Doble Solutions for Testing SEL-T401L Relays

Introduction

The line of protection testing solutions from Doble allow you to efficiently design and perform simulations of electrical conditions that challenge any protection and control system. Power with flexibility describe Doble Protection Suite and Doble RTS software applications as well as Doble F-series Power System Simulators and Manta MTS-5100 Relay Test Systems. Each solution accommodates your company's unique testing program and compliance stance.

The automated protection testing solutions from Doble include methods for verifying innovations in time-domain line protection including ultra-high-speed functions based on traveling wave principles. Traveling waves occur during faults and can be analyzed by polarity, time, and traveled distance. Relays that can detect traveling waves reveal fault location information within milliseconds while offering other critical line protection and control advantages like high-speed tripping and communication functions that increase reliability and security.

The Problem: Generating Traveling Waves During Tests

Algorithms used by the relay detect traveling wave currents that propagate in microseconds at nominal frequency. Tests must apply traveling wave simulations synchronized to current injections at nominal frequency in microsecond intervals and sample relay communication signals in megahertz resolution.

Presently, no digital or conventional relay test set on the market offers this performance stand-alone, so a traveling wave generating instrument must be introduced into the test process. The traveling wave generator and the relay test set must be precisely synchronized to a common time source for successful test executions with realistic traveling waves during fault simulations.

Instance of Traveling Wave and Relay Trip Signal

## The Solution: Use Doble Protection Test Instruments and Software with SEL-T4287 Traveling Wave Test Systems

Doble offers four platforms that provide the necessary tools for testing SEL-T401L relays:

1. F8200/F8300 Power System Simulators controlled by Protection Suite or RTS software
2. F6150e or F6150sv Power System Simulators controlled by Protection Suite or RTS software
3. Manta MTS-5100 Relay Test Systems stand-alone or controlled by RTS software
4. 3rd party relay test sets controlled by RTS software

Each of the four platforms Doble provides can be used with the SEL-T4287 Traveling Wave Test System that generates traveling wave signals during the testing of line differential/traveling wave differential elements.

Doble F8200/F8300 with Protection Suite or RTS software

F8200/F8300 Power System Simulators host GPS (requires F8895 Satellite Receiver Antenna) and IRIG-B connectivity that enable time synchronization with the SEL-T4287. The PC running Protection Suite or RTS software*, and the power system simulator, are connected to the network via Ethernet switch.
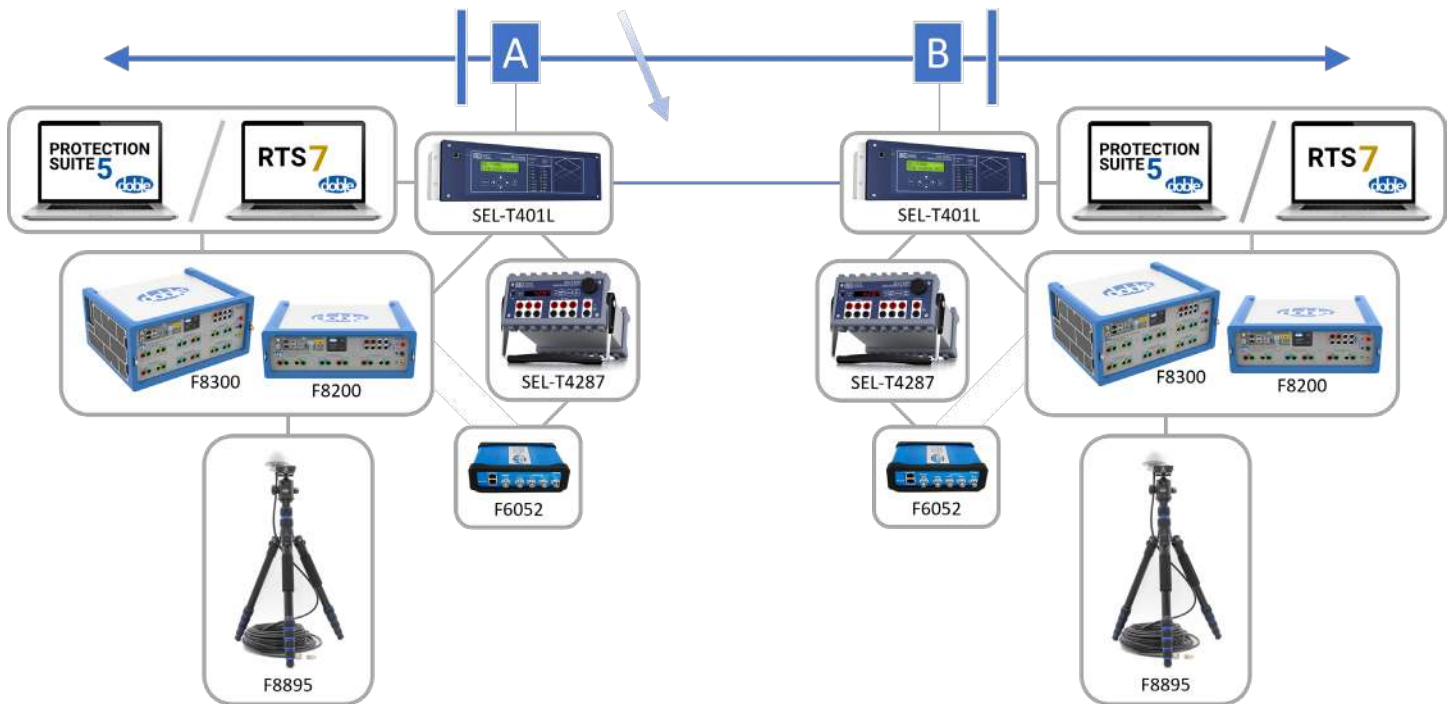
Doble F6150sv/F6150e with Protection Suite or RTS software

