



Hi-Z App / Tech Note

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Topic: Wire Gauge sizing for control cable runs. A method for determining the voltage drop to select the minimum wire gauge to run your system correctly.

For cable runs out to 500 feet typically 18 gauge wires will be suitable. Runs out to 1000 feet, the power (13.8VDC and Ground) wires will need to be 14 gauge and the control can be 18 gauge. The actual control wires handle lower current and therefore can be a smaller gauge.

Best Practices: To have 13.8VDC at the controller. However if the voltage at the controller ≥ 12.0 this is acceptable. Best IMD performance is accomplished by being close as possible to the supply voltage source (138) as possible.

$E=IR$ (voltage drop)-- Using the chart below and the current (I) specification of the selected Hi-Z system
Sample scenario:

1. 400ft run of 18ga control cable
2. 18ga = $6.4\Omega / 1000\text{ft} = .64\Omega / 100\text{ft}$
3. $4 \times .64 = 2.56\Omega$ per run
4. Total R = both wires out and back
5. So $2.56\Omega \times 2 = 5.12\Omega$
6. Assuming 400ma, then $2.56 \times .4 = 2.04$ V drop
7. Starting at 13.8 then the E at the controller $13.8 - 2.04 = 11.76$

MILLIMETER SIZES		GAUGE	MM
	0.80 mm		
	1.00 mm	24	0.50 mm
	1.25 mm	22	0.65 mm
	1.75 mm	21	0.71 mm
	2.00 mm	20	0.80 mm
	2.40 mm	19	0.92 mm
	2.75 mm	18	1.00 mm
	3.00 mm	16	1.30 mm
	3.25 mm	14	1.63 mm
	3.50 mm	12	2.06 mm
	4.00 mm	10	2.57 mm

Bare Annealed Copper				
AWG	Dia (in.)	Circular Mils	Ohms per 1000 ft.	Lbs per 1000 ft.
10	0.1000	10000	1.00	31.43
12	0.0791	6250	1.60	19.77
14	0.0633	4000	2.50	12.43
16	0.0500	2500	4.00	7.818
18	0.0395	1563	6.40	4.917
20	0.0316	1000	10.0	3.092
22	0.0250	625	16.0	1.945
24	0.0200	400	25.0	1.223
26	0.0158	250	40.0	0.769
28	0.0125	156	64.0	0.484
30	0.0100	100	100	0.304
32	0.0079	63	160	0.191
34	0.0063	40	250	0.120
36	0.0050	25	400	0.076
38	0.0040	16	640	0.048
40	0.0032	10	1000	0.030

Table 1 - Chart of wire sizes. Circular Mils is the square of the diameter in thousandths, and is useful for comparison of the cross-sectional area of a conductor.