

FLORIDA GULF COAST UNIVERSITY

GPIB Devices

User Manual on Usage & Creation of GPIB Capable
Virtual Instruments Using NI LabView

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Section 0: Introduction

About: This manual will describe how to use GPIB devices as well as provide instructions on how to construct simple GPIB communication virtual instrument using NI LabView.

Purpose: The purpose of this manual is to instruct the user, on how to use GBIP Multi Device Virtual Instrument created for Data Acquisition & Control Systems course that was taught by Dr. Zalewski in spring 2009 semester. As well as instruct user on how to connect GPIB devices to the host PC and to each other. In addition, this manual will describe how to develop a simple Virtual Instrument that is able to communicate with GPIB device and display the output.

Section 1: Hardware Description & Configuration

Host PC: The host PC is the main controller of the system

Hardware: Dell PC, Intel Core 2 Duo E8500, 3.25 Gb of RAM

NI GPIB PCI Card: Main communication link in between host PC and GPIB devices provides 1 GPIB communication port shown in Figure 1.1

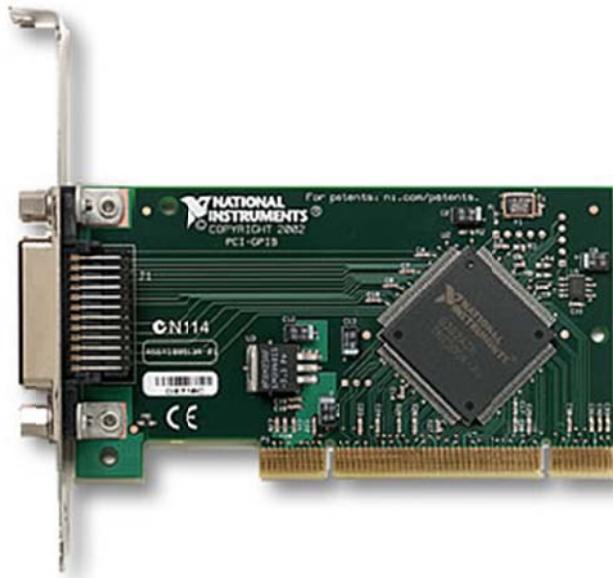


Figure 1.1 PCI GPIB card with communication interface

Detailed Specifications:

Compatibility IEEE 488.1, 488.2
GPIB Transfer Rate 1.5 MB/s
OS Support Windows® 2000/XP
Library Support Visual C++®, Borland C++ Builder®, LabWindows/CVI,
Visual Basic®, Delphi®, LabVIEW
Max. GPIB Connections 15
Bus Type PCI-1671UP: Universal PCI V2.2
I/O Connectors 1 x IEEE 488 standard 24-pin
Dimensions (L x H) 119.91 x 64.41mm (Low profile MD1)
Power Consumption Typical: 5 VDC @ 375 mA
Operating Temperature 0 ~ 60° C (32 ~ 158° F) @ 0-90% RH
Storing Temperature -40 ~ 100° C (-40 ~ 212° F) @ 5-90% RH
Operating Humidity 0 ~ 90% RH, non-condensing

HP 34401A Multimeter (Figure 1.2):



Figure 1.2 HP 34401A Multimeter

Measure up to 1000 volts with
6 1/2 digits resolution
dc accuracy of 0.0015%
ac accuracy of 0.06%
3Hz to 300kHz ac bandwidth
1000 readings/sec. direct to HP-IBM

HP 53131A Universal Counter (Figure 1.3):



Figure 1.3 HP 53131A Universal Counter

225 MHz bandwidth
(optional 1.5, 3, 5, or 12.4 GHz)
10- or 12-digit resolution with
1s gate time
HP-IB interface standard
Data transfer rate of up to 200 fully formatted measurements/sec

Configuring & Connecting Devices:

1. Connect GPIB devices to the GPIB capable workstation:
 - a. Use IEEE standard approved GPIB cables to connect the devices:
 - i. Connect male part of the cable to the GPIB capable workstation
 - ii. Connect other side of the cable to the GPIB device
 - iii. Connect new cable in the female GPIB connection on the first device
 - iv. Connect remaining end to the second GPIB device see Figure 1
 - v. Secure all screws on the connection ends



Figure 1. GPIB Chain Connection

2. Power up devices and workstation:
 - a. Connect the power cables to enabled power outlets
 - b. Power on the devices by pushing respective button on each device separately
 - c. Power up the workstation and login with provided username and password

Section 2: User Manual for GPIB dual instrument

The objective of this section is to show the user how to read data in LabView from the device connected via GPIB interface. The procedure is explained in the following steps.

