SPE Multidrop Enhancements
Mixing Segment Considerations
Trunk Connection

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- Wojciech Koczwara - Rockwell
- Michael Paul - ADI

Acknowledgement

- **Related content**

- SPMD Study Group Connectors
  https://grouper.ieee.org/groups/802/3/SPMD/public/sep19/spmd_cjones_01_0919.pdf

- Specifying Reflections for SPMD
  https://www.ieee802.org/3/da/public/120722/zimmerman_3da_01_12072022.pdf

Purpose

- Background: Up to 75 m trunk cable, 16 node, 10 cm stub lengths, clumped topology with 80 uH, 30 pF node parasitic's, 0.01 V CWA exhibiting RX correlation of ≥ 0.6 can be supported without compensation. Additional nodes can be supported with compensation.

- The presentation addresses framework for developing mixing segment baseline text.
  - Mixing segment specified without cabling stubs utilizing plugs/jack(MDI connector)
  - Compensation, when required, implemented in DTE
    + plug compensation illustrated as possible alternative

Mixing Segment Review

168.6 Mixing segment characteristics

10BASE-T1M PHYs are designed to operate over media that meet the requirements specified in this subclause. The 10BASE-T1M mixing segment (1.4.331) is a single balanced pair of conductors that may have more than two MDIs attached.

Figure 168–x shows an example mixing segment with reference points. The mixing segment specifications in 168.6 are referenced to these designated points and are to be met without the MDI or other loads attached. The mixing segment specifications are based on a trunk-stub configuration. Other configurations may be possible, provided they meet the electrical parameters in this 168.6. The example configuration assumes that the trunk comprises TBD m of 1.02mm (18 AWG) 100 Ω cabling and the stubs are 100 Ω balanced pairs of conductors up to 30 cm long. The trunk is terminated at each end into 100 Ω, at a point designated the 'edge termination'. One end of the stub is designated the trunk connection (TC) and the other designated the 'MDI attachment point'.

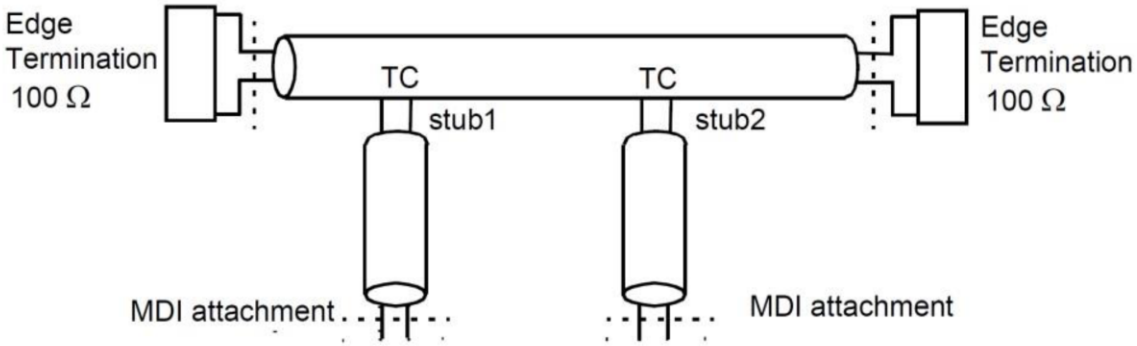


Figure 168–x Mixing segment and reference points

https://www.ieee802.org/3/da/public/062922/diminico_SPMD_02_06292022.pdf

Mixing Segment Review - uncompensated

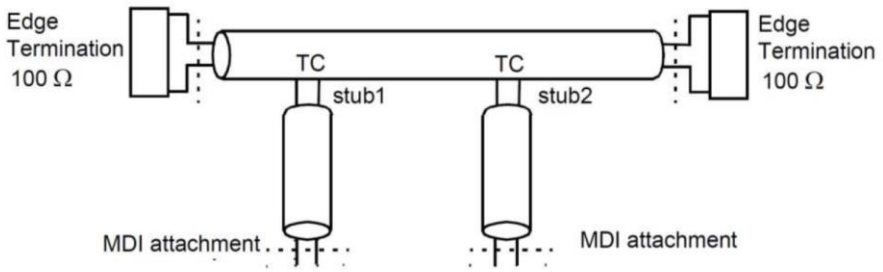
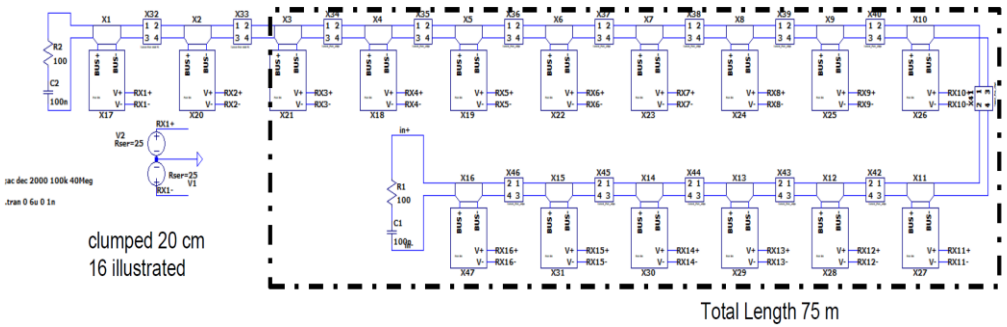


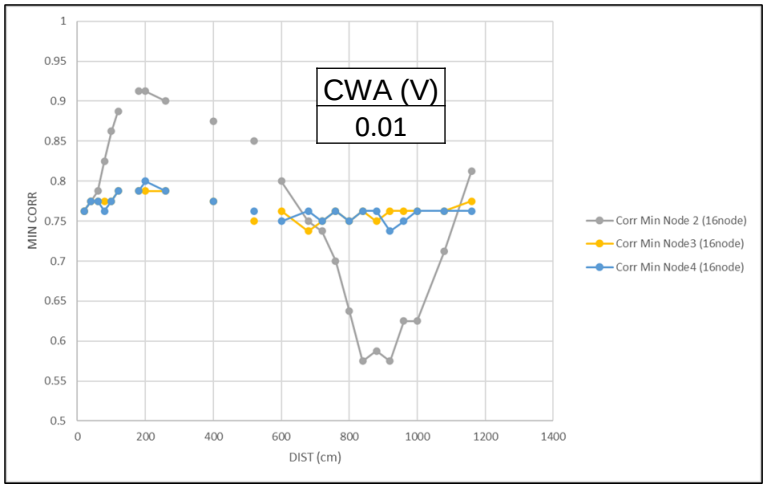
Figure 168–x Mixing segment and reference points

https://www.ieee802.org/3/da/802d3da_objectives.pdf(1)
Define performance characteristics of a mixing segment for 10Mb/s multidrop single balanced pair networks supporting up to at least 16 nodes, for up to at least 50m reach.

