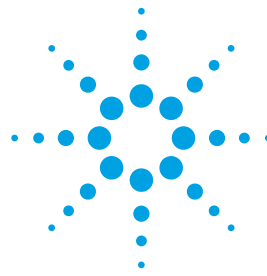


Testplan Development on CVI Labwindows with TS-5400 PXI Series



Application Note

This application note provides set-up guidelines to start developing your testplan on CVI Labwindows using the Agilent U8972A TS-5400 PXI Series functional test system.

1. Summary

The Agilent U8972A TS-5400 PXI Series high performance functional test system is designed to work seamlessly with the Agilent TestExec SL test executive software. Having instruments that are IVI-COM, GPIB or LXI compliant in the test system allow other third party test executives such as CVI LabWindows to be used. This application note will guide users on the fundamental steps required to start developing a test plan using CVI Labwindows on the TS-5400 PXI Series. It provides a comprehensive reference list of drivers and other important files that are required to ensure a successful test plan development.

2. Introduction to the Agilent U8972A TS-5400 PXI Series Functional Test System

The Agilent U8972A TS-5400 PXI Series functional tester is a PXI-based system that is specifically designed for high pin count automotive test applications. The U8972A is designed to work seamlessly with the Agilent TestExec SL test executive. It is also versatile enough to be used with other test executives due to the availability of software libraries, drivers and all related documentations. Figure 1 illustrates a high level block diagram of the test system and its major components.

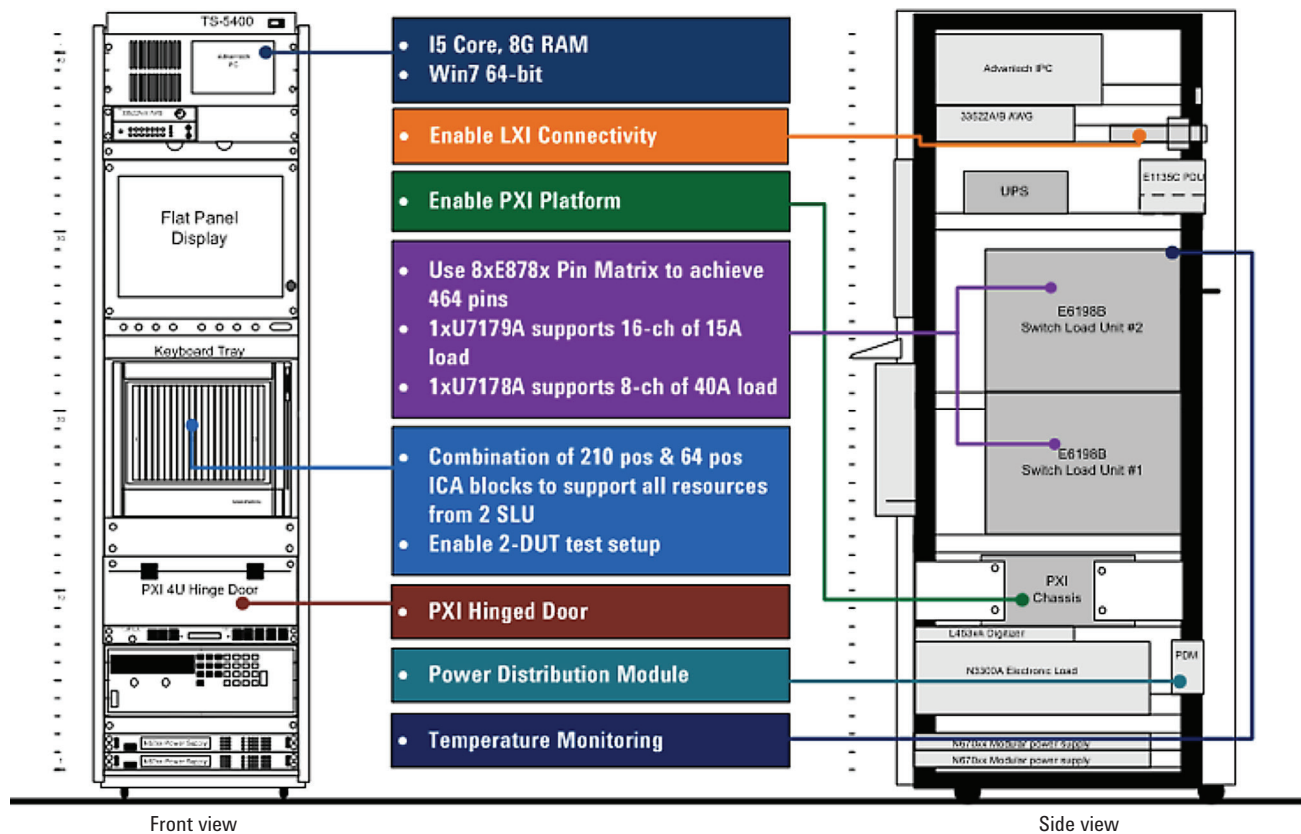


Figure 1. Composition of the U8972A TS-5400 PXI Series functional test system



The unique feature inside the U8972A that differentiates it from the rest of the rack and stack functional test systems in the market is the E6198B switch/load unit (SLU). The Agilent SLU utilizes a standard VERSA Module Eurocard (VME) type enclosure to deliver best-in-class switching solution for mechatronic tests. With the Agilent TS-5000 family of multi-channel load and switch matrix cards, users have the software controlled ability to switch stimulus or measurement signals of up to 2 A and loads of up to 40 A.

