LR-730

TEMPERATURE CONTROLLER POWER BOOSTER

USER'S MANUAL

LR-730
TEMPERATURE CONTROLLER
POWER BOOSTERS

USER'S MANUAL
VERSION 1.0

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OVERVIEW OF LR-730 FEATURES

The LR-730 series of Power Boosters are designed to be used with the LR-700 AC Resistance Bridge along with its Internal Temperature Controller Option. The Internal Temperature Controller Option can deliver DC currents in the range of micro amps up to 100 milli amps full scale with a compliance voltage of -10 volts DC maximum. With the LR-730 Power Boosters, the heater power deliverable by the Internal Temperature Controller is extended to 300 milli amps for the 15 watt version, 1 amp for the 50 watt version and to 3 amps for the 150 watt version. The compliance voltage for the LR-730 series is increased to -50 volts DC.

The LR-730 unit is supplied in its own enclosure and has its own switch mode power supply in the enclosure. The power supply can accept line voltages in the range of 85 to 264 volts AC 47-63 Hertz.

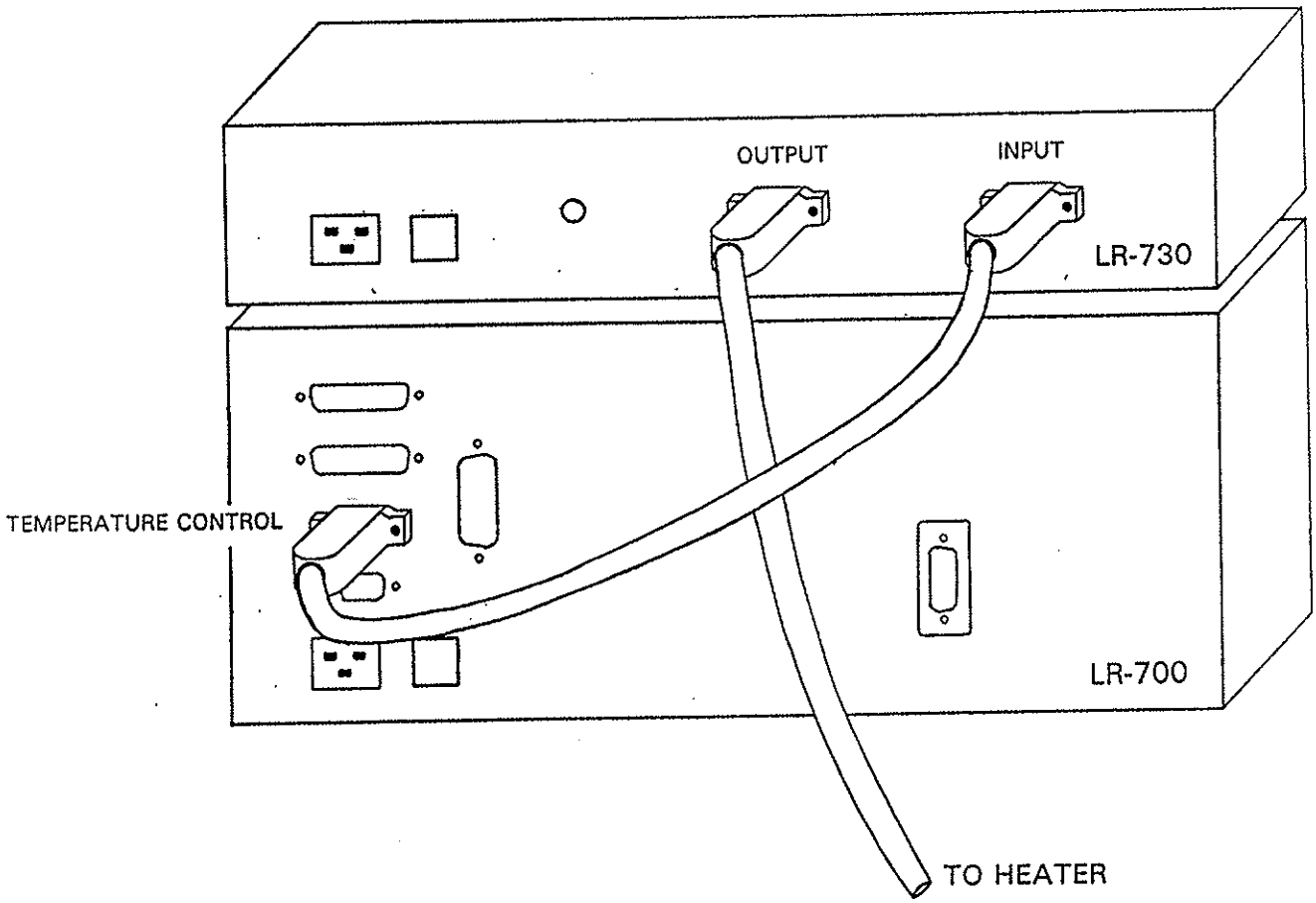
Cables provided with the instrument are a power cable suitable for the country of destination, an interconnect cable that connects the LR-730 Unit to the Temperature Controller connector of the LR-700 Bridge, and a high power heater cable that connects the LR-730 Unit to the heater resistor.

The unit has one control, a switch on the front panel, that turns on the power supply inside the LR-730 unit. The LR-730 is safety interlocked allowing it only to deliver power when it is connected to an LR-700 Bridge and a valid heater cable, which activate an internal relay that makes power available to the power drivers in the unit. All current ranges for the temperature control when using the LR-730 are controlled by the LR-700 Bridge. Therefore, any examples in this manual, or referred to in the LR-700 manual, are referring to setting of parameters in the LR-700 Unit. This includes setting parameters over the IEEE-488 or the RS-232 Interface of the bridge as well as the front panel keyboard.

