



Substation Automation Products

# Bay control REC670/650 Relion<sup>®</sup> 670 and 650 series

# For optimized control and reliable operation of your switchyard

The REC670 and REC650 Bay control IEDs (Intelligent Electronic Device) are designed for the control, monitoring and protection of circuit breakers, disconnectors, and earthing switches in different switchgear configurations. Providing extensive application opportunities, both these IEDs are designed for IEC 61850. They implement the core values of this standard, which ensures open, future-proof and flexible system architectures, with state-of-the-art performance. The IEDs are therefore ideal for refurbishment and extension of existing installations as well as for new installations.

## REC670 – maximum flexibility and performance

The REC670 IEDs provide customized or pre-configured control solutions for any type of switchgear and for different switchgear configurations. The customized REC670 gives you the freedom to select the functionality entirely according to your needs. The REC670 variants simplify handling since the basic functionality is included and pre-configured. If needed, you can add optional functions to easily increase the functionality of the REC670 IEDs to meet the specific requirements of your switchyard.

REC670 enables the manual control of a tap-changer from a Substation Automation system. It can also integrate advanced voltage control for transformers in a substation in a single IED. This eliminates the need for dedicated voltage control devices in cases where the transformer protection is not equipped with voltage control.



### REC650 – ease of use from ready-to-use solutions

REC650 offers optimum 'off-the-shelf' solutions for control applications in single breaker applications in single and double busbar arrangements. For double busbar arrangements, control of a bus coupler bay is also available.

The type-tested variants are equipped and configured with complete functionality, and with default parameters for easy handling of products – from ordering, engineering and commissioning to reliable operation.

The 650 series IEDs introduce a number of innovations, such as significantly reduced parameter settings and extended IED HMI functionality including 15 dynamic three-color-indication LEDs per page, on up to three pages, and configurable push-button shortcuts for different actions. In the 650 series IEDs, all basic parameters are set before delivery from the factory. You only need to set the parameters specific to your application, such as line data. This allows the IEDs to be quickly taken into operation.

### Outstanding control capabilities

The bay control IEDs feature a large HMI for local control and instant access to important data, such as settings, events and disturbance information. It also provides a quick overview of the status of the bay with position indications and service values. You can freely select which of the measurements available in the IEDs should be shown on the HMI of the IEDs.

You can control and visualize locally up to thirty primary apparatus in up to six bays with REC670, and up to eight primary apparatus in one bay with REC650. The control is based on the select-before-operate principle, which ensures secure operation and helps avoid human error. By selecting the control screen as a default screen in REC650, you can quickly execute control commands, and see the most important values. REC650 features three pages of alarm indications and each page consists of 15 dynamic three-color indication LEDs. These three-color LEDs can present the status of any binary input signal on the HMI of REC650 IEDs.

The Protection and control IED manager PCM600 tool offers a symbol library according to IEC and ANSI standards. You can use this tool to easily configure the graphical display of the

IEDs to correspond with your needs and to your substation. The built-in disturbance and event recorders provide you with valuable data for post-fault analysis and corrective actions to increase the security of your power system.

The outstanding I/O capability of REC670 enables the control of several bays with complete measurement with only one IED. For instance, one REC670 IED is capable of handling the control of all apparatus in one entire diameter in an 1 1/2 breaker arrangement, including breaker failure protection for all breakers. REC670 therefore simplifies system design and ensures extremely cost-efficient solutions for any substation at any voltage level supporting different protection and control philosophies.

Additionally, REC670/650 features the two-position versatile switch and the 32-position selector switch functions, which enable you to easily manage switching operations via an icon on the IED HMI. The versatile switch function allows you to directly change, for instance, the autorecloser function from On to Off, or vice versa, without changing the configuration. This function also presents an indication of the selected position. The selector switch can replace an external mechanical selector switch and allows you to directly select the position you desire, for instance to change the autorecloser mode between 1-pole, 3-pole or 1- and 3-pole modes in REC670. In addition to the IED HMI, these switch functions can be operated from a remote system.

### Secure interlocking

The advanced interlocking functionality of REC670 and REC650 IEDs allows you to avoid dangerous or damaging switchgear operations and to assure personnel safety. Both IEDs perform secure bay- and station-wide interlocking using easy-to-use reservation functionality. Reservation prevents simultaneous operation of apparatus and ensures that the interlocking information is correct at the time of operation.

