STEBATEC®

Measure - Control - Regulate

INKA

sewer management by stebatec

Outflow control
Dynamic
Integrated
Emissions-based

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Government Funding

Bundesamt für Umwelt BAFU

eawag aquatic research

UMTEC INSTITUT FÜR UMWELT- UND VERFAHRENSTECHNIK

zweckverband abwasserregion olten

VKA Verband für Kanalisation und Abwasser

The intelligent management of waste water systems makes a significant contribution to water protection, reduces overflows, optimizes the use of storage capacity in the waste water system, and ensures the sewage treatment plant operates at full capacity. For this reason, the Swiss Federal Office for the Environment (FOEN) supported the development of STEBATEC, which is driving this development in cooperation with EAWAG, UMTEC, and other partners.

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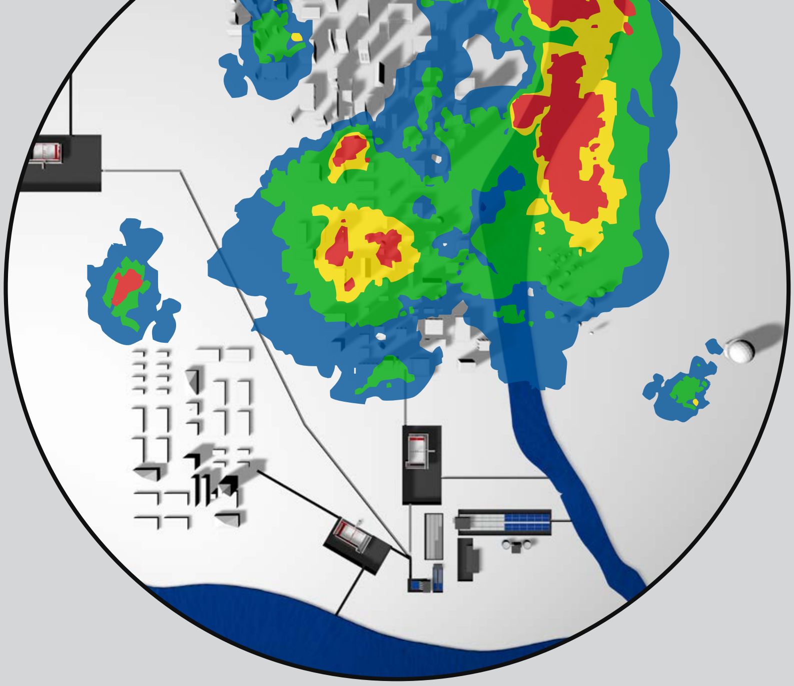


Why INKA improves water protection

For economic reasons, waste water treatment plants (WWTP) are designed to handle average amounts of waste water. In combined sewer systems (waste water and rainwater are collected together), which are the most common type of sewer system, the amount of water created by heavy rains can exceed the capacity of the WWTP, and untreated or partially treated waste water can flow into lakes and rivers. Surveys have shown how critical the situation is, with estimates of the percentage of untreated waste water overflowing into bodies of water of up to twenty percent. In such cases, high concentrations of problematic substances such as pesticides, biocides, or faecal bacteria sometimes flow directly into streams and rivers.

Large sums of money have already been invested in retention basins and stormwater basins to prevent such incidents. Such basins collect the rainwater and allow it to flow into the sewage treatment plants to.

On the one hand, though, these basins are often only equipped with basic control systems, and on the other hand, the entire sewer system is usually designed for fast transport, which means the capacity of the basins, especially those at higher altitudes, is not fully exploited. In addition, the fixed discharge rates of the stormwater basins to the sewage treatment plant prove to be particularly suboptimal when the catchment areas receive different amounts of rainfall.

Simply building additional retention basins is not only impossible due to financial reasons or due to the large amount of land required for their construction. Instead, the capacity of the existing systems should be used more optimally.

INKA

What INKA does

The INKA central control software ensures that when it rains, the WWTP is always operating efficiently and excess waste water in the sewer system is optimally retained and controlled – while taking the stormwater basins and retention basins as well as the sewer system volumes into account.

The software processes the measurement data from the waste water system, information on the status of the receiving waters, and precipitation data and then calculates the optimal amount of water to be transported to the critical points based on this data.

The INKA controller primarily pursues the following goals:

1. Minimum use of storage capacities in the sewer system when the WWTP is not operating at 100% capacity.
2. Filling the storage basins with waste water containing as little contamination as possible.
3. No discharges into the receiving waters if there are still storage basins that are not full yet.
4. Controlled discharge into the receiving waters taking the water quality and capacity of the receiving water into account.
5. Energy-saving operation of the sewer system when the rainwater from heavy rains cannot be processed by the sewage treatment plant anyway.
6. Coordinated emptying of basins under consideration of the entire catchment area.

