

INTRODUCTION

The model 1200c from AB International is the only totally modular Power Amplifier. It features LED output power display and speaker limiting protection, as you would expect from a high-end professional amplifier. But what really sets the 1200c apart is its completely interchangeable output sections. Each of the "output tunnels" is independent of the other and each output module packs its own variable D.C. Fan to make sure your sound system stays cool even when the music's hot.

CIRCUIT DESCRIPTION

To assure absolute long term reliability, the output section of each channel incorporates multiple Motorola Power Transistors, which provide 3 times the amplifiers rated power in watts of dissipation per channel. The output stage is arranged in a fully-complementary format for class AB/2 operation. The bias current is evenly distributed among all output devices. Bias thermal compensation is accomplished by thermally mating a bipolar semiconductor junction to the heat-producing output device. Triple defused high power driver transistors are employed along with high speed, high voltage annular devices for the predriver and inverter stages. Utilization of these components provides the required separation of Ft break points for absolute stability. Fully complimentary drive and loading is utilized throughout. Only 20 dB of negative feedback is used to reduce forward transfer distortion to minimum levels. VI type energy limiters are incorporated for short circuit protection of the amplifier. Due to the unusually large safe operating area of the output stage, the limiters do not actuate until driving a forty-five degree reactive load of under 1.4 ohms at full power.

CONSTRUCTION

The amplifiers are designed on an all-modular concept permitting rigorous preassembly module testing and maximum service accessibility. Each functional module is fully tested before final assembly. Although components of the highest quality are used throughout, each amplifier is burned in, prior to shipment, at the worst case operating point to eliminate any possibility of component malfunction. All chassis components are precision machined from high quality aluminum and sheet steel stock and finished with a highly durable, baked powdercoat finish. The entire packaged concept is directed toward maximum efficiency of space and structure, accounting for the compact size.

INSTALLATION

All AB International amplifiers are designed for mounting in a standard 19 inch equipment rack. The amplifiers require 5-1/4 inches of vertical panel space, with 16-3/4 inches required behind the panel. Total depth, including handles is 18-1/4 inches. Front panels are machined from solid aluminum stock, with a black finish and sturdy rack mount handles.

Placement of the amplifier is not critical for normal operation, provided sufficient air flow is allowed to reach the internal heatsinks. If the unit is to be placed on a shelf or a similar enclosed area, allow four inches behind the rear panel to permit air flow through the system. For installations in a cabinet, allow an additional two inches above and one inch below the amplifier to permit air to be drawn from the rear. If the amplifier is to be mounted in an equipment rack or cabinet with heat producing equipment, be sure that environmental operating temperatures do not exceed 55°C (131°F). Should overheating occur because of inadequate ventilation, the temperature protection circuitry will automatically protect the amplifier. When safe operating temperature is restored, the amplifier will return to operation.

Because the amplifiers are capable of delivering high power from a relatively small package, considerable heat can develop in cabinets containing several instruments. A good rule of thumb to adopt is to provide forced air cooling to any enclosure containing four or more instruments.

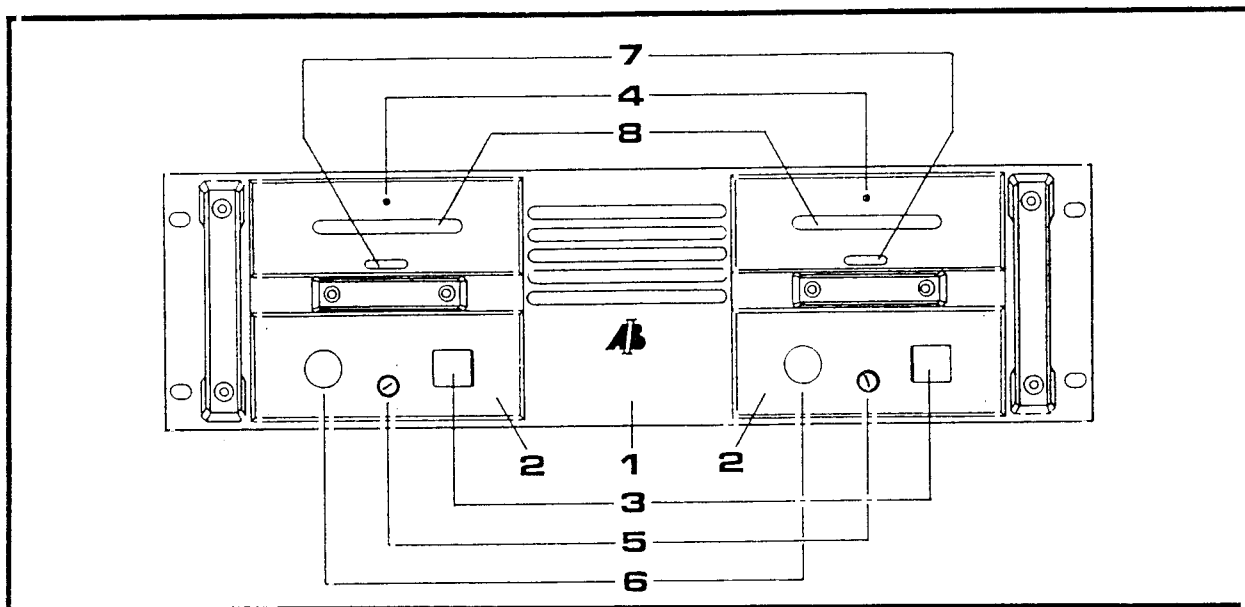
POWER CONNECTIONS

Professional Series power amplifiers are specified for operation from 120/240 Volt 50/60 Hz mains supply.

Model 1200c amplifiers are prewired for the line voltage that is indicated on the rear panel of the amplifier. Follow step 8 of Rear Panel Features for proper power cord connections.

In new installations and portable sound systems, or any situation in which the main power is suspect, it is wise to confirm appropriate voltage and polarity **BEFORE** connecting the instrument to power sources.

FRONT PANEL FEATURES AND CONTROLS



1. 1200c MAIN FRAME

Each amplifier consists of one 1200c Main Frame and two removable 1201c Modules. One module for Channel One and one for Channel Two. NOTE: the 1200c can be operated with only one channel if it is Necessary for a short period of time and is recommended during module replacement only.

2. 1201c MODULE

Each module operates independently and can be removed if a fault occurs. All 1201c modules are identical and having duplicate features, can be operated under various conditions. The 1201c gives the customer field service flexibility through it's modular design. If a situation occurs where a 1201c needs to be removed, follow these precautions: Turn off the module prior to removal (*See 3 below*).

NOTE: It is preferable to turn off both modules prior to removal of either channel and follow Step 5 of Front Panel Features.

3. POWER SWITCH

To turn the module ON or OFF, press the upper or lower portion of the rocker switch.

NOTE: If only one module is turned off, high DC voltages continue to be available at BOTH module connectors. Do not touch or probe the connectors unless BOTH modules are turned off or removed, and the main power is disconnected.

4. POWER INDICATING LED

This LED indicates that the module is turned on and fully enabled.

5. MODULE LOCK

If a 1201c module is to be removed, turn power off and release the module lock by following the indicating arrows. After module is free from main frame, rotate lock screw counter clockwise about two additional turns.

NOTE: When replacing a module in the Main Frame, be careful to align the top fins of the module heat-sink into the plastic guides at the upper front part of the opening. As the module slides into the cavity, lift slightly on the handle to insure the interface connector clears the threshold of the Main Frame opening and that the lock screw tab is in the up (horizontal) position. **DO NOT OVERTIGHTEN** lock.

6. LEVEL CONTROLS

Each Module has a separate low-noise 41 click detent rotary level control. Rotate control clockwise to increase level.

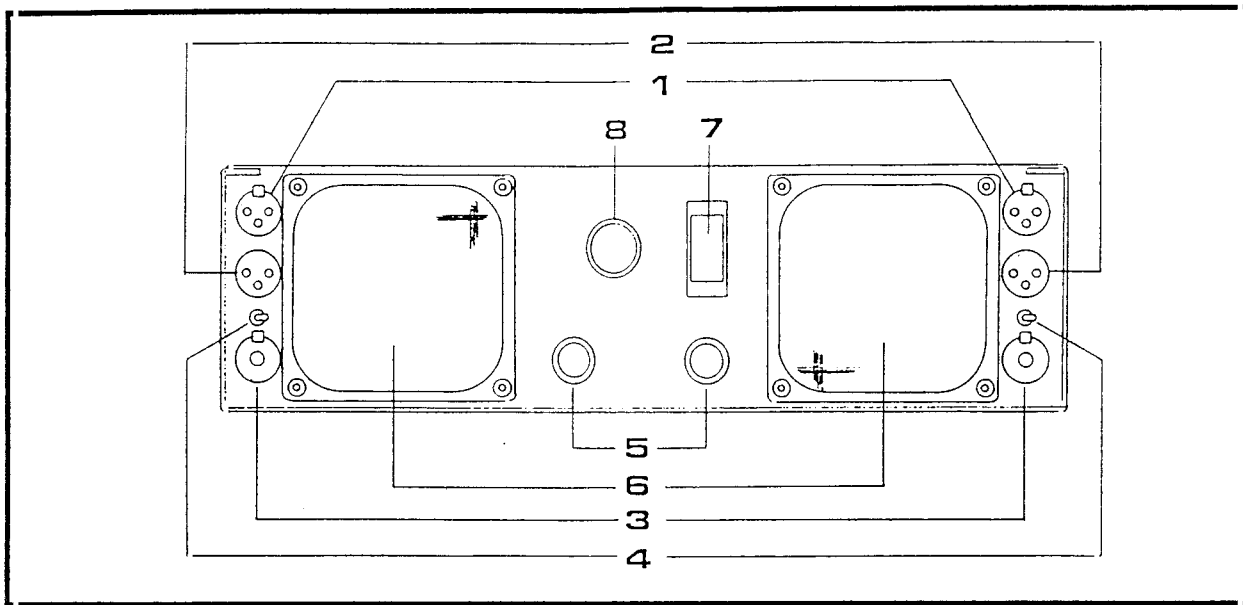
7. "PEAK LIMIT/SOFT CLIP" CONTROL

Each 1201c module has a "Peak Limit / Soft Clip" switch. Prior to using your amplifier you should first decide which feature best fits your application. If you have a need for peak power limiting, select the "LIMIT": "8 ohm", "4 ohm" or "2 ohm" position that corresponds with your speaker load. This will limit the input signal approximately 3dB from rated output power and no clip or overdrive will occur. **NOTE:** 3dB equals half power output. If you select the "SOFT CLIP" position, the amplifier will reach rated output and no hard clipping will occur. The "OFF" position will give no peak limiting or clip protection. If the Red LED regularly illuminates, you should readjust the input level to prevent clipping or select "SOFT CLIP". Most applications will use the "SOFT CLIP" feature since you get both maximum power and overdrive protection.

8. SIGNAL STATUS DISPLAY (EACH MODULE)

An "11 LED STRIP" output display is normally off when no signal is present and illuminates progressively as input signal increases. The Green and Yellow LED's represent the amount of signal (in dB) present at the output of the amplifier. The Red LED will illuminate when the output level exceeds rated output power and the amplifier has gone into "CLIP". If this situation occurs, you should readjust the output level to prevent any speaker damage.

REAR PANEL FEATURES AND CONTROLS



1. BALANCED XLR FEMALE INPUT CONNECTIONS

Balanced input signals may be directly connected to Channel One and Channel Two female XLR receptacles. Note: XLR inputs have a 15k differential balanced input impedance with Pin 1: Ground, Pin 2: High, Pin 3: Low.

2. BALANCED XLR MALE PARALLELED CONNECTIONS

If a balanced signal is applied to the XLR female connector, a paralleled balanced output signal may be accomplished by inserting a connector in the XLR Male input.

3. 1/4" JACK INPUT CONNECTION BALANCED AND UNBALANCED

Balanced input signals may be applied to the locking 1/4" phone receptacles by using a stereo 1/4" plug. The tip of the plug is for positive signals, the ring is negative and the sleeve is ground.

