Instruction Manual for portable Flow Measurement Device PCM 4

(Original Instruction Manual – German)

valid as Firmware Revision No. 4.00

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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.

Copyright

Names

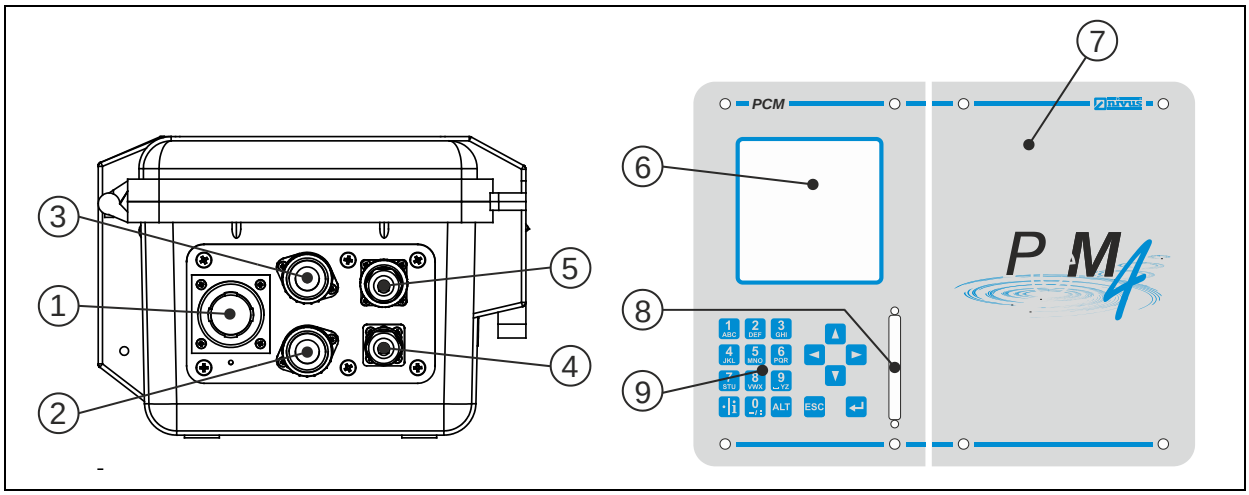
The use of general descriptive names, trade names, trademarks and the like in this handbook does not entitle the reader to assume they may be used freely by everyone. They are often protected registered trademarks even if not marked as such.

1 Contents

1.1 Table of Contents

2 Overview and use in accordance with the requirements

2.1 Overview



1 Multifunctional socket to connect either Connector Box (optional), active digital input, 0/4-20mA input signal or 0-10V voltage output and relay output
2 Socket for connection of water-combi sensor, type POA, CS2 or Electronic box EBM
3 Socket for connection of air-ultrasonic sensor Type OCL or external level measurement 4-20 mA (such as NivuCompact)
4 Socket for combined mains adapter / battery charger
5 Socket for Bluetooth- / GSM module / NivuLog PCM
6 Display
7 (Rechargeable) battery compartment
8 Cover for Compact flash card slot
9 Programming keys

Fig. 2-1 Overview PCM 4

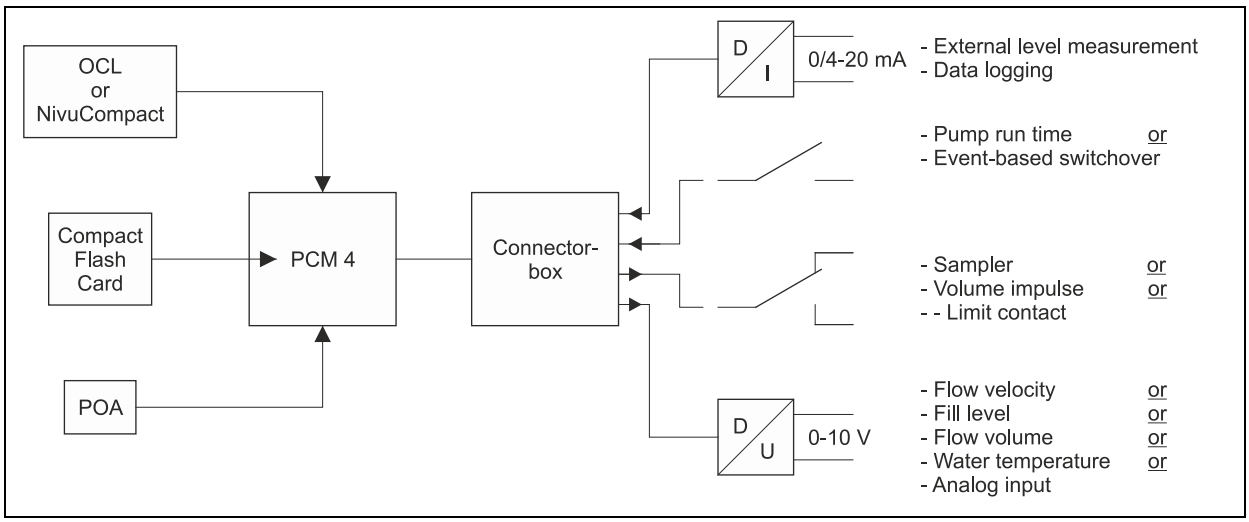


Fig. 2-2 Possible combinations

The Connector Box shall be used only if more than one input or output has been connected to the multifunctional socket of the PCM 4 simultaneously.

2.2 Use in accordance with the requirements

The measurement device, type PCM 4 as well as the accompanying sensors are designed to temporarily measure flow of slight to heavy polluted media in part filled and full sewers, pipes and other channels. External data can be detected and recorded as well. Additionally it is possible to drive external peripheral units optionally.
The unit is designed to be powered independent from mains by using either rechargeable batteries or standard batteries. On the other hand the unit can be powered from mains by using the combined power pack / battery charger.
Measured and recorded data is going to be saved on a non-volatile, exchangeable storage medium.
Please necessarily observe the maximum permissible limit values as specified in chapter 2.3. Any cases varying from these conditions without being 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 Specifications

2.3.1 Transmitter

Power supply	- rechargeable lead gel battery: 12V/12 Ah - battery box compartment for 12 LR20 standard batteries 1.5 V (18 V, type LR20) - power pack 100 - 240 V AC / 50/60 Hz, output: 12 V DC / 2,0 A - Voltage range 11.5 V - 30 V
Enclosure	- material: Polypropylene, impact resistant - weight: approx. 2.0 kg (4.41 lbs, without sensor and batteries) - protection: IP67 if lid is closed and locked
Operating temperature	-10 °C to +50 °C
Storing temperature	-30 °C to +70 °C
Max. humidity	90 %, non-condensing
Display	back-lit graphic display, 128 x 128 pixel
Operation	18 keys, menus in German, English, French, Italian, Czech, Spanish, Polish and Danish
Sockets	- 1 x 4 - 20 mA for external level (active 2-wire sensor) or 1 x active air-ultrasonic sensor Type OCL for level measurement - 1 x active combi-sensor water-ultrasonic/pressure sensor for flow velocity and level measurement (Type POA, CS2) or Electronic box EBM - 1 x multifunctional socket for digital and analog inputs and outputs - 1 x socket for combined power pack and battery charger or alternative power supply - 1 x socket for Bluetooth / GSM module / NivuLog PCM
Inputs via multifunctional socket	- 1 x active digital input, supply voltage 3.3 V DC - 1 x analog input, 0/4 - 20 mA (passive)
Outputs via multifunctional socket	- 1 x relay (SPDT) switching capacity: 250 V AC / 30 V DC, 5 A switching frequency: 5 Hz - 1 x voltage output 0 - 10 V
Memory cycle	1 to 60 minutes, cyclical or event-based
Data memory	- externally on plug-in compact flash card up to 128 MB - internal RAM, 8 MB
Data transmission	- via plug-in compact flash card - via Bluetooth module (optional) - via GSM module (optional) - via NivuLog PCM

2.3.2 Accessories (optional)

Memory card	type: compact flash card; capacity: 128 MB
Read-out adapter	adapter for PCMCIA interfaces, mainly for read-out via Laptop / Notebook
Card reader	with USB interface for PC connection
Connector Box	for simultaneous connection of more than one output or input to the PCM 4 multifunctional socket
Rechargeable battery pack	- rechargeable lead gel battery: 12 V / 12 Ah - rechargeable lead gel battery: 12 V / 26 Ah, for use in external battery box - battery compartment for 12 LR20 standard batteries 1.5 V
Pipe mounting system	for temporary, non-permanent clamping installation of wedge sensors (water-ultrasonic combi-sensor and air-ultrasonic sensor) in pipes DN 200 - 800 and egg profiles up to h = 600mm
Suspension bracket with eyelet	to fasten the PCM 4 on access ladders or similar
Power pack / battery charger	combined battery charger for rechargeable battery pack or for direct mains operation, 100 - 240 V AC / 50 - 60 Hz; IP 40
Evaluation software	type: NivuSoft for Windows XP, Windows Vista or Windows 7 for data read out, data evaluation, generation of hydrographs, average values, hour, day and month totals and more
External battery box	external battery box for connection to PCM 4 via charger socket.
Connection cables	there are numerous pre-configured cables for connection of peripheral units available.
Bluetooth module	For connection to PCM 4
GSM module	For connection to PCM 4
NivuLog PCM	For connection to PCM 4
Rechargeable battery pack	for GSM module; 2,4 V
Battery charger Type EMAKKU01	For rechargeable batteries of GSM module

3 General Notes on Safety and Danger

3.1 Danger Notes

3.1.1 General Danger Notes

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 4 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 adhered to.
All operations, which go beyond steps regarding installation, connection or programming the unit are allowed to 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 hazardous disease germs. Respective precautionary measures must be taken to avoid damage to one's health.

3.2 Device Identification

The instructions in this manual apply only for the type of device indicated on the title page.
The nameplate is fixed on the reverse side of the device and contains the following:

- name and address of manufacturer
- CE label
- type and serial number
- year of manufacture

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.

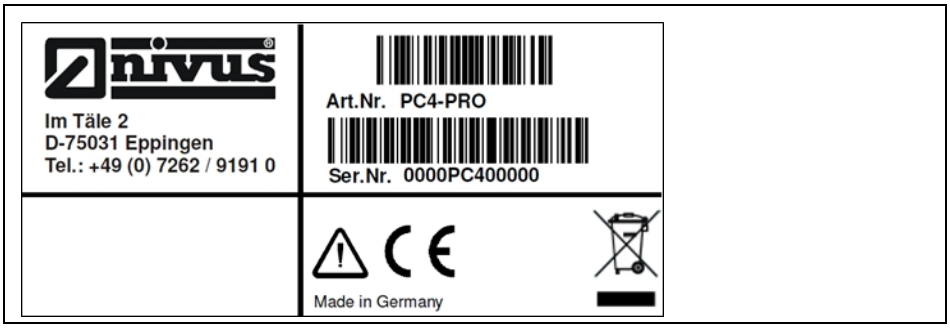


Fig. 3-1 PCM 4 nameplate

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

The safety instructions contained within must be followed.

It is strictly prohibited to disable the safety devices or to modify 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.

Using spare parts / parts subject to wear and tear (such as rechargeable batteries, filters or similar) which are not licensed by NIVUS will invalidate any warranty claims.

3.4 Shutdown Procedure

For maintenance, cleaning and repair purposes (authorized staff personnel only) the device has to be disconnected from batteries / mains.

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 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.

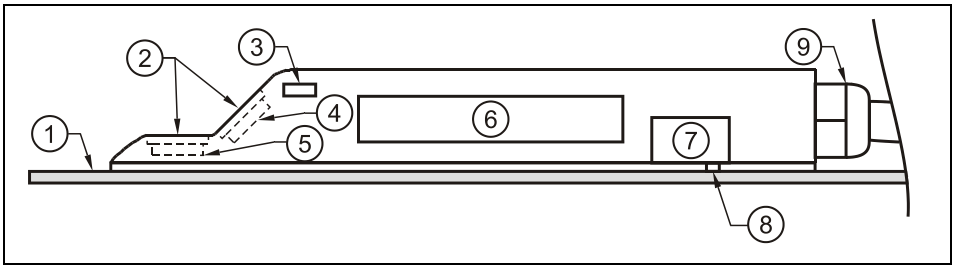
4 Functional Principle

4.1 General

The PCM 4 is a portable measurement system for non-permanent flow measurement and data logging in slight to heavy polluted media of a wide variety of compositions. The system is designed for use in part filled and full channels, sewers and pipes with various shapes and dimensions.

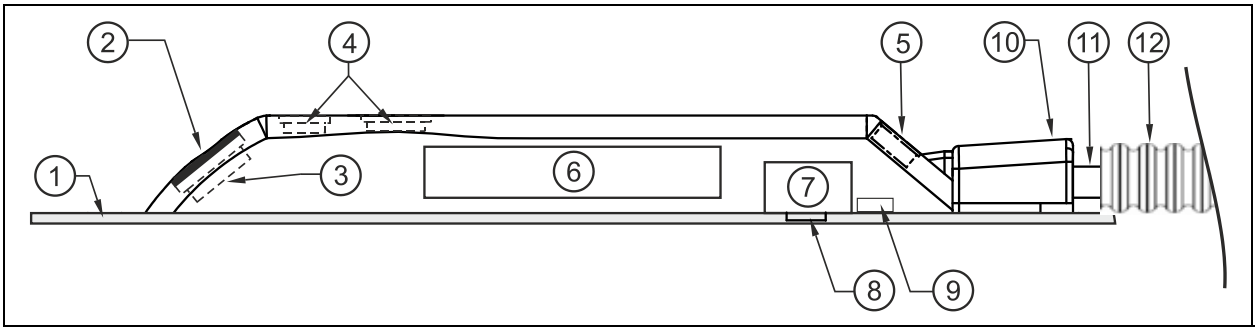
The measurement method is based on the ultrasound reflection principle. Hence, it is indispensable for the system's capability to work that the water contains particles which are able to reflect the ultrasonic signal sent by the sensor (dirt particles, gas bubbles or similar).

The PCM 4 is using a combi sensor POA or CS2 which simultaneously detects flow velocity as well as flow level.
Depending on the type of sensor chosen, the fill level can be measured either by using water-ultrasonic, pressure or a combination of both methods.
Two particular piezo crystals, which independent from each other operate as transmitter or receiver rare used for ultrasonic measurements (flow level and flow velocity).



1 Ground plate
2 Acoustic coupling layer
3 Temperature sensor
4 Flow velocity sensor
5 Level / height sensor
6 Electronics
7 Pressure sensor
8 Duct to pressure measurement
9 Cable gland

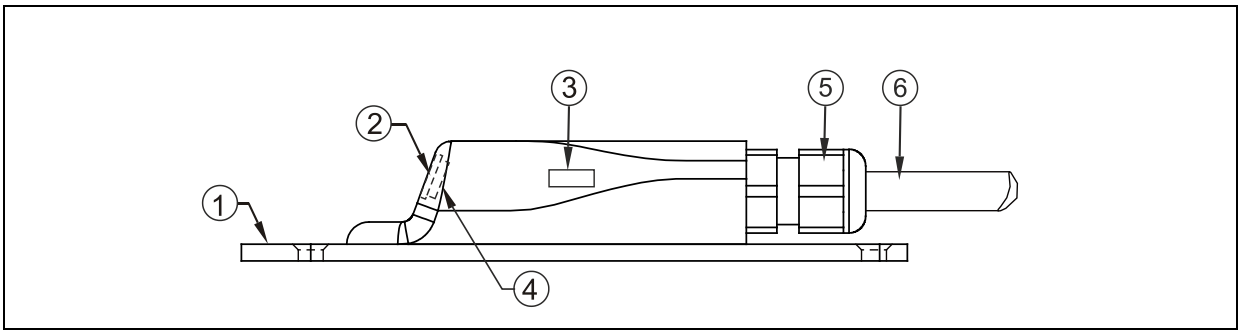
Fig. 4-1 Construction of combi-sensor Type „POA“ for installation on ground



1 Ground plate
2 Acoustic coupling layer
3 Temperature sensor
4 Flow velocity sensor positive flow direction
5 Level / height sensor (optional)
6 Flow velocity sensor negative flow direction
7 Electronics
8 Pressure sensor (optional)
9 Duct to pressure measurement (optional)
10 Protective cover for sensor cable and protection hose fastening
11 Sensor cable
12 Protection hose (optional)

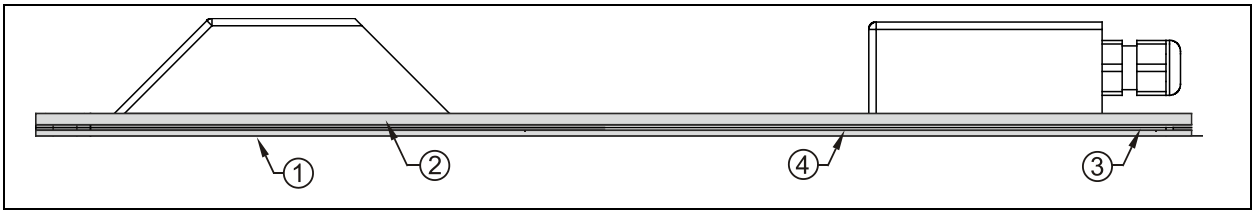
Fig. 4-2 Construction combi-sensor type CS2

The PCM 4 alternatively can be operated using the "Mini" sensor family as well. This sensor family consists of the Electronic Box Type EBM (active electronics) and two passive sensors.
A passive air-ultrasonic sensor Type DSM is used to investigate the level, while the flow velocity is detected with a passive flow velocity sensor Type CSM.



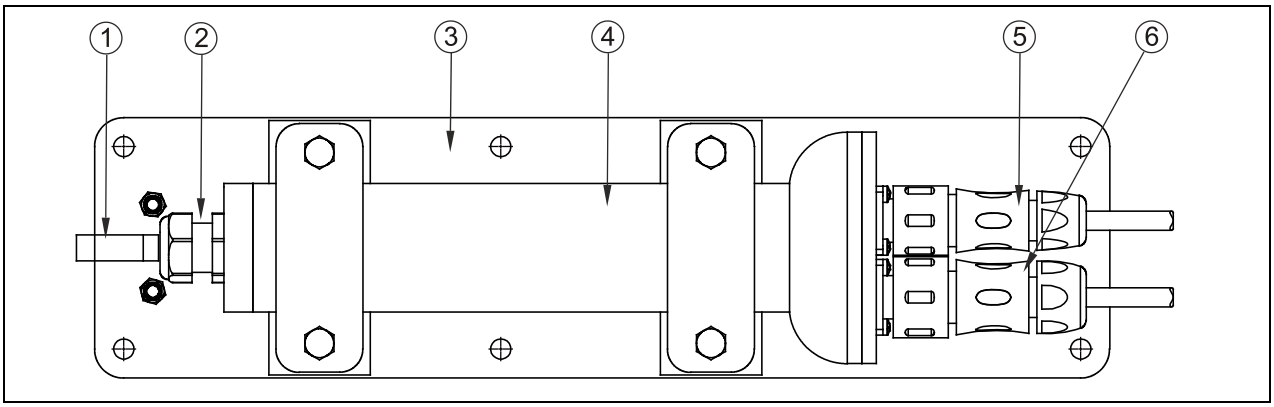
1 Ground plate
2 Acoustic coupling layer
3 Temperature sensor
4 Flow velocity sensor
5 Cable gland
6 Sensor cable

Fig. 4-3 Flow Velocity Sensor, type CSM



1 Ground plate 1
2 Ground plate 2 (base plate)
3 Ground plate 3 (spacer plate)
4 Cut-out for pipe mounting plate

Fig. 4-4 Air Ultrasonic Sensor, type DSM



1 Cable
2 Cable gland
3 Ground plate
4 Electronic body
5 Plug for water-ultrasonic sensor, type CSM
6 Plug for air-ultrasonic sensor, type DSM

Fig. 4-5 Electronic box type EBM

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 Water-ultrasonic Level Measurement

Depending on the type of sensor selected (see chapter 4.5 Unit Versions) the water-ultrasonic combi sensor may include up to two level measurements:

- water-ultrasonic and
- hydrostatic fill level measurement.

If using water-ultrasonic level measurement the horizontal sensor crystal operates according to the ultrasonic transit time method. The time between transmission and reception of a signal being reflected from the water surface is going to be measured.

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

h = fill level
c = sonic transit time
t_1 = time between transmitted and received signal

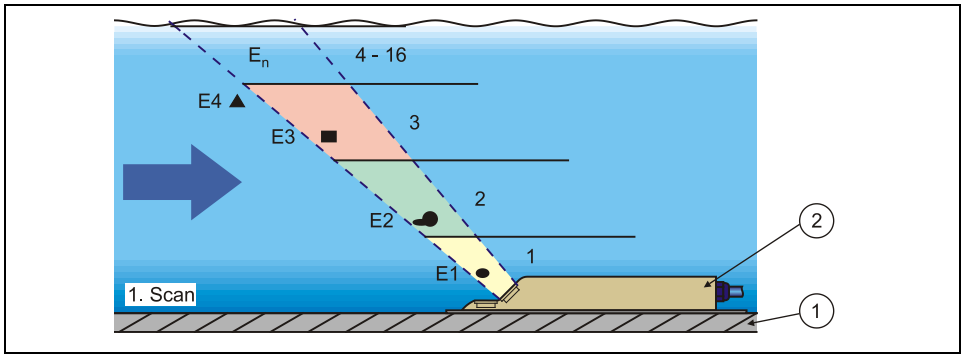
Sound velocity within water at a temperature of 20 °C (68 °F) is 1480 m/s (4854 ft/s). The temperature-dependent deviation is 0.23 % per Kelvin.
In order to achieve an accuracy of a few millimetres during level measurement the medium temperature is going to be investigated permanently, rectifying the sonic transit time for calculation purposes.
The fixed height predetermined by the sensor crystal installation will be added to the investigated value h1. This results in the total flow level h.

4.3 Level Measurement using Pressure

The combi sensor may additionally include a hydrostatic level measurement depending on the type of sensor selected.
The piezo-resistive pressure sensor operates according to the relative pressure principle, i.e. the pressure of the standing water column above the sensor is direct proportional to the flow level. This sensor enables to determine flow levels even if the combi sensor is installed out of the centre.
During initial start-up procedure, the pressure sensor is going to be adjusted by entering a manually investigated reference value. The level caused by the sensor installation position is going to be added as well.

4.4 Flow Velocity Detection

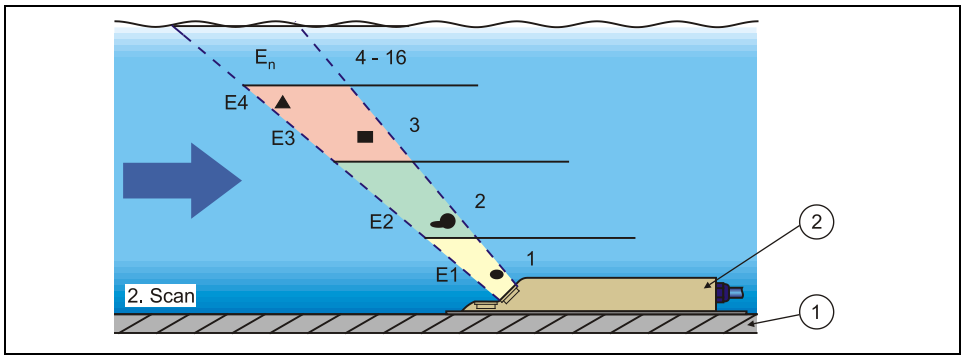
The piezo crystal which has a slope towards the flow direction operates as a flow velocity sensor. Here an ultrasonic burst with a defined angle is sent into the medium. All particles in the measurement path (air, dirt) reflect a small amount of the ultrasonic signal. Depending on shape and size of the particle a particular signal results. The variety of the reflected signals results in a reflection pattern(see Fig. 4-6). This pattern will be saved in a digital signal processor (DSP).



1	channel bottom
2	Wedge sensor
E1 – E4	Reflecting particle
1, 2, 3, En	Measuring window

Fig. 4-6 Situation on 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. 4-7).
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 now have been moving into the measurement range.



1	channel bottom
2	Wedge sensor
E1 – E4	Reflecting particle
1, 2, 3, En	Measuring window

Fig. 4-7 Situation on second signal detection

The DSP checks both the received reflection patterns for similarities using the cross correlation method. All signals which cannot be re-identified clearly are going to be discarded in order to have two distorted and similar signal patterns left over.
These patterns now will be covered with 16 measurement windows according to the previous level measurement. The temporal shift □t of the patte measurement window is going to be investigated subsequently (see Fig. 4-8).

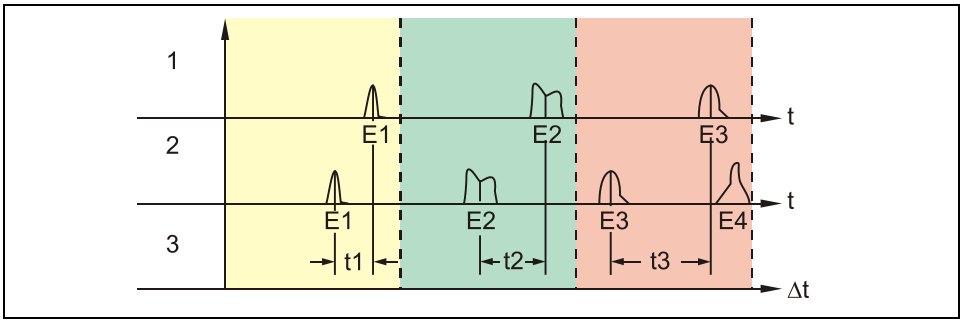


Fig. 4-8 Echo signal images and evaluation

Based on the beam angle, the interval between both transmitted signals and the temporal shift between the signal patterns in each single measurement window the flow velocity can be determined.
Mathematically bringing the single flow velocities in a row results in the flow profile which is indicated on the display of the PCM 4.

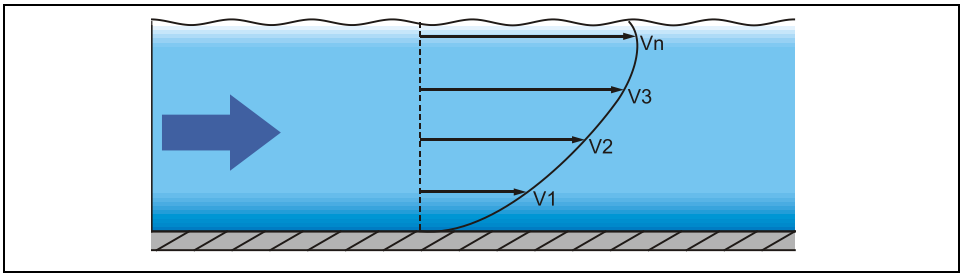


Fig. 4-9 Investigated flow profile

The flow volume is going to be calculated, indicated and saved based on velocity distribution, channel shape, channel dimensions and fill level.