This application note will guide CVI Labwindow users on the steps required to integrate the SLU into the Labwindows testplan, providing references on how to integrate the GPIB as well as PXI measurement and stimulus instruments that are available in the U8972A system.

Table 1 shows the protocol available to each of instrument available on the U8972A system.

	Test Instrument in the U8972A System	PXI	LXI	GPIB	USB	
Power supply	N6702A 1.2 kW high power modules (400 W max) or N6700B low Power modules (1200 W Max) mainframe with support of the following modules: DC Power Module N6752A - High Performance, 50 V, 10 A, 100 W DC Power Module N6762A - Precision, 50 V, 3 A, 100 W DC Power Module N6756A – 60 V, 17 A, 500 W		√			
	DC Power Supply N5764A – 20 V, 76 A, 1520 W		√			
	DC Power Supply N5765A – 30 V, 50 A, 1500 W		√			
	DC Power Supply N6972A - 40 V, 50 A, 2000 W		√			
	DC Power Supply N6971A - 20 V, 100 A, 2 kW		√			
	DC Power Supply N6952A - 40 V, 25 A, 1000 W		√			
	Electronic load	Electronic load main frame N3300A - 1.8 KW max with support of the following modules: Electronic load module N3302A – 150 W; 0-60 V 30 A Electronic load module N3304A – 300 W; 0-60 V 60 A			√	
		Source and Measurement	PXI DMM M9182A - 6.5 Digit	√		
PXI DMM M9183A - 6.5 Digit enhanced performance			√			
PXI Isolated V/I Source M9186A – 3 W 100 V single channel	√					
PXI Isolated DAC M9185A – 8/16 channels	√					
PXI High Voltage DAQ M9216A - 32-channel 250 KS/S 16-BIT 100 V Input	√					
PXA7224 arbitrary waveform generator	√					
PXD7314 high speed digitizer	√					
LXI ARB 33522B, 30 MHz; 2 channels			√			
LXI Digitizer L4532A, 20 MS/S; 16-BIT 2-channel			√			
LXI Digitizer L4534A, 20 MS/S; 16-BIT 4-channel			√			
Switch/Load Unit	E6198B 21 slots SLU chassis with support for the following cards: E8782A SLU pin card with 24 instrument, 40 x 4 measurement matrix E8783A SLU pin card with 64 x 4 measurement matrix N9378A, E6177A, U7177A 24-channel load cards N9379A 48 channel load card N9377A, E6176A and U7179A 16-channel load cards E6175A, E6178B and U7178A 8-channel load cards				√	

Table 1. Communication interface for each instrument in the U8972A TS-5400 PXI Series Functional Test System

All the drivers for the instruments configured in the U8972A are available from Agilent’s website: www.agilent.com. The installer for the respective instruments drivers for the U8972A system can be downloaded from the locations specified in Appendix A.

It is strongly advised that the latest drivers are downloaded into the system prior to test plan development.

3. Getting started – installing the instrument drivers

Prior to writing the testplan, test developers will need to install the latest drivers for the respective instrument that is configured in the U8972A system.

a. IVI drivers

IVI drivers are used by the majority of the instruments in the U8972A with the exception of the E6198B SLU and the N3300 Series electronic load unit. All the IVI drivers can be downloaded from the Agilent website at www.agilent.com/find/drivers.

b. USB driver

USB is only used for the E6198B SLU. The QuickUSB installer is available from the SLU installation CD and should be installed prior to developing the test plan in CVI LabWindow.

c. GPIB driver

The N3300A Series Electronic load units in the U8972A use GPIB communication. The GPIB driver is already built in to the CVI Labwindows environment and no external driver needs to be installed.

4. Header, library and dll files

After installing the drivers, test developers need to link the respective instrument header, library and DLL files to the CVI LabWindows test plan. List of header, library and DLL files for each instrument in the U8972A can be referenced from Appendix B.

The default path of the header files for the instruments in the U8972A are as follows:

d. IVI drivers

- For instruments that have IVI drivers i.e. all the instruments listed under ‘Power Supply’ and ‘Source and Measurement’, the location of IVI drivers is typically at ‘<default installation path>\IVI Foundation\ivi’
- The header files (*.h) for IVI drivers are typically located at ‘<default installation path>\IVI Foundation\ivi\Include’
- The library files (*.h) for IVI drivers are typically located at ‘<default installation path>\IVI Foundation\ivi\Lib\msc’ for 32-bit system and ‘<default installation path>\IVI Foundation\ivi\Lib_x64\msc’ for 64-bit system
- The dll files (*.h) for IVI drivers are typically at ‘<default installation path>\IVI Foundation\ivi\Bin’

Note: The default installation path is typically C:\Program Files\ for 32-bit system and C:\Program Files (x86)\ for 64-bit system.

Test developers can then add the front panel from the respective IVI instrument’s driver path, typically located at ‘<default installation path>\IVI Foundation\IVI\Drivers\<instrument folder>’ to access the function library directly from the ‘Library Tree’ window in CVI Labwindows, as shown in Figure 2.

