Instruction Manual for
PCM Pro Measurement Device

(Original Instruction Manual – German)

valid as of Software-Revision No 3.25

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Translation
If the device is sold to a country in the European Economic Area (EEA) this instruction handbook must be translated into the language of the country in which the device is to be used.
Should the translated text be unclear, the original instruction handbook (German) must be consulted or the manufacturer contacted for clarification.

Names
The use of general descriptive names, trade names, trademarks and the like in this handbook does not entitle the reader to assume they may be used freely by everyone. They are often protected registered trademarks even if not marked as such.

1 Contents

1.1 Table of Contents

1.2 Ex-Approval

Translation

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment and protective systems intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

TÜV 03 ATEX 2268

(4) Equipment: Portable measuring transformer type PCP/E...

(5) Manufacturer: NIVUS GmbH

(6) Address: D-75031 Eppingen, Im Täle 2

(7) This equipment or protective system and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV NORD CERT GmbH & Co. KG, TÜV CERT-Certification Body, notified body number N° 0032 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential report N° 03 YEX 551074.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 EN 50019:2000 EN 50020:2002

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment or protective system must include the following:

II 2 G EEx e ib IIB T4

TÜV NORD CERT GmbH & Co. KG
TÜV CERT-Certification Body
Am TÜV 1
D-30519 Hannover
Tel.: 0511 986-1470
Fax: 0511 986-2555

Hanover, 2003-12-05

Head of the Certification Body

TÜV NORD CERT

TÜV CERT A4 04.02 10.000 Lö

This certificate may only be reproduced without any change, schedule included. Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH & Co. KG

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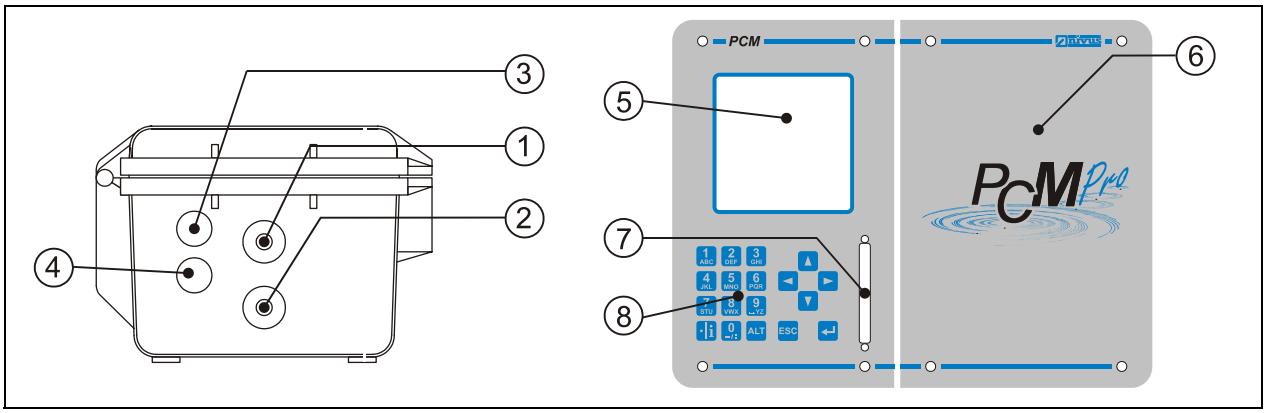
STOP

The approval is only valid in connection with the respective indication on the transmitter's nameplate.

The complete EC-type examination certificate can be downloaded from www.nivus.com.

2 Overview and use in accordance with the requirements

2.1 Overview



1 Socket for Bluetooth- / NivuLog PCM Ex
2 Socket for connection of water-combi sensor, type POA
3 Socket for connection of air-ultrasonic sensor Type OCL or external level measurement 4-20 mA (such as NivuCompact)
4 Socket for Sampler control box
5 Display
6 (Rechargeable) battery compartment
7 Compact flash card slot with cover
9 Programming keys

Fig. 2-1 Overview PCM Pro

2.2 Use in accordance with the requirements

The measurement device type PCM Pro including the respective sensor technology supplied by NIVUS is conceived for temporary flow measurement of slight to heavy polluted media in partial and fully filled channels, pipes or similar.
The measurement device works independent from mains.
The storing detected and measured data is on a non-volatile memory medium.
Here the allowed maximum values, as specified in chapter „Specifications“, must be strictly kept. All cases which vary from these conditions and are not approved by NIVUS GmbH in writing are entirely at owner’s risk.

The device is exclusively intended to be used for purposes as described above.
Modifying or using the devices for other purposes without the written consent of the manufacturer will not be considered as use in accordance with the requirements.
Damages resulting from this are left at user’s risk.

2.3 Ex- Approval

The Ex-version of the measurement device, type PCM Pro including the respective active sensors is designed to be used in areas with explosive atmospheres (zone 1). Here, in addition to the sensor, the transmitter is allowed to be placed in the Ex-area too. Programming the unit under Ex conditions by using the internal keyboard is allowed!

Approval

Transmitter: ⟨Ex⟩ II 2 G Ex e ib IIB T4

The approval is only valid in connection with the respective indication on the transmitters or the sensors nameplate.

For installation and initial start-up the conformity certificates and test certificates of the respective authorities must be followed.

The Ex approval of active sensors is included with the "Technical Instructions of Correlation Sensors".

2.4 Specifications

2.4.1 Transmitter

Power Supply	Rechargeable battery pack: 3 x 6 NiMH – rechargeable battery pre-configured with 25.5 Ah or 28.5 Ah capacity Rechargeable battery pack: 3 x 6 NiMH – rechargeable battery pre-configured with 24.0 Ah capacity Battery pack: 3 x 6 alkaline manganese mono cells with 50 Ah or 54 Ah
Enclosure	- Material: Polypropylene, antistatic with graphite admixture - Weight: ca. 2.0 kg (4.41 lbs) (without sensor and rechargeable battery) - Protection: IP67 if lid is closed and locked
Ex-Approval (optional)	II 2 G Ex e ib IIB T4
Operating Temperature	-10 °C to + 40 °C (in Ex zone 1)
Storage Temperature	-30 °C to + 70 °C
max. Air Humidity	90 %, non condensing
Display	backlit graphic display, 128 x 128 pixel
Operation	keys, conversation mode in German, English, French, Italian, Spanish, Polish, Czech and Danish
Plug sockets	- 1 x 4 – 20 mA for external level (2-wire probe) or 1 x active sensor air-ultrasonic for level measurement - 1 x Combination active sensor water-ultrasonic/pressure sensor for velocity and level measurement - 1 x digital input (switching contact) (optional) - 1 x connection socket for sampler connection box - 1 x connection socket for Bluetooth / NivuLog PCM Ex
Storage cycle	1 - 60 minutes, time-cyclical or depending on events
Data storage	- external on plug-in Compact Flash Card up to 128 MB - internal RAM with 8 MB
Data transmission	- via Compact Flash Card - via Bluetooth module (optional) - via GPRS with NivuLog PCM Ex (optional)

2.4.2 Accessories

Memory Card	Type: Compact Flash Card; Capacity: 128 MB
Reading Adapter	Adapter for PCMCIA interface, primarily for reading with laptop or notebook
Reading Device	USB interface for PC connection
Battery pack	Configured NiMH-rechargeable battery pack
3-line battery charger	for configured NiMH-rechargeable battery pack
Pipe Mounting System	for temporary, non-permanent clamping installation of wedge sensors (Water-Ultrasonic Combination Sensor and Air-Ultrasonic Sensor) in pipes DN 200-800 (~ID6 - 32in) and egg-shaped profiles up to h = 600 mm
Sampler connection box	for sampler control in non-Ex areas
Suspension bracket with eyelet	for fastening of the PCM Pro on step irons or similar
Bluetooth module	for connection to PCM Pro
NivuLog PCM Ex	for connection to PCM Pro

3 General Notes on Safety and Danger

3.1 Danger Notes

3.1.1 General Danger Signs

Cautions
are framed and labelled with a warning triangle.

Notes
are framed and labelled with a "hand".

Danger by electric voltage
is framed and labelled with the Symbol on the left.

Warnings
are framed and labelled with a "STOP"-sign.

For connection, initial start-up and operation of the PCM Pro the following information and higher legal regulations (e.g. in Germany VDE), such as Ex-regulations as well as safety requirements and regulations in order to avoid accidents, must be kept.
All operations, which go beyond steps to install, to connect or to program the device, must be carried out by NIVUS staff only due to reasons of safety and guarantee.

3.1.2 Special Danger Notes

Please note that due to the operation in the waste water field transmitter, sensors and cables may be loaded with dangerous disease germs. Respective precautionary measures must be taken to avoid damage to one's health.

3.2 Device Identification

The instructions in this manual are valid only for the type of device indicated on the title page.
The nameplate is fixed on the bottom of the device and contains the following:

- Name and address of manufacturer
- CE label
- Type and serial number
- Year of manufacture
- Ex-label (on Ex-version devices only) as mentioned in chapter 2.3

It is important for queries and replacement part orders to specify type, year of manufacture and serial number (Article no. if necessary). This ensures correct and quick processing.

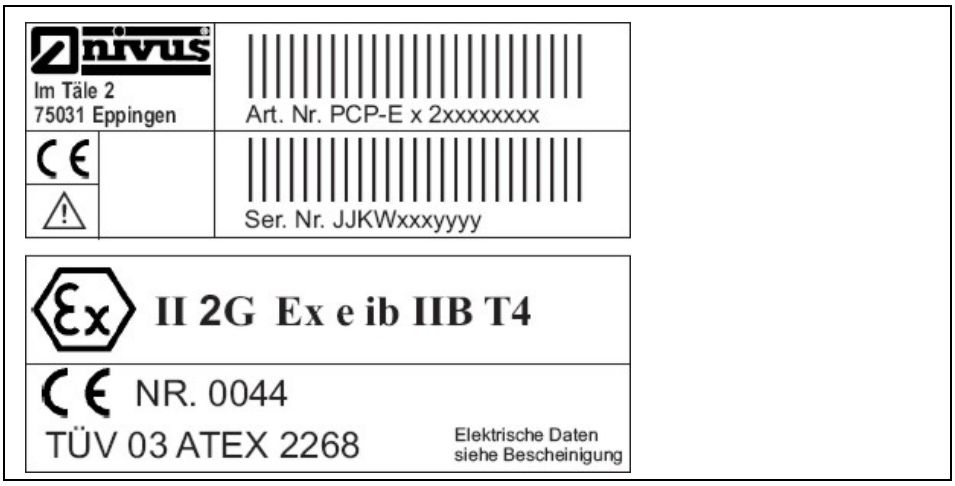


Fig. 3-1 PCM Pro nameplate

This instruction manual is a part of the device and must be available for the user at any time.

The safety instructions contained within must be followed.

It is strictly prohibited to disable the safety devices or to change the way they work.

3.3 Installation of Spare Parts and Parts subject to wear and tear

We herewith particularly emphasize that replacement parts or accessories, which are not supplied by us, are not certified by us, too. Hence, the installation and/or the use of such products may possibly be detrimental to the device's ability to work.
Damages caused by using non-original parts and non-original accessories are left at user's risk.

If spare parts or other parts (e.g. batteries, filters or similar) which are not licensed by NIVUS are used, the Ex-approval expires.

3.4 Turn-off Procedure

For maintenance, cleaning and repairs (authorized staff personnel only) the device has to be disconnected from battery.

3.5 User's Responsibilities

In the EEA (European Economic Area) national implementation of the framework directive 89/391/EEC and corresponding individual directives, in particular the directive 89/655/EEC concerning the minimum safety and health requirements for the use of work equipment by workers at work, as amended, are to be observed and adhered to.
In Germany the Industrial Safety Ordinance of October 2002 must be observed.

The customer must (where necessary) obtain any local **operating permits** required and observe the provisions contained therein.
In addition to this, he must observe local laws and regulations on

- personnel safety (accident prevention regulations)
- safety of work materials and tools (safety equipment and maintenance)
- disposal of products (laws on wastes)
- disposal of materials (laws on wastes)
- cleaning (cleansing agents and disposal)
- environmental protection

Connections

Before operating the device the user has to ensure, that the local regulations (e.g. for operation in channels) on installation and initial start-up are taken into account, if this is both carried out by the user.

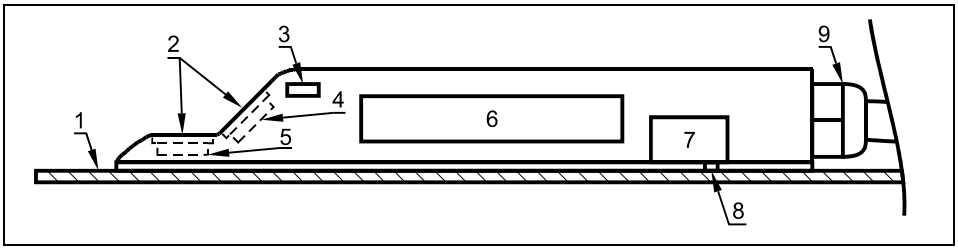
4 Functional Principle

4.1 General

The PCM Pro is a portable measurement system for non-continuous flow measurement and data storage of slight to heavy polluted media with various compositions. It can be operated in partial and fully filled channels and pipes with various geometries and dimensions.

The measurement method is based on the ultrasound reflection principle. Hence, it is indispensable for the system to work that there are particles in the water, which are able to reflect the ultrasonic signal sent by the sensor (dirt particles, gas bubbles or similar).

The PCM Pro uses combination sensor, which simultaneously determines flow velocity and flow level.
The filling level can be measured by using water ultrasonic, pressure or a combination of both depending on the selected type of sensor.
For the ultrasonic measurement (flow level and flow velocity), 2 particular piezo crystals are used which, independent from each other, operate as transmitter as well as receiver.



1 Ground Plate
2 Acoustic coupling layer
3 Temperature Sensor
4 Flow Velocity Sensor
5 Level Sensor
6 Electronics
7 Pressure Sensor
8 Duct to Pressure Measurement
9 Cable Gland

Fig. 4-1 Construction combi sensor type “Pro“ for ground installation

You can find >Technical Information< and specifications such as

- sensor dimensions
- wiring
- sensor cable

on the sensors used in a separate instruction manual.

4.2 Level Measurement via Water Ultrasonic

Depending on the selected type of sensor up to two level measurements can be integrated in the water ultrasonic combination sensor:

- water ultrasonic and
- hydrostatic level measurement.

At level measurement by using water ultrasonic the horizontal sensor crystal works according to the ultrasound travel time method. The time between transmitting and receiving an impulse reflected from the water surface is measured.

$$h = \frac{c \bullet t_l}{2}$$

h = Filling Level
c = Sound Travel Time
t_1 = Time between Transmission and Receiving Signal

The sound travel time within water is 1480 m/s (4.85 fps) at 20 °C (68 °F).
The divergence depending on the temperature is 0.23 % per Kelvin.
To ensure a level measurement which is accurate to the millimetre the medium temperature is constantly investigated and the sound travel time is corrected respectively.
The fixed level, which is determined by the sensor crystal position, is added to the determined value h_1. This results in the total level h.

4.3 Level Measurement via Pressure

Depending on the used sensor type an additional hydrostatic level measurement may be integrated in the combination sensor.
The piezoresistive pressure sensor operates according to the relative pressure principle. The pressure of the static water column above the sensor is direct proportional to the filling level. This sensor enables to determine filling levels if the combination sensor is not installed in the centre.
The pressure sensor is adjusted by entering a manually determined reference value at the initial start-up. Additionally, a height caused by the sensor installation is added.

4.4 Flow Velocity Capture

The piezo crystal which has a slope to the flow direction operates as a flow velocity sensor. Here an ultrasonic burst with a defined angle is sent into the medium. All the particles in the measurement path (air, dirt) reflect a small amount of the ultrasonic signal. Depending on shape and size of the particle a particular signal results. Hence, the multitude of the reflected signals results in a reflection pattern (see Fig. 4-2). This signal pattern is saved in a digital signal processor (DSP).

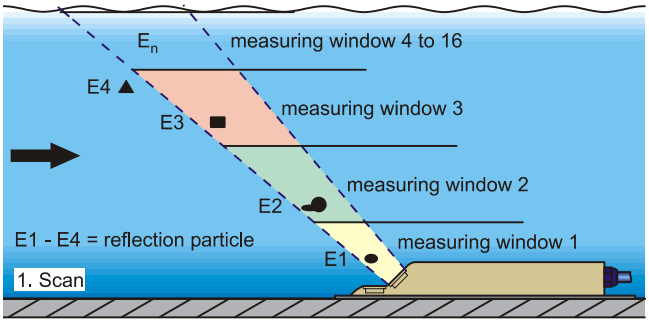


Fig. 4-2 Situation at first signal detection

After a certain period a second ultrasonic burst is sent into the medium. The newly generated reflection signal is saved in the DSP too.
In various flow levels there are different flow velocities (flow velocity profile). Depending on the level, the reflecting particles' movement away from the first measurement point therefore varies. Hence, a distorted reflection pattern results (see Fig. 4-3). At the same time slightly different reflections occur: some particles have been turning around and thus have another shape of reflection; some particles are no longer within the measurement range and others (new) have now moved into the measurement range.

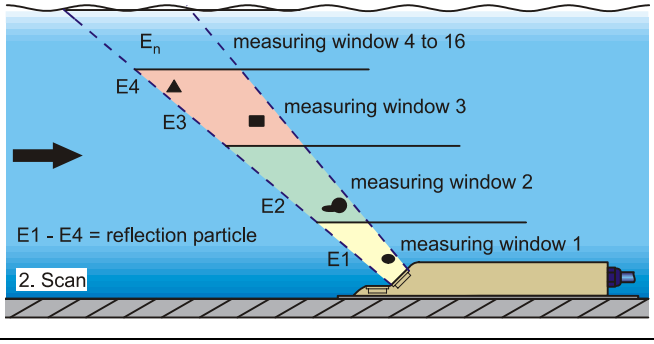


Fig. 4-3 Situation at second signal detection

The DSP checks both the received reflection patterns for similarities using the cross correlation method. All existing signal differences are rejected so that two similar but temporarily offset signal patterns are left for velocity evaluation. Depending on the flow levels both patterns are subdivided into 16 measurement windows. Then, in each measurement window the lag Δt of the signal pattern is investigated (see Fig. 4-4).

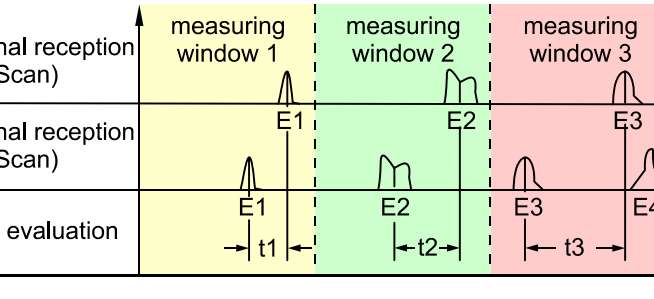


Fig. 4-4 Echo signal images and evaluation

Based on the beam angle, the interval between both transmitted signals and the lag of the signal pattern therefore in each single measurement window the flow velocity can be determined.
It mathematically strings together the single flow velocities results in the flow profile which is indicated on the display of the PCM Pro.

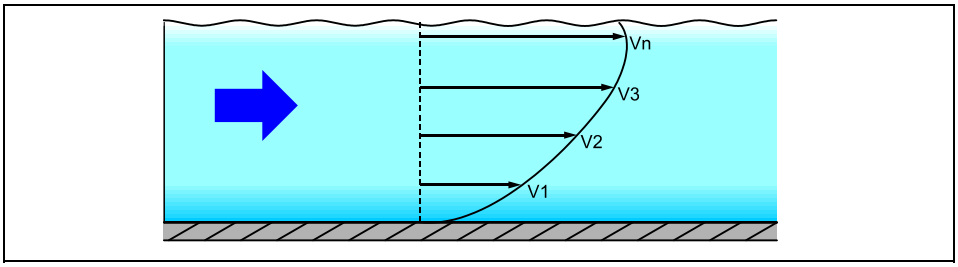


Fig. 4-5 Evaluated flow profile

The flow rate is calculated, indicated and saved based on this flow velocity distribution and using channel shape, channel dimensions and filling level.

4.5 Device Variations

Transmitter

The transmitter is currently available as one version.
The current type of device is indicated by the article number, which can be found on a weatherproof label on the rear side of the enclosure.
From this article key the type of device can be specified.

PCP-E02PRO	**Portable Ex protected flow measurement transmitter, includes NivuDat software for Windows NT / 2000 / XP**

Fig. 4-6 Type keys for PCM Pro transmitters

5 Storing, Delivery and Transport

5.1 Receipt

Please check your delivery according to the delivery note for completeness and intactness immediately after receipt. Any damage in transit must be instantly reported to the carrier. An immediate, written report must be sent to NIVUS GmbH Eppingen as well.
Please report any delivery incompleteness in writing to your representative or directly to NIVUS Eppingen within two weeks.

Mistakes cannot be rectified later!

5.1.1 Delivery

The standard delivery of the PCM Pro measurement device contains:

- The instruction manual with the certificate of conformity. Here, all necessary steps to correctly install and to operate the measurement system are listed.
- PCM Pro measurement transmitter
- One special socket
- readout software, Type NivuSoft for operating systems such as Windows XP, Windows Vista or Windows 7

Additional accessories such as rechargeable battery, power adapter/battery charger, Compact Flash Card, sensors, separate level measurements and more depending on order. Please check by using the delivery note.

5.2 Storing

The following storing conditions must be strictly kept:

Transmitter:	max. temperature:	+ 60° C (+140° F)
	min. temperature:	0° C
	max. humidity:	90 %, non-condensing
Rechargeable battery:	max. temperature:	+ 25° C (+77° F)
	min. temperature:	+ 5° C (+41° F)
	max. humidity:	60 %

Remove the batteries from the PCM Pro and keep them in a frost-free place before storing.

The devices must be protected from corrosive or organic solvent vapours, radioactive radiation as well as strong electromagnetic radiation.

5.3 Transport

The Transmitter is conceived for harsh industrial conditions. Despite this do not expose it to heavy shocks or vibrations.
Transportation must be carried out in the original packaging.

Use the unit handle to carry the PCM Pro in the measurement place area!
Carrying, lifting or lowering the device on the sensor cable is not allowed!

5.4 Return

The unit must be returned at customer cost to NIVUS Eppingen in the original packaging.
Otherwise the return cannot be accepted!

6 Installation

6.1 General

Before feeding the rated voltage the transmitter and sensor installation must be correctly completed. The installation should be carried out by qualified personnel only.

Sensor Installation

Each sensor comes with an „Installation Instruction for Pipe and Wedge Sensors“. Please refer to this manual for sensor installation.

For use in accordance with the requirements – flow detection – and the further use of the gained data it is necessary to have comprehensive knowledge about hydraulic conditions. Please note that improper, faulty or unsuitable installation as well as selecting unsuitable or hydraulically problematic measurement places may lead to faulty or incomplete measurement values which may be insufficient for further processing and editing. This is why the installation should be carried out by authorized personnel only.

If required, NIVUS can organise any training on hydraulics / device specs. Further statutory standards, regulations and technical rulings have to be taken into account.

6.2 Transmitter Installation and Connection

General

The transmitters mounting place has to be selected according to certain criteria. Please strictly avoid:

- direct sunlight (use weatherproof cover if necessary)
- heat emitting objects (max. ambient temperature: +40°C (104°F))
- objects with strong electromagnetic fields (e.g. frequency converters)
- corrosive chemicals or gas
- mechanical shocks
- installation close to footpaths or travel ways
- vibrations
- radioactive radiation

The PCM Pro shall be suspended into shafts or manholes only by using the carrying handle and sufficient straps, ropes or similar.
It is not allowed to suspend the unit by using the sensor cable as this may lead to cable breaks, leaky plug connections or the transmitter may be torn off and even get lost.

The fastening is made on the grip of the PCM Pro by using a suspension gear (Art.-Nr.: PCM0 ZMSH AK01 000) or another sufficient construction; e.g. on the pole steps of the climbing shaft.

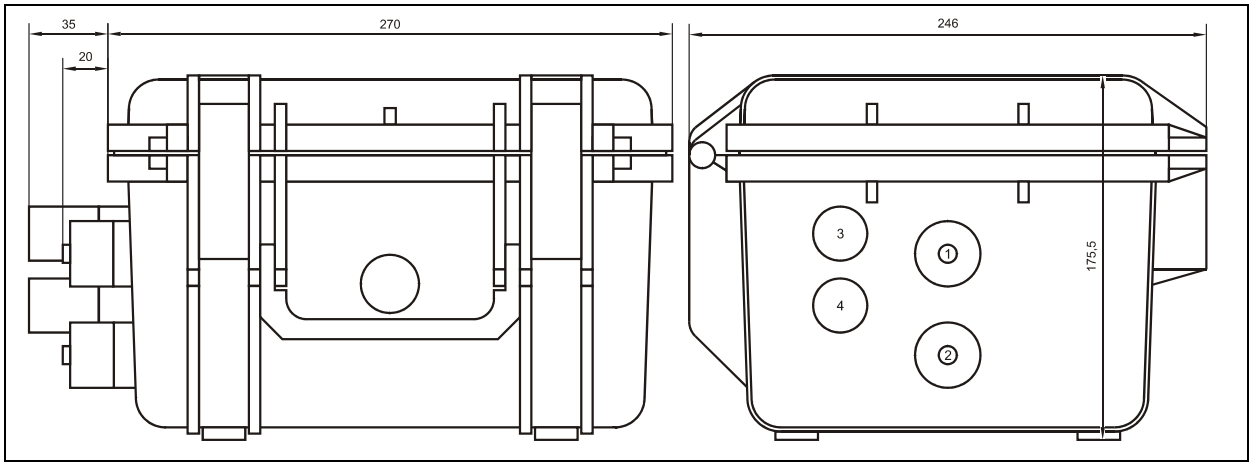
Before locking the enclosure lid please make sure that the sealing is not damaged and clean. Debris and/or dirt shall be removed and the gasket shall be greased again with silicone if required. Damages resulting from leakage or defect sealing are not covered by the manufacturer's liability.

If placed in flood shafts or channels the transmitter must be secured in order to prevent it from being washed away unintentionally (use suspension gear, plastic or steel rope, chain or similar).

Sockets on the PCM Pro which are not required for measurements, sensors or data transmission must be locked watertight before installation by using the covers fastened on each socket. Otherwise the protection grade of the entire unit is no longer guaranteed. Damages resulting from the non-use of the covers are not covered by the manufacturer's liability.

Covers damaged due to the use of force can be ordered from NIVUS at extra costs.

Dimensions



1 8-pole flange socket for Bluetooth- or GPRS module
2 Socket for Water – Ultrasonic combination sensor
3 Socket for Air-Ultrasonic sensor / 2 wire probe
4 7-pole flange socket for sampler connection box

Fig. 6-1 PCM Pro Enclosure and connection sockets

6.3 Sensor connection

6.3.1 Water-Ultrasonic Combi Sensor and Air-Ultrasonic Sensor

Water-ultrasonic combination sensor as well as air-ultrasonic sensor are equipped with the respectively wired plugs. These plugs must be connected to the transmitter according to Fig. 6-1. To do this, unscrew the protective covers from the required sockets, plug in and manually tighten the screw caps on the plugs in order to ensure the grade of protection and secure contact and sensor plug. Protective covers of sensor plugs and sockets shall be screwed together to prevent them from getting dirty.

Keep threads of plugs and sockets carefully free of dirt, sand or similar and clean the threads with a soft and lint-free cloth prior to connection if required.

Sensors with an integrated pressure cell are equipped with an additional air filter with a dehydration agent on the connection plug. This air filter is necessary to constantly adjust the pressure cell according to the current air pressure.

If the colour indicator contained within the dehydration agent turns from blue to pink the filter must be replaced immediately.

Spare filters with plug and connection hose are available from NIVUS under Art.-No. *ZUB0 FILTER*

If there is a risk of flooding the filter please ensure to correctly install the air hose. This means that the air hose must be installed without sharp bends above the possible maximum water level.

