

SPI225 Smart primary injection test system



- Up to 2000A output
- Smallest primary injection test system in its class
- Output current regulation
- Designed for switchgear commissioning, circuit breaker, CT commissioning, ground grid and relay testing
- Software includes thousands of circuit breaker TCC curves

DESCRIPTION

The Model SPI225 is a high current primary injection test system for all forms of high current testing required in a substation, including testing overcurrent relays, circuit breakers, motor overloads, and current transformers.

The SPI system is the FIRST high current test systems to permit a user to type in a predetermined current and the SPI system will generate and regulate the requested high current without preheating the test sample by pulsing the output current at high currents. The SPI system also has the unique ability to turn on at the current zero crossing every time for any load by automatically adjusting the output firing angle. This eliminates DC offset for every circuit breaker type and the need for the user to determine and adjust the firing angle for different loads and circuit breakers.

All SPI systems are fully automated and/or manually controlled. The Smart Touch View Interface (STVI) permits users to manually control the unit and also perform automated testing. The SPI225 unit can also be controlled by a PC for fully automatic testing and report generation.

APPLICATION

Universal in application, the SPI225 is a high current primary injection test unit with the ability to perform high current commissioning tests as well as test low-voltage molded-case circuit breakers. A single SPI225 is designed to test low-voltage molded- case circuit breakers up to a rating of 225 A.

The SPI225 is the smallest and lightest primary injection test system designed to perform high current testing on switchgear, current transformers, and ground fault protection systems, as well as in a multitude of other high current testing applications.

FEATURES AND BENEFITS

Smart Touch View Interface (STVI) is a simplified input and control touch screen

A key feature of the SPI system is the simplified touch screen input. The STVI touch screen input eliminates the confusing menu system of other primary injection and circuit breaker test systems. The touch screen makes the STVI simple for any technician to use even if the technician does not use the STVI on a consistent basis.

Automatic control

- The SPI system has many unique abilities to assist in testing
- The user can type a high current setting then the SPI system will generate the requested output without additional user intervention
- Automatically regulate the systems output to the pre- programmed setting
- Automatically regulate the systems output current to compensate for test sample heating or changing load
- Deliver the requested current without user intervention.

Most primary injection systems require the user to turn on the system high current, then manually adjust the output until the desired test current is set. Once the output is set, the user must still manually adjust the output in order to maintain the desired test current. The SPI system eliminates both of these requirements.

Manual control

The STVI manual controller of the SPI system is sometimes the desired test method. The SPI system permits the operator to run any of the standard tests required for primary injection, as well as low voltage circuit breakers, without the need for a laptop computer.

DC offset elimination

DC offset is a common problem when testing instantaneous trips on low voltage circuit breakers. A standard high current test system will commonly cause DC offset in the initial 2 to 4 cycles of an output waveform. This DC offset will cause circuit breakers to trip at incorrect current amplitudes therefore providing incorrect results.

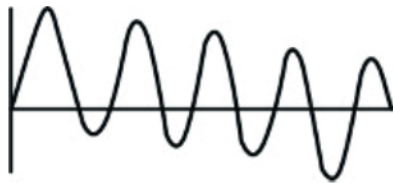


Figure 1: DC current with offset

Current decay

When performing primary injection testing, the test leads, or test sample will heat up due to the high currents applied. This will result in current decay unless the operator manually intervenes. This manual intervention can cause inconsistent test results that misinform the decisions made by the individual operator.

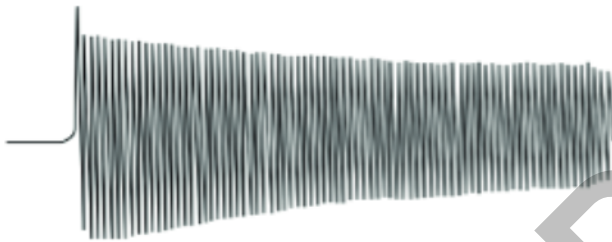


Figure 2: Current decay

The SPI systems eliminates all these problems by providing a constant current output from the beginning of the waveform until test completion.

