Protective Relay Test System

MANTA™ TEST SYSTEMS

At a Glance

Capabilities

- Steady-state testing
- Dynamic testing - step/ramp/state sequence
- Transient waveform testing
- GPS time synchronized testing

Exclusive Features & Benefits

- Direct front panel interface for all functions
- Intuitive operation
- Exceptional productivity for common tasks
- All-in-one, no options required
- Very high VA current output channels
- Realistic fault quantities and waveforms
  (Even under ordinary manual testing)
- Data memory + USB memory drive

Test Applications

Transmission & Distribution: overcurrent, under/overvoltage, directional overcurrent, distance, frequency, line differential, transformer differential (1-phase, 3-phase), bus differential, capacitor protection, out-of-step, synchrocheck, reclosing, breaker failure, lockout, time-delay, and auxiliary relays

Generator Protection and Control: differential, loss-of-field, under/overvoltage, overexcitation, stator ground, negative sequence, frequency, unbalance, reverse power, out-of-step, synchronizing, synchroclose, lockout, time-delay, and auxiliary relays

Industrial: overcurrent, under/overvoltage, transformer differential, bus differential, capacitor, overload, motor protection, lockout, time-delay, and auxiliary relays

Other: Current, voltage, Watt, VAr, frequency transducers and metering

The MTS-5000 Protective Relay Test System

What Can It Do For You?

The MTS-5000 is the first all-in-one relay test system with a direct front panel interface for all functions, without exception! Find out why other relay technicians and protection engineers have found this instrument to be a joy to use, providing them exceptional productivity gains even without using PC software.*

Breeze through single overcurrent relays to multi-terminal end-to-end schemes with this one box. No add-ons, no hidden costs. All the brute force power (VA) that you need for old electromechanical relays; and for modern microprocessor-based relaying, all the powerful functions that you need, simplified by built-in intelligence capabilities. Increase your protection system reliability confidence with realistic transient waveform and GPS time-synchronized testing to mimic real-world conditions.

All the Necessary Output Channels and Inputs for Protection and Control Relay Testing

- 12 Contact/Voltage inputs
- 4 Contact outputs
- Transducer voltage/ current input
- 3-Phase AC Voltage
- DC Voltage
- AC/DC Current
  - 30A Three-phase
  - or 90A Single phase

* Read what other Users are saying about the MTS-5000. www.mantatest.com/mts-5000/reviews

"Why Settle for a Virtual Front Panel Int erface When You Can Get a Real One?"

Despite the widespread use of PC-based interfaces, a hard front panel with real pushbuttons, controls and displays remains the most direct way to perform a test and make a measurement.* Here are just some of the reasons why the MTS-5000's User Optimized Interface gives you immediate familiarity and productivity.

Proven bank machine style interface with context sensitive buttons

Customizable default settings Get started right after power-up

Extra large digits

Most used screens only one keypress away

Control multi-phase quantities/outputs using only one parameter

Key quantities for the task at hand appear in highlighted area

Auto-calculated relaying quantities

Adjust all parameters off-line before applying them to the relay

Quick, direct numerical entry

Dedicated frequent use pushbuttons

Dedicated reset/disable button for safety

Quick power up (switch below)

Sunlight visible backlit display

One box to carry no PC required!

Vertical form factor puts the display and controls closer to eye level and minimizes space requirements in tight areas

No repeat presses Immediate click action and audible beep feedback

No sore fingers Low activation pressure, superior tactile feel pushbuttons

Intelligent fault modes simplify complex 3-phase control

Snappy screen response after any button press never keeps you wondering what is happening

Instantly see the output status from the live phasor diagram (analog display)

Smooth continuous adjustments for pickup tests with the fine resolution dial

Quick access to help for each screen, plus new user tutorial pages

Color coded safety terminals don't obscure controls

* *"Two-thirds of engineers still prefer hard front panels with buttons and knobs"* according to the 2004 Test Instrumentation Insight Study by Test & Measurement World. www.testandmeasurementworld.com

“Be Productive the Very First Day You Use It, Even Without a PC”

