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# *VZDaq*

## Analog Data Acquisition Toolbox

## User Manual

**Version 2.00**

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## Introduction

**VZDaq™** is the latest software product to join the **Visualeyez™** family of motion capture products; it provides **Visualeyez™** system the capability to collect analog data in addition to the motion data acquired by a **Visualeyez™** motion capture system.

Each instance of **VZDaq™** supports a maximum of 64 analog input channels. By running multiple instance of **VZDaq™** on one PC or running **VZDaq™** on multiple PCs, unlimited number of analog channels can be acquired in theory. All the analog channels can be synchronized from a single synchronizing source and aligned with the motion data stream, and saved to a single project file. Multiple computers, each with a DAQ card and running a copy of **VZDaq™**, can be connected through a network, allowing data from a number of analog input channels to be collected from different computers at separate locations. This new feature gives users the ability to analyze large-scale analog input data files that include the motion data.

### How does **VZDaq™** fit into the **Visualeyez™** family and what does it do?

Previously, a convenient tool had not existed for inputting and analyzing analog data corresponding to motion capture data. With **VZDaq™**, the capabilities of a **Visualeyez™** system are enhanced by giving users the ability to analyze analog data (e.g. - the output signal of an EMG, ECG or force platform) synchronized to the motion data.

Consider an example: A team of medical researchers are studying the motion of a test subject as he walks over a test section of flooring covered with force plates. The team of medical researchers capture and analyze the movements of the test subject with a **Visualeyez™** system that includes **VZSoft™** and **VZAnalyzer™**. Before **VZDaq™** was introduced, the research team had no way to synchronize the analog data provided by the force plates with the motion capture data. **VZDaq™** provides the research team the capability to analyze how much force is exerted on the force plate at each point throughout the motion. The point should be stressed: **The motion data and the analog data are synchronized.** The complete set of data can then be saved to a single **VZSoft™** project file.

A **VZSoft™** project file that contains analog input data can be treated like a regular project file. For example, its data can be streamed out to **VZAnalyzer™** for analysis and plotting. It should be noted that **VZAnalyzer™** includes several features intended specifically for the analysis of analog data. For example: Fast Fourier transforms, correlation transforms, and transfer function calculations between the analog input signal data and the motion data. Additional analysis is possible in MATLAB via the MATLAB online and offline plug-ins provided by PhoeniX Technologies Incorporated.

The rest of this document describes how to set up and use the DAQ card and **VZDaq™** software.

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## 1.0 Installing the DAQ Hardware

**VZDaq™** currently supports the next generation of M-Series DAQ cards made by National Instruments. By supporting M-Series NI DAQ, **VZDaq™** is able to operate on most of the NI DAQ cards on various bus type and IO structures. Depending on the end user preference, either a PCI bus DAQ card or a USB DAQ card may be used.

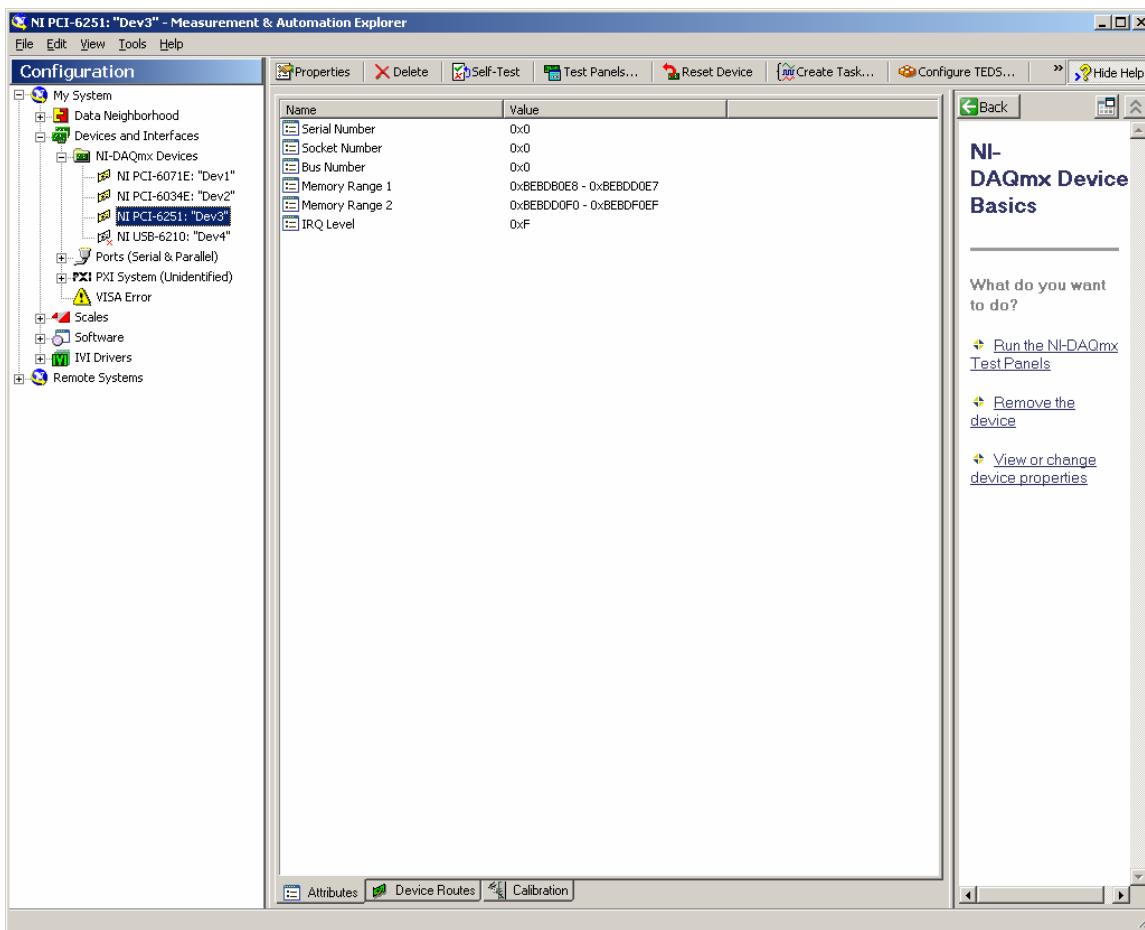
Once the DAQ card is ready or plugged in, you need to install the appropriate driver. Currently, **VZDaq™** support all versions of the most recent NI-DAQmx drivers. If you don't have the drive yet you may go to NI website listed below and download it for free.

