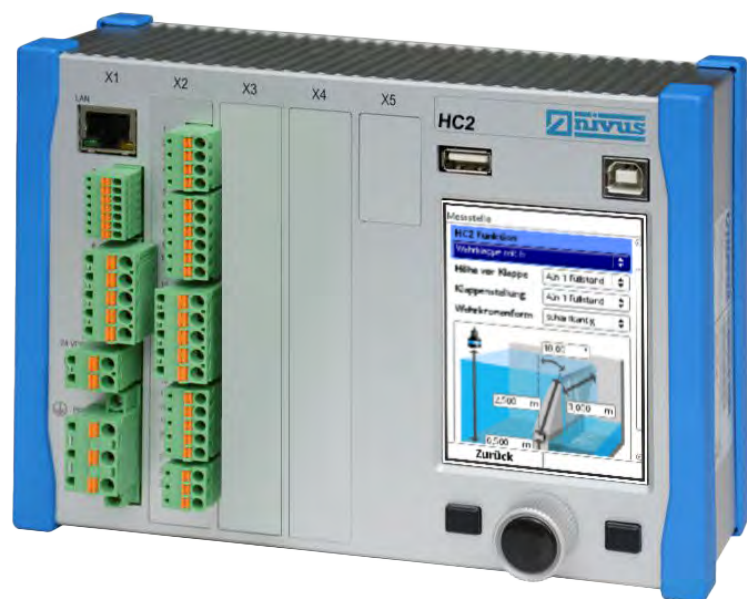


Instruction Manual

Flow Calculator HydraulicCalculator 2



Firmware Revision: 4.1.x

Revised Instruction Manual

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Original Instruction Manual German / Rev. 01 / 08.12.2025

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NIVUS AG, Switzerland

Burgstrasse 28
8750 Glarus, Switzerland
Phone +41 55 6452066
Fax +41 55 6452014
info@nivus.ch
www.nivus.ch

NIVUS, Austria

Mühlbergstraße 33B
3382 Loosdorf, Austria
Phone +43 2754 5676321
Fax +43 2754 5676320
austria@nivus.com
www.nivus.com

NIVUS Sp. z o.o., Poland

Ul. Bolesława Krzywoustego 4
81-035 Gdynia, Poland
Phone +48 58 7602015
biuro@nivus.pl
www.nivus.pl

NIVUS France SAS

28 rue de Londres
75009 Paris, France
Phone +33 1 89708767
info@nivus.fr
www.nivus.fr

NIVUS Ltd., United Kingdom

Unit 2D Middlemarch 4020
Middlemarch Business Park
Siskin Parkway East
Coventry, CV3 4SU
Phone +44 8445 332883
nivusUK@nivus.com
www.nivus.co.uk

NIVUS Middle East (FZE)

Prime Tower
Business Bay Dubai
31st floor, office C-3
P.O. Box: 112037
Phone +971 4 4580502
middle-east@nivus.com
www.nivus.com

NIVUS Korea Co. Ltd.

#2301 M-Dong Technopark IT Center
32 Songdogwahak-ro, Yeonsu-gu
INCHEON, Korea 21984
Phone +82 32 2098588
Fax +82 32 2098590
jhwon@nivuskorea.com
www.nivuskorea.com

NIVUS Vietnam

237/78 Phan Trung Street
Tan Tien Ward, Bin Hoa City
Dong Nai Province, Vietnam
Phone +84 94 2623979
jhwon@nivuskorea.com
www.nivus.com

NIVUS Africa

3rd floor, block no. 3
75th Fadan Area
Abo Rawash Industrial Zone
Giza, Egypt
Phone +20 2 35393975
Fax +20 2 35393976
sales@nivusaf.com
www.nivus.com

NIVUS Technologies India Pvt. Ltd.

5th Floor, 502, RMZ KEPPEL
One Paramount, 10
Mount Poonamallee High Road
Porur, Chennai-600116, TN
India
Phone +91 44 6923 0047
india@nivus.com
www.nivus.in

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Translation

If the device is sold to a country in the European Economic Area (EEA) this instruction manual 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 manual (German) must be consulted or a member company of the NIVUS-Group must be contacted for clarification.

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01	NIVUS addresses updated; Chap. "16 Product Construction and Overview": Fig. 16-1 and Fig. 16-2 updated; Chap. „16.2 Connectable Sensors“ updated; Chap. "22.3.1 DC Power Supply": Fig. 22-1 updated; Chap. „23.2 Connecting Sensors to HydraulicCalculator 2“ supplemented; Chap. „34.2.2 Calculation Function“ and „34.3.2 Analogue Outputs“ supplemented	MoG	16.12.2025
00	New creation on the basis of the German-language instruction manual	MoG	26.08.2025

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General

1 About this Manual



Important Notice

READ CAREFULLY BEFORE USE!

KEEP IN A SAFE PLACE FOR LATER REFERENCE.

This instruction manual is for the HydraulicCalculator 2 flow calculator and serves its intended use. This instruction manual is oriented exclusively to qualified expert personnel.

Read this instruction manual carefully and completely prior to installation or connection since it contains relevant information on this product. Observe the notes and particularly follow the warning notes and safety instructions.

If you should have problems to understand information contained within this instruction manual either contact a member company of the NIVUS-Group or one of the distributors for further support. The member companies of the NIVUS-Group cannot be held responsible for damage to persons or material due to incorrectly understood information in this instruction.



Note

Depending on the equipment/flow calculator type, the descriptions and display illustrations may differ from those shown in this manual.




1.1 Applicable Documentation

For the installation and operation of the complete system extra instruction manuals or technical descriptions may be required apart from this instruction manual.

- Instruction manual for i-Series sensors and software HART PC
- Technical Description for für Pressure and Level probes: NivuBar Plus II, NivuBar G II and HydroBar G II
- Technical Information USB Hart Modem
- Technical Description NIVUS MODBUS TCP/RTU Application Interface for NivuFlow series 5xx, 6xx, 7xx, Energy Saver and NivuParQ 850 Transmitters

These manuals are provided with the auxiliary units or sensors and/or are available as download on the NIVUS homepage.

1.2 Signs and Definitions used

Representa- tion	Meaning	Remarks
	(Action) Step	Execute action steps. Should action steps be numbered observe the specified order of the steps.
	Cross-reference	Refers to further or more detailed information.
	Documentation Reference	Refers to an accompanying documentation.
>Text<	Parameter or menu	Indicates a parameter or a menu that is to be selected or is described.

Tab. 2 Structural elements within the manual

1.3 Abbreviations used

Colour code for wires, single conductors and components

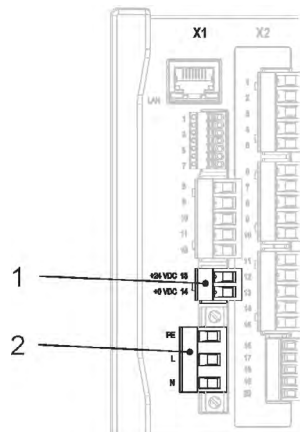
The abbreviations of colours for wire and single conductor labelling follow the international colour code according IEC 60757.

BK	Black	BN	Brown	RD	Red
OG	Orange	YE	Yellow	GN	Green
BU	Blue	VT	Violet	GY	Grey
WH	White	PK	Pink	TQ	Turquoise
GNYE	Green/Yellow	GD	Gold	SR	Silver

2 Connections and Control Elements

2.1 Power Supply

The connection for the power supply of the flow calculator is located in the lower area of the terminal strip X1.



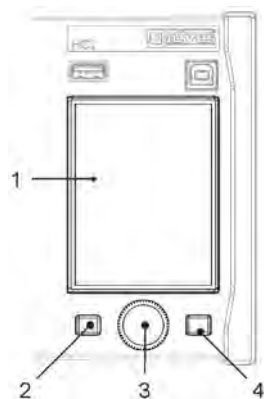
- 1 Power Supply DC Device
- 2 Power Supply AC Device and Protective Earth Connection

Fig. 2-1 Power supply terminal clamps

➡ A detailed wiring diagram can be found in Chapter “22.2 Terminal Wiring Diagrams”.

2.2 Control Elements of the Hydraulic Calculator

The entire parameterisation is menu-driven. The graphics of the display support you with this. The rotary pushbutton and the two function keys are used to select the individual menus and submenus.



- 1 Colour Display

- 2 Left Function Key
- 3 Rotary Pushbutton
- 4 Right Function Key

Fig. 2-2 Control Elements

2.3 Tasks of the control elements

Colour Display

You can read off all settings during parameterisation and diagnostics.

Left Function Key (Menu or Back)

Press this key (Menu) to go from the main display to the main menu. The same key (Back) is also needed to exit the main menu and the submenus.

Rotary Pushbutton

Use the rotary pushbutton to access the individual submenus. The functions are also controlled via the rotary pushbutton.

- Selection of the desired parameter or menu
- Navigation through the submenus and settings
- Selection of letters or numbers for parameterisation

Right Function Key (Enter or Tab)

Use this key to confirm the entry of values (via numeric keypad or alphabetic keypad).

For some parameters, the right function key serves as a >Tab<. This Tab function is always present when digits are visible at the top right of the display. Then the Tab function is used to switch between pages/displays. This applies for the settings below:

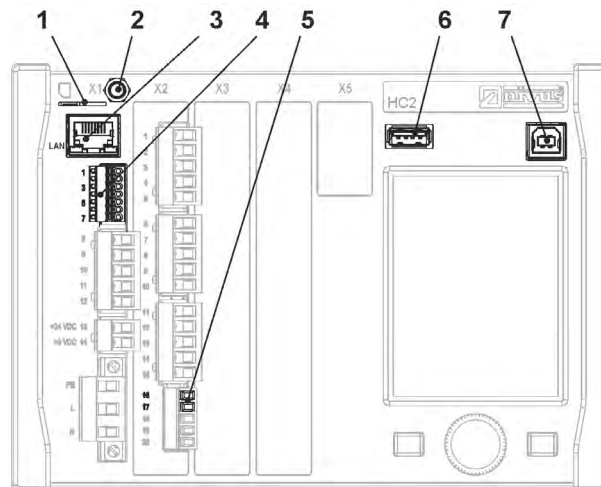
- Menu >Application<
 - Selection of Analogue Inputs
 - Selection of Analogue Outputs
 - (Selection of Digital Inputs)
 - Selection of Digital Outputs



A description of how to use the control elements can be found in Chapter “26 Principles of Operation”.

2.4 Interfaces

The flow calculator has multiple interfaces on the front of the device.



- 1 Slot for SIM card (modem in preparation)
- 2 Antenna socket (modem in preparation)
- 3 Network Interface (LAN)
- 4 BUS Interface (RS485/RS232)
- 5 Analogue input with HART functionality
- 6 USB-A Interface (data transfer, parameter backup, device update)
- 7 USB-B Interface (service mode)

Fig. 2-3 Available interfaces



A description of the individual interfaces can be found in Chapter “37 Parameter Menu Communication”.

Safety Instructions

3 General: Used Symbols and Signal Words

3.1 Information on the Valuation of Accident Levels



The general warning symbol indicates the risk of personal injuries or death. In the text section the general warning symbol is used in combination with the signal words described below.

DANGER

Warning in high degree of risk



Indicates a high-risk, **imminently** hazardous situation which will result in death or serious injury if not avoided.

WARNING

Warning in medium degree of risk and personal injury



Indicates a **possible** danger with medium risk which may result in a life-threatening situation or (severe) bodily injury if not avoided.

CAUTION

Warning in personal injury or property damage



Indicates a possible danger with moderate risk which may result in minor or moderate personal injury or property damage if not avoided.

WARNING

Danger by electric voltage



Indicates a medium-risk, **imminently** hazardous situation caused by electric shock which will result in death or (serious) injury if not avoided.



Important Notice

Contains information that needs to be highlighted.

Indicates a potentially harmful situation that may damage the product or something in its environment if not avoided.



Note

Contains tips or information.

3.2 Warning Notices on the Device (optional)



General Warning Notice

This symbol refers the operator or user to content in this manual.

Consideration of the information contained herein is necessary to maintain the protection provided by the unit for installation and in operation.



Protective earth connection

This symbol refers to the protective conductor terminal of the device.

Depending on the type of installation, the unit may only be operated with a suitable protective earth connection in accordance with applicable laws and regulations.

4 Special safety and Precautionary Measures

When working with the NIVUS equipment, the following safety and precautionary measures must be observed and followed generally and at all times. These warnings and notes are not repeated for each description within the document.

WARNING



Check danger due to explosive gases

Before starting assembly, installation and maintenance work, be sure to check that all regulations on safety at work have been observed and that there is no possible risk of explosive gases. Use a gas warner for the check.

When working in the sewer system, make sure that no electrostatic charge can occur:

- *Avoid unnecessary movements to reduce the building-up of static charges.*
- *Discharge any static electricity present on your body before you start installing the sensor.*

Disregarding may result in personal injury or damage to the system.

WARNING



Germ Contamination

Particularly due to the use of the sensors in the waste water sector, parts can be contaminated with dangerous germs. Therefore, appropriate precautions must be taken when coming into contact with cables and sensors.

Wear protective clothing.

WARNING



Observe Occupational Safety Regulations!

Before and during mounting works, compliance with all work safety regulations must always be ensured.

Disregarding may lead to personal injury.

WARNING



Do not disable Safety Devices!

It is strictly forbidden to disable the safety devices or to change their mode of operation.

Disregarding may result in personal injury or damage to the system.

WARNING**Disconnect the System from Mains Power**

Disconnect the system from the mains power before starting maintenance, cleaning and/or repair work (only by qualified personnel).

Disregarding may lead to electric shock.

**Commissioning only by qualified Personnel**

The entire measuring system may only be installed and commissioned by qualified personnel.

Built-In Backup Battery

The backup battery integrated in the flow calculator may only be replaced by NIVUS or personnel authorised by NIVUS. Non-compliance will result in a limitation of the warranty (see Chap. "5 Warranty").

5 Warranty

The device was functionally tested prior to shipping. When used for the intended purpose (see Chap. "7 Intended Use") and in compliance with the instruction manual, the applicable (see Chap. "1.1 Applicable Documentation") and the safety information and instructions contained therein, no functional restrictions are to be expected and flawless operation should be possible.



Please also refer to the following chapter "6 Disclaimer".

**Limitation of Warranty**

In case of disregarding the safety notes and instructions in this document, the companies of the NIVUS-Group reserve the right to limit the warranty.

6 Disclaimer

The companies of the NIVUS-Group assume no liability

- for consequential damages resulting from a **change** in this document.
The companies of the NIVUS-Group reserve the right to change the contents of this document including this disclaimer without prior notice.
- for personal injury or damage to property resulting from **failure to comply** with the applicable **regulations**. For connection, commissioning and operation of the devices/sensors, all information and higher-level legal regulations of the country (in Germany e.g. the VDE regulations), such as valid Ex regulations as well as the safety and accident prevention regulations applicable to the respective individual case shall be observed.
- for personal injury or damage to property resulting from **improper handling**. For safety and warranty reasons, all work on the equipment that goes beyond the installation and connection measures may only be carried out by NIVUS personnel or by persons or companies authorised by NIVUS.
- for personal injury or damage to property resulting from the operation of the equipment in a technically **faulty** condition.
- for personal injury or damage to property resulting from **improper use**.
- for personal injury or damage to property resulting from **failure to observe** the **safety instructions** in this instruction manual.

- for missing or incorrect readings due to **improper installation or faulty parameterisation/programming** and for any consequential damage resulting therefrom.

7 Intended Use



Note

The device is intended exclusively for the purpose mentioned below. Any other use beyond this, any conversion or modification of the instrument without written agreement with the companies of the NIVUS-Group is considered improper use.

The companies of the NIVUS-Group are not liable for any damage resulting from this. The operator alone bears the risk.

The HydraulicCalculator 2 flow calculator, including the associated sensor system, is designed for calculating discharge and flow rates at hydraulically complex measurement places. These include tangentially flowed or backwater-affected overflow weirs, movable weir flaps, slot outlets (pressure outlets) and similar.

The hydraulic formulas listed in DWA-A 111 were used as the most important basis for calculation. The second important basis was the 7th edition of 'Technische Hydromechanik Bd. 1' (Technical Hydromechanics Vol. 1) by Gerhard Bollrich.

The HydraulicCalculator 2 is capable of processing a maximum of two different input signals of 0/4-20 mA. Furthermore, HydraulicCalculator 2 can supply up to two 2- or 3-wire sensors with a defined voltage.

The flow calculator is designed and produced according to the current state of the art and the recognised safety rules at the time of publication of this document. Nevertheless, risks of personal injury or damage to property cannot be completely ruled out.

The permissible maximum limit values in Chapter "17 Specifications" must be observed. All cases of use deviating from these limit values, which have not been approved by NIVUS GmbH in writing, are excluded from the liability of the NIVUS-Group.

8 Ex Protection

The flow computer can be used in conjunction with i-Series sensors directly or, when using a Zener barrier, with an Ex inclinometer (for Zone 1) or a NivuBar Plus II pressure/level probe for use in areas with explosive atmospheres in Zone 1.

Here, the Ex-approved sensors / probes are installed directly in the Ex zone 1, while the **flow calculator** must be installed in **non-Ex areas**.

The connection diagrams can be found in the corresponding instruction manual or technical description / installation instructions for the sensors or the Inclinometer or Chapter "23.2.2 Special features for the connection of sensors in Ex area Zone 1" in this instruction manual.

Sensor /Probe Approvals



See "Operating Instructions for i-Series Sensors and HART PC Software" or "Data Sheet for the Ex Inclinometer" and "Declaration of Conformity for the Ex Inclinometer" or "Technical Description for für Pressure and Level probes: NivuBar Plus II, NivuBar G II and HydroBar G II".



Validity of the Ex Approval

The flow calculator itself has no Ex approval.

The Ex approval of connected barriers, sensors and/or probes is only valid if the corresponding marking is on the nameplate of the sensors/probes.



Installation and commissioning in connection with potentially explosive atmospheres: Declarations of conformity and test certificates

For the installation and commissioning of sensors in potentially explosive atmospheres the applicable national regulations must be strictly observed. In the EU, this applies, for example, to the national implementations of the ATEX Operator Directive 1999/92/EC.

Type examination certificates from notified bodies and manufacturer's certificates of conformity (NIVUS or other) for the barriers, sensors and probes used must be observed.

The combination of the flow calculator HydraulicCalculator 2 is exclusively adapted to the NIVUS i-Series sensors i-03/i-06/i-10/i-15 and pressure sensors NivuBar Plus II as well as the NDW Ex inclinometer (for Zone 1) with regard to the intrinsically safe system evaluation according to EN 60079-25.

When using sensors from other manufacturers, the operator must carry out a system assessment in accordance with EN 60079-25!

9 Duties of the Operator



Strictly observe and comply with guidelines and requirements

In the EEA (European Economic Area), the national transposition of the Framework Directive (89/391/EEC) as well as the associated individual directives and, in particular, the Directive (2009/104/EC) concerning the minimum safety and health requirements for the use of work equipment by workers at work, as amended, must be observed and complied with. In Germany, the Ordinance on Industrial Safety and Health must be complied with.

Obtain the local operating licence and observe the associated conditions. In addition, you must comply with environmental protection requirements and local legal requirements for the following:

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective equipment and maintenance)
- Product Disposal (Waste Management Act)
- Materials Disposal (Waste Management Act)
- Cleaning (Cleaning Agents and Disposal)

Connections

As the operator, before activating the device, make sure that the local regulations (e.g. for the electrical connection) have been observed during installation and commissioning.

Keep the Instruction Manual for future Reference

Keep the instruction manual in a safe place and ensure that it is always available and can be consulted by the user of the product.

Hand over the Instruction Manual

When selling the flow calculator, this instruction manual must be handed over with it. The manual is part of the standard delivery.

10 Requirements for the Personnel

Installation, commissioning and maintenance may only be carried out by personnel who fulfil the following conditions:

- Qualified personnel with appropriate training
- Authorisation by plant operator



Qualified Personnel

in the sense of these instructions or the warnings on the product itself are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the qualifications appropriate to their job, such as

- I. Training and instruction or authorisation to switch circuits and devices/systems on and off, to earth and to label them in accordance with the standards of safety technology.*
 - II. Training or instruction in accordance with safety technology standards in maintenance and use of appropriate safety equipment.*
 - III. First Aid Training*
-

Delivery, Storage and Transport

11 Scope of Delivery

The standard delivery of the HydraulicCalculator 2 usually comprises:

- A HydraulicCalculator 2 flow calculator in accordance with the delivery documents.
- The instruction manual with declaration(s) of conformity and with all the necessary information for operating the HydraulicCalculator 2 (printed or as a link to the NIVUS download centre).

Check other accessories according to the order and on the basis of the delivery note.

12 Inspection upon Receipt

Check the delivery for completeness and apparent intactness immediately after receipt. Report any transport damage immediately to the delivering freight carrier. Also send a written report to NIVUS GmbH in Eppingen.

Incomplete deliveries must be addressed in writing within two weeks to your responsible representative or directly to the NIVUS GmbH in Eppingen.



Observe the two-week deadline

Complaints received later will not be recognised.

13 Storage

Observe the minimum and maximum values for external conditions such as temperature and humidity according to Chap. "17 Specifications".

Protect the instrument from corrosive or organic solvent vapours, radioactive radiation and strong electromagnetic radiation.

Store the device in the original packaging.

14 Transport

Protect the device from strong impacts, shocks, jolts or vibrations.

Transport the device in the original packaging.

Otherwise, the same rules apply with regard to external influences as for storage (see Chap. "13 Storage").

15 Return

In the event of a return, send the unit to NIVUS GmbH in Eppingen carriage paid and in the original packaging.

Items that have not been sufficiently franked will not be accepted!

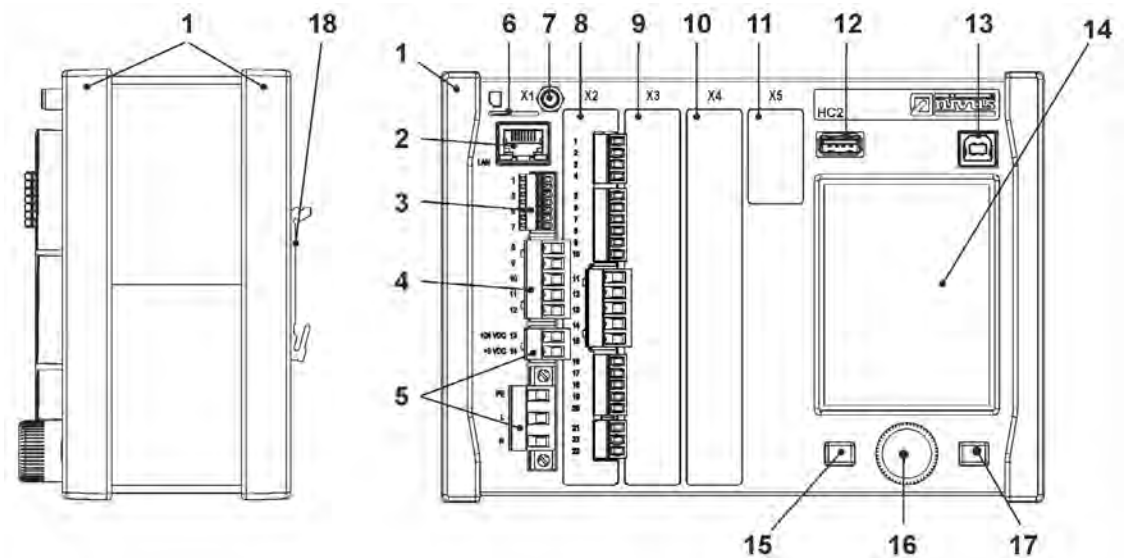
In general, a return note (incl. RMA return number) must be requested from the NIVUS customer service before returning the goods. Without this RMA number, the incoming goods cannot be assigned accordingly.



See Chap. "42.2 Customer Service Information".

Product Specification

16 Product Construction and Overview



- 1 Cover Strips (only for control cabinet installation; installation variant E0)
- 2 Network Interface (LAN)
- 3 Bus Interface (RS485/RS232)
- 4 not connected
- 5 Power Supply
- 6 Slot for SIM card (modem in preparation)
- 7 Antenna socket (SMA, female) (modem in preparation)
- 8 Slot X2 - analogue and digital inputs and outputs
- 9 Slot X3 - expansion slot (not used)
- 10 Slot X4 - expansion slot (not used)
- 11 Slot X5 - expansion slot (not used)
- 12 USB-A Interface (data transfer, parameter backup, device update)
- 13 USB-B Interface (service mode)
- 14 Graphic Display
- 15 Function Key
- 16 Rotary Pushbutton
- 17 Function Key
- 18 DIN rail fastening (for installation in NIVUS field enclosures; installation variant E1: fastened raised by 6 mm)

Fig. 16-1 Device construction HydraulicCalculator 2; installation variants E0/E1

16.1 Enclosure Dimensions

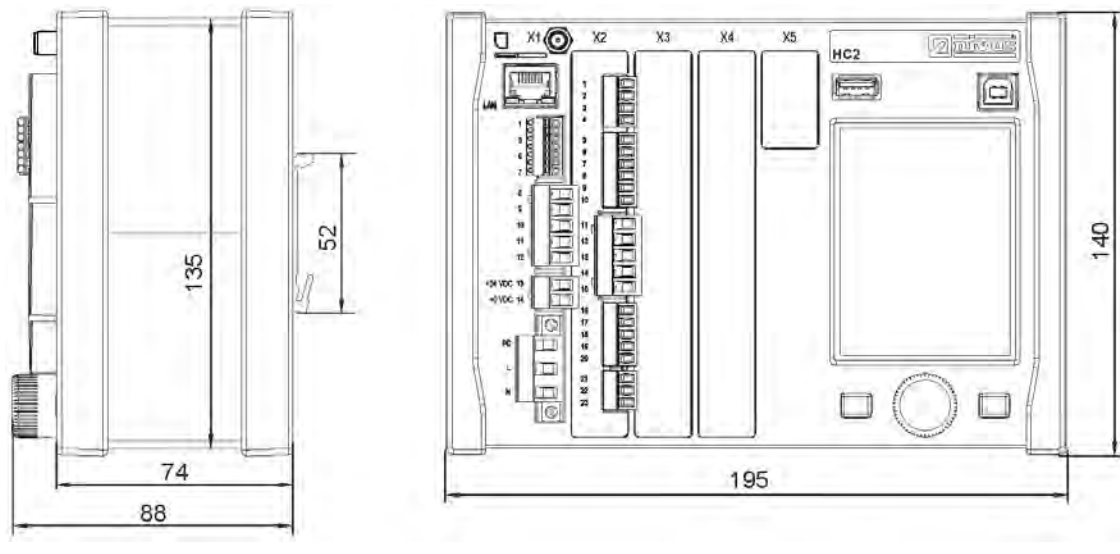
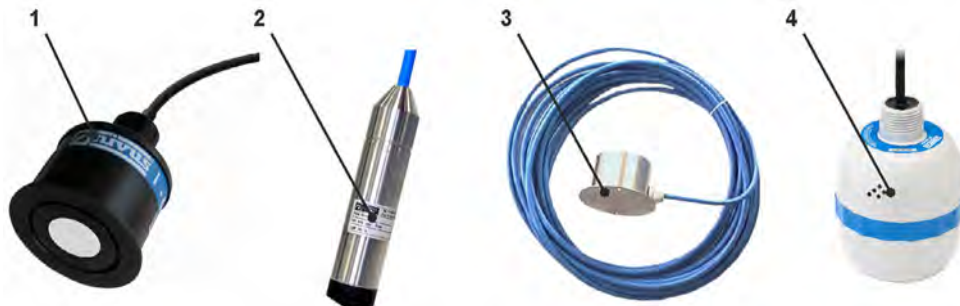


Fig. 16-2 Dimensions HydraulicCalculator 2; installation variant E0

16.2 Connectable Sensors

In the following illustration you will find an overview of the directly connectable NIVUS sensors.



- 1 i-Series ultrasonic sensor NMI0, Type i-03, i-06, i-10 and i-15
- 2 Level pressure sensor, Type NivuBar Plus II
- 3 ND2 inclinometer (non-Ex), or for applications in potentially explosive areas, Ex inclinometer with an Ex-power supply isolation amplifier
- 4 Ri sensor (2-wire radar sensor) (non-Ex), or for applications in potentially explosive areas, Ex Ri sensor (2-wire radar sensor) with an Ex-power supply isolation amplifier

Fig. 16-3 Connectable Sensors

16.3 Device ID

The information in this instruction manual only applies to the device indicated on the title page. The nameplate is stuck to the side of the enclosure and contains the following information:

- Name and address NIVUS GmbH
- CE label
- Marking of the series and type with article number and serial number
- Year of manufacture: the first four digits of the serial number refer to the year of manufacture and the week number (2441.....)
- Power supply (see Article No. and Chap. "18.1 Device Versions")

It is important for all queries and spare parts orders that the article number and serial number of the respective device are specified correctly. This is the only way to ensure proper and fast processing.



Note

Check by means of the nameplates whether the supplied device corresponds with your order.

Check that the correct voltage supply is indicated on the nameplate (bottom left field).



The EU Declaration of Conformity can be found at the end of this instruction manual.

