

670 series Selection Guide

Protection and Control for Generation,
Subtransmission and Transmission Applications

Innovation

from

ABB



ABB

A new level of performance

The open and future-proof 670 series provides protection, monitoring and control for power generation, transmission and sub-transmission applications. 670 series is designed for the IEC 61850 standard, which enables optimized design from integrated to distributed systems depending on your preference.

670 series is based on well proven algorithms from the 316 and 500 series. These have been further enhanced to provide state-of-the art performance in terms of accuracy, speed, functionality, flexibility and information handling, and to comply with the requirements of the IEC 61850 standard.

The 670 series IEDs (Intelligent Electronic Device) are normally delivered pre-configured, type tested and with default parameters for easy handling of products – from ordering, engineering and commissioning to reliable operation. They are equipped with complete functionality adapted for different applications and configuration alternatives. If needed, they can also be easily adapted for your power system's specific requirements.

Multi-object capability

The 670 series products are based on a powerful hardware platform and hardware independent modular function library. This enables whole new application opportunities and unrivalled cost-performance ratio through multi-object protection and control capability. With 670 series products you can, for instance, protect and control a power transformer and a transmission line with a single IED. Or, you can integrate main and back-up protection in one IED. Alternatively, additional objects, such as transformers, can be included in the generator protection scope enabling full duplication of the protection in main one and main two.



Grid reliability

Reliable power supply

No chain is stronger than its weakest link. This is valid also for the power system. A reliable power supply requires high availability of power system objects, for instance transmission lines and transformers. Faults will always occur due to lightning strikes, pollution, aging and other reasons. To maximize the availability it is necessary to minimize the probability of faults and the time to restore operation. Therefore, a reliable protection and control equipment is needed for fast fault clearance and network restoration.

The protection and control IEDs retrieve information about currents and voltages during high load and fault conditions. It should also operate correctly with distorted signals caused by CT transients, CT saturation or extremely low values.

Dependability = Speed + Sensitivity

High speed is especially important for busbar, generator and transformer protection to limit damages from high current faults. High sensitivity is important for line protection since the majority of the faults are single phase-to-earth faults with moderate fault current due to high fault resistance and/or weak-end infeed. Dependability requires high speed and high sensitivity for all faults. The optimum balance between speed and sensitivity depends on the application.

Security = Selectivity + Stability

Differential current measurement used for busbar, generator, transformer and line differential protection provide absolute selectivity. An unwanted operation can initiate a network disturbance. High stability for through faults, CT-saturation and inrush currents are therefore especially essential for busbar, generator, transformer and breaker failure protection. Phase selectivity and stability for load and power swings are essential for transmission line distance protection. Security requires optimum balance between selectivity and stability, which depends on the application.



Reliability = Dependability + Security

The IED should operate correctly with dependable detection of all internal faults and at the same time maintain security for external faults. The IED should also ensure dependable and secure object control, such as interlocking and auto-reclosing. Duplicated protection, local or remote back-up can be used to improve the availability. Efficient information handling reduces the consequences of a disturbance. It is important to select and coordinate protection for the overall availability of the power system.

670 series IEDs designed to always operate correctly

670 series is designed to operate correctly during current transformer saturation and voltage transformer transients and includes an advanced breaker failure algorithm for multiple breakers. It can furthermore handle multiple sets of three phase current transformers for improved security. It also features adaptive communication for handling route switching and loss of GPS synchronization.

For maximum reliability of a power system

Line differential protection IED RED 670

The RED 670 IED is designed for protection, monitoring and control of overhead lines and cables with up to five line terminals. The phase segregated line differential protection of RED 670 enables reliable single/two/three pole tripping and auto-reclosing with synchronizing and synchro-check. In addition, this IED is capable of providing differential protection for transformer feeders and feeders connecting generator and transformer blocks to high voltage substations. It provides an extensive functionality with application opportunities and expandable hardware to meet your specific requirements.

