SMRT410
Megger Relay Test System

SMRT410 with 6 x 60 Amps

- **Small, rugged, lightweight and powerful**
- **Operates with or without a computer**
- **Intuitive manual operation with Smart Touch View Interface**
- **High current, high power output (60 Amps/300 VA rms) per phase**
- **Flexible output design provides up to four-phase voltage and up to ten-phase current**
- **Network interface provides IEC 61850 test capabilities**
- **Fully automated testing using AVTS software**

DESCRIPTION

The SMRT410 has the "smart" combination of high compliance voltage and high current output to test all electromechanical, solid-state and microprocessor-based overcurrent relays, including; voltage controlled, voltage restraint and high impedance directional ground overcurrent.

The SMRT410 provides a complete multi-phase test system for commissioning of protection systems. With up to 4 voltage channels and 6 high current channels, the SMRT410 meets every testing need. The SMRT410 VIGEN modules also provide high power in BOTH the voltage and current channels to test virtually all types of protective relays. The SMRT410 test system may be customized by adding the number of Voltage-Current, "VIGEN", modules needed for specific test applications.

The SMRT410 test system has the ability to be manually controlled with Megger's new Smart Touch View Interface™ (STVI). The STVI, with its large, full color, high resolution, TFT LCD touch screen allows the user to perform manual, steady-state and dynamic testing quickly and easily using the manual test screen, as well as using built-in preset test routines for most popular relays.

STVI with SMRT410

The STVI eliminates the need for a computer when testing virtually all types of relays. Menu screens and touch screen function buttons are provided to quickly and easily select the desired test function. Tests results can be saved to the STVI for download to a memory stick to transfer or print test reports.

For full automatic testing the SMRT410 may be controlled by Megger Advanced Visual Test Software (AVTS). AVTS is a Microsoft® Windows® XP®/Vista™/7/8 compatible software program designed to manage all aspects of protective relay testing using the new Megger SMRT.

APPLICATIONS

Each current channel is rated for 32 Amps @ 200 VA continuous, up to 60 Amps @ 300 VA for short durations. It has a unique flat power curve from 4 to 32 Amps that insures maximum compliance voltage to load at all times. With only 3 currents in parallel the unit provides up to 180 Amps @ 900 VA for instantaneous tests. With a maximum compliance voltage of 50 Volts per phase, just two channels in series provide 100 Volts of compliance voltage to test high impedance relays.

Each voltage channel can provide variable outputs of 0- 30/150/ 300 Volts at 150 VA of output power, and has a unique flat power curve from 30 to 150 Volts insuring maximum output power to the load at all times. With the voltage channels converted to current, a five channel unit can provide 10 currents.

Using the Ethernet ports, the SMRT410 is literally a "plug-and-play" unit, where voltage and current outputs can be seamlessly synchronized with other SMRT units outputs for testing more complex test applications such as back-to-back tests.

FEATURES AND BENEFITS

Constant Power Output – New higher powered Voltage-Current amplifiers. The current amplifier delivers maximum compliance voltage to the load constantly during the test, and range changing is done automatically under load. This insures better test results, and saves time by not having to turn the outputs off to change ranges. Constant power output in many cases eliminates the need to parallel or series current channels together to test high burden relays.

High Output Current – Provides up 32 Amps at 200 VA per phase continuous, or up to 60 Amperes at 300 VA with a 1.5 second duty cycle. With only three current amplifiers in parallel the SMRT410 provides 180 Amperes at 900 VA, for testing all instantaneous overcurrent relays.

New PowerV™ Voltage Amplifier High Power Output – The SMRT provides a new higher VA power output on the voltage channel at the lower critical test voltages (from 30 to 150 Volts). Customers who want to test a panel of relays at one time find it impossible using lower VA rated voltage.

Convertible Voltage Channels – With a 5 channel SMRT410 unit, convertible channels in conjunction with the main current channels, provides 10 currents for testing multi-phase current differential relays.

Perform Multi-Phase Tests – Interconnect the SMRT410 with the SMRT1 single phase unit (or other SMRT units) to increase the total number of test currents for testing multi-phase bus differential protection schemes. For example, a 5 channel SMRT410 may be interconnected with 2 SMRT410 units, providing up to a maximum of 30 current channels.

High resolution and accuracy – Metered outputs provides extremely high accuracy needed for testing a wide variety of devices. With metered values, what you see is what you get.

Steady-State and Dynamic testing capability – The SMRT410 provides, either through manual control or computer control, both steady-state and dynamic testing of protective relays. This includes programmable waveforms with dc offset and harmonics.

Output current and voltage sine waves are generated digitally – Outputs do not vary with sudden changes in input voltage or frequency, which increases test accuracy and reduces testing time.

Digital binary inputs and outputs – The programmable binary inputs, and programmable outputs provide timing and logic operations in real-time with the output voltage and currents. Binary Inputs can be programmed, using Boolean logic, for more complex power system simulations. This provides a low cost, closed loop, power system simulator.

Circuit breaker simulator – Binary outputs provide programmable normally closed and normally open contacts to simulate circuit breaker operation for testing reclosing relays. Sequence of operation, timing, and lockout are easily tested.

Performs transient tests – Perform acceptance or troubleshooting tests by replaying digitally recorded faults or EMTP/ATP simulations in the IEEE- C37.111, COMTRADE Standard format.

Perform End-to-End tests – Using AVTS software and a portable GPS satellite receiver, the SMRT performs satellite-synchronized end-to-end dynamic multi-state or playback transient COMTRADE files either for commissioning or troubleshooting tests.

Wide-ranging output frequency – The output frequency of the current and voltage channels can be set for any frequency from dc to 1 kHz. Popular test frequencies such as 16.66, 25, 33, 50, 60, 100,120, 125, 150, 180, 250, 300 and 400 Hz are easily set and controlled. Multi-purpose test system saves time and money.

