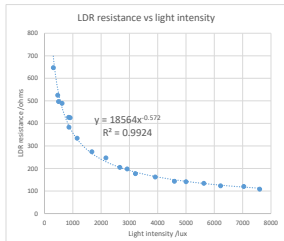


CALIBRATION

Light intensity /lux	LDR resistance /ohms
311	647
468	525
497	497
562	383
1351	334
1675	274
2170	247
2520	198
5000	141
3910	162
7040	120
5630	134
7600	108
8230	123
3210	177
4590	143
2650	205
630	685
905	425
855	427



Blue top resistor resistances /ohms

Reading	Actual
100	102.4
130	134
1000	998
2200	2190
4700	4740
1000	1002
22000	2255
47000	4650
100000	10030
330000	344000
1000000	991000

Lux calculator from potential divider

V0 /volts	2.1	2.1	2.1	2.1
V /volts	0.677	1.225	1.82	1.63
R0 /ohms	394	394	394	394
phi /lux	4117	626	43	1201
actual /lux	4050	440	120	1536

$$\phi = \left( \frac{R_0 V}{V_0 - V} \frac{1}{k} \right)^{\frac{1}{\alpha}}$$



$$R = k \phi^{\alpha}$$

Empirical model

$\phi$  = light intensity / lux  
 $\alpha = -0.572$   
 $k = 18564$

Potential divider:

$$\frac{V}{V_0} = \frac{R}{R + R_0}$$

Measure V  
 $\Rightarrow$  find R  
 and hence  $\phi$

What R yields the largest range of V i.e. makes the sensor most sensitive?

$$\begin{aligned} (R + R_0) \frac{V}{V_0} &= R \\ R_0 \frac{V}{V_0} &= R(1 - \frac{V}{V_0}) \end{aligned} \quad \therefore R = \frac{R_0 \frac{V}{V_0}}{1 - \frac{V}{V_0}} = \frac{R_0 V}{V_0 - V}$$

$$\therefore k \phi^{\alpha} = \frac{R_0 V}{V_0 - V} \quad \therefore \phi = \left( \frac{R_0 V}{V_0 - V} \frac{1}{k} \right)^{\frac{1}{\alpha}} = \left( \frac{R_0 \frac{V}{V_0}}{1 - \frac{V}{V_0}} \frac{1}{k} \right)^{\frac{1}{\alpha}}$$

