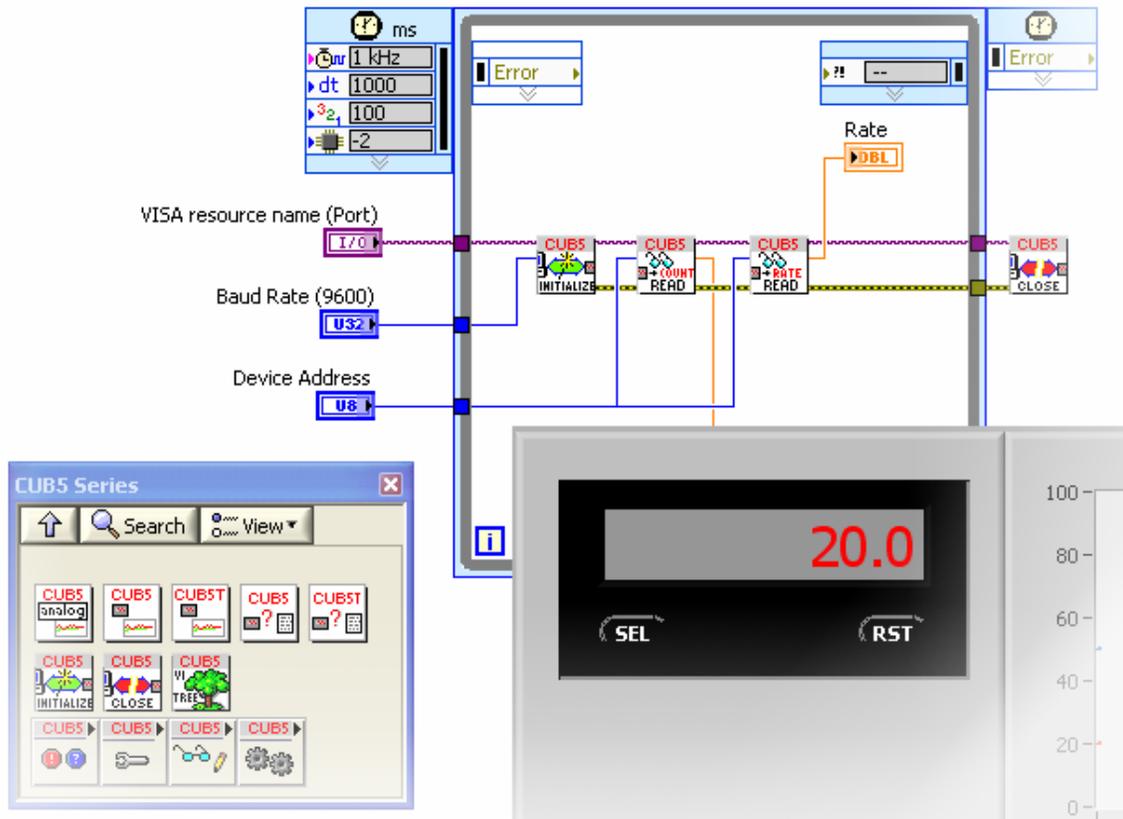


CUB5 Series Communication VI Library

User Manual: Version 1.0



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1. Introduction

This VI library contains VIs (Virtual Instruments) and example code for implementing communication between LabVIEW™ from National Instruments and a Red Lion® Controls* CUB5 series panel meter via RS-485 serial bus. The CUB5 series includes several different types of panel meters including the CUB5 counter, CUB5T timer, CUB5V DC voltage meter, CUB5I DC current meter, CUB5RT Temperature meter, and CUB5P Process Meter (4-20mA).

Communication between LabVIEW and CUB5 series panel meter, allows expanded capabilities such as the ability to log and trend the panel meter value or to remotely change the configuration values on the meter. A single instance of LabVIEW running on a PC can access multiple panel meters and other devices throughout an installation via the RS-485 bus to provide a central view or coordinated control and data acquisition capability at very low cost.

The CUB5 device requires an optional serial interface that is available from Red Lion Controls in order to communicate via serial. Although recommended for RS-485 serial communication, these VIs can also be used with RS-232 serial or USB serial communication if that type of interface is used. Because addressing is not supported by RS-232 serial or USB serial communication, this applies only to a single CUB5 device that is directly connected to the PC.

It is assumed in this document that the reader is familiar with how to program and use LabVIEW. Hardware and wiring are beyond the scope of this document. If you need help setting up the RS-485 serial bus, please consult the user manual for the panel meter, your RS-485 serial interface documentation or one of the numerous references on the internet. More information about LabVIEW is available at <http://www.ni.com/labview> and RS-485 references are also available at <http://www.integratedpro.com>

CAUTION!!!! The VI library can change the configuration, setpoint or other operating parameters of your device(s) and/or other devices connected to the RS-485 bus, resulting in changes to device behavior and especially if the device is connected to a physical process (i.e. operational and controlling something!) Never experiment with an operational device – for development purposes it is recommended to only use an offline device, on an isolated RS-485 serial bus until you have thoroughly verified functionality and safety in your application.

*Integrated Pro is not affiliated with Red Lion® Controls.

2. Installation

Install the VI library by running the installation program, setup.exe. Choose the installation directory, and review the Software License Agreement. The VI library installs under the most current version of LabVIEW. Be sure to review the Readme.txt file information at the end of the installation.

Restart LabVIEW after installing so that the library VIs will show up on the Tools palette (right click the block diagram). You can find them on the CUB5 series palette under User Libraries. You can access help and example VIs under the LabVIEW Help menu.

It is recommended that you Mass Compile the VI library to make sure that the VIs are compiled in your version of LabVIEW and that all of the VIs link to their necessary suVIs. Open the Mass Compile dialog from the Tools->Advanced->Mass Compile menu and navigate to the folder [LabVIEW]\user.lib\CUB5 Series (where [LabVIEW] represents the folder where LabVIEW is installed). Make sure you are inside CUB5 Series folder and choose "Current Folder", then "Mass Compile". Note that the message "Bad VI ... VI Tree CUB5 series.vi" is expected (this VI is not intended to be operational, but only to present the subVIs in categories).

3. Communications Setup

Before using the VI library, you need to know three things:

1. Which communications port your RS-485 serial interface is using to communicate with the Controller. You can then use this information to set the VISA Resource which LabVIEW will use to communicate with the controller.
2. The address of the Controller on the RS-485 serial bus. This will be a number between 1 and 255.
3. The serial baud rate. By default, this is set to 9600 baud. Other serial settings should be set to 8 bit data, No parity, and 1 Stop bit.

Finding the Communications Port

To find out this information consult the documentation for your RS-485 serial interface. Most RS-485 serial interfaces install under Windows as a standard serial port, such as COM5, COM6, etc. In Windows, you can view the installed serial ports under the device manager. MAC OS and Linux have similar utilities.

Finding the Controller Address and Serial Baud Rate

On the CUB5 series panel meters, the Controller address and serial settings are found using the Serial settings programming menu (press and hold the SEL button until the programming menus appear, press the RST button to enter programming mode and then use the SEL button to choose the Serial settings programming menu). Consult the CUB5 panel meter manual for further details.

All devices on the RS-485 serial bus must use the same serial baud rate, but have different addresses. LabVIEW acts as a serial Master device and the Controller acts as a Slave device. The VI library only supports RTU mode, not ASCII communications.

4. Using Example VIs

Example VIs are included with the VI library including:

- CUB5 Counter Example Query Settings.vi
- CUB5 Timer Example Query Settings.vi
- CUB5 Counter Example Panel and Log.vi
- CUB5 Analog Example Panel and Log.vi
- CUB5 Timer Example Panel and log.vi

These VIs are contained in the folder: [LabVIEW]\examples\CUB5 series, where [LabVIEW] represents the path to your LabVIEW installation. They demonstrate how to use the subVIs contained in the VI library to communicate with the panel meter and are meant to be starting points for verifying communication and for use in creating your own custom VIs. It is assumed that the CUB5 series device is properly wired and configured for communication.

Example VIs can be accessed either under CUB5 Series library on the LabVIEW Help menu or from the Tools Palette (right-click on the block diagram). On the Tools Palette, choose the CUB5 Series panel meter palette under User Libraries as shown in Figure 1. When you drop one of the example VIs on a block diagram, it will automatically open to show the front panel.

CUB5 Counter Example Query Device.vi

The purpose of this VI is to query the settings of the CUB5 counter at the address you provide and to report this in text form. The front panel of this example VI is shown in Figure 2.

To run this example VI, follow the instructions on the front panel. The VI will execute a single time and the Status Information will report some status and configurable settings of the panel meter, for example: the current values for the Count and Rate, the Scale Factor and Count Load value (value loaded on reset). This information is also shown on the indicators on the right hand side of the front panel.

