

## **Application Note**

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### **LED DRIVER BOARD**

**Part Number 212-2001**

# LED Driver Board

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This document explains how to use the LED Driver Board and PASS 6.0 Software to enable the Analyzer to illuminate fixture-mounted LEDs for guided assembly.

This document includes the following main sections:

- 1 A list of assumptions – knowledge required to perform the tasks outlined in this document
- 2 A statement of the problem to be solved and the proposed solution
- 3 An overview of the Dynalab solution to the problem including example illustrations for programming the Analyzer to illuminate fixture-mounted LEDs for guided assembly.

## Assumptions

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

- Knowledge of how to build Netlists using PASS 6.0
- Knowledge of how to use the Sequence table to create a Sequence
- Knowledge of basic electrical wiring

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

## Problem

While a harness is being assembled, fixture-block-mounted LEDs should illuminate to guide the operator in connecting the wires.

## Solution

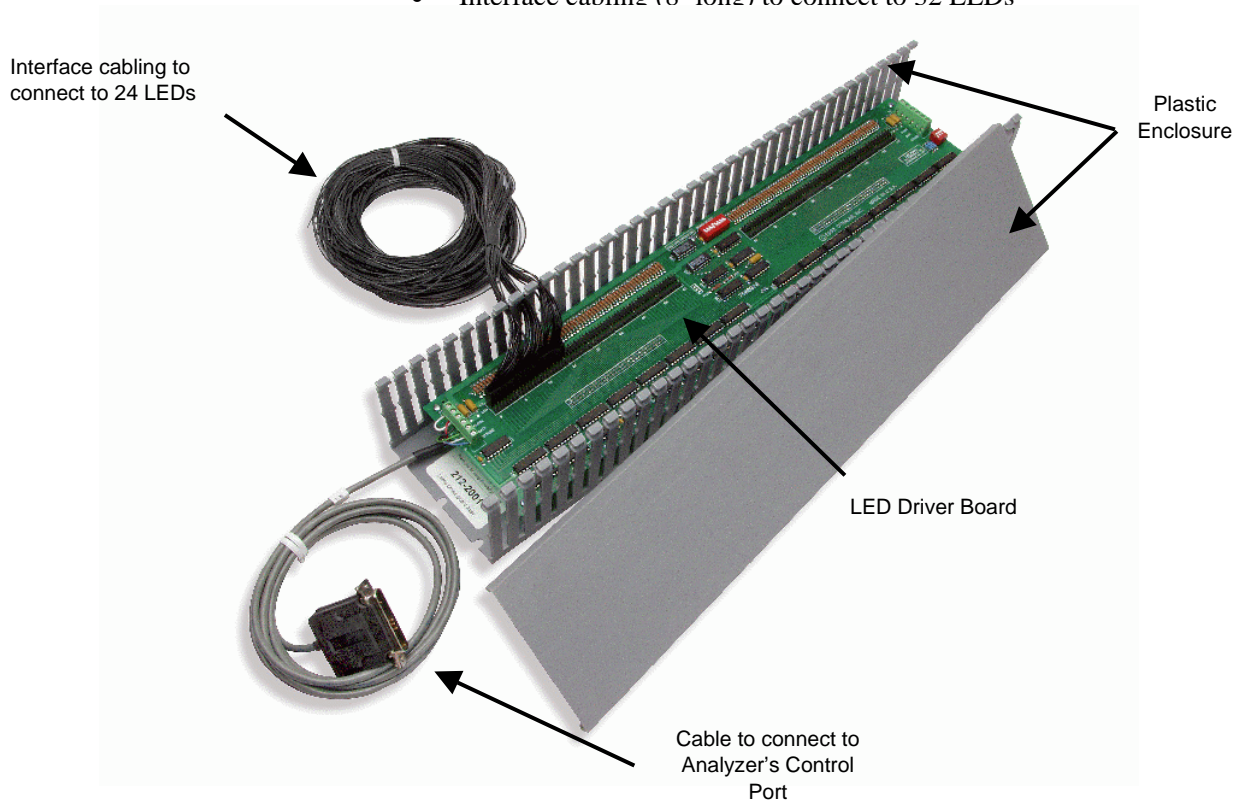
The Dynalab LED Driver Board is used to light fixture-block-mounted LEDs. Up to 128 LEDs can be lit with one LED Driver Board. Up to 8 LED Driver Boards can be cascaded to light 1028 LEDs. The LED Driver Board provides an interface between the XL Series Analyzer and the LEDs. Using PASS 6.0 software, the Analyzer can be programmed to cause the appropriate LEDs to light during the assembly process via the LED Driver Board(s).

