



भारत सरकार  
केन्द्रीय विद्युत प्राधिकरण  
दक्षिण क्षेत्रीय विद्युत समिति  
29, रेस कोर्स क्रॉस रोड  
बैंगलूर-: 560 009



Government of India  
Central Electricity Authority  
Southern Regional Power Committee  
29, Race Course Cross Road  
BANGALORE - 560 009



आई एस ओ : 9001-2015  
ISO: 9001-2015

Email : mssrpc@yahoo.com

www.srpc.kar.nic.in

Phone: 080 -22282516

FAX : 080 -22259343

सं./No: SRPC/SE-III/ PMS/2021/

दिनांक/Date : 01.04.2021

To

1. Dr. R. Nagaraja, Managing Director, M/s PRDC Pvt. Ltd., #5, 11<sup>th</sup> Cross, 2<sup>nd</sup> Stage, West of Chord Road, Bengaluru -560086,
2. Sh. Giri PB, CTO (Software), PRDC Pvt. Ltd., #5, 11<sup>th</sup> Cross, 2<sup>nd</sup> Stage, West of Chord Road, Bengaluru – 560 086

विषय/Sub: Meeting Notice - Go-Live Meeting of PMS Project – reg.

- संदर्भ/Ref: 1. Minutes of the 1<sup>st</sup> Pre Go-Live meeting held on 22.01.2021 issued vide SRPC letter dated 02.02.2021
2. Minutes of the 2<sup>nd</sup> Pre Go-Live meeting held on 26.02.2021 & 03.03.2021 issued vide SRPC letter dated 05.03.2021
3. Minutes of the 3<sup>rd</sup> Pre Go-Live meeting held on 18.03.2021 issued vide SRPC letter dated 18.03.2021
4. Minutes of the 4<sup>th</sup> Pre Go-Live meeting held on 31.03.2021 issued vide SRPC letter dated 01.04.2021

महोदय/ महोदया / Sir/ Madam,

Based on the assessment made (vide Pre Go-Live meetings under reference) by the Executive Committee of PMS Project w.r.t. its completeness, and the readiness of PRDC in operationalizing PMS Project, it has been decided to conduct the final Go-Live meeting of PMS project on 14-15 April, 2021 (from 10:30 hrs to 17:30 hrs on each day) in on-line mode through webex (the meeting credentials will be shared separately).

In the meeting, the verification & assessment w.r.t. completeness of PMS project will be carried out as per the features listed at Annexure. It is therefore requested that PRDC may take steps to demonstrate all listed features thoroughly & in detail so that PMS project can be operationalized without further delay.

धन्यवाद / Thanking You,

भवदीय/ Yours faithfully,

संलग्नक/Encl: यथोपरि/ as above

*N.R.L.K.*

(एन. आर. एल. के. प्रसाद / N.R.L.K. Prasad)

अधीक्षण अभियंता (पी)/ Superintending Engineer (P)

Copy to:

1. Executive Committee Members of PMS Project
2. All PCSC Members & PSCT Licensees (circulation by E-mail)

Features to demonstrated for final Go-Live Meeting	
	<b>General/ Graphical User Interface</b>
8	Module for creating SLD has advanced features as in a professional drafting / drawing package like AutoCAD. For e.g. layering, panning, zooming, real-time zoom, scaling to fit any paper size (A5toA0), printing / plotting of full diagram, selected window, current window, copy and paste options etc.
9	Different views of the same network. Meaning, there shall be a provision to display /print /plot SLD or part of SLD showing only system topology / with load flow results / with fault study results/ others.
11	Flexibility in modeling the system. Meaning there is provision for <ul style="list-style-type: none"> <li>➤ SLD-Database integrated mode for network creation</li> <li>➤ Independently draft the SLD using IEC or ANSI symbols</li> <li>➤ Data entry using interactive forms without SLD</li> <li>➤ Multiple SLD shall be supported for the same data base Create input data in ASCII files</li> </ul>
12	Automatically generates SLD from given system connectivity data for equivalent networks
13	Different ways of executing analysis <ul style="list-style-type: none"> <li>➤ Run any analysis directly from graphic editor</li> <li>➤ Run while interactively entering data through forms</li> <li>➤ Run studies using ASCII input or other batch file</li> </ul>
14	User defined reports including information of the system under study.
16	Generate reports in .csv, html, pdf, xps, prn, emf, png, xls, xml, csv format as well
20	Provision for importing of Geographic coordinates and generating the network.
21	Performing the analysis of the single file com-trade file for the associated relay through the network element modeled.
	<b>Software Licensing/Commercials</b>
22	Software should not have any time limitation for the expiry of license.
23	Life time free software upgrade.
	<b>Power Flow Analysis</b>
25	Zone / Area wise modeling & control, islanding.
26	Simulating the study mode in dynamic changes in the network
29	Contingency analysis ranking.
37	Possible to Model HVDC systems.
38	Computation of Total Transfer Capability (TTC) and Available Transfer Capability (ATC) between two Buses/Areas/Zones and estimation of Loop flows.
39	Sub Station wise load flow for utilities.
40	Simple and Detailed Wind Turbine Model considering all the four IEEE/WECC generic wind turbines models (WT1 to WT4)
41	Modeling suitable for individual Solar plant, Wind Turbine and Wind Farm (Group of Wind Turbines)
50	Estimation of Inter regional load flow on various corridors by proper modeling of other regions of the country including all scenarios of peak/off peak, seasonal, etc.
	<b>Short Circuit Analysis</b>
55	Shall comply with IEC 363 & IEC 909 Fault analysis.
56	Simulation of number of faults one at a time at various buses in a single execution.
57	Computation of fault contributions from adjacent/next adjacent/all buses in the neighborhood of fault and from the user defined nodes.
59	HVDC system contribution to faults.