$\alpha$   
 $k$

-0.572
18564

R0 /ohms	100	200	400	600	800	1000	1200	1400	1600
V/V0	phi /lux	phi /lux	phi /lux	phi /lux	phi /lux	phi /lux	phi /lux	phi /lux	phi /lux
0.1	410987.98	181386.75	187795.81	11366.76	7695.08	5594.80	4271.12	3383.45	
0.11	357780.71	160000.00	11700.38	15603.16	9436.01	6388.00	4644.47	3547.29	2808.74
0.12	301262.89	89680.40	26094.47	13139.22	7945.34	5379.25	3911.05	2987.13	2365.21
0.13	250272.73	76457.90	22749.46	11397.48	6773.66	4584.29	3333.06	2545.68	2015.67
0.14	212104.13	65796.50	19585.13	9639.95	5829.76	3946.64	2869.45	2191.59	1735.30
0.15	181962.07	57139.87	17008.38	8371.65	5062.75	3427.39	2491.92	1903.25	1506.99
0.16	156708.86	49997.96	14883.51	7125.28	4429.96	2999.00	2140.46	1663.36	1318.13
0.17	147947.00	44038.24	13108.52	6452.11	3901.91	2641.52	1920.55	1466.85	1161.45
0.18	133070.54	39014.75	11613.22	5746.11	3456.82	2340.20	1701.47	1299.53	1028.96
0.19	118718.26	34232.34	10341.43	5098.10	3078.99	2084.96	1515.16	1157.22	916.29
0.2	104414.65	31080.30	9251.43	4553.62	2753.80	1864.27	1355.44	1035.24	819.70
0.21	93792.20	27918.40	8310.25	4090.37	2473.65	1674.61	1217.55	929.92	736.31
0.22	84561.74	25170.84	7492.41	3687.82	2230.21	1509.81	1097.72	838.40	663.85
0.23	76493.87	22769.34	6677.57	3335.97	2017.43	1362.76	992.89	758.41	590.55
0.24	69404.55	20659.12	6149.44	3026.80	1830.46	1239.19	900.96	688.13	544.86
0.25	63144.73	18795.80	5594.80	2753.80	1665.36	1127.42	819.70	626.06	495.72
0.26	57927.44	17443.16	5100.17	2511.47	1519.53	1029.29	747.81	571.01	452.13
0.27	52648.05	15671.34	4664.77	2296.03	1388.52	940.01	683.44	521.99	413.31
0.28	48227.78	14355.59	4273.12	2103.26	1271.95	865.08	626.06	478.16	378.61
0.29	44362.38	13176.24	3921.77	1930.33	1167.96	790.28	574.59	438.46	347.48
0.3	40693.50	12112.93	3605.56	1774.68	1073.24	726.56	528.26	403.46	319.46
0.31	37471.79	11153.94	3320.11	1634.18	988.27	669.04	486.43	371.52	294.17
0.32	34555.31	10285.81	3061.70	1506.99	911.35	616.97	448.57	342.61	271.26
0.33	31980.24	9497.88	2827.36	1389.55	841.54	569.71	414.21	316.36	250.69
0.34	29649.81	8780.98	2613.77	1286.52	778.02	526.71	382.96	292.48	231.99
0.35	27503.50	8127.22	2419.17	1190.73	720.09	487.49	354.44	270.71	214.35
0.36	25596.34	7529.71	2241.33	1102.00	667.45	451.95	328.91	250.81	198.99
0.37	23848.37	6982.67	2078.48	1023.04	618.68	418.84	304.52	232.58	184.36
0.38	21772.16	6480.75	1929.07	949.50	574.21	388.73	282.63	215.86	170.92
0.39	20222.44	6014.46	1791.77	881.80	533.34	361.06	263.51	200.50	158.76
0.4	18795.80	5594.80	1665.36	819.70	495.72	335.59	243.99	186.35	147.56
0.41	17480.42	5203.26	1548.81	762.34	461.02	312.10	226.92	173.31	137.23
0.42	16265.85	4841.74	1441.00	709.37	428.99	290.42	211.15	161.27	127.69
0.43	15142.80	4507.44	1341.69	660.39	399.17	270.37	196.57	150.14	118.86
0.44	14103.04	4197.84	1249.57	615.05	371.95	251.80	183.08	139.83	110.72
0.45	13139.22	3911.05	1164.17	573.01	346.53	234.59	170.56	130.27	103.15
0.46	12244.76	3644.80	1084.92	534.01	322.84	218.62	158.95	121.40	96.13
0.47	11413.78	3397.45	1011.29	497.77	301.02	203.79	148.17	113.16	89.60
