Busbar differential protection IED
REB 670

Buyer's Guide

Pre-configured
1MRK 505 172-BEN
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Features

- IED for differential protection of busbars, meshed corners and T-protection
- Three-phase version of the IED with two low-impedance differential protection zones and four or eight three-phase CT inputs
- One-phase version of the IED with two low-impedance differential protection zones and twelve or twenty-four CT inputs. Three IEDs per protection scheme are usually required, one for each phase
- Three configuration alternatives are available – ready to connect
- Two low-impedance differential protection zones with:
  - High speed tripping for internal faults. Typical operating time 12 ms
  - Complete stability for through faults, with heavy CT saturation, and a maximum remanence in the CT core at auto-reclosing
  - Low CT requirement, only 2 milliseconds to saturation needed for correct operation
  - Intelligent detection for open or shorted CT secondary circuits and configurable blocking of differential protection zone
  - Different CT ratios can be easily adjusted via built-in HMI or from PC with the software tool PCM 600
  - Sensitive differential protection stage for power systems with limited earth-fault current
- Software driven dynamic Zone Selection (i.e. busbar replica) ensures:
  - No switching in CT secondary circuits neither interposing CTs are required
  - Easy adaptation to different substation layouts such as: single or double bus (with transfer bus), one-and-half or double breaker, etc.
  - Simple adaptation to buses with only one set of CTs in the bus-section or bus-coupler bays
  - Selective tripping i.e. routing of busbar differential protection trip commands to all circuit breakers connected to the faulty zone
  - Marshaling of integrated or external breaker failure protection backup-trip commands to all surrounding circuit breakers
  - Merging of the two differential zones when required (i.e. during load transfer in double busbar stations)
  - Disconnector and/or circuit breaker status supervision
- Integrated overall check zone independent from any disconnector position is included for increased security for complex station layouts
- Breaker failure protection is optionally available for every CT input. Main features of integrated breaker failure functions are:
  - Operation mode settable as current based, breaker contact based or combination of the two
  - Single- or three-phase starting
  - Re-trip facility to the faulty feeder breaker with or without current check
- Non-directional, inverse or definite time delayed overcurrent protection with four steps is optionally available for every CT input. It can be used as:
  - End-fault or blind-spot protection
  - Main or back-up protection for the feeder or bus-tie bays
- Built-in data communication modules for station bus IEC 61850-8-1
- Data communication modules for station bus IEC 60870-5-103, LON and SPA
- Programmable logic gates as AND, OR, INV, Timers etc. are available for customized solutions
- On screen display of all measured bay currents and all calculated differential currents
- On screen display of bay-to-zone allocations and status of connected switchgear devices
- Cost effective summation type differential principle is available for less demanding applications

- Apparatus position indications can be sent between single phase REB 670 with optional LDCM optical communicaton module
- Auto Reclose scheme for busbar restoration
- Integrated disturbance and event recorder for up to 40 analog and 96 binary signals
- Time synchronization over IEC 61850-8-1, LON, SPA, binary input or with optional GPS module
- Analog measurements accuracy up to below 0.25% for current and voltage and with site calibration to optimize total accuracy
- Versatile local human-machine interface
- Extensive self-supervision with internal event recorder
- Six independent groups of complete setting parameters with password protection
- Powerful software PC tool for setting, disturbance evaluation and configuration

Application

REB 670 is designed for the selective, reliable and fast differential protection of busbars, T-connections and meshed corners. REB 670 can be used for protection of single and double busbar with or without transfer bus, double circuit breaker or one-and-half circuit breaker stations. The IED is applicable for the protection of medium voltage (MV), high voltage (HV) and extra high voltage (EHV) installations at a power system frequency of 50Hz or 60Hz. The IED can detect all types of internal phase-to-phase and phase-to-earth faults in solidly earthed or low impedance earthed power systems, as well as all internal multi-phase faults in isolated or high-impedance earthed power systems.

REB 670 has very low requirements on the main current transformers (i.e. CTs) and no interposing current transformers are necessary. For all applications, it is possible to include and mix main CTs with 1A and 5A rated secondary current within the same protection zone. Typically, CTs with up to 10:1 ratio difference can be used within the same differential protection zone. Adjustment for different main CT ratios is achieved numerically by a parameter setting.

The numerical, low-impedance differential protection function is designed for fast and selective protection for faults within protected zone. All connected CT inputs are provided with a restraint feature. The minimum pick-up value for the differential current is set to give a suitable sensitivity for all internal faults. For busbar protection applications typical setting value for the minimum differential operating current is from 50% to 150% of the biggest CT. This setting is made directly in primary amperes. The operating slope for the differential operating characteristic is fixed to 53% in the algorithm.

The fast tripping time of the low-impedance differential protection function is especially advantages for power system networks with high fault levels or where fast fault clearance is required for power system stability.

The advanced open CT detection algorithm detects instantly the open CT secondary circuits and prevents differential protection operation without any need for additional check zone.

Differential protection zones in REB 670 include a sensitive operational level. This sensitive operational level is designed to be able to detect internal busbar earth faults in low impedance earthed power systems (i.e. power systems where the earth-fault current is limited to a certain level, typically between 300A and 2000A primary by a neutral point reactor or resistor). Alternatively this sensitive level can be used when high sensitivity is required from busbar differential protection (i.e. energizing of the bus via long line).

Overall operating characteristic of the differential function in REB 670 is shown in the following figure.

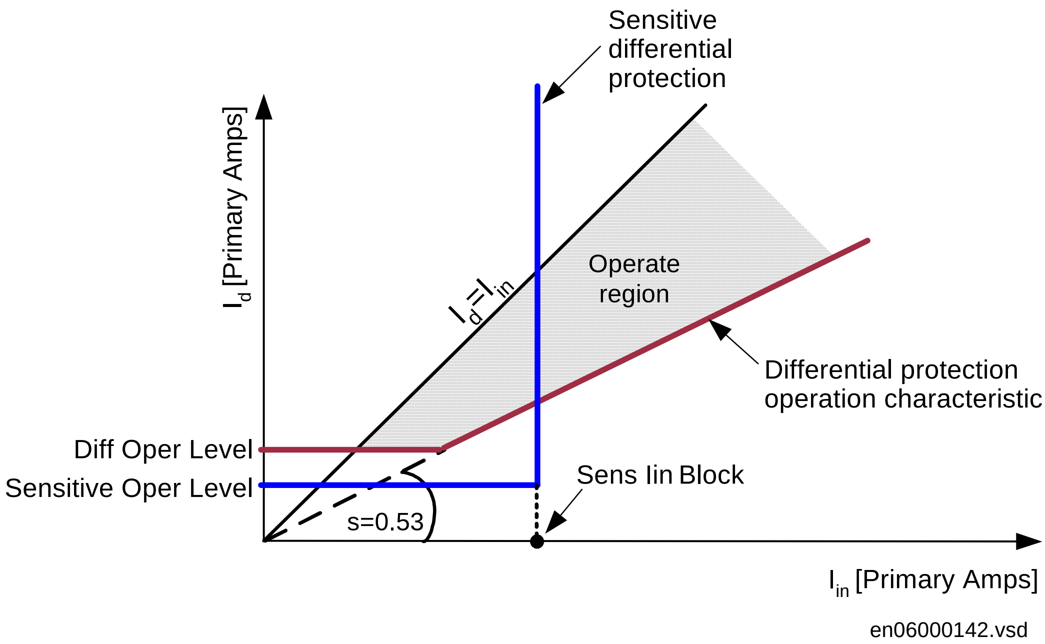

Figure 1: REB 670 operating characteristic

Integrated overall check zone feature, independent from any disconnector position, is available. It can be used in double busbar stations to secure stability of the busbar differential protection in case of entirely wrong status indication of busbar disconnector in any of the feeder bays.

Flexible, software based dynamic Zone Selection enables easy and fast adaptation to the most common substation arrangements such as single busbar with or without transfer bus, double busbar with or without transfer bus, one-and-a-half breaker stations, double busbar-double breaker stations, ring busbars, etc. The software based dynamic Zone Selections ensures:

- Dynamic linking of measured CT currents to the appropriate differential protection zone as required by substation topology
- Efficient merging of the two differential zones when required by substation topology (i.e. load-transfer)
- Selective operation of busbar differential protection ensures tripping only of circuit breakers connected to the faulty zone
- Correct marshaling of backup-trip commands from internally integrated or external circuit breaker failure protections to all surrounding circuit breakers
- Easy incorporation of bus-section and/or bus-coupler bays (i.e. tie-breakers) with one or two sets of CTs into the protection scheme
- Disconnector and/or circuit breaker status supervision

Advanced Zone Selection logic accompanied by optionally available end-fault and/or circuit breaker failure protections ensure minimum possible tripping time and selectivity for faults within the blind spot or the end zone between bay CT and bay circuit breaker. Therefore REB 670 offers best possible coverage for such faults in feeder and bus-section/bus-coupler bays.

Optionally available circuit breaker failure protection, one for every CT input into REB 670, offers secure local back-up protection for the circuit breakers in the station.

Optionally available four-stage, non-directional overcurrent protections, one for every CT input into REB 670, provide remote backup functionality for connected feeders and remote-end stations.

It is normal practice to have just one set of busbar protection relays per busbar. Nevertheless some utilities do apply two independent busbar protection relays per zone of protection. REB 670 IED fits both solutions.

A simplified bus differential protection for multi-phase faults and earth faults can be obtained by using a single, one-phase REB 670 IED with external auxiliary summation current transformers.

The wide application flexibility makes this product an excellent choice for both new installations and the refurbishment of existing installations.

Description of 3 ph variant A20

Three-phase version of the IED with two low-impedance differential protection zones and four three-phase CT inputs (A20). This version is available in 1/2 of 19” case. The version is intended for simpler applications such as T-connections, meshed corners, etc.

Description of 3 ph variant A31

Three-phase version of the IED with two low-impedance differential protection zones and eight three-phase CT inputs (A31). This version is available in full 19” case. The version is intended for applications on smaller busbars, with up to two zones and eight CT inputs.

Description of 1 ph variants B20 and B21

One-phase version of the IED with two low-impedance differential protection zones and twelve CT inputs (B20, B21).

- This version is available in either 1/2 of 19” (B20) or full 19” (B21) case.
- Due to three available binary input modules, the IED in 1/2 of 19” case (B20) is intended for applications without need for dynamic Zone Selection such typical examples are substations with single busbar with or without bus-section breaker, one-and-half breaker or double breaker arrangements. Three such IEDs offer cost effective solutions for such simple substation arrangements with up to twelve CT inputs.
- The IED in full 19” case (B21) is intended for applications in substations where dynamic Zone Selection or bigger number of binary inputs and outputs is needed. Such stations for example are double busbar station with or without transfer bus with up to 12 CT inputs.
- This version can be optionally used with external auxiliary summation transformers.

Description of 1 ph variant B31

One-phase version of the IED with two low-impedance differential protection zones and twenty-four CT inputs (B31).

- This version is available in full 19” case. The IED is intended for busbar protection applications in big substations where dynamic Zone Selection, quite large number of binary inputs and outputs and many CT inputs are needed. The IED includes two differential zones and twenty-four CT inputs.
- This version can be optionally used with external auxiliary summation transformers.

Available configurations for pre-configured REB 670

Three configurations has been made available for pre-configured REB 670 IED. It shall be noted that all three configurations include the following features:

- fully configured for the total available number of bays in each REB 670 variant
- facility to take any bay out of service via built-in HMI or externally via binary input
- facility to block any of the two zones via built-in HMI or externally via binary input
- facility to block all bay trips via built-in HMI or externally via binary input, but leaving all other function in service (i.e. BBP Zones, BFP and OCP where applicable)
- facility to externaly start built-in disturbance recorder
- facility to connect external breaker failure backup trip signal from every bay
- facility to connect external bay trip signal

Configuration #1 Called X01

- This configuration includes just busbar protection for simple stations layouts (i.e. One-and-a-half breaker, Double Breaker or Single Breaker stations). Additionaly it can be used for double busbar-single breaker stations where disconnector replica is done by using just b auxiliary contact from every disconnector and/or circuit breakers. As a consequence no disconnector/breaker supervision will be avavaible. It is as well possible to adapt this configuration by SMT to be used as direct replacement of RED 521*1.0 terminals. This configuration is avaiable for all five REB 670 variants (i.e. A20, A31, B20, B21 & B31). It shall be noted that optional functions breaker failure protection RBRF, end fault protection and overcurrent protection POCM can be ordered together with this configuration, but they will not be pre-configured! Thus these optional functions shall be configured by the end user.

Configuration #2 Called X02

- This configuration includes just busbar protection for double busbar-single breaker stations, where Zone Selection is done by using a and b auxiliary contacts from every disconnectors and/or circuit breakers. Thus full disconnector/breaker supervision is avaiable. This configuration is avaiable for only three REB 670 variants (i.e. A31, B21 and B31). It shall be noted that optional functions breaker failure protection RBRF, end fault protection and overcurrent protection POCM can be ordered together with this configuration, but they will not be pre-configured! Thus these optional functions shall be configured by the end user.