Unbalanced input signals may be applied by using a mono 1/4" plug. The tip of the plug is for positive signals and the sleeve is ground.

The 1/4" phone receptacle has a 15k differential input impedance.

4. GROUND LIFT SWITCH

The Ground Lift Switch is in series between the input circuitry and chassis ground. This allows the source ground to be isolated from the amplifier input circuitry. The Ground Lift feature is particularly useful in systems wherein the power amplifiers are located long distances from the source equipment and "Ground Loop" hum occurs.

5. OUTPUT CONNECTIONS

Output connections are via the Neutrik "Speakon" loudspeaker and amplifier connectors. Included in your amplifier purchase are mating male Speakon connectors and each channel has a separate connector that can handle up to four stranded 12 AWG conductors. In the output receptacles there are four 30 amp pins and are paralleled internally as follows: Pin 1(+) and Pin 2(+), Pin 1(-) and Pin 2(-). A Neutrik Speakon data sheet has been enclosed in the owners manual. For extra Speakon connectors contact AB International or Neutrik USA, 1600 Malone ST. Millville, NJ 08332, Ph. (609)327-3113

6. COOLING SYSTEM

Two variable D.C. fans which operate at 110 cfm at maximum speed, are provided. Two filters are included to protect against debris getting inside the amplifier.

NOTE: Filters must be clean at all times to assure proper amplifier cooling. A periodic maintenance schedule is recommended depending on environmental conditions.

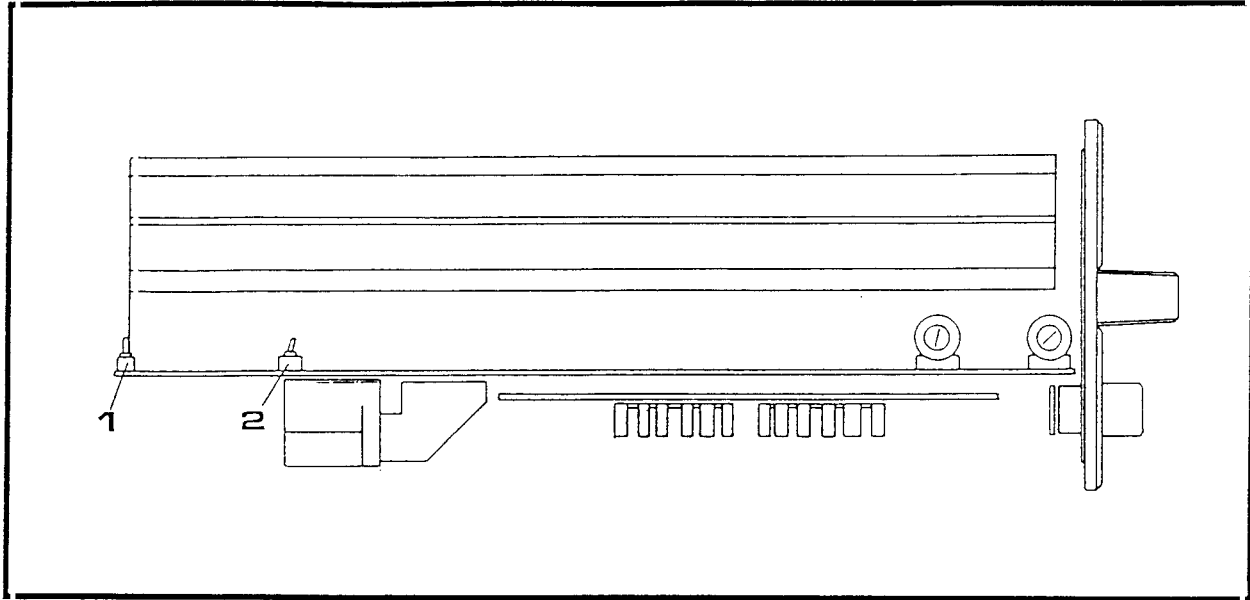
7. CIRCUIT BREAKER

The Circuit Breaker is in series with the AC power line and precedes the 1201c Module power switches. The Circuit Breaker has two ratings: at (100v-120v) the rating is 32 amps and at (208v-240v) the rating is 16 amps.

8. POWER CORD

Model 1200c Main Frames are prewired at the factory for the line voltage labeled on the rear panel of the amplifier. Due to the high current requirements and variations in installations, we recommend that a qualified installation technician decide on the type of Power Cord plug to be used or particularly wired. **NOTE:** A Power Cord wiring diagram has been enclosed in the manual.

1201c MODULE FEATURES



1. HIGH PASS FILTER

Each 1201c Module has a switchable High Pass Filter which was preselected by the factory at 20Hz @ 12 dB per octave. Next to the High Pass switch are two markings "FLT" and "HP"; where switch position "FLT" represents the natural characteristics of the amplifier and switch position "HP" represents the High Pass Filter that was preselected. **NOTE:** If the customer desires a different filter than the one preselected contact your local AB International dealer.

2. BRIDGE MODE

Each 1201c Module has a Mono Bridge/Normal switch. This feature enables the maximum available power in both channels to be delivered into a single load. Next to the Bridge switch there are two markings "B" and "N". The "B" marking represents Bridge Mode and the "N" represents the normal operation of the amplifier. To operate the 1200c in Bridge Mode use the following procedures closely.

BRIDGE MODE (CONTINUED)

- STEP
1. Place Channel Two Bridge switch to the "B" position.
 2. Place Channel One Bridge switch to the "N" position.
 3. Connect the input signal to Channel One.
 4. Output load connections are accomplished thru the Speakon connectors. (Refer to Rear Panel Features STEP 5.) Connect the positive(+) phase of the speaker load to channel ONE Pin 1(+) or Pin 2(+). Connect the negative (-) of the speaker load to Channel Two Pin 1(+) or Pin 2(+).
 5. **DO NOT** use Channel One or Channel Two Pin 1(-) or Pin 2(-).
 6. Assure the speaker load is 4 ohms or above.
 7. Adjust the output by using Channel One level control. Set Channel Two level control to "0".
 8. Use caution not to allow an output short circuit condition to exist in bridge mode operation, as this constitutes connecting the two outputs together. (*See cautionary statement below*)

CAUTION:

The 1200c amplifier is a product of the most advanced technology and manufacturing techniques and is fully protected against overheating, input overload and shorted or mismatched loads. As is the case with any precision instrument, some care should be noted and adhered to in the units operation. Damage resulting from their omission is not covered under the terms of the warranty.

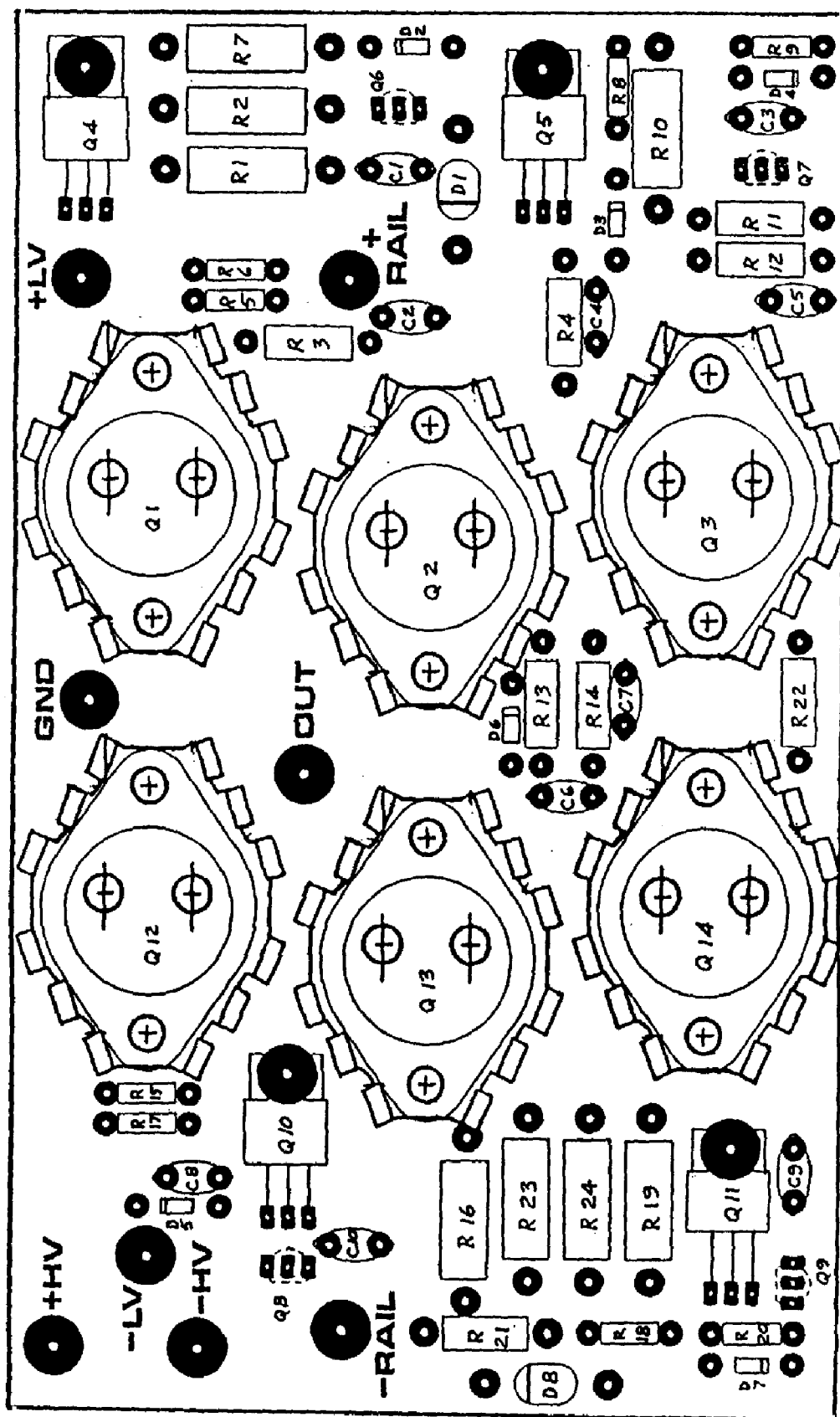
DO NOT PARALLEL THE OUTPUTS OF THE TWO CHANNELS BY CONNECTING THEM TOGETHER OR PARALLEL THEM WITH ANY OTHER AMPLIFIER OUTPUT. UNDER NO CIRCUMSTANCES SHOULD THE AMPLIFIER BE OPERATED WITH THE COVER REMOVED. THERE ARE NO USER SERVICEABLE COMPONENTS INSIDE. AVOID POTENTIALLY DANGEROUS SHOCK HAZARDS, KEEP THE COVER CLOSED AT ALL TIMES!

