

Annexure-7: ECS I/O list

**TYPICAL ECS I/O LIST FOR
FOR DIFFERENT TYPE OF FEEDERS
ECS SYSTEM**

**CAPTIVE POWER PLANT (CPP) PACKAGE
TENDER NO. B016-606-02-43-PG-T-7810**

PROJECT : VISAKH REFINERY MODERNISATION PROJECT

UNIT : 606

OWNER : HPCL VISAKHAPATNAM

PMC : EIL

JOB NO. : B016

A	18.05.2017	ISSUED WITH TENDER	GK	AS	PG
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

Generator Transformer, SCAP, GTG/STG

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
SCAP / ECS Selector Switch					
DI	S	Control from	SCAP	Not_SCAP	Hardwired
DI	S	Control from	ECS	Not_ECS	Hardwired
Generator Synchronisation Selector Switch					
DI	S	Control from	Local (TCP)	Not_Local	Hardwired
DI	S	Control from	Remote (SCAP / ECS)	Not_Remote	Hardwired
Load shed Command Signals from ECS					
DI	S	Load Shed Block-1	Operated	Reset	Hardwired
DI	S	Load Shed Block-2	Operated	Reset	Hardwired
DI	S	Load Shed Block-n	Operated	Reset	Hardwired
Generator Transformers					
DI	S	Trafo OCTC Tap at each tap position			Hardwired signal for each tap position
AI	T	Oil temperature (4-20 mA) (see note 7)			From Trafo, Hardwired
AI	T	Winding temperature (4-20 mA) (see note 7)			From Trafo, Hardwired
Generators (STG/GTG)					
AI	T	Ambient Temperature of ST Skid (4-20 mA signal)			Hardwired
DI	D	STG/GTG/GTG Winding Temp	Alarm	Normal	Hardwired
DI	D	STG/GTG Bearing Temp	Alarm	Normal	Hardwired
DI	S	STG/GTG running mode	Isochronous	Not_Isochronous	Hardwired
DI	S	STG/GTG running mode	Constant MW	Not_Constant MW	Hardwired
DI	S	STG/GTG running mode	Droop	Not_Droop	Hardwired
DI	S	Field CB in service &	Closed	Not closed	Hardwired
DI	S	Field CB in service &	Open	Not open	Hardwired
DI	D	STG/GTG Exciter	Trip	Normal	Hardwired
DI	D	STG/GTG Generator	Trip	Normal	Hardwired
DI	D	STG/GTG Unit	Trip	Normal	Hardwired
DI	D	STG/GTG Rotor Earth Fault	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 80	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 59G	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 27G	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 32 Alarm	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 81 1 st setting	Operated	Normal	Hardwired
DI	D	STG/GTG Relay 81 2nd setting	Operated	Normal	Hardwired
DI	D	STG/GTG Excitation Failure Relay	Operated	Normal	Hardwired
DI	D	STG/GTG Overfluxing Relay	Operated	Normal	Hardwired
DI	D	STG/GTG Numerical relay	Unhealthy	Healthy	
DI	S	STG/GTG connected to grid	True	False	Hardwired
DO	C	STG/GTG Voltage RAISE	Activated	Reset	Hardwired, for Synch
DO	C	STG/GTG Voltage LOWER	Activated	Reset	Hardwired, for Synch

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
DO	C	STG/GTG Freq RAISE	Activated	Reset	Hardwired, for Synch
DO	C	STG/GTG Freq LOWER	Activated	Reset	Hardwired, for Synch
DO	C	Set STG/GTG Run mode to Droop	Activated	Reset	Hardwired
DO	C	Set STG/GTG Run mode to Isochronous	Activated	Reset	Hardwired
DO	C	Set STG/GTG Run mode to Constant MW	Activated	Reset	Hardwired

Following list is **applicable** for 66 kV, 33kV, 11 kV switchgear and 415 PCC/PMCC/EPMCC in CONTRACTOR's scope.

