# RAPTOR DEFAULT TEST TEMPLATES

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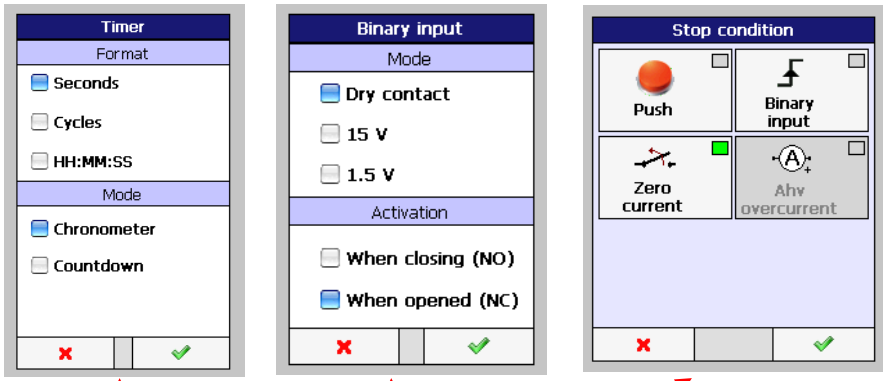
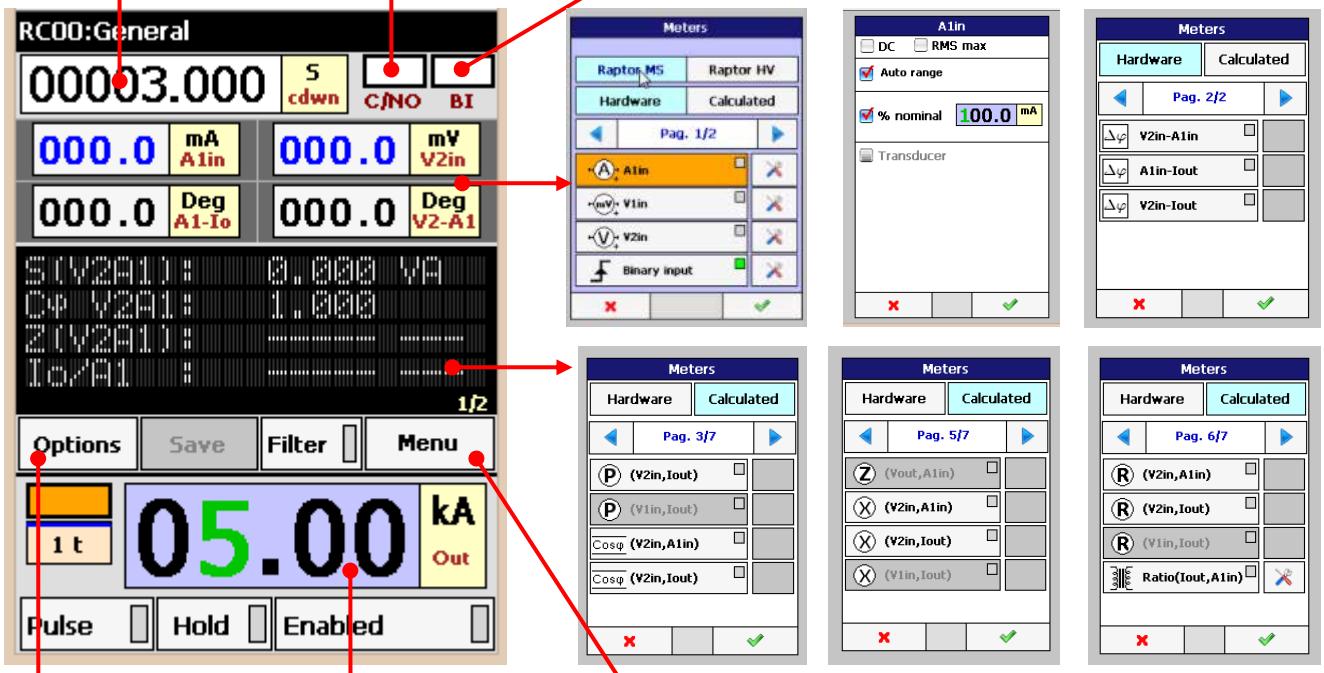
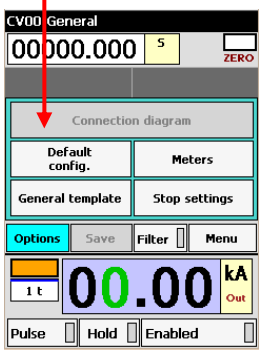
# The Raptor – Default Test Templates in Raptor HH

