3. Relay Testing Methods

There are many different methods available to the relay tester depending on his test equipment. We will review the available options in this section.

A) Steady State

Steady state testing is usually used for pick-up tests. The injected current/voltage/frequency is gradually raised/lowered until the relay responds accordingly. Steady state testing can be replaced by jogging the injected value up/down until the relay responds. A person turning a dial or a computer-controlled test set can perform steady-state testing and this is one of tests we will use.

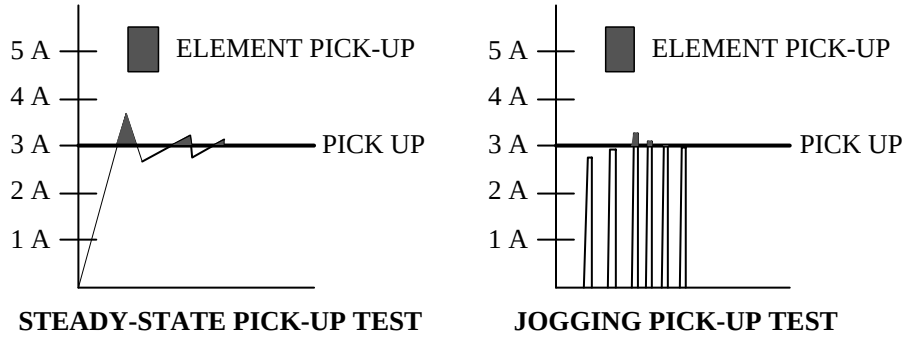

Figure 4- 2: Steady State Pick-up Testing

B) Dynamic On/Off Testing

Dynamic on/off testing is the simplest and was the first test used to determine timing. The pre-test value is zero and it is suddenly increased to the test value by closing a switch between the source and relay or activating a test set. Dynamic on/off testing is performed manually or via computer controlled equipment and is one of the tests we will use.

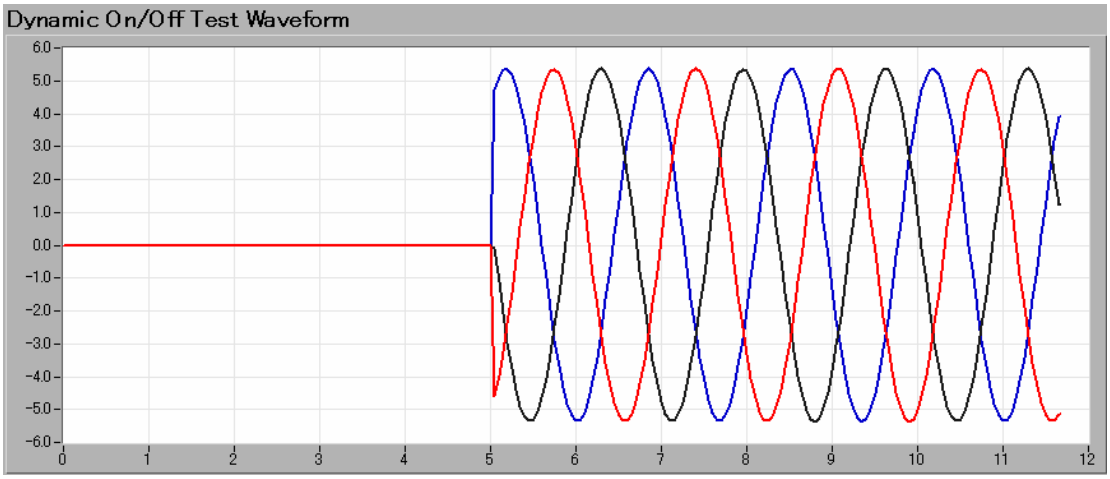

Figure 4- 3: Dynamic On/Off Waveform (Compliments of Manta Test Systems)

C) Simple Dynamic State Testing

Simple dynamic state testing uses pre-fault and/or post-fault values in an attempt to simulate a real life condition for timing tests. A normal current/voltage/frequency applied to the relay

suddenly changes to a fault value. The relay-response time starts at the transition between pre-fault and fault and the timer ends when the relay trips. Simple dynamic state testing is required for some elements like undervoltage (27) or under-frequency (81U) and can be performed manually with two sources or pre-fault and fault modes; or automatically with computer-controlled equipment.