Ready-made and tested interlocking modules are available for almost any type of switchgear arrangement. The interlocking scheme based on these modules can also be adapted to your specific interlocking conditions. These powerful IEDs support interlocking both via a station bus and hardwired signals.

# Cost savings through integrated functionalities

The bay control IEDs utilize [GOOSE messaging](#) based on the IEC 61850 standard to [perform horizontal communication and interlocking](#). This provides a cost-efficient solution for the interlocking.

## Operational reliability

In addition to interlocking, the output relays of the REC670 and REC650 IEDs feature an [integrated continuous supervision function to ensure high security against unwanted operation](#). The Bay control IEDs are designed with the same technology as ABB's other 670 and 650 series protection and control IEDs. [Meeting the stringent EMC requirements set for protection relays](#), these bay control IEDs provide secure control of your primary equipment.

## Cost savings through integrated functionalities

Both REC670 and REC650 bay control IEDs feature [breaker failure protection](#). This provides cost savings and improves availability since no separate breaker failure protection relays are needed. REC650 integrates breaker failure protection for one breaker in each device, and REC670 for breakers in any type of breaker arrangement in a single device. Integrated synchronizing functions, autoreclosing and back-up protection functionality save both space and money. In addition, the integrated local HMI eliminates extensive cabling as the traditional mimic board with related interposing relays is not needed.

The [capacitor bank protection](#) in REC670 [detects dangerous operation situations and trips before any damage occurs](#) in capacitor units that are vulnerable to different phenomena in power systems.

The capacitor bank protection in REC670 IEDs consists of overcurrent protection, undercurrent protection, harmonic overload protection, reactive power overload protection and a reconnection inhibit function. These, together with other protection functions that can be included in REC670 IEDs, such as unbalance protection based on overcurrent protection, provide complete protection for capacitor banks.

In addition to the wide range of overcurrent protection functions, REC670 provides [a negative sequence overcurrent protection](#). This function detects all unsymmetrical faults with or without earth connection. It features high sensitivity, which [enables detection of faults with low fault current](#). The negative sequence overcurrent protection can also be used as directional. This facilitates the coordination with protection for other objects.

The four step negative sequence overcurrent protection can serve as back-up protection for most faults. It can also serve as the main protection for earth faults and other unsymmetrical faults.



The REC650 features [extensive circuit breaker condition monitoring](#) and [monitoring of the station battery supply](#). The three trip circuit supervision outputs of the IED eliminate the need for an external trip circuit supervision unit.

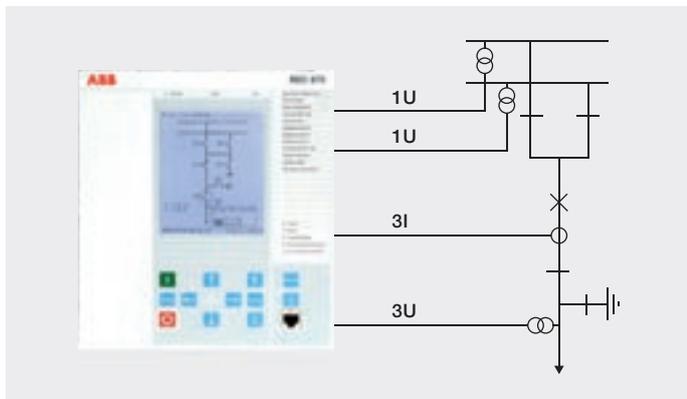
## Fast and efficient system integration

The REC670 and REC650 IEDs provide a compact, bay-oriented control solution with communication capabilities replacing conventional control circuits. Due to their [IEC 61850 compliance](#), they can be easily integrated with any IEC 61850 compliant system. In addition, they can exchange information and cooperate with other vendors' IEC-61850-compliant IEDs.

