EDM Atmospheric (ppm) Correction from Refractive Index

Group refractive index of the EDM carrier, the refractive index of air at field temperature, pressure and humidity, the ppm correction and the corrected distance.

Method: Group refractive index and IUGG air refractivity

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured distance (at reference index)	1,500.0	m
Carrier wavelength	658.00	nm
Air temperature	30.000	°C
Air pressure	950.00	hPa
Relative humidity	60.000	%
Instrument reference temperature	12.000	°C
Instrument reference pressure	1,013.2	hPa
Instrument reference humidity	60.000	%

Calculated results

Parameter	Value	Unit
Group refractivity (ppm)	299.26	
Air refractivity at field conditions (ppm)	251.87	
Refractivity at reference conditions (ppm)	286.34	
Correction (ppm)	34.460	
Corrected distance	1,500.1	m

Notes for this case

• Group refractivity of the carrier (λ in µm): N_g = 287.6155 + 4.88660/λ² + 0.06800/λ⁴. Air: n_a = 1 + [(273.15/1013.25)N_gP/T − 11.27e/T]×10⁻⁶ with P and the vapour pressure e in hPa and T in kelvin (IUGG 1999). An EDM computes distance with its reference index n_ref; the true distance is D = D′·n_ref/n_a. Warm, low-pressure air lengthens the correction; about 1 ppm per 1 °C or per 3.6 hPa. Measure temperature and pressure at both ends for long lines.

Formula and method

$$N_g = 287.6155 + \frac{4.88660}{\lambda^2} + \frac{0.06800}{\lambda^4}, \quad n_a = 1 + \left[\frac{273.15}{1013.25}\frac{N_g P}{T} - \frac{11.27e}{T}\right]10^{-6}, \quad D = D'\frac{n_{ref}}{n_a}$$

Variables

D'	Measured distance (at reference index)	m
λ	Carrier wavelength	m
t	Air temperature	K
P	Air pressure	Pa
RH	Relative humidity	-
t_{ref}	Instrument reference temperature	K
P_{ref}	Instrument reference pressure	Pa
RH_{ref}	Instrument reference humidity	-
N_g	Group refractivity (ppm)	-
$(n_a - 1)10^6$	Air refractivity at field conditions (ppm)	-

$(n_{ref}-1)10^6$	Refractivity at reference conditions (ppm)	-
Δ	Correction (ppm)	-
D	Corrected distance	m

Method and standards

Atmospheric correction.

Assumptions and limits

- Mean atmosphere along the line; light-wave EDM.

References

Group refractive index and IUGG air refractivity

Report details

Report reference	FCC-SCB8-ZF8S (the same inputs always give the same reference)
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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/civil/surveying/edm-atmospheric-correction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.