## Solution Overview

### Product Description

The LED Driver Board, Part Number 212-2001, is provided as part of an assembly that consists of the following components:

- LED Driver Board
- Cable to connect to Analyzer's control port
- Interface cabling (8' long) to connect to 32 LEDs

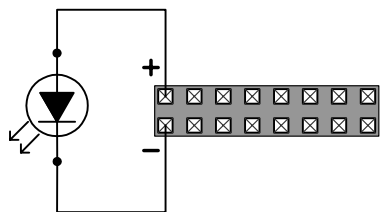
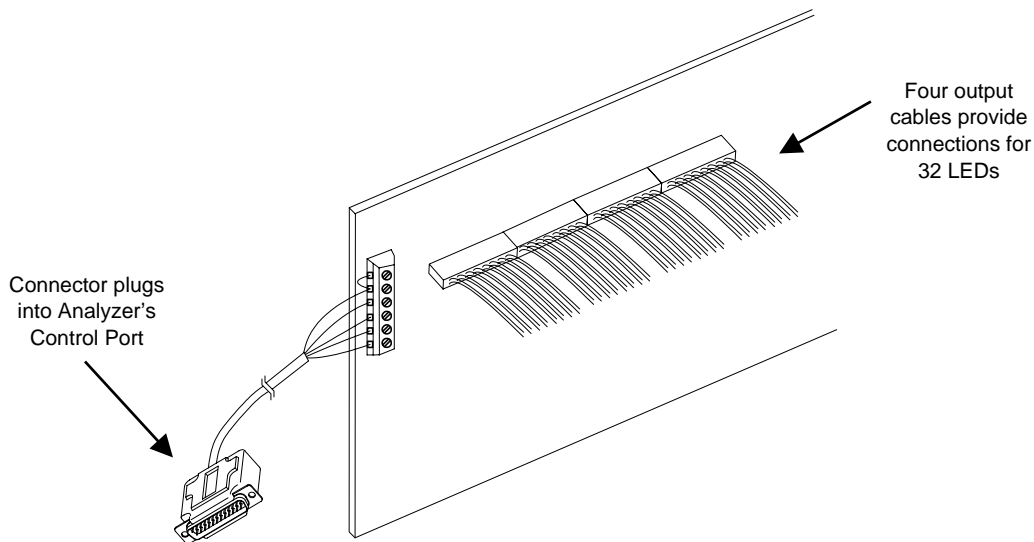


## Connections and Settings

### Single LED Driver Board

The control cable plugs into the Control Port in the back of the Analyzer.

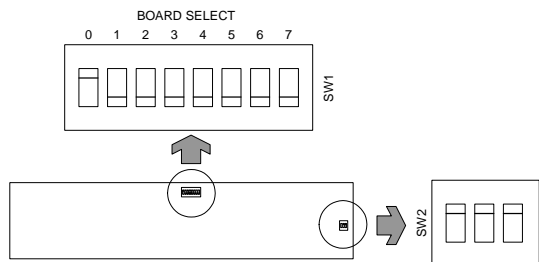
The board is equipped with 4 Output Cables, providing connections for 32 LEDs. Additional Output Cables may be ordered (Part Number 7100019). The LED Driver Board can accommodate up to 16 Output Cables to provide connections for 128 LEDs.



For each pair of wires that connects to an LED, the top wire connects to the positive (anode) side of the LED and the bottom wire connects to the negative (cathode) side of the LED as shown here.

The *negative* side of an LED lead is usually indicated in one of two ways: by the *flat side* of the bulb, or by the *shorter* of the two wires extending from the LED.

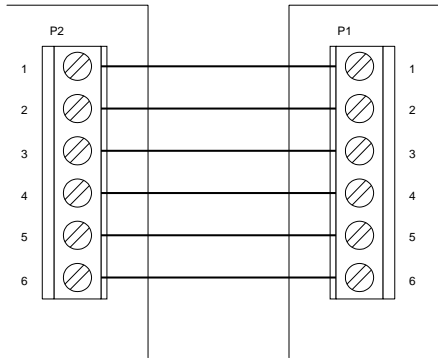
Two DIP switches are located on the LED Driver Board. An 8-position switch is located near the top center of the board. It is labeled SW1, BOARD SELECT. A 3-position switch is located at the right end of the board. It is labeled SW2.



When a single LED Driver Board is being used, these switches should be set as shown here. The 8-position switch should have position 0 set to ON, all other positions set to OFF. The 3-position switch should have all positions set to ON.

