

A Manual Tester Designed for Final Production

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Introduction

This article discusses the use and design of a Production Manual Tester. The simplest form of such a tester replicates the testing used to verify the initial engineering design to produce a production tester. Such a tester solidifies the testing done to verify and validate the original design.

The drawbacks of such a device are the lack of sufficient control of the testing itself. This manual tester approach often misses some of the elements that need to be tested in the product. Also, such a tester has lots of manual setting of test equipment and interpretation of the results. As such, it can be VERY slow to perform by the Operator.

Also, such a testing style doesn't produce a good quality trace of the testing performed. It also often takes a rather highly skilled person to perform the test making each test performed rather costly. Slow speed and expensive skill requirements can result in higher test costs if product volume rises much above even 10 units per month. This approach requires minimal production tester development, and as such, is very low cost to develop.

Reasons for selecting this approach

Such a test approach is warranted if the UUT (Unit Under Test) has very few inputs and outputs. In this case, the production tester can consist of more rugged connectors to interface to the UUT for quick setup and tear down. The connectors make fixed connections to the needed test equipment, perhaps along with a simple switch matrix to connect inputs and outputs. A tester of this type often consists of special cables with "connector savers" that interface directly to the UUT to keep them reliable with lots of use.

The main feature that dictates that the tester is a manual one is the Operator's requirement to set up the tests, then read and interpret the results. Such human intervention in the testing process risks a higher level of error and inaccuracies that can produce significant test accuracy errors. These errors by the Operator lower the quality of the test's results.

After the final product hardware design is completed, a written procedure is necessary to guide the testing personnel to complete a production manual tester. This procedure consists of a written, step-by-step sequence to guide the person performing the test. Manual test results are written on paper checklists or blank procedure spaces to record

measured data. These are collected in a special notebook so that they might be referred to later for quality control purposes.

A more advanced version of a manual tester that solves some of the drawbacks of this previous type of manual testing can be designed by a test engineer. It is beneficial for testing multiple but similar UUTs. Such a tester is discussed in the next section of this article.

Description of an Example Manual Tester

This example tester was designed to meet the needs of a specific client. It was designed to test four different Boards that have a maximum production rate of 15 per month. The boards utilize optoisolators with many I/O channels. It also has some miscellaneous analog circuitry on all boards.

A special test box was designed to minimize the overall cost. The box contains a universal set of input signals, output signals, and a 27 by 3 array of DPDT matrix switches. This tester arrangement allowed for the connection of all points via a universal set of four 36 pin connectors. After this, a custom I/O interface board was designed to perform the custom pin swapping from the universal connectors to the UUT connectors.

Operator readouts were done via two auto-ranging DVMS, one monitoring input current or voltage and one measuring output current or voltage.

