

NTMS BEACON CONTROLLER

- BACKGROUND
- GOALS
- CHASSIS DESIGN DESCRIPTION

[DIFFICULT PART OF PROJECT WAS TO SELECT uCONTROLLER AND RELAY INTERFACE – Done by Wes WA5TKU and code written by Greg AA5C. My portion of the project was to place in a 2U rack mountable chassis. john – k5zmj]

- MAJOR COMPONENTS
- FILTERS
- FILTER TESTS
- SPECIAL MATERIALS USED

BEACON CONTROLLER WITHOUT 32 WIRES FROM RELAY BOARD TO REAR PANEL



BACKGROUND

- NTMS HAS APPROX 10 BEACONS ON A 12 STORY BLDG IN NORTH CENTRAL TX.
- ANTENNAE ARE ON THE ROOF OF THE BLDG. TRANSMITTERS ARE EITHER ON THE ROOF WITH ANTENNA OR IN SOME CASES IN A ROOF DOGHOUSE IN A RACK. (COAX THEN GOES TO A ROOF ANTENNA)
- OUR RACK MOUNTED TRANSMITTERS ARE NEXT TO OTHER TRANSMITTERS AND RECEIVERS, NOT ASSOCIATED WITH THE NTMS EQPT.
- NEW NTMS BEACONS MAY BE ADDED. ALLOW FOR EXPANSION.

GOALS

- BEACON CONTROLLER SHOULD PROVIDE REMOTE ON/OFF CONTROL, FOR INDIVIDUAL BEACONS – CONTROLLED BY KEY NTMS MEMBERS VIA AN E-NET PORT.
- BEACON CONTROLLER SHOULD NOT INTERFERE WITH ANY OTHER EQPT IN THE RACK.
- BEACON CONTROLLER SHOULD NOT BE SUSCEPTIBLE TO BEACON RF OR TO TRANSMITTERS IN THE RACK, OR ANY CO-LOCATED EQPT.
- BEACON CONTROLLER IS 120VAC POWERED. BEING ABOVE THE BLDG ROOF (IN A WEATHERPROOF DOGHOUSE) THE RACK IS SOMEWHAT EXPOSED TO LIGHTNING. REDUCE SUSCEPTIBILITY, WHERE POSSIBLE.
- DESIGN CONTROLLER TO BE FUNCTIONAL WITHOUT FREQUENT MAINTENANCE. (ABOUT 3-4 HRS ROUNDTRIP, FROM NEAREST NTMS MEMBER, FOR SERVICE)

DESIGN DESCRIPTION

- MOUNT ALL COMPONENTS IN A 17 X 11 X 2 INCH ALUM CHASSIS BASE.
- MOUNT BARRIER STRIPS ON REAR OF CHASSIS FOR 16 RELAY CONTACTS (32 POSITIONS). PROVIDE SOME FILTERING TO REDUCE PROBABILITY OF CONDUCTION OF μ P SIGNALS LEAVING BOX AND REDUCE CONDUCTION OF RF OR LIGHTNING SURGES ENTERING BOX.
- FILTER THE 120VAC ENTERING THE BOX : WITH THE CORCOM FILTER, PLUS AN ADDITIONAL FILTERING BOARD. TEST RESULTS ARE SHOWN ON THE TABLE. TWO LARGE FERRITE SLEEVES WERE ADDED AFTER THE CORCOM FILTER, AND TWO 240 μ F CAPS WERE ADDED FROM EA POWER INPUT TERMINAL TO CASE GND.
- THE RELAY BOARD OPERATES DIRECTLY FROM 12VDC. THE VOLTAGE REGULATOR BOARD USES A LM7808 VR IC TO SUPPLY THE ARDUINO COMPATIBLE CONTROLLER BOARD AND ENET SHIELD.
- THE FRONT PANEL HAS TWO LEDs TO INDICATE PRESENCE OF +12 AND +8VDC. ALSO, TWO TEST POINTS ARE USED TO MONITOR RELAY BOARD CURRENT. (AND INDICATION OF THE NUMBER OF RELAYS THAT ARE ENERGIZED)

