



Current Balance in Cabling Systems

Ron Nordin
Masud Bolouri-Saransar
Wayne Fite

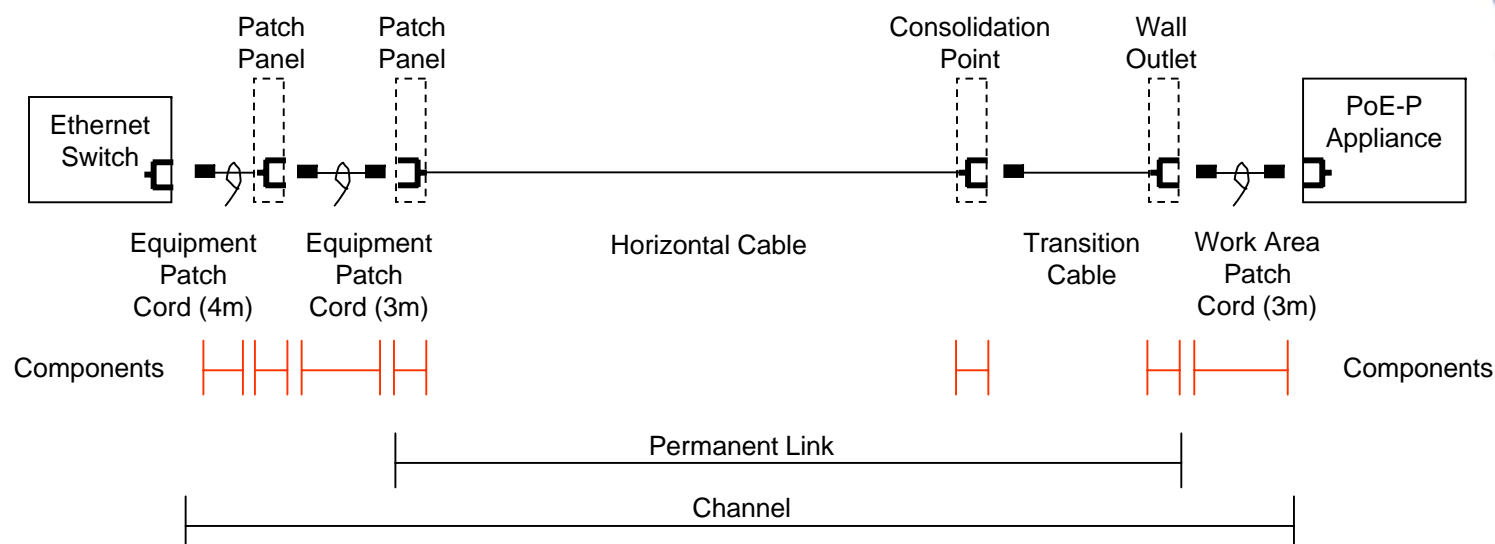
Panduit Corp.



Objectives:

- Describe a cabling model to address current balance in wire pairs
- Describe the appropriate cabling specifications and list some nominal values
- Provide a perspective as to the applicability of a passive resistor ballasting technique

4 connector cabling model



Connector:

Cat 6 or Cat5e Specification

DC Resistance < 0.2 Ω per connector (at 20 $^{\circ}\text{C}$)

Cat 6 or Cat5e Nominal

DC Resistance = 0.05 Ω per connector (at 20 $^{\circ}\text{C}$)

Cable:

Horizontal Cable

Cat 6 or Cat5e Specifications

DC Resistance < 9.38 Ω per 100m (at 20 $^{\circ}\text{C}$)

