



PW41i Protective Relay Test Set



PW41i is a reliable protective relay test set with high current output (3×40A) and high voltage output (4×300V). It supports both local control and PC control. With built-in 10.4inch touch screen for local control system so that the testings could be done easily by the relay test set itself. Connect to external PC via PowerTest relay test software running can do testings as well. PW41i is a favorable and economical testing solution for commissioning work in distribution grid.

Features

- High current and power output, output 3×40A with maximum power up to 400VA/phase
- Support both local control with 10.4inch touch screen and PC control by PowerTest software
- 8 binary inputs, 4 binary outputs
- Auxiliary DC power supply 110V, ADJ(0-300V, software controlled), 220V switchover
- The local software system is designed based on Windows system, which is easy and convenient for operation and upgrade. It supports using templates for various relay testings, for example, G59.

Applications

✓ Relay test

- Distance protection relay
- Directional relay
- Current relay
- Voltage relay
- Frequency relay, etc.



Local control with 10.4inch touch screen

✓ Automatic device

- Synchronizer
- Auto-reclosing

✓ Power system simulation

- Transient, permanent state fault simulation
- Playback of COMTRADE format file

✓ Calibration

- 0.5 Class energy meter
- Disturbance recorder
- Indicating meters, etc.

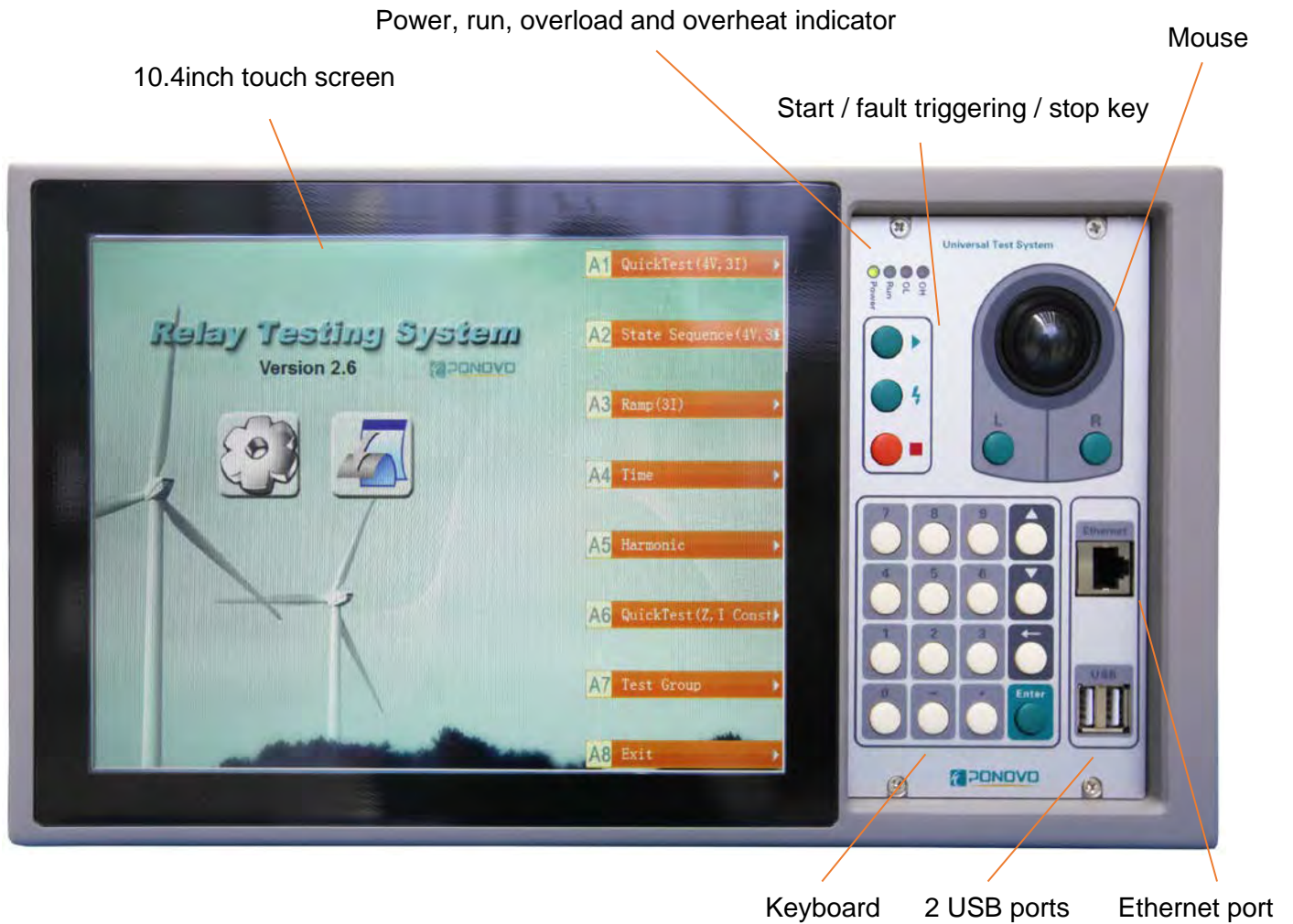


PC control by PowerTest software

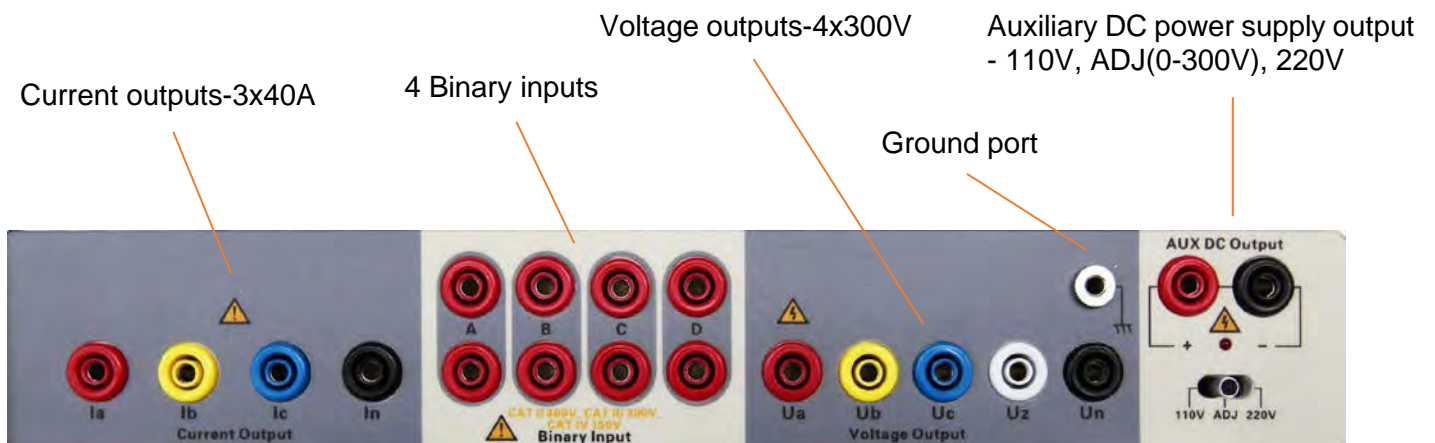
PW41i Protective Relay Test Set

PW41i Panels

▪ Front Panel

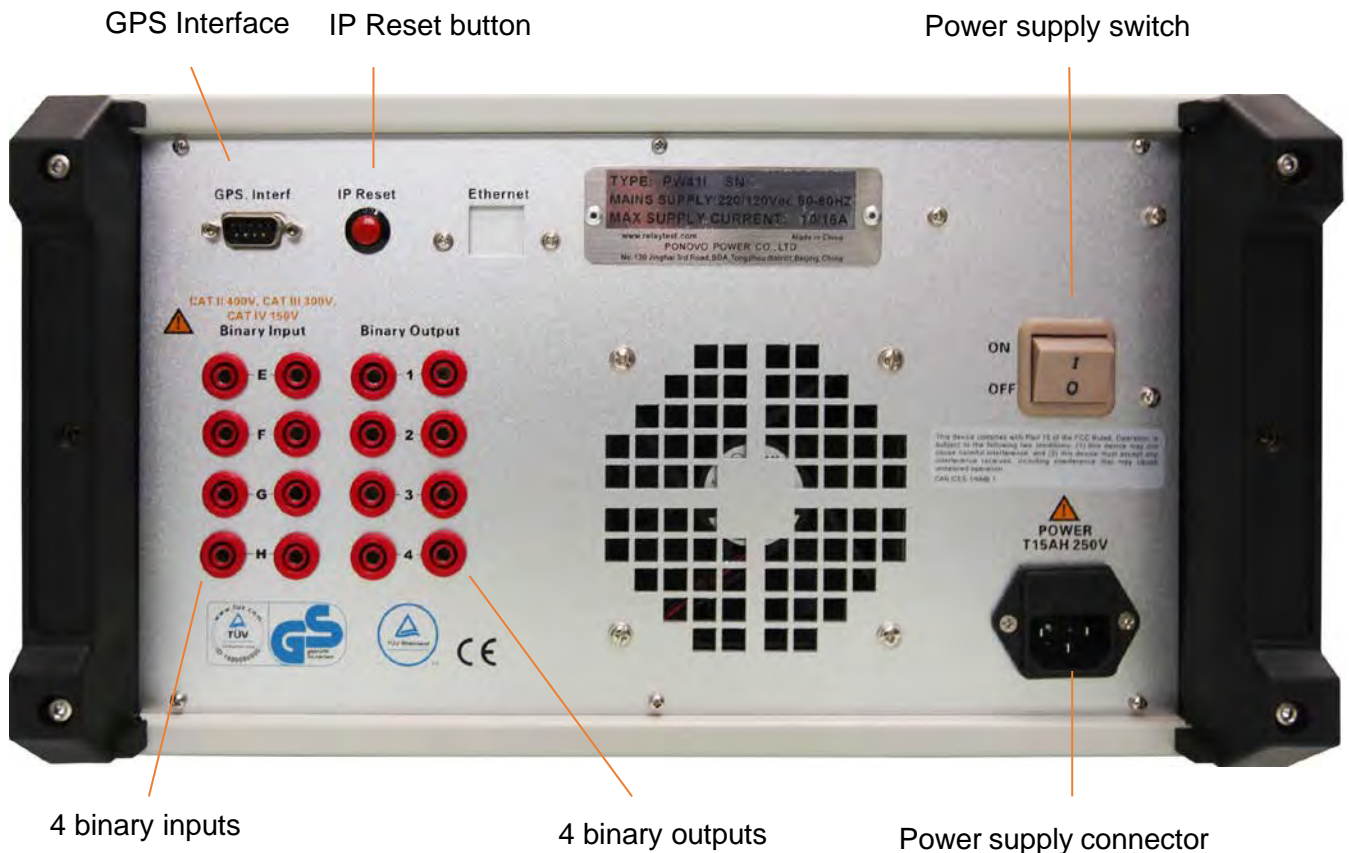


▪ Top Panel



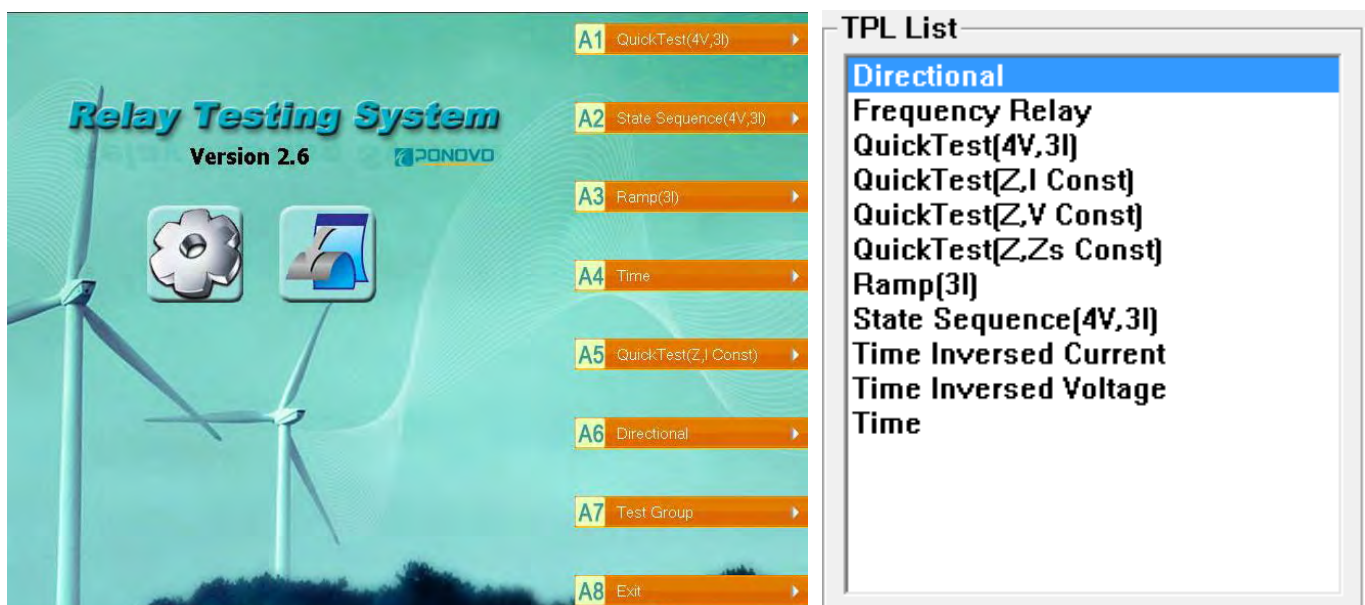
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▪ Rear Panel



