**P-Wave Velocity Gantry: User Guide**

**Manual Information**

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**Introduction**

The velocity logger measures ultrasonic sound speed in materials placed between its transducers in the x-, y-, and z-directions on working-half split core sections or discrete sample cubes (*Figure 1*). Minicores are measured in the x-direction, and cubes can be measured on any axis. Velocity data generated from these sensors are part of the physical properties suite of shipboard sample measurements.

For split core sections, velocity is measured in the x-direction using a caliper velocimeter and in the y- and z-directions using pairs of piezoelectric transducers. The laser measures the position of the top of the sample, and
using this along with the offset to the transducers, calculates the position of the measurement in the sample (recorded as Offset in LIMS).

The caliper velocimeter measures velocity on discrete cubes in all three directions with no offset recorded.

**Figure 1. Section Half Measurement Directions.**

**Method Theory**

Measurement of P-wave velocity requires an estimate of the traveltime and an accurate measurement of the ultrasonic P-wave path length through the sample.

Velocity is defined as follows:

\[
\text{velocity} = \frac{\text{pathlength}}{\text{traveltime}}, \quad \text{or} \quad v = \frac{dS}{dt}.
\]

Traveltime measurement is estimated by an algorithm for graphical first arrival pick. An ultrasonic pulser generates a high-impulse voltage, which is applied to the ultrasonic transmitter and thereby induces oscillation of the crystal element within the transducer-specific frequency band. A trigger pulse from the pulser is then applied to the oscilloscope to record the waveform from the receiving transducer.

By measuring the acoustic traveltime of the waveform through both specimen of the same material but variable thickness and instrumentation, linear regression through the \(dS/dt\) plot provides the instrumentation-specific time delay. Subtraction of the system delay time (+ liner material propagation time, if required) from the total traveltime gives the traveltime for the ultrasonic pulse through the sample.

Precise length of the sample is derived from the readout of a linear variable displacement transducer (LVDT). An AC linear variable differential transformer converts changes in physical position into an AC electrical output. The LVDT requires calibration, which is performed at the same time that the system delay is derived.

This LVDT functionality makes it mandatory that the system fully close the transducers when the software control program is opened and activated. **Therefore, do not place a core section underneath the transducers when the software is started.**

The chisel (bayonet) transducers are fixed at 8.2 cm for the \(z\)-axis (downhole) and 3.44 cm for the \(y\)-axis (IODP axis designation). The \(x\)-axis separation is derived from an LVDT and calibration constants.

Traveltimes for sample half sections are calculated as follows:

- \(x\)-axis = total traveltime – \(x\)-system delay time – liner traveltime
- \(y\)-axis = total traveltime – \(y\)-system delay time
- \(z\)-axis = total traveltime – \(z\)-system delay time

Liner traveltime is calculated as the liner thickness (typically 2.7 mm) divided by the published liner material velocity (cellulose butyrate = 2140 m/s).
**P-Wave Measurement**

A temperature-equilibrated split core section in a half-core liner is placed on the core track. A barcode reader records all relevant sample information, which is used for the data upload into LIMS. A laser sensor measures the distance to the section end and determines the sampling interval from the difference between the position of the sensors and the end of the section. The user positions the section half under the sensor and triggers the measurement from the software control panel. The measurement is taken for a predetermined amount of time, generally 5 s, with the recorded result representing several thousand determinations.

**Caliper Measurement**
- The sample is placed between 2 flat, 1 inch diameter sensors that squeeze firmly onto the specimen to ensure good contact.
- One sensor acts as a transducer and the other as a receiver to record velocity measurements at a rate of 0.5 MHz.
- To measure discrete samples, the sample is measured along each (x-, y-, and z-) axis between the caliper sensors.
- A series of polycarbonate standards of different thickness are measured to obtain a linear regression transit time vs. distance for calibration. Their industry-calibrated standard sonic velocity is 2.750 m/s.

**Bayonet Measurement**
- Two pairs of piezoelectric transducers set at 90° to each other are inserted into the unconsolidated or semisoft section-half materials until the sensors are buried in the material to be measured.
- One of each pair of sensors acts as transducer and the other as receiver to measure velocity in two directions simultaneously.
- Calibration is performed by inserting the probes into a container filled with distilled water of known temperature, and therefore known velocity.