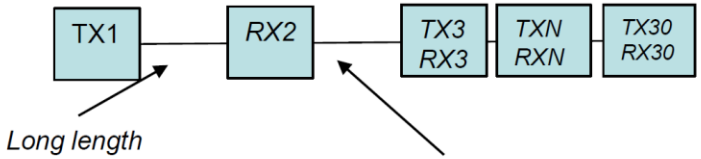
Uncompensated



CORR MIN RX2, RX3, RX4



clumped 20 cm



- *75 m, 16 node, clumped topology*
- *80 uH, 30 pF node parasitics*
- *10 cm stub lengths*

Move RX2 in 20 cm increments from RX3 adjust long length to maintain 75m
20 cm, 40 cm, 60 cm…..

Mixing Segment Review - compensated

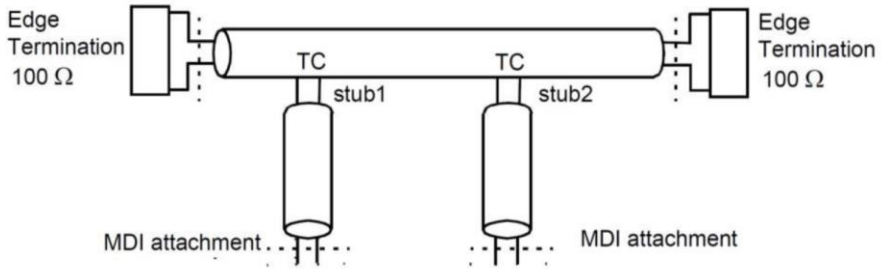
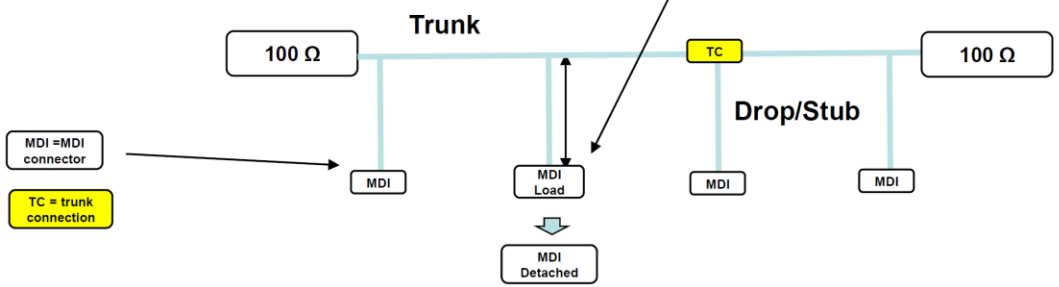


Figure 168–x Mixing segment and reference points

- Mixing segment measurements with MDI attached or MDI loads.
- How to match TC compensation to MDI parasitic's

- Mixing segment RL specifications; MDI attachments/tuning inductors.

Inductors	MDI Attachment	RL
Y	Y	spec supported
N	N	spec supported
Y	N	spec can be supported with an implementation that enables first two conditions
N	Y	NA



- *75 m, 30 node, clumped topology*
- *80 uH, 30 pF node parasitic's*
- *10 cm stub lengths*
- *Noise tolerance TBD*

MDI review 802.3cg

- MDI review 802.3cg

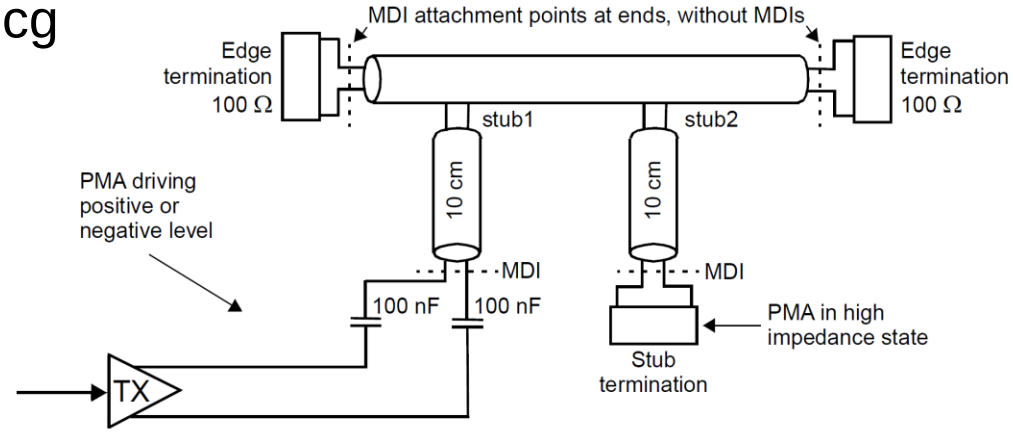


Figure 147–20—Multidrop line termination and PMA

- MDI connector
- Connectors meeting the mechanical requirements of IEC 63171-1 [B39a] or IEC 63171-6:2020 [B39b] may be used as the mechanical interface to the balanced cabling. The plug connector is used on the balanced cabling and the MDI jack connector on the PHY. These connectors should support link segment DCR characteristics for 1.02 mm (18 AWG) to 0.40 mm (26 AWG)
- in Table 146B–1., plug and jack