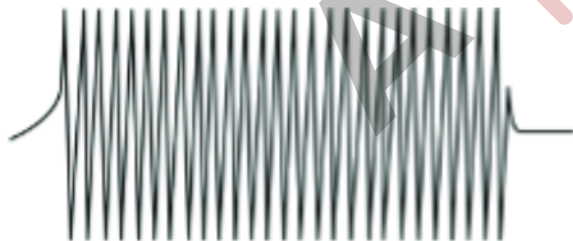


Figure 3: Current decay eliminated

Construction

This test set is built for years of trouble-free, reliable operation. SPI systems feature rugged instrumentation and controls designed to withstand the vibration and shock of frequent transportation.

Protection

Fuse, circuit breaker, and overload protective devices are incorporated into the SPI systems. Temperature sensors provide protection from overheating. An emergency stop button is provided to de-energise all input power to the test set.

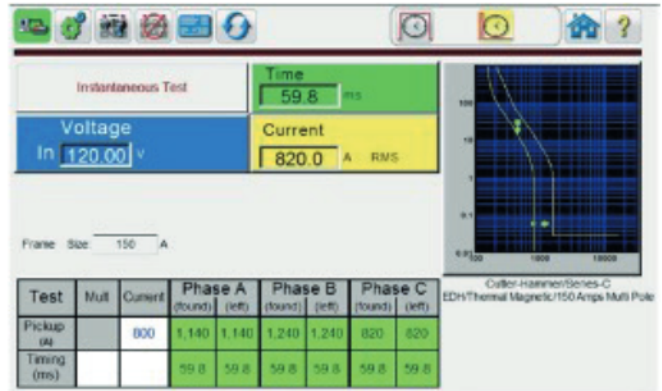


Figure 4: Manufacturer specific test screen

SPI software

SPI software is the premier software for automated testing, report generation, and maintenance record keeping of all primary injection and low voltage circuit breaker tests. These results are then recorded in the PowerDB database for archival or report generation.

The SPI software is specifically designed for primary injection testing of circuit breakers, relays, and other substation equipment. In order to simplify testing the SPI software is pre-loaded with circuit breaker curves in order to permit the user to verify that the circuit breaker under test is operating correctly. Since the SPI software has the curves pre-loaded the user can test all breaker parameters including:

- Long time pick-up
- Long time timing
- Short time pick-up
- Short time timing
- Instantaneous pick-up
- Ground fault pick-up
- Ground fault timing

Included complex breaker curves

The SPI software includes report generation for all testing. Thus, the user can not only perform all the primary injection testing required and generate a report for an end customer or for historical purposes.

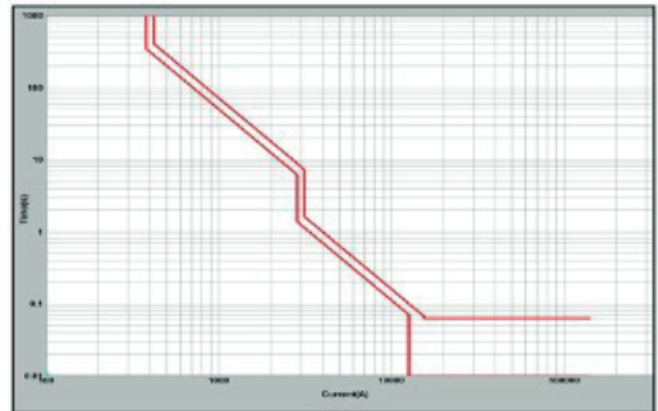


Figure 5: Complex breaker curves in the SPI225 software

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RECLOSER TESTING

The SPI225 can test small reclosers that are rated 400 A or less. It can apply pre-fault and fault current at different levels. The ability to have a pre-fault setting is often required when testing small self-powered reclosers for proper operation. The SPI225 can operate on 120 V or 240 V and is the most compact test set for testing self-powered reclosers on the market.