The F6150e or F6150sv Power System Simulator time-synchronized with the SEL-T4287 by means of the F6052 Universal Time Synchronizer that supports both IRIG-B and PTP. The PC running Protection Suite or RTS software*, and the power system simulator, are connected to the network via Ethernet switch.
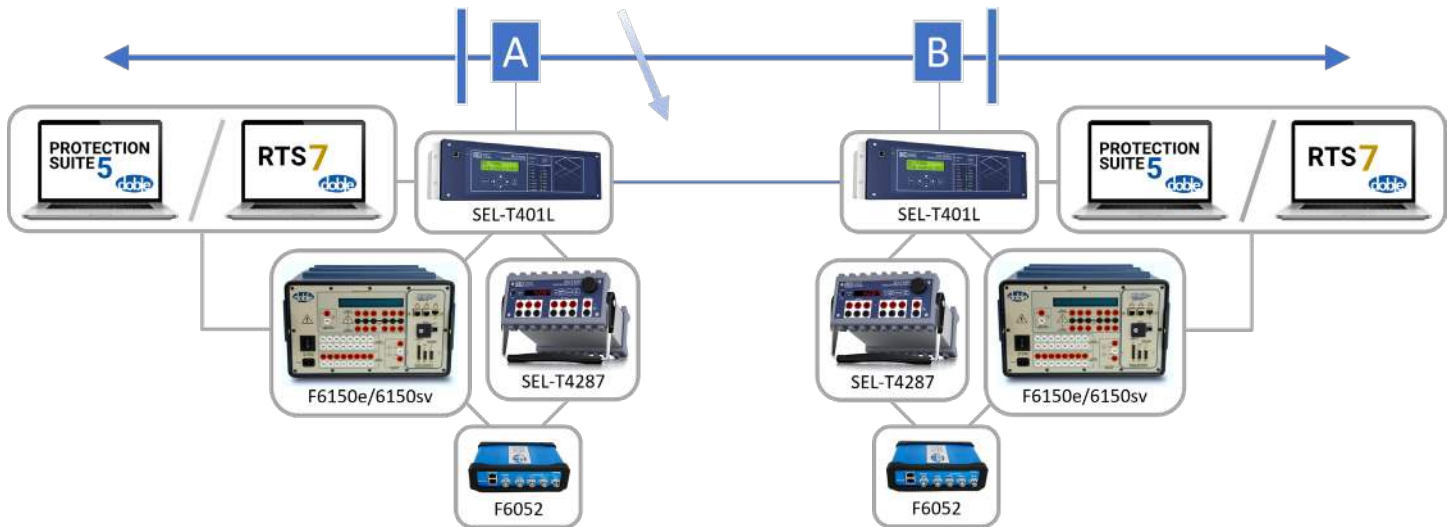
Protection Suite

Protection Suite software provides a power system model that creates all the calculations required for both ends of the line differential. Here, an internal Ph-G fault at 10% of the line from Relay A is shown:


Create these calculations once and share the file with the Protection Suite user at the Relay B location.

Testing impedance and line differential protection is straightforward in Protection Suite version 5. Users can solve complex numbers math with new built-in functions, test multiple zones and faults under one step with the Impedance Characteristic test, and quickly configure fault distance or line differential testing with the power system model built into state simulation tests.

