Dodecahedral Barometer Build Instructions

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This project was inspired by a few recently acquired pieces of electronics. The first is a brand new Setra model 270 Barometric pressure sensor. This is a very accurate sensor suitable for use in weather stations. It requires a supply of 24V and outputs a 0 to 5V analog signal corresponding to an input range of 600 to 1100 millibars.

The second items are some very nice HP displays. The hexadecimal displays are not the typical 7 segment type – each segment is made of several individual LEDs, making for visually appealing numbers and letters. These displays have a 5-bit (4 data bits and decimal point) latched input. The alphanumeric displays are a little more interesting – there are four characters with a complete 5x7 matrix of LEDs. There is a 28 bit shift register corresponding to the data in one column of each character, and 5 separate colum lines to determine which column to light. The display must be continuously updated.

The sensor's output is a little strange to deal with, as the excitation and the output do not share a common return – the output negative is 5V above the excitation negative, and the output positive ranges from 0 to 5V with respect to output negative. There are three ways to deal with this:

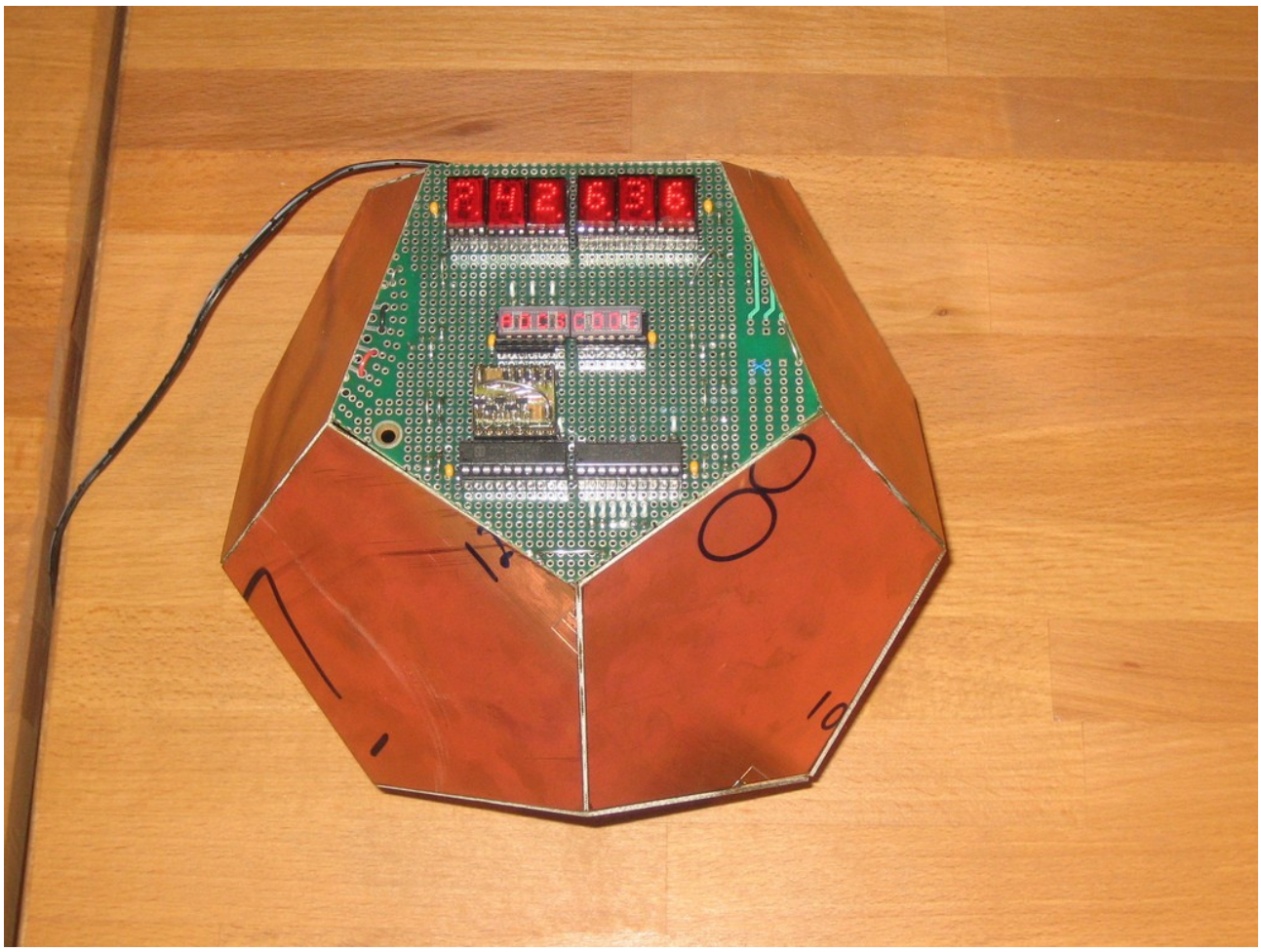
● A difference amplifier to remove the common mode voltage and create a ground referred 0-5V signal.