4.5 Unit Versions

Transmitter

The transmitter currently is manufactured in two versions.
The unit version at hand can be seen from the article number on a weatherproof label on the reverse side of the enclosure.
The unit type can be exactly specified from the type key.

PC4-	**Portable Flow Measurement Transmitter**	
	PRO	Standard version
	PROB	with Bluetooth / GPRS module connection socket
PC4-		

Fig. 4-10 Type key for PCM 4 transmitter

5 Storing, Delivery and Transport

5.1 Receipt

Please check your delivery if it is complete and in working order according to the delivery note immediately after receipt. Any damage resulting from transport or transit shall be reported to the carrier instantly. An immediate, written report must be sent to NIVUS GmbH Eppingen as well.
Please report any shortcoming due to delivery to your representative or directly to NIVUS Eppingen within two weeks in writing.

Mistakes cannot be rectified later!

5.2 Delivery

The standard delivery of the PCM 4 measurement unit contains:

- the instruction manual with the certificate of conformity. All required steps to correctly install and to operate the measurement unit are listed herein.
- a PCM 4 measurement transmitter
- readout software, Type NivuSoft for operating systems such as Windows XP, Windows Vista or Windows 7

Additional accessories such as rechargeable battery, power pack / battery charger, compact flash card, sensors, separate level/height measurement depending on order. Please check by using the delivery note.

5.3 Storing

Please observe the storage conditions as follows:

Transmitter:	max. temperature:	+ 60 °C (140 °F)
	min. temperature:	0 °C (32 °F)
	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 4 and keep them in a frost-free place before storing. Recharge batteries prior to reinstallation.

The measurement system shall be protected from corrosive or organic solvent vapours, radioactive radiation as well as strong electromagnetic radiation.

5.4 Transport

The Measurement transmitter is designed for harsh industrial conditions.
However do not expose it to heavy shocks or vibrations.
Transportation must be carried out in the original packaging.

Please carry the PCM 4 by using the carrying handle. The unit shall not be carried or suspended using the sensor cable!

5.5 Return

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

6 Installation

6.1 General

Before feeding the rated voltage to transmitter and sensor the installation must be completed correctly. The installation shall be carried out by qualified personnel only.
The installation of the sensors is described in the separately "Installation Manual for Sensors" which is a part of the sensor delivery.

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 according training.
Further statutory standards, regulations and technical rulings have to be taken into account!

6.2 Transmitter Installation and Connection

General

The place for transmitter installation shall be selected according to certain criteria. Please strictly avoid:

- direct sunlight
- objects emitting heat
  (max. ambient temperature: +50 °C (122 °F))
- objects with strong electromagnetic fields (e.g. frequency converters)
- corrosive chemicals or gas
- mechanical shocks
- vibrations
- radioactive radiation

The measurement device 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 PCM 4 can be fixed on the carrying handle using an appropriate suspension bracket (Art.-No.: ZUB0 ZMSHAK01) or another sufficient device e.g. on the access ladder / step iron of a manhole.

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 4 which are not required for measurement purposes, sensors or data transmission have to 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.

6.3 Enclosure Dimensions

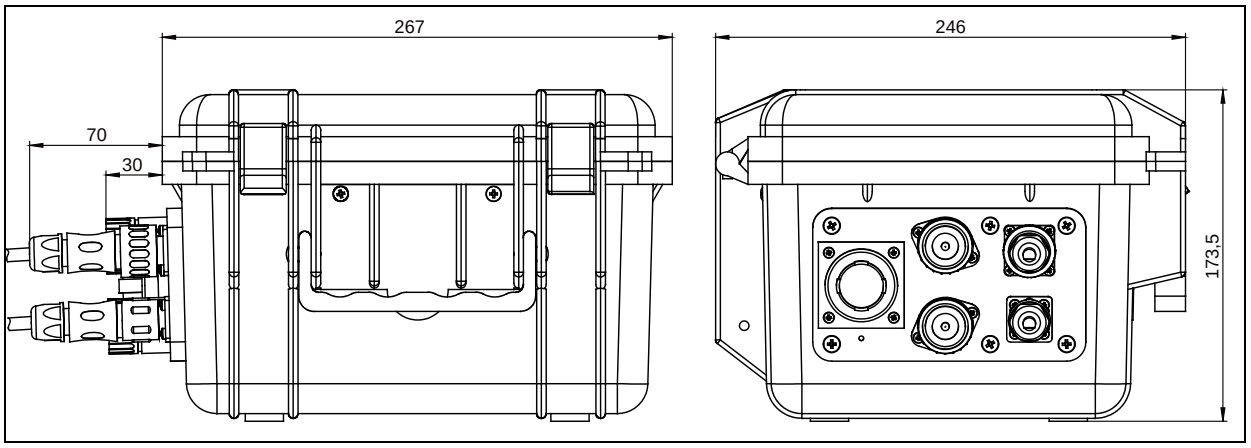


Fig. 6-1 PCM 4 enclosure dimensions and connection sockets

6.4 Sensor Connection

6.4.1 Water-Ultrasonic Combi Sensor and Air-Ultrasonic Sensor as well as Electronic box EBM

Water-ultrasonic combination sensors POA and CS2, air-ultrasonic sensor as well as the Electronic Box EBM 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 and the sensor plug, plug in and manually tighten the screw caps on the plugs in order to ensure the grade of protection and secure contact. To preserve from dirt, screw the protective covers of sensor plugs and sockets together.

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 and colour indicator 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.

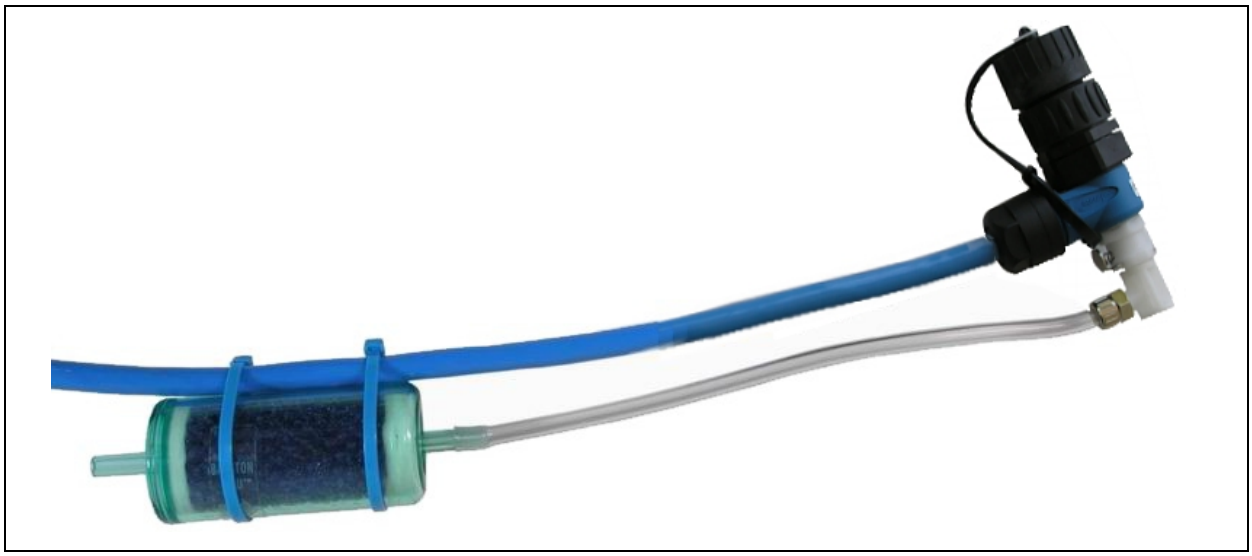


Fig. 6-2 Connection plug, type POA or CS2 with air filter

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.

6.4.2 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 4 for level measurement. The supply voltage for the sensors is 16 V.
Connect the sensors to PCM 4 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**
ZUB0KABNMCxxS0 (PCM 4 –>2-wire 4-20 mA sensor)	brown white	16 V (+) GND (-)	10 m	3 4
ZUB0KABNMC20S0 (PCM 4 –> 2 wire4-20 mA sensor)	brown white	16 V (+) GND (-)	20 m	3 4
ZUB0KABNMC30S0 (PCM 4 –> 2 wire 4-20 mA sensor)	brown white	16 V (+) GND (-)	30 m	3 4

6.4.3 Peripheral Equipment

The PCM 4 is equipped with various analog and digital inputs and outputs which enable to connect a variety of sensors or actuators. An according overview can be found in Fig. 2-2.
Individual connections can be connected directly to the multifunctional socket (see Fig. 6-1) by using pre-configured cables. The following cable types are available:

Art.-No.	Description
PC40 ZVERAE	Connection cable, PCM 4 – analog input (one side with plug for multifunctional socket, other side with open cable end); length of cable 10m (32.8 ft)
PC40 ZVERAA	Connection cable, PCM 4 – analog output (one side with plug for multifunctional socket, other side with open cable end); length of cable 10m (32.8 ft)
PC40 ZVERDE	Connection cable, PCM 4 – digital input (one side with plug for multifunctional socket, other side with open cable end); length of cable 10m (32.8 ft)
PC40 ZVERRA	Connection cable, PCM 4 – relay output (one side with plug for multifunctional socket, other side with open cable end); length of cable 10m (32.8 ft)

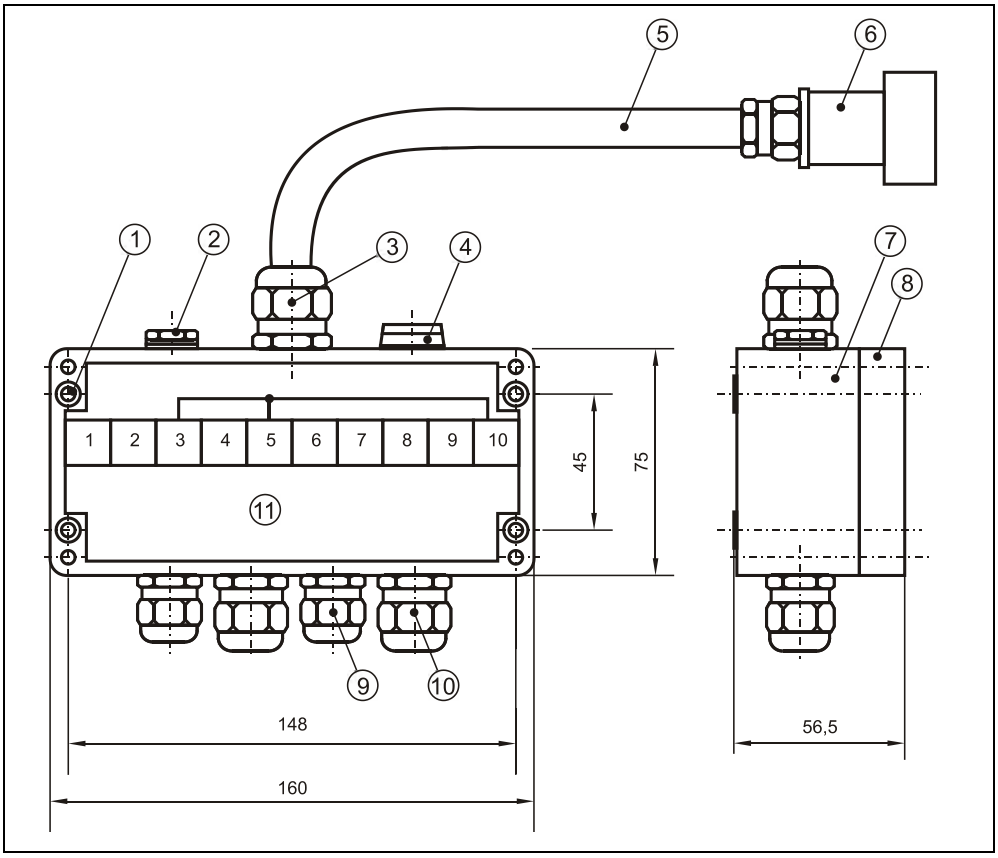
Fig. 6-3 Table of connection cable PCM 4

Art. No.	**Wire colour**	**Function**	**Pin assignment on plug**
PC40 ZVERAE	grey	0/4 – 20 mA	3
(PCM 4 –> analog input)	brown	AGND	2
PC40 ZVERAA	pink	0 – 10 V	4
(PCM 4 –> analog output)	brown	GND	5
PC40 ZVERDE	white	DE active 3.3 V	6
(PCM 4 –> digital input)	brown	GND	5
PC40 ZVERRA	green	root contact (COM)	8
(PCM 4 –> relay output)	brown	normally closed (NC)	7
	grey	normally open (NO)	1

Fig. 6-4 Wiring of pre-configured Cables

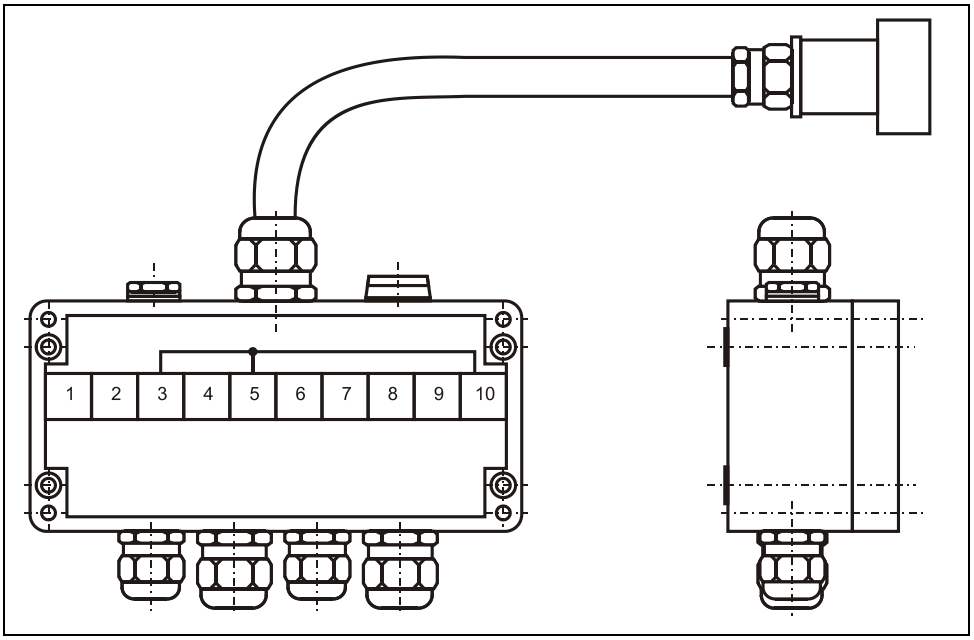
6.4.4 Connector Box

In order to simultaneously connect several signals there is a Connector Box available. This item can be purchased from NIVUS using order code *PC30ZVS1*.



1 Drilled holes for screws M4 for enclosure fastening
2 Pressure compensation element DAE7
3 M20 x 1.5 cable gland
4 Dummy plug M16 x 1,5
5 Connection cable length 1m (3.28 ft)
6 Multifunctional plug with 9 pins for connection to PCM 4
7 Enclosure bottom
8 Enclosure lid
9 2x M16 x 1.5 cable glands for cable ø4-8 mm / peripheral side
10 2x M20 x 1.5 cable glands for cable ø6-12 mm / peripheral side
11 Terminal clamp (description see Fig. 6-5)

Fig. 6-5 Overview Connector Box



1 Analog input (0 - 20 mA) passive
2 Analog ground (AGND)
3 GND
4 Analog output (0 - 10 V)
5 GND
6 Digital input
7 Relay output (NC)
8 Relay output (COM)
9 Relay output (NO)
10 Shield

Fig. 6-6 Terminal clamp compartment of the Connector Box

6.5 PCM 4 Power Supply

6.5.1 Rechargeable / Batteries

A lead gel battery is part of the PCM 4 standard equipment. This battery pack ensures long measurement periods. The rechargeable battery pack is located in a padded battery compartment (see Fig. 2-1, No. 7). This compartment is locked with a lid and 4 knurled screws.

Optionally it is possible to use standard batteries in conjunction with a battery box (Art.-No. *PC40 ZBBOX 020*). The quality of the standard batteries is essential for the duration of the measurement period! Use only batteries from renowned manufacturers therefore.

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

6.6 Charging the Battery charging

The rechargeable battery will be delivered fully charged. Due to reasons of operational safety it is required to reload it before the first use, which particularly applies if being stored for longer periods (see chapter 5.3).
In order to charge or to replace the battery pack, unscrew the 4 screws of the battery compartment lid and remove the cover. Unplug the plug connection and remove the battery pack.
Subsequently tighten the knurled screws of the compartment lid manually.

Charge or/and change the battery in dry environments only.

To charge the battery, use exclusively the NIVUS power adapter and battery charger (PC30ZLGUS000). Please observe 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 LED indicator
3 Rechargeable lead gel battery
4 Adapter
5 Connection cable

Fig. 6-7 Battery charger with rechargeable battery pack

Always disconnect battery charger/power adapter from mains prior to connecting to or disconnecting from the rechargeable battery.
The battery charger/power adapter's built-in LED provides information on charging status.

LED colour	**Status**
yellow	charging battery
green	trickle charging
LED not lit	reversed polarity, short circuit or no mains connection

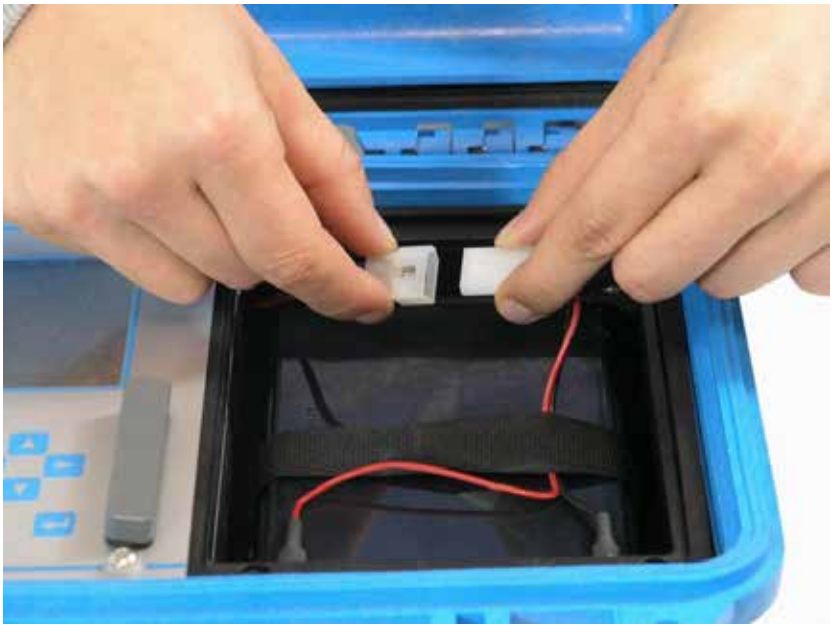


Fig. 6-8 Plug connection to rechargeable battery

The maximum capacity of the rechargeable 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 4.
High or low ambient temperatures and long periods of use are going to reduce the battery capacity as well.

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

This period may be shorter if being used extensively.

The rechargeable battery should be charged each time before using the PCM 4. Remove unused batteries after the latest measurement, store them in a dry and frost-free place (see chap. 5.3) and recharge them after 2 months in order to maintain 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!

6.6.1 Mains Connection

It is possible to power the PCM 4 directly from mains (100-240 V AC) by using the combined mains adapter / battery charger. To do this, connect the plug of the mains adapter / battery charger to the according PCM 4 socket (see also Fig. 6-1). The rechargeable lead gel battery shall remain in the PCM 4 during mains operation as it is going to be charged simultaneously. This ensures to have it available as buffer battery in case of mains failures (charging will begin as described in Chapter 6.5.1. The PCM 4 is ready for operation during the charging process).

Fig. 6-9 Battery charger directly connected to PCM 4

The rechargeable battery shall be charged in dry and frost-free environments only!

6.6.2 Alternative Power Supply

It is possible to additionally power the PCM 4 using alternative power sources (such as solar panels) via the charger socket. For that purpose NIVUS provides an external battery box (*PC40 ZBBOX EXT*) including a rechargeable battery with 26 Ah. The voltage input operates from 11,5 V to 30 V and is protected against overvoltage, overcurrent and reversed polarity. All fuses use an "Auto Reset“ function after errors have been removed.

7 Initial Start-Up

7.1 General

Notes to the user

Before connecting and operating the PCM 4 please follow the notes below!
This instruction manual contains all necessary information to program and to operate the device, addressing qualified technical staff, that have appropriate knowledge about measurement technology, automation technology, information technology and waste water hydraulics.
To ensure a correct function of the PCM 4 please read this instruction manual 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

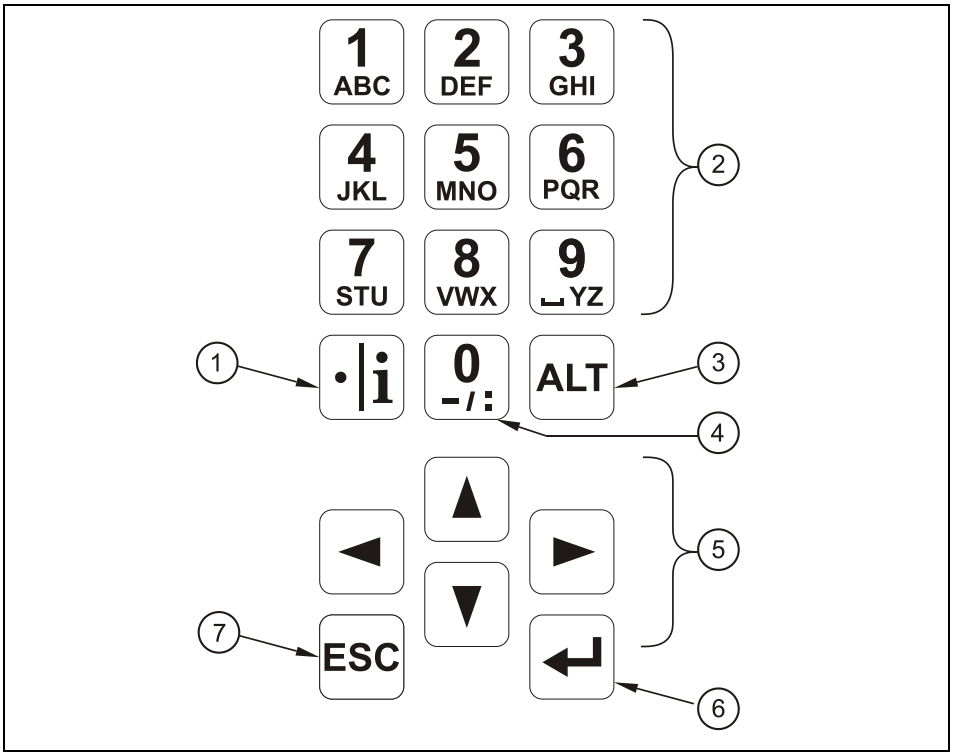
It is not allowed to perform an initial start-up before the installation has been finished and inspected. This manual shall be read prior to initial start-up in order to eliminate the possibility of faulty programming.
Please get familiar with the PCM 4 programming via display and keyboard by reading the instruction manual before you begin to program the device.
After transmitter and sensors have been connected (ref. chapter 6.2 and 6.4) the measurement place parameters must be set. In most cases it is sufficient to set:

- shape and geometry of the measurement place
- the sensor type for level / height measurement
- the memory mode
- the system clock (time and date)

The PCM 4 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.

7.2 Keypad

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

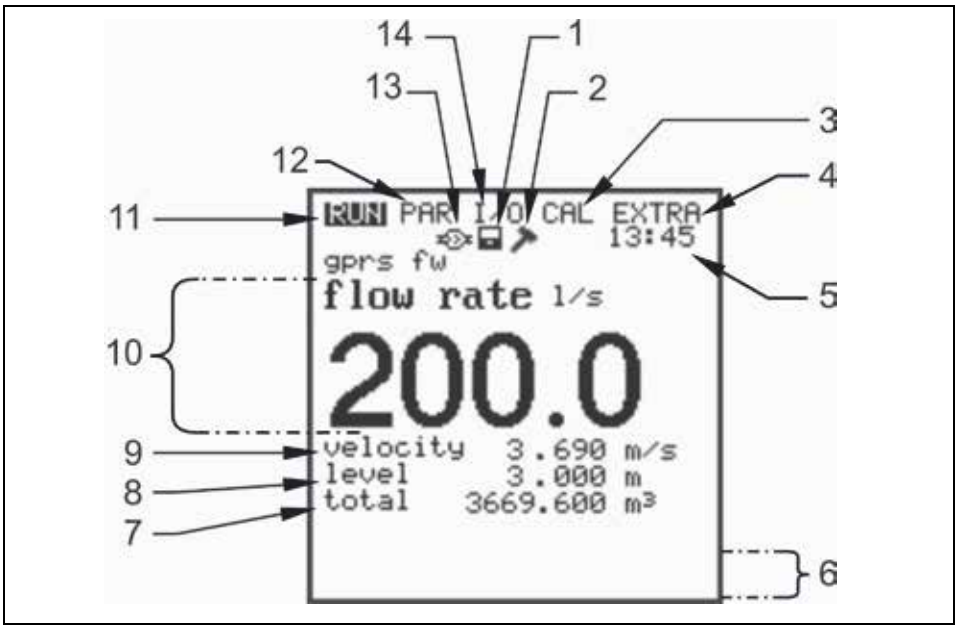


1 Comma / info
2 Figure / letter block
3 Shift key
4 0 / - navigation button
5 Control keys
6 Enter
7 Escape

Fig. 7-1 Keypad

7.3 Display

The PCM 4 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

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

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 4. It is for the complete setting of parameters regarding dimensions of the measurement place, sensors, memory mode, communication and includes other settings such as system reset etc.

I/O This menu includes information about internal operation of the PCM 4. Current readings can be recalled from here. By using various submenus it furthermore allows to watch echo images from sensors, evaluated individual velocities and more in order to asses hydraulic conditions prevailing on the measurement place or 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.

The PCM 4 changes into an energy-saving standby mode four minutes after the last keystroke.

Hence, the PCM 4 will activate only within the cycles set.

The PCM 4 display is disabled during storage mode. To verify the storage routine the display will activate 5 more times. The display remains disabled 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, number 5).

◄ ► Use these buttons to select the main menus

▲ ▼ Buttons for scrolling within the menus.

↵ Use “Enter“ to open the submenu (or the input field) selected with the “left/right“ arrow keys. 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: quickly pressing a button more than once will switch 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 to input digits. In RUN-Mode it also recalls internal information on software versions and used electronic components. The key furthermore serves to start communication between transmitter and sensors.