Nameplate (Example)

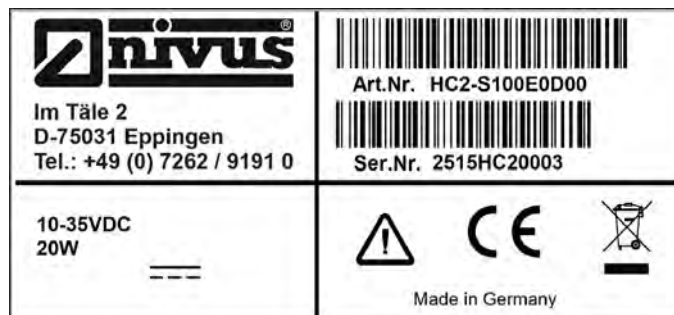


Fig. 16-4 Nameplate DC version

17 Specifications

Power Supply	100...240 V AC, -15 % / +10 %, 47...63 Hz or 10...35 V DC
Connection Power Supply	AC: Plugged and screwed on spring-cage terminal block DC: Plugged spring-cage terminal block
Maximum Power Consumption	AC: 30 VA / DC: 20 W
Type. Power Consumption	230 V AC: 14 VA / 6.8 W 24 V DC: 6.2 W
Enclosure	DIN Rail Material: Aluminium and Plastic Weight: approx. 1300 g Dimensions see Chap. 16.1.
Protection	DIN Rail IP20
Operating Conditions	Protection Class I Overvoltage Category II Pollution Degree 2
Application Altitude	AC unit for use at altitudes up to 3000 m above MSL. For relay voltages >150 V, use is restricted to altitudes up to max. 2000 m above MSL (AC and DC units)
Operation Temperature	DC: -20...+70 °C AC: -20...+65 °C
Storage Temperature	-30...+80 °C
Max. Ambient Temp. for Installation and Operation	+50 °C
Max. Humidity	80 %, non-condensing

User Indicator	Daylight-readable TFT colour graphic display, 240x320 pixel, 65536 colours
Setting Parameters/Programming	Menu-driven using rotary pushbutton and two function keys, in English, German and French
Connection	- General: Plugged spring-cage terminal block - AC Power Supply: Plugged and screwed on spring-cage terminal block
Inputs	- 2 x 0/4 – 20 mA, (1x HART-compatible) - 2x Digital Input
Outputs	- 2x 0/4...20 mA, load 500 Ohm, 12-Bit resolution, accuracy higher than $\pm 0.1\%$ at 20 °C (higher than $\pm 0.4\%$ at -20...+70 °C) - 1x bistable relay (SPDT), loadable up to 230 V AC / 2 A ($\cos \phi$ 0.9), minimum switching current 100 mA - 1x Relays (SPDT), loadable up to 230 V AC / 2 A ($\cos \phi$ 0.9), minimum switching current 10 mA
Data Memory	Internal 1.0 GB, for parameterisation/programming and measurement backup for approx. 570,000 data sets (time stamps); can be read via front-side USB stick
Storage Cycle	30 seconds to 15 minutes
Communication	- Modbus TCP via networks (LAN/WAN) - Modbus RTU via RS485 or RS232 - SMTP/FTP/HTTP

Tab. 3 Specifications

Sensors



The specifications of the associated sensors can be found in the corresponding instructions or technical descriptions.

18 Equipment

18.1 Device Versions

The HydraulicCalculator 2 is manufactured in various versions (see product structure for details).

The article number can be found on the nameplate (see "Nameplate (Example)" on Page 23).



Observe country-specific differences

The flow calculator types listed below are not all available in every country.

For details, please contact the companies in the NIVUS-Group or your local representative.

HC2- Flow calculator for the calculation of discharge rates according to DWA A111 at sills with backwater or tangential flow, movable overflowed weir gates and special structures

Type

S0 2x DI, 2x DO, 2x AI, 2x AO

SG 2x DI, 2x DO, 2x AI, 2x AO; with internal modem (in preparation)

M0 4x AI, 4x AO, 10x DI, 6x DO (in preparation)

MG 4x AI, 4x AO, 10x DI, 6x DO; with internal modem (in preparation)

System-related digits

00 ---

Construction

E0 DIN rail/control cabinet mounting, IP20

E1 DIN rail, prepared for mounting into NIVUS field enclosure

Power Supply

A0 100...240 V AC

D0 10...35 V DC

Firmware Extension

0 None

HC2-	00			0
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Tab. 4 Product Structure

Functional Description

19 Areas of Use

The HydraulicCalculator 2 flow calculator, including the associated sensor system, is designed for calculating discharge and flow rates at hydraulically complex measurement places. These include tangentially flowed or backwater-affected overflow weirs, movable weir flaps, slot outlets (pressure outlets) and similar.

⇒ An overview on **connectable sensors/probes** can be found in Chapter “16.2 Connectable Sensors”.

20 Functional Principles

20.1 Level Measurement - External Level Sensor

Depending on the selected type of level measurement, an external 4...20 mA signal can be used for the level (e.g. using an i-Series sensor).

The 2-wire sensors powered by the HydraulicCalculator 2 (e.g. NivuBar Plus, i-Sensor) can be connected directly. Alternatively, a 4...20 mA signal coming from an external transmitter can be used (e.g. 4...20 mA from the NivuMaster).



i-Series Sensors

The i-Series sensors have pre-programmed measurement ranges. Observe the exact specifications in the instruction manual for i-Series sensors.

	i-3	i-6	i-10	i-15
Distance to sensor face in [m] at 4 mA (empty) 0 %	3.0	6.0	10.0	15.0
Distance to sensor face in [m] at 20 mA (full) 100 %	0.125	0.300	0.300	0.500
Max. possible measurement span (value at 20 mA) in [m]	2.875	5.7	9.7	14.5

Tab. 5 Measurement Span of i-Series Sensors

Installation and Connection

21 General Mounting Instructions

During installation, observe the following instructions on "Electrostatic Discharge (ESD)" and "Installation Location".

- ➡ It is essential to follow applicable legal or company guidelines.

Improper handling may lead to personal injuries and/or equipment damage!

21.1 Avoiding electrostatic discharge (ESD)



ESD Risks

Maintenance procedures that do not require power to the unit must only be carried out after disconnection from the mains to minimise hazards and ESD risks.

Disconnect the HydraulicCalculator 2 from the mains.

The sensitive electronic components inside the unit can be damaged by static electricity. NIVUS GmbH recommend the following steps to prevent damage to the device due to electrostatic discharge:

- ➡ Before touching electronic components of the appliance, discharge any static electricity from the body.
- ➡ Avoid unnecessary movements to minimise the building-up of static charges.

21.2 Installation/Mounting Variants

The transmitter is available in two different installation variants:

- E0 - for direct DIN rail mounting in control cabinets or similar enclosures
- E1 - specially designed DIN rail enclosure without cover strips, with extended DIN rail fastening
 - Installation in NIVUS field enclosure *ZUB0 NFW0* or *ZUB0 NFW0 IP68*

CAUTION



HydraulicCalculator 2 installation variant E0 not suitable for installation in NIVUS field enclosure

*Subsequent installation of a transmitter with installation variant E0 in a NIVUS field enclosure is not possible without **conversion** to installation variant E1. The conversion and the change of connection can be carried out by NIVUS.*

21.3 Selecting the Mounting Place

The HydraulicCalculator 2 with DIN rail mounting is designed for installation in control cabinets, switching boxes and mounting frames.

- ➡ Ensure sufficient ventilation at the mounting place. For example by means of fans or air vents.
- ➡ Make sure that access to any disconnecting devices (mains switches) is not impeded by the installation.

The HydraulicCalculator 2 can also be installed in on-site/field enclosures. Due to its protection class, however, the flow calculator is not suitable for direct unprotected mounting on site.

The following precautions must be taken at the mounting place for safe installation:

- Protect the flow calculator from direct sunlight. If necessary install a sunshade.
- Do not install the flow calculator in the vicinity of strong electromagnetic fields (frequency converters, high-voltage lines, etc.).
- Observe the permissible ambient temperature (see Chap. "17 Specifications").
- Do not expose the flow calculator to strong vibrations or mechanical shocks.

When selecting the installation location, avoid the following conditions under all circumstances:

- Corrosive chemicals or gases
- Radioactive radiation
- Installation close to footpaths or travel ways

21.4 Fastening the flow calculator to a DIN rail in the control cabinet



Gather the required materials beforehand

Mounting material and tools are **not** included in the scope of delivery.

- For mounting use a DIN rail Type TS35 according to EN50022 with a minimum length of 140 mm.
 1. Fasten the DIN rail horizontally in the enclosure/switch cabinet provided using at least two screws.
 2. Hook the flow calculator into the DIN rail from below. The device locks into place by pressing lightly in the direction of the DIN rail.

The electrical installation and connection of the sensors can then be carried out.

22 Electrical Installation

DANGER



Danger by electric voltage

Disconnect the device from mains power.

When working on the electrical connections, there is a risk of electric shock. Necessarily observe the electrical data given on the nameplate.

Disregarding may lead to personal injury.



Note

Observe the national installation instructions.

- Make sure that the following requirements are met:
 1. Please note that installation may only be carried out by qualified personnel.
 2. For electric installation follow the legal requirements of the respective country (in Germany e.g. VDE 0100).
 3. Observe further (country-specific) statutory standards, regulations and technical rulings.
 4. For installation in wet environments or in areas where there is a risk of flooding, additional protection, e.g. by means of a residual current device (RCD), may be required.

5. Check whether the power supply of the units must be integrated into the emergency stop concept of the plant; also with regard to explosion protection.
6. Before feeding the rated voltage the installation of flow calculators and sensors must be completed. Verify whether the installation is correct.



The connection of the sensors is described from Page 34, the connection of the power supply on Page 31.

22.1 Connection to the spring-cage terminal blocks

The flow calculator is equipped with pluggable spring-loaded terminals. The use of the pluggable spring-loaded terminal blocks allows easy pre-installation of the flow calculator. This allows input and output signals to be checked and, if necessary, the flow calculator to be replaced quickly.

The spring-loaded terminal blocks are suitable for the connection of single and multi-wire copper cables and are vibration-resistant.



To open the contacts on the spring-loaded terminal blocks, press the front orange elements with moderate pressure using a slotted screwdriver.

Pluggable and screwable spring-loaded terminal blocks are used to connect the power supply. Use a slotted screwdriver with a blade width of 3.0...3.5 mm to connect the power supply.



Important Notice

The spring-loaded terminal blocks may only be plugged and unplugged in a de-energised and voltage-free state.

DANGER



Danger by electric voltage

Multi-core cables (stranded wires) in the area of the AC power supply as well as the relay connections must be fitted with wire end ferrules with an insulated protective collar (plastic sleeve) in order to avoid danger from individual protruding cores.

Disregarding may lead to personal injury.

Spring-cage terminal block	Power Supply	Bus/ Network	Clamps O/I etc.
Cable cross-section (rigid) in [mm ²]	0.2...2.5	0.2...0.5	0.14...1.5
Cable cross-section (flexible) in [mm ²]	DC only: 0.2...2.5	0.2...0.5	0.14...1.5
Cable cross-section (flexible) with wire end ferrule blank in [mm ²]	DC only: 0.25...2.5	0.25...0.5	0.25...1.5
Cable cross-section (flexible) with wire end ferrule with insulated protective collar in [mm ²]	0.25...2.5	Not defined	0.25...0.5

Tab. 6 Cable cross-sections

The **HydraulicCalculator 2** flow calculator is available in different versions (see Tab. 4 on Page 25).

All variants have identical terminal designations. These blocks are functionally assigned to the different connection areas. The versions S0/M0 are equipped with additional terminal blocks.

22.2 Terminal Wiring Diagrams

DANGER



Risk of Electric Shock

Never remove the spring-loaded terminal block from the plug-in board X1 (connections 15...17).

This spring-loaded terminal block is used to connect the protective earth conductor and the AC power supply and is an integral part of the device. The device may only be operated with the spring-loaded terminal block screwed on.

Disregarding may lead to personal injury.

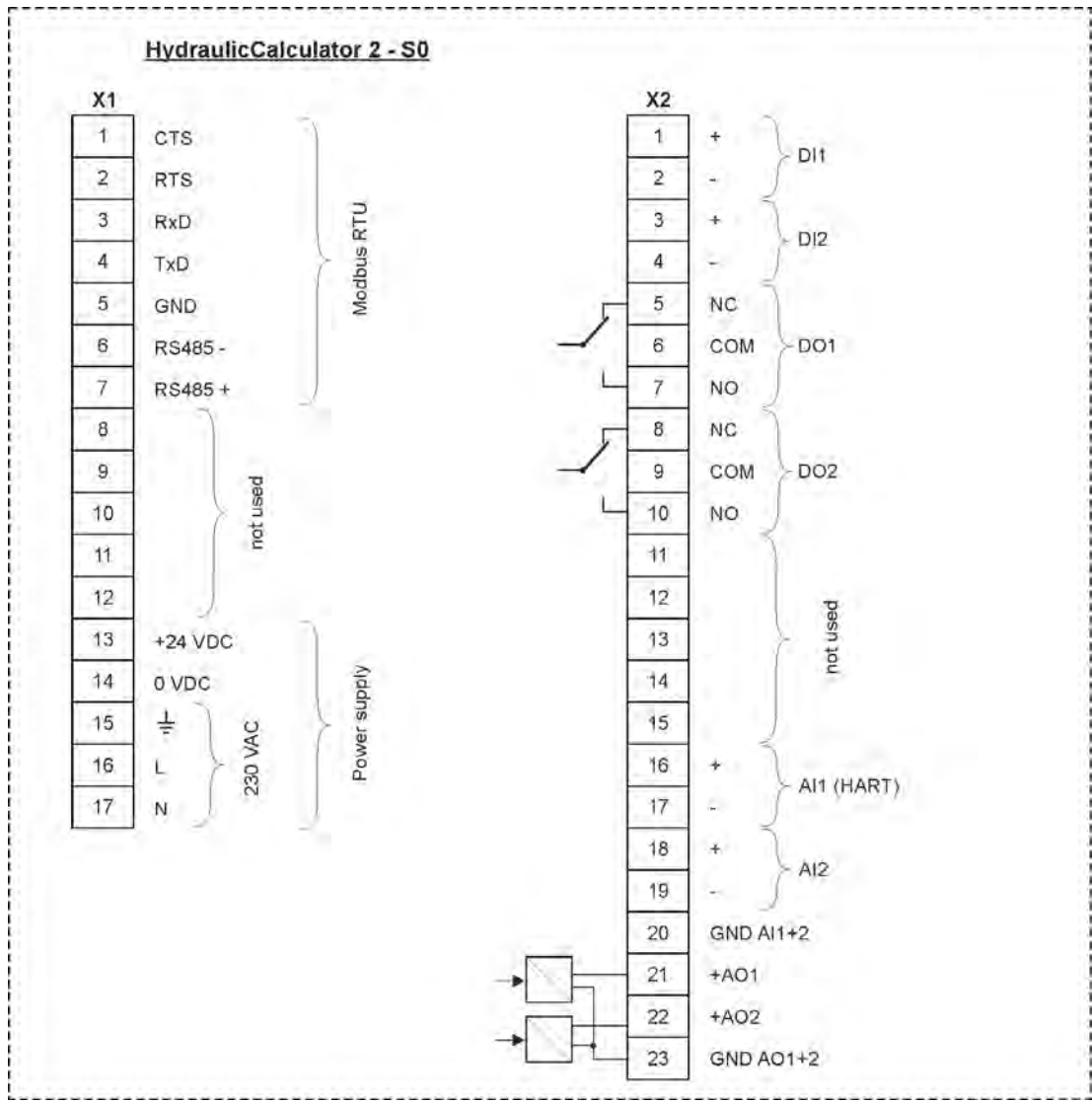


Fig. 22-1 Wiring diagram HydraulicCalculator 2 Type S0

22.3 Connecting the Power Supply

Depending on the type, the flow calculator can be operated with 100...240 V AC (-15 / +10 %) or with 10...35 V DC.

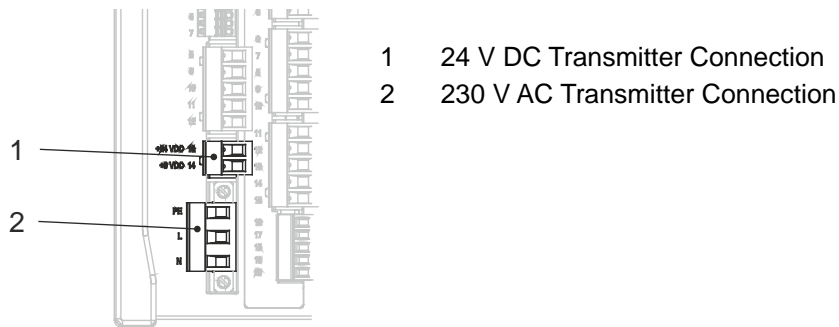


Fig. 22-2 Power Supply Wiring Diagram HC2

DANGER



Risk of Electric Shock

Never remove the spring-loaded terminal block from the plug-in board X1 (connections 15...17).

This spring-loaded terminal block is used to connect the protective earth conductor and the AC power supply and is an integral part of the device. The device may only be operated with the spring-loaded terminal block screwed on.

Disregarding may lead to personal injury.



Use of Alternating Current - Direct Current

A 24 V **DC** unit must **not** be operated with **alternating current** (AC). Conversely, it is also **not** possible to operate a 230 V **AC** unit with 24 V **direct current** (DC).

22.3.1 DC Power Supply

The DC version can be operated directly on the 24 V DC network of a control cabinet.

Prerequisites

- Available input voltage at the input terminals:
 - With maximum load (20 W) at least 10 V
- Terminal voltage:
 - In no-load operation maximum 35 V

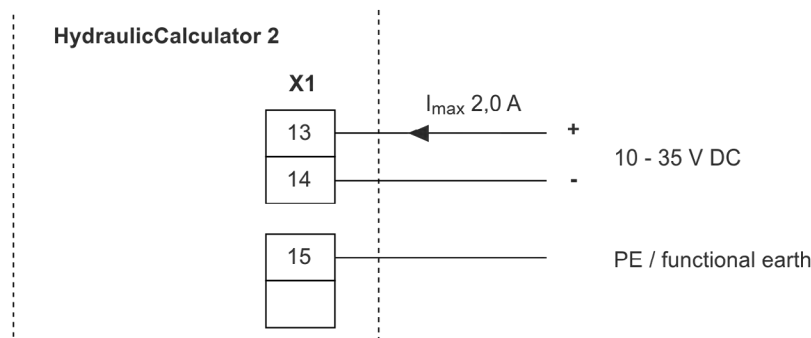


Fig. 22-3 Connection Power Supply DC Version

22.3.2 Power Supply AC

DANGER



Danger by electric voltage

The device may only be operated when the terminal blocks are screwed on tightly over the screw flange.

The spring-loaded terminal block X1 (terminals 15...17), for connecting the protective earth conductor and the AC power supply, is an integral part of the unit and not a plug connection. Disregarding may lead to personal injury.

DANGER



Danger by electric voltage

The power supply of the flow calculator must be separately protected with a 6 A slow-blow fuse and disconnected independently of other circuit parts, e.g. by means of a circuit breaker with characteristic B. The disconnecting device must be marked in a suitable manner.

Disregarding may lead to personal injury.

The AC version of the HydraulicCalculator can be operated directly from the low-voltage mains.



For AC supply requirements, see Chap. "17 Specifications".

Prerequisite

- Cross-section of the mains cables:
 - Minimum 0.75 mm²
 - According to IEC 227 or IEC 245

The AC version of the HydraulicCalculator 2 provides an auxiliary voltage of 24 V with a maximum load capacity of 80 mA at the terminals of the DC connection.

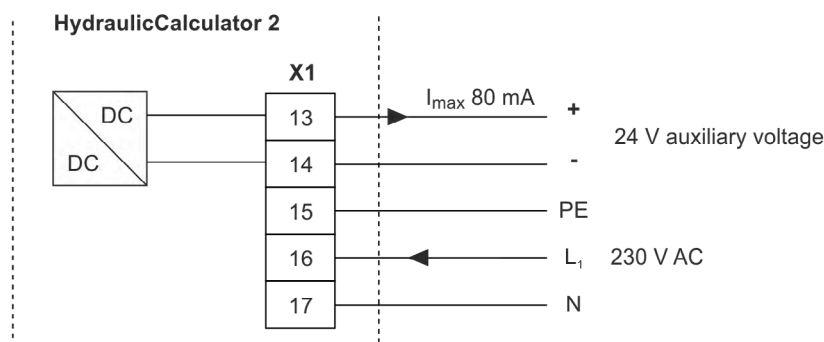


Fig. 22-4 Connection Power Supply AC Version

22.4 Relay

Falling below the specified minimum switching current reduces the reliability of the switching contact.



It is essential to observe the specified connection and switching data in Chapter "17 Specifications".

Relay 2 is designed as a bistable relay (i.e. it remains in the last activated position when de-energised) and is therefore not suitable as an error message relay.

DANGER



Danger by electric voltage – Contact protection measures

For relay voltages >150 V, the test pin connection of the relay terminal blocks does not guarantee touch protection according to the requirements of EN61010-1:2010.

Ensure additional contact protection measures in accordance with the applicable regulations and laws. For example: Open control cabinet/field enclosure only with tool or key, residual current circuit breaker or similar.

Disregarding may lead to personal injury.

DANGER



Danger by electric voltage - Protect relay contacts

If voltages in the low-voltage range (e.g. AC mains voltages) are switched via the relay contacts of the unit, these must be protected with 6 A slow-blow fuse. These contacts must be able to be switched off independently of other circuit parts.

A suitable protective earth connection must also be ensured for DC units to prevent the occurrence of dangerous voltages or currents.

Disregarding may lead to personal injury.

23 Installation and Connection of Sensors

The exact description for mounting the individual sensor types is described in the respective installation instructions.



Note

During assembly work, ensure that all work safety regulations are observed.

23.1 Sensor Installation Principles

The placement of the sensors is decisive for reliability and accuracy of the calculation results. Therefore, care must be taken to ensure good hydraulic conditions at the installation site.

Due to the various application possibilities of the HydraulicCalculator 2, a wide range of different sensors, mounting options and suitable positions are possible, which cannot all be described here.



Be sure to clarify the selection and placement of the sensors with NIVUS in advance

Before installing sensors, be sure to contact the NIVUS service (hotline-ww@nivus.com).

Have drawings, photos, construction plans and a description of the hydraulic situation and the measurement task ready in order to find the optimal position for the sensors.

Here are some examples/tips:

- Sensors on weirs should be located 2-3 times the maximum overflow height (in the backwater-free area) away from the weir edge.
- Sensors on side weir are usually installed at a distance of 15 % and 85 % of the weir length from the weir edge.
- Always install inclinometers on movable weir flaps clockwise and exactly horizontally when the movable weirs are at rest (including weirs under preload). Adjust the 4.0 mA output current precisely by hand.

- Install contactless sensors underwater in locations where there are no strong eddies or waves.
- Sensors and their connection cables on discharge structures are often exposed to high mechanical loads. Therefore, protect them appropriately with covers, protective tubes, solid corrosion-resistant fastenings, etc.



The conditions for mounting the sensors are described in the respective installation instructions.

23.2 Connecting Sensors to HydraulicCalculator 2

The connected sensors are used to

- determine the level
- determine a rotation angle
- input a slide valve position

23.2.1 Connecting Level Sensors

2-wire Sensor

The level is measured via a 2-wire sensor. This level sensor (e.g. i-Sensor, NivuBar Plus pressure probe) is supplied with voltage by the HydraulicCalculator 2.

- ➡ Connect the 2-wire sensor according to Fig. 23-1 / Fig. 23-2.



Fig. 23-1 Connection 2-wire Sensor (HART) for Level Measurement to Analogue Input 1



Fig. 23-2 Connection 2-wire Sensors for Level Measurement to Analogue Input 1 and 2

- If the mA signal of the level measurement is provided by an external transmitter (e.g. NivuMaster or electronic position sensor), connect the transmitter according to Fig. 23-3 or Fig. 23-4.

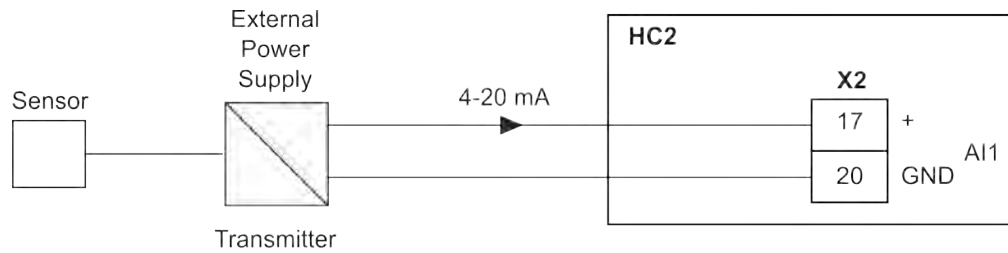


Fig. 23-3 Connection external 4-20 mA Signal to Analogue Input 1

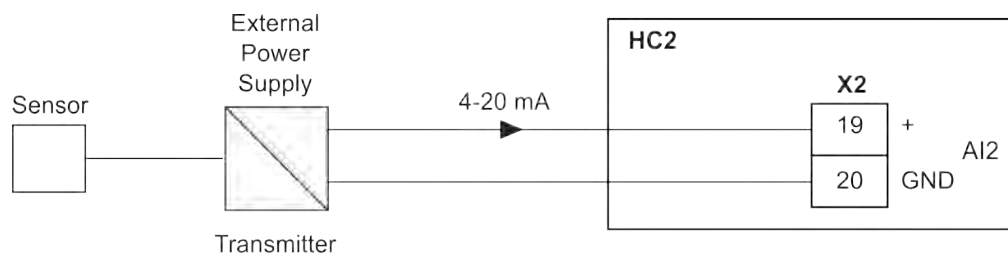


Fig. 23-4 Connection external 4-20 mA Signal to Analogue Input 2

- Connect the 3-wire inclinometer to analogue input 2 according to Fig. 23-5.

