

CoagSense Coagulation Control

Putting a System Together

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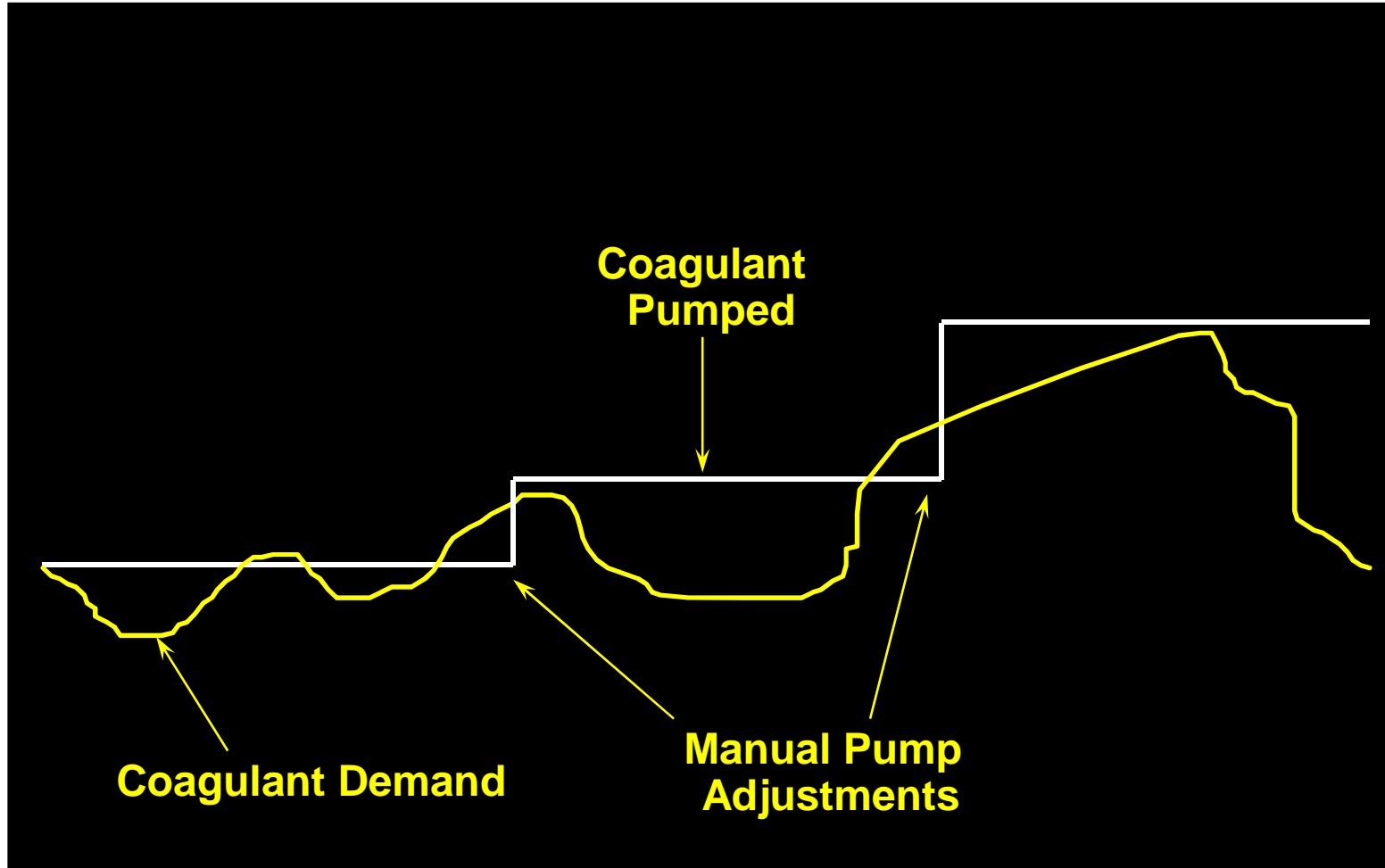


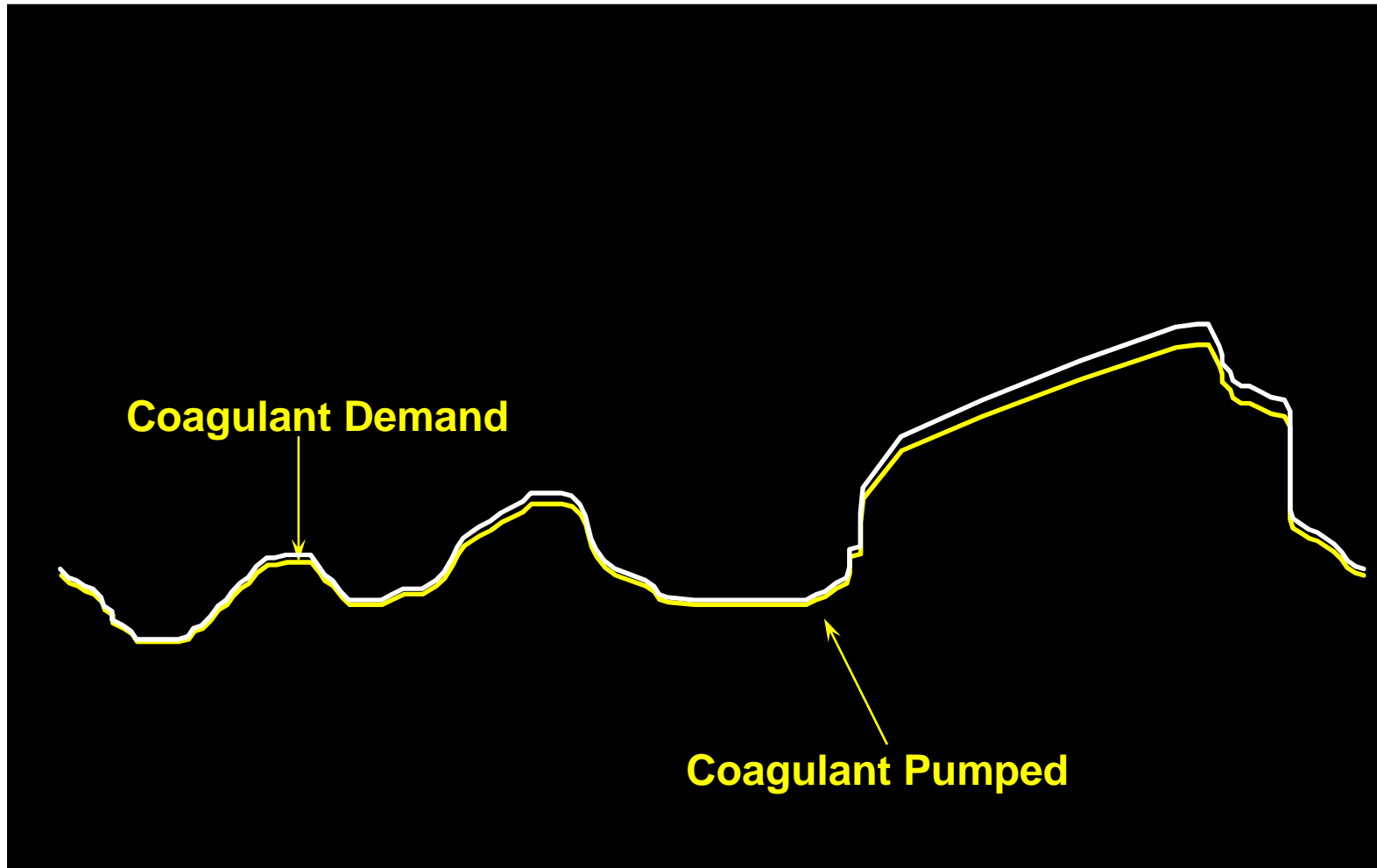
Why Automatic Coagulation Control?

- Optimize water treatment
 - Reduce DBPs (enhanced coagulation- Barrier 6).
 - Improve Pathogen Removal (Barrier 4).
 - Reduce Aluminium carryover (Barrier 10).
- Save money (5 years payback).
 - Reduced coagulant usage.
 - Reduced sludge disposal costs.
 - Reduced operator call out costs.
- Other Considerations
 - Detection of source water contamination.
 - Alarm to loss of coagulant feed.
 - More time for water quality testing & maintenance.

Where?

- Where quality standards are breached.
- Moderate to highly variable water sources.
- Large WTP's where chemical cost are higher and larger population impacted by any exceedance.