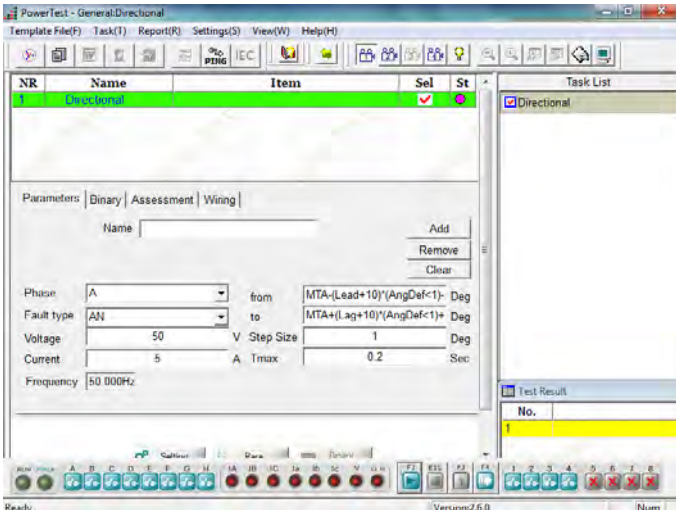
PW41i Local Relay Test Set Software

PW41i is a type of relay tester controlled locally and externally by a PC. A color touchscreen and local control system make PW41i portable and easy to use. The local software embedded in PW41i is called **PowerTestCut**. There are 11 test modules in the software: Directional, Frequency Relay, QuickTest, Ramp, State Sequence, Time Inversed Current, Time Inversed Voltage, and Time. More powerful functions are available with Powertest's PC control.



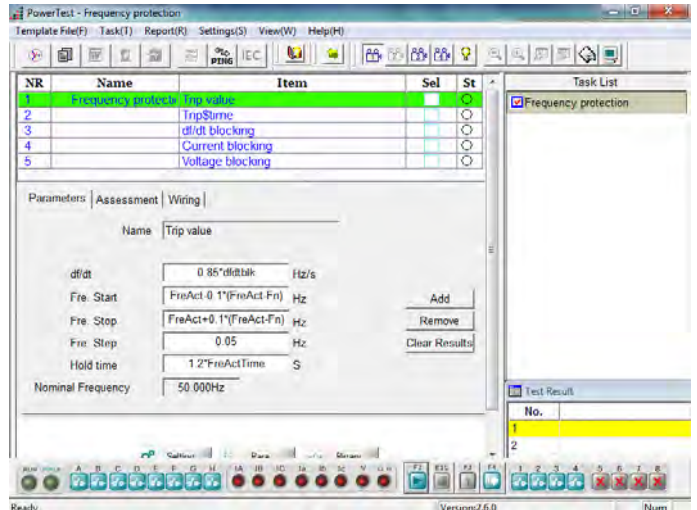
➤ Directional

- ❖ Can search maximum torque angle and two boundary angles (Lead and lag angles)
- ❖ Can set angle define, V lead I or I lead V
- ❖ Can set fault type, single phase, phase-phase or three phase fault



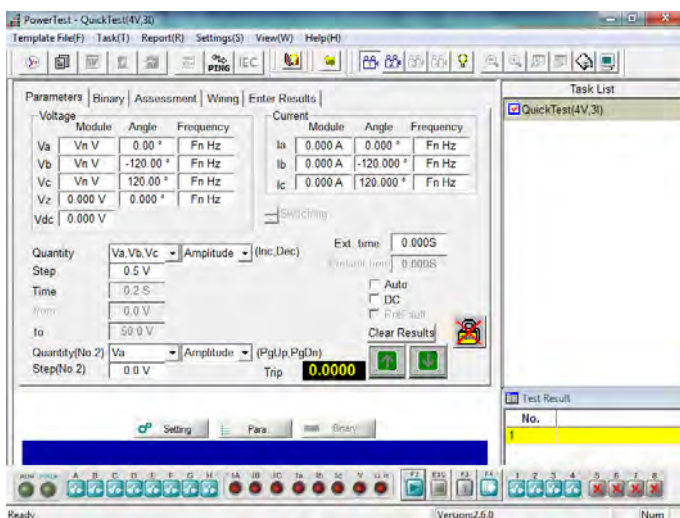
➤ Frequency Relay

- ❖ Can test frequency protection relay, such as over frequency, under frequency, df/dt blocking
- ❖ Including pick up frequency, trip time, df/dt blocking value, voltage blocking value and current blocking value test



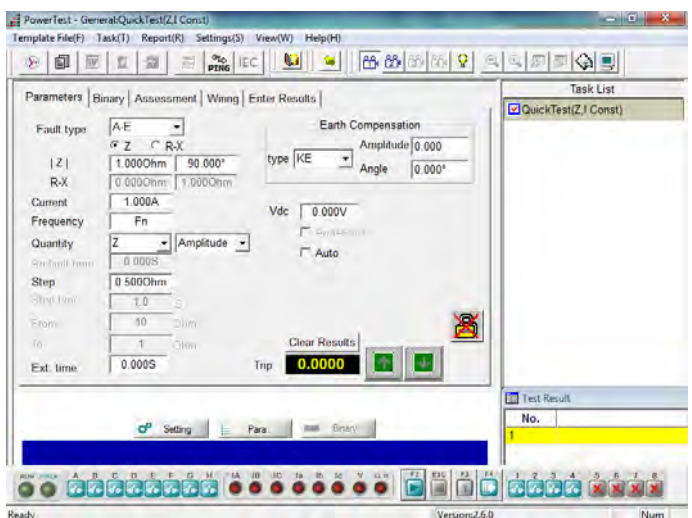
➤ QuickTest (4V, 3I)

- ❖ 4 voltage / 3 voltage and 3 current sources available for test relay
- ❖ Amplitude, phase angle and frequency of voltage and current sources can be controlled independently
- ❖ Test can be in manual or auto mode



➤ QuickTest (Z, I Const)

- ❖ Easy to test impedance relay with constant current
- ❖ Set the fault impedance and fault current, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value

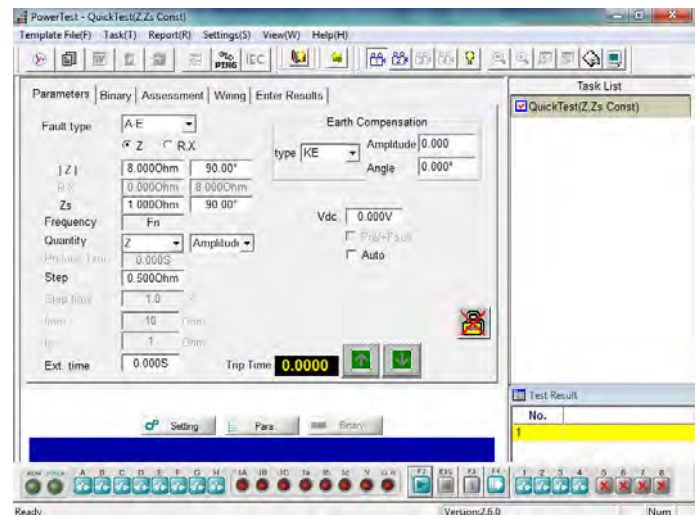
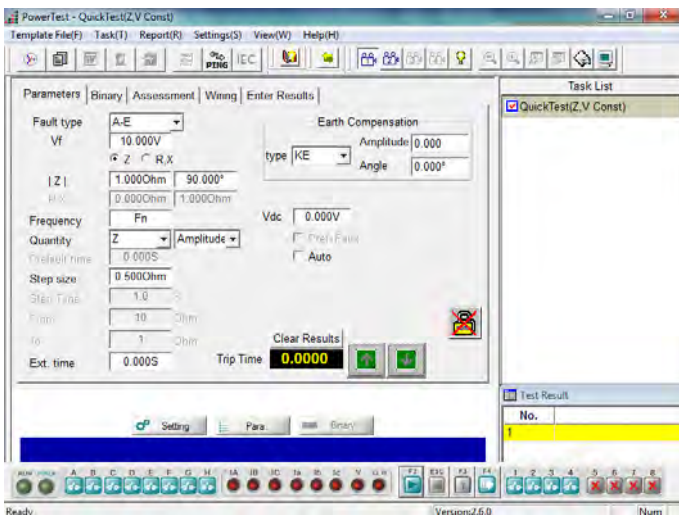


➤ QuickTest (Z, V Const)

- ❖ Easy to test impedance relay with constant voltage
- ❖ Set the fault impedance and fault voltage, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value

➤ QuickTest (Z, Zs Const)

- ❖ Easy to test impedance relay with constant system impedance
- ❖ Set the fault impedance and system impedance, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value

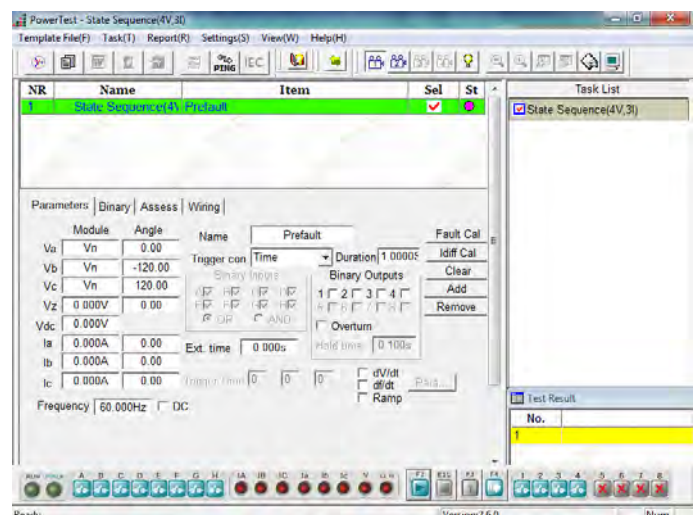
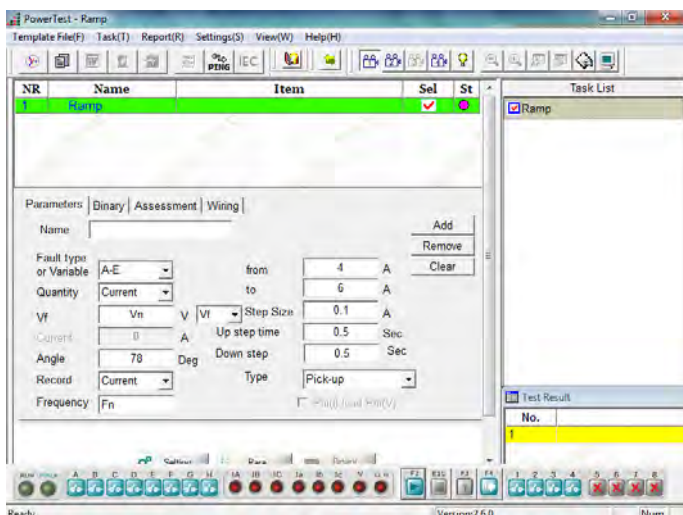


➤ Ramp (3I)

- ❖ Specially designed to realize RAMP for different test applications, such as pick up / drop off value checking, directional relay testing, maximum torque angle checking etc.
- ❖ Both pulse ramp and linear ramp available
- ❖ Can search the relay operation value automatically