<http://www.ni.com/>

We recommend that you install the latest driver; otherwise **VZDaq™** may not work properly. Install the driver by running the Setup program. Once the driver is installed, a “Measurement and Automation” icon should have been placed on your desktop. Before proceeding further, ensure that the driver has been installed correctly by double-clicking on the “Measurement and Automation” icon. A dialog box should appear, then expand the “Device and Information Interface” on the left pane, then expand the NI-DAQmx Devices, it will list all the installed NI-DAQmx devices. From the list you should be able to find your installed device listed and if not, you need to check the installation, plug or even contact NI technical support for assistance.

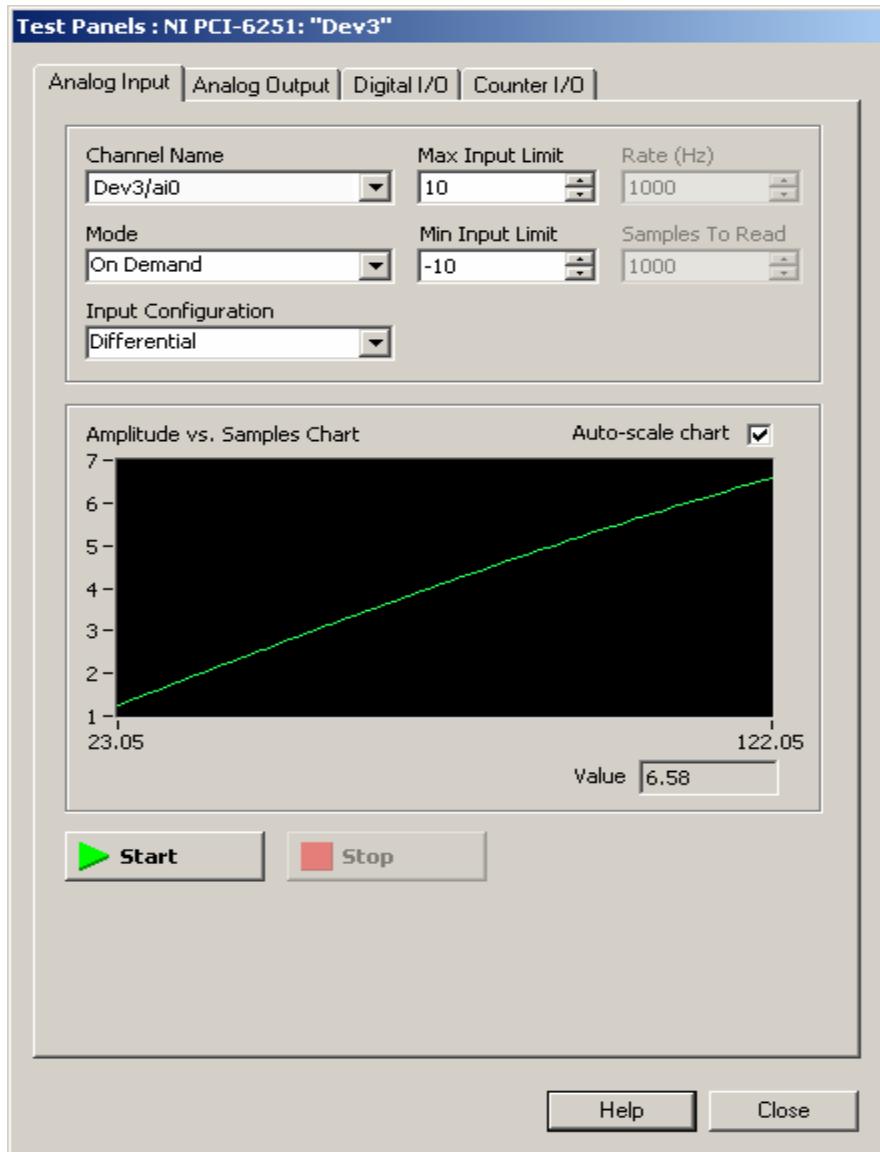
After you saw your device in the “Measurement and Automation”, you may test your device by click “Test Panel” or “Self Test” tab on the top right to give a initial test on your device. For more information on how to test or calibrate your device, please consult the documentation comes with the “Measurement and Automation” software from NI.

A screen snap of the “Measurement and Automation” and the test panel are listed below.



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## **2.0 Installing *VZDaq*<sup>TM</sup>**

### **SYSTEM REQUIREMENTS**

Operating System: Windows 2000/XP  
CPU: 1 GHz or higher  
Memory: 128 MB or greater  
Hard Drive: 10 MB or greater

### **SOFTWARE INSTALLATION**

To install *VZDaq*<sup>TM</sup> to your computer, run the VZDaq200.exe executable program that is included on the CD, and then follow the instructions.

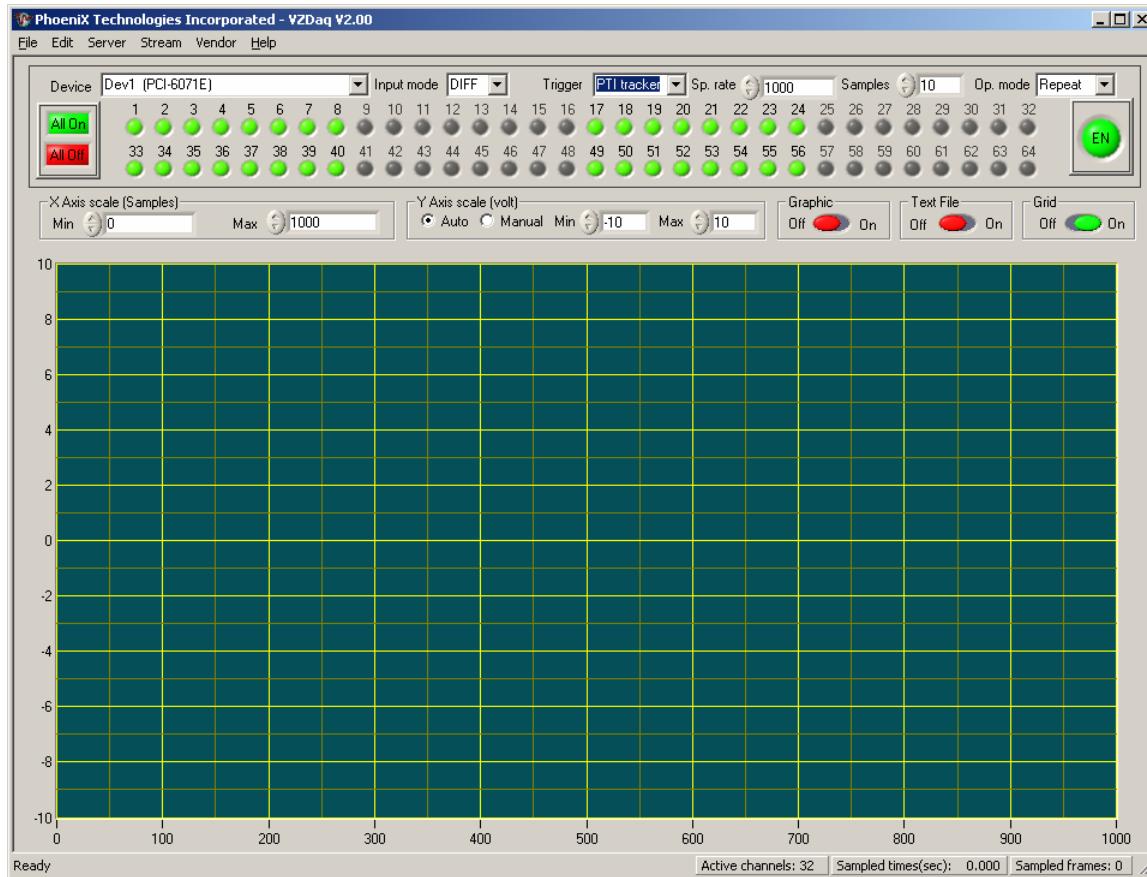
**Note** that *VZDaq*<sup>TM</sup> 2.00 requires *VZSoft*<sup>TM</sup> version 2.70.11beta or later for proper operation.