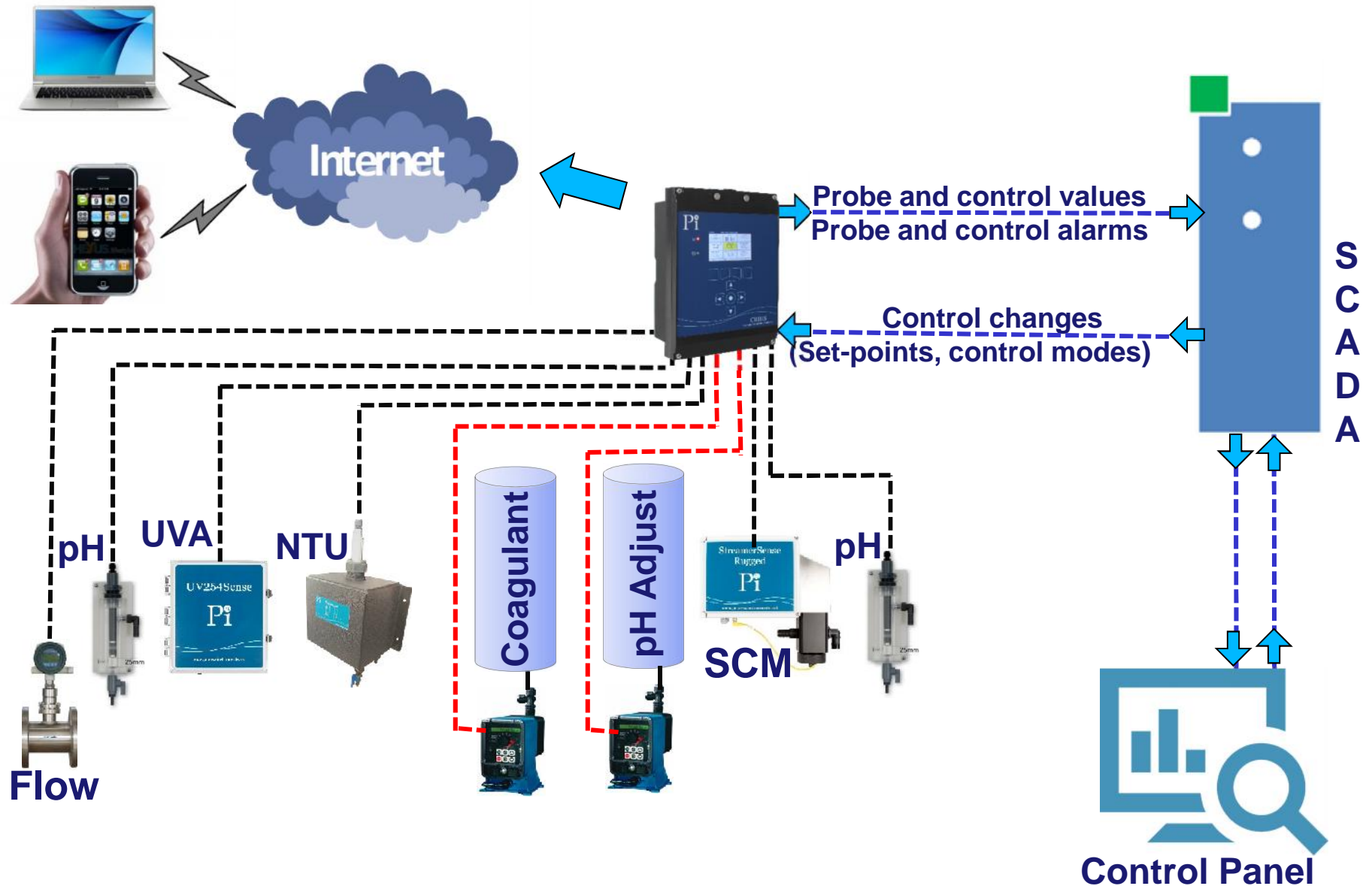




- Different plants need different control measurements.
 - One controller that can take any sensor.
- Some plants need different controls at different times.
 - One controller that can easily switch between controls.
- pH is crucial to coagulation control.
 - pH control from the same controller.
- Controls need to be simple & reliable.
 - Clear controls, simple interface, control validation.
- Interface to SCADA needs to be two way.
 - Read / Write Modbus capability.
- The experts aren't always on site.
 - Remote access during commissioning.

Pi

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Coagulation Control System

- Using modular / field scalable instrument controller provides tailored capability & cost (€7k to €25k).
- A single controller helps controls cost, complexity, learning curve.
- Capability of using existing plant instrumentation further controls cost.

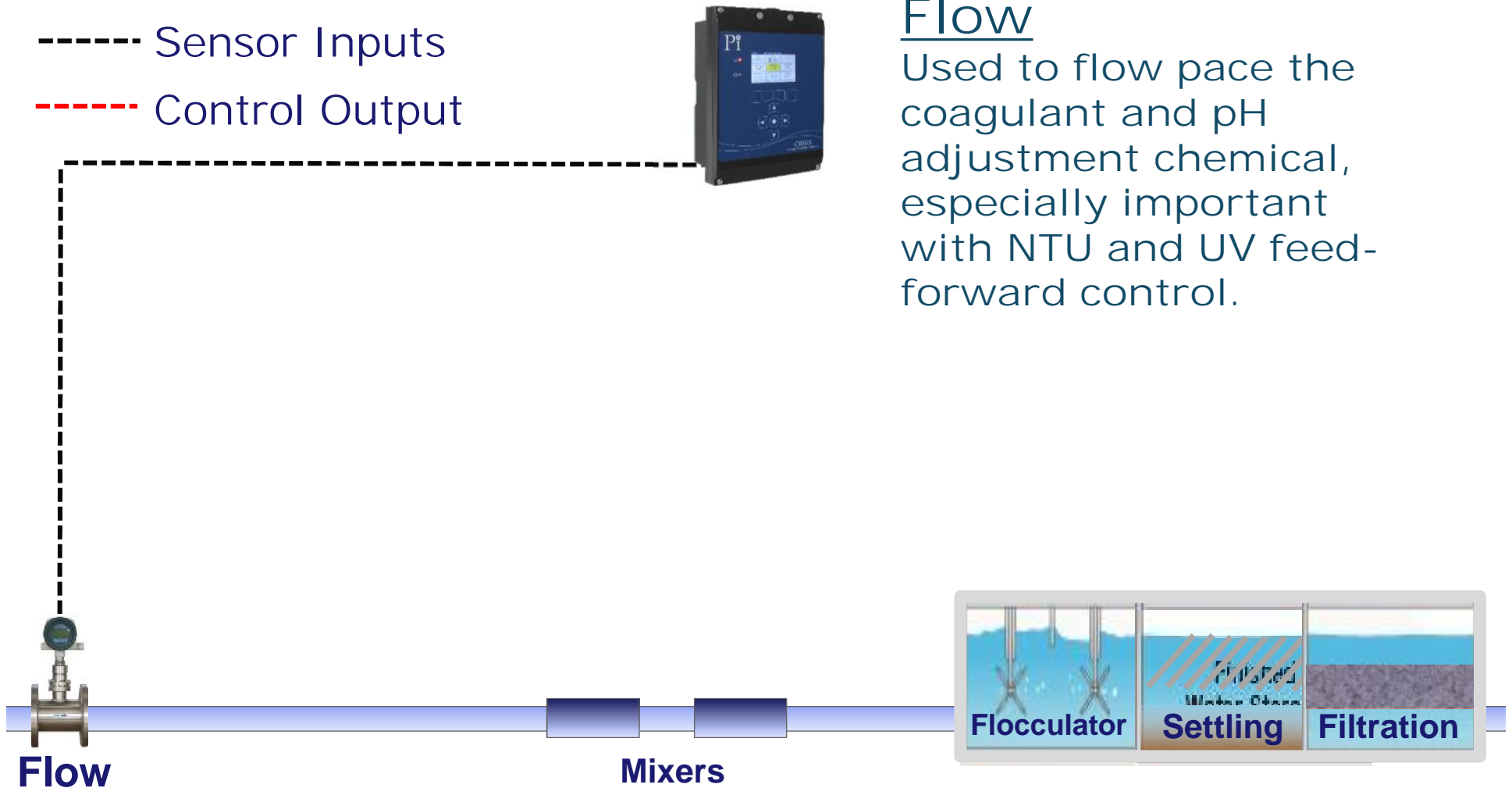
Supplier

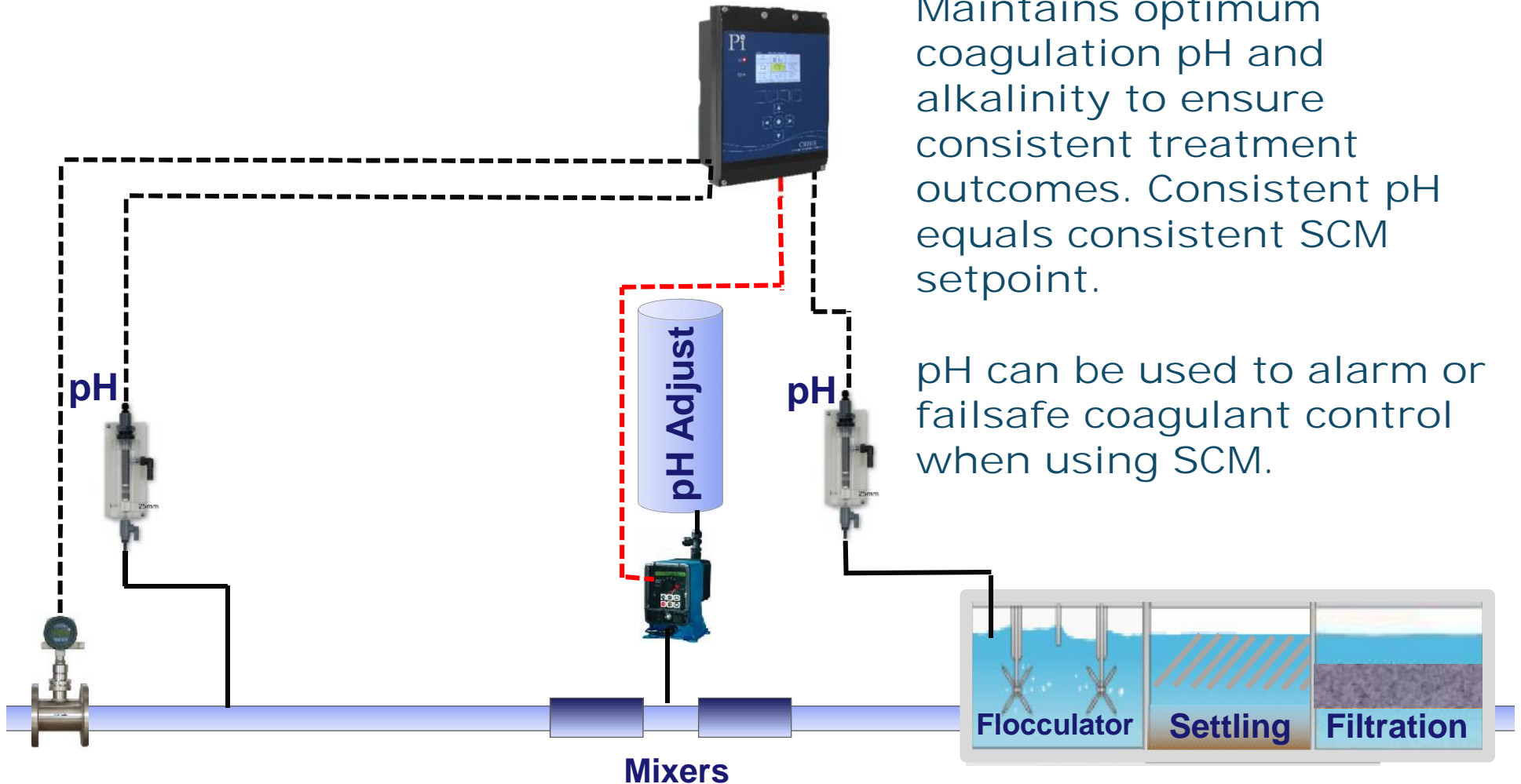
- On site support before, during and after installation.
- Remote access monitoring during initial startup period.