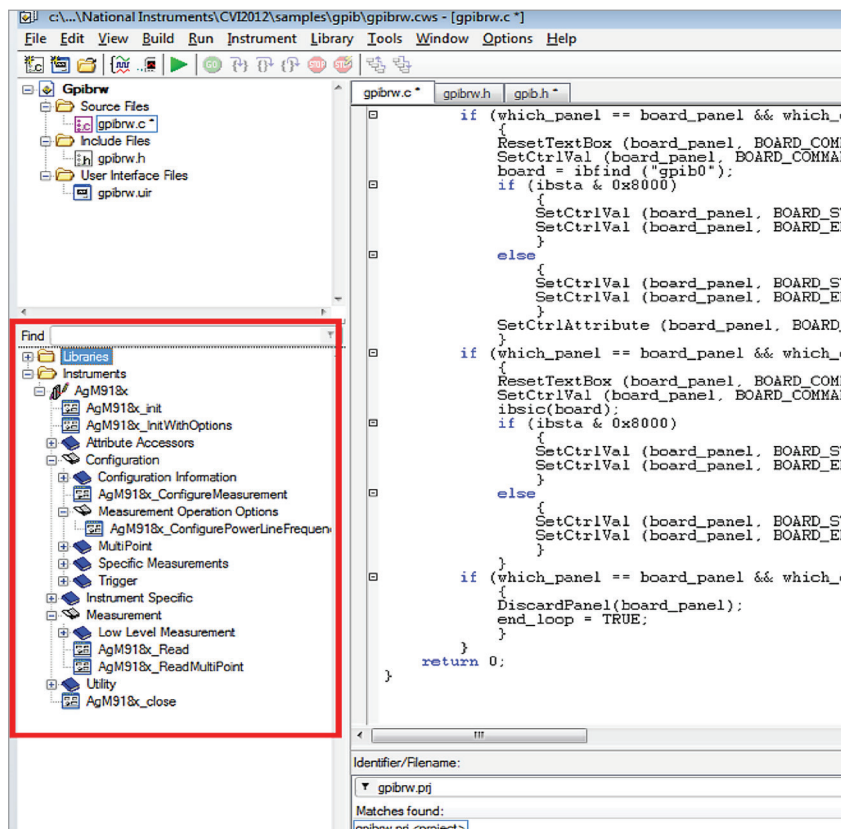


Figure 2: Instrument function panel in CVI LabWindows

e E6198B SLU driver

The driver for the Agilent E6198B switch/load unit (SLU) can be downloaded from www.agilent.com/find/SLU

f. GPIB drivers

- The location of the header file is within the CVI Labwindows folder and is typically located at <default installation path>\National Instruments\CVI2012\include
- The location of the library file is within the CVI Labwindows folder and is typically located at <default installation path>\National Instruments\CVI2012\extlib\msvc for 32-bit system and <default installation path>\National Instruments\CVI2012\extlib\msvc64 for 64-bit system

Note: The default installation path is typically *C:\Program Files* for 32-bit system and *C:\Program Files (x86)* for 64-bit system.

Accessing the front panel library directly from the 'Library Tree' window in CVI Labwindows is shown in Figure 3.

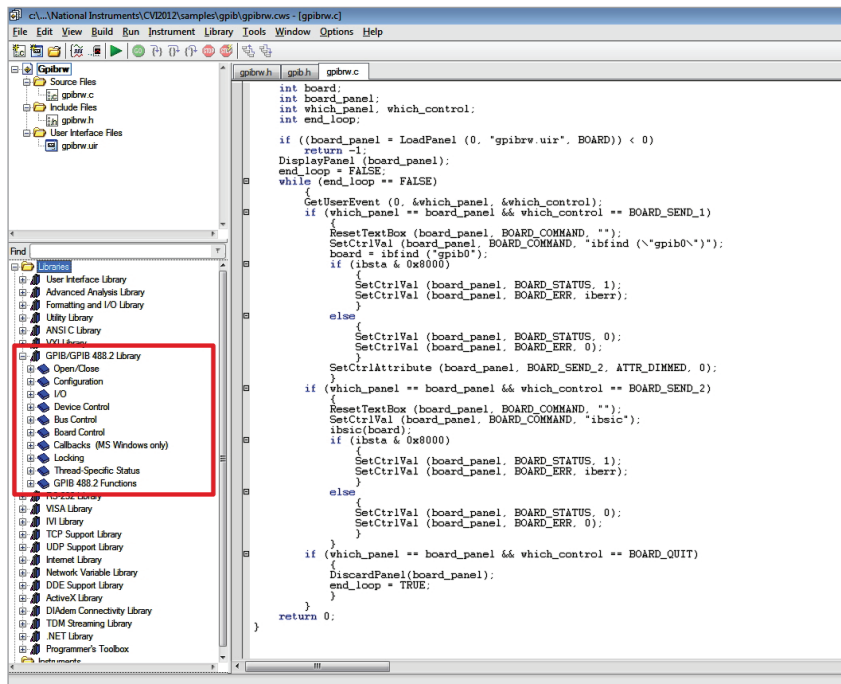


Figure 3. GPIB panel library in CVI LabWindows

5. Documentation and references to instrument functions

The documentation and references for functions to control each instrument are available after the respective instrument drivers have been installed.

g. IVI driver documentations

For instruments that can be interfaced with the IVI driver, test developers can refer to the documentation file that comes with the respective IVI driver installer. An example for the location of the M918x DMM documentation is shown in Figure 4.

