

# Using the Latest PORTABLE FLOW MEASUREMENT TECHNOLOGY



**WATER/  
Wastewater**

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Cross correlation method with triple redundant level measurement for reliable, high accurate and comfortable measurement of extraneous water, wastewater, sludges and chemically polluted water from nightly discharge up to flood. In many cases, users are facing almost unsolvable problems when it comes to choose and to use portable flow measurement technology.

Many times media with pollution loads such as sludge, solids, fibres and grease have to be measured without the risk of measurement failures as well as clear water from influents or ground water intruding the channel system. Additionally, there is very often an extreme discharge behaviour, ranging from volumes tending to zero up to pressurized discharge or backwater within the sewer system. The measurement methods used until now (magnetic-inductive methods, Doppler sensors and similar) very often did not meet these requirements. This is why faulty measurement results or even measurement failures occurred.

Being aware of the problems above and using 20 years of experience in the development of portable flow measurement devices, NIVUS have enhanced the very successful cross correlation method known from stationary measurement technology. The new 'PCM Pro' has proven its usability, reliability and accuracy in the field of portable flow measurement with many units within one year.

### • Measurement Principles:

The PCM Pro uses a combi sensor which simultaneously detects flow velocity by using the cross correlation and filling level by using a pressure element and ultrasound. Apart from that, it is possible to additionally connect and to use an external air ultrasonic sensor.

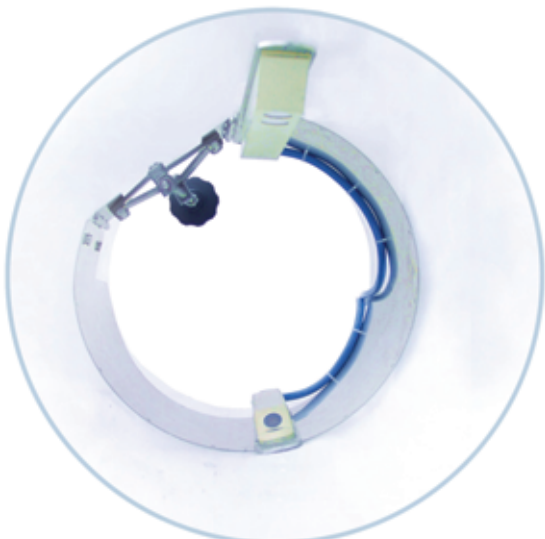


Figure 1: Sensor Installation

The piezo crystal has a certain slope against the flow direction and operates as flow velocity sensor. In order to measure the flow velocity an ultrasonic burst is sent into the measurement medium in a precisely defined angle.

Any particles within the measurement path (gas, dirt etc.) will reflect a small amount of the ultrasonic signal. This results in a unique reflection signal depending on size and shape of each particle. The multitude of the reflected signals causes a common reflection pattern which will be received again and converted into an equivalent voltage signal subsequently. The sensor saves this signal pattern in an integrated DSP.

The course of events above will repeat after a few milliseconds.

Due to various hydraulic conditions, there are different flow velocities in different flow levels. Depending on their levels, the positions of the reflecting particles now vary from their positions detected before. This results in a distorted image of the reflection pattern. At the same time, slightly different reflections occur: some particles have been turning around and thus show another shape of reflection; other particles have been moving out of the range of the measurement window and some particles have been moving into this range.

The DSP now checks both received reflection patterns for similarities by using the cross correlation method. Any existing signal differences will be rejected. What is left for velocity evaluation are two similar signal patterns with a temporal offset.

These two patterns are now covered with 16 measurement windows depending on the flow levels. The temporal shift  $\Delta t$  of the signal pattern within the windows will be determined subsequently. Based on beam angle, temporal shift and the gap between the consecutive signals and the temporal shift  $\Delta t$  of the signal pattern, it is now possible to determine the flow velocity in each single measurement window. Hence, the PCM Pro is the first portable measurement system worldwide which is capable to spatially allocate measured single flow velocities with a very high accuracy.

