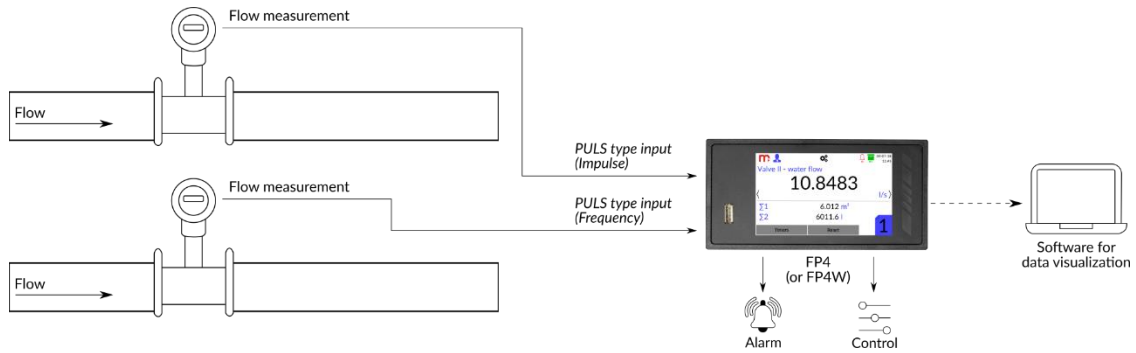


FLOW MEASUREMENT USING PULSE TYPE INPUTS

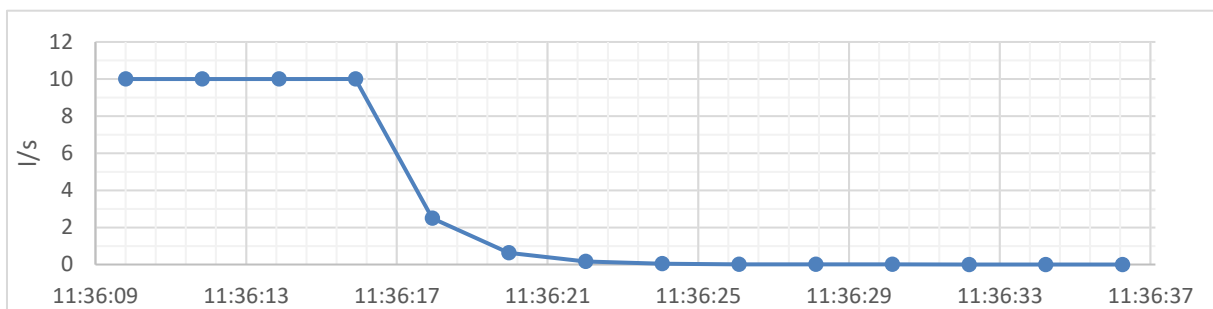
The FP4/FP4W flow meter has two PULS type inputs which can be used for frequency measurement, pulse counting or status detection. A typical application is flow reading from flow meters with a built-in pulse or frequency output. The operating mode of PULS type inputs should be selected depending on the application and with taking into account the difference in the algorithm of calculating the value. In addition, the priority of the recorded value should be set, i.e. the exact value of the flow rate (*Frequency mode*) or the exact value of the totaled flow (*Impulse mode*). The differences between modes of PULS type inputs in the FP4 flow meter applied in the system for flow measurement and data recording are described below.



- **Decrease of the flow rate value after switching off the signal**

Due to the large range of measured frequencies (from 0.1 Hz) and implemented algorithm, after a sudden signal drop out, the flow rate does not indicate zero value immediately (example trend line is presented below). For each impulse its duration is measured. The algorithm is waiting for the next impulse and if the impulse does not appear in the expected time, then every second the frequency is reduced by half. Implemented operation of the device eliminates the possibility of abrupt frequency changes in the case of an impulse delay (which is especially important in the case of low frequencies).

Decreasing the flow rate value after signal drop out is added to the totalizer in the *Frequency mode* and is ignored in the *Impulse mode*.



- **Flow measurement - comparison of operating modes**

Depending on the selected operating mode, the flow rate can be primary (main) or secondary (auxiliary) value, which determines the way of calculating total flow (totalizer value).

It is recommended to select the *Frequency mode* for high frequency signal and the *Impulse mode* for low frequency signal.

Frequency mode

If the flow rate is to be main recorded value, then the PULS input must be configured in the *Frequency mode*. The flow rate value is added to the totalizer according to the entered time base. During decreasing the flow rate, the value is added to the totalizer.

Frequency mode is recommended for high frequency signals. If abrupt frequency changes are anticipated, then user characteristics should be entered. Implemented user characteristics can cut-off small flow values to avoid measurement error (details below).

