

# SMRT36

## Megger Relay Test System



SMRT36 with P Option shown

- **Small, rugged, lightweight and powerful**
- **Operate with or without a computer**
- **Intuitive manual operation with Smart Touch View Interface**
- **High current, high power (60 Amps/300 VA rms) per phase**
- **Network interface provides IEC 61850 test capabilities**
- **Fully automated testing using AVTS Software**

### DESCRIPTION

For size, weight, and features the SMRT36 is conceivably the smallest, lightest, highest output powered, complete three phase relay test system in the world today. The test system may be customized by adding the number of Voltage-Current, "VIGEN", modules needed for specific test applications. For electric utility use, the SMRT36 with three VIGEN Modules provides complete three-phase testing of three-phase impedance, directional power, negative sequence overcurrent and other devices that require a three-phase four-wire wye connected source. With three modules, output current and VA is tripled for high instantaneous or high burden overcurrent relays. With the voltage channels converted to currents, the same unit can provide 6-phase current. The SMRT36 VIGEN modules also provide high power in BOTH the voltage and current channels to test virtually all relays.

### SMRT36 Relay Test System

#### Smart Touch View Interface



The SMRT36 test system has the ability to be manually controlled with Megger's new optional 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. For more information see STVI, page 12, of this document.

For full automatic testing the SMRT36 may be controlled by Megger Advanced Visual Test Software (AVTS). AVTS is a Microsoft® Windows® XP®/Vista™/7 compatible software program designed to manage all aspects of protective relay testing using the new Megger SMRT. More flexibility has been added as well as some new and powerful features. AVTS comes in three different levels:

- Basic Test
- Advanced Test
- Professional Test

Every unit comes with the Basic Test software package. AVTS Basic version includes Online Vector control (for single and multi-state timing tests including reclosing) Online Ramp control (for automatic ramping of voltage, current, phase angles or frequency to find minimum operating/pickup and dropout tests) and Online Click-On-Fault (for dynamic tests of impedance relays) with the ability to import specific relay impedance characteristics. The user may also save, execute and print relay specific test modules and results. Test results may also be exported directly to Microsoft Word. In addition AVTS Basic also includes new enhanced Relay Test Wizards for overcurrent, voltage, differential, impedance and frequency relays. Included with the AVTS Basic Test is PowerDB Basic. PowerDB Basic is a powerful data management software package which includes the ability to bring all STVI data into a database file for retrieval and review whenever needed. PowerDB can integrate test results previously saved in AVTS Software. In fact, an entire organization's

test results can be easily synchronized into a single database file, scalable to Microsoft SQL Server. Microsoft SQL Server allows even the largest user to store all of their test results in a single database. This not only gives every user access to all results, it can also provide the necessary information and reporting needed for NERC/FERC compliance and audits.

The powerful STVI test screens can also be run directly from PowerDB on your PC with all the results seamlessly saved to the local database and synchronized to a central location. PowerDB gives users the ability, via a single click, to trend test results with historical values and compare values from similar equipment using any desired set of search criteria. Beyond just relay test results, PowerDB is designed for any type of test data and includes test forms for most types of electrical apparatus. All of these forms can be edited or customized as desired. Summary reports of noted comments and deficiencies are automatically generated across all test results. And if you have already made an investment in CMMS software, the PowerDB database can be easily linked with an existing system so that data can be shared between them using automated routines.

The Advanced Test version includes the powerful Test Editor, Dynamic Control (includes dynamic end-to-end testing capability), Modbus communication test capability, ASPEN OneLiner™ or Electrocon CAPE™ SS1 File Converter for dynamic testing, and easy to use programming Tools for creating and editing test modules.

The Professional Test version includes all of the features of the Basic and Advanced versions plus some other powerful test tools and features. It includes the DFR Waveform Viewer, One-Touch™ Test for fully automatic tests, and Waveform Digitizer to digitize scanned waveforms of electromechanical over current time curves.

## SMRT System Components

### Some of the unique features include:

**Constant Power Output (CPO) Capability** – The current amplifier delivers maximum compliance voltage to the load constantly through the entire “power curve” of a test. With a CPO rating of up to 300 VA on the current channel it has the power and flexibility to test virtually any relay. Constant power output in the new “PowerV” voltage channel provides a flat power curve at 150 VA from 30 to 150 Volts, which provides testing of electromechanical relays which require higher output current, and other high current applications such as panel testing.

**Unique VIGEN Internal Design** – The Voltage and Current Generator (VIGEN) components have been combined into one small amplifier package. This reduces size, weight and with reduced parts count increases reliability.

**Multiple High Speed Communication Ports** – The SMRT36 is provided with three Ethernet ports, one USB port, and a Bluetooth option. The Bluetooth option provides the additional capability to communicate with the SMRT36 wirelessly from your PC.

## FEATURES AND BENEFITS

**Constant Power Output** – The new SMRT36 employs high powered Voltage-Current amplifiers. The current amplifier delivers maximum compliance voltage to the load constantly during the test. Constant power output in most cases eliminates the need for complicated, time consuming, series and parallel combination connections of current channels together to test high burden relays. Constant power output in the new “PowerV” voltage channel between 30 to 150 Volts provides testing of electromechanical high impedance relays, and other high burden applications such as panel testing.

**Modular design** – Output modules plug-in for system re-configuration and ease of maintenance. Purchase less than a 3 phase system now and upgrade later allows customers to better utilize their limited budgets.

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



SMRT36 with N Option

**Digital inputs and outputs** – SMRT36 with the “N” option and at least two VIGENS has 2 programmable inputs, and 2 programmable outputs. For more binary inputs and outputs, the “P” (Plus) option adds 8 binary inputs, and 4 binary outputs (2 high speed), and the Battery Simulator. Binary

Inputs can be programmed, using Boolean logic, for more complex power system simulations.

**Circuit breaker simulator** – The SMRT36 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 GPS satellite signal, the SMRT36 units can perform satellite-synchronized end-to-end dynamic or transient tests. Provides precisely synchronized testing of remotely located complex protection schemes.

**Wide-ranging output frequency** – The output frequency of the current and voltage channels can be set for any frequency from dc to 1 kHz.

**Ethernet ports** – Three Ethernet ports provide high speed computer interface. This can be used to quickly download transient waveform data, or update test set firmware. One Ethernet port is used to connect the STVI to the SMRT36. Another port is used for automated control using a PC and AVTS software. The third port may be used to either connect to a substation bus for IEC 61850 testing, or “piggy-back” multiple SMRT units together for synchronized multi-phase test systems.

**Bluetooth Communication** – Optional Bluetooth wireless communications provides a reliable communications medium at the same time providing isolation from the PC.

**Universal input voltage** – Operating from 90 to 264 VAC, 50/60 Hz, the SMRT36 can use virtually any standard source in the world.

**Battery simulator** – The SMRT36 with the P option provides a variable dc output voltage from 5 to 250 Volts, at 100 Watts (4 Amps Max), which eliminates needing a separate dc source for providing logic voltage for solid-state relays. The SMRT36 with the N option does not include a battery simulator.

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



**Unique ability to chain multiple unit's together with a single ethernet cable. Permits up to 12 voltages and 12 currents simultaneously.**

**SPECIFICATIONS**

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

**Input Power**

100 to 240 Volts ( $\pm 10\%$ ), AC, 1 $\emptyset$ , 50/60 Hz, 1800 VA.

**Outputs**

All outputs are independent from sudden changes in line voltage and frequency. This provides stable outputs not affected by sudden changes in the mains source. All outputs are regulated so changes in load impedance do not affect the output. All amplifier outputs are independently isolated or floating. The SMRT units can be ordered with the amplifier common return terminals tied to chassis ground as an option.