### 3.0 Using *VZDaq*<sup>TM</sup>

*VZDaq*<sup>TM</sup> is launched through the **Start** button.

Click the **Start** button at the bottom left of your computer, and then select **Programs -> Visualeyez -> VZDaq -> VZDaq V2.00**

This should bring up the *VZDaq*<sup>TM</sup> user interface window.



The *VZDaq*<sup>TM</sup> main window is dominated by a display of a graph. Across the top of the window are the parameters and controls for the DAQ card. These features will be described in the following sections.

The standard Menu Bar is also included, with limited features.

#### 3.1 The *VZDaq*<sup>TM</sup> Menu Bar

The *VZDaq*<sup>TM</sup> Menu contains four items:

##### File

The **File** menu has three submenus:

**Save setting** allows a user to save the present settings of *VZDaq*<sup>TM</sup>.

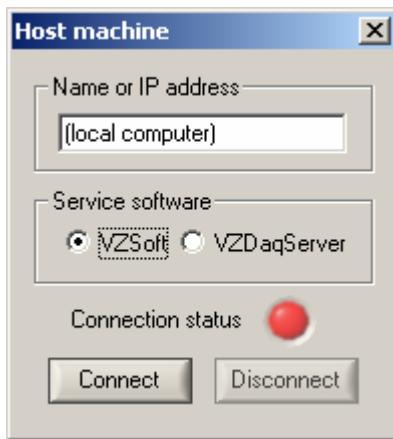
**Load setting** allows a user to load settings from a previous session, so that work may be resumed with all the same settings.

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**Exit** exits **VZDaq™**. You can also exit **VZDaq™** by clicking on the “X” icon on the top right corner of the window.

**Edit** To alter channel properties, click **Edit**, and then select **Channel Properties**. More details regarding Channel Properties are given in section 3.5, Channel Properties Configuration.

**Server** To connect to the source of the start signal (the start source server), which can be either on the same computer or on a different computer through a network, click **Server**, then connection. A dialog box will appear. By connecting to the start source server, the option for the **PTI Tracker Trigger** mode will be enabled.



**Stream** The stream menu is used to toggle on or off the streaming of data to external applications (in real time). If the option is set to “stream on”, data is streamed to an external application enabling the user to read the data.

**Vendor** Indicates the brand of Analog/Digital Card being used (by default this option is set to National Instruments).

**Help** To view **VZDaq™** version information, click **Help**, and then select **About VZDaq**.

## 3.2 **VZDaq™ Parameters and Controls**

### Device

This is the name of the device currently selected. All operations will be done on the currently selected device. When **VZDaq™** starts, it enumerates all the device names by NI driver assigned to the hardware devices and connects the device name with the hardware model number.

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### **Input mode**

It set the channel input mode of each analog channel. The mode must be the same for all selected channels. The options can be one of DIFF, RSE, or NRSE. More details regarding Input Mode are given in section **3.6 Input Mode**.

### **Trigger**

This sets the triggering source. It has 3 options to choose from: **PTI Tracker**, **Internal**, and **External**. More details regarding start source are given in section **3.4 Triggering**.

### **Sp. rate**

This defines the sample rate. This field cannot be changed if the start source is set to PTI Tracker. After connected to **VZSoft™**, any operation that affect the motion frame rate in **VZSoft™** will send a notification to **VZDaq™** with new frame rate information. **VZDaq™** will use this frame rate information and multiply the “Samples” parameter, which in turn will update Sp. rate.

### **Samples**

The number of samples collected in one motion frame for one analog channel.

### **Op. mode**

This is for **One time** or **Repeat** mode selection. When the trigger source is **PTI Tracker** and in **Repeat** mode, the **VZDaq™** will set hardware ready for the next trigger after the previous capture is stopped and data sent to **VZSoft™**. In **One time** mode means after a capture **VZDaq™** will not enter into ready state for next trigger, instead it will enter into an idle state.

### **EN/DIS**

Clicking on the indicator **EN** enables the DAQ card to start sampling the analog input signal(s). Once sampling has started, clicking on the indicator **DIS** stops the sampling.

### **Channels indicator**

There are two rows of round red/green or gray circles on top of the graphic window. These circles represent the analog input channels and are used to turn the input channels on (green) and off (red). Each **VZDaq™** can accept up to 64 analog channels of input. A green circle means the channel is enabled, red circle means the channel is disabled, and a grey channel means the channel does not exist on the selected device. When a device is selected, the status of channels will be updated to follow the device selection. Clicking on the circle will toggle the enable/disable status of the channel if the channel is not in grey color. To enable/disable all the analog

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input channels, **All on/All off** button can be clicked instead of clicking each channel.

When the Device is changed, the maximum channels will change as well. Some channels are grayed out, meaning the channel cannot be used or not exist with the selected analog device. For example, the DAQ card NI PCI-MIO-16E-4 has only sixteen channels for single-ended input. In this case, a maximum of sixteen channels can be selected for this card.