ALT This button is to toggle between uppercase and lowercase letters in text entry mode. In the rest of the parameter setting mode it serves to enable / disable various functions and hence is a toggle key between different programming options. If used in RUN mode the key is going to trigger a forced data dump to Compact Flash Card.

ESC Exit submenus step by step. Entered values will be cancelled. 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 restart 7 seconds after any key has been pressed launching the Start Assistant.

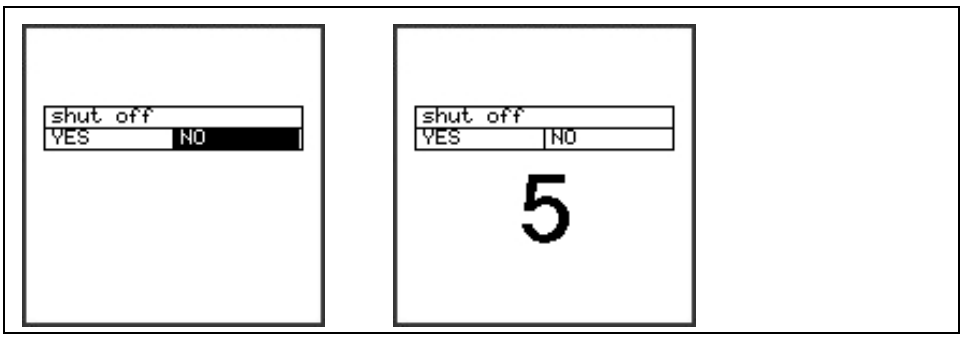


Fig. 7-3 Shut off PCM

7.5 Measurement and Display Functions

After the program settings have been finished the PCM 4 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 4 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 shorter 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 4. Due to energy-saving purposes the display now will not re-activate again and the PCM 4 is going to proceed in the background following the interval set.

Possibility 2

The PCM 4 has been re-programmed or parameters have been modified. After that the modification has been confirmed by entering the PIN code.

- The display goes off for a moment, the PCM 4 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 shorter 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 4 is going to proceed in the background following the interval set (see Fig. 7-4)

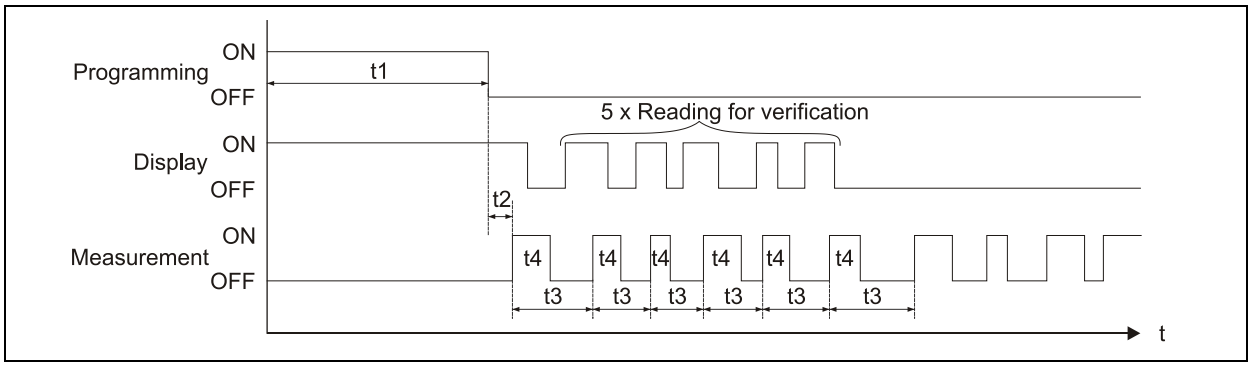


Fig. 7-4 Measurement and display functions after parameter modification

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 4 exactly meets the requirements described before since the PCM 4 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 4 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 2.3.1) 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 using both snap locks before you begin data logging, after settings have been finished and first readings have been checked (see chapter 7.5).

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 accept 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. 6-8).

The PCM 4 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.

A system reset shall be executed prior to each initial start-up in order to reset the unit to default settings. This helps to prevent errors due to faulty settings.

Custom parameters will get lost performing a system reset.

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.

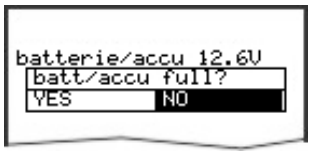


Fig. 8-2 Request battery full

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. 8.5.
Select >NO< if you do not wish to use the start assistant (Fig. 8-3). This will directly open the display menu.

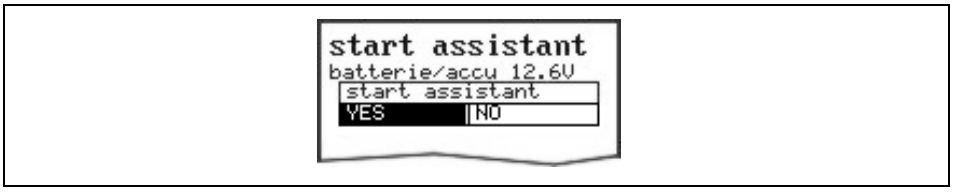


Fig. 8-3 Selecting the start assistant

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 Selecting the 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.

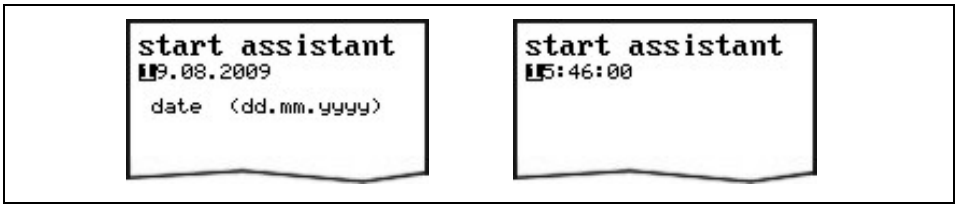


Fig. 8-5 Change Date and Time

Application

This menu allows selecting 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).

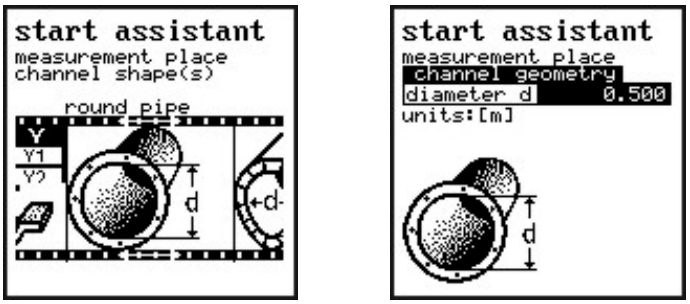


Fig. 8-8 Channel shape and channel geometry selection

*If **"NPP"** has been selected as channel profile here, the unit automatically uses 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 8.5.2).

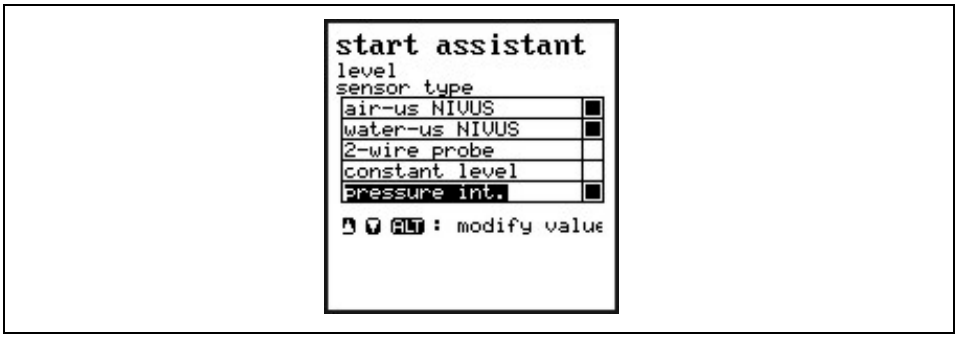
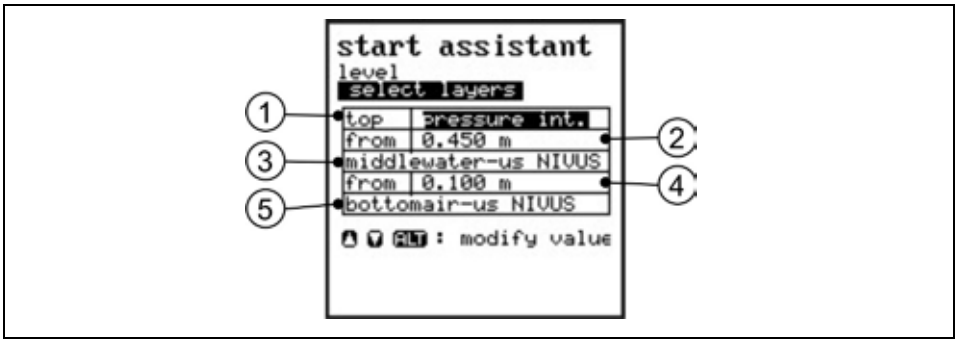


Fig. 8-9 Select level sensor type

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

As soon as "Water-US int." and "Pressure int." have been selected, this value is set to 0 mm as standard. The bottom edge of the ground plate (channel bottom) is the reference point.
In case of choosing "air-US NIVUS" the reference point is the bottom edge of the ground plate as well, which here however is the channel crown.
The mounting height of the air-ultrasonic sensor is specified automatically as soon as the channel dimensions have been set.

The according mounting heights will be adjusted according to the prevailing conditions and the installation situation as soon as the level is adjusted in the CAL menu.

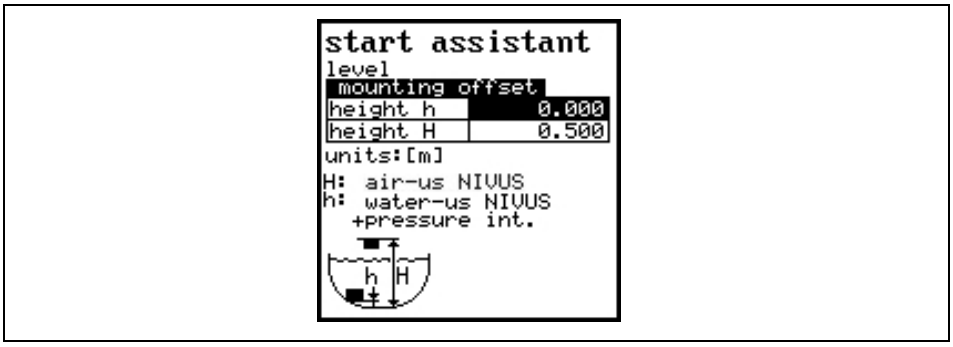


Fig. 8-11 Modifying the mounting offset of level/height sensors

Storage mode

The storage cycles of the compact flash card can be set from 1 to 60 minutes (see chapter 8.5.8).

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

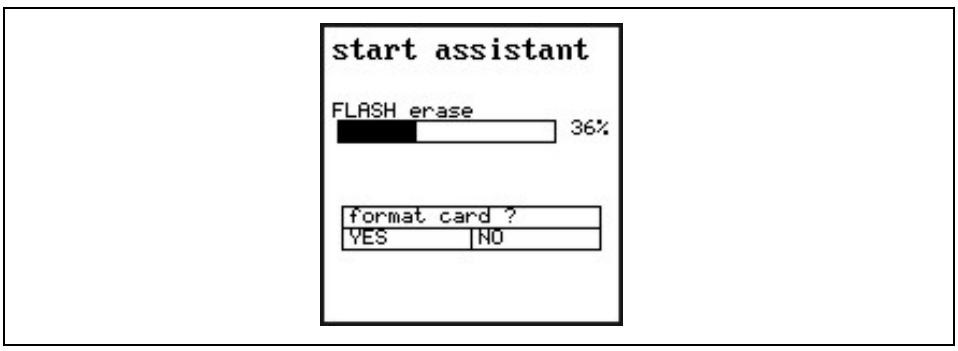


Fig. 8-14 Erase Flash

8.3 Operation Mode (RUN

This menu is a display menu for standard operation mode. Containing the following sub menus, it is not required for parameter setting:

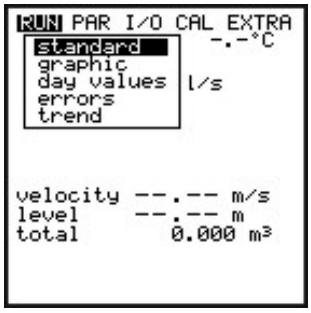


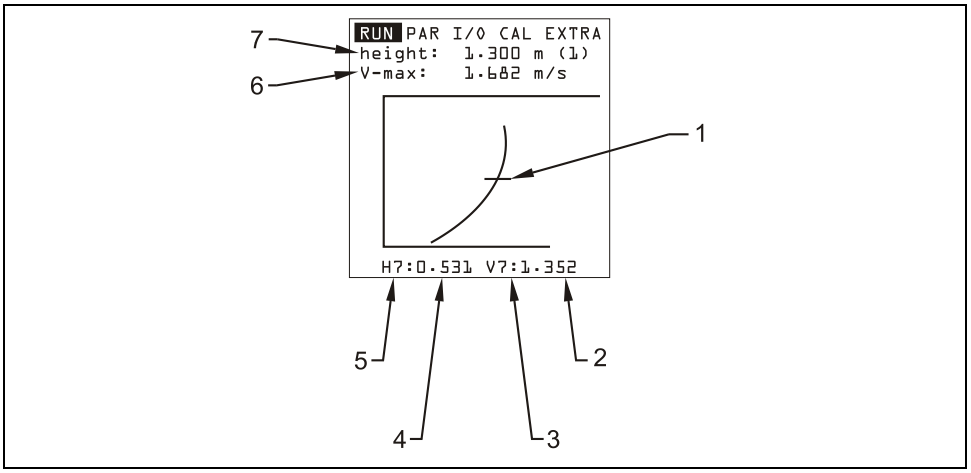
Fig. 8-15 Operation mode selection

Standard

Display (basic screen) indicating information on the name of measurement place, time (alternately appearing medium temperature), flow quantity, level and average velocity (also see Fig. 7-2).

Graphics

Indicates the velocity distribution in a vertical measurement path.
Pressing the "arrow up“ or "arrow down“ keys will move the indicator line accordingly. The selected height as well as the current velocity can be read from the bottom 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)
In case of very unfavourable conditions change the position of the flow velocity sensor.



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

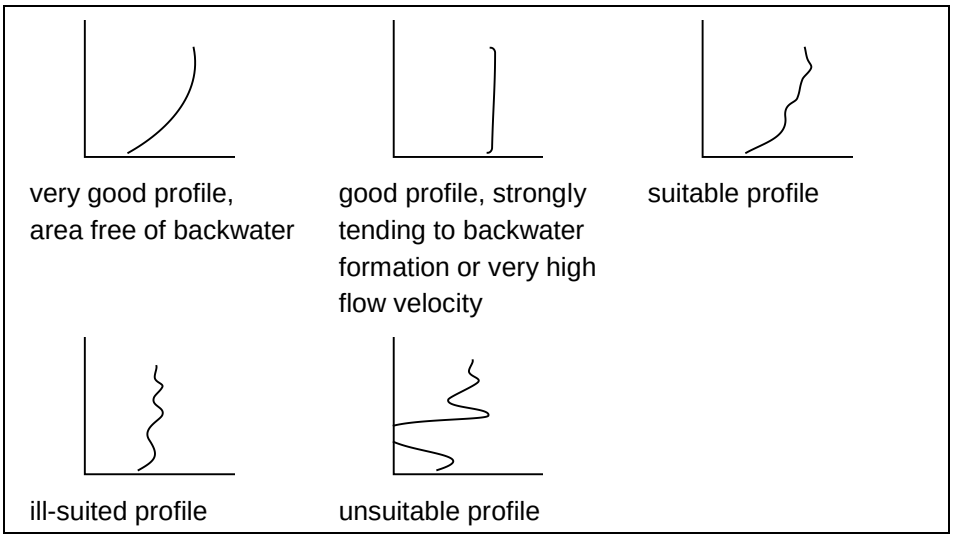


Fig. 8-17 Flow velocity profiles

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.

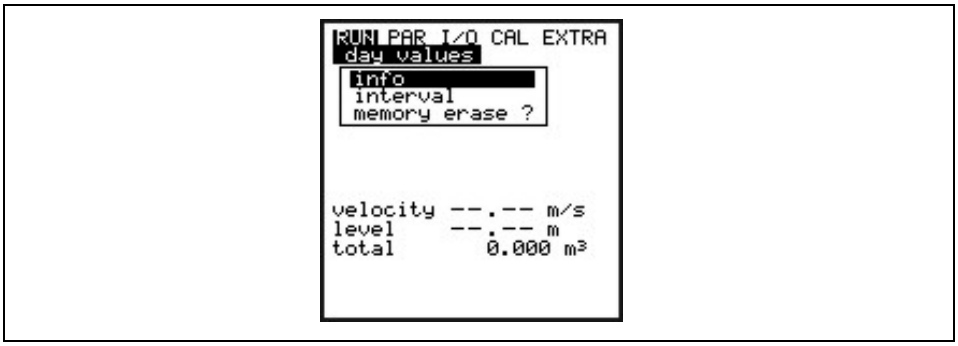


Fig. 8-18 Day total values menu

INFO

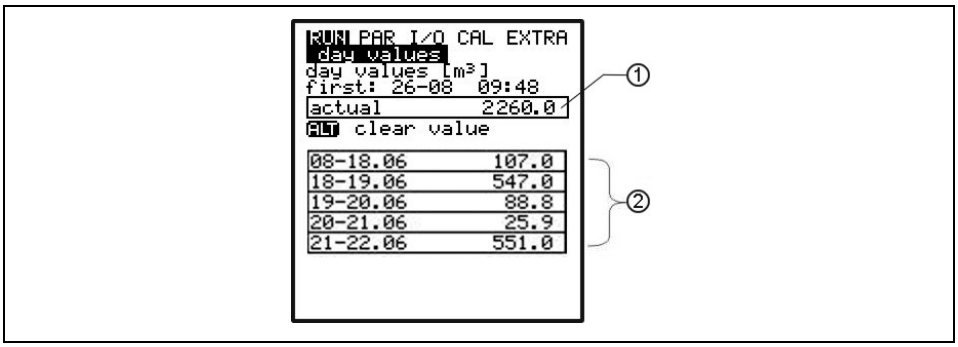
This menu contains the total flow values of the past 90 days (see Fig. 8-19, presumed the transmitter was operated without any interruption in the past 90 days. Otherwise it shows the total for the uninterrupted days of operation) Reset to >0< by pressing the >ALT< key. This reset does not influence the totalizer!

Cycle

The totalization 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 totalization of day values saved in the internal memory (see Fig. 8-115).

Erase memory

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



1 Day values range
2 Day values

Fig. 8-19 Total day values

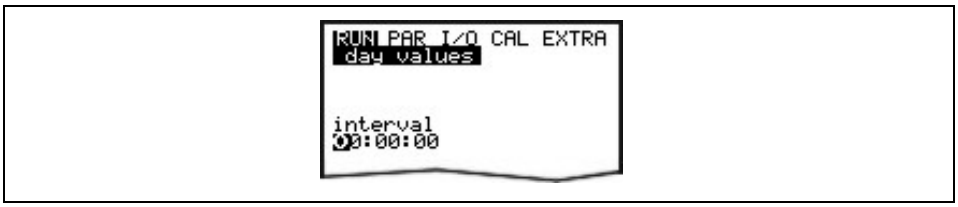


Fig. 8-20 Time of day totalising

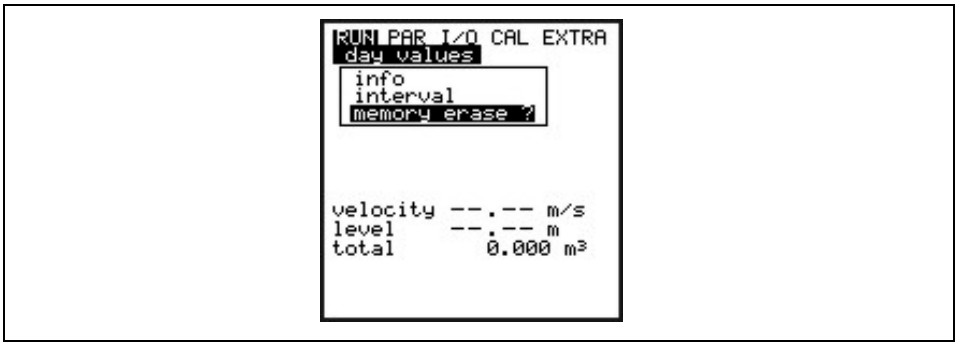


Fig. 8-21 Day values - Erase memory

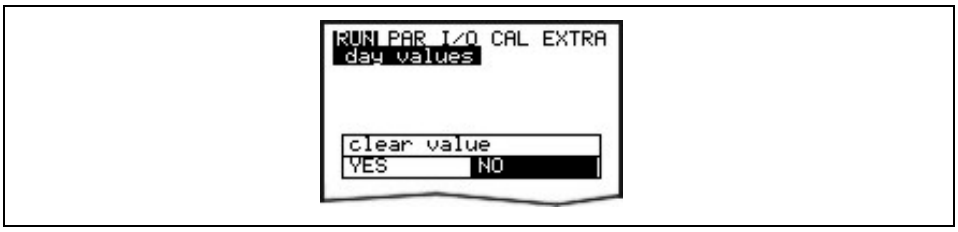


Fig. 8-22 Day values - Confirmation dialog

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 4 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.

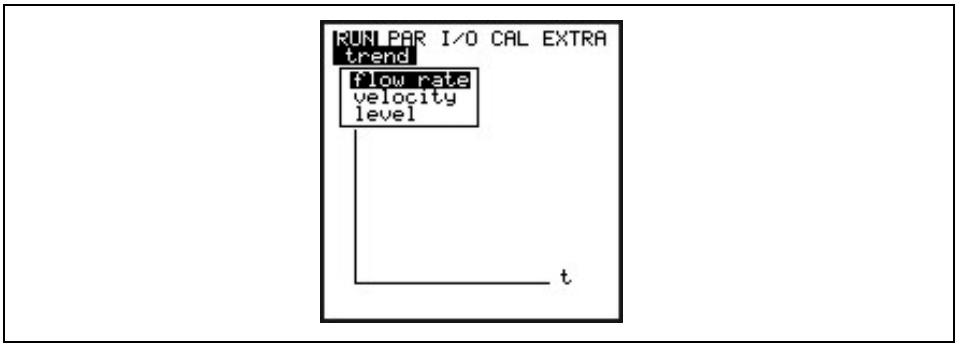
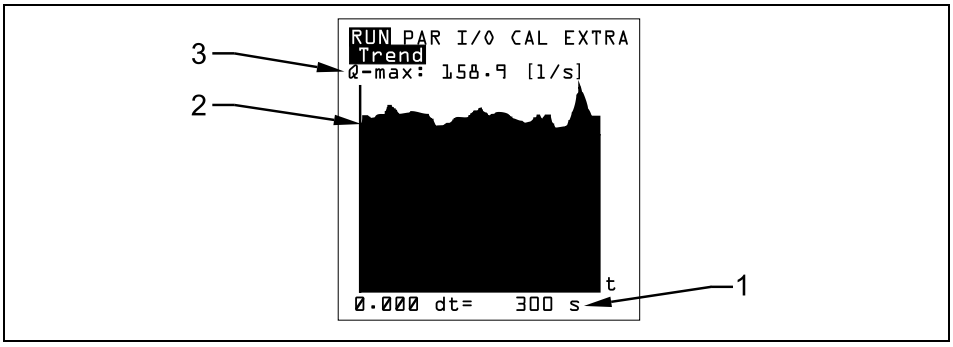


Fig. 8-23 Selection of trend values

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 interval
2 Trend graph
3 Maximum value

Fig. 8-24 Trend graph example

The content of the internal memory will get lost on executing a system reset. All trend graphic values saved previously will get lost as well.

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 (litre, 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 to adjust 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 %.

Set 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”:

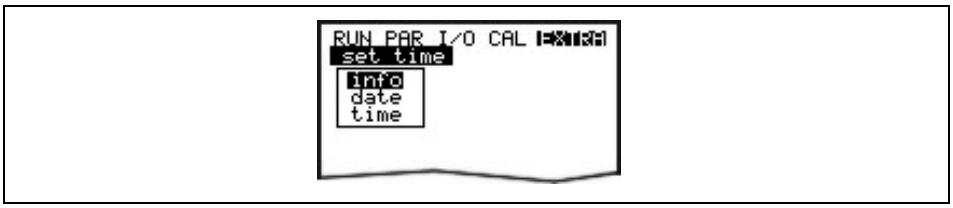


Fig. 8-26 System time submenu

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

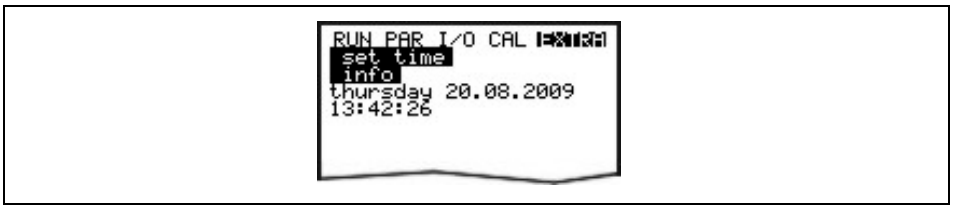


Fig. 8-27 Complete system time

This menu point is for indicating purposes only. Hence the clock cannot be adjusted here. Modifications can be carried out only in the individual menus “set time”.

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.

Set total-counter

Totaliser setting [m³]. Will be set to zero in case of executing a system reset.

8.5 Parameter Menu (PAR)

Fig. 8-29 Submenu parameter settings

This menu is the most extensive and most important regarding the PCM 4 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“

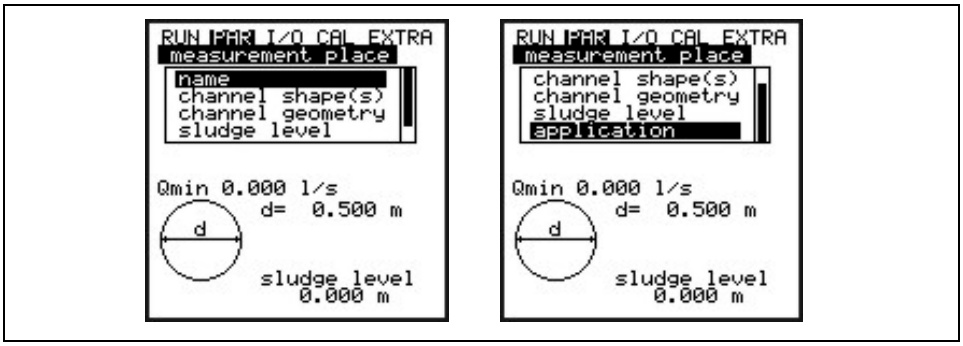


Fig. 8-30 Submenu measurement place

This menu is one of the most important basic menus for parameter setting as the dimensions of the measurement place are going to be defined here.
The menu cannot be indicated completely due to restricted display space. Similar to many well-known PC applications, this is readily identifiable from the black bars on the right-hand side of the screen.

