ViewPoint~Voltage ™

a ***ViewPoint EyeTracker*** ® add-on product

for **Digital Input/Output**

& **Analog Output**

Software & Hardware
UserGuide

Arrington Research

ViewPoint version 2.9.5.146 (32-bit & 64-bit)

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Chapter: 1 - Introduction

ViewPoint~Voltage™ (also known as *VoltagePro*™) is a computer software product that interfaces the *ViewPoint EyeTracker* ® to a variety of hardware products for real-time Analog Voltage Output (AnalogOut) and real-time Digital Input and Output (Digital I/O, or DIO). The behavior of the program depends upon which hardware is used and which software license options you have purchased.

The Digital I/O (also know as TTL I/O or Binary I/O) has only two voltage levels that correspond to On/Off, True/False, etc. These two voltage levels are determined by the hardware that is used; the two levels are typically 0 Volts and +5 Volts. This is typically used to indicate the occurrence of certain events of interest.

Analog Output can vary the voltage levels essentially continuously between a specified range. For example, 12-bit resolution provides 2^12 or 4096 individual voltage levels.

1.1 Digital Input

The Digital I/O option provides Digital Inputs that allow real-time control of the *ViewPoint EyeTracker*, as well as data synchronization.

When the *ViewPoint~Voltage* program receives a Digital Input it sends the *ViewPoint EyeTracker* an event notification. These Digital Input events trigger any associated CLI commands that the user has specified using CLI commands (e.g., in a *Settings* file), for example:

```
TTL_Cmd -4 { dataFile_InsertMarker w ; say "-> TTL Pin 4 LO" }
```

Note that we have deprecated the previous method of having the *ViewPoint~Voltage* program send `dataFile_InsertMarker` commands to the *ViewPoint EyeTracker*, because this was was redundant and confusing, and the option has always been off by default anyway.

1.2 Digital Output

Digital Outputs can be controlled from *ViewPoint* or layered programs such as Python, MATLAB, etc., by using the `TTL_Out` CLI command, e.g.:

```
VPX_SendCommand(" TTL_Out +5 " );
```

Also, the *ViewPoint~Voltage* program provides a simple mechanism for setting Digital Outputs to indicate when the position-of-gaze (POG) is inside any of the first eight (0-7) region-of-interest (ROI) areas.

1.3 AnalogOut

The *AnalogOut* option provides real-time analog voltage signals for a variety of real-time data from the eye tracker. This option also includes all of the Digital Input / Output, capabilities of the Digital I/O option. You may choose hardware that provides 2, 4, or 8 Analog Output channels. A 16-channel analog output may be available upon request.

1.4 Hardware Options

Hardware depend largely upon the type of product purchased. We currently offer three basic categories of hardware. All three provide 8 Digital Input and 8 Digital Output channels. More detailed specifications for each can be found in the next chapter.

1.4.1 PCI-DDA**/12

The PCI-DDA**/12 is a family of PCI cards offering both Analog Output as well as Digital I/O. You may choose **DDA02/12**, **DDA04/12**, or **DDA08/12**, that offer 2, 4, or 8 channels of Analog Output, respectively. Particulars of this hardware are described in Section 2.1.

1.4.2 USB-1208 *BlueBox*

The USB-1208 *BlueBox* products can be used for Digital I/O and for Analog Output. These products have the additional advantage of offering fast *Edge Triggering*. Particulars of this hardware are described in Section 2.2.

1.5 License

ViewPoint~Voltage looks in the same folder as it resides for a sub-folder named **License/** (just as *ViewPoint* does). This folder is expected to contain a *ViewPoint Voltage License* (.VVL) file. This encrypted license file is used to verify that the hardware you are using is authorized.

Note that prior to version 2.9.3.138 the *Voltage* hardware authorization was in the same license file that *ViewPoint* uses, namely the .VPL file. By separating these the *Voltage* hardware is no longer tied to a particular *ViewPoint* hardware license.

1.6 Setup

ViewPoint~Voltage is only for use with the hardware that was provided. No other hardware is supported.

Before you can use the hardware, you must load the drivers and configure the hardware, as described in Chapter 4.

After installing the hardware, drivers, performing the configuration, you may use the *ViewPoint~Voltage* program that is described in Chapter 5.

1.7 Custom Projects & Suggestions

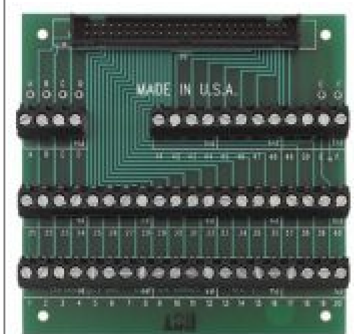
Our products are largely customer driven, so your insights and suggestions are important to us. Please report any problems as soon as possible, a work-around may be easy for you, but may not be so clear for another user.

Chapter: 2 Hardware Devices

2.1 DDA**/12 = AnalogOut + Digital I/O

You may choose **DDA02/12**, **DDA04/12**, or **DDA08/12**, that offer 2, 4, or 8 *channels* of Analog Output, respectively, as indicated by the two numbers before the forward slash. The 12 after the slash indicates 12 bit *resolution* of the Analog Output voltages. These boards have a 100-pin High Density Male Connector.

What you get:

DDA**/12	C100FF-3	CIO-MINI50
2, 4 or 8 Channel, 12-Bit Analog Output PCI Board with Digital I/O	100 Pin High Density Connector to two 50 Pin Connectors	One 50 Pin Universal Screw Terminal Accepts 12 to 22 AWG wire
		

The provided **C100FF-3** cable has a *100 Pin High Density Female Connector* that splits into two ribbon cables, each with a *50 Pin Female Connector*. The 100 pin connector should be attached to the PCI card. <u>Match the white triangles together. Do not force it in upside down!</u> When oriented correctly it should seat easily and the two release levers on the sides should snap outward.

Note that on the 50-pin connectors the even and odd pin numbers are opposite each other in pairs in a 2x25 layout.

2.1.1 Analog Output Pins

For **Analog** Output: *The 50 Pin Connector* labeled **PINS 1-50** should be used. For example:

```
Channel #0 : pin-1 (Vout-0) & pin-2 (Analog Ground)
Channel #1 : pin-3 (Vout-1) & pin-4 (Analog Ground)
Channel #2 : pin-5 (Vout-3) & pin-6 (Analog Ground)
Channel #3 : pin-7 (Vout-4) & pin-8 (Analog Ground)
etc.
```

2.1.2 Digital I/O Pins

For **Digital** Input/Output: The *50 Pin Connector* labeled **PINS 51-100** should be connected to the **CIO-MINI50** Screw Terminal break-out board. Consult the appendices A, B, and C for the appropriate pin-out diagram. The break-out board screw-terminals are numbered 1 through 50. Add 50 to obtain the corresponding cable pin number. For example pin#75 in the ribbon cable labeled 51-100 would appear on the board as #25.

2.1.3 Connector Options

The 50-Pin-Universal-Screw-Terminal may be used for either of the 50-pin connectors, however it is mostly useful for Digital I/O connections.

The user may wish to purchase a second **CIO-MINI50** Screw-Terminal break-out board, however purchasing the optional **BNC BreakOut Box** may make Analog Output connections easier.

BNC BreakOut Box

2.2 USB-1208 *BlueBox* = AnalogOut + Digital I/O

The USB-1208 *BlueBox* is a family of products that vary in capabilities. Only the **USB-1208HS** can be used for *AnalogOut*, the other models are slower and are primarily used for Digital I/O including *Edge Triggering*.

The USB-1208 products require at least USB-2.0.

What you get:

USB-1208	USB Cable
AnalogOut + Digital Digital I/O. Screw Terminals accepts 16 to 30 AWG wire	USB 2.0 high speed cable has A type male connector on one end and a B type Male connector on the other. Length is 6 ft.
	

IMPORTANT: When connecting this box to a USB computer port, you must wait until the drivers are finished loading, before continuing to the next step. This can sometimes take several minutes if the operating system is searching the web for the drivers.

ViewPoint Voltage, as of version 2.9.5.129, no longer requires "installation" of USB-1208 hardware with the *InstaCal* program. The PCI and PCIe hardware does still require *InstaCal* before it can be used.

ViewPoint~Voltage uses the counter input terminal on USB-1208 *BlueBox* hardware as a very fast *Edge Trigger; s*ee Chapter 6 for details.

Chapter: 3 Resting Input Voltage – Pull-Up/Down

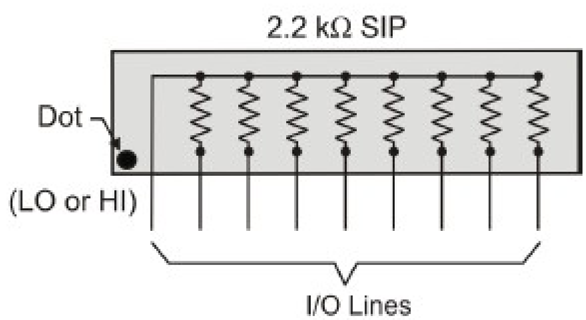
Digital-Input can by default be set to either Pull-Up or Pull-Down, that is, the default resting-voltage of the input channel is either HI (e.g. +5 volts) or LO that is 0 volts or Ground. This is required to keep the input values from floating when the circuit is open, and to provide a *reference voltage* at start-up.