**Output Current Sources**

The SMRT36 with three VIGEN modules can provide up to six current sources; three high current/high power, and three convertible channels providing lower current/high power. Output power ratings are based upon an input voltage of 120 volts; higher output ratings are possible with 230 volt input. Output power ratings are specified in AC rms values and peak power ratings.

| Output Current | Power             | Max V     | Duty Cycle |
|----------------|-------------------|-----------|------------|
| 1 Ampere       | 15 VA (282 peak)  | 15.0 Vrms | Continuous |
| 4 Amperes      | 200 VA (282 peak) | 50.0 Vrms | Continuous |
| 15 Amperes     | 200 VA (282 peak) | 13.4 Vrms | Continuous |
| 30 Amperes     | 200 VA (282 peak) | 6.67 Vrms | Continuous |
| 60 Amperes     | 300 VA (424 peak) | 5.00 Vrms | 90 Cycles  |
| DC 200 Watts   |                   |           |            |

**With two currents in parallel**

| Output Current | Power             | Max V     | Duty Cycle |
|----------------|-------------------|-----------|------------|
| 2 Amperes      | 30 VA (282 peak)  | 15.0 Vrms | Continuous |
| 8 Amperes      | 400 VA (565 peak) | 50.0 Vrms | Continuous |
| 30 Amperes     | 400 VA (565 peak) | 13.4 Vrms | Continuous |
| 60 Amperes     | 400 VA (565 peak) | 6.67 Vrms | Continuous |
| 120 Amperes    | 600 VA (848 peak) | 5.00 Vrms | 90 Cycles  |

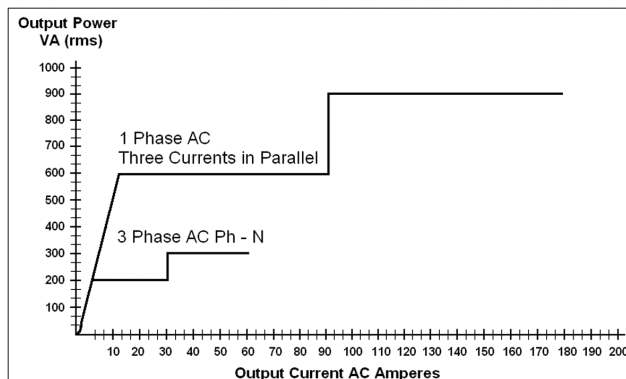
**With three currents in parallel**

| Output Current | Power              | Max V     | Duty Cycle |
|----------------|--------------------|-----------|------------|
| 3 Amperes      | 45 VA (282 peak)   | 15.0 Vrms | Continuous |
| 12 Amperes     | 600 VA (848 peak)  | 50.0 Vrms | Continuous |
| 45 Amperes     | 600 VA (848 peak)  | 13.4 Vrms | Continuous |
| 90 Amperes     | 600 VA (848 peak)  | 6.67 Vrms | Continuous |
| 180 Amperes    | 900 VA (1272 peak) | 5.00 Vrms | 90 Cycles  |

With two currents in series, the compliance voltage doubles to provide 4.0 Amperes at 100 Volts rms.

**Current Amplifier – Extended Power Range**

The SMRT current amplifier provides a unique flat power curve from 4 to 30 Amperes 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 per phase.



Current Amplifier Output Power Curve

**AC Voltage Output**

Outputs are rated with the following Ranges:

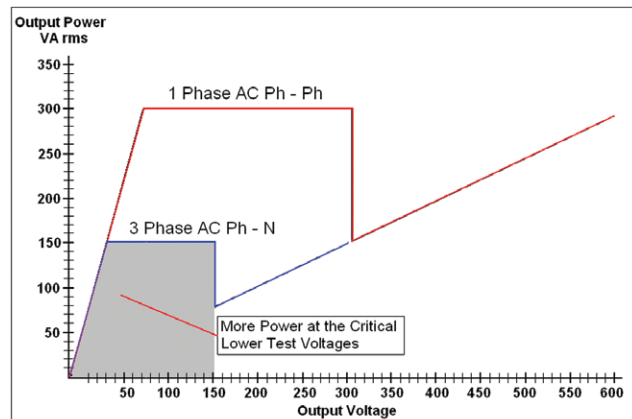
**Per phase**

| Output Volts | Power               | Max I    |
|--------------|---------------------|----------|
| 30 Volts     | 150 VA              | 5 Amps   |
| 150 Volts    | 150 VA <sup>1</sup> |          |
| 300 Volts    | 150 VA              | 0.5 Amps |
| DC 150 Watts |                     |          |

**Duty Cycle:** Continuous

**"PowerV" Voltage Amplifier - Extended Power Range**

The SMRT voltage amplifier provides a flat power curve in the 150V range to permit testing of a panel of relays, and other high power applications.



"PowerV" Voltage Amplifier Output Power Curves

**With two voltages in series**

| Output Volts | Power               | Max I    |
|--------------|---------------------|----------|
| 60 Volts     | 300 VA              | 5 Amps   |
| 300 Volts    | 300 VA <sup>1</sup> |          |
| 600 Volts    | 300 VA              | 0.5 Amps |

**Voltage Amplifier in Current Mode**

| Per Phase | Output Current | Power             | Max V     | Duty Cycle |
|-----------|----------------|-------------------|-----------|------------|
|           | 5 Amperes      | 150 VA (212 peak) | 30.0 Vrms | Continuous |
|           | 15 Amperes     | 120 VA            | 8.0 Vrms  | 90 Cycles  |

**With two convertible amplifiers in Parallel**

| Output Current | Power             | Max V     | Duty Cycle |
|----------------|-------------------|-----------|------------|
| 10 Amperes     | 300 VA (424 peak) | 30.0 Vrms | Continuous |
| 30 Amperes     | 240VA             | 8.0 Vrms  | 90 Cycles  |

**With three convertible amplifiers in parallel**

| Output Current | Power             | Max V     | Duty Cycle |
|----------------|-------------------|-----------|------------|
| 15 Amperes     | 450 VA (636 peak) | 30.0 Vrms | Continuous |
| 45Amperes      | 360 VA            | 8.0 Vrms  | 90 Cycles  |

<sup>1</sup> SMRT – Similar to the current channel, the voltage channel provides a constant output power of 150 VA. Provides test capability of electromechanical relays that require more than 1 amp at test voltages from 30 Volts to 150 Volts.

**Battery Simulator**

The SMRT36 with the P (Plus) option includes a battery simulator providing 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 SMRT36 with the N option does not include a battery simulator.

**Metering**

Measured output quantities such as AC Amperes, AC Volts, DC Volts or DC Amperes, and Time may be simultaneously displayed on the large, variable contrast, color TFT LCD touch screen. The AC and DC outputs display the approximate voltage/current output prior to initiation of the outputs.

**AC Voltage Amplitude**

**Accuracy:**  $\pm 0.05\%$  reading +  $0.02\%$  range typical,  $\pm 0.15\%$  reading +  $0.05\%$  range maximum

**Resolution:** .01

**Measurements:** AC RMS

**Ranges:** 30, 150, 300V

**AC Current Amplitude**

**Accuracy:**  $\pm 0.05\%$  reading +  $0.02\%$  range typical,  $\pm 0.15\%$  reading +  $0.05\%$  range maximum

**Resolution:** .001/.01

**Measurements:** AC RMS

**Ranges:** 30, 60A

**DC Voltage Amplitude**

**Accuracy:** 0.1% range typical, 0.25% range maximum

**Resolution:** .01

**Measurements:** RMS

**Ranges:** 30, 150, 300V

**DC Current Amplitude**

**Accuracy:**  $\pm 0.05\%$  reading +  $0.02\%$  range typical,  $\pm 0.15\%$  reading +  $0.05\%$  range maximum

**Resolution:** .001/.01

**Measurements:** RMS

**Ranges:** 30A

**Convertible Source in AC Current Mode**

**Accuracy:**  $\pm 0.05\%$  reading +  $0.02\%$  range typical,  $\pm 0.15\%$  reading +  $0.05\%$  range or  $\pm 12.5$  mA whichever is greater

**Resolution:** .001

**Measurements:** AC RMS

**Range:** 5, 15A

**Phase Angle****Ranges**

0.00 to 359.99 degrees, Counter Clock Wise, or Clock Wise rotation, or 0.00 to  $\pm 180.00$  degrees

**Accuracy:**  $\pm 0.02^\circ$  typical,  $\pm 0.25^\circ$  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.

**Resolution:** .001 Hz

**Frequency Accuracy**

2.5 ppm typical

25 ppm  $0^\circ$  to  $50^\circ$  C, at 50/60 Hz

**Total Harmonic Distortion**

Less than 0.1% typical, 2% maximum at 50/60 Hz.

