



F6150



POWER SYSTEM SIMULATOR for Testing Protection Relays and Schemes

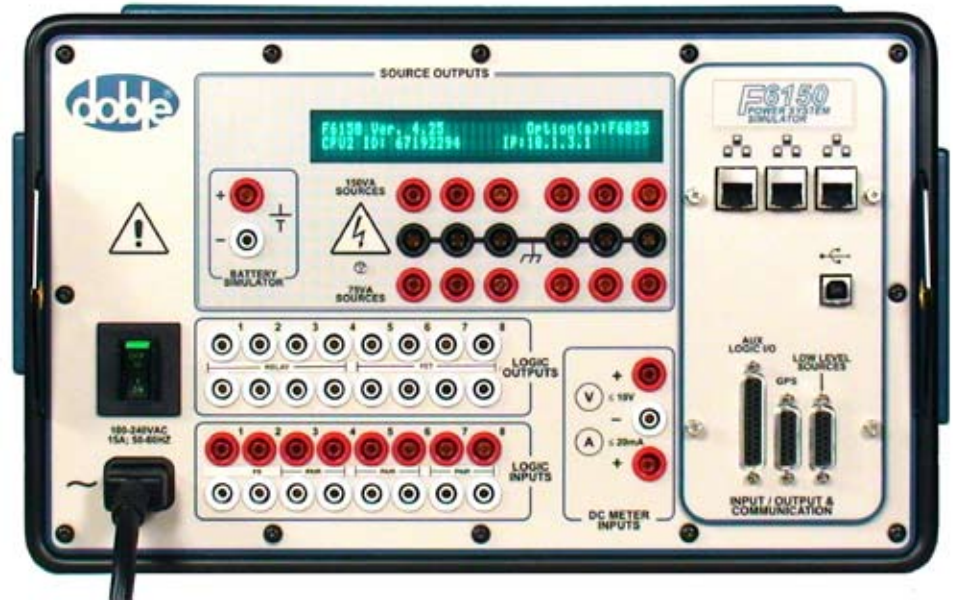


Everything you need for protection scheme testing

The F6150 is the only instrument with the high power, flexibility and software to perform full simulation tests on all types of relays as well as entire protection schemes.

It's a single-box solution used by protection engineers worldwide to ensure protection system performance and reliability for 1A and 5A protection.

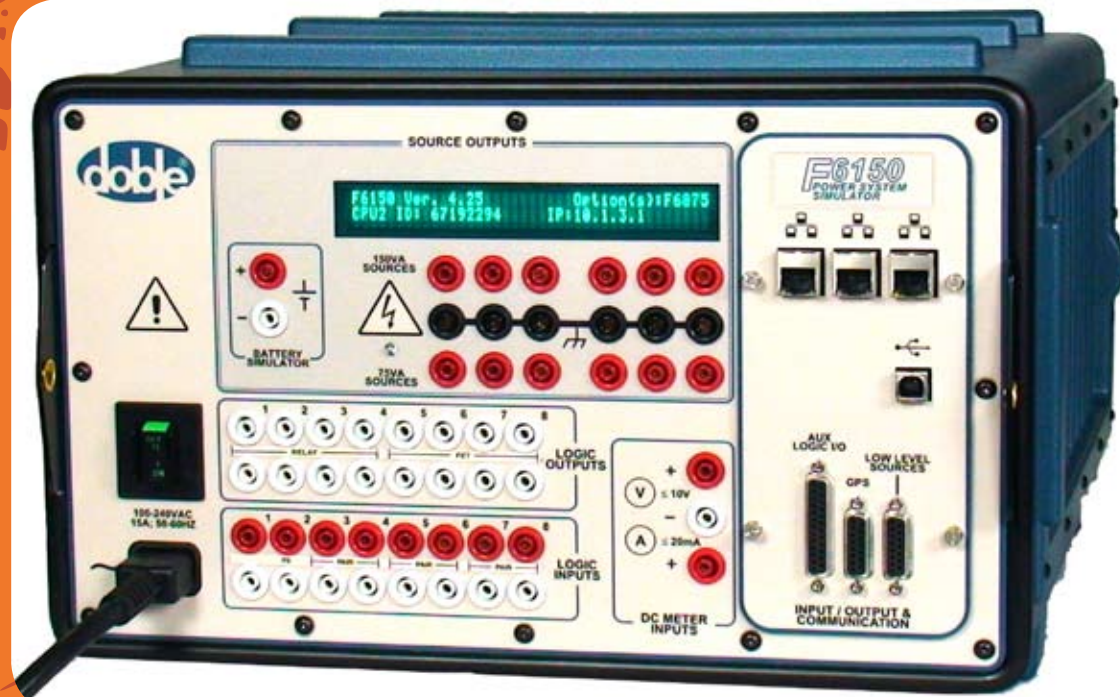
TOGETHER WE POWER THE WORLD®



If you only test relays, you're not testing enough.

