# Industrial Robots and Motion Systems Safe Diagnostic Test Plan - Communication or Data Fault

Industrial Robots and Motion Systems | Communication or Data Fault | Asset ID FIX-20-02-06

**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 industrial robots and motion systems. It helps a trained team record mode, task step, safety state, axis position and recent changes before intervention. 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 | Communication or Data Fault |
| Operating state | Stopped / standby / starting / running / loaded |
| Safety owner | _____ |
| OEM reference used | Document number and revision: _____ |

## Evidence areas for this system

For a communication or data fault, 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 | Controller mode and safety state | As-found note: _____ |
| 2 | Alarm and event history | As-found note: _____ |
| 3 | Task or program step | As-found note: _____ |
| 4 | Axis and feedback status | As-found note: _____ |
| 5 | End-effector condition | As-found note: _____ |
| 6 | Recent mastering or configuration change | As-found note: _____ |

## Safe Diagnostic Test Plan

Use this section to separate device health, power, connection, configuration and network timing. Record which nodes fail, which remain healthy and what changed recently before choosing the next action.

| Test area | Question | Reference state | Control |
|---|---|---|---|
| Controller mode and safety state | Question: _____ | Expected: _____ | Authority / permit: _____ |
| Alarm and event history | Question: _____ | Expected: _____ | Authority / permit: _____ |
| Task or program step | Question: _____ | Expected: _____ | Authority / permit: _____ |
| Axis and feedback status | Question: _____ | Expected: _____ | Authority / permit: _____ |
| End-effector condition | Question: _____ | Expected: _____ | Authority / permit: _____ |
| Recent mastering or configuration change | Question: _____ | Expected: _____ | Authority / permit: _____ |

### Plan rule

- Start with the least invasive observation that can change the decision.
- Define the safe state and acceptance limit before the test.
- Use only suitable, in-calibration equipment.
- Name the qualified person who authorises live or energised testing.
- Stop if the result exceeds the OEM or site limit.

## Industrial Robots and Motion 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 | Controller mode and safety state | Observe and identify | Evidence ID: _____ | Finding: _____ |
| 2 | Alarm and event history | Record source and time | Evidence ID: _____ | Finding: _____ |
| 3 | Task or program step | Compare with reference | Evidence ID: _____ | Finding: _____ |
| 4 | Axis and feedback status | State what it supports | Evidence ID: _____ | Finding: _____ |
| 5 | End-effector condition | State what it rules out | Evidence ID: _____ | Finding: _____ |
| 6 | Recent mastering or configuration change | Choose the least invasive next check | Evidence ID: _____ | Finding: _____ |

## Scenario boundary

For this communication or data fault, preserve configuration and logs before replacement or reset. 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.

## Communication or Data Fault Condition Workbook

The goal is to separate device health, power, connection, configuration and network timing. 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 | Which nodes fail, which remain healthy and what changed recently |
| 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 | Controller mode and safety state | Method / source: _____ | Value / state: _____ | Time: _____ |
| 2 | Alarm and event history | Method / source: _____ | Value / state: _____ | Time: _____ |
| 3 | Task or program step | Method / source: _____ | Value / state: _____ | Time: _____ |
| 4 | Axis and feedback status | Method / source: _____ | Value / state: _____ | Time: _____ |
| 5 | End-effector condition | Method / source: _____ | Value / state: _____ | Time: _____ |
| 6 | Recent mastering or configuration change | 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 | Controller mode and safety state hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 2 | Alarm and event history hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 3 | Task or program step hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 4 | Axis and feedback status hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 5 | End-effector condition hypothesis | For: _____ | Against: _____ | Next evidence: _____ |
| 6 | Recent mastering or configuration change hypothesis | For: _____ | Against: _____ | Next evidence: _____ |

## Five-why chain with evidence

| Level | Explanation | Proof or gap |
|---|---|---|
| Problem | Communication or Data Fault | 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 | Communication or Data Fault | Absent / present / not tested |
| Primary function | Controller mode and safety state | Pass / fail / not tested |
| Related function | Alarm and event history | 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 communication or data fault, 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 controller mode and safety state | 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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