MEDIUM VOLTAGE RING MAIN UNIT
SFA-RM up to 17.5 kV
Introduction to SFA-RM

A - SFA-RM Solution

SFA-RM units are designed for supplying reliable energy, protecting electrical equipment in secondary distribution networks up to 17.5 kV. SFA-RM units are the best solution for indoor/outdoor distribution substations. Their compact design makes them suitable for various network applications such as transformer substations, wind power plants, industrial zones, etc. SFA-RM SF6 gas insulated units offer the following features:

- Compact design up to 17.5 kV; KEMA type tested
- Switching units sealed in SF6 gas filled stainless steel tank
- High level operator safety and operating reliability
- Embedded cable testing compartment, easy and safe cable testing without cable connection removal
- High quality tank welding, leakage rate of less than 0.1% per year
- Maintenance free unit offering a life expectation of over 30 years
- Smart interlocking padlocking system for maximum operator safety
- Different feeder combinations with switch disconnector and vacuum circuit breaker
- Compatible with SCADA systems for remote control and monitoring
- Motorized options for circuit breakers and switches
- High resistance to pollution and humidity

B - Quality Management

SFA-RM units are produced with an integrated quality system carefully defined for all departments. During each stage of the manufacturing process we ensure that the SFA-RM units are built perfectly; and comply with the highest adherence standards. The SFA quality system is ISO 9001:2015 Certified.

C - Quality Checks and Tests

Every SRA-RM unit undergoes routine quality tests and intensive related IEC Standards checks to ensure the highest quality product. These tests are:

1- Sealing check
2- Gas filling pressure check
3- Opening/Closing speed check
4- Tightness test
5- Rotational torque measurement
6- Partial discharge test
7- Dielectric test
8- Conformity with drawings and diagrams check
9- Resistance measurement

The Quality Control Department prepares a test quality certificate for each unit and records the results for future accessibility and quality assurance.
Introduction to SFA-RM

D - Environmental Precision

Using SF6 gas inside the switchgears contributes to the improvement of the reliability, safety and easy maintenance of SFA-RM units during its life cycle.

Though the use of SF6 gas in electrical equipment is one of the least harmful environmental emissions for utilities, some governments require SF6 disposal methods be implemented for gas insulated RMUs at the end of its lifetime.


- Collection of SF6 on site with industrial waste treatment equipment
- Heating of SF6 at above 1,000°C at partner companies approved facility, (At these temperatures SF6 starts to dissociate into reactive fragments, which interact with appropriate partner chemicals mainly hydrogen and oxygen to form SO2 and HF.)
- Removal of HF and SO2 by passing through a calcium hydroxide solution
- Neutralization of the acids and forming of solid sulfates and fluorides
- SF6 gas can thus be destroyed with a removal efficiency greater than 99%

<table>
<thead>
<tr>
<th>Greenhouse Gas</th>
<th>Concentration (parts per billion)</th>
<th>Concentration Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>353.10³</td>
<td>60%</td>
</tr>
<tr>
<td>CH4</td>
<td>17.10³</td>
<td>15%</td>
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<tr>
<td>N2O</td>
<td>310</td>
<td>5%</td>
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<tr>
<td>O3</td>
<td>10.5</td>
<td>8%</td>
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<tr>
<td>CFC-11</td>
<td>0.28</td>
<td>4%</td>
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<tr>
<td>CFC-12</td>
<td>0.48</td>
<td>8%</td>
</tr>
<tr>
<td>SF6</td>
<td>0.002</td>
<td>0.10%</td>
</tr>
</tbody>
</table>

Table 1: Concentration Percentages of Greenhouse Gases
SFA–RM in Network
Applications

SFA–RM units are widely used in the following applications:

A - Infrastructure and buildings: ports, railway stations, airports, hospitals, schools, hotels, malls, commercial centers, holiday resorts etc.

B - Industries: water, iron and steel, automotive, oil and gas etc.

C - Energy: wind power plants, solar power plants, hydro power plants, secondary distribution networks, transformer substations etc.

D - Special applications: high air pollution areas, high humidity areas etc.
Operating Conditions and Standards

− SFA-RM has an embedded hermetically-sealed gas tank filled with SF6 gas having minimum pressure of 1.3 bar.

− The expected lifetime of the product is more than 30 years with leakage rate of less than 0.1 % per year.