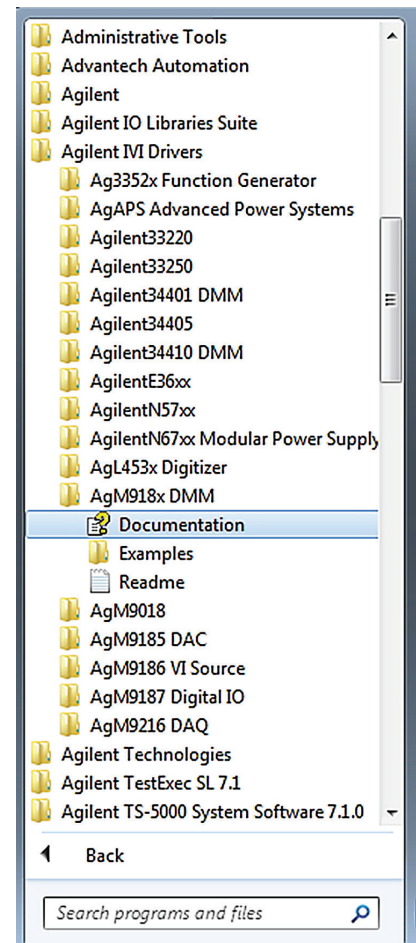


Figure 4. Location of documentation for IVI drivers

Figure 5 shows an example of an IVI-C driver documentation for the 34410 DMM.

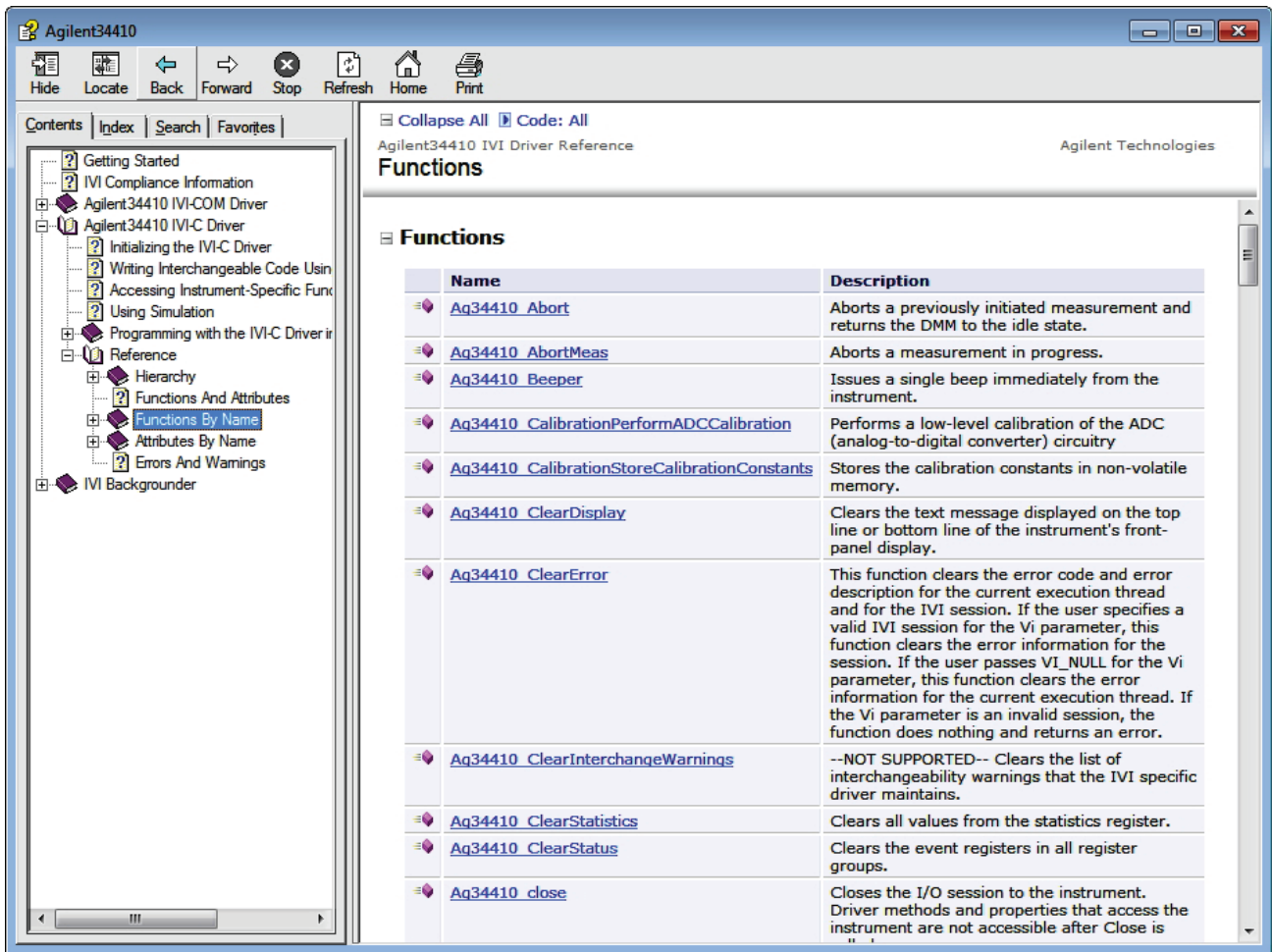


Figure 5: Example of documentation for IVI-C driver

h. SLU driver documentations

Download from www.agilent.com/find/SLU
 All functions of the SLU is documented in the 'SLU Generic API definition.docx' file.

i. GPIB driver documentations

The SCPI programming reference is available at the following link: <http://cp.literature.agilent.com/litweb/pdf/5964-8198.pdf>

6. Sample CVI LabWindows testplan

Test developers can download a sample of the CVI LabWindows test plan that is developed for the U8972A from Agilent.com website.