The decision to install the SIPs as either pull-up or pull-down resistors is determined by the hardware to which you will be interfacing.

- Pull-**down** : input channels will show logical zero for each open circuit; connecting the channel pin to a +5V pin will change this to a logical one.
- Pull-**up** : input channels will show logical one for each open circuit; connecting to Ground will change this to a logical zero.

3.1 SIP Installation (DDA**/12 board)

On the PCI cards, a *Single Inline Package* (SIP) resister must be installed. The common pin on the end marked by a dot can be plugged into either the HI or LO positions on either end of group – just rotate the SIP and plug it accordingly.



Eight-Resistor SIP Schematic

Make sure that the SIP is installed in the port that is configured for INPUT. This is **FirstPort-A** (careful, this is different from SecondPort-A) on the DDA**/12 board.

Arrington Research solders stand-offs on the boards so that the SIP resistors can be easily re-positioned for pull-up/down. By default the SIPs are positioned for pull-down.

See full details in the *Measurement Computing product UserGuide*.

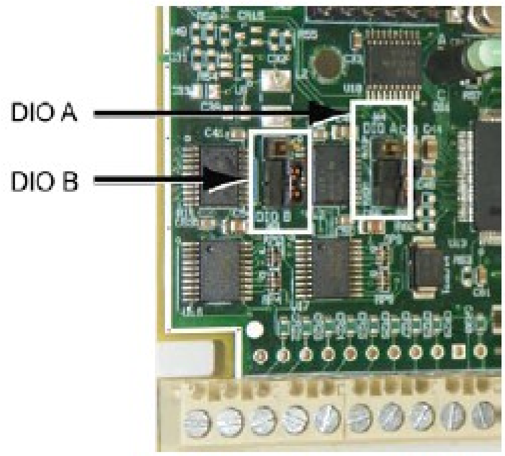
3.2 Jumper pin (USB-1208)

On the USB-1208 *BlueBox* products, the position of a jumper pin determines how the port is set. The factory default is usually pull-up, but this can easily be changed by moving the jumper pin on the board inside the box.

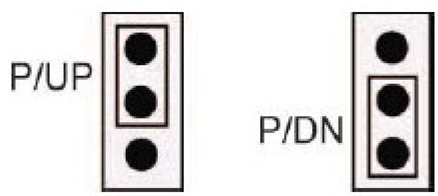
The images below show the location of the jumpers and the configurations.

Note that on the USB-1208 products Digital-Input is on **DIO A**, i.e., **Port-A**.

See full details in the *Measurement Computing product UserGuide*.



Pull-up/down jumper locations



Pull-up/down jumper configuration

Chapter: 4   Hardware, Drivers, & Configuring.

Instacal™ is a program provided by the hardware manufacturer, which detects installed hardware and optionally adds that hardware to the configuration file.

ViewPoint~Voltage, as of version 2.9.5.129, no longer requires "installation" of USB-1208 *BlueBox* hardware with the *InstaCal* program. The PCI and PCIe hardware does require *Instacal* before it can be used and this <u>must</u> be done for all PCI products before *ViewPoint~Voltage* can see and use that hardware.

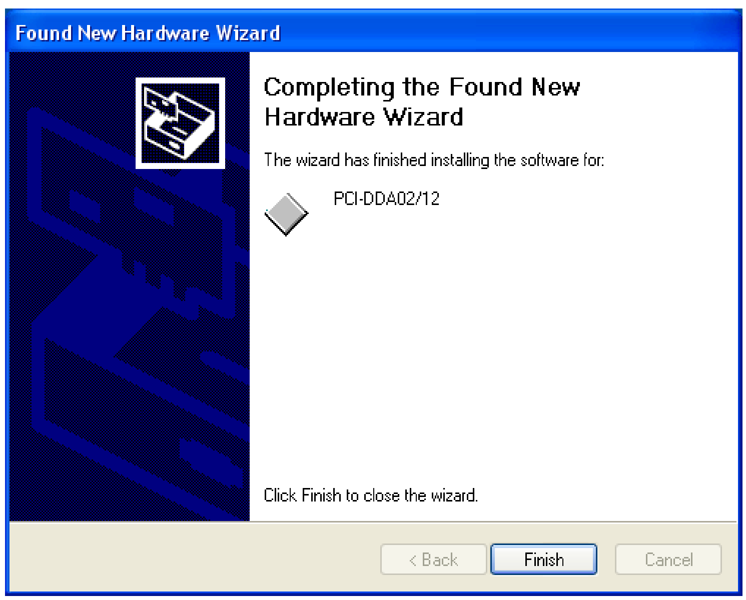
Install the *Instacal* software in accordance with the instructions provided in the *Measurement Computing Software™ Installation Manual*. This may vary from one device to another.

You may check for the latest version of *Instacal* from the download site at

< http://www.measurementcomputing.com/download.htm >

Click on: **Download MCC DAQ Software**

(a) Turn off computer, Install PCI card, restart computer. The hardware wizard will guide you through the next steps. You do not need to turn off the computer when installing a USB product. It may take several minutes for to complete step – <u>Do Not proceed until it tells you the hardware is ready!</u>



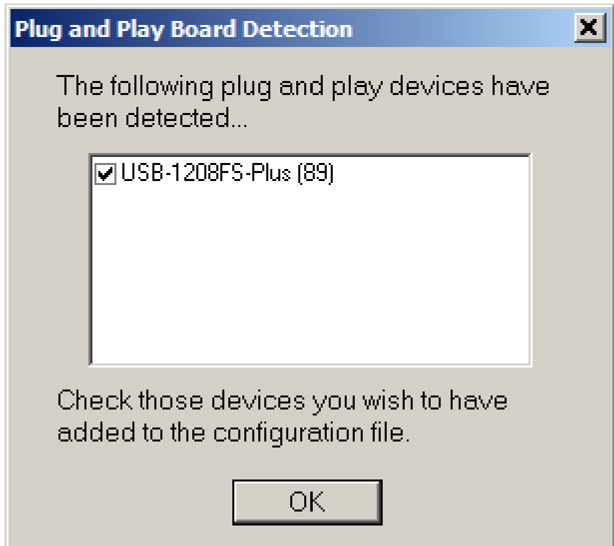
(b) After installing *Instacal*, <u>Reboot</u> the computer !

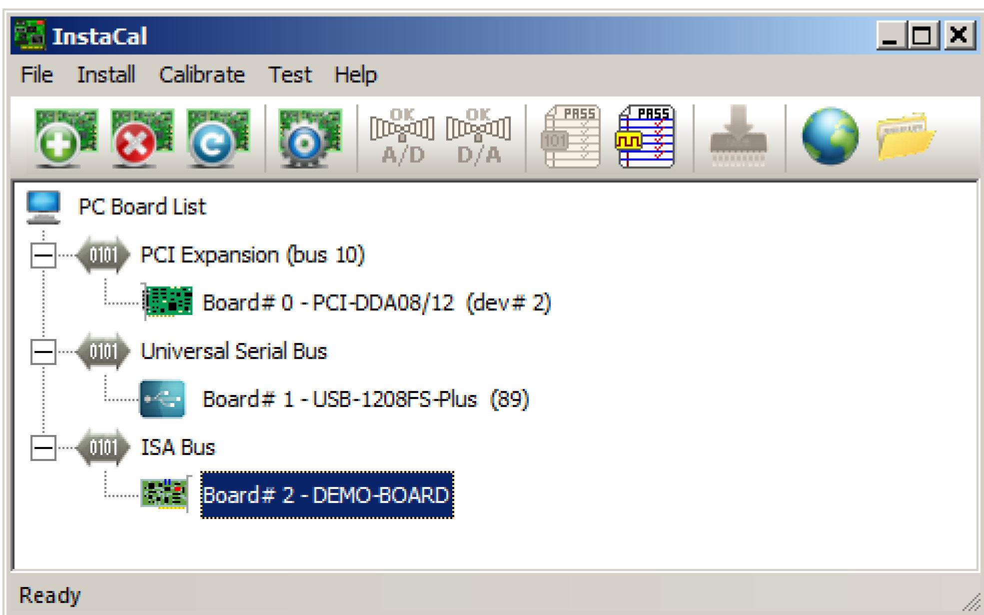
(c) Launch *Instacal* :

`Windows START > All Programs > Measurement Computing > Instacal`

(d) *Windows Plug and Play Board* detection should find the board

-- make sure that the board is checked and then press OK.





(e) Hardware should now appear in *Instacal* list.

Now you are ready to use *ViewPoint~Voltage*.