62	Wind Turbines contribution to Faults for all the four IEEE/WECC generic wind turbines models (WT1 to WT4) and Solar Inverter contribution to Faults.
<b>Transient Stability (Dynamic) Studies</b>	
67	Motor starting analysis is inbuilt.
68	Built in standard IEEE type voltages regulators, AVR, governors, static VAR compensators, power system stabilizers
69	Support for user defined control system
70	Reports critical fault clearing time to aid in deciding rating of various equipment's.
71	Study of machine swing curves at various machines and its states
73	Disturbances that can be simulated are listed below: <ol style="list-style-type: none"> <li>1. Change in transformer parameters (for changing number of transformers in parallel, tripping and reconnecting transformer)</li> <li>2. Change in transmission line parameters (for changing the number of circuits, tripping and reconnecting transmission line)</li> <li>3. Change in real and reactive power of the load.</li> <li>4. Change in shunt impedance</li> <li>5. Change in load model</li> <li>6. Change in number of generator sets.</li> <li>7. Total generation outage.</li> <li>8. Single line to ground fault with pole reclosure.</li> <li>9. Three phase to ground fault with auto-reclosure.</li> <li>10. Loss of excitation</li> <li>11. Motor starting studies</li> </ol>
75	Simulation of operation of voltage/current/frequency relays and distance relays.
77	Simulation of over/under frequency and df/dt relays for different levels of load shedding at three setting levels of load frequencies.
78	Simulation of over/under voltage relays.
79	Possible to plot Linear graph of absolute/relative swing curves for various machines.
80	Power swing curves of transmission lines and distance relay performance verification.
81	Wind Turbine behavior considering all the four IEEE/WECC generic wind turbines models (WT1 to WT4) and Solar Inverter contribution to Faults.
82	Capability to simulate ramp up/down of the generation.
<b>Protection Calculation Tool/ Engine</b>	
87	Primary and backup relay pairs can be modeled.
88	There shall be a provision for manual selection of primary and backup relays.
89	Shall Consider thermal curve of all equipments
90	Simulation of relay responses for Existing settings of the relays
91	Relay co-ordination for radial and interconnected power system networks for distance, over current and earth fault relays.
92	Motor hot and cold curves.
94	Option to check existing relay settings as per the site.
95	Switching status for all Relay elements from the screen. Highlighting of Relay Operational Sequence after the analysis.
96	Display of Sequence Operation of Relays with respect to tripping time.
97	Display of Fault on the SLD with standard notation after fault creation.
98	Disturbance Analysis with single click on mapping of disturbance files with corresponding relay.

