

Relion® 630 series

Transformer protection and control RET630

Flexibility for demanding utility distribution and industrial applications

RET630 is a comprehensive transformer management IED for protection, control, measuring and supervision of power transformers, unit and step-up transformers including power generator-transformer blocks in utility and industry power distribution networks. RET630 is a member of ABB's Relion® product family and a part of its 630 protection and control product series characterized by functional scalability and flexible configurability. RET630 also features necessary control functions constituting an ideal solution for transformer bay control. The supported communication protocols including IEC 61850 offer seamless connectivity to various station automation and SCADA systems.

Application

RET630 provides main protection for two-winding power transformers and power generator-transformer blocks. RET630 also includes an optional voltage regulation function. Two predefined configurations to match your typical transformer protection and control specifications are available. The pre-defined configurations can be used as such or easily adapted or extended with freely selectable add-on functions, by means of which the IED can be fine-tuned to satisfy the specific requirements of your present application.

Protection

RET630 features transformer differential protection with stabilized and multi-slope instantaneous stages to provide fast and selective phase-to-phase, winding interturn fault, and bushing flashover protection. Besides second harmonic restraint, an advanced waveform-based blocking algorithm ensures stability at transformer energization and the fifth harmonic restraint ensures stability at moderate transformer overexcitation.

For more critical or prolonged overflux situations, a dedicated overexcitation (volts-per-hertz) protection function is available. Sensitive restricted earth-fault protection (REF) completes the overall differential protection to detect even single phase-to-earth faults close to the transformer neutral. Either the conventional high-impedance scheme or a numerical low-impedance scheme can be selected for protection of the windings. When low-impedance REF protection is used, no stabilizing resistors or varistors are needed. In addition, the transforming ratio of the neutral earthing CT may differ from that of the phase current transformers. Due to its unit protection character the REF protection does not need any time grading with other protection schemes, and therefore a fast protection operating time can be achieved.

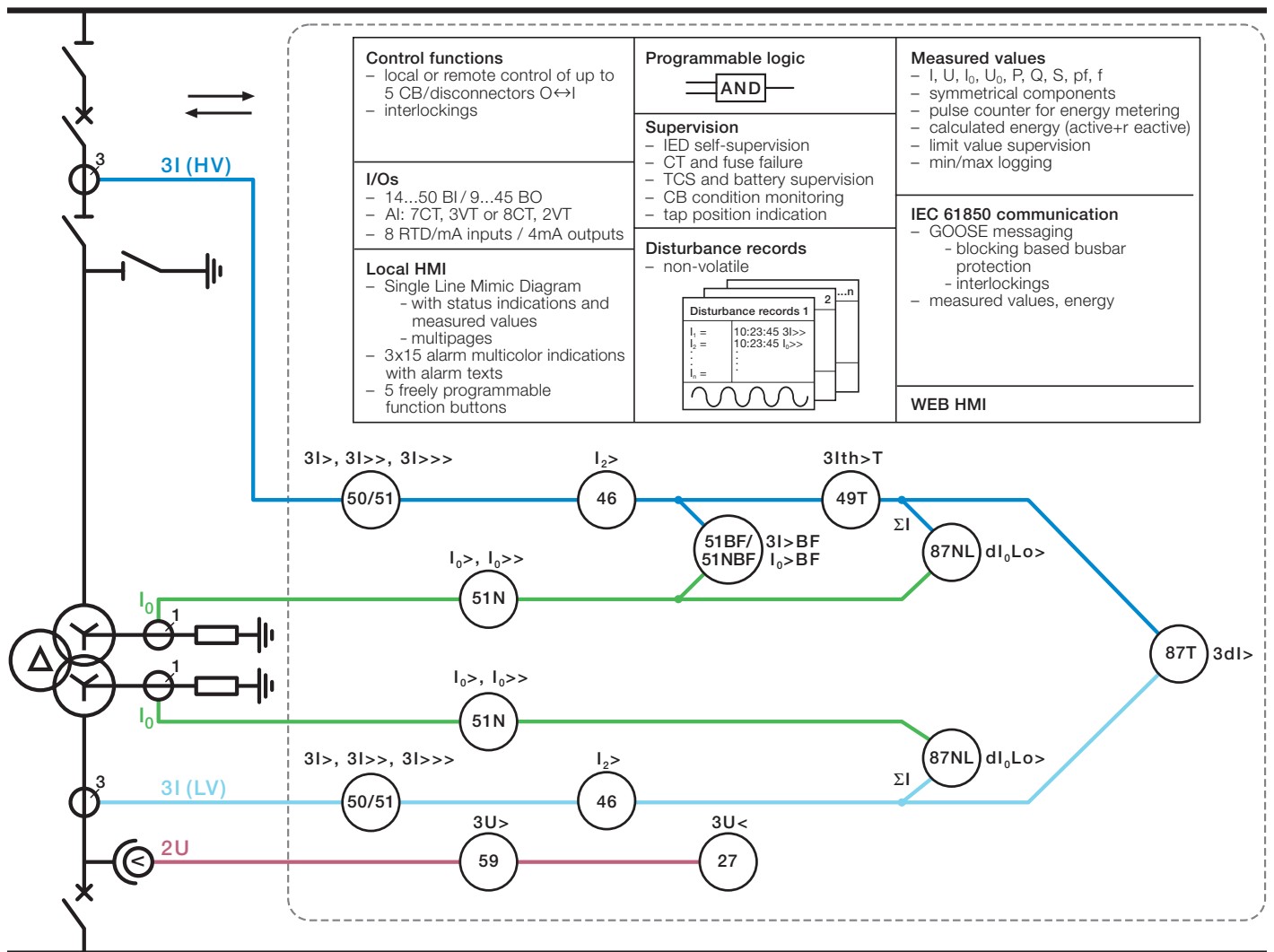
The IED also incorporates thermal overload protection to prevent an accelerated aging of the transformer isolation. Multiple stages of short-circuit, phase overcurrent, negative-phase-sequence and earth-fault back-up protection are separately available for both windings. The IED also features earth-fault protection based on the measured or calculated residual overvoltage of the power system.