CONNECTING THE LR-730 UNIT

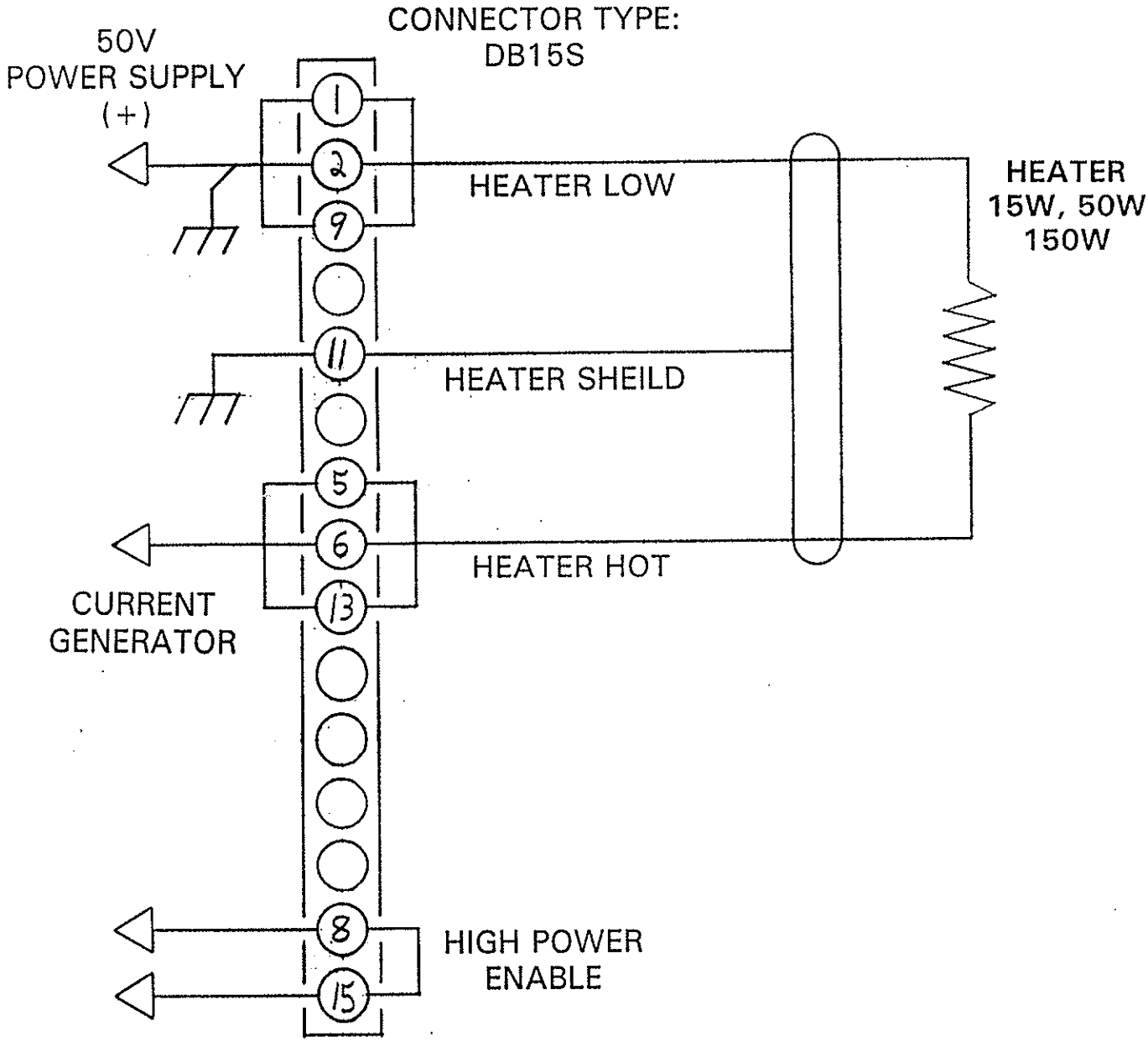
Figure 1 shows a diagram of the connections made from the LR-730 Unit to the unit to the LR-700 Bridge. These connections should be made while both units have their power switches turned off, and even more preferably with the AC power cords disconnected. The connectors have small screws to firmly attach the connectors so that they can not come out during normal operation. These should be employed so that the connections do not get broken while heavy currents are flowing between the instruments. And, for the same reason, the high power heater connector should also be attached with its two screws so that that connector can not inadvertently disconnect during operation.

Figure 1



LR-730 HEATER CONNECTIONS

Figure 2 shows the high power heater cable output from the LR-730 connecting to the high power heater. Please note that the internal power supply will be inhibited if the heater connector is not connected with this high power enable short between pins number 8 and 15. An important note: The heater hot line (pins number 5, 6 and 13) has a compliance voltage between 0 and -50 volts DC. It is important that this line does not short out to other signals or lines in your cryostat, due to the 50 volt differential it could have to ground. Note that no damage will be done to the LR-730 unit itself if this line is shorted continuously to ground and the unit continuously delivers its full rated output. For example, the 300 milli amps on the 15 watt version or even up to 3 amps full scale on the 150 watt version.



Notes:
1. Unnumbered pins have no connections.

2. Cable covers current ranges of:
   30μA full scale to
   300mA full scale(15W),
   1A full scale(50W),
   3A full scale(150W).

3. Heater hot compliance voltage from:
   0V to -50V.

Figure:

LR-730
High Power Heater Cable

LR-730 SPECIFICATIONS

LR-730-15W / -50W / -150W
TEMPERATURE CONTROLLER POWER BOOSTERS

TEMPERATURE RANGE
MilliKelvin to above 600° Celsius.

ANALOG CIRCUITRY
Digital management of a completely analog signal path is used giving almost infinite resolution and eliminating any least count digital hunting as in completely digital systems. The digital management only occurs when changing settings not in normal operation.

LOW HEATER NOISE
Output power is generated by a low noise linear amplifier current generator.

GROUNDED HEATER DRIVE
Like the LR-700-TC Option, one side of the heater is driven by the current source. The other side of the heater is returned to chassis ground inside the LR-730.

OUTPUT HEATER POWER
Microwatts to 15/50/150 watts.
Output power is delivered by a current source with full scale outputs from 30μA to up to 3 amps in 1-3-10 steps.

MAXIMUM OUTPUT POWER
These power boosters increase the maximum output current of the LR-700-TC Temperature Controller to 0.3, 1, and 3 amps while increasing the compliance voltage to 50VDC.

UNIT	OUTPUT TO HEATER, MAXIMUMS		
	POWER, WATTS	CURRENT, AMPS	VOLTAGE, VOLTS
LR-730-15W	15W	0.3A	50V
LR-730-50W	50W	1.0A	50V
LR-730-150W	150W	3.0A	50V
LR-700-TC OPTION ONLY	1W	0.1A	10V

COMPUTER OPERATION
Can be controlled through the
LR-700's IEEE-488 or RS-232 interfaces.

COMPLIANCE VOLTAGES

Constant current compliance is -50V.

HEATING/COOLING WITH LR-700-TC

To drive peltier thermal electric heating/cooling module loads, the Model LR-730-BP should be used. This unit delivers bipolar output currents of ±1 amp. The unit is designed to control payloads such as laser diodes that are heat sunk to copper blocks etc. Temperature stabilities in the 100 microKelvin region can be achieved at room temperature.

AVERAGE POWER / POWER RESERVE

Power rating of a booster unit should be selected with a reserve of power. For example, if 13 watts of average heater power is determined to be needed to hold a thermal system at the desired temperature, then a power booster rated at 15 watts would not have enough reserve power and a 50 watt unit should be selected.

The larger unit will assure continuous linear operation of the control system in response to unanticipated load fluctuations.

DETERMINING POWER REQUIREMENTS

For a high heater power set-up check that the existing heater resistance will work with the LR-730 or that you can choose the heater resistance for LR-730 current and voltage compatibility.

A good rule of thumb for conservative design is to operate the heater driver at less than or at about 75% of both its maximum current and compliance voltage.

Thus, when using a LR-730-50W unit, and using the 75% target, the average output should be: average heater current = 0.75 amps, at a heater voltage of 37.5 volts, with heater resistance of 50Ω, for a average heater power of 28.1 Watts. Note: this is 52.6% of the units 50 Watt maximum capability.

PHYSICAL DIMENSIONS

The LR-730-15W and LR-730-50W Units are each packaged in 3½ inch high, 19 inch wide rack mountable aluminum enclosure.

