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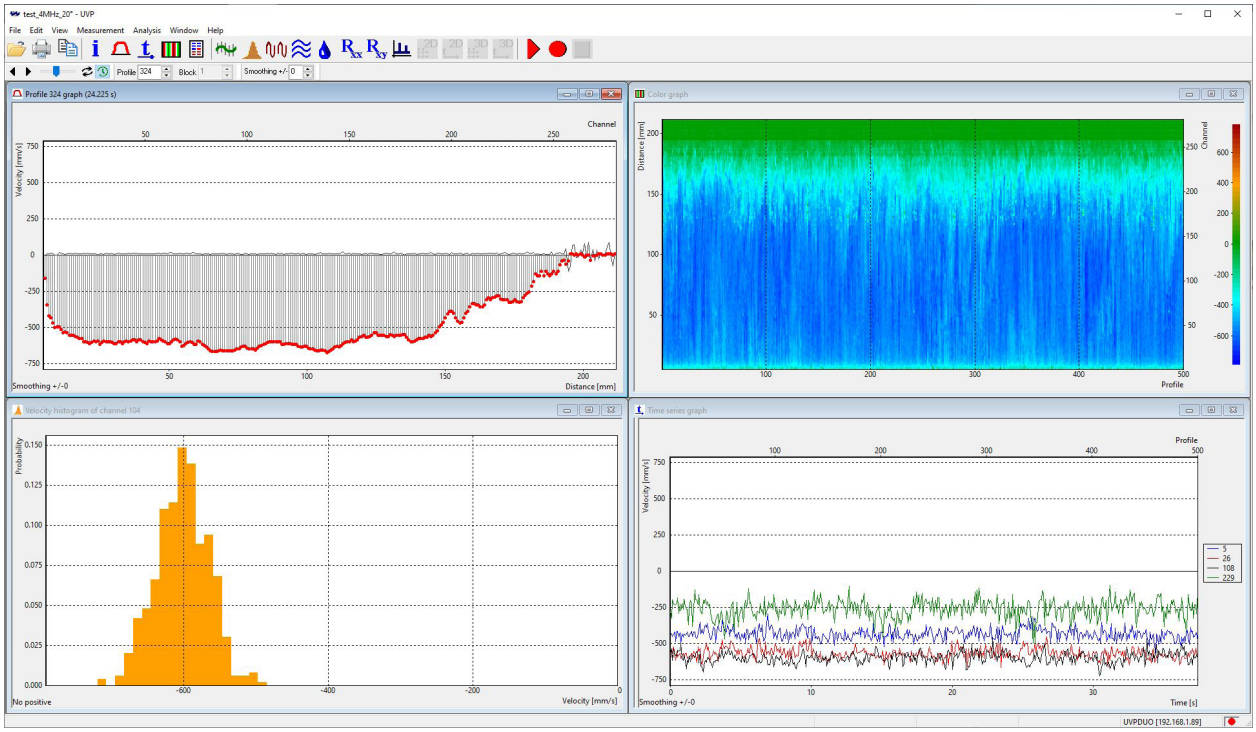
UVP Software



Velocity profile measurement of a channel flow with gravel bed

UVP software Version 3 features

- ✓ Remote control of UVP profilers through standard Ethernet/LAN
- ✓ Data acquisition and analysis in a single core program
- ✓ Standard Win32 user interface, clean and intuitive
- ✓ Stable running and self-recovery in case of connection loss
- ✓ Unlimited number of configuration file
- ✓ Turbulent statistics, RMS, skewness, kurtosis, histograms
- ✓ Cross-correlation, auto-correlation, power spectrum
- ✓ Integrated 2D/3D flow mapping module, on-line transducer grid editor
- ✓ Direct export to: Clipboard, MS Word®, Excel®, Tecplot®, MATLAB®
- ✓ Compatible with any MS Windows® operating system up to Windows 10/64bits

Met-Flow acquisition and analysis UVP software packages are the most advanced and accessible, providing various possibilities to monitor the measurement and numerous functionalities to process the collected data.

Since our beginnings back in the nineties, we have always put a lot of effort to develop a user-friendly software, while providing many analysis tools in an integrated application. Today, we propose everything in a single core program, stable and resource-efficient, with a straight-forward setup on your own PC, for remote control of your UVP instrument via Ethernet.

Our Met-Flow UVP software is available in two versions:

- UVP software Version 3: a multi-license MS Windows application supplied with our UVP profilers, with both UVP device control and data analysis tools embedded.
- UVP ActiveX library: a set of ActiveX functions to control UVP profiler by a user-made software, in any ActiveX compatible programming environment such as Matlab, Labview, Visual Basic, C++.