USB 2.0 interface port – The USB port provides a PC interface for automated control of the SMRT unit. Also provides secure isolation when testing IEC 61850 devices (for customers who require secure isolation from their IEC 61850 substation bus).

Three Ethernet ports – PC/OUT Ethernet Port is the primary PC connection port. The IN/IEC61850 Ethernet Port provides interface to multiple SMRT units, and may be used to connect to the IEC 61850 substation bus. The OUT Ethernet Port is primarily used to interconnect multiple SMRT units together for synchronous multi-unit operation. The STVI PoE (Power over Ethernet) port and is used to connect to the STVI.

Bluetooth – Optional Bluetooth provides more flexibility. A wireless interface between the PC and SMRT, in conjunction with the SMRT IEC 61850 Ethernet port, provides the isolation required for a secure substation access interface between the SMRT and the IEC 61850 substation network.

Open communication architecture – Use with third party software for more flexible automated control.

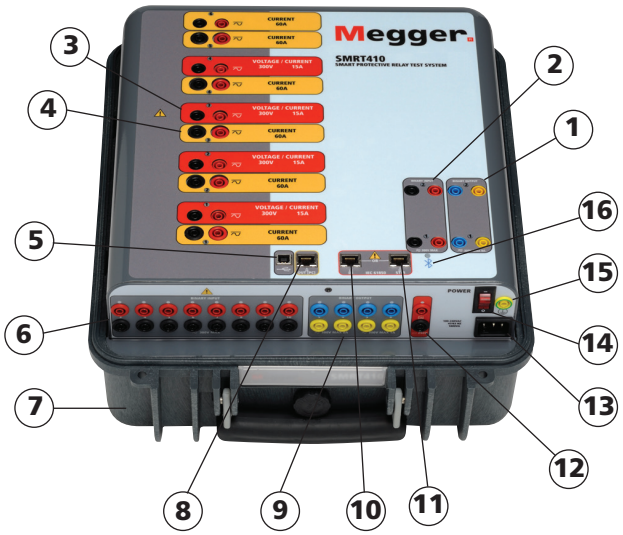
Immediate error indication – Audible and visual alarms indicate when amplitude or waveforms of the outputs are in error.

Modular design – Output modules plug-in and out easily for system re-configuration and maintenance.

IEC 61850 – Optional integrated interface provides testing using the IEC 61850 GOOSE protocol.

Optional Transducer Testing Capability – This optional hardware feature (see Ordering Information) provides transducer DC Inputs to test transducers easily and effectively. The STVI software is designed to automatically recognize the Transducer DC Inputs, and thus provide the Transducer Test Screen when selected. AVTS software comes standard with Transducer Test Modules, which will provide automatic transducer test capability in conjunction with the optional hardware.

SMRT410 RELAY TESTER



1. **Binary Outputs 1 and 2:** Rated for 300 V at 8 Amps.
2. **Binary Inputs 1 and 2:** Rated 5 to 300 V AC/DC
3. **Voltage Outputs:** Up to 4 channels 300 V at 150 VA, convertible to currents 15 A at 120 VA per phase.
4. **Current Outputs:** Up to 6 channels 60 Amps at 300 VA per phase.
5. **USB 2.0 Interface:** Communication and control port.
6. **Additional Binary Inputs:** Provides 8 additional monitor circuits.
7. **Rugged Case:** Fiberglass reinforced plastic.
8. **PC/OUT:** Ethernet Port is the primary PC connection port. Ethernet Port used to chain multiple SMRT units together for synchronous multi-unit operation.
9. **Additional Binary Outputs:** Adds 4 outputs. Binary Outputs 3 and 4 are rated for 300 V AC/DC, 8 amperes. Binary Outputs 5 and 6 are high speed and have an AC/DC voltage rating of 400 volts peak, 1 ampere.
10. **IN/61850:** This port may also be used for connecting to the IEC 61850 substation bus for testing IEC 61850 devices.
11. **STVI:** Ethernet Port is a PoE (Power over Ethernet) port and is used to connect to the STVI for manual control.
12. **Battery Simulator:** Variable 5 to 250 Volts DC output at 100 Watts (4 amperes maximum).
13. **Incoming Power/Line Cord Socket:** 100 to 240 V, 50/60 Hz.
14. **POWER ON/OFF Switch:** Illuminates when power is on.
15. **Protective Earth Ground Jack.**
16. **Bluetooth:** Bluetooth® provides wireless control.

APPLICATIONS SELECTION GUIDE

Protective Relays by IEEE Device #		SMRT410 Three Channels	SMRT410 Four Channels
2	Time Delay	■	■
21	Distance Single Phase	■	■
21	Distance Three Phase Open Delta	■	■
21	Distance Three Phase wye	■	■
24	Volts/Hz	■	■
25	Synchronizing	■	■
27/59	Under/Over Voltage	■	■
32	Directional Power Single Phase	■	■
32	Directional Power Three Phase	■	■
37/76	DC Under/Over Voltage/Current	■	■
40	Loss of Field	■	■
46	Phase Balance Current	■	■
46N	Negative Sequence Overcurrent	■	■
47	Phase Sequence Voltage	■	■
50	Instantaneous Overcurrent	**Up to 225 Amps**	**Up to 300 Amps**
51	Time Delay Overcurrent	**Up to 105 Amps**	**Up to 140 Amps**
55	Power Factor	■	■
60	Voltage/Current Balance	■	■
67	Directional Overcurrent	■	■
67N	Ground Directional Overcurrent	■	■
78	Out of Step	■	■
79	Reclosing	■	■
81	Frequency	■	■
85	Carrier or Pilot Wire	■	■
87	Differential	■	■
91	Voltage Directional	■	■
92	Voltage and Power Directional	■	■
94	Tripping	■	■

SPECIFICATIONS[1]

Input Power
90 to 260 Volts (± 10%) AC, 1Ø, 50/60 Hz, 1800 VA

Outputs[2]
All outputs are independent from sudden changes in mains voltage and frequency, and are regulated so changes in load impedance do not affect the output. All amplifier outputs are isolated or floating. The SMRT units can be ordered with the amplifier common returns tied to chassis ground as an option.

