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Dated : 16th April 2015

**CORRIGENDUM WITH REFERENCE TO THE TENDER NOTIFICATION**

Reference No. : IIT(BHU)/IPCell/IWD/2014 – 15/1168 Dated 13<sup>th</sup> January, 2015 for 33KV Gas Insulated Sub Station & 11KV distribution Sub Station.

After the Pre-Bid conference held on 28<sup>th</sup> January, 2015 regarding the above referred tender and subsequent queries submitted by the followings;

1. *M/s. Schneider Electric*
2. *M/s. ABB*
3. *M/s. Siemens Ltd.*

The technical Evaluation Committee has approved the following bidding schedule.

<b>Bid Reference</b>	<i>IIT(BHU)/IPCell/IWD/2014 – 15/1168 Dated 13<sup>th</sup> January, 2015</i>
<b>Date of commencement of bidding</b>	<i>14<sup>th</sup> January, 2015</i>
<b>Uploading amendments on Institute Website</b>	<i>17<sup>th</sup> April, 2015</i>
<b>Last Date and Time for receipt of Bids</b>	<i>8<sup>th</sup> May, 2015 – upto 16.00 Hrs.</i>

The replies to the queries raised by above prospective bidders are also uploaded. It is also notified that any other bidders who comply the tender terms & conditions alongwith the subsequent amendments and have not participated in the pre-bid conference, may also submit the bid. For any queries regarding uploaded replies to the queries of prospective bidders e-mail can be sent on **mondal.amitava08@gmail.com**

**Deputy Registrar**

**AMENDMENT OF BID DOCUMENT BASED ON PRE BID DISCUSSIONS.**

Sl.No.	Tender Document	As per original BID document.	Revised after pre bid discussions
1	Page no. 21 to 23	BOQ	Refer revised BOQ
	<b>33 KV GIS</b>		
2	Page no. 24 (3.3)	Internal arc classification -AFL ( for the panels with no rear access required)	This point to be deleted.
3	Page No. 25 (4.2)A	IAC classification acc.to IEC 62271-200 : AFL	This point to be deleted.
4	Page No.26 (4.2)A	Dimensions	Dimensions as per manufacturers standard design.
5	Page No.26 (4.2)A	Properties :	As per manufacture standard design.
6	Page No.26 (5.1)	The switchgear units, incorporating vacuum circuit breakers, are to be designed for use on single busbar primary distribution systems to high current ratings.	Double Bus-bar should be considered.
7	Page No.27 (5.3)	The basic switchgear unit is to be designed for wall flush mounting. All operating & maintenance procedures shall be performed from the front , for enhanced operator safety. As an option the units can be made suitable for free standing installation within a switch room.	Floor mounting, free standing with the provision for rear access having 1000 mm clearance from panel rear side.
8	Page No.28(5.8)	Installation Facility.	As per manufacturers standard design.
9	Page No.30(8.1)	Current Transformer : (a) Out going feeder variant : C.T secondary current : 1-1-1-1A. (b) Incomer feeder variant : C.T secondary current : 1-1-1-1A. © Transformer feeder variant : C.T secondary current : 1-1-1-1A.	Current Transformer : (a) Out going feeder variant : C.T secondary current :1- 1-1A. (b) Incomer feeder variant : C.T secondary current :1- 1-1A. © Transformer feeder variant : C.T secondary current : 1-1-1A.
10	Page No.30(8.1)	Bus-coupler variant.	This point to be deleted.
11	Page No.31(8.4)	Bus VT as applicable.	Line V.T as applicable.
12	Page No.32(12)	Protection & control system.	All protective relays , Auxiliary relay and meter should be SCADA compatibility as per IEC 61850.
	<b>11 KV H.T Board</b>		
13	Page No.40(3.6)	Protection & Relays.	All protective relays,Auxiliary & meter should be SCADA compatibility as per IEC 61850.
14	Page No.45	6 MVA Transformer 33KV/11KV : (13) % Impedance at 75°C, rated current & frequency % ( subject to IS tol ) : 4. (14) No load loss at rated voltage & frequency KW (subject to IS tol ) : 1.5. (15) Load loss at rated current & 75°C , KW ( subject to IS tol ) : 13.5	6 MVA Transformer 33KV/11KV : (13) % Impedance at 75°C, rated current & frequency % ( subject to IS tol ) : 6.25. (14) No load loss at rated voltage & frequency (subject to IS tol ) : Should be minimum & as per relevant IS (15) Load loss at rated current & 75°C , ( subject to IS tol ) : Should be minimum & as per relevant IS.
15	Page No.49	1000KVA Transformer : (16) % Impedance :< 5%. (18) Iron losses at normal voltage ratio:<2.2 KW. (19) Copper losses at normal voltage ratio at full load : <12.0 KW.	1000KVA Transformer : (16) % Impedance :4.75. (18) Iron losses at normal voltage ratio:Should be minimum& as per relevant IS. (19) Copper losses at normal voltage ratio at full load : Shold be minimum & as per relevant IS.
16	Page No.61	SLD for 33/11 KV GIS sub-station	Attached revised SLD.
17	Page No.62	SLD for 11 KV switch Board. ( DSS : A )	.....Do.....
18	Page No.63	SLD for 11 KV switch Board. ( DSS : B )	.....Do.....
19	Page No.64	SLD for 440V Power control center.	.....Do.....

21	<b>New Documents Attached.</b>		
(a)			General specification for GIS.
(b)			Details of 6MVA transformer RTCC Panel.
(c)			General specification for Battery Charger.
(d)			General specification for SCADA along with articheture drawing.
(e)			General specification for CIVIL Works.

## UPGRADATION OF ELECTRICITY FOR IIT ( BHU )

**Package : " A " PART-I to be executed on Turnkey Basis.Design and supply.  
Revised BOQ for proposed 33 KV GIS and DSS (A,B)**

