

# NX APPLICATION NOTE

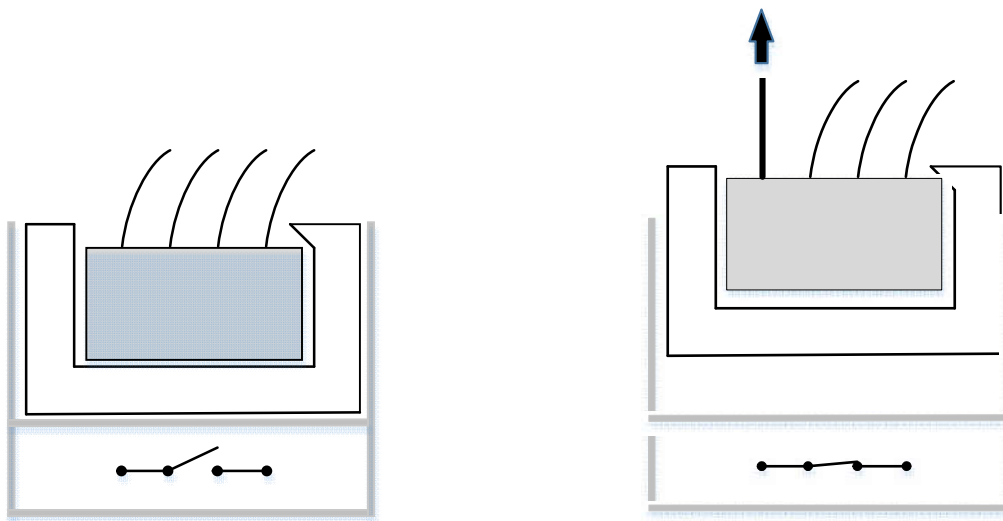
## Led Guided Assembly Connector Pinning

### Background

Many wire harness connectors are designed to use a “push-click-pull” method of wire insertion. This method requires the operator to push the terminated wire into the proper connector cavity until it clicks into place. Then the operator is expected to pull or tug on the wire to ensure that the terminal is properly seated. If the operator pins the wire to the wrong cavity or if the operator neglects to perform the pull test, defective wire harnesses may be shipped. To overcome these potential quality problems, some wire harness manufacturers employ a guided assembly method for pinning connectors using LED illumination to indicate the connector and cavity location for pinning the wire. This method also verifies that the operator has performed the pull test by monitoring a fixture block detection switch that is activated when the operator pulls on the wire with sufficient force.

This application note describes how to equip and program a Dynalab NX Tester to support guided assembly of wires to “push-click-pull” connectors using special LED-illuminated fixture blocks that are equipped with a built-in pull test feature where continuity testing is not required. If continuity testing is required, please refer to the Application Note entitled *LED Guided Assembly – Connector Pinning with Continuity*.

The pull test feature of the fixture blocks enables the operator to pull on an inserted wire, and if enough force is applied in pulling the wire, a built-in detection switch will close as illustrated below:



Detection switch open

Operator pulls on wire. If wire is properly seated, fixture block will move upward, causing built-in detection switch to close

## Requirements

- NX Editor version 1.0.19.233 or later
- NX Tester equipped with firmware version 2.19.213 or later
- 5-4009 (LED Test Point Board)

*Note: This solution requires that the NX Tester be equipped ONLY with LED Test Point Board(s), part 5-4009. Standard NX Test Point Boards are not compatible with this solution.*

In addition to the items listed above, the following items are required which are not available from Dynalab:

1. An assembly board equipped with “push-click-pull” fixture blocks that have the following characteristics:
  - The fixture block is equipped with one LED per cavity, so that each cavity of a connector can be illuminated.
  - Each fixture block is equipped with a normally-open detection switch.
  - Each fixture block is equipped with a mechanism which allows the operator to pull on an inserted wire, resulting in the closure of its detection switch.
  - In addition to the cavity LED’s, each fixture block is equipped with an additional single LED.
2. Each parts bin should be equipped with an LED.

## NX Tester

This section explains the differences in behavior when an NX Tester is equipped with the LED Test Point Board and firmware version 2.19.213 or later.