The events described above will be repeated up to 2000 times per second and hence produces very accurate single velocities for each measurement window.

Putting together the single flow velocities will result in the velocity profile.

By using numeric equations and the calculation algorithms of the finite element method, the flow distribution within the

overall cross-sectional area can be calculated based on the accurately measured vertical flow profile. This allows to accurately determine the average flow velocity which, multiplied by the wetted hydraulic area provides the precise current flow value.

### • Sensor Technology:

The user is free to choose between various level measurement methods. This ensures to safely detect many different filling levels.

Even very low discharge values during the night, in dry weather periods as well as extraneous water and can be detected very safely thanks to the use of the air ultrasonic sensor which is installed out of the measurement medium.

The pressure element, which is integrated in the sensor, enables to detect filling levels in case of a lateral sensor offset or in case of an entirely flooded channel system without any problems.

Water ultrasonic measurement is the choice to meet the requirements of higher filling levels and high accuracy.

Due to the maintenance-free and drift-free ultrasonic method, pollution such as grease or sewer films does absolutely not affect the measurement.

Backwater as well as even very low flow velocities within a range of a few millimetres can be measured with a very high reliability.

High resistant sensors made of PEEK are available for use in high aggressive media in chemical industry.

### • Transmitter:

Due to the detection of the flow profile and its representation on the large back-lit full graphic display of the transmitter, it is virtually impossible to install the system in hydraulically bad places. Display and keypad of the device ensure a very simple programming even under Ex-conditions as well as precise profile monitoring and sensor diagnosis functions in conversation mode.

Periodically variable scan rates depending on events allow to ideally adjust the measurement in case of rainfall events.

The powerful and rechargeable NiMH battery guarantees to supply the system for several months, depending on the cycles set.

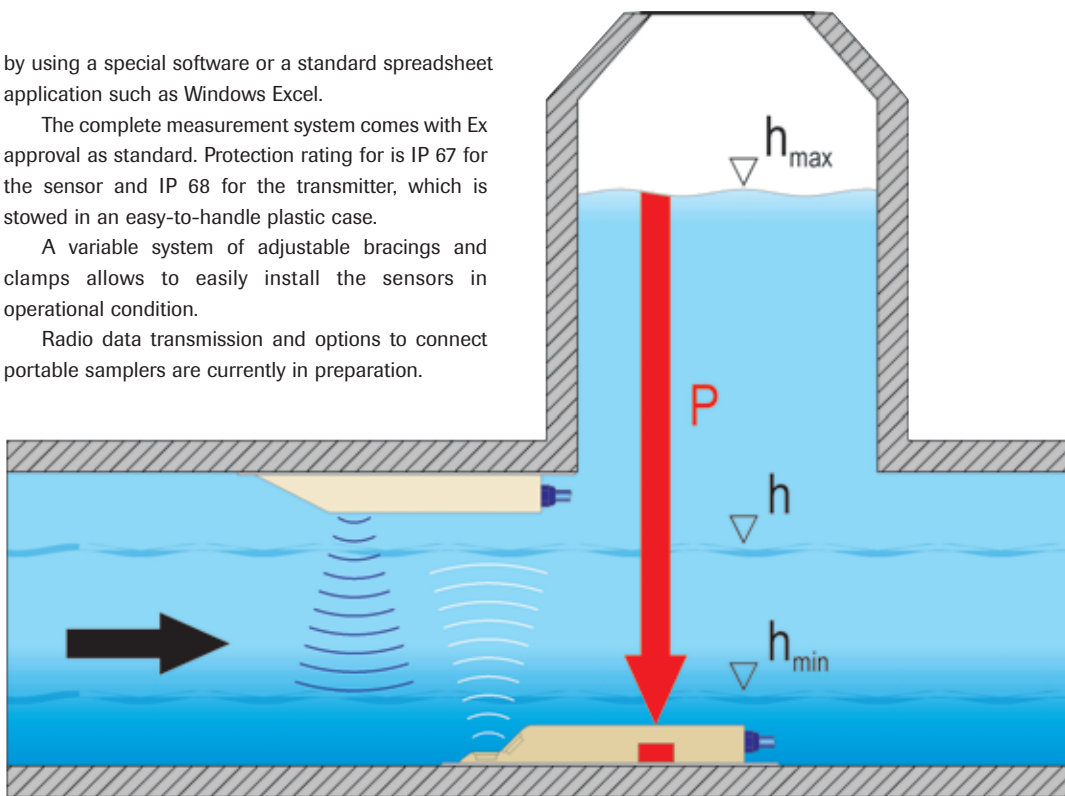
A Compact Flash Card with a capacity of several years is used for data storage. Data evaluation can be carried out

