

## 1. APPLICATION

The NIVOSONAR GPA open channel flow metering system by NIVELCO enables flow measurements of fluids in various open channels and gravitational sewers. The flow measuring system consists of PilotTREK, EasyTREK or EchoTREK level transmitters and a Parshall flume reducing element. Depending on the flow rate 9 different sized – measurement range – channels are available to the users. The flow-meter formula of the selected Parshall flume is included in each ultrasonic transmitter's software, made by NIVELCO. The total measuring range of the flume is from 1...6627 m<sup>3</sup>/h. The PilotTREK, EasyTREK or EchoTREK level transmitters (*upon choice*) and the MonoCONT Smart Field Display & Data Logger, or MultiCONT Multichannel Process Controller – which are requirements to build a complete measuring system – are optionally available.

## 2. TECHNICAL DATA

### 2.1 Metric (SI) Units

| Type                            |                   | NIVOSONAR GPA |        |        |       |       |       |       |       |       |
|---------------------------------|-------------------|---------------|--------|--------|-------|-------|-------|-------|-------|-------|
|                                 |                   | P1            | P2     | P3     | P4    | P5    | P6    | P7    | P8    | P9    |
| Q <sub>min</sub>                | m <sup>3</sup> /h | 0.94          | 1.88   | 2.8    | 5.5   | 8.1   | 10.5  | 15.8  | 20.8  | 31.3  |
| Q <sub>max</sub>                | m <sup>3</sup> /h | 22.3          | 54.4   | 196    | 604   | 1324  | 2152  | 3232  | 4359  | 6627  |
| W                               | cm                | 2.54          | 5.08   | 7.62   | 15.24 | 22.86 | 30.48 | 45.7  | 61    | 91.4  |
| B                               | cm                | 30            | 34     | 39     | 53    | 75    | 120   | 130   | 135   | 150   |
| C                               | cm                | 9.29          | 13.49  | 17.8   | 39.4  | 38.1  | 61    | 76.2  | 91.44 | 121.9 |
| D                               | cm                | 16.75         | 21.35  | 25.88  | 39.69 | 57.47 | 84.46 | 102.6 | 120.7 | 157.2 |
| E                               | cm                | 23            | 26.4   | 46.7   | 62    | 80    | 92.5  | 92.5  | 92.5  | 92.5  |
| L                               | cm                | 63.5          | 77.5   | 91.5   | 152.4 | 162.6 | 286.7 | 294.3 | 301.9 | 316.9 |
| O                               | cm                | 5             | 5      | 5      | 10    | 10    | 10    | 10    | 10    | 10    |
| U                               | cm                | 24.8          | 28.6   | 49.2   | 69.6  | 87.6  | 100.1 | 100.1 | 100.1 | 100.1 |
| V                               | cm                | 30.7          | 35.35  | 39.9   | 54    | 80    | 100   | 120   | 140   | 180   |
| m                               | kg                | 9             | 10.6   | 19.1   | 49    | 81    | 146   | 183   | 231   | 252   |
| h <sub>d</sub> / h <sub>a</sub> |                   | 0.6           |        |        |       |       | 0.7   |       |       |       |
| a                               |                   | 0.0609        | 0.1197 | 0.1784 | 0.354 | 0.521 | 0.675 | 1.015 | 1.368 | 2.081 |
| b                               |                   | 1.552         | 1.553  | 1.555  | 1.558 | 1.558 | 1.556 | 1.560 | 1.564 | 1.569 |

$Q = a \cdot h_a^b$  [m<sup>3</sup>/s], where h<sub>a</sub>: the measured level in meters, a: see table, b: see table.

### 2.2 Imperial Units

| Type                            |      | NIVOSONAR GPA |       |      |      |       |       |       |       |       |
|---------------------------------|------|---------------|-------|------|------|-------|-------|-------|-------|-------|
|                                 |      | P1            | P2    | P3   | P4   | P5    | P6    | P7    | P8    | P9    |
| Q <sub>min</sub>                | GPM  | 4.1           | 8.3   | 12.3 | 24.2 | 35.7  | 46.2  | 69.6  | 91.6  | 137.8 |
| Q <sub>max</sub>                |      | 98.2          | 239.5 | 863  | 2659 | 5829  | 9475  | 14230 | 19192 | 29178 |
| W                               | inch | 1             | 2     | 3    | 6    | 9     | 12    | 18    | 24    | 36    |
| B                               |      | 11.8          | 13.4  | 15.4 | 20.9 | 29.6  | 47.2  | 51.2  | 53.2  | 59    |
| C                               |      | 3.7           | 5.3   | 7    | 15.5 | 15    | 24    | 30    | 36    | 48    |
| D                               |      | 6.6           | 8.4   | 10.2 | 10.2 | 15.6  | 33.3  | 40.4  | 47.5  | 61.9  |
| E                               |      | 9             | 10.4  | 18.4 | 24.4 | 31.5  | 36.4  |       |       |       |
| L                               |      | 25            | 30.5  | 36   | 60   | 64    | 112.9 | 115.9 | 118.9 | 124.8 |
| O                               |      | 1.97          |       |      | 3.94 |       |       |       |       |       |
| U                               |      | 9.8           | 11.3  | 19.4 | 27.4 | 34.5  | 39.4  |       |       |       |
| V                               |      | 12            | 13.9  | 15.7 | 21.3 | 31.5  | 39.4  | 47.2  | 55.1  | 70.9  |
| m                               | lb   | 19.8          | 23.4  | 42.1 | 108  | 178.6 | 321.9 | 403.5 | 509.3 | 555.6 |
| h <sub>d</sub> / h <sub>a</sub> |      | 0.6           |       |      |      |       | 0.7   |       |       |       |
| a                               | ft   | 0.2           | 0.4   | 0.6  | 1.2  | 1.7   | 2.2   | 3.3   | 4.5   | 6.8   |
| b                               |      | 5.1           | 5.1   | 5.1  | 5.1  |       | 5.1   | 5.1   | 5.1   | 5.1   |

