124	F15	4
93-96 and 125-128	F16	4

Each of these groups of 8 has a fuse associated with it above the barrier block. These fuses are 2AG, quick blow glass, with a 2amp rating matching the load of the magnets, with a maximum size of 2 amps.

The VDC and GND for the logic are located on the center green barrier block.

The Vdc and GND for the magnets are located on the 4 terminal barrier blocks labeled GND, +V1, +V2 and +V4, +V3, GND. The positive (+) terminal of power supply that is driving the magnet coils must be hooked to each of these +Vx terminals through a fuse with a maximum size of 3Amps (when driving a combination action in the console, this will have to be raised to a maximum of 5A). The GND (-) terminal of this power supply that is driving the magnets must be hooked to the GND terminals of the +Vx barrier blocks, these GND wires matching the +Vx terminal wires in gauge size and number.

If separate power supplies are used for logic and magnet coils on an Output card, their grounds (-) must be tied together.

OUTPUT CIRCUIT CARD TYPE -   Ground Common - 2987A - .35a per pin max.

Outputs are wired as a current sourcing circuit with the common side of the coil wired to GROUND (-) and the switched side of the coil wired to the connector. All magnet coils must have a unique diode associated with them. In order to use the diode internal to the driver chip, you must hook up the wiring exactly as stated here. Otherwise you must locate a diode right at the terminals of the coil. This Ground Common circuit board takes care of all the diodes and voltage polarities if you hook it up according to these directions:

Pins	+VDx
1-16 and 33-48	1
17-32 and 49-64	2
65-84 and 97-112	3
85-96 and 113-128	4

The VDC and GND for the logic are located on the center green barrier block

The VDC and GND for the magnets are located on the 4 terminal barrier blocks labeled +V1, +V2, GND and GND, +V4, +V3. The positive (+) terminal of power supply that is driving the magnet coils must be hooked to each of these +Vx terminals through a fuse with a maximum size of 3Amps. The GND (-) terminal of this power supply that is driving the magnets must be hooked to the GND terminals of the +Vx barrier blocks, with wire gauge size and number matching that of the +Vx wires.

If separate power supplies are used for logic and magnet coils on an Output card, their grounds (-) must be tied together.

VI. FIBER OPTICS and RIBBON CABLE

INSTALLATION OF THE FIBER OPTIC CABLES

A fiber optic loop will connect all of the input and output circuit cards in the console to the CPU circuit card. Start at the INPUT TX console port (grey) on the CPU card, progress thru all of the INPUT cards (in blue, out grey) in ascending consecutive address order, then progress thru the OUTPUT cards (in blue, out grey) in ascending consecutive order, next thru the A to D card (in blue, out grey) if being used, and return to the CPU card at the INPUT RX (blue) port. A fiber optic daisy chain will connect the CPU card and all of the OUTPUT cards in the pipe chamber. Start this chain at the OUTPUT TX chamber (grey) on the CPU card and run through all of the Output (in blue, out grey) cards in the pipe chamber, in any order of addresses. Please see examples of console and chamber card layouts in II. Physical Components.

TERMINATION OF PLASTIC FIBER OPTIC CABLE

1. After cutting the cable to the desired length, strip off approximately .3" of the outer jacket with a 16ga. wire stripper.

2. Place the crimp ring and the connector over the end of the cable, with adhesive if desired, the clear fiber should protrude about .12", and crimp the ring in place with a generic crimping tool, slightly oval is all that is needed. After glue has set (if used), trim off excess clear fiber with flush cut side cutter to clear protrudes .06".

