Application Note

DETECTING THE PRESENCE OF MECHANICAL FEATURES

How to detect the presence of connectors, secondary locks, retainer clips, etc.

Dynalab
TEST SYSTEMS

Detecting the Presence of Mechanical Features

This document explains how to use PASS 6.0 software to program the Analyzer to detect the presence of mechanical features of a harness such as connectors, secondary locks, retainer clips, etc.

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 detection switches
3. an explanation of how to program the Analyzer to interact with detection switches, including two example Sequences

Assumptions

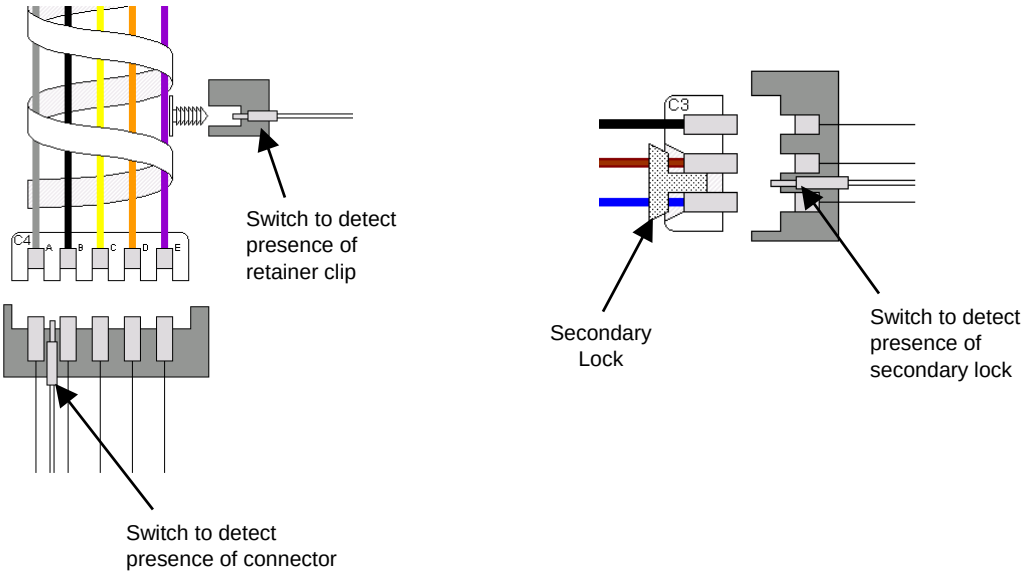
To successfully use this document, the following knowledge is required:

- 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

Overview of Detection Switches

Sometimes, it is desirable to verify the presence of mechanical features of the harness as part of the test. Detection switches are used for this purpose. The following illustrations depict the use of detection switches to sense a variety of mechanical features.



In general, a detection switch is used to sense the presence of a mechanical feature of the harness such as a connector, secondary lock, or retainer clip. The detection switch is open when the feature is not present. The detection switch is closed when the feature is present.

In an end-of-line testing scenario, detection switches are usually scanned before testing begins as a way of insuring that the harness is physically in place on the fixture and that mechanical features have been properly assembled.

In a test-during-assemble scenario, detection switches are sometimes scanned after testing is complete to insure the assembly of parts that are added after a successful test, such as retainer clips.

Detection switches must be electrically isolated from the harness.

Programming the Analyzer

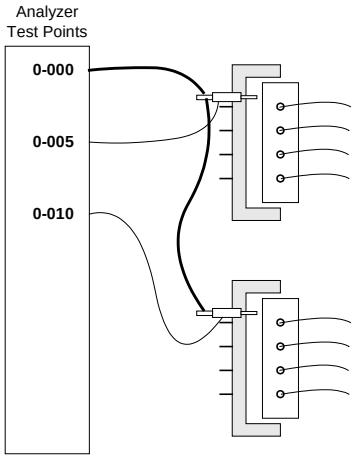
The Dynalab Analyzer may be programmed to check the state of detection switches. This is done using PASS 6.0 software. There are two aspects to this:

