Instruction manual for the
Flow monitoring sensor NivuGuard 2

(original manual – englisch)

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Translation

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

Names

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

1 General

Important

READ CAREFULLY BEFORE USE

KEEP IN A SAFE PLACE FOR LATER REFERENCE!

This instruction manual for NivuGuard 2 is intended for the initial start-up of the sensor depicted on the title page. This manual is oriented exclusively to qualified expert personnel.
Read this instruction manual carefully and completely prior to installation and connection since it contains relevant information on this product.

Observe the notes and particularly follow the warning notes and safety instructions. Keep this manual in a safe place and make sure it is available for the users of this sensor at any time.
If you should have problems to understand information contained within this instruction manual either contact the manufacturer or one of the distributors for further support. The manufacturer cannot be held responsible for damage to persons or material due to incorrectly understood information in this instruction.

In case of selling the NivuGuard 2-sensor this instruction manual shall be provided to the purchaser since it is a part of the standard delivery.

Detailed information on how to operate the complete system can be found in the accompanying instruction manual of NivuGuard Monitor.

Personnel requirements

Installation, commissioning and maintenance shall be executed only by personnel meeting the demands as follows:

- Expert personnel with relevant training an appropriate qualification
- Personnel authorised by the plant operator

Qualified personnel

within the context of this documentation or the safety notes on the product itself are persons who are sufficiently familiar with installation, mounting, starting up and operation of the product and who have the relevant qualifications for their work; for example.

- *Training, instruction or authorisation to activate/deactivate, isolate, ground, and mark electric circuits and devices/systems according to the safety engineering standards.*
- *Education and instruction according to the standards of safety engineering regarding the maintenance and use of adequate safety equipment.*
- *First aid training*

2 Safety Instructions and Hazard Warnings

2.1 Used Hazard Warnings

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

DANGER

Hazard warnings

Indicates an immediate high risk which may result in death or severe personal injury if not avoided.

WARNING

Danger of electrical shock

Indicates a possible danger by electrical power with moderate risk which may result in death or severe personal injury if not avoided.

WARNING

Warning notice

Indicates a possible danger with moderate risk which may result in death or severe personal injury if not avoided.

CAUTION

Notes for caution

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

Important Note

Indicates a situation that could cause damage on this instrument if it is not avoided.

Contains information that should be highlighted.

Note

Indicates a situation that will not result personal injury.

2.2 Safeguards and Precautions

WARNING

Germ contamination

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

Wear protective clothing.

WARNING

Observe regulations for health and safety at work

Before starting installation work, observing the work safety regulations need to be checked.

Failure to do so may cause personal injury..

WARNING

Do not disable safety devices!

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

Failure to observe may cause personal injury as well as to system damage.

Important Note

The entire measurement system shall be installed and put into operation only by qualified personnel.

2.3 Liability Disclaimer

The manufacturer reserves the right to change the contents of this document including this liability disclaimer without prior notice and cannot be held responsible in any way for possible consequences resulting from such changes.

For connection, initial start-up and operation of the sensor the following information and higher legal regulations (e.g. in Germany VDE), such as Ex-regulations as well as safety requirements and regulations in order to avoid accidents, must be kept.
All operations on the sensor which go beyond installation or connection measures in principle shall be carried out by NIVUS staff or personnel authorised by NIVUS due to reasons of safety and guarantee. The manufacturer is not liable for failures resulting from improper or inappropriate use.

2.4 User's Responsibilities

Important Note

In the EEA (European Economic Area) national implementation of the frame-work directive 89/391/EEC and corresponding indi-vidual directives, in particu-lar the directive 2009/104/EEC con-cerning the minimum safety and health requirements for the use of work equipment by workers at work, as amended, are to be observed and adhered to.

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

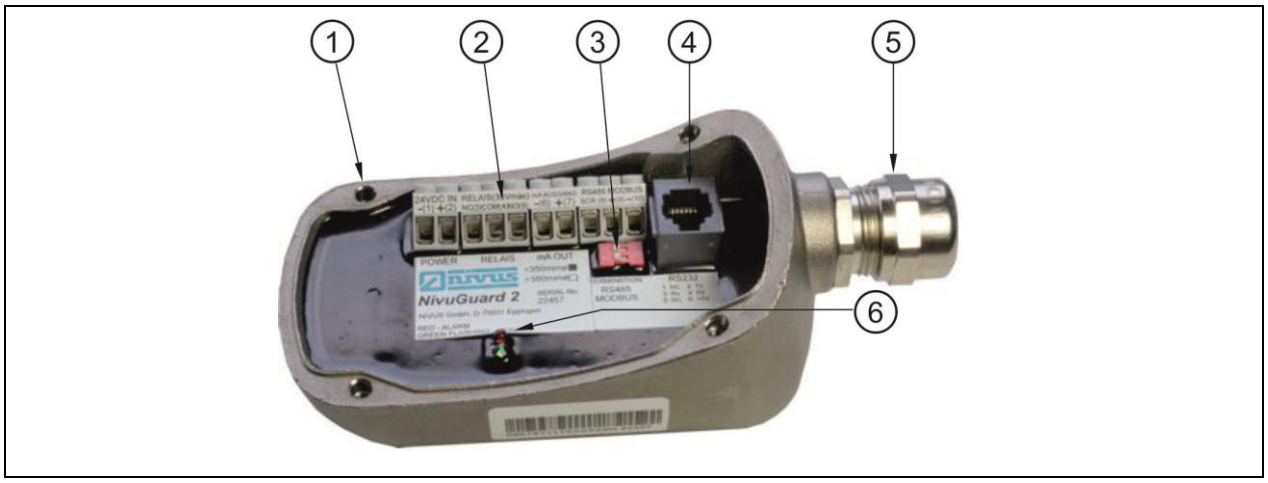
- personnel safety (accident prevention regulations)
- safety of work materials and tools (safety equipment and maintenance)
- disposal of products (laws on wastes)
- disposal of materials (laws on wastes)
- cleaning (cleansing agents and disposal)
- environmental protection.

Connections:

As an operator make sure prior to activating the sensor that during installation and initial start-up, if executed by the operator himself, the local regulations (such as regulations for electrical connection, operation in channels) are ob-served.

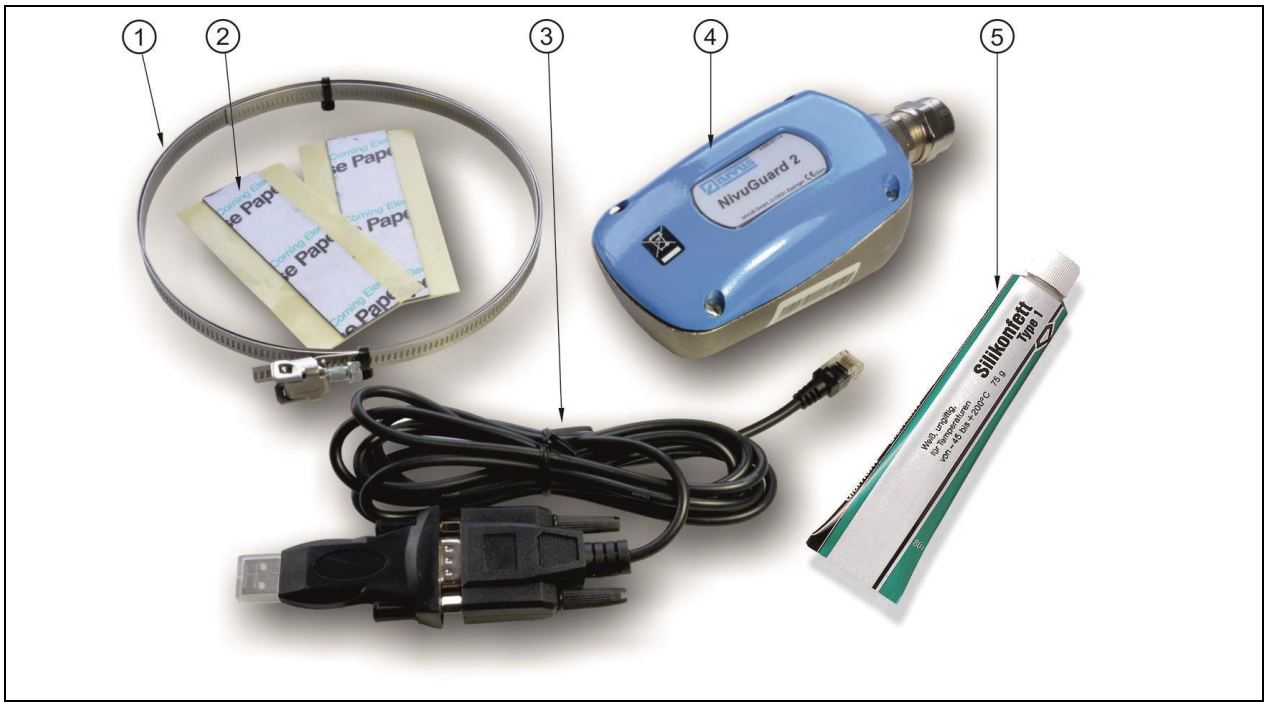
3 Overview and Intended Use

3.1 Overview



1 Thread for housing screws
2 Connection clamps
3 DIP-switch for Modbus (2x)
4 Interface for programming (RS232)
5 cable gland
6 Status LEDs

Fig. 3-1 Overview NivuGuard 2



1 Tensioning strap for clamp on
2 Gel tape for acoustic coupling to vibrations
3 Interface cable for programming
4 NivuGuard 2
5 Silicone grease for acoustic coupling

Fig. 3-2 Overview – scope of delivery

3.2 Intended Use

Important Note

The sensor is exclusively intended to be used for purposes as described below. Modifying or using the devices for other purposes without the written consent of the manufacturer will not be considered as use in accordance with the requirements.

Damages resulting from this are left at user's risk.

The NivuGuard 2 is an ultrasonic non-invasive flow monitor designed for use on most industrial liquid flow applications. The NivuGuard 2 uses a novel spread spectrum analysis technique never before used in flow monitoring. It introduces a radical new Digital Signal Processing approach for exceptional repeatability.

Ultrasound is fired through the pipe wall at 90 degrees to the flow via a tangentially mounted high-output ceramic, then refracted at angles across the axis of the flow and subsequently reflected from bubbles, particles and vortices in all directions and at a wide range of frequencies. The wide, refracted, ultrasonic beam maximises the ultrasound energy captured from flowing particles. These multiple reflections are received back into the unit via a second crystal.

The mass of data generated is analysed using NivuGuard 2 sensor Refracted Spread Spectrum Analysis (RSSA) digital signal processing platform to derive flow information. RSSA analyses and integrates the received signals over a wide frequency range, then uses them for real-time analysis and flow rate calculation

Strictly observe the maximum permissible limit values of the NivuGuard 2 sensor as specified in chapter 3.4. Any applications deviating from the aforementioned limit values without the written authorisation by NIVUS GmbH are left at user's risk.