This test plan was developed from the 'atedemo.cws' example test plan in CVI LabWindows. Figure 6 shows the location of the sample test plan.

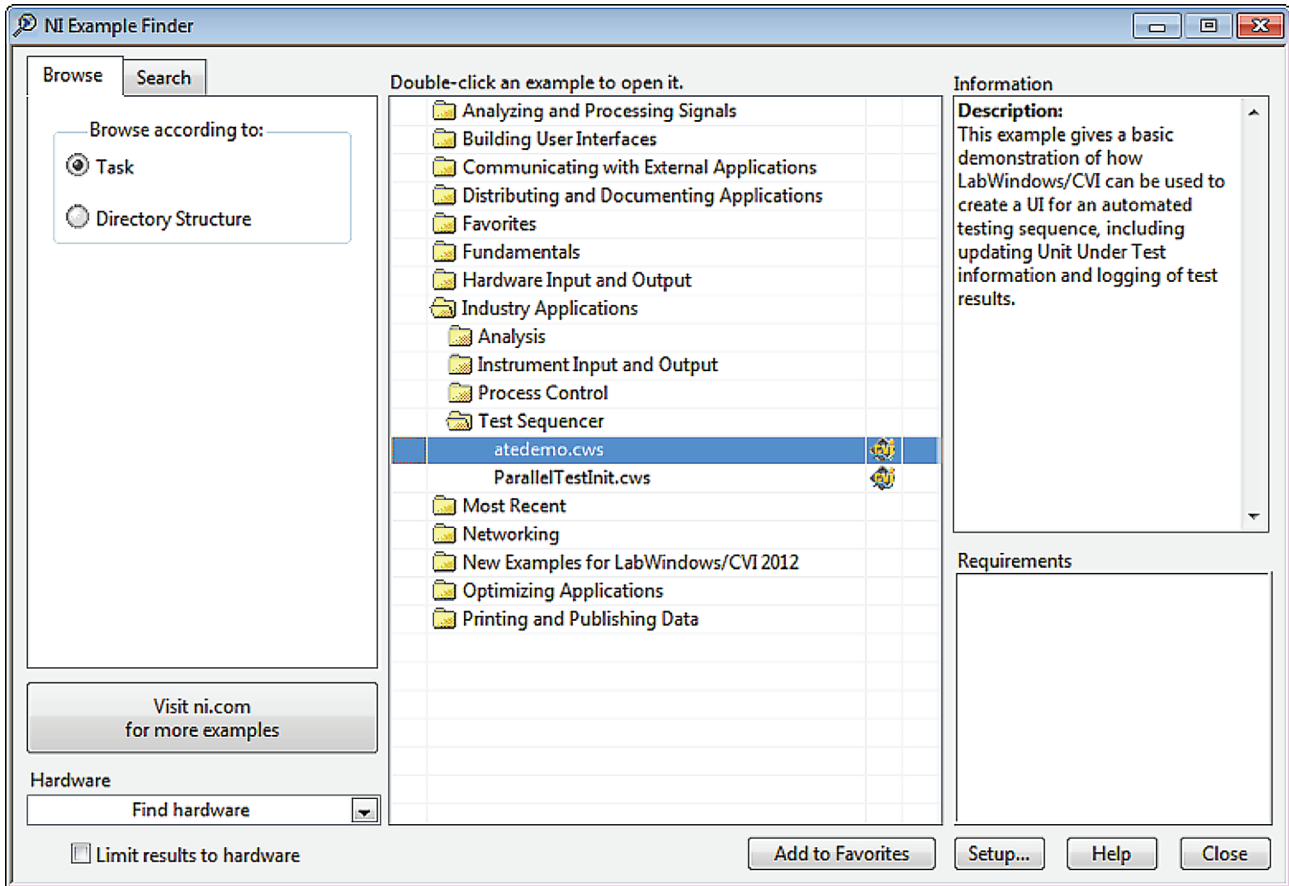


Figure 6. Location of the atedemo.cws testplan in CVI LabWindows

It incorporates all the necessary header files required to control the instruments in the test system (refer to table 2 for the list of instruments). In the test plan there is a basic sequence of tests that does the following:

1. Global reset.
 - a. Resets all instrument in the test system
2. Power on the device under test or DUT (figure 7)
 - a. Switch channel 1 and channel 2 on the E6176A 16-channel high current SLU load card in slot 2 to power bus 1 (PB1) and 2 (PB2) respectively. In this example, the PB1 is connected to ground while PB2 is connected to a N6752A high performance DC power supply module.
 - b. Sets the N6752A to supply 12 V at 3 A.