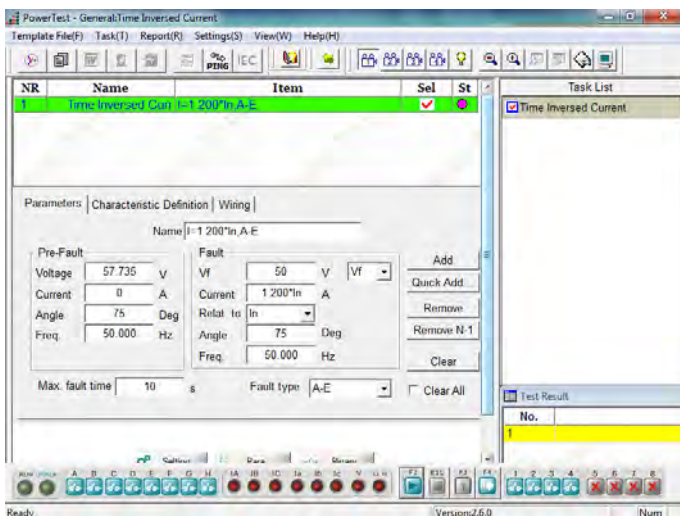
➤ State Sequence (4V, 3I)

- ❖ Used to define multiple continuous state sequences for special test applications, such as generate a series of states to test the tripping time and close time
- ❖ 4 voltage / 3 voltage and 3 current sources available for each state
- ❖ Trigger condition in each state can be set separately



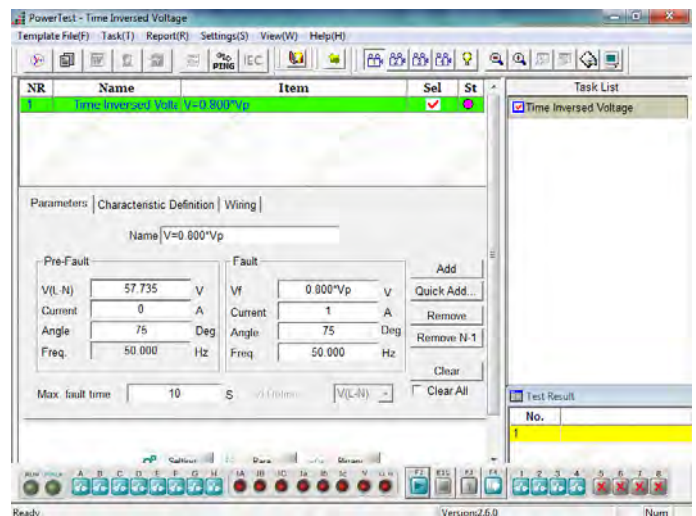
➤ Time Inversed Current

- ❖ Realize the directional over-current test and non-directional over-current test
- ❖ Include testing positive sequence, negative sequence and zero sequence inverse-time over-current, definite-time over-current, over-heat protection.
- ❖ Can import the IEC and IEEE standard curve or user defined curve



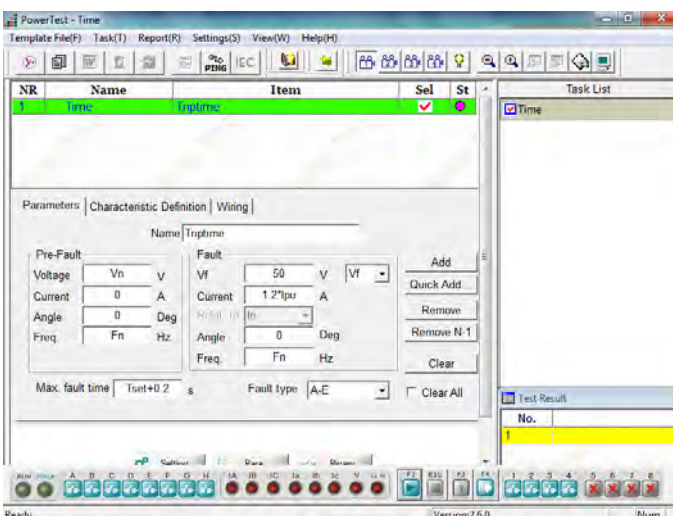
➤ Time Inversed Voltage

- ❖ Can test time inversed over voltage and time inverse under voltage relay
- ❖ Include testing directional, time definite and with time delay voltage relay
- ❖ Can simulate three phase, phase-earth fault, and phase-phase fault



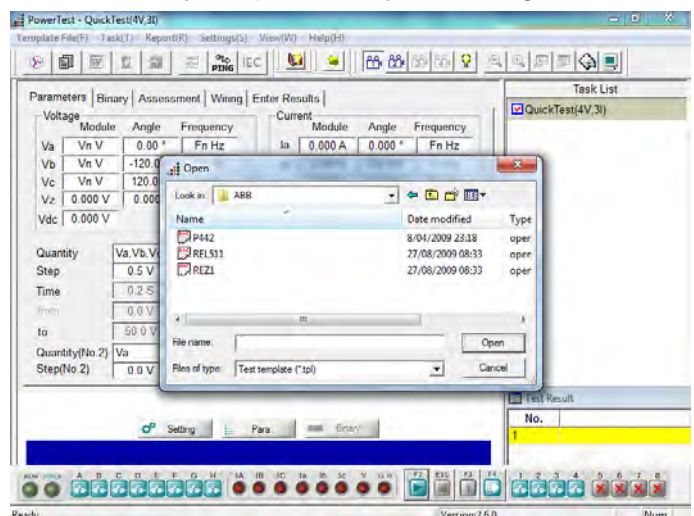
➤ Time

- ❖ Used to test trip time of protection relay
- ❖ Various value can be set separately, such as fault types, fault time, the voltage and current at pre-fault and fault state, etc.



About templates

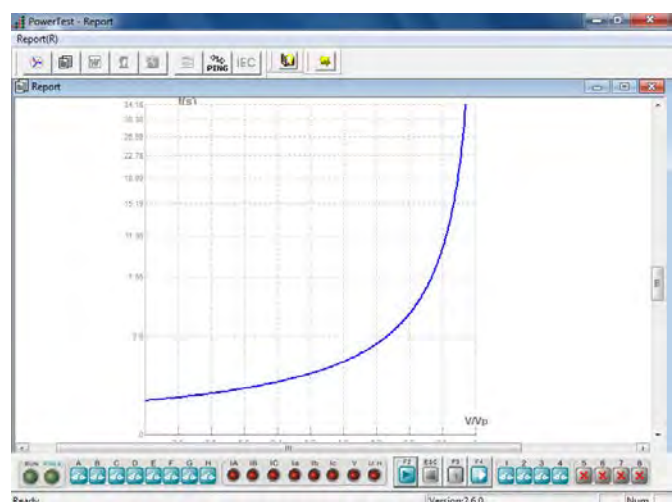
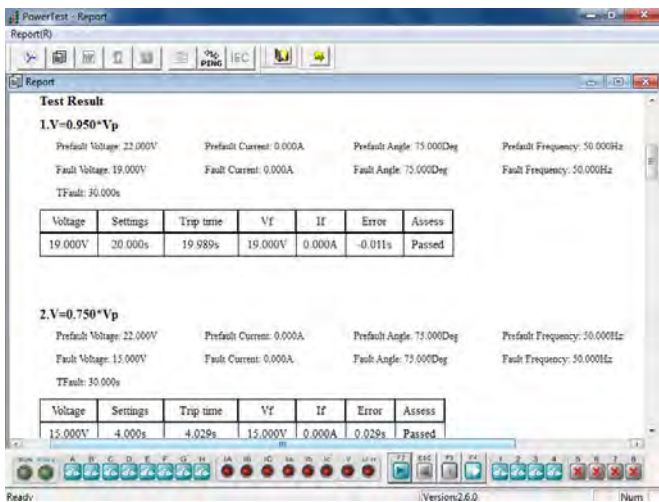
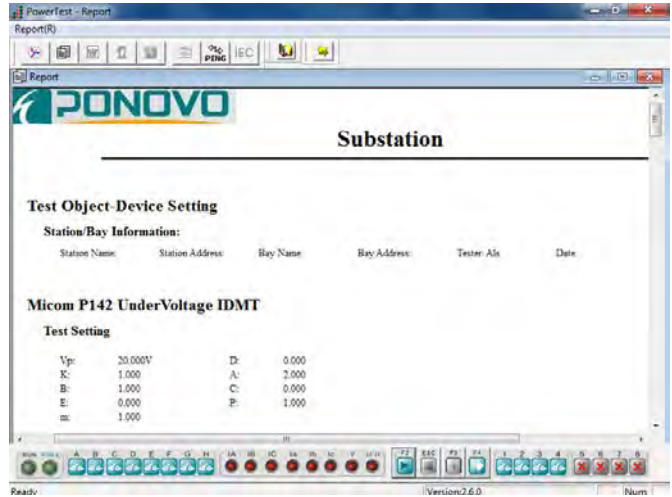
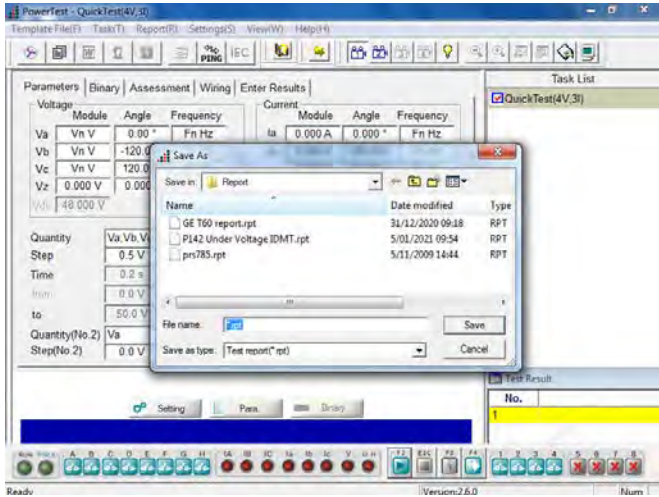
PW41i supports using relay templates in its local system for testings, which includes more than 400 available relay types for engineer's use for their testings. Register on our website to download the available relay templates for your testing use.



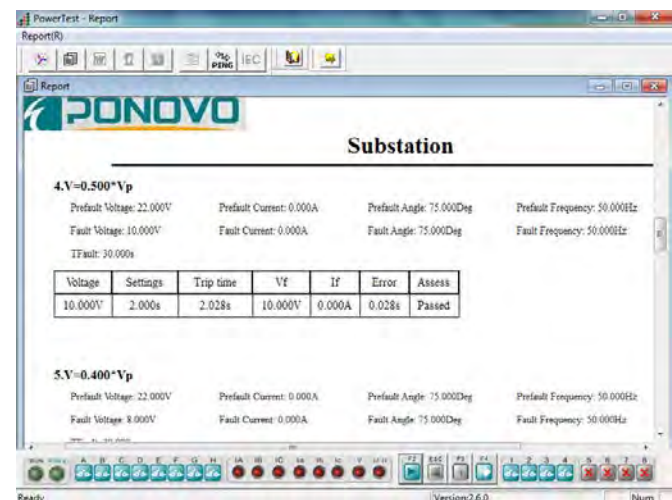
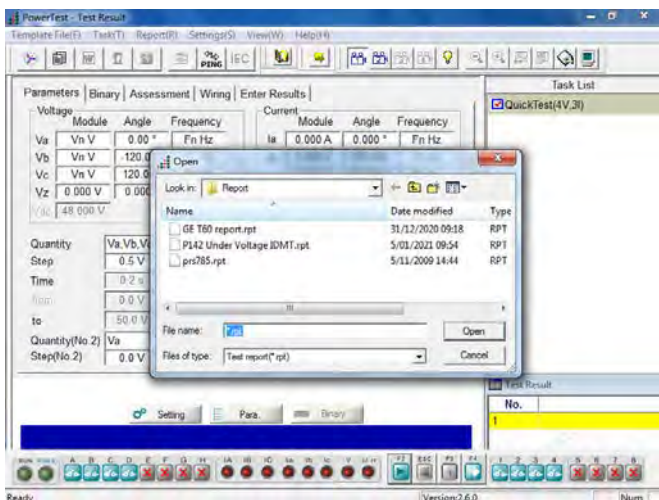
Local Reports

After testing, each test items can be saved report in .rpt format and open it locally. Test object information, test equipment information, system parameters, characteristic curve, binary setting, test setting value, test result (including testing data, operating characteristic diagram, test result assessing), ect.

