

Conformance Testing in Development

Cory Conger, Qi Zeng, Artem Bobritsky
ODVA

October 21, 2026

Session Roadmap

- Why Conformance Testing Matters
- CT Platform Evolution: CT22 -> CT23
- Expanded Protocol Coverage
- Test Automation Improvements
- Test package manager
- Usability Improvements
- CIP Security and User Authentication Enhancements
- CIP Safety Test Enhancements
- Q & A

© 2026 ODVA, Inc.
All rights reserved.

Why conformance testing matters

- Ensure compliance with evolving CIP Specification
- Stay current with new CIP Specification Enhancements (SEs)
- Detect interoperability issues before certification
- Improve certification readiness and shorten debug cycles
- Enhance product quality before ODVA testing

Key Benefits:
The CT tool helps users keep pace with evolving requirements while reducing risk, rework, and certification effort.

© 2026 ODVA, Inc.
All rights reserved.

CT Platform Evolution

CT22	CT23
Released in October 2025	Released in October 2026
Expanded protocol test coverage	Expanded protocol test coverage
DLR / Time Sync Test Automation	Automation Expansion
New Utilities	Integrated Workflows
Multiple Tools	Unified User Experience

© 2026 ODVA, Inc.
All rights reserved.

Expanded Protocol Conformance Coverage

- Object & Profile Test Updates:
  - Identity Object Application Profile attribute check and improved Type 2 Reset testing
  - Parameter Object updates
  - Assembly Object Test enhancements
  - Motion Device Axis Object updates
  - New Process Device Profiles coverage
  - IO-Link Test improvements
  - QoS Object PCP (Priority Code Point) attributes and behavior test
  - LLDP Management Object NV attributes and LLDP packets transmission interval validation

© 2026 ODVA, Inc.
All rights reserved.

Expanded Protocol Conformance Coverage

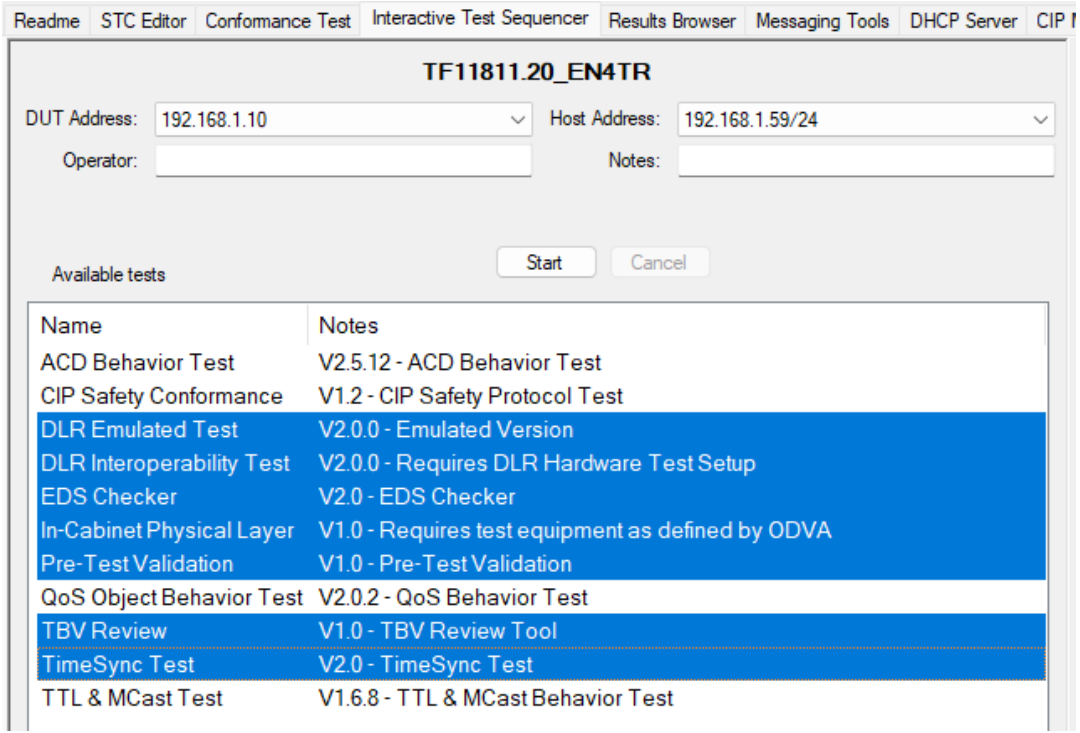
- Explicit Messaging compliance
  - Verifies handling of services larger than 0x7F with no response.
  - Validation of optional Class attributes 202-205 for each CIP Object
  - General Status 0x04 with two associated Extended Status validation
  - General Status 0x25 with Extended Status 0x114-0x116 validation
- Connection & Communication Testing
  - New validation for Get_Connection_Owner and Redundant Owner Connection
  - Enhanced Concurrent Connection test coverage
  - Improved Change-of-State I/O connection handling
  - Verifies multiple IP modes within a single CT Conformance Mode test run
  - Adds MAC address validation for multi-port Ethernet devices

© 2026 ODVA, Inc.
All rights reserved.

