

Technical Evaluation Criteria for - Portable Three Phase Test System:

Supporting features for various protection IED's, IEC 61850 GOOSE & Sampled Values, ARC Flash, Transducers, Energy Meters, Transient Playback, Recording Capabilities

Evaluation Methodology

The evaluation will be performed by the Eskom evaluating representatives. It begins at Level 1 followed by Level 2 and then proceeds to Level 3.

Level 1 will include the desktop evaluation of the mandatory criteria. Submissions failing to meet the requirements at Level 1 will be deemed non-responsive and will be immediately disqualified and removed from further evaluation. Submissions meeting the requirements will proceed to Level 2.

Level 2 will include a desktop evaluation of the functional criteria. The submissions will be evaluated and scored. Submissions failing to meet the stipulated threshold at Level 2 will be deemed non-compliant and will be immediately disqualified and removed from further evaluation.

The Level 2 threshold is set at 80%.

Evidence required for Level 1 and Level 2 evaluations must be submitted by the tender closing date.

Submissions meeting the requirements will proceed to Level 3.

Level 3 is the sample evaluation. The Level 3 threshold is 100%. Failure to meet the threshold of 100% will be deemed non-compliant.

Deviations or deficiencies identified during functional evaluation and/or sample evaluation must be addressed prior to contract award.

Level 1 - Mandatory Criteria and Returnable

No	Criterion	Returnable
1	This product allows the testing of all generations (electro-mechanical, analogue, solid state, numerical and IEC 61850 based IEDs) and all types of	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.

	protective relays (impedance, differential, overcurrent, motor protection, MV protection, etc), as well as measurement transducers and energy meters. Protective relays can be tested using a 'function by function' approach - or using a power systems oriented application approach.	Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.
2	The product offered must be light weight and portable to transport	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.
3	The product is a stand-alone device and is not an add on component to another testing system.	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.
4	The product must have very reliable and robust hardware and must be user friendly and easy to use guided test software with customizable reports	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.
5	The product must have guided test software that can be operated by a PC or Tablet	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.

Level 2 - Functional Criteria and Returnable

The functional threshold is set at 80%. Submissions failing meet the threshold will not proceed further.

Part marks will be allowed as indicated in the scoring column of the criteria table.

The total available points = 100%.

Criterion	Returnable	Scoring Model
Technical Testing Specification		
Power Supply Nominal Voltage 100 V - 240 V Permissible Voltage Range 85 V - 264 V Nominal Frequency 50 Hz / 60 Hz Permissible Frequency Range 45 Hz - 65 Hz Power Consumption 2300VA at 230V	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.	5%

Rated Current 12A at 115V / 10A at 230V Connection Standard AC sockets (IEC 60320)	Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative	
Weight max. 17 kg Housing IP 20 as per EN 60529 Environment Operating Temperature -10°C ... +50 °C Storage Temperature -25 °C ... 70 °C Humidity 5 % ... 95 % r.h. (non-condensing) Ingress Protection Rating IP31 (IP32 with front cover)	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative	5%
Hardware		
General All functions should be combined in one hardware unit The unit shall be of a robust and sturdy construction PC card design: Wire jumpers on a single printed circuit board are not permissible Electronic components: No potentiometers are allowed No moving elements or elements that are susceptible to damage, i.e. controls elements or displays on the face plate are permissible Output Amplifiers The amplifier stages are to be fully electronic, i.e. not via transformer All current amplifiers to be fully protected and proof against any open-circuit-, overload-, overburden- and over-temperature- condition. Any such condition is to be immediately displayed in all active software modules. Except for an over-temperature condition an automatic shut down of the amplifiers is NOT permissible All voltage amplifiers to be fully protected and proof against any short-circuit-, overload-, overburden- and over-temperature- condition. Any such condition is to be immediately displayed in all active software modules. Except for an over-temperature condition an automatic shut down of the amplifiers is NOT permissible All amplifiers to use linear amplification elements and to be dc-coupled Ability to generate dc and ac signals The amplifiers, low-level outputs, the measurement inputs and the main power supply to be galvanically isolated from each other and earth (2kV insulation voltage)	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative .	5%
Voltage Amplifiers Setting range 4x 0..300V _{rms} (L-N), 3x 0..520V _{rms} (L-L)	A product brochure	5%