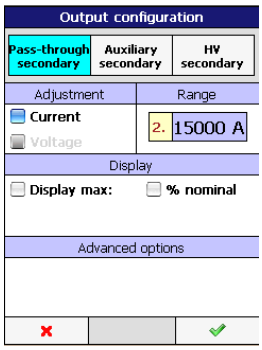
June 2015

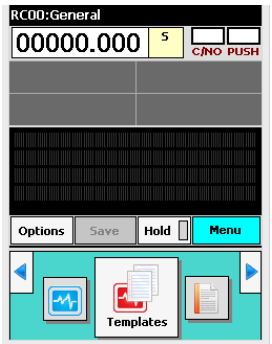

***General parts of main screen:***

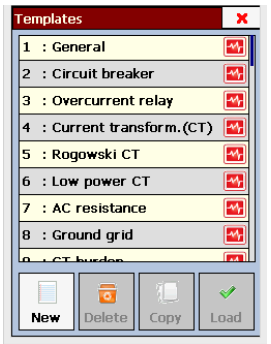


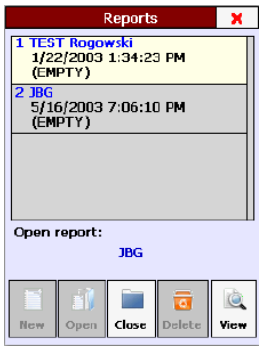



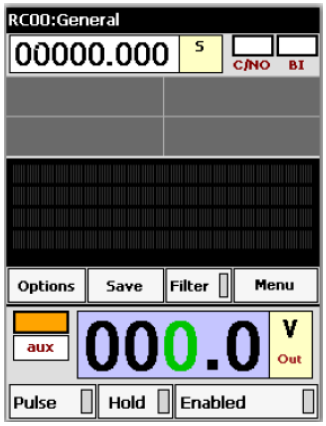



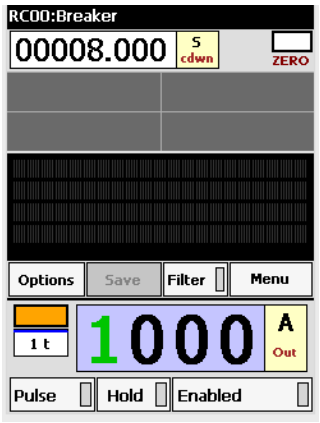



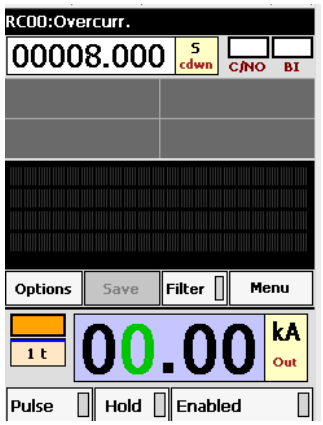



***TEST TEMPLATES:*** Default test templates are factory configured tests, providing the user the capacity to just select the appropriate template and start the test, however all these test templates, configuration and conditions, can be modified by the operator to their own convenience, and can also create their own test templates. In every test template it is always possible to return to the default configuration.

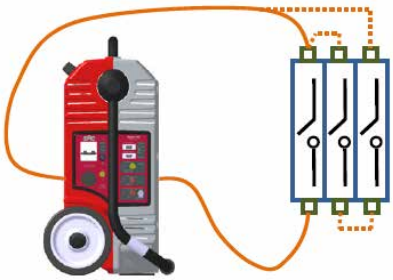


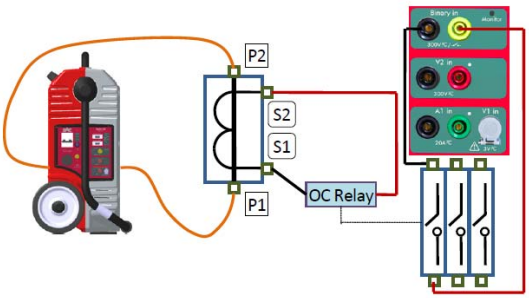




1. **General:** Default screen. General Template, it allows selecting and controlling any output value. This can be also selected directly on the Options Button, besides the Test Templates listing.
   Possibility to choose the Output Source (High current Pass-Through Secondary or Auxiliary Secondary – current or voltage – or High Voltage source through HV unit)

2. **Circuit Breaker:** Measures trip time by detecting zero current stop condition. Classical application for trip time testing of MCB, MCCB, ACB, etc, both in terms of its thermal element and its magnetic or instantaneous element.
   Injection by Pass-Through Secondary (main Ammeter, Io)
   Timer as countdown
   Timer stops by Zero Current



3. **Overcurrent Relay:** Through injection of a fault current through the primary of the CT, check correct operation of the protection, the effective trip of the breaker, and verify the complete primary/secondary/primary loop.
   Injection by Pass-Through Secondary (main Ammeter, Io)
   Timer as countdown
   Timer stops by Binary Input activation
   Binary input as Dry contact, Normally Open




**4. Current Transformer (CT):** Measures CT Turn ratio, polarity and angle error. With same template, determine connected burden in VA at the test current, in impedance and the power factor of the burden.

Injection in Primary and measuring in secondary with the ammeter and voltmeter. Ratio meter displayed as Io/A1 and/or ratio error, if nominal ratio of the CT entered.

Injection by Pass-Through Secondary (main Ammeter, Io)

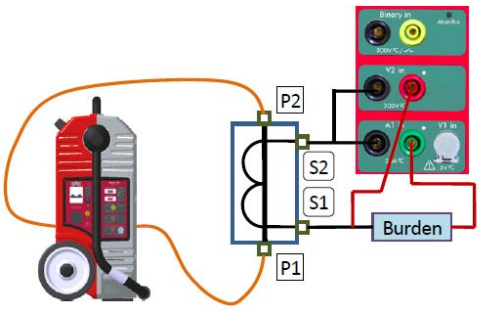
Timer as countdown

Meters:

- Ammeter (A1)
- Voltmeter (V2)
- Phase angle (A1-Io) , (V2-A1)

Calculated parameters:

- CT Turn Ratio (Io/A1in)
- Ratio error
- Burden, Z (V2A1)
- Apparent Power in VA, S (V2A1)
- Cosφ (V2A1)





**5/6. Rogowski CT/Low Power CT:** Measures CT ratio, polarity and angle error of Rogowski transformers, or also low power CT.

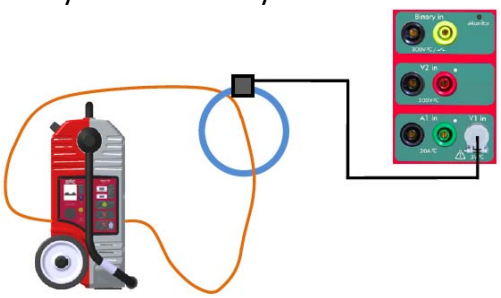
Injection by Pass-Through Secondary (main Ammeter, Io)

Meters:

- Low signal Voltmeter (V1)
- Phase (polarity) between primary and secondary of the Transformer (V1-Io)

Calculated parameters:

- CT turn ratio (Io/V1)




**7. AC resistance:** measures the resistance of connections, contacts and other elements with a very low induction, calculated by injecting high current and measuring voltage drop in the element terminals.

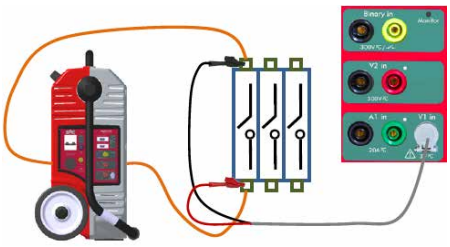
Injection by Pass-Through Secondary (main Ammeter, Io), countdown timer.