RTS

Line fault configurations in RTS are designed using the FasFault interface, which is an interactive, visual power system modeling tool. Here, an internal Ph-G fault at 10% of the line from Relay A is shown:
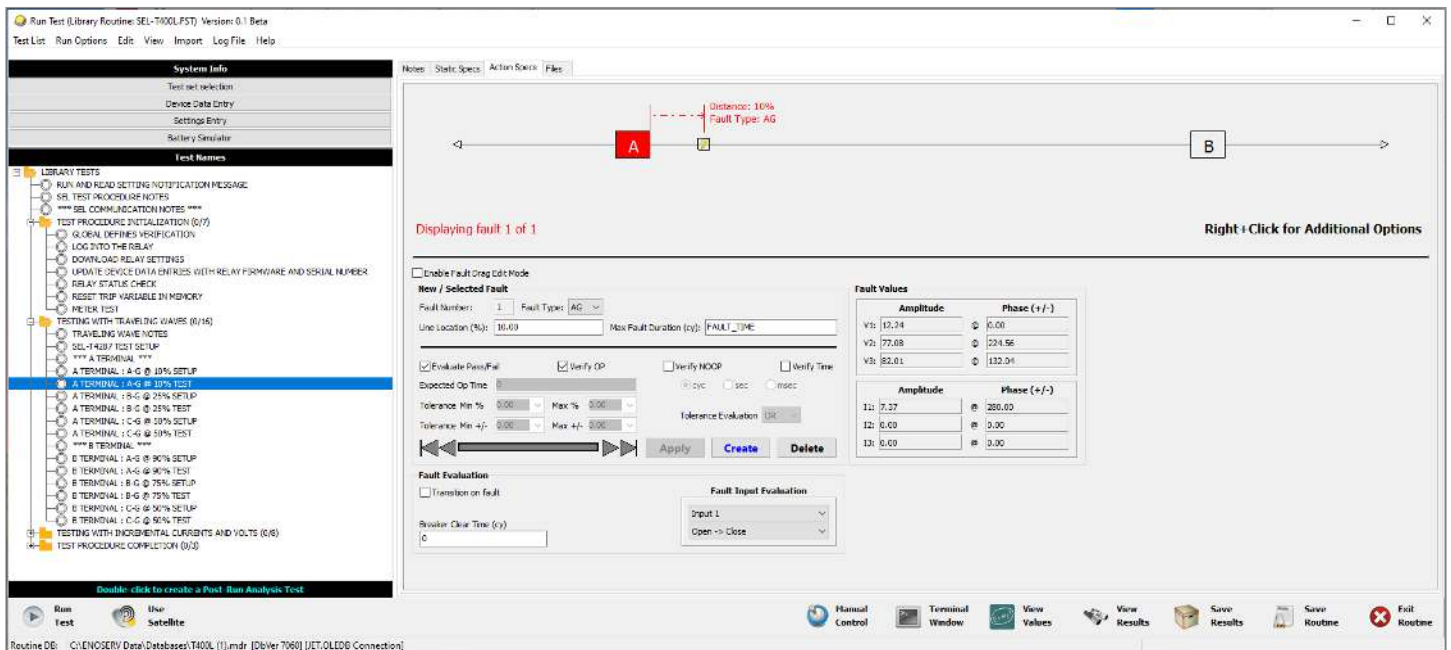
Enter source impedance and other line parameters and the FasFault interface auto-calculates test quantities for each fault location placed on the line model. RTS software has FasFault and other user-friendly test creation tools which are showcased in the RTS T401L automated test routine that is available to customers.