− No maintenance or gas refilling is required during the lifetime of the SFA-RM.

− The main busbar and switching compartment has an IP 67 protection degree rating whereas the other sections of indoor products are rated at IP 41 and the outdoor products are rated IP 54.

Operating Conditions:
• Ambient temperature range from -25 °C to 55 °C
• Altitude range of (0-1000 m)*
• Maximum relative humidity of 100%

SFA-RM fully complies with the following IEC standards used under general operation conditions for indoor switchgears;

a - Switchgear Standards:
• IEC-62271-1
• Verified lightning impulse withstand voltage
• Maintenance free under indoor ambient conditions
• IEC-62271-200
• Internal Arc Classification of Accessibility
• Type A, Classified type FLR for 21 KA / 1Sec (indoor & Outdoor)

b - Switch-Disconnector Standards:
• IEC-62271-103/102
• Class M1 / E3 / E0
• 1000 CO cycles at rated current and 0.7 p.f.
• 5 times close on fault

c - Circuit Breaker Standards
• IEC-62271-100
• Class M1/E1
• 0.3 Sec - CO - 3 min - CO cycle

d - Other Standards
• IEC-62255 for electrical relays
• IEC-62271-102 for alternating current earthing switch
• IEC 61243-5 for voltage detection system

*: For 1000+ m please contact alfanar
SFA–RM Range

Compact SFA-RM units are excellent solutions for secondary distribution networks. It covers all medium voltage functions such as connection, supply and protection of MV equipment for different applications.

• SBS 3-Way Compact Indoor Type RMU

Figure 1: 17.5 kV, 2 ring switches up to 630 A + 1 vacuum circuit breaker up to 630A; front view and single line diagram

• SBS 3-Way Compact Outdoor Type RMU

Figure 2: 17.5 kV, 2 ring switches up to 630A + 1 vacuum circuit breaker up to 630A; front view and single line diagram
SFA–RM Range

- SBBS 4-Way Compact Indoor Type RMU

![Image of SBBS 4-Way Compact Indoor Type RMU]

Figure 3: 17.5 kV, 2 ring switches / up to 630A + 2 vacuum circuit breakers / up to 630A; front view and single line diagram

- SBBS 4-Way Compact Outdoor Type RMU

![Image of SBBS 4-Way Compact Outdoor Type RMU]

Figure 4: 17.5 kV, 2 ring switches / up to 630A + 2 vacuum circuit breakers / up to 630A; front view and single line diagram
SFA–RM Range

- SSBS 4-Way Compact Indoor Type RMU

![Diagram of SSBS 4-Way Compact Indoor Type RMU](image1)

Figure 5: 17.5 kV, 3 ring switches / up to 630A + 1 vacuum circuit breaker / up to 630A; front view and single line diagram

- SSBS 4-Way Compact Outdoor Type RMU

![Diagram of SSBS 4-Way Compact Outdoor Type RMU](image2)

Figure 6: 17.5 kV, 3 ring switches / up to 630A + 1 vacuum circuit breaker / up to 630A; front view and single line diagram
**SFA-RM Range**

- **B Modular**

![B Modular Diagram](image1)

*Figure 7: 12 kV, one vacuum circuit breaker / up to 630A; front view and single line diagram*

- **S Modular**

![S Modular Diagram](image2)

*Figure 8: 12 kV, one ring switch / up to 630A; front view and single line diagram*
Design

1 Cable Test Compartment
2 Gas Tank
3 Interlocking Latch for Cable Test Compartment
4 Padlocking Facilities for Load Break Switch
5 Load Break Switch Operating Mechanism
6 Padlocking Facilities for Earthing Switch
7 Vacuum Circuit Breaker
8 Ring Switch Cable Compartment
9 MV Cable Fixing Support
10 Tee-Off Switch Cable Compartment
11 Voltage Presence Indicator
12 Switch-disconnector Operation (Motor Optional*)
13 Operation Counter
14 Circuit Breaker Operation (Motor Optional*)
15 Operating Latch for Vacuum Circuit Breaker
16 Protection Relay
17 Lifting Lugs
18 Padlocking Facilities for Vacuum Circuit Breaker
19 Vacuum Circuit Breaker Operating Mechanism
20 Gas Pressure Indicator
Operating Mechanism

On the front panel of SFA-RM units, the status of the operating mechanisms can be clearly seen from the mimic diagram (closed, opened, and earthed):

• The operating mechanism triggers the moving contact assembly during the closing action. The opening spring of circuit breaker mechanism is charged while the closing operation is in process.

