

# OMNICAL2

TRACKER CALIBRATION SOFTWARE



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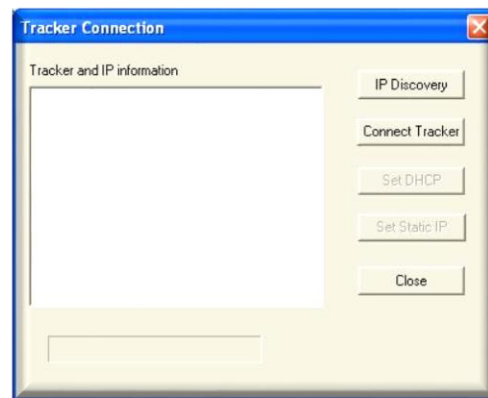
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## Software Installation

Your API laser tracker is delivered with two software packages: the API OmniCal™ Software (for maintenance and field calibration) and a third party geometric analysis package as appropriate for the user's applications. If your computer was included as part of your order from API, the calibration software, and the geometric analysis package is pre-installed. To Install OmniCal™ Software, insert the API calibration software USB flash drive into your computer, open the file explorer to view the USB flash drive, and double click on the "OmniCal.exe" file (note: actual name of file may be slightly different depending on version number). The setup program will guide you through the installation process.

## Starting OmniCal™ Software

To initialize the tracker program double click on the "OmniCal™ SW." icon located on the desktop. If the icon is not present the software may be run from the start menu under "Programs: API Laser Tracker System".



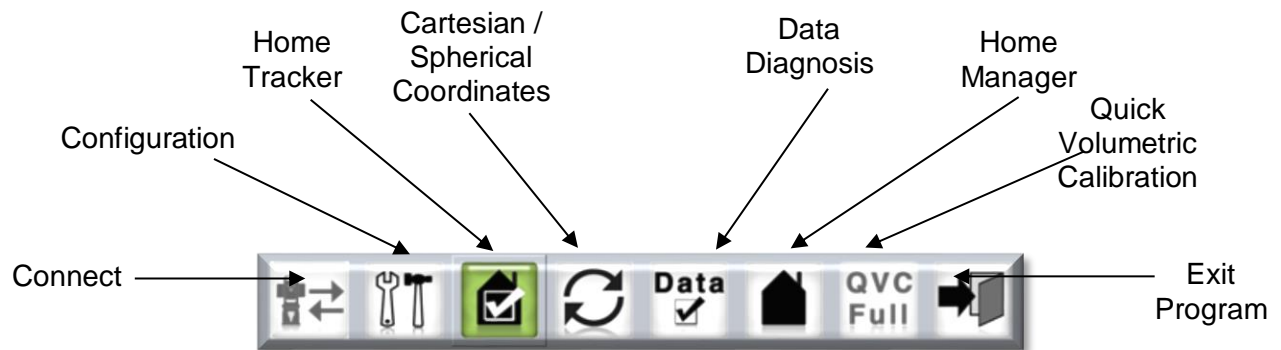
The user will be immediately prompted with a Tracker connection dialog. To initialize the tracker, click the "IP Discovery" button, choose the IP address corresponding to the tracker (default is 192.168.0.168) in the *Tracker and IP information* field, and click the "Connect Tracker" button. When the API Tracker begins the initialization routine, the Tracker will cycle through an index search of the encoders on the tracker unit. (NOTE: the system index only occurs the first time after the system has been powered on, or reset). As soon as the search index pulse is found, the program will proceed to the main operations screen. Please note that the laser head must be allowed to warm up for one half hour to achieve best accuracy. The laser distance display will indicate that the laser is warming up. Once the laser is ready, the laser distance reading will display a numerical value, and the green led on the tracker head will light up.

## Choosing an API Product

OmniCal™ software is designed to function with only the API OT2/OT 2 Core ADM based Laser Precision Measurement System

## Software Operation

The main operations screen contains various icons that provide the user with data feedback from the tracker in addition to two tool bars and the main menu. The icons are described below:



**Coordinate Screen** – The target location screen shows the position of the target in terms of the active coordinate system, which may be toggled, between Cartesian or

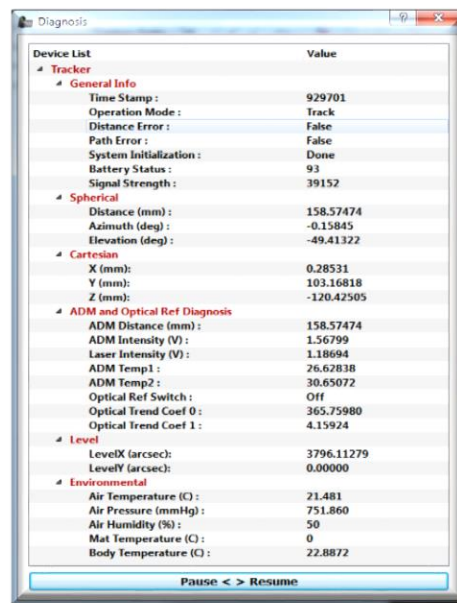
spherical coordinates. The distance from the laser head to the target is always displayed.

## System Checks & Calibration Procedures

The main menu contains several basic functions. The operators will need to use two of the functions to evaluate the system performance. Those functions are the **Quick Front sight / Back sight**

### Data Diagnosis Window

system performance. Those functions are the **Volumetric Calibration** and **functions**.



Device List	Value
<b>Tracker</b>	
<b>General Info</b>	
Time Stamp :	929701
Operation Mode :	Track
Distance Error :	False
Path Error :	False
System Initialization :	Done
Battery Status :	93
Signal Strength :	39152
<b>Spherical</b>	
Distance (mm) :	158.57474
Azimuth (deg) :	-0.15845
Elevation (deg) :	-49.41322
<b>Cartesian</b>	
X (mm) :	0.28531
Y (mm) :	103.16818
Z (mm) :	-120.42505
<b>ADM and Optical Ref Diagnosis</b>	
ADM Distance (mm) :	158.57474
ADM Intensity (V) :	1.56799
Laser Intensity (V) :	1.18694
ADM Temp1 :	26.62838
ADM Temp2 :	30.65072
Optical Ref Switch :	Off
Optical Trend Coef 0 :	365.75980
Optical Trend Coef 1 :	4.15924
<b>Level</b>	
LevelX (arcsec) :	3796.11279
LevelY (arcsec) :	0.00000
<b>Environmental</b>	
Air Temperature (C) :	21.481
Air Pressure (mmHg) :	751.860
Air Humidity (%) :	50
Mat Temperature (C) :	0
Body Temperature (C) :	22.8872

Pause < > Resume

## Evaluating System Performance

Before using the laser tracker, it should always be checked for system accuracy and performance. This is done by monitoring the system sensors and by running a **One Point QVC** (or **Front sight / Back sight**) measurement. On models equipped with an ADM system, the ADM Verification tool is also used to check ADM system accuracy.

