LabView Notes

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April 21, 2015

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1 Various Sub VIs

1.1 position test (SubVI).vi

- Takes in String and Numeric.
- Returns Boolean
- Numeric is sent to "Number to Decimal String" which converts the number to a string of decimal digits at least width characters wider. If no width is specified then it uses exactly the number it needs with no extra padding.
- The string "\FF/0' " and Number to Decimal output, and "\00\03\r\n" are concatenated together.
- This string is compared to Input String.
- If the two are same, outputs True, else False.

1.2 Move SC Motot (SubVI).vi

- Inputs= Speed, Boolean (Button, Test mode or not), Test Readout (Input, string), Test String (output, string), Test Steps (double), VISA Resource Name, VISA errors, String.
- Button goes into Property Node
  - Gets (reads) and/or sets (writes) properties of a reference. Can use to access private data of a LabView class.
  - Class= Boolean
  - Property = Value, Data value of this control. TRUE or FALSE
  - We are getting/reading this value.
  - This value (T/F) sets the Case. If FALSE, nothing happens. If TRUE, lots of stuff happens.
  - Reference Out goes into True Case and is an input for another property node (Boolean), where the property F is written.
- All other Vi inputs are sent into the True Case, where there is a Stacked Case:
  - Case 0:
    - VISA Resource Name and Error go to VISA Write and then Read.
    - The String (\2 = Si or \1 = TL) is concatenated with "F1R\r\n". This new string is concatenated with a Carriage Return and a Line Feed and then sent to VISA Write Buffer, which is sent to the device.
    - A byte count of 50 is set on VISA Read, which reads out buffer from device.
  - Case 1:
    - VISA Resource name/error sent to VISA Write and then Read.
    - String (\2 or \1) and "V" and Speed (through Number to Decimal String) and "R\r\n" are concatenated.
    - This new string is concatenated with a Carriage Return and Line Feed.
    - The newer string is sent to VISA Write Buffer and sent to the device.

    * 50 byte count on VISA Read.
  - Case 2:
    * VISA resource name and error sent to VISA Write and then VISA Read with 50 bytes.
    * Output of VISA Read is set as property of the Output Boolean (on front panel).
    * The following is read into the VISA Write buffer:
      · Speed is sent to Case 2, goes to Property Node with property set to Value = Data value of control. This data value is read out and sent to To Long Integer (converts the number to 32 - bit integer).
      · This Long Int is put into 2 T/F Cases. The first is whether it's equal or not to 0.
      > If Long Int does not equal 0, then if Long Int is greater than 0, the Long Int is inputted into Number to Decimal String (# to string of decimal digits). This String and the String constant "P" are sent out of the double T/F Cases.
      > If Long Int does not equal 0 and the Long Int is less than 0, the Long Int is negated (x goes to -x) and sent to the Number to Decimal String. This along with the string constant "D" are sent out of both T/F Cases.
      > If Long Int equals 0, the string constant "Z" and "1000000" are sent out of the T/F Cases.
      · The strings coming out of the T/F Cases are sent to Concatenate Strings. In position 1, the String ("\1" or "\2") is set. The 4th position is the string constant: "R\r\n"
      · This half String is written to the Property Node attached to the Input button.
      · This concatenated String is also sent to position 1 in another Concatenate String, Position 2 is a Carriage Return and Position 3 is a Line Feed.
      · This full String is written to the VISA Write buffer.
    * Buttons, refnum controls, allow you to open a reference to a LabView application, pass references as a parameter to another VI. This way you can control the behavior and read the properties of an application.
  - If Button button to Boolean is False, nothing happens.

1.3 Move SC Motor 2 (SubVI).vi

- Inputs: String constant ("\1" or "\2"), Speed (for Si and TL speed), Input (reference to Si/TL input), Output (reference to Si/TL output), Position, VISA resource name, and VISA Error.
- Stacked Case:
  - Case 0:
    * VISA resource name and error sent to VISA Write, then to VISA Read (50 Bytes).
    * String constant concatenated with '\F1R\r\n'
    * This is concatenated with Carriage Return and Line Feed and then sent to VISA Write Buffer.

- Case 1:
  - Same for VISA name, error, and 50 Bytes.
  - String constant (#1), 'V' (#2), Speed (sent through Number to Decimal String, #3), and 'R\r\n' (#4) are all concatenated together.
  - This is then concatenated with Carriage Return and Line Feed.
  - This string is sent to VISA Write Buffer.
- Case2:
  - If position=0, True
    - VISA resource name, error, 50 Bytes.
    - String constant + 'Z1000000R\r\n' are concatenated with Carriage Return and Line Feed. This is also set as the property (Value) node of the Input Button.
    - Full string is written to buffer of VISA Write.
    - The buffer read from VISA Read is sent as the value of the property Output Button.
  - If position does not equal 0, False:
    - VISA resource name, errors, 50 Bytes.
    - String constant + 'A' + Position (through Number to Decimal String) + 'R\r\n'
    - This string is set as the value of the property Input Button.
    - This string is also concatenated with Carriage Return and Line Feed and sent to the Write buffer of VISA Write.
    - The Read buffer is set as the value for the property Output Button.