▲ ▼ Use "Up“ and "Down“ keys to scroll the menu.

Measurement place 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.
After the submenu >Name of Measurement Place< has been selected 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	Lets you optionally select special characters which are not available on the keypad (such as >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. Moving the cursor to the right-hand side with the arrow key >RIGHT< creates a space character if in uppercase or lowercase menu. Pressing the arrow key >LEFT< will delete the previous character.
▲	Shift to uppercase letters
▼	Shift to lowercase letters

Faulty entries can be corrected by moving the cursor back and overwriting the character accordingly.

↵	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.

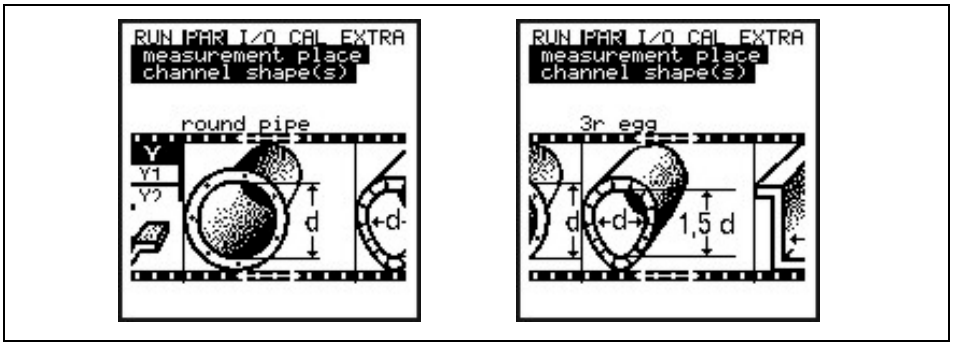


Fig. 8-32 Selecting the channel shape

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

NPP:

If **"NPP"** has been selected as channel profile here, the unit automatically uses 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.

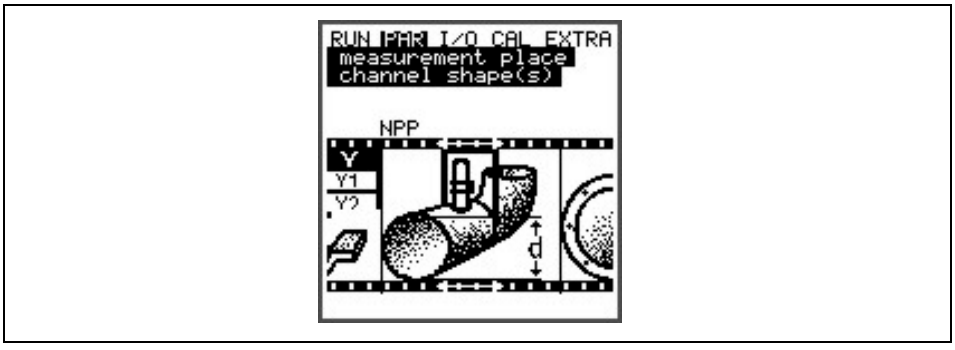


Fig. 8-33 Example selected NPP

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

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

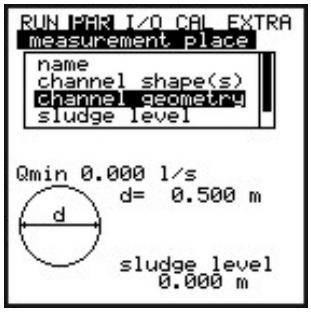
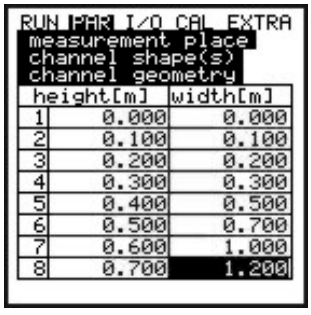


Fig. 8-35 Selected profile

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	0.300	0.300
5	0.400	0.500
6	0.500	0.700
7	0.600	1.000
8	0.700	1.200

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.

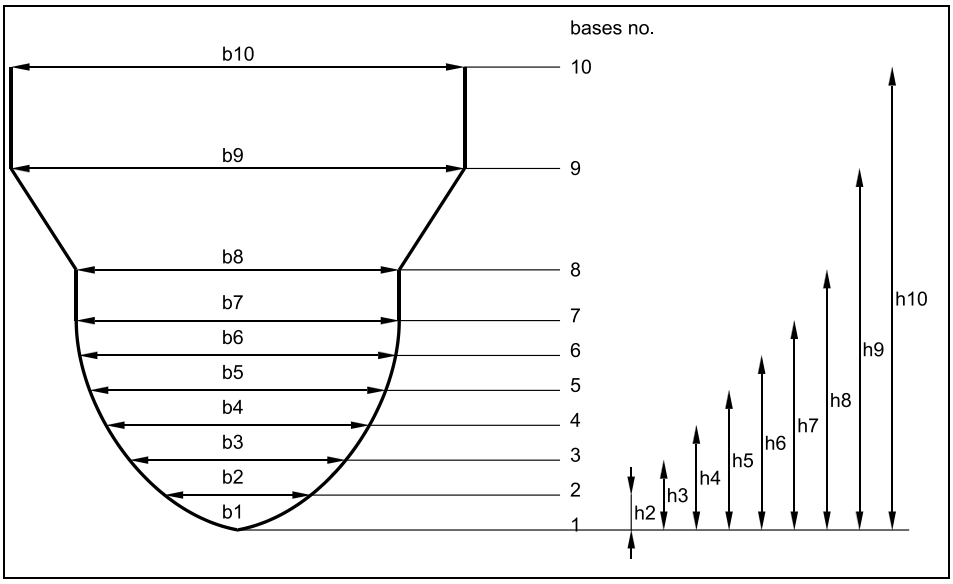


Fig. 8-37 Custom profile breakpoints

Special Profiles:

To define special profiles the options **"2-part profile“** and **"3-part profile“** are available.

If **"2-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 profile

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

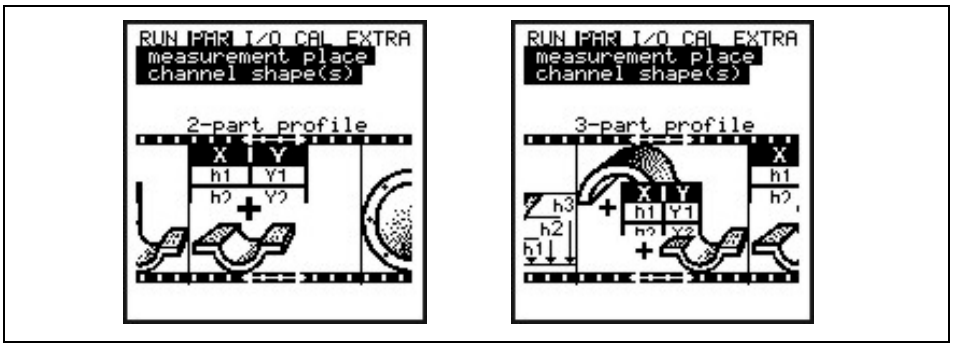


Fig. 8-38 Example of selecting custom profiles

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 Profile Dividing into three zones

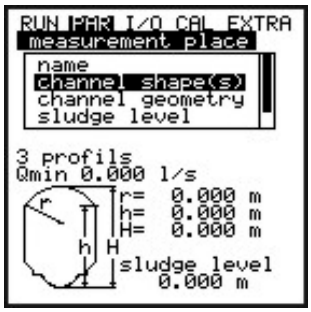


Fig. 8-40 Three-part profile

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 case of exceptional and very unusual profiles with convex tops. The procedure requires comprehensive knowledge and experience in operating the PCM 4. To avoid faulty programming or if in doubt this procedure should be performed by NIVUS service personnel or expert companies authorised by NIVUS.

Sludge Level

The sludge level set is going to be calculated as non-moving channel sub-area and will be subtracted from the wetted hydraulic total area prior to executing flow calculation.

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 Selection level measurement

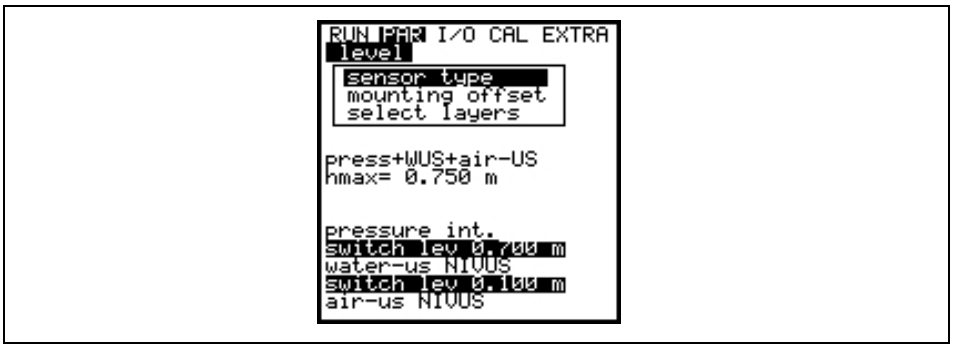
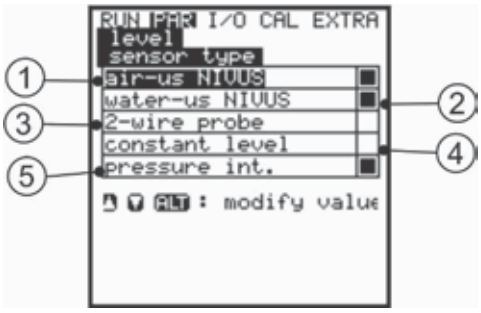


Fig. 8-43 Level measurement – submenu

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

This menu defines any parameter regarding level measurement. The start screen depicted below as well as the parameters to be set may vary depending on the sensor type selected.
First of all determine the sensor type by using the >up< and >down< arrow keys.

Select and de-select sensors using >ALT<. Choose from the types below:



1	Air-ultrasound Type >OCL< or >DSM< by NIVUS
2	Water-ultrasound integrated into flow velocity sensor, Types: POA-V1H1, POA-V1U1, CS2-V2H1 or CS2-V2U1
3	2-wire probe e.g. Type: NMC0 or HSB0NBP
4	Fixed value for permanently full filled applications or for testing
5	Pressure measurement cell integrated into flow velocity sensor, Type: POA-V1D0 or CS2-V2D0

Fig. 8-44 Defining the sensor type

If combi sensors featuring multiple level measurements are used (water-ultrasound and pressure measurement cell, e.g. Type POA-V1U1 or CS2-V2U1), both level measurements shall be selected in the menu.

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.
An air-ultrasonic sensor Type OCL or DSM is required!

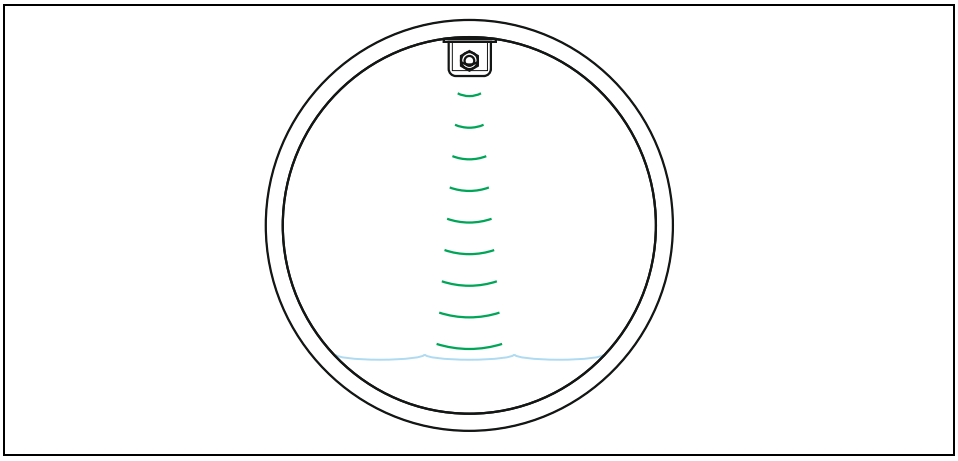


Fig. 8-45 Sensor type 1: Air-Ultrasonic

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 sensor if the sensor is placed out of the center (e.g. if there is sedimentation or the risk of soiling)! Otherwise there is a risk of echo loss and hence measurement failure.

In this case a different level sensor (air-ultrasound from top down or pressure measurement cell) must be selected.

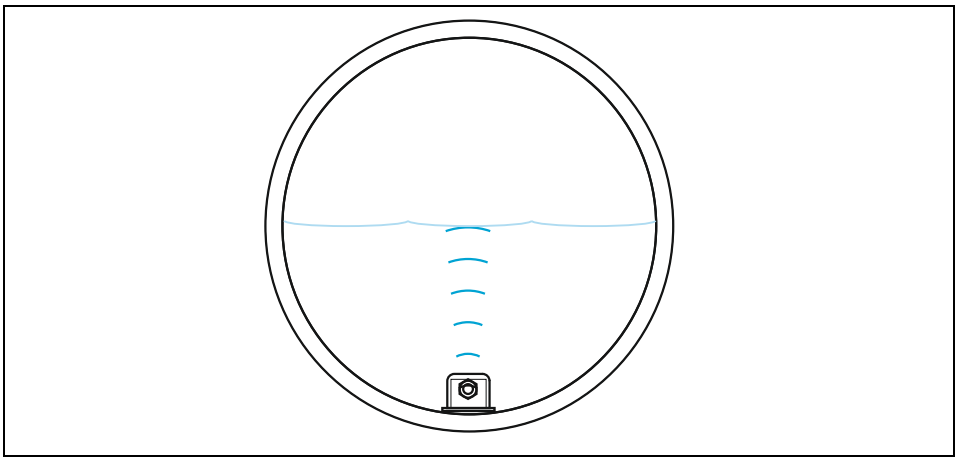


Fig. 8-46 Sensor type 2: Water-Ultrasonic NIVUS

Option 3: 2 Wire Sensor

Level measurement by external 2-wire sensor, supplied by PCM 4 (such as NivuBar Plus or NivuCompact). Flow rate calculated by exclusively using a Q = f(h) relation without additional flow velocity sensor. The sensor however may be combined with the flow velocity sensor.

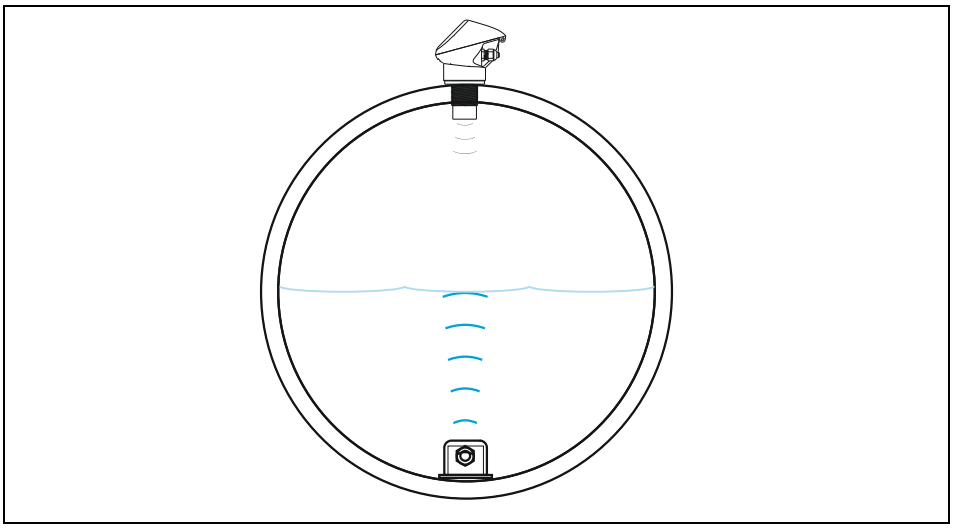


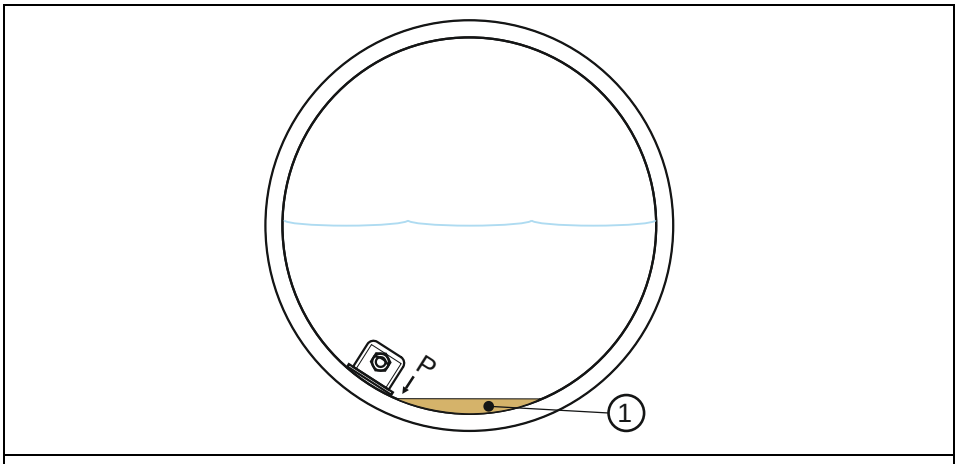
Fig. 8-47 Sensor type 3: 2 wire sensor

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 menu „PAR / Fixed value / Scaling / 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 using a combi sensor with integrated pressure measurement cell from bottom up. Off-centered installation possible, e.g. due to sedimentation or high pollution load.
Filling level measurement in case of overflow possible.



1	Sedimentation

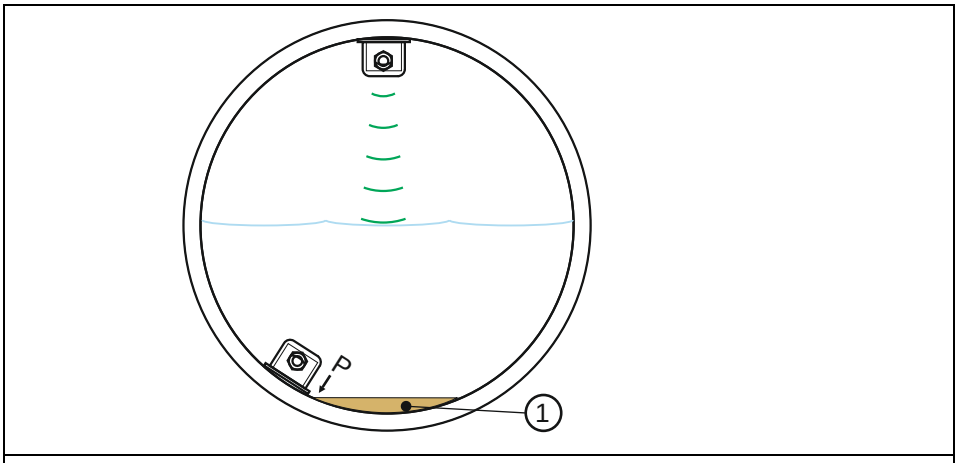
Fig. 8-48 Sensor type 5: Pressure int.

Sensor combination examples

It is possible to combine different options as described below. These combinations may be required if due to constructional conditions a single sensor does not cover the entire measurement range (see also Fig. 8-54).

Air-US NIVUS + Pressure internal

Combination of sensor types 1 and 5.
Recommended if an area from flow level 0 mm up to impoundment must be measured. This combination is recommended for measurement ranges from 0 cm level up to overflow. The air-ultrasound sensor type OCL or DSM detects low levels, the pressure sensor the overflow area. Pressure sensors can be installed out of the channel centre due to heavy sedimentation (Fig. 8-49).



1 Sedimentation

Fig. 8-49 Combination: Air-Ultrasonic and pressure int.

2-wire sensor + Pressure internal

Combination of sensor type 1 and 5. Same applications as described under pressure + air-US. A 2-wire probe is used instead of the air-US sensor.

Water-US internal +Pressure int.

Combination of sensor type 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 sensors detects the middle range. The water-ultrasound sensor shall be installed in the centre of the bottom.

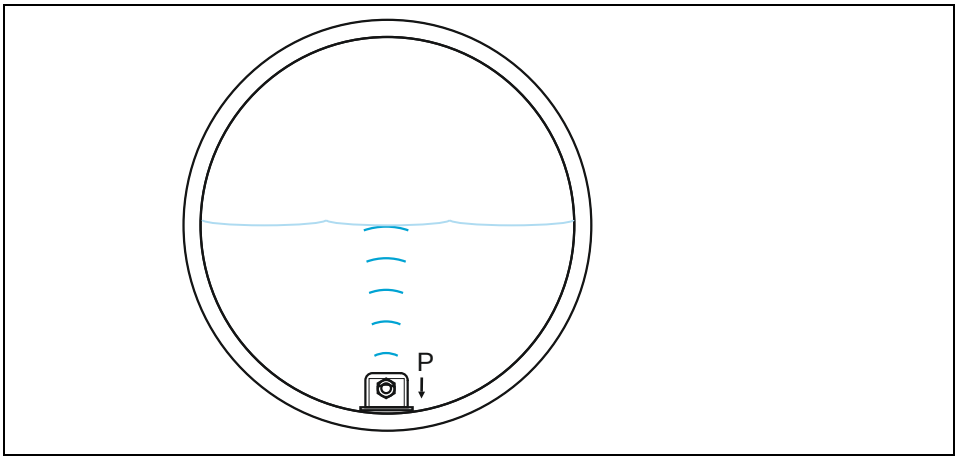


Fig. 8-50 Water-US and Pressure int.

Air-US NIVUS + Water-US

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.

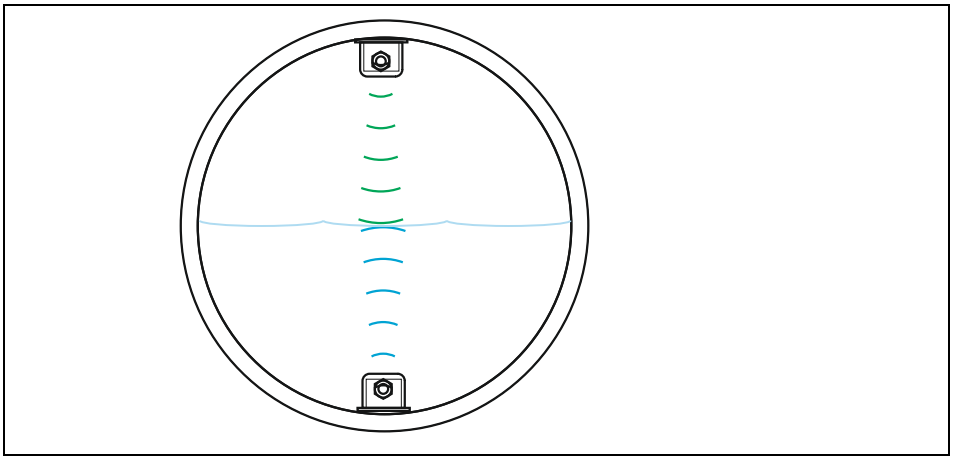


Fig. 8-51 Air- and Water Ultrasonic

Water-US internal + 2-wire sensor

Combination of sensor type 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 sensor type 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.

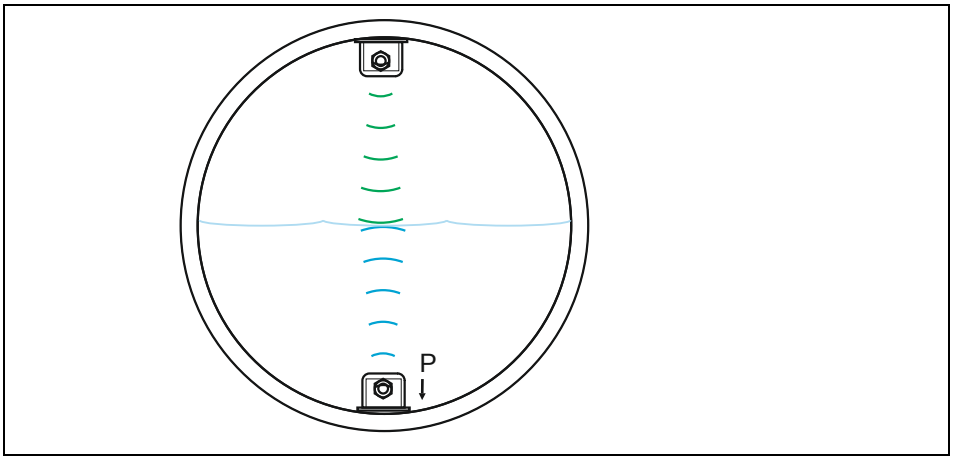


Fig. 8-52 Sensor type Air-US, Water-US and Pressure

Pressure+
Combination of sensor type 2, 3 and 5.

Water-US internal +
Application as the combination Air US + Water US + Pressure.

2-wire sensor
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
As soon as "Water-US int" and "Pressure int." have been selected, this value is set to 0 mm as standard. The bottom edge of the ground plate (channel bottom) is the reference point.
If "air-US NIVUS" should have been chosen, the reference point is the bottom edge of the ground plate as well, which in this case however is the channel crown.
The mounting height of the air-ultrasonic sensor Type OCL or DSM is specified automatically as soon as the channel dimensions have been set.

The according mounting heights will be adjusted to the prevailing conditions and the installation situation as soon as the level is adjusted in the CAL menu.

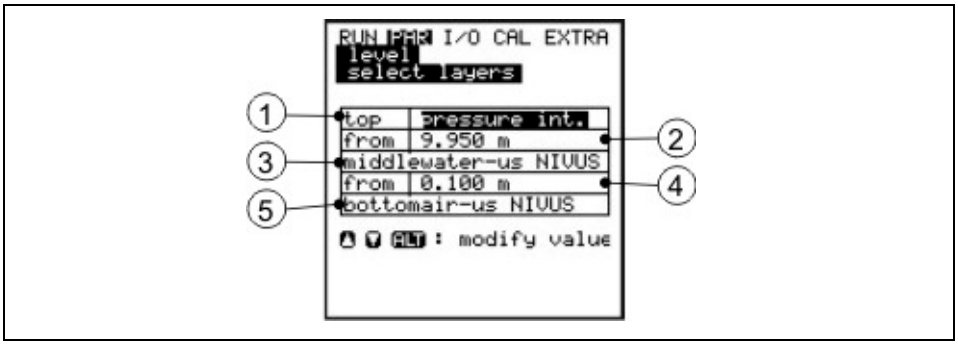
Height h: mounting height "water-US int" + "pressure int."
Height H: mounting height "water-US NIVUS"

Fig. 8-53 Mounting offset of level sensors

As soon as the mounting height of the pressure or water-US level sensors is modified, the mounting height in the PAR/Flow velocity menu must be adjusted by the same value!

