

Thermal performance of Single Pair Cables and Connectors

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- Wayne Hopkinson affiliated with CommScope who did the measurements and modelling of 1-pair cables and connectors

Current capacity (mA per conductor) of single pair cables of different conductor diameters in air and conduit for a 37 cable bundle for different Temperature rise (°C)

Trise	0,32(28AWG)		0,40(26AWG)		0,51(24AWG)		0,57(23AWG)		0,65(22AWG)		0,81(20AWG)		1,02(18AWG)	
	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit
2	307	262	384	327	490	417	548	466	624	532	779	663	981	835
4	435	370	543	463	693	590	775	660	883	753	1101	938	1387	1181
6	533	454	666	567	849	723	949	808	1082	922	1349	1149	1699	1446
8	615	524	769	655	981	835	1096	933	1249	1065	1558	1327	1962	1670
10	688	586	860	732	1096	934	1225	1044	1397	1190	1742	1484	2194	1867
12	753	642	942	802	1201	1023	1342	1143	1530	1304	1908	1625	2403	2046
14	814	693	1017	867	1297	1105	1450	1235	1653	1409	2061	1755	2596	2210
16	870	741	1087	926	1387	1181	1550	1320	1767	1506	2203	1877	2775	2362
18	923	786	1153	983	1471	1253	1644	1400	1874	1597	2337	1991	2943	2506
20	973	829	1216	1036	1551	1321	1733	1476	1976	1684	2463	2098	3102	2641

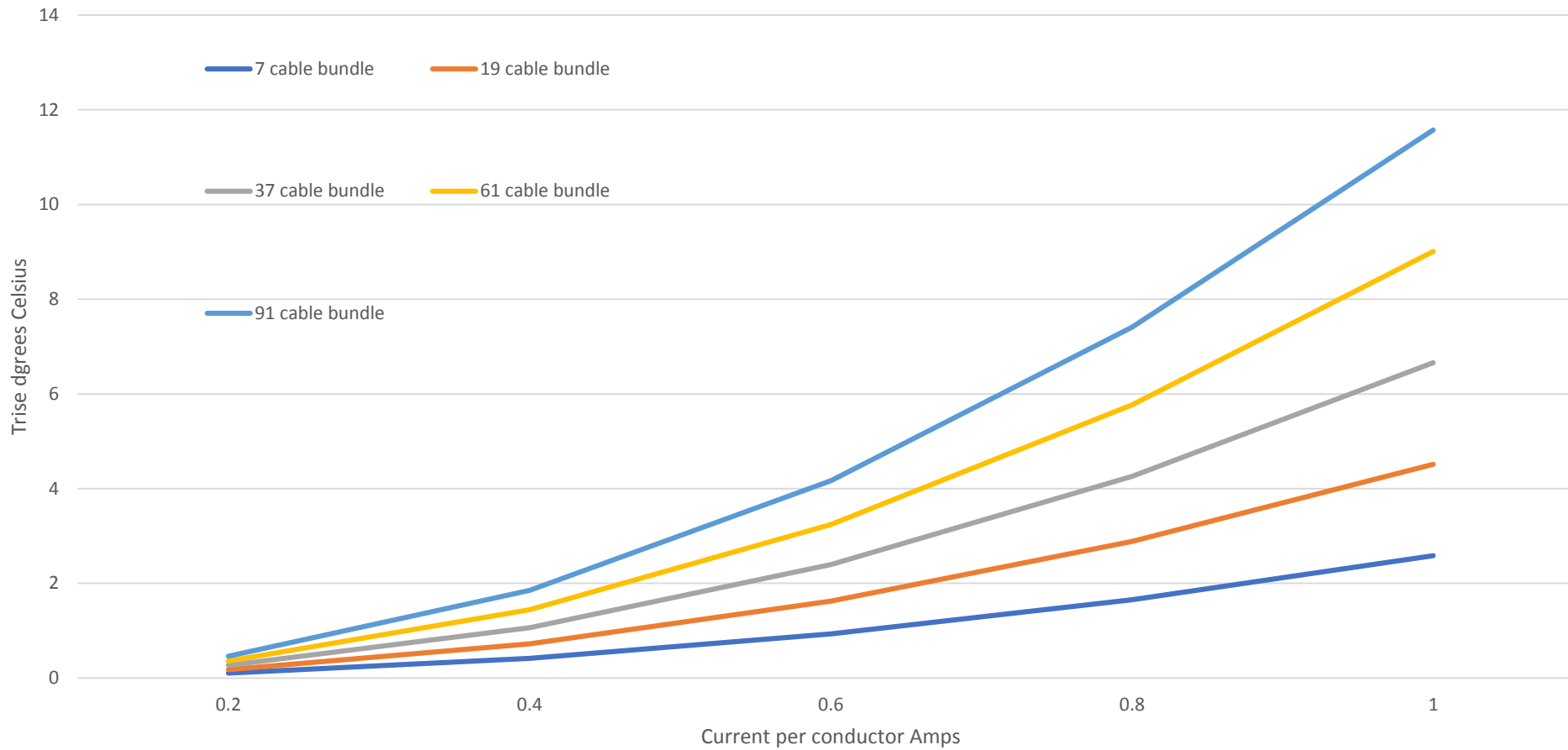
Current capacity (mA per conductor) of single pair cables of different conductor diameters in air ONLY for a 19 cable bundle for different Temperature rise (°C)