Chapter: 5 Using *ViewPoint~Voltage*

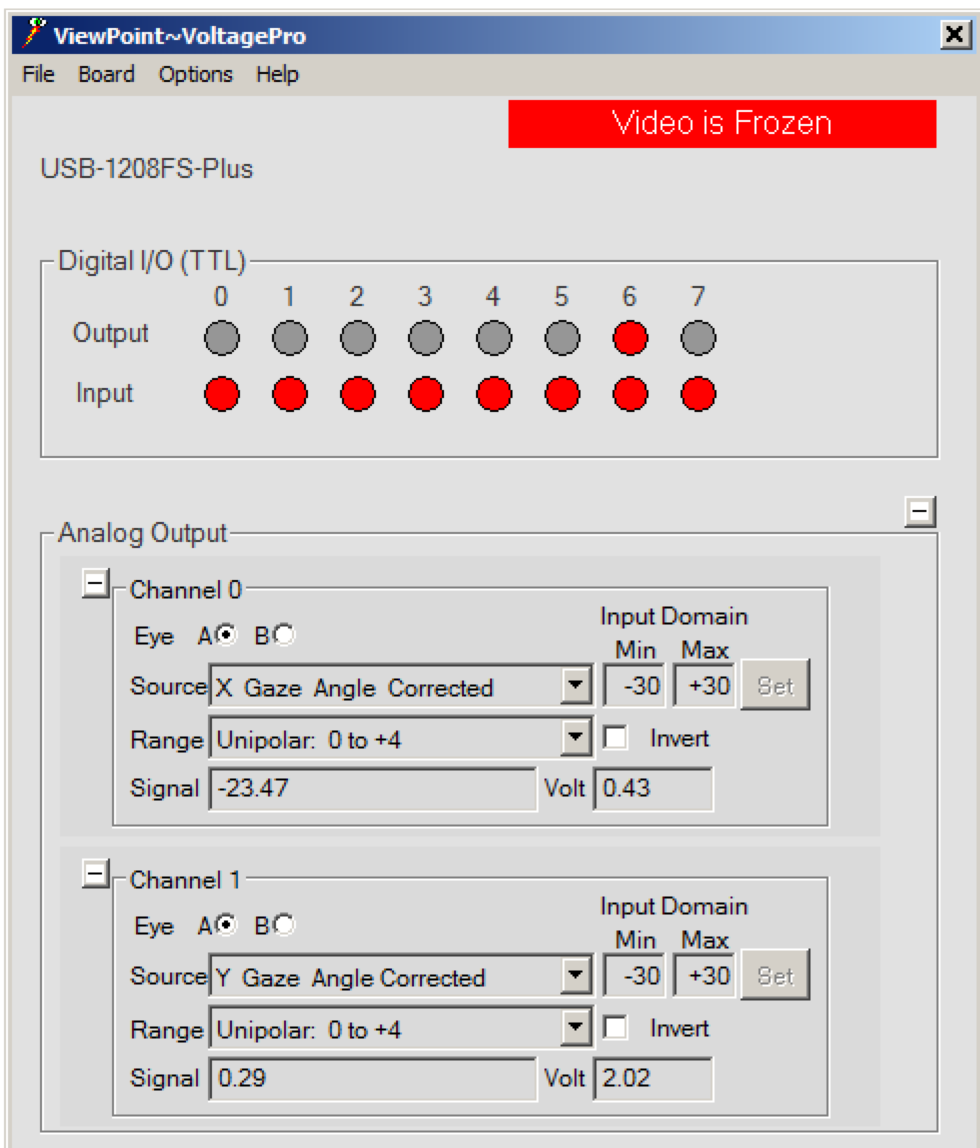
5.1 Prerequisites

Before running *ViewPoint~Voltage*, the hardware (PCI board or USB device) must have been registered using *Instacal* program, as described in Chapter 2.

Make sure that the *ViewPoint~Voltage* application is using the same *VPX_InterApp.dll* that the *ViewPoint EyeTracker* is using. This is most easily done putting both applications in the same directory.

Hint: you may want to put the line `launchApp Voltage.exe` into the `ViewPoint/Settings/Startup.txt` file. (Your executable may be named slightly differently, e.g. `Voltage_64.exe` or `Voltage_32.exe`).

For an AnalogOut board the screen looks something like this.

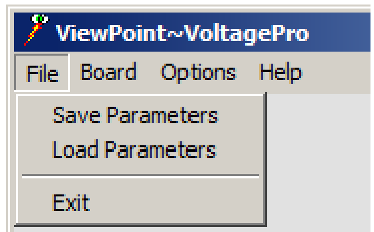


5.2 Saving & Loading Parameters

The most recent program settings are automatically saved if the program is properly exited, then these latest settings are automatically reloaded the next time *ViewPoint~Voltage* starts. These default parameters are saved in file:

```
~/Settings/VoltageParams.prm
```

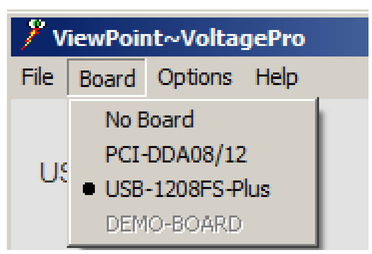
Alternatively, you may wish to save different sets of parameters for different projects – this can be achieved by explicitly saving and then loading different sets as needed. Under menu **File > Save Parameters** and menu: **File > Load Parameters**.



5.3 Board Selection

More than one PCI or USB device may be installed and used. The user may select the desired board menu item: **Board > ***

Menu item: **Board > *** will list all hardware that has been registered with *Instacal* application. Only those allowed by your license will be able to be selected, the others will be grayed out.

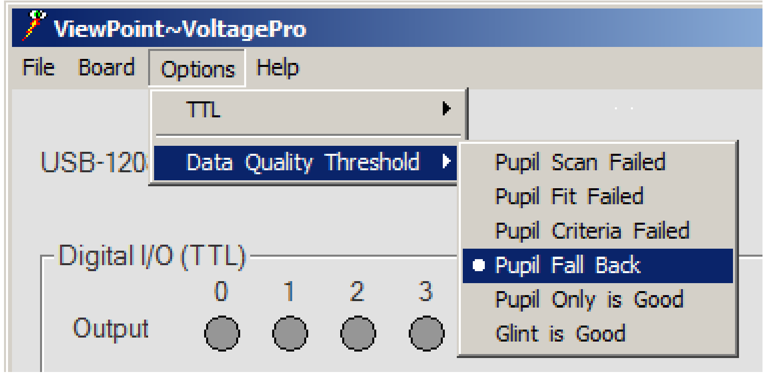


If more than one board is installed, the most recently use board is automatically selected as program start up.

5.4 Data Quality Threshold

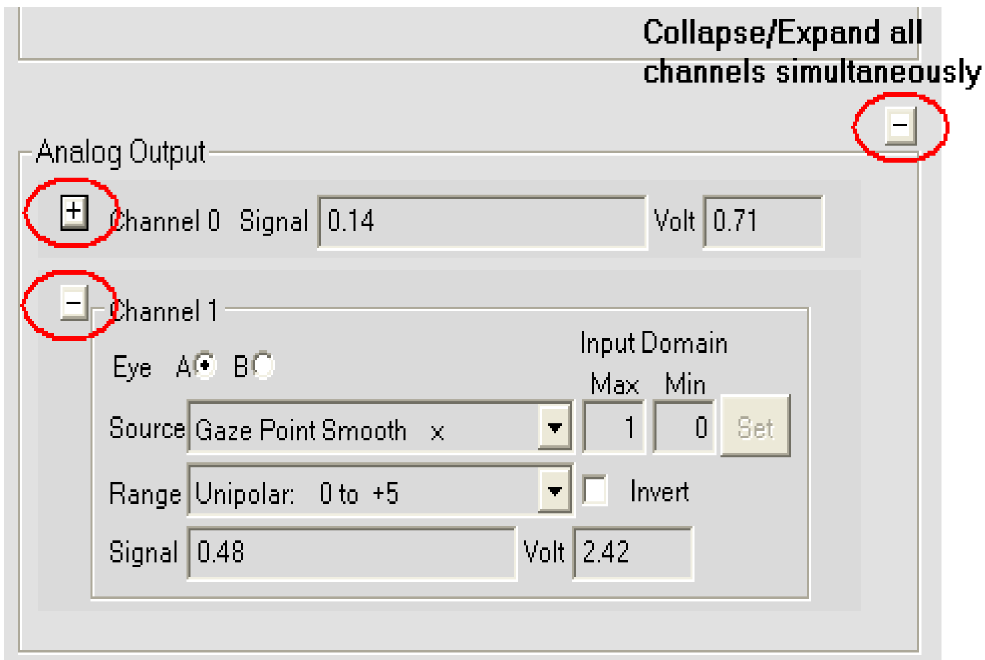
The *ViewPoint EyeTracker* provides real-time Data Quality values that can be used to decide whether to use the current data values. See the *ViewPoint EyeTracker UserGuide* for a description of the Data Quality values. *ViewPoint~Voltage* allows you to set a threshold based on the Data Quality. If the current quality is below threshold, the output voltages will not show the bad values.

Use menu: **Options > Data Quality Threshold > *** to set this criterion.



5.5 Analog Channels

ViewPoint~Voltage displays a channel setup dialog for each analog channel on the board. Up to 16 channels can be accommodated. All available parameters for each channel can be independently set and modified. The user many also save and reload parameter files via the **File** menu; see section 5.2.



Notice the collapse/expand buttons for each channel and for all channels simultaneously. In the collapsed mode only the channel number, the value of the selected source parameter and the output voltage are displayed.

5.6 Signal Source Selection

The source selection for each analog channel is independent of the other channel(s). Furthermore, if binocular data are available, the user may select the desired eye. The available sources correspond to the **SDK Functions** described in the *ViewPoint EyeTracker UserGuide* , e.g. `VPX_GetGazePointCorrected2`, and these signals are also what are shown in the *ViewPoint PenPlot* window.