## Monitoring the System Sensors

Click on the Data Diagnosis icon from the Toolbar or select it from the View menu. This will open a dialog box displaying the raw system data. Given this information the user should check the following conditions:

### Check the Laser Intensity

1. Track the SMR to a distance of approximately 5 meters from the Tracker

2. Observing the Laser Intensity in the Data Diagnosis window, it should decrease no more than 20%
3. Open the Data Diagnosis window and note the raw intensity values

## Check the Weather Station

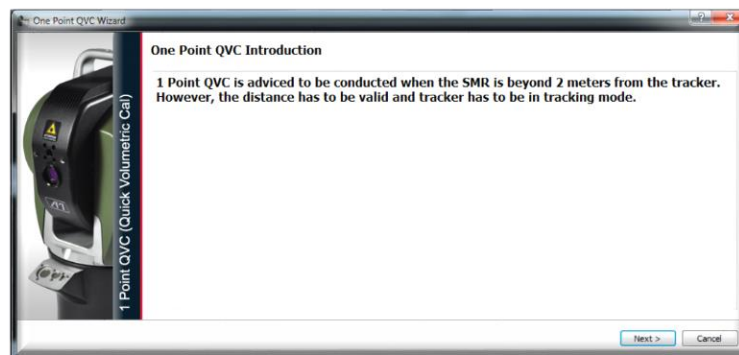
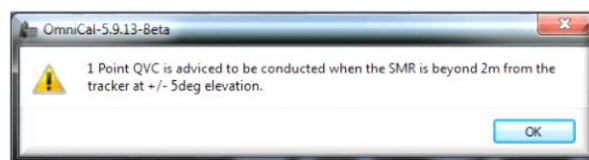
With the Data Diagnosis Window open, refer to the AirT and AirP parameters. Verify that these parameters are active and updating.

## One Point QVC

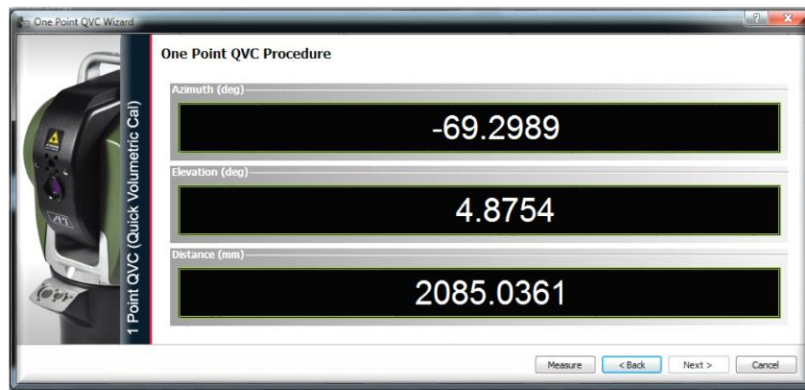


The “One Point QVC” is the main field-adjustment tool for the Tracker3™. It combines the volumetric compensation and Backsight Verification simplified into a single tool. As the name implies, the “One Point QVC” requires only a single point to compensate the Tracker geometry. QVC stands for “Quick Volumetric Compensation.” Most any point can be used with the single point QVC method, the only requirement is that the point be at least 2 meters away from the Tracker3™ system. This 2 meter range gives a much better statistical assumption to compensate the full working range of the instrument than calibrations performed at a close range. For best practice, it is usually most meaningful to run the “One-Point Quick Volumetric Compensation” at a point in the expected working volume of your job.

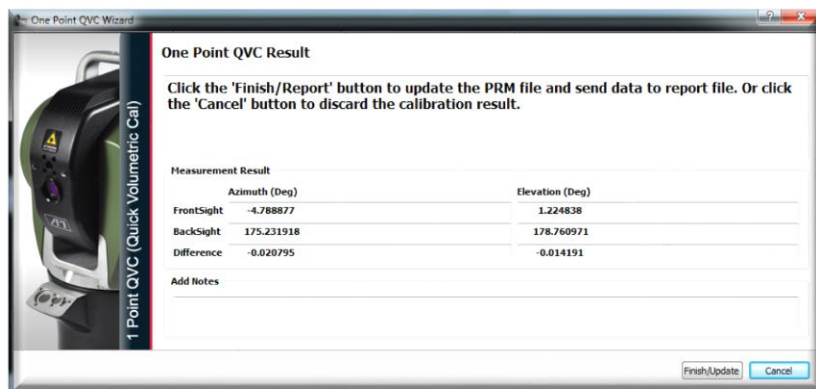
To start the One Point QVC, go to the Calibration menu and select “One Point QVC”. A dialog box will open reminding you that the procedure be activated when the SMR is beyond 2 meters (6.5 Feet). Click “Next” to proceed to the next screen.



A second dialog box will display a digital readout of the SMR position. Click the button labeled “Measure” to proceed. The Tracker will then take a single reading from the front sight and backsight positions.



**SOFTWARE TIP:** The Measure button will be unavailable until the SMR is moved beyond the 2-meter requirement.



The difference between the two measurements will be displayed in the “Difference” row

After the measurement is complete, press the “Update” button to apply the compensation to the tracker’s parameter file. From this point, the procedure is the same as the standard QVC detailed below (see Saving QVC Data).

## Quick Volumetric Compensation

### 4-Point QVC

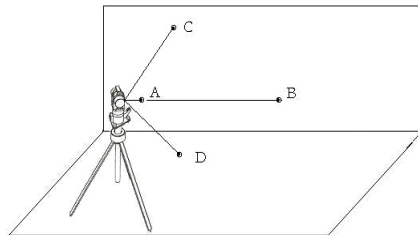
The Quick Volumetric Compensation (QVC) uses a four-position volumetric calibration method. API OmniTrac2™ angular measurements are taken at four fixed positions (A, B, C and D). The API Tracker Software automatically calculates six system error parameters and applies the appropriate compensation. The Full QVC should be run if the One-Point QVC gives a result greater than 0.003 degrees in elevation or azimuth.

