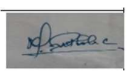


TECHNICAL SPECIFICATION

FPI (Communicable Type) for Overhead Lines

Central Engineering Services

TPCODL/TPNODL/TPWODL/TPSODL

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1.0 SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading, supply at stores, commissioning assist at the time of each installation of FPI for Overhead Lines(11kv & 33kV) with all accessories and necessary training for trouble free & efficient performance.

This shall be either with or without communication accessories based on tender requirements.

It is not the intent to specify completely herein all the details of tech design and construction of material. However, the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in manner acceptable to the TPCODL/TPNODL/TPSODL/TPWODL, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not. All necessary mounting fixture is in scope of supplier.

2.0 APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest editions of the following Standards /IEC and shall conform to the regulations of local statutory authorities.

IEC 60068-2-2	Electronic Equipment & Product Standards – For Dry Heat
IEC 60068-2-30	Electronic Equipment & Product Standards – Damp heat cyclic Test
IEC 60950	Information Technology equipment - Safety
IEC 61000-2	Electromagnetic compatibility for low-frequency conducted disturbances and signaling in public low power supply systems
IEC 61000-4	EMC - Testing & Measurement
IEC 61000-6	EMC- Immunity for Residential, Commercial and light industrial environments.
IEC 61010	Standard for safety requirements for electrical equipment for measurement, control, and laboratory use
IS 11353/1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
IS 1248/2003	Indicating instruments.
EN 60-950	Product Safety testing standard for "Information Technology Equipment" (known as ITE
IEEE 495-2007	Guide for testing faulted circuit indicators
IEC 60529	Degree of Protection.
IEC 60060-1	High-voltage test techniques – Part 1: General definitions and test requirements
IEC 60068-2-52	Salt mist, cyclic (sodium chloride solution)
IEEE STD 495	IEEE Guide for Testing Faulted Circuit Indicators
IEC 60870-5	Communication protocol.

Note- In case of any conflict on any technical particular in the specification, the stricter requirement

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mentioned in the relevant standard shall be valid.

3.0 CLIMATIC CONDITIONS AT THE INSTALLATION

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	100%
5	Average Annual Rainfall	150cm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has heavy saline conditions along the coast and High cyclonic Intensity winds with speed up-to 300 Kmph. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

4.0 GENERAL TECHNICAL REQUIREMENTS

Sr. No	Parameter Description	Requirement	As offered by Bidder
A	<i>For Communicable FPI without accessories:</i>		
1	Offered Model no. or type of FPI for Overhead lines along with Make	Bidder to submit followings, a. Make b. Model no./Type c. Country of origin	
2	Application	Product shall be suitable for application on overhead lines of different size conductors and ABC	
3	Power	Self- powered for normal functioning without external auxiliary power for FPI	
3	Supply voltage Suitability	Suitable for 7 KV to 33 KV overhead conductors	
4	Power Frequency	50Hz	
5	Ingress Protection of enclosure	IP67 or better	
6	Short - circuit withstand	25kA/170 ms	
7	Suitable diameter of jaw	Suitable for Conductor- Dog, Wolf, Panther, Goat, Zebra	
8	Conformal coating	The relay PCB should have conformal	

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		coating	
	Fault Detection Parameters		
9	Current setting Trigger value	100 A to 800 A steps of 100 A and Manually or Automatic Mode- Can be set on site remotely	
10	Transient faults detection feature	This feature can be made On or Off, Manually and Remotely as per application site need.	
11	Minimum fault current impulse filter time	60 to 300ms (To filter inrush current)	
12	Beacon Flash Indication Duration (user settable)	30 min to 720 min in steps of 30 min - Manual and Remote Settable	
13	Inrush transient restraint	2 sec	
	Reset (Permanent Fault)		
14	Auto-reset on restoration on supply	Should auto-reset after 30 seconds delay and within one min of supply restoration.	
15	Pre-set Timer Reset	30 min to 360 min in steps of 30 min - Manual and Remote Settable	
16	Manual Reset (Local and Remote both)	Manual and Remote Resettable	
	Fault indication		
17	Fault Indications	Bright Red flash light (LEDs) for permanent faults, Preferably Green LED for transient fault with different blinking rate Preferably Yellow LED for low battery indication Bidder to submit the offered equipment details of features for indication of above faults categories.	
18	Light Power	40 Lumens	
19	Visibility Angle	360 Degree and 300 mtr	
20	Flash Period for permanent faults	1 flash every 3 sec and/or Red flashing LED	
21	Flash Period for transient faults	2 flash every 12 sec and/ or Green flashing LED	
22	Standard total flash duration	Min. 1000 Hrs under permanent fault operation	
23	Battery low indication	The FPI should have low battery indication Local and remote alert (Bidder to submit details of provision)	
24	Internal Battery of FPI	Lithium Ion rechargeable battery (Shall recharge from line current)	
25	Life of the Battery (In operating condition)	More than 10 years	
26	Shelf Life of battery	More than 15 years	
27	FPI Battery capacity	Bidder to mentioned details of voltage and Ah rating	
28	Operation Temperature	-5 deg. C to +70 deg. C or better	
29	Storage Temperature	-5dec. C to +70 deg. C or better	

