F6150SV

POWER SYSTEM SIMULATOR

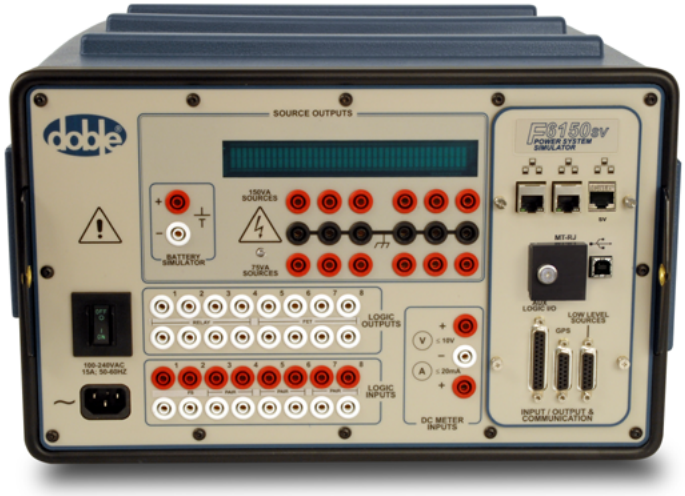
The Ultimate Tool for Protection Scheme Testing

TOGETHER WE POWER THE WORLD®

The F6150SV is your versatile, all-in-one solution for testing protection relays and schemes. Designed to meet your needs, the F6150SV is capable of performing the most simple through the most complex tests. Whether you need to test an individual component or test an entire scheme, the F6150SV is the proven solution to assess protection system performance for analog testing of 1A and 5A protection devices. Now with increased output power of amplifiers, the F6150SV offers IEC61850 testing, as well as Sample Value "Process Bus" and Station bus applications in one test set.

The F6150SV Features:

- IEC61850 testing with 3 packets of 9-2 LE communication protocol and station bus messaging - one fiber and one copper IEC61850 communication port
- Wi-Fi Capable
- Standard relay calibration and verification testing of High Burden and Microprocessor relays
- Increased amplifier power output and ranges (enhanced ratings)
- Protection scheme testing using State Simulation and Transient testing: powerful models made available in Protection Suite Software
- Metering at 0.2 class CTs and Transducers
- End to End testing of Communication Based Schemes with GPS time syncing
- 12 Source, (6-Voltage, 6 Current), configurable for Bench testing and proof of concept testing for complicated relaying schemes



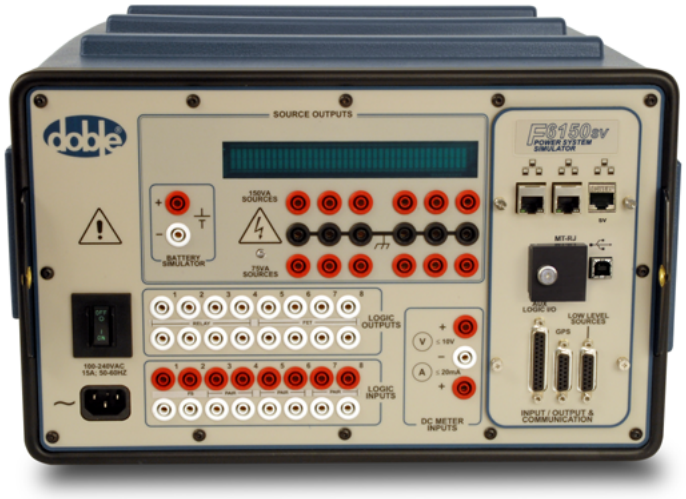
Benefits of the F6150SV

Evaluate your protection relays and schemes in their environment, using simulated power system conditions and events.

No other single-box solution can equal the test capabilities of the F6150SV.

Exceptional test flexibility

Six independently controlled direct coupled sources, each rated at 175 VA, provide more than 100 user-selectable test configurations to match any test requirement. Each continuous current source can be configured as two independent 87.5 VA sources for a total of 6 current sources.



Field-rugged design

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

Convenient panel display

Front panel display indicates active voltage/current amplitudes and phase values during testing.

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. Includes fiber optic and copper IEC61850 communication ports.

Accurate meter testing

High-precision measurements for energy meter and transducer testing.