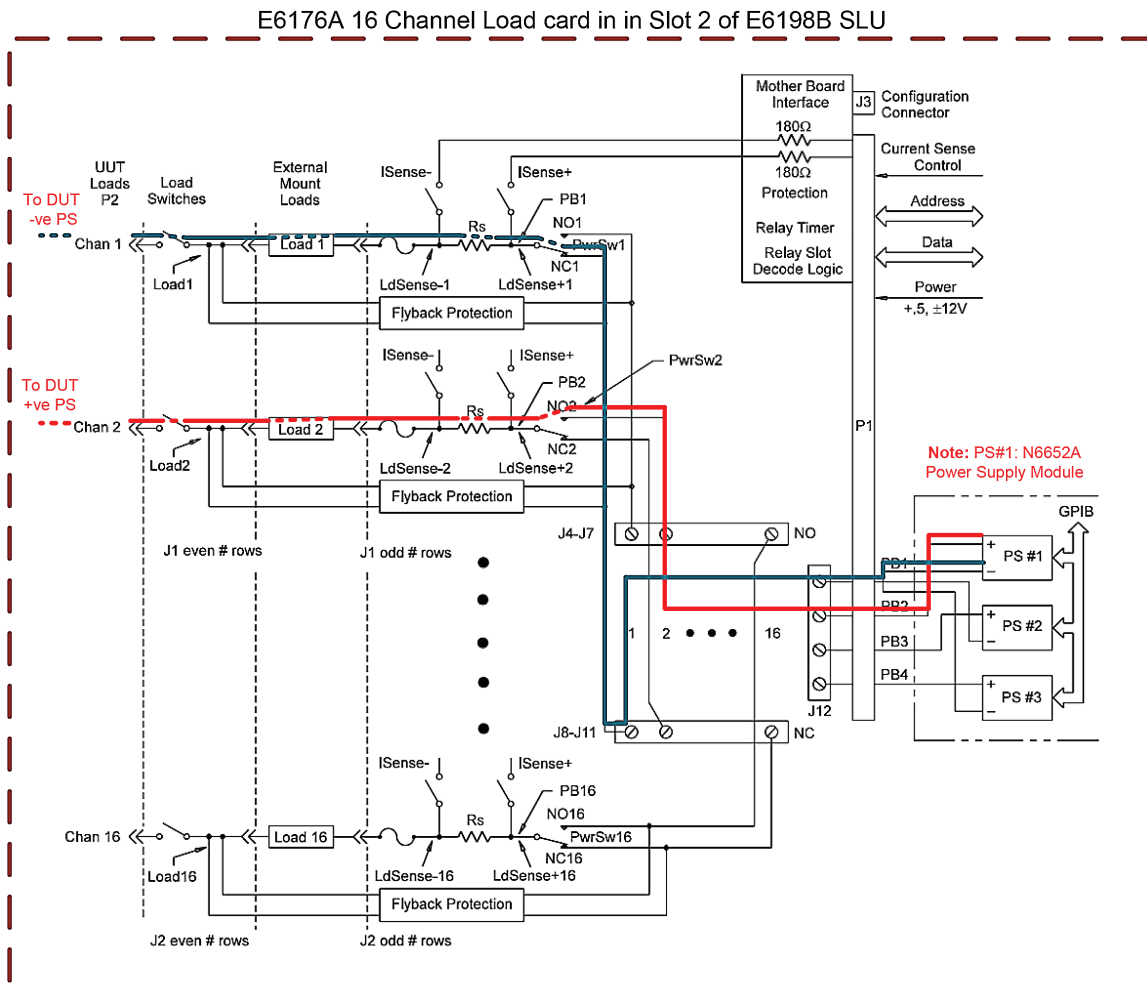
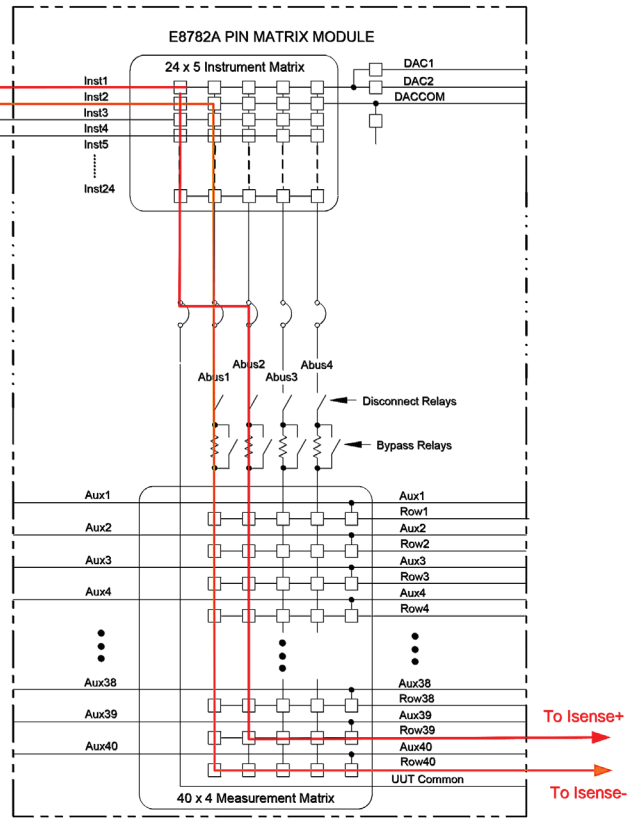