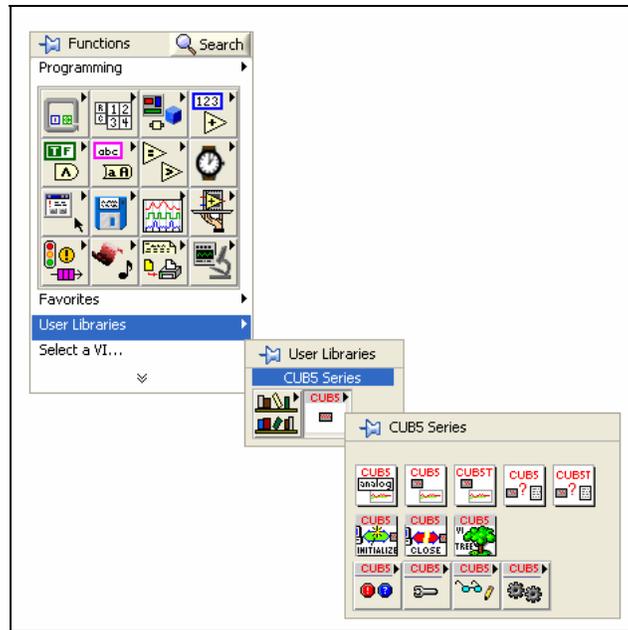


Figure 1 - CUB5 Series library VIs under User Libraries on the Tools Palette

CUB5 Timer Example Query Device.vi

The purpose of this VI is to query the settings of the CUB5 timer at the address you provide and to report this in text form. The front panel of this example VI is shown in Figure 3.

To run this example VI, follow the instructions on the front panel. The VI will execute a single time and the Status Information will report some status and configurable settings of the panel meter, for example: the current values for the Timer and Cycles, Timer Start value, Timer Stop value, and Cycle Count Start value. This information is also shown on the indicators on the right hand side of the front panel.

CUB5 Counter Example Panel and Log.vi

The purpose of this VI is to simulate the front panel of the CUB 5 counter, showing the Count and Rate values. Trend values of Count and Rate are logged to a chart on the front panel at about every second. The front panel of this example VI is shown in Figure 4.

Follow the instructions on the front panel. The VI executes in a loop, with an event structure controlling the update rate and responding to user input from the front panel controls. By default, the VI will only retrieve the values of Count and Rate. By turning the Write Enable switch ON, the VI can be used to set the Count using the Update Count numeric control.

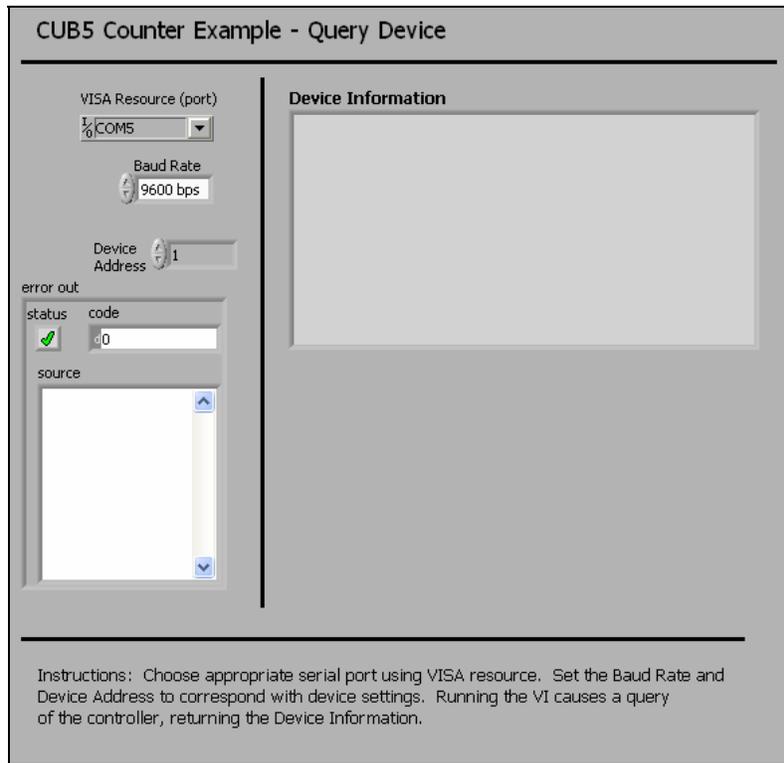


Figure 2 – CUB5 Counter Example Query Device VI front panel

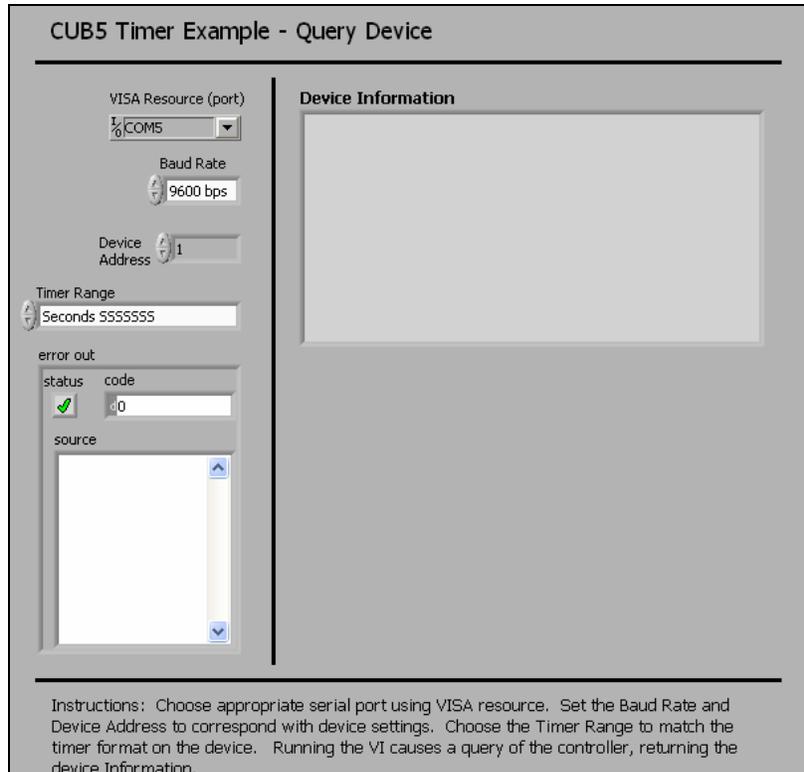


Figure 3 - CUB5 Timer Example Query Device VI front panel

CUB5 Timer Example Panel and Log.vi

The purpose of this VI is to simulate the front panel of the CUB5 timer, showing the Time and Cycle Count values. Trend values of Time and Cycle Count are logged to a chart on the front panel at about every second. The front panel of this example VI is shown in Figure 5. Follow the instructions on the front panel. The VI executes in a loop, with an event structure controlling the update rate and responding to user input from the front panel controls.

CUB5 Analog Example Panel and Log.vi

The purpose of this VI is to simulate the front panel of the CUB5 Analog Meter (DC Voltage, DC Current, Temperature, or Process Meter), showing the Input value. Trend values of the Input are logged to a chart on the front panel at about every second. The front panel of this example VI is shown in Figure 6. Follow the instructions on the front panel. The VI executes in a loop, with an event structure controlling the update rate and responding to user input from the front panel controls.

