United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Reston, Virginia 20192

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Memorandum

OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM 2017.01

SUBJECT: Use of the FlowTracker2 ADV for Streamflow Measurements.

This memorandum provides guidance regarding SonTek/YSI's[1] FlowTracker2 Acoustic Doppler Velocimeter (ADV) for making streamflow measurements.

The FlowTracker2 is a new ADV manufactured by SonTek that replaces the company's original FlowTracker model, which is commonly used in the USGS for wading discharge measurements. Previous FlowTracker and related mid-section streamflow measurement policies and best practices (TM3-A8) are applicable to the FlowTracker2. Key differences between the original and new models include: the user interface, the support software, the file formats, and the handheld unit. The handheld unit for the Flowtracker2, which computes and stores the data, is a separate part from the ADV Probe, which measures the velocity. Details of the new handheld user interface and Windows software can be found in the FlowTracker2 User's Manual (SonTek, 2016), available from within the FlowTracker2 Windows software. Additional guidance associated with new FlowTracker2-specific features and design changes is provided below.

Quality Assurance Testing

FlowTracker2 ADV's are quality assured as part of the ADV Quality Assurance Program documented in OSW Technical Memorandum 2010.02. Each FlowTracker2, including handheld and ADV probe, is tested at the Hydrologic Instrumentation Facility (HIF) when initially purchased through the HIF and then is recalled every three years as part of this program.

Check Measurements and Comparisons

OSW Technical Memorandum 2016.02 requires that a comparison streamflow measurement be completed with any new or repaired velocity meter and at least once every three years. In order to better evaluate the Flowtracker2's performance over a wide range of conditions, OSW requests that any FlowTracker2 comparison measurement data be submitted to the Hydroacoustics Testing and Evaluation SharePoint site. OSW has created a test plan describing the suggested procedures for collecting and documenting the comparison

measurements. OSW requests that comparison measurements be collected as described in test plan, using currently recommended FlowTracker2 software and firmware. Information on the recommended software and firmware is available on the FlowTracker2 page of the OSW Hydroacoustics website.

Serial Numbers

The FlowTracker2 consists of a handheld unit and an ADV probe. The handheld unit runs software that initiates data collection, stores measurement data, and computes discharge. The FlowTracker2 ADV probe contains the components that sample and compute the water velocity. For record keeping purposes, where only one serial number may be associated with a measurement or with quality assurance (QA) information about the instrument, the ADV probe serial number should be used.

Beam Checks

As described in OSW Technical Memorandum 2010.06 for the original FlowTracker, automated diagnostics should be completed with each FlowTracker2 discharge measurement. When starting a measurement, the user will be prompted to start the "Automated BeamCheck". The automated BeamCheck should be completed in the cross section where there is adequate depth to ensure the sample volume can be placed away from the bed and water surface and any other potential boundary.

OSW Technical Memorandum 2010.06 also documented the need for a more detailed beam check that stored additional system data for evaluating instrument performance. The original FlowTracker software was required to perform this more detailed beam check with the original FlowTracker. The FlowTracker2 has a more detailed BeamCheck that can be performed and recorded from the handheld interface under "Utilities", "BeamCheck". The recorded file can be downloaded from the handheld for additional review and archival with the instrument's other related files and logs. The more detailed BeamCheck continues to be required only when (1) a new instrument is received, (2) if physical damage (e.g., dropping) may have occurred, (3) a firmware upgrade or repair was made, and (4) after automated beam check failures.

Tilt Sensor

The FlowTracker2 contains a tilt sensor and graphically indicates whether the ADV probe is level. A beep warning can be set to alert the user when a specified tilt is exceeded. Note that, depending on the wading rod and mount, it is possible the rod might be at a slight tilt when the ADV probe is level. If there is a significant difference between wading rod and ADV probe tilt, try adjusting the wading rod and mount.