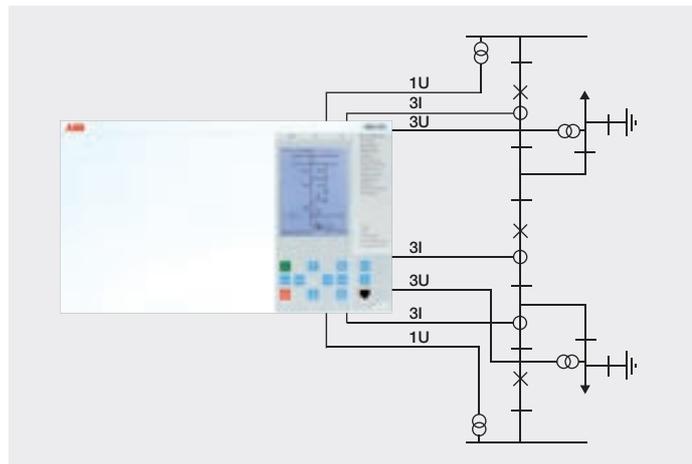
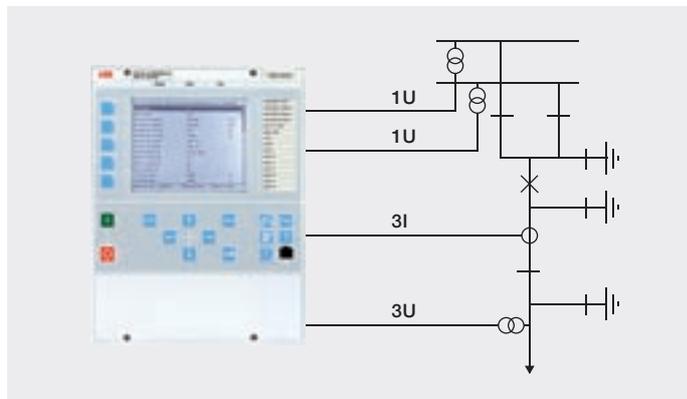
Relion® 670 series IEDs support [IEC 62439 standard redundant communications on the station bus as per IEC 61850 standard](#). The solution from ABB utilizes the IEC 62439-3 [standardized Parallel Redundancy Protocol \(PRP\)](#). PRP improves the communication system reliability and features a unique capability of zero seconds' recovery time in case of communication failures. This means that there will be [no interruption in communication](#) if one link fails as the other link instantaneously takes over the communication. As a result, there is no data lost when communication failures have occurred.

The [supervision of communication links](#) provides real-time status information about both communication links individually. If a failure occurs, an alarm is sent to the IED HMI and the substation automation system. This also allows for maintenance of the station bus while it is in operation. Thus, redundant communication further [improves personnel safety](#) and ensures that the [necessary information](#) about the system is available [for operators in all situations](#).

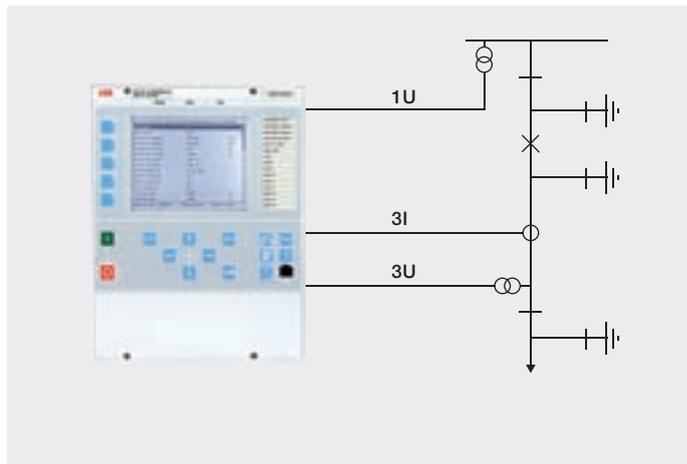
## Application examples



REC670/650 in a double busbar single circuit breaker arrangement.



One REC670 is capable of handling control of all apparatus in one entire diameter in 1 1/2 breaker arrangement.



REC650 in a single busbar single circuit breaker arrangement.

Relion 670 series IEDs can also [support synchronized sampled measured value communication over the process bus using IEC 61850-9-2 LE](#) which replaces conventional wiring between the process and the secondary system. This enables new design of substations. For example, utilization of sensor technology eliminates problems caused by, for instance, CT saturation and EMC influence. Furthermore, extensions and maintenance of substations can be completed more efficiently as fiber-optic cables are used instead of copper wires.