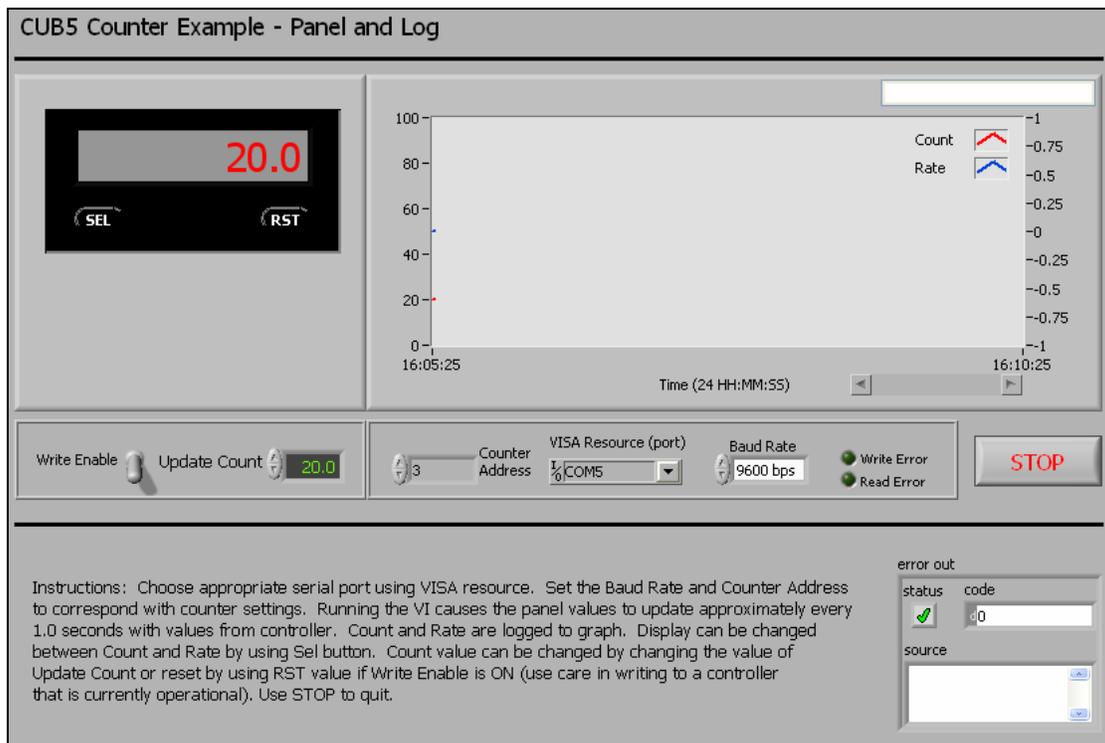


Figure 4 - CUB5 Counter Example Panel and Log VI front panel

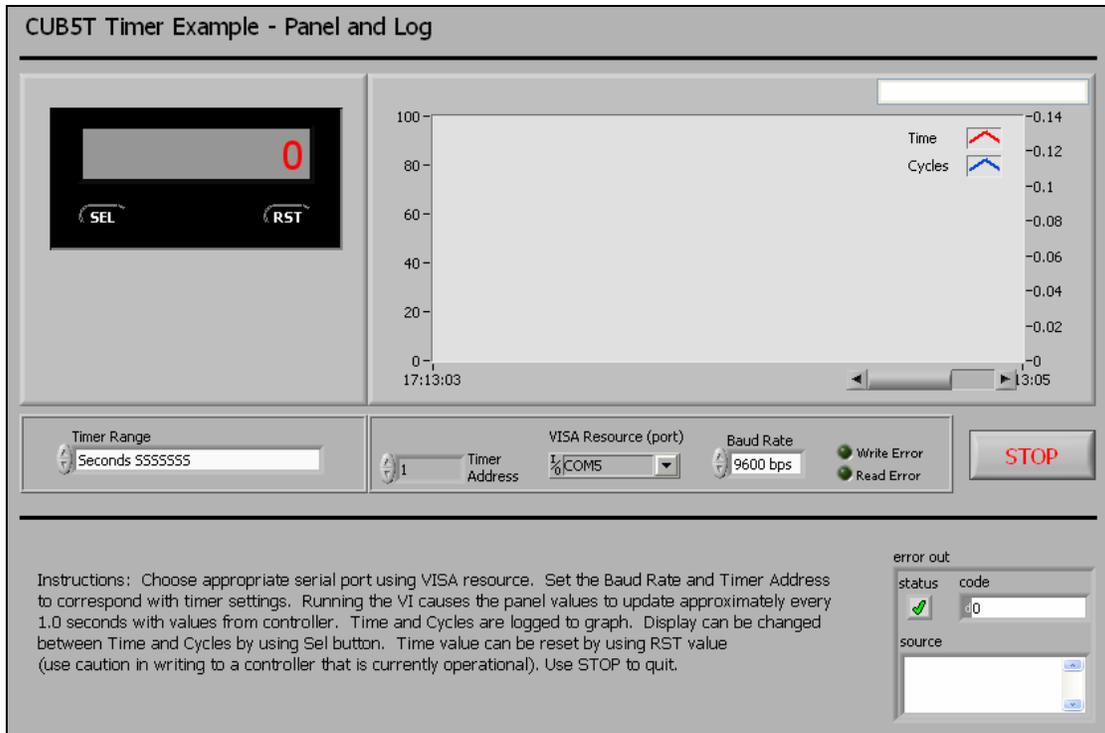


Figure 5 - CUB5 Timer Example Panel and Log VI front panel

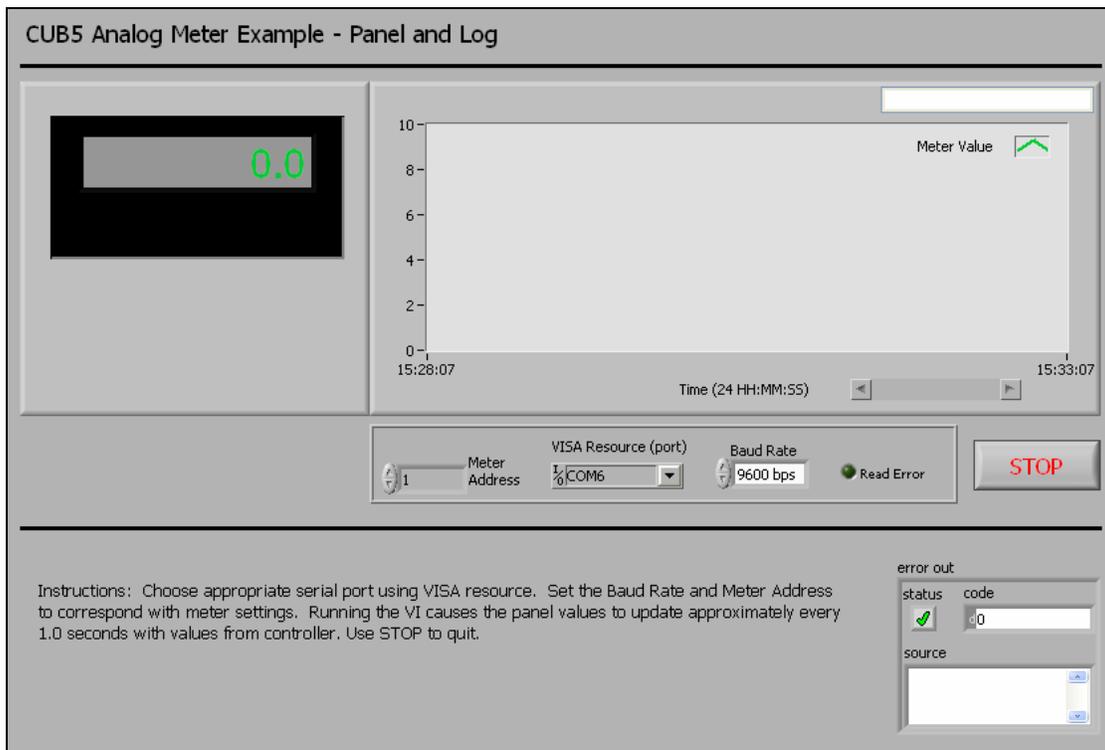


Figure 6 - CUB5 Analog Meter Example Panel and Log VI front panel

5. Creating Custom VIs

After using the example VIs to verify communications between LabVIEW and the device, you can use the VI library to create your own custom VIs or modify the examples. Here is a simple example showing how to use a few of the library VIs to develop a custom VI.

CAUTION!!!! The VI library can change the configuration, setpoint or other operating parameters of your device(s) and/or other devices connected to the RS-485 bus, resulting in changes to device behavior and especially if the device is connected to a physical process (i.e. operational and controlling something!) Never experiment with an operational device – for development purposes it is recommended to only use an offline device, on an isolated RS-485 serial bus until you have thoroughly verified functionality and safety in your application.

A Basic VI Application

Start with a blank VI and open the CUB5 Series VI palettes by right-clicking on the block diagram of the new VI, choosing User Libraries from the Tools Palette and opening the CUB5 series Controller palette as shown in Figure 1. Make it stay open “Pinning” the palette (click the push-pin icon in the upper left hand corner) of the CUB5 series Controller palette.

Drag the Initialize CUB5.vi and Close CUB5.vi onto the block diagram. Now open the Data sub-palette. Depending upon which type of device you have: if your device is a CUB5 counter, then drag Read Count CUB5.vi onto the block diagram; or if your device is a CUB5T timer, then drag Read Timer CUB5T onto the block diagram; or if your device is a CUB5V, CUB5I, CUB5RT or CUB5P, then drag the Read Input CUB5 Analog.vi onto the block diagram.

Arrange the VIs on the block diagram as shown in Figure 7 (CUB5 counter example shown). You can view the connector pane for each of the subVIs by turning on the LabVIEW context help (the ? button in the upper right of the block diagram window) and hovering with the mouse over each of the icons. Notice that there are required inputs on some of the subVIs, so connect these up to a control or a constant. The VISA resource name, Baud Rate and Controller Address controls can be easily created by right clicking on the appropriate VI inputs on the block diagram and choosing Create->Control, from the right-mouse click menu.

When correctly wired, the front panel and block diagram should look similar to Figure 7 and Figure 8. Set the VISA resource name, Baud rate, and Device Address. Save the VI and run it. The value shown on the front panel (in the example shown, Count) should now correspond to the value on the CUB5 series panel meter.

