MINIMISING VOLTAGE DROP

Low voltage power systems often operate at rather high current levels. If the interconnecting cables are too small, a large proportion of the power available will be wasted in the cable itself. This loss can be reduced by using a larger cable, but this increases costs. The acceptable maximum voltage drop for DC loads is 5% of nominal battery voltage. The chart and the formula on this page are provided to help you in selecting the best cost / power loss compromise.

Wire chart

12-volt

acceptable cable size (mm²)

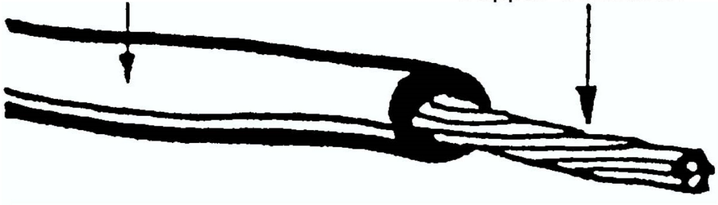
Amps	Cable Length (metres) 1	2	5	10	15	20	25	30
0.5	0.4	0.4	0.4	0.4	1.84	1.84	1.84	1.84
1	0.4	0.4	0.4	1.84	1.84	1.84	1.84	1.84
1.5	1.84	1.84	1.84	1.84	1.84	1.84	2.9	2.9
2	1.84	1.84	1.84	1.84	1.84	2.9	4.6	4.6
3	1.84	1.84	1.84	1.84	2.9	4.6	4.6	7.9
4	1.84	1.84	1.84	2.9	4.6	7.9	7.9	7.9
5	1.84	1.84	1.84	4.6	4.6	7.9	7.9	13.6
7.5	1.84	1.84	2.9	4.6	7.9	13.6	13.6	25.7
10	1.84	1.84	4.6	7.9	13.6	13.6	13.6	25.7
15	1.84	1.84	4.6	13.6	25.7	25.7	25.7	32.2
20	2.9	2.9	7.9	13.6	25.7	25.7	32.2	49.2
25	4.6	4.6	7.9	25.7	25.7	32.2	49.2	49.2
30	4.6	4.6	13.6	25.7	32.2	49.2	49.2	
40	7.9	7.9	13.6	25.7	49.2	49.2		
60	13.6	13.6	25.7	49.2				
80	25.7	25.7	25.7	49.2				
100	32.2	32.2	32.2					
125	49.2	49.2	49.2					

24-volt

acceptable cable size (mm²)

Amps	Cable Length (metres) 1	2	5	10	15	20	25	30
1	0.4	0.4	0.4	1.84	1.84	1.84	1.84	1.84
2	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
3	1.84	1.84	1.84	1.84	1.84	1.84	2.9	2.9
4	1.84	1.84	1.84	1.84	1.84	2.9	4.6	4.6
5	1.84	1.84	1.84	1.84	2.9	4.6	4.6	4.6
7.5	1.84	1.84	1.84	2.9	4.6	4.6	7.9	7.9
10	1.84	1.84	1.84	4.6	4.6	7.9	7.9	13.6
15	1.84	1.84	2.9	4.6	7.9	13.6	13.6	25.7
20	2.9	2.9	4.6	7.9	13.6	13.6	25.7	25.7
25	4.6	4.6	4.6	7.9	13.6	25.7	25.7	25.7
30	4.6	4.6	4.6	13.6	25.7	25.7	25.7	32.2
40	7.9	7.9	7.9	13.6	25.7	25.7	32.3	49.2
60	13.6	13.6	13.6	25.7	32.2	49.2	49.2	
80	25.7	25.7	25.7	25.7	49.2	49.2		
100	32.2	32.2	32.2	32.2	49.2			
125	49.2	49.2	49.2	49.2				

NOTE: The Cable Length in the above tables are route length which is half the total conductor length. If the positive and negative leads are different lengths an average must be taken.



All the methods of determining voltage drop on this page are for DC only. AC electricity behaves quite differently.

Metric cables are specified by the copper area (in square millimetres), the number of strands of wire and the number of conductors or cores in each sheath. The voltage drop is the same regardless of voltage, assuming that amps, distance and cross sectional areas are the same. If the wattage remains the same for different voltages, the amps can be calculated by dividing watts by volts.

The formula

If you need to calculate the voltage drop under a given set of circumstances, there is a formula by which it can be determined.

Let: A = cross sectional area of cable in (mm²)
L = route length in metres
I = current measured in amps
R = resistance of cable ( )

resistance of copper = 0.017   aluminium = 0.028
steel = 0.18

Voltage Drop = 2 x L x I x R ÷ A

Example:

You have a power point connected to a power source. The route length is 8 metres. If the wire is 4.6 mm² multi-stranded copper cable and the expected current is expected to be 10 amps, we have:

A = 5   L = 9   I = 10   R = 0.017

Voltage drop can then be calculated to be 0.58 volts. If this figure is considered to be acceptable it would avoid spending more money on larger wire.

mm²		per metre	30 m roll	ampacity
1.84	twin sheathed	WIR-M02	WIR-302	15 amps
2.9	twin sheathed	WIR-M03	WIR-303	20 amps
4.6	twin sheathed	WIR-M05	WIR-305	25 amps
7.9	single (black or red)	WIR-M08	WIR-308	45 amps
13.6	single (black or red)	WIR-M14	WIR-314	70 amps
25.7	single (black or red)	WIR-M25	WIR-325	90 amps
32.	single (black or red)	WIR-M32	WIR-332	110 amps
49	single (black or red)	WIR-M49	WIR-349	150 amps

NOTE: The above cables are rated for extra low voltage