**Timer**

The Timer-Monitor Inputs are designed to monitor and time-tag inputs, as a sequence of events recorder. In addition, the binary input controls enable the user to perform logic AND/OR functions on the inputs, and conditionally control the binary output relays 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:

**(Auto Ranging)**

**Seconds:** 0.0001 to 99999.9

**Cycles:** 0.01 to 99999.9

**Accuracy:**  $\pm 0.001\%$  of reading, typical.  $\pm 2$  least significant digit,  $\pm 0.005\%$  of reading from 0 to  $50^\circ$  C maximum.

**Binary Inputs – Start/Stop/Monitor Gates**

SMRT36 with a minimum of two VIGENS and the P option have 10 (with the N option have 2) identical, independent, galvanically isolated, Start/Stop or Monitor circuits provided. To monitor operation of relay contacts or trip SCR, a continuity light is provided for each input gate. Upon sensing continuity the lamp will glow. In addition to serving as wet/dry contacts the Binary Inputs may be programmed to trigger binary output sequence(s). Binary Inputs can also be programmed using Boolean logic for more complex power system simulations.

**Input Rating:** up to 300 V AC/DC

**Binary Output Relays**

SMRT36 with a minimum of two VIGENS and the P option have 6 (with the N option have 2) independent, galvanically isolated, output relay contacts to accurately simulate relay or power system inputs to completely test relays removed from the power system. Binary outputs simulate normally open / normally closed contacts for testing breaker failure schemes. Outputs 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 adds 2 more.

**AC Rating:** 400 V max., Imax: 8 amps, 2000 VA max. breaking capacity

**DC Rating:** 300 V max., Imax: 8 amps, 80 W

**Response Time:** <10ms

**High Speed Output Relays:** SMRT36 P Option adds 2

**AC/DC Rating:** 400 V peak, Imax: 1 amp

**Response Time:** <1ms typical

**Waveform Generation**

Each output channel can generate a variety of output waveforms such as: DC; sinewave; sinewave 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.

**Waveform Storage**

Each output channel can store waveforms for playback on command. End-To-End playback of stored waveforms is possible, when triggered externally by a GPS receiver.

**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, 2 are shared)

USB

Bluetooth (optional)

**IEC 61850 GOOSE Option**

The SMRT with the GOOSE option enabled, in conjunction with the optional Megger GOOSE Configurator (MGC) software, can be used in the testing or commissioning of IEC 61850 compliant devices. The MGC graphical user interface provides a quick and easy tool used to configure the test set. The traditional methods of substation interlocking and tripping a breaker via a contact have been replaced by high speed peer to peer GOOSE (Generic Object Oriented Substation Events) messages. This message will be used extensively when performing tests using the SMRT and the Megger GOOSE Configurator software.

**IEC 61850 Test Applications**

In order to test the IEC 61850 Intelligent Electronic Devices (IED) it is necessary to capture all the GOOSE messages from the IED. The SMRT is able to subscribe as well as publish GOOSE messages to the individual IED or to the entire network. A GOOSE message can be imported directly from an SCL (Substation Configuration Language) type file or directly captured by "sniffing" the network. Once a GOOSE message is imported or captured, the user will be able to either subscribe or publish GOOSE messages. The SMRT will provide the test signals to the relay under test. The IED being tested will publish a trip GOOSE to tell the breaker to trip. The SMRT reads the trip GOOSE, changes the analogue outputs from the SMRT, and "publishes" a GOOSE message telling the relay that the breaker tripped. In a trip and reclose scheme, the relay may "publish" another GOOSE telling the breaker to Close. The SMRT will read the close GOOSE, change the outputs from the SMRT, and publish a GOOSE back to the relay saying that the circuit breaker has closed. In addition to testing IED's, the SMRT with the MGC software may also be used to test the substation interlocking system, as well as monitor dataset status changes in specific GOOSE messages using a change in color of the effected GOOSE message(s). Using the Merge feature, the MGC may also be used to troubleshoot the substation SCL file by comparing the captured GOOSE messages with those in the SCL file.

**IEC 61850 Manual or Automated Testing**

The MGC assigns GOOSE messages to individual Binary Inputs and Outputs of the SMRT, thus instead of monitoring a set of relay contacts, the SMRT will monitor the GOOSE messages indicating pickup or trip operations. Once the SMRT has been configured using the MGC, the SMRT can be operated manually via the Smart Touch-View Interface controller, or automatically with the AVTS software. The SMRT with the IEC 61850 option provides selectable priority, VLAN-ID, and meets the IEC 61850-5 standard Type 1A, Class P 2/3, for high speed trip and reclose simulations.

**Temperature Range**

**Operating:** 32 to 122° F (0 to 50° C)

**Storage:** -13 to 158° F (-25 to 70° C)

**Relative Humidity:** 5 - 90% 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 12.0 D in.  
(360 W x 194 H x 305 D mm)

**With the lid off:** 14.2 W x 7.2 H x 12.0 D in.  
(360 W x 180 H x 305 D mm)

**IEC Enclosure Rating:** IP30

**Weight**

**With the transit lid on:** 27.9 lb. (12.55 kg)

**With the transit lid off:** 25.8 lb. (11.6 kg)

**Safety Standards**

**Safety:** EN 61010-1, UL 61010-1, CSA-C22.2 #61010-1

**Shock, Vibration and Transit Drop**

**Shock:** MIL-PRF-28800F (30g/11ms half-sine)

**Vibration:** MIL-RFP-28800F (5-500Hz, 2.05 grms)

**Transit Drop Test:** MIL-PRF-28800F (46cm, 10 impacts)

**Environmental**

**Steady Cold:** MIL-STD-810, Method 502.2

**Cold Storage:** MIL-STD-810, Method 502.2

**Steady Dry Heat:** MIL-STD-810, Method 501.2

**Hot Storage:** MIL-STD-810, Method 501.2

**Electromagnetic Compatibility****Emissions**

EN 61326-2-1

EN 61000-3-2/3

FCC Subpart B of Part 15

**Immunity**

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

## ORDERING INFORMATION

**Model SMRT36-**

## Style Number Identification

| <b>Voltage/Current Modules</b><br>Enter <b>1, 2, or 3</b>                                                                                                                                                                                                                                                  |  | <b>0</b> |  |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------|--|--|--|--|--|--|--|
| Reserved for Future Use                                                                                                                                                                                                                                                                                    |  |          |  |  |  |  |  |  |  |
| <b>Base Unit Options</b><br>Enter <b>N</b> = No Extra Binary Inputs / Outputs<br>Enter <b>P</b> = Plus Binary I/O and Bat Simulator                                                                                                                                                                        |  |          |  |  |  |  |  |  |  |
| <b>Smart Touch View Interface Option</b><br>Enter <b>1</b> = With STVI-1<br>Enter <b>0</b> = Without STVI-1                                                                                                                                                                                                |  |          |  |  |  |  |  |  |  |
| <b>Common Returns Option</b><br>Enter <b>F</b> = Floating Ungrounded Returns<br>Enter <b>G</b> = Grounded Common Returns                                                                                                                                                                                   |  |          |  |  |  |  |  |  |  |
| <b>Bluetooth Option</b><br>Enter <b>1</b> = With Bluetooth option<br>Enter <b>0</b> = Without Bluetooth option                                                                                                                                                                                             |  |          |  |  |  |  |  |  |  |
| <b>Power Cord Option</b><br>Enter <b>A</b> = North American Power Cord<br>Enter <b>I</b> = International Power Cord comes with jacket strip international color coded wires ready for installation of desired connector.<br>Enter <b>E</b> = Continental Europe Power Cord comes with CEE 7/7 Schuko plug. |  |          |  |  |  |  |  |  |  |
| <b>IEC61850 Option</b><br>Enter <b>1</b> = With Option<br>Enter <b>0</b> = Without Option                                                                                                                                                                                                                  |  |          |  |  |  |  |  |  |  |
| <b>Enclosure Options</b><br>Enter <b>S</b> = Standard rugged field enclosure<br>Enter <b>R</b> = Rack-mount Option. Unit comes with hardware for rack mount in 19 in rack                                                                                                                                  |  |          |  |  |  |  |  |  |  |
| <b>Test Leads Option</b><br>Enter <b>1</b> = With Leads (see Test Leads and Accessories for description of available leads)<br>Enter <b>0</b> = Without Option                                                                                                                                             |  |          |  |  |  |  |  |  |  |

**SELECTION OF CONFIGURATION AND OPTIONS****Voltage/Current Module**

The SMRT36 unit can have up to a total of 3 voltage/current modules. Enter the number of desired Voltage/Current modules 1, 2 or 3.