SPECIFICATIONS

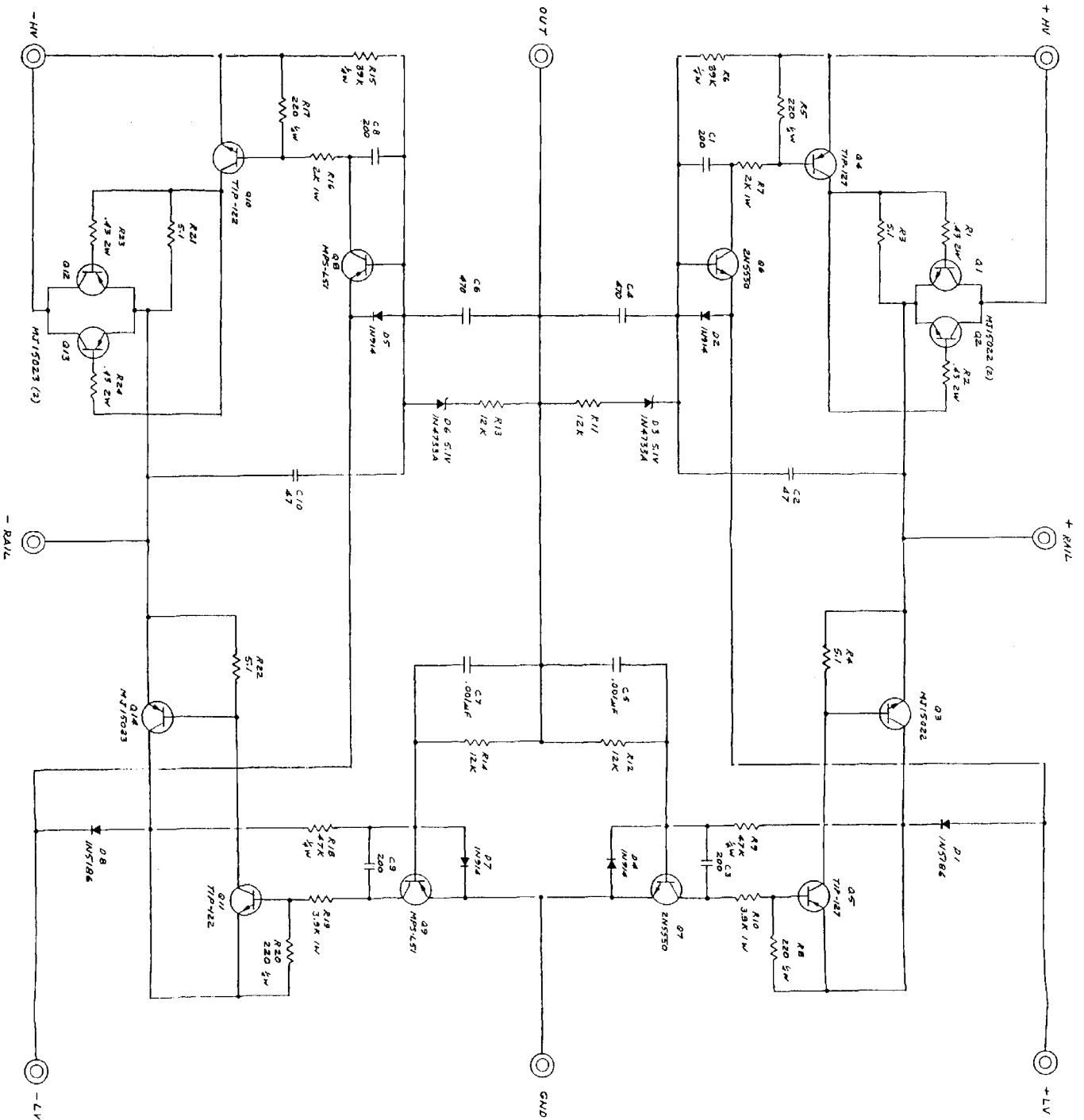
Type:	Two Channel Audio Power Amplifier
Gain:	32.5 dB (each channel)
Continuous Power: (120 VAC, 1KHz, single channel driven)	800 watts per channel at 8 ohms 1350 watts per channel at 4 ohms 1950 watts per channel at 2 ohms 1850 watts bridged mono 8 ohms 2350 watts bridged mono 4 ohms
Frequency	+/- 0.5dB
Response:	20Hz to 20KHz
Distortion:	No more than 0.25% THD or IM, 0.01W Unweighted to rated power, 20Hz to 20KHz (0.1 THD Typical)
Hum and Noise:	100dB below rated output (unweighted 20KHz bandwidth)
Input Sensitivity:	1.9 VRMS for rated power
Input Impedance:	15K ohms, normal
Transient Intermodulation Distortion:	Less than 0.02%
Crosstalk:	-86dB
Damping Factor:	500:1 at 1KHz
Slew Rate:	Closed loop response greater than 40v/ μ sec.
Thermal Protection:	Thermal sensor activates module shut down at 95 C.
D.C. Protection:	D.C. sensor activates module shut down if a D.C. condition exists.
Turn-On Delay:	3 Seconds, solid-state actuated
Heat-Sink and Cooling:	High efficiency, Forced air cooling utilizing massive heat-sink extrusions. Dual variable speed fans.
Input Connectors:	(2) 1/4 Inch Phone Jacks (2) XLR Male (2) XLR Female
Output Connectors:	Neutrik "Speakon" (30 Amp Rated)
Weight:	64 lbs. (29 kg) (69 lbs. Shipping Weight in Carton)

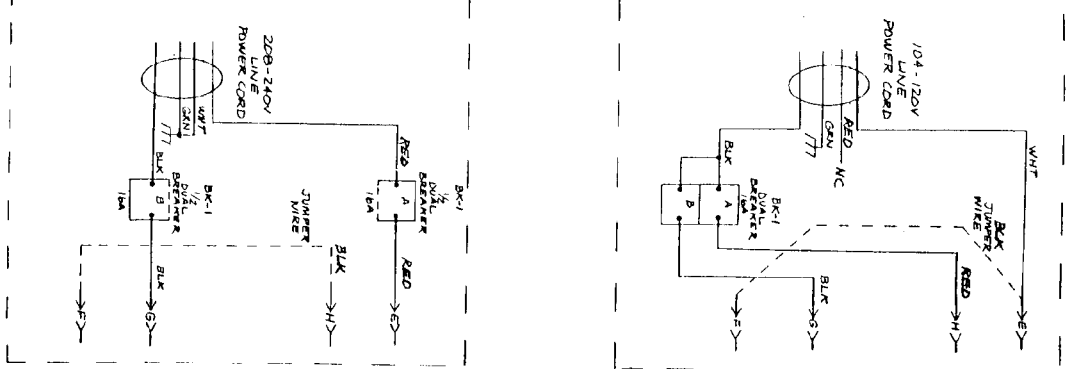
SPECIFICATIONS (CONTINUED)

Controls & indicators:	(Front Panel 1201c) Power Switch, Power On LED Indicator, Level Control, Selectable "Peak Limiter" / "Soft Clip" feature, Clip LED and 11 LED "VU" Output Display. (Rear Panel) AC Mains Power Switch/Breaker
Power(Input):	100-120 VAC, 208-240 VAC 50/60 Hz Recommended AC Service for 120v is 45A
Dimensions:	5 1/4" H (13,3 cm) 19" w (48.3 cm) 16-3/4" D (42.5 cm) behind panel 18-1/4" D (46.4 cm) overall

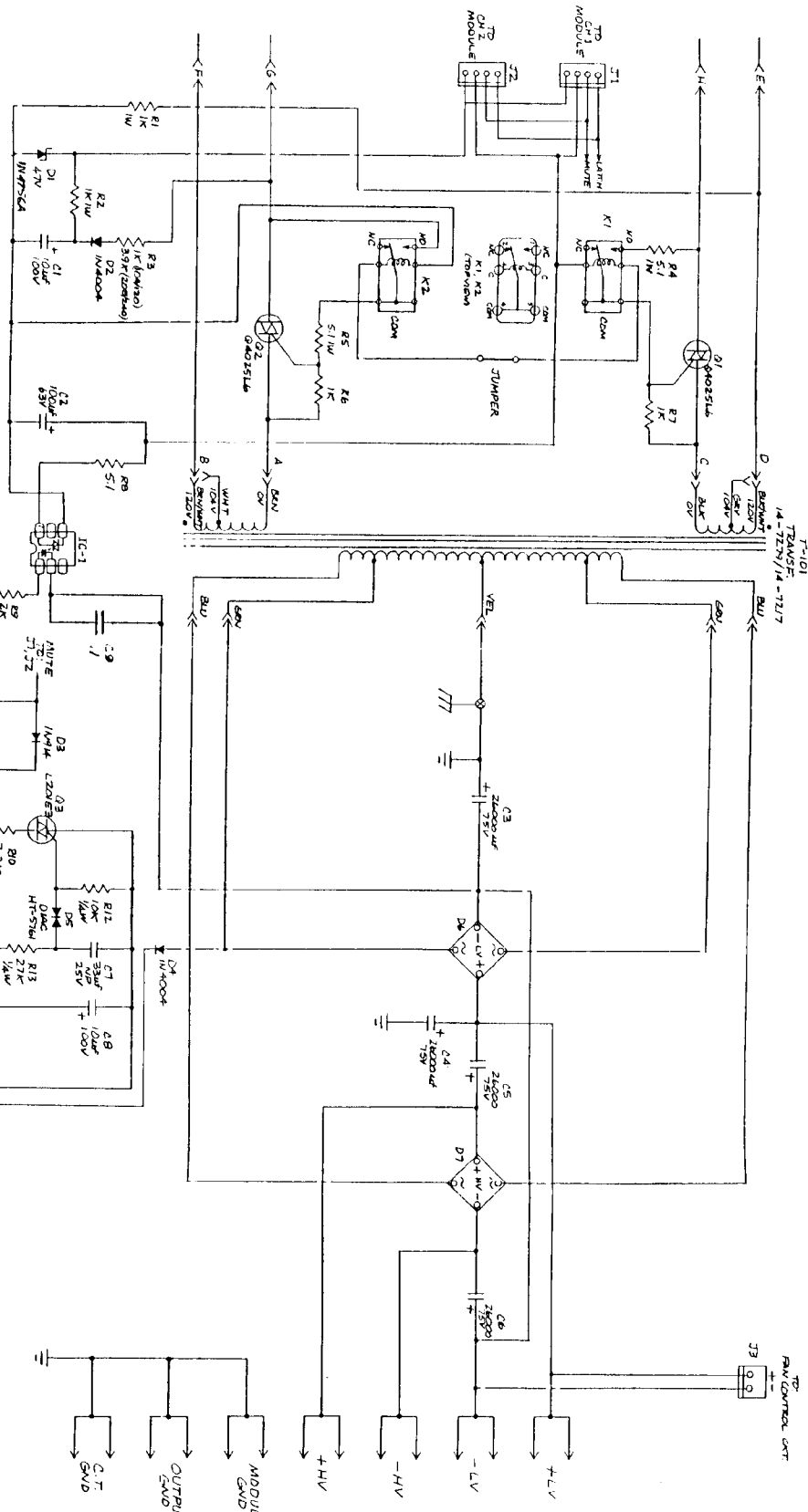


- NOTES: (VALUES OTHERWISE SPECIFIED)
1. ALL RESISTORS IN OHMS, $\frac{1}{2}$ W, 5%.
 2. ALL CAPS IN PICOFARADS (PF).
 3. \odot DENOTES MECHANICAL AND ELECTRICAL CONNECTION TO CHANNEL AMP BOARD ASSY 502-710.





