SCPI LabVIEW Applications | LUNA 6415

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SCPI LabVIEW Applications *LUNA 6415*

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1 Introduction

This document provides information about using SCPI commands to operate the Luna 6415 remotely in LabVIEW[1] environment.

Several sample LabVIEW programs are provided as examples for users to develop their own test applications in LabVIEW, and in other applicable programming languages (such as BASIC, C, C++, etc.) and/or test application environments (such as LabWindows/CVI, LabVIEW, MATLAB, Microsoft Visual Studio, Agilent VEE, etc.).

The purpose of these examples is to demonstrate how to remotely connect to and control the Luna 6415 via SCPI commands. Although more advanced features are included, none of the examples is intended to be a fully featured program. Users should use the included code as an example when writing their own automation software.

This document assumes that the user already has some familiarity with the following areas: Luna 6415 operation, SCPI commands, and LabVIEW programming.

1.1 Luna 6415 SCPI support

Luna 6415 Users Guide has a full coverage on the proper methods to set up and use the Luna 6415 application software, as well as more detailed information on Luna's SCPI support. For the user's convenience, several relevant paragraphs from the User's Guide are presented in the below in this section to give the users a general picture on how the SCPI is implemented in the Luna 6415.

> *SCPI commands may be sent to the controller over a network interface using the TCP/IP protocol. The IP address of the controller is displayed in the "About" settings page for your reference.*
>
> *Port 5025 is used to communicate with the controller over a raw TCP/IP socket connection. Use this port when sending SCPI commands from most all programs since it is more compliant with the SCPI standard than port 5024.*
>
> *Port 5024 is used to communicate with the controller using a telnet client. Use this port when you are sending SCPI commands manually as it has several advantages over port 5025 for manual use (Refer to the User Guide for more details).*
>
> *The following are a few examples of command sequences to help demonstrate the use of SCPI of the Luna 6415.*
>
> *Keep in mind that it might be a good idea to follow each SCPI command or query with :SYST:ERR? to determine if an error was generated during the previous program message unit. For the sake of brevity, these command sequences examples don't demonstrate the use of the :SYST:ERR? query.*

[1] *LabVIEW is a registered trademark of National Instruments Inc.*

1.1.1 *Example 1: Take Sequential Measurements*

```
DEL REFL            # Use REFLection mode
LENG 20             # Use 20 meter mode
GIND 1.4682         # Set the group index to 1.4682
MEAS:RL? 3,0.05     # Take a measurement and get the return loss at a distance of 3m
                    with a width of 0.05m
MEAS:RL? 3ft        # Take a measurement and get the return loss at 3ft
                    (still with a width of 0.05m)
MEAS:OFDR?          # Take a measurement and return the amplitudes from the OFDR plot
MMEM:STOR ofdr,"test1"    # Store the measurement data to the file "test1.ofdr"
MMEM:STOR tsv_ose,"test1"# Store all the measurement data to the file "test1.tsv"
```

1.1.2 *Example 2: Get Multiple Results from a Single Measurement*

```
DEL REFL            # Use REFLection mode
LENG 20             # Use 20 meter measurement mode
GIND 1.4682         # Set the group index to 1.4682
CONF:RL DEF,0.05    # Set the return loss width to 0.05 meters
CONF:IL DEF,0.2     # Set the insertion loss width to 0.2 meters
CONF:SPEC DEF,0.5   # Set the spectral cursor width to 0.5 meters
INIT                # Start a measurement
FETC:OFDR?          # Wait for the measurement and get amplitudes in dB from the OFDR plot
FETC:DIST?          # Get distances in meters from the OFDR plot
FETC:SPEC? 1        # Get the return loss values in dB from the spectral plot with the spectral
                    cursor at 1m
FETC:WAV?           # Get the wavelengths in nm from the spectral plot
FETC:EVEN?          # Get the event table
FETC:RL? 1.2        # Get the return loss at a distance of 1.2 meters from the unit
FETC:RL? 3ft        # Get the return loss at a distance of 3 feet from the unit
FETC:IL? 3.4m       # Get the insertion loss at a distance of 3.4 meters from the unit
```

1.1.3 *Example 3: Make a Continuous Measurement*

```
DEL REFL            # Use REFLection mode
GIND 1.4682         # Set the group index to 1.4682
LENG 20             # Use 20 meter measurement mode
CONF:RL DEF,0.05    # Set the return loss width to 0.05 meters
CONF:IL DEF,0.2     # Set the insertion loss width to 0.2 meters
CONF:SPEC DEF,0.5   # Set the spectral cursor width to 0.5 meters
INIT:CONT ON        # Start taking continuous measurements
FETC:OFDR?          # Wait for the measurement to complete and get amplitudes in dB
                    from the OFDR plot
. . .
INIT:CONT OFF       # Stop taking continuous measurements
```

Please refer to the User Guide for a complete list of Luna 6415 supported SCPI commands.