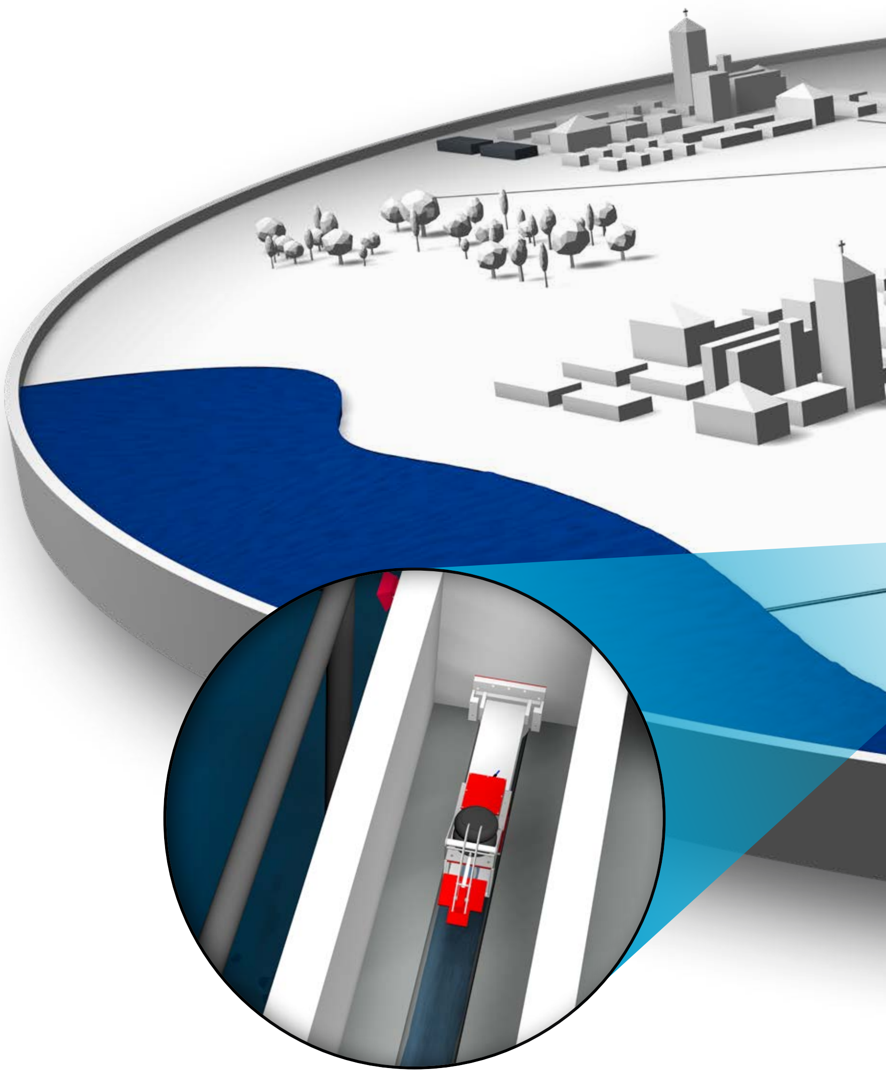
Minimum requirements for sewer systems

The following minimum technical requirements should be fulfilled to use INKA and control sewer systems dynamically:

- Permanent data communication between the stormwater basins and measuring stations over a network
- Continuous measurement of the fill levels in the storage basins to be managed

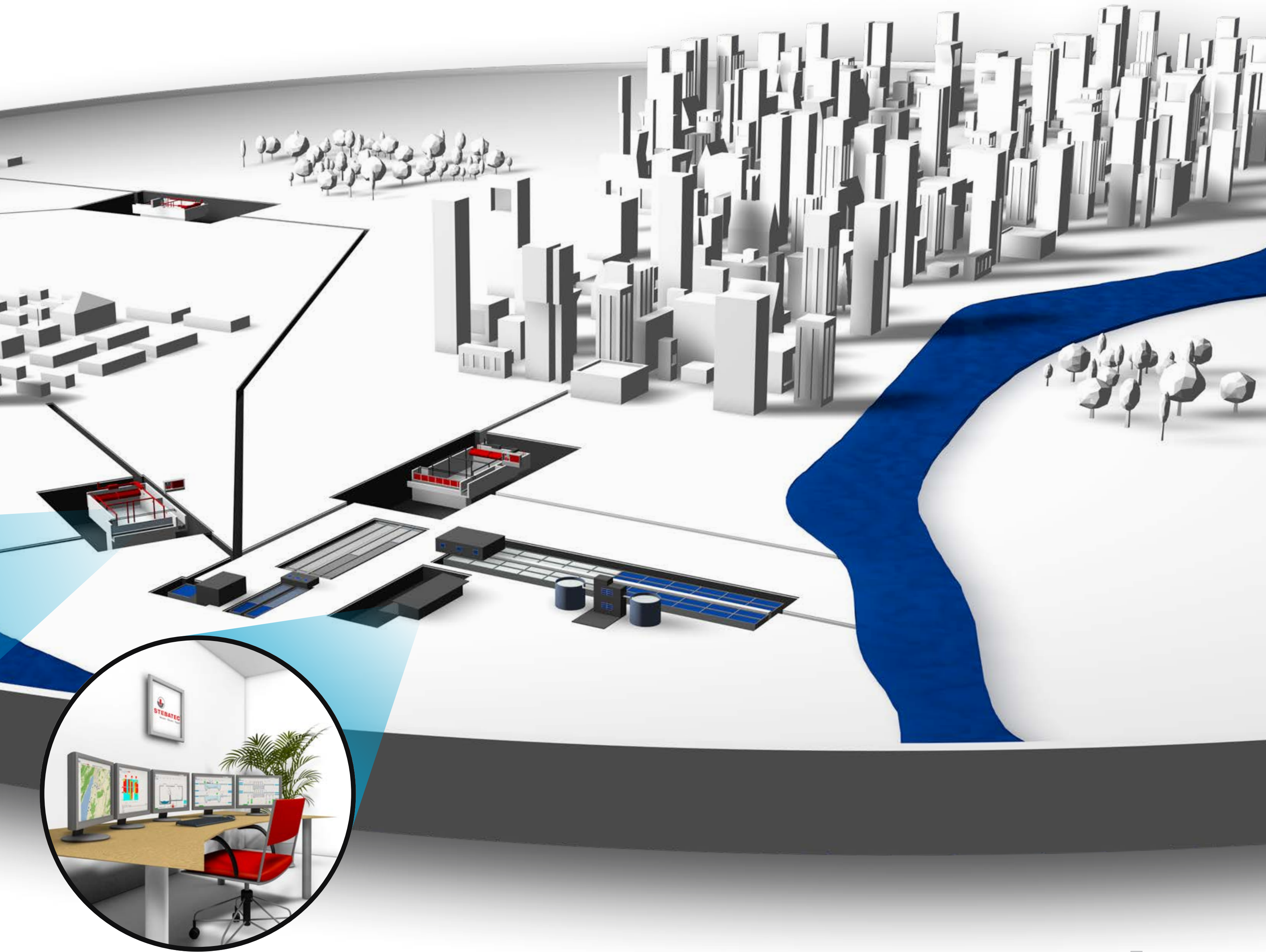
Optimal:

- Controllable and reliable outflow controller with a dynamically adjustable flow rate
- Fallback function in case of communication or power failures



The use of the retention capacity of the existing sewer system increases the capacity of the existing infrastructure and thus significantly reduces the overflow of untreated waste water. In addition, optimal management of the existing infrastructure makes large investments such as investments in construction measures unnecessary.

In this regard, it is possible to optimize the system even further if the control system does not regulate the inflows and outflows based on the volume, but also on pollution loads existing locally. If the pollution loads in the waste water system are measured reliably, then the capacity of the overall system can be based on water protection criteria: If the amount of waste water to be handled exceeds the retention capacity of the sewer system, then the less polluted waste water is discharged first, which also leads to less pollution in the streams and rivers.



Integrating INKA into existing systems

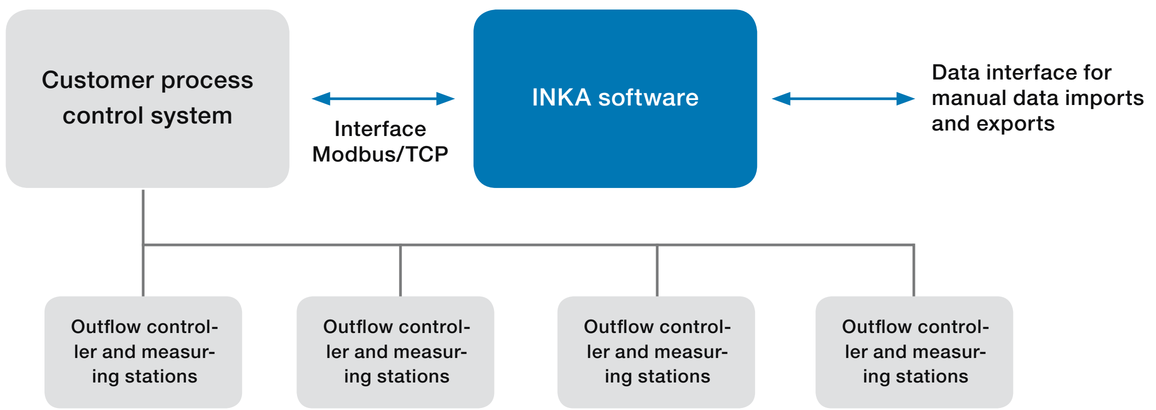
INKA is an independent software program that, on the one hand, integrates seamlessly into the ARAbella process control system, but that also can be connected to any process control systems via an interface. INKA communicates with the various structures using existing data communication – infrastructures and processes the data from outflow and fill level measurements to adjust the outflow controller to an optimal flow rate.

Connecting INKA to existing systems requires detailed planning and requires the manufacturer of the process control system to provide some services. It is not only necessary to transfer measurement data and set the optimal flow rates via a Modbus interface, but it is also necessary to realize a fallback program for extraordinary situations such as the failure of the communication network. Each outflow controller must be able to move to its fallback position as soon as the data communication connection to the control center fails or there is a power failure.

The INKA hardware can be placed on a table in a housing, mounted on the wall, or even mounted in a rack.

