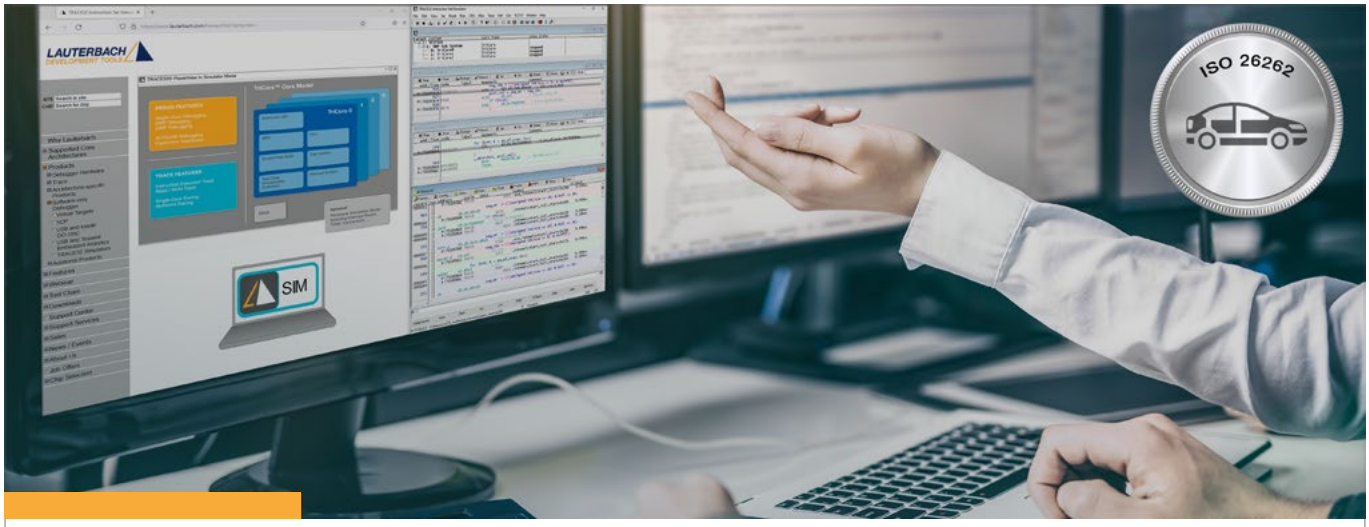
FACT SHEET
TRACE32 Instruction Set Simulator and ISO 26262



TRACE32 Instruction Set Simulator at a Glance

- Available for all main core architectures used in the automotive industry.
- ISO 26262 compliant use in software unit and module integration testing for safety-related automotive projects.
- TRACE32 Tool Qualification Support Kit makes qualification process easier and saves you time.

- Enables software testing before the first device samples are available.
- Enables testing of production code right from the start of the project.
- As a pure software solution, very scalable and easy to use in distributed teams.
- Best for PIL simulation and algorithms testing.
- Integral part of the TRACE32 tool chain providing seamless migration to testing with evaluation board or target hardware.

Website-Links

TRACE32 Instruction Set Simulators	www.lauterbach.com/sim.html
TRACE32 Trusted Tool for Functional Safety	www.lauterbach.com/trusted_tools.html
TÜV Nord Certificate for ISO 26262:2018	www.lauterbach.com/certificate_tqsk_2018_07.pdf
Customer Portal for Tool Qualification Support Kit	www.lauterbach.com/register_tqsk.html
Simulator-Based PIL Testing	www.lauterbach.com/intsimulink.html

Using a TRACE32 Instruction Set Simulator (ISS) for software unit and module integration testing in an ISO 26262 project provides many advantages. This fact sheet answers the following questions:

- What is a TRACE32 Instruction Set Simulator?
- What are the benefits of its use?
- How to integrate it into an ISO 26262 workflow with the required **confidence in use?**

But let's take it one step at a time!

What Is a TRACE32 Instruction Set Simulator?

TRACE32 PowerView, the debug software from Lauterbach, contains a built-in instruction set simulator. This applies to all common core architectures that TRACE32 supports.