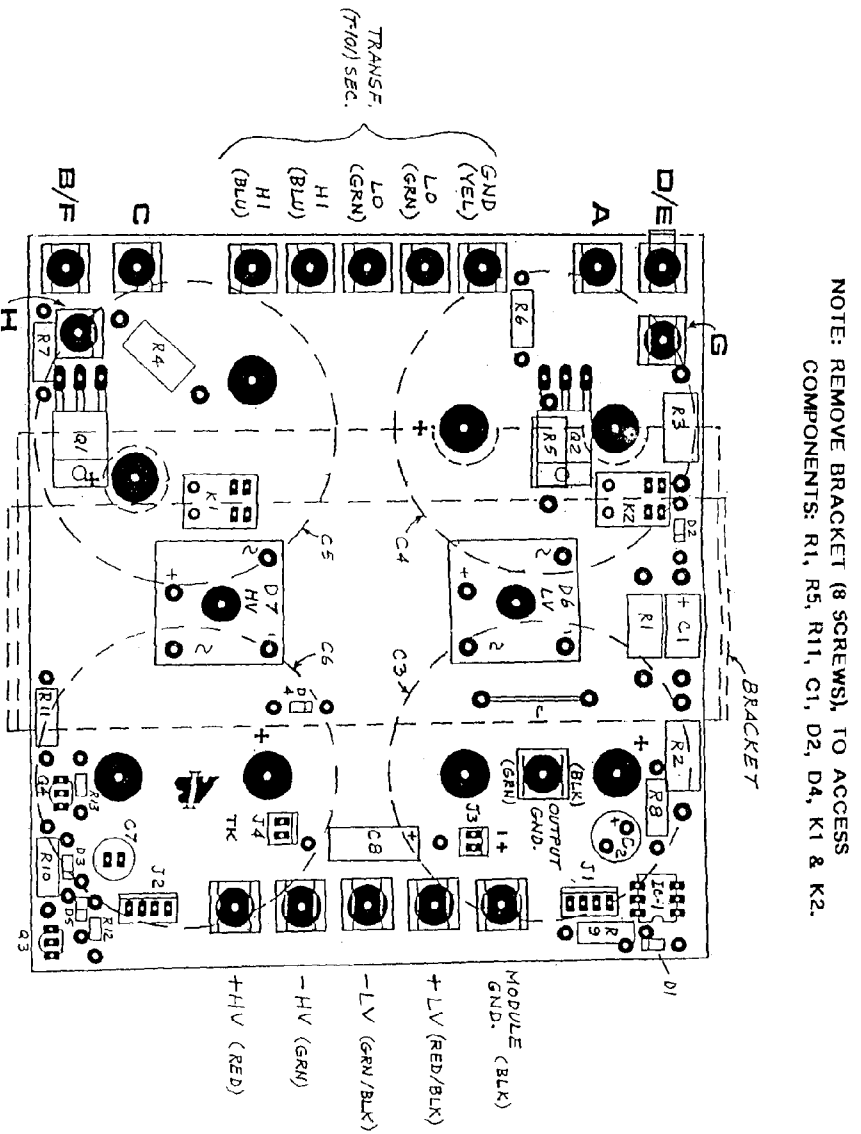
NOTES: (UNLESS OTHERWISE SPECIFIED:
 1. ALL RESISTORS ARE IN OHMS, 1/2W, 5%
 2. ALL CAPACITORS ARE IN MICROFARADS, ELECTROLYTIC
 3. ALL CIRCUIT GROUND, 177 CHASSIS (EARTH) GROUND



AB INTERNATIONAL
 TITLE: SCHEMATIC POWER
 MODEL: 1200C
 DATE: 6-26-70 M.H.
 7-3-71 G.E.D.
 8-6-71 G.E.D.

LINE AND TRANSFORMER (T-1) CONNECTIONS
TO POWER SUPPLY BOARD

LINE VOLTS 50-60 HZ	A	B	C	D	E	F	G	H
194	BROWN (FROM T-1)	WHITE (FROM T-1)	BLACK (FROM T-1)	GRAY (FROM T-1)	WHITE (POWER CORD)	BLACK (JUMPER TO E)	BLACK (FROM BREAKER)	RED (FROM BREAKER)
120	BROWN (FROM T-1)	BROWN/RED (FROM T-1)	BLACK (FROM T-1)	BLACK/WHITE (FROM T-1)	WHITE (POWER CORD)	BLACK (JUMPER TO E)	BLACK (FROM BREAKER)	RED (FROM BREAKER)
208	BROWN (FROM T-1)	WHITE (FROM T-1)	BLACK (FROM T-1)	GRAY (FROM T-1)	RED (FROM BREAKER)	BLACK (JUMPER TO H)	BLACK (FROM BREAKER)	BLACK (JUMPER FROM F)
224	BROWN (FROM T-1)	BROWN/RED (FROM T-1)	BLACK (FROM T-1)	GRAY (FROM T-1)	RED (FROM BREAKER)	BLACK (JUMPER TO H)	BLACK (FROM BREAKER)	BLACK (JUMPER FROM F)
240	BROWN (FROM T-1)	BROWN/WHITE (FROM T-1)	BLACK (FROM T-1)	BLACK/WHITE (FROM T-1)	RED (FROM BREAKER)	BLACK (JUMPER TO H)	BLACK (FROM BREAKER)	BLACK (JUMPER FROM F)



AB INTERNATIONAL, INC.

ASSY. PCB: POWER SUPPLY

MODEL: 1200C

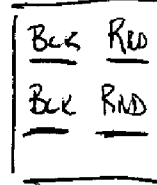
DATE: 7-30-90 Geo. A.
7-2-91 Geo. A.

ASSY. NO. 502-712 REV C

1200 CONVERSION

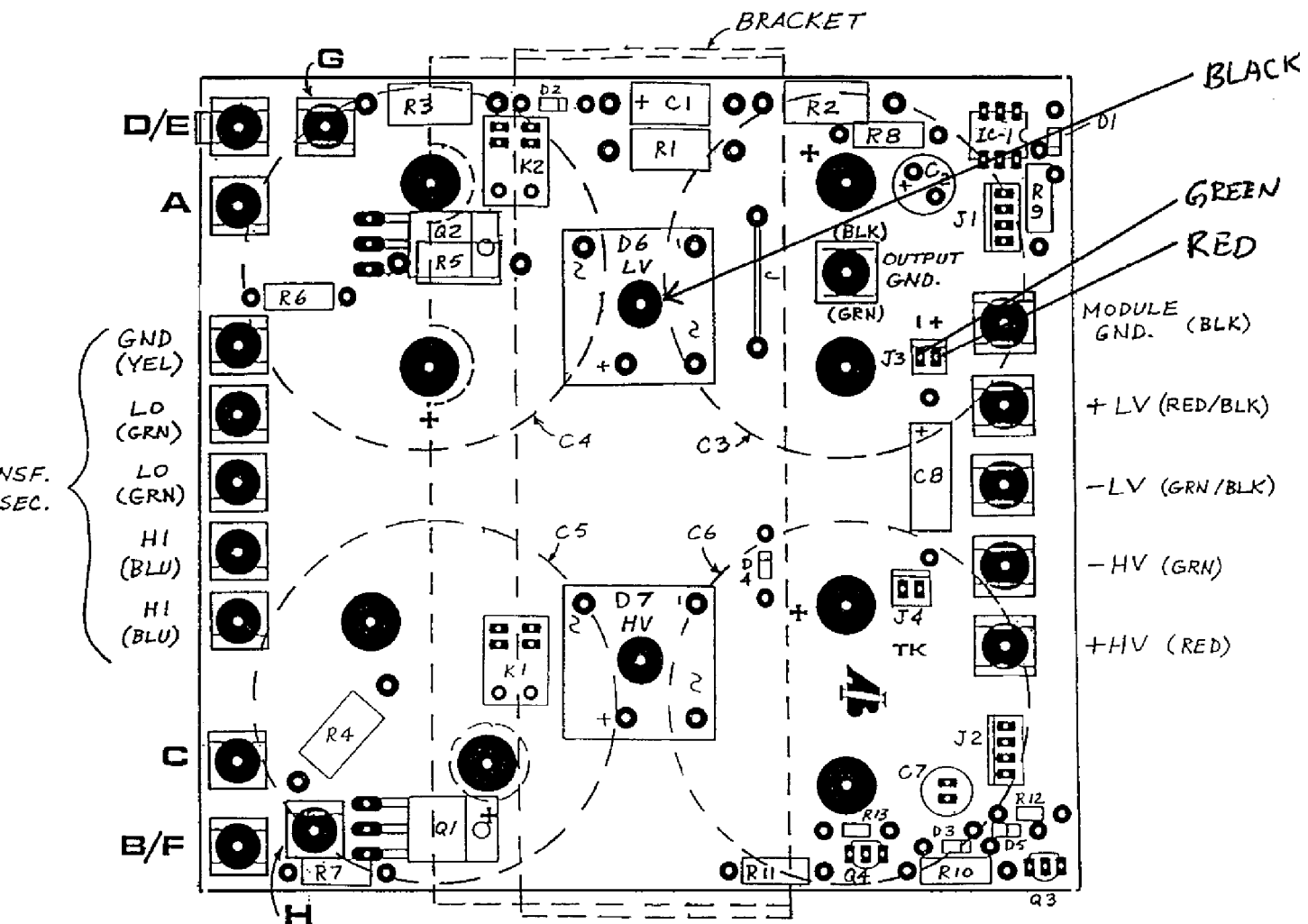
120V TO 240/220V

- 1) CUT BUS WIRE OFF OF BOTTOM OF BRK. SWITCH ON REAR OF CHASSIS.
 - 2) CONNECT RED & BLACK WIRE'S FROM POWER CORD TO BOTTOM TWO TERMINALS OF BRK. SWITCH.
 - 3) CONNECT RED & BLACK WIRE'S FROM POWER SWITCH TO POWER SUPPLY BLACK GOES TO ^{D/E} RED GOES TO G (SEE REVERSE)
- NOTE: WHILE COMPLETING STEPS 2 & 3 MAKE SURE THE BLACK & RED WIRE'S ARE ALIGNED TOGETHER.



- 4) CONNECT THE GREEN & WHITE WIRE FROM THE POWER CORD TO REAR PANEL CHASSIS GROUND.
- 5) CHANGE RESISTOR R5. TO 3.9K 1 WATT
- 6) IF AMP WAS 120V REMOVE JUMPER FROM D/E TO ~~B/F~~ AND REPLACE WITH JUMPER FROM B/F TO H
- 7) IF AMP WAS 120V REMOVE WHITE TRANSFORMER WIRE (D/F) AND REPLACE IT WITH BLK/WHITE TRANS. WIRE.

TIE BLK WIRE TO ANY CENTER TAP GROUND



AB INTERNATIONAL, INC.

ASSY. PCB: POWER SUPPLY

MODEL: 1200C

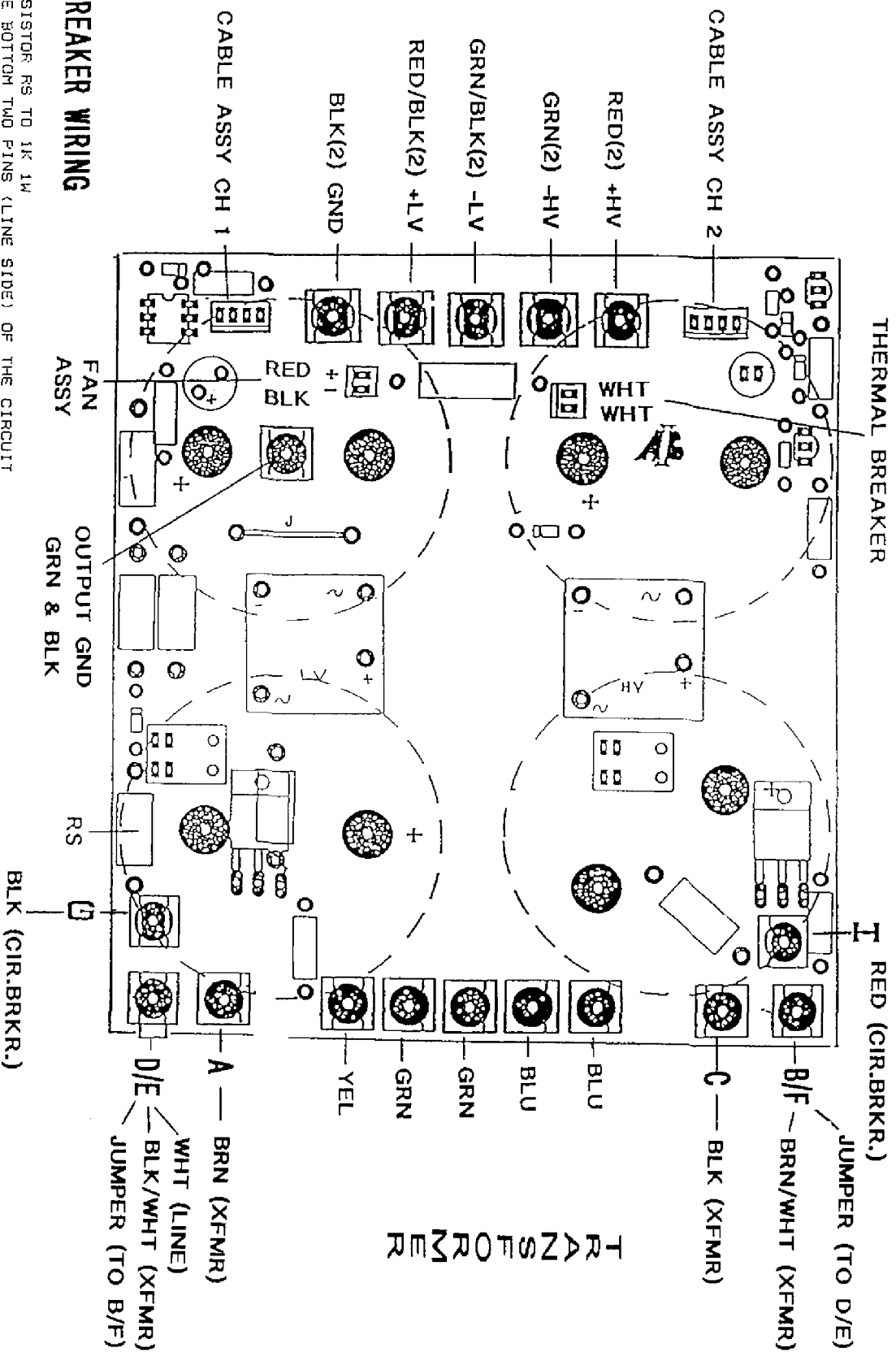
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ASSY. NO. 502-712 REV C