F6150SV Enchanced Ratings

Enhanced Ranges AC	Enhanced Ranges DC	Enhanced Power
6 X 8.75, 17.5 A rms (L-N)	6 X 5.83, 11.6 A dc	6 X 87.5VA / 87.5 W
3 X 8.75, 17.5, 35 A rms (L-N)	3 X 5.83, 11.6, 23.3 A dc	3 X 175VA / 175 W
1 X 17.5, 26.25, 35, 52.5, 70, 105 A rms (L-N), S1 S2 S3	1 X 5.83, 11.6, 35,70 A dc S1 S2 S3	1 X 525VA / 525 W

Enhanced Transient Ranges AC*	Enhanced Transient Ranges DC*	Enhanced Transient Power*
6 X 8.75, 17.5, 35 A rms (L-N)	6 X 5.83, 11.6 A dc	6 X 131.25VA / 131.25 W
3 X 8.75, 17.5, 35, 70 A rms (L-N)	3 X 5.83, 11.6, 23.3 A dc	3 X 262.5VA / 262.5 W
1 X 17.5, 26.25, 35, 52.5, 70, 105, 210 A rms (L-N), S1 S2 S3	1 X 11.6, 22.3, 35, 46.7, 70, 140 A dc S1 S2 S3	1 X 787.5VA / 787.5 W

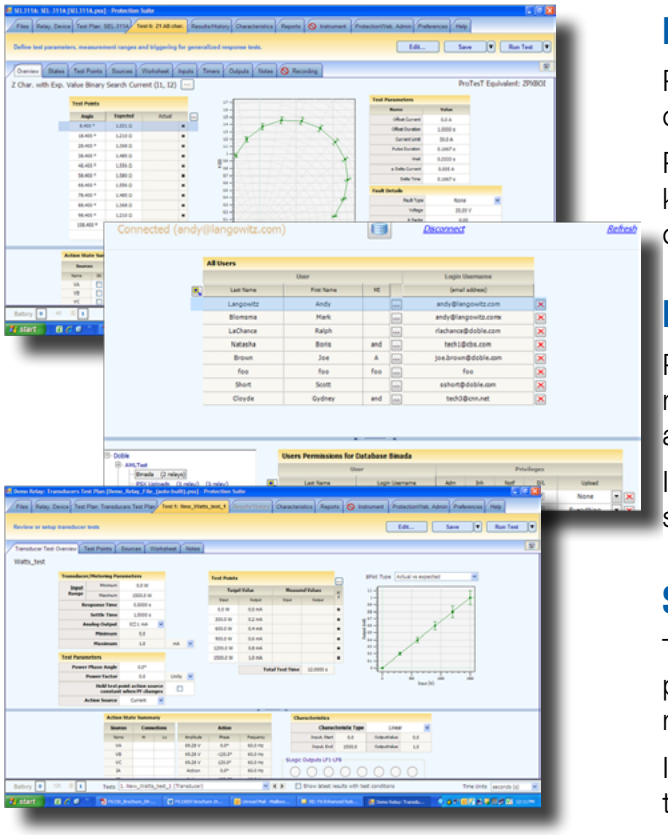
* Times of longer than 1.5 sec are possible; cooldown time applied by software

Protection Suite Solutions

Protection Suite and F6Test are robust software programs for reliable, computer-based protection testing that is PRC-005 compliant.

Protection Suite and Protection Web

Protection Suite and Protection Web work together to form a file based management system for the field testing and administrative control of all relay testing.



Protection Suite

Protection Suite is a technician's control system to test and check complicated relaying schemes.

PRC-005 compliant testing can be performed and all records kept electronically and stored via Protection Web on your company's server for ease of NERC reporting and auditing.

Protection Web

Protection Web is a server based application that collects and manages test results and reporting features tailored to NERC auditing and compliance.

It is also used to assign administrative users and privilege settings. Host on your company's network or on a Doble server.

Spotlight: Transducer and Meter Control Panel

This graphical interface enables test engineers to quickly perform simple performance verification tests on Class 0.2 metering and transducers.

It allows users to develop a library of automated tests based on their specific practices and test results.

F6Test - Visual Testing Software

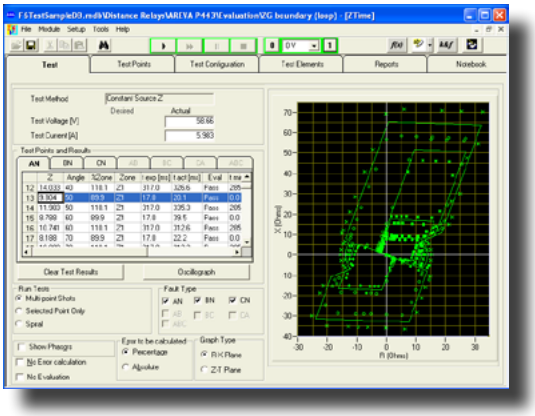
F6Test is a highly-automated and graphical testing solution for all protection testing.