If TRACE32 PowerView is started in simulator mode, a core model for the specified architecture is enabled. TRACE32 now runs the executable object code on this core model for all test activities. Simultaneously, program and data flow trace are generated based upon a bus trace protocol. Figure 1 shows a generic block diagram of a TRACE32 ISS. The complexity of the core model and the debug/trace features depend intrinsically on the core architecture used. Block diagrams showing this in detail can be found at www.lauterbach.com/sim.html.

Typical use cases include activities such as PIL simulations and algorithm tests. A TRACE32 ISS is only suitable for test scenarios that are not tightly coupled to the behavior of peripherals or other target system components.

Benefits of a TRACE32 ISS

- **Virtual testing in early project stages**

  Testing can be started before the first device samples are available. Early verification avoids extensive rework in later project phases.

- **Testing with production code**

  To minimize the risk of hidden compiler errors, it has proven beneficial to use the same compiler throughout all project phases and configure it in the same fashion as required for the production device. A TRACE32 ISS supports this effort.

- **Fast testing**

  Testing with TRACE32 ISS is faster than executing tests on an evaluation board or the target hardware.

- **Very good scalability**

  Testing can be well organized into distributed teams, since everything required is just software. If bottlenecks occur under deadline pressure due to missing device samples or hardware-based debug tools, additional test benches can easily be equipped with simulators.

- **Seamless migration of test scripts**

  As soon as sufficient device samples are available, consecutive testing with TRACE32's hardware-assisted debug and trace tools becomes a necessity. Since all TRACE32 tools offer a common range of functions and a uniform look-and-feel, the test scripts written for the TRACE32 ISS are ported in no time.