Output Current Sources
The SMRT410 with five modules can provide up to ten current sources; six high current/high power[3], and four convertible channels providing lower current/high power. The per channel output current and power ratings are specified in AC rms values and peak power ratings.

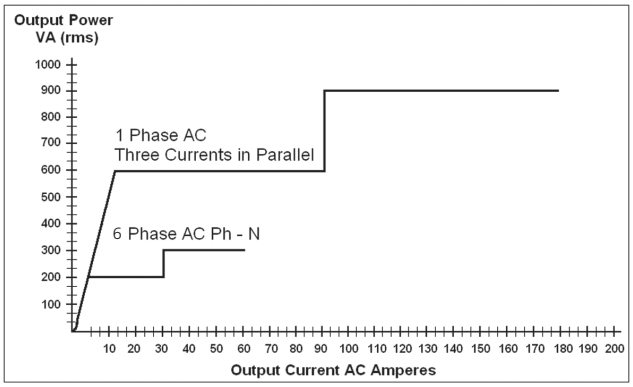
Output Current	Power	Max V/Duty Cycle
1 Ampere	15 VA	15.0 Vrms Continuous
4 Amperes	200 VA (282 peak)	50.0 Vrms Continuous
15 Amperes	200 VA (282 peak)	13.4 Vrms Continuous
32 Amperes	200 VA (282 peak)	6.67 Vrms Continuous
60 Amperes	300 VA (424 peak)	5.00 Vrms 1.5 Sec
DC 200 Watts		

With three currents in parallel:

Output Current	Power	Max V/Duty Cycle
12 Amperes	600 VA (848 peak)	50.0 Vrms Continuous
45 Amperes	600 VA (848 peak)	13.4 Vrms Continuous
96 Amperes	600 VA (848 peak)	6.67 Vrms Continuous
180 Amperes	900 VA (1272 peak)	5.00 Vrms 1.5 Sec

With two currents in series:
The compliance voltage doubles to provide 4.0 Amperes at 100 Volts rms up to 32A at 13 Vrms.

Current Amplifier - Extended Power Range



Current Amplifier Output Power Curve

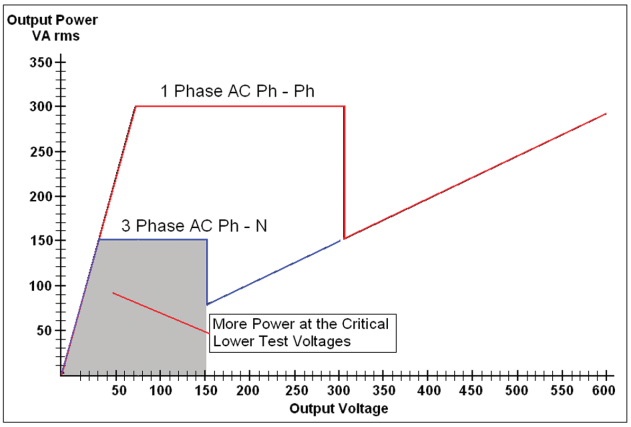
The SMRT current amplifier provides a unique flat power curve from 4 to 32 Amperes per phase to permit testing of electromechanical high impedance relays, and other high burden applications, with an extended operating range up to 60 Amperes at 300 VA rms.

AC Voltage Output
Outputs are rated with the following Ranges:

Output Volts	Power	Max I
30 Volts	150 VA	5 Amps
150 Volts	150 VA	Variable[4]
300 Volts	150 VA	0.5 Amps
DC 150 Watts		

Duty Cycle: Continuous

With two voltages in series
The output voltage and power doubles to provide 600 volts at 300 VA.



"PowerV" Voltage Amplifier Output Power Curves

"PowerV™" Voltage Amplifier - Extended Power Range
The SMRT voltage amplifier provides a flat power curve from 30 to 150 Volts in the 150V range to permit testing of high current applications such as panel testing.

Voltage Amplifier in Current Mode:
The voltage amplifier is convertible to a current source with the following output capability. Output power ratings are specified in rms values and peak power ratings.

Output Current	Power	Max V	Duty Cycle
5 Amperes	150 VA (212 peak)	30.0 Vrms	Continuous
15 Amperes	120 VA	8.0 Vrms	1.5 Sec

Phase Angle
Ranges: 0.00 to 359.99 degrees, Counter Clock Wise, or Clock Wise rotation, or 0.00 to ±180.00 degrees
Accuracy: ±0.02° typical, ±0.25° max at 50/60 Hz

Frequency
The output modules provide a variable frequency output with the following ranges and accuracy.

Ranges
DC
0.001 to 1000.000 Hz
Output amplifiers can provide transient signals with a range of DC to 10 kHz for transient playback using COMTRADE files.
Resolution*: .0001/.001 Hz
Frequency Accuracy:
2.5 ppm typical
25 ppm 0° to 50° C, at 50/60 Hz Maximum

[1] Megger reserves the right to change product specifications at any time.

[2] For 4 VIGEN modules, with or without DIGEN modules, operating at input voltages below 200 VAC a derating of the simultaneously available total output power of the voltage/current amplifiers and battery simulator will occur. The maximun output power of a single amplifier is not affected.

[3] Six high current/high power channels require optional DIGEN, Double Current Generation, see Ordering Information for details.

[4] PowerV™ voltage amplifier output current varies depending on the voltage setting on the 150 Volt range, see curve.