Test Automation Improvements

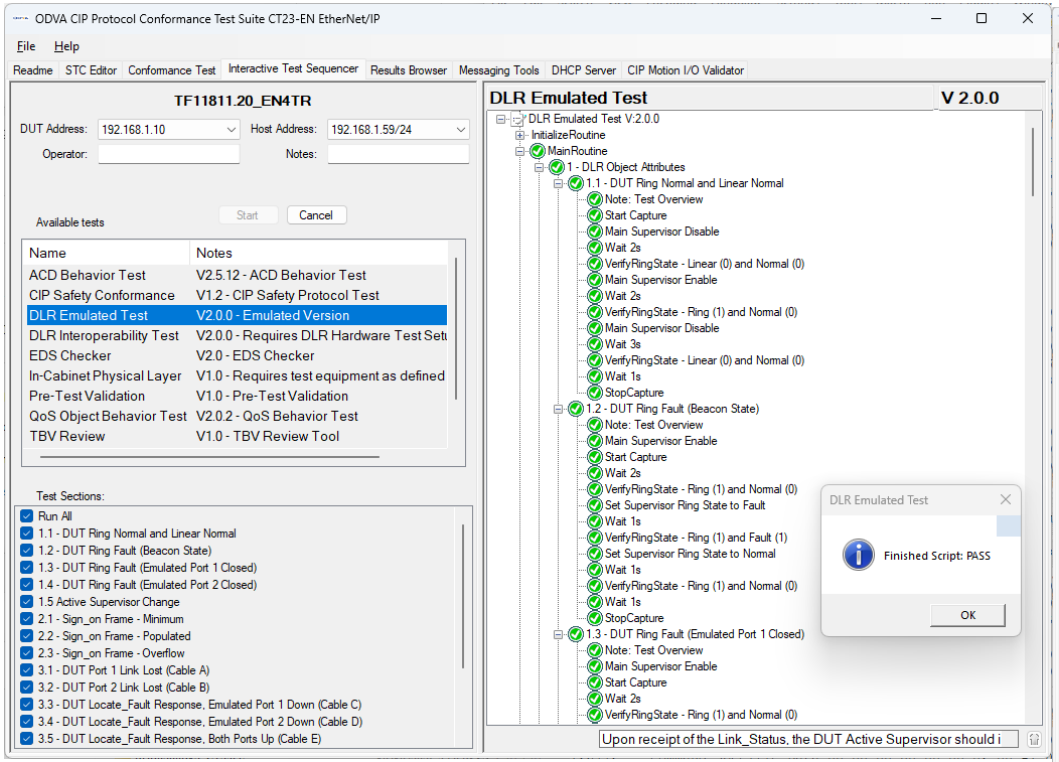
Automate manual tests for greater accuracy, Consistency, and efficiency.

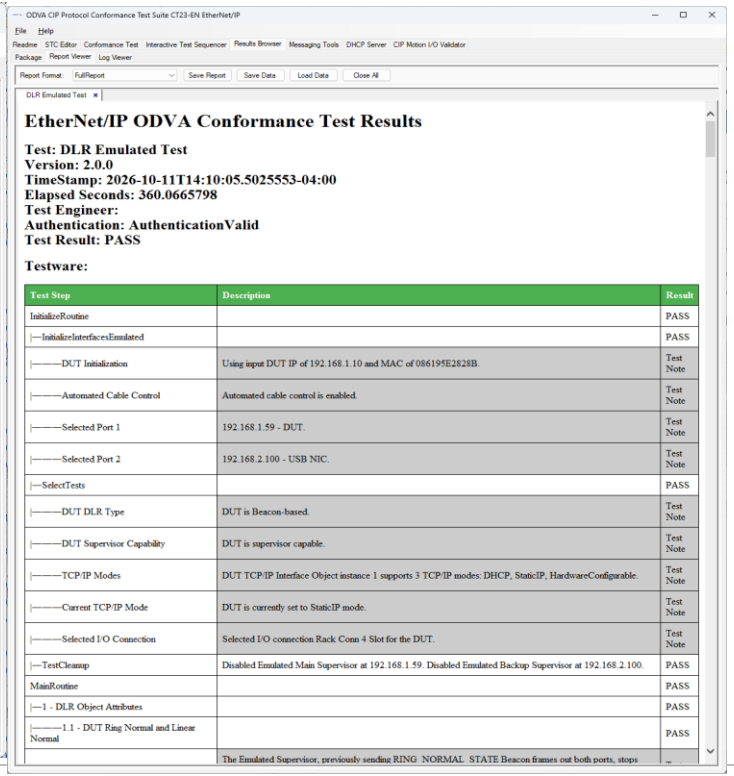
- DLR Emulated Test
- DLR Interoperability Test
- EDS Checker
- In-Cabinet Physical Layer
- Time Sync Test
- Pre-Test Validation
- TBV Review



© 2026 ODVA, Inc.
All rights reserved.

Test Automation Improvements





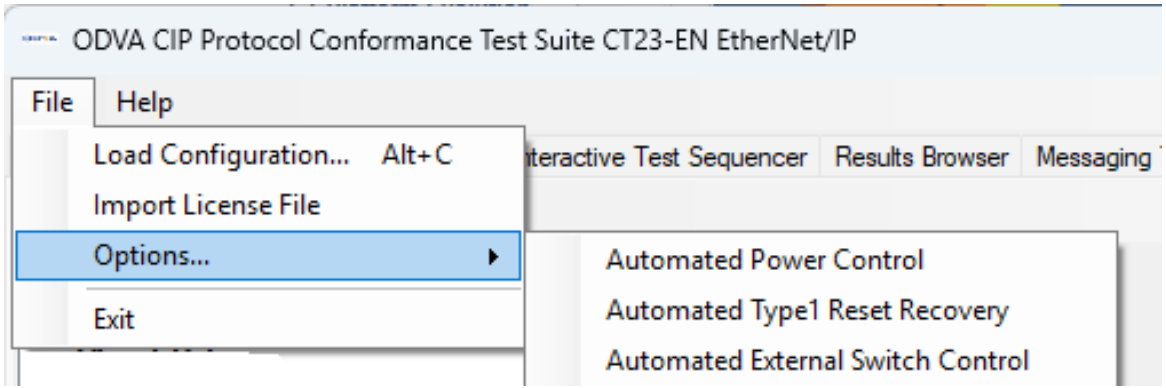
© 2026 ODVA, Inc.

All rights reserved.