Complex multi-zone distance relays and differential characteristics are easy to test with a point-and-click interface.

The test modules are based on state simulation providing a realistic dynamic test.

Other functions like power swings are tested graphically with automatic generation of transient oscillation and fault conditions with the WaveSim module.

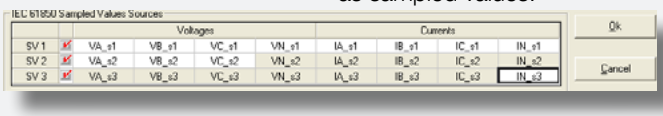
A versatile state simulation module allows testing of advanced protection schemes.



Spotlight on IEC61850 Testing with F6Test and the F6150SV

F6TesT supports the F6150SV power system simulator for testing IEC61850-based systems using process bus sampled values (per IEC61850 9-2 LE guidelines) and generic substation events (GSE) messages.

- F6Test offers easy configuration of sampled value streams with up to 24 currents and voltages.
- It also allows testing in mixed mode using a combination of conventional voltages and currents as well as sampled values.



Customize your Protection Testing

Doble provides several options for expanding your F6150SV so you can configure it to exactly fit your needs. These options include:

- F6910 Simulator Control and Automation Module
- F6800 Transducer Interface
- F6810 High Power Convertible Voltage/ Current Sources
- F6300 High Current Source
- F6860 Support for IEC61850 GSE
- F6885 Global Positioning System (GPS) Receiver Interface
- F6895 Global Positioning System Receiver and Antenna
- F6820 AIM Option

Expert Help When You Need It

With a Doble Services Agreement you have access to valuable resources and tools to enhance your protection and control testing.

Services agreements include:

- Test plan consulting from Doble's application engineers
- Product support
- Annual on-site training customized for your team
- Doble Client Committee membership
- Client Conference invitation
- Software upgrades
- Doble Portal access and more
- fserieshelp@doble.com for answers from Doble's Protection experts

Doble Knowledge is Power

Doble customers using Doble's protection test software are invited to participate in the International Protection Testing Users Group (PTUG), which is a venue for relay protection engineers and technicians to exchange ideas and new techniques for testing relays. PTUG meetings are held throughout the world.

Service Agreement clients are encouraged to participate in Doble's Client Committees, including the committee on Protection, Automation Controls and Communications (PACC).

Client Committees review topics of greatest interest and concern, share service advisories, best practices and lessons learned. Participation is limited to representatives from utility, industrial or testing companies to facilitate open discussion without the presence of manufacturers.

Committees meet twice a year at the International Conference of Doble Clients and the Client Committee Meetings. Join the conversation.

TOGETHER WE POWER THE WORLD®

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Doble is an ESCO Technologies Company

MKT-SL-F6150SV-03/12

F6150sv
Technical Specifications

CONVERTIBLE AMPLIFIERS				
Current Mode				
Convertible Source AC Ranges	**Convertible Source DC Ranges**	**Power**	**Resolution AC Ranges**	**Resolution DC Ranges**
6 X 0.5, 1.0 A RMS (L-N)	6 X 0.354, 0.707 A DC	6 X 75VA / 75 W	0.0001 A	0.0001 A
3 X 0.5, 1.0, 2.0 A RMS (L-N)	3 X .354, 0.707, 1.41 A DC	3 X 150VA / 150 W	0.0001 A	0.0001 A
1 X 1.5, 3.0, 6.0 A RMS (L-N) S1 ‖ S2‖ S3	1 X 1.06, 2.12, 4.24 A DC S1 ‖ S2‖ S3	1 X 450VA / 450 W S1 ‖ S2‖ S3	0.001 A	0.001 A
Current Transient Mode				
Convertible Source AC Ranges	**Convertible Source DC Ranges**	**Power**	**Resolution AC Ranges**	**Resolution DC Ranges**
6 X 0.75, 1.5 A RMS (L-N)	6 X 0.53, 1.06 A DC	6 X 97.5VA / 97.5 W	0.0001 A	0.0001 A
3 X 0.75, 1.5, 3.0 A RMS (L-N)	3 X 0.53, 1.06, 2.12 A DC	3 X 195VA / 195 W	0.0001 A	(0.0001 A) @ 0.53, 1.06 A DC (0.001 A) @ 2.12 A DC
1 X 2.25, 4.5, 9.0 A RMS (L-N) S1 ‖ S2‖ S3	1 X 1.59, 3.18, 6.36 A DC S1 ‖ S2‖ S3	1 X 585VA / 585 W S1 ‖ S2‖ S3	0.001 A	0.001 A
Voltage Mode				
Convertible Source AC Ranges	**Convertible Source DC Ranges**	**Power**	**Resolution AC Ranges**	**Resolution DC Ranges**
6 X 75, 150V RMS (L-N)	6 X 106, 212V DC	6 X 75VA/ 75W	0.01 V	(0.01 V) @ 106V DC (0.1 V) @ 212V DC
3 X 75, 150, 300V RMS (L-N)	3 X 106, 212, 424V DC	3 X 150VA / 150 W	0.01 V	(0.01 V) @ 106V DC (0.1 V) @ 212, 424V DC
1 X 150, 300, 600V RMS (L-L) S1 & S2	1 X212, 424, 848V DC S1 & S2	1 X 300VA / 300 W S1 & S2	0.01 V	0.1 V DC