1. Locate and open the VI:
 - a. Locate VI in C:\Documents and Settings\Administrator\Desktop\GPIB\userMode.vi or Locate VI in C:\Documents and Settings\Administrator\Desktop\GPIB\advancedMode.vi
 - i. The user operating regime provides basic functionality of the device
 - ii. In advanced operating regime user is able to sent detailed command to the device, through the provided command field
 - iii. Advanced commands for HP 34401A can be found [here](#) [1]
 - iv. Advanced commands for HP 53131A can be found [here](#) [3]
2. Start the VI by clicking appropriate button on the top of the LabView window as shown in figure 2

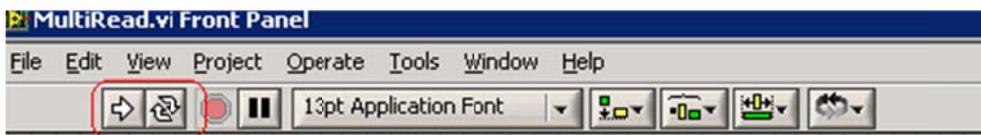


Figure 2. Initiation of Virtual Instrument

- a. The VI can operate in three different modes
 - i. Multimeter Mode (Figure 3): only communication with HP 34401A multimeter is established, communication is initialized with strictly this device. The functions that are not included into the native interface of this device will not be available

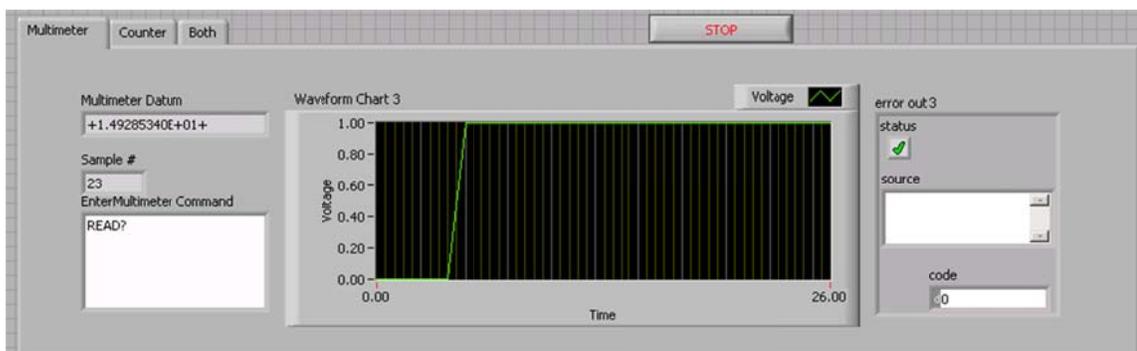


Figure 3. Multimeter mode

- ii. Counter Mode (Figure 4): similar to multimeter mode, the counter mode will establish communication exclusively with HP 53131A universal counter.

