

Automatic polymer station (ASP)

Instruction for use

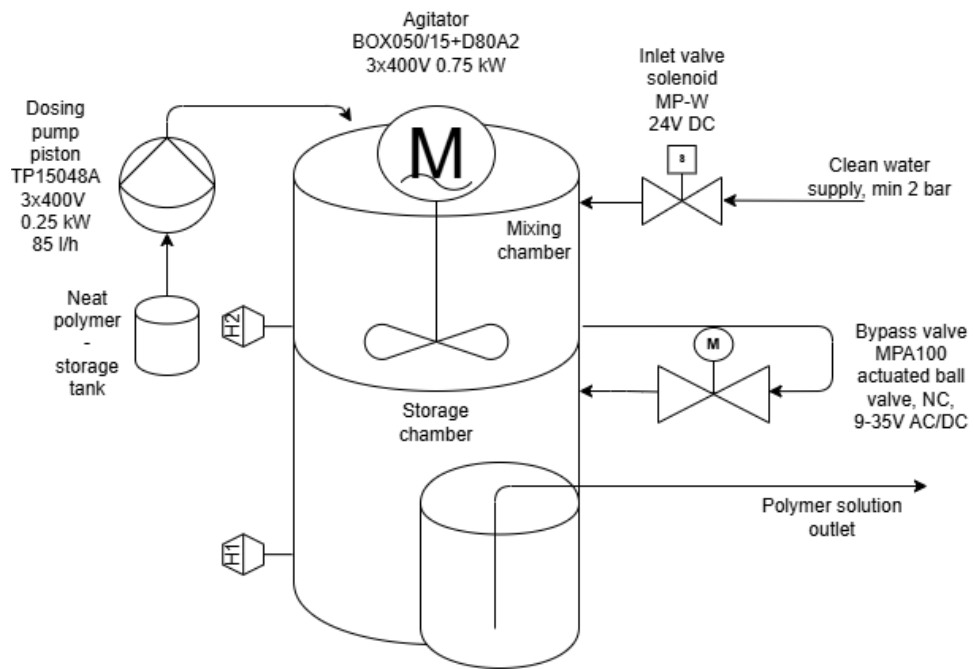


*Instructions for use of the ASP automatic polymer station, Tomáš Mívalt,
created on March 5, 2015 Version: English translation, rev. 1, updated 1/2025*

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Scheme of the machine



Introduction and the principle

Automated polymer station is used for preparation of activated polymer solution (flocculant) out of regular water and the polymer concentrate (in form of powder or liquid), to direct usage in dewatering machines etc.

The machine consists of two chambers – the mixing and the storage chamber. When the level of prepared flocculant in the storage chamber drops under defined level (it means under the trigger level), the new mixing cycle is started). The storage chambers works also as a place from where the dosing pump pumps the prepared flocculant into a following technology.

There are these steps during each cycle of preparing of new dose of flocculant:

- Checking of emptiness of the mixing chamber
- Closing overflow ball valve
- Clean water solenoid valve is open – start filling of mixing chamber
- Mixing chamber is full of clean water, inlet solenoid valve is closed
- Mixing motor is started, dosing system is started (powder dispenser or neat polymer pump) for set amount of time, which determinates amount of powder dosed into the mixing chamber
- Dosing is finished, mixing still runs for pre-set amount of time for mixing and activating the polymer
- When the mixing time is finished, mixing is stopped, the content of the mixing chamber is brought into the lower storage chamber by opening of the bypass ball valve
- When top chamber is empty, bypass valve is closed and cycle starts again (if conditions for new cycle are met)

Parameters of the machine

- Usable volume of the mixing chamber: **per model (e.g. 450l for ASP-700/450)**
- Usable volume of the storage chamber: **per model (e.g. 700l for ASP-700/450)**
- Material: **Polypropylene for -PP models / stainless steel DIN 1.4301/AISI304 for -SS models**
- Power consumption of the agitator: **0.75 kW**
- Power consumption of the dosing machine: **0.25 kW** – liquid concentrate piston pump for -C models / **0.37 kW** – powdered dispenser for -P variants
- Power supply of control box: **3x230/400 V 50/60 Hz 3+N+PE**
- Fully automated function
- Control touch screen panel – 7"

Components of the machine

a) Mixing motor

The polymer is mixed by directly driven gearmotor. The rotation of the shaft is up to $n = 193$ RPM; the shaft is seated in dry sliding bearing at the bottom of the mixing chamber.

