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### General Relay Testing Guidelines:

- The CH2 with the optional Energization Module is the only tester Cirris recommends for testing assemblies with relays.
- Each relay needs to be tested to verify it is changing states and each set of contacts needs to be verified that they open and close as voltage is applied to the relay coil with the resulting impact on interconnections.
- Most often relays are “Single Side Stable” They have one state when you apply the specified voltage to the coil and another state when you remove the voltage. Latching relays will maintain their set/reset state after the voltage is removed. Power does not need to be applied at the time of the connection measurement for a latching relay. Otherwise, it can be considered the same as a “Single Side Stable” relay.
- The state of the relay results in normally open contacts (Form A or NO) being closed when voltage is applied to the coil. Similarly, coil activation causes the normally closed (Form B or NC) contacts to open. Form C contacts can be thought of as a combination of a Normally open and normally closed contact with a common connection contact (Form C or Common C with NO & NC).
- The “Open” and “Close” commands, used for switch testing, can be used to easily test the NO and NC contact states. See “How to set up OPEN/CLOSE instructions in easy-wire software” at <http://www.cirris.com/testing/guidelines/switch-testing.html>
- When checking paths that exist only with relay activated, use the open command to verify no shorts have occurred to this path. This would include checks to each side of the coil if the coil were isolated.

### What To Look For In Your Assembly Schematic To Develop A Relay Test

Test Application	Test Strategy
If all connections to a relay (coil and contacts) are accessible as test points Or, you can make them accessible by test clips etc.	You can test this relay independent from other circuitry in your device under test. Make sure normally open contacts are open and then activate the relay and make sure you have closed the contacts. If other relays in their deactivated state have contacts that short the coil or contacts of this relay, they will need to be activated to so that the open and close of contacts of this relay can be tested

<p>If the coil is completely isolated from the contacts and other interconnection circuitry</p>	<p>You still need to test isolation between coil and contacts. For this reason, you do need to have test points connected to the coil, not just energization points.</p> <p>Also measure coil resistance using a resistor component <sup>1</sup> A very embarrassing defect is to have used the wrong relay (much lower voltage coil). It works initially but the coil will burn out in time due to the wrong voltage. Don't let this be a field failure</p>
<p>If there is a diode across a relay coil, does this need to be tested? How is it tested?</p>	<p>These diodes eliminate energy stored in the relay coil (property of inductance) from causing voltage spikes that may harm other relay contacts and other components when the relay is turned off. Usually the default current in a test is kept low in a Cirris tester so as not to harm components. The CH2 uses a maximum of 10mA for resistance and diode measurements. Thus, coil resistances of about 50 Ohms or less will mask the presence of a parallel diode. To measure the coil resistance without interference from the diode, make the first point of the resistor instruction the cathode of the diode, thus reverse biasing the diode during the resistance measurement. The diode can readily be detected with the DIODE instruction for coils above 100 ohms.</p>
<p>Contacts from different relays are connected in parallel between different relays (more than one relay can complete the same connection path</p>	<p>Start with all relays involving NC contacts in the parallel paths activated so you start with an open path. Then change the state of each relay involved in the parallel paths one at a time to make sure that they can each create the connection.</p>

## How to Test Isolated Serial Contacts

Isolated Serial Paths (More than one contact in separate relays can open the path) Whenever you are testing connection paths that

1. Require more than one relay to be in a specific state to have continuity (closed), and
2. A connection in the path goes between pairs of contacts in at least two of the relays (or one relay opens the power connection to the coil of another relay), and
3. There is no test point connection to this connection between contacts (or to the relay coil being switched)

You have these isolated serial paths. You must focus on testing the path involved, not the relays. If possible during test, make a connection to this isolated serial connection and avoid the complexities that follow:

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## How to Test Isolated Serial Contacts

Test Application	Test Strategy
If contacts connect in series to complete a path and there is no connection test point connected to this interconnection between the two sets of relay contacts in the path	Focus on testing paths and then secondarily look at each relay involved in turn. Start out with a closed path. Relays with NO contacts activated and relays with NC contacts not activated. Change the state of each relay one at a time and make sure the connection is broken (OPEN) in each case. Put each relay in the state that closes the contact before proceeding with the next relay.
Contacts on one relay must be closed (requiring relay activation) to get power to the coil of another relay	Consider this a special case of cascading contacts. Now the activation of the relay to apply power to the relay of interest must be included in the set of relays that must be tested one at a time to break the series of contact connections in the path.
Combinations of serial and parallel relay contacts exist for the same isolated serial path.	Focus on one path at a time and the type of contacts in the path. Turn all NO contact relays on in the serial path and all relays off in the parallel path. Verify you have an open. Then close contacts on each relay in the parallel path one at a time to verify that you can close the path. Then leaving this last parallel path relay closed, check each of the relays in the serial path to make sure that they can open the path.
Combinations of switches and relay contacts are used in the same electrical path	Think of switch contacts as a latching relay only you must manually do the latching. When mixed with relay contacts they create parallel contacts and series contacts that are tested in the same way. Because of the number of manual interactions that might be required, you may need to make temporary connections to the isolated serial paths to minimize operator test time.

- Being able to self-learn the assembly would be helpful , yet in these assemblies it is not practical. A tester would need to learn states of all the relays in every combination. This doubles the number of complete learns for every relay (growing by a power of 2 per relay). This can result in days if not years of learning to sort out the effects of relay combinations. For this reason, you need a schematic and need to evaluate how connections are made. A related application note can be found at <http://www.cirris.com/testing/guidelines/images/switches-relays.pdf>