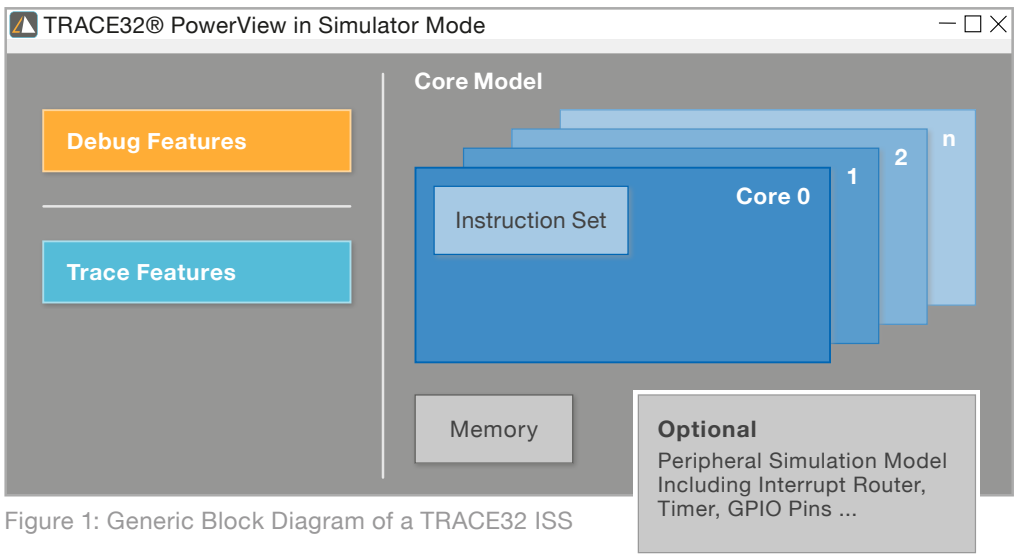


Figure 1: Generic Block Diagram of a TRACE32 ISS

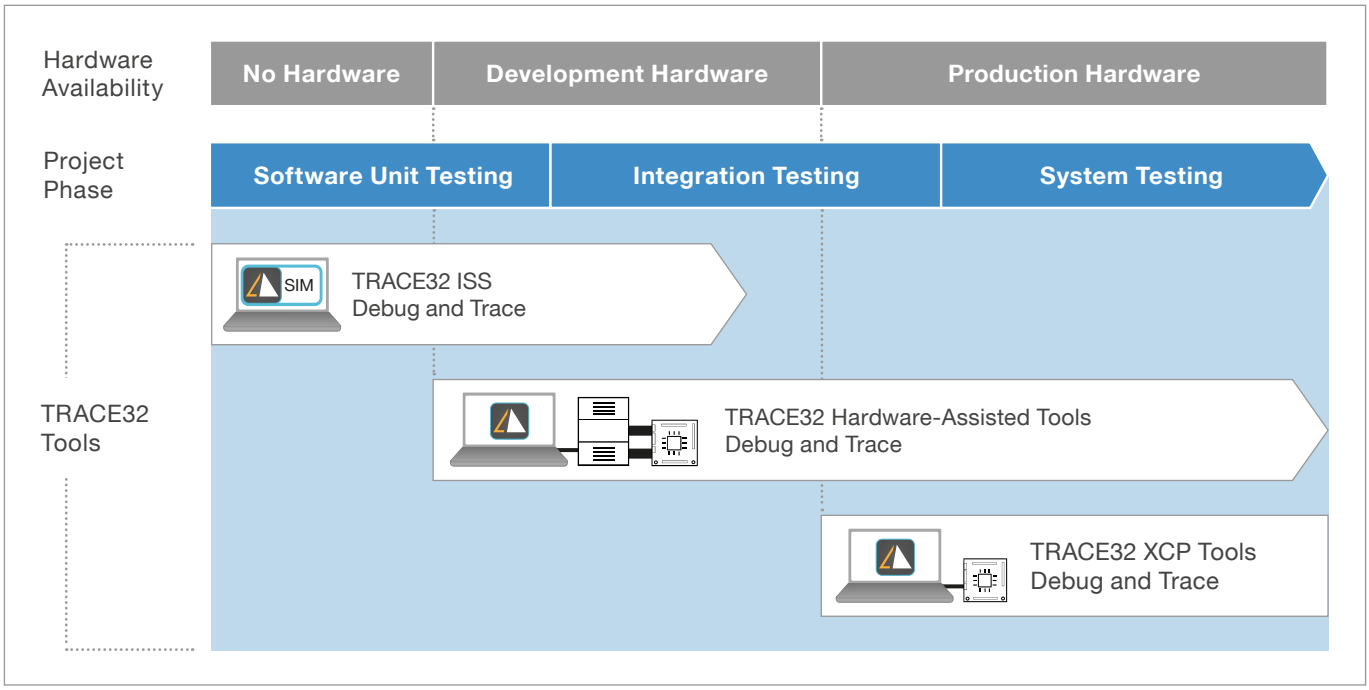


Figure 2: Overview of the Complete TRACE32 Tool Life Cycle for Automotive Projects

Integration into ISO 26262 Workflow

ISO 26262 permits processor emulators like the TRACE32 ISS as tools for software unit and module integration testing. The same tool qualification guidelines apply as would be used for other software tools. Users should determine early in the project life cycle for which activities the TRACE32 ISS should be used. Following the qualification guidelines ensures that it can be used with confidence. Alternatively, confidence in use can be justified by comparing the test outputs of the TRACE32 ISS with a reference test. Depending upon the application scenario, there are two ways to set up such a project workflow.

- If TRACE32 ISS is used for PIL simulation, confidence in use may be justified by performing the same tests with SIL simulation (see figure 3).
- When TRACE32 ISS is used to test algorithms, confidence in use can be established by running the same tests with a virtual target or an evaluation board (see figure 4 on the next page).

In summary, there are two options: Invest in tool qualification to reduce additional testing effort in the project; or, proceed without qualification which increases the required testing effort. For some projects in the automotive industry, both qualification and additional testing may make sense.

Qualification of TRACE32 ISS

Regardless of the choice, tool qualification is an important factor that must be considered for each project. The TRACE32 ISS is a commercially available tool and is typically