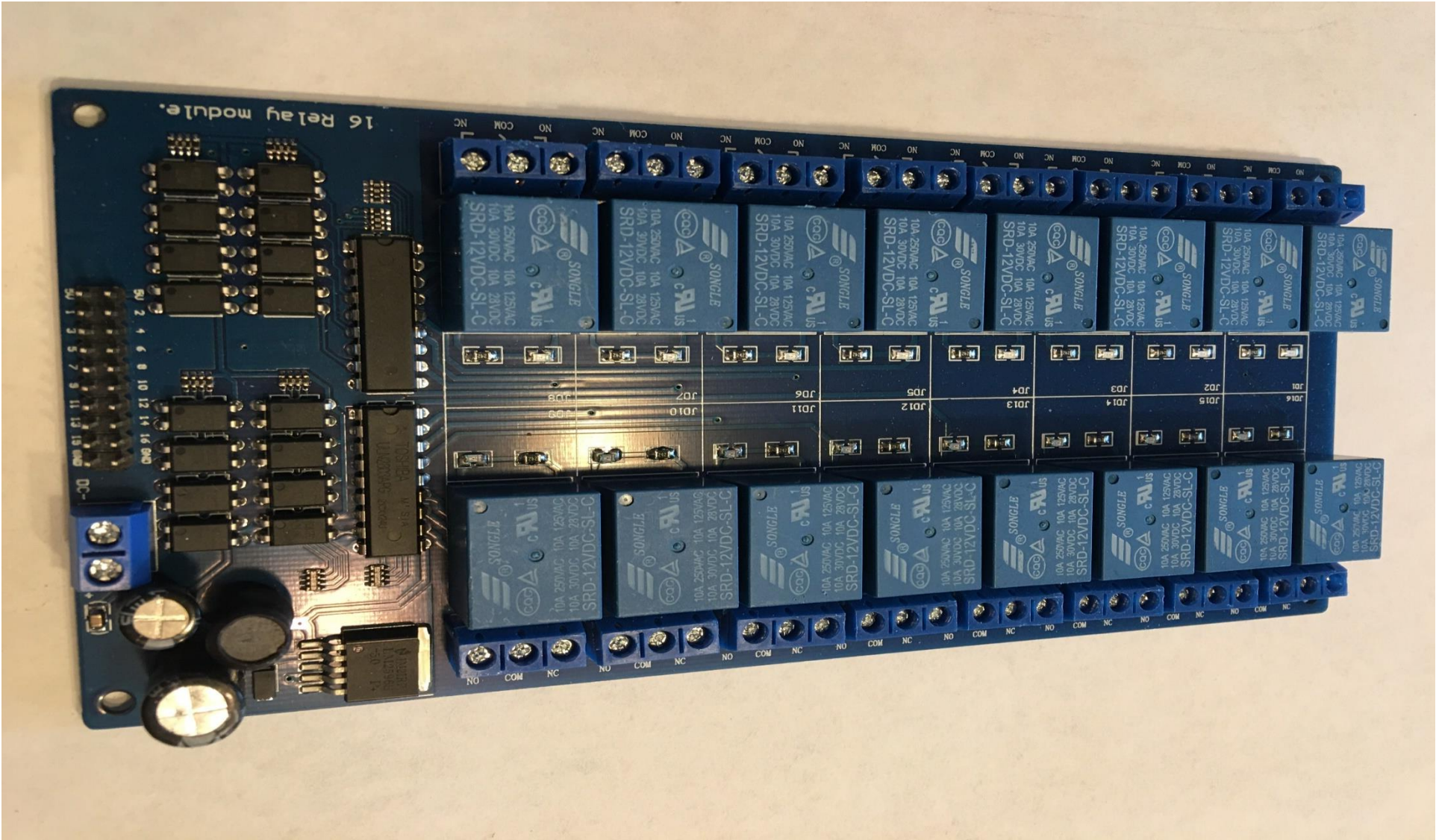
MAJOR COMPONENTS

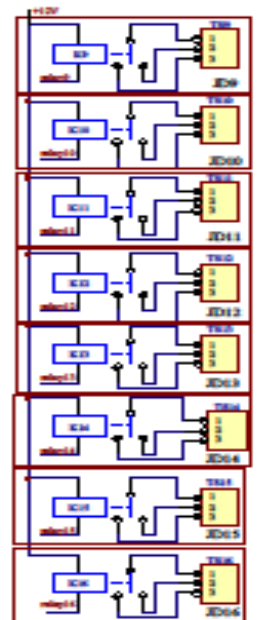
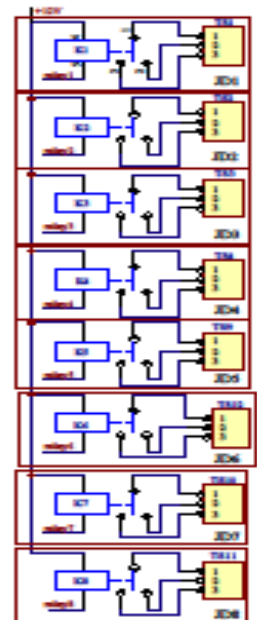
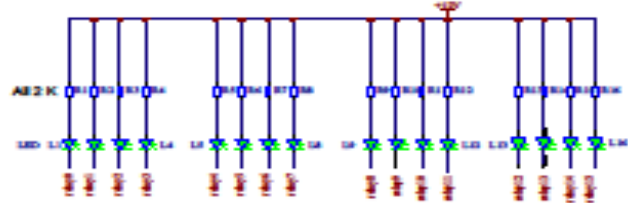
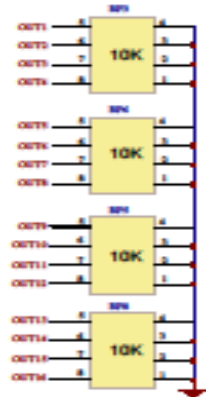
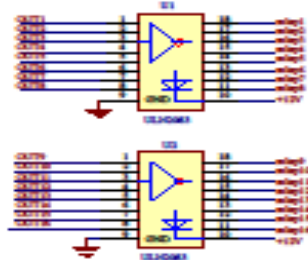
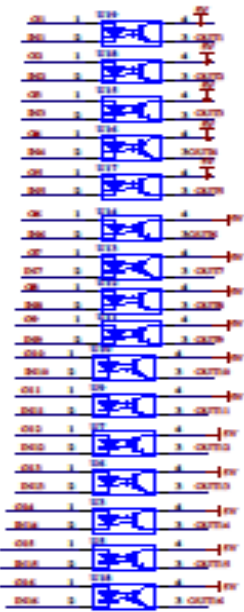
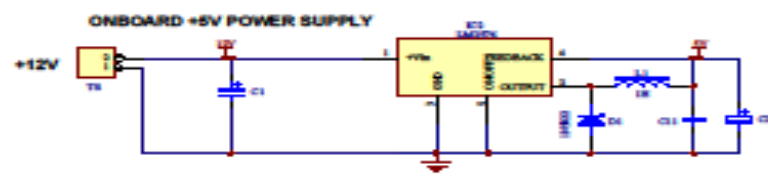
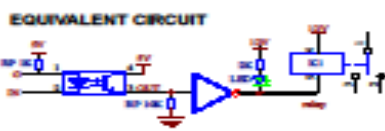
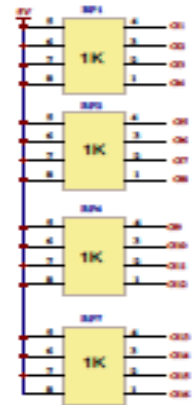
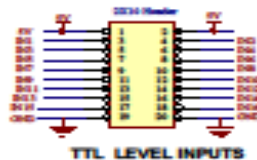
- MICROCONTROLLER -- MEGA 2560 with E-NET SHIELD
- RELAY BOARD (16 RELAYS) – MARLIN P. JONES 34349 MP
- 12V 30W PS -- MEANWELL P/N IRM – 30 – 12ST.
- CORCOM IEC-320 TYPE POWER ENTRANCE AND LINE FILTER MOUNTED ON REAR PANEL.
- HOME BUILT ANCILLARY AC LINE FILTER BOARD. [BETWEEN CORCOM FILTER AND MEANWELL PS.]
- 8V VOLTAGE REGULATOR BOARD, WITH ALUM HEATSINK.
- 32 WIRE FILTER BETWEEN RELAY BOARD AND REAR TERMINALS.

ARDUINO COMPATIBLE MICROCONTROLLER WITH ENET SHIELD



LOW COST M P Jones -- 16 RELAY BOARD WITH 10A FORM C CONTACTS





**NOTE : ALL GNDs ARE THE SAME
ALL +5V ARE THE SAME**

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www.mpja.com		
Title 16 CHANNEL RELAY BOARD		
Size	Document Number 34349 MP	Rev.
Date	Sheet	