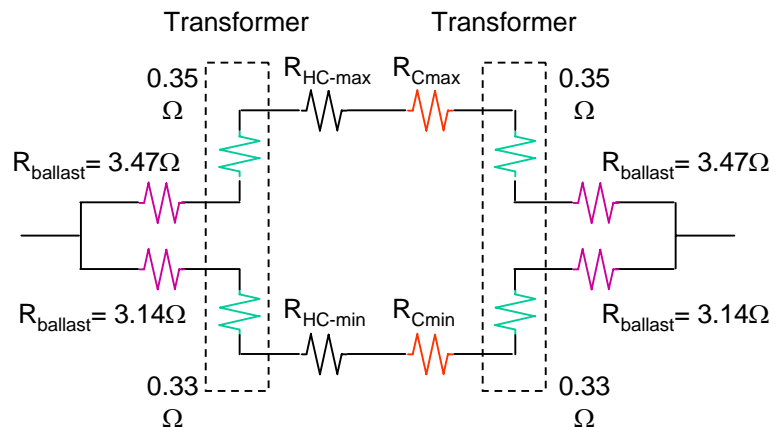
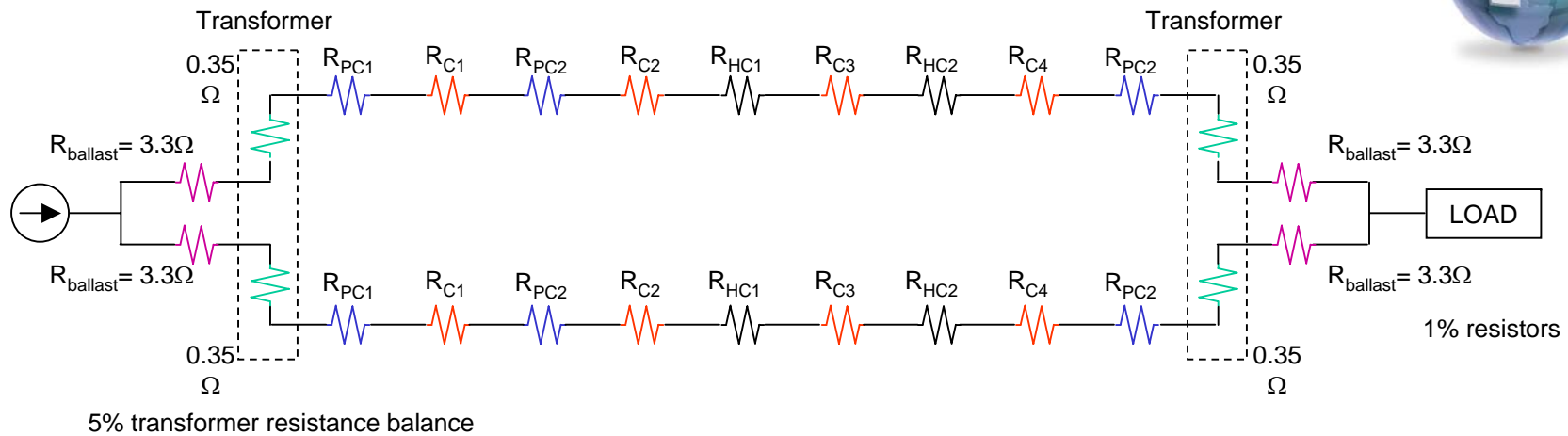
DC Resistance unbalance < 5% (at 20 $^{\circ}\text{C}$)

Nominal Values

DC Resistance < 7.0 Ω per 100m (at 20 $^{\circ}\text{C}$)

DC Resistance unbalance < 3% (at 20 $^{\circ}\text{C}$)

4 connector cabling model



Assumptions:

Standards based analysis

$$R_{HC-max} = 9.38 \Omega \text{ per } 100 \text{ m } (R_{PC} = R_{HC})$$

$$R_{HC-min} = 8.91 \Omega \text{ per } 100 \text{ m } (R_{PC} = R_{HC})$$

$$R_{C(max)} = 0.2 \Omega \quad R_{C(min)} = 0.01 \Omega$$

Nominal value based analysis:

$$R_{HC-max} = 7.0 \Omega \text{ per } 100 \text{ m}$$

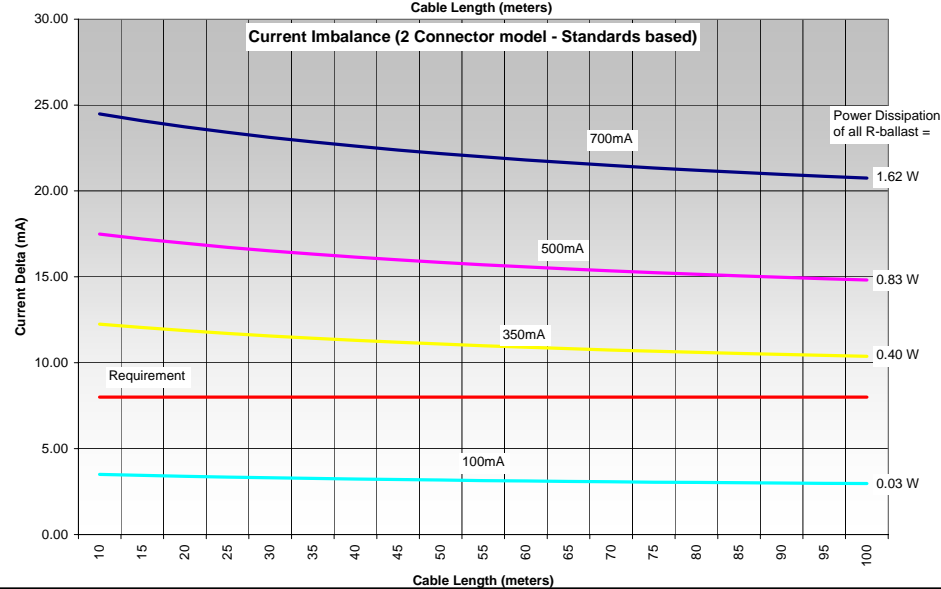
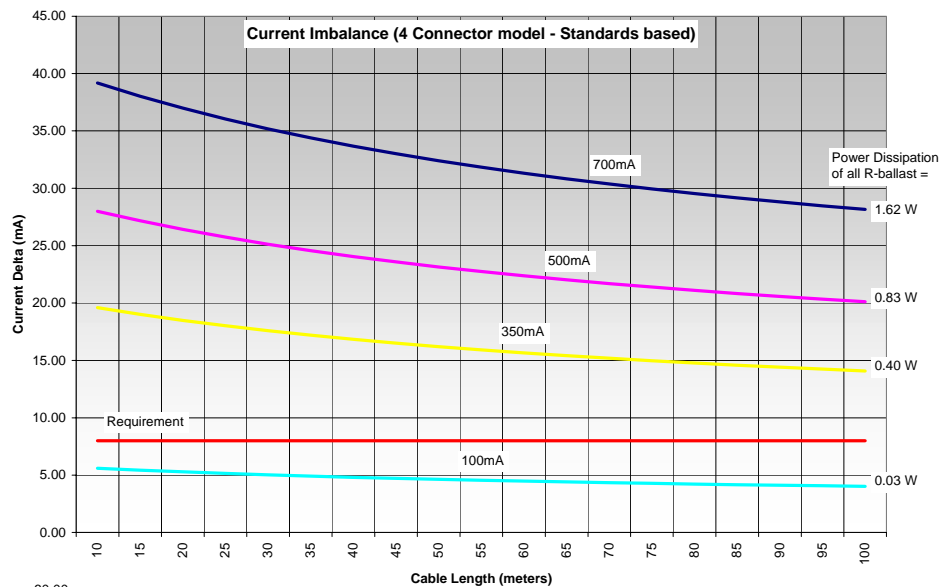
$$R_{HC-min} = 6.65 \Omega \text{ per } 100 \text{ m}$$

$$R_{C(max)} = 0.05 \Omega \quad R_{C(min)} = 0.01 \Omega$$

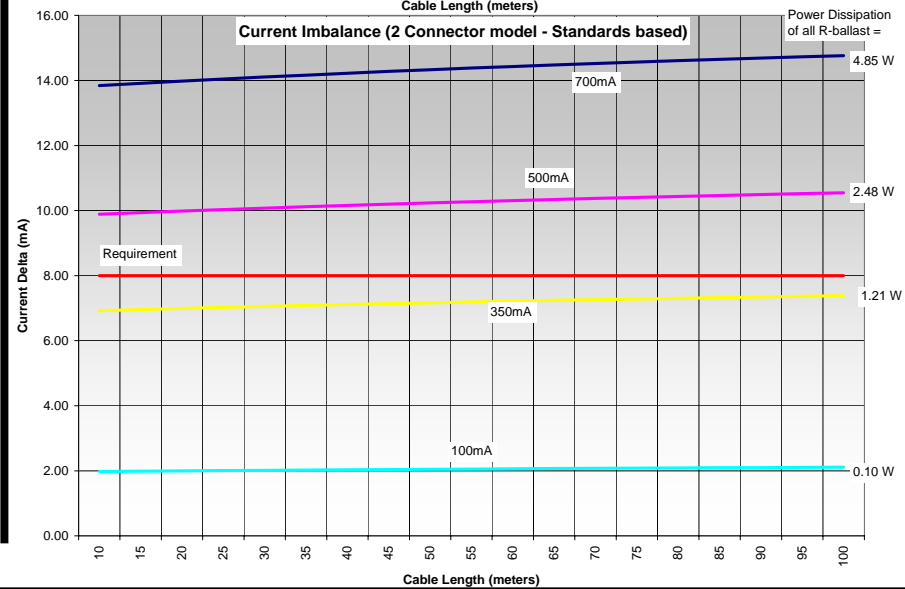
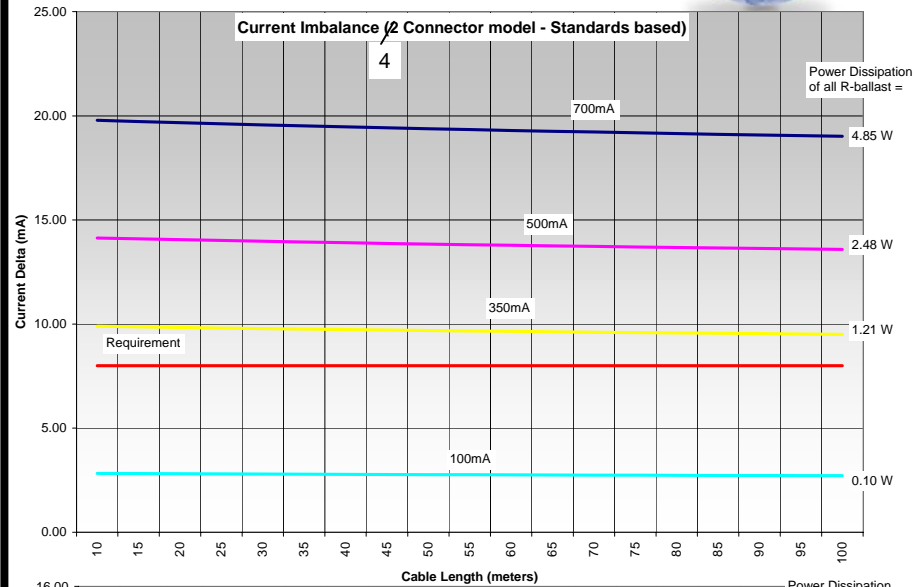
Specification Based Analysis



