FL530

User Manual

SIM STRUMENTI SNC

Via Merendi 42
20010 CORNAREDO (MI)
ITALY
Tel +390297003039
Fax +390297270167
www.simstrumenti.com
sim@simstrumenti.com

Description

The SIM STRUMENTI Flow Probe is a rugged and highly accurate water velocity instrument for measuring flows in open channels and partially filled pipes. The water velocity probe consists of a protected propeller and water bearing for measuring water velocity, coupled to a telescoping probe handle ending in with a LCD display flow computer.

The Flow Probe is ideal for storm water runoff studies, sewer flow measurements, measuring flows in rivers and streams, and monitoring water velocity in ditches and canals (fig.1).

fig. 1

The flow computer incorporates true velocity averaging for the most accurate flow measurements. The computer's primary display shows the instantaneous velocity and is updated once per second. A secondary display can be toggled between average velocity, minimum or maximum velocity, and a timer than can be used to measure the length of time in seconds that measurements are being taken. A reset function allows the average, minimum and maximum velocity measurements to be restarted; as well as resetting the timer to zero. Up to 30 separate measurements of average, minimum and maximum velocity can be stored in memory and viewed at any time. Velocities can be displayed in both feet per second or meters per second, a simple menu function allows you to switch between these units at any time without changing previously stored data.

General Instructions

> Remove any debris that may interfere with the flow probe's propeller. Make sure that the propeller turns freely by blowing on it. Some chattering of the propeller in air is normal, the bearing is designed to operate best when wet. (fig. 2)

fig. 2

> Point the propeller directly into the flow you wish to measure. Face the arrow inside the propeller housing downstream. The FL530-04 probe handle is a two-piece rod expandable from approximately 3′ to 6′, the FL530-05 is a three-section rod expandable from 5′ to 15′, the FL530-03 is a shorter version expandable from 2.5′ to 5.5′. To expand the rod for correct placement in flow, loosen the locking nut on the handle. To aid in properly orienting the flow probe inline with flow, an optional alignment fin is available from SIM STRUMENTI, part number FL530-AX-AL.

➤ To extend battery life, a low power mode is incorporated that will take effect after 5 minutes of inactivity. If the propeller is stopped and none of the pushbuttons are pressed for 5 minutes, this mode will take effect and the velocity displays will go blank. Press any of the 4 pushbuttons to start the computer back up for taking measurements or viewing stored data.

➤ To make a measurement, make sure that the computer is not in low power mode by confirming that the velocity displays are shown. If these displays are blank, press any button to restart the computer. Place the propeller at the desired measuring point and press the RESET button to begin taking new average, minimum and maximum readings. If you do not reset this data, the minimum reading will be zero and the average will include all zero readings since the last reset. The measurements are updated once per second. Pressing RESET before beginning a measurement is required for best accuracy.

➤ To determine flow from the velocity data, measure or calculate the cross-sectional area of your flow stream in square feet (or square meters when taking measurements in m/s). If you are measuring flow in round pipes, measure the depth of water and pipe diameter, then use the enclosed tables to determine cross-sectional area (see Appendix A: Calculations for Flow in Partially Filled Pipes). If you are measuring flow in another channel type, manually measure water depth at several points across the flow. These measurements are most easily recorded by drawing a diagram on graph paper with a scale of 1 square foot (or meter) per graph paper square. Cross-sectional area (in square feet or meters) can then be found by counting the number of squares in the stream.

➤ The average velocity times the cross-sectional area equals flow or $Q = V \times A$; where velocity is in FT/S and area is in FT² (or M/S and M²)

➤ If the propeller gets fouled while measuring flow, clean it until the prop turns freely and start over

Average Velocity

The Flow Probe is used to measure the average water velocity. Stream flow velocity varies for several reasons:

➤ The velocities vary throughout the flow's cross-section due to the friction between the water and the channel. In general, the velocities are greater in the center of the flow and less near the bottom and sides of the channel.