66kV GIS & 33kV GIS

Incomers I/O signals					
AI	A	R phase current			Hardwired
					Hardwired
AI	A	Y phase current			Hardwired
AI	A	B phase current			Hardwired
AI	W	3-phase real power			Hardwired
AI	R	3-phase reactive power			Hardwired
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired
DI	D	Relay 86	Operated	Reset	Hardwired
DI	D	Relay 95	Operated	Reset	Hardwired
DI	D	Feeder Trip on Undervoltage	Operated	Reset	Hardwired
DI	D	Unit Transformer, if any, Alarm	Operated	Reset	Hardwired
DI	D	Numerical relay	Unhealthy	Healthy	
DI	D	Bus 1 Isolator	closed	open	Hardwired
DI	D	Bus 2 Isolator	closed	open	Hardwired
DO	C	Bus 1 isolator closed command	Activated	Reset	Hardwired
DO	C	Bus 1 isolator open command	Activated	Reset	Hardwired
DO	C	Bus 2 isolator closed command	Activated	Reset	Hardwired
DO	C	Bus 2 isolator open command	Activated	Reset	Hardwired
DO	C	Dead Bus Close from ECS	Activated	Reset	Hardwired
DO	C	Synch Close from ECS	Activated	Reset	Hardwired
DO	C	Trip From ECS	Activated	Reset	Hardwired
Line VT					
AI	V	R – Y Line Voltage			Hardwired
AI	V	Y – B Line Voltage			Hardwired
AI	V	B – R Line Voltage			Hardwired
AI	F	Line Frequency			Hardwired
DI	D	Line VT MCB	Tripped	Closed	Hardwired
DI	D	Line	Dead	Not Dead	Hardwired
Bus VT					
AI	V	R – Y Bus Voltage			Hardwired
AI	V	Y – B Bus Voltage			Hardwired
AI	V	B – R Bus Voltage			Hardwired
AI	F	Bus Frequency			Hardwired
DI	D	Bus VT MCB	Tripped	Closed	Hardwired

DI	D	Bus	Dead	Not_Dead	Hardwired
DI	D	Under Frequency Relay	Operated	Reset	Hardwired
DI	D	df/dt Relay	Operated	Reset	Hardwired
DI	D	Control Supply	Failed	Healthy	Hardwired
Bus Coupler/ bus Sectionalizer					
AI	A	R phase current			Hardwired
AI	A	Y phase current			Hardwired
AI	A	B phase current			Hardwired
AI	W	3-phase real power			Hardwired
AI	R	3-phase reactive power			Hardwired
DI	S	CB in service &	Closed	Not closed	Hardwired for ECS
DI	S	CB in service &	Open	Not open	Hardwired for ECS
DI	D	Relay 86 (Differential)	Operated	Reset	Hardwired for ECS
DI	D	Relay 86	Operated	Reset	Hardwired for ECS
DI	D	Relay 95	Operated	Reset	Hardwired for ECS
DI	D	Numerical relay	Unhealthy	Healthy	
DO	C	Dead Bus Close from ECS	Activated	Reset	Hardwired
DO	C	Synch Close from ECS	Activated	Reset	Hardwired
DO	C	Trip From ECS	Activated	Reset	Hardwired
DI	S	L-E selector switch (see note 2)	Local	Not on local	Hardwired
DI	S	L-E selector switch (see note 2)	ECS	Not on ECS	Hardwired
Outgoing Feeder					
AI	A	R phase current			Hardwired
AI	A	Y phase current			Hardwired
AI	A	B phase current			Hardwired
AI	W	3-phase real power			Hardwired
AI	R	3-phase reactive power			Hardwired
DI	S	CB in service &	Closed	Not closed	Hardwired for ECS
DI	S	CB in service &	Open	Not open	Hardwired for ECS
DI	D	Relay 86	Operated	Reset	Hardwired for ECS
DI	D	Relay 95	Operated	Reset	Hardwired for ECS
DI	D	Numerical relay	Unhealthy	Healthy	
DO	C	Close from ECS	Activated	Reset	Hardwired
DO	C	Trip From ECS	Activated	Reset	Hardwired

HV & MV switchboards

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
Isolating breaker I/O signals – If Applicable					
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired
DO	C	Trip from ECS	Activated	Reset	Hardwired
HV incomer I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	3-phase real power			
AI	R	3-phase reactive power			
AI	H	Frequency			
AI	T	Oil temp (4-20 mA)			From Trafo, Hardwired
AI	T	Winding temp (4-20 mA)			From Trafo, Hardwired