Each mixing ring includes three angled blades which provide proper mixing in both radial and axial direction and this results in correct and fast mixing of the mixture of the concentrate and water. Two mixing ring with blades is tightened with adjusting screw in axial direction on the shaft so it is adjustable. We recommend locating one mixing ring just above the bottom of the tank to avoid polymer settling and second one in $2/3$ of the chamber height to provide agitation to the level.

b) Dosing machine

Per station model, station either consist of liquid neat polymer dosing pump or for powder versions (dry polymer) it is equipped with powder dispenser. Both kinds of polymer have their pros and cons, so we recommend consulting with your supplier which option suits you the best.

Dosing machine for liquid polymer

In case of using liquid polymer the machine is equipped with piston dosing pump TP15048A (manufactured by *Injecta*). The pump has adjustable stroke, which means flow is adjustable. Another way of regulation is the time of dosing, which is adjustable and this determine final amount of concentrate, which flows into the mixing chamber during one cycle. For more information see the chapter *Control*. The flow of the pump is up to 85 LPH and the highest pressure is 10 bar = 1 MPa. The suction height/distance from liquid polymer source tank to the pump should be lowest possible, otherwise you can encounter problems with suction and unstable flow. You should use also at least DN15 mm hose for suction. Using a check valve/foot valve on the end of suction line/hose is optional, but can aid dosing stability, especially for longer length of suction hose.

Dosing machine for powdered polymer

In case of using powder (dry) polymer, the machine is equipped with screw dosing device. The regulation of the amount is controlled by time. **It is necessary to check regularly the amount of powder in the storage hopper. If you running the machine in place with high humidity it is also necessary to regularly check of output tube dosing machine in order to prevent clogging by wet powdered polymer.** Dosing machine for powdered polymer is powered by engine with screw gearbox BOX with output rotation speed $n = 56$ RPM.

c) Overflow electro-actuated ball valve

Overflow ball valve is used for overflowing the content from the mixing chamber to the storage chamber after the end of each mixing cycle. It is equipped with motor, which is controlled by control unit of the machine.

d) Solenoid valve

This stainless-steel valve is used for control of the clean inlet water. The valve works under the pressure up to 0.7 MPa = 7 bar in temperature range from – 10 to 85 °C. The valve is closed and when the control unit sends a command, the valve opens. In case of loss of voltage/blackout it closes itself.

e) Water level sensors

There are 2 level sensors, one for each tank. The sensor measures hydrostatic pressure caused by water volume in the chamber. The sensor is flat-head diaphragm sensor, with fixed range of 0-300 mbar (0-3058 mmAq) and electrical output 0-10V. Type is (SS402).

Be careful when dismantling the sensor, head diaphragm is very sensitive to damage, even when it is slightly pushed by finger. Sensors are generally maintenance free, shall there be any miss-reading, dismount the sensor, clean it thoroughly with steady stream of water of low/medium intensity (do not use narrow type of water beam, which could affect the sensor's head).

