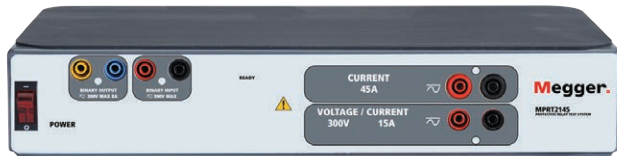


MPRT2145

Single Phase Relay Test System



- **Open communication architecture for third party software application**
- **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/400 VA rms)**
- **Network interface provides IEC 61850 test capabilities**
- **Fully automated testing using AVTS software**

DESCRIPTION

As a stand-alone unit, the MPRT 2145 has the high compliance voltage and high current to test electromechanical, solid-state and microprocessor-based overcurrent relays, including voltage controlled, voltage restraint and directional overcurrent; test under/over voltage, single-phase impedance, single-phase power, directional, synchronizing, auto-synchronizing, negative sequence under/over voltage, current balance, frequency, volts/hertz, reclosing, thermal, and various other relays. See the Applications Guide for more.

The MPRT 2145 test system has the ability to be manually controlled with Megger's new Smart Touch View Interface™ (STVI). The STVI, with its large, full color, high resolution, TFT LCD touch screen allows the user to perform manual, steady-state and dynamic testing quickly and easily using the manual test screen, as well as using built-in preset test routines for most popular relays.



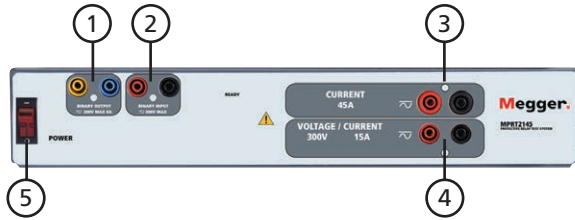
Model STVI with MPRT 2145

APPLICATIONS

The current channel is rated for 30 amps @ 200 VA continuous, up to 45 amps @ 300 VA for short durations. It has a unique flat power curve from 4 to 30 amps that insures maximum compliance voltage to load at all times. With a high compliance voltage of 50 volts, the MPRT 2145 has the capability to test high impedance overcurrent relays.

The voltage channel can provide a variable output of 0- 30/150/ 300 volts at 150 VA of output power, and has a unique flat power curve from 30 to 150 volts insuring maximum output power to the load at all times. With the voltage channel converted to current, it can perform minimum operating point, slope, and timing on current differential relays, including harmonic restraint transformer differential relays (which can be tested one phase at a time).

It is also designed to operate in conjunction with other MPRT 2145 units. Using the Ethernet ports, MPRT 2145 is literally a "plug-and-play" unit, where voltage and current outputs can be seamlessly synchronized with other MPRT 2145 units voltage and current outputs for testing more complex relays like three phase directional power, distance, loss of excitation, or 6, 9 up to 12 phase current test applications.



1. **Binary output:** Rated for 300 V at 8 amps
2. **Binary input:** Rated 5 to 300 V AC/DC
3. **Current channel:** 0–30 amps at 200 VA continuously, up to 45 amps at 300 VA for short durations
4. **Voltage channel:** 0–300 V at 150 VA, convertible to current rated for 5 amps at 150 VA continuously, 15 A at 120 VA for short durations
5. **POWER ON/OFF switch** illuminates when power is on

Applications Selection Guide	
Protective relays by IEEE device #	MPRT 2145
2 time delay	■
21 distance single phase	■
21 distance open delta	+
21 distance three phase wye	++
24 volts/Hz	■
25 synchronizing	+
27/59 under/over voltage	■
32 directional power single phase	■
32 directional power three phase (open delta)	+
37/76 DC under/over voltage/current	■
40 loss of field	■
46 phase balance current	■
46N negative sequence overcurrent	■
47 phase sequence voltage (open delta)	+
50 instantaneous overcurrent	Up to 60 Amps
51 time overcurrent	Up to 35 Amps
55 power factor	■
60 voltage/current balance (open delta)	+
67 directional overcurrent	■
67N ground directional overcurrent	■
78 out of step	■
79 reclosing	■
81 frequency	■
85 carrier or pilot wire	■
87 differential	■
91 voltage directional (open delta)	+
92 voltage and power directional (open delta)	+
94 tripping	■
+ Requires additional MPRT 2145 for each +	

FEATURES AND BENEFITS

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

High output current – Provides up 30 amps at 200 VA per phase continuous for timing tests and can provide up to 45 amperes at 300 VA for testing instantaneous overcurrent relays or parallel with convertible voltage/current channel to provide up to 60 amps.

