SYMETRIX SOLUTIONS: TECH TIP

May 2015

ARC Network Design

The Purpose of this Tech Tip is to provide information regarding ARC Network Design. This document will provide an overview of how to use the "ARC Power Calculator" to determine if the cable segments and number of ARC controllers will work in a system design. This document will also cover the maximum cable segment length limitations for ARC power over CAT-5 cable, and maximum number of ARC expansion units per modular ARC base unit.

ARCs can be daisy-chained and fed power from the REMOTE ARC ports of an ARC-PSe, SymNet DSP, Jupiter or Zone Mix 761 products. As the length of the cable increases so does the resistive line loss, which lowers the voltage available at each subsequent ARC. The actual power drain on each ARC output can vary substantially depending on the number of ARCs and the distance between them.

In order to assist with system design, Symetrix has made available a Microsoft Excel spreadsheet to help system designers determine power requirements based upon cable length, number of ARCs, and the power supply to be used. This spreadsheet can be downloaded from the Technical Support pages at:

http://www.symetrix.co/downloads/arc-power-calculator/

The following table provides at-a-glance cable length limitations based on DC power (the table is not relevant if only RS-485 is distributed) and assumes 24 gauge CAT5 cabling. The lengths shown on the table for multiple ARCs on a single chain assume equal distance for each cable segment between ARCs.

CABLE SEGMENT LENGTH LIMITATIONS FOR ARC POWER OVER CAT-5 CABLE				
	ARC TYPE			
Number of ARC's on chain	ARC-3	ARC-2e	ARC-K1e	ARC-SW4e
1	3000'	3000'	3250'	3250'
2	1100'	1200'	3000'	3000'
3	550'	700'	1250'	1250'
4	200'	250'	400'	400'

The table is intended for quick reference only. For more detailed configuration scenarios including expansion ARCs, use "ARC Power Calculator"

http://www.symetrix.co/downloads/arc-power-calculator/

Special note: for multiple ARCs on single chain, the listed value is assumed to be the cable length between each device. For example, a value of 600' means 600' between the DSP unit and the first ARC, 600' between the first and second ARCs, etc. The total cable length will be the listed segment length multiplied by the number of ARCs on the chain.

MAXIMUM NUMBER OF ARC EXPANSIONS UNITS POSSIBLE PER MODULAR ARC BASE UNIT	
MODULAR ARC BASE UNIT	ARC-EX4e
ARC-K1e	4
ARC-SW4e	3
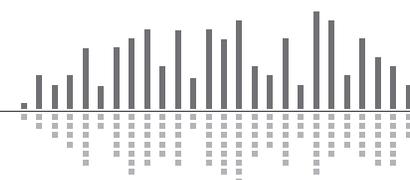
Below are instructions on how to use the "ARC Power Calculator"

Note: Parameters that can be adjust are highlighted in yellow

1. Select the device that will be supplying power to the ARC chain (i.e. SymNet Express, Jupiter, or ARC-PSe).

	A	B	C	D	E	F	G
1	**Go to Instructions**			Note: Editable values are highlighted in yellow.			
2							
3	**Powering Device**	**SymNet Edge**		24V, 500 mA)			
4	Custom power supply rating:			24 Volts		mA	
5	**Defaults**						
6	**ARC-Audio lines**	Not grounded					
7	**Power Supply Voltage**			24 Volts			
8	**24 AWG Cable Resistance**			28 Ω / 1000'			
9	**26 AWG Cable Resistance**			41 Ω / 1000'			
10	**28 AWG Cable Resistance**			75 Ω / 1000'			
11	*Note: Most CAT-5 cable uses 24AWG conductors.*						

2. Based on how many ARCs are in each chain (1-8), use the appropriate section on the spreadsheet.

	2 ARCs on the chain							
46				**ARC #1:**			**ARC #2:**	
47			Cable	*Type:* ARC-2e	Cable		*Type:* ARC-2e	
48			24 AWG	*Exp. Panels:*	24 AWG		*Exp. Panels:*	
49	AWG of CAT5 cable	**SymNet Edge**	100		50			
50	Length of cable (feet)							
51				**OK**			**OK**	
52								
68	Total cable length (feet)	150						
69	Total power to chain (W)	2.72						
70	Total ARC power (W)	2.67						
71	Total "wasted" power (W)	0.04						
72	Total current to chain (mA)	113	**OK**					

	3 ARCs on the chain									
74				**ARC #1:**			**ARC #2:**			**ARC #3:**
75			Cable	*Type:* ARC-2e	Cable		*Type:* ARC-2e	Cable		*Type:* ARC-2e
76			24 AWG	*Exp. Panels:*	24 AWG		*Exp. Panels:*	24 AWG		*Exp. Panels:*
77	AWG of CAT5 cable	**SymNet Edge**	100		50			50		
78	Length of cable (feet)									
79				**OK**			**OK**			**OK**
80										
96	Total cable length (feet)	200								
97	Total power to chain (W)	4.13								
98	Total ARC power (W)	4.01								
99	Total "wasted" power (W)	0.12								
100	Total current to chain (mA)	172	**OK**							