➤ The water surges in velocity with time. In a smooth running stream, the velocity at a specific point can easily vary 1-2 feet per second over the period of a minute. This pulsating or surging of flow should be averaged to obtain an accurate average flow reading (leave the probe in the flow through a series of flow surges).

➤ The water is not always moving in the same direction. Even the smoothest water flow contains turbulence that causes the water to move in different directions. These velocity vectors not parallel to the flow will be seen as moving slower because only a part of the vector parallel to flow. Unlike other types of water velocity measuring devices, the SIM STRUMENTI's Flow Probe propeller's protective housing will channel the water parallel to flow and help to eliminate errors caused by improperly measuring velocity vectors not parallel to flow.

➤ Large obstructions in the flow such as rocks and trees will cause the water to flow around them, which may cause the flow to change direction for a short distance from these obstructions. To properly measure the true water velocity, the flow probe needs to be directly inline with the flow.

The Flow Probe can be used in three ways to determine average velocity in a stream

> For small streams and pipes, the probe can be moved slowly and smoothly throughout the flow during average velocity measurements. Move the probe smoothly and evenly back and forth from top to bottom of the flow so that the probe stays at each point in the flow for approximately the same amount of time. The timer function in the display can be used to monitor the measurement time. Keep moving the probe for 20-40 seconds to obtain an accurate average value that accounts for surging. (Move the probe as if you were spray painting and attempting to get an even coat of paint over the entire surface.)
> The Flow Probe uses true velocity averaging. Pushing the RESET button zeros the average /minimum /maximum velocities and a running average is started. As long as the probe remains in the flow, the averaging continues. To stop averaging press the SAVE button, in Save Data mode the averaging is halted. In this mode the function of the SAVE button changes to SET. Press SET to store the data and reset avg/min/max, or press BACK to resume the previous averaging without storing the data to memory. One reading is taken per second, and a continuous average is displayed. For example, after 10 seconds, 10 readings are totaled and then divided by 10 and this average is displayed. Once the average reading becomes steady, the true average velocity of the stream is obtained.

> For larger streams and rivers where the Flow Probe can't easily be moved throughout the flow, divide the stream into subsections 1-3 feet wide, depending on the width of the stream. We recommend dividing subsections on your graph paper diagram of the flow profile. Run a measuring tape across the stream for reference. Obtain a verticalflow profile at the center of each subsection: zero the averaging function and move the Flow Probe vertically from the surface to the bottom, up and down, slowly and smoothly for 20-40 seconds to obtain a good average. The average velocity (obtained with the Flow Probe) times the area of the subsection (use your graph paper diagram) equals the flow for the subsection (Q = V x A). Once the flow of each subsection is obtained, add all of the subsection flows to obtain the total stream flow.

> For the USGS "6 tens method", the Flow Probe is placed at the center of the subsection at a depth from the surface of 0.6 of the total depth. The Flow Probe is held in place and the average velocity is obtained over a period of 40 seconds. The 0.6 depth is assumed to be the average velocity point for the vertical profile. Therefore, this average is similar to that obtained in technique 2 (above) however; we feel that technique 2 is more accurate.

Computer Operation

Main Display

In the main display, the 4 buttons are labeled as shown (fig. 3).

The MODE button toggles the upper display between average velocity minimum, maximum and timer. The label next to this display changes to correctly indicate which parameter is shown.

The MENU button is used to view stored data, delete data, set the flow units to FT/S or M/S, and change the calibration setting. Press the MENU button for 2 seconds to enter the setup menu. In menu mode, the labeling of the 4 buttons on the LCD display may change to indicate different functions.

The SAVE button is used to save the average, minimum and maximum velocity data to memory.

The RESET button causes the average, minimum and maximum data to be set to the current instantaneous velocity shown in the large lower display. Averaging and storage of minimum and maximum values begins at that time at the rate of once per second.

