# Keysight Technologies Accelerate Program Development using Keysight Command Expert with Microsoft Visual Studio

Application Note

Active Instruments	Welcome to Keysight Command Exp	ert		
None	A faster and easier way to program instruments			
My Instruments				
18-slot PXIe Chassis	Quick Start		Examples	
3352XA	Create an instrument		SCPI 33210_FunctionArbGe	enerator_Linea 🖄
34401A	Create an offline instrument		SCPI 33220_FunctionArbGe	nerator_Linea
3441X	View Command Expert help		SCPI 3441x_DigitalMultime	ter_Triggered
90000A	View Command Expert tutorials		SCPI 34980_MultifunctionS	witch_Trigger
DMM			SCPI 663xx_PowerSupplyFa	imily_OutputS
DSO5054A	Recent Sequences		SCPI 66xxx_PowerSupplyFa	mily_OutputS
FGEN	C:\Expert\Examples\Scpi\Command Expert\InfiniiVi	ision_6000Series_ScreenCapture.iseq	SCPI 8113x_PulseGenerator	r_OutputSqua
MSO6000 Series	C:\Examples\Scpi\Command Expert\34980_Multifu	nctionSwitch_TriggeredMeasure.iseq 💷	SCPI E4360_ModularSolarA	rraySimulator
MSO6032A	C:\\Examples\Scpi\Command Expert\InfiniiVision_6	i000Series_WaveformDownload.iseq	SCPI E5071_ENA_NetworkA	nalyzer_Peak
	C:\deborah\Deborah\TSO Feb2010\Mojo\Infiniivis	sion_5000Series_ScreenCapture.iseq	SCPI ESG_Family_StepSwee	p.
New Instrument	C:\t\Examples\Scpi\Command Expert\3441x Digita	IMultimeter Triggered Measure.iseg 🗵	SCPI Infiniium_90000ASerie	es_Waveform 😒
0	Name: Untitled	Description: No description v	unt .	
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Status I	nstrument Co	ode	Results	
1				
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## Introduction

# Keysight Command Expert for fast and easy instrument control!

Keysight Technologies, Inc. Command Expert is a FREE software application that provides fast and easy instrument control in many PC application environments. Command Expert combines instrument command sets, command sequences, documentation, syntax checking, and command execution in one simple interface. Command Expert helps you to:

- Find instrument commands
- Access command documentation
- Verify command syntax
- Build instrument command sequences
- Execute instrument command sequences
- Integrate sequences into the Visual Studio, Excel, LabVIEW, MATLAB, Keysight VEE, or Keysight SystemVue PC application environment
- Generate code for command sequences in Visual C#, VisualBasic.NET, Visual C/C++, and MATLAB
- Profile command execution time
- Debug command sequences using breakpoints and single-stepping
- Generate SCPI.NET for use in Visual Studio

Instrument command sets are available for instruments that use Standard Commands for Programmable Instrumentation (SCPI) or IVI-COM drivers.

# This application note contains two main sections:

- Command Expert Basics Introduces you to the Command Expert user interface and shows an example sequence.
- Command Expert in the Visual Studio Environment
   Describes how to generate code for use in Visual Studio projects and how to use SCPI.NET drivers in Visual Studio.

### Command Expert Basics

This section describes how to download, install, and start Command Expert, and uses an example sequence to show the features of the Command Expert user interface.



Figure 1. Command Expert and Visual Studio Integration

### Downloading and Installing Command Expert



Figure 2. Command Expert Icon

You can download Command Expert from www.keysight.com/find/commandexpert.

After downloading, click **Run** in the installer window and follow the instructions on your screen.

#### Additional required software

Be sure to install Keysight IO Libraries Suite to find and communicate with instruments. You can download Keysight IO Libraries Suite from **www.keysight.com/find/iosuite**.

#### **Visual Studio Versions Supported**

Command Expert can be used with Visual Studio 2005, Visual Studio 2008, or Visual Studio 2010.

### Starting Command Expert

#### Click Start > All Programs > Keysight Command Expert > Keysight Command Expert.

The Command Expert opening window (Welcome Window) is shown below.

Command Expert comes with a number of preconfigured examples for popular instruments. The installation software installs an example instrument named *N6700* that provides the commands for the Keysight N6700B Power Supply. We will use this instrument and the *N6700\_PowerSupply\_OutputSetup* example to introduce you to the Command Expert user interface.