Trise	0,32(28AWG)		0,40(26AWG)		0,51(24AWG)		0,57(23AWG)		0,65(22AWG)		0,81(20AWG)		1,02(18AWG)	
	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit
2	373		467		595		665		759		946		1191	
4	528		660		842		941		1073		1338		1685	
6	647		809		1032		1153		1314		1639		2064	
8	747		934		1191		1331		1518		1892		2383	
10	835		1044		1332		1488		1697		2115		2664	
12	915		1144		1459		1630		1859		2317		2919	
14	989		1236		1576		1761		2008		2503		3153	
16	1057		1321		1685		1883		2147		2676		3370	
18	1121		1401		1787		1997		2277		2838		3575	
20	1182		1477		1884		2105		2400		2992		3768	

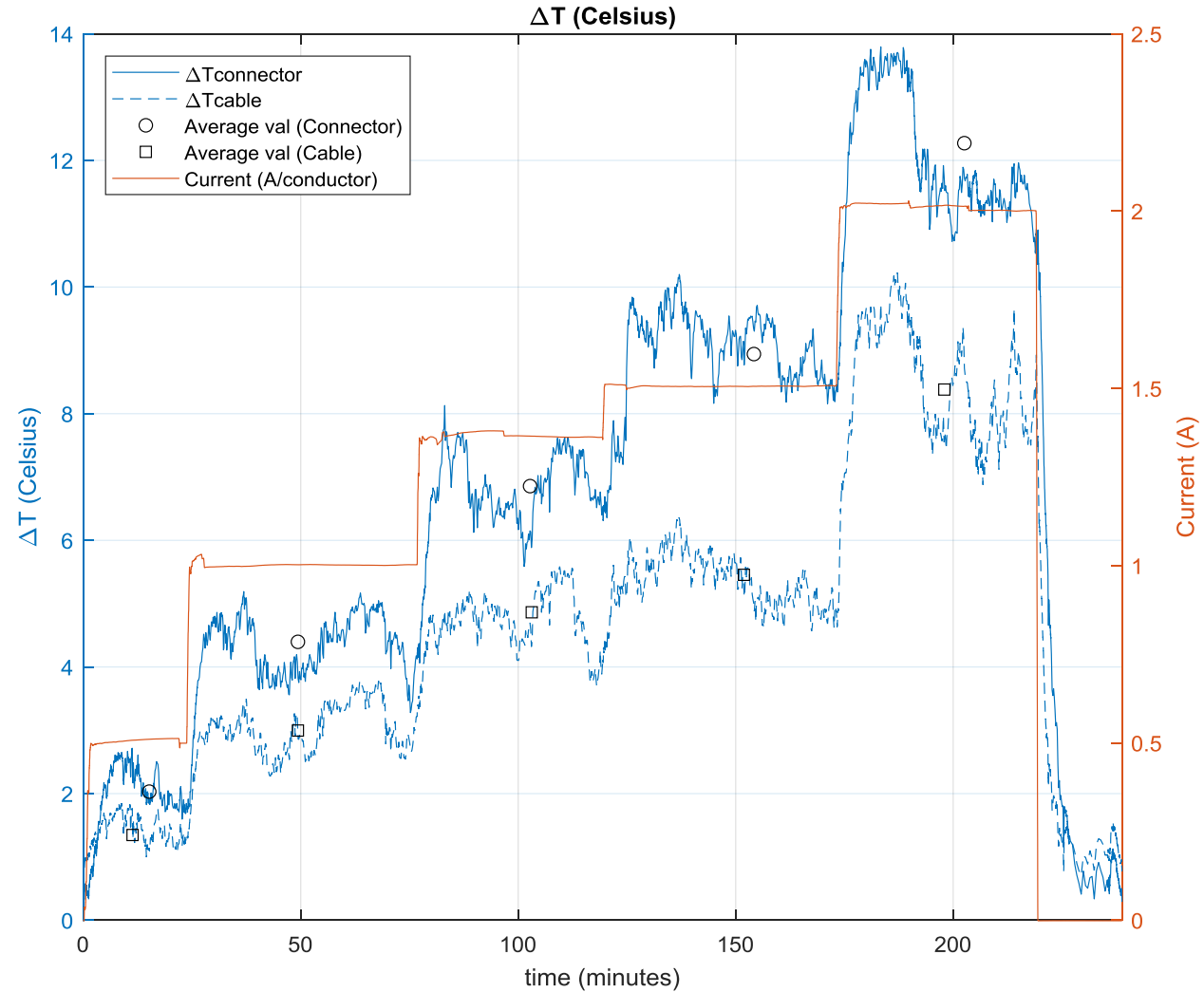
Temperature rise (°C) of single pair cables of different conductor diameters at 1 A per conductor

