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Sequence of Operation of a Main-Tie-Main

The following is a sequence of operation of how the PMCP Controller operates a Double Ended Substation application, MAIN TIE MAIN, transfer scheme. Only 2 ETC products are required to operate this transfer scheme: the **PMCP Controller** and the **Breaker Add-On Panel**: Refer to Diagram 1 on page 5.

Definitions:

Normal state = S1 and S2 are available, both Mains are closed and TIE opened

S1 = Main source

S2 = Alternate source

M1 = S1 feeder breaker

M2 = S2 feeder breaker

PMCP Controller

Breaker Add-On Panel = PCB containing control relays

Manual Re-transfer feature: inhibit re-closing Mains until feature is deactivated

Auto Manual Mode operation: no breaker operation when Manual Mode is selected

Test 1 feature: activated to simulate a S1 failure

Test 2 feature: activated to simulate a S2 failure

OPEN transfer: load power is interrupted during retransfer

CLOSED transfer: NO interruption of load power during retransfer

Main Tie Main standard features: refer to page 6

Sequence of Operation:

Start in Normal State: S1 & S2 available, M1 & M2 closed, and Tie open

1.0 S1 Failure:

1.1 M1 opens and TIE closes

1.2 S2 powers Load 1 and Load 2

2.0 S1 Returns:

Selected for Open Transfer:

2.1 If the controller is selected for OPEN transfer, then the TIE opens and M1 re-closes. The controller returns the MTM to its Normal State.



If the manual re-transfer feature is activated, the controller will not return the MTM to its Normal State until the Manual Re-transfer feature is deactivated. The manual re-transfer feature is bypassed if the S2 source fails.

Selected for Closed Transfer:

2.2 If controller is selected for CLOSED transfer, the PMCP controller senses both S1 and S2 sources for proper synchronization before retransferring. Once both sources have meet the synchronization requirements (5% voltage difference, 0.2 HZ frequency difference, and within 5 electrical degrees of each other) then M1 closes and the TIE opens (no interruption of power to the loads shall occur.

If the manual re-transfer feature is activated, the controller will not close M1 or open TIE. The manual re-transfer feature is bypassed if the S2 source fails.

Notes: If a breaker fails to operate properly or a Bell Alarm input is activated, the PMCP shall activate the alarm output contact on the Breaker Add-On Panel and then go into a sleep mode until the Alarm Reset feature is activated: activated by a momentary closure across terminals #1 and #3 on the Breaker Add-On Panel.

3.0 S2 Failure:

3.1 M2 opens and TIE closes

3.2 S1 powers Load 1 and Load 2

4.0 S2 Returns:

Selected for Open Transfer:

4.1 If the controller is selected for OPEN transfer, then the TIE opens and M2 re-closes. The controller returns the MTM to its Normal State.

If the manual re-transfer feature is activated, the controller will not return the MTM to its Normal State until the Manual Re-transfer feature is deactivated. The manual re-transfer feature is bypassed if the S1 source fails.



Selected for Closed Transfer:

- 4.2 If controller is selected for CLOSED transfer, the PMCP controller senses both S1 and S2 sources for proper synchronization before retransferring. Once both sources have meet the synchronization requirements (5% voltage difference, 0.2 HZ frequency difference, and within 5 electrical degrees of each other) then M2 closes and the TIE opens. Load power is not interrupted.
If the manual re-transfer feature is activated, the controller will not close M2 or open TIE. The manual re-transfer feature is bypassed if the S1 source fails.

Notes: If a breaker fails to operate properly or a Bell Alarm input is activated, the PMCP shall activate the alarm output contact on the Breaker Add-On Panel and then go into a sleep mode until the Alarm Reset feature is activated: activated by a momentary closure across terminals #1 and #3 on the Breaker Add-On Panel.

5.0 S1 and S2 Failure:

- 5.1 M1, M2 and TIE shall remain in their present state.
- 5.2 The PMCP waits until either S1 or S2 returns:

6.0 S1 and/or S2 Returns:

6.1 S1 and S2 Returns:

- 6.1.1 If both sources return simultaneously, PMCP checks TIE for open position and then close both M1 & M2. Restored to Normal State

6.2 S1 Returns ONLY:

- 6.2.1 If S1 returns, The PMCP will close M1 and TIE
- 6.2.2 S1 powers Load1 and Load 2
- 6.2.3 Afterwards when S2 returns, follow section 4.0



6.3 S2 Returns ONLY:

- 6.3.1 If S2 returns, the PMCP will close M2 and TIE
- 6.3.2 S2 powers Load1 and Load 2
- 6.3.3 Afterwards when S1 returns, follow section 2.0

Note: If a breaker fails to operate properly or a Bell Alarm input is activated, the PMCP shall activate the alarm output contact on the Breaker Add-On Panel and then go into a sleep mode until the Alarm Reset feature is activated: activated by a momentary closure across terminals #1 and #3 on the Breaker Add-On Panel.

7.0 System Test Feature:

- 7.1 The PMCP Controller provides 2 inputs to simulate a S1 and S2 failure: Refer to Diagram 1
- 7.2 Activation of Test 1 to simulate a S1 failure will follow Section 1.0
- 7.3 Activation of Test 2 to simulate a S2 failure will follow Section 3.0

Note: Test 1 and Test 2 Features are used to perform a full system test of the Main Tie Main transfer scheme.

8.0 Input Features:

- 8.1 The PMCP Controller monitors the position of M1, M2 and TIE
- 8.2 The PMCP Controller monitors the Bell Alarms of the M1, M2 and TIE
- 8.3

9.0 Manual/Auto Mode Feature:

An input is provided on the PMCP Controller Terminal Block to put the Main-Tie-Main into a Manual or Auto Mode operation. In Auto Mode, The PMCP shall operate as normal. If the Manual Mode of operation is selected, the PMCP will enter a sleep mode and no operation of the breakers are performed. The Manual Mode will shutdown all operations for maintenance purposes.