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30	Suitability for Wind Resistance	For wind pressure 200kg/sqm up to an elevation of 10 mts	
31	Weight of FPI unit	Bidder to submit details of offered product	
32	Size of FPI unit (Dimensions)	Bidder to submit details of offered product	
33	Fixing on line conductor	Should be Easy to fix with hot stick	
34	FPI power up current	FPI should be power up with Minimum 5A line current & battery power shall be used only after fault	
B For Communicable FPI with accessories(Optional as per tender requirement):			
35	Data Transmission/collector Unit package	This package shall include, Data Collector or Communication unit Battery bank Resin cast PT for auxiliary supply. 4G Modem/RTU for SCADA communication Communication cables and supply cables Installation hardware with GI material for all equipment (Bidder to mention the package details along with Make and model of equipment)	
36	Inbuilt Radio range	100 meter (A short-range radio interface shall be embedded in this Fault Passage Indicator/ so that to allow it communicate with the 2G/3G/4G/ 4G LTE, etc. communication interface)	
37	Communication Unit devise interface	A GSM/GPRS communication interface, pole-mounted, acting as a communication gateway between Fault Passage Indicators using short-range radio and the remote control center using GSM/GPRS communication. Inbuilt modem shall support all technology i.e. 2G, 3G, 4G & 4G LTE, 5G etc.	
38	SMS Alert	SMS alarm forwarding facility available for at least 5 different numbers.	
39	Communicable protocol for future support	Communicable protocol like IEC 101 & 104 & MQTT should be provided for future support.	
40	The communication unit protocol with server	The communication unit should provide data to SCADA in IEC-60870-5-104 and MQTT over the Ethernet port.	
41	Line Loading data	FPI should transmit real time line loading (phase wise), fault data to ADMS through FPI over IEC-60870-104 and MQTT.	
42	The DCU communication compatibility (if required)	Compatible to send data over 2G/3G/4G/RF modem connected to the Ethernet port of the modem	
43	Data Transmission rate	Data Transmission rate over Ethernet should be 10/100Mbps	

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44	Multi master reporting	One DCU (if required)/FPI should report at- least 8 master with single CASDU	
45	FPI Data downloading at site	Data downloading from FPI to Laptop should be possible over any non- proprietary protocol. LAPTOP software to be provided free of cost & should be compatible with windows 10 and latest edition	
46	Self-diagnostic alerts in DCU (if required)	DCU Door open alarm, Battery charger failure, LT Supply failure, Battery low alarm, DCU Malfunction	
47	Communication unit battery back up	Battery (Along with charger) backup of 4 hrs. Should be provided for automation unit. Aux PT should be Ph-Ph. Aux Supply :VDC 24 or higher	
48	Installation supervision	The bidder shall provide installation supervision	
49	SCADA integration of data.	The scope shall include the data integration up to SCADA.	
50	DCU and Modem	Remote Configuration should be compatible	
51	For Modem (4G)	Provision required for Automatic restart (configurable)	

4.1 CONTROLLER FOR FPI

SL. NO.	TECHNICAL PARTICULARS	TPCODL REQUIREMENT	BIDDER's RESPONSE
1	Make & Model Proposed	Make	
		Model	
2	Controller Redundancy	Optional (CPU, Power, Communication & Memory)	
3	Digital Inputs (Wireless)	As per RFP / FPI type and Indicative Signal List	
4	Digital Outputs (Wireless)	As per RFP / FPI type and Indicative Signal List	
5	Analog Inputs (Wireless)	As per RFP / FPI type and Indicative Signal List	
6	FPI Integration (Wireless)	Facility to interface FPI through high frequency wireless module. (Fault Passage Indicator should have a short-range radio interface embedded in it to communicate with DCU) Capable of Acquiring 32 bit Analog and Accumulator Data from nearby (100 meter) 9 nos. FPIs (3X 3 sets) without any additional license/ hardware enhancement	
7	CPU Processing Speed	32 bit ARM Core CPU operating @ minimum 450 MHz	
8		All ports shall be galvanically isolated	

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	Ports Requirement and Type For Structuring (Configuration) System (Separate Port)	2 Nos. Ethernet Ports / FRTU (Both the ports should support IEC 104 other standard protocols for Communication with MODEM)	
		A galvanically isolated USB port for local engineering through laptop	
9	Protocol Support	IEC60870-5-104 (Master & Slave), MODBUS (Serial & TCP/IP), SNTP & SNMP with Server and Client licenses, MQTT Controller must have at least one TCP/IP Ethernet port to for communication with master station over IEC-60870-5-104 without external protocol converter.	
		Type test certificate of the controller for IEC 60870-5-104 from NABL Accredited Laboratory /Any reputed international laboratory	
10	Time synchronization between FRTU, I/O modules, IEDs	Required on SNTP and direct pulse (1 PPS, 1 PPM). DCU shall have capability for Time Synchronization from Minimum 2 Server with priority selection	
	Real time stamping at Controller level, I/O level	Required, Mandatory	
11	Response Time		
	Digital Input	1 msec or better	
	Analog Measurement	1 sec or better	
	Digital Output	<1 sec or better	
12	I/O handling Capacity	Min 500 Physical Tags /Controller	
13	Pseudo Points (Digital, Analog)	Required	
14	Calculated Points (Digital, Analog)	Required	
15	SOE List storage	Min 500 (shall be user configurable)	
	SOE list Retention Period	1 Month	
	Measurement Events	500	
16	Fault Disturbance Recorder	100 events	
	FDR Retention Period	1 Month	
17	Development of Interlock logic	Required, Mandatory	
18	Support of mathematical function - Arithmetic, Logical, Trigonometric functions, Differential and Integration functions, Timer, Counter etc.	Required, Mandatory	
19	Logic and Calculation functionality	Required, Mandatory	
20	Status LEDs on all module – for fault indication and Inputs / Outputs	Required	
21	Number of Multi Master Reporting possible with same ASDU	5 Nos. (Mandatory)	
22	Web Based Monitoring	Required	