Number of cables	One Pair cables (conductor diameter mm)						
	0,32 (28AWG)	0,40 (26AWG)	0,51(24AWG)	0,57(23AWG)	0,65(22AWG)	0,81(20AWG)	1,02(18AWG)
1	2.9	1.9	1.1	0.9	0.7	0.5	0.3
7	8.2	5.2	3.2	2.6	2.0	1.3	0.8
19	14.3	9.2	5.6	4.5	3.5	2.2	1.4
24	16.4	10.5	6.4	5.2	4.0	2.6	1.6
37	21.1	13.5	8.3	6.7	5.1	3.3	2.1
48	24.7	15.8	9.7	7.8	6.0	3.9	2.4
52	25.9	16.6	10.2	8.2	6.3	4.0	2.5
61	28.6	18.3	11.3	9.0	6.9	4.5	2.8
64	29.4	18.8	11.6	9.3	7.1	4.6	2.9
74	32.2	20.6	12.7	10.2	7.8	5.0	3.2
91	36.7	23.5	14.5	11.6	8.9	5.7	3.6
97	38.2	24.5	15.1	12.1	9.3	6.0	3.8
100	39.0	25.0	15.4	12.3	9.5	6.1	3.8
127	45.5	29.1	17.9	14.3	11.0	7.1	4.5
169	54.9	35.2	21.6	17.3	13.3	8.6	5.4

1-pair T-rise vs. current for 23 AWG (0.57 mm) bundle sizes 7 to 91 in air



Thermal Performance up to 2 A per conductor for IEC 63171-1 connector



Summary

- **Single** IEC 61156-11 compliant 23 AWG (0.57 mm) 1-pair cables can support 2 A per conductor with a temperature rise of ~ 10 C
- **Single** IEC 63171-1 compliant LC Style connectors can support 2 A per contact with a temperature rise of ~ 12 C
- 19 cable bundles of 23 AWG single pair cables with 1 A per conductor will have a temperature rise of ~ 4 C
- IEEE 802.3SPMD should consider an architecture with 10 to 20 23AWG (0.57 mm) cables per bundle to make temperature rise insignificant
- Assuming 32 nodes per cable, this still allows the bundle to support up to 640 powered devices per bundle with **~ 2 watts per device with 57 V at PSE**