				PRICE (RS.)				
Sl. No	Description	Make	Quantity	Unit Rate (Rs.)	EX. Works.	E.D	Sales Tax.	FOR Site including fright Insurance
1(a)	33 KV L.A	M/S CGL/ Alostom(SEIL)	30 nos.					
(b)	33KV L.A Structure (G.I febricated)	JINDAL/TATA /SAIL	6 Sets.					
2(a)	33 KV motorised gange operated Isolator with earth switch (1250A). With febricated G.I latic structure.	M/S ABB/SIEMENS/Schneider	2Sets.					
(b)	33 KV motorised gange operated Isolator without earth switch (1250A). With febricated G.I latic stricture.	M/S ABB/SIEMENS/Schneider	2Sets.					
3	L.M tower with spike (Fabricated G.I latic structure) , L.M height 9 mtrs. With spike.	JINDAL/TATA /SAIL	3 Nos.					
4(a)	Fire fighting extinguisher required for G.I.S equipments and oil filled transformer.	CEASE Fire/Reputed make	Lot.					
(b)	Rubber mat suitable for 33KV GIS, 11KV switch board and 1.1 KV L.T Switch board	Reputed make	Lot.					
5	33 KV ,3CX300 sq mm H.T XLPE armoured Al. cable supply from 132 KV sub-station to Propose GIS .	M/S Gloster/KEI/Universal	4 Km.					
6	33 KV Armoured XLPE (3CX300 sq.mm) & 11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable ( stranded & multicore) connecting various electrical equipments inside sub-station including switch yard required for successful commissioning.	M/S Gloster/KEI/Universal	1 Lot.					
7	33 kv cable end termination , out door type (18 nos)and Indoor type (4 nos.) with holding structure complete.	M/S 3M/Raychem	22 Nos.					
8 (a )	33/11 KV GIS Sub-station ( No. of Bay - 7 ) 2 no. line, 3 nos. transformer, 1 no. out going & 1 no. bus-coupler. Inbuilt control & relay with RCS (Remote control station)	M/S ABB/SIEMENS/Schneider/L&T	7 Bays.					
(b)	Trivector meter 3ph, 4W, 3 ELE, CTR : 400-200/1A, PTR : 33KV/110V A.C for both 33 KV Incomer panel.	SEMS	2 Nos.					
9	33/11 KV ,6MVA Power Transformer .Cooling ONAN & ONAF with OLTC and RTCC.	M/S ABB/Schneider/Crompton Greaves.	2 Nos.					
10	<b>Distribution Sub-station - A ( Near GIS )</b>							
a	11KV /0.433 KV distribution sub-station ,with supply of electrical equipments . Suitable for VCB ,11 panel boards switchgear.( Horizontal Isolation )	M/S ABB/SIEMENS/Schneider	1Set.					
b	11KV/0.433V, 3 Phase, 50Hz. 1000 KVA distribution Transformer.	M/S ABB / Crompton Greaves / Schneider	2 nos.					
c	433 V, 50Hz. A.C , L.T panel suitable for 2 transformer incomer & 1 Bus-coupler and out going feeder.	M/S ABB / SIEMENS / Schneider / L&T	1 set.					

d	42A , Battery charger .(Including FCBC,DVR and DCDB )	M/S Amar raja/HBL	1 set.					
e	200Ah, 110V D.C Battery bank.( With 55 nos. cells)	M/S Amar raja/HBL	1 set.					
f	11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable ( stranded & multicore) connecting various electrical equipments inside sub-station required for successful commissioning.	M/S Gloster/KEI/Universal	1 Lot.					
g	Automatic Lighting Control Panel ( ALCP )	M/S Kybee / Jasper	1 No.					
h	433 V, 50Hz. A.C Distribution Board	M/S Kybee/Jasper	1 No.					
10	<b>Distribution Sub-station - B</b>	<b>Make</b>	<b>Quantity</b>					
a	11KV /0.433 KV distribution sub-station ,with supply of electrical equipments , Suitable for VCB, 7 panel boards switchgear.( Horizontal Isolation )	M/S ABB/SIEMENS/Schneider	1 Set.					
b	11KV/0.433V, 3 Phase, 50Hz. 1000 KVA distribution Transformer.	M/S ABB/C.G/Schneider	2 nos.					
c	433 V, 50Hz. A.C, L.T panel suitable for 2 transformer incomer & 1 Bus-couplers.	M/S ABB/SIEMENS/Schneider/L&T	1 No.					
d	25A , Battery charger .(Including FCBC,DVR and DCDB )	M/S Amar raja/HBL	1 set.					
e	100Ah, 110V D.C Battery bank. ( With 55 nos. cells)	M/S Amar raja/HBL	1 set.					
f	11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable (stranded & multicore) connecting various electrical equipments inside sub-station required for successful commissioning.	M/S Gloster/KEI/Universal	1 Lot.					
g	Automatic Lighting Control Panel ( ALCP )	M/S Kybee/Jasper	1 Nos.					
h	433 V, 50Hz. A.C Distribution Board	M/S Kybee/Jasper	1 No.					
11	Retrofitting with the help of New Horizontal Isolation VCB panel & coupler panel with existing vertical Isolation VCB panel of 800Amps. (Areva make) at Dhanaraj giri Sub-station.	M/S ABB/SIEMENS/Schneider	1 Set.					
12	Commissioning spare to be supplied for 33KV GIS & 11 KV Switchgear panels along with spare list consider.	M/S ABB/SIEMENS/Schneider	Lot.					
13	Illumination materials for GIS control room, yard, DSS-A & DSS-B ( Lux level for yard 50 lux & Indoor side 200 lux)	M/S Philips	Lot.					
14	Supply for 40 mm dia M.S rod, G.I FLAT ( 75X10 mm & 50X6 mm ) & G.I pipe electrode ( length -3 mtrs. & dia-50 mm ) for GIS Building, yard, DSS-A & DSS-B	G.I Pipe - JINDAL/TATA & Flat-Reputed party.	Lot.					
15	Supply for Air Conditioning of GIS building & control room.( 4nos. for 3 Ph. 3 Ton each, and 2 nos. for 1 Ph. 1.5 Ton each).	Voltas/Blue-star	Lot.					

Note :

- i) List of Mandatory spare for maintenance of two years with item wise price to be quoted separately.
- ii) Price for civil works, Erection, testing & commissioning shall be quoted separately.

## UPGRADATION OF ELECTRICITY FOR IIT ( BHU )

**Package : " A " PART - II to be executed on Turnkey Basis. Design, Civil Construction, Equipments Erection, Testing & Commissioning.**