670 series IEDs allow you to mix conventional wiring and fiber-optic communication with IEC 61850-9-2 LE in a single IED. This way you can shift from conventional wiring for analog data to fiber-optic-based communication for synchronized sampled measured values step by step.

## Relion® – Complete confidence

Bay control REC670/650 IEDs belong to the Relion® protection and control product family. The Relion product family offers the widest range of products for the protection, control, measurement and supervision of power systems. To ensure interoperable and future-proof solutions, Relion products have been designed to implement the core values of the IEC 61850 standard. With ABB's leading-edge technology, global application knowledge and experienced support network, you can be completely confident that your system performs reliably – in any situation.

### Features

- Fully IEC 61850 compliant
- Protection, monitoring and control integrated in one IED
- Extensive self-supervision including analog channels
- Six independent parameter setting groups
- Large HMI with up to six LCD pages for local control and visualization of single line diagrams
- Ethernet interface for fast and easy communication with PC
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling

### Pre-configured solutions

- Pre-configured and type-tested solutions including default settings for:
  - Single breaker with selective single- or three-phase tripping
  - Double breaker with selective single- or three-phase tripping
  - 1 1/2 circuit breaker arrangements with selective single- or three-phase tripping

### Control functions

- Apparatus control for up to six bays and 30 apparatus
- Function instances included to cover a complete diameter with one REC670
- Ready to use interlocking modules for different switchgear arrangements
- Several alternatives for reservation functionality
- Synchronizing, synchrocheck and energizing check
- Autorecloser
- Automatic voltage control for a single transformer
- Automatic voltage control for up to four/eight parallel transformers based on the minimum circulating current principle or the master-follower principle
- Versatile switch with two positions
- Selector switch with up to 32 positions

### Protection functions

- Current
  - Instantaneous phase- and residual overcurrent protection
  - Four step phase- and residual overcurrent protection
  - Four step directional negative sequence overcurrent protection
  - Sensitive directional earth-fault protection
  - Broken conductor check
  - Thermal overload protection
  - Breaker failure protection
  - Stub protection
  - Pole discordance protection
  - Capacitor bank protection
- Power functions
  - Directional under- and over power protection
- Voltage
  - Two step phase- and residual overvoltage protection with definite and inverse time characteristics
  - Two step undervoltage protection with definite and inverse time characteristics
  - Voltage three-phase differential for capacitor banks
  - Loss of voltage check
- Secondary system supervision
  - Fuse failure supervision
  - Current circuit supervision
- Frequency functions
  - Under- and overfrequency protection
  - Rate-of-change frequency protection
- Multi-purpose function
  - General current and voltage protection

### Logic

- Tripping logic
- Trip matrix logic
- Configurable logic blocks
- Logic gates with quality and time

### Monitoring

- Disturbance recorder
  - 100 disturbances
  - 40 analog channels (30 physical and 10 derived)
  - 96 Binary channels
- Event list for 1000 events
- Disturbance report
- Event and trip value recorders
- Fault locator
- Event counters
- Supervision of AC and mA input quantities
- Small and large HMI in local language
- LED indications with 6 red and 9 yellow LEDs

### Metering

- U, I, P, Q, S, f, and  $\cos\phi$
- Differential voltage per zone
- AC input quantities with accuracy better than 0.5%
- Inputs for mA measuring
- Energy metering function for energy statistics
- Pulse counting support for energy metering

### Communication

- IEC 61850-8-1 including GOOSE messaging
- IEC 61850-9-2 LE Process bus
- Individually supervised redundant station bus with zero seconds' recovery time
- IEC 60870-5-103 serial communication
- DNP 3.0 slave protocol
- LON
- SPA
- Remote end communication for transfer of 192 binary signals

### Setting, configuration and disturbance handling

- Protection and control IED manager PCM600

### Hardware

- 1/1 x 19", 3/4 x 19" or 1/2 x 19" 6U height case selected according to the number of required I/O modules
- Power supply modules from 24 to 250 V DC  $\pm$  20%
- TRM module with measurement transformers
- ADM module
- Up to 14 I/O modules in 1/1 x 19" case
- Binary input module, 30 mA and 50 mA, with 16 inputs
- Binary output module with 24 outputs
- Static binary output module with 12 outputs (6 static)
- Binary input/output module, 30 mA and 50 mA, with 8 inputs and 12 outputs
- mA input module with 6 transducer channels
- Accurate time-synchronization through GTM, GPS time module or IRIG-B, SNTP and DNP 3.0
- Remote end data communication modules for C37.94, X.21 and G.703/G.703E1
- COMBITEST test switch module

Technical details are available in the REC670 Product Guide.

