

Data Transmission
via Bluetooth



PCM 4

**Portable Flow
Measurement for
universal use**


Undoubtedly the most accurate portable flow measurement

The portable PCM 4 is designed for temporary flow measurement over long-term periods in open channel applications such as wastewater collection systems, storm sewer systems, and combined sewer systems. The battery powered system provides high accuracy depth and velocity data.

The PCM 4 can be used for many project applications, like

- infiltration/inflow analysis and reduction
- master plan studies
- storm sewer monitoring
- suitable for MCERTS testing ...

Some of the most important features for using the PCM 4 even in difficult applications are:

- data transmission via Bluetooth
- measures the real flow velocity profile
- spatial allocation of single velocities
- no calibration required
- absolutely stable zero point and drift-free
- triple redundant level measurement
- measurement in all part filled and full pipes and channels
- measurement in heavily polluted and abrasive media
- multilingual parameter setting in dialog mode
- easy operator guidance
- also available as PCM Pro, for the use in Ex areas 



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:

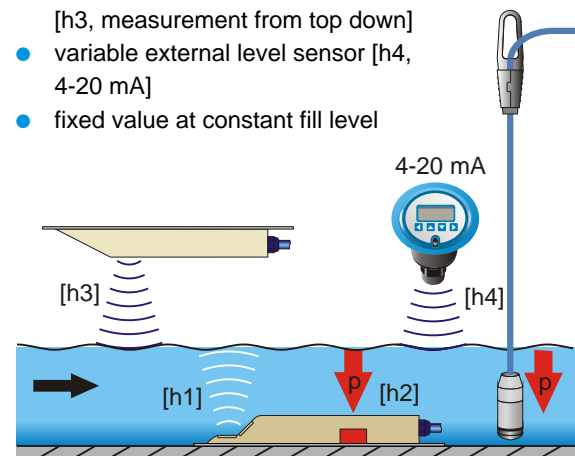
$$Q = A \cdot \bar{v}$$

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 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 ideally compensated.

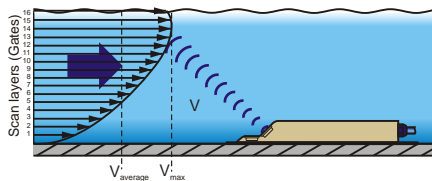
External sensors

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.

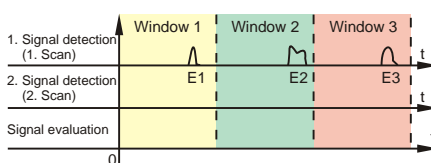
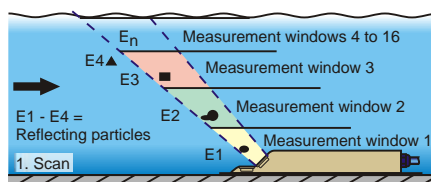


Flow velocity measurement

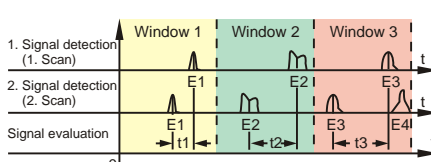
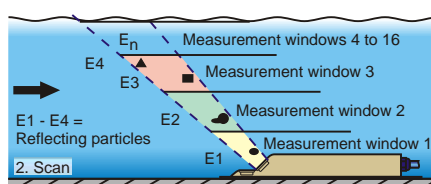
An ultrasonic converter (sensor) sends an ultrasonic burst into the medium. The particles or gas bubbles in the medium reflect this impulse. The sensor operates in impulse-echo mode, i.e. the ultrasonic converter will switch to receiving mode immediately after transmitting the burst, receiving the reflected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



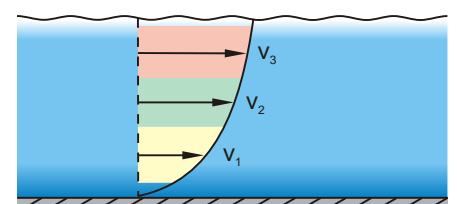
By using the **cross correlation method** the characteristic echo image patterns within the time slots are now checked for compliance. The temporal shift of the echo image pattern of the second scan compared to the first scan can be converted directly into the flow velocity within the individual measurement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

Formula

$$x(t) \cdot y(t-t) \quad \int_{-T/2}^{T/2} f(t) g(t+x) dt$$

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*

* only 6 kg unrivalled operating weight

The most important details at a glance:

