

MEDIUM VOLTAGE PRODUCTS

Outdoor switching points

Catalogue

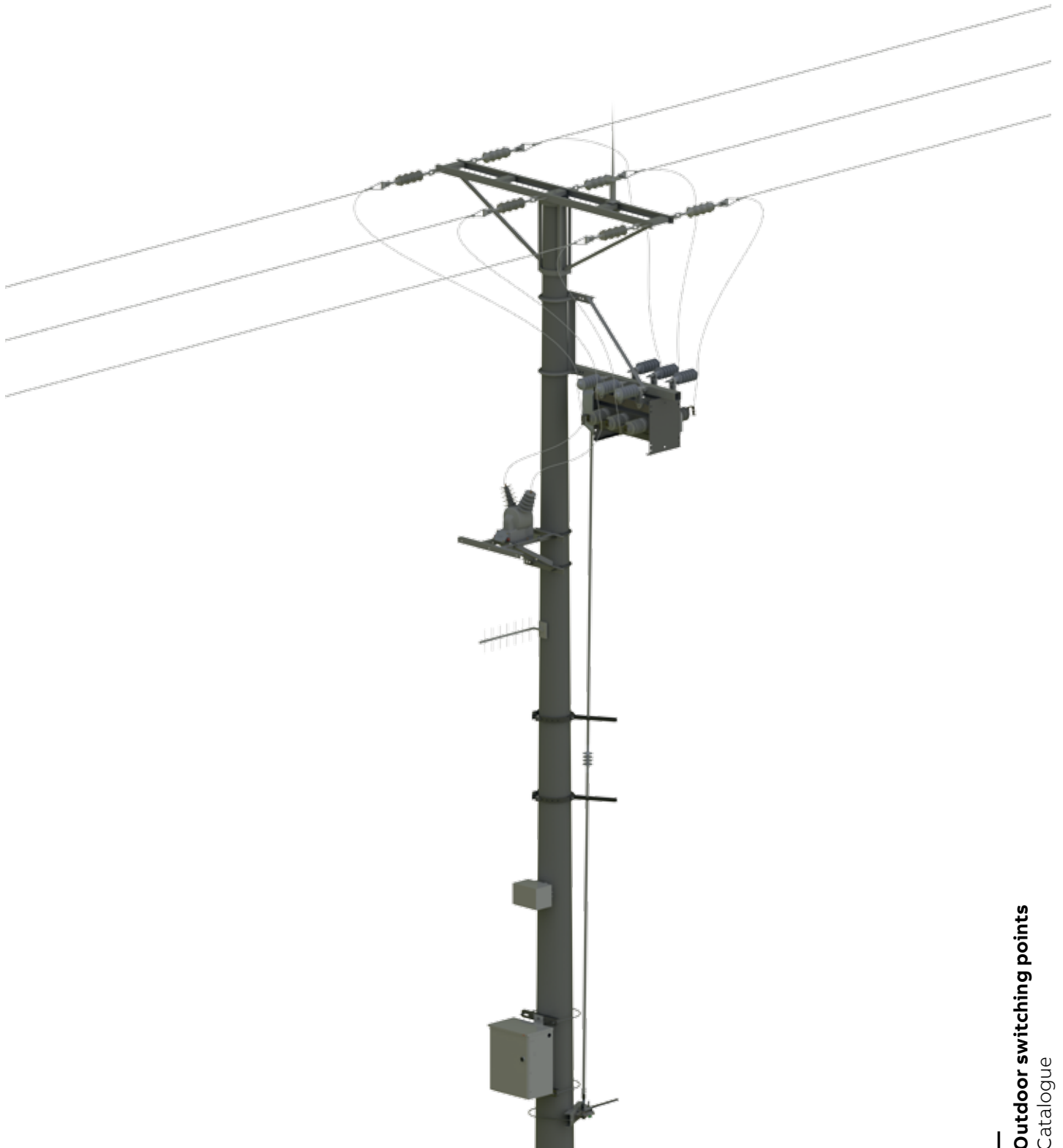


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Introduction

1.1. Feeder automation drivers

In modern energy distribution there are few main factors which drives network automation:

- Improvement of the quality of the power supply
- Improvement the operational efficiency
- Effective utilization of distribution network
- Improvement of safety for the utility personnel

1.1.1. Improvement of the quality of the power supply

Country regulators every year increase requirements for energy's quality. Quality of energy it is not only voltage's parameters (value, asymmetry, frequency etc.) but also continuity and reliability of power supply. Reliability of power supply is defined by international standard by the indexes. There are three main indexes widely used by utilities SAIDI, SAIFI, MAIFI. Description of indexes in the following part.

1.1.2 Improvement the operational efficiency

Utilities operates on the competitive market, where customers demands quality of energy on particular level and keeping competitive price. At the same time utilities have to deliver profits to owners. These factors drives the need to look for new more effective solutions and tools. One of the method is to use maintenance-free devices or with extended time between service.

1.1.3 Effective utilization of distribution network

Growing demand on the electric energy, causes that networks designed for smaller load are reaching the limits. Investment in new lines or modernization existing is the long-term and costly process. Therefore alternative solutions to deliver energy in more effective way are required. For example reduce transmission of reactive power and reduce outages.

1.1.4 Improvement of safety for the utility personnel

The biggest asset of every company are people. Increase work safety is the priority for most of companies. In outdoor overheads networks it could be realized by using high quality devices, reduction of service trips and works in hard atmospheric conditions.

1.2 Energy supply reliability indexes.

Reliability indexes are defined by IEEE 1366 standard. Below three most common indexes are explained. Many utilities have in their strategic goal to reduce SAIDI, SAIFI, MAIFI indexes.

SAIDI (System Average Interruption Duration Index) is a sum of all interruption time from one year (in minutes), divided by overall number of customers. In other words it is overall time of interruptions during the year which could be expected by the customer.

SAIFI (System Average Interruption Frequency Index) is a sum of all unplanned interruptions in one year, divided by overall number of customer. It is average number of interruption in one year which could be expected by customer.

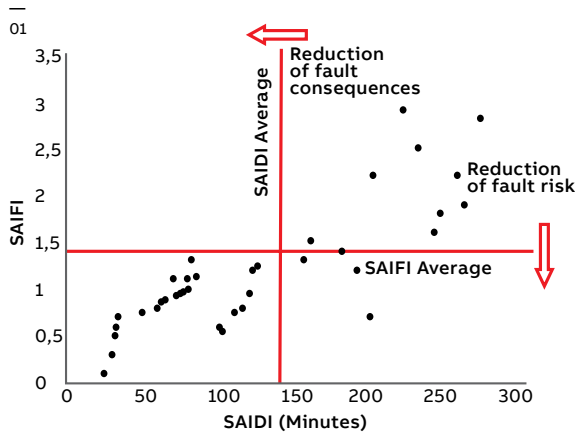
SAIDI and **SAIFI** indexes doesn't consider interruptions shorter than 3 minutes.

MAIFI (Momentary Average Interruption Frequency Index) is a sum of all unplanned short interruptions (shorter than 3 minutes) in one year, divided by overall number of customer. Index of average number of short interruptions in one year per customer.

01
Relation between SAIDI and SAIFI and method to reduce these indexes

- Reduction of fault consequences**
- utilization of feeder automation and Distribution Management Systems
 - fault localization
 - network reconfiguration and restoration
 - crew management and crew support

- Reduction of fault risk**
- utilization of primary network concepts
 - construction and topology
 - feeder automation usage
 - asset management
 - performance monitoring



1.3 Zone concept in modern energetics

Increased requirements for uninterrupted deliveries energy led to the creation of a concept dividing power supply areas into smaller areas. It was called Zone Concept.

The main concept is based on minimizing the area without electricity in case of failure occurrence. The smaller the separated zone the less customers are without power in case of failure.

In the traditional distribution network in the event of fault, usually the entire supplied line it is disconnected.