LR-730 ASSEMBLY

1. Build all Subassemblies:
   a) Fet boards (LR-730-1)
   b) Heat Sinks
   c) Motherboard (LR-730P-2)
   D) Terminal Board
   E) Connectors
      1. Input
      2. Output
      3. FET
      4 LED
      5. Power Supply
   f) AC wiring Harness
   G) Interface Cable
   H) Heater Cable

2. Punch bottom panel if not already.
   a) use template provided

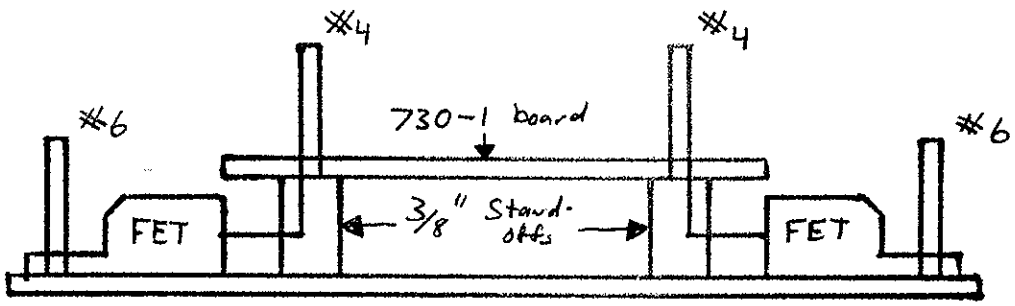
3. Populate Panels: a) Rear panel w/ Filter, circuit breaker & B/C. use #4 flathead hardware on filter
   b) Bottom Panel w/ 48 V. power supply; use #4 x 3/4" hardware using 3/8" standoffs. Motherboard using #4 x 3/4" hardware using 3/8" standoffs. Terminal board using #6 x 1/2 hardware. Heat Sinks usin #6 x 3/4" hardware and placing 1 shoulder washer below & above heatsink.

4. Place panels on jig according to ~~wiring~~ layout diagram

5. Attach all connectors
   a) Use jackscrew short hardware on DB connectors
   b) Attach loose wires according to wiring diagram
   c) Attach AC wiring harness according to diagram
   d) Attach LEDs to front panel, LED w/ yellow goes to LED 2 position, Black goes to LED 1 position see diagram

6. Assemble unit w/ #6 X ½" screws on front panel & Rear panel + bottom panel to attach to 730 side panels.

FET BOARD CONSTRUCTION



1. Bend FET leads where they change in width 90° upward.
2. Place FETs on #6 screws with leads facing inward on mounting jig.
3. Place board on #4 screws feeding FET leads through solder pads.
4. Populate rest of 730-1 board if not already done so.
5. After board is complete, apply heat sink grease to bottom of FETs + mount on Heat Sink.

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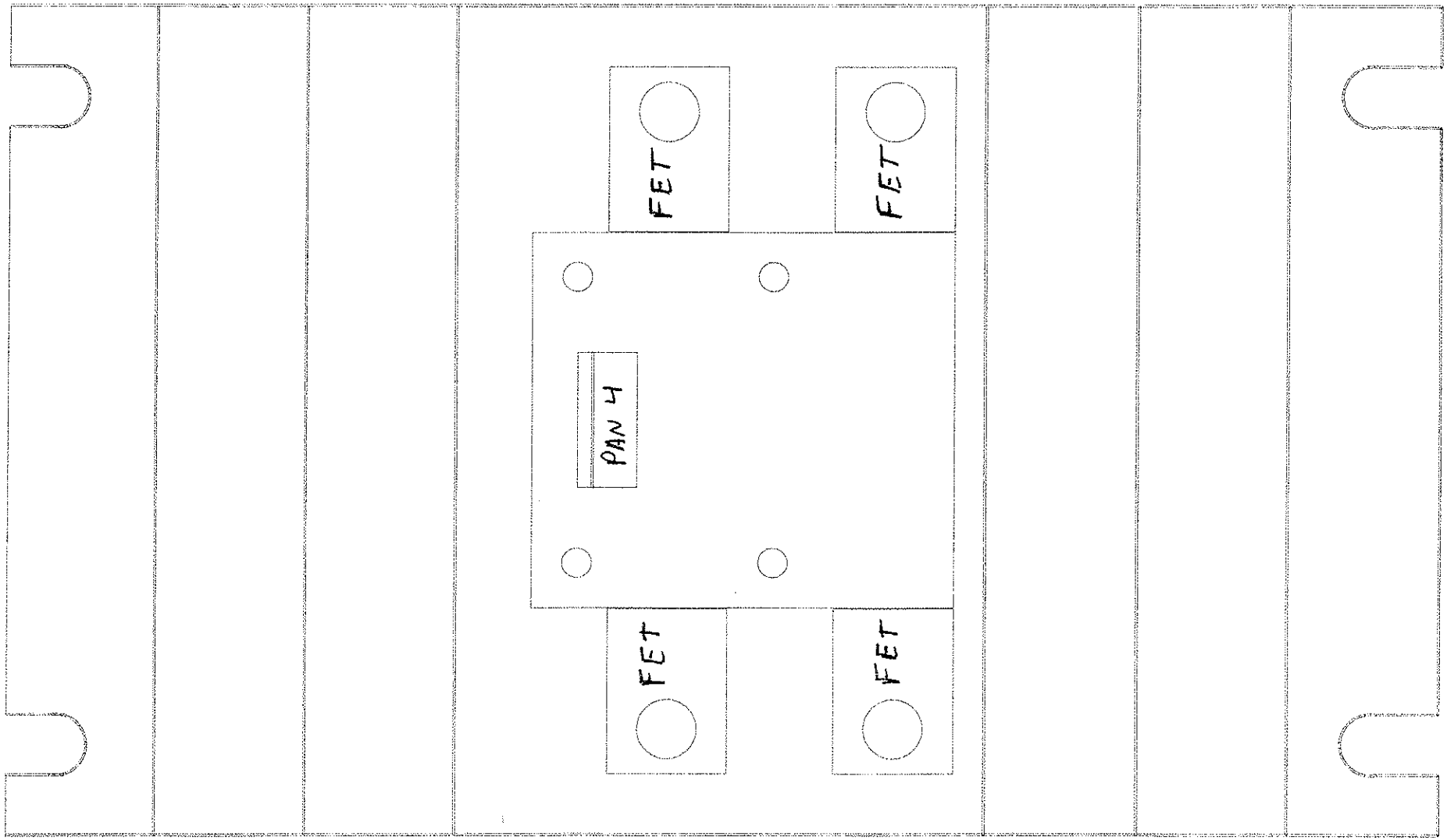
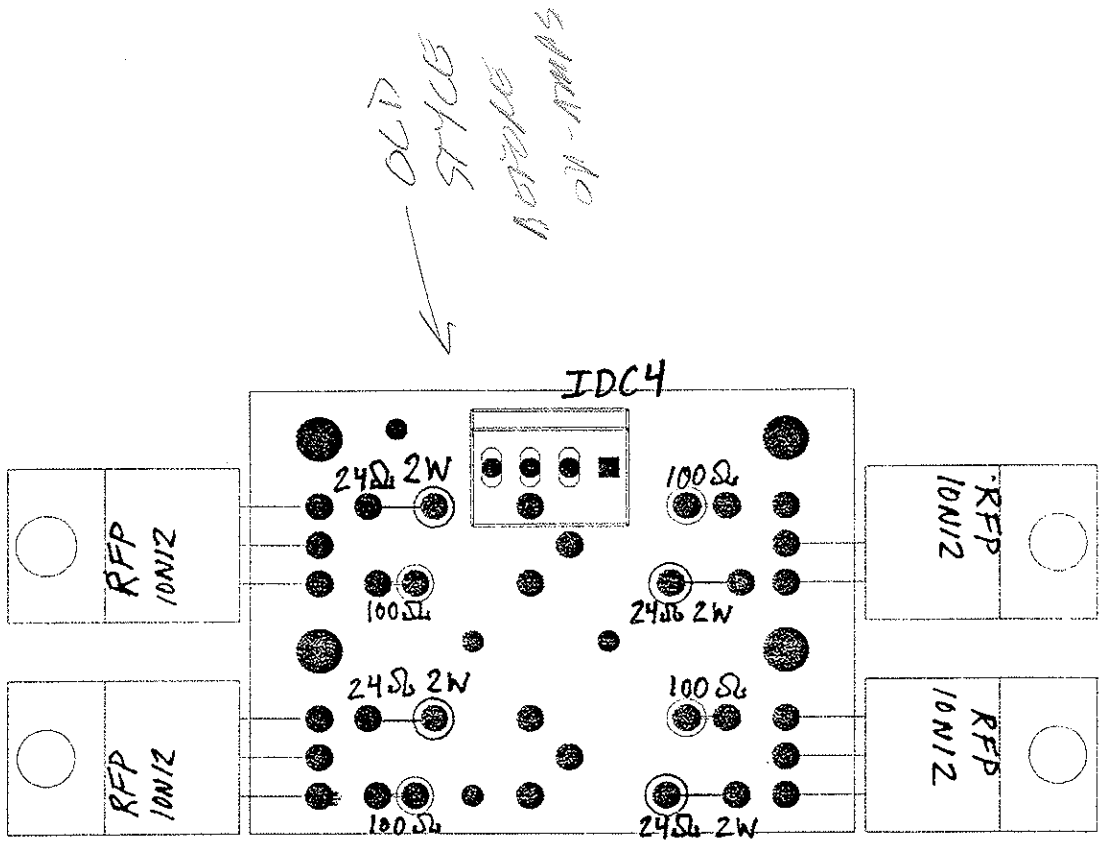