The commands that are not native for HP 53131A counter will not be available

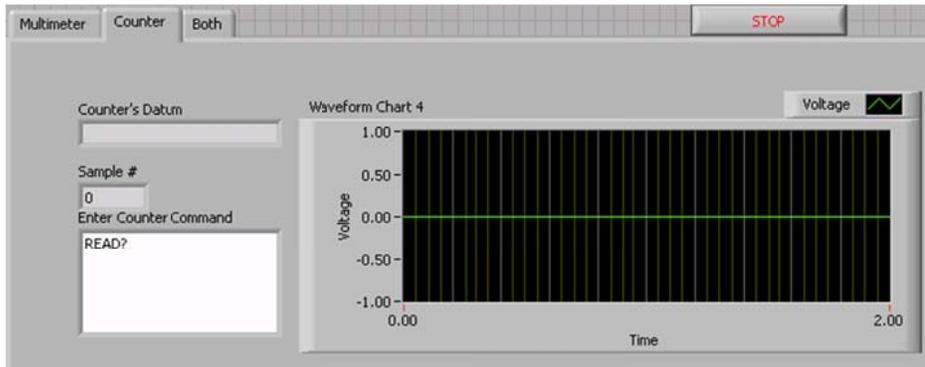


Figure 4. Counter Mode

- iii. Both (Simultaneous) Mode (Figure 6): unlike first two modes, the Both mode allows user to communicate with both HP 34401A and HP 53131A simultaneously. When user clicks on the “Both” tab, the VI automatically starts sending commands to both devices, as well as starts reading and outputting the datum received onto the graph. Sample commands include:
- READ? – provides a single read of data, compatible with both devices
 - MEASure : VOLTage : DC? – makes a single DC voltage read, only on HP 34401A multimeter

You can change the command while the program is running, by typing it in the respective text box. When you start typing a little button with the checkmark will appear on the top (Figure 5); this button must be pressed to make the command effective.



Figure 5. Accept text button

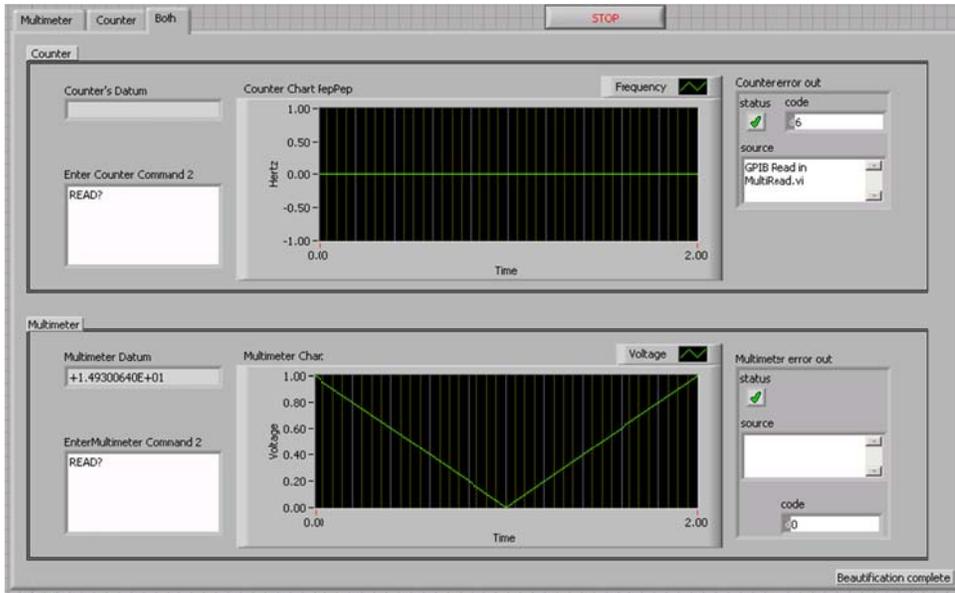


Figure 6. Both (Simultaneous) Mode

3. Expected results:

- a. If steps were followed properly, then user will begin to see some output few seconds after the VI is initialized and/or command is typed
- b. If steps were not followed properly, then user will receive an error message as shown in Figure 7