Connection, putting into service

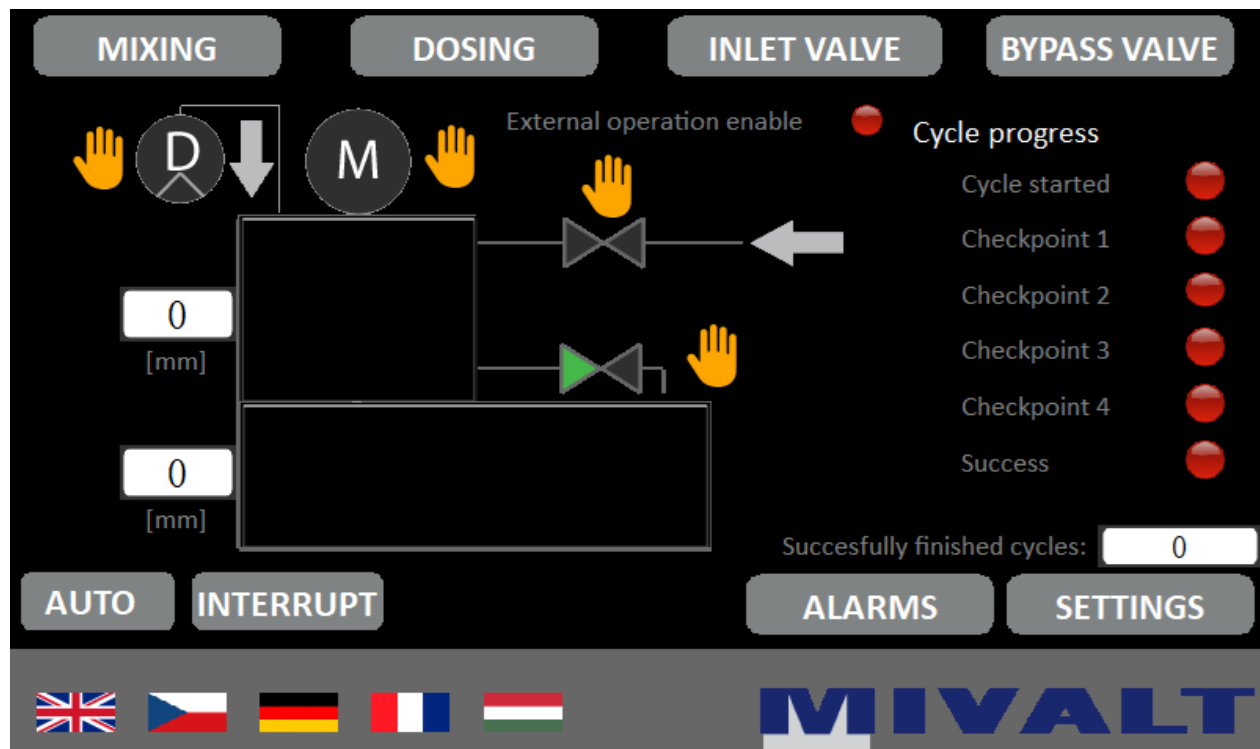
Electrical connection can only be performed by qualified and authorized person.

- Connect power supply **3x400 V** on the relevant switchboard terminals (follow the scheme in the switchboard).
- It is necessary to connect clean water supply – connect tube to the hose connector ahead of solenoid valve and secure it with hose clamp. The water pressure should be in range between **2 and 7 bar**.
- Assure that the bypass ball valve in storage chamber is in closed position.
- Dive the suction tube (with foot valve on the end) of the dosing pump into prepared container with liquid concentrate or put dry polymer into hopper of dosing machine for powdered concentrate
- Turn on the station and set times
- Holes for M10 screws in the bottom of the station can be used for fixation to the base (it is important when the station stands for example on the frame).

Control system

After connecting the control box to the electricity assure that E-STOP press button is not closed, then make sure safety circuit of the control box is released (either undervoltage module on Main breaker or RESET button on the control box door).

Home page will appear after loading of display:



It is possible to change between languages – English, Czech and others by pressing relevant flag.

The display is in English now. You can see status of all components at the home page (D is dosing pump, M is mixing engine), upper valve is solenoid for clean water; bottom valve is overflow spherical valve.

Number boxes next to the chamber are actual levels in the particular chamber. In the same time, amount of filling is scaled per blue background of the tank to visualize filling of each chamber.

When the dosing pump or the mixing motors are on, the component turns green.

When the valve is gray, it is closed. When the valve is green, it is open. The ball valve can be half and half gray and green, which means that it is currently changing the position and it is neither open or closed.

There is some information about current mixing cycle on the right side of the home page:

The cycle goes in check points and this is how it can be watched in which phase the cycle currently is and in case of voltage drop station continues from last point.