### Splash Screen

Upon power up, the NX Tester will momentarily display the following splash screen:

4<sup>th</sup> line indicates that unit is equipped with LED Test Point Board →

© Dynalab, Inc. 2015
Version 2.19.213
SN 000000035
NX Pro-LED 128TP

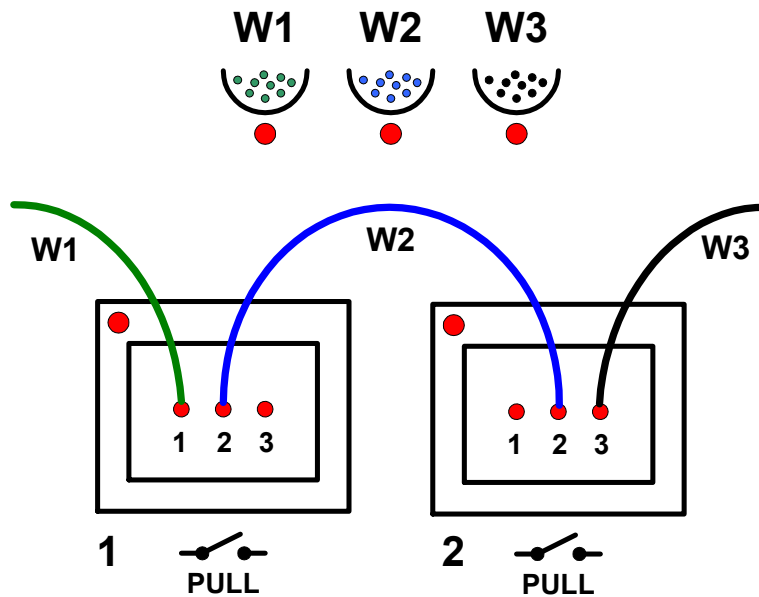
### Test Point Diagnostics

If the fixture is connected when test point diagnostics are executed, the LEDs will illuminate for several seconds.

## Example Scenario

The following example will be used throughout this document.

- W1, W2 and W3 are bin locations containing wires with corresponding LEDs
- 1 and 2 are fixture blocks that contain an LED in the cavity location for each pin and a LED for each fixture Block. The PULL switch is a detection switch that is activated when the operator pulls on the wire.

