SMRT43D
Megger Multi-Phase Relay Test System

- **Integrated Smart Touch View Interface™ running RTMS software provides stand-alone operation using intuitive high resolution graphic touchscreen, no PC required**
- **4 Voltage channels, 3 Current channels**
- **High current output - 45 Amps at 300 VA per phase**
- **Dynamic, Transient and GPS Satellite Synchronized End-to-End Testing Capability**
- **IEC 61850 Testing Capability**

DESCRIPTION

The SMRT43D is a multipurpose, light-weight, field portable test set capable of testing a wide variety of electro-mechanical, solid-state and microprocessor-based protective relays, motor overload relays and similar protective devices.

The unit can be operated either manually via the built-in touch-screen user interface, or placed under full computer control via the AVTS, Advanced Visual Testing Software, or the RTMS, Relay Test Management Software, running on a PC.

The built-in user interface, called the Smart Touch-View Interface™, is Megger's second generation of automatic / semi-automatic manual user interface running the new RTMS software. It incorporates a large, easy to read **Full Color** high resolution, high definition, TFT LCD touch-screen display, which displays metered values such as AC and DC Amperes, AC and DC Volts, and Time in both seconds and cycles. Depending on the type of test selected, other values may be displayed, such as Phase Angle, Frequency, Ohms, Watts, VA, or Power Factor.

APPLICATIONS

The test system may be customized by adding the number of Voltage-Current, "VIGEN", modules needed for specific test applications, with a maximum of 3 channels. For example, the SMRT43D 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 sources.

Each current channel is rated for 30 Amps @ 200 VA rms continuous, and up to 45 Amps @ 300 VA rms for short durations. For testing relay panels or electromechanical relays, it has a unique flat power curve from 4 to 30 Amps that insures maximum compliance voltage to the load at all times.

With a maximum compliance voltage of 50 Volts per phase, two channels in series provide 100 Volts to test high impedance relays. Three currents in parallel provide test currents up to 12 Amperes at 600 VA for testing ground overcurrent relays at high multiples of tap rating.

With three currents in parallel it can provide up to 135 Amps at 900 VA for testing instantaneous overcurrent relays.

Each voltage channel can provide variable outputs of 0- 30/150/300 Volts at 150 VA of output power. Automatic range changing is done on-the-fly and under load. For testing a panel of relays or older electromechanical impedance relays, it has a unique flat power curve from 30 to 150 Volts insuring maximum output power to the load at all times. A fourth voltage channel can provide a synchronizing reference voltage, or serve as a battery simulator.

Using the Ethernet ports, the SMRT43D is a plug-and-play unit where voltage and current outputs seamlessly synchronize with other SMRT units for testing more complex applications, even back-to-back or up to 30 phase currents for bus differential scheme tests.

MANUAL OPERATION

The RTMS software in conjunction with the Smart Touch View Interface™ 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 with the control knob, and the touch screen, the powerful RTMS software is extremely easy to use.

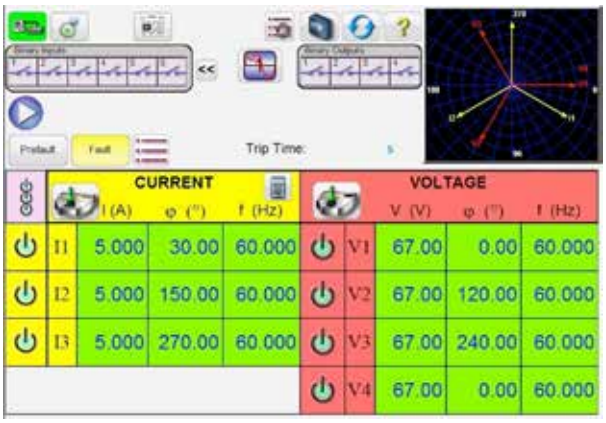


Figure 1 Advanced User Interface

The most significant feature of the RTMS software 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 built-in controller and RTMS software eliminates the need for a computer when testing virtually all types of relays. Enhanced graphics, intuitive menu screens, and touch screen icon buttons are provided to quickly and easily select the desired test function. For more details on the RTMS software test capability see the RTMS datasheet.