Test Automation Improvements

New Options menu for

- Automated Power Control
- Automated Type 1 Reset Recovery
- Automated External Switch Control

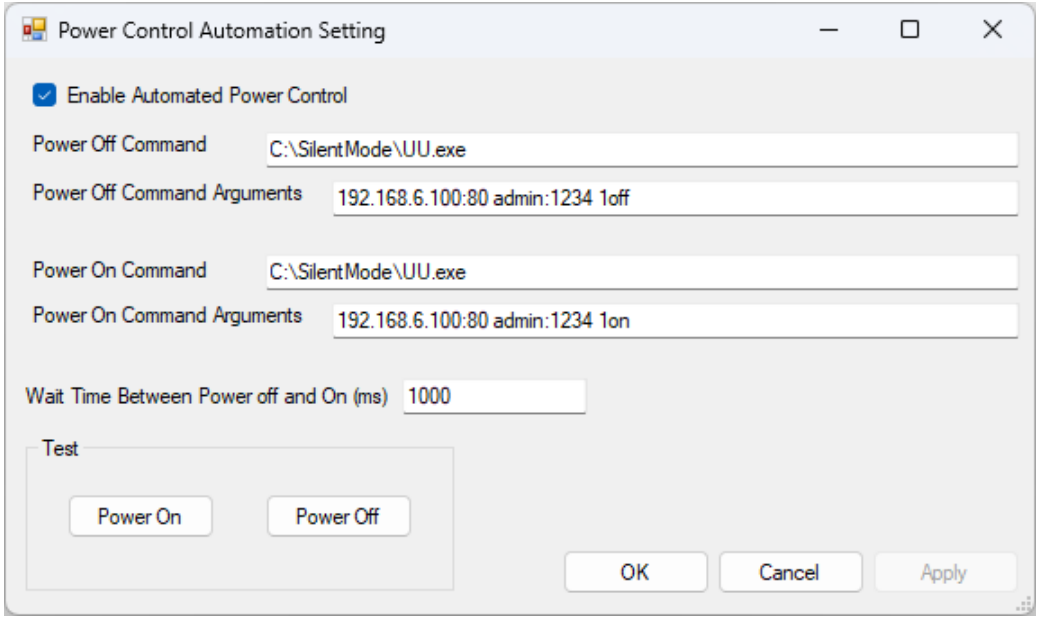


© 2026 ODVA, Inc.
All rights reserved.

Test Automation Improvements

Automated Power Control

Automates DUT power cycling for CT protocol and Interactive Test Sequencer tests.



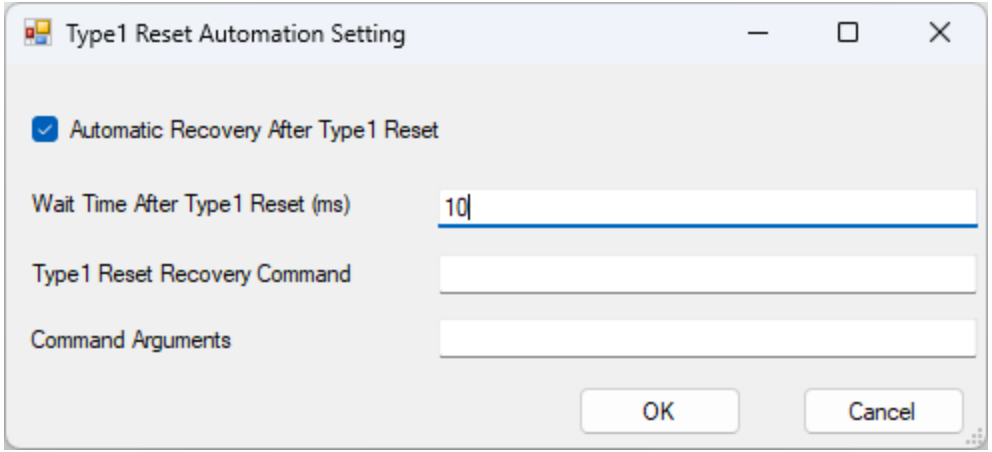
© 2026 ODVA, Inc.

All rights reserved.

Test Automation Improvements

Automated Type 1 Reset Recovery

Automates configuration for the selected DUT after a Type 1 Reset.

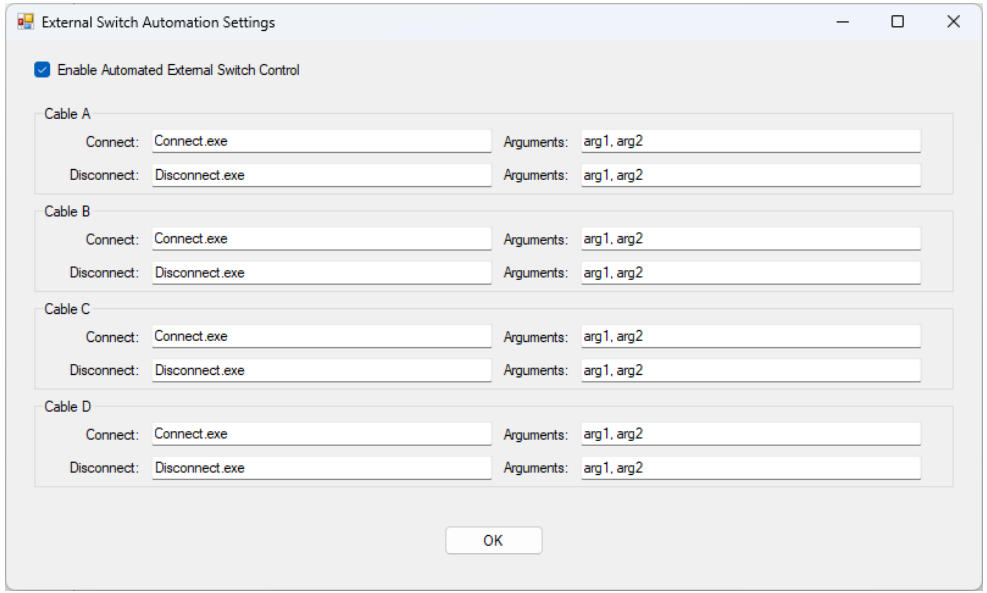


© 2026 ODVA, Inc.
All rights reserved.

Test Automation Improvements

Automated External Switch Control

Automates switch operations required for DLR Interoperability testing.



