

Application Note

TESTING SWITCHES IN A HARNESS

Testing Switches in a Harness

This document explains how to use the PASS 6.0 software to program the Dynalab Analyzer to test switches that are part of a wire harness or cable assembly. The procedures described will allow testing of switches in each possible position.

For instructions on how to test switches after pre-testing the base harness, see the "Post Test Component Assembly" application note.

This document contains the following main sections:

- 1 a list of assumptions – knowledge required to perform the tasks outlined in this document
- 2 an overview of the Dynalab solution to switch testing outlining two basic methods – including information on when to use each method
- 3 solution Method 1 examples
- 4 solution Method 2 examples

Assumptions

To successfully use this document, the following knowledge is required:

- basic knowledge of how to enter harness data using PASS 6.0
- knowledge of how to use the Sequence table to create a Sequence

For assistance on how to use features of PASS 6.0, see the PASS 6.0 Help file.

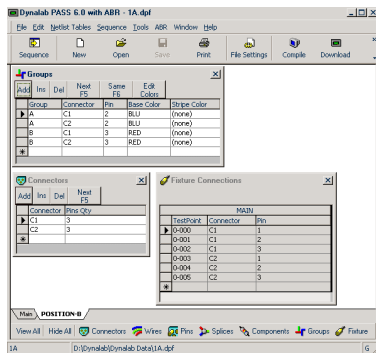
Switch testing overview

The Dynalab Analyzer tests all types of switches using the same principles. These principles are demonstrated below using a very simple example with only one switch. Even this simple example is similar to many real-world situations.

Basic switch testing concept

There are two steps to programming the Analyzer to perform any test.

First, Netlists describing the physical properties of the harness are created using Netlist tabs in PASS 6.0. Netlists contain the information needed to instruct the Analyzer where continuity exists in the harness. Because the Analyzer can only test the elements that are programmed into Netlists, any elements the Analyzer discovers that are not part of a Netlist are reported as errors. One additional Netlist is required to test each additional switch position.



Additional Netlists are created using Netlist tabs.

To create an additional Netlist

- 1 Choose **Edit > New Netlist Tab...** to open the **New Netlist** dialog.
- 2 Enter desired Netlist name in the text box. Often this will be a part number or description.
- 3 Choose **Link to MAIN**. **Link to MAIN** is the default setting and causes all Netlist tabs to use the same Fixture table as the MAIN tab.
- 4 Click **OK**.

Second, Sequence items to test each of the Netlists are entered into the PASS 6.0 Sequence table. If Netlist scanning Sequence items do not reference the Netlists created in the first step, they are not tested.

Switch testing methods

This document provides two basic methods and related examples for testing switches. Each example includes a detailed description of when and why it should be used and a line-by-line description explaining each Sequence item used.

Method 1

Method 1 requires defining the entire harness configuration for each switch position, so it is most effective when testing small point count harnesses. This method provides a very thorough test of harness, because the Analyzer knows exactly what the entire harness should look like for all switch positions. Because Method 1 is so thorough, it should be used as the main choice for testing switches.

The biggest disadvantage of Method 1 is that testing may take a long time if fixture connections are intermittent. Method 1 also requires completely programming the harness configuration for all Netlists tabs. This can add a substantial amount of time for programming, especially for large harnesses.

Method 2

Method 2 defines the entire harness configuration in the MAIN Netlist. The additional Netlists define only the electrical changes caused by the switch moving to the other position. This is desirable when testing very large harnesses, because programming the entire harness for each switch present may take several extra hours, and re-testing every circuit path can add considerable time to the test. Testing large harnesses can be especially problematic and lengthy if fixture connections are intermittent.

The main disadvantage of Method 2 is that the test is not as thorough as Method 1, because the Analyzer does not know what the complete harness looks like for the additional Netlists. The Analyzer will not find short errors when using Method 2 if they occur only after moving the switch from position A, because the CONTINUITY Sequence item is used instead of the TEST Sequence item.