ENHANCED CURRENT AMPLIFIERS				
AC Ranges	**DC Ranges**	**Power**	**Resolution AC Ranges**	**Resolution DC Ranges**
6 X 8.75, 17.5, (35)* A RMS (L-N)	6 X 5.83, 11.7, (23.3)* A DC	6X 87.5VA / 87.5 W; (6 X 131.25VA /131.25 W)*	0.001 A	(0.001) A @ 5.83 A DC (0.01) A @ 11.6, (23.3)* A DC
3 X 8.75, 17.5, 35,(70)* A RMS (L-N)	3 X 5.83, 11.7, 23.3,(46.6)* A DC	3 X 175VA / 175 W; (3 X 262.5VA /262.5 W)*	(0.001) A @ 8.75, 17.5, 35 A RMS (0.01) @ (70)* A RMS	(0.001) A @ 5.83 A dc (0.01) A @ 11.7, 23.3, (46.6)* A DC
1 X 8.75, 17.5, 26.25,52.5, 105, (210)* A RMS (L-N) S1 ‖ S2‖ S3	1 X 5.83, 11.7, 17.5, 35,70, (140)* A DC S1 ‖ S2‖ S3	1 X 525VA / 525 W; (1X787.5VA/787.5 W)* S1 ‖ S2‖ S3	(0.001) A @ 8.75, 17.5, 26.25 A RMS (0.01) A @ 52.5, 105, (210)* A RMS	(0.001) A @ 5.83 A DC (0.01) A @ 11.7, 23.3, 35, 70, (140)* A DC

* Maximum power delivered at high source range

AC Amplitude Accuracy @ 50-60 Hz @ 20° - 30° C		Phase Angle @ 50/60 Hz			Frequency		
Typical	**Guaranteed**	**Range**	**Accuracy**	**Resolution**	**Bandwith**	**Range**	**Resolution**
0.02% of reading + .01% of range	0.09% of reading + .04% of range	(+359.9°) -(0°) - (-359.9°)	± 0.25°	± 0.1°	DC - 3kHz at Full Power	DC, 0.1 Hz - 2.0 kHZ Continuous Full Load	0.001 Hz
Convertible Source in Current Mode @ 20° - 30° C		Distortion @ 50/60Hz V & I Sources Total Harmonic Distortion (THD)			**Accuracy**		
Guaranteed		**Typical**	**Guaranteed**		**Typical**	**@ 20° - 30° C**	**@ 0° - 50° C**
<0.5%		<0.02%	<0.1%		0.5 ppm	1.5 ppm	10 ppm

F6150sv
Technical Specifications

Logic Inputs (Voltage or Contact Sense)	
Total Inputs:	8*
Isolated Inputs	
Inputs:	2 (First Strike)
Voltage Sense:	250V RMS AC / 300V DC
Open Circuit Test Voltage:	12V DC
Short Circuit Test Current:	20mA DC
Response Time:	0.1 msec max pickup /dropout
Input Impedance:	150KΩ
Isolation:	± 500V peak
Paired Inputs	
Inputs:	3 Pairs (6)
Voltage Sense:	250V RMS AC / 300V DC
Open Circuit Test Voltage:	4V DC
Short Circuit Test Current:	>50mA DC
Response Time:	0.1 msec max pickup /dropout
Input Impedance:	150KΩ
Isolation:	± 500V peak