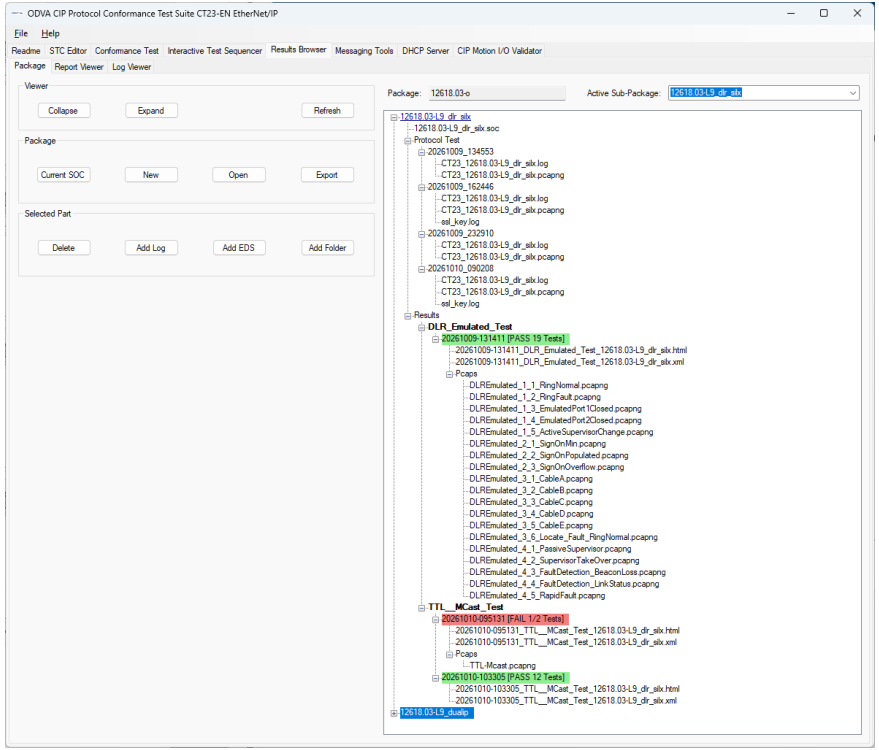
© 2026 ODVA, Inc.
All rights reserved.

Test Package Manager

- Package-centric workflow that simplifies test execution and results management.
- Automates packets capture and results collection for protocol tests and Interactive Test Sequencer execution.
- Consolidates SOC, EDS, CT log files and network captures into a unified package structure.
- Supports both CT GUI and Silent mode execution workflows.
- Enables flexible package management with file add/remove capabilities.

© 2026 ODVA, Inc.
All rights reserved.

Test Package Manager



© 2026 ODVA, Inc.

All rights reserved.

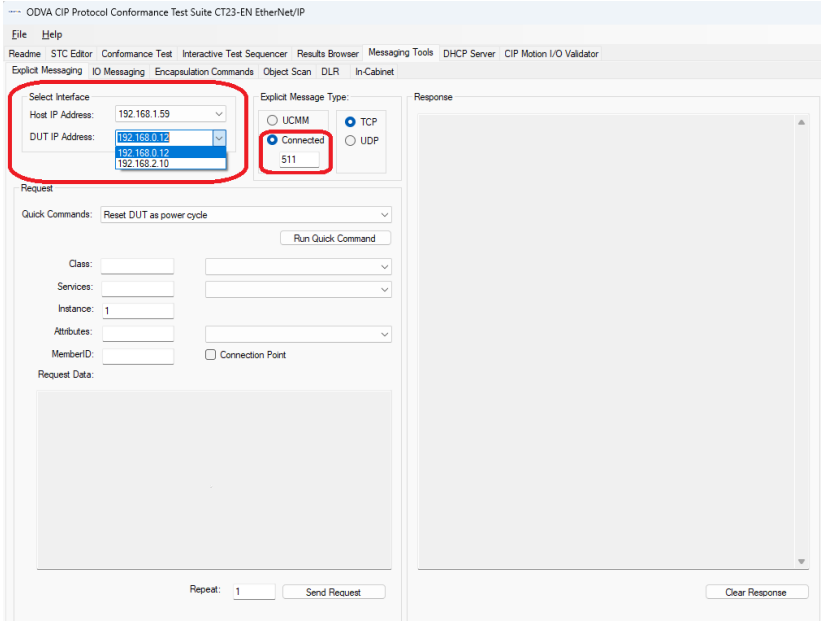
Usability Improvements

- New Splash Screen for a more informative startup experience
- DUT interface selection enabled in the Messaging Tool
- Configurable connection size in the Explicit Messaging Tab
- Dedicated Close Connection button in the I/O Messaging Tab
- Share host and DUT interface selection across Messaging Tool
- Faster object selection with double-click in the Test Configuration GUI
- Flexible Conformance mode with or without security session
- New In-Cabinet utility for testing configuration and diagnostics
- SOC update at original import location

© 2026 ODVA, Inc.
All rights reserved.

Usability Improvements

- DUT interface selection enabled in the Messaging Tool
- Configurable connection size in the Explicit Messaging Tab

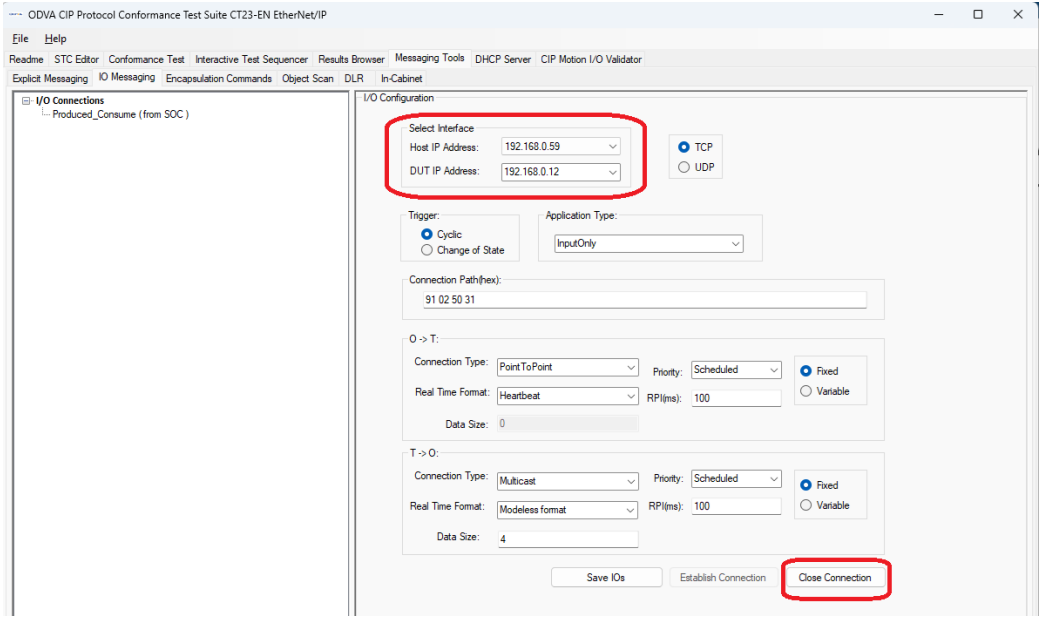


© 2026 ODVA, Inc.