- Saved report in .rpt format



- Open report in .rpt format locally





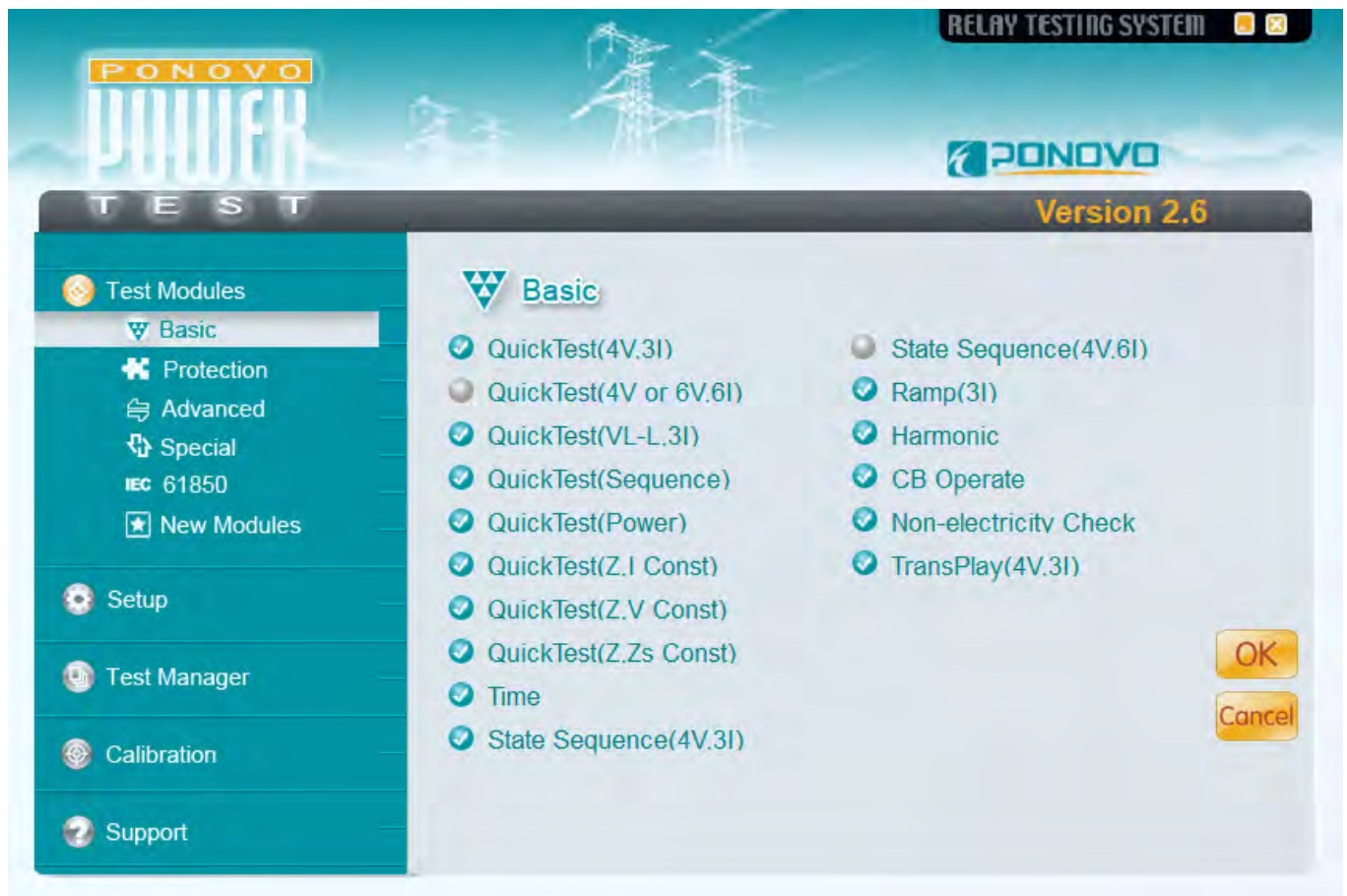
PowerTest - Relay Test Set Software



PW41i supports both local control and PC control, the software setup on PC called **PowerTest**. PowerTest is one universal software for all three phase or six phase relay testers of PONOVO, including different test packages, the **Basic** package, **Protection** package, **Advanced** package, **Special** package, **New Modules**, which packages includes different testing module, that can be used for all kinds of relay testing, and it also has the special package for more testing application, such as energy meter, etc.

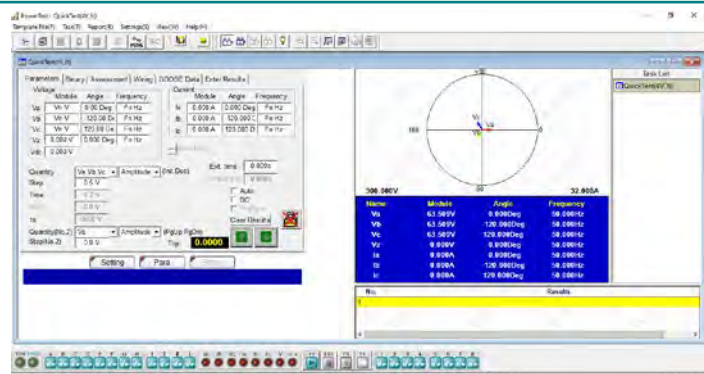
➤ Basic Package

In the **Basic** package, there are different Quick Test modules, Time module, State Sequence, Ramp, Harmonic, CB Operation, Non-electricity Check, and TransPlay for playing back the comtrade file can be used by PW41i relay test set.



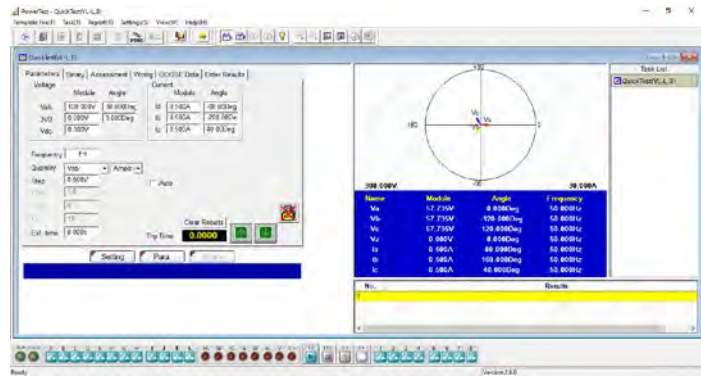
QuickTest (4V, 3I)

- ❖ 4 voltage and 3 current sources available for test relay
- ❖ Amplitude, phase angle and frequency of voltage and current sources can be controlled independently
- ❖ Test can be in manual or auto mode



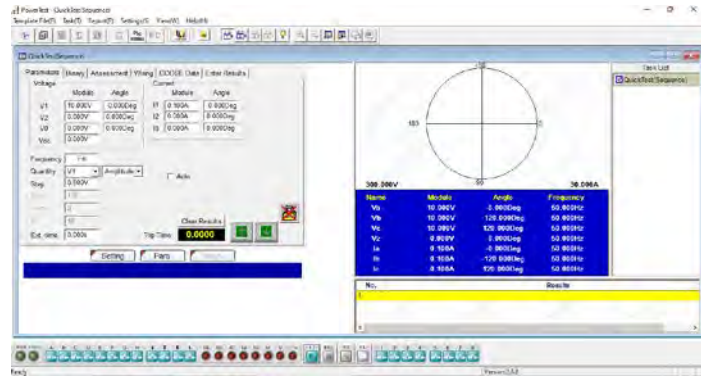
QuickTest (VL-L, 3I)

- ❖ Easy to control the phase-phase voltage, 3V0 (zero sequence voltage) and 3 currents
- ❖ Amplitude, phase angle and frequency of current sources and phase-phase voltage, zero sequence voltage can be controlled independently
- ❖ Test can be in manual or auto mode



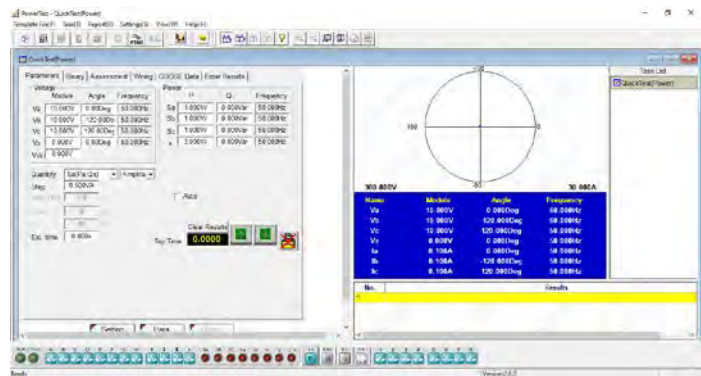
QuickTest (Sequence)

- ❖ Easy to control the sequence components (positive sequence, negative sequence and zero sequence) for voltage and current
- ❖ Amplitude and phase angle of the sequence components of voltage and current can be controlled independently
- ❖ Test can be in manual or auto mode



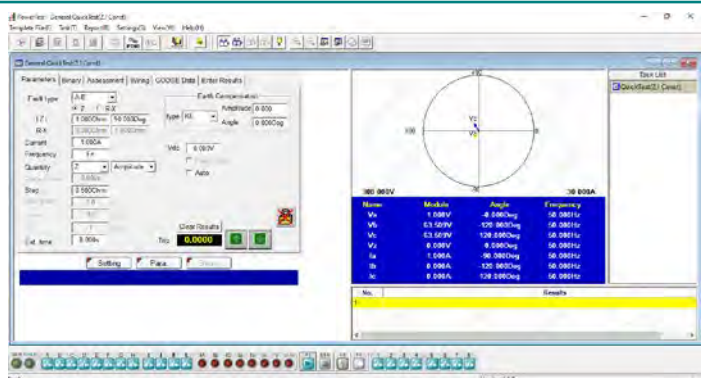
QuickTest (Power)

- ❖ Easy to control the output of power, including active power, reactive power and apparent power
- ❖ Amplitude of active power, reactive power and apparent power can be controlled independently
- ❖ Test can be in manual or auto mode



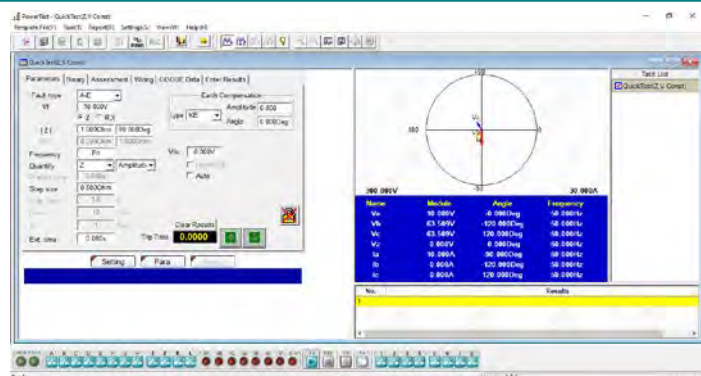
QuickTest (Z, I Const)

- ❖ Easy to test impedance relay with constant current
- ❖ Set the fault impedance and fault current, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value



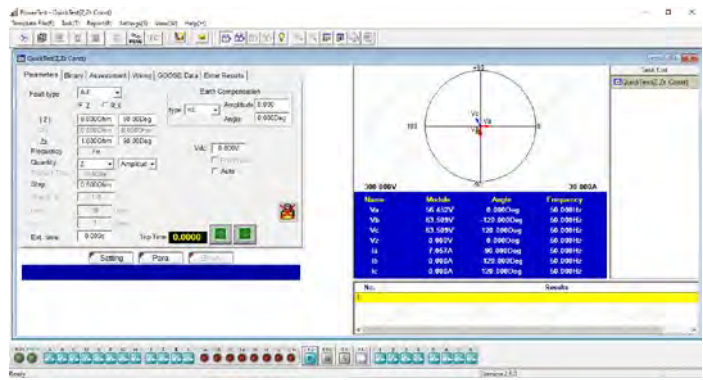
QuickTest (Z, V Const)

- ❖ Easy to test impedance relay with constant voltage
- ❖ Set the fault impedance and fault voltage, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value



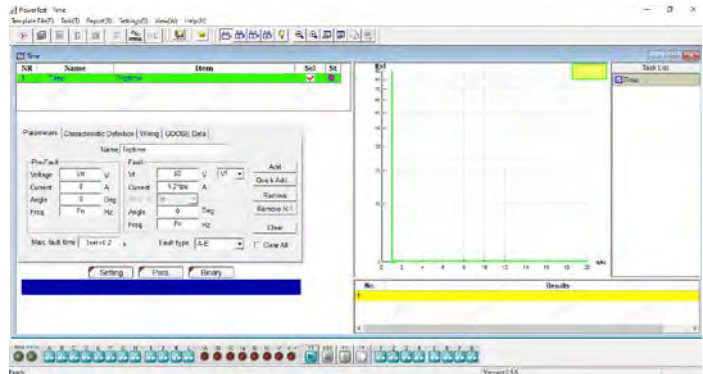
QuickTest (Z, Zs Const)

- ❖ Easy to test impedance relay with constant system impedance
- ❖ Set the fault impedance and system impedance, obtain the amplitude and phase angle of each phase voltage and current according to the fault type
- ❖ Can manually or automatic search the relay operation value



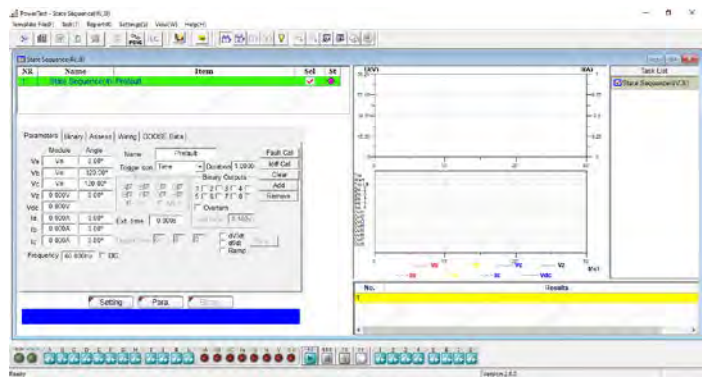
Time

- ❖ Time module is used to test trip delay time of protection relay
- ❖ Various value can be set separately, such as fault types, fault time, the voltage and current at pre-fault and fault state, etc.



