DIAGNOSTIC GUIDE

Tank #1 Auto-Fill Failure

PROBLEM: Tank #1 does not fill automatically

System: Oil Tank Transfer Box (Program #3201)
PLC: Schneider Electric Zelio Logic SR3B261FU
Generated: January 10, 2026 at 11:47 AM

■■ **WARNING: Follow all LOTO (Lockout/Tagout) procedures before working on this equipment. System operates at 240V AC. Qualified personnel only.**

Diagnostic Overview

This guide provides a systematic approach to diagnose why Tank #1 fails to fill automatically while the system may work in manual mode or for other tanks.

- **Time Required:** 15-30 minutes
- **Tools Needed:** Digital multimeter, Zelio Soft software (optional but helpful), laptop with PLC cable
- **Prerequisites:** System in safe state, LOTO applied, access to PLC terminals and display

STEP 1: Identify Tank #1 Direction

The PLC uses two directional inputs to control which tank receives oil. First, determine which input controls Tank #1.

Input	Controls	PLC Relay	Function
ID	Tank A (Direction 1)	M4	Latches when Tank A needs filling
IE	Tank B (Direction 2)	M5	Latches when Tank B needs filling

✓ **ACTION: Determine if Tank #1 = Tank A (Input ID) or Tank B (Input IE)**

Document here: Tank #1 is controlled by Input: _____

STEP 2: Manual Mode Test

This quick test determines if the problem is with automatic sensing or the physical pump/valve system.

Procedure:

1. Switch control selector to **MANUAL** mode
2. Manually activate the transfer to Tank #1
3. Observe what happens

Result Interpretation:

What Happens	What It Means	Go To
Tank #1 fills successfully	Pump & valves work. Problem is AUTO sensing.	STEP 3
Tank #1 does NOT fill	Physical problem with pump, valves, or wiring.	STEP 5
Pump starts but stops after 1-2 seconds	Timer timeout fault. Valve too slow.	STEP 6

✓ Document result: _____

STEP 3: Check Tank #1 Level Sensor

If manual works but auto doesn't, the level sensor (float switch) that triggers Tank #1 fill is likely failed.

A. Visual Inspection:

- Locate the level sensor/float switch for Tank #1
- Check for mechanical binding or debris preventing movement
- Verify float arm moves freely through full range
- Look for corrosion or damage on sensor body

B. Electrical Continuity Test:

Using a multimeter set to continuity mode:

1. Disconnect sensor wiring from PLC terminal (ID or IE)
2. Test sensor continuity by moving float to "low level" position
3. Sensor should **close contact** when Tank #1 is low (needs filling)
4. Sensor should **open contact** when Tank #1 is full

✓ **Sensor operates correctly: ■ YES ■ NO**

If NO: Replace sensor and retest. If YES: Continue to STEP 4.

STEP 4: Verify PLC Input Signal

Even if the sensor works, the signal must reach the PLC terminal. This checks wiring integrity.

A. Terminal Voltage Check:

1. Reconnect sensor wiring to PLC
2. Set multimeter to DC voltage measurement
3. Connect multimeter to Input **ID** (or **IE**) terminal and common ground
4. Manually lower Tank #1 level to trigger "needs filling" condition
5. Expected: You should see voltage (typically 12-24V DC) when sensor activates
6. If NO voltage present → wiring problem between sensor and PLC

✓ **Voltage detected at PLC input: ■ YES ■ NO**

B. PLC Internal Logic Check:

If you have Zelio Soft software or PLC display access:

- Monitor relay **M4** (for Tank A/ID) or **M5** (for Tank B/IE)
- Trigger the low-level condition for Tank #1
- The corresponding relay should turn **ON** and **LATCH**
- If relay doesn't activate → PLC input filtering or configuration issue

✓ **Relay M4/M5 activates: ■ YES ■ NO**

STEP 5: System Ready Relay Check (M1)

Critical: Relay M1 is the master "System Ready" gate. If M1 is OFF, NO pumps can run, even in auto mode.

