Pump Station Demo

Test and Verification Report — Siemens S7-1200 / TIA Portal V19 / WinCC Unified

1. Test Environment

- PLC: Siemens S7-1200 CPU 1214C
- Engineering software: TIA Portal V19
- PLC simulation: S7-PLCSIM V19
- HMI: WinCC Unified
- HMI device: MTP700 Unified Comfort
- HMI resolution: 800 x 480

The project is a fully simulated PLC/HMI system. No physical field equipment is connected.

2. Verification Scope

The verification covers the implemented PLC control functions, analog level processing, operating modes, interlocks, pump feedback diagnostics, fault handling, HMI operation, operator settings, and the final pump command output mapping.

Verification was performed using the implemented TIA Portal project and the working WinCC Unified HMI in the S7-PLCSIM simulation environment.

The browser-based Falmont Edge demonstration is treated as a separate presentation layer and is not used as the primary PLC verification environment.

3. Test Matrix

ID	Test	Expected Result	Status
T-01	**PLC startup and RUN state**	**CPU reaches RUN and HMI reports CONNECTED / RUN**	**PASS**
T-02	Analog level scaling at minimum	Raw input 5530 produces approximately 0 % level	PASS
T-03	Analog level scaling at maximum	Raw input 27648 produces approximately 100 % level	PASS
T-04	Under Range	Raw input below Raw Min sets Under Range and invalid level state	PASS
T-05	Over Range	Raw input above Raw Max sets Over Range and invalid level state	PASS
T-06	**Manual start**	**MANUAL + START produces pump run command when start is permitted**	**PASS**
T-07	Manual stop	MANUAL + STOP removes the pump run command	PASS
T-08	Automatic start	AUTO + level below Low Level produces Auto Request and pump run command when permitted	PASS
T-09	Automatic stop and high-level interlock	AUTO + level above High Level clears Auto Request; at or above the High Level limit the tank interlock requires pump stop	PASS
T-10	High-level interlock	High level prevents start and requires pump stop	PASS
T-11	**Invalid-level interlock**	**Invalid level prevents pump start and requires pump stop**	**PASS**
T-12	Start failure	Pump start command without Running feedback produces Start Failure and Fault after Start Timeout	PASS

ID	Test	Expected Result	Status
T-13	Stop failure	Pump stop command with persistent Running feedback produces Stop Failure and Fault after Stop Timeout	PASS
T-14	Running feedback failure	Running feedback loss during commanded operation produces Running Failure and Fault after Running Timeout	PASS
T-15	Pump output mapping	db_pump_1.run drives pump_1_run_cmd at %Q0.0	PASS

4. HMI Verification

The WinCC Unified HMI was verified as part of the simulated PLC/HMI system.

The verification scope includes:

- Main screen process indication.
- AUTO / MANUAL mode indication and selection.
- Manual START and STOP commands.
- Pump operating state indication.
- Interlock and fault indication.
- RESET FAULT command.
- PLC operating state indication.
- Navigation between Main and Settings.
- Settings parameter selection.
- Numeric keypad input.
- Draft value handling.
- SAVE and CANCEL behavior.
- Settings validation and Settings Error popup.
- INITIALIZING state on the Settings screen.

5. Verification Evidence

The documentation package contains the following evidence sources:

- 01_HMI_Main_Normal.jpg
- 02_HMI_Main_Manual.jpg
- 03_HMI_Main_Pump_Running.jpg
- 04_HMI_Main_UnderRange.jpg
- 05_HMI_Settings.jpg
- PLCSIM simulation state used for functional verification.
- Online PLC watch values used to confirm signal behavior.