1200C POWER SUPPLY

120V



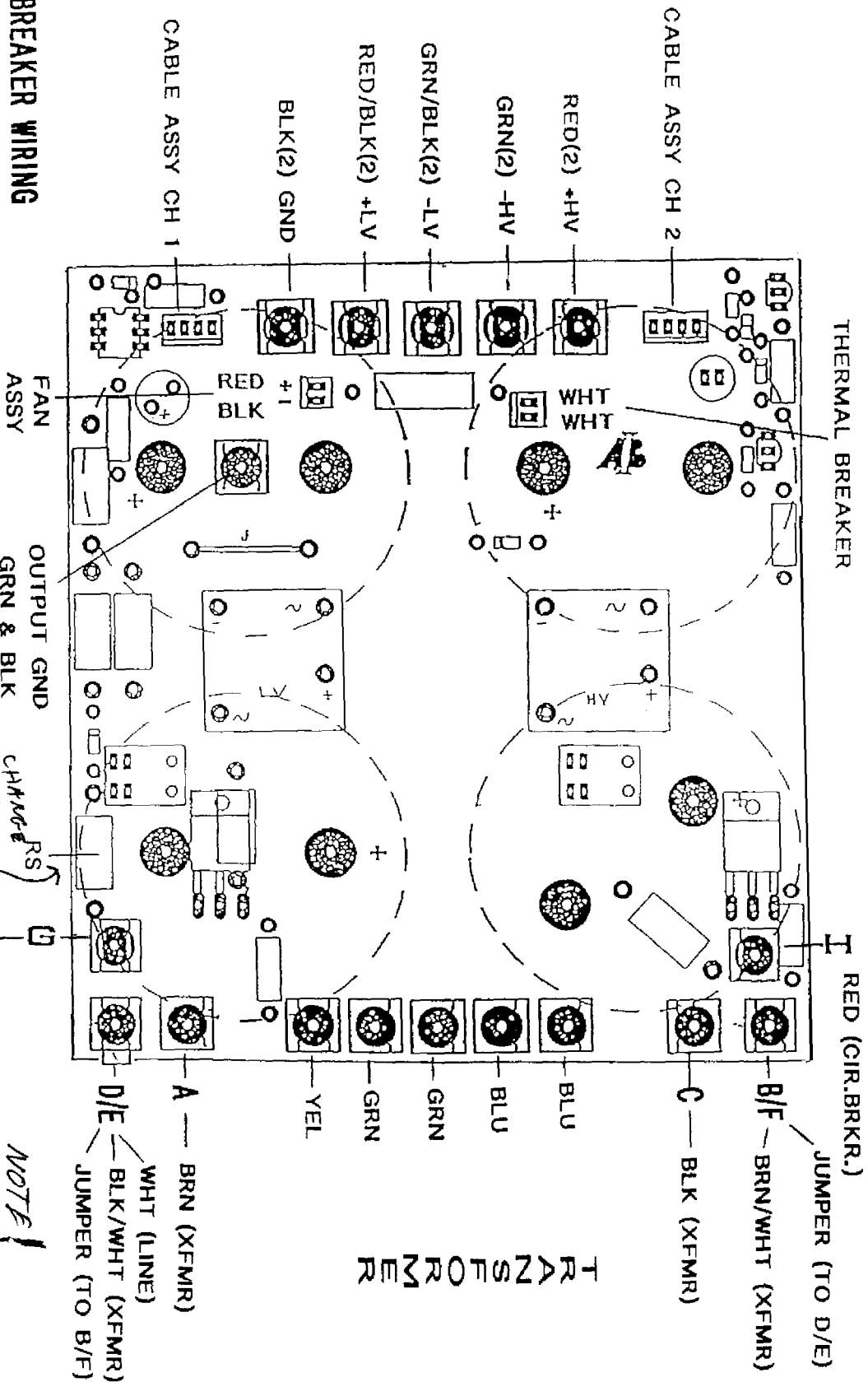
CIRCUIT BREAKER WIRING

1. CHANGE RESISTOR RS TO 1K 1W
2. JUMPER THE BOTTOM TWO PINS (LINE SIDE) OF THE CIRCUIT BREAKER TOGETHER. CONNECT THE BLACK WIRE FROM THE POWER CORD TO ONE OF THE PINS.
3. CONNECT THE WHITE WIRE FROM THE POWER CORD TO PIN (E) ON THE POWER SUPPLY.
4. CONNECT THE RED & BLACK WIRES FROM PINS (G & H) OF THE POWER SUPPLY TO THE TOP TWO PINS OF THE CIRCUIT BREAKER.

NOTE: STEP 4 THE WIRE POLARITY DOES NOT MATTER.

120V

NOTE:RED WIRE ON POWER CORD N/C



1. CHANGE RESISTOR R5 TO 1K 1W
2. JUMPER THE BOTTOM TWO PINS (LINE SIDE) OF THE CIRCUIT BREAKER TOGETHER. CONNECT THE BLACK WIRE FROM THE POWER CORD TO ONE OF THE PINS.
3. CONNECT THE WHITE WIRE FROM THE POWER CORD TO PIN (E) ON THE POWER SUPPLY.
4. CONNECT THE RED & BLACK WIRES FROM PINS (G & H) OF THE CIRCUIT BREAKER TO THE PINS OF THE POWER SUPPLY.