Punch mounting holes for FETs using template.
Drill holes @ # 27. Attatch with # 6 x 3/4", flat, Lock + nut.



Mounted on TO-3 Finned heat sink w/ H.S. grease on power FETS.

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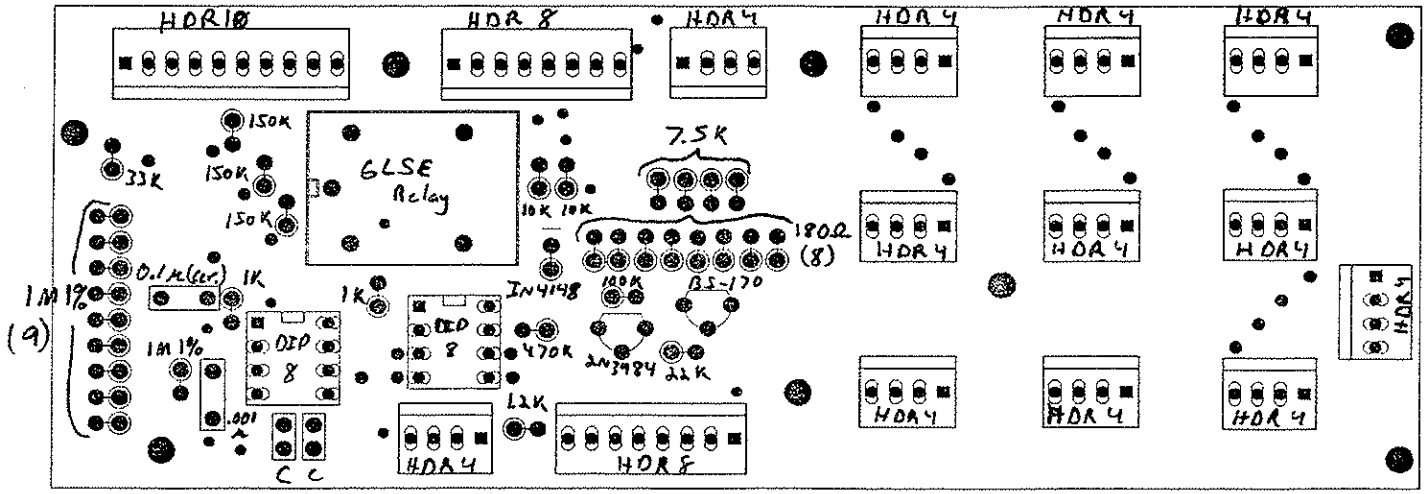
LR-730 MOTHERBOARD



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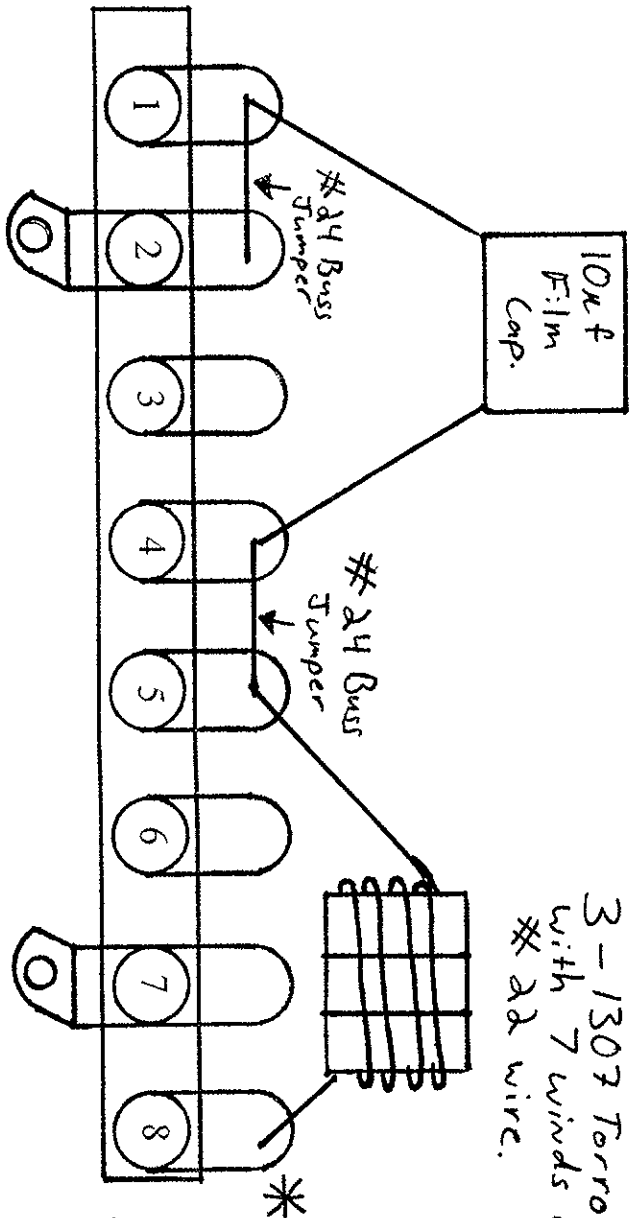
Terminal Board Assembly



3 - 1307 Toroids with 7 winds of *22 wire.