**Future:** 0, Reserved for future use.

**Base Unit Option**

The base unit can come with or without extra binary inputs, outputs and battery simulator. There are presently two options available. The first option is no extra binary inputs and outputs, or a battery simulator. With the SMRT36 the first two channels provide 1 binary input and 1 binary output each. A two channel unit provides a total of 2 binary inputs and 2 binary outputs, which is usually sufficient for most relay tests. Enter the alpha character N for No extra binary I/O or battery simulator. For the user who requires the extra binary inputs, outputs and/or the battery simulator enter P for Plus option.

**Smart Touch View Interface Option**

Enter the number 1 for the unit to come with the STVI-1, or enter the number 0 for without. Note that users can still set IP addresses, as well as all of the other system default settings normally set using the STVI-1 by using the AVTS Basic software (which comes with each unit).

| Item (Qty)                                            | Cat No. |
|-------------------------------------------------------|---------|
| <b>Smart Touch View Interface Option</b>              |         |
| Includes the following:                               |         |
| Smart Touch View Interface (1 ea.)                    | STVI-1  |
| STVI Ethernet Cable Assy., 210cm (7 ft.) long (1 ea.) | 620094  |

**Common Returns Option**

The SMRT unit has two options for the return terminals associated with each output channel. They are **F** for floating returns and **G** for grounded common returns. The floating returns option provides independent, isolated return terminals for each output channel. This option requires the user to connect, or common, all of the returns together externally using jumper leads (jumpers supplied with the **optional** Standard Test Leads, see **Test Leads and Accessories** for more information). Floating outputs is widely accepted in many countries, even though it requires the users to make extra test connections to common the returns together. One significant advantage is when running output currents in parallel and at high current amplitudes. By providing additional parallel leads to the common returns, instead of potentially burning up the internal grounded commons, all of the current is forced through the externally connected common return jumper test leads. It also allows more than two current channels to be series together in a push-push-push configuration. Normally this is done to increase the compliance voltage. Since the SMRT already provides 50 Volts per phase (100 Volts with two in series) this is not normally something that the SMRT user will need to do, but it is available with the floating output option. The second option is **G** for grounded common returns. All of the return terminals are interconnected internally and connected to chassis ground. This is popular in many parts of the world, since previous standard models (from Megger and other relay test set manufacturers) use grounded common returns.

**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 installed. Enter **0** for the standard unit.

**Power Cord Option**

There are three optional power cords to choose from. Depending on the destination country, customers can choose which type of power cord they want the unit to come with. Enter **A** for the North American Power Cord. The North American Power cord is used in 36 different countries and territories around the world. Enter **I** for the International Power Cord, which comes with international color coded wires (light blue, brown and green with yellow stripe) with the insulation jacket stripped ready for installation of the appropriate male connector. The international power cord is fairly universal since it does not come with the male connector. It allows the user to install their locally available connector. Enter **E** for the Continental Europe Power Cord, which comes with CEE 7/7 Schuko plug. This plug is commonly used in 42 different countries around the world, which includes most of Europe.

**IEC 61850 Option**

Enter the number **1** for the unit to come with the IEC 61850 option enabled. Enter **0** for the unit without IEC 61850 enabled.

**Enclosure Options**

Enter **S**, for Standard, rugged fiberglass reinforced ABS plastic field type enclosure. The options are **S** for Standard, and **R** for rack mount. The rack mount is not available at this time. The rack unit will come in a metal enclosure with 19 inch rack mount hardware installed.

**Test Leads Option**

Enter the number **1** for the unit to come with Test Leads. Enter **0** for the unit without Test Leads. Due to the optional number of Voltage/Current generators, and the optional Binary Input/Output with Battery Simulator, the type and number of test leads the unit comes with will vary. See the following for detailed descriptions.

**Test Leads and Accessories**

All units come with a power cord (see Power Cord option), and Ethernet communication cable, and instruction manual CD. All other accessories varies depending on the options selected, see Table of Accessories.

**Included Accessories****Included Standard Accessories**

| Item (Qty)                                                                                | Cat No. |
|-------------------------------------------------------------------------------------------|---------|
| 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   |

**Ethernet Crossover Cable**

Ethernet crossover cable for interconnection to PC



|                                |        |
|--------------------------------|--------|
| 210cm (7 ft.) long (Qty. 1 ea) | 620094 |
| STVI Application Software CD   | 81302  |

### SMRT36 Accessories

The following accessories are supplied with the selection of the Test Leads Option, 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.

|                                                                                     | <b>Optional Accessories Descriptions</b>                                                                                                                                                                                                                                                                                          | <b>STVI, or Binary I/O Bat SIM, or Test Leads Options</b> | <b>One (1) Voltage Current Module</b>     | <b>Two (2) Voltage Current Modules</b>    | <b>Three (3) Voltage Current Modules</b>  | <b>Binary I/O, Battery Simulator Option</b> |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|---------------------------------------------|
|    | <b>Accessory Carry Case:</b> Use to carry power cord, Ethernet cable, Optional STVI and test leads. Carry case may be clipped to the SMRT enclosure, or use carry strap to carry over shoulder.                                                                                                                                   | Qty. 1 ea.<br>Part No.<br><b>2001-487</b>                 |                                           |                                           |                                           |                                             |
|    | <b>Sleeved Pair of Test Leads:</b> 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.<br>Part No.<br><b>2001-394</b> | Qty. 6 pr.<br>Part No.<br><b>2001-394</b> | Qty. 2 pr.<br>Part No.<br><b>2001-394</b> | Qty. 3 pr.<br>Part No.<br><b>2001-394</b>   |
|                                                                                     | <b>Cable/Spade Lug Adapter (Small):</b> Small lug fits most new relay small terminal blocks.                                                                                                                                                                                                                                      |                                                           |                                           |                                           |                                           |                                             |
|    | Lug adapter, <b>red</b> , 4.1 mm, use with test leads up to 1000 V/20 Amps CAT II.                                                                                                                                                                                                                                                |                                                           | Qty. 3 ea.<br>Part No.<br><b>684004</b>   | Qty. 6 ea.<br>Part No.<br><b>684004</b>   | Qty. 12 ea.<br>Part No.<br><b>684004</b>  | Qty. 3 ea.<br>Part No.<br><b>684004</b>     |
|  | Lug adapter, <b>black</b> , 4.1 mm, use with test leads up to 1000 V/20 Amps CAT II.                                                                                                                                                                                                                                              |                                                           | Qty. 3 ea.<br>Part No.<br><b>684005</b>   | Qty. 6 ea.<br>Part No.<br><b>684005</b>   | Qty. 12 ea.<br>Part No.<br><b>684005</b>  | Qty. 3 ea.<br>Part No.<br><b>684005</b>     |
|  | <b>Jumper Lead:</b> 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. 2 ea.<br>Part No.<br><b>2001-573</b> | Qty. 4 ea.<br>Part No.<br><b>2001-573</b> |                                             |
|  | <b>Sleeved Combination Voltage Test Leads:</b> 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, three red and black, 200 cm (78.7") long, 600 V, 32 Amperes CAT II. |                                                           |                                           |                                           | Qty. 1 ea.<br>Part No.<br><b>2001-395</b> |                                             |
|  | <b>Sleeved Combination Current Test Leads:</b> 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, three red and black, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.                                |                                                           |                                           |                                           | Qty. 1 ea.<br>Part No.<br><b>2001-396</b> |                                             |

| Item (Qty) | Cat No. |
|------------|---------|
|------------|---------|

**Deluxe Test Leads and Accessories Kit**

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.