- large back-lit graphic display
- dialog mode user interface
- graphic indication of hydraulic conditions at the measurement place
- numeric and graphic sensor diagnosis
- protocol function for the most important measurement data
- logging of current flow measurement values (Q, h, v, T) and system parameters

- variable measurement modes for cyclic, event-based and continuous measurement with freely selectable storage interval
- removable data memory (flash card) up to 128 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 battery
- can be used with standard batteries (size D) alternatively
- line powered operation possible

- recording of pump run times and switching events
- storage of external analog signals (fill levels, flows, analysis values...)
- enclosure rating: IP 67
- analog output of measured values
- sampler driving
- transmission of error messages
- output of limit values
- output of volume impulse
- telemetered communication (pending)

Programming



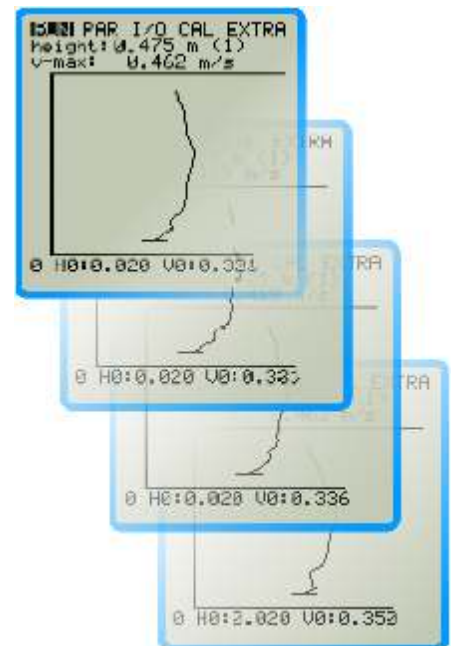
Programming the unit is remarkably simple. The user will be guided through the menu thanks to the windows-like program and the dialog mode on the large graphic display. Programmed settings will be clearly indicated graphically. The program structure is perfectly set for the requirements of a portable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



This virtually eliminates any possibility of faulty programming. As 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

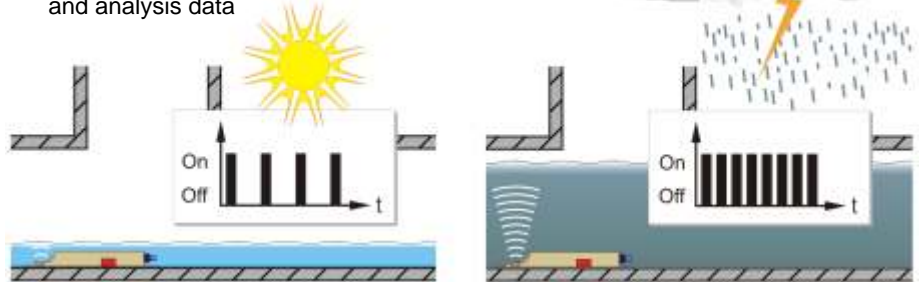


Echo profile analysis

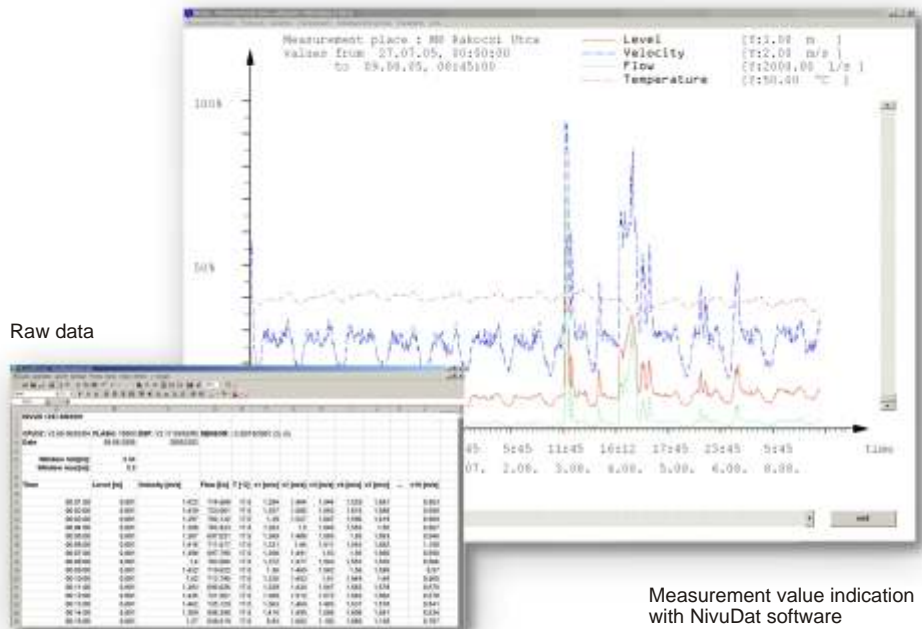
The versatile diagnostic options allow the user to perfectly select a measurement place and trouble-free operation of the measurement system.