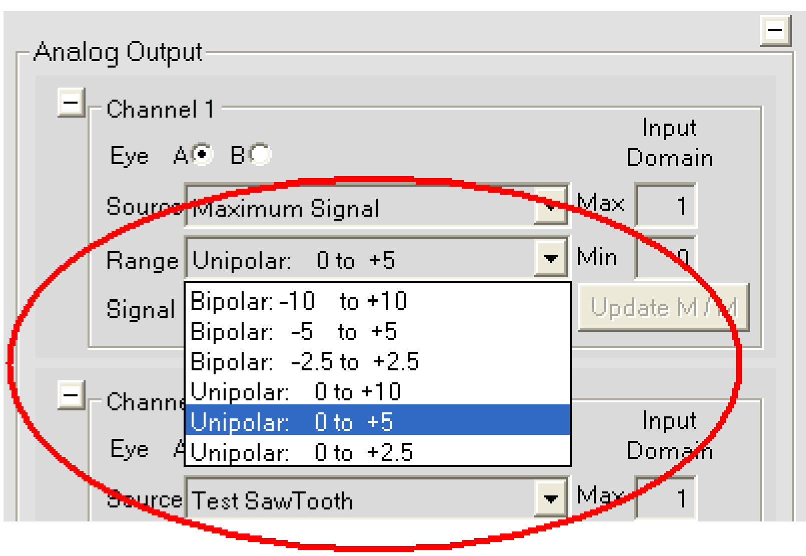
There are several **Test Signals** that may be selected; *ViewPoint* does not need to be running to use these:

Signal Source Name	***Description***
Test Signal = 0	Sets analog channel output voltage to zero.
Test Signal = 1	Sets analog channel output voltage to the maximum specified in the Gain selection.
Test Signal SawTooth { 0..1 }	Produces an artificial saw tooth with signal {0..1} on the corresponding analog channel.

5.7 Output Voltage Range

The voltage Range depends on the hardware that is being used. The PCI products offer a variety of ranges, the USB product offers only 0 to +4 volts.

With DDA**/12 product the user may select from a variety of AnalogOut voltages ranges. These include bipolar (-n to +n) and unipolar (0 to +n). See the **Range** drop-down menu items for available selections, as these vary with different hardware options.

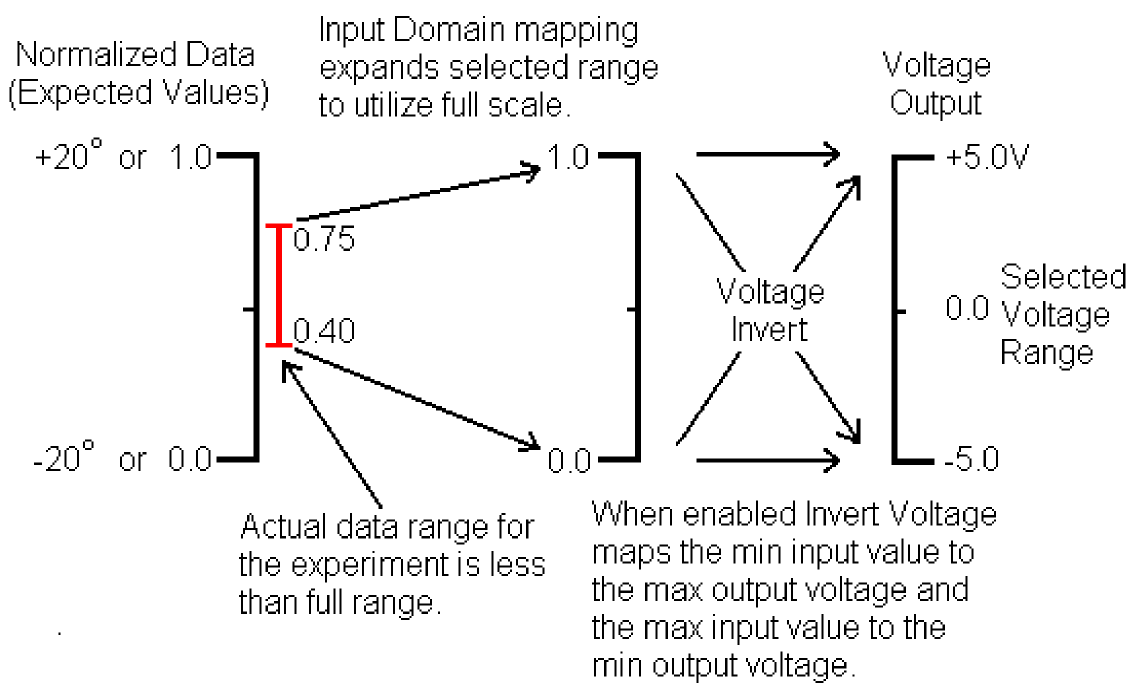


5.8 Voltage Mapping – Input Signal Domain

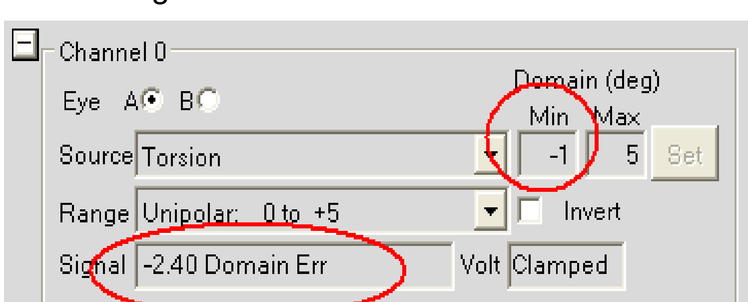
Specifying the Input Domain acts as a scaling factor and as a way to focus upon the values of interest. This allows the user to maximize the output voltage range according to the range of the selected input signal. The selected signal input values are scaled between **Min** and **Max** such that when the signal value equals **Min** the voltage output will be the minimum voltage (according to the selected voltage range) and similarly, when the *Signal* value equals **Max** the Output voltage is the maximum in the *Range* (again, according to the selected voltage range). Signal input values in between these limits are linearly scaled appropriately.

Consider, for example, the case in which the Gaze Point is being recorded and the gaze space has been calibrated. Depending on the size of the calibrated region, it may be possible for the subject to look outside of the region. When this happens the value of the gaze point (either x or y) which is normalized with respect to the calibration region will be outside the range of 0.0 – 1.0. These out of range values would normally cause the output voltage to be clamped, i.e. to retain the last good value, and the information contained there would not be recorded. However, the investigator may wish to look at those data without changing/recalibrating the gaze space. This is an ideal case in which to expand the input domain. The **Min** could be set to -0.2 and the **Max** could be set to 1.2. This would provide a "cushion" and allow the gaze point to travel outside the calibrated gaze space by 20% and still be recorded.

Another example would be that if you know that the data will not vary over the full scale and you want to increase precision then you could restrict the input domain. Here is a graphical explanation of how it works.



Consider the following:



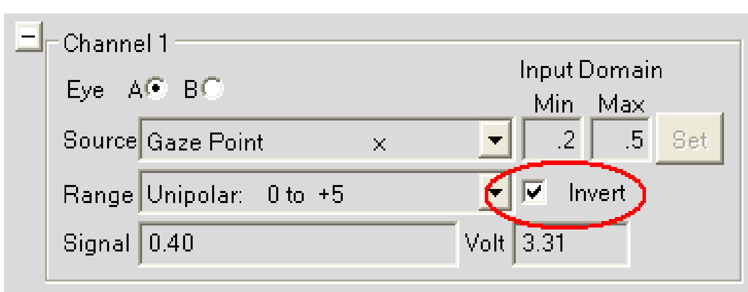
Here the **Torsion** has been selected as the output for channel 0. Previously, simple inspection determined for this particular experiment that the value of the Torsion is varying between 0° and 4°. To maximize the sensitivity of the recording, the **Max** was set to 5° and the **Min** was set to -1°. In this case, when the Torsion angle is -1°, the voltage output will be 0 volts and when the angle is 5°, the output voltage will be 5 volts. This Domain was found to be good for most of the data. However, when the value goes out of the domain range (in this case -2.40° < -1°), a **Domain Err** is indicated and the output voltage is "clamped", retaining the last value which was within the **Domain Range**. Obviously, if a Domain Err occurs too frequently, the Domain, either the **Min** or **Max**, or both, should be adjusted.

Note that typical values for **Max** and **Min** for "non-angle" parameters, such as Gaze Point (either x or y), are 0.0 and 1.0, respectively. For "angle" parameters, such as Torsion, typical values would range from +/- 10° to 20°. HeadAngle can range 0° to 360°.

Notice the "**Set**" button. After a **Max** or **Min** value has been changed, in the dialog box it must be updated within *ViewPoint~Voltage*. When such a change has been detected, the "**Set**" button will become enabled. Clicking on the button will first check to ensure that the "Min value" is less than the "Max value" and if so will update the values. Otherwise an error message will be displayed. After the values have been updated the button becomes disabled, indicating that the values have been updated. When enabled, the button may be clicked manually, or if not clicked in a few seconds, *ViewPoint~Voltage* will automatically update the values and disable the button, again indicating that the values are acceptable and have been updated.