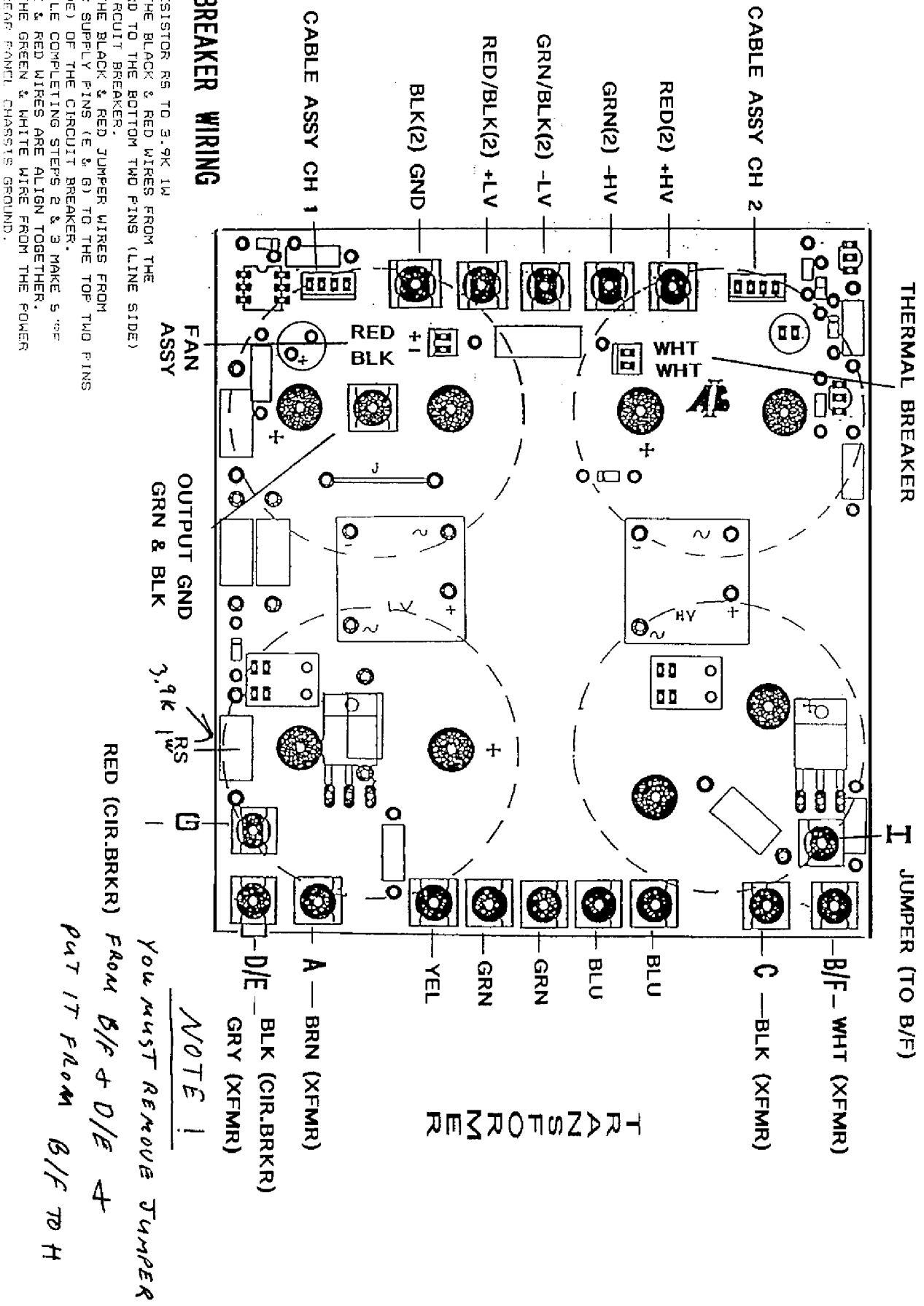
CIRCUIT BREAKER WIRING

NOTE

BLK (CIR.BRKR.) You must REMOVE JUMPER
FROM H-B/E
AND PUT A JUMPER FROM
B/F TO D/E

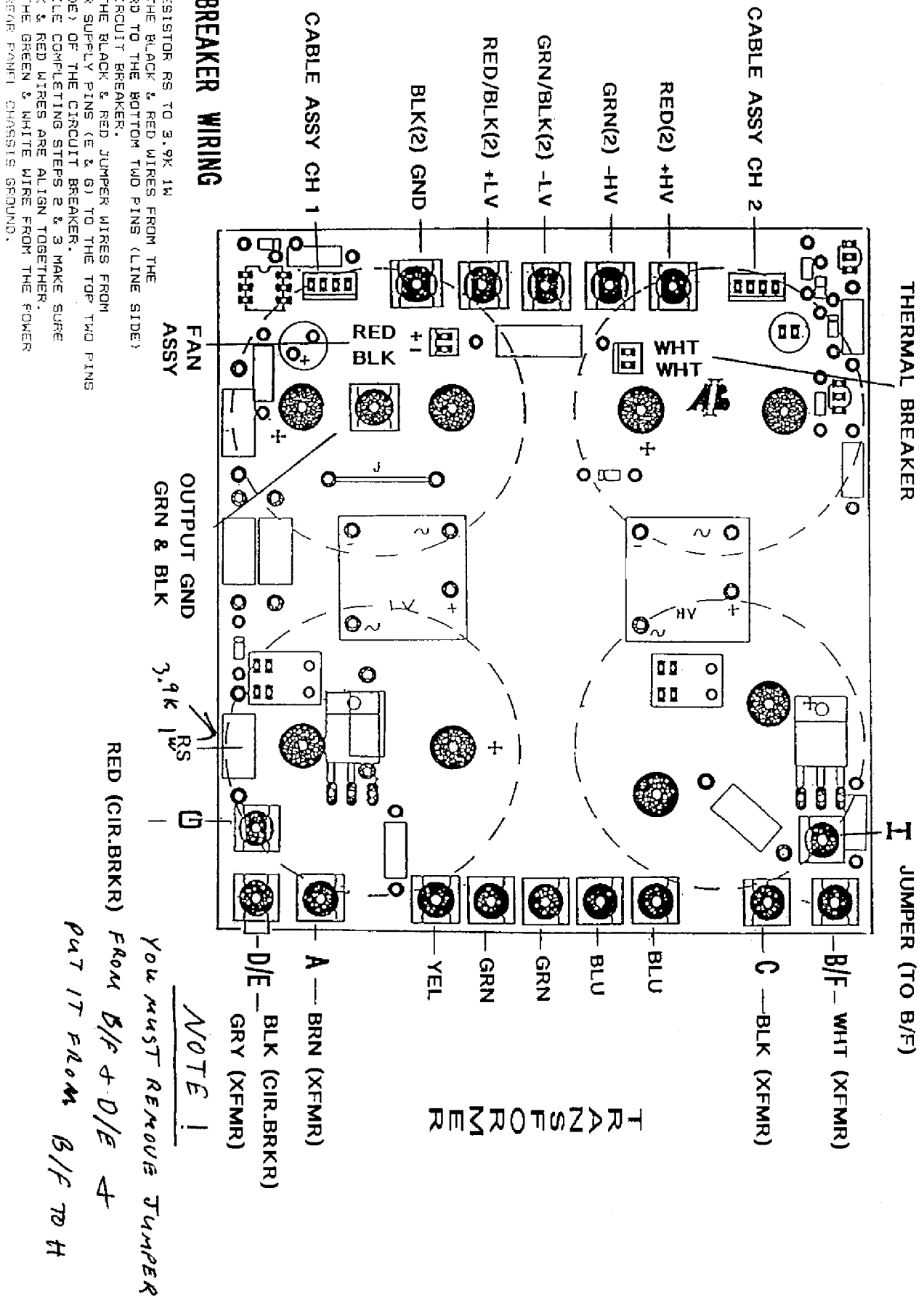
1200C POWER SUPPLY

208V/220V

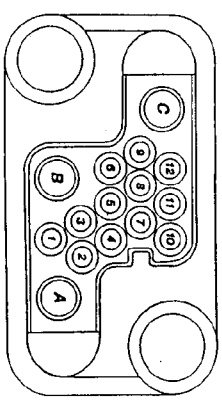
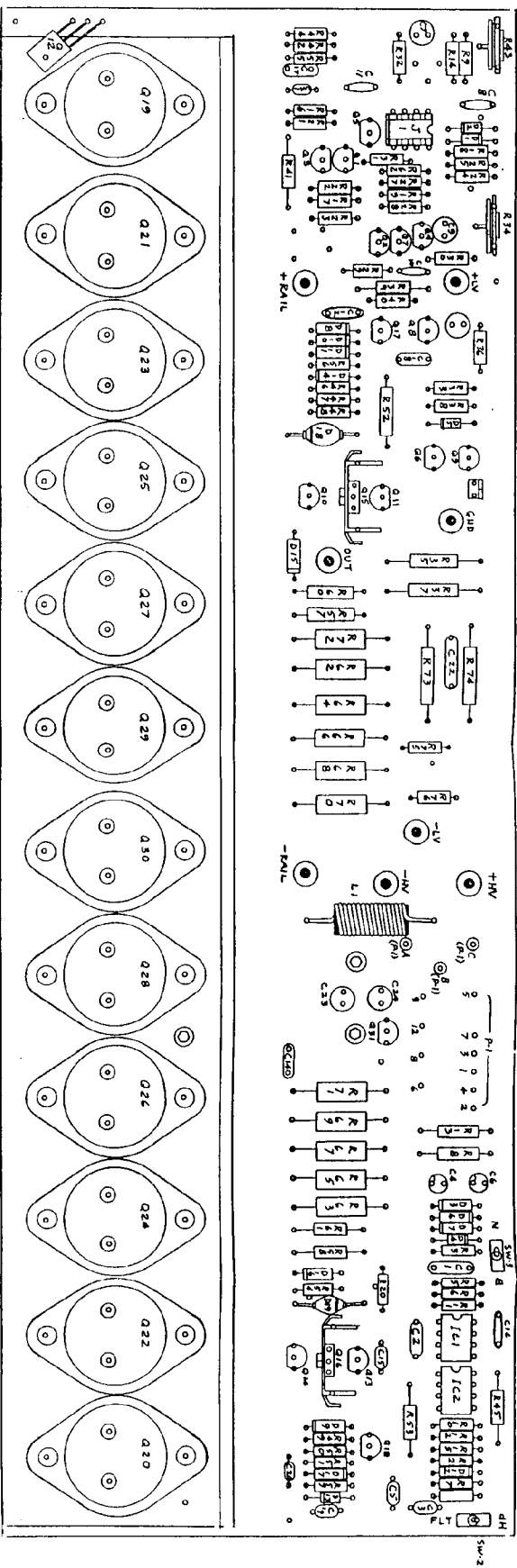


1200C POWER SUPPLY

208V/220V



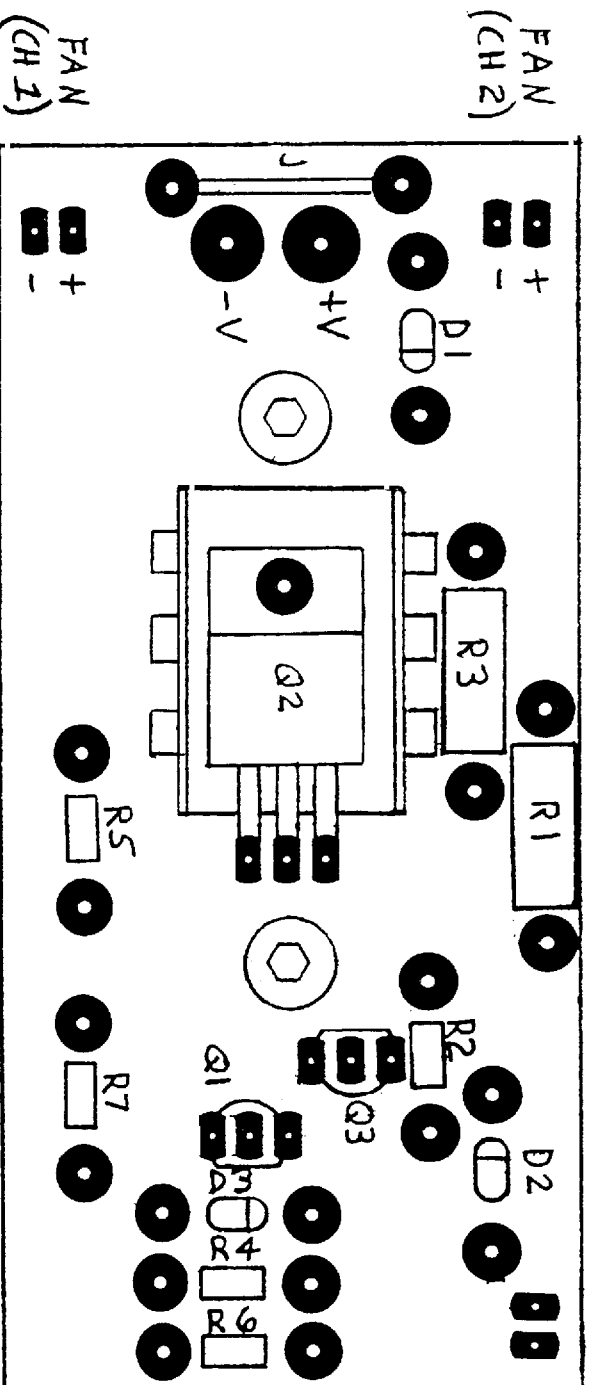
1. CHANGE RESISTOR RS TO 3.9K 1W
2. CONNECT THE BLACK & RED WIRES FROM THE POWER CORD TO THE BOTTOM TWO PINS (LINE SIDE) OF THE CIRCUIT BREAKER.
3. CONNECT THE BLACK & RED JUMPER WIRES FROM THE POWER SUPPLY PINS (E & G) TO THE TOP TWO PINS (LOAD SIDE) OF THE CIRCUIT BREAKER.
4. CONNECT THE GREEN & WHITE WIRE FROM THE POWER CORD TO GEAR PANEL CHASSIS GROUND.



A	-HV	6	MODULE GND
B	OUTPUT	7	MUTE
C	+HV	8	LATCH
1	NC	9	+LV
2	+SIG (RED)	10	PNR SW (BLU)
3	+SIG (WHT)	11	PNR SW (BLU/BLK)
4	-SIG (BLK)	12	-LV
5	BRIDGE IN		

AB INT
 TITLE: ASSY
 MODEL: 124
 DATE: 7-10-
 ASSY NO. 5

THERMAL SENSOR



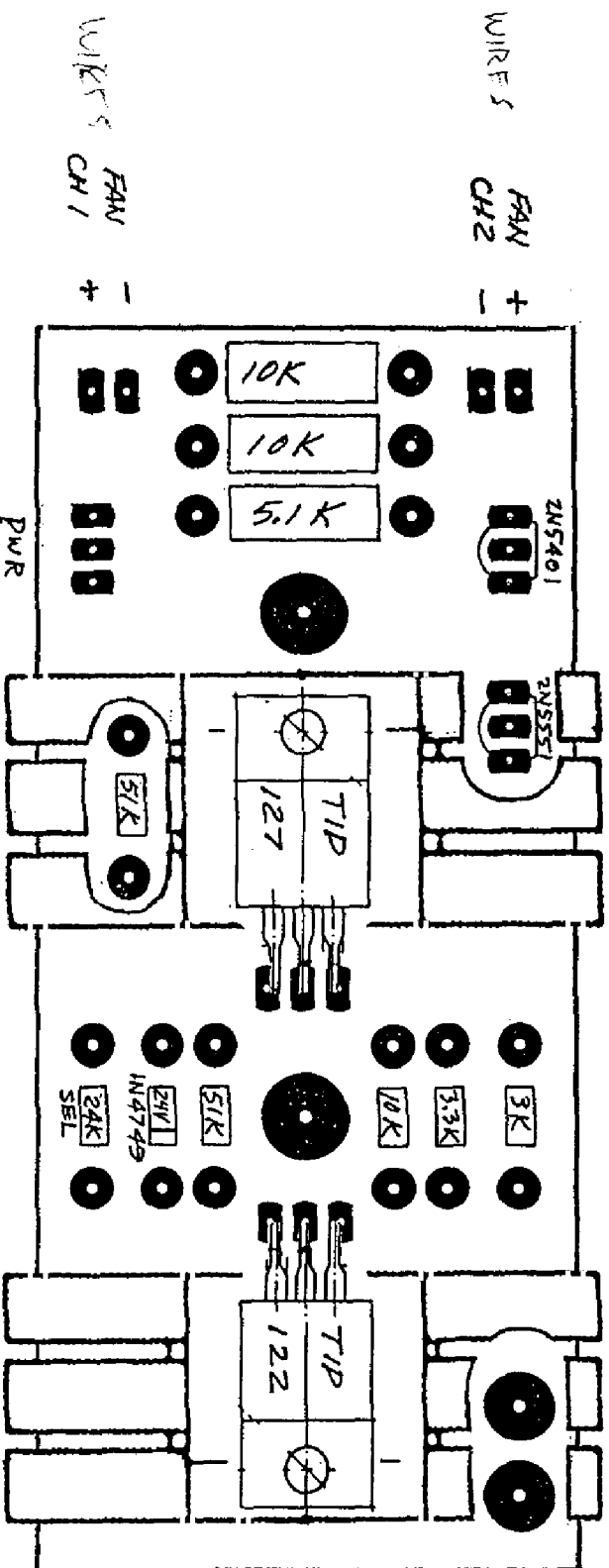
AB INTERNATIONAL INC.

ASSEMBLY DIA.: FAN CONTROL

MODEL: 1200C

DATE: 4-90 J.K.

