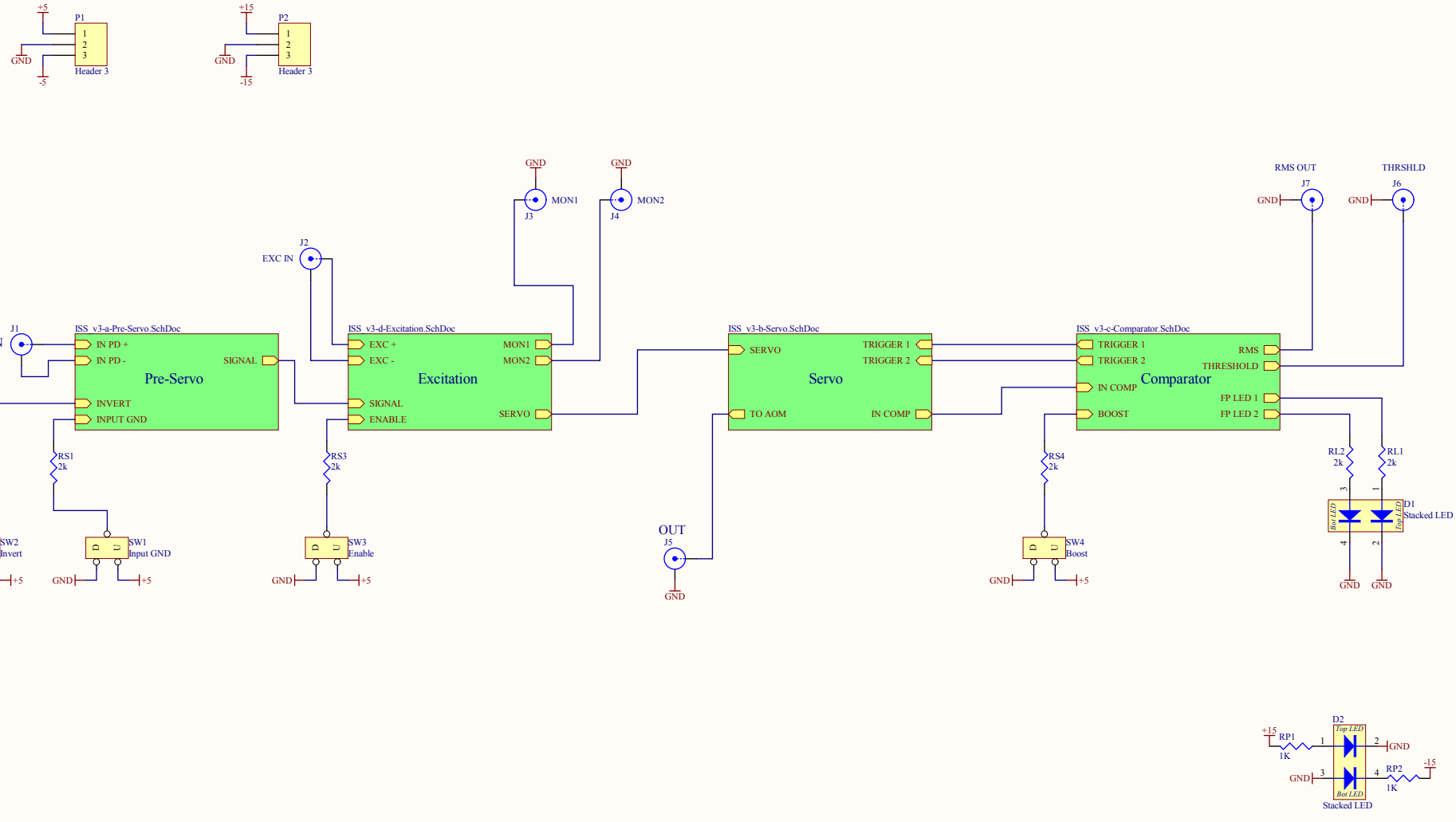
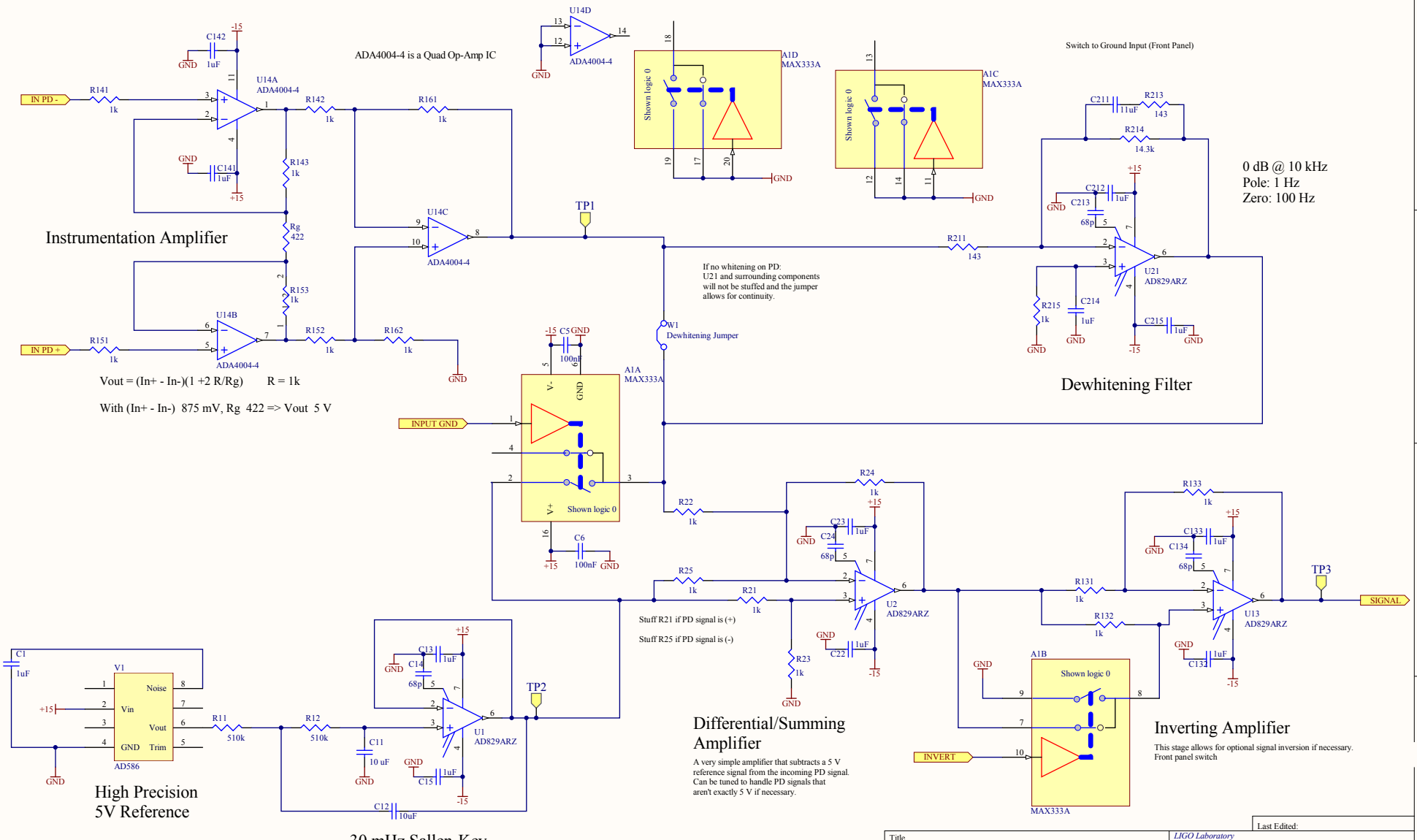