** Note: Solder lead of toroid to Pin 8 Leaving enough room to run zip-tie through.

~~Zip tie toroid to pins 6 & 8 on back side of terminal Board~~

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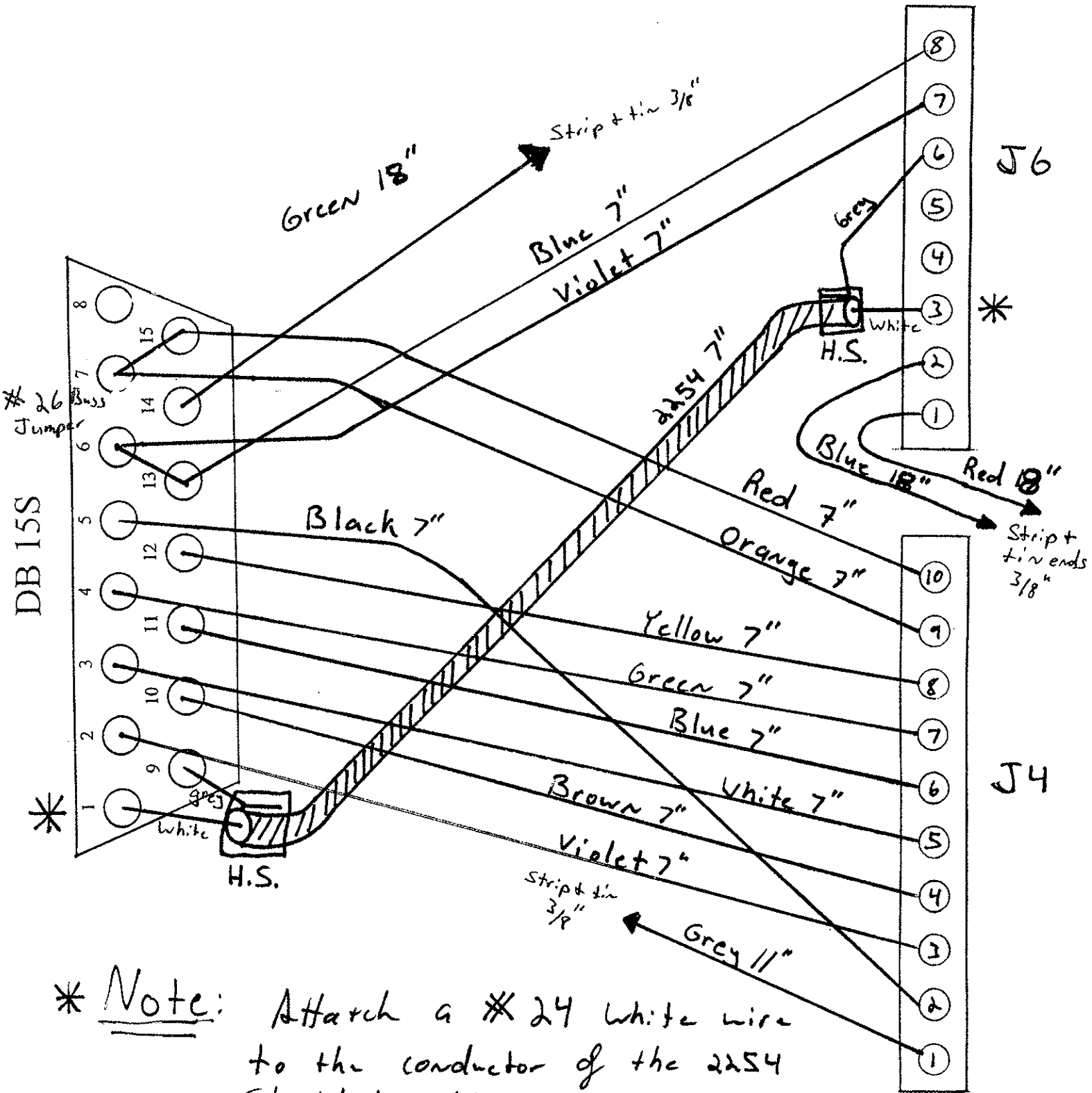
Input Connector



* Note: Attatch a * 24 White wire to the conductor of the 2254 Sheilded cable. Attatch a Grey wire on the sheild. Cover w/ H.S. tubing.

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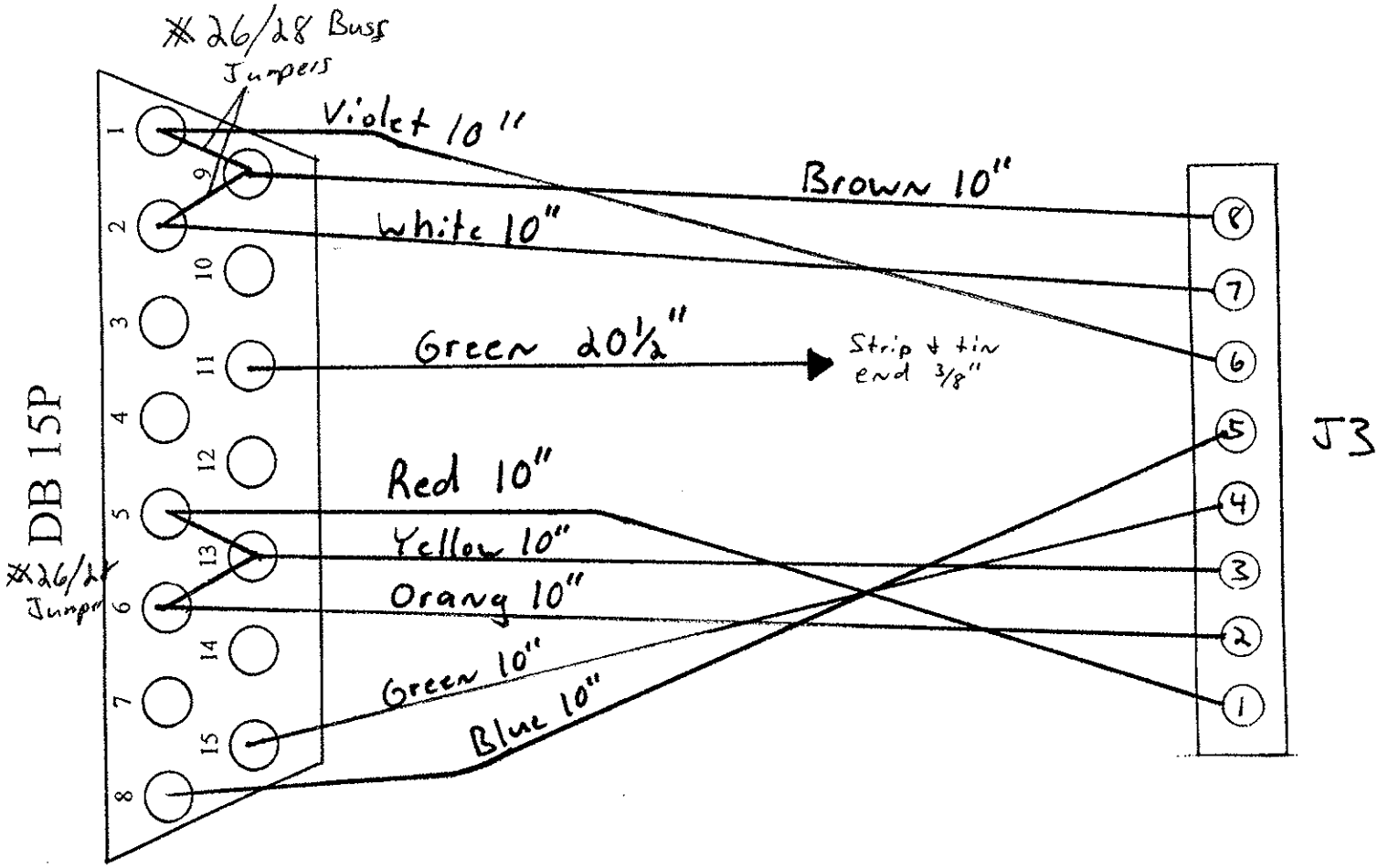
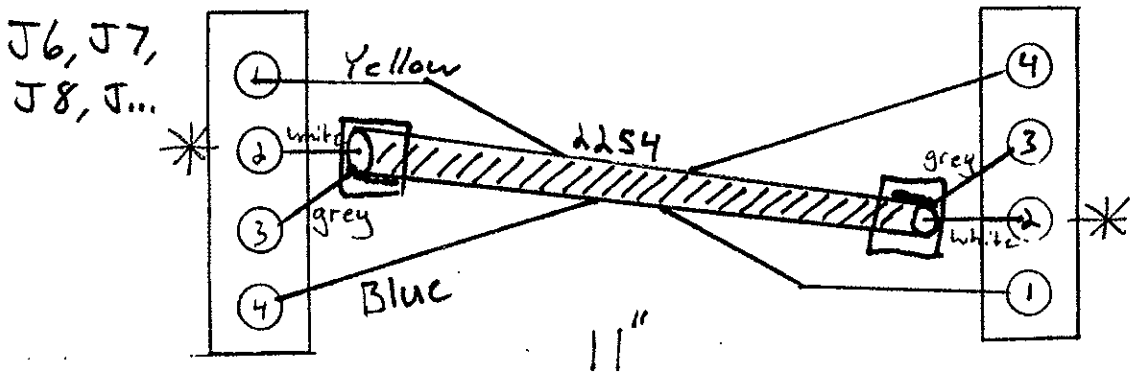
OUTPUT CONNECTOR