3.3 Device Identification

The instructions in this manual are valid only for the type of sensor indicated on the title page. The nameplate can be found where the cable enters the sensor body as well as on the end of the cable. The nameplate is protected against weathering and abrasion by using a transparent shrunk-on hose and contains the following:

- Name and address of manufacturer
- CE label
- Type and serial number
- Year of manufacture

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

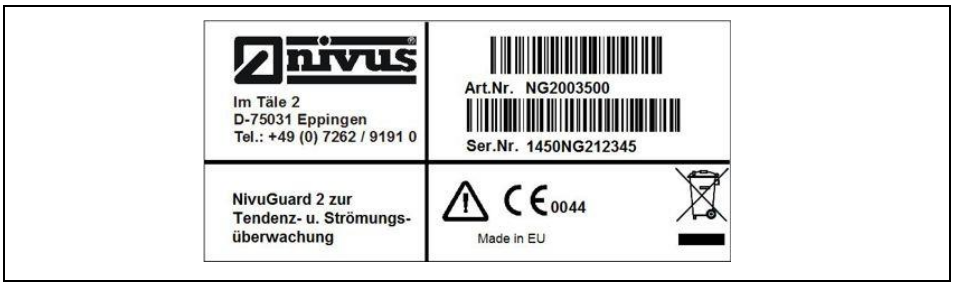


Fig. 3-3 Nameplates NivuGuard 2

3.4 Specifications

Power supply	DC 18 – 28 V, 125 mA
Power Consumption:	2.5 W @ 24 V typical, 3 W @24 V maximum
Dimensions	120 x 65 x 65 mm (4.75 x 2.6 x 2.6 inch)
Weight	Nominal 1.5 kg (3.3lbs)
Enclosure material	Type 316 stainless steel casting
Cable entry detail	1 cable entry M20 x 1.5 mm gland
Maximum cable length	500 m
Recommended cable	Cross section min. 0.5 mm², shielded; 6-12 mm Cable outer diameter
IP Rating	IP67 (when cable gland is closed tightly and covered)
Operating temperature	-20 ºC to +70 ºC
Performance accuracy	±5 %, typical subject to installation, pipe conditions and hydraulic conditions
Resolution	3 mm/ sec.
Max. range (flow)	4.0 m/sec
Min. range (flow)	0.3 m/ sec
Response time	fully adjustable (1 sec. minimum)
Signal Processing	Doppler principle
Particle size	>100 µ
Particle concentration	>200 ppm
Pipe diameter	DN50 – DN350
Pipe material	Metal or plastic
Max. pipe wall thickness	20 mm
Outputs	
Analog output	1 x 4-20 mA into a 1kΩ load (when supply voltage is 22 VDC or greater) with 20µA resolution and user programmable span
Digital output	1 x relay for alarms, 1A at 24V DC, potential free
Communication	Half Duplex RS485 with Modbus RTU
Programming	
PC Programming	via RS232 or RS485 using NivuGuard PC

Storing

Strictly observe the storing conditions below:
max. temperature: +80 °C
min. temperature: - 40 °C
max. humidity: 100 %, non-condensing:

During the storage always protect the device from corrosive or organic solvent vapours, radioactive radiation and strong electromagnetic radiation.

3.5 Equipment

3.5.1 Delivery

The standard delivery of the NivuGuard 2 contains:

- The technical instruction with the EC Declaration of Conformity and approvals where all necessary steps to correctly install and to operate the sensor are listed.
- one NivuGuard 2
- one interface cable for programming
- one CD with Software „NivuGuard 2 PC“
- Installation set consisting of
  Tensioning strap, acoustic gel tape and silicone grease.

Check additional accessories depending on your order and by using the delivery note.

3.5.2 Receipt

Check the delivery according to the delivery note for completeness and intactness immediately after receipt. Report any damage in transit to the carrier instantly. Send an immediate, written report to NIVUS GmbH in Eppingen as well. Incomplete delivery shall be directly reported to the headquarters in Eppingen or your local distributor in written form within two weeks.

Mistakes cannot be rectified later!

3.5.3 Transport

Protect the NivuGuard 2 from shock and impact loads and vibrations. The transportation must be carried out in the original packaging.

3.5.4 Return

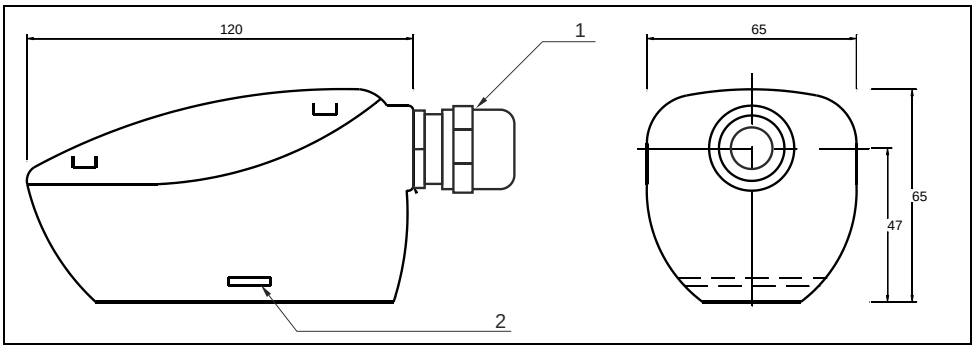
The sensor must be returned at customer cost to NIVUS Eppingen in the original packaging free of charge.
Returns with insufficient postage will not be accepted!

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

We herewith particularly emphasize that replacement parts or accessories, which are not supplied by us, are not certified by us, too. Hence, the installation and/or the use of such products may possibly be detrimental to the device’s ability to work.
Damages caused by using non-original parts and non-original accessories are left at user’s risk. You can find spare parts or accessories in chapter 10.

4 Construction and Functions

4.1 Dimensions



1 Cable gland M20

2 Slot for banding

Fig. 4-1 Dimensions NivuGuard 2

4.2 Functional Description

The NivuGuard 2 injects an ultrasonic signal through the pipe, and analyses the returned signal in real-time to extract flow information. This provides robust and repeatable flow monitoring using a scalable 4 to 20 mA output and a volt-free relay switch. Interface with the PC over both the RS-485 and RS-232 serial port is fully supported by the NivuGuard 2 PC software, which can be used for setting up and operating the device.

Option - NivuGuard Monitor:

Connect the NivuGuard 2 via RS485 output with the optional NivuGuard Monitor. The NivuGuard Monitor has a LCD display and supports remote monitoring, logging, and programming of the NivuGuard 2.
The NivuGuard Monitor has also:

- a mA output
- two relays

For the best results, NivuGuard 2 should be applied where:

- the pipe material: steel, cast iron, ductile iron or plastic (but not rubber or flexible plastic pipes!)
- pipe diameter min. 50 mm and max. 350 mm
- pipe wall thickness is less than 20 mm
- the solids concentration in the fluid is greater than 200 ppm (e.g. hard tap water), and typical particle sizes are larger than 100 µ.
- there is no significant build-up within the pipe

5 Installation and Connection

5.1 Installation instructions

- Observe appropriate installation!
- Follow applicable legal or operational guidelines!

Inappropriate use may result in injuries and/or damage on instruments!

5.2 NivuGuard 2 Installation

Hints to avoid electrostatic discharge (ESD)

CAUTION

ESD Risks:

Maintenance procedures which do not require power supply of the instrument shall not be executed before the unit has been disconnected from mains power in order to minimise danger and ESD risks.

The sensitive electronic components inside the unit may get damaged by static electricity. The manufacturer recommends the following steps to prevent the device from getting damaged due to electrostatic discharge:

- Before installation, ensure that the necessary cabling has been fitted and that the device is not being powered.
- NivuGuard 2 must be mounted on the external, dry surface of the pipe. The device should not be submerged in liquid.
- NivuGuard 2 and the pipe surface around the installation location should not be exposed to external flowing liquid.
- NivuGuard 2 should be installed on a straight section of pipe at least 5 pipe diameters from any restrictions or sources of fluid turbulence (e.g. pumps, valves, tees, elbows) where possible.
- On horizontal pipes, it is preferable to mount NivuGuard 2 between 1 o'clock and 5 o'clock position on the pipe to avoid air pocket on top or sedimentation on the bottom, as illustrated in Fig. 5-1.

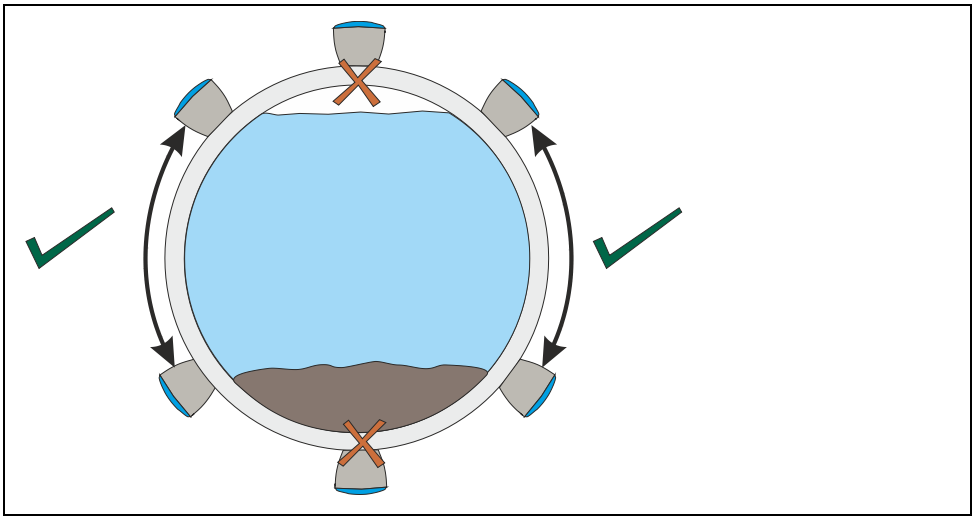
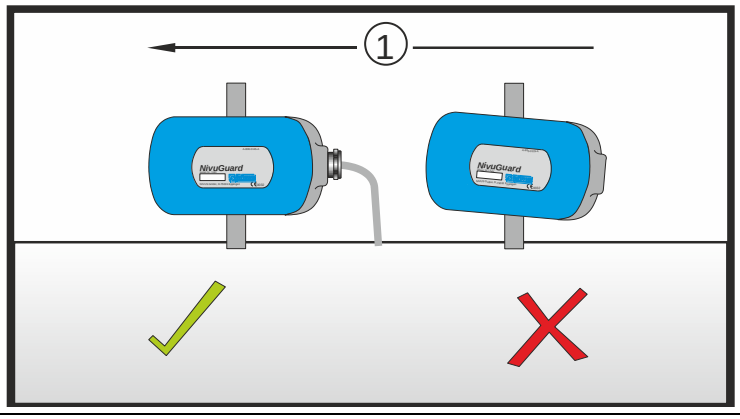


Fig. 5-1 Recommended positioning on horizontal pipes

- Ensure that both the base of the NivuGuard 2 and the pipe surface is free from debris. Pipes with flaking paint should be cleaned down.
- Apply silicone grease or silicone pad to the base of NivuGuard 2. Silicone pad is recommended where vibration and heat are frequently encountered.
- NivuGuard 2 should be strapped onto the pipe with the supplied metal banding. If further installation attempts are made, reapply silicone grease. In the case of silicone pad, ensure that the pad surface is clean from debris, the pad is in good condition, and there is no folding that might cause uneven contact with the pipe.
- Ensure that the NivuGuard 2 is aligned along the pipe axis, as illustrated in Fig. 5-2.
- Tighten the banding while ensuring best contact and correct alignment between the Flow Pulse and the pipe.



