

10.021 ACOUSTIC DOPPLER CURRENT PROFILER

Approval Date: 6th, October 1999

Reviewed on : 23 October 2007

Version: 2

Purpose

The Acoustic Doppler Current Profiler (ADCP) is to be used for automated discharge measurements from a small boat on rivers and canals. Typical applications are verification of velocity-area data, discharge measurements at important locations and discharge measurements on large rivers. The ADCP will be deployed in a roving mode, being transported from the one site of interest to the other.

Conditions & Requirements

- The ADCP shall be of such a design that it operates reliably and accurately under the prevailing environmental and hydraulic conditions.
- The ADCP shall be easy to operate and maintain.
- All materials on the ADCP exterior shall be non-corrosive.
- The ADCP shall be small, light and easy to transport.
- The sensor-head shall be sturdy and impact resistant.
- The ADCP shall be installed in the survey boat in such a way that no air will be sucked underneath the transducers of the profiler.
- The ADCP shall be easy to install and deploy from a small boat. For this purpose, matching rigging material has to be part of the delivery.
- The X-direction of the ADCP shall be in parallel with the longitudinal axis of the boat.
- The ADCP shall have small dead zones at the surface and the bottom as it will be used in very shallow and deeper water.
- A portable PC, meeting the requirements of the current profiler is to control the ADCP, to monitor the data acquisition process, to store the collected data and to visualise collected data files.
- A compass for direction referencing shall be part of the ADCP to relate the velocity data to East-West and North-South direction..
- The compass shall have calibration functions, amongst others by sailing a circle with ADCP installed in the boat. The calibration shall compensate for local magnetic conditions and for the magnetic effects of the boat, including engine, generator etc. on the compass reading.
- If the compass is not integrated in the ADCP sensor-head, then it shall meet the following requirements.
 - ◇ The data shall be delivered by serial (RS232) connection either directly to the data acquisition PC or to a 'deck-box' (depending on ADCP type and make).
 - ◇ The compass data format shall comply with NMEA-0183 specification.
- The ADCP shall support accurate Bottom Tracking.
- The ADCP shall support use of DGPS, to be used during moving bed conditions, under normal conditions the extra DGPS will not be used.
- If the Bottom Tracking requirement is not complied with, then a DGPS system shall be part of the delivery and included in the bid price. The DGPS shall meet the following requirements.
 - ◇ fully compatible with the ADCP system, hardware and software
 - ◇ same power supply (car battery)
 - ◇ comprise of two receivers and a digital radio link to transport the reference data from the fixed station to the boat

- ◇ position accuracy of the DGPS shall be ≤ 0.5 m
- ◇ update rate of ≤ 1 second
- ◇ position conversion to the co-ordinate system used for the streams
- ◇ proper and accurate referencing to boat in order to allow accurate conversion of Doppler velocity into actual water velocity (including direction)
- ◇ the combination of ADCP and GPS systems shall meet the accuracy requirements as specified below under Specifications.
- ◇ generally meet the requirements as specified in document 10 0025 02
- All relevant data from ADCP, (GPS), compass, echo-sounder and other devices shall be stored on PC for validation and post processing.
- The supplier shall provide adequate training at his workshop and on site.
- A small portable generator will be required to charge the batteries used for the current profiler.
- The current profiler shall be supplied with the required accessories, software and operator's manual

Specifications

1. Sensor

mode of operation	real time from a sailing boat
measuring range	± 10 m/s (velocity relative to instrument)
stream velocity range	-5 to 5 m/s
stream velocity accuracy	$\leq 0.25\% \pm 0.005$ m/s
resolution	≤ 0.01 m/s
ping interval	≤ 0.1 s
configuration	3 or 4 beams
beam angle	$\geq 20^\circ$ and $\leq 30^\circ$
acoustic frequency	highest possible frequency for adequate bottom tracking at depths of 30 m in fast flowing, sediment laden waters
number of depth cells	programmable, 1 to 128
depth cell (bin) size	programmable, 0.25 to 2 m

2. Bottom tracking (or GPS)

accuracy	1 cm/s @ 5 m/s
stream velocity range	0 to 5 m/s
depth range	30 m or more

3. Tilt sensor

range	-20° to $+20^\circ$, both X and Y axis
accuracy	2°

4. Compass

type	in-built flux gate
accuracy	0.5°
repeatability	0.2°
resolution	0.1°
permissible tilt	15°

5. Auxiliary

communication interface	serial RS232 C at PC end
The communication between ADCP and PC shall be suitable for the cable lengths involved.	
baud rate	9600 or more
power supply	220 VAC $\pm 25\%$; 47 to 53 Hz
and	10 to 15 VDC or 20 to 30 VDC

housing	corrosion proof
ingress protection	waterproof, compliant with IP68, 20 m
operating temperature	10 to 60°C
The operating temperature range specification applies to all components of the ADCP, like: sensor head, cables, interfaces, etc.	
humidity	up to 100 %

6. Software

operating system	MS Windows 95/98
set-up	preparation of the instrument for data collection, setting of depth-cell size, number of depth cells and ping rate, averaging, storage interval. In case the instrument features an in-built compass then software assisted compass calibration shall be supported. set-up of bottom tracking and/or on line DGPS

data collection	The PC software shall control the data collection process, record the data in a file system on disk and report aberrations.
monitoring	The collected data shall be graphically visualised.
processing	calculation of bin-wise discharge and total discharge user input/selection of extrapolation methods to bottom, surface and stream banks display of input data and processing results in graphical and numerical format
data export	Data export to spreadsheet and ASCII formats shall be supported.

Accessories

- tools
- spare parts
- mounting brackets
- shipping case

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As per HP-1

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