$$R_{\text{ballast}} = 3.3 \, \Omega$$



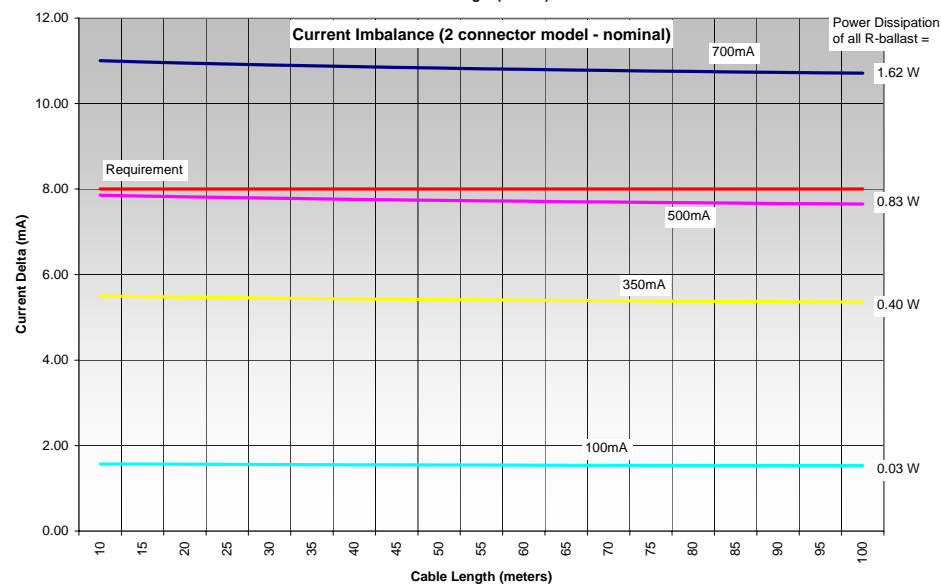
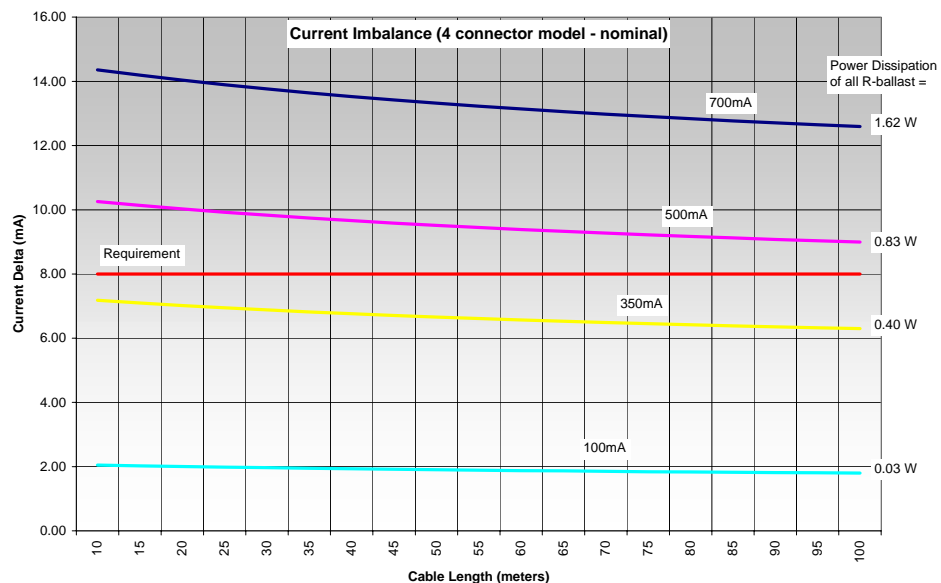
$$R_{\text{ballast}} = 9.9 \, \Omega$$



