

Ultrasonic Doppler Velocimeter **DOP5000**



UDOP

The DOP5000 is a powerful and very flexible instrument

Build around 16 channels, divided in 4 groups, it allows within a group to measure velocity profiles and other quantities simultaneously, sequentially and can also perform 2D/3D measurements.

The 4 groups can be combined with each other and therefore offer a high degree of flexibility.



Overview

A pulsed ultrasonic velocimeter

The DOP5000 is based on pulsed ultrasonic velocimetry and measures velocity profiles and other types of data profiles. This instrument has been designed to meet almost all user demands in terms of specifications, number of channels, acquisition mode and ease of use.

It calculates and displays data profiles in real time, based on the analysis of echoes from gates placed along the ultrasonic beam. Different types of profiles, such as velocity profile, echo profile, Doppler energy profile and other data profiles are available independently or simultaneously.



A plug and play device

Like all our velocimeters, the DOP5000 is connected to an USB interface of an external PC or laptop, which controls the instrument through the UDOP software.

The ultrasonic probe can be placed directly in contact with the liquid or on the exterior of the container, allowing measurements through a wall by means of a coupling gel.

On the basis of very simple indications given by the user, such as the measuring depth along the ultrasonic beam and the maximum speed to be measured, all operating parameters can be set automatically. Time-consuming manual adjustment can therefore be avoided. Of course, advanced users can always fine-tune all of these settings or bypass this automatic mode.

Controlled by UDOP software

UDOP software is designed to be highly interactive, which means that a single change to a parameter is instantly reported on the acquisition screen.

All ultrasonic parameters (starting depth, number of doors, resolution, etc.) and treatment conditions (PRF, TGC, number of emissions per profile) can be automatically defined or adjusted by the user.

Each channel has its own set of parameters and all channels are independent of each other. In addition, the user can save / recall many configuration parameters or recall a configuration from a file.

UDOP continuously acquires and saves profiles in its internal memory, the size of which is defined by the user, removing the oldest when its memory is full. Data acquisition can be synchronized with an external (logic) or internal trigger signal.

UDV 2D/3D capability (in option)

The UDV 2D or 3D ultrasonic Doppler velocimetry measurement technique is a method that simultaneously measures two velocity components (V_x and V_z) or three velocity components (V_x , V_y and V_z) along a line. As the DOP5000 can receive simultaneously on 4 channels, 2D/3D UDV can be achieved without reducing the maximum measurable velocity range. It only takes a few tens of milliseconds to calculate and display a full 2D or 3D velocity field. This is not possible through the use of the standard channel multiplexer.

Note that in order to use this hardware, an additional software package must be purchased and installed.

The key features

High resolution, high dynamic

The time between two adjacent measuring points or gates can be as slow as 160 ns and can be increased up to 20 ms with a step of 160 ns. In addition, a profile can contain up to 1000 gates.

The analog processing circuitry provides the DOP5000 with excellent dynamic range (14 bits) to process signals containing strong stationary echoes.

To obtain optimal resolution and a very good SNR ratio, the bandwidth of the demodulated signal has been set at 250 kHz.



4 channels process in parallel

The 16 channels are connected to a very fast analog multiplexer, which connects the 4 channels of a group to the analog front end.

As each channel in a group has its own transmit circuit, the DOP5000 can control whether a channel should be operated in transmit / receive mode.

Before reaching the digital processing unit, the 4 channels are processed in parallel by the analog circuit, with a common TGC control for the first and last two channels. After demodulation and high pass filtering, the 4 channels are then sampled by a single very fast AD converter.

Small size and small weight

The aluminum case of the DOP5000 is only 256 x 56 x 204 mm

Its weight... only 1.9 Kg

Flexible emitting frequency

The DOP5000 can emit an ultrasound burst with a frequency of 10.5 MHz to 450 kHz, with a resolution of 1 kHz. This fine adjustment capability optimizes the transfer of ultrasonic energy when crossing walls.

Easy to synchronize

The DOP5000 contains three connectors which can be defined by software as input and / or output, plus a dedicated external trigger input. These 3 connectors could enable precise synchronization of many instruments, extending the ability to acquire information simultaneously from different instruments. In addition, the following signals may be available on these 3 connectors: Pulse at each emission or profile, acquisition region.