• The same mechanism is used for opening the circuit breaker, triggered in the opposite direction. Opening is activated by a latch or a relay.

• Earthing contacts are opened or closed with a specific operating shaft. The access hole of the shaft is covered by a plate, which can be opened if the load break switch or circuit breaker is in open position, and remains locked when it is in close position.

• Since the operating shafts are directly connected to status indicators, it is very easy and safe to understand the position of the switches from the front panel.

• Padlocking facilities are available for preventing access to the load break switch, circuit breaker and earthing switch operating shafts.
Interlocking System

• Access to the load break switch, circuit breaker and earthing switch are separated from each other to enforce safety. The cover for the earthing switch can be opened only if the load break switch or circuit breaker is in an open position.

• Access to the cable compartment is fully interlocked with the earthing switch. Access to the cable compartment is only possible when the earthing switch is in the close position.

• Access to the earthing switch is only possible when the cable compartment cover is closed.

• The earthing switch can only be accessed after closing the cable testing compartment cover.

• The cable test compartment can be opened only if the earthing switch is in the close position.
Internal Arc Withstand

SFA-RM units are designed to withstand rated short circuit current for 1 second without any danger.

Overpressure in the gas tank due to the internal arc is limited with the help of the bursting disk located at the bottom of the stainless steel tank.

The internal arc in the cable compartment and the withstand capability of the SFA-RM units have been proven and verified by CESI laboratories to comply with all clauses of IEC 62271 standards to ensure maximum operator safety.

Figure 16: A Picture Taken During the Internal Arc Test of 17.5kV SFA-RM
# Technical Data Sheet

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td><strong>Rated Voltage</strong></td>
<td>17.5 kV Up to 17.5 kV</td>
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<tr>
<td><strong>Busbar Rating</strong></td>
<td>Up to 630 A</td>
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<tr>
<td><strong>Rated Frequency</strong></td>
<td>50 / 60 Hz</td>
</tr>
<tr>
<td><strong>Rated Nominal Current For Ring Switch</strong></td>
<td>Up to 630 A</td>
</tr>
<tr>
<td><strong>Rated Nominal Current For Tee-off Feeder</strong></td>
<td>200/400 / 630 A</td>
</tr>
<tr>
<td><strong>Rated Short Time Withstand Current</strong></td>
<td>21 kA / 1 Sec 21 kA / 3 Sec</td>
</tr>
<tr>
<td><strong>Internal Arc Classification</strong></td>
<td>A (FLR) 21kA / 1 Sec (indoor &amp; outdoor)</td>
</tr>
<tr>
<td><strong>Rated Filling SF6 Gas Level For Insulation</strong></td>
<td>1.2 bar (absolute)</td>
</tr>
<tr>
<td><strong>Minimum Functional SF6 Gas Level</strong></td>
<td>1.1 bar (absolute)</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>100%</td>
</tr>
<tr>
<td><strong>IP Class (Gas Tank / Indoor / Outdoor)</strong></td>
<td>IP 67/IP41/IP54</td>
</tr>
<tr>
<td><strong>Rated Lightning Impulse Withstand Voltage</strong></td>
<td>95 kV-peak</td>
</tr>
<tr>
<td><strong>Rated Power Frequency Withstand Voltage</strong></td>
<td>38 kV-rms</td>
</tr>
<tr>
<td><strong>Applied Standard</strong></td>
<td>IEC 62271-200</td>
</tr>
</tbody>
</table>

**Ring Switch Feeder (S)**

- **Type of Switch-Disconnector**: General purpose, three-positioned (OPEN-CLOSED-EARTHED)
- **Electrical Endurance**: E3 / E0
- **Mechanical Endurance**: M1
- **Nominal Current**: Up to 630 A
- **Short-Circuit Making Current**: 21 kA (also valid for earthing switch) 54.6kA Peak
- **Applied Standard**: IEC 62271-103/102

**TEE-OFF Feeder (B)**

- **Type of Breaker**: Vacuum
- **Electrical Endurance**: E3
- **Mechanical Endurance**: M1
- **Nominal Current**: Up to 630 A
- **Short-Circuit Breaking Current**: 21 kA
- **Applied Standard**: IEC 62271-100
A - Vacuum Circuit Breaker