Configuration #3 Called X03

- This configuration includes BBP with breaker failure protection RBRF, end fault protection and overcurrent protection POCM for double busbar-single breaker stations, where Zone Selection is done by using a and b auxiliary contacts from every disconnectors and/or circuit breakers. Thus full disconnector/breaker supervision is avaiable. This configuration is avaiable for only three REB 670 variants (i.e. A31, B21 and B31).

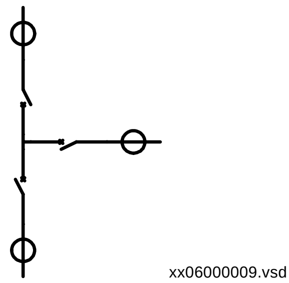

Figure 2: Example of T-connection

Application examples of REB 670

Examples of typical station layouts, which can be protected with REB 670 are given below:

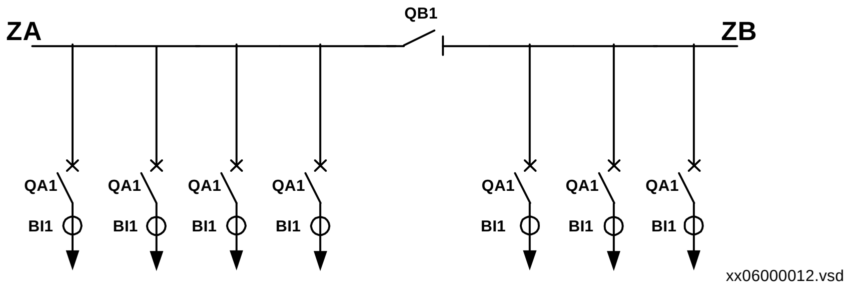

Figure 3: Example of single bus station

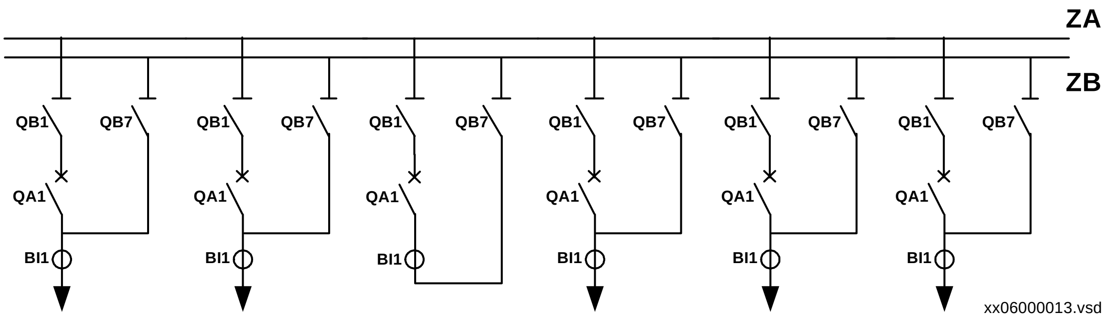

Figure 4: Example of single bus station with transfer bus

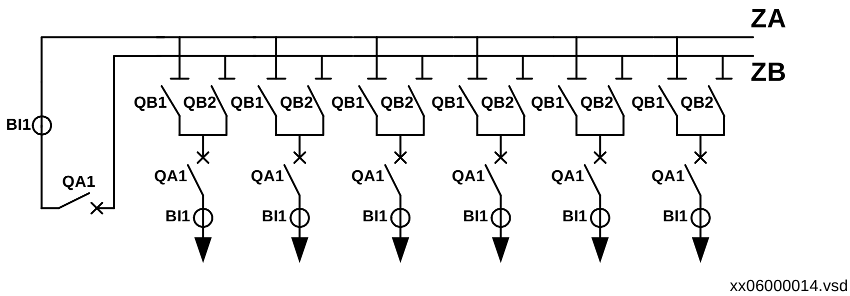

Figure 5: Example of double bus-single breaker station

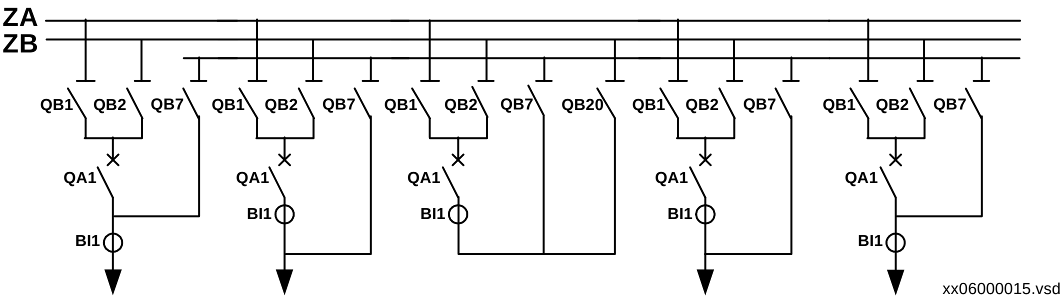

Figure 6: Example of double bus-single breaker station with transfer bus

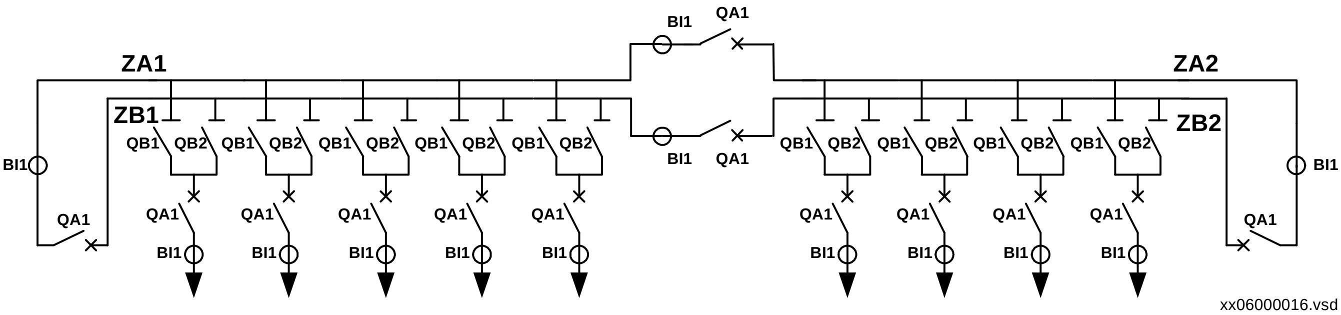

Figure 7: Example of double bus-single breaker station with two bus-section and two bus-coupler breakers

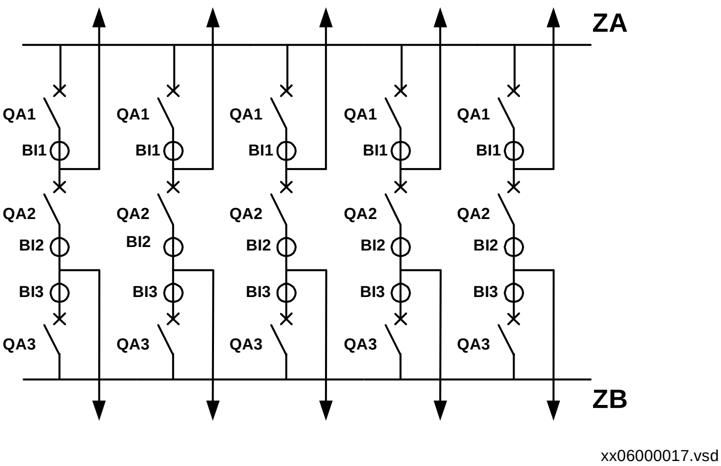

Figure 8: Example of one-and-a-half breakar station

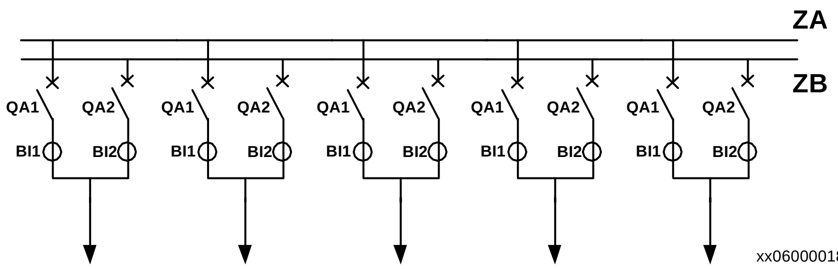

Figure 9: Example of double bus-double breaker station

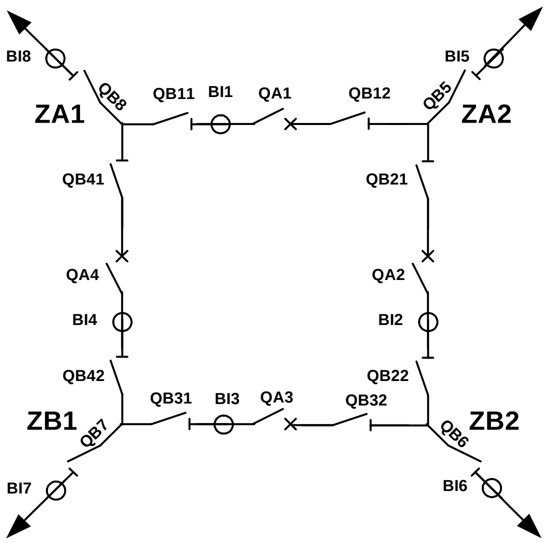

Figure 10: Example of mesh or ring bus station

Available functions

ANSI	Function description	3Ph; 2-zones, 4-bays BBP (A20)		3Ph; 2-zones, 8-bays BBP (A31)		1Ph; 2-zones, 12-bays BBP (B20/B21)		1Ph; 2-zones, 24-bays BBP (B31)	
		Basic	Option (Qty/ option design)	Basic	Option (Qty/ option design)	Basic	Option (Qty/ option design)	Basic	Option (Qty/ option design)
Differential protection									
87B	Busbar differential protection, 2 zones, three phase/4 bays	1	-	-	-	-	-	-	-
87B	Busbar differential protection, 2 zones, three phase/8 bays	-	-	1	-	-	-	-	-
87B	Busbar differential protection, 2 zones, single phase/12 bays	-	-	-	-	1	-	-	-
87B	Busbar differential protection, 2 zones, single phase/24 bays	-	-	-	-	-	-	1	-
	Status of primary switching objects for busbar protection zone selection	20	-	40	-	60	-	96	-
Current protection									
51	Four step phase overcurrent protection (POCM)	-	4/C06	-	8/C07	-	-	-	-
51	Four step single phase overcurrent protection (PCOM)	-	-	-	-	-	12/C08	-	24/C09
50BF	Breaker failure protection (RBRF)	-	4/C10	-	8/C11	-	-	-	-
50BF	Breaker failure protection, single phase version (RBRF)	-	-	-	-	-	12/C12	-	24/C13
Control									
79	Autorecloser (RREC)	-	2/H05	-	2/H05	-	2/H05	-	2/H05
Station communication									
	IEC61850-8-1 Communication *)	1	-	1	-	1	-	1	-
	LON communication protocol *)	1	-	1	-	1	-	1	-
	SPA communication protocol *)	1	-	1	-	1	-	1	-
	IEC60870-5-103 communication protocol *)	1	-	1	-	1	-	1	-
	Single command, 16 signals	3	-	3	-	3	-	3	-
	Multiple command and transmit	60/10	-	60/10	-	60/10	-	60/10	-
Remote communication									
	Binary signal transfer receive/transmit *)	2	-	2	-	2	-	2	-
*) In order to utilize it, an appropriate optional hardware port must be ordered.									

Functionality

Differential protection

The function consists of differential protection algorithm, sensitive differential protection algorithm, check zone algorithm, open CT algorithm and two supervision algorithms.

Busbar differential protection (PDIF, 87B)

This protection function is intended for fast and selective tripping of faults within protected zone. For each current input, the CT ratio can be set from the front HMI or via the parameter-setting tool, PCM600. In this way adaptation to different CT ratios is provided in the simplest way. The minimum pick-up value for the differential current is then set to give a suitable sensitivity for all internal faults. This setting is made directly in primary amperes. For busbar protection applications typical setting value for the minimum differential operating current is from 50% to 150% of the biggest CT. The settings can be changed from the front HMI or via the parameter-setting tool, PCM 600.

All current inputs are indirectly provided with a restraint feature. The operation is based on the well-proven RADSS percentage restraint stabilization principle, with an extra stabilization feature to stabilize for very heavy CT saturation. Stability for external faults is guaranteed if a CT is not saturated for at least two milliseconds during each power system cycle. It is also possible to add external tripping criteria by binary signal.