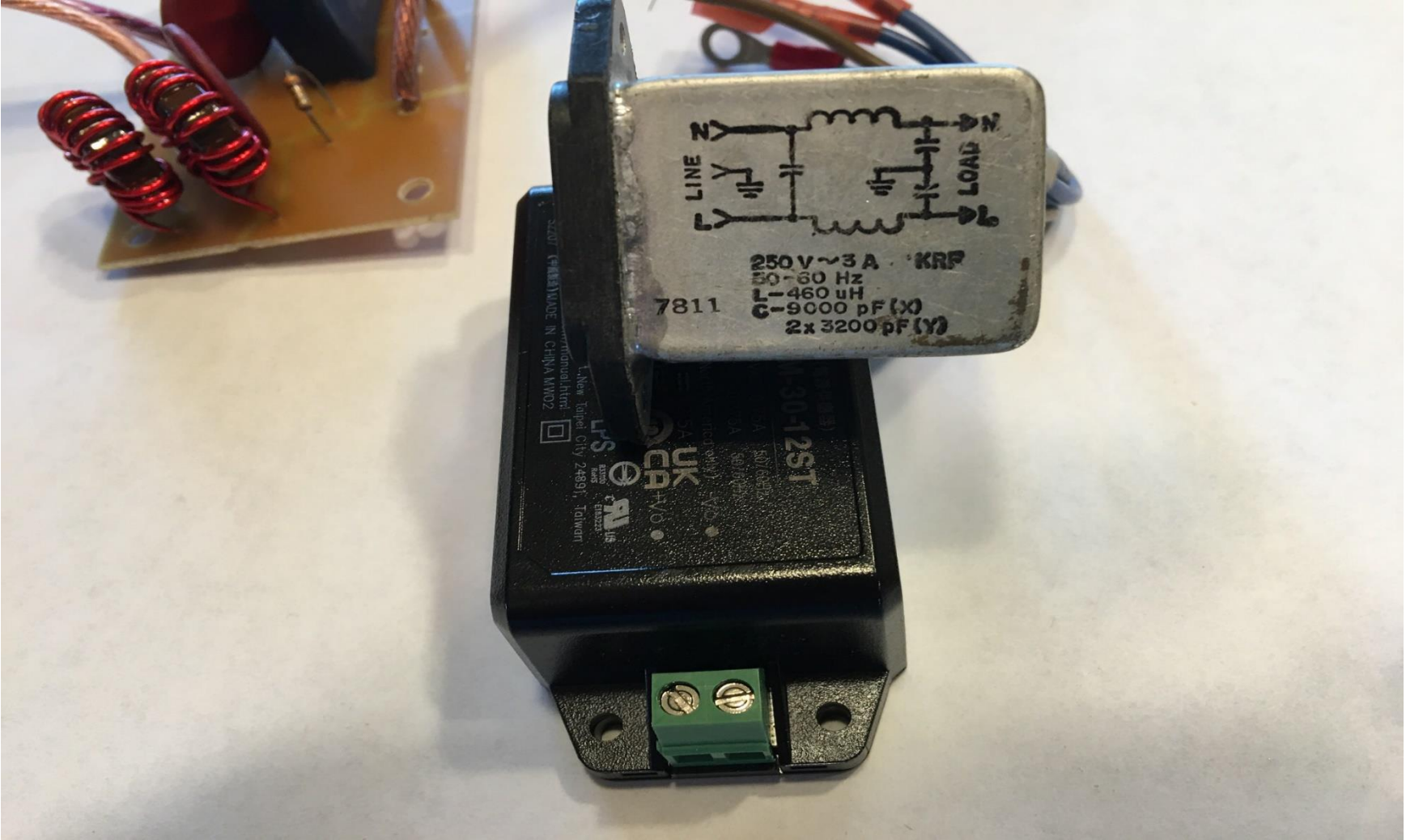
REAR PANEL : AC INPUT AND 32 TERMINALS FOR THE 16 RELAYS. [TIGHT FIT]