For sensor type CS2-V2H1 / CS2-V2U1 set the switchover value >h< between lower and middle layer to > 0.2 m.

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. 8-54 Select layers (level)

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

Fig. 8-55 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 4 on, the sensors are supplied with power for the time delay set here. No readings will be recorded however. The external sensors need the delay to ensure stable measuring.

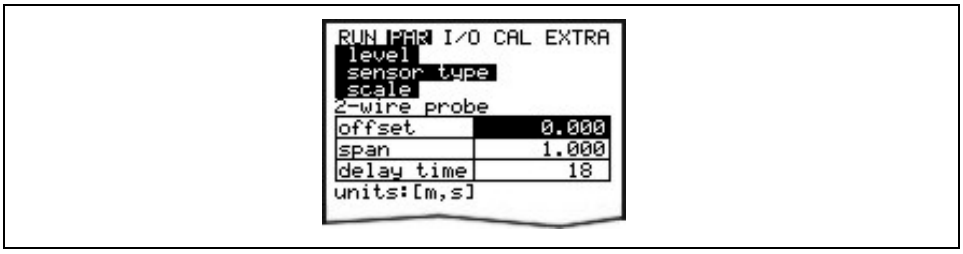


Fig. 8-56 2-wire sensor settings

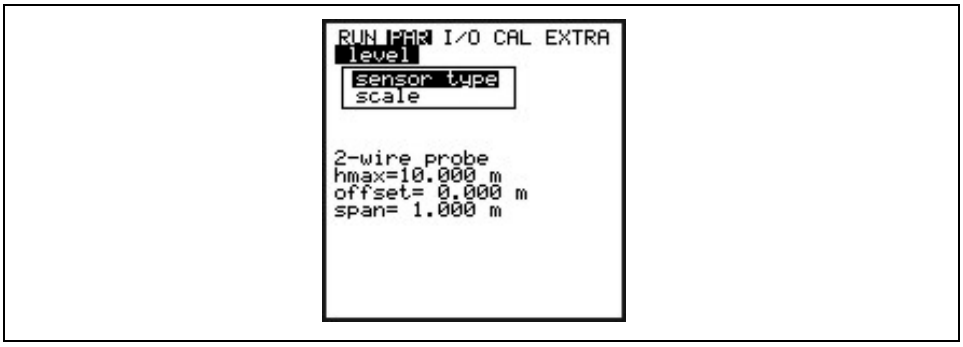


Fig. 8-57 Screen at 2-wire sensor

For sensor connection, please take chapter 6.4 into account.

8.5.3 Parameter Menu “Velocity“

The PCM 4 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.

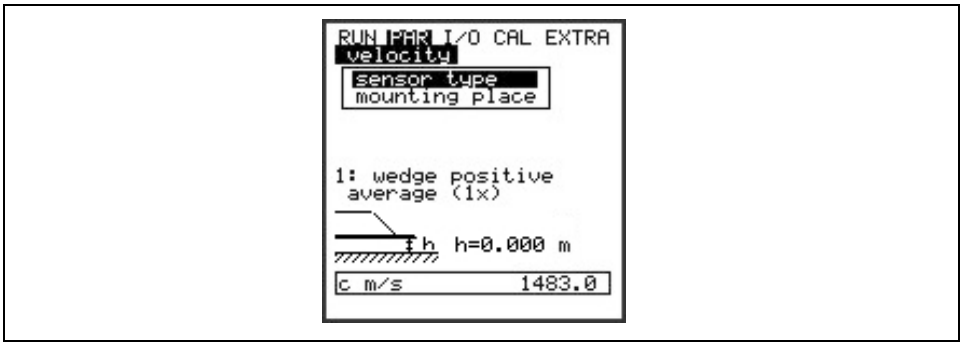


Fig. 8-58 Sensor settings

The sensor selection will bring up the screen below:

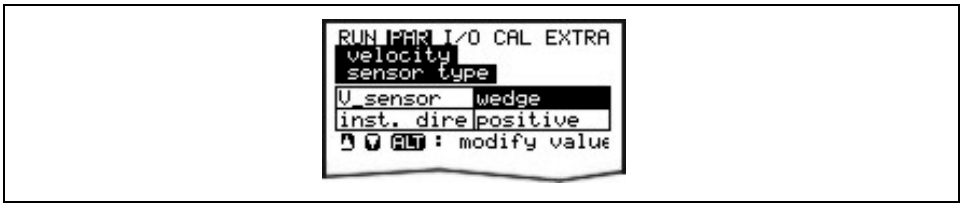


Fig. 8-59 Selecting the sensor type

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.
The **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. This value is set to 0 mm per default; the reference point is the bottom edge of the ground plate (channel bottom). The setting does not need to be modified as long as the sensor is not installed in an elevated position. In case of elevated installation the additional mounting height shall be added to the standard mounting height of 0 mm.

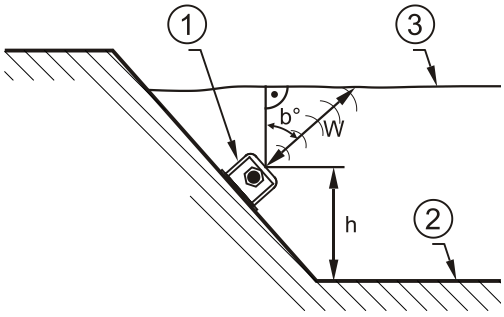
If >Pos-alpha< has been selected, the following >mounting places< are available:

>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. 8-60 Parameter off-centre sensor installation



1 Sensor body
2 Channel bottom
3 Surface

Fig. 8-61 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 "Digital Inputs“

The relays with the use of sampler connector box can be programmed here. You can find the parameter descripted in a separate instruction manual for >Sampler connector box<.

Fig. 8-62 Sub-menu digital inputs

Name

Does not have to be entered. It is helpful to set a name if the analog input values are to be saved on memory card. This name will be saved on the storage medium.
Set the name as described under >PAR/Measurement place/Name<.

Function

One of the following functions is going to be assigned to the digital input:

- inactive
- running time

The transmitter detects switching events via the digital input even in stand-by mode (between measurement cycles) and accurately saves the runtime to the second.

The digital input is enabled and powered with a voltage of 3.3 V DC.

8.5.5 Parameter Menu "Analog Outputs“

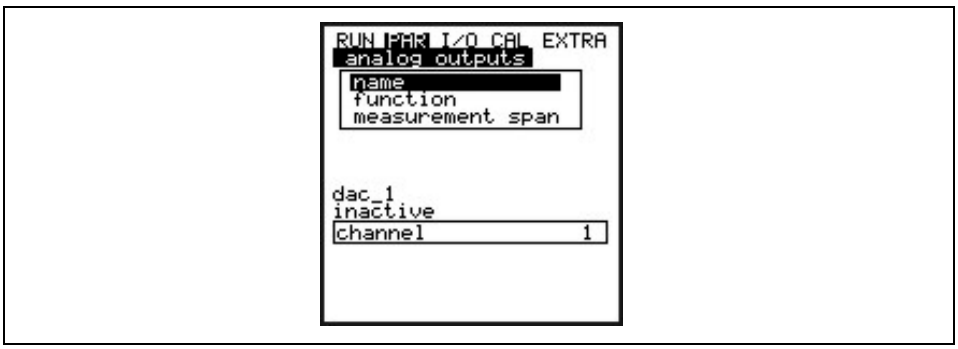


Fig. 8-63 Submenu analog outputs

The analog output is a 0 – 10 V voltage output.
Determine the functions of the analog output in this menu.

Name

Does not have to be entered as the name is for internal use currently. Set the name as described under >PAR/Measurement place/Name<.

Function

One of the following functions is going to be assigned to the analog output:

- inactive (no signals from analog output)
- flow rate output (will output an analog signal which is proportional to the calculated flow volume)
- level output (will output an analog signal which is proportional to the calculated fill level)
- velocity output (will output an analog signal which is proportional to the average flow velocity calculated from single velocity readings)
- temperature water (will output the water temperature reading as analog signal)
- analog input 1, socket 3 (will output the value from analog input 1 which might have been changed by a characteristic)

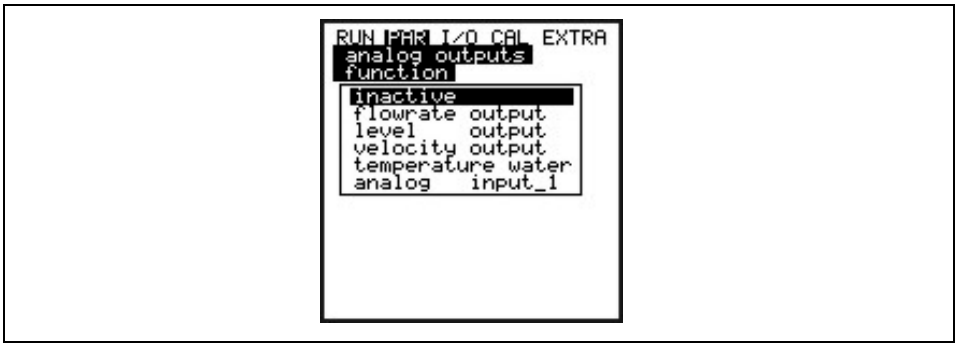


Fig. 8-64 Selecting analog output functions

Measurement Span

Define the values of the output signal here. Input in the units selected under menu "Extra“.
Negative values can be entered as well!

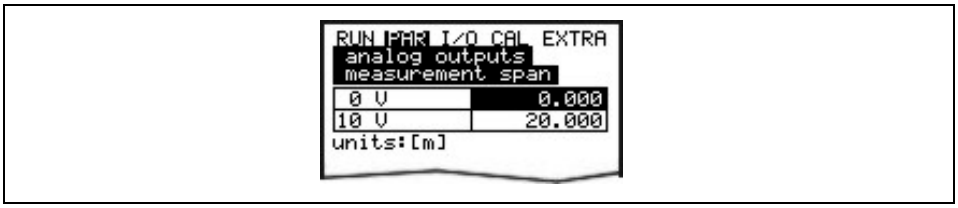


Fig. 8-65 Measurement span

Fig. 8-66 Screen after settings have been made

Example:

A measurement place is partly tending to backwater formation and the negative value is to be detected as well. This case requires the output signal to be set "floating".
This means that flow = 0 will output a V signal in the middle of the measurement span.

Example:
0 V = -100 l/s
10 V = 100 l/s
In this case flow = 0 yields 5 V as output. Backwater will cause the analog signal to decrease, positive flow will cause it to increase.

The analog output will be updated during a measurement cycle. Between two measurement cycles (PCM 4 in "sleep mode") the voltage value will be held using the latest value.

8.5.6 Parameter Menu "Digital Outputs"

Fig. 8-67 Sub-menu digital outputs

Function

One of the following functions is going to be assigned to the relay which has been chosen by selecting the channel number:

- inactive
- flow rate output (relay will energise if the value exceeds a certain flow threshold and will de-energise if the value falls below a second threshold.)
- velocity output (relay will energise if the value exceeds a certain velocity threshold and will de-energise if the value falls below a second threshold
- level output (relay will energise if the value exceeds a certain level threshold and will de-energise if the value falls below a second threshold.)
- pos-total impulse
- sample

Name

This menu can be viewed only as soon as a function has been enabled. “Name” means the name of the relay output. It is not necessary however to input a name as it currently is for device-internal use only. Set the name as described under >PAR/Measurement place/Name<.

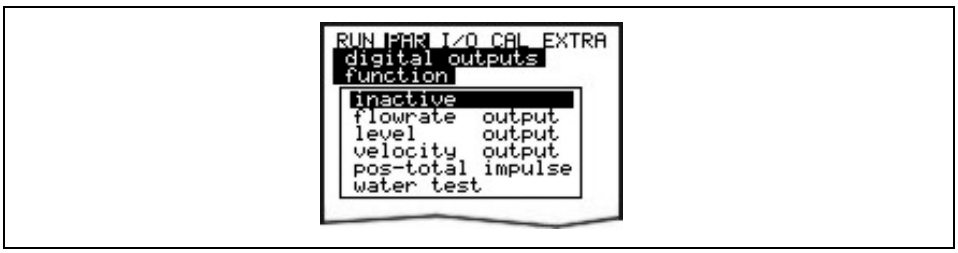


Fig. 8-68 Defining relay functions

Logic

Select between >normally open< and >normally closed< by using the >ALT< key.
Choosing >normally open< will cause the relay to energise as soon as the threshold set has been reached, choosing >normally closed< will cause the relay to energise immediately after the parameters have been set and to de-energise as soon as the according threshold has been reached.

Trigger level

This menu can be viewed only as soon as the function >Limit contact< has been enabled.

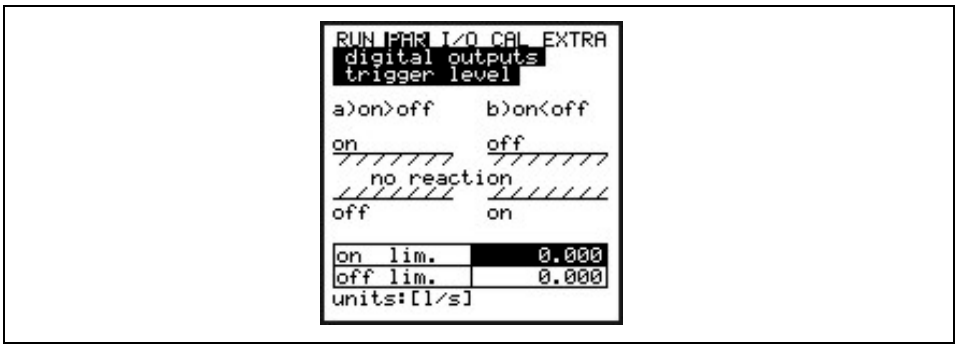


Fig. 8-69 Relay trigger level settings

The switching behaviour depends if the switch-on point is set higher or lower than the switch-off point: threshold behaviour (ON>OFF) or as in-bounds alarm (ON<OFF).

Pos-Total Impulse

This menu is visible only if >Pos-Total impulse< has been selected as function.

Fig. 8-70 Setting relay impulse parameters

Duration s

Enter the impulse duration here and adjust the value to the impulse counter used.

Volume [m³]

If this volume has been reached the contact will be closed for the duration set.

The PCM 4 has been programmed to immediately process the impulses which have been cumulated within the memory cycle. The unit will switch over to permanent mode until the impulses have been processed if the measurement time is not sufficient.
Due to this reason it is important to adjust the number of impulses to the expected maximum volume.

Example:
measurement cycle = 5 min., duration = 0,5 s, volume 1 m³,
measured flow rate = 100 l/s
5 min x 60 s x 100 l/s / 1000 = 300 impulses x 0,5 s = 150 s

The PCM 4 will operate in permanent mode for the calculated period.

Sampling

This menu can be viewed only as soon as the function >water test< has been enabled.

Fig. 8-71 Sampling relay settings

Duration s Set impulse duration here. Adjust the setting depending on the sampler used.

Volume [m³] The contact will close for the duration set as soon as this volume has been reached.

Level [m] This parameter is to protect the connected sampler. The contact will be closed only if the fill level set has been exceeded. This helps to prevent the sampler from drawing air.

The PCM 4 will operate in continuous mode if >water test< has been selected as function. The selected memory cycle now defines only the storage interval for the compact flash card. This ensures absolutely precisely timed sampling in case of reaching the volume set.

In this mode PCM 4 battery lifetime is approx. 3 days.

8.5.7 Parameter Menu “Setup Parameter“

This menu allows to modify or to restore the basic system settings described below.

Fig. 8-72 Submenu settings

Load factory setup Enables to execute a general reset. The following screen appears

Fig. 8-73 Executing a general system reset

Selecting “YES“ will erase the flash memory.

Fig. 8-74 Save new values after system reset

Leaving the menu indicates >save new values?<.
Selecting “YES“ will reset the PCM 4 to the default parameter settings

All customer settings will be reset (general reset of system).

In order to avoid faulty programming and settings it is required to execute a general system reset 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 be 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 4 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 maximum measuring time has been set too short. The battery life is reduced if the measuring time has been set too long.

8.5.8 Parameter Menu "Storage Mode“

The PCM 4 allows to save recorded data regarding flow velocity, level, temperature and flow rates 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 4 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 4 display is disabled when in memory mode (see also chapter 7.5.1).

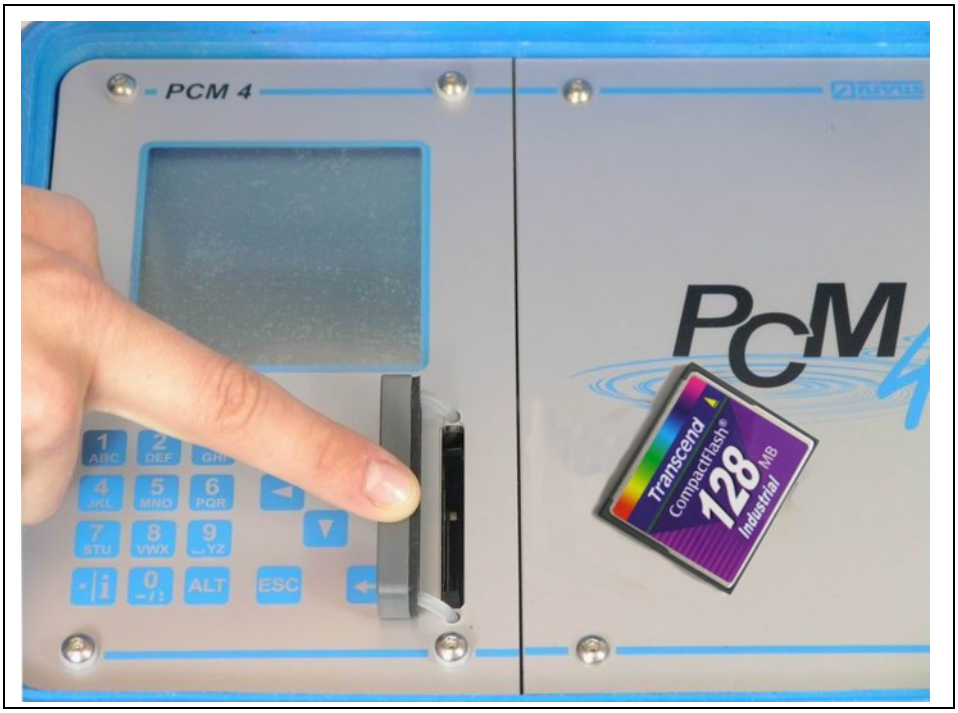


Fig. 8-75 Memory card slot

Due to the card's technically restricted number of storage cycles (approx. 100.000 writing events), the PCM 4 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 4 (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.

Transmit data to compact flash card prior to card replacement as described above to make sure all data being saved on memory card.

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.

Never format memory cards on PC but always on PCM 4. The PCM 4 is not capable of using formats created by PC and therefore does not accept cards formatted on PC.

Data will always be saved as current values at the moment of saving.

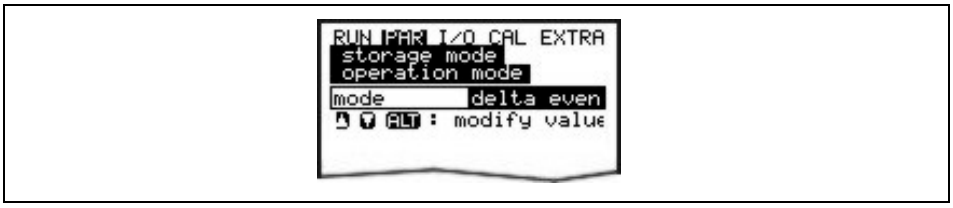


Fig. 8-76 Selecting memory options

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
delta	= The PCM 4 is able to toggle between two saving cycles.
event	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.

Continuous operation:
Continuous recording of readings as if using a non-portable flow meter; data will be saved according to the storage cycle set. This mode is conceived for use in case of very high discharge dynamics and for short-term use of the PCM 4.

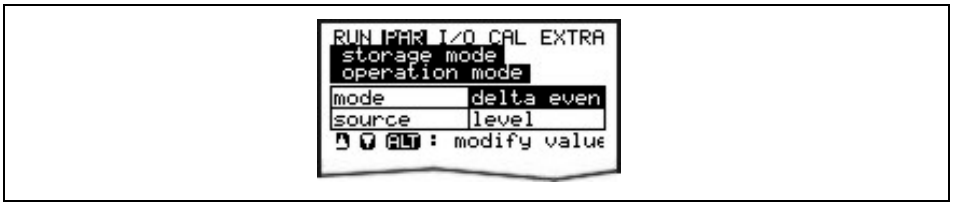


Fig. 8-77 Selecting memory options

Source

Level	This setting will force the sensor-integrated pressure measurement cell to retrieve fill level data every 5 seconds. The PCM 4 will be activated immediately in case of exceeding the threshold, switching over to event mode.
Digital I1	The PCM 4 is permanently monitoring the digital input. The unit will switch over to event mode immediately as soon as the digital input is going to be enabled.

Fig. 8-78 Storage mode screen

Periodic Interval

This parameter is to define the saving interval. 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 values between 1 minute and 1 hour. 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. 8-79 Setting the storage cycle

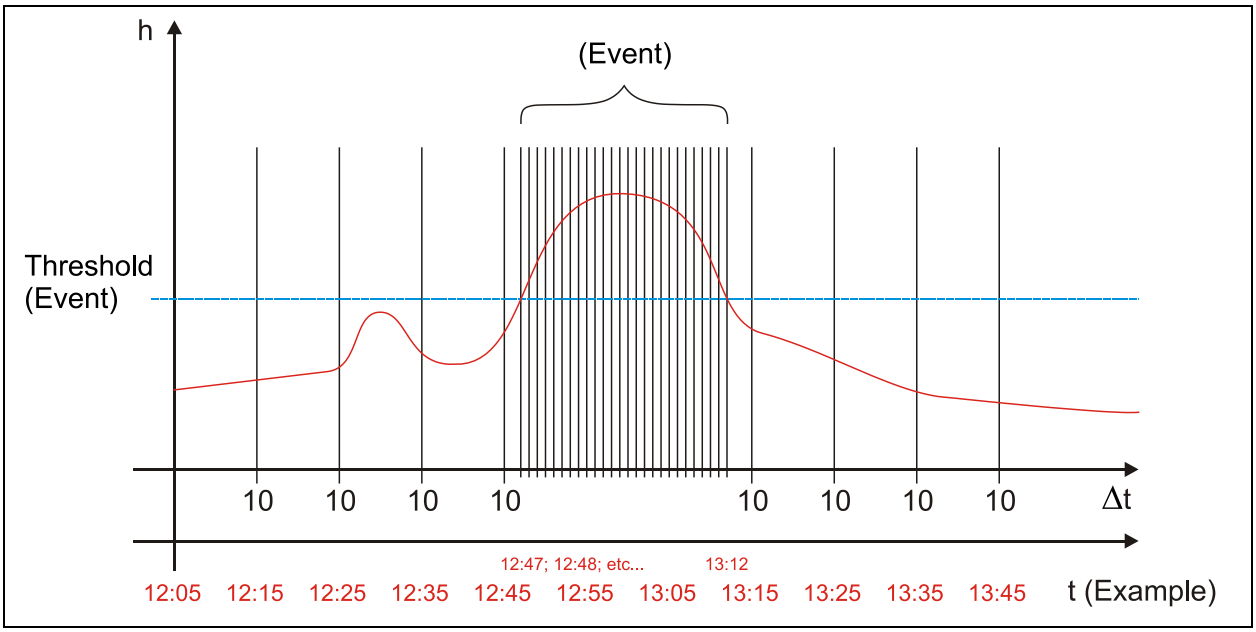


Fig. 8-80 Event parameter setting example

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.
When it comes to be saved on memory card, it is possible to define a unit for each of the measured and calculated flow, velocity and fill level readings. These settings do not have an effect on the display. There are various units available depending on the selection made previously.

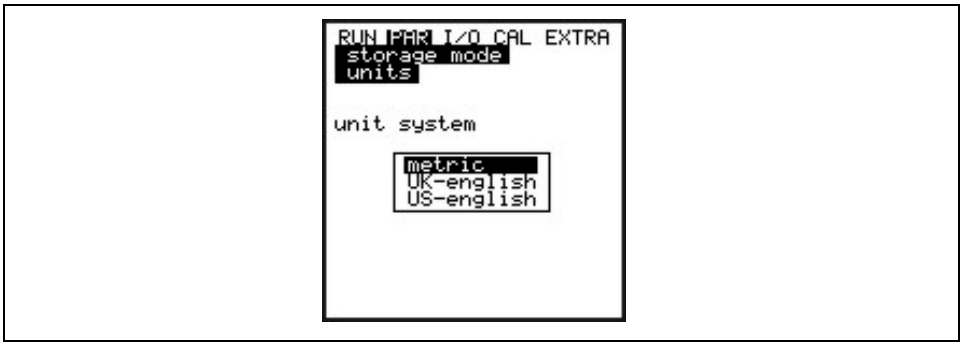


Fig. 8-81 selecting the unit system in storage mode

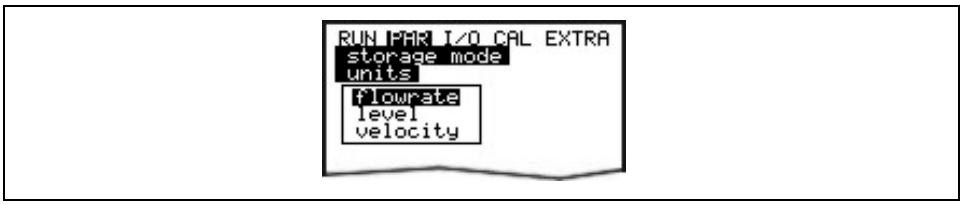


Fig. 8-82 Selecting the measurement value in storage mode

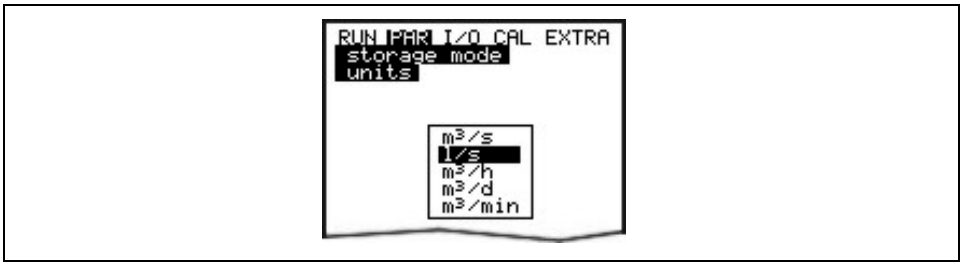


Fig. 8-83 Selecting the units in storage mode

Wakeup level

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

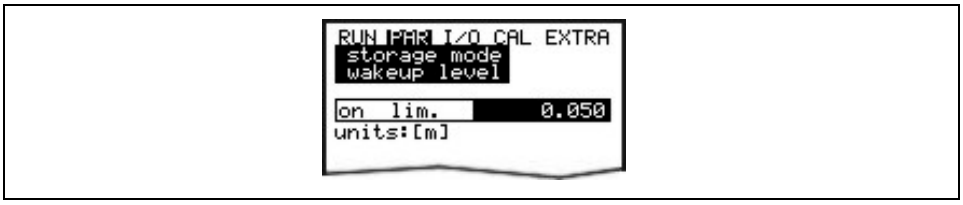


Fig. 8-84 Wakeup level screen in storage mode

Format of numbers

Choose between commas or dots to be used as decimal points.