- Defining the detection switches
- Programming the Sequence to test the state of the detection switches

Defining the detection switches

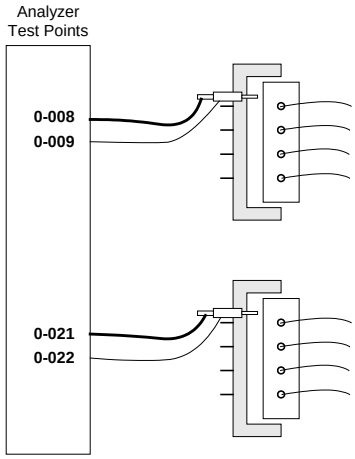
Detection switch wiring

PASS 6.0 supports three methods of detection switch wiring. The two most useful methods are shown here. (The third method is only used in special applications.)



One common for all switches

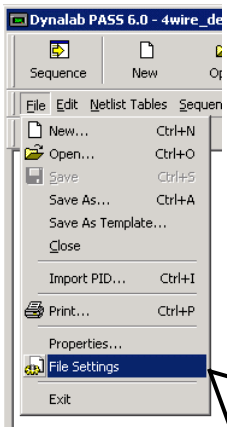
This method of wiring detection switches uses one common for all switches. This allows the use of many detection switches without requiring a large number of test points. The number of test points needed is only one more than the number of switches. The wiring is simplified using this method.



One common per switch

This method of wiring detection switches uses one common for each switch. This approach requires the use of two test points per switch.

File Settings

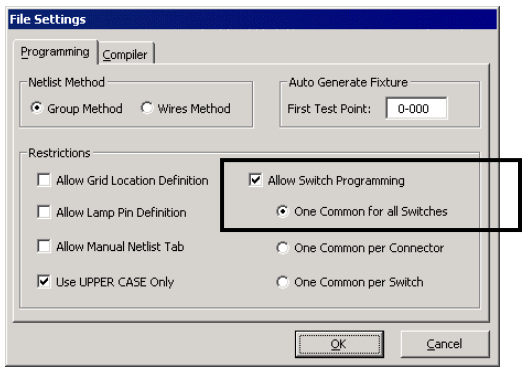


The first step to programming switches is to adjust the File Settings.

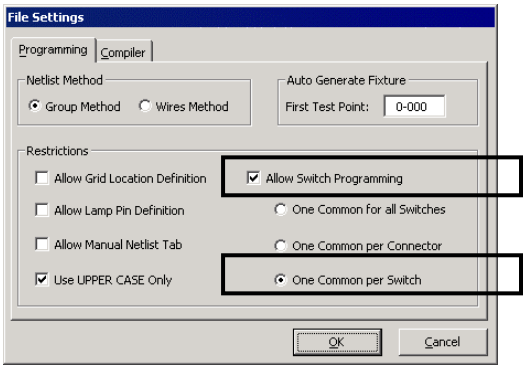
1. Choose **Settings** from the **File** menu to open the **File Settings** dialog.
2. Check the **Allow Switch Programming** checkbox.
3. Select the desired detection switch wiring method:

   One Common for all Switches or

   One Common per Switch
4. Click **OK** to close the dialog

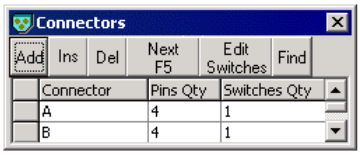


File Settings for One Common for All Switches

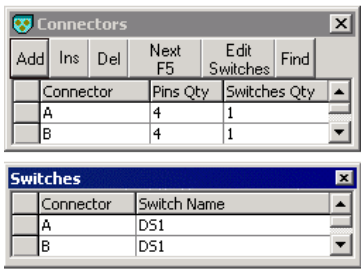


File Settings for One Common per Switch

Defining the detection switches and connectors in the MAIN netlist



Next, define the connectors and switches corresponding to the detection switches. This is done by making entries in the Connectors table. It is important to understand that in PASS, a detection switch is always associated with a connector. In the example shown at left, Connectors A and B each have one associated detection switch.