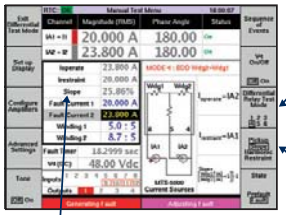
Novices and veterans alike need help to keep up with the rapid advances in protection technology to contend with the complexities of testing today’s sophisticated relays and systems. In fact, the latest IEEE Power System Relaying Committee’s Survey on Relay Test Practices found that ***“most relay test personnel receive fewer than 16 hours of relay training per year.”**** That’s why we’ve rethought from the ground up, what a truly ***“intuitive to use”*** relay test set should and should not be, so that you’ll be productive from the very first day that you use it. That’s why we provide built-in intelligence to simplify the control of advanced testing capabilities which require the use of multiple inputs and outputs. Here are a few examples:

Relay Specific Productivity Screens

With the press of a button, you enter relay test screens that simplify the testing of common relay types. Each screen is designed to get the job done in as few steps as possible.

You’ve tested differential relays before, but can you remember the formulae and test connections for the different configurations?
The MTS-5000 configures itself, draws pictures of the connections, lists the formulae, and calculates the results.

Differential Test Screen

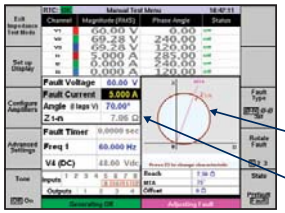


Built-in setups for common relays (BDD, HU, SEL-387, etc.) including 6 current input digital types

Built-in setups for standard tests

Direct display of operate and restraint currents plus slope

Impedance/Distance Test Screen



The impedance test screen simplifies the testing of single and 3-phase impedance elements. Only information essential to these testing these elements is presented on this screen.

Compare impedance directly to relay characteristics

Direct calculated impedance display

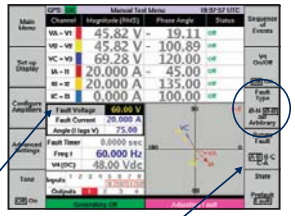
Immediately Recall Favorite Tests

Improve your efficiency even more by saving settings for often used tests right in the built-in memory and recalling them later

* For details on the IEEE Survey on Relay Test Practices, see www.pes-psrc.org

Single Button Access for Steady-State Injections

Many tests require just a simple single phase or 3-phase injection. Just one button from the main screen is the manual test screen, where you can immediately energize the outputs and test the device. Phase sequence, amplitude and frequency automatically default to your pre-defined system defaults.



Intelligent Phase-Phase & 3-Phase Adjustment

Select phase-neutral or phase-phase or 3-phase adjustment. For phase-phase, just 3 parameters control phase-phase voltage, current and fault phase angle, changing appropriate amplitude and phase angle settings of outputs automatically in order to correctly simulate phase faults.

Similarly, for 3-phase faults, changing the fault current, fault voltage and phase angle changes the outputs of all 3 phases simultaneously.

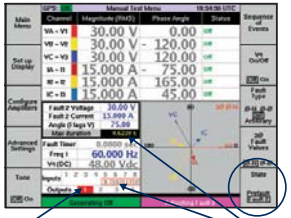
Rotate fault parameters to the next phase with a single button press

Ramping and State Sequencing

For applications such as rate-of-change of frequency relays, motor bus transfer schemes, or simply automatic pickup testing, ramp one or all parameters directly from the front panel.

For reclosing scheme testing or evolving faults, set up multi-state tests directly from the front panel.

Ramp any combination of parameters independently in any state

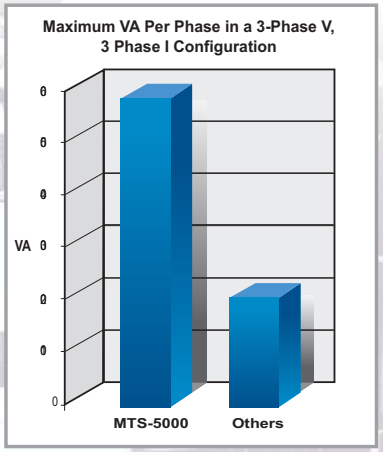


Contact outputs can simulate breaker status signals, permissive signals, etc.