8.5.9 Data Structure on Memory Card

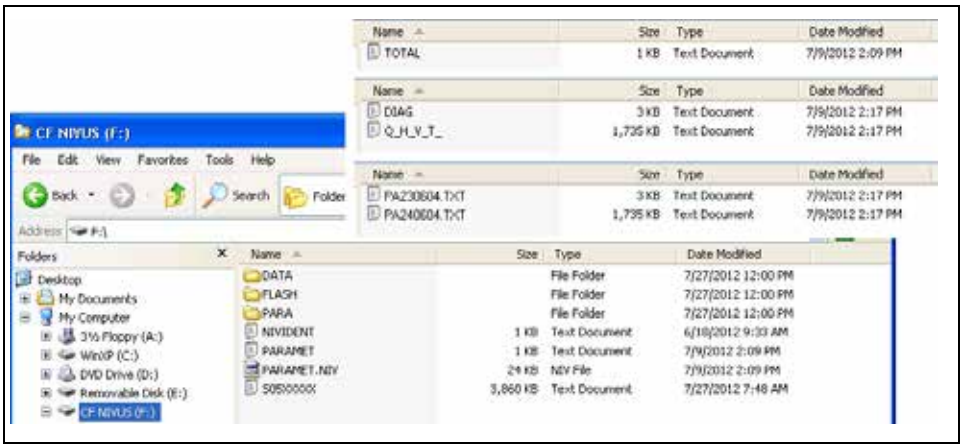


Fig. 8-85 Data structure on memory card

DATA

Day totals are saved in the data file >TOTAL.TXT< in this folder. Save by using the menu points >I/O/Memory card/Day values< (see Chapter 8.8.7)

Flash

This is the folder where the backup file is being saved (to execute select I/0 – Memory Card – Save backup).
The name of the saved file is always >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 start and end of Internet communication, modem restart, 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 includes all parameter files with a date stamp.
PA TT MM JJ .TXT (TT = day, MM = month; JJ = year)
The content of this folder allows to retrace transmitter settings regarding the measurement place as well as parameter settings which might have been modified.
The latest modification within the course of a day will be saved.

NIVIDENT

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 4, the unit will prompt to format the card. The PCM 4 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 programmable 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 4. 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 “

Specific communication parameters are adjusted in this menu.
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” „GSM-Module“ and „Bluetooth-Module“, enclosed to the respective units.

Fig. 8-86 Communication

8.6.1 NivuLog PCM

In order to connect a NivuLog PCM to the PCM, select Type NivuLog.

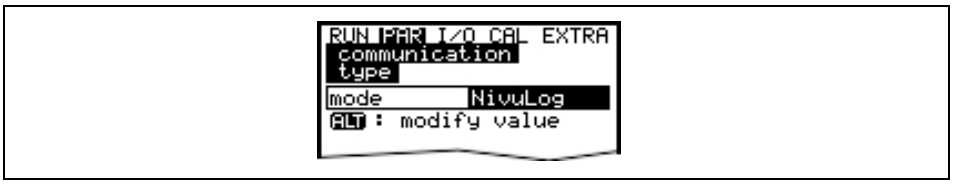


Fig. 8-87 select type NivuLog

Use the connection cable (part of NivuLog PCM deliver<) for connection between PCM 4 (socket 5) and NivuLog PCM.
Then proceed as described in the NivuLog PCM instruction manual as well as in the D2W user handbook.
Detailed explanations on the parameters required for connecting a GSM module or Bluetooth module can be found in the respective instruction manuals for NivuLog PCM, GSM module and Bluetooth module. These manuals are a part of the according instrument delivery.

8.7 Independent Readings

There are two programmable analog inputs available in the PCM 4. The sockets 1 and 3 can be chosen via the arrow keys >left< and >right< (see Fig. 8-89). These independent analog inputs can be used e.g. for throttle verification purposes. A 2-wire probe installed within the throttle shaft can be connected to sockets 1 or 3.
This level sensor does not influence the flow measurement.

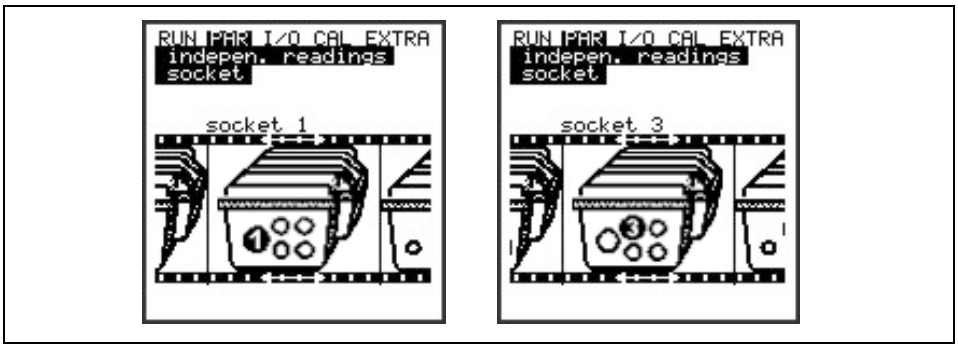


Fig. 8-88 Socket selection - independent readings

Socket

Socket 1:
Input via multifunctional socket 1
(2 wire signal, input is passive)

Socket 3:
Input via multifunctional socket 3
(2 wire signal, powered via PCM 4).

Measurement Span

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

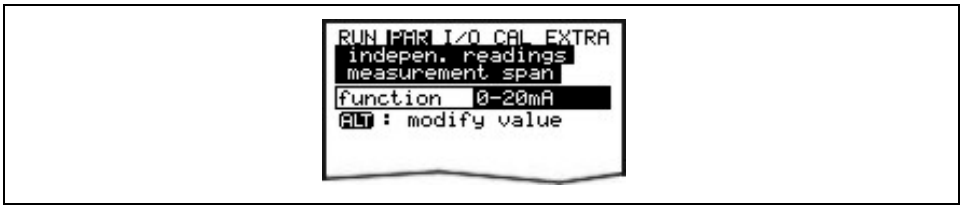


Fig. 8-89 Measurement span of independent readings

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

Fig. 8-90 Overview of independent readings

Units

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

Fig. 8-91 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 4 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.

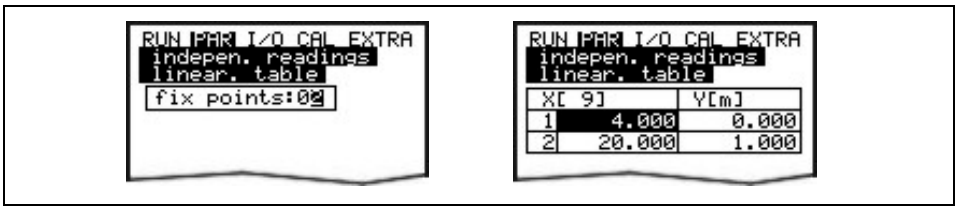


Fig. 8-92 Linearisation of independent readings

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

Echo-sounding level sensors normally need several seconds to reliably detect ultrasonic signals. Due to this reason a time delay from 0 – 20 seconds can be specified here.

Fig. 8-93 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 and outputs, echo profiles, individual velocities etc.), however does not enable to influence signals or conditions (offset, adjustment, simulation or similar). The menu therefore primarily serves for assessment of the measurement place, the hydraulic conditions and for error diagnosis.

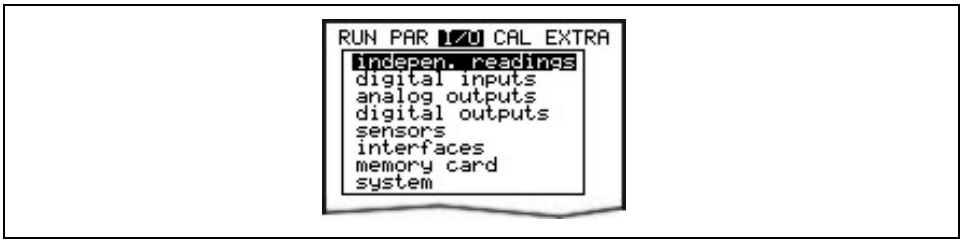


Fig. 8-94 I/O Submenu

8.8.1 I/O Menu „Independent readings”

Within this menu it is possible to control and inspect the analog input values connected to sockets 1 and 3 of the PCM (see Fig. 8-88).
Values before (values in [mA/V]) or after (calculated values) the possible linearisation of the analog inputs are indicated.

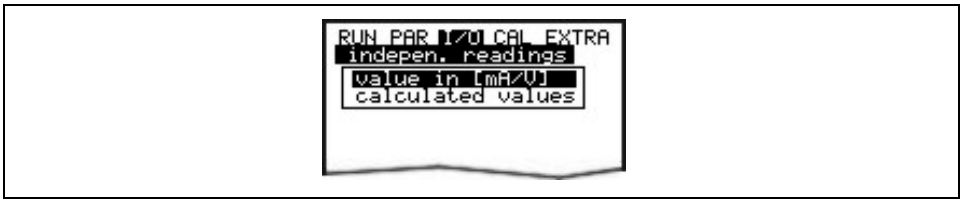


Fig. 8-95 Independent readings

Value 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. 8-88).

A 4 [mA] Input signal from multifunctional socket 1.
Indicates the input current for the mA input.

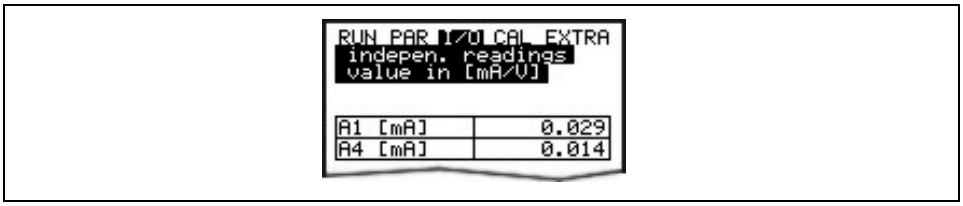


Fig. 8-96 Value in mA / V

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

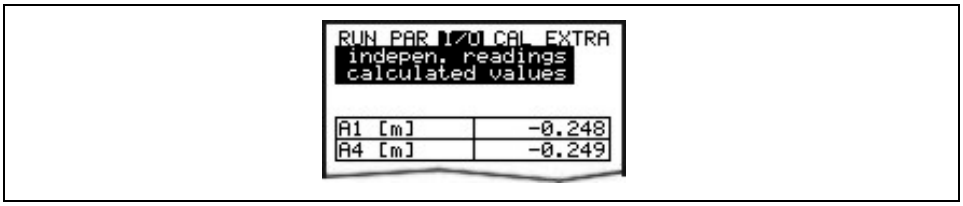


Fig. 8-97 Calculated values

8.8.2 I/O Menu "Digital Inputs”

Digital input values routed to the transmitter input clamps can be viewed here. Reading is either logically "OFF“ or "ON“.

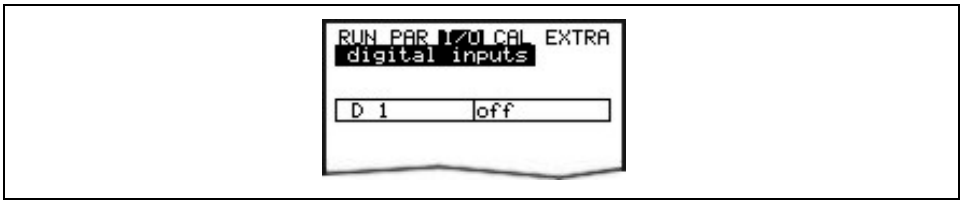


Fig. 8-98 Screen digital values

8.8.3 I/O Menu "Analog Outputs”

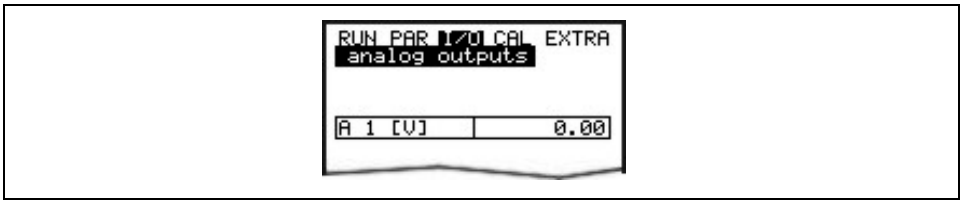


Fig. 8-99 Screen analog values

This menu is to indicate the calculated value which is to be sent to the analog converter.

8.8.4 I/O Menu "Digital Outputs”

This submenu indicates the conditions calculated by the transmitter and being put out on the relay.
A distinction is made between logical "OFF" or "ON".

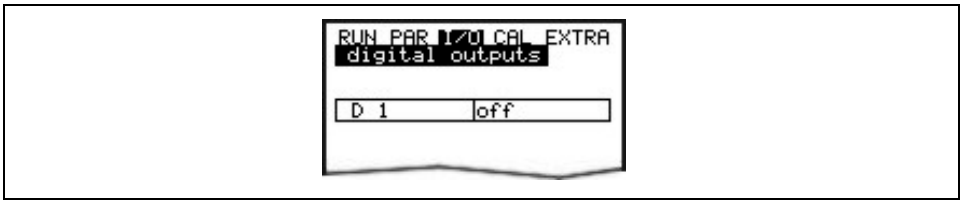


Fig. 8-100 Digital values

8.8.5 I/O Menu "Sensors”

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

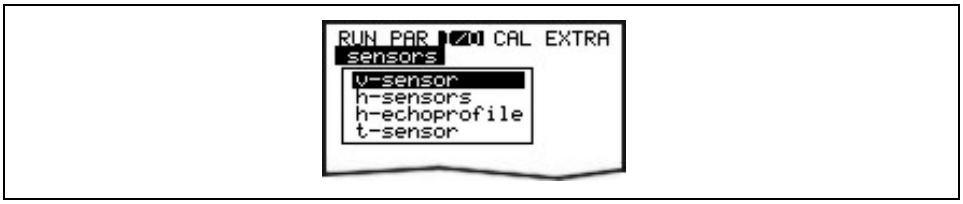


Fig. 8-101 I/O Submenu, v-sensor

V-Sensor

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

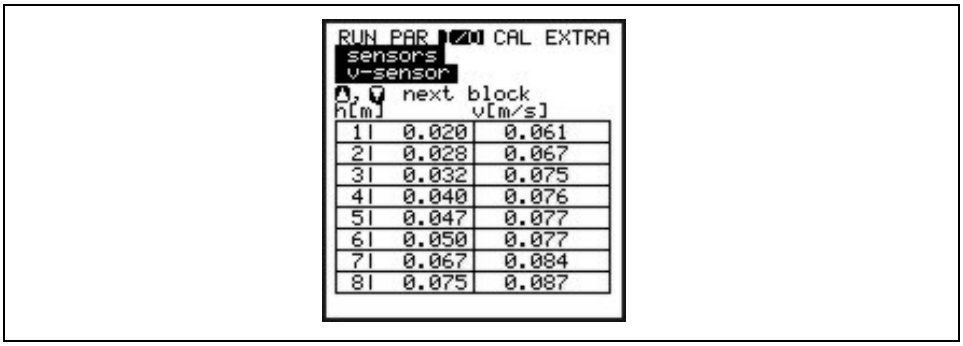


Fig. 8-102 Measured individual velocities

▲ + ▼

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. This might happen due to very clean water or vorticity within this area.

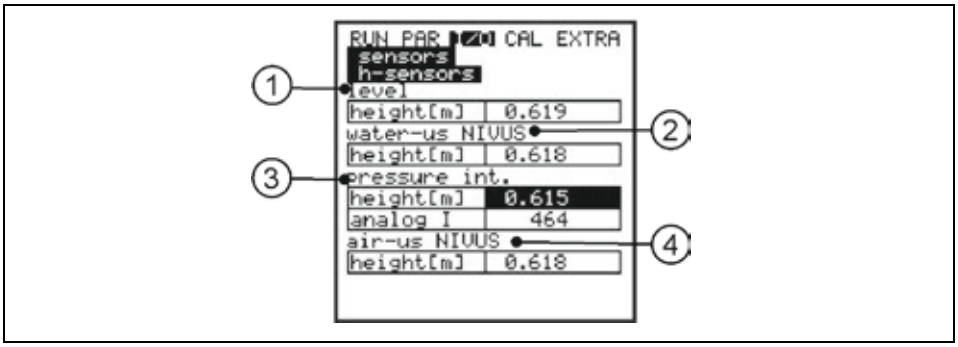
This effect might occur as well in case of low flow levels as from approx 35 cm (13.78 in), however is caused due to the PCM 4 automatically reducing the number of measurement windows here. It does not affect the measurement result if single or few windows might fail!

H-Sensor(s)

Indicates the measured fill levels.

There are varying menus depending on the sensor version (level measurement using water-ultrasonic, pressure, air-ultrasonic or external sensor) used (see chapter 8.5.2:

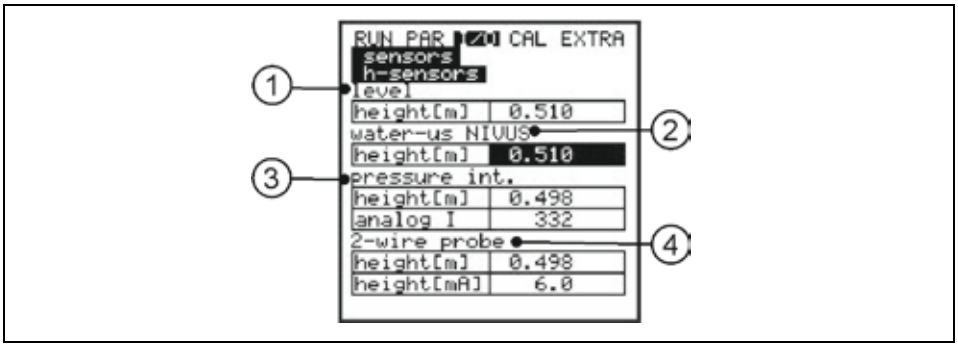
Example 1:



1 level
2 level water-us NIVUS
3 level pressure interne
4 level air-us NIVUS

Fig. 8-103 Menu with water-ultrasonic, pressure and air-ultrasonic

Example 2:



1 level
2 level water-us NIVUS
3 level pressure interne
4 level 2-wire probe

Fig. 8-104 Menu with water-ultrasonic, pressure and 2 wire sensor

The sensor types are going to be displayed accordingly if only 1 or 2 types have been selected.

H- Echo Profile

Enabled only in case of level water ultrasonic measurement from bottom up or air-ultrasonic measurement from top down.

Fig. 8-105 Selecting level measurement echo profile

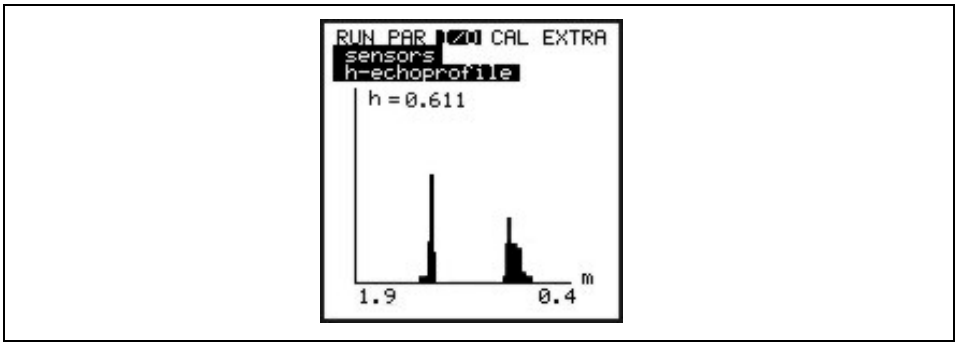


Fig. 8-106 Screen level measurement echo profile

This graph 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 4). Invalid values indicate cable break, short circuits or incorrectly clamped connections.

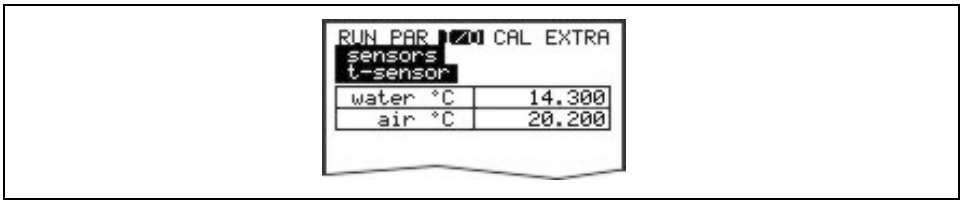


Fig. 8-107 Temperature screen

8.8.6 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.

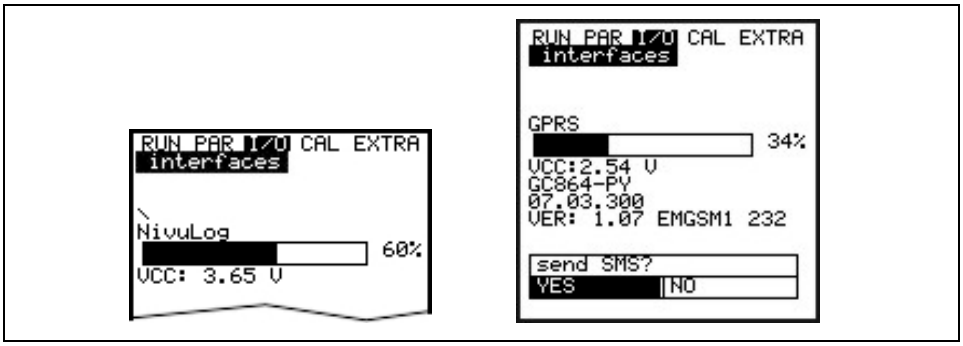


Fig. 8-108 Signal quality screen NivuLog PCM and GSM-Module

The Parameters are described in the instruction manuals “NivuLog” or „GSM Module“.

8.8.7 I/O Menu „Memory Card”

This menu allows to recall information on the memory card.

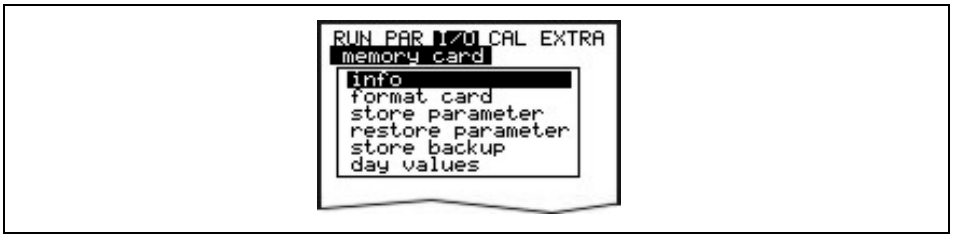


Fig. 8-109 Memory card options

Fig. 8-110 Card info menu

Information can be recalled only if the memory card is plugged. To be able to indicate the remaining capacity time the card must be plugged into the PCM 4 one hour at least.
You can use the >Memory Card< menu to execute card formatting as well.

Fig. 8-111 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 but always on PCM 4. The PCM 4 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 4.
Parameters set will be written to memory card by using the menu point "Save 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. 8-112 Saving parameters on memory card

The menu point „Load parameters" first of all will show all program files saved on memory card. The file will be transferred to the PCM 4 after choosing.
The name of the file required to program the PCM 4 by memory card is „PARAMET.NIV".

Fig. 8-113 Loading parameters to memory card

The PCM 4 has an additional internal memory which can be saved on memory card as well (save 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. 8-114 Save 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. 8-20).
The circular memory always indicates the past 90 days.

Fig. 8-115 Save day values (total)

8.8.8 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.

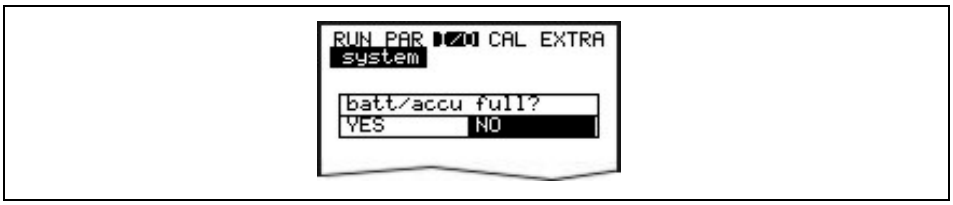


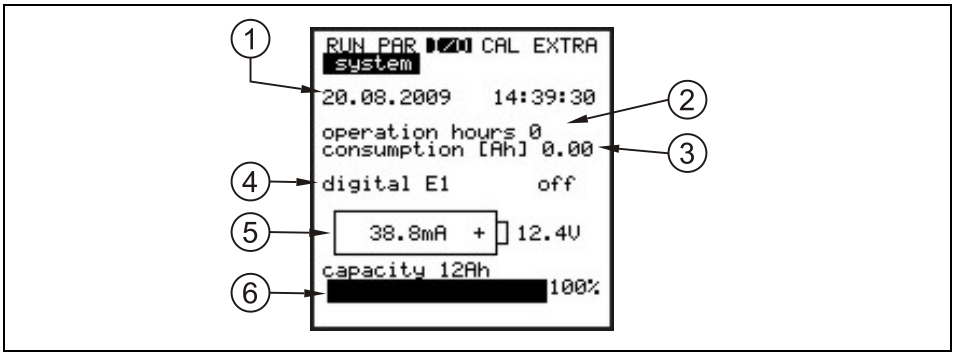
Fig. 8-116 System menu

Confirming this message with >YES< will reset the capacity to 100% and the PCM 4 is going to recalculate the battery lifetime.

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 11 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 4 operating (measuring) hours.
Does not count standby periods.

3 Power consumption during operating hours in Ah.

4 Condition of digital input.

5 Current power consumption and current battery voltage.
The battery should be replaced or charged on a limit of 11,5 V

Due to battery protection purposes sensors will be switched off if voltage reaches 11.2 V (error message: error sensor 1).
The PCM 4 will be switched off at a voltage of 11,0 V.

6 Maximum capacity of rechargeable battery.
Enter this value under >PAR-Settings-Battery<.

Percentage provides insight into remaining battery lifetime.

