# FLOW RECORDING IN AN OPEN CHANNEL USING THE PARSHALL FLUME ACCORDING TO ISO 9826

The use of the DL2/DL7 data logger, Parshall flume and ultrasonic probe enables measurement of volumetric flow in an open channel. The data logger calculates the flow based on the height of the medium (measured by the probe) and entered math formula. The data recorded by the DL2/DL7 data logger enable analysis of the system operation and are a confirmation of the operating conditions.

Below there is a description of using the DL2 data logger to calculate and monitor flow in an open channel.
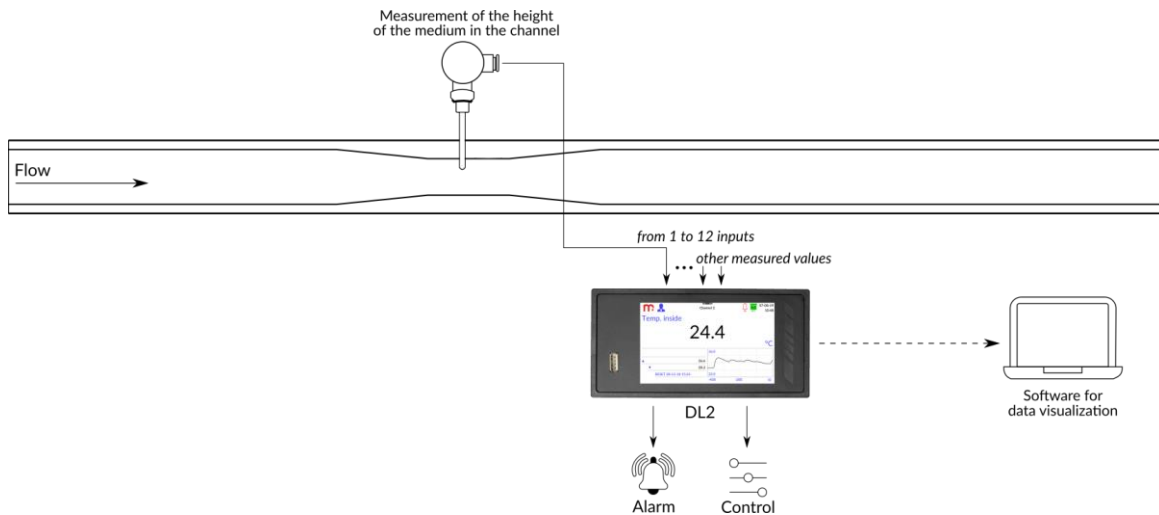
• Description

The Parshall flume accelerates the flow of the medium in the channel. The mounted ultrasonic probe measures the height of the medium in the channel and transmits data in the form of a 4-20 mA signal. The DL2 data logger with the IN6I(24V) module installed converts the read current value to the height expressed in meters.

The device enables entering a math formula which determining the flow (Q), based on the height of the medium, e.g. $Q=k \cdot h^a$. The formula is given by the Parshall flume manufacturer (for example, the volume flow Q, expressed in m^3/h, can be calculated using the formula: $Q=(2.2248740 \cdot h^{1.5206460}) \cdot 3600$). The device has one 4-20mA analog output which enable retransmission of any channel value (also computed channel value).

Each channel can have two independent totalizers enabled for flow counting. Totalizers can operate in daily, weekly, monthly, resettable or unresettable mode. The value of the channel can be assigned to subsequent channels, which enables summation of flow in different modes.

Each channel can have assigned two independent alarms regarding the process value. Two functions are available: alarm or control. Exceeding the indicated height of the medium value or the temporary flow value (exceeding the alarm level) can cause a change in the state at the assigned relay output (the DL2 data logger has 4 relay outputs). The data logger screen displays the process value, as well as the maximum and minimum values, which allows a quick assessment of the operating conditions.

The DL2 data logger has 30 channels to which the data are assigned, for example measurement of the height (h) or value of the flow (Q). The flow can also be calculated based on the tabular (user) characteristics entered in the device.

• Reading and recording results

The DL2/DL7 data logger archives values of channels, values of totalizers and records exceeding the alarm levels, according to the entered settings. Archive files can be downloaded from the device using a portable memory (USB key) or using an Ethernet cable and a web server. Additional software on the PC enables visualization of archived data or current values (DL2-RP/DL2-RPplus, DL7-RP/DL7-RPplus, mLog). The DL2/DL7 data logger can be connected to the SCADA master system.
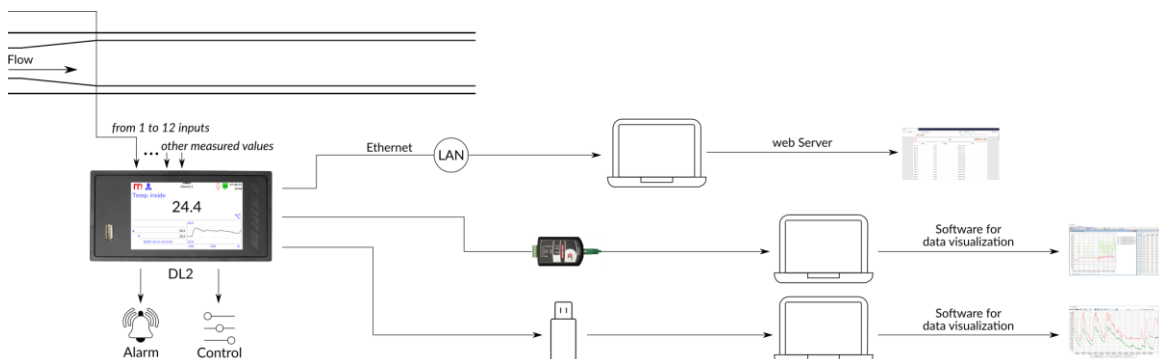
- ## Example of device configuration