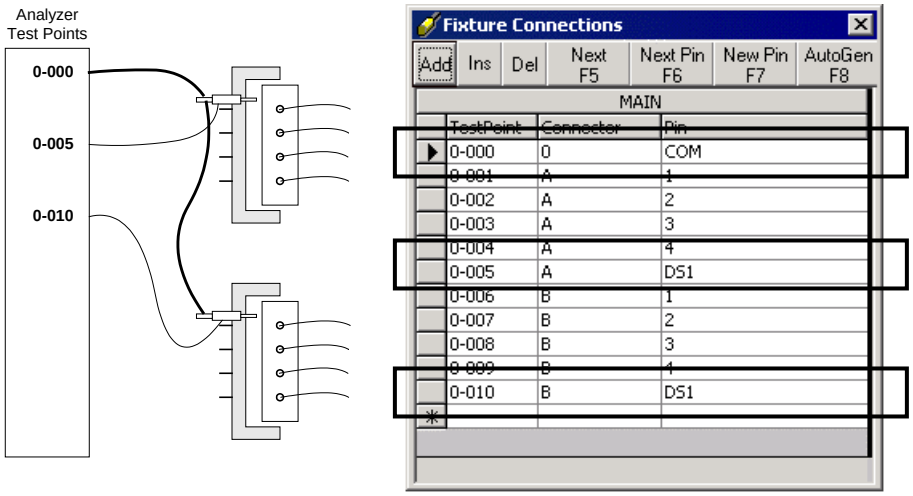


Once the connectors are defined as shown above, pressing the “Edit Switches” button will cause the Switches table to appear. In the Switches table, the Switch Names will automatically be populated. Although the switch name associated with each Connector is automatically named “DS1”, it is possible to change the name to something more meaningful.

In addition to defining the detection switches and connectors, it will be necessary to define all the other harness elements in the MAIN Netlist. Once this is done, the Fixture Connections table in the MAIN Netlist must have an entry for each detection switch. The nature of the detection switch entries in the Fixture Connections table depends upon the wiring method used. Shown below are example Fixture Connections tables for each of the two wiring methods.

Fixture Connections Table: One Common for All Switches

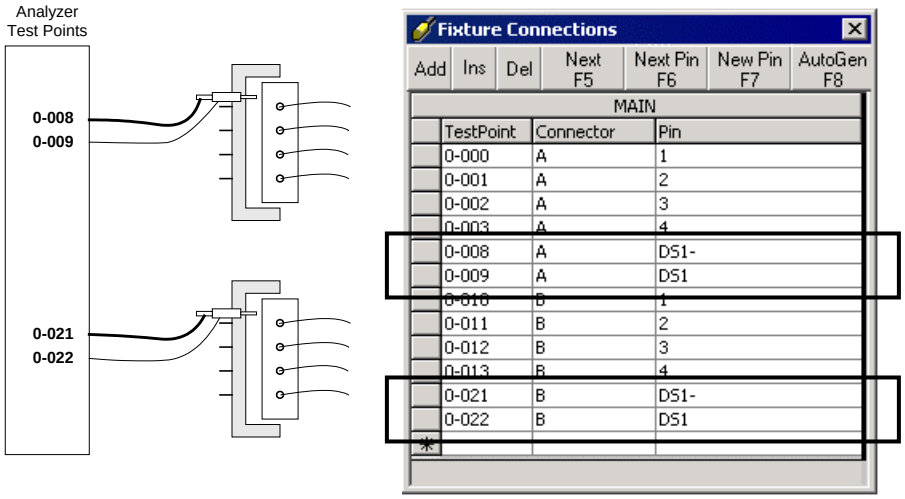
Note that the Fixture Connections table has one entry for the common connection – Connector **0**, PIN **COM** (COM at test point 0-000), and one entry for each detection switch connection (test points 0-005 and 0-010)



Note: In the examples shown here, the names of the detection switches (DS1) automatically generated by the PASS program. It may be advisable to change these names to ones that are more meaningful. The names may be changed in the Switches table, shown on the previous page.

