



PCM Pro Ex

portable flow measurement
for demanding applications

Undoubtedly the most accurate portable flow measurement

- portable, flexible use even in difficult applications
- measures the real flow profiles
- spatial allocation of individual velocities
- very high accuracy
- no calibration required
- stable zero point and drift-free
- triple redundant level measurement
- measurement in all part filled and full filled pipes and channels
- measurement in heavily polluted and abrasive media
- easy to install using variable fastening system
- multilingual parameter setting, also in Ex areas
- large, back-lit graphic display
- parameter and measurement data storage on plug-in compact flash card
- long battery lifetimes thanks to optimised energy-saving process flow
- Ex zone 1 approval according to ATEX



Flow level measurement

You are free to select between 5 different detection principles depending on your application.

- water-ultrasonic integrated in combi sensor [h1, measurement from bottom up]
- pressure measurement cell integrated in combi sensor [h2, measurement from bottom up]
- wedge sensor with air-ultrasonic [h3, measurement from top down]
- variable external level sensor [h4, 4-20 mA]
- fixed value at constant fill level

Measurement principle

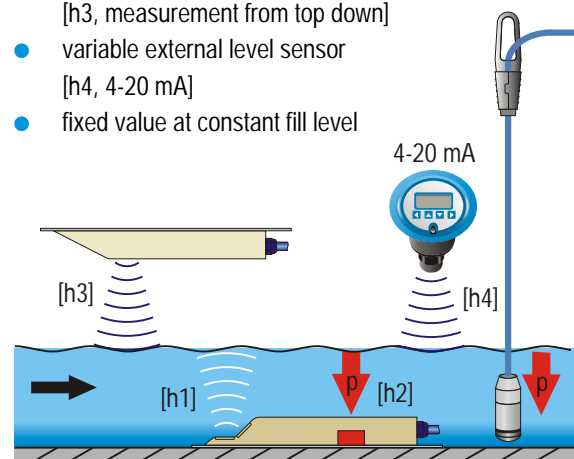
The quantity >>flow "Q"<< cannot be measured directly. The following general equation is the basis for flow calculation:

$$Q = A \cdot \bar{v}$$

A = wetted cross-sectional area
 \bar{v} = average flow velocity

The wetted cross-sectional area A depends on the cross-sectional profile and the flow level.

This flow level will be determined by using integrated and / or external sensors. The wetted cross-sectional area will be calculated taking the cross-sectional profile into account.



Ultrasonic

In case of water-ultrasonic as well as in case of air-ultrasonic [h1; h3] the flow level will be detected using the echo sounder principle.

The interface between water and air (water surface) will be detected in both cases and the sound transit time between sensor and water level will be measured.

The flow level is proportional to the measured time which will be determined as a result from that.

This measurement method stands out for its accuracy and its long-term stability.

Foam or other substances floating on the water surface do not affect the result of the water-ultrasonic measurement.

Hydrostatic

Level measurement is even possible in strongly absorbing media by using a hydrostatic measurement [h2] which can also be integrated into the sensor.

The high-resistant Hastelloy diaphragm allows the sensor to be used in heavily contaminated or aggressive media.

By detecting atmospheric pressure and the hydrostatic pressure of the measurement medium simultaneously air pressure fluctuations are compensated ideally.

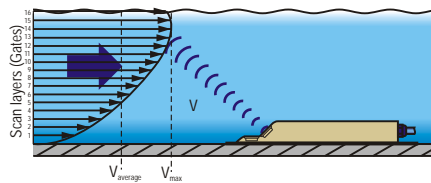
The additional use of a resistant-free air filter reduces measurement inaccuracies to a minimum.

External sensors

External level sensors with 4-20 mA signals can be integrated into the system without any problems.

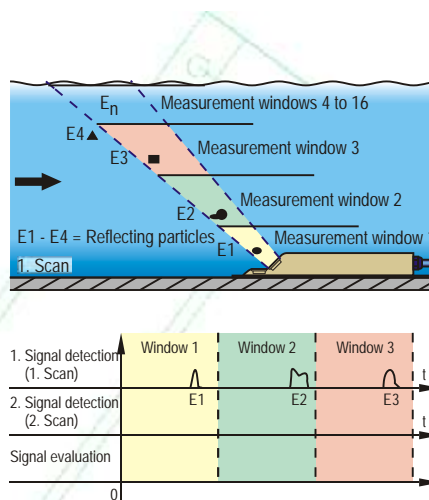
In case of constant fill levels no additional level sensors are required due to the use of a fixed value.