Note: Its O.K. to Solder wires to Jumpers of pins 1, 9, 2 and 5, 13, 6 of DB connector.

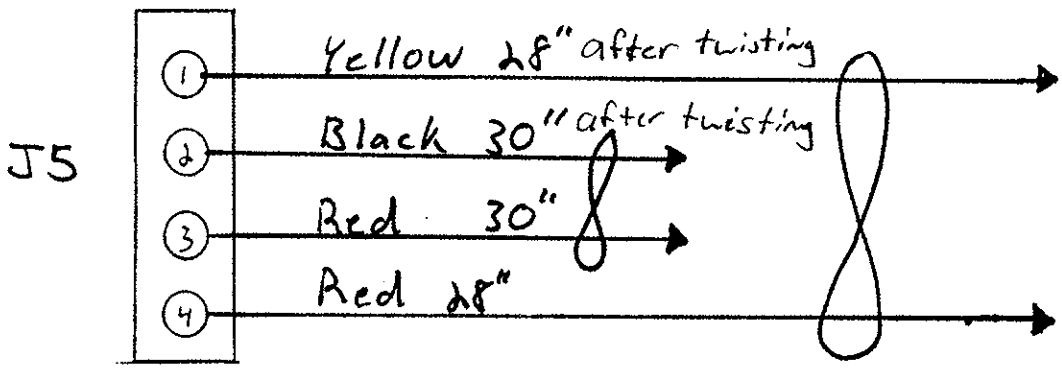
FET CONNECTOR



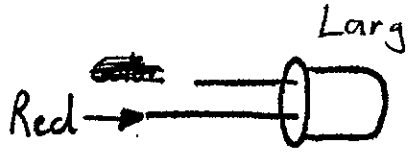
* Put a #24 White wire on the Conductor of the 2254 Cable. Then Grey on shield. Cover w/ H.S.

Note: for 15W, need 1. for 150W, need 9.
for 50W, need 3.

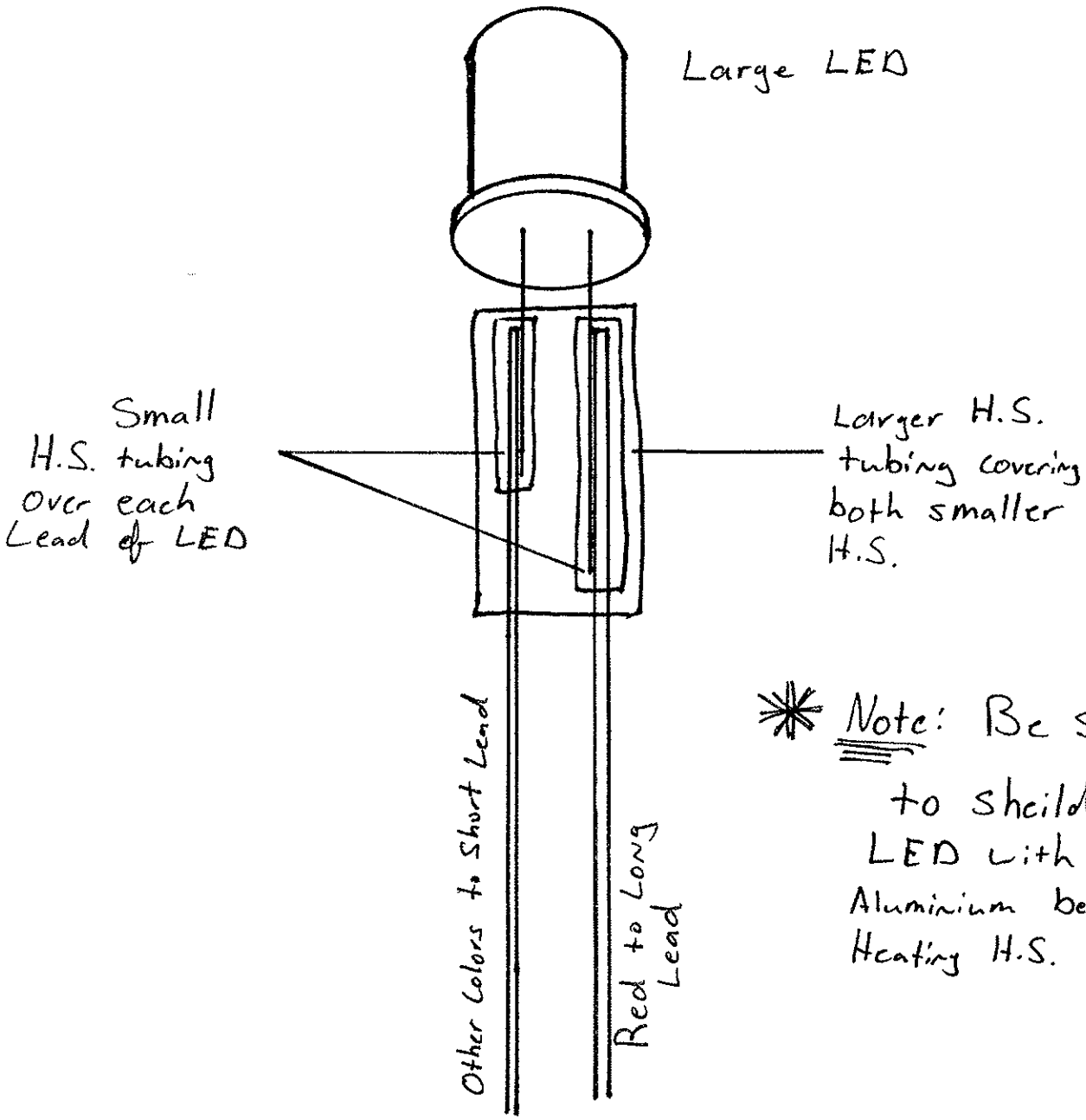
LED CONNECTOR



Note: Red wires go to long lead of LEDs. Each lead gets small H.S. tubing then cover both leads larger H.S. tubing
Use guard when Heating H.S. tubing



LED Construction



✳ Note: Be sure to sheild LED with Aluminium before Heating H.S.