**Data Quality**

Velocity data quality is affected by several variables:
- Quality of the acoustic coupling between the core material and the sensor transducers. **Note:** Use water to increase the quality of the contact.
- Quality of the coupling between both the transducer and the core liner and between the core liner and sample. **Note:** Use water to increase the quality of the contact.
- Consolidation of the sediments; noncohesive sediments containing microcracks or gas voids cannot be measured accurately.
Apparatus, Reagents, & Materials

Hardware

The velocity track system consists of the following components (Figure 2):

- Caliper transducers
- Chisel-type transducers (bayonet transducers)
- Linear actuator
- Laser sensor
- Barcode reader

Caliper Transducers: Panametrics-NDT Microscan Delay Line Transducers

<table>
<thead>
<tr>
<th>Specification</th>
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<tr>
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<tr>
<td>Element diameter (mm)</td>
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<td>Part number</td>
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Bayonet Transducers

Custom
**Exlar Linear Actuator**

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<td>Resolution (revolution)</td>
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<tr>
<td>Accuracy (revolution)</td>
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<td>Operating temperature (°C)</td>
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<td>Model Number</td>
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<td>Voltage (VDC)</td>
<td>48</td>
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<td>Current (A)</td>
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**Acuity 1000 Laser Distance Sensor**

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<tr>
<td>Laser</td>
<td>650 nm, 1 mW visible red</td>
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<tr>
<td>Accuracy</td>
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<td>Resolution</td>
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<td>Operating temperature (°C)</td>
<td>–10–50</td>
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<tr>
<td>Linearity/accuracy (mm)</td>
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</table>

**Microscan MS-4 Ultracompact Imager Barcode Reader**

<table>
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<th>Specification</th>
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<tbody>
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<td>Operating humidity (%)</td>
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<td></td>
<td>Stacked: MicroPDF, PDF417, RSS</td>
</tr>
<tr>
<td></td>
<td>Linear: all standard</td>
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<tr>
<td>Read parameters</td>
<td>Pitch = ±30°</td>
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<tr>
<td></td>
<td>Skew = ±30°</td>
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<tr>
<td></td>
<td>Tilt = 360°</td>
</tr>
<tr>
<td></td>
<td>Decode rate = 10/second</td>
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</table>

**Software**

Generally, only the marine technicians should access configurations settings in the velocity software. However, there are some configuration issues that users need to be aware of.

Select **Configuration > Open Editor** from the **Main** screen (*Figure 3*) to open the **Velocity Configuration Editor** screen (*Figure 4*).
Figure 3. Open Configuration Editor.

Figure 4. Velocity Configuration Editor.

**Configuration Editor: Station Setup Tab**

The **Station Setup** tab (Figure 5) stores the physical configuration measurements of the caliper and bayonet transducers.

- **Axis Offsets**: physical offset from the laser zero point to the center of the transducer pair for the three stations (caliper, bayonet Y, bayonet Z). This measurement will not change unless the station location is physically changed.
- **Transducer Separation**: physical distance between the bayonet transducer pair. This measurement should never change unless the holder is physically changed.
The DAQ Setup tab (Figure 6) stores settings for pick and arrival calculations.

- **Stack Max**: no longer used; no setting required.
- **Stack Level**: maximum ± voltage level that the stacked signal must attain for a successful first pick calculation. The acquisition stacks for 10 seconds to arrive at this value. If after 10 seconds the value has not exceeded 5 V, the measurement is aborted. If this happens, reposition the sample under the transducer. *Do not change the Stack Level value.*
- **Stack Iterations**: number of stacks that exceed ±5 V, averaged to reduce noise. Increasing this value will increase acquisition time.
- **Threshold Level**: value used to detect the initial peak and subsequent first arrival. *Do not change this value.*
- **Peak Width**: value used to detect the initial peak and subsequent first arrival. *Do not change this value.*
- **2 MHz Filter**: value used to filter out electrical noise. This value is set at user’s discretion.

*Caliper Calibration Tab*

This tab (Figure 7) shows the results of the latest calibration and values used to calculate the calibration; *values cannot be changed.*

- Caliper System Delay, Slope, Intercept, and r-Value: transducer system delay parameters
- LVDT Slope, Intercept, and r-Value: calibration of LVDT volts output to millimeters
- Linear Velocity and Liner Thickness: standard values used to correct the measurement of delay time through the core liner.