Flow velocity measurement

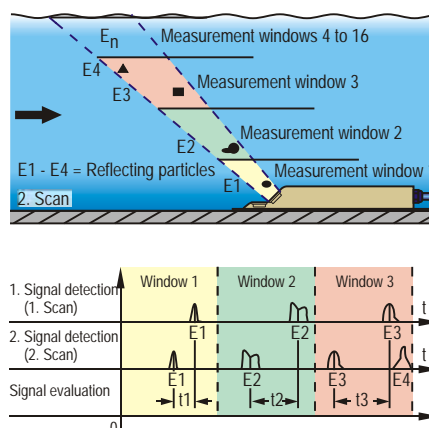


An ultrasonic converter (sensor) sends an ultrasonic burst into the medium. The particles or gas bubbles in the medium reflect this impulse. The sensor operates in impulse-echo mode, i.e. the ultrasonic converter will switch to receiving mode immediately after transmitting the burst, receiving the reflected ultrasonic echo as a characteristic echo image pattern.

These echo patterns from the first scan will be digitised and saved.



During the second scan, an ultrasonic burst will be sent again and the reflected echo patterns will be saved as well.



By using the cross correlation method the characteristic echo image patterns within the time slots are now checked for compliance. The temporal shift of the echo image pattern of the second scan compared to the first scan can be converted directly into the flow velocity within the individual measurement windows taking the beam angle into account.

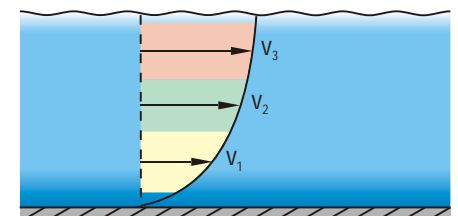
Formula

$$x(t) \cdot V \rightarrow y(t-t)$$

$$f_g(\cdot) = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{-T/2}^{+T/2} f(t) g(t + \cdot) dt$$

This event will be repeated up to 2000 times per second.

The flow profile will be determined directly from the individual velocities in real time by the integrated digital signal processor (DSP). This allows the user to obtain measurement values with the highest accuracy without additional calibration.



Determined flow profile



Transmitter: **lightweight** ^{*} lightweight in Ex areas



* only 6.5 kg unrivalled operating weight

The most important details at a glance:

- large back-lit graphic display
- menu-drive user interface
- graphic representation of hydraulic conditions at the measurement place
- numeric and graphic sensor diagnosis
- protocol function for the most important measurement data up to 14 days.
- variable measurement modes for cyclic, event-based and continuous measurement with free selectable storage interval
- removable data memory up to 64 MB for data storage and data transfer to PC
- operating time per battery charge 40.000 measurement cycles 3 months / 5 minute cycle
- environmentally acceptable rechargeable NiMH battery
- Ex approval for zone 1 according to ATEX
- protection IP 67

Programming



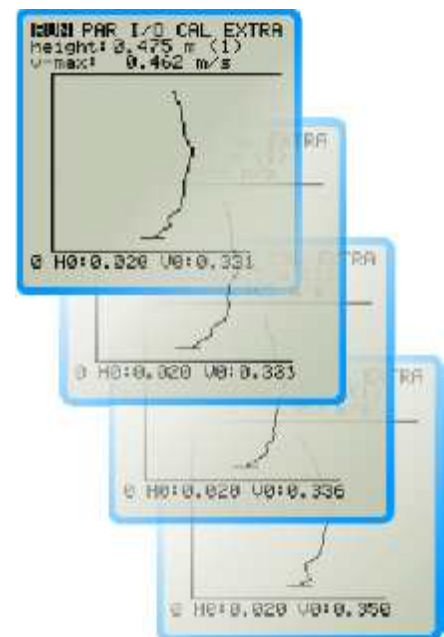
Programming the unit is remarkably simple. The user will be guided through the menu thanks to the windows-like program and the dialog mode on the large graphic display. Programmed settings will be clearly indicated graphically. The program structure is perfectly set for the requirements of a portable measurement system.



This virtually eliminates any possibility of faulty programming. As a standard, access can be restricted in order to prevent the unit from unauthorised modification.

Display

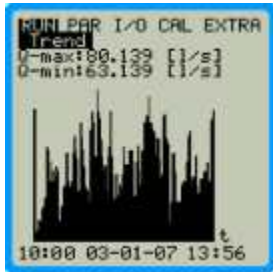
The back-lit display can be clearly read even in dark shafts and manholes. It enables the user to easily program the unit as well as to simply recall sensor data, echo profiles, velocity distributions, historical trend graphs...