Total Harmonic Distortion
Less than 0.1% typical, 2% maximum at 50/60 Hz

Timer
The Timer-Monitor Input is designed to monitor and time-tag inputs, like a sequence of events recorder. In addition, the binary input controls enable the user to perform logic AND/OR functions, and conditionally control the binary output relay to simulate circuit breaker, trip, reclose and carrier control operation in real-time. The Timer function displays in Seconds or Cycles, with the following range and resolution:
Seconds: 0.0001 to 99999.9
Cycles: 0.01 to 99999.9
Accuracy: ±0.001% of reading, typical. ±2 least significant digit, ±0.005% of reading from 0 to 50° C maximum

Binary Input – Start/Stop/Monitor Gate
To monitor operation of relay contacts or trip SCR, continuity light is provided for the input gate. Upon sensing continuity, or voltage applied, the lamp will glow. In addition to serving as wet/dry contacts the Binary Inputs may be programmed to trigger binary output sequence(s). The first two VIGEN Modules have 1 each and the P option adds 8 more.
Input Rating: up to 300 V AC/DC

Binary Output Relays
SMRT410 has independent, galvanically isolated, output relay contacts to accurately simulate relay or power system inputs to completely test relays removed from the power system. The binary output simulates normally open / normally closed contacts for testing breaker failure schemes. The binary output can be configured to change state based on binary input logic.
High Current Output Relays: The first two VIGEN Modules have 1 each and the P option add 2 more.
AC Rating: 400 V max., Imax: 8 amps, 2000 VA max.
DC Rating: 300 V max., Imax: 8 amps, 80 W
Response Time: <10ms
High Speed Output Relays: SMRT410 P Option adds 2
AC/DC Rating: 400 V peak, Imax: 1 amp
Response Time: <1ms typical

Battery Simulator
The SMRT410 with the P (Plus) option includes a battery simulator with a variable DC output voltage ranging from 5 to 250 Volts at 100 Watts, 4 Amps max, providing capability to power up relays with redundant power supplies. Voltage output is controlled via the Smart Touch View Interface, or through AVTS software. The SMRT410 with the N option does not include a battery simulator.

Waveform Generation
Each output channel can generate a variety of output waveforms such as: DC; sine wave; sine wave with percent harmonics at various phase angles; half waves; square waves with variable duty cycles; exponential decays; periodic transient waveforms from digital fault recorders, relays with waveform recording capability or EMTP/ATP programs, which conform to the IEEE C37.111 COMTRADE standard format.

Metering
Measured output quantities such as AC Amperes, AC Volts, DC Volts or DC Amperes, and Time may be simultaneously displayed on the large, color TFT LCD touch screen. The AC and DC outputs display the approximate voltage/current output prior to initiation of the outputs. All accuracies stated are from 10 to 100% of the range at 50/60Hz.

AC Voltage Amplitude
Accuracy: ±0.05 % reading + 0.02 % range typical, ±0.15 % reading + 0.05 % range max
Resolution: .01
Measurements: AC RMS
Ranges: 30, 150, 300V

AC Current Amplitude
Accuracy: ±0.05 % reading + 0.02 % range typical, ±0.15 % reading + 0.05 % range max
Resolution: .001/.01
Measurements: AC RMS
Ranges: 32, 60A

DC Voltage Amplitude
Accuracy: 0.1% range typical, 0.25% range max
Resolution: .01
Measurements: RMS
Ranges: 30, 150, 300V

DC Current Amplitude
Accuracy: ±0.05 % reading + 0.02 % range typical,
±0.15% reading + 0.05% range maximum[5]
±0.15% reading + 0.20% range maximum[6]
Resolution: .001/.01
Measurements: RMS
Ranges: 32A

Convertible Source in AC Current Mode
Accuracy: ±0.05% reading + 0.02% range typical, ±0.15 % reading + 0.05 % range or ±12.5 mA whichever is greater
Resolution: .001
Measurements: AC RMS
Range: 5, 15A

DC IN Inputs (Optional Transducer Feature)

DC IN Volts
Range: 0 to ±10 V DC
Accuracy: ±0.001% reading + 0.005% range typical, ±0.003% reading + 0.02% range max
Resolution: .001
Measurements: Average

DC IN Amperes
Range: 0 to ±1 mA DC
4 to ±20 mA DC
Accuracy: ±0.001% reading + 0.005% range typical, ±0.003% reading + 0.02% range max
Resolution: .001
Measurements: Average

Environmental

Operating Temperature: 32 to 122° F (0 to 50° C)
Storage Temperature: -40 to 158° F (-40 to 70° C)
Relative Humidity: 5 - 95% RH, Non-condensing

Unit Enclosure

The SMRT unit comes housed in a rugged, virtually indestructible, lightweight and ergonomic enclosure. It features a large oversized rubber cushioned handle, and removable lid for use in tight spaces.

Dimensions

With the lid on:
14.2 W x 7.6 H x 16.25 D in.
(360 W x 194 H x 413 D mm)
With the lid off:
14.2 W x 7.2 H x 16.25 D in.
(360 W x 180 H x 413 D mm)
IEC Enclosure Rating: IP20

Weight

With the transit lid on: 39.5 lb. (17.76 kg)
With the transit lid off: 36.5 lb. (16.4 kg)

Conformance Standards

Safety:	EN 61010-1
Shock:	MIL-PRF-28800F (30 g/11ms half-sine) IEC 60068-2-27 (15 g/11 ms half-sine)
Vibration:	MIL-PRF-28800F (10-500 Hz, 2.05 g rms) IEC 60068-2-6 (10-150 Hz, 2 g)
Transit Drop:	MIL-PRF-28800F (10 drops, 46 cm), ISTA 1A

