

**Annexure SAS VI- Technical Specification for Protection Testing Tool**

S. No.	Item	Specification
1	Functional Requirement	<ol style="list-style-type: none"> <li>1. The instrument should be suitable for testing all types &amp; models of relays (used in protection schemes of transmission lines, transformer, reactor and bus bar etc.) of all the major manufacturers in fully automatic mode (including high-burden electromechanical relays) as well as transducers having accuracy class of 0.25 or better. The test kit should be suitable for dynamic and transient testing, with facility of transient (COMTRADE format) record playback for both analog and digital channels.</li> <li>2. The kit shall be suitable for testing of the relays in the substations having conventional protection as well as protection based on IEC 61850 protocol using GOOSE/GSSE. The test results should have repeatability, consistency in results.</li> <li>3. The kit shall also be suitable for testing of the relays and merging units which have Sampled Values (SV) capability (according to IEC 61850-9-2 LE).</li> </ol>
2	Output	<ol style="list-style-type: none"> <li>1. All outputs shall have over voltage and short circuit protection. Specifically, all the voltage and current generators shall have over-voltage/short-circuit protection. The instruments should not get over heated, while supplying the rated output continuously. Further, the kit should be stable even during extensive continuous usage and should not get hanged or restarted.</li> <li>2. V/I Generators: <ol style="list-style-type: none"> <li>a) Current Outputs: Software controlled/configurable six phase. Current outputs: 0 – 30A (r.m.s) minimum, Resolution: 1mA or less. Output Burden: minimum 150 VA per phase.</li> <li>b) Voltage Outputs: Software controlled/configurable four-phase voltage. Voltage output: 0-300 Volts AC/DC (Ph-N), Resolution: 10mV or less. Output Burden: minimum 50VA per phase.</li> <li>c) The total current/voltage output channels should be at least 08 nos.</li> </ol> </li> <li>3. Aux. DC Output: Software controlled, 0-250 V and 50W min. (continuous rating), with continuous / step-less control. The DC supply should have short circuit protection, galvanically isolated and over load indication</li> </ol>
3	Measuring Input	<ol style="list-style-type: none"> <li>1. Voltage range: -10V to +10 V DC</li> </ol>

डेटा वर्गीकरण : प्रतिबंधित/RESTRICTED

		<p>2. Current range: -20mA to +20 mA DC</p> <p>3. Accuracy: -0.02% or better</p>
4	Test Frequency	V/I Generator/Amplifier shall have controlled frequency range from 10Hz to 1 kHz for sine and DC to 3 kHz (minimum) for transients with resolution of 1 mHz or better and accuracy 0.01 % or better.
5	Phase Angles	0 to 359.9° lag/lead with resolution of 0.1 degree or better, with accuracy of 0.5 deg. (min.).
6	Accuracy	Accuracy shall be $\leq \pm 0.2\%$ for voltage and current sources throughout the range. The total distortion shall also be less than 0.2%.
7	Binary I/O Configuration	Minimum four binary outputs and eight inputs with galvanic isolation. Software controlled input should be capable of sensing potential free relay contacts (NO/NC) as well as potential of 0 to 250V AC/DC. Associated timers should have time resolution of 100 $\mu$ S or better. The software-controlled outputs should have potential free contacts (NO/NC) with breaking capacity of 8 Amp 250V AC/DC.
8	Fault Replay	It should also have the facility of Transient data playback, by accepting transient fault data in COMTRADE format along with the facility to extend pre-fault/ post-fault durations. It should accurately simulate disturbance signal along with DC and high frequency components (with sampling rate of 3kHz or better) as well as Binary signals. Further, it should offer repeatability of results, e.g., same fault location for a particular fault etc.
9	Communication ports / IEC 61850 compatibility	<p>Shall have the ETHERNET connectivity as a standard feature.</p> <p>The ETHERNET port shall be suitable for control through external PC as well as for IEC 61850 protocols.</p> <p>GOOSE/GSSE configuration software module and Sampled Values configuration module should be provided with the kit for effective testing of protection relays/IEDs based on IEC 61850 protocol.</p> <p>The kit shall have the capability to simulate and subscribe to GOOSE messages. It shall have the facility to transfer GOOSE and Sampled Values information to suitable modules during testing of IEDs and Merging Units.</p> <p>Specifically, it will be the responsibility of the supplier to demonstrate the working of IEC 61850 module for input/output GOOSE messaging, publishing/subscribing Sampled Values.</p> <p>The kit, via its own hardware or external software shall have the capability to work as an IEC 61850 client with following features:</p> <ul style="list-style-type: none"> <li>- Capability to read current/voltage and other such primary values from the relay's IEC61850 data model</li> <li>- Capability to read/write values from/to the IED's IEC 61850 data model</li> <li>- Capability to perform control operation on the data objects (via IEC 61850 direct control; direct with enhanced security control; SBO control; SBO with enhanced security control), thus enabling the test engineer to change the Test Mode/Sim Mode etc. during testing.</li> <li>- Capability to simulate multiple IEDs simultaneously from their SCL file (GOOSE and MMS Reports), thus enabling local HMI testing and Gateway testing.</li> </ul>
10	Test Leads and accessories	<p>a. 3 sets - Relay tools kits</p> <p>b. 2 nos. - Test plugs for TTB</p> <p>c. 2 nos. - Special type Test plugs for using with modular type relays cases (if applicable)</p>