Figure 3. Command Expert Welcome Window

#### Internet access and command sets

The N6700 instrument and its SCPI command set are installed by default. For other instrument examples, you will be prompted to install the instrument's command set. After installing Command Expert, you will need Internet access to download SCPI command sets or IVI-COM instrument drivers for your instruments. If you work in a secure environment with limited Internet access, you can still use Command Expert. Simply download the SCPI command sets or IVI-COM instrument drivers using a computer with internet access. You can then transfer the command sets or drivers to the computer with no internet access (using a USB drive, for example).

### The Command Sequence

The command sequence for the *N6700\_PowerSupply\_OutputSetup* example is shown in the Sequence Pane in the graphic below. A Command Expert sequence is a series of steps that are executed in order to connect to an instrument, configure an instrument, set outputs, and perform measurements.



Figure 4. Command Expert User Interface Overview

- The Instruments Pane shows your instruments and lets you connect to them.
- The Search/Browse Pane shows you the commands for the selected instrument and lets you search for commands.
- The Command Pane shows the selected command and its documentation, and lets you execute the command.
- The Status Bar shows progress messages as Command Expert performs operations.
- The Parameters Pane expands to show sequence parameters and lets you view and edit their names and values.
- The Sequence Pane shows the various steps in the Command Expert sequence and lets you edit the sequence and replay commands. The Sequence Pane has the following features:

### The Command Sequence cont'd



Figure 5. Sequence Pane Details

#### Working offline

The absence of a specific instrument address in step 1 of the sequence shown above indicates that we are working offline. To connect to an actual instrument, select step 1 in the Sequence Pane, and enter the instrument address in the address field in the Command Pane.

Working offline is a simulation mode where you can view and perform commands as usual, but the commands return default values. This is a good way to explore a command set, view documentation, and prototype sequences without having to connect to a physical instrument.

### Sequence Steps

Keysight Command Expert SCPI Co File Edit Play Help	mmand æ		These Parameters are Used in the	×
Active Instruments  Active	ns here Sear Recent AMPLitude] TRIGgered MODE PROTection ROTection RANGe SLEW	ch Con SO + +	:SOURce:VOLTage:PROTection:LEVel <voltage>,<chanlist> mmand Query URce:VOLTage:PPOTection:LEVel Use Param? Param Name Value Units voltage Voltage Voltage (chanlist) (chanlist)</chanlist></voltage>	
<ul> <li>STA</li> <li>SYS</li> <li>TRIC</li> <li>*CLS</li> <li>*CLS</li> <li>*CLS</li> <li>*ESE</li> <li>*ESE</li> <li>*IDM</li> <li>K</li> </ul>	Tus Tem Sger S R N	[5 [: عبر عبر Syr	COURce:]VOLTage:PROTection	
Parameters     Sequence     Parameters     Parameters			Vame: N6700B Output Setup Description:	
voltage2 3	Status	Instrument	Code Results	
chanlist2     @1     voltage     10	1 2 3	N6700 N6700 N6700	(Connect "N6700", "", "N6700 Power Supplies / C.02.18") *RST *CLS Selected Step *CLS	
<ul> <li>♥ chanlist</li> <li>@1</li> </ul>	4	N6700	:SOURce:VOLTage: EVel:IMMediate: AMPLitude <voltage2 :SOURce:VOLTage: PROTection: IFVel <voltage> <chaplist></chaplist></voltage></voltage2 	2
Ready				

Selecting a step in the Sequence Pane reveals details about the command and its parameters.

Figure 6. Command Details

#### Command Expert uses these types of steps:

- Connect steps (to connect to instruments)
- Command steps (SCPI or IVI-COM commands)
- Wait statements
- Comments
- Steps to control timeouts and error handling

### Sequence Debugging

You can debug a sequence by inserting breakpoints. When you run the sequence, execution pauses at the first step with a breakpoint and Command Expert enters single-step mode. In single-step mode you can single-step the sequence, monitor parameters and results, replay the sequence, and play selected steps. When you are ready to run the sequence without pausing at the breakpoint, remove the breakpoint and run the sequence normally.



Figure 7. Debugging the Sequence

You can also skip steps to help with debugging.

#### Substituting an instrument

You can temporarily switch command sets in a sequence to see the effects of switching to a different instrument. Any commands that aren't supported by the new instrument are highlighted in red.

### Using IVI-COM

If you prefer, you can use IVI-COM commands instead of SCPI commands. Command Expert has a number of IVI-COM examples and the operation is very similar to SCPI.