To detect reversed power flow or circulating currents at parallel power transformers RET630 also offers directional overcurrent protection. The IED also includes overfrequency, underfrequency, positive sequence, negative sequence, underimpedance, overvoltage, undervoltage and earth-fault protection. Furthermore, RET630 also offers circuit-breaker failure protection.

The optional RTD/mA module incorporates eight analog RTD or mA measuring inputs and provides four mA outputs. The RTD and mA inputs can, for instance, be used for measuring the oil temperature at the bottom and top of the transformer tank and the ambient air temperature or for the supervision of analog signals provided by external transducers. An RTD input can also be used as a direct resistance measuring input for position tracking of an on-load tap changer. Alternatively, the tap changer position can be obtained via a mA-transducer. The RTD/mA inputs can also be used as inputs for DC voltage transducers. The RTD/mA module enables the use of the multipurpose protection functions. These protection functions can be used for tripping and alarm purposes based on RTD/mA measuring data, or analog values communicated via GOOSE messaging. The mA outputs can be used for transferring freely selectable measured or calculated analog values to devices provided with mA input capabilities.

Control

RET630 incorporates local and remote control functions. In addition to control functions, the RET630 features a set of logical functions allowing automation and logic operations to be integrated into the unit. The RET630 offers a number of freely assignable binary inputs/outputs, logic circuits for establishing bay control and interlocking functions for circuit breakers and motor operated switch-disconnectors. RET630 supports both single and double busbar substation layouts. The number of controllable primary apparatuses depends on the number of available inputs and outputs in the selected configuration. Besides conventional hardwired signaling, also GOOSE messaging according to IEC 61850-8-1 can be used for signal interchange between IEDs to obtain required interlocking information.



RET630 functional overview of pre-configuration B.

RET630 includes also integrated voltage regulation capability for automatic and manual voltage regulation of power transformers with a motor driven on-load tap-changer. In small substations with a single power transformer RET630 can be used for load-side voltage regulation. For substations with two or more power transformers operating in parallel three alternative voltage regulation methods are selectable, i.e. the master/follower principle, the negative reactance principle (NRP) or the minimizing circulating current (MCC) principle.

To protect the IED from unauthorized access and to maintain information integrity the device is provided with an authentication system including unique passwords for each user, which in turn are organized into user groups with different access levels.

Communication

RET630 features support for the IEC 61850 standard for communication in substations. The feeder management IED also supports the DNP3 (TCP/IP) and 60870-5-103 communication protocols. All operational information and controls are available through these protocols.