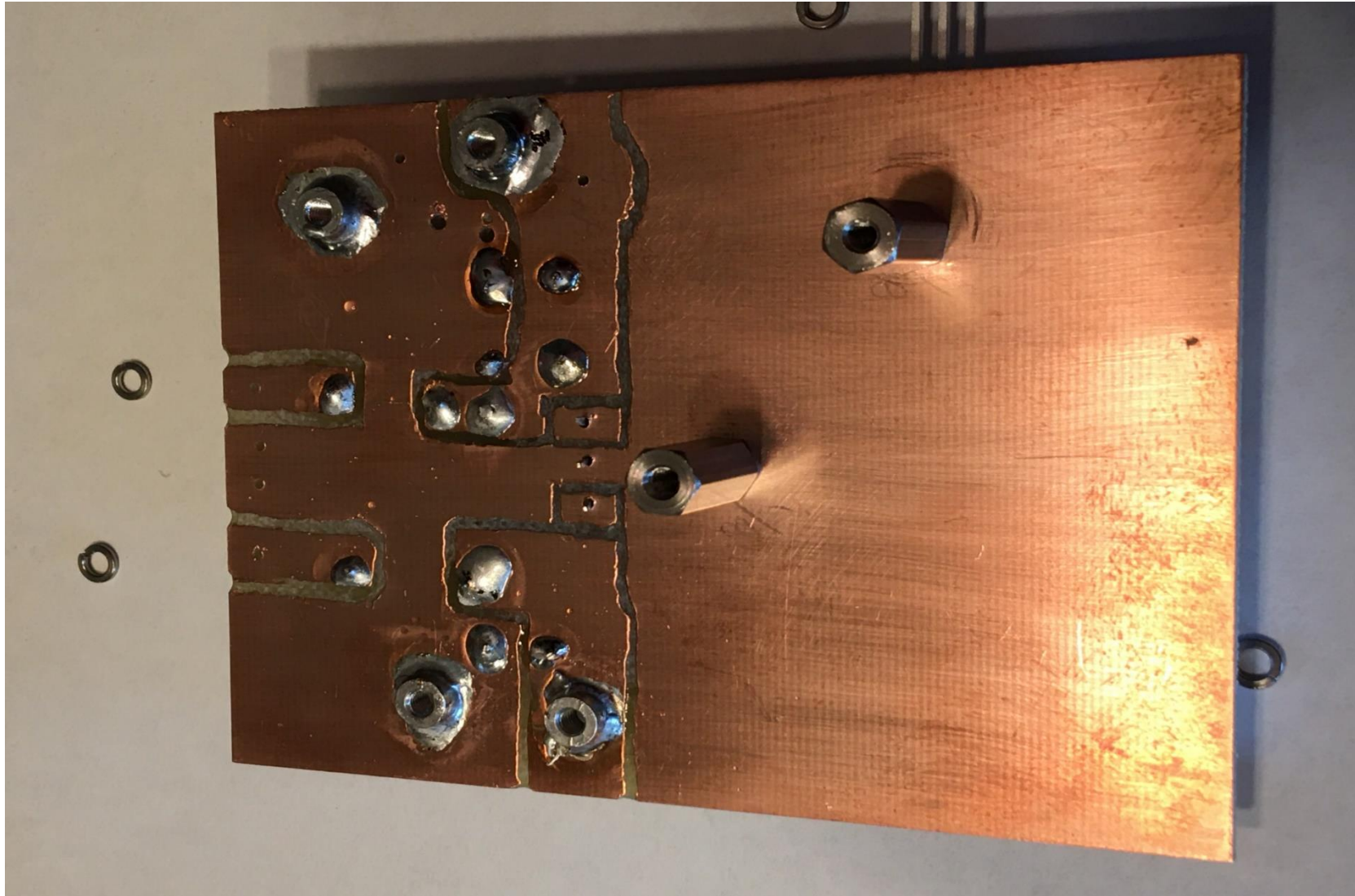
LOW COST 12V 30W POWER SUPPLY FROM MOUSER



POWER ENTRANCE FILTER



DREMEL TOOL GENERATED 8V REGULATOR BOARD – INCOMPLETE
NOTE : SOLDER IN SCREW TERMINALS – NEAR BOTTOM (3mm METRIC)