**BOQ for proposed 33 KV GIS and DSS (A,B).**

Sl. No	Description	Quantity	Unit Price (Rs.)	Total Price (Rs.)
1(a)	33 KV L.A	30 nos.		
(b)	33KV L.A Structure (G.I fabricated)	6 Sets.		
2(a)	33 KV motorised gange operated Isolator with earth switch (1250A). With fabricated G.I latic structure.	2Sets.		
(b)	33 KV motorised gange operated Isolator without earth switch (1250A). With fabricated G.I latic stricture.	2Sets.		
3	L.M tower with spike (Fabricated G.I latic structure) , L.M height 9 mtrs. With spike.	3 Nos.		
4	33 KV ,3CX300 sq mm H.T XLPE armoured Al. cable laying from 132 KV sub-station to Propose GIS . (Through excavation ) Cable jointing shall be at air, including providing & fixing of 4 pole structure .(Structure height should be 7 mtrs. From ground level.)	4 Km.		
5	33 KV Armoured XLPE (3CX300 sq.mm) & 11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable ( stranded & multicore) connecting various electrical equipments inside sub-station & including switch yard and termination required for successful commissioning with all materials.	1 Lot.		
6	33 kv cable jointing for out door (18 nos.) and Indoor (4 nos) with holding structure where require for out door termination with all materials.	22 Nos.		
7	33/11 KV GIS Sub-station ( No. of Bay - 7 ) 2 no. line, 3 nos. transformer, 1 no. out going & 1 no. bus-coupler. Including RCS .	Lot.		
8	33/11 KV ,6MVA Transformer with RTCC.	2 Nos.		
9	<b>Civil construction work for GIS building, operator room , 11 KV switch room for DSS- A,( Size of the building as required), all switchyard equipments and 4 pole structure for 33 KV cable jointing.</b>	L.S		
10	<b>Distribution Sub-station - A ( near GIS )</b>			
a	Erection of 11 KV Switch board (11 panels).	1 Set.		
b	11KV/0.433V, 3 Phase, 50Hz. 1000 KVA distribution Transformer.	2 nos.		
c	433 V, 50Hz. A.C , L.T panel suitable for 2 transformer incomer & 1 Bus-coupler.	1 set.		
d	42A , Battery charger .(Including FCBC,DVR and DCDB )	1 set.		
e	200Ah, 110V D.C Battery bank.	1 set.		
f	11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable ( stranded & multicore) connecting various electrical equipments inside sub-station required for successful commissioning.	1 Lot.		
g	Automatic Lighting Control Panel ( ALCP )	1 Nos.		
h	430 V, 50Hz. A.C Distribution Board	1 No.		

10	<b>Distribution Sub-station - B</b>		
a	Erection of 11 KV Switch board (7 panels).	1 set.	
b	11KV/0.433V, 3 Phase, 50Hz. 1000 KVA distribution Transformer.	2 nos.	
c	433 V, 50Hz. A.C , L.T panel suitable for 2 transformer incomer & 1 Bus-coupler.	1 set.	
d	25A , Battery charger .(Including FCBC,DVR and DCDB )	1 set.	
e	100Ah, 110V D.C Battery bank.	1 set.	
f	11 KV XLPE Armoured cable AL. conductor (3CX185sq.mm), 1.1KV PVC Armoured AL. conductor cable , 1.1 KV grade PVC copper armoured control cable ( stranded & multicore) connecting various electrical equipments inside sub-station required for successful commissioning.	1 Lot.	
g	Automatic Lighting Control Panel ( ALCP )	1 No.	
h	433 V, 50Hz. A.C Distribution Board	1 No.	
i	<b>Civil construction work for control room building &amp; Transformer room for DSS - B . Building size as required.</b>	1 Lot.	
11	Retrofitting with the help of New Horizontal Isolation VCB panel & coupler panel with existing vertical Isolation VCB panel of 800Amps. (Areva make) at Dhanaraj giri Sub-station.	1 Set.	
13	Illumination of GIS control room, yard, DSS-A & DSS-B and associated cabling work( Lux level for yard 50 lux & Indoor side 200 lux)	1 Lot.	
14	Earthing station work with G.I FLAT ( 75X10 mm & 50X6 mm) ,40 mm dia M.S rod & G.I pipe electrode ( length -3 mtrs. & dia-50 mm ) for GIS Building, yard, DSS-A & DSS-B	1Lot.	
15	Erection of Air Conditioners including cabling work.	1 Lot.	

Note :

- 1- Erection, testing & commissioning, include nut bolts, glands, termination kit, painting, gas , electrode all others consumable materials required for successful commissioning is within the bidder scope.
- 2- Income Tax @ 2% Trade Tax @ 5 % shall be deducted from bill.

## UPGRADATION OF ELECTRICITY FOR IIT ( BHU )

Package : " A " ( PART - III ) to be executed on Turnkey Basis. Design, manufacturing, supply & ETC.

**SCADA for proposed 33 KV GIS , DSS-A, DSS-B, and OLD IIT DSS.**

Sl. No	Description		Unit Price (Rs.)	Total Price (Rs.)
1 (a)	SCADA as per general specifications attached with architecture drawing for GIS, DSS-A, DSS-B with cabling (length-1.2 Km) ,as per route shown in lay out.	Lot.		
1(b)	SCADA as per general specifications attached with architecture drawing for existing IT (OLD) sub-station including replacement of existing relays, meter with new relays & meters laising SCADA compatibility as per IEC 61850 including cabling work as per location of existing sub-station shown in the lay out.	Lot.		



**GENERAL SPECIFICATION OF GIS, RTCC**  
**33KV GIS**

Sl. No.	Description	Comments
1	SLD	Revised as per required enclosed SLD.
2	Body	We do prefer GIS of Steel body thickness not less than 2mm.
3	Internal ARC Fault	Should be as per IEC 62271-200 AFLR / Rear access should be provided for GIS Panel with free floor standing.
4	Bus bar rating	2000A
5	Breaker rating	1250A
6	Designed voltage	36kV
7	Rated operating voltage	33kV
8	Short time rating	31.5 KA/3Sec.
9	SF-6 Gas pressure control	As per manufacturer's standard practice. But justification to be furnished.
10	Voltage indication	Alarm/JVIS shall be as per manufacturer's standard practice.
11	Provision for releasing pressure	Shall be as per manufacturer's standard practice.
12	Double bus bar (copper)	Double bus bar with Electrical & Mechanical interlock.
13	Bus bar joints Copper Bus bar	Shall be as per manufacturer's standard design. However proper justification for method of Busbar joint considered to explain.
14	Gas compartment	Separate Gas chamber for BB 3position switch, CB is preferred and however manufacturers may quote as per standard manufacturer's design giving proper justification.
15	Inter panel Bus bar Unit Bus bar joint	Preferred to be inside Gas chamber, however any deviation by manufacturer, proper justification to be submitted.
16	Cable connection	Provision for 2Run, 3 core x 300 Sqmm. but in practice 1Run, 3core x 300 Sqmm. XLPE armoured cable Al. conductor.
17	Power cable connection	Front or back as per manufacturer's standard practice. However voltage indication shall be in front of the panel.
18	Mounting	Floor mounting, free standing.
19	P.T.	Should be in incomer. Mounting shall be as per manufacturer's standard design.
20	C.T.	Mounting shall be as per manufacturer's standard design.
21	Isolator inside the SF6 Gas will be motorised / manual to be confirm.	
22	33KV GIS Panel Local/Remote position available/not.	
23	33KV GIS	RCS required.
24	33KV P.T. (Incomer Feeder)	Location should be confirmed.
25	Fire fighting equipment required as per GIS Substation.	
26	Lightning must required for open switchyard (03 Nos.)	
27	33KV Grange operated isolator/isolator with earthing switch required for open switchyard (04 sets).	
28	TVM is required for energy reading in both the 33 KV Incomer panel.	