● Float the excitation supply, grounding the output negative such that output positive swings 0-5V with respect to ground
● Float an Analog to Digital converter and level shift the digital signals.

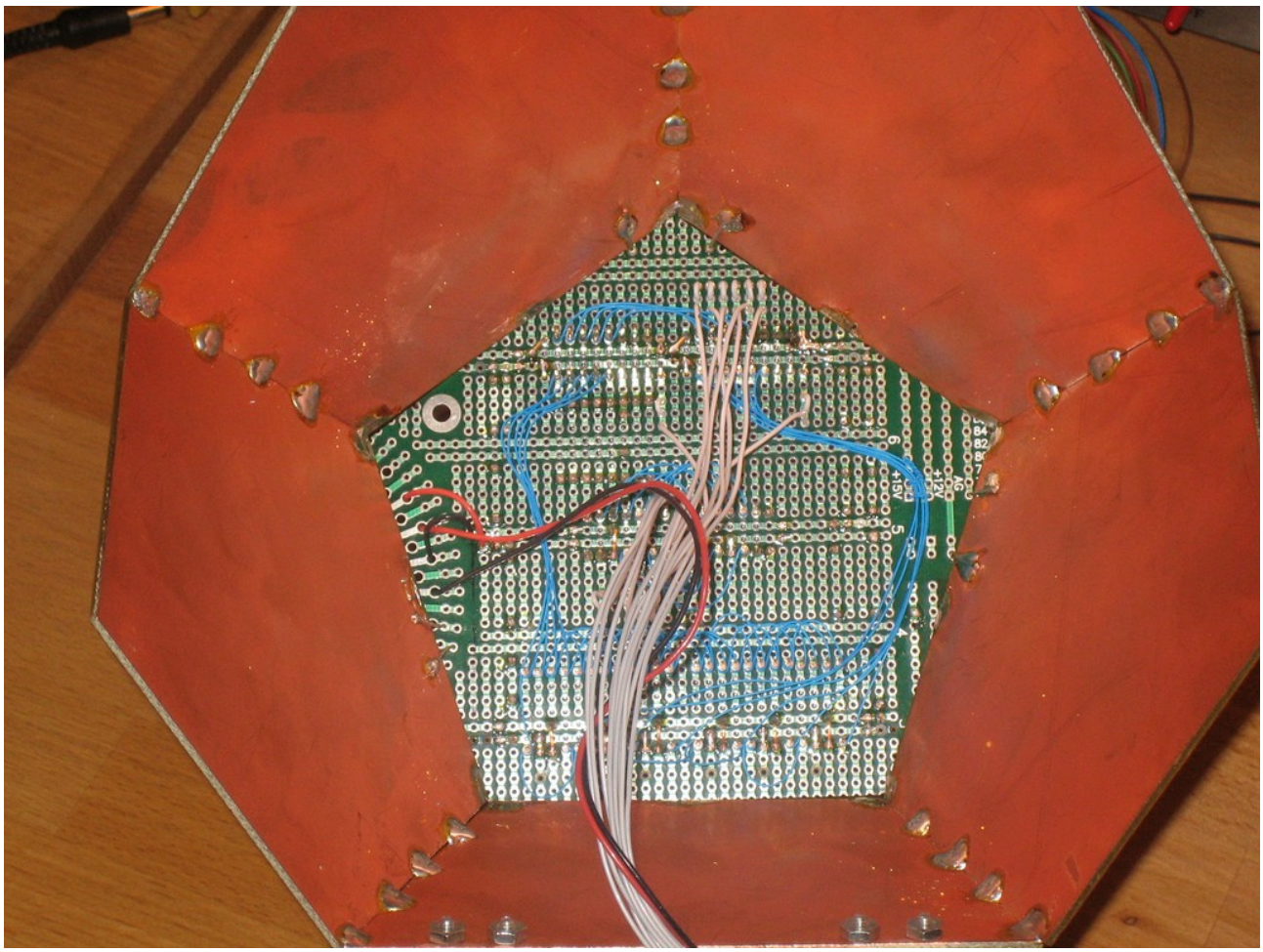
The first approach is straightforward, but necessarily introduces errors as precision components are required. The second and third approach sidestep the analog level shift problem entirely, and the third approach is used in this project as