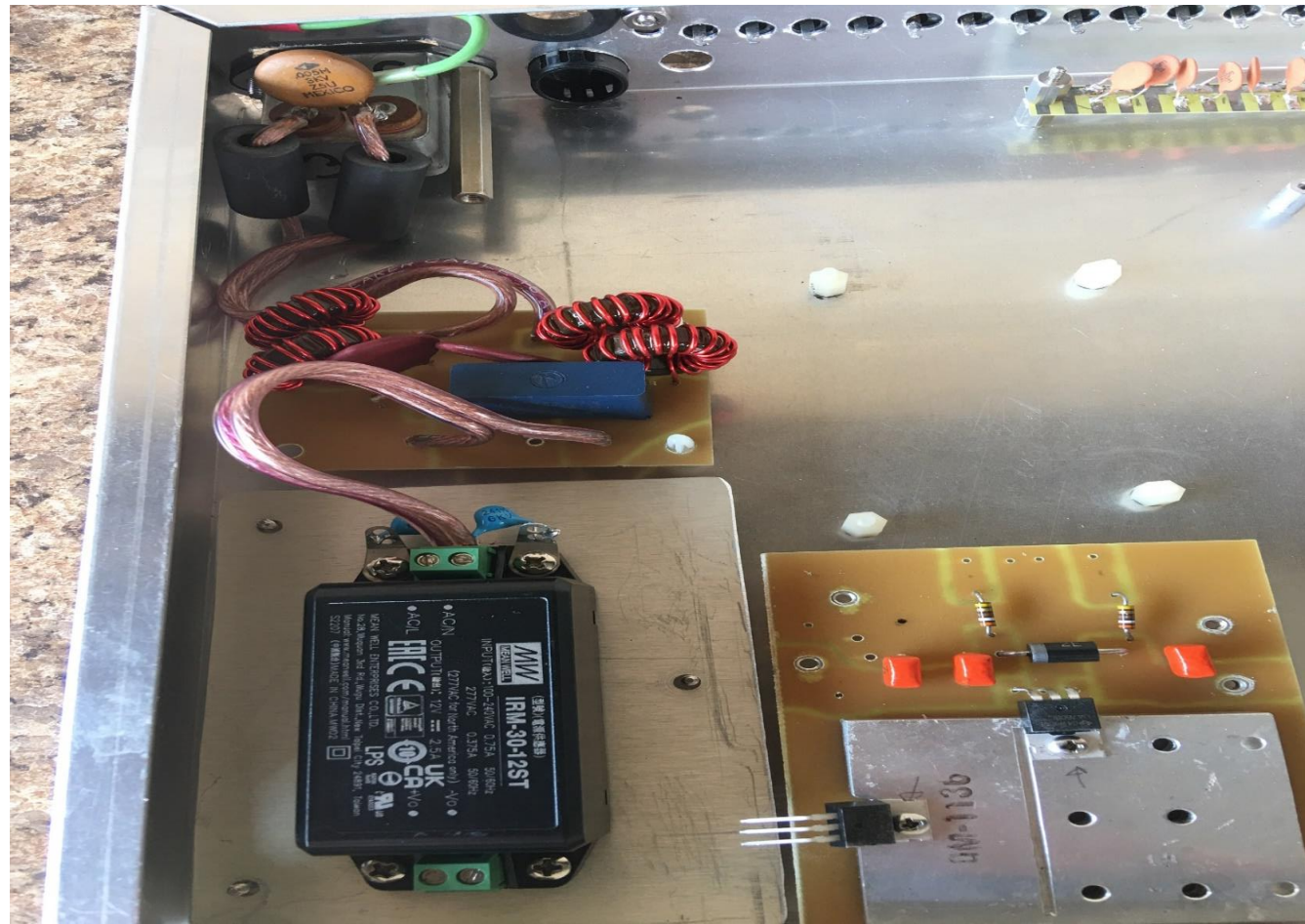


FILTER DESIGNS

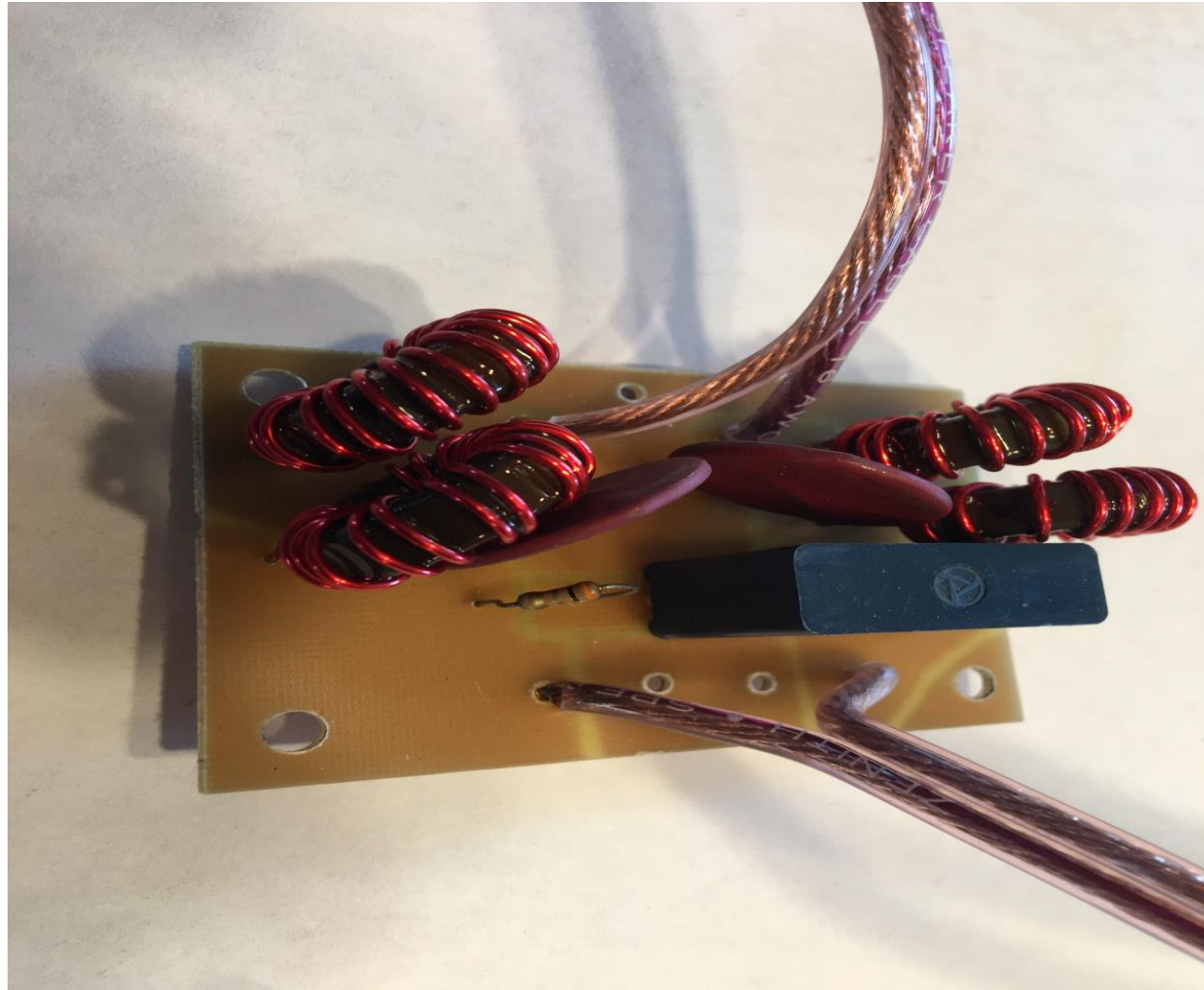
- BOTH THE AC LINE FILTER AND THE 32 RELAY WIRES WERE FILTERED WITH T-SECTION FILTERS.
- FOR A SIMPLE LOW PASS FILTER, THE T-SECTION IS A UNIVERSAL TOPOLOGY THAT CAN BE IMPLEMENTED WITH LOW COST COMPONENTS.
- I USED A 10 nF ON BOTH DESIGNS, FOR THE CENTER SHUNT ELEMENT – IT HAS A RELATIVELY LOW IMPEDANCE IN THE RANGE OF FREQUENCIES THAT NEEDED SUPPRESSED. AN IMPEDANCE OF 10 OHMS AT THE LOWEST FREQUENCY OF INTEREST, IS A GOOD STARTING POINT. IT SHOULD BE 1 OHM IF POSSIBLE, AT THE HIGHER FREQUENCIES. *
- THE INDUCTORS ON EACH SIDE OF THE CAPACITOR, SHOULD IDEALLY BE 50 OHMS OR GREATER, AT THE LOWEST FREQUENCY OF INTEREST.