Equipment Recommended for QVC

- Radian or OmniTrac2
- Tracker Stand
- API Calibration Tripod or SMR Drift Nest

### QVC SMR positions:

1. **Position A** – Place the SMR and nest on the wall or API Calibration Tripod less than one meter from the tracker. Slide the SMR up or down to locate the tracker elevation at  $0^\circ$ . If using a Drift Nest, hot glue the SMR nest to the wall at this position.
2. **Position B** – Move the SMR with nest/Calibration Tripod to a distance greater than 5 meters from the tracker. Slide the SMR up or down to locate the SMR at  $0^\circ$ .
3. **Position C** – Place the SMR and nest on the wall or Calibration Tripod approximately 0.2 to 1 meters from the tracker. Slide the nest up or down to locate **the SMR** (not the nest) at  $+55^\circ$ .
4. **Position D** – Place the SMR and nest on the wall **or floor** approximately 0.6 to 1 meters from the tracker. Slide the nest to locate **the SMR** (not the nest) at  $-55^\circ$ .



Point	Position
<b>A</b>	<ol style="list-style-type: none"> <li>1. Mount SMR nest on Tripod at <math>0^\circ \pm 0.5^\circ</math></li> <li>2. Distance from tracker: less than 1 meter</li> </ol>
<b>B</b>	<ol style="list-style-type: none"> <li>1. Mount SMR nest on Tripod at <math>0^\circ \pm 0.5^\circ</math></li> <li>2. Distance from tracker: 5 to 20 meters</li> </ol>
<b>C</b>	<ol style="list-style-type: none"> <li>1. Mount SMR nest on Tripod at <math>(+)55^\circ \pm 5^\circ</math></li> <li>2. Distance from tracker: 0.2 to 1 meters</li> </ol>
<b>D</b>	<ol style="list-style-type: none"> <li>1. Mount SMR nest on tripod or drift nest on floor at <math>(-)55^\circ \pm 5^\circ</math></li> <li>2. Distance from tracker: 0.2 to 1 meters</li> </ol>

**NOTE:** If you do not own an API Calibration Tripod, you may use a drift nest hot-glued to a wall or structure at each of the 4 positions

### QVC Procedure

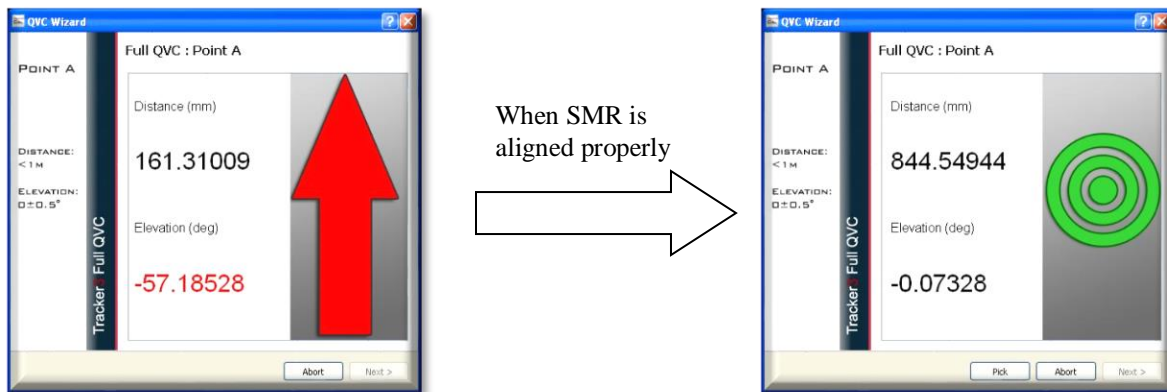
To start the QVC procedure, go to the **Calibration** menu and select **Quick Volumetric Compensation**. The QVC procedure will automatically step you through the measurement sequence.

Click– **Start Calibration**



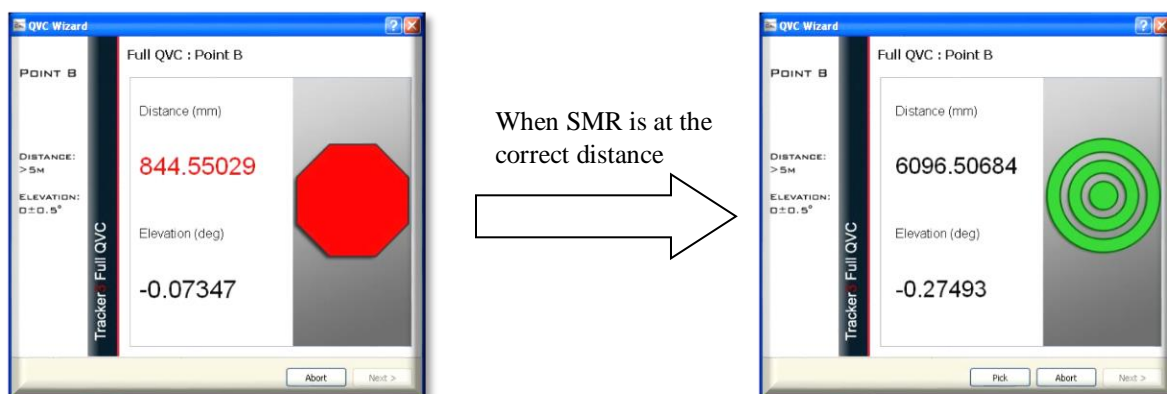
### Position A

1. Position the SMR at *Position A*
2. The graphical arrow on the right side of the window will prompt you to move the SMR in the indicated direction. When the SMR is in the correct position, a green target will replace the arrow to indicate proper positioning.
3. Click – **Pick Up This Point**
4. You will observe the tracker taking measurement in front sight and back sight.



### Position B

1. Position the SMR on *Position B*
2. When the SMR is at the correct distance, the Red stop sign in the graphical window will be replaced by a green target.
3. Click – **Pick Up This Point**



### Position C

1. Position the SMR on *Position C*
2. Follow the on-screen indicators to position the SMR correctly
3. Click – **Pick Up This Point**

## Position D

1. Position the SMR on *Position D*
2. Follow the on-screen indicators to position the SMR correctly
3. Click – **Pick Up This Point**

## Saving QVC Data

The software will prompt you to apply the new QVC data.  
Click “Apply” to save the results.  
Click on “Don’t Apply” to cancel without applying any results.



**IMPORTANT NOTE:** Make sure that the connection between the OT2 and the computer is not interrupted during the PRM update.