System Cost

| Component | Price |
|-----------------------------|---------|
| SCM | €13,000 |
| UV | €7,000 |
| pH | €2,000 |
| Controller (Stand alone) | €5,000 |
| (Part of System) | €3,000 |
| Total | €25,000 |

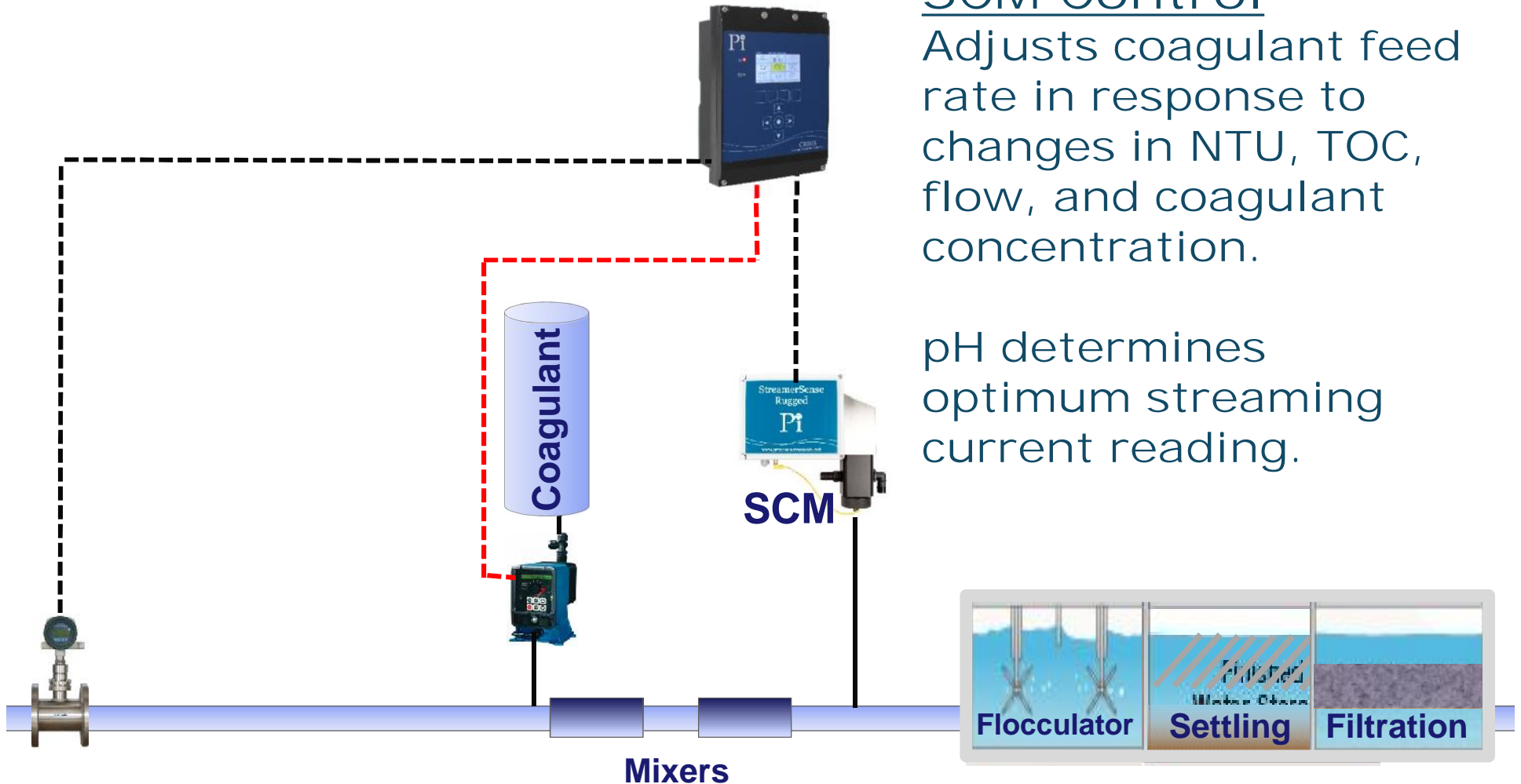


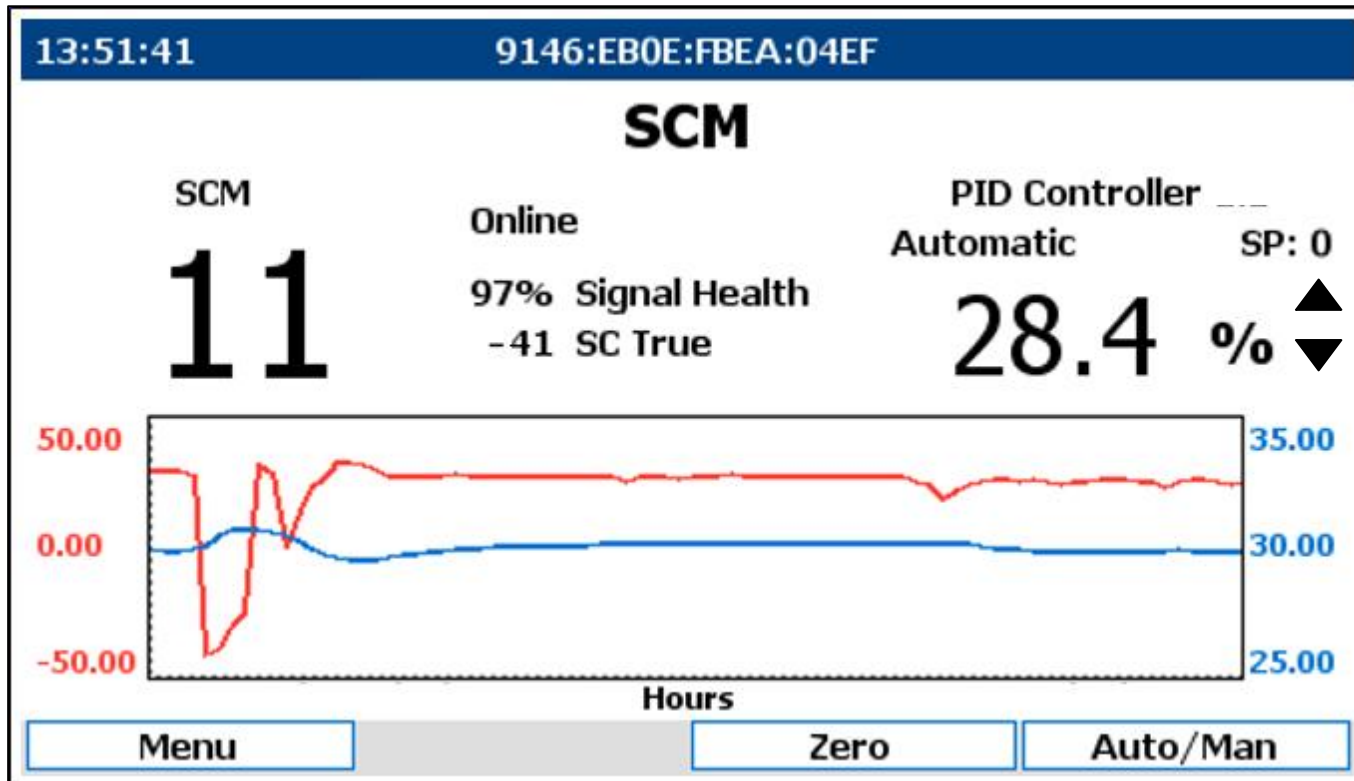


pH Control

Maintains optimum coagulation pH and alkalinity to ensure consistent treatment outcomes. Consistent pH equals consistent SCM setpoint.

pH can be used to alarm or failsafe coagulant control when using SCM.