99	Possible to model Transformer Differential Protection
100	Possible to model Restricted Earth Fault Protection
101	Possible to model Line Pilot Protection
102	Possible to model Bus Bar Differential Protection
103	Possible to model Line/Cable Differential Protection
104	Transformer over fluxing computations
105	<p>Specific Features of Over Current Relay Coordination:</p> <ol style="list-style-type: none"> <li>1. Phase Relay Coordination</li> <li>2. Earth Relay Coordination (Co-ordination between Normal Non – Directional Earth Fault and Common Earth Fault should be provided.)</li> <li>3. Standby Earth Fault</li> <li>4. Partial Bus-bar Protection Simulation</li> <li>5. Fuse Coordination</li> <li>6. Instantaneous Setting for Relays</li> <li>7. Directional and Non-directional Feature for Relays</li> <li>8. Pre-loaded Standard Relay Curves</li> <li>9. Normalized Curve and Fault Line Feature</li> <li>10. View existing and newly computed relay settings simultaneously</li> <li>11. Partial Analysis for selected relays</li> <li>12. Solve</li> </ol>
106	<p>Specific Features of Distance Relay Coordination:</p> <ol style="list-style-type: none"> <li>1. Automatic computation of zone setting in terms of Primary and Secondary for the standard/approved relay formats. It will be the approved database (along with facility to update) for all types of conductors (for example from Dog to Quad Moose, Cables etc.) data. <math>e.R1/X1/Z1R0/X0/Z0</math>, Zero Sequence Impedance angle etc. for computing the Line impedances. For Zone 2 and Zone 3, Zone 4 setting it has the facility to check whether the setting is not covering the next voltage level (considering the Transformer impedances from the Percentage impedances data).</li> <li>2. Recommended Arc Resistance, Tower footing Resistance for different voltage level</li> <li>3. Standard Relay Characteristics (example: mho, circular, quadrilateral, user defined etc.).</li> <li>4. View existing and newly computed relay settings simultaneously</li> <li>5. Impedance seen by the relay for faults</li> <li>6. Solve for the existing and proposed setting calculation as per the user choice.</li> </ol>
107	<p>Specific Features of Transformer Differential Protection:</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer/generic types.</li> <li>2. User defined bias slope setting</li> <li>3. Provision to enter CT details for 2 winding and 3 winding Transformers &amp; Single Phase Transformer for Railway Application.</li> <li>4. Provision to enter existing relay settings.</li> <li>5. Program Computed Transformer differential settings.</li> <li>6. Program Computed Operating Time</li> </ol>

108	<p>Specific Features of Restricted Earth Fault Relay:</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Current or voltage setting</li> <li>3. Provision to enter current setting range details like minimum, Maximum and step Sensitive or Normal selection will be from the REF data.</li> <li>4. User choice of voltage setting details in % or volts.</li> <li>5. Choice of continuous, uniform or discrete voltage setting variation.</li> <li>6. Provision to add and delete voltage setting records.</li> <li>7. User defined bias slope setting for Low Impedance RE/F application</li> <li>8. Provision to enter CT details for 2 winding and 3 winding Transformers along with Neutral CT details.</li> <li>9. Provision to enter existing relay settings.</li> <li>10. Program Computed Restricted Earth Fault settings.</li> <li>11. Program Computed Operating Time</li> </ol>
109	<p>Specific Features of Line Pilot Relay</p> <ol style="list-style-type: none"> <li>1. User defined Line Pilot relay characteristics</li> <li>2. Choice of pilot wire voltage (either 5 or 15 kV)</li> <li>3. Choice of Loop Resistance between measured and computed data</li> <li>4. Provision to input isolation transformer data</li> <li>5. Provision to input CT data</li> <li>6. Padding resistance as a computed output.</li> </ol>
110	<p>Specific Features of Bus Bar Differential:</p> <ol style="list-style-type: none"> <li>1. Provision to enter relay details like max, min and step values of current in %.</li> <li>2. Provision to enter relay details like max, min and step values of alarm in %.</li> <li>3. Provision to enter relay details like max, min and step values of time in seconds.</li> <li>4. Variable resistor Values: Enter Minimum, Maximum and step values</li> <li>5. Provision to input Pick up Characteristics data for minimum, maximum and step details for over current setting in %, Stabilizing factor (selective), stabilizing factor (check zone) and Time in ms.</li> <li>6. Provision to view computed and existing stabilizing resistance simultaneously</li> </ol> <p>Specific Features of Line/Cable Differential:</p> <ol style="list-style-type: none"> <li>1. User defined values for minimum, maximum and step values in % for differential set, switch on, high set and 2<sup>nd</sup> harmonic restraint.</li> <li>2. Provision to view computed and existing settings simultaneously.</li> </ol>
111	<p>Specific Features of Generator Overall, Generator Transformer and Unit Differential Protection</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User defined bias slope setting</li> <li>3. Provision to enter CT details for 2 and 3 and Multiple winding (for Overall differential) Transformers</li> <li>4. Provision to enter existing relay settings.</li> <li>5. Program Computed Transformer differential settings.</li> <li>6. Program Computed Operating Time.</li> </ol>