![Figure 7. Configuration Editor: Caliper Calibration Tab.](image)

**Bayonet Calibration Tab**

This tab (Figure 8) shows the results of the latest bayonet calibration. *Values cannot be changed.*

- **Y-Bayonet axis system delay**: water velocity corrected to temperature for Y-bayonet.
- **Z-Bayonet axis system delay**: water velocity corrected to temperature for Z-bayonet.

![Figure 8. Configuration Editor: Bayonet Calibration Tab.](image)

**VISA Resources Tab**

This tab (Figure 9) shows the alias locations for the serial ports configured using LabView **Measurement and Automation Explorer Program**. *Only Application Developers can change the values on this tab.*
Figure 9. Configuration Editor: VISA Resources Tab.

File Paths Tab
This tab (Figure 10) shows the file paths used by the application to store the configuration file and data files. Only Application Developers can change the values on this tab.

Figure 10. Configuration Editor: File Paths Tab.

Standards
- Laboratory reagent water (distilled)
- Acrylic cylinders of known length and velocity (Figure 11; all cylinders have the same velocity but variable lengths); velocity = 2750 m/s
- Acrylic (as above) half-cylinders of variable thicknesses to accommodate transducer placement on the half-core section. As of August 2010, the velocity is ~2950 m/s but subject to further verification.

Figure 11. P-Wave Acrylic Cylinder Standards.
Instrument Calibration

The bayonet and caliper transducers must be calibrated and the system delay determined daily.

- The **bayonet** transducers are calibrated by measuring the transducer spacing and backcalculating the system delay from the total traveltime for the y- and z-axes from the transducer separation value and theoretical velocity of distilled water at the temperature of the water bath.
- Calibration of the **caliper** requires the transducer and system delay to be calibrated concurrently. The transducer separation is measured with an LDVT, which requires a line fit and linear interpolation to derive the transducer separation.

System delay is derived from a separation-traveltime curve. Separation is entered by the operator for the calibration standard and traveltime is derived from a traveltime pick algorithm. As the current transducers have pliable plastic pole faces the system delay is on the order of 25 µs.

The calibration uses the derived velocity of the standard material to test for acceptance or rejection of the data. Acrylic plexiglas, the material used for the calibration standards, has a published sound speed of 2750 m/s. The calibration pieces are cut from a single rod of plexiglas at variable thicknesses between 10 and 75 mm and are a numbered set for consistency.

Calibrating the Bayonet Transducers

Because the distance between the bayonets is fixed, only the system time delay needs to be calculated. This is achieved by determining by measuring velocity in water of known temperature and calculating the velocity correction. The difference between the known and measured value is due to system delay.

**Procedure**

1. Prepare a water bath by setting ~2 L of distilled water at room temperature for a couple of hours.
2. Once at room temperature, insert the thermocouple/digital thermometer and record the temperature of the water bath.
3. On the **Main** window, select **Configuration > Calibration > Bayonet Y Station** (or **Bayonet Z Station**) (**Figure 12**).

![Figure 12. Bayonet Calibration.](image)

4. Enter the temperature of the water bath into the **Temperature** field on the calibration screen (**Figure 13**). The screen displays a plot of measured velocity vs. temperature of the water bath. An algorithm calculates the temperature-corrected velocity of the water bath and displays the result. Click **OK** to continue.
5. Use the **Open** and **Close** controls on the **JOG** screen to raise or lower the transducer into the water bath (the black dot should be covered) (*Figure 14*).

6. When the graph shows an acceptable waveform, click **OK** on the **Temperature Correction** screen to start the acquisition (*Figure 15*).
7. The computer calculates the system delay for the $y$- and/or $z$-axes and displays the ultrasonic waveforms on the corresponding graphic display (Figure 14). Based on the system delay, the software takes a velocity measurement of the water. Compare the measured velocity to the theoretical value and accept or repeat the calibration procedure (Figure 16).

![Figure 16. Accept Calibration.](image1)

8. Once accepted, the system delay times are saved to the configuration file and the calibration indicator and date time stamps are updated. If results are not acceptable, rerun the bayonet calibration.

9. Repeat the calibration procedure for the other bayonet.

**Calibrating the CALIPER**

Caliper calibration is a little bit more involved. Because the distance between the calipers is variable, the system delay is determined using a set of standards of identical velocity but various lengths. The actual velocity of the standard is irrelevant, but is good to know as a quality check. To determine the system delay time, the first arrival time is plotted against distance and the intercept with “zero distance” equals the system delay (Figure 17). As a quality check the the slope will equal the velocity of the material used. This value should be close to the known value and the r-value (fit) should equal 1 (or be very, very close). The calibration should look like the example shown below (note: the delay time will change as the transducers wear).

