

Application Validation Report

SmartPump_Duplex — version 3.6.0

Attestation

Application	SmartPump_Duplex v3.6.0
Validated	2026-08-09T21:51:04Z
Device MAC	53430263
Firmware (core)	1.5.8
Source commit	fb797e7 (clean)
Release tag	pump-station-duplex/v3.6.0 (at this commit)
Device files (SHA-256)	sha256:dafb3cd6a7903132e78fc033e56cad9e6364b2327d1bb406e8c36e9a63a95cf4
Files validated	app.py, app_vars.py, config.json, makstation.py
Promotion	Promoted to RELEASED 2026-08-09T21:51:44Z — device-file fingerprint verified byte-identical to the release tag. Run executed on commit f107bec prior to tagging.

What this report certifies

This report records an automated, end-to-end validation of the **SmartPump_Duplex** application running on a physical SmartController Classic with real m.Smart Universal IO modules. Each test drives the controller's field inputs (levels, floats, faults, currents, power status) over the live Modbus/RS-485 and cloud command path exactly as in the field, then observes the controller's pump run and speed outputs, confirming the control logic and protective lockouts behave as specified. The exact software validated is pinned by the source commit and the SHA-256 fingerprint of the deployed files above.

Results summary

PASS 11 / 11 (11 of 11 scenarios passed).

#	Scenario	Result
1	Clearwell level tracks suction pressure	PASS
2	OD-PP: enable ping-pongs on completed demand cycles	PASS
3	OD-PP: fault hands the enable over; the pump is retried at its next turn	PASS

4	OD-PP: a pump in Off is disqualified from the rotation	PASS
5	Lead starts, lag joins, both stop, rotate next cycle	PASS
6	Pressure mode cycles on discharge setpoints	PASS
7	Low-suction cutout with hysteresis	PASS
8	High-discharge cutout with hysteresis	PASS
9	Fault promotion: faulted lead hands off to the other pump	PASS
10	Tower->pressure failover (timed; hardware)	PASS
11	Reboot: no false start, no boot-latched lockout (timed; hardware)	PASS

Test detail

1. Clearwell level tracks suction pressure PASS

The station reports the level of the clearwell it draws from, computed from the suction transducer (1 psi of water column = 2.31 ft), so operators read feet of water instead of converting pressure. Monitoring only - dry-run protection still acts on the suction cutout in psi.

Requirement: clearwell level = suction psi x 2.31

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ drive Suction Press = 20	0.0 s
✓ expect Clearwell >= 44.2 within 150.0s	0.0 s
✓ expect Clearwell <= 48.2 within 150.0s	33.6 s
✓ drive Suction Press = 40	0.0 s
✓ expect Clearwell >= 90.4 within 150.0s	41.4 s
✓ expect Clearwell <= 94.4 within 150.0s	0.0 s
✓ drive Suction Press = 60	0.0 s

2. OD-PP: enable ping-pongs on completed demand cycles **PASS**

In OD-PP mode the VFDs start and stop themselves on pressure demand; the controller only moves a single enable between the pumps. The enable starts on pump 1 and, each time the enabled pump completes a run, hands over to the other pump - alternating cycle for cycle with no gap in enablement.

Requirement: OD-PP enable alternates on demand-cycle completion

	Step	At
✓	Configure 12 setpoint/mode value(s)	
✓	drive Suction Press = 60	0.0 s
✓	drive Disch Press = 40	0.0 s
✓	inject demand on	0.0 s
✓	Configure 1 setpoint/mode value(s)	
✓	expect running == {} within 15.0s	0.0 s
✓	inject demand off	0.0 s
✓	Configure 3 setpoint/mode value(s)	
✓	expect running == {Pump 1 Run Out} within 15.0s	1.4 s
✓	inject demand on	0.0 s
✓	wait 8.0s	8.0 s
✓	inject demand off	0.0 s
✓	expect running == {Pump 2 Run Out} within 15.0s	4.0 s
✓	inject demand on	0.0 s
✓	wait 8.0s	8.0 s
✓	inject demand off	0.0 s
✓	expect running == {Pump 1 Run Out} within 15.0s	4.0 s

3. OD-PP: fault hands the enable over; the pump is retried at its next turn **PASS**

A fault on the enabled pump hands the enable to the other pump immediately; the faulted pump is not locked out - once its fault clears it is given another try at its next turn in the rotation.