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Transformer Trouble	Operated	Reset	
DI	D	Trip on undervoltage	Activated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
DI	S	OLTC L/R Sel Switch	Local	Not_Local	Hardwired
DI	S	OLTC L/R Sel Switch	Remote	No_Remote	Hardwired
DI	S	OLTC C/R Sel Switch	RTCC	Not_RTCC	Hardwired
DI	S	OLTC C/R Sel Switch	ECS	Not_ECS	Hardwired
DI	S	OLTC I/A Sel Switch	Independent	Not_Independen nt	Hardwired
DI	S	OLTC I/A Sel Switch	Auto	Not_Auto	Hardwired
DI	S	OLTC Tap on position 17	Set	Reset	Hardwired
DI	S	OLTC Tap on position 16	Set	Reset	Hardwired
DI	S	OLTC Tap on position 15	Set	Reset	Hardwired
DI	S	OLTC Tap on position 14	Set	Reset	Hardwired
DI	S	OLTC Tap on position 13	Set	Reset	Hardwired
DI	S	OLTC Tap on position 12	Set	Reset	Hardwired
DI	S	OLTC Tap on position 11	Set	Reset	Hardwired
DI	S	OLTC Tap on position 10	Set	Reset	Hardwired
DI	S	OLTC Tap on position 9	Set	Reset	Hardwired
DI	S	OLTC Tap on position 8	Set	Reset	Hardwired
DI	S	OLTC Tap on position 7	Set	Reset	Hardwired
DI	S	OLTC Tap on position 6	Set	Reset	Hardwired
DI	S	OLTC Tap on position 5	Set	Reset	Hardwired
DI	S	OLTC Tap on position 4	Set	Reset	Hardwired
DI	S	OLTC Tap on position 3	Set	Reset	Hardwired
DI	S	OLTC Tap on position 2	Set	Reset	Hardwired
DI	S	OLTC Tap on position 1	Set	Reset	Hardwired
DI	D	Tap Change	In Progress	Completed	Hardwired
DI	D	Tap Changer	Stuck	Normal	Hardwired
DO	C	Tap Raise	Activated	Reset	Hardwired
DO	C	Tap Lower	Activated	Reset	Hardwired
HV line PT I/O signals					
AI	V	R-Y line voltage			These signals are required over numerical relay and metering LAN
AI	V	Y-B line voltage			
AI	V	B-R line voltage			
DI	D	Line PT MCB	Open	Closed	
HV bus coupler I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	3-phase Real power			

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
AI	R	3-phase Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Auto-changeover	Blocked	Not blocked	
DI	D	Numerical Relay	Unhealthy	Healthy	
DI	S	Switchboard (A-I-M selector switch)	In auto mode	Not in auto mode	Hardwired
DI	S	Switchboard (A-I-M selector switch)	In indep mode	Not in indep mode	Hardwired
DI	S	Switchboard (A-I-M selector switch)	In manual mode	Not in manual mode	Hardwired
DI	D	AC control supply #1	Failed	Healthy	Hardwired
DI	D	AC control supply #2	Failed	Healthy	Hardwired
DI	D	DC control supply #1	Failed	Healthy	Hardwired
DI	D	DC control supply #2	Failed	Healthy	Hardwired
DI	D	AC space heater supply #1	Failed	Healthy	Hardwired
DI	D	AC space heater supply #2	Failed	Healthy	Hardwired
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
HV bus PT I/O signals					
AI	V	R-Y bus voltage			These signals are required over numerical relay and metering LAN
AI	V	Y-B bus voltage			
AI	V	B-R bus voltage			
DI	D	Bus PT MCB	Open	Closed	
HV plant feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	Real power			
AI	R	Reactive Power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
Outgoing transformer feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	Real power			
AI	R	Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Transformer trouble	Operated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
HV motor feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	Real power			
AI	R	Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 86 (Process trip)	Operated	Reset	
DI	D	Relay 95	Operated	Reset	
DI	D	Trip on undervoltage	Activated	Reset	
DI	D	Motor Trip from Process	Activated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
HV synchronous motor feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	Real power			
AI	R	Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 86 (Process trip)	Operated	Reset	
DI	D	Relay 95	Operated	Reset	
DI	D	Trip on undervoltage	Activated	Reset	
DI	D	Motor Trip from Process	Activated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
DI	S	Excitation control in constant PF mode	Set	Reset	Hardwired
DI	S	Excitation control in constant VAR mode	Set	Reset	Hardwired
DI	S	Excitation control in VAR control mode	Set	Reset	Hardwired
DI	S	L-E selector switch (see note 3)	Local	Not on local	Hardwired
DI	S	L-E selector switch (see note 3)	ECS	Not on ECS	Hardwired
DO	C	Set Excitation in Constant PF mode	Activated	Not_Activated	Hardwired
DO	C	Set Excitation in Constant VAR mode	Activated	Not_Activated	Hardwired
DO	C	Set Excitation in VAR control mode	Activated	Not_Activated	Hardwired
DO	C	Excitation raise	Activated	Not_Activated	Hardwired
DO	C	Excitation lower	Activated	Not_Activated	Hardwired

