
Addendum
Telecommunications Systems Bulletin TSB-184
Guidelines for Supporting Power Delivery
Over Balanced Twisted-Pair Cabling

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Background

- Power delivery over BASE-T PHYS with specified operation over TIA/ISO cabling
 - 802.3af, 802.3at, 802.3bt
- Coordination with TIA/ISO cabling committees on power delivery - 802.3af and 802.3at
 - TSB-184
Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling

Purpose

- Review TIA-184 - Publication: July 2009
- Review TIA-184 addendum

Telecommunications Systems Bulletin (TSB)-184

- Guidelines to support safety extra low voltage (SELV*) limited power source (LPS) applications using remote power supplied over balanced twisted-pair cabling.
 - 802.3af, 802.3at
 - TIA-862 building automation and security devices
 - Remote cameras
 - IP telephone
 - Multimedia devices supported by IEEE Std 1394-2008.
- Environmental conditions related to the installed cabling,
 - bundled cabling, cabling in conduit, different cabling categories and cable types
- Parameters needed for remote powering;
- References to safety standards;
- Different installation conditions that require special considerations;
- Application considerations;
- Mitigation considerations; and
- cabling configurations and related field test considerations

*SELV power as defined in IEC 60950-1.

TSB-184 - Summary contents

4 Configuration, structure and topology

4.1 General

4.1.1 End-point DCPS

4.1.2 Mid-span DCPS

4.2 Functional elements

4.3 Cabling topology

5 Cabling selection and performance

6 Installation guidelines

6.1 General

6.2 Ambient temperature

7 Transmission requirements

7.1 dc loop resistance

7.2 dc resistance unbalance

8 Remote powering configurations and related transmission performance

8.1 Recommendations for cabling system for use with end-point DCPS

8.2 Recommendations for cabling systems with mid-span DCPS

8.2.1 Mid-span DCPS with no continuity on power insertion pairs (case I)

8.2.2 Mid-span DCPS with ac continuity on all pairs (case II)

8.3 Additional field test considerations

Annex A (informative) – Additional installation guidelines

A.1 General

A.2 Minimum cabling category

A.3 Temperature rise and current capacity

A.4 Measurement results for current capacity

A.5 Considerations for current capacity of category types and installation conditions

TSB-184 Annex A

- TSB-184 Annex A - Additional installation guidelines supporting the delivery of power over installations of category 5e, category 6 or category 6A cabling.
- Maximum current capacity guidelines in this document ensures that balanced twisted-pair cabling installations meeting the installation requirements of ANSI/TIA-568-C.1 and the requirements for pathways and spaces in ANSI/TIA-569-B, will function properly for data and remote power delivery.
- No additional spacing or separation requirements are needed for the cabling that is supporting power delivery.

Temperature rise and current capacity

- Temperature of the cabling will rise due to heat generation of the conductors. Heat will dissipate (generally) until a steady state is reached with the temperature of the cable bundle higher than the ambient temperature of the surrounding environment.
- The temperature of any cable should not exceed the temperature rating for the cable. Generally, cables used in commercial premises have a temperature rating of 60 °C.

Current capacity per pair - 100 cable bundle

Table A.1 - Current capacity per pair for a 100-cable bundle

Temperature rise (°C)	Current capacity (mA)		
	Category 5e	Category 6	Category 6A
0.0	0	0	0
1.0	190	208	223
2.0	268	294	318
3.0	329	360	387
4.0	380	418	447
5.0	424	465	499
6.0	465	509	547
7.0	502	550	591
7.5	520	568	612
8.0	537	588	632
9.0	569	624	670
10.0	600	657	708
11.0	629	689	741
12.0	657	720	774
12.5	671	735	790
13.0	684	749	805
14.0	710	778	838
15.0	735	805	865

- Closed form equation is provided to calculate the maximum current per pair given ambient temperature (t).

$$I_t = \rho \times 10^3 \times (1 - t/60)^{0.5} \text{ mA}$$

ρ factors for equation

Category 5e	Category 6	Category 6A
1.47	1.61	1.73

Ambient temp	I _t Cat5e ma	I _t Cat6 ma	I _t Cat6A ma
25	1122.73	1229.66	1321.31
30	1039.45	1138.44	1223.29
35	948.88	1039.25	1116.71
40	848.70	929.53	998.82
45	735.00	805.00	865.00

- TSB-184 specifies 15°C as the maximum allowed temperature rise above ambient. Given a cable temperature rating of 60 °C and ambient temperature's above 45 °C.
- A table of maximum current per pair that can be supported by category 5e, 6 and 6A cabling without exceeding the cable temperature is provided.

