CALCULATING POE POWER LOSS DUE TO CABLE RESISTANCE

In PoE applications, there are power losses due to cable resistance. That is the reason why the PoE standard defines a higher PoE output voltage for PSE (Power Sourcing Equipment) than the PoE output voltage at the destination, which is a PoE Powered Device (PD). The voltage dictates how much power is available at a PoE powered device. To meet PoE standard, PoE injector ports and PoE powered devices have to meet the following voltage, wattage, and current requirements:

Standard PoE parameters and comparison

Property	802.3af (802.3at Type 1)	802.3a Type 2 (PoE+)
Power available at PD	12.95 W	25.50 W
Maximum power delivered by PSE (Power Sourcing Equipment)	15.40 W	34.20 W
Voltage range (at PSE)	44.0–57.0 V	50.0–57.0 V
Voltage range (at PD)	37.0–57.0 V	42.5–57.0 V
Maximum current	350 mA	600 mA
Maximum cable resistance (100M cable)	20 Ω (Category 3) or lower	12.5 Ω (Category 5) or lower
Supported cabling	Category 3 and Category 5 or higher	Category 5 or higher
Supported modes	Mode A (endspan), Mode B (midspan)	Mode A, Mode B

In any PoE applications, it is critically important that a cable power loss calculation be performed to ensure the PoE PD devices will have required power available to them. The following method can be used to calculate the power loss due to cable resistance and the available power at the PoE powered device:

- Step 1 – Calculate Output Current
  - Icurrent = Pout/ Vout
    Where:
    Icurrent = Output current from PoE Switch
    Pout = Output power from PoE Switch
    out = Output voltage from PoE switch
- Step 2 – Calculate voltage drop across the cable due to cable resistance
  - Vdrop = Icurrent * Rcable
    Where:
  - Vdrop = Voltage drop over the cable length due to cable resistance
  - Rcable = Cable resistance
- Step 3 – Calculate the actual voltage (Vpd) at the destination (PoE PD device)
  - Vpd = Vout - Vdrop
- Step 4 – Calculate the actual wattage (Pfinal) available for the PoE PD device
  - Pfinal = Vpd * Icurrent

Two examples on how to calculate power loss are provided below, one for PoE and one for PoE Plus application:

- **Example 1** – PoE Application (15.4-watts) using RocketLinx ES7510 PoE port

Cable Type	CAT5 or higher (12.5Ω cable resistance)
Cable Length	100 Meters (328-feet)
Power Input Voltage	48VDC
PoE Output Power	15.4-Watts
PoE Output Voltage	46.5VDC (Typical PoE output voltage from ES7510 at 15.4-watts)

Given the above information, the power loss and the actual wattage at the PoE PD (Pfinal) can be calculated as follows:

o Step 1:
Icurrent = Pout/ Vout = 15.4/ 46.5= 0.33A = 330mA

o Step 2:
Vdrop = Icurrent * Rcable = 0.33 * 12.5 = 4.12VDC

o Step 3:
Vpd = Vout – Vdrop = 46.5 – 4.12 = 42.38VDC

o Step 4:
Pfinal = Vpd * Icurrent = 42.38 * 0.33 = 13.98-watts

As illustrated above, the available power at the destination (PoE PD) will be 13.98-watts with the installation shown in the above table.

- **Example 2** – PoE Plus Application (30-watts) using RocketLinx ES7510 PoE port

Cable Type	CAT5 or higher (12.5Ω cable resistance)
Cable Length	100 Meters (328-feet)
Power Input Voltage	55VDC
PoE Output Power	30-Watts
PoE Output Voltage	53VDC (Typical PoE output voltage from ES7510 at 30-watts)

Given the above information, the power loss and the actual wattage at the PoE PD (Pfinal) can be calculated as follows:

o Step 1:
Icurrent = Pout/ Vout = 30/ 53= 0.56A = 560mA

o Step 2:
Vdrop = Icurrent * Rcable = 0.56 * 12.5 = 7VDC

o Step 3:
Vpd = Vout – Vdrop = 53 – 7 = 46VDC

o Step 4:
Pfinal = Vpd * Icurrent = 46 * 0.56 = 25.7-watts

As illustrated above, the available power at the destination (PoE PD) will be 25.7-watts with the installation shown in the above table.

Warranty Information
Comtrol offers a 30-day satisfaction guarantee and 5-year limited warranty.

Sales Support
+1.763.957.6000
sales@comtrol.com

Technical Support
+1.763.957.6000
www.comtrol.com/support

Email, FTP, and Web Support
info@comtrol.com
ftp.comtrol.com
www.comtrol.com