2001-619

**Sleeved Combination Voltage Test Leads:**

Keeps the test leads from getting entangled.

Sleeved Three Phase Test Leads,  
three red and black, 200 cm (78.7") long,  
600 V, 32 Amperes CAT II (Qty. 1 ea)

2001-395

**Sleeved Combination Current Test Leads:**

Keeps the test leads from getting entangled.

Sleeved Three Phase Test Leads,  
three red and black, 200 cm (78.7") long,  
600 V, 32 Amperes CAT II (Qty. 1 ea)

2001-396

**Sleeved Pair Test Leads**, one red, one black,  
200 cm (78.7") long, 600 V, 32 Amperes CAT II,  
(Qty. 5 pair)

2001-394

**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**

2001-487

| Item (Qty) | Cat No. |
|------------|---------|
|------------|---------|

**Additional Accessories (Not Included in the 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

**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

90001-843

Retractable Sleeve Test Lead, black, 50 cm (20") long,  
use with test leads up to 600 V, 32 Amperes CAT II

90001-844

**Item (Qty) Cat No.**



**In-Line Fused Test Lead:** Use with high speed binary outputs 5 or 6 to protect for switching of currents higher than 1 Amp.

Test lead, blue, in-line 500 mA fuse protection, 200 cm long (78.7") (Qty. 1 ea) **568026**



**In-Line Fused Test Lead:** Use with Battery Simulator output to protect for accidental connection to substation battery.

Test lead, black, in-line 3.15 A fuse protection, 200 cm long (Qty. 1 ea) **568025**



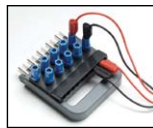
**In-Line Resistor Test Lead:** Use with old solid state relays with "leaky" SCR trip gates.

Test lead, red, in-line 100 k Ohm resistor, use with test leads up to 1000 V/32 Amps CAT III **500395**



**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 **FTP10**



**STATES® 10 Pole Test Paddle Attachment:** Use with STATES FTP10 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, 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. The case is small (meets airline total dimensions restrictions of 62 in/157 cm as checked luggage), and weighs only 23 pounds (10.35 kg). With a three channel SMRT36, test leads and STVI it is light enough to check as luggage on commercial airliners (slightly more than 55 lbs/24.75 kg).

Rugged, hard-sided transit case (1ea) **1001-632**

**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 SMRT36 three phase unit, with the extra binary I/O and Battery Simulator, with the STVI-1, with grounded common returns, no Bluetooth, no IEC61850, in the standard enclosure with test leads.

The style number would be, **SMRT36 - 30P1G0A0S1**

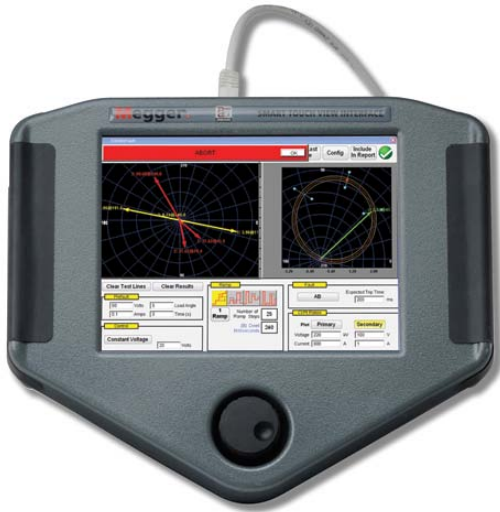


For customers in **Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, Portugal, Spain, Sweden, Turkey,** and other countries where the CEE 7 standard connector is used could order a unit with the Continental European Power Cord with CEE 7/7 Schuko plug. In this example the unit is a 3 phase unit, with the extra binary I/O and Battery Simulator, without the STVI-1, with floating outputs, no Bluetooth, with IEC61850 enabled, in the standard enclosure with test leads.

The style number would be, **SMRT36 - 30P0F0E1S1**

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, Demark, India/South Africa, Ireland, Israel, Russia, Switzerland, or the United Kingdom.** 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 3 phase unit, with the extra binary I/O and Battery Simulator, with the STVI-1, with the floating outputs, with Bluetooth, with IEC61850 enabled, in the standard enclosure with test leads.

The style number would be, **SMRT36 - 30P1F1I1S1**

**STVI****Smart Touch View Interface**  
**Handheld Controller for SMRT and MPRT Test Sets**

- **Large High Resolution Color TFT LCD touch-screen intuitive smart navigation makes testing relays easier**
- **Designed for either right or left handed operation with control knob centrally located**
- **Automatic Ramp, Pulse Ramp, Binary Search and Pulse Ramp Binary Search Capability for pick up and dropout tests**
- **Overcurrent Relay Test includes IEC, IEEE and hundreds of Specific Relay Time-Curves Built-in**
- **Dynamic Testing Capability, Multi-Shot Trip and Reclose "Sequencing" test screen**
- **Save/View/Print results from internal PowerDB Database**

**DESCRIPTION**

The Smart Touch View Interface™ (STVI) is Megger's second generation of handheld controllers for the new SMRT and older MPRT<sup>1</sup> relay test systems. The STVI, with its large, full color, new high resolution, and high definition TFT LCD touch screen allows the user to perform manual, steady-state and dynamic testing quickly and easily using the Manual or Sequencer test screens, as well as using built-in preset test routines for most popular relays. Ergonomically designed for either right or left hand operation using the rubber cushion grips, the centrally located control knob, and the touch screen, the STVI is extremely easy to use. Use the new built-in stand for single-handed operation. The STVI uses a standard Ethernet cable, and Power Over Ethernet (POE) operation. The STVI includes non-volatile built-in data storage for saving tests and test results. A USB port is provided for transferring test results to your PC.

**APPLICATION**

The most significant feature of the STVI is its ability to provide the user with a very simple way to manually test, for both commissioning and maintenance, from the simple overcurrent relay to the most complex relays manufactured today. Manual operation is simplified through the use of a built-in computer operating system and the touch screen. The STVI eliminates the need for a computer when testing virtually all types of relays. Intuitive menu screens and touch screen buttons are provided to quickly and easily select the desired test function.

**Here's how easy it is****Manual Test Screen**

In the following Manual Test Screen the pre-selected outputs are set using the touch screen, or power-up preset default values maybe automatically set from the user defined configuration screen. The user can select from a variety of test options including manual control using the control dial, a dynamic sequence of tests to include trip and reclose operations, an automatic ramp, pulse ramp, binary search or pulse ramp binary search to determine pickup or drop out of relay contacts, or perform relay specific timing tests. By pressing the ON  button, the selected output indicators will change colors indicating which

| VOLTAGE |        |         |        | CURRENT |       |         |        |
|---------|--------|---------|--------|---------|-------|---------|--------|
|         | Volts. | Degrees | Hertz. |         | Amps. | Degrees | Hertz. |
| 1       | 69.00  | 0.00    | 60.000 |         | 0.000 | 0.00    | 60.000 |
| 2       | 69.00  | 120.00  | 60.000 |         | 0.000 | 120.00  | 60.000 |
| 3       | 69.00  | 240.00  | 60.000 |         | 0.000 | 240.00  | 60.000 |

Figure 1. STVI Manual Test Screen

<sup>1</sup> Requires external power supply adapter

outputs are energized. A vector graph indicates the relative phase angles of all of the outputs. The user may select to have all output amplitudes metered to provide real time verification of all of the selected outputs, or have setting values displayed. In the Manual test screen the user can set Prefault and Fault values. The user can toggle back and forth between the two values to monitor contact activity. To do a simple timing test the user can set Prefault time duration in seconds, and then press the Blue Play button. The Prefault values will be applied for the Prefault time, then change to the Fault values and start the Timer running. When the relay trips, it will stop the timer, and may turn selected outputs off depending on the user defined Auto-Off configuration.