RED 670 provides absolutely selective protection without time grading. All line short circuits and earth faults can be cleared instantaneously. Additionally, the high sensitivity of RED 670 allows for detection of small fault currents, which in turn allows high resistive phase to earth faults to be cleared.



Line distance protection IED REL 670

The REL 670 IED is designed for protection, monitoring and control of overhead lines and cables. It provides extensive functionality with diverse application opportunities, as well as expandable hardware to meet your specific requirements. The powerful IED provides distance protection for all types of overhead lines, cables and power network groundings.

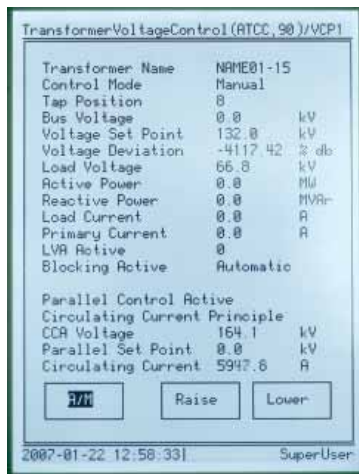
REL 670 features full scheme distance protection with independent phase selection, power swing detection and a wide range of scheme communication logics. The five zone distance protection for phase to phase and phase to earth faults enables you to protect and control several objects, for instance a line and a transformer with a single IED. As a result this IED increases both the reliability and profitability of your entire power system.

Arrangement	Sub arrangement	Line Differential Protection					Line Distance Protection					
		RED 670 A31	RED 670 B31	RED 670 A32	RED 670 B32	RED 670	REL 670 A21	REL 670 A31	REL 670 B31	REL 670 A32	REL 670 B32	REL 670
Open options	To be customized					■						■
Impedance grounding	3 phase trip						■					
1 Circuit Breaker	3 phase trip	■						■				
1 Circuit Breaker	1 phase trip			■						■		
2 Circuit Breakers	3 phase trip		■						■			
2 Circuit Breakers	1 phase trip				■						■	

Extensive application opportunities

Transformer protection IED RET 670

RET 670 provides fast and selective protection, monitoring and control for all types of transformers, such as two and three-winding transformers, autotransformers, phase shifting transformers, shunt reactors, step-up transformers in power stations and special railway transformers. With up to six three phase restraint current inputs into differential protection, multi-breaker substation arrangements on any side is permitted.



The advanced communication capabilities allow you to integrate this IED into your substation automation system or use it as a stand-alone multifunction unit. RET 670 can be equipped with advanced voltage control functionality for single and up to eight parallel transformers in any combination of parallel groups.

The extremely fast differential protection with automatic ratio matching, vector group compensation and tap-changer position reading make RET 670 an ideal solution even in the most demanding applications. RET 670 offers the best possible coverage for power transformer winding turn-to-turn faults, including low-level internal faults. It places low requirements on the main CTs and no interposing CTs are needed.

The low impedance restricted earth-fault function for all directly or low impedance earthed windings provides excellent stability for through faults. Having individual protection for each winding without the need for harmonics stabilization ensures high sensitivity and fast tripping.

Arrangement	Subarrangement	Transformer Protection						
		RET 670 A10	RET 670 A25	RET 670 A30	RET 670 B30	RET 670 A40	RET 670 B40	RET 670
Open options (24 AI)	To be customized							■
Station (12 AI)	Back up protection	■						
Transformer	Voltage Control		■					
2 winding (12/24 AI)	1 Circuit Breaker			■				
2 winding (24 AI)	2 Circuit Breakers				■			
3 winding (24 AI)	1 Circuit Breaker					■		
3 winding (24 AI)	2 Circuit Breakers						■	

State-of-the-art protection for equipment and people

Busbar protection IED REB 670

The REB 670 IED is designed for the protection and monitoring of busbars, T-connections and meshed corners from medium to extra high voltage levels.

