



CONPROVE

Since 1984



REAL-TIME SIMULATOR AMPLIFIER

Smart Solution for Signal Amplification in
Test Systems with Digital Simulators



Conprove offers an efficient solution for amplifying signals from real-time simulators. Our relay test sets were designed natively to allow them to be used as amplifiers for external signals. Analog signals or digital Sampled Value signals can be routed to current and voltage amplifiers, providing a wide range of possibilities in terms of current range and total number of channels.

CONPROVE's test sets, when used as amplifiers, were specially designed for power system simulations, solving the issue of the high-power analog voltage and current signals required. Currently, the physical interface between the simulator and the devices under test can be achieved through low-level analog outputs from the simulator connected to dedicated signal amplifiers, or implemented over a network using Sampled Values (SV) outputs, in accordance with the IEC 61850-9-2 or IEC 61869-9 standards.

Real-time digital simulation technology is widely used in power systems through closed-loop testing. Regardless of whether digital simulation or digital-to-analog model simulation is used, power amplifiers are essential components of the test and simulation system, acting as an interface between the real-time simulator and the devices under test.



RELATED CONPROVE SOLUTIONS



CE-6707

The CE-6707 is a versatile tool that includes several functionalities in a single equipment for testing the electrical system. This portable instrument, ideal for both field and laboratory, is capable of testing / calibrating / measuring the most diverse types of equipment at secondary levels. For secondary levels it can be used to test relays: electromechanical, static or microprocessed.

CE-6710

The CE-6710 is a versatile tool that includes several functionalities in a single equipment for testing the electrical system. This portable instrument, ideal for both field and laboratory, is capable of testing / calibrating / measuring the most diverse types of equipment at secondary levels.



CE-7012

The CE-7012 is a versatile tool that includes several functionalities in a single equipment for testing the electrical system. This portable instrument, ideal for both field and laboratory, is capable of testing / calibrating / measuring the most diverse types of equipment, whether at primary or secondary levels.

At primary levels it can be used to test current transformers (CT), potential transformers (VT), switches, disconnectors, circuit breakers, grounds and power transformers.



With a range of different amplifiers that allow parallel connection, the solution can be used for simulations with high current levels, simulating even the highest short-circuit situations. The amplifiers are DC-coupled, allowing the reproduction of a wide spectrum of stimuli (subtransitory with exponential components, e.g.).

CONPROVE's test set is versatile and can be installed in a rack or even used portably, transported in its case for testing in other locations.

Using the CE-LVA1 (Low Level Analog Adapter), Conprove's test sets can be used as analog signal amplifiers for simulators such as RTDS®, OPAL-RT®, or Typhoon Hil®. For digital Sampled Values, electrical (RJ-45) or optical fiber (LC connection) interfaces can be software-selected.

Typical Applications

The CE-LVA1 accessory is used to couple analog signals from real-time simulators to Conprove test sets, enabling accurate and safe amplification of these signals for:

- Real-time testing of protection relays;
- Dynamic behavior studies of IEDs (Intelligent Electronic Devices);
- Performance evaluation in simulated power networks;
- This system is widely used in laboratories, research centers, and academic institutions, and is compatible with models CE-6707, CE-6710, and CE-7012.

Benefits of Using CE-LVA1 with Conprove Test Sets

- Direct integration with real-time digital simulators;
- High fidelity in signal amplification;
- Enhanced safety and control in testing.

Ethernet Link with Power to Amplify

A very interesting and useful feature when using real-time simulators with Sampled Values (SV) output is the ability of the test sets to act as amplifiers, subscribing to the published SV frames and routing these inputs to their analog outputs, generating proportional current and voltage signals. For this, it is essential that the system is properly time-synchronized, ensuring the correct relationship between angle and frequency.

CONPROVE has implemented this technology natively in its test sets since 2013. In addition to all the functionalities required for testing in accordance with the IEC 61850 standard, the CE-7012, CE-6710, and CE-6707 models offer the ability to subscribe to SV for both protection and power quality measurement applications, in compliance with IEC 61850-9-2LE and IEC 61869-9 standards.

These devices can route the SV inputs to their analog outputs, respecting the generation limits and the number of channels of each model. They are also capable of subscribing to up to two SV streams, performing an important oversampling filter to ensure excellent angle stability in the generated waveform.

Regarding synchronization, CONPROVE's test sets offer four options for external synchronization: PTP, IRIG-B / 1PPS, internal GNSS, and external GNSS (CE-GNSS accessory). An important distinguishing feature is that, in PTP mode, the test sets can operate either as Master or Slave, allowing them to be synchronized by an external Grandmaster or to act as the system's PTP Grandmaster themselves.

Main Technical Features

- Wide connectivity: 4.0 mm banana-type inputs and front 2EDGK connectors;
- Fixed amplification gain:
- Voltage: 55 V / 1 V;
- Current: 5.667 A / 1 V (CE-6707 / CE-6710) or 8.5 A / 1 V (CE-7012).

