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 <br> 12 Volt

| acceptable cable size $\left(\mathrm{mm}^{2}\right)$ |  |  |  |  |  |  |  |  |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Amps | 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 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

24 Volt

| Amps | cceptable cable size ( $\mathrm{mm}^{2}$ ) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 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: $\quad \mathrm{A}=$ cross sectional area of cable in $\left(\mathrm{mm}^{2}\right)$
$\mathrm{L}=$ route length in metres
$\mathrm{I}=$ current measured in amps
$\mathrm{R}=$ resistance of cable ( )
resistance of copper $=0.017 \quad$ aluminium $=0.028$ steel $=0.18$
Voltage Drop $=2 \times \mathrm{L} \times \mathrm{I} \times \mathrm{R} \div \mathrm{A}$

## Example:

You have a power point connected to a power source. The route length is 8 metres. If the wire is $4.6 \mathrm{~mm}^{2}$ multi-stranded copper cable and the expected current is expected to be 10 amps , we have:

$$
\mathrm{A}=5 \quad \mathrm{~L}=9 \quad \mathrm{I}=10 \quad \mathrm{R}=0.017
$$

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.

| $\mathrm{mm}^{2}$ |  |  | per metre |  |
| :---: | :--- | :--- | :--- | :--- |
| 30 m roll | ampacity |  |  |  |
|  | 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