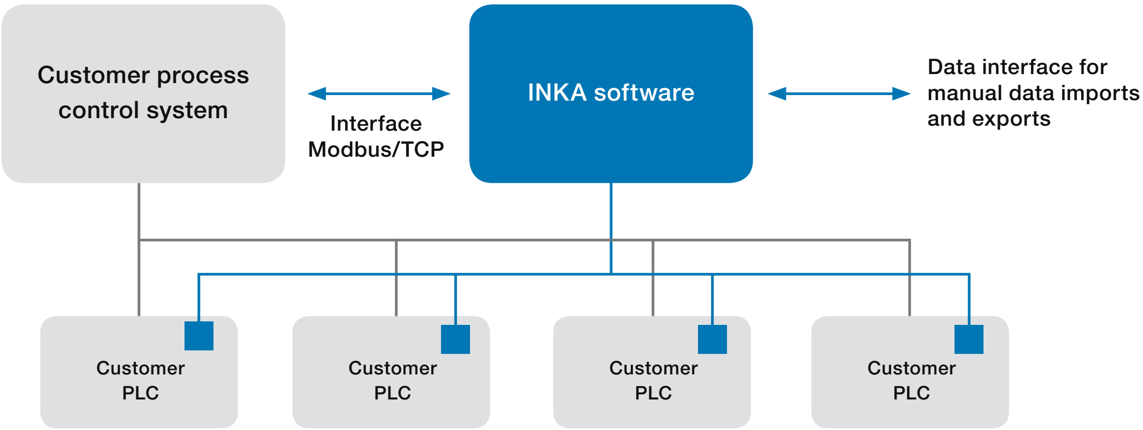
Variant A: Connection to existing process control systems

This variant assumes that the customer's automation company only sends verified measurement data to the INKA program and that it automatically goes into the fallback mode when individual parts of the system fail.



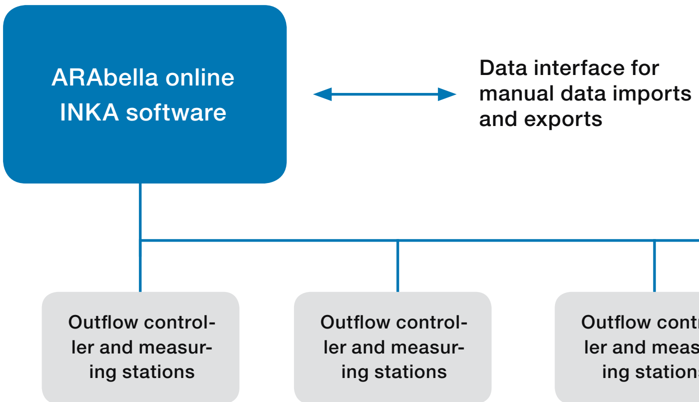
Variant B: Integration in an existing infrastructure

INKA communicates directly over the existing network with its own software modules, which are contained in the INKA scope of delivery and which are installed in the customer's control systems located in the outdoor structures.

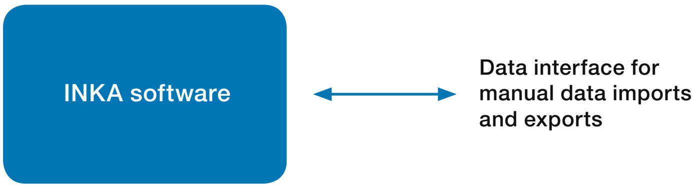


The INKA software module is integrated into the customer's control systems and monitors the functionality of the systems on-site as well as the data connection to the INKA control center. The software module puts the remote station in a safe mode as soon as it loses the connection to the control center. In addition, it ensures that only correct measurement data and information is passed to the INKA software.

Variant C: Integration into ARAbella online and ARAbella locally



Variant D: Online service as measurement data analysis software without performing an active control function