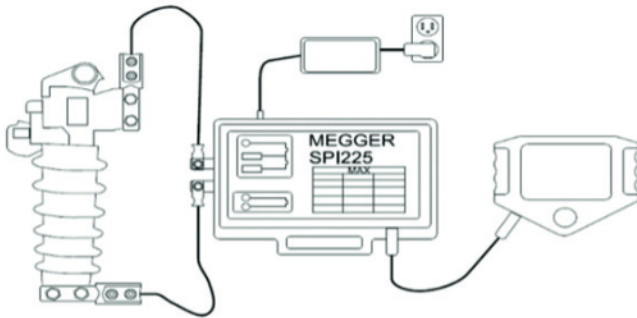


Figure 6: Test set up of the SPI225 testing a recloser on a 500 A tap.

Up to ten trip/reclose operations can be recorded. Each trip current, trip time, and reclose time is recorded and can be displayed in a report format.

Recloser Timing Tests

Mode: **Test**

Pre-Fault % Output: 10.00

Pre-Fault Time (S): 80

Fault % Output: 28.00

Total Time for Trips and Reclose (S): 30

Current: 367.6 A

Pre-Fault Time: 972.2 ms

	Current (A)	Time (Sec)
Prefault	84.726	80
Trip 1	360.671	3.0179
Reclose 1	-	10.0115
Trip 2	366.309	3.0026
Reclose 2	-	Locked Out

Figure 7: Test screen and test results for recloser test

Reclosers Tested with SPI225

- Siemens Fusesaver**
- Hubbell Versa-Tech II**
- S&C TripSaver II**
- ABB Eagle**

Figure 8: List of tested reclosers

MANUFACTURE OF RECLOSERS

The SPI225 can test some of the most common self-powered reclosers on the market. Each manufacturer has unique compliance voltage and impedance differences when primary injecting testing.

PARALLEL/SERIES OPERATION

Up to four SPI225 units may be operated in a parallel or series configuration. This allows for higher current (up to 7800 A) or a higher compliance voltage (up to 14 V on the high current tap). SPI225 units operated in a parallel or series configuration requires the main supply source to have the same phase angle.

SPI225 PARALLEL CURRENT

	Number of SPI225 units	1	2	3	4
120 V source	2 ft (61 cm) leads	1952 A	3523 A	5725 A	7478 A
240 V source	10 ft (305 cm) leads	1394 A	2429 A	3097 A	5460 A

Figure 9: Actual data taken from testing with an 800 A breaker

SPI PRIMARY INJECTION TEST REPORT

Substation: Electric Utility | Position: Cubical A | Equipment Location: Toronto

Manufacturer: Cutler-Hammer | Breaker Type: Molded Case | Trip Unit Type: Thermal/Magnetic

ALL TESTS PASSED

Cutler-Hammer/Series-C/EDH/Thermal Magnetic/150 Amps Multi Pole

Test	Nominal (A)	Min (A) or (S)	Max (A) or (S)	Phase A		Phase B		Phase C		Pass/Fail							
				As Found (A)	As Left (S)	As Found (A)	As Left (S)	As Found (A)	As Left (S)								
LT Timing	450.00	0.0	13.823	86.012	450.00	13.690	450.00	11.7	450.00	25.820	450.00	25.63	450.00	33.580	450.00	36.78	Pass
Inst Pickup	450.00	800.00	1,000.00	400.00	0.000	900	0.000	1,100.00	0.000	1,200	0.000	1,400.00	0.000	1,440	0.000	7.000	Pass

TEST EQUIPMENT USED: SPI 225(0800010613) | TESTED BY: Joe

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SPECIFICATIONS¹

Input	Input voltage	Input current	Frequency
Standard (N)	115/230 ± 15 %	15/8 A	60/50 Hz
CE compliant (C)	230 ± 15 %	8 A	60/50 Hz

Outputs

Output ranges

Continuously adjustable in three ranges to meet a variety of test circuit impedances:

25 to 500 A at 3.5 V max.