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23	Software - All diagnostic tools, simulator tool, maintenance tools, configuration application for database and process control program development, documentation and maintenance	Required	
24	Engineering Functions	a) Configuration shall be possible both locally and remotely (Remote configuration over MODEM with static SIM)	
		b) Controller shall have multilevel passwords	
		c) On-line monitoring facility of real time data for monitoring/analysing the real time status of the process, program logic from the engineering station	
		f) Controller must have the provision to configure the IP of the redundant SCADA Systems (Socket IP)	
25	Battery Backup / Flash-PROM backup	Required if memory is volatile	
26	Auxiliary Power Supply	Redundant 18-72 VDC (24V DC) Supply with MCBs with add-on NO contact. The Controller shall have adequate protection against reversed polarity, over current and under voltage conditions, to prevent the internal logic from being damaged and becoming unstable causing mal-operation	
27	Auto-Startup and Restoration	In case of Power Supply Failure, Auto-Startup and Restoration of the Controller required	
28	Controller health monitoring contacts (CPU, Communication, I/O modules, Power Supply)	Required both Physical and Soft, Mandatory	
29	Environment Requirement, Reliability & Cooling	The Controller shall be capable of operating in ambient temperature from 0 to +65 degree C with rate of temperature change of 20 degree C/hour and relative humidity of 95%, non-condensing. Conformal coating is mandatory.	
30	DR Data Collection (Optional)	Support FTP protocol to transfer disturbance recorder data to remove server	
31	CPRI report for the product offered as per the Gol order no. 25-17/6/2018-PG dated 2nd July 2020 and subsequent order No. 12/34/2020-T&R dated 8th June 2021	Cyber security compliance as per the enclosed letter of MoP. Type test certificate on cybersecurity compliance from NABL Accredited Laboratory / Any reputed international laboratory. Applicable standards are IEC 62351 series (specifically IEC 62351-100 parts 1 & 3), IEC 27036, IEC 20243 & IEC 62443)	
32	Battery Charger & Battery bank with proper rating of MCBs	5 Amp FCBC Battery Charger / 6AH 2X12V Battery Bank	

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4.2 DUAL SIM 5G/4G MODEM CUM ROUTER

Sr. No.	Technical requirement	TPCODL Requirement	BIDDER RESPONSE
1	Product Description		
1.1	Make & Model	Bidder to provide Make & Model of proposed Cellular Modem. Also provide life cycle details	
2	Radio Interface		
2.1	Radio Interface	5G Fall back to 4G/3G/2G	
2.2	Data interface	Cat 5 , Download and Upload 1000 Mbps	
2.1	Supported frequency band	1. Modem should support multiband connectivity with FDD 5G & TDD 5G. 2. It should support Band 1, 3, 5, 8, 40 and Band 48. 3. The offered cellular modem should support and compatible to the data & radio interface of the network of public mobile service provider in Odisha City.	
2.4	Radio Transmitter Power	Vendor to provide details of radio transmitter power	
2.5	Receiver Sensitivity	Vendor to provide details of receiver channel sensitivity	
2.6	Cellular Module / Chip	Vendor shall give details of cellular chip /Module used along with datasheet	
3	Operating Condition		
3.1	Operating Temperature	-20 C to 70 C	
3.2	Operating Humidity	5 % to 100 % (non -condensing)	
3.1	Power Consumption	Vendor to provide power consumption for idle and max during data transmission	
3.4	Storage /transport temperature	-40 °C to 85 °C	
3.5	MTBF	Vendor to provide details of MTBF	
3.6	Protection from pollution	Vendor shall provide design details such as protective paint /conformal coating on MCB, high grade electronic components uses to protect from environmental pollution.	
4	System Characteristics		
4.1	CPU	1. Vendor to provide make & technical details of CPU used. 2. Vendor should also attached technical data sheet of CPU. 3. CPU usage should not crossed 40 % in typical operating & maintenance condition	
4.2	RAM	1. Vendor to provide details of memory type, Speed & Size. 2. Usage of memory should not crossed 60 % in typical operating & maintenance condition	
4.3	Flash Storage	Vendor to provide details of flash storage Memory Provision to store system logs, event logs ,configuration file	
5	Mechanical Construction		

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5.1	Dimension (W X H X D)	Vendor to provide details of Dimension (W X H X D)	
5.2	Weight in Kg	Vendor to provide details of Weight in KG	
5.3	Housing	Metal Preferred Aluminum alloy having better heat dissipation & ruggedness	
5.4	Mounting	DIN rail Mounting	
5.5	Degree of Protection	IP30	
6	Interface/Port Type		
6.1	Ethernet	1. Minimum 2 X RJ45 Port Ethernet, Speed 10/100 Mbps auto negotiable having status LED indication. 2. Port should be configurable as LAN /WAN as required.	
6.2	Cellular interface	1. Cellular modem should have dual SIM provision . 2. Dual SIM for network redundancy /backup. 3. Dual SIM operation ensures that the cellular connection is always available. 4. It will automatically disconnect the 1st SIM card's low/weak cellular connection and will reconnect to establish a stronger connection using the 2nd SIM card.	
6.3	Ethernet Cable (CAT 4)	Vendor to provide Ethernet Cable (CAT 6) minimum 1.5 M	
7	Software Features / Supported protocols		
7.1	Network Protocols	TCP/IP ,UDP/IP, HTTP, ARP,DHCP, ICMP, SNMP, V1/V2 &V1, NTP, SSL/TLS	
7.2	Routing	Astatic Routing, RIP 1 &2 ,OSPF V2 &V1	
7.3	VPN	Open VPN , IP Sec, L2TP, PPTP, GRE	
7.4	Alarm Message	Device shall have alarm notification on SNMP trap	
7.5	Management /Monitoring	1. Cellular modem should shall support Local /Remote management through web HTMLS, SSHP & Telnet 4. 2. It shall support monitoring through system logs & SNMP version V1/V2 & V3. 3. Notification & command shall be possible over SMS. 4. Firmware upgradation through Web, backup & restore of configuration shall be possible.	
7.6	Operating System	Vendor to give the details of operating system & its Version	
7.7	Application	Vendor to give the details of application & package installed in modem	
7.8	AT Command Support	YES /NO	
7.9	Scheduled rebooting	Device should be capable to program auto rebooting as per configured / scheduled configured scheduled time.	
7.1	Watch dog feature	Modem Shall have feature of tracking data connectivity status by periodic ping test and switchover on backup.	

