

### Integration Test Plan and Test Case Design (Based on Use Case Diagram)

#### \*\*1. Test Objectives\*\*

Validate the interfaces and interactions between system modules (data acquisition, cleaning, calculation, analysis, exception handling, UI) to ensure end-to-end process correctness, data consistency, and fault tolerance under exceptions.

#### \*\*2. Test Scope

- \*\*Integrated Modules\*\*:
  - Data Acquisition (`get\_data`, `get\_collection data`, `get\_sensor\_id`)
  - Data Cleaning (`Data Cleaning`)
  - Calculation Module (`get\_angle`, `get\_pitch\_angle`, `get\_coll\_angle`)
  - Analysis Module (`Analysis`, `Comparison & Deviation Analysis`, `Structured\_Results`)
  - Exception Handling (`Exceptions`, `Exceptions\_Rules`)
  - User Interface (`UI`)

#### \*\*3. Test Strategy

- \*\*Bottom-up Integration\*\***:** Test 底层 modules first (data acquisition and cleaning), gradually integrate calculation and analysis modules, and finally validate UI and exception handling.
- \*\*Critical Path Coverage\*\***:** Prioritize the main workflow (Data Acquisition → Cleaning → Calculation → Analysis → UI Display).
- \*\*Exception Scenario Coverage\*\***:** Simulate exceptions (e.g., missing sensor data, calculation overflow, interface timeout) to validate exception rules and user notifications.

#### \*\*4. Test Case Design

**Case ID**	**Test Scenario**	**Input/Action**	**Expected Result**
**Related Modules**			
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**TC-01**	Data Acquisition & Cleaning Integration	Call `get_data` to fetch sensor data   Data cleaning module receives raw data and outputs standardized data	Data Acquisition, Data Cleaning
**TC-02**	Cleaned Data Transfer to Calculation	Input cleaned data to the calculation module   Calculation module generates angles, pitch angle, and collision angle correctly	Data Cleaning, Calculation Module
**TC-03**	Calculation & Analysis Integration	Input calculation results to the analysis module   Analysis module generates deviation reports and structured results (e.g., JSON)	Calculation Module, Analysis Module
**TC-04**	Structured Results Display on UI	Trigger UI display command	UI correctly shows analysis results (tables/charts)   Analysis Module, UI

**\*\*TC-05\*\***	Sensor ID Missing Exception Handling	Simulate `get\_sensor\_id` returning null	Trigger `Exceptions\_Rules`, UI displays "Sensor Not Connected"	Data Acquisition, Exception Handling, UI
**\*\*TC-06\*\***	Calculation Overflow (e.g., angle > 360°)	Input invalid angle value to the calculation module	Trigger exception rules, log error, and halt subsequent processes	Calculation Module, Exception Handling
**\*\*TC-07\*\***	Data Cleaning Failure Tolerance	Input dirty data (e.g., non-numeric characters)	Cleaning module filters invalid data and marks as "Invalid Record"	Data Cleaning, Exception Handling
**\*\*TC-08\*\***	End-to-End Process Integrity	Execute full workflow: Acquisition → Cleaning → Calculation → Analysis → UI	UI displays structured results with no error logs	All Modules

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#### #### **\*\*5. Test Environment & Tools\*\***

- **\*\*Environment\*\***: Test server with simulated sensor data, database, UI testing environment.
- **\*\*Tools\*\***: Postman (API testing), Selenium (UI automation), JUnit (unit testing framework), Log4j (log monitoring).

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#### #### **\*\*6. Risks & Mitigations\*\***

- **\*\*Risk 1\*\***: Inconsistent data formats due to unclear interface definitions.  
**\*\*Mitigation\*\***: Review interface documentation in advance; validate formats using mock data.
- **\*\*Risk 2\*\***: Incomplete coverage of edge cases in exception scenarios.  
**\*\*Mitigation\*\***: Supplement boundary tests (e.g., null values, extreme values, oversized data).

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#### #### **\*\*7. Deliverables\*\***

- Test Report (includes pass rate, defect list).
- Automated Test Scripts (APIs and UI).
- Log Analysis Report (exception handling validation).

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\*This plan can be further refined with interface parameters and data samples based on actual system design.\*