## **RTCC Panel 6MVA Transformer**

Make shall be as per manufacturer of Transformer. The following facility shall be included in the Panel.

1. Lamp for AC supply.
2. Lamp for Tap changing in progress.
3. 8-point Facia Annunciator with alarm accepts reset, test & silence PB (micro processor board).
4. Voltage indication plate for T.
5. Tap position indicator (Digital).
6. Sequence selector switch.
7. Tap changer supply switch ON-OFF.
8. Isolator switches for 110V DC supply.
9. OLTC control selector – Auto manual.
10. Raise push button.
11. Lower push button.
12. Heater switch.
13. Automatic voltage regulating relay.
14. Door switch for illumination lamp.
15. Door handles with central lock & key.
16. Out of step relay.
17. Time delay relay.
18. Hooter for fault in Annunciator.
19. Motor protection timer.
20. HRC fuse.
21. HRC fuses for DC circuit.
22. Time.
23. Buzzer for tap changing in progress.
24. Cable holding bracket.
25. Illuminating lamp.
26. Spare heater.
27. Flexible link for earthing.
28. Detachable gland plate (undrilled).
29. Remote temp indicator for RWTI, HV&LV (Digital type).
30. Selector switch for RWTI, HV&LV.
31. LED for Fans control supply on, Fans manual, Fans auto, Fan-1 to Fan-n – ON (Red) Fan-1 to Fan-n – Trip (Green).
32. Fan control switch.
33. Panel is suitable for VERMIN Proof (IP-52) sheet thickness – 2mm. CRCA sheet, louvers.

## **Battery Charger :-**

### **GENERAL DESCRIPTION**

The Float Cum Boost Charger basically consists of one Three phase double wound Charger input transformer, Rectifier power Bridge, Charger Control Card, LC Filter circuit, Auto/Float/Boost Charging mode selector switch, AC Input circuit breakers, DC output Switch-Fuse Protection. With In built DCDB Feeders.

The Charger is manufactured utilizing thyristers which are connected in full wave full controlled bridge configuration. The Charger output voltage regulation and over load drooping characteristics are achieved by care fully determining the precise moment to fire the thyristers by supplying proper gate pulses. Charger control card accomplishes this function.

The charger works on Three phase, 50Hz supply. The Charger is capable of delivering full rated current at the specified voltage at output terminals. This voltage is maintained for an AC input voltage variations of +/-10% and load current variations from 0 to 100% of rated full load.

The Charger charges the battery in Auto or Manual Float or Manual Boost modes depending on the mode selector switch position. In auto mode, the battery shall be charged either in float or boost mode depending on the battery charging current, when charging current exceeds a preset value Charger operates in boost mode, and when charging current comes down to a preset value Charger operates in float mode automatically.

All these circuits and DCDB are housed in a single cabinet of folded sheet steel construction. All the meters, indications, pushbuttons and control & switches are brought on to the front panel.

## TECHNICAL SPECIFICATION OF CHARGER

Scheme	:	FLOAT CUM BOOST CHARGER
RATING	:	110V/42A suitable for 110V/200AH VRLA battery of 55 Cells.
AC INPUT	:	
Voltage	:	415V AC $\pm$ 10%.
Frequency	:	50Hz $\pm$ 5%.
Phase	:	Three phase, 3-wire.
DC OUTPUT	:	
Float voltage	:	123.75V DC (55X2.25V/Cell) adjustable by +2%, -5%.
Boost voltage	:	126.5V DC (55 X 2.3V/Cell) adjustable by +2%, -5%.
Regulation	:	Better than $\pm$ 1% of set value.
Ripple	:	<1% Peak to Peak.
Current	:	42A
System Output	:	121.0 + 1% after dropper diode circuit.
METERS	:	Following analog type meters of 96*96 Sq.mm with 90 <sup>0</sup> deflection are provided in the system for measuring the respective parameters. <ol style="list-style-type: none"><li>DC voltmeter with selector switch to measure voltage across charger output, battery input and load terminals.</li><li>DC ammeter to measure current at charger output.</li><li>AC voltmeter with selector switch to measure current in each phase.</li><li>AC ammeter with selector switch to measure current in each phase.</li></ol>
INDICATION	:	Pilot lamps are provided at AC input for mains available condition, LED' indicators are provided for the following conditions with audio alarm abnormal conditions. <ol style="list-style-type: none"><li>AC mains fail.</li><li>Rectifier fuse fail.</li><li>Charger fail.</li><li>DC over voltage.</li><li>DC under voltage.</li><li>Float ON.</li><li>Boost ON.</li></ol>

**Note :** Group Alarm Potential Free Contacts will be provided for Remote Alarm and the same will be wired to a terminal block for Customer remote connection.

PROTECTION	:	Following protections are provided in the system.
		<ul style="list-style-type: none"> <li>a. AC input Circuit Breaker.</li> <li>b. DE output Switch-Fuse.</li> <li>c. Fast semiconductor fuses for rectifier bridge.</li> <li>d. DC over voltage cutback.</li> <li>e. Charger over load/short circuit.</li> <li>f. Battery charging current limit.</li> <li>g. Blocking diode.</li> </ul>
CONTROLS & SWITCHES	:	Following controls & switches are provided in the system.
		<ul style="list-style-type: none"> <li>a. AC input Circuit Breakers.</li> <li>b. DC output Switch-fuse.</li> <li>c. Auto/Float/Boost mode selector switch.</li> <li>d. Float &amp; Boost voltage variable potentiometer.</li> <li>e. Manual voltage adjustment potentiometer.</li> <li>f. Battery current adjust potentiometers.</li> <li>g. Alarm silence and lamp test push buttons.</li> <li>h. Heater, door lamp and socket power supply switch.</li> <li>i. AC voltage &amp; Amps selector switch.</li> <li>j. DC voltage selector switch.</li> </ul>
SPECIAL FEATURES	:	The following features are provided in the system.
		<ul style="list-style-type: none"> <li>a. Soft start on DC side.</li> <li>b. Class-F insulation for all magnetic.</li> <li>c. Filter circuit to eliminate ripple.</li> <li>d. Charger current limit.</li> <li>e. Built in auto phase reversal of operation.</li> <li>f. Battery path current limit.</li> </ul>
DCDB	:	In-built DC Distribution Board.
Incoming feeder	:	100Amp_ 2P – MCCB – 1 No.
Outgoing feeders	:	16Amp – 2P – MCB – 10 Nos.
	:	32Amp – 2P – MCB – 6 Nos.
<b>General</b>	:	
Cabinet construction	:	Free standing cabinet, floor mounting type, sheet steel easy access for installation and maintenance, cable entry at bottom.
Paint	:	Surface treatment – 7 tank process according to IS 6005, Class C Shade – RAL 7032 Painting process – Powdered coating Finish – Texture.
Protection	:	IP – 42 as per IS 13947.
Ambient Temperature range of operation	:	0-50 Deg. C
Relative humidity	:	0-95% non-condensing.