Concept & design

Remote control of UVP profilers through standard LAN

UVP software version 3 can operate remotely any UVP instrument connected to a Local Access Network /LAN, with either fixed IP address or DHCP. The connection to the controlling PC can be direct (peer-to-peer) to guarantee the highest possible bandwidth to transfer the UVP data, or through the local computer network if the controlling PC is not physical close to the UVP instrument.

Data acquisition and analysis in a single core program, easy export, included measurement configuration

No need to export your acquired data in a third-party software, you can just read them in your UVP program thanks to the numerous data analysis and display tools provided. Many export options are also available to transfer your processed data in your favorite programs for further analysis, visualization or editing.

The parameters setting used for a measurement session is embedded in the corresponding acquired data file. So any data file can be used as a configuration file by simply loading it in UVP software before starting your next measurement session, with as many configurations saved as data files saved, namely no limit.

Consistent software programming, MS Windows compatible

Our UVP software can be run by any MS Windows operating system up to Windows 10/64 bits. We propose a user-friendly and intuitive user interface, compliant with Win32 standard.

Stable functioning is guaranteed during data acquisition, with data buffering on the UVP-DUO in case of short network connection loss. In case of prolonged loss, system self-recovery will occur once the connection is restored, with precise counting of the lost velocity profiles and corresponding time stamp, with no crash on the UVP instrument side.

Real time data acquisition

Parameters settings

Great care has been taken to make version 3 as user-friendly as possible.
A wizard-style dialog allows for easy setting of UVP parameters, checking settings consistency and suggesting suitable ranges when required, using visual aids for some specific data.
Parameters are recorded in each UVP file header, then to retrieve the settings of any UVP measurement one simply opens any data file to load the corresponding parameters.

Computation, display and storage on the fly

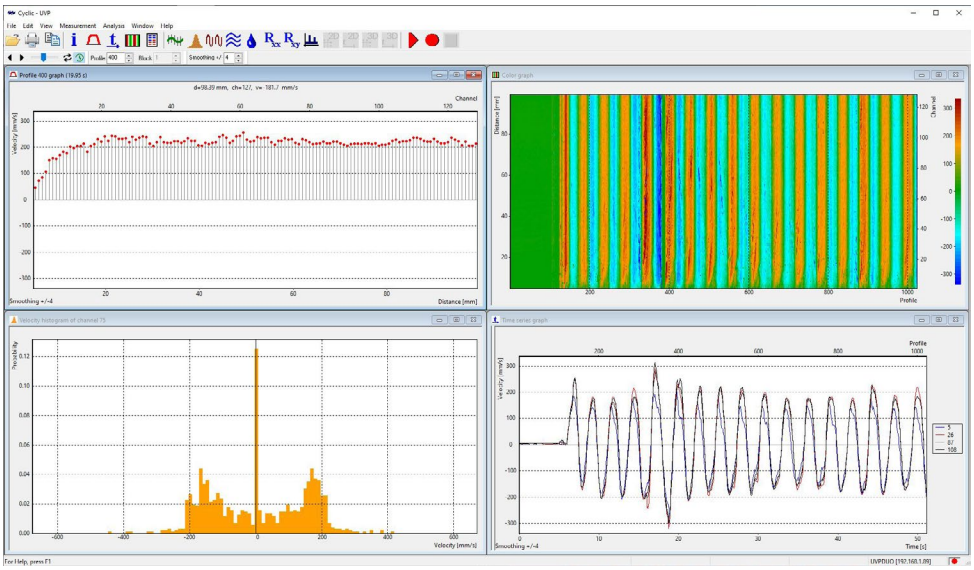
The velocity calculation from the Doppler-shift detection is being made on the fly by UVP internal. As a consequence UVP software can display real-time velocity profiles while storing the corresponding data.

All velocity data graphs are interactive: Mouse cursor coordinates are continuously displayed, graphs zooming and moving is possible at any time, context-sensitive options can be modified by mouse right-button click, with crossed displays opening.

Raw echo amplitude can be acquired and displayed real-time in parallel with velocity profiles, on the same distance scale. The latter is very useful to correlate both, sometimes showing the strong static reflections from the fixed solid objects such as walls or obstacles, or pointing out multiple reflections interfering with the velocity measurement directly in the flow section.

Time series from a single velocity point or channel can be monitored real-time, showing time evolution of velocity at a fixed distance. Sets of time series from different velocity channels can be displayed in parallel, smoothing filter can be applied real-time without losing the original raw velocity data.

Color graph is a three dimensional graph of the data set, showing a color-coded velocity as a function of time and distance. Also displayed real-time, it shows what lies behind the velocity data, for example fluctuations, periodicities, flux of particles, flow boundaries such as walls and interface, lack of echo signals, giving the spatio-temporal behavior of the flow at a glance.