New PowerV™ voltage amplifier high power output – The MPRT 2145 provides a new higher VA power output on the voltage channel at the lower critical test voltages (from 30 to 150 volts). Customers who want to test a panel of relays at one time find it impossible using lower VA rated voltage sources.

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

Steady-state and dynamic testing capability – The MPRT 2145 provides, either through manual control or computer control, both steady-state and dynamic testing of protective relays. This includes programmable waveforms with harmonics.

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

Digital binary input and output – The programmable binary input, and programmable output provide timing and logic operations in real-time with the output voltage and currents. The binary input can be programmed, using Boolean logic, for more complex power system simulations.

Circuit breaker simulator – Binary output provides a programmable normally closed or normally open contact 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 receiver, the MPRT 2145 performs satellite-synchronized end-to-end dynamic multi-state or playback transient COMTRADE files either for commissioning or troubleshooting tests.

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

Two Ethernet ports – PC/IN Ethernet port is the primary PC connection port. It is also used when chaining multiple MPRT 2145 units together. The 61850/OUT Ethernet port is primarily used to interconnect multiple MPRT 2145 units together for synchronous

multi-unit operation, or it may be used to connect to the IEC 61850 substation bus.

Universal input voltage – Operation from 90 to 264 VAC, 50/60 Hz, the MPRT 2145 can use virtually any standard source in the world.

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

Bluetooth – Optional Bluetooth provides more flexibility. A wireless interface between the PC and MPRT 2145, in conjunction with the MPRT 2145 IEC 61850 Ethernet port, provides the isolation required for a secure substation access interface between the MPRT 2145 and the IEC 61850 substation network.

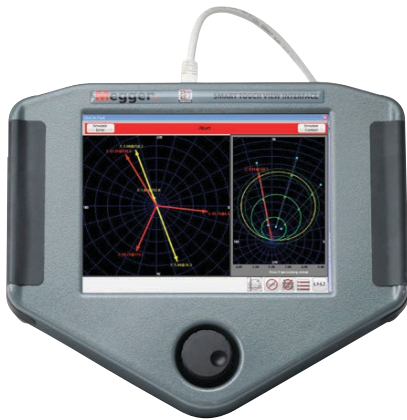
MANUAL or COMPUTERIZED CONTROL

The MPRT2145 can be operated manually via the STVI Interface controller, or automatically with the AVTS software package (see AVTS section for description of the software capabilities).

MANUAL OPERATION

The Smart Touch View Interface™ (STVI) 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.

Figure 1. Smart Touch View Interface



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. Enhanced graphics, intuitive menu screens, and touch screen buttons are provided to quickly and easily select the desired test function.

Manual Test Screen

In the following Manual Test screen the pre-selected outputs are set using the touch screen. 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 knob, a dynamic sequence of tests to include trip and reclose operations, an automatic ramp, pulse ramp, 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 color indicating which outputs are energized.

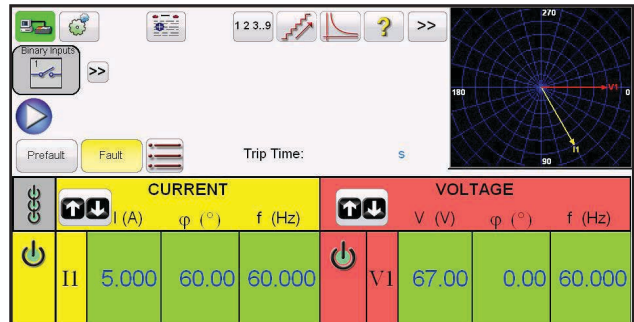


Figure 2. Manual Test Screen – MPRT2145

A vector graph indicates the relative phase angles of all 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 automatically determine pickup or dropout of various types of relays. Pressing the Auto Ramp button presents three choices; Step Ramp, Pulse Ramp, and Pulse Ramp Binary Search.