## Additional LED Driver Boards

If more than 128 LEDs need to be illuminated, additional boards can be connected. Each board adds the capability to light an additional 128 LEDs. Up to eight LED Driver Boards can be cascaded to light 1028 LEDs.

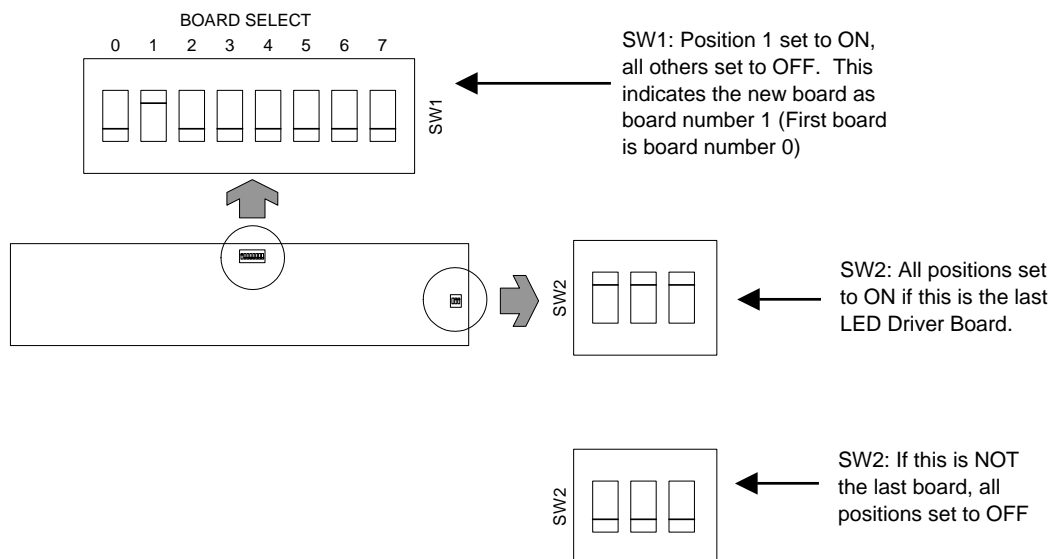


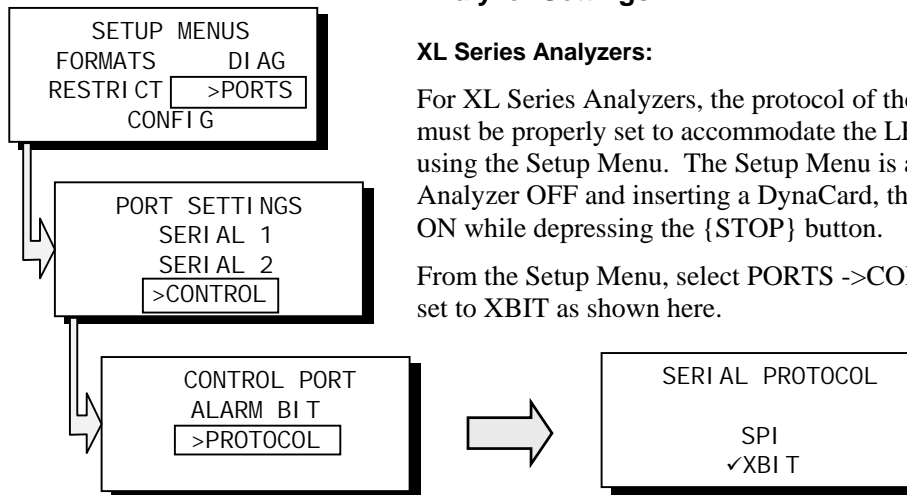
When adding an additional LED Driver Board, remove the Control Port Cable that is attached to P1. Connect P1 of the additional board to P2 of the previous board as shown at left. This configuration is repeated for each additional board for a maximum of 8 boards.

The DIP Switches SW1 and SW2 must also be properly set when adding an additional LED Driver Board. In general, SW1 should reflect the LED Driver Board number, starting with 0 and going to 7. So, the first board is board 0, the second is board 1, etc. SW1 should have the position corresponding to the board number set to the ON position. All others are set to OFF.

SW2 should have all positions set to ON only for the last LED Driver Board. For all other boards, all positions are set to OFF.