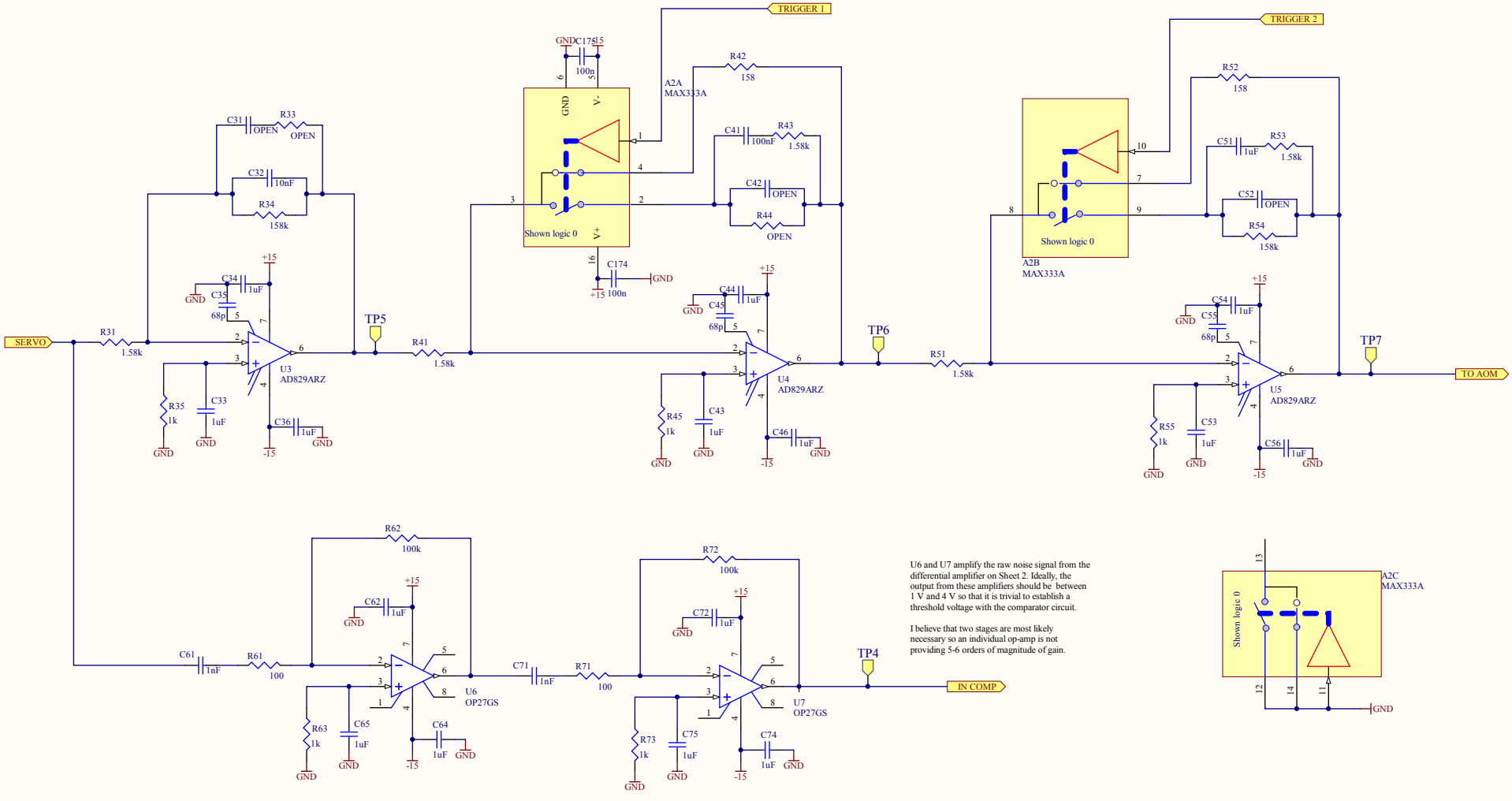
Title: *ISS: Layout + Front Panel Ports/Switches*			*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: B	DCC Number: *	Revision: *	Engineer: *Charles Blakemore*	Date: 8/15/2013 Time: 8:51:42 PM Sheet 1 of 5
File: C:\Users\cit40m\Documents\ISS Schematics - Chas\40m\v1\ISS_v3.SchDoc				Last Edited:


ADA4004-4 is a Quad Op-Amp IC
Switch to Ground Input (Front Panel)
Instrumentation Amplifier
Vout = (In+ - In-)(1 +2 R/Rg) R = 1k
With (In+ - In-) 875 mV, Rg 422 => Vout 5 V
If no whitening on PD:
U21 and surrounding components
will not be stuffed and the jumper
allows for continuity.
Dewhitening Filter
0 dB @ 10 kHz
Pole: 1 Hz
Zero: 100 Hz
Stuff R21 if PD signal is (+)
Stuff R25 if PD signal is (-)
Differential/Summing
Amplifier
A very simple amplifier that subtracts a 5 V
reference signal from the incoming PD signal.
Can be tuned to handle PD signals that
aren't exactly 5 V if necessary.
Inverting Amplifier
This stage allows for optional signal inversion if necessary.
Front panel switch
High Precision
5V Reference
30 mHz Sallen-Key
LP Filter
Shown logic 0
IN PD -
IN PD +
INPUT GND
INVERT
SIGNAL
TP1
TP2
TP3
W1
Dewhitening Jumper
U14A
ADA4004-4
U14B
ADA4004-4
U14C
ADA4004-4
U14D
ADA4004-4
A1A
MAX333A
A1B
MAX333A
A1C
MAX333A
A1D
MAX333A
U1
AD829ARZ
U2
AD829ARZ
U13
AD829ARZ
U21
AD829ARZ
V1
AD586
Noise
Vin
Vout
GND
Trim
R141
R142
R143
R151
R152
R153
R161
R162
Rg
422
R11
510k
R12
510k
R21
R22
R23
R24
R25
R131
R132
R133
R211
R213
R214
R215
C1
C5
C6
C11
C12
C15
C22
C23
C24
C131
C132
C133
C134
C141
C142
C211
C212
C213
C214
C215
GND
+15
-15
Title
ISS: Pre-Servo
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology
LIGO
Size: B
DCC Number: *
Revision: *
Engineer: Charles Blakemore
Last Edited:
Date: 8/15/2013
Time: 8:51:42 PM
Sheet 2 of 5
File: C:\Users\cit40m\Documents\ISS Schematics - Chas\40m\v1\ISS_v3-a-Pre-Servo.SchDoc