1.2 LabVIEW programming with Luna SCPI

The LabVIEW Internet Toolkit is obsolete as of 2014 and National Instruments (NI) software currently does not come with any native support for creating built-in Telnet, SSH, RLOGIN, or RAW client functionality in your applications. NI now support communicating with an Ethernet/LAN instrument in LabVIEW by using VISA VIs or using TCP/IP Client VIs ("raw" TCP socket), which is currently the proper method to implement SCPI applications in LabVIEW (LabVEIW 2018 in this document). Three LabVIEW samples are provided in this document to demonstrate how to use SCPI to remotely operate Luna 6415 instrument.

Before starting using the sample, the user needs to make sure the Luna 6415 controller PC and LabVIEW remote PC can establish connection via ethernet. The user can accomplish this firstly by checking if SCPI commands can be executed properly on a remote Telnet terminal.

The user also needs to make sure the NI hardware and software are properly setup to communicate with an Ethernet/LAN instrument in LabVIEW. This can usually be properly set in a normal LabVIEW software/application installation. In case there is an issue and there is need of troubleshooting, the user can refer to the "Ethernet Instrument Control Tutorial" from NI website for more detailed information[2]. The tutorial shows you how to set up NI hardware and software to communicate with an Ethernet/LAN instrument in LabVIEW.

2 SCPI LabVIEW Samples

Three sample programs in LabVIEW are introduced below. The sample programs were written and tested using LabVIEW 2018 on Windows 10 computer, and Luna 6415 is on the latest version (v2.2.0). By current factory default, Luna 6415 controller PC is on Ubuntu 18.04.

The first two samples are simple but demonstrate fundamentally how to program in LabVIEW to execute SCPI commands remotely and to receive return(s). The third sample is an application packed with more features, which demonstrates how the user can carry out more complex tasks by using LabVIEW programming with Luna's SCPI commands.

[2] https://knowledge.ni.com/KnowledgeArticleDetails?id=kA03q000000x3gXCAQ&l=en-US

2.1 LabVIEW Sample A

This LabVIEW example is based on TCP/IP Client VIs and its LabVIEW front panel and block diagram screenshots are shown in Figure 1 and Figure 2 respectively. This program demonstrates how to use LabVIEW to execute SCPI commands remotely and to receive return(s) properly by using TCP/IP VIs. The basic steps demonstrated are:

1) establish network connection between the remote PC and controller PC

2) send SCPI command from the remote PC to the controller PC over the network connection

3) receive SCPI command return (if there is any) over the network connection; and 4) properly close the network connection.

All the supported Luna SCPI commands that can be executed by using a remote Telnet terminal can also be successfully executed in this LabVIEW sample.

