

Examples of modified differential ground fault protection systems



These examples represent typical operating conditions of a main-tie-generator switchgear application, but the design techniques used can be applied to other applications based on the equipment used and the customer requirements.

The examples incorporate the following components:

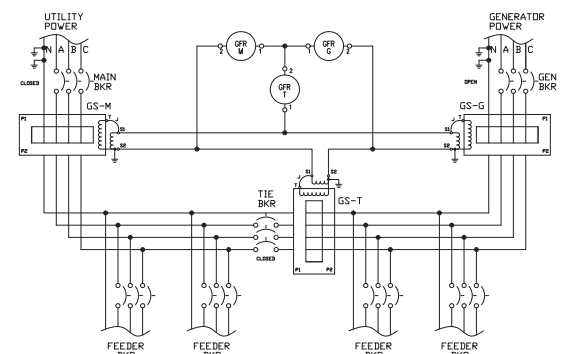
- Three ABB Type GS ground sensors (302L0731UL)
- Three ABB Type GKC ground fault relays (202R2318UL)

The Type GKC is a drawout case relay with adjustable pickup current and time delay settings to provide time-current coordinated ground fault protection. It is designed to be used with the Type GS ground sensor and has provisions for testing the relay and operation of the disconnect device. ABB Type GKT ground fault relays with a ground sensor test function may also be used but they require the use of ground sensors that include a test winding (terminal "T").

Other relays and sensors may be selected based on the application and physical constraints of bus size. Zero-sequence current transformers are used, eliminating issues such as wiring multiple CTs together for a summation measurement, or different CT ratios for different sizes of main, tie, and generator circuit breakers.

LEGEND:

- GS = GROUND SENSOR
- GFR = GROUND FAULT RELAY



NORMAL CONDITION: MAIN AND TIE BREAKERS ARE CLOSED, GENERATOR BREAKER IS OPEN. NO GROUND FAULT CONDITION SO THEREFORE NO SIGNAL CURRENT IS COMING FROM THE GROUND SENSORS. NO TRIPS FROM ANY OF THE GROUND FAULT RELAYS.

Example 1 - Normal operating mode

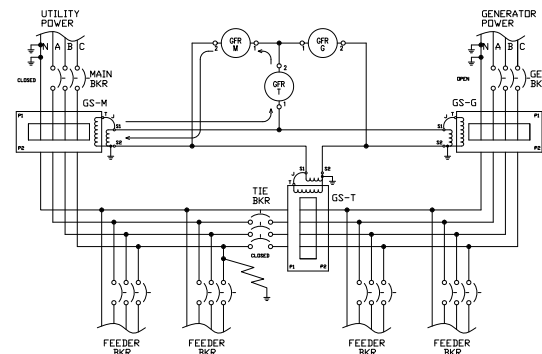
This example shows the wiring connections and normal operating conditions of a typical main-tie-generator application. No ground fault is detected and no current is flowing in the detection circuits.

Example 2 - Normal operating mode

This example shows the normal operating mode of a typical main-tie-generator switchgear application but there is a ground fault condition detected on the main bus side of the tie circuit breaker. Current begins to flow in the signaling circuit through the GFR-M and GFR-T relays causing the main and tie ground fault relays to trip.

LEGEND:

- GS = GROUND SENSOR
- GFR = GROUND FAULT RELAY



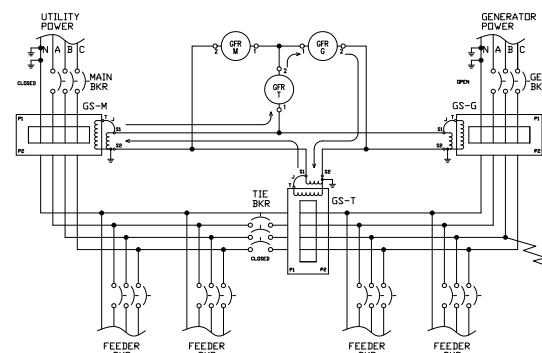
NORMAL CONDITION: MAIN AND TIE BREAKERS ARE CLOSED, GENERATOR BREAKER IS OPEN
GROUND FAULT CONDITION ON MAIN BUS SIDE OF TIE BREAKER. GS-M DETECTS THE GROUND FAULT CONDITION

Example 3 - Normal operating mode

This example shows the normal operating mode of a typical main-tie-generator switchgear application but there is a ground fault condition detected on the generator bus side of the tie circuit breaker. Current begins to flow in the signaling circuit through the GFR-T and GFR-G relays causing the generator and tie ground fault relays to trip.

LEGEND:

- GS = GROUND SENSOR
- GFR = GROUND FAULT RELAY



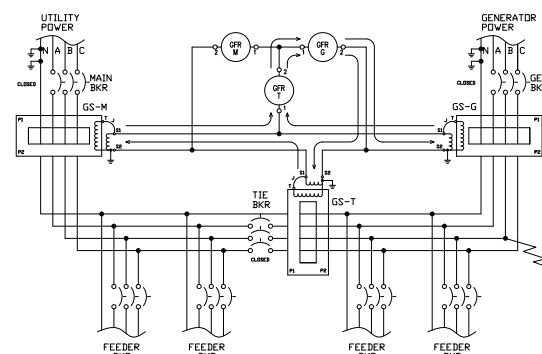
NORMAL CONDITION: MAIN AND TIE BREAKERS ARE CLOSED, GENERATOR BREAKER IS OPEN
GROUND FAULT IS ON THE GENERATOR BUS SIDE OF TIE BREAKER. GS-G AND GS-T BOTH DETECT THE

Example 4 - Parallel operating mode

This example shows an operating mode with the main and generator in parallel with the tie circuit breaker closed, there is a ground fault condition detected on the generator bus side of the tie circuit breaker. All three ground sensors detect the fault and current begins to flow in the signaling circuit through the GFR-T and GFR-G relays causing the main and tie ground fault relays to trip.

LEGEND:

- GS = GROUND SENSOR
- GFR = GROUND FAULT RELAY



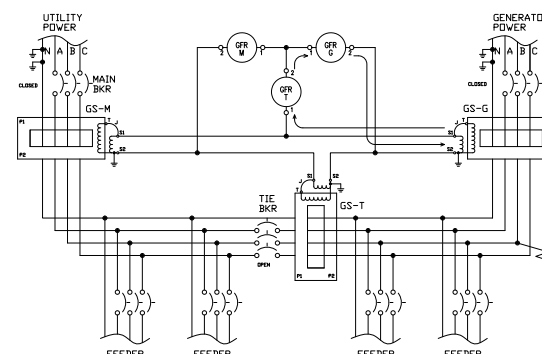
PARALLEL OPERATION: MAIN, TIE AND GENERATOR BREAKERS ARE CLOSED
GROUND FAULT IS ON THE GENERATOR BUS SIDE OF TIE BREAKER. GS-M, GS-G AND GS-T ALL DETECT THE

Example 5 - Isolated operating mode

This example shows operating off of utility power and backup generator in isolated mode with the tie circuit breaker open, there is a ground fault condition detected on the generator bus side of the tie circuit breaker. The generator ground sensor detects the ground fault and current begins to flow in the signaling circuit through the GFR-T and GFR-G relays causing the generator and tie ground fault relays to trip.

LEGEND:

- GS = GROUND SENSOR
- GFR = GROUND FAULT RELAY



ISOLATED OPERATION: MAIN AND GENERATOR BREAKERS ARE CLOSED, TIE BREAKER IS OPEN

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