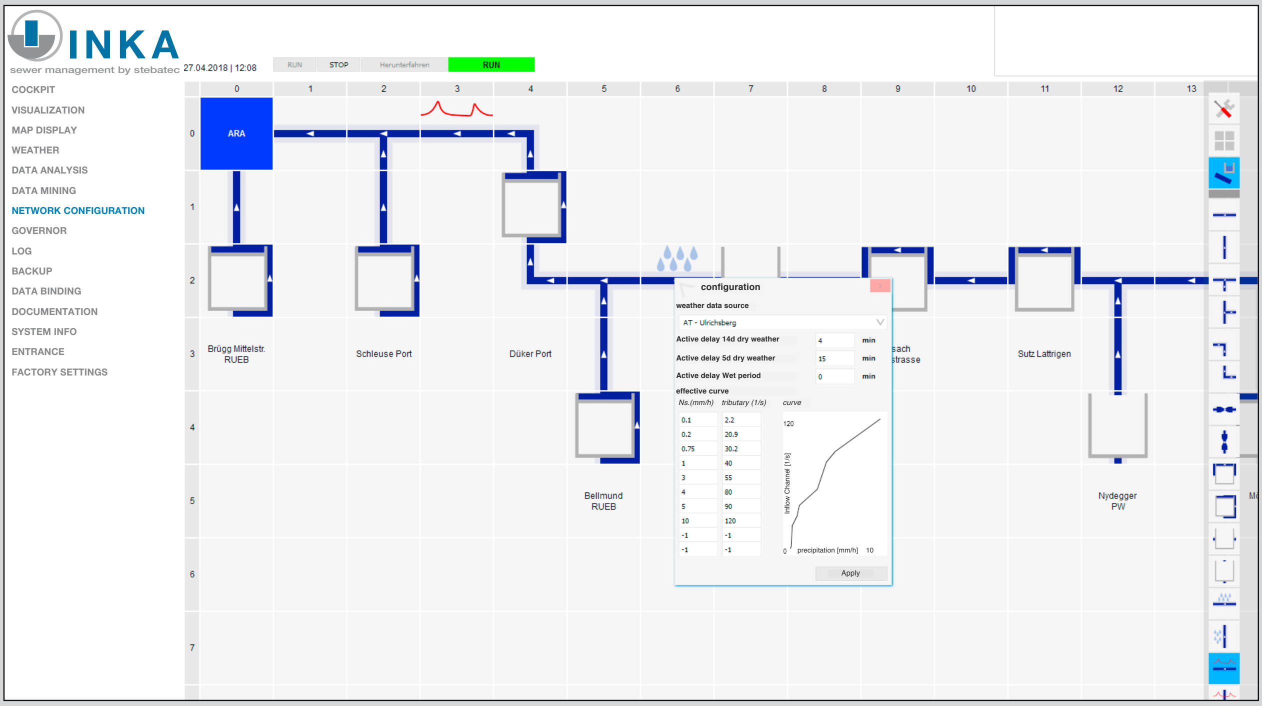


Infrastructure configuration

The INKA user interface allows you to create a modular model of the existing sewer system and its associated components. Sections of sewer pipes can be inserted and configured by entering some basic data for use as guidelines by the INKA controller. For example, two different outflow values must be associated with their corresponding flow times so that the system can automatically calculate all other values linearly and determine the maximum transport capacity of the pipeline.

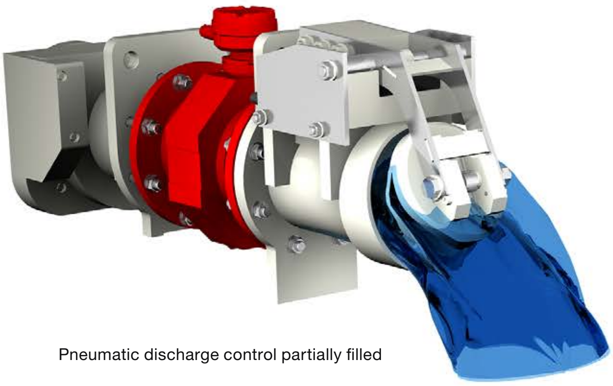
Additional modules such as retention volumes, outflow controllers, flow rates, and rainfall sensors can be created individually.

The modelling interface also allows you to visualize the measurement data recorded, replay storms, and examine the changing fill levels for analysis.

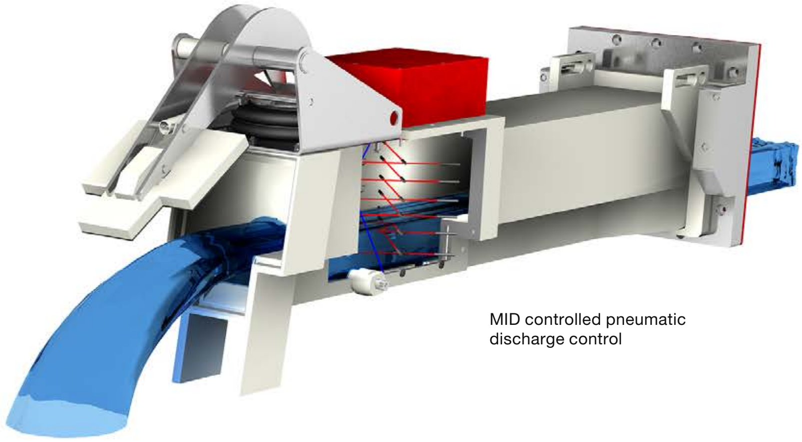


The sewer system configuration with the tools available from the toolbar shown on the right side. The system allows you to combine modules such as pipeline sections, bottlenecks, and storage basins, etc.

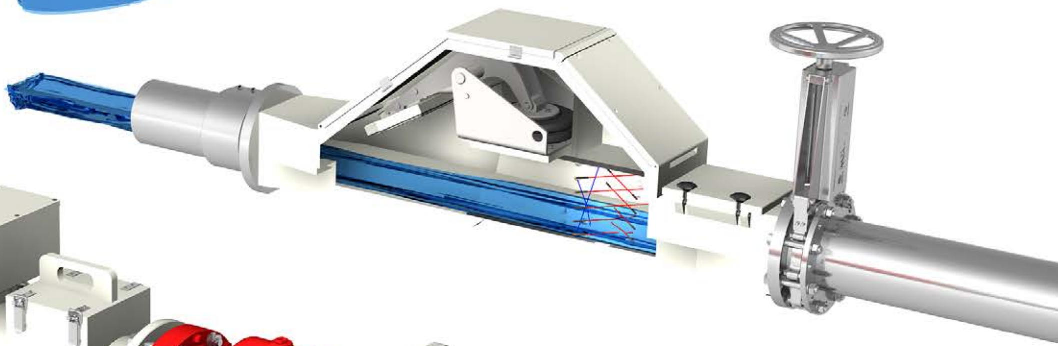
Pneumatic outflow controllers from STEBATEC are optimally suited for the dynamic control of sewer systems.