**All On:** Turn all analog channels on.

**All Off:** Turn all analog channels off.

When one channel is turned on or off, the “Active channels” count shown on the right bottom status bar will be updated to reflect the number of analog channels currently enabled.

The On/Off state of a channel is corresponding to its hardware specification. Depending on the connection method, the number of available channels will change too.

### X-axis Scale

Setting the values in this block allows you to specify the minimum and maximum values of the graph in X or horizontal direction. Anytime the number of data for each channel shown on the graphic screen is maximum value minus minimum value. After one screen of graphic has been shown and the new data keeps coming, the graph will slide left and the new data will be shown on the right. Note that if you choose limits that are too small, only a portion of the incoming data will be seen on the graph.

### Y-axis Scale

By default, this parameter is set to “Automatic”, in which case the graph adjusts to an appropriate size to fit the data. Setting it to Manual, allows you to specify the minimum and maximum values of the graph. Note that if you choose limits that are too small, only a portion of the incoming data will be seen on the graph.

### Graph

This button turns plotting on and off. If the **VZDaq™ Start** button has been pressed, and data is coming in, you can confirm the progress at the bottom of the window by noting the changing values of “Active Channels”, “Sampled Times (sec)”, and “Sampled Frames”. However, if the “Graph On” button has been toggled to “Off”, no plot will be drawn. This option is provided to reduce CPU usage, so that more of the computer’s resources can be applied to acquiring data.

### Text File

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By default, this button is “Off”. If you would like to output data to a text file, toggle this button to “On”. You will then be prompted to name the path and name of the file to which you would like the data output. Active channel data will then be output to this file, which can later be opened by, say, Microsoft Excel for analysis

### Grid

This toggles on and off the grid. If you do not want to see the gridlines of the graph, turn the grid “Off”.

At the bottom of the window the Number of Active Channels, the Time Sampled, and the Number of Sampled Frames will be displayed.

### 3.3 Graph operation

To pan a plot around the graph field, hold down the Shift key while left-click dragging the mouse around the graph field.

To zoom in on a particular region of the graph field, hold down the Control key and left-click and drag the mouse down and to the right. This creates a box in which the view will be zoomed. After a view has been zoomed, double-clicking in the zoomed view takes the view back one view. For example, if you zoomed in a view five times. Double-clicking would then take the view back to the view as it appeared the fourth time you zoomed in.

### 3.4 Start analog data collection

Analog data collection can be started or triggered by three different ways:

1. **PTI Tracker** start: The data collection is started after receiving the first EOF pulse from **PTI Visualeyez™** motion capture system and continues collecting until a stop command is received through TCP/IP from **VZSoft™** when **VZSoft™** stops the capture motion. During data collection, the collected data is saved in a temporary file in the **VZDaq** folder. After the stop command the collected analog data saved in the temporary file will be sent to **VZSoft™** through a **TCP/IP** connection with **VZSoft™**. **VZSoft™** will then save the data together with the motion data in a single project file. To enter **PTI Tracker** start, click the “EN” button and **VZDaq™** will be ready for the trigger signal.
2. **Internal** started analog data collection: The data collection is initiated by clicking the “EN” button on the **VZDaq™ GUI**. After **VZDaq™** starts, the “EN” button changes color from green to red and the text on the button becomes “DIS” to indicate it is collecting analog data. **VZDaq™** continues collecting until another click on the same button but now with a “DIS” on it.
3. **External** start: This means to start analog data collection by an external trigger source.

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For example, if you set the triggering source to PTI Tracker, sampling will start after a pulse comes from the PTI **Visualeyez™** Motion Capture System. These three methods are described below.

### 3.4.1 Triggering via a PTI **Visualeyez™** Motion Capture System

In order for the analog DAQ device to be triggered by PTI **Visualeyez™** Motion Capture System, a special TCM with EOF connector from Phoenix Technologies Inc. must be used for the trigger purpose. The TCM-EOF has a special connector which has an end of frame pulse at end of every motion frame, even though the end of frame is generated on every end of motion frame, only the first will trigger the analog data collection and the rest of the EOF will be ignored by **VZDaq™**.

#### 1. EOF

All **TCM** from **Phoenix Technologies Inc.** has the ability of output an **EOF** signal. However a **TCM** does not contain the **EOF** output connector by default. A user must specify the **EOF** requirement when placing an order so that the **TCM** will be customized to have the **EOF** output connector at the factory before shipping. The **EOF** signal is lead out of **TCM** box by a female **BNC** connector. It is a normally 4v high and low pulse about 0.2 micro-seconds width at 0v, output from a **RTL** driver circuit.

