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Design and implementation of 220kV Double Main Transfer system switchgear interlocks using PLC programing

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Abstract
In this study, a comprehensive review on selection and role of a double main transfer bus-bar and scheme and its possible extension is important initial step in substation design. The aspects which influence this decision are operational flexibility, system safety, reliability, ability to facilitate system control and cost. An important factor in selection of double main transfer bus-bar scheme is the degree of reliability of supply expected during maintenance or faults. In recent years much attention has been given to the use of PLCs (Programmable Logic Controllers) in substation and distribution automation application.
Keywords: Double main transfer bus bar development, PLC implementation, Interlocks.

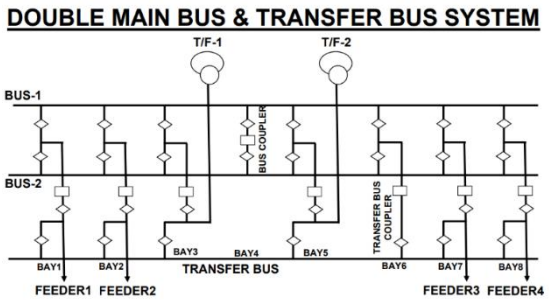
Introduction

In power system, the substations are classified into various types based on the bus configurations. Those are single main (SM), Single main with transfer bus (SMT) , Double main (DM), Double main with transfer system (DMT) etc. To control switchgears in any type of substations some interlocks should be satisfied. These interlocks can be implemented through hard wiring up or through soft logic using PLC programming. In this project various interlocks required to open or close the switchgears are discussed and implemented using PLC programming for 220kV Double Main Transfer System (DMT).

ABOUT PLC

The PLC in this project is used to implement the soft interlocks for controlling the substation switchgears. In general, the interlocks can also be done with the help of hardwiring but it takes lot of time and required lot of space in panels. Hence in this project PLC is selected to make the interlocks automatic. A PLC is specialised computer for industry control and process applications. It consists of memory units, digital inputs (DI), digital outputs (DO), power supply modules etc. The inputs required to implement the logic in the PLC should be connected to DI module and all the outputs will be taken from DO modules. So Machine is a software from schneider electric. This software is used to program the PLC. The PLC should be programmed in such away that one DO should be assigned for one switchgear likewise each switchgear should be configured program to individual DO in the PLC.

SYSTEM PROPOSED



1. In this each Feeder / Transformer / Reactor is having one Circuit Breaker.
2. One Circuit Breaker for Bus Coupler.

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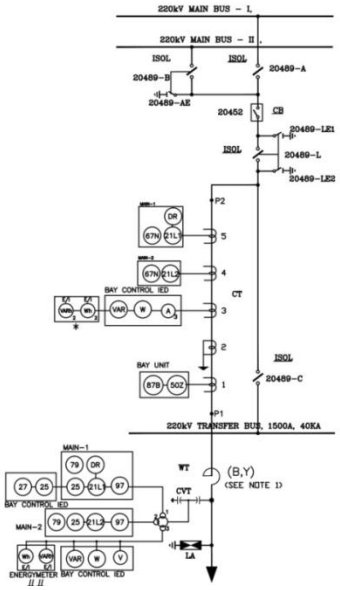
3. One more Circuit Breaker for Transfer Bus Coupler.
4. The details are as follows based on layout.
5. CB designation is very specific.
6. First number will show voltage level. For 765 KV - 7, 550KV-5, 400KV -4, 220KV-2, 132KV - 1.
7. Second number will show Bay number. 8. 52 is ANSI code for CB. Some of the locations it is called Q0.
8. In this each Feeder / Transformer / Reactor is having four Isolators.
9. One Isolator for Bus-1, one Isolator for Bus-2, one isolator for Transfer Bus and another Isolator for Feeder / Transformer / Reactor.
10. In case of Bus Coupler only Bus-1 & Bus-2 Isolators will be available.
11. In case of Transfer Bus Coupler, Bus-1, Bus-2 & Transfer Bus isolators are available.