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7.11	Factory Reset	Provision of Resetting the device for factory configuration.	
7.12	Diagnosis Feature	Device Shall support real time diagnostic such as active connection ,traffic on interfaces	
7.13	SCADA Protocols	1. Transparent Mode: The modem should be capable for communicating with multiple protocol RTUs in Transparent Mode 2. DLMS Master Mode: The modem should be capable to reading multiple DLMS meters connected to it 3. Modbus Master Mode: The modem should be capable of reading Multiple Modbus Meters connected to it 4. Data Segregation Mode: modem should segregate the collected data as per Instantaneous Parameters, Billing, Load Profile and Tamper parameters in separate files per Meter 5. IEC 104 – 104 Master – Multi Slave Mode: The modem should be capable to reading RTUs in IEC60870-5-104 protocol and communicate with SCADA system on IEC 60870-5-104 protocol upto 8 masters. Adequate data interlock mechanisms should be implemented to avoid data loss. 6. IEC 104 Slave mode Multi Master support 7. DNP3 Slave mode with Integrity poll, Static, Event data, Class 0,1,2,3 support 8. Other Data Sending Modes: modem should support TCP, UDP, HTTPS, MQTT data sending formats 9. Simultaneous Operations of multiple protocols. Ex modem should be capable of sending Modbus Data over 104 and MQTT simultaneously	
8	Security		
8.1	Security	HTTPs, SSH, Authentication with RADIUS or TACACS + , activate cellular interface with SMS ,Ethernet 802.1X(EAP-PEAP/MsCHPv2 or EAP -TLS	
8.2	Authentication	User Management (local ,RADIUS, TACACS + , Mixed)	
8.3	State inspection firewall	Static firewall IPv4 / IPv4 with incoming and forwarding ruleset ,DoS protection ,IP /Port/Protocol filtering ,NAT	
9	Antenna		
9.1	No Of Antenna	The 5G Cellular modem Should have two antenna connection (MIMO).One is primary cellular antenna & second is diversity antenna(MIMO)	
9.2	Cable Length	Cable should have Low loss RF Cable with minimum 5M	

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9.3	Type of Antenna	Antenna Should be Omni directional with high gain (High gain ≥5)	
9.4	Construction of antenna	It should be Steady ,good quality material ,water/ weather proof having adequate gold plate connector compatible with cellular modem antenna. Port. It should be suitable mounting arrangement to installed indoor	
9.5	Frequency Band, impedance & Polarization	Vendor Shall provide the details of frequency Band. Antenna should be compatible with offered device & network service provide with frequency band, port impedance & radio signal polarization	
9.6	VSWR	Vendor Shall provide details of VSWR	
9.7	Gain of antenna	Vendor Shall provide Gain details of primary & secondary antenna	
10	Power Supply		
10.1	Power Supply	18V to 72 V dc	
10.2	Connector Type	Modem Should have preferable screw type firm connection. It should have reverse polarity protection & surge protection	
11	Status & diagnostics indicator		
11.1	LED indicator	Vendor to provide details of status & diagnostics indicator. (Power- ON & OFF ,ERR- Error Red, Signal, network, SIM status)	
12	Certification:- IEC Specified as below or equivalent to international Standard		
12.1	Electrostatic discharge immunity test	IEC EN 61000-4-2	
12.2	Radiated, radio-frequency, electromagnetic field immunity test	IEC EN 61000-4-1	
12.3	Electrical fast transient/burst immunity test	IEC EN 61000-4-4	
12.4	Surge immunity test	IEC EN 61000-4-5	
12.5	Immunity to conducted disturbances, induced by radio-frequency fields	IEC EN 61000-4-4	
12.6	Information technology equipment –Safety	IEC 60950	
12.7	Environmental testing-Vibration (sinusoidal)	IEC 60048-2-4	
12.8	Environmental testing-Shock	IEC 60048-2-27	
12.9	Environmental testing-Free Fall (withdrawn)	IEC 60048-2-12	

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12.1	Proof of check	vendor should give one number of modem along with Technical offer for performance & application compatibility check for period of minimum 15 days	
12.11	Country of manufacturing	Vendor to provide Country of manufacturing details	
12.12	Service Centre in India	Vendor to provide details of Service Centre in India	
12.13	Regulatory compliance	Vendor shall confirm that offered product is compiled & certified by all Indian government bodies related to telecommunication/ wireless communication (WPC ,DOT) to operate &user this product in country . Vendor to share compliance certificate of the same	
12.14	Surge protection /electrical isolation	It should be available on all Ethernet communication port & power supply input .vendor shall share certification	
12.15	Environmental Condition	Cyclonic environment with wind velocity up to 250kmph. Some of the regions, where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for electronic equipment. Some places are in heavily industrial polluted areas. Therefore, all supplied material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.	

4.3 BATTERY & BATTERY CHARGER

Sr. No.	Technical requirement	TPCODL Requirement	BIDDER RESPONSE
A.1	Make of Battery Charger	To be provided by bidder	
A.2	Model of Battery Charger	To be provided by bidder	
B.1	Make of Battery	To be provided by bidder	
B.2	Model of Battery	To be provided by bidder	
1	Scope	The battery & battery charger are intended for operating FPI DCUs. The battery should capable of providing back up for minimum 8 hours for operationalisation of DCU/4G Modem.	
2	Average Number of Operations	Not Applicable	
3	Standards	IS 1885/IEC 600504, IS -15549/2005	
4	Climate	Must able to operate efficiently considering hot & humid climate of Odisha region. The battery shall be capable of operating satisfactorily in outdoor applications when it is housed in a Cubicle between 10 deg. C and 65 deg.C and in locations where the relative humidity between 30% to 100%	
5	Battery Ratings		