an Avago HCPL092 digital isolator was already present on the microcontroller board. Of course this is overkill when there's only a 5V difference to deal with, but it can be extended to other measurement scenereos where much larger ground differences are present. Sensor excitation is provided by an LT3494A boost converter configured for 24V output.

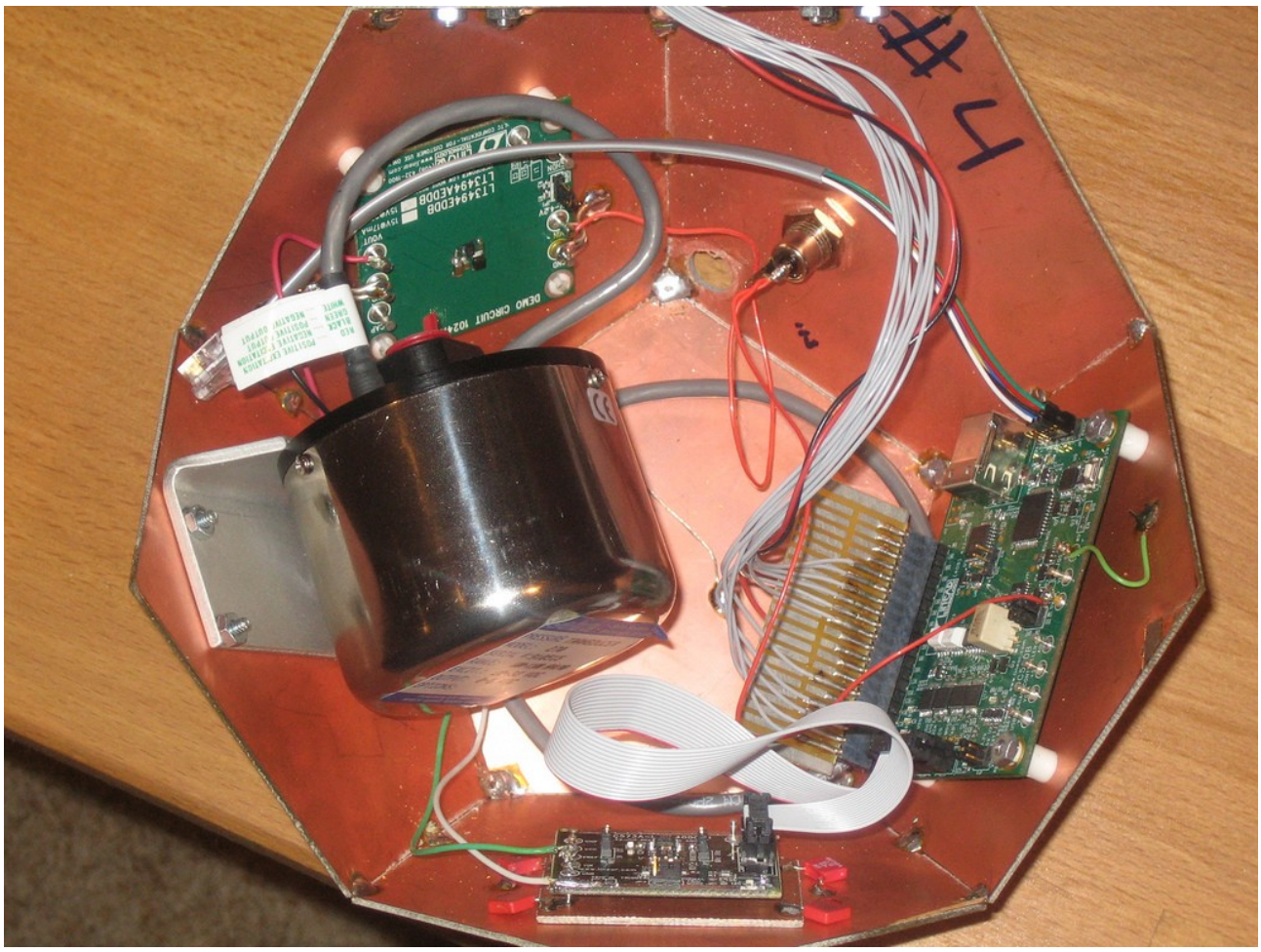
An LTC2420, 20 bit analog to digital converter and LT1236 reference measure the output of