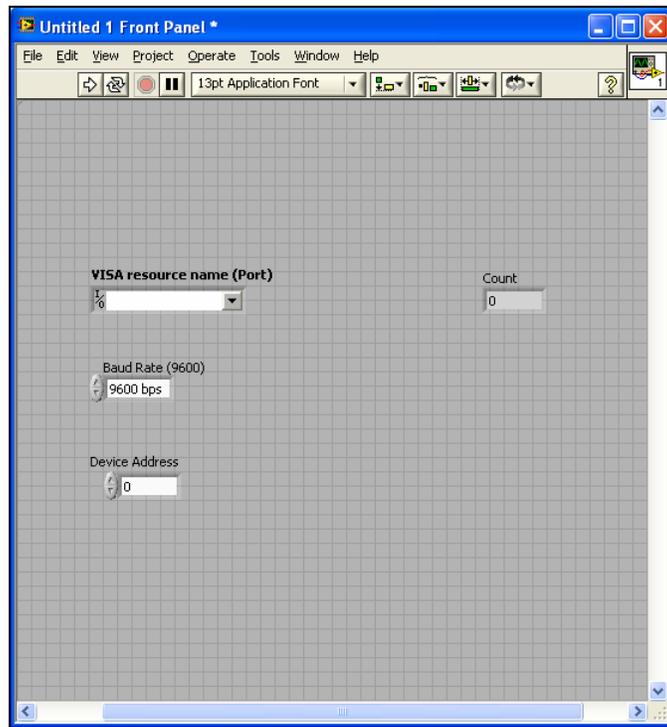


Figure 7 – Basic Application VI front panel

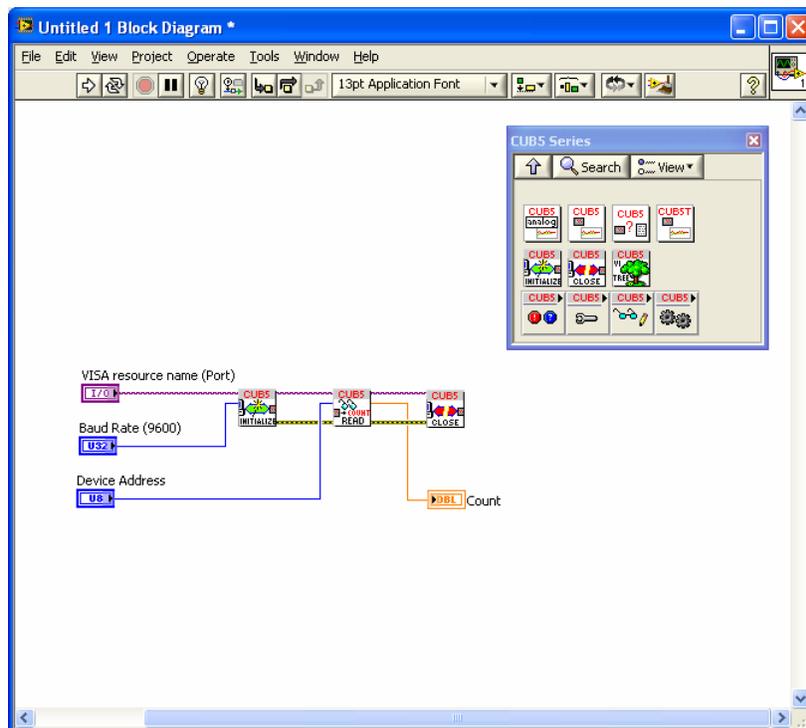


Figure 8 – Basic Application VI block diagram

Adding More Functionality

The basic pattern for the subVIs on the block diagram is always similar to that shown in the simple example, except that the Initialize CUB5.vi and Close CUB5.vi subVIs are only called at the beginning and end of the program and only once for any particular RS-485 serial bus, even if there are multiple Controllers. To further illustrate things, let's add a timed loop to read the values of the input to the CUB5 device.

Using the Basic Application VI as a starting point (save it as a new VI if you would like), add a timed loop (found on the Timed Structures subpalette of the Structures palette) to control how often the values read from the device are updated. Leave the default timing values (1000ms update) and don't forget to add a STOP button control. You can add other VIs from the Data sub-palette of the CUB5 series library if you would like (for instance, Read Rate CUB5.vi in the example shown)

Your front panel should look similar to Figure 10. Notice that the VISA resource and error wires are connected through all the subVIs from left to right and that each individual library VI in the middle of the program requires the Device Address input. If you have multiple controllers on your RS-485 serial bus, you can call them individually by simply changing the controller address input on the given subVI. Running the VI should cause the values shown on the front panel to update approximately once per second to match the values on the front panel of the Device.

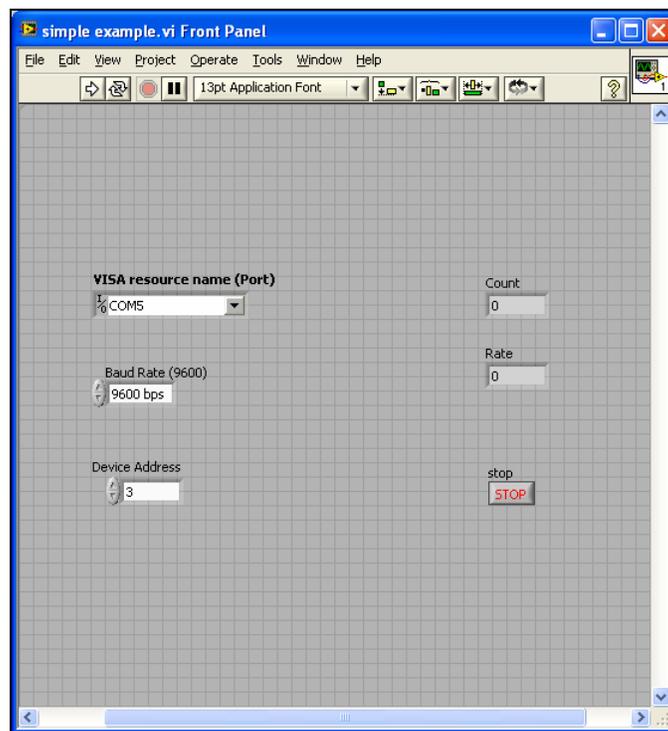


Figure 9 - Simple Example VI front panel

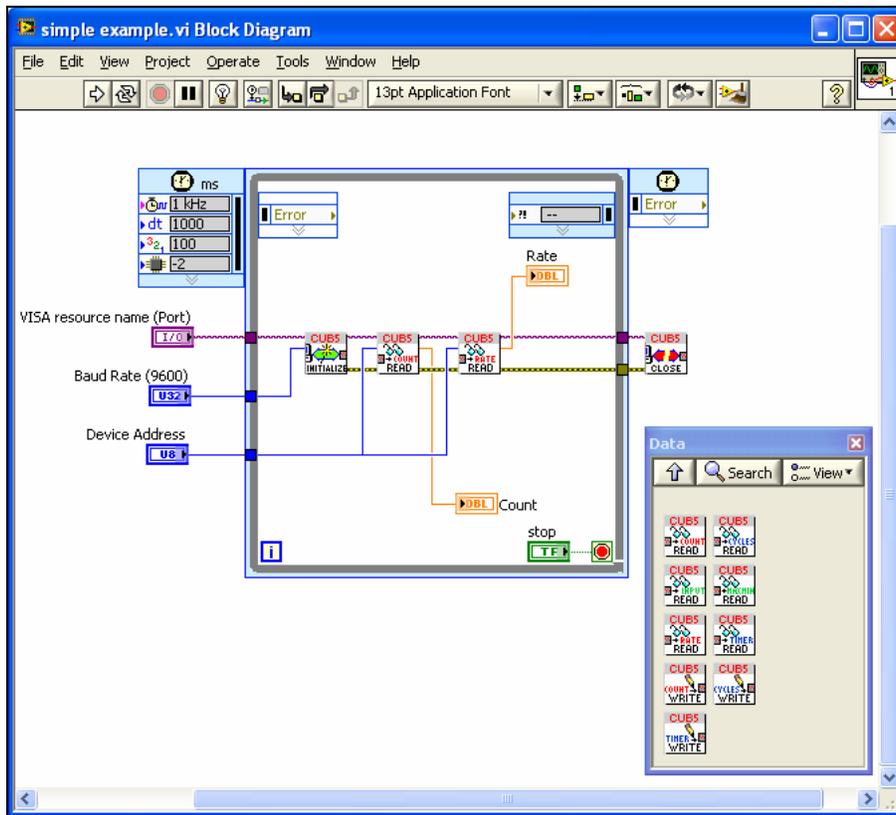


Figure 10 - Simple Example block diagram

Changing Configuration Values

If you want to add the ability to change a configuration value on the Device, this can be done by inserting a subVI and using the Set/Get property. For example, the block diagram of a simple VI to change the Cycle Count Start Value for a CUB5T Timer would look similar to Figure 11, where the Set or Get Cycle Count Start Value CUB5.vi is used.

The default value of the Set/Get property is to Get (read) the current configuration value. If it is desired to change the value, then the desired values must be wired to the appropriate input of the subVI and the Set/Get property must be changed to Set (write). Note that the subVI will always Get (read) the value of the property after setting it and return the current configuration value.