Control sequencing using fixed durations and/or changes detected on input channels

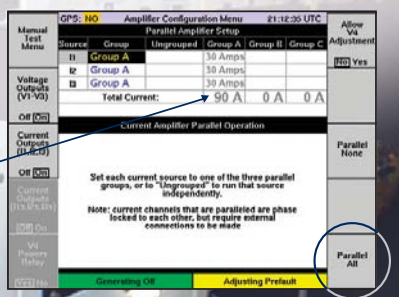
"High VA Output for Electromechanical Relays"

The rest of the world may have gone all digital, but the truth is that it may be a decade or more before the installed base of electromechanical relays is displaced by digital relays.* Hence, the need for high power current outputs remains. The MTS-5000 deals with this reality head-on, with 600 VA per phase, that is 3 or more times the VA capability of all other modern relay test sets, without even paralleling channels!



The high VA output is required to generate high compliance voltage output to provide useable power to drive test currents into high burden electromechanical relay panels. Note that paralleling channels on other test sets increases available current, but will not increase output compliance voltage to be able to achieve those higher currents into high burdens.

For high set instantaneous elements, parallel all current channels for up to 90A and 1800VA single phase with a single button press. Still control the amplitude and phase angle of the paralleled group as if it were one channel on all other screens. Fast, simple, intuitive.



How many of your relay panels still look like this?

* Depending on the type, 57% - 77% of the installed base of protective relays is still electromechanical as of the end of the year 2005, according to a study of the protective relay market by the leading industry research organization, Newton-Evans Research. www.newton-evans.com

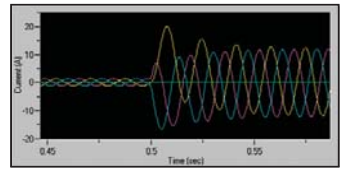
"Realistic Output Waveforms Even When Using Traditional (Manual) Test Methods"

The North American Electric Reliability Council, (NERC) has emphasized time and again **"The use of increasingly complex protection systems demands careful planning, contingency analysis, personnel training and ongoing review. … *Protection systems should be tested with methods which mimic actual conditions as closely as possible".*** Thus we have seen the growing application of transient testing of protective relays. Now you can get some of the benefits of realistic test waveforms, even when using traditional (manual) test methods, where others must resort to computer driven methods. Here are some examples:

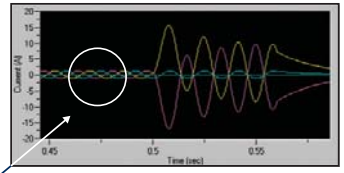
Automatic Current DC Offset & Controlled Fault Inception Angle

The exponentially decaying DC offset component of real-world fault currents is automatically generated by the MTS-5000. This ensures proper, realistic test waveforms essential to testing today's high-speed sub-cycle, line and bus protection relays. Even electromechanical relays, such as the Westinghouse KD, are known to operate incorrectly in response to high di/dt in test currents which do not include the exponentially decaying DC component.** Not accounting for DC offset has also been identified as a key cause of mis-operations in generator protection and breaker failure protection relays.**

In addition, the fault inception angle can be controlled directly from the front panel. Fault inception angle has a significant affect on the degree of DC offset as well as the operation time of high speed protections.

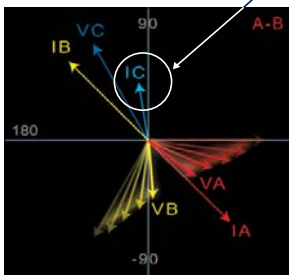


Realistic fault currents for a 3phase fault (θ IA inception angle)



Realistic fault currents for a phase fault (θ IA inception angle)

Affect of load automatically included with a single setting

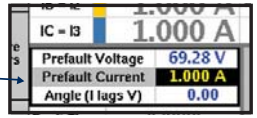


True Phase-Fault Simulation

The MTS-5000 automatically calculates realistic voltage and current phasors without zero sequence components for phase faults. This is especially important to properly test relays which employ zero sequence impedance or negative sequence impedance directional supervision, residual current supervision or sophisticated polarization and/or fault phase selection techniques.** Other test sets allow control of phase-phase voltage and current to simulate phase faults, but often produce high zero sequence voltages not present in the real world. With the MTS-5000 only a single amplitude for each of voltage and current needs to be set/adjusted to ensure realistic outputs for simulating these faults.

