GE Energy

SVERKER 750™
SVERKER 760™

Relay Test Unit
Programma® Products

GE imagination at work

SVERKER 750™/760™

Relay Test Unit

The Sverker 750/760™ Relay Test Unit is the engineer's toolbox. The control panel features a logical layout, still SVERKER 650™ users will find it comfortably familiar and will be able to start work right away.

The SVERKER 750/760™ features many functions that make relay testing more efficient. For example, its powerful measurement section can display (in addition to time, voltage and current) Z, R, X, S, P, Q, phase angle and cos φ. The voltmeter can also be used as a 2nd ammeter (when testing differential relays for example). All values are presented on a single easy-to-read display.

You can also test directional protective equipment efficiantly by means of the built-in variable voltage source. In SVERKER 760™ this has a continuous phase shift function as well. Automatic reclosing devices can also be tested – just as easily.

Designed to comply with EU standards and other personal and operational safety standards, SVERKER 750/760™ is also equipped with a serial port for communication with personal computers and the PC software SVERKER Win™. Since the compact SVERKER™ weighs only 18 kg (39 lbs), it's easy to move from site to site.

Two or more SVERKER™ units can also be synchronized, which for example allows the user to connect three SVERKER™ into a basic 3-phase test set.

Application

Relay Testing

SVERKER 750/760 is intended primarily for secondary testing of protective relay equipment. Virtually all types of single-phase protection can be tested.

SVERKER 750/760 is able to test three-phase protection that can be tested one phase at a time, and also a number of protective relay systems that require phase shifting. Moreover, automatic reclosing devices can be tested.

Examples of what SVERKER 750/760 can test:	IEEE® No.
Overcurrent relays	50/76
Inverse time overcurrent relays	51
Undercurrent relays	37
Ground fault relays	50
Directional overcurrent relays	67
Directional ground fault relays	67N
Overvoltage relays	59
Undervoltage relays	27
Directional voltage relays	91
Directional power relays	32
Power factor relays	55
Differential protection (differential circuits)	87
Distance protection equipment (phase by phase)	21
Negative sequence overcurrent relays	46N
Motor overload protection	51/86
Automatic reclosing devices	79
Tripping relays	94
Voltage regulating relays	
Overimpedance relays, Z>	
Underimpedance relays, Z	
Thermal relays	
Time-delay relays	

Other fields of application

- Plotting excitation curves
- Current and voltage transformer ratio tests
- Burden measurement for protective relay test equipment
- Impedance measurement
- Efficiency tests
- Polarity (direction) tests
- Injection
    Maintained
        Injection continues without any time limitation.
    Momentary
        Injection continues only as long as the button is kept depressed.
    Max. time
        Injection stops automatically when the preset maximum time is reached.
- Filtering
    When filtering is selected, five successive readings are averaged. The following can be filtered: Current, Voltage and Extra items that are measured.
- Off delay
    The turning off of generation can be delayed after tripping throughout a specified time interval that is expressed in mains-frequency cycles.

Application example

IMPORTANT!
Read the User's manual before using the instrument.

Testing the pick-up and drop-out (SVERKER 760)

1. Connect as shown in the diagram.
2. Select stop conditions, dry or wet contact.
3. Select **HOLD** to freeze the current reading.
4. Press button **SEL/Ⓐ** until you get a red light at the built-in ammeter. **Note!** Maximum allowed current through the separate ammeter used in this connection example is 6 A. The other measurement points do not have this limitation.
5. Press the **MODE** button.
6. Use the key ▼ to select Ω, φ, **W, VA...**
7. Press **CHG** (Change)
8. Select φ (°, **Iref**) or (°, **Uref**) by using the key ▼.
9. Press **SEL** (Select)
10. Press **ESC**
11. Set the voltage amplitude with the upper small knob.
12. Make sure the main knob is set to **0**.
13. Turn on the SVERKER output by activating **ON** using the start switch ▼.
14. Set the phase-angle. Use the lower knob for fine adjustment, and the middle knob for step of 90°. **Note!** A small current flowing in the circuit is required to measure the phase angle.

