

Accelerate safety standards compliance for C & C++ with Cantata automated unit & integration testing

QA SYSTEMS

The Software Quality Company

Driving embedded software quality



Cantata works with your environment

Cantata installs on Windows® and Linux® host operating systems, with a Built-on-Eclipse® IDE, as an Eclipse-Ready® plug-in set, and as Visual Studio Code Extension. It supports GCC and Microsoft Visual Studio® compilers, and is also integrated with an extensive set of embedded development toolchains:

- | | |
|----------------------------------|-------------------------------------|
| ✓ IDEs / RTOSs | ✓ Build / Continuous Integration |
| ✓ GCC, Microsoft, Cross-Compiler | ✓ Software Configuration Management |
| ✓ Debuggers | ✓ Requirements Management |

Non-Eclipse toolchain build settings are automatically imported into Cantata test projects. To confirm how your tools and platforms are supported, please contact QA Systems.

Unrestricted embedded target use

For target environments, a built-in wizard provides unlimited deployment and use without any license restrictions. Cantata deployments consist of libraries and configuration options, binary compatible with your code. These are tested and controlled for certified use on safety related projects. Deployment switching makes it easy to use one set of tests across multiple targets for different product variants.

Easy and flexible testing on target

Cantata tests (platform independent test scripts in C/C++ and platform specific deployments) are built as C/C++ executables, downloaded, and run on a target platform just as you would with your own code on a:

- | | | |
|-------------|------------|-------------------------|
| ✓ Simulator | ✓ Emulator | ✓ Physical Target-Board |
|-------------|------------|-------------------------|

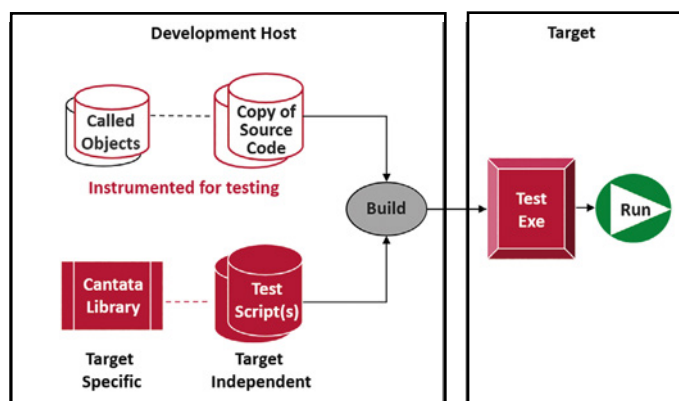
Functional and code coverage test results are directed back to the host for diagnostics and reporting. The process is completely automated using Cantata Makefiles, test scripts and platform customisations for easy and flexible on-target testing from the GUI or CLI.

Cantata highlights

- › Automated test harness and test case creation.
- › Extensive platform support and toolchain integrations.
- › Easy to use Eclipse® GUI and tests written in C/C++.
- › Bi-directional requirements traceability.
- › Unique function call control to simulate and intercept calls.
- › Flexible user code injection.
- › Support for Test Driven Development.
- › Integrated code coverage analysis.
- › Automated regression testing.
- › Test maintenance for code changes.
- › Free tool certification kit for all major safety standards.

Types of testing supported:

- black-box / white-box
- positive / negative
- requirements / robustness
- single / large input data sets
- procedural / object oriented
- from code / from headers
- call simulation / interception
- isolation / integration
- host / target execution
- new / regression



User code is driven by portable test scripts with target compatible libraries and built as a single test executable to run on multiple host or target platforms. Instrumentation is used for white-box access and code coverage, so production code is never modified for testing.

Why Industry leaders use Cantata

Cut the cost of standards compliance

Cantata meets the dynamic testing requirements of software safety standards. It is a single solution for dynamic unit and integration testing on host and target platforms.

Certification of development tools can be a heavy compliance cost burden. Cantata has been independently certified by SGS-TÜV SAAR and provides a tool certification kit with everything needed out-of-the-box, available free of charge.

Understanding how to comply with software safety standards is complex and time consuming. Comprehensive guidance is provided free of charge for using the full feature set in Cantata to meet dynamic testing requirements of specific standards. This combination of guidance and Cantata capabilities accelerates the achievement of standards compliance.