All rights reserved.

Usability Improvements

- Dedicated Close Connection button in the I/O Messaging Tab
- Share host and DUT interface selection across Messaging Tool

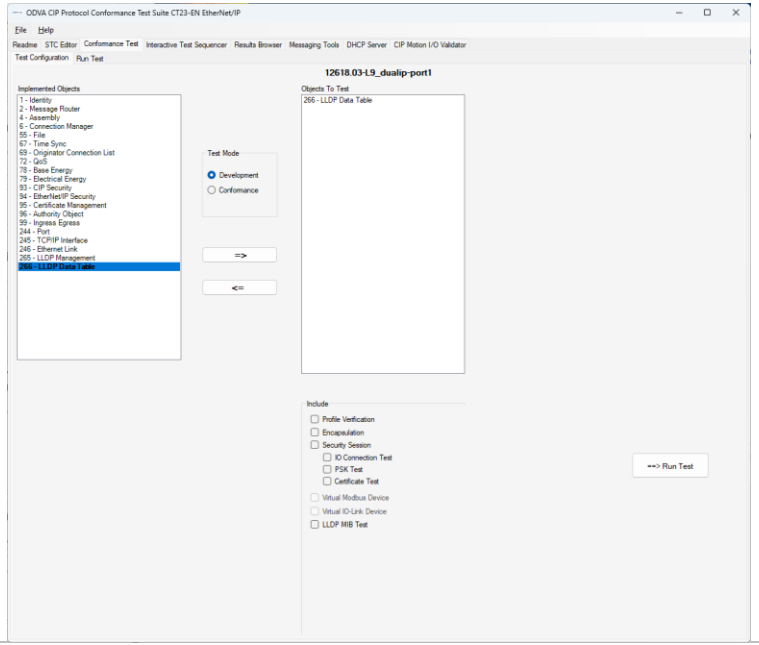


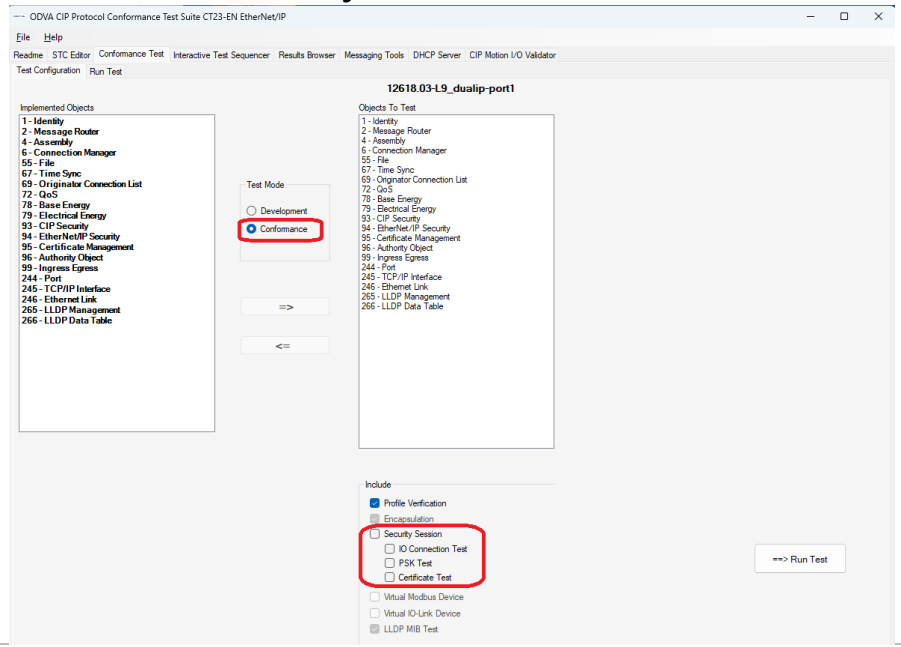
© 2026 ODVA, Inc.

All rights reserved.

Usability Improvements

- Faster object selection with double-click in the Test Configuration GUI
- Flexible Conformance mode with or without security session