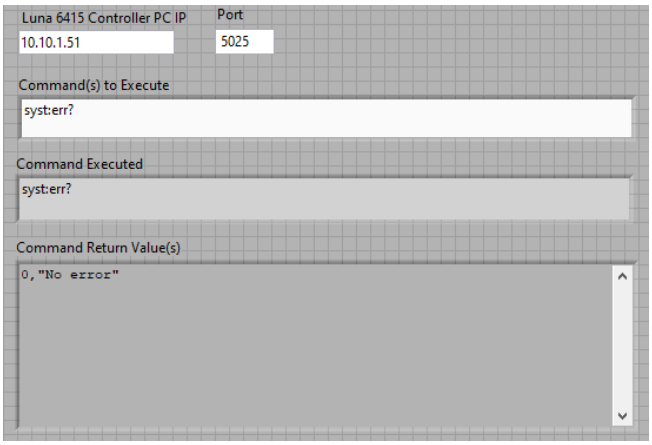

Figure 1. LabVIEW sample 1 – Front Panel

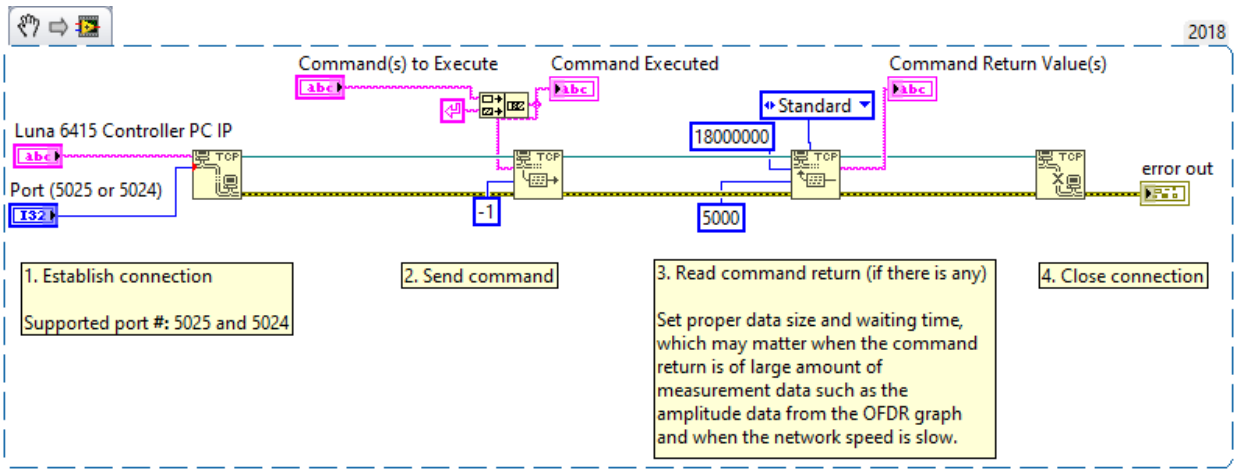

Figure 2. LabVIEW sample 1 – Block Diagram

Before running this example, the user needs to input the correct controller computer IP address that is displayed in main application's "About" settings page (Figure 3). The Port # can be either 5025 or 5024.

Figure 3. IP Address displayed in "About" page

The user may need to adjust the data size limit and/or the waiting time limit to more proper values in running certain commands to read return(s). This is usually not needed when the user sends a command which has no returned value or with value of smaller sized data. However, this may become necessary when the command return is of large amount of measurement data (i.e. the amplitude data from the OFDR graph) and when the network speed is slow. For example, when changing to a longer measurement mode, the user may need to increase the date size and waiting time limits in order to be able to receive the complete amplitude data in the command return on the remote side.

2.2 LabVIEW Sample B

This LabVIEW example is based on VISA Vis. Its LabVIEW front panel and block diagram snips are shown in Figure 4 and Figure 5 respectively. This example demonstrates how to program in LabVIEW to execute SCPI commands remotely and to receive return(s) properly by using VISA VIs. The basic steps demonstrated are as those listed in the Sample A.