The relay scheme is one of the most critical components for the effective operation of your power grid. Yet most test instruments do not actually test the protection scheme – they test only the individual relays. And testing individual relays in a protection scheme does not guarantee the proper functioning of the complete scheme.

At Doble Engineering, we believe the only true test is to evaluate your protection relays and scheme performance in their environment, using simulated power system signals and events. That's why we created the F6150 Power System Simulator. More than 9,000 F-Series test instruments are in use around the world ensuring that electric utilities keep the lights on for their customers.



The F6150:

The total test solution for protection schemes.

The F6150 is the only instrument with the high power, flexibility and sophisticated software to run full simulation tests on your relays and protection schemes. It provides everything you need in a single, field-rugged, portable box.

It can test everything from a single high burden electromechanical earth/ground fault relay, to complete modern multi-function numerical microprocessor protection schemes without the need for additional instruments. It can perform steady state, dynamic state and transient simulation tests. The F6150 can even be used for synchronized end-to-end, protection scheme tests using Global Positioning System technology to synchronize remotely located F6150s.

No other instrument provides the range of test applications of the F6150. And no other instrument can ensure the effectiveness of your overall system protection schemes. And the F6150 Power System Simulator is supported by Doble Engineering, the leader in test and diagnostic instruments. Why choose anything less?

A COMPLETE range of tests.

In a single, VERSATILE instrument

The F6150 Power System Simulator uses state-of-the-art digital signal processing and power amplifiers to deliver a high power, lightweight simulator for all protection testing applications.

It's the only instrument that can test the full range of protection schemes, electromechanical, numerical and combinations of all types. With the F6150, you can easily run a wide variety of tests to determine whether your relays are detecting signals properly, communicating correctly, and responding appropriately to power system events.

In addition, with its high accuracy output, the F6150 can be easily applied to calibration testing of transducer and energy metering applications including meters rated at 0.2 Class.

True power system simulation: It's a matter of power

Some vendors claim their instruments do power system simulation testing. But when you look closely at specifications these instruments lack a fundamental requirement: Test Power!

In order to run full simulations on all types of relay schemes – microprocessor, electromechanical or a mixture – you need an instrument that can generate high test power and provide flexible configurations for many types of tests. The F6150, with its high power rating and built-in configuration flexibility, is the industry's only true single-box solution for simulation testing of all relay protection schemes.

12 sources for test versatility

The F6150 is the only instrument that allows dynamic state testing and transient simulation testing using 12 independently controlled sources in a single instrument to test any type of protection scheme. In addition, there are other Doble complimentary simulation software that help relay engineers generate dynamic state simulation data and Comtrade compliant transient data very quickly and easily.

A database of test results that grows with you

The F6150 software suite includes a powerful database capability that lets you build your knowledge of protection schemes over time. You can compare present with past results, track protection scheme performance over time, even evaluate the impact of proposed design changes to your grid and protection relays. Our team of experts can assist you with the database capabilities of the F6150 software, and help you evaluate and interpret your test results.

Even tests that are difficult to perform with other instruments are simple with the F6150. For example:

- Ground overcurrent relay are typically difficult to test due to low tap settings and high burden. Using multiple current ranges, the F6150 delivers high power at low current to meet this challenge.
- Relay schemes such as overcurrent and distance protection require testing at 20 to 30 times the nominal secondary current value. The F6150 delivers 180 A at 675 VA to meet virtually all high current test requirements.

The power of the F6150: Why trust your critical protection to anything less?

Testing high impedance electromechanical relays is a challenge for any test instrument, especially if you are using an overcurrent electromechanical relay to detect ground or earth faults. You know it is the most critical and sensitive protection on the system. Ground overcurrent relays are the ones you rely on the most to detect a high resistance fault on the system when everything else fails. How do you ensure that your ground overcurrent relay is working correctly?