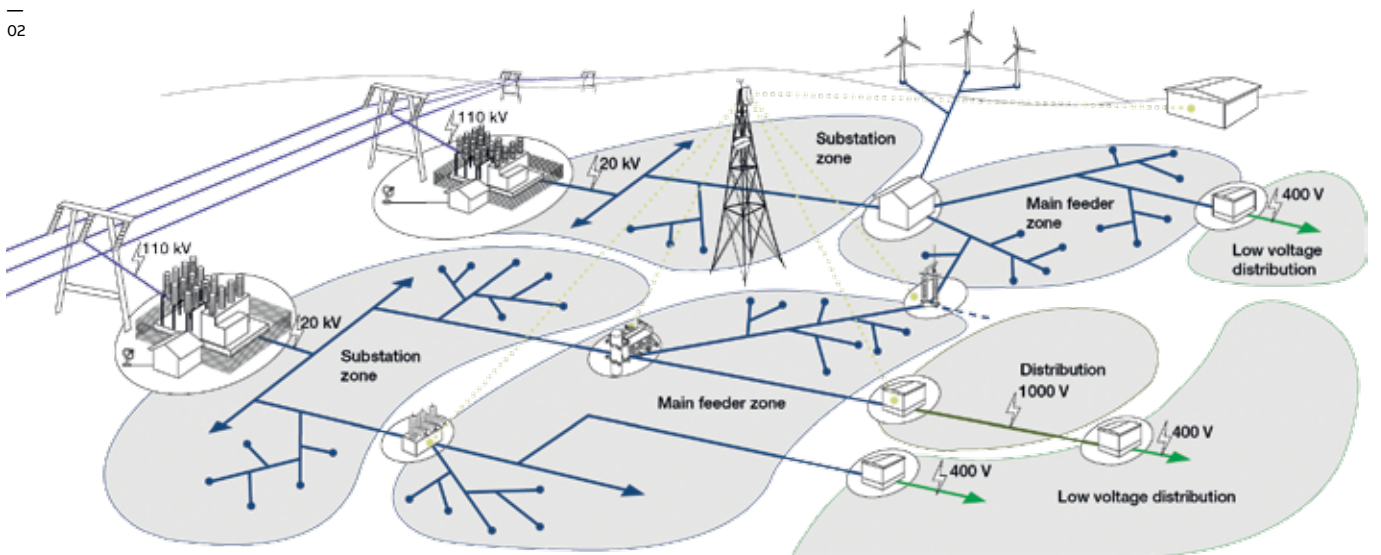
Integration of protective functions and reclosing deeper into the network distribution, leads to selective switching off the damaged section of the network. In this way unaffected branches of network remain with power supply and more

customer has the supply of energy. In the above concept, the main power line is divided into sub-zones by reclosers, automatic sectionalizers, remotely controlled switch disconnectors. All apparatus are equipped with a remote control option which is particularly useful for network reconfiguration to restore energy. It is not practical to install only circuit breakers/recloser at all branches. In most cases the switch disconnector is sufficient. Damaged section network can be isolated by remotely controlled switch disconnector, or an automatic sectionalizer (switch disconnector equipped with short circuit current detection and local automation).

The zone concept can be extended step by step as the requirements grow and available funds. The most sensitive zones are created by using small substations or zone circuit breakers/reclosers. In the next steps, the zone is divided into smaller sub-zones by switch disconnectors and sectionalizers.

A complete solution requires a reliable, cost effective and safe communication. The most popular solution for overhead apparatus is connectivity using cellular network. Cellular network is widely and easily available, no additional investments in infrastructure are needed by utility. Using a dedicated VPN channel and encryption security on the highest level is ensured.

02
Example of local automation on one network's branch



02

1.4. Benefits of zone concept

High quality energy for consumers. The solution significantly reduces the quantity and length of energy supply interruptions as well fewer customers experience voltage lost. Automation allows faster and easier network management in the event of a failure. Power for customers is restored faster and in a controlled manner.

Increased security power supply

In the first steps investments are directed in areas most exposed to failures. It is allowing to limit the impact of a failure only to a small area (zone), which simultaneously improves reliability of the entire network.

Effective use of the distribution network

Implementation of communication in the distribution network with the central system SCADA/DMS allows to effectively use the whole network. Disturbance states can be effectively eliminated thanks to precise functions of short-circuit localization and DMS (Distribution Management System). In case of failure circuit breaker/recloser, thanks to protection relay function disconnects the damaged zone. Then the area directly affected by the failure is isolated by remotely controlled switch disconnectors. Power to other part of this zone is restored.

Effective use of investments

Zone concept investments are relatively inexpensive. However, investments have wide impact on the network and immediate effect of cost reduction related to outages. This means a short payback period. The solution of the zone concept reduces also emergency network overloading, and by this extends the lifetime of all components of distribution network.

Adaptation to operational changes

Investments can be made in phases, starting from the most critical places. A single investment can be carried out in any period of the year. The zone concept solutions can be fully used in the process

of network continuous improvement and long-term investment strategies. The zone concept is also applicable in case of connection to the distribution network renewable energy sources or new important customers. The zone concept grows together with requirements, offering solutions both for today and for the future.

1.5. Automation concepts for distribution network

Sectioning can be carried out on several ways, using local automation:

- based on a voltage signal
- based on the detection of short circuit current
- based on the detection of short circuit current and voltage signal

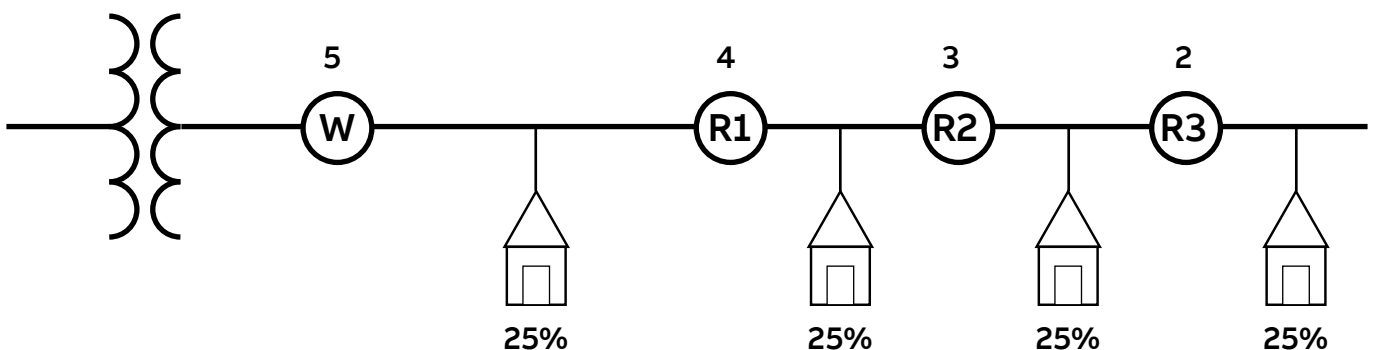
The next step is integration with centralized automation system SCADA type. With this solution you can manage a much larger area of distribution network. You can use local automation to coordinate only for one branch of the network, for each branch it is set independently. At the beginning of each branch must be located circuit breaker or recloser.

The overhead distribution line is powered from the station. A breaker is installed at the station (W) with protection automation or at the beginning of the line branch the recloser with protection automation. Then the network is divided for subsequent sections (zones) by overhead switch disconnectors/sectionalizers (R1, R2, R3). Due to the selectivity of operation in one branch one breaker/recloser and 3 switch disconnectors are installed. This is due to the maximum amount of reclosing cycles, that the breaker/recloser can do, usually it is up to 5 cycles.

Each subsequent switch disconnector further from breaker should have set one reclosing cycle less. It is worth to note that up to 80% of failures in the overhead networks are transient. This means that they disappear by itself (for example branch that fell on the overhead line). Therefore in the first reclosing cycle, is checked whether the fault clear themselves.

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03

Substation



The number of reclosing for permanent lock-out, in the model network:

- W – breaker/recloser – 5 reclosing
- R1 – sectionalizer – permanent opening in 4-th voltage free break
- R2 – sectionalizer – permanent opening in 3-rd voltage free break
- R3 – sectionalizer – permanent opening in 2-nd voltage free break

1.6. Automatic sectionalizer based on the voltage signal.

In this solution, each sectionalizer is equipped with voltage detection from the supply side. Each apparatus is programmed that it would count only the loss of voltage. They start from the second voltage loss, it opens automatically in an interval without voltage, up to permanent lock-out. When voltage appears, sectionalizers close successively from the closest to the breaker.

See drawing no. 4.

1. Protection relay of the recloser detects a fault, trips and recloser is opening
2. Sectionalizers and the recloser start to count (counter = 1)
3. After the set time (usually 1-2 seconds) the recloser performs 1 reclosing cycle.
4. Because the short circuit is permanent, the recloser opens again (counter = 2)
5. Sectionalizers (R1, R2, R3) open during a voltage-free break. Sectionalizer R3 remains permanently open – lock-out opening in the second voltage-free break.
6. Recloser is closing for the second time after 15 seconds (2-nd reclosing) and a fault is not detected
7. The sectionalizer R1 detects the voltage recovery and after a few seconds (10s) it closes

8. After R1 is closed, the R2 sectionalizer detects voltage recovery and after a few seconds (10s) is closing. It is a closing against short circuit.
9. Recloser's protection relay re-detects fault and trip the recloser (counter 3).
10. The sectionalizers (R1, R2) open during a voltage free break. The R2 sectionalizer remains permanently open.
11. Recloser is closing for the third time after 45 seconds (3-rd reclosing)
12. The R1 sectionalizer detects the voltage recovery and after a few seconds (10s) it closes.
13. The R2 sectionalizer remains open, short circuit is isolated. Customers which are connected between W and R2 have again power supply (50% of recipients of the whole branch).