**डेटा वर्गीकरण : प्रतिबंधित/RESTRICTED**

		Complete set of test leads, PC cables, drawings, manuals, tools, Licensed software of the testing kit, combination plugs, power supply cables, original carrying case (which should be hardened and robust/rugged enough for proper safety of the kit during transportation by road/rail/air), manual (in soft copy) etc. required for carrying out all types of testing.
12	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
13.	Power Supply	It shall work on single phase 230 Volts $\pm$ 10%, 50 Hz $\pm$ 5% supply and standard AC socket.
14	Operating Temperature	0 to +50 deg C
15	Relative humidity	Max. 90 % non-condensing
16	Protection/Control	Against short circuit, over voltage, improper ground connection over load & transient surges, the kit should have alarm/cut-off features settings to protect the instrument.
17	Cooling Arrangement	Necessary in-built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/ accessory shall have to be required.
18	Weight	It should be easily portable for smooth movement.
19	Software	<p>The software should be suitable for automatic testing &amp; report generation and analysis. The software of the kit should be Windows 8 (or higher) based and should be operated through suitable Laptop PC.</p> <p>All control tasks and data acquisition, processing and recording of test results shall be performed by the operating software on laptop PC or controller.</p> <p>The software should be capable of creating customized relay characteristics as well as importing relay characteristics.</p> <p><b>The kit should support GPS receiver</b> with suitable port which shall enable carrying out end-to-end testing using GPS receivers available at both ends of the local and remote substations.</p> <p>Software should have facility to simulate line fault for end-to-end testing. For publishing Sampled Values, the test kit should be capable to get time-information from PPS source/PTP source.</p> <p>The software shall be able to get updated with respect to new relays and new operating techniques whenever they are introduced. The updating shall be intimated and done by supplier during the period of Extended Warranty (Minimum 5 years).</p> <p>Software for energy meter testing shall be demonstrated for its verification. The kit shall be able to generate proper reports in user friendly formats.</p>
20	PC Interface	It shall include supply of one laptop PC of Dell/Lenovo/HP make with the following minimum specifications: 11 <sup>th</sup> Gen Core i7 Intel (or equivalent) Processor with 8 cores, 16GB RAM, 500GB SSD, 15'' FHD LED backlit screen, Combo DVD Drive (built in or external having DVD read/write facility with required cables and connectors), preloaded operating MS Window 11 Professional, antivirus for PC (with at least 3 years subscription) along with latest version of application software required for storage, analysis and record management. The laptop shall have 3 USB ports, and three Ethernet (RJ-45) ports (i.e., either three built-in Ethernet network interface card(s) (NIC) or, one built in Ethernet NIC along with two external Ethernet Adapters). The laptop shall be Wi-Fi enabled. Also, the laptop PC shall have web camera for video conferencing, inbuilt microphone and mic.

डेटा वर्गीकरण : प्रतिबंधित/RESTRICTED

21	Environment	The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC.
22	Calibration Certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
23	Warranty	Kit shall have Warranty for minimum 5 years for smooth and reliable operation of the kit. The warranty includes: a) Calibration of instrument (annually till completion of 5 years) b) As much as visits for repairs to site. c) If the kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of spares, software, transportation, transit insurance (To & Fro), etc. of kit for repair at test lab/works. Kit after repairs need to be returned within thirty days from the date of dispatch. d) All the expenses for maintaining the supplied instrument “Healthy and in working condition” is to be borne by Successful bidder during the Extended Warranty period of 5 years as per LOA
24	After sales service	Bidder will have to submit the documentary evidence of having established mechanism in India for prompt “after sale services”.
25	Demonstration and handing Over of the Instrument	The contractor shall have to demonstrate the instrument to the satisfaction of POWERGRID. The Supplier shall have to ensure the kit is made user friendly apart from the detailed demonstration at the site. The instrument failed during the demonstration shall be rejected and no repairs are allowed.
26	Training	The contractor shall provide hands-on training for 15 POWERGRID personnel at the location requested by POWERGRID in India. The training must cover all the aspects related to testing of relays and IEDs (compliant with IEC 61850) covering all the technical features of the Relay Test Kit.

**Annexure SAS VII Technical Specifications for IEC 61850 Station Overview Tool**

The Tool (software/hardware) should have the following capabilities (as a minimum requirement):

- a. Offline Visualization of IEC 61850 communication of the entire substation as per the SCD of the substation.
- b. Online and real time visualization IEC 61850 communication of the entire substation by connecting with the substation's Ethernet communication Network w.r.t SCD. During the online visualization errors in the real substation w.r.t the defined communication in the SCD shall be presented for diagnostics (e.g., discrete information such as presence of GOOSE as per SCD in network and subscription information from all subscriber IEDs based on LGOS information from the subscriber IEDs)
- c. Simulation of GOOSE & MMS data from all the IEDs simultaneously for testing and validation.
- d. The Tool should be supplied with all the required licensed software/hardware and a carrying case. The Tool should be capable of being powered from 220V, 50Hz AC supply (in case of hardware-based tool).

**Annexure SAS VIII: Technical Specifications for Network and Signal Analyzer**

1. The Tool (software/hardware) shall have the capability to analyse IEC 61850 GOOSE, Sampled Values and conventional voltage, current and binary status signals. It should have the capability of comparing analogue voltage/ current and IEC 61850 SVs on the Ethernet communication Network in a substation.
2. The tool should have the following capabilities (as a minimum requirement):
  - a. Continuous Network traffic of IEC 61850 monitoring and should be able to issue alerts in case of abnormalities which can be defined by the user.
  - b. Real time verification of definitions as per IEC 61850 SCL files and the actual information on the communication network.
  - c. Measurement of propagation delays of GOOSE & Sampled Values.
  - d. Insights into IEEE 1588 frames on the communication network.
3. The tool should be supplied with all the required licensed software/hardware and a hardened carrying case. The tool should be capable of being powered from 220V, 50Hz AC supply (in case of hardware-based tool).