### Features

- Fully IEC 61850 compliant
- Protection, monitoring and control integrated in one IED
- Extensive self-supervision including analog channels
- Four independent parameter setting groups
- Large HMI for local control, visualization of single line diagrams and on-line measurements
- Integrated or detachable HMI with 1-5 m cable for flexible panel mounting
- Ethernet interface for fast and easy communication with PC
- Accurate time-synchronization via SNTP, DNP 3.0, IEC 60870-5-103 and IRIG-B serial interface
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling

### Configured solutions

- Single busbar, single breaker bay with three-phase tripping
- Double busbar, single breaker bay three-phase tripping
- Buscoupler bay with bus earthing switches with three-phase tripping

### Control functions

- Apparatus control for one bay and up to 8 apparatus
- Ready to use interlocking modules
- Simpler and safe reservation functionality
- Three-phase autorecloser
- Synchronizing, synchrocheck and energizing check
- Selectable operator place allocation
- Versatile switch with two positions
- Selector switch with up to 32 positions

### Protection functions

- Current
  - Instantaneous phase overcurrent protection
  - Instantaneous residual overcurrent protection
  - Four step directional phase overcurrent protection with definite and inverse time characteristics
  - Four step residual directional overcurrent protection with definite and inverse time characteristics
  - Sensitive directional earth-fault protection
  - Two step negative sequence based directional overcurrent protection
  - Broken conductor check
  - Thermal overload protection
  - Breaker failure protection
  - Stub protection
  - Pole discordance protection
- Power functions
  - Directional under- and over power protection
- Voltage
  - Two step phase- and residual overvoltage protection with definite and inverse time characteristics
  - Two step undervoltage protection with definite and inverse time characteristics
  - Loss of voltage check
- Secondary system supervision
  - Fuse failure supervision
  - Current circuit supervision
  - Breaker close/trip circuit monitoring
- Frequency functions
  - Under- and overfrequency protection
  - Rate-of-change frequency protection

### Logic

- Tripping logic
- Trip matrix logic
- Configurable logic blocks
- Configurable logic blocks with quality and time

### Monitoring

- Disturbance recorder
  - 100 disturbances
  - 40 analog channels (30 physical and 10 derived)
  - 96 binary channels
- Event list for 1000 events
- Disturbance report
- Event and trip value recorders
- Event counters
- Trip circuit supervision
- Supervision of AC input quantities
- Indication of up to 135 binary signals via 15 three-color-state indication LEDs on up to three pages
- Insulation gas monitoring function
- Insulation liquid monitoring function
- Circuit breaker condition monitoring
- Station battery supervision
- Large HMI

### Measurements

- U, I, P, Q, S, f, and  $\cos\varphi$
- Differential voltage per zone
- AC input quantities with accuracy better than 0.5%

### Metering

- Energy metering function or energy statistics
- Pulse counting support for energy metering

### Communication

- IEC 61850-8-1 including GOOSE messaging
- DNP 3.0 slave protocol
- IEC 60870-5-103 serial communication

### Setting, configuration and disturbance handling

- Protection and control IED manager PCM600

### Hardware

- 1/2 x 19" 6U height case
- 10 analog inputs (5 CT and 5 VT or 6 CT and 4 VT inputs depending on the configured solution)
- Universal 1A/5A CT inputs
- Communication and processor module with 14 inputs
- Binary input/output module with 9 inputs and 9 outputs
- Possibility to add one optional binary input/output module (single busbar, single breaker bay with three-phase tripping variant)
- Power supply modules from 48 to 250 V DC or 100 to 240 V AC with 9 outputs, 3 of which with trip circuit supervision

Technical details are available in the REC650 Product Guide.

# Contact us

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