Testing the operation time

15. Increase the current to 1.5 times the pick-up value.
16. Invoke the ON+TIME state by means of the start switch. The outputs will now remain turned on until the protective relay equipment operates.
17. Read the time from the display. Check also the high current setting using the same procedure.
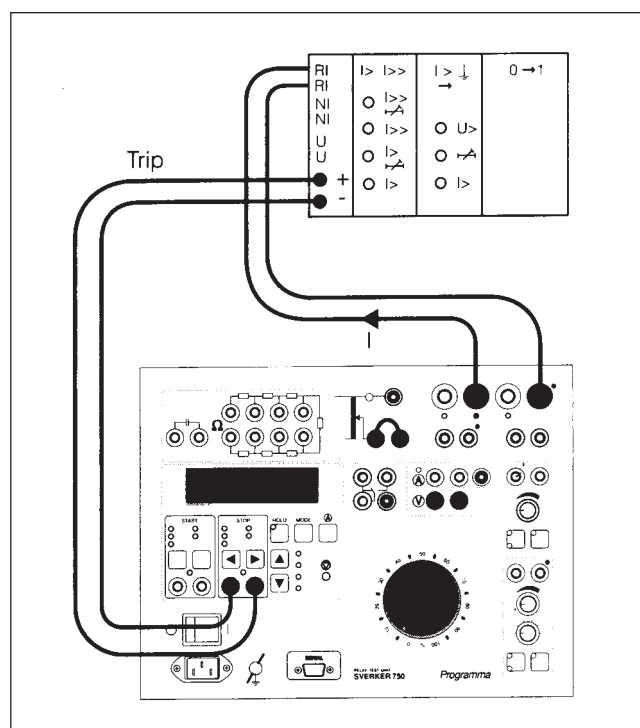
❶ Set of resistors
Fine regulation of current and voltage are easy thanks to the built-in set of resistors.

❷ Display
Presents time, current, voltage and other entities. Also used to make many setting, after you enter the setting mode by pressing button marked MODE.

❸ Freeze function (HOLD)
This makes it possible to measure voltages and current as short as a quarter of a mains-voltage period by immobilizing the reading on the display. Voltage and current readings are frozen when the timer stops. If the timer does not stop, the reading present when the current was interrupted is frozen on the display.

❹ Start and stop conditions
The timer's start and stop inputs respond to changes, voltage or contact closing/openings. The timer's start input is also used when testing auto-reclosing relays, to synchronize two or more SVERKER units and to start generation with an external signal.

❺ Status indicator
The timer's start and stop inputs are each equipped with indicator lamps which, when lighted, indicate a closed circuit (useful for detecting contact closings/openings) or the presence of voltage. These indicator lamps make it possible (for example) to check circuits before starting a measurement cycle.

❻ Timer inputs
The timer has separate start and stop inputs, and it can be used to measure both external cycles and sequences initiated by SVERKER. The measured time appears on the display. Each input can be set to respond to the presence or absence of voltage (AC or DC) at a contact.

❼ Start switch
Controls the turning on and off of the current source and timer. Can be set to one of four states. ON+TIME. Starts generation and timing simultaneously. Used to test over... relays (...means current, voltage or some other entity). Generation continues a) until the protective relay equipment operates and stops the timer or b) until the maximum time expires or the start switch is released if time-limited generation has been selected. OFF. Turns off the current source, whereupon generation is interrupted. ON. Turns on the current source in the generating state. OFF+TIME. Interrupts generation and starts the timer simultaneously. Used when testing under ...relays (...means current, voltage or some other entity). The timer is stopped

when the protective relay equipment operates. When automatic reclosing is to be tested, SVERKER an be set so that new generation will start when the timer's start input is activated by the closing command.

❽ Computer communication interface SVERKER is equipped with a serial port for communication with personal computers and the PC software Sverker Win.