#### 2. Alignment between motion and analog data when EOF is used

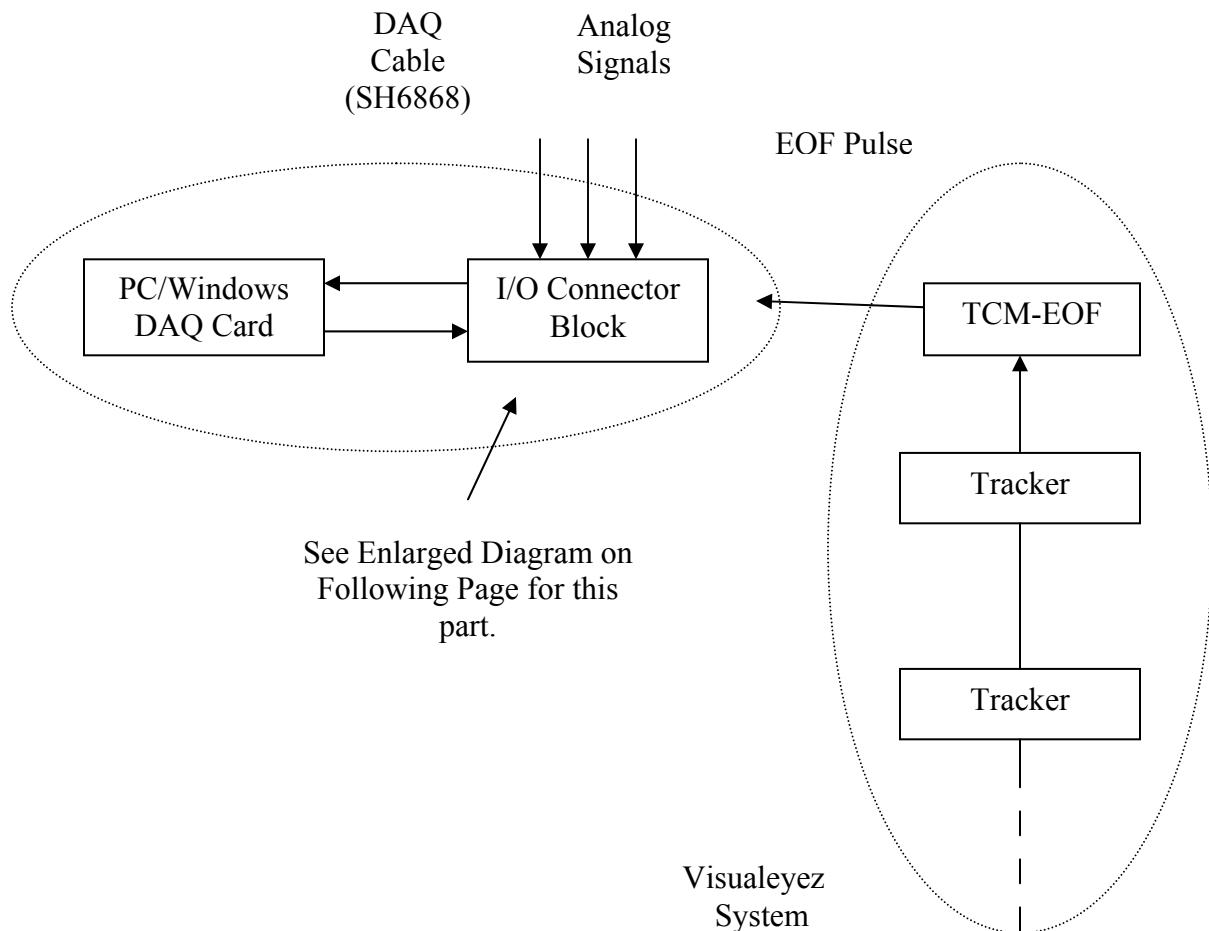
Because the trigger is from the end of motion frame instead of the start of motion frame, the analog collection triggered by this EOF has one motion frame time lag to the captured motion. In this case when processing the analog signal and the motion together, the first motion frame must be removed so that the motion and the analog will be aligned at the start.

#### 3. Timing

When EOF is used for trigger the start of analog, caution must be taken in selecting the motion frame rate and the analog frame rate and samples per motion frame. Analog devices usually have a crystal as the analog data collection clock source is divided by the internal “integral number” divider to meet the set frame rate. When synchronizing motion and analog, the two frame rate from motion and analog must be the same or one is the integer multiple of the other. Because the analog device is faster it is common that the analog frame rate is the integer multiple of motion frames. In order for the analog frame rate be divisible by analog internal binary divider, the chosen frame rate must be carefully calculated for both analog and motion. Most analog devices from National Instrument has a internal clock source of 4MHz, most of the frame rate can be easily obtained by this crystal like 100 FPS, 200FPS, 50FPS, 1000FPS etc. An example frame rate that can not be obtained by an “integral divider” from a 4MHz crystal is 150FPS. To check out the exact internal clock source of your device, please consult the manual that comes with the analog device or contact the manufacture of the device.

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## Overview of System:

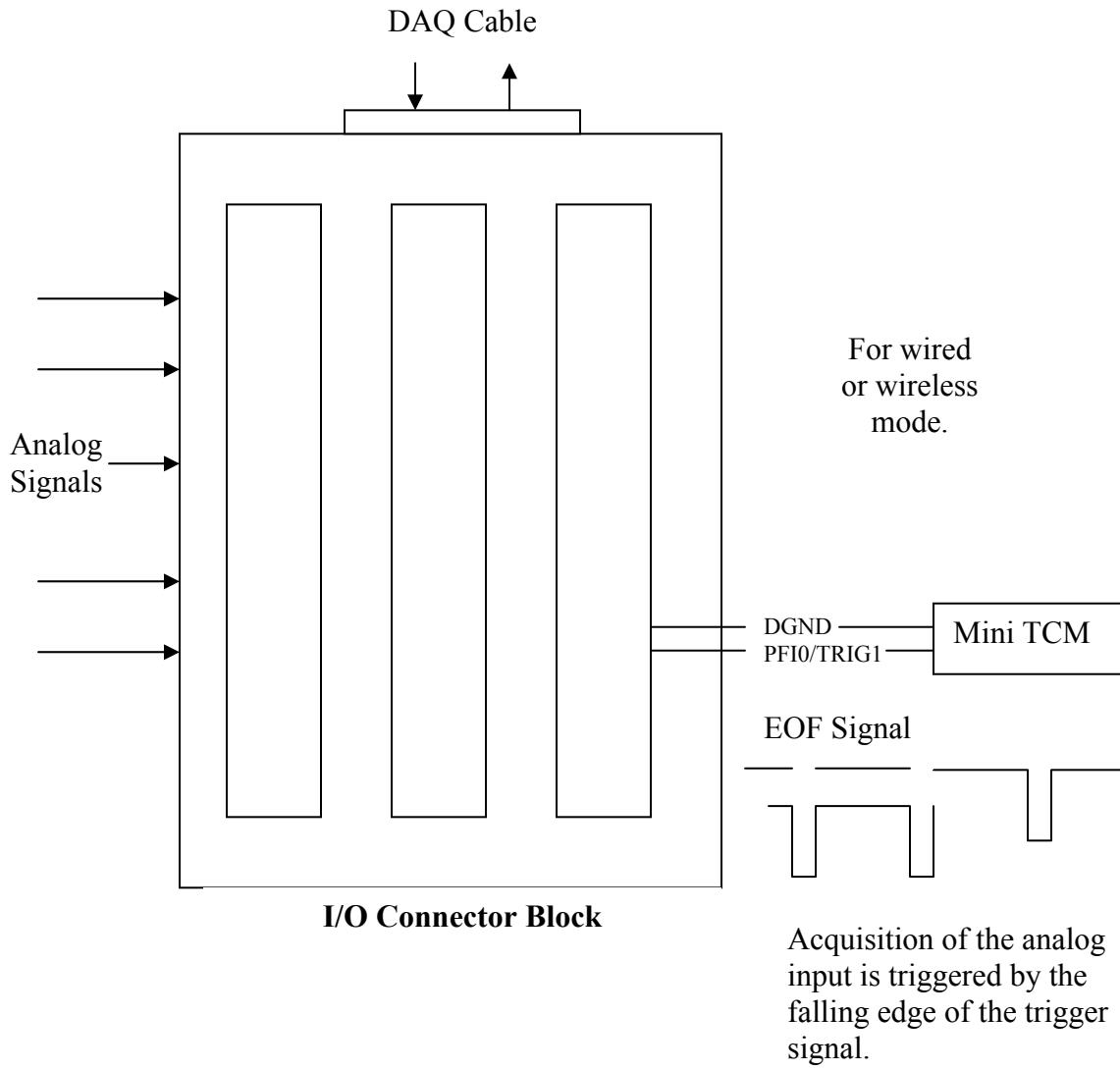


### Enlarged Diagram of I/O connector block

The DAQ cable comes from National Instruments and should be specified for the type of DAQ card ordered.