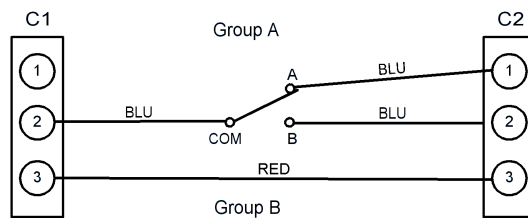
Method 1 programming details

Method 1 Netlist programming

For detailed information about the basics of Netlist data entry, see the PASS 6.0 Help file "Creating Netlists" sections.

- 1 Determine the first switch position that you want to test. For this example, this is position A.
- 2 Program the harness for the switch in position A in the MAIN tab. Use either the Group or Wires Method.

The diagram below shows both the schematic and the **Groups** table entries for position A of a simple harness. The MAIN Netlist tab contains programming for Position A.



Groups				
Add	Ins	Del	Next F5	Same F6
Edit Colors				
Group	Connector	Pin	Base Color	Stripe Color
A	C1	2	BLU	(none)
A	C2	1	BLU	(none)
B	C1	3	RED	(none)
B	C2	3	RED	(none)
*				

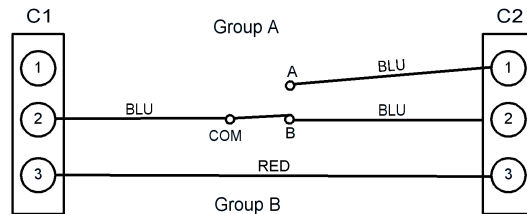
Main POSITION-B

- 3 Create a new Netlist tab and program the tables to match the electrical configuration with the switch in position B.

When creating the new Netlist tab, use the **Link to MAIN** option.

The diagram below shows both the schematic and the **Groups** table entries for position B of a simple harness.

Note: The Analyzer cannot be display color and circuit information from additional Netlist tabs. All color and circuit information displayed by the Analyzer is from the MAIN tab.



Groups				
Add	Ins	Del	Next F5	Same F6
Edit Colors				
Group	Connector	Pin	Base Color	Stripe Color
A	C1	2	BLU	(none)
A	C2	2	BLU	(none)
B	C1	3	RED	(none)
B	C2	3	RED	(none)
*				

Main POSITION-B

- 4 Next, modify the Sequence to perform the test in the desired manner. The Sequence examples shown below are designed to test the entire harness for all switch positions.

Each sample Sequence includes a detailed description of the Sequence items used and why they were chosen.

The table with each example shows the same fields as the Sequence table of PASS 6.0, so the Sequence can be entered as shown to test the effect.

Method 1 Sequence programming – Example 1-A

Table 1 outlines a very simple switch-testing Sequence. This is one of the simplest Sequences possible that offers secure, reliable switch testing. The default Sequence cannot be used, because it will only test one switch position. (If fixture connections are intermittent, Method 2 may offer a better solution.)

Using this Sequence, the Analyzer will halt the test each time an error is found and display the error. The operator must fix the error to continue testing. The operator must also acknowledge each message the Analyzer displays.

The Sequence displays a message and waits for operator input (START button press). After the START button is pressed, the harness is tested with the switch in position A. Then, the Analyzer displays another message, and waits for START button input. Next, the Analyzer tests the harness with the switch in position B.

When all tests are complete, the Analyzer plays a sound, displays the message "HARNESS PASSED", and waits for START button input. After the START button is pressed, the Sequence repeats.

Table 1. Switch Testing Sequence Example 1-A

Line	Sequence item	Parameter	Application Effect
1	ADVOFF		Forces the operator to repair errors before continuing the test
2	KMESSAGE	10	Displays message: "INSTALL HARNESS AND MOVE SWITCH TO POSITION A, THEN PRESS START"
3	TEST	MAIN	Performs a complete Netlist scan with switch in position A
4	KMESSAGE	11	Displays message: "MOVE SWITCH TO POSITION B, THEN PRESS START"
5	TEST	POSITION-B	Performs a complete Netlist scan with switch in position B
6	SOUND	0	Plays sound 0
7	KMESSAGE	12	Displays message: "HARNESS PASSED... PRESS START TO CONTINUE"
8	REPEAT		Go to line 1 and continue Sequence execution

Line 1 The ADVOFF Sequence item at the beginning of the Sequence instructs the Analyzer not to accept input from the START button when stopped on an error encountered during the TEST scan. This Sequence item prevents the operator from advancing and completing the test until the error has been fixed.