Storage

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



High-level data availability requires novel 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 software

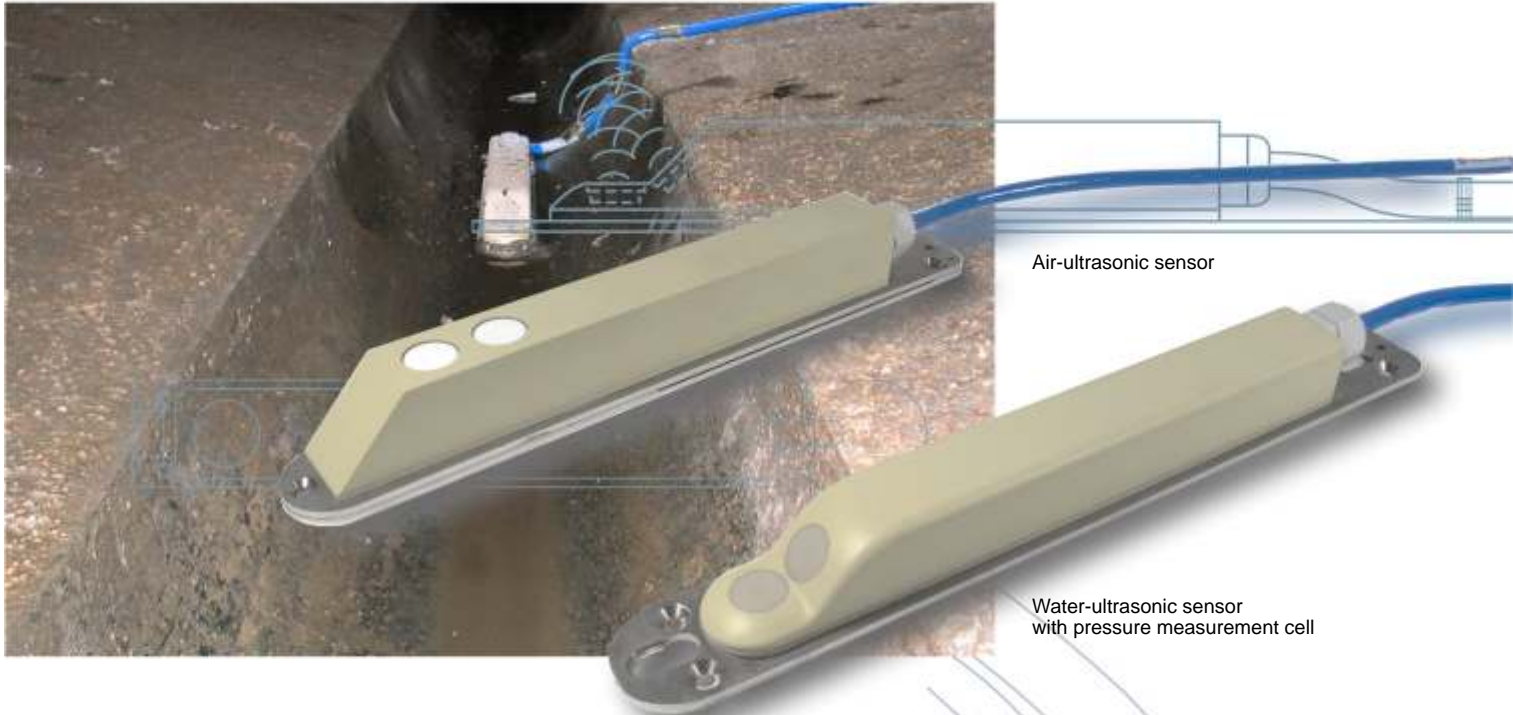
NivuDat

Apart from options to evaluate data using common spreadsheet applications, the NivuDat 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 sequential data export, averaging functions, min. and max. value output, administration of measurement places and more complete the program.