The trip command from the differential protection including sensitive differential protection and circuit breaker failure backup-trip commands can be set either as self-resetting or latched. In second case the manual reset is needed in order to reset the individual bay trip output contacts.

Sensitive differential level (PDIF, 87B)

Differential protection zones in REB 670 include a sensitive operational level. This sensitive operational level is designed to be able to detect internal busbar earth faults in low impedance earthed power systems (i.e. power systems where the earth-fault current is limited to a certain level, typically between 300A and 2000A primary by a neutral point reactor or resistor). For increased security, the sensitive differential protection must be externally enabled by a binary signal (e.g. from external open delta VT overvoltage relay or external power transformer neutral point overcurrent relay). Finally it is as well possible to set a time delay before the trip signal from the sensitive differential protection is given. This sensitive level can be alternatively used in special applications when high sensitivity is required from busbar differential protection (i.e. energizing of dead bus via a long line).

Operation and operating characteristic of the sensitive differential protection can be set independently from the operating characteristic of the main differential protection. However, the sensitive differential level is blocked as soon as the total incoming current exceeds the pre-set level or when differential current exceed the set minimum pickup current for the usual differential protection. Therefore, by appropriate settings it can be ensured that this sensitive level is blocked for all external multi-phase faults, which can cause CT saturation. Operating characteristic of sensitive differential characteristics is shown in figure 1.

Check zone (PDIF, 87B)

For busbar protection in double busbar stations when dynamic zone selection is needed, it is sometimes required to include the overall differential zone (i.e. check zone). Hence, the built-in, overall check zone is available in REB 670. Because the built-in check zone current measurement is not dependent on the disconnector status, this feature ensures stability of the busbar differential protection even for completely wrong status indication from the busbar disconnectors. It shall be noted that the overall check zone, only supervise the usual differential protection operation. The external trip commands, breaker failure backup-trip commands and sensitive differential protection operation is not supervised by the overall check zone.

The overall check zone in REB 670 has simple current operating algorithm, which ensures check zone operation for all internal faults regardless the fault current distribution. In order to achieve this the outgoing current from the overall check zone is used as restraint quantity. If required, the check zone operation can be activated externally by a binary signal.

Open CT detection

The innovative measuring algorithm provides stability for open or short-circuited main CT secondary circuits, which means that no separate check zone is actually necessary. Pick-up current level for open CT detection can usually be set to detect the open circuit condition for the smallest CT. This built-in feature allows the protection terminal to be set very sensitive, even to a lower value than the maximum CT primary rating in the station. At detection of problems in CT secondary circuits, the differential protection can be instantly blocked and an alarm is given. Alternatively the differential protection can be automatically desensitized in order to ensure busbar differential protection stability during normal through-load condition. When problems in CT secondary circuits has been found and associate error has been corrected a manual reset must be given to the IED. This can be done locally from the front HMI, or remotely via binary input or communication link.

However, it shall be noted that this feature can be only partly utilized when the summation principle is used.

Differential protection supervision

Dual monitoring of differential protection status is available. The first monitoring feature operates after settable time delay when differential current is higher than the user settable level. This feature can be for example used to design automatic reset logic for previously described open CT detection feature. The second monitoring feature operates immediately when the busbar through-going current is bigger than the user settable level. Both of these monitoring features are phase segregated and they give out binary signals, which can be either used to trigger disturbance recorder or for alarming purposes.

Zone selection

Typically CT secondary circuits from every bay in the station are connected to the busbar protection. The built-in software feature called “Zone Selection” gives a simple but efficient control over the connected CTs to busbar protection IED in order to provide fully operational differential protection scheme for multi-zone applications on both small and large buses.

The function consists of dedicated disconnector/circuit breaker status monitoring algorithm, bay dedicated CT-connection control algorithm and zone interconnection algorithm.

Switch status monitoring

For stations with complex primary layout (i.e. double busbar single breaker station with or without transfer bus) the information about busbar disconnector position in every bay is crucial information for busbar protection. The positions of these disconnectors then actually determine which CT input (i.e. bay) is connected to which differential protection zone. For some more advanced features like end-fault or blind-spot protection the actual status of the circuit breaker in some or even all bays can be vital information for busbar protection as well. The switch function block is used in REB 670 to take the status of two auxiliary contacts from the primary device, evaluate them and then to deliver the device primary contact position to the rest of the zone selection logic.

For such applications typically two auxiliary contacts (i.e. normally open and normally closed auxiliary contacts) from each relevant primary switching object shall be connected to the IED. Then the status for every individual primary switching object will be determined. In REB 670 dedicated function block for each primary switching object is available in order to determine the status of the object primary contacts. By a parameter setting one of the following two logical schemes can be selected for each primary object individually by the end user:

- If not open then closed (i.e. as in RADSS schemes)
- Open or closed only when clearly indicated by aux contact status (i.e. as in INX schemes)

Table1 gives quick overview about both schemes

It shall be noted that the first scheme only requires fast breaking normally closed auxiliary contact (i.e. b contact) for proper operation. The timing of normally open auxiliary contact is not critical because it is only used for supervision of the primary object status. The second scheme in addition requires properly timed-adjusted, early-making normally open auxiliary contact (i.e. early making a contact) for proper operation.

Regardless which scheme is used the time-delayed disconnector/circuit breaker status supervision alarm is available (i.e. 00 or 11 auxiliary contact status). How two integrated differential protection zones behave when disconnector alarm appears is freely configurable by the end user.

It is as well possible by a parameter setting to override the primary object status as either permanently open or permanently closed. This feature can be useful during testing, installation and commissioning of the busbar protection scheme. At the same time, separate alarm is given to indicate that the actual object status is overwritten by a setting parameter.

It shall be noted that it is as well possible to use only normally closed auxiliary contacts for Zone Selection logic. In that case the Switch function blocks are not used at all.

Table 1: Treatment of primary object auxiliary contact status within BBP in REB 670

Primary equipment		Status in BBP		Alarm facility	
Normally Open auxiliary contact status (i.e. “closed” or “a” contact)	**Normally Closed auxiliary contact status (i.e. “open” or “b” contact)**	**when “Scheme 1 RADSS” is selected**	**when “Scheme 2 INX” is selected**	**Alarm after settable time delay**	**Information visible on built-in front HMI**
open	open	closed	Last position saved	yes	intermediate_00
open	closed	open	open	no	open
closed	open	closed	closed	no	closed
closed	closed	closed	closed	yes	badState_11

Bay

Each CT input into REB 670 is allocated to one dedicated bay function block. This function block is used to provide complete user interface for all signals from and towards this bay. It is also used to influence bay measured current.

First of all it is possible by a parameter setting *CTConnection* to connect or disconnect the CT input to the bay function block. Once the CT input is connected to the bay function block this associated current input can be included to or excluded from the two internally available differential functions in software. This can be done by a parameter setting for simple station layouts (i.e. one-and-a-half breaker stations) or alternatively via dedicated logical scheme (i.e. double busbar stations). For each bay the end user have to select one of the following five alternatives:

- Permanently connect this bay current to zone A (i.e. ZA)
- Permanently connect this bay current to zone B (i.e. ZB)
- Permanently connect this bay current to zone A and inverted bay current to ZB (i.e. ZA and-ZB)
- Connect this bay current to ZA or ZB depending on the logical status of the two input binary signals available on this bay function block. These two input signals will include measured current to the respective zone when their logical value is one (i.e. CntrlIncludes). This option is used together with above described Switch function blocks in order to provide complete Zone Selection logic
- Connect the bay current to ZA or ZB depending on the logical status of the two input binary signals available on this bay function block. These two signals will include measured current to the respective zone when their logical value is zero (i.e. CntrlExcludes). This option is typically used when only normally closed auxiliary contacts from the busbar disconnector are available to the Zone Selection logic

At the same time, an additional feature for instantaneous or time delayed disconnection or even inversion of the connected bay current via separate logical signals is also available. This feature is provided in order to facilitate for bus-section or bus-coupler CT disconnection for tie-breakers with a CT only on one side of the circuit breaker. This ensures correct and fast fault clearance of faults between the CT and the circuit breaker within these bays. The same feature can be individually used in any feeder bay as well in order to optimize busbar differential protection performance, when feeder circuit breaker is open. Thus, the end-fault protection for faults between circuit breaker and the CT is available in REB 670. However to use this feature circuit breaker auxiliary contacts and closing command to the circuit breaker shall be wired to the binary inputs of the IED. Therefore REB 670 offers best possible coverage for these special faults between CT and circuit breaker in feeder and bus-section/bus-coupler bays.

Within the Bay function block it is decided by a parameter setting how this bay should behave during zone interconnection (i.e. load transfer). For each bay individually one of the following three options can be selected:

- Bay current is forced out from both zones during zone interconnection (used for bus-coupler bays)
- Bay current is unconditionally forced into both zones during zone interconnection (used in special applications)
- Bay current is connected to both zones during zone interconnection if the bay was previously connected to one of the two zones (typically used for feeder bays)

The third option ensures that the feeder, which is out of service, is not connected to any of the two zones during zone interconnection.

Within the Bay function block it is as well decided by a parameter setting whether this bay should be connected to the check zone or not. In this way the end user has simple control over the bays, which shall be connected to the overall check zone.

By appropriate configuration logic it is possible to take any bay (i.e. CT input) out of service. This can be done from the built-in HMI or externally via binary signal. In that case all internal current measuring functions (i.e. differential protection, sensitive differential protection, check zone, breaker failure protection and overcurrent protection) are disabled. At the same time, any trip command to this bay circuit breaker can be inhibited.

Via two dedicated binary input signals it is possible to:

- Trip only the bay circuit breaker (used for integrated OC protection tripping)
- Trip the whole differential zone to which this bay is presently connected (used for backup-trip command from either integrated or external bay circuit breaker failure protection)

Finally dedicated trip binary output from the Bay function block is available in order to provide common trip signal to the bay circuit breaker from busbar differential protection, breaker failure protection, backup overcurrent protection, etc.

In this way the interface to the user is kept as simple as possible and IED engineering work is quite straight forward.

Zone interconnection (Load transfer)

When this feature is activated the two integrated differential protection zones are merged into one common, overall differential zone. This future is required in double busbar stations when in any of the feeder bays both busbar disconnectors are closed at the same time (i.e. load transfer). As explained in above section Bay each CT input will then behave in the pre-set way in order to ensure proper current balancing during this special condition. This feature can be started automatically (when Zone Selection logic determines that both busbar disconnectors in one feeder bay are closed at the same time) or externally via dedicated binary signal. If this feature is active for longer time than the pre-set vale the alarm signal is given.

Current protection

Four step phase overcurrent protection (POCM, 51)

The four step phase overcurrent function has an inverse or definite time delay independent for each step separately.

All IEC and ANSI time delayed characteristics are available together with an optional user defined time characteristic.

This function can be used as a backup bay protection (e.g. for transformers, reactors, shunt capacitors and tie-breakers). A special application is to use this phase overcurrent protection to detect short-circuits between the feeder circuit breaker and feeder CT in a feeder bay when the circuit breaker is open. This functionality is called end-fault protection. In such case unnecessarily operation of the busbar differential protection can be prevented and only fast overcurrent trip signal can be sent to the remote line end. In order to utilize this functionality the circuit breaker status and CB closing command must be connected to the REB 670. One of the overcurrent steps can be set and configured to act as end-fault protection in REB 670.

Breaker failure protection (RBRF, 50BF)
The circuit breaker failure function ensures fast back-up tripping of surrounding breakers. The breaker failure protection operation can be current based, contact based or adaptive combination between these two principles.

A current check with extremely short reset time is used as a check criteria to achieve a high security against unnecessary operation.

The breaker failure protection can be single- or three-phase started to allow use with single phase tripping applications. For the three-phase version of the breaker failure protection the current criteria can be set to operate only if two out of four e.g. two phases or one phase plus the residual current starts. This gives a higher security to the back-up trip command.

The function can be programmed to give a single- or three phase re-trip of the own breaker to avoid unnecessary tripping of surrounding breakers at an incorrect starting due to mistakes during testing.

Control

Autorecloser (RREC, 79)
The autoreclosing function provides high-speed and/or delayed three pole autoreclosing. In REB 670 the autoreclosing can be used for delayed busbar restoration. One AR per zone can be made available.

Logic

Configurable logic blocks
A high number of logic blocks and timers are available for user to adapt the configuration to the specific application needs.

Fixed signal function block
The fixed signals function block generates a number of pre-set (fixed) signals that can be used in the configuration of an IED, either for forcing the unused inputs in the other function blocks to a certain level/value, or for creating a certain logic.

Monitoring

Event counter (GGIO)
The function consists of six counters which are used for storing the number of times each counter has been activated. It is also provided with a common blocking function for all six counters, to be used for example at testing. Every counter can separately be set on or off by a parameter setting.

Disturbance report (RDRE)
Complete and reliable information about disturbances in the primary and/or in the secondary system together with continuous event-logging is accomplished by the disturbance report functionality.

