Fieldbus Segment Current and Voltage at the Last Device

Total current of a fieldbus segment and the voltage at the farthest device from the power conditioner voltage, trunk and spur cable resistance and device currents.

Method: Segment DC voltage budget; Liptak; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Power conditioner output voltage	24.000	V
Devices on the segment	12.000	
Current per device	20.000	mA
Trunk length	600.00	m
Longest spur length	60.000	m
Cable loop resistance per km	44.000	Ω/km
Minimum device voltage	9.0000	V

Calculated results

Parameter	Value	Unit
Segment current	240.00	mA
Trunk voltage drop	6.3360	V
Voltage at the farthest device	17.611	V
Voltage margin	8.6112	V
Longest trunk for the minimum voltage	1,415.5	m

Notes for this case

• Worst case with all devices lumped at the far end of the trunk: V = V_s − I_t·r·L_t − I_d·r·L_s (r is loop resistance, both conductors). Check the conditioner current limit and add spur short-circuit protection current where couplers are used.

Formula and method

$$I_t = nI_d, \quad V_{dev} = V_s - I_t r L_t - I_d r L_s$$

Variables

V_s	Power conditioner output voltage	V
n	Devices on the segment	-
I_d	Current per device	A
L_t	Trunk length	m
L_s	Longest spur length	m
r	Cable loop resistance per km	Ω/m
V_{min}	Minimum device voltage	V
I_t	Segment current	A
ΔV_t	Trunk voltage drop	V
V_{dev}	Voltage at the farthest device	V
$V_{dev} - V_{min}$	Voltage margin	V
$L_{t,max}$	Longest trunk for the minimum voltage	m

Method and standards

Segment budget.

Assumptions and limits

- DC voltage budget only.

References

Segment DC voltage budget, Liptak, Instrument Engineers' Handbook, Vol. 1 and 2 (CRC Press)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/signals-calibration/fieldbus-segment-voltage

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.