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5.1	Voltage	24 VDC specified at 27 deg.C.			
5.2	Battery Type	SMF,VRLA with chargers of conventional type			
5.3	Voltage/cell	12 volts			
5.4	Capacity of Batteries	7 AH,5 Amps			
5.5	Connecting cables	Cable size selection should provide the lowest voltage Drop possible between battery system and operating Equipment.			
5.6	Method of charging	Constant voltage method and current limit(variable Current)			
5.7	Efficiency	Not less than 90% at full rated load			
6	Battery Charger Rating				
6.1	Battery Charger type	Constant Voltage and Current limiting charger. Charger with inbuilt battery health monitoring is highly preferable.			
6.2	Charger Input Voltage	Single phase (2 wire) voltage 250V AC +30% to -20% Frequency 50Hz ± 5%.			
6.3	Charger Output				
6.3.1	Regulation	± 1%			
6.3.2	Charger current	5 Ampere			
6.3.3	Efficiency	Not less than 85% at full rated load			
6.3.4	Current limit	110% of rated load			
6.3.5	Insulation	Not less than 5 mega Ohms.			
		i. between DC output terminals and AC input terminals.			
		ii. Between AC input terminals and earth			
6.3.6	Indication	The charger shall have suitable indicators to visually know its mode of operation. Charger indication as below must be available:			
		Mains on (Red LED), Charger on (Yellow), Boost on (Yellow LED), Float on (Green LED) and Battery reverse polarity (Red LED), O/p DC fuse blown (Red LED) LED lamp indication. (LED colors can be changed)			
6.3.7	Protection	Input single pole MCB's for AC & DC of 10 Amperes separate for battery & charger.			
		The battery charger must include protections like:			
		i) AC input MCCB & ELBS with input ON/OFF switch and fuses/ contactor.			
		ii) DC output MCCB with output ON/OFF switch and fuses.			
		iii) Current limit protection, soft start feature, surge suppressor.			
iv) Fast semiconductor fuses for rectifier bridge.					

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		v) Charger over load / short circuit vi) Battery polarity reverse, Battery Over/Under voltage, Charger rectifier fail, etc.	
6.3.9	Battery & charger Alarms	Potential free contacts must be available to integrate with SCADA for abnormality if any. Most preferred alarms are like: AC supply fail, DC supply fail, Battery Low, Battery Fail, Battery Charger fail, Battery polarity reverse. Serial Communication is preferred.	
6.3.8	Cooling	External exhaust fan(Optional)	
6.4	Climate	Must able to operate efficiently considering hot & humid climate of Odisha region. The battery shall be capable of operating satisfactorily in outdoor applications when it is housed in a Cubicle between 10 deg. C and 65 deg.C and in locations where the relative humidity between 30% to 100%	
6.5	Wiring	The internal wiring of the charger shall be carried out with PVC insulated	
6.6	Accessibility	650V grade standard copper conductor. The control wiring shall be carried out with 2.5 Sq.mm copper conductors.	
		All the important components of the charger must be easily accessible for maintenance, repair, and replacement in case of trouble without giving interruption to total D.C. supply as far as possible.	
6.7	Test		
6.7.1	ACCEPTANCE AND ROUTINE TESTS	All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the bidder. The test certificates are to be furnished for approval.	
6.7.2	Acceptance test for battery charger with batteries	1. Marking	
		2. Verification of dimensions.	
		3. Regulation test.	
		4. Ripple test,	
		5. Megger values and HV Test.	
		6. Test for battery discharge capacity.	
6.7.3	Type Tests:	Following shall constitute type tests in respect of chargers and batteries.	
		1. Insulation resistance	
		2. High voltage test at 1.5KV for 1 minute	
		3. Regulation (Load & Line)	
		4. Dry heat test at 55°C for 16 hrs with full load on as per IS: 9000 part 3/Sec5/1977.	
		5. Damp heat test at 55°C and at 95% RH for two cycles as per IS: 9000 part 5/Sec1/1981	
		6. Cold test at -10°C for 4 hrs as per IS: 9000 part 2/Sec4/1977	

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7	Drawings	Detailed drawings, circuit details and technical literature of batteries shall be enclosed to the offer. Tenders not accompanied by the above are liable for rejections. Trouble shooting charts shall be supplied with each unit to trace faults in the charger with voltage and Resistances to be measured at various test joints.	
8	Painting	The box shall be painted with powder coating with Siemens grey colour.	

4.4 SINGLE PHASE POTENTIAL TRANSFORMER SUPPLY KIT (PT)

Sl. No.	Technical requirement	TPCODL Requirement	BIDDER RESPONSE
1	Manufacturer's name and country of manufacture	To be provided by bidder	
2	Type	Outdoor VT	
3	Installation type	Outdoor Resin Cast VT	
4	Rated Voltage / Highest System Voltage	11kV/12kV or 33kV/36kV	
5	Insulation Class	E	
6	Rated frequency	50Hz	
7	Conforming to Standard	IS16227-1&3	
8	No. of secondary windings	Single	
9	Rated System Voltage	11kV or 33kV	
10	Winding details	Enamel Copper Wire Winding	
11	Rated Primary Voltage	11kV or 33kV	
12	Rated Secondary Voltage	230 V	
13	Accuracy Class	1	
14	Rated Secondary Burden	50 VA	
15	Rated Voltage Factor	1.2 continuous & 1.9 for 8 hours	
16	Primary terminal material and details	Brass link	
17	Secondary terminal material and details	Brass Secondary terminal	
18	One minute power frequency withstand voltage test on primary winding	As Per IS 162227 – 1 & 3	
19	Lightning impulse withstand voltage	As Per IS 162227 – 1 & 3	
20	One minute power frequency withstand voltage test on secondary winding	As Per IS 162227 – 1 & 3	
21	Total creepage distance (min)	31 mm/kV	
22	Total weight of equipment		
23	Mounting details	As Per Drawing	
24	Measurement of Partial Discharge @ 1.2Um / $\sqrt{3}$	As Per IS 16227 – 1 & 3	

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25	Measurement of Partial Discharge @ 1.2*Um	As Per IS 16227 – 1 & 3		
26	Fuse protection on Secondary	YES		

4.5 Lightning Arrestor

1	Type	Polymeric type	
2	Rating	9 kV or 30 kV rated 10 KA As per line requirement	
3	Class	Class DH as per IEC 60099-4	
4	Minimum continuous operating voltage	7.65 kV MCOV & 20.78 kV MCOV	
5	Preferred Make	Raychem, Oblem, Elpro	
6	With an insulation class on HT terminal		