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

Protection

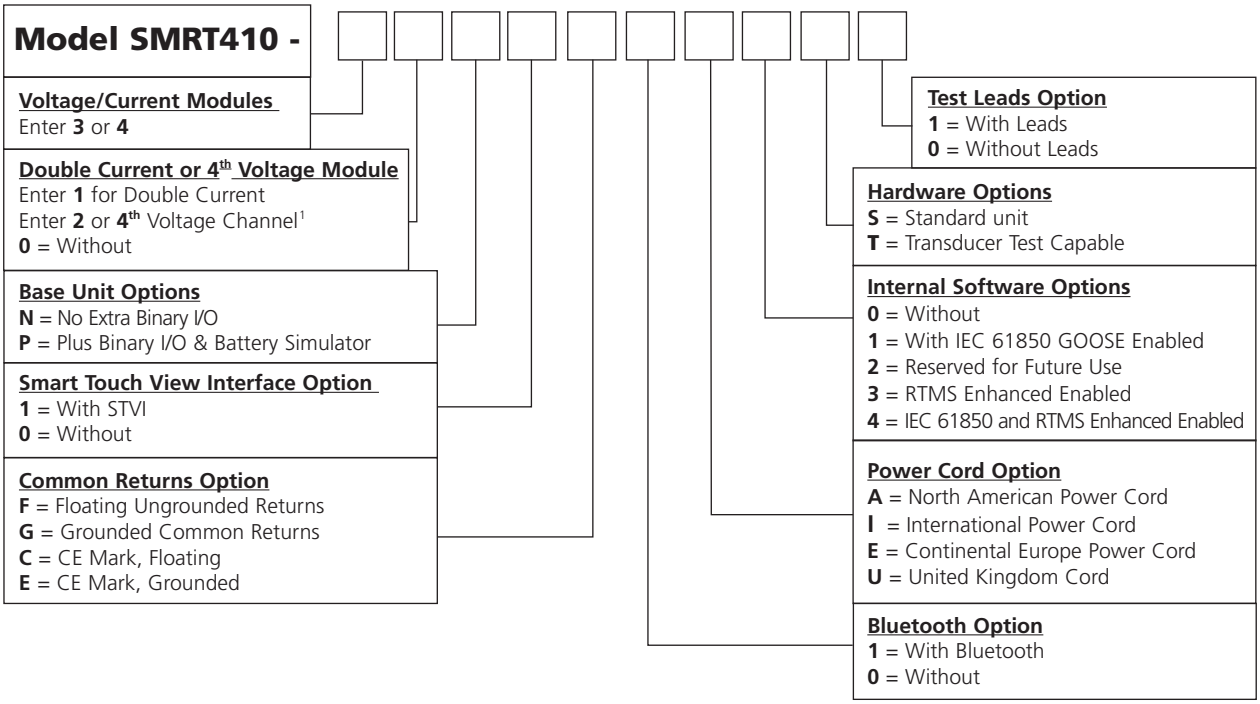
Voltage outputs are protected from short circuits and thermally protected against prolonged overloads. Current outputs are protected against open circuits and thermally protected against prolonged overloads.

Communication Interfaces

Ethernet (3)
USB 2.0
Bluetooth (optional)

ORDERING INFORMATION

STYLE NUMBER IDENTIFICATION



DESCRIPTIONS OF HARDWARE OPTIONS

This modular system lets you select the testing capabilities you need now and expand as testing requirements change. Customize the system by adding the number of Voltage-Current amplifier (VIGEN) modules (3 or 4), with optional Double-Current (DIGEN) module, or Voltage-Only (VGEN) module. For example, start with the base unit of 3 VIGEN modules. For more demanding tests, start with 4 VIGENS, and add a DIGEN to provide 4 Voltages, 6 Currents simultaneously, with convertible voltage channels up to 10 Currents.

Voltage/Current Module: The SMRT 410 unit can have either 3 or 4 voltage/current modules. Enter the number of desired modules 3, or 4.

Double Current or 4th Voltage[1] Module: The SMRT410 5th and last slot can be a Double Current (DIGEN) Module. Enter the number **1** for the unit to come with the DIGEN. The 4th slot can host a single Voltage Channel for those who want a 4th Voltage Channel in addition to 3 Voltage/Current modules. Enter the number **2** for this option.

Base Unit Options: The first two channels provide 1 binary input and 1 binary output each. Enter **N** for No extra binary I/O or battery simulator. Note the 4th voltage channel can be used as the Battery Simulator. For the user who requires the extra binary inputs, outputs and battery simulator enter **P** for Plus option.

Smart Touch View Interface Option: Enter **1** for the unit to come with the STVI, or enter the number **0** for without.

Common Returns Option: The floating returns option provides independent isolated return terminals for each output channel. The grounded common returns option, the return terminals are interconnected internally and connected to chassis ground. The CE Mark C and E units have been certified to the IEC standards for EMC. The F and G units are designed to operate in countries which do not require the CE mark.

Bluetooth Option: For customers, who wish to have a wireless control of the SMRT unit, enter the number **1** for the unit to come with the Bluetooth option, or for without enter **0**.

Power Cord Option Customers can choose which type of power cord they want the unit to come with.

- **A** option – NEMA 5-15 to IEC60320 C13 connectors, UL & CSA approved for countries with NEMA outlets.
- **I** option - International color coded wires (light blue, brown and green with yellow stripe) insulation jacket stripped ready for male connector with IEC 60320 C13 connector. CE marked.
- **E** option - CEE 7/7 "Schuko" plug to IEC 60320 C13 connector is CE marked.
- **U** option – United Kingdom power cord with IEC 60320 C13 connector, and 13 Amp fuse. BS 1363 / CE Marked.

Internal Software Options: The SMRT410 in conjunction with the optional Megger GOOSE Configurator (MGC) software can be used in the testing or commissioning of IEC 61850 compliant devices. In order for the SMRT410 to be able to subscribe as well as publish GOOSE messages, the IEC 61850 feature needs to be enabled[2]. Enter the number **1** for the unit to come with the IEC 61850 option enabled. The number **2** is reserved for future use. Enter the number **3** to enable additional RTMS software features such as the Synchronizer and Frequency test. Enter the number **4** to have both IEC 61850 and RTMS software features enabled. Enter **0** for the unit without internal enhanced software options enabled.

Options: S= Standard unit. **T=** With Transducer test capability enabled.