3. Place a piece of 600 grit sandpaper on a flat smooth surface. Insert the now crimped connector with protruding cable into the polishing fixture,and with the fixture flat on the sandpaper and cable perpendicular to sandpaper surface, draw large figure eight patterns until connector end is flush. Repeat this process using the pink 3 micron lapping film.
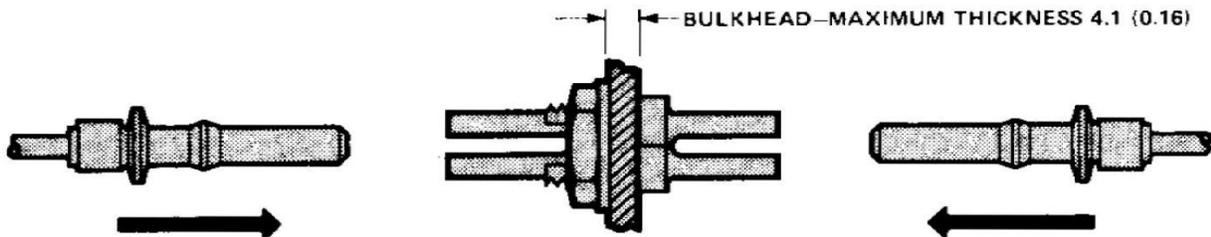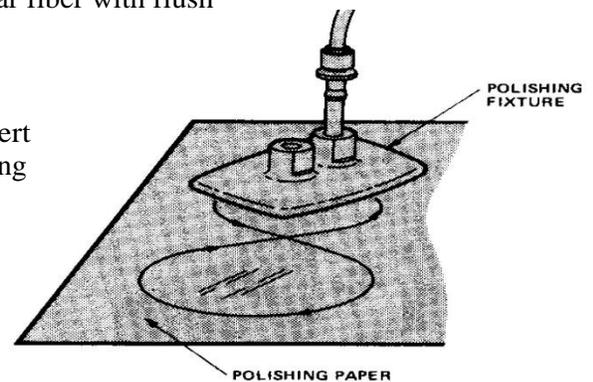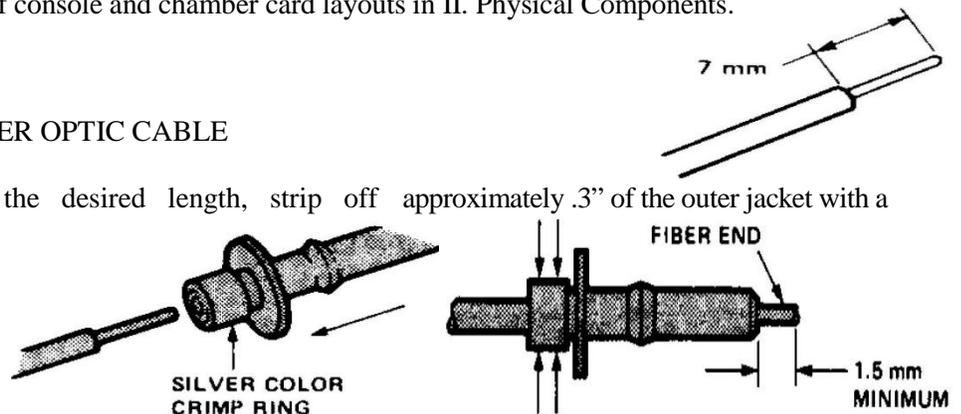
FIBER OPTIC CABLE COUPLING
Fiber optic cable can be coupled, for example a movable console with or without multiple locations. Shown is the plastic to plastic coupling, this can be done with glass to glass in the same fashion.

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TRANSLATION OF FIBER CABLE TYPES

When the length of a single run of fiber cable exceeds 100', it is necessary to translate the cable to glass that can be used in single run lengths of 4km. This is done with a small circuit board at the start of this run converting from plastic to glass cable, and at the end of the run a similar small circuit board converting from glass to plastic.

INSTALLATION of the RIBBON CABLE to LCD, MIDI CONNECTOR, and LIGHTS

The 34 wire cable, furnished with a 34 pin connector attached, plugs onto the CPU circuit card. The first 10 wires are split off of this 34 wire cable, a 10 pin plug is attached and plugged onto the MIDI connector board. The next 16 wires are split off, a 16 pin connector attached and plugged onto the LCD. The final 8 wires are for console lights. The first of these eight (wire 27 of 34) is for the Fortissimo, the second (wire 28 of 34) is for the Crescendo, the third of these six (wire 29 of 34) is for the Set Piston, and the fourth (wire 30 of 34) is for the Player/Menu Piston. The remaining 4 of 8 are not defined at this time. Please keep (cut) these cable splits to the shortest possible lengths.