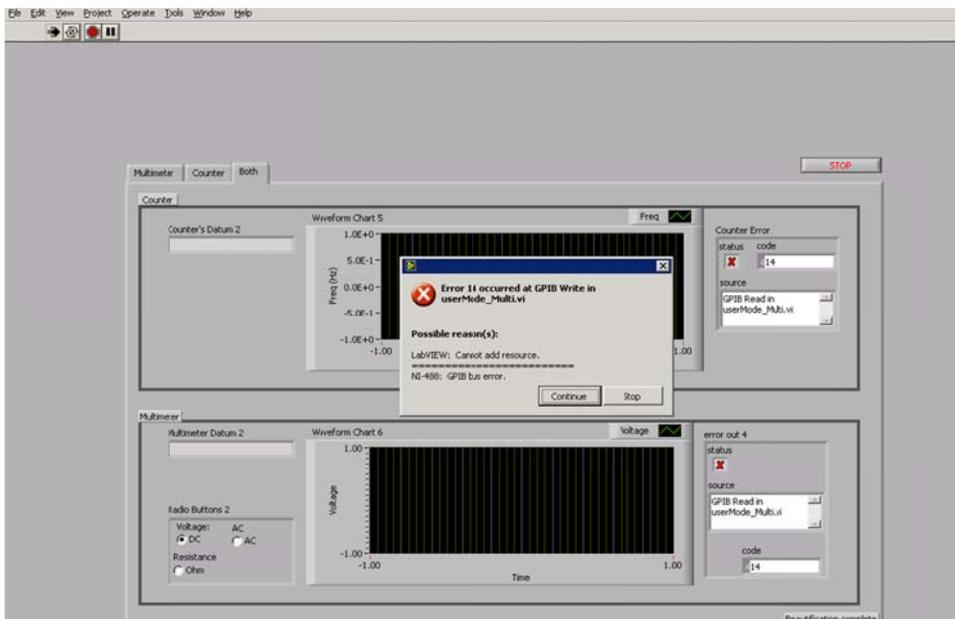


Figure 7. Error Message

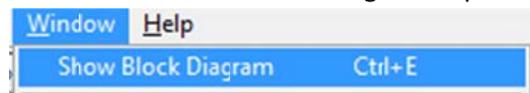
Error 14 means that devices are not found or were not connected properly.

4. To terminate the program, press the **STOP** button, shown in Figure 7 on the top right

Section 3: Programming Simple GPIB Communication VI

The objective of this section is to provide general instructions on writing GPIB communication software in LabView. This section guides the reader through the process of creating a VI that conducts multiple reads from the HP 34401 multimeter. It can be followed in general, but please be aware that specific commands need to be passed to your particular device. These commands are found in manufacturer's user manual . If I found manual like this during the creation of my program, it would save me a lot of headache. The following steps describe the development process. Enjoy!

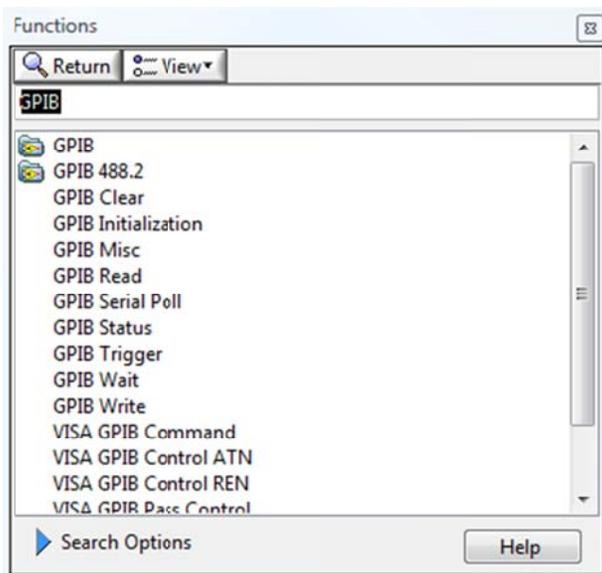
1. Open Labview, select File>New or press Ctrl+N combination of keys.
2. Click on Window > Show Block Diagram or press Ctrl+E combination of keys.