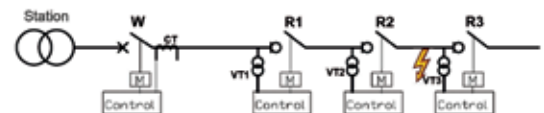
Time to restore the power is 93 seconds with assumption as in diagrams

Advantages of the solution:

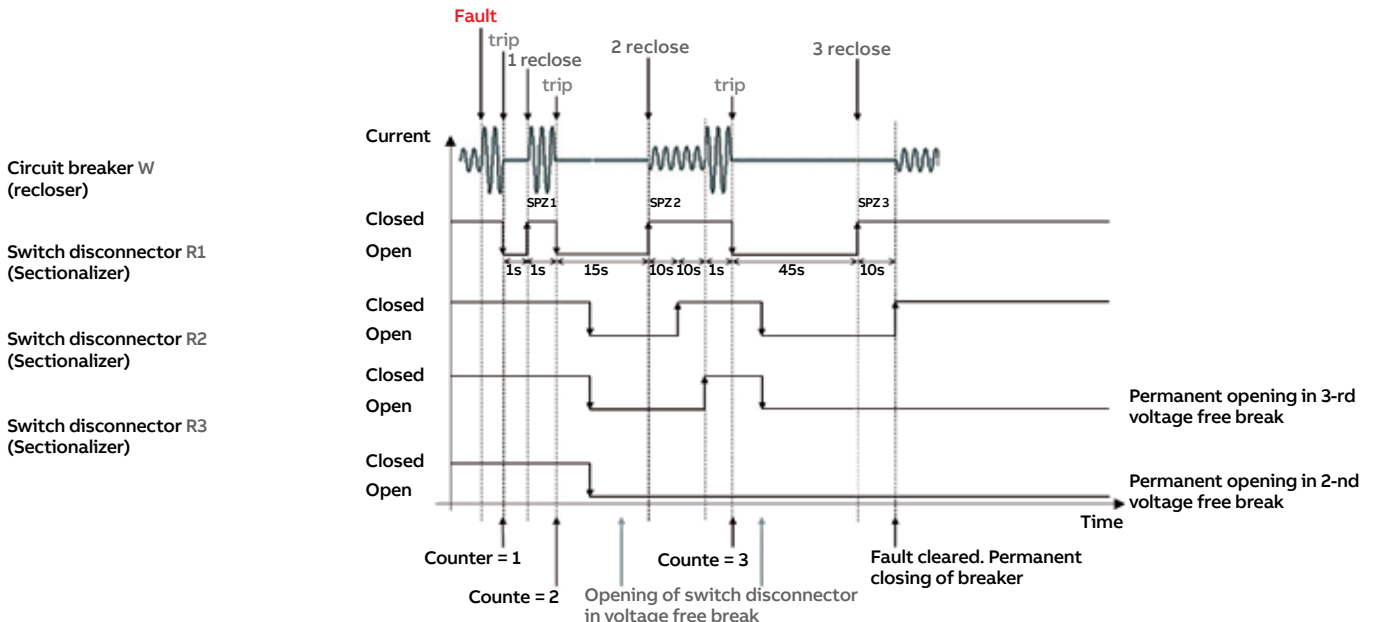
- complicated SCADA/DMS system and remote communication are not needed
- significantly reduces the time to isolate the fault vs manual operated switches
- simple controller and measurement systems

Disadvantages:

- sectionalizers perform closing operations against short circuit
- a large number of mechanical operations
- time to isolate fault in relation to the next concepts



04



1.7. Automatic sectionalizer based on fault current detection.

In this solution, each sectionalizer is equipped with fault current detection. Each apparatus is programmed that it would count only the fault clearing.

They start from the second fault clearing, it opens automatically in an interval without current, up to permanent lock-out.

See drawing no 5.

1. Protection of the recloser detects a fault, trips and recloser is opening
2. Sectionalizers R1 and R2 detected faults.
3. The sectionalizer and the recloser start to count (counter = 1)
4. After the set time (usually 1-2 seconds) the recloser performs 1 reclosing cycle.
5. Because short circuit is permanent, the recloser opens again (counter = 2)
6. Recloser is closing for the second time after 15 seconds (2-nd reclosing)
7. Recloser opens again (count 3).
8. Sectionalizer R2 which has set counter to 3 is opening in current free break.

9. Recloser is closing for the third time after 45 seconds (3-rd reclosing)
10. The R2 sectionalizer remains open, short circuit is isolated. Customers which are connected between W and R2 have again power supply (50% of recipients of the whole branch).

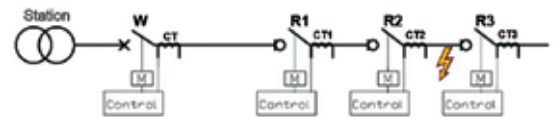
Time to restore the power is 63 seconds with assumption as in diagrams

Advantages of the solution:

- disconnectors do not perform closing operations against short circuit
- number of mechanical operations of disconnectors is limited
- shorter time to isolate fault comparing to the sectionalize based on voltage signal
- complicated SCADA/DMS system and remote communication are not needed

Disadvantages:

- fault detection needed in each sectionalizer



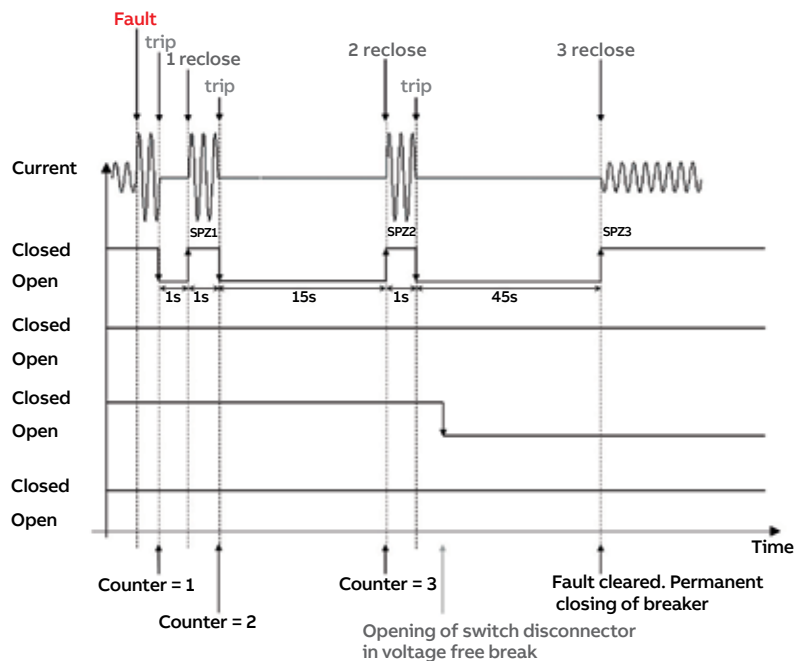
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05

Circuit breaker W (recloser)

Switch disconnector R1 (sectionalizer)

Switch disconnector R2 (sectionalizer)

Switch disconnector R3 (sectionalizer)



1.8. Automatic sectionalizer based on fault current detection and voltage signal.

In this solution, each sectionalizer is equipped with fault current detection and voltage loss signalisation. Each apparatus is programmed that it would count only the fault clearing.

They start from the second fault clearing, it opens automatically in an interval without current and voltage, up to permanent lock-out. Comparing to the sectionalizer based on fault current detection, sectionalizer could open only after confirmation that there is no voltage on line.

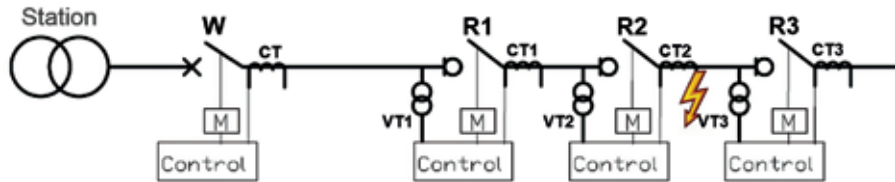
Switching diagram is identical like in the sectionalizer based on fault current detection, but opening is only when there is no voltage.

Advantages of the solution:

- sectionalizers do not perform closing operations against short circuit
- number of mechanical operations of sectionalizers is limited
- shorter time to isolate fault comparing to the sectionalize based on voltage signal
- complicated SCADA/DMS system and remote communication are not needed
- double protection against opening the fault

Disadvantages:

- fault detection needed in each sectionalizer
- voltage loss signal needed



1.9. Automatic sectionalizer with DMS system.

In this solution complete system is integrated and controlled by DMS (Distribution Management System) or SCADA. All apparatus are connected to the DMS system.

Decision of opening sectionalizer is done in DMS system, based on the signals from sectionalizers. In case of decision taken remotely, crucial is the fast and reliable communication between DMS and switching points. In case of fast communication, time to clear the fault could be significantly reduced.

See drawing no 07

1. Protection of the recloser detects a fault, trips and recloser is opening. Information about the fault and tripping the recloser is send to DMS system.
2. Sectionalizers R1 and R2 detected faults and send these information to DMS.
3. The sectionalizers and the recloser start to count (counter = 1)
4. After the set time (usually 1-2seconds) the recloser performs 1 reclosing cycle.
5. Because short circuit is permanent, the recloser opens again (counter = 2) information is send to DMS.
6. DMS using proper algorithms is analyzing the situation.

7. Sectionalizers R1 and R2 detected the fault, R3 didn't detect the fault. Fault is between R2 and R3, DMS is sending command to open R2.
8. Sectionalizer R2 is opening and sending status confirmation to DMS.
9. Recloser closes for the second time (2-nd reclosing) -15 seconds
10. The R2 sectionalizer remains open, short circuit is isolated. Customers which are connected between W and R2 have again power supply (50% of recipients of the whole branch).