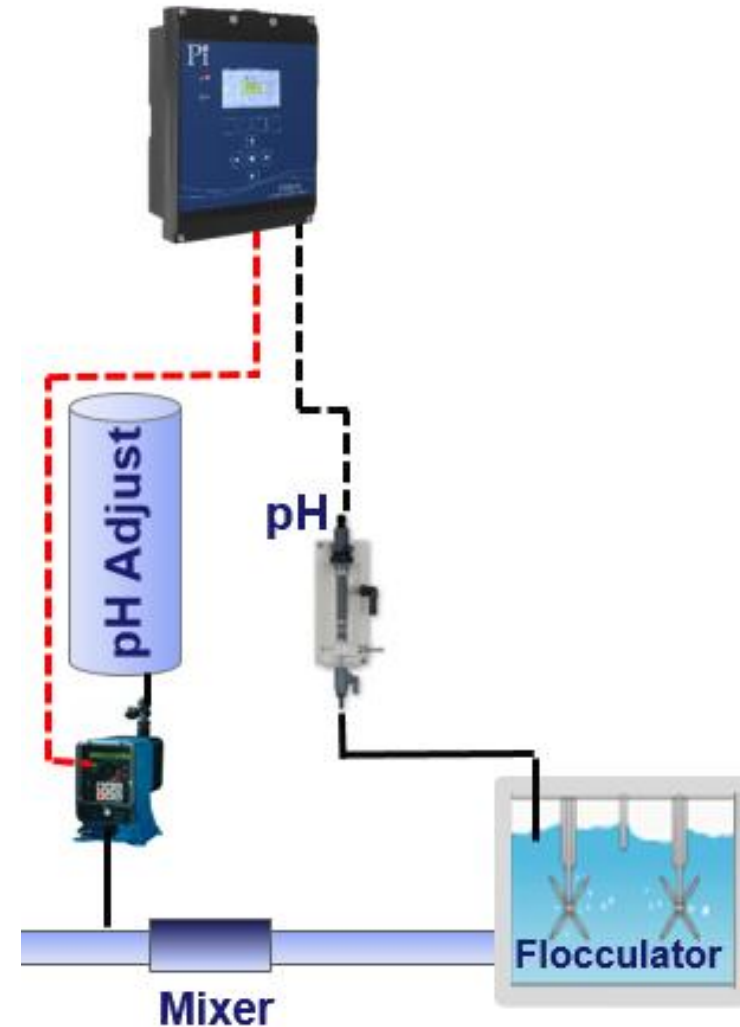


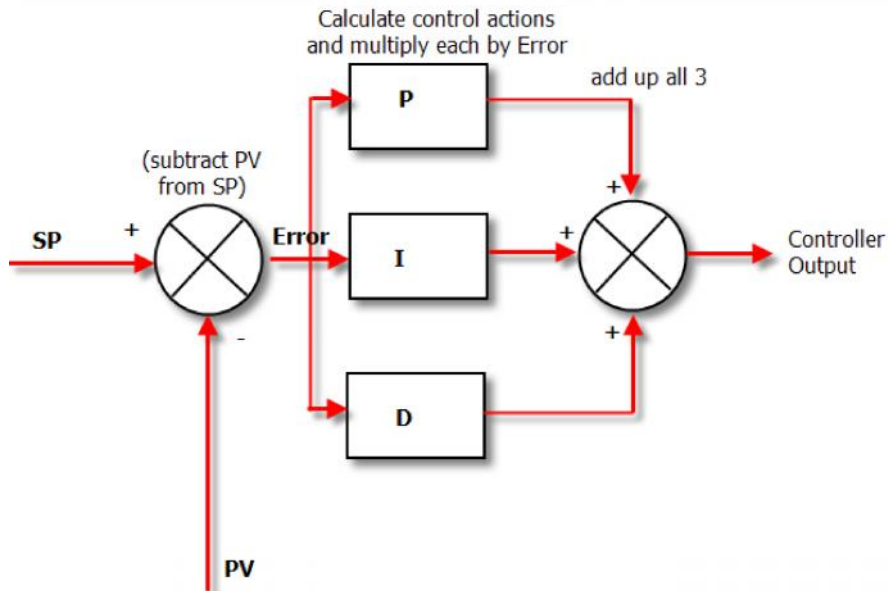


- Informative display with simple user controls is critical to operator comfort level with control system.

Advantages

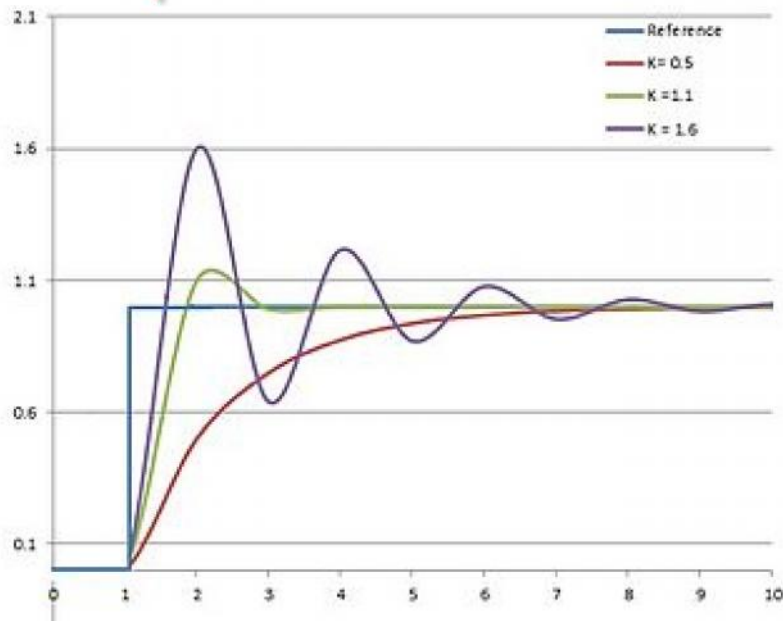
- No advance modelling required.
- Responds to the disturbance and verifies the correction.
- Compensates for changes in chemical make up composition.
- Responds to pump changes/ failure.
- No requirement to measure or calibrate pumping volume.

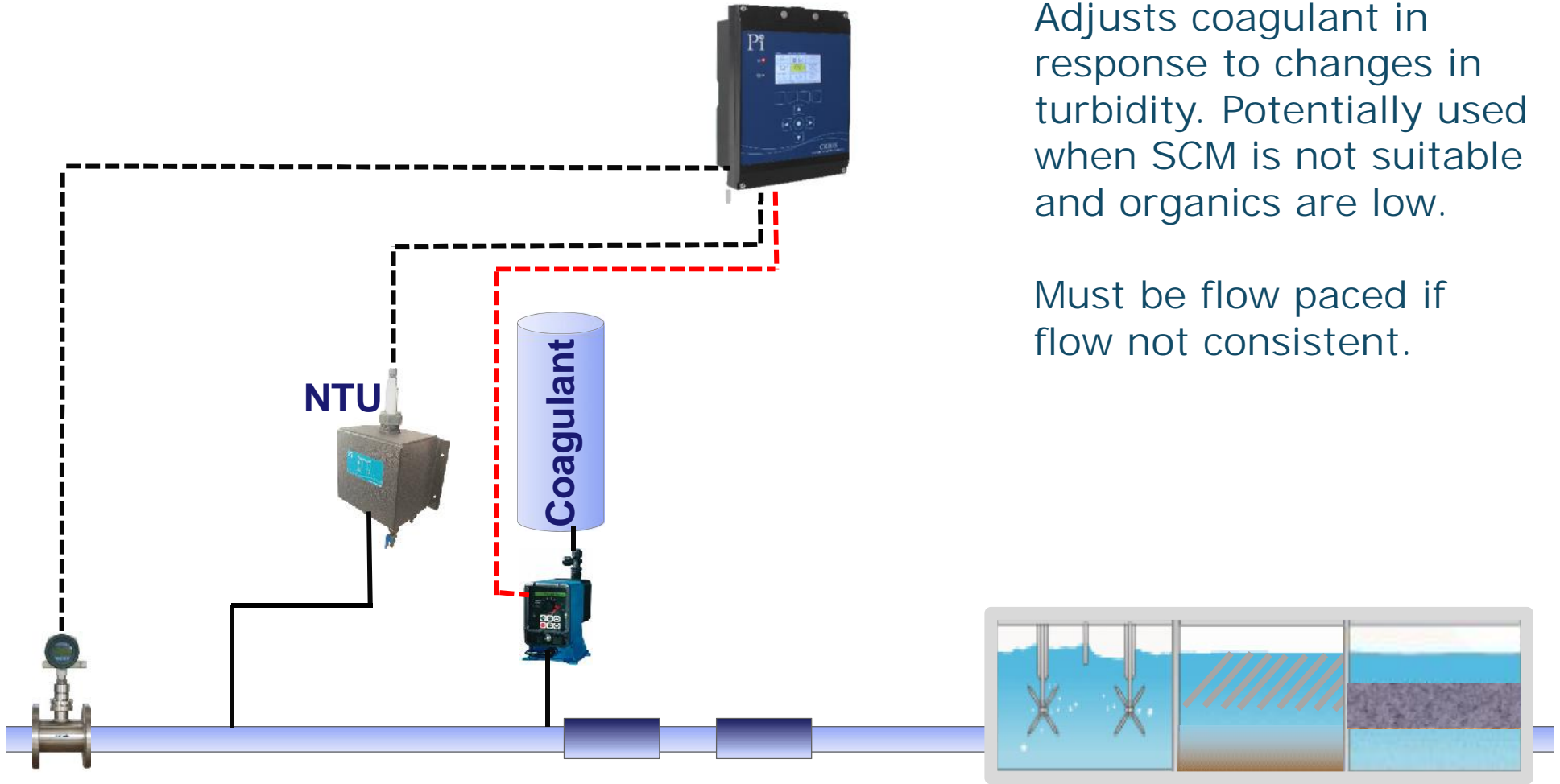




Disadvantages

- Compensates for change after it has occurred.
- Requires PID tuning, improper tuning can lead to control instability.