Note that the propeller should already be in position to begin taking measurements when the RESET button is pressed; if it isn't, the button can be pressed again. When the RESET button is pressed while the propeller is not turning, the avg/min/max parameters are all set to zero. This will cause the minimum velocity to always read zero and the average velocity will include all the zero readings since the last reset. Press the RESET button when beginning to take any new measurement.

fig. 3

Save to Memory

When the SAVE button is pressed, the save data screen is displayed and the function of the buttons is changed. In this mode, the averaging and accumulation of minimum and maximum values is halted. The upper display shows the next empty memory location, in this case 024. The lower display shows the current average reading. Press the BACK button to return to the main display mode without saving and resume data collection where it left off. Pressing the SET button stores the current parameters to the memory location shown in the upper display and the computer returns to the main display mode; automatically resetting the average, minimum and maximum values.

The memory location is automatically incremented. That is, if data is saved to location 024, the next time SAVE is pressed the location will show 025. There are a total of 30 memory locations. Once data is saved to location 030, the next save function will wrap around back to location 001, take care to not overwrite previously saved data. If you do not want to store data into the location shown, use the UP and DOWN arrow buttons to select the desired memory location before pressing SET. If there is already data stored in a particular memory location, pressing SET will overwrite the old data with the new data and no warning will be given.

Setup Menu

To enter the setup menu, press and hold the MENU button for 2 seconds. Each press of the MENU button cycles through 1 of 4 options (fig 4), Press BACK at any time to return to the main display mode. The 4 menu options are View data, Delete All Data, Set Velocity Units and Set Calibration Number; press SET to enter the setup screen for the current menu function.

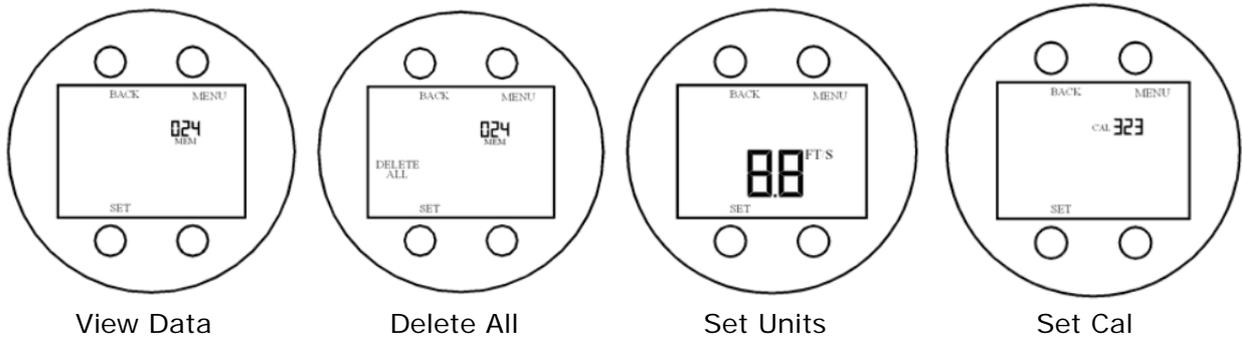| View Data | Delete All | Set Units | Set Cal |

fig. 4

View Data

From the View Data menu screen, press SET to review recorded data.

The memory location is shown in the upper display and the data is shown in the lower larger display. Use the UP and DOWN arrow buttons to change the memory location you wish to view. Use the MODE button to select the average, minimum or maximum data value for the selected memory location. The AVG, MIN or MAX icon is shown at the far right to indicate which data value is being displayed, AVG in the example shown. Press the SET button to return to the menu display.

Delete All

From the Delete All menu screen, press SET to delete all stored data.

The upper display shows the number of stored data sets and the lower display reads zero. As a warning, the display is flashing. Press BACK to abort the Delete All function and return to the menu screen. Press SET to delete all data from memory. Once deleted, the data cannot be recovered.

Set Flow Units

From the Set Units menu display, Press SET to change the Flow Units.

The lower display shows the current flow units of either FT/S or M/S. Use the UP and DOWN arrows to select a new unit. Press SET to save the new selection and return to the menu screen. Press BACK to return to the menu screen without saving. In the menu screen, the current unit selected is displayed.