5.0 GENERAL CONSTRUCTION

- 5.0.1 The Overhead Fault Passage Indicator shall locate the passage of faults on overhead lines. The FPI shall indicate transient faults and permanent faults on the O/H lines. The transient fault detection feature should have disable feature with manual as well as remote settable.
- 5.0.2 FPI should detect the fault during trail charge. (Switch on to fault (SOTF) feature in FPI).
- 5.0.3 The Overhead Fault Passage Indicator shall operate on passing over of the absolute threshold current (user settable).
- 5.0.4 Current peaks, caused by switching on power equipment like transformers etc. can reach the operating point of FPI and may lead to a wrong evaluation, to avoid this, the incoming impulse must be filtered internally.
- 5.0.5 The filtration shall be such that the fault will only be indicated by FPI, if the current impulse lasted longer than the pre adjusted minimum impulse duration.
- 5.0.6 This duration should be internal set as 60ms minimum or/and can be adjustable in range of 60 to 300ms based on equipment in network application.
- 5.0.7 The faults are indicated by all FPI indicators placed on line between the source input side and up to the location of the fault. Such that the fault location shall be between the last flashing FPI and the next non- flashing FPI which is in standby mode.
- 5.0.8 SPD to be provided
- 5.0.9 FPI configuration option should be through wireless device like dongle with supporting software and remote, should not through hardware like USB Cable.
- 5.0.10 Protection setting and troubleshooting from web browser (OEM configuration tool can be avoided), as the program can be accessible from any user specific system or laptop.
- 5.0.11 Considering the lightning prone geography, need to consider SPD for FPI power supply.
- 5.0.12 Hard rebooting of FPI through SMS (MODEM should have single DO) shall be included in specification as a standard feature.
- 5.0.13 Cyber security needs to be ensure.
- 5.0.14 The FPI should report to 8 masters with one single CASDU.
- 5.0.15 The Fault passage Indicator (FPI) shall be designed to manage the risks associated with it such that there shall not be any safety hazard to the employees in normal service and during inspection and maintenance.
- 5.0.16 The Fault passage Indicator (FPI) shall be totally safe against inadvertent touch (by human/animal) of any of its constituent live parts.
- 5.0.17 The Fault passage Indicator (FPI) shall be cooled by natural air flow.
- 5.0.18 All cable requirements should be considered.
- 5.0.19 All the components of fault detection system shall be antirust, corrosion resistant and UV

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resistant hence suitable for long time outdoor exposure ensuring long life.

5.1 TRIP CURRENT AND FAULT TYPES

- 5.1.1 Trip current for the FPIs shall be settable at site.
- 5.1.2 FPIs shall constantly monitor, measure the line current and evaluate the same. In case current exceeds a pre-set value, a fault has to be indicated. Alternatively, there shall also be an "Automatic Mode", in which the FPIs will get adapted to the service current.
- 5.1.3 The FPI shall detect and indicate phase to phase & phase to earth faults. In addition to this, the FPI shall also detect and differentiate between transient, temporary and permanent faults.
- 5.1.4 The FPI shall be equipped to filter out the inrush current due to transformer magnetizing currents thus avoiding the possible false indication of faults.
- 5.1.5 In case of faults, the Fault Passage Indicator which are detecting the variation of the electromagnetic field due to fault current (Indicator installed between the circuit breaker and fault point) shall provide a fault indication, while Fault Passage Indicators downstream the fault or on non-faulty branches shall not provide any indication.
- 5.1.6 The Fault Passage Indicator shall be selective in action as indicated below
 - a. It shall not respond to any sudden variation (increases/decrease) in load current.
 - b. It shall not respond to an over current not due to a fault.
 - c. It shall not respond to high magnetizing inrush currents, created upon line energizing.

5.2 LED/INDICATION

- 5.2.1 The FPI shall indicate faults by means of bright red LED for permanent faults so that the indication is clearly visible during night times and by means of a red luminous flag, so as to be clearly visible in the bright sunlight during day times.
- 5.2.2 Alternately it is preferred that FPI shall have different color light (LEDs) for permanent faults, transient fault and low battery indication.
- 5.2.3 Bidders to mention the options provided for various faults and indication purposes.

5.3 RESET

- 5.3.1 Once the fault is cleared, the FPI shall reset itself upon the power return.
- 5.3.2 It shall also have a facility of resetting with settable time duration and manual reset.
- 5.3.3 If FPI is busy in flashing on transient fault and if the permanent fault occurs, the FPI shall automatically change the priority and shall start flashing differently to show the permanent fault; thus helping maintenance crew to review the priorities.
- 5.3.4 The Fault indication shall remain until:
 - a. a time-out, configurable to at least 4 possible values between 2 and 16 hours, has expired,
 - b. the medium voltage is back,
 - c. the Fault Passage Indicator is reset manually
 - d. **Whatever condition comes first.**
- 5.3.5 The Fault indication reset shall consist in:
 - a. stopping the local light indication flashing
 - b. Sending an alarm to the GSM/GPRS interface which shall itself forward this alarm to the SCADA Control Centre according to its configuration.

5.4 BATTERY

- 5.4.1 The FPIs shall be powered by inductive pickup from the 11kV conductor with a minimum operating current of 5A. During faults, when the system is down, FPIs shall be powered by lithium-Ion battery.
- 5.4.2 The lithium-Ion battery provided inside the FPI shall be replaceable type, in case of battery failures. The battery shall have a minimum indicating life of 10 years / 1000 hours & a shelf life of minimum 15 years.
- 5.4.3 Low battery alarm indication shall be provided on local as well as SCADA control station.
- 5.5.1 Battery and charger monitoring feature must be included like; AC/DC fail, Battery test, Charger fail.