3. To initiate communication with GPIB device right click on any white space, then click on Search

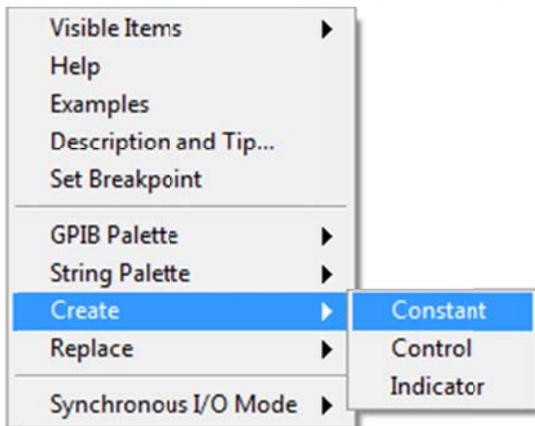


4. Type in GPIB into the search box, then double click on top result GPIB



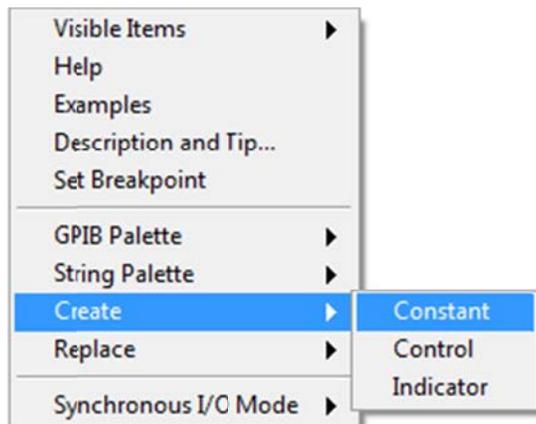


5. You should see the following pane, select GPIB Write icon
 - a. Note before, any reading can be done from the GPIB device, you must send it a command, that if why GPIB Write is the first and initial step in taking read from the GPIB device
 - b. GPIB Write has 2 inputs that absolutely must be present (marked purple)
 - i. The address of the device
 - ii. The command string
6. Create constant string, by right clicking on top purple input, select Create >> Constant



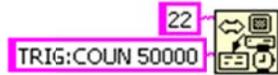
Note the address of the device is displayed by the device during the initiation or can be viewed through the Measurement & Automation Explorer, located at Tools >> Measurement and Automation Explorer

7. Fill in the address of the device in the appeared purple text box (purple wire should be automatically connected)
8. Create a command string
 - a. This can be done in a similar way, right click on the second purple input, Create> Constant



Note: This is sufficient for initiation command. If it is not, I would recommend creating control. This will add the text box in the Front Panel, and any dynamic command can be passed to the device from that point.

9. To initiate continuous read on the HP 34401 multimeter, we will use trigger, as mentioned above, for this purpose, string constant was created. Fill in purple text box with TRIG:COUN 5000

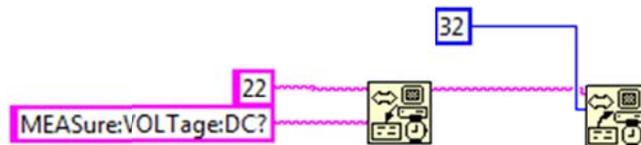


TRIG, stands for trigger, COUN stands for count, or amount of reads to perform, maximum value is 50000, MIN 0

Note: As mentioned, this is only valid for HP 34401

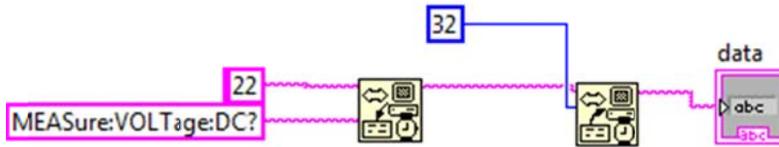
Device is now ready to perform read 50000 times.

10. Specify what reading to take. To specify what reading to take, we must pass another command to same device (please use your specific user manual to refer to the measuring commands)
 - a. Repeat steps 1-8, now for the measuring command, I strongly recommend using control, but if all you want to measure is Voltage DC, AC, or something that will remain relatively constant, the string constant will do.
 - b. Fill in MEASure:VOLTage:DC? In the purple text box, the device, will now start reading voltage DC.
11. Now we are ready to read from the GPIB device, repeat steps 1-6, but now select GPIB Read.
 - a. GPIB read has 2 required input: (1) address of the device(string), it can be done by following step 6 and filling in the address of the device, or by wiring previously created constant, to the required input on the GPIB Read icon. (2) The size of the read in bytes, can be created by following step 6, but right clicking onto the second blue bubble on the left of the icon, fill in 32 for long Double.