The implementation of the IEC 61850 substation communication standard in RET630 covers both vertical and horizontal communication, including GOOSE messaging. Analog GOOSE messaging enables fast transfer of analog measurement values over the station bus, thus facilitating for example sharing of RTD input values, such as surrounding temperature values, to other IED applications. The IED interoperates with other IEC 61850 compliant IEDs, tools and systems. The substation configuration language enables smooth configuration and commissioning of substation devices. For accurate time stamping RET630 supports synchronization over Ethernet using SNTP or over a separate bus using IRIG-B.

Customizable device

The user-friendly graphical configuration tool of the PCM600 Protection and Control IED Manager supports flexible development of application-specific configurations. To facilitate effective IED engineering a set of pre-configuration templates are available, offering smart re-use of configuration data. RET630 incorporates a customizable graphical display for visualizing single line mimic diagrams for various switchgear bay solutions.

RET630 transformer protection and control pre-configurations

Pre-configurations

Description	Pre-configuration
Pre-configuration A for two-winding HV/LV transformer	A
Pre-configuration B for two-winding HV/LV transformer including stabilized REF protection	B
Number of instances available	n

Supported functions with codes and symbols

Functionality	IEC 61850	IEC 60617	ANSI	A	B	n
Protection						
Three-phase non-directional overcurrent, low stage (LV side)	PHLPTOC	3I>	51P-1	1	1	2
Three-phase non-directional overcurrent, low stage (HV side)	PHLPTOC	3I>	51P-1	1	1	2
Three-phase non-directional overcurrent, high stage, (LV side)	PHHPTOC	3I>>	51P-2	1	1	2
Three-phase non-directional overcurrent, high stage, (HV side)	PHHPTOC	3I>>	51P-2	1	1	2
Three-phase non-directional overcurrent, instantaneous stage (LV side)	PHIPTOC	3I>>>	50P/51P	1	1	2
Three-phase non-directional overcurrent, instantaneous stage (HV side)	PHIPTOC	3I>>>	50P/51P	1	1	2
Three-phase directional overcurrent, low stage	DPHLPDOC	3I> →	67-1	-	-	2
Three-phase directional overcurrent, high stage	DPHHPDOC	3I>> →	67-2	-	-	1
Non-directional earth-fault, low stage (LV side)	EFLPTOC	I0>	51N-1	-	1	2
Non-directional earth-fault, low stage (HV side)	EFLPTOC	I0>	51N-1	1	1	2
Non-directional earth-fault, high stage (LV side)	EFHPTOC	I0>>	51N-2	-	1	2
Non-directional earth-fault, high stage (HV side)	EFHPTOC	I0>>	51N-2	1	1	2
Directional earth-fault, low stage	DEFPLPDEF	I0> →	67N-1	-	-	2
Directional earth-fault, high stage	DEFHPDEF	I0>> →	67N-2	-	-	1
Stabilised restricted earth-fault, (LV side)	LREFPNDF	dI0Lo>	87NL	-	1	2
Stabilised restricted earth-fault, (HV side)	LREFPNDF	dI0Lo>	87NL	-	1	2
High impedance based restricted earth-fault protection	HREFPDIF	dI0Hi>	87NH	-	-	2
Negative-sequence overcurrent, (LV side)	NSPTOC	I2>	46	1	1	4
Negative-sequence overcurrent, (HV side)	NSPTOC	I2>	46	1	1	4
Three-phase current inrush detection	INRPHAR	3I2f>	68	-	-	1
Three-phase thermal overload for transformers	T2PTTR	3Ith>T	49T	1	1	1
Three-phase overvoltage, (LV side)	PHPTOV	3U>	59	2	2	2
Three-phase undervoltage, (LV side)	PHPTUV	3U<	27	2	2	2
Positive sequence overvoltage	PSPTOV	U1>	470+	-	-	2
Positive sequence undervoltage	PSPTUV	U1<	47U+	-	-	2
Negative sequence overvoltage	NSPTOV	U2>	470-	-	-	2
Overexcitation protection	OEPVPH	U/f>	24	-	-	2
Three-phase underimpedance protection	UZPDIS	Z< GT	21GT	-	-	2
Residual overvoltage	ROVPTOV	U0>	59G	-	-	3
Frequency gradient	DAPFRC	df/dt>	81R	-	-	6
Overfrequency	DAPTOF	f>	81O	-	-	3
Underfrequency	DAPTUF	f<	81U	-	-	3
Transformer differential protection for 2 winding transformers	TR2PTDF	3dl>T	87T	1	1	1
Circuit-breaker failure (HV side)	CCBRBRF	3I>/I0>BF	51BF/51NBF	1	1	2
Tripping logic, (LV side)	TRPPTRC	I → O	94	1	1	2
Tripping logic, (HV side)	TRPPTRC	I → O	94	1	1	2
Multipurpose analogue protection function	MAPGAPC	MAP	MAP	-	-	16