Requirement: OD-PP fault handoff + retry

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ inject demand off	0.0 s
✓ Configure 3 setpoint/mode value(s)	
✓ expect running == {Pump 1 Run Out} within 15.0s	1.8 s
✓ inject fault P1 on	0.0 s
✓ expect running == {Pump 2 Run Out} within 15.0s	4.2 s
✓ inject fault P1 off	0.0 s
✓ inject demand on	0.0 s
✓ wait 8.0s	8.0 s
✓ inject demand off	0.0 s
✓ expect running == {Pump 1 Run Out} within 15.0s	3.8 s

4. OD-PP: a pump in Off is disqualified from the rotation **PASS**

Switching a pump to Off removes it from the OD-PP rotation: the remaining pump keeps the enable and continues taking every demand cycle until the other pump is returned to Auto.

Requirement: OD-PP Off disqualifies

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ inject demand off	0.0 s
✓ Configure 3 setpoint/mode value(s)	
✓ expect running == {Pump 1 Run Out} within 15.0s	1.4 s
✓ Configure 1 setpoint/mode value(s)	
✓ inject demand on	0.0 s
✓ wait 8.0s	8.0 s
✓ inject demand off	0.0 s
✓ expect running == {Pump 1 Run Out} within 15.0s	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ inject demand on	0.0 s
✓ wait 8.0s	8.0 s
✓ inject demand off	0.0 s
✓ expect running == {Pump 2 Run Out} within 15.0s	4.2 s

5. Lead starts, lag joins, both stop, rotate next cycle **PASS**

Confirms tower-fill control: the lead pump starts when the tower level drops to the Start setpoint, the lag pump joins at the lower Lag Start setpoint, both stop once the tower refills to the Stop setpoint, and the lead role rotates to the other pump on the next cycle so duty is shared evenly.

Requirement: lead/lag + rotation

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ Configure 4 setpoint/mode value(s)	
✓ expect single lead within 15.0s	3.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {Pump 1 Run Out, Pump 2 Run Out} within 15.0s	4.8 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	3.8 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect rotated lead within 15.0s	2.2 s

6. Pressure mode cycles on discharge setpoints **PASS**

In discharge-pressure mode the station maintains line pressure: a pump starts when discharge pressure falls to the start setpoint and stops once it recovers to the stop setpoint.

Requirement: pressure mode control

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ Configure 5 setpoint/mode value(s)	
✓ drive Disch Press = 45	0.0 s
✓ expect single lead within 15.0s	1.4 s
✓ drive Disch Press = 75	0.0 s
✓ expect running == {} within 15.0s	4.2 s

7. Low-suction cutout with hysteresis PASS

Protects the pumps from cavitation / dry-running: pumps lock out when suction pressure falls below the low-suction cutout, hold the lockout inside the hysteresis deadband (cutout to cutout+hysteresis), resume once pressure recovers past the cutout plus hysteresis, and release immediately if the operator lowers the cutout below the recovered pressure minus hysteresis.

Requirement: low-suction cutout + hysteresis latch

	Step	At
✓	Configure 12 setpoint/mode value(s)	
✓	drive Suction Press = 60	0.0 s
✓	drive Disch Press = 40	0.0 s
✓	inject demand on	0.0 s
✓	Configure 1 setpoint/mode value(s)	
✓	expect running == {} within 15.0s	0.0 s
✓	Configure 5 setpoint/mode value(s)	
✓	drive Suction Press = 60	0.0 s
✓	expect single lead within 15.0s	2.6 s
✓	drive Suction Press = 15	0.0 s
✓	expect running == {} within 15.0s	4.2 s
✓	drive Suction Press = 22	0.0 s
✓	wait 15.0s	15.0 s
✓	expect running == {} within 3.0s	0.0 s
✓	drive Suction Press = 26	0.0 s
✓	expect single lead within 15.0s	4.6 s
✓	drive Suction Press = 15	0.0 s
✓	expect running == {} within 15.0s	3.4 s
✓	drive Suction Press = 22	0.0 s
✓	wait 15.0s	15.0 s
✓	expect running == {} within 3.0s	0.0 s
✓	Configure 1 setpoint/mode value(s)	
✓	expect single lead within 15.0s	3.8 s

8. High-discharge cutout with hysteresis **PASS**

Protects the system from over-pressure: pumps lock out when discharge pressure exceeds the high-discharge cutout and resume only after it drops back below the cutout minus a hysteresis margin.