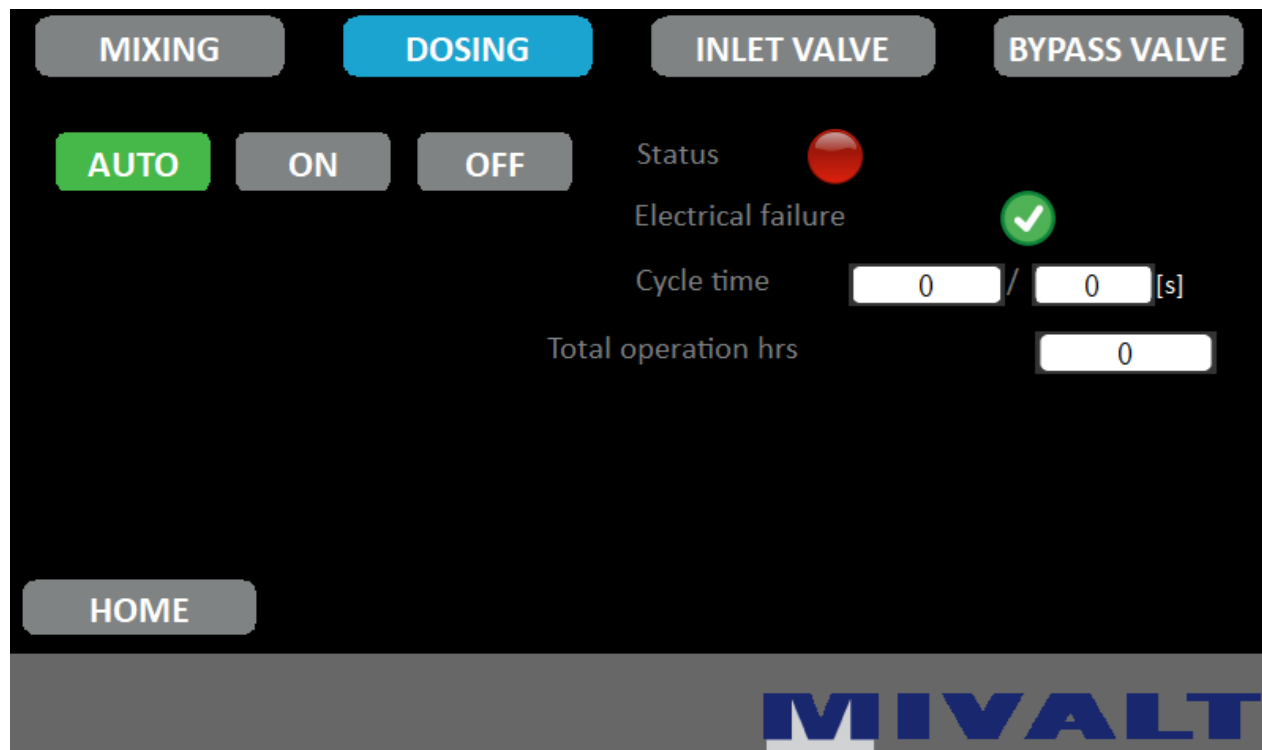
POINT	CONDITION
Check point 1	Mixing chamber is empty and closed.
Check point 2	Mixing chamber is full of clean water = filled.
Check point 3	Dosing successfully finished.
Check point 4	Mixing successfully finished.
Successful finish.	Overflow valve is open and mixing chamber is empty. Successfully drained.

It is possible to cancel current mixing cycle by pushing the **INTERRUPT** button no matter in which phase the cycle is.

The automated mode is turned on by pressing **AUTO** button.