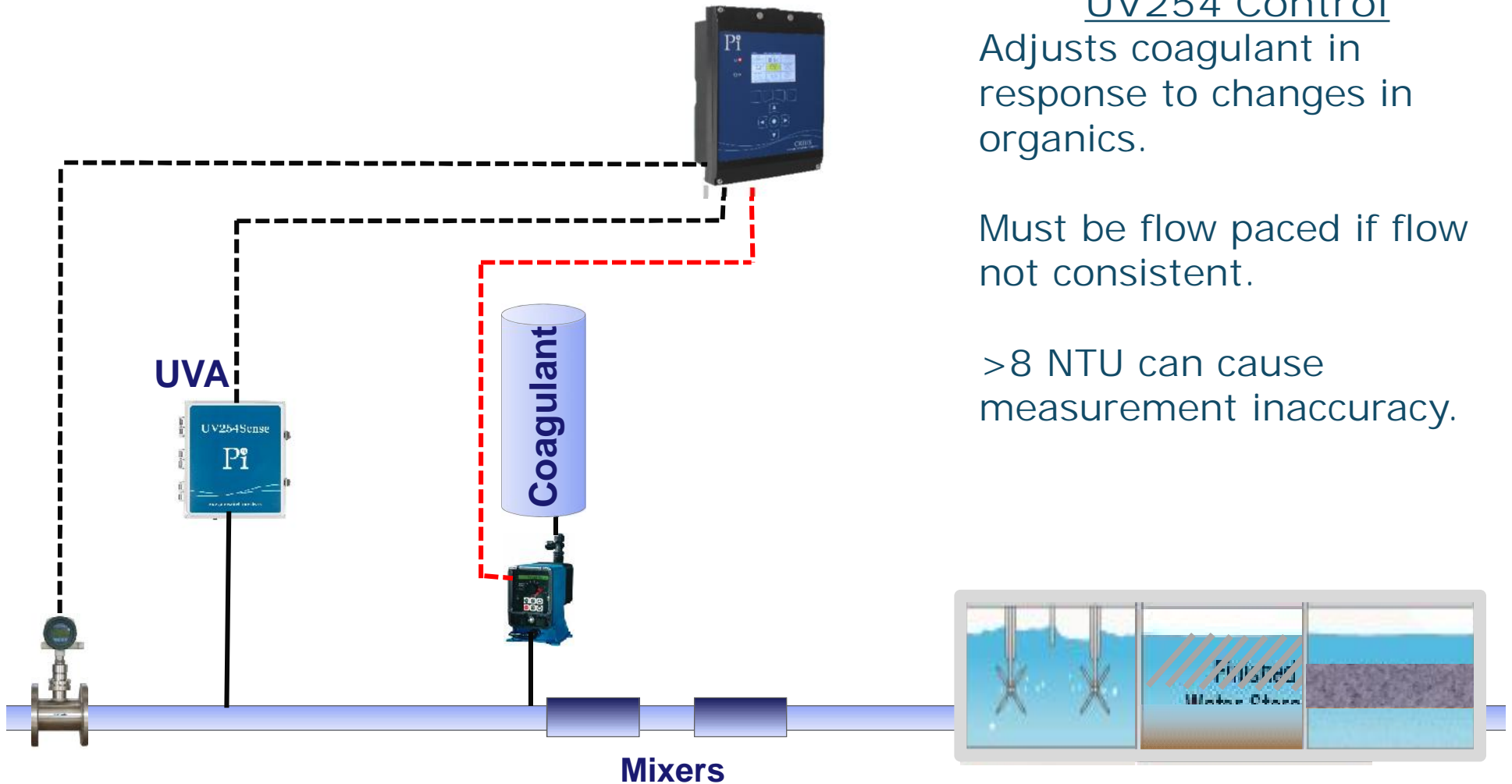




NTU

Adjusts coagulant in response to changes in turbidity. Potentially used when SCM is not suitable and organics are low.

Must be flow paced if flow not consistent.



UV254 Control

Adjusts coagulant in response to changes in organics.

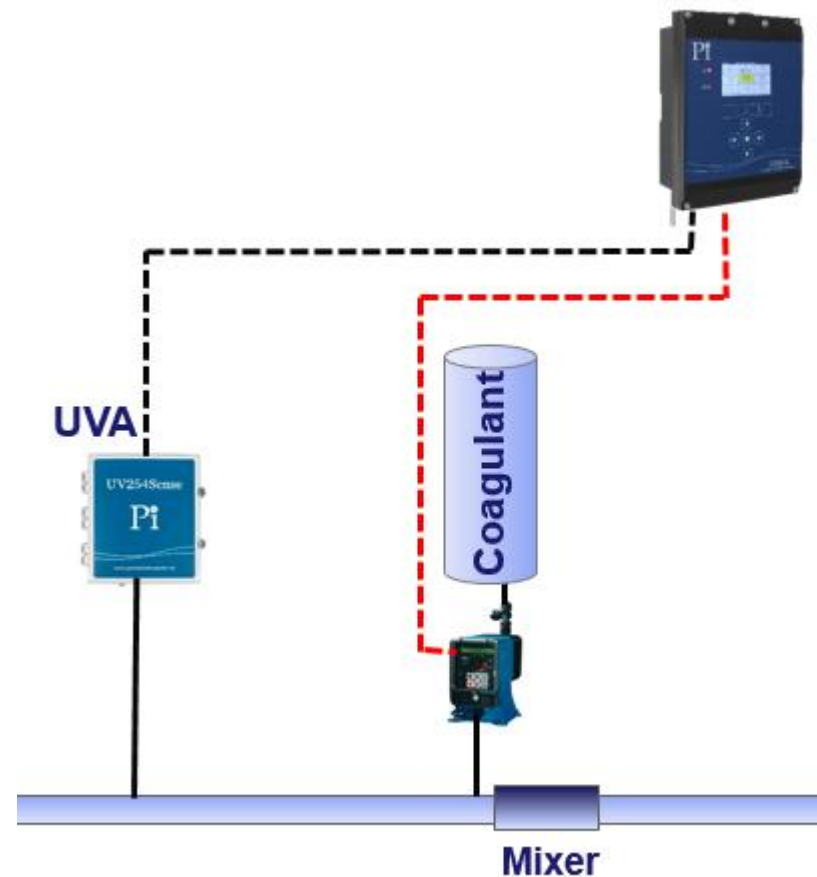
Must be flow paced if flow not consistent.

>8 NTU can cause measurement inaccuracy.

Pi^π Feedforward Control (UVA, NTU, Flow)

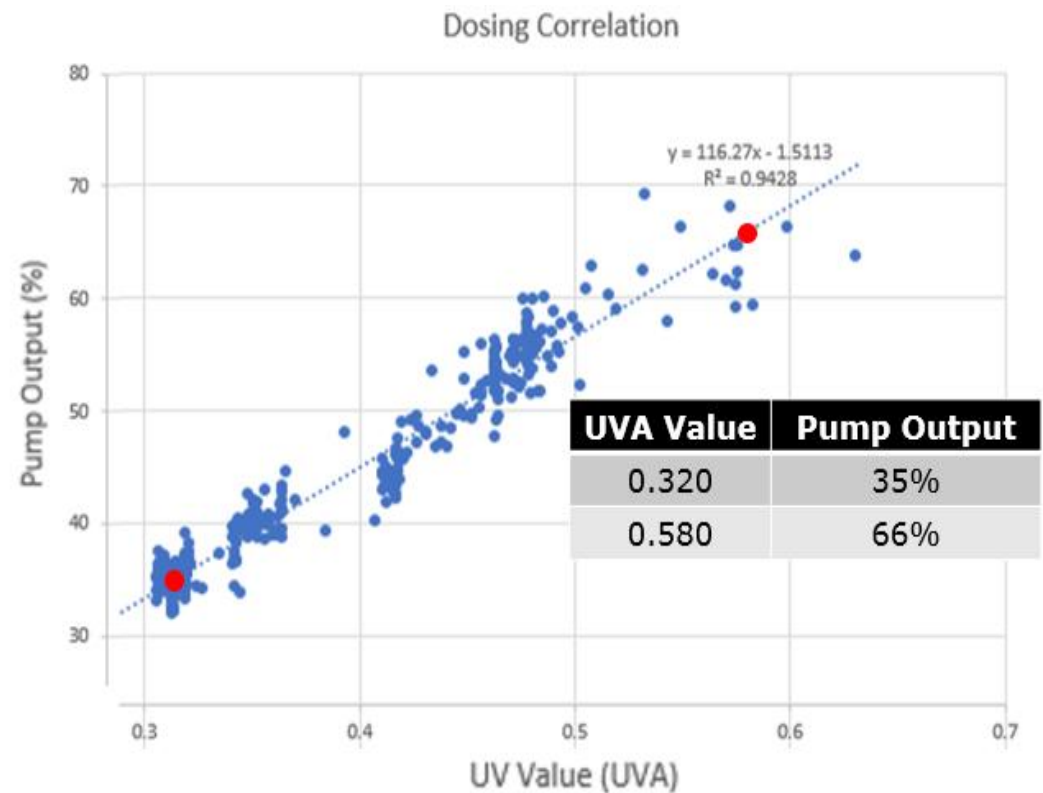
Advantages

- Instantly compensates for change, no lag time.



Advantages

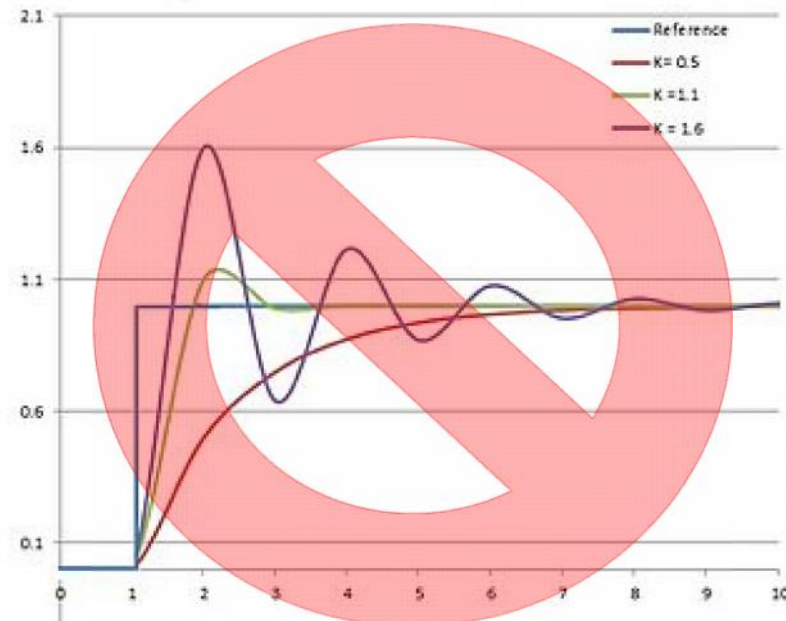
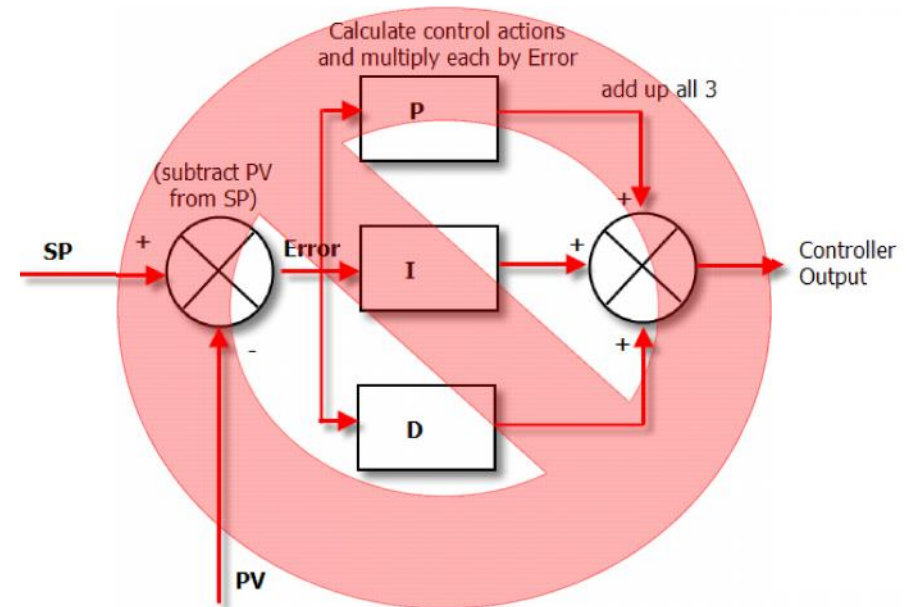
- Instantly compensates for change, no lag time.
- Generally simple linear relationships.