Fig. 8-117 Battery lifetime screen

8.9 Calibration and Calculation Menu (CAL)

This menu allows to adjust the level sensors and the settings for the flow velocity detection as well as to simulate relay switching events, the analog output and flow.

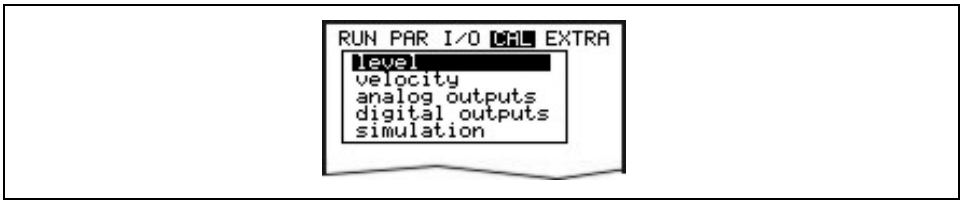


Fig. 8-118 Selection menu

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.
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 come up after the calibration prompt has been confirmed:

Fig. 8-119 Level screen - calibration

The currently enabled 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 can be achieved at low fluctuation range.
Accepting the current level reading by pressing the >ENTER< key requires to investigate an accompanying reference value. Input this value in the screen below.

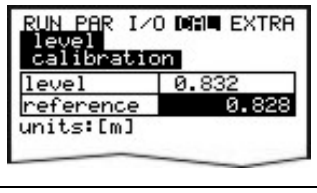


Fig. 8-120 Entering the level reference value

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 4 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. 8-121 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 new 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. 8-122 Saving values

8.9.2 Cal Menu "Velocity“

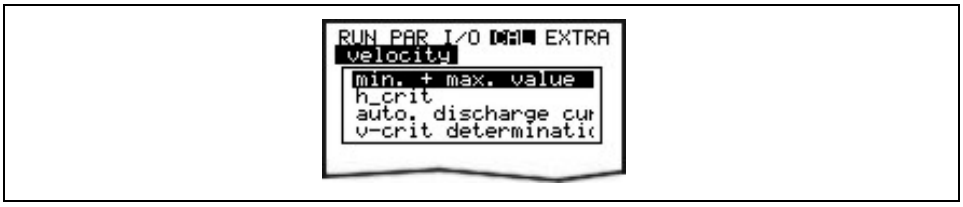


Fig. 8-123 Flow velocity screen

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

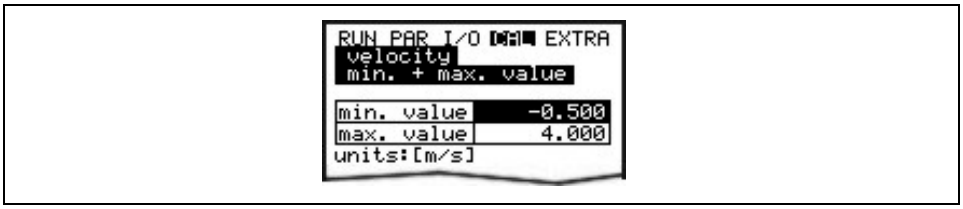


Fig. 8-124 Measurement range of flow velocity

h_crit

It is no longer possible to measure the flow velocity once the level has fallen below a certain threshold. This level is called h_crit.
The value of h_crit depends on the construction of the sensor as well as on the measurement method used and is stored in the sensor memory.
The PCM automatically accepts the stored h_crit values from the sensor after the initialisation process.

The h_crit values below are stored in the respective sensor memory:

- POA sensor: 0.065 m
- CS2 sensor: 0.10 m
- CSM sensor: 0.03 m

The PCM now uses the h_crit values from the sensor, which however cannot be viewed in the Cal\Flow velocity\h_crit menu. This menu still indicates the value 0.000.
As soon as h_crit has been modified manually, the menu Cal\Flow velocity\h_crit indicates the according modification.
The h_crit values will be adjusted automatically in the background if the mounting height of the V sensor is changed.

After start-up the PCM uses the initial values found in the Manning-Strickler table (CAL / Flow velocity / v-crit determination / Manning-Strickler) until it reaches the stored h_crit value.
Going through a level range of 9-12 cm featuring a decreasing trend causes the unit to re-determine the application coefficient for h_crit (automatic >YES<).
Then the PCM under h_crit operates using the investigated application coefficient.

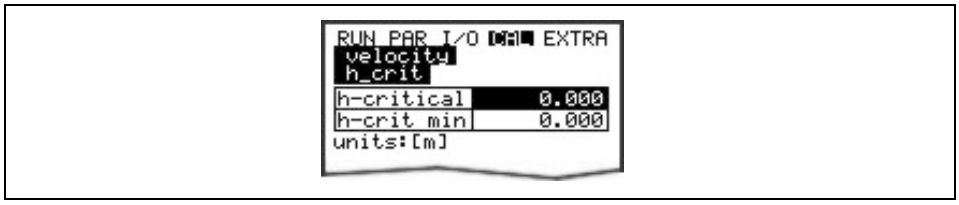
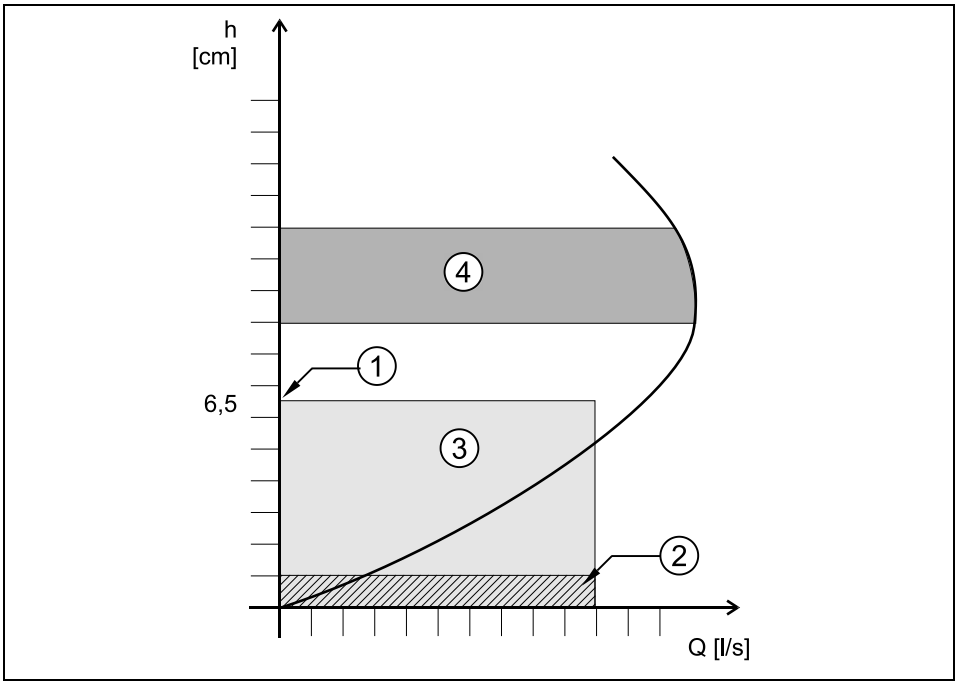


Fig. 8-125 Parameter h_crit

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. 8-126 Determining v-crit

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<).

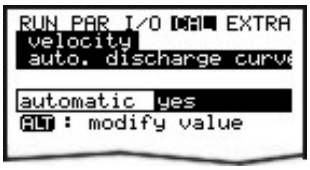


Fig. 8-127 Auto discharge curve

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. 8-128 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. 8-126, No. 4) will be verified using this method.

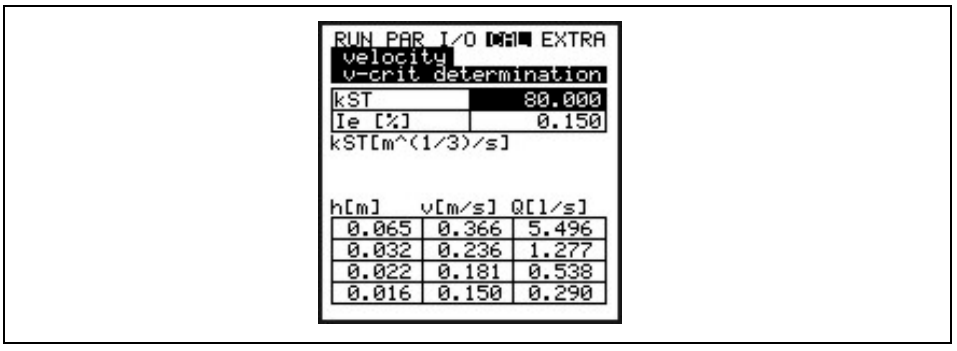


Fig. 8-129 Manning-Strickler

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. 8-126, No. 4) will be verified using this method.

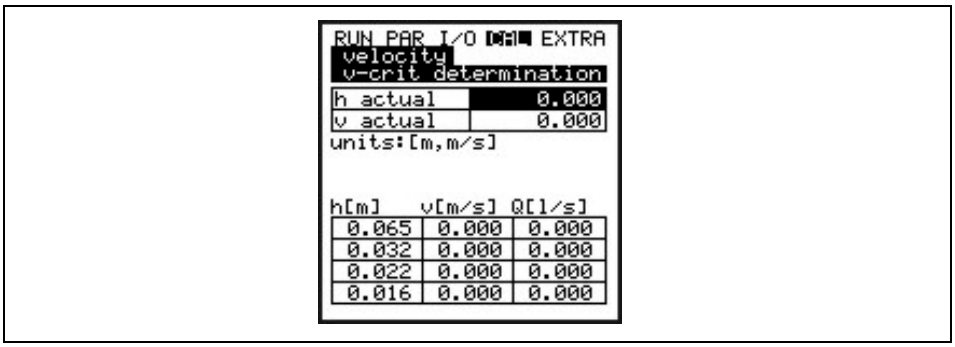


Fig. 8-130 Manually setting v-crit determination

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. 8-126, No. 4) will be verified using this method.

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

Fig. 8-131 Assistant – start measuring v-crit determination

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

Fig. 8-132 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. 8-133 Create dam-up – start measuring

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

Fig. 8-134 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. 8-135 Investigated values – screen (Assistant)

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

8.9.4 Cal - Menu „Analog outputs“

This parameter allows to simulate the PCM 4 analog output signals.

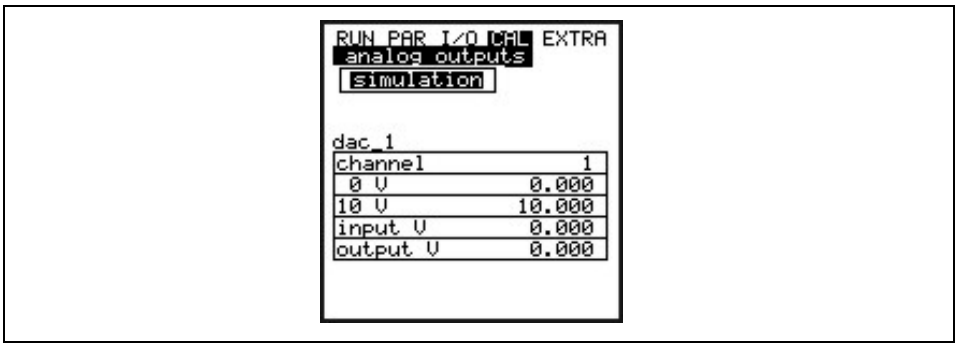


Fig. 8-136 Overview adjustment of analog outputs

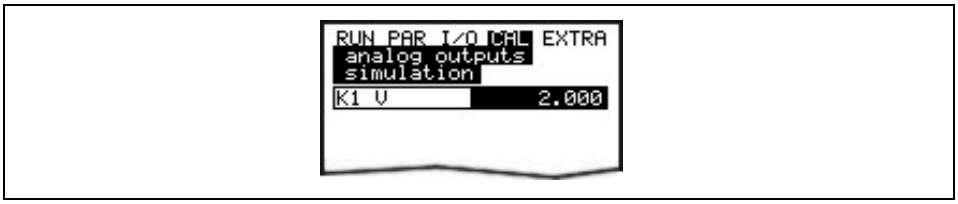


Fig. 8-137 Entering the analog output value

Simulation Select this parameter, enter the desired value in Volt and confirm with >Enter< in order to directly output it on the according clamp.

8.9.5 Cal - Menu “Digital outputs”

The relay will be engaged/disengaged directly by using the arrow keys >up< or >down<.

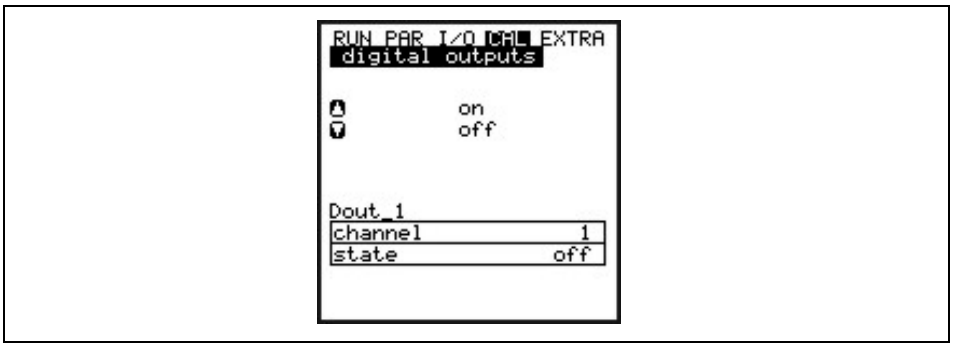


Fig. 8-138 Digital output simulation

8.9.6 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 4 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.

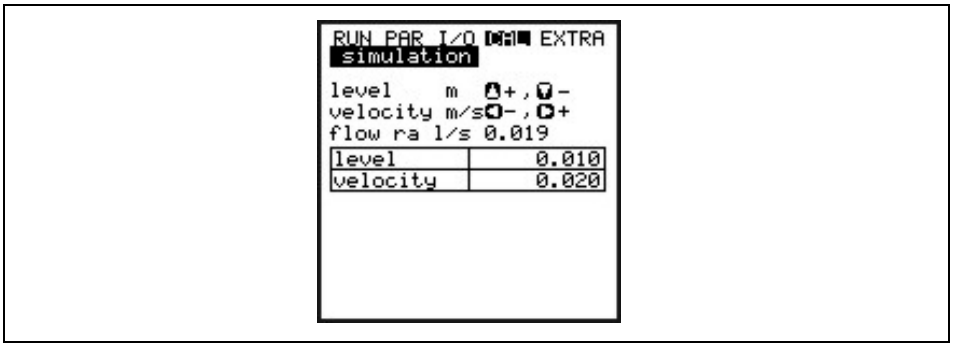


Fig. 8-139 Flow measurement simulation

8.10 Operating a NPP (NIVUS Pipe Profiler)

Connecting an NPP to a PCM 4 merely requires to set the following parameters:

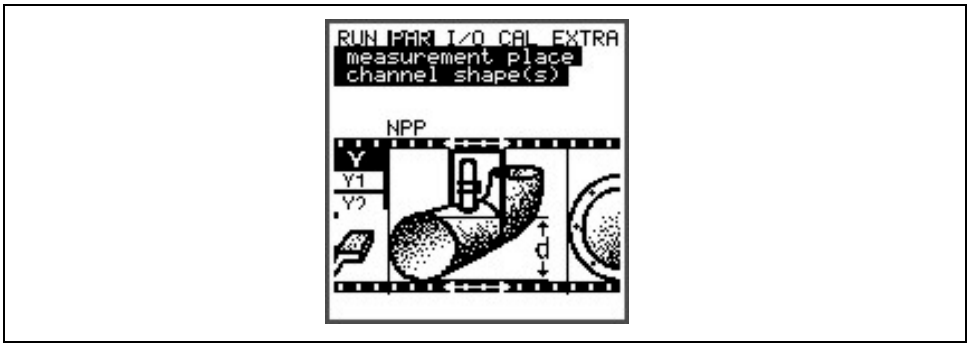
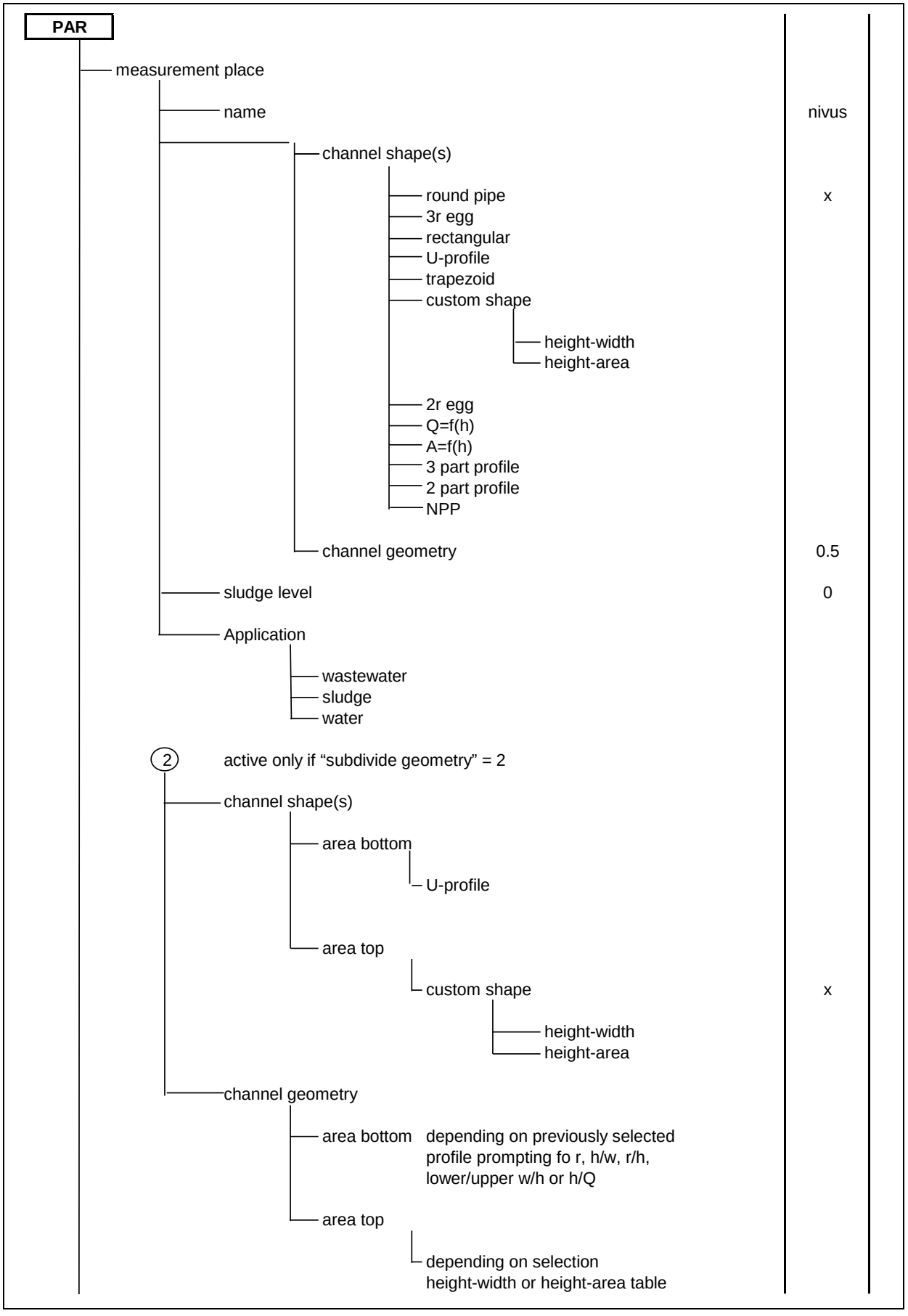


Fig. 8-140 Selection NPP

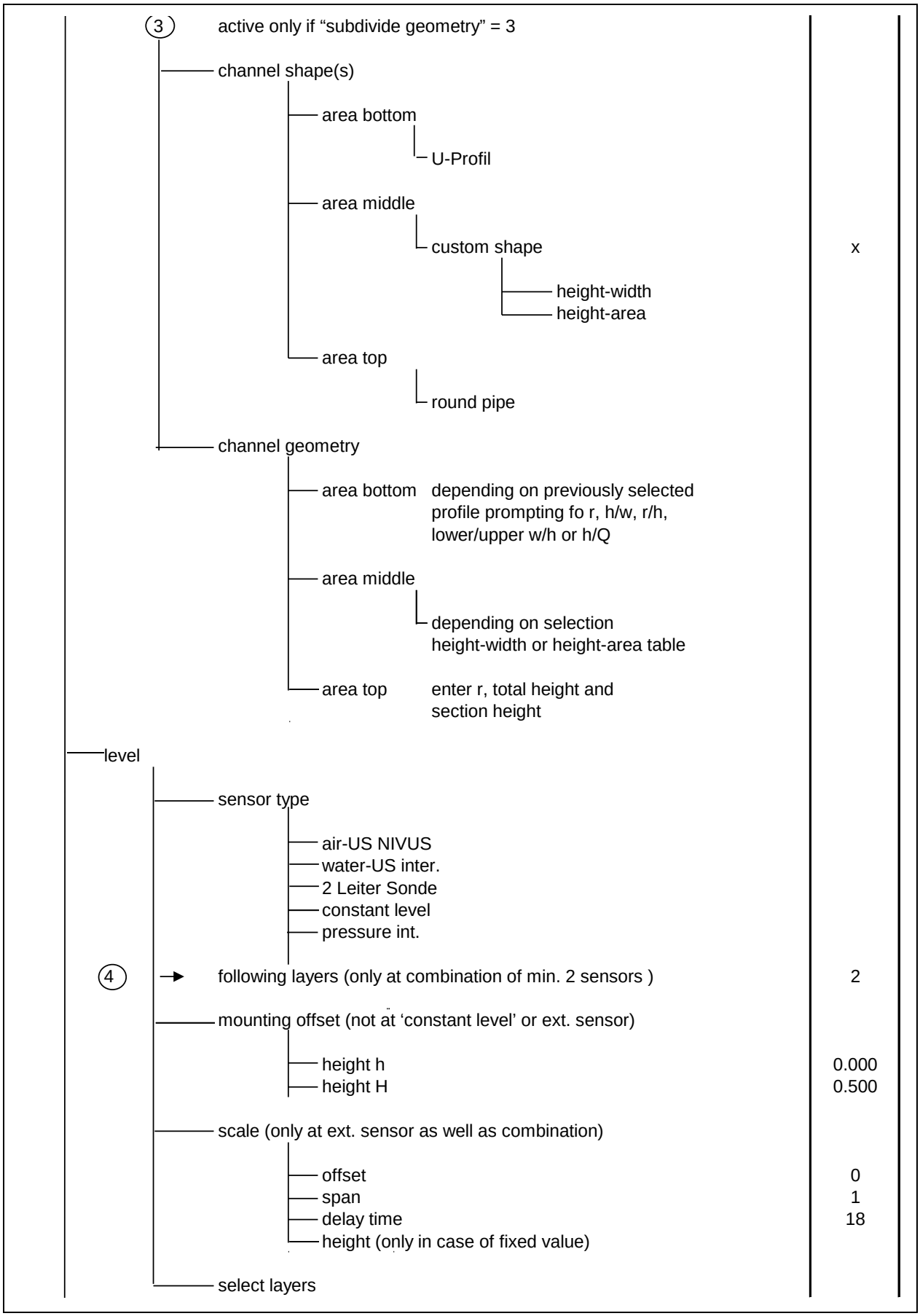
First select "NPP" as profile under >PAR / Measurement place / Channel profile(s)<.
Then enter the accurate inside diameter of the NPP into parameter >channel dimensions< and finish the parameter setting procedure.