The disturbance report, always included in the IED, acquires sampled data of all selected analogue input and binary signals connected to the function block i.e. maximum 40 analogue and 96 binary signals.

The disturbance report functionality is a common name for several functions:

- Event List (EL)
- Indications (IND)
- Event recorder (ER)
- Trip Value recorder (TVR)
- Disturbance recorder (DR)

The function is characterized by great flexibility regarding configuration, starting conditions, recording times and large storage capacity.

A disturbance is defined as an activation of an input in the DRAx or DRBy function blocks which is set to trigger the disturbance recorder. All signals from start of pre-fault time to the end of post-fault time, will be included in the recording.

Every disturbance report recording is saved in the IED in the standard Comtrade format. The same applies to all events, which are continuously saved in a ring-buffer. The Local Human Machine Interface (LHMI) is used to get information about the recordings, but the disturbance report files may be uploaded to the PCM 600 (Protection and Control IED Manager) and further analysis using the disturbance handling tool.

Event list (RDRE)
Continuous event-logging is useful for monitoring of the system from an overview perspective and is a complement to specific disturbance recorder functions.

The event list logs all binary input signals connected to the Disturbance report function. The list may contain of up to 1000 time-tagged events stored in a ring-buffer.

Indications (RDRE)
To get fast, condensed and reliable information about disturbances in the primary and/or in the secondary system it is important to know e.g. binary signals that have changed status during a disturbance. This information is used in the short perspective to get information via the LHMI in a straightforward way.

There are three LEDs on the LHMI (green, yellow and red), which will display status information about the IED and the Disturbance Report function (trigged).

The Indication list function shows all selected binary input signals connected to the Disturbance

Report function that have changed status during a disturbance.

Event recorder (RDRE)
Quick, complete and reliable information about disturbances in the primary and/or in the secondary system is vital e.g. time tagged events logged during disturbances. This information is used for different purposes in the short term (e.g. corrective actions) and in the long term (e.g. Functional Analysis).

The event recorder logs all selected binary input signals connected to the Disturbance Report function. Each recording can contain up to 150 time-tagged events.

The event recorder information is available for the disturbances locally in the IED.

The event recording information is an integrated part of the disturbance record (Comtrade file).

Trip value recorder (RDRE)
Information about the pre-fault and fault values for currents and voltages are vital for the disturbance evaluation.

The Trip value recorder calculates the values of all selected analogue input signals connected to the Disturbance report function. The result is magnitude and phase angle before and during the fault for each analogue input signal.

The trip value recorder information is available for the disturbances locally in the IED.

The trip value recorder information is an integrated part of the disturbance record (Comtrade file).

Disturbance recorder (RDRE)
The Disturbance Recorder function supplies fast, complete and reliable information about disturbances in the power system. It facilitates understanding system behavior and related primary and secondary equipment during and after a disturbance. Recorded information is used for different purposes in the short perspective (e.g. corrective actions) and long perspective (e.g. Functional Analysis).

The Disturbance Recorder acquires sampled data from all selected analogue input and binary signals connected to the Disturbance Report function (maximum 40 analog and 96 binary signals). The binary signals are the same signals as available under the event recorder function.

The function is characterized by great flexibility and is not dependent on the operation of protection functions. It can record disturbances not detected by protection functions.

The disturbance recorder information for the last 100 disturbances are saved in the IED and the Local Human Machine Interface (LHMI) is used to view the list of recordings.

Event function (EV)
When using a Substation Automation system with LON or SPA communication, time-tagged events can be sent at change or cyclically from the IED to the station level. These events are created from any available signal in the IED that is connected to the Event function block. The event function block is used for LON and SPA communication.

Analog and double indication values are also transferred through the event block.

Basic IED functions

Time synchronization
Use the time synchronization source selector to select a common source of absolute time for the IED when it is a part of a protection system. This makes comparison of events and disturbance data between all IEDs in a SA system possible.

Human machine interface
Six SLD pages can be defined.

The local human machine interface is equipped with an LCD that is used among other things to locally display the following crucial information:

- Connection of each bay with respect to the two differential protection zones and the check zone. The user can freely set in PST the individual bay names in order to make easy identification of each primary bay for station personnel
- Status of each individual primary switchgear device (i.e. open, closed, 00 as intermediate and 11 as bad state). The user can freely set in PCM 600 the individual primary switchgear object names in order to make easy identification of each switchgear device for station personnel

The local human-machine interface is simple and easy to understand – the whole front plate is divided into zones, each of them with a well-defined functionality:

- Status indication LEDs
- Alarm indication LEDs which consists of 15 LEDs (6 red and 9 yellow) with user printable label. All LEDs are configurable from the PCM 600 tool
- Liquid crystal display (LCD)
- Keypad with push buttons for control and navigation purposes, switch for selection between local and remote control and reset
- An isolated RJ45 communication port

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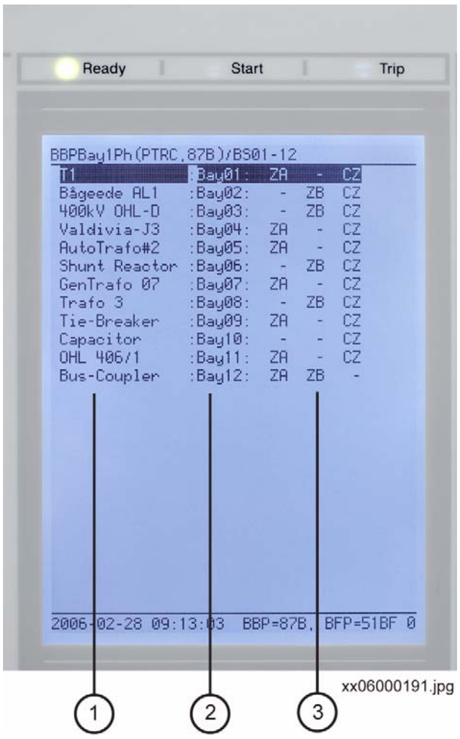
Figure 11: Example of medium graphic HMI



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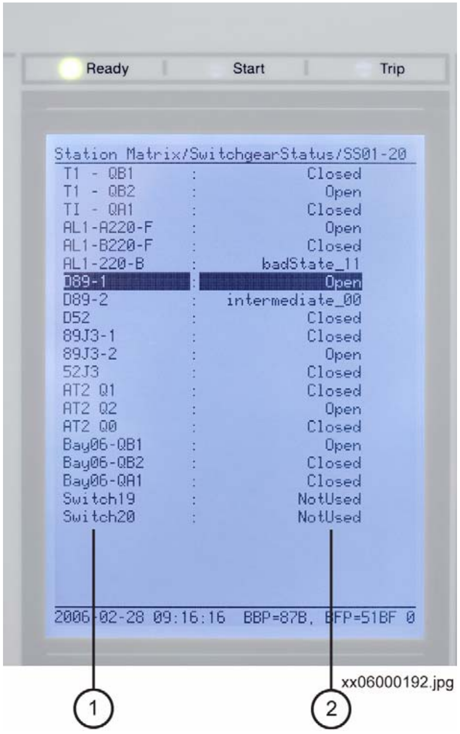
1 User settable bay name
2 Internally used bay FB
3 Connections to internal zones

Figure 12: Bay to zone connection example



1 User settable switchgear names
2 Switchgear object status

Figure 13: Example of status of primary switchgear objects

Station communication

Overview

Each IED is provided with a communication interface, enabling it to connect to one or many substation level systems or equipment, either on the Substation Automation (SA) bus or Substation Monitoring (SM) bus.

Following communication protocols are available:

- IEC 61850-8-1 communication protocol
- LON communication protocol
- SPA or IEC 60870-5-103 communication protocol

Theoretically, several protocols can be combined in the same IED.

IEC 61850-8-1 communication protocol

Single or double optical Ethernet ports for the new substation communication standard IEC61850-8-1 for the station bus are provided. IEC61850-8-1 allows intelligent devices (IEDs) from different vendors to exchange information and simplifies SA engineering. Peer- to peer communication according to GOOSE is part of the standard. Disturbance files uploading is provided.

Serial communication, LON

Existing stations with ABB station bus LON can be extended with use of the optical LON interface. This allows full SA functionality including peer-to-peer messaging and cooperation between existing ABB IED's and the new IED 670.

SPA communication protocol

A single glass or plastic port is provided for the ABB SPA protocol. This allows extensions of simple substation automation systems but the main use is for Substation Monitoring Systems SMS.

IEC 60870-5-103 communication protocol

A single glass or plastic port is provided for the IEC60870-5-103 standard. This allows design of simple substation automation systems including equipment from different vendors. Disturbance files uploading is provided.

Single command, 16 signals

The IEDs can receive commands either from a substation automation system or from the local human-machine interface, LHMI. The command function block has outputs that can be used, for example, to control high voltage apparatuses or for other user defined functionality.

Multiple command and transmit
When 670 IED's are used in Substation Automation systems with LON, SPA or IEC60870-5-103 communication protocols the Event and Multiple Command function blocks are used as the communication interface for vertical communication to station HMI and gateway and as interface for horizontal peer-to-peer communication (over LON only).

Remote communication

Binary signal transfer to remote end, 6 x 32 signals
Each of the six binary signal transfer function blocks can be used for sending and receiving of 32 binary signals, transfer trip and/or other binary signals between local and/or remote IEDs. An IED can communicate with up to two IEDs by means of the data communication module (LDCM). For REB 670 primary apparatus position indication can be sent between the single phase IEDs.

Line data communication module, short, medium and long range (LDCM)
The line data communication module (LDCM) is used for communication between the IEDs situated at distances <150 km or from the IED to optical to electrical converter with G.703 or G.703E1 interface located on a distances <3 km away. The LDCM module sends and receives data, to and from another LDCM module. The IEEE/ANSI C37.94 standard format is used.

The line data communication module is used for binary signal transfer. The module has one optical port with ST connectors.

Hardware description

Hardware modules

Power supply module (PSM)
The power supply module is used to provide the correct internal voltages and full isolation between the terminal and the battery system. An internal fail alarm output is available.

Binary input module (BIM)
The binary input module has 16 optically isolated inputs and is available in two versions, one standard and one with enhanced pulse counting capabilities on the inputs to be used with the pulse counter function. The binary inputs are freely programmable and can be used for the input of logical signals to any of the functions. They can also be included in the disturbance recording and event-recording functions. This enables extensive monitoring and evaluation of operation of the IED and for all associated electrical circuits.

Binary output modules (BOM)
The binary output module has 24 independent output relays and is used for trip output or any signalling purpose.

Binary input/output module (IOM)
The binary input/output module is used when only a few input and output channels are needed. The ten standard output channels are used for trip output or any signalling purpose. The two high speed signal output channels are used for applications where short operating time is essential. Eight optically isolated binary inputs cater for required binary input information.

Optical ethernet module (OEM)
The optical fast-ethernet module is used to connect an IED to the communication buses (like the station bus) that use the IEC 61850-8-1 protocol. The module has one or two optical ports with ST connectors.

Serial SPA/IEC 60870-5-103 and LON communication module (SLM)
The optical serial channel and LON channel module is used to connect an IED to the communication that use SPA, LON, or IEC60870–5–103. The module has two optical ports for plastic/plastic, plastic/glass, or glass/glass.

Line data communication module (LDCM)
The line data communication module is used for binary signal transfer. Each module has one optical port, one for each remote end to which the IED communicates.

Alternative cards for Short range (900 nm multi mode) are available.

GPS time synchronization module (GSM)
This module includes the GPS receiver used for time synchronization. The GPS has one SMA contact for connection to an antenna.

Transformer input module (TRM)
The transformer input module is used to galvanically separate and transform the secondary currents and voltages generated by the measuring transformers. The module has twelve inputs in different combinations.