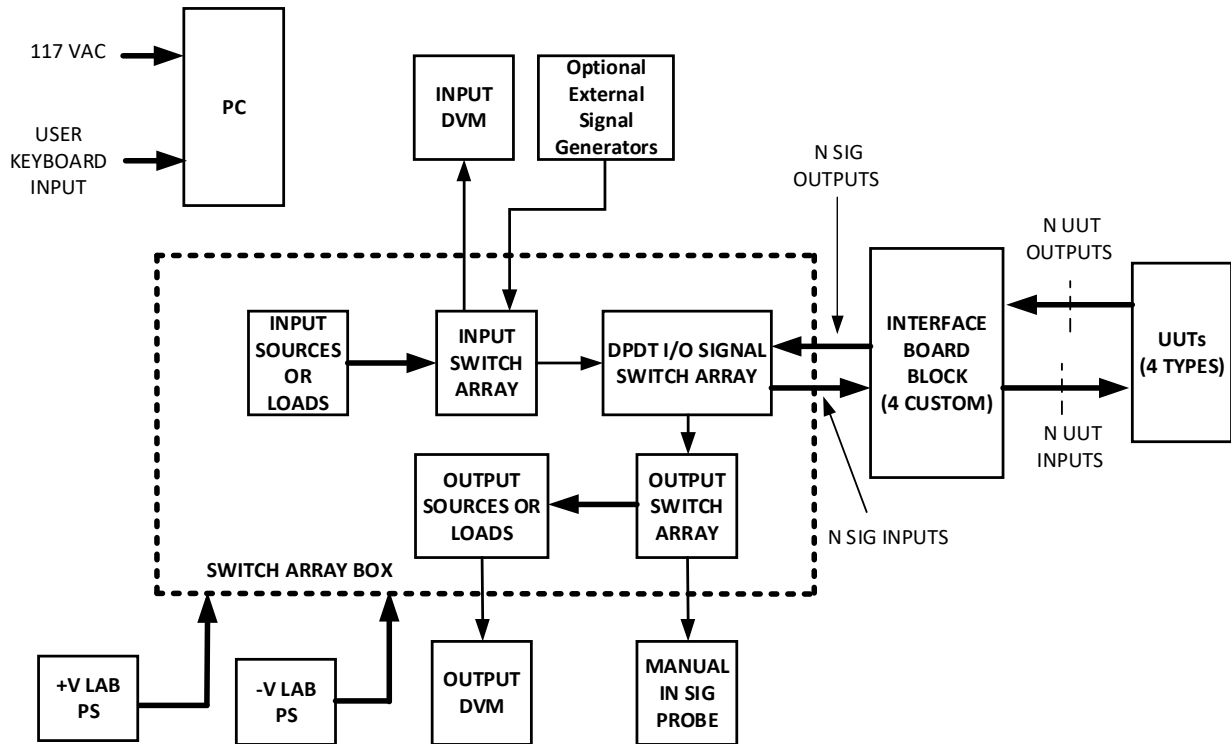
A standardized test procedure facilitated the testing via a unique piece of software that guided the testing. This software allows the Operator to indicate pass or fail. A unique input text file was generated to guide test steps. This input text file utilizes a small set of script commands to serve as the procedure. The test results are then recorded in an archival output file for later review.

Manual Tester Block Diagram

The block diagram below illustrates the system interconnections at the block diagram level. Note that it contains several switch arrays inside the switch array box. There is an input array to select voltage, current, or load sources. These are switched into a bus on the one common side of a DPDT switch array. The DPDT array also controls an output array that is common to the Output / Load switch array. Throwing a switch connects the common bus input or output line to both one input and one output simultaneously.

These, in turn, connect to a set of grouped input connectors and a set of output connectors. The input/output connectors connect into a pin for a pin-compatible set of similar connectors on the custom interface card connector. The interface card connects these connectors to the appropriate connectors on the UUT.

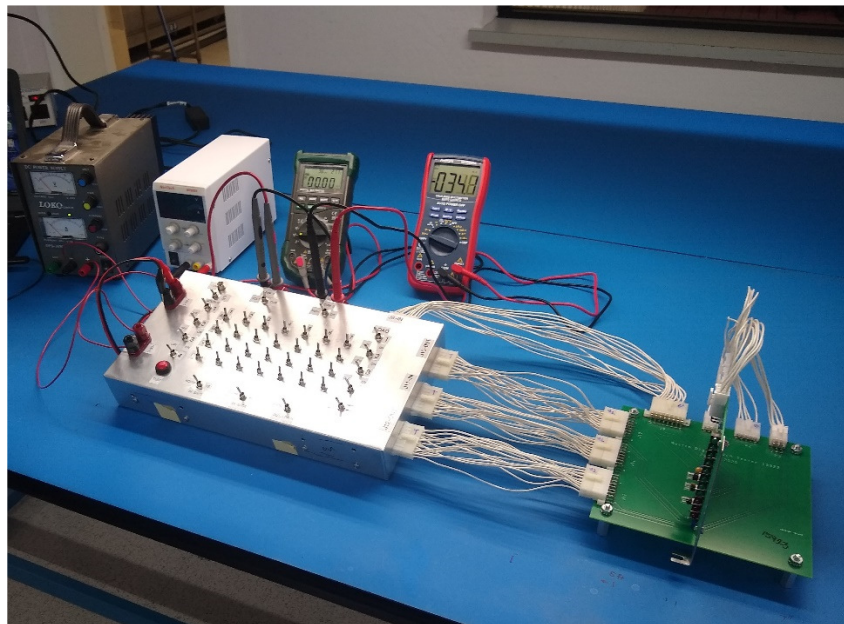
The user selects a switch to a specific input and output to place the input signal into the UUT and route the output signals from the appropriate output. These inputs and outputs are then routed via the UUT interface card to the appropriate pins on the UUT.