![Figure 17. Caliper System Delay.](image2)

In addition to the delay time determination, the LVDT output (volts) must be calibrated to distance in millimeters (Figure 18). The known lengths of the same standards are used and both calibrations are performed at the same time. As standards are measured, the LVDT calibration improves, so previous measurements are constantly recalculated. This is one of the reasons why at least 6 measurements are required before accepting calibration.
Procedure

1. From the Main window, select Configuration > Calibration > Caliper Station (Figure 19) to open the Caliper Calibration window (Figure 20). The Standard Information dialog box (Figure 21) will open immediately.
2. Place the cursor in the **Scanner String** field and scan the standard’s 2D bar code. Once the information is automatically entered into the box, confirm the standard length and ensure the unit is meters. This value can be entered manually if necessary.

3. Place the standard in the caliper and click **Start Measurement**. During acquisition, the waveform, time pick, and calibration plots (after two measurements) will update on the **Caliper Calibration** window (Figure 22).
4. To stop the calibration, click the **Stop – Return** button on the **Standard Information** box (**Figure 21**). To resume measurement, click the **Measure A Standard** button on the **Caliper Calibration** window (**Figure 22**). To complete calibration, at least six standards must be measured; however, additional standards can be added or any standard can be measured multiple times.

**Editing Calibration Points**

Calibration points can be edited if necessary. For example, the calibration curve in **Figure 23** shows an obvious problem with one point: The wrong length was assigned to the standard.
Procedure
1. Click the Stop – Return button on the Standard Identification box (Figure 21).
2. Locate the Index number of the point containing the wrong information on the Caliper Calibration screen and type it into the Index field (Figure 24).
3. Click Delete by Index to delete data for that point from the calibration.
4. Remeasure the standard using the Measure A Standard button.
5. Other options in the Array section of the Caliper Calibration screen include deleting only the last measurement (Delete Last) or deleting all data points and starting a new calibration (Delete All Data and Start Again) (Figure 24).

Accepting Calibration
To accept the calibration, click the Save button on the Caliper Calibration window (Figure 22).

Sample Preparation
Two types of samples can be measured using the velocity gantry:
- Section-half core samples
- Discrete samples

Sample Prep Overview
- Allow samples to equilibrate to room temperature before measuring velocity. [Note: most samples will have already been run through the Whole-Round Multisensor Logger and will have been equilibrated to room temperature before that run.]
- Before placing the working half in the core tray, make sure the surface is clean (lightly scrape away any material smeared across the cut surface during core splitting).
- Place the core section in the tray and make sure it is as flat as possible.

Instrument Preparation
- Clean transducers of any residue with water and paper towels.
- Before initializing the P-wave software, ensure the caliper transducers and laser beam are not blocked. Note: This step is crucial.
Sample Analysis

Measuring Section-Half Samples

Before measuring samples, be sure the samples are properly prepared and the system is calibrated.

1. Start the Velocity application by clicking the icon (Velocity 2.0.5) on the desktop.
2. Once the application is launched, click the Make a Measurement button.
3. In the Scan Sample Label dialog box, place the cursor in the Scanner String field (Figure 25).

![Figure 25. Scan Sample Dialog Box.](image)

4. Scan the barcode on the section half label to populate the fields on the Scan Sample Label dialog box. Enter Operator (user last name) and confirm measuring Station and Mode.

   Stations Bayonet Y and Bayonet Z are for soft sediments. To use a Bayonet measuring station, the Mode value must be Section w/liner (material is still in core liner). Note: The orientation assigned to the sample measurement depends on the Station selected.

5. For Section w/liner mode, a Position Sample dialog box opens (Figure 26). Confirm the sample position as measured by the laser (the laser at the end of the track measures the range to the end of the core and calculates the position in the liner based on an offset for that station). Click OK.

![Figure 26. Position Sample Dialog Box.](image)
6. The bayonet transducers lower into the section half; ensure they are completely inserted into the sample. If contact between the transducers and sediment is poor, add distilled water around the transducers to improve contact with sediment.