Certified for:	
	ISO 26262:2018
	EN 50128:2011/A2:2020
	EN 50657:2017
	IEC 62304:2006
	IEC 61508:2010
	IEC 60880:2006
Qualifiable for:	
	DO-178C / DO-330
Other standards as required	

Reduce risk of software failure

Product recalls and infection of the wider brand and corporate reputations can far exceed the development cost of each application. Unit testing is the most thorough way to test application code and prevent bugs within shipping devices.

Project over-runs can be mitigated by shifting verification effort to the earliest stages in the software development lifecycle. This reduces the risks of delays during later testing stages because unit tested components are easier and more predictable to integrate.

Fitness for purpose litigation against companies and individuals is now an increasing risk. Where companies fail to employ accepted industry practices such as thorough unit testing with Cantata, they cannot use the “state of the art” legal defence against such litigation.

Lower testing costs

Testing earlier lowers costs by minimising code re-work later in the development lifecycle. Developers can identify defects with Cantata unit and integration testing as soon as each component is available.

The high cost of standards compliant unit and integration testing can be dramatically lowered through automation. Satisfying the dynamic testing requirements of safety standards is accelerated by Cantata automation of:

- › Test framework generation
- › Test case generation
- › Baseline tests on legacy code
- › Test execution on host or target
- › Regression testing in Continuous Integration
- › Results diagnostics and report generation

Integrating tools into a toolchain can add hidden testing costs. Cantata’s tight integration with cross-compilation environments, DevOps workflows and its intuitive C/C++ code tests in Eclipse® GUI or code editors make it easy to slot into any toolchain. These integrations lower the tool learning curve and accelerate the testing activity, lowering overall testing costs.

Shorten time to market

Industry leaders recognise the need to ship faster without endangering quality. Cantata tests provide two key time advantages for development managers:

- › Team collaboration and efficiency is improved with structured consistent tests and certification ready reports.
- › Integration times are shorter and more predictable when integrating individually proven software components.

Flexible test framework

A flexible test framework (test scripts and supporting library) enables any combination of testing styles for both unit and scalable integration testing. Tests can be edited in a GUI or directly as C/C++ code and run as executables on both embedded target and host platforms.

Test Driven Development (TDD)

Cantata allows tests to be written as soon as function prototypes are created within header files. This allows the test framework to be constructed before the body of the software under test is fully implemented. Cantata for TDD enhances traditional black-box TDD techniques, by giving access to fully featured white-box testing on encapsulated code internals such as private/static data and functions.

Black and white box testing

Highly automated test cases provide power and precision for black-box testing, and more efficient thorough white-box testing. Black-box testing is enabled with user-selected or pre-defined parameterised looping tests, a combinatorial effect calculator, and CSV import/export for large data sets.

Precise white-box testing via Cantata instrumentation automatically accesses encapsulated code directly from the test script, without conditional compilation, giving control over both static and private functions and data. Users can inject extra code (via instrumentation) for testing purposes, without modifying the production code.

Robustness testing

Robustness testing is made easy with Cantata Rule Sets of pre-defined values for basic data types, in looping test cases. All accessible global data is automatically checked for inadvertent changes.

Object oriented testing

Cantata object-oriented style tests are implemented as classes for testing methods, templates, or classes. They feature automated:

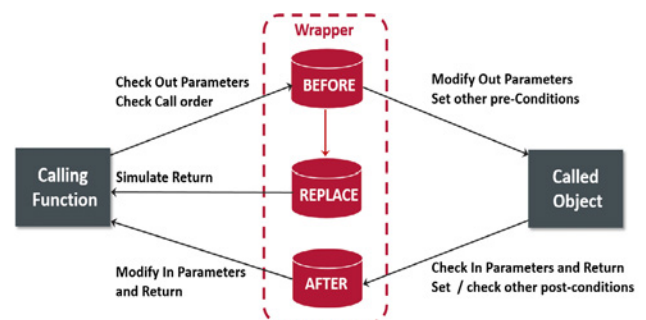
- › Test case re-use via a parallel inheritance hierarchy.
- › Test class inheritance structure for inherited classes.
- › Concrete implementation of abstract base classes (ABCs) or pure virtual methods (PVMs).
- › Resolution of dependencies on undefined references that are not directly called by the code.