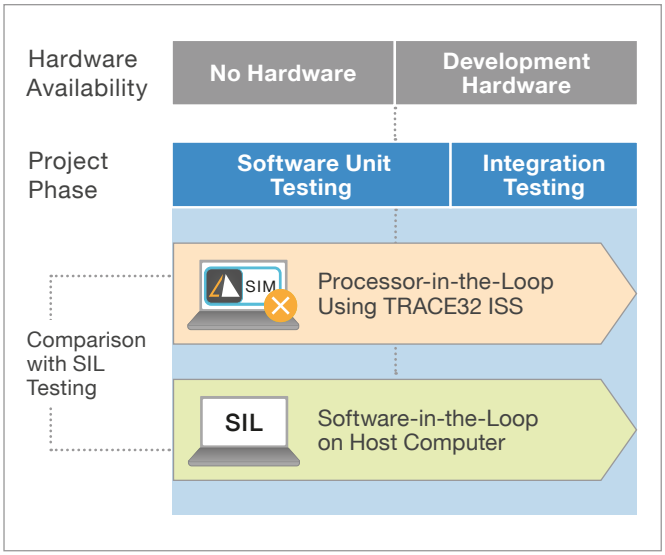


Figure 3: Workflow with Output Comparison from Testing with SIL

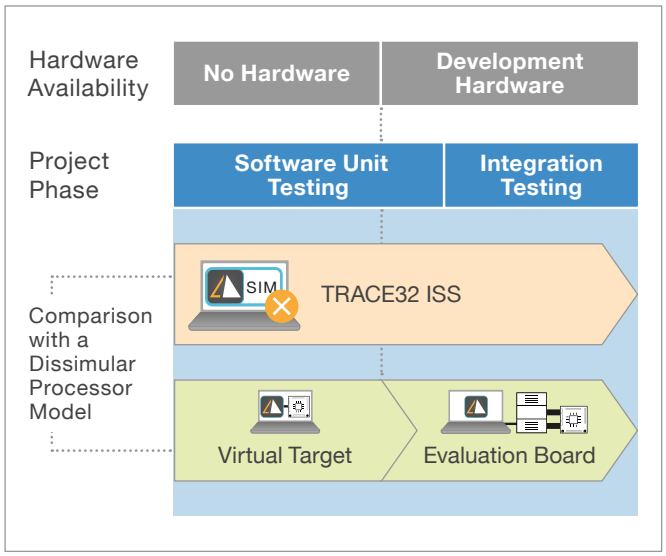


Figure 4: Workflow with Output Comparison From Another Processor Model

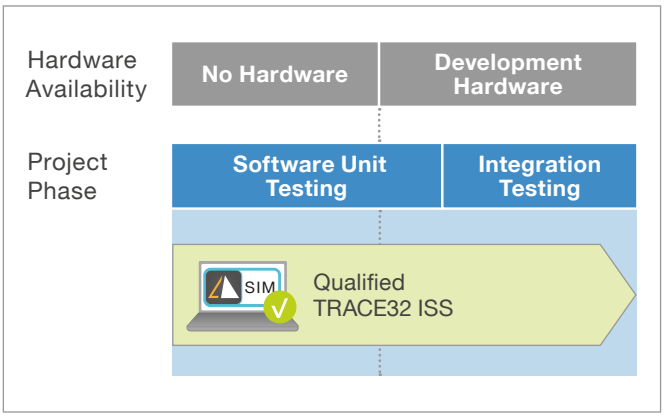


Figure 5: Workflow With Qualified TRACE32 ISS

classified as TCL2/TCL3. Although tool qualification must be performed by the user with regard to specific projects and use cases, Lauterbach has made the process simpler, and less time-consuming. The TRACE32 Tool Qualification Support Kit contains the documentation required for the qualification process, the test suites for the individual ISS, and the results of the prequalification performed. The use of ISS test suites requires the correct floating license(s) to be purchased. Once qualified, the TRACE32 ISS can be integrated as a test tool in the workflow of a safety-related automotive project (see also Figure 5).

Qualifying a software tool is certainly an elegant way to demonstrate confidence in its use, especially in the case of an audit or as documentary evidence to customers. In addition, a qualifiable ISS is suitable for back-to-back testing. ISO 26262 only allows model-based testing in the software unit and module integration verification if the MIL tests are accompanied by PIL tests. A comparison of both test outputs ensures the equivalency of the model and the derived object code.

Conclusion

According to ISO 26262, you can choose a flexible workflow when using a processor simulator for software unit and module integration testing, as long as the necessary confidence in its use is justified. TRACE32 ISS is a software tool that takes full advantage of this flexibility. Using TRACE32 ISS for software unit and module integration testing in an ISO 26262 project saves valuable time and helps to reduce deadline pressure.