NivuDat

Sensors: unrivalled in versatility



Air-ultrasonic sensor

Water-ultrasonic sensor with pressure measurement cell

- triple redundant level measurement (air-ultrasonic, water-ultrasonic, hydrostatic)
- high accuracy 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 C276)
- sensors resistant to chemical substances for highest demands
- IP 68
- flexible to use
- easy to install using variable fastening system

... remarkably easy to install

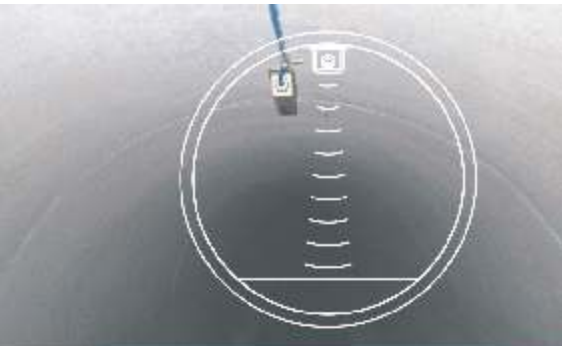


5 min

Made of stainless steel

... suitable for any application.

MCERTS testing



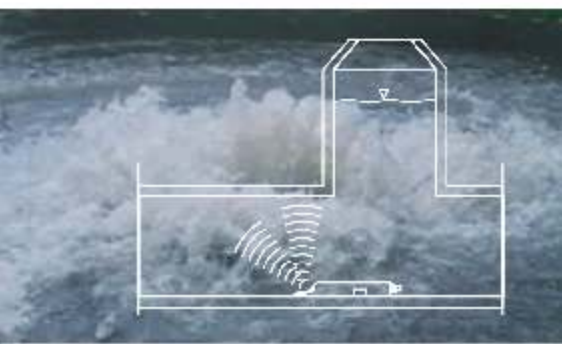
Air-ultrasonic - detection of low flow levels, e.g. for investigation of extraneous water



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
- data collection for the hydraulic calibration of sewer network models
- billing networks
- collection of basic planning data for storm water detention basins
- recording of rainwater feed
- 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 4 represents a long-life and reliable working flowmeter.

Logging and controlling

More than just a flow measurement

The standard peripheral interfaces of the PCM 4 not only allow accurate and reliable flow measurement, but also allow to easily integrate additional measurement systems into a complete recording concept.

Variable output interfaces enable the integration of the PCM 4 into existing systems without any problems. This flexibility allows the creation of solutions for various tasks such as:

Sampling

Relay and analog output enable to drive sampling devices either based on volume, time or flow (freely selectable). Presetting a minimum level for sample drawing ensures reliable sampling.

Throttle verification

By measuring throttle volume and tank fill level simultaneously the PCM 4 simply meets any requirements of throttle verifications.

Pump efficiency measurement

Recording pumping rate and pump run times simultaneously enables the control of the current pump efficiency. This point is useful to clarify cost-cutting potentials.

Event monitoring

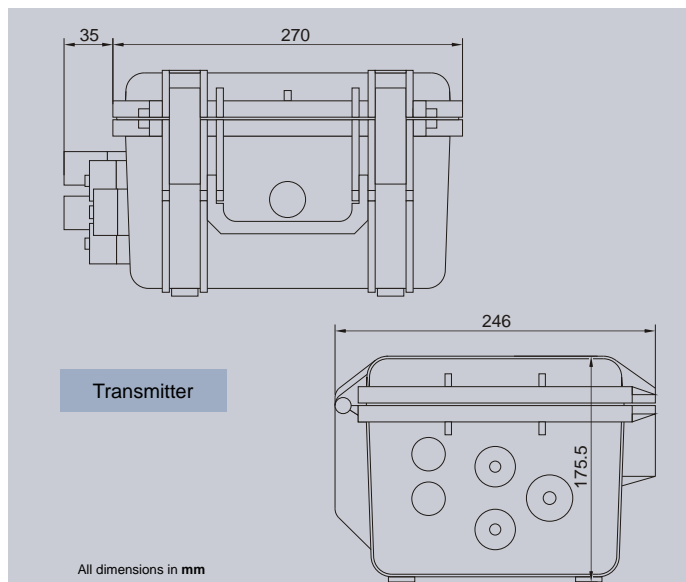
External switching contacts (float switches, pump relays and similar) or internal limit values either allow to start the flow measurement based on events or to switch over measurement and storage cycles dynamically. This results in long battery life and high data density during flow-relevant measurement periods.