Fixture Connections Table: One Common Per Switch

Note that the Fixture Connections table has two entries for each switch. (0-008 & 0-009 for the detection switch associated with Connector A, and 0-021 & 0-022 for the detection switch associated with Connector B)



Programming the Sequence

Once the detection switches have been defined, it is necessary to program the Sequence to scan the detection switches at the appropriate time.

This section explains two approaches to scanning detection switches:

1. Scan detection switches before electrical testing
2. Scan detection switches after electrical testing

1- Scan detection switches before electrical testing

Some applications employing detection switches require that they be scanned before electrical testing begins. For instance, in an end-of-line testing scenario, detection switches are usually scanned before testing begins as a way of insuring that the harness is physically in place on the fixture and that mechanical features have been properly assembled.

Two methods are available to determine that detection switches are closed:

A. Ordered scan – this scans the detection switches one at a time in the order they appear in the Switches table. The Analyzer will wait until a detection switch is closed before scanning the next switch in the list.

B. Random scan – this scans the detection switches continuously. The Analyzer senses the closure of any detection switch in any order. While the Analyzer is performing this random scan of detection switches, a progress bar is updated on the Analyzer's display. The progress bar increases in length as each detection switch is closed. This is useful for situations where there are many detection switches, and where there is the possibility of intermittent connections. Once momentary connection is established, the connection is considered closed by the Analyzer – eliminating "wiggle-jiggle" of the connections by the operator.

An example Sequence for each of these methods follows.

A – Ordered Scan

The following example Sequence causes the Analyzer to verify that the detection switches are closed before electrical testing begins. When electrical testing is complete, the detection switches are scanned again, this time to make sure they have opened – this ensures the mechanical integrity of the detection switches.

Sequence to check detection switches before testing begins

Line	Sequence Item	Parameter	Application Effect
1	ADVOFF		Prevent advance on error by pressing START button
2	**TEST**	**MAIN**	**Verifies that detection switches defined in MAIN Netlist are closed and performs a complete scan of the MAIN Netlist**
3	MESSAGE	1	Displays message "Harness Passed… remove harness to continue
4	**SW-OPEN**	**MAIN**	**Verifies that detection switches defined in MAIN Netlist are open**
5	AUTO	MAIN	Verifies that harness is removed
6	REPEAT		Goes to line 1 to repeat the sequence

Line 1 ADVOFF prevents the operator from logging errors by pressing the START button. When errors are displayed, the operator must fix the error before the scan will continue. (When an error is encountered, the Analyzer stops on the error, displays the error message, and continuously scans the points where the error occurred, waiting for the operator to fix the error. With ADVOFF, the START button has no effect – the Analyzer will not advance, but will wait for the operator to fix the error).

Line 2 TEST[1] performs a complete scan of the MAIN Netlist. Before testing for continuity and shorts, TEST will cause the Analyzer to first scan all the detection switches, verifying that they are closed. The detection switches are scanned in the order they appear in the Switches table.

Line 3 MESSAGE 1 displays a message informing the Operator that the harness has passed all tests, and instructing the Operator to remove the harness.

Line 4 SW-OPEN performs a continuity scan on all the detection switches defined in the MAIN Netlist, verifying that they are open. This is used to test the fixture to verify that the switches are indeed operational. For instance, if a detection switch is stuck in the closed position, SW-OPEN will detect this failure.

Line 5 AUTO instructs the Analyzer to perform a continuous continuity scan of the MAIN Netlist, looking for all harness connections to be open. Once all connections are open, the Analyzer continues execution with the next Sequence item. AUTO is used to determine that a harness has been completely removed from the fixture.

