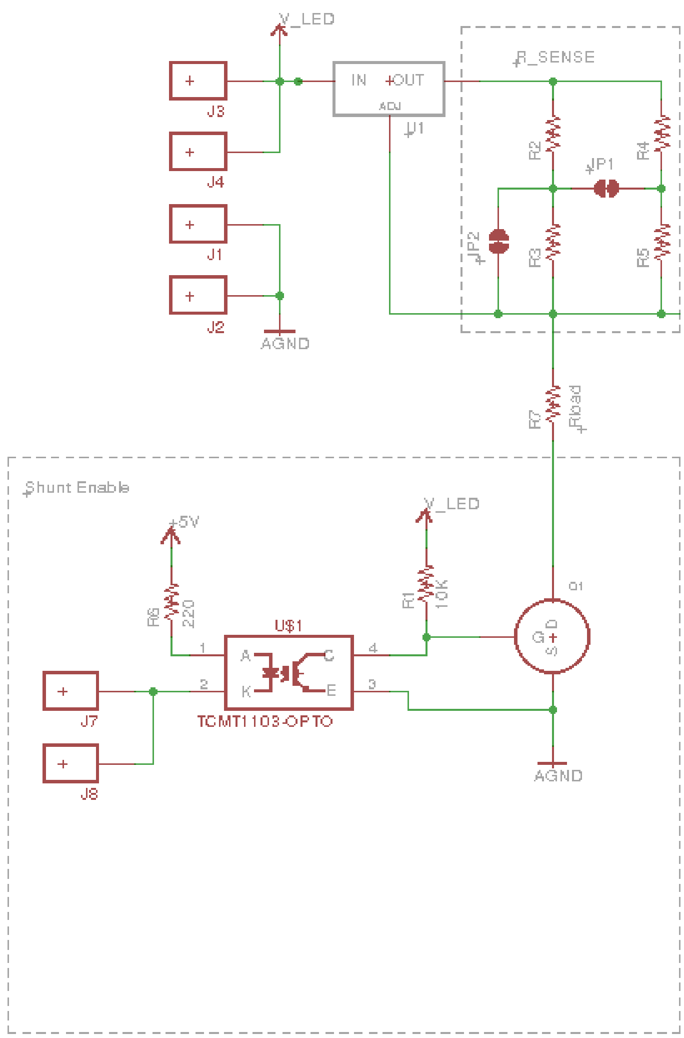
Goal/Objective:

Calculate the required sense and load resistor values for each channel in each enclosure.

Given/Draw:



Voltage regulator LM-317 configured to operate in constant current mode. The regulator will maintain 1.25V across R_{SENSE}.

	Enclosure LED Channels			
Enclosure	White	Blue	Green	Red
4 Rail	HGL-320-54(8)	HLG-320-54	HLG-320-54	HLG-240-36
3 Rail	HLG-320-54(6)	HLG-240-54	HLG-240-54	HLG-150-36
5 Rail (Shorty)	HLG-320-54(5)	HLG-240-54	HLG-240-54	HLG-240-36

From: PS Count.pdf

Current shunt shutoff: 5.5% of I_{MAX}

HLG Power Supply	I_{MAX} (mA)	Current Shut Cutoff (mA)
HLG-320-54	5950	327.25
HLG-240-54	4450	244.75
HLG-240-36	6700	368.50
HLG-150-36	4200	231.00

	Parallel LED Branches				
Enclosure	White 1	White 2	Blue	Green	Red
4 Rail	6	6	8	8	8
3 Rail	6	6	6	6	6
5 Rail (Shorty)	6	0	5	5	5

Assume:

N/A

Equations:

$$V = IR \qquad\qquad P = VI$$

Solve:

A) Calculate LED branch currents per enclosure

$$I_{BRANCH} = \frac{I_{SHUTOFF}}{branches}$$

solved with Calc (calculations.ods).

	LED Branch Currents at Shunt Cut Off (mA)				
Enclosure	White 1	White 2	Blue	Green	Red
4 Rail	54.45	54.45	40.91	40.91	46.06
3 Rail	54.45	54.45	40.79	40.79	38.50
5 Rail (Shorty)	54.45	X	48.95	48.95	73.70

B) V_{LED} at I_{MIN}

	LED Voltage at I_{MIN}				
Enclosure	White 1	White 2	Blue	Green	Red
4 Rail	40.95	40.95	38.14	36.72	26.88
3 Rail	40.95	40.95	38.14	36.72	26.88
5 Rail (Shorty)	40.95	X	38.14	36.72	26.88

C) Calculate V_{LED} at I_{LED} (min) and Shunt Cut Off

solved with Octave (v_led_shunt.m)

	LED Voltage at Shunt Cut Off (V)				
Enclosure	White 1	White 2	Blue	Green	Red
4 Rail	43.289	43.289	40.920	38.742	28.754
3 Rail	43.289	43.289	40.914	38.737	28.513
5 Rail (Shorty)	43.289	X	41.289	39.026	29.454