The triggering signal (from the PTI Tracker or external source) connects to pins 9 and 11 of the I/O Connector Block.

Acquisition of the analog input is triggered by the falling edge of the trigger signal.



#### 4. Repeat or One time mode

The Op. mode (sampling operation mode) can be set for **Repeat** or **One time** when triggering with PTI motion capture system. **Repeat** specifies that the triggering be done repeatedly. After **VZDaq™** receives a stop capture command through TCP/IP connection from **VZSoft™**, **VZDaq™** will send the collected data to **VZSoft™**, stop capture, clean up memories and variables and initialize them to the initial state, then make the system ready for the next triggering signal. You do not need to switch back to **VZDaq™** user interface and make it ready for the next trigger by clicking on the EN button; the **VZDaq™** will automatically do it for you. Any time you want to terminate this repeat process, click the DIS button and the whole repeat process will be void and the system will become idle and the text on button becomes “EN” again. **One time** specifies

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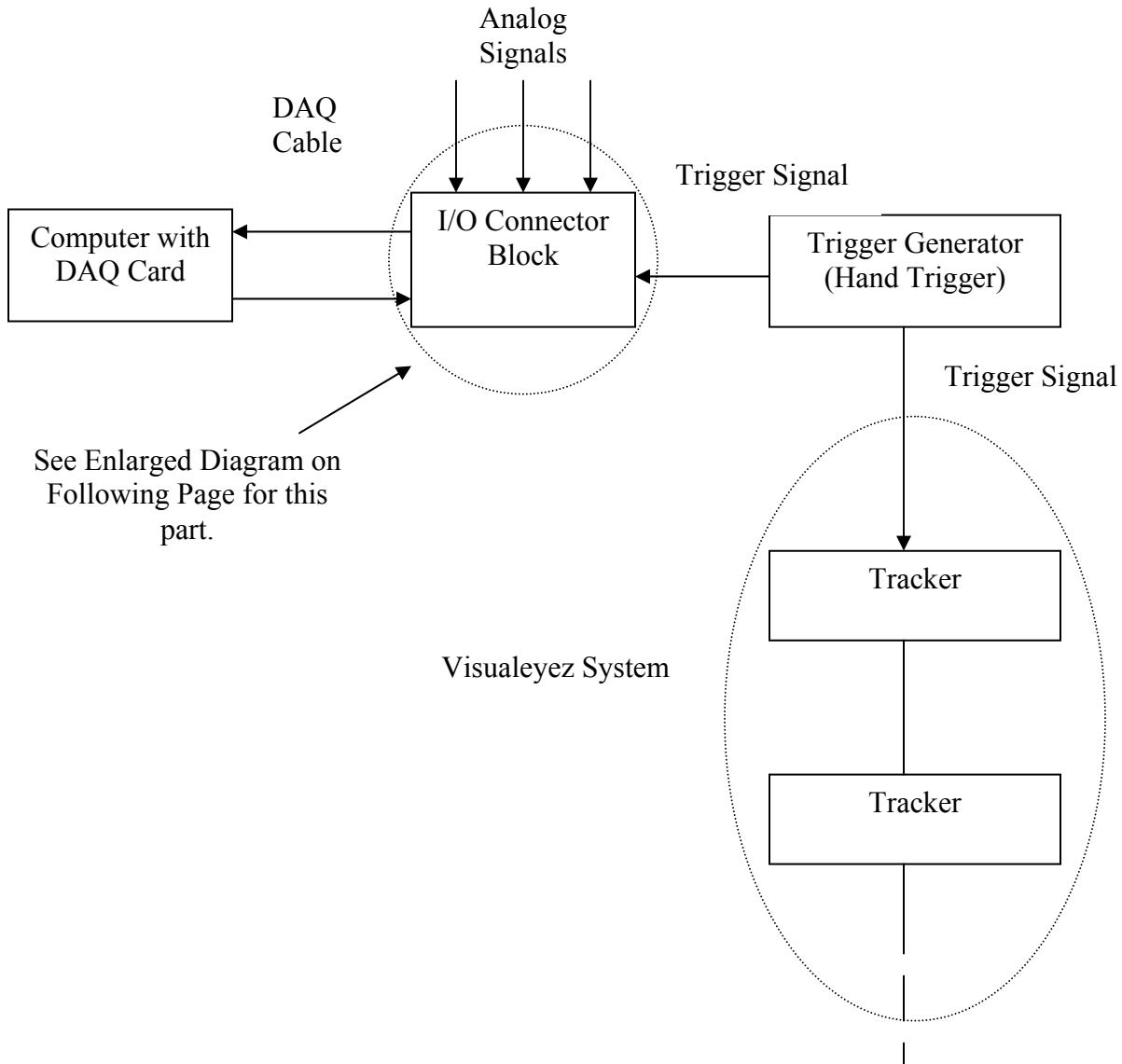
that the analog data collection will be triggered only once after which you will need to click the EN button again to make it ready for the trigger signal.

### **3.4.2 External Triggering**

In this triggering mode, the **VZDaq™** and the analog hardware will be triggered by an external digital trigger signal, the acceptable trigger signal specification can be found on the hardware manual that comes with the hardware. PTI can provide an External Hand Trigger, a small hand held device which generates the acceptable signal for NI DAQ hardware. By using an External Triggering source, both analog device and PTI motion capture system can be triggered at the same time. Unlike PTI system triggered analog collection, in which PTI system is the source of the trigger signal and the analog device is the sink of the trigger, the External Triggering method made both analog device and PTI motion capture system the sink of one externally generated signal.