112	<p>Specific Features of Generator Inter-turn Differential Protection.</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Current or voltage setting</li> <li>3. Provision to enter current setting range details</li> <li>4. User choice of voltage setting details in % orvolts.</li> <li>5. Provision to enter CT details</li> <li>6. Provision to enter existing relay settings.</li> <li>7. Program Computed Generator Inter-turn Differential Protection settings.</li> <li>8. Program Computed Operating Time</li> </ol>
113	<p>Specific Features of Generator Stator Earth Fault Protection (Both 95% and 100% protection).</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Selection of 100% Generator Stator Earth Fault Protection ( 20Hz or Third Harmonic Principle)</li> <li>3. Provision to enter Voltage setting range details</li> <li>4. User choice of voltage setting details in % orvolts.</li> <li>5. Provision to enter CT details ( for 20HzPrinciple)</li> <li>6. Provision to enter existing relay settings.</li> <li>7. Program Computed 95% and 100% Stator Earth Fault Protection settings.</li> <li>8. Program Computed Operating Time.</li> </ol>
114	<p>Specific Features of Generator Rotor Earth Fault Protection</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Selection of Rotor Earth Fault Protection</li> <li>3. Provision to enter Voltage &amp; Ohms setting range details</li> <li>4. User choice of voltage setting details in % orvolts.</li> <li>5. Provision to enter existing relay settings.</li> <li>6. Program Computed Rotor Fault Protection settings.</li> <li>7. Program Computed Operating Time.</li> </ol>
115	<p>Specific Features of Generator Loss of Excitation Protection(Field Failure) ( with and without Under voltage)</p> <ol style="list-style-type: none"> <li>1. Automatic computation of Different Stages of Loss of Excitation</li> <li>2. Standard Relay Characteristics</li> <li>3. View existing and newly computed relay settings simultaneously</li> <li>4. Impedance seen by the relay.</li> <li>5. Provision to enter existing relay settings.</li> <li>6. Program Computed Rotor Fault Protection settings.</li> <li>7. Program Computed Operating Time</li> </ol>
116	<p>Specific Features of Forward Power and Reverse Power Protection</p> <ol style="list-style-type: none"> <li>1. Automatic computation of Different Stages of Power Protection.</li> <li>2. View existing and newly computed relay settings simultaneously</li> <li>3. Provision to enter existing relay settings.</li> <li>4. Program Computed Power Relay settings.</li> <li>5. Program Computed Operating Time</li> </ol>
117	<p>Specific Features of Back-Up Impedance protection</p> <ol style="list-style-type: none"> <li>1. computation of zone setting</li> <li>2. Standard Relay Characteristics (example: mho, circular etc.</li> <li>3. View existing and newly computed relay settings simultaneously</li> <li>4. Impedance seen by the relay for faults</li> <li>5. Quick Solve</li> </ol>

118	<p>Specific Features of Generator Inadvertent energization</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Selection of Generator Inadvertent energization.</li> <li>3. Provision to enter Voltage &amp; current setting range details</li> <li>4. User choice of voltage setting details in % or volts.</li> <li>5. Provision to enter existing relay settings.</li> <li>6. Program Computed Generator Inadvertent energization settings.</li> <li>7. Program Computed Operating Time.</li> </ol>
119	<p>Specific Features of Generator Negative Sequence Protection</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of Selection of Generator Negative Sequence.</li> <li>3. Provision to enter Voltage &amp; current setting range details</li> <li>4. Provision to enter existing relay settings.</li> <li>5. Program Computed Generator Negative sequence settings.</li> <li>6. Program Computed Operating Time.</li> </ol>
120	<p>Specific Features of Generator Thermal Overload Protection</p> <ol style="list-style-type: none"> <li>1. Choice of relay library based on the manufacturer.</li> <li>2. User choice of voltage setting details in % or volts and necessary curves.</li> <li>3. Choice of continuous, uniform or discrete voltage setting variation.</li> <li>4. Provision to enter existing relay settings.</li> <li>5. Program Computed Generator Thermal Overload Relay settings.</li> <li>6. Program Computed Operating Time</li> </ol>
<b>COMTRADE Viewer &amp; Fault Analyzer</b>	
121	Viewing of Analog and Digital plots of disturbance files of COMTRADE format (both as instantaneous and RMS values) stored in the relay including trajectory of impedance locus
122	Computation of harmonics in the wave forms of analog channels
123	Harmonics up to the order of $N/2$ Hz ( $N \rightarrow$ Sampling Frequency)
124	Harmonics view in Tabular form /bar graphs
125	Saving of the analyzed file in Image format
126	<p>Automatic Fault Analysis based on multiple COMTRADE Files provided to the system by User.</p> <p>The COMTRADE files shall be attached to the PDMS once it is made available in SRPC server. The same shall be downloaded by the constituent members.</p> <p>Based on the incident operating database updation and available COMTRADE files in PDMS, Constituent members shall be able to simulate and conduct the analysis of the incidents in the local designated PC.</p>
127	<p>Generation of Report based on the analysis of COMTRADE Files with the following outputs:</p> <ol style="list-style-type: none"> <li>1. Fault Summary &amp; Fault location based on Single-ended/ Double-ended fault data.</li> <li>2. Correctness &amp; validation of operation of each relay.</li> <li>3. Actual impedance seen by the distance relay can be viewed in the R-X plane.</li> <li>4. Identification of nature of Fault (Like fire, tree, decapping, lightning etc.) based on Historical / Expert database available in the PMS.</li> <li>5. Suggestive remedial action/ measures to be taken including suggestions for relay settings.</li> </ol>