Standard Features

- Complying with the related standard - IEC 62271-100
- Contacts are in vacuum tubes and the whole mechanism is in an SF6 gas-filled tank isolated from climatic conditions
- Spring charge hole on the front panel with a spring position indicator
- Operating latch for opening or closing operations
- Spring operated, stored energy mechanism
- Operation independent of operator
- Padlocking facility on front panel to prevent unwanted closing operation
- Smart mimic diagram indicating the switching status clearly (ON, OFF)
- A mechanical numeric indicator counting operation cycles
- Colored position indication bar directly connected with operating shaft
- Trip coil for initiating the tripping operation via signal from self-powered relay
- Shunt trip coils for external tripping
- Electrical endurance: E1
- Mechanical endurance: M1

Optional Features

- Motor operation
- For circuit breaker: 24 VDC, 110 VDC or 220 VAC
- Communications with intelligent systems (SCADA, DAS, etc)
- Auxiliary contacts for position indication
- For circuit breaker: 8 NO and 8 NC
- For earthing switch: 2 NO and 2NC

Figure 17: Circuit Breaker and Disconnector Assembly
B - Three Position Load Break Switch

Standard Features

- Complying with the related standards - IEC 62271-103 and IEC 62271-102
- Contacts are in SF6 gas filled tank independent from climate conditions
- Three phased and three positioned (ON, OFF and Earthing) switching mechanism
- Two separate holes on the front panel for Earthing and Disconnecting functions for safe operation
- Spring operated stored energy mechanism
- Independent of the operator operation
- Padlocking facilities on front panel for both Earthing and disconnecting functions of operation
- Smart mimic diagram indicating clearly the switching status (ON, OFF, Earth position)
- Colored position indication bar directly connected with operating shaft
- Interlocking latch for accessing the cable testing compartment
- Switch-disconnector electrical endurance: E3
- Switch-disconnector mechanical endurance: M1
- Earthing switch electrical endurance: E2
- Earthing switch mechanical endurance: M1

Optional Features

- Motor operation
- For load break switch: 24 VDC, 110 VD
- Communicating with intelligent systems (SCADA, DAS, etc)
- Auxiliary contacts for position indication
- For load break switch: 3 NO and 3 NC
- For earthing switch: 2 NO

Figure 18: Switch Disconnector Assembly
Components

C – Cable Testing Compartment

For SFA-RM units; the operator does not need to access the cable compartment for cable testing. SFA-RM units offer a safe way of cable testing from the easily accessible cable testing compartment on the front panel (Refer to Figure 17). Operators can simply conduct the cable testing through plug-in type connectors after opening the cover. The cable test cover is safely interlocked and cannot be opened unless the load break switch is earthed.

![Figure 19: Front view of Cable Testing Compartment](image)

D – Gas Pressure Indicator

Gas density is an important operating parameter for SF6 insulated MV equipment. If the required gas density is not sufficient, safe operation cannot be guaranteed. On SFA-RM units, a gas pressure indicator is fitted to the tank for providing a reliable warning indication against low gas levels. The gas pressure indicator has sections to show the minimum pressure for safe operation.

![Gas Pressure Indicator](image)

E – Voltage Presence Indication System

All SFA-RM units are integrated with a voltage presence indication system. A voltage signal comes from the VPIS through the voltage divider positioned into the cable entrance of bushings.

The VPIS can be used to check whether a voltage is present across the cables.
Components

F - Protection Relays

• Overcurrent Protection:

1- 50P/50N Function: Phase/Neutral instantaneous overcurrent

Time of operation is independent from the current of operation flowing through the relay, hence if the phase current increases more than its determined value for an equal or greater amount of time than the specified value, then protection function activates (trips) and does not reset itself till the value of the phase drops below the point of current pick-up.

The function activates at 100% of the preset input, and deactivates at 95%, where the reset is instantaneous.

The accuracy of the operating time is equal to the present time plus a maximum of 30 ms.

2- 51P/51N Function: Phase/Neutral Time overcurrent Protection

A - Definite Time O/C Protection

If the option “Definite time” is selected for the curve setting. In this case, the unit operating time is set by the parameter “Operating time” so as to trip the fault after a preset specific time setting.

