



Substation Automation and Protection Division

Testing REL352 for IKEY and ITA2

Introduction

After the settings have been placed on the REL352 relay, the tester needs to verify that the settings work as required. This application note assists in determining the proper test values to put on the test set verify proper operation.

IT development

The REL352 relay uses a composite sequence filter to derive a single current from the three phase currents. Clark components are used to derive the positive, negative, and zero sequence currents from the phase currents. These sequence currents are multiplied by their respective setting coefficients and added together to derive the IT quantity. This is expressed in the equation

$$IT = C_0 I_0 - C_1 I_1 + C_2 I_2$$

where C_0 , C_1 , and C_2 are setting coefficients chosen by the user.

Derivation of Test Quantities

Two quantities are of interest when testing the REL352 relay. They are Ikey, the current at which the relays starts keying carrier, and ITA2, the value at which the relay will trip assuming coincidence of the local and remote signals. These settings are both levels of IT. To test these quantities it's necessary to convert from a relay test source current to a value of IT. IT is displayed in the metering (Volts/Amps/Angle) vacuum florescent display on the front of the relay. For example:

If C_2 and $C_0 = 0$, The value of the (IT) current supplied by a three phase test set would be $C_1 I_1$,

Or $I_1 = \text{test set current} = IT/C_1$

In the majority of the cases, C_2 is not zero. Our recommended settings are : $C_1 = 0.1$, $C_2 = 0.7$

In these cases determining the value of the test current to derive Ikey, and ITA2 is not as straight forward. IT is developed from the Clark components. To help you in this endeavor, determining IT from a test current, or determining a test current to yield a given IT, a MathCad simulation has been developed. This simulation requires MathCad 7 to run. The simulation runs in two parts.

Part I : Manual mode. Enter coefficients C_0 , C_1 , and C_2 .
Enter any prefault and fault quantities and file will calculate magnitude and angle of IT (sequence network filter output).

Part II : using the coefficients entered in Part I, this section calculates the magnitude and angle of IT for all 10 fault types assuming a constant fault current of 5 amps rms. See bottom of file for summary.

Conclusion

Determining the test values to apply to the REL352 relay to verify the IKEY and ITA2 settings can be complex depending on the coefficients chosen. Using Mathcad , Snfauto simulation will aide derive the quantities needed.

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Results summary : **IT magnitude in rms amps vs. fault type.**
(All faults constant 5 amps rms fault current)

Phase to Ground faults

ITAGrms=0.9659258263

ITBGrms=1.239516754

ITCGrms=1.239516754

Phase to Phase faults

ITABrms=1.8445669376

ITBCrms=2.283110692

ITCArms=1.8445669376

Phase to Phase to Ground faults

ITABGrms=1.4747099364

ITBCGrms=1.9553155817

ITCAGrms=1.4747099364

Three Phase faults

ITABCrms=0.5283431195

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