🤄 Keysight Command Expert - - - X File Edit Play Help **Active Instruments** n67xx.Initialize("", false, false, "Simulate=true"); Enter search terms here Search N67xx N67xx Search Recent \* N67xx name ^ 4 📃 IlviDCPwr My Instruments Enter instrument address or leave blank to work offline 4 -> address IL Close N6700 DriverOperation command set \* N67xx SCPI-99 D Identity **1** Initialize Update Step 1 Perform 🖶 Initialized Outputs The Connect command connects to an instrument and enables sending commands A DCPwrOutput1 using that connection. ConfigureCurrentLim ConfigureOVP The name input provides a name for the instrument within the sequence, New Instrument. > < > Name: N67xx Output Setup Description: 🕑 Configures channel 1 and enables the output of ar Parameters Status Instrument Code Results N67xx agn67xx.Initialize("", false, false, "Simulate=true") CType(n67xx,IIviDCPwr).Outputs.Item("DCPwrOutput1").VoltageLevel = 3 2 N67xx 3 N67xx CType(n67xx,IIviDCPwr).Outputs.Item("DCPwrOutput1").ConfigureOVP(true, 10) 4 CType(n67xx,IIviDCPwr).Outputs.Item("DCPwrOutput1").ConfigureCurrentLimit(Ivi.DCPwr.Interop.IviDCPw.. N67xx 5 CType(n67xx,IIviDCPwr).Outputs.Item("DCPwrOutput1").Enabled = true N67xx 6 'Wait for output to settle. 7 System.Threading.Thread.Sleep(60) 8 Dim retval As Double = CType(agn67xx,IIviDCPwr).Outputs.Item("DCPwrOutput1").Measure(Ivi.DCPwr.Intero... N67xx Ready

The example below (filename: N67xx PowerSupply OutputSetup.xlsx) uses IVI-COM commands:

Figure 8. IVI-COM commands

#### **IVI-COM command sets and drivers**

IVI-COM command sets are automatically extracted from IVI-COM drivers. You must install an IVI-COM driver (outside of Command Expert) before you can use the driver's command set in Command Expert. You can download Keysight IVI-COM drivers from **www.keysight.com/find/ivi**.

### Using IVI-COM cont'd

The Command Expert IVI-COM interface is very similar to the SCPI interface. All elements within the interface operate as described earlier in this application note. For more information, see *Command Expert for IVI-COM Tutorial* in the Command Expert help:



Figure 9. IVI-COM Help

### Using Command Expert with Non-Keysight Instruments

You can use Command Expert with any SCPI instrument that follows the SCPI-99 standard, using the *Generic SCPI-99 Instrument* command set. This command set provides the commands that are common to SCPI-99 instruments.

You can also use direct commands to send additional SCPI commands. Using direct commands, you can send any SCPI command to any SCPI instrument.

Any instrument that has an IVI-COM driver can be used with Command Expert, regardless of the manufacturer.

### Getting Started with Command Expert

To get started using Command Expert, you can start with one of the many example sequences and modify that sequence, or you can create your own sequence. For a step-by-step tutorial showing how to create a sequence, see *Command Expert Tutorial* in the Command Expert help:



Figure 10. Command Expert Tutorial

### Command Expert in the Visual Studio Environment

You can use Command Expert to help automate instrument control in Visual Studio using either or both of these approaches:

- Generating code from Command Expert
- Using SCPI.NET drivers

### Generating Code from Command Expert

You can use Command Expert to automatically generate code from SCPI or IVI-COM command sequences. This allows you to efficiently develop and test instrument command sequences before incorporating the code into your Visual Studio project.

The steps for generating code are:

- 1. Create a SCPI or IVI-COM command sequence in Command Expert
- 2. Select a code generation option and export the sequence to the clipboard
- 3. Paste the generated code into a Visual Studio project
- 4. Add any required references to your Visual Studio project
- 5. Build and run the application

The Visual Studio code generation options for SCPI command sequences are:

- C/C++ with calls to VISA Formatted I/O
- C# with calls to SCPI.NET Drivers
- VB.NET with calls to SCPI.NET Drivers

The code generation options for IVI-COM command sequences are:

- C# with calls to IVI-COM Drivers
- VB.NET with calls to IVI-COM Drivers

#### **Examples**

This application note shows a code generation example for *C/C++ with calls to VISA Formatted I/O* and for *C# with calls to SCPI.NET Drivers*. The code generation process for the other options listed above is similar. Detailed information and tutorials are located in the Command Expert help.