Direct flow profile indication on the display

System diagnostics

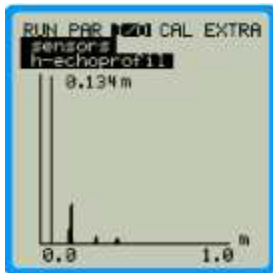
Recalling the most important system data on the display



Internal protocol functions to assess the measurement progress without any aid onsite



Diagnostic tools to assess the measurement quality, e.g. flow level



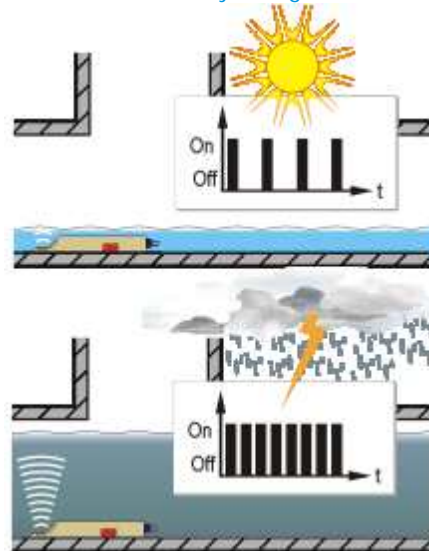
Echo profile analysis

The versatile diagnosis options allow the user to perfectly select a measurement place and trouble-free operation of the measurement system.

Storage

- plug-in industry standard data memory
- redundant data saving
- data files in txt format
- additional storage of parameter and analysis data

Event-based memory changeover



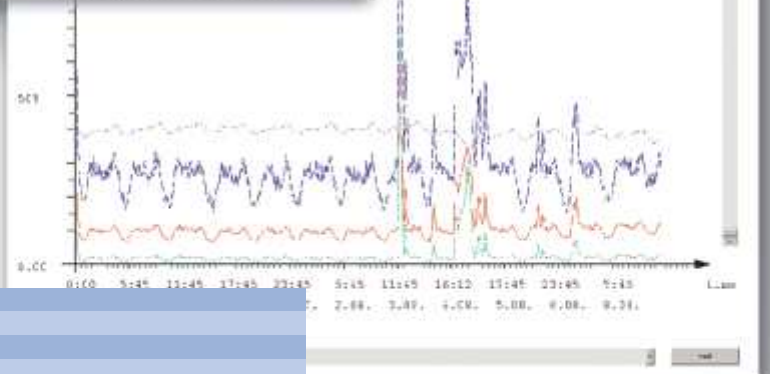
High-level data availability requires unusual solutions.

Since standard memory cards do not meet these requirements, NIVUS relies on industry standard.

A redundant memory management (parallel data storage on memory card and the internal RAM) virtually eliminates any possibility of data loss. The additional storage of parameter settings and analysis data completes the safety kit.

The storage in txt-format ensures compatibility with any standard calculation and spreadsheet applications.

Raw data



Measurement value indication with NivuDat Pro software

NivuDat Pro

Apart from options to evaluate data using common spreadsheet applications, the NivuDat Pro software allows the user to clearly and quickly represent measurement data as tables or graphs under Windows XP / Windows 2000. Additional editing options such as se

quential data export, averaging functions, min. and max. value output, administration of measurement places and more complete the program.