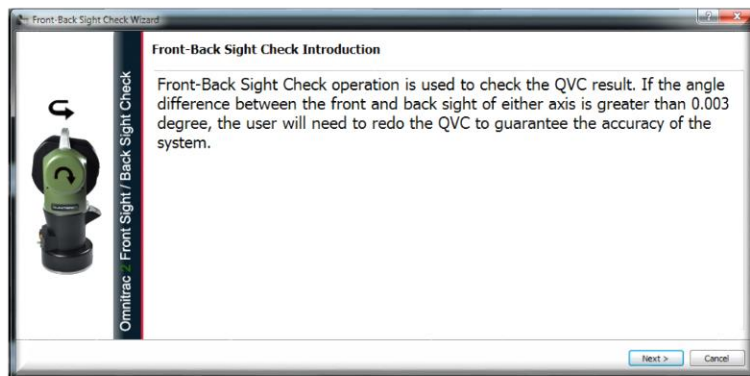
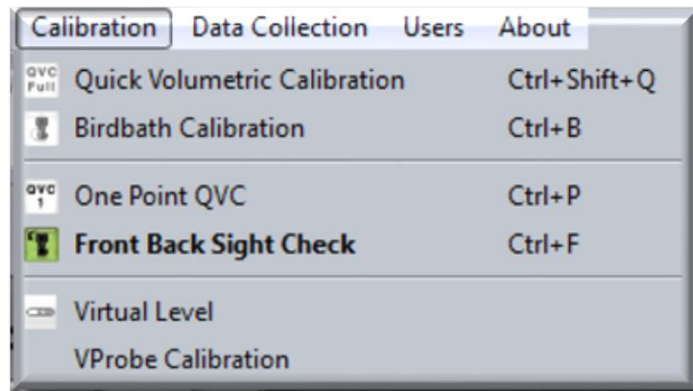
## Backsight Accuracy Check

By measuring the Backsight angle of several targets throughout the work volume, the user can quickly evaluate tracker calibration status. When the backsight measurements are taken, the angle difference between subsequent measurements should be less than 0.003 degrees.

☛ **IMPORTANT NOTE:** *Full/Four Point QVC should be performed at the start of any new measurement job.*

## BackSight Accuracy Check Procedure:

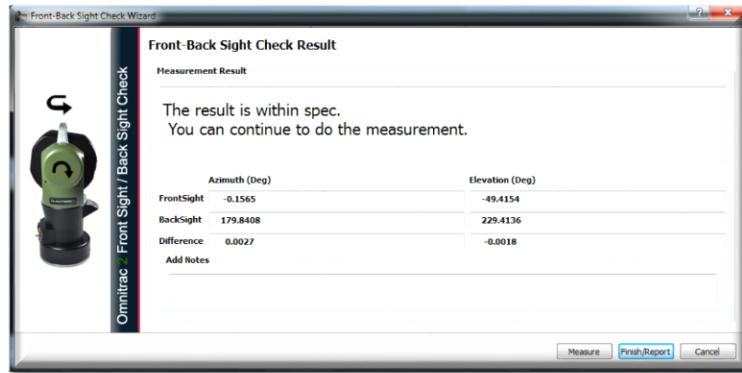
1. Track the SMR out to a stable nest or Calibration Tripod
2. Click on the “Front Back Sight Check” (located in the “Calibration” menu or Ctrl + F)



3. Follow the instructions printed on the screen and click "Next" to continue.



4. When the SMR is positioned properly, the user must click "Measure" to pick up the measurement. The tracker will measure the Front Sight position, then switch to the Back Sight position and report the error (it will also return to Front Sight).



5. If the error exceeds the tolerance, a Quick Volumetric Compensation must be performed. The software will indicate when the result is out of API specification.

## ADM Accuracy Performance Check

One of the methods to quickly check/verify the ADM accuracy of an OT2/OT Core tracker system is by Scalebar method since OT2/OT Core system doesn't have an onboard IFM laser to use as a reference we utilize the Scalebar method. Since Scalebars are certified artifacts we can use this to verify the accuracy of the ADM of an OT2/OT Core laser system.

### In-line Scalebar Method

Is typically used to verify the ADM linear accuracy of the system minimizing the influence of the encoder uncertainty during this method. During the set-up, the scalebar has to be properly secured and positioned to minimize EL and AZ encoder movement during the testing.

### Perpendicular Scalebar Method

Is typically used to verify the 3D accuracy (ADM, EL and AZ encoder) of the tracker system. The scale bar can be positioned at any position relative to the tracker system.

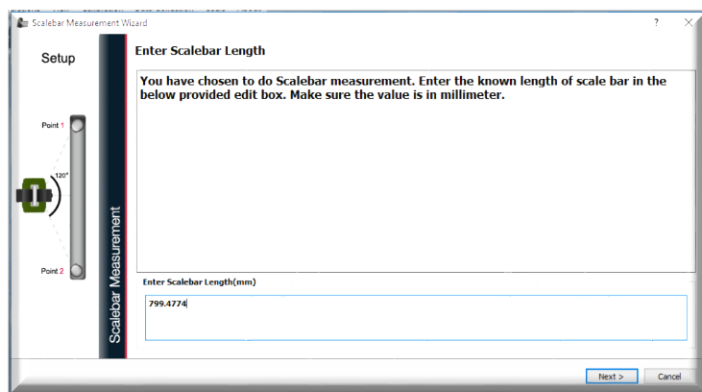
## Scalebar Feature

1. Using the OmniCal 5.10.0 or newer see image below to get to the Scalebar feature of the software.

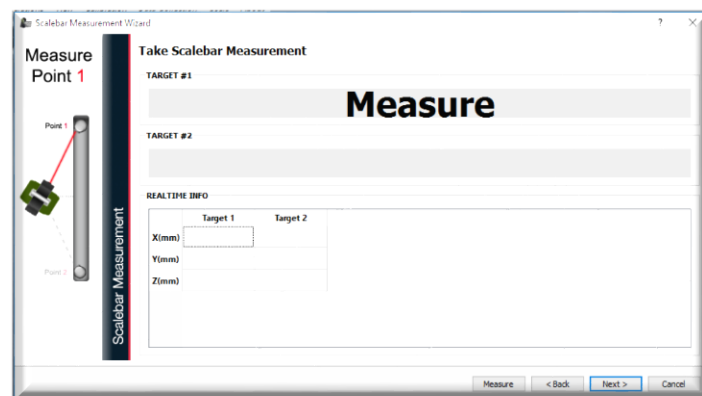
Main Menu > Calibration > Scalebar Measurement