ASSEMBLY NO. 502-713-B

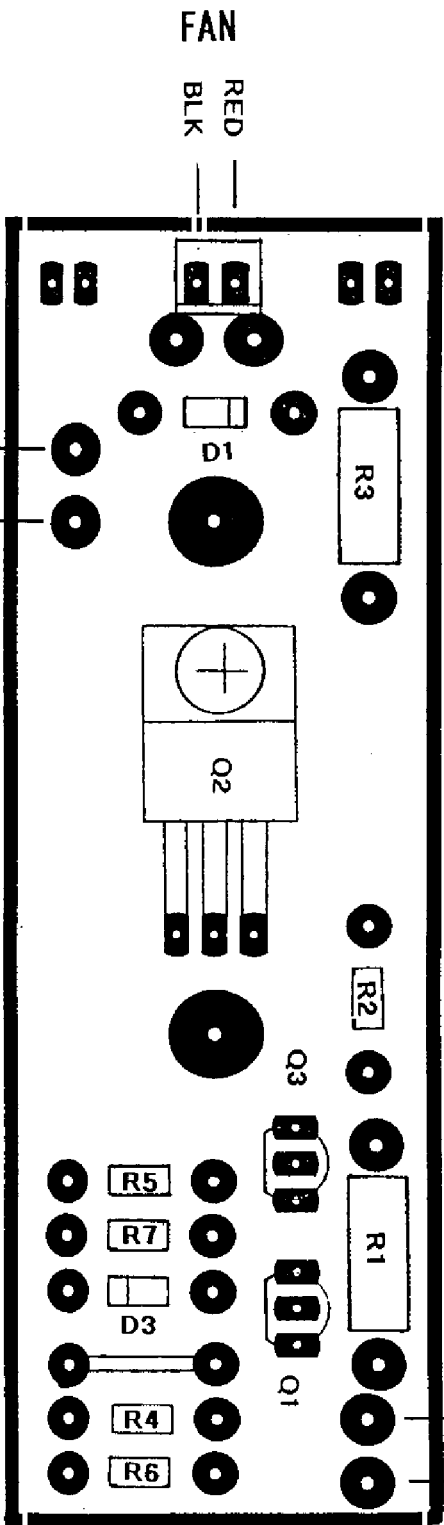


500-721A
502-727

1200c

THERMAL SWITCH

WHT
WHT



AB INTERNATIONAL, INC.

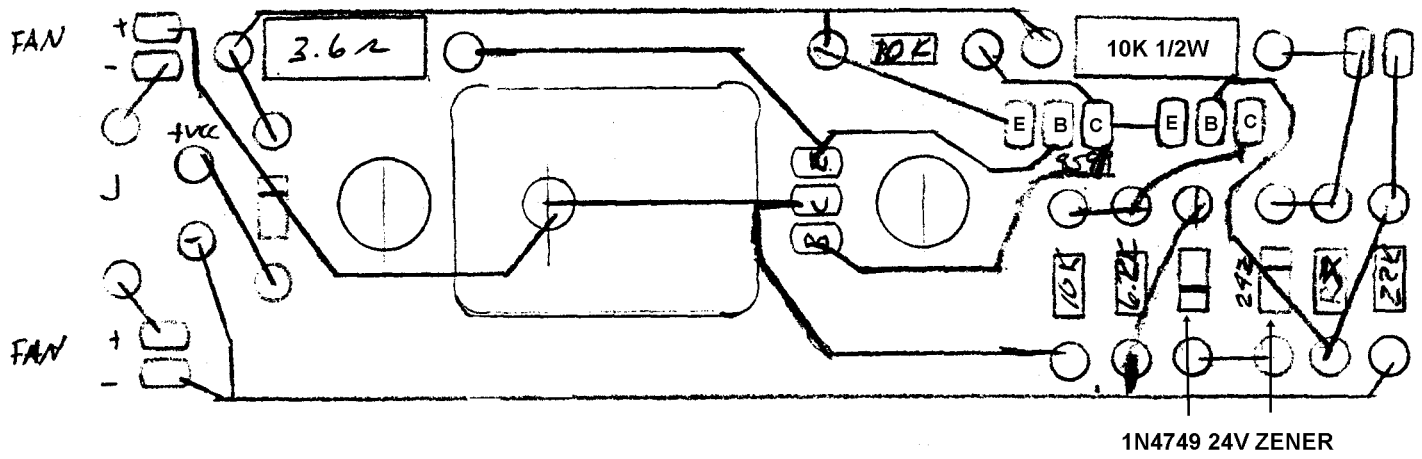
TITLE: FAN CONTROL PCB

MODEL: FX1B ,TWO-RACK AMPS

DATE 11-91

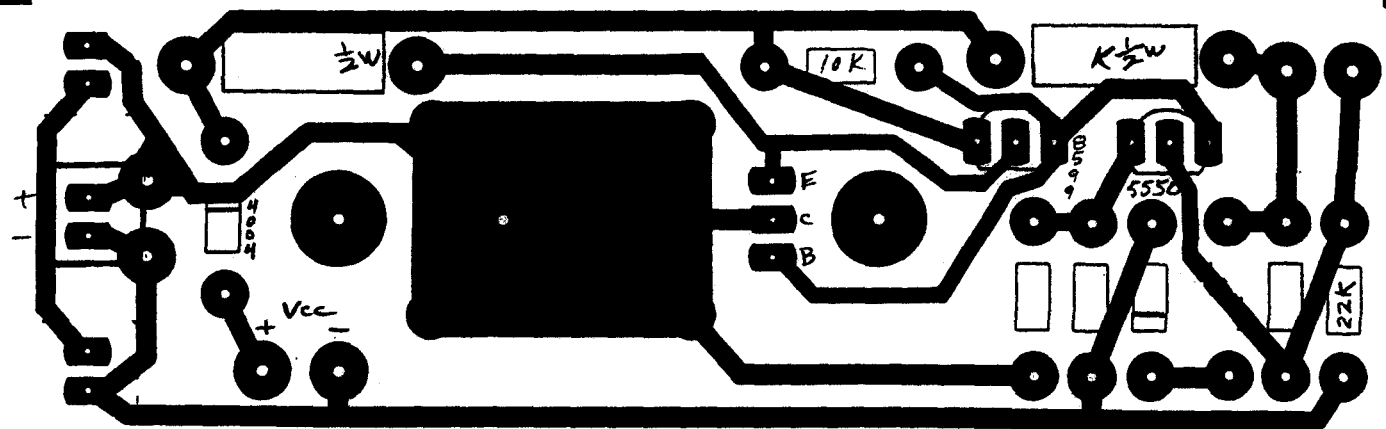
ASSY. NO. 502-716

REV. C

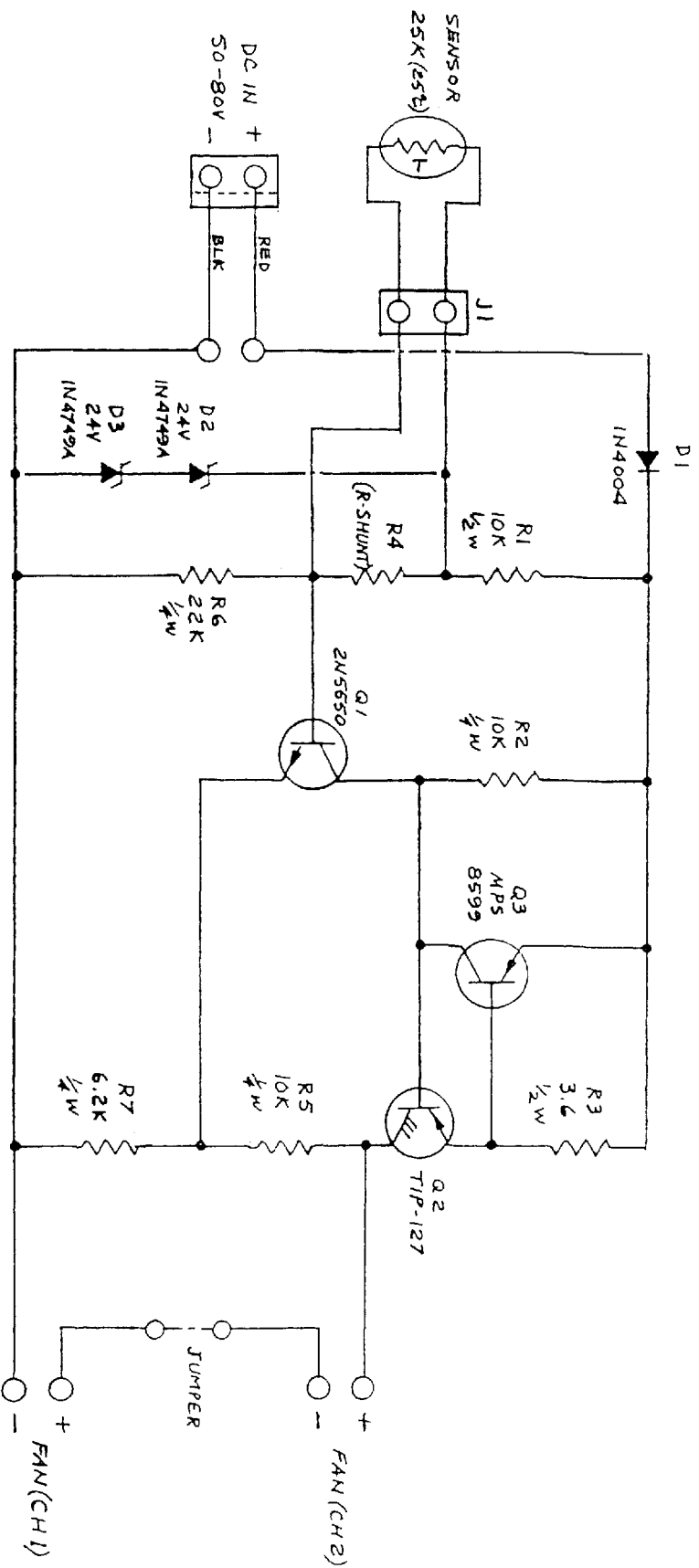


1N4749 24V ZENER

SW



500-713 C



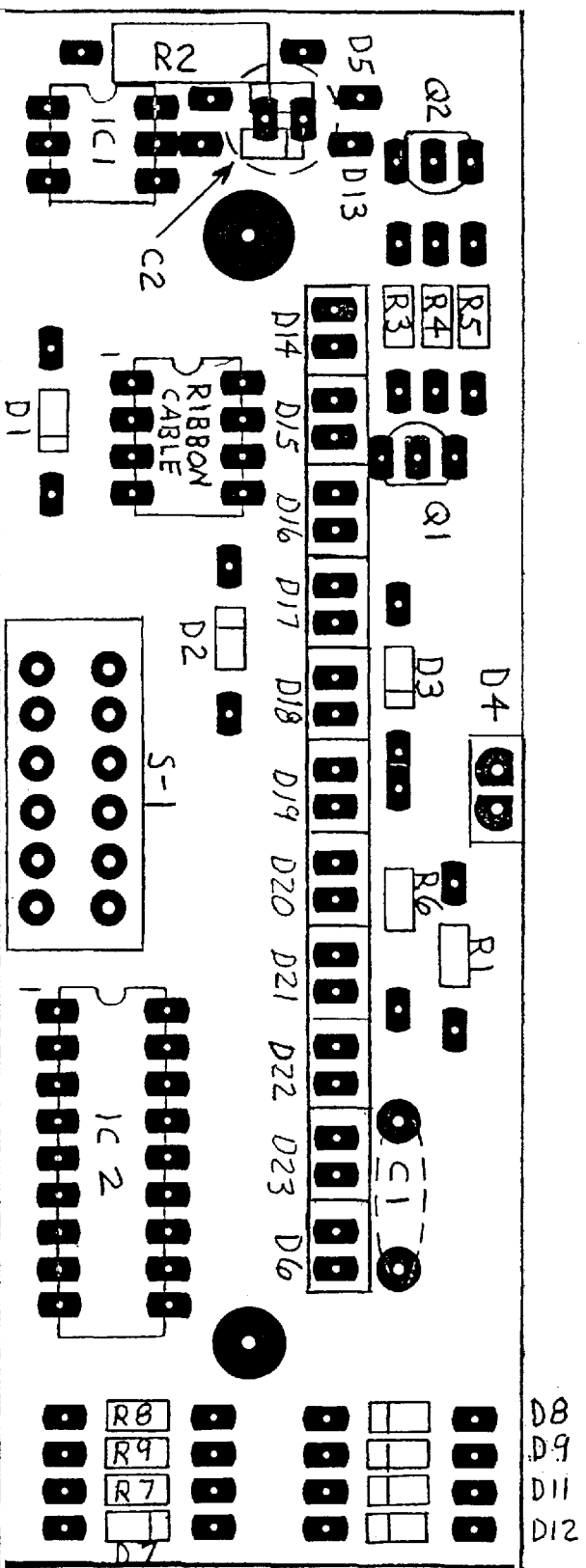
AB INTERNATIONAL, INC.

