

Product description

Flow-Lab™ : Educational Fluid Mechanics Laboratory
Viosense Corporation



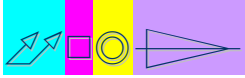
Summary

The Flow-Lab™ is a flexible training system for teaching fluid mechanics principles and modern flow measurement techniques. It includes a bench-top water tunnel with interchangeable test sections, complete LDV system with 3D traverse and documentation, including student worksheets in Microsoft Word® format for easy modification.

The Flow-Lab™ is targeted at educators who want a turnkey laboratory system to complement their fluid mechanics classes and is also available with the PIV system, PixelFlow-Educational™ and a portable storage cart for convenient storing when not in use.

Who should be interested?

- Engineering fluids laboratory supervisors and trainers
- Undergraduate fluid mechanics instructors
- Professors interested in teaching the principles and practice of experimental fluid mechanics, turbulence, LDV, PIV and/or data acquisition and processing
- Employees of industry or government research organizations who use modern fluid mechanics diagnostic instrumentation



Flow-Lab™ System specifications

Specifications subject to change without notice.

Product ID: **Flow loop**

Description: Bench scale re-circulating water tunnel with interchangeable test sections and dye injection system

Power: 115 VAC, 220VAC also available

Size (h x l x w): 43.5" x 52" x 22"

Weight: 90 lbs (empty), 250 lbs (full)

Major components: 1) Water reservoir: capacity: 20 g
2) Sumersible recirculating pump: 1/3 HP, 0 – 40 gpm
3) Control valve
4) Head tower with adjustable stand pipe
5) Return plenums: wier plenum (standard)
free plenum (optional, required for hydraulic jump)
6) Nozzle: contraction ratio: 6.25:1
7) Dye injection system (uses standard food coloring)

Product ID: **Interchangeable test sections**

Dimensions: 2" x 2" x 24"

Material: plexiglass with o-ring seals

Airfoil: NACA 0012, 2" cord, adjustable angle of attack

Cylinder: diameter: .25", brass, round, Re = ~20,000

Pipe flow: diameter: .25", length: 23.9", plastic, round

Flat plate: stainless steel plate with knife edge, length: 23.9"

Axisymmetric jet: diameter: 19mm, Re = ~60,000

max. velocity (centerline): ~5 m/s

Impinging jet: diameter: , includes self-sealing quick disconnect

Hydraulic jump: barrier height: 1 3/4"

Product ID: **Documentation**

Manual: 64 pages

Formats: hard copy and Word® document on CD-ROM

Product ID: **Measurement system**

Description: 1D MiniLDV-100 probe with VioBP-1 Burst processor and 3D manual traverse

Laser: laser diode, 660 nm, 20 mw power, typical cable length: 15'

Probe volume: size, d_x x d_y x d_z : 400 x 60 x 120 um, typical standoff distance (in air): 100 mm, typical

Velocity: range: 0.008 - 92 m/s, typical

resolution: .1%, typical

accuracy: .3%, typical, depends on SNR

Software: National Instruments LabVIEW® runtime

Outputs: U_i , $i = 1, N$, U_{bar} , U_{rms} , $U_{bar}(x,y,z)$, $U_{rms}(x,y,z)$

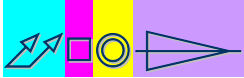
PC: Microsoft Windows 2000®, Intel Pentium4®, recommended

Traverse: dimensions: 6" x 6" x 26" (manual)



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VioSense is a Caltech Technology Transfer Company™ and JPL Technology Affiliate™.



Flow-Lab™ System components

The Flow-Lab™ includes the following components: Flow loop, Interchangeable test sections, Measurement system and Documentation, described below.



Flow loop

The flow loop is a re-circulating water tunnel that accommodates interchangeable test sections. The water tunnel is small enough to fit on a bench and portable for easy stowage. The tunnel uses tap water and seeding particles (optional). Water flow is provided by a 1/3 HP submersible pump, capable of delivering 40 gallons per minute,

corresponding to a fluid velocity of approximately 1 m/s across the 2" x 2" test section, or 5 m/s at the centerline of the axisymmetrical jet ($Re = \sim 60,000$).

Flow rate is controlled using a gate valve and an adjustable stand-pipe. Two exit plenums are available. The weir exit plenum comes with the basic system, and a free exit plenum is also available. The free exit plenum is required for the hydraulic jump test section and can be used with the other test sections for increased velocity. The weir exit plenum is constructed to allow visualizing the cross sectional area of the test section from behind.

Documentation

The Documentation describes suggested experiments, including a discussion of study topics, procedures for setting-up and carrying out the experiments and sample questions. The documentation is included as a Microsoft Word® document for modification to meet instructor's specific requirements.



Interchangeable test sections

The interchangeable test sections are each 2" x 2" x 24" and constructed of Plexiglas with o-ring seals at the end flanges. The interchangeable test sections are listed below, along with suggested study topics.

Interchangeable test sections Suggested study topics

Cylinder	wake flow vortex shedding Strouhal number
Airfoil with adjustable angle of attack	lift and drag forces boundary layer thickness separated and re-attaching flows stall
Pipe flow	transition to turbulence Reynolds number skin friction and pressure drop laminar and turbulent velocity profiles
Flat plate (optional)	boundary layer thickness momentum and displacement thickness bursting phenomena
Axisymmetric turbulent jet & Impinging jet (optional)	jet flow conservation of momentum and mass entrainment and intermittency self-similarity
Hydraulic jump (optional)	supersonic flow subcritical and supercritical flow Froude number
Blank plug	for mounting user-supplied models

☉ Measurement system

The Measurement system consists of a 1D laser Doppler velocimeter and 3D manual traverse with integrated software. The outputs from the measurement system are velocity vs. time and profiles of mean and rms velocity. All hardware and software required to carry out the experiments is included¹ and a computer controlled traverse is available as an option. Flow-Lab™ is also available with the VioSense PIV system, PixelFlow-Educational™. For more information, see the PixelFlow-Educational™ and MiniLDV™ Product descriptions.

Benefits

- A powerful complement to undergraduate fluid mechanics courses
- Includes all documentation in Word format for easy modification
- Includes 6 classic fluid mechanics flows² and dye visualization
- Written by and developed by experienced fluid mechanics and instrumentation engineers
- Turnkey system

¹ except the PC, which is available as an option.

² Note: some flows are optional.