Easily Include the Affects of Load

Simulating actual in-service conditions as closely as possible also includes accounting for load. Failure to account for increasing load on the network or the effects of load on protection operation has been shown to contribute to protection system failure.** With the MTS-5000, the affect of load can be automatically included with a single setting.



** See www.mantatest.com for references to technical papers on these subjects.

“Transient Waveform Playback and GPS Synchronized Testing Made Effortless”

(1) Connect GPS antenna (or IRIG-B input)

USB memory drive for rapid waveform file transfer

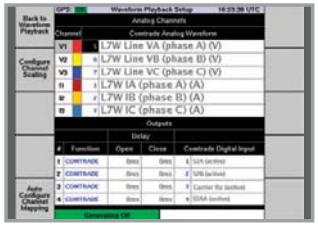
Built-in GPS receiver means less equipment to carry

The built-in high capacity memory even allows direct playback of events such as power swings and motor starts

(2) Select waveform file

Select file from data memory or USB memory drive

(3) Check selected channels



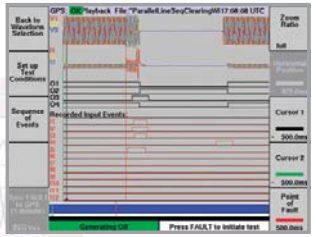
Channels are automatically assigned to COMTRADE file contents upon loading. Change if required

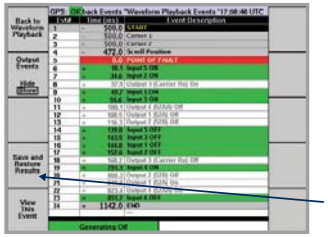
(4) Initiate test

Check satellite lock and co-ordinate with remote terminals (for time synchronized testing)

Press FAULT (Synchronizes test to top of the next minute in case of GPS synchronized testing)

(5) Verify operation





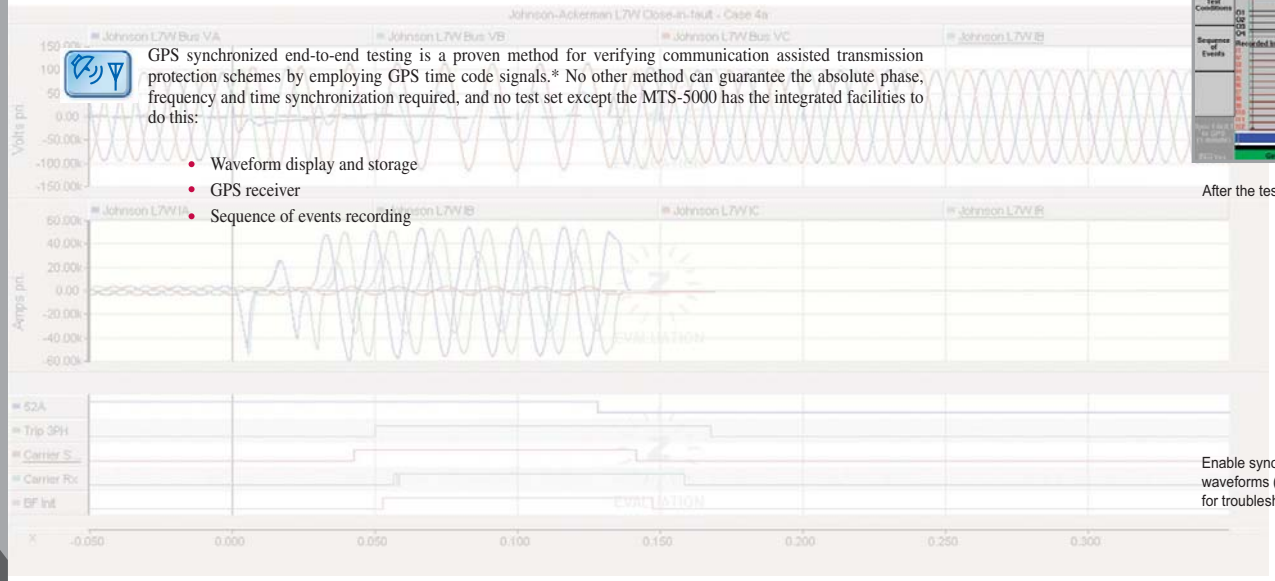
Save results to a file if desired for later reference