1.4 Shield_new.vi

- Buttons on Front Panel are Move (T/F), Power (T/F), Home (T/F), Abort (T/F), Steps (String), Readout (String), Position in Inches (extended).
- References to all Buttons are sent to Shield sub VI.
- VISA Serial has resource name and 9600 Baud rate.
- Bool Refnum (Power) and Str Refnum (Pos Readout) and DigNum Refnum are also sent into While loop with 2000 ms Wait.
- From VISA Serial:
  - VISA Write takes in resource name and errors, write buffer is '\1?O\r\n + Carriage Return + Line Feed.'
  - Resource name and errors are sent to VISA Read with 50 Bytes.
  - Output of VISA Read goes to 2 places.
    - One Output goes to T/F Case. T/F comes from value (read) of property connected to Bool RefNum (power). This value is also sent to T/F indicator called Power and to the Field Point FP-DIO-550@2 Output.
      - If False, it writes 'MOTOR OFF' to Position Readout 2 and writes it to the value of the property node connected to Str Refnum (Pos Readout).

        - If True, it writes output of VISA Read to Position Readout 2 and Str RefNum (Pos Readout).
      - Second Output goes into Search/Split String with an offset of 4. Then it goes into a Reverse String and then into another Search/Split String with an offset of 4. Then to another Reverse String. Basically this removes the first and last 4 characters of the string.
      - The new string is sent through Decimal String to #.
      - The number is divided by 820000 and made into an extended precision float. This is sent to Position in Inches 2, Position2, and read to the property node of DigNum RefNum.
- Resource name is sent out of While loop using Shift Registers, to VISA Close.
- Errors go through the Clear Errors.vi and then out to VISA Close.
- VISA Close errors are sent to General Error Handlers.vi

2 Scattering Chamber Controls

2.1 First While Loop - to monitor Target Ladder (TL) and Silicon (Si) Detector positions

- Waits 1000 milliseconds before outputing readings.
- A blank queue is sent in, info is added to it and it is passed back out. The loop to move both Si and TL will then read this queued information later.
- Bundle for the queue includes: TL VISA Read readout, TL numeric position, SI VISA Read readout, Si numeric position, SC Power ON/OFF. The readouts are strings, the positions are numbers, and the power is a boolean (T/F).
- Through the VISA Serial Port -
  - Resource Name (specifics the resource to open)
  - Baud Rate (transmission rate) is 9600 (default).
  - Resource Name is passed out.
  - Error is also an optional input and output.

- Case Loop (True for SC ON, or False for SC OFF):
  - Case structure inside of this:
    - One for Si (#1)
    - One for TL (#2)
  - Resource name, error, and string are sent to VISA Write. This writes data from the write buffer to device or interface specified by resource name. Write buffer string is sent to instrument:
    - TL gets /1?0\r\n
    - Si gets /2?0\r\n
  - VISA Write waits a set amount of time and then looks for the VISA Read.

- VISA Read takes in the resource name, error, and the number of bytes from device or interface. This reads the information from the instrument.
- VISA Read passes out:
  - resource name (all the way out of the while loop)
  - Error(all the way out of the while loop)
  - Read buffer: returns data in data buffer
- Read buffer goes into a readout_convert sub VI to convert it to a numeric.
- Converted read data is sent to two indicators: Numeric indicator and a Bar indicator
- Converted read data is also written to a local variable, made from the string indicator. Make a local variable from the String indicator outside of the T/F Case structure (called TL or Si Position Readout). This local variable is placed in the 0/1 Case and wired to the output of Read.
- Case 0 (TL): The Read buffer and the numeric output from the readout convert are passed out of the 0/1 Case to a bundle, then to a queue.
- Case 1 (Si): The same as TL. Also sent to bundle and then queue.
- Bundle also gets the resource name and error from outside of the while loop. Bundle is passed out of the while loop and sent to Release Queue, to be used later.
- VISA Readout sends out the resource name and errors. Errors are cleared and then both are sent out of the 0/1 Case and the T/F Case to a VISA Close. This closes the device session. Errors are sent out of this.
- The VISA Serial Port in and VISA Close out of While loop need to have connected changed to "Shift Register." This allows data to be passed between loop iterations.
- At bottom, inside While loop, is a stop. If the Stop button (on front panel) is True, the position readout will stop.
- For False Case: VISA Serial Port outputs are sent straight through. Si and TL Position Readouts are defined as OFF. OFF and 0 are sent to bundle. Bundle is sent to queue and queue is sent out of While loop and to Release Queue.