### Auto Ramp, Pulse Ramp and Binary Search Features

The STVI may be used to determine pickup or dropout of various types of relays. Pressing the Auto Ramp button  presents four choices; Step Ramp, Pulse Ramp, Binary



Figure 2. Ramp and Search Tool Bar

Search and Pulse Ramp Binary Search. The first selection, Step Ramp, will ramp the output by applying a value and then waiting a specific amount of time before incrementing. For example, to automatically ramp output current the user will select the channel to be ramped, input Start and Stop Amplitudes, an Increment (A), and a Delay time in Cycles (B). See the following figure.

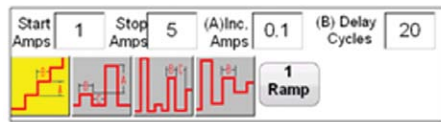


Figure 3. Ramp Setting Example

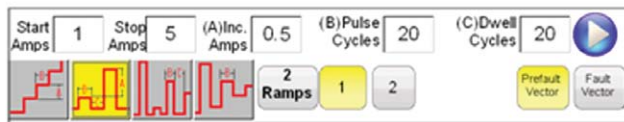


Figure 4. Pulse Ramp Setting Example

Pulse Ramp will start at user defined prefault condition, increment up or down returning to the prefault condition between each increment. Instead of Delay time the user sets the Pulse Cycles time, which applies the fault value to the relay for the specified time. The user can select a 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> ramp if desired, changing the size of the increment with each ramp. This feature is most used when

doing instantaneous pickup tests. The output current, or voltage, can be incremented in large steps getting to the pickup point quickly, and then reduce the size of the increment to zero-in on the pickup value. This reduces the test time, heating of the relay under test, and provides a very accurate test result. This feature is also used when testing multi zone distance relays using three phase voltage and currents. Set the Pulse Cycles duration just long enough for the intended zone to operate. If you are not sure exactly where the pickup value of the relay is, you can use the Pulse Ramp Binary Search feature.

### Timing Test Feature

Pressing the Time test button  on the top menu bar, the user is presented a menu of relays to test. Built-in timing tests are provided for a wide variety of protective relays, including Overcurrent, Voltage, and Frequency relays. To make it even easier and faster, the STVI has IEEE and IEC standard time curve algorithms built-in. In addition, the STVI also includes time curves and time curve algorithms for hundreds of different specific relays selectable by manufacturer, model number, and curve shape (inverse, very inverse, definite time etc.). In the following example, the Alstom relay with a 1 Amp Tap and a number 2 Time Dial was selected.

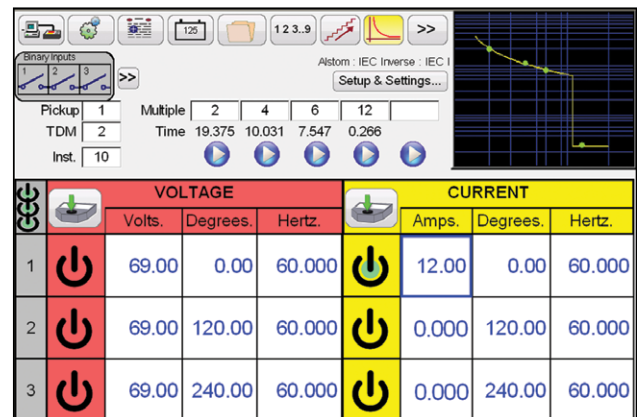


Figure 5. Timing Test Screen for Alstom Inverse Overcurrent Relay

By entering the appropriate values in the setting screen, when the timing test is conducted, the test results will automatically be plotted and compared to the theoretical values from the relay specific time curve that was selected. If the test Multiple is changed, the appropriate theoretical trip time will change automatically.

### View Test Reports

To View the test result, press the Add to Reports  button. The user can now enter appropriate information relative to the test in the Test Report header. See the following example report.

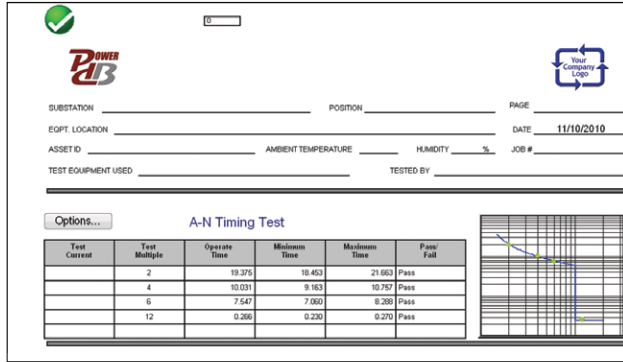


Figure 6. Test Report Alstom IEC Inverse Timing Test

Note that the software automatically compared the Operating Time to the theoretical and made a Pass/Fail determination based upon the manufacturers time curve characteristic. If the recorded test point(s) is out of specification it appears red in color. If it is within specification it will be green in color. This provides excellent visual As Found reporting. Up to 5 points maybe plotted including Instantaneous trip points. If the data is imported into PowerDB reports can be generated that summarize the comments and failures of every test you perform.

### State Sequence Timing Test Feature

Pressing the State Sequence button **1 2 3..9** on the top menu bar takes the user to the Sequence Timing Test Screen. There are 9 programmable steps available in the Sequence Test Screen.

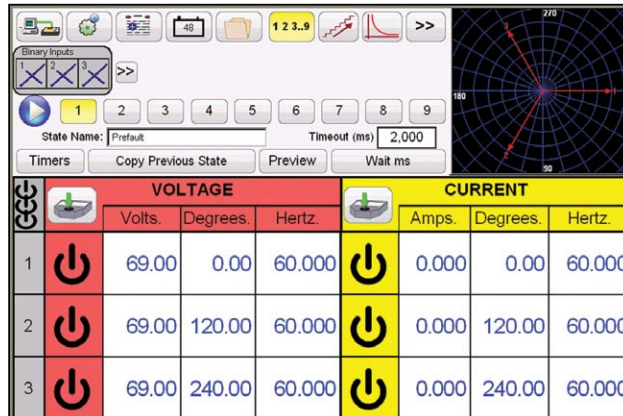


Figure 7. Sequence Test Screen

By default, the 9 states are already labeled as Prefault, Trip1, Reclose 1, etc. up to Lockout in step 9. Therefore, it is initially setup for a four shot trip, reclose to lockout scenario. The user is free to change the labels, or use the default labels. With each state the user may input values of voltage, current, phase angle, frequency and set the Binary Input sensing for each state. Both single pole and three pole trip can be simulated. There are default values and binary settings for a single phase trip and reclose scenario already programmed in. The user can either use the defaults or change them to suit the application. Press the Timers button to view the Timer Settings and Labels.

In addition the user can view where each timer starts and stops in association with each trip and reclose operation (see the following figure).

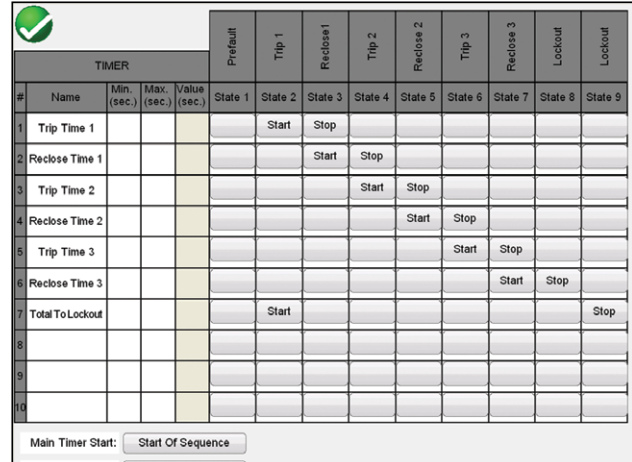


Figure 8. Sequence Timers Settings and Labels Screen

Note that the Total Time to Lockout is also included in the setting and indicates where the total timer starts and stops. This allows for 1, 2, 3, or 4 shots to lockout including reclose times. To set the conditions for each change of state press the Wait button directly under the Timeout window. The user will be presented with several conditional settings to choose from, such as wait milliseconds, wait cycles, wait any contact (OR), and wait all contacts (AND). These are some of the conditions that the unit will take in order to determine when to change to the next state.