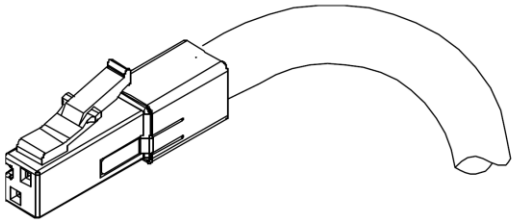


Figure 147–21—IEC 63171-1 plug

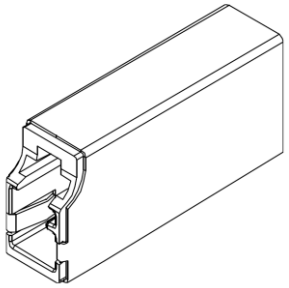


Figure 147–22—IEC 63171-1 jack

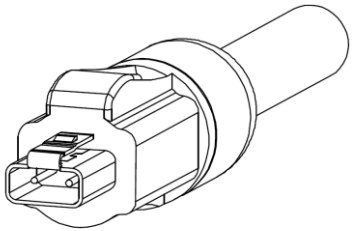


Figure 147–24—IEC 63171-6 plug

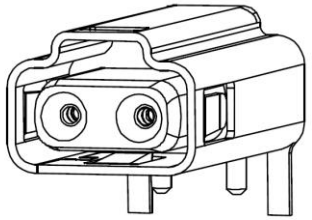
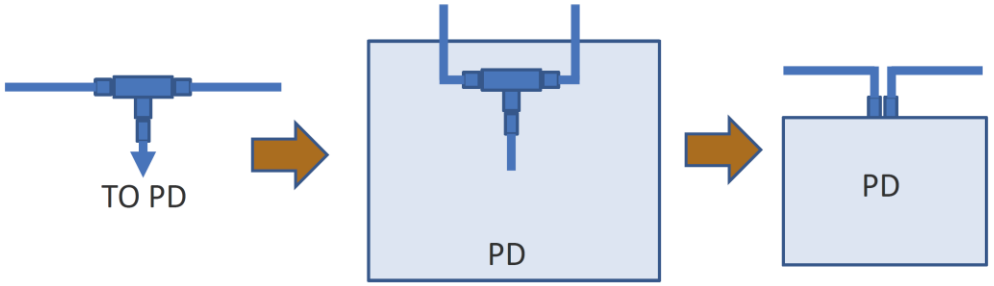


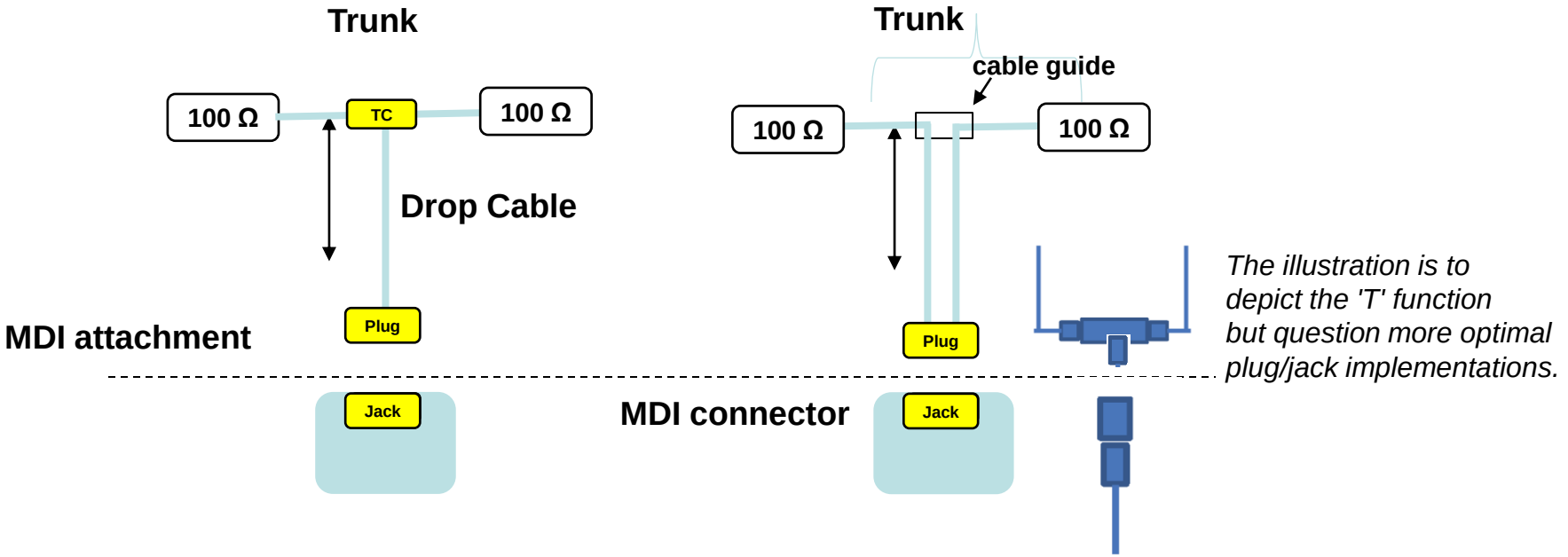
Figure 147–25—IEC 63171-6 jack

MDI trunk connection

To ‘T’ or not to ‘T’