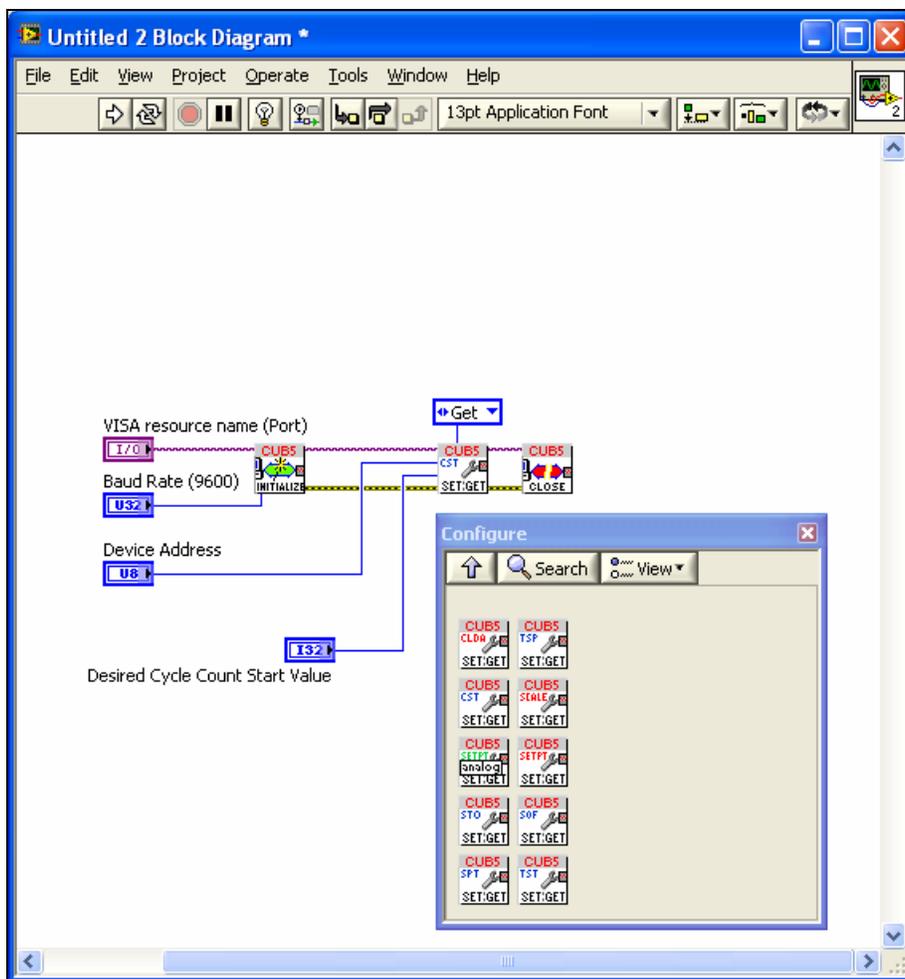


Figure 11 - Using Set/Get property to read or write configuration values

Timer Formats

The CUB5T Timer device can display time values in a number of formats on the front panel of the device. Internally on the device, all of these formats are converted to a 7 place, unsigned integer value and the decimal place (if any) shown on the front panel of the device is assumed according to the format chosen in the Device setup menu. This makes it necessary to use an assumed choice for the Timer Range input when displaying the time value as shown on the actual CUB5T device in LabVIEW.

Additionally, the VI Library uses a typedef cluster, named Time Values, containing individual numeric controls for the values of Days, Hours, Minutes and Seconds, as an input and output of subVIs that read and write time values to and from the CUB5T Timer Device and the time values are converted to and from the device format as required. The Timer Range input and the Time Values cluster are shown on the front panel shown in Figure 12. Several VIs are provided for manipulating the time formats and values. These are illustrated in CUB5T Timer Example Panel and Log.vi and CUB5T Timer Example Query Device.vi example applications.

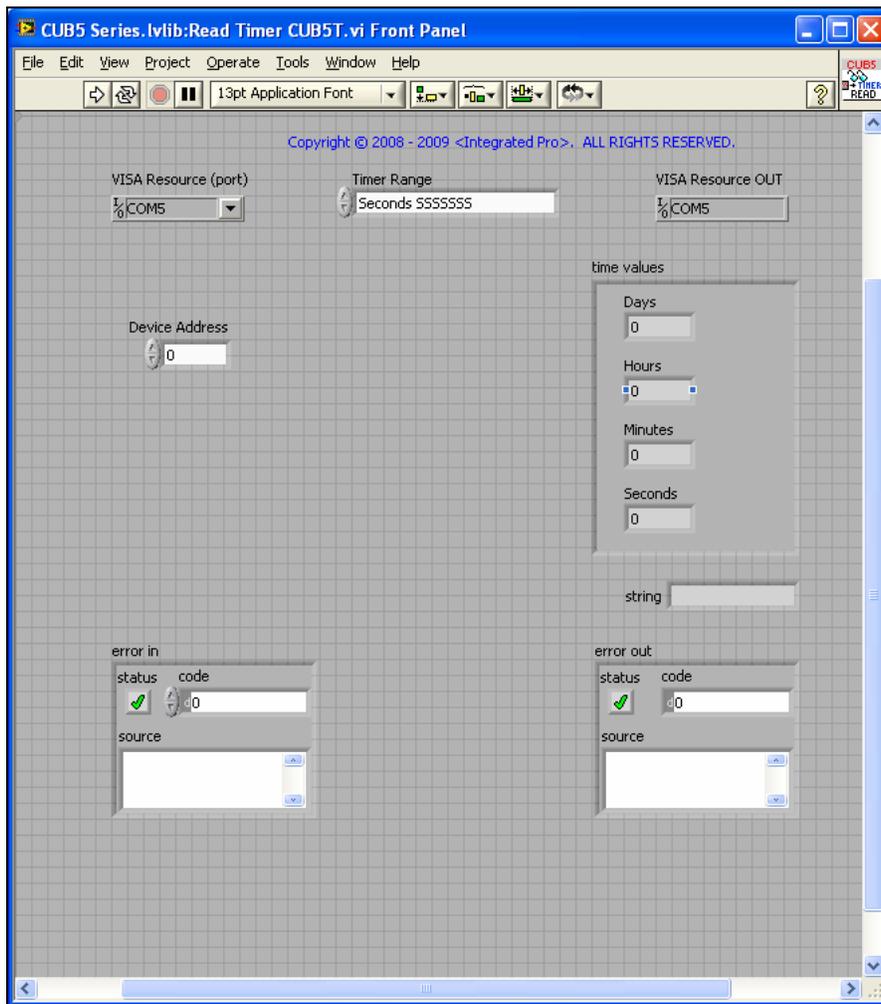


Figure 12 - Read Timer CUB5T.vi front panel showing Timer Range and time values controls

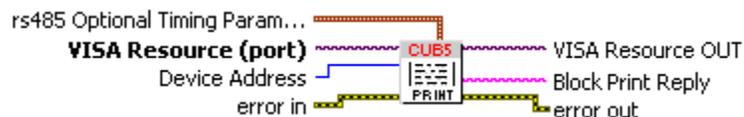
VIs for All Devices

Block Print CUB5.vi

Requests a block print string from the device. The content of the reply string will depend on the User Input Function Setup Parameters on the actual device (see CUB5 manual). An Optional Timing cluster input is included to vary the delay after the request until the response is read to allow the entire string to be transmitted. Depending on length of the reply string you may wish to adjust the Optional Read Delay value of this cluster. The default delay is 1 second. Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Optional Timing Parameters (optional)	Use to adjust the read delay between sending the block print request and receiving the reply string.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Block Print Reply	String received from the device in response to the block print request.
error out	

Connector Pane



Close CUB5.vi

Terminates the software connection to serial port. Call this VI to make sure the serial port is closed at the end of your application.

Inputs	
VISA resource name (Port)	Choose VISA resource corresponding to serial port you are using. Required.
error in (no error)	
Outputs	

error out	
-----------	--

Connector Pane



Initialize CUB5.vi

Initializes Serial Communications on given port at chosen baud rate. Returns error if unsuccessful. Call this VI before calling other VIs, but generally, you need to call the Initialize VI only once at the beginning of an application.

Uses the following serial port settings: 8bit data, No Parity, 1 Stop bit with Termination Character disabled, with port timeout of 10 seconds. Other settings are at default for the platform.

Also stores global Optional Timing Parameters to be used in RS-485 communications. These values specify values specific to RS-485 (modbus) communications that are to be used throughout the program. Unless you have a good reason for doing so, it is not necessary to change these values:

Max Retries (5): The number of times the program will retry automatically after receiving a serial communication error.

Optional write delay (20ms): The modbus specification requires that the RS-485 serial bus be quiet between transmitted messages. These delays are based on the baud rate. Often it is desirable to insert additional delay to account for noise, slow settling, slow device response or other factors. This optional delay is inserted before the required minimum delay before a message is written.