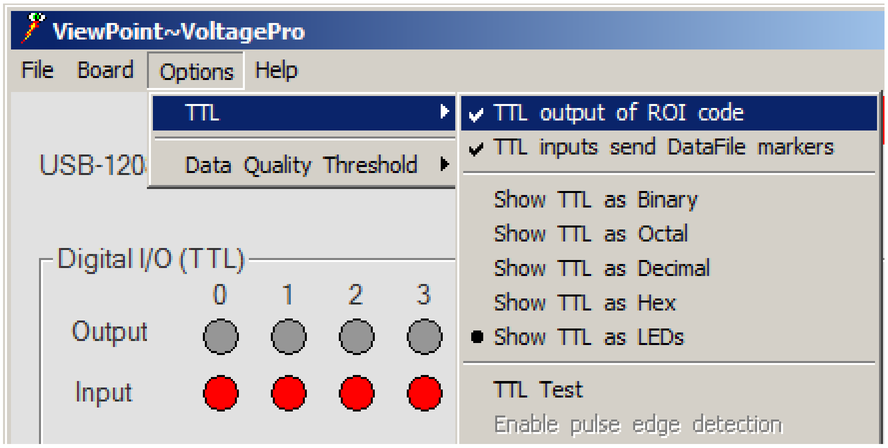
5.9 Voltage Inversion

When selected this "inverts" the output voltage around the center of the selected output range. In other words the minimum input signal is mapped to the maximum output voltage while the maximum input signal is mapped to the minimum output voltage. (See the figure in the previous section.)



5.10 Digital Output

Select the menu item: **Options > TTL > TTL output of ROI code** to include Digital Output switching. If this is selected, eight Digital Output channels are switched from logical zero (ground) to logical one (+5V) whenever the subject's position of gaze is inside any of the respective *ViewPoint* regions of interest (ROIs). If the ROIs overlap, then more than one channel will be active.



See section 5.13 for a table that details the ROI numbers and the Digital channel pin out numbers.

ViewPoint can also provide Digital Outputs not associated with the ROI. These requests can be related to events or conditions that *ViewPoint* is signaling. *ViewPoint~Voltage* monitors these requests and sets the Digital Outputs accordingly. Because of the ambiguity of knowing the source of an output, the event Digital and the ROI Digital options are mutually exclusive.

When **Options > TTL > TTL Test** is selected, the Digital Output values will be changed every 50 milliseconds, cycling through all combination. See section 8.1.

5.11 Digital Input → Markers

Eight Digital Input channels are sampled at the video rate supplied through *ViewPoint* if it is running, otherwise if the *ViewPoint EyeTracker* is not running then *ViewPoint~Voltage* samples at 30 Hz. The state of each input is indicated (default indication is an “LED”).

When **Options > TTL > TTL Test** is selected, the Digital Inputs are not sampled (since with respect to *ViewPoint~Voltage* the Digital Inputs are passive (i.e. read only and changed from outside *ViewPoint~Voltage*)), but the displayed states are cycled parallel with the Digital Outputs (which are driven by *ViewPoint~Voltage*). To include markers in the data file, select the menu item: **Options > TTL > TTL inputs send DataFile markers.** A marker character (record tag #2) is inserted into the *ViewPoint* data file whenever the voltage changes. A capital letter is inserted upon voltage rise from logical zero (ground) to logical one (+5V), and a lower case letter is inserted upon voltage fall. The characters ‘S’ to ‘Z’ correspond to Digital channels 0 to 7 rise, and the characters ‘s’ to ‘z’ correspond to Digital channels 0 to 7 fall.

See: Appendix E : *Example of ViewPoint data file with event markers* for a *ViewPoint* data file listing that includes Digital generated event markers. See section 5.13 *Digital Pin Numbers and Values* for a table that details these values.

DO <u>NOT</u> CONNECT TO +12V or -12V. The user is responsible for any damage caused by improper connections.

5.12 Digital Bit Code

The most intuitive Digital display is the “LED” representation. However, the high and low voltages on a set of eight Digital channels can be also represented as an ordered set of zeros and ones that compose a binary number value. These values can be displayed as binary (base-2), octal (base-8), decimal (base-10) or hex (base-16). Use menu item: **Options > TTL > Show TTL as *** to select.

5.13 Digital Pin Numbers and Values

5.13.1 Digital OUT = FROM *ViewPoint*

Channel	*Pin Number*		*ROI*	*Binary*	*Oct*	*Dec*	*Hex*
	DDA 50-pin	***USB-1208***					
none	none	none	none	00000000	0	0	0
0	8	32	0	00000001	1	1	1
1	7	33	1	00000010	2	2	2
2	6	34	2	00000100	4	4	4
3	5	35	3	00001000	10	8	8
4	4	36	4	00010000	20	16	10
5	3	37	5	00100000	40	32	20
6	2	38	6	01000000	100	64	40
7	1	39	7	10000000	200	128	80

5.13.2 Digital Input (pull-UP resistors) = Sent TO *ViewPoint*

Channel	*Pin Number*		*Marker*	*Binary*	*Oct*	*Dec*	*Hex*
	DDA 50-pin	***USB-1208***					
none	none	none	-	00000000	0	0	0
0	32	21	S/s	00000001	1	1	1
1	31	22	T/t	00000010	2	2	2
2	30	23	U/u	00000100	4	4	4
3	29	24	V/v	00001000	10	8	8
4	28	25	W/w	00010000	20	16	10
5	27	26	X/x	00100000	40	32	20
6	26	27	Y/y	01000000	100	64	40
7	25	28	Z/z	10000000	200	128	80

5.13.3 Digital Input (pull-DOWN resistors) = Sent TO *ViewPoint*

Channel	*Pin Number*		*Marker*	*Binary*	*Oct*	*Dec*	*Hex*
	DDA 50-pin	***USB-1208***					
none	none	none	-	11111111	0	0	0
0	32	21	S/s	11111110	376	254	FE
1	31	22	T/t	11111101	375	253	FD
2	30	23	U/u	11111011	373	251	FB
3	29	24	V/v	11110111	367	247	F7
4	28	25	W/w	11101111	357	239	EF
5	27	26	X/x	11011111	337	223	DF
6	26	27	Y/y	10111111	277	191	BF
7	25	28	Z/z	01111111	177	127	7F

Chapter: 6 Short Trigger Pulses (Edge Trigger)

ViewPoint~Voltage uses the Counter (CTR) input on USB-1208 *BlueBox* hardware, as a very fast Edge Trigger.

Every time +5V DC is connected to the CTR pin (this is pin-20 on USB-1208FS) it will produce an *EdgeTrigger* event.

Note that this feature appears in *ViewPoint~Voltage* version 2.9.5.136 that was part of *ViewPoint-EyeTracker* release version 2.9.5.137 (sorry for the confusion).

6.1 Voltage & Hardware Specifications

Like other inputs, the counter input can drift and must be pulled down to zero volts by connecting it to ground (GND) with a resistor. Applying the input TTL volage produces a rising-edge *Edge Trigger* event. See the table below for device specific details.

	USB-1208 Hardware Device	
Parameter	**1208HS**	**1208FS-Plus**
Trigger type	Schmitt trigger	Schmitt trigger
Pin or Screw-Terminal	CTR0	CTR
Pulse width (nanosecond) min	25	500
Maximum input frequency (MHz)	1	20
Input high voltage	2.2 V min, 5.5 V absolute max	2.43 V typical, 5.5 V absolute max
Input low voltage:	1.5 V max, –0.5 V absolute min, 0 V recommended min	1.42 V typical, –0.5 V absolute min, 0 V recommended min
pull-down to ground	47 kΩ	47 kΩ

6.2 ViewPoint Interface

When *ViewPoint~Voltage* detects an *Edge Trigger* event it sends the *ViewPoint EyeTracker* a TTL_INPUT event signal specified with code **99**. The user can specify how *ViewPoint* responds to *EdgeTrigger* signal using the Command Line Interface (CLI) instruction, as shown here below:

```
ttl_cmd 99 { say 'TTL EdgeTrigger' }
```