Set Calibration Factor

From the Set Calibration menu screen, press Set to change the calibration factor.

The calibration factor is factory set and will generally not need to be changed. If you wish to change it, press SET. Use the UP and DOWN arrow buttons to select a new calibration factor. Press SET to save the new selection and return to the menu screen. Press BACK to return to the menu screen without saving. In the menu screen, the calibration number shown indicates the current stored setting.

The calibration factor is equal to the rotation speed of the propeller in revolutions per minute that is equivalent to 1 foot per second of water velocity. It is used to scale the rotation of the propeller to the water velocity in FT/S. In the example shown, 323 RPM = 1 FT/S. The calibration factor must be set in the range of 200-400.

The calibration factor scales rotational speed to velocity in FT/S only. If the flow units are set to M/S (meters per second), the calibration factor does not need to be changed. Conversion between FT/S and M/S is done mathematically by the flow computer.

The flow probe computer is factory calibrated to each flow probe at the time of purchase and should not need to be changed. The calibration factor is supplied on the sticker that comes with each flow probe. Should this scaling factor be accidentally changed, consult the sticker on the the flow probe or contact SIM STRUMENTI and provide the serial number of the flow probe. Because each flow probe varies slightly, the calibration factor may be different for each one. If a replacement computer is purchased, or the computer is to be used on a different flow probe, the calibration factor may need to be changed in order to gain the most accuracy. The scaling factor is used to calibrate out the differences between flow probes only, there is no variation from one computer to another.

Specifications

Range	0.3-19.9 FT/S (0.1-6.1 M/S)
Accuracy	0.1 FT/S (0.1 M/S)
Averaging	True digital running average, updated once per second
Display	LCD, Glare and UV Protected
Sensor Type	Turbo-Prop propeller with magnetic pickup
Materials	PVC and anodized
Probe	aluminum with stainless steel water bearing
Computer	ABS/Polycarbonate housing with polyester overlay
Power	Internal Lithium, Approx 5 year life Non-Replaceable
Operating Temperature	-20° to 70° C (-4° to 158° F) Non-Freezing
Storage Temperature	-30° to 80° C (-22° to 176° F)

Maintenance

Probe Handle

When the Flow Probe expansion joint becomes submerged, water will enter the Probe handle. After use, dry the Probe by separating the two handle sections, draining the water inside the Probe handle, and letting the handle dry out in a warm place before reassembling. The Flow Probe handle can be cleaned with mild soap and water. You should not submerge the top of the pole and the computer. If the computer gets submerged, remove it from the Flow Probe and dry with a soft cloth

Battery

The flow probe computer's battery is not replaceable. It should last approximately 5 years with normal use. There is a low battery indicator on the display that will come on when the battery becomes too low to ensure accuracy. The display will also start to become dim as the battery voltage drops. The display may normally become dim and show the low battery indicator in very cold conditions. It should return to normal at warmer temperatures.

When the battery has lost it's charge or the product is no longer useable for any other reason, do not discard the computer to a landfill. SIM STRUMENTI offers an electronics recycling program, please contact SIM STRUMENTI to arrange to have the Flow Probe Computer recycled at no charge.

Cleaning

Make sure the Turbo Prop turns freely before and after your measurements. Blow on the prop in the direction of flow. The prop should turn freely. If not, rinse the probe in clean water and remove any visible strings or other debris from the prop bearing. This should correct the problem. If the prop still does not turn freely, remove the prop screw and the prop, and wash them in clean water or soap and water. Replace prop and screw. Tighten screw firmly but make sure prop still spins freely.

Trouble Shooting

➢ Blow on the propeller. The prop should spin freely and may make a noise (chatter) when you blow on it. The prop should be loose on the shaft when you push it with your finger. If the prop does not spin freely, rinse it with clean water or soak it in mild soapy water.

➢ A small metal magnet covered with clear adhesive is installed on one blade of the propeller. Be sure the magnet is in place and has not been removed. This magnet is necessary to generate the signal for the computer.