❾ Make/break contact
Changes state automatically when a test is started. Can be used (for example) to synchronize two or more SVERKER units, other eternal equipment or to switch the voltage applied to the protective relay equipment back and forth between non-faulty and faulty.

❿ Current source
Provides 0-250 A AC, 0-250 V AC or 0-300 V DC, depending on the output that is being used. Settings are made using the main knob. The readings of current, voltage and other entities appear on the display. The start switch is used to turn the current source on and off. When time is being measured, this is done in synchronization with the timer.

⓫ Ammeter and voltmeter
Current and voltage are measured by the built-in ammeter and voltmeter. Resistance, impedance, phase angle, power and power factor can also be measured. Readings appear on the display. These instruments can also be used to take measurements in external

circuits. The voltmeter can also be used as a 2nd ammeter (when testing differential relays for example). Current and voltage can be displayed either as amperes and volts or as percentages of a given current or voltage (the present settings of the protective relay equipment for example).

⓬ Auxiliary voltage source
Provides 20-220 V DC in two ranges. Equipped with overload protection and separated from the other outputs. Used frequently to supply the object being tested.

⓭ AC voltage source
Intended primarily for use with voltage inputs to the protective relay equipment. Can provide 0-140 V AC and 0-359° phase shift (SVERKER 760). Since the AC voltage source is separated from the other outputs, it can be set independently of the current source.

⓮ Tripping indicator
Lights when a stop condition is fulfilled to indicate operation of the protective relay equipment. If the test being conducted incorporates timing, this indicator starts to blink when relay operation occurs.

⓯ Main knob
Used to set current output from the current source.

Optional accessories

CSU20A
Current and Voltage Source

CSU20A is a small light-weight current and voltage source primarily intended to work together with the SVERKER 750/760 Relay Testing Unit when testing differential relays. Using the CSU20A together with SVERKER 750/760 gives the user two independent current sources, and the timer/measurement section in SVERKER 750/760 is used both for measuring the two outputs as well as measuring the trip time of the relay.

Besides testing differential relays the unit can be used as a multi-purpose AC/DC source. The CSU20A features one AC current/voltage output, one fully rectified DC output and one half-wave rectified DC output for harmonic restraint testing.

Other features are a current measurement shunt, selectable current/voltage ranges and an AC mains input/output. Connecting the SVERKER 750/760 mains to the mains output of the CSU20A gives an in-phase synchronization of the two units.

PSS750
Phase Selector Switch

The PSS750 is specifically designed to work with SVERKER 750/760 when testing three-phase relays. It is connected between SVERKER 750/760 and the relay inputs and allows the user to easily select which phase to test.

The PSS750 handles both the current and voltage sources and single-phase or phase-phase testing can be selected. Together with the output-input switching the unit also contains a variable resistor that can be used together with the built-in capacitor in SVERKER 750/760. This feature gives the user the possibility to create a variable phase shift at a decreased amplitude of the test voltage.

The design is passive which makes it very general. You may for example use any of the inputs for current or voltage as long as you do not exceed the specification. It is also possible to connect the measuring inputs of the SVERKER 750/760 to the PSS750 and use the switch for selecting measurement signals.

The PSS750 simplifies phase switching, selecting type of fault, phase reversing and gives a possibility to create a variable phase shift.

Specifications CSU20A

Specifications are valid at nominal input voltage and an ambient temperature of +25°C, (77°F). Specifications are subject to change without notice.

Operating temperature	-20°C to +50°C (-4°F to +122°F)
Mains voltage	115 / 230 V AC, 50 / 60 Hz
Thermal protection	Built-in
Dimensions	280 × 178 × 246 mm (11" × 7" × 9.7")
Weight	5.9 kg (13 lbs) excl. transport case
Current measurements	Current shunt 0.1 A / 1 V, ± 2%

Output, AC

20 A setting	Output voltage (min)	Load time
Idle/non-load	26 V	Continuous
5 A	25 V	Continuous
10 A	22 V	Continuous
20 A	18 V	2 min
10 A setting	Output voltage (min)	Load time
Idle/non-load	52 V	Continuous
3 A	50 V	Continuous
5 A	47 V	Continuous
10 A	41 V	10 min

Output, DC

DC current	As above, less the voltage drop over the rectifying diodes

Specifications PSS750

Specifications are valid at nominal input voltage and an ambient temperature of +25°C, (77°F). Specifications are subject to change without notice.