Layout and dimensions

Dimensions

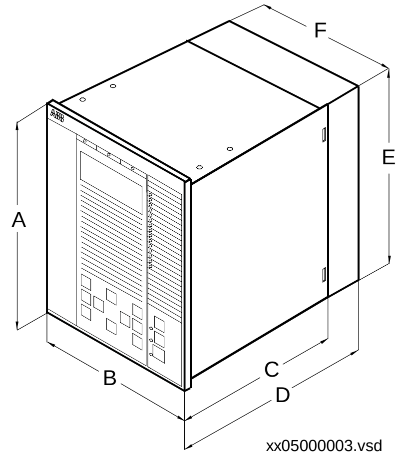


Figure 14: 1/2 x 19” case with rear cover

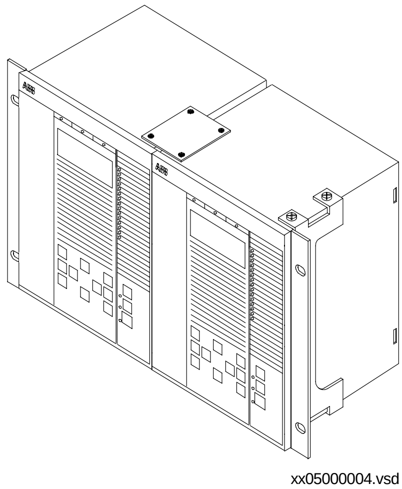


Figure 15: Side-by-side mounting

Case size	**A**	**B**	**C**	**D**	**E**	**F**
6U, 1/2 x 19”	265.9	223.7	201.1	242.1	252.9	205.7
6U, 1/1 x 19”	265.9	448.1	201.1	242.1	252.9	430.3
						(mm)

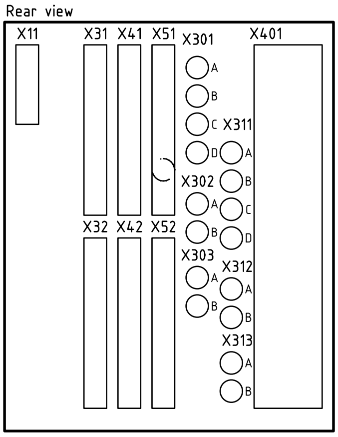
Mounting alternatives
Following mounting alternatives (IP40 protection from the front) are available:

- 19” rack mounting kit
  - 1/2 case size (h) 254.3 mm (w) 210.1 mm
  - 1/1 case size (h) 254.3 mm (w) 434.7mm
- Wall mounting kit

See ordering for details about available mounting alternatives.

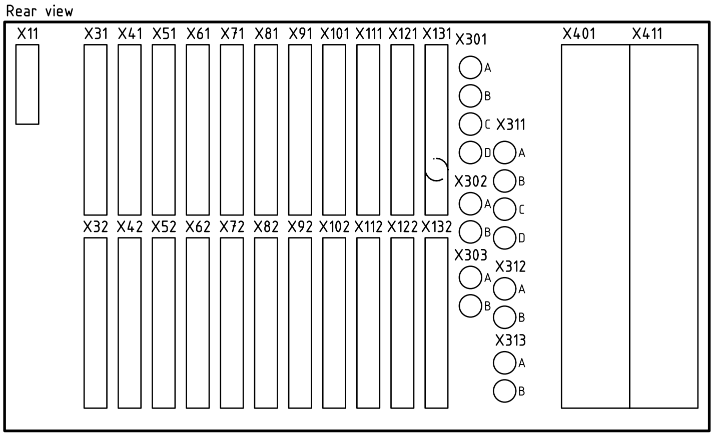
Connection diagrams

Table 2: Designations for 1/2 x 19” casing with 1 TRM slot



Module	Rear Positions
PSM	X11
BIM, BOM or IOM	X31 and X32 etc. to X51 and X52
GSM	X51
SLM	X301:A, B, C, D
OEM	X311:A, B, C, D
LDCM	X312:A, B
LDCM	X313:A, B
TRM	X401

Table 3: Designations for 1/1 x 19” casing with 2 TRM slots



Module	Rear Positions
PSM	X11
BIM, BOM or IOM	X31 and X32 etc. to X131 and X132
MIM	X31, X41, etc. or X131
GSM	X131
SLM	X301:A, B, C, D
OEM	X311:A, B, C, D
LDCM	X312:A, B
LDCM	X313:A, B
TRM 1	X401
TRM 2	X411

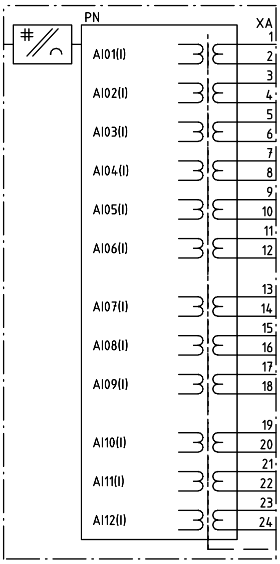


Figure 16: Transformer input module (TRM)

	CT/VT-input designation according to figure 16											
Current/voltage configuration (50/60 Hz)	AI01	AI02	AI03	AI04	AI05	AI06	AI07	AI08	AI09	AI10	AI11	AI12
12I, 1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A
12I, 5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	5A

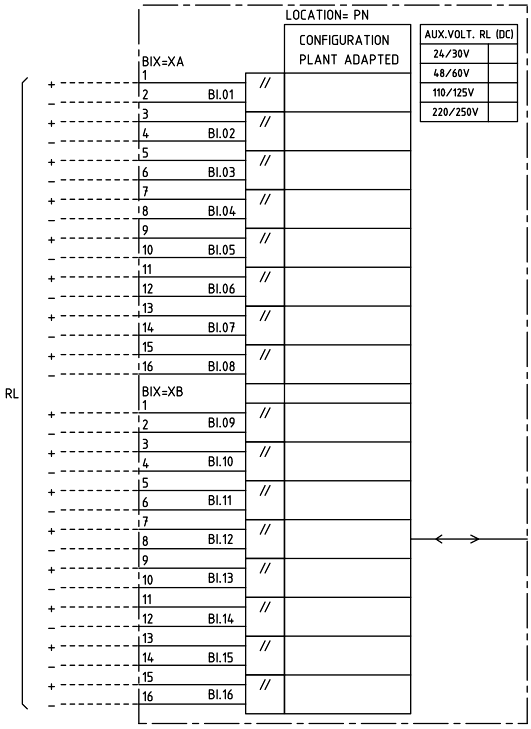


Figure 17: Binary input module (BIM). Input contacts named XA corresponds to rear position X31, X41, etc. and input contacts named XB to rear position X32, X42, etc.

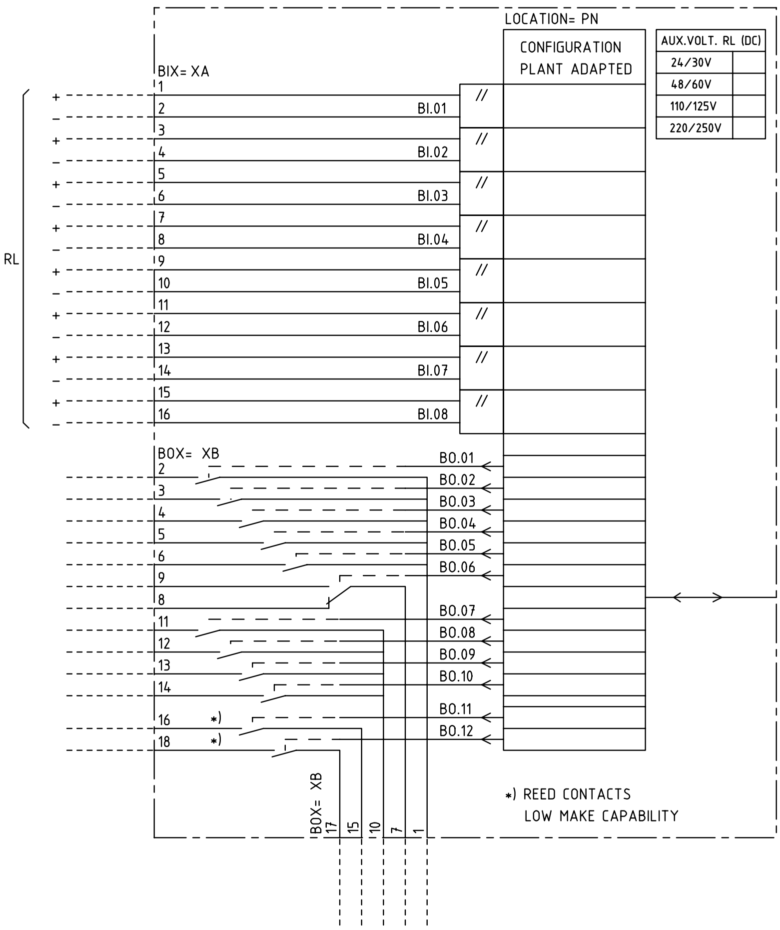


Figure 18: Binary in/out module (IOM). Input contacts named XA corresponds to rear position X31, X41, etc. and output contacts named XB to rear position X32, X42, etc.

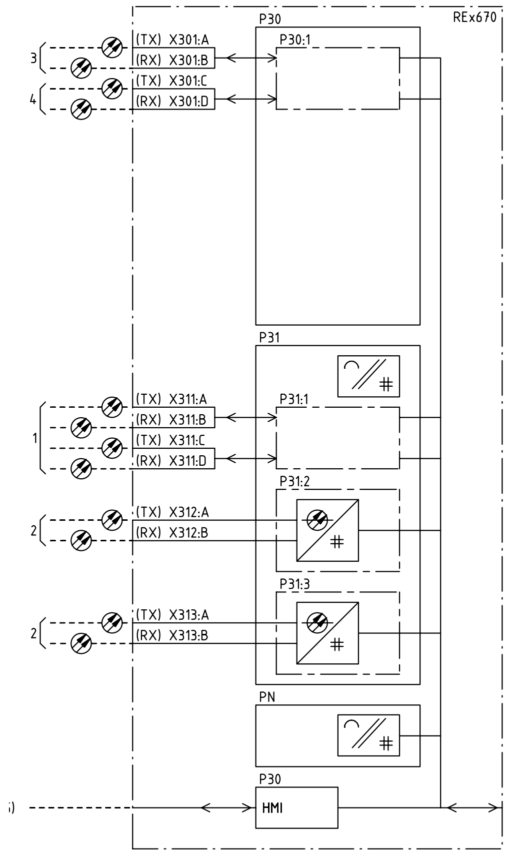


Figure 19: Communication interfaces (OEM, LDCM, SLM and HMI)

Note to figure 19

1) Rear communication port IEC 61850, ST-connector
2) Rear communication port C37.94, ST-connector
3) Rear communication port SPA/ IEC 60870-5-103, ST connector for glass alt. HFBR Snap-in connector for plastic as ordered
4) Rear communication port LON, ST connector for glass alt. HFBR Snap-in connector for plastic as ordered
5) Front communication port, Ethernet, RJ45 connector

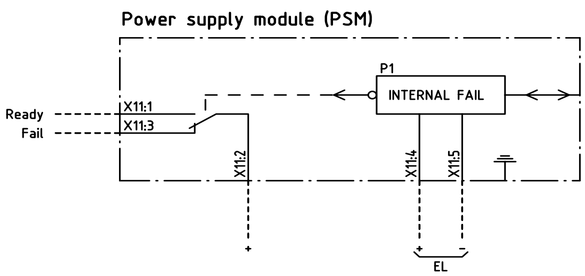


Figure 20: Power supply module (PSM)

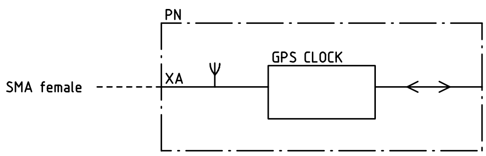


Figure 21: GPS time synchronization module (GSM)

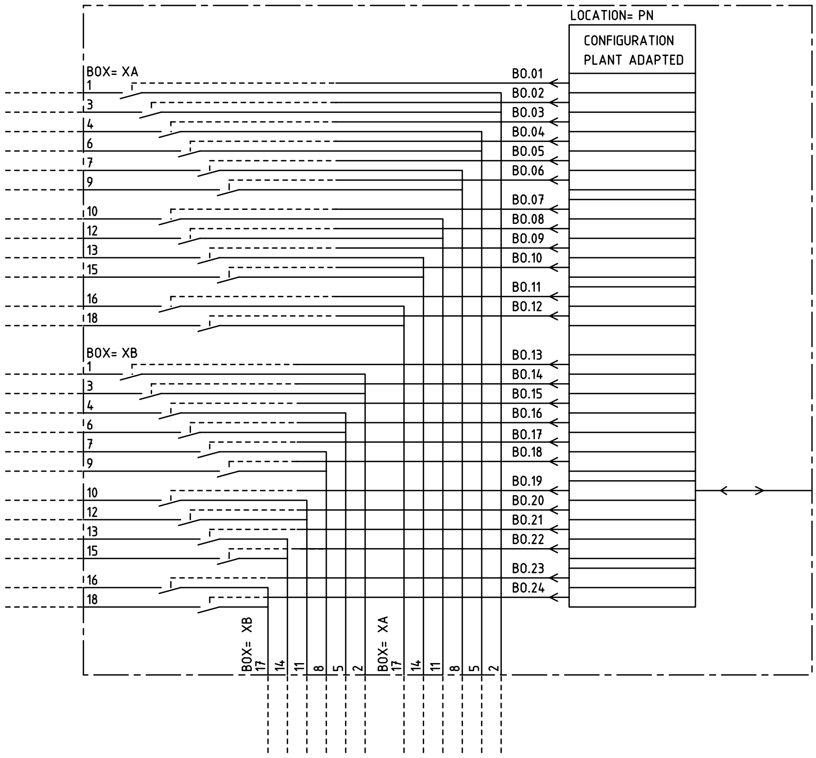


Figure 22: Binary output module (BOM). Output contacts named XA corresponds to rear position X31, X41, etc. and output contacts named XB to rear position X32, X42, etc.