LP Filter
60 dB @ DC
Pole: 10 Hz

0 dB @ 100 kHz
Pole: *DC*
Zero: 10 kHz

60 dB @ DC; 0 dB @ 100 kHz
Pole: 10 Hz
Zero: 10 kHz



U6 and U7 amplify the raw noise signal from the differential amplifier on Sheet 2. Ideally, the output from these amplifiers should be between 1 V and 4 V so that it is trivial to establish a threshold voltage with the comparator circuit.

I believe that two stages are most likely necessary so an individual op-amp is not providing 5-6 orders of magnitude of gain.

Last Edited:

Title: *ISS: Servo*			*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: B	DCC Number: *	Revision: *	Engineer: *Charles Blakemore*	Date: 8/15/2013 Time: 8:51:42 PM
File: C:\Users\cit40m\Documents\ISS Schematics - Chas\40m\v1\ISS_v3-b-Servo.SchDoc				Sheet 3 of 5

AD8436 RMS-to-DC Converter

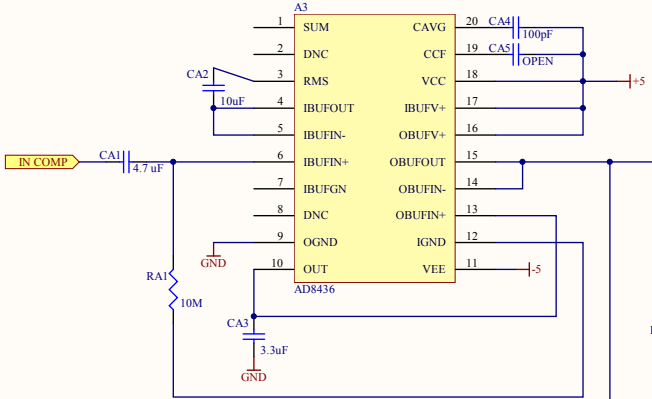
Here, the AD8436 is connected according to the manufacturer reccomendations.
Pin connections on the AD8436 come directly from the manufacturer's datasheet.
(www.analog.com/static/imported-files/data_sheets/AD8436.pdf)

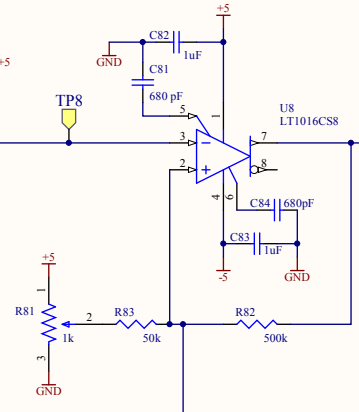
This is a very simple design to accomplish basic RMS-to-DC conversion
and should work quite effectively for the type of inputs we're interested in.