**OVERALL MANUAL TESTER BLOCK DIAGRAM
CARL ANGOTTI – 4/5/2021**

Illustration of the UUT under Test

A picture of the actual UUT PCB assembly under test using the actual tester is shown below.



Manual Testing the UUT

The unit under test sequence using a Universal Basic test code executable is described here. Testing is accomplished utilizing a unique PC test control program. The test process is described in this section.

When the program starts, the program opens a window on the PCB. The program requests the name of the Operator and the PCB serial number on the PC screen.

After this, PCB testing proceeds by opening an input text file. Test instructions are presented to the Operator, and the results appear on the PCB monitor. They are presented with the Pass/Fail criteria. The Operator then checks the results on the two DVMs and responds to the test pass/fail status. This response is then recorded on an output test archive file. After this, the subsequent instructions are presented, and the process continues until all of the tests are completed.

A snippet of the output file follows a snippet of the input test code for the PCB.

Input Test Code Snippet

The snippet below illustrates the form of the Input file commands from the text file that controls the program via the PC executable. It illustrates the simplicity of entering tests to the Operator for manual testing. This text file is the formalized Test Procedure that the Test Engineer creates. The code is broken into Sections (Groups) that can be skipped by the Operator if desired to advance more quickly to a particular set of tests.

To make the input text more understandable, comments were added to the actual procedure file. These comments appear in the snipped example below just to the right of the "<<." Note: A complete set test script commands is available by emailing carl@angotti.com.

```
'4/7/21 - InputFile3 Open          << Printed Comment to Operator
' *****
' Start Formal Board Testing
' All Tests Do Not Use Com Port
' *****
CC Check to see if ComPort is Open << "CC" is a Special Test Sometimes
                                Required to support testing
' *****
'Test the XY 16880 Board
'Uses a Semi-Automatic Manual Test Approach
C To Continue Press Enter          << "C" Stops testing to allow user to read
                                instructions before going on
' *****
# Section 1 Input Current Limit Tests << "#" is the Start of a Test Section
                                of a series of Tests
' *****
'Use the Test Setup in Appendix 3 of the
'Test XY 16880 Procedure
? Is the Testing Setup OK?         << "?" Asks a Question of the Operator
' *****
# Section 2
' *****
```

```

'Check PS1 Current Limit per
'test procedure
'Adjust Voltage to +12 V
? Is Current limit 150 to 180 mA?
' >>>>>>>>
'Test PS2 Current Limit per
'test procedure
'Adjust Voltage to +12 V
? Is Current limit 150 to 180 mA?
'*****
# Section 2
'*****
'+45V LED Test OK?
?
'*****
# Section 3
'*****
'-12 V LED Tests OK?
? Is the Test Result OK?
'+5V PWR Tests OK?
? Is the Test Result OK?
'+12 V PWR LED Tests OK?
? Is the Test Result OK?
' +12V T & V PWR Tests
? Is the Test Result OK?
.
.                                     >> Intermediate Tests in the procedure
.
'*****
# Section 7 END OF TAPE SENSOR Tests
'*****
'END OF TAPE SENSOR Tests #1 OK?
? Is the Test Result OK?
'END OF TAPE SENSOR Tests #2 OK?
? Is the Test Result OK?
'END OF TAPE SENSOR Tests #3 OK?
? Is the Test Result OK?
'END OF TAPE SENSOR Tests #4 OK?
? Is the Test Result OK?
@ Test 25
'End of Testing - Available commands are:
' P(rev) - Run Previous Test << Messages to Test Operator
'Y(es) Finish Testing this UUT
'N(o) Finish testing this UUT (not recommended)
?
'
/ >>>> END TESTING THIS UUT <<<<<< << "/" indicates the End of Testing

```

Output Test Code Snippet

The snippet below illustrates the form of the Output (Archival) file generated by the PC executable from the input file as testing proceeds. It illustrates what such a file might look like in practice during manual testing.

Again, to make the input text more understandable, comments were added to the actual procedure file. These comments appear in the snipped example below just to the right of the "<<."