If the unit operates with defined time, the function is activated at 100% of the set tap value, and it deactivates at 95%. If the unit operates with a curve, the function is activated at 110% of the set pick-up value, and it deactivates at 100%. The reset is instantaneous in both cases. The activation time is accurate to ±5% or ±30ms, whichever is greater, of the theoretical activation time. The curves used are IEC 60255-151.

B - Inverse Time O/C Protection (IDMT)

If a curve (e.g. inverse, very inverse or extremely inverse) is selected for the curve setting, the operating time principally depends on the current value which is set through the curve type, and dial and tap settings.
A - Operating Handles

In SFA-RM units, there are two operating handles; the first one is for the operation of the load break switch and the second is for charging the spring of vacuum circuit breaker. The design of the operating handles enables a safe and easy operation for the user.

B - IR / PD Windows

The SFA-RMU can be optionally equipped with IR & PD windows, a new feature that complies with the new requirements of the Saudi Electric Company.

The inclusion of an Infrared inspection window is considered as a very effective method for maintenance personnel to identify any possible problems with loose electrical terminations without the need to shut down the RMU. The window consists of polymer and mesh optics to allow thermal infrared inspection by employing a broadband media.

The inclusion of a partial discharge window is to facilitate the ability to measure partial discharge of a live RMU and estimate the expected life of insulation components.

C - Motorization Kit (LBS / VCB)

Motors with gearboxes can easily be installed to load break switch and circuit breaker mechanisms either in the factory or on-site. A built-in electrical interlocking system prevents any unintentional operations.

When the unit is installed with the motor mechanism, it can be used with intelligent systems such as SCADA, DAS, etc.

With the help of a selector switch, SFA-RM units can be controlled remotely by choosing the remote control option.

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Figure 21: Switch Disconnector & Disconnector Operating Handle
Figure 22: Circuit Breaker Spring Charging Handle
Figure 23: Motor with Gearbox
**Accessories**

**D - Earth Fault Indicator (EFI)**

EFI can also be implemented in SFA-RM units. EFIs help the operator to find the fault location easily in medium voltage ring networks.

Earth fault is indicated with a LED flashlight and a flag when asymmetrical currents are detected in three phase cables.

EFI is fed via either auxiliary supply with internal batteries or core balance current transformer.

![Figure 24: EFI](image)

**E - Operation Counter for Load Break Switch Mechanism**

In SFA-RM units, implementation of an operation counter for mechanical operation of load break switches is available as an option.

![Figure 25: CVI Auxiliary Contacts](image)

**F - CVI Auxiliary Contacts**

To automate voltage indication in SFA-RM Units, auxiliary contacts could be integrated with CVI units.

This feature makes it suitable for SFA-RM to accommodate the following:

**Absence of voltage applications**
- Automation on voltage loss.
- Alarms on voltage loss
- Automatic transfer systems

**Presence of voltage applications**
- Earth locking on presence on voltage
- Alarms on voltage presence

![Figure 25: CVI Auxiliary Contacts](image)

**G - Gas Pressure Indicator with Contacts**

As an optional feature; a gas pressure indicator with electrical switch contacts can be implemented.

The gas pressure indicator warns the operator when the gas density drops below the defined “alarm” level, and can block the operation.

![Figure 26: Gas Pressure Indicator](image)
**MV Cable Termination**

**A - Cable Compartment**

For safe operations, the cable compartment of SFA-RM units has an interlocking mechanism for preventing access to the cable compartment when the earthing switch is opened.

When the cable compartment is open, closing the load break switch or circuit breaker is prevented by an additional interlocking mechanism.

As an option, increasing the depth of the cable compartment is also possible for a lightning arrester installation.

The Internal Arc Withstand Capacity of cable compartment is proven by type tests performed in KEMA Laboratories.

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**B - Bushings**

Electrical current is carried from outside to inside the RMU via epoxy bushings ensuring the insulation between the energized conductor and the tank of RMU. Power frequency and partial discharge tests are conducted to each bushing used in SFA-RM units.