1 flow direction

Fig. 5-2 Sensor correctly aligned along the pipe axis

The manufacturer recommends the following steps to prevent the device from getting damaged due to electrostatic discharge:

- Discharge static electricity from your body before touching the instrument's electronic components.
- Avoid unnecessary movements to reduce the risk of building up static electricity
- Wear a properly grounded antistatic wrist strap to discharge your body and to keep away static electricity.

Touch components which are sensitive to electrostatic build-up only in antistatic working areas. Use antistatic floor coverings and working surfaces always if possible.

5.2.2 Power supply

The following rules should be observed with regard to power supply:

- Make sure that the supply voltage is correct.
  The NivuGuard 2 needs 18-28 V DC voltage.
- The typical operating current is 2.5 W.
- The maximum current consumption may not exceed 3 W.
- Ensure the voltage supply by means of an appropriate fuse (250 mA).
- Check the correct terminal assignment before connecting the operating voltage.

Cable extension

If you are using longer cables (over 100 m) make sure, that at least 22 V DC is applied to NivuGuard 2.
This is needed in order to guarantee reliable operation.

5.2.3 Relay Output

The relay can be programmed for a variety of alarms. The relay contacts are rated at 1A at 24V DC. All connections should be such that the short circuit capacity of the circuits to which they are connected, is limited by fuses rated so that they do not exceed the relay rating.
The N.O. terminal is normally open while the N.C. terminal is a normally closed circuit to the common terminal

5.2.4 Analog output

There is one mA output, of 4 - 20mA with a maximum load of 1kΩ. It has a 20 µA resolution and a user programmable and adjustable span

5.2.5 RS232 Serial Interface

The RS232 interface is available on the RJ-11 socket for setting up and operating the Flow Pulse using the NivuGuard PC-Software.
It is recommended that the serial cable does not exceed 10 metres in length.

5.2.6 RS485 Serial Interface with Modbus

It is recommended that a screened cable is used, and the cable screen is connected to the screen terminal of the RS485 terminals. If RS485 connection is not required, the cable screen should be connected to the metal enclosure of NivuGuard 2 at the cable entry point and earthed at the other end of the cable.
The RS485 terminals are galvanically isolated.
Please ensure that the termination switch is set to the “ON” position if termination is required.
The RS485 serial port can either be used with the Modbus RTU protocol or to interface with NivuGuard PC.

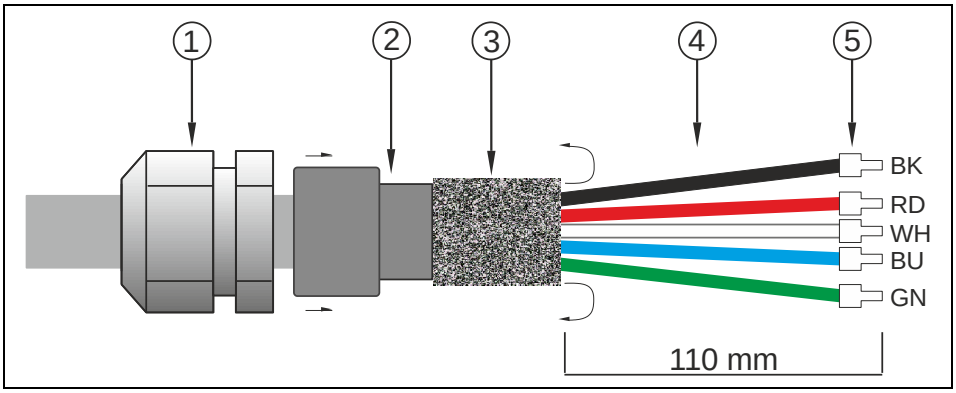
5.2.7 Cable Screen and Earth Requirement

A screened multi-core cable should be used (minimum conductor size of 0.5 mm². The cable screen should be connected to the enclosure at the cable entry point via the cable gland, see figure below. The screen of the cable should be earthed at the other end. The supplied cable gland is suitable for cables up to 12 mm O.D.

If using RS485 then connect terminal 8 (RS485 SCR) to the Modbus return.

Important Note

The power supply ground on NivuGuard 2 must not be earthed or connected to the cable screen.



1	Cable gland
2	Gland insert
3	Cable shield
4	Wires
5	Wire end ferrule

Fig. 5-3 Cable gland and wire colours

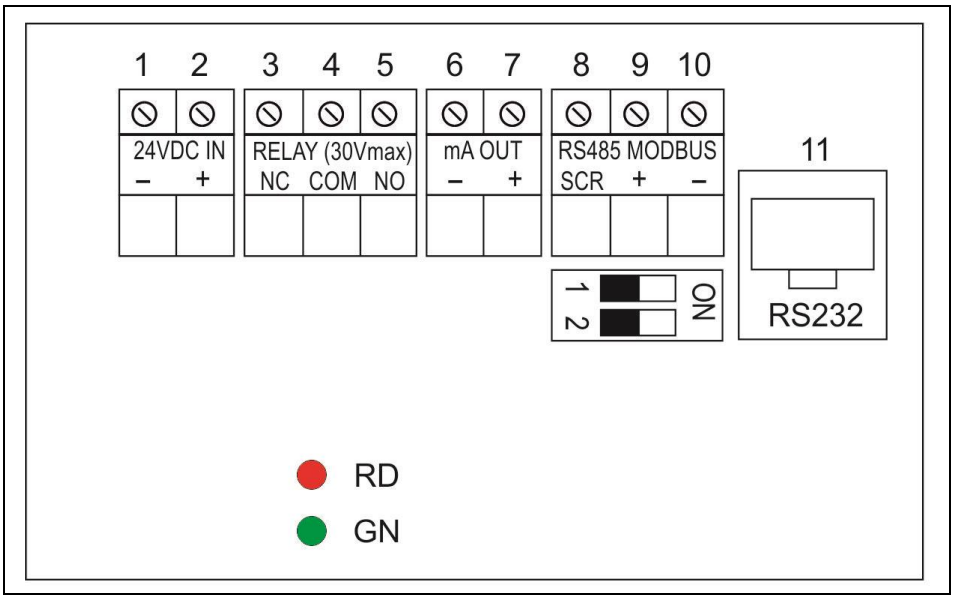
Note:

The number of wires as well as the colours may vary depending on used cable type.

Note for cable shield:

- Pull out the inner part of the supplied cable gland
- Lift the cable shield over the inner part of the cable gland (inside out)
- Then insert the inner part into the gland again.
  A good ground continuity via the cable shield is ensured
- Earth the other end of the cable, too!

5.2.8 Terminal Connection Details



LED RD – Alarm

LED GN – flashing (healthy)

Fig. 5-4 Terminal Connection Details

5.3 Preparation for Operation

Important Note

Observe chapter 6.1 for the NivuGuard set-up.

5.3.1 Installation of NivuGuard PC Software

The NivuGuard PC Software is supported on Windows® Vista and Windows® 7 (32 and 64 bit). A Software-CD is attached to each delivery the .Net Framework 4.0 is required to run the program. This is free for download online from Microsoft®.

Run Setup.exe to install the NivuGuard PC Software. A shortcut icon will be created on the Desktop. Double click on the shortcut icon to launch the program.

5.3.2 Power supply and start of PC Software

Before applying power, check if the sensor is mounted correctly with optimum acoustic coupling between the base and the pipe surface.
The power supply is correctly connected at the terminal block.
There is no exposed or loose wiring around the connection terminals.

- Remove the lid, and apply power to the NivuGuard 2.
- The RED led will flash for 6 seconds, then the GREEN led will begin to flash. The flashing of the GREEN led indicates that the device is operational
- Connect the relevant serial cable and converter to the PC depending on whether RS232 or RS485 is being used.
- Launch the NivuGuard PC program.
- If using PC-over-RS485, change baud rate to 19200 using Setup->Serial Port, default is 57600 over RS232. Click the “Tick” icon to connect.
- When connection is established, the current parameters stored on the NivuGuard 2 will be extracted by NivuGuard PC. The “Device” bulb on the top right corner of the program will light up to indicate a successful connection. The green tick lowerleft turns to a red X.
- Choose the “Parameters” tab on NivuGuard PC, where the current device parameters are shown and can be modified. (please refer to the Chapter 6.1 before modification)
- On the top left corner of the “Parameters” tab, set the Pipe I.D. field to the pipe’s internal diameter in units of either millimetres (default) or inches.
- Click on the “SAVE” button.
- Return to the “Flow” tab to monitor flow.

6 Setting-Up NivuGuard 2

6.1 Interface

The default method for interfacing with NivuGuard 2 is by using the supplied NivuGuard PC software and serial cable.
If the optional the NivuGuard Monitor is installed, common setup parameters can be programmed directly from the Monitor. Please refer to the NivuGuard Monitor user manual for more information.

6.2 Using NivuGuard PC Software

Install the software (see chapter 5.3.1).
After launching the program and connecting to the NivuGuard 2, the device parameters will be automatically extracted once a connection is established. Refer to the section on “Preparation for Operation” in Chapter 5.3 for more details on NivuGuard PC installation and how to connect to NivuGuard 2.

6.2.1 Pipe Internal Diameter

The pipe internal diameter is the only parameter that must be entered to get the NivuGuard 2 working to measure the flow.

- Chose “Parameters” tab
- Enter the pipe internal diameter in units of mm in the “Pipe I.D.” field.
- Click the “SAVE” button
- Return to the “Flow” tab to monitor flow
- The “Record” tab shows a time plot of flow.

Explanation of the Software Symbols

	**Connect:** click to attempt connection to the Flow Pulse device. Set the baud rate to 57600 (Setup>Serial Port) with RS232 or to 19200 with RS485
	**Disconnect:** appears after connection is established. Click to disconnect from the NivuGuard 2 from PC.
	**Diagnostic Trace:** requests for diagnostic trace. • When active, this icon border will light up yellow and 'live' traces can be observed on the "Trace" tab. • Click again to deactivate.
	**Save Data to File:** click to record data from Flow Pulse. When activate, this icon will light up yellow. Click again to deactivate. • In order to record diagnostic traces along with the flow data, please ensure that the trace icon is active and live traces are shown on the Trace tab. • The recording interval is set via the Setup->Recording Interval menu. The default is one record in every 2 seconds. • Files are automatically named with the "NivuGuard -" prefix followed by the current date+time stamp. An example is "NivuGuard-12-7-2012-08-00-00.txt" • If recording over a long duration, a new file will be automatically generated after 30 minutes. • The recorded data files are stored on the NivuGuard PC installation folder by default. • When recording is active, click again to stop recording.
	**Replay recorded data:** click to replay recorded data. This can be performed without connection to a NivuGuard 2. • The program will disconnect from a NivuGuard 2 during replay. • A prompt will appear for choosing the data files to play. • Select the data files to replay, ensure that only NivuGuard PC recorded data files are selected. • To replay more than one file, select multiple files by holding down the CTRL key on the keyboard while clicking additional files. • Recorded traces are shown in the Trace tab and the recorded flow is shown in the Flow tab. • During replay, click again to stop.
	**Increase Replay Speed:** during replay click to increase replay speed.
	Decrease Replay Speed: during replay click to decrease replay speed.