Time to restore the power is 17 seconds with assumption as in diagrams

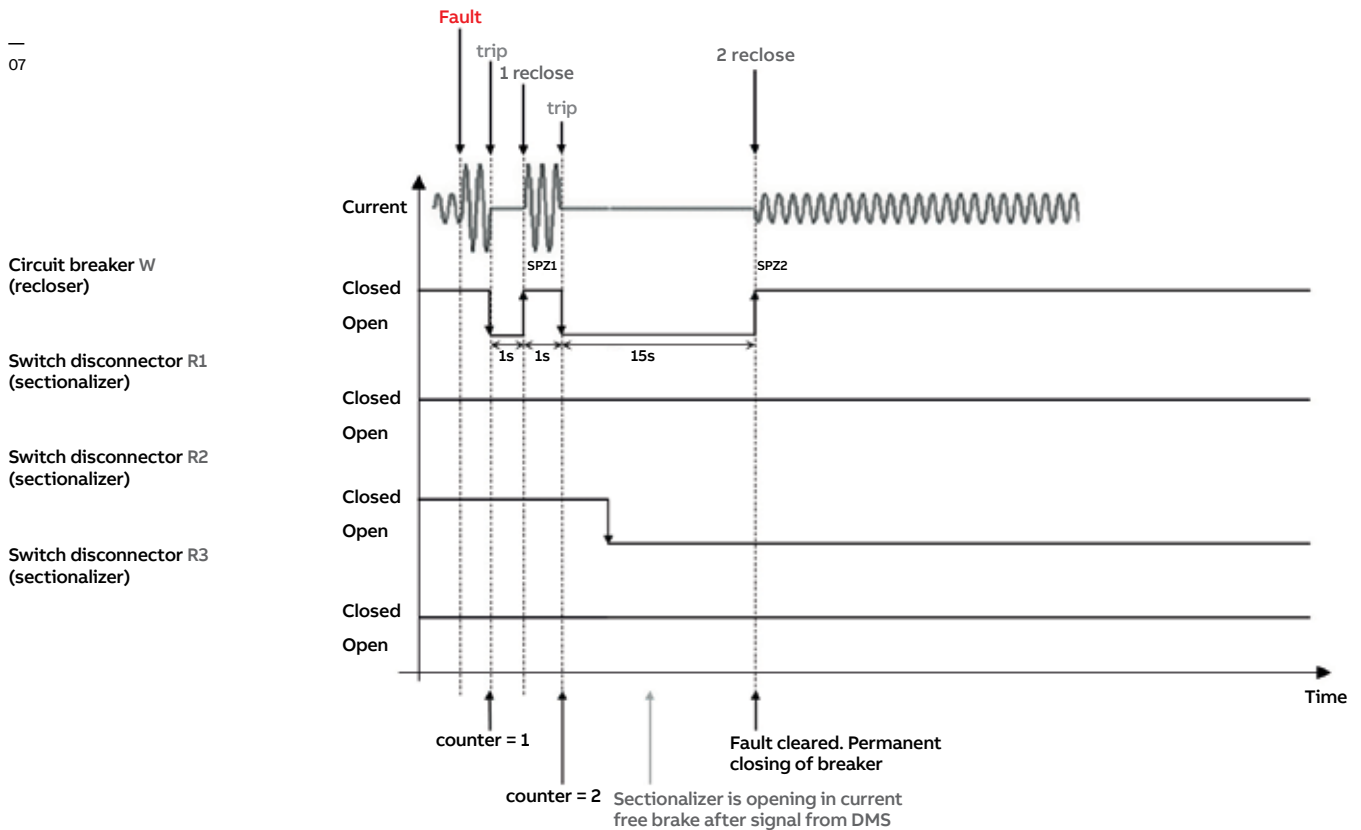
Advantages of the solution:

- sectionalizers do not perform closing operations against short circuit
- number of mechanical operations of sectionalizers is limited
- shorter time to isolate fault comparing to solution without DMS system

Disadvantages:

- fault detection needed in each sectionalizer
- DMS/SCADA system is needed
- fast and reliable communication is needed

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07



1.10. Network sectionalizing using DMS system in ring network.

Most advanced solution is using open ring network topology. Two independent network branches are supplied from two substations. Both branches are connected via normally open point (R7 on diagram no 09). In normal state R7 is open. In case of fault in one branch, part of customer could be connected to the the second branch via R7 sectionalizer.

See drawing no. 08 and diagram no. 09.

Till point 9 procedure is the same as in previous point

10. DMS is sending command to open the sectionalizer R3 to isolate fault from other side
11. Sectionalizer R3 is opening and sending confirmation to DMS (10s)
12. DMS is sending command to close normally open sectionalizer R7 to close the ring.
13. Sectionalizer R7 is closing and sending confirmation to DMS (10s)
14. Customers which are connected between R3 and R7 have again power supply (it means additional 25 % and in total 75% of customers of the whole branch).

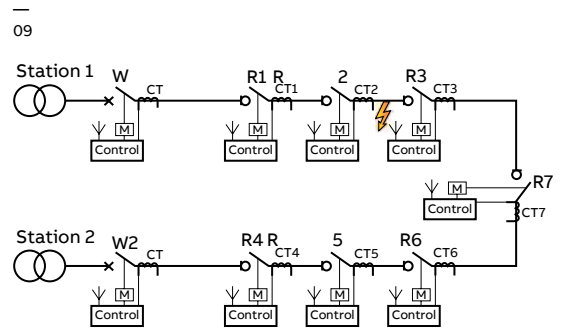
Time to restore the power to customers between R3 and R7 is additional 20 seconds with assumptions like in diagram.

Advantages of the solution:

- sectionalizers do not perform closing operations against short circuit
- number of mechanical operations of sectionalizers is limited
- shorter time to isolate fault comparing to solution without DMS system
- more customer has the energy supply in short time

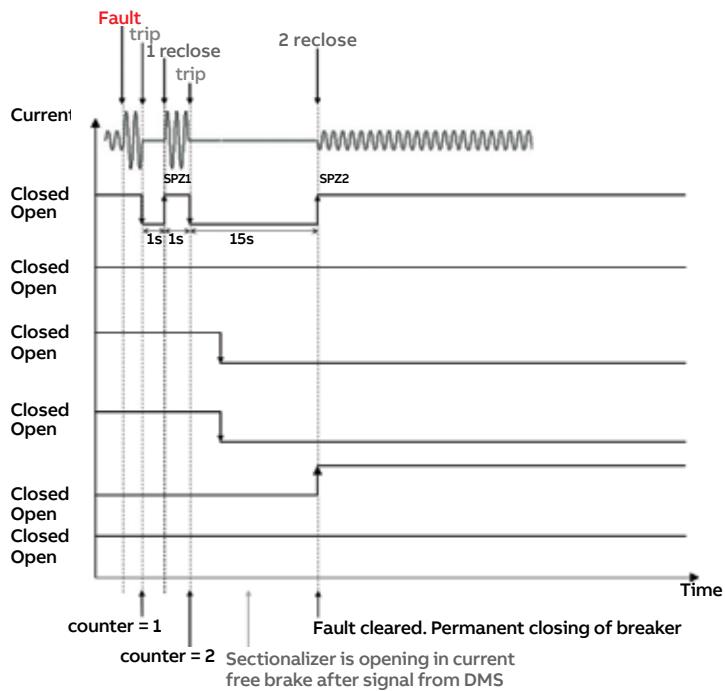
Disadvantages:

- fault detection needed in each sectionalizer
- DMS/SCADA system and communication is needed
- ring network topology with normally open point sectionalizer
- substation with spare power



08

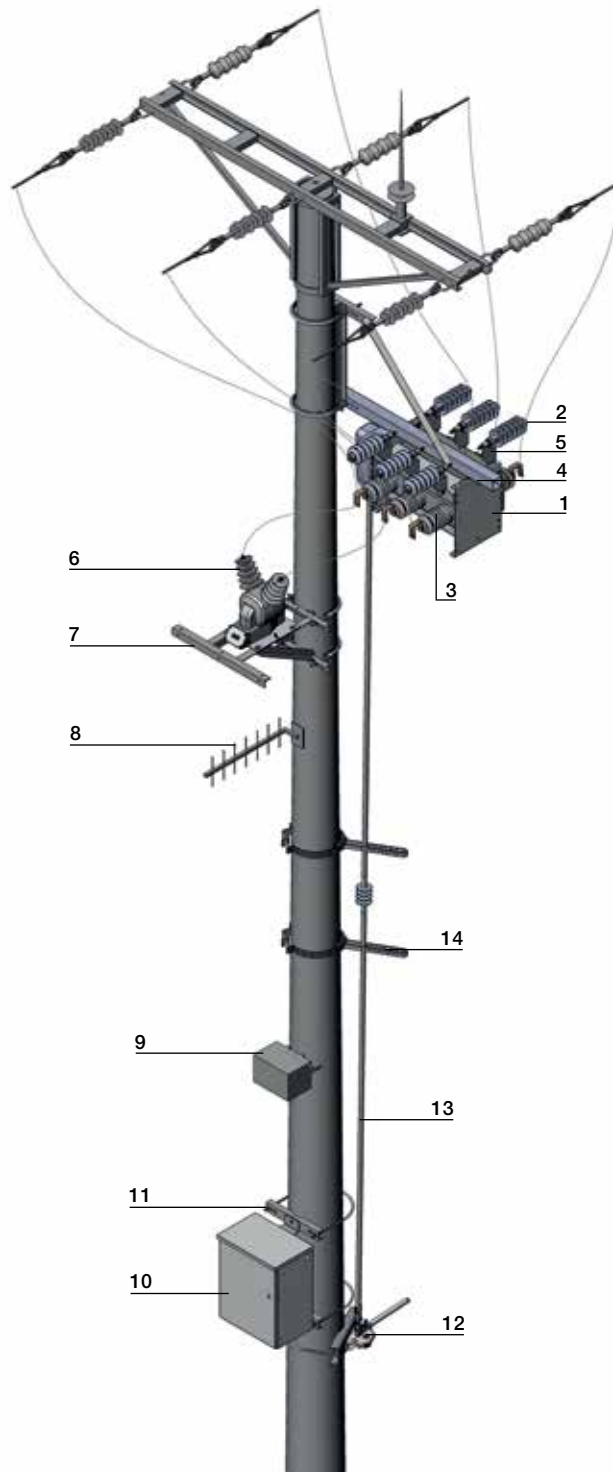
- Circuit breaker W (recloser)
- Switch disconnector R1 (sectionalizer)
- Switch disconnector R2 (sectionalizer)
- Switch disconnector R3 (sectionalizer)
- Switch disconnector R7 (sectionalizer)
- Switch disconnector R4, R5, R6 (sectionalizer)