Figure 3. Step Ramp, Pulse Ramp and Pulse Ramp Binary Search Selection Bar

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).

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 2nd, 3rd and 4th 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. 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 ANSI, IEC, and IEEE Standards time curve algorithms built-in. The STVI also includes time curves and time curve algorithms for hundreds of specific relays. The user can select from a pull-down list of 18 different manufacturers, then select the relay model number, and/or curve shape (inverse, very inverse, definite time etc.). The list includes relay manufacturer’s digitized log-log, and semi-log, electromechanical relay time curves. Therefore, tests are conducted using the manufacturer’s actual time curve. In the following example, the G.E. IAC-51B relay with a 1 Amp Tap and a number 2 Time Dial was selected.

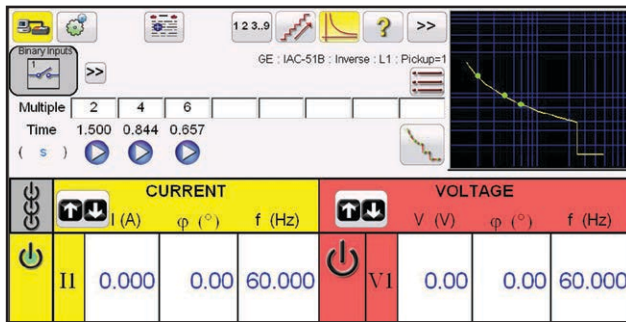


Figure 4. Timing G.E. IAC51B Overcurrent Relay

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. Up to eight test points may be 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.

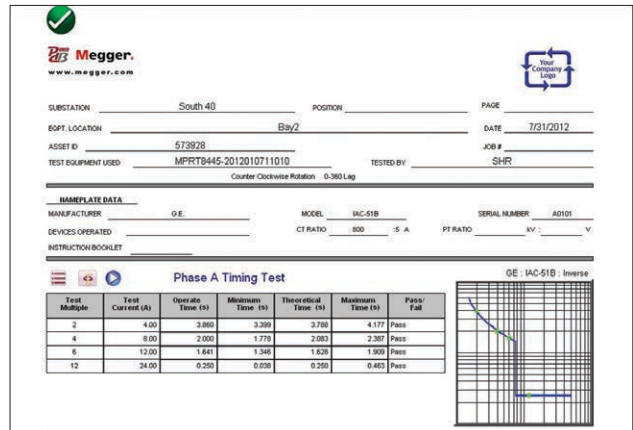


Figure 5. Test Report G.E. IACSIB Timing Test

Note that the software automatically compared the Operating Time to the theoretical and made a Pass Fail determination based upon the manufacturer’s 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. If the data is imported into PowerDB reports can be generated that summarize the comments and failures of every test you perform for future NERC requirements.

State Sequence Timing Test Feature

Pressing the State Sequence button on the top menu bar takes the user to the Sequence Timing Test Screen. There are up to 15 programmable steps available in the Sequence Test Screen.

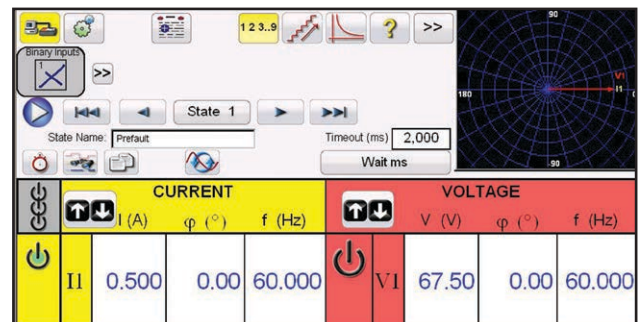


Figure 6. Sequence Test Screen

By default, there are 9 states 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. 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 trip and reclose times. The user can set conditional settings such as wait milliseconds, wait cycles, wait any contact (OR), and wait all contacts (AND). The user can set the Binary Output to simulate the 52a or 52b contacts.