Max input voltage	250 V AC / 3 A
Max input current	6 A / 250 V AC
Max resistor loading	200 V AC / 200 mA (0.5 A during 5 seconds)
Dimensions	200 × 120 × 85 mm (7.9" × 4.7" × 3.3")
Weight	1.3 kg (2.9 lbs)

CSU20A

PSS750

Application example

IMPORTANT!
Read the User's manual before using the instrument

1. Connect the current and voltage outputs of SVERKER 750/760 to the PSS750 inputs.
2. Connect the current and voltage inputs of the relay to the PSS750 outputs.
3. Select which phase to test and type of test (phase-to-ground or phase-phase) with the selector switch.
4. Proceed with the test for each phase and fault type.
5. To create a phase shift, connect the 10 μF capacitor in SVERKER 750/760 in series between the voltage output and the PSS750 input, and connect the variable resistor in parallel with the PSS750 input.
6. Set the SVERKER 750/760 for phase (and impedance) measurement. Connect the voltage measurement input to the PSS750 input.
7. Start the test with the resistor in maximum position. Gradually decreasing the resistor gives increasing phase shift in the voltage signal. The test voltage/impedance will decrease at the same time so an adjustment of the test current might be necessary to get the correct impedance. Please observe that the phase shift depends on the input resistance and may vary between different relays. Some relays may also have a low voltage limit where the relay will not operate. For additional 180 degrees phase shift use the phase reversal switch.

SVERKER Win
PC software for SVERKER 750/760

The SVERKER Win software makes fieldwork easier while providing neater reports. The SVERKER Win software enables you to control the SVERKER from a PC. The SVERKER is connected to the PC's serial port. Test results can be reported either directly with table and graph, or from an external program, e.g. Microsoft® EXCEL.

SVERKER Win enables customised reports in an easy way. Very useful are the reference graphs, together with the current/voltage graph presentation for each test point during the test. The graph can of course be printed out on the test report if you like.

A new feature is the ready-made current curves available for many relay types.

During relay testing, each measured value is stored in a log list. In this list you can add comments to each test point. When the entire test is finished, you can save everything as a data file. Later, you can print out the test results. You save time by not having to write your report in the field. All report writing can be done conveniently back at the office.

The SVERKER Win software provides easy access to connection instructions, test instructions and the like, which you prepare in advance. These instructions, which can contain both text and graphics, can be prepared using standard word processing packages.

The settings you make on SVERKER are also saved in a file, so that the next time you want to test the same or similar protective relay equipment, all you have to do in order to set-up the SVERKER, is to open the file.

Specifications SVERKER Win

The SVERKER Win software comprises a 32-bit program written to run under Windows® 95/98/2000/NT/XP. We recommend a Pentium® computer with at least 16 MB of RAM. The amount of space needed to save reports and settings will depend on how many protective systems that are to be tested. Roughly estimated, you will thus need a total of about 20-100 MB of free space on the hard disk. Languages in SVERKER Win are: Czech, English, French, German, Spanish and Swedish.
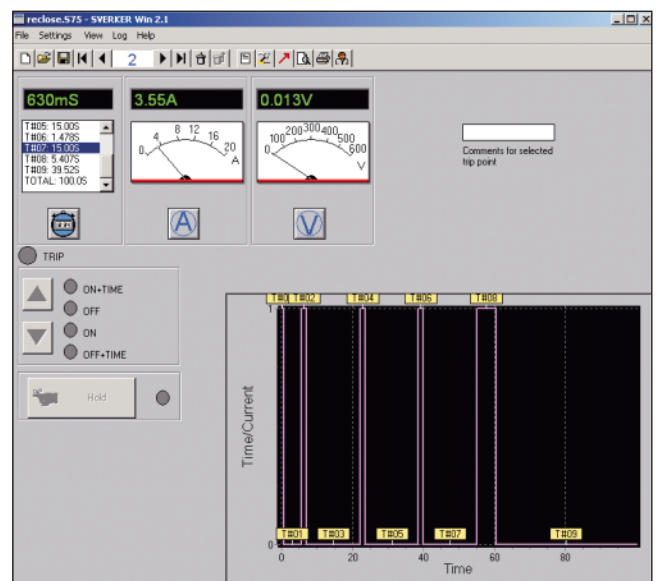
SVERKER Win