As an example, the second of two LED Driver Boards would have the DIP switches set as shown here:





## Analyzer Settings

### XL Series Analyzers:

For XL Series Analyzers, the protocol of the Analyzer's Control Port must be properly set to accommodate the LED Driver Board. This is done using the Setup Menu. The Setup Menu is accessed by turning the Analyzer OFF and inserting a DynaCard, then turning the Analyzer back ON while depressing the {STOP} button.

From the Setup Menu, select PORTS ->CONTROL->PROTOCOL and set to XBIT as shown here.

### Old 1024 Analyzers

For old style 1024's the PDC setting must be enabled in order to activate the LED Driver Board during a test scan and to automatically clear all LED Driver circuits under sequence control if the program is aborted. This setting is manually toggled from the CONFIGURATION MENU on the analyzer. The EPROM version must be 4.13 or later.

## Programming the Analyzer

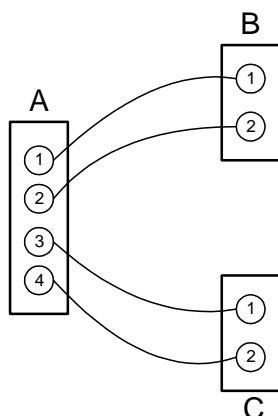
This section describes how to program the Analyzer to illuminate the proper fixture-block-mounted LEDs to guide the operator in assembling the harness. Two approaches are described:

- 1 One LED is associated with each connector
- 2 One LED is associated with each pin (each I/O point)

The following two sections describe each approach.

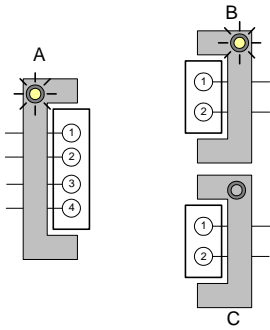
### Programming the Analyzer: One LED per connector

As an example, consider the following 3-connector harness:



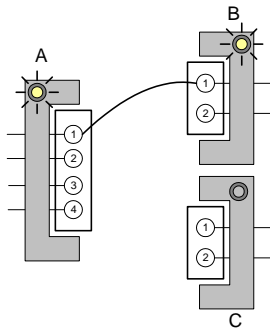
As this harness is being assembled, the Analyzer will show the next connection to be made on its display. At the same time, the Analyzer will use the LED Driver Board to cause the fixture-block-mounted LEDs to be lit that are associated with the connectors between which the wire is to be connected.

This is illustrated as follows:



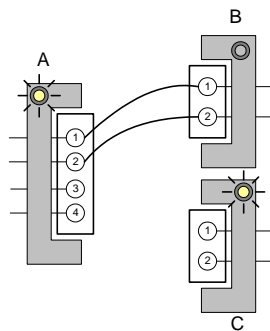
At the beginning of the test, the Analyzer displays the first connection to be made. The LEDs associated with Connector A and Connector B are lit.

OPEN  
A-1  
B-1



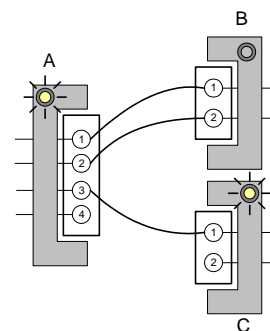
Operator installs the wire between Connector A - Pin 1 and Connector B - Pin 1. The Analyzer displays the next connection to be made. The LEDs associated with Connector A and Connector B are lit.

OPEN  
A-2  
B-2



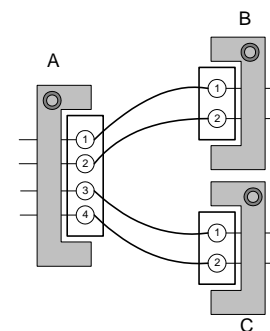
Operator installs wire between Connector A - Pin 2 and Connector B - Pin 2. The Analyzer displays the next connection to be made. The LEDs associated with Connector A and Connector C are lit.

OPEN  
A-3  
C-1



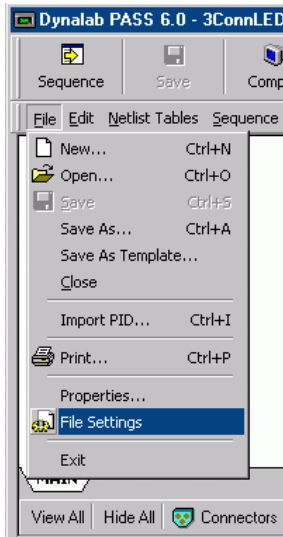
Operator installs wire between Connector A - Pin 3 and Connector C - Pin 1. The Analyzer displays the next connection to be made. The LEDs associated with Connector A and Connector C are lit.