	**Exit:** click to exit program.

6.3 Program Tabs

6.3.1 „Flow“ Tab

The default screen of NivuGuard PC (Fig. 6-1) is the Flow tab. The dial on the left displays the linear flow velocity, while the numerical display on the right shows the volumetric flow rate. The default volumetric unit is litres per second, and is configurable on the Parameters tab.

Signal Strength

The signal strength gives an indication of the strength of the flow signal detected. A signal strength level of higher than 60 % is recommended for reliable operation. A higher Sensitivity setting may improve the Signal Strength (please refer to the Sensitivity section before changing).

Stability

The stability level is an indication of the consistency of flow reading, as derived from the combination of signal strength and statistical fluctuations of the flow reading. A high level of stability would point to a low-noise environment, clean and optimum acoustic pipe conditions, and a relatively laminar liquid flow within the pipe. However, the stability level does not necessarily indicate the accuracy of the flow reading as this is subject to calibration. A higher stability level indicates higher level of repeatability and better flow-tracking.

Fig. 6-1 „Flow“ Tab

6.3.2 „Flow Record“ Tab

The Flow Record provides a record of flow over time. Each point of flow on the graph represents a 1.2 second interval. However when the trace button has been pressed and a trace is being retrieved from the NivuGuard this slows down how frequently a point on the graph is plotted and the points then represent a 2 second interval.

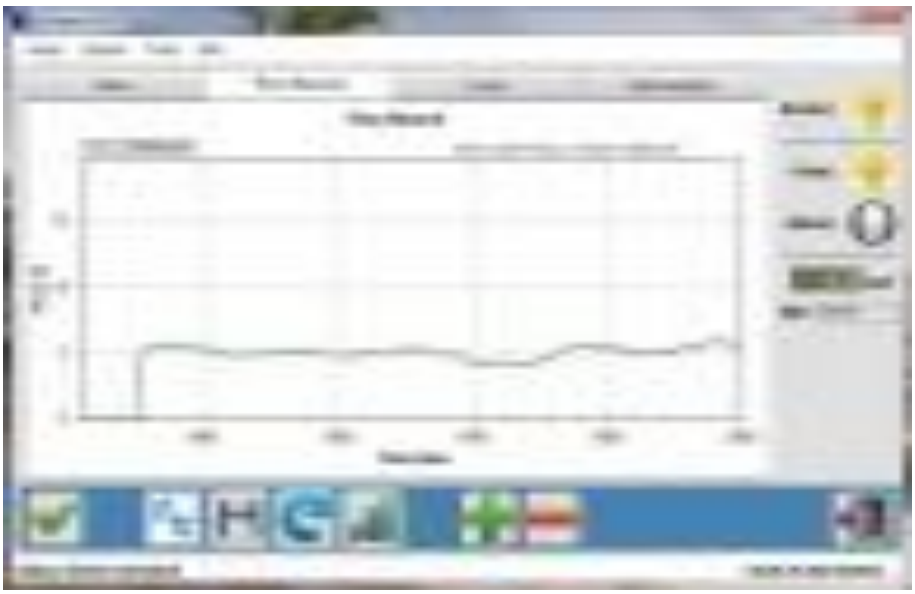


Fig. 6-2 Recording of flow rates

You can zoom in by clicking and holding the mouse then selecting the region to zoom in on. Zoom out by right clicking on the chart and selecting “Undo All Zoom”.
To clear the Flow Record chart, select Setup->Clear Flow Record Chart menu while the chart is inactive.

Note

When the save data to file function is being used, flow information and traces will be written to file at the fixed interval selected via Setup->Recording Interval (see Record to file function in “Using NivuGuard PC”).

6.3.3 „Trace“ Tab

This calls and displays diagnostic traces when the Trace button is activated. Please refer to “Diagnostic” and Troubleshooting (chapter 8.1) for more information on interpreting the traces.

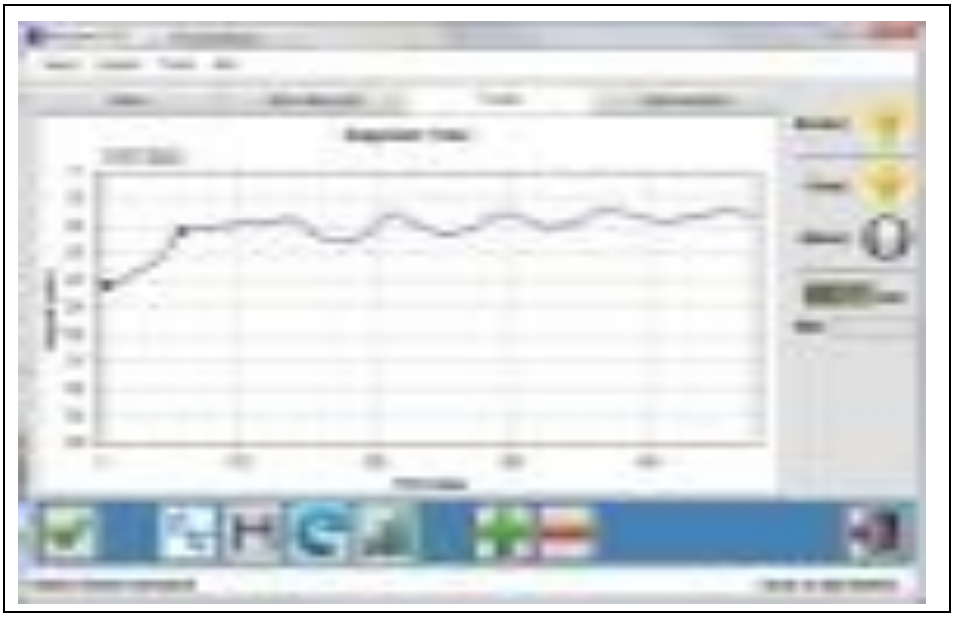


Fig. 6-3 Presentation of Diagnostic

6.3.4 „Parameters“ Tab

This enables the user to setup the NivuGuard 2. It is important to note the following to ensure that NivuGuard 2 is correctly programmed:

- At every connection to NivuGuard 2 the software will synchronise the values on the Parameter tab to that stored on NivuGuard 2.
- After changing any parameter click the „SAVE“ button.
- The values need to be valid and within allowed range for a parameter change to be successful.
- If the change is not successful, the values shown on the Parameter tab will reflect the current parameter value on NivuGuard 2.

Note

If NivuGuard 2 is being controlled simultaneously on both RS232 via NivuGuard PC and RS485 via Modbus interface, the values on the Parameter tab will not be instantly updated on NivuGuard PC if a parameter change is instructed via the RS485 Modbus.

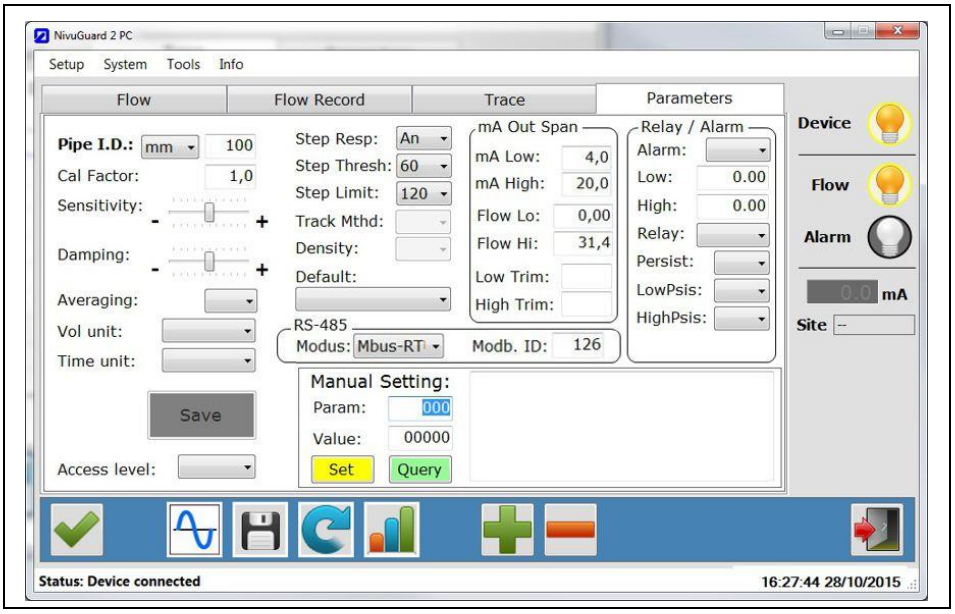


Fig. 6-4 Parameter setting

Calibration Factor

The calibration factor can be used to internally scale the flow reading by a multiplication factor.
As an example a factor of 0.5 will scale the reading to give only half of its original value, or a factor of 1.2 will scale the reading to give 120 % of its original.
This is set to 1.0 by default, implying no scaling. Note that any change in the calibration factor is stored on NivuGuard 2!

Sensitivity

The sensitivity of NivuGuard 2 can be increased for difficult pipes or liquids. When using NivuGuard 2 on high sensitivity setting, observations should be made to ensure that no-flow indication is consistent. Operating at higher sensitivity may increase the susceptibility of the device to external sources of noise. A lower sensitivity may be desirable when operating in an environment that has the potential for electrical interference. At lower sensitivities, observations need to be made to ensure that there is sufficient signal strength for reliable detection of flow. This needs to allow for any long-term variation in pump or pipe conditions. In general, minimum signal strength of 60 % is required.

It is recommended that the sensitivity be set as high as possible subject to the constraint of false flow indication under no-flow condition!

High Sensitivity	- Good for low flow or poor pipe condition with weak signal strength. - If set very high, watch for false indication of flow when the pump is not running and there is no flow. This may not be critical in applications where the main alarm condition is for low or no flow while pumping is called for.

Low Sensitivity	- Good for high flow or excellent pipe condition with strong signal strength. - If set very low, watch for false indication of no flow when the pump is running and there is flow. It is recommended that the sensitivity be set as high as possible subject to the constraint of false flow indication.

Damping

Fluctuations from non-laminar flow as well as from electrical noise will affect the stability of the flow readings. The damping parameter allows these fluctuations to be smoothed, at the expense of response time.
A higher damping will produce a more stable reading with less fluctuation, but the response time to a sudden change of flow is longer, and vice versa.
Note that a “Step Response” feature allows a large change of flow to by-pass damping, potentially giving a faster response at the start and end of pumping cycles. Please refer to the Step Response section for more details.
By default, the damping is set to give a stable reading, and the response time is in the region of 30 seconds.

