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Application Note

RC48N NEUTRAL GROUNDING RESISTOR MONITOR IN MEDIUM VOLTAGE SYSTEMS

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RC48N GROUND-FAULT & NEUTRAL-GROUNDING-RESISTOR MONITOR IN MEDIUM-VOLTAGE APPLICATIONS

The RC48N Ground-Fault Neutral-Grounding-Resistor Monitor is used to monitor high-resistance-grounded systems up to and including 5 kV AC. The RC48N cannot be used on systems above 5 kV—it is not compatible with coupling devices rated above 5 kV.

The RC48N has certain limitations when applied to 5-kV systems.

RC48N NGR-FAILURE DETECTION:

The RC48N will alarm on a neutral-grounding-resistor failure under two conditions:

1. The measured NGR resistance is greater than 2 kΩ, or
2. Neutral voltage V_N is above the UΔ neutral-voltage setting AND neutral current is below the IΔn setting. See Fig. 2.

That is: $V_N > U\Delta$ AND $I_N < I\Delta n$ where AND means that both conditions must be met

Condition 1 is detected when the NGR is open and there is no ground fault.

Condition 2 is monitored because a ground fault defeats the resistance-measurement circuit used to detect Condition 1. It ensures that NGR failure will be detected on alarm-only (non-tripping) systems.

Choosing RC48N Settings:

An NGR-failure alarm cannot occur if I_N neutral current is above the IΔn ground-fault-alarm setting. The maximum UΔ neutral-voltage setting is 400 V and, to prevent a false NGR-failure alarm, the IΔn ground-fault-alarm setting must be chosen such that V_N neutral voltage cannot exceed UΔ when neutral current is below the IΔn setting. Neutral voltage follows Ohm's law; neutral current times NGR resistance: $V_N = I_N \times R_{NGR}$. The IΔn setting times the NGR resistance must be below the UΔ setting, which has a 400-V maximum.

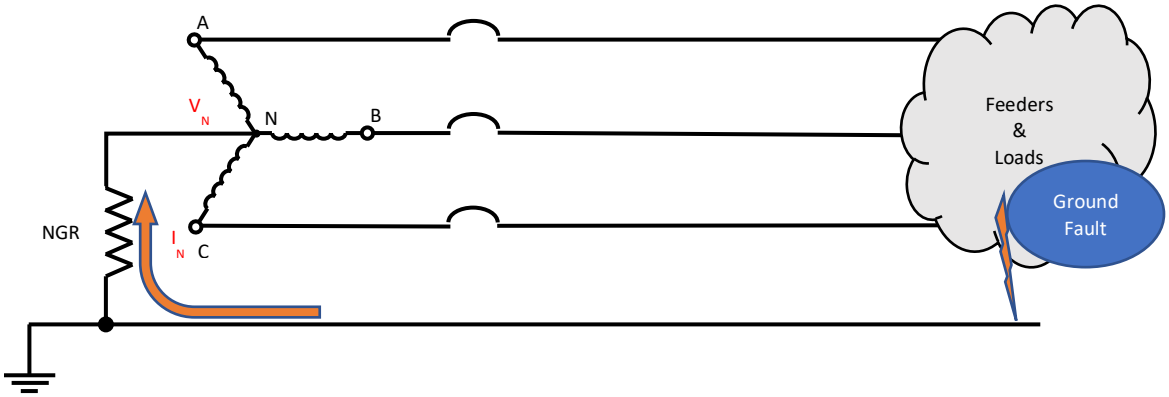

Figure 1: Neutral Current I_N and Neutral Voltage V_N

Example 5-kV system

Example:

System Voltage	4,160 V_{LL}	2,400 V_{LN}
NGR	10 A	240 Ω

- Select the UΔ 400-V maximum setting.
- Calculate the maximum IΔn setting that would prevent a false resistor-fault trip by instead alarming on a ground fault:
    - 400 V/240 Ω = 1.67 A.
- Set IΔn to about 1.5 A;
    - Set the IΔn range-selector switch to x10, and
    - Rotate the IΔn/V potentiometer to the 0.15 position, approximately 1/4 way between the 0.1 and 0.3 markings (see Fig. 2).

The above ground-fault-alarm setting of 1.5 A is within the guideline of choosing a setting that is one tenth to one fifth of the NGR let-through-current rating, which ensures the detection of a high-impedance ground fault.

The above example illustrates that, **for 4,160-V applications, the RC48N voltage-pickup UΔ selector should be at the 400-V maximum setting, and the current-pickup IΔn setting should be no more than 16.7% of the NGR let-through-current rating.**

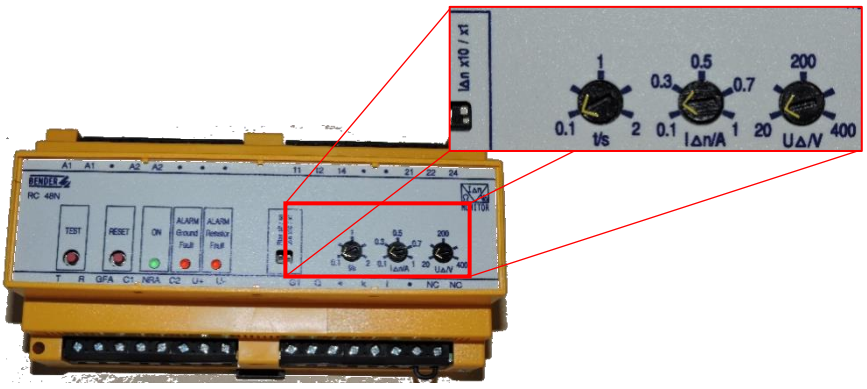

Figure 2: RC48N Ground-Fault & Neutral-Grounding-Resistor Monitor

Adjusting Current Setpoint for higher fault levels

In order to increase the current pickup value on higher amperage NGR's or Low Resistance Grounded (LRG) applications a method of connecting cascaded CT's can be used. CT cascading is when two CT's are used to further transform the primary current to a useable level. This method is accomplished by passing the neutral conductor (between Xo and grounding resistor) through the first current transformer rated to handle the full NGR current (e.g. 500:1 CT) and then routing the output of this CT through the

ground-fault monitoring CT. This will allow the ground -fault monitor to be set in an adequate range for the LRG application.

Example:

A customer has a 500 A grounding resistor. The customer can install a 500:1 CT with all of the system conductors routed through the opening. If a ground fault of 500 A is present the CT will output 1 A.

The secondary output of this CT can be routed through a Bender W series ground-fault CT. The ground fault monitor CT will now see 1A when a ground fault of 500 A is present on the main system. With the RC48N dip switch set to the 1x position the range of setpoints is up to 500 A. The IΔn setting on the ground-fault monitor could be set to 20% and would pick up at 100 A of primary current.

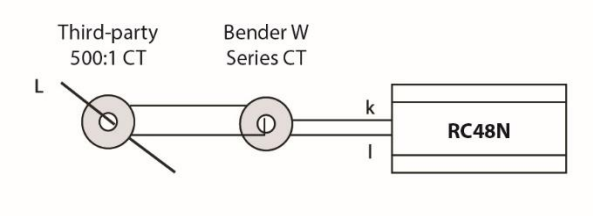

Fig 3: Cascaded CT connection from example