OPEN  
A-4  
C-2

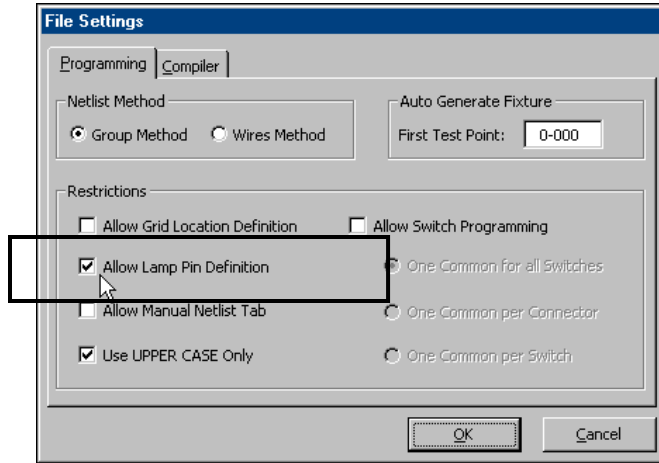


Operator installs wire between Connector A - Pin 4 and Connector C - Pin 2. The Analyzer displays a message indicating that harness is complete.

ASSEMBLY OK



To program the Analyzer to light one LED per connector as illustrated in the previous example, select **File->File Settings**. This will present the File Settings window as shown below. Select “Allow Lamp Pin Definition” by clicking the checkbox.



Connectors				
Add	Ins	Del	Next F5	Find
Connector	Pins Qty	Lamp Board	Lamp Point	
A	4	0	0	
B	2	0	1	
C	2	0	2	

The Connectors Table will now have two additional fields: *Lamp Board* and *Lamp Point* as shown at left. These two additional fields allow for the association of one LED per Connector. For each connector, simply enter the LED Driver Board number and connection point number.

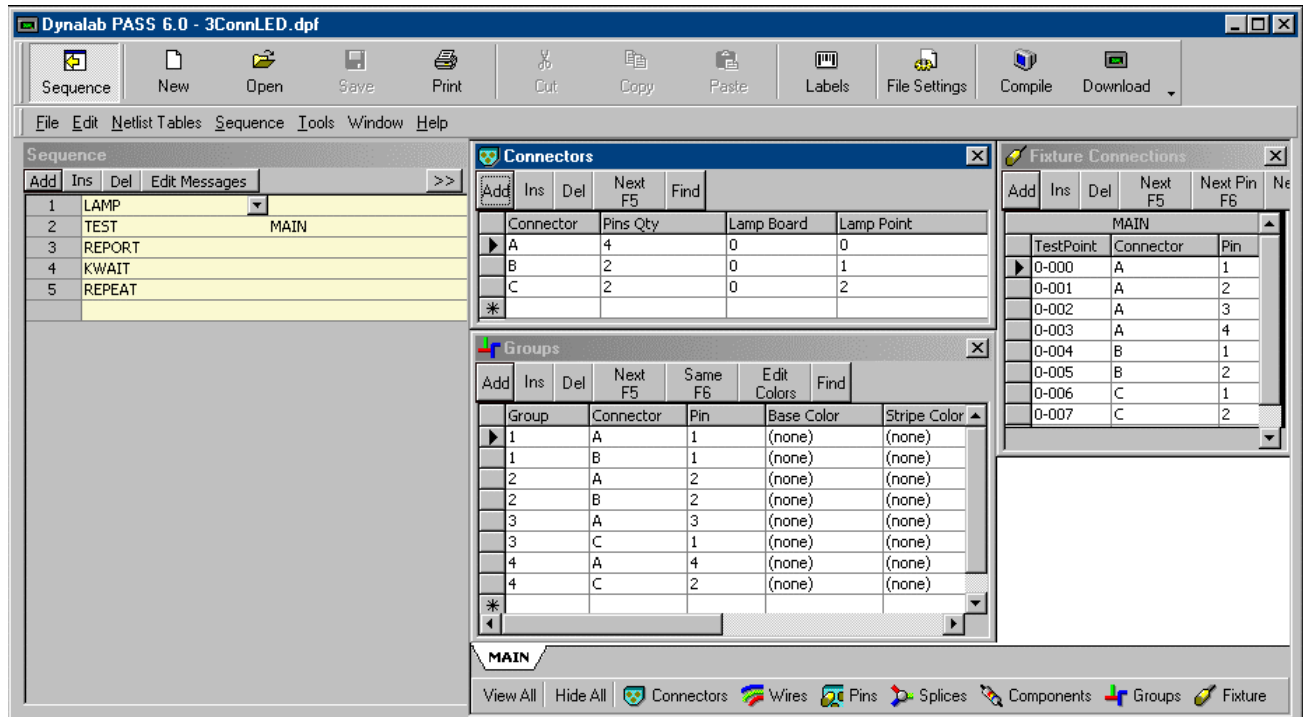
In this example, the LED Driver Board is board number 0. Lamp Point 0 is associated with Connector A, Lamp Point 1 with Connector B, and Lamp Point 2 with Connector C. These LED Driver Board connection points must be wired to the fixture mounted LEDs in accordance with this table.