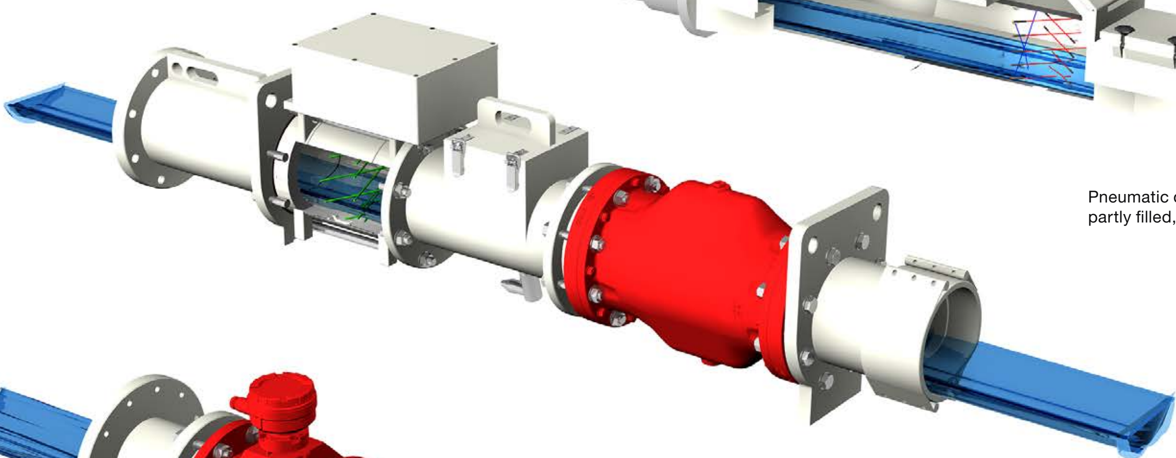
Pneumatic discharge control partially filled



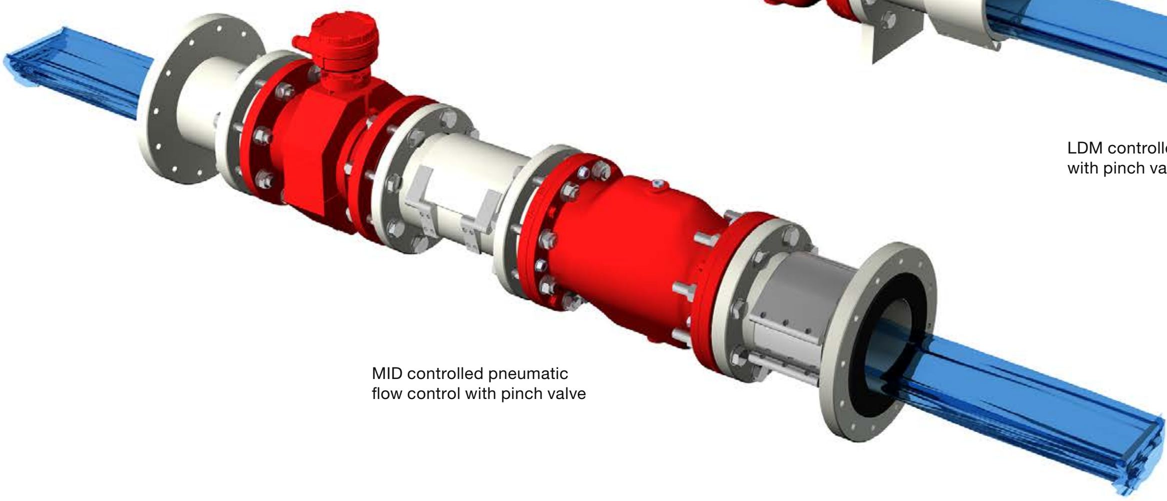
MID controlled pneumatic
discharge control