Sub-menu component

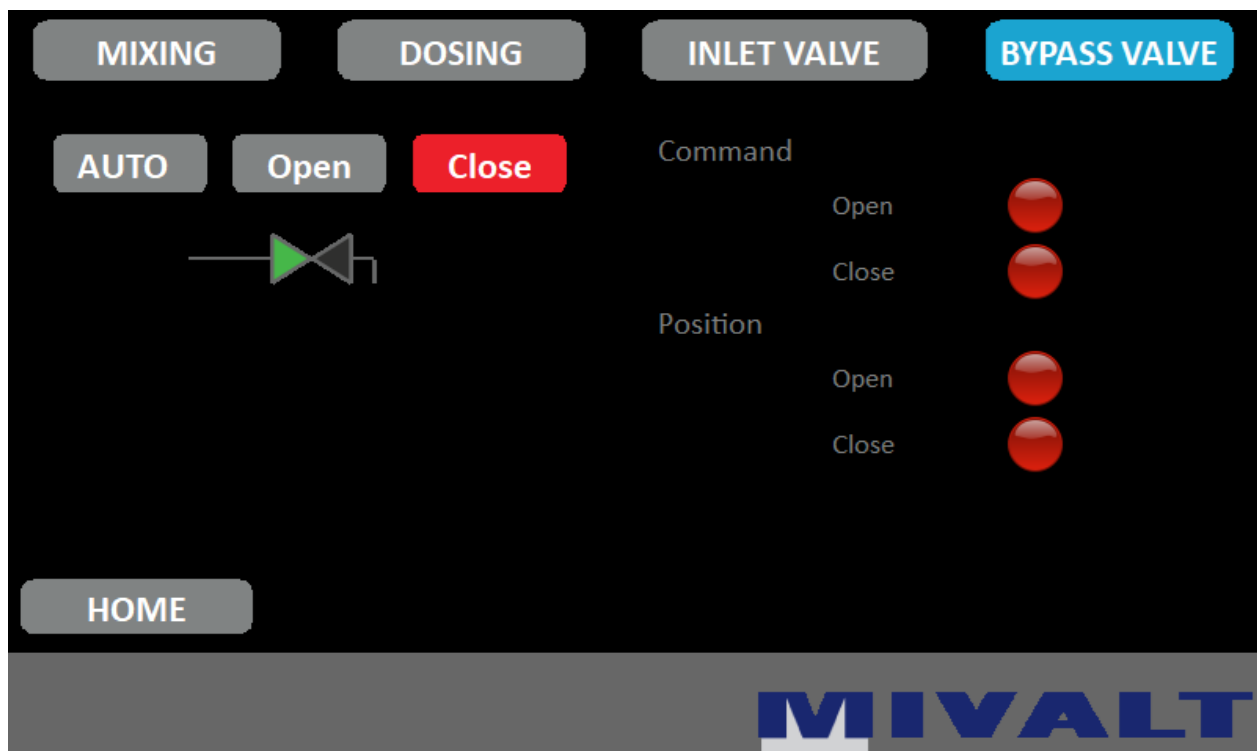
There are buttons in the upper line, by pressing them it is possible to get to the sub-menu of each components.



It is possible to switch on the components manually in the sub-menu without line to the program or leading cycle. This can be done in unusual situations or during maintenance. It is important to switch on automatic mode at the end of maintenance, otherwise the station could not be working correctly.

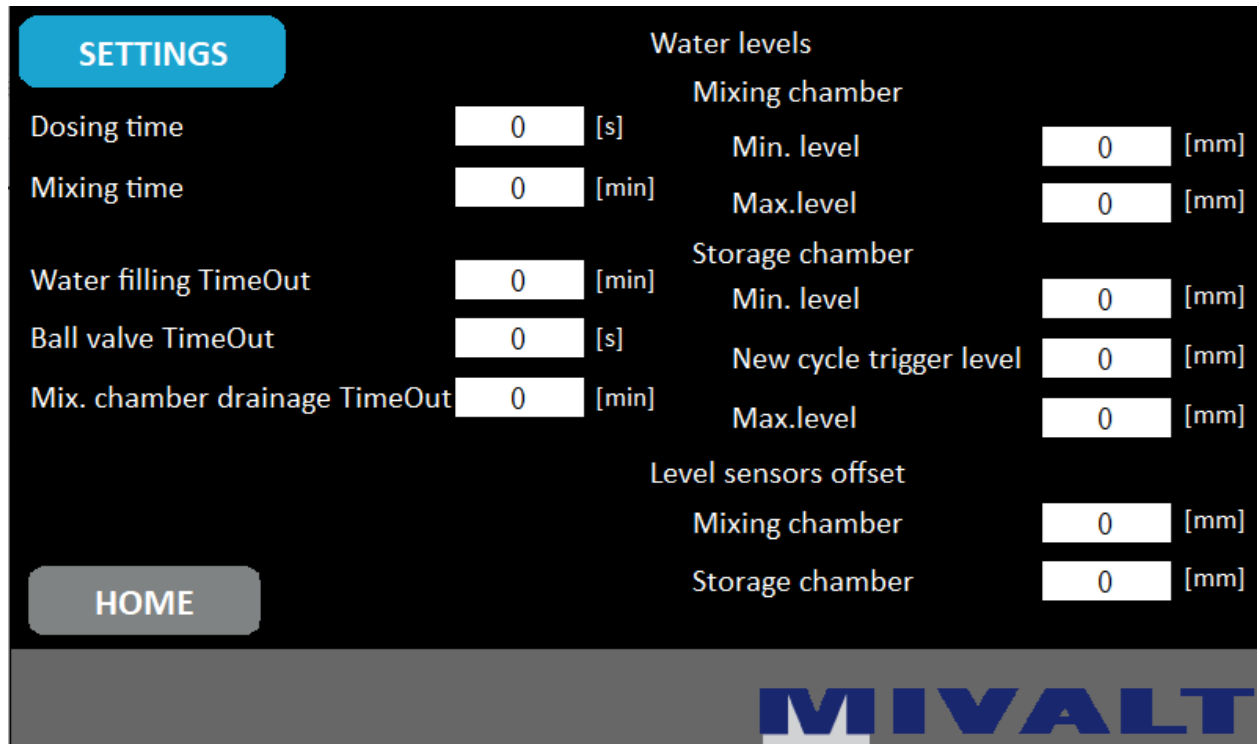
There is status of particular components on the right side (red = switched off; green = switched on). When electrical failure appears (triggered motor thermal protection = exceeding the operating current) electrical fault lights up and the station is shut down. There is also a counter of operating hours of particular components and when some component is running in automatic mode it can be seen in which phase the component currently is (for example 40/80 means that dosing has been running for 40 seconds and it is set for 80 seconds).