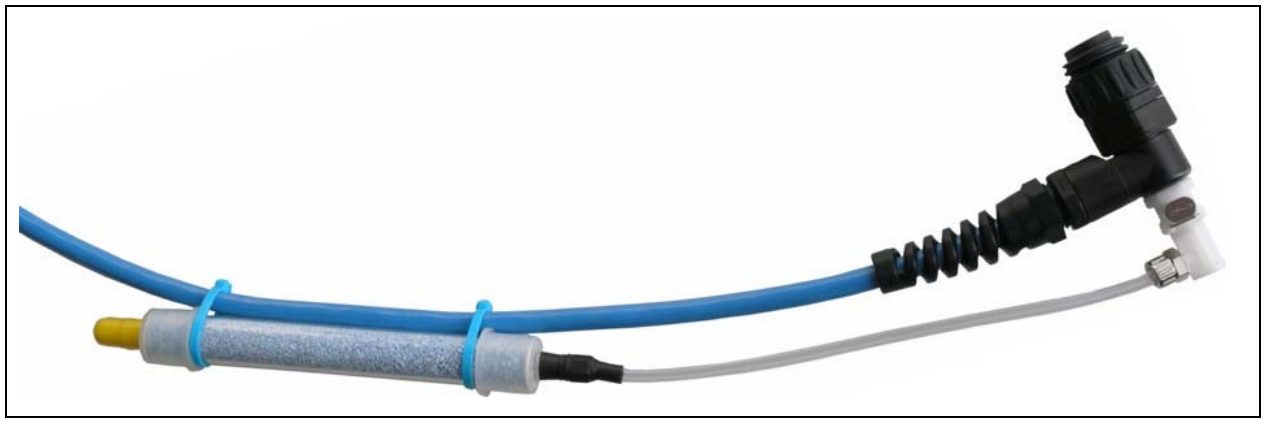


Fig. 6-2 Connection plug with air filter

When using sensors with integrated pressure cell and air filter never operate the transmitter without the filter!

If the filter plug is removed from the sensor plug it will be locked automatically. This prevents water from getting into the sensor, but air balance is impossible too. It is no longer possible to accurately measure the filling level by using the pressure cell then.

The air balance hose must neither be hanging in the water nor be blocked or have sharp bends. Please ensure continuous and unhindered air flow into the filter.

6.3.2 2 Wire Sensors

External 4 - 20 mA 2-wire sensors (such as compact echo sounder Type NivuCompact, hydrostatic level measurement Type NivuBar Plus, ...) can be connected to the PCM Pro for level measurement. The supply voltage for the sensors is 16 V.
Connect the sensors to PCM Pro via socket 3 (see Fig. 6-1).
There are pre-configured cables with various lengths available:

Art. No	**Wire colour**	**Function**	**Cable length**	**Pin assignment on plug**
ZUB0KABNMC10S0 (PCM Pro –> 2-wire 4-20 mA sensor)	brown white	16 V (+) GND (-)	10 m	3 4
ZUB0KABNMC20S0 (PCM Pro –> 2-wire 4-20 mA sensor)	brown white	16 V (+) GND (-)	20 m	3 4
ZUB0KABNMC30S0 (PCM Pro –> 2-wire 4-20 mA sensor)	brown white	16 V (+) GND (-)	30 m	3 4

6.4 PCM Pro Power Supply

General

The PCM Pro is equipped with a state-of-the-art rechargeable NiMH battery pack. This pre-configured battery pack ensures long lifetime of the measurement as well as safe operation in conformity with Ex-conditions.
The rechargeable battery is placed in an upholstered battery case. This case is locked with a lid and 4 safety screws. The safety screws prevent the lid to be opened by unauthorized persons within the Ex area (special socket wrench required).

If spare parts or other parts (e.g. batteries or similar) which are not licensed by NIVUS are used, the Ex-approval expires.

The battery case must always be firmly locked during operation.

The safety screws must not be replaced by usual screws.

Please ensure to dispose of your batteries according to your countries respective environmental regulations and laws.
Used NiMH batteries can either be returned to the manufacturer or taken to respective collecting points.

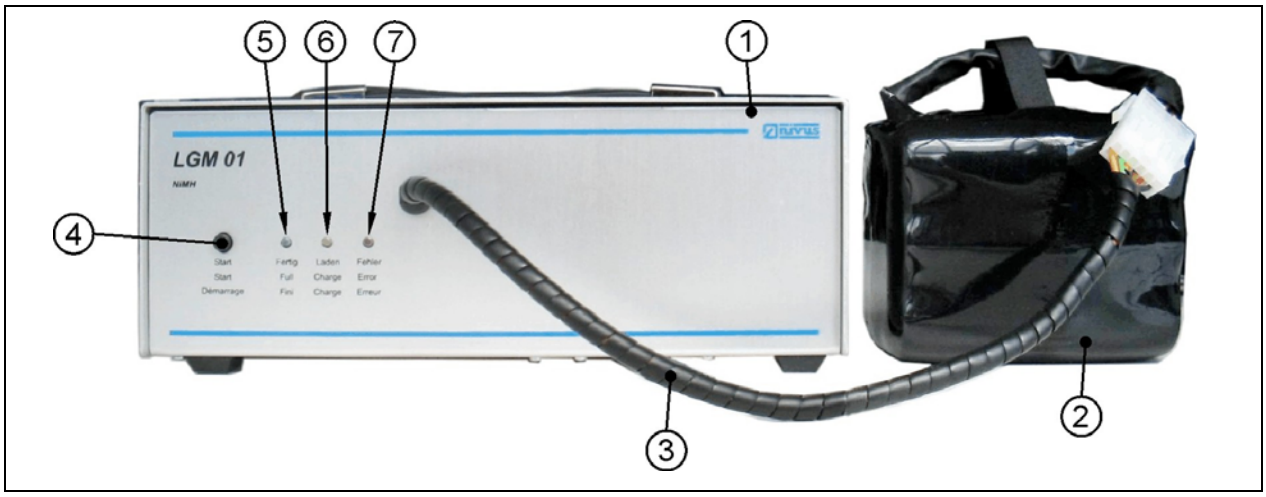
6.5 Charging the Battery charging

The rechargeable battery normally comes in charged condition. Due to reasons of operational safety the battery must be charged before the first initial start-up however.
To replace the battery pack within the Non-Ex-area unscrew the 4 cover screws by using the supplied socket wrench and remove the lid. Disconnect the rechargeable battery and remove it. Firmly tighten the screws (see Fig. 2-1) of the battery case lid after replacement.
The required socket wrench comes with the PCM Pro (see chapter 5.2). If this key is lost, it can be ordered from NIVUS (Art-No. PCP5 ZKEY 1000 000) at extra cost.

The battery pack must not be replaced within Ex-areas. Charging the batteries is allowed in non-Ex-areas and in dry environments only

To charge the NiMH battery, use exclusively the 3-line battery charger by NIVUS. Please note the specifications of the battery charger.

The use of inappropriate battery chargers may lead to battery damage such as battery leakage, explosion etc.



1 Battery Charger
2 NiMH – rechargeable Battery
3 Cable
4 Start – Button
5 Display > ready < green LED
6 Display > load < yellow LED
7 Display > error < red LED

Fig. 6-3 Battery Charger with rechargeable battery

Connect the rechargeable battery with the charger. Start charging by pressing the >Start< key. The display shows >Charge< while the battery is charged. After charging is finished this will be indicated by the >Ready< display.
After that the battery charger turns to the compensation charge mode.
This will lit the green and the yellow LED simultaneously.

The red LED is lit in case of error. he reasons may be cable break, short circuit or defect cells.
In this case the used rechargeable battery must be replaced by a new one.

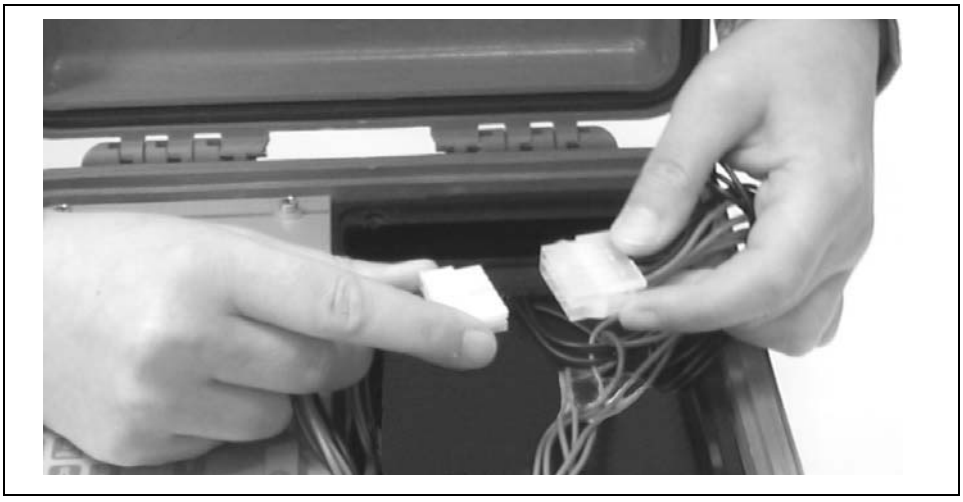


Fig. 6-4 Connection Rechargeable Battery

The maximum capacity of the rechargeable NiMH battery is going to deteriorate in the course of time. This will reduce the lifetime which cannot be considered by the integrated lifetime calculation function of the PCM Pro.
High or low ambient temperatures and long periods of use are going to reduce the battery capacity as well.
In order to protect the cable the rechargeable battery must be installed as shown in Fig. 6-5.

Fig. 6-5 Rechargeable Battery inside of PCM Pro

Rechargeable batteries are parts subject to wear and tear und must therefore be replaced after a maximum of 2 years.

This period may be shorter if used extensively.

The rechargeable battery should be charged each time before using the PCM Pro.
Remove unused batteries after the last measurement, store them in a dry and frost-free place and recharge them after 2 months in order to keep the capacity as long as possible.

STOP

The use of spare / replacement parts (such as rechargeable batteries or similar) not authorised by NIVUS will invalidate liability claims.

Always keep the battery compartment firmly locked during operation.

Please make sure to dispose of rechargeable batteries or standard batteries according to laws on environments.

Used batteries can be returned to the manufacturer or can be brought to appropriate collecting points.

Never remove other screws than the safety screws on the battery cover from the unit enclosure!

7 Initial start-up

7.1 General

Notes to the user

Before you connect and operate the PCM Pro you should strictly follow the notes below!
This instruction manual contains all necessary information to program and to operate the device. It is addressed to qualified technical staff who have appropriate knowledge about measurement technology, automation technology, information technology and waste water hydraulics.
To ensure a correct function of the PCM Pro this instruction manual must be read thoroughly!
If any problems regarding installation, connection or programming should occur please contact our technical division or our service centre.
To put the entire measurement system into operation consult the "Installation Instruction for Pipe and Wedge Sensors“ as well as the „Technical Instruction of Correlation Sensors“ additionally. These documents are part of the standard sensor delivery.

General Principles

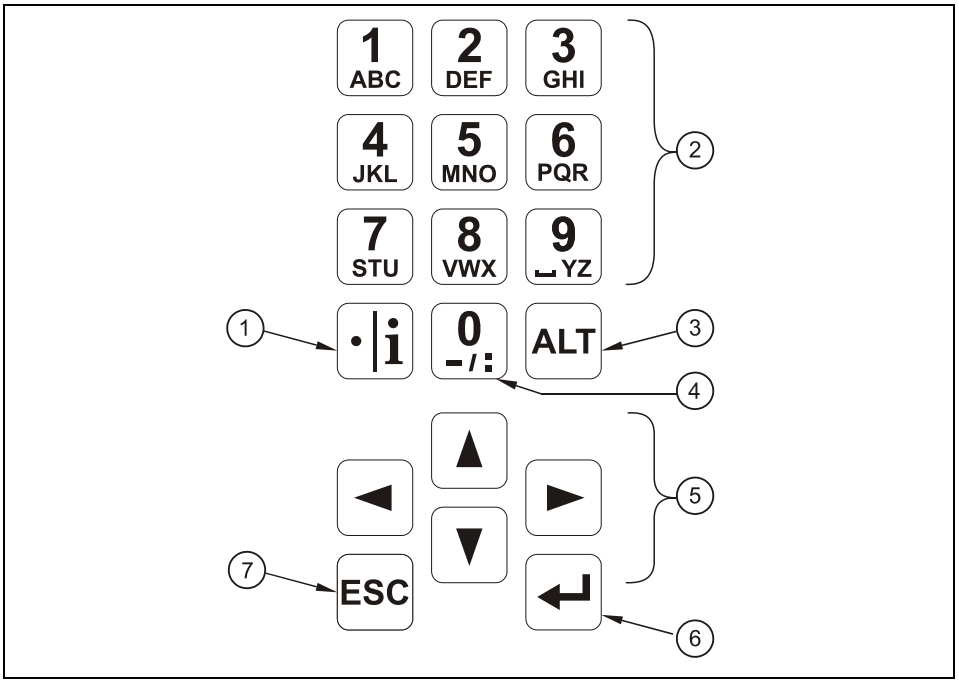
The initial start-up is not allowed until the installation is finished and checked. To exclude faulty programming this instruction manual must be read before the initial start-up in order to eliminate the possibility of faulty programming.
Please get used to the PCM Pro programming via display and keyboard by reading the instruction manual before you begin to program the device.
After transmitter and sensors are connected (see chapter 6.2 and 6.3) the parameters must be set. In the most cases all you need is:

- enter the geometry of the measurement place
- select the sensor type for level measurement
- set the storage mode
- the system clock (time and date)

The PCM Pro user surface is designed in a way that even unfamiliar users are able to easily set up basic settings in graphic dialog mode which ensure reliable device operation.
For extensive programming, difficult hydraulic conditions, special channel shapes or absence of expert staff, if high data integrity and high measurement quality are required or if a setup and error protocol is required, the programming should be carried out by the manufacturer or an expert company which is authorised by the manufacturer.

7.2 Keypad

For input of required data, a comfortable 18-button keypad is available.

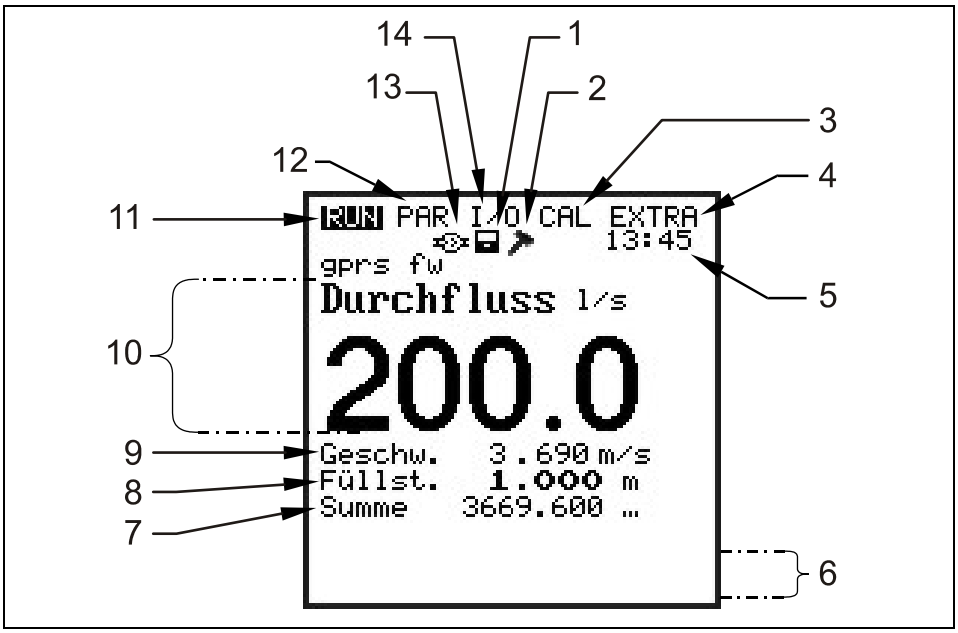


1 Comma / info
2 Figure / letter block
3 Shift key
4 0 / - navigation button
5 Control keys
6 Enter
7 Escape

Fig. 7-1 Keypad

7.3 Display

PCM Pro has a large back-lit graphic display with a resolution of 128 x 128 Pixel. This ensures a comfortable communication mode for the user.



1 Memory mode enabled
2 Service mode enabled
3 Calibration menu
4 Display menu
5 current system clock time, alternately appearing medium temperature
6 Field for indication of digital outputs
7 Total
8 Fill level reading (height)
9 Velocity reading
10 Flow reading
11 Operation menu
12 Parameter menu
13 Symbol for Bluetooth / GSM communication
14 Status menu of inputs, outputs and sensors

Fig. 7-2 Display overview

5 basic menus can be selected, visible in the headline of the display. They are individually selectable:

RUN The standard operation mode. Apart from indicating the names of measurement places it allows to display time, flow volume, flow level, average flow velocity as well as to optionally show flow velocity distribution, day totals error messages including a function enabling to record flow volume, flow level and average flow velocity.

PAR This menu is the most extensive of the PCM Pro. It is for the complete setting of parameters regarding dimensions of the measurement place, sensors, memory mode and other settings such as battery capacity and similar.

I/O This menu includes information about internal operation of the PCM Pro. All current values can be displayed. By using various submenus it furthermore allows to watch echo images from sensors, single velocity evaluations etc. and hence to asses hydraulic conditions at the measuring point and to determine the remaining capacities of memory card and rechargeable battery.

CAL Here it is possible to adjust the level measurements as well as to modify settings regarding the automatic self-calculation of flow volumes.

EXTRA This menu contains basic display settings: contrast, lighting, language, units, system times and totaliser presets.

4 minutes after the last key action the PCM Pro falls into the energy saving standby mode. This means that the PCM Pro turns on in the programmed mode only.

While in memory mode the PCM Pro display is deactivated. In order to verify the memory routines the display will be activated 5 times. After that, the display remains deactivated until the next key action.

7.4 Operation Basics

The entire operation is menu driven and supported by explanatory graphics. To navigate within the menu structure use the 4 control keys (see Fig. 7-1).

◄ ► Use these buttons for selecting the main menus.

▲ ▼ Buttons for scrolling within the menus.

↵ Selected submenus can be entered, inputs can be opened. The “Enter“ key further serves to confirm data entries.

1 ABC – 9 YZ These buttons are used for parameter setting and to enter digits. In some sub menus the buttons are to input letters (e.g. name of measuring point, description of relay output, various storage submenus). Function compares with mobile phone or cell phone buttons: multiple quick pressing switches over to the next letter. The cursor will jump to the next digit if no key will be pressed for approx. 2 seconds.

•|i The key “dot/i“ serves for entering digits. It also recalls internal information about device, software versions and used modules. This key starts the communication between transmitter and sensors.

ALT This button is for switching between uppercase and lowercase letters. In the course of the further programming mode it activates/deactivates various functions. It therefore operates as a toggle switch between different programming options.
Pressing in RUN mode will cause forced storage on Compact Flash Card.

ESC Exit submenus step by step. Will cancel entered data.

Pressing „ESC“ in the main screen for approx. 1 second will bring up a request if the PCM is to be switched off. >YES< will shut the unit down after 5 seconds. Measurements as well as data storage are disabled now (see Fig. 7-3).
The unit will be re-activated using the start assistant 7 seconds after any key has been pressed.

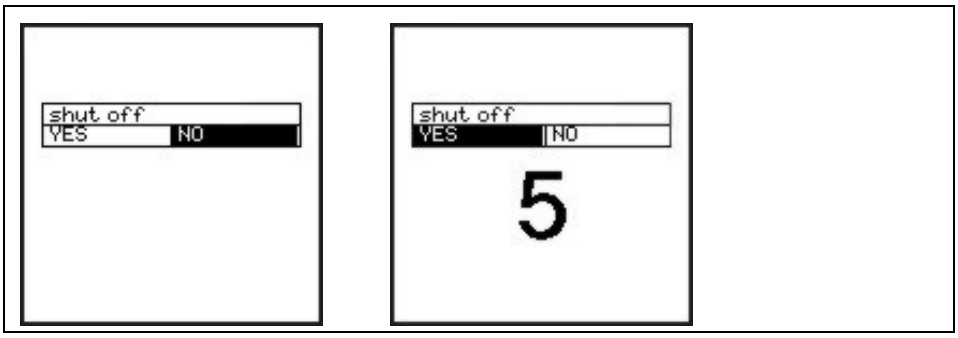


Fig. 7-3 Cutoff PCM

7.5 Measurement and Display Functions

After the program settings have been finished the PCM Pro will restart performing a complete system reset. The unit subsequently begins to measure using the cycle set. The required measurement duration is going to be determined by the PCM within each cycle depending on flow and hydraulic conditions.
The number of storage events per hour will be calculated from a full hour divided by the periodic interval. The reference to calculate the points in time is a full hour.
Example (12 measurement events):

- cycle set: 5 minutes
- programming finished: 12:17 h
- first storage: 12:20 h
- second storage: 12:25 h
- third storage: 12:30 h

and so on

7.5.1 Display Functions in Memory Mode

Possibility 1

The unit has been turned on for maintenance purposes (indication of data, sensor check, battery replacement or similar) without modifying any parameters.

- The device shows the current readings for 4 minutes. New data will be saved in the background according to the current cycle if the interval is set to less than 3 minutes.
  4 minutes after the last key action the unit falls to standby mode and the display goes off. The display subsequently will activate for five times following the cycle set of PCM Pro. Due to energy-saving purposes the display now will not re-activate again and the PCM Pro is going to proceed in the background following the interval set.

Possibility 2

The PCM Pro has been programmed or parameters have been modified. After that the modification has been confirmed by entering the PIN.

- The display goes off for a moment, the PCM Pro is going to restart and subsequently will indicate the current readings for 3 minutes. New data will be saved in the background according to the current cycle if the interval is set to less than 3 minutes.
  4 minutes after the last key action the unit falls to standby mode and the display goes off. The display then will activate for five times following the cycle set. Due to energy-saving purposes the display now will not re-activate again and the PCM Pro is going to proceed in the background following the interval set (see Fig. 7-4).

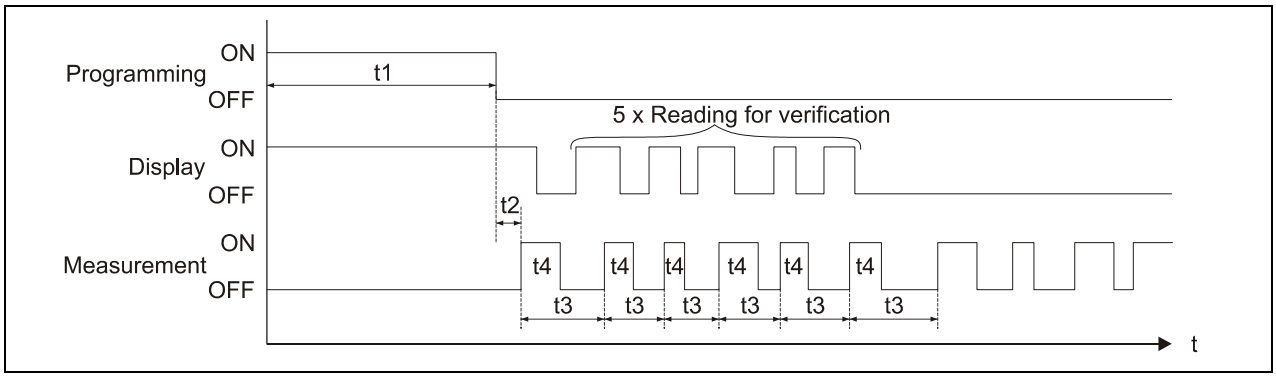


Fig. 7-4 Operation mode of measurement and display after parameter modification

7.5.2 Display Functions without Memory Mode

For initial set-up of the portable flow measurement system in difficult applications, if using the unit for short-term and punctual verification of other metering systems (flumes, weirs, magnetic-inductive systems or similar) or throttles the memory function may be irrelevant. On the other hand it might be important to permanently indicate current readings. The PCM Pro exactly meets the requirements described before since the PCM Pro operates continuously as long as the memory function is disabled.

Current readings are going to be indicated permanently on the display but will not be saved however if the PCM Pro memory mode has not been enabled.

At the same time the power consumption will strongly increase.

8 Parameter Setting

8.1 Parameter Setting Basics

The degree of protection for the unit (see chapter 2.4) can be guaranteed only if the enclosure lid is closed and has been safely locked by using both locks.
Due to this reason always ensure to safely lock the transmitter before you begin data logging, after settings have been finished and first readings have been checked.

In case of unfavourable situations regarding weather conditions (precipitation) or locations with water leaking from above it is necessary to replace / exchange batteries and / or CF card in a dry place.
If this should not be possible protect the opened unit from ingress of moisture sufficiently.

The unit shall be locked safely by using both snap locks after the parameters have been set. Otherwise the protection degree cannot be guaranteed.

In parameter setting mode the unit will proceed to operate in the background using the settings which have been previously saved. Just after you finish the new entries, the system asks to accepting the new values.
“YES“ requires to enter the PIN. Whilst setting parameters the PIN will be requested only once a day!
Exception: the PIN must be entered again as soon as the power supply has been interrupted.

2718 Type in this number if prompted.

Never give the PIN to any unauthorised persons. Even do not leave the PIN next to the equipment or write it down on it. The PIN protects against unauthorized access.

If a faulty PIN has been entered three times the parameter mode will be aborted. The unit will proceed to operate using the values set earlier.
If the correct PIN has been entered the modified parameters are accepted and the system resets. This reset will take approx. 20-30 seconds.

After mounting and installing sensor and transmitter (see previous chapters) activate the power supply. To do this connect the plug in the battery compartment to the socket of the rechargeable battery (Fig. 6-4).

The initial start-up dialog is the language selection:

Fig. 8-1 Language selection

Select the desired language by using the arrow keys and press >Enter< to confirm.

Before every initial start-up a system reset must be carried out in order to reset the unit to default values. This avoids errors caused by unintentional settings.

Carrying out a system reset will erase all customer data.

The battery status is checked after the language has been selected.
This check is necessary in order to compute the remaining battery lifetime.
The current battery voltage is indicated in the top line.

Fig. 8-2 Query Battery full?

There is the possibility to enable the >start assistant< after the interrogation of charge condition (Fig. 8-3).

8.2 Start Assistant

The >start assistant< appears exclusively at first initial start-up, after a system reset, after restarting a deactivated PCM or after reconnecting the battery. It allows a quick start-up guiding the user step by step through the most important setting of parameters. Use >ENTER< to go to the next step. Please find a detailed description of parameters in chap. 8.2.
Select >NO< if you do not wish to use the start assistant (Fig. 8-3). This will directly open the display menu.

Fig. 8-3 Selecting the start assistant

Change set time

Choose >YES<, the clock settings (date and time) can be modified if required. Confirm with >ENTER<. Please observe the clock to be adjusted to the local time.

Fig. 8-4 Modify Set time

Change date and time

Within the system time menu, date and time can be modified. Confirm with >ENTER< to get to the next step.

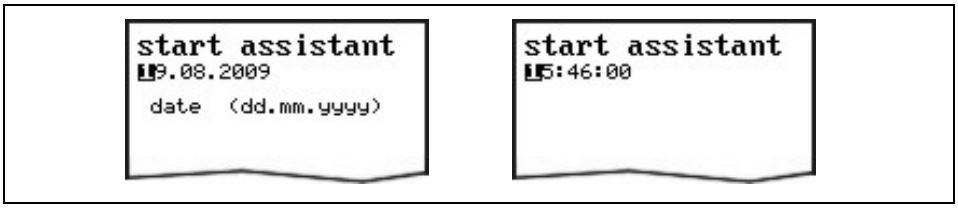


Fig. 8-5 Change Date and Time

Application

This menu allows to select the degree of medium pollution. Toggle between various pollution degrees by pressing the >ALT< key (see chapter 8.5.1). Wastewater (medium pollution), sludge (high pollution) or natural water (slight pollution).

Fig. 8-6 Select medium pollution

Name

NIVUS recommends to coordinate and to define names according to names stated in the respective documents. Names may contain up to 21 letters. Setting the name is quite similar to operating a mobile phone (e.g. SMS) (see chapter 8.5.1).