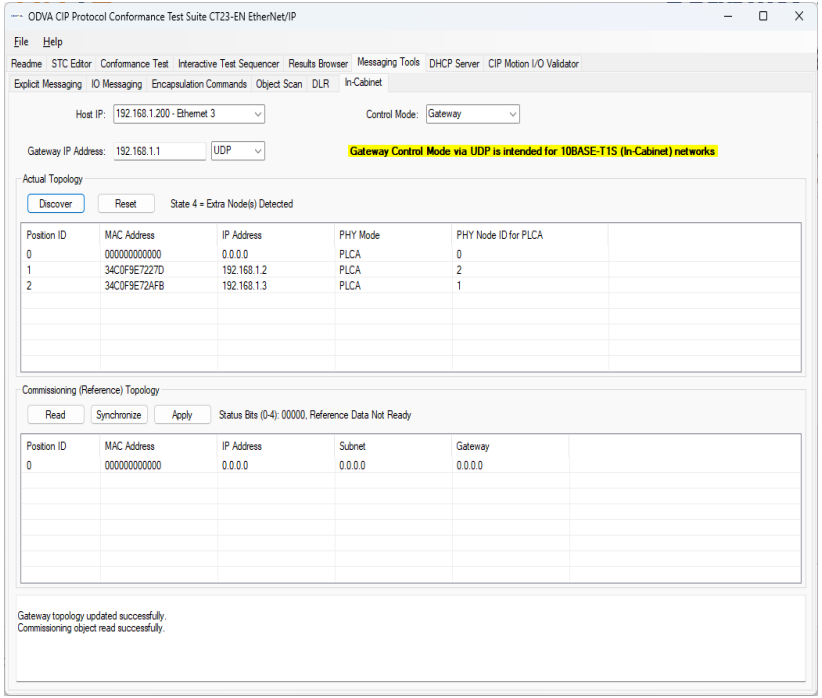


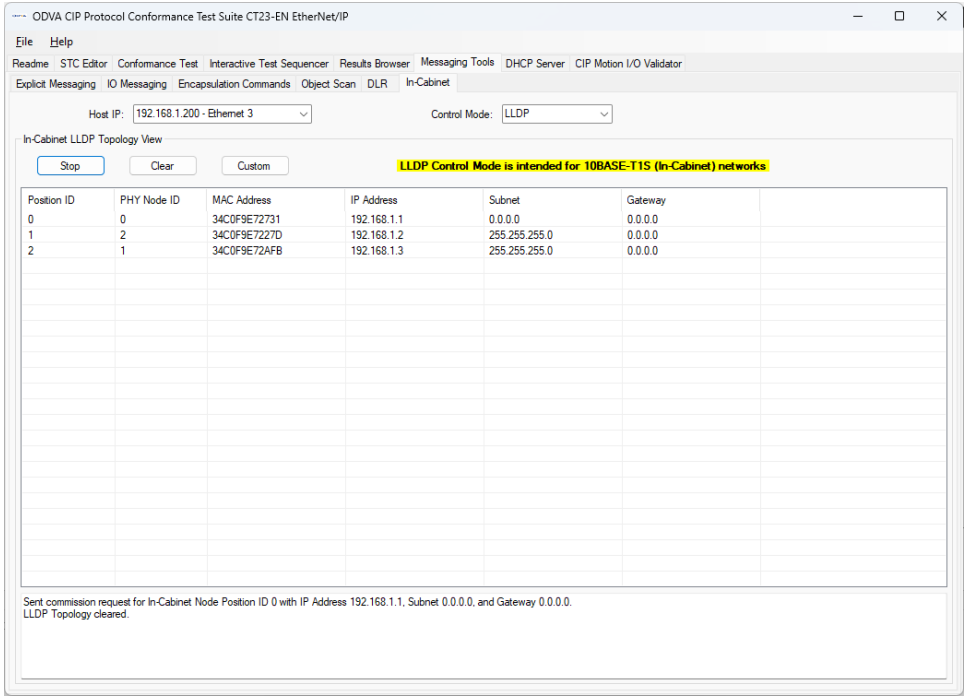
© 2026 ODVA, Inc.

All rights reserved.

Usability Improvements

- New In-Cabinet utility for testing configuration and diagnostics

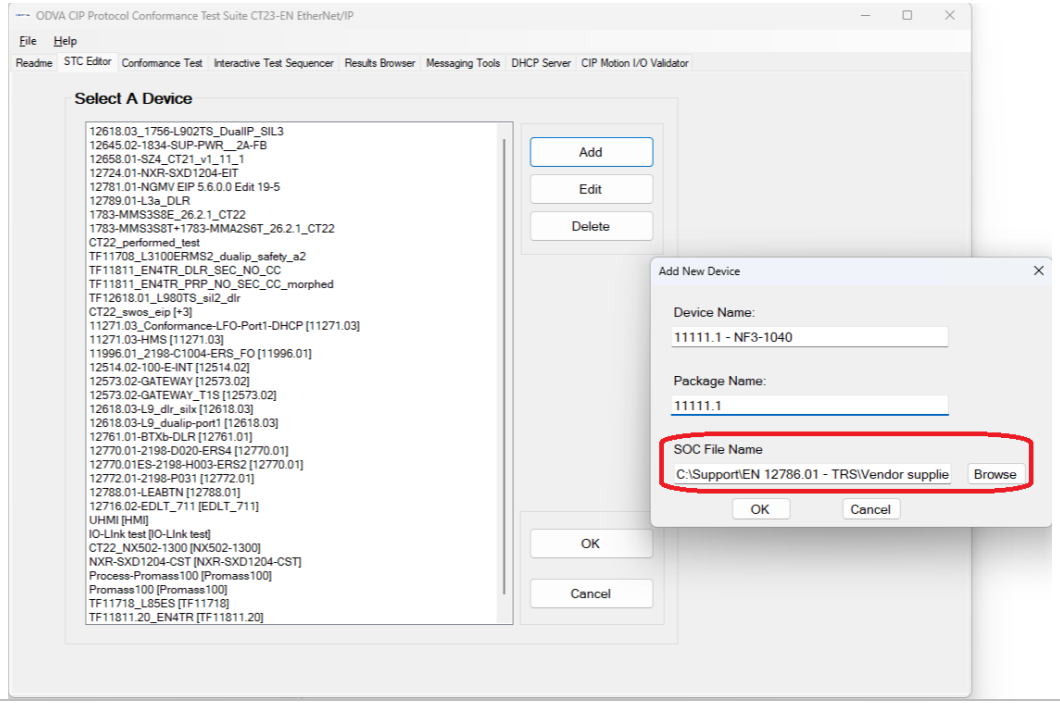




© 2026 ODVA, Inc.
All rights reserved.

Usability Improvements

- Automatically update SOC at original import location



© 2026 ODVA, Inc.

All rights reserved.

CIP Security and UAP Enhancements

- **Expanded cipher suite validation**, including non-PFS cipher suites for constrained CIP Security profile and verification of all cipher suite claimed by the DUT.
- **Enhanced TLS compliance testing**, including TLS version verification, Encrypt then MAC Extension checks, and Secure Renegotiation Extension validation.
- **Improved Ingress Egress Object test**, including Set_Rules service test and validation of instances referenced by Associated Communications Objects attribute of Port Object.
- **Expanded Secure Forward_Open validation**: verifying restrictions on establishing non-secure I/O connections over Secure Forward_Open.
- **Enhanced packet analysis support** through more frequent ssl_key.log generation for Wireshark packet decryption during live captures.

© 2026 ODVA, Inc.
All rights reserved.