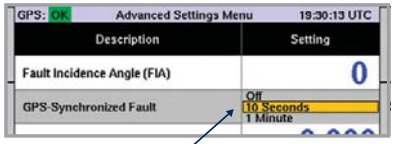
After the test executes, verify correct operation directly on the sequence of events graph or table

Transient playback tests the response of protection relays to real world waveforms. Performance under these simulated “actual conditions” can be analyzed and verified in ways not possible with sinusoidal phasor based testing.* This is an invaluable way to assure that a protection system will operate satisfactorily for known and often difficult fault conditions for that system.

GPS synchronized end-to-end testing is a proven method for verifying communication assisted transmission protection schemes by employing GPS time code signals.* No other method can guarantee the absolute phase, frequency and time synchronization required, and no test set except the MTS-5000 has the integrated facilities to do this:

- Waveform display and storage
- GPS receiver
- Sequence of events recording





Enable synchronization to perform phase, frequency and time synchronized testing with sinusoidal waveforms (in non-playback mode without COMTRADE files) with even fewer steps. Indispensable for troubleshooting line current differential schemes!

* See www.mantatest.com for references to technical papers on these subjects.

Standardize Tests

Create and save test plans for any protective relay test using the standard MTS-5000 interface… no PC required.

Test with ready-built device specific procedures or create your own test procedure. All test plans can be saved before, during, or after a test. Test settings can be:

- Stored on the MTS-5000 in-use
- Stored, uploaded, or executed via USB stick
- Stored or uploaded from any network-enabled computer using standard FTP protocols
- Easily transferred to other users or MTS-5000 test sets via USB stick, email, or FTP

The ability to save any test allows you to:

- Easily customize and restore your favorite MTS-5000 front panel configurations
- Quickly apply commonly used test procedures
- Create a test plan for all the relays in your system to perform identical tests during maintenance
- Quickly modify test plans for new applications and standardize tests between users
- Share test procedures with all users

REMOTE CONSOLE Interactive PC-Based Testing

Manta Test Systems also offers our ***Remote Console*** program for PC-oriented users. This program can be used to control the MTS-5000 via any TCP/IP network. The interface is nearly identical to the MTS-5000 front panel so there are no new screens to learn.

Remote Console works without an MTS-5000 as well and creates a virtual test set on your computer to allow you to:

- Create, test, and save test plans before the job starts to increase productivity and reduce testing times
- Train new users without an actual test set that could be better used testing relays
- Help users in the field using your ***Remote Console*** to give exact instructions

RAPID REPORTER™ Automatic Reporting

Create reports that can be viewed by anyone who uses a web browser via the MTS-5000 front panel with no external software or PC required… or use ***RapidReporter***™ software to save, organize, and generate custom reports built to your specifications.

The MTS-5000 can create test reports using the universal xml format which include your test results and every setting in the test set at the moment of test. You can create your own filters to import this information to any existing or future data storage program in your organization, or use ***RapidReporter***™ to:

- Organize, sort, and view your results
- Quickly review evaluations for Pass/Fail
- Correct or revise user supplied information (Test set generated results are locked)
- Create and save custom title page templates
- Create and save custom report templates with as much or as little information as you require
- Create flexible rules which allow different templates for different tests
- Only print the results that matter to you with any level of detail required
- Create an open-source database of your results which can be linked to other programs in your organization

This is only a sampling of what the MTS-5000 has to offer.
Book a demonstration and find out more today!

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