Velocity profile measurement of a piston cyclic flow

Data analysis functions

Various types of analysis and post-processing of the velocity data can be performed, either real time during data acquisition or offline, i.e. after an acquisition sequence is completed. Here is a list of the main functions available:

Real-time

- **Profile graph** shows measured velocity profile and raw echo amplitude
- **Time series** draws time evolution of any selected profile channel
- **Color graph** shows a color-coded velocity as a function of time and distance
- **Profile table** lists velocity values of each channel in the selected profile

Offline

- **Measurement information** displays all measurement parameters and multiplexer table.
- **Average and statistics graph** shows profile average, RMS, variance, skewness, kurtosis graphs, plus a recap table with all values, including a validation success rate. Useful for turbulence analysis in the flow structure.
- **Velocity histogram** graphs the velocity probability distribution.
- **Period enhancement (time)** depicts phase-averaged periodic flow in time domain.
- **Period enhancement (profile)** depicts phase-averaged periodic flow in space domain.
- **Flow rate (parallel or circular)** graphs through-flow through circular or rectangular channel.
- **Auto-correlation** displays flow periodicities in time domain.
- **Cross-correlation** shows flow relations between different spatial points.
- **Power spectrum** displays frequency distribution of turbulent energy in the flow for each velocity channel.

2D/3D flow mapping module

A complete 2D and 3D flow mapping modules are available in software version 3.

It performs 2D or 3D velocity measurements by calculating the velocity field at the crossing points of a transducers array, each transducer being connected to the UVP profiler multiplexer.

It includes the following functionalities to support your multi-dimensional velocity measurement:

Setup

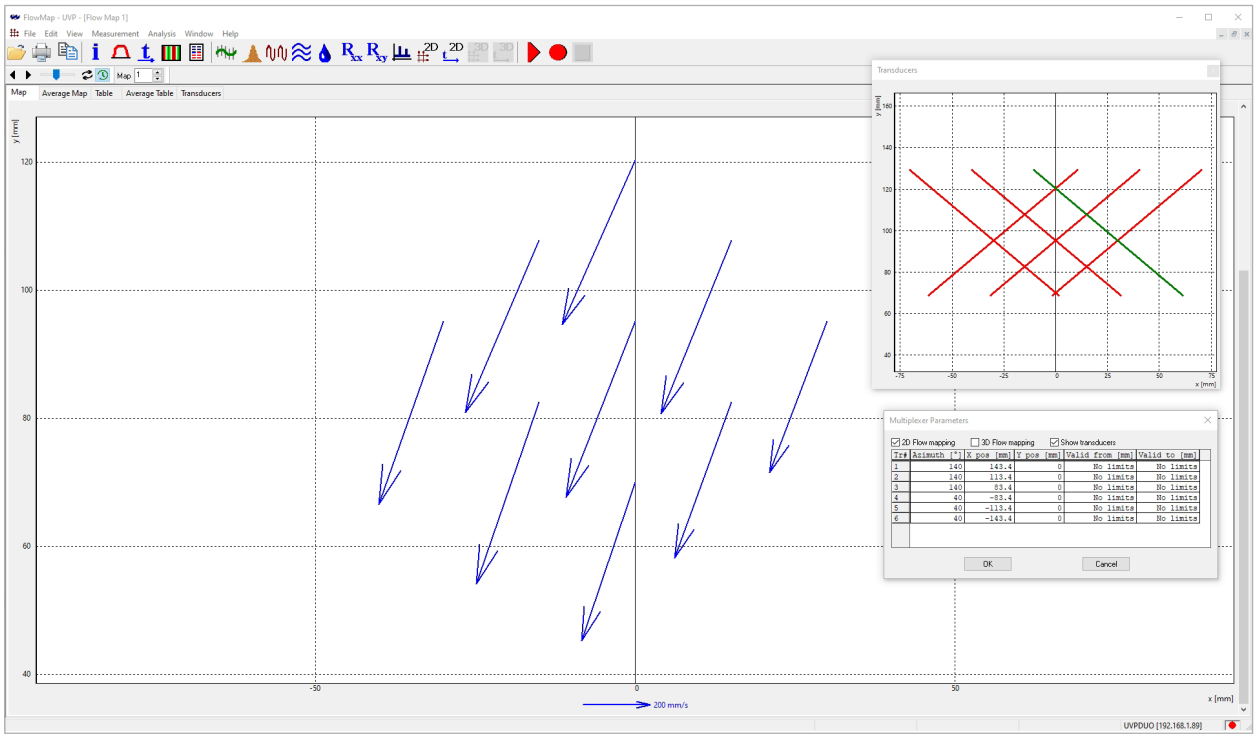
- **Editing of flow map table:** Editing of the transducers position is straightforward, using Cartesian coordinates and azimuth of ultrasonic axis, including a real time visual aid.
- **Setting up of flow mapping parameters:** number of samples, measurement repetitions, valid mapping length for each transducer, least acceptable crossing angle of ultrasonic axes can be defined.
- **Flow mapping measurement:** During test measurement, it is possible to monitor any transducer output individually to optimize UVP parameters setup.