Once all of the Binary Input and Output, 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 a sample sequence.



SPECIFICATIONS¹

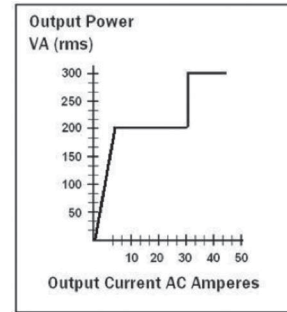
¹ Megger reserves the right to change product specifications at any time without notice.

Input Power 100 to 240 volts (± 10%) AC, 1Ø, 50/60 Hz, 700 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.

Output Current Output power ratings are specified in AC rms values and peak power ratings.

Output current	Power	Max V/duty cycle
1 ampere	15 VA	15.0 V rms continuous
4 amperes	200 VA (282 peak)	50.0 V rms continuous
15 amperes	200 VA (282 peak)	13.4 V rms continuous
30 amperes	200 VA (282 peak)	6.67 V rms continuous
45 amperes	300 VA (424 peak)	6.67 V rms 90 cycles
DC 200 watts		



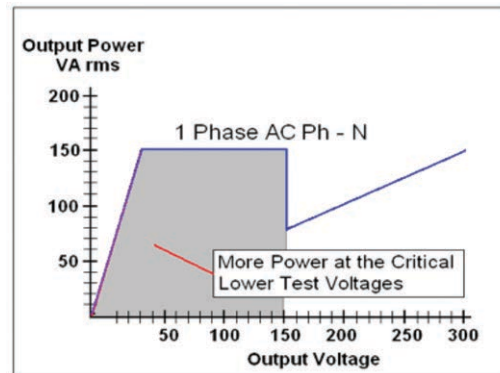
Current Amplifier - Extended Power Range

The MPRT 2145 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 45 amperes at 300 VA rms.

AC Voltage Output Outputs are rated with the following ranges:

Output Volts	Power	Max I
30 volts	150 VA	5 amps
150 volts	150 VA	See "PowerV"
300 volts	150 VA	0.5 amps
DC 150 watts		

Duty Cycle: Continuous



"PowerV" Voltage Amplifier - Extended Power Range

The MPRT 2145 voltage amplifier provides a flat power curve from 30 to 150 Volts in the 150V range to permit testing of high power applications such as panel testing.

Voltage Amplifier in Current Mode

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

Output current	Power	Max V duty cycle
5 amperes	150 VA (212 peak)	30.0 Vrms continuous
15 amperes	120 VA	8.0 Vrms 90 cycles

Phase Angle

Ranges 0.00 to 359.99 degrees, counter clock wise, or clock wise rotation, or 0.00 to ±180.00 degrees

Accuracy: ± 0.02° typical, ± 0.25° max at 50/60 Hz

Frequency

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

Ranges	DC
	0.001 to 1000.000 Hz
	Output amplifiers can provide transient signals with a range of DC to 10 kHz for transient playback using COMTRADE files.

Resolution*: .0001/0.001 Hz

Frequency accuracy: 2.5 ppm typical
25 ppm 0° to 50° C, at 50/60 Hz maximum

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, as 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

To 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 Relay

MPRT 2145 has an independent, galvanically isolated, output relay contact to accurately simulate relay or power system inputs to completely test relays removed from the power system. The binary output simulates normally open/ normally closed contacts for testing breaker failure schemes. The binary output can be configured to change state based on binary input logic.