Selected simulation screenshots

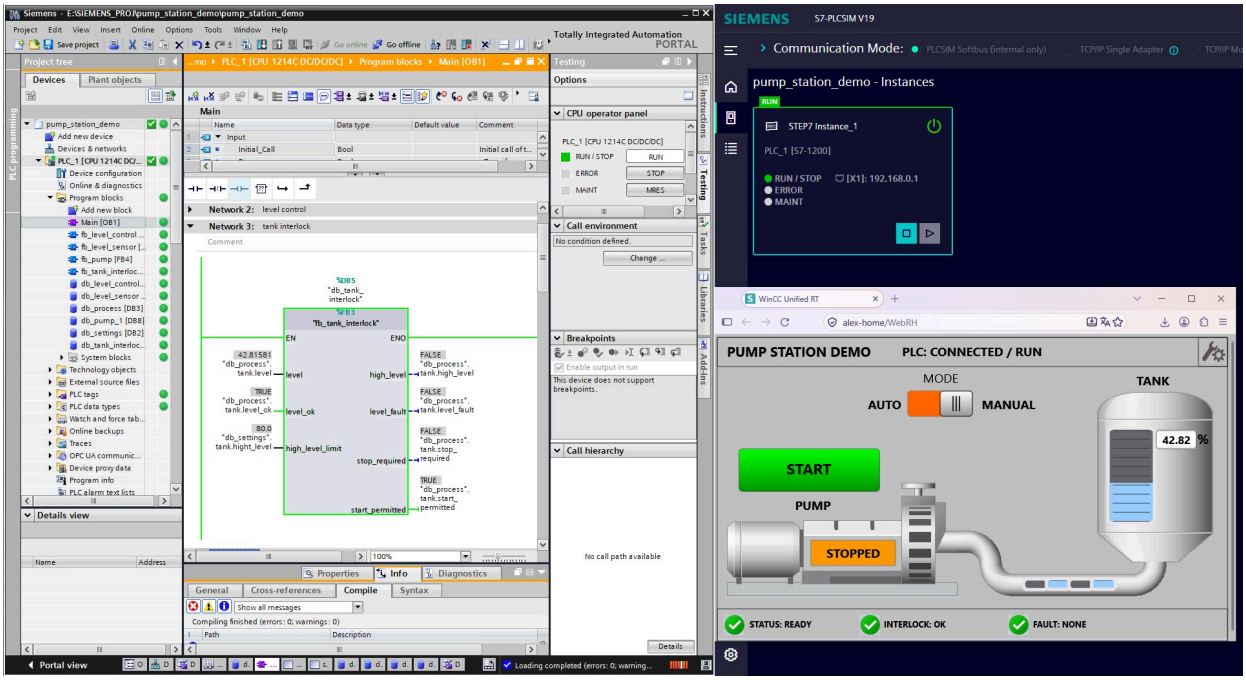


Figure 1. Integrated simulation view: TIA Portal logic monitoring, S7-PLCSIM in RUN, and WinCC Unified HMI in Manual mode.