0.48	10649.99	3167.42	942.82	464.06	280.64	189.99	138.13	105.50	83.54
0.49	9921.64	2953.30	879.09	432.69	261.67	177.15	128.80	98.37	77.89
0.5	9251.43	2753.80	819.70	403.46	243.99	165.18	120.10	91.73	72.63
0.51	8626.50	2567.78	764.33	376.21	227.51	154.02	111.98	85.53	67.72
0.52	8043.13	2394.20	712.60	350.78	212.11	143.61	104.41	79.75	63.14
0.53	7498.75	2233.09	664.43	327.03	197.77	133.80	97.34	74.35	58.87
0.54	6989.85	2080.61	619.32	304.83	184.35	124.80	90.74	69.30	54.87
0.55	6514.01	1938.98	577.16	284.08	171.80	116.10	84.56	64.58	51.14
0.56	6066.83	1806.46	537.77	264.67	160.06	108.36	79.78	60.17	47.64
0.57	5652.13	1682.42	500.79	246.49	149.07	100.92	73.37	56.04	44.37
0.58	5261.89	1566.26	466.22	229.48	138.78	93.95	68.31	52.17	41.31
0.59	4896.28	1457.44	433.82	213.51	129.11	87.42	63.56	48.55	38.44
0.6	4553.62	1355.44	403.46	198.59	120.10	81.30	59.11	45.15	35.75
0.61	4232.38	1259.82	375.00	184.58	111.62	75.57	54.94	41.96	33.23
0.62	3931.12	1170.15	348.31	171.44	103.60	70.19	51.03	38.98	30.86
0.63	3648.55	1086.04	323.27	159.12	96.23	65.14	47.36	36.17	28.64
0.64	3383.45	1007.13	299.78	147.56	89.23	60.41	43.92	33.55	26.56
0.65	3134.73	933.09	277.75	136.71	82.67	55.97	40.69	31.08	24.61
0.66	2901.34	863.62	257.07	126.53	76.52	51.80	37.66	28.77	22.78
0.67	2682.35	798.43	237.66	116.98	70.74	47.89	34.82	26.59	21.06
0.68	2476.87	737.27	219.46	108.02	65.32	44.22	32.15	24.56	19.44
0.69	2284.09	679.49	202.39	99.61	60.24	40.78	29.65	22.65	17.93
0.7	2103.26	626.06	186.35	91.73	55.47	37.55	27.30	20.95	16.51
0.71	1933.67	575.58	171.33	84.33	51.00	34.52	25.10	19.17	15.18
0.72	1774.68	528.76	157.34	77.40	46.80	31.69	23.04	17.60	13.93
0.73	1625.68	483.90	144.04	70.90	42.88	29.03	21.10	16.12	12.76
0.74	1486.11	442.36	131.67	64.81	39.19	26.53	19.29	14.73	11.67
0.75	1355.44	403.46	120.10	59.11	35.75	24.20	17.60	13.44	10.64
0.76	1233.19	367.07	109.06	53.78	32.52	22.02	16.01	12.23	9.68
0.77	1118.90	333.05	99.14	48.80	29.51	19.98	14.52	11.09	8.78
0.78	1012.15	301.28	89.68	44.14	26.69	18.07	13.14	10.04	7.95
0.79	912.54	271.42	80.85	39.80	24.07	16.29	11.85	9.09	7.16
0.8	819.70	243.99	73.63	35.75	21.62	14.64	10.64	8.13	6.44
0.81	733.30	218.27	66.97	31.98	19.34	13.09	9.52	7.27	5.76
0.82	653.00	194.37	59.76	28.48	17.22	11.66	8.48	6.47	5.13
0.83	578.51	172.20	53.26	25.23	15.26	10.33	7.51	5.78	4.54
0.84	509.55	151.67	45.15	22.22	13.44	9.10	6.61	5.05	4.00
0.85	445.86	132.72	38.50	19.44	11.76	7.96	5.79	4.42	3.50
0.86	387.20	115.26	34.31	18.89	10.71	6.91	5.03	3.88	3.04
0.87	333.35	99.22	29.54	14.54	8.79	5.95	4.33	3.31	2.82
0.88	284.08	84.56	25.17	12.89	7.49	5.07	3.69	2.82	2.23
0.89	239.12	71.21	21.20	10.43	6.31	4.27	3.11	2.37	1.88
0.9	198.59	59.11	17.60	8.66	5.24	3.55	2.58	1.97	1.56
0.91	162.02	48.23	14.36	7.07	4.27	2.89	2.10	1.61	1.27
0.92	128.37	38.51	11.46	5.65	3.41	2.31	1.68	1.28	1.02
0.93	100.52	29.82	8.91	4.39	2.65	1.79	1.30	1.09	0.79
0.94	75.35	22.43	6.68	3.29	1.99	1.35	0.98	0.75	0.59
0.95	53.78	16.01	4.77	2.35	1.42	0.96	0.70	0.53	0.42
0.96	35.75	10.64	3.17	1.56	0.94	0.64	0.46	0.32	0.28