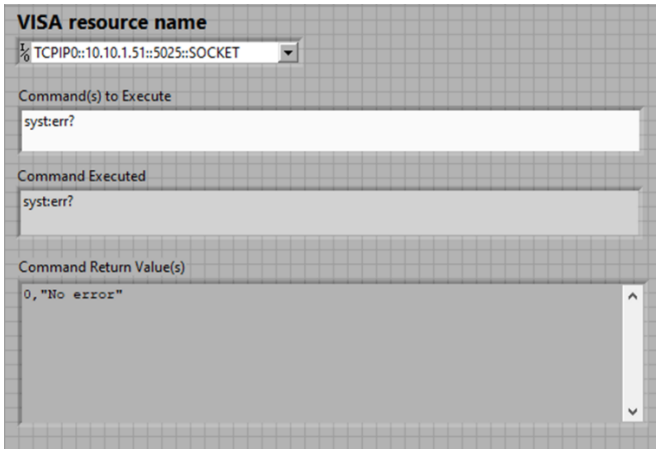

Figure 4. LabVIEW sample 2 – Front Panel

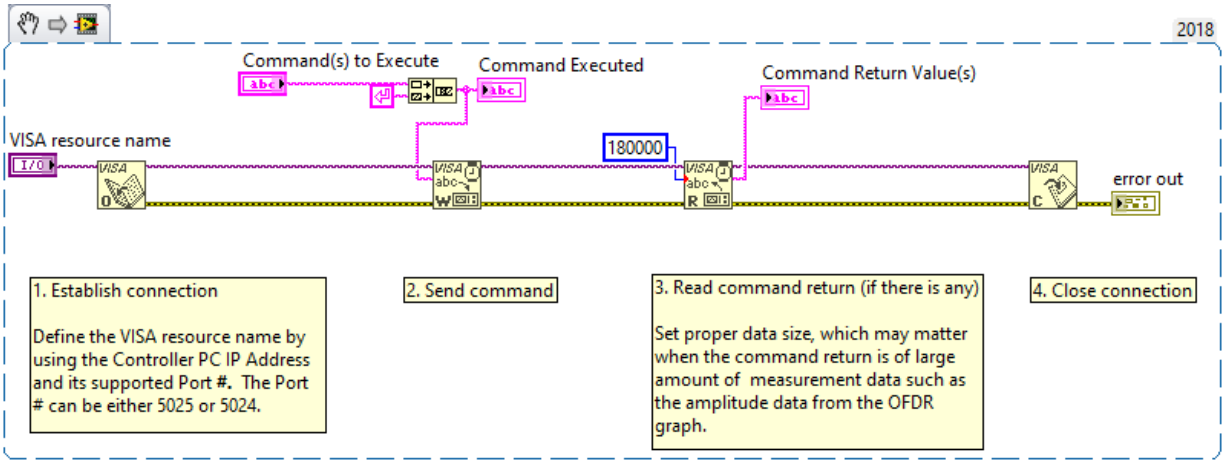

Figure 5. LabVIEW sample 2– Block Diagram

Before running this example, the user needs to compose and input the correct VISA resource name, in proper format as shown in the screenshots, by using the controller computer IP address (Figure 3) and supported Port # information. The controller computer IP address can be found in the main application's "About" settings page; and the Port # can be either 5025 or 5024.

Nearly all the supported Luna SCPI commands that can be executed using a remote Telnet terminal can also be executed remotely in this LabVIEW example. However, unlike the TCP/IP VIs in the Sample A, the VISA VIs in this example has no option to define a waiting time limits, therefore the

user needs to be extra cautious in running commands to read return that may take longer time to complete the full data transmission. For this reason, the approach demonstrated in the Sample A is more robust than the one demonstrated in Sample B.

2.3 LabVIEW Sample C

This LabVIEW example is a remote-control application with more advanced user interface (UI) and loaded features, as shown in its LabVIEW front panel screenshot in Figure 6.

This program demonstrates how to remotely connect to a Luna 6415 system, retrieve and display system and measurement setting information, change measurement settings such as measurement mode type, group index value, filter width value, etc. In addition to demonstrating how to perform measurements, this program also demonstrates how to acquire a set of measurement data for a measurement to plot its time delay data in a graph (i.e., the Delay Plot in the controller program) and to display its event analysis results (i.e., the Event Table in the controller program).

To accomplish these featured functions, this example was written in relatively more complex LabVIEW programming code and structure. Yet, regarding to SCPI operations, this example fundamentally used the Sample A as the basic building block under the hood.

Before using this SCPI remote control program, user should pay attention to following two things:

I. "Continuous Measurement" is not supposed to be used with this LabVIEW Sample C program. This is because it may need longer time to acquire a set of data over network, particularly when some data are of large sizes and/or network speed is slow. In "Continuous Measurement", there may not be enough time to retrieve the whole set of required data from one measurement before starting the next measurement. There is a high risk of mixing up data from different measurements in this example if "Continuous Measurement" is running. Therefore, user should not use "Continuous Measurement" with this LabVIEW Sample program.

II. Be cautious on changing "Measurement Length" option, particularly on changing to longer lengths. User may need to adjust the “DataTransTime” and “DataSize” values to ensure that large sized data, such as graph data, can be completely received.

Apart from the above two things to look out, this example is a fully functional remote-control application. Yet again, the purpose of the samples is to provide source code examples showing how remote Luna 6145 application can be achieved by using SCPI command in LabVIEW. It is not intended to be used directly in a production environment. Users should write their own application code based on the Luna examples.