6.25 to 125 A at 14 V max.

1.25 to 25 A at 70 V max.

Output capacity

Percent rated current	Maximum time on	Maximum time off
100 % (1X)	30 min.	30 min.
200 % (2X)	3 min.	8 min.
300 % (3X)	30 sec.	4 min.
400 % (4X)	7 sec.	2 min.

The output ranges will provide several times their current rating, provided the output/compliance voltage is sufficient to push the desired current through the impedance of the test circuit.

The SPI225 will test the time-delay characteristic of thermal devices rated up to 225 A using the recommended test current of three times their rating (675 A). To perform an instantaneous trip test, it will provide 2000 A through a typical 225 A molded- case circuit breaker.

Because the magnitude of the output current is determined by the impedance of the load circuit, the voltage rating must be sufficient to push the desired current through the device under test and the connecting test leads.

Ammeter

Operating mode: Memory, continuous

Digital display: 5-digit auto ranging display

Ranges: 1.0000 A to 99.999 kA

Overall, ammeter system: Continuous ± 1 % of reading or ± 0.05 A

Accuracy: RMS pulse ± 1.5 % of reading or ± 0.075 A

Voltmeter

Digital display: 5-digit auto ranging display

Ranges: 0.01 to 600.00 V

Accuracy: ± 1 % of reading

Timer range

Digital display: 5-digit auto ranging display

Ranges: 0.001 to 99999 seconds

0.01 to 99999 cycles

Accuracy: ± 1 % of reading

Communications port

Ethernet (2)

USB 2.0

Bluetooth (optional)

Dimensions

(N):

14.2 W x 7.6 H x 12.0 D in.
(360 W x 194 H x 305 D mm)

(C):

14.2 W x 7.6 H x 17.0 D in.
(360 W x 194 H x 432 D mm)

Weight

Standard system (N):

47.5 lb. (21.5 kg)

CE compliant system (C):

50.7 lb. (23 kg)

Operating temperature range and humidity

Operating: 0 °C to 50 °C

Storage: - 30 °C to 70 °C

Humidity: 0 to 90 % non-condensing

Conformance standards

Safety: EN 61010-1

Shock: EN/IEC 60068-2-27

Vibration: EN/IEC 60068-2-6

Transit drop: ISTA 1A

Free fall: EN/IEC 60068-2-32

Drop/topple: EN/IEC 60068-2-31

Electromagnetic compatibility

Emissions: EN 61326-2-1, EN 61000-3-2/3,

FCC Subpart B of Part 15 Class A






Immunity: EN 61000-4-2/3/4/5/6/8/11

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INCLUDED ACCESSORY DESCRIPTIONS

Description	Part No.
 <p>Accessory carry case: Used to carry power cord, Ethernet cable, optional STVI and test leads.</p>	2001-487
<p>Alligator clip: 4.1 mm, use with test leads up to 1000 V/32 A CAT III. Excellent for test connections to terminal screws and pins where spade leads cannot be used.</p>	
 <p>Alligator clip, red, 4.1 mm</p>	684006
<p>Alligator clip, black, 4.1 mm</p>	684007
<p>Sleeved pair of test leads with retractable shroud: Sleeved test leads, one red, one black, 200 cm (78.7 in) long, 600 V, 32 A CAT II</p>	
 <p>Sleeved test leads in pairs will reduce tangling. These leads and alligator clips are used when the 25 A, 70 V output tap is used. This lead set allows the user to utilise the maximum output compliance voltage.</p>	2008-539-2
<p>The 4/0 high current leads allow the SPI225 to generate the maximum current specified. These leads also include Megger's unique adapters to allow connection to multiple breaker styles. The AWG #6 high current lead is used with the SPI225's 125 A 14 V output tap. This lead is used when 14 V output compliance voltage is required.</p>	
 <p>Current lead: AWG#6 61 cm (2 ft) long</p>	1004-728
 <p>Current lead: AWG 4/0 61 cm (2 ft) long, red</p>	1008-280
<p>Current lead: AWG 4/0 61 cm (2 ft) long, black</p>	1008-279