[1]If a 4th Voltage channel is selected you are limited to a total of 3 VIGENS (Voltage Current Generators)

Test Leads Option: Enter the number **1** for the unit to come with Test Leads. Enter **0** for the unit without Test Leads

DESCRIPTION OF SOFTWARE OPTIONS

#	Included Software	Part Number
1	AVTS Basic with RTMS Application Software	84978
	Optional Software	
1	AVTS Basic with IEC 61850 Megger GOOSE Configurator, and RTMS Application Software	1002-103
2	AVTS Advanced with RTMS Application Software	81570
3	AVTS Advanced Test with IEC 61850 Megger GOOSE Configurator, and RTMS Application Software	1001-106
4	AVTS Professional with RTMS Application Software	81571
5	AVTS Professional Test with IEC 61850 Megger GOOSE Configurator, and RTMS Application S/W	1002-102

Descriptions of Software

Included Software – Every unit comes with **AVTS Basic**, and the PC version of the **RTMS software**

AVTS Basic with RTMS software (PC Version)
Part Number: 84978
AVTS Basic includes Online Vector, Online Ramp and Online Click-On-Fault controls, with the ability to import, execute automatically determine the reach characteristics of single or multi-zone Distance relays using shot for single point tests, or Ramp, Pulse Ramp, or Binary Search tools along user defined search lines. Basic also includes enhanced Relay Test Wizards for; Overcurrent, Differential, Voltage, Frequency and Distance relays. AVTS Basic does not require a software license key to run.

The powerful RTMS software can be run directly from a PC providing both manual and automatic test capabilities. See the RTMS datasheet for more detailed descriptions of test features and capabilities.

Additional Optional Software
AVTS Advanced with RTMS software
Part Number: 81570
AVTS Advanced includes all of the features of AVTS Basic in addition to the powerful Test Editor and test editor tools, which includes the Dynamic Control (with dynamic end-to-end test capability, and Recorder features) for developing sequential tests for virtually any function or measuring element within digital relays. In addition, it also includes Modbus communications for automatic download of settings, SS1 File Converter for ASPEN® and CAPE® dynamic test files, End-to-End DFR Playback test capability and basic programming Tools for creating and editing test modules. Software comes with a USB software license key to run on any PC. Test files created in Advanced Test can be used with any PC running AVTS Basic without a software license key.

AVTS Professional with RTMS software
Part Number: 81571
Professional Test includes all of the features of AVTS Advanced Test version plus the following additional specialized test tools. The DFR Waveform Viewer and Playback tools are used for viewing and analyzing IEEE C37.111 COMTRADE Standard files from digital fault recorders and microprocessor based relays. The DFR Waveform Viewer includes tools to recreate the analog and digital channels for playback into protective relays for troubleshooting or evaluation. It includes the capability to extend the prefault data as well as start the timer associated with the event to time relay operation. These playback test files can also be used in end-to-end tests to recreate the transient event and evaluate the protection scheme. Test files created in Professional can be used with Advanced Test and Basic. Also included is the One-Touch Test Editor Control Tool for fully automatic testing of microprocessor based relays using VB script files to automatically download relay settings, and automatically test all the measuring elements within the relay based upon those settings. The Waveform Digitizer feature is also included in the Professional Test version of AVTS. It provides tools to create digital time curves for virtually any electromechanical relay time curve (that do not fit a time curve algorithm). It can even be used for digitizing scanned waveforms from a light-beam chart recorder. Software comes with a USB software license key to run on any PC. Test files created in Professional Test can be used with any PC running AVTS Basic without a software license key.

IEC 61850 Megger GOOSE Configurator Software
(See Table for Part Numbers)
The Megger GOOSE Configurator (MGC) provides easy to use tools for testing relays and substations using the IEC 61850 protocol. It is an optional software tool available with Basic, Advanced or Professional versions of AVTS Software; see Descriptions of Software Options above. The Configurator provides relay test engineers and technicians the capability to import parameters from configuration files in the Substation Configuration Language (SCL) format, and/or capture GOOSE messages directly from the substation bus. All imported SCL GOOSE messages will be unconfirmed messages. Only captured messages are confirmed messages due to the Capture feature of the MGC. Use the MGC Merge feature to compare imported SCL and captured GOOSE messages to verify all GOOSE messages needed to perform tests. Use them to configure the SMRT to subscribe to preselected GOOSE messages by assigning the data attributes to the appropriate binary inputs of the SMRT. Use the configurator to assign the appropriate binary outputs of the SMRT to publish GOOSE messages simulating circuit breaker status. After the appropriate assignments of binary inputs and outputs have been made, the test file can be saved for reuse. This provides both manual and automatic testing of the relay using either the RTMS or AVTS software. Use standard test modules in AVTS to perform automatic tests. Use the Dynamic Control in AVTS Advanced or Professional to perform high speed trip and reclose tests, or use to perform interoperability high-speed shared I/O tests between multiple IED's. The MGC provides mappings of Boolean and Bit Strings and/or simulation of STRuct, Integer/Unsigned, Float and UTC datasets.

[2]Requires the Optional Megger GOOSE Configurator software to program the unit to subscribe and publish GOOSE messages, see Software Options for part numbers and descriptions.

DESCRIPTION

Included Standard Accessories	Part Number
Power Cord - Depending on the style number, the unit will come with one of the following,	
Line cord, North American	620000
Line cord, Continental Europe with CEE 7/7 Schuko Plug	50425
Line cord, International color coded wire	15065
Line cord, United Kingdom	90002-989
Ethernet cable for interconnection to PC, 210cm (7 ft.) long (Qty. 1 ea)	90003-684
Instruction manual CD	80989

Table of Accessories

Accessories are supplied with the selection of the Test Leads Option, and/or the Binary Input/Output/Battery Simulator Option, and/or the STVI Option. With the Test Leads Option the number and type of leads varies depending on the number of channels ordered. If desired, Test Leads and Accessories can be ordered individually, see description and part numbers below.