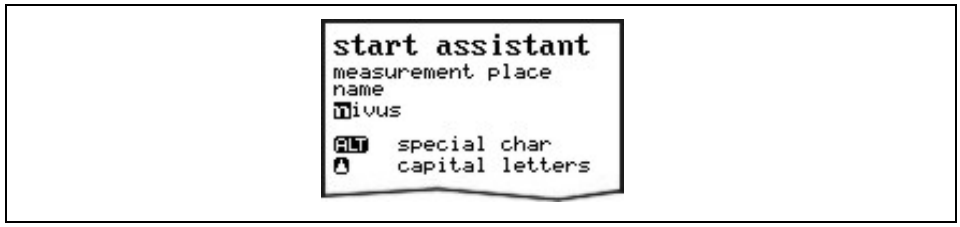


Fig. 8-7 Modify name of measurement place

Channel shape(s)
Channel geometry

Select channel shapes with >left< or >right< arrow keys and confirm with >ENTER<. Select from the following standard profiles according to ATV A110:

- Pipe
- Egg (standard; h:w = 1,5:1),
- Rectangle
- U-Profile
- Trapezoid A = f (h, b) and
- 2r Egg (h:w = 1:1)
- NPP (NIVUS Pipe Profiler).

It is also possible to subdivide special profiles such as Q = f (h), A = f (h), three-part profiles and two-part profiles. Confirm with >Enter< and type in the respective channel dimensions. (see chapter 8.5.1).

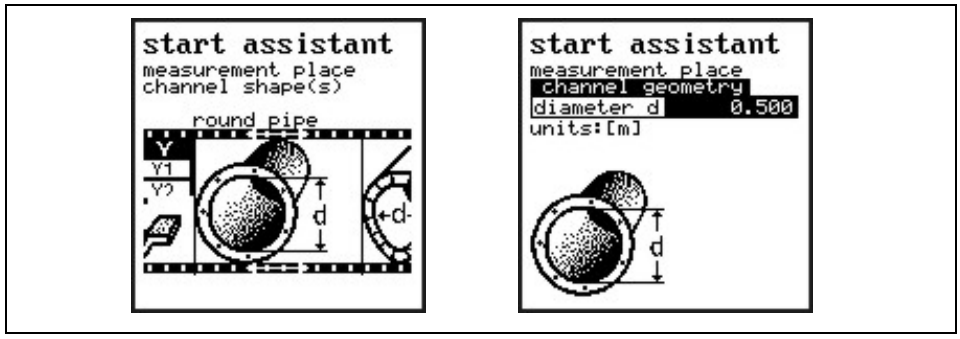


Fig. 8-8 Channel shape and channel geometry selection

*Selecting the channel profile **"NPP"** causes the unit to automatically use optimised settings for measurements in full pipes in the background.*

Sensor type

First of all determine the sensor type(s) by using the arrow keys >up< and >down<. Pressing the >ALT< key will select the respective sensor.
Select the sensors if using more than one and confirm with >ENTER< (see chapter 8.5.1).

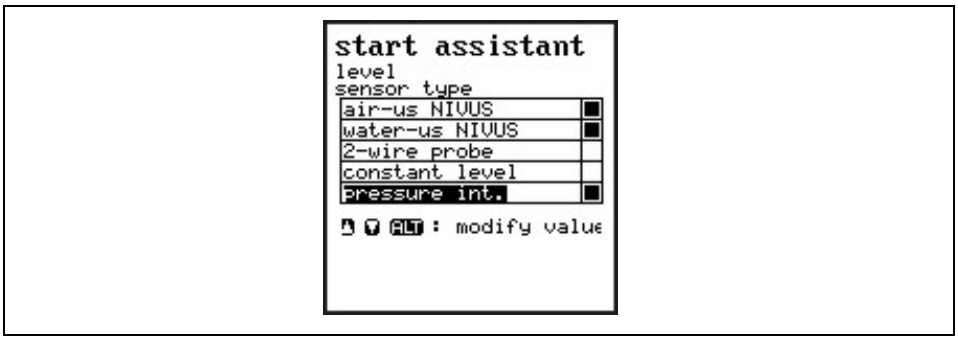
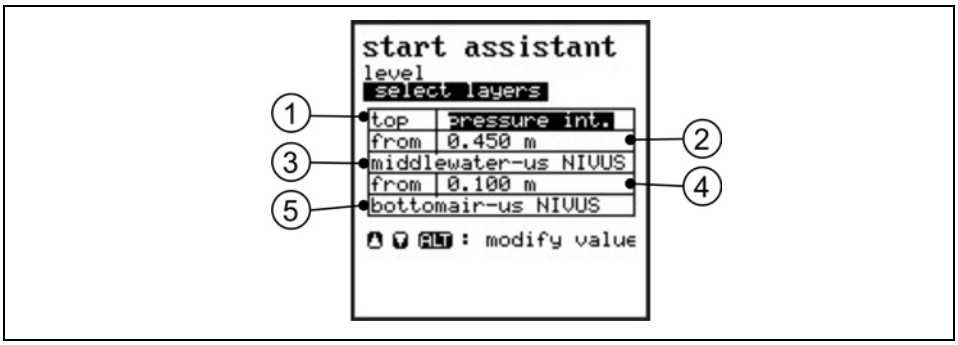


Fig. 8-9 Select level sensor type

Select layers

This parameter will be indicated only if a sensor combination has been selected..
The PCM automatically aligns the sensors to partial layers. Layer borders however may be defined freely as well. Use the >ALT<-key to do this. Determine the threshold levels between the layers using the box in the >from< line (Fig. 8-10; no. 2 and 4).



1 Top layer sensor
2 Threshold level between middle and top layer
3 Middle layer sensor
4 Threshold level between middle and bottom layer
5 Bottom layer sensor

Fig. 8-10 Subdividing level sensors

Mounting offset

In most application this parameter does not need to be changed! This value is set to 10 mm (0.394 in) as standard if the water-ultrasonic sensor (h) has been selected and corresponds with the sensor surface position of the level sensor above the channel bottom.
If the pressure sensor (H) is in use the standard mounting height is 5 mm (0.197 in) , which is the diaphragm position above the channel bottom. Entering the filling level in CAL men will adjust the mounting offset respectively. The mounting offset of the air-ultrasonic (L) sensor is entered automatically after the channel dimensions of the profile have been set.

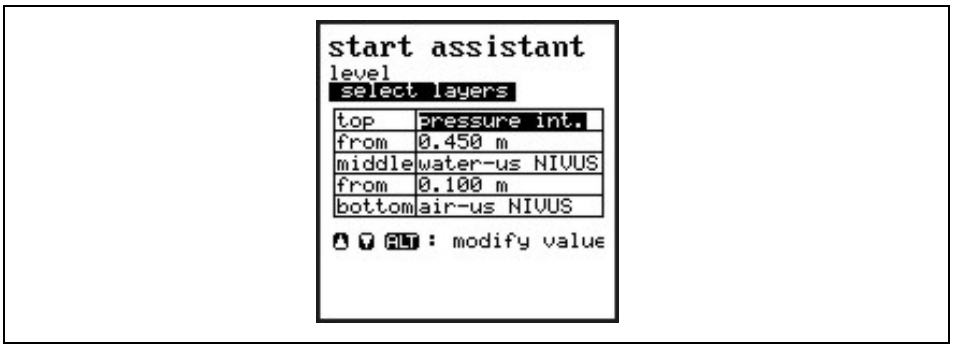


Fig. 8-11 Modifying the mounting offset of level/height sensors

Storage mode

The storage cycles of the compact flash card can be set from 1 to 60 minutes (see chapter 8.5.6).

Fig. 8-12 change storage cycle

Save new values

A request will prompt you to either save all values or not before finishing the start assistant. Reject all values by pressing >No< at the end of the parameter setting procedure. It is possible to jump back to the Start Assistant by using the >Back< function to check all values again. This enables the user to modify settings which might have been forgotten without the need to buffer previously modified settings. “YES“ requires to enter the PIN. All values will be saved subsequently and the unit subsequently will start automatically.

Fig. 8-13 Save new values

Format card

This query is indicated as soon as the name of the measurement place has been changed and only one file containing readings can be saved on the memory card. Choosing >YES< erases all data on CF card and in the flash memory. >NO< brings up the "format card" screen.

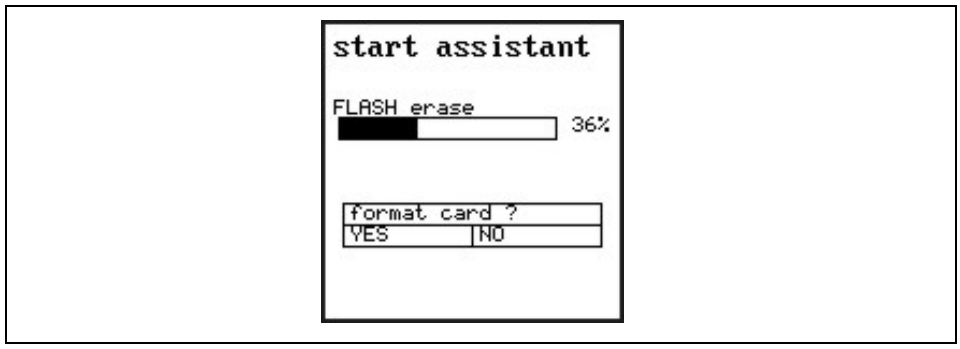


Fig. 8-14 Format card and erase flash memory

8.3 Operation mode (RUN)

This menu is the display menu for standard operation mode. It is not needed for parameter setting. It contains the following sub menus:

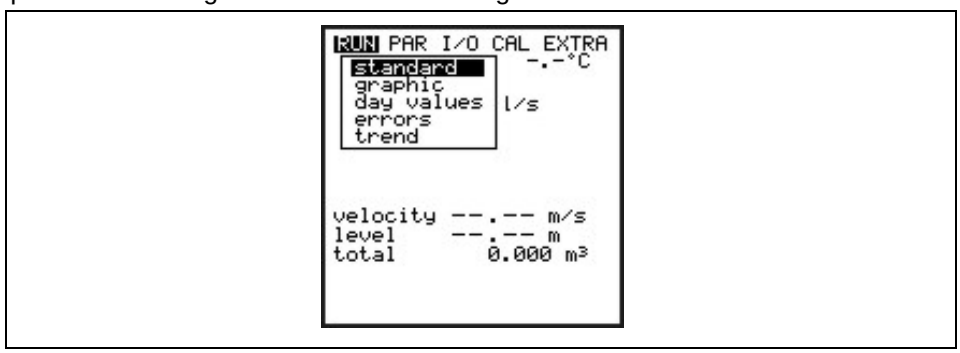
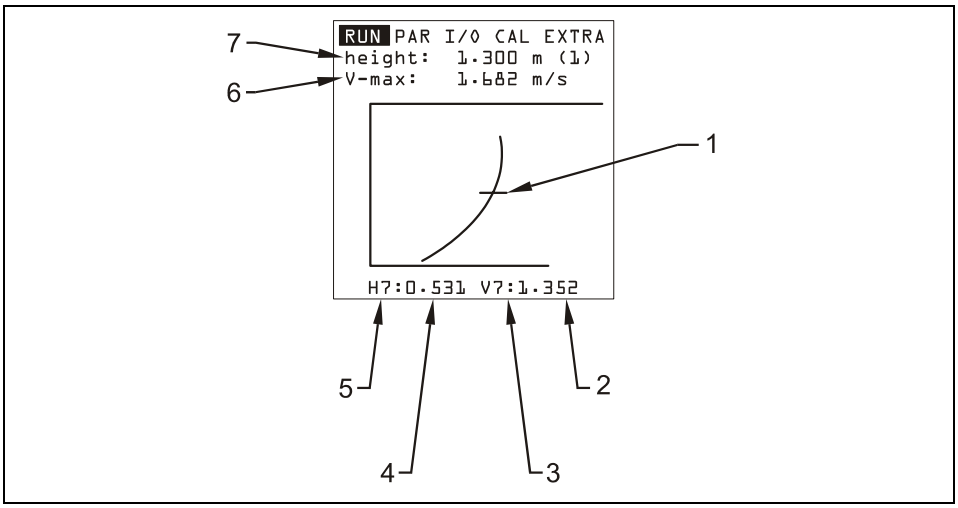


Fig. 8-15 Select operation mode

Standard Display (basic screen) indicating information on the name of measurement place, time, flow quantity, level and average velocity.

Graphic Display of velocity distribution in a vertical measurement path. Pressing the buttons the "arrow up“ or "arrow down“ keys will move the indicator line accordingly.. The selected height as well as the current velocity is displayed in the lower line of the display (see Fig. 8-16)
This graphic indication enables to understand the current flow conditions at the chosen measurement place. The velocity profile should be evenly distributed and should not have any errors (see Fig. 8-17).
For very unfavourable conditions, the mounting position of the sensor should be changed.



1 Measurement Window Indication
2 Velocity Value
3 Velocity Measurement Window no.
4 Level Value
5 Level Measurement Window no.
6 Maximum Measured Velocity
7 Maximum Height

Fig. 8-16 Flow velocity distribution

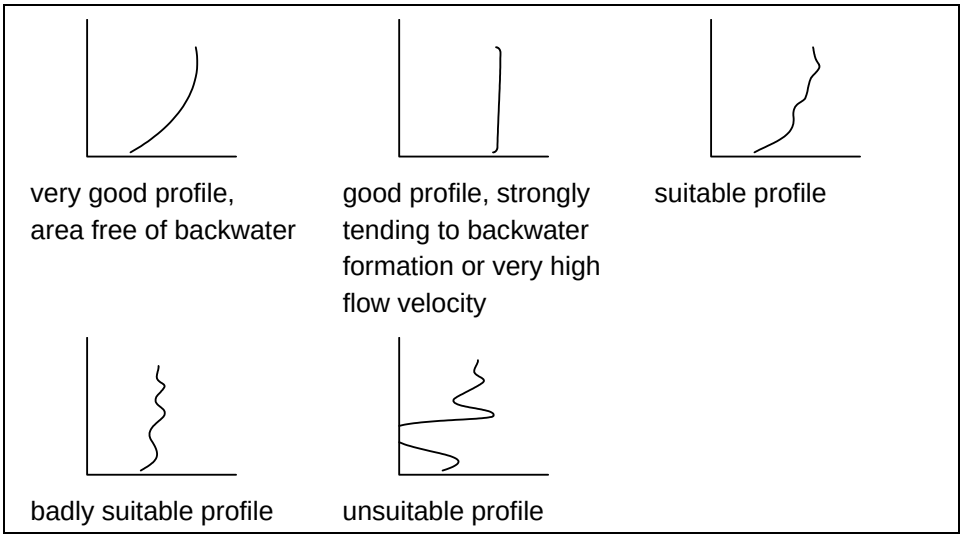


Fig. 8-17 Flow velocity profiles

Day Values

This menu is to indicate day total values.
Additionally, you can get information about partial total value since the last reset (comparable with route mileage counters in cars).
Recall day total values of the past 90 days in the menu point >INFO<.
The totals (difference to previous day) are going to be saved internally for a period of 90 days. These data can be saved on compact flash card using the I/O menu.

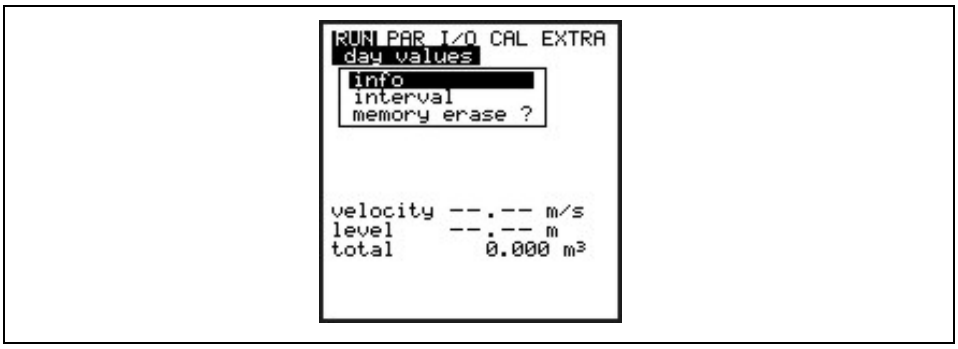


Fig. 8-18 Selecting info menu

INFO

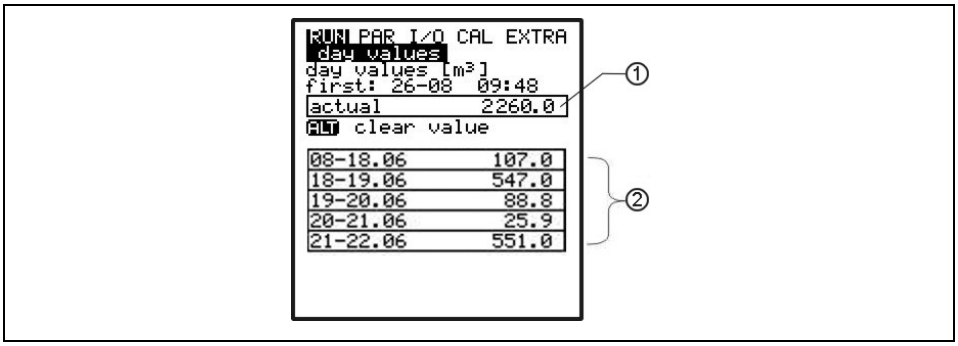
This menu contains the total flow values of the past 7 days (see Fig. 8-19), presumed the transmitter was operated without any interruption in the past seven days. Otherwise it shows the total for the uninterrupted days of operation)
Reset to >0< by pressing the >ALT< key. This reset does not influence the totaliser!

Cycle

Daily totalisation normally is carried out at 00:00 h (midnight). If desired, this value can be modified under RUN – Day Totals - Interval (see Fig. 8-20). The modification however will influence totalisation of day values saved in the internal memory.

Erase memory

Will erase internal totaliser memory. The readings indicated on the display will not be influenced.



1 Day values range
2 Day values

Fig. 8-19 Total day values

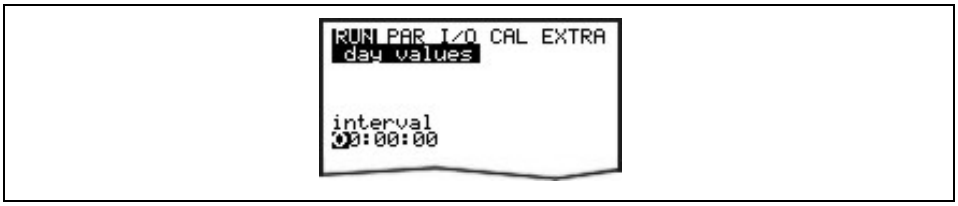


Fig. 8-20 Time of day totalising

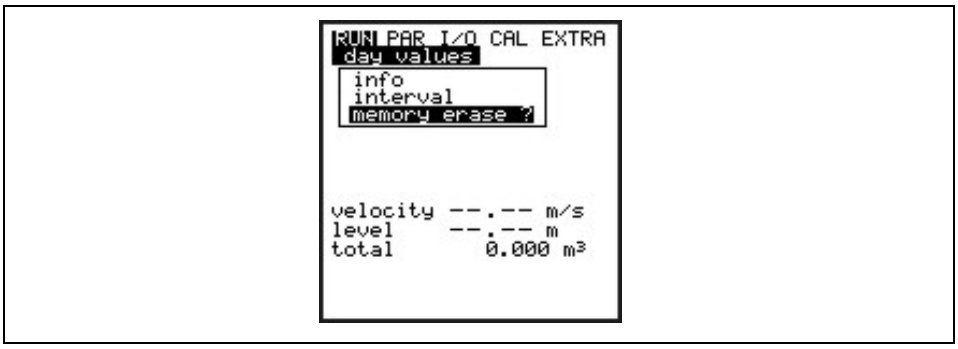


Fig. 8-21 Day values - Erase memory

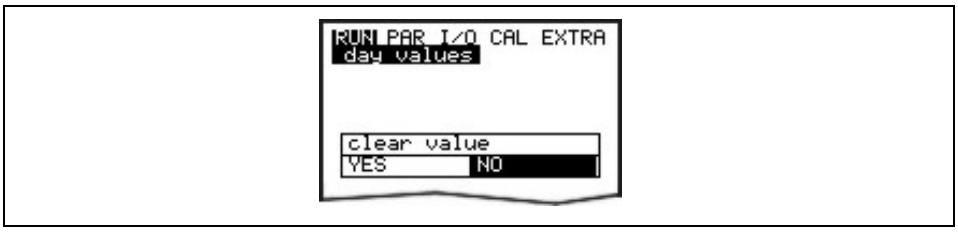


Fig. 8-22 Confirmation clear day values?

Errors

This menu is to monitor any interruptions in the unit function. Errors are going to be saved and ordered by type of error, date and time.
Pressing the >ALT< key will delete all error messages one by one (from the latest one back to the oldest one). To delete an error message is equivalent to confirming it. If the respective error still is present in the moment of confirmation it is not going to be written into the error memory again.

Trend

This menu operates like an electronic logger, saving cycle values on fill level, average flow velocity and height in an internal memory. The capacity of the PCM Pro memory is capable to save readings for each minute within a period of 14 days.
The submenu allows to select and to watch individual trends. This enables to quickly monitor past situations at measurement places on-site without any additional aid.

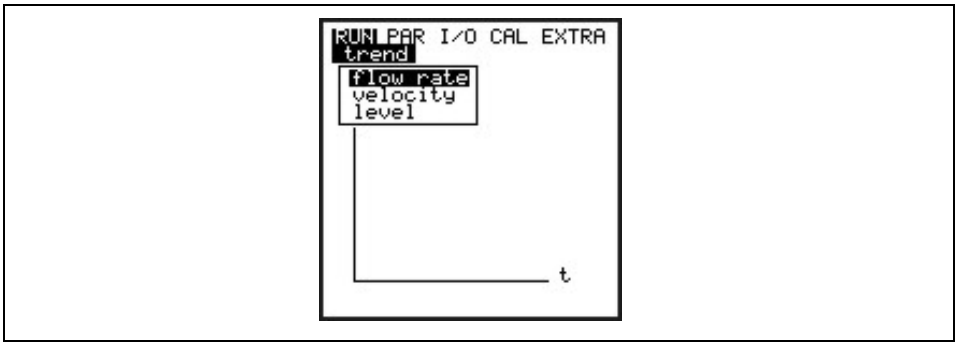
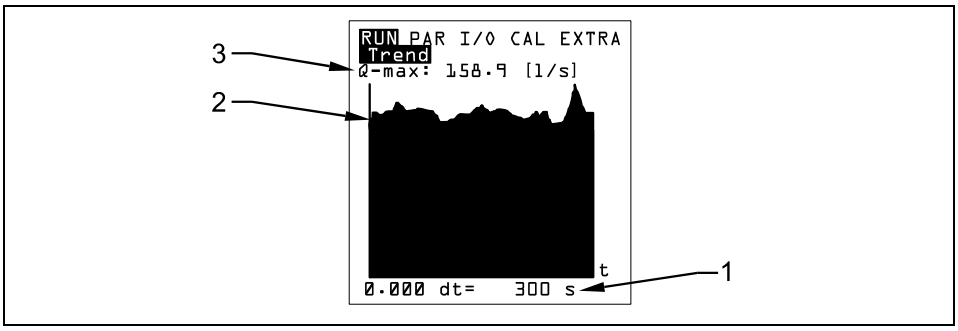


Fig. 8-23 Selection of trend values

The bottom line indicates the specified period including date and time. Select the desired period (max. 14 days) using the >left< and >right< arrow keys.



1 Memory Cycle
2 Graphics
3 maximum Value

Fig. 8-24 Trend graphic example

The internal memory will be erased in case of a system reset. This also removes the trend display of the erased period.

8.4 Display Menu (EXTRA)

In this menu, you have the possibility to control the standard display, units, operation language and the display. It contains the following menus:

Fig. 8-25 Extra submenus

Units

Here you can select between the metric system (liter, cubic meters, cm/s etc.), English system (ft, in, gal/s, etc.) and American system (fps, mgd etc.).
These settings only have an effect on how units are indicated on the display and do not influence the units which are to be saved on compact flash card.
Modify setting regarding the memory card under "Parameters -> Memory mode -> Units".
The next selection will come up automatically after confirmation.
For each one of the following metered or calculated values you can select a unit appearing on the display:

- Flow rate
- Velocity
- Fill level
- Total

Depending on the unit system selected there are various units available

Language

Select from German, English, French, Italian, Czech, Spanish, Polish and Danish.

Display

Allows adjusting display settings regarding contrast and brightness. Use arrow keys >DOWN< and >LEFT< to decrease; >UP< and >RIGHT< to increase values. >RIGHT < and >LEFT< will modify settings in steps of 5 %, >UP< and >DOWN< in steps of 1 %.

Change Time

In order to perform various control and memory functions, the unit includes an internal system clock saving dates of year, weekdays and week numbers. The clock settings can be modified if required.

First select the menu point “Info”:

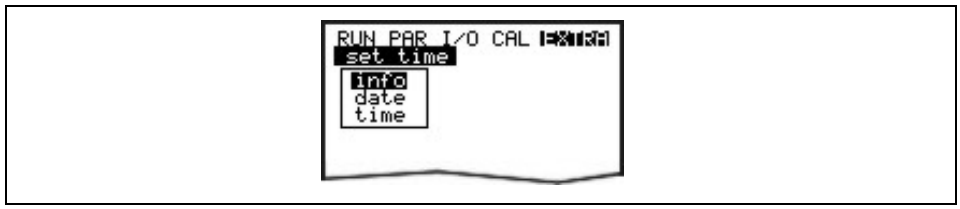


Fig. 8-26 System time submenu

The actually system time is indicated after the settings have been confirmed:

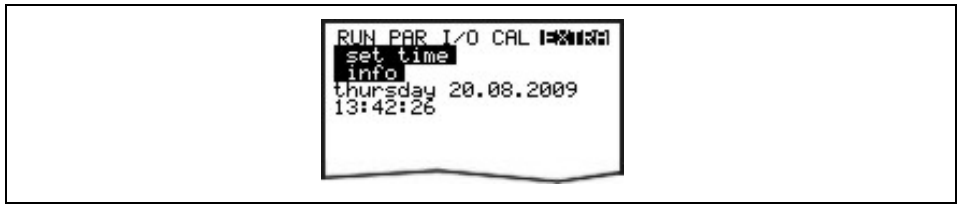


Fig. 8-27 Complete system time

No system time changes can be done here. This screen is for display only. Changes can be carried out only within the submenus of the “change time“ menu.

Fig. 8-28 Setting the data

In menu points “Set time / Date and Time” it is possible to set the date as well as the time.

Totaliser Totaliser setting [m³]. In case of a system reset this value will be set to zero..

8.5 Parameter Menu (PAR) setting

Fig. 8-29 Parameter settings - submenu

This menu is the most extensive and most important regarding the PCM Pro settings. It nevertheless is sufficient in most cases to set only some essential parameters, which usually are:

- name of measurement place
- channel shape
- channel dimensions
- sensor type
- storage mode

All other functions are additions which are required in special cases only.

8.5.1 Parameter Menu “Measurement Place “

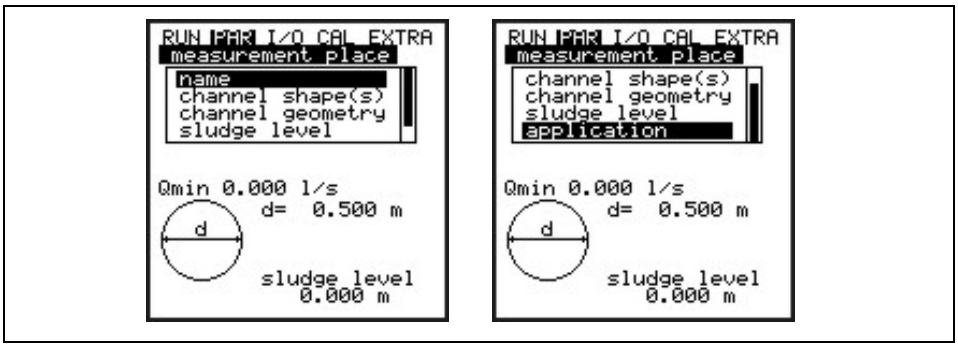


Fig. 8-30 Submenu measurement place

This menu is one of the most important basic menus for parameter setting.
The measurement place is defined with its dimensions.
For applications purposes the whole menu isn't visible. This is recognizable at the black bar on the right hand side of the menu.