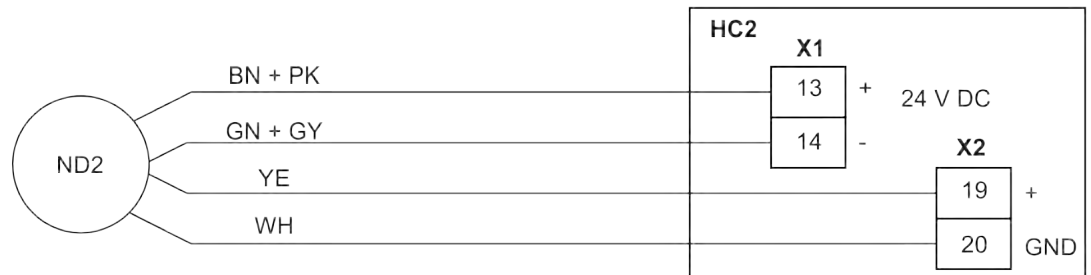


Fig. 23-5 Connection 3-wire Inclinometer to Analogue Input 2

23.2.2 Special features for the connection of sensors in Ex area Zone 1

- 4...20 mA signals from external transmitters (which are themselves located in the non-Ex area):
Connection to the HydraulicCalculator 2
- i-Sensors with Ex Approval:
 - Zone 1:
connection directly to HydraulicCalculator 2
 - Zone 0:
Direct connection to the HydraulicCalculator 2 is **not permitted**, but it can be **connected** to the HydraulicCalculator 2 via an **Ex-power supply isolation amplifier**

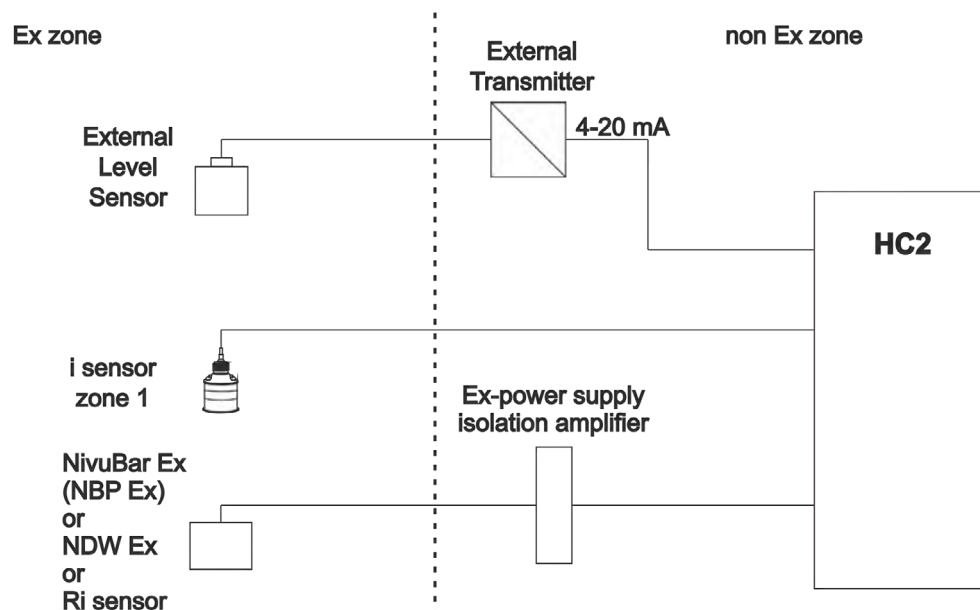


Fig. 23-6 Special features for the connection in Ex area Zone 1

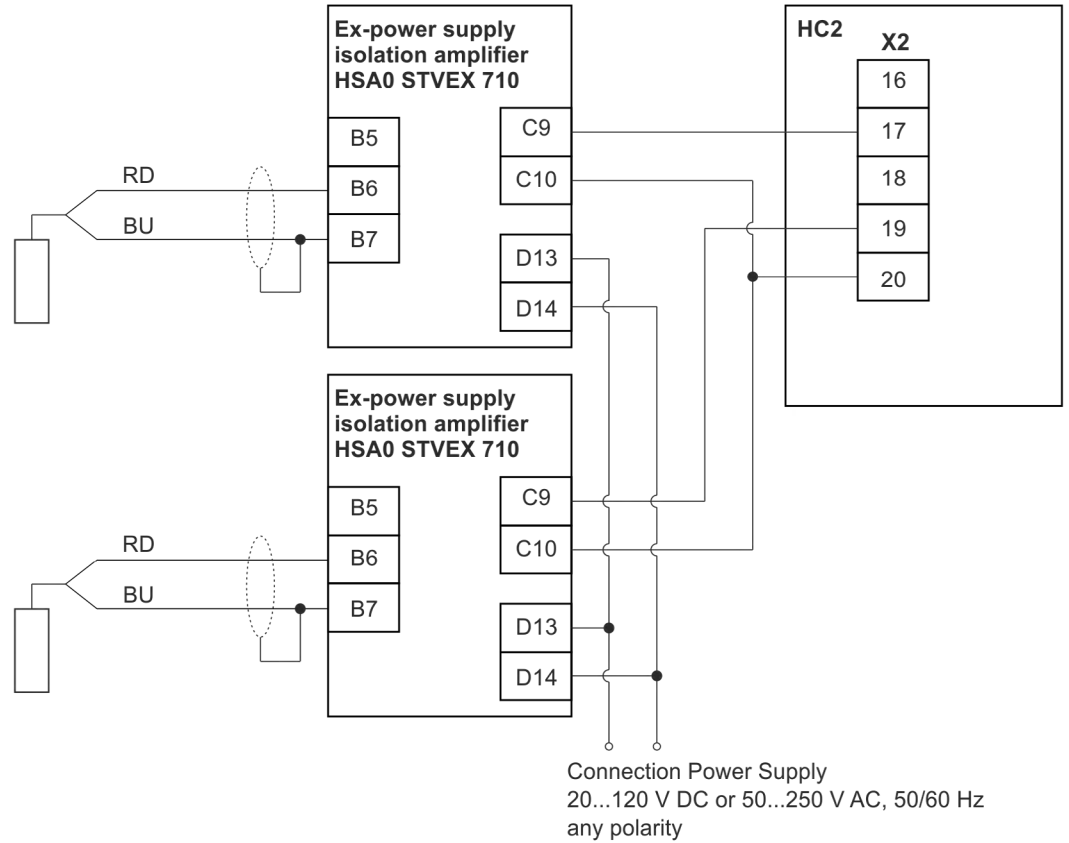


Fig. 23-7 Connection 1-2x NBP via Ex-power supply isolation amplifier in Ex-Zone 1

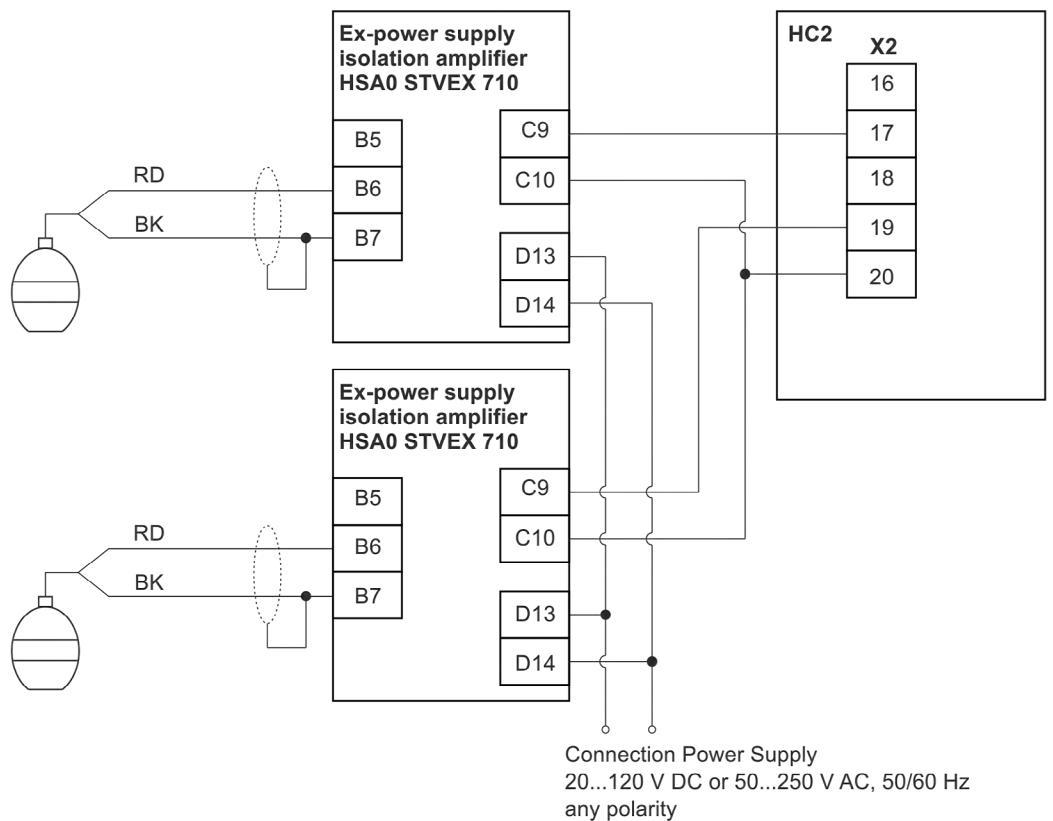


Fig. 23-8 Connection 1-2x Ri-series sensor via Ex-power supply isolation amplifier in Ex-Zone 1

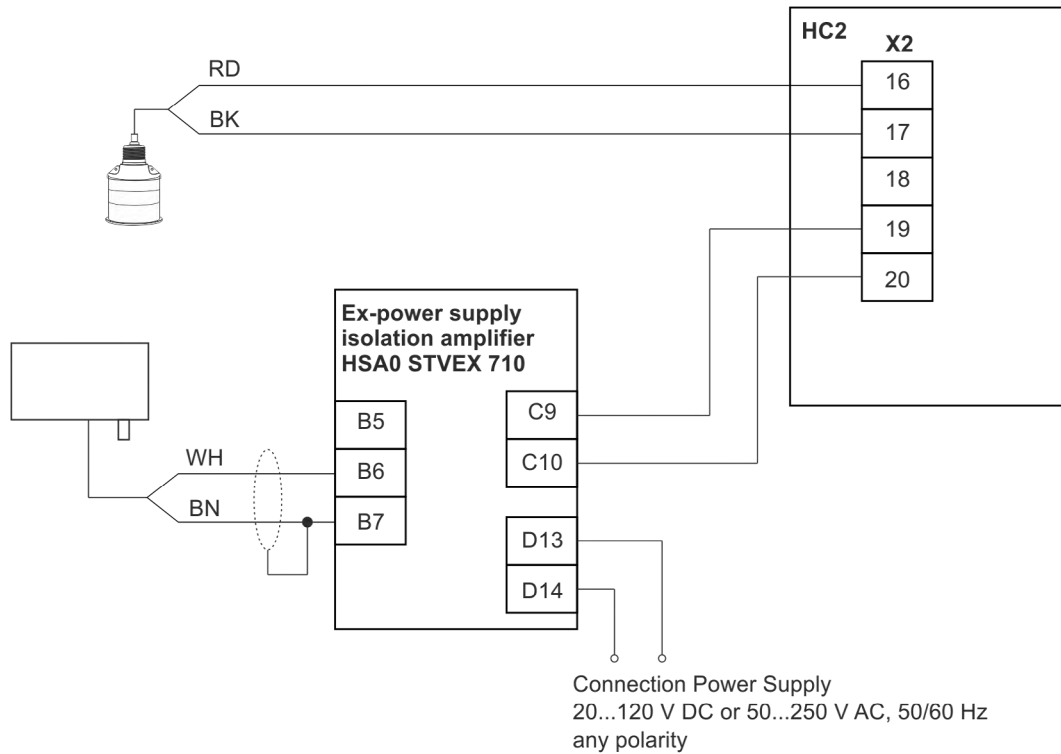


Fig. 23-9 Connection 1x 2-wire Ex Inclinometer via Ex-power supply isolation amplifier and 1x i-series sensor (Ex zone 1) directly in Ex-Zone 1

24 Overvoltage Protection Measures

In the HC2 flow calculator, basic overvoltage protection is provided by installing surge arresters in the area of the mains supply and the sensor connections. For effective protection of the HC2 it is nevertheless necessary to protect the power supply as well as the mA outputs and mA inputs using additional external overvoltage protection devices.

NIVUS recommend the types EnerPro 220Tr or EnerPro 24Tr (with 24 V DC power supply) for the mains side. For the mA outputs/inputs NIVUS recommend the type DataPro 2x1 24/24Tr.

DANGER



Important Information on Overvoltage Protection Equipment

- *Overvoltage protection devices must be installed at least 10...15 cm away from the transmitter.*
- *The cross-section of the overvoltage conductor must be at least 1.5 mm² and must not be longer than 1 metre. In addition, larger cross-sections must be selected or the arrester must be placed directly on an arrester strip.*

The spatial separation of the unprotected side and the arrester from the protected side must be strictly observed: Spatial separation of the incoming and outgoing cables at the overvoltage protection element from the outgoing, protected cables.



Observe connection direction

Ensure that the connection is on the correct side (p-side towards the transmitter) and that the cable feed is correct and straight. The down conductor (earth) must be necessarily routed in the direction of the unprotected side.

Incorrect connections disable the function of the overvoltage protection.

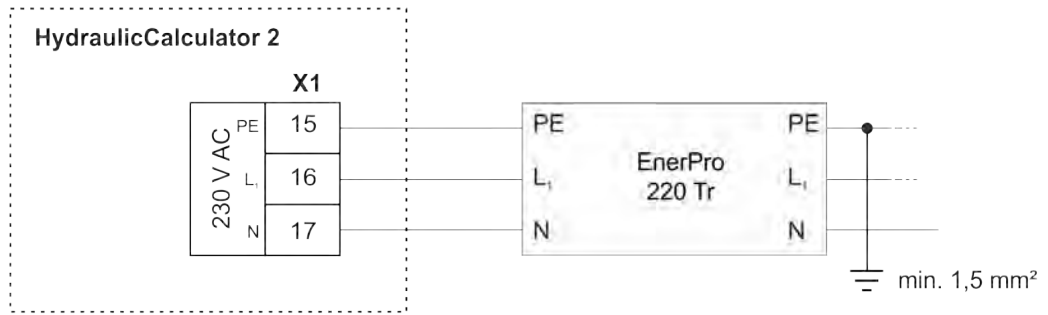


Fig. 24-1 Overvoltage protection for AC power supply

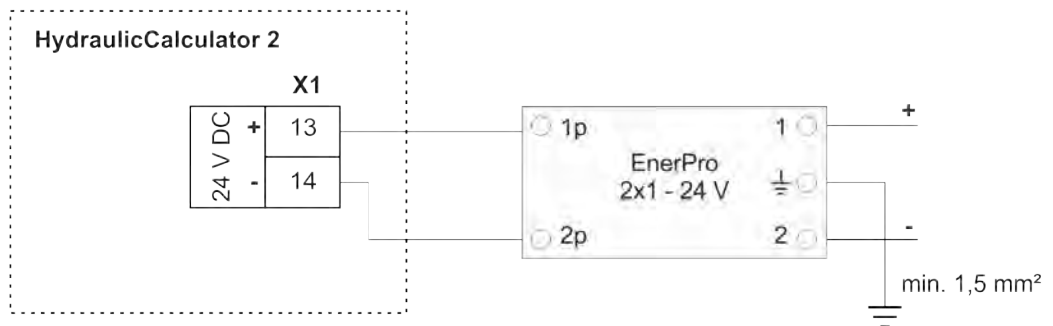


Fig. 24-2 Overvoltage protection for DC power supply

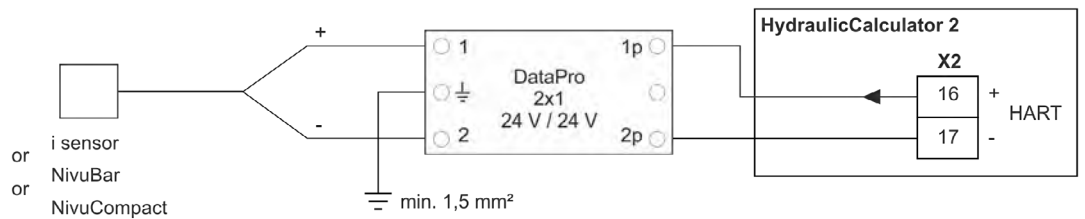


Fig. 24-3 Overvoltage protection external level measurement

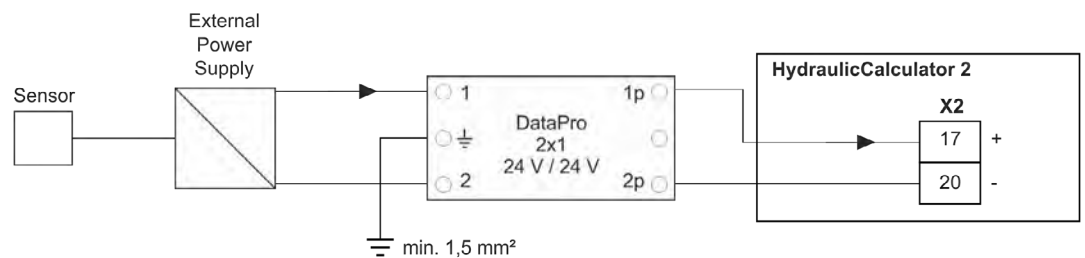


Fig. 24-4 Overvoltage protection analogue input of ext. transmitters



Note on discharge (earthing)

The minimum conductor cross-section is 1.5 mm² (not for stranded wires).

The maximum permissible cable length of the arrester is 1 m. In addition, it must be laid on a down conductor rail.

Commissioning

25 Notes to the User

Before connecting and operating the HydraulicCalculator 2 the instructions below shall be followed.

This instruction manual contains all information required for parameterisation and use of the device. The instruction manual is intended for qualified expert personnel. Appropriate knowledge in the areas of measurement systems, automation technology, control engineering, information technology and hydraulics are preconditions for putting the HydraulicCalculator into operation.

Read this instruction manual carefully to ensure proper functioning of the HydraulicCalculator. Connect the HydraulicCalculator according to the specified connection diagrams in Chapter "22.2 Terminal Wiring Diagrams".

If you have any questions regarding installation, connection or parameter setting, please contact our hotline at:

- +49 7262 9191-955

General Principles

Commissioning of the measurement system shall not be carried out before installation has been finished and verified.

Observe the information in this instruction manual to prevent incorrect or faulty or parameterisation. Familiarise yourself with the operation of the flow calculator using rotary pushbutton, function keys and display before you start parameterisation.

After connecting the flow calculator and sensors (according to Chapters "22.1 Connection to the spring-cage terminal blocks" and "23.2 Connecting Sensors to HydraulicCalculator 2") the measurement place must be parameterised.

To do this, in most cases it is sufficient to specify:

- the correct hydraulic special application
- the hydraulic parameters of the special application (overflow width, roughness, slot width, etc.)
- sensors used and their positioning within the application
- the working range of the sensors used
- display units / language
- function and span of analogue outputs as well as function and corresponding detailed parameterisation of digital outputs

The user interface of the HydraulicCalculator is easy to understand. You can quickly make the **basic settings** yourself.

The parameterisation of the device should be carried out by NIVUS or by a specialist company authorised by NIVUS if one or more of the following conditions apply to you:

- Comprehensive programming tasks
- Difficult hydraulic conditions
- Requirement in the service specifications for a settings and error log by NIVUS or an authorised company
- Qualified personnel not specially trained or with little metrological experience

26 Principles of Operation

The entire operation of the HydraulicCalculator is done via the control elements (see Chapter "2.2 Control Elements of the HydraulicCalculator"). A rotary pushbutton and two function keys are available for parameterisation and entering required data.

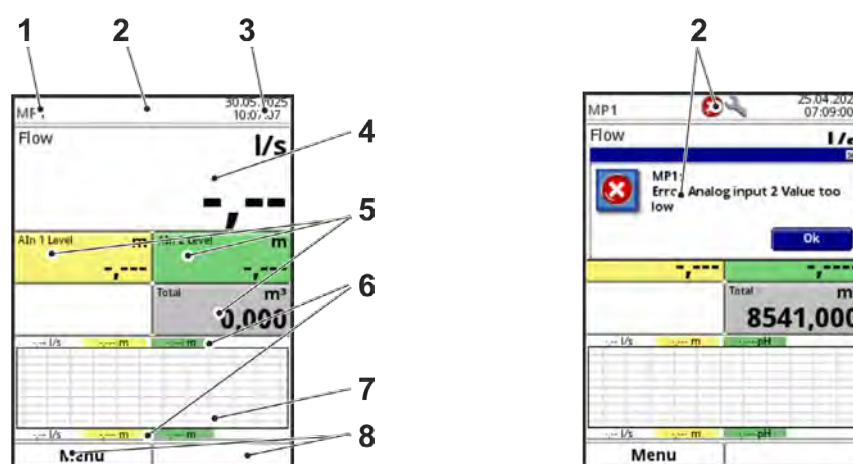
The display shows at any time where entries are currently being made in the menu.



Important Information on Initial Parameterisation of HydraulicCalculator 2

Be sure to read the chapter "34.1 Basic Procedure for Initial Parameterisation of Hydraulic-Calculator 2" before you start parameterisation.

26.1 Overview Display



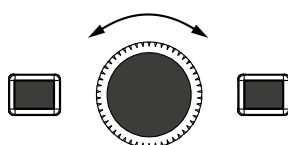
- 1 Measurement Place Name
- 2 Possible error message, system status information or display for active parameterisation or service mode
- 3 Date/Time
- 4 Display Area 1 (output field 1 for the flow rate)
- 5 Display area 2 (output field for AI1 / AI2 / Total)
- 6 Automatic scaling for display area 3 (Pos. 7)
- 7 Display area 3 (trend hydrograph of AI1, AI2 and calculated volume)
- 8 Function displays for the assignment of the keys

Fig. 26-1 Main Screen (with default settings)

26.2 Using the Control Elements

➡ Select >Main Menu< by pressing the left function key.

1. Turn the rotary-push button until the desired menu or the corresponding parameter is highlighted blue.
2. Press the rotary pushbutton to go to the next parameter level or to enter the corresponding parameter.



- Repeat the procedure until the desired menu or parameter is reached.
Designations or **numerical values** can be entered for parameters.



See Chapters "26.3 Input via Keypad" and "26.4 Input via Numeric field".

- Press the left function key to exit the menus step by step.
The device continues to work in the background with the last set values during the parameterisation process.
The following prompt for **saving the changed parameters** does not appear in the display before the current parameterisation process has been completed and confirmed.

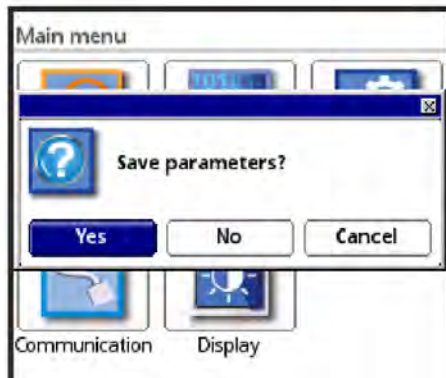


Fig. 26-2 Query for saving the parameters

- Confirm entry with >YES<.
A **password request** follows.



Fig. 26-3 Password request after setting the parameters

- Enter password (default password "2718").
The HydraulicCalculator takes over the new parameters at this point and continues to work with these values.

Depending on the parameterisation, the flow calculator restarts the evaluation and calculation in the background. To prevent the display and analogue and digital outputs from going to "0" or putting out errors or limit violations that do not make any sense at this moment, the flow calculator holds the display and output of the last measured value for a period of about 10...20 seconds after programming has ended. This state is represented by showing an "H" (= Hold) in the upper line of the display (Fig. 26-4). As soon as the new valid measurement values are available, this "H" disappears and the flow calculator returns to the display and output of the newly determined valid measurement values.

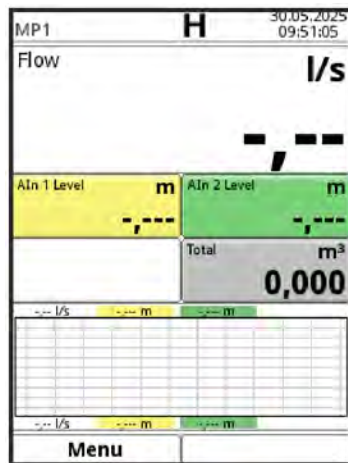
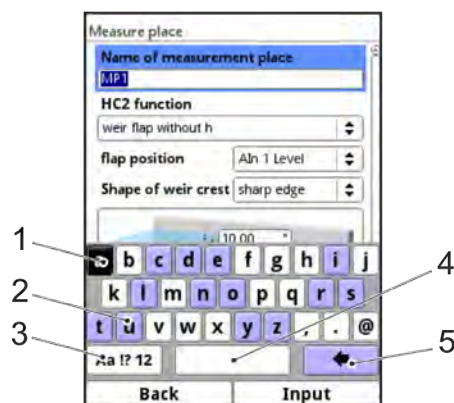


Fig. 26-4 Main Screen with Hold Symbol

26.3 Input via Keypad

Names or designations can be entered in some parameters. When selecting such a parameter, a keyboard field opens in the lower part of the display.



- 1 Selected Field
- 2 Multiple field
- 3 Shift
- 4 Space
- 5 Backspace/delete button

Fig. 26-5 Keypad



Note

The use of the keypad is described here once. Later in the instruction manual, there is only a request to enter designations or names.

At the bottom left of the keypad is the shift key (Fig. 26-5 Pos. 3).

- The functions of this shift key are:
 - Upper case
 - Lower case
 - Special characters
 - Numbers
- These setting options allow individual designations (e.g. of the measurement place name).

- To **activate** the shift key, turn the rotary pushbutton until the shift key is highlighted in black.
- To **enter** designations (e.g. measurement place name), proceed as follows:
 1. Press the rotary pushbutton - a keyboard field with individually selectable letters opens in the lower half of the display.
 2. Turn the rotary pushbutton to navigate through the keyboard field. Letters with a blue background (Fig. 26-5 Pos. 2) have a multiple assignment. The assignment switches when the rotary pushbutton is pressed and held for approx. 1 second.
 3. Press the rotary pushbutton until the desired letter is highlighted in black. The letter is transferred to the text field.
 4. Repeat the procedure until the complete text (e.g. measurement place name) is stored in the display.

26.4 Input via Numeric field

In some parameters, dimensions or other numerical values can be entered. When selecting such a parameter, a numerical field opens in the lower part of the display (analogue to the keyboard field).



Note

The use of the numeric field is described here once. Later in the instruction manual, there is only a request to enter dimensions or numerical values.

- Press the rotary pushbutton - a numerical field appears.
 1. Enter the values digit by digit. The input is done in the same way as described for the keyboard field.
Pay attention to the use of decimal points and default settings in dimensions.
- To **enter further dimensions** (e.g. for a trapezoidal profile), after confirming (by pressing the rotary pushbutton), continue turning the rotary pushbutton until you reach the next possible dimension entry. Repeat the process as long as necessary.

26.5 Input Correction

- Incorrect entries are deleted letter by letter or digit by digit backwards with the backspace key:
 1. Open the keypad.
 2. Turn the rotary pushbutton until the >Back< arrow (back button) (Fig. 26-5 Pos. 5) is visible.
 3. Press the rotary pushbutton - the last incorrect letter or the last incorrect digit will be deleted. Repeat the process as often as necessary.
- Then continue writing until the correct designation or dimension is completely shown in the display, then confirm the entry with the right function key.
The designation or the numerical value is taken over by the HydraulicCalculator 2 and is shown in the display (e.g. for the measurement place name).

26.6 Menus

All menus are described in a logical programming sequence in chapter "Setting Parameters". There are five basic menus available for this purpose. The basic menus can be viewed and selected by pressing the right function key.

In detail these are:

Application	Guides commissioning personnel through the complete parameterisation of measurement place dimensions, sensor selection, analogue and digital inputs/outputs and diagnostics.
Data	<ul style="list-style-type: none"> • Graphical representation of the history of analogue inputs 1 and 2 and calculated volume • Display and option to reset different flow totals • Storage of data, memory erasure • Saving and loading of parameters • Formatting the USB stick • Change in storage cycles and totals • Display of the daily and total transmitter operating hours as table
System	<ul style="list-style-type: none"> • Retrieval of basic information (serial number, version, article number, etc.) on the flow calculator (required for queries) • Setting language, time/date format and displayed/stored (measurement) units under >Country Setting< • Setting the system time and time zones under >Time/Date< • Error messages under >Error Messages< • Service levels, password changes, reset and restart of the measurement system
Communication	Setting parameters for all communication interfaces of the Hydraulic-Calculator such as TCP/IP and web server
User Indicator	<ul style="list-style-type: none"> • Input of basic parameters such as backlighting, dimming of the display as well as (partial) definition of the type of display in the main display • Setting the output fields (text, decimal places etc.)

Tab. 7 Overview Basic Menus

Main Screen

Quick Access

In addition to displaying the values themselves, the main screen also allows for direct access to the most important setting parameters.

The quick access enables to directly jump to important individual menus without having to go through the (sub)menus of the parameterisation. It hence serves as quick and uncomplicated check of the individual sensors involved in the measurement.

Quick diagnosis, uncomplicated parameter adjustment and adjustment are possible by using the quick access. Direct queries for basic device data such as serial and article numbers as well as the firmware version of the flow calculator is also possible in just a few steps.

27 General Overview



Note on the Displays and Descriptions in the Manual

Depending on the equipment/flow calculator type, the descriptions and display illustrations may differ from those shown in the instruction manual.

The following information is provided in the **top area** of the display:

- Measurement Place Name
- Date (alternatively 1, 2, 3 etc.; see Fig. 28-1)
- Time (alternatively 1, 2, 3 etc.; see Fig. 28-1)

The **red full circle with a white cross** in the top display area indicates pending errors in the system or individual sensors.

The **service key** in this area indicates that the password has been entered within the last six hours and that all further **parameter changes** can be saved **without** having to enter the **password** again. The six-hour period begins when the password is entered once and ends automatically.

If a number is displayed directly next to the service key, the flow calculator is in service mode. This is usually the case when a NIVUS service technician has access to the flow calculator.



See also Chap. "32.1 Save Parameters" and "26.2 Using the Control Elements".

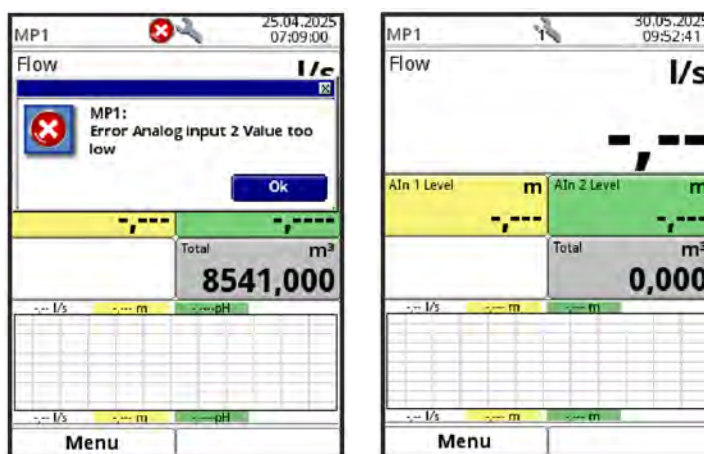
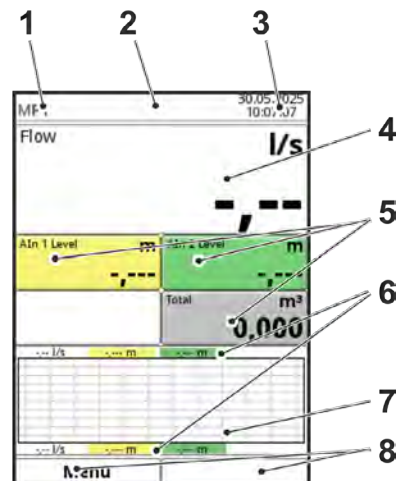


Fig. 27-1 Error and Maintenance Symbols

In operation mode (with factory setting), the flow calculator displays the following important measured values in the **main area**:

- Calculated Volume
- Analogue input 1
- Analogue input 2 (optional; depending on the hydraulic application)
- Grand Total

The **bottom part** of the display shows a trend graph (hydrograph) and the assignment of the two control keys.



- 1 Measurement Place Name
- 2 Possible error message, system status information or display for active parameterisation or service mode
- 3 Date/Time
- 4 Display Area 1 (output field 1 for the calculated volume)
- 5 Display Area 2 (output field 2, 3 and 5 for analogue input 1 and 2 and total)
- 6 Automatic scaling for display area 3 (Pos. 7)
- 7 Display Area 3 (trend hydrograph of analogue input 1, analogue input 2 and calculated volume)
- 8 Function displays for the assignment of the keys

Fig. 27-2 Main Screen Overview (with default settings)

➡ **Direct access** to the most relevant settings and information:

1. Rotate the rotary pushbutton until the selected field is indicated black.
2. Press the rotary pushbutton: the dialogue window of the according section opens.

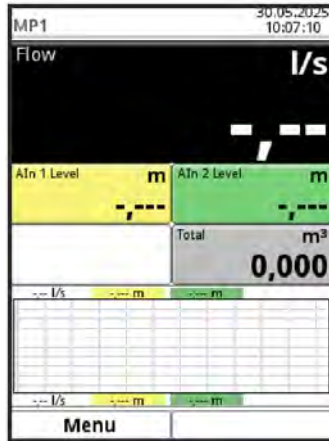


Fig. 27-3 Selected Screen Calculated Volume / Flow



Note

After changing system-specific parameters, the changes must be saved for them to take effect.