1.11. Switching point - description

The growing importance of outages time reduction and improve of operation efficiency has led to new product definition "outdoor switching point".

The most popular are pole mounted switching points which provide compact, ergonomic design and easy service.



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10
Main elements of
switching points:

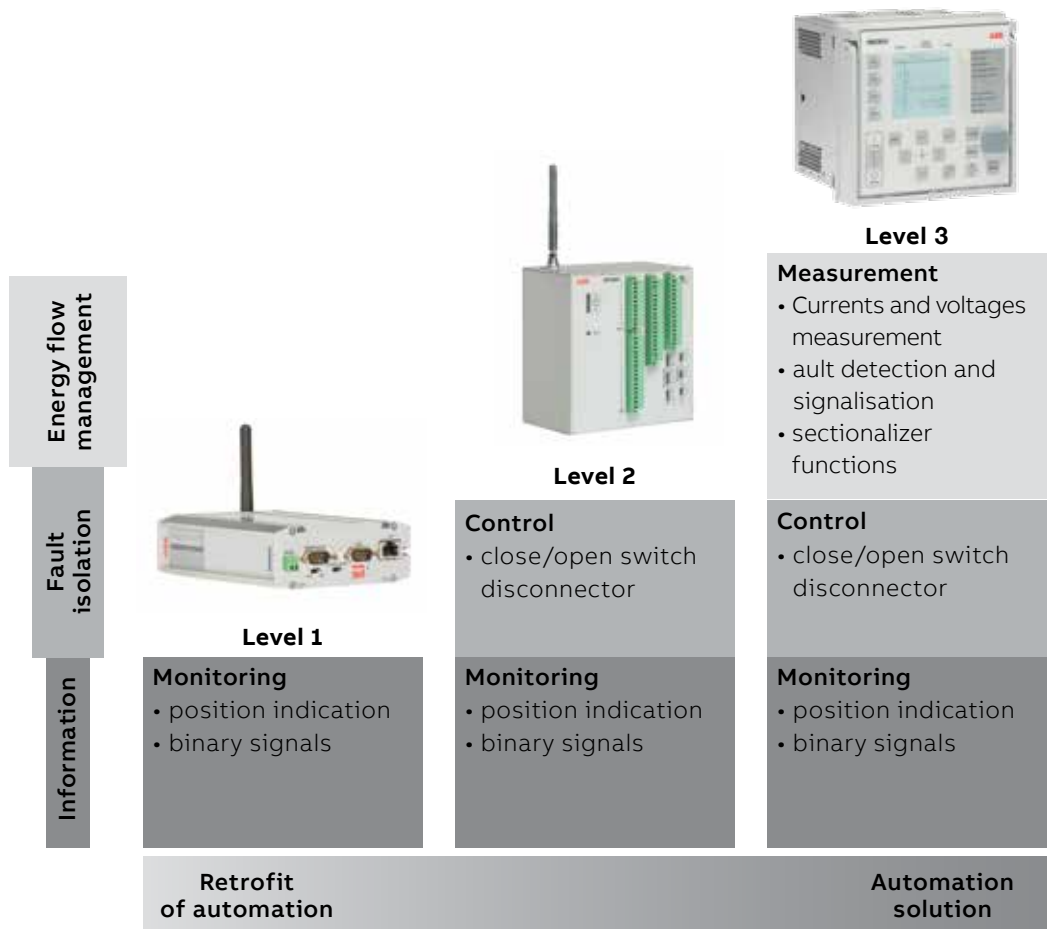
- 1 – Switch disconnector
Sectos NXB
- 2 – Surge arresters
POLIM
- 3 – Current transformers
KOKU
- 4 – Supporting
structure of swich
disconnector
- 5 – Supporting structure
of surge arresters
- 6 – Supply voltage
transformer VOL
- 7 – Supporting structure
of VT
- 8 – Communication
antena
- 9 – Fuse box
- 10 – Control cabinet
UEMC-A
- 11 – Supporting structure
of control cabinet
- 12 – Manual drive SEMD2
- 13 – Connection rods for
manual drive
- 14 – Rods support

1.12. Automation levels (1-4)

Switching points are not the switch disconnectors but mostly the remote control, automation and communication. In ABB portfolio 4 levels can be distinguished:

- 1. **Level 1:** The basic – monitoring only. Information about switch position and some binary signals are transmitted to the user.
- 2. **Level 2:** The most popular – monitoring and control. The same as level 1 but with remote control of switch. Based on ARC600 RTU.

- 3. **Level 3:** Most suitable for the switch disconnectors. Level 2 plus measurement of currents and voltages, fault detection, automatic sectionalizer functions. Based on REC615 relay.
- 4. **Level 4:** Suitable for circuit breakers and reclosers. Level 3 plus protection functions.



1.12. Automation level (1-4) continued

| IED | Communication | Level 2 | | | Level 3 | | |
|---|--------------------------|------------------------|-------------------------------------|-------------------------------------|----------------------------------|--|--|
| | | Monitoring and control | | | Monitoring, control, measurement | | |
| | | 1 motor driver | 1 motor driver and 1 fault detector | 3 motor driver and 1 fault detector | up to 3 motor drivers | up to 3 motor drivers | up to 3 motor drivers |
| | | | | | Current measurement | | Current and voltage measurement |
| | | | | | 4 x current transformer | 4 x current transformer 3 x voltage transformer | 4 x current transformer 6 x voltage sensors |
| Arctic ARR600A3261 (8 x I, 2 x O) | Integrated LTE module | X | | | | | |
| Arctic ARR600A3262 (6 x I, 4 x O, 2 x AI) | Integrated LTE module | | X | | | | |
| ARC600 (17 x I, 10 x O, 2 x AI) | Integrated LTE module | | | X | | | |
| REC 615 AAAN (8 x I, 10 x O) | External LTE module | | | | X | | |
| REC 615 AAAA (14 x I, 13 x O) | External LTE module | | | | | X | |
| REC 615 BABN (12 x I, 10 x O) | External LTE module | | | | | | X |

*Presented 3 levels of automation based on ABB products type Arctic controllers and REC type relays.

Sectos pole mounted SF6 load break switch



2. Sectos pole mounted SF6 load break switch

Sectos is an SF6-insulated, outdoor pole mounted load break switch family for overhead lines and specifically designed for use in modern remote controlled distribution automation systems. The Sectos offers reliable maintenance free operation even in the most demanding climatic conditions including salt laden atmospheres, corrosive industrial pollution, snow and ice. It has excellent load breaking and fault making capacity and satisfies the isolation requirements specified for load break switch. The earthed metal tank prevents all possible leakage currents across an open switch. Sectos can be manually operated or motor operated for local and remote electric control, and can be upgraded easily.

The high quality 3 mm stainless steel are used for tank, which is designed for its maximum robustness and minimum welding line to minimize corrosion, and specifically to guarantee the safety of the operation personnel even with the internal arc faults at the maximum fault capacity of the tank the Sectos can withstands an internal fault without venting hot gases.

The NXB and NXBD type are available as 2-position (ON-OFF) or 3-position (ON-OFF-EARTH) switch. When supplied as a 3-positions switch the unit has facility to earth the line on one side of the switch.

The independent spring operation mechanism adopt ABB patent spiral spring, provides a guaranteed load break fault make capability by ensuring the opening and closing speed of the switch.

Standard SF6 gas density units with temperature compensated are provided by Sectos (density switch is standard for electrical operated type; density gauge is standard for manual operated type), which ensure no misguide to wrong operating or lock-out by reliable and stable gas pressure measuring.

The Sectos is provided with light reflecting position indicator which are directly connected to the switch operating shaft providing clear and unambiguous switch position indication. Indicator made of light reflecting material, which is easily visible from ground level even at night in driving rain.

Advanced and Integrated helium leakage detecting and filling equipment are be adopted, which ensuring SF6 leakage of each switch is less than 0.1% strictly per year.

