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ISOLATOR DON'T BELIEVE INDICATION (DBI) CONDITION ON NUMERIC BUSBAR PROTECTION

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PURPOSE AND SCOPE

The purpose of this document is to describe the behaviour of REB 500, 7SS522 & DRS BB numeric busbar protections when the isolator DBI condition occurs. The report also gives guidance as to what needs to be done following the DBI occurrence.

PART 1 –PROCEDURAL

1 INTRODUCTION

Isolators indicate their fully open, fully closed or neither fully open nor fully closed position using combination of two binary outputs. One binary output is N/C (Normally Closed), the other N/O (Normally Open). The N/C signal should be 0 when the isolator is fully open, and 1 at all other times. The N/O signal should be 0 when the isolator is fully closed and 1 at all other times.

Table 1 below summarises all possible Isolator positions (status) indicated by the combination of N/O and N/C binary outputs.

N/O	N/C	Indicated Isolator Status
1	0	Fully Open.
0	1	Fully Closed.
1	1	DBI. Closing or opening (may indicate failure of the isolator to fully operate).
0	0	DBI. Most likely mis-wiring, wiring loop break or electronic component failure.

Table 1

Both 1-0 and 0-1 signals indicate that isolators are working correctly, i.e they are fully open or fully closed respectively.

1-1 signal will occur during Isolator closing or opening operation. Upon one of these operations the busbar protection starts a timer, whose time-out is set to the maximum isolator operating time. After that time has elapsed, if the signal is still 1-1, an isolator DBI alarm will be raised. At that point, it is unknown whether the isolator is closed or open. The same is true when a 0-0 signal is present (again DBI alarm).

2 ABB REB 500 BUSBAR PROTECTION

2.1 Operating Principle

The REB 500 is a low impedance distributed busbar protection system and works on different principles compared to 2, main and check schemes done with high impedance system. The REB 500 has multiple discriminating zones mirroring the primary system and multiple criteria/algorithms to be satisfied for a trip. The software replica logic determines dynamically the boundaries of the protected busbar zones (protection zones) using isolator auxiliary contacts. The system monitors any inconsistencies of the binary input circuits connected to the isolator auxiliary contacts and generates an alarm after a set time delay. In the event of an alarm the protection can be blocked or selectively blocked.

The first measuring technique (first algorithm) is of current differential principle and it is based on the Kirchoff's Current Law (KCL); the sum of currents entering and leaving a busbar section/zone should be zero under no-fault condition in that section/zone. The second measuring technique determines the direction of the energy flow and involves comparing the phases of the current of all feeders connected to a busbar section/zone. The fundamental frequency current phasors are compared. In the case of an internal fault, all of the feeder currents have almost the same phase angle, while in normal operation or during an external fault at least one current is approximately 180 degrees out of phase with the others. The algorithm detects an internal fault when the difference between the phase angles of all feeder currents lies within the tripping angle of the phase comparator.

The task of processing the algorithms is shared between the bay units and the central processing unit. Each of the bay units continuously monitors the currents of its own feeder, processes them accordingly and then filters the resulting data according to a Fourier function. The analogue data filtered in this way are then transferred at regular intervals to the central processing unit running the busbar protection algorithms.

2.2 Behaviour Under Isolator DBI Condition

When an isolator DBI alarm occurs, all bay units in that particular zone signal an alarm (yellow LED to alert the operator). The bay unit LCD text display will only show 'error'. The central unit also signals the alarm and has a pre configured output 'Isolator alarm'. The central unit LCD display text will provide the alarm details. Thus, it is possible to view the alarm on the central unit with the bay ID. Details can be obtained on the event list (100 event buffer) if the REB WIN software is used to interrogate the system.

The first algorithm in REB500 adds the currents of all feeders connected to a busbar section/zone and the second algorithm compares the current phase angle of all feeders connected to a busbar section/zone, so DBI will affect both current differential and the phase comparison algorithms. This may cause the protection to mal-operate for an out-zone fault or fail to operate for an in-zone fault.

The DBI alarm output contact is on the central unit. ABB indicated that it is possible to view which bay unit has the DBI condition on the central unit.

If the DBI condition is "0" and "0" the last isolator position stored will be used by REB 500. If the DBI condition is "1" and "1" the isolator position will be assumed as CLOSED. This logic in the relay is fixed, i.e. it is not governed by user selectable settings.