Line 6 REPEAT instructs the Analyzer to go to line 1 and repeat execution of the Sequence.

[1] For a detailed description of the TEST Sequence item, refer to the Application Note entitled *Sequence Basics – the Default Sequence*

B. Random Scan

In some circumstances, it may be desirable to scan the detection switches randomly. The SW-RND-CLOSED Sequence item is used for this purpose. During this test mode, the Analyzer scans all detection switches simultaneously and keeps a record of each. When a switch closes, the Analyzer removes its name from the list of detection switches to scan and continues scanning only the remaining switches. This process continues until all detection switches have been removed from the list. While the Analyzer is performing this random scan of detection switches, a progress bar is updated on the Analyzer's display. The progress bar increases in length as each detection switch is closed.

If this type of random detection switch scanning is required, the TEST Sequence item is not suitable, since it performs an ordered scan of detection switches. Instead, SW_RND_CLOSED must be used as illustrated in the following example. This Sequence behaves identically to the previous example, except the detection switches are scanned in random order:

Sequence to randomly check detection switches before testing begins

Line	Sequence Item	Parameter	Application Effect
1	ADVOFF		Prevent advance on error by pressing START button
2	**SW-RND-CLOSED**	**MAIN**	**Randomly verifies that detection switches defined in MAIN Netlist are closed**
3	CONTINUITY	MAIN	Performs complete continuity scan of MAIN Netlist
4	SHORT	MAIN	Performs complete short scan of MAIN Netlist
5	BSS	3	Branch to CONTINUITY test on Soft Short error
6	MESSAGE	1	Displays message "Harness Passed… remove harness to continue
7	**SW-OPEN**	**MAIN**	**Verifies that detection switches defined in MAIN Netlist are open**
8	AUTO	MAIN	Verifies that harness is removed
9	REPEAT		Goes to line 1 to repeat the sequence

Line 1 ADVOFF prevents the operator from logging errors by pressing the START button. When errors are displayed, the operator must fix the error before the scan will continue.

Line 2 SW-RND-CLOSED scans all detection switches defined in the MAIN Netlist until they are all closed. The Analyzer senses the closure of any detection switch in any order.

Line 3 CONTINUITY performs a continuity scan of the MAIN Netlist

Line 4 SHORT performs a short scan of the MAIN Netlist

Line 5 BSS branches to line 3 if a soft short error was found T performs a short scan of the MAIN Netlist

Line 6 MESSAGE 1 displays a message informing the Operator that the harness has passed all tests, and instructing the Operator to remove the harness.

Line 7 SW-OPEN performs a continuity scan on all the detection switches defined in the MAIN Netlist, verifying that they are open. This is used to test the fixture to verify that the switches are indeed operational. For instance, if a detection switch is stuck in the closed position, SW-OPEN will detect this failure.

Line 8 AUTO instructs the Analyzer to perform a continuous continuity scan of the MAIN Netlist, looking for all harness connections to be open. Once all connections are open, the Analyzer continues execution with the next Sequence item. AUTO is used to determine that a harness has been completely removed from the fixture.

Line 9 REPEAT goes to Line 1 to repeat the Sequence

2 - Scan detection switches after electrical testing

Sometimes, it is necessary to scan the detection switches after electrical testing. For instance, in a test-during-assemble scenario, detection switches are sometimes scanned after testing is complete to insure the assembly of parts that are added after a successful test. For instance, some harnesses contain retainer clips that are added after the wiring is complete. The following is an example Sequence that illustrates how this can be done. In this example, the harness is tested for continuity and shorts first. Then, the operator is prompted to assemble retainer clips and attach the clips to fixture-mounted holders. These holders have been equipped with detection switches. Once the Analyzer has sensed that all the detection switches are closed, the Operator is instructed that all tests have passed and to remove the harness. The Analyzer checks to make sure that the detection switches have opened and that the harness is completely removed – then the Sequence re-starts automatically.