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## System Overview:



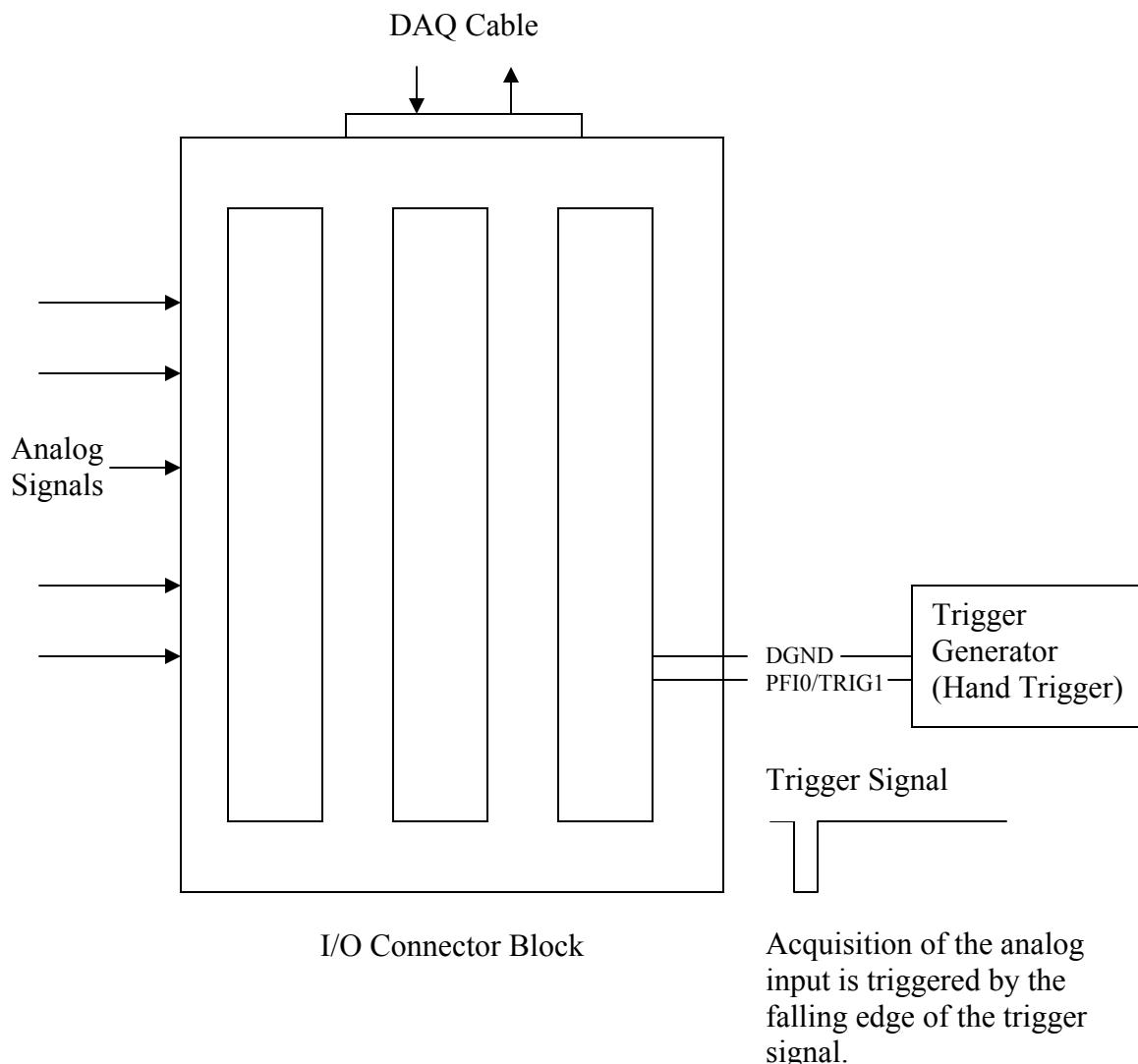
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## Enlarged Diagram of I/O connector block

The DAQ cable comes from National Instruments and should be specified for the type of DAQ card ordered.

The triggering signal (from the PTI Tracker or external source) connects to pins 9 and 11 of the excitation box.

Acquisition of the analog input is triggered by the falling edge of the trigger signal.



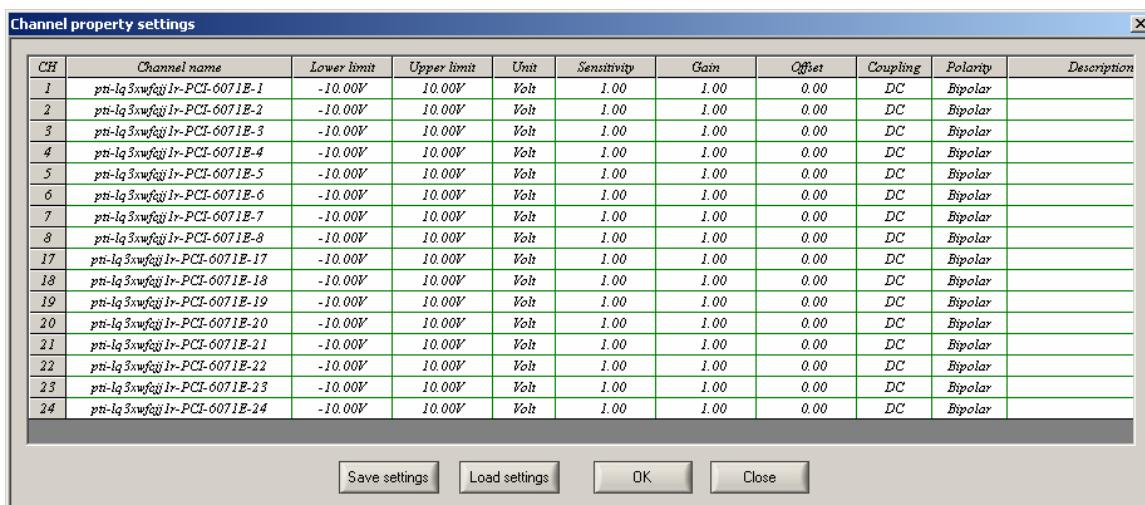
### 3.4.3 Internal Triggering

In this triggering mode, the DAQ card within the computer will generate the self-triggering signal. Click the EN button to start the analog data collection. Once the collection is started, the EN button becomes DIS and the color becomes red. Click DIS to stop the collection. The Repeat Op.mode does not apply to Internal Triggering.

We recommend that you use this triggering mode as a standalone sampling, do not use with **VZAnalyzer™** motion capture system.