Specifications SVERKER 750 / 760

Specifications are valid at nominal input voltage and an ambient temperature of +25°C, (77°F). Specifications are subject to change without notice.

Environment

Application field	The instrument is intended for use in high-voltage substations and industrial environments.
Temperature	
Operating	0°C to +50°C (32°F to +122°F)
Storage & transport	-40°C to +70°C (-40°F to +158°F)
Humidity	5% – 95% RH, non-condensing

CE-marking

LVD	Low Voltage Directive 73/23/ EEC am. by 93/68/EEC
EMC	EMC Directive 89/336/EEC am. by 91/263/EEC, 92/31/EEC and 93/68/EEC

General

Mains voltage	115 / 230 V AC, 50 / 60 Hz
Power consumption (max)	1380 W
Protection	Thermal cut-outs, automatic overload protection
Dimensions	
Instrument	350 x 270 x 220 mm (13.8" x 10.6" x 8.7")
Transport case	610 x 350 x 275 mm (24.0" x 13.8" x 10.8")
Weight	
SVERKER 750	17.3 kg (38.1 lbs) 26.3 kg (58 lbs) with accessories and transport case
SVERKER 760	17.9 kg (39.5 lbs) 26.9 kg (59.3 lbs) with accessories and transport case
Test lead set, with 4 mm stackable safety plugs	2 x 0.25 m (0.8 ft), 2.5 mm^2 2 x 0.5 m (1.6 ft), 2.5 mm^2 8 x 2.0 m (6.6 ft), 2.5 mm^2
Test leads with spade-tonge connectors	2 x 3.0 m (9.8 ft), 10 mm^2
Display	LCD
Available languages	English, French, German, Spanish and Swedish

Measurement section

Timer

Time can be displayed in seconds or in mains-frequency cycles.

Range	Resolution	Inaccuracy
000-9.999 s	1 ms	±(1 ms + 0.01%)*
10.00-99.99 s	10 ms	±(10 ms + 0.01 %)*
100.0-999.9 s	100 ms	±(100 ms + 0.01 %)*

* For the OFF+TIME start condition in INT mode, 1 ms shall be added to the above measurement error.

Range	Resolution	Inaccuracy
0.0-999.9 cycles	0.1 cycles	±(0.1 cycles + 0.01%)
1000-49999 cycles at 50 Hz 1000-59999 cycles at 60 Hz	1 cycle	±(1 cycle + 0.01 %)

Ammeter

Measurement method	AC, true RMS DC, mean value

Ranges

Internal	0.00 – 250.0 A
External	0.000 – 6.000 A

Inaccuracy

Internal range [1]	
0 – 10 A AC	±(1% + 20 mA)
0 – 40 A AC	±(1% + 40 mA)
0 – 100 A AC	±(1% + 200 mA)
External range [1]	
0 – 0.6 A AC	±(1% + 20 mA)
0 – 6 A AC	±(1% + 20 mA)
0 – 0.6 A DC	±(0.5% + 2 mA)
0 – 6 A DC	±(0.5% + 20 mA)

Resolution

Internal range	10 mA (range <100 A) 100 mA (range >100 A)
External range	1 mA

Voltmeter

Measurement method	AC, true RMS DC, mean value
Range	0.00 – 600.0 V
Inaccuracy [1]	AC, ±(1% + 200 mV) Max. value DC, ±(0.5% + 200 mV) Max. value Values are range depending