7. On the JOG Bayonet screen (Figure 27), monitor the waveform and position the transducer to obtain the best trace. The plot displays the live signal with no stacking. A weak signal is fine, as long as a clean first arrival is present. Once the waveform is acceptable, click Continue to begin sample acquisition.

![Figure 27. JOG Bayonet Y Screen.](image)

8. During acquisition, the program adds multiple waveforms until the total (max peak) is greater than ±5 V. This process is repeated and the waveform is averaged.

**Measuring Discrete Samples**

Discrete samples measured on the Cailper station are hard material that has been cut from the core as cubes, minicores, or slabs. Because the material can be measured in various orientations, the user must select the measurement axis (see Figure Appendix A).

Traveltime is calculated as total traveltime minus x-system delay time. Discrete sample measurements are not corrected for the core liner nor is an offset recorded in the LIMS. The transducer separation is measured with an LDVT as it is for the sample half measurement. For discrete samples the axis of measurement is selected for each measurement.

Retaining the correct “up” direction is critical for axis determination and P-mag orientation; make sure the sample has the “up” direction marked on it (see Figure Appendix A).

Before measuring samples, be sure the samples are properly prepared and the system is calibrated.

1. Start the Velocity application by clicking the icon (Velocity 2.0.5) on the desktop.
2. Once the application is launched, click the Make a Measurement button.
3. In the Scan Sample Label dialog box, place the cursor in the Scanner String field (Figure 28).
4. Scan the barcode on the discrete sample label to populate the fields on the Scan Sample Label screen. Enter Operator (user last name) and confirm measuring Station (Caliper) and Mode (Discrete).

5. Enter information requested in the Additional Discrete Information dialog box (Figure 29): Measurement Axis: X, Y, or Z.

6. If the material to be measured is a whole piece removed from the liner (rarely used), select Piece w/o Liner mode in Step 4 and complete the offset (position of the piece in the liner before it was removed) in the Additional Piece Information dialog box (Figure 30).

If the orientation of the piece is unknown, check the Orientation Unknown box; otherwise the measurement is assigned to the X-direction.
7. Place the discrete sample in the caliper and add distilled water to create a good sample-transducer contact if needed.

8. On either the Additional Discrete Information (discrete samples) or Additional Piece Information (piece samples) box, select OK - AutoClose (for hard samples) or OK – Manual Close (for softer/friable samples).

   **AutoClose** automatically closes the caliper on the sample. The transducer moves to a predefined position or until the actuator stalls.

9. On the **JOG Caliper** screen (*Figure 31*), monitor the waveform and position the transducer to obtain the best trace. The plot displays the live signal with no stacking. A weak signal is fine, as long as a clean first arrival is present. Once the sample is properly positioned, click **Continue** to begin sample acquisition.

10. During acquisition, the program adds multiple waveforms until the total (max peak) is greater than ±$5\,\text{V}$. This process is repeated and the waveform is averaged.

   The touch-screen **Open/Close** commands may be sluggish in response. If there is no response, try actuating the button using the mouse.

11. Repeat the measurement process for each axis to be measured.

**Accepting Results and Manual Pick**

Once the velocity data have been acquired, the results are shown on the **Display Results** screen (*Figure 32*).
The Manual Pick Velocity field remains blank until the user clicks the Manual Pick Arrival Time button and sets a manual pick time. The first arrival should be picked in the same manner the system was calibrated. Both Manual Pick and Auto Pick are saved with the sample data.

1. Select the Manual Pick Arrival Time button to open the Manual Pick screen (Figure 33), showing the waveform. Select the Cursor Movement Tool on the graph palette, then use the mouse to drag the red cursor line to the first arrival.

To help select the first arrival, the plot can be zoomed in using the graph palette zoom function or by entering Zoom Range Minimum and Zoom Range Maximum times below the waveform plot on the Manual Pick screen.
2. Click **Continue** to accept the manual pick and save it to the data file or **Cancel** to discard the manual pick results.

### Data Handling

From the **Display Results** screen one of 4 data handling choices can be selected:

- **Exit Save Data**: saves data and returns to the Sample Information dialog box for the next sample.
- **Cancel Without Saving Data**: does not save the data but returns to the Sample Information dialog box. Use this option if there is a data quality warning or if the waveform for the sample was unacceptable.
- **Repeat Without Saving Data and Keep ID**: does not save data but returns to the JOG screen where the user can reposition the transducer and take another measurement of the same sample.
- **Save Data and Repeat with Same ID**: saves the data and returns to the JOG screen where the same sample can be run again. This option allows replicate measurements.