Pi^π Feedforward Control (UVA, NTU, Flow)

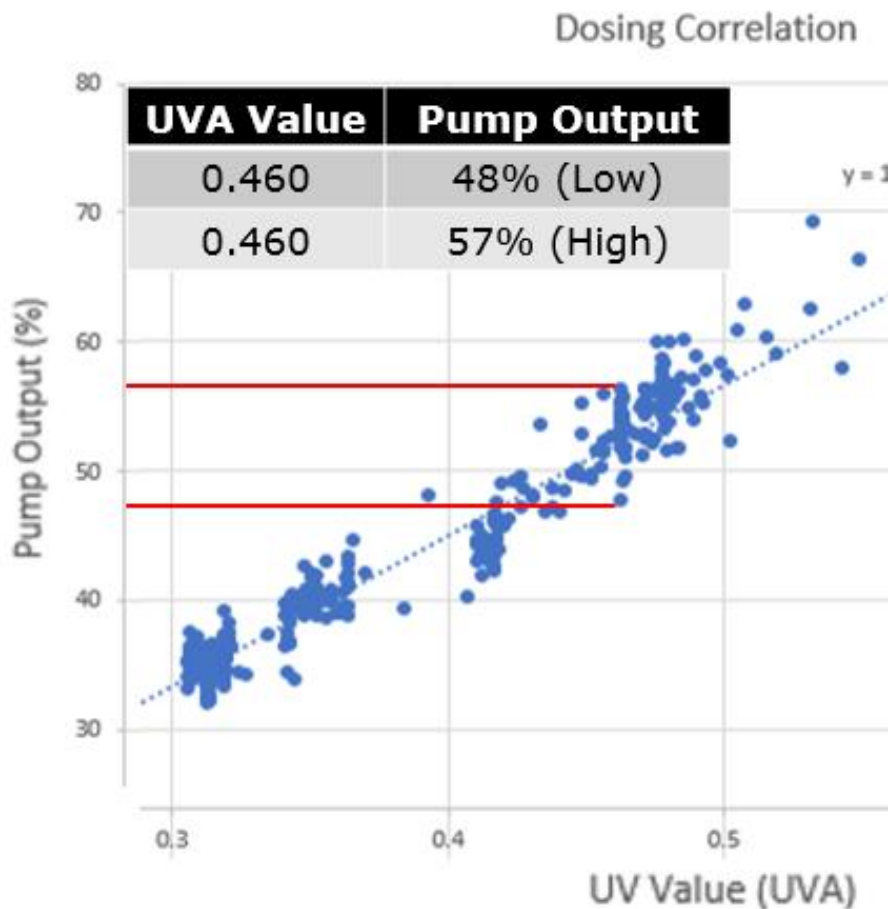
Advantages

- Instantly compensates for change, no lag time.
- Generally simple linear relationships.
- No tuning factors that may introduce instability.



Disadvantages

- Control cannot be initiated until model is determined.
- Modelling never perfect for all conditions, requires operator to apply a "Bias".



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- No confirmation action actually happens.



Pi

Feedforward Control (UVA, NTU, Flow)

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- Requires measurement / calibration of pumping volume.



Pi

Feedforward Control (UVA, NTU, Flow)



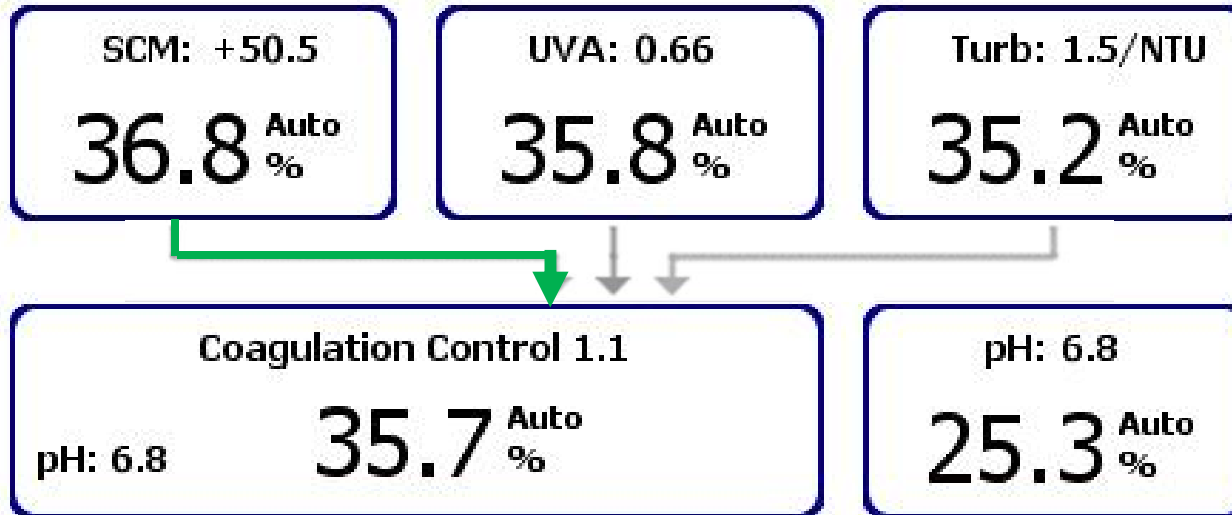
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11:36:06

Crius - A110:789F:BEA4:CC7F

CoagSense



Menu



Modbus Map

Modbus Map: Crius (B53B:9B64:2E09:4273)

Input Registers (Read Only)

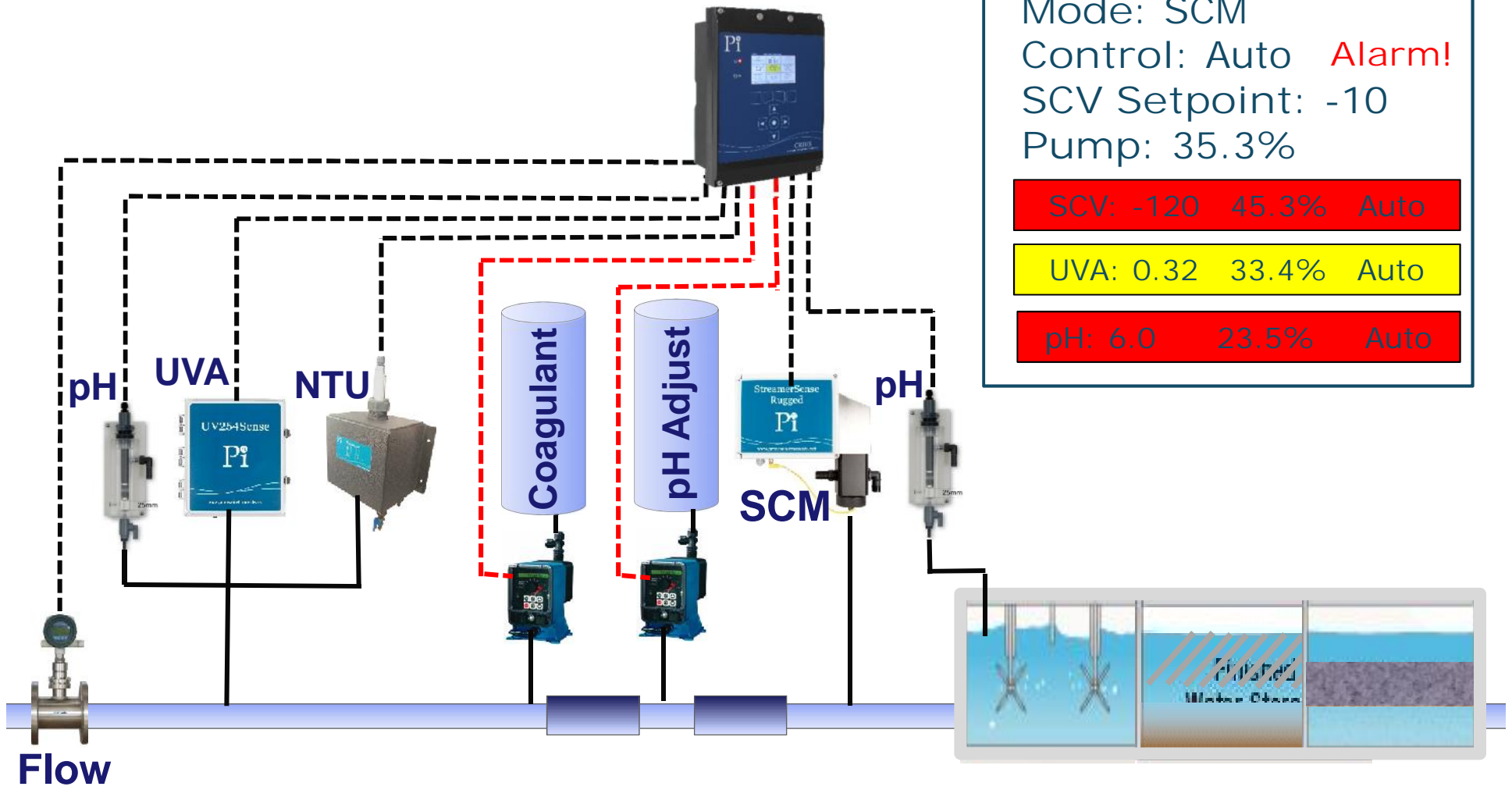
| Address | Size | Type | Device | Description | Ref. |
|---------|------|-------|------------|----------------|------|
| 0 | 2 | FLOAT | UV-254 1.1 | Official Value | |
| 2 | 2 | FLOAT | UV-254 1.1 | Official Value | |
| 4 | 2 | FLOAT | SCM 1.2 | Official Value | |
| 6 | 2 | FLOAT | Flow | Official Value | |
| 8 | 2 | FLOAT | pH Raw | Official Value | |