Analysis

- **2D/3D Flow map:** After measurement completion, 2D/3D velocity components are displayed as an interactive animated vector chart, with corresponding velocity data tables, both instantaneous and time-averaged.
- **2D/3D Time series:** Time evolution of each 2D/3D velocity components is displayed individually in a time-based graph.
- **Saving of results:** All flow mapping data and parameters are automatically saved within a single data file for future processing, compatible with single transducer acquired data file.

Export

- **Printing of flow maps:** Flow maps can be previewed, printed, copied to Clipboard and pasted to others applications.
- **Export to external programs:** It is possible to export flow-mapping results into third-party programs, either as text, Excel or Tecplot files.
- **Separate transducers export:** All data collected by each transducer part of the multiplexer sequence can be gathered in separate single transducer files, to analyse the data of each transducer individually.



2D vector flow map in channel flow

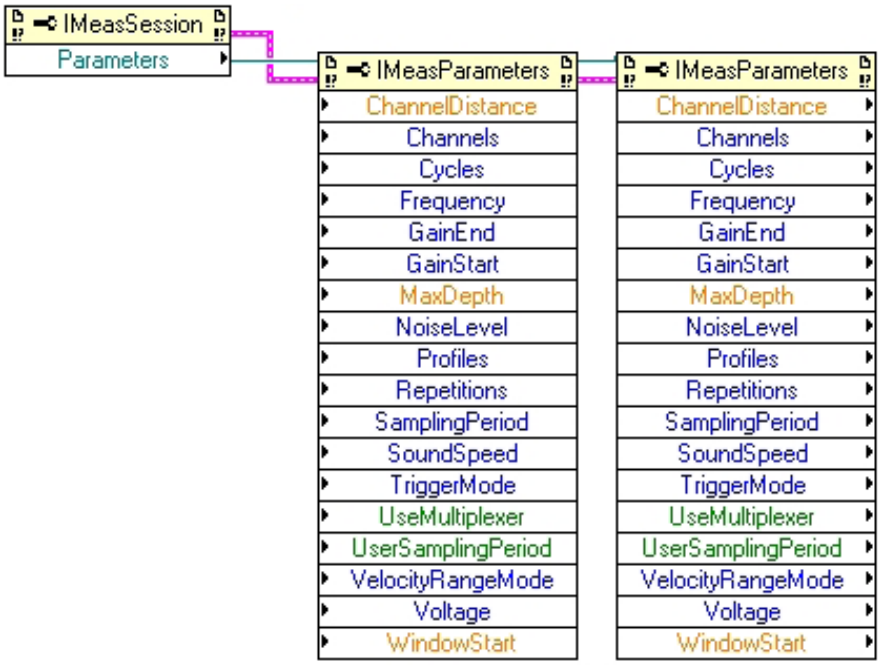
Software updates and add-ons

UVP software is installed on the remote PC controlling the UVP profiler, running Microsoft Windows® operating system. Our software is compatible with all existing MS Windows OS up to Windows 10/64 bits.

Software update: UVP software is regularly updated, including bug fix and minor enhancements. The last software version is available for free to all our regular UVP users on our website met-flow.com

Software add-ons: Some additional functions are available at a cost, such as 3D flow mapping module, please check our website for further details.

UVP ActiveX library features



Object programming using UVP ActiveX functions

Programming with ActiveX objects

- ✓ Create your own software application to control UVP-DUO profiler
- ✓ Full compatibility with MATLAB, LabVIEW, C++, Visual Basic 7
- ✓ All UVP software analysis functions accessible to programmers
- ✓ Multiplexer functions fully supported
- ✓ Easy integration of UVP-DUO profilers in complex measurement systems
- ✓ Programming of custom-made data analysis and display tools
- ✓ Access to demodulated echo signals I and Q, for custom-made signal processing

Concept & use

UVP ActiveX library is a special software package including several ActiveX objects, to reproduce all Met-Flow UVP software control, acquisition and analysis functions in a custom-made programming environment.

It is useful for advanced UVP users to integrate and synchronize UVP measurement in a complex laboratory measurement chain, in process control loops, for example appreciated in industry related research.

Additionally, UVP ActiveX library gives access to the demodulated echo signals I & Q, bypassing UVP-DUO internal digital signal processor, enabling experienced users to apply their own signal processing on the raw signals, either for velocity determination or for any special echo analysis.