▲ ▼ Using the arrow keys the menu can be scrolled through.

Name (of Measurement Place)

NIVUS recommends to coordinate and define the name with the documents. The name can be with max. 21 characters. The programming is similar to mobile phone programming.
After selection of submenu >name<, the basic setting “nivus“ will come up

Fig. 8-31 Setting the name of the measurement place

Enter the desired name with the keypad, where each key has assigned three letters and a number. Select between these four characters by briefly pressing a key several times.
The cursor will jump to the next character if no keys have been pressed for two seconds.

[ALT] Option to select additional special characters which are not available on the keypad (e.g. >ä<, >ö<, >ü<, >ß<). More special characters will be indicated but however are not allowed to be used as measurement place names. The signs can be used to specify inputs and outputs.

[◄] [►] These keys move the cursor left or right within the special character menu.
In the uppercase or lowercase letter menu the arrow key >RIGHT< creates a space character. Pressing the arrow key >LEFT< will delete the previous character.

[▲] Shift to uppercase letters

[▼] Shift to lowercase letters

Faulty input can be corrected by going back with the cursor and writing anew.

[↵] Confirm the entered name with “Enter“ and exit the menu.

Channel shape(s)

Select the desired profile with >left< or >right< arrow keys and confirm with >Enter<. Currently it is possible to select from following standard profiles according to ATV A110:

- Pipe
- Egg (standard; h:w = 1.5:1)
- Rectangle
- U-Profile
- Trapezoid
- A = f (h, w) and
- 2r Egg (h:w = 1:1)
- NPP (NIVUS Pipe Profiler)

Special profiles such as Q = f (h), A = f (h), three-part profiles and two-part profiles may be chosen as well.

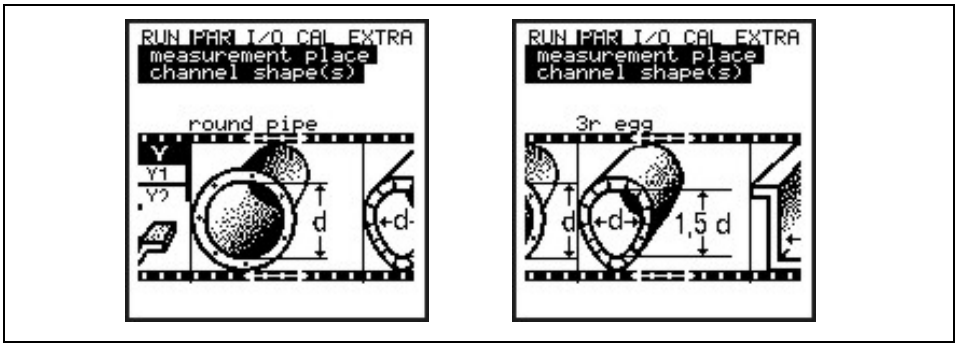


Fig. 8-32 Selecting the channel shape

The selected profile is stored. The next step requires to enter the channel dimensions of the profile.

NPP:

Selecting the channel profile “NPP“ causes the unit to automatically use optimised settings for measurements in full pipes in the background.

Enter the inner diameter of the NPP in channel dimensions as soon as the "NPP" profile has been selected.

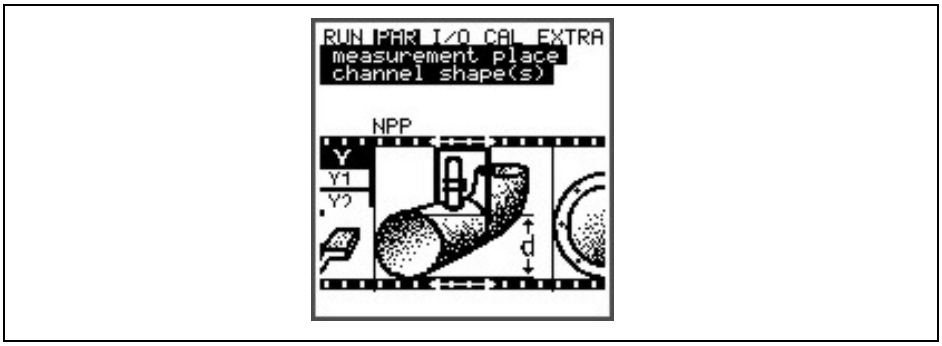


Fig. 8-33 Example selected NPP

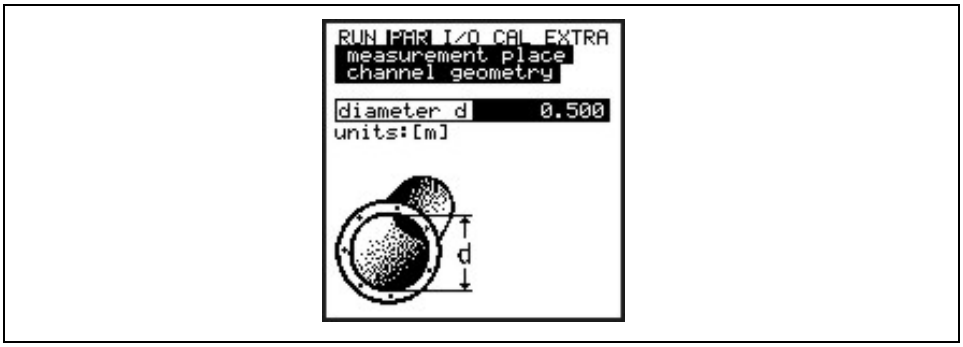


Fig. 8-34 Setting the channel geometry in pipe profiles

The selected profile and the channel dimensions are subsequently indicated in programming mode.

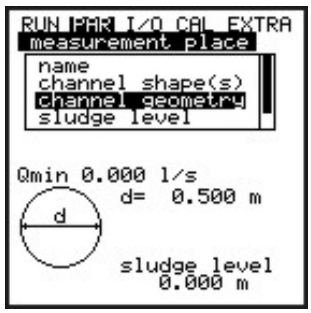
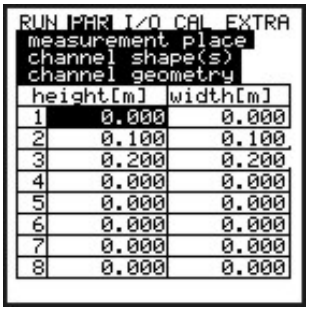


Fig. 8-35 Selected profile

Channel geometry Type in the respective channel dimensions.

Please observe indicated units!

Entering **A = f (h, b)** (height-width ratio) **or A = f (h)** (height-area ratio) as profile will indicate a table of 32 possible breakpoints on the display. This is where the "custom profile“ may be set



	height[m]	width[m]
1	0.000	0.000
2	0.100	0.100
3	0.200	0.200
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000

Fig. 8-36 List of custom shape breakpoints

In order to define the zero point of the channel **start by entering 0 – 0 in breakpoint 1**. All further breakpoint can be set freely regarding height as well as width/area. There may be different distances between individual level points. Furthermore it is not required to use all of the 32 breakpoints possible. The PCM 4 however is going to use a linearisation function between the breakpoints. Decrease the distance between breakpoints in case of heavy and irregular fluctuation within the area.

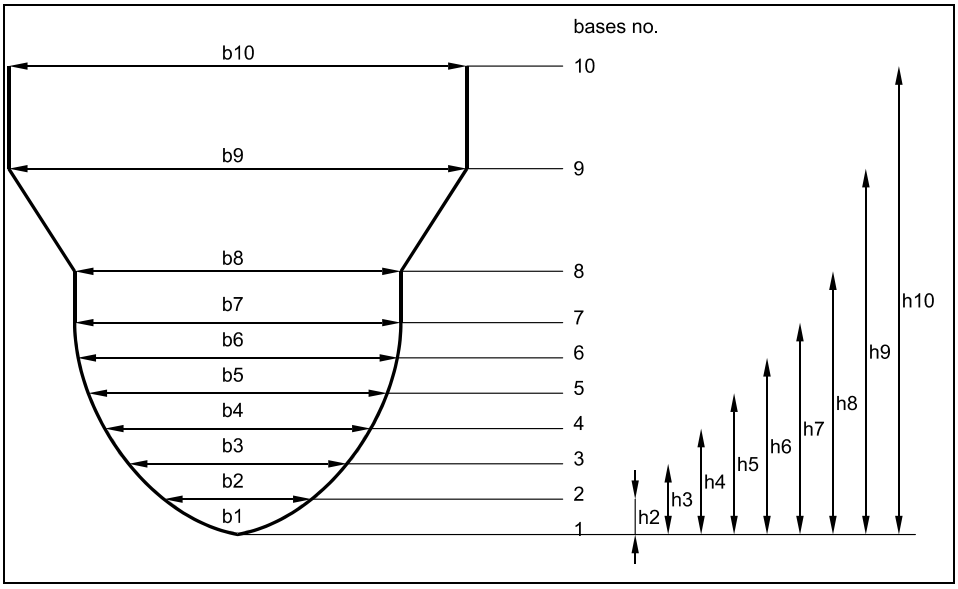


Fig. 8-37 Bases for custom shape

Special Profiles:

To define special profiles the options **"Two-part profile“** and **"Three-part profile“** are available.

If **"Two-part profile“** has been selected in the channel selection (Fig. 8-38), the setting options below are indicated:

Bottom area: - U-profile

Top area: - custom shape

The top area can be defined freely using breakpoints (see Fig. 8-37).

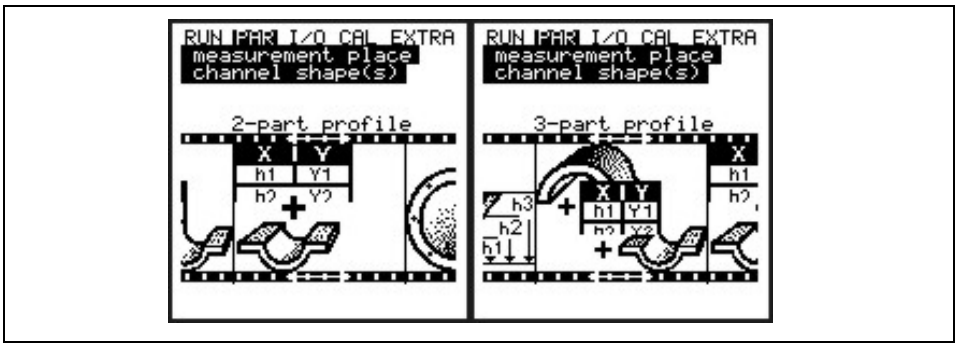


Fig. 8-38 Example of selecting custom profiles

Choosing **"Three-part profile"** will reveal the following setting options:

Bottom area: - U-Profile

Centre area: - Custom profile

Top area: - Pipe

Here the centre area can be defined freely. Such special profiles are used in cases such as shown in Fig. 8-40.

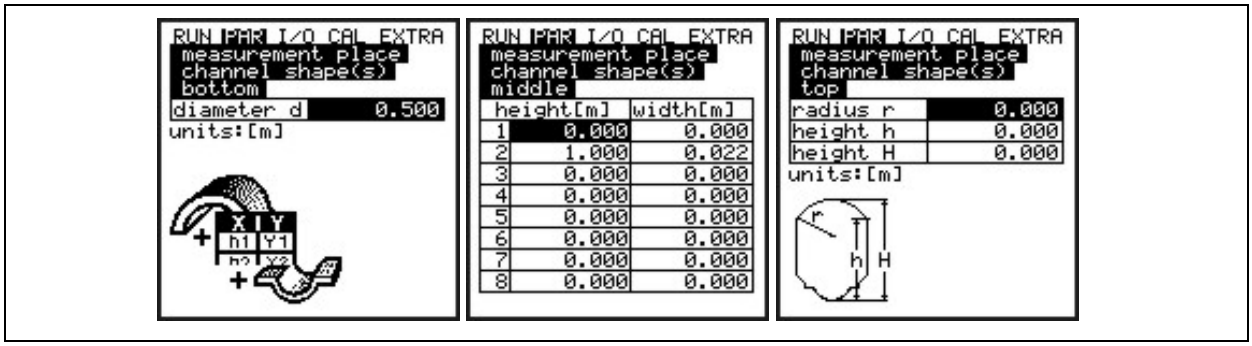


Fig. 8-39 Dividing the profile into three zones

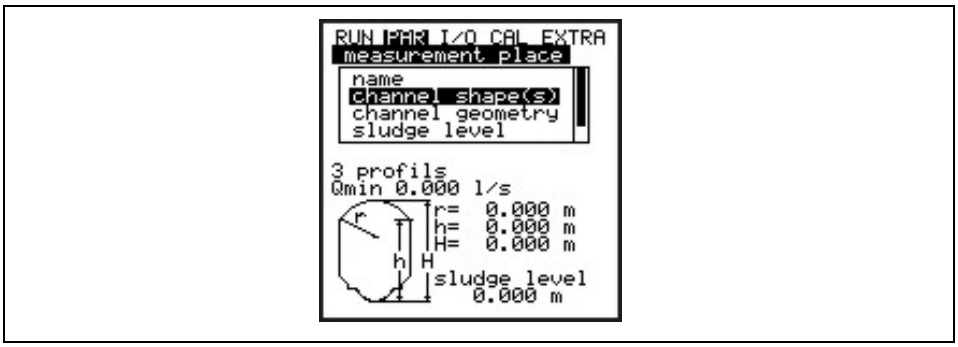


Fig. 8-40 Three-part profile

If the function Q=f(h) has been selected only one level zone can be defined, i.e. it is not possible to divide into centre area or top.

Programming subdivided profiles makes sense only in case of exceptions or very unusual profiles with segmental arch tops. It requires comprehensive experience and knowledge about the PCM Pro and should be carried out by authorized and trained personnel only in order to avoid faulty programming.

Sludge Level

The sludge level set is going to be calculated as non-moving patch
It is subtracted from the wetted hydraulic total area before calculating the flow.

Application

A selection of the degree of medium pollution is expedient to optimize the ultrasonic measurement. Make your choice by pressing the >ALT< key:

Wastewater:
Polluted media e.g. untreated wastewater

Sludge:
Media with high pollution rate (e.g. sewage sludge), apparently clean or only slightly polluted media with high gas rate (e.g. ventilated wastewater) should be selected here.

Normal water:
Pure, clean media as well as media with lower gas or particle rate , e.g. rain water, fresh water, tap water, treated wastewater and similar.

Fig. 8-41 Select degree of medium pollution

8.5.2 Parameter Menu "Level“

Fig. 8-42 Level measurement – submenu

Further programming procedure depends on the sensor type selected.
Incorrect sensor selection leads to faulty measurements.

This menu defines all parameters for the level measurement. Depending on the chosen sensor type, the parameter start display as well as the entered parameters are different.
First of all determine the sensor type or the sensor combination by using the >up< and >down< arrow keys. Select and de-select sensors using >ALT< and subsequently confirm with >ENTER<.

Select from the options below:

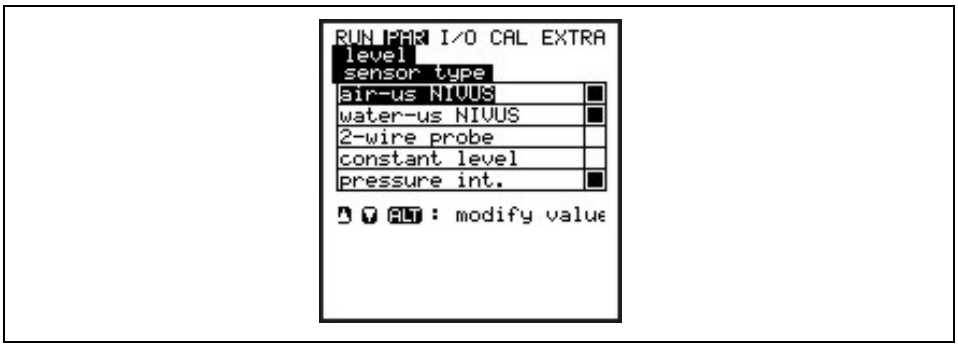


Fig. 8-43 Defining the sensor type

Option 1: Air-Ultrasonic (air-US NIVUS)

Air-ultrasonic fill level measurement from top down. The sensor however may be combined with the flow velocity sensor.
Detection of low flow levels, e.g. to detect extraneous water.
The sensor shall be installed exactly in the centre of the flume crown (+/- 2°) parallel to the water surface.

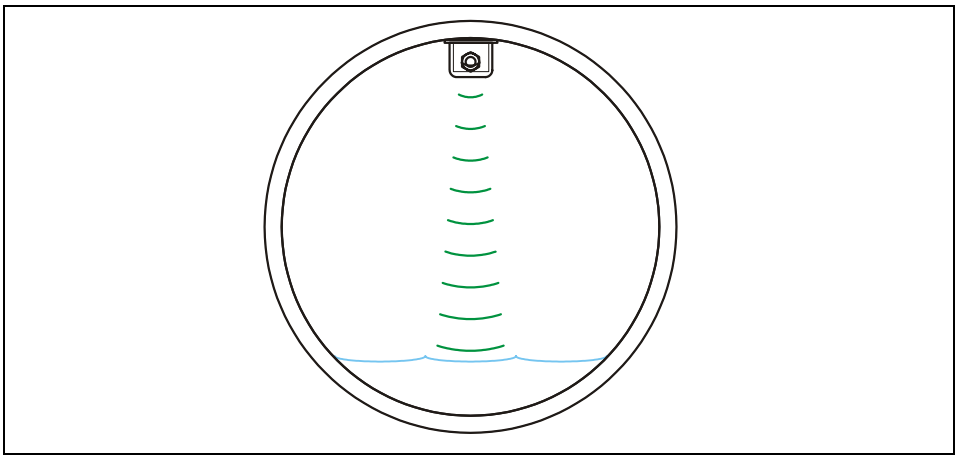


Fig. 8-44 Sensor type 1: Air-Ultrasonic

Option 2: Water-Ultrasonic (Water-US NIVUS)

Level measurement by combi sensor; height measurement via water ultrasound from bottom up.
Discharge detection in medium filled pipes.
The sensor has to be placed exactly in the centre (+/- 2°) of the bottom.

Do not select water-ultrasound sensors if the sensor must be placed out of the centre (e.g. due to sedimentation or high pollution loads)!

In this case use the combi sensor with integrated pressure measurement cell.

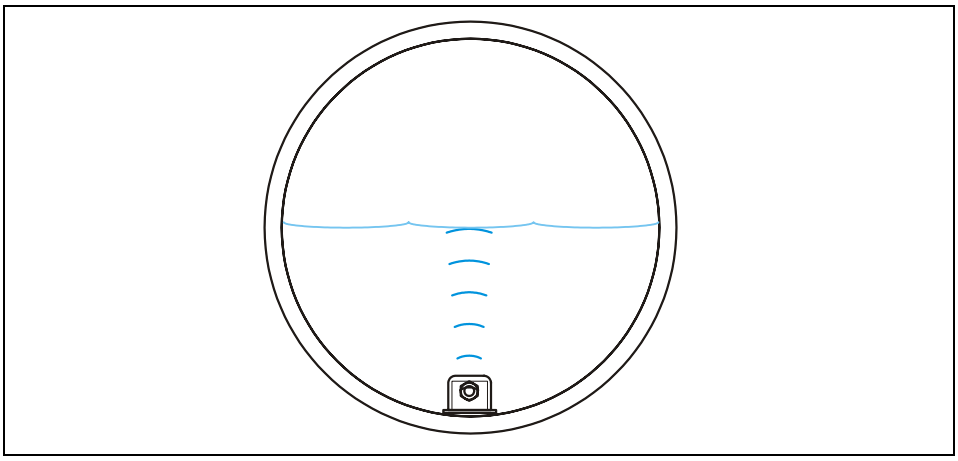


Fig. 8-45 Sensor type 2: Water-Ultrasonic NIVUS

Option 3: 2 Wire Sensor

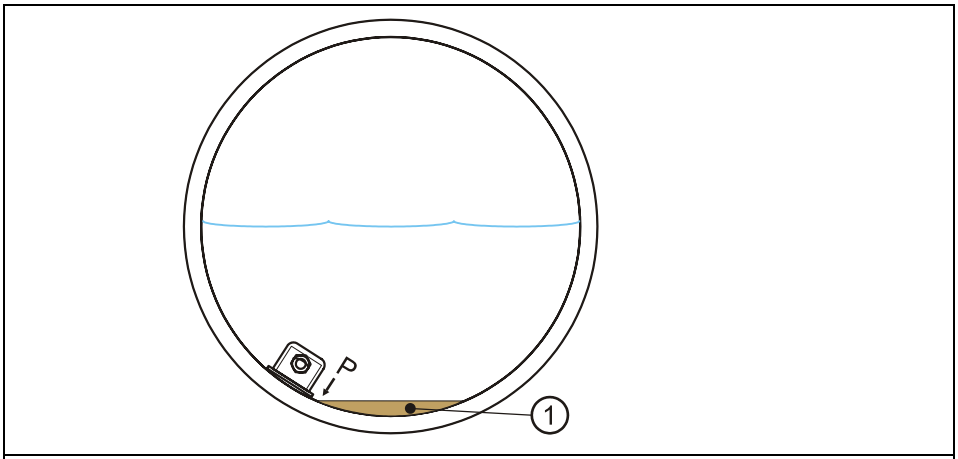
Level measurement by external 2-wire sensor, supplied by PCM Pro (such as NivuBar Plus or NivuCompact). The sensor however may be combined with the flow velocity sensor.

Option 4: Fixed Value

This option is going to be used for constantly filled pipes and channels (e.g. NPP). Such applications normally do not need level measurements. Set the constant fill level under “PAR/Level/Scale/Height“.
This parameter is useful in case of testing or initial start-ups if there is no level reading available.

Option 5: Pressure int.

Level measurement by using a combi sensor with integrated pressure measurement cell from bottom up.
Off-centred installation is possible, e.g. due to sedimentation or high pollution load.
Filling level measurement in case of overflow possible.



1 Sedimentation

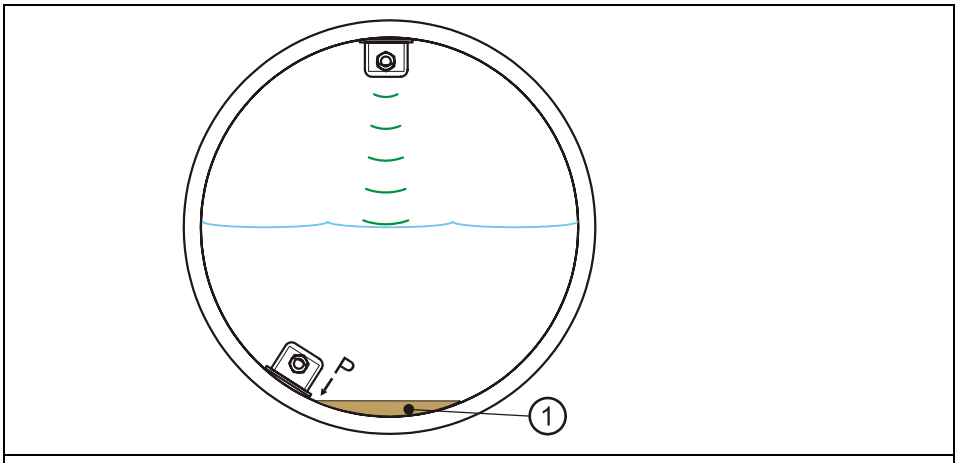
Fig. 8-46 Sensor type 5: Pressure int.

Sensor combination examples

The following combinations between the different variations are possible as listed below. These combinations may be required if due to constructional conditions a single sensor does not cover the entire measurement range (see also Fig. 8-52).

Air-US NIVUS + Pressure internal

Combination of options 1 and 5.
This combination is recommended for measurement ranges from 0 cm level up to overflow. The air-ultrasound sensor detects low levels, the pressure sensor the overflow area. Pressure sensors can be installed out of the channel centre due to heavy sedimentation (Fig. 8-47).



1 Sedimentation

Fig. 8-47 Combination: Air-Ultrasonic and pressure int.

2-wire sensor + Pressure internal

Combination of options 3 and 5.
To be used like in version Air-US NIVUS + Pressure internal
A 2-wire probe is used instead of the air-US sensor.

Water-US internal +Pressure int.

Combination of options 2 and 5.
Recommended if an area from flow level 0.5 cm up to impoundment must be measured. In this case the pressure sensor detects the lower as well as the upper measurement range. The water-ultrasonic sensor detects the middle range. The water-ultrasound sensor shall be installed in the centre of the bottom.

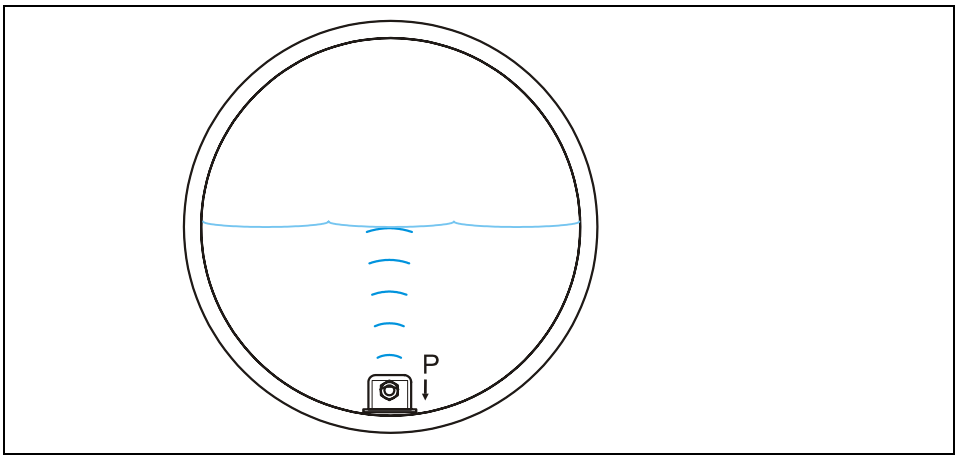


Fig. 8-48 Water-US and Pressure internal

Air-US NIVUS + Water-US int.

Combination of options 1 and 2.
Recommended for areas from flow level 0 cm up to 80 % fully filled. The water-ultrasound sensor detects the filling level from approx. 5 cm up while the air-ultrasound senor detects the low filling levels.
Please observe to install the sensor in the centre of the bottom.

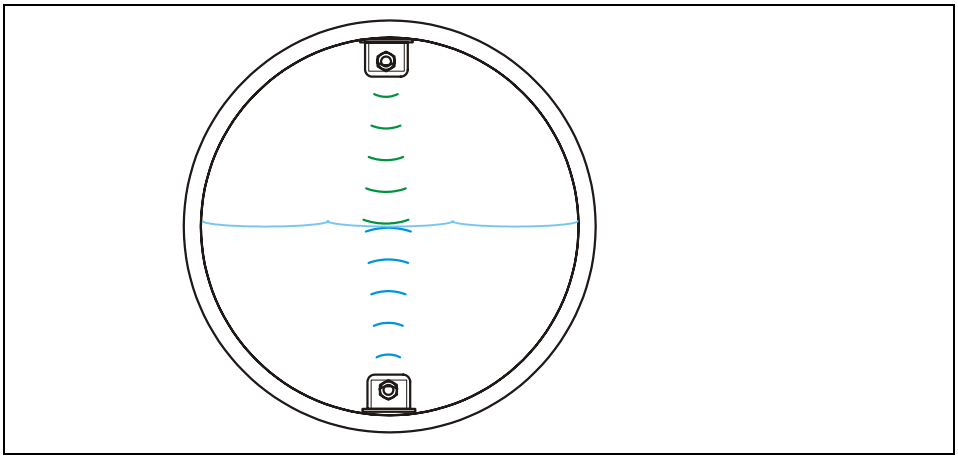


Fig. 8-49 Air- and Water Ultrasonic

Water-US internal + 2-wire sensor

Combination of options 2 and 3.
To be used in applications as described in water-US int. + air-US.
An external 2-wire sensor instead of an air-ultrasonic sensor is going to be used to detect low flow levels.

Air-US NIVUS + Water-US internal + Pressure int.