<p>Single phase operation 1x 0..600V_{rms} (L-L)</p> <p>Output power 3x 100VA at 100..300V (L-N) or 1x 200VA at 100..300V (L-N) or 1x 275VA at 200..600V (L-L)</p> <p>Maximum Load current 3x 1A_{rms}; 1x 2A_{rms}</p> <p>Accuracy error < 0.03% of reading (0..300V) + 0.01% of range</p> <p>THD+N < 0.015%</p> <p>Connection 4mm Banana sockets amplifier combination plug (3xV and 3xI)</p>	<p>confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative</p>	
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<p>Current Amplifiers</p> <p>Setting range 6x 0...32A_{rms} 3x 0...64A_{rms}</p> <p>Single phase operation 1x 0...128A_{rms}</p> <p>DC (LL-LN) 1x 0...+-180A</p> <p>Output power 6x 430VA at 25A 3x 860VA at 50A 1x 1000VA at 80A (LL-LN) or 1x1740VA at 25A (L-L-L-L)</p> <p>Maximum compliance voltage (L-N)/(L-L)/(L-L-L-L) 6x 35V_{pk} / 3x70V_{pk} / 1x140V_{pk}</p> <p>Accuracy error < 0.05% of reading (0..32A) + 0.02% or range</p> <p>THD+N < 0.05%</p> <p>Connection 4mm Banana sockets generator combination plug (3xV and 3xI) Independent amplifiers The six current amplifiers are to be independent from the four voltage amplifiers</p> <p>Low-level signal Generators</p> <p>6 additional analog low level signals to control external amplifiers or to test relays with low-level input, e.g. from Rogowski coils, linear voltage or linear current sensors must be provided. To allow for expandable options from 6 to 12 outputs.</p> <p>Full simulation of Rogowski coil signal (i.e. first order differential of signal) to be performed in hardware.</p> <p>Together with 10 internally used signal generators the system should provide 16 independent signal channels in total</p> <p>Output settings range 0 ... 10 V_{pk}</p> <p>Accuracy <0.025%</p> <p>Overload Protection Yes</p> <p>The quantities displayed in the software must be saleable for primary or secondary voltages (or currents).</p> <p>Signal Generation All outputs to be continuously and independently adjustable in amplitude, phase (0 to +/- 360°) and frequency. Able to generate continuous sine waves with a frequency between 10 and 1kHz and to generate transient files with a bandwidth from dc up to 3 kHz. Frequency error to be less than 0.5 ppm. Phase error to be less than 0.02°</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative</p>	<p>5%</p>
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Components		
Binary Inputs Number of inputs 10 inputs at five galvanic isolated groups(2kV insulation voltage) Mode/Trigger criteria Pick-up and drop-out of potential-free contacts or dc voltages of up to 600Vdc. Trigger levels to be adjustable Max. Input Voltage 600V Max. error / Sample rate < 100 µs Counting function inputs capable of counting number of pulses up to 3kHz. Connection 4mm Banana sockets	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.	5%
Analogue Inputs for Measurement Number 10 inputs at five galvanic isolated groups (2KV insulation voltage) Input ranges 100mV, 1V, 10V, 100V, 600V Accuracy <0.06% Bandwidth dc..10kHz Sampling frequency 3.16kHz, 9.48kHz and 28.44kHz Overload protection Yes Recording buffer 300s for 1 channel at 3kHz, 3.5s for 10 channels at 28kHz Connection 4mm Banana sockets	A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures. Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.	5%

<p>Analog low level measuring inputs for transducer testing</p> <p>Direct current range Range 1: 0 ... ± 1 mA</p> <p>Range 2: 0 ... ± 20 mA</p> <p>Direct voltage range 0 ... ± 10 V</p> <p>Max. error < 0.003%</p> <p>Connection 4mm Banana sockets</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>
<p>Auxiliary DC supply to power test objects</p> <p>Range Range 1: 0 ... 264 Vdc, 0.2A</p> <p>Range 2: 0...132 Vdc, 0.4A</p> <p>Range 3: 0...66 Vdc, 0.8A</p> <p>Power max. 50W</p> <p>Max. error < 2%</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>