### VISA Formatted I/O Code Generation Example

The following example uses the *SCPI N6700\_PowerSupply\_OutputSetup* example to show how to generate *C/C++ with calls to VISA Formatted IO* and paste that code into a Visual Studio C++ project. The advantages to using *C/C++ with calls to VISA Formatted I/O are:* 

- The VISA C/C++ formatted I/O functions are an industry standard.
- The VISA C/C++ formatted I/O functions perform data translation; that is, the functions convert between programming language data structures and SCPI command/response strings.
- The generated code can be used in unmanaged C or C++ applications.
- The generated code can also be used in LabWindows/CVI applications.

#### Procedure

- 1. If not already open, open the *N6700\_PowerSupply\_OutputSetup* example from the Welcome Window.
- 2. The example opens with the SCPI commands listed (default mode). This example sets the output voltage and current of a Keysight N6700B Power Supply:

Activ	e Instrun	nents	nter searci	n terms here	(Connect "N	6700", "", "N670	10 Power Supplies /	( C.02.18")
N6700  My Instruments  N6700 SCPI-99		nts 🔿	16700 s ⊿ ⊳ [	Gearch Recent	e]  address Enter instrument address or leave blank command set * N6700 Power Supplies / C.02.18 Update Step 1 Perform The Connect command connects to an instrument and applied		ank to work c	
			D-	POWer	commands using th	at connection.		
Ne	ew Instrum	nent		STED Name: N6700E	The name input pro	vides a name for	the instrument withi	in the sequence. el 1 and enables
Ne Param	ew Instrum	nent	trument	CTED Name: N6700E	The name input pro	vides a name for	the instrument withi	in the sequence. el 1 and enables Results
Ne	ew Instrum	Status Ins	trument	CTFD Name: N6700E	The name input pro	vides a name for	the instrument withi	in the sequence. el 1 and enables Results
Ne	w Instrum	Status Ins	trument 5700	Connect "N6700", "", "N6700 P	The name input pro	vides a name for	the instrument withi	in the sequence. el 1 and enables Results
Ne	w Instrum	Status Ins	trument	Connect "N6700", "", "N6700 P *RST *CLS	The name input pro	) Description:	the instrument withi	in the sequence. el 1 and enables Results
Ne	I I I I I I I I I I I I I I I I I I I	Status Ins	trument 5700 5700 5700	Connect "N6700", "", "N6700 P *RST *CLS :SOURce:VOLTage:LEVel:IMMed	The name input pro	) Description:	the instrument withi	in the sequence. el 1 and enables Results
Ne	I I I I I I I I I I I I I I I I I I I	Status Ins Status Ins Ne Ne Ne	trument 5700 5700 5700 5700 5700	Connect "N6700", "", "N6700 P *RST *CLS :SOURce:VOLTage:LEVel:IMMed :SOURce:VOLTage:PROTection:L	The name input pro	vides a name for Description: (	the instrument withi	el 1 and enables
Ne	Instrum	Status Ins Status Ne Ne Ne Ne	trument 5700	Connect "N6700", "", "N6700 P "RST *CLS :SOURce:VOLTage:LEVel:IMMed :SOURce:VOLTage:PROTection:L :SOURce:CURRent:LEVel:IMMed	The name input pro	)	• Initializes channe	el 1 and enables
Ne	1 2 3 4 5 6 7	Status Ins Status Ne Ne Ne Ne Ne	trument   5700 5700 5700 5700 5700 5700 5700 5700 5700 5700 5700 5700	Connect "N6700", "", "N6700 P (Connect "N6700", "", "N6700 P *RST *CLS :SOURce:VOLTage:LEVel:IMMed :SOURce:VOLTage:PROTection:L :SOURce:CURRent:LEVel:IMMed :SOURce:CURRent:PROTection:S	The name input pro	)	the instrument withi	el 1 and enables
Ne	1 2 3 4 5 6 7 8	Status Ins Status Ins Ne Ne Ne Ne Ne	trument 5700 5700 5700 5700 5700 5700 5700 570	CONNECT North Nort	The name input pro	vides a name for Description: ( )	the instrument withi	el 1 and enables
Ne	1 2 3 4 5 6 7 8 9	Status Ins Status Ins Ne Ne Ne Ne Ne Ne	trument 5700 5700 5700 5700 5700 5700 5700 570	CONNECT NOTOO", "", "NOTOO P (Connect "NOTOO", "", "NOTOO P *RST *CLS :SOURce:VOLTage:LEVel:IMMed :SOURce:VOLTage:PROTection:L :SOURce:CURRent:LEVel:IMMed :SOURce:CURRent:PROTection:S :OUTPut:STATe 1,(@1) (Wait 25ms)	The name input pro	vides a name for Description: ( )	the instrument withi	el 1 and enables