To set the Binary Outputs to simulate the 52a and/or 52b contacts press the smaller **>>** "more" button next to the Binary Inputs block to expand the selection window. Press on Show All Binary Outputs, and all the appropriate number of Binary Outputs, along with a select number of Binary Inputs will be displayed. In the prefault state you may choose to have Binary Output 1 contact in the closed condition to simulate breaker closed. Click on Binary Output 1 and the Binary Output setting window will appear. The default setting is Open. Click on the Close Contact Button to simulate breaker closed. Note the Name in the window is defaulted to 1. The user is free to rename it to any name or value (that will fit in the allotted space) by touching the window and use the virtual keyboard.

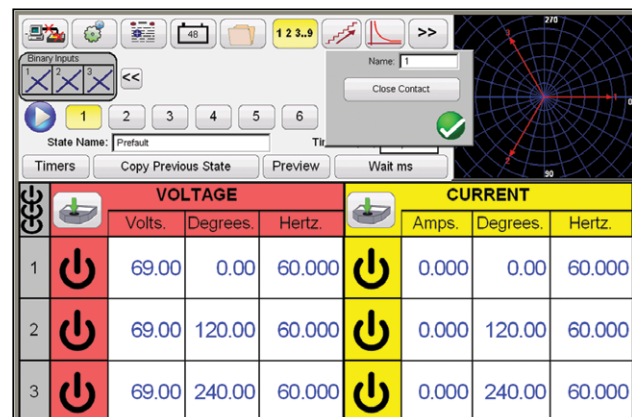


Figure 9. Binary Output Setting Screen

Once all of the Binary Inputs, Outputs, Prefault, Fault and Reclose settings are completed, the user can then press the Preview button to get a visual representation of the voltage and current outputs, as well as a visual of the binary inputs and outputs for each stage of the simulation. The following figure illustrates the default sequence.

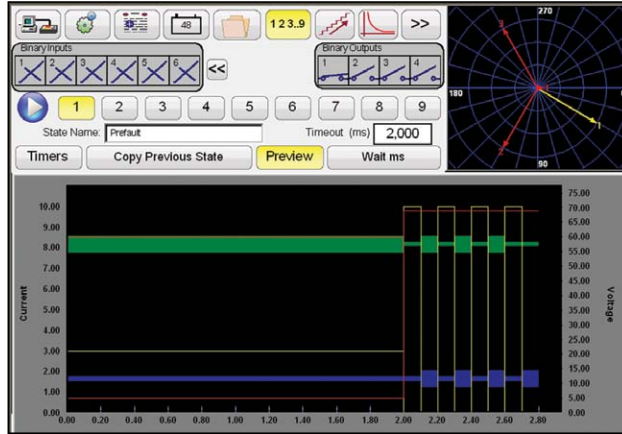


Figure 10. State Sequence Preview Screen

Press the Preview button again to return to the State Sequence Test Screen. To execute the test press the Blue play button. Save and review test results as previously discussed.

### Adding New Features

The STVI has many powerful test features. However, there are many new features that are still to come. Megger is continuously developing new products and improving existing products. Once a new feature completes certification tests, it may be downloaded into the STVI as a field upgrade. One of the new features for the STVI that is undergoing certification tests is Click-on-Fault (CoF) for testing impedance relays.

### Testing Impedance Relays

To test impedance relays, the user would press the large more button **>>** located next to the Vector display screen. Select the Impedance relay from the menu bar. The user will be taken to the Click on Fault Impedance relay test screen. The user will have two choices, select Generic Characteristics or select Relay Library. Selecting Generic Characteristics the user will be presented with a selection screen of generic impedance relay characteristics, see the following figure.

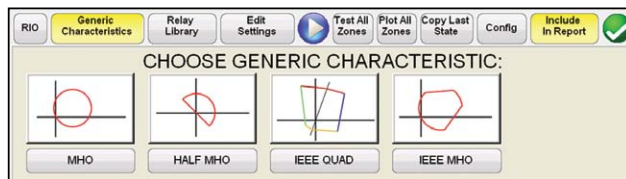


Figure 11. Generic Impedance Relay Selection Screen

The user simply selects the relay operating characteristic from the menu bar, like MHO. From here the user can define the Reach, Angle, and Offset (if any) for up to 5

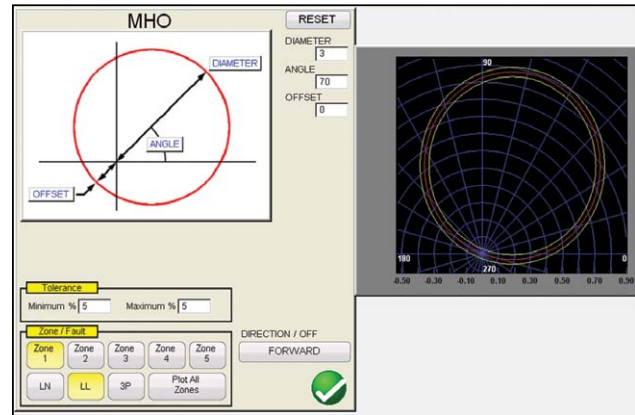


Figure 12. Generic MHO Setting Screen

Zones. In addition, the user selects phase to ground, phase to phase, or three phase faults, and if the characteristic is in the Forward or Reverse direction. The final selection is whether to see all zones together or not. Clicking on the green check button will take the user to the test screen, see the following.

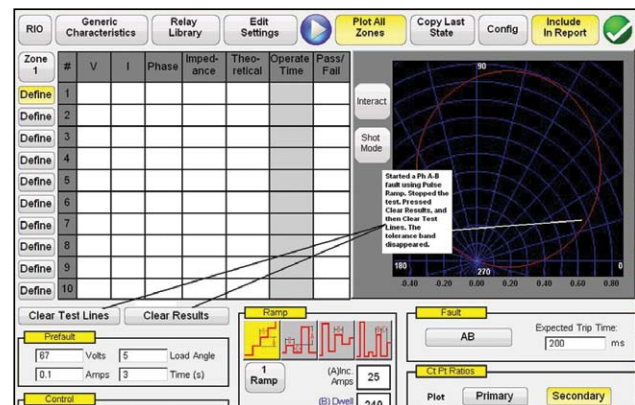
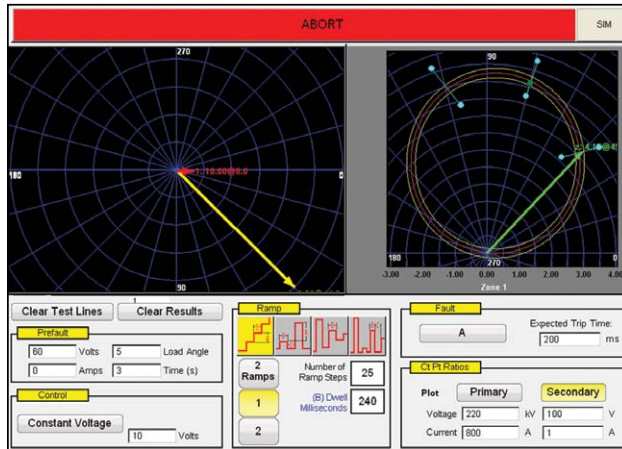
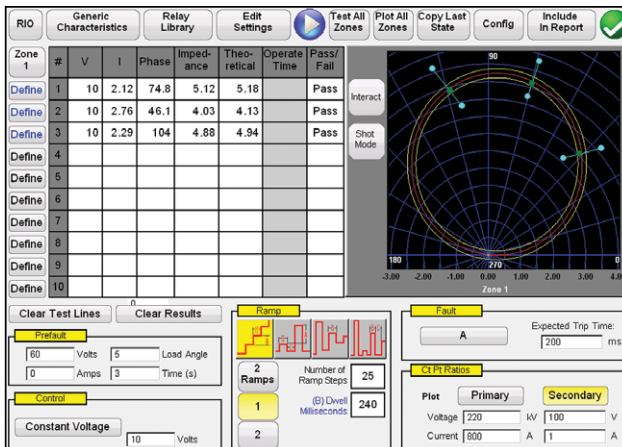


Figure 13. MHO Relay Click On Fault Test Definition Screen

The user selects Zone, Constant Voltage, Constant Current, Constant Source, or Constant Source (RX). The user inputs the appropriate test quantity (fault voltage, current, or impedance and angle), and selects the type of fault to simulate, and the type of ramp desired to test the zone. Four types of ramps are available, linear ramp, pulse ramp, binary search, and pulse ramp binary search. Then the user simply touches the screen to create a line where they wish to test. The built-in fault calculator will automatically calculate the test values depending on the control setting and display the test quantities on the left side. Up to 10 points per test per zone may be defined. The user simply presses the blue execute button and the SMRT will automatically perform all the tests and record the results. A typical test may look like the following Figure.


