# PLC and Industrial Automation Systems Functional Verification and Return-to-Service Checklist - Recurring Fault After Repair

PLC and Industrial Automation Systems | Recurring Fault After Repair | Asset ID FIX-09-08-10

**Safety gate: Stop, isolate and verify before exposure to hazardous energy. Lockout/Tagout and live testing require the applicable site procedure, authorised controls and a qualified person. Never bypass a guard, interlock or protective device to complete this workbook.**

## How to use this field resource

This is an equipment-agnostic documentation workbook for plc and industrial automation systems. It helps a trained team trace input, logic, interlock, output and field response without bypassing protections. It does not identify a fault by itself and does not replace the equipment-specific OEM manual, drawings, limits, permits or a qualified technician's judgement.

| Intake field | Record |
|---|---|
| Asset or equipment ID | _____ |
| Site and location | _____ |
| Reported by / time | _____ |
| Fault situation | Recurring Fault After Repair |
| Operating state | Stopped / standby / starting / running / loaded |
| Safety owner | _____ |
| OEM reference used | Document number and revision: _____ |

## Evidence areas for this system

For a recurring fault after repair, focus on evidence that can be dated, repeated and handed to another technician. Capture the as-found state before clearing alarms, changing settings or disturbing connections.

| # | Evidence area | First record |
|---|---|---|
| 1 | Machine state and sequence step | As-found note: _____ |
| 2 | Input status | As-found note: _____ |
| 3 | Interlock and permissive state | As-found note: _____ |
| 4 | Logic command | As-found note: _____ |
| 5 | Output status | As-found note: _____ |
| 6 | Field-device response | As-found note: _____ |

## Functional Verification and Return-to-Service Checklist

Use this section to compare the new event with the original evidence and the completed repair record. Record what changed, what stayed the same and how long the repair held before choosing the next action.

| Function | Acceptance criterion | Observed result | Status |
|---|---|---|---|
| Machine state and sequence step | Acceptance: _____ | Result: _____ | Pass / fail / not tested |
| Input status | Acceptance: _____ | Result: _____ | Pass / fail / not tested |
| Interlock and permissive state | Acceptance: _____ | Result: _____ | Pass / fail / not tested |
| Logic command | Acceptance: _____ | Result: _____ | Pass / fail / not tested |
| Output status | Acceptance: _____ | Result: _____ | Pass / fail / not tested |
| Field-device response | Acceptance: _____ | Result: _____ | Pass / fail / not tested |

### Release sequence

- Account for tools, parts, temporary leads and materials.
- Restore guards, covers, labels, seals and safety devices.
- Clear Lockout/Tagout only through the authorised site process.
- Test at a controlled condition before normal duty.
- Record residual defects, restrictions and the person accepting the asset.

## PLC and Industrial Automation Systems Evidence Map

**Evidence first: Preserve alarms, event history, settings, trends and the as-found physical state before reset, disconnection or adjustment. If safe access is uncertain, stop and refer the task to the authorised person.**

| # | System area | Evidence action | Trace | Record |
|---|---|---|---|---|
| 1 | Machine state and sequence step | Observe and identify | Evidence ID: _____ | Finding: _____ |
| 2 | Input status | Record source and time | Evidence ID: _____ | Finding: _____ |
| 3 | Interlock and permissive state | Compare with reference | Evidence ID: _____ | Finding: _____ |
| 4 | Logic command | State what it supports | Evidence ID: _____ | Finding: _____ |
| 5 | Output status | State what it rules out | Evidence ID: _____ | Finding: _____ |
| 6 | Field-device response | Choose the least invasive next check | Evidence ID: _____ | Finding: _____ |

## Scenario boundary

For this recurring fault after repair, reopen the diagnosis instead of repeating the same replacement without evidence. Write the boundary before testing so urgency does not quietly change the rules.

| Boundary | Definition |
|---|---|
| Known good condition | _____ |
| Known failed condition | _____ |
| Difference between them | _____ |
| First missing evidence | _____ |
| Stop-work threshold | _____ |
| Escalation owner | _____ |

### Evidence labels

- FACT - directly observed and traceable.
- REPORT - supplied by another person; source recorded.
- INFERENCE - reasonable explanation that still needs a test.
- UNKNOWN - important gap that must not be filled by assumption.
- LIMIT - OEM, engineering or site acceptance value.

## Recurring Fault After Repair Condition Workbook

The goal is to compare the new event with the original evidence and the completed repair record. Describe the failed state narrowly enough that another trained person could look for the same thing without being told your suspected cause.

| Question | Boundary prompt | Record |
|---|---|---|
| What changed? | Function, output, indication or behaviour | _____ |
| Where? | Asset, side, circuit, zone or process stage | _____ |
| When? | Sequence step, runtime, load or environment | _____ |
| How often? | Every cycle, random, once, or after delay | _____ |
| What restores it? | Nothing, time, reset, cooling or load change | _____ |
| What stays normal? | Unaffected systems or functions | _____ |
| What changed recently? | Work, software, settings, parts or operating duty | _____ |

## Controlled reproduction plan

| Plan field | Record |
|---|---|
| Safe starting state | _____ |
| One condition to vary | _____ |
| Conditions held constant | _____ |
| Evidence captured | What changed, what stayed the same and how long the repair held |
| Maximum attempts | _____ |
| Immediate stop signal | _____ |
| Authorising person | _____ |