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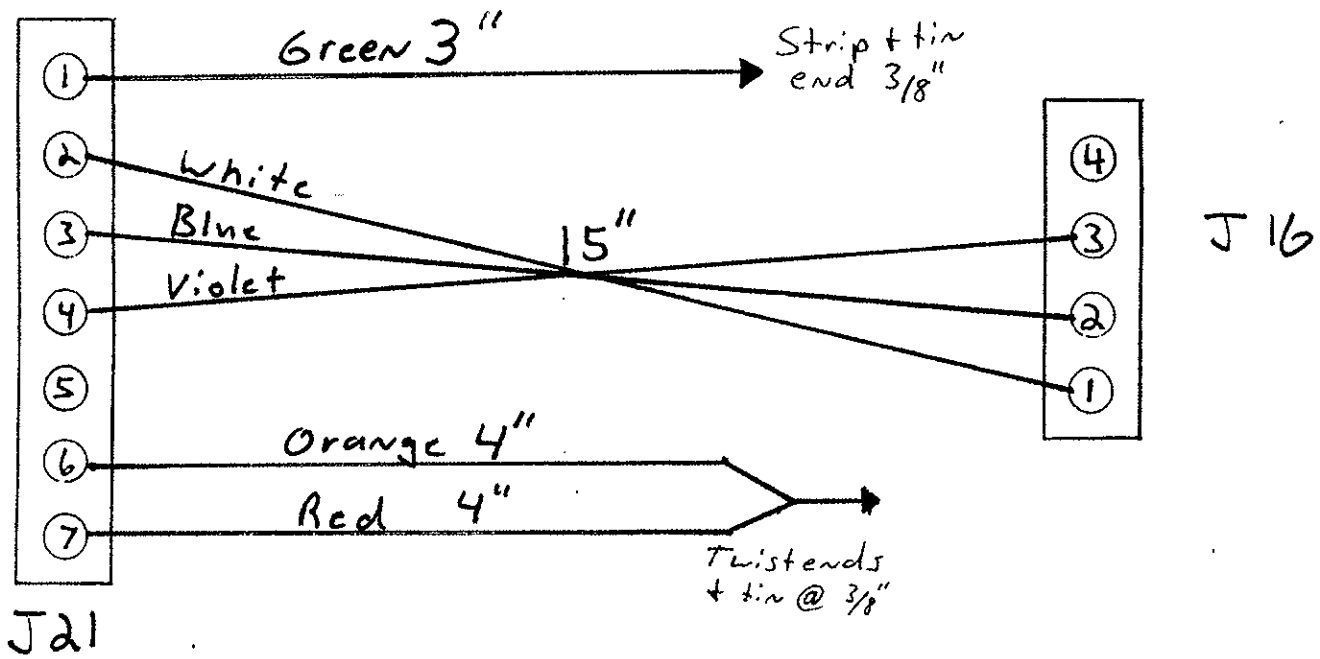
Power Supply Connector



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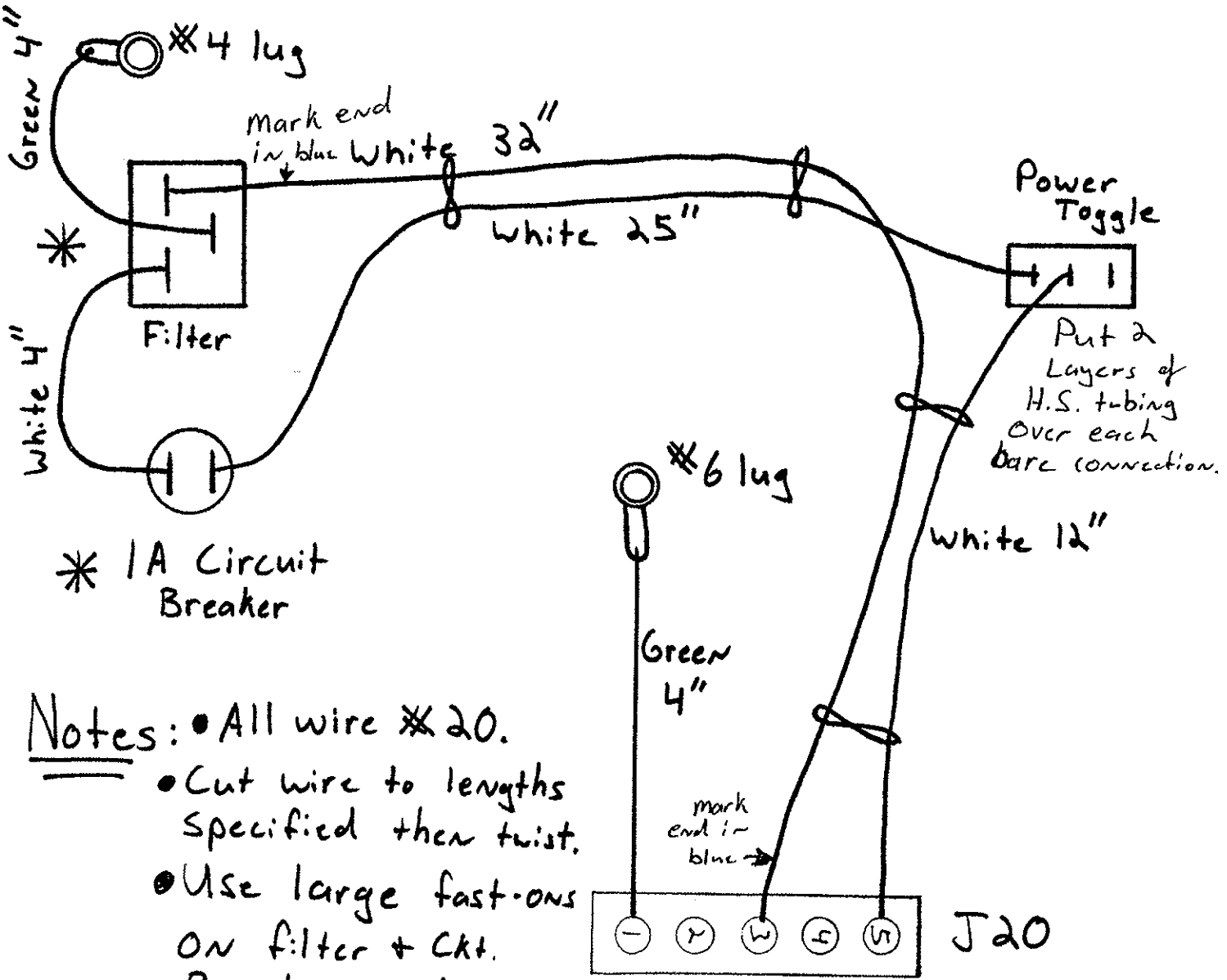
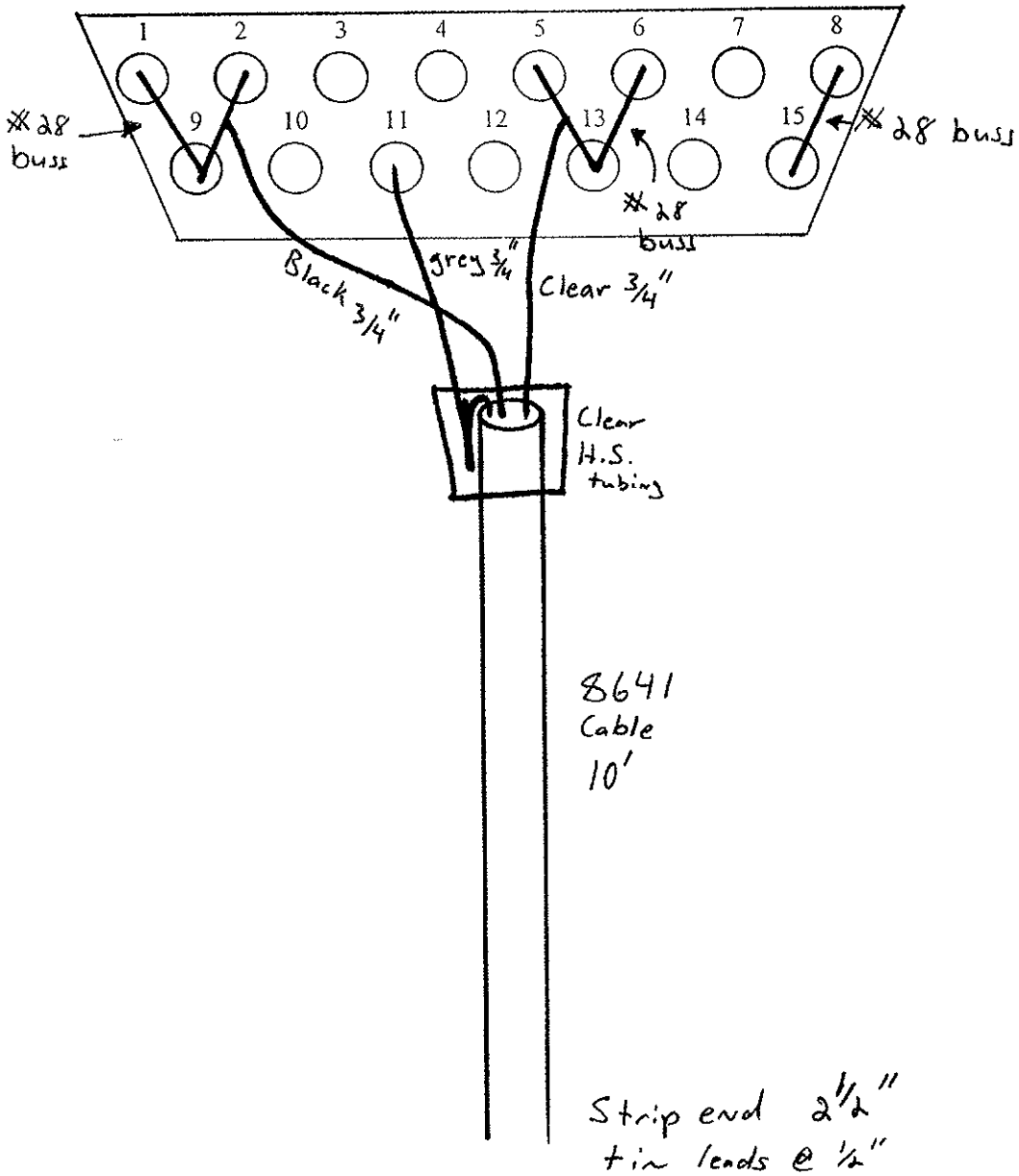
AC Wiring Harness