Unique function call control

Cantata automatically generates test controls to both simulate (stub) and intercept (wrap) all function calls from the software under test, providing:

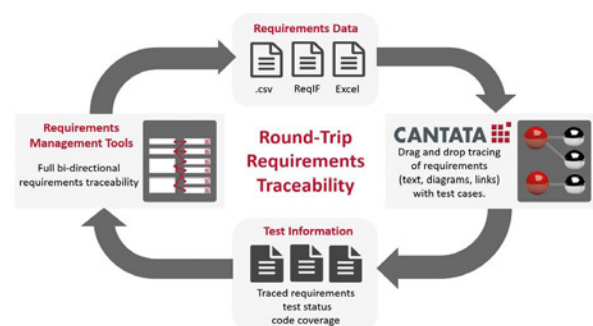
- › Optional automatic checks on parameters and data
- › Multiple instances for differential call behaviour
- › Flexible call order verification in each test case
- › Interface error detection and error injection
- › Control coupling testing

Wrappers intercept calls to verify the actual, not the assumed, or simulated behaviour of the called object. Where simulation is not possible or desirable (internal calls at integration, OS calls, hardware interfaces etc.), wrappers provide powerful call control unique to Cantata.



Requirements tracing

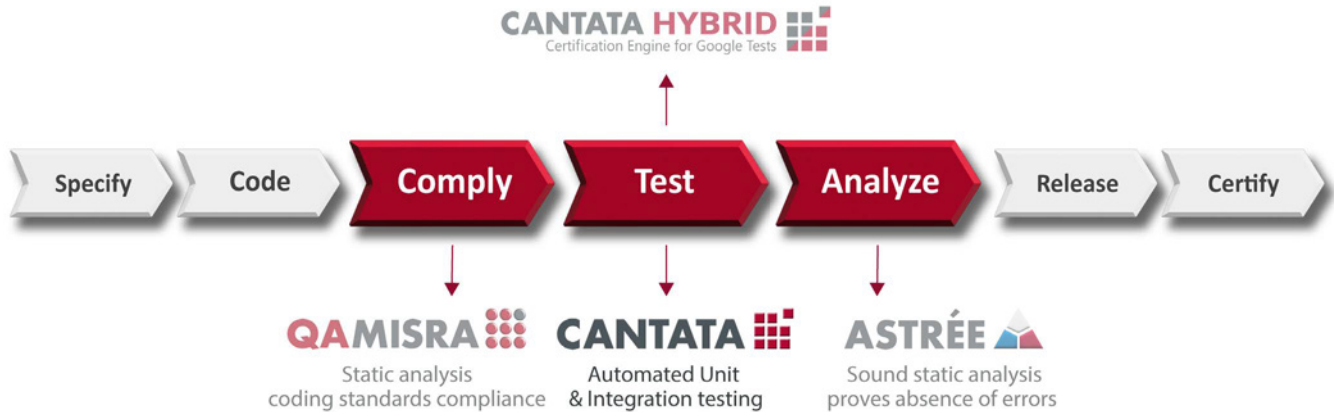
Requirements or test plan sets are imported to a Cantata server. Relationships are assigned with a drag-and-drop interface, and then exported with Cantata test results status and code coverage information for bi-directional traceability



Import / export can be via CSV, Microsoft Excel®, or requirements interchange format (ReqIF™), to fit your workflow and specific requirements management tool version (e.g. IBM® Rational® DOORS®, PTC Windchill® & codebeamer®, Siemens Polarion® ALM™).

Verification Centric Tools

QA Systems static analysis and dynamic software testing tools support verification in the linear flow of software development below. We recommend applying sequential approach to these verification stages with tools targeted for each purpose.



Comply Test

Use **QA-MISRA** for fast coding standard compliance at the developer's desktop first.
Use **Cantata** for automated dynamic execution of the standard compliant software.
Use **Cantata Hybrid** to generate certified Cantata test results from existing Google tests.

Analyze

Use **Astrée** for proving absence of run-time errors on whole application.
NB: Astrée uses the same configuration as QA-MISRA, so the effort to apply it later to a QA-MISRA project is low.

Special shared license bundle option

QA-MISRA and Cantata share the same license technology. This allows customers to obtain a bundled solution for both tools to share the same concurrent user license pool, as well as the tools being integrated together in the Eclipse based IDE.

When QA-MISRA is purchased as a bundle with Cantata or when an existing Cantata license is converted to a bundle, there are very attractive combined prices available. Please contact us for more information.

Start free trial

Take Cantata for a test drive with your own code and development environment.

 **START TRIAL**

What to expect in trial

- › A bespoke demo kick-start and Q&A session
- › Very simple installation
- › Simple configuration for your compiler
- › Unrestricted use, time-limited trial license

Learn more



qa-systems.com/tools/cantata



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