The switch can be manually controlled or it can be provided with an integrated motor drive device for both remote and/or local electrical control. The motor drive device can easily be retrofitted on site to manually operated units. The control cabinet is fitted with an automatism option (equip with advanced FTU type REC615) which makes the Sectos an automatic sectionalizer function. It can be current-counter scheme with current detection or can be voltage-time scheme with voltage detection

NXB is designed up to 24 kV rated voltages. The unique feature of this type is integrated earthing switch option.

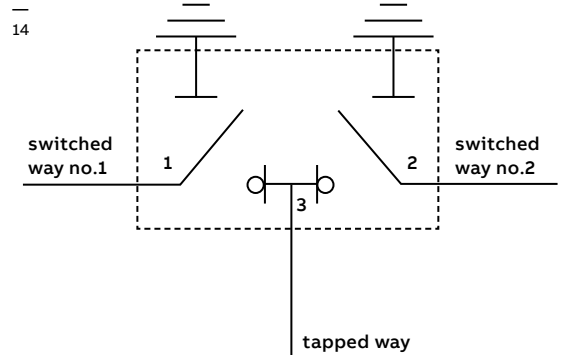
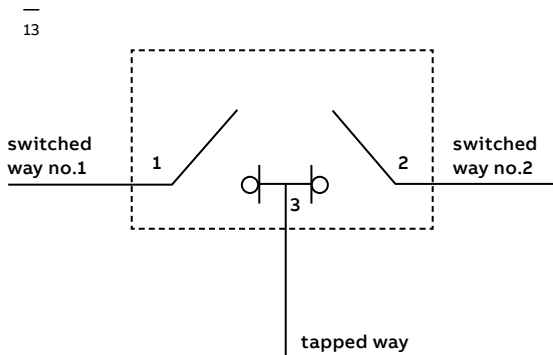
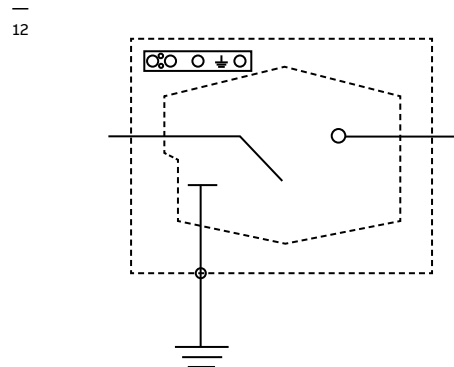
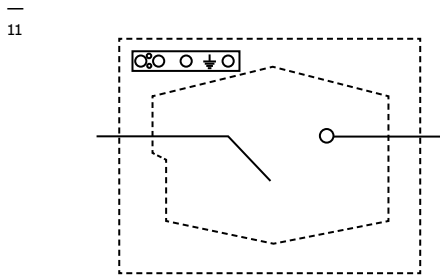
NXBD is a 3-way load break switch using NXB components. Two independent load break switch in one enclosure with the third tapped way can be used for easy and reliable line branching in overhead, cable, or mixed networks.

NXA is available for rated voltages 36 kV to IEC standards.

Reference standards IEC 62271-102, IEC 62271-103, IEC 62271-1

2.1. Basic switch configurations

Basic switch configurations Two-position load break switch are available for all NXA_ and NXB_ types. All NXB_ types are also available with an integrated earthing switch for safe and reliable earthing of the downstream line. This version is called a 3-position switch to differentiate from the standard 2-position switch.



11
NXA/NXB switch diagram without earthing switch

12
NXB switch diagram with earthing switch

13
NXBD switch diagram without earthing switch

14
NXBD switch diagram with earthing switch

Manual drives

3. Manual drives

Manual drives allows manual operation (open/close) of switch disconnecter from ground level. In case of switches equipped with motor drives, manual drives are only used in case of emergency.

In case there is no need for remote operation or when small number of operation is required, manual drives could function as the main drives.

Hook stick operation

Sectos switch could be operated from ground level using telescopic insulated hook stick. This hook stick lever can be pulled in the left to open and the right to close. And it is the only way to be operated for earthing switch when equipped.



SEMD drive

SEMD is manual drive for Sectos switch with access from ground level. SEMD is auxiliary (emergency) drive for motorized switch.

SEMMD – Sectos Emergency Manual Drive

2 – two position (Close – open)

3 – three position (close-open-earth)

A- version

SEMD drive is completely independent from motor drive.

Main elements of SEMD drive:

- lower part with operating lever on ground level
- operating rods connecting lower and upper parts
- upper part connected to the switch disconnecter under aluminum cover with mechanic clutch and electric interlock.

SEMD2 – for two-position switches
(without earthing switch)

SEMD3 – for three-position switches
(with earthing switch)



Motor drives and control cabinets

4. Motor drives and control cabinets

Motor drives and control cabinets are one of switching point element. Allows local and remote control of switch disconnecter – operation by motor drive. Each control cabinet could be equipped with remote control and automation devices – automation levels described in paragraph 1.11.

4.1. Motor drive installed on the ground level UEMC50

Electric motor drive UEMC50 is used for local or together with automation to remote control of Sectos switch. In UEMC50 motor together with control circuit is inside the control cabinet, which is connected via operating rods with switch disconnecter. UEMC50 could be used only for two position switches (without earthing switch).

Enclosure

Enclosure with protection degree IP55 made from stainless steel is available in two sizes:

Size 1 dimensions: 480 x 300 x 205 mm (height x width x depth), suitable for switching points without remote control

Size 5 dimensions: 620 x 500 x 330 mm (height x width x depth)

suitable for switching points where automation devices has to be installed inside the cabinet.

Enclosures could be equipped with three-position interlock and door retainer. In case unauthorized opening of the box, „open door” alarm is send to the DMS system.

Electric motor

Available supply voltages 24, 48, 110, 220 VDC and 110, 230 VAC. For remote control recommended motor voltage is 24 VDC to allow battery supply.

Power supply of control cabinets

The basic power source for the control box are the 24 VDC 17 Ah batteries. Battery charger is supplied by AC voltage from the auxiliary voltage transformer (MV/LV). Charger has protective function against deep discharge batteries.

Fully charged batteries allows up to 48 hours of operation without primary voltage.*



Control cabinets accessories

Control cabinet could be equipped with:

- anti-condensation heater with thermostat – keeps the humidity inside the cabinet on the certain level, which increase the reliability of electronic equipment
- three-position selector- allows locking of motor control in certain position: local, remote or off
- control push-buttons open/close – local control of electrical motor
- service socket on 110 or 230 VAC which allows to connect laptop directly from cabinet

*time depends on the type of telemechanics and communication module used in the control cabinet which are key elements when it comes to power consumption

4.2. Motor drive integrated with switch disconnect UEMC40K8 and control cabinet UEMC-A

Using UEMC-A control cabinet, motor drive is integrated with Sectos switch disconnect. Inside control cabinet control circuits are located. Motor with control circuit is connected via multicore cable. UEMC40K8 motors could be used for two or three position switches (earthing is always manual).

Enclosure

Enclosure with protection degree IP55 made from stainless steel is available in two sizes:

- size A2 – to control single switching points
- size A3 – to control multiple switching points (2-4).

Enclosures are equipped with three-position interlock and door retainer. In case unauthorized opening of the box, "open door" alarm is send to the DMS system.

Functionality and accessories

The basic power source for the control box are the 24 VDC 17 Ah batteries. Battery charger is supplied by AC voltage from the auxiliary voltage transformer (MV/LV). Charger has protective function against deep discharge batteries. In standard UEMC-A control cabinets are equipped with:

anti-condensation heater with thermostat;
three-position selector; control push-buttons open/close; service socket. More details about accessories can be found in paragraf 4.1.



4.3 Communication modules

The Arctic family offers secure and cost-effective wireless connectivity for all industrial and utility applications, ranging from enabling the industrial Internet of Things to remote real-time grid automation. As the backbone for communication, the Arctic family utilizes wireless cellular networks, making it possible to combine the products into secure and cost-effective wireless communication systems with global coverage.

Thanks to the support for secure communication VPN, static IP address, intelligent self-test system, NAT, redirection ports, a firewall to monitor IP traffic and blocking unwanted gate connections Arctic provide safe and reliable solution.

Key features:

- Serial transmission over TCP / IP
- Ethernet over TCP / IP
- Secure communication via VPN and firewall
- operating temperature range -30 to +75
- Supply voltage 12-48VDC
- Aluminum housing
- Mounting on a DIN rail

Additional functionalities with the M2M gateway:

- Serial and Ethernet devices integrated wirelessly to a centralized system management
- Security and application systems
- Registration PLC, IED
- Monitoring (IP cameras)
- Weather monitoring stations
- Intelligent building control systems
- Intelligent traffic management systems



| Selection table | | |
|-----------------------|-------------------|-------------------|
| Type | ARG600A 1260NA | ARG600A 2625NA |
| Radio | LTE | LTE |
| Data speed | 100 Mbps | 100 Mbps |
| LAN/WAN | 1 | 4 |
| RS232/485 | 2 | 2 |
| SIM cards | 1 | 2 |
| Supply voltage | 12-48 VDC | 12-36VDC |

4.4. Monitoring and remote control (level 2)

Wireless Controller ARC600 is a compact, solution based device for remote controlling and monitoring of secondary substations, such as network disconnectors, load break switches in distribution networks. It enables the SCADA system to wireless monitor and control the field devices over the public communication infrastructure (cellular network). Wireless Controller ARC600 utilizes the built-in wireless communication features for reliable and secure end-to-end communication providing remote monitoring and control of three switching devices and can be expanded as required by using external I/O expansion modules.