AC Rating: 400 V max., I_{max}: 8 amps, 2000 VA max. breaking capacity

DC Rating: 300 V max., I_{max}: 8 amps, 80 W

Response Time: < 10ms

Waveform Generation

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

Metering

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

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: .001/0.01

Measurements: AC RMS

Ranges: 30, 45A

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: .001/0.01

Measurements: RMS

Ranges: 30 A

Convertible Source in AC Current Mode

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

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 MPRT 2145 unit comes housed in a rugged, metal, lightweight enclosure. IEC enclosure rating IP20

Dimensions 13.5 in. (33.75 cm) W x 2.4 in. (6 cm) H x 6.75 in. (16.88 cm) D

Weight 8.9 lb. (4 kg)

Conformance Standards

Safety:	EN 61010-1, UL 61010-1
Shock:	MIL-PRF-28800F (30g/11ms half-sine)
Vibration:	MIL-RFP-28800F (5-500Hz, 2.05 g rms)
Transit Drop:	MIL-RFP-28800F (10 drops, 20 cm, without transit case)
EMC Emissions:	EN 61326-2-1, EN 61000-3-2/3, FCC Subpart B of Part15 Class A
Immunity:	EN 61000-4-2/3/4/5/6/8/11

Protection

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

Communication Interfaces

Ethernet (2)
Bluetooth (optional)

Software

AVTS – STVI Basic

Every unit comes with AVTS Basic software and the PC version of the STVI Basic software packages. AVTS Basic version includes Online Vector control (for single and multi-state timing tests), Online Ramp control (for automatic ramping of voltage, current, phase angles or frequency) and Online Click-On-Fault (for dynamic tests of impedance relays). Test results may be exported directly to Microsoft Word. AVTS software includes a database for saving test results, which can also provide the necessary information needed for system reliability audits. See AVTS bulletin for more information.

The PC version of the STVI software includes the ability to bring all STVI test data (from other STVI units) into file folders for retrieval, review and printing whenever needed. See STVI bulletin for more information.

AVTS Advanced

The AVTS Advanced version includes all the feature in AVTS Basic plus the powerful Test Editor, Dynamic Control (includes dynamic end-to-end testing capability, and waveform recording 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. See AVTS bulletin for more information.

AVTS Professional

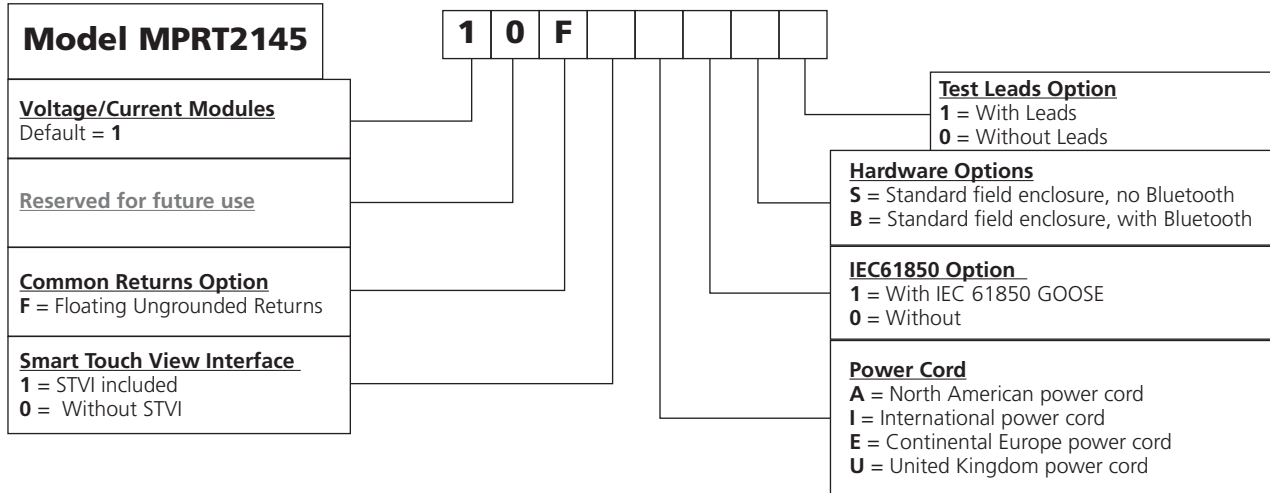
The AVTS Professional version includes all of the features of the Basic and Advanced versions plus some other powerful test tools and features. It includes the DFR Waveform Viewer, One-Touch™ Test for fully automatic tests, and Waveform Digitizer to digitize scanned waveforms of electromechanical over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

IEC 61850 GOOSE

The MPRT 2145 with the GOOSE enabled, in conjunction with the Megger GOOSE Configurator (MGC) software, can be used in the testing or commissioning of IEC 61850 compliant devices. See AVTS bulletin for more information.