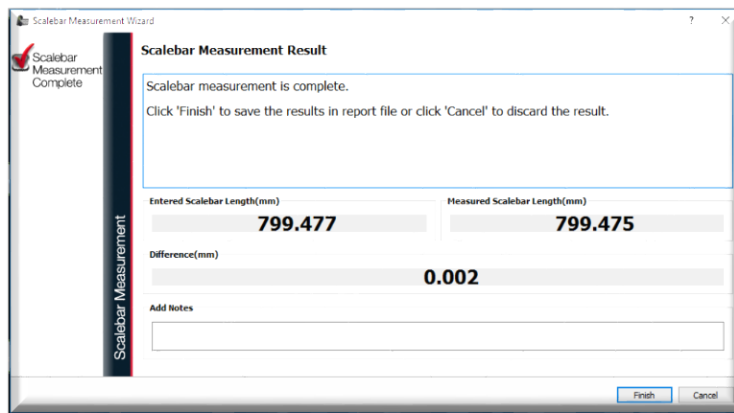
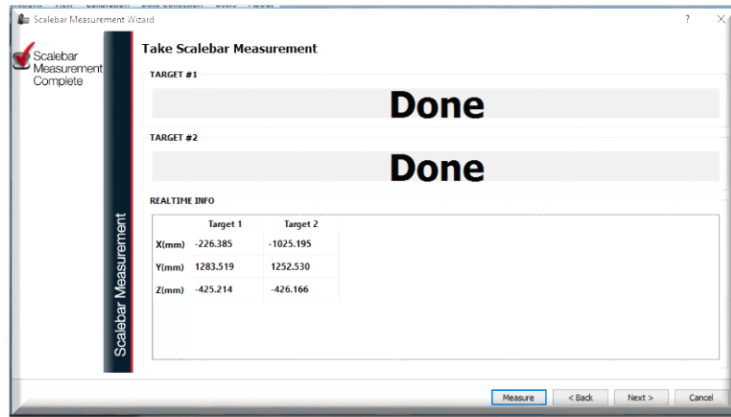


2. Enter the Scalebar length given for the Scalebar being used.

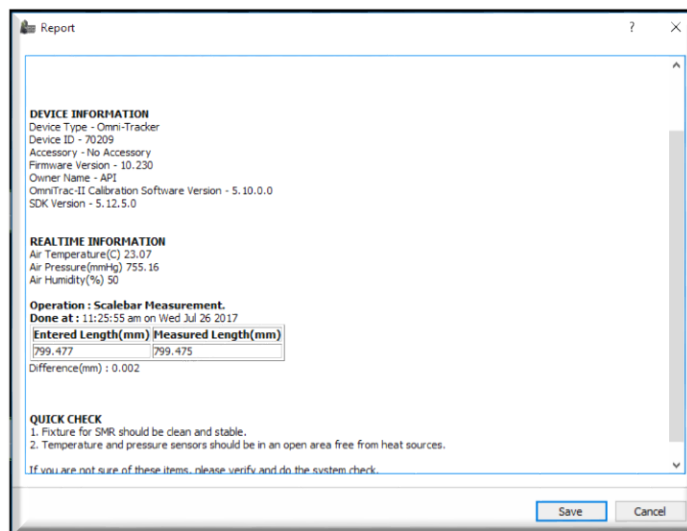


3. Then measure the two points on the Scalebar.





- You can add notes in the notes section as well. Once you click the "Finish" button it will create a report like the image shown below.