## TECHNICAL SPECIFICATION OF BATTERY CHARGER

Scheme	:	FLOAT CUM BOOST CHARGER
RATING	:	110V/25A suitable for 110V/100AH VRLA battery of 55 Cells.
AC INPUT	:	
Voltage	:	415V AC $\pm$ 10%.
Frequency	:	50Hz $\pm$ 5%.
Phase	:	Three phase, 3-wire.
DC OUTPUT	:	
Float voltage	:	123.75V DC (55X2.25V/Cell) adjustable by +2%, -5%.
Boost voltage	:	126.5V DC (55 X 2.3V/Cell) adjustable by +2%, -5%.
Regulation	:	Better than $\pm$ 1% of set value.
Ripple	:	<1% Peak to Peak.
Current	:	25A
System Output	:	121.0 + 1% after dropper diode circuit.
METERS	:	Following analog type meters of 96*96 Sq.mm with 90 <sup>0</sup> deflection are provided in the system for measuring the respective parameters. <ol style="list-style-type: none"><li>DC voltmeter with selector switch to measure voltage across charger output, battery input and load terminals.</li><li>DC ammeter to measure current at charger output.</li><li>AC voltmeter with selector switch to measure current in each phase.</li><li>AC ammeter with selector switch to measure current in each phase.</li></ol>
INDICATION	:	Pilot lamps are provided at AC input for mains available condition, LED' indicators are provided for the following conditions with audio alarm abnormal conditions. <ol style="list-style-type: none"><li>AC mains fail.</li><li>Rectifier fuse fail.</li><li>Charger fail.</li><li>DC over voltage.</li><li>DC under voltage.</li><li>Float ON.</li><li>Boost ON.</li></ol>

**Note :** Group Alarm Potential Free Contacts will be provided for Remote Alarm and the same will be wired to a terminal block for Customer remote connection.

PROTECTION	:	Following protections are provided in the system. <ol style="list-style-type: none"><li>AC input Circuit Breaker.</li><li>DE output Switch-Fuse.</li><li>Fast semiconductor fuses for rectifier bridge.</li><li>DC over voltage cutback.</li><li>Charger over load/short circuit.</li><li>Battery charging current limit.</li><li>Blocking diode.</li></ol>
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CONTROLS & SWITCHES	:	<p>Following controls &amp; switches are provided in the system.</p> <ol style="list-style-type: none"> <li>a. AC input Circuit Breakers.</li> <li>b. DC output Switch-fuse.</li> <li>c. Auto/Float/Boost mode selector switch.</li> <li>d. Float &amp; Boost voltage variable potentiometer.</li> <li>e. Manual voltage adjustment potentiometer.</li> <li>f. Battery current adjust potentiometers.</li> <li>g. Alarm silence and lamp test push buttons.</li> <li>h. Heater, door lamp and socket power supply switch.</li> <li>i. AC voltage &amp; Amps selector switch.</li> <li>j. DC voltage selector switch.</li> </ol>
SPECIAL FEATURES	:	<p>The following features are provided in the system.</p> <ol style="list-style-type: none"> <li>a. Soft start on DC side.</li> <li>b. Class-F insulation for all magnetic.</li> <li>c. Filter circuit to eliminate ripple.</li> <li>d. Charger current limit.</li> <li>e. Built in auto phase reversal of operation.</li> <li>f. Battery path current limit.</li> </ol>
DCDB	:	In-built DC Distribution Board.
Incoming feeder	:	63Amp – 2P – MCCB – 1 No.
Outgoing feeders	:	16Amp – 2P – MCB – 6 Nos.
	:	32Amp – 2P – MCB – 4 Nos.
<b>General</b>	:	
Cabinet construction	:	Free standing cabinet, floor mounting type, sheet steel easy access for installation and maintenance, cable entry at bottom.
Paint	:	Surface treatment – 7 tank process according to IS 6005, Class C Shade – RAL7032 Painting process – Powdered coating Finish – Texture.
Protection	:	IP – 42 as per IS 13947.
Ambient Temperature		
Range of operation	:	0-50 Deg. C
Relative humidity	:	0-95% non-condensing.

## Civil work for Substation

### Civil Work :-

1. Civil construction shall be as per latest National building code.
2. Size of the building/Room should accommodate all the electrical panel keeping clearance as per electricity rule.
3. Layout of building, Design & drawing shall be approved by IIT(BHU) before construction.
4. Building shall be RCC Frame structure.
5. Doors & windows shall be made of steel angle frame of 6mm. thick and sheet steel shall be 3mm. thick with required stiffeners. Equipment door shall rolling shutter (Manual operated).
6. One toilet of (5' x 8' approx.), one rest room (11'x14' approx.) and one store room (10'x12') to be constructed in the Main substation.
7. 1000mm. clearance should be given on the back side of the panel.
8. Minimum 1.25 Mtr. clearance between bottom of roof beam to top of a panel.
9. Plinth height – 900mm. from existing ground level.
10. Soil bearing capacity 10MT/M<sup>2</sup> at 1.5 Mtr. Depth of existing soil (Soil test to be done at site before design).
11. Exterior Painting : Weather coat acrylic.  
Interior Painting : Oil bound Distemper.
12. Roof treatment : With brick coba.
13. Window opening as per site condition.
14. Foundation depth is minimum 1500mm. from OGL.
15. Rain water discharge = PVC pipe (100mm. dia) with other fittings.
16. Ramp & stair shall be as per requirement of site to finalize during design stage.
17. Trench cover : Inside substation Building : MS chequered plate of 70.P.  
Outside Building/Yard : RCC slab cover of adequate thickness as per site condition.
18. RCC fire wall shall be considered in between two transformers.
19. Operator's Room shall house RCS for 33KV GIS, 11KV Board & SCADA console, RTCC (6MVA Transformers).
20. Water charges 1% of civil cost and electricity charges shall be as per actual consumption shall be deducted from bills.
21. Same building for 33KV GIS, 11KV substation (DSS-A) (with 1000KVA Transformer 2Nos.) & SCADA Room cum operator's room.
22. DSS-B building (unmanned substation) shall house 11KV Switch board, 02 Nos. 1000KVA transformers, LT Board, ACDB & other electrical accessories/Panel.
23. Concrete in RCC should be M-25 design mix with maximum water cement ratio = 0.5.
24. Primary steel made of SAIL/TATA/Jindal is to be used.
25. Make of Cement : ACC/JP/Birla Gold/PRISM.
26. Type of Cement & Grade : OPC/PPC. (OPC, Grade : 43)
27. Grade of PCC : 1:3:6.
28. Factor of safety for design: As per IS 456.
29. Rain water harvesting system to be considered on the substation buildings.
30. One mono rail with lifting tools if required for maintenance point to be considered in GIS room.