Holding Registers (Read Write)

| Address | Size | Type | Device | Description | Ref. |
|---------|------|-------|----------------------|-------------|------|
| 1000 | 1 | U8 | PID/Flow Control 1.1 | Run mode | 34 |
| 1001 | 2 | FLOAT | PID/Flow Control 1.1 | Value | |



Validation of Coagulant Control





Validation at Plant B

From Crius - B9BC:A05E:02BF:D5EF <crius@processinstruments.co.uk>

Subject: **Alarm Active**

Alarm message update: 29/12/2016 11:04:53 GMT

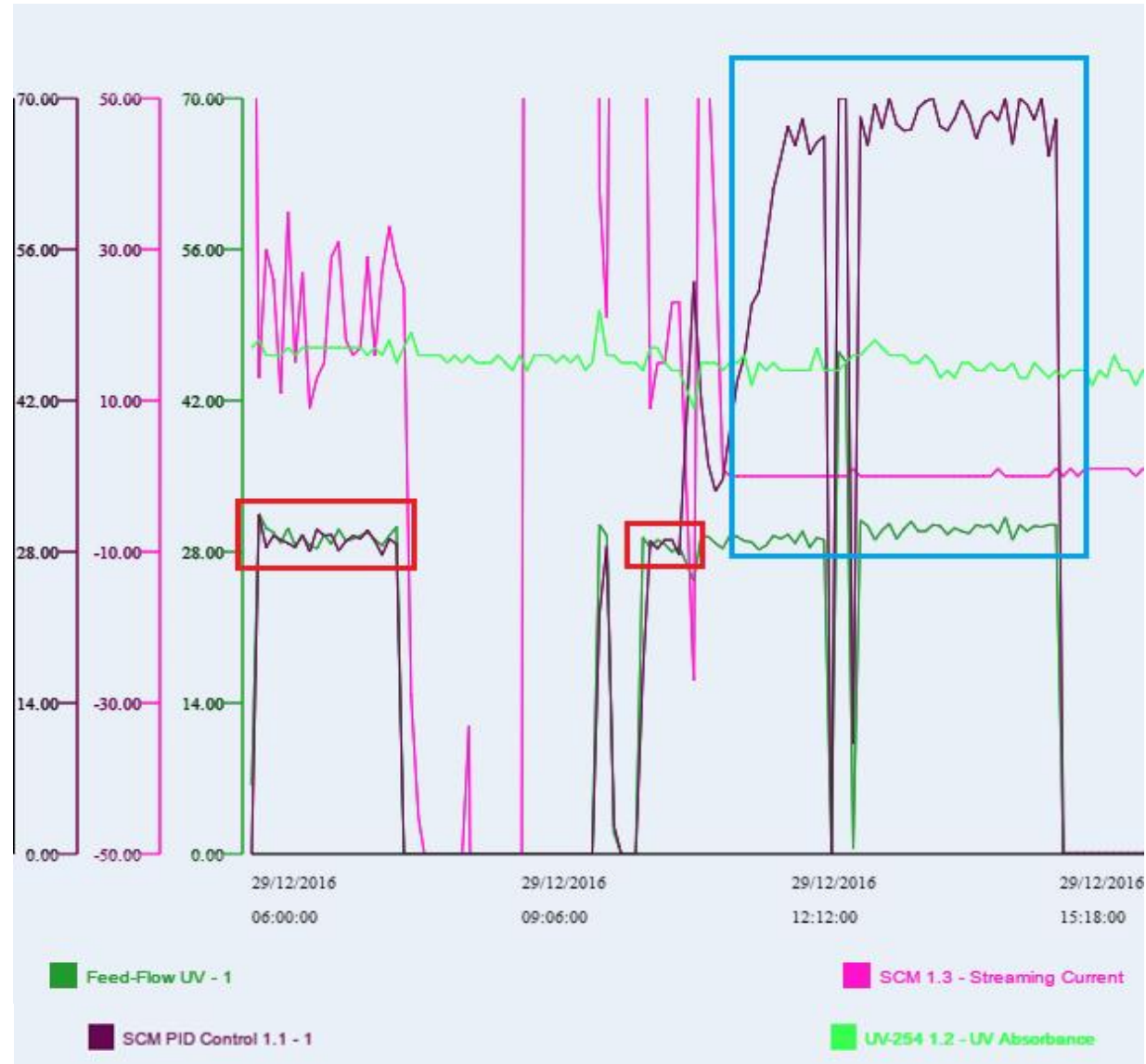
Alarm details:

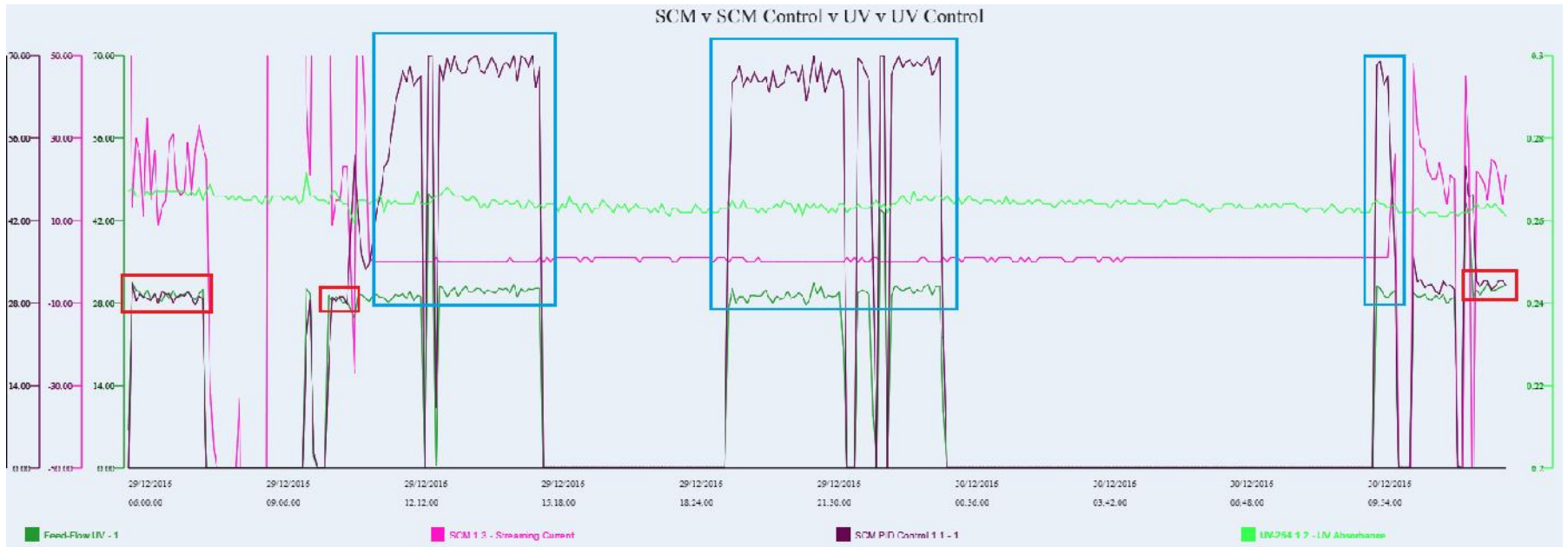
Coagulation Control 1.1

Control input validation error

Control in fail safe

Validation at Plant B

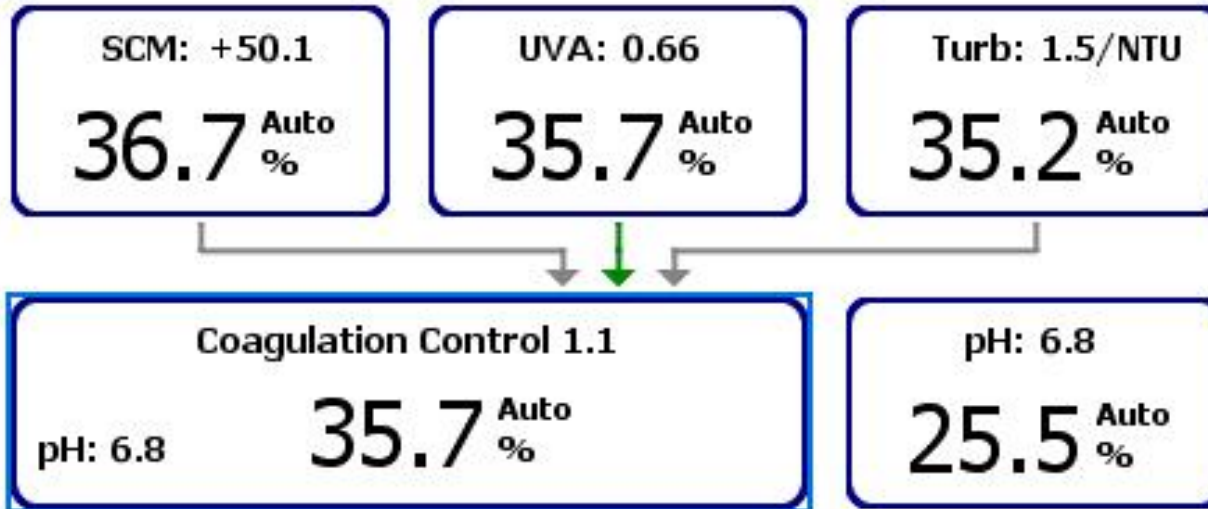




12:11:27

Crius - A110:789F:BEA4:CC7F

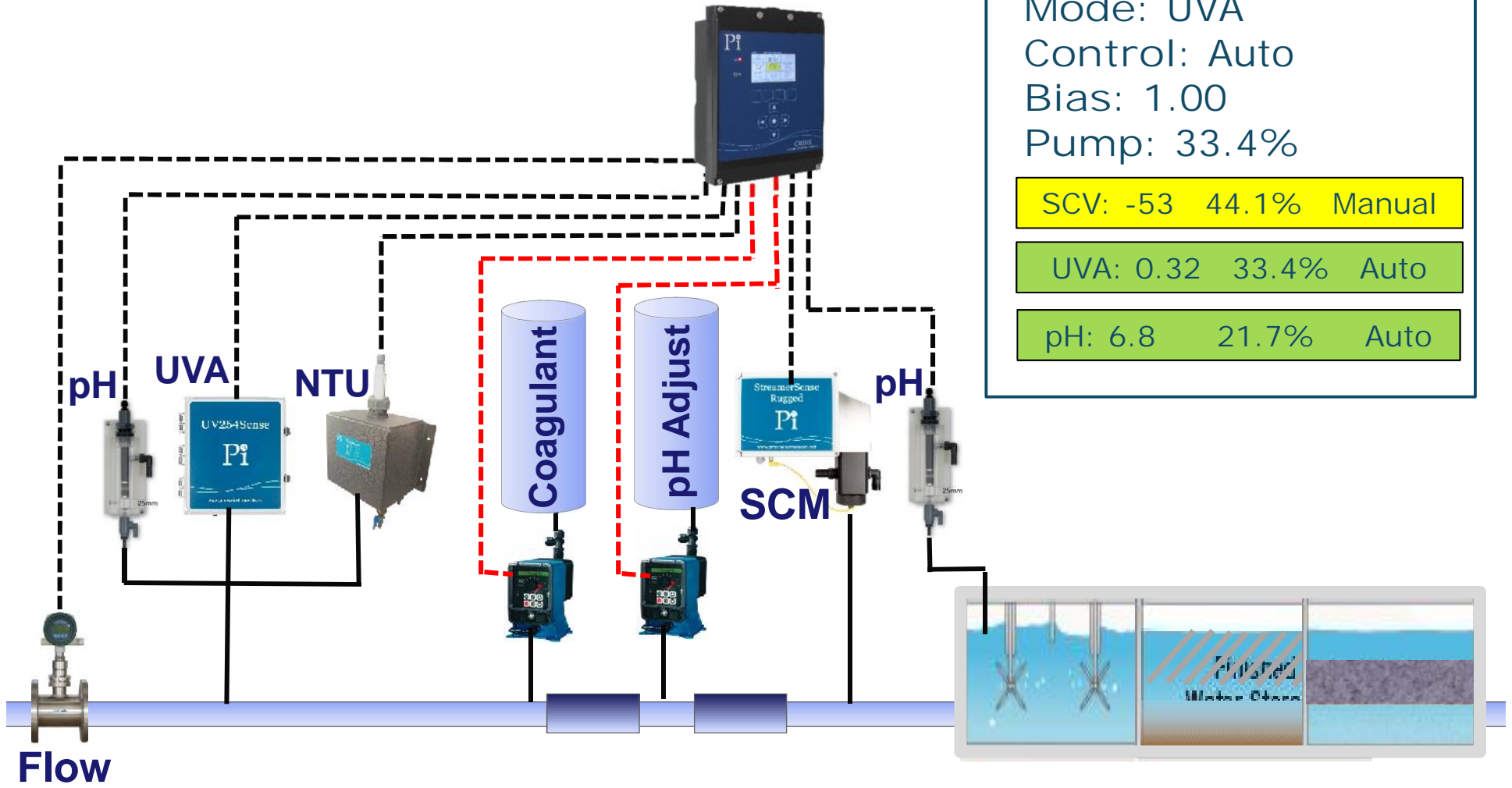
CoagSense



Menu



Validation of Coagulant Control





Coagulation Controller

Must Have

Ability to accept multiple sensor inputs (NTU, SCM, UV, pH, Flow)

Provide multiple control schemes with simple transition.

Validation features to help identify control problems sooner.

Seamless SCADA integration using Modbus RTU/TCP (Read-Write).

- A coagulation control system (CCS) isn't a single instrument.
- Neither is it just a group of instruments.
- It is the instrument(s) capable of best optimising coagulation for a specific WTP with its unique water quality concerns.
- To have the best chance of success there has to be a knowledgeable party who comes to the site before, during and after installation.
- The decision as to whether or not to install a CCS should be made on a cost/risk/benefit analysis.

Which Sensor Technology?

Alkalinity: Low

NTU: Low, Always <5

TOC: High & Variable

Coag pH: 6.2 - 6.6 ←

Source: River

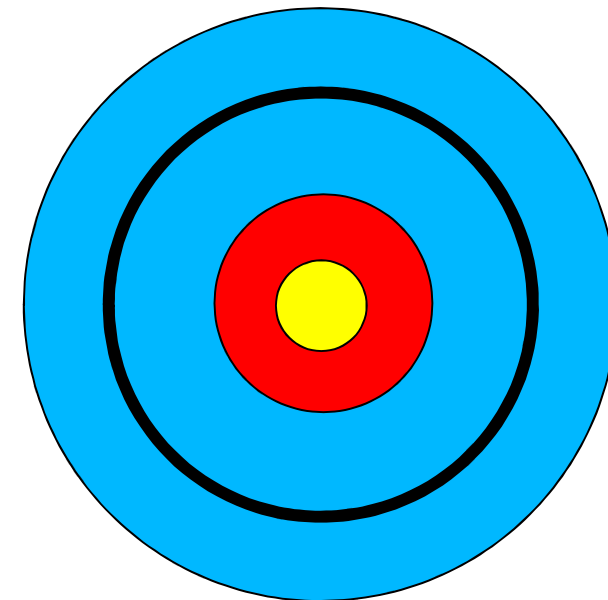
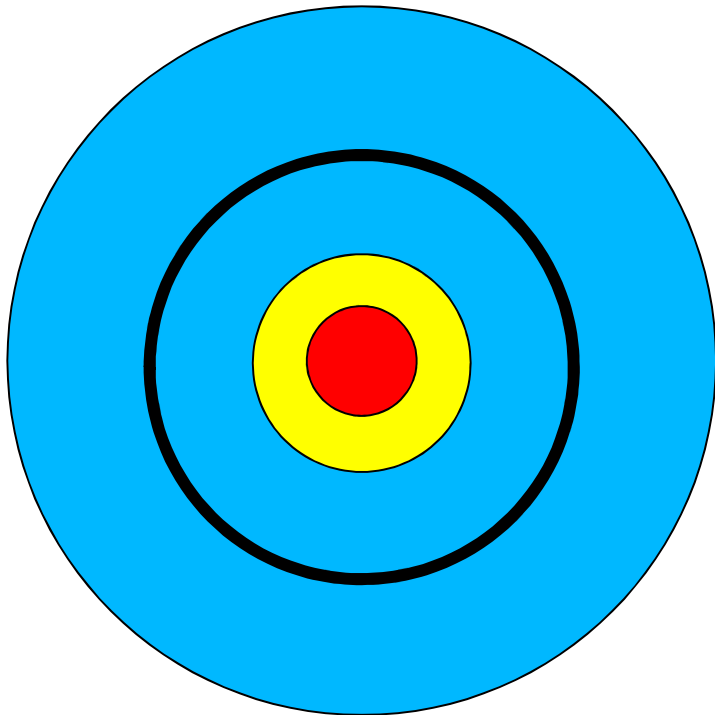
Alkalinity: Low

NTU: 1 to 30 NTU

TOC: Moderate & Variable

Coag pH: 6.2 – 6.6

Source: 2 Rivers Blended



● NTU Ctrl

● UVA Ctrl

● SCM Ctrl

Which Sensor Technology?

Alkalinity: Moderate

NTU: 1 to 50

TOC: Low to Moderate / Variable

Coag pH: 6.5 – 7.5

Source: River

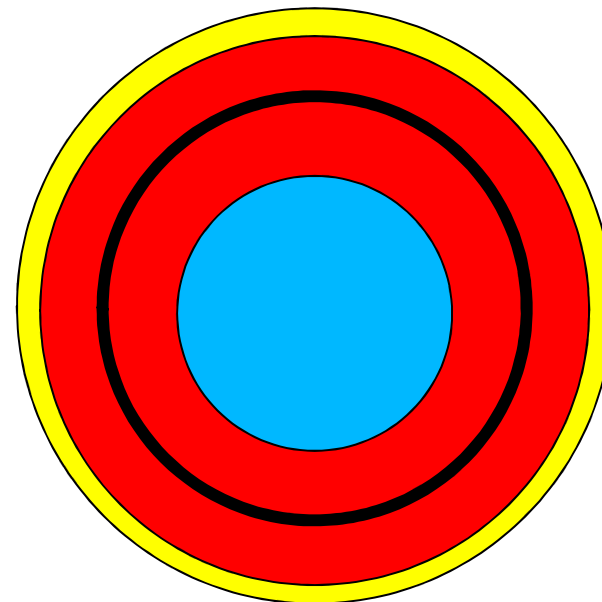
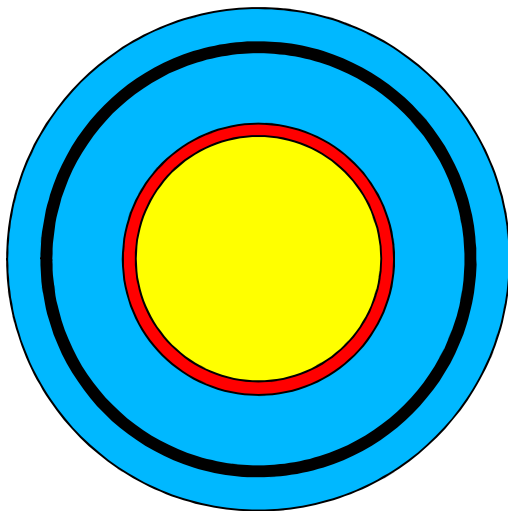
Alkalinity: High

NTU: 1 to 50

TOC: Low (No DBP Concerns)

Coag pH: 7.4 – 8.0

Source: Lake



● NTU Ctrl

● UVA Ctrl

● SCM Ctrl

- The decision as to whether or not to install a Coagulation Control System (CCS) should be made on a cost/risk/benefit analysis.
- There are no easy solutions or miracle cures, but there are automation tools that go a long way to help WTP's improve outcomes.
- If a decision is made to invest in a CCS, make sure you will be supported (ask for and talk to multiple references).

Thank You

Any Questions?