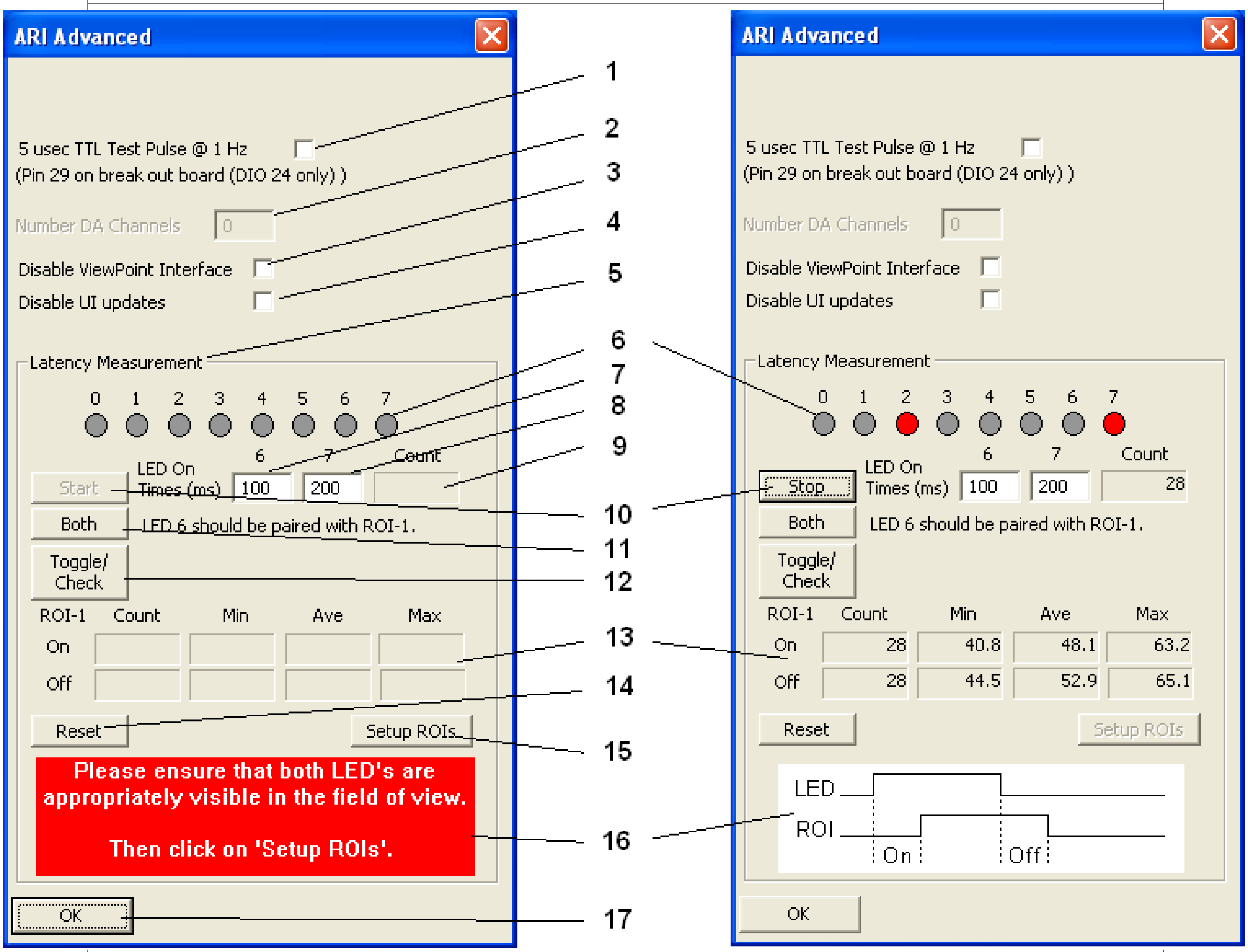
Chapter: 7 Latency Measurement

The latest versions of the *ViewPoint~Voltage* application include extra features, as described below.

In particular, items in the Latency Measurement group box are for testing the total throughput latency. *ViewPoint~Voltage* raises a Digital Output voltage that turns on an LED that shines a spot of light on the camera sensor. The camera sends the image to ViewPoint that performs image analysis including region-of-interest (ROI) discrimination and sends the active ROI information back to *ViewPoint~Voltage*. This is done several times and the average, minimum and maximum latency is reported.

The following text sections describes each item in the figure below.

Advanced Panel in ViewPoint~Voltage



The Advanced panel in the *ViewPoint~Voltage* application. Items #5 through #16 are used for latency measurement.

1) Generate a Digital Pulse which is high for 5 μs at a rate of 1 per second. Box must be checked and dialog closed in order for the pulse to be generated. Intended to generate a short Digital Pulse to test the *Edge Triggered* input on the USB-1208 *BlueBox*.

2) The number of D/A channels. Applies to boards that have analog outputs or when stimulating such a board. Initially reports the number D/A channels available, but may be increased to simulate more D/A channels.

3) Disable *ViewPoint* Interface. May by useful if stand alone pulse generation and/or monitoring is desired. (Dialog box must be closed with “OK” for this to take effect. May then be re-opened for pulse generation.)

4) Disable UI updates. Disables screen updating of Digital/LED values and analog values. Actual Digital Output and Analog Output from the boards is not effected. The effect of this control is immediate, closing the dialog with OK is not necessary.

5) Latency Measurement Group Box. Everything within the box relates to measuring *ViewPoint* latency. The basic idea is the two LED's simulate pupils (in bright pupil mode). (Note that the dialog automatically sets *ViewPoint* pupil type to bright pupil.) The LED's are alternately turned ON and OFF, and the time for the pupil detection as measured via ROIs is quantitated. This latency or delay includes latency in the hardware (e.g. frame/field transfers and digitization within the camera, digitization of analog cameras, DMA transfers) and software (e.g. image analysis once the program has received a new image.)

6) Representation of the state of each LED associated with the test. LEDs 6 and 7 represent the physical LEDs that are being monitored by the camera. LED's 1 and 2 represent ROIs 1 and 2 respectively. It is assumed that the location of LED 6 within the field of view of the camera corresponds with ROI 1 and LED 7 corresponds to ROI 2. Red indicates active.

7) The “ON” time for LED 6. Note that during the test when one LED is ON the other is OFF. The total cycle time is the sum of both “ON” times.

8) The “ON” time for LED 7. Note that during the test when one LED is ON the other is OFF. The total cycle time is the sum of both “ON” times.

9) “Count” —The running count of the number of times LEDs 6 and 7 have been cycled. The count is zeroed with the “Start” button when initiating a test or with the “Reset” button during a test.

10) “Start / Stop” the test. The function of the button toggles according to whether the test is active. All counts and Min/Ave/Max values are reset to 0.0 when a test starts. Note that this button is initially disabled. It is enabled by doing a “Setup ROIs”.

11) "Both". Useful during setup when locating and adjusting positions of LED within the field of view. Normally the state of each LED is mutually exclusive. However, when the "Both" option is enabled, both LEDs will toggle "ON" or "OFF" together.

12) "Toggle/Check". Again useful during the setup or when verifying the LED / ROI pairing.

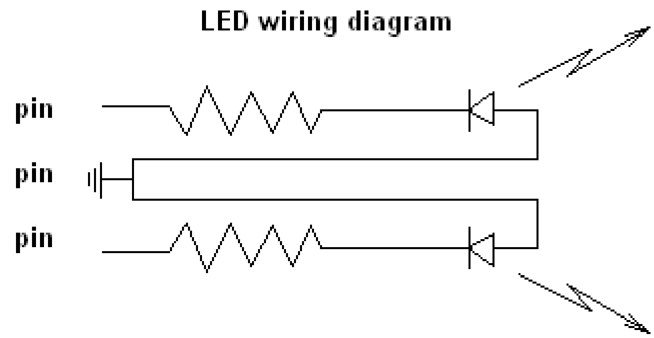
13) The results section. Only the results for ROI 1 (LED 6) are reported, however the On and Off are recorded separately. The On measures the latency between when the LED turns on and when *ViewPoint* detects the "pupil" is in the associated ROI while the Off latency is a measure of the time between when the LED turns off and when *ViewPoint* determines that the "pupil" is no longer in the ROI. "Count" is the number of transitions for each state and should be equal to the number of cycle counts (see 9). Any discrepancies between these three "counts" indicates that the *ViewPoint* is detecting either too few or too many expected transitions. The latency for each event is measured and associated Min/Max for each is updated as well as the running sum. Each "count" serves as the denominator for calculating the average. Occasionally unusually long delays can occur, depending on system activity, and can bias the average. Manually clicking "Reset" can be useful when this happens.

14) "Reset". Used to reset all measured parameters while the test is under way. The averaging of the latency times does not discriminate individual delays. As mentioned above, sometimes during the latency test the computer operating system might be busy servicing a mouse movement or window event such as opening or moving. At this times an unusually long delay may occur and from then on the average will be biased. After a sufficient amount of time the average may return to the pre-long delay value or, to hasten the process, the "Reset" button may be pushed .

15) "Setup ROIs". This automatically defines a proper ROI for each LED. The sequence that automatically occurs is as follows. First only LED 7 is turned ON and an autoThreshold for pupil criteria is performed. Then the location of the pupil is requested and after a delay of 200 ms the pupil location is again requested. These successive measurements continue up to 10 times until two successive measurements give the same values. Then an ROI is setup with a width and height of 0.1 centered on the pupil location and associated with LED 7. Then the same procedure is used for LED 6. This ensures that the each LED is properly associated with an ROI.

16) Initially, on opening the dialog, this displays a message with regard to setting up both LEDs so they are visible in the camera's field of view. After the ROIs are setup up, this then shows a schematic representation of the latency measurements.

17) OK exit. Necessary when doing 5 μs pulse or disabling *ViewPoint* Interface.



Parts:

2 X	Light Emitting Diodes (LEDs)
2 X	Resistors, e.g. 210 ohms

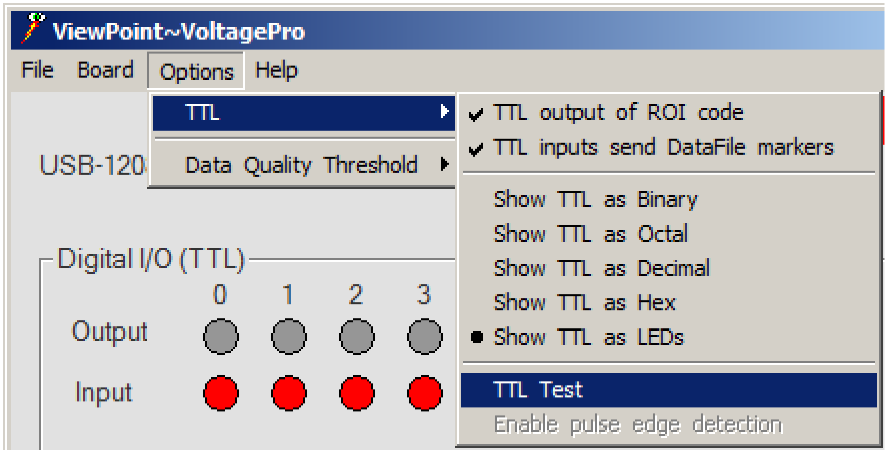
Chapter: 8 Demonstrations

8.1 *ViewPoint~Voltage* : TTL Test

Activate the following menu item in *ViewPoint~Voltage* :

Options > TTL > TTL Test

This cycles though all 2^8 combinations for the eight TTL channels, 00000000 (all LO) through 11111111 (all HI), for both the Input and Output channels.