* IF USED ON A 120VAC LINE OR NEUTRAL WIRE – LEAKAGE CURRENT SHOULD BE LIMITED TO A FEW MILLIAMPERES, FOR SAFETY.

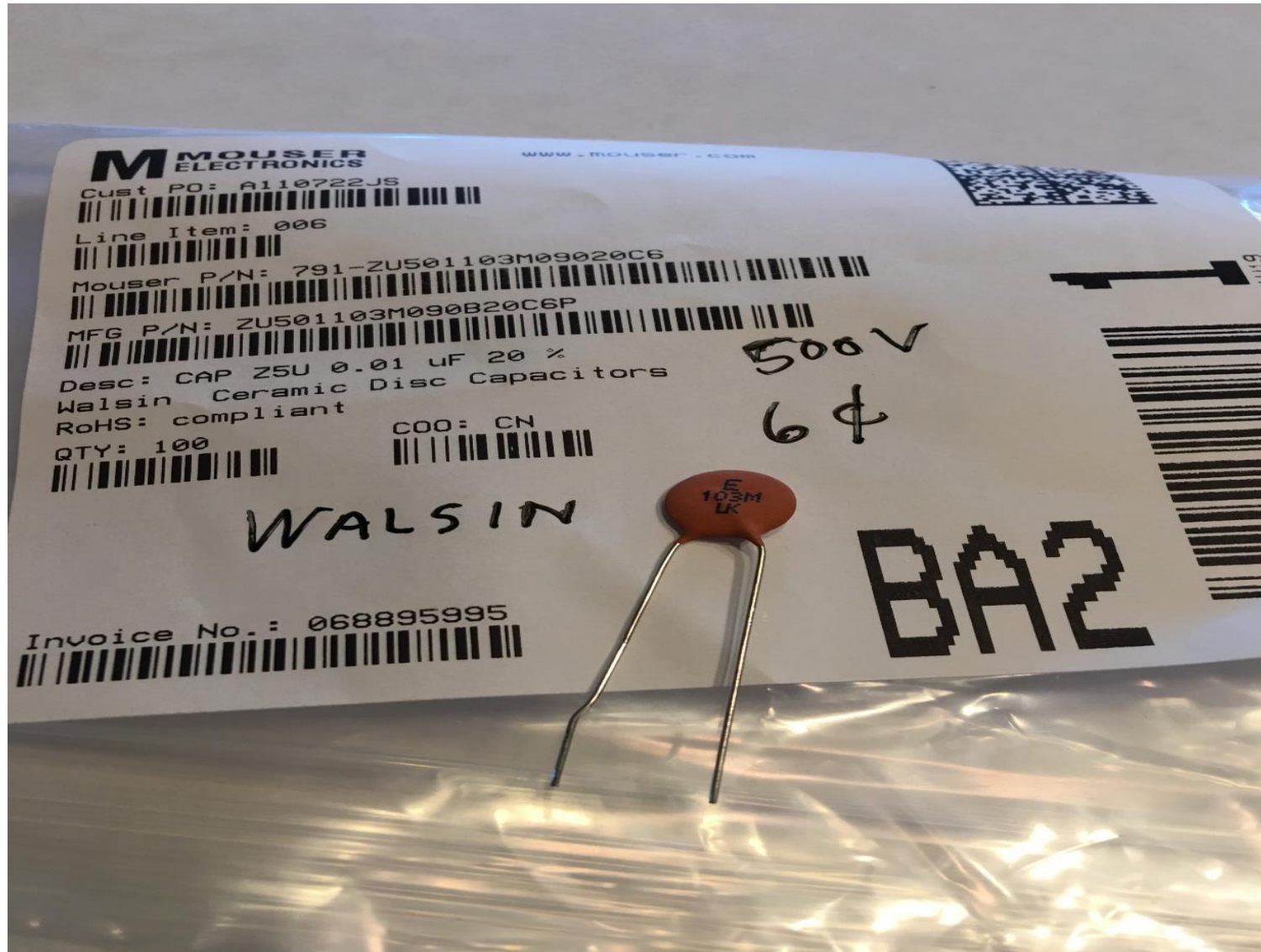
VIEW OF AC LINE FILTERING : CORCOM POWER ENTRANCE, UPPER LEFT.
HOMEBREW ADDITIONAL LINE FILTER BOARD, BETWEEN CORCOM AND MOLDED PS.
NOTE : EXTRA FERRITE SLEEVES BELOW CORCOM, AND 240 pF CAPS FROM PS, TO
CHASSIS. (SEE FILTER TEST DATA SHEET)