9 Parameter Tree

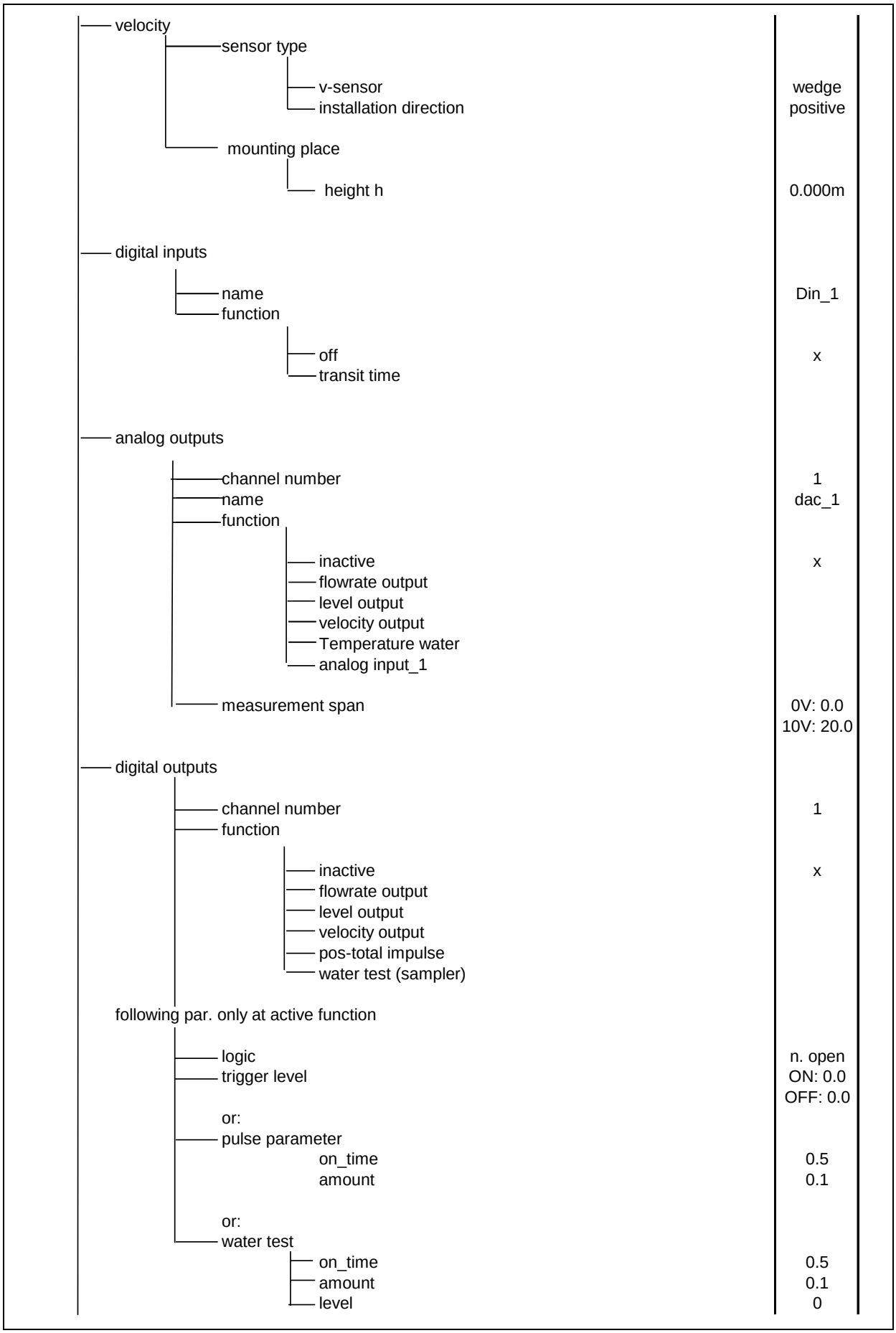
Parameter Menu (PAR) Part 1



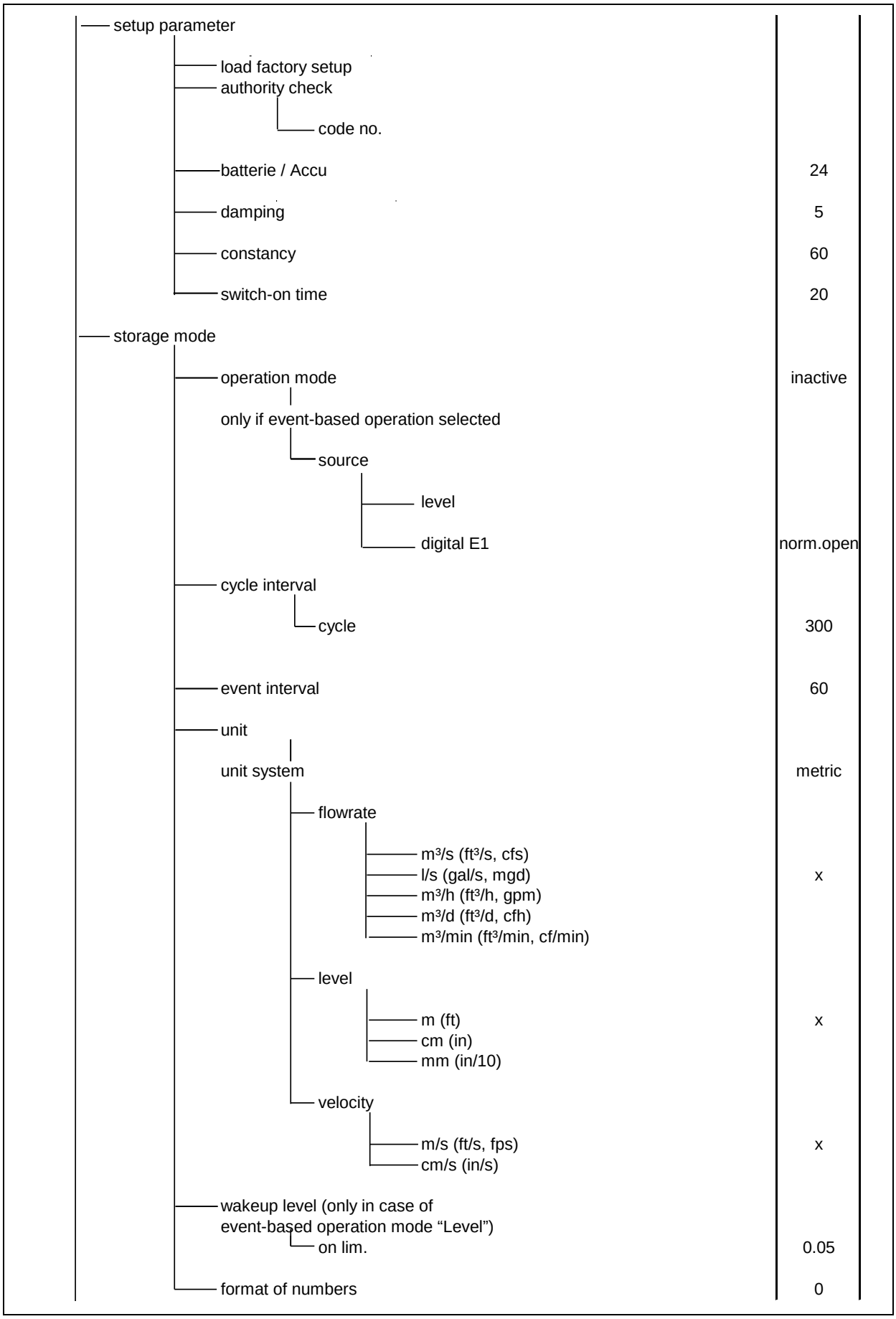
Parameter Menu (PAR) Part 2



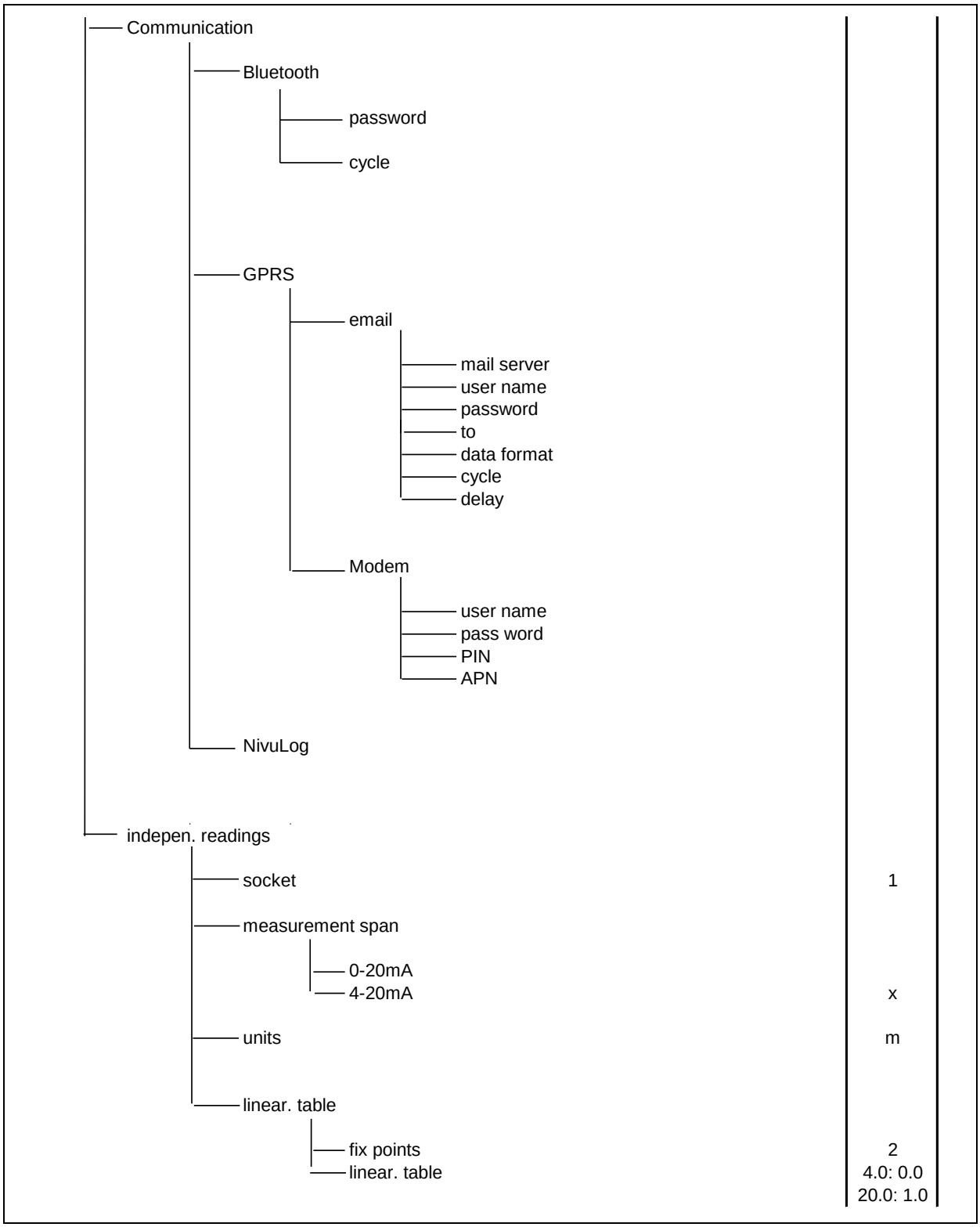
Parameter Menu (PAR) Part 3



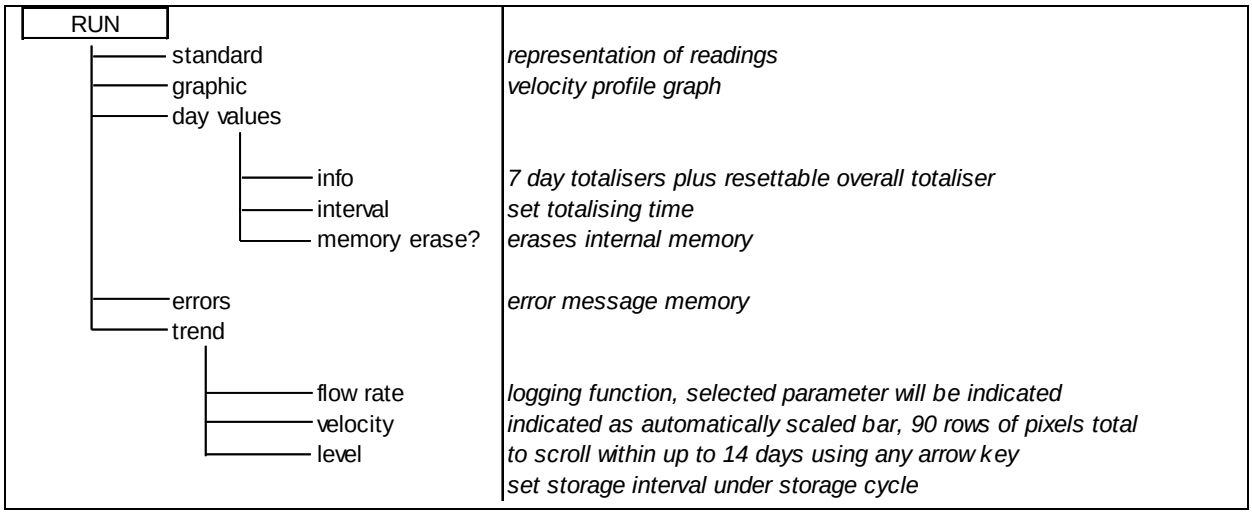
Parameter Menu (PAR) Part 4



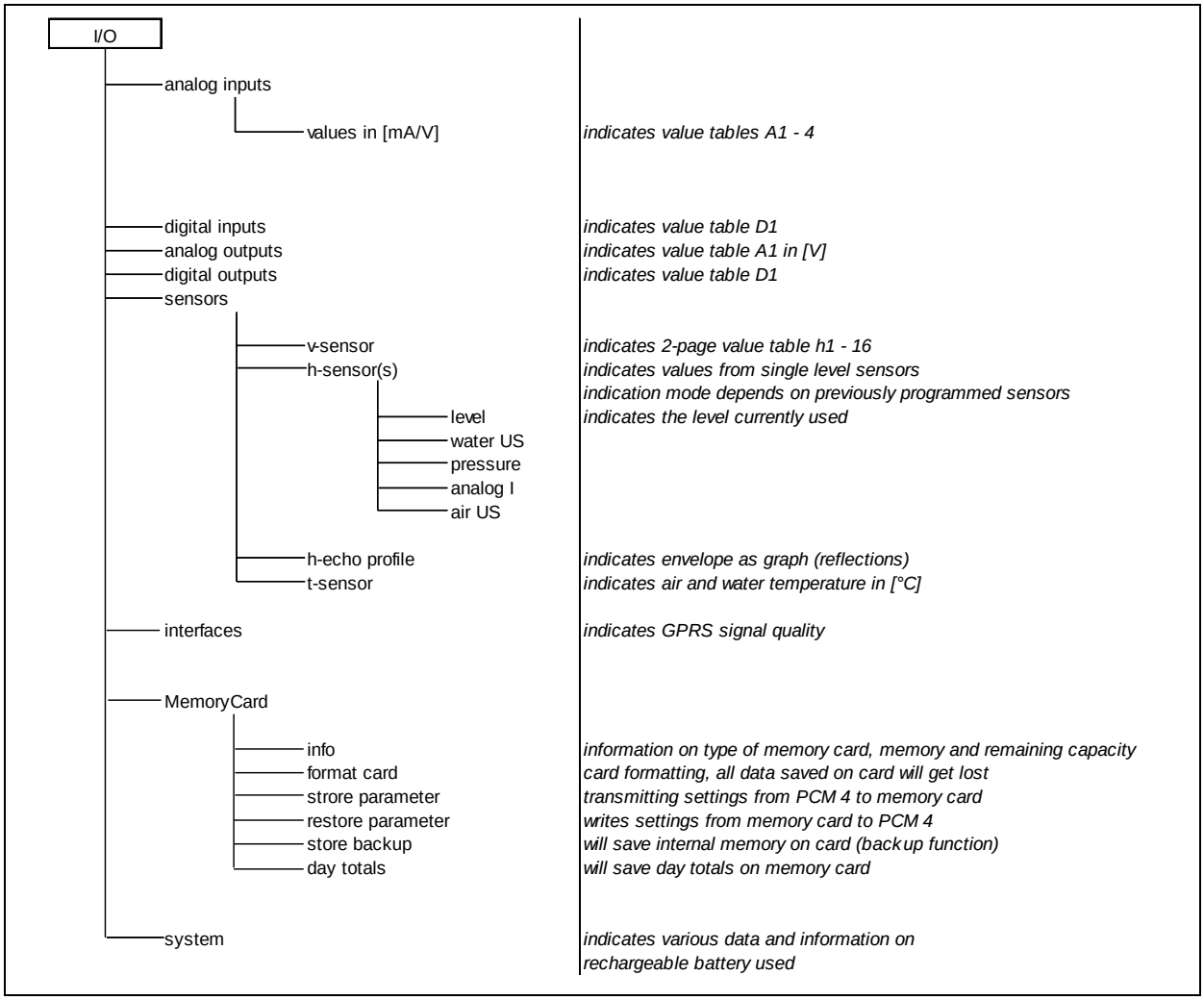
Parameter Menu (PAR) Part 5



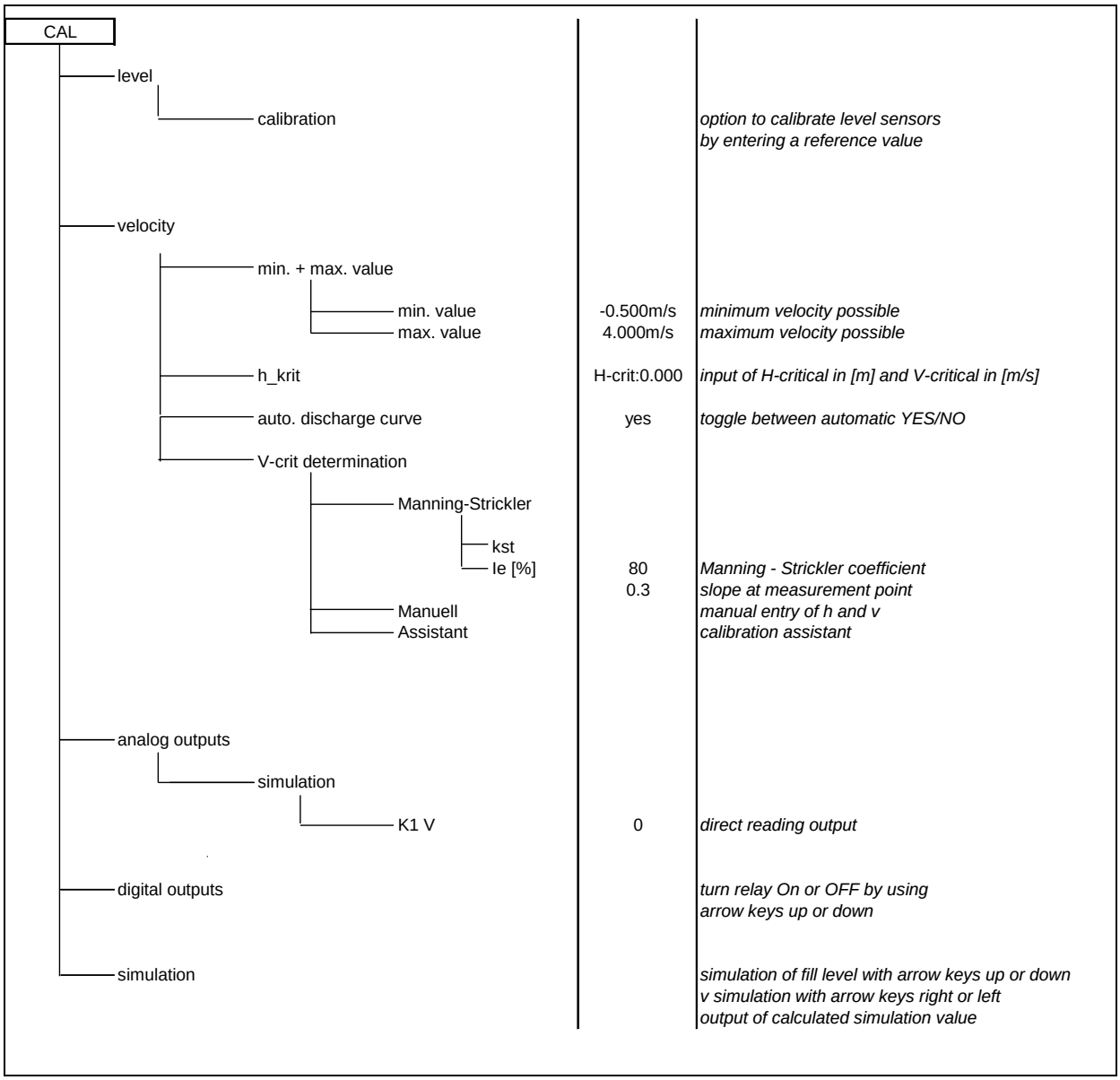
Operation Mode (RUN)



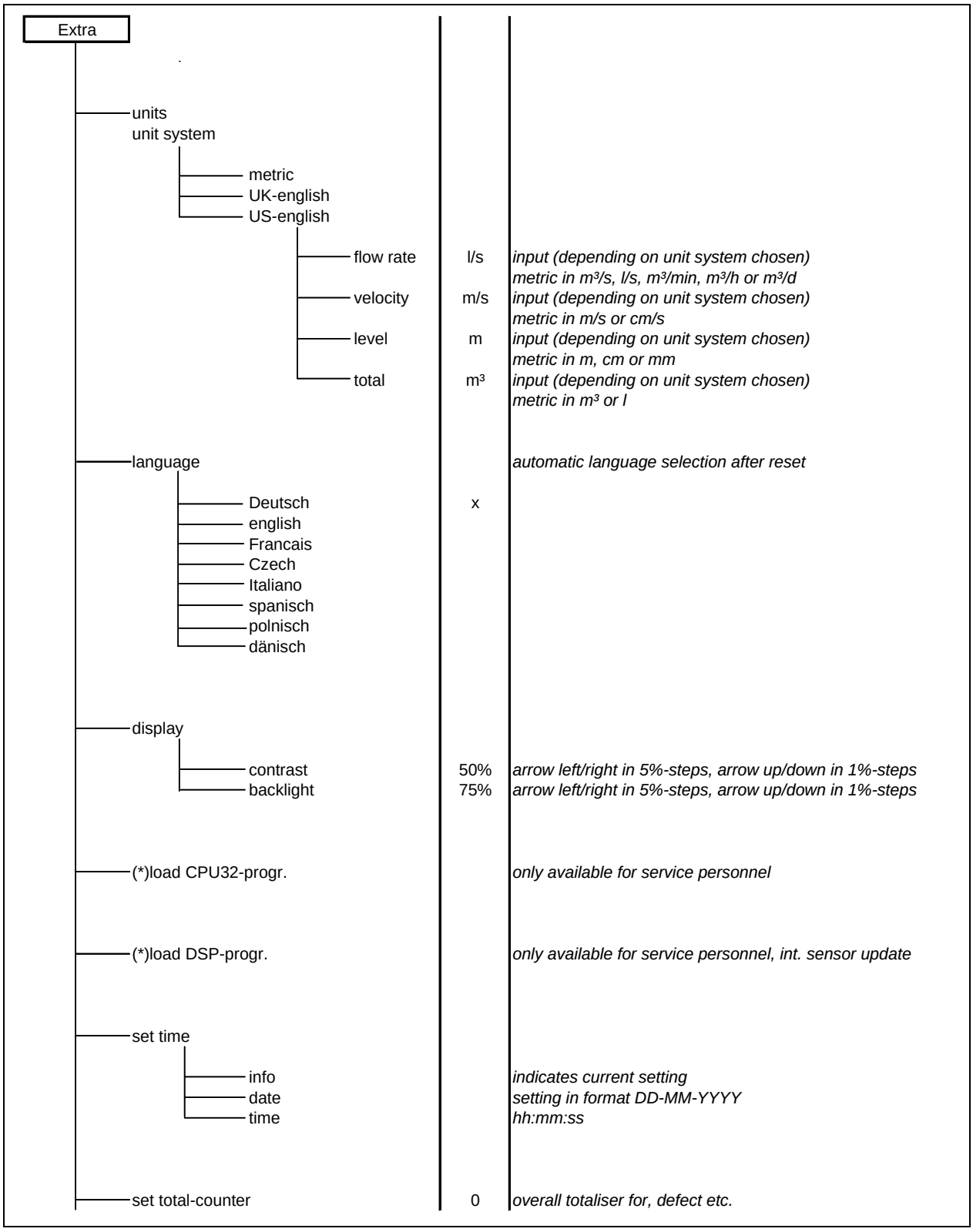
Signal Input / Output Menu (I/O)



Calibration Menu (CAL)



Display Menu (EXTRA)



10 Troubleshooting

Error	Possible Reason	Correction
No indication of flow (0)	Connection	Check sensor connection to PCM 4.
	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<.
		In full channels without level measurement check value of parameter "fixed level“ in the level measurement.
	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 screen (black / flickering)	Connection	Check power connection (battery plug).
	Power supply	Check supply voltage level (min. 11,0 V).
	Memory card	Unauthorised 3rd party manufacture. Use NIVUS memory card.
		Memory card formatted on PC? Send card to NIVUS.
Screen >Sensor Error<	Connection	Check connection cable.
	Battery voltage	Voltage lower than 11.0 V, 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 implausible	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 if the correct shape of measurement place has been set, check dimensions (observe units), sensor type, sensor installation height etc.
No / incomplete data on memory card	Memory card	Memory card defect. To be checked in menu: I/O – Memory card – Info.
		Unauthorised manufacturer. Use NIVUS memory card.
		Memory card formatted on PC. Send card to NIVUS.
	Transmitter	Memory card not firmly plugged in (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.

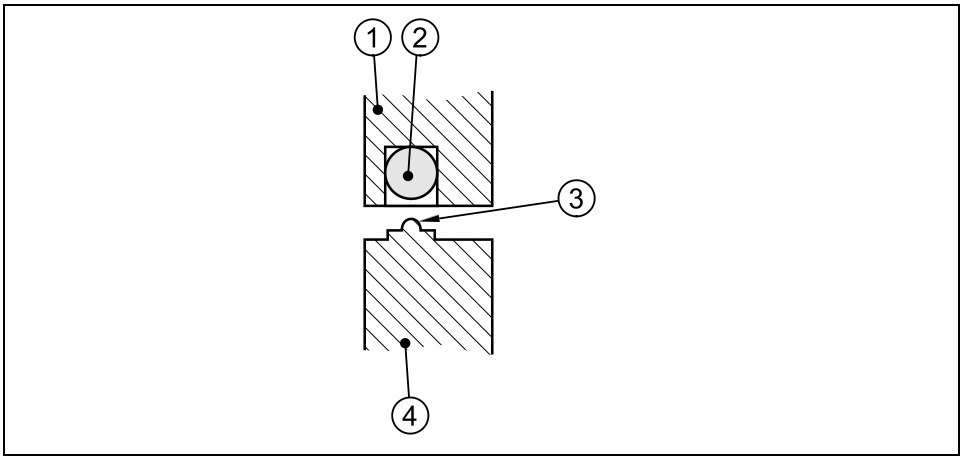
Extent and intervals of maintenance measures depend on the following conditions:

- 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 PCM4. The sealing lip hence lies firmly against the unit and the locking clamps can be latched effortlessly.

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. Besides frequent maintenance, it also depends on the frequency of use as well as on conditions of use and storage.
Please see chapter 6.5.1 for more information on maintenance and 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 shall be disposed according to the local regulations for electronic products.
Do not leave (rechargeable) batteries in the PCM 4 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	3 100	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	75	1.5
	hard-burned bricks, carefully joint; well-manufactured ashlar facing; concrete from joint-free wooden formwork	70...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; quarrystone walls; less accurate 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

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DE / EN / FR

EU Konformitätserklärung

EU Declaration of Conformity

Déclaration de conformité UE

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E-Mail: info@nivus.com
Internet: www.nivus.de

Für das folgend bezeichnete Erzeugnis:

For the following product:

Le produit désigné ci-dessous:

Bezeichnung:	**Portabler Durchflussmessumformer PCM 4**
Description:	*Portable flow measurement transmitter*
Désignation:	*Convertisseur de mesure de débit portable*
Typ / Type:	**PC4-…**

erklären wir in alleiniger Verantwortung, dass die auf dem Unionsmarkt ab dem Zeitpunkt der Unterzeichnung bereitgestellten Geräte die folgenden einschlägigen Harmonisierungsvorschriften der Union erfüllen:

we declare under our sole responsibility that the equipment made available on the Union market as of the date of signature of this document meets the standards of the following applicable Union harmonisation legislation:

nous déclarons, sous notre seule responsabilité, à la date de la présente signature, la conformité du produit pour le marché de l'Union, aux directives d'harmonisation de la législation au sein de l'Union:

- 2014/30/EU

Bei der Bewertung wurden folgende einschlägige harmonisierte Normen zugrunde gelegt bzw. wird die Konformität erklärt in Bezug die nachfolgend genannten anderen technischen Spezifikationen:

The evaluation assessed the following applicable harmonised standards or the conformity is declared in relation to other technical specifications listed below:

L'évaluation est effectuée à partir des normes harmonisées applicable ou la conformité est déclarée en relation aux autres spécifications techniques désignées ci-dessous:

- EN 61326-1:2013

Diese Erklärung wird verantwortlich für den Hersteller:

This declaration is submitted on behalf of the manufacturer:

Le fabricant assume la responsabilité de cette déclaration:

NIVUS GmbH
Im Taele 2
75031 Eppingen
Allemagne

abgegeben durch / *represented by / faite par:*

Marcus Fischer (Geschäftsführer / *Managing Director / Directeur général)*

Eppingen, den 20.04.2016

Gez. *Marcus Fischer*