Voltage Amplifiers

Range	6 x 300V (CE-7012) 4 x 300V (CE-6710 / CE-6707)
Power	6 x 100VA (CE-7012) 4 x 100VA (CE-6710) 4 x 60VA (CE-6707)
Accuracy	< 0,15% rd + 0,05% rg
Distortion (THD + N)	< 0,15%
Analog Gain	55V/1V

Current Amplifiers

Range	6 x 50A (CE-7012) 6 x 32A (CE-6710) 3 x 32A (CE-6707)
Power	6 x 450VA (CE-7012) 6 x 210VA (CE-6710) 3 x 180VA (CE-6707)
Accuracy	< 0,15% rd + 0,05% rg
Distortion (THD + N)	< 0,15%
Analog Gain	8.5A/1V (CE-7012) 5.667A/1V (CE-6710 / CE-6707)

General

Bandwidth	DC to 3kHz
Phase (between channels)	< 0,10°
Amplifiers propagation delay	500us ± 5us
Galvanic isolation	Input to outputs and between outputs
Frequency drift / stability	< ±1ppm

IEC 61850 Subscribing

Sampled Values:	IEC 61850-9-2 LE IEC 61869-9
Number of Streams:	2
Sampling Frequency (Hz):	4000 → up to 2 ASDUs 4800 → up to 2 ASDUs 5760 → up to 2 ASDUs 14400 → 6 ASDUs 12800 → 8 ASDUs 15360 → 8 ASDUs
Buffer SV input	5 to 80 samples
SV subscribing packets treatment	Interpolation; Automatic Sample Count Alignment; Delayed packets repositioning; Stop triggering with number of consecutive packet loss (programmable); Stop triggering with number of packet loss per second (programmable).

Time Synchronization

Precision Time Protocol	Master and Slave Functionality PTP V2 (IEEE 1588-2008) PTP V2.1 (IEEE 1588-2019) Utility Profile (IEC 61850-9-3) Power Profile V1 (IEEE C37.238-2011) Power Profile V2 (IEEE C37.238-2017)
IRIG-B & PPS	Master and Slave Functionality
Internal GNSS	Embedded
External GNSS	Using CE-GNSS (accessory)

Integration Example with RTDS Simulator:

In a practical scenario, the CONPROVE equipment receives analog signals from the simulator, amplifies them according to the test set's gain, and injects them directly into the relay under test. This configuration enables testing with high realism and accuracy.

Compatible Products

- CE-6707 – 4 Voltage Amplifiers + 3 Current Amplifiers
- CE-6710 – 4 Voltage Amplifiers + 6 Current Amplifiers
- CE-7012 – 6 Voltage Amplifiers + 6 Current Amplifiers

Conprove's signal amplification solution is an essential technology for ensuring efficiency and reliable results in tests with real-time digital simulators such as RTDS®, OPAL-RT®, and Typhoon Hil®. Using the CE-LVA1 adapter, Conprove test sets play a crucial role in amplifying low-level signals generated by the simulators, allowing them to be adapted to the devices under test, especially in electrical power system simulations.

Furthermore, the flexibility of Conprove amplifiers, which can be used both in parallel and individually, offers a robust solution for simulations involving high levels of short circuits. Additionally, the device, which can be installed in racks or transported portably, provides a significant advantage in terms of mobility and adaptability to different test environments.

Therefore, Conprove has established itself as a reliable and innovative option for companies and professionals seeking to improve the quality and accuracy of their tests in energy system simulations, ensuring safer and more consistent results for industrial and research applications.



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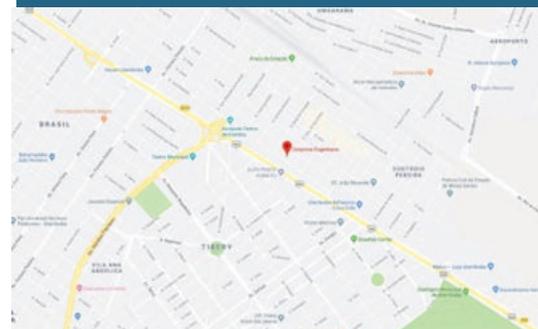
Since 1984

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Since 1984, CONPROVE has been working in the area of testing and training solutions for power system. This pioneerism has placed us in a leading position in the market for electrical tests in Brazil. We have state-of-the-art products and innovative softwares that allow the application of primary and secondary tests, included in a single equipment. All our solutions have led us to conquer a portfolio of renowned clients covering the transmission, generation and distribution of electric power, industries, service providers and universities. With the purpose of helping our clients and strengthening partnerships, CONPROVE offers the best after sales with a team of highly qualified professionals and modern structure.

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