Sequence			
Add	Ins	Del	Edit Messages
1	LAMP		
2	TEST		MAIN
3	LAMPOFF		
4	REPORT		
5	KWAIT		
6	REPEAT		

The Sequence table must also be modified to include the LAMP Sequence item. The LAMP Sequence item places the Analyzer in a mode that automatically lights LEDs matching either Connectors or Test Points with errors using the Dynalab LED Driver Board. LAMPOFF is the companion Sequence item that disables this feature. The example at left shows the Default Sequence with the addition of the LAMP and LAMPOFF Sequence items.

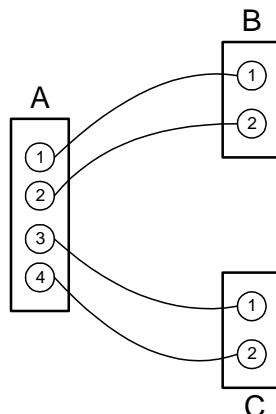


The complete PASS program is shown here:



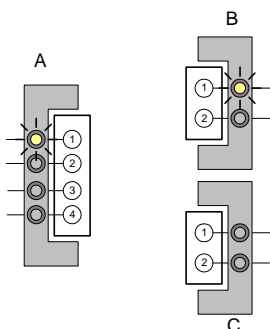
### Programming the Analyzer: One LED per PIN

The previous example showed how to program the Analyzer to illuminate one LED per connector. Using the same example harness, this section shows how to program the Analyzer to illuminate one LED per I/O point.



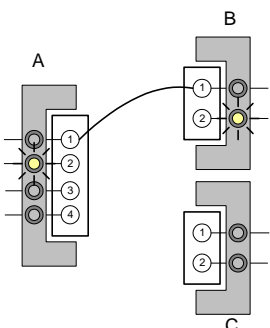
As this harness is being assembled, the Analyzer will show the next connection to be made on its display. At the same time, the Analyzer will use the LED Driver Board to cause the fixture-block-mounted LEDs to be lit that are associated with the connectors and pins between which the wire is to be connected.

This is illustrated as follows



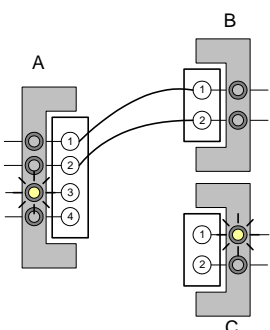
At the beginning of the test, the Analyzer displays the first connection to be made. The LEDs associated with Connector A – Pin 1 and Connector B – Pin 1 are lit.

OPEN  
A-1  
B-1



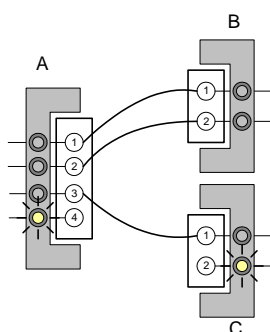
Operator installs the wire between Connector A - Pin 1 and Connector B - Pin 1. The Analyzer displays the next connection to be made. The LEDs associated with Connector A – Pin 2 and Connector B – Pin 2 are lit.

OPEN  
A-2  
B-2



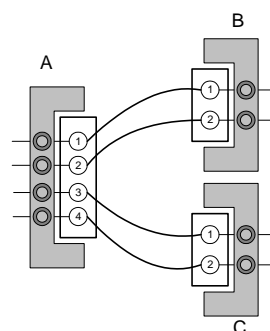
Operator installs wire between Connector A – Pin 2 and Connector B – Pin 2. The Analyzer displays the next connection to be made. The LEDs associated with Connector A – Pin 3 and Connector C – Pin 1 are lit.

OPEN  
A-3  
C-1



Operator installs wire between Connector A – Pin 3 and Connector C – Pin 1. The Analyzer displays the next connection to be made. The LEDs associated with Connector A – Pin 4 and Connector C – Pin 2 are lit.