<p>Binary output contacts</p> <p>Number 4</p> <p>Breaking capacity 300V, 8A, 2000VA or 50W</p> <p>Type Software controlled dry contacts that can be used to switch ac or dc</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>
<p>ARC flash simulation</p> <p>Facility to simulate an arc flash with a high intensity flash bulb inside medium voltage switchgear for trigger the arc flash sensor units of IEDs using both point sensors as well as linear fibre sensors.</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>
<p>Time Synchronization</p> <p>The test set should be able to synchronise to a GPS clock via a 1pps or IRIG B signal. Timing accuracy for 1pps / IRIG-B: 1 μs. Maximum distance between GPS receiver and test equipment for 1pps signal: 40m. Test set needs to be synchronise to the IEEE 1588 Precision Time Protocol (PTP) via Ethernet. Timing accuracy for PTP: 100ns. Maximum distance between GPS receiver and test equipment for PTP: 2000m. IEEE 1588 / PTP clock to be powered over Ethernet (PoE), i.e. no separate power supply should be necessary.</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the</p>	<p>5%</p>

	relevant OEM representative.	
<p>Interface to PC</p> <p>Interface to the IBM compatible PC via Ethernet interface OR USB</p> <p>10/100Mbit/s copper (autosensing, auto crossover) via RJ45 connector</p> <p>Note: Centronics parallel port (Lpt) and/or serial RS232 ports are not permissible as modern laptops do not provide such ports.</p> <p>Two Ethernet communications ports to support communication on a process bus (IEC61850-8-2 (GOOSE), IEC61850-9-2LE (Sampled Values) and UCA2.0) AND station bus at the same time.</p> <p>Communications card to support IEEE 1588 / Precision Time Protocol (PTP) to synchronize the test set to a PTP enabled Grandmaster clock in the substation for End-to-end tests / Synchro phasor tests.</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative. A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	5%
<p>General</p> <p>Software</p> <p>Windows 10 (32bit and 64bit) software. Long filenames, tool tip help, context sensitive menu function (right mouse click) and an integrated help browser must be provided.</p> <p>All software functions, options and actions should be easily available by click of a button and/or shortcut key to avoid having to navigate through complicated menu structures and having to drill through multiple menu levels. The Microsoft ribbon based menu structure used in Office 2010 / Office 2013 is an example of sorting all functions, options and actions and making all easily accessible in the right place.</p> <p>No programming to be necessary to test an application - entry of setting parameters to be all that is required to set up and perform a test</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the</p>	5%

<p>Future expansions in functionality by means of software updates. Firmware updating to be handled by the software, i.e. exchange of any hardware components is not permissible.</p> <p>Generation of reports on paper or file. All graphics and text to be printable.</p> <p>Test report must be configurable to include custom information in graphical format (e.g. logos, wiring diagrams) and text format (tester, date of test, substation, reminders)</p> <p>The test set software should be able to import relay settings records from relay setting softwares (or relay settings databases) in a text file and/or XML format. An example is the XRIO file format for the transfer of relay setting parameters for all types of relays.</p> <p>It must be possible to test multi-function relays / panels with one test routine / document.</p> <p>Test sequence to be pausable at pre-defined points in the test sequence, by popping up a custom instruction dialogue (with or without audible warning), instructing the user to change either a setting on the relay, change of hard wiring or to record a specific measurement / status from the relay / scheme.</p> <p>All testing to be in closed loop.</p> <p>On Line Pass/ Fail assessment for ALL tests. This is particular important for automatic testing.</p> <p>Full automatic testing must be possible, i.e. without launching various test modules manually.</p> <p>Test software to be future proof to allow the complete testing of any new relay, both in form of entry of relay settings as well as testing all functions of such a relay.</p>	<p>relevant OEM representative.</p>	
<p>Manual Control Function</p> <p>Direct entry of actual relay settings into test software. Test specific parameters (e.g. set I1 to 110% of I>>) must be automatically re-adjusted according to the entered relay settings.</p> <p>Manual and independent adjustment of amplitude, phase angle and frequency for all generator outputs.</p> <p>Graphical display of natural voltages and currents in a vector diagram.</p> <p>Direct entry sequence components and graphical display in a vector diagram</p> <p>Direct entry of impedances and graphical display in a R/X diagram</p> <p>Direct entry of power and graphical display in P/Q diagram</p> <p>Ramping and stepping of any of the above quantities: one, two or three phases at the same time</p> <p>Pulse ramping function for any of the above quantities</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>