	Optional Accessories Descriptions	STVI, or Binary I/O Bat SIM, or Test Leads Options	Three (3) Voltage Current Modules	Four (4) Voltage Current Modules	With DIGEN or VIGEN Module[1]	Binary I/O, Battery Simulator Option
	**Accessory Carry Case:** Use to carry power cord, Ethernet cable, Optional STVI and test leads.	**Qty. 1 ea. Part No. 2003-725**				
	**Sleeved Pair of Test Leads:** Keeps the test leads in pairs and from getting entangled. Sleeved Test Leads, one red, one black, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.*		**Qty. 3 pr. Part No. 2008-539**	**Qty. 4 pr. Part No. 2008-539**	**Qty. 2 pr. Part No. 2008-539**	**Qty. 3 pr. Part No. 2008-539**
	**Cable/Spade Lug Adapter (Small):** Small lug fit most new relay small terminal blocks. Lug adapter, **red**, 4.1 mm, use with test leads up to 1000 V/ 20 Amps CAT II.		**Qty. 3 ea. Part No. 684004**	**Qty. 14 ea. Part No. 684004**	**Qty. 2ea. Part No. 684004**	**Qty. 3 ea. Part No. 684004**
	Lug adapter, **black**, 4.1 mm, use with test leads up to 1000 V/ 20 Amps CAT II.		**Qty. 3 ea. Part Number 684005**	**Qty. 14 ea. Part Number 684005**	**Qty. 2ea. Part Number 684005**	**Qty. 3 ea. Part Number 684005**
	**Jumper Lead:** Used to common returns together on units with floating ground returns, or parallel of current channels. Jumper lead, black, 12.5 cm (5") long, use with voltage / current outputs, 600 V, 32 Amps CAT II.		**Qty. 4 ea. Part Number 2001-573**	**Qty. 6 ea. Part Number 2001-573**		
	**4x6 Sleeved Combination Voltage Leads with Retractable Shrouds:** Keeps the test leads from getting entangled. Three common leads connect to the test set, which are interconnected down to one black common to connect to the relay under test. Sleeved Three Phase Test Leads, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.*		**Qty. 1 ea. Part Number 2008-540**	**Qty. 1 ea. Part Number 2008-540**		
	**6x6 Sleeved Combination Voltage Leads with Retractable Shrouds:** Keeps the test leads from getting entangled. Three pairs of leads connect to the test set, with three pairs to connect to the relay under test. Sleeved Three Phase Test Leads, 200 cm (78.7") long, 600 V, 32 Amperes CAT II*		**Qty. 1 ea. Part Number 2008-541**	**Qty. 1 ea. Part Number 2008-541**		

Note that the sleeved "combination" leads come with either the three, or four Voltage/Current module configurations only.

[1]Adding the DIGEN or VGEN module adds the extra leads and spades lugs as shown in the column.

*600V, 32 Amperes, CAT IV available as an option.

Deluxe Test Leads and Accessories Kit Part No.: 1001-619

The Test Leads and Test Lead Accessories are an option. Test leads and accessories can be ordered with the unit, or later as a kit. The Deluxe Test Leads and Accessories Kit includes sleeved pairs of leads for use with the extra binary inputs/outputs/battery simulator option, as well as the three phase sleeved combination leads for voltage and current channels. The following test leads and test lead accessories are included in the Deluxe Test Leads and Accessories Kit in quantities shown.

Description	Part No.
Sleeved Pair of Test Leads: Keeps the test leads in pairs and from getting entangled. Sleeved Test Leads, one red, one **black**, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.*	**2008-539**
4x6 Sleeved Combination Voltage Leads with Retractable Shrouds: Keeps the test leads from getting entangled. Three common leads connect to the test set, which are interconnected down to one black common to connect to the relay under test. Sleeved Three Phase Test Leads, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.*	**2008-540**
6x6 Sleeved Combination Voltage Leads with Retractable Shrouds: Keeps the test leads from getting entangled. Three pairs of leads connect to the test set, with three pairs to connect to the relay under test. Sleeved Three Phase Test Leads, 200 cm (78.7") long, 600 V, 32 Amperes CAT II*	**2008-541**
Jumper lead, **black**, 12.5 cm (5") long, use with voltage / current outputs, 600 V, 32 Amps CAT II (Qty. 4 ea.)	**2001-573**
Cable/Spade Lug Adapter (Small): Small lug fits most new **relay** small terminal blocks. Lug adapter, **red**, 4.1 mm, use with test leads up to 1000 V/ 20 Amps CAT II (Qty. 15 ea.)	**684004**
Lug adapter, **black**, 4.1 mm, use with test leads up to 1000 V / 20 Amps CAT II (Qty. 15 ea.)	**684005**
Accessory Case, black, used to carry test leads and/or STVI (Qty. 1 ea.)	**2003-725**

Additional Accessories (Not Included in the SMRT410 Test Leads Option or Deluxe Lead Kit)

Additional Optional Test Leads and Accessories can be ordered individually, see description and part numbers below. The following accessories and part numbers are in quantities of 1 each. Order the appropriate number required.

Individual (non-sleeved) Test Leads: Excellent for widely separated individual terminal test connections.

Test lead, **red**, use with voltage/current output, or binary I/O, 200 cm long (78.7") 600 V/32 Amps CAT II.	**620143**
Test lead, **black**, use with voltage/current output , or binary I/O, 200 cm long (78.7") 600 V/32 Amps CAT II.	**620144**

Individual (Non-Sleeved) Extra Long Test Leads: Excellent for widely separated individual terminal test connections.

Extra long test lead, **black**, use with voltage/current output, or binary I/O, 360 cm long (12 ft) 600 V/ 32 Amps CAT II.	**2003-172**
Extra long test lead, **red**, use with voltage/current output, or binary I/O, 360 cm long (12 ft) 600 V/ 32 Amps CAT II.	**2003-173**

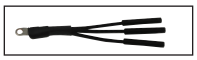
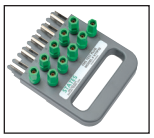
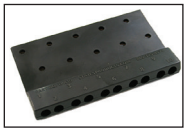
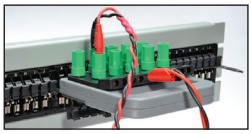
Description	Part No.
RLC, Relay Lead Connector: Excellent for easily connecting three phase voltage and current leads to the test system.	
	
