Voltage Sag Magnitude versus Fault Distance (Divider Model)

Remaining voltage at a common bus during a three-phase fault on a radial feeder, from source fault level and feeder impedance, and the critical distance for a sag.

Method: Voltage divider model of sags

Input parameters

Unit system: SI

Parameter	Value	Unit
Nominal line voltage	11.000	kV
Fault level at the common bus	250.00	MVA
Feeder impedance magnitude	0.40000	Ω/km
Distance to fault	5.0000	km
Sag threshold of interest	70.000	%

Calculated results

Parameter	Value	Unit
Source impedance	0.48400	Ω
Feeder impedance to the fault	2.0000	Ω
Voltage at the common bus during the fault	80.515	%
Critical distance for the threshold	2.8233	km

Notes for this case

• Voltage divider: V_sag = Z_f/(Z_s + Z_f) with Z_s = V²/S_sc and Z_f = z·L (same impedance angle assumed). Faults closer than L_crit drive the bus below V_t; counting faults per km-year inside it estimates how often sensitive loads trip. Single-phase faults and transformer winding connections change what the load sees.

Formula and method

$$V_{sag} = \frac{Z_f}{Z_s + Z_f}, \quad Z_s = \frac{V^2}{S_{sc}}, \quad L_{crit} = \frac{Z_s}{z}\frac{V_t}{1 - V_t}$$

Variables

V	Nominal line voltage	V
S_{sc}	Fault level at the common bus	VA
z	Feeder impedance magnitude	Ω/m
L	Distance to fault	m
V_t	Sag threshold of interest	-
Z_s	Source impedance	Ω
Z_f	Feeder impedance to the fault	Ω
V_{sag}	Voltage at the common bus during the fault	-
L_{crit}	Critical distance for the threshold	m

Method and standards

Sag divider.

Assumptions and limits

- Three-phase fault; radial feeder; equal impedance angles; pre-fault voltage 1 pu.

References

Voltage divider model of sags

Report details

Report reference	FCC-1DEZ-K1E8 (the same inputs always give the same reference)
Generated	23 November 2026, 17:51 UTC
Calculator	Voltage Sag Magnitude versus Fault Distance (Divider Model)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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

This calculator online

https://calc.firecad.com/electrical/power-quality/voltage-sag-fault-distance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.