RIBBON CABLE CONNECTORS

CPU– 34 Pin

V notch – PIN 1

Top View – strain relief

| 34 | Lights | 27 | LCD | 11 | MIDI | 1 |

Wire 1

L4–Player Piston
L3–Set Piston
L2–Crescendo
L1–Full Organ

Bottom view – female connector

LCD– 16 Pin

V notch – PIN 1

Wire 1

Bottom view – female connector

MIDI
10 Pin

V notch – PIN 1
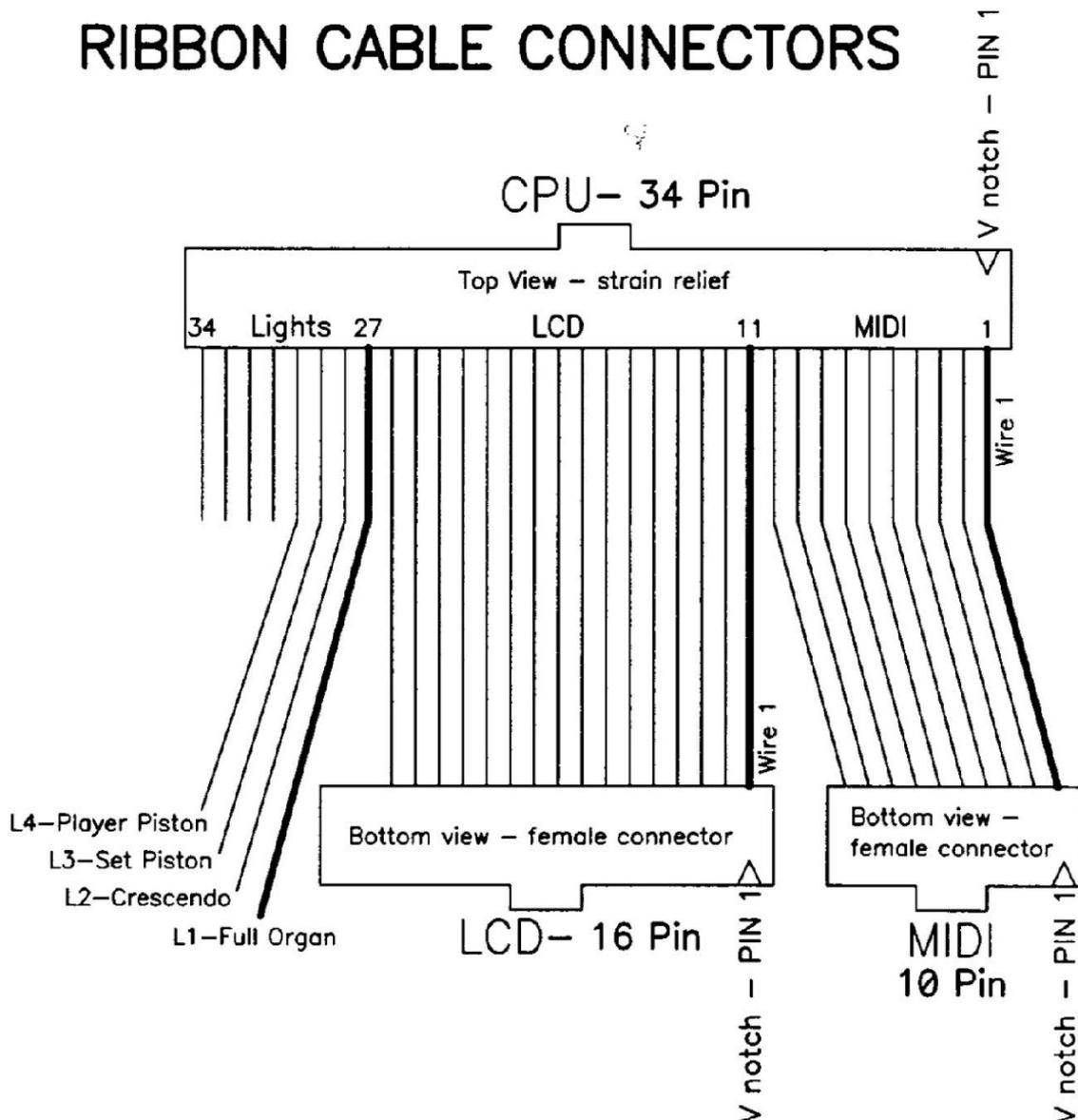
VII. ANALOG to DIGITAL

This circuitry whereby the swell and crescendo rollers are replaced by potentiometers installed on the pivot of the pedals thus eliminating discreet contacts, is referred to as 'A to D'. There are eight (8) channels available for 8 pedals (seven (7) with CPx Upgrade).

If using the CPx upgrade, A to D is implemented on card, please skip the next paragraph.

If using the CPU card, A to D is implemented by the use of a separate circuit card installed at the end of the console fiber optic loop, that is after the input and output cards. Voltage to this card is to be furnished from a 3A fused source (organ rectifier) just as the input and output card logic voltages.

There are 3 pins on a potentiometer; the outside two are the fixed value of the resistor, and the middle pin being the variable value.   The fixed pins (1&3) are hooked to +V and GND, the order such that the number on the LCD during power up programming runs from low to high as the pedal is pushed down. If incorrect, that is high to low, simply reverse the wires to these fixed pins (1&3).   The middle (variable) pin is hooked to any channel number from 1 to 7(8). Potentiometer resistor values of 1K to 10K ohms will work with the A to D card.

The potentiometers are hooked up as follows:

Pot – Terminal	Long Green Barrier Block Terminal for Swell Pedals	
	CPU/AtoD external card	CPx/AtoD on card
1 fixed	+V1-4	+V
variable	1	1
fixed	GND	GND
2 fixed	+V1-4	+V
variable	2	2
fixed	GND	GND
3 fixed	+V1-4	+V
variable	3	3
fixed	GND	GND
4 fixed	+V1-4	+V