Supported functions with codes and symbols

Functionality	IEC 61850	IEC 60617	ANSI	A	B	n
Control						
Bay control	QCCBAY	CBAY	CBAY	1	1	1
Interlocking interface	SCILO	3	3	4	4	10
Circuit breaker/disconnector control	GNRLCSWI	I ↔ O CB/DC	I ↔ O CB/DC	4	4	10
Circuit breaker	DAXCBR	I ↔ O CB	I ↔ O CB	1	1	2
Disconnector	DAXSWI	I ↔ O DC	I ↔ O DC	3	3	8
Local remote switch interface	LOCREM	R/L	R/L	-	-	1
Tap changer control with voltage regulator	OLATCC	COLTC	90V	-	-	1
Synchrocheck	SYNCRSYN	SYNC	25	-	-	1
Generic process I/O						
Single point control (8 signals)	SPC8GGIO	-	-	-	-	5
Double point indication	DPGGIO	-	-	-	-	15
Single point indication	SPGGIO	-	-	-	-	64
Generic measured value	MVGGIO	-	-	-	-	15
Logic Rotating Switch for function selection and LHMI presentation	SLGGIO	-	-	-	-	10
Selector mini switch	VSGGIO	-	-	-	-	10
Pulse counter for energy metering	PCGGIO	-	-	-	-	4
Event counter	CNTGGIO	-	-	-	-	1
Supervision and Monitoring						
Circuit breaker condition monitoring (HV side)	SSCBR	CBCM	CBCM	1	1	2
Fuse failure supervision	SEQRUFUF	FUSEF	60	1	-	1
Current circuit supervision, (LV side)	CCRDIF	MCS 3I	MCS 3I	-	-	2
Current circuit supervision, (HV side)	CCRDIF	MCS 3I	MCS 3I	-	-	2
Trip-circuit supervision	TCSSCBR	TCS	TCM	2	2	3
Tap position indication	TPOSSLTC	TPOSM	84M	-	-	1
Energy monitoring	EPDMMTR	E	E	1	1	1
Station battery supervision	SPVNZBAT	U<>	U<>	-	-	1
Measured value limit supervision	MVEXP	-	-	-	-	40
Measurement						
Three-phase current, (LV side)	CMMXU	3I	3I	1	1	2
Three-phase current, (HV side)	CMMXU	3I	3I	1	1	2
Three-phase voltage, (phase-to-phase)	VPPMMXU	3Upp	3Vpp	1	1	1
Three-phase voltage, (phase-to-earth)	VPHMMXU	3Upe	3Vpe	1	1	1
Residual current measurement	RESCMMXU	I0	I0	2	2	2
Residual voltage measurement	RESVMMXU	U0	Vn	-	-	1
Sequence current measurement	CSMSQI	I1, I2	I1, I2	-	-	1
Sequence voltage measurement	VSMSQI	U1, U2	V1, V2	-	-	1
Power monitoring with P, Q, S, power factor, frequency	PWRMMXU	PQf	PQf	1	1	1
Disturbance recorder function						
Analog channels 1-10 (samples)	A1RADR	ACH1	ACH1	1	1	1
Analog channel 11-20 (samples)	A2RADR	ACH2	ACH2	-	-	1
Analog channel 21-30 (calc val)	A3RADR	ACH3	ACH3	-	-	1
Analog channel 31-40 (calc val)	A4RADR	ACH4	ACH4	-	-	1
Binary channels 1-16	B1RBDR	BCH1	BCH1	1	1	1
Binary channels 17 -32	B2RBDR	BCH2	BCH2	1	1	1
Binary channels 33 -48	B3RBDR	BCH3	BCH3	1	1	1
Binary channels 49 -64	B4RBDR	BCH4	BCH4	1	1	1
Station communication (GOOSE)						
Binary receive	GOOSEBINRCV	-	-	-	-	10
Double point receive	GOOSEDPRCV	-	-	-	-	32
Interlock receive	GOOSEINTLKRCV	-	-	-	-	59
Integer receive	GOOSEINTRCV	-	-	-	-	32
Measured value receive	GOOSEMVRCV	-	-	-	-	62
Single point receive	GOOSESPRCV	-	-	-	-	62

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