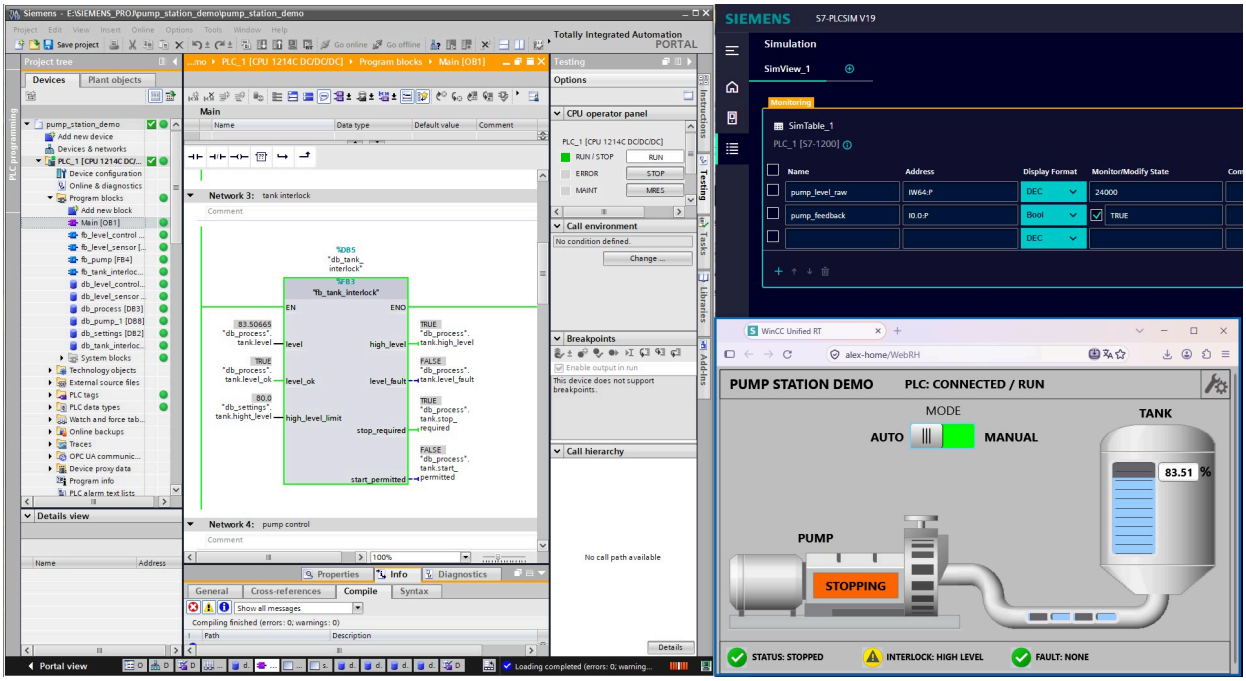


Figure 2. High-level warning at 83.5% tank level; the pump is in the Stopping state.

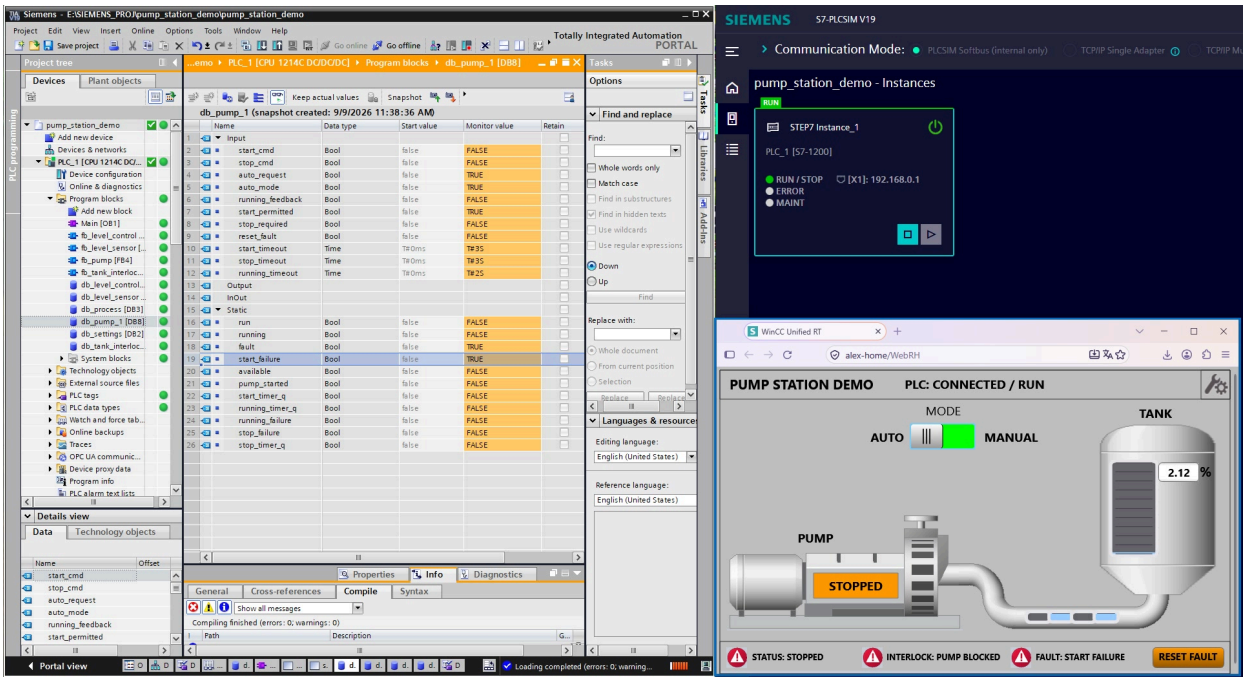


Figure 3. Automatic start failure: running feedback was not received before the configured timeout; HMI displays Start Failure.