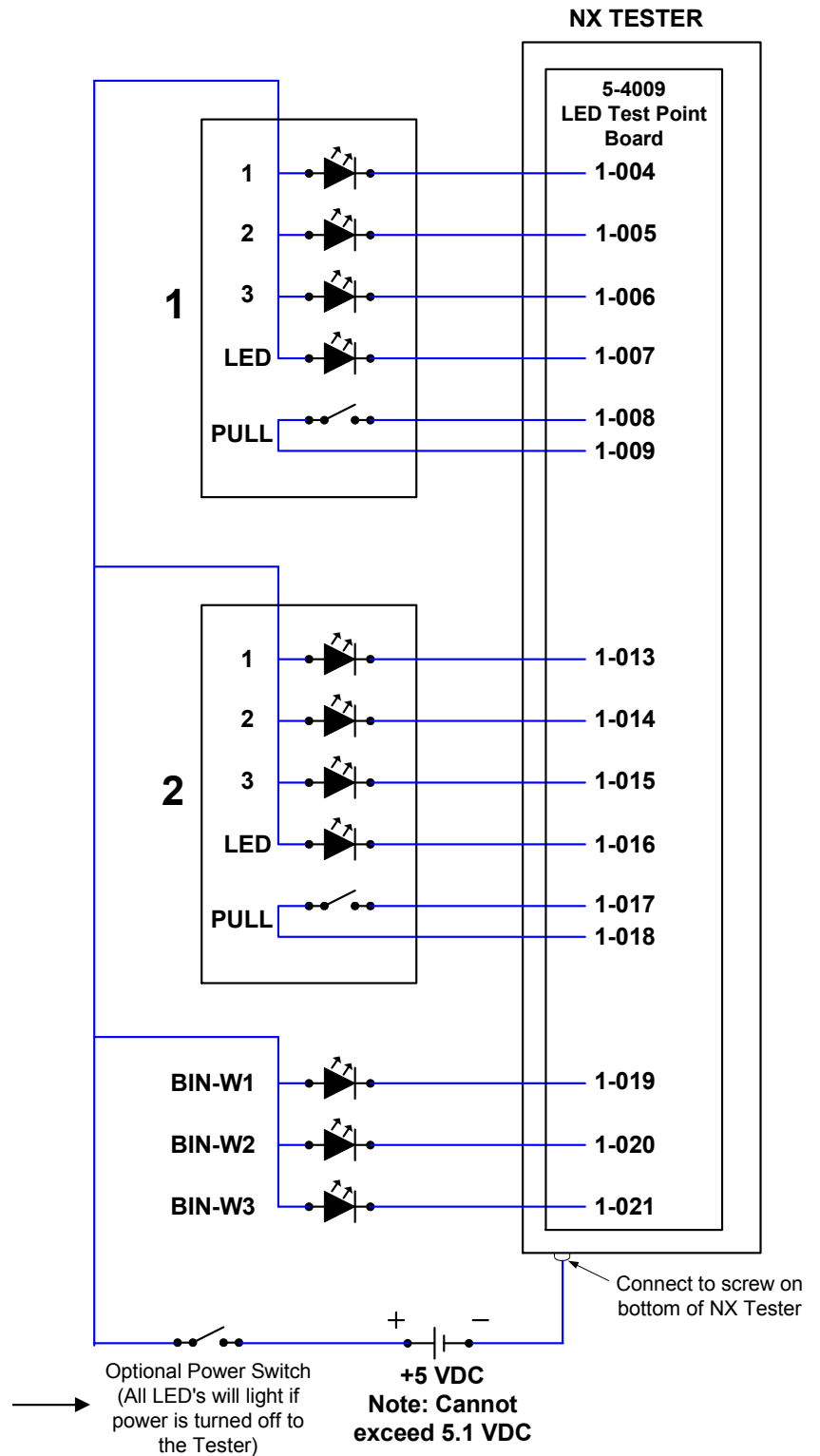


Step	Task	Illuminated LED(s)	Tester Display	Wait For
1	Select a green wire from the wires bin labeled W1. Insert one end of W1 into connector 1, cavity 1 and pull to test.	<ul style="list-style-type: none"> <li>➤ Wires bin W1</li> <li>➤ Fixture Block 1</li> <li>➤ Cavity 1-1</li> </ul>	<b>LED</b> 1-1 <b>BIN-W1</b> GRN	1-PULL detection switch closure
2	Select a blue wire from the wires bin labeled W2. Insert one end of W2 into connector 1, cavity 2 and pull to test	<ul style="list-style-type: none"> <li>➤ Wires bin W2</li> <li>➤ Fixture Block 1</li> <li>➤ Cavity 1-2</li> </ul>	<b>LED</b> 1-2 <b>BIN-W2</b> BLU	1-PULL detection switch closure
3	Insert the other end of W2 into connector 2, pin 2 and pull to test.	<ul style="list-style-type: none"> <li>➤ Fixture Block 2 (flashing)</li> <li>➤ Cavity 2-2</li> </ul>	<b>LED</b> 2-2 <b>BIN-W2</b> BLU	2-PULL detection switch closure
4	Select a black wire from the wires bin labeled W3.. Insert one end of W3 into connector 2, cavity 3 and pull to test.	<ul style="list-style-type: none"> <li>➤ Wires bin W3</li> <li>➤ Fixture Block 2</li> <li>➤ Cavity 2-3</li> </ul>	<b>LED</b> 2-3 <b>BIN-W3</b> BLK	2-PULL detection switch closure

## Wiring

This diagram illustrates the wiring between the assembly fixture board and the NX Tester's LED Test Point Board.

**Warning:** Damage will occur to diodes if the cathode is accidentally connected to ground and the anode is connected to +5VDC. The 5-4009 LED Test Point Board has built-in current limiting for diode protection



Note: If the Tester power is turned off and the +5VDC to the LED's is turned on, all LED's will light. An optional power switch or a Control Port (5-1060) can be used to turn off the power to the LED's

## Programming

The NX Editor program for this example is described below.

### Fixture Blocks Table

Here is the NX Editor's Fixture Blocks table for this example.