Technical data

General

Definitions

Reference value:

The specified value of an influencing factor to which are referred the characteristics of the equipment.

Nominal range:

The range of values of an influencing quantity (factor) within which, under specified conditions, the equipment meets the specified requirements.

Operative range:

The range of values of a given energizing quantity for which the equipment, under specified conditions, is able to perform its intended functions according to the specified requirements.

Energizing quantities, rated values and limits

Analog inputs

Table 4: TRM - Energizing quantities, rated values and limits

Quantity	Rated value	Nominal range
Current	I_r = 1 or 5 A	(0.2-40) × I_r
Operative range	(0.02-100) x I_r	
Permissive overload	4 × I_r cont. 100 × I_r for 1 s *)	
Frequency	f_r = 50/60 Hz	± 5%
*) max. 350 A for 1 s when COMBITEST test switch is included.		

Auxiliary DC voltage

Table 5: PSM - Power supply module

Quantity	Rated value	Nominal range
Auxiliary dc voltage, EL (input)	EL = (24 - 60) V EL = (90 - 250) V	EL ± 20% EL ± 20%
Power consumption	50 W typically	-
Auxiliary DC power in-rush	< 5 A during 0.1 s	-

Binary inputs and outputs

Table 6: BIM - Binary input module

Quantity	Rated value	Nominal range
Binary inputs	16	-
DC voltage, RL	RL24 (24/40) V RL48 (48/60) V RL110 (110/125) V RL220 (220/250) V	RL ± 20% RL ± 20% RL ± 20% RL ± 20%
Power consumption RL24 = (24/40) V RL48 = (48/60) V RL110 = (110/125) V RL220 = (220/250) V	 max. 0.05 W/input max. 0.1 W/input max. 0.2 W/input max. 0.4 W/input	 -
Counter input frequency	10 pulses/s max	-
Oscillating signal discriminator	Blocking settable 1–40 Hz Release settable 1–30 Hz	

Table 7: BIM - Binary input module with enhanced pulse counting capabilities

Quantity	Rated value	Nominal range
Binary inputs	16	-
DC voltage, RL	RL24 (24/40) V RL48 (48/60) V RL110 (110/125) V RL220 (220/250) V	RL ± 20% RL ± 20% RL ± 20% RL ± 20%
Power consumption RL24 = (24/40) V RL48 = (48/60) V RL110 = (110/125) V RL220 = (220/250) V	 max. 0.05 W/input max. 0.1 W/input max. 0.2 W/input max. 0.4 W/input	 -

Quantity	Rated value	Nominal range
Counter input frequency	10 pulses/s max	-
Balanced counter input frequency	40 pulses/s max	-
Oscillating signal discriminator	Blocking settable 1–40 Hz Release settable 1–30 Hz	

Table 8: IOM - Binary input/output module

Quantity	Rated value	Nominal range
Binary inputs	8	-
DC voltage, RL	RL24 = (24/40) V RL48 = (48/60) V RL110 = (110/125) V RL220 = (220/250) V	RL ± 20% RL ± 20% RL ± 20% RL ± 20%
Power consumption RL24 = (24/40) V RL48 = (48/60) V RL110 = (110/125) V RL220 = (220/250) V	 max. 0.05 W/input max. 0.1 W/input max. 0.2 W/input max. 0.4 W/input	-

Table 9: IOM - Binary input/output module contact data (reference standard: IEC 61810-2)

Function or quantity	Trip and signal relays	Fast signal relays (parallel reed relay)
Binary outputs	10	2
Max system voltage	250 V AC, DC	250 V AC, DC
Test voltage across open contact, 1 min	1000 V rms	800 V DC
Current carrying capacity Continuous 1 s	 8 A 10 A	 8 A 10 A
Making capacity at inductive load with L/R>10 ms 0.2 s 1.0 s	 30 A 10 A	 0.4 A 0.4 A
Breaking capacity for AC, cos φ > 0.4	250 V/8.0 A	250 V/8.0 A
Breaking capacity for DC with L/R < 40 ms	48 V/1 A 110 V/0.4 A 220 V/0.2 A 250 V/0.15 A	48 V/1 A 110 V/0.4 A 220 V/0.2 A 250 V/0.15 A
Maximum capacitive load	-	10 nF

Table 10: BOM - Binary output module contact data (reference standard: IEC 61810-2)

Function or quantity	Trip and Signal relays
Binary outputs	24
Max system voltage	250 V AC, DC
Test voltage across open contact, 1 min	1000 V rms
Current carrying capacity Continuous 1 s	 8 A 10 A
Making capacity at inductive load with L/R>10 ms 0.2 s 1.0 s	 30 A 10 A
Breaking capacity for AC, cos φ>0.4	250 V/8.0 A
Breaking capacity for DC with L/R < 40 ms	48 V/1 A 110 V/0.4 A 220 V/0.2 A 250 V/0.15 A

Influencing factors

Table 11: Temperature and humidity influence

Parameter	Reference value	Nominal range	Influence
Ambient temperature, operate value	+20 °C	-10 °C to +55 °C	0.02% /°C
Relative humidity Operative range	10%-90% 0%-95%	10%-90%	-
Storage temperature	-40 °C to +70 °C	-	-

Table 12: Auxiliary DC supply voltage influence on functionality during operation

Dependence on	Reference value	Within nominal range	Influence
Ripple, in DC auxiliary voltage Operative range	max. 2% Full wave rectified	12% of EL	0.01% /%
Auxiliary voltage dependence, operate value		± 20% of EL	0.01% /%
Interrupted auxiliary DC voltage Interruption interval 0–50 ms 0–∞ s Restart time		24-60 V DC ± 20% 90-250 V DC ± 20%	 No restart Correct behaviour at power down <140 s

Table 13: Frequency influence (reference standard: IEC 60255–6)

Dependence on	Within nominal range	Influence
Frequency dependence, operate value	f_r ± 2.5 Hz for 50 Hz f_r ± 3.0 Hz for 60 Hz	± 1.0% / Hz
Frequency dependence for differential protection	f_r ± 2.5 Hz for 50 Hz f_r ± 3.0 Hz for 50 Hz	± 2.0% / Hz
Harmonic frequency dependence (20% content)	2nd, 3rd and 5th harmonic of f_r	± 1.0%
Harmonic frequency dependence for differential protection (10% content)	2nd, 3rd and 5th harmonic of f_r	± 6.0%

Type tests according to standards

Table 14: Electromagnetic compatibility

Test	Type test values	Reference standards
1 MHz burst disturbance	2.5 kV	IEC 60255-22-1, Class III
100 kHz disturbance	2.5 kV	IEC 61000-4-12, Class III
Electrostatic discharge Direct applicaton Indirect application	15 kV air discharge 8 kV contact discharge 8 kV contact discharge	IEC 60255-22-2, Class IV IEC 61000-4-2, Class IV
Fast transient disturbance	4 kV	IEC 60255-22-4, Class A
Surge immunity test	1-2 kV, 1.2/50 μs high energy	IEC 60255-22-5
Power frequency immunity test	150-300 V, 50 Hz	IEC 60255-22-7, Class A
Power frequency magnetic field test	1000 A/m, 3 s	IEC 61000-4-8, Class V
Radiated electromagnetic field disturbance	20 V/m, 80-1000 MHz	IEC 60255-22-3
Radiated electromagnetic field disturbance	20 V/m, 80-2500 MHz	EN 61000-4-3
Radiated electromagnetic field disturbance	35 V/m 26-1000 MHz	IEEE/ANSI C37.90.2
Conducted electromagnetic field disturbance	10 V, 0.15-80 MHz	IEC 60255-22-6
Radiated emission	30-1000 MHz	IEC 60255-25
Conducted emission	0.15-30 MHz	IEC 60255-25

Table 15: Insulation

Test	Type test values	Reference standard
Dielectric test	2.0 kV AC, 1 min.	IEC 60255-5
Impulse voltage test	5 kV, 1.2/50 μs, 0.5 J	
Insulation resistance	>100 MΩ at 500 VDC	

Table 16: Environmental tests

Test	Type test value	Reference standard
Cold test	Test Ad for 16 h at -25°C	IEC 60068-2-1
Storage test	Test Ad for 16 h at -40°C	IEC 60068-2-1
Dry heat test	Test Bd for 16 h at +70°C	IEC 60068-2-2
Damp heat test, steady state	Test Ca for 4 days at +40 °C and humidity 93%	IEC 60068-2-3
Damp heat test, cyclic	Test Db for 6 cycles at +25 to +55 °C and humidity 93 to 95% (1 cycle = 24 hours)	IEC 60068-2-30

Table 17: **CE compliance**

Test	According to
Immunity	EN 61000-6-2
Emissivity	EN 61000-6-4
Low voltage directive	EN 50178

Table 18: **Mechanical tests**

Test	Type test values	Reference standards
Vibration	Class I	IEC 60255-21-1
Shock and bump	Class I	IEC 60255-21-2
Seismic	Class I	IEC 60255-21-3

Differential protection

Table 19: **Busbar differential protection (PDIF, 87B)**

Function	Range or value	Accuracy
Operating characteristic	S=0.53 fixed	± 2.0% of I_r for $I < I_r$ ± 2.0% of I for $I > I_r$
Reset ratio	> 95%	-
Differential current operating level	(1-100000) A	± 2.0% of I_r for $I < I_r$ ± 2.0% of I for $I > I_r$
Sensitive differential operation level	(1-100000) A	± 2.0% of I_r for $I < I_r$ ± 2.0% of I for $I < I_r$
Check zone operation level	(0-100000) A	± 2.0% of I_r for $I < I_r$ ± 2.0% of I for $I > I_r$
Check zone slope	(0.0-0.9)	-
Timers	(0.000-60.000) s	± 0.5% ± 10 ms
Timers	(0.00-6000.00) s	± 0.5% ± 10 ms
Operate time	19 ms typically at 0 to 2 x Id 12 ms typically at 0 to 10 x Id	-
Reset time	21 ms typically at 2 to 0 x Id 29 ms typically at 10 to 0 x Id	-
Critical impulse time	8 ms typically at 0 to 2 x Id	-

Current protection

Table 20: **Four step phase overcurrent protection (POCM, 51/67)**

Function	Setting range	Accuracy
Operate current	(1-2500)% of I_{base}	± 1.0% of I_r at $I \leq I_r$ ± 1.0% of I at $I > I_r$
Reset ratio	> 95%	-
Min. operating current	(1-100)% of I_{base}	± 1.0% of I_r
Maximum forward angle	(40.0–70.0) degrees	± 2.0 degrees
Minimum forward angle	(75.0–90.0) degrees	± 2.0 degrees
Second harmonic blocking	(5–100)% of fundamental	± 2.0% of I_r
Independent time delay	(0.000-60.000) s	± 0.5% ± 10 ms
Minimum operate time	(0.000-60.000) s	± 0.5% ± 10 ms
Inverse characteristics, see table 42 and table 43	19 curve types	See table 42 and table 43
Operate time, start function	25 ms typically at 0 to 2 x I_{set}	-
Reset time, start function	25 ms typically at 2 to 0 x I_{set}	-
Critical impulse time	10 ms typically at 0 to 2 x I_{set}	-
Impulse margin time	15 ms typically	-

Table 21: **Four step single phase overcurrent protection (POCM, 51)**

Function	Setting range	Accuracy
Operate current	(1-2500)% of I_{base}	± 1.0% of I_r at $I \leq I_r$ ± 1.0% of I at $I > I_r$
Reset ratio	> 95%	-
Second harmonic blocking	(5–100)% of fundamental	± 2.0% of I_r
Independent time delay	(0.000-60.000) s	± 0.5% ± 10 ms
Minimum operate time	(0.000-60.000) s	± 0.5% ± 10 ms
Inverse characteristics, see table 42 and table 43	19 curve types	See table 42 and table 43
Operate time, start function	25 ms typically at 0 to 2 x I_{set}	-

Function	Setting range	Accuracy
Reset time, start function	25 ms typically at 2 to 0 x I_{set}	-
Critical impulse time	10 ms typically at 0 to 2 x I_{set}	-
Impulse margin time	15 ms typically	-

Table 22: Breaker failure protection (RBRF, 50BF)

Function	Range or value	Accuracy
Operate phase current	(5-200)% of I_{base}	$\pm$ 1.0% of I_r at $I \leq I_r$ $\pm$ 1.0% of I at $I > I_r$
Reset ratio, phase current	> 95%	-
Operate residual current	(2-200)% of I_{base}	$\pm$ 1.0% of I_r at $I \leq I_r$ $\pm$ 1.0% of I at $I > I_r$
Reset ratio, residual current	> 95%	-
Phase current level for blocking of contact function	(5-200)% of I_{base}	$\pm$ 1.0% of I_r at $I \leq I_r$ $\pm$ 1.0% of I at $I > I_r$
Reset ratio	> 95%	-
Timers	(0.000-60.000) s	$\pm$ 0.5% $\pm$ 10 ms
Operate time for current detection	10 ms typically	-
Reset time for current detection	15 ms maximum	-