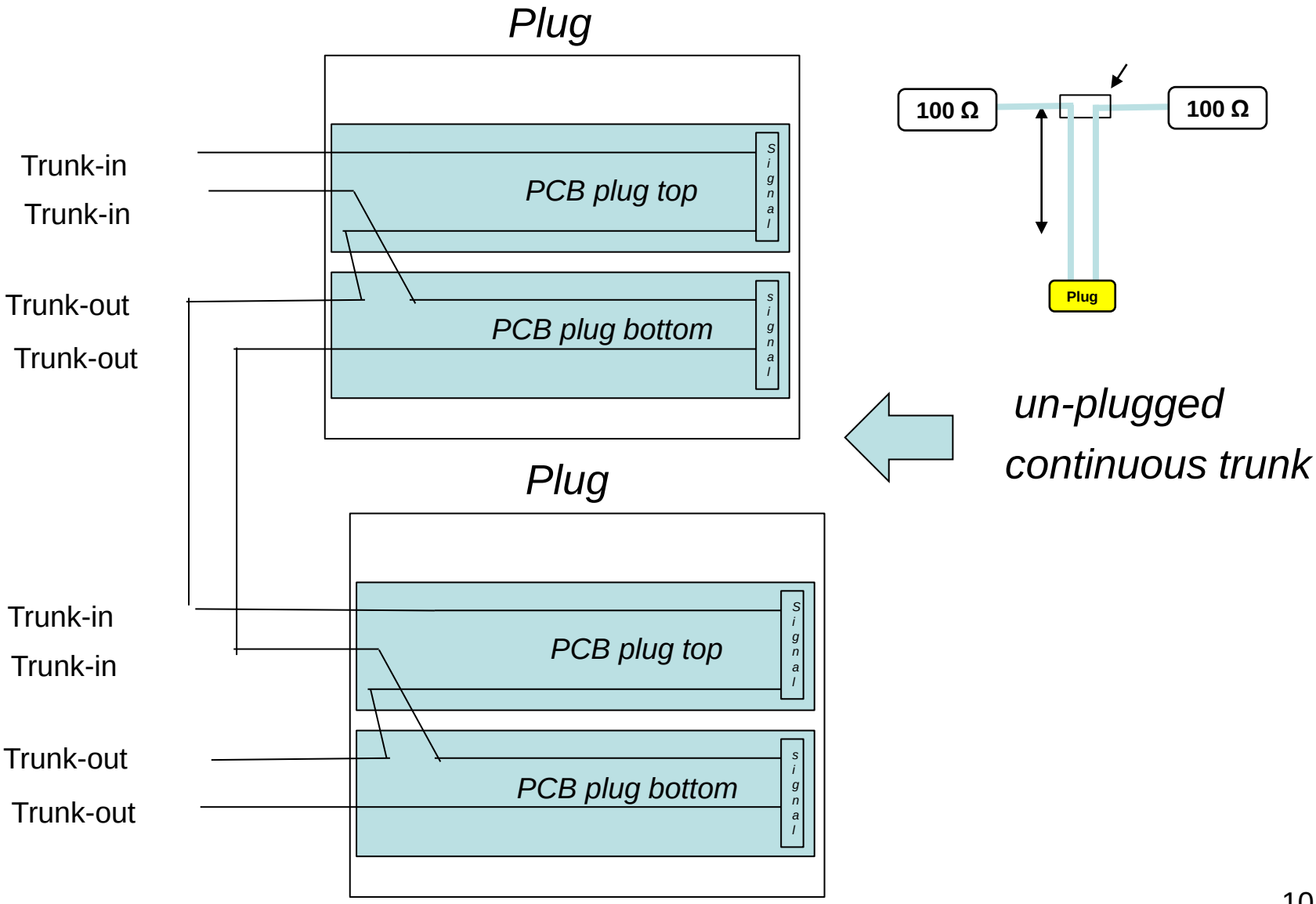
Source: https://grouper.ieee.org/groups/802/3/SPMD/public/sep19/spmd_cjones_01_0919.pdf





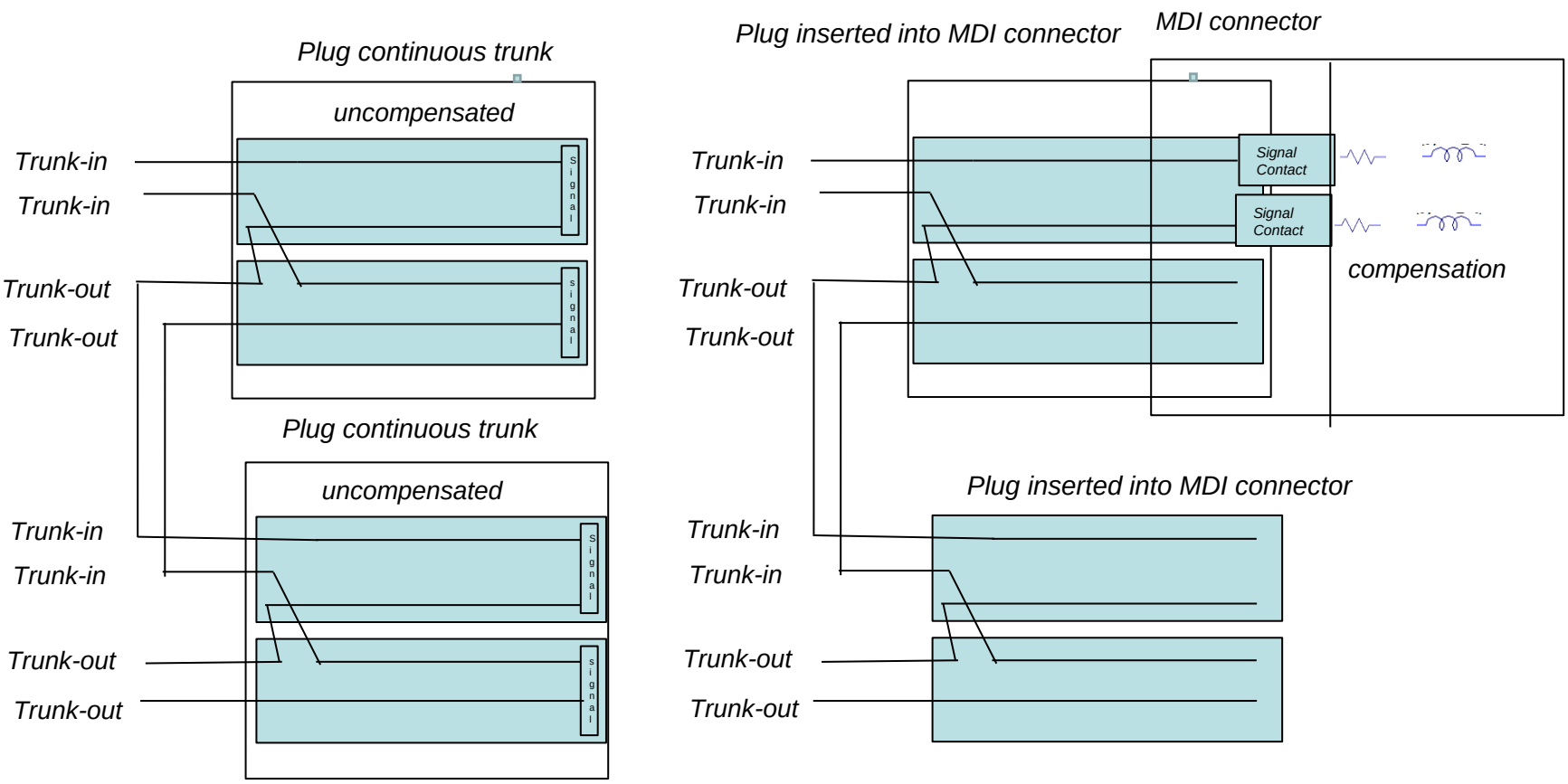
The illustration is to depict the 'T' function but question more optimal plug/jack implementations.