Volumetric Unit and Time Unit

The flow measurement on the NivuGuard 2 is performed in terms of volumetric flow rate.
The defaults are litres for the volumetric unit and seconds for the time unit, giving flow rate in units of litres per second. This can be modified to give the desired units of flow rate. Please note that both volumetric and time units should be selected such that the numerical range falls within 0.01 to 60000 for the corresponding pipe internal diameter.

The table below lists the valid combination of volumetric and time units:

Valid Volume	Per Time
Litres	• Second • Minute
Cubic Metres	• Minute • Hour
Cubic Feet	• Second • Minute
Imperial Gallons	• Second • Minute
US Gallons	• Second • Minute
Million US Gallons	• Hour • Day

Access Level

The access level refers to the permission to perform actions or modify some parameters. There are two levels of access:

- USER
- SERVICE

At power-up, the access level on NivuGuard 2 always defaults to USER.

Step Response

The step response allows Flow Pulse to temporarily bypass damping and track any sudden change in flow commonly encountered during the beginning and end of a pumping cycles.
This function is on by default

Step Response Threshold

The step response threshold is the change in flow required for the normal damping to be bypassed. The range of the step response threshold is:
Min = 25, Max = 400 **Default = 60**
400 relates to the 'Flow High' value.
The higher the step response threshold, the larger the jump in flow needs to be before damping is skipped.

mA Output

mA Low, mA High, Flow Low, Flow High

The mA output has a range of 4 to 20 mA by default. This is scaled to the flow range set by the Flow Low and Flow High parameters. The following figure illustrates this.

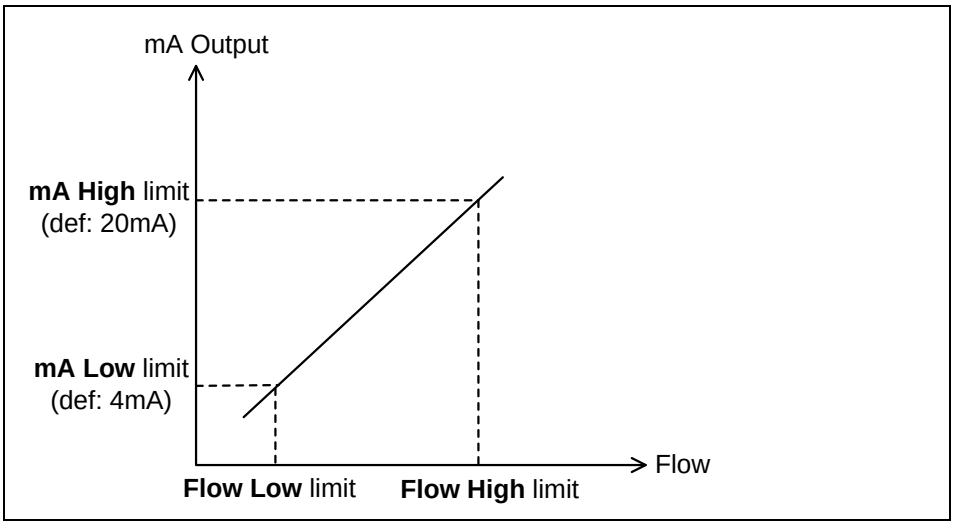


Fig. 6-5 mA output scaling versus the low-high range of flow

The mA High limit must be larger than the mA Low limit, and the Flow High limit must be larger than the Flow Low limit.
The Flow Low and Flow High limits are in units of volumetric flow rate as determined by the volumetric and time unit parameters (litres/sec by default). Therefore, the Pipe I.D. should be correctly set before setting the Flow Low and High limits.
As an example, in an application with low flow through a 100 mm Pipe I.D., the user can choose to scale the mA output from 4 to 20 to correspond to a flow range of 0 to 15 litres/sec instead of the full flow range of 0 to 31 litres/sec. This is achieved by first ensuring that the Pipe I.D. has been correctly set, and then setting the Flow High limit to 15 (the Flow Low limit is 0 by default).
The mA Low and mA High setting can also be used to make small adjustment to calibrate the device's mA output at Flow Low limit and Flow High limit.

For example:
If the mA output is 4.05 mA at Flow Low limit, the mA Low setting can be set from 4.0 to 3.95 for calibrating the actual mA output to 4.00 mA exactly.

>Q bei 4 mA< und >Q bei 20 mA<

The “Flow Low” and “Flow High” parameters represent the minimum and maximum flow rate setting, in units of volumetric flow rate.
By default, the flow rate limits, in units of litres per second, are set to correspond to the specification of flow velocity range of 0 to 4 m/s.
Note that the mA output is scaled to the flow rate limits that are set here

For example:
If the range is set to Flow Low = 3 litres/sec and Flow High = 10 litres/sec, then the mA output will be 4 mA at 3 litres/sec and 20 mA at 10 litres/sec. Please refer to the “mA Output” section for more information.

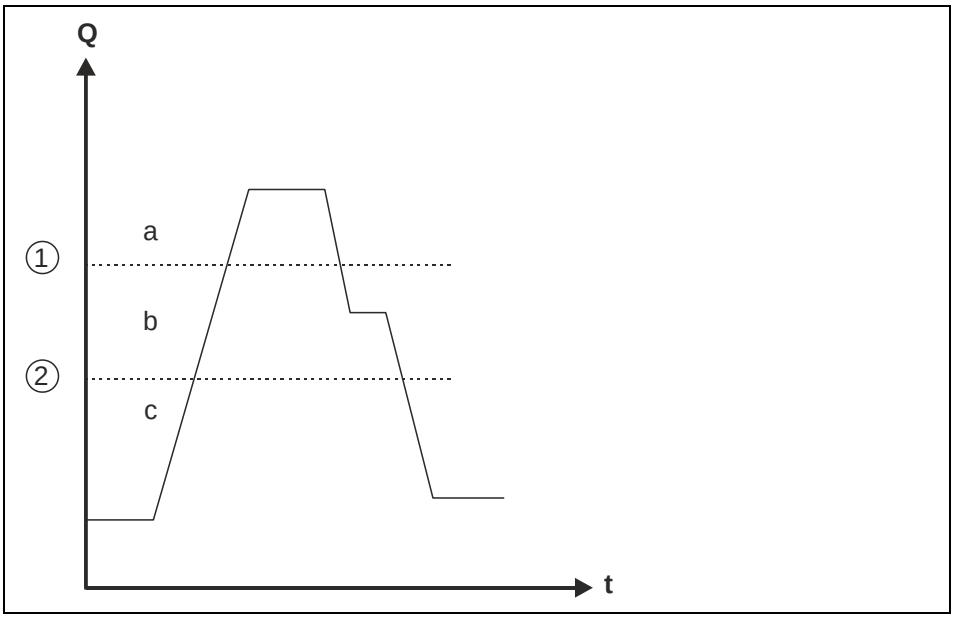
mA Output: mA Trim

The mA trim allows calibration to the mA output by using a fixed mA offset.
The offset is in units of micro amps (µA).
For example, if the mA output is 4.1 mA at Flow Low limit, an offset of minus 100 µA can be entered. Entering and saving -100 (minus 100) to mA Trim would produce 4.0 mA at Flow Low limit.
The maximum offset allowed is ±500 µA (±0.5 mA). The mA trim should only be used to make small offset to the mA output. This offset is applied across the full mA range.

Relay/Alarm

The Relay/Alarm parameters allow the set points and switching mode to be configured. Fig. 6-6 shows the alarm zones defined by the low and high set points, and the function of the different alarm modes.

Default: „Min“.



1 High setpoint
2 Low setpoint
a Zone high
b Zone mid
c Zone low

Fig. 6-6 Function of alarm modes

Alarm Mode	Zone Low	Zone Mid	Zone High
Low (Default)	Alarm ON	No Change	Alarm OFF
High	Alarm OFF	No Change	Alarm ON
Out of Range	Alarm ON	Alarm OFF	Alarm ON
Alarm OFF	De-energise	Alarm ON	Alarm OFF

The alarm modes and its effect in the relay/alarm zones as defined by the low and high set points.

The default alarm mode is low alarm.

The default relay mode is normally de-energised. The connection to the NC terminal is closed.

For low and high alarms, the Mid zone can be used as a buffer zone before switching occurs.

The Relay parameter (P204) is used to set whether you wish the relay to de-energise or energise in a state of alarm.

The Low and High Set-points are in units of volumetric flow rate as determined by the volumetric and time unit parameters (litres/sec by default). Therefore, the Pipe I.D. should be correctly set before setting the Low and High Set-points. Persistence is the number of continuous flow reading that must exceed the relevant set points before the alarm/relay status is switched. The Low Persist (LowPsis) parameter is associated with the Low Set-point while the High Persist (HighPsis) parameter is associated with the High Set-point.
For example, at low alarm mode, the flow must exceed the High Set-point before the alarm is disarmed and the relay switched. If the High Persist value is set to 2, then there must be 2 consecutive flow readings that exceed this set point before a switch is triggered.

RS-485

The NivuGuard 2 can be interfaced using Modbus via the RS485 terminals. The default **Modbus-Slave-ID** is **126**. The chapter on Parameter Guide provides more details on Modbus register addresses and valid values.

The RS-485 port can also be used to interface with the NivuGuard PC software, by selecting the PC-485 mode. Please ensure that you have a USB to RS-485 converter before setting NivuGuard 2 to this mode, as this is required for communicating with the device in the PC-485 mode. Refer to the PC-over-RS485 section in Chapter 8.2 „PC via RS485“.

6.3.5 Manual Setting

There is an option for manually setting the parameters using the Manual Setting terminal on the Parameter tab, as illustrated in the following figure.

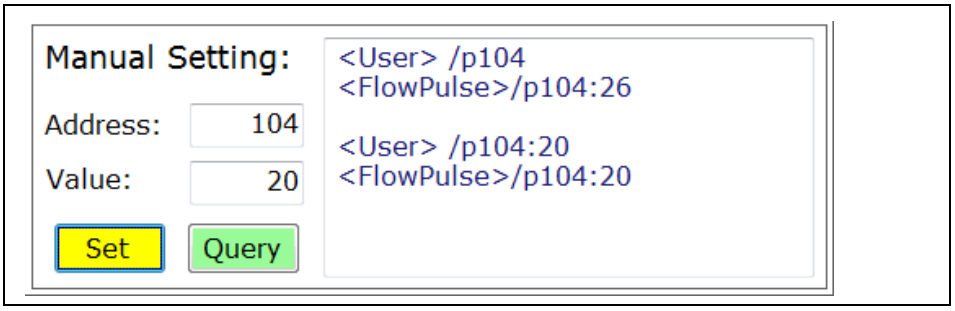


Fig. 6-7 The manual setting window on the „Parameter“ tab

Every parameter on NivuGuard 2 is identified by a unique Address, and the content is the parameter Value.
All configurable parameters can be queried by entering the parameter address in the Address field and clicking on the Query button. The NivuGuard 2 will reply with the current value of the parameter.