Line 2 KMESSAGE Sequence item instructs the Analyzer to display message 10 to instruct the operator. The message remains on the display until the operator presses the START button.

Line 3 TEST instructs the Analyzer to perform a complete test of the Netlist specified by the parameter, in this case, MAIN. (The

I NSTALL HARNESS AND
 MOVE SWITCH TO
 POSITION A, THEN
 PRESS START

Analyzer display showing message 10.

TEST Sequence item is actually a series of scans. See PASS Help for more information about the TEST Sequence item.)

MOVE SWITCH TO
POSITION B, THEN
PRESS START

*Analyzer display showing message
11.*

HARNESS PASSED...
PRESS START TO
CONTINUE

*Analyzer display showing message
12.*

- Line 4** Displays message 11 and waits for START button.
- Line 5** Performs a complete test of Netlist POSITION-B.
- Line 6** Plays sound zero – “twirl”. Sound zero is generally used to indicate that the harness has passed the test. (See PASS 6.0 Help for a description of available sounds.)
- Line 7** Displays message 12 and waits for START button.
- Line 8** REPEAT instructs the Analyzer to go to line 1 and repeat execution of Sequence. Sequence execution will continue to repeat in this manner until the STOP button is pressed.

Method 1 Sequence programming – Example 1-B

Table 2 outlines an example of a switch-testing Sequence that requires no input from the operator under normal conditions. This Sequence is useful when it is desired that the operator's hands to be free to perform other activities.

Using Example 1-B, the Analyzer will halt the test each time an error is found and display the error. The operator must fix the error to continue testing. The message telling the operator which switch position is being tested will remain on the bottom line of the Analyzer's display while the error information is shown on the top three lines.

```
OPEN:
C1-2 BLU
C2-1 BLU
TESTING POSITION A
```

Analyzer display showing instructional message and the first error found during TEST of Netlist MAIN.

After the operator chooses the RUN command from the Analyzer Main Menu, the Sequence begins by displaying the first error on the top three lines of the Analyzer's display and an instructional message on the bottom line to let the operator know what action is expected. After all errors associated with position A have been corrected, the Analyzer will play a four "chirp" sounds to indicate that position A has passed. Then, the next error information is displayed along with a message to instruct the operator that the Analyzer is now testing position B. After all errors associated with position B have been corrected, the Analyzer will play a "twirl" sound to indicate that the all test have passed and the harness is OK.

When all tests are complete, the Analyzer displays the message "HARNESS PASSED... REMOVE HARNESS TO CONTINUE", and waits for the harness to be removed. After the operator removes the harness, the Sequence repeats.

Table 2. Switch Testing Sequence Example 1-B

Line	Sequence item	Parameter	Application Effect
1	ADVOFF		Forces the operator to repair errors before continuing the test
2	LINE4	10	Displays message: "TESTING POSITION A"
3	TEST	MAIN	Performs a complete Netlist scan with switch in position A
4	SOUND	4	Plays sound 4 – 4 chirps
5	DELAY	1	Pauses Sequence execution for 1 second
6	LINE4	11	Displays message: "TESTING POSITION B"
7	TEST	POSITION-B	Performs a complete Netlist scan with switch in position B
8	SOUND	0	Plays sound 0 – twirl
9	MESSAGE	12	Displays message: "HARNESS PASSED... REMOVE HARNESS TO CONTINUE"
10	AUTO	MAIN	Pauses Sequence execution until harness is completely removed
11	REPEAT		Go to line 1 and continue Sequence execution