Figure 7. Switching path from power supply to DUT via the E6176A load card

3. Measures the current across PIN 2 of DUT connected to channel 2 of the E6176A load card (Figure 8)
 - a. Switches the instrument matrix relay of the E8792A Pin Matrix SLU Card so tha the M918A DMM is now connected to ABus1 (DMM Lo) and Abus2 (DMM Hi).
 - b. Switches the measurement matrix relay of the E8792A pin matrix SLU card so that channel 2 cur rent senses (Isense +/-) of the E6176A load card in slot 2 are now connected to ABus1 and Abus2 respectively.
 - c. Instruct the M9183A DMM to measure the voltage across channel 2 Isense lines of the E6176A load card.
 - d. Calculate the current by using the value of the shunt resistor in between the Isense lines of the E6176A Load Card at 0.05 Ω .
 - e. Undo all relay connections done in step `a` and `b` above.



E6176A 16 Channel Load card in in Slot 2 of E6198B SLU

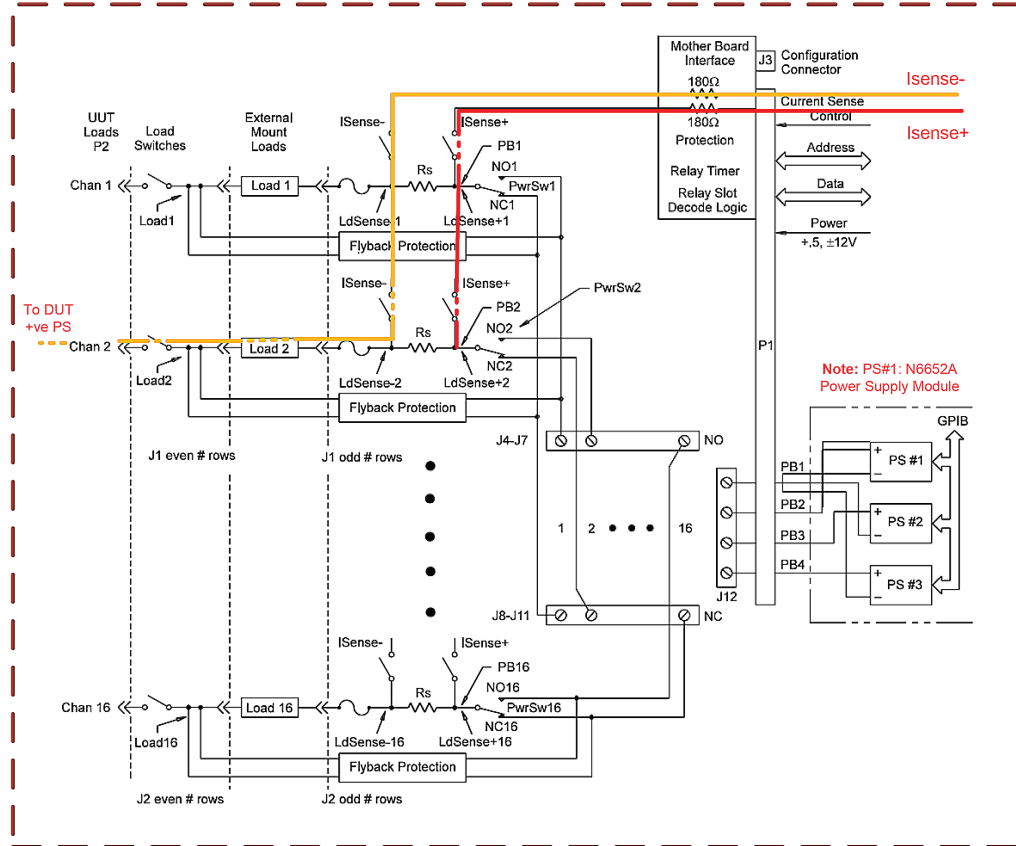


Figure 8: Switching path for DMM voltage measurement to measure current across PIN 2 of the DUT

Conclusion

The U8972A consists of a number of Agilent test and measurement instruments and all these instruments are designed to be compatible across different test executives. Agilent TestExec SL test executive is the recommended test executive to be used in the U8972A. As this guide has shown, other third party test executives such as CVI Labwindows could easily be used in place of TestExec SL. Agilent is the global leader in test and measurement and

our instruments are designed to be compatible across multiple platforms, providing options to users to select the test executive that best fit their preference. Developing test plan on CVI Labwindows is code intensive and requires deep understanding on how each instrument is to be programmed. As such, it is imperative that the software environment is set up correctly to enable the user to start developing the test plan on the U8972A immediately.