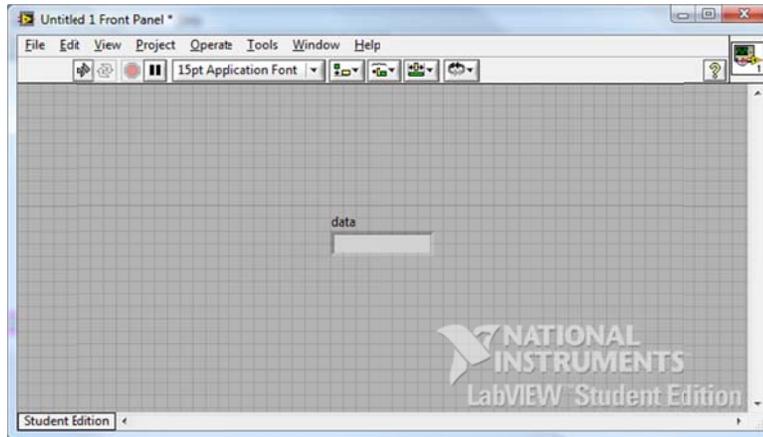


12. Display the output

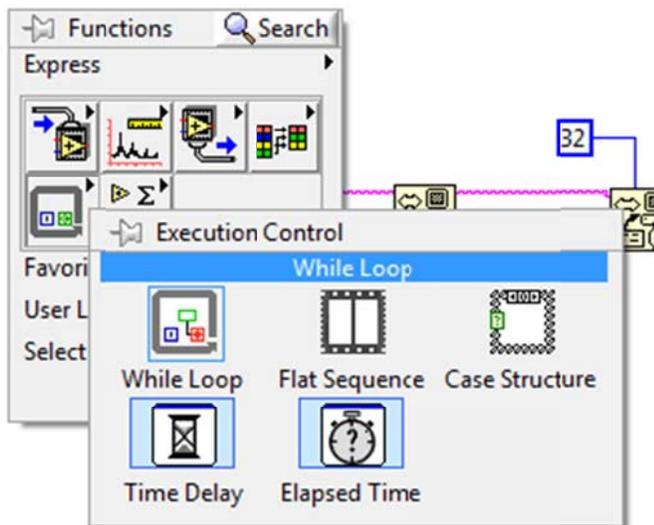
- a. Right click on the data (purple bubble on the right hand side of the GPIB read icon) Create >>Indicator



- b. Text indicator will appear on the Front Panel

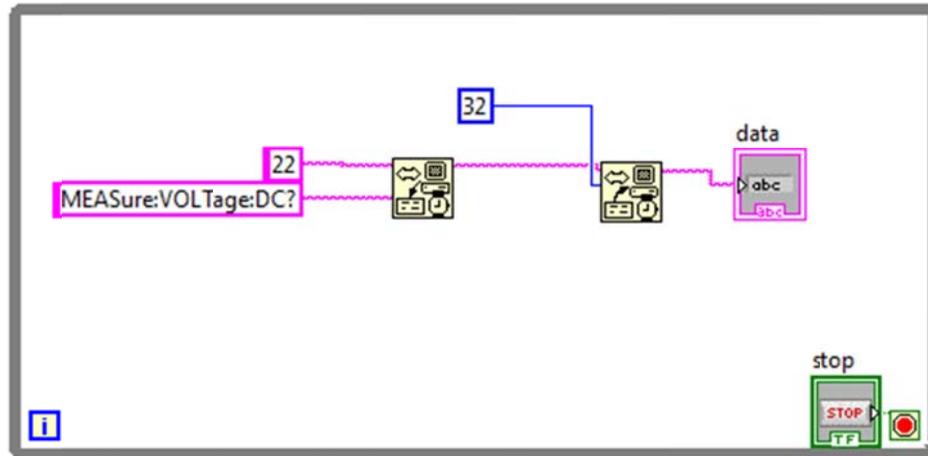


- 13. Loop step 10-12, for continuous read: right click on any white space, select while loop