Line 1 The ADVOFF Sequence item at the beginning of the Sequence instructs the Analyzer not to accept input from the START button when stopped on an error encountered during the TEST scan. This Sequence item prevents the operator from advancing and completing the test until the error has been fixed.


```
OPEN:
C1-2 BLU
C2-1 BLU
TESTING POSITION A
```

Analyzer display showing message 10 and the first error found during TEST of Netlist MAIN.

```
OPEN:
C1-2 BLU
C2-2
TESTING POSITION B
```

Analyzer display showing message 11 and the first error found during TEST of Netlist POSITION-B.

```
HARNESS PASSED...
PRESS START TO
CONTINUE
```

Analyzer display showing message 11 and the first error found during TEST of Netlist POSITION-B.

Line 2 LINE4 Sequence item instructs the Analyzer to display message 10 to instruct the operator. The message remains on the bottom line of the display until the test of switch position A is completed.

Note: *The LINE4 Sequence item requires EPROM version 7.032 or higher and PASS 6.0 Release 2.*

Line 3 TEST instructs the Analyzer to perform a complete test of the Netlist specified by the parameter, in this case, MAIN. (The TEST Sequence item is actually a series of scans. See PASS Help for more information about the TEST Sequence item.)

Line 4 Plays sound 4 – “4 chirps”. This sound provides audible feedback to the operator that switch position A is OK.

Line 5 DELAY instructs the Analyzer to wait a specified number of seconds before executing the next Sequence item.

Line 6 The LINE4 Sequence item instructs the Analyzer to display message 11 to instruct the operator. The message remains on the bottom line of the display until the test of switch position B is completed.

Line 7 Performs a complete test of the POSITION-B Netlist.

Note: *The Analyzer cannot be display color and circuit information from additional Netlist tabs. All color and circuit information displayed by the Analyzer is from the MAIN tab.*

Line 8 Plays sound zero – “twirl”. Sound zero is generally used to indicate that the harness has passed the test. (See PASS Help for a description of available sounds.)

Line 9 Displays message 12.

Line 10 AUTO instructs the Analyzer to perform a continuous continuity scan of the MAIN Netlist. When no continuity is found, Sequence execution continues to line 11.

Line 11 REPEAT instructs the Analyzer to go to line 1 and repeat execution of Sequence. Sequence execution will continue to repeat in this manner until the STOP button is pressed.

Method 2 programming details

This section outlines two examples using Method 2. These examples will not be as detailed as those for Method 1, because they are only slightly modified versions of the examples given for Method 1. So, in this section only the changes from Method 1 will be detailed.

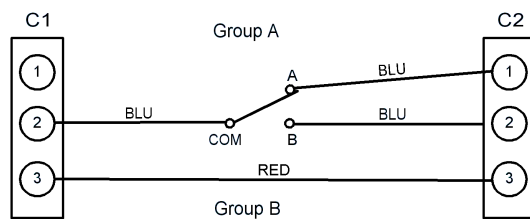
Method 2 Netlist programming

For detailed information about the basics of Netlist data entry, see the PASS 6.0 Help file "Creating Netlists" sections.

In this scenario, the MAIN tab is the same as in Method 1, but the additional Netlist tab only identifies a single set of points that have continuity when the switch is in position B.

- 1 Determine the first switch position that you want to test. For this example, this is position A.
- 2 Program the harness for the switch in position A in the MAIN tab. Use either the Group or Wires Method.

The diagram below shows both the schematic and the **Groups** table entries for position A of a simple harness. The MAIN Netlist tab contains programming for Position A.