Impulse mode

If the total flow is to be main recorded value, then the PULS input must be configured in the *Impulse mode*. The amount of pulses multiplied by the value entered for a single pulse is added to the totalizer. Displayed flow rate is an auxiliary value and does not affect the value of the totalizer. The decreasing of the process value of the channel after signal drop out is not added to the totalizer.

Impulse mode is recommended for low frequency signals. The input provide precise pulses counting. In special situations, for rare pulses, the flow rate value can be displayed as 0, but the pulses will be added to the totalizer. Due to the method of determining the process value (presented as the channel value), in the case of the *Impulse mode*, using math channels is not recommended. Math channels calculate formulas on the process values of channels, which in the case of *Impulse mode* may be affected by an error (the channel value is a secondary value).

• **Cut-off small flow values (user characteristics)**

Due to the algorithm implemented in the FP4 flow meter and the ability to measure low frequencies (0.1 Hz), after a sudden signal drop out, the flow rate value does not disappear immediately. In real conditions, abrupt changes with such a fast rise or fall time occur only in special systems. In applications with rapid frequency changes (e.g. periodic condensate pumping), user characteristics with the use of a cut-off should be used.

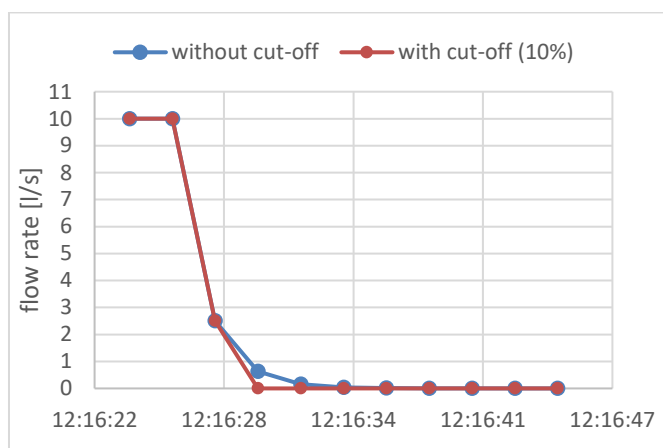
For the PULS type input configured in the *Frequency* mode, it is possible to enter a characteristic with cut-off. To enter the characteristics, in the Main Menu, in the Channels window, in the Characteristic field, select the User option and enter the flow values (y value) corresponding to a specific frequency value (x value).

Entered characteristic (cut-off on 10% level)	
0 Hz	0.000
999 Hz	0.000
1000 Hz	1.000
10000 Hz	10.000

Entered characteristic (cut-off on 50% level)	
0 Hz	0.000
4999 Hz	0.000
5000 Hz	5.000
10000 Hz	10.000

The comparison of flow rate and total flow in an application without cut-off and with a cut-off on 10% and 50% level is presented below.

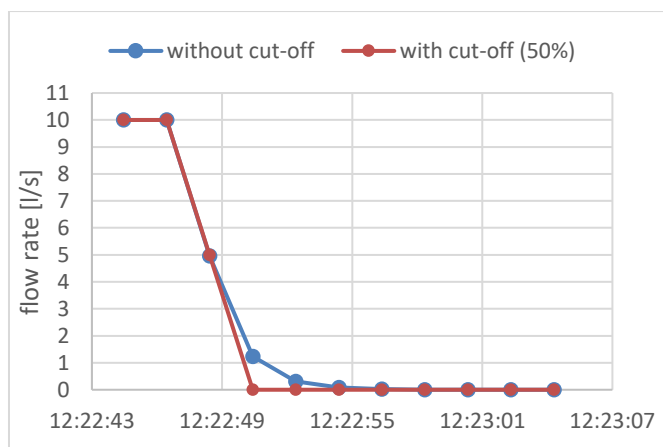
Cut-off on 10% level



Time	Flow rate [l/s] (without cut-off)	Flow rate [l/s] (with cut-off)
12:16:24	10	10
12:16:26	10	10
12:16:28	2.5	2.5
12:16:30	0.625	0
12:16:32	0.156	0
12:16:34	0.039	0
12:16:36	0.01	0
12:16:38	0.002	0
12:16:40	0.001	0
12:16:42	0	0
12:16:44	0	0

Total flow for the application without cut-off: 2430.186 l, total flow for the application with cut-off: 2428.864 l.

Cut-off on 50% level



Time	Flow rate [l/s] (without cut-off)	Flow rate [l/s] (with cut-off)
12:22:44	10	10
12:22:46	10	10
12:22:48	4.961	5
12:22:50	1.24	0
12:22:52	0.31	0
12:22:54	0.078	0
12:22:56	0.019	0
12:22:58	0.005	0
12:23:00	0.001	0
12:23:02	0	0
12:23:04	0	0

Total flow for the application without cut-off: 2320.033 l, total flow for the application with cut-off: 2315.112 l.

• **Information from the Manufacturer**

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

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