Combination of options 1, 2 and 5.
This combination is recommended from 0 cm filling level up to overflow if the best possible measuring accuracy is required.
In this case the pressure sensor detects the upper measurement range. The water-ultrasound sensor detects the medium range and the air-ultrasound sensor detects the low range.
Please observe to install the water ultrasonic sensor in the centre of the bottom.

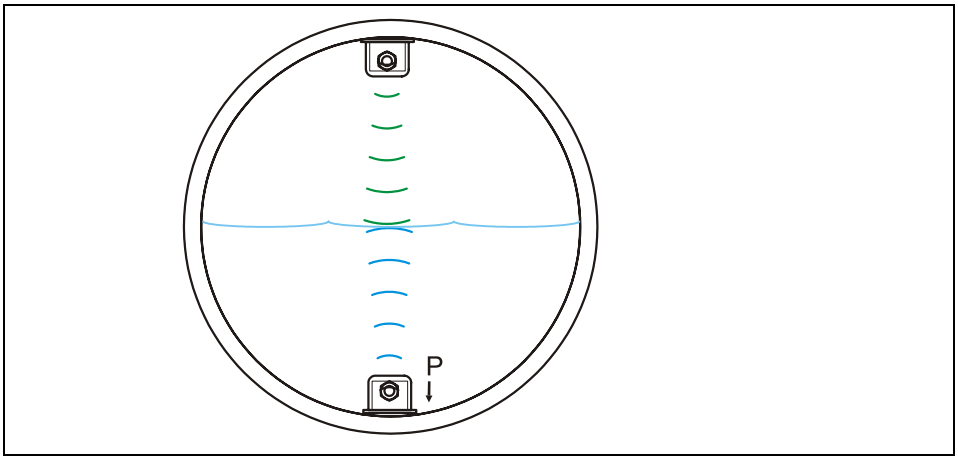


Fig. 8-50 Sensor type Air-US, Water-US and Pressure

Water-US internal + 2-wire sensor + Pressure int.

Combination of options 2, 3 and 5.
Application as the combination Air US + Water US + Pressure.
An external 2-wire probe is used to detect low filling levels instead of the air-ultrasound sensor.
Observe to install the active combi sensor with pressure and water-ultrasonic measurement in the centre of the channel bottom.

Mounting offset

This parameter is only required for special applications.
The value is set to 10 mm (0.394 in) as standard if the water-ultrasonic sensor (h) has been selected, which is the height of the level sensor above the channel bottom. If the pressure sensor (H) is in use the standard mounting height is 5 mm (0.197 in), which is the diaphragm position above the channel bottom.
Entering the filling level in CAL men will adjust the mounting offset respectively. The installation height of the air-ultrasonic sensor (L) is determined automatically after the channel dimensions have been entered.

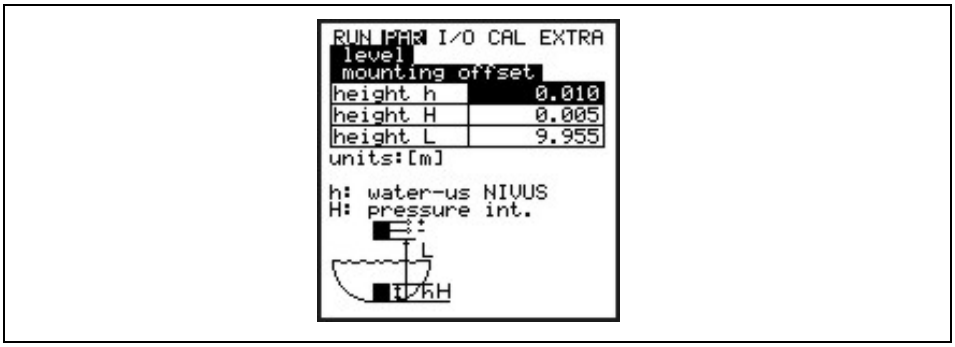
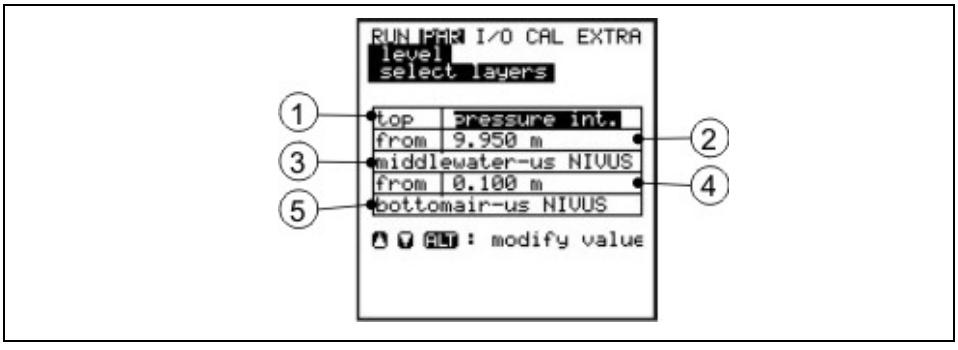


Fig. 8-51 Mounting offset of level sensors

Select layers

This parameter will be indicated only if a sensor combination has been selected. The PCM automatically aligns the sensors to partial layers.
Layer borders however may be defined freely as well. Use the >ALT<-key to do this. Determine the threshold levels between the layers using the box in the >from< line.



1 Top layer sensor
2 Threshold level between middle and top layers
3 Middle layer sensor
4 Threshold level between middle and bottom layer
5 Bottom layer sensor

Fig. 8-52 Select layers

After being selected the sensors will be indicated on the screen:

Fig. 8-53 Overview on level sensors

Scale

A measuring offset, the measurement span and the time delay or a fixed filling level corresponding to the input signal is entered here depending on the sensor type set.

Time delay:

After switching the PCM Pro on, the sensors are supplied with power for the time delay set here. No readings will be recorded however. This delay is required for the sensors to stabilise.

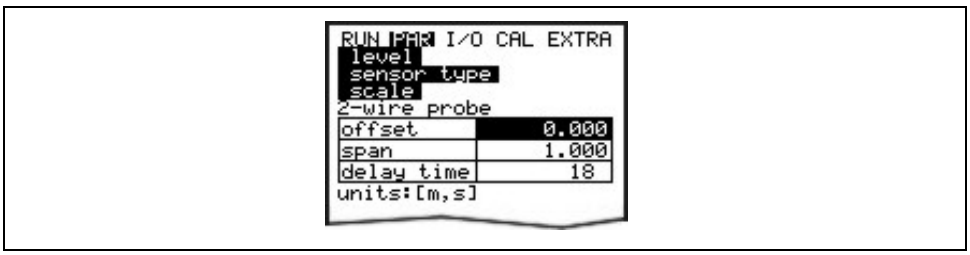


Fig. 8-54 2-wire sensor settings

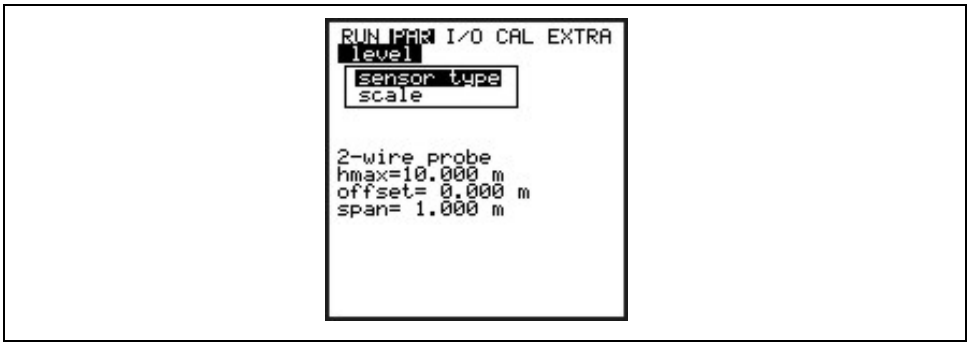


Fig. 8-55 Screen at 2-wire sensor

For sensor connection, please take chapter 6.3 into account.

8.5.3 Parameter Menu “Velocity““

The PCM Pro allows to use a connected flow velocity sensor as combi sensor with integrated level measurement (Type V1H, V1D or V1U) or as flow velocity sensor (Type V10) only.

Fig. 8-56 Sensor settings

The sensor selection will bring up the screen below:

Fig. 8-57 Selecting the sensor type

Sensor type

Select between wedge and tube sensor, float (measurement from above) or >Pos-alpha< (sensor installation in any angle to vertical) by pressing the >ALT< key.
Installation position is set to “positive“ per default. This parameter should not be modified. It is going to be used only for special applications where the flow velocity sensor is heading upstream (unlike heading downstream towards the flow direction as in standard applications) but is to detect positive velocities however. This is the only case which requires to set “negative“ here.

Mounting place

This menu point is to modify the installation height of the flow velocity sensor. The standard setting is 20 mm (0.788 in) which is equivalent to the position of the sensor centre above the channel bottom. This setting does not need to be modified unless the sensor has been installed higher or lower. If the sensor has been installed higher enter the additional mounting height plus 20 mm (0.788 in), if installed lower subtract the missing height from 20 mm and enter overall height.

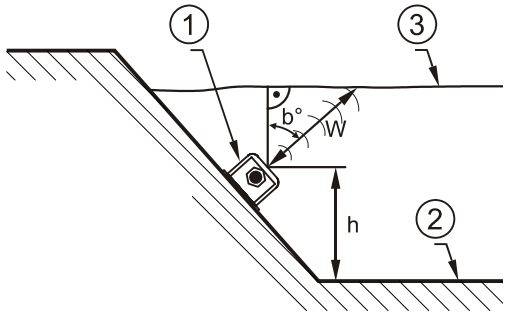
If >Pos-alpha< has been selected, the following >mounting places< are available

>height h< mounting height of the sensor body.

>angle b°< is the sensor installation angle diverging from vertical.

>w< is the max. possible distance between sensor and an obstruction.
Example: the opposite wall in case of horizontal installation.
This dimension must be calculated and entered by the customer.
The path length (w) will be determined automatically as soon as the distance to the water surface is shorter due to the filling level.

Fig. 8-58 Parameter off-centre sensor installation



1 Sensor body
2 Channel bottom
3 Surface

Fig. 8-59 Measurement place settings

If the mounting place of the level sensor has been modified please necessarily increase the value in parameter >Cal/Flow velocity//h_crit< by the same amount.

8.5.4 Parameter Menu "Relay outputs"

This menu point is to enter the parameters for the relay of the sampler connection box.
These parameters are required only if the box is used.
You can find a description of the parameters in a separate instruction manual included with the "Sampler Connection Box" delivery.

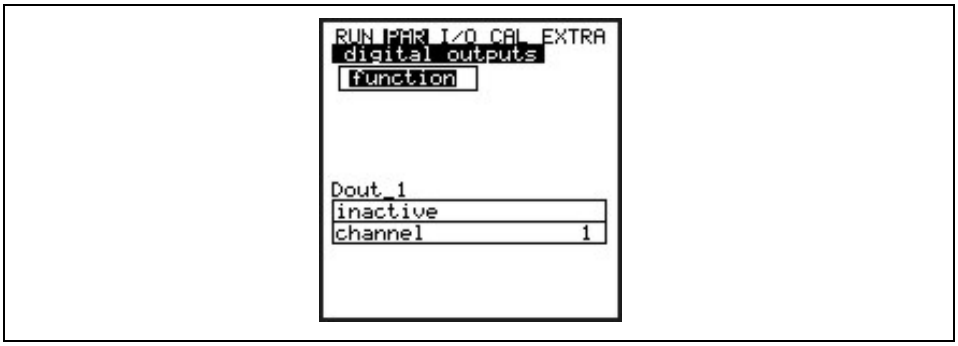


Fig. 8-60 Submenu – relay outputs

8.5.5 Parameter Menu ”Setup Parameter“

This menu item allows you to change or to restore some fundamental settings of the system.

Fig. 8-61 Submenu - Setup Parameter

Load factory setup This sub-menu item allows a general reset. The selection appears as:

Fig. 8-62 Executing a general system reset

Selecting “YES“ will erase the flash memory.

Fig. 8-63 Save new values after system reset

Leaving the menu indicates >save new values?<.
Selecting “YES“ will reset the system to the default parameter settings!

All customer settings will be reset!!
(General reset of system)

In order to avoid faulty programming it is required to execute a general system reset (load factory setup) prior to each initial start-up.

Service code

Additional system setting options are going to be revealed as soon as a special code has been entered. It is possible to modify e.g. beam angle or medium sound velocity, transmit voltages or special adjustments regarding the transmitter crystal drive. These settings are reserved to used by the NIVUS initial start-up service as these modifications require comprehensive expert knowledge and do not need to be adjusted during standard use.

Battery / rechargeable

Enter the maximum capacity of the used power source here. This value will be used as a basis to calculate the remaining capacity and more.

Damping

This menu enables to adjust the display and analog output damping between 5 and 600 seconds.

Example 1:

damping 30 seconds, jump from 0 l/s to 100 l/s (=100 %) – the unit requires 30 seconds to run from 0 l/s to 100 l/s.

Example 2:

damping 30 seconds, jump from 80 l/s to 100 l/s (=20 %) – the unit requires 6 seconds to run from 80 l/s to 100 l/s.

Stability

This parameter is going to „stabilise“ the readings for the time set in case of measurement dropouts which might be caused by e.g. hydraulic interferences.

The parameters damping and stability will take no longer effect as soon as the unit is going to switch over to active memory mode. Due to the short measurement duration in this mode the unit will use the internally stored damping and stability period of 0 seconds.

Max. Measurement time

The PCM Pro automatically controls the required measurement time depending on several parameters. This parameter can be used to influence the automatism, which however is not recommended to be carried out without the aid of a NIVUS technician (e.g. if there is not enough time to reliably detect a measurement value).

Readings cannot be detected reliably if the max. measuring time has been set to short. The battery life is reduced if the measuring time has been set too long.

8.5.6 Parameter Menu "Storage Mode"

The PCM Pro allows to save recorded data regarding flow velocity, level, temperature and flow values as well as input and output signal readings on compact flash card.
You can use NIVUS compact flash cards with capacities from 8 to 128 MB. These cards can be purchased from your NIVUS representative if required.

Use memory cards purchased from NIVUS only. Other manufacturer's cards may lead to irreversible loss of data or measurement failure (e.g. permanent transmitter reset).

NIVUS is not going to assume any liability due to data loss resulting from the use of third party memory cards.

The enabled memory mode will be indicated by an icon in RUN menu (see also chapter 7.3.)

The PCM Pro will fall to energy-saving standby mode four minutes after the last key action, i.e. the unit is only going to turn on following the intervals set. The PCM Pro display is disabled when in memory mode (see also chapter 7.5.1).

Fig. 8-64 Memory card slot

Due to the card's technically restricted number of storage cycles (approx. 100.000 writing events), the PCM Pro does not constantly save upcoming data on card. This is to protect the card. First of all the measurement data are saved in an internal memory. Then the readings are going to be transmitted to memory card once per hour. Activating the PCM Pro (by pressing any key) or by pressing the >ALT< key if the unit is active will immediately execute data transmission to memory card which will be indicated on the display by the message „*Memory card busy*". The interval is pre-set by the internal system time.

In order to save all data on the Flash Card before replacing it, storing must be executed by pressing a key.

Data sets are going to be saved in ASCII format creating a file with the name of the respective measurement place set. The suffix is >.txt<.
The data sets can be read and edited using common software with ASCII interface such as EXCEL.

STOP

Never format memory cards on PC! The PCM Pro is not capable of using formats created by PC and therefore does not accept cards formatted on PC.

The data storage is carried out always as a temporary value at the moment of storage. If set to continuous operation mode data will be saved as average values.

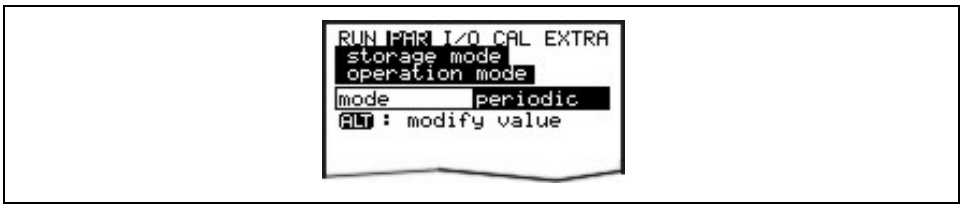


Fig. 8-65 Selecting memory options

Operation Mode

ALT Use this key to toggle between following modes:

disabled	no data saving
periodic	periodic saving of flow readings and peripheral input signals → saving of current values
Event	The PCM Pro is able to toggle between two saving cycles. Switchover will be carried out immediately as soon as a level-dependent threshold has been exceeded or by receiving a respective impulse from the digital input. → saving of current values
Continuous	Continuous logging of readings as with a non-portable flowmeter; average values will be saved using the storage cycle set previously. This mode is designed for use with very high discharge dynamics and for short-term use of the PCM Pro. The battery life during continuous mode is approx. 3 days.

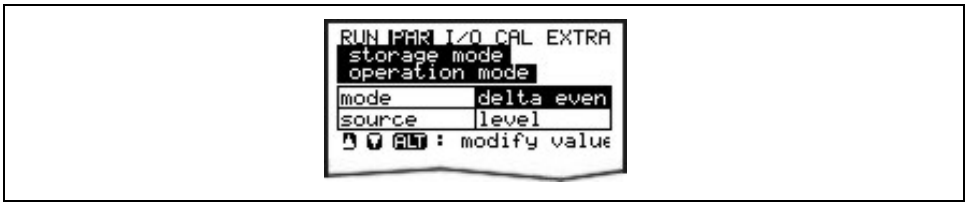


Fig. 8-66 Source for event-based storage

Cause (source)

Level	This setting will force the sensor-integrated pressure measurement cell to retrieve fill level data every 5 seconds. The PCM Pro will be activated immediately in case of exceeding the threshold, switching over to event mode.
Digital I1	The PCM Pro is permanently monitoring the (optional) digital input. The unit will switch over to event mode immediately as soon as the digital input is going to be enabled.

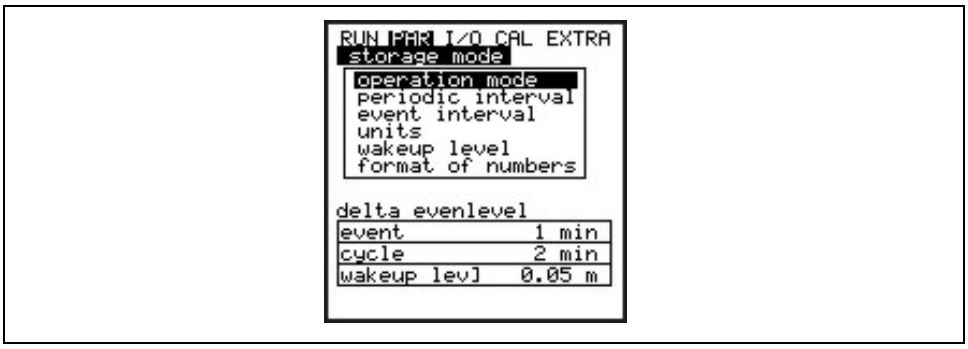


Fig. 8-67 Storage mode screen

Periodic interval

This parameter is to define the saving interval. It is possible to set a value between 1 and 60 minutes.
There are only exact fractional amounts of 1 hour allowed to be set (1 min.; 2 min.; 3 min.; 4 min.; 5 min.; 6 min.; 10 min.; 15 min.; 20 min.; 30 min. or 60 min.).

Event interval

This parameter is active if the event mode has been enabled and is to define the saving cycle in case of events occurring. It is possible to set a value between 1 and 60 minutes. There are only exact fractional amounts of 1 hour allowed to be set (1 min.; 2 min.; 3 min.; 4 min.; 5 min.; 6 min.; 10 min.; 15 min.; 20 min.; 30 min. or 60 min.).

Fig. 8-68 Setting the saving cycle

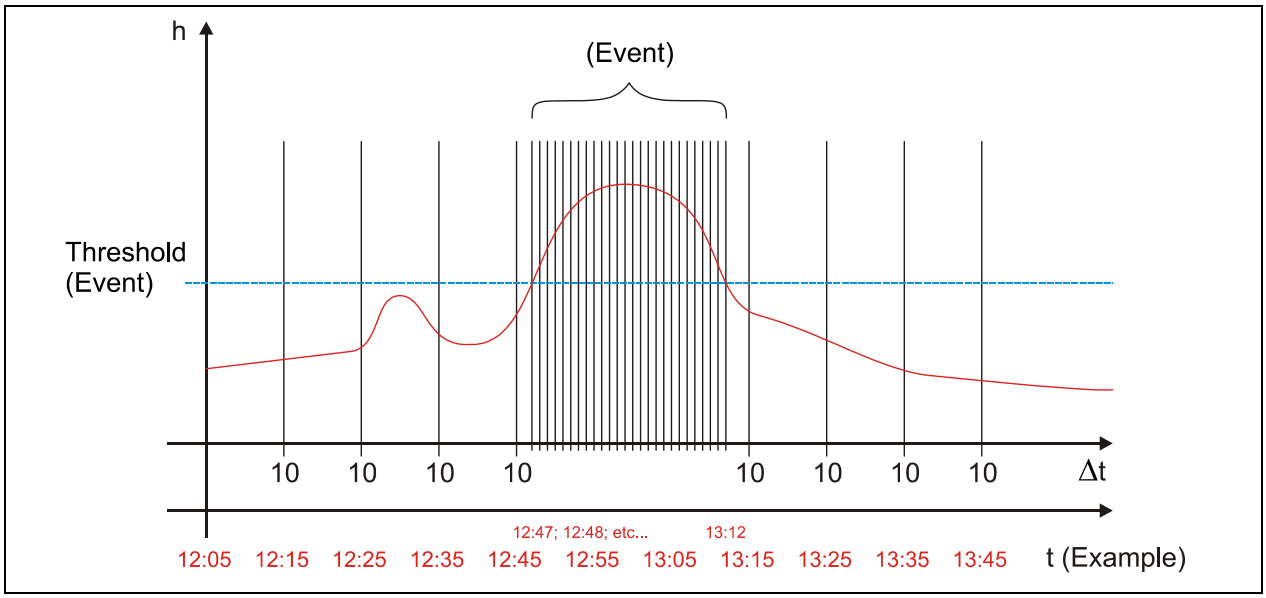


Fig. 8-69 Event parameter setting example

Units

Define which units are to be used to save the 3 parameters flow, level and velocity. Select from metric (e.g. litres, cubic metres, cm/s and more), English (ft, in, gal/s, and more.) or American system (fps, mgd and more). After your selection has been confirmed the display will jump to the next screen automatically.
For each of the three calculated and measured values flow, velocity and fill level the unit can be determined by saving the values on memory card. These settings do not have an effect on the display.
There are various units available depending on the selection made previously (see chapter 8.5).

Fig. 8-70 Selecting the unit system in storage mode

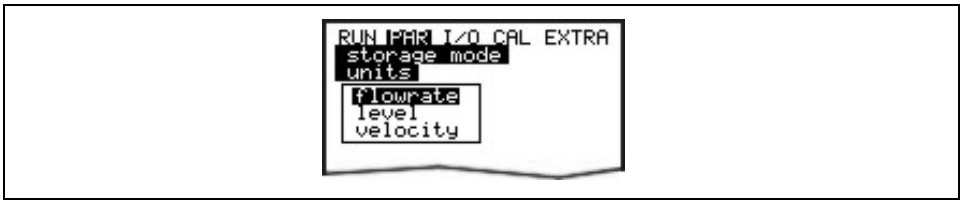


Fig. 8-71 Selecting the measurement value in storage mode

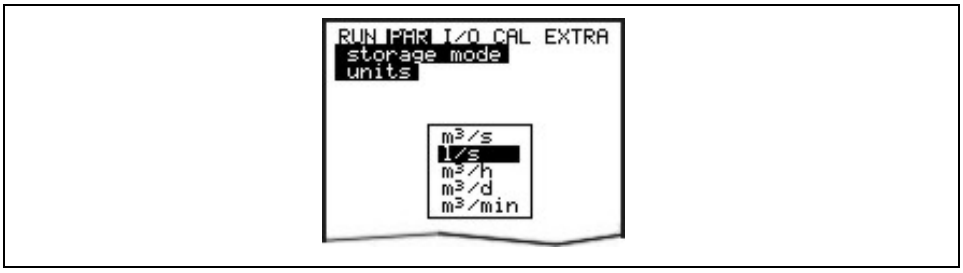


Fig. 8-72 Selecting the units in storage mode

Wakeup level

This menu is to define the fill level which is used to switch over from periodic interval to event interval.

Fig. 8-73 Wakeup level screen in storage mode

Format of numbers

Choose between commas or dots to be used as decimal points

8.5.7 Data Structure on the Memory Card

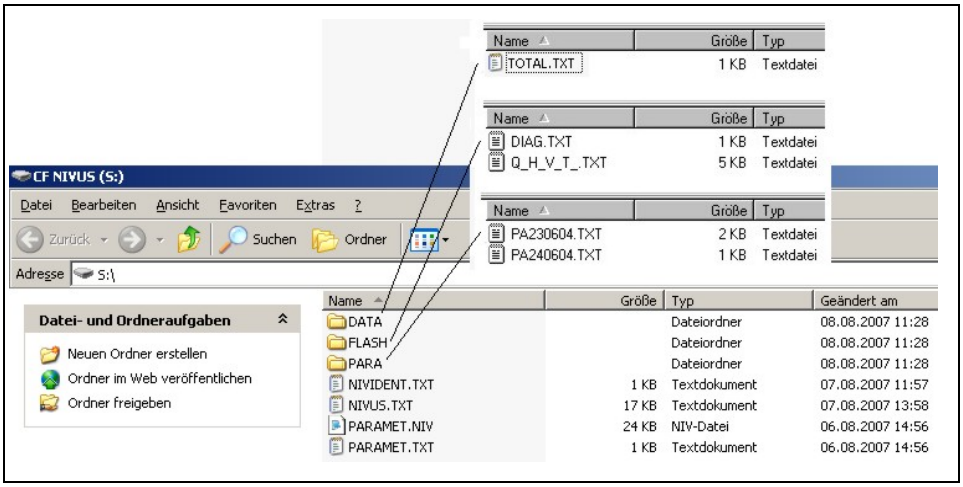


Fig. 8-74 Data structure on the memory card

DATA

This folder contains the day values in a file called >TOTAL.TXT<. Save by using the menu points >I/O/Memory card/Day values< (see Chapter 8.8.5.

Flash

This folder contains the backup file. This file is always called >Q_H_V_T.TXT<. It contains the internal memory values on level, velocity, flow and temperature.
The file >DIAG.TXT< contains all messages including error messages which might have been occurred during measurement operation.
These might be a CPU restart after system reset or after reprogramming.
The respective message is labelled with date and time:
>: received error/message
<: reason of error/message cleared

PARA

This folder contains all parameter files including their time stamps:
PA TT MM JJ .TXT (TT=day- MM=month- JJ=year of file save date). It allows to later comprehend the values of the transmitter on the measurement place as well as eventual parameter modifications.
The last modification of each day will be saved.

NIVIDENT

Contains the name of the measurement place.
If the name of the measurement place saved on card does not comply with the name of the measurement place saved in the PCM Pro, the unit will prompt to format the card. The PCM Pro will not save any data as long as the card has not been formatted.

Name of Measurement Place.TXT

This is the file where the measurement values are saved. It is going to be saved using the name of the measurement place set.

PARAMET.NIV
PARAMET.TXT

These files are created as soon as parameters are being saved on the memory card. The file PARAMET.NIV is required in order to upload data to the PCM Pro. PARAMET.TXT is the print version of PARAMET.NIV as text file (only parameters modified before are going to be exported).

8.6 Parameter Menu "Communication"

This menu point comprises the specific communication parameters to be set. These parameters are required only in connection with GSM or Bluetooth modules.
The description of the required parameters can be found in the separately Instruction Manual “NivuLog PCM Ex“, „GSM-Module“ and „Bluetooth-Module“, enclosed to the respective units.

Fig. 8-75 Communication

8.7 Independent Readings

The PCM Pro features one programmable analog input.
This independent analog input can be used e.g. for throttle verification purposes. A 2-wire probe installed within the throttle shaft can be connected to socket 3 (see Fig. 6-1).
This level sensor does not influence the flow measurement.