Here's how: One instrument, multiple ranges at full test power

The F6150 is the only instrument with the high power necessary to test these ground overcurrent relays correctly. The unique design of the amplifier provides multiple current ranges and each range is capable of delivering full power. The amplifier delivers 1.5 A, 3.0 A or 6.0 A at 450 VA single phase, and when used in 3-phase mode it provides 0.5 A, 1.0 A or 2 A at 150 VA. No other instrument is capable of delivering such high power at low current ranges.

Testing overcurrent relays at high per-unit currents determines performance under actual system conditions. For 5 Amp relays this means you need the instrument to deliver 150 to 175 Amps. The F6150 current amplifier with its multiple range feature is able to deliver 180 A at 675 VA for 1.5 Seconds.

To meet this challenging requirement the F6150 is the only instrument which allows relay engineers to test any type of relay from 0.5 A to 180 A at a high power.

Others promise. The F6150 delivers.

Other instruments claim to test all relays but cannot deliver the power required to test the protection scheme. That's why relay engineers worldwide rely on the F6150. With its multiple ranges and high power, the F6150 is the only instrument in a single compact package that can test any relay irrespective of type and model.

The F6150 lets you evaluate your protection relays and schemes in their environment, using simulated power system conditions and events. No other single-box solution can equal the F6150's test capabilities.

Exceptional test flexibility

Six independently controlled direct coupled sources, each rated at 150 VA, provide more than 100 user-selectable test configurations to match any test requirement. Each source can be configured as two independent 75 VA sources. This configuration provides 12 sources. This configuration is used for the back-to-back testing of a complete line protection scheme.

Easy to use

PC interface (Ethernet or USB communications) and software for steady state, dynamic state, and transient testing. All sources can be controlled from a PC for easy configuration for each test.

Field-rugged design

Rugged construction and proven state-of-the-art design provide laboratory accuracy with uncompromised field performance.

Lightweight, portable

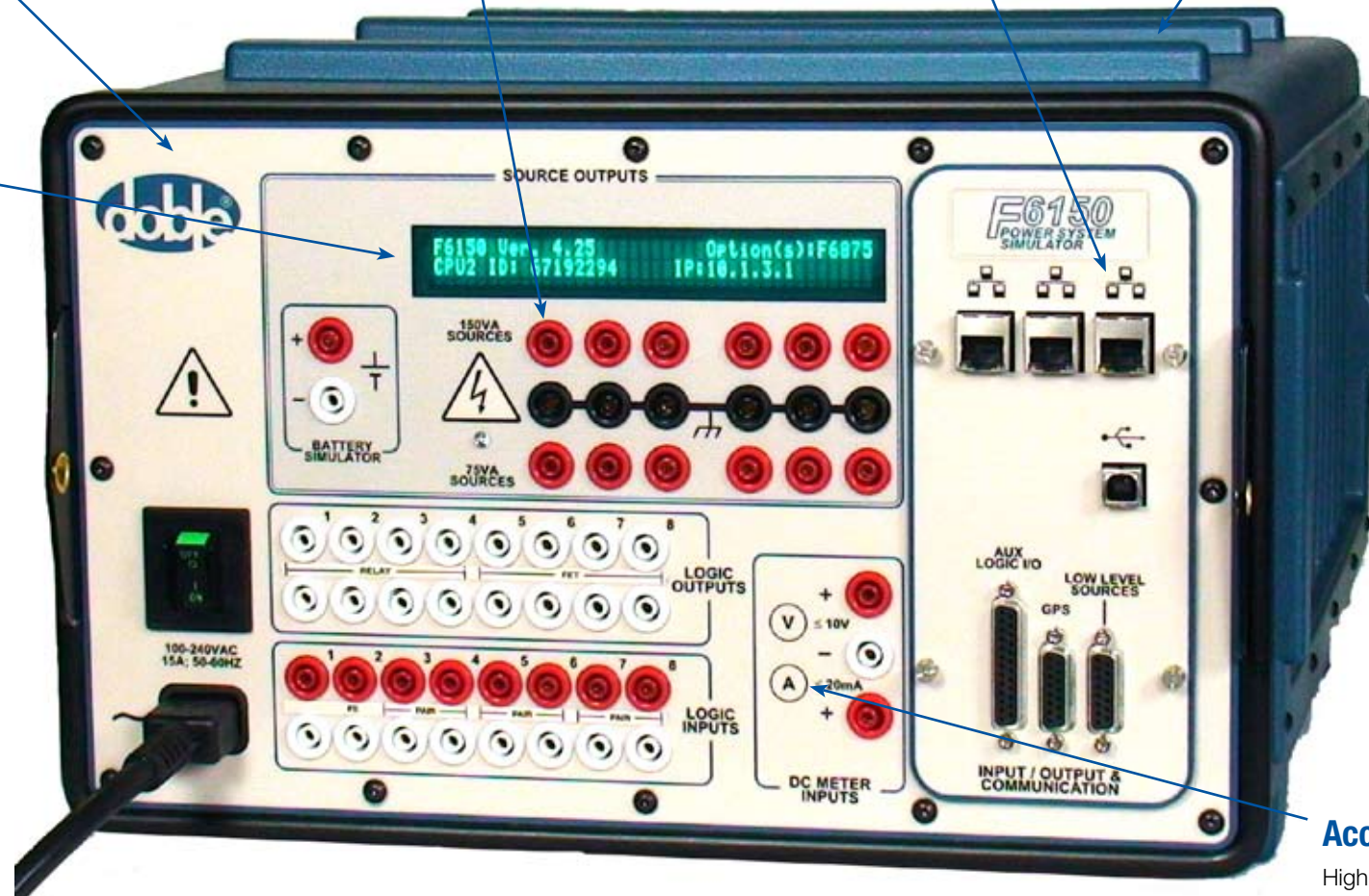
At less than 37.5 lbs /17 kg, the F6150 is the only single-box solution capable of delivering high power with flexible test configurations.

