Interconnection Protection Features Overview

(✔ = Standard, ○ = Option)

Protection functions	ANSI	MCA4-2	MRA4-2	MRU4-2	MCDTV4-2	MCDGV4-2	MRN3	XRW1	XRN2	XUF2	XU2-AC	BU1-AC
Phase Distance Protection	21P					✔						
Overexcitation V/Hz	24				✔	✔						
Synchro check	25	✔	✔	✔	✔	✔						
Undervoltage	27	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Power protection: P, Q, Qr, S, Pr	32F, 37F, 32Q, 37Q, 37QR, 32S, 37S, 37R	✔	✔		✔	✔						
QU protection (undervoltage- directional reactive power protection)	27&32Q<	✔	✔		✔	✔						
I< underload protection steps	37											
Loss of excitation	40					✔						
Negative sequence elements (current/DEFT/INV)	46	✔	✔		✔	✔						
Negative/positive sequence elements (voltage)	47	✔	✔	✔	✔	✔						
Overload protection with thermal replica	49	✔	✔		✔	✔						
Circuit breaker failure protection	50BF / 62BF	✔	✔	✔	✔	✔						
Phase current elements (non-directional and directional)	67	✔	✔		✔	✔						
Earth current elements (non-directional and directional)	67N	✔	✔		✔	✔						
Inrush detection IH2 (2nd harmonic)		✔	✔		✔	✔						
Voltage controlled current protection	51C	✔	✔		✔	✔						
Voltage restraint current protection	51V	✔	✔		✔	✔						
Negative sequence elements (current/IEC/ANSI curves)	51Q	✔	✔		✔	✔						
Power factor cos (φ)	55	✔	✔		✔	✔						
Overvoltage	59	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Residual voltage elements	59N	✔	✔	✔	✔	✔						
100% stator earth fault protection	59TN / 27TN					✔						
Voltage transformer supervision	60FL	✔	✔	✔	✔	✔						
Current transformer supervision	60L	✔	✔		✔	✔						
Out of Step Tripping / Power Swing Blocking (Pole Slip Protection	68 / 78					✔						
Trip circuit supervision	74TC	✔	✔	✔	✔	✔						
Vector surge	78	✔	✔	✔	✔	✔	✔	✔	✔			
Auto reclosing	79	✔	✔									
Underfrequency / Overfrequency	81 O/U	✔	✔	✔	✔	✔	✔	✔	✔	✔		
Frequency gradient (ROCOF)	81R	✔	✔	✔	✔	✔						
Lockout function	86	✔	✔	✔	✔	✔						
Generator differential protection	87G				✔	✔						
Transformer differential protection	87T				✔	✔						
Restricted earth fault elements	87N (64REF)				✔	✔						
Breaker Wear Monitor	BKM	✔	✔		✔	✔						
Protection parameter sets		4	4	4	4	4	2	1	1			
Reverse interlocking		✔	✔		✔	✔						
Event, failure and disturbance recorder		✔	✔	✔	✔	✔	✔					
Trend recording		✔	✔	✔	✔	✔						
Control												
Control function for 1 / up to 6 switchgear(s)		6	1	1	6	6						
Logic (up to 80 equations)		✔	✔	✔	✔	✔						
Measuring functions												
Currents		✔	✔		✔	✔						
Thermal overload θ		✔	✔		✔	✔						
Voltages		✔	✔	✔	✔	✔						
Frequency		✔	✔	✔	✔	✔						
Hardware												
Number of binary output relays (depends on type of device)		7/13	7/13	6	11/11	11/11/11/16	2	4	4	2	2	1
Number of digital inputs (depends on type of device)		8/16	8/16	8	16/8	16/8/24/16	4	2	2			
Number of analog inputs and outputs (depends on type of device)					0/2+2	0/2+2/0/0						
Communication												
IEC61850 (RJ45 or fiber optic [FO] LC)		○	○	○	○	○						
RS485 Open Data							✔	✔	✔	○	○	
MODBUS RTU (via fiber optic [FO] ST or RS485)		○	○	○	○	○	○					
Modbus TCP (RJ45 or fiber optic [FO] LC)		○	○	○	○	○						
IEC60870-5-103 (via fiber optic [FO] ST or RS485)		○	○	○	○	○						
Profibus DP (via fiber optic [FO] ST or RS485)		○	○	○	○	○						
DNP3.0 RTU (via fiber optic [FO] ST or RS485)		○	○	○	○	○						
DNP3.0 TCP (RJ45 or fiber optic [FO] LC)		○	○	○	○	○						
IRIG-B interface (time synchronization)		✔	✔	✔	✔	✔						