<p>Synchronized switching of multiple variables at the same instance in time.</p> <p>Timing function for pick-up and drop-out measurements.</p> <p>On-line Reporting Function</p> <p>Synchronise generator outputs to any third party signal, e.g. mains frequency.</p>		
<p>Automated Testing</p> <p>State Sequencer Function</p> <p>Direct entry of actual relay settings into test software. Test specific parameters (e.g. set I1 to 110% of I>>) must be automatically re-adjusted according to the entered relay settings.</p> <p>Manual testing.</p> <p>Fully automatic testing.</p> <p>Ability to generate test sequences from any number of states. Each state consists of any combination of voltage, current, frequency and any binary output state.</p> <p>Graphical display of natural voltages and currents in a vector diagram.</p> <p>Graphical display of voltages, currents and binary signals over time.</p> <p>Direct entry sequence components and graphical display in a vector diagram</p> <p>Direct entry of impedances and graphical display in a R/X diagram</p> <p>Direct entry of power and graphical display in P/Q diagram</p> <p>Define trigger conditions for each state either in fixed time or dependant upon a logical combination of the binary inputs for accurate timing measurements.</p> <p>Synchronization to GPS / PTP and other digital timing pulses.</p> <p>Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.</p> <p>Linear Ramping and Pulse Ramping Functions</p> <p>Direct entry of actual relay settings into test software. Test specific parameters (e.g. set I1 to 110% of I>>) must be automatically re-adjusted according to the entered relay settings.</p> <p>Manual testing.</p> <p>Fully automatic testing.</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	15%

Ability to linearly ramp up to two independent variables (e.g. voltage and frequency) at the same time, while keeping the other quantities at a defined constant value.

Ability to ramp a single variable in a pulsed fashion i.e. ramped quantity shall be set back to a predefined value between every step to allow the relay to reset.

Graphical display of natural voltages and currents in a vector diagram.

Graphical display of voltages, currents and binary signals over time.

Define trigger conditions for pick-up / drop-out measurements upon a logical combination of the binary inputs.

Synchronization to GPS / PTP and other digital timing pulses.

Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.

Transient Playback Function

IEEE COMTRADE (C37.111-1991) compatible (ASCII and binary formats).

Synchronization to GPS / PTP and other digital timing pulses.

Timing accuracy 1 μ s.

Graphical display of voltage and current traces as well as digital signals and relay responses.

Editing of signals: Extending (repeating) and deleting portions of the recorded signal.

Ability to generate composite harmonic wave shapes.

Ability to edit own digital signals OR to select recorded binary signals to play back via binary outputs.

Unlimited length (in time) of Comtrade file to play back.

Overcurrent Relay Testing

Direct entry of actual relay settings into test software. Test specific parameters (e.g. test points) must be automatically re-adjusted according to the entered relay settings.

Manual testing.

Fully automatic testing.