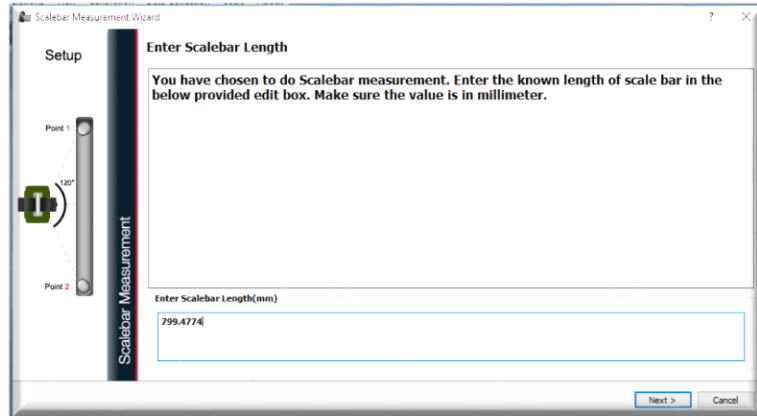


5. With OmniCal 5.10.0 or newer see image below to get to the Scalebar feature of the software.

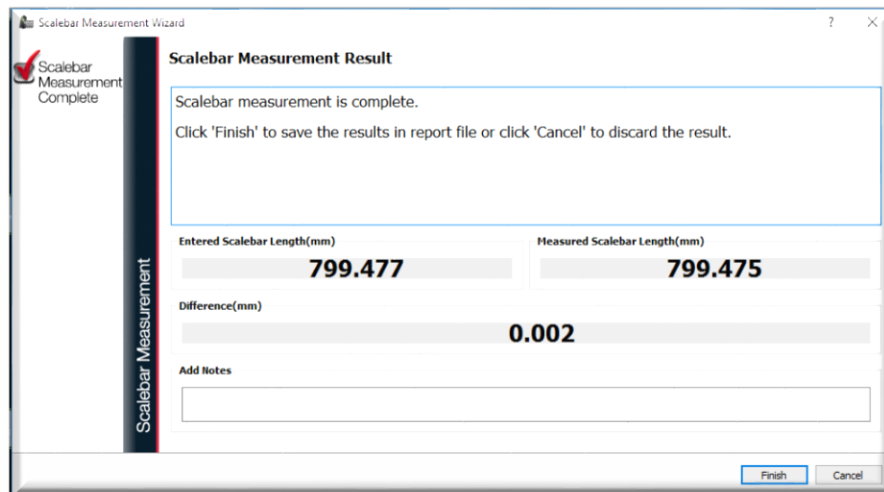
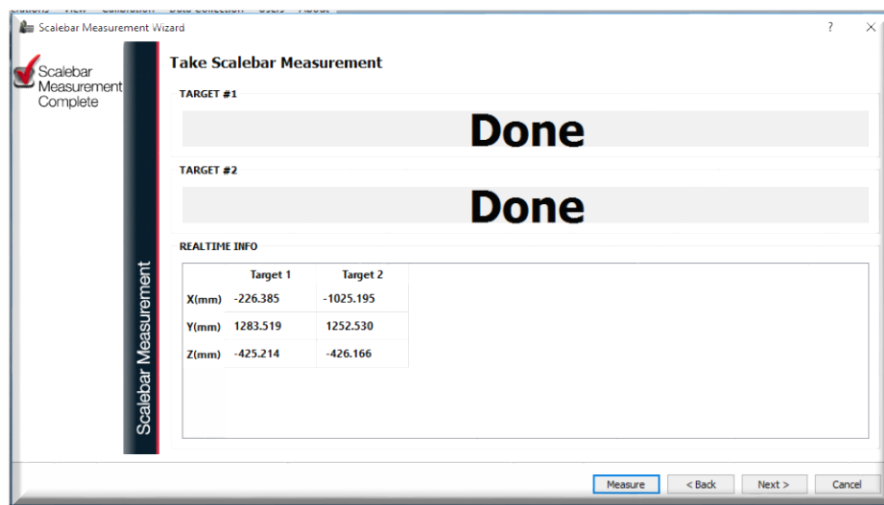
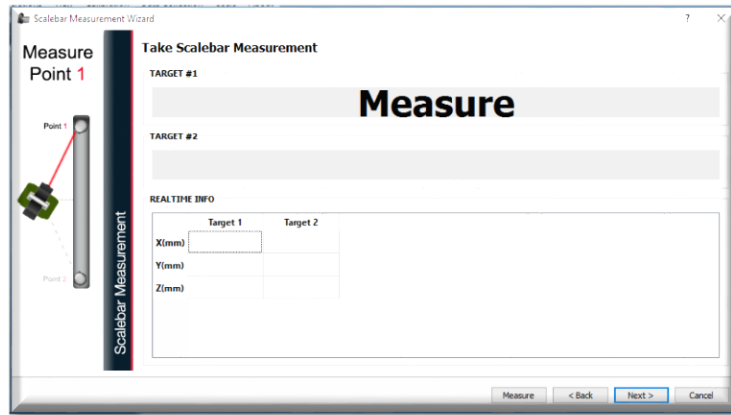
Main Menu > Calibration > Scalebar Measurement



6. Enter the Scalebar length given for the Scalebar being used.

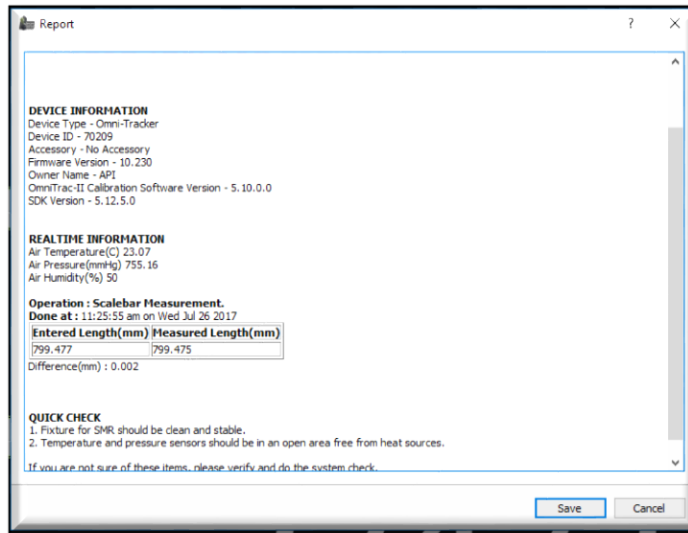


7. Then measure the two points on the Scalebar.



- You can add notes in the notes section as well. Once you click the "Finish" button it will create a report like the image shown below.

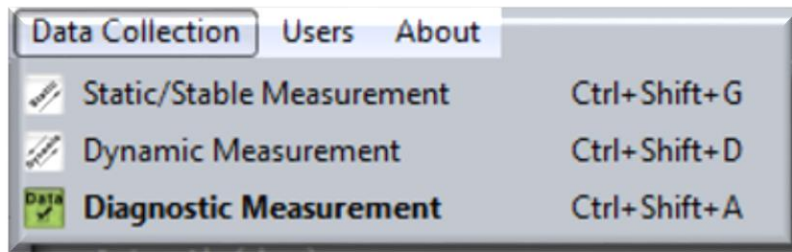




## Data Acquisition

There are three methods to acquire data in OmniCal™ software: Static Measurement, Dynamic Measurement and Diagnostic Measurement.

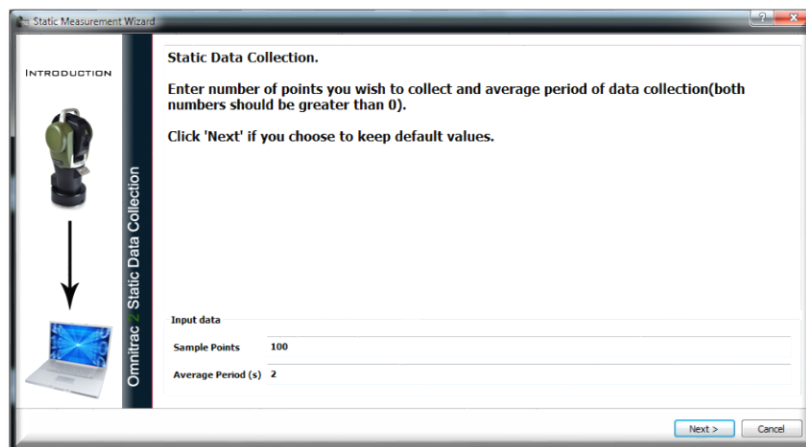
1. **Static Measurement** uses a time-based averaging technique to lower the contribution of outliers to the overall data. In this mode, the user specifies the sampling period and number of samples i.e. 100 points @ 1 second sampling period will have measurement duration of 1 second with 100 points averaged into one measurement.
2. **Dynamic Measurement** collects data without the use of software filters. All data collected in this mode are raw data and displayed in the output file i.e. if the software is set to collect 100 points @ 100 Hz, the data collected will contain 100 points and the measurement will have duration of 1 second.
3. **Sigma Measurement** is a form of Static Measurement that uses a Sigma (standard error) band to remove outliers from the measurement. Like the Static Measurement mode, the Sigma Measurement performs a temporal average but unlike the Static Measurement mode, Sigma Measurement also employs a sigma band filter to remove outliers. For example, if the Sigma band is set to 2 Sigma, the software will automatically remove all points that are greater than 2 standard deviations from the mean.