Application of the DL2 data logger with the ultrasonic probe requires the installation and configuration of an additional module for 4-20 mA current loop reading. The data logger can be configured on a computer using a dedicated program or from the device level.

An example configuration of the DL2 data logger (with the IN6I (24V) module installed) for monitoring the flow based on the height of the medium in the channel is presented below. Described configuration is performed from the device level.

1. Configuration is possible from the Administrator level (⚙ → 👥 → *Login* → **Login**),
2. The IN6I(24V) module input should be set in a mode compatible with the way of connecting the probe, for example
   4-20mA: ⚙ → ⚡ → *Select the input* → **IO 1 / .. / IO 6** → **Mode** → *4-20mA* → **Adjustment** → *value* → ✅,
3. The read results should be assigned to the channels. The DL2 data logger has 30 freely configurable channels:
   a. Select the *Measurement* channel type and indicate the measurement input to which the ultrasonic probe is connected. The device automatically selects the channel Characteristics as Linear - enter values corresponding to 4 mA and 20 mA: ⚙ → 🔢 → **Inputs** → *Channel Type* → *Measurement* → **Input** → *Select the measurement input* → **Characteristic** → *enter values corresponding to 4 mA and 20 mA*,
   b. For the Computed channel type there is possible to enter the math formula which determine the flow: ⚙ → 🔢 → **Inputs** → *Channel Type* → *Computed* → **Formula** → *Formula given by the flume manufacturer*,
   c. Provide the time base for the flow value (selection from the drop-down list: /s, /min, /h), this setting is necessary to configure the totalizers: ⚙ → 🔢 → **General** → *Time base* → */s*,
   d. In the General tab it is possible to enable archiving of the process value: ⚙ → 🔢 → **General** → *Archiving* → ☑ → ✅,
   e. In the Alarm 1 or Alarm 2 tab it is possible to set the *high* or *low* alarm mode, the alarm level and hysteresis value. Select the *control* or the *alarm* option. The data logger enables setting of two alarms from exceedances for each channel, it is possible to archive none, one or both events: ⚙ → 🔢 → **Alarm 1/Alarm 2** → *Mode* → *high/low* → **Type** → *Control* → **Level** → *value* → **Hysteresis** → *value* → **Colour** → *selection from the drop-down list* → **Log event** → ☑ → ✅,
   f. Flow counting can be executed in a daily, weekly, monthly, resettable or unresettable mode. Each channel can have assigned two totalizers (Σ1 and Σ2) operating independently, it is possible to archive none, one or both totalizers: ⚙ → 🔢 → **Σ1/Σ2** → *Mode* → *select mode from the drop-down list* → **Unit** → *entered Unit performs only the information function* → **Multiplier** → *1* → **Resolution** → *0.000* → **Archiving** → ☑ → ✅,
   g. The channel value can be assigned to subsequent channels, which enables to set several alarm thresholds for one parameter or to calculate the flow in different modes, for example in daily, monthly and non-resettable mode.
4. Enabled channels are displayed as single result windows (switching by using arrows). The results can be displayed in the form of a result table (the ability to display min, max, process value or totalizers values) or in the form of trend graphs (only channel value): ⚙ → 🖼 → **Result Tables** → *configuration* → **Trends** → *configuration* → ✅,
5. Define the archiving settings. Archive files are created in a daily, weekly or monthly mode. In the bottom part of the Archive settings window, an information regarding the current status of channels and totalizers archiving is displayed, the archived value is marked in green colour: ⚙ → ⬛ → *configuration* → ✅,
6. Exit the menu and confirm the willingness of making changes. The device will reboot with the new settings.

Note: To start the archiving process, press the **START** button in the Archive window (⬛ icon on the menu bar).

- ## Wall enclosure for DL2/DL7 data logger

It is possible to order the DL2/DL7 device in the DL2W KIT/DL7W KIT set containing the power supply and a housing with a high degree of protection against water and hazardous parts (IP65). The set is dedicated for wall mounting. If additional protection against atmospheric precipitation is provided (roofing), the device can be installed outdoor.

- ## Information from the Manufacturer

All functions of the recorder are subject to modifications for the benefit of technical progress.

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