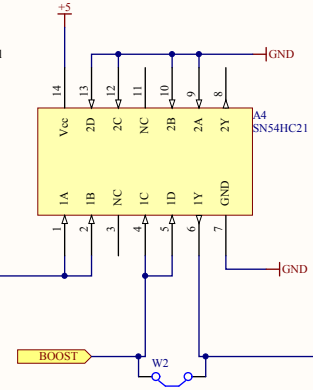
The LT1016 and accompanying circuitry has two states.
If the DC-voltage from the AD8436 is larger than the threshold
established by the potentiometer then the LT1016's output is
set at 0 V.

If the DC-voltage input is lower than the threshold, then the
LT1016's output is ~3.5 V (based on datasheet).

The ratio R83/R82 sets the hysteresis. If Voh is the high level
output of the comp. and Vol is the low level then
deltaV ~ (R83/R82)*(Voh - Vol)

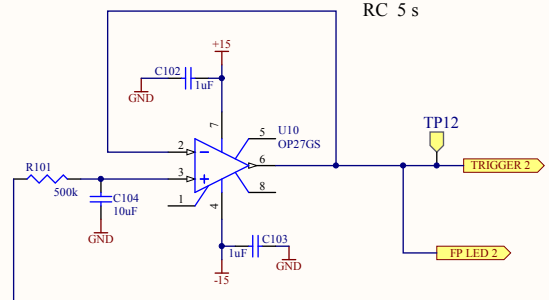




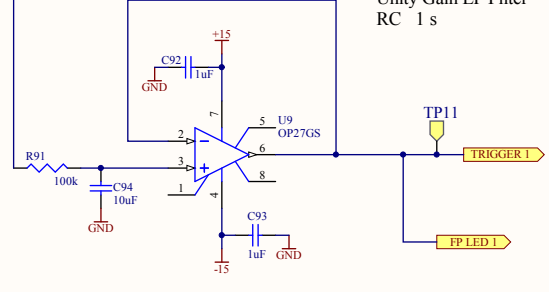


1A/1B	BOOST	Boosts
	(1C/1D)	enabled
1	0	0
0	1	0
1	1	1

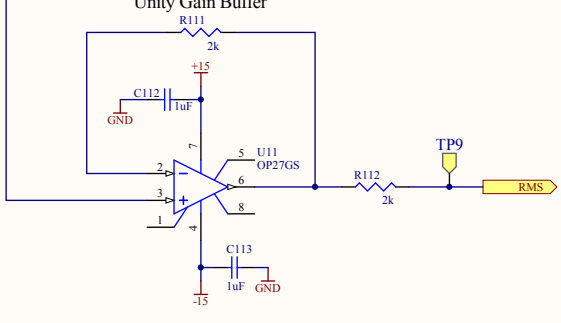
Unity Gain LP Filter
RC 5 s



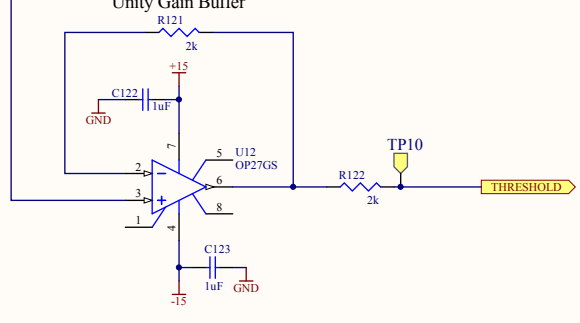
Unity Gain LP Filter
RC 1 s



Unity Gain Buffer



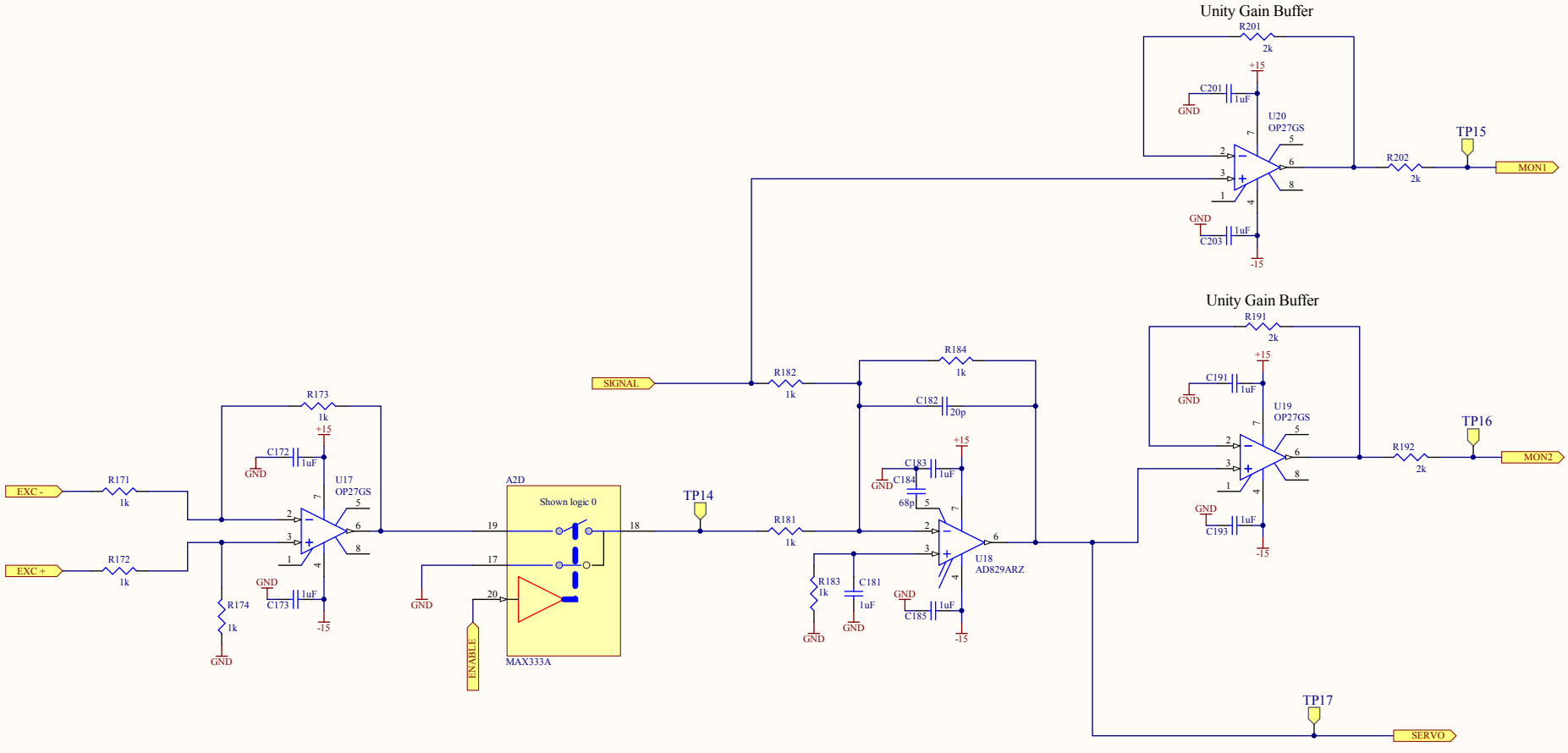
Unity Gain Buffer



U9 and U10 serve as buffer stages so that there is not
a significant amount of current drawn from the LT1016,
and to slightly delay activation of the second and third
filter stages by the indicated time constants.

Last Edited:

Title: *ISS: Comparator + Triggering*		*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: B	DCC Number: *	Revision: *	Engineer: *Charles Blakemore*
File: C:\Users\cit40m\Documents\ISS Schematics - Chas\40m\v1\ISS_v3-c-Comparator.SchDoc			Date: 8/15/2013 Time: 8:51:42 PM Sheet 4 of 5



Title: *ISS: Excitation*			*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: B	DCC Number: *	Revision: *	Engineer: *Charles Blakemore*	Last Edited: Date: 8/15/2013 Time: 8:51:43 PM
File: C:\Users\cit40m\Documents\ISS Schematics - Chas\40m\v1\ISS_v3-d-Excitation.SchDoc				Sheet 5 of 5

D*******-v1
ISS Board

Serial Number