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
AO	C	Excitation set point			4-20mA signal from ECS, Hardwired
HV capacitor feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	R	Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Numerical relay	Unhealthy	Healthy	
DI	S	L-E selector switch (see note 2)	Local	Not on local	Hardwired
DI	S	L-E selector switch (see note 2)	ECS	Not on ECS	Hardwired
DO	C	Close from ECS	Activated	Reset	Hardwired
DO	C	Trip from ECS	Activated	Reset	Hardwired
MV PMCC incomer I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
DI	W	Real power			
DI	R	Reactive power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Trip on U/V	Activated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
MV PMCC line PT I/O signals					
AI	V	R-Y line voltage			These signals are required over numerical relay and metering LAN
AI	V	Y-B line voltage			
AI	V	B-R line voltage			
DI	D	Line PT MCB	Open	Closed	
MV PMCC bus PT I/O signals					
AI	V	R-Y bus voltage			These signals are required over numerical relay and metering LAN
AI	V	Y-B bus voltage			
AI	V	B-R bus voltage			
DI	D	Bus PT MCB	Closed	Open	
MV PMCC bus coupler I/O signals					
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Auto-changeover	Blocked	Not blocked	
DI	D	Numerical Relay	Unhealthy	Healthy	
DI	S	Switchboard (A-I-M selector switch)	In auto mode	Not in auto mode	Hardwired
DI	S	Switchboard (A-I-M selector switch)	In indep mode	Not in indep mode	Hardwired
DI	S	Switchboard (A-I-M selector switch)	In manual mode	Not in manual mode	Hardwired

Type	Pt type	Signal description	Set condition description	Reset condition description	Remarks
DI	D	AC control supply #1	Failed	Healthy	Hardwired
DI	D	AC control supply #2	Failed	Healthy	Hardwired
DI	D	DC control supply #1	Failed	Healthy	Hardwired
DI	D	DC control supply #2	Failed	Healthy	Hardwired
DI	D	AC space heater supply #1	Failed	Healthy	Hardwired
DI	D	AC space heater supply #2	Failed	Healthy	Hardwired
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
MV PMCC outgoing feeder I/O signals					
AI	A	R phase current			These signals are required over numerical relay and metering LAN
AI	A	Y phase current			
AI	A	B phase current			
AI	W	Real power			
AI	R	Reactive Power			
DI	S	CB in service &	Closed	Not closed	Hardwired
DI	S	CB in service &	Open	Not open	Hardwired (for SOE)
DI	D	Relay 86	Operated	Reset	These signals are required over numerical relay and metering LAN
DI	D	Relay 95	Operated	Reset	
DI	D	Numerical Relay	Unhealthy	Healthy	
DO	C	Trip from ECS	Activated	Reset	Hardwired
DO	C	Breaker inhibited from closing due to load shedding	Operated	Reset	Hardwired
Miscellaneous I/O signals					
DO	C	Lighting feeder ' ON'	Activated	Reset	Hardwired
DO	C	Lighting feeder ' OFF'	Activated	Reset	Hardwired
DI	D	UPS Charger	Failure	Normal	Hardwired
DI	D	UPS Inverter	Failure	Normal	Hardwired
DI	D	UPS Battery	Discharged	Normal	Hardwired
DI	D	UPS Battery	Isolated	Normal	Hardwired
DI	S	UPS load on	Inverter	Bypass Trafo	Hardwired
DI	D	DC supply Charger - I	Failure	Normal	Hardwired
DI	D	DC supply Charger - II	Failure	Normal	Hardwired
DO	C	Load Shedding	Operated	Reset	Hardwired

