Phenomenon of Transiency in Water Supply Systems

Assistant professor PhD Student **Nikolett FECSER[1]**

[1] Széchenyi István University, 1 Egyetem tér, Győr, H-9026, e-mail: fecser.nikolett@sze.hu

Abstract: *Transient is a flow condition in which velocity and pressure change rapidly with time. A transient normally occurs when a flow control component changes status and this change flows through the system as a pressure wave. Due to the devastating effects a hydraulic transient can cause, its analysis is very important in determining the values of transient pressures. I present the measurements carried out at Pannon-Víz Zrt and their results in my study.*

Keywords: *Transient, pressure wave, flow, analysis, measurements, pump*

1. Introduction

Transient operating states occur in water supply systems under pressure. Transient operating states place such extreme loads on the pipes that they might cause burst water pipes. The main reasons of the occurrences of transient phenomena are, for example, a sudden change in flow or power failures at pump stations. In extreme situations, transient phenomena can endanger the soundness of the pipe itself [1,2,3].

2. The venue of the measuring process

Pannon-Víz ZRt, the largest water and sewage service in Győr-Moson-Sopron county, operates several regional drinking water supply systems. My measuring instruments were installed at the booster station in Pápai út, Győr. I applied 1 Sebalog D-3 measuring instrument to monitor the transient state in the pipeline system.

Fig. 1. Measurement venue (Pápai út)
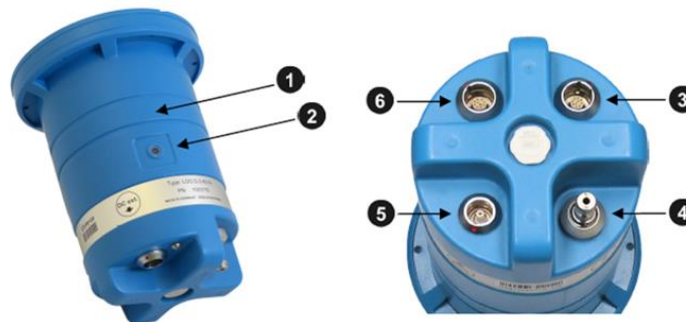
3. Describing the measuring instrument

Sebalog D-3 is a compact, robust and extremely versatile data logger. The device can record the readings of various sensor types in user-defined intervals. When using the internal pressure sensor, in addition to the standard pressure measurement the recording of sudden pressure fluctuations is possible. Recorded measuring data are stored in the memory of the logger and can be retrieved via short range radio. Loggers equipped with a GSM module can also send the data regularly to an FTP server, from where they can be downloaded to any Internet-capable computer [4].

Table 1 shows the technical data of the measuring instrument.

Table 1: Parameters of measuring instrument [4]

Parameters	Value
Communication	Short-range radio/
Inputs / outputs	2 or 4 freely programmable channels
Internal pressure sensor	optional: 16 bar / 25 bar / 35 bar; accuracy: +/- 1 %; resolution: 0.006 bar
Log interval standard measurement pressure surge means	Pressure surge measurement 0.1 sec or 1 sec selectable
Memory	4 MB internal memory
Alarm	Switching input and threshold monitoring for each channel possible
Battery	Internal lithium batteries
External power supply	12 V DC
Operating temperature	-20°C…..+70°C
Storage temperature	-20°C…..+70°C
Dimensions	185 x 115 mm
Weight	0.9 kg
Degree of protection	IP 68

Fig. 2 shows the structure of the measuring instrument.

Fig. 2. Measuring instrument

Table 2 shows the structure of the measuring instrument.

Table 2: Structure of measuring instrument

Item	Description
1	contact area (On/Off)
2	control lamp (I/O)
3	DC ext. socket
4	Pressure sensor
5	GSM socket
6	IN socket

The SebaDataView-3 software is used on a PC to program the logger before the measurement and to retrieve the collected data after the measurement. A short-range radio is used for communication between the devices.

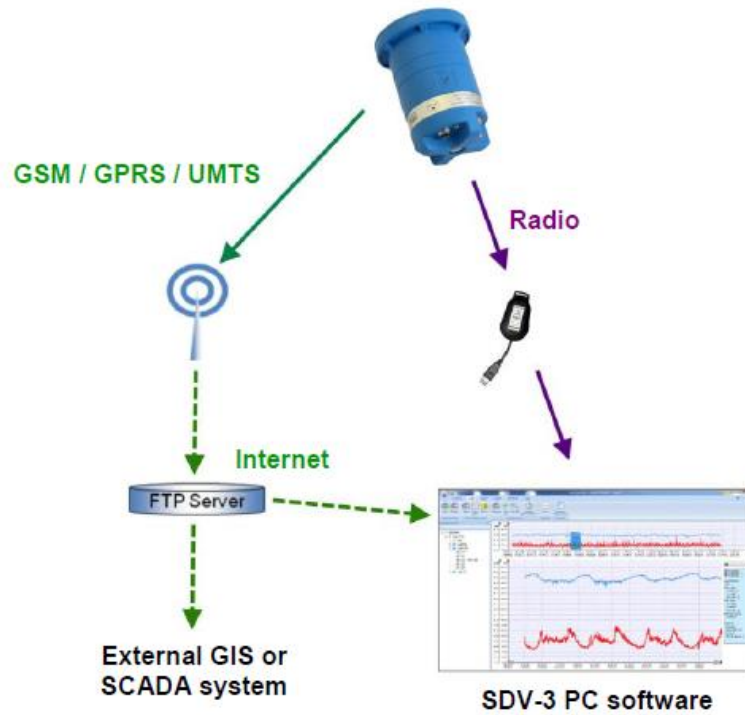Fig. 3 shows the operation of the measuring instrument.