Table 23: Breaker failure protection, single phase version (RBRF, 50BF)

Function	Range or value	Accuracy
Operate phase current	(5-200)% of I_{base}	$\pm$ 1.0% of I_r at $I \leq I_r$ $\pm$ 1.0% of I at $I > I_r$
Reset ratio, phase current	> 95%	-
Phase current level for blocking of contact function	(5-200)% of I_{base}	$\pm$ 1.0% of I_r at $I \leq I_r$ $\pm$ 1.0% of I at $I > I_r$
Reset ratio	> 95%	-
Timers	(0.000-60.000) s	$\pm$ 0.5% $\pm$ 10 ms
Operate time for current detection	10 ms typically	-
Reset time for current detection	15 ms maximum	-

Control

Table 24: Autorecloser (RREC, 79)

Function	Range or value	Accuracy
Number of autoreclosing shots	1 - 5	-
Number of autoreclosing programs	8	-
Autoreclosing open time: shot 1 - t1 1Ph shot 1 - t1 2Ph shot 1 - t1 3PhHS shot 1 - t1 3PhDld	(0.000-60.000) s	$\pm$ 0.5% $\pm$ 10 ms
shot 2 - t2 shot 3 - t3 shot 4 - t4 shot 5 - t5	(0.00-6000.00) s	
Extended autorecloser open time	(0.000-60.000) s	
Autorecloser maximum wait time for sync	(0.00-6000.00) s	
Maximum trip pulse duration	(0.000-60.000) s	
Inhibit reset time	(0.000-60.000) s	
Reclaim time	(0.00-6000.00) s	
Minimum time CB must be closed before AR becomes ready for autoreclosing cycle	(0.00-6000.00) s	
Circuit breaker closing pulse length	(0.000-60.000) s	
CB check time before unsuccessful	(0.00-6000.00) s	
Wait for master release	(0.00-6000.00) s	
Wait time after close command before proceeding to next shot	(0.000-60.000) s	

Logic

Table 25: Configurable logic blocks

Logic block	Quantity with update rate			Range or value	Accuracy
	fast	medium	normal		
LogicAND	90	90	100	-	-
LogicOR	90	90	100	-	-
LogicXOR	15	15	10	-	-
LogicInverter	45	45	50	-	-
LogicSRMemory	15	15	10	-	-
LogicGate	15	15	10	-	-
LogicTimer	15	15	10	(0.000–90000.000) s	± 0.5% ± 10 ms
LogicPulseTimer	15	15	10	(0.000–90000.000) s	± 0.5% ± 10 ms
LogicTimerSet	15	15	10	(0.000–90000.000) s	± 0.5% ± 10 ms
LogicLoopDelay	15	15	10	(0.000–90000.000) s	± 0.5% ± 10 ms

Monitoring

Table 26: Event counter (GGIO)

Function	Range or value	Accuracy
Counter value	0-10000	-
Max. count up speed	10 pulses/s	-

Table 27: Disturbance report (RDRE)

Function	Range or value	Accuracy
Pre-fault time	(0.05–0.30) s	-
Post-fault time	(0.1–5.0) s	-
Limit time	(0.5–6.0) s	-
Maximum number of recordings	100	-
Time tagging resolution	1 ms	See Table 41: "Time synchronization, time tagging".
Maximum number of analog inputs	30 + 10 (external + internally derived)	-
Maximum number of binary inputs	96	-
Maximum number of phasors in the Trip Value recorder per recording	30	-
Maximum number of indications in a disturbance report	96	-
Maximum number of events in the Event recording per recording	150	-
Maximum number of events in the Event list	1000, first in - first out	-
Maximum total recording time (3.4 s recording time and maximum number of channels, typical value)	340 seconds (100 recordings) at 50 Hz, 280 seconds (80 recordings) at 60 Hz	-
Sampling rate	1 kHz at 50 Hz 1.2 kHz at 60 Hz	-
Recording bandwidth	(5-300) Hz	-

Station communication

Table 28: IEC 61850-8-1 communication protocol

Function	Value
Protocol	IEC 61850-8-1
Communication speed for the IEDs	100BASE-FX

Table 29: LON communication protocol

Function	Value
Protocol	LON
Communication speed	1.25 Mbit/s

Table 30: SPA communication protocol

Function	Value
Protocol	SPA
Communication speed	300, 1200, 2400, 4800, 9600, 19200 or 38400 Bd
Slave number	1 to 899

Table 31: IEC 60870-5-103 communication protocol

Function	Value
Protocol	IEC 60870-5-103
Communication speed	9600, 19200 Bd

Table 32: SLM – LON port

Quantity	Range or value
Optical connector	Glass fibre: type ST Plastic fibre: type HFBR snap-in
Fibre, optical budget	Glass fibre: 11 dB (1000 m typically *) Plastic fibre: 7 dB (10 m typically *)
Fibre diameter	Glass fibre: 62.5/125 µm Plastic fibre: 1 mm
*) depending on optical budget calculation	

Table 33: SLM – SPA/IEC 60870-5-103 port

Quantity	Range or value
Optical connector	Glass fibre: type ST Plastic fibre: type HFBR snap-in
Fibre, optical budget	Glass fibre: 11 dB (1000 m typically *) Plastic fibre: 7 dB (25 m typically *)
Fibre diameter	Glass fibre: 62.5/125 µm Plastic fibre: 1 mm
*) depending on optical budget calculation	

Remote communication

Table 34: Line data communication module (LDCM)

Quantity	Range or value
Type of fibre	Graded-index multimode 62.5/125 µm or 50/125 µm
Wave length	820 nm
Optical budget Graded-index multimode 62.5/125 µm Graded-index multimode 50/125 µm	 13 dB (typical distance 3 km *) 9 dB (typical distance 2 km *)
Optical connector	Type ST
Protocol	C37.94
Data transmission	Synchronous
Transmission rate	64 kbit/s
Clock source	Internal or derived from received signal
*) depending on optical budget calculation	

Hardware

IED

Table 35: Case

Material	Steel sheet
Front plate	Steel sheet profile with cut-out for HMI
Surface treatment	Aluzink preplated steel
Finish	Light grey (RAL 7035)

Table 36: Water and dust protection level according to IEC 60529

Front	IP40 (IP54 with sealing strip)
Rear, sides, top and bottom	IP20

Table 37: Weight

Case size	Weight
6U, 1/2 x 19”	≤ 10 kg
6U, 1/1 x 19”	≤ 18 kg

Connection system

Table 38: CT circuit connectors

Connector type	Rated voltage and current	Maximum conductor area
Terminal blocks of feed through type	250 V AC, 20 A	4 mm^2

Table 39: Binary I/O connection system

Connector type	Rated voltage	Maximum conductor area
Screw compression type	250 V AC	2.5 mm^2 2 × 1 mm^2

Basic IED functions

Table 40: Self supervision with internal event list

Data	Value
Recording manner	Continuous, event controlled
List size	1000 events, first in-first out

Table 41: Time synchronization, time tagging

Function	Value
Time tagging resolution, Events and Sampled Measurement Values	1 ms
Time tagging error with synchronization once/min (minute pulse synchronization), Events and Sampled Measurement Values	± 1.0 ms typically
Time tagging error with SNTP synchronization, Sampled Measurement Values	± 1.0 ms typically

Inverse characteristics

Table 42: Inverse time characteristics ANSI

Function	Range or value	Accuracy
Operate characteristic: $t = \left(\frac{A}{\left(I^P - 1\right)} + B \right) \cdot k$ Reset characteristic: $t = \frac{t_r}{\left(I^2 - 1\right)} \cdot k$ $I = I_{measured}/I_{set}$	k = 0.05-999 in steps of 0.01 unless otherwise stated	-
ANSI Extremely Inverse no 1	A=28.2, B=0.1217, P=2.0, tr=29.1	ANSI/IEEE C37.112, class 5 + 30 ms
ANSI Very inverse no 2	A=19.61, B=0.491, P=2.0, tr=21.6	
ANSI Normal Inverse no 3	A=0.0086, B=0.0185, P=0.02, tr=0.46	
ANSI Moderately Inverse no 4	A=0.0515, B=0.1140, P=0.02, tr=4.85	
ANSI Long Time Extremely Inverse no 6	A=64.07, B=0.250, P=2.0, tr=30	
ANSI Long Time Very Inverse no 7	A=28.55, B=0.712, P=2.0, tr=13.46	
ANSI Long Time Inverse no 8	k=(0.01-1.20) in steps of 0.01 A=0.086, B=0.185, P=0.02, tr=4.6	

Table 43: Inverse time characteristics IEC

Function	Range or value	Accuracy
Operate characteristic: $t = \left(\frac{A}{\left(I^P - 1\right)} \right) \cdot k$ $I = I_{measured}/I_{set}$	k = (0.05-1.10) in steps of 0.01	-
Time delay to reset, IEC inverse time	(0.000-60.000) s	± 0.5% of set time ± 10 ms

Function	Range or value	Accuracy
IEC Normal Inverse no 9	A=0.14, P=0.02	IEC 60255-3, class 5 + 40 ms
IEC Very inverse no 10	A=13.5, P=1.0	
IEC Inverse no 11	A=0.14, P=0.02	
IEC Extremely inverse no 12	A=80.0, P=2.0	
IEC Short-time inverse no 13	A=0.05, P=0.04	
IEC Long-time inverse no 14	A=120, P=1.0	
Customer defined characteristic no 17 Operate characteristic: $$t = \left(\frac{A}{\left(I^{P} - C\right)} + B \right) \cdot k$$ Reset characteristic: $$t = \frac{TR}{\left(I^{PR} - CR\right)} \cdot k$$ $I = I_{measured}/I_{set}$	k=0.5-999 in steps of 0.1 A=(0.005-200.000) in steps of 0.001 B=(0.00-20.00) in steps of 0.01 C=(0.1-10.0) in steps of 0.1 P=(0.005-3.000) in steps of 0.001 TR=(0.005-100.000) in steps of 0.001 CR=(0.1-10.0) in steps of 0.1 PR=(0.005-3.000) in steps of 0.001	IEC 60255, class 5 + 40 ms
RI inverse characteristic no 18 $$t = \frac{1}{0.339 - \frac{0.236}{I}} \cdot k$$ $I = I_{measured}/I_{set}$	k=(0.05-999) in steps of 0.01	IEC 60255-3, class 5 + 40 ms
Logarithmic inverse characteristic no 19 $$t = 5.8 - \left(1.35 \cdot In \frac{I}{k}\right)$$ $I = I_{measured}/I_{set}$	k=(0.05-1.10) in steps of 0.01	IEC 60255-3, class 5 + 40 ms

Ordering

REB 670, Busbar differential protection IED

Guidelines

Carefully read and follow the set of rules to ensure problem-free order management. Please refer to the function matrix for included software functions given in each software option package. Please observe that the character length of the software option section varies depending on the included options.

Enter option codes in the shaded spaces to complete the ordering number. To obtain the complete ordering code, please combined code from sheet 1 and sheet 2, as given in the example below. 1 BIM and 1 BOM in A20, A31, B20 and 2 BIM and 1 BOM in B21, B31 is basic. Order futher I/O as required.