Sequence to check status of detection switches after testing is complete

Line	Sequence Item	Parameter	Application Effect
1	ADVOFF		Prevent advance on error by pressing START button
2	CONTINUITY	MAIN	Performs a continuity scan of MAIN
3	SHORT	MAIN	Performs a short scan of MAIN
4	BSS	2	Branches to Line 2 if Soft Short error was encountered
5	SOUND	4	Plays sound 4
6	LINE4	10	Displays message on line 4: INSTALL RET CLIPS
7	SW-CLOSED	MAIN	Verifies that detection switches are closed
8	SOUND	0	Plays sound 0
9	LINE4	11	Displays message on line 4: “GOOD HARNESS: REMOVE”
10	SW-OPEN	MAIN	Verifies that detection switches are open
11	AUTO	MAIN	Verifies that harness is removed
12	REPEAT		Repeats sequence starting at Line 1

Line 1 ADVOFF prevents the operator from logging errors by pressing the START button. When errors are displayed, the operator must fix the error before the scan will continue. (When an error is encountered, the Analyzer stops on the error, displays the error

message, and continuously scans the points where the error occurred, waiting for the operator to fix the error. The default behavior of the Analyzer is to allow the operator to press the START button to log the error – the Analyzer then would then advance by continuing to scan the remainder of the Netlist. With ADVOFF, the START button has no effect – the Analyzer will not advance, but will wait for the operator to fix the error).

Line 2 CONTINUITY performs a continuity scan of the MAIN Netlist

Line 3 SHORT performs a short scan of the MAIN Netlist

Line 4 BSS branches to line 2 if a soft short error was found

Line 5 SOUND plays sound number 4 – 4 "chirps". This sound is used to indicate that the harness has passed continuity and short scans

Line 6 LINE4 10 displays as message instructing the Operator to install the retainer clips. This message is displayed on the fourth line of the display so as not to be overwritten by messages generated by subsequent Sequence items.

Line 7 SW-CLOSED performs a continuity scan on all detection switches defined in the MAIN Netlist, verifying that they are closed.

Line 8 SOUND 0 plays a "twirl" sound, indicating that the harness is good and ready to be removed.

Line 9 LINE4 11 displays a message informing the Operator that the harness has passed all tests, and instructing the Operator to remove the harness. This message is displayed on the fourth line of the display so as not to be overwritten by messages generated by subsequent Sequence items.

Line 10 SW-OPEN performs a continuity scan on all the detection switches defined in the MAIN Netlist, verifying that they are open.

Line 11 AUTO instructs the Analyzer to perform a continuous continuity scan of the MAIN Netlist, looking for all harness connections to be open. Once all connections are open, the Analyzer continues execution with the next Sequence item. AUTO is used to determine that a harness has been completely removed from the fixture. However, since AUTO does not check detection switches, Line 10 was inserted first to make sure that all detection switches had opened. The combination of Lines 10 and 11 have the effect of insuring that the harness is completely removed from the fixture. This allows for automatically re-starting the test.

Line 12 REPEAT instructs the Analyzer to go to line 1 and repeat execution of the Sequence.

Summary of Sequence items used for programming detection switches

The following Sequence items are available to check the status of detection switches:

- **SW-CLOSED**

  Performs a continuity test on all detection switches. Switches are scanned in the order they appear in the Switches table.

- **SW-RND-CLOSED**

  Performs a random order continuity test on all detection switches. Switches may be closed in any order. While the Analyzer is performing this random scan of detection switches, a progress bar is updated on the Analyzer's display. The progress bar increases in length as each detection switch is closed. This is useful for situations where there are many detection switches, and where there is the possibility of intermittent connections. Once momentary connection is established, the connection is considered closed by the Analyzer – eliminating "wiggle-jiggle" of the connections by the operator.

- **SW-OPEN**

  Performs a test for no continuity on all detection switches. This is used to test the fixture to verify that the switches are indeed operational. For instance, if a detection switch is stuck in the closed position, SW-OPEN will detect this failure.