When an Input channel change is sent to *ViewPoint*, it will cause *ViewPoint* to issue whatever CLI command has been previously associated with that Input channel signal by using the TTL_Cmd command. The CLI commands that are associated with each of the channels can be viewed in *ViewPoint* by selecting menu item: **Help > Info** and selecting the **TTL Cmds** tab on the *Info* window.

This test does not send *dataMarkers* to the *ViewPoint EyeTracker*.

8.2 *ViewPoint EyeTracker* : ROI Simulation

Activate the following item in *ViewPoint* :

Controls window > Simulation radio button **> Manual** selection.

Move the cursor in the *GazeSpace* window to ROI#0 through ROI#7; as you do this, in *ViewPoint~Voltage* you should see the Digital I/O values change for Outputs 0 through 7.

Chapter: 9 Trouble Shooting & FAQ

9.1 Can we use our own Analog or Digital hardware?

ViewPoint~Voltage is only for use with the hardware that was provided. No other hardware is supported.

9.2 *Instacal* doesn't see my hardware.

Probably you did not wait long enough for the *Found New Hardware* procedure to complete loading the drivers. This is particularly a problem with USB hardware, which can take several minutes.

9.3 Why are the values not changing?

- The *ViewPoint* EyeTracker video may have been frozen – unfreeze it.
- *ViewPoint~Voltage* and the *ViewPoint EyeTracker* may be using different copies of the *VPX_InterApp.dll*
- *If this variable is not currently being used by ViewPoint, then the variables will not change. This can happen for instance when the ViewPoint EyeTracker has the* ***Feature Method*** *set to* ***Pupil Only****, but the ViewPoint~Voltage program has a channel* ***Source*** *set to* ***Raw Glint (x)****. Then the output for that channel would not change.*

9.4 Why are all Digital Input lights ON?

The USB-1208 has the open-circuit voltage pulled HI by default.

9.5 Why are the Digital Out lights flickering?

Probably the ROI are being hit in ViewPoint EyeTracker and you have *ViewPoint~Voltage* set to output ROI hits as Digital changes.

9.6 Digital Out values are not as expected.

The Digital Output values can be set by several different things which can cause confusion. For example they can be set by:

ViewPoint EyeTracker CLI :	`TTL_Out`
ViewPoint EyeTracker CLI :	`TTL_Out_Quality`
ViewPoint~Voltage menu :	**Options > TTL > TTL output of ROI code**

Make sure that only one source of change is being used.

9.7 Unable To Locate Component cbw32.dll

Symptom:

Voltage.exe - Unable To Locate Component

This application has failed to start because cbw32.dll was not found.

Re-installing the application may fix the problem.

Description:

The *ViewPoint~Voltage* application requires the dynamic link library (DLL) that controls the voltage input / output hardware.

Solution:

Most likely the Measurement Computing drivers have not been installed. Load the Measurement Computing driver software for the hardware (PCI card or USB device).

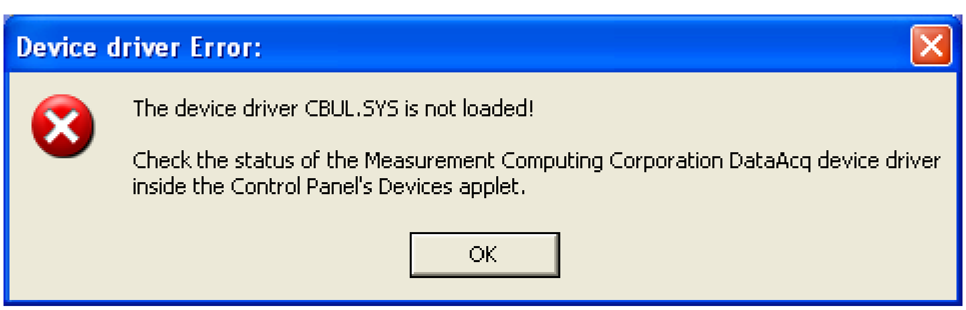
Procedure:

Follow the instructions provided in the *Measurement Computing Software™ Installation Manual*.

9.8 Device driver Error

Symptom:

The first attempt to run the *Instacal* program produced and error message that the device driver **CBUL.SYS** is not loaded!



Solution:

You have not finished the startup process that includes the computer being restarted. Please restart the computer and try again.

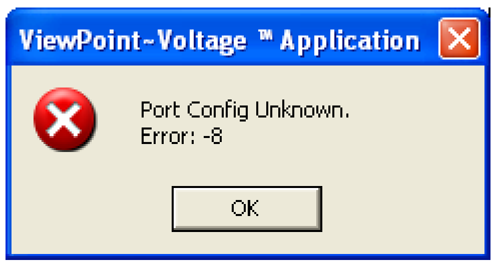
9.9 Port Config Unknown

Symptom:

Error Message box: ViewPoint~Voltage Application

Port Config Unknown.

Error: -8



Solution:

Try selecting menu item “No Board” and then re-selecting the hardware that you have installed. Make sure the hardware that you installed using *Instacal* matches the hardware you have selected in *ViewPoint~Voltage*.

9.10 Analog Output : Range options are wrong.

Symptom:

This can occur when changing between different device types, e.g. from the PCI-DDA**/08 boards to the USB-1208 *BlueBox*. This is a known problem, but there is a work-around.

Solution:

(a) select the hardware that you want to use;

(b) close *ViewPoint~Voltage* and then

(c) open *ViewPoint~Voltage* again.

The correct Range selections options should now appear.

Appendix: A - PCI card DDA**/12 connector pins (VP~V)

100-Pin, High Density Connector Diagram

Signal	Pin#	Pin#	Signal	indicates ROI #	inserts data file Marker V-Rise	inserts data file Marker V-Fall	TTL OUT	TTL IN
Analog Channel 0 Vout	1	51	TTL output	7			7	
Analog Ground	2	52	TTL output	6			6	
Analog Channel 1 Vout	3	53	TTL output	5			5	
Analog Ground	4	54	TTL output	4			4	
No Contact	5	55	TTL output	3			3	
No Contact	6	56	TTL output	2			2	
No Contact	7	57	TTL output	1			1	
No Contact	8	58	TTL output	0			0	
No Contact	9	59	Not Used					
No Contact	10	60	Not Used					
No Contact	11	61	Not Used					
No Contact	12	62	Not Used					
No Contact	13	63	Not Used					
No Contact	14	64	Not Used					
No Contact	15	65	Not Used					
No Contact	16	66	Not Used					
No Contact	17	67	Not Used					
No Contact	18	68	Not Used					
No Contact	19	69	Not Used					
No Contact	20	70	Not Used					
No Contact	21	71	Not Used					
No Contact	22	72	Not Used					
No Contact	23	73	Not Used					
No Contact	24	74	Not Used					
No Contact	25	75	TTL input		Z	z		7
No Contact	26	76	TTL input		Y	y		6
No Contact	27	77	TTL input		X	x		5
No Contact	28	78	TTL input		W	w		4
No Contact	29	79	TTL input		V	v		3
No Contact	30	80	TTL input		U	u		2
No Contact	31	81	TTL input		T	t		1
No Contact	32	82	TTL input		S	s		0
No Contact	33	83	Not Used					
No Contact	34	84	Not Used					
No Contact	35	85	Not Used					
No Contact	36	86	Not Used					
No Contact	37	87	Not Used					
No Contact	38	88	Not Used					
No Contact	39	89	Not Used					
No Contact	40	90	Not Used					
No Contact	41	91	Not Used					
No Contact	42	92	Not Used					
No Contact	43	93	Not Used					
No Contact	44	94	Not Used					
No Contact	45	95	Not Used					
No Contact	46	96	Not Used					
No Contact	47	97	Not Used					
No Contact	48	98	Not Used					
No Contact	49	99	+5 V					
Digital Ground	50	100	Digital Ground					

TTL Input (pins 75 through 82 here on the 100 pin connector) are in FirstPortA.