FEATURES AND BENEFITS

Large Color TFT LCD touch-screen display – Easy to use and read (even in direct sunlight) display provides manual control of the test set. Color contrasts accentuate vital information. This reduces human error and time in testing relays.

Constant Power Output –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 and/or series current channels together to test high burden relays, which also saves time.

Higher Output Current – The SMRT43D provides up 30 Amps at 200 VA per phase continuous, or up to 45 Amperes at 300 VA with a 1.5 second duty cycle. Three current amplifiers can be paralleled to provide a maximum of 135 Amperes at 900 VA for testing all instantaneous overcurrent relays.

PowerV™ Voltage Amplifier High Power Output –
The SMRT43D provides a higher VA output on the voltage channel at the lower critical test voltages (from 30 to 150 Volts), with a maximum output voltage of 300 Volts. Users, who want to test a panel of relays at one time, or certain older electromechanical impedance relays, find it impossible using lower VA rated voltage source.

High resolution and accuracy – Metered outputs and timer provides extremely high accuracy. With metered outputs, what you see is what you get.

Internal memory – Provides storage of test set-up screens and test reports, which reduces testing time and paper work.

Steady-State and Dynamic test capability – The SMRT43D 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.

Touch screen provides four different languages – Prompts the user in English, Spanish, French, or German.

Digital inputs and outputs – Up to 10 programmable inputs, and 6 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 – The SMRT43D can 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 Dynamic Control, or the RTMS Sequencer Test; with a portable GPS satellite receiver (or suitable IRIG-B time code source input into Binary Input #1), the SMRT43D performs satellite-synchronized end-to-end dynamic or transient tests. This provides precisely synchronized testing of remotely located complex protection schemes.

Perform Multi-Phase Tests – The SMRT43D can be interconnected 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 3 channel SMRT43D may be interconnected with 6 SMRT1's, or 2 SMRT36 units, providing up to 15 current channels. A maximum of 30 currents are permitted with the RTMS software.

Three Ethernet Ports – The Ethernet port provides a high-speed computer interface, IEC-61850 test capability, and an interface for interconnecting other SMRT units for multi-phase test applications.

Immediate error indication – Audible and visual alarms indicate when amplitude or waveforms of the outputs are in error due to short circuit, open circuit, or thermal overload.

Open Communication Architecture – Use with third party software for more flexible automated control.

SPECIFICATIONS[1]

Input Power
90 to 264 Volts AC, 1Ø, 50/60 Hz, 1800 VA.

Outputs
All outputs are independent from sudden changes in line voltage and frequency. All outputs are regulated so changes in load impedance do not affect the output. Each output (VIGEN) module consists of one voltage amplifier, and a current amplifier. 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 SMRT43D with three VIGEN modules can provide up to three current sources. The per channel output current and power ratings are specified in AC rms values and peak power ratings.

Per Channel Output

Output Current	Power	Max V
1 Ampere	15 VA	15.0 Vrms
4 Amperes	200 VA(282 peak)	50.0 Vrms
15 Amperes	200 VA(282 peak)	13.4 Vrms
30 Amperes	200 VA(282 peak)	6.67 Vrms
45 Amperes	300 VA(424 peak)	6.67 Vrms
DC 30 Amperes	200 Watts	

Duty Cycle: 30 Amps Continuous, 45 Amps 1.5 seconds

Three Currents in Parallel:

Output Current	Power	Max V
12 Amperes	600 VA(848 peak)	50.0 Vrms
50 Amperes	600 VA(848 peak)	13.4 Vrms
90 Amperes	600 VA(848 peak)	6.67 Vrms
135 Amperes	900 VA(1272 peak)	6.67 Vrms

Two Currents in Series

With two currents in series, the compliance voltage doubles to provide 4.0 Amperes at 100 Vrms up to 30 Amperes at 13 Vrms.