### LIMS Integration

#### Sample/Analysis Attributes and Components

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<th>Analysis</th>
<th>Component</th>
<th>Unit</th>
<th>Description</th>
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<td>bottom_depth</td>
<td>m</td>
<td>Location of bottom of individual measurement on the sample, measured from top of hole</td>
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<tr>
<td></td>
<td>distance_in_caliper</td>
<td>mm</td>
<td>Displacement between the faces of the transducers in contact with the sample</td>
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<td>instrument_group</td>
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<td>Core logger on which the sensor is deployed</td>
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<td>liner_correction</td>
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<td>Liner correction value applied to calculation: 0: measurement on discrete sample 1: measurement on section half passing through 1 core liner</td>
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<td>number_of_readings</td>
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<td>Number of signals stacked together while obtaining this result</td>
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<td></td>
<td>offset</td>
<td>cm</td>
<td>Location of measurement on sample measured from top</td>
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<td>Serial number of the raw P-wave data file in the digital asset management system (ASMAN)</td>
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<td>Filename of raw P-wave data file</td>
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<td></td>
<td>top_depth</td>
<td>m</td>
<td>Location of top of individual measurement on the sample, measured from top of hole</td>
</tr>
<tr>
<td></td>
<td>travel_time</td>
<td>µs</td>
<td>Travetime of the sonic wave from transducer to transducer through the sample</td>
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<td></td>
<td>velocity</td>
<td>m/s</td>
<td>Velocity of pressure wave through sample</td>
</tr>
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<td></td>
<td>velocity_x</td>
<td>m/s</td>
<td>Velocity of pressure wave through sample in the x-axis</td>
</tr>
<tr>
<td></td>
<td>velocity_y</td>
<td>m/s</td>
<td>Velocity of pressure wave through sample in the y-axis</td>
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**P-Wave Velocity User Guide**  
3 January 2014
Data Upload Procedure

Before running a sample or completing a calibration, you must start the Data Uploader so the data uploading process will run in the background looking for files to upload and every section measured on the logger will automatically upload to LIMS.

1. Open the LIMS Uploader icon on the desktop.
2. Click **Start Monitoring** to save data files and automatically upload calibration files to LIMS.
3. When data collection is completed, click **Stop Monitoring**.

Health, Safety, & Environment

Safety

- Keep extraneous items and body parts away from the moving parts.
- The track system has a well-marked yellow and red emergency stop button (Figure 34) to halt the system if needed.
- Do not look directly into the laser light source (class 2 laser product).
- Do not direct the laser beam at other people.
- Do not attempt to work on the system while a measurement is in progress.
- Do not lean over or on the track.
- Do not stack anything on the track.
- This analytical system does not require personal protective equipment.

![Emergency Stop Button](image)
## Maintenance & Troubleshooting

### Common Issues

The following are common problems encountered when using the P-wave Velocity Gantry and their possible causes and solutions. For information about the laser Measurement and Operation software, see the Vp GiESA Gantry Laser Operation manual.