Manta MTS-5100 stand-alone or with RTS software

With its built-in computer and embedded Onboard Software, the MTS-5100 will test traveling wave relays stand-alone or controlled from a PC running either the Onboard Software remote version or Doble RTS*. The MTS-5100 is connected to the network via Ethernet switch and synchronized to the T4287 with the F6052 Universal Time Synchronizer.
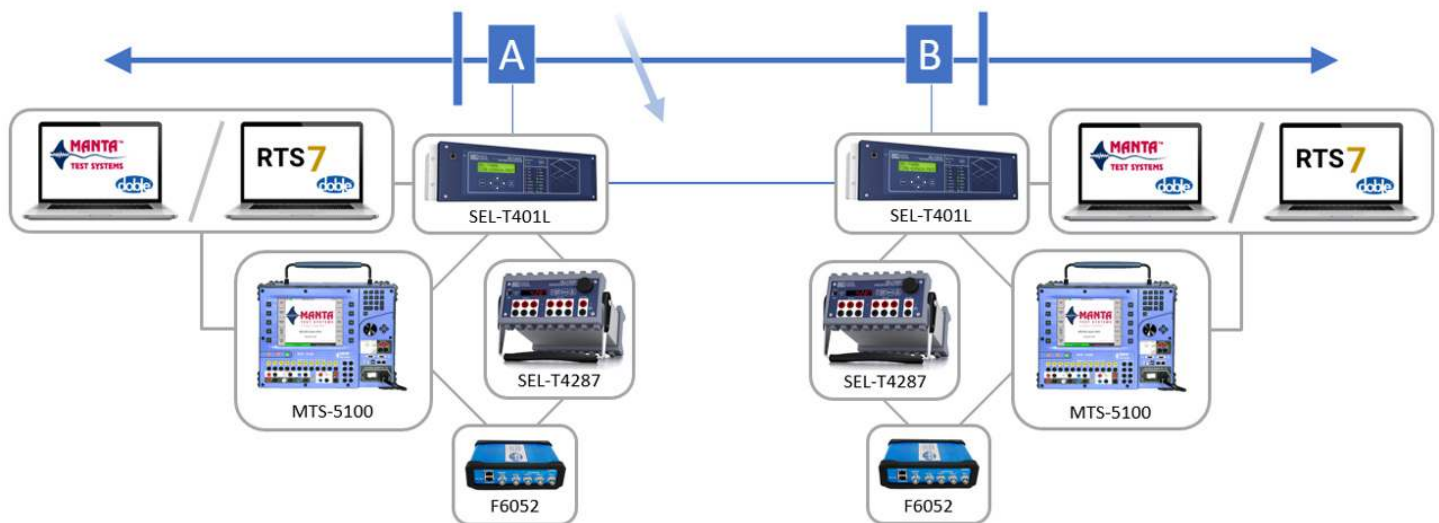
RTS software with 3rd party protection test sets

Companies having a variety of relay test sets in their fleet can use RTS to standardize their protection system maintenance programs. The RTS test routine for the SEL-T401L relay can be used with test sets from other manufacturers seamlessly.
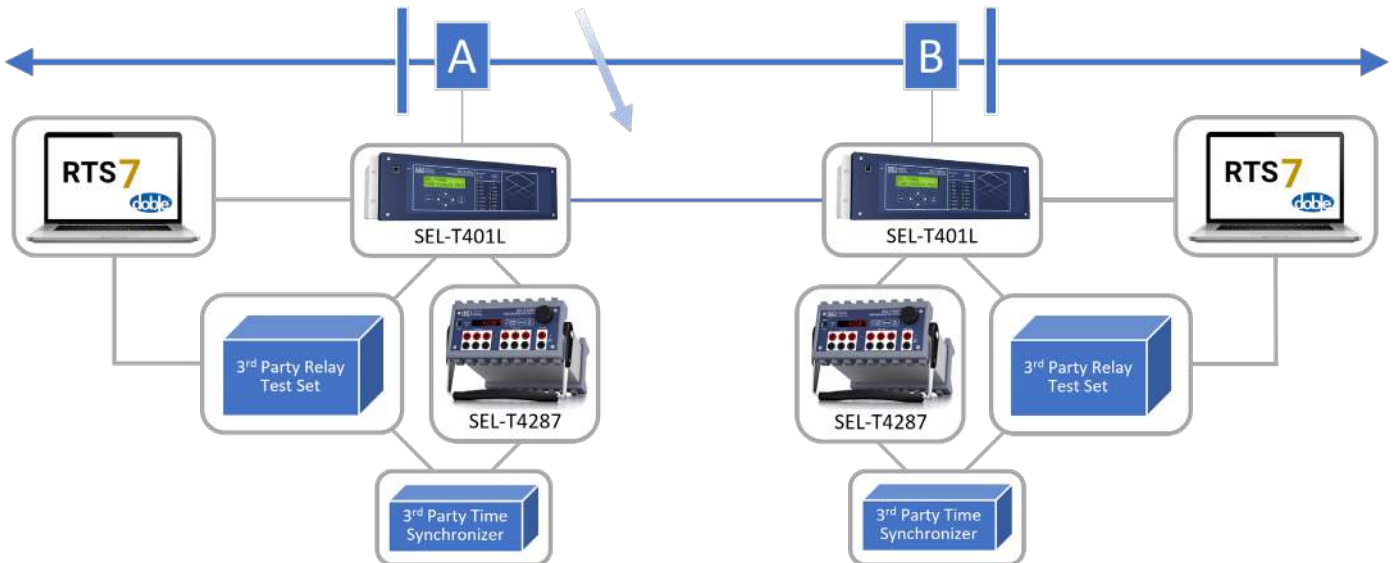
Technical presentations and papers given at Doble Protection Seminars offer more detail on testing the SEL-T401L relay. Contact Doble for more information on how the protection testing solutions Doble provides improve your processes and allow you more time to focus on the critical nature of your work.