Fig. 3. Operation of measuring instrument [2]

4. Presenting measurement results

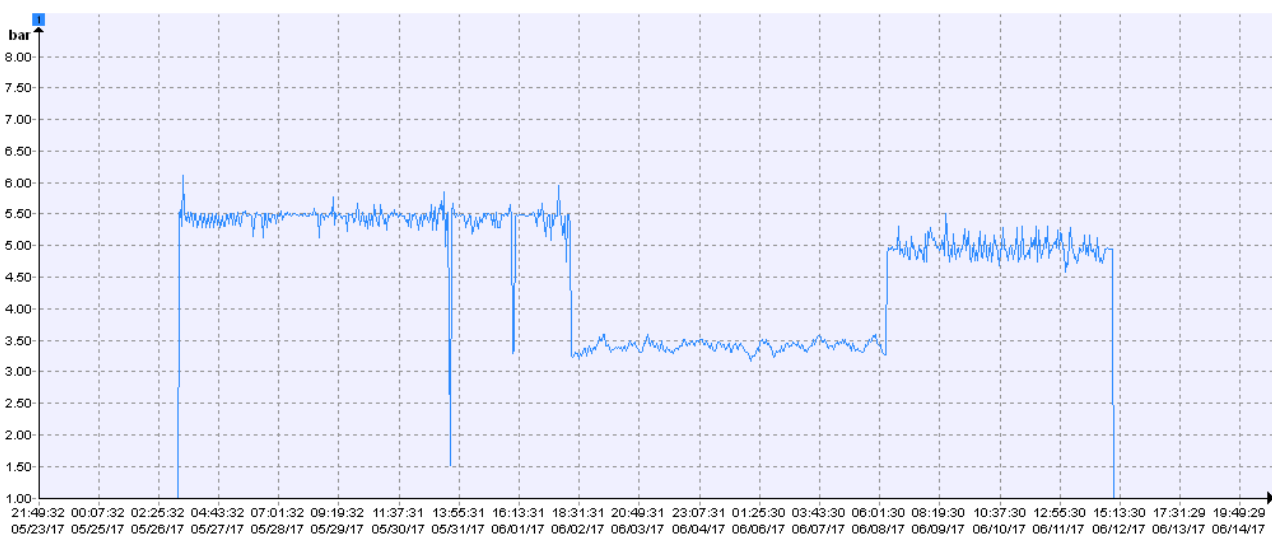Fig. 4. illustrates the measurements of Sebalog D-3 measuring instrument.

Fig. 4. Operation of measuring instrument [3]

The series of measurements covered 12 day. Table 3 shows the value of transient.

Table 3: The value of transient

Time		Pressure value [bar]
05.26.	12:15	6.119
05.27.	14:00	6.212
	18:15	6.217
	22:45	5.991
05.28.	01:45	5.760
	05:40	5.827
05.29.	05:55	6.166
	06:00	5.770
	07:20	6.166
05.30.	15:25	5.785
	18:55	5.791
05.31.	06:00	5.734
	06:30	5.847
	06:00	5.734
	13:20	6.063
	16:35	5.714
06.01.	09:55	5.755
	23:50	5.940
06.02.	01:30	5.965
	03:20	5.873
	03:25	6.171
	05:55	5.739
	08:10	6.063
	08:20	6.032
	08:25	6.012
	08:40	5.945
	08:45	6.058
	08:50	6.042
	08:55	6.048
	09:00	6.032

Conclusion

In my study I intended to draw attention to the existence of the phenomenon of pressure transiency. The phenomenon of pressure transiency is a potential danger to any water system. My goal is to reveal what might cause the appearance of transient in the water supply systems.

Acknowledgment

References

[1] Szlivka, Ferenc. *Csővezetékekben fellépő tranziens jelenségek / Transient phenomena in pipelines.* Budapest, Hungary, 2012. http://www.ontozesmuzeum.hu/download/7ViZGAZDHirtelenzaras.pdf

[2] György, István. *Vízügyi létesítmények kézikönyve. Szivattyúüzemi kézikönyv / Handbook of water facilities. Pump Manual.* Technical Publishing House, Budapest, Hungary, 1974, pp. 11-45.

[3] Csongrádi, Zoltán, Nikolett Fecser, and Bálint Lajtai. "Studying Transients in Water Supply Systems." *Hidraulica - Magazine of Hydraulics, Pneumatics, Tribology, Ecology, Sensorics, Mechatronics*, Romania, 2018.

[4] SebaKMT. *User Manual, Data Logger, Sebalog D-3.* Accessed April 13, 2017. https://www.sebakmt.com/en/portfolio-reader/sebalog-d-3-en.html.