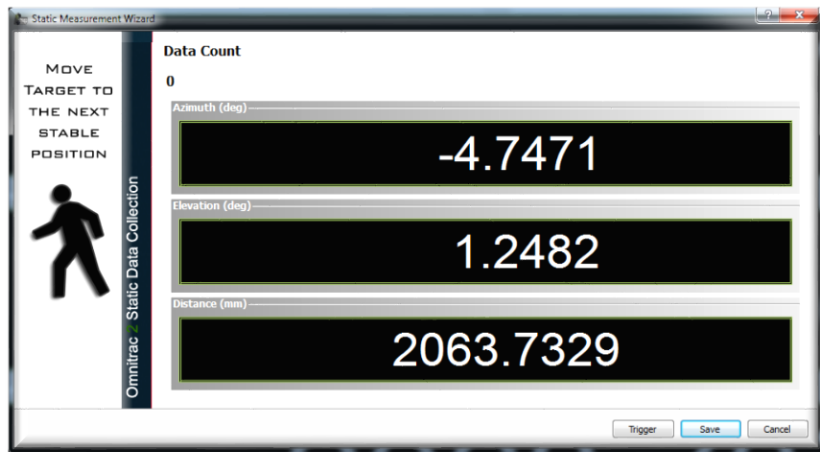
The data acquisition profiles can be accessed in the “Data Collection” menu on the main coordinate screen.

## Static/Stable Measurement

To open the Static Data Collection wizard, choose Static Measurement from the dropdown menu.



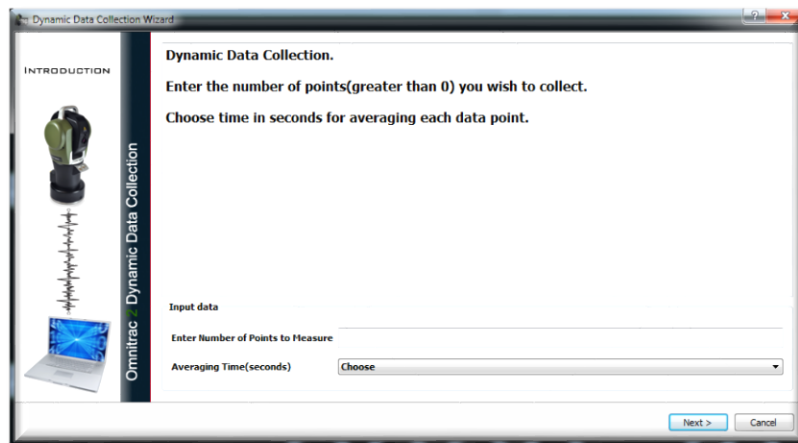
The wizard will prompt the user for measurement information. The “Sample Points” field contains the number of points the user intends to average during the measurement process. The “Average Period” field contains the amount of time the user intends to run the measurement. For example, if the user wishes to measure for 20 seconds and average 20 points for a measurement, both fields will contain “20.” Press “Next” to continue to the next step in the wizard.



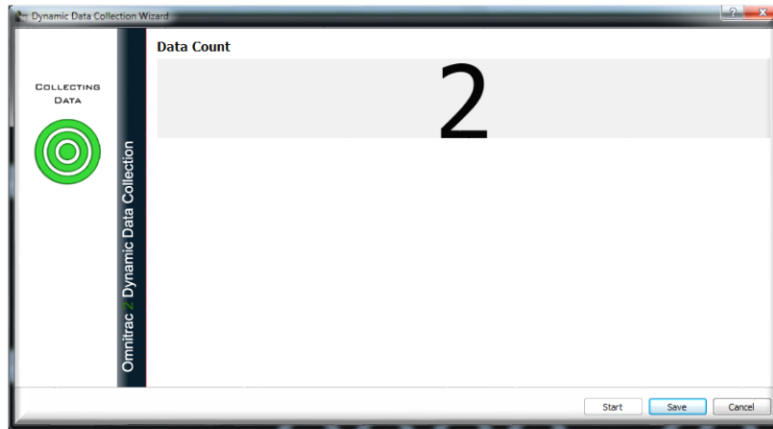
To acquire data, press the “Trigger” button which will trigger the Tracker to take a measurement. When the user is finished collecting data, he/she must press the “Save” button and follow the onscreen dialog. The file will be saved as a CSV (comma separated value) format.

## Dynamic Measurement

To open the Dynamic Data Collection wizard, choose Dynamic Measurement from the dropdown menu.



The wizard will prompt the user to enter information on the number points and the sampling frequency for the measurement. The “Check Here to Obtain Diagnostic” box allows the user to acquire full diagnostic information on all sensors in the API Tracker. To simply acquire X,Y,Z (point) and Environmental Sensor information, uncheck the diagnostic option box. After the information fields have been completed, press “Next” to continue with the wizard.



The user must press the “Start” button to initialize the measurement. The “Data Count” field will count the number of points acquired by the software as the measurement progresses. When the data counter has reached the number of points entered at the initial screen of the wizard, the measurement is complete, and the user will be prompted to save the data as a file. The outputted file (file path specified by the operator) will be represented in a CSV (comma separated value) format.

## Diagnostic Measurement

This is only used for diagnosing tracker data with the guidance of a qualified API Technical personnel. The data is encrypted that can only be decrypted by the API support team.

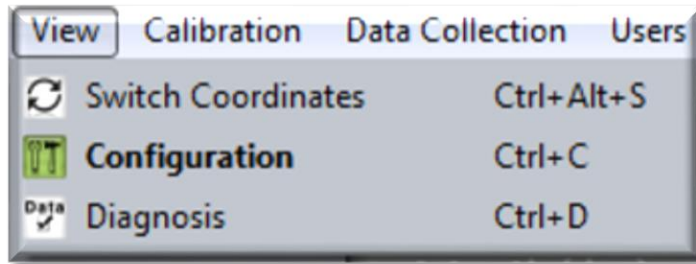
## Target Types and Home Position

### Defining Target Type

OmniCal™ software allows the user to choose from three different sizes of SMRs:

1. 1½ inch SMR
2. 7/8 inch SMR
3. ½ inch SMR

These targets can be changed by selecting the “Configuration” dialogue under the “View” drop down menu.



The Target Type selection is made in the dropdown menu tab.