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5.5 REMOTE CONTROL UNIT FEATURES

- 5.5.2 The FPI shall be supplied along with suitable Remote Control Unit, having a LCD display, common for all the Overhead Fault Passage Indicator. The supplier shall supply one number of Remote Control Unit free of charge along with every 9 numbers of FPIs.
- 5.5.3 The FPI shall be equipped with remote Test and Reset features, so that the functionalities including status of battery and flag can be tested without removing the FPI from the line. The Remote Control Unit shall capable of performing the following operations:
- I. Perform Test / Reset operations by standing below the FPIs.
 - II. View settings of various parameters of the FPI like trip current, response time, reset time, temporary fault indication status, transient fault indication status, auto-reclosure support status etc.
 - III. Set various parameters of the FPI like trip current, response time, reset time, temporary fault indication status, transient fault indication status, auto-reclosure support status etc.
 - IV. Perform battery check and flag check.
 - V. View real-time value of the current flowing though the 11kV line on which a particular FPI is installed. This current shall be indicated in terms of Amps (A).
 - VI. Operating range for the Remote Control Unit shall be minimum 30m radius.
- 5.5.4 The settings for the FPI shall be settable at site, without dismounting the FPI from the line. Following parameters shall be settable at time.
- Trip Current
 - Response Time
 - Reset Time
 - Turn On / Off indication for Transient Faults
 - Turn On / Off auto-reclosure support function

FOR COMMUNICABLE TYPE FPI:

5.6 DATA TRANSMISSION UNIT (For communicable FPI)

- 5.6.1 Bidder to mention the offered unit package.
- 5.6.2 The DTU receives the measurement and alarming data from the FPI through high frequency wireless module. The frequency band provided by the bidder shall be license free brand and congestion free. Range of operation of 1 no DTU shall be 3 set (3 nos.) of FPIs.
- 5.6.3 The bidder providing more range of operation shall be preferred. After storing and processing the data, it connects with the SCADA server through GSM/4G/GPRS network.
- 5.6.4 IEC 104 communication protocol to be used to transfer data to SCADA. It sends the monitoring data to the server and the control command sent by the server to achieve bidirectional controllable operation.
- 5.6.5 The Data Transmission Terminal Unit shall consist of minimum following:
- i) Main Control board/PCB
 - ii) High Frequency wireless module
 - iii) GSM/ 4G/ GPRS Module
 - iv) Li-Ion Battery/ Battery arrangement to store power from PT

5.7 DTU CABINET (For communicable FPI)

- 5.7.1 The enclosure shall be made up of stainless steel with IP55 tested for protecting internal components against electromagnetic, electrostatic and environmental influence, along with cable glands at suitable ends.

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- 5.7.2 The cabinet should have limit light switch to work in shut down period.
- 5.7.3 Latent defects should be removed.
- 5.7.4 It should have pad lock provisions.
- 5.7.5 The control cabinet shall be of sufficient size to accommodate the addition of a 4G/RF modem, customer SCADA wiring.
- 5.7.6 The controller should have two pole MCB directly connected to AC input from PT and DC MCB for isolation of battery.
- 5.7.7 The wiring should be such that the controller relay shall be powered up with Aux. AC supply or charger dc supply and in case of no power via auxiliary PT, the relay shall automatically take power from battery. Battery shall take charging power through charger.
- 5.7.8 All control wires shall be FR grade PVC, single core copper, multi stranded, flexible wires without any joints in between runs.
- 5.7.9 The input voltage should have inbuilt surge protection device.
- 5.7.10 Indicator light should be added in the cabinet.
- 5.7.11 QR code sticker should be placed on the inside surface of the door arrangement of DTU cabinet, which will help in accessing the schemes, architecture and other important documents.

5.8 GSM/GPRS COMMUNICATION INTERFACE

Minimum No of TCP/IP Ethernet Port	3 (Among them one must be engineering port) 1 No. of maintenance port, 2 Nos of data port
Data Transmission Rate of TCP/IP Ethernet Port	10/100Mbps.
Communication	Controller must have at least one TCP/IP Ethernet port to for communication with master station over IEC-60870-5-104 & MQTT. No external protocol converter will be accepted.
Master station communication protocol	Support IEC -60870-5-104/MQTT for communicating with master station. Preferably support FTP protocol to transfer disturbance recorder to remote server. Simultaneously communication facility to field engineer for faster local restoration
DATA Reporting	Device should support periodic data reporting configurable from 2 second to 1 hr interval and spontaneous data as well. Digital data should have higher priority than analog data. The dead band for reporting analog data by exception shall be initially set to 1 % (in 1%) of full scale value.
Multi-Master reporting	8 master with single CASDU
CPU Processing Speed	32 bit ARM Core CPU operating @ minimum 450 MHz
RAM	64 MB
Modem	GPRS (2G/3G/4G/5G)/RF Modem to be connected in one Ethernet port for SCADA communication along with the facility of sending SMS. MODEM must have minimum 2 LAN port for communication. MODEM should have % meter antenna length.
Controller	Must have External DI contact (to capture ON/OFF Status.) DO will use for control & DI will be for status. DI/DO card should have sufficient ratings to take care of operations without CMR.

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Cyber Security	User level authentication, Disabling the DNS, Disabling/enabling/configurable TCP/UDP port,	
Protection Features	PT Failure, Charger Failure, Battery Failure/Door lock alarm integrated to Controller	
Minimum Event Storage Capacity		
Measurement Event	10000	
System Event	1000	
Alarm Event	1000	
Normal Event	5000	

Detailed hardware requirement and architecture will be decided at the time of detailed engineering phase prior to implementation.

5.9 SINGLE PHASE POTENTIAL TRANSFORMER SUPPLY KIT (PT)

- 5.9.1 This kit shall be composed of a PT (Resin Cast Type) and rechargeable battery. It shall be provided with a cable of minimum length 3m for connection to the GSM/GPRS communication interface installed on the same pole.
- 5.9.2 The mounting bracket for PT also need to be provided which shall be suitable for trapezoidal shaped RCC poles.

5.10 MEASUREMENTS

- 5.10.1 Event time-stamping, any change of state of information shall generate a time-stamped event stored in the GSM/GPRS interface memory.
- 5.10.2 The event storage capacity shall be at least 1000 events.
- 5.10.3 Short-range radio- Short range radio shall use license-free radio frequency. It shall be designed so that to allow a maximum distance between GSM/GPRS interface and the Fault Passage Indicators equal to 100m or more.

5.11 COMMUNICATION WITH THE CONTROL CENTRE

- 5.11.1 Communication between the GSM/GPRS interface and the control centre shall be through GSM/GPRS network, dual-band 900 MHz – 1800 MHz, and using any standard protocol.
- 5.11.2 It shall allow communication in 2 ways:
- At any time, based on configured periodic calls or on operator action, the GSM/4G/ GPRS interface shall be ready to receive a call from the control center.
 - Whenever a monitored information declared as alarming in the GSM/4G/GPRS interface configuration changes status, the GSM/4G/GPRS interface shall make a call to the control center and send it an alarm.
- 5.11.3 Each monitored information (fault current detection, voltage absence/presence, digital inputs etc...) shall be configurable as "alarming" when changing state, individually and independently of others.