Meters:

- Low signal Voltmeter (V1)
- Phase between current injected and measured voltage (V1-Io)

Calculated parameters:

- Cosφ (V1Io)
- Impedance Z (V1Io)
- Resistance R (V1Io)

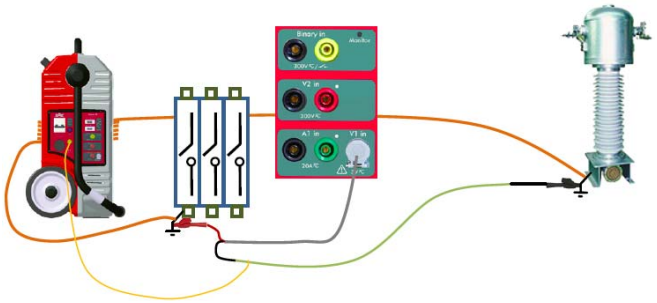



**8. Ground Grid:** By injecting high current and measuring with the low level signal voltmeter, it is possible to detect the existence of any excessive stress (bad or eroded contact) in the ground grid. C-15 configuration at least for grid test. Cable cross-section about 40-50 mm, winding 10 turns in the equipment.

Injection by Pass-Through Secondary (main Ammeter, Io)

Timer as chronometer. Stop condition by push button.

Meters: Low signal Voltmeter (V1)




**9. CT Burden:** Burden connected must be lower than rated CT burden, and so this template enable us to determine if the CT is suitable or not for this burden. By injecting current through secondary, calculates impedance, power and power factor of the load. Current to be injected into the burden is the nominal secondary current of the CT, that is, either 1 A or 5 A.

Injection through auxiliary secondary (current)

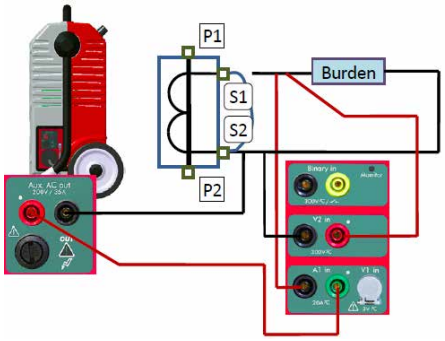
Timer as chronometer. Stop condition by push button.

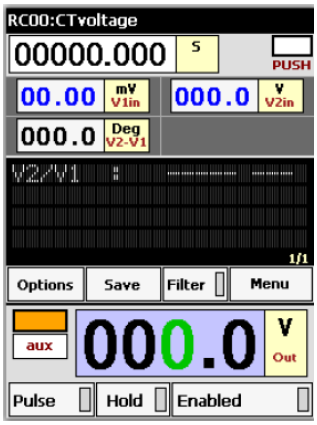
Meters:

- Ammeter (A1)
- Voltmeter (V2)
- Phase angle (V2-A1)

Calculated parameters:

- Burden, Z (V2A1)
- Apparent Power in VA, S (V2A1)
- Cosφ (V2A1)




**10. CT, Voltage method:** Calculates the CT turn ratio and polarity, by injecting Voltage, for the cases where is not possible to directly inject primary current into the CT, for whatever reason, being this template an alternative. Disconnecting the load, it is performed applying voltage on its secondary side with the auxiliary output of Raptor, and measuring the secondary voltage with the voltmeter and the primary voltage with the low signal voltmeter.

Injection through auxiliary secondary (Voltage)

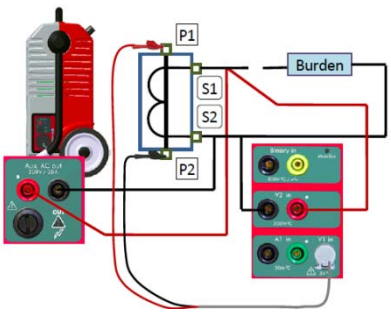
Timer as chronometer. Stop by push button.

Meters:

- Voltmeter (V2)
- Low Level Voltmeter (V1)
- Phase angle between (V2-V1)

Calculated parameters:

- CT turn ratio (V2/V1)



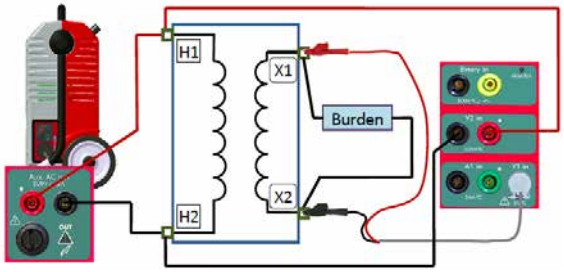

**11. Voltage Transformer (VT):** Checks VT turn ratio, polarity and primary/secondary phase angle, by applying voltage to the primary with the Raptor auxiliary voltage output, measuring the primary voltage with the voltmeter and the secondary voltage with the low signal voltmeter.

Injection through auxiliary secondary (Voltage)

Timer as chronometer. Stop cor

Meters:

- Voltmeter (V2)
- Low Level Voltmeter (V1)
- Phase (polarity) of VT (V2-V1)




Calculated parameters:

- VT turn ratio (V2/V1)


**12. VT burden:** Calculate impedance, power and power factor of the load, disconnecting the secondary of the VT, and applying voltage to the load from the auxiliary voltage output of Raptor, and measuring with the ammeter and voltmeter.

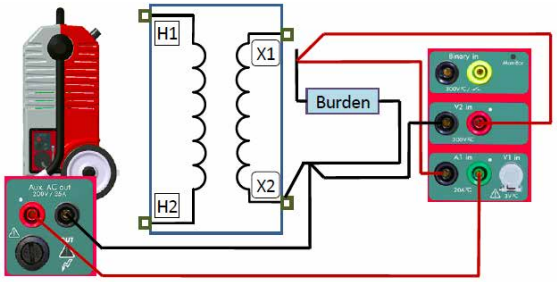
Injection through auxiliary secondar

Timer as chronometer

Stop condition by push button

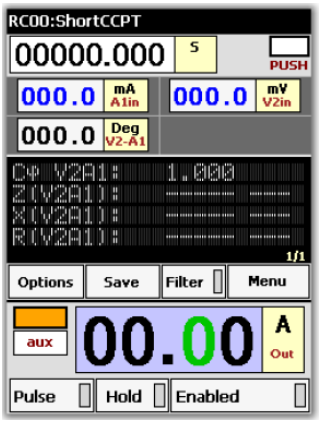
Meters:

- Ammeter (A1)
- Voltmeter (V2)
- Phase angle of (V2-A1)




Calculated parameters:

- Burden Z (V2A1)
- Apparent Power in VA, S (V2A1)
- Cosφ (V2A1)



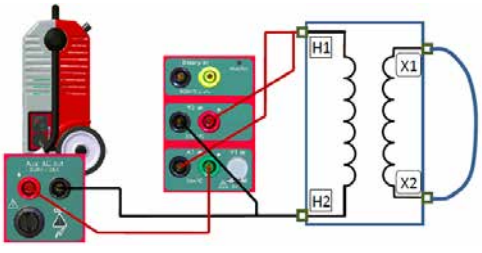

**13. Short-circuited PT:** Template to carry out short-circuited impedance tests in PT. Several data are got with this template, injecting current in one winding, shorting the other, and measuring with the ammeter and voltmeter.

Injection through auxiliary secondary (current)

Timer as chronometer. Stop condition by push button

Meters:

- Ammeter (A1)
- Voltmeter (V2)
- Phase angle (V2-A1)




Calculated parameters:

- Cosφ (V2A1)
- PT short-circuit Impedance Z (V2A1)
- PT reactance losses X (V2A1)
- Resistance R (V2A1)


**14. PT ratio:** Measures the voltage ratio between the primary winding and the relative secondary winding of a PT. If the PT is three-phase, a measurement must carry out in each phase. If the neutral is not accessible in either of the two windings, inject between two phases (H1H2) and measure on the Low side in agreement with the calculation and connection diagram required, depending on the PT connection group.

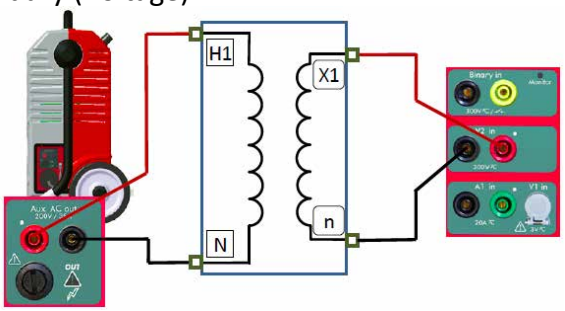
Injection through auxiliary secondary (Voltage)

Timer as chronometer

Stop condition by push button

Calculated parameters:

- Voltage ratio (Vo/V2)




**15. Polarity Test:** Specific template to be used with the optional accessory Raptor Polarity Tester (Raptor PT), to check polarity and correct wiring of all secondary circuits, while the Raptor is injecting a special polarized signal from the primary of the transformers.

Injection through any output – but already set as polarized.


**16. HV Dielectric (Withstand Voltage Test):** used to check the insulation integrity of the transformer through the leakage current monitoring while injecting high voltage between primary and secondary, or between secondary winding and ground.

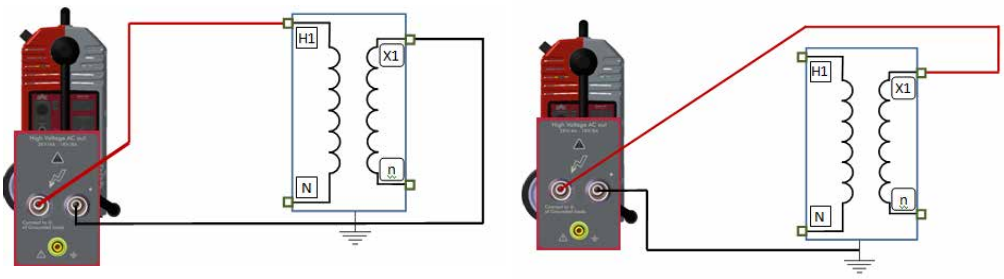
Injection through HV

Stop by overcurrent in HV Ammeter, Ahv, which also shows peak value.

Timer as countdown, by default 60 s.

Calculated parameters:

- Impedance Z
- Reactance X
- Resistance R
- Phase angle (Ahv –Vhv)
- Cosφ(Ahv,Vhv)




**17. HV Voltage Transformer:** Using the high voltage ouput of the HV unit, checks VT turn ratio, polarity, primary/secondary phase angle, and burden by applying voltage to the primary, and measuring secondary voltage.

Injection through HV.

Timer as chronometer. Stop condition by push button.

Meters:

- Voltmeter (V2)
- Ammeter (A1)
- Phase (V2-A1), (V2-Vhv)

Calculated parameters:

- Apparent Power in VA, S
- Impedance Z
- Cosφ (V2-A1)
- VT turn ratio (Vhv/V2)


**18. HV no-load PT:** measures the voltages ratio in distribution and power transformers, using the high voltage output of the Raptor HV. Injection in primary between two phases or phase and neutral.

Injection through HV.

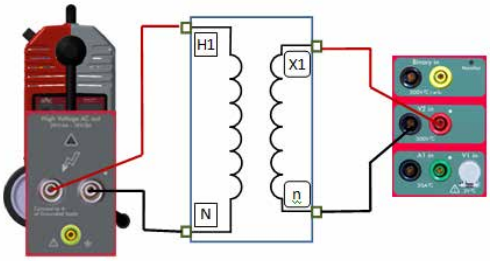
Timer as chronometer. Stop condition by push button.

Meters:

- Voltmeter (V2)
- Ammeter (Ahv)
- Phase (V2-Vhv), (Ahv, Vhv)

Calculated parameters:

- Magnetization Impedance Z
- Magnetization Reactance X
- Cosφ (Ahv-Vhv)
- Voltages ratio (Vhv/V2)





**19. HV PT short-circuit:** Using the HV, template to carry out short-circuited impedance tests in distribution and power transformers.

Injection through HV.

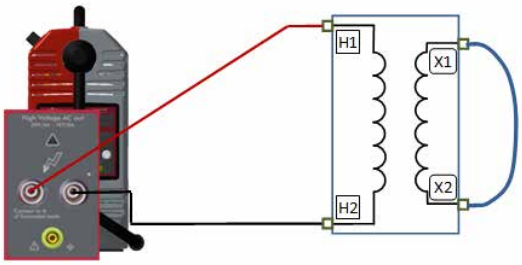
Timer as chronometer. Stop condition by push button.

