

RD Instruments
Acoustic Doppler Solutions

StreamPro ADCP Application Note: Discharge Measurements Using StreamPro ADCP as Compared to Traditional Wading Method and Stage-Discharge Rating (Gelbach, Germany)

SUMMARY: Discharge measurement tests using RD Instruments new StreamPro ADCP were conducted in Gelbach, a small stream in Germany on July 25, 2003. Discharge data were also obtained from the stage-discharge rating curve from that site, and a traditional wading method using a mechanic meter. Discharge measured by StreamPro, wading, and rating curve are 1.445, 1.45, and 1.44 m³/s respectively. The excellent agreement between the three independent methods indicates that StreamPro can accurately measure discharge in small streams.



Figure : 1 StreamPro ADCP (above); Test site at Gelbach (below).

Gelbach means “yellow stream” in German. Its color indeed was yellow because of suspended fine sediments in the water. The stream was 6 meter wide, and its maximum depth was 0.4 meters. The mean velocity was 0.62 m/s. The stream was straight, and the flow was strong, steady, and fully mixed. Figure 1 shows the StreamPro in this environment and the actual test site. The StreamPro was tethered and pulled from a bridge.

The StreamPro was easily configured using its standard software, running on an iPAQ pocket PC. Since the water was shallow, small cell size (3cm) was chosen. The parameter settings are summarized as follows:

- Transducer depth: 4 cm
- Cell size: 3 cm
- Number of cells: 20

A total of 3 transects were made from 13:12 to 13:22. The float speed was kept at approximately 0.04 cm/s. Each transaction takes about 2-3 minutes to complete.

Figure 2 shows a screenshot from RDI’s WinRiver software playing back a StreamPro data file collected from a transect. The top plot shows the velocity magnitude contour as well as water depth along the float track.



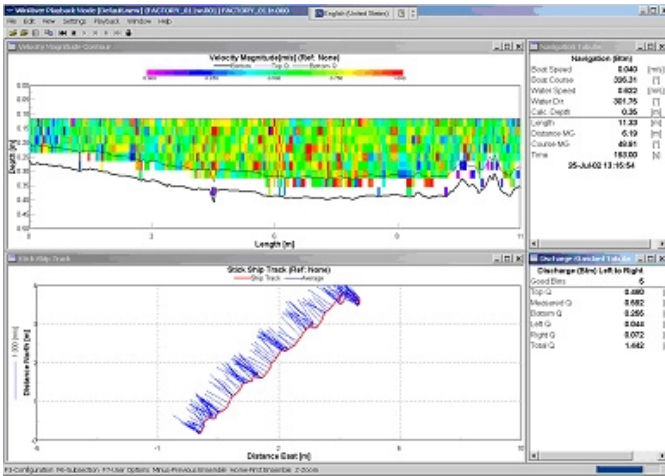


Figure 2 Screenshot from WinRiver software when playing back a StreamPro data file.

The bottom plot on the screenshot shows the float track (red line) as well as depth-averaged velocity vector (blue sticks) along the track. The StreamPro outputs the velocity vectors (and all other data) at 1 Hz, i.e., one vector per second (StreamPro pings at a fixed rate of 48 Hz). It should be noted that the velocity direction and float track direction are relative to the ADCP instrument coordinates, not to earth coordinates. This is because StreamPro has no compass installed it. A compass is not needed for discharge measurement when float (or boat) velocities are obtained from bottom tracking data.

Table 1 shows discharge data from the 3 transects. Some statistics of the discharge data set are obtained as follows:

- Mean = 1.445 m³/s
- Standard deviation = 0.003 m³/s
- Coefficient of Variation, CV = mean/standard deviation = 0.2%
- Maximum Deviation from Mean, MDM = max(individual discharge – mean)/mean = 0.2%

The statistics indicate that the StreamPro provides repeatable and accurate discharge measurement.

To verify the StreamPro discharge measurements, discharge was also measured using a wading method with a mechanical current meter during the test. This is a traditional method used at this site. The wading method yielded a discharge of 1.45 m³/s. In addition, discharge was checked from the Stage-Discharge rating curve that was developed at this site from over 10 years data. The rating curve showed a discharge of 1.44 m³/s. Table 2 summarizes the discharge results from these three independent methods.

Table 2: Summary of Discharge Results from Three Independent Methods

Method	Discharge (m³/s)
StreamPro ADCP	1.445
Wading	1.45
Stage-Discharge Rating Curve	1.44

It can be seen from Table 2 that the discharge measured from three independent methods agree very well. The excellent agreement between the three independent methods indicates that StreamPro can accurately measure discharge in small streams, thus offers user a much faster and easier option that allows for accurate measurements - without the need to wade across the stream.

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 RD Instruments manufactures, sells and services a wide array of acoustic Doppler products. From the shallowest stream, to a raging river, to the deepest ocean -- RDI has a current profiling and/or flow measurement solution for you. Visit www.rdinstruments.com today to learn more.

Table 1: Summary of StreamPro ADCP Discharge Measurements

Transect	Start Time	End Time	Discharge (m/s)
1	13:12:41	13:15:54	1.442
2	13:16:26	13:18:58	1.446
3	13:19:42	13:22:13	1.448

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