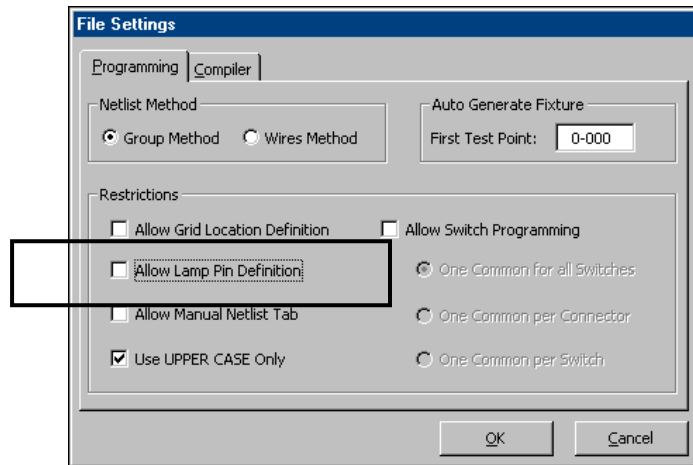
OPEN  
A-4  
C-2



Operator installs wire between Connector A – Pin 4 and Connector C – Pin 2. The Analyzer displays a message indicating that harness is complete.

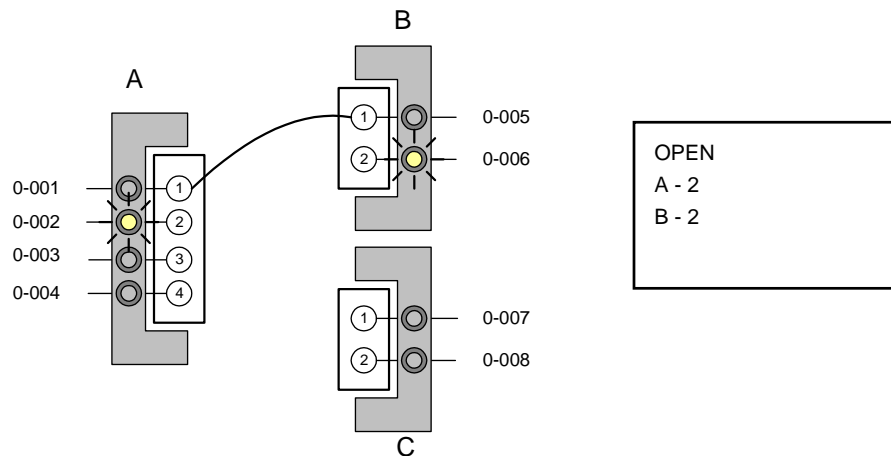
ASSEMBLY OK

To program the Analyzer to light one LED per I/O point, the same approach is used as in the previous example. The PASS program for this example is identical to the one in the previous example except the “Allow Lamp Pin Definition” box is NOT checked in the Files Settings Window:



When an error condition is encountered, the Analyzer will light the LEDs whose addresses are identical to the addresses of the two test points that constitute the end points of the circuit in error.

For instance, in the example harness when the Analyzer display indicates that there is an OPEN between Connector A – Pin 2 and Connector B – Pin 2 it lights the LEDs associated with these two points as shown below.



Note that the addresses of the two test points associated with the error are 0-002 and 0-006. The Analyzer will light the LEDs whose addresses are also 0-002 and 0-006. These are the LEDs that are connected to LED Driver Board 0, points 2 and 6. So, when wiring the fixture mounted LEDs, it is important to make sure that each LED is wired to an LED Driver Board with the same address as the associated test point.

## Activating Devices Under Sequence Control

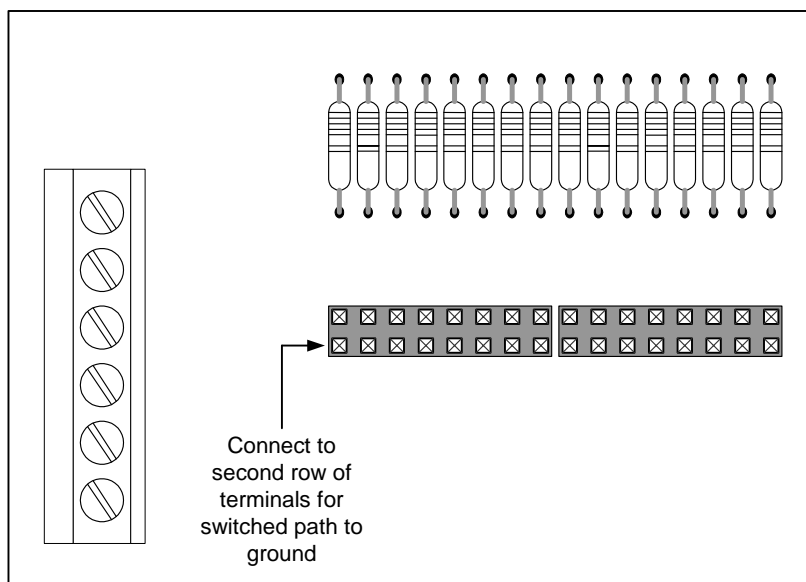
Although the LED Driver Board was designed to light fixture-mounted LEDs for guided assembly, it is possible to use the LED Driver Board to activate devices under Sequence control.

