# IEEE 802.3 Ethernet Working Group
# DRAFT Liaison Communication

Source: IEEE 802.3 Working Group[1]

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Subject: Reply to Incoming Liaison JTC 1/SC 25/WG 3 N 1330

Approval: Agreed to at IEEE 802.3 Working Group meeting, Teleconference, 18 May 2023

Dear Dr. Oehler,

We would like to thank you for your liaison communication JTC 1/SC 25/WG 3 N 1330. We notice that you ask for information on three separate points:

- predicted average lengths of installed cabling and length expectations for 1 pair remote powering
- cabling structures, e.g., connected via plug or fixed cabling
- use cases for 1 pair remote powering, especially applications requiring 2 A

[1] This document solely represents the views of the IEEE 802.3 Working Group and does not necessarily represent a position of the IEEE, the IEEE Standards Association, or IEEE 802.

We will address the three of these separately.

For predicted average lengths, IEEE 802.3 does not specify lengths of cabling for powering, but instead specifies the loop resistance. Because we do not specify the construction of cabling, including such factors as the gauge and materials of the wiring, these are not directly translatable to length. Furthermore, we specify a maximum resistance and therefore do not have information to offer you on average lengths of cable used for 802.3 powering applications. We would appreciate WG3's assistance in providing generic cabling specifications to meet the loop resistance specifications found in Clause 104 of IEEE Std 802.3-2022.

Regarding cabling structures, generally IEEE 802.3 looks to other standards bodies, including ISO/IEC JTC 1/SC 25/WG 3, to define the construction and structure of the cabling. However, any link segment which meets the performance requirements specified in IEEE Std 802.3 would be compliant. The cabling technology used to implement IEEE 802.3 systems can vary substantially by use case. For example, the IEEE P802.3dg Task Force has recently seen discussions of the construction of special purpose cabling used in motor control applications which is significantly different than the generic cabling we might normally consider. One can see that our constructions could be very broad ranging.

Industry groups outside of IEEE 802.3 and ISO/IEC JTC1/SC 25/WG 3 are incorporating SPE technologies into their own application specifications. One significant application adopting IEEE 802.3 10BASE-T1L specifications is the Ethernet-APL[2] specification. Ethernet-APL has a Port Profile specification. Annex A, "Connectors", line 600, Table A.2 – Electrical requirements terminal block / connector requires a minimum current rating per contact of 4 amps. This current rating is uniform for screw/compression terminals, M8, and M12 connectors. https://library.fieldcommgroup.org/10186/TS10186/1.1/#page=30

For use cases, we offer several sources to consider.

1) Please find the 'use case library' compiled by the Single Pair Multidrop Study Group: https://www.ieee802.org/3/SPMD/usecase/SPMD_Usecase_Library.pdf. The consensus is the use cases listed on slide two of the presentation are generally applicable to point-to-point cases in addition to multidrop use cases.

2) The 802.3cg Task Force compiled use cases and these are available on the archived site:

https://www.ieee802.org/3/cg/public/Jan2017/10SPE_Powering_Use_Cases_BV.pdf

https://www.ieee802.org/3/cg/public/Jan2017/Graber_10SPE_09a_0117.pdf

3) SPE Client Device Power Demand for Building Automation: Network edge devices are expected to transition away from legacy protocols and local power to SPE. In many cases, these devices can demand greater than 500 milliamps to function. Building automation practitioners find the need for higher power in devices like a VAV box, an HVAC zone level flow control that uses a damper/automated actuator to control conditioned air delivered to a controlled space. Another high-power building automation application is LED lighting where both power for illumination and control power must be provided by the SPE connection. An examination of some of these building automation use cases can be found at: https://www.ieee802.org/3/cg/public/May2017/herbst_3cg_01a_0517.pdf.

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[2] Ethernet APL is maintained by FieldComm Group, ODVA Inc., OPC Foundation, PROFIBUS & PROFINET International. The APL standards are proposed as IEC standards.

4) Use cases are available from the Ethernet-APL Engineering Guideline:
https://www.ethernet-apl.org/wp-content/uploads/APL-Engineering-Guideline-V114_1.14.pdf

Page 39, Paragraph 4.3.3 Power classes, states "The power class describes the amount of power that a source port can drive, or a load port sinks. Table 4-5 shows the APL power classes and permitted combinations." Note that Power class 3 and 4 require 57.5W @ 46 VDC min (1.25 amps) and 92 W @ 46 VDC min (2.0 amps) respectively.

5) SPE Client Device Power Demand for Industrial: Many network edge devices are today controlled by legacy protocols and powered by local 24 VDC power sources. Regulations and practices in both the industrial environment and commercial building environment specify 30V or less as the maximum voltage in many use cases. As these devices are modernized and SPE is adopted, the consumer expectation is that both power and data will be transmitted, eliminating the need for local power supplies. Given the low voltage of the power source (and therefore the low input voltage of the load), current levels are significantly increased to deliver the required amounts of power. Examples of these applications are devices like linear actuators where power is required for both control and motive force or remote I/O where the device often services analog outputs like 4-20 milliamps. Known applications have driven SPE powering levels above 500 milliamps for classes 12, 14, and 15 (Table 104-1a – Class power requirements matrix for PSE, PI, and PD for classes 10-15, IEEE 802.3cg-2019). Industry expectations indicate requirements as high as 2 amps will be required to meet application demands.

6) A presentation was given to the IEEE 802.3 PDCC Ad Hoc on 29 March 2023:
https://www.ieee802.org/3/ad_hoc/PDCC/public/graber_PDCC_01_03292023.pdf

These are a representative of the use cases noted by IEEE 802.3. Some of these use cases may not be appropriate for ISO/IEC JTC1/SC 25/WG 3, and we look to the Working Group for guidance as to which of these falls within their scope.

As you should gather from the use cases presented in the examples, current capacity greater than 0.75A is well represented for Single Pair Ethernet remote powering. IEEE 802.3 continues to request that ISO/IEC JTC1/SC 25/WG 3 provides generic cabling standards that supports higher current carrying capacity.

Thank you for your continued collaboration with the IEEE 802.3 Working Group.

Sincerely,

David Law

Chair, IEEE 802.3 Ethernet Working Group