128	<p>Summary of the report shall include:</p> <ul style="list-style-type: none"> <li>(i) File Information</li> <li>(ii) Summary of Analog Channels</li> <li>(iii) Digital channel data</li> <li>(iv) Digital channel sequence events</li> <li>(v) Images of analog, digital and phasor section</li> </ul> <p>Report types: Multiple</p> <ul style="list-style-type: none"> <li>(i) Report-1: Automatic Fault Analysis based on multiple COMTRADE Files provided to the system by User</li> <li>(ii) Report-2: Storing and displaying fault parameters for each line/ equipment based on different search-categories specified by the User such as Duration, Date, Time, Nature of fault, Fault current.</li> </ul>
129	Merging of two existing COMTRADE files received from disturbance recorder can be edited or modified by removing unwanted channels and create a new COMTRADE file for further processing.
130	Comparison of two or more channels on the same screen
131	Computational View
132	Customized Printing: Printing of only required area on the viewer
	<b>Network Modification Module</b>
133	Used defined number of cases should be possible to be imported into PMS
134	Static and dynamic equivalents (equivalent inertia constant) for the power system
135	Initial system condition will be taken from load flow
136	It is possible to select the busses to be retained, individually or zone/area wise.
137	Output of network reduction will give output for both Ybus and Zbus matrices for the reduced system.
138	Network reduction module will give impedance values of additional series and shunt connections arising out of network reduction.
139	Output of network reduction includes equivalent generator's inertia, power, voltage and impedance.
140	The reduced network database will be created automatically.
	<b>Protection Database Management System</b>
147	<p>Relay Template management</p> <ul style="list-style-type: none"> <li>1. Create\Edit\Delete relay templates</li> <li>2. Viewing relay template</li> <li>3. Locking and Unlocking templates</li> <li>4. Copy &amp; Edit templates from the existing template</li> <li>5. Important Export templates</li> </ul>
148	<p>Relay Data management</p> <ul style="list-style-type: none"> <li>1. Create\Edit\Delete relay data</li> <li>2. Viewing relay data</li> <li>3. Locking and Unlocking relay data</li> <li>4. Copy &amp; Edit relay data from the existing data</li> <li>5. Import and Export relay data</li> </ul>

156	There is option to accept setting data as per the audit and verify\compare the field setting with protection database setting and generate error report
159	Capturing the History of Protection audit of the sub-stations and reports are available each Utility-wise and State-wise.
160	<p>Reports:</p> <ul style="list-style-type: none"> <li>• Shall be possible to generate reports as per user requirement. Some of these are: <ul style="list-style-type: none"> <li>➤ Tripping Event Analysis Report</li> <li>➤ Sequence of Events Operation as viewed from SLDC Operation</li> <li>➤ Sequence of Breakers Tripped as viewed from Substation</li> <li>➤ Relays operated on each element-wise</li> </ul> </li> <li>• User shall be able to export generated reports to the standard formats like .xls, pdf,</li> </ul>
<b>Security and Data back-up</b>	
161	<p>Latest software and hardware firewalls to be installed for security of the database from hacking or other malicious manipulation.</p> <p>Use should be made of 128 bit SSL protocol to encrypt the channel between a client and server to protect data during transit</p>
162	All settings data, SLD, configuration data, hierarchy controls, etc. will be backed up by Network Data Management Protocol (NDMP) for faster disaster recovery. All hardware, software for such backup creation shall be deemed to be considered part of the project.
<b>Disaster Recovery/ Backup</b>	
164	The database has automatic backup/ failsafe mechanisms to prevent loss of data with at least two separate storages.

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