Optional read delay (20ms): (see above) This optional delay is inserted before the required minimum delay before a reply is read.

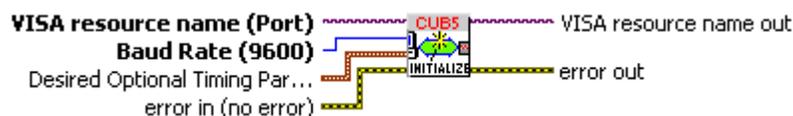
Device read timeout (200ms): Specifies how long to wait for a reply from the device before retrying. This is a programmatic delay and not the same thing as the VISA serial port timeout.

Termination Delay Character (* 50ms): CUB5 devices determine how long to wait after receiving a command before replying based on this character, which is part of the command string written to the device. * = 50ms (recommended for RS-485) and \$ = 2ms

(recommended for RS-232 or USB only, both of which can only be used with a single device on a direct connection).

Inputs	
VISA resource name (Port)	Choose VISA resource corresponding to serial port you are using. Required.
Baud Rate	Select the baud rate corresponding to the settings on the Process Controller. Required.
Optional Timing Parameters (typedef)	
Error In (no error)	
Outputs	
VISA resource name out	Pass-thru
error out	

Connector Pane



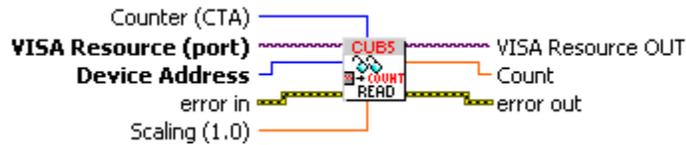
VIs for CUB5 Counter

Read Count CUB5.vi

Reads count from Counter (specify Counter A or Counter B with input). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Counter (enum)	Set to choose Counter A or Counter B.
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling). This value can be used to set the decimal place if desired.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Count (double)	Count read from counter
error out	

Connector Pane

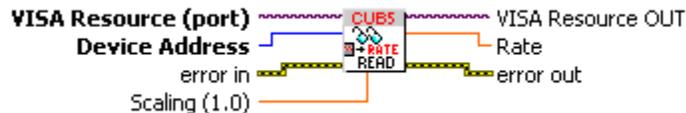


Read Rate CUB5.vi

Reads Rate from Counter. Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling). This value can be used to set the decimal place if desired.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Rate (double)	Rate Value read from counter
error out	

Connector Pane



Reset Counter CUB5.vi

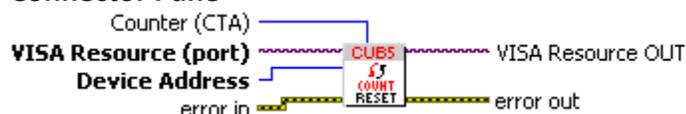
Resets count from Counter (specify Counter A or Counter B with input). The value of the counter after reset will depend on the Input Setup Parameters on the actual device (see CUB5 manual). Read the count using Read Counter.vi after calling this VI to verify reset.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
--------	--

VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Counter (enum)	Set to choose Counter A or Counter B.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane

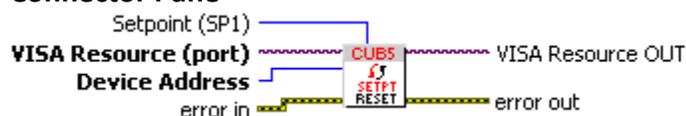


Reset Counter Setpoint CUB5.vi

Resets the Counter Setpoint Output (specify Setpoint 1 or Setpoint 2 with input). The action of the setpoint under reset conditions depends on counter setup (see Manual). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Setpoint (enum)	Set to choose Setpoint 1 or Setpoint 2.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



Set or Get Scale Factor CUB5.vi

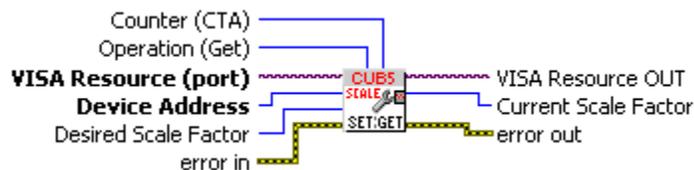
Use this VI to get or set the value of the scale factor (specify Counter A or Counter B with input). The value of the scale factor must be within the limit of the counter. This is NOT checked by this VI. The current setpoint is always returned by this VI.

The desired scale factor is a six digit positive number with assumed 4 decimal places and the returned scale factor value is shifted 4 decimal places to become a six digit positive number after being read. For example: a desired scale factor of 1.000 must be entered as an I32 value of 10000 and a returned scale factor I32 value of 200 corresponds to a count scale factor of 0.0200 on the device (see Counter documentation).

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Counter (enum)	Set to choose Counter A or Counter B
Desired Scale Factor (I32)	Desired Scale Factor
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Scale Factor (I32)	current scale factor value (after Set operation, if applicable)
error out	

Connector Pane



Set or Get Timer Setpoint ON Value CUB5T.vi

Use this VI to get or set the value of the Timer Setpoint ON Value (SPT) on the timer. The input value is a 7 digit integer and is interpreted by the device according to the Timer range as set on the device. Signs are disregarded (all numbers are treated as positive values). The range of the 7 digit integer is checked to be between 9999999 and 0 and an error is returned if out of range. Note that for mixed unit ranges including seconds or minutes where the maximum value for a unit is 59, this check is not sufficient. For example, the value 9999999 will be clipped to 9995959 by the device if the timer range on the device is HHHMMSS.

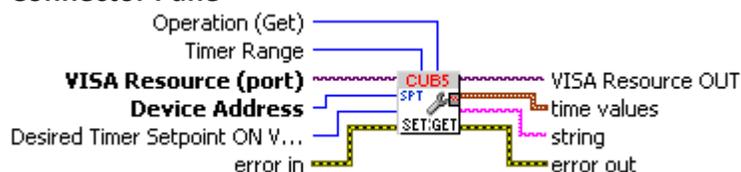
Use Format Timer Value.vi to format the Timer Setpoint ON Value number according to a specific timer range (which should be chosen to correspond to the timer range on the device) and check individual unit values.

The current Timer Setpoint ON Value is always returned by this VI. Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Timer Setpoint ON (enum)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Desired Timer Setpoint ON Value (I32)	Desired Timer Setpoint ON Value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Setpoint ON Value (I32)	current value of Setpoint ON value (after Set operation, if applicable)
error out	

Connector Pane



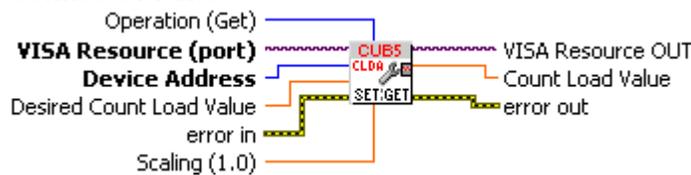
Set or Get Count Load Value CUB5.vi

Use this VI to get or set the value of the Count Load Value for Counter A. The value of the Count Load Value must be within the limit of the counter. This is NOT checked by this VI. The desired Count Load Value is divided by scaling value (default = 1.0) to correspond to the counter scaling factor and converted to I16 before being written. The current count load value is always returned by this VI.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Desired Count Load Value (double)	Desired Setpoint value
Scaling value (double)	Optional input to adjust scaling of Setpoint value output (default is no scaling).
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Count Load Value (double)	current value of count load value (after Set operation, if applicable)
error out	

Connector Pane



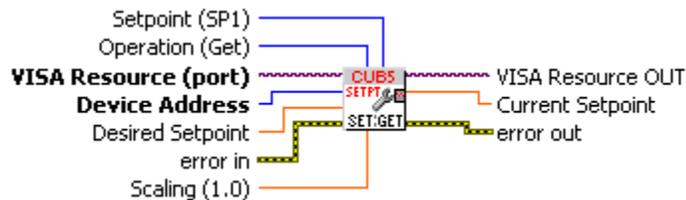
Set or Get Setpoint CUB5.vi

Use this VI to get or set the value of the setpoint (specify Setpoint 1 or Setpoint 2 with input). The value of the setpoint must be within the limit of the counter. This is NOT checked by this VI. The desired setpoint is divided by scaling value (default = 1.0) to correspond to the counter scaling factor and converted to I16 before being written. The current setpoint is always returned by this VI. Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Setpoint (enum)	Set to choose Setpoint 1 or Setpoint 2.
Desired Setpoint (double)	Desired Setpoint value
Scaling value (double)	Optional input to adjust scaling of Setpoint value output (default is no scaling).

error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Setpoint Value (double)	current value of setpoint (after Set operation, if applicable)
error out	

Connector Pane

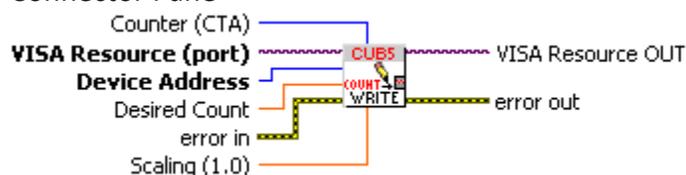


Write Count CUB5.vi

Writes desired count value to Counter (specify Counter A or Counter B with input). The desired count value is divided by scaling value (default = 1.0) to correspond to the counter scaling factor and converted to I16 before being written. Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Counter (enum)	Set to choose Counter A or Counter B.
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling).
Desired Count (double)	Count written to panel meter
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



VIs for CUB5T Timer

Format Timer Value CUB5T.vi

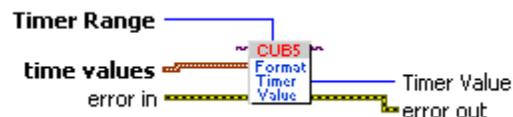
Formats Time Value for Write Timer.vi, Set or Get Timer Start Value.vi, Set or Get Timer Stop Value.vi from individual Day,Hour,Minute,Second unit values. This VI checks ranges on individual unit values (for instance max 59 seconds, max 999 hours, etc). Returns error if out of range.