The component INLET VALVE is solenoid valve, which is commanded open/close. The component BYPASS-VALVE has also signalization of end positions (fully open/closed).



Screen setup

With the setup button on the home screen is possible to get to the setup screen.



By pressing numeric field screen appears and there you can set required value for each settlement, which you enter by pressing „ENT”. All settlements are permanent and stays saved even when the station shuts down.

Settlement of the dosing time is essential, which means the amount of flocculant dosed into water in mixing chamber. We recommend to check this time because even with the same dosing pump the resultant amount can be different depending on properties of specific polymer concentrate used, pumping height, etc. We always recommend to measure actual dosing rate with full set-up – meaning, all pipes, valves, polymers to be used is on site with standard temperature and pump suction hose dived in. Start the dosing pump in manual mode for given period of time (for example 50s, measured by stop-watch) and let the discharge hose to dose into the jar. After time passed, stop the pump and evaluate how much material ended up in the jar. By that, you can calculate exact dosing time for actual operation, considering mixing tank volume and desired concentration.

Another important settlement is mixing time, which is time of running cycle. We recommend 10-20 minutes to mix liquid concentrate.

Another 3 settlements are time limits – if some part of cycle did not run through the time limit, fault probably appeared and it is necessary to turn on alarm and stop the machine.

Water filling TimeOut – if the mixing chamber is not fully filled with water during the time limit, the valve for clean water is closed again – we recommend to try how long it takes to fill the chamber in your conditions and add approximately 2 minutes to this value. Upper water level of mixing chamber is recognized by two water level probes, so the time limit is another and not only the one safety measure against flooding the surrounding area.

Ball valve TimeOut (bypass) – when the bypass valve is not switched from one end position to another in settled time, an alarm occurs – manufacturer of electric drive presents about 12 seconds. We recommend to settle the time for 20 seconds.

Mix. chamber drainage timeout – it is time during that the mixing chamber should be drained. Again we recommend to try and increase the time limit approximately 30 % higher.

Level settings

Levels are pre-set per exact model of the ASP and its dimensions during final check of manufacturing.

Min level of each tank should be as close to zero as physically possible, normally we recommend to set it to about 20-40 mm, because always certain layer of liquid will remain in the tank as discharge pipes are located in the walls, not in the bottom of the chamber.