Meters:

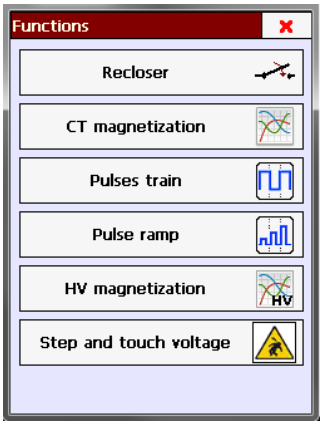
- Ammeter (Ahv)
- Phase (Ahv, Vhv)

Calculated parameters:

- Short circuit Impedance Z
- Short circuit Reactance X
- Short circuit Resistance R
- Cosφ (Ahv-Vhv)




**New Template**: the user can copy, edit and change the test templates; it is also possible to create new Test Templates, with the type of hardware meters and calculated parameters desired in the screen, the type and configuration of the output source, start and stop time conditions, etc.., and save them with a new name.

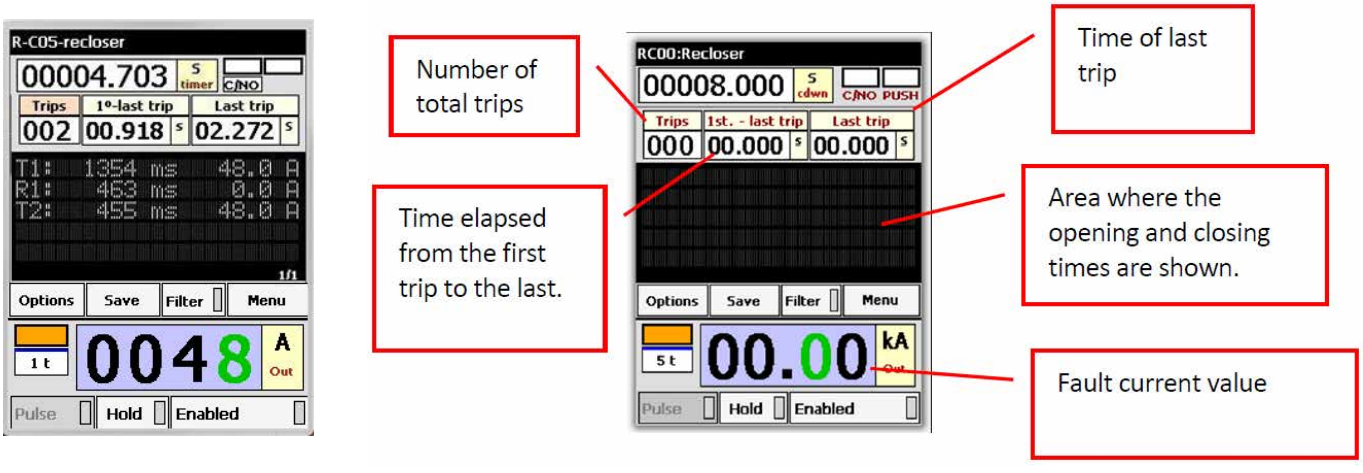



***FUNCTIONS: Automatic tests, pre-designed from factory***

**Recloser:**

This function is designed to verify, in a very simple manner, the correct operation of an integrated RECLOSER; that is, a device that include the MV circuit breaker, the protection CTs, the protection relay with recloser function and the total control of the system. These devices are found more and more frequently in Medium Voltage Distribution circuits.

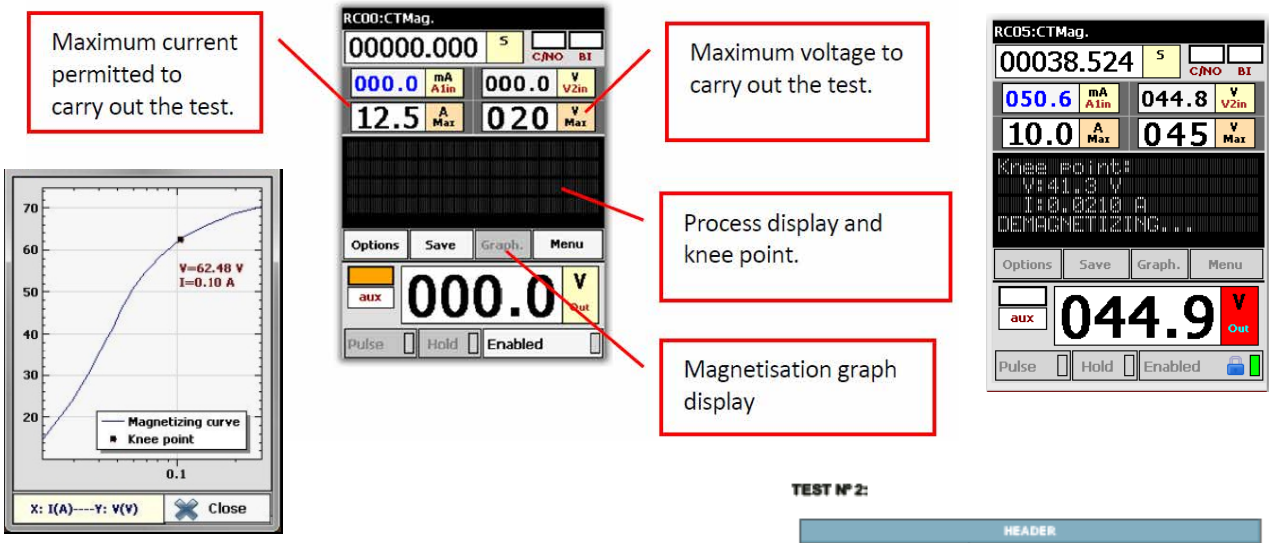
The results shown include trip time and reclosing time of each one of the reclosing cycles that the device carries out. It does not require any type of configuration by the operator.




The automatic test of the Raptor provides a simple way to perform a functional test of these important devices. This involves, under simulated fault conditions, the operation of the protective relays and circuit breakers, verifying the number and sequence of operations of the recloser until lockout. This primary injection testing of the recloser, makes a reliable diagnostic of the recloser status and is quicker and easier than the test performed through a secondary injection in the electronic control, enabling to check the entire system, including the breaker, CTs, relays, control cables and wiring. It is also possible to program the total test time to adapt to the different reclosing times of these systems.