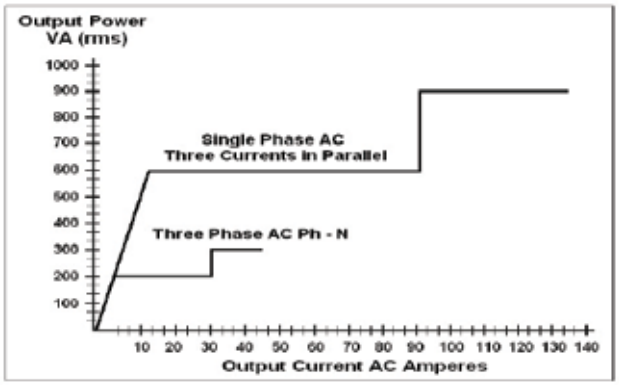


Figure 2 Current Output Power Curve

Current Amplifier - Extended Power Range:

The SMRT43D current amplifier provides a unique flat power curve from 4 to 30 Amperes per phase to permit testing of electromechanical high impedance relays, and other high burden applications, with an extended operating range up to 45 Amperes at 300 VA rms for short durations.

AC Voltage Output

The SMRT43D can provide three voltage sources 0 – 300 Volts AC/DC. The unit can provide a 4th AC/DC voltage source to serve as either a reference synchronizing voltage or as a battery simulator, see AC/DC AUX Voltage Channel.

Outputs are rated with the following Ranges:

Output Volts	Power	Max I
30 Volts	150 VA	5 Amps
150 Volts	150 VA	Variable[2]
300 Volts	150 VA	0.5 Amps
DC	150 Watts	

Duty Cycle: Continuous

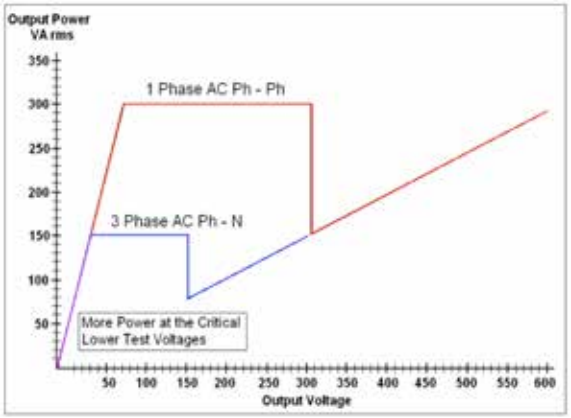


Figure 3 Voltage Amplifier Output Power Curve

"PowerV™" Voltage Amp-Extended Power Range

The SMRT43D 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, and older electromechanical distance relays which demand a higher power voltage source to properly test.

AC/DC AUX

The AC/DC AUX voltage channel can be either a variable AC voltage source to use as a polarizing or synchronizing voltage source, or a battery simulator with a variable DC output voltage.

Ranges(AC)	Power	Max I
30 Volts	100 VA	3.33 A
150 Volts	100 VA	0.67 A

Ranges(DC)	Power	Max I
30 Volts	100 Watts	3.33 A
250 Volts	100 Watts	0.4 A

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: 0.001 Hz

Frequency Accuracy: 2.5 ppm typical

25 ppm, 0° to 50° C, at 50/60 Hz Maximum

AC/DC AUX: 250 ppm, 50/60 Hz Maximum

Metering

Measured output quantities such as AC Amperes, AC Volts, DC Volts or DC Amperes, and Time may be simultaneously displayed on the touch screen. Preset AC and DC outputs display the approximate voltage/current output prior to initiation. This provides a fast, easy method for preset of outputs. Other values that may be displayed, depending on which test screen is in view, are phase angle, frequency, Ohms, Watts, VA, and Power Factor. All Accuracies stated are from 10 to 100 % of the range at 50/60 Hz.