28 Display Field Calculated Volume / Flow

After activating the dialogue window by pressing the rotary pushbutton, the individual menus (Information, Diagnostics, Settings, Display and Error Messages) can be accessed directly via the pop-up menu (see Chapter “36.1 Information”, “Diagnostics”, “34.2 Setting the Measurement Place Parameters (Menu Application)”, “38 Parameter Menu Display” and “36.4 Error Messages”).

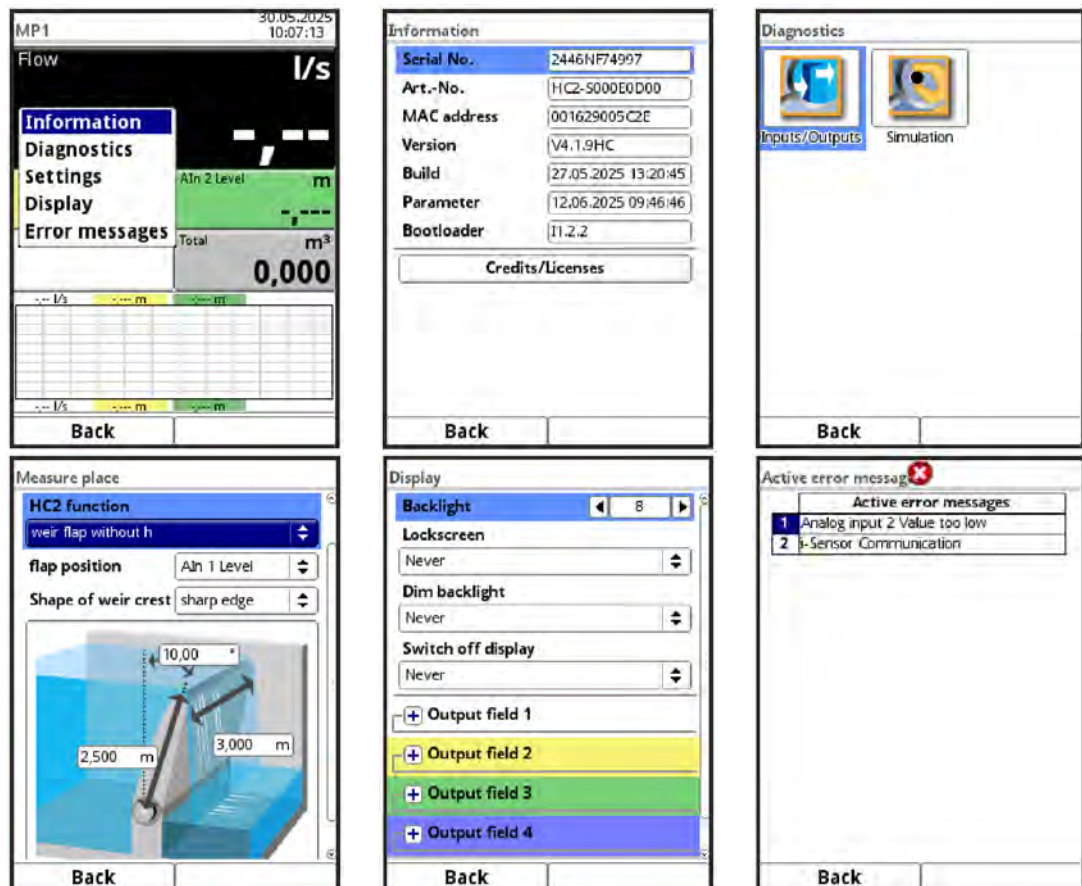


Fig. 28-1 Flow: Pop-Up-Menu and Menu Pages

29 Display Field Analogue Input 1 / 2

After activating the dialogue window by pressing the rotary pushbutton, the individual menu (Display) can be accessed directly via the pop-up menu (see Chapter “38 Parameter Menu Display”).

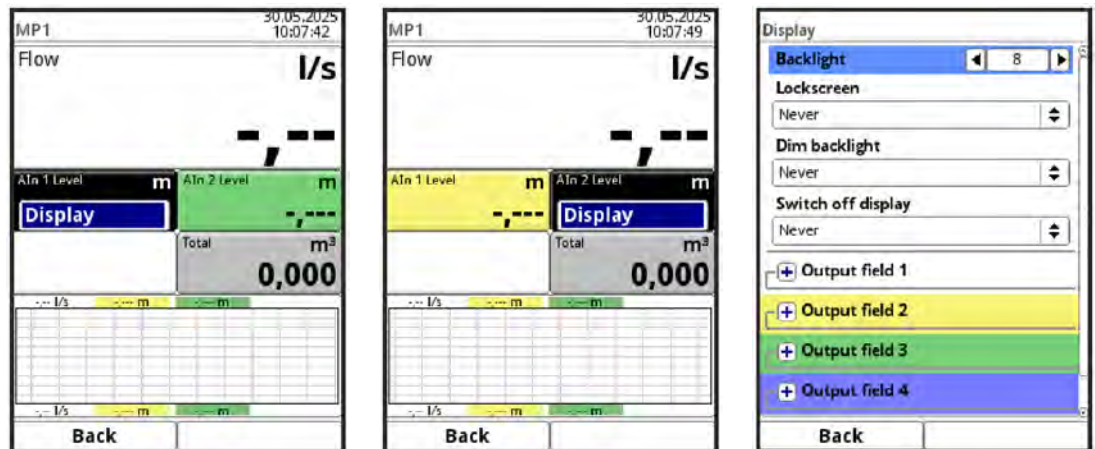


Fig. 29-1 Analogue Input: Pop-Up-Menu and Menu Page

30 Display Field Total

After activating the dialogue window by pressing the rotary pushbutton, the individual menus (Total, Daily Totals and Display) can be accessed directly via the pop-up menu (see Chapter “35.2 Total”, “35.3 Day Totals” and “38 Parameter Menu Display”).

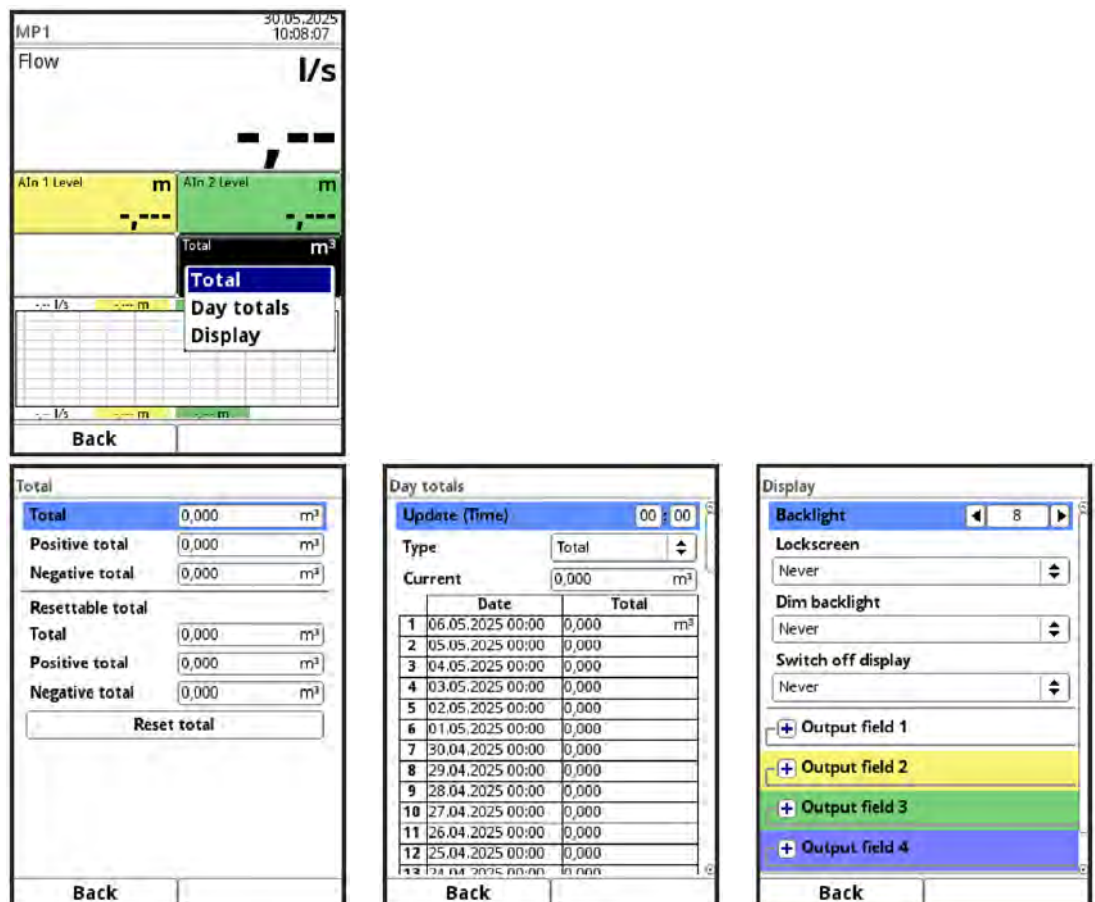


Fig. 30-1 Total: Pop-Up-Menu and Menu Pages

31 Display Field Trend/Hydrograph



Fig. 31-1 Trend/Hydrograph: Pop-Up-Menu and Menu Page

If a more detailed and extensive graphic display is required beyond the main display, the graphic field can be selected directly (see Chapter “35.1 Trend”).

The display period and the display area are available for selection.

The displayed time period can be moved using the >Scroll< function (arrow keys below the diagram).

Setting Parameters

32 Basics

In principle, changed parameters do not become effective before they have been saved.

When exiting all menus, the flow rate calculator checks whether any parameters have been changed. Finally, you will be asked whether you wish to save the parameters.

- >Yes<: the changed parameter setting is accepted and saved.
- >No<: the changes to the parameters are discarded and the flow rate calculator checks exits the menus.
- >Cancel<: You exit the query, remain in the parameterisation and can continue with the adjustment of the parameters. The changed parameters are not yet effective and not saved.

32.1 Save Parameters

Enter a valid password to accept and save the parameters.

Default setting: 2718

The **service key** in the upper display area indicates that the password has been entered within the last six hours and that all further **parameter changes** can be saved **without** having to enter the **password** again. The six-hour period begins when the password is entered once and ends automatically.

This period and thus the possibility to unintentionally change parameters without password entry can be deliberately cancelled. To do this, select the >Service Level< under >System< / >Service<. When asked for the password, do **not** make an entry, but confirm the empty, untouched field with the right button >Enter<. The flow calculator checks exits the mode with parameterisation without password entry.

If a number is displayed directly next to the service key, the flow calculator is in service mode. This is usually the case when a NIVUS service technician has access to the flow calculator.

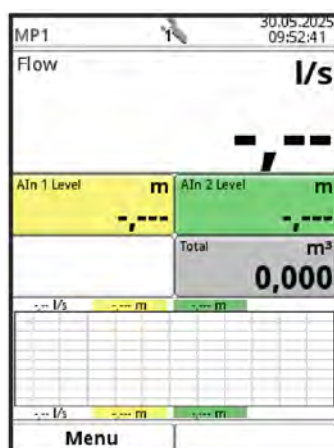


Fig. 32-1 Service Key - Service Mode

32.2 Change Password

⇒ See also Chapter "36.5.2 Change (System) Password".

The default password can be changed at any time. Note that a changed password secures the changes to all flow rate calculator settings. The input is limited to a maximum of ten characters.

☞ Procedure to change the password:

1. Open the >System< menu.
2. Select the >Service< submenu.
3. Activate the >Change Password< field.
4. Enter the existing password by using the numerical field.
5. Enter the new password (ten characters max).

The new password is accepted by the flow calculator and saves all flow calculator settings.



Important Notice

Only give the password to authorised persons!

If you write down the password, keep it in a safe place.

If the password is lost, contact the NIVUS hotline.

33 Parameter Functions

33.1 Main Menu

The flow calculator is parameterised via the total of five settings menus of the first menu level. The individual menus and submenus are explained in greater detail starting with Chapter "34 Parameter Description".

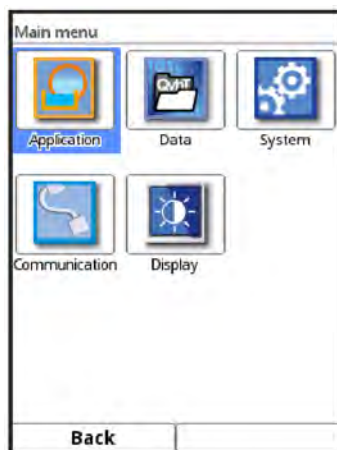


Fig. 33-1 Overview Main Menu

⇒ When setting parameters observe Chapter "26 Principles of Operation".

33.2 Functions of the first Menu Level

33.2.1 Menu - Application

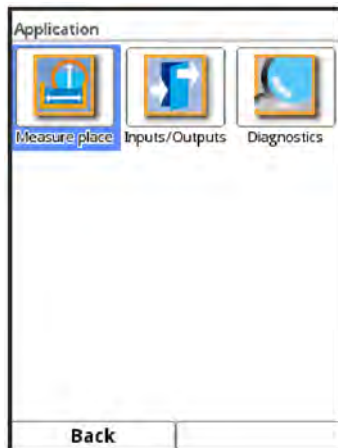


Fig. 33-2 Menu - Application

The special hydraulic application and dimensions of the measurement place are parameterised in the application menu. The level, angle of rotation or position sensors or signals used are defined and the data for their mounting position is parameterised.

You also define the required analogue and digital inputs and outputs here:

- Functions
- Measurement Ranges
- Measurement Spans
- Limit Values
- Error Messages

In the >Application< menu there are options available for:

- diagnostics of inputs and outputs and
- the simulation of inputs for calculation verification

⇒ The diagnostic functions are explained in chapter "Diagnostics" starting at Page 98.

33.2.2 Menu - Data

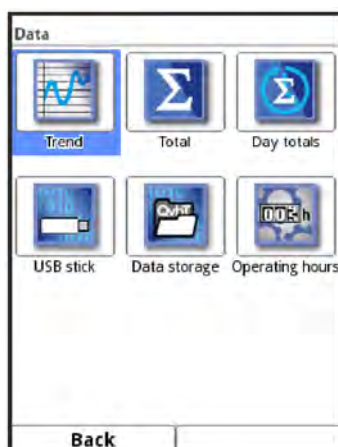


Fig. 33-3 Menu - Data

The >Data< menu allows access to all internally saved measurement values.

The following functions are available:

- Graphic representation of the measurement values
- Listing of the last 100 24h day totals and operating hours
- Listing of all totals (resettable and non-resettable positive, negative and grand totals)
- Communication and transmission options of internal files
- Loading and saving parameters
- Formatting the external USB stick
- Transfer of set parameters from and to USB stick
- Setting and deleting options of the internal data memory
- Setting the storage cycle

33.2.3 Menu - System

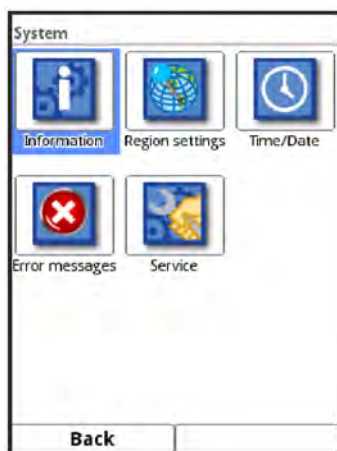


Fig. 33-4 Menu - System

The >System< menu contains information on the flow rate calculator:

- Article Number
- Firmware Version
- Serial number
- MAC Address
- Information about Open Source Software used in the device firmware (Credits/Licences)

In addition, the following settings/corrections are possible:

- Set Language
- Set units (for measurements or storage, unit system, decimal separator)
- Set/correct date and time (system time, time zone, time server)
- Read active messages
- Delete error memory
- Change Password
- Restart (system or measurement)
- Parameter Reset
- Update of the flow calculator (in service level; only in consultation with NIVUS)

33.2.4 Menu - Communication



Fig. 33-5 Menu - Communication

This menu includes the setting options of various communication interfaces with other communication systems:

- TCP/IP
- Web Server
- Data Transmission

33.2.5 Menu - Display



Fig. 33-6 Menu - Display

In this menu, adjustments are made to the background lighting and, if required, any corrections to the five output fields of the main display are set.

34 Parameter Description

34.1 Basic Procedure for Initial Parameterisation of HydraulicCalculator 2

The HydraulicCalculator 2 can only be parameterised if the following steps are carried out once during initial parameterisation.

➡ First working steps:

1. Open Menu >Application< / >Measurement Place< and select the appropriate calculation function (application) of the HC2.
See Chap. "34.2.2 Calculation Function".
2. Back to menu >Application<.
3. Open Menu >Inputs/Outputs< / >Analogue Inputs< and activate only analogue input 1 (AI1) or both analogue inputs (AI1 / AI2) depending on the selected calculation function.
See Chap. "34.3 Setting Parameters of Inputs and Outputs (analogue and digital)".
4. Select the sensors or passive current inputs assigned to the respective analogue input (AIx).
5. Return to the menu >Application< / >Measurement Place< and continue with the parameterisation of the measurement place/calculation function.
See Chap. "34.2 Setting the Measurement Place Parameters (Menu Application)".

34.2 Setting the Measurement Place Parameters (Menu Application)

The submenu >Measurement Place< is the main menu of HydraulicCalculator 2.

It includes the following basic settings:

- Measurement Place Name
- Calculation function (Application)
- Assignment of analogue inputs (AI)
- Calculation reference point
- Dimensions and parameters of the selected calculation function
- Hydraulic parameters depending on the selected calculation function, such as weir crest shapes, overflow coefficients, Strickler coefficient, slope, etc.

34.2.1 Measurement Place Name



Fig. 34-1 Specifying the Name of the Measurement Place

The desired measurement place name is entered here. The input is limited to 256 characters.

Default setting of the measurement place name: MP1

When resetting the measurement place name, the default name is automatically deleted after the first letter or number is selected.

➡ Procedure:

1. Use the keypad to enter the measurement place name completely into the text field (see Chap. "26.3 Input via Keypad").
2. Confirm the measurement place name with the right function key "Input".
The measurement place name is transferred to the main menu and displayed there.

34.2.2 Calculation Function



References

The calculation functions contained in HC2 are based on, among other things, the DWA worksheet DWA-A 111 'Hydraulic dimensioning and operational performance verification of systems for limiting discharge and water levels in drainage systems' and the two reference books Bollrich – 'Technische Hydromechanik Band 1' (Technical Hydromechanics Volume 1) and R. Rössert – 'Hydraulics in Hydraulic Engineering'.

The correct selection and parameterisation of this function requires a good basic knowledge of hydraulics. If in doubt, please contact the NIVUS commissioning service.

➡ See Chap. "42.2 Customer Service Information".

The selected calculation function generates a basic graphical representation of the application, in which all necessary parameters can be entered directly.



Fig. 34-2 Selectable HC 2 Functions / Calculation Functions

➡ Procedure:

1. Select from the available calculation functions:
 - Weir flaps without h (without impoundage target correction)
 - Weir flaps with h (with impoundage target correction)
 - Tangential weir (weirs with tangential flow)
 - Weir with backwater
 - Slot
 - Slot with backwater

- Underflowed gate
 - Exponential calculation
 - $Q=f(h)$
2. Assign the analogue input(s) to the corresponding calculation variables and then fill in the dimension and application fields displayed.

Info:

Dimensions are always given in metres [m], flap angles in degrees [°].



Fig. 34-3 Example of a calculation on a weir flap with impoundage target correction

Explanations, details and examples of HC2 functions / calculation functions

- **Weir flap without h (without impoundage target correction)**

This calculation function is used when a special, mechanically balanced overflowed weir flap adjusts its angle of inclination depending on the overflow volume so that the fill level in front of the weir flap (height in front of the flap) always remains constant.

The angle of the weir flap (flap position) is the most important variable for calculating the overflow volume.

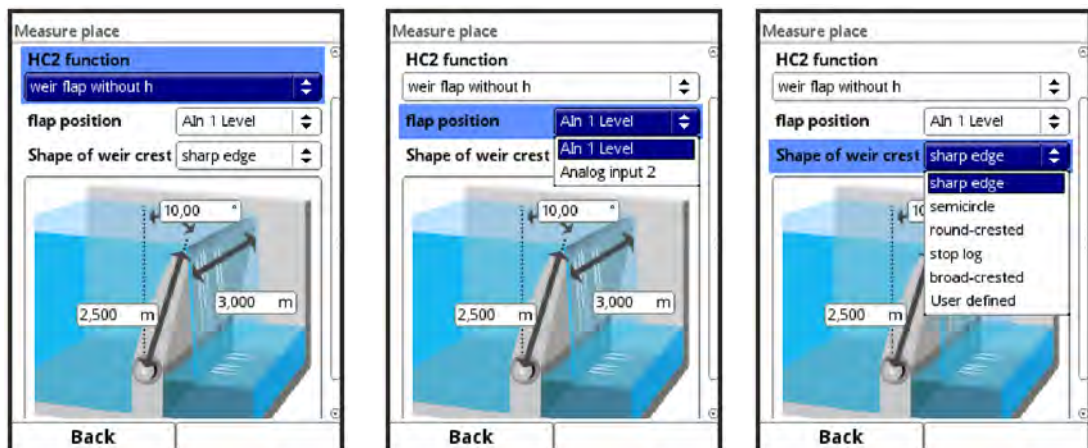


Fig. 34-4 Parameterisation weir flap without impoundage target correction

The **>Flap Position<** is usually measured using an inclination angle sensor or similar device. This signal is usually applied as a 4-20 mA signal to analogue input 1 and selected via the **>Flap Position<**.

Install the flap position sensor so that the sensor's current signal is exactly 4.0 mA when the damper is in its rest position (vertically upright) (do not take the flap preload into account).

The **measuring range of the inclination sensor** is parameterised accordingly in the menu >Application< / >Inputs/Outputs< / >Analogue Input< (usually via analogue input 1).

In doing so, set the start of the measuring range (4 mA) to the angle of the sensor when the flap is in the rest position: 0° (despite preloaded flap).

Set the end of the measuring range (20 mA) to the end range of the inclination angle sensor (usually 90°), even if this cannot be reached due to the design of the flap.

The overflow is calculated using the Poleni formula. This calculation requires an >Overflow Coefficient<. To do this, select the appropriate shape in the variable >Weir Crest Shape< (the overflow coefficient is stored there accordingly). Most flaps are semi-circular in shape. For the >Weir Crest Shape< 'User-defined', the >Overflow Coefficient< must be entered manually (refer to standard technical literature if necessary).

In most cases, overflowed weir flaps are not exactly vertical, but slightly inclined. Therefore, enter the flap preload in [°] to take this **angle** into account when calculating the overflow height over the flap in the event of a change in inclination during operation.

Finally, enter the exact **height** of the flap (from the centre of the pivot axis to the upper edge of the flap) and the **width** of the flap.

- **Weir flap with h (with impoundage target correction)**

This calculation function is an extension of the calculation function 'Weir flap without h (without impoundage target correction)' (with an assumed constant fill height).

This assumed constant **fill level** (regardless of the overflow volume) can be easily achieved under laboratory conditions. In practice, however, due to inadequate maintenance, lack of smooth movement of the flaps, mechanical distortion, jamming and floating of the flaps in the event of backwater, the effect is that the fill level in front of the overflow flaps can fluctuate. This means that there is no defined fixed reference point for the overflow height when calculating the overflow volume based solely on the flap angle. The volume calculation, based solely on the flap position, is therefore likely to be inaccurate or implausible, depending on the correct mechanical function of the flap.

For this reason, the additional use of a level measurement >h< upstream of the weir flap has proven effective in compensating for this mechanical malfunction on overflowed weir flaps.

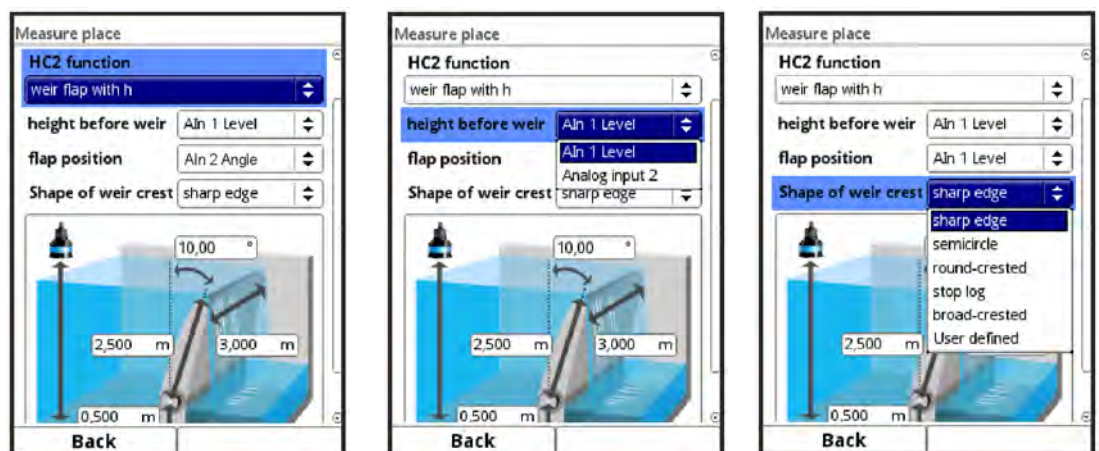


Fig. 34-5 Parameterisation weir flap with impoundage target correction

The basic parameterisation is partly identical to "Weir flap without h (without impoundage target correction)" starting at Page 58.

The level sensor – usually an ultrasonic i-Series sensor – is best connected to analogue input 1 (AI1), while the inclination angle sensor of the weir flap is connected to analogue input 2 (AI2).

The assignments of the two analogue inputs, the parameterisation of the inclination angle sensor, the flap preload, and the height and width of the flap are carried out as described in "Weir flap without h (without impoundage target correction)".

Measuring the **fill level** upstream of the weir flap requires the definition of a **reference point** for measurement and correct calculation.

When using contactless and drift-free level measurement (ultrasound, radar), this reference point can be set precisely to the height position of the centre point of the flap's axis of rotation (= distance from the lower edge of the sensor to the centre point of the axis of rotation) and entered as the '0-point' in the level sensor's parameterisation. Then enter the value '0' in the new parameter for the distance between the reference point (= '0 point' of the level measurement) and the centre of the axis of rotation.

If a pressure probe (e.g. NivuBar) is used for level measurement, it should preferably be installed several centimetres below the pivot point of the weir flap.

Info:

Pressure probes tend to zero point drift. Although this can be compensated for during regular maintenance via an offset in the analogue input, this does not work with a positive offset and positioning exactly in the middle of the pivot point, as the '0-point' of the probe cannot be shifted below 4 mA.

If, in addition to the discharge volume, the fill level in the storage area upstream of the weir flap is also to be output, the reference point for the calculation must be set to the tank floor and, in addition, analogue output 1/2 must be parameterised to "External Measurement Value" (= fill level upstream of the weir) (see Chap. "34.3.2 Analogue Outputs").

Info:

For higher outlet areas (AI2), the HydraulicCalculator display shows fill levels > 0. However, this displayed value is not relevant for the calculation.

When using pressure probes for level measurement upstream of the weir sill: enter the value of the fixed measuring span of the pressure probe in the analogue input span.

When using contactless, configurable probes (ultrasound, radar), compare the measurement range value with the configured measurement range of the respective probe.

- **Tangential weir (weirs with tangential flow)**

This calculation function refers to the calculation function specified in DWA-A 111 for determining the discharge volume at tangentially flowed weirs. Here, an inclined water level forms in front of the weir edge, which cannot be calculated correctly using only one level measurement or two level measurements and simple averaging due to the exponential function of the discharge calculation.

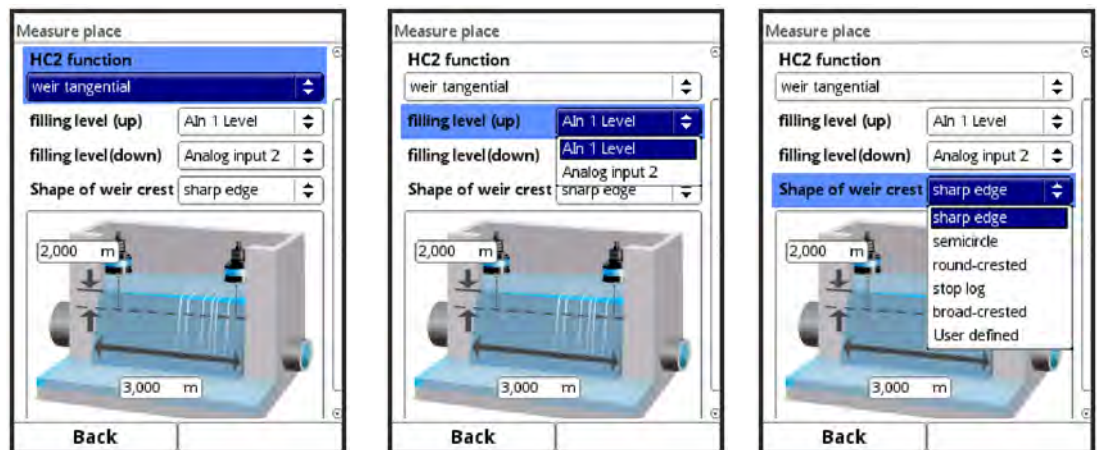


Fig. 34-6 Parameterisation side weirs with tangential flow

Two level measurements are used to record the inclined water level at the side weir.

The **>Upper Water Level<** corresponds to the level on the intake side of the weir, while the **>Lower Water Level<** corresponds to the level on the discharge side in front of the weir.