Figure 11. N6700 Example

### VISA Formatted I/O Code Generation Example cont'd

 To add Keysight VISA I/O calls to the SCPI commands and export the sequence, click File > Export Sequence... and select C/C++ with calls to Visa Formatted I/O:

🚊 Keysight C	ommand Center	
File Edit	Export Sequence	
Active Ins	Language: C/C++ with calls to Visa Formatted I/O	
Nerru N6700 SCPI-9	<pre>//Initializes channel 1 and enables the output of a Keysight N6700B power supply. // // Instructions for Running: // 1. Enter your instrument address in the Connect step. // 2. Run the sequence. // // Operation: // 1. Reset the power supply. // 2. Set voltage and current to 1.5 amperes. // 3. Set voltage and current protection. // 4. Turn the output of channel 1 on. // 5. Wait for output to settle. // 6. Measure the voltage. // 7. Reset the power supply, turning off the output. //</pre>	name h
Parameters	// Requirements: // This example was written for the N6700B power supply. This example was tested with the following instrument(s // // You have a royalty-free right to use, modify, reproduce and distribute this example program (and/or any modifier void N6700B_Output_Setup() r Copy to Clipboard Save to File Close	and enabl

Figure 12. Exporting the Sequence (Visa Formatted I/O)

4. Click **Copy to Clipboard** followed by **Close**. The Keysight VISA I/O calls (viOpen, viPrint) are automatically added to the sequence and copied to the clipboard.

#### When Command Expert generates code:

- The generated code for skipped statements is commented out.
- Comments in a sequence become comments in the generated code.
- Wait statements become calls to appropriate library functions.
- 5. You can now paste this code into a Visual Studio console application to create a working program. The following graphic shows the generated code from the N6700\_PowerSupply\_OutputSetup example pasted into a Visual Studio C++ console application. Be sure to add the appropriate #include statements (see the Command Expert help for details).

### VISA Formatted I/O Code Generation Example cont'd



Figure 13. C++ Example

The above example is included with Command Expert as a Visual Studio C++ project. A number of examples are included for Visual Studio. These examples are located in:

C:\Documents and Settings\All Users\Keysight\Command Expert\Examples (for Windows XP)

C:\ProgramData\Keysight\Command Expert\Examples (for Windows 7)

Visual Studio examples are in these subfolders:

...\Scpi\Visual Studio (SCPI examples)

...\IviCom\Visual Studio (IVI-COM examples)

#### For More Information

These tutorials are available in the Command Expert help:

- Tutorial on Using Generated VISA Code
- Command Expert for IVI-COM Tutorial

### Using SCPI.NET Drivers

A SCPI.NET driver is a .NET assembly that provides a strongly typed interface to a SCPI command set. Using a SCPI.NET driver allows you to efficiently add instrument control steps without leaving the Visual Studio environment. This allows you to make use of standard Visual Studio productivity aids such as IntelliSense and compile-time type checking. Command Expert installs the SCPI.NET driver for a command set when you install the SCPI command set.

A typical process for using SCPI.NET drivers is:

- 1. Create a command sequence in Command Expert or open an example command sequence.
- 2. Export the sequence to the clipboard using the SCPI.NET code generation option.
- 3. Paste the generated code into your Visual Studio project.
- 4. Add references to required SCPI.NET drivers to the Visual Studio project.
- 5. In Visual Studio, modify the generated code by adding, removing or editing steps, and adding comments to the code.
- 6. Build and run the application.

#### C# SCPI.NET Example

- 1. If not already open, open the *N6700\_PowerSupply\_OutputSetup* example from the Welcome Window.
- 2. The example opens with the SCPI commands listed (default mode). This example sets the output voltage and current of a Keysight N6700B Power Supply:

Activ	e Instruments	Enter searc	h terms here Search	(Connect "N6700", "", "N6700 Power Su	pplies / C.02.18")
● N6700 Se My Instruments		N6700	Search Recent      [AMPLitude]      TRIGgered      MODE      PROTection      STATe      RANGe      DIGital      LIST      ROWLE		leave blank to work c 2.18 orm t and enables sending
Ne	w Instrument		СТЕР У Name: N6700	B Output Setup Description: 💽 Initializes	ent within the sequence.
	Stat	us Instrument		Code	Results
	1	N6700	(Connect "N6700", "", "N6700 F	Power Supplies / C.02.18")	
	2	N6700	*RST		
	3	N6700	*CLS		
	12/2/1	N6700	:SOURce:VOLTage:LEVel:IMMed	diate:AMPLitude 3,(@1)	
4444	4	N6700 :SOURce:VOLTage:PROTection:LEVel 10.(@1)			
	4	N6700	:SOURce:VOLTage:PROTection:		
4444	4 5 6	N6700 N6700	:SOURce:CURRent:LEVel:IMMed	diate:AMPLitude 1.5,(@1)	
	4 5 6 7	N6700 N6700 N6700	:SOURce:CURRent:LEVel:IMMee :SOURce:CURRent:PROTection:	diate:AMPLitude 1.5,(@1) STATe 1,(@1)	
19494	4 5 6 7 8	N6700 N6700 N6700 N6700	:SOURce:VULTage:PROTection: :SOURce:CURRent:LEVel:IMMed :SOURce:CURRent:PROTection: :OUTPut:STATe 1,(@1)	diate:AMPLitude 1.5,(@1) STATe 1,(@1)	
19999	4 5 6 7 8 9	N6700 N6700 N6700 N6700	:SOURce:VULTage:PROTection: :SOURce:CURRent:LEVel:IMMed :SOURce:CURRent:PROTection: :OUTPut:STATe 1,(@1) (Wait 25ms)	diate:AMPLitude 1.5,(@1) STATe 1,(@1)	

Figure 14. N6700 Example

### Using SCPI.NET Drivers cont'd

3. Click File > Export Sequence... and select C# with calls to SCPI.NET Drivers:

iy Help		
Export Sequence		
Language: C# with calls to SCPL!	LNET Drivers	
Use short-form keywords in SC	iCPI commands	
Omit optional keywords in SCP	:PI commands	
77 7. Keset the power supply, tur	iming on the output.	
11		
// Requirements:		
// This example was written for the	the N6700B power supply. This example was tested with	the following instrument(s
//		6 (A ) (C)
// You have a royalty-free right to	to use, modify, reproduce and distribute this example pro	ogram (and/or any modified
private void N6/00B_Output_Set	etup() {	
double[] outputvoitage = null;	II,	
n6700 SCPLRST Command()	12	
n6700 SCPLCI S Command()		
n6700.SCPI.SOURce.VOLTage.	e.LEVel.IMMediate.AMPLitude.Command(3, "@1");	
n6700.SCPI.SOURce.VOLTage.	e.PROTection.LEVel.Command(10, "@1");	
n6700.SCPI.SOURce.CURRent.I	t.LEVel.IMMediate.AMPLitude.Command(1.5, "@1");	
n6700.SCPI.SOURce.CURRent.	t.PROTection.STATe.Command(true, "@1");	
n6700.SCPI.OUTPut.STATe.Cor	ommand(true, null, "@1");	
System.Threading.Thread.Slee	ep(60);	
n6700.SCPI.MEASure.SCALar.V	.VOLTage.DC.Query("@1", out outputvoltage);	
n6700.SCPI.RST.Command();		
1		50
		×
<b>N</b>		2
	Copy to Clipboard Save to Fi	lie Close
N6700 6700 S		
N0/00 N0/00.5	.SCPI.SOURCE.VOLTage.PROTection.LEVel.Command(10,	j

Figure 15. Exporting the Sequence (SCPI.NET)

- 4. Click **Copy to Clipboard** followed by **Close**. Command Expert automatically adds the C# SCPI.NET calls to the sequence and copies the sequence to the clipboard.
- 5. You can now paste this code into a Visual Studio console application to create a working program.

The following graphic shows the generated code from the *N6700\_PowerSupply\_OutputSetup* example pasted into a Visual Studio C# project. Be sure to add the required references (see the *SCPI.NET Drivers Tutorial* in the online help for details).