When preparing to make any mid-section measurement, a tagline (or other method establishing the cross section) should be installed across the section so that as much flow as possible is perpendicular to the tagline. Then, when aligning the wading rod for a velocity sample, users should also make sure that the ADV probe is oriented perpendicular to the

tagline so that the sample volume is parallel to the tagline. This ensures the correct velocity component is measured and used to compute discharge.

Velocity-Measurement methods

The same velocity-measurement methods should be used with the FlowTracker2 as with the original FlowTracker. As stated in TM3-A8, the 0.6 velocity method should be used at depths less than 1.5 feet. As long as the FlowTracker can measure the water velocity accurately at the 0.8 depth, the two-point method should be used in depths of 1.5 ft or greater. The depth at which the FlowTracker2 interface automatically defaults to the 0.6 velocity method is a setting in the FlowTracker2. The factory default setting for the "0.6 Depth" method is 1.64 ft (0.5 meters). Since the USGS policy is to use 1.50 feet, users should create a new discharge template with a setting of 1.50 feet. Any new measurement started with this template would then have the proper setting. Detail instructions on the use of templates can be found in the FlowTracker2 manual.

Wading Rod Probe Mount

The FlowTracker2 has a partially drilled alignment hole in the probe mounting arm to aid in consistently and securely mounting the probe to the wading rod bracket. However, this alignment hole requires a larger set screw than the original FlowTracker's wading rod offset bracket. If using the FlowTracker2 with an original FlowTracker wading rod bracket and small set screw, the arm must be placed in the bracket so that the set screw does not go into the alignment hole. The original set screw is not long enough to securely hold the probe when aligned with the hole. As of December 2016 all new brackets purchased through the HIF (item #1113018) have the larger set screw. The brackets with the larger set screws can still be used with original the FlowTracker.

Pressure sensor

The FlowTracker2 is now available with an optional pressure sensor for measuring water depth. As of January 2017, only limited testing of the pressure sensor has been completed by OSW. If a FlowTracker2 with pressure sensor is used to measure depths, a graduated wading rod should still be used and all depths measured by the FlowTracker2 visually verified.

Output File Formats

The FlowTracker2 stores the streamflow measurement data in a single file in the JavaScript Object Notation (JSON) format documented in the User's Manual. It is not necessary to export or create any other type of files. SVMobile 1.0.31 supports direct import of FlowTracker2 ".ft" files. If a measurement is edited in the FlowTracker2 desktop software, all of the original data is maintained in the original ".ft" file and two additional files are created, one with the filename containing added extension ".edited" and one with the extension ".edits". If a file is edited in the software, all three files should be retained as part of the measurements archive. When loading a ".ft" file into the FlowTracker2 Windows software, the software will

also load any changes that have been made. SVMobile will also automatically load the ".edited" version when importing the ".ft" file if one exists in the same directory.

Time Zone Setting

The FlowTracker2 date and time is stored as Coordinated Universal Time (UTC) along with an offset for local time. Make sure the "Offset From UTC" time is correct for your location. If the time offset is not correct, the times imported into SVMobile will be in error.

PC Software

The FlowTracker2 requires the use of new FlowTracker2 Windows software for downloading and reviewing a measurement after it is completed. The FlowTracker2 software allows for correcting some mistakes. If an erroneous value is found after ending the discharge measurement on the handheld, the value may be changed in the FlowTracker2 software. The reason for any changes should be carefully documented with the discharge measurement in the SVMobile site visit file.

The FlowTracker2 Windows software is also used in updates to the handheld device. Handheld updates may contain updates to the ADV probe. If a handheld update contains an ADV probe update, the user will be prompted to upgrade the ADV probe the next time it is connected. Typically the handheld and probe versions that come with any new release of the FlowTracker2 Windows software should be used when a new version of the FlowTracker2 Windows software is used.

Questions concerning the policies outlined in this memo may be addressed to Mike Rehmel (msrehmel@usgs.gov).

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[1]Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

SELECTED REFERENCES
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