Fig. 8-76 Socket selection - independent readings

Socket

Socket 3:
Input via connection socket 3
(2 wire signal, powered via PCM Pro).

Measurement Span

The measurement span can be modified from 0-20 mA to 4-20 mA by using the >ALT<-key.

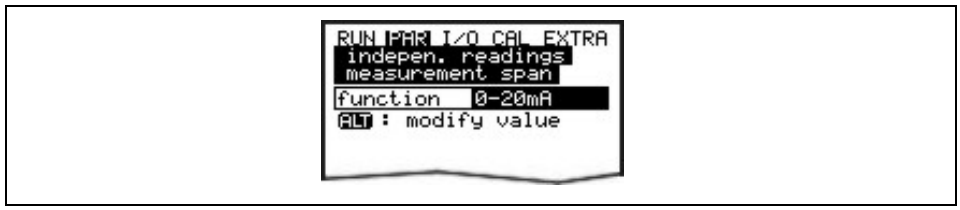


Fig. 8-77 Measurement span of independent readings

The required parameters can be set after the measurement span has been selected.

Fig. 8-78 Overview of independent readings

Units

This Parameter is going to be assigned to the breakpoint table below using the saved name.

Fig. 8-79 Units of independent readings

Linearisation

The analog input span can be defined here. Additionally it is possible to modify the weighting of the analog input by means of a 16-digit (max.) breakpoint table. If used properly, this point will open up some helpful special options regarding the setting of *PCM Pro* parameters. For example it is possible to convert a level/height signal into a volume-proportional signal which can be saved or route this signal to one of the analog outputs for further processing or display purposes.
Just enter the number of breakpoints.

↵ Confirm entry!

↵ A table with the respective units will come up subsequently.

Fig. 8-80 Linearisation of independent readings

Enter the mA value in the X-column and the other value in the Y-column (appropriate unit has been selected before under "Units“).
In case of classic applications such as to save a measurement value just enter "2“ as breakpoint value. Subsequently define the analog input span, i.e. enter the respective values for 4 mA and 20 mA

Delay time

Level sensors based on the echo sounder principle normally require several seconds to detect stable ultrasonic signals, so it is possible to set a time delay of 0 - 20 seconds here.

Fig. 8-81 Delay time of independent readings

8.8 Signal Input-/Output Menu (I/O)

This menu includes several submenus which both serve to assess and to check sensors as well as to control signal inputs and outputs. It allows to indicate various values (current values of inputs, echo profiles, individual velocities etc.), however does not enable to influence signals or conditions (offset, adjustment, simulation or similar). The menu therefore primarily serves to assess the measurement place, the hydraulic conditions and for error diagnosis.

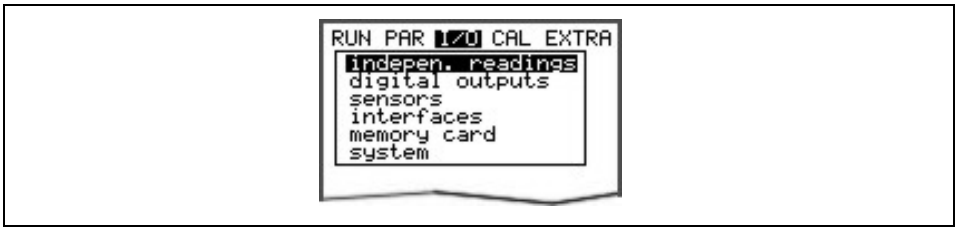


Fig. 8-82 I/O Submenu

8.8.1 I/O Menu "Indepen. readings"

Within this menu it is possible to control and inspect the analog input value connected to sockets 3 of the PCM (see Fig. 8-76). Values before (values in [mA/V]) or after (calculated values) the possible linearisation are indicated.

Fig. 8-83 Indepen. readings

Values in mA / V

This function is mainly used within commissioning procedures in order to check the power signals from external level measurement units.
A 1 [mA] Input signal from socket 3 (see Fig. 6-1)

A 4 [mA] socket not connected

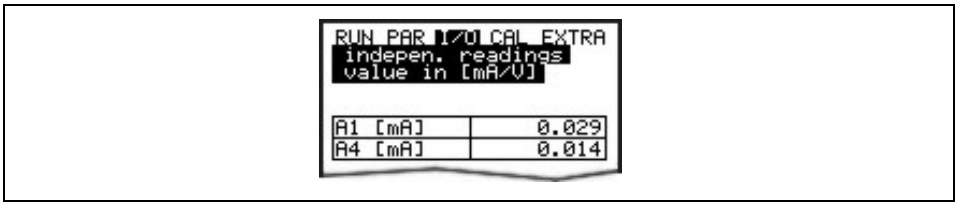


Fig. 8-84 Value in mA / V

Calculated Values

This menu allows to read the calculated values from the analog input signal in the unit selected before.

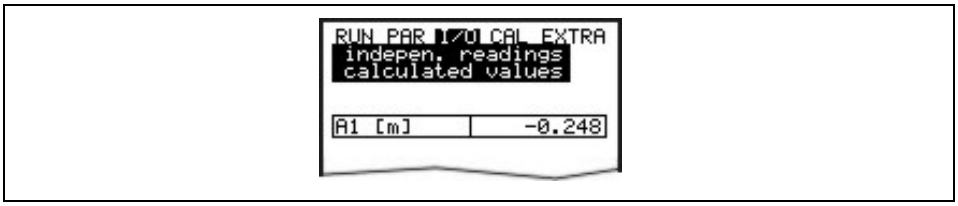


Fig. 8-85 Calculated values

8.8.2 I/O Menu "Digital Outputs"

This submenu indicates the conditions being put out to the sampler connection box. Reading is either logically "OFF“ or "ON“.

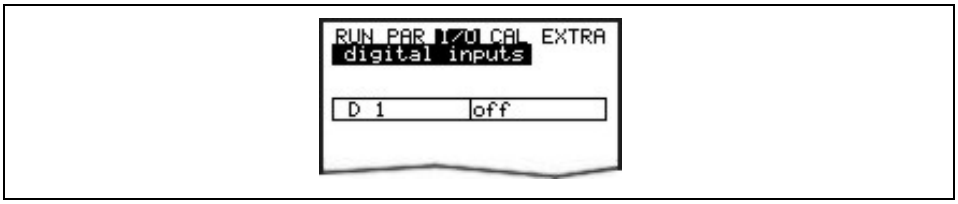


Fig. 8-86 Screen digital values

8.8.3 I/O Menu "Sensors"

This menu is including the respective submenus allow to view and to asses the most important sensor conditions. It hence provides information on the quality of the measurement place, echo signal quality and many more parameters.

Fig. 8-87 I/O Submenu, v-sensor

V-Sensor

Choosing this point is going to bring up a 2-page table including all single velocities measured and the heights of the respective measurement windows.

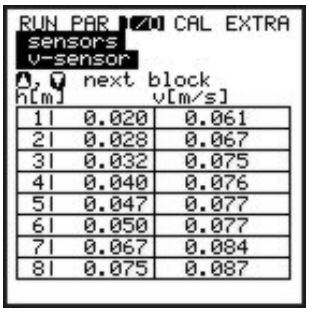


Fig. 8-88 Display of measured single velocities

▲ + ▼

Toggle between both pages (measurement windows 1-8 and 9-16) by using the up and down keys.

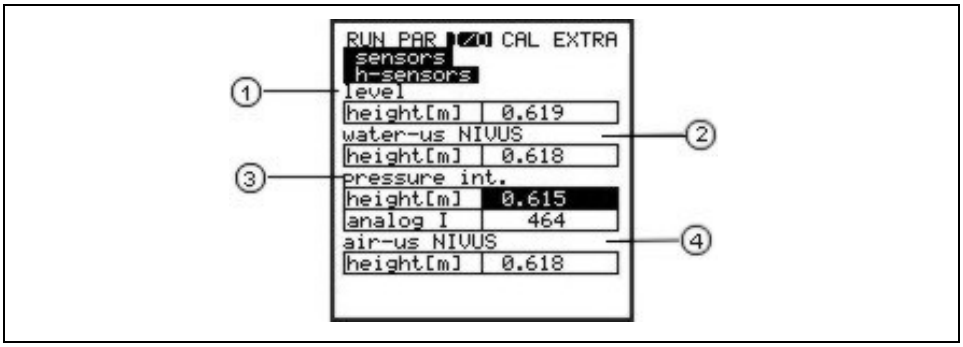
A reading of ------ in a measurement window indicates that there is currently no flow velocity able to be measured in the according window (gates). This might happen due to very clean water or vorticity within this area.
This effect might occur as well in case of low flow levels as from approx 35 cm (13.78 in), however is caused due to the PCM Pro automatically reducing the number of measurement windows here. It does not affect the measurement result if single or few windows might fail!

H-Sensor(s)

This menu indicates the measured filling levels

Depending on the used sensors for level measurement (via water-ultrasonic, pressure, air-ultrasonic or 2-wire sensor, see chap. 8.5.2) different menus are displayed:

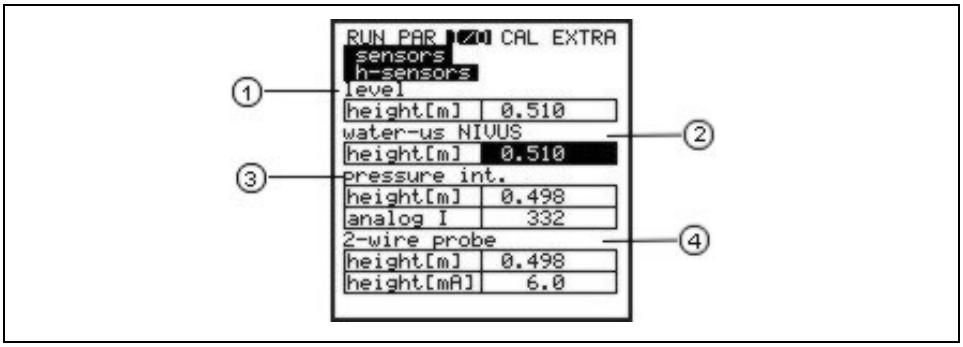
Example 1:



1 Level
2 Level water-ultrasound
3 Level pressure internal
4 Level air-ultrasound NIVUS

Fig. 8-89 Menu selection with water-ultrasonic, pressure and air-ultrasonic

Example 2:



1 Level
2 Level water-ultrasound
3 Level pressure internal
4 Level 2-wire probe

Fig. 8-90 Menu with water-ultrasonic, pressure and 2 wire probe

If 1 or 2 sensor types were selected only this will be indicated respectively

H- echo profile

Active on level measurement via water-ultrasonic from the bottom and air-ultrasonic from the top.

Fig. 8-91 Selecting level measurement echo profile

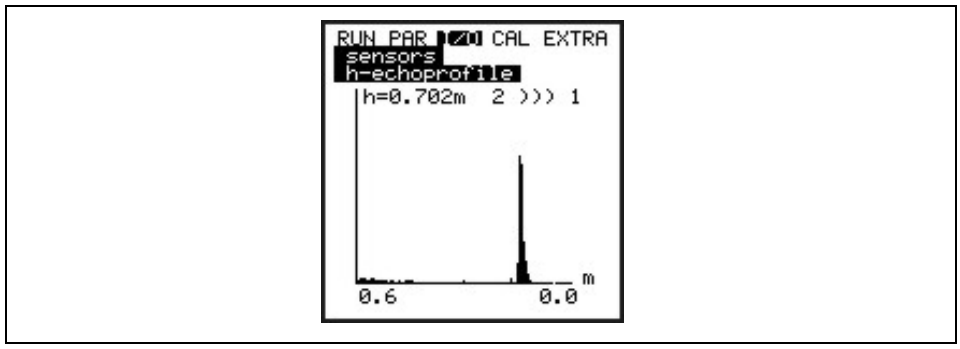


Fig. 8-92 Display echo profile level measurement

This graphic enables the service personnel to assess the echo signal in the measured acoustic path. Ideally the first peak (reflections from the interface between water and air) is very narrow, steep und high, all further peaks (double and multiple reflections caused by the echo signal moving back and forth between the interfaces water/air and water/ground) are lower and wider.

T-Sensor

This screen allows to view the measured water and air temperature (only possible in case of using external air-ultrasonic sensor driven by PCM Pro). Invalid values indicate cable break, short circuits or incorrectly clamped connections.

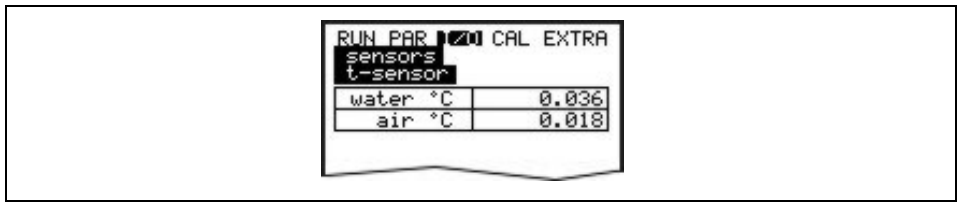


Fig. 8-93 Temperature screen

8.8.4 I/O Menu "Interfaces"

This menu is indicated only if the GPRS mode has been activated.
Signal quality and battery voltage of the GSM module (GPRS) are indicated in this menu. The Parameters are described in the instruction manual “NivuLog PCM Ex“ and „GSM Module“.

Fig. 8-94 Signal quality screen

8.8.5 I/O Menu "Memory Card"

This menu allows to recall information on the memory card..

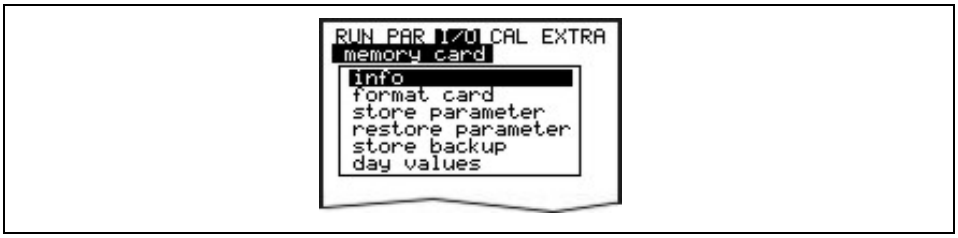


Fig. 8-95 Memory Card options

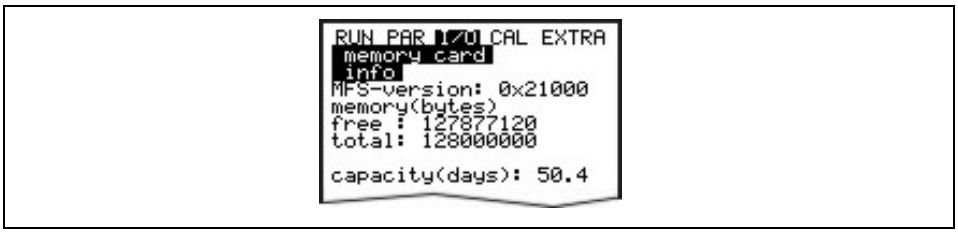


Fig. 8-96 Memory Card info menu

The display is only available if the memory card is plugged. To be able to indicate the remaining capacity time the card must be plugged into the PCM Pro one hour at least. You can use the >Memory Card< menu to execute card formatting as well.

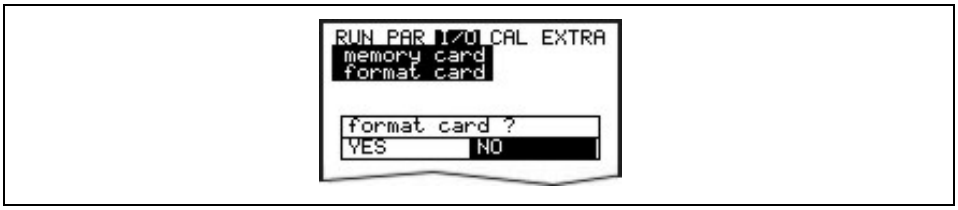


Fig. 8-97 Format card

Use memory cards purchased from NIVUS only. Other manufacturer's cards may lead to irreversible loss of data or measurement failure (e.g. permanent transmitter reset).

Never format memory cards on PC! The PCM Pro is not capable of using formats created by PC and therefore does not accept cards formatted on PC..

Formatting the card will erase all data saved on the card.
The card can be replaced at any time by pressing the >ALT< key. This action is going to transmit all data from the internal memory to the memory card. The message >Memory card busy< appears.

Do not replace the card as long as the message >Memory card busy< is indicated on the display.

Furthermore it is possible to read out settings from or to save settings to the PCM Pro. Parameters set will be written to memory card by using the menu point "store parameters". This will take approximately 30 seconds.
The progress is going to be indicated by a progress bar moving from left to right. After transmission has been finished successfully the display will indicate >OK< and jump back to the memory card menu subsequently.

Fig. 8-98 Saving parameters on memory card

The menu point „restore parameters" first of all will show all program files saved on memory card. The file will be transferred to the PCM Pro after choosing. Nach der Auswahl wird die Datei auf das PCM Pro übertragen. The name of the file required to program the PCM Pro by memory card is „PARAMET.NIV".

Fig. 8-99 Loading parameters to memory card

The PCM Pro has an additional internal memory which can be saved on memory card as well (store backup). This circular buffer has a capacity of approx. 20.000 measurement values which allows to record the parameters >Level, velocity, flow and temperature< for a period of 14 days.
In order to indicate trends in RUN menu, data from the internal memory is going to be used furthermore.

Executing a system reset will erase all data from the internal memory.

Fig. 8-100 Store backup

It is possible to save a maximum of 90 day totals on compact flash card. The data will be saved in the „Data“ folder using the name >Total.txt< including date, time and total (difference to previous day). The totalising time refers to the settings in „RUN / Day totals / Cycle“(see Fig. 8-22).
The circular memory always indicates the past 90 days

Fig. 8-101 Save day values (total)

8.8.6 I/O-Menu "System"

This menu allows to recall information on the rechargeable/battery. It also serves to recalculate the capacity of the rechargeable battery after it has been replaced.

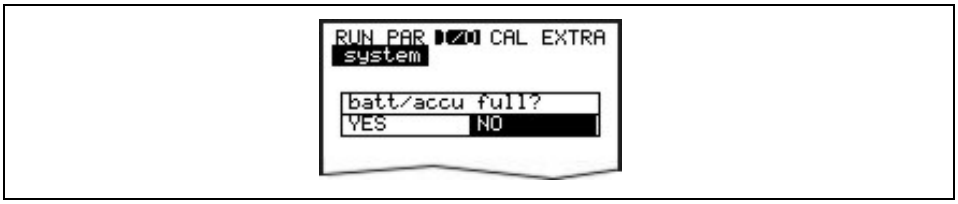


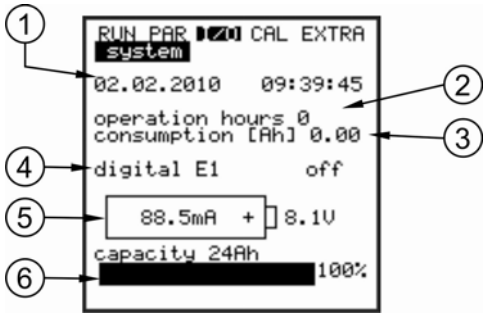
Fig. 8-102 Query battery full?

Confirming this message with >YES< will reset the capacity to 100% and the lifetime will be recalculated

The indicated lifetime bargraph with % indication is the result of a calculation assuming the maximum capacity and the power consumption. To achieve accurate results please observe to always use a completely charged battery. This reading shall be considered as a typical value due to the system-inherent lifetime of rechargeable batteries.
In order to avoid total discharge and data loss replace the rechargeable battery if the voltage drops below 7.0 V during standard operation.

Confirmation with >NO< will retain the current values which is useful to recall information on the remaining battery lifetime.

Always confirm with >YES< after replacing the rechargeable battery by a new one.



1 Current date and time

2 Number of PCM Pro operating (measuring) hours.
Does not count standby periods.

3 Power consumption during operating hours in Ah.

4 Condition of digital input. (optional)

5 Current power consumption and current battery voltage.
The battery should be replaced or charged on a limit of 7.0 V.
Due to battery protection purposes sensors will be switched off if voltage reaches 6.4 V (error message: error sensor 1)
The PCM Pro will be switched off at a voltage of 6.2 V.

6 Indication of the maximum battery capacity.
Enter this value under >PAR-Settings-Battery<. Percentage provides information on remaining battery lifetime.

Fig. 8-103 Battery lifetime screen

8.9 Calibration and Calculation Menu (CAL)

This menu allows to adjust the level sensors, to enter settings for flow velocity determination and to simulate relay switching cycles as well as flow events.

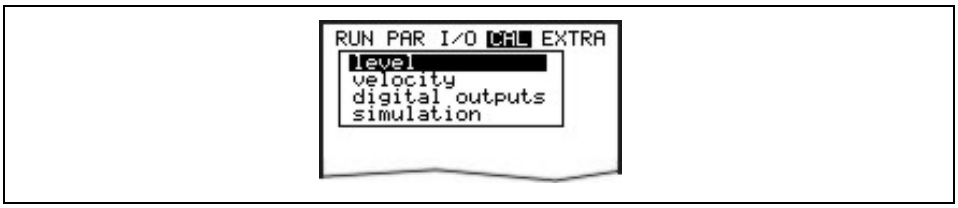


Fig. 8-104 Selection menu

8.9.1 Cal Menu "Level"

This submenu enables to calibrate the level sensors used e.g. in order to compensate a level offset due to constructional conditions.
The calibration is carried out by entering a reference value. This reference value has been determined by an independent measurement such as by using a precision ruler.

All active sensors are going to be adjusted to this reference value.

The following screen will appear after the calibration prompt has been confirmed:

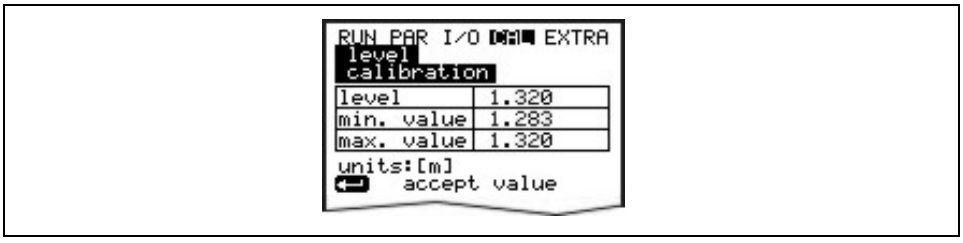


Fig. 8-105 Level screen - calibration

The currently active fill level sensor as well as its fluctuation range including min. and max. values will be displayed. This allows to draw conclusions on the prevailing flow level conditions (e.g. waviness of surface).
Best results are obtained at low fluctuation ranges.
Accepting the current level reading by pressing the >ENTER< key requires to investigate an accompanying reference value. Input this value in the screen below.

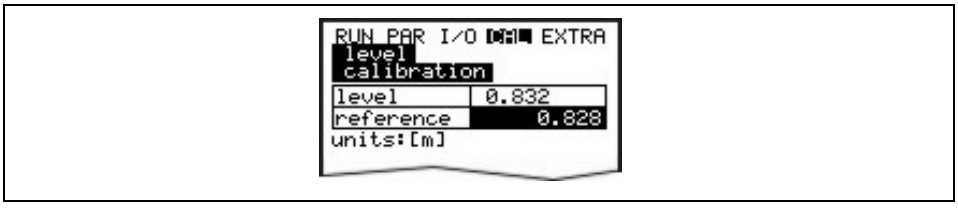


Fig. 8-106 Entering the level reference value

Confirmation with >ENTER< is going to bring up an overview screen displaying all active level sensors. This overview is a comparison between the previous (current) and the new (new) offset. The PCM will output an error message if the deviation between both values is too high. The adjustment will not be accepted. In this case repeat the adjustment procedure and if required check the conditions of installation.

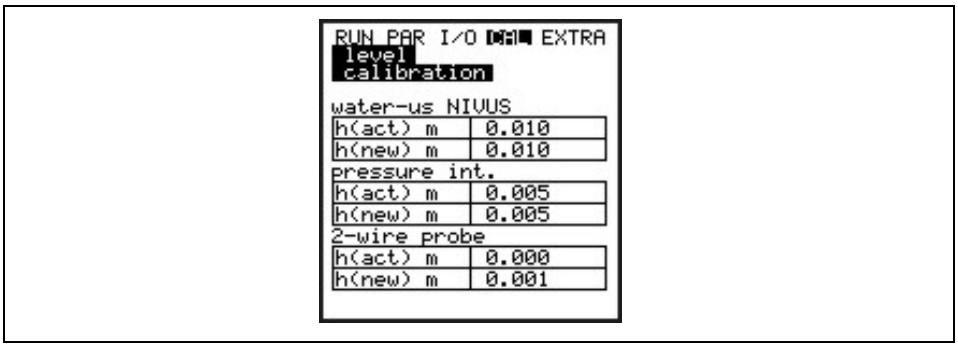


Fig. 8-107 Level adjustment screen

Executing an adjustment will adapt the installation height of the single sensors in PAR / Level menu accordingly. Hence it is required to confirm the prompt >Save values?< with >YES< before leaving the menu. This action will cause the adjustment values to be accepted.
Entering >NO< will abort the adjustment procedure.
Choosing >BACK< will take you back to the start of the procedure without accepting modified values.

Fig. 8-108 Screen "save new values?"

8.9.2 Cal Menu "Velocity"

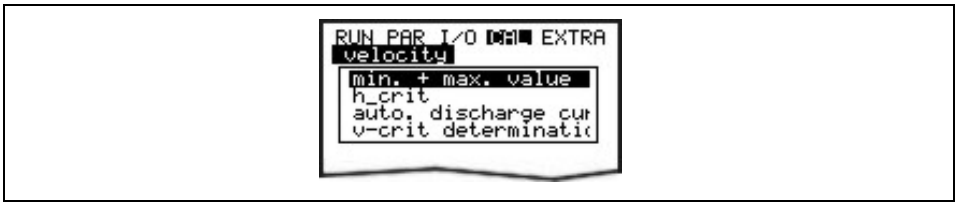


Fig. 8-109 Flow velocity screen

min. + max. Value Defines the flow velocity measurement range.

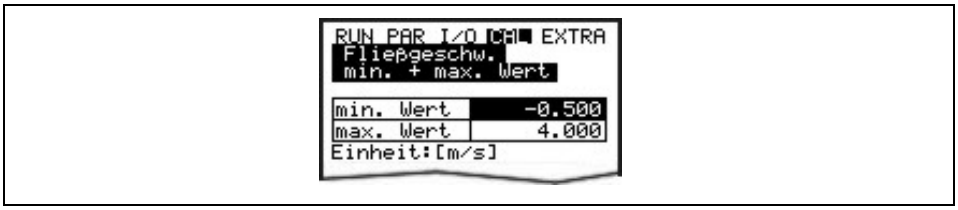


Fig. 8-110 Measurement range of flow velocity

Set the min. value to >0< if the negative flow direction is not to be measured.

h_crit Measuring the flow velocity is no longer possible as soon as the level falls below a certain level called h_crit.
The level h_crit is pre-determined by the construction of the sensor as well as the measurement method and is set to 0.065 m (2.56 in) per default.
After initial start-up, the PCM operates using the start values found in the Manning-Strickler table (CAL / Flow velocity / v-crit determination / Manning-Strickler) until it reaches the h-crit value set.
Going through a level range of 9-12 cm featuring a decreasing trend causes the unit to determine an application coefficient (automatic activated).
Then the PCM under h-crit operates using the investigated application coefficient.