Testing of the operating characteristic (trip time vs. I_{test}) for all types of fault (earth faults, phase faults, negative sequence and zero sequence faults)

<p>Display of overcurrent characteristic and test points in I/t diagram.</p> <p>Determination of the pick-up and drop-out current for all fault types.</p> <p>Determination the pick-up and drop-out of directional characteristic for directional overcurrent relays.</p> <p>Breaker simulation: Simulate the 52a and 52b auxiliary contacts of a breaker with the binary outputs, switch the currents off at zero crossing of current after a trip signal has been received.</p> <p>Characteristic formulae: IEC255-4, BS142 and IEEE PC37.112-1995, I²t characteristics to be supported. Definition of custom characteristics must be possible.</p> <p>Automated testing of the directional characteristics with flexible directional boundary definition capabilities with graphically displayable directional plane.</p> <p>Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.</p> <p>Frequency and Voltage Relays Testing</p> <p>Direct entry of actual relay settings into test software. Test specific parameters (e.g. test points) must be automatically re-adjusted according to the entered relay settings.</p> <p>Manual testing.</p> <p>Fully automatic testing.</p> <p>Generation of ramps for amplitudes, phase angles and frequency.</p> <p>Pick-up, timing and stability tests.</p> <p>Graphic and tabular display of relay pick-up and drop-out vs. time.</p> <p>Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.</p> <p>Distance Relay Testing</p> <p>Testing of line impedance relays and field failure characteristics on generator protection relays.</p> <p>Direct entry of the actual relay settings of an ABB REL 670/RED670/511/531; SEL 321/421; Alstom Quadromho, Optimho, Micromho; Siemens 7SA511/3, 7SL27, R3Z27; GEC YTG, PYTS; BBC LZ32 distance relay into the test software. The tripping characteristic must be generated automatically for each of the above relays.</p> <p>Impedance characteristics supported: Quadrilateral, Mho, Tomato or Lens characteristic.</p> <p>Manual testing.</p> <p>Fully automatic testing.</p>		
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Test the trip time at specific fault impedances. Fault impedances must be specifiable in relation to zone reaches, e.g. 90% Z1. Automatic assessment of whether the tested trip time is passed or failed.

Check the reach of a relay by placing a fault shot at the inner and outer tolerance border (i.e. theoretical reach minus and plus the defined reach tolerance of the relay). Automatic assessment of whether the tested reach is Passed or Failed.

Automatically test the characteristic in the impedance plane (R/X diagram) and/or in the time grading diagram (Z/t diagram). Automatic assessment of whether the tested reach is passed or failed.

Test models supported: constant test current, constant test voltage and constant source impedance.

DC offset simulation: Control of angle of fault incidence, time constant of dc offset to be calculated on-line from system parameters (R/L).

The separate arc resistance algorithm is to be supported for both earth faults and phase faults (as implemented on numerical distance relays).

Apply Pre-fault voltage, i.e. duration settable.

Breaker simulation: Simulate the 52a and 52b auxiliary contacts of a breaker with the binary outputs, switch the currents off at zero crossing of current after a trip signal has been received.

Graphical display of analog voltages and currents plus relay contact responses vs. time.

Display of injected voltages and currents on a vector diagram in natural and/or in symmetrical components.

Testing of auxiliary functions: Manual close, power swing, Auto-reclose function, VT fuse fail.

Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.

Differential Relay Testing

Testing of transformer differential relays, line differential relays, motor / generator differential and busbar differential relays.

Direct entry of the actual relay settings of ABB RET670/RED670/SPAD 346, Reyrolle Duobias, SEL 387/487/587/787, Reyrolle Duobias M and Siemens 7UT51 differential relay directly into the test software. The operating characteristic must be generated automatically for each of the above relays.

Manual testing.

Fully automatic testing.