Automated operation

Automated procedures and standard test templates save time and ensure consistent test methods.

Front panel display

Indicates active voltage/current amplitudes and phase values during testing.



Accurate meter testing

High-precision measurements for energy meter and transducer testing.

End-to-end testing. Because you need to be certain.

The F6150 with GPS satellite synchronization allows you to conduct an end-to-end test under simulated power system conditions. You can now evaluate how your overall protection system operates, dramatically increasing confidence in the reliability and proper operation of the entire protection scheme, end-to-end including all communications.

Are there gaps in your protection testing?

Traditional steady state testing can only test each individual component of a system, which does not tell you how the entire system behaves under true power system conditions. This leaves many uncertainties in performance and, as protection engineers know, misoperations do occur.

The F6150 with satellite-synchronized transient testing provides the closest simulation to true power conditions available. It provides a more uniform, complete scheme test that significantly reduces testing time and gives you more accurate, reliable test results. You can confirm the configuration, settings and correct operation of the protection scheme. And since the test results describe how the relay scheme operates under actual power system conditions, the test data can be used to help evaluate future relay operations.

End-to-end testing made simple

With the F6150, end-to-end satellite synchronized testing is very simple and easy. There's no elaborate test set up, and all the required software is in the F6150 instrument. Only a GPS antenna with an access to open sky is required. If access to the sky is not possible, you can use the optional F6050 high precision time synchronizer unit which simulates a GPS signal. So no matter where you are, you can easily perform state-of-the-art end-to-end tests.

Testing of IEC61850-Compliant Devices

The Doble F6150 Power System Simulator is certified by KEMA as being compliant with IEC 61850 communications protocol.

Add the options you need to complete your system

Doble provides several options for expanding your F6150 so you can configure it to fit your needs exactly. These options include:

F6910 Simulator Control and Automation Module Enables the F6150 to communicate with automated test software applications like ProTesT and F6TesT.

F6800 Transducer Interface Enables the instrument to test energy meters and transducers with highest accuracy. Includes meter measurement studio software.

F6810 High Power Convertible Voltage/Current Sources Provides high compliance voltage/low current ranges for overcurrent relay testing. Enables testing of older, high burden electromechanical and all 1 Amp protection.

F6300 High Current Source Provides six 150 VA (0-30 A) high current sources. When used with F6150, the complete system provides three 450 VA current sources (0-90 A) or three 675 VA current sources (0-180 A) for 1.5 seconds for dynamic state or transient testing of the protection scheme. The F6150 plus F6300 combination can also provide nine 150 VA current source (0-30 A) or 9*225 VA (0-60A for 1.5 seconds) current sources for dynamic state or transient testing of three winding transformer differential protection.

F6860 Support for IEC 61850 GSE This option allows testing of IEC 61850 IED's with ease through an user friendly interface.

GPS Options

F6885 Global Positioning System (GPS) Receiver Interface Enables the GPS Receiver Interface Input on the F6150. Requires connection to the F6895 GPS Antenna or F6050 GPS universal time synchronization.

F6895 Global Positioning System Receiver and Antenna Provides GPS signal and information to the F6150. Requires access to an open sky.

