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Automatic multi-machine station for coolant monitoring and parameter tuning

Issues to be solved:

- Increase of coolant service life;
- Increase of tool life;
- Reduction of harmfulness to human skin;
- Reduction of risk of biofilm formation and bacterial growth;
- Reduction of risk of corrosion on machine components and workpieces;
- Elimination of foaming;

Station description:

The automatic multi-machine station for coolant monitoring and parameter tuning is designed to monitor physical and chemical parameters of coolant with reference to the following parameters:

- pH;
- dH;
- EMC;
- Concentrations;
- Temperature;

and to implement corrective link and feedback.

In case one or more parameters exceed the permissible limits, the feedback is implemented:

- Correction of basic parameters;
- Escalation to the operator panel;
- Escalation to the user web-interface, etc;
- Response by discrete inputs to the machine CNC system.

The system is equipped with:

- Telemetry unit;
- PLC-based control unit;
- Colour control panel with touch input;
- Treated water tank;
- Water treatment system;
- Coolant inlet filter.

The system configuration involves several performance options:

- Stand-alone (without water main connection);
- Integrated (with water main connection);
- Monitoring (without coolant addition).

Possible options: single- or multi-machine versions.

All telemetry data is stored in a database for further use in predictive analytics and big data mining.

ASM Coolant specifications

Main characteristics		
Dimensions	1400x1800x900	Width * Height * Depth, mm
Communication lines:		
- electric supply	380	V
- water supply (main)	20	l/min
- water supply (container)	20	l/min
- coolant supply	12	l/min
- removal of coolant	12	l/min
- CNC communication		
Tank with treated water	150	l
Coolant filter	100	µm
Water filter		
- 1 cleaning step	10	µm
- 2 cleaning step	5	µm
- 3 cleaning step	0,6	µm
Coolant mixer unit	1-10	%
Pressure sensor (3 points)	0-25	bar
Coolant level sensor	0-1500	mm
Circulation pumps (2 pcs)	60	l/min
Communication protocols	Web-server, MySQL, OPC UA ,Modbus , MQTT, OwenCloud, HTTP	
Control system		
Operation panel - programmable logic controller	OWEN SPK110	
Digital inputs	12	
Digital outputs	20	
Analog inputs	16	
Communication interfaces	Ethernet, 3×RS-485, 2×RS-232, USB Host, USB Device, SD-card	
Communication protocols	Modbus (RTU, ASCII, TCP), OBEH, OPC UA (Server), SNMP (Manager/Agent)	

pH measurement subsystem			
	Range	Discretization	Accuracy
pH	0-15	0,01	±0,02
Temperature, °C	0-100	0,1	±0,3

Total hardness and spec. conductivity measurement subsystem			
	Range	Discretization	Accuracy
Spec. conductivity, μS /cm	0-20000	0,0001	$\pm(0,03+0,02*\text{æ})$
Total hardness, mg/l	0-10000	0,0001	$\pm(0,03+0,025*C)$

Concentration measurement subsystem			
	Range	Discretization	Accuracy
Refracting	1,3200 - 1,4200	0,0001	± 0,0002
Concentration, %	0 - 50	0,005	±0,1
Prism material	Synthetic sapphire		

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