AC Voltage Amplitude

Accuracy: ±0.05 % reading + 0.02 % range typical,
±0.15 % reading + 0.05 % range maximum
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 maximum
Resolution: .001/.01
Measurements: AC RMS
Ranges: 30, 60A

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

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

DC Voltage Amplitude
Accuracy: 0.1% range typical, 0.25% range maximum
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
Resolution: .001/.01
Measurements: RMS
Ranges: 30A

AC/DC AUX Voltage Channel
AC Accuracy: ±0.05 % reading + 0.02 % range typical,
±0.15 % reading + 0.05 % range
DC Accuracy: 0.1% range typical, 0.25% range maximum
Resolution: .01
Measurements: RMS
Ranges: 30, 150 AC/DC, 250 DC

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
(Auto Ranging)
Cycles: 0.01 to 99999.9
(Auto Ranging)
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 up to 10 inputs monitor operation of relay contacts or trip SCR, continuity light is provided for the 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).
Input Rating: up to 300 V AC/DC

Binary Output Relays
SMRT43D has up to 6 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, or 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 1 to 4:
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 5 and 6:
AC/DC Rating: 400 V peak, Imax: 1 amp
Response Time: <1ms typical

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. Each channel can store up to 256,000 samples.

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

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
Ranges: 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: -13 to 158° F (-25 to 70° C)
Relative Humidity: 5 - 90% RH, Non-condensing

Conformance Standards
Safety: EN 61010-1
Shock: EN/IEC 60068-2-27
Vibration: EN/IEC 68-2-6
Transit Drop: ISTA 1A
Free Fall: EN/IEC 60068-2-32
Drop / Topple: EN/IEC 60068-2-31
Electromagnetic Compatibility
Emissions: EN 61326-2-1, EN 61000-3-2/3, FCC Subpart B of Part 15 Class A
Immunity: EN 61000-4-2/3/4/5/6/8/11

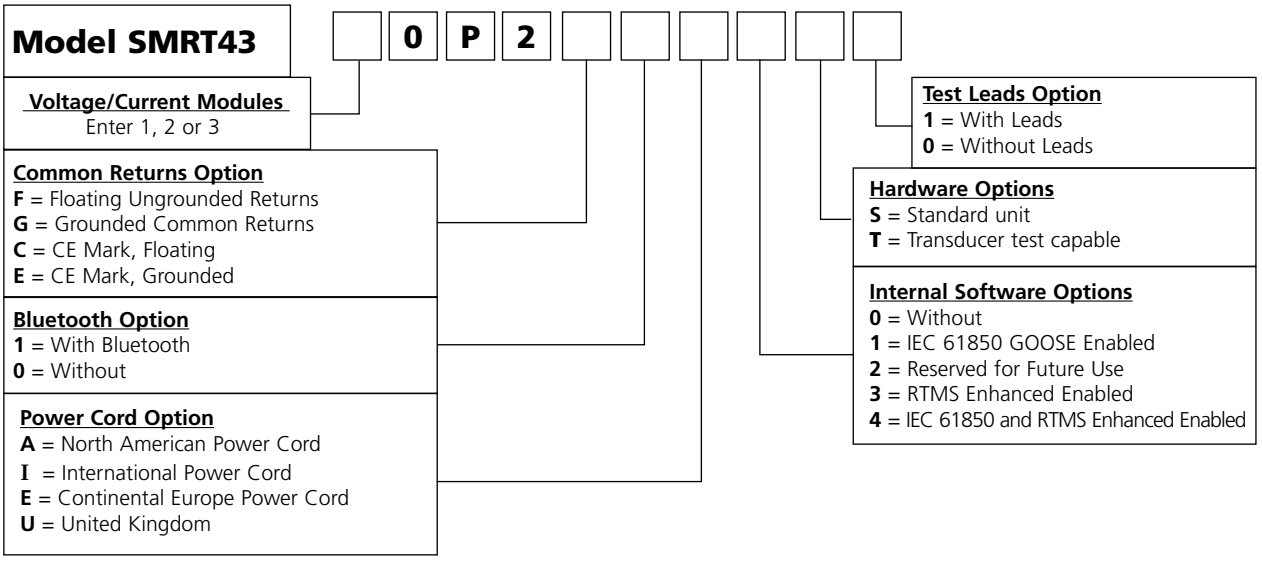
Weight
Weight varies depending on the number of output modules in the system. The weight below is for a three-phase test system.
29.35 lb. (13.2 kg)