**Figure 14. COF Real Time Test Screen**

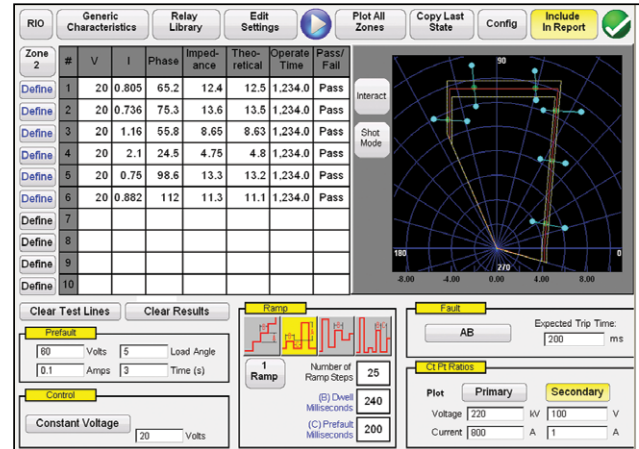
On the right side the user can visually see the test pointer moving in the impedance plane indicating exactly where the test impedance is in real time. When the relay operates a green colored test point is displayed indicating where the relay operated. On the left side the user can see the test vectors changing in real time. If desired the user can select to see the positive, negative and zero sequence values in the left side with a change in the user configuration screen. When the test is completed, the test results are displayed for each defined test point with PASS/FAIL indication, see the following figure for a sample result.


**Figure 15. Generic MHO COF Test Results**

Test results that pass are shown with a green dot, and results that do not pass are shown as red dots.

Selecting from the **Relay Library** the user may select from a list of relay specific predefined operating characteristics from ABB, ASEA, AREVA, GE, Siemens, and SEL, see the following figure for an example relay.

To test the user simply selects the type of fault desired (Line to Earth, Line to Line, Three Phase) and presses the touch screen to select test points. The STVI will automatically calculate the appropriate test currents and


**Figure 16. REL 670 Test Result Screen**

phase angles based upon the Settings and the Fault Type selected. In the Settings screen the user can define Constant Voltage, Constant Current or Constant Source Z. If using the Search the test will progress down a line, either as a **ramp**, a **pulse ramp**, a **binary search**, or the new **pulse ramp binary search** looking for the relay to operate. Test results are automatically displayed for each test point similar to Figure 16.

## FEATURES AND BENEFITS

**Large Color TFT LCD touch-screen display** – The STVI features an easy to read high resolution display providing manual control of the test set, and displays measured values of voltage, current, along with phase angle and frequency even in direct sunlight. Color contrasts accentuate vital information. This reduces human error and saves time in testing relays.

**Use with SMRT and MPRT relay test sets** – Operates the new SMRT as well as the older MPRT relay test sets. Universal application provides flexibility of use.

**Easy to use for manual tests** – The STVI touch screen is intuitive to use, and requires no special training. Touch screen function buttons, with powerful testing tools such as auto ramp, pulse ramp, binary search, pulse ramp binary search, or the simple to use control knob may be used to determine pickup or drop out of relay contacts.

**Internal memory** – The STVI provides storage of test set-up screens and test results, which reduces testing time and paper work. Saved test results can be downloaded into the PowerDB database software for report generation using the built-in USB port.

**Steady-State and Dynamic test capability** – The STVI in conjunction with either the SMRT or older MPRT provides both steady-state and dynamic testing of protective relays. Set pre-fault, fault and simulate circuit breaker operation using the STVI sequence test screen. Perform trip and reclose timing tests with up to 9 operations including lockout. Save trip, reclose times to the internal memory and print out later. The STVI provides complex timing tests without the need of a PC.

**Display screen prompts operator** – The STVI features a touch screen that prompts the user with easy to use function buttons. Single button operation and intuitive ease of use saves time in testing relays and minimizes human error.

**Display screen provides four languages** – The STVI display screen currently prompts the user in English, French, German, and Spanish.

**Immediate error indication** – Audible and visual alarms indicate when amplitude or waveforms of the outputs are in error, such as shorting a voltage channel.

### STVI Specification

#### Input Power:

The STVI draws power through the Ethernet cable using Power-Over-Ethernet (POE) from the host unit (SMRT36), or from an external Power Over Ethernet power supply and Ethernet interface for use with SMRT1 or MPRT units.

#### Communication Interfaces

Ethernet RJ45, 10/100 Mbps/s

**USB Ports:** 2

#### Power over Ethernet

IEEE Std 802.3 AF

#### Display Screen

The TFT LCD display provides high resolution, and features Wide Viewing Angle Technology and a large screen with high luminance for reading in direct sunlight.

**Dimensions:** 5.13 H X 6.84 W in (128.2 H X 170.9 W mm), 8.4" Diagonal

**Display:** 262k Colors, backlit, TFT LCD touch screen, Anti-glare surface with hard coating, 800 Cd/m<sup>2</sup> Luminance, 640 x 480 pixels

**Languages:** English, French, Spanish and German.

#### Temperature Range

**Operating:** 32 to 122° F (0 to 50° C)

**Storage:** -13 to 158° F (-25 to 70° C)

**Relative Humidity:** 5 - 90% RH, Non-condensing

#### Unit Enclosure

The STVI unit comes housed in a rugged, lightweight and ergonomic plastic enclosure. It features large rubber handles, and a built in stand for hands-off operation.

#### Dimensions

11 W x 9.375 H x 1.875 D in. (275 W x 234 H x 46.8 D mm)

#### IEC Enclosure Rating

IP30

#### Weight

3.6 lb. (1.6 kg)

### CONFORMANCE STANDARDS

#### Safety

EN 61010-1, UL 61010-1, CSA- C22.2 #61010-1

#### Shock, Vibration and Transit Drop

**Shock:** MIL-PRF-28800F (30g/11ms half-sine)

**Vibration:** MIL-RFP-28800F (5-500Hz, 2.05 g rms)

**Transit Drop Test:** MIL-PRF-28800F (46cm, 10 impacts)

#### Environmental

**Steady Cold:** MIL-STD-810, Method 502.2

**Cold Storage:** MIL-STD-810, Method 502.2

**Hot Storage:** MIL-STD-810, Method 501.2

**Steady Dry Heat:** MIL-STD-810, Method 501.2

#### 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

### ORDERING INFORMATION

| Item (Qty)                                                            | Cat. No.  |
|-----------------------------------------------------------------------|-----------|
| Smart Touch View Interface for SMRT36 relay test system (1 ea)        | STVI-1    |
| Smart Touch View Interface for SMRT1 or MPRT relay test system (1 ea) | STVI-2    |
| <b>Included Accessories with STVI-1</b>                               |           |
| STVI Application Software CD                                          | 81302     |
| STVI Ethernet Cable Assy., 210 cm (7ft.) long, (1 ea)                 | 620094    |
| <b>Included Accessories with STVI-2</b>                               |           |
| STVI Application Software CD                                          | 81302     |
| STVI Ethernet Cable Assy., 210 cm (7ft.) long, (1 ea)                 | 620094    |
| Power Over Ethernet Power Supply for SMRT1 or MPRT (1 ea)             | 90001-736 |