Pneumatic discharge control
partly filled, dry installed



LDM controlled pneumatic flow control
with pinch valve



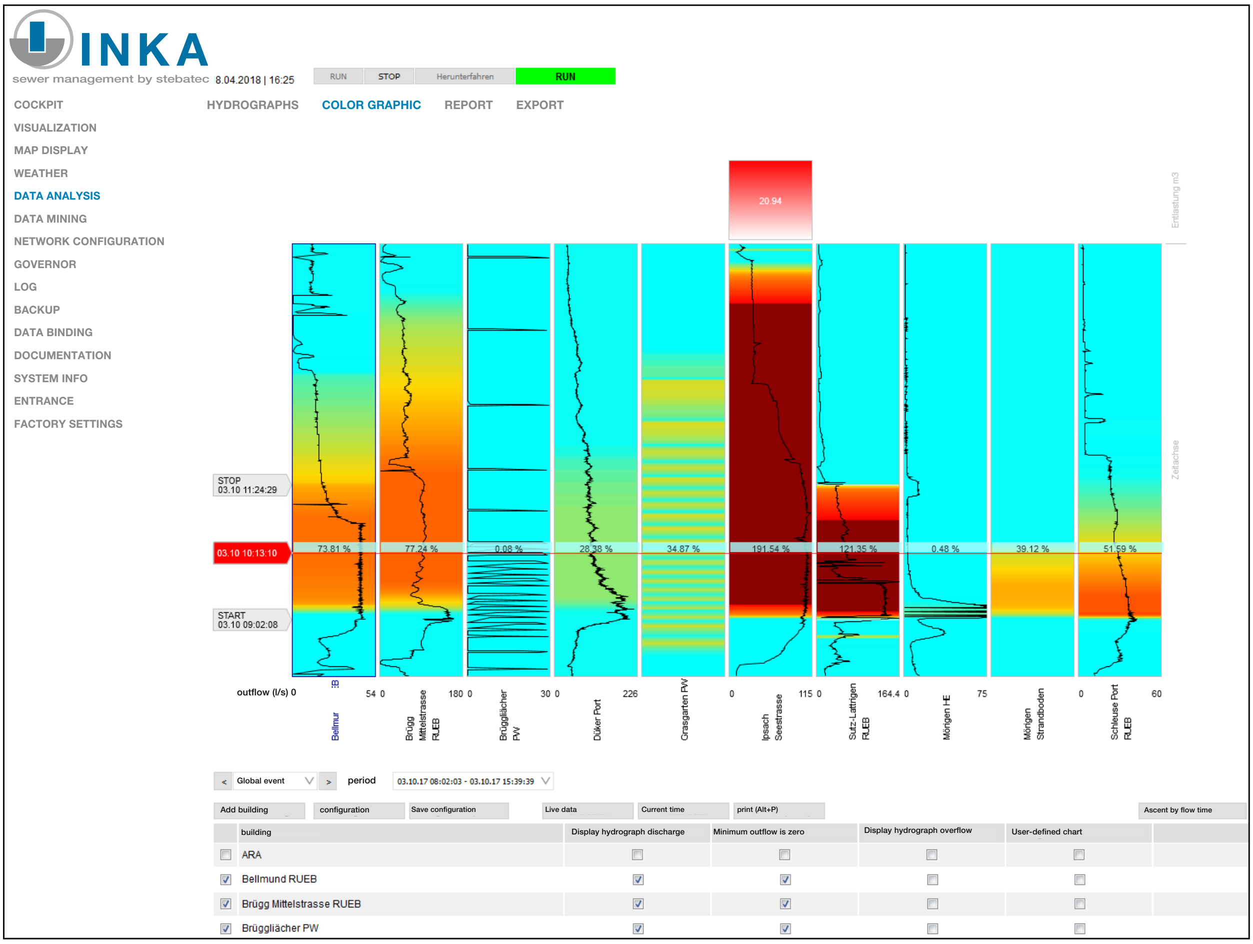
MID controlled pneumatic
flow control with pinch valve

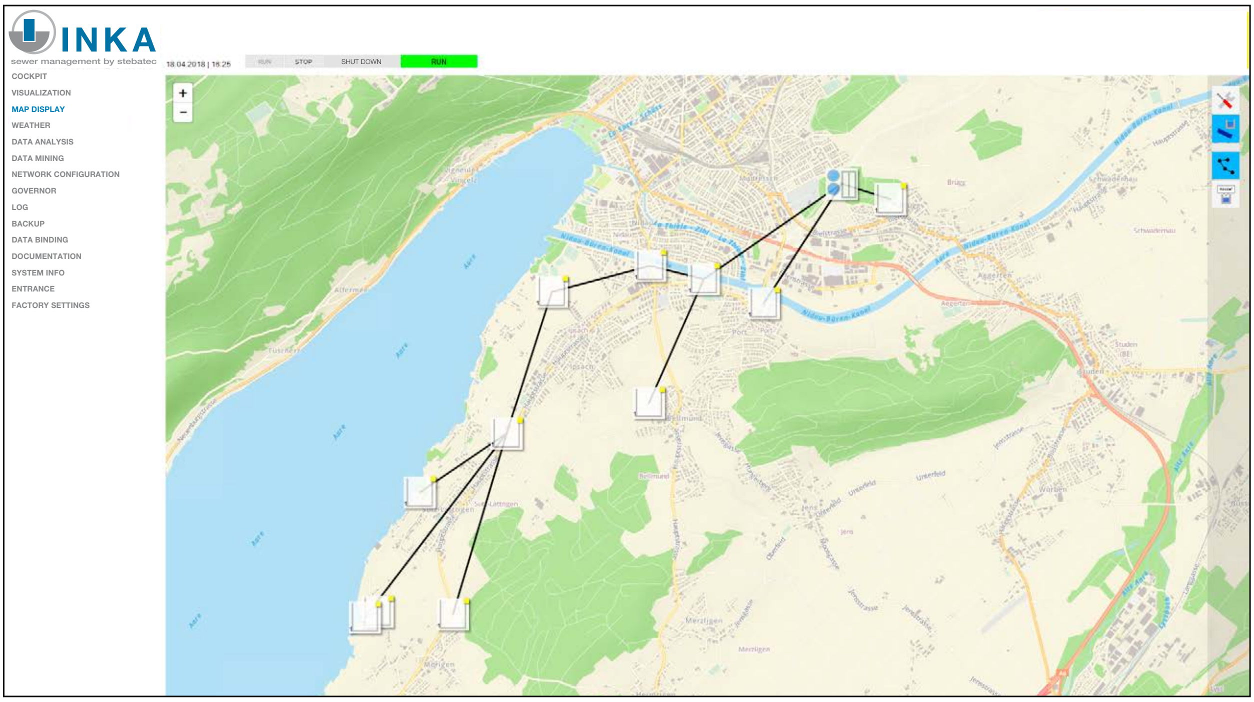
Analysis tools for displaying simplified diagrams of complex interactions