Two sets of test leads (one for voltages and one for currents), sleeved, 4 mm (0.16 in.) terminals with retractable safety shrouds, color coded red, yellow, blue, black, 200 cm long (78.7") 600 V/ 32 Amps CAT II	**RLC**
Cable/Spade Lug Adapter (large): Large spade lug fits older relay terminal blocks, or STATES® Company FTP10 or FTP14 Test paddles, ABB or General Electric test plugs with screw down terminals.	
	
Lug adapter, **red**, 6.2 mm, use with test leads up to 1000 V/20 Amps CAT II.	**684002**
Lug adapter, **black**, 6.2 mm, use with test leads up to 1000 V/20 Amps CAT II.	**684003**
Alligator/Crocodile Clip: Excellent for test connections to terminal screws and pins where spade lugs cannot be used.	
	
Alligator clip, **red**, use with test leads up to 1000 V/32 Amps CAT III.	**684006**
Alligator clip, **black**, use with test leads up to 1000 V/32 Amps CAT III.	**684007**

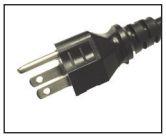
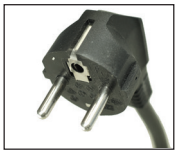
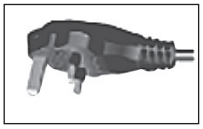
Flexible Test Lead Adapter: Use with rail-mounted terminals or screw clamp connections where spade lugs and crocodile/alligator clips cannot be used.

Flexible test lead adapter, **black**, 1.8 mm male pin, use with test leads up to 1000 V/32 Amps CAT III.	**90001-845**

Flexible Test Lead Adapter with Retractable Insulated Sleeve: Use for connection to old style non-safety sockets with retractable protective sleeve on one end.

Retractable sleeve test lead, **red**, 50 cm (20") long, use with test leads up to 600 V/32 Amperes CAT II.	**90024-781**
Retractable sleeve test lead, **black**, 50 cm (20") long, use with test leads up to 600 V/32 Amperes CAT II.	**90024-780**

Description	Part No.
Parallel test lead adapter:	
	
Used when paralleling up to three current test leads together to a common test point. Usually used when connecting to a test paddle (like the pictured States Company test paddle.)	**1002-286**
STATES® 10 Pole Test Paddle: Use with STATES FMS Test Switch or ABB FT-1 10 pole Test Switch.	
	
Test paddle features knobs which also serve as insulated Ø 4 mm rigid socket accepting spring loaded Ø 4 mm plugs with rigged insulating sleeve, or retractable sleeve. Use with test leads up to 600 V, 32 Amperes CATII.	**V1TP10**
STATES® 10 Pole Test Paddle Attachment: Use with STATES V1TP10 Test Paddle.	
 	
Test paddle attachment provides an additional 10 insulated connection points for front connection, as well as the standard top connections for test leads. Adapter can provide convenient parallel test connections of test currents to two terminals at one time. Use with test leads up to 600 V, 32 Amperes CAT II.	**TPA10**
Transit Case	
Hard-Sided Transit Case: Includes custom designed foam inserts for the SMRT unit and accessory case. Transit case includes retractable handle, polyurethane wheels with stainless steel bearings, double-throw latches, fold-down handles, and stainless steel hardware and padlock protection, with O-ring seal making the case water-tight, with an IP 67 rating. Tested and certified to US Department of Defense Standards for impact, vibration, and low/high storage temperatures.	
	
Rugged, hard-sided transit case (1ea).	**1002-787**

Description	Part No.
Example Configurations	
	
For customers in **North America, Central America, Japan, Philippines, South Korea, Taiwan, Thailand, Venezuela, Virgin Islands**, and other countries that use standard NEMA type power outlets of 100, 110, 115 or 120 volts at 50/60 Hz. could order a unit with the standard North American power cord. In this example the unit is a SMRT410 4 channel unit, with the extra binary I/O and Battery Simulator, with the STVI-1, with floating ungrounded returns, no Bluetooth, no IEC61850, with standard hardware, and with test leads.	The style number would be, **SMRT410 – 40P1F0A0S1**
	
For customers in **Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, Portugal, Spain, Sweden, Turkey**, and other countries where the CEE 7 standard connector is used could order a unit with the Continental European Power Cord with CEE 7/7 Schuko plug. In this example the unit is a 4 channel unit with double current (DIGEN) generator, with the extra binary I/O and Battery Simulator, without the STVI1, CE Marked 220-230 V Input and floating outputs, no Bluetooth, with IEC61850 enabled, with the standard hardware, and with test leads.	The style number would be, **SMRT410-40P0C0E1S1**
	
For customers in **United Kingdom, Ireland, Anguilla, Cyprus, Dominica, Gambia, Gibraltar, Malta, Malaysia, Malawi, St. Lucia, St. Vincent, Zambia**, and other countries where the UK standard connector is used could order a unit with the UK Power Cord. In this example the unit is a 4 channel unit, with the extra binary I/O and Battery Simulator, with the STVI-1, CE Marked 220-230 V input and floating commons, no Bluetooth, with IEC61850 enabled, with standard hardware, and with test leads.	The style number would be, **SMRT410-40PIC0U1S1**
The final example is for countries that have more unique power connectors, which will require international color coded wires ready for appropriate male connectors to be installed like; **Australia/New Zealand, Argentina, China, India, Israel, Russia, South Africa, or Switzerland**. These countries are more likely to order the unit with the international color coded power cord ready for mounting the appropriate male connector. In this example the unit is a 4 channel unit, **with double current (DIGEN) generator**, with the extra binary I/O and Battery Simulator, with the STVI-1, with grounded common returns, with Bluetooth, with IEC61850 enabled, with standard hardware, and with test leads.	The style number would be, **SMRT410 – 41P1G1I1S1**

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