Groups				
Add	Ins	Del	Next F5	Same F6
Edit Colors				
Group	Connector	Pin	Base Color	Stripe Color
A	C1	2	BLU	(none)
A	C2	1	BLU	(none)
B	C1	3	RED	(none)
B	C2	3	RED	(none)
*				

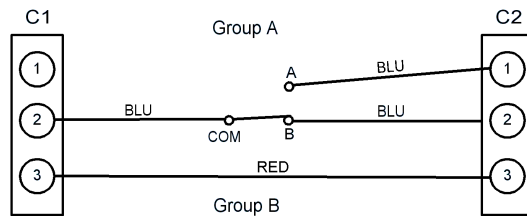
Main POSITION-B

- 3 Create a new Netlist tab and program the tables only for the electrical configuration of the switch in position B. In this case, this means only continuity from C1-2 to C2-2.

When creating the new Netlist tab, use the **Link to MAIN** option.

Because only the continuity of the switch is programmed, the Analyzer will find false short errors if the TEST Sequence item is used. To prevent this, use the CONTINUITY Sequence item instead.

The diagram below shows both the schematic and the **Groups** table entries for position B of a simple harness.



Groups						X
Add	Ins	Del	Next F5	Same F6	Edit Colors	
	Group	Connector	Pin	Base Color	Stripe Color	
	A	C1	2	BLU	(none)	
	A	C2	2	BLU	(none)	
*						
Main POSITION-B						

- 4 Next, modify the Sequence to perform the test in the desired manner. The Sequence examples shown below are designed to test only the electrical changes due to the moving of the switch to position B.

Each sample Sequence includes a detailed description of the Sequence items used and why they were chosen.

The table with each example shows the same fields as the Sequence table of PASS 6.0, so the Sequence can be entered as shown to test the effect.

Method 2 Sequence programming – Example 2-A

See Example 1-A for a description of the Sequence in Table 3. The only change is to line 5 and is described in detail below.

Table 3. Switch Testing Sequence Example 2-A

Line	Sequence item	Parameter	Application Effect
1	ADVOFF		Forces the operator to repair errors before continuing the test
2	KMESSAGE	10	Displays message: "INSTALL HARNESS AND MOVE SWITCH TO POSITION A, THEN PRESS START"
3	TEST	MAIN	Performs a complete Netlist scan with switch in position A
4	KMESSAGE	11	Displays message: "MOVE SWITCH TO POSITION B, THEN PRESS START"
5	CONTINUITY	POSITION-B	Performs only a continuity scan with switch in position B
6	SOUND	0	Plays sound 0
7	KMESSAGE	12	Displays message: "HARNESS PASSED... PRESS START TO CONTINUE"
8	REPEAT		Go to line 1 and continue Sequence execution

Line 5 Performs only a CONTINUITY scan of the POSITION-B Netlist.

Notice the use of the CONTINUITY in place of the TEST Sequence item in the example. Since the Netlist does not provide a complete description of the harness, the Analyzer will find false Short errors when testing the switch-only Netlist.

Method 2 Sequence programming – Example 2-B

See Example 1-B for a description of the Sequence in Table 4. The only change is to line 7 and is described in detail below.

Table 4. Switch Testing Sequence Example 2-B

Line	Sequence item	Parameter	Application Effect
1	ADVOFF		Forces the operator to repair errors before continuing the test
2	LINE4	10	Displays message: "TESTING POSITION A"
3	TEST	MAIN	Performs a complete Netlist scan with switch in position A
4	SOUND	4	Plays sound 4 – 4 chirps
5	DELAY	1	Pauses Sequence execution for 1 second
6	LINE4	11	Displays message: "TESTING POSITION B"
7	CONTINUITY	POSITION-B	Performs only a continuity scan with switch in position B
8	SOUND	0	Plays sound 0 – twirl
9	MESSAGE	12	Displays message: "HARNESS PASSED... REMOVE HARNESS TO CONTINUE"
10	AUTO	MAIN	Pauses Sequence execution until harness is completely removed
11	REPEAT		Go to line 1 and continue Sequence execution

Line 7 Performs only a CONTINUITY scan of the POSITION-B Netlist.

Notice the use of the CONTINUITY in place of the TEST Sequence item in the example. Since the Netlist does not provide a complete description of the harness, the Analyzer will find false Short errors when testing the switch-only Netlist.