Requirement: high-discharge cutout + hysteresis

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ Configure 5 setpoint/mode value(s)	
✓ drive Disch Press = 40	0.0 s
✓ expect single lead within 15.0s	3.6 s
✓ drive Disch Press = 95	0.0 s
✓ expect running == {} within 15.0s	4.2 s
✓ drive Disch Press = 78	0.0 s
✓ expect single lead within 15.0s	4.8 s

9. Fault promotion: faulted lead hands off to the other pump **PASS**

If the running lead pump faults, the station promotes the healthy pump so supply continues instead of stalling on the failed pump.

Requirement: fault promotion

	Step	At
✓	Configure 12 setpoint/mode value(s)	
✓	drive Suction Press = 60	0.0 s
✓	drive Disch Press = 40	0.0 s
✓	inject demand on	0.0 s
✓	Configure 1 setpoint/mode value(s)	
✓	expect running == {} within 15.0s	0.0 s
✓	Configure 3 setpoint/mode value(s)	
✓	expect single lead within 15.0s	7.0 s
✓	inject fault P1 on	0.0 s
✓	expect rotated lead within 15.0s	3.6 s
✓	inject fault P1 off	0.0 s

10. Tower->pressure failover (timed; hardware) **PASS**

If tower-level telemetry goes stale, the station fails over to discharge-pressure control to keep managing supply. Proven end-to-end on hardware: the lead keeps running on the frozen level until the loss timeout elapses, then control moves to discharge pressure - the lead stops on the high-discharge stop setpoint and restarts when discharge falls to the start setpoint - all while the operator's selected mode PV stays 'Tower', reverting to tower control when the level signal returns.

Requirement: tower-loss failover (mode PV unchanged)

	Step	At
✓	Configure 12 setpoint/mode value(s)	
✓	drive Suction Press = 60	0.0 s
✓	drive Disch Press = 40	0.0 s
✓	inject demand on	0.0 s
✓	Configure 1 setpoint/mode value(s)	
✓	expect running == {} within 15.0s	0.0 s
✓	Configure 6 setpoint/mode value(s)	
✓	expect single lead within 15.0s	3.4 s
✓	drive Disch Press = 75	0.0 s
✓	expect single lead within 15.0s	0.0 s
✓	inject comms_loss on	0.0 s
✓	expect running == {} within 660.0s	388.2 s
✓	expect Station Mode == Tower within 3.0s	0.0 s
✓	drive Disch Press = 45	0.0 s
✓	expect single lead within 15.0s	2.6 s
✓	inject comms_loss off	0.0 s

11. Reboot: no false start, no boot-latched lockout (timed; hardware) **PASS**

Reboots the controller mid-suite and proves clean boot behavior: no pump starts without demand after the restart, and the station starts normally on the first real demand - i.e. the boot did not falsely start a pump and did not latch a protection lockout on not-yet-read sensor data.

Requirement: clean boot: no false start, no boot lockout

Step	At
✓ Configure 12 setpoint/mode value(s)	
✓ drive Suction Press = 60	0.0 s
✓ drive Disch Press = 40	0.0 s
✓ inject demand on	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	0.0 s
✓ Configure 4 setpoint/mode value(s)	
✓ drive Suction Press = 23	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ wait 15.0s	15.0 s
✓ reboot device (back within 300.0s)	66.0 s
✓ wait 10.0s	10.0 s
✓ expect running == {} within 3.0s	0.0 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect single lead within 120.0s	35.6 s
✓ Configure 1 setpoint/mode value(s)	
✓ expect running == {} within 15.0s	3.0 s

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