Transformer Protection – Selector Guide

Transformer Protection

Features	Device	345	P642	P652
APPLICATIONS & FUNCTIONALITY				
Low to Medium size LV and MV Transformers		•	•	•
Medium to Large size MV-HV Transformers		•	•	
Auto-transformers			•	
Non-Standard Transformers				
Two windings		•	•	•
Three windings				
More then three windings				
3-phase Voltage inputs				
PROTECTION & CONTROL				
Transformer Differential	87T	•	•	•
Maximum Number of Windings/Restraint Inputs		2	2	2
Harmonic Restraint		•	•	•
Internal Winding Standard Phase Shift Compensation		•	•	•
Internal Winding Non-Standard Phase Shift Compensation				
Dynamic CT Ratio-Matching		•		
CT Mismatch Range		16/1	15/1	12/1
Restricted Ground Fault - RGF/REF	87G	•	•	•
Over-excitation (Voltz Per Hertz)	24		•	
Phase Undervoltage	27P			
IOC, Ground/Neutral/Phase	50G/N/P	G/N/P	G/N/P	G/N/P
TOC, Ground/Neutral/Phase	51G/N/P	G/N/P	G/N/P	G/N/P
Negative Phase Sequence Overcurrent	46	•	•	•
Custom programmable overcurrent curves		•		
Overvoltage - Phase	59P			
Overvoltage - Neutral	59N			
Overvoltage - Auxiliary	59X			
Overvoltage - Negative Sequence	59_2			
Current Directional, Neutral/Phase.	67 N/P			
Voltage Transformer Fuse Failure	VTFF/VTS			
Current Transformer Supervision	CTS		•	
Under/Overfrequency	81U/O			
Synchrocheck	25			
Synchrophasor				
Thermal Overload	49	•		
Power Swing Blocking	68			
Out of Step	78			
Backup Distance Protection	21			
Voltage Dependent Overcurrent (VCO/VRO)	51V		•	
Transformer Hottest-spot Temperature			•	
Transformer Aging factor			•	
Transformer Loss of Life			•	
Lockout	86		•	•
Tap Changer Monitoring				
Breaker Failure	50BF		•	•
Arc Flash Detection				
AUTOMATION				
Settings Groups		2	4	2
Contact Inputs (max)		10	12	6
Contact Outputs (max)		7	12	6
Non-volatile latches			•	•
Programmable Logic		•	•	simple
FlexElements™				
Virtual Inputs/Outputs		32	64/32	
Direct Inputs/Outputs				
Programmable Pushbuttons		•	10	
Trip/Close Coil Supervision		Trip	Trip	
User-Programmable LEDs			18	
User-Programmable Self Test				
Selector Switch				
Digital Counters				
Digital Elements		16		
Transducer Analog Inputs/Outputs (max)			4/4	
RTD Inputs (max)			10	

Transformer Protection

Features Continued	Device	345	P642	P652
MONITORING & METERING				
Power Factor				
Current – RMS		•	•	•
Current – Phasor			•	•
Current – Demand				
Current - Unbalance			•	•
Voltage			•	
Power - Apparent, Real, Reactive				
MW, MVA, Mvar Demand				
Breaker Arc Current				
Energy				
Frequency			•	
Temperature			•	
Current Harmonics (max)		5		
Loss of Life Calculations			•	
Fault Report		•	•	
User Programmable Trip Reports				
Event Recorder - Number of Events		256	512	512
Oscillography/Transient Recorder - Sampling Rate		32	24	16
Trip Counters				
Data Logger / Trend Recording		•		
Simulation Mode				
COMMUNICATIONS INTERFACES				
Front Port Local Access		•	•	•
Rear Communications (RS232/RS422)			•	
Rear Communications (G.703, C37.94)				
Ethernet		•	•	
Fiber (Ports)		• (1)		
PROTOCOLS				
Courier			•	
ModBus RTU		•	•	•
DNP3 Serial		•	•	
EGD Protocol				
IEC61850		•	•	
IEC 60870-5-104		•		
IEC 60870-5-103		•	•	•
Simple Network Time Protocol		•	•	
TCP/IP			•	
HTTP				
PRP (IEC 62439-3 Clause 4)			•	
HSR (IEC 62439-3 Clause 5)			•	
IRIG-B Input		•		
Process Bus (IEC 61850-9-2)				

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Transformer Protection – Selector Guide