Notes:

1. It is assumed that HV boards and MV PCCs & MCCs have numerical relays. All signals of I/O list that are to be acquired on the relay LAN have been indicated as such. All other I/Os shall be acquired hardwired. In case any of these data can not be acquired over the relay LAN, these signals have to be provided as hardwired.
2. There shall be one Local-ECS selector switch in each HV capacitor feeder in HV switchboard. When this switch is in Local mode, CB closing from local shall be permitted and CB closing from ECS shall be blocked. When the switch is in ECS mode, CB closing shall be permitted from ECS but blocked from local. Simultaneous monitoring and CB tripping are permitted both from ECS and local. Motor feeders are not to be closed from ECS.
3. There shall be one Local-ECS selector switch in each HV synchronous motor feeder in HV switchboard. When this switch is in Local mode, the excitation control of the motor shall be from local. When the switch is in ECS mode, the excitation control of the motor shall be from ECS but blocked from local. The excitation control from ECS may be hardwired raise/lower contacts, or in the form of 4-20 mA signal. Provision has to be kept in ECS for both. Simultaneous monitoring and CB tripping are permitted both from ECS and local.

4. There shall be one lighting feeder ON/OFF DO pair (non-latched) per sub-station. These contacts are to be multiplied on 110 V DC control supply voltage, by CPP CONTRACTOR and used for centralised lighting control in his area.
5. ECS shall also be used for load-shedding purposes and will trip some of the breakers to which ECS monitoring is extended, on load shedding. The reset command for breakers tripped on load shedding shall also be generated from the ECS so that a load tripped on load shedding is not allowed to be restored until the exigency leading to load shed has been attended to. Hence a latched changeover type contact DO shall be provided for each breaker feeder, which shall inhibit closing of the circuit breaker tripped on load shedding. CPP CONTRACTOR shall keep suitable provisions in the switchboard control schemes to implement the same.
6. This I/O list is indicative only. Any other I/O required to meet the contract requirements shall be identified and provided by CPP CONTRACTOR.
7. For the purpose of ECS, "MV", "LV" or "LT" stands for voltage rating ≤ 415 V. "HV" or "HT" stands for voltage rating ≥ 3.3 kV.

Guidelines for ECS I/O Interface Design:

Analogue Input Signals

All measurements for I, V, MW, MVAR, Hz, obtained through signal transducers shall have an accuracy limit of $\pm 0.2\%$ within the nominal range of measurement i.e. 0-120%.

For all measurements for I, V, MW, MVAR, Hz, obtained on the relay and metering LAN, maximum possible accuracy shall be ensured.

Digital Input Signals

Alarm (D)

Alarm is a signal which requires operator to be alerted such as VT circuit MCB (closed, open), relays 86 & 95 (operated, reset), auto-changeover (blocked, not blocked), DC control supply (healthy, failed), line voltage (unhealthy, healthy), bus voltage (unhealthy, healthy), motor trip from process, under-voltage trip. This shall be hardwired / on relay LAN as specified.

For hardwired signal, potential free contacts of rating 2 A, 110 V DC or 240 V AC, make to alarm (NO) preferred. CONTRACTOR shall specifically indicate if NC contact is being provided in place of NO contact.

Generally a hardwired alarm point is put under "sequence of event" monitoring.

Status (S)

For hardwired signal, potential free contacts of rating 2 A, 110 V DC or 240 V AC, make to alarm (NO) required.

Digital Output Signals

Command (C)

Hardwired through potential free changeover type contact of interposing relay, contact rating 5 A, 240 V AC and/or 6 A, 110 V DC.