ORDERING INFORMATION

STYLE NUMBER IDENTIFICATION



DESCRIPTION OF SOFTWARE OPTIONS

Included Software	Part Number
AVTS Basic with STVI Application CD	81302
Software Options	
AVTS Basic with IEC 61850 Megger GOOSE Configurator, and STVI Application CD	1002-103
AVTS Advanced with STVI Application CD	81570
AVTS Advanced Test with IEC 61850 Megger GOOSE Configurator, and STVI Application CD	1002-106
AVTS Professional with STVI Application CD	81571
AVTS Professional Test with IEC 61850 Megger GOOSE Configurator, and STVI Application CD	1002-102
Included Standard Accessories	
Power cord—depending on the style number, the unit will come with one of the following	
Line cord, North America	620000
Line cord, Continental Europe with CEE 7/7 Schuko plug	50425
Line cord, International color coded wire	15065
Ethernet crossover cable for interconnection to PC, 210 cm (7 ft) long, (Qty 1 ea)	620094
Instruction manual CD	80989

DESCRIPTIONS OF HARDWARE OPTIONS

Voltage/Current Module: The MPRT2145 default will always be 1 for the first digit.

Future: 0, reserved for future use.

Common Returns Option: The MPRT2145 unit has only one option for the return terminals associated with each output channel. It is **F** for floating returns.

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

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. CE Marked.






IEC 61850 Option: The MPRT2145, in conjunction with the Megger GOOSE Configurator (MGC) software, can be used in the testing or commissioning of IEC 61850 compliant devices. In order for the MPRT2145 to be able to subscribe as well as publish GOOSE messages, the IEC 61850 feature needs to be enabled. Enter **0** for the unit to come without IEC 61850 enabled.

Hardware Options: S – unit comes in standard field enclosure, **no Bluetooth: B** – unit comes in standard field enclosure, **with Bluetooth.**

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

Test Leads and Accessories

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

	Optional Accessories Descriptions	STVI, or Test Leads Options	Test Leads Option
	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: 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. 4 pr. Part No. 2001-394
	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. 4 ea. Part No. 684004
	Lug adapter, black , 4.1 mm, use with test leads up to 1000 V/ 20 Amps CAT II.		Qty. 4 ea. Part No. 684005
	Jumper Lead: Used to common returns together on units with floating ground returns, or parallel of current ground rreturns, 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. 41 ea. Part No. 2001-573

Descriptions of Software

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

AVTS Basic with STVI Application Software (PC Version) Part Number: 81302

AVTS Basic includes Online Vector, Online Ramp and Online AVTS Basic includes Online Vector, Online Ramp and Online Click-On-Fault controls, with the ability to import, save and execute relay specific test modules. The 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. Includes enhanced Relay Test Wizards for; Overcurrent, Differential, Voltage, Frequency and Distance relays.

The powerful STVI screens can be run directly from a PC providing both manual and automatic test capabilities. Intuitive menu screens and buttons are provided to quickly and easily select the desired test function. The Manual Test Screen 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 cursor up down arrows or use the mouse control wheel to vary outputs. In addition a dynamic sequence test includes trip and reclose up to 9 operations. An automatic ramp, pulse ramp, binary search or pulse ramp binary search is built in to determine pickup or drop out of relay contacts, or perform relay specific timing tests using the Timing Test Screen. 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. The PC version of the STVI software includes the ability to bring all STVI test data (from other STVI units) into file folders for retrieval and review whenever needed. Each copy of the PC version of the STVI software is licensed for loading onto one PC.