2.2 Second While Loop - Moving Target Ladder (TL) and Silicon (Si) Detector

- In the upper left are definitions for several settings:
  - Faraday Cup (Position 1, Home) = 71000
  - Position 2 = 163000
  - Position 3 = 249000
  - Position 4 = 339000
  - Position 5 = 429000
  - TL Speed = 4000
  - Si IN = 49000
  - Si MID (arbitrarily set to between IN and HOME) = 26000
  - Si Speed = 2000

  - FC Enable - Boolean for whether or not position can be used.
  - Pos 2 - Boolean for whether or not position can be used.
  - Pos 3 - Boolean for whether or not position can be used.
  - Pos 4 - Boolean for whether or not position can be used.
  - Pos 5 - Boolean for whether or not position can be used.
  - TL Input - Strings, inputs into device, outputs from device.
  - TL Output - Strings, inputs into device, outputs from device.
  - Si Input - Strings, inputs into device, outputs from device.
  - Si Output - Strings, inputs into device, outputs from device.
  - Normal/Override Button (T/F Button) is shown at bottom left. There are lots of local variables of this.

- VISA Serial passes in the resource name with a Baud rate of 9600 (default), and passes in errors.
- Queue from position Readings is sent in and Released.
- For TL:
  - The String and Numeric Readouts for the TL are sent to Position test - SubVIs. This returns T or F if the input string and numeric are equal or unequal respectively.
  - If Position Test and Normal are selected, then True Case in TL Case structure.
  - The TL control on the main page is sent to this T/F Case as well.
    * The TL control is through Radio Button Control which gives the user the control to select from a list of items, one item at a time. The data type for Radio Button control is enumerated type, so you can use the buttons control to select the cases of a Case structure.
    * The TL Radio Button is sent to the Case Structure inside the T Case, via '?' which selects case.
    * Radio Selection #1: Numeric constant '0' is sent out. Boolean T is sent out.
    * Radio Selection #2: Local variable Faraday Cup and Local variable FC Enable are sent out.
    * Radio Selection #3: Same as 2 but for Position 2 and Pos 2.
    * Radio Selection #4: Same as 2 but for Position 3 and Pos 3.
    * Radio Selection #5: Same as 2 but for Position 4 and Pos 4.
    * Radio Selection #6: Same as 2 but for Position 5 and Pos 5.
  - The TL Button is also sent through Case T to a shift register out of While loop (more in a moment on other end of shift register).
  - Position of TL from queue is compared with selected Radio Selection. This comparison and the NOT of whether that position is enabled is sent to an OR gate, which goes to a T/F Case.
  - So if position from queue and position from Radio Selection are the same, the new case = True, do nothing. (Same if that position is enabled or not enabled).
  - If position from queue and position from Radio Selection are different and if position is not enabled, do not do anything.

  - If position from queue and position from Radio Selection are different and if position is enabled, send the following to Move SC Motor 2 Sub VI:
    * Local variable TL Speed
    * Reference TL Input
    * Reference TL Output
    * Numeric Position from Radio Selection
    * VISA resource name
    * VISA errors
    * String constant \1.
  - If position is not enabled, do nothing
  - If position is enabled, the left side of the shift register is passed in and written to Local Variable TL.

- For Si:
  - The String and Numeric positions are sent to Position Test Sub VI. This returns T if they are the same.
  - IF Position Test returns T and Normal is ON then True for Case Structure:
    * Si Radio Button Control sends information into Case structure inside True. Radio Selection #1 is Home, Numeric '0' sent out. Radio Selection #2 is SI MID, local variable. Radio Selection #3 is SI IN, local variable.
    * If position from queue equal the Radio Button then do nothing.
    * If not, then send the following to Move SC Motor 2 Sub VI: String ('\2'), VISA resource name and errors, Local variable Si Speed, References to Si Input and Si Output, and Radio Button position.
  - Position of TL from queue is compared to (local) Position3.
    * If queue position if less than Position, and Normal/Override is in either, '1' is sent to disable Si motion.
    * If queue position if not less than 3 and you are in normal - 1 is sent to disable Si, or in override - 0 is sent to enable Si. This keeps the user from running the Si detector into the back of the Faraday Cup.

- Testing Sub Vi - Moving SC Motors:
  - The following for both TL and Si have references that go to Move SC Sub Vi:
    * Boolean, TL/Si Test - Control on Front panel
    * String constant, TL/Si Test Readout - Indicator on Front panel
    * String constant, TL/Si Test String - Indicator on Front panel
    * Double, TL/Si Test Steps - Indicator on Front panel
  - Also sent to the Sub Vi are the local variables of speed, VISA resource name and errors, and the strings (\1 for TL and \2 for Si)

- Abort SC - Control on Front panel (if False, do nothing)
  - If True:
    * Case 0

            - VISA resource name and errors sent to VISA Write, then Read with 50 Bytes.
            - \1TR\r \n + Carriage Return and Line Feed are concatenated and written to the buffer.
            - The read buffer is sent to Tl Abort Readout.
        * Case 1
            - Same thing as Case 0, except to Si Abort Readout.
            - Also the string uses \2 for the Si instead of \1 for the TL
        * False is written to the value of the property node of Abort SC.
        * False is written to Local variable Normal/Override
    - VISA resource name and errors are sent out the other side of the While loop through shift registers.

3 Definitions

- **VISA** = Virtual Instrument Software Architecture, provides interface between hardware and developing environments such as LabView.