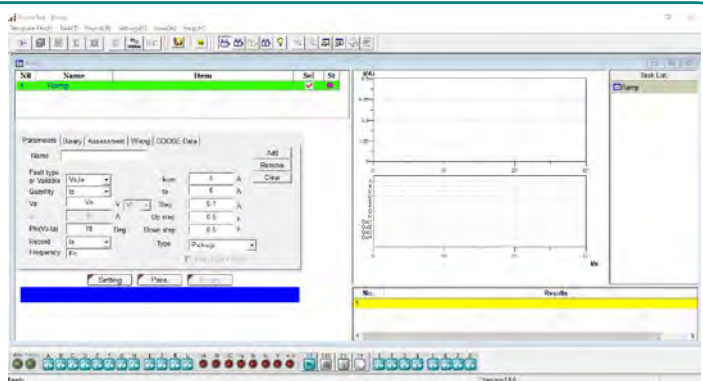
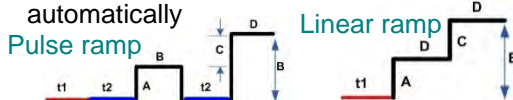
State Sequence (4V, 3I)

- ❖ Used to define multiple continuous state sequences for special test applications, such as generate a series of states to test the tripping time and close time
- ❖ 4 voltage and 3 current sources available for each state
- ❖ Trigger condition in each state can be set separately



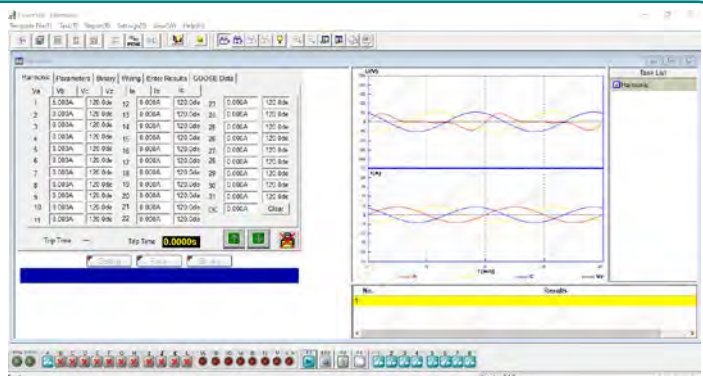
Ramp (3I)

- ❖ Specially designed to realize RAMP for different test applications, such as pick up/drop off value checking, directional relay testing, maximum torque angle checking etc.
- ❖ Both pulse ramp and linear ramp available
- ❖ Can search the relay operation value automatically



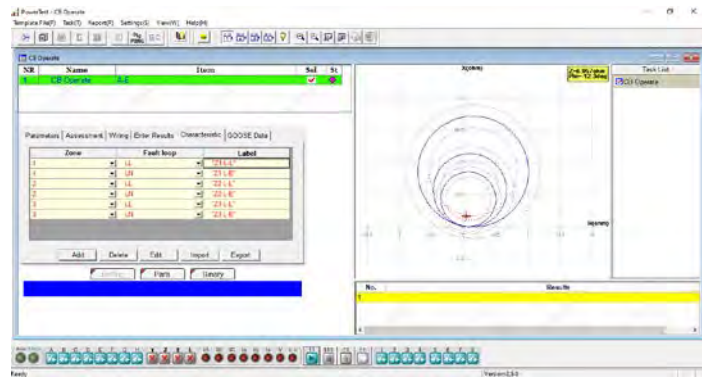
Harmonic

- ❖ Can generate harmonics for all voltage and current outputs
- ❖ Can check the 2nd / 3rd / 4th / 5th harmonic restraint of current differential
- ❖ Can check the harmonic measurement of the relay up to 31st harmonic
- ❖ Can set the harmonic for each channel separately



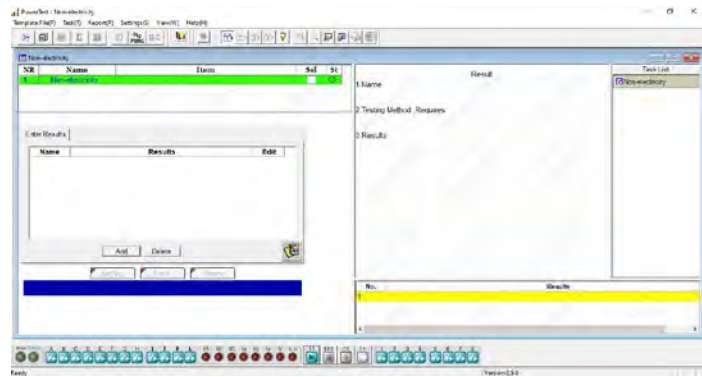
CB Operate

- ❖ Can check different types of line protection system, including over current, distance, etc.
- ❖ Can check the whole relay system, including auto-reclosing and circuit breaker simulate
- ❖ Can set different fault type
- ❖ Can do end-to-end test with GPS control mode



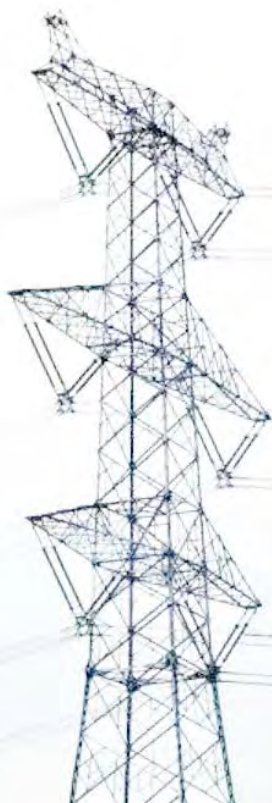
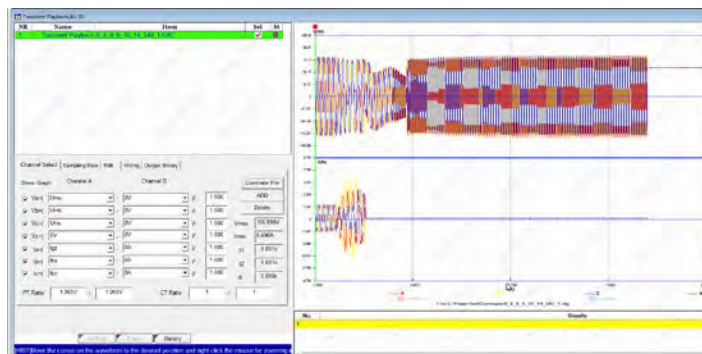
Non-electricity

- ❖ Give tips before and after testings to have test scheme prepared well and finished well
- ❖ Neither has any output value nor judge the binary input. It only generates a complete report for project check from appearance and safety.



Transient Playback (4V,3I)

- ❖ Can play back the COMTRADE format file which records 4 voltage channels and 3 current channels
- ❖ Display the waveform and data of the imported COMTRADE file



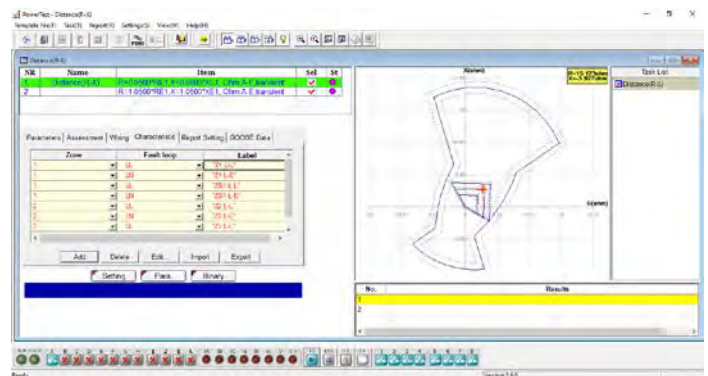
➤ Protection Package

In protection package, there are more testing modules for relay's characteristics testings, such as Distance, Differential, Directional, Time Inversed Current, Time Inversed Voltage, Frequency, Auto-Reclosing can be used by PW41i relay test set.



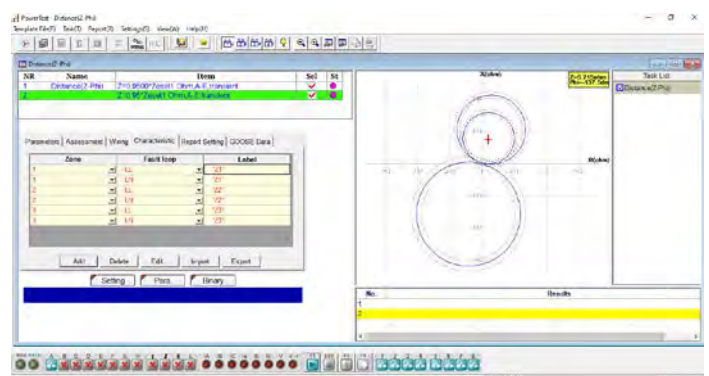
Distance (R-X)

- ❖ Can test impedance relay with R-X setting in different ways
- ❖ Input impedance characteristic to Z plain
- ❖ Associate the characteristic with relay settings
- ❖ Select test point/ items directly on Z plain or in setting box
- ❖ Zone verification
- ❖ Z-T test
- ❖ Edit new characteristic



Distance (Z-Phi)

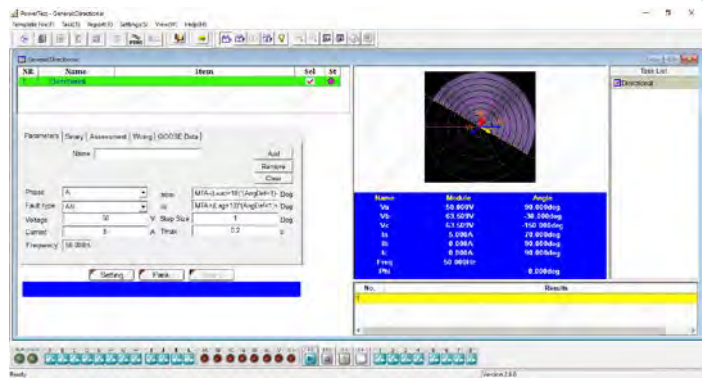
- ❖ Can test impedance relay with Z-Phi setting in different ways
- ❖ Input impedance characteristic to Z plain
- ❖ Associate the characteristic with relay settings
- ❖ Select test point/ items directly on Z plain or in setting box
- ❖ Zone verification
- ❖ Z-T test
- ❖ Edit new characteristic



PowerTest - Relay Test Set Software

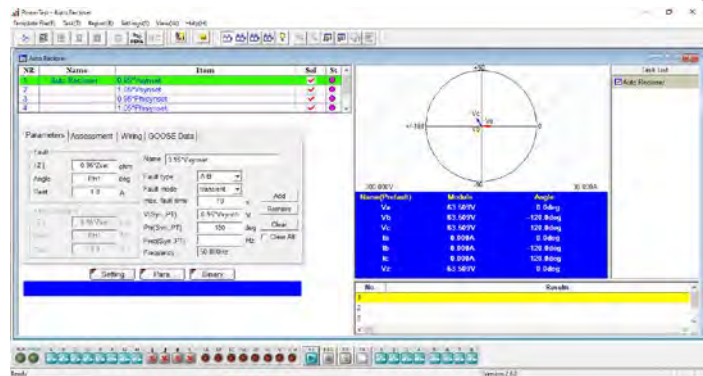
Directional

- ❖ Can search maximum torque angle and two boundary angles (Lead and lag angles)
- ❖ Can set angle define, V lead I or I lead V
- ❖ Can set fault type, single phase, phase-phase or three phase fault



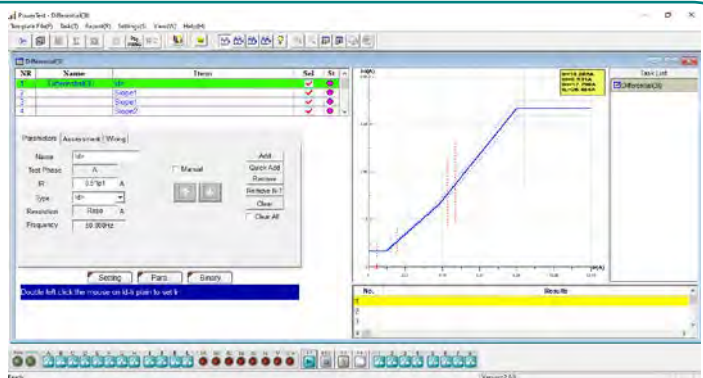
Auto-Reclosing

- ❖ Can test the reclose function
- ❖ Realize relay automatic reclosing with checking the difference between two systems, checking the synchronization setting, reclose set time checking and automatic evaluating of testing results.