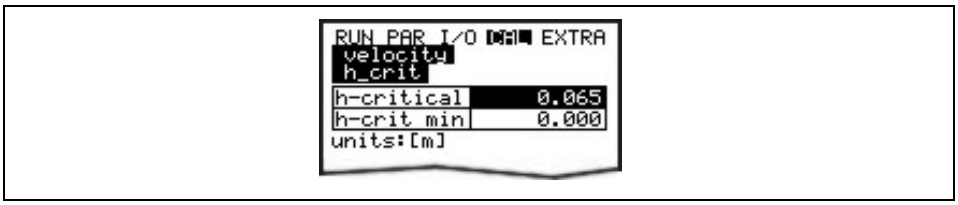
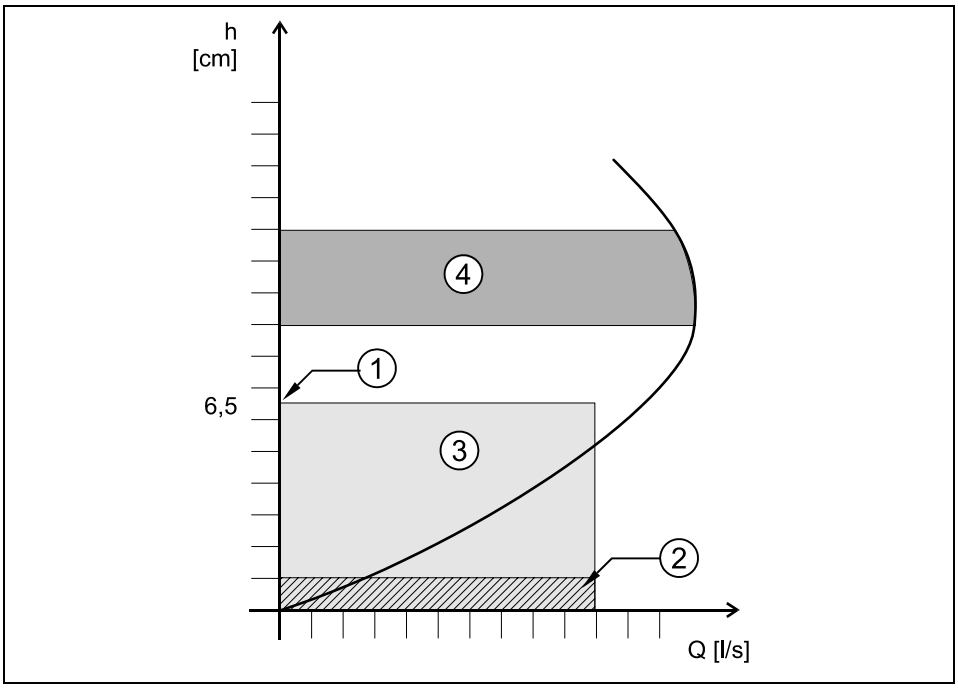


Fig. 8-111 Parameter h_crit, h_crit min

h_crit min The flow velocity will not be calculated below "h_crit min“ and hence will be set to >0<.



1 h-critical
2 h_crit min
3 Range of automatic Q/h relation
4 determination of application coefficient

Fig. 8-112 Flow velocity determination graph

Auto discharge curve

Depending on the selected setting, entered values are verified and corrected if necessary with the next measuring event (automatic >YES<). Another option is to permanently operate using the values entered in "Manning Strickler", "manual" or "Assistant" (automatic >NO<).

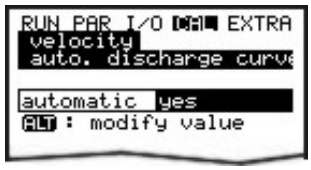


Fig. 8-113 Auto discharge curve

Please avoid backwater up to levels of 0.012 m if "Automatic YES".

8.9.3 v-crit Determination

This menu is conceived to be used for commissioning at low filling levels lower than 6.5 cm. There are three options to determine the flow velocity:

- Manning-Strickler (if slope and roughness are known)
- Manual (if a reference value can be determined)
- Assistant (if a minimum dam-up of 6.5 cm is possible)

Comprehensive expert knowledge is required to utilise these parameters to the best possible extent. NIVUS recommends to attend an according device training.

Fig. 8-114 Selecting v-crit determination

Manning Strickler

The theoretical discharge curve is calculated using the settings under >Dimensions<, >Slope< and >Roughness<.
This function may be combined with the automatic mode. The theoretical settings within the flow velocity monitoring area (see Fig. 8-112, No. 4) will be verified using this method.

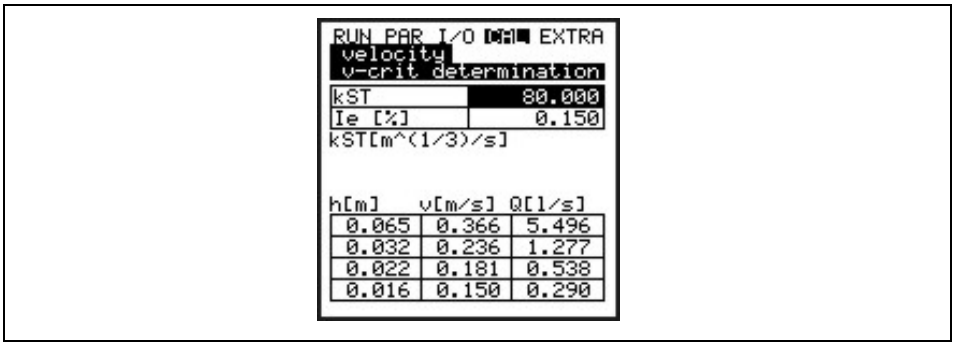


Fig. 8-115 Manning Strickler v-crit determination

kst Enter the Manning - Strickler coefficient
Ie [%] Enter the slope at measurement point in %

Please see Table "Manning - Strickler Coefficient in Chapter 13 for more information.

Manual

Enter the current level and the current flow velocity (measured using a reference) directly. The theoretical discharge curve is calculated from these values.
This function may be combined with the automatic mode. The theoretical settings within the flow velocity monitoring area (see Fig. 8-112, No. 4) will be verified using this method.

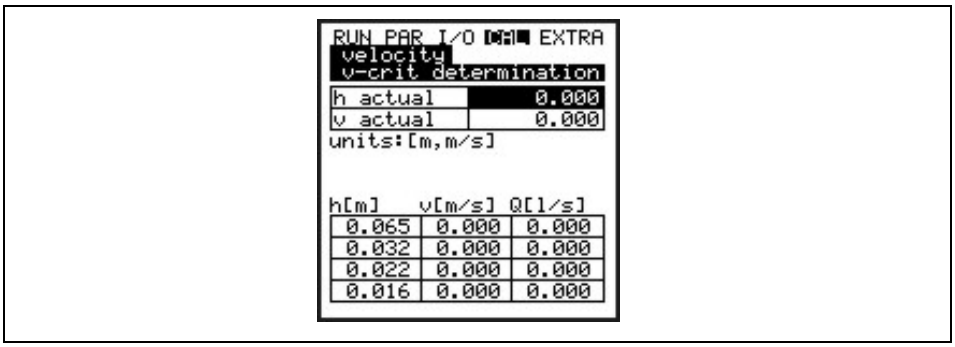


Fig. 8-116 Manually setting v-crit determination

Assistant

The PCM guides through a menu using an artificial dam-up (e.g. using a sandbag) to determine required characteristics. The theoretical discharge curve will be generated automatically.
This function may be combined with the automatic mode. The theoretical settings within the flow velocity monitoring area (see Fig. 8-112, No. 4) will be verified using this method.

First ensure free discharge, then start level measurement with >ENTER<.

Fig. 8-117 Assistant – start measuring v-crit determination

The PCM executes the first level measurement in free discharge. Measuring will take 8 seconds.

Fig. 8-118 Measuring Countdown Assistant

After the first measuring, a dam-up of minimum 6.5 cm (12 cm are recommended) must be created behind the sensor by using a sandbag or similar.
The second level measurement in the dam-up cannot be started before "h-actual“ shows stable values.

Fig. 8-119 Create dam-up – start measuring

The PCM will execute a new 8-second level measurement.

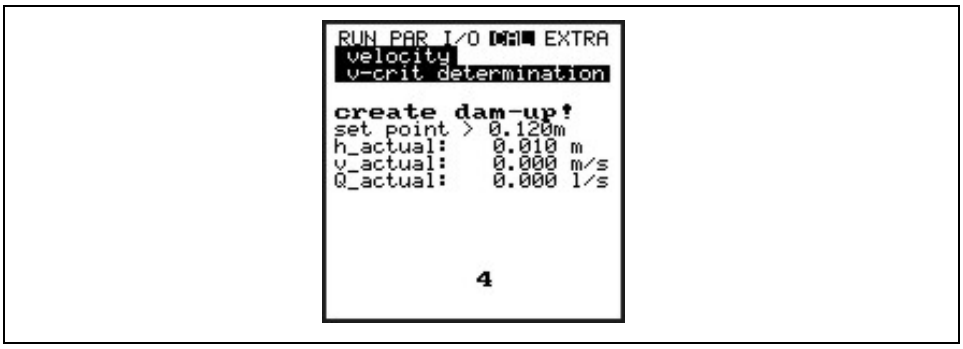


Fig. 8-120 Measuring countdown for the second measuring

The readings below will be indicated after the second measurement has been finished:

- h_actual: actual level
- h: level before creating a dam-up
- v: measured flow velocity
- Q: investigated flow

Fig. 8-121 Investigated values – screen (Assistant)

Pressing >ENTER< determines and subsequently enters an application coefficient (factor) fort he measurement point.

8.9.4 Cal - Menu "Relay Outputs"

Using the >up< or >down< arrow keys energises or de-energises the relay in the sampler control box directly.

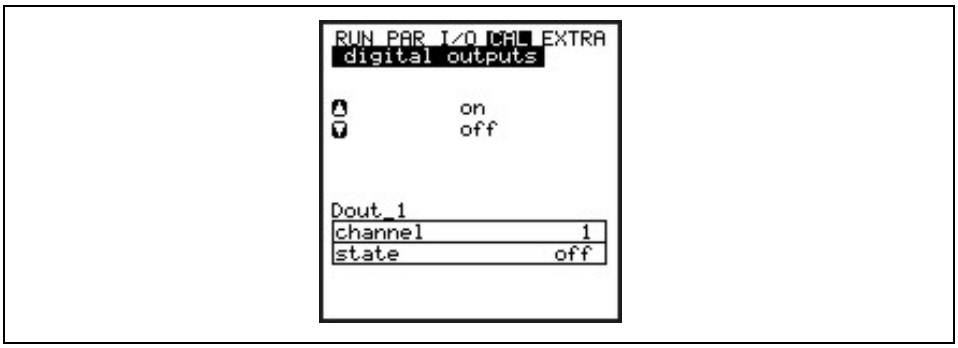


Fig. 8-122 Digital output simulation

8.9.5 Cal - Menu „Simulation“

This function allows to simulate a theoretical flow by entering supposed level and velocity values without having these values actually available. The PCM Pro is going to calculate the current flow value by using the simulated values based on the channel dimensions set. The results are going to be sent to the respective outputs (analog + digital).

Simulate the desired flow velocity by pressing the >left< or >right< arrow keys. Using the >up< or >down< keys will simulate the desired flow level.
Both values simulated are going to be indicated in the table. The calculated flow value can be seen above the table

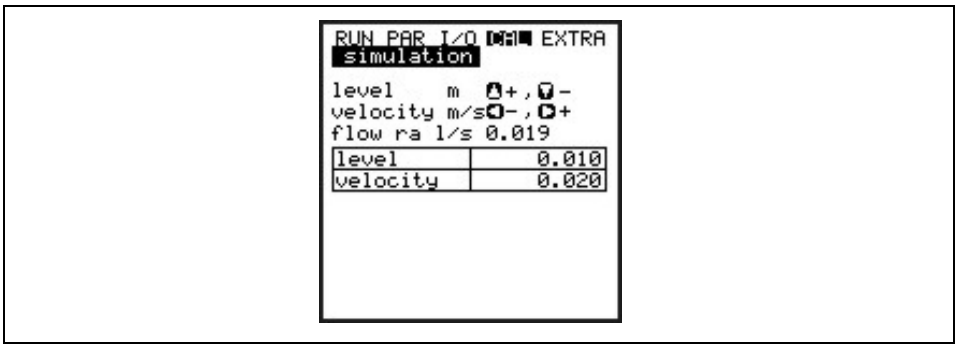


Fig. 8-123 Flow measurement simulation

8.10 Operating a NPP (NIVUS Pipe Profiler)

Connecting an NPP to a PCM Pro requires to set the following parameters first:

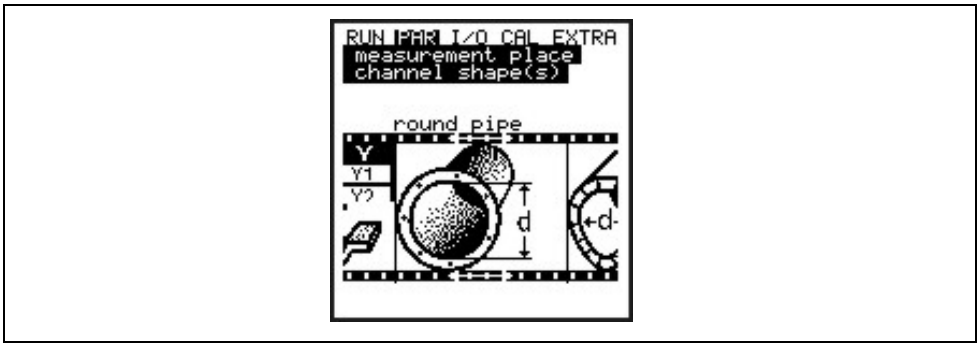
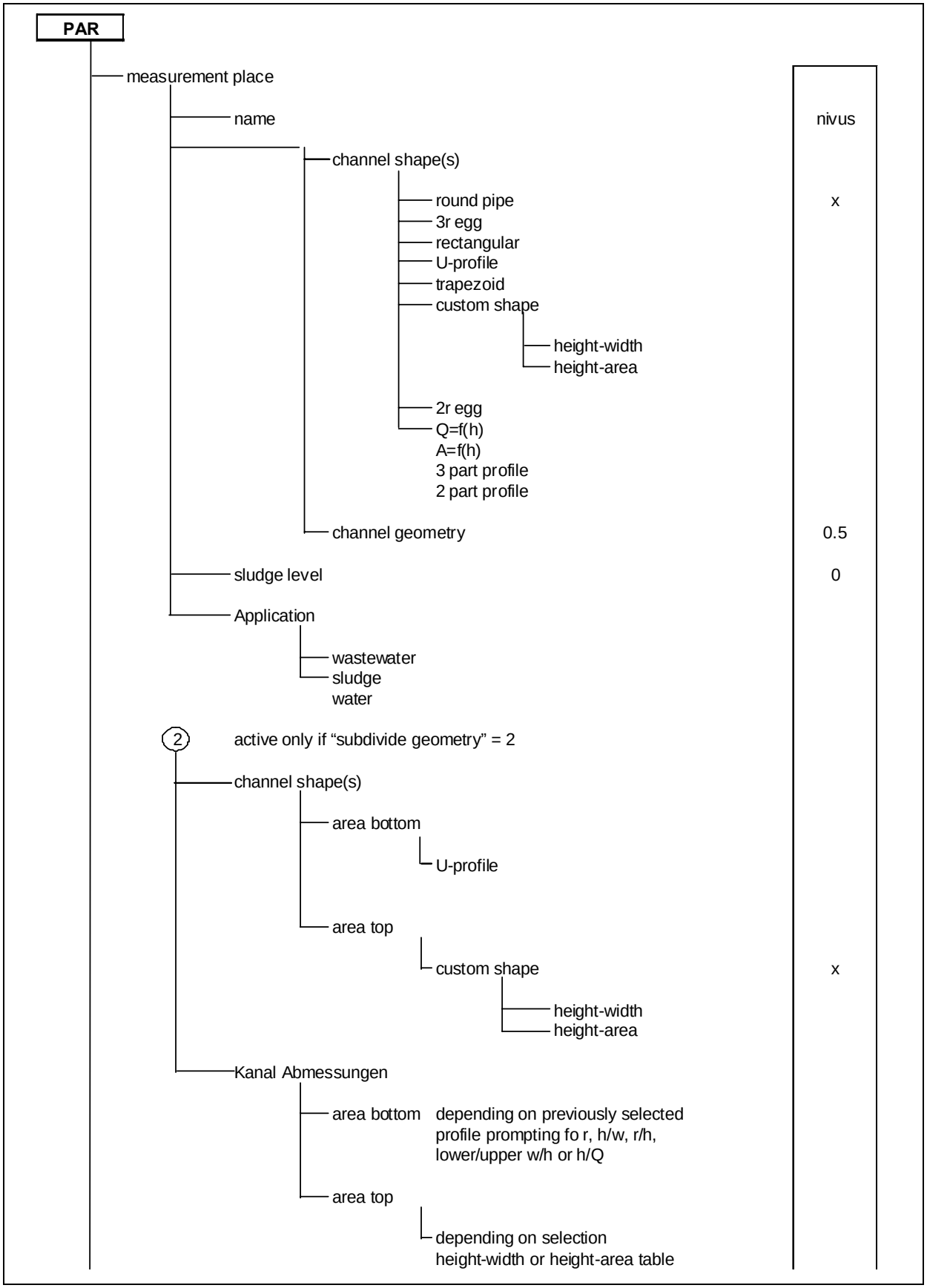


Fig. 8-124 Selection – NPP

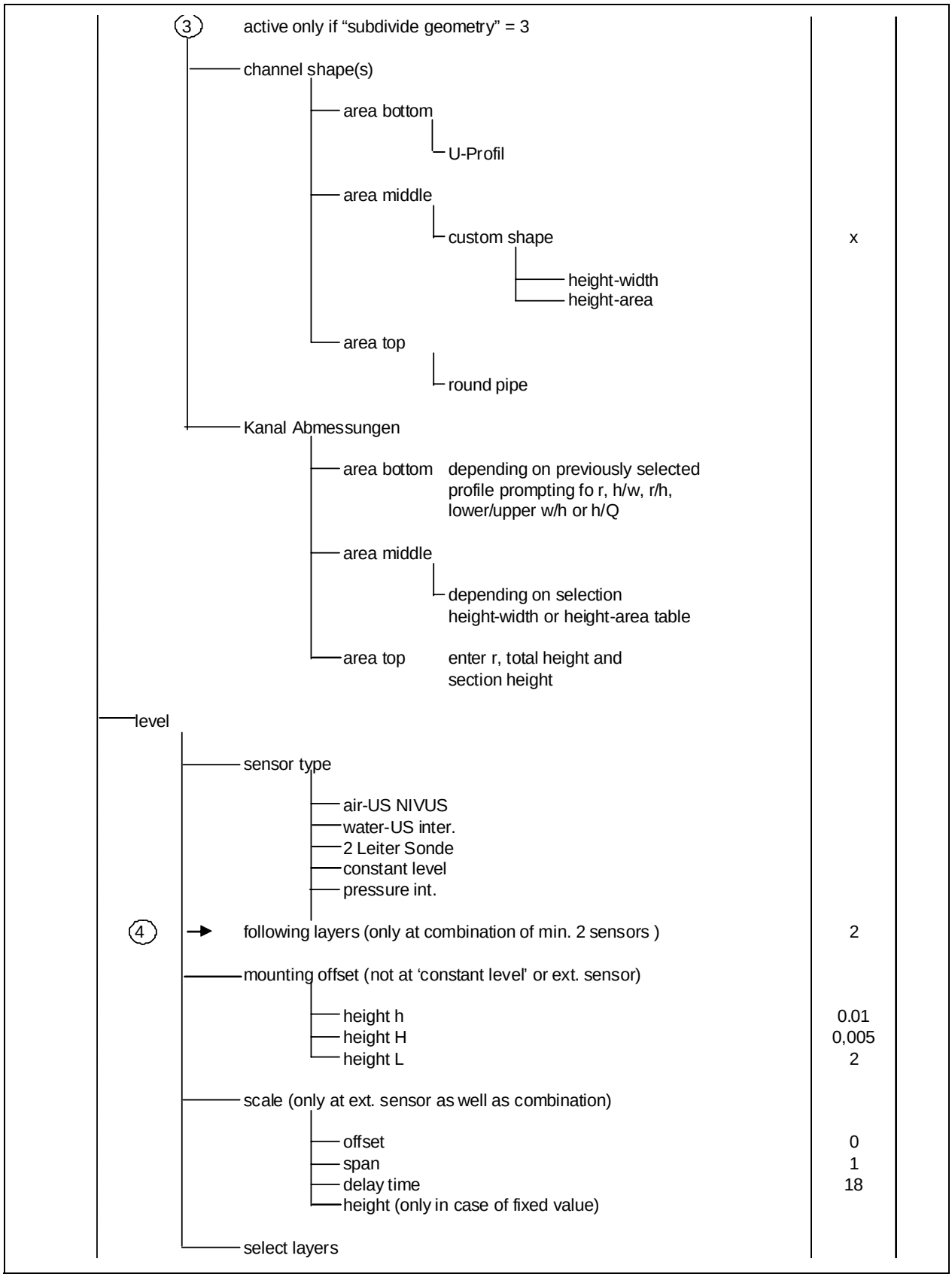
Firstly select "NPP“ as profile in parameter >PAR / measurement place / channel shape(s)<.
Then enter the accurate inside diameter of the NPP into parameter >channel dimensions< and finish the parameter setting procedure.