### Using SCPI.NET Drivers cont'd

🗢 OutputSetupScpiDotNet2010 - Microsoft Visual Studio (Administrator)	
File Edit View Refactor Project Build Debug Team Data Tools Architecture Test Analyze Window Help	
👔 • 🔛 • 🚰 🛃 🗿 👗 🐴 🖏 🔊 • 🔍 • 💭 • 🖏 🕨 Debug 🔹 Any CPU 🔹 🦉 ps	
[國務局來編]推進[國왕] 그위대 체대생왕이다.	
III Program.cs ×	Solution Explorer 🛛 👻 귀 🗙
💱 🐉 OutputSetupScpiDotNet.Program 🔹 🔊 Main(string[] args) 🔹	
<pre>Geoupdated psephoduretrogram</pre>	Solution 'OutputSetupScpiDotNet2010' (1 pr OutputSetupScpiDotNet2010 Properties AssemblyInfo.cs References - AgN6700_C_02_18 - System.Core - System.Data - System.Data - System.Data.DataSetExtensions - System.Xml - System.Xml - System.Xml.Linq Program.cs Class View Properties - # ×
// nb/00.SCPI.SOURCE.VOLTage.PROTection.LOCal.POSitive.LEVel.Command(overVoltageSe	
n6700.SCPI.SOURce.CURRent.LEVel.IMMediate.AMPLitude.Command(currentSetting, channe 100 % • (	
Ready. Ln 73	Col 3 Ch 3 INS 📑

Figure 16. N6700 C# Example

6. To use IntelliSense in Visual Studio, begin typing a SCPI command string.

For example, type: n6700.SCPI.SOURce.VOLTage.

IntelliSense displays the available command strings and descriptions:

	n6700.SCPI.SOURce.CURRent.PR n6700.SCPI.SOURce.VOLTage.	OTection.STATe	.Command(true, channel);
	n6700.SCPI.OUTPut.STATe.Co // wait for output to sett Thread.Sleep(msSettlingTim // The measured voltage is	Equals GetHashCode GetType	channel);
	// an element for each cha double[] measuredVoltage n6700.SCPI.MEASure.SCALar.	LEVel MODE PROTection	hannel, out measuredVoltage);
	Console.WriteLine("Measure Console.WriteLine();	RANGe SLEW ToString	Keysight.CommandExpert.ScpiNet.N6700_C_02_18.SC This command sets the output voltage range. Units ar
,	<pre>Console.WriteLine("Press ent Console.ReadLine();</pre>	er to exit");	

Figure 17. IntelliSense

Select a string, such as RANGe, to append it to the SCPI command.

### Using SCPI.NET Drivers cont'd

7. To view SCPI documentation in Visual Studio, right-click the rightmost SCPI keyword in the driver call. For example, right-click the *AMPLitude* keyword in this line of code:

n6700.SCPI.SOURce.CURRent.LEVel.IMMediate.AMPLitude.Command(currentSetting, channel);

Click **Go to Definition** from the Visual Studio context menu. Visual Studio displays the source code for the SCPI.NET driver class. Click the link directly under // Remarks: to view the HTML documentation for the AMPLitude command.

Keysi	ght.CommandExpert.ScpiNet.N6700_C_02_18.SCPI.SOURce.CURRent.LEVel.IMM+ 👘 Command(double current, string chanlist)
⊞As	sembly N6700_C_02_18.dll, v2.0.50727
us	ing System;
⊟nar	<pre>mespace Keysight.CommandExpert.ScpiNet.N6700_C_02_18.SCPI.SOURce.CURRent.LEVel.IMMediate.AMPLitud</pre>
	// Summary:
	// This command sets the immediate current level of the specified output channel.
	// Units are in amperes. The immediate level is the output current setting.
	11
	// Remarks:
	<pre>// file:///C:/ProgramData/Keysight/Command%20Expert/ScpiCommandSets/87953516-78b5-4eae-98b</pre>
2	public class AMPLitudeClass
	{
	public virtual int Query incourt ( get, set )
	public vircusi inc query timour [ Bec, set, ]
(H)	public virtual void Command(double current, string chanlist):
+	public virtual void Command(string current, string chanlist);
(+)	public virtual void Command(double current, string currentUnits, string chanlist);
÷	public virtual void Query(object minMax, string chanlist, out double[] current);
+	public virtual void Query(string minMax, string chanlist, out double[] current);
}	
% .	• • • III

Figure 18. SCPI Documentation in Visual Studio

The preceding example is included with Command Expert as a Visual Studio C# project. A number of Visual Studio examples are included for Visual Studio. Examples are located in:

C:\Documents and Settings\All Users\Keysight\Command Expert\Examples (for Windows XP)

C:\ProgramData\Keysight\Command Expert\Examples (for Windows 7)

Visual Studio examples are in these subfolders:

...\Scpi\Visual Studio (SCPI examples)

...\IviCom\Visual Studio (IVI-COM examples)

#### For More Information

For a step-by-step tutorial, see SCPI.NET Drivers Tutorial in the Command Expert help.