Due to its extensive I/O capability, REB 670 protects single and double busbars with or without transfer bus, double circuit breaker or one-and-half circuit breaker arrangements. It provides selective, reliable and fast fault clearance for all types of internal phase-to-phase and phase-to-earth faults in solidly earthed or low impedance earthed power systems. It can also handle all internal multi-phase faults in isolated or high-impedance earthed power systems.

This IED features extremely short operate time, typically 12 ms, for most internal faults regardless of the number of connected feeders. At the same time, it maintains complete stability for external faults, even when heavy CT saturation occurs.



REB 670 features complete busbar protection, which in addition to differential protection includes flexible dynamic zone selection (disconnecter replica) integrated in one IED. This enables dynamic CT connections to differential zones, as well as selective busbar and breaker failure tripping, disconnecter and circuit breaker status supervision. Due to its unique measuring principle, 670 series IEDs has very low CT requirements compared to other numerical differential protection devices.

Arrangement	Subarrangement	Busbar Protection				
		REB 670-A20	REB 670-A31	REB 670-B20	REB 670-B21	REB 670-B31
4 bays/2 zones	3 phase	■				
8 bays/2 zones	3 phase / IED		■			
12 bays/2 zones (3 IEDs)	1 phase / IED			■	■	
24 bays/2 zones (3 IEDs)	1 phase					■
12 bays/2 zones	3 phase Summation			■	■	
24 bays/2 zones	3 phase Summation					■

Optimized control and reliable operation of a switchyard

Bay control IED REC 670

The REC 670 IED is designed for the control, monitoring and protection of circuit breakers, disconnectors, and earthing switches in any type of switchgear and different switchgear configurations. Additionally, it enables the manual control of a tap-changer from a Substation Automation system. With versatile functionality, the REC 670 IEDs can be applied to both single and multiple bay arrangements.

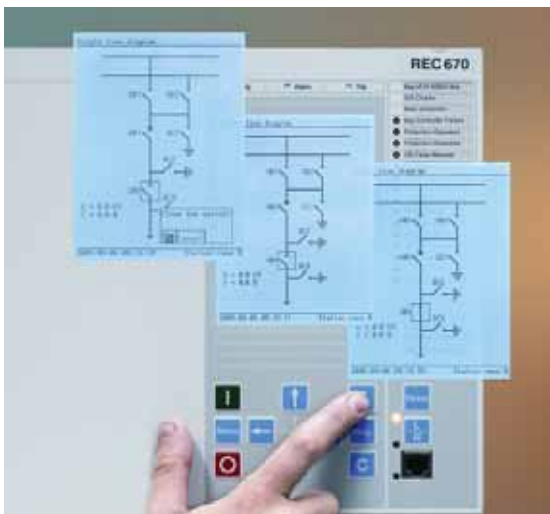
Furthermore, the REC 670 IED integrates advanced automatic voltage control for all transformers in a substation in a single IED. This eliminates the need for dedicated voltage IEDs in cases where the transformer protection is not equipped with voltage control.



The REC 670 IEDs feature a large HMI for local control and instant access to important data, such as settings, events and disturbance information. You can control and visualize locally up to 30 primary apparatuses with a single REC 670 IED. The control is based on the select before operate principle, which ensures secure operation and helps to avoid human mistakes.

REC 670 handles a large number of analog signals from CTs and VTs. The outstanding I/O capability enables control of several bays with complete measurement with only one IED, which simplifies the system design and ensures extremely cost-efficient solutions for any substation at any voltage level supporting different protection and control philosophies.

The powerful REC 670 supports interlocking both via a station bus and hardwired signals. REC 670 IEDs utilize GOOSE messaging based on the IEC 61850 standard to perform horizontal communication and interlocking.



Arrangement	Subarrangement	Bay Protection			
		REC 670-A30	REC 670-B30	REC 670-C30	REC 670
Open options	To be customized				■
1 Circuit Breaker	Control & Protection	■			
2 Circuit Breakers	Control & Protection		■		
1 ½ Circuit Breaker	Control & Protection			■	

Stepping-up performance

Generator protection IED REG 670

REG 670 IED provides protection and monitoring for generators, prime movers and step-up transformers in hydro-, pump storage-, gas-, combined cycle-, steam- and cogeneration stations. With excellent performance, flexibility and scalability it fulfils the demanding requirements of every corner of the world for both new installations and retrofits.