Each point on the LED Driver Board may be individually turned on or off with the XBSET or XBCLEAR Sequence items. Additionally, all devices may be turned off with the XCLEAR Sequence item.

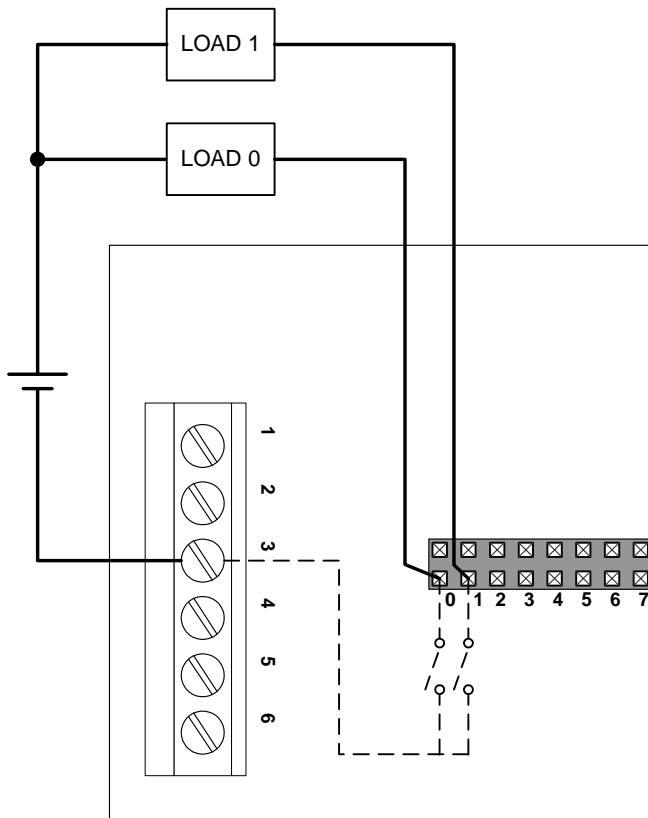
XBSET and XBCLEAR require a parameter whose value is in the range of 0-1023. The parameter represents the point to be turned on or off. If there is only one LED Driver Board, then there are 124 output points numbered 0-123. If there are two boards, then the 124 output points of the second board are numbered 124-247. If there are three boards, the output points of the third board are numbered 248-371, etc.

When using the LED Driver Board to activate external devices, only one terminal is used for each output point. The output terminals in the second row are used to provide switched paths to ground as shown in the diagram below.

Power for the device to be controlled must be externally provided and cannot exceed 24 VDC. The maximum current per circuit is 0.5 amps (2 amps total maximum per group of 8 points).



The diagram below illustrates how an external power supply and loads are connected to the output terminals of the LED Driver Board. In this example, one LOAD is connected to terminal 0, and the other is connected to terminal 1.



In the program Sequence:

- XBSET 0 switches LOAD 0 ON
- XBCLEAR 0 switches LOAD 0 OFF
- XBSET 1 switches LOAD 1 ON
- XBCLEAR 1 switches LOAD 1 OFF

## Analyzer / LED Driver Board Interface

The LED Driver Board is interfaced with the analyzer through the control port. The pin configuration is given in the table below.

Control Port (DB25)	LED Driver Board (Terminal Strip)	Wire Color
n/a	Pin 1, Device Power *	
Pin 13	Pin 2, +5	RED
Pin 15	Pin 3, Common Ground	BLACK
Pin 7	Pin 4, Clock	GREEN
Pin 8	Pin 5, Data	WHITE
Pin 9	Pin 6, Strobe	BLUE

- ◆ Place a jumper between pins 1 and 2 of the LED Driver Board if the devices to be controlled are 5v and a maximum of 1 amp.