the sensor, with floating power provided by an LT3439 low-noise, slew rate limited, push-pull, power supply. Once the sensor output is accurately digitized, the digital signals are sent "back to earth" through the digital isolator to a PIC16F877A microcontroller.

The display board has decoding logic and power switches for the alphanumeric display column inputs. Normally wire wrapping is a last resort, but it made sense for this project.

And lastly, this project deserves a nice enclosure. The dodecahedron is constructed of garbage-picked copper-clad board. A quick web search on "polar graph paper" produced numerous utilities for generating graph paper with arbitrary numbers of spokes and concentric circles. Choose 5 spokes and enough circles so that you can choose the right size. Use the graph paper to mark out 12 pentagons on copper clad board, and then VERY carefully cut them out on a shear. Cut the apex off of one of them and drill holes for a hinge. Next, temporarily tape the two hemi-dodecahedra together and solder the inner edges together. Install the hinge and you're done!



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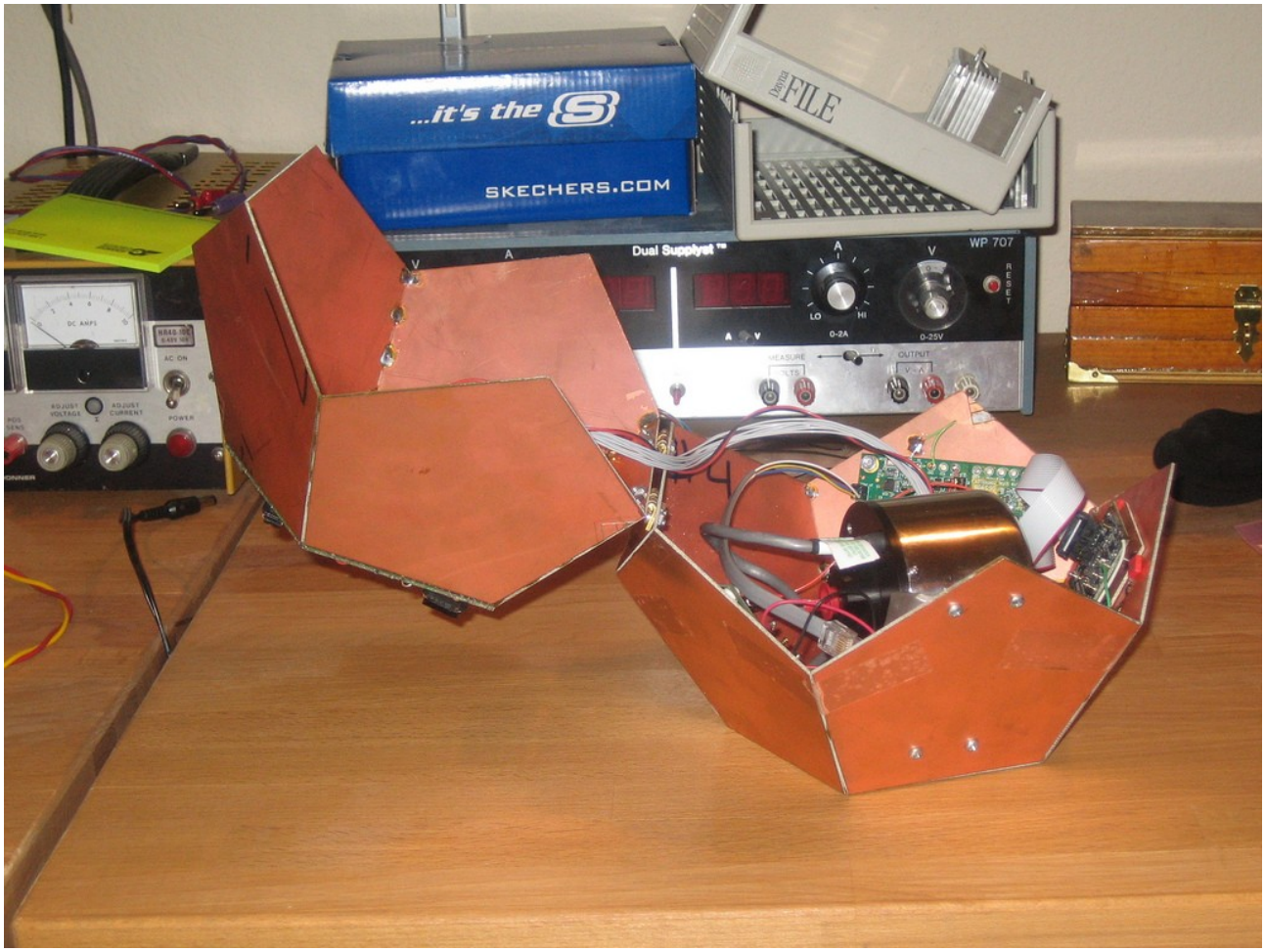
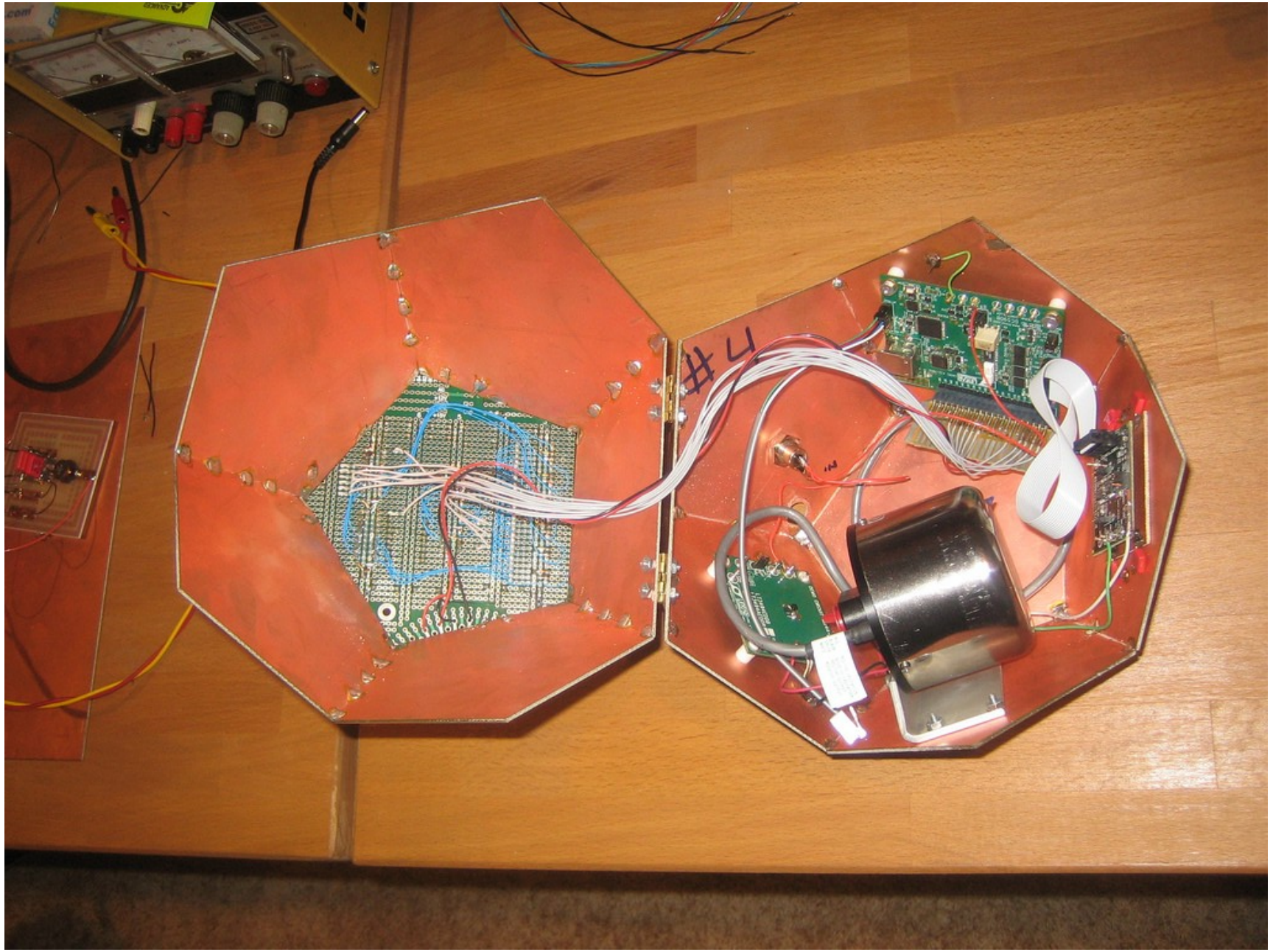

...it's the
SKECHERS.COM
FILE
Dual Supplyst™
WP 707
LO
HI
0-2A
0-25V
RESET
OUTPUT
DC AMPS
AC ON
POWER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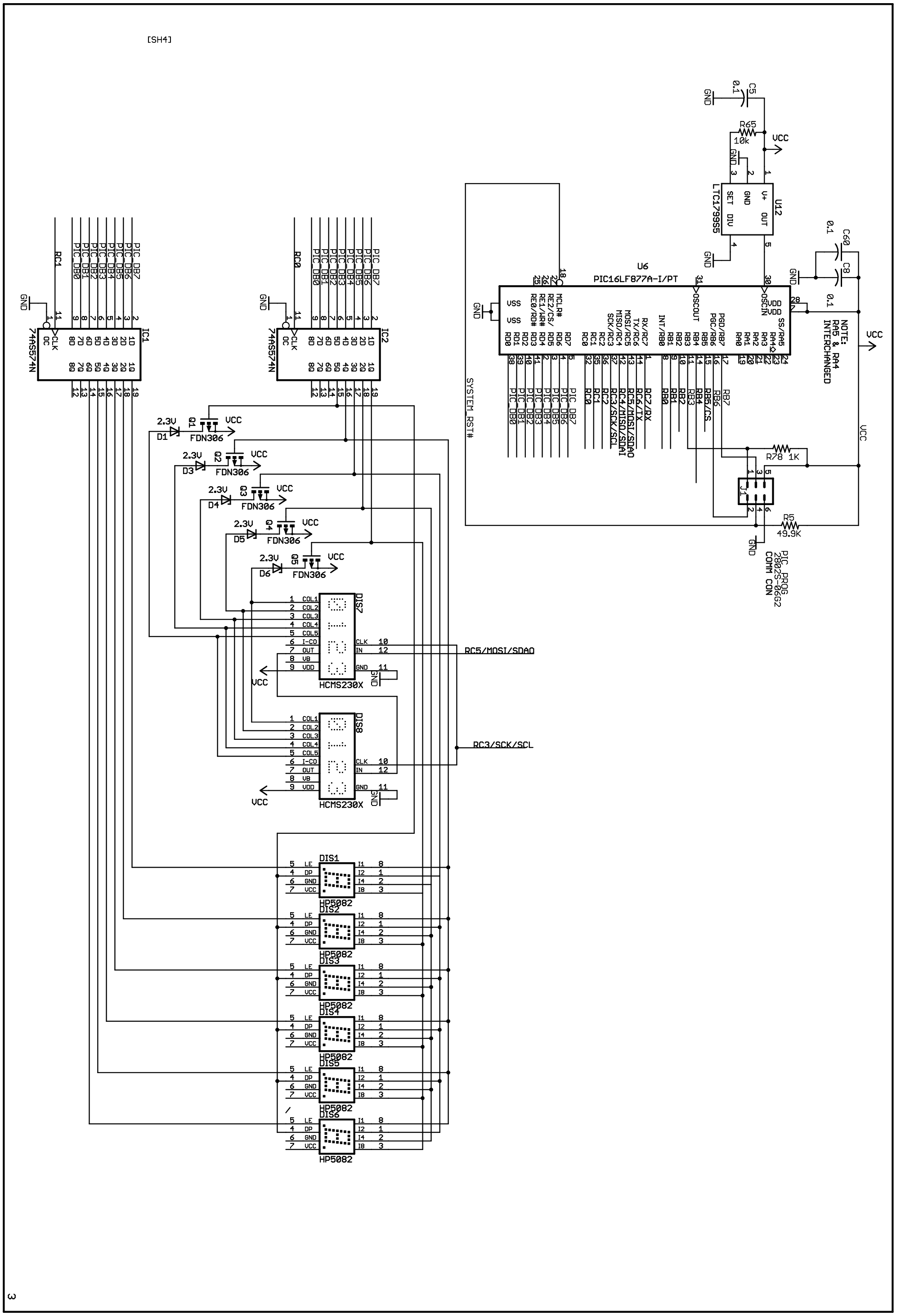