Based on ABB's extensive experience, REG 670 takes generator protection to a new performance level. Up to 24 analog inputs permit integration of main and back-up protection in one IED. Alternatively, additional objects, such as transformers, can be included in the generator protection scope. This enables full duplication of the protection for both protected objects within only two IEDs.

All this reduces the number of IEDs needed to protect the entire generating station and increasing availability at the same time. This in turn simplifies the installation and reduces lifecycle cost from commissioning to maintenance and spare parts. The IED functions also incorporate intelligent fault criteria to ensure unrivalled selectivity and sensitivity.



A generator protection system with REG 670 meets the requirements for maximum dependability and availability. The generator differential protection features extremely fast detection criteria, with a typical operate time of 15 ms – and yet the IED maintains high security.

The internal/external fault discriminator is based on negative sequence differential values, enabling a fast and selective decision to operate. The IED flexibility can be used to create intelligent, application specific functions to enhance your protection system to meet very specific requirements, for instance, when the operating conditions of the plant change.

Arrangement	Subarrangement	Generator Protection			
		REG 670-A20	REG 670-B30	REG 670-C30	REG 670
Open-Options	To be customized				■
Generator protection	12 AI	■			
Generator and auxiliaries protection	24 AI		■		
Generator - Transformer unit protection	24 AI			■	

Main protection functions

The 670 series Application Function Library includes the advanced and well proven protection algorithms from the 316/500-series. The further improved A/D conversion, CPU capacity and increased number of analog inputs has resulted in even higher speed, accuracy and reliability. In addition, the increased functionality allows the integration of parallel algorithms with advanced logic and communication.

It is even possible to integrate several different differential protection functions with parallel distance protection functions in RET 670, RED 670 or REG 670 IEDs. In addition, back-up phase-and-earth over-current protection can be included giving an efficient back-up protection for communication or voltage circuit failure.

■ = Basic □ = Optional

IEC 61850	ANSI	Function description	Busbar		Bay		Line Differential		Line Distance				Transformer				Generator																						
			REB 670-A20	REB 670-A31	REB 670-B20	REB 670-B21	REB 670-B31	REC 670-A30	REC 670-B30	REC 670-C30	REC 670	RED 670-A31	RED 670-B31	RED 670-A32	RED 670-B32	RED 670	REL 670-A21	REL 670-A31	REL 670-B31	REL 670-A32	REL 670-B32	REL 670	RET 670-A10	RET 670-A25	RET 670-A30	RET 670-B30	RET 670-A40	RET 670-B40	RET 670	REG 670-A20	REG 670-B30	REG 670-C30	REG 670						
Differential protection																																							
BTZNPDI	87B	Busbar differential protection, 2 zones, three phase/4 bays	■																																				
BTZNPDI	87B	Busbar differential protection, 2 zones, three phase/8 bays	■																																				
BSZNPDI	87B	Busbar differential protection, 2 zones, single phase/12 bays		■	■																																		
BSZNPDI	87B	Busbar differential protection, 2 zones, single phase/24 bays				■																																	
SWSGGIO		Status of primary switching object for busbar protection zone selection - disconnector replica	■	■	■	■	■																																
T2WPDIF	87T	Transformer differential protection, two winding																								■	■					□	□	□	□	□	□		
T3WPDIF	87T	Transformer differential protection, three winding																										■	■	■	□			□	□	□	□		
HZPDIF	87	1 phase High impedance differential protection					□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	
GENPDIF	87G	Generator differential protection																																				□	
REFPDIF	87N	Restricted earth fault protection, low impedance																																					□
L3CPDIF	87L	Line differential protection, 3 CT sets, 2-3 line ends									■	■	□																										
L6CPDIF	87L	Line differential protection, 6 CT sets, 3-5 line ends									□	□	□	□	□																								
LT3CPDIF	87LT	Line differential protection 3 CT sets, with in-zone transformers, 2-3 line ends									□	□	□	□																									
LT6CPDIF	87LT	Line differential protection 6 CT sets, with in-zone transformers, 3-5 line ends									□	□	□	□	□																								
Impedance protection																																							
ZMQPDIS	21	Distance protection zones, quadrilateral characteristic																																					
ZMQAPDIS																																							
ZDRDIR		Directional impedance quadrilateral																																					
ZMCPDIS	21	Distance measuring zone, quadrilateral characteristic for series compensated lines																																					
ZMSCAPDIS																																							
ZDSRDIR		Directional impedance quadrilateral, including series compensation																																					
ZMHPDIS	21	Full-scheme distance protection, mho characteristic																																					
ZMMPDIS	21	Full-scheme distance protection, quadrilateral for mho																																					
ZDMRDIR		Directional impedance element for mho characteristic																																					
ZDARDIR		Additional distance protection directional function for earth faults																																					
ZSMGAPC		Mho Impedance supervision logic																																					
FDPSPDIS	21	Phase selection with load encroachment, quadrilateral characteristic																																					
FMPSPDIS	21	Faulty phase identification with load encroachment																																					
ZMRPSB	78	Power swing detection																																					
ZMRPSL		Power swing logic																																					
PSPPPAM	78	Pole slip protection																																					
ZCVPSOF		Automatic switch onto fault logic, voltage and current based																																					
LEXPDIS	40	Loss of excitation																																					
PPLPHIZ		Phase preference logic																																					