MDI trunk connection - plug



MDI trunk connection - plug/jack

- Uncompensated plug-trunk opens on plug insertion to jack (make before break)
- DTE will incorporate compensation as necessary to meet requirements specified at MDI



- Example implementation of concept not proposed solution.

Review: 165.5.2 Test Points

Source: IEEE P802.3cy™/D2.0, July 1, 2022

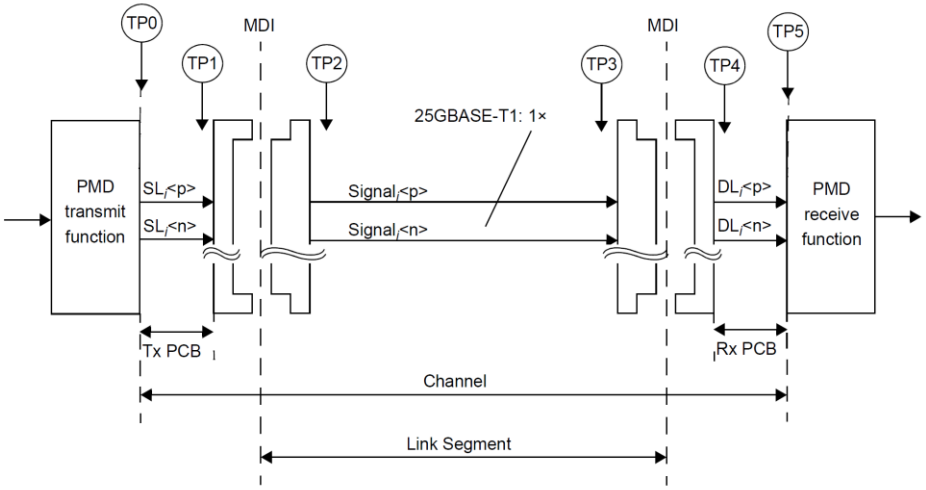


Figure 165–34—25GBASE-T1 link

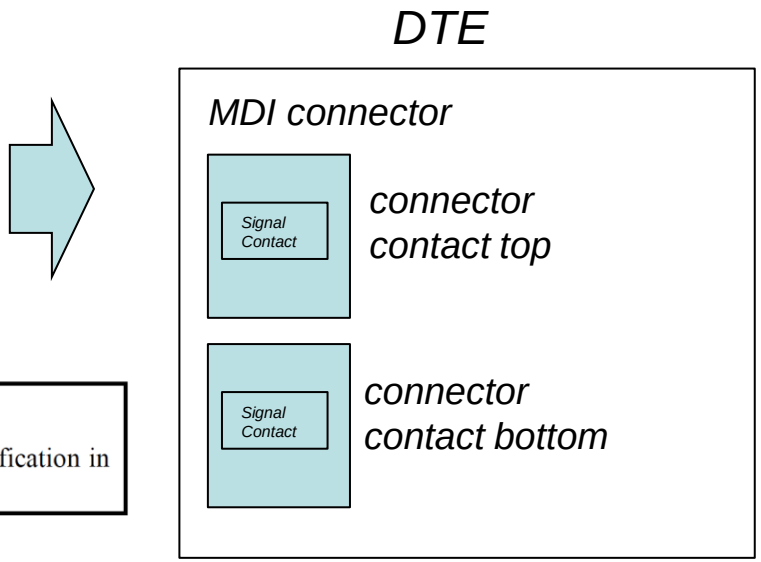
Test Points	Description
TP0 to TP5	The channel including the transmitter and receiver differential controlled impedance PCB insertion loss and the link segment insertion loss.
TP1 to TP4	All link segment measurements are made between TP1 and TP4 as illustrated in Figure 165–34.
TP0 to TP2 TP3 to TP5	A mated connector pair has been included in both the transmitter and receiver specifications defined in 165.5.3 and 165.5.4. The recommended maximum insertion loss from TP2 to TP0 or from TP3 to TP5 including the test fixture is provided in 165A.2.1.
TP2	Unless specified otherwise, all transmitter measurements defined in 165.5.3 are made at TP2.
TP3	TP3 represents the link partner's TP2 test point.