# TECHNICAL SPECIFICATIONS OF SCADA

## Design Philosophy

The Control & Supervision SCADA System comprises of:

- **Main Supervision System:** Based on Client / Server Architecture, this system is the single window to monitor & control the entire Electrical System (in Tender Scope) upto ACB Level. Detailed Specs shall be as per Tender Documents.
- **Fiber Optic network/ring** shall be part of SCADA Scope.
- All **11 kV & 33 kV** for new substations and in existing substation (only one IIT Old) supervision & control of meters & 11KV breakers to consider with Main relays on IEC 61850 protocols shall be communicating to RTU/Data Concentrator via IEC 61850 Ethernet Switches. Similarly all Hard Wired IOs for Circuit Breaker, Battery Charger etc. shall be connected to same RTU/Data Concentrator (Specs as per Tender Documents). RTU/Data Concentrator shall be connected with all meters (on Modbus Serial Protocol). RTU/Data Concentrator shall be hooked on FO Network/Ring via Router/LAN Switch.
- Control Room shall have redundant SCADA Server, Printer, Engineering Workstation, Operator Workstation & Maintenance Laptop.

## Technical Specs:

### SUBSTATION AUTOMATION SYSTEM (SAS):

1. The Substation Automation System (SAS) shall be installed to control and monitor all the sub-station equipment from Central control room
2. The SAS shall contain the following main functional parts:
  - Bay control Intelligence Electronic Devices (IED s) for control and monitoring.
  - Station Human Machine Interface (HMI)
  - Redundant managed switched Ethernet Local Area Network communication infrastructure with hot standby.
  - Peripheral equipment like printers, display units, key boards, Mouse etc.

## System design

### General system design

The Substation Automation System (SAS) shall be suitable for operation and monitoring of the complete substation.

The systems shall be of the state-of-the art suitable for operation under electrical environment present in substations, follow the latest engineering practice, ensure long-term compatibility requirements and continuity of equipment supply and the safety of the operating staff.

The offered SAS shall support remote control and monitoring from Remote Control centers via gateways.

The system shall incorporate the control, monitoring and protection functions specified, self-monitoring, signaling and testing facilities, measuring as well as memory functions, event recording and evaluation of disturbance records.

Maintenance, modification or extension of components may not cause a shutdown of the whole substation automation system. Self-monitoring of components, modules and communication shall be incorporated to increase the availability and the reliability of the equipment and minimize maintenance.

## **System architecture**

The SAS shall be based on a decentralized architecture and on a concept of bay-oriented, distributed intelligence.

Functions shall be decentralized, object-oriented and located as close as possible to the process.

The main process information of the station shall be stored in distributed databases. The typical SAS architecture shall be structured in two levels, i.e. in a station and a bay level.

At bay level, the IEDs shall provide all bay level functions regarding control, monitoring and protection, inputs for status indication and outputs for commands. The IEDs should be directly connected to the switchgear without any need for additional interposition or transducers.

Each bay control IED shall be independent from each other and its functioning shall not be affected by any fault occurring in any of the other bay control units of the station.

The data exchange between the electronic devices on bay and station level shall take place via the communication infrastructure. This shall be realized using fibre-optic cables, thereby guaranteeing disturbance free communication. The fibre optic cables shall be armoured.

Data exchange is to be realised using IEC 61850 protocol with a redundant managed switched Ethernet communication infrastructure. The communication shall be made in fault tolerant ring in redundant mode, excluding the links between individual bay IEDs to switch wherein the redundant connections are not envisaged, such that failure of one set of fiber shall not affect the normal operation of the SAS. However failure of fiber shall be alarmed in SAS. Each fiber optic cable shall have four (4) spare fibers. At station level, the entire station shall be controlled and supervised from the station HMI. It shall also be possible to control and monitor the bay from the bay level equipment at all times.

The GPS time synchronising signal for the synchronization of the entire system shall be provided.

### **FUNCTIONAL REQUIREMENTS**

The high-voltage apparatus within the station shall be operated from different places:

- Station HMI.
- Local Bay controller IED (in the bays)

Operation shall be possible by only one operator at a time.

The operation shall depend on the conditions of other functions, such as interlocking, synchrocheck, etc.

#### *Select-before-execute*

For security reasons the command is always to be given in two stages: selection of the object and command for operation under all mode of operation except emergency operation. Final execution shall take place only when selection and command are actuated.

#### *Command supervision*

Bay/station interlocking and blocking Software Interlocking is to be provided to ensure that inadvertent incorrect operation of switchgear causing damage and accidents in case of false operation does not take place. In addition to software interlocking hardwired interlocking are to be provided for:

- (a) Bus Earth switch Interlocking
- (b) Transfer Bus interlocking (if applicable)

It shall be a simple layout, easy to test and simple to handle when upgrading the station with future bays. For software interlocking the bidder shall describe the scenario while an IED of another bay is switched off or fails. A software interlock override function shall be provided which can be enabled to bypass the interlocking function.

#### *Run Time Command cancellation*

Command execution timer (configurable) must be available for each control level connection. If the control action is not completed within a specified time, the command should get cancelled.

### *Self-supervision*

Continuous self-supervision function with self-diagnostic feature shall be included.

### *User configuration*

The monitoring, controlling and configuration of all input and output logical signals and binary inputs and relay outputs for all built-in functions and signals shall be possible both locally and remotely.