Dimensions
13.25 W x 6.75 H x 10.75 D in.
337 W x 172 H x 273 D mm

Enclosure and Transit Cases
The unit comes mounted in a rugged metal enclosure for field portability. Optional soft-sided and hard-sided transit cases are available. The soft-sided case has approximately 1 inch of padding, which provides moderate protection against rain, dust, vibration and shock. The robust design of the optional hard-sided transit case provides protection when transporting the unit over rugged terrain and long distances.

ORDERING INFORMATION

MODEL SMRT43D 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 (1, 2, or 3), selecting floating or grounded common returns, power cord, IEC 61850 test capable, and/or with enhanced RTMS software features, standard hardware or transducer feature added, and with or without test leads. See the following descriptions.

Voltage/Current Module: The SMRT43D unit can have 1, 2 or 3 voltage/current modules. Enter the number of desired modules 1, 2 or 3.

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 for both the grounded and floating options. 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 SMRT43D 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 SMRT43D 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 SMRT43D to be able to subscribe as well as publish GOOSE messages, the IEC 61850 feature needs to be enabled[3] . 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 the 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.

Hardware Options: S= Standard unit. **T=** With Transducer test capability enabled (requires 3 channel configuration). When equipped with the Transducer test feature the total number of binary inputs and outputs are reduced by 1.

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

[3]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 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 No.: 84978

AVTS Basic includes Online Vector, Online Ramp and Online Click-On-Fault controls, with the ability to import, execute and save relay specific test modules. The easy to use online tools of Vector and Ramp provide automatic pickup, or dropout tests as well as timing and multi-state dynamic tests. The Online Click-On-Fault tool is used to 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 No.: 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 No.: 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 STVI 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.

TEST LEADS AND ACCESSORIES

All units come with a power cord, an Ethernet communication cable, and instruction manual CD. All other accessories varies depending on the number of amplifier modules selected, see **Table of Accessories**.

Included Standard Accessories

Description	Part Number
Power Cord - Depending on the style number, the unit will come with one of the following,	
Line cord, North American	90015-267
Line cord, Continental Europe with CEE 7/7 Schuko Plug	90015-268
Line cord, International color-coded wire	90015-269
Line cord, United Kingdom	90015-270
Ethernet cable for interconnection to PC, 210cm (7 ft.) long (Qty. 1 ea.)	90003-594
Instruction manual USB memory stick	81757

Table of Accessories

Accessories are supplied with the selection of the Test Leads Option. With the Test Leads Option the number and type of leads varies depending on the number of channels ordered. Test Leads and Accessories can be ordered individually, see part numbers below.

	Descriptions of Optional Test Leads and Accessories	Test Leads Options	One (1) Voltage Current Module	Two (2) Voltage Current Modules	Three (3) Voltage Current Modules
	**Accessory Carry Case:** Use to carry power cord, Ethernet cable, Optional STVI and test leads.	**Qty. 1 ea. Part No. 2001-487**			
	**Sleeved Pair of Test Leads:** 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. 3 pr. Part No. 2008-539**	**Qty. 6 pr. Part No. 2008-539**	**Qty. 2 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, rated up to 1000 V/ 20 Amps CAT II.	**Qty. 3 ea. Part No. 684004**	**Qty. 3 ea. Part No. 684004**	**Qty. 6 ea. Part No. 684004**	**Qty. 12ea. Part No. 684004**
	Lug adapter, **black**, 4.1 mm, rated up to 1000 V/ 20 Amps CAT II.	**Qty. 3 ea. Part Number 684005**	**Qty. 3 ea. Part Number 684005**	**Qty. 6 ea. Part Number 684005**	**Qty. 12ea. Part Number 684005**
	**Jumper Lead:** Jumper lead, black, 12.5 cm (5") long, use with voltage / current outputs, 600 V, 32 Amps CAT II.			**Qty. 2 ea. Part Number 2001-573**	**Qty. 4 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**
	**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**