MDI trunk connection - jack

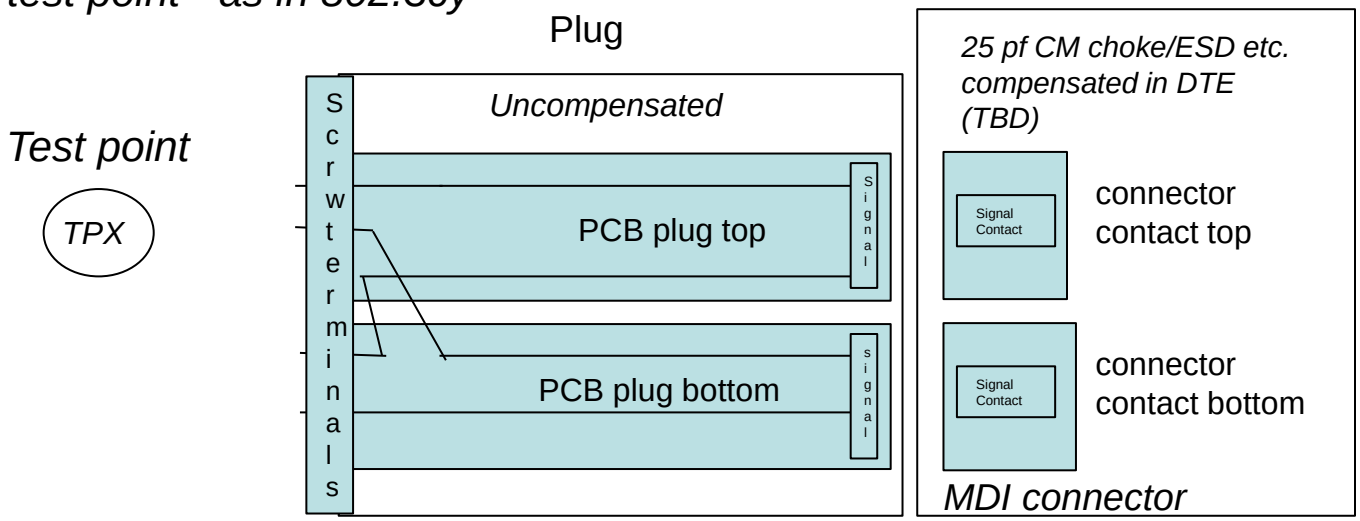
MDI specified in conjunction with mixing segment but tested independent of mixing segment.

168.8 MDI specification

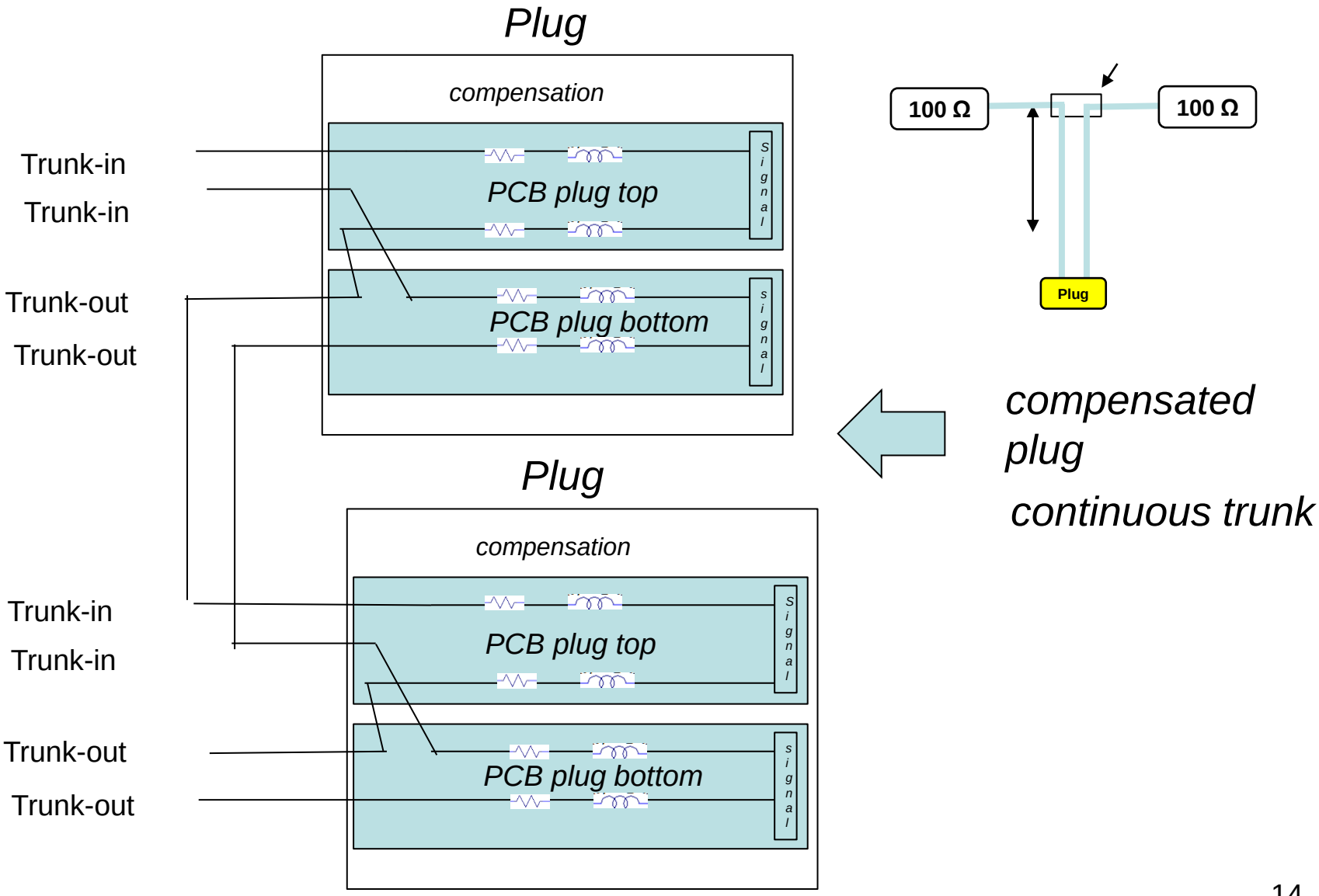
> ***Editor's Note (to be removed prior to Working Group ballot):***
>
> Contributions and baselines are needed to fill out the MDI connector and the electrical specification in the subclauses here. See 802.3cg clause 147 for example text.