Features	Device	745	845	P643	P645	T35	T60
APPLICATIONS & FUNCTIONALITY							
Low to Medium size LV and MV Transformers		•	•	•			
Medium to Large size MV-HV Transformers			•	•	•	•	•
Auto-transformers		•	•	•	•	•	•
Non-Standard Transformers						•	•
Two windings		•	•			•	•
Three windings		•	•	•	•	•	•
More then three windings					•	•	•
3-phase Voltage inputs			•	•	•	•	•
PROTECTION & CONTROL							
Transformer Differential	87T	•	•	•	•	•	•
Maximum Number of Windings/Restraint Inputs		3	3	3	5	6	6
Harmonic Restraint		•	•	•	•	•	•
Internal Winding Standard Phase Shift Compensation		•	•	•	•	•	•
Internal Winding Non-Standard Phase Shift Compensation						•	•
Dynamic CT Ratio-Matching		•	•			•	•
CT Mismatch Range		16/1	20/1	15/1	15/1	32/1	32/1
Restricted Ground Fault - RGF/REF	87G	•	•	•	•		•
Over-excitation (Voltz Per Hertz)	24	•	•	•	•		•
Phase Undervoltage	27P		•	•	•		•
IOC, Ground/Neutral/Phase	50G/N/P	G/N/P	G/N/P	G/N/P	G/N/P		G/N/P
TOC, Ground/Neutral/Phase	51G/N/P	G/N/P	G/N/P	G/N/P	G/N/P	G/P	G/N/P
Negative Phase Sequence Overcurrent	46	•	•	•	•		
Custom programmable overcurrent curves		•	•			•	•
Overvoltage - Phase	59P		•	•	•		•
Overvoltage - Neutral	59N		•	•	•		•
Overvoltage - Auxiliary	59X		•				•
Overvoltage - Negative Sequence	59_2		•	•	•		•
Current Directional, Neutral/Phase.	67 N/P		P/N	P/N	P/N		P/N
Voltage Transformer Fuse Failure	VTFF/VTS		•	•	•		•
Current Transformer Supervision	CTS			•	•		
Under/Overfrequency	81U/O	•	•	•	•		•
Synchrocheck	25		•				•
Synchrophasor							•
Thermal Overload	49	•				•	•
Power Swing Blocking	68						•
Out of Step	78						•
Backup Distance Protection	21						•
Voltage Dependent Overcurrent (VCO/VRO)	51V			•	•		
Transformer Hottest-spot Temperature		•	•	•	•		•
Transformer Aging factor		•	•	•	•	•	•
Transformer Loss of Life		•	•	•	•		•
Lockout	86			•	•	•	•
Tap Changer Monitoring		•	•				•
Breaker Failure	50BF			•	•		
Arc Flash Detection			•				
AUTOMATION							
Settings Groups		4	6	4	4	6	6
Contact Inputs (max)		16	14	40	40	96	96
Contact Outputs (max)		8	10	24	24	64	64
Non-volatile latches			•	•	•	•	•
Programmable Logic		•	•	•	•	•	•
FlexElements™						•	•
Virtual Inputs/Outputs		16/16	32/32	64/32	64/32	64/96	64/96
Direct Inputs/Outputs						32/32	32/32
Programmable Pushbuttons			3	10	10	12	12
Trip/Close Coil Supervision		Trip	•	Trip	Trip	Trip/Close	Trip/Close
User-Programmable LEDs			15	18	18	48	48
User-Programmable Self Test			•			•	•
Selector Switch			•			•	•
Digital Counters			•			•	•
Digital Elements			•			•	•
Transducer Analog Inputs/Outputs (max)		1	4/7	4/4	4/4	24/12	24/12
RTD Inputs (max)		1	12	10	10	24	24

Features Continued	Device	745	845	P643	P645	T35	T60
MONITORING & METERING							
Power Factor		•	•	•	•	•	•
Current – RMS		•	•	•	•	•	•
Current – Phasor			•	•	•	•	•
Current – Demand		•	•				•
Current - Unbalance		•		•	•		
Voltage		•	•	•	•	•	•
Power - Apparent, Real, Reactive		•	•	•	•	•	•
MW, MVA, Mvar Demand			•	•	•		•
Breaker Arc Current			•			•	•
Energy		•	•	•	•	•	•
Frequency		•	•	•	•	•	•
Temperature		•		•	•	•	
Current Harmonics (max)		21	25				25
Loss of Life Calculations		•	•		•		•
Fault Report		•	•	•	•	•	•
User Programmable Trip Reports			•			•	•
Event Recorder - Number of Events		40	1024	512	512	1024	1024
Oscillography/Transient Recorder - Sampling Rate		12	128	24	24	64	64
Trip Counters			•			•	•
Data Logger / Trend Recording		•	•			•	•
Simulation Mode		•					
COMMUNICATIONS INTERFACES							
Front Port Local Access		•	•	•	•	•	•
Rear Communications (RS232/RS422)		•		•	•	•	•
Rear Communications (G.703, C37.94)						•	•
Ethernet		•	•	•	•	•	•
Fiber (Ports)			•(2)			•(3)	•(3)
PROTOCOLS							
Courier				•	•		
ModBus RTU		•	•	•	•	•	•
DNP3 Serial		•	•	•	•	•	•
EGD Protocol						•	•
IEC61850			•	•	•	•	•
IEC 60870-5-104			•			•	•
IEC 60870-5-103			•	•	•	•	•
Simple Network Time Protocol			•	•	•	•	•
TCP/IP			•	•	•	•	•
HTTP		•	•			•	•
PRP (IEC 62439-3 Clause 4)			•	•	•	•	•
HSR (IEC 62439-3 Clause 5)				•	•		
IRIG-B Input			•			•	•
Process Bus (IEC 61850-9-2)					•	•	•

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