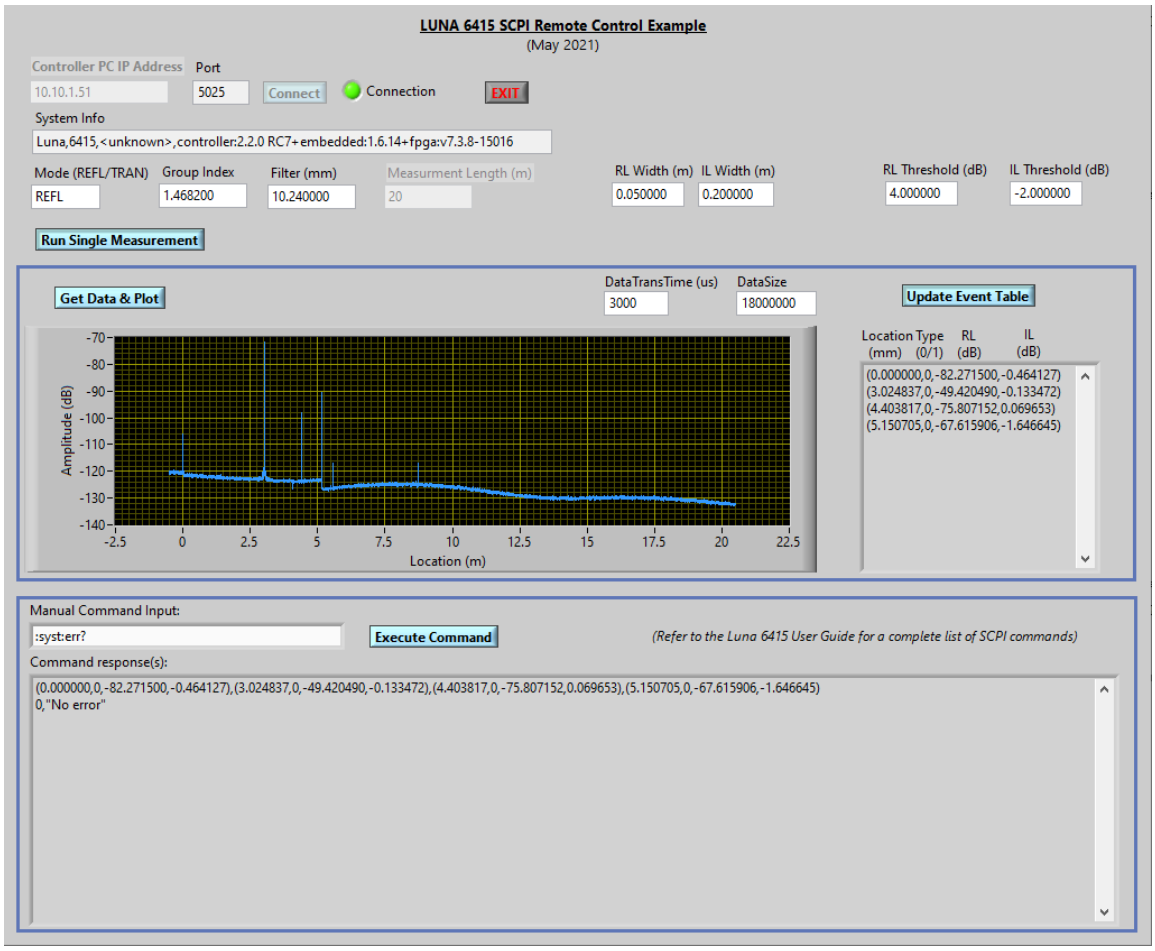

Figure 6. LabVIEW sample 3 – Front Panel

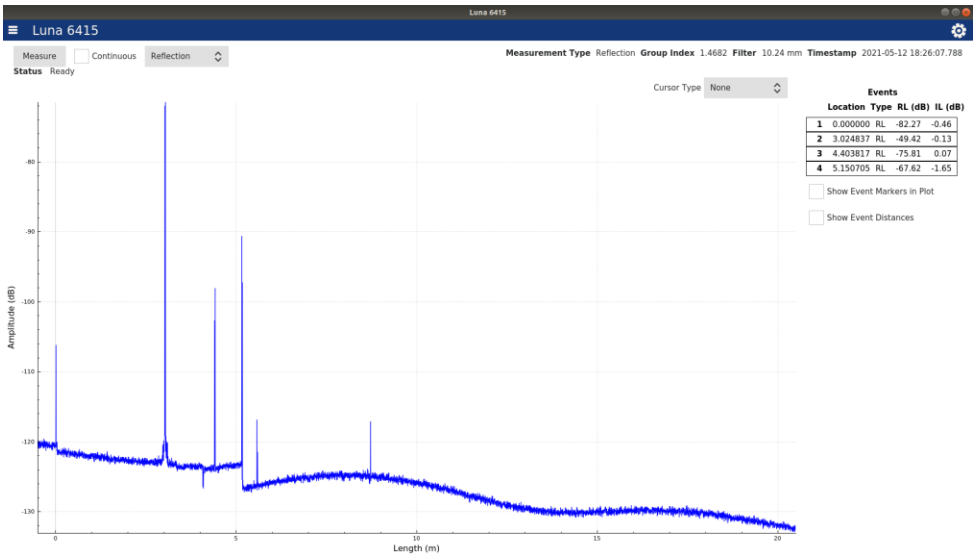

Figure 7. Comparison: Luna 6415 Main Application display vs LabVIEW sample 3 display (same measurement)

3 Technical Support

If you should have any problems with or questions about the information contained in this document, please don't hesitate to contact our technical support staff via one of the following methods:

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