Appendix A: Download links of instrument driver installers for the Venturi Series III system

	Test Instrument in Venturi Series III System	Location of instrument driver
Power supply	N6702A 1.2kW High Power modules (400W Max) or N6700B Low Power modules (1200W Max) mainframe with support of the following modules: DC Power Module N6752A - High Performance, 50V, 10A, 100W DC Power Module N6762A - Precision, 50V, 3A, 100W DC Power Module N6756A - 60V, 17A, 500W	Link: N67xx Modular Power Supply IVI and MATLAB Instrument Drivers
	DC Power Supply N5764A - 20V, 76A, 1520W DC Power Supply N5765A - 30V, 50A, 1500W	Link: N57xx, N87xx DC Power Supply IVI and MATLAB Instrument Drivers
	DC Power Supply N6972A - 40 V, 50 A, 2000 W DC Power Supply N6971A - 20 V, 100 A, 2kW DC Power Supply N6952A - 40 V, 25 A, 1000 W	Link: Advanced Power System N6900 and N7900 Series IVI and MATLAB Instrument Drivers
Electronic load	Electronic load main frame N3300A - 1.8 KW max with support of the following modules: Electronic load module N3302A - 150W 0-60V 30A Electronic load module N3304A - 300W 0-60V 60A	Link: VXIPlug&Play Driver for N330xA Load Mainframes
Source and Measurement	PXI DMM M9182A - 6.5 Digit PXI DMM M9183A - 6.5 Digit Enhanced Performance	Link: M918x PXI Digital Multimeter Instrument Drivers
	PXI Isolated V/I Source M9186A - 3W 100V Single Channel	Link: M9186A Voltage/Current Source Instrument Drivers
	PXI Isolated DAC M9185A – 8/16-Channels	Link: M9185A PXI 8/16-Channel Isolated D/A Converter Instrument Drivers
	PXI High Voltage DAQ M9216A - 32-Channel 250KS/S 16-BIT 100V Input	Link: M9216A PXI 32-channel High Voltage Data Acquisition Instrument Drivers
	LXI ARB 33522B, 30 MHZ 2-Channels	Link: 335XX Function / Arbitrary Waveform Generator IVI and MATLAB Instrument Drivers
Switch/Load Unit	LXI Digitizer L4532A, 20 MS/S 16-BIT 2-Channels LXI Digitizer L4534A, 20 MS/S 16-BIT 4-Channels	Link: L453X Digitizers IVI and MATLAB Instrument Drivers
	E6198B 21 slots SLU chassis with support for the following cards: E8782A SLU Pin Card with 24 instrument , 40x4 measurement matrix E8783A SLU Pin Card with 64x4 measurement matrix N9378A, E6177A, U7177A 24 channel load cards N9379A 48 channel load card N9377A, E6176A and U7179A 16 channel load cards E6175A, E6178B and U7178A 8 channel load cards	Available on the SLU installation CD

Table 2: Communication interface for each instrument in Venturi Series III

Appendix B: Download links of instrument driver installers for the Venturi Series III system

	Test Instrument in Venturi Series III System	header files (*.h)	Library file	DLL file
Power supply	N6702A 1.2kW High Power modules (400W Max) or N6700B Low Power modules (1200W Max) mainframe with support of the following modules: DC Power Module N6752A - High Performance, 50V, 10A, 100W DC Power Module N6762A - Precision, 50V, 3A, 100W DC Power Module N6756A - 60V, 17A, 500W	AgN67xx.h	AgN67xx.lib	AgN67xx.dll
	DC Power Supply N5764A - 20V, 76A, 1520W DC Power Supply N5765A - 30V, 50A, 1500W	AgN57xx.h	AgN57xx.lib	AgN57xx.dll
	DC Power Supply N6972A - 40 V, 50 A, 2000 W DC Power Supply N6971A - 20 V, 100 A, 2kW DC Power Supply N6952A - 40 V, 25 A, 1000 W	AgAPS.h	AgAPS.lib	AgAPS.dll
Electronic load	Electronic load main frame N3300A - 1.8 KW max with support of the following modules: Electronic load module N3302A - 150W 0-60V 30A Electronic load module N3304A - 300W 0-60V 60A	gpib.h	gpib.lib	NA
Source and Measurement	PXI DMM M9182A - 6.5 Digit	AgM918x.h	AgM918x.lib	AgM918x.dll
	PXI DMM M9183A - 6.5 Digit Enhanced Performance			
	PXI Isolated V/I Source M9186A - 3W 100V Single Channel	AgM9186A.h	AgM9186A.lib	AgM9186A.dll
	PXI Isolated DAC M9185A – 8/16-Channels	AgM9185.h	AgM9185.lib	AgM9185.dll
	PXI High Voltage DAQ M9216A - 32-Channel 250KS/S 16-BIT 100V Input	AgM9216A.h	AgM9216A.lib	AgM9216A.h
	LXI ARB 33522B, 30 MHZ 2-Channels	Ag3352x.h	Ag3352x.lib	Ag3352x.dll
	LXI Digitizer L4532A, 20 MS/S 16-BIT 2-Channels	AgL453x.h	AgL453x.lib	AgL453x.dll
Switch/Load Unit	LXI Digitizer L4534A, 20 MS/S 16-BIT 4-Channels			
	E6198B 21 slots SLU chassis with support for the following cards: E8782A SLU Pin Card with 24 instrument , 40x4 measurement matrix E8783A SLU Pin Card with 64x4 measurement matrix N9378A, E6177A, U7177A 24 channel load cards N9379A 48 channel load card N9377A, E6176A and U7179A 16 channel load cards E6175A, E6178B and U7178A 8 channel load cards	Slu.h SluDef.h	AgilentSwitch LoadUnit.lib	AgilentSwitch LoadUnit.dll

Table 3. Header, library and DLL files for each instrument in Venturi Series III

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