Extra measurements

Power factor and phase angle measurements

	Range	Resolution	Inaccuracy
Power factor cos φ	-0.99 (cap) to +0.99 (ind)	0.01	±0.04
Phase angle φ (°)	000 – 359°	1°	±2°

Impedance and power measurements

AC	Z (Ω and °), Z (Ω), R and X (Ω and Ω), P (W), S (VA), Q (VAR)
DC	R (Ω), P (W)
Range	Up to 999 kX (X= unit)

Make / Break contact

Max. current	1 A
Max. voltage	250 V AC or 120 V DC

Reclosing test

Items measured	Tripping and reclosing times
Display	After test is finished a list of all times appears in display
Breaker state feedback	The Make / Break contact can be used to feed back the breaker state
Max. number of reclosings	49
Max. testing time	999 s

Sets of resistors and a capacitor

Resistors	0.5 Ω to 2.5 kΩ
Capacitor [1]	10 µF, max voltage 450 V AC

1) Measurement intervals longer than 100 ms.   2) SVERKER 750

Outputs

Current outputs – AC

Range	No-load voltage (min)	Full-load voltage (min)	Full-load current (max)	Load / unload times On (max) / Off (min)
0 – 10 A	90 V	75 V	10 A	2 / 15 minutes
0 – 40 A	25 V	20 V	40 A	1 / 15 minutes
0 – 100 A	10 V	8 V	100 A	1 / 15 minutes
0 – 100 A	10 V	-	250 A	1 sec / 5 minutes

Voltage outputs – AC / DC

Range	No-load voltage (min)	Full-load voltage (min)	Full-load current (max)	Load / unload times On (max) / Off (min)
0 – 250 V AC	290 V AC	250 V AC	3 A	10 min / 45 min
0 – 300 V DC	320 V DC	250 V DC	2 A	10 min / 45 min

Separate AC voltage source

SVERKER 750

Range	No-load voltage (min)	Full-load voltage (min)	Full-load current (max)
0 – 60 V AC	70 V	60 V	0.25 A
60 – 120 V AC	130 V	120 V	0.25 A

Both ranges are divided into voltage steps of 10 V that are steplessly variable.

SVERKER 760

Range	No-load voltage (min)	Full-load voltage (min)	Full-load current (max)
0 – 130 V AC	140 V	130 V	0.25 A cont. 0.35 A, 1 minute

Phase angle	Resolution	Inaccuracy
0 – 359°	1°	±2°

Auxiliary DC output

Range	Voltage	Max. current
20 – 130 V DC	20 V DC 130 V DC	300 mA 400 mA
130 – 220 DC	130 V DC 220 V DC	235 mA 400 mA

Ordering information

SVERKER 750	Art.No.
Complete with: Test lead set GA-00030 Transport case GD-00182	
115 V Mains voltage	**CD-11190**
230 V Mains voltage	**CD-12390**

SVERKER 760	
Complete with: Test lead set GA-00030 Transport case GD-00182	
115 V Mains voltage	**CD-21190**
230 V Mains voltage	**CD-22390**

Optional accessories

SVERKER Win PC Software Please specify the SVERKER serial number when ordering. SVERKER Win contains software, a copy-protection key and a cable used to connect the PC to SVERKER. Note that the software key can be installed on a single SVERKER. The software itself, however, can be installed on an unlimited number of PCs.	**CD-8102X**
SVERKER Win Upgrade	**CD-8101X**
PROM* update, done by GE Energy	**CD-89010**
PROM* update, done by customer	**CD-89011**
* SVERKER Win requires PROM-version R04A or higher	
CSU20A Complete with cables and transport case 115 V Mains voltage	**BF-41190**
CSU20A Complete with cables and transport case 230 V Mains voltage	**BF-42390**
PSS750	**CD-90020**

Test lead set