The INKA software provides various measurement data visualization tools and statistics functions that can be used to show the complex interactions of the events taking place in the sewer systems in a manner that is easy to understand.

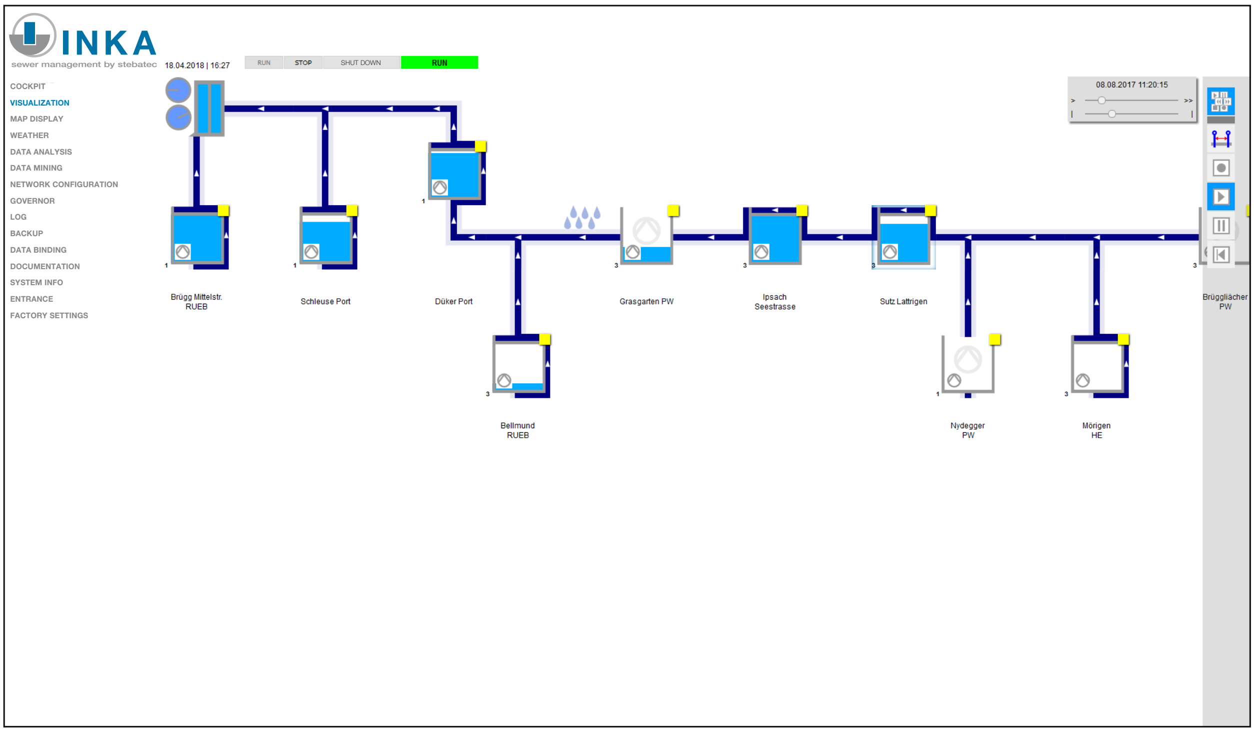
The visualization of the recorded measurement data shows the chronology of events while the basin was filling up using a negative example. Blue indicates low fill levels and the correspondingly low capacity level at which the sewage treatment plant is operating, while red indicates when the plant is operating at full capacity.

Essentially, the storage capacity in the network was completely in use during the storm being analyzed even though the sewage treatment plant could have processed the corresponding volume of water. It can also be seen that rain did not fall in equal quantities over the catchment area. The total overflows of rainwater/sewage mixtures are shown in the bars above the colored diagram.





The fill levels of the storage basins from past rainstorms can be played back in real time or accelerated by a specific factor to analyze the measurement data recorded.



Analysis of the sewer system operation with the schematic visualisation of the measured data.

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