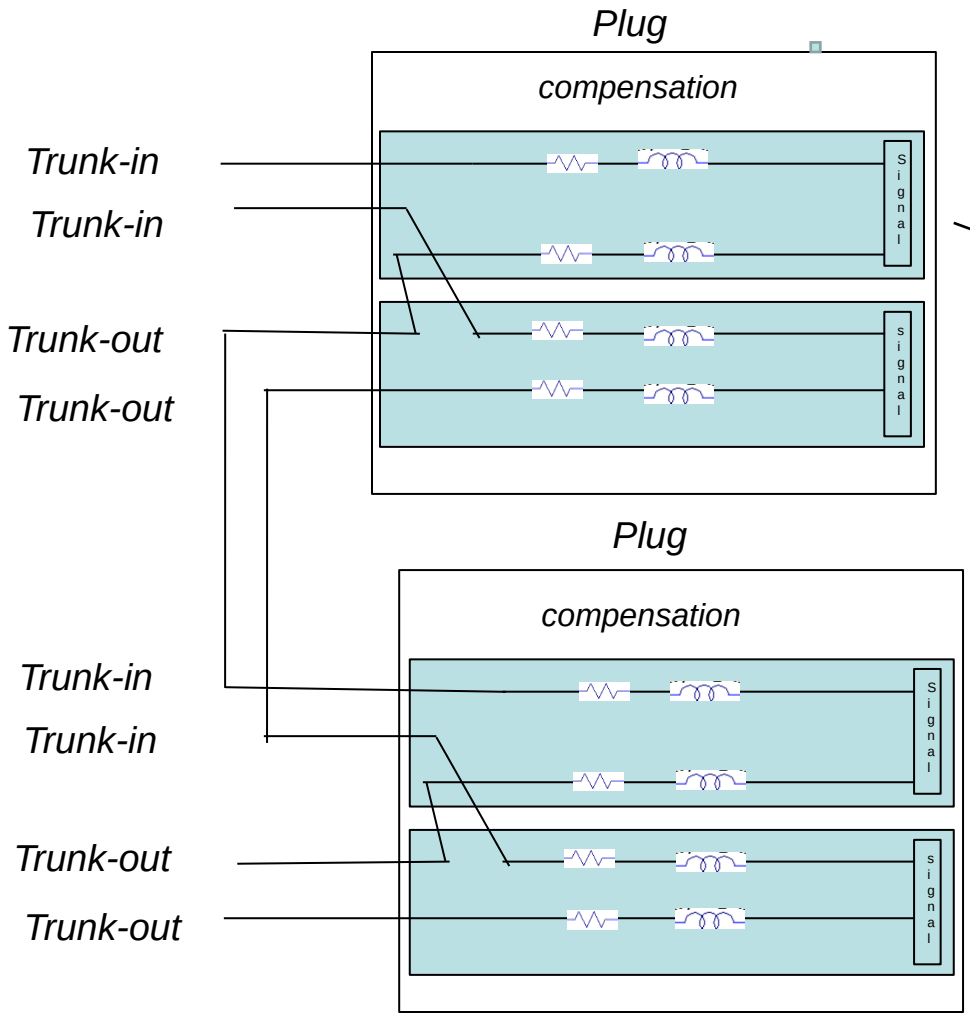
Specified test point - as in 802.3cy

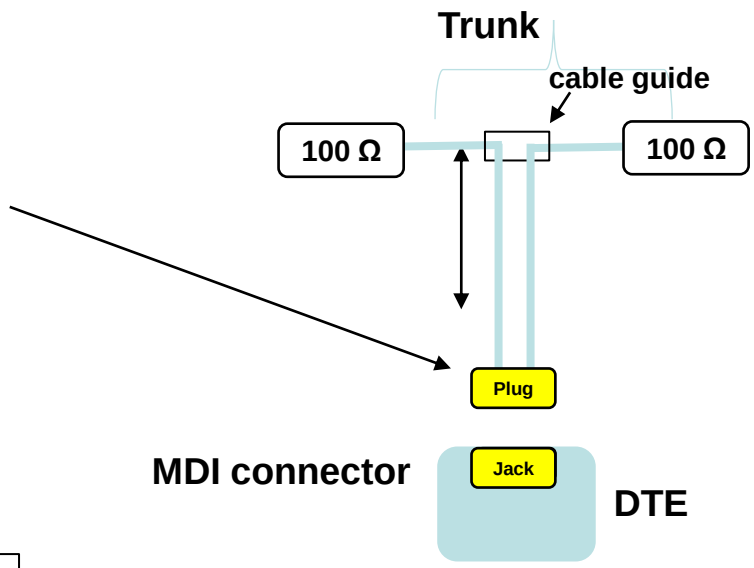


MDI trunk connection - plug compensation



Compensation in cabling requires MDI loads attached





Inductors	MDI Attachment	RL
Y	Y	spec supported
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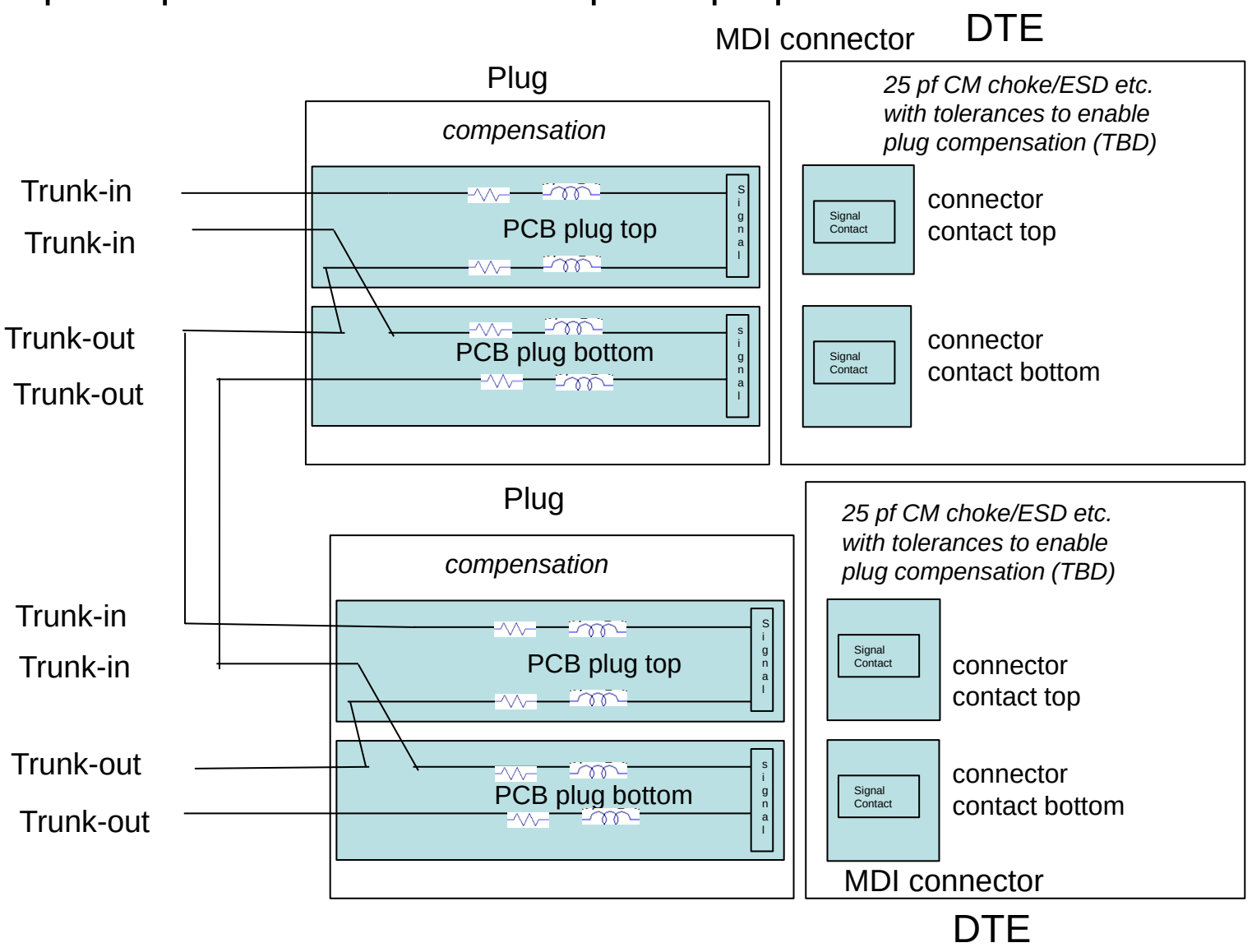
Y	N	spec can be supported with an implementation that enables first two conditions
N	Y	NA

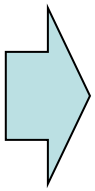
MDI trunk connection - plug compensated/jack

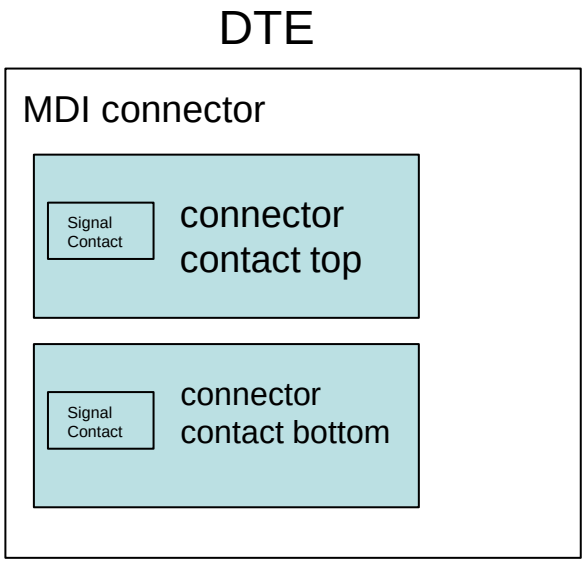