by using a special software or a standard spreadsheet application such as Windows Excel.

The complete measurement system comes with Ex approval as standard. Protection rating for is IP 67 for the sensor and IP 68 for the transmitter, which is stowed in an easy-to-handle plastic case.

A variable system of adjustable bracings and clamps allows to easily install the sensors in operational condition.

Radio data transmission and options to connect portable samplers are currently in preparation.



### Summary

The measurement method described above opens up completely new possibilities in the field of portable flow measurement technology. It stands out for high accuracy, exact reproducibility of measurement values, versatility in case of various measurement tasks and hydraulic conditions, straightforward installation in existing profiles, extremely simple and menu driven usability even under Ex conditions, graphic representation of the velocity distribution, very high data storage capacity and a long lifetime and many, many more.

## New Specification Ultrasonic Flowmeters



**Crydom** (UK) have introduced a new specification for their Ultrasonic Flowmeters. The Flowsonic range now comprises pulsed output and analogue 4-20mA units.

The pulsed output version now provides 1000 pulse per litre, with the pulse being of Open Collector (Open Drain) type. The analogue output version now has a 4-20mA output (into 100Ohms max impedance), so is suitable for connection to many process control instruments.

The Flowsonic range features a clear flow path with no moving parts so it cannot clog or jam due to contaminants in the flow. In addition, the unit features automatic temperature and viscosity compensation and low pressure drop.

The Flowsonic series is ideal for measuring beverage delivery, flow in heating systems and white goods.

The standard measuring range for these units is 0 - 25 litres per minute, with an accuracy of better than 3% of reading (or 0.1 litres per minute), and a response time better than 0.4 seconds.

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## Herbicides Analysis Using Evaporative Light Scattering Detection



**Polymer Laboratories** (UK) has published a new technical bulletin entitled Analysis of Herbicides in Water Using PL-ELS 2100 Evaporative Light Scattering Detection.

Phenylurea pesticides are used widely in agriculture as selective herbicides. Common phenylurea herbicides' degradation products have a relatively long lifetime, the mobility of these herbicides increases the chance of migration to ground water via leaching and surface run-off. The need to develop analytical methods for the analysis of phenylurea herbicides in surface and ground water is vital to understanding the herbicide degradation pathways in the environment.

The application of gas chromatography to the analysis of phenylurea pesticides is difficult as they are thermally unstable and degrade rapidly to isocyanates and amines. An alternative approach for thermally sensitive compounds is to use HPLC, coupled with evaporative light scattering detection. Evaporative light scattering detectors respond to all compounds which are less volatile than the mobile phase. The PL-ELS 2100 evaporative light scattering detector is designed to evaporate highly aqueous mobile

phases at ambient temperature. By operating the PL-ELS 2100 at ambient temperature the loss of semi-volatile components is minimized, the sample integrity is preserved and maximum sensitivity is achieved.

For full details of the effectiveness and the use and operation of the PL-ELS 2100 for herbicides analysis in water, request Polymer Laboratories' new technical bulletin, TB 1064.

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- absolutely stable zero point and drift-free
- OCM Pro suitable for M Certs applications, PCM Pro suitable for M Certs testing

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