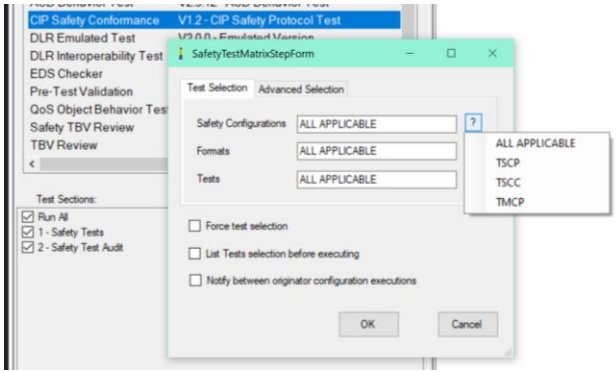
CIP Security and UAP Enhancements

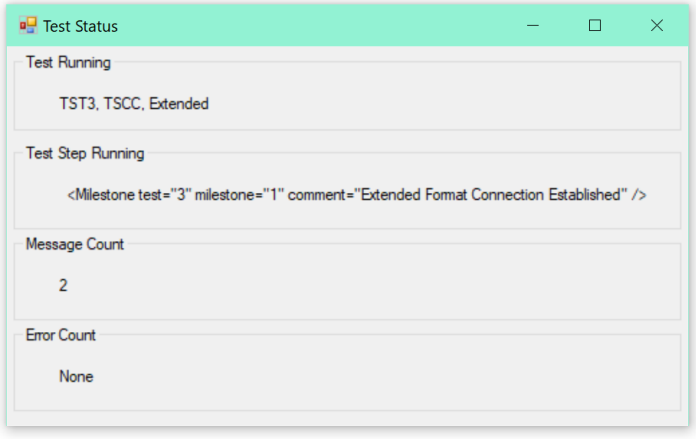
- Enhanced User Authentication Profile (UAP) Testing
  - Trust provisioning via Password Authenticator Object, Certificate Authenticator Object, OAuth/OpenID Connect, or Client Token.
  - Authority Object testing with provisioned credentials.
  - Common Object Permission Set support
  - UAP Session ID validation across role-based object access and DUT reset.
  - Expands UAP error-code coverage

© 2026 ODVA, Inc.
All rights reserved.

CIP Safety - CT22-ES: Setup and Test Selection

- Embedded Python 2.7 runtime - SPTE's Python is now bundled with CT (no system-wide install, no version conflicts)
- Guided test selection - valid-value prompts for Safety Configurations, Formats and TSTs
- Live execution feedback - status window shows milestones and errors during the run





© 2026 ODVA, Inc.
All rights reserved.

CIP Safety - CT22-ES: Coverage and Run Conditions

- TST108 - constrained to run against target configurations
- TST130 - now requires Propose/Apply TUNID List implementation
- Safety Supervisor - Safety Concurrent Connection attributes and services supported
- Concurrent Connection tests are MVR (manufacturer validation required) - see CIP Safety PCTS

© 2026 ODVA, Inc.
All rights reserved.

CT23-ES: CIP Safety Enhancements

- Safety I/O in automated scripts: DLR, QoS and TTL/Multicast
- Safety Tools: live-connection controls - RPI, forced output, Safety Validator diagnostics
- Advanced test selection: type tests, pull failed tests from the Safety Audit, retry-until-pass
- Multi-port originator devices: a target config (.cfg) per TCP/IP interface, selected by DUT Address
- Package Manager: Safety Audit integrated; scripts auto-capture Wireshark traces and logs
- Bug fixes: TST44 default OUNID; Safety Supervisor null config-assembly error; DOP deactivated-outputs test

© 2026 ODVA, Inc.
All rights reserved.

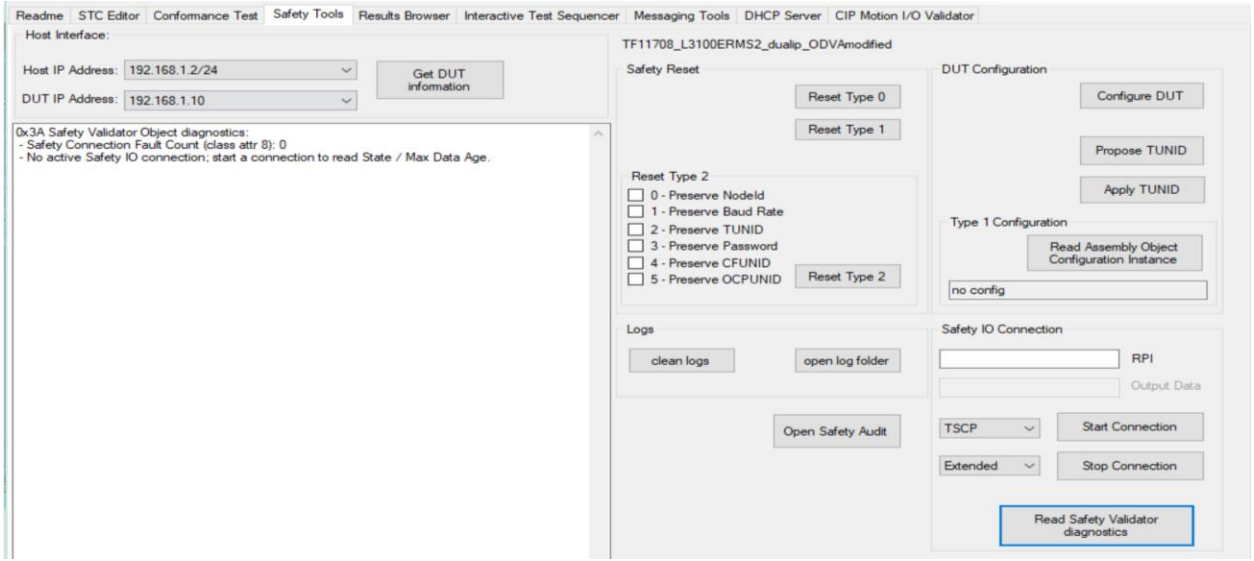
Safety I/O in Automated Scripts

- DLR - ring-fault behavior exercised with a live safety I/O connection
- QoS - priority marking verified on DUT-produced Safety Data and Time Coordination packets
- TTL / Multicast - TTL and multicast address verified on safety I/O packets

© 2026 ODVA, Inc.
All rights reserved.