Easy to handle

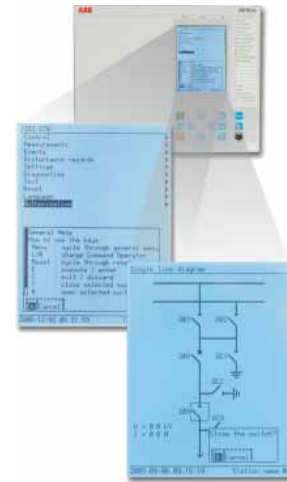
670 series IEDs are easy to handle throughout the life cycle of the installation from selection to operation and maintenance.

Built in IED HMI – Direct interaction without tools

The local HMI of the IEDs gives a quick yet detailed overview of the process with setting and control capabilities in any situation. The user-friendly navigation structure of the HMI allows fast and easy access to a desired function, settings or important data, such as event and disturbance information.

With up to six pages of the HMI, you can control and visualize up to 30 primary apparatuses. Measured service values are displayed and actual apparatus position status are presented. The single line diagram

corresponding to your switchgear arrangement can be displayed on the HMI. The symbols are available in the library according to both IEC and ANSI standards.



Function	Small HMI	HMI (Large display)	PCM 600 IED Manager	PCM 600 Engineering	PCM 600 Engineering Pro
Read on-line measuring values	■	■	■	■	■
Read stored events (1000)	■	■	■	■	■
Read stored fault locator values	■	■	■	■	■
Read stored disturbance recorder values			■	■	■
Upload stored disturbance recorder values (Manual)			■	■	■
Upload stored disturbance recorder values (Automatic)			■	■	■
Disturbance report generation (Automatic)			■	■	■
Read setting groups parameters (6)	■	■	■	■	■
Change active setting group	■	■	■	■	■
Write setting group parameters	■	■	■	■	■
Change lock (Block via BI)	■	■			
Test mode selection (Block/Activate functions)	■	■			
IED diagnostics (Internal events)	■	■	■	■	■
Object status (closed, open, value)		■			
Object control (close, open)		■			
Authorization	■	■	■	■	■
Bay graphical display		■			
Multi page (6) bay graphical display		■			
Multi page (6) bay graphical display editor			■	■	■
Signal matrix tool (Link I/O)			■	■	■
IEC 61850-8-1 communication configuration (CCT)					■
IEC 61131-3 graphical configuration				■	■

Information management power

Protection and Control IED Manager PCM 600 is an easy-to-handle tool for configuration and communication engineering, parameter setting, and monitoring. It provides versatile functionalities required throughout the life cycle of protection and control IEDs in transmission and distribution applications. It features functionality for creating and editing single line diagram for the IED HMI, and supports the efficient configuration of I/O signals. With PCM 600, you can also graphically adapt the configuration or create new configurations to meet your specific needs.

