Wire Sizing Chart/Formula

This chart is useful for finding the correct wire size for any voltage, length, or amperage flow in any AC or DC circuit. For most DC circuits, particularly between the PV modules and the batteries, we try to keep the voltage drop to 3% or less. There's no sense using your expensive PV wattage to heat wires. You want that power in your batteries!

Note that this formula doesn't directly yield a wire gauge size, but rather a VDI number, which is then compared to the nearest number in the VDI column, and then read across to the wire gauge size column.

1. Calculate the Voltage Drop Index (VDI) using the following formula:
   VDI = Amps × Feet ÷ (% Volt Drop × Voltage)
   Amps = Watts divided by Volts
   Feet = One-way wire distance
   % Volt Drop = Percentage of voltage drop acceptable for this circuit (typically 2%–5%)
2. Determine the appropriate wire size from the chart below.
   A. Take the VDI number you just calculated and find the nearest number in the VDI column, then read to the left for AWG wire gauge size.
   B. Be sure that your circuit amperage does not exceed the figure in the Ampacity column for that wire size. (This is not usually a problem in low-voltage circuits.)

Example: Your PV array consisting of four Sharp 80-watt modules is 60 feet from your 12-volt battery. This is actual wiring distance, up pole mounts, around obstacles, etc. These modules are rated at 4.63 amps × 4 modules = 18.5 amps maximum. We'll shoot for a 3% voltage drop. So our formula looks like:

VDI = (18.5 A × 60 ft.) ÷ (3% × 12 V) = 30.8

Looking at our chart, a VDI of 31 means we'd better use #2 wire in copper, or #0 wire in aluminum. Hmmm. Pretty big wire.

What if this system was 24-volt? The modules would be wired in series, so each pair of modules would produce 4.4 amps. Two pairs × 4.63 amps = 9.3 amps max.

VDI = (9.3 A × 60 ft.) ÷ (3% × 24 V) = 7.8

Wow! What a difference! At 24-volt input, you could wire your array with little ol' #8 copper wire.

Wire Size (AWG)	Copper Wire		Aluminum Wire	
	VDI	Ampacity	VDI	Ampacity
0000	99	260	62	205
000	78	225	49	175
00	62	195	39	150
0	49	170	31	135
2	31	130	20a	100
4	20	95	12	75
6	12	75	—	—
8	8	55	—	—
10	5	30	—	—
12	3	20	—	—
14	2	15	—	—
16	1	—	—	—

Chart developed by John Davey and Windy Dankoff. Used with permission.