The two sensors are installed at approximately 15 % and 85 % of the weir length. Keep a sufficient distance from the weir so as not to enter the area of jet lowering.



See also worksheet DWA-A 111, section 5.3, Side Weirs.

The common **reference point** for the two level measurements when using pressure measurement cells can be set at the start of the discharge at the weir edge, as described in the calculation function 'Weir flap with h (with impoundage target correction)'. To do this, enter the mounting position of the two sensors (diaphragm) in relation to the start of the discharge.

When using drift-free sensors (echo sounder, pressure probe), the reference point (= '0-point') of the configurable pressure probes can be set to the start of the discharge. In this case enter the value "0".

If, in addition to the discharge volume, the fill level in the storage area upstream of the weir flap is also to be output, the reference point for the calculation must be set to the tank floor and, in addition, analogue output 1/2 must be parameterised to "External Measurement Value" (= fill level upstream of the weir) (see Chap. "34.3.2 Analogue Outputs").

Measure the **width** of the weir precisely and enter it in the diagram.

The overflow is calculated using the Poleni formula. This calculation requires an **>Overflow Coefficient<**. To do this, select the appropriate shape in the variable **>Weir Crest Shape<** (the overflow coefficient is stored there accordingly). Most flaps are semi-circular in shape. For the **>Weir Crest Shape<** 'User-defined', the **>Overflow Coefficient<** must be entered manually (refer to standard technical literature if necessary).

- **Weir with backwater**

Info:

Classic calculations of the discharge or overflow volume via a weir sill use the Poleni formula for this purpose. This is usually based on a non-backwater weir, with the reduction factor $>c<$ contained in the Poleni formula set to '1' and thus removed from the formula.

In practice, this approach often proves to be a mistake. Due to storm-related backwater from the receiving waters; backwater flaps obstructing the outflow from the system or undersized drain pipes often cause more or less severe backwater, which often reaches the overflow sill. This backwater leads to a reduction in the discharge capacity of the weir and, with the same discharge volume, to a rise in the water level upstream of the weir. In the classic calculation, this measured increased fill level then often leads to an extremely high volume that seems completely implausible and does not fit into the hydraulic system at all.

The additional recording of the backwater height behind the weir by means of a second measurement, the calculation and consideration of the reduction factor $>c<$ from the two weir heights and the sill shape leads to a correct calculation of the overflow volume and is able to set this calculated overflow to '0' in the event of complete overflow of the sill on the receiving water side. Even backflow from the receiving waters into the canal system when the level of the receiving waters is significantly increased can be detected and calculated as a negative volume.



See also worksheet DWA-A 111, section 5.2.

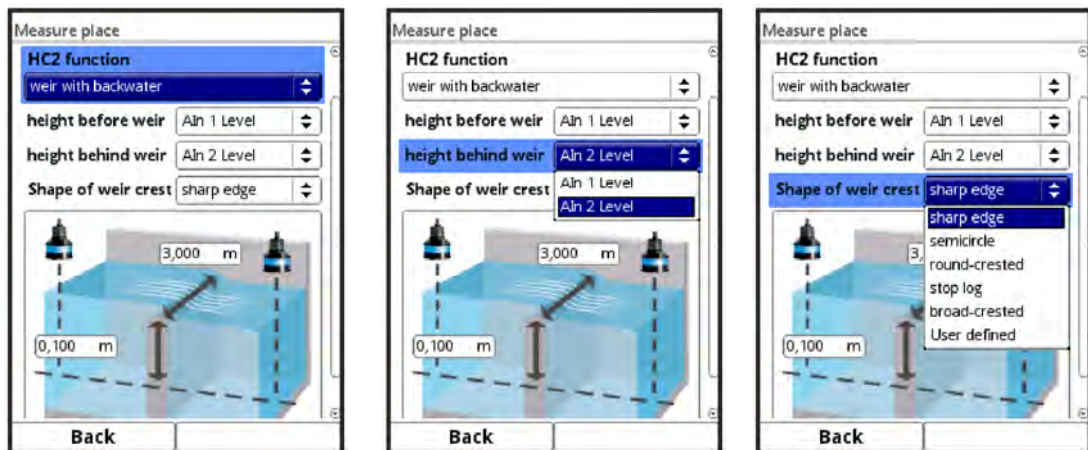


Fig. 34-7 Parameterisation of backwater weirs

Two level measurements (one upstream and one downstream of the weir) are used. **Position the probes** so that the measurement in front of the weir is not in the area of the jet lowering and the measurement behind the weir is at a location that is free of turbulence, waves and eddies in order to always ensure a reliable measurement.

To configure the parameters, assign the two activated **analogue inputs** to the heights upstream and downstream of the weir.

The common **reference point** for the two level measurements when using pressure measurement cells can be set at the start of the discharge at the weir edge, as described in the calculation function 'Weir flap with h (with impoundage target correction)'. To do this, enter the mounting position of the two sensors (diaphragm) in relation to the start of the discharge.

When using drift-free sensors (echo sounder, pressure probe), the reference point (= '0-point') of the configurable pressure probes can be set to the start of the discharge. In this case enter the value "0".

If, in addition to the discharge volume, the fill level in the storage area upstream of the weir flap is also to be output, the reference point for the calculation must be set to the tank floor and, in addition, analogue output 1/2 must be parameterised to "External Measurement Value" (= fill level upstream of the weir) (see Chap. "34.3.2 Analogue Outputs").

Info:

For higher outlet areas (A12), the HydraulicCalculator display shows fill levels > 0. However, this displayed value is not relevant for the calculation.

Measure the **width** of the weir precisely and enter it in the diagram.

The overflow is calculated using the Poleni formula. This calculation requires an **>Overflow Coefficient<**. To do this, select the appropriate shape in the variable **>Weir Crest Shape<** (the overflow coefficient is stored there accordingly). Most flaps are semi-circular in shape. For the **>Weir Crest Shape<** 'User-defined', the **>Overflow Coefficient<** must be entered manually (refer to standard technical literature if necessary).

- **Slot**

Info:

Slotted weirs are often found as sewage overflow in rainwater treatment plants. They are designed in such a way that they act as discharge limiters and thus cause only a minimal impact on water bodies. At the same time, they limit the flow velocity in the storage basin, ensuring that dirt and suspended solids can settle in the basin.

Classic slots function like a classic overflow weir up to the upper slot limit, with the possibility of calculation according to Poleni, and then transition into a pressurised outlet. From this point onwards, the flow characteristic curve becomes very steep and, depending on the further rise of the water level in the basin, only a slightly higher flow rate occurs. This calculation method therefore works with one level sensor.



For further information, see also Bollrich's reference book 'Technische Hydromechanik Band 1' (Technical Hydromechanics Volume 1).



Specially shaped weir slot designs

Some weir slot designs available on the market are very specially shaped or designed, and the hydraulic principles described in this chapter do not apply to them.

In this case, ask the manufacturer or planning engineering office for the applicable Q/h characteristic curve and use it as the calculation function on the HC2 'Q=f(h)'.

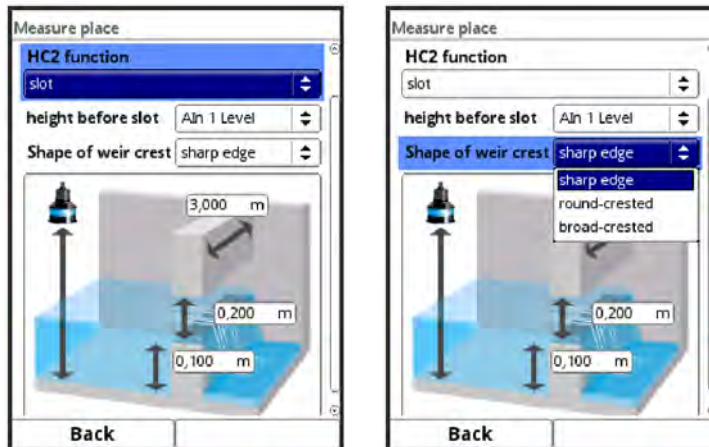


Fig. 34-8 Setting Parameters for Slot Weirs

A level sensor is installed in the storage space in front of the slot.

For parameterisation, the activated and parameterised **analogue input** is assigned to the height in front of the slot.

The **reference point** for the level measurement when using a pressure measurement cell can be set at the start of the discharge at the weir edge, as described in the calculation function 'Weir flap with h (with impoundage target correction)'. To do this, enter the mounting position of the sensor (diaphragm) in relation to the start of the discharge.

When using a drift-free sensor (echo sounder, pressure probe), the reference point (= '0-point') of the configurable pressure probe can be set to the start of the discharge. In this case enter the value "0".

If, in addition to the discharge volume, the fill level in the storage area upstream of the slot (weir) is also to be output, the reference point for the calculation must be set to the tank floor and, in addition, analogue output 1/2 must be parameterised to "External Measurement Value" (= fill level upstream of the slot (weir)) (see Chap. "34.3.2 Analogue Outputs").

Measure the **height** and the **width** of the slot precisely and enter it in the diagram.

Tip:

Due to the design with lower and upper edges, slot calculations can only be performed with increased measurement uncertainty. That is why there are only three types of crown shapes to choose from, although in practice the broad crown shape is probably the most common (and should be selected in case of doubt).



Weir with multiple Slots

Some rainwater treatment systems have several shorter slots separated by concrete supports.

If these slots have the same slot height and the start of the overflow is at the same reference height for all partial slots, the individual slot lengths can be added together to form a single common slot length.

- **Slot with Backwater**

The calculation function >Slot with Backwater< is a calculation function extended by the variable >Height behind Slot< (= fill level behind the slot (weir)).

It is divided into four possible sections of the calculation.

- Height in front of slot (weir): less than slot height, height behind slot (weir): lower as start of overflow
→ Poleni formula
- Height in front of slot (weir): less than slot height, height behind slot (weir): greater than/equal to overflow
→ Poleni formula with reduction factor c
- Height in front of slot (weir): greater than slot height, height behind slot (weir): lower as start of overflow
→ Discharge under pressure (according to Bollrich)
- Height in front of slot (weir): greater than slot height, height behind slot (weir): greater than/equal to overflow
→ Discharge under pressure with reduction factor (according to Bollrich)

Both analogue inputs are required for this calculation function, which can be assigned according to the variables.

For parameterisation, the activated and parameterised **analogue inputs** are assigned to the height in front of the slot.

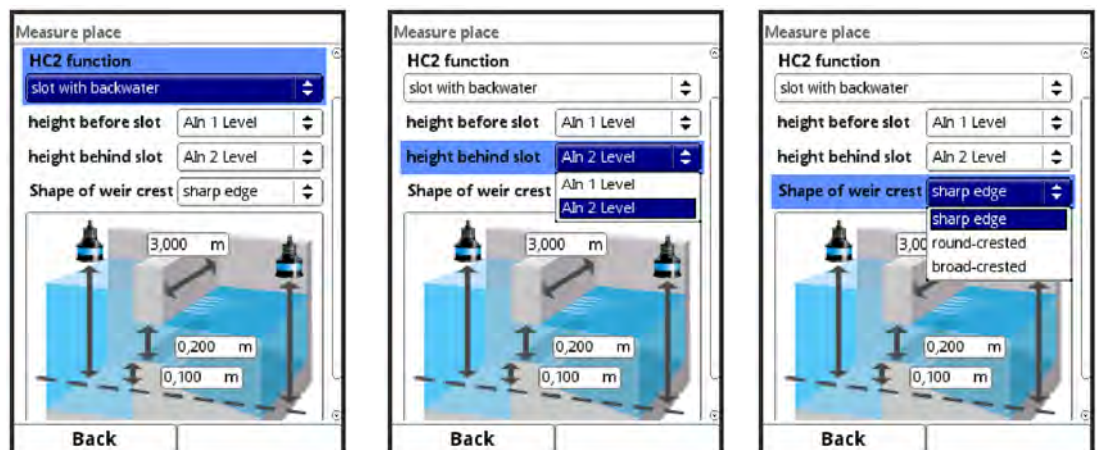


Fig. 34-9 Parameterisation of Slots with Backwater

The same **height contour** should be used for the reference point of the >Height behind Slot< as for the height in front of the slot. So there is a common point of reference.

This common **reference point** for the two level measurements (upstream and downstream of the slot (weir)) when using pressure measurement cells can be set at the start of the discharge at the weir edge, as described in the calculation function 'Weir flap with h (with impoundage target correction)'. To do this, enter the mounting position of the two sensors (diaphragm) in relation to the start of the discharge. When using drift-free sensors (echo sounder, pressure probe), the reference point (= '0-point') of the configurable pressure probes can be set to the start of the discharge. In this case enter the value "0".

If, in addition to the discharge volume, the fill level in the storage area upstream of the slot (weir) is also to be output, the reference point for the calculation must be set to the tank floor and, in addition, analogue output 1/2 must be parameterised to "External Measurement Value" (= fill level upstream of the slot (weir)) (see Chap. "34.3.2 Analogue Outputs").

Info:

For higher outlet areas (AI2), the HydraulicCalculator display shows fill levels > 0. However, this displayed value is not relevant for the calculation.

Measure the **height** and the **width** of the slot precisely and enter it in the diagram.

- **Underflowed gate**

This calculation method can be used to determine flow rates for gates that are immersed vertically from above (in rectangular channels) or plate gates with a horizontal lower edge.

Requirements for this calculation with two analogue inputs of the HC2:

- Roughness of the rectangular channel known.
- Slope of the rectangular channel known.
- Gate/slide valve equipped with an electronic position transmitter (0/4-20 mA).
- Contactless level measurement (no pressure sensor!) installed in front of the gate.

Two different **methods** are used in the calculation:

1. For non-submerged gate: Calculation according to Manning-Strickler based on water level, slope, roughness and channel/gate width
2. With submerged gate: Calculation according to 'free discharge under gates' in accordance with Bollrich based on the fill level upstream of the gate and the gate position.

The μ_A discharge coefficient required for method 2, calculated from the gate shape, gate angle of inclination (specified as 90°), gate opening height and headwater level, was stored in a table in the HC2.



Tables showing the Strickler value can be found in the relevant specialist literature, e.g. Bollrich.

If necessary, sand roughness values k_s must be converted to Strickler values k_{St}

CAUTION



The calculation form cannot be used for all applications/channels

Applications in channels other than

- rectangular channels,
- with curved gate blades,
- inclined gates or
- channels without free discharge on the underwater side

cannot be calculated using this calculation form.

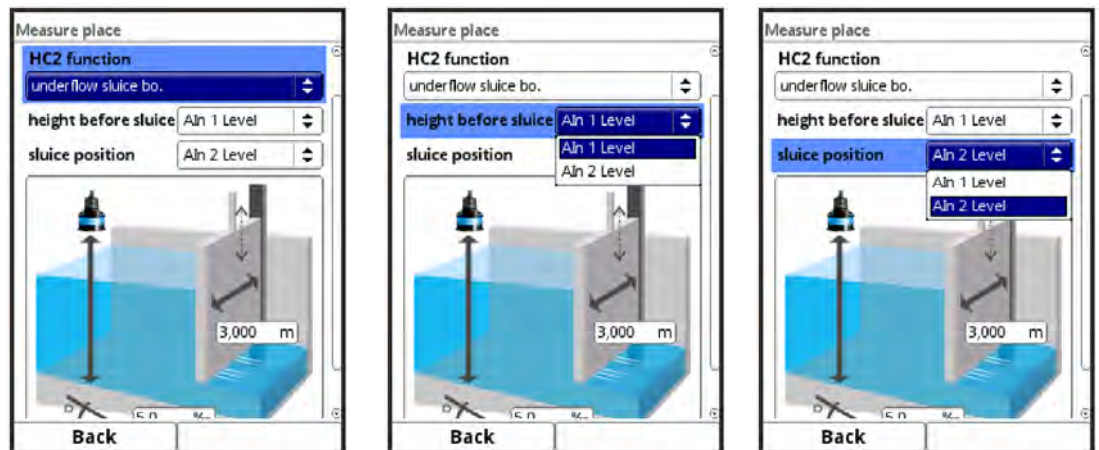


Fig. 34-10 Setting Parameters for underflowed gates

Assign the **>Level upstream of Gate<** (level measurement) and the **>Gate Position<** to the corresponding analogue inputs and parameterise them.

Set the '0 point' of the analogue input for the height in front of the gate to the position of the channel bottom under the level sensor used.

Configure the analogue input for the gate position so that '0/4 mA' corresponds to a completely closed gate and '20 mA' corresponds to a completely open gate (reference value).

Enter the **gate width**, the **slope** in front of the gate (in per mille) and the **Strickler value** (roughness) in the corresponding fields of the graphic.

- **Exponential calculation**

Exponential calculations refer to a variable – in this case, an analogue input. In most cases, this is a level (in front of a Venturi, a special weir, in a gravity flow drain, etc.) or another measuring device where the current flow level can be calculated from a measured variable (e.g. height) using an exponential formula, known exponents and knowledge of the maximum flow rate associated with the maximum measured value.

A flow rate is assigned to the input value according to the basic formula $Q = k \cdot h^x$.

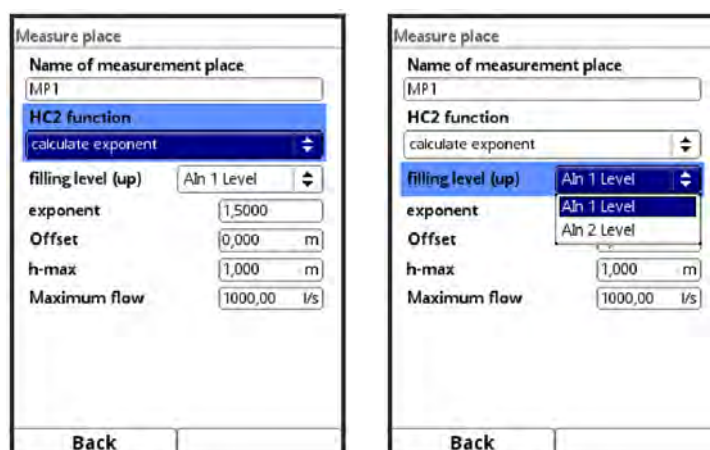


Fig. 34-11 Parameterisation of exponential calculation

After assigning the analogue input to **>Fill level (top)<** (= h), enter the exponent (= x) (e.g. Venturi according to DIN 19559: 1.5; triangular weir: 2.98; etc.).



This exponent can be taken from the relevant literature (e.g. Detlef Aigner, 'Überfälle' in 'Dresdner Wasserbauliche Mitteilungen', issue 36, etc.), depending on the application.

Depending on the size of the design, the application has a corresponding maximum flow rate at maximum fill level. Enter these two important parameters for '**h-max**' and '**Flow Rate max.**'.

The '**Offset**' input field shifts the exponential curve up or down from the '0 point'. NIVUS recommends leaving it at '0'.

A change is only necessary if the reference point for the measurement is lower or higher than the actual exponential formula or if a zero point adjustment is required.

- **Q = f(h)**

This calculation function can be used to display and output non-linear relationships or relationships that cannot be expressed in formulas between an input value and the corresponding quantity.

A common application is the transfer of old, drawn discharge curves for existing structures or measurement devices (e.g. VRi channels, historical Venturi tubes, etc.) into a flow calculator in order to convert the graphical representation of the curve into a measurement curve.

In both cases, a graphical correlation between the measured value and the corresponding flow rate must be established on the drawing and entered in the table of values.

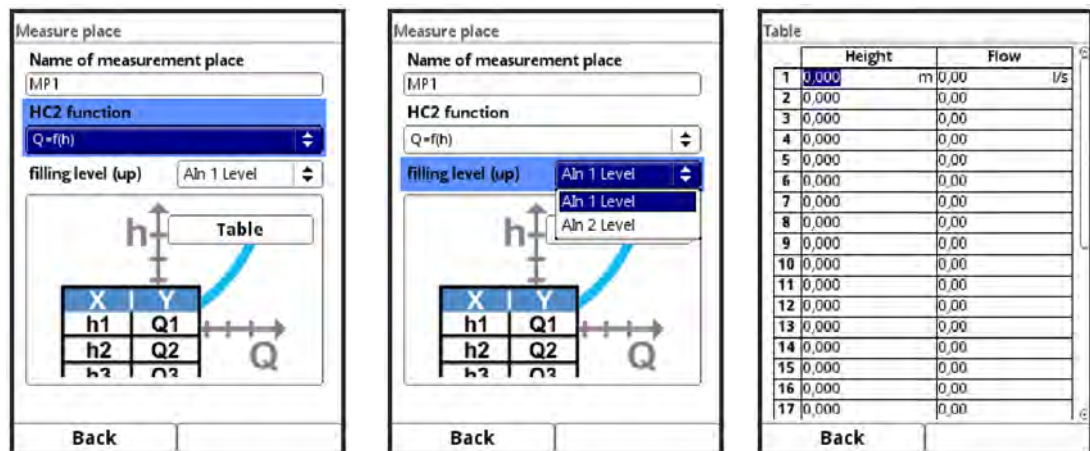


Fig. 34-12 Parameterisation of the Q-h relationship

After assigning the **analogue input** to the fill level (this is the guide value; alternatively, it could also be a rotation angle or similar), entry begins at the '0 point' with a '0' in both columns of the first table line.

Then define individual **value pairs** on the existing drawing. Make sure to set the value pairs closer together for strongly bent curves, as the flow calculator linearises between the value pairs. In addition, always set a pair of values at points with a significant change in direction.

For (almost) straight sections, one pair of values at the beginning and one at the end of the section is sufficient.

A maximum of 32 value pairs is possible, whereby the maximum number does not have to be used, but the last value pair should be slightly above the maximum fill level if possible.

34.3 Setting Parameters of Inputs and Outputs (analogue and digital)

In this menu, the functions of the analogue and digital inputs and outputs are defined. Further parameter settings such as measurement and output spans, offsets, limit values, error reactions etc. are also possible in this menu.

The >Inputs/Outputs< menu is opened via the main menu.

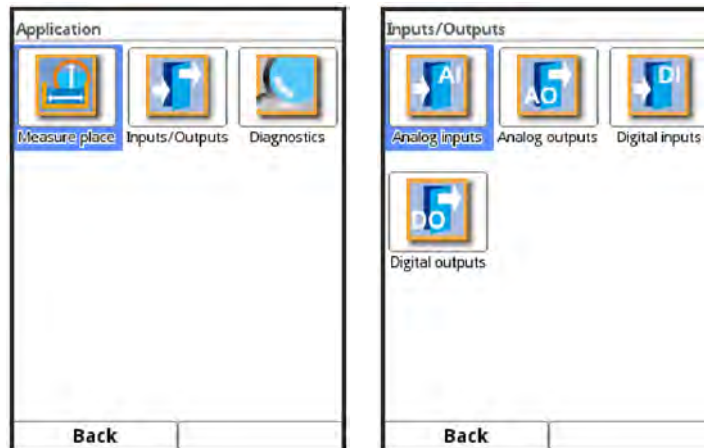


Fig. 34-13 Selecting Inputs and Outputs

The Inputs/Outputs menu is divided into four sections:

- Analogue Inputs
- Analogue Outputs
- Digital Inputs
- Digital Outputs

34.3.1 Analogue Inputs

The available analogue inputs are shown in the top right corner of the display.

Select the analogue inputs one after the other by pressing the right control button >Tab<. The selected input is shown in plain text in the top left corner of the display.

Default setting: analogue inputs inactive.

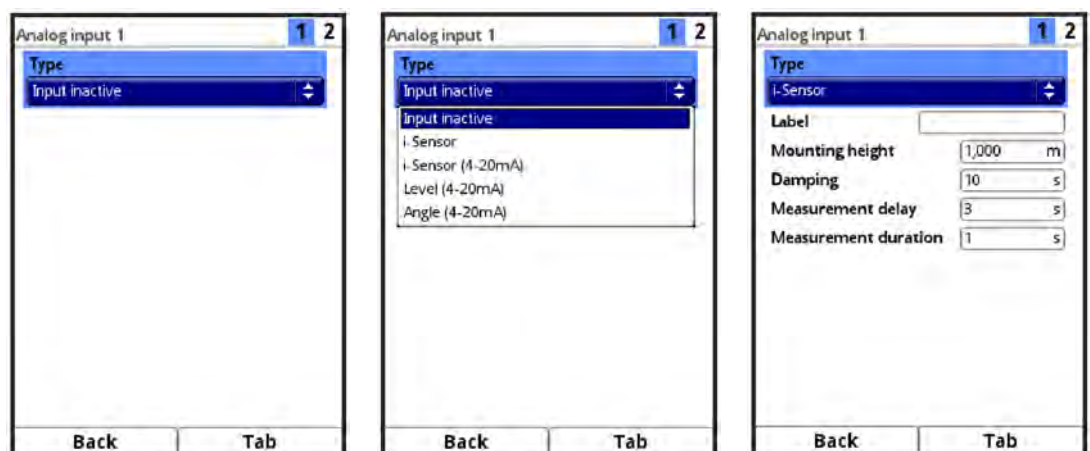


Fig. 34-14 Activation Analogue Inputs /

The following different functions can be assigned to the analogue inputs:

- i-Sensor
- i-Sensor 4-20 mA (only for analogue input 1)

- Level (4-20mA)
- Angle (4-20mA)

The following settings for **input range**, **designation**, **mounting height**, **linearisation**, **damping**, **measurement delay** and **measurement duration** largely apply to all of the above functions.

- **Input range:** >0-20 mA< or >4-20 mA< (not for i-Sensor / i-Sensor 4-20 mA)
- **Designation:** manual input; freely selectable name with up to 16 characters, which is displayed, for example, under Diagnostics for the respective analogue input
- **Mounting height:** manual input (ONLY for i-Sensor)
- **Linearisation:** >2-Point< or >Table< (not for i-Sensor)
 - For >2-Point< linearisation: manual input of the values for 4 or 20 mA
 - For >Table< linearisation: enter the number of >Entries< manually, then select >Table<, fill in and confirm
- **Damping:** manual entry of values
- **Measurement delay:** manual entry of values
- **Measurement duration:** manual entry of values



Fig. 34-15 i-Sensor (4-20mA) / Level (4-20mA) / Angle (4-20mA)



Note

Input via keypad: see Chapter "26.3 Input via Keypad".

In **Cycle/Clock Control Operation** of the flow calculator (this function is currently not supported), if external level sensors are used, these sensors require some lead time after the voltage has been supplied before they display a (correct) measurement value. To avoid incorrect measurements, it is therefore necessary to delay the recording of the measurement value by this lead time. This is done using the >Measurement Delay< parameter.

In addition, the minimum measurement duration for reliable measurement value recording can be defined under >Measurement Duration<.

The use of these two parameters is not relevant when not in cycle/clock control mode.

34.3.2 Analogue Outputs

The both available analogue outputs are shown in the top right corner of the display.

Pressing the right control key >Tab< selects the analogue outputs one after the other. The selected analogue output is shown in plain text in the top left corner of the display.

Default setting: analogue outputs inactive.

Different functions can be assigned to the analogue outputs. It is possible to assign the same function to two analogue outputs in different measurement ranges.

- Example:
 - Analogue output 1 = flow 4-20 mA corresponds to 0-100 l/s
 - Analogue output 2 = flow 4-20 mA corresponds to 0-5000 l/s

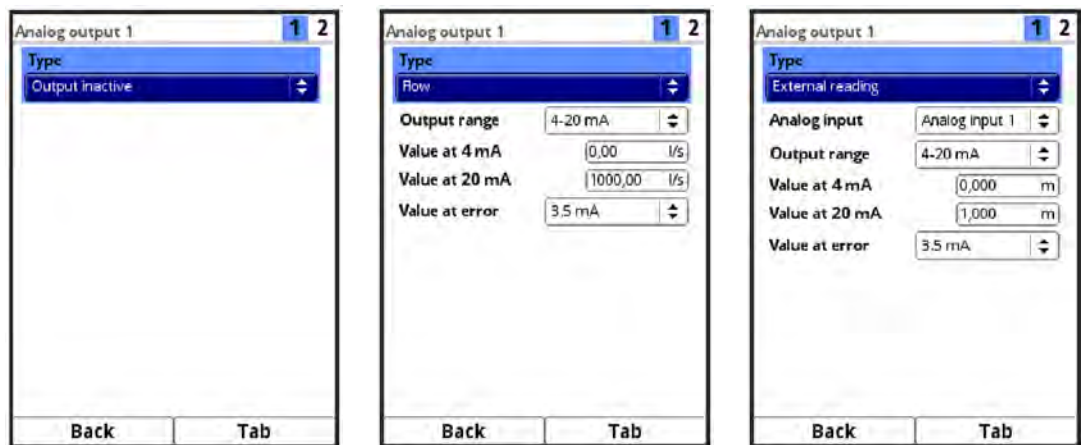


Fig. 34-16 Activation Analogue Outputs

The following functions of the analogue output are possible:

- **Flow**
The calculated flow rate of the application is output at the selected analogue output.
- **External Reading**
Measurement values applied to the analogue input and linearised, if applicable, can be output here again.
This function allows a fill level (e.g. the tank fill level) to be output in addition to the calculated flow value upstream of the hydraulic structure. To do this, the reference point for the calculation and thus also the zero point for the measurement of AI1 and AI2 (if AI2 is used) must be set at the lowest common point.

The following settings of **Output Range**, **Output Span** and **Value at Error** apply to all functions explained above.

- After selecting the function, the output range can be selected:
 - 0-20 mA
 - 4-20 mA
- Then set the output span.
- If the measurement value fails, an error behaviour can be set for the analogue output. The following settings are possible in the event of an error:
 - 0 mA
 - Hold value (hold the last reading that is still valid) (Hold))
 - 3.5 mA
 - 21 mA



Fig. 34-17 Analogue Input / Output Span / Value at Error

34.3.3 Digital Input

The HydraulicCalculator 2 is equipped with one digital input.

