ARCHER SEPARATION

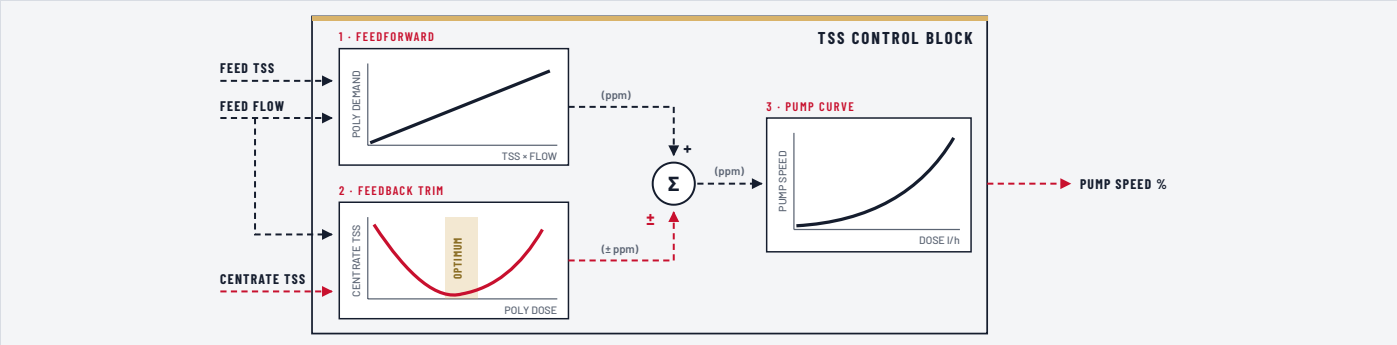
TSS CONTROL BLOCK

Closed-loop polymer dosing control for decanter centrifuges

TECHNICAL DATASHEET
DS-IIOT-TSS REV A · 08/2026

The Archer TSS control block sets polymer dose from measured process conditions instead of a fixed operator setpoint: forward from the dry solids load arriving at the bowl, back from measured centrate quality. It executes in the centrifuge PLC or a dedicated Archer panel, separately from the monitoring service (DS-IIOT-CM), which stays read-only.

CONTROL ARCHITECTURE



HOW THE LOOP WORKS

STAGE 1 · FEEDFORWARD

Feed flow and feed solids give the dry solids load arriving at the bowl. A commissioned characteristic, linear, piecewise-linear or lookup, converts that load into a base dose, expressed as specific dose against dry solids and converted to a polymer solution rate using the makedown strength. When the sludge thickens or the feed steps up, the dose moves with it in the same second.

STAGE 2 · FEEDBACK TRIM

A bounded trim from the centrate controller raises or lowers the base dose within a commissioned band, and the result is clamped between a minimum and maximum rate. Dose against centrate TSS is a U-curve, so the trim is gradient-aware: it holds the under-dose branch and perturbs the dose periodically to confirm which way the slope runs before it crosses the trough.

STAGE 3 · PUMP OUTPUT

The commanded rate is linearised through the dosing pump's own characteristic, entered as a commissioned lookup, into a speed reference. The same commanded dose therefore delivers the same rate across the pump's range. Output is rate-limited on change to protect the floc and the pump.

Coefficients, breakpoints, trim authority and the pump lookup are all site values, established from the step tests on page 2 and recorded in the loop folder at handover.

PROCESS INPUTS

SIGNAL	TYPICAL RANGE	INTERFACE
Feed solids	0 to 8 % DS	4–20 mA or fieldbus
Feed flow	0 to 60 m^3/h	4–20 mA, pulse or fieldbus
Centrate TSS	0 to 3000 mg/l	4–20 mA or fieldbus
Polymer solution flow	0 to 2000 l/h	4–20 mA or pulse
Torque, differential and bowl speed, run state	–	Existing centrifuge PLC

Solution strength (0.5 to 5 g active/l) by operator entry or from the makedown unit. Ranges are set to the installed instrument at commissioning.

OUTPUTS

SIGNAL	FORM	NOTES
Polymer pump speed	4–20 mA or fieldbus	Rate-limited, clamped to commissioned band
Loop mode	Discrete	Auto / manual / degraded / standby
Computed dose	Value	kg active/t DS and mg/l, to HMI and historian

TUNING, FAILURE MODES AND DELIVERY

TUNING PARAMETERS

PARAMETER	TYPICAL	EFFECT
Trim update interval	60 to 300 s	Must exceed the centrate transport delay
Trim authority $\pm\Delta_{max}$	10 to 30 %	How far feedback may move feedforward
Centrate deadband	5 to 10 %	Suppresses trim chatter on analyser noise
Perturbation step, interval	2 to 5 %, 2 to 8 h	Gradient test amplitude and frequency
Dose clamps q_{min}, q_{max}	site specific	Floor and ceiling on delivered dose
Output rate limit	1 to 5 %/s	Protects floc and pump from step changes

Block executes at 500 ms; stale timeout 30 to 120 s. Values are starting points, finalised from the step tests and recorded in the loop folder.

EXECUTION PLATFORM

Machine PLC	TwinCAT 3 function block (structured text) or Rockwell Add-On Instruction, with HMI faceplate, from the Archer library
Archer panel	Beckhoff CX-series controller, 24 VDC, with analogue I/O, where the machine PLC cannot host the block
Ownership	Source and documentation handed over; the loop runs on plant hardware under plant control

DEGRADED OPERATION

CONDITION	RESPONSE
Centrate TSS bad or stale	Trim frozen at last good value, feedforward continues; alarm
Feed solids or flow bad	Recipe nominal or last good rate; alarm
Both feed signals lost	Reverts to last known good fixed rate; alarm
Polymer flow off command	Alarm; reverts to fixed rate pending inspection
Dose held at a clamp	Alarm: dose limit reached, loop continues at the clamp
Gradient test inconclusive	Trim suspended, feedforward only; advisory

Detected on quality bit, out-of-range or a value frozen beyond the stale timeout. Loss of the monitoring link has no effect on control; every transition is timestamped in the PLC alarm history.

INTERLOCKS AND PERMISSIVES

- Bowl at speed, machine running and feed flow above the commissioned minimum, else standby with the pump stopped
- Scroll torque below the high-torque limit, else trim frozen and dose held
- HMI manual overrides at any time; the loop tracks output for bumpless return

COMMISSIONING SEQUENCE

STAGE	DURATION	OUTCOME
Baseline	2 to 4 weeks	Existing dose, feed variability and centrate quality recorded before any automation is enabled
Step tests	1 to 2 days	Dose stepped across its working range at steady feed to map the centrate response and locate the trough
Closed-loop trial	1 to 2 weeks	Coefficients, pump lookup, clamps and trim authority set from the test data; loop run in auto at reduced authority under operator oversight
Handover and review	First quarter	Operator training, loop folder, alarm list and as-commissioned settings issued; dose per dry tonne and centrate quality then reviewed against the pre-control baseline

Scope and responsibility. The block writes to the polymer dosing pump only. It does not modify centrifuge protection, drive control or machine interlocks, and requires no write path from the Archer monitoring gateway, which stays read-only. Closed-loop performance depends on the accuracy and maintenance of the feed and centrate analysers.

Specifications are typical and subject to change without notice; final configuration is confirmed in Archer's scope of supply.