It shall also be possible to interconnect and derive input and output signals, logic functions, using built-in functions, complex voltage and currents, additional logics (AND-gates, OR gates and timers). (Multiactivation of these additional functions should be possible). The Functional requirement shall be divided into following levels:

- a. Bay (a bay comprises of one circuit breaker and associated disconnecter, earth switches and instrument transformer) Level Functions
- b. System Level Functions

### *Bay level functions*

In a decentralized architecture the functionality shall be as close to the process as possible. In this respect, the following functions can be allocated at bay level:

Bay control functions including data collection functionality in bay control/protection unit.

Bay protection functions

Separate IEDs shall be provided for bay control function and bay protection function.

## **Bay control functions**

### **Overview**

#### Functions

- Control mode selection
- Select-before-execute principle
- Command supervision:
- Interlocking and blocking
- Double command
- Run Time Command cancellation
- Transformer tap changer control (Raise and lower of tap ) (for power transformer bays)
- Digital Input Module with voltage (110V DC) & peak current (25mA max.) capability
- Operation counters for circuit breakers
- Breaker position indication
- Alarm annunciation
- Supply input from Dual Source with Automatic Source Switch feature
- Embedded Maintenance Web Server
- Measurement display
- Local HMI (local guided, emergency mode)
- Interface to the station HMI.
- Data storage for at least 200 events
- Extension possibilities with additional I/O's inside the unit.

## **System level functions**

### *Status supervision*

The position of each switchgear, e.g. circuit breaker, isolator, earthing switch, transformer tap changer etc., shall be supervised continuously. Every detected change of position shall be immediately displayed in the single-line diagram on the station HMI screen, recorded in the event list, and a hard copy printout shall be produced. Alarms shall be initiated in the case of spontaneous position changes.

The switchgear positions shall be indicated by two auxiliary switches, normally closed (NC) and normally open (NO), which shall give ambivalent signals. An alarm shall be initiated if these position indications are inconsistent or if the time required for operating mechanism to change position exceeds a predefined limit.

### *Measurements*

The analogue values acquired/calculated in bay control/protection unit shall be displayed locally on the station HMI and in the control centre.

The abnormal values must be discarded. The analogue values shall be updated every 2 seconds.

Threshold limit values shall be selectable for alarm indications.

### *Event and alarm handling*

Events and alarms are generated either by the switchgear, by the control IEDs, or by the station level unit.

They shall be recorded in an event list in the station HMI. Alarms shall be recorded in a separate alarm list and appear on the screen. All, or a freely selectable group of events and alarms shall also be printed out on an event printer. The alarms and events shall be time-tagged with a time resolution of 1 ms.

#### ○ **Station HMI**

### *Substation HMI Operation:*

On the HMI the object has to be selected first. In case of a blocking or interlocking conditions are not met, the selection shall not be possible and an appropriate alarm annunciation shall occur. If a selection is valid the position indication will show the possible direction, and the appropriate control execution button shall be pressed in order to close or open the corresponding object.

Control operation from other places (e.g. REMOTE) shall not be possible in this operating mode.

SCADA HMI should run on Windows 7 operating system and have advanced graphical features like zooming, cluttering, de-cluttering & NERC-CIP compliant Cyber Security. SCADA should have IEC 61850 compliant Advanced Engineering Tool to Identify SLD components & auto import all of them in one shot from any single line diagram (bmp, png, jpeg, autocad etc<.) etc., Self evaluation & self configuration of IEDs for Substation Augmentation, Create the IEC61850 data flow among various IEDs & generate their own ICD & SCD files based on the SLD for upcoming substations, System performance evaluation considering data flow (report & Goose) from various IEDs in a substation with different type of architectures & criticality's.

### **Presentation and dialogues**

#### *General*

The operator station HMI shall be a redundant with hot standby and shall provide basic functions for supervision and control of the substation. The operator shall give commands to the switchgear on the screen via mouse clicks.

The HMI shall give the operator access to alarms and events displayed on the screen. Aside from these lists on the screen, there shall be a printout of alarms or events in an event log.

An acoustic alarm shall indicate abnormalities, and all unacknowledged alarms shall be accessible from any screen selected by the operator.

The following standard pictures shall be available from the HMI:

- ✓ Single-line diagram showing the switchgear status and measured values
- ✓ Control dialogues with interlocking or blocking information details.

This control dialogue shall tell the operator whether the device operation is permitted or blocked.

- ✓ Measurement dialogues
- ✓ Alarm list, station / bay-oriented
- ✓ Event list, station / bay-oriented
- ✓ System status

#### *HMI design principles*

Consistent design principles shall be adopted with the HMI concerning labels, colors, dialogues and fonts.

Non-valid selections shall be dimmed out.

The object status shall be indicated using different status colors for:

- ✓ Selected object under command
- ✓ Selected on the screen
- ✓ Not updated, obsolete values, not in use or not sampled
- ✓ Alarm or faulty state
- ✓ Warning or blocked
- ✓ Update blocked or manually updated
- ✓ Control blocked
- ✓ Normal state

- Process status displays and command procedures

The process status of the substation in terms of actual values of currents, voltages, frequency, active and reactive powers as well as the positions of circuit breakers, isolators and transformer tap-changers shall be displayed in the station single-line diagram.

In order to ensure a high degree of security against undesired operation, a "select-before-execute" command procedure shall be provided. After the "selection" of a switch, the operator shall be able to recognize the selected device on the screen, and all other switchgear shall be blocked.

As communication between control centre and device to be controlled is established, the operator shall be prompted to confirm the control action and only then final execute command shall be accepted. After the "execution" of the command the operated switching symbol shall flash until the switch has reached its new position.

The operator shall be in a position to execute a command only, if the switch is not blocked and if no interlocking condition is going to be violated. The interlocking statements shall be checked by the interlocking scheme implemented at bay and station level.

After command execution the operator shall receive a confirmation that the new switching position has been reached or an indication that the switching procedure was unsuccessful with the indication of the reason for non-functioning.

#### *System supervision & display*

The SAS system shall be comprehensively self-monitored such that faults are immediately indicated to the operator, possibly before they develop into serious situations. Such faults are recorded as a faulty status in a system supervision display. This display shall cover the status of the entire substation including all switchgear, IEDs, communication infrastructure and remote communication links, and printers at the station level, etc.

#### *Event list*

The event list shall contain events that are important for the control and monitoring of the substation. The event and associated time (with 1 ms resolution) of its occurrence has to be displayed for each event.

The operator shall be able to call up the chronological event list on the monitor at any time for the whole substation or sections of it. A printout of each display shall be possible on the hard copy printer.

The events shall be registered in a chronological event list in which the type of event and its time of occurrence are specified. It shall be possible to store all events in the computer for at least one month. The information shall be obtainable also from a printed event log.