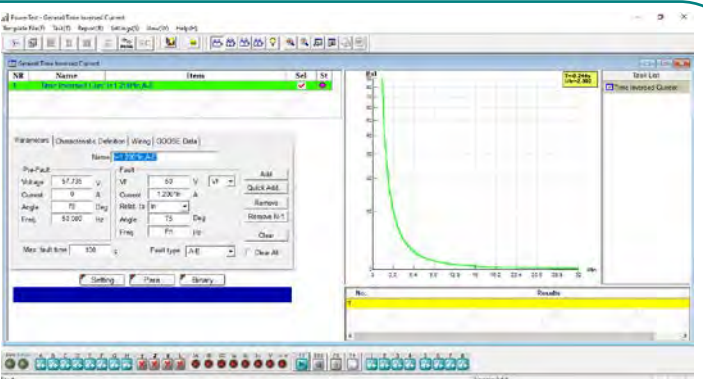
Differential (3I)

- ❖ Can search out the percentage restraint curve, harmonic restraint, trip time for single phase fault
- ❖ Can search the percentage restraint curve
- ❖ Can check 2nd harmonic restraint
- ❖ Can check 3rd harmonic restraint
- ❖ Can check 5th harmonic restraint
- ❖ Can check tripping time of set points



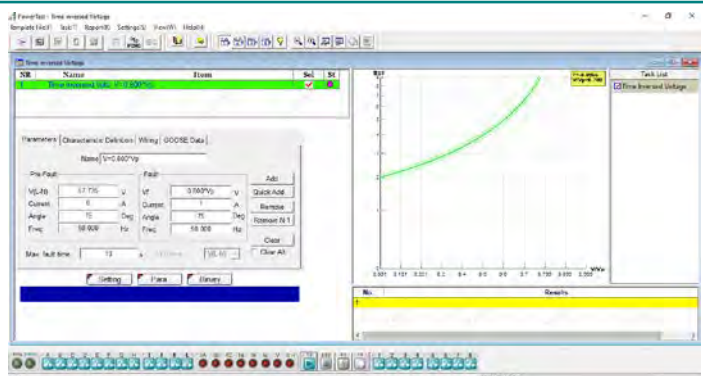
Time Inversed Current

- ❖ Realize the directional over-current test and non-directional over-current test
- ❖ Include testing positive sequence, negative sequence and zero sequence inverse-time over-current, definite-time over-current, over-heat protection.
- ❖ Can import the IEC and IEEE standard curve or user defined curve



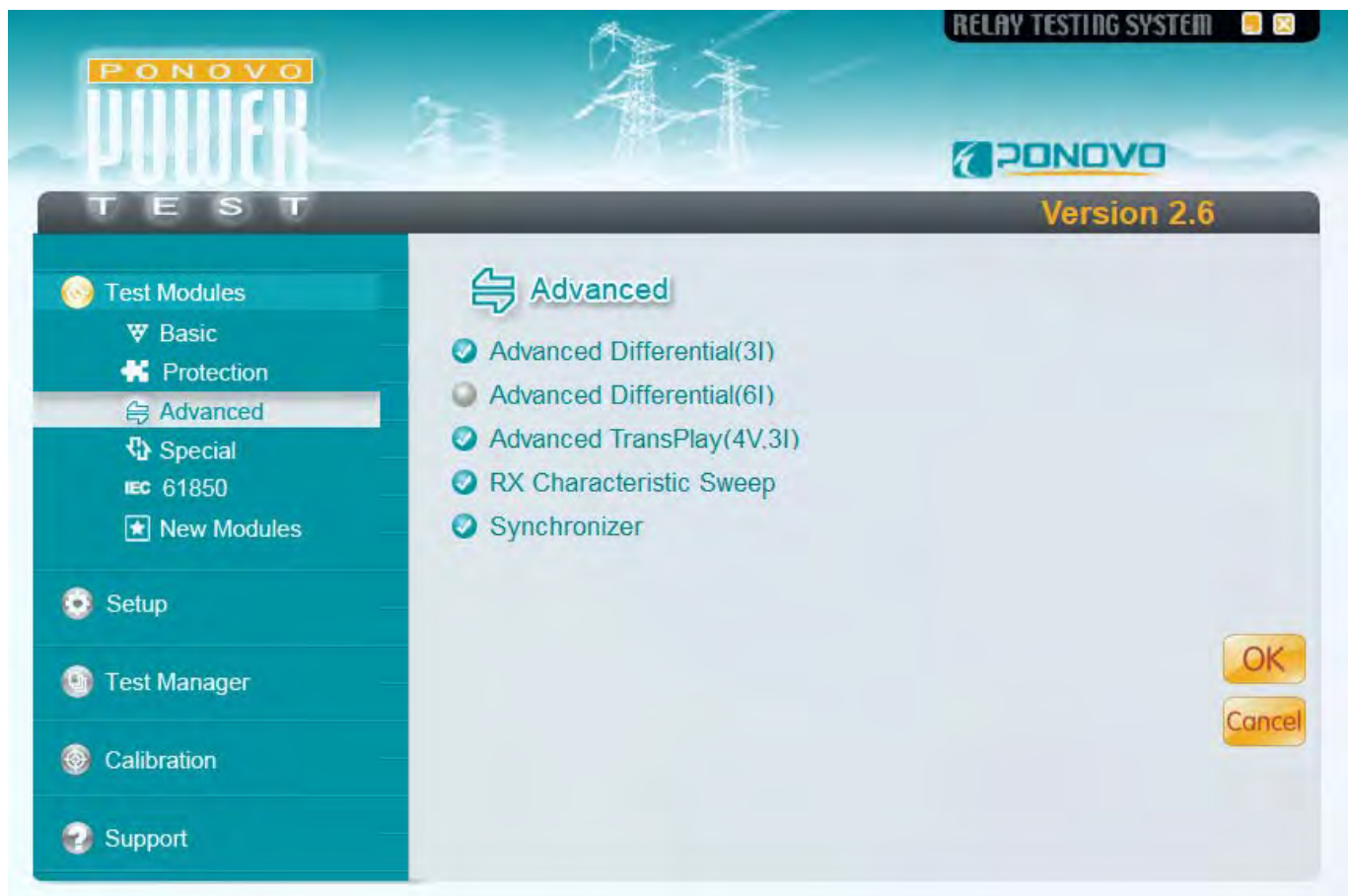
Time Inversed Voltage

- ❖ Can test time inversed over voltage and time inverse under voltage relay
- ❖ Include testing directional, time definite and with time delay voltage relay
- ❖ Can simulate three phase, phase-earth fault, and phase-phase fault



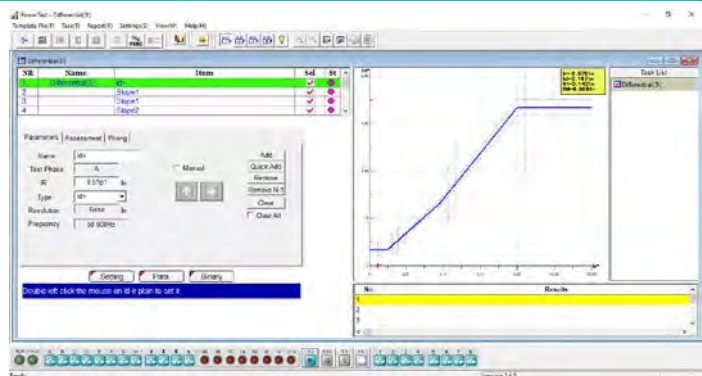
➤ Advanced Package

In the advanced package, the centralization testing the RX Characteristic Sweep testing for distance relay, Advanced Differential, Advanced Transplay, Synchronization, can be used by PW41i relay test set.



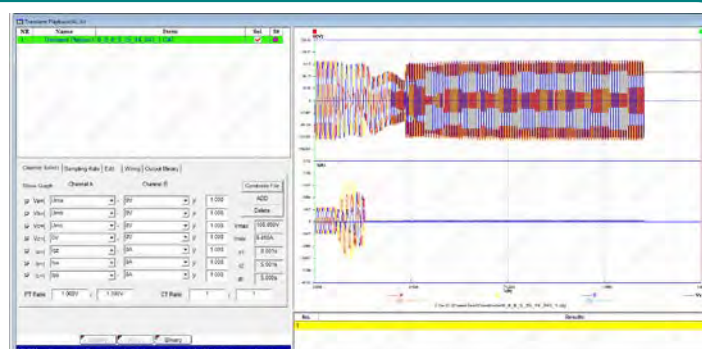
Advanced Differential (3I)

- ❖ Can search the percentage restraint curve, harmonic restraint, trip time for single phase fault
- ❖ Can automatic to calculate the matching factor via the transformer parameter and CT/PT parameter
- ❖ Only check single phase fault



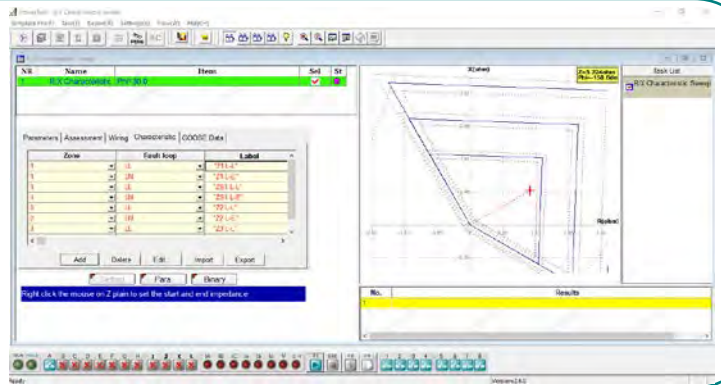
Advanced TransPlay (4V,3I)

- ❖ Can play back the COMTRADE format file, including CFG, which describe signal names, sampling frequencies, etc. and DAT which contains the sampling values for each channel.
- ❖ Can edit the COMTRADE data



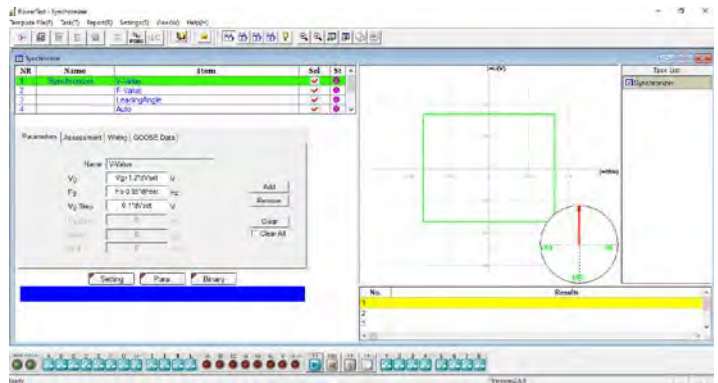
RX Characteristic Sweep

- ❖ Can search the characteristic boundary of the impedance relay
- ❖ Can find the boundary at different angles