Sheet 1									Sheet 2
REB 670*		-	-	-	-	-	-	-	

Option	Code	Notes and Rules
SOFTWARE		
Version number		
Latest version	XX	
Version No	1.0	
Configuration alternatives		
3 phase, 4 bays	A20	
3 phase, 8 bays	A31	
1 phase, 12 bays, 1/2 19” case	B20	
1 phase, 12 bays, 1/1 19” case	B21	
1 phase, 24 bays	B31	
CAP configuration		
Simple station layout, 1 1/2CB, 2CB, 1CB, b-contacts, PDIF only	X01	
Double bus-single breaker, a and b contacts, PDIF only	X02	Note: Only for A31, B21 and B31
Double bus-single breaker, a and b contacts, PDIF, RBRF and POCM	X03	Note: Only for A31, B21 and B31
Software options		All fields in the ordering form do not need to be filled in
No option	X00	
Four step phase overcurrent protection, 4 bays	C06	Note: Only for A20
Four step phase overcurrent protection, 8 bays	C07	Note: Only for A31
Four step single phase overcurrent protection, 12 bays	C08	Note: Only for B20 and B21
Four step single phase overcurrent protection, 24 bays	C09	Note: Only for B31
Breaker failure protection, 4 bays	C10	Note: Only for A20
Breaker failure protection, 8 bays	C11	Note: Only for A31
Breaker failure protection, 12 bays, single phase	C12	Note: Only for B20 and B21
Breaker failure protection, 24 bays, single phase	C13	Note: Only for B31
Autorecloser, 2 circuit breakers	H05	
Additional HMI language		
No second HMI language	X0	
German	A1	
Russian	A2	
French	A3	
Spanish	A4	
Italian	A5	
Polish	A6	
Hungarian	A7	
Czech	A8	
Swedish	A9	
Casing		
1/2 19” case	A	Must be used for A20 and B20
1/1 19” case 2TRM slots	E	Must be used for A31, B21 and B31
Mounting details with IP40 of protection from the front		
19” rack mounting kit for 1/2 19” case or 2xRHGS6 or RHGS12	A	
19” rack mounting kit for 1/1 19” case	C	
Wall mounting kit	D	
Flush mounting kit	E	
Flush mounting kit + IP54 mounting seal	F	
Auxiliary power supply		
24-60 VDC	A	
90-250 VDC	B	
Human machine interface		
Small size - text	A	
Medium size	B	

Sheet 1 (Enter option codes from sheet 1 in spaces below)																**Sheet 2**																		
REB 670*		-			-			-		-		-		-		-			-	*	A										-		-	

Analog system (First module X401, second module X411)			
First Transformer input module, 12I, 1A	A1		
First Transformer input module, 12, 5A	A2		
No second TRM included		X0	Note: 2 TRM only in A31 and B31
Second Transformer input module, 12I, 1A		A1	
Second Transformer input module, 12I, 5A		A2	

Binary input and output, mA and time synchronizating boards. Note! Basic 1 BIM and 1 BOM included.																	
Slot position (rear view)	**Note! Max 3 positins in 1/2 rack and 11 in 1/1 rack with 2 TRM and 14 in 1/1 rack wiht 1 TRM**	X31	X41	X51	X61	X71	X81	X91	X101	X111	X121	X131					
1/2 Case with 1 TRM (A20 and B20)	Note! Only for A30 and B30. Only position X31 to X51 can be selected																
1/1 Case with 2 TRM																	
No board in this slot				X	X	X	X	X	X	X	X	X					
Binary output module 24 output relays (BOM)	Note! Maximum 4 BOM boards		A	A	A	A	A	A	A	A	A	A					Note! Not in B21/B31
BIM 16 inputs, RL24-30 VDC	Note! Basic configuration in A20, A31 and B20 adapted for 1BIM and 1 BOM	B		B	B	B	B	B	B	B	B	B					
BIM 16 inputs, RL48-60 VDC		C		C	C	C	C	C	C	C	C	C					
BIM 16 inputs, RL110-125 VDC	Note! Basic configuration in B21and B31 adapted for 2 BIM and 1 BOM	D		D	D	D	D	D	D	D	D	D					
BIM 16 inputs, RL220-250 VDC		E		E	E	E	E	E	E	E	E	E					
BIMp 16 inputs, RL24-30 VDC for pulse counting				F	F	F	F	F	F	F	F	F					
BIMp 16 inputs, RL48-60 VDC for pulse counting				G	G	G	G	G	G	G	G	G					
BIMp 16 inputs, RL110-125 VDC for pulse counting				H	H	H	H	H	H	H	H	H					
BIMp 16 inputs, RL220-250 VDC for pulse counting				K	K	K	K	K	K	K	K	K					
IOM 8 inputs, 10+2 output, RL24-30 VDC				L	L	L	L	L	L	L	L	L					
IOM 8 inputs, 10+2 output, RL48-60 VDC				M	M	M	M	M	M	M	M	M					
IOM 8 inputs, 10+2 output, RL110-125 VDC				N	N	N	N	N	N	N	N	N					
IOM 8 inputs, 10+2 output, RL220-250 VDC				P	P	P	P	P	P	P	P	P					
GPS on GCM card (in last slot)				S								S					
Serial communication unit for remote end communication																	
Slot position (rear view)													X312	X313			
No remote communication board included													X	X			
C37.94 single channel 3 km													A	A			
Serial communication unit for station communication																	
Slot position (rear view)															X301	X311	
No first communication board included															X		
No second communication board included																X	
Serial SPA/IEC 60870-5-103 and LON communication module (plastic)															A		
Serial SPA /IEC 60870-5-103 (plastic) and LON (glass) communication module															B		
Serial SPA/IEC 60870-5-103 and LON communication module (glass)															C		
Optical ethernet module, 1 channel glass																D	
Optical ethernet module, 2 channel glass																E	

Example:
REB 670*1.0-A20X01-C06C10-X0-A-A-B-A-A1-X0-DAX-XX-XD

Accessories

External current transformer unit

3 pcs SLCE 8–1 summation transformers on apparatus plate (2U high), 1/1 A	Quantity:	☐	1MRK 000 643-EA
3 pcs SLCE 8–1 summation transformers on apparatus plate (2U high), 5/1 A	Quantity:	☐	1MRK 000 643-FA
3 pcs SLCE 8–1 summation transformers on apparatus plate (2U high), 2/1 A	Quantity:	☐	1MRK 000 643-GA

GPS antenna and mounting details

GPS antenna, including mounting kits	Quantity:	☐	1MRK 001 640-AA
Cable for antenna, 20 m	Quantity:	☐	1MRK 001 665-AA
Cable for antenna, 40 m	Quantity:	☐	1MRK 001 665-BA

Test switch

The test system COMBITEST intended for use with the IED670 products is described in 1MRK 512 001-BEN and 1MRK 001024-CA. Please refer to the website www.abb.com/substationautomation and ABB Product Guide > High Voltage Products > Protection and Control > Modular Relay > Test Equipment for detailed information

Due to the high flexibility of our product and the wide variety of applications possible the test switches needs to be selected for each specific application.

Select your suitable test switch based on the available contacts arrangements shown in the reference documentation.

However our proposal for suitable variants are:

RK926 315-CA is provided with four three-phase CT inputs with current shorting and with six trip output blocking contacts. It is suitable when internal CT earthing is acceptable both for the three-phase version and single-phase versions. When more than four feeders are available or expected in future several test switches are required and tripping must be blocked either by series connection of the trip test switch contacts, and/or blocking of tripping with the input contact 29-30 and configuration logic.

RK926 315- AV is provided with one three-phase CT input with current shorting and with sixteen trip output blocking contacts. It is suitable when external CT earthing is required both for the three-phase version and single-phase versions. One such switch is then used per bay. With such arrangement the best possible test facilities for BBP & integrated BFP are available

Test switches type RTXP 24 are ordered separately. Please refer to Section "Related documents" for reference to corresponding documents.

RHGS 6 Case or RHGS 12 Case with mounted RTXP 24 and the on/off switch for dc-supply are ordered separately. Please refer to Section "Related documents" for reference to corresponding documents.

Mounting details

19” rack mounting kit for one test switch	Quantity:	☐	1MRK 002 420-BE
19” rack mounting kit for two test switches	Quantity:	☐	1MRK 002 420-BB

Protection cover

Protective cover for rear side of RHGS6, 6U, 1/4 x 19”

Quantity: ☐ 1MRK 002 420-AE

Protective cover for rear side of IED, 6U, 3/4 x 19”

Quantity: ☐ 1MRK 002 420-AB

Protective cover for rear side of IED, 6U, 1/1 x 19”

Quantity: ☐ 1MRK 002 420-AA

Combiflex

Key switch for lock-out of settings via LCD-HMI

Quantity: ☐ 1MRK 000 611-A

Note: To connect the key switch, leads with 10 A Combiflex socket on one end must be used.

Side-by-side mounting kit

Quantity: ☐ 1MRK 002 420-Z

Configuration and monitoring tools

Front connection cable between LCD-HMI and PC

Quantity: ☐ 1MRK 001 665-CA

LED Label special paper A4, 1 pc

Quantity: ☐ 1MRK 002 038-CA

LED Label special paper Letter, 1 pc

Quantity: ☐ 1MRK 002 038-DA

Protection and control IED manager PCM 600

PCM 600 ver. 1.1, IED Manager

Quantity: ☐ 1MRK 003 395-AA

PCM 600 ver. 1.1, Engineering, IED Manager + CAP 531

Quantity: ☐ 1MRK 003 395-BA

PCM 600 ver. 1.1, Engineering Pro, IED Manager + CAP 531 + CCT for IEC 61850-8-1 configuration of IED

Quantity: ☐ 1MRK 003 395-CA

Manuals

Note: One (1) IED Connect CD containing user documentation (Operator’s manual, Technical reference manual, Installation and commissioning manual, Application manual and Getting started guide), Connectivity packages and LED label template is always included for each IED.

Rule: Specify additional quantity of IED Connect CD requested

Quantity: ☐ 1MRK 002 290-AA

Rule: Specify the number of printed manuals requested

Operator’s manual

Quantity: ☐ 1MRK 505 168-UEN

Technical reference manual

Quantity: ☐ 1MRK 505 167-UEN

Installation and commissioning manual	Quantity:		1MRK 505 169-UEN
Application manual	Quantity:		1MRK 505 170-UEN
Engineering guide IED 670 products	Quantity:		1MRK 511 179-UEN

Reference information

For our reference and statistics we would be pleased to be provided with the following application data:

Country: End user:

Station name: Voltage level: kV

Sample specification

Numerical IED with differential, circuit breaker failure, end fault and overcurrent protection is intended for the selective, reliable and fast protection of busbars, T-connections and meshed corners. The IED shall be applicable for the protection of medium voltage (MV), high voltage (HV) and extra high voltage (EHV) installations at a power system frequency of 50Hz or 60Hz. The IED shall be able to detect all types of internal phase-to-phase and phase-to-ground faults in solidly grounded or low impedance grounded power systems, as well as all internal phase-to-phase faults in isolated or high-impedance grounded power systems. For power systems with limited earth fault current a sensitive differential protection shall be available.

For all applications, it shall be possible to connect main CTs with different ratios (e.g 10:1) within the same differential protection zone. There shall be no requirements for any auxiliary CTs. Compensation of different main CT ratios shall be achieved numerically by parameter settings.

The differential protection function shall have completely phase-segregated measurements. The typical operating time in case of internal faults shall be around 12 milliseconds, with guaranteed stability of the differential function for all external faults even with very high short-circuit currents and heavy CT saturation.

The IED shall include the ability to detect CT open circuit condition. No incorrect operation of the protection IED shall occur for CT open circuit condition and an alarm shall be issued to the supervisory system. Stability of the differential function must be guaranteed even for the case when only two feeders are connected to the zone of protection and then one of the two CTs is accidentally open circuited under full through-load condition. It shall be possible to reset the CT open circuit condition locally or remotely via the communication. Reset of the CT open circuit condition shall only be possible if there is no differential current detected in the protected zone.

It shall be possible to engineer the complete busbar differential protection, zone selection logic, circuit breaker failure and end fault protection scheme by using a graphical configuration tool. The graphical configuration tool shall be easy to use and intuitive for experienced protection engineers. It shall be possible to engineer the complete scheme including future extension feeders, such that at a latter stage they can be activated one by one. The integrated disconnector replica shall insure busbar differential protection and circuit breaker failure protection selective bay tripping. Disconnector and circuit breaker status supervision shall be provided. Integrated overall check zone shall be available in order to provide full busbar differential protection stability in case of completely wrong status indication of individual bay disconnectors. The facility to selectively block any integrated protection functions or alternatively to take a bay out of service shall be provided. Autoreclosing facility for delayed busbar restoration after busbar differential protection operation shall be available.

Comprehensive and continuous self-monitoring of the IED shall ensure no incorrect operations of the differential function in case of internal relay failure. The front mounted, menu driven human-machine-interface shall display:

- Magnitude and phase angle of all individual bay currents per phase
- Magnitude of differential and total through-load currents for each phase and zone of protection
- Internal software connections between bay currents and individual zones
- Actual status of each primary switchgear object
- Tripping and open CT indications
- Self supervision information

Integrated disturbance recorder and event list shall be available. Communication to the station control system via IEC 61850-8-1 and/or IEC 60870-5-103 shall be available.

Time synchronization of the internal real time clock via minute-pulse or alternatively via GPS shall be available.

Related documents

Documents related to REB 670	Identity number
Operator's manual	1MRK 505 168-UEN
Installation and commissioning manual	1MRK 505 169-UEN
Technical reference manual	1MRK 505 167-UEN
Application manual	1MRK 505 170-UEN
Buyer's guide	1MRK 505 172-BEN
Connection and Installation components	1MRK 013 003-BEN
Test system, COMBITEST	1MRK 512 001-BEN
Accessories for IED 670	1MRK 514 012-BEN
Getting started guide IED 670	1MRK 500 065-UEN
SPA and LON signal list for IED 670	1MRK 500 075-WEN
IEC 61850 Data objects list for IED 670	1MRK 500 077-WEN
Generic IEC 61850 IED Connectivity package	1KHA001027–UEN
Protection and Control IED Manager PCM 600 Installation sheet	1MRS755552
Engineering guide IED 670 products	1MRK 511 179–UEN

Latest versions of the described documentation can be found on www.abb.com/substationautomation

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