- integrated wireless communication
- High level data security through internal VPN and Firewall
- Highly reliable control and monitoring of up to three switching devices
- Overload protection of actuator motors
- Built-in battery charger with advanced battery control
- Disconnector position and earthing status indications with front LEDs
- IEC-101/104 SCADA compliant
- Robust aluminum casing design and easy DIN rail mounting



Level 2

Control

- close/open disconnector

Monitoring

- position indication
- binary signals

4.5. Monitoring, control and fault detection (level 3)

REC615 is a grid automation protection and control relay designed for remote control and monitoring, protection, fault indication, power quality analyzing and automation in medium voltage secondary distribution systems. REC615 is suitable for a wide variety of power distribution networks, which can include distributed power generation, secondary equipment such as medium voltage disconnectors, switches and ring main units. REC615 is a member of the Relion® product family. The Relion family relays have been designed to unleash the full potential of the IEC 61850 standard for communication and interoperability between substation automation devices.

With REC615, grid reliability is enhanced, ranging from basic, non-directional overload protection to extended protection functionality with power quality analyses. Thus, REC615 meets today's requirements for smart grids and supports the protection of cable feeders in isolated neutral, resistance earthed, compensated and solidly earthed networks. REC615 is freely programmable with horizontal GOOSE communication, thus enabling sophisticated interlocking functions. The new adaptable standard configurations allow for this relay to be taken into use as soon as the application-specific parameters have been set. REC615 provides superior fault location, isolation and restoration (FLIR) to lower the frequency and shorten the duration of power outages. REC615 also includes advanced earth-fault detection methods that can detect developing faults in the network before they cause an outage.

REC615 offers a variety of features to enhance grid reliability and functionality.

- Multiple controllable objects (up to nine objects including one breaker)
- Sophisticated protection functionality to detect, isolate and restore power in all types of networks
- Integrated power quality measurement, including voltage dips and swells logging
- Freely programmable
- Load profile and event logging
- Flexible autoreclosing function
- Six easily manageable setting groups
- Adaptable standard configurations for rapid commissioning
- Web-based parametrization tool with download possibility
- Cyber security features such as audit trail
- Withdrawable-unit design
- Large, easy-to-read LCD screen, local control and parametrization possibilities with dedicated push buttons for safe and easy operation
- IEC 60870-5-101/104, DNP3 level 2, Modbus or IEC 61850 with GOOSE messaging communication for high-speed protection, fault isolation and restoration
- Extendable I/O with RIO600



Level 3

Measurement

- Currents and voltages measurement
- fault detection and signalisation
- sectionalizer functions

Control

- close/open disconnector

Monitoring

- position indication
- binary signals

Current measurement

5. Current and voltage measurement

5.1. Current transformers type KOKU

Current transformers type KOKU are dedicated for installation on Sectos bushing. As a primary winding is a fully insulated Sectos bushing. A ring core with a secondary winding is cast in epoxy resin, assuring good electrical and mechanical properties. Parameters of KOKU 072 G are customized for the Sectos ratings and customer requirements. They are made in accordance with the standard IEC 61869-1 and IEC 61869-2.



| Type of CT | KOKU 072 G4 | |
|---|-------------|--|
| Rated Voltage U_m | [kV] | 0,72 |
| Power frequency test voltage U_p (1 min) | [kV] | 3 |
| Lightning test voltage U_{pp} | [kV] | - |
| Frequency f_n | [Hz] | 50 lub 60 |
| Primary current I_{pn} | [A] | 50 ÷ 800 |
| Rated secondary current I_{sn} | [A] | 1 lub 5 |
| Rated thermal current I_{cont} | [A] | 1,2 x I_{pn} |
| Short-time withstand current I_{th} (1s) | [kA] | 60 x I_{pn} (Max 100 kA) |
| Peak withstand current I_{dyn} | [kA] | 2,5 x I_{th} (Max 250 kA) |
| Secondary terminals | | 6 mm ² |
| Operating temperature range | [°C] | -35 ÷ +40 |
| Transport and storage | [°C] | -65 ÷ +55 |
| Electrical standards | | PN-EN, IEC, VDE, ANSI, BS, AS, CAN |

5.2. Voltage sensors

Voltage sensors are a relatively new solution used to measure voltages for monitoring and protection of the medium voltage distribution line. CVD voltage sensor is based on capacitive voltage divider, which guarantee wide dynamics and linearity. Signal from voltage sensors does not saturate. Output Signal is voltage, proportional to primary measured voltage.



| CVD sensors | |
|-------------------|---|
| Type | Capacitive Voltage Divider |
| Primary voltage | 20:√3 kV |
| Secondary Voltage | 2:√3 V |
| Accuracy | class 3P |
| System consist | • 3 or 6 CVD • connection cables from sensors to the control cabinet |
| Output | suitable for REC615 relay |
| Connection cable | Double screened |
| Signal cable | The length of the cable to control cabinet is 10m. |

Supply voltage transformer VOL



6. Supply voltage transformer VOL

Description and technical data

The VOL outdoor double-pole insulated voltage transformer is used for power supply of auxiliary circuits. It is made of resin insulation and is designed for networks up to 40,5 kV.

The transformer's primary terminals are connected across the respective lines, to the phase-to-phase voltage, usually in the 'V' type of connection. One of the terminals of each secondary winding must be earthed during the transformer operation.

Construction features

For insulation and protection, the assembly is cast in hydrophobic cycloaliphatic epoxy (HCEP). The HCEP material offers superior arc track, ozone, and ultraviolet-resistive properties while maintaining physical strength. The hydrophobic surface properties of HCEP ensure highly reliable performance in wet or humid environments.

Terminals

Primary terminals are M10 copper pin is with electroplated coating. Clamp-type secondary terminals accommodate 2.5 mm² through 25 mm² wire.

The M8 ground terminal is also provided for grounding the secondary circuit at the transformer.

Junction box

The metal junction box has a PG21 conduit hub on each end. The box is anchored to the body of the transformer with screws and can be easily detached, simplifying installation and change-out procedures. Junction box is equipped with stopper and cable gland.

The junction box has IP 54 according to standard EN 60529

Baseplate

The base is constructed of corrosion-resistant aluminum.

Mounting

The VOL-24 can be mounted in either vertical or horizontal positions. Stress relief devices should be used to support cable connections.

Standards

VOL voltage transformer meets IEC 61869-3 standard

Technical parameters

| | | |
|--|--------|-------------------|
| Highest voltage for equipment (r.m.s.) | [kV] | up to 40,5 |
| Rated power-frequency withstand voltage (r.m.s.) | [kV] | up to 95 |
| Rated lightning impulse withstand voltage (peak) | [kV] | up to 200 |
| Rated frequency | [Hz] | 50, 60 |
| Rated primary voltages | [kV] | up to 38 |
| Voltage factor | [-] | 1,2xUn/continuous |
| Max. number of secondary winding | [-] | 2 |
| Rated secondary voltages | [V] | up to 230 |
| Max. rated output*/ accuracy class | [VA/-] | 500 / cl.3 |
| Thermal limiting output | [VA] | 700 |
| Creepage distance (VOL24/VOL40,5) | [mm] | 800 / 1325 |
| Approximate weight (VOL24/VOL40,5) | [kg] | 43 / 70 |
| Ambient temperature | [°C] | -40 ÷ +40 |

* sum of rated output per voltage transformers

Other value of parameters: rated output, classes, rated frequency, voltage factor, rated secondary voltage, rated primary voltage can also be supplied on request.