There are 3 types of bushings on SFA-RM units:

<table>
<thead>
<tr>
<th>Bushing Type</th>
<th>Application</th>
<th>Applicable Standard</th>
<th>Interface Type</th>
<th>Material</th>
<th>Current Rating</th>
<th>Voltage</th>
</tr>
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<tbody>
<tr>
<td>RMT24</td>
<td>Cable Testing</td>
<td>IEC 60137</td>
<td>-</td>
<td>Epoxy Resin</td>
<td>-</td>
<td>24/50/125kV</td>
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<tr>
<td>RMS24</td>
<td>Load Break (S)</td>
<td>IEC 60137</td>
<td>C</td>
<td>Epoxy Resin</td>
<td>630A, 21kA/1s</td>
<td>24/50/125kV</td>
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<tr>
<td>RMB24</td>
<td>Circuit Breaker (B)</td>
<td>IEC 60137</td>
<td>C</td>
<td>Epoxy Resin</td>
<td>630A, 21kA/1s</td>
<td>24/50/125kV</td>
</tr>
</tbody>
</table>
MV Cable Termination

C - Cable Connectors

The following types of cable terminations are available within SFA-RM units:

Figure 29: “L - Type” Cable Termination Alternatives

Figure 30: “L - Type” Cable Termination Alternatives
SSBS and SBBS 4-Way Compact Indoor Type RMU

17.5 kV, 2 ring switches Up to 630 A + 2 vacuum circuit breakers up to 630 A
17.5 kV, 3 ring switches Up to 630 A + 1 vacuum circuit breaker up to 630 A

SBBS and SSBS 4-Way Compact Outdoor Type RMU

17.5 kV, 2 ring switches Up to 630A + 2 vacuum circuit breakers up to 630A
17.5 kV, 3 ring switches Up to 630A + 1 vacuum circuit breaker up to 630A
**Dimensions**

**SBS 3 Way Compact Indoor Type RMU**

17.5 kV, 2 ring switches Up to 630 A + 1 vacuum circuit breaker up to 630 A

**SBS 3-Way Compact Outdoor Type RMU**

17.5 kV, 2 ring switches Up to 630A + 1 vacuum circuit breaker up to 630A
Dimensions

B Modular

12 kV, one vacuum circuit breaker / up to 630A

S Modular

12 kV, one ring switch / up to 630A
SFA–RM – Smart

Introduction

- SFA-RM – Smart is remotely controllable with an integrated RTU and modem, it is designed to be used effectively in a medium voltage network and DAS (Distribution Automation System).
- It is self-powered equipment as the CPT (Control Power Transformer) is connected directly to the main bus.
Overview and Layout

1. Protection Relay
2. SF6 Gas Indicator
3. ON & Off Push Buttons
4. Earth Fault Indicator
5. LV Compartment
6. L/R Selector Switch
7. MV Compartment
8. CVI
Overview and Layout

Open Doors View

1. Battery
2. AC/DC supply and battery charger
3. RTU with integrated modem and antenna
4. Cable test compartment
SFA-RM - Smart

• Control and Measuring Function

SFA-RM - Smart has an integrated (RTU) to provide the capability of remote monitoring and control via the control center.

Connection between the local RTU and control center is established over a secured Virtual Private Network connection (VPN) or through an access point named “APN”

The exchanged data
- Status information from RTU to data center
- Control signal from control center to RTU
- Analog measurements

Status information from RTU to data center
- Close/Open for each CB/LBS
- Earth status for each circuit
- Lock /Unlock for each circuit
- Selector switch status local/remote
- SF6 Gas pressure low/normal
- Power supply status
- Door open/close

Control command from control center to RTU
- Close/Open for each circuit
- Lock/Unlock for each circuit

Analog measurements
- \( V_\text{phase} \) (A,B,C)
- \( I_\text{phase} \) (A,B,C)
- Frequency
- Total active power [kW]
- Total reactive power [kVAR]
- Total apparent power [kVA]
The RTU is a device installed at a remote location that collects data, codes the data into a format that is transmittable and transmits the data back to a central station, or master.

The RTU collects information from the master device and implements processes that are directed by the master. RTUs are equipped with input channels for sensing or metering, output channels for control, indication or alarms and a communications port.