Default setting: digital input inactive.

Under Designation, a freely selectable name with up to 16 characters can be entered, which is displayed, for example, under Diagnostics for the respective digital input.

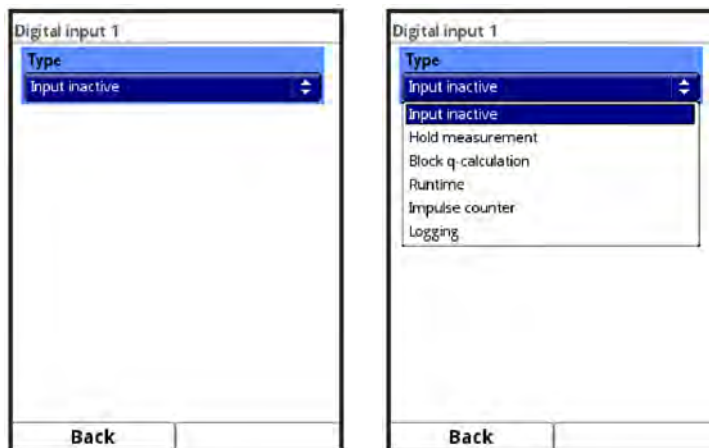


Fig. 34-18 Activation Digital Input

The following different functions can be assigned to the digital input:

- **Hold Measurement**
Activation of this digital input causes a "freezing" of the flow measurement value at the time of activation itself. Changing readings or values going to "0" no longer have any effect on the measurement value while the signal is applied to the input. The flow measurement value has an influence on a possible downstream process.
- **Block Q-Calculation**
By means of an external contact the flow calculation can be blocked as long as a signal is present at the digital input.
- **Runtime**
The duration of the signal present at the digital input is recorded and stored by the system. This recording is used, for example, for pump or device running times.
- **Impulse Counter**
The number of the signals present at the digital input is counted and stored by the system. The evaluation of the counting impulse is done by detecting the change of state of the digital input (1->0 or 0->1).

A minimum impulse duration of 100 ms is required for reliable detection.

- **Logging**

An applied signal is recorded and stored including start and end time (time stamp function).

Possible applications include e. g. access control, event recordings, runtimes etc.

The following settings of **Edge** or **Logic** and **Designation** apply to all functions explained above.

- **Edge:**

>rising< (change of state from "0" to "1") or

>falling< (change of state from "1" to "0")

- **Logic:**

>not inverted< or

>inverted<

- **Designation:**

manual input

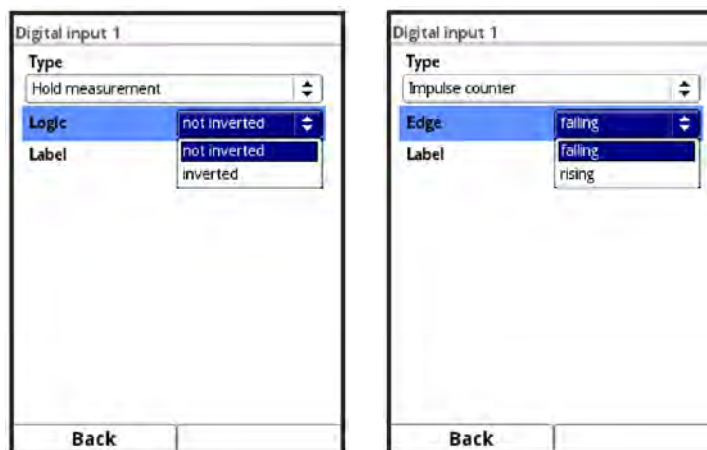


Fig. 34-19 Changeover options Edge and Logic

34.3.4 Digital Outputs

The both available digital outputs are shown in the top right corner of the display.

Pressing the right control key >Tab< selects the digital outputs one after the other. The selected output is shown in plain text in the top left corner of the display.

Default setting: digital outputs inactive.

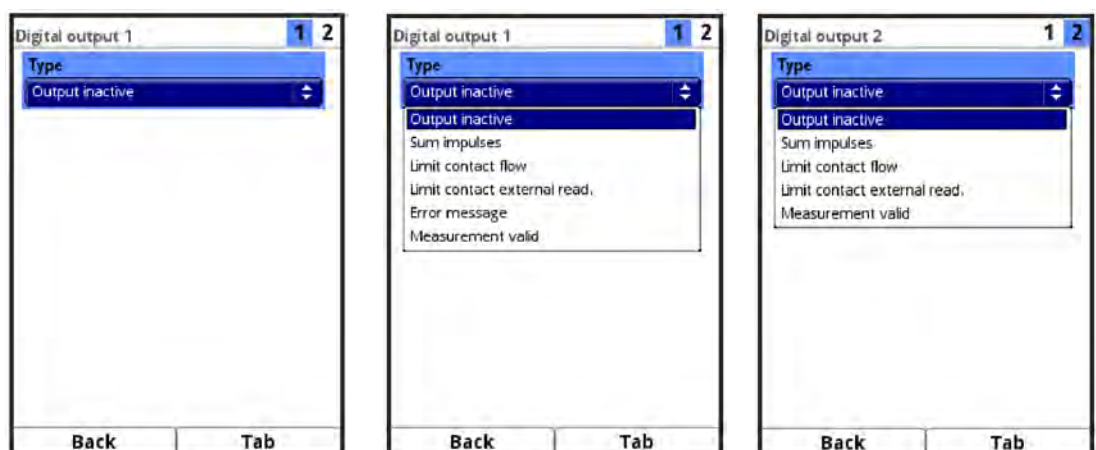


Fig. 34-20 Activation Digital Outputs

The following functions can be assigned to the digital outputs:

- **Sum Impulses**

Quantity-proportional sum impulses of the main sum counter ("Sum" in the main display) are output.

- Selection/input options:

Logic: >Normally open< or >Normally closed<

Negative sum impulses: check box

Quantity: manual input (impulses per quantity to define)

Duration: manual input (adjustable duration: 100...5,000 ms, the impulse/pause ratio is always 1:1)

If the output frequency of the impulse output is below the frequency of the flow rate when the flow rate increases sharply, the total impulses that have not yet been output are stored internally until the calculated flow rate falls below the impulse frequency again. After that, the sum impulses are processed.

In addition, it is possible to enable the output of negative sum impulses. If this box is activated, only the negative sums (backflow) are output. The positive sums are ignored.

Prerequisite for this selection:

Option 1: An application with backwater has been selected and the backwater in the application becomes so great that a reversal of flow direction occurs.

Option 2: A Q/h characteristic curve was selected and negative flow rates were entered in the table, or a negative maximum flow rate was entered for the selected exponential calculation.



Fig. 34-21 Setting Parameters Impulse Generator

- **Limit Contact Flow**

Set a flow limit value for >Threshold On< and >Threshold Off< respectively.

If this flow limit is exceeded, a digital signal is output. If the flow falls below the second flow limit value, this digital signal is reset = hysteresis function to prevent fluttering outputs.

- Selection/input options:

Logic: >Normally open< or >Normally closed<

Threshold On: manual input

Threshold Off: manual input

Amount: check

Value at error: >On< or >Off< or >Hold Value<

Delay: manual input (Relay only switches when the conditions for the state to be output are present without interruption for at least this entered delay time and continue to be present at the time switch point)

Hold: manual input (Prevent the digital output from reacting if the value briefly falls below a limit value)

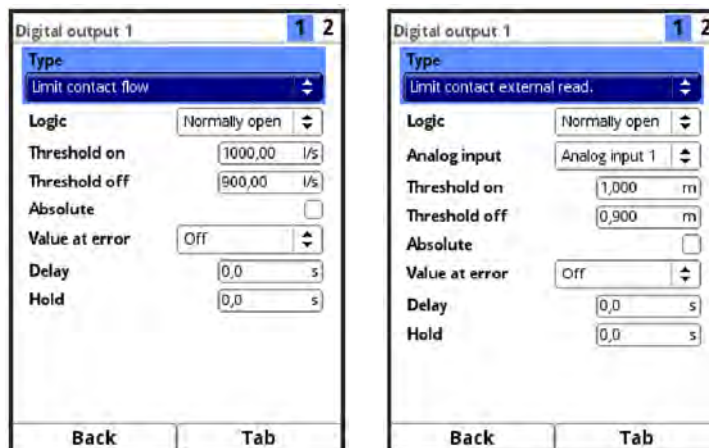


Fig. 34-22 Setting Parameters Limit Contact

- **Limit Contact External Reading**

The limit contact must be assigned to an active analogue input. Then a suitable value (e.g. Start of Impoundage, Start of Overflow, etc.) can be assigned.

The settings and functionalities correspond to the procedure for >Limit Contact Flow< (see Page 74).



Fig. 34-23 Setting Parameters Error Message

- **Error Message**

By activating the individual selection fields (check using the rotary pushbutton) the individual error types to be output can be assigned to the digital output.

The output of the system errors occurs, among other things, during manual booting and updating of the unit, during restart after a programme sequence error, during cold starts (start-up after power failure) and after setting the time.

The errors can - like the other functions - be output with a delay or continue to be output (hold) for a definable time after the cause of the error has been eliminated.

- Selection/input options:
 - Logic:** >Normally open< or >Normally closed<
 - Error mask:**
 - External Reading:** check box
 - System:** check box
 - Delay:** manual input

Hold: manual input



Digital output 2 cannot be selected as error output

Digital output 2 is not suitable as an error output since it is designed as a bistable relay. The relay remains in its last position in a de-energised state and cannot be used for error messages.

- Measurement valid (only in conjunction with Cycle/Clock Control Mode)**
 The flow calculator signals via this output that the measured values are valid for this measurement cycle.
 This time period is particularly important when using externally connected data loggers so that they can access data values in cycle/clock control mode (see Chapter "37.5.2 Cycle Mode / Clock Control"). Enter the value for "Hold" manually.
Info: this function is currently not supported.

34.4 Diagnostics

The diagnostics menu is required at the end of parameterisation or for troubleshooting during operation. Therefore, this menu is described after setting the parameters in Chapter "Diagnostics" starting at Page 98.

35 Parameter Menu Data

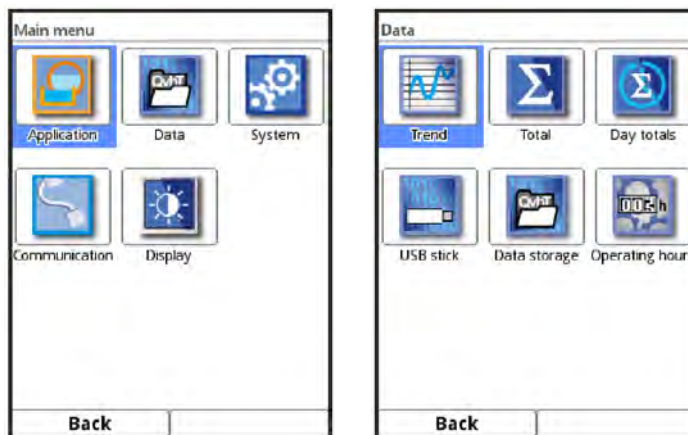


Fig. 35-1 Data Menu

The data menu is primarily a display menu (recorder functions, totals, operating times, etc.). Furthermore, internally stored measurement values as well as the parameterisation of the measurement instrument can be loaded onto a USB stick (to be plugged in).

35.1 Trend

The trend display is a visualising recorder function. When the trend display is selected, the previously stored (historical) measurement data can be accessed.

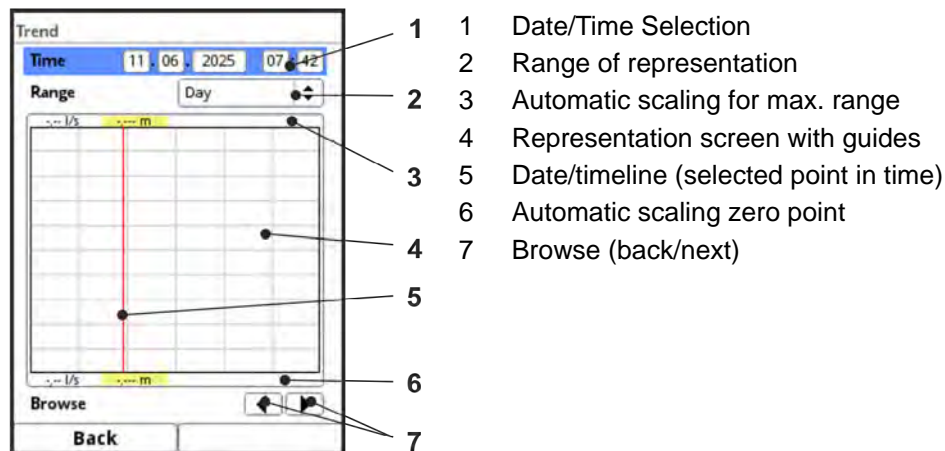


Fig. 35-2 Representation Trend Graph

Current Measurement Data

➡ Procedure for the representation of current readings:

1. Select the desired range (range of representation; Fig. 35-2 Pos. 2).
The selected range (up to the current time) is displayed. During the display, there is no automatic updating of the measurement data (the current measurement data is shown in the lower third of the main screen).
2. If necessary, use the arrows (Fig. 35-2 Pos. 7) to scroll forwards and backwards with the same basic display setting.
3. Press the left function key ("Back") several times to return to the main screen.

In the top area of the screen you can find the **Date/Time Selection** (Fig. 35-2 Pos. 1). The line is highlighted in blue and is therefore active.

➡ To select a specific point in time (historical measurement data), proceed as follows:

1. Press the rotary pushbutton - the first field (day) is activated.
2. Enter the desired day.
3. Press the rotary pushbutton again - jump to the next field (month).
4. Repeat the entry until the desired time is entered completely (day, month, year, hour, minute).
5. Confirm entry with the right function key. Date and time are adopted.
The display shows the measurement data of the selected date depending on the set time period (Fig. 35-2 Pos. 2).
The red vertical line (Fig. 35-2 Pos. 5) is on the selected point in time (date and time).

➡ To interrupt your input, press the left function key (Back).

Representation:

The selected period is shown from the left to the right edge of the display.

The **Time Period**, in which the data is to be displayed can be changed.

➡ This setting is made using the >Range< (see Fig. 35-2 Pos. 2).

1. Rotate the rotary pushbutton until >Range< is highlighted blue.
2. Press the rotary pushbutton - the selectable time periods become visible.

The choices are:

- (1) Hour
 - 4 Hours
 - (1) Day
 - (1) Week
 - 4 Weeks
3. Rotate the rotary pushbutton until the desired range is highlighted blue.
 4. Confirm entry with the right function key. The selected range is adopted.

Representation:

Selection	Representation in the Display Area		
	Left Margin	Right Margin	Guides
Hour	0 Minutes	59 Minutes	15 Minutes each
4 Hours	0/4/8/12/16/20 o'clock, depending on the set time	4 Hours later	1 Hour each
Day	0 o'clock	24 o'clock	4 Hours each
Week	Monday, 0 o'clock	Sunday, 24 o'clock	1 Day each
4 Weeks	Monday, 0 o'clock	4 Weeks later, Sunday, 24 o'clock	1 Week each, time reference point for the start: 01.01.2010, 0 o'clock

Tab. 8 Explanation of the periods displayed



Note

For the time period >4 Weeks< it may take a few seconds until the data is completely loaded.

Below the display you can find the **>Browse< function**.

- ➡ Browse forwards or backwards using the arrow symbols: by one selected period unit (Hour, 4 Hours, Day, Week or 4 Weeks) each time the button is pressed.

35.2 Total

The total sums, divided into positive and negative totals, are displayed. The total sum is the arithmetical sum of the positive and negative total.

Application example:

Since the commissioning of a discharge sill subject to backwater, 10,000 m³ have flowed from the sewer into the receiving water. In the same period, 2,000 m³ flowed back from the receiving water into the sewer due to backwater.

The display now shows:

- *Total 8,000 m³*
- *Positive total 10,000 m³*
- *Negative total 2,000 m³*

The resettable totals are shown in the bottom area. Their meaning and operation is basically identical to the totals described in the upper section. The resettable totals can, if required, be set to "0" after reading after any period of time via the button **>Reset total<** and count up the totals again from this point on. This makes it easy to determine flow rates between two reading cycles. For security reasons, the reset must be confirmed by entering the password.

35.3 Day Totals

Here, the total flow values or also daily average values can be read in the displayed table. The values are 24-hour values in each case.

The entered update time shows the time at which the value formation takes place daily. This means that the entered value refers to the time range from 24 hours before this date/time to the set date/time.

As per **Default**, the values are always formed at 0.00 o'clock.

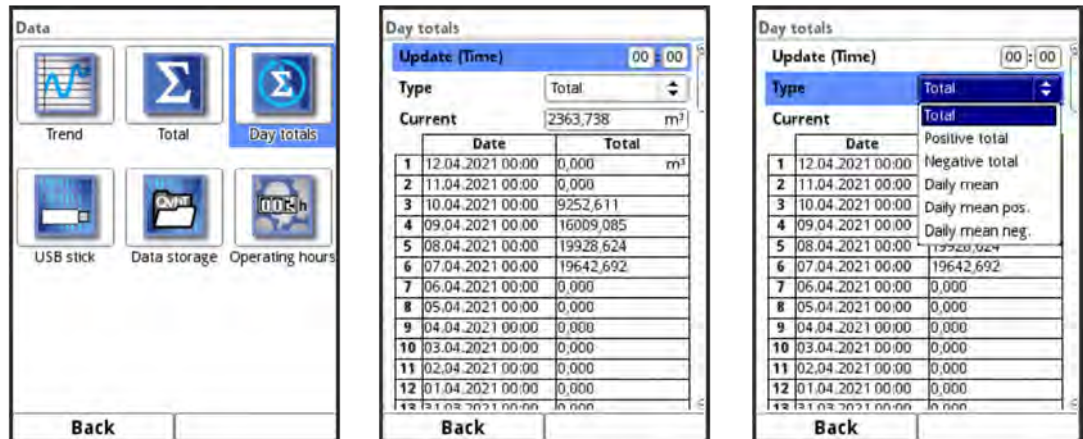


Fig. 35-3 Selecting Day Totals

The representation of the right table column can be changed by means of the setting >Type< . The following display setting options are possible:

- Total: total sums over 24 hrs each
- Positive total: positive totals over 24 hrs each
- Negative total: negative totals over 24 hrs each
- Daily mean: averaged value of the total sum over 24 hours each
- Daily mean pos.: averaged value of the positive total over 24 hours each
- Daily mean neg.: averaged value of the negative total over 24 hours each

Below the button for setting the type, the current daily value is displayed in >Current< . This reading will be moved to the first row of the table at the next update time (after 24 hours at the latest).

A maximum of 100 daily values (= 100 days on which a value was recorded) are stored. From value 101 onwards, the oldest value is always overwritten (ring memory).

- Turn the rotary pushbutton to the right to scroll down in the table; to the left to scroll up again.

In this way, older daily values can also be displayed. A prerequisite for the display of older values is that the device has also been running for a longer period of time.

Example: 98 values - The device has been running for 98 days

Generally, only the daily values can be read on which the flow calculator was actually in operation.

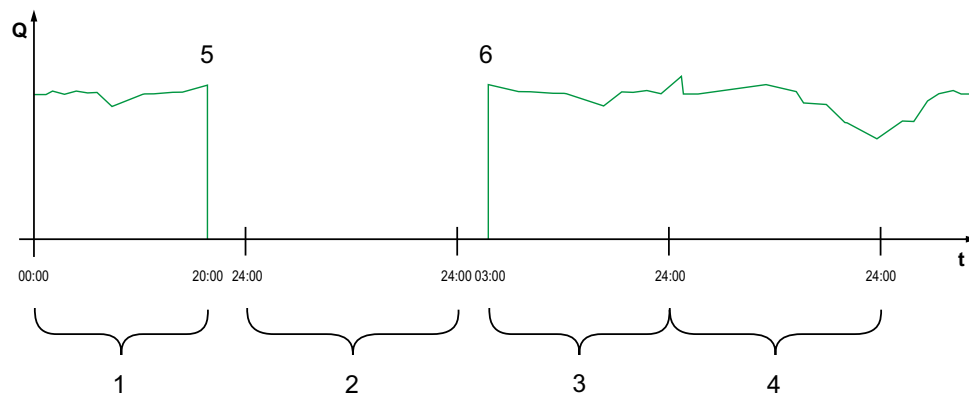
If the flow calculator is switched off between two totalising events (< 24 hours), the flow calculator computes a total from the **measured** values. This total does **not** correspond to the **actual** daily quantity that flowed, but to the quantity that the flow calculator measured while it was switched on.

When determining the daily average values, the "0" values during the switched-off period are included in the calculation.

Example:

There is a constant flow rate of 1,000 m³/h. If the flow calculator was switched off between 08:00 and 10:00 o'clock, then it measures nothing for two hours. In that case, a total flow rate of 22,000 m³ is displayed at the end of the day. However, 24,000 m³ actually flowed. The flow calculator has stored a flow rate of 0 m³ for the duration of these two hours and added it as a valid value to the total flow rate. The daily total does not show that the flow calculator did not measure for two hours on this day.

If the flow calculator is switched off before the time of the next totalising and then remains switched off until the time of the next totalising (> 24 hours), the flow calculator does not calculate a total or an average value for this period of time (see Fig. 35-4). No data is stored and the time period remains unknown. This "gap" can be recognised by the fact that the relevant entry (date/values) is completely missing in the list sequence. No blank lines are shown.



- 1 Total Day 1: total of 20 hours
- 2 Day 2: power failure - no totalising
- 3 Total Day 3: total of 21 hours
- 4 Total Day 4: total of 24 hours
- 5 Power failure
- 6 Power back again

Fig. 35-4 Scheme of Totalising

- The **time** of the totalising is 00:00 o'clock **by default**, but can be changed as described below.
- The factory setting of the time results in the **time period** of the totalising or averaging between 00:00 and 24:00 o'clock. This means that the daily total is always computed between 00:00 and 24:00 o'clock.

➡ Changing the time of totalising is done as follows:

1. Rotate the rotary pushbutton until >Update (Time)< is highlighted blue.
2. Press the rotary pushbutton - the hour section is activated.
3. Enter the desired start time for the totalising (e.g. 08:00) and turn to the minute section.
4. Specify the minute value.
5. Confirm the values with the right >Enter< function key.
The time of totalising is changed to 08:00 o'clock.
This automatically calculates the 24-hour value from 08:00 o'clock to 08:00 the next day.

35.4 USB Stick

Requirements for the USB stick used:

- formatted as FAT 32 (or FAT 12 or FAT 16) (the flow calculator cannot read NTFS or exFAT)
- maximum permissible memory size 32 GB (alternatively a larger USB stick that has been "force-formatted" to FAT 32)
- Partitioning table: MBR (GPT currently not supported)

Working with the USB Stick:

➡ Plug the USB stick into the slot above the display.

Function:

- Transmission of measurement data to USB stick
- Backing up device parameters to the USB stick
- Retransfer of saved parameters from the USB stick to the device
- Formatting the USB stick

The flow calculator has an internal data memory. If required, part of the measurement data or all stored measurement data can be transferred to a USB stick.

Per default, the flow calculator offers the transmission period since the last data transmission up to the current time. This transmission period can be adjusted, however.

➡ To save data to USB stick proceed as follows:

1. Press the rotary pushbutton - the first field is activated.
2. Turn the rotary-push button to select the day of the desired start time.
3. Press the rotary pushbutton again - now the month can be specified.
4. Repeat the process until the desired date and time have been entered completely.
5. Confirm the start time with the right >Enter< function key.
6. Turn the rotary pushbutton - the field >to< is highlighted blue.
7. Turn the rotary-push button to select the day of the desired end time.
8. Set the end time in the same way as the start time.

This sets the time period for the data to be transferred to the USB stick.

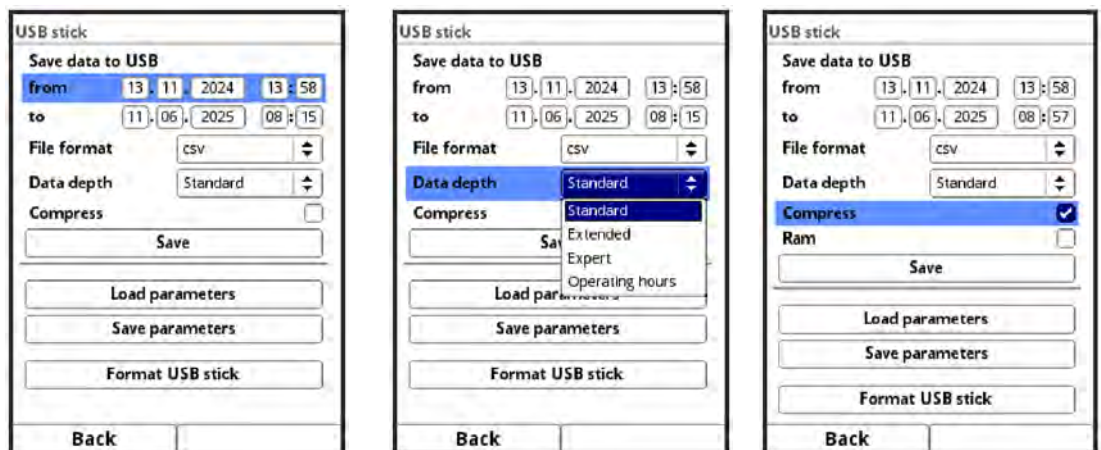


Fig. 35-5 Transmission Period/Data Depth/Compression

9. To select the desired file format, press the rotary pushbutton - a selection menu opens.
The choices are: txt and csv.
10. Press the rotary pushbutton to accept the file format.

The adjustable **data depth** comprises four possible selection ranges (whereby 'Standard', "Advanced" and 'Expert' are currently identical in terms of content):

- **Standard**

The stored data sets contain the following information:

- Date and Time
- Totaliser
- calculated Volume
- Current values and the values calculated from them for the activated analogue and digital inputs The totals saved in the menu >Data< / >Day Totals< as well as the positive and negative totals are stored on the plugged USB stick after selecting and pressing the button >Save<.

- **Extended**

The stored data sets contain the following information:

- All data sets from the previous data depth >Standard<

- **Expert**

The stored data sets contain the following information:

- All data sets from the previous data depth >Standard<

- **Operating Hours**

The operating hours per day saved in the menu >Data< / >Operating Hours< are stored on the plugged USB stick after selecting and pressing the button >Save<.

The **>Compress< function** is only useful for transmitting large amounts of data. In this case, the selected files are zipped into the ".zip" format. If this option is checked, **>Ram<** can also be selected and the data is written to the internal Ram memory (approx. 16 MB) instead of a USB stick. The selected, stored data can then be retrieved from this ram memory, e.g. via remote access.

- Once the transfer period, data format and data depth have been defined, save the data to the USB stick.

1. Activate the >Save< field.
2. Press the rotary pushbutton to save the data to the USB stick.

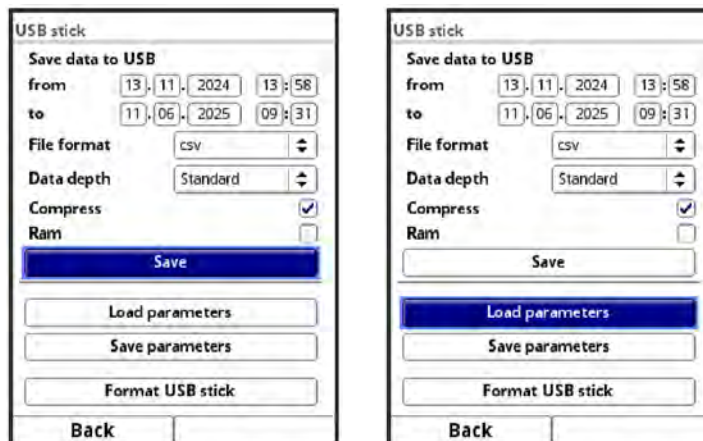


Fig. 35-6 Save/Load Parameters

With the function **>Load Parameters<** a previously saved parameter file can be loaded from the USB stick to the flow calculator.

With the **function >Save Parameters<** the set parameterisation of the measurement place can be loaded to the USB stick. Here two files are created and saved.

The files have the following formats:

- XXXX_DOC_AABBCCDDEE.pdf**

This file is for documentation purposes and can be opened and printed directly using a pdf reader. In the header, it contains information on the flow calculator type, date and time of parameterisation, firmware, serial number and article number of the Current values and the values calculated from them for the activated analogue and digital inputs.

Basic parameter settings such as measurement place description/dimensions, used and parameterised level sensors, used flow velocity sensors in relation to type, installation position, installation height, installation angle etc. are output.

In addition, the display of the parameter settings of analogue and digital inputs and outputs, a possibly parameterised controller incl. its parameters, various system information such as time/date format, country and device settings as well as Modbus and display settings.
- XXXX_PAR_AABBCCDDEE.xmz**

This file contains the complete parameter set of the flow calculator. It is used to save the parameterisation that has been set and can only be read by the device due to the file format.