A sensitive instrument

Sensitivity is a very important parameter because it influences the possible application range of the instrument. A highly sensitive instrument allows measurements in liquids containing few particles and / or in liquids with a high attenuation coefficient. Sensitivity is defined as the minimum instantaneous power of Doppler echoes from which Doppler information can be extracted.

Signal processing has put a lot of effort into providing very sensitive instruments. That's why, when many other instruments have failed, our ultrasonic velocimeters always provide quality information.

DOP5000

Specifications

Ultrasonic emission

Emitting frequency	from 10.5 MHz down to 450 kHz step of 1 kHz
Emitting power	3 levels, approximated instantaneous maximum power: Low = 0.5W, Medium = 8W, High = 35W
Number of emitted cycles	from 2 to 32, step of 2 cycles
Pulse repetition frequency	from 0.1 Hz to 15'625 kHz (100'000 ms to 64 ms step 1 ms)

Reception

Number of gates	from 4 to 1000 gates, step of 1 gate
Position of first gate	movable by step of 1 gate, but not earlier than the end of the emitted burst
Amplification (TGC)	Uniform: -40 dB to +40 dB, step 1 dB Slope mode: linear in dB custom mode: number of cells from 1 to 2048
Sensitivity dBm	5 levels, from >-100 dBm to >85 dBm

Sampling volume

Lateral size	defined by the acoustical properties of the transducer
Longitudinal size	defined by the burst length internal IQ filter bandwidth : 250 kHz (around 0.8mm for C=1500 m/s, defined at 6dB)
Display resolution	distance between the center of each sampling volume selectable from 0.160 to 20 ms, step of 0.160 ms

Environment

Configuration parameters	9 saved configurations with description
Ultrasonic interface	16 BNC, probe In/Out (1 for each channel)
Logic interface	3 BNC, Logic input/output selectable (user defined) 1 BNC, logic Trigger input
Power interface	Used for optional devices (multiplexer)
Operating system	Windows (starting from XP version)
Powersupply	110 - 220 VAC, 50 - 60 Hz
Communication	USB 2, Connector type B
Temperature	5 - 35 degrees
Sizes	256 x 56 x 204 mm
Weight	1.9 Kg

Options

2D /3D software package

Ultrasonic processor

Doppler frequency	computation based on a correlation algorithm. 5 levels of the received Doppler energy may disable the computation Output value: signed byte format
Wall filter	IR high-pass filter 2nd order
Emissions per profile	from 2 to 512, any values minimum acquisition time per profile: about 2-3 ms
Filters on profiles	moving average: from 2 to 1000 profiles zero values included or rejected median: from 3 to 32 profiles
Velocity resolution	1 LSB, Value given in a signed byte format. Depends on velocity scale and emitting frequency
Velocity	variable positive and negative velocity range, movable origin. automatic computation of the projected velocity component along the flow axis
Compute and display	velocity profile, with or without histogram Doppler energy, with or without histogram echo profile, with or without histogram velocity profile with echo profile or Doppler energy velocity profile with v(t) of a selected gate power spectrum of one selected gated velocity profile and time-space velocity profile and fbwrate
Cursor	4 available cursors in tracking mode (follow the displayed curve). Statistical values available (mean, standard deviation, minimum, maximum)
Additional tools	auto correction of the aliasing measurement of the ultrasonic field raw data acquisition (15'000 demodulated IQ values)

Acquisition

External Trigger	manual or external signal (logic state) automatic record capability trigger delay: up to 32s, step of 1 ms
Data format	binary ASCII (only statistical values if desired)
Dynamic	14 bits
Replay mode	replays a recorded measure
Acquisition mode	save the past (sizeable circular memory) record the future
Internal memory size	from 1 to 65'536 blocks each block containing from 1 to n profiles n fixed by the amount of available memory

Multiplexer

Number of channels	16 divided in 4 groups each channel has its own set of parameters except in simultaneous acquisition inside a group where they have all the same parameters, excepted: - the velocity scale - the velocity offset - the Doppler angle - the sound velocity
Switching time	inside a group: < 20 ns between groups < 1 ms
Acquisition of profiles	inside a group: simultaneous or sequential between groups sequential
Cross talk between channels	inside a group: > 50 dB between groups > 30 dB

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