



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 pre-fault 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.

Contributed by:  
Roger A. Hedding  
Revision 0, 12/00

---

**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

<p><b>ABB, Inc.</b> 7036 Snowdrift Road Allentown, PA 18106 800-634-6005    Fax 610-395-1055 Email: <a href="mailto:powerful.ideas@us.abb.com">powerful.ideas@us.abb.com</a> Web: <a href="http://www.abb.com/substationautomation">www.abb.com/substationautomation</a></p>
--