SCHEMATIC: FAN CONTROL CIRCUIT

MODEL: 1200C

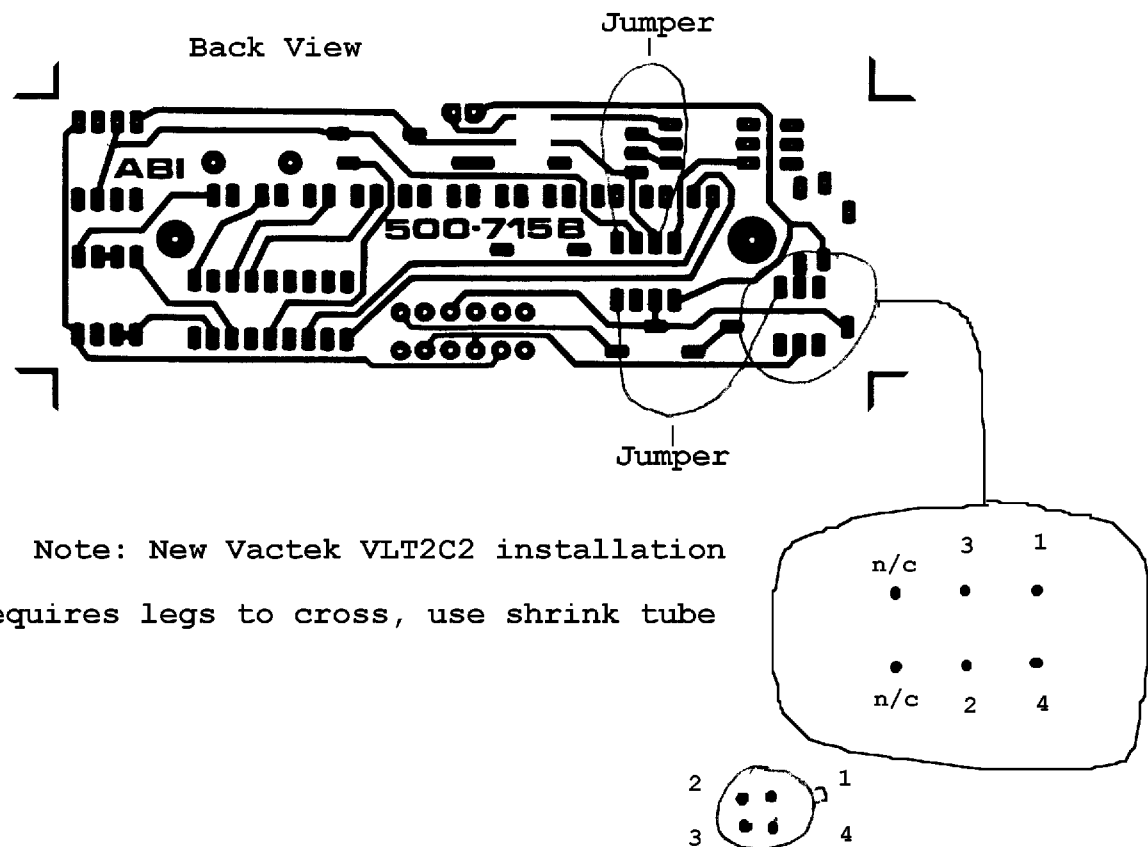
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ASSEMBLY NO. 502-713 REV. B

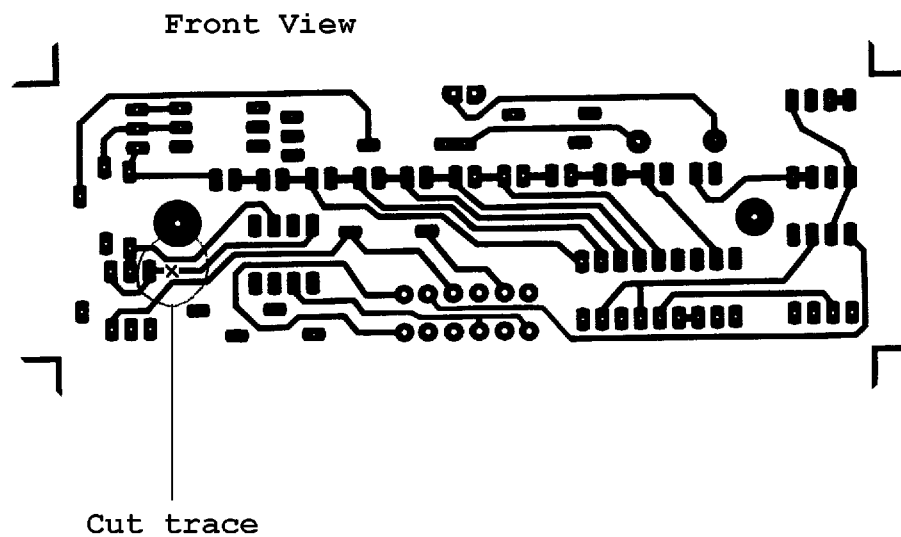


NOTE: C1 & C2 ON BACKSIDE

AB INTERNATIONAL, INC.
 ASSEMBLY: VU DISPLAY
 MODEL: 1201C
 DATE: 6-18-90 GEO. A.
 ASSY. NO 502-715 REV. D.



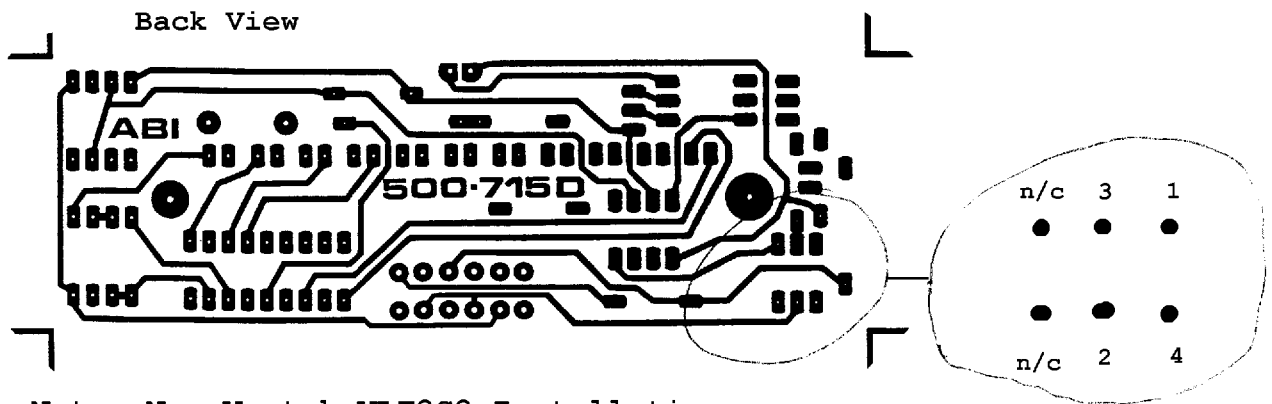
Top view of Vactek



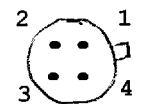
Mods needed to install VACTEK VTL2C2

500-715B-C

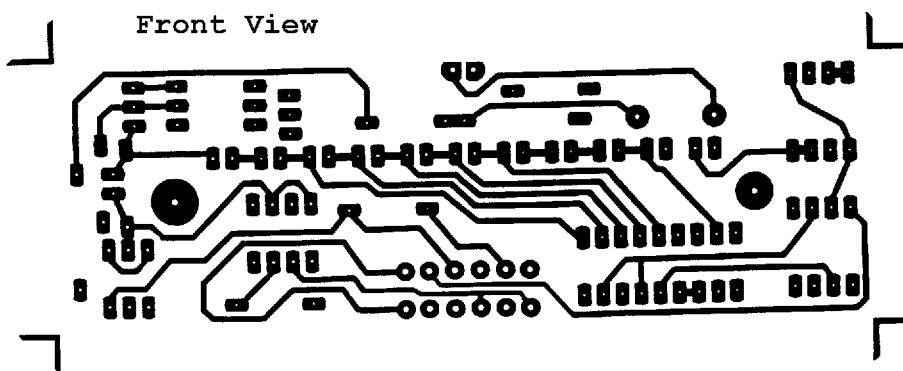
rev B-C



Note: New Vactek VLT2C2 Installation
Requires legs to cross, use shrink tube



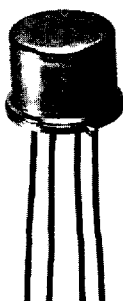
Top view of Vactek



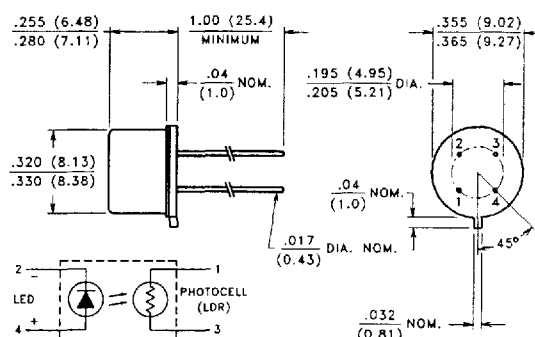
No Mods to pcb to install new Vactek

TO-5 Hermetic LED Vactrols

VTL2C1, 2C2



PACKAGE DIMENSIONS inch (mm)



TO-5 PACKAGE OUTLINE

DESCRIPTION

VTL2C1 offers the steepest slope, largest dynamic range, and fastest response time of any VTL2Cx series device.

VTL2C2 has a low "on" resistance and small temperature coefficient of resistance, with minimal light history memory.

ABSOLUTE MAXIMUM RATINGS @ 25°C

Maximum Temperatures

Storage and Operating: -40°C to 75°C

Cell Power: 100 mW

Derate above 30°C: 2.22 mW/°C

LED Current: 40 mA **1**

Derate above 30°C: 0.9 mA/°C

LED Reverse Breakdown Voltage: 3.0 V

LED Forward Voltage Drop @ 20 mA: 2.0 V (1.65 V typical)

Min. Isolation Voltage @ 70% Relative Humidity: 500 V pk

Output Cell Capacitance: 5.0 pF

Cell Voltage: 70 V (VTL2C1), 100 V (VTL2C2)

Input - Output Coupling Capacitance: 2.0 pF

ELECTRO-OPTICAL CHARACTERISTICS @ 25°C

Part Number	Material Type	Output Resistance					Response Time 4		
		ON Resistance 2			OFF 3 Resistance @ 10 sec. (Min.)	Slope (Typ.) R @ .5 mA R @ 5 mA	Dynamic Range (Typ.) R _{ON} R @ 20 mA	Turn-on to 63% Final R _{ON} (Typ.)	Turn-off (Decay) to (Max.) 1 MΩ 100 kΩ
		Input Current	Dark Adapted (Typ.)	Light Adapted (Max.)					
VTL2C1	1	5 mA 40 mA	50 kΩ 2 kΩ	— 10 kΩ	100 MΩ	—	80 db	0.5 ms	3.5 ms —
VTL2C2	0	1 mA 40 mA	10 kΩ 300 Ω	— 500 Ω	1 MΩ	15	63 db	3.5 ms	— 500 ms