- **Power Supply**
- **CPU Processor**
- **DI Digital Input**
- **DO Digital Output**
- **CT/TV Module**
- **Integrated 3G Modem**
- **Antenna**
SFA–RM – Smart

B – Features & function:

1. Data gathering: collect digital and analog inputs from the RMU’s elements and measuring sensors
2. Processing the received signals with a highly sophisticated logic engineering environment as per IEC61131-3.
3. Reporting and receiving the data from/to control center through one of the available communication ports
4. Record and retrieve event and alarm list
5. Acting as master station for the protection relay
6. Communicate simultaneously on all communication ports
7. Modular extendable RTU

C – Supported Protocols

1. Tele control protocols: IEC 60870-5-101/ -104
2. Station bus protocols: IEC 60870-5-101/ -104
3. IED protocols:
   - IEC 60870-5-101/ -103/ -104
   - Modbus
   - SAT 1703
4. Electric metering protocol: IEC 62056 (IEC 1107)
5. Standards: GSM/GPRS
6. GSM frequencies: 850, 900, 1800, 1900 MHz

• Power Supply and Batteries:

The proposed Smart RMU is a self-powered unit, where the Supplied power comes from the CPT (Control Power Transformer) which is directly connected to the live bus and feeds the AC/DC converter and battery system by 220VAC.

The AC/DC converter and battery system feed all equipment in the LV circuit by 24 VDC including the aux relays, RTU, modem and trip close motor coils. The batteries are capable of providing sufficient power to buffer the load for more than 24 hours with up to 120 single operations.
Ordering

For easy selection please use table No 4:

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<thead>
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<th>Function</th>
<th>Code</th>
<th>Description</th>
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<td>MT</td>
<td>Metering</td>
<td></td>
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<tr>
<td>S</td>
<td>Load break switch</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Circuit breaker</td>
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<tr>
<th>Ingress Protection (IP)</th>
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<th>Indoor application</th>
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<td></td>
<td>54</td>
<td>Outdoor application</td>
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<th>17.5 kV</th>
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<td></td>
<td>12</td>
<td>12 kV</td>
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<table>
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<th>630 Amp</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>400 Amp</td>
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<table>
<thead>
<tr>
<th>Circuit Breaker Rating</th>
<th>2</th>
<th>200 Amp</th>
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<tr>
<td></td>
<td>4</td>
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<td>6</td>
<td>630 Amp</td>
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<table>
<thead>
<tr>
<th>Function</th>
<th>NM</th>
<th>Non-Motorized</th>
</tr>
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<tbody>
<tr>
<td>E</td>
<td>Extensible</td>
<td></td>
</tr>
<tr>
<td>NE</td>
<td>Non extensible</td>
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Table 3: Code List

<table>
<thead>
<tr>
<th>Unit Configuration</th>
<th>Voltage System</th>
<th>Extensibility</th>
<th>Ingress Protection</th>
<th>Load Break Switch</th>
<th>Circuit Breaker</th>
<th>Motor Kit</th>
<th>Tee-off load rating 1</th>
<th>Tee-off load rating 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>12</td>
<td>E</td>
<td>54</td>
<td>63</td>
<td>2</td>
<td>M</td>
<td>T1</td>
<td>T1</td>
</tr>
<tr>
<td>MT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NM</td>
<td>T2</td>
<td>T2</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td>4</td>
<td></td>
<td>T3</td>
<td>T3</td>
</tr>
<tr>
<td>SBS</td>
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<td></td>
<td></td>
<td>T4</td>
<td>T4</td>
</tr>
<tr>
<td>SSBS</td>
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<td></td>
<td></td>
<td></td>
<td>T5(^1)</td>
<td>T5(^1)</td>
</tr>
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<td>SBBS</td>
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</tr>
</tbody>
</table>

Table 4: Code Map

Example 1: SBS

| SBS | 12 | E | 54 | 63 | 4 | NM | - | T2 |

Example 2: SBS+S

| SBS | 12 | E | 54 | 63 | 4 | NM | - | T2 |
| S   | 12 | E | 54 | 63 | 4 | NM | - | -  |

Example 3: SBS+B+B

| SBS | 12 | E | 54 | 63 | 4 | NM | - | T2 |
| B   | 12 | E | 54 | 63 | 4 | NM | - | T3 |
| B   | 12 | E | 54 | 63 | 4 | NM | - | T1 |

Transformer rating (1&2) is applicable only with circuit breaker

- T1<250 KVA
- 250 KVA < T2 < 1500 KVA
- 1500 KVA < T3 < 3000 KVA
- 3000 KVA < T4 < 6000 KVA
- T5 > 6000 KVA

\(^1\) Please contact alfnar for further clarification
## Ordering

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