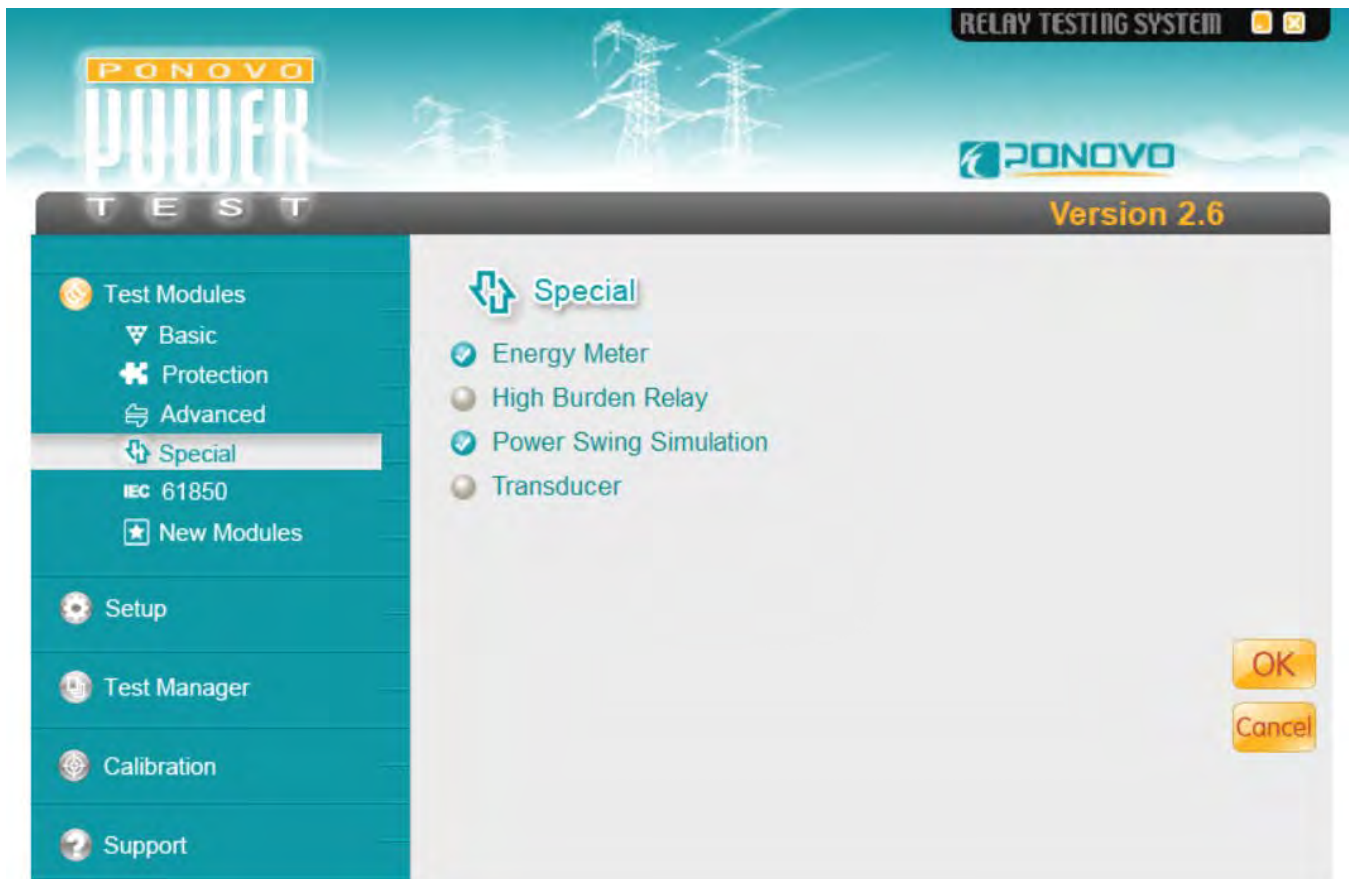
Synchronizer

- ❖ Can check synchronizing relay
- ❖ Can check voltage difference
- ❖ Can check frequency difference
- ❖ Can check leading time and leading angle
- ❖ Can check pulse width for frequency adjustment
- ❖ Can check pulse width for voltage adjustment
- ❖ Can check auto-adjusting function with both voltage and frequency varying



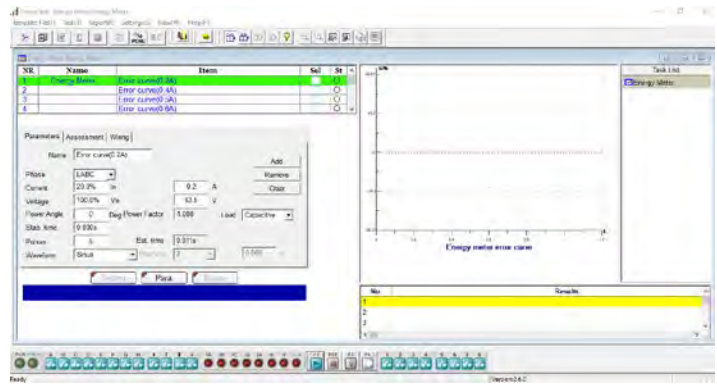
➤ Special Package

In the special package, there are Energy Meter, Power Swing Simulation modules can be used by PW41i relay test set.



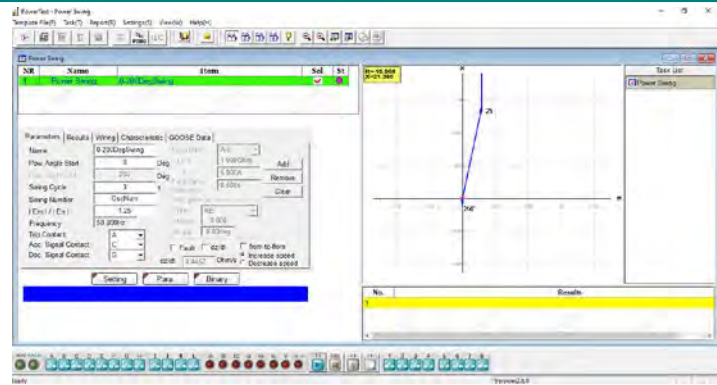
Energy Meter

- ❖ Can check the functionality and accuracy of energy meter with or without optional accessory PACB108
- ❖ 1-phase or 3-phase energy meters can be checked
- ❖ Active power meter, reactive power meter, and apparent power meter can be checked



Power Swing Simulation

- ❖ Can really simulate the oscillations in power flow reference the power parameter
- ❖ Can simulate Out-of-Step and Stable swing
- ❖ Can simulate increase and decrease swing
- ❖ Can be a tool for relay test engineer to observe the relay behavior during dynamic power swing process.



➤ New Modules Package

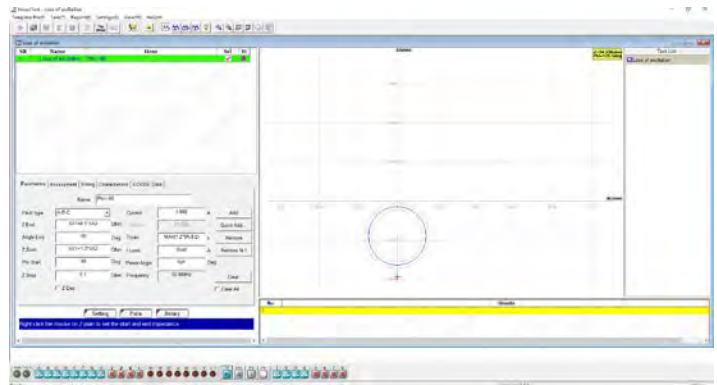
In the New Modules package, there are loss of excitation, QuickTest(harmonic) modules can be used by PW41i relay test set.



PowerTest - Relay Test Set Software

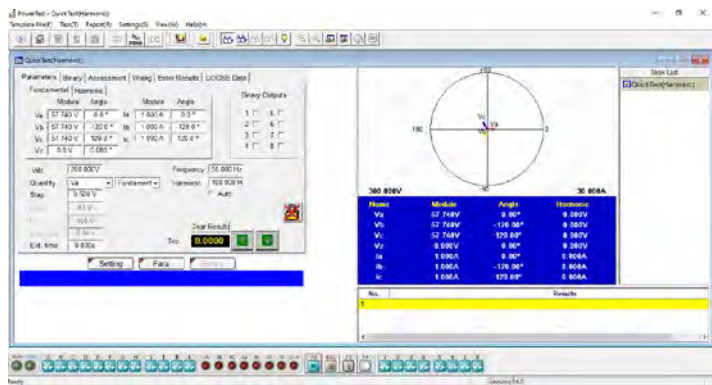
Loss of excitation

- ❖ Can search for two different excitation loss characteristics
- ❖ During the test process a series of shots will be generated to search out the boundary along this shot line. Then next shot at a different angle will be generated. In this way we can then find out the boundary at different angles.



QuickTest (Harmonic)

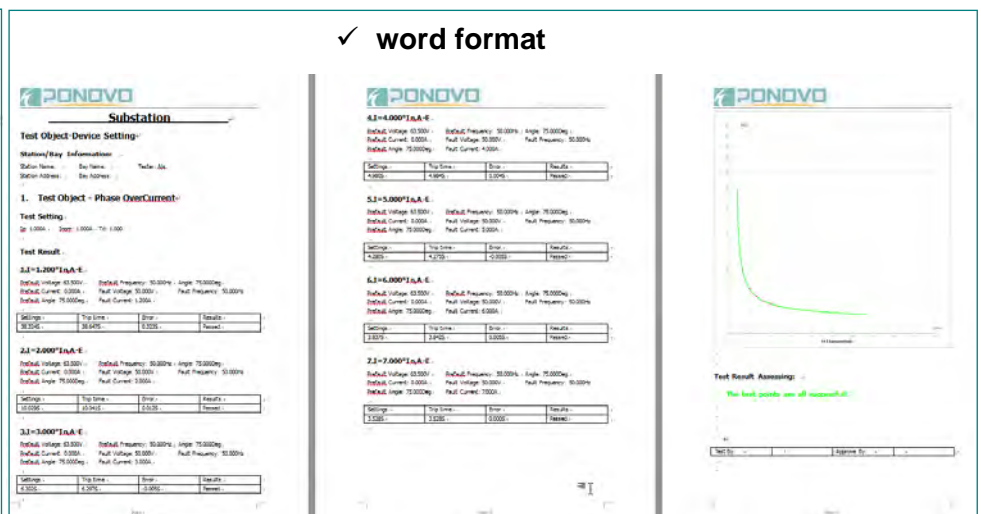
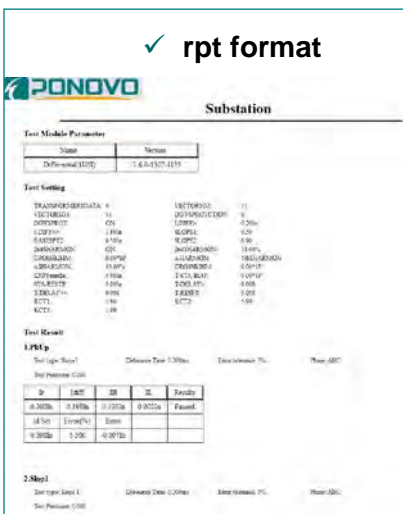
- ❖ Can automatically and manually superposition harmonics with user-defined frequency
- ❖ The fundamental and harmonic of voltage and current sources can be controlled independently



Test Report generated by PowerTest software

After testing, each test can be saved report in .rpt format and word format on PC.

Test result in both format displays the same content, including test object information, test equipment information, system parameters, characteristic curve, binary setting, test setting value, test result (testing data, operating characteristic diagram, test result assessing), ect.