	Name	Test Point
	1-1	001-04
Fixture Block 1 cavity LEDs	1-2	001-05
	1-3	001-06
Fixture Block 1 LED	1-LED	001-07
Fixture Block 1 pull test switch	1-PULL(+)	001-08
	1-PULL(-)	001-09
	2-1	001-13
Fixture Block 2 cavity LEDs	2-2	001-14
	2-3	001-15
Fixture Block 2 LED	2-LED	001-16
Fixture Block 2 pull test switch	2-PULL(+)	001-17
	2-PULL(-)	001-18
	BIN-W1	001-19
Wire bins LEDs	BIN-W2	001-20
	BIN-W3	001-21
Mandatory "dummy" test point X-X	X-X	001-55

There are three types of entries in the Fixture Blocks table:

1. Fixture blocks with detection switches that accept a connector
2. Wire bins LEDs
3. Mandatory fixture block "X" containing one dummy test point

The following rules apply to the entries in the Fixture Blocks table:

**1. Fixture blocks and detection switches that accept a connector**

- The fixture block name can be anything except “X”. In this example, the fixture block names are **1** and **2**.
- A single detection switch must be defined for each fixture block. The detection switch may be given any name. In this example, fixture block detection switches are named **PULL**.
- Each cavity LED must conform to the naming convention: **f-p**, where **f** is the fixture block name and **p** is the cavity pin name. For instance, in the example shown in this document the cavity LED’s are named **1-1**, **1-2**, **1-3**, **2-1**, **2-2**, and **2-3**.
- The LED for the fixture block must conform to the naming convention: **f-LED**, where **f** is the fixture block name. For instance, in the example shown in this document the fixture block LEDs are named **1-LED** and **2-LED**.

**2. Wire bins LEDs**

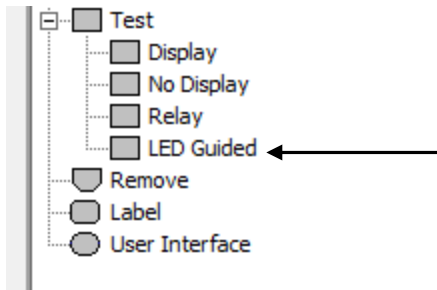
- Each wire bin LED must have an entry in the fixture blocks table.
- The fixture block name and pin name for the wire bin LED can be anything. In this example, all wire bin LEDs are associated with a fixture block named **BIN**. Each wire bin LED’s name is the wire name: **BIN-W1**, **BIN-W2**, and **BIN-W3**.

**3. Mandatory fixture block “X”**

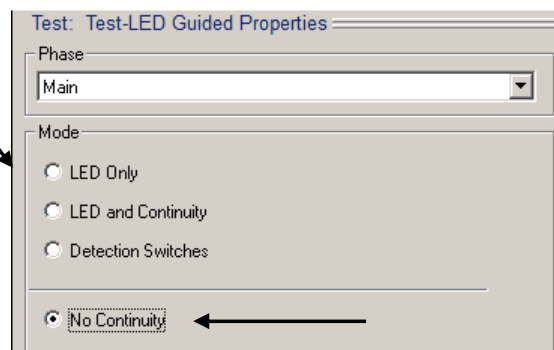
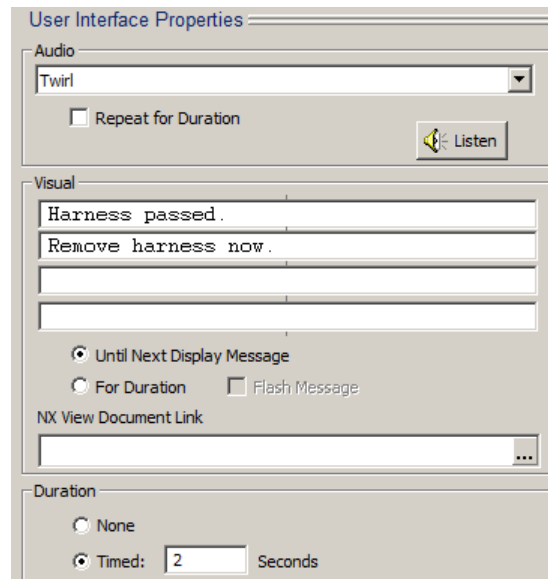
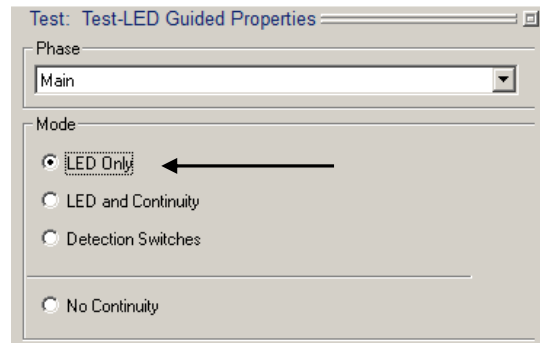
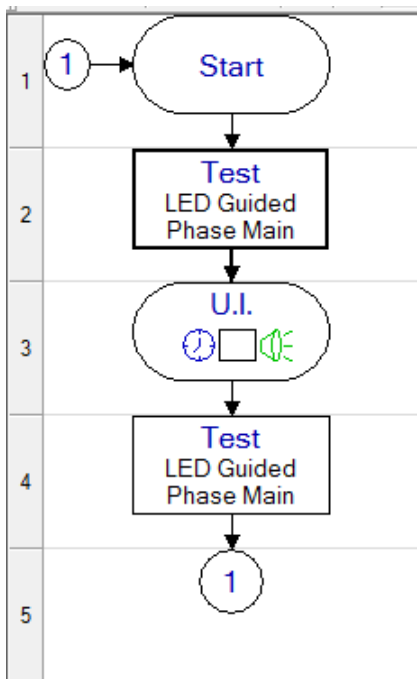
- A fixture block named **X** must be defined.
- Fixture block **X** must have one pin named **X**. This is a dummy connection point. Any unused test point can be assigned to **X-X**.