The chronological event list shall contain:

- ✓ Position changes of circuit breakers, isolators and earthing devices
- ✓ Indication of protective relay operations
- ✓ Fault signals from the switchgear
- ✓ Indication when analogue measured values exceed upper and lower limits. Suitable provision shall be made in the system to define two level of alarm on either side of the value or which shall be user defined for each measurands.
- ✓ Loss of communication.

Filters for selection of a certain type or group of events shall be available. The filters shall be designed to enable viewing of events grouped per:

- ✓ Date and time
- ✓ Bay
- ✓ Device
- ✓ Function e.g. trips, protection operations etc.
- ✓ Alarm class

#### *Alarm list*

Faults and errors occurring in the substation shall be listed in an alarm list and shall be immediately transmitted to the control centre. The alarm list shall substitute a conventional alarm tableau, and shall constitute an evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults. The date and time of occurrence shall be indicated.

The alarm list shall consist of a summary display of the present alarm situation. Each alarm shall be reported on one line that contains:

- ✓ The date and time of the alarm
- ✓ The name of the alarming object
- ✓ A descriptive text
- ✓ The acknowledgement state.

Whenever an alarm condition occurs, the alarm condition must be shown on the alarm list and must be displayed in a flashing state along with an audible alarm. After acknowledgement of the alarm, it should appear in a steady (i.e. not flashing) state and the audible alarm shall stop. The alarm should disappear only if the alarm condition has physically cleared and the operator has reset the alarm with a reset command. The state of the alarms shall be shown in the alarm list (Unacknowledged and persistent, Unacknowledged and cleared, Acknowledged and persistent).

Filters for selection of a certain type or group of alarms shall be available as for events.

### *Object picture*

When selecting an object such as a circuit breaker or isolator in the single-line diagram, the associated bay picture shall be presented first. In the selected object picture, all attributes like

- ✓ Type of blocking
- ✓ Authority
- ✓ Local / remote control
- ✓ RSCC / SAS control
- ✓ Errors etc shall be displayed.

### *Control dialogues*

The operator shall give commands to the system by means of mouse click located on the single-line diagram. Data entry is performed with the keyboard. Dedicated control dialogues for controlling at least the following devices shall be available:

- ✓ Breaker and disconnecter
- ✓ Transformer tap-changer

### *User-authority levels*

It shall be possible to restrict activation of the process pictures of each object (bays, apparatus...) within a certain user authorisation group.

Each user shall then be given access rights to each group of objects, e.g.:

- ✓ Display only
- ✓ Normal operation (e.g. open/close of switchgear)
- ✓ Restricted operation (e.g. by-passed interlocking)
- ✓ System administrator

For maintenance and engineering purposes of the station HMI, the following authorisation levels shall be available:

- ✓ No engineering allowed
- ✓ Engineering/configuration allowed
- ✓ Entire system management allowed

The access rights shall be defined by passwords assigned during the log-in procedure. Only the system administrator shall be able to add/remove users and change access rights.

### *Reports*

The reports shall provide time-related follow-ups of measured and calculated values. The data displayed shall comprise:

- ✓ Trend reports:
  - Day (mean, peak)
  - Month (mean, peak)
  - Semi-annual (mean, peak)
  - Year (mean, peak)

- ✓ Historical reports of selected analogue Values:
  - Day (at 15 minutes interval)
  - Week
  - Month
  - Year

It shall be possible to select displayed values from the database in the process display on-line. Scrolling between e.g. days shall be possible. Unsure values shall be indicated. It shall be possible to select the time period for which the specific data are kept in the memory.

Following printouts shall be available from the printer and shall be printed on demand:

- i. Daily voltage and frequency curves depicting time on X-axis and the appropriate parameters on the Y-axis. The time duration of the curve is 24 hours.
- ii. Weekly trend curves for real and derived analogue values.
- iii. Printouts of the maximum and minimum values and frequency of occurrence and duration of maximum and minimum values for each analogue parameter for each circuit in 24 hr period.
- iv. Provision shall be made for logging information about breaker status like number of operation with date and time indications along with the current value it interrupts (in both condition i.e. manual opening and fault tripping)
- v. Equipment operation details shift wise and during 24 hours.
- vi. Printout on adjustable time period as well as on demand for MW, MVAR, Current, Voltage on each feeder and transformer as well as Tap Positions, temperature and status of pumps and fans for transformers.
- vii. Printout on adjustable time period as well as on demand system frequency and average frequency.
- viii. Reports in specified formats which shall be handed over to successful bidder. The bidder has to develop these reports. The reports are limited to the formats for which data is available in the SAS database.

#### *Trend display (historical data)*

It shall be possible to illustrate all types of process data as trends – input and output data, binary and analogue data. The trends shall be displayed in graphical form as column or curve diagrams with a maximum of 10 trends per screen. Adjustable time span and scaling ranges must be provided.

It shall be possible to change the type of value logging (direct, mean, sum, or difference) on-line in the window. It shall also be possible to change the update intervals on-line in the picture as well as the selection of threshold values for alarming purposes.

#### *Automatic disturbance file transfer*

All recorded data from the IEDs with integrated disturbance recorder as well as dedicated disturbance recording systems shall be automatically uploaded (event triggered or once per day) to a dedicated computer and be stored on the hard disc.

#### *Disturbance analysis*

The PC-based work station shall have necessary software to evaluate all the required information for proper fault analysis.

#### *IED parameter setting*

It shall be possible to access all protection and control IEDs for reading the parameters (settings) from the station HMI or from a dedicated monitoring computer. The setting of parameters or the activation of parameter sets shall only be allowed after entering a password.

#### *Automatic sequences*

The available automatic sequences in the system should be listed and described, (e.g. sequences related to the bus transfer). It must be possible to initiate pre-defined automatic sequences by the operator and also define new automatic sequences

## Cyber Security:

### Implementation

Following measures have been implemented:

- Four level access,
- Password strengthening,
- Disabling of unused application and physical ports,
- Inactivity timer,
- Storage of security events,
- NERC-compliant default display.

### Standards

Shall be as per international/Indian standard to mention bidder in their offer.

### ❖ LIST OF EQUIPMENTS

Quantity of equipments shall be decided by bidder in order to achieve guaranteed reliability and availability as declared by bidder.

- i) Station HMI
- ii) Redundant Station HMI (in Hot-standby mode)
- iii) Bay level units along with bay mimic.
- iv) Disturbance Recorder Work Station (Maintenance HMI)
- v) Colour Laser Printer – 1 No. (For Reports & Disturbance records)
- vi) Communication infrastructure between Bay level units, Station HMI, Printers, redundant LAN etc. as required