Additional Optional Software AVTS Advanced with STVI Application Part Number: 81570

AVTS Advanced includes all of the features of AVTS Basic in addition to the powerful Test Editor and test editor tools, which includes the Dynamic Control (with dynamic end-to-end test capability, and Recorder features) for developing sequential tests for virtually any function or measuring element within digital relays. In addition, it also includes Modbus communications for automatic download of settings, SS1 File Converter for ASPEN® and CAPE® dynamic test files, End-to-End DFR Playback test macros and basic programming Tools for creating and editing test modules. Test files created in Advanced Test can be used with AVTS Basic.


AVTS Professional with STVI Application Part Number: 81571



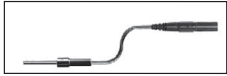



Professional Test includes all of the features of AVTS Advanced Test version plus the following additional specialized test tools. The DFR Waveform Viewer and Playback tools are used for viewing and analyzing IEEE C37.111 COMTRADE Standard files from digital fault recorders and microprocessor based relays. The DFR Waveform Viewer includes tools to recreate the analog and digital channels for playback into protective relays for troubleshooting or evaluation. It includes the capability to extend the predefault 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.

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 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 MPRT to subscribe to preselected GOOSE messages by assigning the data attributes to the appropriate binary inputs of the MPRT. Use the configurator to assign the appropriate binary outputs of the MPRT 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.

Description	Part No.
Additional Accessories (Not Included in the MPRT2145 Test Leads Option or Deluxe Lead Kit)	
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.
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
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 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

Description	Part No.
MPRT2145 Carry Case Rugged two-pocket Hard/Soft Carry Case (1 ea)	
	
Two-Pocket Carry Case: The fabric covered hard sides protects the unit from light rain and dust, while the custom designed foam padded inside provides protection while in transit for the MPRT2145, STVI-2, and test leads. Tested and certified to MIL-SPEC Standards for impact. The case is small, and weighs only 5.8 pounds (2.6 kg). With a MPRT2145 and STVI it is small and light enough to hand carry on virtually all major commercial airlines.	2002-468
MPRT2145 Carry Case Rugged single-pocket Hard/Soft Carry Case (1 ea)	
	
Single- Pocket Carry Case: The fabric covered hard sides protects the unit from light rain and dust, while the custom designed foam padded inside provides protection while in transit for the MPRT2145, and test leads. Tested and certified to MIL-SPEC Standards for impact. The case is small, and weighs only 1.56 pounds (0.7 kg). With a MPRT2145 it is small and light enough to hand carry on virtually all major commercial airlines.	2002-567
STATES 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

Description	Part No.
Example Configurations	
	
For customers in North America, Central America, Japan, Philippines, South Korea, Taiwan, Thailand, Venezuela, Virgin Islands , and other countries that use standard NEMA type power outlets of 100, 110, 115 or 120 volts at 50/60 Hz. could order a unit with the standard North American power cord. In this example the unit is a MPRT2145 unit, with the STVI, no IEC61850, in the standard enclosure no Bluetooth, and with test leads.	The style number would be, MPRT2145 – 10F0A051
	
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 MPRT2145, without the STVI, with IEC61850 enabled, in the standard enclosure no Bluetooth, and with test leads.	The style number would be, MPRT2145 – 10F0E151
	
For customers in United Kingdom, Ireland, Anguilla, Cyprus, Dominica, Gambia, Gibraltar, Malta, Malaysia, Malawi, Scotland, St. Lucia, St. Vincent, Wales, Zambia , and other countries where the UK standard connector is used could order a unit with the UK Power Cord. In this example the unit is a MPRT2145, with the STVI-1, with IEC61850 enabled, in the standard enclosure with Bluetooth, and with test leads.	The style number would be, MPRT2145 – 10F1U1B1
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 MPRT2145, with the STVI, with IEC61850 enabled, in the standard enclosure with Bluetooth, and with test leads.	The style number would be, MPRT2145 – 10F1I1B1

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