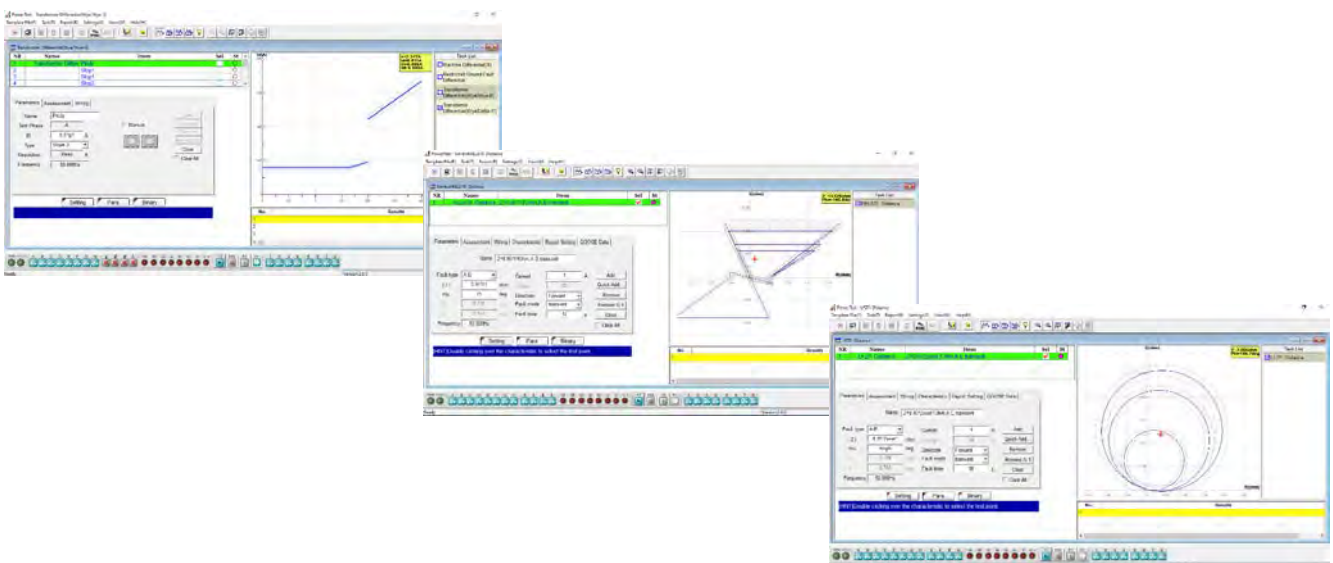
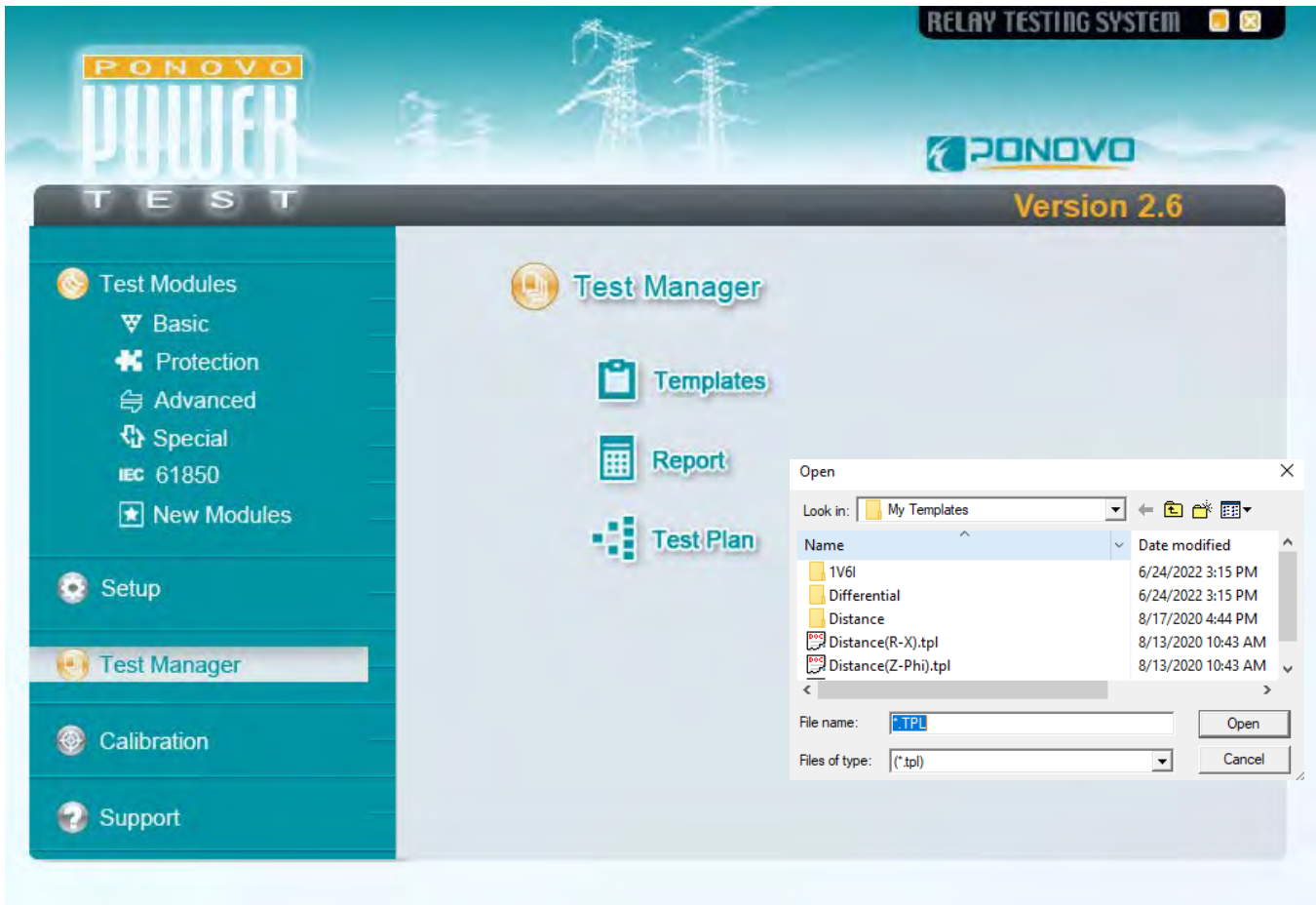


PONOVO Template Service

Besides the above standard test modules, the relay templates are provided for the automatic testing purposes. Every relay template is created based on each relay model and its function from different relay manufacturers, and the setting names in the templates are the same as what they are in the relay, so it is easy for the engineer to conduct the site testing and simplify the works greatly. There are more than 500 different relay templates available for customers to download from the website for free.

The CSV/RIO/XIRO files can be imported into the templates by PowerTest.

The optional service such as offering the customized templates and reports is provided by PONOVO.



More Templates can be download from our website www.ponovo.net



- CAG17
- CTIG
- CTIGM
- CTMFM
- CTMM
- CTNM
- CTT
- CTTM
- CTU
- DIFB
- MFVUM
- Micromho
- MVAPM
- MWTU
- Optimho
- P111
- P115
- P120
- P121
- P122
- P123
- P124
- P127
- P141
- P142
- P143
- P144
- P145
- P241
- P242
- P243
- P342
- P343
- P344
- P345
- P430
- P433
- P435
- P436
- P437
- P438
- P441
- P442
- P443
- P921
- P922
- P923
- P940
- P941
- P942
- P943
- PPX
- PVMM
- Quadromho
- SKE
- SKD
- VAGM22
- VAPM
- P632
- P633
- P634
- P642
- P643
- P645



- SEL300
- SEL351
- SEL587
- SEL311B
- SEL487B
- SEL487E
- SEL167
- SEL411
- SEL311C
- SEL311L
- SEL321
- SEL421
- SEL501
- SEL587



- 7RW600
- 7SA6XX
- 7SA511
- 7SA513
- 7SA518
- 7SA519
- 7SA522
- 7SD5
- 7SD52
- 7SD63
- 7SJ61
- 7SJ63
- 7SJ80
- 7SS52
- 7ST6
- 7UM61
- 7UM62
- 7UM512
- 7UM515



- LZ96
- REG100
- REL511
- REL531
- MSOC
- RAZFE
- REB670
- REC670
- REF542
- REG216
- REL300
- REL316
- REL350
- REL352
- REL356
- REL511
- REL512
- REL521
- REL531
- REL561
- REL650
- REL670



- PCS-902
- RCS-915
- RCS-931
- RCS-993
- RCS-902
- PCS-9611
- PCS-902H
- PCS-931D
- PCS-9611C



- SR489
- SR745
- F650
- SR750
- GT60
- D60
- DLDP
- G30
- L90
- GE345



- SEPAM 10
- SEPAM 80
- SEPAM 2000
- SEPAM S42
- T20



- MRA4
- MRDT4
- MRI4
- MRM
- MRN



- GRB100
- GRD110
- GRD140
- GRD150
- GRF100
- GRL100



- F_PRO
- L_PRO
- T_PRO



- VAMP 255
- VAMP 265



- 326GD



- PCT210



Optional Accessories

- **PW-VP50 CT Polarity checker**



2 units. Master machine injects pulse current to primary side of CT, slave machine receives and analysis the waveform of induced pulse current at the secondary side so as to judge the polarity is positive or negative automatically by the LED indicator on the kits.

- **GPS synchronization (PGPS02/PGPS04i)**



PGPS02

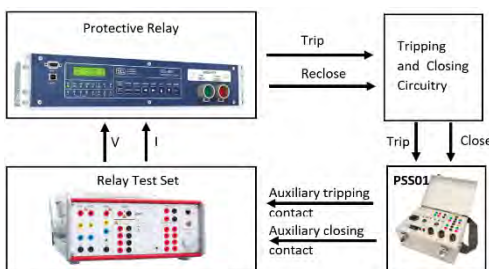
PGPS02: It provides GPS synchronization signal in PPS (pulse per second) or PPM (pulse per minute) for synchronized test. Trigger time can be set for end-to-end test application.



PGPS04i

PGPS04i: The PGPS04i is a multi-functional time synchronization device that integrates with GPS time synchronization, IRIG-B (DC-TTL/DC-RS422/optical) outputs, IRIG-B (DC-TTL/DC-RS422/fiber) pulse input, 1PPS/1PPM (DC-TTL/DC-RS232 /fiber) pulse output, timing set of whole trigger points, real-time clock auto-generating and other relevant functions.

- **Circuit breaker simulator (PSS01)**



Working together with PONOVO relay testing device, PSS01 is to be used to simulate the circuit breaker operation for checking the relay scheme performance. Complicated software settings can be avoided by using this simple accessory.

- **Scanning Head (PACB108)**



PACB108

The passive optical scanning head PACB108 detects the status of an LED, that is either an optical pulse output from an energy meter or the binary status of a protective relay or other similar optical source.

PW41i Protective Relay Test Set



Testing different protection relays, including electromagnetic, solid state, numerical, microcomputered and digital relay based on IEC61850

Specifications

Voltage generators		Binary inputs	
Setting range		Number	8
4-phase ac(L-N)	4x0~300V	Input characteristics	Dry/Wet
1-phase ac(L-L)	1x0~600V	Max. measuring time	999999.999 s
dc (L-N)	4x±0~300V	Accuracy	0.1%±1ms
dc (L-L)	1x±0~600V	Resolution	1ms
Power		Binary output, relay	
4-phase ac(L-N)	4x75VA at 300V typ.	Number	4
3-phase ac(L-L)	3x100VA at 300V typ.	Type	Potential free relay contacts, software controlled
1-phase ac(L-L)	1x200VA at 600V typ.	Break capacity ac	Vmax: 300Vac /Imax: 8A /Pmax: 2000VA
dc (L-N)	4x100W at ±300 V	Break capacity dc	Vmax: 300Vdc /Imax:8A /Pmax: 150W
Accuracy	< 0.16% rd.+0.04%rg. guar., < 0.08% rd.+0.02%rg. typ.	Power supply	
Ranges	300V	Nominal input voltage	110~240Vac
Resolution	10mV	Permissible input	90~260Vac
Distortion	0.1%	Nominal frequency	50/60Hz
Current generators		Permissible frequency	45~65Hz
Setting range		Environmental conditions	
3-phase ac(L-N)	3x0~40A	Operation temperature	0~+50°C
1-phase ac(3L-N)	1x0~120A	Storage temperature	-25~+70°C
dc (3L-N)	1x±0~60A	Relative humidity	5~95% non-condensing
Power		EMC(E&I)	EN/IEC 61326-1 EN/IEC 61000-3-2/3 EN/IEC 61000-4-2/3/4/5/6/8/11/18
3-phase ac(L-N)	3x65VA at 5A 3x400VA at 40A	Environment	EN/IEC 60068-2-1/2/3/6/27
dc (3L-N)	700W at 60A	Safety	EN/IEC 61010-1/1-12/2-030 EN/IEC 60255-25/27
Accuracy	< 0.16% rd.+0.04%rg. guar., < 0.08% rd.+0.02%rg. typ.	Others	FCC Part 15: Sub B ECS-001:2006 LVD EU
Resolution	5mA	Others	
Distortion	0.1%	USB port	2
General		Local display	10.4inch touch screen
Frequency		Control mode	Local control and PC control
Range	DC, 0.001Hz~1000Hz	GPS interface	DB9/TTL
Accuracy	0.002% at 50Hz	Ground socket(earth)	4mm banana socket
Resolution	0.001Hz	Weight	23kg
Phase		Dimensions (W x H x D)	364mmx200mmx475mm
Angle range	0~360°		
Accuracy	0.2°		
Resolution	0.001°		
Auxiliary dc supply			
Voltage range	220V, 110V, ADJ(0~300V)		
Power	110W at 220V, 55W at 110V, 90W at 300V		

Professional Solution Provider For The Power World

Since 2001, Ponovo Power has been focusing on providing professional solutions to over 5000 clients in the fields of intelligent testing and power quality control in China and abroad



PONOVO POWER CO., LTD.

No.139 Jinghai Third Road, BDA, Beijing, China. 100176

Tel : +86 (10) 59089666

Fax: +86 (10) 59089999

www.ponovo.net

info@relaytest.com

support@relaytest.com