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<thead>
<tr>
<th>Issue</th>
<th>Possible Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser sensor: no laser light/no laser range data</td>
<td>Sampling is turned off</td>
<td>Turn sampling on through laser Measurement and Operation software</td>
</tr>
<tr>
<td></td>
<td>Power supply voltage too low</td>
<td>Check power supply input voltage through laser Measurement and Operation software</td>
</tr>
<tr>
<td>Laser sensor: Serial port not responding</td>
<td>Power supply voltage too low</td>
<td>Check power supply input voltage through laser Measurement and Operation software</td>
</tr>
<tr>
<td></td>
<td>Baud rate incorrect or unknown</td>
<td>See Acuity manual 3.5.1; laser Measurement and Operation software</td>
</tr>
<tr>
<td>Laser sensor: Error code (Exx) transmitted on serial port</td>
<td>I/O error</td>
<td>Check drive or Expert software for faults</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use MOTION1/MOTION2/JOG commands. Use arrow up to upload parameters</td>
</tr>
<tr>
<td></td>
<td>Power interruption</td>
<td>Check wiring</td>
</tr>
<tr>
<td>Exlar actuator: No response</td>
<td>I/O error</td>
<td>Check drive or Expert software for faults</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use MOTION1/MOTION2/JOG commands. Use arrow up to upload parameters</td>
</tr>
<tr>
<td></td>
<td>Power interruption</td>
<td>Check wiring</td>
</tr>
<tr>
<td>Exlar actuator: Behaving erratically</td>
<td>Drive improperly tuned</td>
<td>Check gain settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use MOTION1/MOTION2/JOG commands. Use arrow up to upload parameters</td>
</tr>
<tr>
<td></td>
<td>Too much load on motor</td>
<td>Check for load irregularity or excess load</td>
</tr>
<tr>
<td>Exlar actuator: Cannot move load</td>
<td>Too much load or friction</td>
<td>Check load and friction sources</td>
</tr>
<tr>
<td></td>
<td>Excessive side load</td>
<td>Check side load</td>
</tr>
<tr>
<td></td>
<td>Misalignment of output rod to load</td>
<td>Check alignment of rod and load</td>
</tr>
<tr>
<td></td>
<td>Current limit on drive too low</td>
<td>Check current on drive</td>
</tr>
<tr>
<td></td>
<td>Power supply current too low</td>
<td>Check power supply current</td>
</tr>
<tr>
<td>Exlar actuator: Housing vibrates when shaft in motion</td>
<td>Loose mounting</td>
<td>Tighten mounting screws</td>
</tr>
<tr>
<td></td>
<td>Drive improperly tuned</td>
<td>Check gain settings</td>
</tr>
<tr>
<td>Exlar actuator: Output rod rotates during motion</td>
<td>Rod rotation prevents proper linear motion</td>
<td>Install anti-rotation assembly</td>
</tr>
<tr>
<td>Exlar actuator: Overheating</td>
<td>Ambient temperature too high</td>
<td>Check ambient temperature</td>
</tr>
<tr>
<td></td>
<td>Actuator operation outside continuous ratings</td>
<td>Check operation settings</td>
</tr>
<tr>
<td></td>
<td>Amplifier poorly tuned</td>
<td>Check gain settings</td>
</tr>
</tbody>
</table>

### Actuator Utilities

The actuator utilities can be used to test the caliper and bayonet actuators (move them up and down) and view the waveform detected by the transducers. There are also utilities to test the home position of the actuators and to check the laser function. This utility is useful when configuring the station offsets.
To change the behavior and/or force of the actuators, the Exlar utility must be used. Open the Actuator utility (Figure 35) from Main > Actuator Utility and then select one of the JOG screens, Home All, or Read Laser.

![Figure 35. Actuator Utilities.](image)

### Scheduled Maintenance

**After Every Sample**

Clean contact sensors with tissue, cloth, or paper towel and water.

**Daily**

Clean dust from the laser sensor lens using compressed air or delicate tissue wipes. Do **not** use organic cleaning solvents on the sensor lens.

**Weekly**

Check set screws on piezoelectric transducers to make sure they are firmly held in position when embedding in sample.

**Annually**

Coat (not pack) the following parts with grease:
- Angular contact thrust bearings
- Roller screw cylinder
- Roller screw assembly in the actuators

Examine the cable management system for abraded cables or other indications of wear.

### Vendor Contact/Consumable Parts

**Panametrics transducer**

Olympus (www.olympusndt.com)
- Transducer: NDT M2008
- Light source: HL-2000-FHSA or HL-2000-FHSA-LL
- Spare bulb: HL-2000-B or HL-2000-LL-B
- Reflectance standard: WS-1-SL

**Laser displacement sensor (AR1000)**

Acuity Laser Measurement
www.acuiltyaser.com
702-616-6070

**Barcode reader (MS-4)**

Microscan  
www.microscan.com  
helpdesk@microscan.com  
800-251-7711

**Actuator (TLM 20)**

Tritex  
www.exlar.com

**Related Documentation and Links**

- Vp GIESA Gantry Laser Operation manual
- Olympus Panametrics-NDT Ultrasonic Transducers
- Acuity Laser Measurement AccuRange AR1000™ Laser Distance Sensor User Manual
- Acuity Laser Measurement AR1000 Laser Distance Sensor: Quick Start Guide
- Acuity Laser Measurement AR1000 Laser Distance Sensor Data Sheet
- Exlar Tritex Linear & Rotary Actuator Installation, Operation, and Service Manual
- Exlar Tritex Technical Notification 4/12/07