3. Select the type of ARC from the drop-down menu. (e.g. ARC-3, ARC-2e, ARC-K1e, or ARC-SW4e)

	1 ARC on the chain			
18				
19				**ARC #1:**
20			Cable	*Type:* ARC-2e
21	AWG of CAT5 cable	**SymNet Edge**	24 AWG	*Exp. Panels:*
22	Length of cable (feet)		100	
23				**OK**
24				
40	Total cable length (feet)	100		
41	Total power to chain (W)	1.35		
42	Total ARC power (W)	1.34		
43	Total "wasted" power (W)	0.01		
44	Total current to chain (mA)	56	**OK**	

4. For modular ARCs, also select the number of add-on EX4e panels in use. For standard configurations without add-ons, leave this set to zero.

	1 ARC on the chain			
17				
18				
19				**ARC #1:**
20			Cable	*Type:* ARC-K1e
21	AWG of CAT5 cable	**SymNet Edge**	24 AWG	*Exp. Panels:* 1
22	Length of cable (feet)		100	
23				**OK**
24				
40	Total cable length (feet)	100		
41	Total power to chain (W)	0.98		
42	Total ARC power (W)	0.98		
43	Total "wasted" power (W)	0.01		
44	Total current to chain (mA)	41	**OK**	
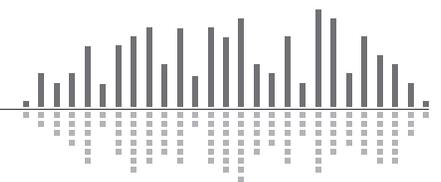
5. Enter the length of cable in feet between the powering device (e.g. SymNet Express, Jupiter, or ARC-PSe) and the ARC, and between each additional ARC under "Cable".

73											
74	**3 ARCs on the chain**										
75					ARC #1:			ARC #2:			ARC #3:
76			Cable	Type: ARC-2e		Cable	Type: ARC-2e		Cable	Type: ARC-2e
77	AWG of CAT5 cable	SymNet Edge	24 AWG	Exp. Panels:		24 AWG	Exp. Panels:		24 AWG	Exp. Panels:
78	Length of cable (feet)		100			50			50	
79				OK			OK			OK
80										
96	Total cable length (feet)	200								
97	Total power to chain (W)	4.13								
98	Total ARC power (W)	4.01								
99	Total "wasted" power (W)	0.12								
100	Total current to chain (mA)	172	OK							

- For those working in the metric system, a feet/meters conversion calculator is available at the bottom of the page in the Main tab.

135					
136	**Feet/Meters Conversion**				
137	Enter meters:	100	meters	328.1	feet
138	Enter feet:	300	feet	91.44	meters
139					

6. Choose the wire gauge of the cable from the drop-down list under "Cable" (Most but not all CAT-5 cable uses 24AWG conductors. This information is often printed on the cable itself. If not, see the cable manufacturer's data sheet for more information.)

7. If the selected configuration will work each ARC will display "OK". If not it will display "Won't Work" or another error message. If it doesn't work, decrease cable lengths, number of ARCs and/or wire gauge. Or see other ideas in the "Solutions" section of the Instructions tab.

101															
102	**4-8 ARCs on the chain**														
103				ARC #1:		ARC #2:		ARC #3:		ARC #4:		ARC #5:			
104			Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: None		
105	AWG of CAT5 cable	SymNet Edge	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:		
106	Length of cable (feet)	100		50		50		50		0				
107											empty			
108				OK		OK		OK		OK				
125	ARCs Selected	4												
126	Total cable length (feet)	250												
127	Total power to chain (W)	5.60												
128	Total ARC power (W)	5.36												
129	Total "wasted" power (W)	0.24												
130	Total current to chain (mA)	233	OK											

101															
102	**4-8 ARCs on the chain**														
103				ARC #1:		ARC #2:		ARC #3:		ARC #4:		ARC #5:			
104			Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: ARC-2e	Cable	Type: None		
105	AWG of CAT5 cable	SymNet Express	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:	24 AWG	Exp. Panels:		
106	Length of cable (feet)	100		50		50		50		0				
107			Max Current Exceeded		Max Current Exceeded		Max Current Exceeded		Max Current Exceeded		empty			
108														
125	ARCs Selected	4												
126	Total cable length (feet)	250												
127	Total power to chain (W)	5.47												
128	Total ARC power (W)	4.88												
129	Total "wasted" power (W)	0.60												
130	Total current to chain (mA)	365	ERROR											