**CT Magnetization Curve and Knee Point:**

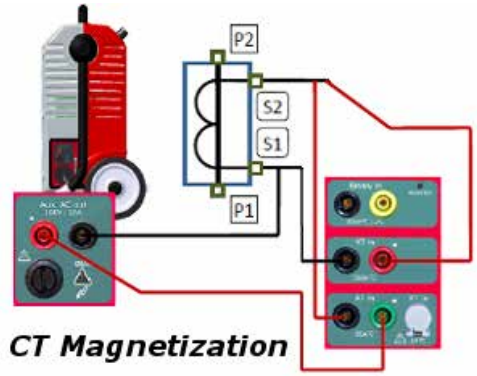
Automatic test, using the IEC standard criteria, for obtaining the CT magnetization curve and knee point. It is performed by applying voltage to the secondary of the CT, (auxiliary output from the RAPTOR), and measuring with the voltmeter and ammeter. The test is fully automatic, including the final core demagnetization, and only requires leaving open the CT primary. Note: This test is limited by the Master output voltage of 200 V. This voltage is sufficient for measuring CTs (20% saturated above nominal) but limited for protection CT's where voltage may eventually need more than 1000 V to saturate, and for those it is used the HV unit

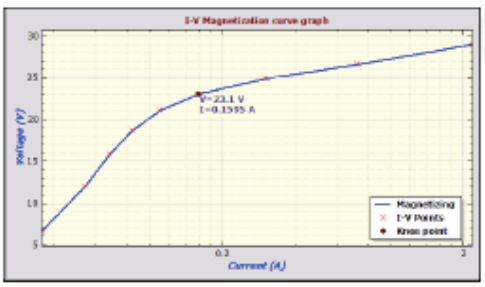


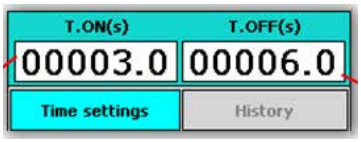

The test consists of injecting a ramp of ascending voltage values up to 20% above the maximum voltage entered or a maximum of 40 steps (logarithmic voltage increases). After the maximum test value has been reached, the CT is demagnetized, generating the same voltage points, in descending order and with a smaller time interval. When the test ends, in Graph button, it shows the graph of the test points that make up the magnetizing curve and the position of the knee point, if it has been detected. All voltage and current values measured, and magnetization curve graph will be displayed in the subsequent report.

**TEST Nº 2:**

| HEADER | |
|---|---|
| Name | CTMag. |
| Date | 1/7/2003 1:14:09 PM |
| Description | ekurhuleni |
| RESULTS | |
| POWER OUTPUT | |
| Synchronism | Line |
| Polarized | No |
| METERS | |
| Initial time | 0.000 s |
| Time | 33.188 s |
| Max. Magnetize V | 40.0 V |
| Max.Magnetize I | 2.0 A |
| Curve points: | |
| | 1.- V=6.7 V ; I=0.0356 A |
| | 2.- V=12.0 V ; I=0.0536 A |
| | 3.- V=15.8 V ; I=0.0677 A |
| | 4.- V=18.7 V ; I=0.0843 A |
| | 5.- V=21.1 V ; I=0.1100 A |
| | 6.- V=23.1 V ; I=0.1595 A |
| | 7.- V=24.9 V ; I=0.3000 A |
| | 8.- V=26.6 V ; I=0.7240 A |
| | 9.- V=29.0 V ; I=2.1700 A |
| CALCULATED | |
| Knee point | V_kn=23.1 V ; I_kn=0.1595 A |



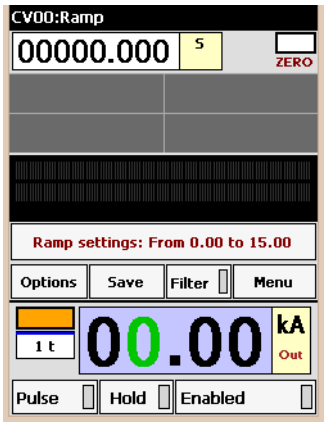



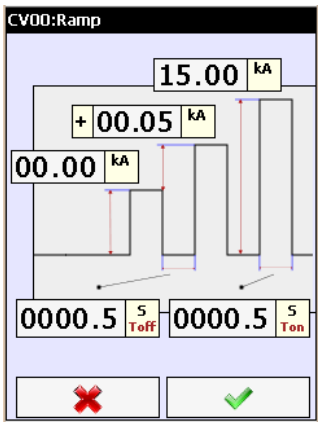




**Pulses Train:** This function allows the generation of pulses at regular intervals, with the setting of the injection time and off time between pulses. It is possible to use any of the output sources of the Raptor (high current, low current, low voltage or high voltage with HV).

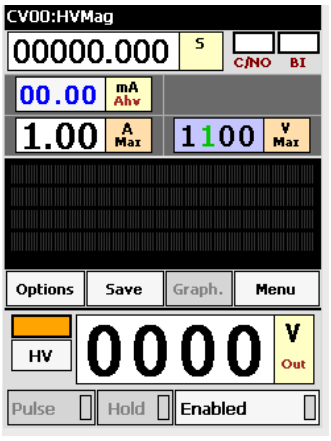
**Pulses Ramp:** This function allows generating a ramp of pulses, with an output level that increases or decreases from the initial level to the final level, with a defined step. The duration of the injection time is adjustable, as well as the time between pulses (not less than 500 ms). It is possible to use any of the output sources of the Raptor.

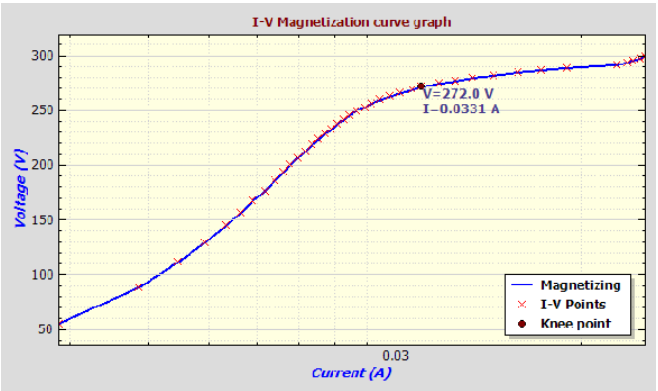
The default stop condition is zero current detection, since one of the main applications of this function is the search of the instantaneous trip time of breakers through a ramp of high current pulses.