<p>Simulation of two and three winding transformers for all possible vector groups (e.g. YY0, YD1, YD11, etc.).</p> <p>Testing the operating characteristic (I_{diff} vs. I_{bias}) for all types of fault: earth fault, phase faults and three phase faults. The various types of I_{bias} formulae ($I_{bias} = (I_p + I_s)/k$; $I_{bias} = \max(I_p, I_s)$; etc; numerical zero sequence elimination and both reference side have to be supported.</p> <p>Testing the harmonic restraint characteristic (I_{diff} vs. %I harmonic) for second harmonic (inrush restraint) and fifth harmonic (over fluxing restraint).</p> <p>Testing of the inrush restraint characteristic for relays which utilize the gap detection technique.</p> <p>Testing the trip time characteristic (trip time vs. I_{diff}) for all types of fault.</p> <p>Be able to compensate for Zero Sequence components</p> <p>Be able to allow for the testing of relays with combined phase and ground differential characteristics</p> <p>Test the stability of the relay to confirm the correctness of the vector group correction, CT mismatch correction and zero sequence elimination.</p> <p>Apply pre-fault current, i.e. through fault current condition. Test current and duration settable.</p> <p>Apply voltage in addition to six currents - according to HV or LV voltage</p> <p>GPS / PTP synchronized End-to-end tests to test the operating characteristic of line differential relays, i.e. by simulating either the local or remote end of a line.</p> <p>Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.</p> <p>Synchronizing Devices</p> <p>Direct entry of actual relay settings into test software. Test specific parameters (e.g. test points) must be automatically re-adjusted according to the entered relay settings.</p> <p>Manual testing.</p> <p>Fully automatic testing.</p> <p>Adjustment control mode to be tested closed loop.</p> <p>Graphical of quantities in a $\Delta V/\Delta f$ diagram as well as relative phase angles in a synchroscope.</p> <p>Feedback signals: closing pulse and adjustment pulses (V_+, V_-, f_+, f_-). Display of adjustment controls vs. time.</p>		
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Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.

Testing with GOOSE Messages

All the above protective relay test modules must be support testing for IEC 61850-8-2, i.e. be able to trigger on GOOSE message as well as simulate GOOSE message (if need be).

Import of SCD, ICD of GOOSE sniffer files to configure the triggering / simulation of GOOSE messages.

Sensing of up to 360 simultaneous GOOSE message must be possible.

Testing with Sampled Values

All the above protective relay test modules must be support testing for IEC 61850-9-2LE, i.e. be able to simulate all voltages and currents as Sampled Value signals.

Simulation of up to THREE sets of IEC61850-9-2LE signals must be possible.

Testing Single and Three Phase Transducers

Manual testing.

Automatic testing.

Generation of sweeps for amplitudes, phase angles, frequency, power (W, VA, Var).

Individual setting of voltages and currents (ito amplitude, phase angle and frequency) should be possible per test point.

For single phase transducers phase injected should be selectable.

L-L voltage transducers to be tested with full three phase voltage system.

On-line calculation of error (absolute, percentage and full-scale).

Display of transducer output and absolute, percentage and full-scale errors vs. sweep quantity graphically and/or as table.

Feedback signal: Low-level analog voltage (0..+/- 10V) or current (0..+/-20mA)

Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.

Energy meter testing according to IEC 62053

Manual testing.

Automatic testing.

Load test, No-load test, creep test, mechanism test, Injection test.

Ability to generate automatic load profiles, i.e. test the meter for different load conditions.

On-line display of error.

Feedback signal via optical pick-up / scanning head:

Meter pulses of up to 100 KHz

Third Harmonic Test

DC test

Automatic assessment of test results (Pass / Fail) with actual results and deviation from nominal.

On-line Multimeter Measurement Function

Up to 10 independent inputs

Software to display amplitudes and phase angles of ac voltages and currents, symmetrical components of voltages and currents, line to line voltages, frequencies, power (active, reactive and apparent) and $\cos(\phi)$ independently for each input.

All ac measurements to be true RMS.

On-line vector diagram for voltages and currents as well as power.

On-line measurement of Vdc, Idc and dc power for each input.

On-line display of harmonics measured both numerically (in a table per harmonic frequency) and graphically in a bar graph

Transient Recording Function

The recording function should enable recordings at the specified sampling frequency.

Any recordings done, should automatically be uploaded to the controller PC.

The recordings should be saved in COMTRADE format on the PCs hard drive.

Trigger conditions: amplitude, swell and sag, harmonic, frequency, frequency change, notch as well as any combination of these triggers.

A pre-trigger buffer should be definable.

Analysis software should be provided to analyse the recorded waveshapes in terms of analog waveshapes (RMS and instantaneous values), vector diagram, impedance plots (L-N and L-L fault loops) as well as harmonics.