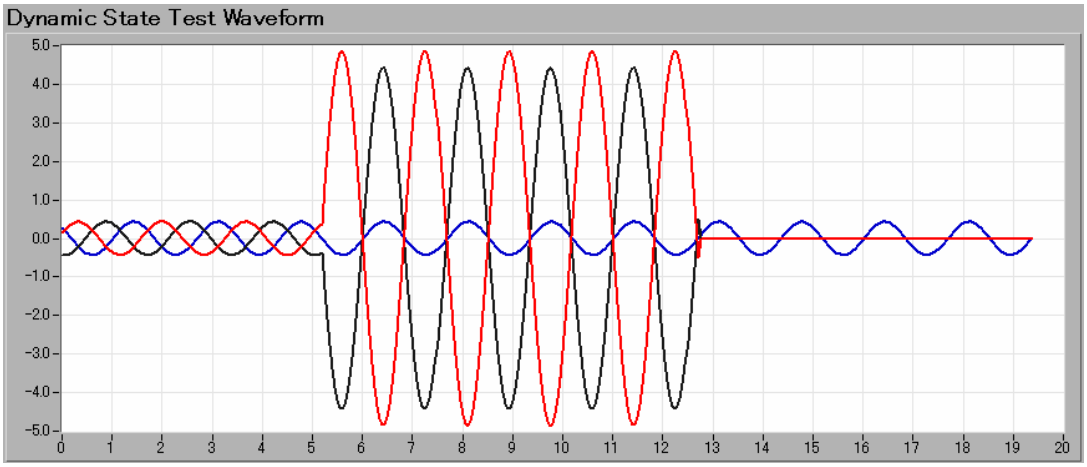

Figure 4- 4: Simple Dynamic Test Waveform (Compliments of Manta Test Systems)

D) Complex Dynamic State Testing

Complex dynamic state testing recognizes that all faults have a DC offset that is dependant on the fault incidence angle and the reactance/resistance ratio of the system. Changing the fault incidence angle changes the DC offset and severity of the fault and can significantly distort the sine wave of a fault as shown in the following figure. This kind of test requires high end test equipment to simulate the DC offset and fault incidence angle and is may be required for high speed and/or more complex state-of-the-art relays.

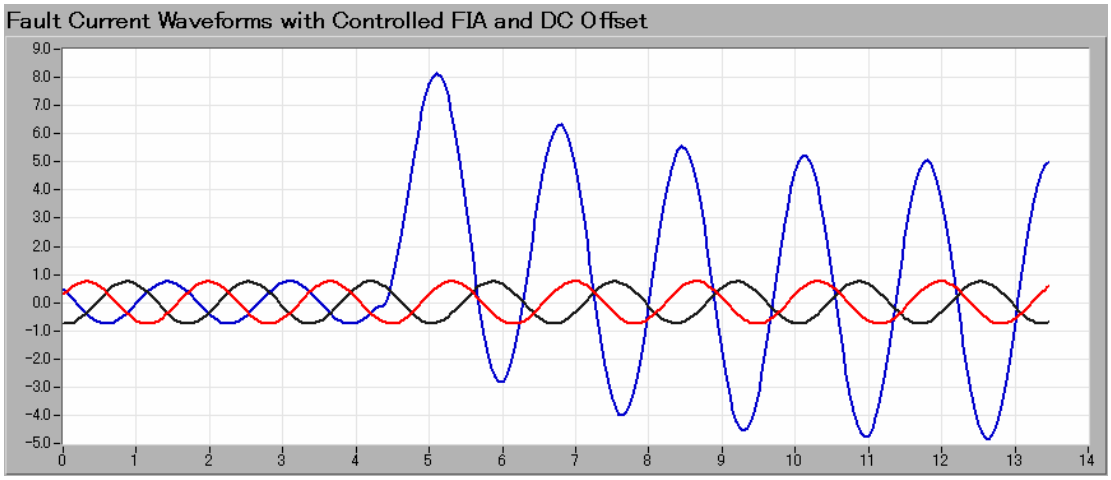

Figure 4- 5: Complex Dynamic Waveform (Compliments of Manta Test Systems)

E) Dynamic System Model Based Testing

Dynamic system model based testing uses a computer program to create a mathematical model of the system and create fault simulations based on the specific application. These