Complex Solution for the Distribution Substation

REF 542plus

Application and Setting Guide
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Standard indoor switchgear: 2 sections, 10 cubicles per section.

Thereby is:
Q01, Q02 incoming cubicles  
Q03, Q04 voltage transformer cubicles  
Q05 - Q10 outgoing feeders  
Q11 bus coupler  
Q12 bus riser

The protections should be placed from economical point of but to save basic functionality of the substation. The functionality of the cubicles can be divided into several groups:

• High functionality (incoming feeder and bus coupler)  
• Medium functionality (outgoing feeders)  
• Limited functionality (VT cubicles)

The task is to use maximum functionality in a cheapest way.

One of the best solutions is to combine several types of the protections in order to get the best functionality. Here we offer to use REF 542plus, REF 610 and REA as an arc protection system.

At first it is necessary to define auxiliary power supply. The most widespread case is 220 VDC.

Then define the most complicated protections in this kind of scheme:

Incoming feeders and bus coupler. REF 542plus

In order to have best optionality choose REF 542plus with maximum binary I/O boards (3), also choose communication board MODBUS RTU, and software license Multi (see detailed info in the TRM).
Complex Solution for the Distribution Substation REF 542plus

Application and Setting Guide

Type definition code: 76B2NFFF301WB26

[76] REF 542plus
[B] Mainboard - basic version
[2] Power supply - rated voltage 220 VDC
[N] No analog I/O
[F] Binary I/O3 - 80...250 V/143V Standard
[F] Binary I/O3 - 80...250 V/143V Standard
[F] Binary I/O3 - 80...250 V/143V Standard
[30] Analog input 3CT+3VT+1CT0.2A+1VT
[I] Modbus RTU/SPA bus RS485 communication board
[W] Housing-Wide
[B] HMI V5 - IEC auxiliary voltage 110-220VDC
[2] HMI cable 2.5m
[6] Software Multi License

This protection allows to implement all kinds of logic schemes and to fit all requirements.

The outgoing feeders should be equipped with REF 610. REF 610 has only current analog inputs hence only current protections, but it is possible to implement voltage protections by using dry contacts in the interbay communications from REF 542plus. It will work like external trip. So it is possible to make underfrequency load shedding.

Also REF 610 allows to implement arc selective arc protection for outgoing feeders (to control only cable compartments). By using loop sensor we can control arc in the cable compartments of the cubicle and as REF 610 gets the analog signal from current transformers of the cubicle we can achieve selective trip in case of the arc.

So here we can define the order code for the protection: REF610C52HCHT

REF610 type of the protection
C current release of the device
5 analog input current 5A
2 earthfault current 0.2A (for better sensitivity)
H auxiliary voltage AC 100/110/120/220/240 V Input voltage,
DC 110/125/220/250 V
C not used
H input/output binary card extension (3 SO & 3 DI DC 110/125/220/250)
T communication card RS_485 with input for arc protection

Also it is necessary to specify the length of the loop sensor for the arc protection. They could be the following types:

1.5 m ±3% 1MRS120534-1.5
3.0 m ±3% 1MRS120534-3.0
5.0 m ±3% 1MRS120534-5.0

The length depends on the size of the cubicle and of the mounting track.
The dimension of the protection is on the picture above.

Some notes about wiring in the cubicles with REF 610.

To wire properly REF 610 it is necessary to put the following input signals:

- CB position open
- CB position closed
- External trip (if needed)
- CBFP (from downstream cubicle)
- Overcurrent protection blocking from downstream cubicle (if needed)
- There is no inputs for the earthing switch or CB disconnector (truck). So interlocking should be made by dry contacts.

- Output contacts PO1, PO2 and PO3 are used for CB control. It has TCS function. (for TCS application see TRM p.70).

- Output contacts also are used for CBFP and overcurrent blocking the upstream CB (incoming or bus coupler), signaling contacts.

**Arc protection**

Arc protection: as the main unit for arc protection REA is used. REA is the independent arc protection unit which works separately from usual relay protections. REA takes current analog inputs from incoming CT's and light signal from it is own loop. REA protection unit has one input for loop sensor to control the following compartments:

- Cable compartment of the incoming cubicle
- Busbars of the section
- CB compartment of the section
So when the arc occurs in the mentioned above compartments REA trips the incoming CB in order to have selectivity. But it will not trip if the arc occurs in the cable compartment of the outgoing cubicle. REA has 2 trip contacts. One usually trips the CB, second one is usually for signaling purposes.

So the scheme of the arc protection:

Code definition for the arc protection: **REA-101-AAA**
It has power supply unit for 110…240 VAC / 110…250 VDC. Also it is necessary to order the loop sensor for the protection. To calculate the length you need the general arrangement plan. Loop has to be wired via busbar compartment and comes back from CB compartment (or vice versa). The total length is double front size of the section plus length of two distances between CB compartment and busbar compartment plus mounting backup (20%).

REA has standard types of the sensors:

<table>
<thead>
<tr>
<th>Length</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 M ± 3 %</td>
<td>1MRS 120512.005</td>
</tr>
<tr>
<td>10 M ± 3 %</td>
<td>1MRS 120512.010</td>
</tr>
<tr>
<td>15 M ± 3 %</td>
<td>1MRS 120512.015</td>
</tr>
<tr>
<td>20 M ± 3 %</td>
<td>1MRS 120512.020</td>
</tr>
<tr>
<td>25 M ± 3 %</td>
<td>1MRS 120512.025</td>
</tr>
<tr>
<td>30 M ± 3 %</td>
<td>1MRS 120512.030</td>
</tr>
<tr>
<td>40 M ± 3 %</td>
<td>1MRS 120512.040</td>
</tr>
<tr>
<td>50 M ± 3 %</td>
<td>1MRS 120512.050</td>
</tr>
<tr>
<td>60 M ± 3 %</td>
<td>1MRS 120512.060</td>
</tr>
</tbody>
</table>

The maximum length of the sensor is 60 m. The loop is constantly controlled.
MCB recommendations for different circuits:

<table>
<thead>
<tr>
<th>Type of the circuit/voltage</th>
<th>110 VDC</th>
<th>220 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection supply</td>
<td>S202-P-K6</td>
<td>S282-UC-K4</td>
</tr>
<tr>
<td>Binary inputs</td>
<td>S202-P-K2</td>
<td>S282-UC-K1</td>
</tr>
</tbody>
</table>

MCB should be with K-characteristic (8-12 Inom).

It is better to separate power supply circuits from binary inputs and signaling circuits.

For more detailed information look at technical reference manuals and application notes of the products.