## 3.5 Channel Properties Configuration

To configure the channel properties, in the **Menu** click on **Edit**, and then **Channel Properties**.



The “**Channel Properties Settings**” box will appear, listing all active channels, each channel’s name, its input range, the units relevant to each channel, and a description of the input for the channel. Click in a cell of the grid to change the name, units, or description. Clicking in an input range cell allows you to choose different input ranges for a channel. Note that selecting a small input range for a large signal will cause part of the signal to be cut off. On the other hand, using a large input range for a small signal reduces the resolution of the graph. It is best to select a range appropriate for each signal. To change all of the channel settings in one column at once, click on the column heading. This will highlight the whole column and only allowing the first cell to be modified.

Channel property settings can be saved to a file for future use.

Alternately, if settings have been saved previously, they can be loaded into **VZDaq™** so that another data acquisition session may be done using the same settings used during the previous session.

## 3.6 Input Mode

### PhoeniX Technologies Incorporated

**VZDaq™** supports three input modes relevant to the DAQ card: **DIFF**, **RSE**, and **NRSE**. For details regarding these settings, please see the DAQ card User Manual.

**E Series Help**

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**Connecting Analog Input Signals**

The following sections discuss the types of signal sources, specify the use of single-ended and DIFF measurements, and provide recommendations for measuring both floating and ground-referenced signal sources.

The following table summarizes the recommended input configuration for both types of signal sources.

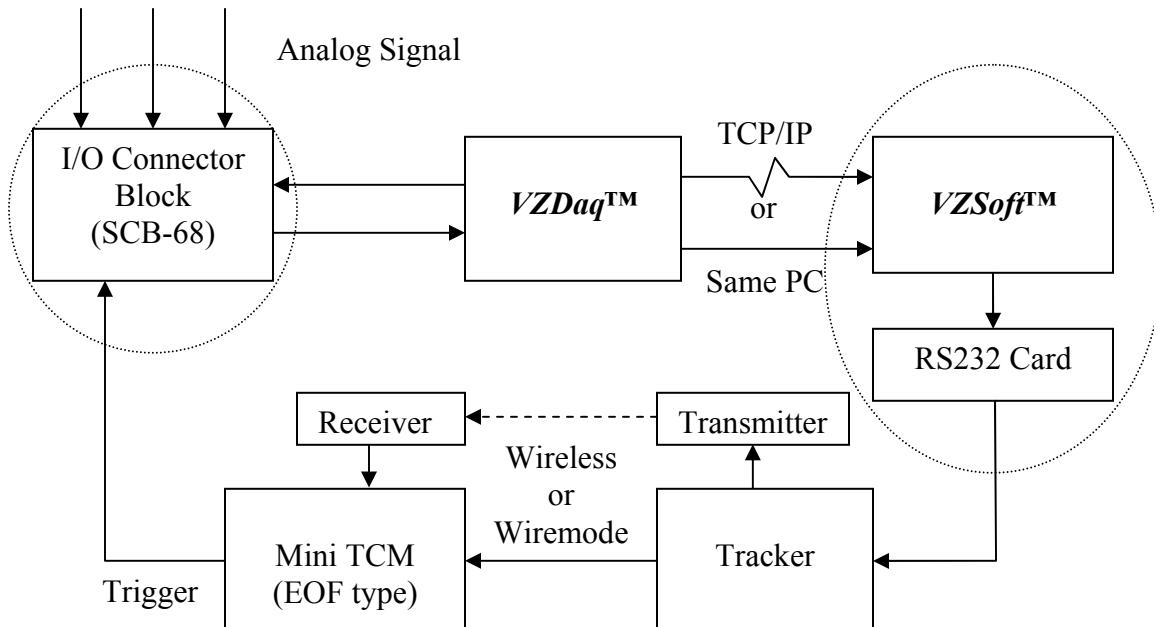
Input	Signal Source Type	
	Floating Signal Sources (Not Connected to Building Ground)	Ground-Referenced Signal Sources
<b>Differential (DIFF)</b>	<p>Examples</p> <ul style="list-style-type: none"> <li>• Ungrounded thermocouples</li> <li>• Signal conditioning with isolated outputs</li> <li>• Battery devices</li> </ul>	<p>Examples</p> <ul style="list-style-type: none"> <li>• Plug-in instruments with nonisolated outputs</li> </ul>
<b>Single-Ended—Ground Referenced (RSE)</b>		<p><b>NOT RECOMMENDED</b></p> <p>Ground-loop losses, <math>V_g</math>, are added to measured signal.</p>
<b>Single-Ended—Nonreferenced (NRSE)</b>		

Refer to [Analog Input Terminal Configuration](#) for descriptions of the input modes.

## 4.0 Using *VZDaq™* With *VZSoft™*

There are four main steps to using *VZDaq™* and *VZSoft™* to create one single project file consisting of analog data synchronized with the motion data. Refer to the figure below.

1. Select PTI tracker trigger mode from start source, and input how many samples of each analog input channel belong to a motion frame in *VZDaq™*. In this trigger mode, the sampling rate will depend on the frame rate of *VZSoft™*.
2. Connect *VZDaq™* to *VZSoft™*. Both programs must be running and they may be on the same computer or on different computers connected through a local network. To make a connection, click the **Server** on the **Menu** and select **connection**. A dialog box will open. Enter the host computer's name or IP address, choose *VZSoft™* or *VZDaqserver*, and then click on the **Connect** button. *VZDaq™* will then prime itself and wait for the command to start recording.
- VZDaqServer** is only used with multiple DAQ card and *VZDaq™* copy running in single computer or multiple computer, are connected through a local network.  
**VZDaqServer** program can be started from *VZSoft™* folder as the server.
3. Start the analog data acquisition by pushing the **EN** button on *VZDaq™*. *VZDaq™* will wait for *VZSoft™* to start capturing motion data. When *VZSoft™* starts motion capture, *VZDaq™* will automatically start data acquisition.
4. Stop the capture by clicking the **Stop** button in *VZSoft™*. *VZDaq™* will automatically stop data acquisition and transfer data to *VZSoft™*. A file will be created that contains both the motion data and the analog data.



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## **5.0 Additional Technical Support**

Should you encounter problems for which you cannot find an answer in this help file, please do not hesitate to contact PhoeniX Technologies Inc. for additional technical support. You can e-mail us at [support@ptiphoenix.com](mailto:support@ptiphoenix.com) or call us at 1-(604) 321-3238 and ask for technical support. You need to provide us with your system specifications and a detailed description of the problem.

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