### Attempt notes

| Attempt | Starting condition | Result | Decision |
|---|---|---|---|
| 1 | State: _____ | Observed: _____ | Next decision: _____ |
| 2 | State: _____ | Observed: _____ | Next decision: _____ |
| 3 | State: _____ | Observed: _____ | Next decision: _____ |
| 4 | State: _____ | Observed: _____ | Next decision: _____ |

## Measurement and Evidence Register

**Measurement boundary: This page records an approved test; it does not authorise one. A qualified person must choose the method, instrument category, connection points, isolation state and protective controls from the applicable procedure.**

| ID | Evidence area | Traceable source | Result | When |
|---|---|---|---|---|
| 1 | Machine state and sequence step | Method / source: _____ | Value / state: _____ | Time: _____ |
| 2 | Input status | Method / source: _____ | Value / state: _____ | Time: _____ |
| 3 | Interlock and permissive state | Method / source: _____ | Value / state: _____ | Time: _____ |
| 4 | Logic command | Method / source: _____ | Value / state: _____ | Time: _____ |
| 5 | Output status | Method / source: _____ | Value / state: _____ | Time: _____ |
| 6 | Field-device response | Method / source: _____ | Value / state: _____ | Time: _____ |

## Instrument and reference record

| Control | Record |
|---|---|
| Instrument or data source | _____ |
| Identifier and range | _____ |
| Calibration / validation status | _____ |
| OEM or engineering reference | Document and revision: _____ |
| Equipment operating state | _____ |
| Uncertainty or limitation | _____ |

### Before using a value

- Check units, scale, timestamp and source identity.
- Keep raw evidence where practical; do not retain only a conclusion.
- Record values that disagree with the current theory.
- Compare only like operating conditions.
- Treat a single normal reading as one data point, not proof that an intermittent fault is absent.

## Cause and Evidence Matrix

List competing explanations before the team settles on one. A good next check separates hypotheses; a poor check produces the same answer no matter which cause is true.

| # | Hypothesis | Supporting | Contradicting | Discriminating check |
|---|---|---|---|---|
| 1 | Machine state and sequence step hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 2 | Input status hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 3 | Interlock and permissive state hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 4 | Logic command hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 5 | Output status hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 6 | Field-device response hypothesis | For: _____ | Against: _____ | Next evidence: _____ |

## Five-why chain with evidence

| Level | Explanation | Proof or gap |
|---|---|---|
| Problem | Recurring Fault After Repair | Evidence ID: _____ |
| Why 1 | _____ | Evidence: _____ |
| Why 2 | _____ | Evidence: _____ |
| Why 3 | _____ | Evidence: _____ |
| Why 4 | _____ | Evidence: _____ |
| Why 5 | _____ | Evidence: _____ |

### Cause confidence

- Confirmed - reproduced or directly measured against a valid reference.
- Probable - best fit, but one meaningful alternative remains.
- Possible - plausible and worth a safe test.
- Unrelated - contradicted by the evidence.
- Unknown - evidence is missing or unreliable.

## Repair Decision and Return-to-Service Gate

**Release authority: Completion of a repair is not permission to energise or operate. Restore energy and return equipment to service only through the site's authorised process, with guards and protective functions reinstated.**

| Decision field | Record |
|---|---|
| Confirmed problem | _____ |
| Evidence-supported cause | _____ |
| Approved repair reference | Document and revision: _____ |
| Work completed | _____ |
| Parts / settings changed | _____ |
| Residual defect or restriction | _____ |
| Person completing / checking | _____ |

## Controlled verification

| Verification | Acceptance basis | Status |
|---|---|---|
| As-found symptom | Recurring Fault After Repair | Absent / present / not tested |
| Primary function | Machine state and sequence step | Pass / fail / not tested |
| Related function | Input status | Pass / fail / not tested |
| Protection and alarms | Normal protective state retained | Pass / fail / not tested |
| Leak, heat, noise or damage | No new adverse condition | Pass / fail / not tested |
| Recorded operating condition | Load / mode / duration: _____ | Accepted / restricted |

### Release signatures

- Technical check by: _____ Date/time: _____
- Operations acceptance by: _____ Date/time: _____
- Safety or permit close-out by: _____ Date/time: _____
- Follow-up owner and due date: _____

## Handover, Follow-Up and Prevention Plan

Close the record so the next shift can understand the recurring fault after repair, the evidence, the repair decision and any remaining restriction without relying on memory.

| Handover field | Record |
|---|---|
| Current equipment state | _____ |
| What was confirmed | _____ |
| What remains unknown | _____ |
| Operating restriction | _____ |
| Evidence location | Log / work order / folder: _____ |
| Next owner and action | _____ |
| Escalation trigger | _____ |

## Follow-up schedule

| When | Review | Record |
|---|---|---|
| Next shift | Confirm state and restriction | Owner: _____ Result: _____ |
| 24 hours | Review machine state and sequence step | Owner: _____ Result: _____ |
| 7 days | Check for repeat events under comparable duty | Owner: _____ Result: _____ |
| 30 days | Review effectiveness and maintenance action | Owner: _____ Result: _____ |

### Prevention decision

- Update the task, limit, drawing or training only when the cause supports it.
- Remove any temporary control by its approved expiry point.
- Share the lesson without exposing private, security-sensitive or proprietary data.
- Record whether the action reduced repeat faults, downtime or diagnostic effort.
- Reopen the analysis if the symptom returns under the same conditions.

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