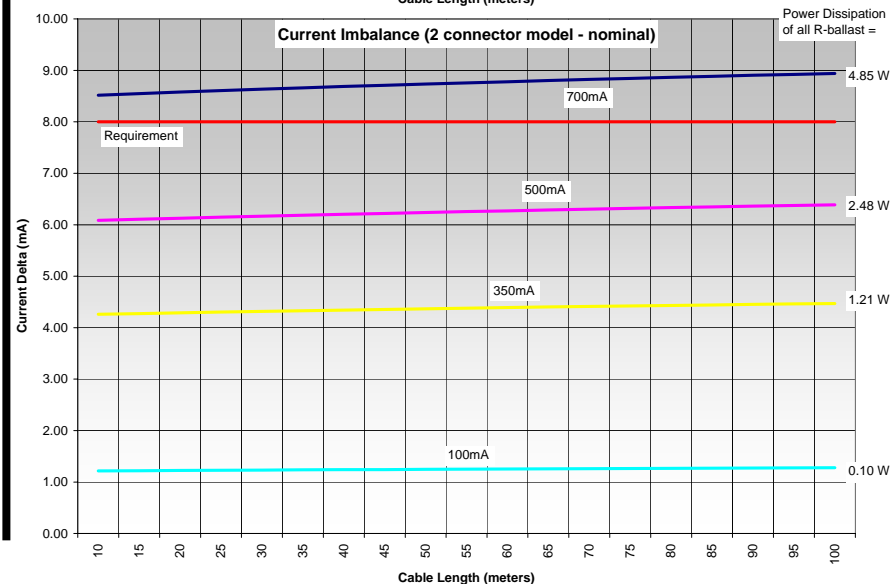
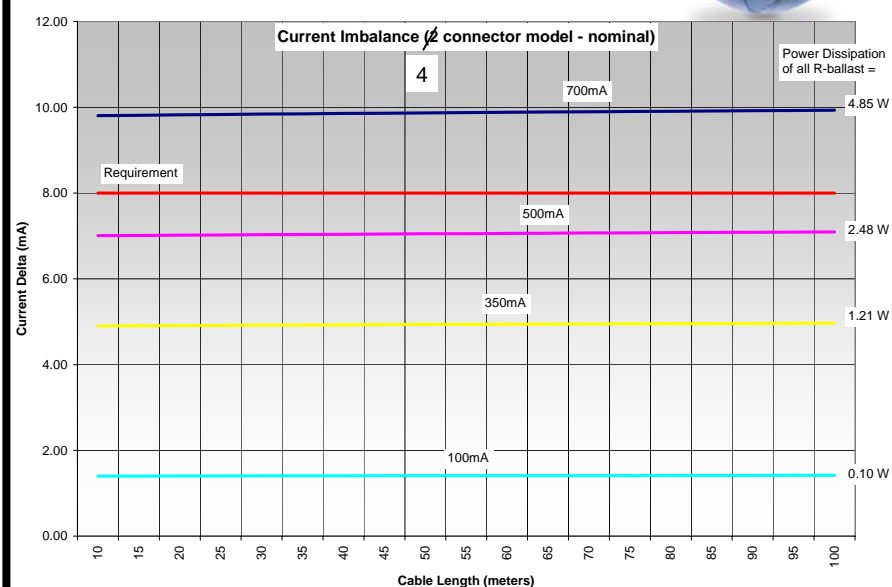
Nominal Value Based Analysis



$$R_{\text{ballast}} = 3.3 \, \Omega$$



$$R_{\text{ballast}} = 9.9 \, \Omega$$





Summary:

- Ballast resistors required at a minimum
and / or the transformer maximum DC bias current could be raised
- Active ballasting recommended to keep power dissipation low
- Recommend a cabling adhoc group be formed to validate assumptions and
provide guidance to the task force