* Additional 8 inputs available with F6816 option

Logic Outputs		
Type:	FET (High Speed Electronic)	Relay
Number:	4	4
Isolation Voltage:	±500V peak	±500V peak
Response Time:	0.1millisecond pick up /dropout	<10 millisecond pick up /dropout
Maximum (Make/ Break Current):	0.5 amps	(Breaking cap AC: 2000 VA with Vmax 250V, Imax 8 A) (Breaking cap DC: 50W with Vmax 300 V, Imax 8A)
Input Voltage:	250 V RMS	250 V RMS

Metering Functions	
DC Meter Inputs	
Input Range:	0 - ±10V DC / 0 - ±20mA DC
Typical:	<0.003%
Guaranteed:	<+0.05%
AC Sources	
Typical:	<0.02% of metering loads
Logic Input As Counters	
Frequency:	10 kHz
Pulse width:	>175 µsec

Variable Output Battery Simulator	
Range:	6 - 300V DC
Resolution:	0.3V
Power:	90 W, 1.5 A max
50/60 Hz Ripple:	<0.2% of Range
Accuracy:	<± 5%

(AIM) Analog Input Measurement (F6820 Option)	
Recording:	8 external Analog or Digital Signals
Internal Source recording:	12 Sources
Ranges:	250 mV, 2.5V, 25V, 250V RMS
Bandwidth:	DC, 0-5kHz
Input Impedance:	150KΩ
Max Input Voltage:	250V RMA AC / 300V DC
Isolation:	± 500V peak channel to channel
Accuracy	
Typical:	±0.06%
Maximum:	±0.15%
Timing and Trigger	
Timers Number:	8
Max Recording Time:	<24 Hours
Accuracy:	±0.0005% of reading, ±50 µsec
Resolution:	100 µsec

General Specifications							
Enclosure:	High-impact, molded, flame-retardant ABS- meets National Safe Transit Association testing specification No.1A for immunity to severe shock and vibration	**Environmental:**	IEC 60068-2-2 Dry Heat (+85°C storage; + 50°C Rating Operating), IEC 60068-2-1 Cold (-50°C storage; 0°C operating), IEC 60068-2-30 Damp Heat (+55°C, 6 cycles, 95% humidity), NEMA Enclose Rating Type 1IEC Enclosure IP20	**Electrostatic Discharge Immunity:**	IEC 801-2 I.E.C. performance level 1 @ 10kV: normal performance within specifications. I.E.C. performance level 2 @ 20kV: no permanent damage.	**IEC61850 GOOSE:**	Certified by KEMA as being compliant with IEC61850 protocol (IEC61850-7-2 and 8-1)
Mechanical:	IEC 60068-2-27 Shock (15g/11ms, half sine) IEC 60068-2-6 Vibration (10-150 Hz, 20m/s2) IEC 60068-2-6 Drop Test	**EMC Emissions:**	FCC 47 CFR Part 15 Class A (USA), EN55011:1998/A1:1999/ A2:2002 Group 1 Class A ISM(EU), AS/NZS CISPR 11:2004 Class A ISM (Australia), ICES-001 Issue 3 ISM (Canada)	**Surge Withstand Capability:**	ANSI/IEEE c37.90. The simulator functions as a source during surge withstand capability tests, when the ANSI/IEEE specified isolating circuit is interposed between the simulator and the test relay.	**IEC61850 Sample Values (Publishing):**	80 samples per cycles for nominal frequencies 50Hz and 60Hz using GPS time synchronized signals
Weight:	42lb,19.05kg (front cover and strap included)	**EMC Immunity:**	EN 61000-6-2:2005; IEC 61000-4-2/3/4/5/6/11	**Line Power Supply:**	105-264V, 47-63 Hz	**Communication Interfaces (Ethernet, Wi-Fi, USB)**	Ethernet or USB control to PC, Wi-Fi (802.11 B+G bands, 30 - 80ft, 9 - 24m)
Dimensions:	15 X 9.5 X 18 inches, 38 X 24 X 45.7 cm	**Quality Assurance Management System:**	Third Party certification to ISO 9001:2000	**Safety:**	EN 61010-1; UL 61010-1; CSA 27.2 # 61010-1		
Calibration:	Certification traceable to N.I.S.T. standards	**Humidity:**	Up to 95% relative humidity, non-condensing				

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