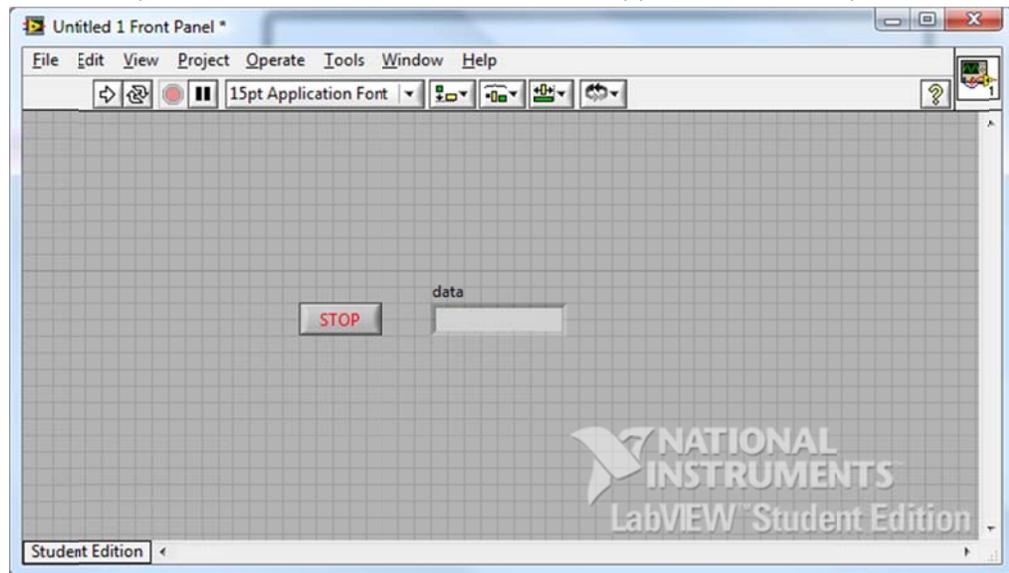


- a. Enclose items that were added in step 10-12

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A while loop comes with the STOP button that will appear on the front panel

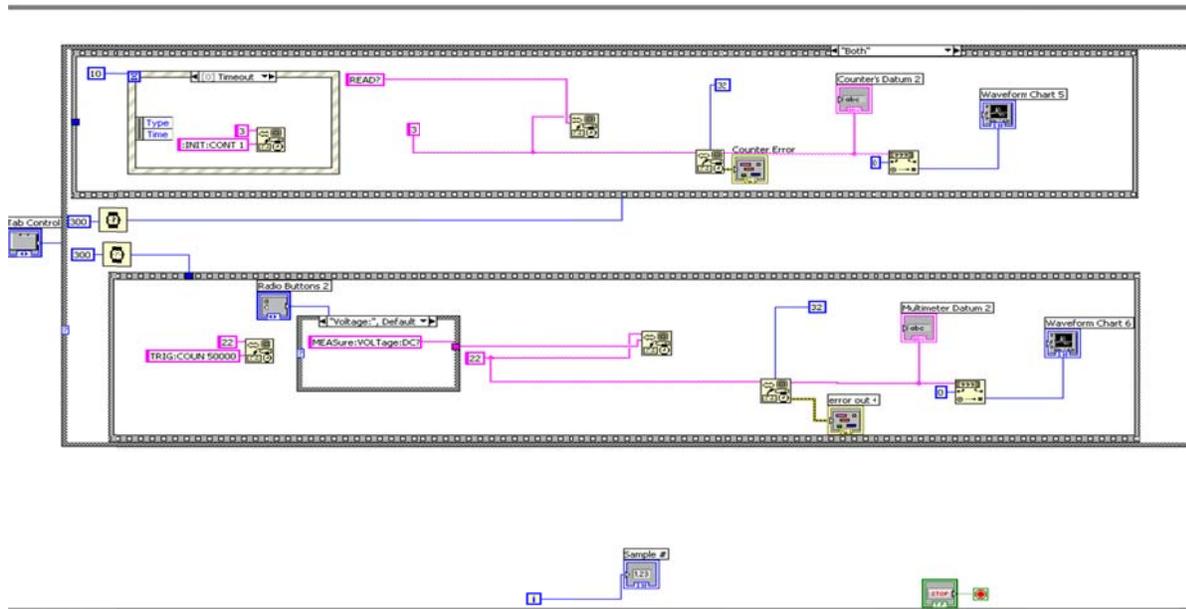


Now when you start VI, the digits will start appearing, every 150 ms.

Section 4: Conclusion

It is the basic VI for communication between the host and GPIB devices. What you can do with GBIB, in general, is much more than that. You can have thousands of commands, indicators, and up to 14 devices chained together to give you as many reads as you need/want.

A more complicated VI developed for Data Acquisition & Control class, Spring 09, FGCU is shown bellow. The same development principles apply to it, this VI is able to communicate with 2 devices, display numerical as well as graphical output simultaneously or separately, and conduct simultaneous read/write.



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References:

[1] HP 34401A User Manual:

http://www.sec.upm.es/docencia/plan_92/im/descarga_IM/ZIPs/HP%2034401A%20Programming%20Reference.pdf

[2] HP 34401A Data Sheet:

http://www.jlab.org/~beise/g0-exp/TargetControls/manuals/ag_34401a_spec.pdf

[3] HP 53131A User Manual:

<http://www.eie.fceia.unr.edu.ar/ftp/Mediciones%20II/53131-90055.pdf>

[4] HP 53131A Data Sheet:

<http://www.airlink.dk/Dokumenter/HP53132A.pdf>