➢ Remove the computer holder from the pole handle by pulling the holder up away from the pole. The holder should come off with a snap sound. Make sure there is no moisture around the plug or socket. If the plug and socket are wet, dry the parts off and place both in a warm place overnight. Push the computer holder back on to handle until you hear a snap sound. If you don't hear this sound, the holder is not on all the way seated or the connector may be defective.

➢ Check the calibration number in the setup menu. This number is shown on the sticker supplied with the flow probe. It can also be obtained by contacting the Technical Support department at SIM STRUMENTI, be ready to supply the serial number for the flow probe.

➢ If the display is blank, press any of the 4 buttons to activate it. If the display remains blank, appears dim, or shows the low battery indicator; the battery may be weak. The battery is not replaceable, a new computer will need to be purchased From SIM STRUMENTI.

Warranty

➢ SIM STRUMENTI warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from factory. SIM STRUMENTI's obligations under this warranty are limited to, at SIM STRUMENTI's option: (I) replacing or (II) repairing; any products determined to be defective. In no case shall SIM STRUMENTI's liability exceed the products original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by SIM STRUMENTI, or which has been subject to misuse, negligence or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

➢ The warranty begins on the date of your invoice

Appendix A:

Calculations for Partially Filled Round Pipes

B	C	B	C
0.01	0.0013	0.51	0.4027
0.02	0.0037	0.52	0.4127
0.03	0.0069	0.53	0.4227
0.04	0.0105	0.54	0.4327
0.05	0.0147	0.55	0.4426
0.06	0.0192	0.56	0.4526
0.07	0.0242	0.57	0.4625
0.08	0.0294	0.58	0.4723
0.09	0.0350	0.59	0.4822
0.10	0.0409	0.60	0.4920
0.11	0.0470	0.61	0.5018
0.12	0.0534	0.62	0.5115
0.13	0.0600	0.63	0.5212
0.14	0.0668	0.64	0.5308
0.15	0.0739	0.65	0.5404
0.16	0.0811	0.66	0.5499
0.17	0.0885	0.67	0.5594
0.18	0.0961	0.68	0.5687
0.19	0.1039	0.69	0.5780
0.20	0.1118	0.70	0.5872
0.21	0.1199	0.71	0.5964
0.22	0.1281	0.72	0.6054
0.23	0.1365	0.73	0.6143
0.24	0.1449	0.74	0.6231
0.25	0.1535	0.75	0.6318
0.26	0.1623	0.76	0.6404
0.27	0.1711	0.77	0.6489
0.28	0.1800	0.78	0.6573
0.29	0.1890	0.79	0.6655
0.30	0.1982	0.80	0.6736
0.31	0.2074	0.81	0.6815
0.32	0.2167	0.82	0.6893
0.33	0.2266	0.83	0.6969
0.34	0.2355	0.84	0.7043
0.35	0.2450	0.85	0.7115
0.36	0.2546	0.86	0.7186
0.37	0.2644	0.87	0.7254
0.38	0.2743	0.88	0.7320
0.39	0.2836	0.89	0.7384
0.40	0.2934	0.90	0.7445
0.41	0.3032	0.91	0.7504
0.42	0.3130	0.92	0.7560
0.43	0.3229	0.93	0.7612
0.44	0.3328	0.94	0.7662
0.45	0.3428	0.95	0.7707
0.46	0.3527	0.96	0.7749
0.47	0.3627	0.97	0.7785
0.48	0.3727	0.98	0.7816
0.49	0.3827	0.99	0.7841
0.50	0.3927	1.00	0.7854

H= Height of water; D= Diameter of pipe (in feet)

H/D = Column B

Read Column C adjacent to your pipe's B

C x D2 = Filled area, A (sq.ft.)

A x Average Velocity = Volumetric flow (CFS)

CFS x 448.83 = Gallons/minute (GPM)

GPM x 1440 = Gallons/day (GPD)

Round Pipe

NOTES