F6050 GPS Universal Time Synchronizer Allows test engineers to perform end-to-end tests if access to a GPS satellite is not available for the duration of the test, such as in underground substations. The F6050 is first synchronized with the GPS satellite, then locks the internal high-precision crystal to the GPS signal and accurately reproduces this signal for the next 8 hours. The error between the actual GPS signal and the one generated by the F6050 is within +/-10 microseconds good over an 8 hour period on a fully charged built in battery back up. Visual indication of errors exceeding the specification, low battery charge or GPS signal availability is indicated on the user interface. The F6050 is housed in a small field portable package.

Choose the software modules that work the way YOU test.

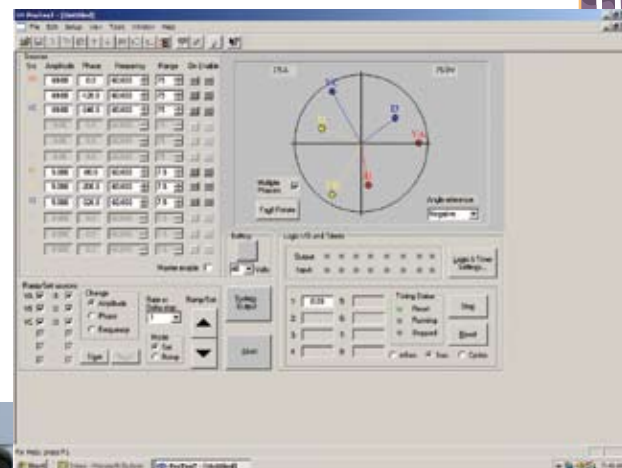
Doble's user-friendly software suite for the F6150 makes it easy for test engineers to perform everything from routine characteristic checks to dynamic state and transient simulation tests. And by using automated procedures and standard test templates, the F6150 software suite saves time and ensures consistent test methods.

Several software modules are available. Choose the one that best fits your requirements.

F6 Control Panel – Simple to use, manual and interactive testing

This virtual front panel provides "point-and-click" control of all sources, inputs, outputs and timers. Operators can run a quick check of a protection scheme without an elaborate test plan.

- Automatically run Reach, Pickup and Dropout tests quickly, accurately, and without manual errors.
- Perform operating time tests for up to eight separate events.
- A graphical display shows real time voltage and current phasor relationships with "drag-and-drop" operation of each phasor.
- Automatically switch phasor values for all fault types without wiring changes.
- Test 3-phase protection like distance relays, for all types of faults, with the click of a button.



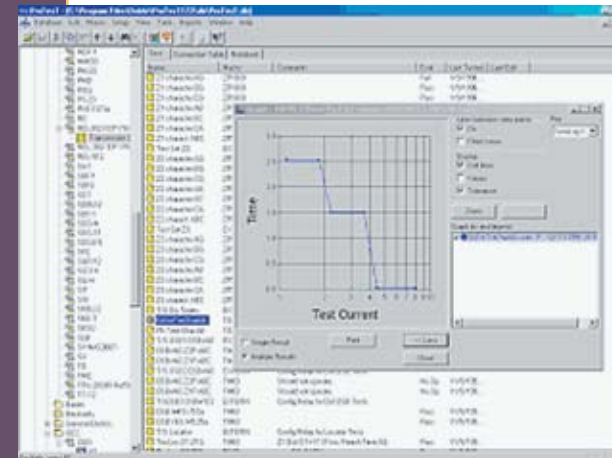
ProTesT™ software – Fully customized automated testing of all protection schemes

ProTesT is a comprehensive software solution for steady state, dynamic state and transient testing for relays and protection schemes. A graphical interface and over 50 customizable test templates allow users to create an automated test plan for every protection relay or scheme. It includes a powerful database and reporting capabilities.

- Steady-state calibration – Automates the testing of impedance, voltage, current and frequency relays using standard test templates.

• Dynamic-state simulation – Allows the assessment of a protection scheme performance under actual power system conditions. Evaluate relays for load flow, fault resistance, cross country faults, current reversals and other specific power system events.