NivuDat Pro

Sensors: unrivalled

in versatility



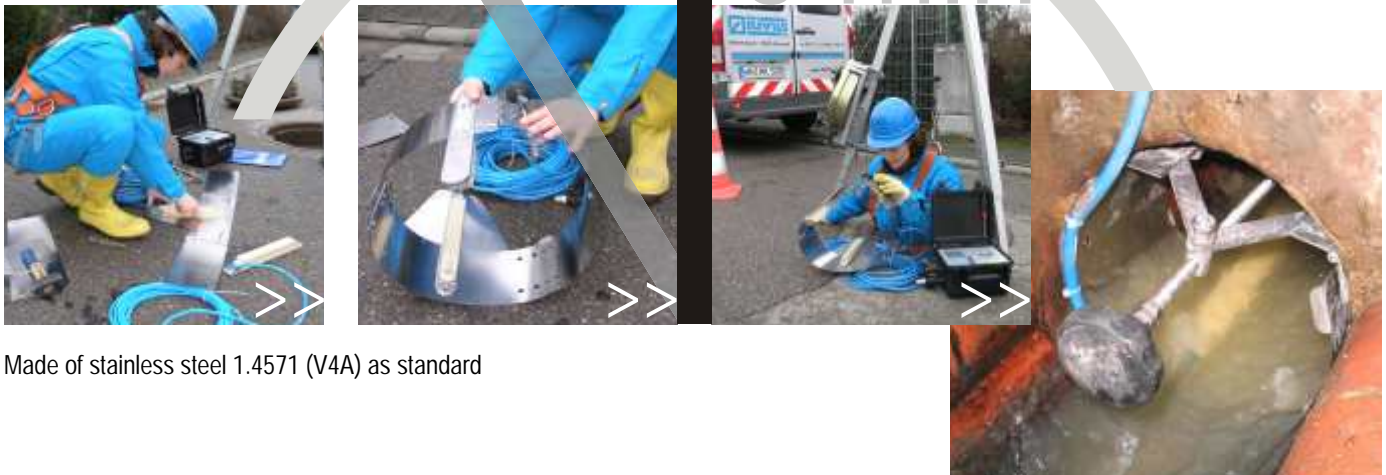
Air-ultrasonic sensor

Water-ultrasonic sensor with pressure measurement cell

- triple redundant level measurement (air-ultrasonic, water-ultrasonic, hydrostatic)
- high accurate flow velocity measurement
- external level sensors can be connected
- high measurement dynamics from 5mm/s to 6m/s
- measurement in both flow directions
- standard sensors with high medium resistance (PPO, PEEK, 1.4571, Hastelloy)
- sensors resistant to chemical substances for highest demands
- IP 68
- Ex approval zone 1
- flexible to use
- easy to install using variable fastening system

... remarkably easy to install

5 min

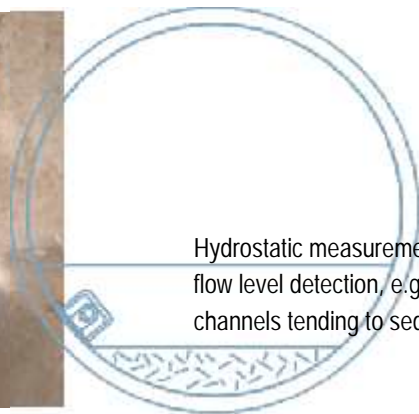


Made of stainless steel 1.4571 (V4A) as standard

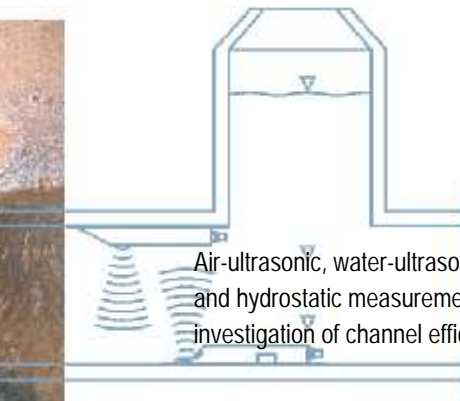
... goes with any application.



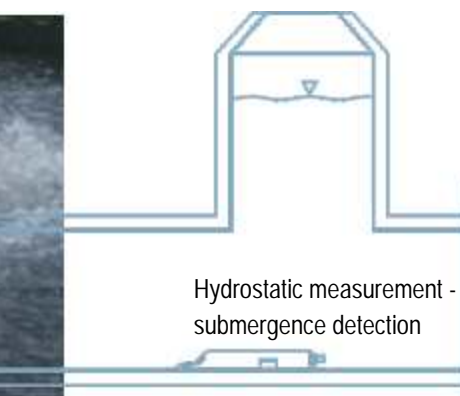
Air-ultrasonic -
detection of low flow levels, e.g.
for investigation of extraneous
water



Hydrostatic measurement -
flow level detection, e.g. in
channels tending to sedimentation



Air-ultrasonic, water-ultrasonic
and hydrostatic measurement -
investigation of channel efficiency



Hydrostatic measurement -
submergence detection

Areas of use

- investigation for infiltration
- determination of data records for the hydraulic calibration of discharge models
- billing networks
- recording of planning data for storm water basins
- recording of rainwater feed according to BWK M3
- throttle calibration
- verification of existing sewer systems
- indirect influent monitoring
- temporary verification of process flows
- and much more

No matter if used by local councils, water and environment authorities, engineering consultants and planning agencies, test centres or authorised experts - with its versatile and universal areas of use, its high accuracy and user-friendliness the PCM Pro Ex represents a long-life and reliable working tool.



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