## Workflow

The **Test LED Guided** workflow item must be used for this application. Do not use Test-Display, Test-No Display, Test-Relay, or Remove workflow items for this application.



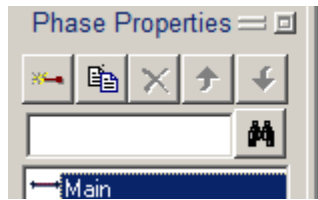
The workflow should contain the following cells:



Although the connections phase can have any name, it is suggested that the **Main** phase name be used for this application.

## Connections

**Before entering any connections data, make sure that the Workflow contains a Test-LED Guided workflow item that uses the same phase name. In this example, the selected phase is named Main. This suppresses the normal NX Editor connections grouping behavior.**



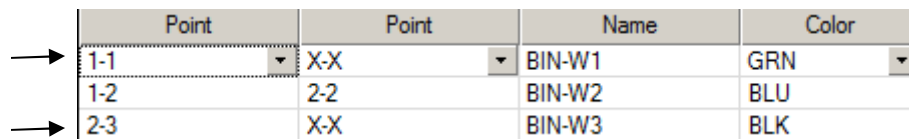
Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

Note: The rules governing the significance of entries in the Connections table are very different from that of a normal NX Editor application. These rules are explained below, and apply only to the LED Guided Assembly application.

- There are two types of entries in the Connections table for the LED Guided Assembly application:

- A wire that is terminated to a connector on one end and is unterminated on the other end.**

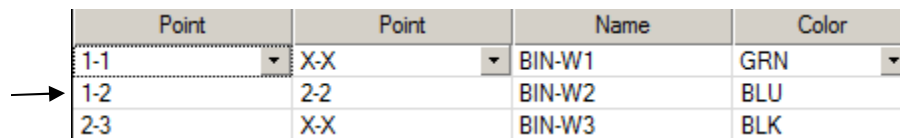
For this type of entry, the cavity LED point to which the wire is pinned is entered in the left-hand POINT column and X-X is entered in the right-hand column. In the example, there are two unterminated wires, W1 and W3:



Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

- A wire that is terminated to a connector on both ends**

The cavity LED point corresponding to the first cavity to which the wire is terminated is entered in the left-hand POINT column. The cavity LED point corresponding to the second cavity to which the wire is terminated is entered in the right-hand POINT column. In the example, there is one wire that is terminated on both ends, W2:



Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

- Wire bin LED connection points are entered in the Name field of the Connections table. In the example, there are 3 wire bin LEDs: BIN-W1, BIN-W2, and BIN-W3 .

Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK



The following explains each entry in the example's Connections table in further detail:

Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

- The following three LEDs are illuminated
  - Fixture block 1
  - Cavity 1 of fixture block 1
  - Wire bin BIN-W1
- The tester waits for closure of the detection switch associated with fixture block 1

Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

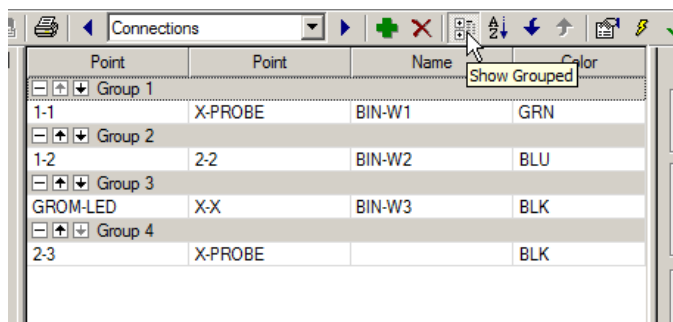
- The following three LEDs are illuminated
    - Fixture block 1
    - Cavity 2 of fixture block 1
    - Wire bin BIN-W2
  - The tester waits for closure of the detection switch associated with fixture block 1
  - After the detection switch closes, the three LEDs are turned off, and the following LEDs are illuminated:
    - Fixture block 2 (flashing)
    - Cavity 2 of fixture block 2
- The tester for closure of the detection switch associated with fixture block 2.

Point	Point	Name	Color
1-1	X-X	BIN-W1	GRN
1-2	2-2	BIN-W2	BLU
2-3	X-X	BIN-W3	BLK

- The following three LEDs are illuminated
  - Fixture block 2
  - Cavity 3 of fixture block 2
  - Wire bin W3
- The tester waits for closure of the detection switch associated with fixture block 2

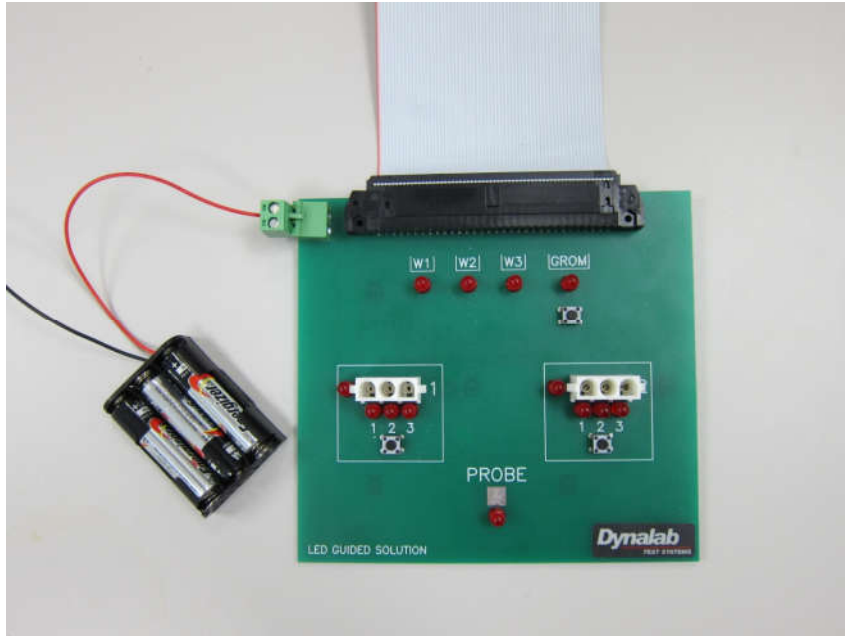
### Changing Assembly Order

To change the order of the operations described above, select "Show Grouped" mode, and then use the up and down arrows to change the order.



## Tutorial Board

The LED Guided Tutorial Board, part number 5-1091, is available from Dynalab Test Systems. It is designed to be compatible with the example scenario used in this document.



The LED Guided Tutorial Board has LEDs corresponding to wire bins W1, W2, W3 and parts bin GROM. A push detection switch is provided to emulate the grommet bin acknowledgment switch. Each fixture block is equipped with LEDs and a push switch to emulate the pull-test detection switch. A probe point and LED are also provided. The LEDs are battery powered. A battery holder is provided with the tutorial board. An interface cable is also provided that plugs into the NX Tester. Fixture block assignments are identical to the example scenario in this document.

To setup the board:

- Connect the red wire of the battery pack to the top connection point on the terminal block as shown above.
- Connect the black wire of the battery pack to the screw on the bottom of the NX Tester
- Connect the interface cable to slot 1 on the back of the NX Tester, with the red stripe facing to the right as viewed from the rear of the tester.