For setting a parameter, both the Address and Value must be entered before clicking on the Set button. The appropriate access levels are required for setting parameters.
The list of parameter addresses and valid values are available in the chapter 7.4

Note

The Manual Setting terminal should not be used for the normal setting up of NivuGuard 2. Refer to the "Parameter Guide" before setting parameters using address-value pair.

6.4 Navigation bar

6.4.1 Setup Menu

The Recording Interval menu controls the time interval before a new flow record and trace is saved to file when the save-to-feature is in use.
This menu enables setting up of the RS232 port. The default setting when interfacing using NivuGuard PC Software:

- 57600 Baud/8
- Bit/No
- Parity /1Stop-Bit.

There is normally no need to change the default parameters. The COM port number is automatically detected.
The Clear Flow Record chart option allows the Flow Record chart to be cleared.
The "Work Folder" allows the setting of a default folder for data files to be saved.

6.4.2 System Menu

This menu provides the option to perform the following actions:

Save Device Parameters	Extract configuration parameters from the device and save onto PC as a parameter file. This is saved to NivuGuard PC's installation folder and the filename is prefixed with "ParamNivuGuard 2".
Load Parameter to Device	Load the parameters from a parameter file onto NivuGuard 2. This should only be used with a file that has a prefix of " ParamNivuGuard 2".
Bootloader Control	Launch the Bootloader PC program for connecting to NivuGuard 2-Bootloader. This allows the firmware on NivuGuard 2 to be upgraded. Note that any customised parameters will be erased during a firmware upgrade, and therefore it is recommended that device parameters are saved onto PC before performing a firmware upgrade.

Reset sensor To Bootloader (Service parameter)	Reset Flow Pulse into Bootloader mode. The BootloaderPC program must be used to connect to NivuGuard 2 in this mode. The device will resume normal operation if no connection is established within 30 seconds.
Parameter Factory Reset	This resets all parameters to factory default.

6.4.3 Data

CSV Export
Creates a CSV file for documentation purposes from a system parameter file (flg.).

Print graph
Use this function to recall saved flow rate graphs.

Modbus at RS-485
Activates Modbus at the RS-485 interface.

Write Modbus register
This menu can be used to configure the Modbus interface.

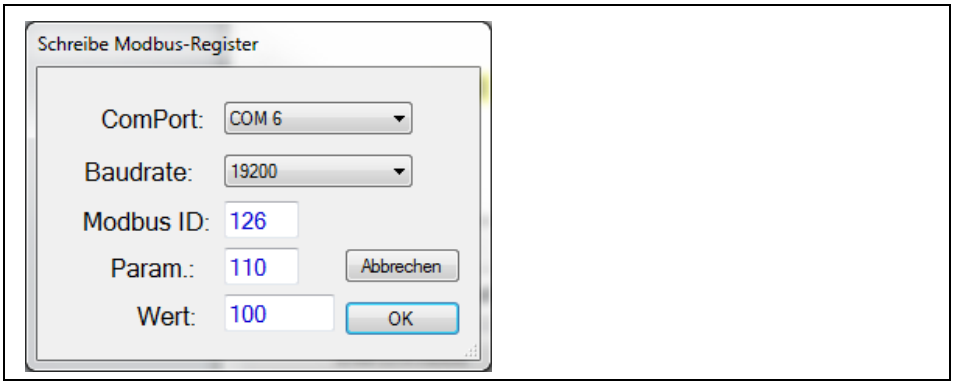


Fig. 6-8 Screen "Write Modbus Register“

6.4.4 Info

This menu provides information on the current version of NivuGuard PC program.
When connected to a NivuGuard 2, information on the firmware and hardware versions of the device are also available.

7 Overview RS485 Parameter (Modbus)

7.1 Parameter System

Every parameter on the NivuGuard 2 is represented by a unique address and a value. The parameters consist of two main types:

- Output parameters
- Configuration parameters.

Output parameters are read only and cannot be set by the user.

Examples are current flow reading and current signal strength.

Configuration parameters can be queried and set. With each parameter, there is:

- a factory default value
- an associated access level which is required for setting
- a valid range of values for each parameter

The naming syntax for the parameters is with a prefix of ‘p’ before the address. For example, a parameter at address 102 is “P102”. The value/content of the parameter is delimited by a colon “:”, such that “P102:20” indicates that the parameter at address 102 has a value of 20.
The terms “parameter” and “register” are used interchangeably as the parameter number is the actual address of the storage register.

7.2 Parameter Access

The parameters on the Flow Pulse can be accessed using any of these methods. It is recommended that only one method of access is used at any point in time:

1. the parameters tab on NivuGuard PC (RS232 or RS485)
2. the manual setting terminal on NivuGuard PC (RS232 or RS485)
3. Modbus communication protocol (RS485)

Note

When using methods (2) or (3), the parameter guide in this chapter should be referred to as the value required may be different from the values normally entered on FlowPulsePC with method (1)

7.3 Output Parameters

Flow Rate (P20 and P21)

The current flow rate can be read from register 20 and 21, in the following form:

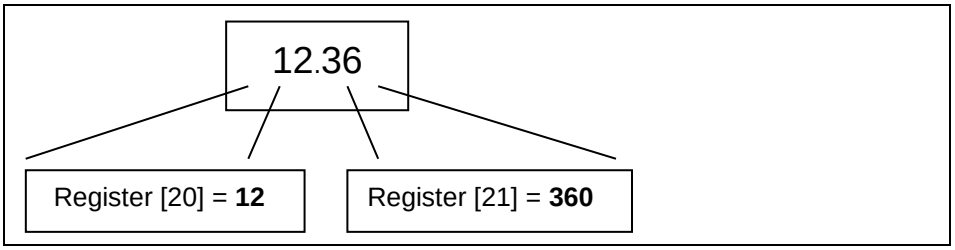


Fig. 7-1 flow rate format

P20 contains the whole number part of the flow reading, while P21 contains the fractional part of the flow reading. The p21 is stored as whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999).

Signal Strength (P22)

P22 gives the current signal strength in terms of percentage, from 1 to 100.

Stability (P23)

P23 gives the current stability in terms of percentage, from 1 to 100.

7.4 Configuration Parameter

7.4.1 RS485-Communication and Modbus

Default setting for RS485 is

- 19200/8Bit
- No parity -1 Stop-Bit.

P51 allows the Modbus protocol to be turned on and off, and P52 is the Modbus Slave ID of the NivuGuard 2.
When using Modbus-RTU, note that the register addressing scheme uses Base-0 addressing protocol (i.e. there is no offset of 1).

Parameter	Addr	Options	Default	Notes
Modbus Mode	51	0 = Not in use 1 = RTU 2 = N/A 3 = PC-4850 =	1	ASCII mode not fully supported yet. The PC-485 mode enables NivuGuardPC interface using RS485. Modbus protocol turned off while using PC-485. Refer to PC over 485 section in Chapter 5 for more information.
Device Address	52	Unique Address, 1 - 127	126	Modbus device ID
Baud Rate	53	0 = 1200 1 = 2400 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200	4	Baud rate for RS 485.
Parity	54	0 = No parity 1 = Odd parity 2 = Even parity	0	Parity for RS 485
Stop-Bit	55	1 – One stop bit 2 – Two stop bits	1	Stop bit for RS 485

RS232-Communication

Default setting for RS232 is

- 57600/8Bit
- Noparity /1Stop-Bit.

Parameter	Addr	Options	Default	Notes
Baud rate	61	0 = 1200 1 = 2400 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200	6	Baud rate for RS 232 NivuGuard PC/ Debug/Reflash port.
Parity	62	0 = No parity 1 = Odd parity 2 = Even parity	0	Parity RS 232
Stop Bit	63	1 – One stop bit 2 – Two stop bits	1	Stop Bit RS 232

Processing Parameters

The following are parameters that relate to the detection and processing of the flow signal.

Parameter	Addr	Options	Default	Notes
Magnitude Threshold (Sensi-tivity)	102	1200 - 3000	1600	A higher number gives lower sensitivity.
Damping	104	10 - 40	24	A higher number gives more damping.
Average Count	105	1 - 20	6	This is the number of averaging to perform on the reading – this is in-dependent of the damp-ing process. Reducing this will in-crease flow sampling rate at the expense of

Calibration Factor	108	1 - 500	100	The calibration factor for flow reading in percentage terms, default is 100 %. As example, 50 % would half and 200 % would double.
Pipe Internal Diameter	110	10 - 3000	15	Expected Pipe Internal Diameter in units of millimetres.
Step Response Mode	113	0 = OFF 1 = ON	1	When StepResp is off, no damping by pass will be performed.
Step Response Threshold	115	22 - 426	60	The threshold that the step change size needs to exceed before damping by pass is invoked. May use diagnostic trace to adjust this.
Step Change Limit	121	22 - 426	119	StepChangeLimit is the limit on any sudden change in flow reading. May use diagnostic trace to adjust this.

mA Output Parameters

The following are parameters that relate to the mA output and scaling to flow measurement. Please refer to the diagrams in Chapter 5.2.5 before setting the parameters manually or over Modbus.

Parameter	Addr	Options	Default	Notes
mA Low	162	3000 - 9000	4000	In units of µA (1000=>1mA). This can be used to adjust the lower limit of the mA output. Small adjustment can also be made to calibrate the mA output.
mA High	163	10000 to 20000	20000	In units of µA (1000=>1mA). This can be used to adjust the higher limit of the mA output. Small adjustment can also be made to calibrate the mA output.
mA Trim	164	0 - 1000	500	In units of µA, applies an offset across the full range of mA output. This is centred upon 500, such that the default value of 500 = 0 offset. 400 would give -100 µA offset, while 650 would give +150 µA offset. This differs from the method of directly entering -100 or +150 on the NivuGuard PC parameter tab.

Parameter	Addr	Options	Default	Notes
Flow Low (Integer part)	176	0 - 65535		P176 contains the whole number part of Flow Low limit, while P177 contains the fractional part of Flow Low limit. The P177 is stored as whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999) Note: The flow value is in units of the current volumetric flow rate
Flow Low (Fractional part)	177	0 - 1000		
Flow High (Integer part)	178	0 - 65535		P178 contains the whole number part of Flow High limit, while P179 contains the fractional part of Flow High limit. The p179 is stored as whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999) Note: The flow value is in units of the current volumetric flow rate
Flow High (Fractional part)	179	0 - 1000		

Alarm-/Relay parameter

Please refer to the diagrams in Chapter 5.2.3 Relay Output Alarm section before setting the Alarm/Relay parameters manually or over Modbus.