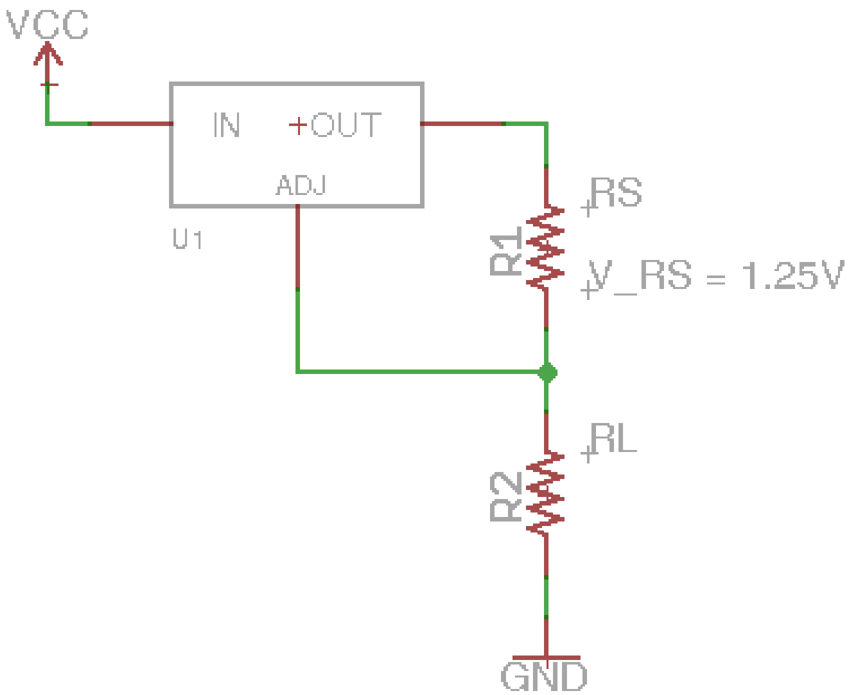
D) Determine I_{SHUNT}, V_{MIN}, and V_{MAX} per HLG Type

These values represent the worst case scenario per HLG type.

HLG Power Supply	I_{SHUNT} (mA)	V_{MIN} (V)	V_{MAX} (V)
HLG-320-54	327.25	36.72	43.289
HLG-240-54	244.75	36.72	41.289
HLG-240-36	368.50	26.88	29.454
HLG-150-36	231.00	26.88	28.513

E) Calculate ideal R_{SENSE} and R_{LOAD} Values

LM317 Dropout Voltage is ~ 1.75V @ 500mA I_{FWD} & T_{JUNC} = 25 °C. We will set minimum LM317 'head room' to 2 V.



$$V_{RL}(V) = V_{MIN} - V_{REG} - V_{RS}$$

$$R_S(\Omega) = \frac{1.25\,(V)}{I_{SHUNT}\,(A)}$$

solved with Calc (calculations.ods).

			P_{REG} (W)			
HLG Power Supply	R_{RS} (Ω)	R_{RL} (Ω)	V_{MIN}	V_{MAX}	P_{RS} (W)	P_{RL} (W)
HLG-320-54	3.82	102.28	0.65	2.80	0.41	10.95
HLG-240-54	5.11	136.75	0.49	1.61	0.31	8.19
HLG-240-36	3.39	64.12	0.74	1.69	0.46	8.71
HLG-150-36	5.41	102.29	0.46	0.84	0.29	5.46

F) Identify Actual R_{RS} & R_{RL} Values

solved with Calc (calculations.ods).

			P_{REG} (W)				
HLG Power Supply	R_{RS} (Ω)	R_{RL} (Ω)	V_{MIN}	V_{MAX}	P_{RS} (W)	P_{RL} (W)	P_{TOTAL} Max (W)
HLG-320-54	3.5	100.0	0.90	3.05	0.37	10.71	14.13
HLG-240-54	5.0	137.0	0.47	1.59	0.30	8.21	10.10
HLG-240-36	3.0	62.0	1.03	1.97	0.41	8.42	10.80
HLG-150-36	5.0	100.0	0.58	0.96	0.27	5.34	6.56

Resistor Value (Ω)	MFG	MFG Part #	Mouser Part #
0.5, 3W, 1%	Ohmite	WHDR50FET	588-WHDR50FET
1.0, 2W, 1%	Ohmite	WHC1R0FET	588-WHC1R0FET
5.0, 2W. 1%	Ohmite	WHC5R0FET	588-WHC5R0FET
62.0, 25W, 1%	Vishay/Dale	RH02562R00FE02	71-RH02562R00FE02
100.0, 25W, 1%	Vishay/Dale	RH025100R0FE02	71-RH025100R0FE02
137.0, 25W, 1%	Vishay/Dale	RH025137R0FC02	71-RH25-137