variable	4	4
fixed	GND	GND
5 fixed	+V5-8	+V
variable	5	5
fixed	GND	GND
6 fixed	+V5-8	+V
variable	6	6
fixed	GND	GND
7 fixed	+V5-8	+V
variable	7	7
fixed	GND	GND
8 fixed	+V5-8	
variable	8	
fixed	GND	

VIII. 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: reading of 110VAC
    Leads of meter on black and green wires: reading of 110VAC
    Leads of meter on white and green wires: reading of 0VAC Check 24VAC transformer
    Leads of meter on output of transformer: reading of 24VAC

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

Check Power Supply (rectifier) Output Voltage
    Leads of meter, red lead on +, black lead on -, reading should be rated output dc voltage

TESTING OF LOGIC DC VOLTAGES
Measure voltages on each circuit card. There is a test port labeled for +VCC which must read the same voltage as the power supply output. There is a test port labeled +5VDC which must read +5VDC. Voltage is measured in relation to the terminal block pins labeled GND.

TESTING OF INPUT CIRCUITS
Testing of the input circuit wiring is done at the header pins on the input cards after the connectors have been plugged onto the cards. With the power turned off, clip the black wire of your meter to the common (ground) of the input switches. Touch the red lead of your meter to the correct header pin. When the switch is open the reading should be greater than 10K ohms and when the switch is closed the reading should be zero ohms.

TESTING OF OUTPUT CIRCUITS
Testing of the output circuit wiring is done at the header pins on the output cards after the connectors have been plugged onto the cards. With the power turned on and a clip lead attached to ground for the 2803A card or positive for 2981A and 2987A cards, you should be able to energize the correct magnet coil by touching the correct header pin. If this test is done with the power off using a meter, you should read the ohm rating of the magnet.