### Where to Go Next

The easiest way to get started using Command Expert with Visual Studio is to browse through the example folders and select an example that is similar to your test and measurement application. Examples are provided for Visual Studio 2005, Visual Studio 2008, and Visual Studio 2010.

Image: Second	h N6700_PowerSupply_OutputSe 🔎
Organize ▼ Include in library ▼ Share with ▼ Burn New folder	i - 🗊 🔞
E5071C_ENA_NetworkAnalyzei  Name ESG_Family_StepSweep	Date modified Ty
Infiniium_90000ASeries_Wavef InfiniiVision_6000Series_Screer Utype=Utyp	2/15/2012 3:54 PM File 2/15/2012 5:54 PM File 2/15/2012 5:54 PM File
InfiniiVision_6000Series_Wavef L4411A_DigitalMultimeter_Tric OutputSetup2005.sln	2/13/2012 3:34 PM PM 2/13/2012 12:07 AM Mi
MXG_Family_StepSweep MXG_Family_StepSweep N90x_XSeries_PeakFrequency OutputSetup2010.opensdf OutputSetup2010.odf	3/21/2012 12:07 AM
N5700_PowerSupply_TriggerA N5700_PowerSupply_OutputSet N6700_PowerSupply_OutputSet	2/13/2012 12:07 AM Mi
📕 N6705A_PowerAnalyzer_Triggr 🚽 🤞 🏢	•

Figure 19. More Examples

Command Expert has extensive application documentation containing FAQs, tutorials, examples, and getting started information. You can use one of these tutorials, available in the Command Expert help, for step-by-step information on how to use Command Expert with Visual Studio:

- Tutorial on Using Generated VISA Code
- Command Expert for IVI-COM Tutorial
- SCPI.NET Drivers Tutorial

### Where to Go Next cont'd

Hide Back Print Options		
	Command Expert Tutorial	
<ul> <li>Command Expert</li> <li>Release Notes</li> <li>The Command Expert Application</li> <li>Starting Command Expert Window</li> <li>Command Expert Window</li> <li>Command Expert Tutoral</li> <li>Setting Up Instruments</li> <li>Connecting to Instruments</li> <li>Finding Commands</li> <li>Working with Sequences</li> <li>Working with Sequencess</li> <li>Working Sequence Steps</li> <li>Using Sequence Parameters</li> <li>Generating Code</li> <li>Error Handling in Command Expert</li> <li>Managing Command Sets</li> <li>Command Expert Options</li> <li>Example Sequences</li> <li>Command Expert Options</li> <li>Example Sequences</li> </ul>	<ul> <li>Topics</li> <li>Overview</li> <li>Start Command Expert</li> <li>Set the Address of the N6700 Instrument</li> <li>Connect to the Power Supply</li> <li>Perform a SCPI Command Using the Command Tree</li> <li>Perform a SCPI Command Using Search</li> <li>Perform a SCPI Command Using Command Completion</li> <li>Insert a Wait Statement</li> <li>Perform a SCPI Command Using Copy and Paste</li> <li>Delete a Sequence Step</li> <li>Play the Sequence</li> <li>Document the Sequence</li> <li>Parameterize the Sequence</li> <li>Change Parameter Values and Replay the Sequence</li> <li>Generate Code for the Sequence</li> <li>Save the Sequence</li> </ul>	

Figure 20. Command Expert Tutorials

Be sure to check the Command Expert help for important information on using the various Visual Studio versions. You can find more information on Command Expert, including links to other application notes,

at www.keysight.com/find/commandexpert.

### PC Operating Requirements

Operating System	Windows XP, Service Pack 2 or above, 32-bit only. Editions: Home, Professional Windows 7, 32-bit or 64-bit. Editions: Starter, Home Basic, Home Premium, Professional, Ultimate, or Enterprise
Disk	At least 1GB free disk space
Keysight IO Libraries Suite	Version 15.0 or above www.keysight.com/find/iosuite
Monitor	At least 1024x768 monitor resolution
Browser	Internet Explorer 6 or above (7 or above recommended)

You can find the current list of instrument SCPI command sets at: www.keysight.com/find/commandsetlist

### Application Development Environment Requirements

Visual Studio	Visual Studio 2005, 2008, 2010 or above
LabVIEW	LabVIEW 8.2.1 or above.
VEE	VEE Pro 9.22 or above.
Excel	Excel 2007 or Excel 2010.
MATLAB	MATLAB Instrument Control Toolbox R2009a or above

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www.keysight.com/find/commandexpert

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