Information on File Naming:

XXXX	=	Name of the measurement place set
AO	=	Year
BB	=	Month
CC	=	Day
DD	=	Hour
EE	=	Minute

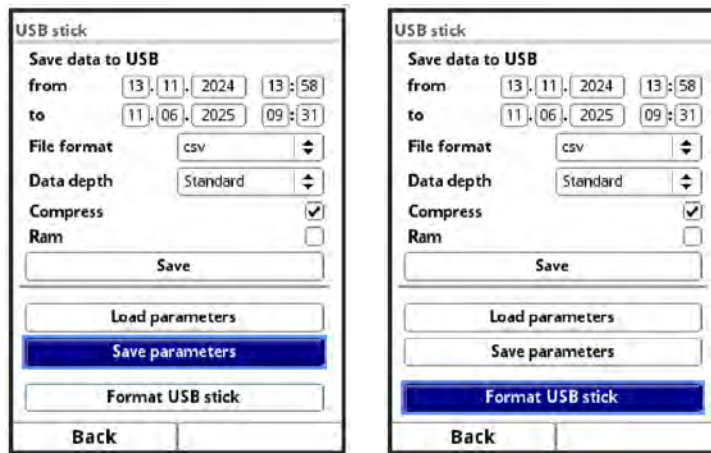


Fig. 35-7 Save Parameters/Format USB

- Unformatted or incorrectly formatted USB sticks can be converted to the correct storage format directly at the device:
 1. Rotate the rotary pushbutton until >Format USB Stick< is highlighted blue.
 2. Press the rotary pushbutton - the plugged USB stick is formatted.
When the USB stick has been formatted, the message >SUCCESSFUL< appears on the display.

35.5 Data Memory (Internal)

In this submenu you can change the storage cycle and delete the internal data memory.

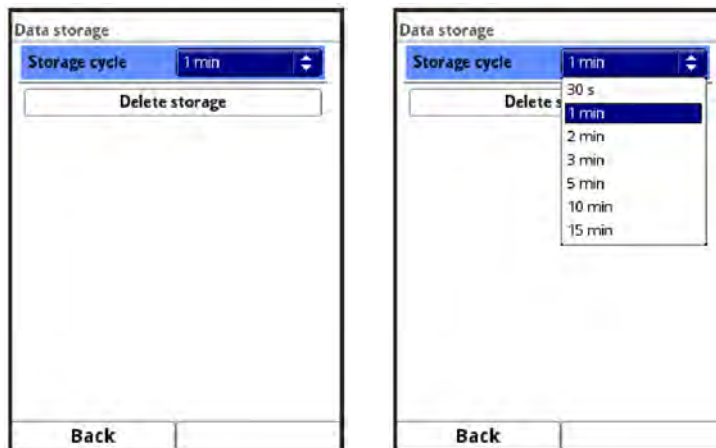


Fig. 35-8 Data Memory

Selection options for the >Storage Cycle< are:

- 30 s, 1 min, 2 min, 5 min, 10 min, 15 min

Default setting for the storage cycle: 1 min

The average value over the selected cycle is **always** saved, not the instantaneous value at the time of saving.

By using >Delete Storage< the stored measurement data in the internal data memory can be deleted. The data is password protected to prevent accidental deletion.



Deleted data cannot be restored!

➡ Procedure:

1. Enter the password to delete the data.
2. Confirm password with the right function key >Enter<.

35.6 Operating Hours

Here, the number of total operating hours and the individual daily totals can be read in the displayed table. The table values are 24-hour values in each case.

Date		Operating hours
1	10.06.2025	00:00
2	09.06.2025	00:00
3	08.06.2025	00:00
4	07.06.2025	00:00
5	06.06.2025	00:00
6	05.06.2025	00:00
7	04.06.2025	05:13
8	03.06.2025	00:07
9	02.06.2025	00:00
10	01.06.2025	00:00
11	31.05.2025	00:00
12	30.05.2025	04:24

Fig. 35-9 Selection Operating Hours

>Total Operating Hours< shows the operating time of the system since the supply voltage was applied. It runs continuously when voltage is applied and stops when the power supply is interrupted.

Display format:

xx:yy:zz (days:hours:minutes)

>Current< shows the operating time of the measuring system for the current day.

Below this is a table with the daily totals.

A maximum of 100 total values (= 100 days on which a value was recorded) are stored. From value 101 onwards, the oldest value is always overwritten (ring memory).

➡ Turn the rotary pushbutton to the right to scroll down in the table; to the left to scroll up again.

In this way, older values can also be displayed. A prerequisite for the display of older values is that the device has also been running for a longer period of time.

Example: 98 values - The device has been running for 98 days

Generally, only the values can be read on which the flow calculator was actually in operation.



Note

The operating hours counter is intended for control purposes and for this reason cannot be reset.

36 Parameter Menu System

36.1 Information

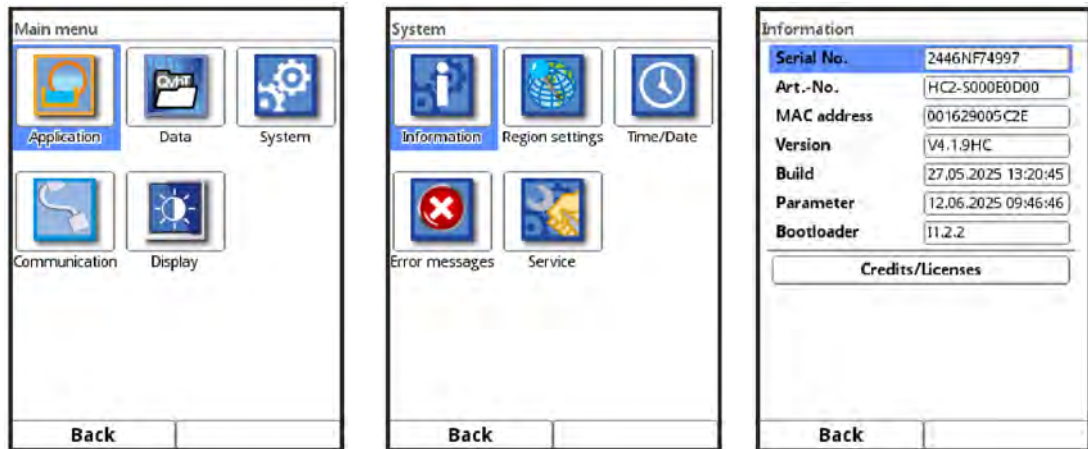


Fig. 36-1 Submenu System / Information

This menu is a display menu. It contains the following information about the flow calculator and the connected sensors and devices:

- Serial number and article number
- MAC Address
- Firmware version
- Bootloader data
- Date of the last software update (firmware) and the last parameter storage
- Information about Open Source Software used (Credits/Licences)

By pressing the button **>Credits/Licenses<** at the end of the display, the descriptions and links of the open programmes used in the flow calculator are saved as pdf to a USB stick to be inserted.

➡ See also Chap. "47 List of Sources of the Licences and Codes used".

This menu is primarily used by the authorised service for (initial) information during commissioning, checking or troubleshooting (on site or by telephone).

36.2 Country Settings

In this menu you can make the following settings:

- (Operating) Language
- Date Format
- Units of the measurement values
A distinction can be made here between the units used in the display and the units used for reading out data.



Fig. 36-2 Region Settings / Language / Date Format

36.2.1 (Operating) Language

All listed languages (Fig. 36-2) provide texts in the national language or the substitute language English.

The current selection is:

- English, German, French, Italian, Spanish, Portuguese, Swedish, Danish, Finnish, Polish, Hungarian, Romanian, Czech, Russian, Korean and Chinese

36.2.2 Date Format

The following date formats can be set:

- DD.MM.YYYY (Day/Month/Year)
- MM/DD/YYYY (Month/Day/Year)

36.2.3 Units

➡ Procedure:

1. Rotate the rotary pushbutton until the field >Units< is highlighted blue.
2. Press the rotary pushbutton - the PLUS at the front turns to MINUS and a selection list opens.
3. Turn the rotary pushbutton to the respective selection field.

Decimal Separator

- Comma (,)
- Dot (.)

The decimal separators entered here are only used for the display of the flow calculator.

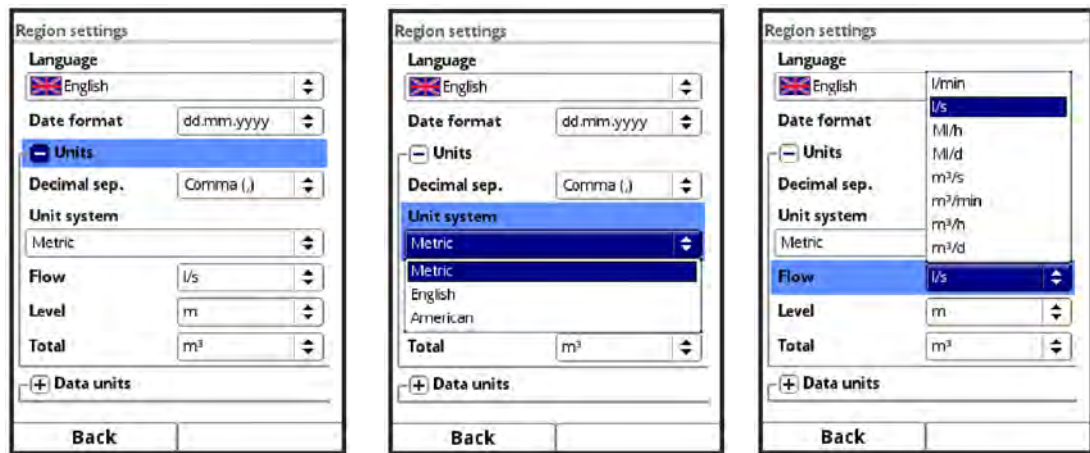


Fig. 36-3 Units System

Units System

The choices are:

- Metric
- English
- American

The adjustable units depend on the selection of the unit system:

- In the metric system - e.g. l, m³, cm/s, m³/min etc.
- In the English system - e.g. ft³, in, ft³/s, Mgal/d etc.
- In the American system - e.g. gpm, in, ft/s, mgd etc.

Units for the representation in the display for

- Flow
- Level
- Total

36.2.4 Data Units

➡ For the setting >Data Units<, proceed in exactly the same way as for the >Units<.

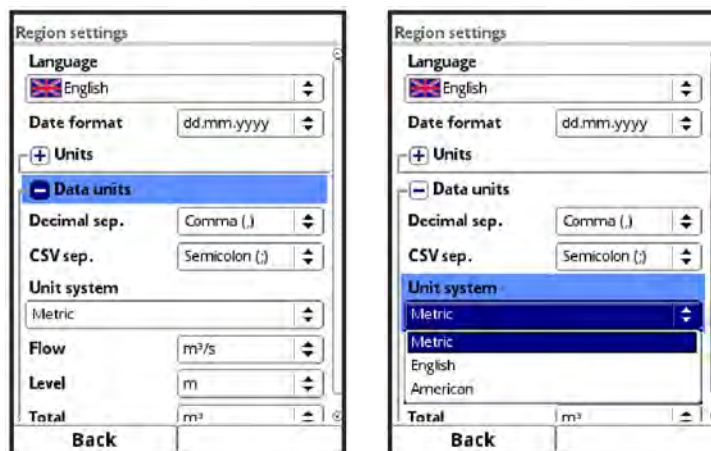


Fig. 36-4 Data Units

The units in which the recorded measurement values are **output** are specified in the >Memory Units<.

>Decimal Separator<

- Comma (,)
- Dot (.)

The specification of the decimal separators is important for the correct reading of the data. Especially when evaluating the measurement data with a software in another language (e.g. English Excel), make sure that the decimal separators are correctly selected.

>CSV Sep.< (CSV Separator)

- Comma (,)
- Semicolon (;)

This selection determines how the individual data are separated in the .csv file when reading out the data.

>NIVUS Header<

By checking this box, you can activate the saving of the file header with the name of the measurement place, serial and article number of the flow calculator as well as information on the firmware version.

Standard Excel applications as well as the NIVUS evaluation software have no problems displaying this useful additional information. If other programmes have problems reading in or evaluating the data, leave the header switched off.

>Units System<

The choices are:

- Metric
- English
- American

The adjustable units depend on the selection of the unit system:

- In the metric system - e.g. l/s, m³/s, m³/d, cm/s etc.
- In the English system - e.g. ft³/s, in, gal/min, Mgal/d, in/s, yd/s etc.
- In the American system - e.g. gps, gpm, cfs, cfm, cfh, cfd, mgd etc.

Units for the Storage of Measurement Data for

- Flow
- Level
- Total

36.3 Time/Date

In this submenu, the current date and the system time of the flow calculator can be changed.

The function is needed for the changeover from summer to winter time or after a failure of the internal back-up battery and after a power failure. If the flow calculator is operated for a longer period of time, the internal clock may deviate. These deviations can be corrected here.

**Note**

Changing the system time affects the storage of the data. If data storage is activated, duplicate data or data gaps may occur after system time changes.

Setting of the current system time and the time deviation from UTC.
In addition, a time server (SNTP) can be configured here.

This setting can only take effect with an active Internet connection.

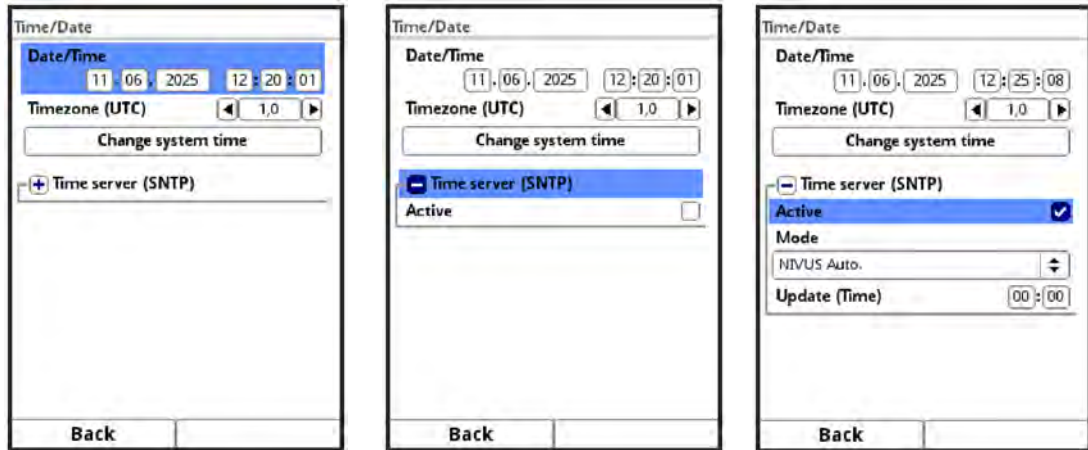


Fig. 36-5 Setup

36.4 Error Messages

In this menu, the current pending error messages and the error memory containing previous errors can be called up. Moreover, the error memory can be deleted.

The data is password protected to prevent accidental deletion.

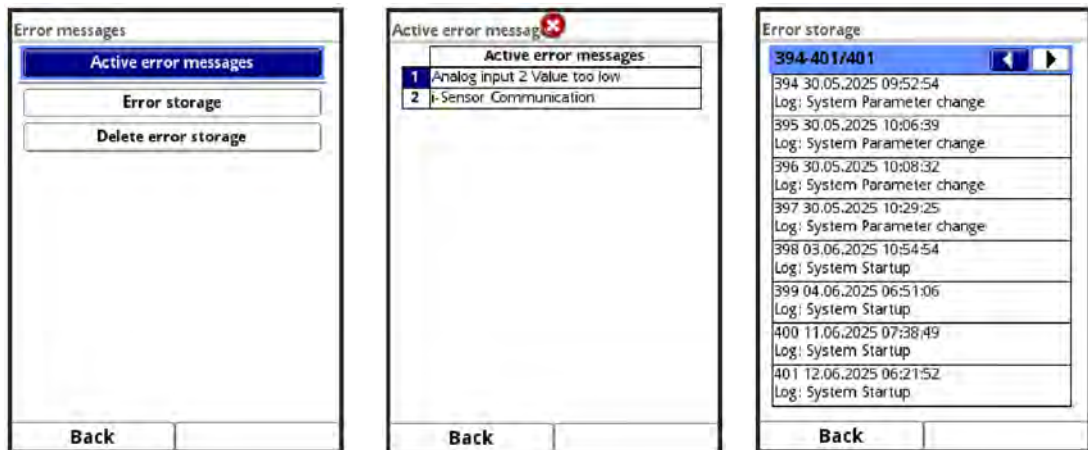


Fig. 36-6 Error Messages

36.5 Service

This submenu contains the following functions:

- Service Level
- Change Password
- Feature Unlock
- Restart (of system)
- Restart Measurement
- Parameter Reset
- Disable Coin Cell
- Update HC2 (only in service level with password)

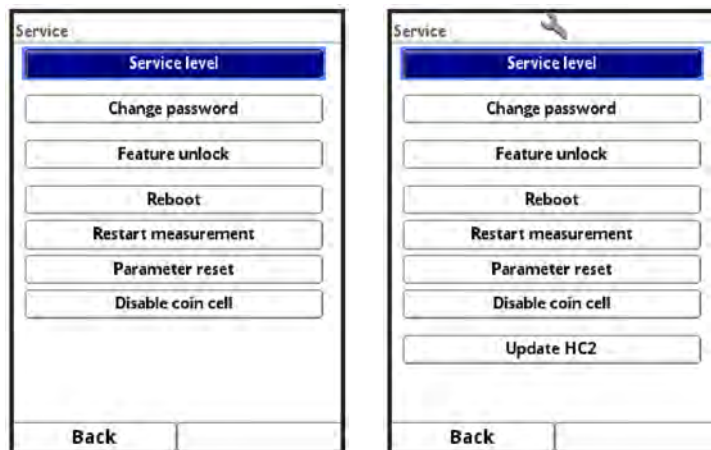


Fig. 36-7 Service

36.5.1 Service Level

Under the service level, which can be activated with the password of the flow calculator, additional functions and settings are stored in various places.

The other service levels are reserved for the NIVUS customer service and authorised specialist companies and are therefore also protected with special service passwords.

System-relevant changes and special settings for special applications are set here.

These changes may only be made by the NIVUS commissioning personnel!

36.5.2 Change (System) Password

Default setting of the password: "2718"

NIVUS recommends changing this password to protect the system from unauthorised access. The password can be chosen freely, although it is limited to ten characters.

For your own security, we recommend that you only give your password to **authorised persons**.

A password that you have changed **cannot** be recovered by NIVUS!

If the password is lost, the entire system must be reset, which leads to the loss of set parameters and requires a new parameterisation.

Write down the password and keep the note in a safe place.

➡ See also Chapter "32.2 Change Password".

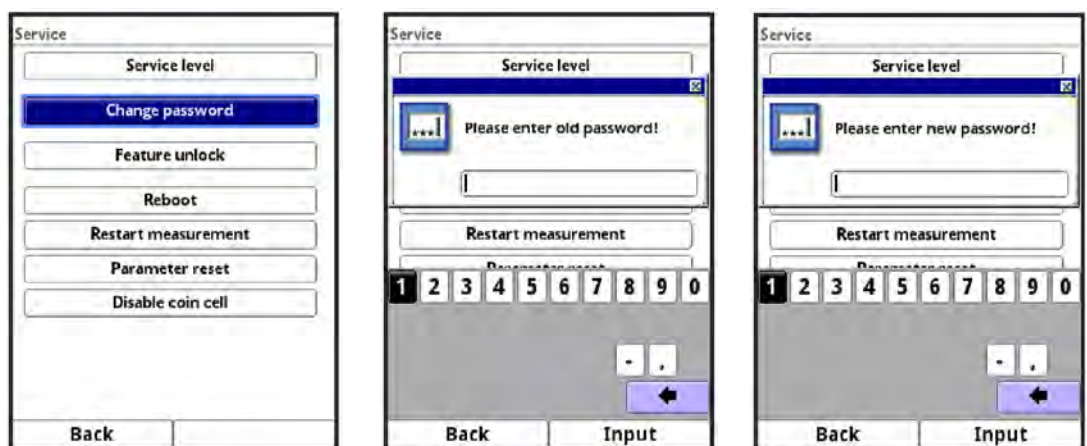


Fig. 36-8 Changing the (System) Password

36.5.3 Feature Unlock

This parameter currently has no function, as there are no functional enhancements for HydraulicCalculator 2 yet.

36.5.4 Restart

A restart of the flow calculator interrupts the current calculation process.

The system boots using the set (saved) parameters. After booting, the system behaves as when it is switched on (analogous to the PC).

This menu point replaces switching the system off and on again. All parameters, counters and stored data are retained.

36.5.5 Restart Measurement / Calculation

When the measurement / calculation is restarted, the currently running calculation is aborted and a new calculation is started.

The flow calculator holds the previous display, calculation and output values for the duration of the measurement / calculation restart and takes over the new values after the measurement / calculation has been restarted successfully.

36.5.6 Parameter Reset

During parameter reset, all parameters are reset to the default settings. Counter readings, changed passwords and stored measurement data are retained in the system.

The actual resetting of the parameters is only carried out after exiting the parameterisation (back to the main menu) and confirming the storage. Until then, the process can still be cancelled.

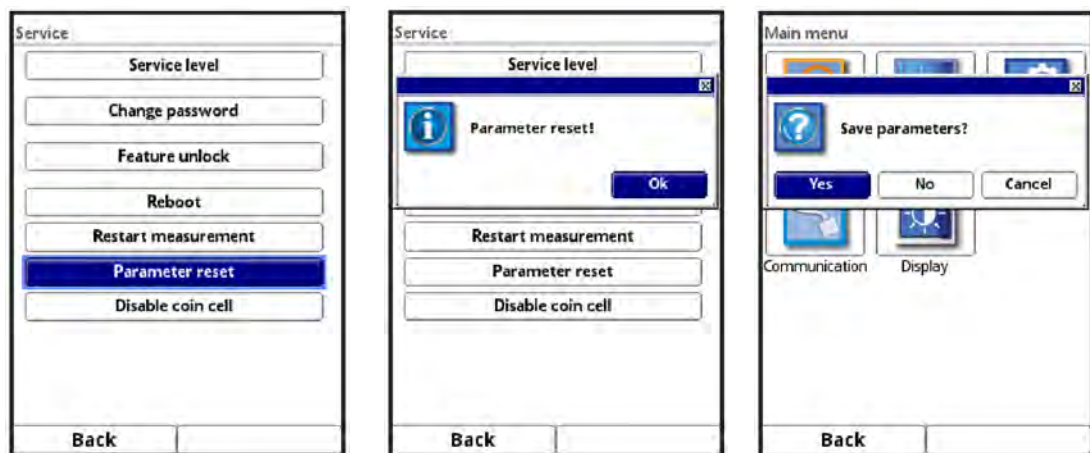


Fig. 36-9 Resetting the Parameters to Default

36.5.7 Disable Coin Cell

Disables the coin cell (internal back-up battery in the flow calculator) to save energy when the flow calculator is stored.

➡ Procedure for disabling (including enabling to operate the flow calculator again):

1. Click >Disable Coin Cell< and confirm the message with "Yes".
2. Disconnect the unit from the mains within a few seconds (switch off the power) so that the function remains active. If the flow calculator is not off the mains power for a short time, it automatically switches the function off again.

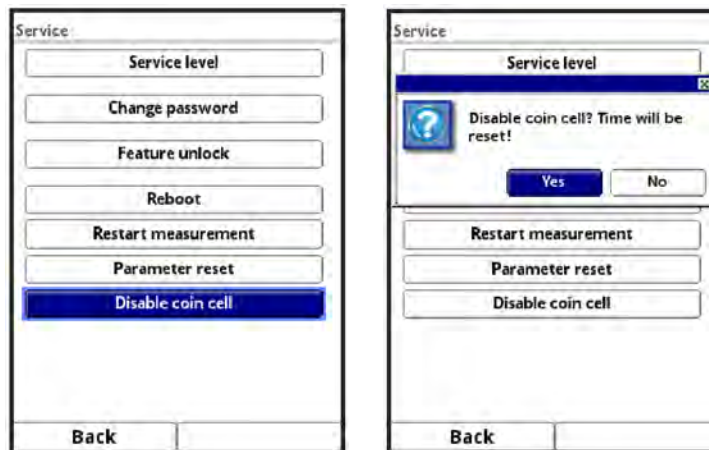


Fig. 36-10 Disable Coin Cell

➡ Procedure for enabling to operate the flow calculator again:

1. Connect the transmitter to mains power. The device is initialising.
2. Set the date, time and, if necessary, the time zone according to Chap. "36.3 Time/Date" and exit.
The transmitter operates normally again.

36.5.8 Update HC2

Upload of a HydraulicCalculator 2 firmware saved on USB.
Access possible in the service level.



Only in consultation with the companies of the NIVUS-Group

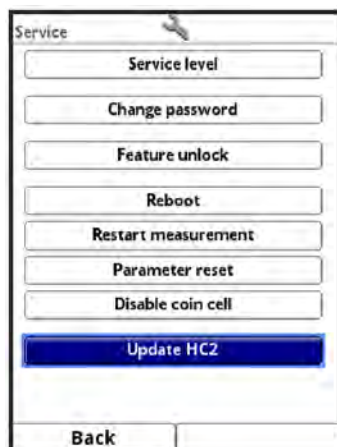


Fig. 36-11 Update HydraulicCalculator 2

37 Parameter Menu Communication

In this menu you can establish communication with other devices.

In addition, you can integrate the unit into a network here. Details are only partially described here.

If you do not have the necessary IT knowledge, leave this activity to either an IT specialist or the NIVUS commissioning personnel.

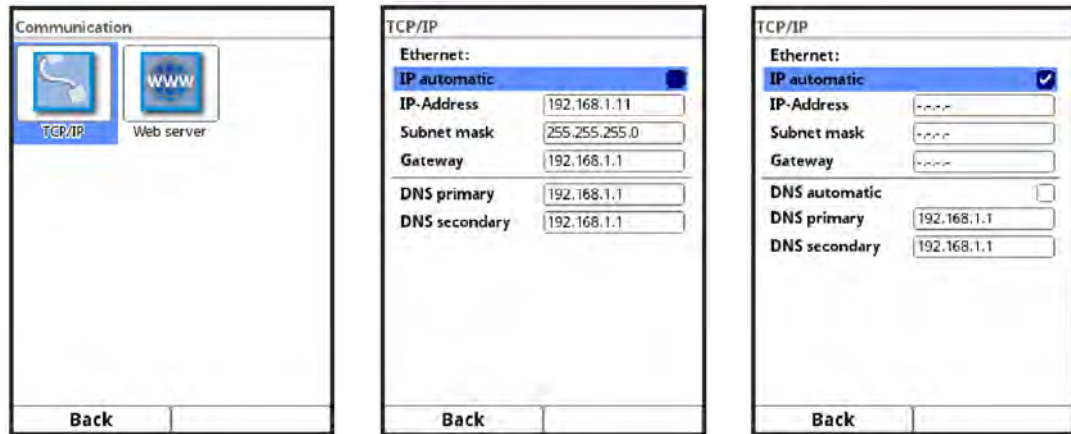


Fig. 37-1 Communication / TCP/IP

37.1 TCP/IP

Settings for data transport in a decentralised network. Settings for the IP address and the domain are adjusted here or just displayed.

>IP automatic<:

If activated (check box), the IP address is automatically obtained from the network via DHCP; the addresses are only displayed and cannot be changed by entering them; if the function is activated, the DNS can be automatically selected in the same way.

>IP-Address<:

Address within local network

>Subnet Mask<:

Description of the local network

>Gateway<:

Router address (only if available)

>DNS<:

Addresses of the name servers for address resolution; split into primary and secondary; except if >DNS automatic< is activated, then only primary.

37.2 Web Server

Here you can configure the settings required for remote operation of the HydraulicCalculator 2. The web server makes all (operating) functions available via the Internet as an alternative to on-site operation.

The access data to the HTTP or FTP web server are defined here. The HTTP server allows remote operation via a web browser, the FTP server allows data transfer via an FTP programme.

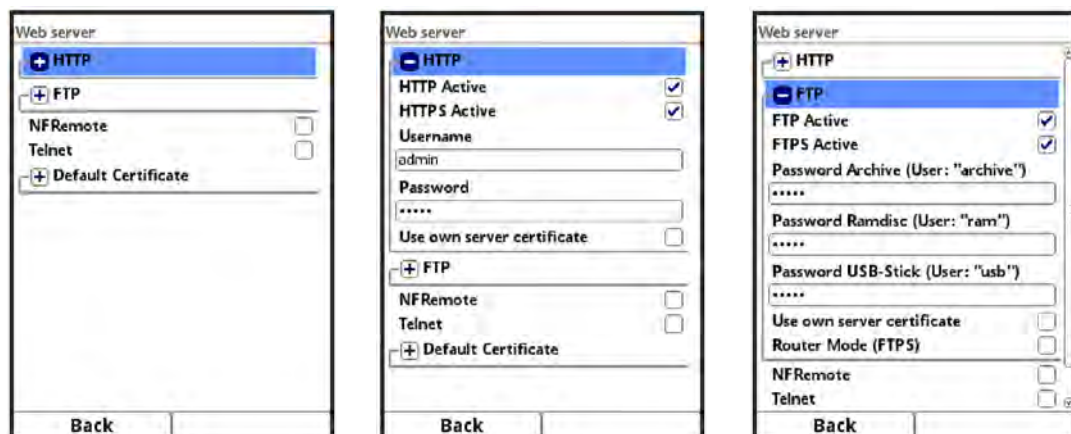


Fig. 37-2 Web Server

HTTP:

- **>HTTP Active<:**
Activation of unencrypted access via port 80
- **>HTTPS Active<:**
Activation of encrypted access via port 443
- **>Username<** and **>Password<:**
Must be set to enable access.
Default setting: admin / nivus
- **>Use own Server Certificate<:**
Check box and select file

FTP:

- **>FTP Active<:**
Activation of unencrypted access via port 21
- **>FTPS Active<:**
Activation of encrypted access via port 21
- **>Password xxx<:**
Access to the various "drives" via the user name; only parameterisation of the passwords required;
Default setting: nivus
- **>Use own Server Certificate<:**
Check box and select file
- **>Router Mode (FTPS)<:**
Check and enter external IP address or corresponding ports (Port Start / Port Num); special FTP mode for TLS via router



The parameter settings in the flow calculator and router must match.

