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List of Abbreviations

ADC .... *Analogue-to-digital converter*
AR .... *Automatic reclosing*
CB .... *circuit-breaker*
CBLS .... *Contingency Based Load Shedding*
DFT .... *Discrete Fourier Transform*
ENTSO-E .... *European Network of Transmission System Operators*
FFT .... *Fast-Fourier-Transformation*
FIR .... *Finite Impulse Response*
IIR .... *Infinite Impulse Response*
LSE .... *Least Square Estimation*
NC ER .... *Network Code Electricity Emergency and Restoration*
NDZ .... *Non-Detection-Zone*
PLL .... *Phase-Locked-Loop*
PMU .... *Phasor Measurement Unit*
RE .... *Renewable Energy*
ROCOF .... *Rate of change of frequency*
SFR .... *Simplified-Frequency-Response*
THD .... *Total Harmonic Distortion*
UFLS .... *Underfrequency load shedding*

List of Formulas

$\mathrm{d}f/\mathrm{d}t$	Frequency change (quasi-steady)
f	Operating frequency, momentary value
f_{nenn}	Nominal frequency 50 Hz, or rated frequency f_r
$f_<$	Setting value of the underfrequency protection
Δf	Amount of the required accuracy without disturbance variables: The underfrequency protection does not respond reliably at $f > (f_< + \Delta f)$, at $f < (f_< - \mathrm{D}f)$ it responds reliably if there are no disturbances.
Δf_{ob}	Amount of the required accuracy for tests for unwanted operation with disturbance variables: The underfrequency protection will not respond reliably at $f > (f_< + \Delta f_{\mathrm{ob}})$ if disturbances are present.
Δf_{un}	Amount of required accuracy for tests for incorrect operation of protection with disturbance variables: The underfrequency protection responds reliably at $f > (f_< + \Delta f_{\mathrm{un}})$ when disturbances are present.
H	Equivalent stored energy constant of all synchronous generating units
ΔP	Change in active power $(P_{\mathrm{Verbrauch}} - P_{\mathrm{Erzeugung}})$
S_{nenn}	Nominal apparent power of the machines
t_{AFi}	Tripping time of the underfrequency protection at the i test. If ramps are used, then the tripping time is considered to be the time when the response value is first undershot until the OFF contact of the protection device is closed.
t_{AFmmax}	Maximum trip time with disturbances Maximum value of all measurements with disturbances
t_{AFomax}	Maximum trip time without disturbances Maximum value of all measurements without disturbances
t_{nach}	Time period during which no unwanted operation may occur
t_{vor}	Duration of pre-fault voltage during tests
U_{B}	The voltage value that has to be undershot for the underfrequency protection to be blocked.