The advanced PCM 600 takes the first step towards a new era in disturbance handling. It scans and retrieves disturbance information for automatic report file generation. Automatic reporting allows relay engineers to concentrate on disturbance analysis instead of manually collecting data. This way there is more time for analysis of demanding fault cases.

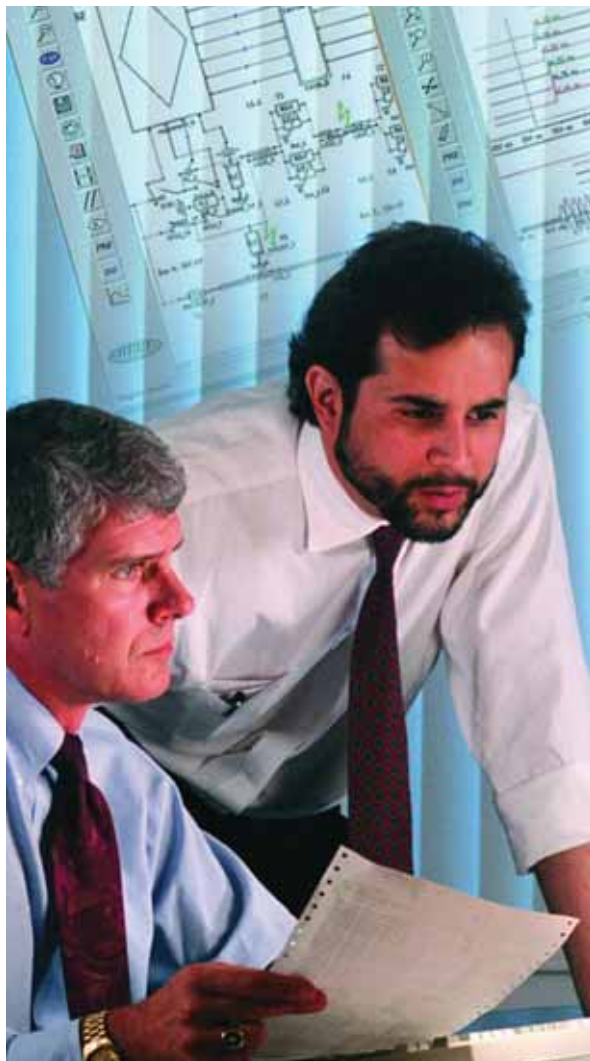
PCM 600 is fully compliant with IEC 61850 standard, which simplifies IED engineering and enables information exchange with other IEC 61850 compliant tools.

Future-proof concept

Migration with backward-compatible solutions

670 series enables IEC 61850 compliant substation automation and protection solutions for new installations and retrofit projects. Your previous investments in ABB are secured with backward-compatible solutions.

- Interoperability throughout the lifetime of the installation
- Openness for evolving communication technologies
- Re-usable applications
- Stepwise investments adjusted to your plans
- Flexible substation retrofits and extensions



Full scope of services

In addition to our broad range of protection and control products and systems, ABB offers a comprehensive selection of services to help you manage your power system behavior under diverse operational and disturbance situations. This enables you to utilize the full potential of your power system.

Our training courses provide engineers and operators a unique opportunity to benefit from ABB's deep power system knowledge. In our training courses, you will meet experienced and dedicated instructors. In addition to lectures, our training courses include extensive hands-on sessions and well-documented exercises. This will help you to be well prepared to both efficiently handle the equipment in daily operation and to meet any type of operational situation. You will also learn how to adapt the products to your specific requirements.



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