- Example implementation of concept not proposed solution.



MDI trunk connection - jack

MDI specified in conjunction with mixing segment but tested independent of mixing segment.





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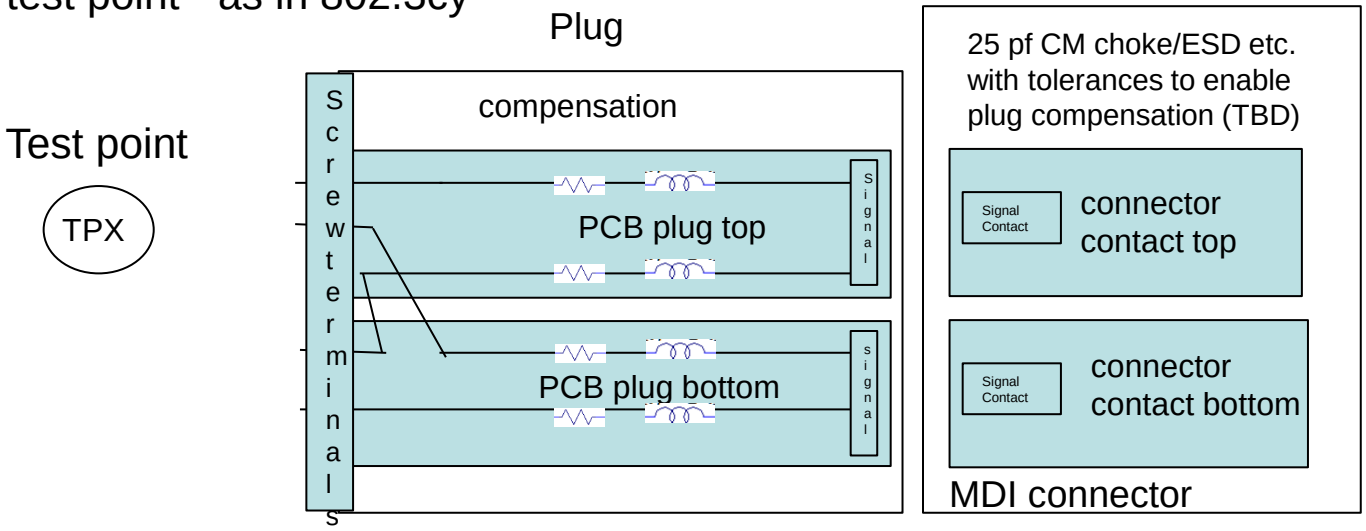
Specified test point - as in 802.3cy



Summary

- The presentation addresses framework for developing mixing segment baseline text.
  - Mixing segment specified without cabling stubs utilizing plugs/jack(MDI connector)
  - Compensation, when required, implemented in DTE
    + plug compensation illustrated as possible alternative