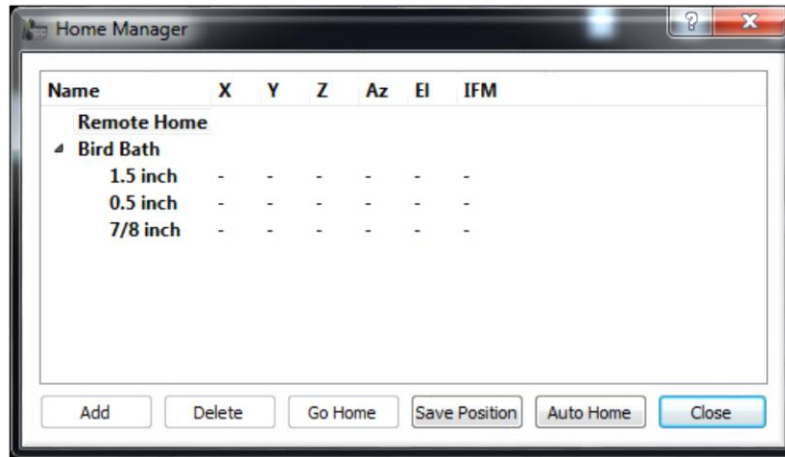
The selected target will be interpreted by OmniCal™ software as the active target for the duration of the software session.

## Home Manager (Remote Home and Birdbath Locations)

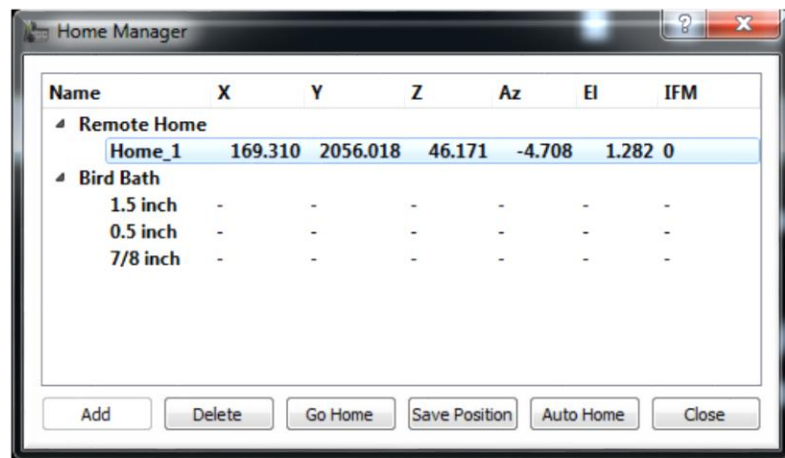
The Home Manager is a tool used to define the home positions of each target type as well as the Remote Home feature. This tool is found under the “Operations” dropdown menu, or by clicking the Home Manager button in the upper icon menu bar.



The user will be prompted with a Home Manager main window. To add a remote home position, drag the SMR out to a remote location then select the Remote Home item and click the “Add” button in the remote home main window.



To return to the Remote Home position, select the position added by the Remote Home utility and click the “Go Home” button in the Home Manager main window.



To remove Remote Home locations, select the Remote Home position you wish to remove and click the “Delete” button in the Home Manager main window.



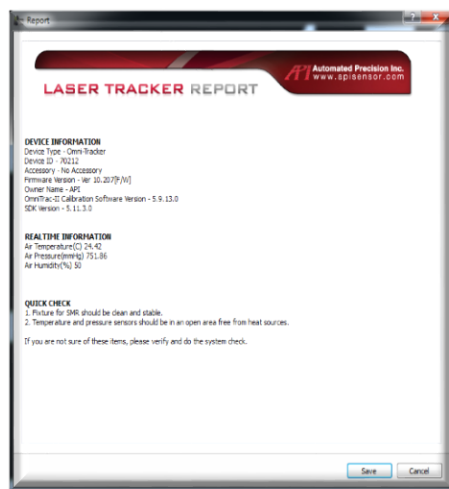
**IMPORTANT NOTE:** The remote home location *MUST* be stable with respect to the API Tracker system over the full duration of the measurement process.

## Reporting

The OmniCal™ Software provides the option to format the results of a System Check in a convenient PDF file. To perform this action, click the “Report Button,” step number “3” of the System Check icon list



The System Check Report will be in a similar format to the following:



The report will display information relevant to the System Check performed while the OmniCal™ software was active i.e. QVC/1-Point QVC results, Backsight Check results, ADM Verification/Calibration results, etc. The report also contains additional information relative to the API Tracker such as Serial Number, API accessories, Firmware Revision, Weather conditions, and others. This report can be saved as a PDF file viewable in most PDF readers.

## Log File

Results of each QVC and ADM Linear Calibration as well as ADM Verifications are stored in the log file located in the TrackerCal™ 4 install directory. Time and date information for each procedure is also recorded. To examine this file, open it with text editing software such as MS Notepad or MS Wordpad. The Log file will have the same name as the PRM file, but with a .log extension instead of .PRM.

## Advanced Topics

### Parameter File (PRM)

The PRM file contains all of the factory settings your Laser Tracker, as well as the most recent in-field adjustment data (QVC, ADM Linear, etc.). This file is stored on the tracker controller and downloaded to the computer each time you start the TrackerCal™ 4 software. Please note that the instrument can only be operated successfully using a computer that contains

the PRM file (or a copy thereof). Each PRM file has a name corresponding to the instrument's serial number (usually in the form "3xxx.PRM").

The PRM file is updated each time an in-field adjustment is performed. For this reason, a backup copy of the original PRM file is provided on the API software that is included with your instrument. Under normal working conditions, the PRM file will be downloaded from the controller, edited by TrackerCal™ 4 and uploaded to the controller without any concern from the user. However, if a problem should occur during the upload or download of the PRM file, or if the file becomes corrupt for any reason a backup copy of the factory calibration will be restored automatically in the controller. If this should happen, a notification will appear in the software. The user should then perform the in-field adjustments (One Point QVC and ADM compensation). For more information, or if you are having problems with your instrument please contact API directly.

## Getting Help with API's Products

### API Software Products

TrackerCal™ 4 and supporting metrology software products contain help features that cover a wide range of topics.

### API Customer Support

Automated Precision Inc. is committed to providing superior support to its customers. To assist you with technical and application questions API asks that customers use a following method to contact our help desk:

**Telephone** Contact the help desk at (800)-537-2720 between the hours of 8:30AM and 6:00PM EST.

**Email:** Email questions or concerns to [support@apisensor.com](mailto:support@apisensor.com)

#### **Mailing address –**

API Worldwide Headquarters  
15000 Johns Hopkins Drive  
Rockville, Maryland 20850

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