Signal transfer

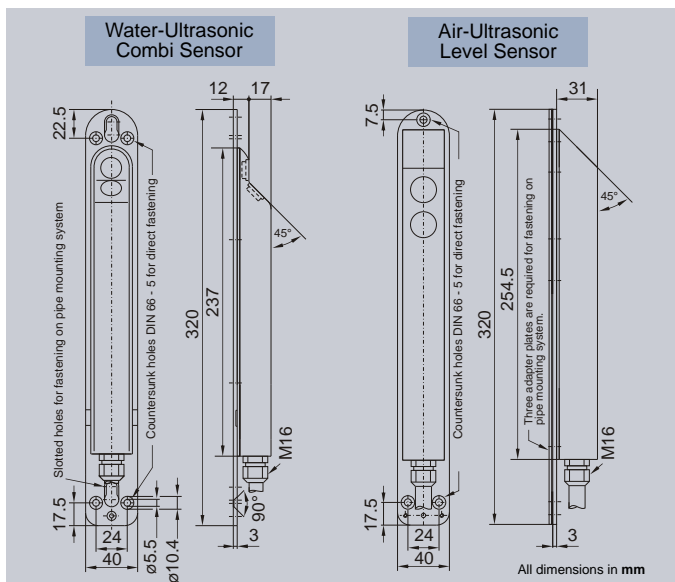
Digital and analog output signals allow information transfer to main systems. Freely definable output ranges, impulse lengths and limit values enable connection to devices from various manufacturers.

Measuring - Controlling - Logging >>PCM 4
One measurement system - many possibilities

Specifications



All dimensions in mm



All dimensions in mm

Transmitter

Power supply	12 V DC, 12 Ah rechargeable lead battery or battery box for 12 x mono cells 1.5 V (type LR20), power pack 100 - 240 V AC, 50/60 Hz
Enclosure	Material: Polypropylene (PP), shock-resistant Weight: approx. 2.0 kg (without sensor and rechargeable battery)
Protection	IP 67 if lid is closed and locked
Operating temperature	-20 °C to +50 °C
Storage temperature	-30 °C to +70 °C
Max. humidity	90%, non-condensing
Display	back-lit graphic display, 128 x 128 pixel
Operation	18 button keypad or alternatively via Bluetooth, multilingual dialog mode
Plug-in socket IP 68	1 x 4-20 mA for external level (2-wire probe, active) or 1 x active air-ultrasonic for level measurement 1 x active water-ultrasonic/pressure combi sensor for velocity and level measurement 1 x multifunctional socket for digital and analog inputs and outputs 1 x connection socket for combined power supply and charger unit or alternative power supply 1 x Bluetooth for data transmission
Inputs via multifunctional socket	1 x active digital input, supply voltage 3.3 V DC 1 x analog input 0/4-20 mA (passive)
Outputs via multifunctional socket	1 x relay (SPDT) contact rating: 250 V AC, 5 A / 30 V DC, 5 A switching frequency: 5 Hz 1 x voltage output
Storage cycle	1 to 60 minutes, time-cyclical or depending on events
Data storage	external, on plug-in compact flash card up to 128 MB capacity; internal RAM with 8 MB
Data transmission	via pluggable compact flash card and/or Bluetooth

Sensors

Measurement principle	ultrasonic transit time (level/height) piezoresistive pressure meas. (level/height) correlation with digital pattern detection (flow velocity)
Measurement range (v)	-1 m/s to +6 m/s
Measurement range (h)	pressure 3.5 m; ultrasonic 2 m
Measurement frequency	1 MHz
Protection	IP 68
Operating temperature	-20 °C to +50 °C
Storing temperature	-30 °C to +70 °C
Measurement uncertainty	deviation less than 1 %, (under given specific conditions)
Operational pressure	max. 4 bar (combi sensor with pressure measurement cell max. 1 bar)
Cable length	max. 100 m, in case of using sensors with pressure measurement after 30 m a pressure compensation element is required
Sensor types	V100 flow velocity sensor (v; temperature) V1H1 combi sensor (v meas., level meas. using water-ultrasound and temperature measurement) V1D0 combi sensor (v meas., level meas. using pressure and temperature measurement) V1U1 combi sensor (v meas., level meas. using water-ultrasound and redundancy using pressure and temperature measurement)
Constructions	wedge sensor for installation on channel bottom
Materials	Polyurethane, stainless steel 1.4571, PPO GF30, PA
Option	PEEK, Hastelloy C276 ground plate, Titanium ground plate;
Accessories	Bluetooth modem (antenna), compact flash card, card reader, adapter, pipe mounting system, suspension bracket, etc.

You can find more information in the instruction manual or on www.nivus.com

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