NF Remote:

- **>NF Remote<:**
Allow remote access via special application.
Not recommended!

Telnet:

- **>Telnet<:**
Allow remote access via Telnet.
Not recommended!

Standard Certificate:

- **>Standard Certificate<:**
Enter / change the certificate used; enter/select IP address and domain type (IP / name) or load **>Root Certificate<** from USB stick;
the device has its own certificate, but can load a third-party certificate via the USB port if required.

38 Parameter Menu Display

The following changes can be made for the main display in the display menu:

- Backlight (intensity)
- Lockscreen, Dim backlight and Switch off display (period until switch-off)
- Name of the five display fields of the main display
- Decimal places of the individual value representations

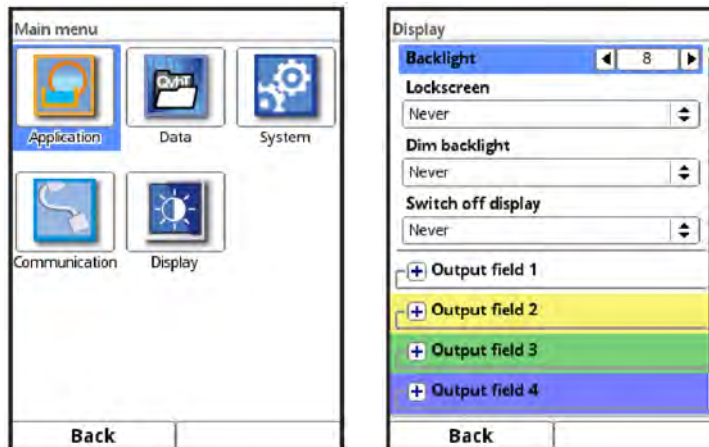


Fig. 38-1 Display / Backlight / Delay Time

Backlight

You can change the backlight in ten levels.

Adjust the backlight to the ambient conditions. Avoid setting the display too bright.

NIVUS recommends setting the automatic display dimming / **Dim backlight** or display switch-off here to protect the display and extend its service life.

The display switches off automatically if you have not used it for a certain time. You can define this time via the delay time / **Switch off display** (Never, 30 s, 1 min, 2 min and 5 min).

As soon as you make any setting on the flow calculator (e.g. press a key), the display immediately switches back to the standard brightness.

If you want to ensure that the flow calculator display can only be reactivated by authorised persons, use the **>Lockscreen<** function. Then the password for the flow calculator must be entered before the display can be used again.

Default settings: >Backlight< on level „8“, >Lockscreen<, >Dim backlight< and >Switch off display< = "Never".

Output Fields

The output fields 1...5 of the main display can be freely defined in terms of designation and the number of decimal places.

The two analogue inputs can be assigned to output fields 2 and 3 or alternatively selected as 'inactive'.

For the output fields 4 and 5, you can also select under >Value< which value should actually be displayed.

All adjustable types of analogue inputs (AI) or 'Total', 'Total positive', 'Total negative', 'Daily Average', 'Daily Average positive' and 'Daily Average negative' are possible.

**Note**

The assignment of the values to the fields can **NOT** be changed in output field 1. The change can only be made in the output fields 2, 3, 4 and 5 by selecting "Value".

Example: The calculated flow rate is **ALWAYS** output in the flow field (output field 1), even if you have changed the designation to "Temperature".

The highlighted colours of the output fields correspond to the colours of the values in the main display.

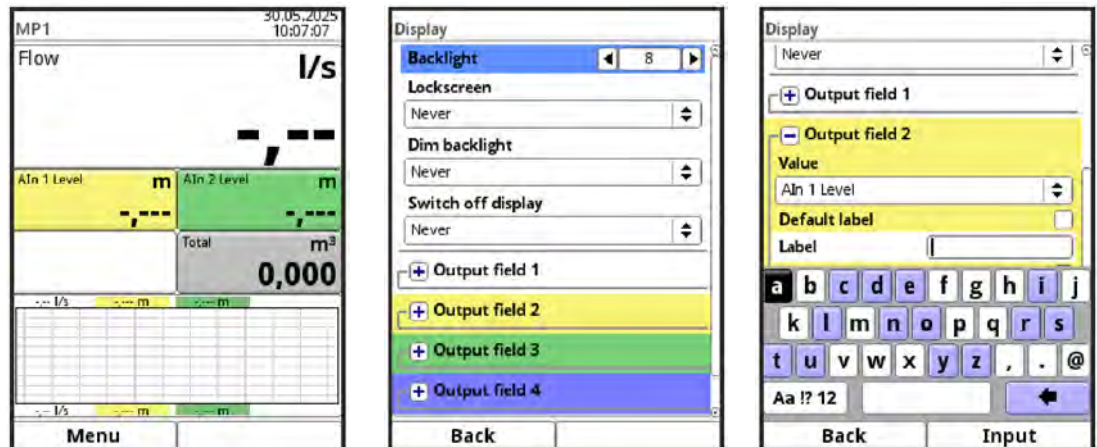


Fig. 38-2 Change Output Fields, Colours and Designation

➡ Procedure to **change the name**:

1. Expand the output field.
2. Uncheck the >Default Label< box.
3. Enter a new name. This designation is freely selectable up to a maximum of 16 characters.
The new name enter does **not** change the value of the fields in the main display.
4. Go "Back" several times to save the parameters.

➡ To save see Chapter "32.1 Save Parameters".

➡ Procedure to **change the number of decimal places**:

1. Expand the output field.
2. Uncheck the >Standard Decimal Places< box.
3. Specify the new number of decimal places.
Any numbers can be entered, but only up to a maximum of five decimal places are accepted.
4. Go "Back" several times to save the parameters.

**Observe the measurement accuracy of the sensors**

When setting the decimal places, observe the measuring accuracies of the sensors and the set units of measurement.

Diagnostics

39 Basics of the Diagnostics Menu

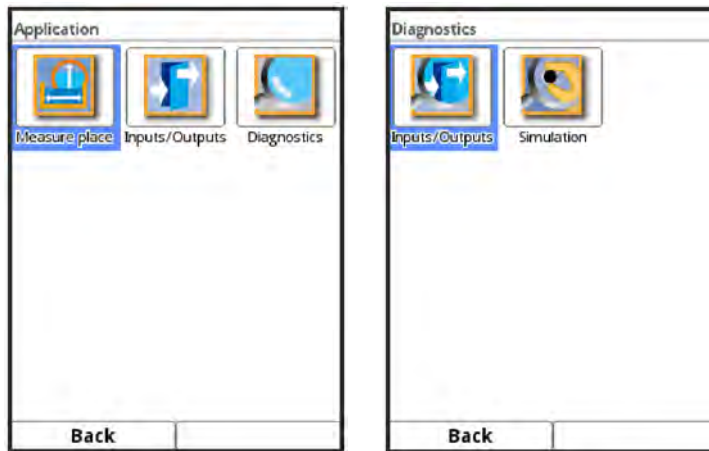


Fig. 39-1 Menu Diagnostics

The menu >Diagnostics< can be found in the >Application< menu. Diagnostics is divided into two submenus.

The Diagnostics menu and all submenus are purely display and simulation menus. There is no parameterisation possible within the menu.

In this section, the following settings can be checked or simulated:

- **Inputs and Outputs:**
Status, current value and physical value calculated from this for the digital and analogue inputs. Display of current values and the associated calculated physical values. Simulation of the activated analogue and digital inputs and outputs.
- **Simulation:**
Access to and change option for all recorded active inputs and calculated values (flow rate).
Display of the resulting calculated digital and analogue signal outputs.



Important Notice

It is essential to follow the safety instructions for the simulation in Page 103.

40 Diagnostics Inputs and Outputs (analogue and digital)

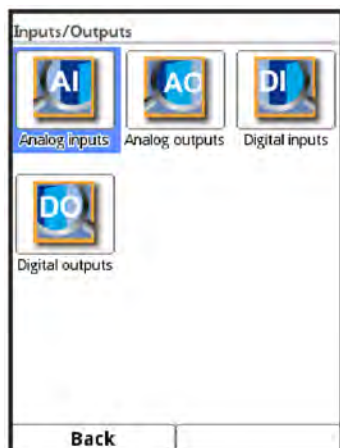


Fig. 40-1 Menu Diagnostics Inputs/Outputs



See also Chapter "34.3 Setting Parameters of Inputs and Outputs (analogue and digital)".

40.1 Analogue Inputs

In this menu, the current values present at the analogue inputs of the flow calculator can be displayed as mA values as well as the measured values (assigned by means of the measuring span parameterised in the flow calculator).

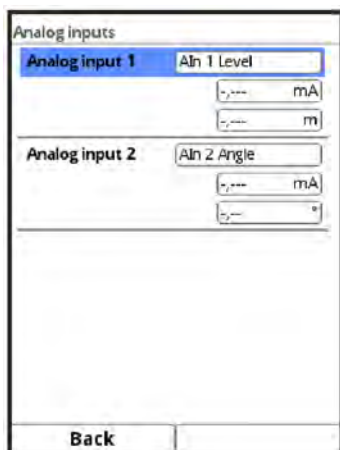


Fig. 40-2 Display of analogue Input Values

With this display, the presence of an external signal and its correct value can be checked without using a measurement device. The immediate conversion into the parameterised measurement span enables the plausibility of the measured value to be checked as well as the correct parameterisation of the input span.

40.2 Analogue Outputs

In this menu, the calculated current values to be output at the analogue transformer and the measured values (assigned by means of measurement span) are displayed. A password-protected simulation of the individual analogue values is also possible.

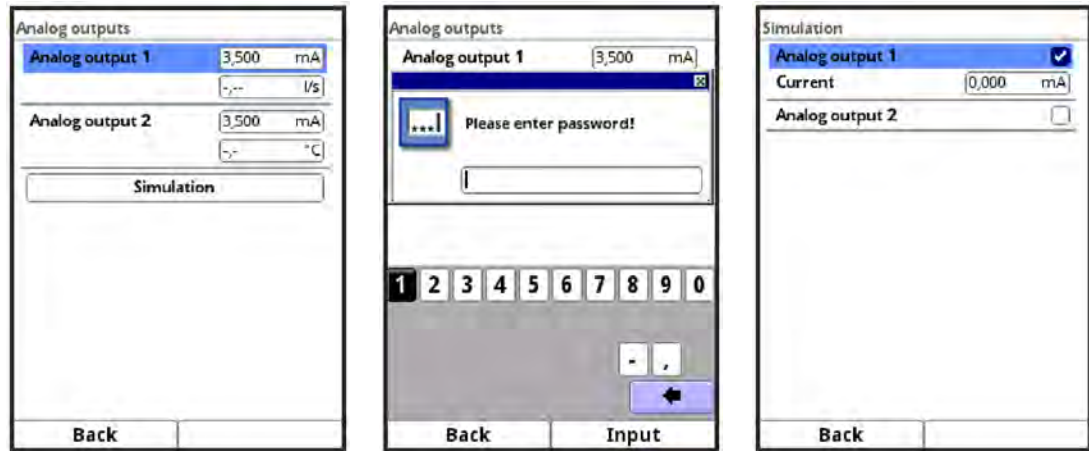


Fig. 40-3 Display of analogue Output Values



The actual flowing currents are not output.

The display only shows the signal that the analogue output converter receives for output. An external faulty circuit or a defective D/A converter cannot be detected and displayed.

DANGER



Personal injury or property damage

The simulation of the analogue outputs shall only be carried out by qualified electricians. These specialists must have precise knowledge of the entire regulation and control process of the system.

Prepare the simulation in detail:

- Switch the following equipment to manual operation.
- Switch off any actuators or similar devices or limit their function.

A safety person is absolutely necessary during the performance!

Disregarding may result in personal injury or damage to the system.

Due to the extremely high risk potential and the incalculable consequences of inadequate or incorrect simulation or disregard of the safety instructions, NIVUS hereby decline any responsibility whatsoever for any personal injury or damage to property in any amount!

DANGER



Effect on Plant Sections

A simulation of the HydraulicCalculator 2 outputs directly accesses all following plant sections without any safety interlock!

Simulations shall only be carried out by qualified personnel.

Be sure to observe the preceding warning!

**Note**

For the previously mentioned safety reasons, access to the simulation is protected by a password.

To protect yourself, only pass on the password to authorised and instructed specialist personnel!

➡ To simulate an analogue output, proceed as follows:

1. Enter the password
2. Rotate the rotary pushbutton until the desired analogue output is highlighted blue.
3. Press the rotary pushbutton - the analogue output is activated by a tick.
4. Then enter the desired output current as a numerical value.
Make sure that the analogue outputs continue to supply the entered current values until the simulation menu is closed again.
5. Press the left function key to exit the simulation menu.

40.3 Digital Inputs

This menu shows the signals present at the digital inputs.

All available digital inputs (according to the flow calculator type) are always displayed, regardless of their activation. The parameterised function of the digital input is shown in brackets after "DI xx".

Inactive digital inputs are identified by the designation "(In. inact.)".

The status of the digital inputs (depending on "inverted"/"not inverted") is indicated by a tick/no tick following the name of the input.



Fig. 40-4 Display of digital inputs

40.4 Digital Outputs

The digital output values available at the flow calculator are displayed in this menu. All available digital outputs (according to the flow calculator type) are always displayed, regardless of their activation. The parameterised function of the digital output is shown in brackets after "DO xx".

Inactive digital outputs are identified by the designation "(Out inact.)".

The status of the digital outputs (depending on "inverted"/"not inverted") is indicated by a tick/no tick following the name of the output.

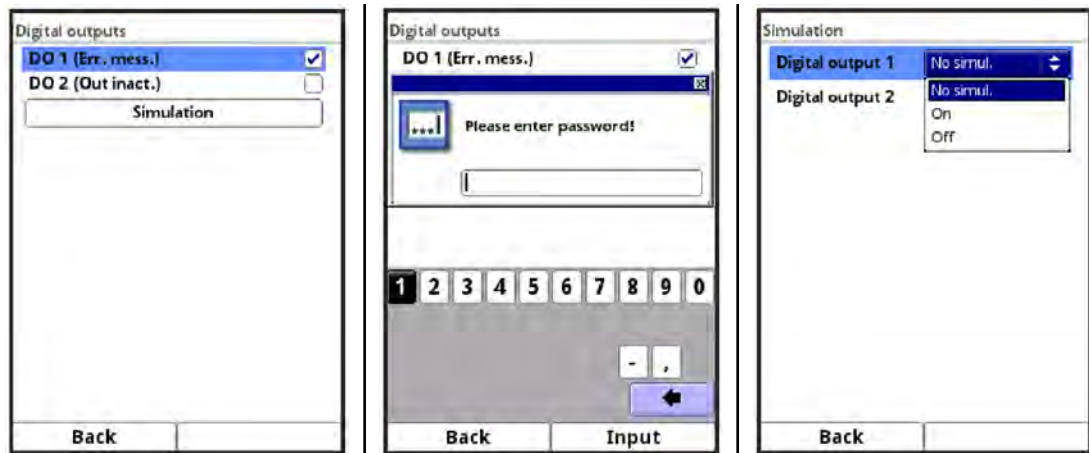


Fig. 40-5 Display of digital outputs

A password-protected simulation of the digital outputs is also available in this menu.

DANGER



Personal injury or property damage

The simulation of the digital outputs shall only be carried out by qualified electricians. These specialists must have precise knowledge of the entire regulation and control process of the system.

Prepare the simulation in detail.

- *Switch the following equipment to manual operation.*
- *Switch off any actuators or similar devices or limit their function.*

A safety person is absolutely necessary during the performance!

Disregarding may result in personal injury or damage to the system.

Due to the extremely high risk potential and the incalculable consequences of inadequate or incorrect simulation or disregard of the safety instructions, NIVUS hereby decline any responsibility whatsoever for any personal injury or damage to property in any amount!

DANGER



Effect on Plant Sections

A simulation of the HydraulicCalculator 2 outputs directly accesses all following plant sections without any safety interlock!

Simulations shall only be carried out by qualified personnel.

Be sure to observe the preceding warning!



Note

For the previously mentioned safety reasons, access to the simulation is protected by a password.

To protect yourself, only pass on the password to authorised and instructed specialist personnel!

➡ To simulate a digital output, proceed as follows:

1. Enter the password
2. Rotate the rotary pushbutton until the desired digital output is highlighted blue.
3. Press the rotary pushbutton - the digital output is activated by a tick.

4. Then enter the desired output current as a numerical value.
Make sure that the digital outputs continue to supply the entered current values until the simulation menu is closed again.
5. Press the left function key to exit the simulation menu.

Activating the simulation of each output is done in the same way.

41 Diagnostics Simulation

In this menu, a theoretical flow can be simulated by manually entering fictitious analogue input values in the parameterised application.

The flow calculator uses these simulated values - based on the dimensions of the parameterised application - to calculate the prevailing flow value.

This value is output at the previously defined analogue and digital outputs according to the parameter settings made.

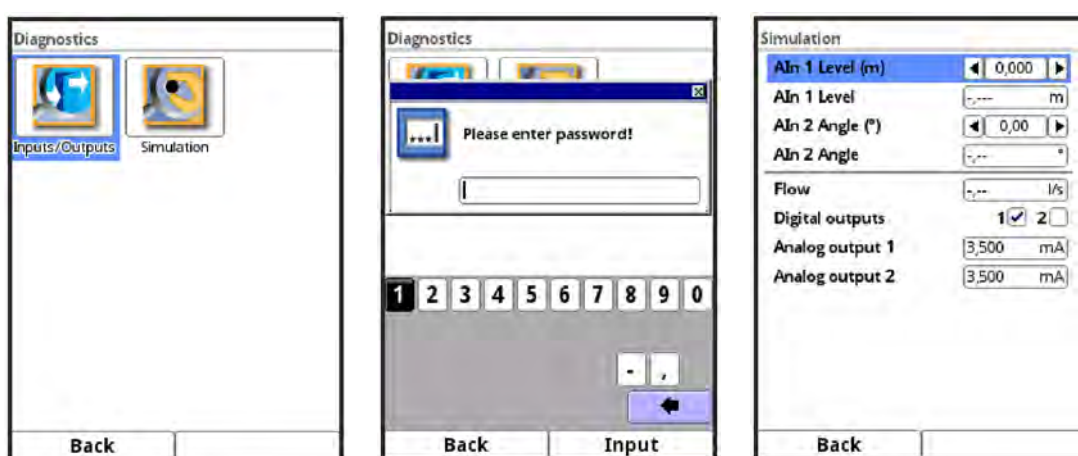


Fig. 41-1 Diagnostics / Simulation

DANGER



Personal injury or property damage

The simulation shall only be carried out by qualified electricians. These specialists must have precise knowledge of the entire regulation and control process of the system.

Prepare the simulation in detail.

- Switch the following equipment to manual operation.
- Switch off any actuators or similar devices or limit their function.

A safety person is absolutely necessary during the performance!

Disregarding may result in personal injury or damage to the system.

Due to the extremely high risk potential and the incalculable consequences of inadequate or incorrect simulation or disregard of the safety instructions, NIVUS hereby decline any responsibility whatsoever for any personal injury or damage to property in any amount!

DANGER



Effect on Plant Sections

A simulation of the HydraulicCalculator 2 outputs directly accesses all following plant sections without any safety interlock!

Simulations shall only be carried out by qualified personnel.

Be sure to observe the preceding warning!



Note

For the previously mentioned safety reasons, access to the simulation is protected by a password.

To protect yourself, only pass on the password to authorised and instructed specialist personnel!

➤ Procedure for the simulation:

1. Enter the password
2. Turn the rotary pushbutton until the desired value to be simulated (AI1 or AI2) is highlighted in blue.
3. Activate the field by pressing the rotary pushbutton and enter the desired measurement value.
Either at **Analogue Input 1** or **Analogue Input 2** by rotating the rotary pushbutton in 1/1000 steps
or at **Analogue Input 1** or **Analogue Input** with direct entry of the value.
4. Confirm entry with the right function key.
The **Flow** field automatically displays the flow rate value calculated by the two simulated analogue input values.
Any parameterised digital/analogue outputs behave as if they were actually parameterised and output these values in real terms.
These output signals and values are shown on the display.
5. Press the left function key to exit the simulation menu.

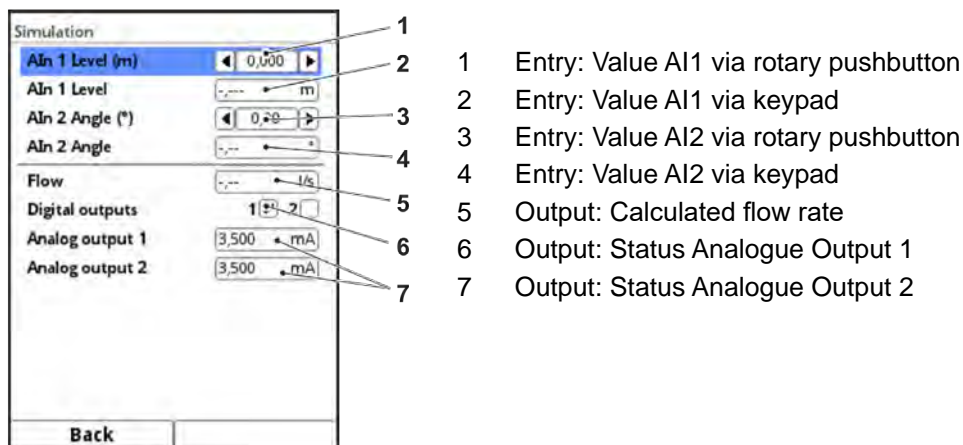


Fig. 41-2 Display of calculated values and output states

Maintenance and Cleaning

WARNING***Disconnect the System from Mains Power***

*Disconnect the unit from the mains and secure the higher system against being switched on again before starting maintenance.
Disregarding may lead to electric shock.*

WARNING***Germ Contamination***

Due to the frequent use in the wastewater sector, parts can be contaminated with dangerous germs. Therefore, appropriate precautions must be taken when coming into contact with cables and sensors.

Wear protective clothing.

42 Maintenance

42.1 Maintenance Interval

The Type HydraulicCalculator 2 flow computer is virtually free of calibration, maintenance and wear by design.

Nevertheless, NIVUS recommend **an annual check** of the entire measuring system by the NIVUS customer service.

Depending on the area of application of the measuring system, the maintenance interval may vary.

The scope of maintenance and its intervals depend on the following factors:

- Measurement principle of the level sensors
- Measurement Medium and Hydraulics
- General regulations for the operator of the measurement system
- Environmental conditions

NIVUS recommends having the measurement system completely be inspected by a company of the NIVUS-Group **after latest ten years**.

Generally the verification of instruments and sensors is a basic measure in order to improve operational reliability and to increase the lifetime.

42.2 Customer Service Information

For the recommended annual inspection of the entire measuring system or complete maintenance after ten years at the latest, contact our customer service:

NIVUS GmbH - Customer Centre

Phone +49 7262 9191-922

customercenter@nivus.com

43 Cleaning

43.1 Flow Calculator

WARNING



Disconnect the System from Mains Power

Make sure that the flow calculator is disconnected from mains power.

Disregarding may lead to electric shock.



Important Notes

- The **blue plastic strips** of the DIN rail enclosures must not be removed for cleaning the enclosure.
- **Never wipe the terminal blocks or plug connections** with a damp cloth or similar.

If necessary, clean the flow calculator enclosure with a dry lint-free cloth.

In case of heavier dirt, you can wipe the enclosure with a damp cloth. Do **not** use harsh cleaning agents or solvents. Instead, it is better to use mild household cleaners or soap suds.

43.2 Sensors

Be sure to follow the instructions for maintenance and cleaning of the sensors. These instructions can be found in the respective technical description or instruction manual.

The technical description or operating instructions are part of the sensor delivery or can be downloaded at www.nivus.com.

44 Dismantling/Disposal

Improper disposal may be harmful to the environment.

- ➡ Dispose of device components and packaging materials in accordance with the applicable local environmental regulations for electrical products:

1. Disconnect the device from mains power.
2. Disconnect connected cables on the front of the device with a suitable tool.
3. Remove the flow calculator from the DIN rail.
4. Remove the buffer battery (coin cell) from the flow calculator (see procedure described as follows) and dispose of it separately and properly.



EU WEEE Directive

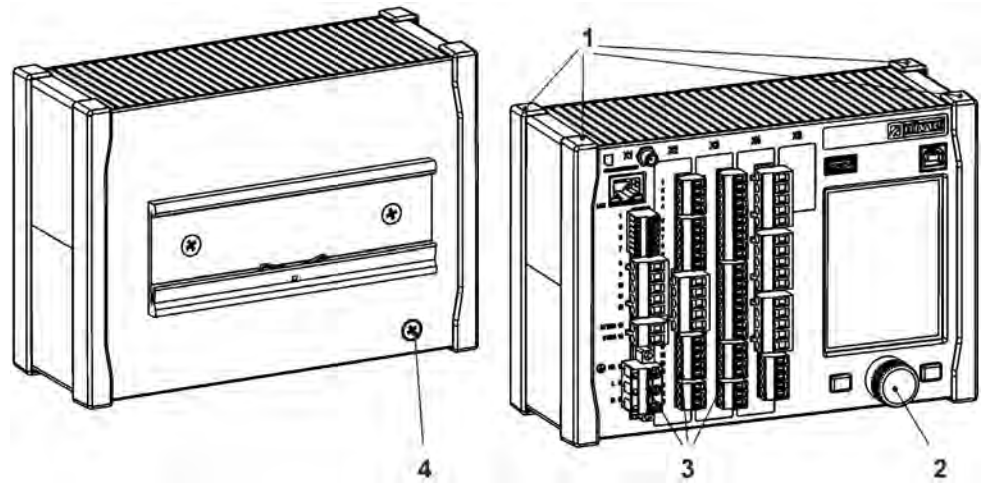
This symbol indicates that the requirements of Directive 2012/19/EU on waste electrical and electronic equipment must be observed when disposing of the device. NIVUS GmbH support and promote the recycling or environmentally sound, separate collection/disposal of waste electrical and electronic equipment to protect the environments and human health. Observe the local laws and regulations on disposal.

NIVUS GmbH is registered with the EAR, therefore public collection and return points in Germany can be used for disposal.

The device is equipped with a buffer battery (lithium button cell) that must be disposed of separately.

➡ Procedure for removing the buffer battery (coin cell) on the removed flow calculator:

1. If present, remove the four blue plastic strips (Pos. 1). These are plugged in and glued to the basic unit.



2. Remove the cover cap (Pos. 2) on the rotary pushbutton with a screwdriver or similar.
3. Loosen the fastening inside the rotary push-button with a screwdriver or similar.
4. Unscrew the countersunk screw M4x8 (Pos. 4) (for earthing/fastening) incl. serrated lock washer on the back of the housing.
5. Pull off the rotary pushbutton and existing connector strips (Pos. 3) from the front of the enclosure.
6. Unscrew 4x M3 Torx self-tapping screws on the front of the enclosure (previously covered by the plastic strips) and remove the front panel together with the circuit boards.



7. Remove the buffer battery (Pos. 5) mounted on the upper board.

45 Installation of Spare Parts and Wearing Parts

We expressly draw your attention to the fact that spare parts and accessories which have not been supplied by us have also not been tested and approved by us.

The installation or use of such products may therefore negatively alter or invalidate the design properties of your measurement system.

NIVUS are expressly excluded from liability for damage caused by the use of non-original parts and non-original accessories.



You will find a selection of the accessories of the NIVUS GmbH in Chapter "46 Accessories".

46 Accessories

Article No	Description
ZUB0 USB STICK	USB stick for readout of parameters and readings
BSL0 xx	Various overvoltage protection elements for power supply, sensors and data lines of the transmitter
ZUB0 ZENER MZ787	Zener barrier Type for intrinsically safe power supply for pressure sensors Type NivuBar Plus and Ex Inclinator

Tab. 9 Accessories (selection) for the flow calculator HC2



Further information on spare parts and accessories can be obtained from your responsible distributor/agency or directly from the NIVUS GmbH.

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Open Source Software

47 List of Sources of the Licences and Codes used

The HydraulicCalculator 2 flow computer uses code from the following open source projects:

- Freetype (<http://www.freetype.org>)
- Libharu (<http://libharu.org>)
- Libjpeg (<http://www.ijg.org>)
- Libpng (<http://www.libpng.org>)
- Zlib (<http://www.zlib.net>)
- Mini-XML (<http://www.msweet.org>)
- Nano-X/nxlib (<http://www.microwindows.org>)
- FLTK (<http://www.fltk.org>)
- Appendix1: LGPL
- Appendix2: MPL



Licensing Issues

For questions on licensing contact opensource@nivus.com

Approvals and Certificates

DE / EN / FR

EU Konformitätserklärung*EU Declaration of Conformity**Déclaration de conformité UE*

Für das folgend bezeichnete Erzeugnis:

*For the following product:**Le produit désigné ci-dessous:*

NIVUS GmbH
Im Taele 2
75031 Eppingen

Telefon: +49 07262 9191-0
Telefax: +49 07262 9191-999
E-Mail: info@nivus.com
Internet: www.nivus.de

Bezeichnung:	Durchflussrechner stationär HydraulicCalculator 2
<i>Description:</i>	<i>permanent flow calculator</i>
<i>Désignation:</i>	<i>calculateur de débit fixe</i>
Typ / Type:	HC2-S0...

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
- 2014/35/EU
- 2011/65/EU

Bei der Bewertung wurden folgende einschlägige harmonisierte Normen zugrunde gelegt bzw. wird die Konformität erklärt in Bezug auf 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
- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

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
Germany

abgegeben durch / *represented by / faite par:*

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

Eppingen, den 24.06.2025

Gez. *Marcus Fischer*