For impedance plots, the relays impedance characteristic should be displayable in relation to the impedance trajectory measured by the relay.

<p>System-based testing of relays</p> <p>Provide a power systems based simulation software to test the function of a relay in the primary power system, i.e. by specifying the primary power system topology (e.g. from a single line diagram) and power systems parameters (network source impedances, line and transformer impedances, CT and VT parameters).</p> <p>Allow definition of power system events, e.g. any type of fault (L-N, L-N, L-L-N and L-L-L faults) as well as switching event (opening of closing of breakers)</p> <p>Full Transient simulation simulating power system phenomena such as DC offset, saturation of CTs, power swings, series compensated lines, transformer in-rush, etc.</p> <p>Distributed testing, i.e. injecting multiple test set simulating voltages and currents and different points in the network from ONE PC - even when the test sets are physically NOT in the same location (e.g. at different ends of a line)</p> <p><u>Special applications:</u></p> <p>Line impedance protection scheme on series compensated lines with tele-protection scheme</p> <p>Line differential protection system testing (up to three terminals)</p> <p>Power transformer differential relay testing with internal winding faults</p> <p>Bus zone system testing for out-of-zone through faults, in-zone faults, dead-zone faults as well as isolator transition faults</p>		
<p>Accessories</p> <p>Generator combination cable To combine 3xV and 3xI into one test lead, 8x 4mm banana plugs</p> <p>Measurement leads 12 x 2 m; 2 mm²</p> <p>Other accessories: South African Power cord</p> <p>Connection lead from test set to PC</p> <p>Various connection accessories</p> <p>Hardcover carrying cases for test hardware with retractable handle and wheels</p> <p>Soft Bag for test set and accessories</p> <p>Instruction Manual</p> <p>Software for report downloading and configuration as well as offline test sequence generation.</p>	<p>A product brochure confirming this requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	<p>5%</p>
<p>Local Support</p> <p>Hotline support hours</p>	<p>A product brochure confirming this</p>	<p>5%</p>

<p>Local telephonic support to be offered in the hours of 07h00 - 20h00 South African time.</p> <p>Email support Email support to be offered with a guaranteed turnaround time of 1 business day.</p> <p>Back-up units to be available in South Africa</p> <p>Calibration facility available in South Africa</p> <p>Guaranteed turnaround time for repairs and calibration < 5 working days</p> <p>Product training offered in South Africa</p> <p>In-house / On-site training to be offered on request</p> <p>Warranty on Hardware FIVE years from date of delivery</p>	<p>requirement or letter from the OEM if the required information is not contained on existing brochures.</p> <p>Note the letter must be on the OEM's letterhead and must be signed by the relevant OEM representative.</p>	
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Level 3 - Sample Criteria and Returnable

The functional threshold is set at 100%. Submissions failing meet the threshold will not proceed further.

No part marks are allowed.

Eskom reserves the right to allow concessions related to deviations at this stage.

Note – due to the high cost of the item, Eskom reserves the right to perform the sample evaluation over MS Teams or in person, in a manner that effectively demonstrates the compliance of the product offered. The supplier will be allowed to be present to perform the required demonstrations.

Criterion	Returnable	Scoring Model
All components and parts stated in the evidence at stage 2 are supplied with the sample.	<p>As required for Portable Three Phase Test System:</p> <p>Supporting features for various protection IED's, IEC 61850 GOOSE & Sampled Values, ARC Flash, Transducers, Energy Meters, Transient Playback, Recording Capabilities</p> <ol style="list-style-type: none"> 1. Testing All required leads and cables. 2. All required accessories, Leads, Smart adaptors etc 3. Interface to PC 	25%

	4. All required safety accessories. 5. Transport case.	
Demonstration of tester capability wrt IED's, IEC 61850 GOOSE & Sampled Values, ARC Flash, Transducers, Energy Meters, Transient Playback, Recording Capabilities	Demonstration	50%
Demonstration of software wrt IED's, IEC 61850 GOOSE & Sampled Values, ARC Flash, Transducers, Energy Meters, Transient Playback, Recording Capabilities	Demonstration	25%