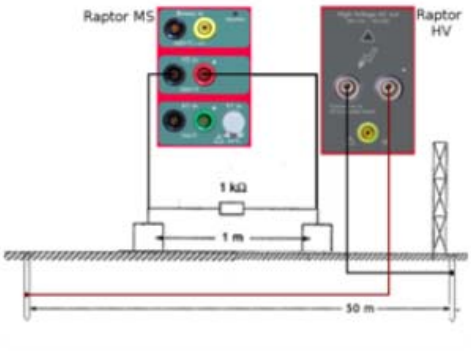

**HV Magnetization:** Similar test to the previously described, but using the Raptor HV, for the CT magnetization curve and knee point. Besides the capacity to use up to 2000 V, the connection is much simpler, simply connecting the voltage injection cables in the secondary of the transformer. Measurements during the voltage ramp injection are performed by the built-in ammeter and voltmeter of the HV unit.

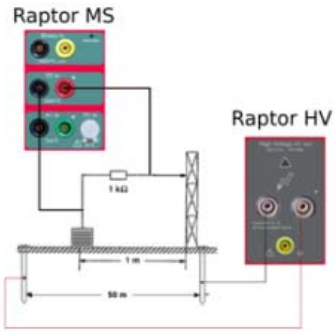


**Step and Touch Voltage:** For measuring the step & touch voltage characteristics of the protective earthing installations in substations and other electrical facilities, the Raptor HV is required by using its voltage output in the 1000 V range and the measurement capabilities of the Raptor Master unit. This Function requires the use of the optional Step & Touch accessories kit.

Step voltage: The measurement is performed between two ground points at a distance of 1 m as shown on Fig. The 25 kg measuring probes/electrodes simulates the feet. The voltage between the probes is measured by a voltmeter with an internal resistance of 1 kΩ that simulates the body resistance.




Touch voltage: The measurement is performed between an earthed accessible metal part and ground as shown on Fig.

The voltage between the probes is measured by a voltmeter with an internal resistance of 1kΩ that simulates the body resistance.

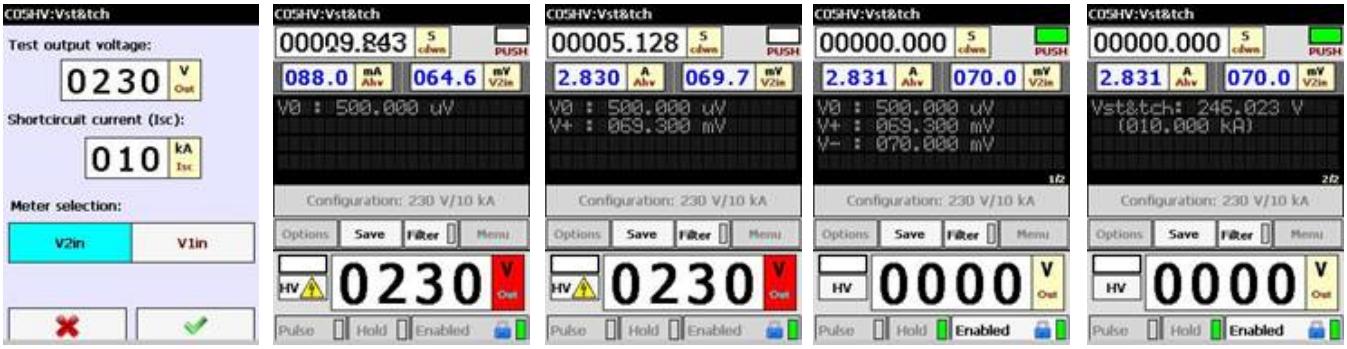
This function use the timer as countdown timer (default 20 sec), and have three phases which take place automatically without user intervention (each phase consume a third of the timer):

• Phase 1. The Raptor-HV injects 0VAC and obtain step & touch voltage generated by currents outside the Raptor, "Vo".

• Phase 2. The Raptor-HV inject voltage configured in setting, in phase with the line, and get the step & touch voltage generated by the same and those currents outside the Raptor "V +".

• Phase 3: The Raptor-HV inject voltage configured in setting, in opposite phase to the line, and get the step & touch voltage generated by the same and those currents outside the Raptor "V - ".

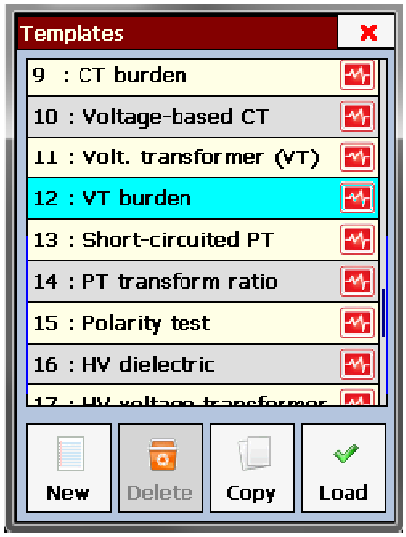
Finally, it is calculated the Vst & tch, at the configured Isc (shortcircuit current of the grid under test), which is selected in the settings.

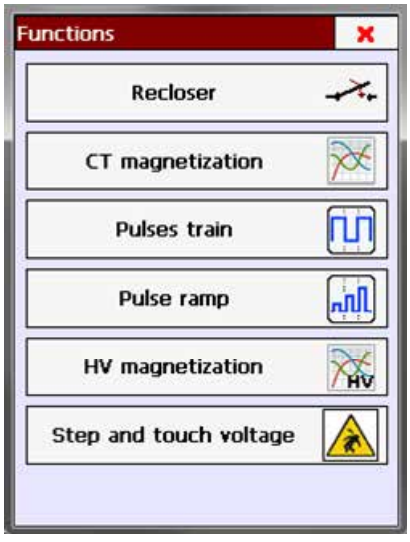



**NOTE**: This paper is not intended as a user manual, but a summary of main functions included by default in the Raptor System for purchase evaluation. At the time of using the equipment, always consult the appropriate user manual, especially regarding safety precautions and dangers actions which must be carefully observed.