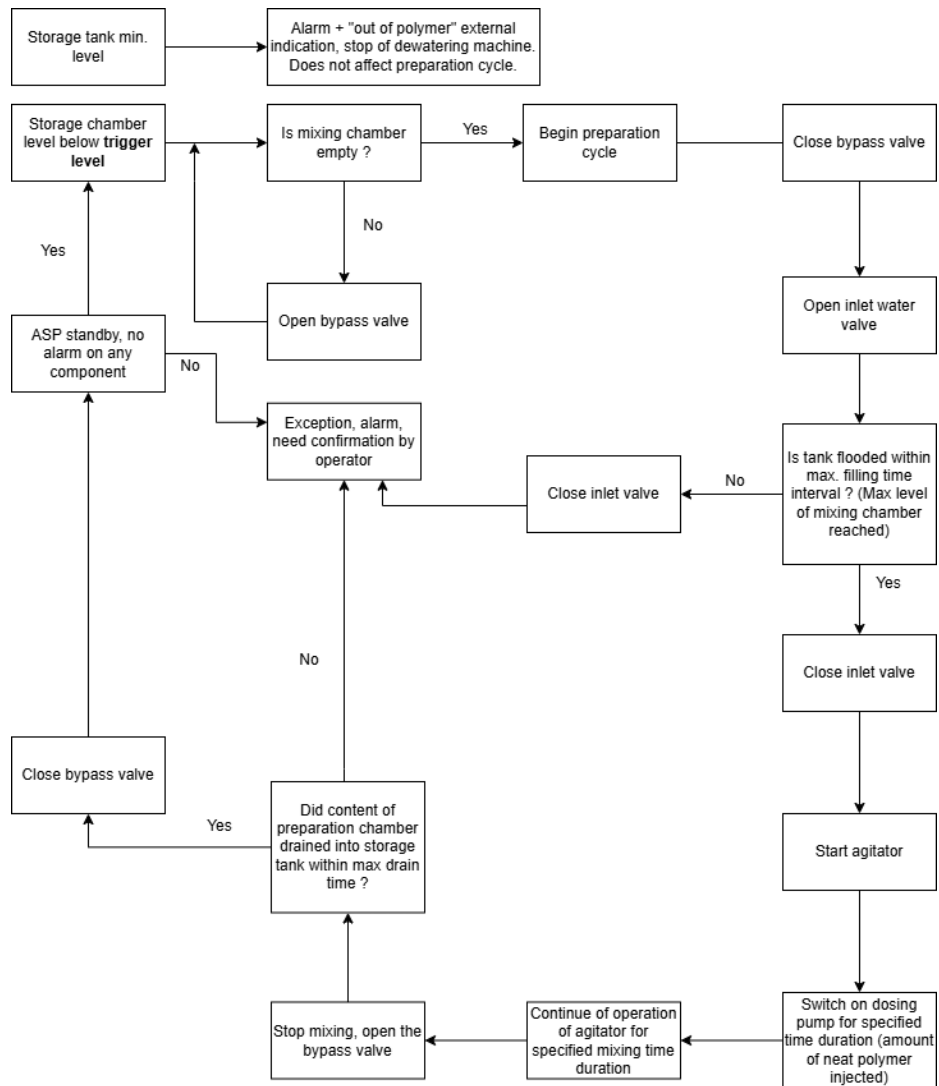
Max. level should be set with some tolerance slightly lower than the physical height of the tank. Especially for mixing tank, setting max level too high might result in over-filling of the chamber and then some material escaping the tank over the lid, once mixer is started.

Trigger level in the storage chamber sets to level, when new preparation cycle is started. If actual level is above this level, new cycle of preparation won't be initiated.

Level sensor offsets

By setting positive or negative sensor offsets, you can correct miss-reading of the sensor. Physically measure actual level in the tank with gauge and compare it with reading. If reading is off, you can adjust offset value to match physical reading with reading on the HMI. After changing the offset, it is important to verify the reading on 2nd measuring point – e.g. add some water to the tank (at least by 100mm) and do the verification again – compare physical gauge reading with indicated reading. If physical reading does not match with HMI reading, sensor is probably faulty and needs to be replaced. Most common reason for faulty sensor is damaged diaphragm by improper handling of the sensor during maintenance/cleaning.

PID diagram of the ASP



Screen of alarms

After pressing „Alarms” on the home screen, there can be seen a list of current and past alarms.

Except time limits, mentioned in previous part, between alarms – faults - also belong:

- Prepared polymer is out (storage chamber is completely empty)
- Electrical fault of mixing engine (shut down engine starter – overloaded?)
- Electrical fault of dosing machine (shut down engine starter – overloaded?)
- Bypass valve indicates both positions simultaneously
- Contradiction between water level probes (water level probe in one chamber indicates upper water level, not bottom)

Control box is equipped with one dry (no-potential) contact, which closes when the storage chamber is empty (prepared polymer is out). This can be used as a signal for follow up technology to stop the running.

RESET button deletes all alarms.

Manufactured by

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