OPTIONAL ACCESSORY DESCRIPTIONS

Description	Part No.
 <p>Smart Touch View Interface: For SMRT33, SMRT36, SMRT46, SMRT410, MRCT and SPI225. This option allows the user to control the SPI unit without the need for a PC.</p>	STVI-1
<p>SPI 6' lead set consists of: SPI 6' RED 4/0 SPI 6' BLK 4/0 SPI 6' RED 14V</p> <p>Note: Reduces max current to 1725 A. 2 current leads, AWG 4/0, 183 cm (6 ft) long one red, one black</p>	
<p>SPI 10' lead set consists of: SPI 10' RED LEAD SPI 10' BLK LEAD</p> <p>Note: Reduces max current to 1650 A. 2 current leads, AWG 4/0, 305 cm (10 ft) long one red, one black</p>	
 <p>High current test probe: Current lead AWG 4/0, 305 cm (10 ft) Probe dimensions: 61 cm (2 ft), 15 cm (6 in) in diameter supplied with 2 high current tips. Return Lead AWG 4/0 122 cm (4 ft)</p>	1007-833

Description	Part No.
<p>Power cord: Depending on the style number, the unit will come with one of the following:</p>	
Line cord, North American	620000
Line cord, Continental Europe with CEE 7/7 Schuko Plug	50425
Line cord, international colour coded wire	15065
Line cord, United Kingdom	90002-989
<p>Megger's high current alligator clips are used with Megger's high current leads to allow fast connection to circuit breakers with tab terminations.</p>	
 <p>High current alligator clamp: assembly, 100 A</p>	1003-863
 <p>High current alligator clamp: assembly, 75 A</p>	1003-864
<p>Megger's high current probes are used with Megger's high current leads to allow fast connection to circuit breaker lug terminations.</p>	
 <p>High current probe: diameter 7.6 mm (0.3 in)</p>	2003-732
<p>High current probe: diameter 5.1 mm (0.2 in)</p>	2003-733
<p>High current probe: diameter 3.2 mm (0.125 in)</p>	2003-734
<p>Ethernet cable: for interconnection to PC 210 cm (7 ft.) long</p>	
<p>SPI software and manual on USB stick</p>	
	83404

Description	Part No.
 <p>Ground lead: 610 cm (20 ft)</p>	2003-724
 <p>Current lead: with 400 A clip, AWG 4/0, 400 cm (10 ft) long, red</p>	1014-164
<p>Current lead: with 400 A clip, AWG 4/0, 400 cm (10 ft) long, black</p>	1014-165
<p>Line Cord, North America 250 V NEMA L6-20P</p>	
	90038-265
<p>Power Cord Splitter: C14-2X C13 300 V</p>	
	90038-266

SPI225

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ORDERING INFORMATION

STYLE NUMBER IDENTIFICATION

Model SPI225 -



Regulatory

N = Standard System 115/230 VAC
C = CE Compliant System 230 VAC*

Bluetooth Option

1 = With Bluetooth
0 = Without Bluetooth

Power Cord Option

A = North American power cord
I = International power cord
E = Continental Europe power cord
U = United Kingdom power cord

NOTE:

*CE Marked units operating at 230V will have reduced outputs

A-RENT

UNITED STATES

4545 West Davis Street
Dallas, TX 75211-3422
T 800.723.2861
T +1 214.333.3201
F +1 214.331.7399
E usasales@megger.com

CANADA

550 Alden Road, Unit 106
Markham, Ontario L3R 6A8
T (800) 567-0286
F (416) 298-7214
E casales@megger.com

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us.megger.com
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A-RENT

a-rent.com

(IL) 630.748.8900

(TX) 713.564.8900

sales@a-rent.com