Additional Installation Considerations

- Additional guidance for situations where installed cabling conditions differ from assumptions used above that include;
 - a maximum allowable temperature rise of 15 °C (max ambient of 45 °C)
 - a bundle size of 100 cables
 - power delivery on all four pairs.
- Cable bundle count >100 cables

Temperature rise for a category of cable v. cable bundle size (720mA per pair)

Number of cables	Temperature rise (°C)		
	Category 5e	Category 6	Category 6A
1	1.1	0.9	0.8
7	2.0	1.6	1.4
19	3.8	3.0	2.6
37	6.7	5.3	4.6
61	9.9	7.9	6.9
91	13.9	11.1	9.6
127	18.8	15.0	13.0
169	24.3	19.4	16.8

NOTE - The temperature rise (°C) is based upon a current of 720 mA per pair, for all pairs in all cables in the bundle.

Additional Installation Considerations

- Energizing the number of pairs within a 100 cable bundle for different cabling categories.
- The temperature rise for applications delivering 600 mA on two pairs of each cable in a 100-cable bundle of category 5e is 5 °C.

Temperature rise for category of cable vs. number of energized pairs in 100-cable bundle (600 mA per pair)

Number of pairs	Temperature rise (°C)		
	Category 5e	Category 6	Category 6A
24	0.6	0.5	0.4
48	1.2	1.0	0.8
96	2.4	2.0	1.7
144	3.6	3.0	2.6
192	4.8	4.0	3.5
200	5.0	4.2	3.6
236	5.9	4.9	4.2
284	7.1	5.9	5.1
332	8.3	6.9	6.0
380	9.5	7.9	6.8
400	10.0	8.3	7.2

NOTE - The temperature rise (°C) is based upon a current of 600 mA on each energized pair.

Telecommunications Systems Bulletin (TSB)-184-A

- Project Request – June 13, 2014
- Scope Summary:
 - Revise TIA TSB-184 to include considerations for 4-Pair PoE and higher current.
 - The update will focus on increased current levels (up to 1A per pair), specific use cases and installation condition considerations.
 - Examples of the installation conditions to be considered are delivery systems such as conduit, cable tray, and through fire stops.
 - Other areas will include expanding the recommendations on cable bundle sizes, bundling of patch cords, additional cable types and mixing of cable type bundles.

TSB-184-A - Summary contents

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4.2 Functional elements

4.3 Cabling topology

5 Cabling selection and performance

6 Installation guidelines

6.1 General

6.2 Ambient temperature

7 Transmission requirements

7.1 dc loop resistance

7.2 dc resistance unbalance (within pair)

7.3 dc resistance unbalance (pair to pair)

8 Remote powering configurations and related transmission performance

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8.3 Additional field test considerations

Annex A (informative) – Additional installation guidelines

A.1 General

A.2 Minimum cabling category

A.3 Temperature rise and current capacity

A.4 Measurement results for current capacity

A.5 Considerations for current capacity of category types and installation conditions

DC resistance unbalance (pair to pair)

- TR42.7 investigation to characterize Category 5e, Category 6, Category 6A to include in addendum. 1000's of channel measurements contributed from multiple cabling manufacturers to 3rd party (ETL) for independent analysis.
 - cable, connecting hardware, channel

Current capacity per pair - 100 cable bundle

- The current capacity per pair for different temperature rises in 100-cable bundles of No. 26 AWG, category 5e, 6 and 6A, and 8 cables with all four pairs energized included.
- Closed form equation provided to calculate the maximum current per pair given ambient temperature (t).

Temperature rise vs cable bundle size

- Guidelines to determine the maximum temperature rise and associated current capacity for cable bundles of different counts (than 100) for Category 5e, 6, 6A, 8 for 720 ma per pair and 1000 ma per pair.

Considerations for current capacity of category types and installation conditions

A.5.1 Maximizing current capacity

Information on cable bundle count and cabling category that should be considered in order to support the highest possible current within the constraints of this TSB.

A.5.1.1 Cable bundle count

A.5.1.2 Cabling category

A.5.1.3 Limiting cable bundle size

A.5.1.4 Mixing cable categories within a bundle

A.5.2 Temperature rise considerations

Summary

- Review TIA-184 - Publication: July 2009
- Review TIA-184 addendum