Test Leads and Accessories (Transducer Option)

The following quantities of Test Leads and Accessories are supplied with the selection of the **Transducer Option**. Test Leads and Accessories can be ordered individually, see part numbers and descriptions below.

	Descriptions of Optional Test Leads and Accessories	
	**Sleeved Pair of Test Leads:** Sleeved Test Leads, one red, one black, 200 cm (78.7") long, 600 V, 32 Amperes CAT II.	**Qty. 2 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, rated up to 1000 V/ 20 Amps CAT II.	**Qty. 2 ea. Part No. 684004**
	Lug adapter, **black**, 4.1 mm, rated up to 1000 V/ 20 Amps CAT II.	**Qty. 2 ea. Part Number 684005**

Additional Optional Accessories (Not Included in the SMRT43D Optional Test Lead Accessories) -

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.

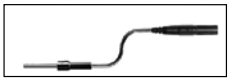
Description	Part No.
Individual (Non-Sleeved) Test Leads: Excellent for widely separated individual terminal test connections.	
	
Test Lead, red, use with voltage/current output, or binary I/O, 200 cm long (78.7") 600 V/ 32 Amps CAT II	**620143**
Test Lead, black, use with voltage/current output , or binary I/O, 200 cm long (78.7") 600 V/ 32 Amps CAT II	**620144**

Description	Part No.
Extra-Long 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, 360 cm long (144") 600 V/ 32 Amps CAT II	**2003-173**
Test Lead, **black**, use with voltage/current output , or binary I/O, 360 cm long (144") 600 V/ 32 Amps CAT II	**2003-174**

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**

Description	Part No.
Cable / Spade Lug Adapter (Large): Large spade lug fits older relay terminal blocks, STATES® Company	
	
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**

Description	Part No.
Jumper Lead: Used to common returns together externally when paralleling current channels (not required when using the sleeved combination current leads 2001-396).	
	
Jumper lead, black, 12.5 cm (5") long, use with voltage / current outputs, 600 V, 32 Amps CAT II	**2001-573**

Description	Part No.
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**
In-Line Fused Test Lead: Use with high speed binary outputs 5 or 6 ("P" Option) to protect for accidental switching of currents higher than 1 Amp.	
	
Test lead, **blue**, in-line 500 mA fuse protection, 200 cm long (78.7").	**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 (78.7").	**56802**
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**
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 or relay terminal.	
	
Parallel test lead adapter, use with test leads up to 600 V/ 32 Amps CAT II	**1002-286**

Description	Part No.
GPS unit with accessories	
	
GPS unit with all-weather antenna, power supply, and 15 meter cable	**MGTR-II-50**
GPS unit with all-weather antenna, power supply, and 30 meter cable	**MGTR-II-100**
STATES® Company 10 Pole Test Paddle: Use with STATES® FMS 10 Pole 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**
Soft-Sided Carry Case: The soft-sided carry case protects the unit from light rain and dust. The padded sides provide moderate protection while in transit.	
	
Soft-sided carry case (1ea)	**2006-066**
Hard-Sided Transit Case	
Includes custom designed foam inserts for the SMRT46 unit, and accessories. Transit case includes retractable handle, built-in wheels, twist and lock-down latches, spring loaded fold-down handles, with O-ring seal.	
	
Rugged, hard-sided transit case (1ea).	**1006-131**

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