Notes:
- All wire * 20.
- Cut wire to lengths specified then twist.
- Use large fast-ons on filter + Ckt. Breaker ends.
- * Filter + Breaker not needed during assembly of harness.

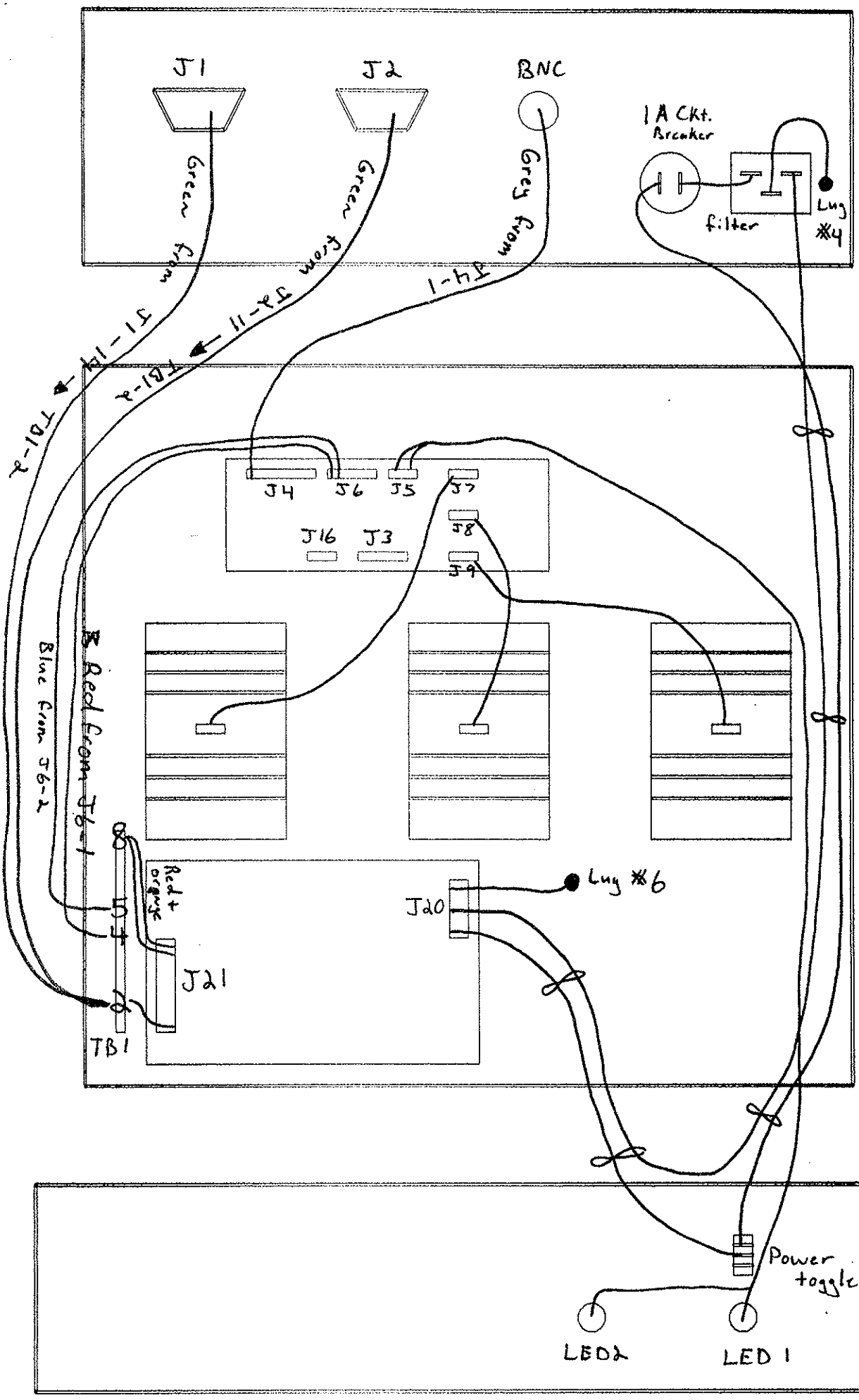
LR-730 HEATER CABLE

DB 15S



Attach DB15 hood using the smallest diameter cable strain relief provided in the hood package

Wiring Diagram for LA-730



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