HOMEBREW FILTER BETWEEN CORCOM FILTER AND POWER SUPPLY. T-SECTION, FOR LINE AND NEUTRAL SIDE. 1.4 kV 10 nF DISC CERMIC TO GROUND. 17 μ H IRON POWDER TOROIDS ON EA SIDE OF CAPACITOR. A 3 OHM SHUNT RESISTOR HELPS STABILIZE INPUT SEEN BY PS. (IN SERIES WITH A 0.47 μ F CAPACITOR)



SHUNT CAPACITOR TO GROUND, USED ON THE 32 RELAY CONTACTS. FERRITE INDUCTORS USED ON INPUT AND OUTPUT OF THIS LOW COST CAPACITOR.



SOME OF THE 32 FERRITE CYLINDERS USED FOR THE RELAY CONTACT FILTER.
A SECOND FERRITE COMPONENT IS ALSO USED. A "BEAD ON A LEAD"(WITH PIGTAILS).



FILTERING	dBm MEASURED AT FREQUENCY				
	<u>10 MHz</u>	<u>50 MHz</u>	<u>150 MHz</u>	<u>450 MHz</u>	<u>915 MHz</u>
	AC LINE -- IEC 320 + Fe POWDER TOROID BD	-43	-40	-26	-32
AC LINE -- ABOVE WITH ADDED FERRITE					
SLEEVES AND 240 pF CAPS	-54	-55	-51	-43	-48
FILTER FOR 32 RELAY CONTACTS	-27	-46	-38	-29	-25

SPECIAL MATERIALS USED

- Glyptal 1202, CLEAR. (USED TO HOLD #18 AWG WINDING IN PLACE ON IRON POWDER TOROIDS. FROM hisco.inc (EXPENSIVE)
MG CHEMICALS CARRIES SOME SIMILAR PRODUCT, IN SMALLER QUANTITIES FROM SEVERAL DISTRIBUTORS.
- Bonderite M-Cr 1201 Aero (formerly Alodine 1201) FROM aircraftspruce.com (used for protecting Alum top cover made from 50 mil sheet stock. Cover, not shown.)
- Mix 43 FERRITE BEADS. Fair-Rite P/N 2643021001. (for #24 AWG insulated wire from relay board to 10 nF disc ceramic caps, next to terminal strips)
- Mix 43 FERRITE BEADS. Fair-Rite P/N 2743009111. Bead on a lead. (used between 10 nF caps and barrier strip on back wall)
- Adafruit Accessories. P/N 4207 (from Mouser) Solders into a 0.156 HOLE, for easy wire connections w/o soldering. (requires 3mm METRIC screw)