Safety Tools - Live I/O Connection Controls

- Configurable RPI for the Forward Open / safety connection
- Force the produced safety output data
- Read Safety Validator diagnostics: Connection Fault Count, Validator State, Max Data Age

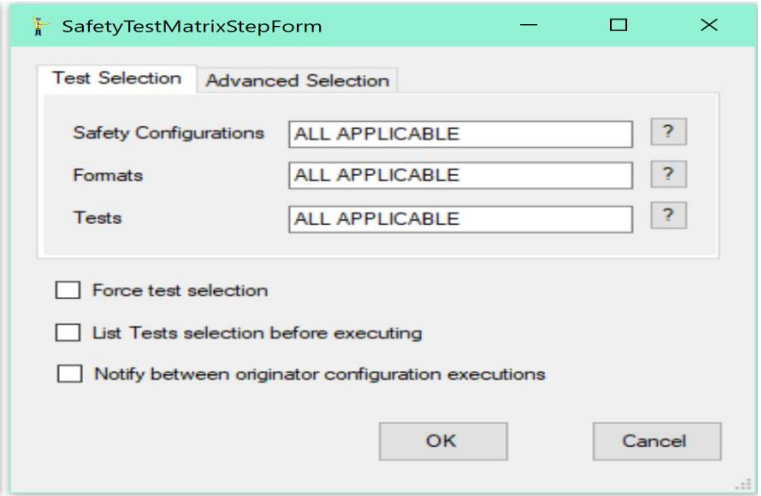


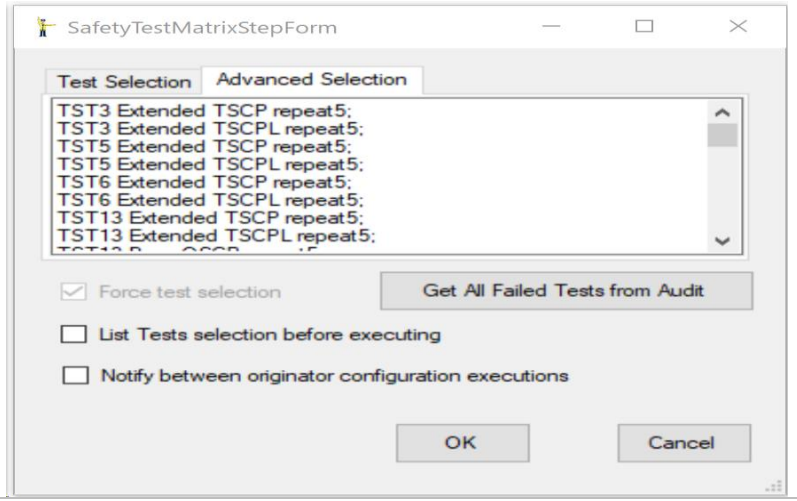
© 2026 ODVA, Inc.

All rights reserved.

Advanced Test Selection

- Type tests as text - e.g. TST3 Extended TSCP repeat5;
- Get All Failed Tests from Audit - one click queues every failing/missing test
- Retry-until-pass - repeats until no errors and the CRC check passes
- Review failures cleared by retry (test instability vs DUT defect) - see CIP

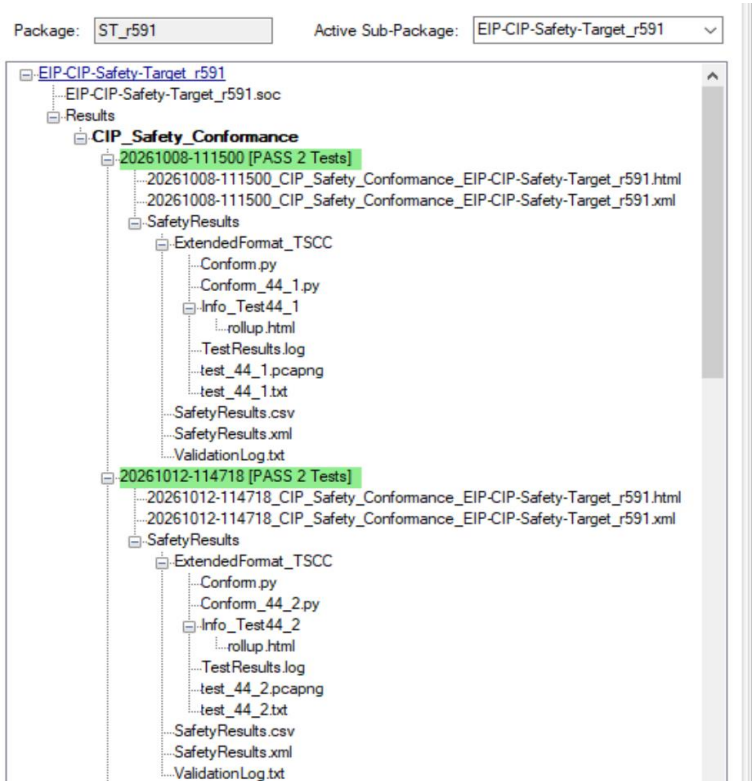




© 2026 ODVA, Inc.
All rights reserved.

Packaging and Workflow

- Package Manager - bundle test artifacts for submission and review
- Safety scripts auto-capture Wireshark traces and pack safety logs



© 2026 ODVA, Inc.
All rights reserved.

CIP Safety PCTS - Manual-Review Items (Section 4)

- Review Section 4 of the CIP Safety PCTS for items relevant to your product
- TST108 / SRS119 - automated for target devices; originators and unsupported configs need manual verification (IP assignment incl. DHCP/BOOTP; TUNID/IPAddr mismatch -> Abort)
- TST130 - conditional (F-5 C17); manual verification when Propose/Apply TUNID List is not implemented
- Safety Concurrent Connection - MVR: contact ODVA to discuss conformance strategy
- Repeated/retry tests - a failure cleared by re-running must be reviewed (test instability vs DUT defect) via rollup.html and Vol 5 Appendix F

© 2026 ODVA, Inc.
All rights reserved.

Q & A

Questions & Comments:

odva@odva.org

Conformance:

conformance@odva.org

© 2026 ODVA, Inc.
All rights reserved.



Thank you!