## RAPTOR TEST TEMPLATES & ACCESSORIES

| Default Test Templates & Functions | RAPTOR C-XX | RAPTOR HV | Accessories |
|---|---|---|---|
| General Test Template | √ | √ | *Options |
| Circuit Breaker | √ | | *Options |
| Overcurrent Relay | √ | | *Options |
| AC Resistance | √ | | *Options |
| Ground Grid | √ Minimum C-15 | | cable 40/50 mm |
| Polarity test | √ | | Polarity Tester |
| Step & Touch Voltage | | √ | Step & Touch kit |
| Recloser | √ | | *Options |
| Train of Pulses | √ | | *Options |
| Pulses Ramp | √ | | *Options |
| For CTs | | | |
| Current Transformer (CT) Ratio, burden, polarity | √ | | *Options |
| Rogowski CT /Low Power CT | √ | | *Options |
| CT Burden | √ | | *Options |
| CT, Voltage method | √ | | *Options |
| CT Magnetization | √ | | *Options |
| CT Magnetization - HV | | √ | *Options |
| Withstand Voltage | | √ | *Options |
| For VTs | | | |
| Voltage Transformer (VT) Ratio, burden, polarity | √ | | *Options |
| VT burden | √ | | *Options |
| VT - HV | | √ | *Options |
| Withstand Voltage | | √ | *Options |
| For PTs | | | |
| PT Ratio | √ | | *Options |
| PT Ratio - HV | | √ | *Options |
| Short-circuited PT | √ | | *Options |
| Short-circuited PT-HV | | √ | *Options |
| Withstand Voltage | | √ | *Options |

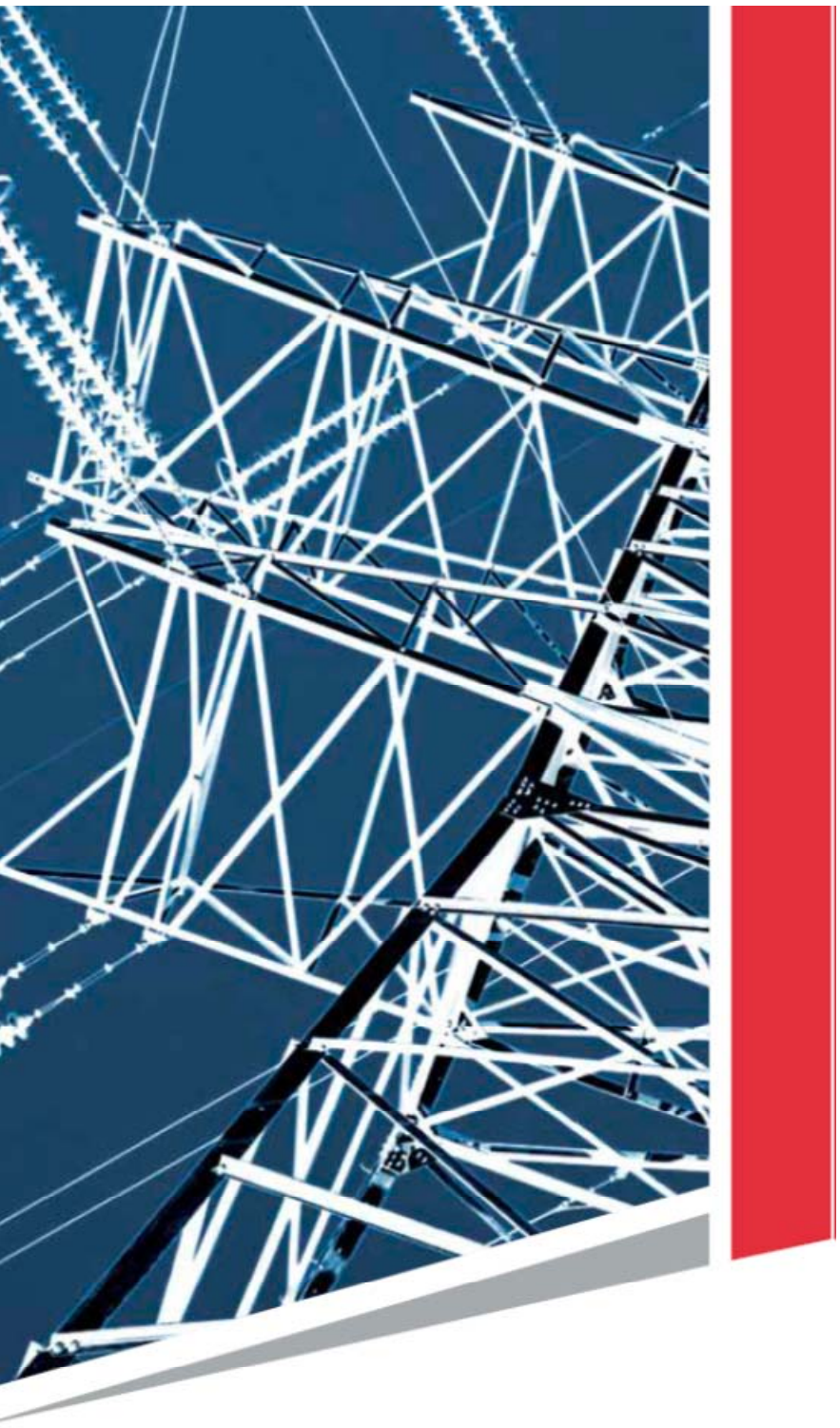




***Options for all configurations:**

- RAPTOR SL
- RAPTOR HV
- Ultra-flexible high current cables
- Grouping plates
- High Current Clamps
- 4m extension for HH

- Polarity Tester
- Hard Transport Case
- Warning Lamp for HV
- Emergency Stop for HV
- Step & Touch kit

*** END OF THE DOCUMENT ***

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- ELECTRICAL MEASUREMENT
- CIRCUIT BREAKER ANALYZERS
- PHASE ANGLE METERS
- DIGITAL MICRO-OHMETERS
- IEC-61850 GOOSE SNIFFER
- TRANSFORMER MAINTENANCE
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