$Q = a' \cdot h_{\{ab\}}$  [ft<sup>3</sup>/s], where h<sub>{ab}</sub>: the measured level in feet, a': see table (converted from SI by multiplying a with 10.764), b: see table (converted to feet if originally given in meters).

### 2.3 Accessories

- User Manual
- Warranty Card
- EU Declaration of Conformity

# NIVOSONAR

GPA-IP□-0  
Open-channel Metering System

## USER'S MANUAL



CE

Manufacturer:

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## 2.4 Order Code

NIVOSONAR G P A - 1 P   - 0

| Measuring range (m³/h) [GPM]                                                                               | Code |
|------------------------------------------------------------------------------------------------------------|------|
| $Q_{\min} = 0.94 \text{ m}^3/\text{h}$ [4.14 GPM]; $Q_{\max} = 22.3 \text{ m}^3/\text{h}$ [98.18 GPM]      | 1    |
| $Q_{\min} = 1.88 \text{ m}^3/\text{h}$ [8.28 GPM]; $Q_{\max} = 54.4 \text{ m}^3/\text{h}$ [239.52 GPM]     | 2    |
| $Q_{\min} = 2.8 \text{ m}^3/\text{h}$ [12.33 GPM]; $Q_{\max} = 196 \text{ m}^3/\text{h}$ [862.96 GPM]      | 3    |
| $Q_{\min} = 5.5 \text{ m}^3/\text{h}$ [24.22 GPM]; $Q_{\max} = 604 \text{ m}^3/\text{h}$ [2,659.33 GPM]    | 4    |
| $Q_{\min} = 8.1 \text{ m}^3/\text{h}$ [35.66 GPM]; $Q_{\max} = 1324 \text{ m}^3/\text{h}$ [5,829.4 GPM]    | 5    |
| $Q_{\min} = 10.5 \text{ m}^3/\text{h}$ [46.23 GPM]; $Q_{\max} = 2152 \text{ m}^3/\text{h}$ [9,474.97 GPM]  | 6    |
| $Q_{\min} = 15.8 \text{ m}^3/\text{h}$ [69.57 GPM]; $Q_{\max} = 3232 \text{ m}^3/\text{h}$ [14,230.07 GPM] | 7    |
| $Q_{\min} = 20.8 \text{ m}^3/\text{h}$ [91.58 GPM]; $Q_{\max} = 4359 \text{ m}^3/\text{h}$ [19,192.1 GPM]  | 8    |
| $Q_{\min} = 31.3 \text{ m}^3/\text{h}$ [137.81 GPM]; $Q_{\max} = 6627 \text{ m}^3/\text{h}$ [29,177.8 GPM] | 9    |

## 3. INSTALLATION

The Parshall flume is a rigid structure, welded out of polypropylene sheets with narrow tolerances to ensure high accuracy of metering, therefore during transport and installation great care should be taken to prevent the flume of getting deformed. The Parshall flume is delivered as a compact unit, its installation is easy, doesn't require any special skills. When selecting the position of the mounting, particular attention should be paid to ensure laminar flow conditions. Flow measurement using a Parshall flume in closed channels is exclusively possible if the fluid doesn't fully occupy the entire cross-section of the tube (eg. *gravitational sewers*). In such cases, it is inevitable to disassembly the pipeline network to insert a meter shaft in order to install the reducing element.