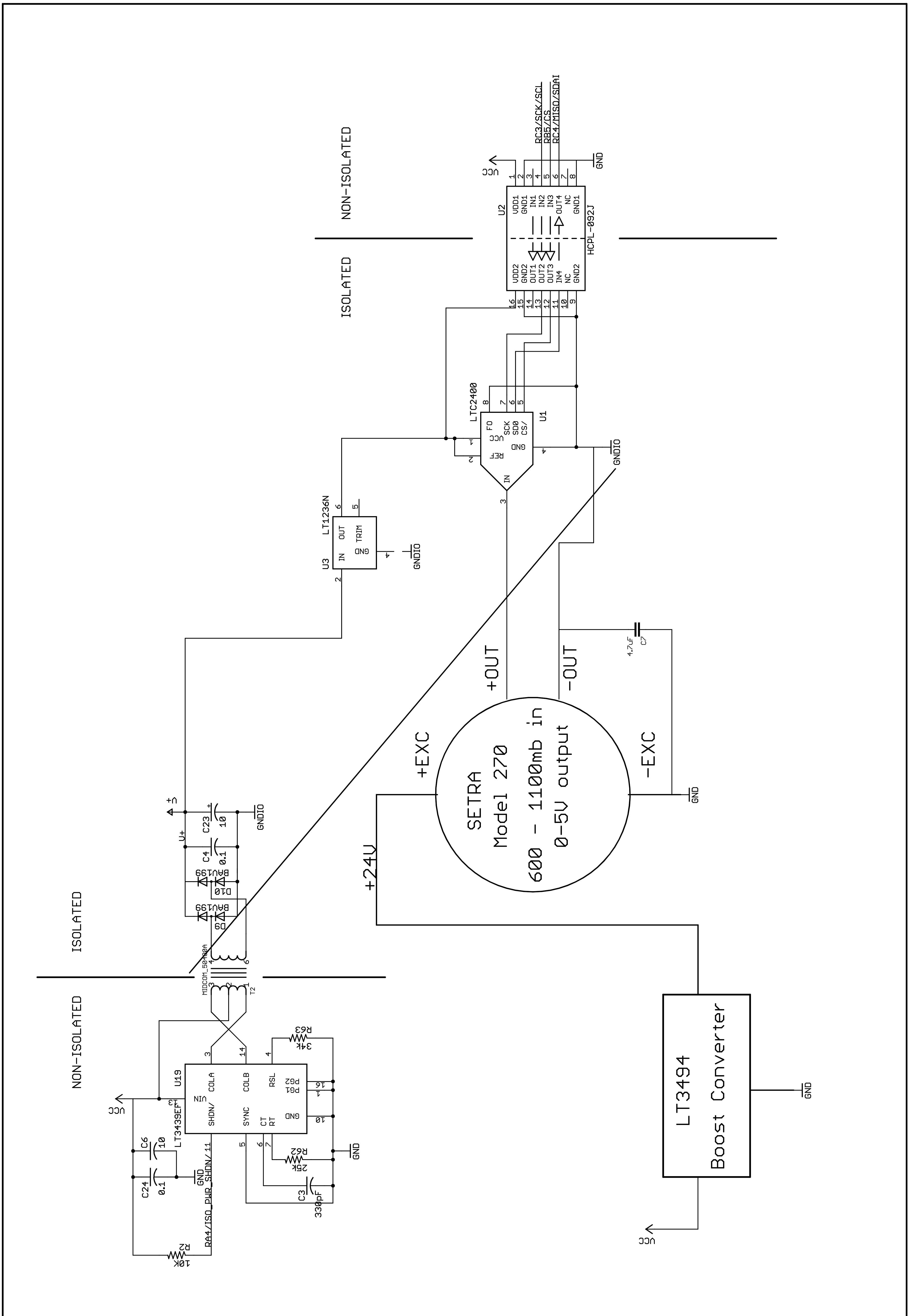

U6
PIC16LF877A-I/PT
U12
LTC1799S5
C5
0.1
C60
0.1
C8
0.1
R65
10k
VCC
GND
NOTE:
RA5 & RA4
INTERCHANGED
SYSTEM_RST#
R78 1K
J1
R5
49.9K
PIC_PROG
2802S-06G2
COMM CON
IC1
IC2
74AS574N
RC1
RC0
PIC_DB7
PIC_DB6
PIC_DB5
PIC_DB4
PIC_DB3
PIC_DB2
PIC_DB1
PIC_DB0
Q1
Q2
Q3
Q4
Q5
FDN306
2.3V
D1
D3
D4
D5
D6
DIS7
DIS8
HCMS230X
COL1
COL2
COL3
COL4
COL5
I-CO
OUT
VB
VDD
CLK
IN
RC5/MOSI/SDAO
RC3/SCK/SCL
DIS1
DIS2
DIS3
DIS4
DIS5
DIS6
HP5082
LE
DP
GND
VCC
I1
I2
I4
I8


NON-ISOLATED
ISOLATED
U2
HCPL-092J
VDD1
GND1
IN1
IN2
IN3
OUT4
NC
GND1
VDD2
GND2
OUT1
OUT2
OUT3
IN4
NC
GND2
VCC
GND
RC3/SCK/SCL
RB5/CS
RC4/MISO/SDAI
LTC2400
U1
FO
SCK
SD0
CS/
VCC
REF
GND
IN
GNDIO
LT1236N
U3
IN
OUT
TRIM
GND
+OUT
-OUT
4.7uF
C7
+EXC
-EXC
SETRA
Model 270
600 - 1100mb in
0-5V output
+24V
V+
C23
10
C4
0.1
BAU199
D10
D9
MIDCOM_50400A
T2
U19
LT3439EF
VIN
SHDN/
COLA
COLB
SYNC
RSL
CT
RT
PG2
PG1
R63
34K
R62
25K
C3
330pF
C6
10
C24
0.1
RA4/ISO_PWR_SHDN/
R2
10K
LT3494
Boost Converter