Surge arresters POLIM

7. Surge arresters POLIM

Description

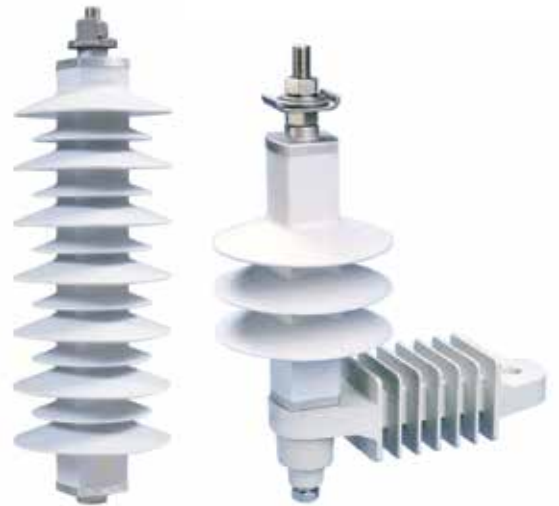
- Metal-oxide (MO) surge arrester without spark gap, designed and type tested according to IEC 60099-4, with own ABB metal-oxide resistors since more than 30 years.
- Direct molded silicone housing in patented loop design for best -
- environmental robustness.
- High quality, safe and reliable, maintenance free.
- For alternating current (AC) systems.
- For indoor and outdoor installations

Advantages

- low level of protection
- high energy absorption capacity
- wide protective range - stable characteristic
- protected against aging processes
- resistant to pollution
- non-explosive housing
- it can work as support insulator
- maintenance-free

Main technical data

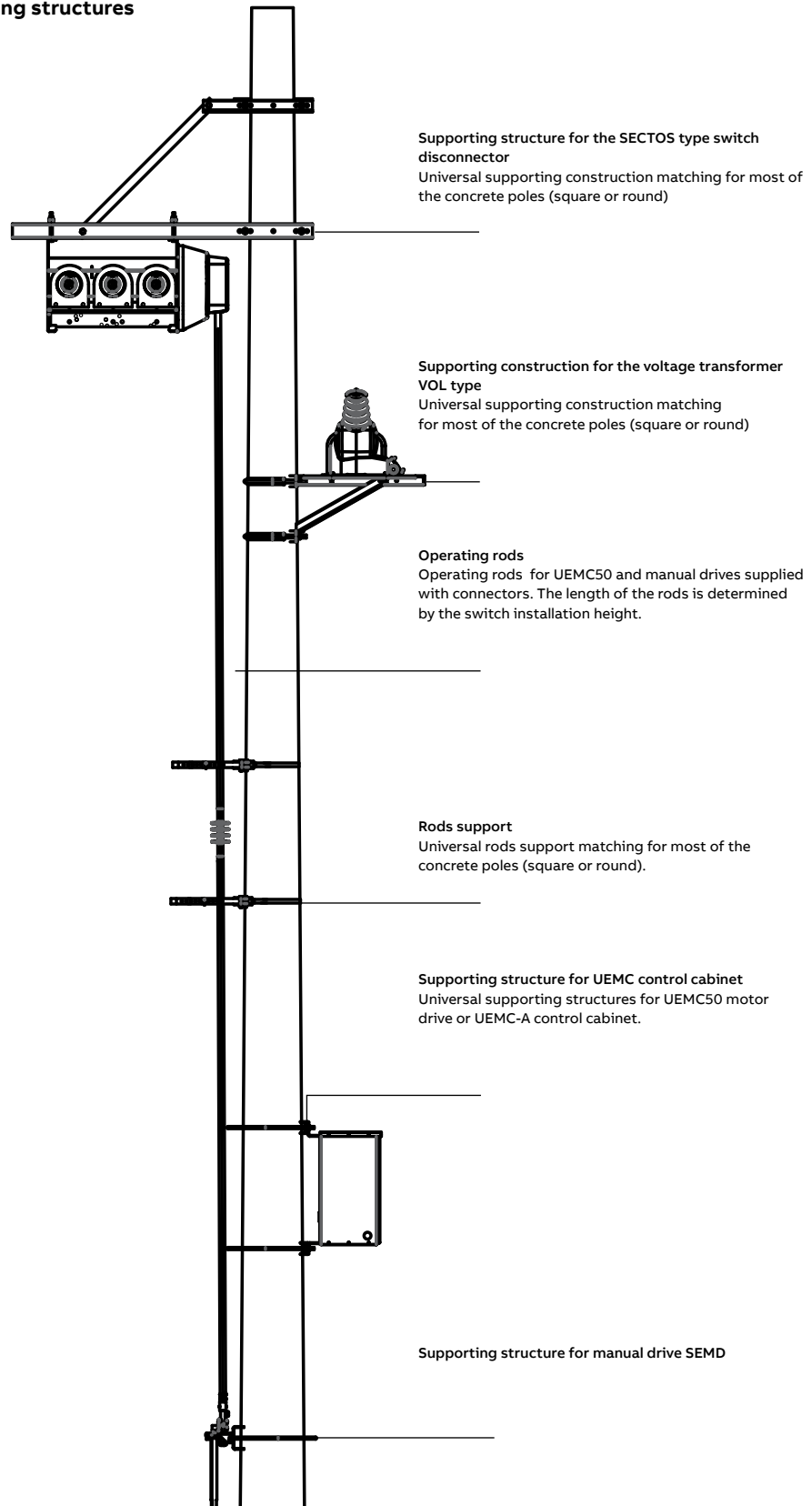
Network voltage up to 36 kV
 Continuous operating voltage up to 36 kV
 Nominal discharge current 8/20 μ s (peak) 10 kA
 High current impulse 4/10 μ s (peak)..... 100 kA
 Long duration current impulse (peak)..... 250 A, 2000 μ s
 Frequency..... do 62 Hz
 Line discharge class (LD) 1
 Classification according to IEEE (ANSI) C62.11 distribution heavy duty
 Short circuit rating 20 kA/0,2 s



Supporting structures

8. Supporting structures

—
15
Supporting structures



Switching point accessories

9. Switching point accessories

First Passive Indicator of Voltage Presence for Indoor and Outdoor Use. Nominal voltage: 3 kV – 36 kV. ABB's VisiVolt™ is a compact and easily installable indicator of voltage presence applicable on outdoor and indoor medium voltage systems. This technical innovation is based on the liquid-crystal technology and neither employs any electronic circuit or needs any power supply, what makes it a robust and durable device. VisiVolt's large reflective display provides good visibility in all lighting conditions – from dim indoor light to bright outdoor sunlight.

Key product features

- Applicable on any unshielded medium voltage system; for permanent installation
- For nominal system voltages from 3 kV to 36 kV
- Information on voltage presence status of the system available all the time
- Outdoor and indoor application
- Good visibility in all lighting conditions
- Economical solution
- Maintenance free; passive device – no power supply needed
- Easy to install

Can be installed on:

- busbars
- conductors
- unshielded, naked or insulated,
- of any typical diameter or cross section

Functions

Check of voltage status

Without using any additional equipment, the personnel can check the status of voltage presence.

Easier fault localization

By immediate visual information on voltage status at every point of the system, application of VisiVolt makes fault finding easier and quicker.

Additional warning function

Contributes to a higher level of safety of operating and servicing the system. Provides additional and independent indication of presence of dangerous voltage and by active warning the personnel, can prevent accidents and the related costs and other consequences.



Operation

VisiVolt indicates the presence of voltage by displaying a large, well visible lightning arrow sign on its LCD. VisiVolt indication is based on its sensitivity to the electric field around the live conductor, on which it is installed.

In 3-phase systems VisiVolt indicates the presence of both phase-phase and phase-ground voltages. In 1-phase systems VisiVolt indicates the presence of phase-ground voltage.

Two types, VV-A and VV-B are available for two ranges of nominal voltages.

VisiVolt indicator is a completely passive device (powered by the electric field surrounding the energized conductor, on which it is installed) and is entirely maintenance free.

Selection form

10. Selection form

To obtain first budgetary offer, please fill the form according your requirement and send it to nearest ABB sales representative.

| NETWORK AND INSTALLATION PARAMETERS | | | | | | |
|--|------------|----|-------------------|-------------|-------------------|---------|
| Network nominal voltage | [kV] | | | | | |
| Type of the pole | | | | | | |
| Installation height of switch | [m] | | | | | |
| Installation height of control cabinet | [m] | | | | | |
| SWITCHING POINT PARAMETERS | | | | | | |
| Sectos type NXB/NXBD/NXA | NXB | | NXBD | | NXA | |
| Earthing switch | YES | | | | NO | |
| Gas density switch | YES | | | | NO | |
| Gas density gauge (manometer) | YES | | | | NO | |
| Low pressure electric interlock | YES | | | | NO | |
| Manual interlock | YES | | | | NO | |
| Bird guards | YES | | | | NO | |
| Current transformers | YES | NO | Parameters: | | | |
| MV surge arresters | YES | NO | quantity: | Parameters: | | |
| Power supply VT | YES | | | | NO | |
| Manual drive type | hook stick | | SEMD | | without | |
| Control cabinet type | without | | UEMC-A | | UEMC50 | |
| Communication module type | | | 1260NA ARG600A | | 2625NA ARG600A | without |
| Automation level | 2 | | 3 | | without | |
| External fuse box | YES | | | | NO | |
| Support structure of switch | YES | | | | NO | |
| Support structure of VT | YES | | | | NO | |
| Support structure of control cabinet | YES | | | | NO | |
| VisiVolt | YES | NO | quantity: | [pcs] | | |

Configuration's example

11. Configuration's example

Specification:

- SECTOS NXB24C630A3
- Surge arresters POLIM D 24 N 6pcs
- Current transformers KOKU 072G4 300//1A
3pcs
- Control cabinet UEMC-A2
- Communication module ARG600A 1260NA
- Relay REC615
- Power supply VT VOL-24 21000/230
- Manual drive SEMD2A
- Communication antenna
- Set of supporting structures for round concrete pole

Functionalities:

- outdoor switch disconnecter for rated voltage 24kV and rated current 630A
- remote control
- manual operation and interlocking in every position
- Overvoltage protection
- remote communication
- auto-sectionalizing function
- complete set of mounting structures on round concrete pole
 - phase currents measurement
 - zero-sequence current
- voltage measurement
- Frequency measurement
- Power measurement
- Power factor P, Q, S
- Energy measurement
- Overvoltage protections
- Undervoltage protection



Notes

A large grid of small dots for taking notes, consisting of 20 columns and 30 rows of dots.

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