Determining Wire Gauge Requirements

When you are installing electronic access control systems, you need to determine the correct gauge of wire to prevent voltage drop off over long wire runs. The charts below show approximate distance/wire gauge recommendations based on voltage/amperage requirements. You need to determine the total amperage required by the equipment you are using before determining wire size.

- - - - - - - - - - - 12V AC/DC - - - - - - - - - - -

AMPS	20AWG	18AWG	16AWG	14AWG	12AWG	10AWG
.250	300'	450'	750'	1200'	2000'	3000'
.500	150'	225'	375'	600'	1000'	1500'
.750	100'	150'	250'	375'	600'	1000'
1.00	75'	100'	200'	300'	500'	800'
1.25	60'	90'	150'	240'	380'	600'
1.50	50'	80'	125'	200'	300'	500'
1.75	40'	70'	100'	170'	275'	460'
2.00	35'	60'	90'	150'	240'	400'
2.25	-	50'	80'	130'	200'	350'
2.50	-	-	75'	120'	190'	300'
2.75	-	-	70'	100'	170'	280'
3.00	-	-	60'	100'	160'	260'

- - - - - - - - - - - 24V AC/DC - - - - - - - - - - -

AMPS	20AWG	18AWG	16AWG	14AWG	12AWG	10AWG
.250	600'	900'	1500'	2400'	4000'	6000'
.500	300'	450'	750'	1200'	2000'	3000'
.750	200'	300'	500'	750'	1200'	2000'
1.00	150'	200'	400'	600'	1000'	1600'
1.25	120'	180'	300'	480'	760'	1200'
1.50	100'	160'	250'	400'	600'	1000'
1.75	80'	140'	200'	340'	550'	920'
2.00	70'	120'	180'	300'	480'	800'
2.25	-	100'	160	260'	400'	700'
2.50	-	-	150'	240'	380'	600'
2.75	-	-	140'	200'	340'	560'
3.00	-	-	120'	200'	320'	520'

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Wiring and Voltage Loss

Wiring is usually the most disregarded subject associated with electric locks. Most people use a wire gage that they are familiar with, usually 18 or 22 gage. Recently I was reminded of the importance of proper wire size. This was on a project where over 800 low voltage locks were used. The electrical contractor specified a gage wire that was sufficient for the continuous current draw but he neglected to calculate the voltage drop during the inrush cycle. This resulted in a 10 volt drop in a 24 volt circuit and the lock would not properly unlock. The original blame was put on the lock manufacturer but after expending many hours of time (and money) the truth came out: the problem was with the wiring.

I have a simple formula for figuring out the voltage drop in a given current. You take the resistance per 1000 feet of wire and multiply it by the current. This equals the voltage loss.

Gage Wire	Resistance / 1000 Feet in Ohms @ 77°F	
12 Gage	1.62	
14 Gage	2.58	
16 Gage	4.09	
18 Gage	6.51	
20 Gage	10.4	*(Figures from the Circ. 31,*
22 Gage	16.5	*U.S. Bureau of Stds.)*

Problem:
1500 ft. of 18 gage wire w/ an electric strike drawing .3A.

Formula:
Ohms x (Wire Length/1000) x Current = Voltage Drop

Equation:
6.51 x (1500/1000) x .3 Amps =

Simplified:
51 x 1.5 x .3 = 2.91 Volts

Solution:
2.91 Voltage Drop

Example:
If you have an electric strike that takes .3 amps at 24 volts, by the time you send the power out you only have 21.09 volts at the strike. This would usually fall within the tolerances of the electric strike and not be a problem. But, if you had a 12 volt electric strike at the same current and wire length, you would only have 9.09 volts at the strike which would not fall within the nominal 10%+15% variance given by most manufacturers. In this case you would only have 75% of the rated voltage needed to power the strike. Obviously its operation would be marginal.

As a rule of thumb, if you increase your wire length you must increase your wire gage. Likewise, the lower your voltage, the larger your wire gage must be. In any case you should calculate the voltage loss and make your wire selection based on your findings.

If you have any technical questions or need more information please feel free to call me or any of my sales technicians.

Sincerely,

Ray Baldwin
CEO, JLM Wholesale

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