Wire error output from this VI to error input of Write Timer.vi, Set or Get Timer Start Value.vi, Set or Get Timer Stop Value.vii, if used to keep Write Timer CUB5.vi from executing if the inputs are out of range.

Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Inputs	
VISA Resource (Port)	Pass-thru only (so VI can be wired in front of other Write VIs)
Timer Range (enum, required)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Time Values (cluster, typedef)	time units values to be format as timer value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Value (I32)	Use as input to Write Timer CUB5.vi
error out	

Connector Pane



Read Cycles CUB5T.vi

Reads current cycle count of timer (CUB5T). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Cycle Count (I32)	cycle count on timer
error out	

Connector Pane



Read Timer CUB5T.vi

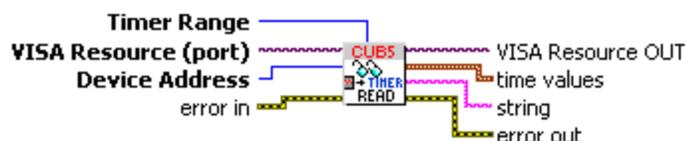
Reads current value of timer (CUB5T). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Timer Range (enum)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Value (typedef cluster, double)	Cluster output of Days, Hours, Minutes, Seconds. Content will depend on the value read from the device as interpreted by the Timer Range input. Wire only valid values

	per timer range input used.
string out (string)	timer string read from the device (useful for debugging)
error out	

Connector Pane



Reset Cycles CUB5T.vi

Resets cycle count from timer (CUB5T). The value of the cycle count after reset will depend on the counter start parameter on the device (see CUB5 manual). Read the count using Read Cycles.vi after calling this VI to verify reset.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



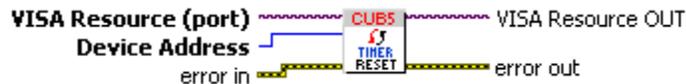
Reset Timer CUB5T.vi

Resets timer (CUB5T). The value of the timer after reset will depend on the timer start parameter on the device (see CUB5 manual). Read the count using Read Timer.vi after calling this VI to verify reset.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



Reset Timer Setpoint CUB5T.vi

Resets timer setpoint (CUB5T) per Setpoint Assignment on the Device (see manual).

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



Set or Get Cycle Count Start Value CUB5T.vi

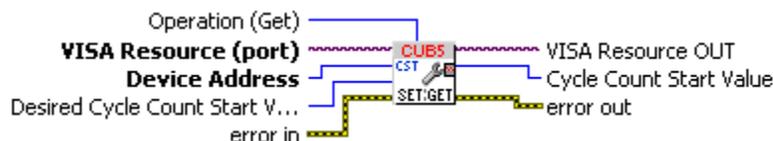
Use this VI to get or set the value of the Cycle Count Start (CST) Value on the timer. The value of the Cycle Count Start Value must be within the 6 digit limit of the counter or the value is not written and an error is returned.

The current Cycle Count Start Value is always returned by this VI.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Desired Cycle Count Start Value (I32)	Desired Cycle Count Start Value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Cycle Count Start Value (I32)	current value of cycle count start value (after Set operation, if applicable)
error out	

Connector Pane



Set or Get Setpoint Time-out Value CUB5T.vi

Use this VI to get or set the value of the Timer Setpoint Time-out Start (STO) Value on the timer. When writing, the input is assumed to be in the format MM.ss.ss where the decimal points are

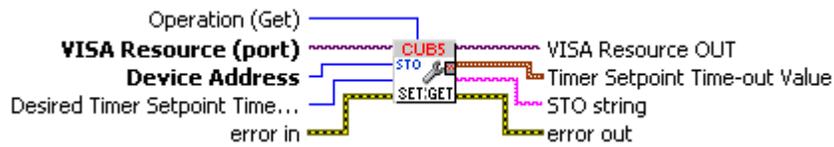
ignored (see device manual). The value of the Timer Setpoint Time-out Value must be within the 6 digit limit of the counter or the value is not written and an error is returned.

The current Timer Setpoint Time-out Value is always returned by this VI.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Desired Setpoint Time-out Value (I32)	Desired Setpoint Time-out value in MM.ss.ss format (decimals ignored)
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
STO string (string)	actual string returned from the timer
Timer Setpoint Time-out Value (enum, typedef)	current value of timer setpoint time-out value (after Set operation, if applicable)
error out	

Connector Pane



Set or Get Timer Setpoint OFF Value CUB5T.vi

Use this VI to get or set the value of the Timer Setpoint OFF Value (SOF) on the timer.

The input value is a 7 digit integer and is interpreted by the device according to the Timer range as set on the device. Signs are disregarded (all numbers are treated as positive values). The range of the 7 digit integer is checked to be between 9999999 and 0 and an error is returned if out of range. Note that for mixed unit ranges including seconds or minutes where the maximum value for a unit is 59, this check is not sufficient. For example, the value 9999999 will be clipped to 9995959 by the device if the timer range on the device is HHHMMSS.

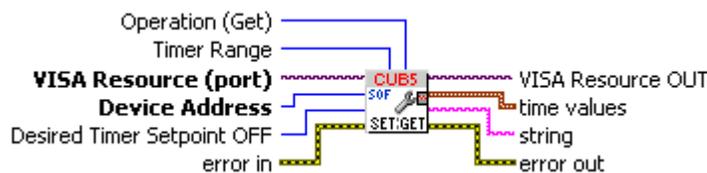
Use Format Timer Value.vi to format the Timer Setpoint OFF value number according to a specific timer range (which should be chosen to correspond to the timer range on the device) and check individual unit values.

The current Timer Setpoint OFF Value is always returned by this VI. Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Timer Range (enum)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Desired Timer Setpoint OFF Value (I32)	Desired Timer Setpoint OFF Value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Setpoint OFF Value (I32)	current value of timer setpoint OFF value (after Set operation, if applicable)
error out	

Connector Pane



Set or Get Timer Start Value CUB5T.vi

Use this VI to get or set the value of the Timer Start Value (TST) on the timer.

The input value is a 7 digit integer and is interpreted by the device according to the Timer range as set on the device. Signs are disregarded (all numbers are treated as positive values). The range of the 7 digit integer is checked to be between 9999999 and 0 and an error is returned if

out of range. Note that for mixed unit ranges including seconds or minutes where the maximum value for a unit is 59, this check is not sufficient. For example, the value 9999999 will be clipped to 9995959 by the device if the timer range on the device is HHHMMSS.

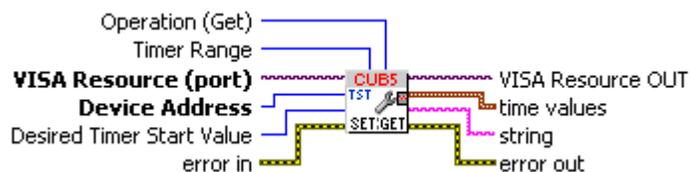
Use Format Timer Value.vi to format the Timer Start Value number according to a specific timer range (which should be chosen to correspond to the timer range on the device) and check individual unit values.

The current Timer Start Value is always returned by this VI. Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Timer Range (enum)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Desired Timer Start Value (I32)	Desired Timer Start Value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Start Value (I32)	current value of timer start value (after Set operation, if applicable)
error out	

Connector Pane



Set or Get Timer Stop Value CUB5T.vi

Use this VI to get or set the value of the Timer Stop Value (TSP) on the timer.

The input value is a 7 digit integer and is interpreted by the device according to the Timer range as set on the device. Signs are disregarded (all numbers are treated as positive values). The range of the 7 digit integer is checked to be between 9999999 and 0 and an error is returned if out of range. Note that for mixed unit ranges including seconds or minutes where the maximum value for a unit is 59, this check is not sufficient. For example, the value 9999999 will be clipped to 9995959 by the device if the timer range on the device is HHHMMSS.