Parameter	Addr	Options	Default	Notes
Alarm Mode	201	0 = Low alarm 1 = High alarm 2 = Out of range alarm 3 = In range alarm	0	Refer to Relay/Alarm section in Chapter 5.2.3
Relay Mode	204	0 = Non-Energised during Alarm (power-failure => alarm) 1 = Energised during Alarm	0	

Persist Mode	205	0 – ON 1 – OFF	1	Switch both low and high persist on or off.
Low Set Point Persist	206	0 - 100	2	The number of times that a low set point is exceeded consecutively before triggering relay.
High Set Point Persist	207	0 - 100	2	The number of times that a high set point is exceeded consecutively before triggering relay.
Low Set Point (Integer Part)	208	0 - 65535		P208 contains the whole number part of Flow Low limit, while P209 contains the fractional part of Flow Low limit. P208 is stored as a whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999). Note: The flow value is in units of the current volumetric flow rate.
Low Set Point (Fractional part)	209	0 - 1000		P208 contains the whole number part of Flow Low limit, while P209 contains the fractional part of Flow Low limit. P208 is stored as a whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999).
High Set Point (Integer part)	210			P178 contains the whole number part of Flow High limit, while P179 contains the fractional part of Flow High limit. The p179 is stored as whole number from 0-999 (allowing a fractional representation from 0.001 to 0.999). Note: The flow value is in units of the current volumetric flow rate.
High Set Point (Fractional part)	211			

Flow Unit Parameters

The table below lists the valid combination of volumetric and time units:

Valid Volume	Per Time
Litres	• Second • Minute
Cubic Metres	• Minute • Hour
Cubic Feet	• Second • Minute
Imperial Gallons	• Second • Minute
US Gallons	• Second • Minute
Million US Gallons	• Hour • Day

Parameter	Addr	Options	Default	Notes
Volumetric Unit	192	1 – litre 2 – cubic meter 3 – cubic feet 4 – UK Gal 5 – US Gal 6 – Mil US Gal	1	NOTE: Refer to the table on valid combinations of volumetric and time units. Setting invalid combinations will result in significant measurement errors
Time Unit	193	1 – sec 2 – minute 3 – hour 4 – day	1	

Device Information Parameters

These parameters are read-only, and are usually only updated by the device.

Parameter	Addr	Options	Notes
Serial Number	240 & 241		Registers 240 and 241 form a 32-bit number. Register 240 => Most significant 16-bit Register 241 => Least significant 16-bit
Firmware ID	261		A number associated with the version of firmware.
Hardware ID	626		A number associated with the version of hardware.

Device Control Parameters

These parameters are for controlling the device or to perform system action.

Parameter	Addr	Options	Notes
Access Parameter	280	0	Write the necessary access code to this register in order to gain associated access level. No access code is required for user-level access. Read from this register to get the current access level: 0: User-level
Simulated Flow	288	0	Switch simulated flow on and off. 0: Off 1: On This is switched Off with every power-up. As simulated flow overrides real flow, ensure that this is switched Off when not required.

Parameter	Addr	Options	Notes
Simulated Flow Value	289	0	Simulated flow value in millimetres/sec. When on, simulated flow value will override any real flow detected. Simulated flow is affected by calibration factor, controls mA output and triggers relay in the same way as real flow.
Factory Reset	297	0	Writing integer 7 to this register will reset all parameters to factory default.
Reset to Bootloader	299	0	Writing integer 9 to this register will reset the device into Bootloader mode. Device will remain in Bootloader mode for around 35 seconds. If no Bootloader software is connected to the device after 35 seconds, device will resume normal operation if a valid firmware is already present.

8 Optimisation and Diagnostic

8.1 Interpreting Diagnostic Trace

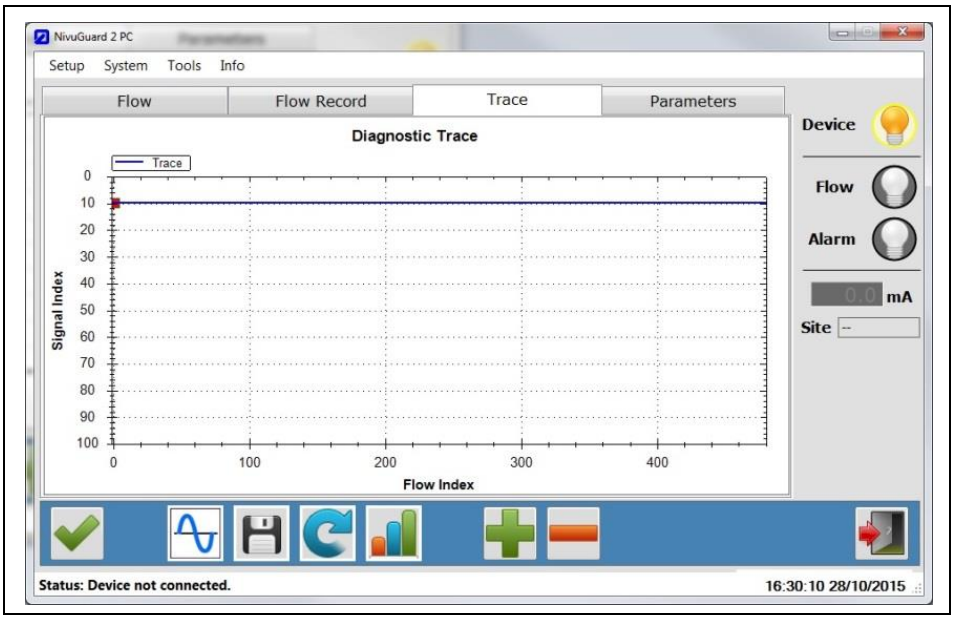


Fig. 8-1 Example of traces for no-flow (top) and 2.0 m/s flow (bottom

The vertical axis is related to the signal strength, while the horizontal axis is related to detected flow. .

The top chart in Fig. 8-1 shows the trace under no-flow condition. When there is no flow, the trace should be relatively flat and rest on signal index=90. If the line is not relatively flat, does not rest around signal index of 90 or there is any peak that is more than 10 signal index in size, then noise is affecting the device.

When signal is received, the Green square indicator will move down from 90 on the vertical axis. The further the Green indicator moves from 90, the larger the strength of the received signal. During flow condition, the Green indicator will normally be within the range of 30 to 70.

When flow is detected, the Red circle indicator will move horizontally to indicate flow detection. The Red indicator should always be within 80 to 90 on the vertical axis, under both flow and no-flow conditions. On the horizontal axis, the Red indicator should stay at 0 under no-flow, and move along the horizontal axis when flow is detected.

Under flow condition, the line should still approach and flat-line at signal index 90.

If the trace remains flat or the indicators struggle to remain stable during flow, then increase the Sensitivity setting.

Refer to the High Noise Environment section if unusual observations are seen on the diagnostic trace. See chapter 8.7

8.2 PC-over-RS485

In addition to the RS232 port NivuGuard 2 can also be interfaced to the PC via the RS-485 connection. A standard USB to RS485 converter is required. While using PC over RS-485, the Modbus RTU protocol will not be available. Follow these steps to use PC over RS-485:

1. If PC-over-485 is already enabled, then skip to Step 3otherwise connect over RS232 and use NivuGuard PC to set the RS485 mode to PC-485. Alternatively, if Modbus RTU is running on RS485, set register 51 to value 3.
2. Once the mode is saved or the register set, the change will take effect immediately. Therefore current connection of NivuGuard PC over RS232 or Modbus will be terminated.
3. Remove the USB to RS232 converter, and connect the USB to RS485 converter the NivuGuard 2.

To restore, set RS485 mode to >Off< or Modbus RTU (register 51 to 0 or 1). Set the baud rate back to 57600 when using the RS232 port.

8.3 Quick-Response Setup

In applications where a quick response is required, the NivuGuard 2 can be set to give a minimum response time of approximately 1 second.
Please follow these steps to setup Quick Response:

1. Establish connection using NivuGuard PC
2. Slide Sensitivity to the lowest setting.
3. Slide Damping to the lowest setting.
4. Set Avging to 2.
5. Set Step Thresh to 40.
6. Set Step Limit to 300.
7. Set Persist to Off.
8. Click SAVE and wait for 10 seconds to complete

While testing the response time, please ensure that diagnostic traces are not being called by NivuGuard PC.
To restore factory default, select System->Parameter Factory Reset.

8.4 Simulated Flow

Simulated flow can be used to test the device output and response. Using the Manual Setting:

1. Set register 288 to value 1 to turn on simulated flow.
2. Set register 289 to the flow value in units of millimetres/second flow speed.
3. Turn off simulated flow by setting register 288 to 0.

Simulated flow overrides actual flow and must therefore be turned off when not required.

8.5 Saving & Loading Device Parameters

For a device which parameters are heavily customised, the user may wish to replicate such customisation on a second device. Saving and loading parameters can be used to avoid having to set-up the parameters individually again:

1. Connect NivuGuard 2 PC to the first device, and then select System->Save Device Parameters.
2. A confirmation message will appear and the parameters saved to a file within the default folder (use Info->Data Folder Path to see the folder location). The filename is prefixed by „ParamNivuGuard 2 -" followed by the date and time.
3. Connect NivuGuard 2 PC to the second device on which to load the parameters. Select System->Load Parameters to Device, then choose the parameter file to load.

Reconnect NivuGuard 2 PC to see new parameter values.

8.6 Firmware-Upgrade (For Service only)

Note

This chapter is for Service Personnel only!

Ensure that Device Parameter Cloning is performed to ensure that any customised parameters are saved before proceeding with a firmware upgrade. Firmware upgrade is performed in the Bootloader mode. Note that all flow measurement and output operation will be halted when the NivuGuard 2is in the Bootloader. Please follow these steps:

1. Please ensure that the device is connected to the PC via the RS232 port or the RS485 port. You need the firmware file, and the COM port number on the PC.
2. Put the device into Bootloader mode by connecting NivuGuard 2 PC and select System->Switch Device into Bootloader.
3. Select System->Bootloader Control on NivuGuard this will launch the Bootloader interface.

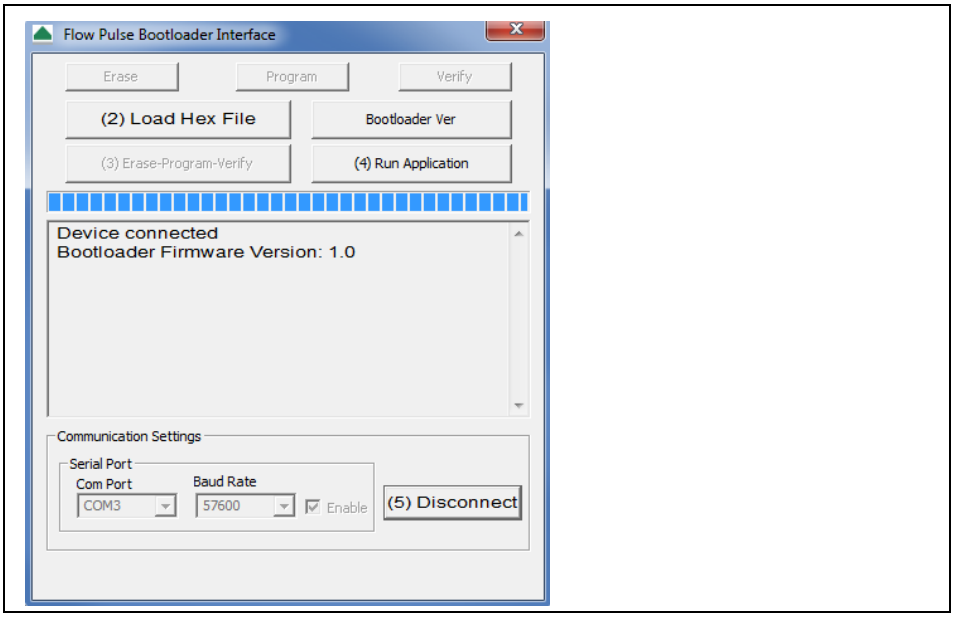


Fig. 8-2 Bootloader connecting

4. On the Bootloader Interface, choose the COM port number of the PC that is connected to the device. For Baud Rate, choose 57600 if using RS232, or 19200 is using RS485. Click Connect“.
5. Click Load Hex file, and choose the firmware file.
6. Click Erase-Program-Verify, and then wait for the process to complete.
7. When “Verification successful” message is displayed, click Run Application then click Disconnect.
8. Close the Bootloader Interface program, and reconnect to the device using NivuGuardPC.

