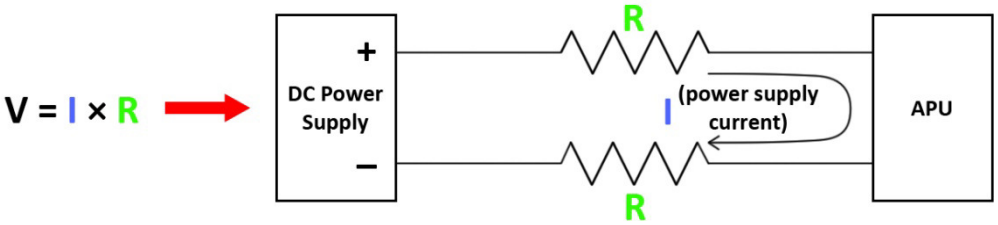
Selecting APU Power Wire

Introduction

When selecting wire for connecting a Fiber SenSys Alarm Processing Unit (APU) to a power supply, it is important to choose a wire of appropriate size; the American Wire Gauge (AWG) standardized system is used as the reference for this document. Due to the inherent resistance of electrical wire, the voltage at the load end of the wire will be lower than the voltage at the supply end. How much lower depends on the resistance and the length of the specific wire in question as well as the amount of current flowing in the circuit. In general terms, larger wire (lower AWG) will have lower resistance, and consequently less voltage drop will occur.

The National Electrical Code (NEC) has safety requirements for ampacity, related to the maximum allowable current that can safely flow through wire of a particular gauge and type before heating of the wire becomes a fire hazard. However, since our APUs are relatively low power devices, this is not an issue assuming that each APU is powered with its own, separate pair of wires. And while the NEC makes recommendations in the form of "Fine Print Notes" regarding voltage drop in power supply wiring (maximum drop of 5% of nominal, for example), these are not safety issues and therefore are not regulated by the code. For the low DC voltages and currents involved in powering our APUs, the only real consideration is that the voltage across the APU power terminals must be greater than or equal to the minimum required operating voltage. There may be site-specific requirements such as regulatory agency compliance issues or telecom installer guidelines that might override the recommendations presented here. However, the solutions provided here meet NEC safety requirements and will allow proper APU operation in all circumstances.

The recommendations in the table below are based upon several assumptions. First, the chart uses the resistance value of typical copper wire at a temperature of 75°C (167°F). Second, each APU is powered with its own, separate pair of wires – the power supply wiring is not run in parallel (daisy-chained) for multiple APUs. Third, the minimum operating voltage of all APUs referenced in the chart is 11 VDC. Finally, since power supply wiring consists of two conductors that are usually of equal length (each having its own voltage drop), the Connection Distance shown takes that into account by halving the distance generated by the voltage drop calculation. Note that the basis for the calculations is Ohm's Law:



The voltage drop (V) across each leg of the wiring is equal to the power supply current (I) flowing in the wire multiplied by the wire's resistance (R).

From the chart below you can see that the use of larger gauge wire will allow for greater distance between the power supply location and the APU location. It may be used as a guideline for selecting the appropriate wire gauge. When compiling the chart this calculator was used (Click on URL to follow link):

Advance Voltage Drop Calculator and Voltage Drop Formula. Electrical Technology. Pub. 12/08/2014. Web. 3 Feb. 2016. <http://www.electricaltechnology.org/2014/12/advance-voltage-drop-calculator-voltage-drop-formula.html>.

Reference Chart

	300 Series Alarm Processors		FD525 Alarm Processor	
	Max 4 Watts Power Consumption (current=.33A @ 12VDC, .17A @ 24VDC)		Max 18 Watts Power Consumption (current=1.5A @ 12VDC, .75A @ 24VDC)	
	Wire Size	Maximum Connection Distance in Feet	Wire Size	Maximum Connection Distance in Feet
12 VDC Power Supply	22 AWG	38	22 AWG	8
	20 AWG	60	20 AWG	13
	18 AWG	100	18 AWG	21
	16 AWG	155	16 AWG	33
	14 AWG	250	14 AWG	55
24 VDC Power Supply	22 AWG	988	22 AWG	220
	20 AWG	1575	20 AWG	350
	18 AWG	2500	18 AWG	557
	16 AWG	3950	16 AWG	885
	14 AWG	6325	14 AWG	1400

Conclusion

After connecting the power supply to the APU you should verify the voltage across the APU's power terminals. This can be done by using a voltmeter on the power input pins of the terminal block. For 300 Series processors it is also possible to check the input power voltage using the "STATUS" command in the SpectraView software. The process of checking the status can be found in an earlier Tech Tip "Using the STATUS Function to Troubleshoot Your FSI System" found at FiberSenSys.com. Using either of these methods, verify that the voltage received at the APU **while it is powered on** is within the appropriate range (11-24 VDC).

If you need further information regarding voltage drop calculations or resistance values of alternative wire types there are many online resources and voltage drop calculators available. Please contact Fiber SenSys technical support at +1 (503) 726-4455 or support@fibersensys.com for any technical assistance.

For more information, contact us:
info@fibersensys.com
Tel: +1(503)692-4430
Toll free (US) +1(800)641-8150
www.fibersensys.com

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