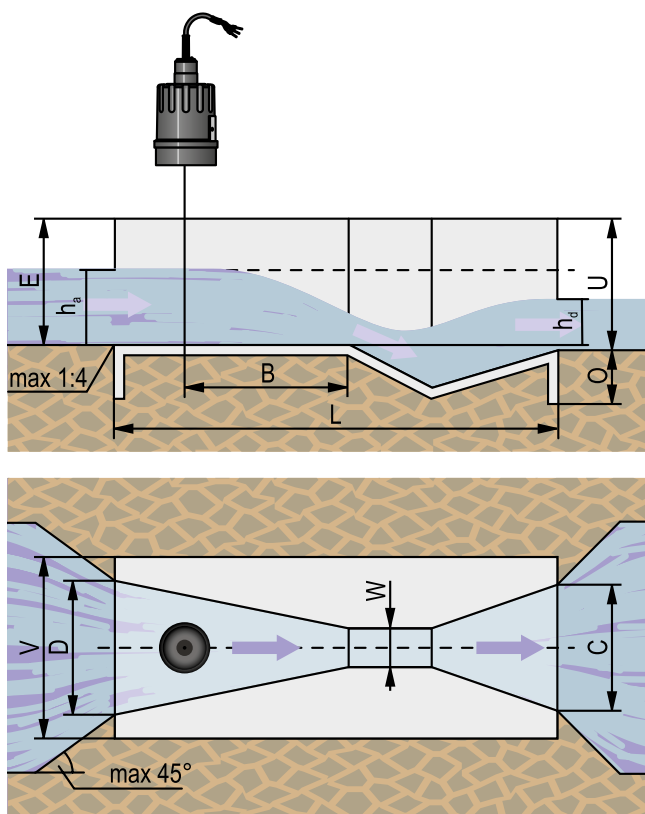


Figure 1.

$Q = a \cdot h_a^b$  [m³(ft)/s], where  $h_a$ : the measured level in meters, a: see table, b: see table.

## 4. PUTTING INTO OPERATION, SETUP

In the Parshall flume applied as a reducing element, the stagnation pressure causes the liquid level to rise. This change of the level is proportional to the velocity and rate of the liquid flow. A PilotREK, an EasyTREK or an EchoTREK Ultrasonic Level Transmitter measures the changes of the fluid level and transmits the measured data via HART® communication to the MultiCONT Multichannel Process Controller, MonoCONT Smart Field Display & Data Logger or a PC, using a UNICOMM HART®-USB/RS485 modem. The ultrasonic transmitters can be programmed; while the measured data can be gathered, transmitted and displayed in a remote way (4...20 mA, RS485), as well as there are multiple relay outputs also possible.

## 5. SPECIAL CONDITIONS OF SAFE USE

- The Parshall flume should be installed into the longitudinal axis of the channel so that the hydraulic conditions comply with the general regulations both at the inlet and outlet.
- The direction of the flow and the position of the ultrasonic sensor are indicated on the flume. Stability of flow and flow-rate profile should be ensured; vortexing or waving motion is not allowed.
- A flow homogenization section – basically a straight one without any disturbing object/effect – of 2...3 times the flume width (D) should be ensured before the flume inlet. The same should be provided at the flume outlet with a length of 3...4 times the flume width (C), but at least 5 m (16.4 feet) straight section. At these sections, the shapes of the cross-section of the channels should be regular and symmetrical to the longitudinal axis. When installing the Parshall flume, its corresponding sides should be connected with the sidewalls and the bottom of the channel to be measured. The angle between the connecting plates and the axis of the Parshall flume should not be larger than 45°. The tilt angle of the bottom connecting plates should not be larger than 15° (see Figure 1).
- In case of narrow channels, the biggest allowed angle of the side walls connected to the Parshall flume is 10°.
- The flow can be stabilized posteriorly using sidewalls or floats.
- At the flume outlet, it is necessary to ensure that the “flooding” does not exceed the permissible extent ( $h_d / h_a$  ratio, see *Technical Data table*). If the liquid level exceeds the permissible height, the location of the flume or the sizes of the homogenizing sections after the flume outlet have to be modified.
- The accuracy of the flume heavily depends on its installation, so it is recommended to employ a specialist to make a hydraulic plan and to execute the installation. The prefabricated Parshall flume is recommended to be laid in concrete at the watercourse.
- At first, the flume bottom has to be embedded in concrete, so that the top cover of the flume remains horizontal. Then the shutters of the sections joining the channel sidewalls to the flume have to be prepared, in accordance with the previously described principles.
- The walls of the flume should be supported from the inside before concreting to avoid structural deformation. It is recommended to install wooden spacers in  $1.5 \times 1.5 \text{ cm}$  [ $0.59'' \times 0.59''$ ] sizes along the borders – upper edge, front and backside – of the flume. After the concrete is solidified, the spacers should be removed and the gaps filled with flexible sealing (eg. *silicone rubber*). In case if the reinforcing rib of the tunnel obstructed the level measurement, it can be cut off after mounting!

## 6. MAINTENANCE AND REPAIR

The Parshall flume is suitable for outdoor placement and resists well to acids or to the most of solvents under normal conditions. The flume needs to be checked regularly and cleaned whenever necessary. Sedimentation or other contamination may impair the accuracy of the measurement!



**Warning!**

The water in the measuring flume should not get frozen, as this may cause cracks or a distorted shape of the flume.

## 8. STORAGE CONDITIONS

Storage temperature:  $-25...+60 \text{ }^\circ\text{C}$  ( $-13...+140 \text{ }^\circ\text{F}$ )

The flumes should not be transported or stored with piled up on each other!

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NIVELCO reserves the right to change technical data without notice