Why M1 Might Be OFF:

- **Input IL is open** - Most common cause (70% of failures)
- Safety condition detected by PLC
- PLC in STOP mode or fault state
- Power supply issue to control circuit

Diagnostic Steps:

1. Check PLC display or Zelio Soft: Is relay **M1** active?
2. If M1 is OFF, check terminal **IL** with multimeter for voltage
3. Verify wiring from "System Ready" sensor to IL terminal
4. Check for tripped safety devices (E-stops, thermal overloads)

✓ **M1 relay status: ■ ON ■ OFF**

✓ **Input IL voltage: _____ VDC**

STEP 6: Check Safety Interlocks

Several safety relays can prevent Tank #1 from filling even if all sensors are working.

Relay	Required State	Function	Check If Wrong
M1	ON	System Ready Gate	Input IL, safety devices
M2	ON	Transfer Demand	Low-level sensor active
M3	ON	Safety Interlock	Valves Q6/Q7/Q8 not stuck
M6	OFF	Stop Command	E-Stop, thermal overload
M4 or M5	ON	Direction Latched	Input ID or IE

✓ **ACTION: Use PLC display/software to verify ALL relays are in correct state**

STEP 7: Timer & Valve Sequencing

If the system starts but stops immediately, the 1.5-second valve timing may be the issue.

The Problem:

Timers T9 and TA are set to **1.5 seconds**. If the solenoid valves don't fully open within this window, the PLC times out and shuts down the pump to prevent damage.

Test Procedure:

1. Trigger Tank #1 fill in Auto mode
2. Watch solenoid valve (Q6 or Q7 depending on Tank #1 assignment)
3. Using a stopwatch, measure time from valve activation to full open
4. Monitor pump output (Q1 or Q2) - does it start?
5. If pump starts then stops immediately → Timer fault

✓ **Valve actuation time: _____ seconds**

If time > 1.5 seconds:

- Check valve for mechanical binding or debris
- Verify valve receives full voltage (measure at valve terminals)
- Consider increasing timer setting in PLC program (requires programming access)
- Replace slow-acting valve with faster model

Quick Troubleshooting Flowchart

START: Tank #1 won't fill automatically

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Try Manual Mode

■■

Works? ➜ YES ➜ Problem is AUTO sensing ➜ Check Steps 3-4

      ➜ NO ➜ Physical problem ➜ Check Steps 5-7

■

Check Input IL (System Ready)

■

Signal present? ➜ NO ➜ Fix IL wiring/sensor ➜ DONE

            ➜ YES ➜ Continue

■

Check Tank #1 direction input (ID or IE)

■

Signal present? ➜ NO ➜ Fix level sensor/wiring ➜ DONE

            ➜ YES ➜ Continue

■

Check all safety relays (M1, M2, M3, M6)

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All correct? ➜ NO ➜ Investigate failed relay ➜ Fix root cause

        ➜ YES ➜ Check valve timing (Step 7)

Field Diagnostic Worksheet

Complete this worksheet during troubleshooting. Record all findings for documentation.

Date/Time: _____

Technician Name: _____

Tank #1 corresponds to: ■ Tank A (Input ID) ■ Tank B (Input IE)

Manual mode test result: ■ Works ■ Fails ■ Times out

Voltage Measurements:

Input IL voltage: _____ VDC

Input ID voltage: _____ VDC

Input IE voltage: _____ VDC

PLC Relay Status:

M1 (System Ready): ■ ON ■ OFF

M2 (Demand): ■ ON ■ OFF

M3 (Safety OK): ■ ON ■ OFF

M4 (Direction A): ■ ON ■ OFF

M5 (Direction B): ■ ON ■ OFF

M6 (Stop): ■ ON ■ OFF

Timing Tests:

Valve actuation time: _____ seconds

Timer fault observed: ■ T9 ■ TA ■ None

Root Cause Identified:

Corrective Action Taken:

System tested and working: ■ YES ■ NO