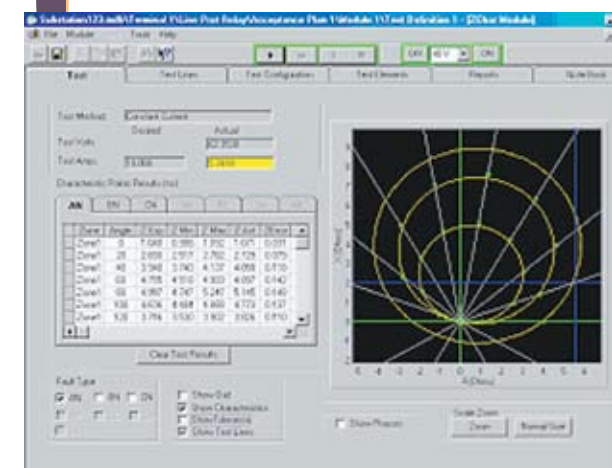
- Transient simulation – Controls playback of COMTRADE data for Transient Simulation tests. The high playback rate (10kHz) accurately simulates true power system events including dc and high frequency components.



Transducer and metering control panel



This graphical interface enables test engineers to quickly perform simple performance verification tests on all meters and transducers. It allows users to develop a library of automated tests based on their specific practices and test results.



F6TesT Preconfigured templates for automated testing

This module provides preconfigured graphical templates with a point-and-click interface for testing impedance, voltage, current and frequency relays. Easy-to-read displays show test plans and associated results for quick and easy evaluation of protection schemes and relays.

Overview of F6150 Technical Specifications

F6150 has been tested per all relevant ANSI and IEC Tests. For detailed listing please refer to F6150 Technical Specifications document

Input Power: 90-264 VAC
47-63 Hz

Source Configurations:
Voltage Source:
Power and Range: 3 x 150 VA 75, 150, 300 V
6 x 75 VA 75, 150 V

Each voltage source can be configured as a high power, low current range source to test high impedance ground/earth fault relays.

Power and Range: 3x150 VA 0.5, 1, 1.5 A
6x75 VA 0.5, 1 A
1x450 VA 1.5, 3, 6 A

Accuracy: < 0.02% typical

Current Source:
Power and Range: 3 x 150 VA 7.5, 15, 30 A
6 x 75 VA 7.5, 15 A
1 x 450 VA 7.5, 15, 22.5, 30, 45, 90 A

Accuracy: < 0.02% typical

Each current source can be used in a transient mode which provides 50% more power at 2x current range.

Phase Angle: 0 to +359.9° (Lead)
0 to -359.9° (Lag)

Accuracy: < 0.1° typical

Frequency:
Range: DC to 3 kHz
Accuracy: 0.5 PPM

Number of Logic Inputs: 8
Number of Logic Outputs: 8

Operating Temperature: 0° to 50°C / 32° to 122°F

Enclosure: High impact, molded, flame retardant ABS – meets National Safe Transit Association testing specification No. 1A for immunity to severe shock and vibration.

Dimensions: 15 x 9.5 x 18 inches
38 x 24 x 45.7 cm

Weight: 37.5 lb / 17 kg



All interconnecting cables, connectors and accessories required for application are supplied - in a rugged cable bag for field use.

World-Class Service and Support

Customer Service

The Doble team is available to assist you with service and support related to any Doble F Series products.

Contact Doble Engineering Company

Telephone +1-617-926-4900

Fax +1-617-926-0528

Email fserieshelp@doble.com

Doble also has a global network of authorized sales, service and support representatives—contact us for the location of the one nearest you.

Protection Applications Support

Doble's experienced team of Protection Application Engineers is available to provide telephone support, on-site training and guidance in the use of our equipment and software to maximize the benefits for our customers.

Protection User Group

All Doble customers using ProTesT protection test software are invited to participate in the Protection User Group (PTUG), which holds meetings each year in a number of locations around the world.

At the PTUG meetings, technical presentations are presented to inform users on the latest protection test techniques. Extensive hands-on training sessions are also offered to provide the opportunity for increasing proficiency in the use of our equipment. PTUG members are encouraged to provide feedback and recommendations to help direct enhancements of our Protection solutions to best meet our customers' challenging test requirements.

Members of the PTUG are provided access to the technical presentations made at recent and past PTUG Meetings. The PTUG facilitates the exchange of information and knowledge, and PTUG members directly benefit from sharing test experiences and solutions with their peers at these meetings and throughout the year. In addition, PTUG members are encouraged to participate in Doble's Client Committee on Protection, Automation Controls and Communications (PACC), which holds meetings twice a year.

Let Doble be your partner for the ongoing assessment and management of your important protection assets.



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TOGETHER WE POWER THE WORLD®

Doble is certified ISO 9001:2000
Doble is an ESCO Technologies Company