How To Make A DC-Current Shunt for a Digital or Analog Meter

(5/7/2007)

AWG gauge	Diameter Inches	Diameter mm	Ohms per 1000 ft	Ohms per km	Maximum amps for chassis wiring	Maximum amps for power transmission	Shunt length in Inches for 1 mv = 1 amp	Shunt length in CM for 1 mv = 1 amp
OOOO	0.4600	11.6840	0.0490	0.1607	380	302	244.898	622.200
OOO	0.4096	10.4038	0.0618	0.2027	328	239	194.175	493.330
OO	0.3648	9.2659	0.0779	0.2555	283	190	154.044	391.371
0	0.3249	8.2525	0.0983	0.3224	245	150	122.075	310.151
1	0.2893	7.3482	0.1239	0.4064	211	119	96.852	246.068
2	0.2576	6.5430	0.1563	0.5127	181	94	76.775	195.060
3	0.2294	5.8268	0.1970	0.6462	158	75	60.914	154.760
4	0.2043	5.1892	0.2485	0.8151	135	60	48.290	122.687
5	0.1819	4.6203	0.3133	1.0276	118	47	38.302	97.312
6	0.1620	4.1148	0.3951	1.2959	101	37	30.372	77.165
7	0.1443	3.6652	0.4982	1.6341	89	30	24.087	61.196
8	0.1285	3.2639	0.6282	2.0605	73	24	19.102	48.532
9	0.1144	2.9058	0.7921	2.5981	64	19	15.150	38.490
10	0.1019	2.5883	0.9989	3.2764	55	15	12.013	30.521
11	0.0907	2.3038	1.2600	4.1328	47	12	9.524	24.197
12	0.0808	2.0523	1.5880	5.2086	41	9.3	7.557	19.199
13	0.0720	1.8288	2.0030	6.5698	35	7.4	5.991	15.221
14	0.0641	1.6281	2.525	8.282	32	5.9	4.752	12.074
15	0.0571	1.4503	3.184	10.444	28	4.7	3.769	9.575
16	0.0508	1.2903	4.016	13.172	22	3.7	2.988	7.592
17	0.0453	1.1506	5.064	16.610	19	2.9	2.370	6.020
18	0.0403	1.0236	6.385	20.943	16	2.3	1.879	4.775
19	0.0359	0.9119	8.051	26.407	14	1.8	1.490	3.787
20	0.0320	0.8128	10.150	33.292	11	1.5	1.182	3.004
21	0.0285	0.7239	12.800	41.984	9	1.2	0.938	2.382
22	0.0254	0.6452	16.140	52.939	7	0.92	0.743	1.889
23	0.0226	0.5740	20.360	66.781	4.7	0.729	0.589	1.497
24	0.0201	0.5105	25.670	84.198	3.5	0.577	0.467	1.188
25	0.0179	0.4547	32.37	106.17	2.7	0.457	0.371	0.942
26	0.0159	0.4039	40.81	133.86	2.2	0.361	0.294	0.747
27	0.0142	0.3607	51.47	168.82	1.7	0.288	0.233	0.592
28	0.0126	0.3200	64.90	212.87	1.4	0.226	0.185	0.470
29	0.0113	0.2870	81.83	268.40	1.2	0.182	0.147	0.373
30	0.0100	0.2540	103.20	338.50	0.86	0.142	0.116	0.295
31	0.0089	0.2261	130.10	426.73	0.7	0.113	0.092	0.234
32	0.0080	0.2032	164.10	538.25	0.53	0.091	0.073	0.186
Metric 2.0	0.0079	0.2000	169.39	555.61	0.51	0.088	0.071	0.180
33	0.0071	0.1803	206.90	678.63	0.43	0.072	0.058	0.147
Metric 1.8	0.0071	0.1800	207.50	680.55	0.43	0.072	0.058	0.147
34	0.0063	0.1600	260.90	855.75	0.33	0.056	0.046	0.117
Metric 1.6	0.0063	0.1600	260.90	855.75	0.33	0.056	0.046	0.117
35	0.0056	0.1422	329.0	1079.1	0.27	0.044	0.036	0.093
Metric 1.4	0.0055	0.1400	339.0	1114.0	0.26	0.043	0.035	0.090
36	0.0050	0.1270	414.8	1360.0	0.21	0.035	0.029	0.074

Metric1.25	0.0049	0.1250	428.2	1404.0	0.2	0.034	0.028	0.071
37	0.0045	0.1143	523.1	1715.0	0.17	0.0289	0.023	0.058
Metric1.12	0.0044	0.1120	533.8	1750.0	0.163	0.0277	0.022	0.057
38	0.0040	0.1016	659.6	2163.0	0.13	0.0228	0.018	0.046
Metric 1	0.0039	0.1000	670.2	2198.0	0.126	0.0225	0.018	0.045
39	0.0035	0.0889	831.8	2728.0	0.11	0.0175	0.014	0.037
40	0.0031	0.0787	1049.0	3440.0	0.09	0.0137	0.011	0.029

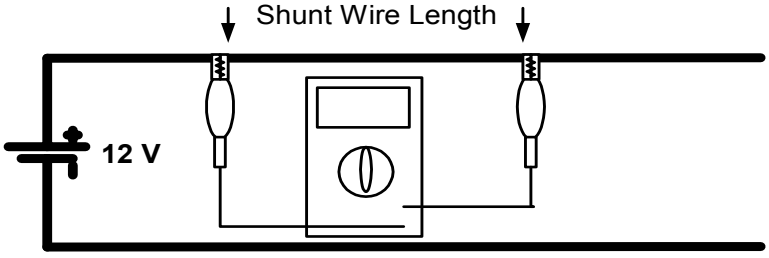
The "Shunt Length" column in the above table can be used to determine the length of cable to be used to make a heavy duty DC amp meter. The way the result works is one measures the voltage drop across a given length of the cable that is currently in use supplying the 12 volts from the battery. This voltage drop is measure ideally by use of a digital meter; however an analog meter can also be used. One mili-volt measured is equal to one amp of current. Harbor Fright tools digital meter item 90899 or equivalent can be used. These are on sale at times in the store for as low as $2.99 see http://www.harborfreight.com/

90899-2VGA
Cen-Tech

7 FUNCTION MULTI-TESTER

$9.99
$4.99

If this meter is used on the 200 mv scale then one can read in tenths of an amp up to 200 amps. For small wire sizes if one uses 10 times the length as shown in the table above then the readings will be down to one hundredth of an amp. One simply clips, solders, or clamps the volt meter leads onto the proper length of existing 12 volt supply cable.



If an analog meter is used that is close to 1 ma full scale (meter movement about 81 ohms) and planned to be used to measure 20 amps full scale instead of a digital meter, then multiply the length found above by a factor of 4. For other configurations see:
http://www.uoguelph.ca/~antoon/gadgets/shunts/shunts.html

Load Carrying Capacities (see table above)

The chart is a guideline of ampacity or copper wire current carrying capacity following the *Handbook of Electronic Tables and Formulas* for American Wire Gauge. As you might guess, the rated ampacities are just a rule of thumb. In careful engineering the insulation temperature limit, thickness, thermal conductivity, and air convection and temperature should all be taken into account. The Maximum Amps for Power Transmission uses the 700 circular mils per amp rule, which is very very conservative. The Maximum Amps for Chassis Wiring is also a conservative rating, but is meant for wiring in air, and not in a bundle. For short lengths of wire, such as is used in battery packs you should trade off the resistance and load with size, weight, and flexibility. See: http://www.powerstream.com/Wire_Size.htm This table is quite useful to print out and use as a reference.