Appendix: B - PCI card DDA**/12 connector pins (MCC)

Signal name	Pin	Pin	Signal name
Digital Ground	100	50	Digital Ground
+5V	99	49	NC
FIRSTPORTC Bit 0	98	48	NC
FIRSTPORTC Bit 1	97	47	NC
FIRSTPORTC Bit 2	96	46	NC
FIRSTPORTC Bit 3	95	45	NC
FIRSTPORTC Bit 4	94	44	NC
FIRSTPORTC Bit 5	93	43	NC
FIRSTPORTC Bit 6	92	42	NC
FIRSTPORTC Bit 7	91	41	NC
FIRSTPORTB Bit 0	90	40	NC
FIRSTPORTB Bit 1	89	39	NC
FIRSTPORTB Bit 2	88	38	NC
FIRSTPORTB Bit 3	87	37	NC
FIRSTPORTB Bit 4	86	36	NC
FIRSTPORTB Bit 5	85	35	NC
FIRSTPORTB Bit 6	84	34	NC
FIRSTPORTB Bit 7	83	33	NC
FIRSTPORTA Bit 0	82	32	NC
FIRSTPORTA Bit 1	81	31	NC
FIRSTPORTA Bit 2	80	30	NC
FIRSTPORTA Bit 3	79	29	NC
FIRSTPORTA Bit 4	78	28	NC
FIRSTPORTA Bit 5	77	27	NC
FIRSTPORTA Bit 6	76	26	NC
FIRSTPORTA Bit 7	75	25	NC
SECONDPORTC Bit 0	74	24	NC
SECONDPORTC Bit 1	73	23	NC
SECONDPORTC Bit 2	72	22	NC
SECONDPORTC Bit 3	71	21	NC
SECONDPORTC Bit 4	70	20	NC
SECONDPORTC Bit 5	69	19	NC
SECONDPORTC Bit 6	68	18	NC
SECONDPORTC Bit 7	67	17	NC
SECONDPORTB Bit 0	66	16	NC
SECONDPORTB Bit 1	65	15	NC
SECONDPORTB Bit 2	64	14	NC
SECONDPORTB Bit 3	63	13	NC
SECONDPORTB Bit 4	62	12	NC
SECONDPORTB Bit 5	61	11	NC
SECONDPORTB Bit 6	60	10	NC
SECONDPORTB Bit 7	59	9	NC
SECONDPORTA Bit 0	58	8	Analog Ground
SECONDPORTA Bit 1	57	7	NC
SECONDPORTA Bit 2	56	6	Analog Ground
SECONDPORTA Bit 3	55	5	NC
SECONDPORTA Bit 4	54	4	Analog Ground
SECONDPORTA Bit 5	53	3	Vout 1
SECONDPORTA Bit 6	52	2	Analog Ground
SECONDPORTA Bit 7	51	1	Vout 0

Appendix: C - PCI card DDA**/12 - Digital I/O Pins

The pin# indicates the breakout board screw terminal numbers. Add 50 to obtain the corresponding cable pin number. For example pin#75 in the ribbon cable labeled 51-100 would appear on the board as #25.

TTL-Side: 50-Pin Connector Diagram

	indicates ROI #			Pin#	Pin#		indicates ROI #		
OUT 7	7		TTL output	1	2	TTL output	6		6 OUT
5	5		TTL output	3	4	TTL output	4		4
3	3		TTL output	5	6	TTL output	2		2
1	1		TTL output	7	8	TTL output	0		0
			Not Used	9	10	Not Used	3		
			Not Used	11	12	Not Used	2		
			Not Used	13	14	Not Used	1		
			Not Used	15	16	Not Used	0		
			Not Used	17	18	Not Used			
	inserts data file Marker		Not Used	19	20	Not Used	inserts data file Marker		
IN			Not Used	21	22	Not Used			IN
	V-Rise	V-Fall	Not Used	23	24	Not Used	V-Rise	V-Fall	
7	Z	z	TTL input	25	26	TTL input	Y	y	6
5	X	x	TTL input	27	28	TTL input	W	w	4
3	V	v	TTL input	29	30	TTL input	U	u	2
1	T	t	TTL input	31	32	TTL input	S	s	0
			Not Used	33	34	Not Used			
			Not Used	35	36	Not Used			
			Not Used	37	38	Not Used			
			Not Used	39	40	Not Used			
			Not Used	41	42	Not Used			
			Not Used	43	44	Not Used			
			Not Used	45	46	Not Used			
			Not Used	47	48	Not Used			
			+5 V	49	50	Digital Gnd			

Red numbers are the TTL channel numbers

TTL Input (pins 25 through 32 here on the 50 pin connector) are in FirstPortA.

Appendix: D - USB-1208 AnalogOut + Digital I/O

USB: 40-Pin Connector Diagram

	Pin#		Pin#		inserts data file Marker V-Rise	inserts data file Marker V-Fall	IN	OUT
Not Used	1	• •	21	TTL input	S	s	0	
Not Used	2	• •	22	TTL input	T	t	1	
Gnd	3	• •	23	TTL input	U	u	2	
Not Used	4	• •	24	TTL input	V	v	3	
Not Used	5	• •	25	TTL input	W	w	4	
Gnd	6	• •	26	TTL input	X	x	5	
Not Used	7	• •	27	TTL input	Y	y	6	
Not Used	8	• •	28	TTL input	Z	z	7	
Gnd	9	• •	29	Gnd				
Not Used	10	• •	30	PC +5 Volts				
Not Used	11	• •	31	Gnd				
Gnd	12	• •	32	TTL output	ROI # 0			0
AnalogOut 0	13	• •	33	TTL output	ROI # 1			1
AnalogOut 1	14	• •	34	TTL output	ROI # 2			2
Gnd	15	• •	35	TTL output	ROI # 3			3
Calibration	16	• •	36	TTL output	ROI # 4			4
Gnd	17	• •	37	TTL output	ROI # 5			5
Trigger Input	18	• •	38	TTL output	ROI # 6			6
Gnd	19	• •	39	TTL output	ROI # 7			7
CTR Not Used	20	• •	40	Gnd				

Red numbers are the TTL channel numbers

TTL Input (pins 21 through 28 here on the 40 pin connector) are in PortA.

Pin	Signal Name	Pin	Signal Name
1	CH0 IN	21	Port A0
2	CH1 IN	22	Port A1
3	AGND	23	Port A2
4	CH2 IN	24	Port A3
5	CH3 IN	25	Port A4
6	AGND	26	Port A5
7	CH4 IN	27	Port A6
8	CH5 IN	28	Port A7
9	AGND	29	GND
10	CH6 IN	30	PC +5V
11	CH7 IN	31	GND
12	AGND	32	Port B0
13	D/A OUT 0	33	Port B1
14	D/A OUT 1	34	Port B2
15	AGND	35	Port B3
16	CAL	36	Port B4
17	GND	37	Port B5
18	TRIG_IN	38	Port B6
19	SYNC	39	Port B7
20	CTR	40	GND

Appendix: E - Example of *ViewPoint* data file with event markers

Record Type	TotalTime Elapsed	DeltaTime or Marker	X_Gaze Position	Y_Gaze Position	Region Of Interest	PupilWidth	PupilAspect Ratio	Data Line Count
2	6.4919	S						
10	6.5206	33.157	0.3562	0.7229	-1	0.3438	0.8271	195
10	6.5539	33.354	0.3703	0.7542	-1	0.3906	0.9440	196
10	6.5873	33.397	0.3344	0.7312	-1	0.4062	0.9923	197
10	6.6206	33.334	0.3578	0.7479	-1	0.3781	1	198
10	6.6540	33.379	0.3891	0.7292	-1	0.3906	0.9615	199
10	6.6874	33.358	0.3984	0.7271	-1	0.3344	0.8168	200
2	6.6920	s						
10	6.7207	33.364	0.3797	0.7312	-1	0.3969	0.9845	201
10	6.7541	33.367	0.3750	0.7479	-1	0.3875	0.9758	202
10	6.7875	33.388	0.3719	0.7396	-1	0.3688	0.9440	203
10	6.8209	33.353	0.3719	0.7708	-1	0.3750	0.9167	204
10	6.8542	33.382	0.3687	0.7354	-1	0.3688	0.9291	205
10	6.8876	33.343	0.3781	0.7667	-1	0.3875	0.9032	206
10	6.9210	33.392	0.3500	0.7250	-1	0.3938	0.9545	207
10	6.9543	33.331	0.3719	0.7375	-1	0.3375	0.8571	208
2	6.9588	T						
10	6.9877	33.369	0.3578	0.7729	-1	0.4031	0.8450	209
2	6.9923	t						
10	7.0211	33.388	0.3844	0.7937	-1	0.3562	0.8684	210
10	7.0544	33.371	0.3859	0.7312	-1	0.3969	0.9845	211
2	7.0593	S						
10	7.0878	33.317	0.3625	0.7417	-1	0.3938	0.9841	212
10	7.1212	33.438	0.3719	0.7437	-1	0.3813	0.9919	213
10	7.1545	33.355	0.3828	0.7250	-1	0.3594	0.8712	214
2	7.1590	T						
10	7.1879	33.311	0.3719	0.7542	-1	0.3562	0.9661	215
10	7.2212	33.386	0.3766	0.7563	-1	0.3656	1	216
10	7.2547	33.432	0.3766	0.7042	-1	0.3719	0.8380	217
10	7.2886	33.925	0.3516	0.7271	-1	0.3906	0.9542	218
10	7.3214	32.759	0.3453	0.7125	-1	0.3781	0.8768	219
10	7.3547	33.37	0.3891	0.7375	-1	0.3719	0.9444	220
10	7.3881	33.412	0.3656	0.7083	-1	0.3750	0.8571	221
10	7.4214	33.306	0.3500	0.7333	-1	0.3875	0.9688	222
10	7.4548	33.378	0.3562	0.7312	-1	0.3438	0.8527	223
10	7.4882	33.346	0.3625	0.7271	-1	0.3875	0.9466	224
10	7.5216	33.406	0.3656	0.7312	-1	0.3812	0.9457	225
10	7.5549	33.318	0.3563	0.7563	-1	0.3875	0.9435	226
10	7.5883	33.411	0.3547	0.7417	-1	0.3781	0.9758	227
10	7.6216	33.327	0.3578	0.7354	-1	0.3594	0.9055	228
2	7.6262	s						
2	7.6264	t						
10	7.6550	33.372	0.3734	0.7646	-1	0.3594	0.9826	229

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