9. When the device is in Bootloader mode, the Red led flashes continuously and the Green led is off.

In step (4), if the Bootloader Interface software does not connect to the device within 40 seconds, the NivuGuard 2will resume normal operation with its current firmware. Repeat step (2) to put the device into Bootloader mode again.

8.7 High Noise Environment

NivuGuard 2 may be affected by both ultrasonic and electrical noise. Exercise the following precautions during installation:

1. Avoid using other clamp-on ultrasonic device less than 1 metre from NivuGuard 2.
2. Ensure that screened cables are used and that the NivuGuard 2enclosure is properly Earthed – do not connect the cable screen to the Ground (-) terminal of the power supply or the mA output. If RS485 is not used, the cable screen should be connected to the enclosure using the cable entry gland. If RS485 is used, connect cable screen to the RS485 screen terminal, then earth the Flow Pulse enclosure separately if possible.
3. Relocate the device away from pumps, valves, tees or elbows where possible.

9 Common Questions and Answers

9.1 Will mechanical vibration affect flow measurement?

Typical mechanical vibration sources such as pumps are much lower in frequency compared to the ultrasonic signal of the NivuGuard 2. However, in situations where the signal strength is weak (less than 70% with maximum sensitivity) the accuracy may be affected or there could be readings under no-flow conditions. Very strong continuous mechanical vibration may affect the mechanical coupling of the device. Install away from vibrational sources if possible, or use damping material between clamping band and pipe to reduce vibration.

9.2 Is it possible to operate the device in a high noise environment?

Yes, refer to High Noise Environment section in chapter 8.7.

9.3 What is the effect of pipe lining?

Any form of lining with air gap between the liner and the pipe wall will stop ultrasonic signal. Better results can be expected with bonded liners such as cement, epoxy and tar. However, an on-site test is highly recommended for lined-pipe applications.

9.4 What is the effect of poor pipe condition?

One of Flow Pulse's unique strength is its ability to detect flow with very weak ultrasonic signals. However, severe pipe corrosion, both externally and internally, can affect the accuracy of measurement. Flaky pipe surfaces should be cleaned and sand-down. Severe build up or deposit on the pipe internal can also significantly attenuate ultrasonic signal.

9.5 Does Flow Pulse measurement drift over time?

NivuGuard 2 is calibrated using an in-house test-rig with a Magnetic Flowmeter installed. Any electronically induced drift is several magnitudes smaller than the specified variation of NivuGuard 2 due to the precise crystal-controlled timing circuitry.

9.6 Can NivuGuard 2 be operated in a wet environment?

The NivuGuard 2 enclosure is rated at IP68 to give maximum electrical safety in the event of accidental or temporary contact with liquid. Operation in an environment that frequently exposes the device to liquid is not recommended. External liquid moving in direct contact with the device or the pipe surface where it is installed may be interpreted as flow and produce flow reading in no-flow conditions. Consider applying an air filled or porous cladding around the device and pipe vicinity to prevent detection of external liquid flow.

9.7 Troubleshooting

LED-Indication

GREEN	RED	STATUS
Flashing	On	Normal operation, with alarm condition
Flashing	Off	Normal operation, no alarm condition
Flashing	Off with Alarm Condition	A recoverable fault has occurred, check Fault Codes (query registers 270 – 279) If repetitive servicing maybe required
Off	Flashing	In Bootloader mode/Waiting for connection from Bootloader PC software.
Off	Off	Device not powered, or if powered, a critical fault has developed.

9.8 Fault Registers and Log File

The registers 270-279 can be queried (via NivuGuard PC or Modbus) to check for fault codes:

1. Retrieved parameter exceeded valid range.
2. Parameter value entered by user exceeded valid range.
3. Number of self-reset events (register 266) exceeded the maximum allowed.
4. Fail to retrieve stored parameters.

While using NivuGuard PC, all parameter changes are time-stamped and logged to a file within the Debug folder.

9.9 Flow measurement is significantly different from expectation

POSSIBLE CAUSES	ACTION
Calibration Error	Verify Pipe Internal Diameter setting
Actual flow rate is indeed different from what is expected	Check pump and valves, verify flow using other methods.
Improper device installation	Check clamping is not loose and coupling compound is applied. If a coupling pad is used, ensure that it is not creased, torn or folded.
Inadequate signal peneration	Relocate closer to elbows or flow disturbance as internal build-up and deposit may be less severe. Do not install directly on Tees or elbows.
Pipe is not full	Reinstall on the lower quadrant of the pipe.
Noise and/or interference	If possible, relocate away from pumps and valves (about 10 diameters), and elbows and tees (about 5 diameters). Ensure a screened cable is used, and the screen is not connected to the ground of the power supply or mA output. The cable screen should be connected to the enclosure using the cable entry gland and earthed on the other end. If RS485 is used, the cable screen should be connected to the RS485 screen terminal and the NivuGuard 2 enclosure separately earthed if possible. If variable speed drives (VSD) are present ensure that VSD manufacturers wiring and grounding instruction is followed. Reinstall device and cabling away from VSD and isolate power supply. Refer to the High Noise Environment section in chapter 8.7.

9.10 Flow reading under no-flow condition

POSSIBLE CAUSES	ACTION
Strong vibration on pipe	Reduce the “Sensitivity” setting. Reinstall away from vibration source.
Local electrical noise	Ensure screen cable is used, and the screen is not connected to the ground of the power supply or mA output. The cable screen should be connected to the enclosure using the cable entry gland and Earthed on the other end. If RS485 is used, the cable screen should be connected to the RS485 screen terminal and the NivuGuard 2 enclosure separately Earthed if possible.
Variable Speed Drive (VSD) interference	Ensure that VSD manufacturers wiring and grounding instruction is followed. Reinstall device and cabling away from VSD and isolate power supply.
Contact with external flowing liquid	Clad the device and pipe vicinity with porous or air filled material (i.e. similar to bubble wrap) to prevent ultrasonic signal from reaching external flowing liquid.

9.11 Flow reading fluctuates or erratic

POSSIBLE CAUSES	ACTION
Device installed too close to valve, pump, tees or elbows. Non-return valves can produce strong knocking.	Reinstall further away if possible. Increase the “Damping” setting on the device. Turn “Step Response”off if necessary. Use a smaller “Step Limit” if fluctuation persists. The response time will increase with such settings.

9.12 No flow indicated under flow-condition

POSSIBLE CAUSES	ACTION
Coupling compound washed out or worn.	Check and reapply coupling compound if necessary.
Insufficient suspended particles or gases, poor pipe condition, severe (more than 50%) internal build-up, or flow too low.	Increase “Sensitivity” setting. Relocate onto the top position of the pipe. Relocate to more turbulent pipe section.

9.13 Relay state not stable

POSSIBLE CAUSES	ACTION
Frequent crossing of the low and high set points	Increase “Damping”, and turn “Step Response” off if necessary. Increase buffer between low and high set points. Turn on “Persistence” and increase low and high persistence numbers.

10 Accessories

E-PMA-SILIKFE1:	Diamante silicone grease type 1; 75 gram tube
ZUB0GELTAPE:	Gel tape
E-KAS-CY10X1:	cable TRONIC CY 10 x 1 mm²

11 Maintenance and Cleaning

There are no user serviceable parts inside NivuGuard 2.
If you experience any problems with the unit, then please contact the NIVUS Hotline:
Tel. +49 (**0) 7262 9191-888** for advice

To clean the equipment, wipe with a damp cloth. Do not use any solvents on the enclosure.
When relocating or reinstalling the NivuGuard 2, please ensure that the pipe internal diameter value stored on the device is updated accordingly

12 Dismantling/Disposal

EC WEEE-Directive logo

This symbol indicates that the Directive 2002/96/EG on waste electrical and electronic equipment requirements shall be observed on the disposal of the equipment!

Improper disposal may be harmful to the environment.

- Always dispose equipment components and packaging materials according to applicable local regulations on environmental standards for electronic products.

13 Parameter Record

Parameter Details	**Entered Values**					
Description	**Default**	**1**	**2**	**3**	**4**	**5**
Pipe Internal Diameter	100					
Calibration Factor`	1					
Volumetric Units	1 (litre)					
Time Unit	1 (second)					
mA Low	4 mA					
mA High	20 mA					
mA Trim	-					
Flow Low	-					
Flow High	-					
Alarm Mode	0 (low.)					
Low Set	0,0					
High Set	0,0					
Relay Mode	0					
Low Persist	-					
High Persist	-					
RS 485 Mode	3					
Modbus ID	1					
Firmware	Read Only					

14 Table of Pictures

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DE / EN / FR

EU Konformitätserklärung

EU Declaration of Conformity

Déclaration de conformité UE

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

Für das folgend bezeichnete Erzeugnis:

For the following product:

Le produit désigné ci-dessous:

Bezeichnung:	**Clamp-On Ultraschall Strömungswächter**
Description:	*clamp-on ultrasonic guard*
Désignation:	*Surveillance de flux par ultrasons Clamp-On*
Typ / Type:	**NG20…**

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 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:*

Ingrid Steppe (Geschäftsführerin / *Managing Director / Directeur général)*

Eppingen, den 24.10.2022

Gez. *Ingrid Steppe*

UK Declaration of Conformity

NIVUS GmbH
Im Täle 2
75031 Eppingen

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

For the following product:

Description:	**Clamp-on ultrasonic guard**
Type:	**NG20…**

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

- SI 2016 / 1091 The Electromagnetic Compatibility Regulations 2016
- SI 2016 / 1101 The Electrical Equipment (Safety) Regulations 2016
- SI 2012 / 3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

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

- BS EN 61326-1:2013
- BS EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

This declaration is submitted on behalf of the manufacturer:

NIVUS GmbH
Im Taele 2
75031 Eppingen
Germany

represented by:
Ingrid Steppe (Managing Director)

Eppingen, 24/10/2022

Signed by *Ingrid Steppe*