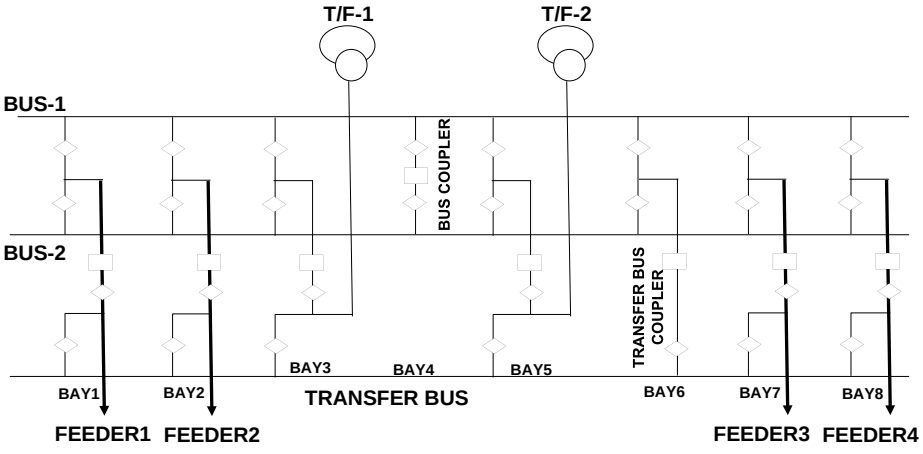
Double Main Transfer System

It represents the Double Main Transfer System. This type of bus configuration consists of two buses and one transfer bus.

There are several advantages for of this type bus configurations. The main advantage is power can be delivered even CB or any one bus has taken for maintenance.



Double Main Transfer Bus Bar Interlocks



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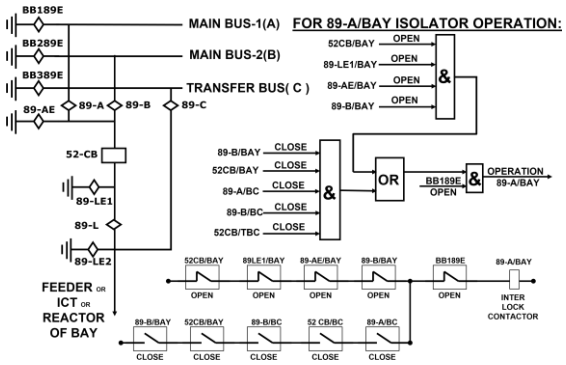
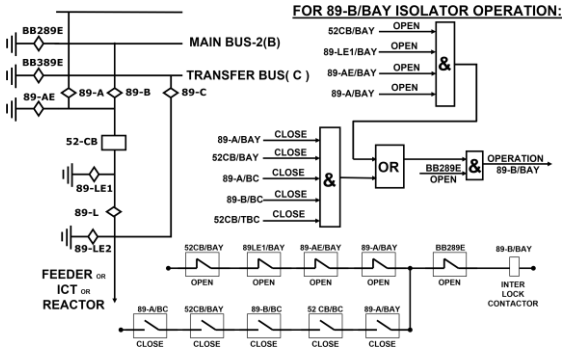
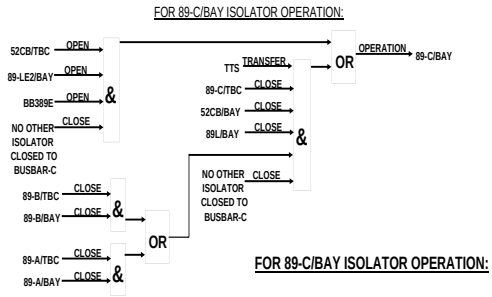
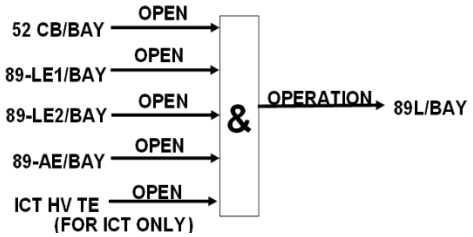


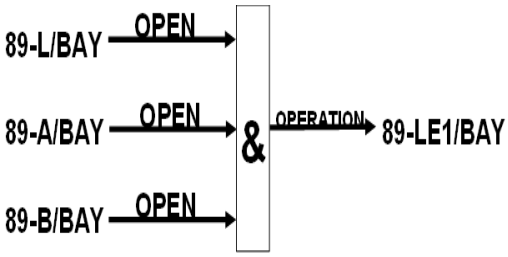




For 89-L/Bay Isolator Operation



For 89-LE1/Bay Isolator Operation



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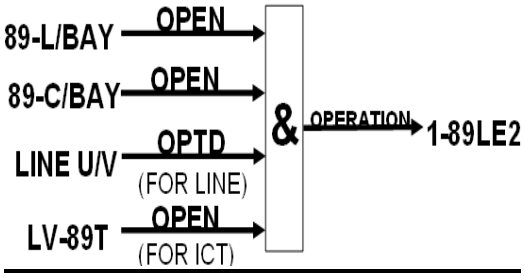
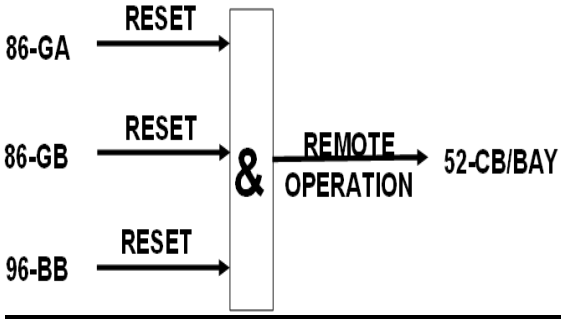
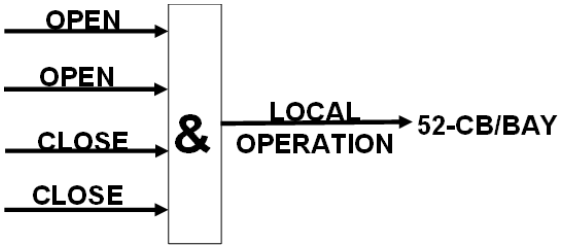
For 89-LE2/Bay Isolator Operation