9 Parameter Tree

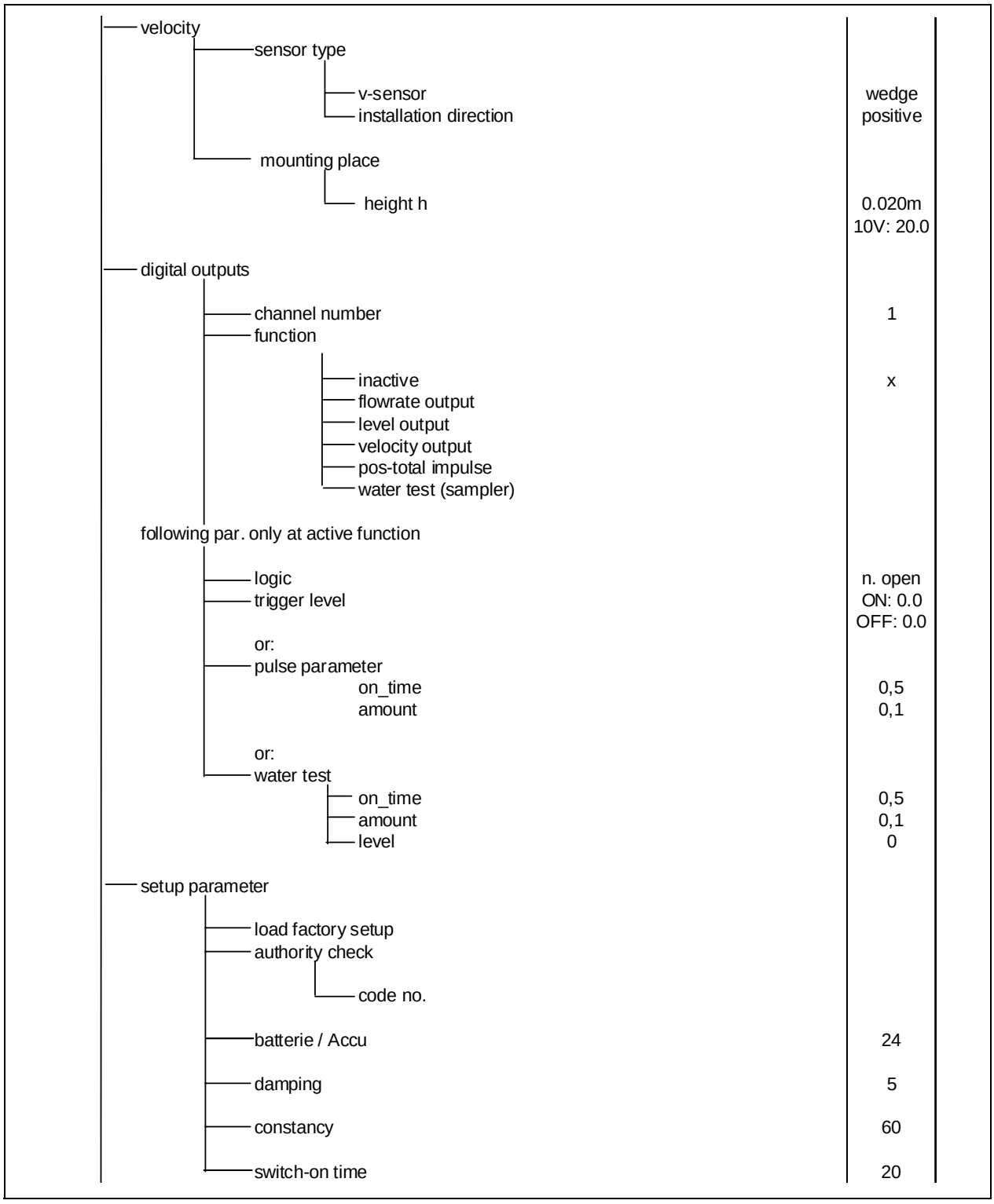
Parameter Menu (PAR) Part 1



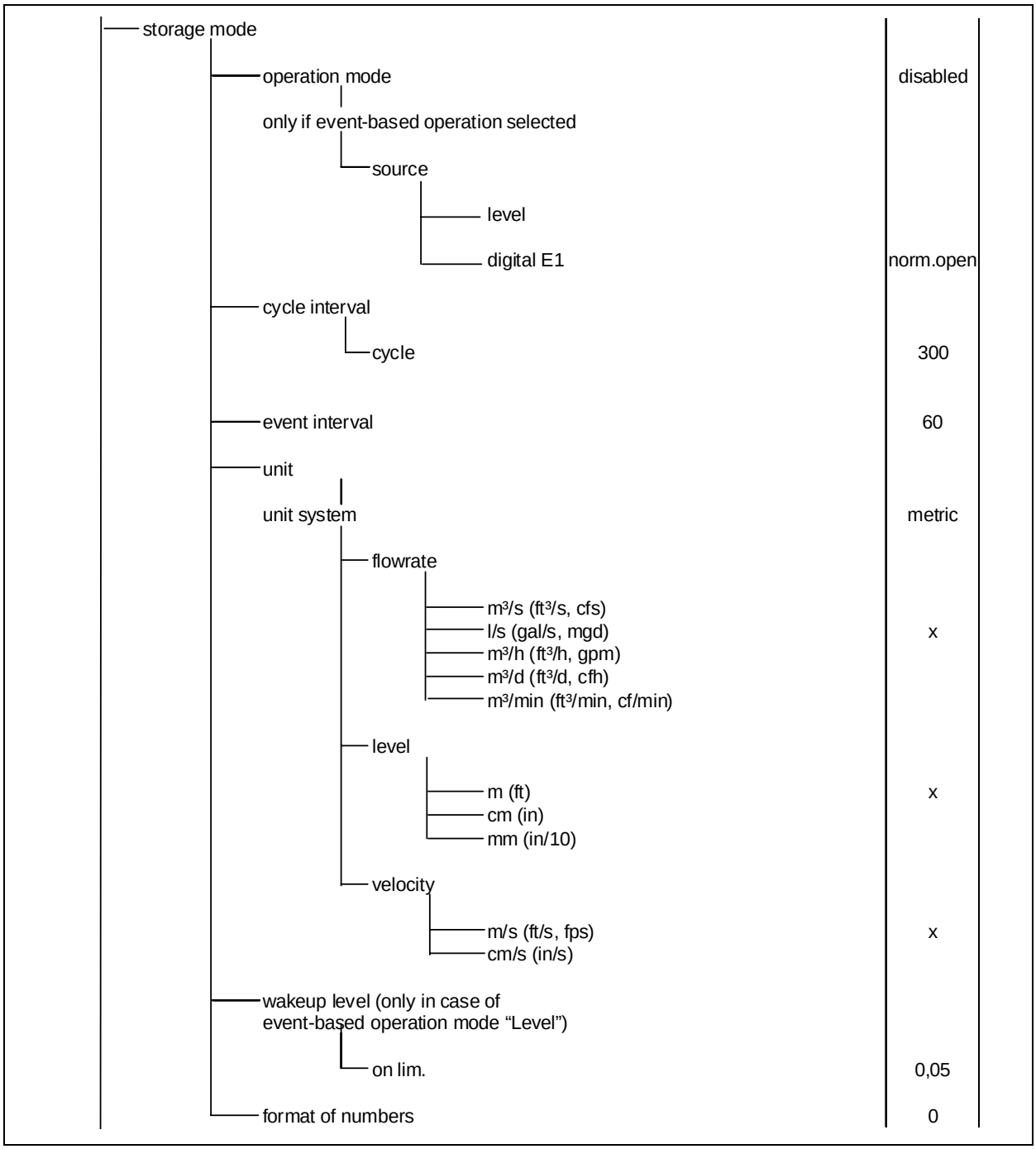
Parameter Menu (PAR) Part 2



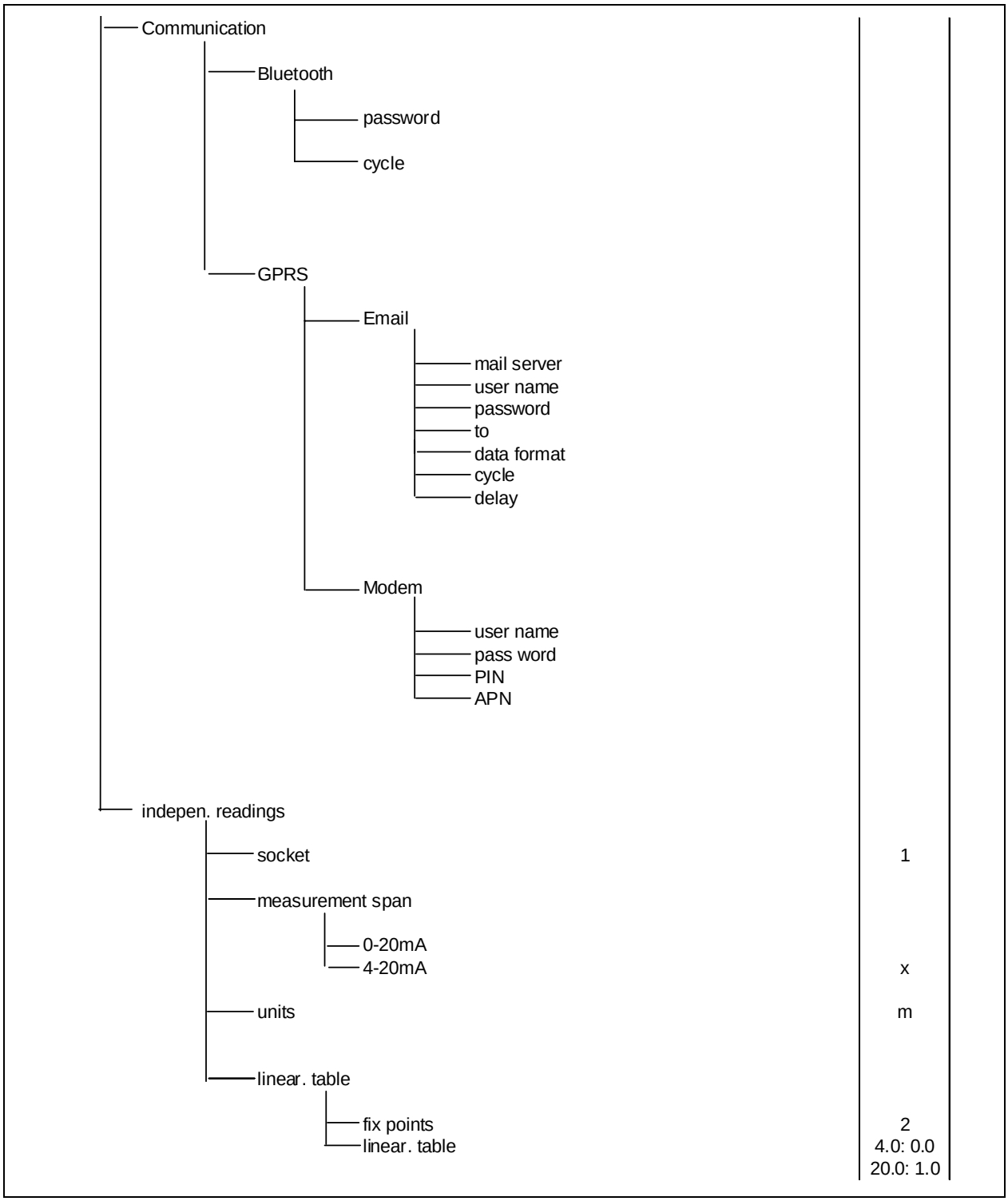
Parameter Menu (PAR) Part 3



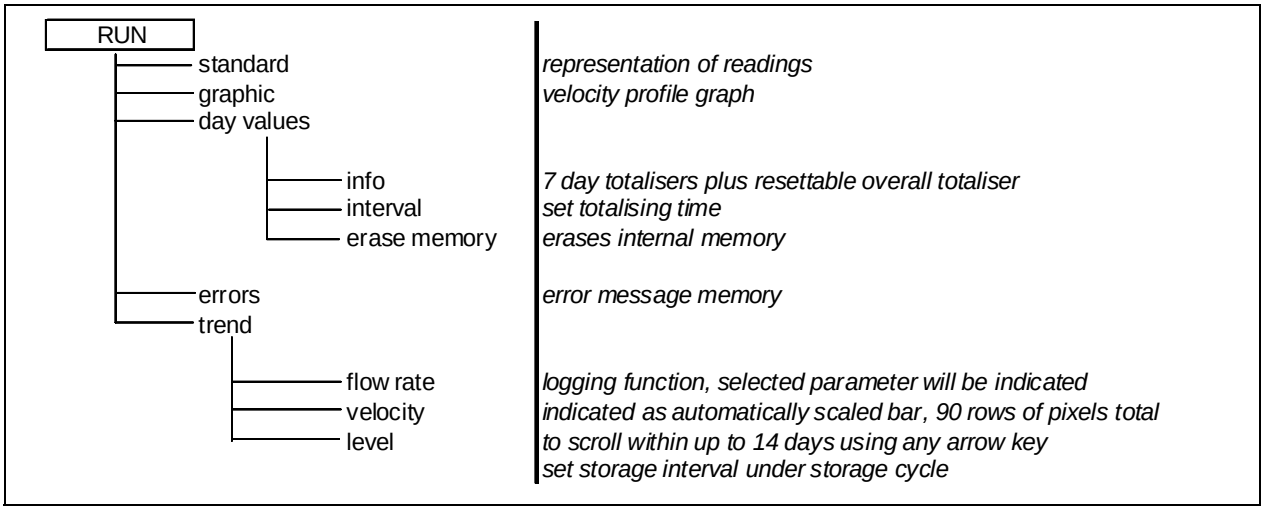
Parameter Menu (PAR) Part 4



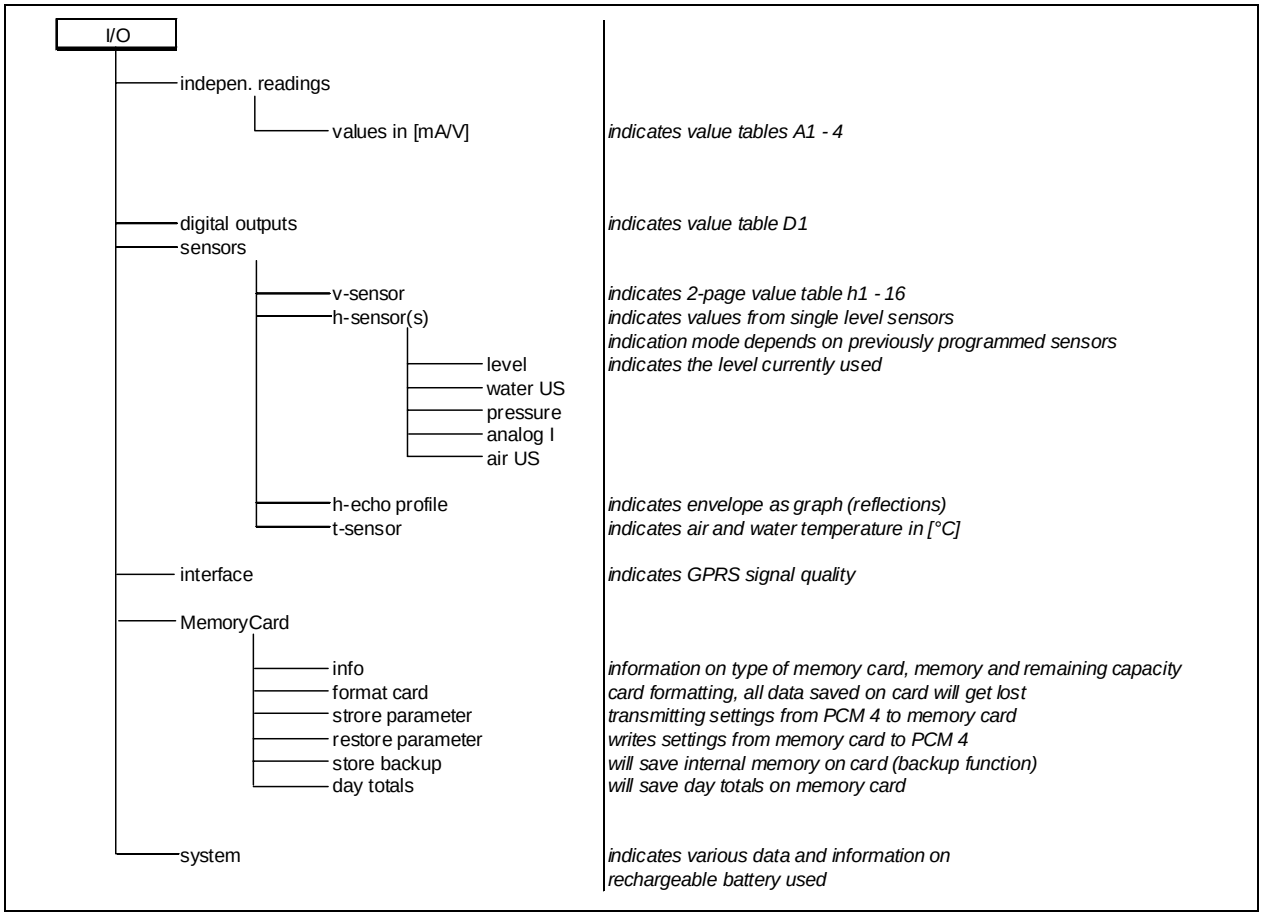
Parameter Menu (PAR) Part 5



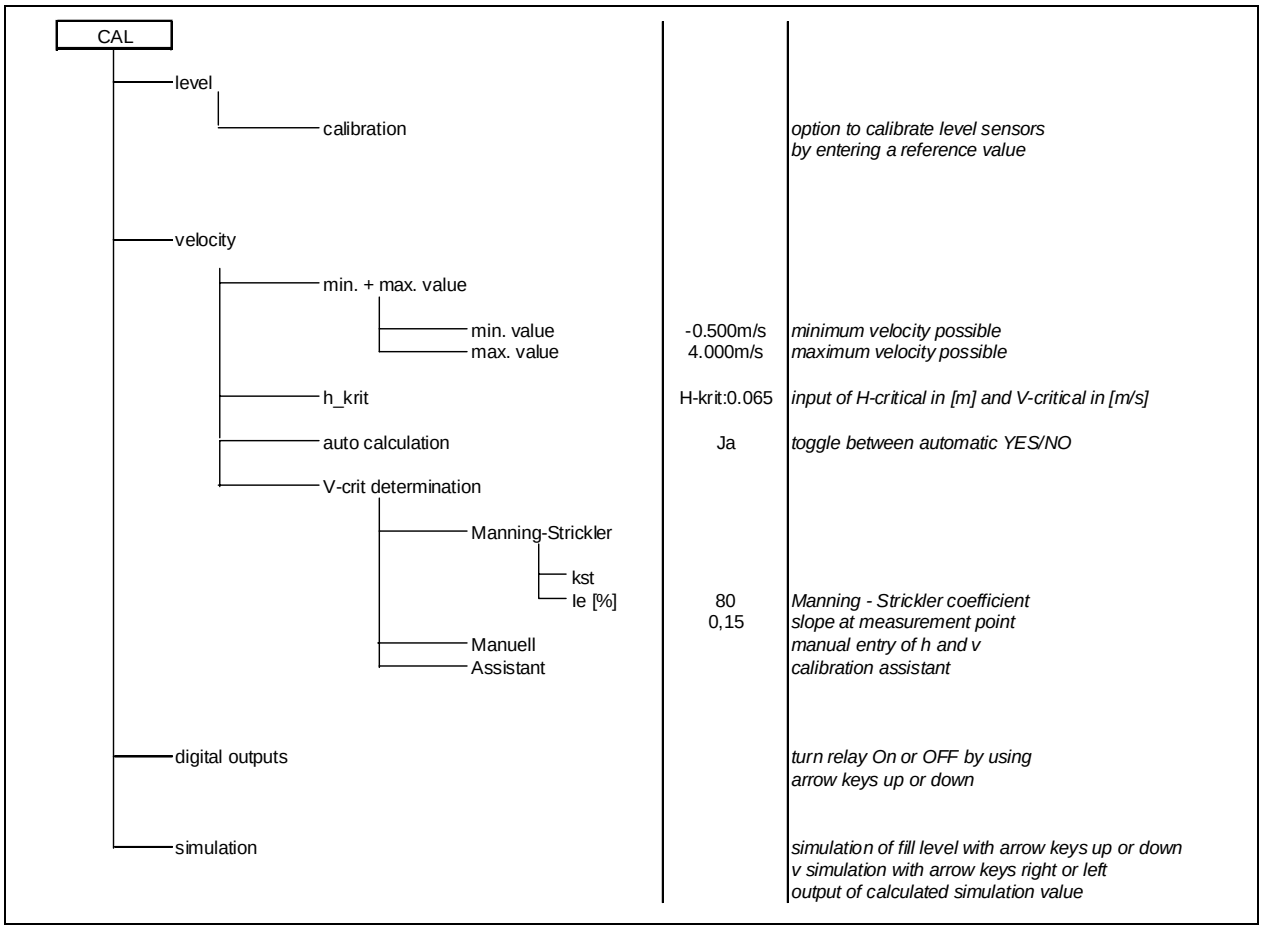
Operation Mode (RUN)



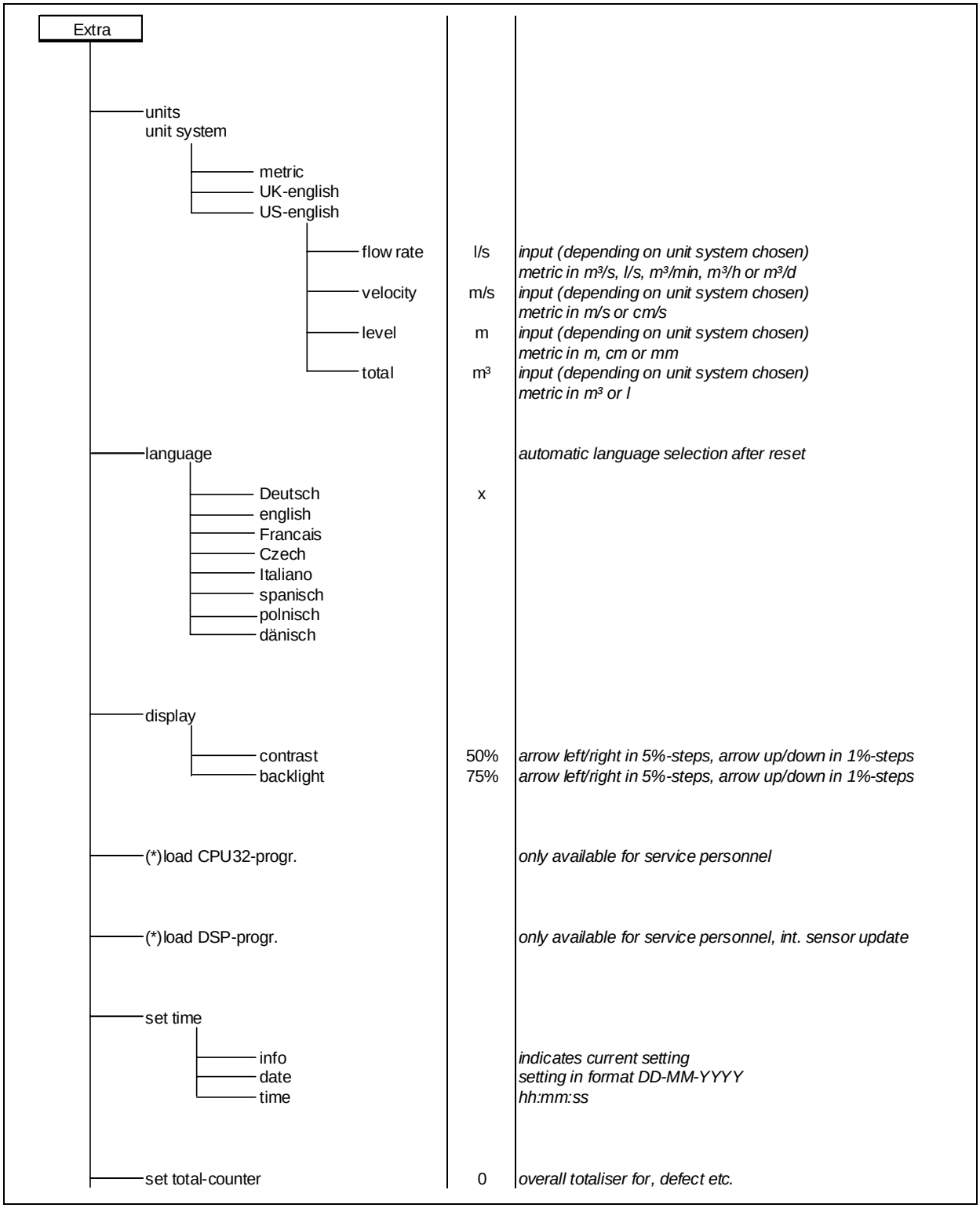
Signal Input / Output Menu (I/O)



Calibration Menu (CAL)



Display Menu (EXTRA)



10 Troubleshooting

Error	Possible Reason	Correction
No indication of flow (0)	Connection	Check sensor connection to PCM Pro.
	Sensor	Check if sensor is installed horizontally and towards flow direction.
		Check if sensor is dirty, blocked, covered with sedimentation (to be removed) or damaged (replace sensor).
	Level measurement	**No Level = no flow velocity measurement possible!** Check if water-ultrasonic sensor is installed horizontally; check if pressure sensor is blocked, check functions and signals from air-ultrasonic or external level measurement (cables, clamped connections, short circuits, resistive loads) in menu >I/O-Sensors - H-Sensor - Echo profile<.
		Flow level <65 mm (2.56 in)? In this case, the PCM Pro is in Q/H measurement mode at initial start-up. See chapter 8.9.2, h_crit determination.
		For full-filled pipes without level measurement, check entry for fixed value in the level measurement parameter.
	Transmitter	Recall error memory. Proceed depending on error message (check cables, check sensor installation) or call NIVUS service personnel (DSP or CPU error).
	Programming	Check complete parameter settings of transmitter.
No Display (dark / flickering)	Connection	Check power connection (battery plug).
	Power supply	Check supply voltage level (min. 7,0 V).
	Memory card	Unauthorised 3rd party manufacture. Use NIVUS memory card.
		Memory card formatted on PC? Send card to NIVUS.
>Error Sensor<- Display	Connection	Check connection cable.
	Battery voltage	Voltage lower than 7,0V replace (rechargeable) battery.
DSP error	Communication	Communication with CPU or Sensor disturbed. Can be checked by pressing the >I< key. DSP version should be indicated in the third line of the following screen. Erase error memory (under >>RUN<<) completely. If required disconnect unit from mains for approx. 10 seconds and restart.
	Contacting problems	Can be checked by NIVUS service personnel only.

Unstable measurement values	Insufficient hydraulic conditions on measurement place	Check quality of measurement place by using the flow profile graph. Relocate the sensor to a hydraulically better suitable place (extend calming section).
		Remove soiling, sedimentation or obstructive constructions in front of the sensor.
		Straighten the flow profile by installing appropriate baffle plates and calming elements, flow straighteners or similar upstream of measurement.
		Increase damping.
	Sensor	Check sensor installation (towards flow direction, horizontal installation).
		Check if sensor is dirty or blocked.
Measured value not plausible	Insufficient hydraulic conditions on measurement place	See error "Unstable measurement values“.
	External level signals	Check if connection is correct
		Check if cables are crushed, for short circuits and improper resistive loads or current consumers without galvanic isolation.
		Check measurement range and span.
		Check input signal in I/O menu.
	Sensor	Check if connection is correct.
		Check if cables are crushed, check for extensions/cable types, short circuits, surge arresters or improper resistive loads.
		Check level signal, echo profile, flow velocity signal, cable parameters and temperature in I/O menu.
		Check if sensor is installed on a vibration-free place. Check sensor installation (towards flow direction, horizontal installation), check sensor for soiling.
	Programming	Check channel geometry, dimensions (note measurement units), sensor type, sensor mounting height etc.
No / incomplete data on memory card	Memory card	Memory card faulty. Verify in the menu: I/O – Memory card – info
		Unauthorized card. Use NIVUS Memory card
		Memory card formatted on PC. Send card to NIVUS.
	Transmitter	Memory card not properly inserted (reversed or not deep enough)
		Memory card not plugged in for a sufficient period of time. Data has not been saved before card has been unplugged (>ALT< key action)
	Programming	Storage not enabled in Memory Mode – Operation Mode – Mode.

11 Maintenance and Cleaning

Due to using the measurement system mostly in the waste water field which may be contaminated with hazardous germs, please ensure to take respective precautions getting in contact with system, transmitter, cables and sensors.

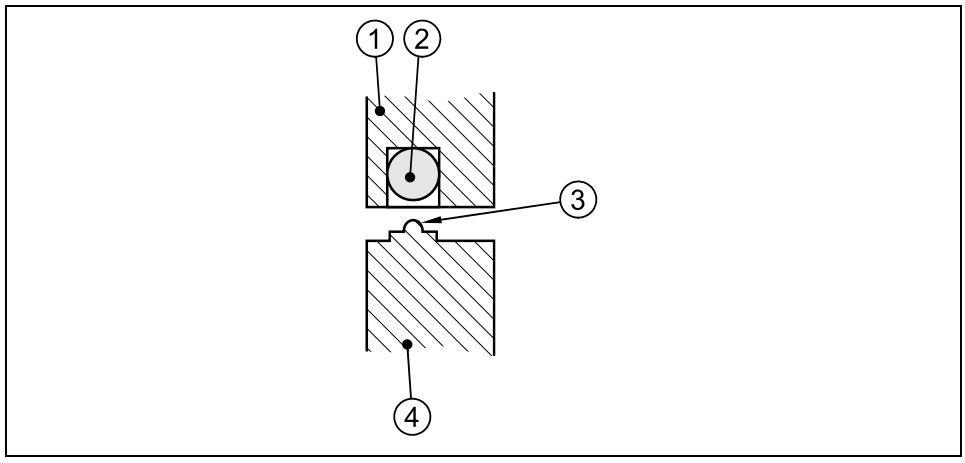
Extent and intervals of maintenance measures depend on the following conditions:

- measurement principle of level sensor
- material wear and tear
- measurement medium und hydraulic conditions of channel
- general regulations for operators of measurement facility
- frequency of use
- environmental conditions

In order to ensure reliable, accurate and trouble-free operation of the measurement system we recommend to have an inspection performed by NIVUS at least once per year.

11.1 Transmitter Enclosure

Regularly check the enclosure for leakage (protection IP67). Check the black gasket in the rim of the lid for mechanical damage or dirt. Remove dirt with a wet cloth. Then slightly grease the gasket with silicone grease or similar.



1 Enclosure lid
2 Black gasket
3 Sealing lip
4 Enclosure wall

Fig. 11-1 Enclosure sealing

The gasket of the enclosure lid is subject to wear and tear.
In order to guarantee the degree of protection it is required to return the transmitter to NIVUS once per year to check and if necessary to replace the gasket (not free of charge).

Any damages resulting from a non-maintained gasket are not covered by the manufacturer's liability!

Firmly press down the lid whilst closing in order to facilitate locking the PCM Pro. The sealing lip hence lies firmly against the unit and the locking clamps can be easily latched.

11.2 Sockets

Dirty contacts shall be dry and clean before reconnecting the sensors. Dry dirt may be removed cautiously using pressurised air or a brush with plastic bristles (no metal!!). Use contact spray for contact maintenance if required.

11.3 Batteries / rechargeable

Batteries are subject to wear and tear and have to be replaced frequently. While standard batteries are for single use only and have to be disposed according to local regulations after their capacity is used up, rechargeable batteries can be charged again in order to be used many times. But even the lifetime of rechargeable batteries is not unlimited however. Beside regular maintenance it also depends on the frequency of use as well as on the conditions of use and storage.
Please refer to chapter 6.5 in order to get more information on how to charge batteries.

Rechargeable batteries are subject to wear and tear and hence shall be replaced after a maximum period of 2 years.

This period may be shorter if used extensively.

12 Dismantling / Disposal

The device has to be disposed according to the local regulations for electronic products.

Do not leave (rechargeable) batteries in the PCM Pro after being discharged. Please ensure to dispose of used batteries according to environmental regulations.

13 Table "Manning - Strickler Coefficient"

Consistency of channel wall		M in m1/3/s	k in mm
smooth	glass, PMMA, polished metal surfaces	> 100	0...0.003
	plastic (PVC, PE) new steel plate with protective coating; smoothened cement plaster	≥ 100	0.05 0.03...0.06
moderately rough	asphalt coated steel plate; concrete from steel or vacuum formwork, no joints, carefully smoothened; planed wood, joint-free, new; asbestos cement, new	90...100	0.1...0.3
	smoothened concrete, smooth finish planed wood, well-joint	85...90	0.4 0.6
	concrete, good formwork, high cement contents	80	0.8
rough	non-planed wood; concrete pipes	5	1.5
	hard-burned bricks, carefully joint; well-manufactured ashlar facing; concrete from joint-free wooden formwork	7..75	1.5..2.0
	rolling-cast asphalt finish	70	2
	well-manufactured ashlar masonry; moderately incrusted steel pipes; non-finished concrete, wooden formwork; squared stones; old and swelled wood; cement walls	65...70	3
	non-finished concrete; old wooden formwork; brickwork, no joints, finished; dry-stone wall; soil material, smooth (fine-grained)	60	6
Rougher surfaces are difficult to measure under hydraulic aspects and hence are not described here			

14 Table of Pictures

15 Index

16 Declaration of Conformity

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Internet: www.nivus.de

EG-Konformitätserklärung
EC Declaration of Conformity
Déclaration de conformité CE
Świadectwo Zgodności UE

Für das folgend bezeichnete Erzeugnis:
We hereby declare that the design of the:
Le produit désigné ci-dessous:
Dla niżej opisanego produktu:

Bezeichnung: *Description / Désignation / Opis:*	**Portabler Durchflussmessumformer PCM Pro** *Portable flow measurement transmitter / Convertisseur de mesure de débit portable / Przepływomierz przenośny*
Typ */ Type / Type / Typ:*	**PCP-E02PRO**

wird bestätigt, dass es mit den folgenden Richtlinien übereinstimmt:
as delivered complies with the following EC directives:
Est certifié, conforme aux directives CE suivantes:
stwierdza się, iż odpowiada on wymaganiom następujących dyrektyw:

94/09/EG
2004/108/EG

Die Geräte stehen im Einklang mit den folgenden harmonisierten Normen oder Dokumenten:
The devices furthermore comply with the following harmonised standards or documents:
En outre, ces appareils satisfont aux normes et documents harmonisés désignés ci-après:
Urządzenie odpowiada wymogom następujących norm sharmonizowanych lub dokumentów:

EN 60079-0	EN 60079-7	EN 60079-11
EN 61000-6-2	EN 61000-6-4	

Diese Erklärung wird verantwortlich für den Hersteller / Importeur:
This declaration is submitted on behalf of the manufacturer / importer:
Le fabricant / importateur assume la responsabilité de cette déclaration:
Za niniejsze świadectwo odpowiada producent / importer

NIVUS GmbH
Im Taele 2
75031 Eppingen, Germany

abgegeben durch / *represented by / faite par / wydane przez:*
Ingrid Steppe (Geschäftsführerin / *Managing Director / Gérante / Dyrektor)*

Eppingen, den 12.11.2010 Ingrid Steppe

(Rechtsgültige Unterschrift / *Legally valid sign / Signature authentique / prawnie wiążący podpis)*

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