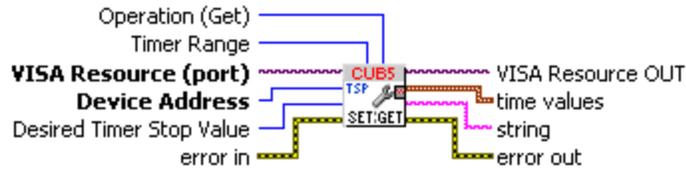
Use Format Timer Value.vi to format the Timer Stop value number according to a specific timer range (which should be chosen to correspond to the timer range on the device) and check individual unit values.

The current Timer Stop Value is always returned by this VI. Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Timer Range (enum)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Desired Timer Stop Value (I32)	Desired Timer Stop Value
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer Stop Value (I32)	current value of timer stop value (after Set operation, if applicable)
error out	

Connector Pane



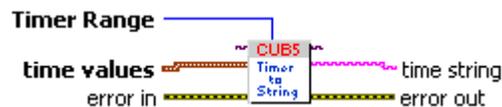
Time Values to String CUB5T.vi

Formats Timer Values from individual Day,Hour,Minute,Second unit values into a string value that matches the display format on the device. This VI checks ranges on individual unit values (for instance max 59 seconds, max 999 hours, etc). Returns error if out of range.

Requires input "Timer Range" which corresponds to one of the 18 possible timer ranges (for example MMM.SS.SS) on the front panel of the device. This needs to be set according to the actual device setting so that the timer value is interpreted correctly.

Inputs	
VISA Resource (Port)	Pass-thru only (so VI can be wired in front of other Write VIs)
Timer Range (enum, required)	Set to one of 18 timer modes as set on device (for example MMM.SS.SS)
Time Values (cluster, typedef)	Individual values for days, hours, minutes, seconds
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Timer String (string)	formatted time values display string
error out	

Connector Pane



Write Cycles CUB5T.vi

Writes desired cycle count value to Timer (CUB5T). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Desired Cycle Count (I32)	Cycle Count written to timer
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



Write Timer CUB5T.vi

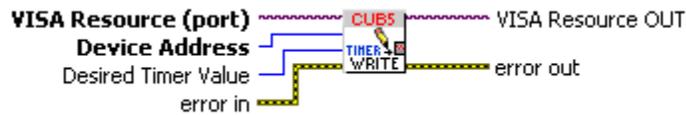
Writes desired cycle count value to Timer (CUB5T). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

The input value is a 7 digit integer and is interpreted by the device according to the Timer range as set on the device. Signs are disregarded (all numbers are treated as positive values). The range of the 7 digit integer is checked to be between 9999999 and 0 and an error is returned if out of range. Note that for mixed unit ranges including seconds or minutes where the maximum value for a unit is 59, this check is not sufficient. For example, the value 9999999 will be clipped to 9995959 by the device if the timer range on the device is HHHMMSS.

Use Format Timer Value.vi to format the Timer Write number according to a specific timer range (which should be chosen to correspond to the timer range on the device) and check individual unit values.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Desired Cycle Count (I32)	Cycle Count written to timer
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



VIs for CUB5, CUB5I, CUB5RT, CUB5P Analog Meters

Set or Get Setpoint CUB5 Analog.vi

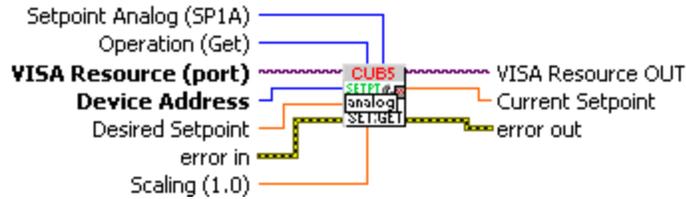
Use this VI to get or set the value of the setpoint on analog models of panel meter (specify Setpoint 1 or Setpoint 2 with input). The value of the setpoint must be within the limit of the counter. This is NOT checked by this VI. The desired setpoint is divided by scaling value (default = 1.0) to correspond to the meter scaling factor and converted to I16 before being written.

The current setpoint is always returned by this VI.

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Operation (enum)	Use to choose whether to Set or Get value
Setpoint (enum)	Set to choose Setpoint 1 or Setpoint 2.
Desired Setpoint (double)	Desired Setpoint value
Scaling value (double)	Optional input to adjust scaling of Setpoint value output (default is no scaling).
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Setpoint Value (double)	current value of setpoint (after Set operation, if applicable)
error out	

Connector Pane

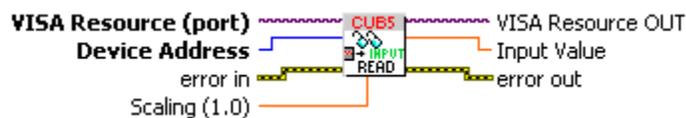


Read Input CUB5 analog.vi

Reads current value of the input on analog models (CUB5V,CUB5I,CUB5P,CUB5TC,CUB5RT). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling).
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling). This value can be used to set the decimal place if desired.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Input Value (double)	Input value on panel meter
error out	

Connector Pane



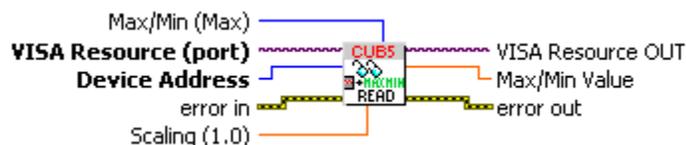
Read MaxMin CUB5 analog.vi

Reads current MAX or MIN value of the input on analog models (CUB5V,CUB5I,CUB5P,CUB5TC,CUB5RT). This feature must be enabled on the meter (see

manual). Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
MAX/MIN (enum, Maximum)	Specifies whether to read Max or Min value on meter
Scaling value (double)	Optional input to adjust scaling of Counter value output (default is no scaling).
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
Max/Min Value (double)	Max/Min value on meter (if enabled)
error out	

Connector Pane



Reset MaxMin CUB5 analog.vi

Resets the Maximum or Minimum value on analog models of panel meter (specify Setpoint 1 or Setpoint 2 with input). Max/Min must be enabled on the meter and the action of the setpoint under reset conditions depends on panel meter setup (see Manual).

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Max/Min (enum)	Set to choose to reset MAX or MIN.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



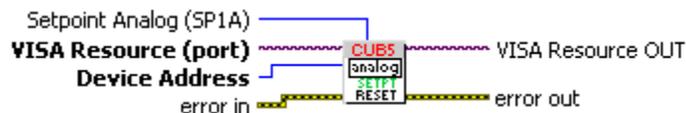
Reset Setpoint CUB5 analog.vi

Resets the Setpoint Output on analog models of panel meter (specify Setpoint 1 or Setpoint 2 with input). The action of the setpoint under reset conditions depends on panel meter setup (see Manual).

Error checking is used - If error input is wired, this VI checks for previous errors and does not execute if error.

Inputs	
VISA Resource (Port)	Required.
Device Address (I32)	Device address on RS-485 bus. Required.
Setpoint (enum)	Set to choose Setpoint 1 or Setpoint 2.
error in (no error)	
Outputs	
VISA Resource OUT	Pass-thru
error out	

Connector Pane



7. Optional Parameters

Optional Timing Parameters

Initialize CUB5.vi is used to open communications between LabVIEW and the RS-485 bus. It also sets global values for the Optional Timing Parameters to be used in RS-485 communications. These are values specific to RS-485 communications that are used throughout the program. They can be modified through an input cluster on the Initialize CUB5.vi, but unless dictated by such factors as electrical interference on the RS-485 bus, for instance, it is generally not necessary, nor is it recommended, to change these values:

Max Retries (5): The number of times the program will retry automatically after receiving a serial communication error.

Optional write delay (20ms): The specification requires that the RS-485 serial bus be quiet between transmitted messages. These delays are based on the baud rate. It may be desirable to insert additional delay to account for noise, slow settling, slow device response or other factors. This optional delay is inserted before the required minimum delay, before a message is written.

Optional read delay (20ms): (see Optional write delay, above) This optional delay is inserted before the required minimum delay, before a reply is read.

Device read timeout (200ms): Specifies how long to wait for a reply from the device before retrying. This delay is a programmatic delay and not the same thing as the VISA serial port timeout, which will return an error in the case of hardware or other failure, and cause the subVI not to retry, but rather to return the error.

Termination Delay Character (* 50ms): CUB5 devices determine how long to wait after receiving a command before replying based on this character, which is part of the command string written to the device. * = 50ms (recommended for RS-485) and \$ = 2ms (recommended for RS-232 or USB only, both of which can only be used with a single device on a direct connection).

Optional Scaling Value

Some of the SubVIs that read or write the input value of the Device, or that adjust configuration parameters relating to the input value of the Device (such as Read Count CUB5.vi) have optional scale factor inputs. The default scaling value is 1.0 Unless you have a good reason for doing so, it is not recommended to change these values; however, if you do, you should make sure that all VIs having this input terminal receive the same value scale factor.

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