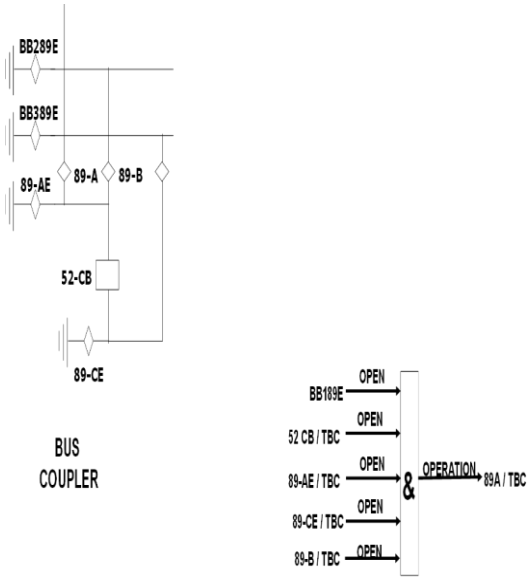
FOR 52 CB/BAY CIRCUIT BREAKER FOR REMOTE OPERATION:



FOR 52 CB /BAYCIRCUIT BREAKER FOR LOCAL OPERATION:



FOR 89-A / TBC ISOLATOR OPERATION:



FOR 89-B / TBC ISOLATOR OPERATION:

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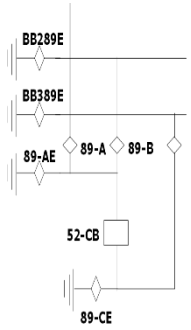
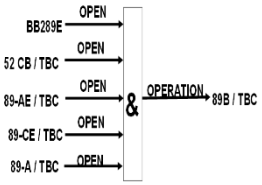
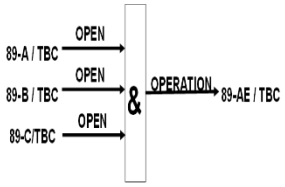


BUS
COUPLER

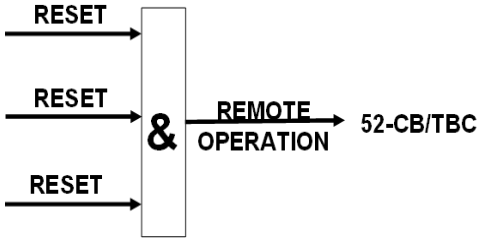


FOR 89-AE / TBC EARTH SWITCH OPERATION:

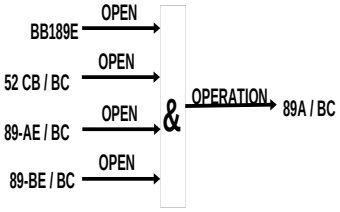
TRANSFER



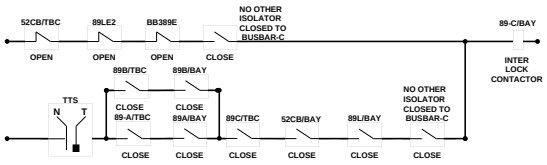
FOR 52 CB / TBC CIRCUIT BREAKER FOR REMOTE OPERATION:



FOR 89-A / BC ISOLATOR OPERATION:



Interlocks implementation using PLC



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it is observed that from DMT system consists of many switchgears such as bus isolators, line isolators, Transfer bus isolator, earth switches, circuit breaker etc. The figure -2 represents the interlocks required for one isolator is implemented in PLC From figure-3 it is observed that, to close or open the isolator there are lot of NO/NC contacts are implemented in series with closing or opening coil of the isolator. Those NO/NC contacts are act as interlock for isolator.

Conclusion:

All the switchgears in the substations have some interlocks to open or close. These interlocks for switchgears vary based on the type of bus configuration i.e, isolator interlocks for single main system is different compared to other bus configurations. In this project interlocks required for DMT system is implemented.

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References:

1. Schneider electric PLC technical Manual.
2. PGCIL control and relay panel drawings