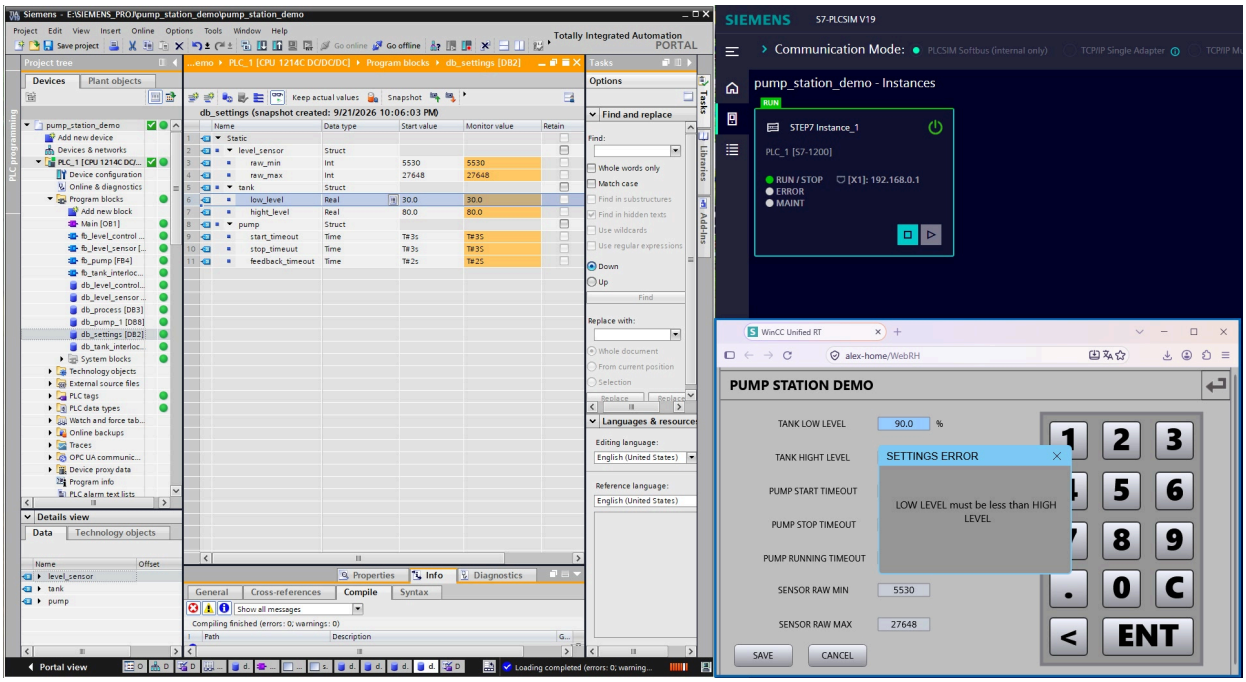


Figure 4. Settings validation rejects a low-level value of 90 when the high-level limit is 80; the applied low-level setting remains 30.

6. Final Result

The listed functional tests were executed repeatedly during PLC and HMI development in the simulated environment. The test cases document the functions that were exercised and verified during development, including the final pump output mapping.

Verification status:

T-01 ... T-15: PASS Overall result: PASS

PASS indicates that the corresponding function was exercised and verified during repeated PLC/HMI development testing in the simulated project.

7. Test Limitations

Testing is performed in a simulated environment using S7-PLCSIM and WinCC Unified.

The verification confirms PLC/HMI functional behavior in simulation. It does not validate physical pump hardware, real field wiring, instrument accuracy, cabinet hardware, field commissioning, or response of connected equipment.

The browser-based Falmont Edge demonstration is a separate presentation and simulation layer and is not used as the primary acceptance environment for the PLC application.