TESTING OF VOLTAGES WITH OSCILLOSCOPE
The voltage of the power supply to the magnets must remain constant when worst case conditions are met, that is, combination action use, slider motor movement, and maximum number of chest magnets. 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.

IX. INITIAL POWER UP SEQUENCE

1. Turn on the on/off switch and adjust LCD variable resistor on the CPU circuit card adjacent to the RIBBON cable connector with a screwdriver for the optimum viewing of ML 1 in the lower left corner of the LCD.
2. Turn the power off.
3. If using the external A to D card (with the CPU card), remove this card from the fiber optic loop and run the fiber optic cable directly from the last output card back to the CPU card.
4. Turn on the power switch holding down GT division keys 1, 2, & 3 to get into Power Up Programming. Complete pages 1 through 11 in order (1 through 12 if using the CPx). Do not proceed to the next page number of Power Up Programming until everything is working and programmed correctly for the current page number. If you are not using the external A to D card with the CPU card, power up is complete. If you are using the CPx Upgrade, the power up is complete. If you are using the CPU card with the external A to D card, continue to #5below. If you are using the CPx Upgrade, you can backup the Power Up Programming as often as you like using the #10. Memory Config/Memory Backup/Save PUP to FlDr.

Note: If A to D is being used
5. Proceed from step 4 above to #12. A to D in the power up programming sequence and enter with GT key 8. The LCD should now say Disabled on the 4th line. Select Enable by hitting Inc (GT key 3) and Enter (GT key 8). The LCD should now say Enabled.
6. Turn the Power Off.
7. Put the A to D card back into the fiber optic loop.
8. Turn on the power switch holding down GT division keys 1, 2, & 3 to get into Power Up Programming.
9. Increment to #12. A to D with GT key 3 and Enter with GT key 8. The LCD should now read Enabled. Enter with GT key 8 to display channel 1.
10. Proceed with programming using the Power Up Programming #12. A to D key overlay. When complete hit GT key 1 to exit this programming sequence and return to Power Up Programming #1. Input Card Address Assignments.
11. Increment with GT key 3 to #7. Stop Programming and Enter with GT key 8. A level of programming will now have to be entered into memory for each A to D swell channel, that is, steps 12 through 17 below will have to be repeated for each A to D channel defined as a swell function.
12. Increment to the desired level and enter with GT key 8.
13. Do not select any stops. The LCD should display S0-0. Enter with GT key 8.
14. With GT key 3, increment to the division A to D. Qualify the channel number with GT key 5 and enter with GT key 8.
15. A low and high input will now appear based on the number of pins (# of contacts) that you set when programming #12. A to D. Enter with GT key 8.
16. Select the output card address with GT key 3 and Enter with GT key 8.
17. Select the low pin with GT key 3 and Enter with GT key 8. The LCD will increment to the next level number. Repeat steps 12 through 17 for each channel of A to D for expression functions that you are using.

   Power Up Programming is now complete.

X. 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. Check for correct DC voltages
2. Test problem circuit
3. Repair

This is a repeat of VII. Testing of Wiring for Power Up.

NOTE: If the problem seems to be a circuit board problem, swap the board with one that is known to be good. The boards may be bypassed with voltage and fiber optics to keep the system functioning if a replacement board is not available. However, the CPU and INPUT card address 0 must always be in the system.

FUSES - check with an ohm meter, do not rely on checking visually only. There are a variety of fuses, in amp rating and location; these are covered in previous sections III, V, and VII.

NOTE: In the event of the need to call us for assistance, please have your documentation, voltmeter, and a hands free phone ready so that we can help you.

NOTE: Most problems encountered are either voltage or wiring. Without the use of both a digital multimeter and an oscilloscope to monitor the quantity and QUALITY of the voltage, trouble shooting is at best a shot in the dark.