5.12 CONFIGURATION AND MAINTENANCE

Equipment configuration and diagnostic shall be performed by connection of a laptop PC to the GSM/GPRS interface using the PC RS232 interface.

6.0 NAME PLATE & MARKING: -

The Relay shall be provided with durable and legible nameplate sticker containing all parameters. The box of Relay shall be provided with legible name plate sticker on box with minimum following information:

Manufacturer name & address
Model No.

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PO number & date

Property of TPCODL/TPNODL/TPSODL/TPWODL

The FPI shall be provided with durable and legible nameplate sticker containing all technical parameters.

Manufacturer's Name/Logo

Manufacturing month & year Type/Model

The other material shall have details of PO and Property of TPCODL/TPNODL/TPSODL/TPWODL mention on the box or equipment as per suitability.

7.0 TESTS

All the Routine and acceptance tests shall be carried out in accordance with the relevant IS/IEC standards. All acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components within the relay enclosure shall have to be tested for Routine/acceptance and Type tests as per the relevant standards. All Type tests as per latest IS / IEC shall have been carried out on relay as a whole as per relevant IS/IEC. Following tests shall be necessarily conducted on the equipment and its components.

Note- In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid.

7.1 TYPE TESTS

A) For FPI line unit:

Sr. no.	Test	Standard
1	Impulse Test	IEC60060-1
2	Power Frequency Magnetic Field Immunity	IEC 61000-4-8
3	Dry Heat Test	IEC 60068-2-2
4	Damp Heat Cyclic Test (With moisture at Upper temp 550C)	IEC 60068-2-30
5	EFT (Electrical Fast Transient) Immunity	IEC 61000-4-4
6	Surge Immunity Test	IEC 61000-4-5
7	Ingress Protection	IEC 60529
8	Salt mist, cyclic (sodium chloride solution) test	IEC 60068-2-52
9	Short Circuit Withstand test	IEEE 495 and IEC 62271-1

B) Other Accessories involved for communicable FPI shall have to be tested as per relevant IEC/IS and reports to be submitted along with Bid,

- Modem – OEM Type Test reports including GPRS/GSM compiling the relevant protocol
- PT – OEM Type Test report
- Controller/data collector – OEM Type Test report
- DCU Unit - IP Test for IP 54 Rating

PT Type tests should be from CPRI/ERDA .Type Test validity as per CEA guidelines

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- a) Lightning Impulse Test
- b) Power Frequency Withstand Test

7.2 ROUTINE TESTS

Following routine tests are to be done on 100% of the lot quantity

- 1. Visual Inspection.
- 2. Electric strength or AC voltage test
- 3. Dimensional & Visual Checks
- 4. Functional Test

7.3 ACCEPTANCE TESTS

A. FPI: Following test shall be conducted at factory acceptance of in presence of our inspectors.

Sr. No.	Test	Method	Requirement
1	Insulation Resistance Test	IEC 60950-1	Withstand & value >100MOhm
2	Electric Strength (2kV)	IEC 60950-1,	Withstand without any damage/flash.
3	Visual Checks	As per specs and approved documents.	Should meet requirements
4	Functional Test	As per approved documents and specification requirements	Should meet requirements

B. Other Accessories involved for communicable FPI shall have to be tested as per relevant IEC/IS and reports to be submitted along with Bid,

- a) Modem – OEM Type Test reports
- b) PT – OEM Type Test report (TTR to be submitted as per TS No. TPU-D-ENG-ENV-10066)
- c) LA - OEM Type Test report (TTR to be submitted as per TS No. ENV-HV-2015 & ENG-EHV-1021)
- d) Cable - OEM Type Test report
- e) Controller/data collector – OEM Type Test report

8.0 TYPE TEST CERTIFICATE

The Bidder shall furnish the type test certificates of the relay of same model as offered in bid for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA or any other International Laboratory as per the relevant standards of IS and IEC. Type tests shall have been conducted in certified Test laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

Bids without all type test reports shall stand disqualified.

9.0 PRE-DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized representative of the TPCODL/TPNODL/TPSODL/TPWODL. Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to TPCODL/TPNODL/TPSODL/TPWODL's representatives at all times when the work is in progress. Inspection by the TPCODL/TPNODL/TPSODL/TPWODL or it's authorized representatives shall not

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relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL. Following documents shall be sent along with material

- a) Routine Test reports
 - b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
 - c) Invoice in duplicate
 - d) Packing list
 - e) Drawings
 - f) Delivery Challan
 - g) Installation and maintenance Manual soft copy
- Other Documents (as applicable)

10.0 INSPECTION AFTER RECEIPT AT STORE

The material received at TPCODL/TPNODL/TPSODL/TPWODL Store will be inspected for acceptance and shall be liable for rejection if found different from the reports of the pre-dispatch inspection.

If any deviation or anomaly observed at this stage same need to be rectified by bidder at bidders own cost at earliest.

During P2P bidder shall complete all the signal tests with SCADA as per approved IO list.

11.0 GUARANTEE

1. Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Purchaser up to a period of at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is earlier, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the " Security cum Performance Deposit" as the case may be.
2. Warranty should be comprehensive at site warranty, it shall be clearly mentioned like what covered under warranty, considering the large geography OEM refuses to support.

12.0 Warranty, Maintenance, Upgrades, Patch Management & Database Modification Requirements

This Section specifies the requirements for Warranty, hardware and software maintenance for the System, Warranty maintenance and support, system upgrades, patch management etc.

Bidder to note the environmental condition of locations, the proposed system is being planned to be installed and operational.

Bidder shall provide facilities for carrying out online and offline maintenance of the components supplied as a part of the system. In general, this should include adequate testing equipment, tools, safety devices and other accessories. Bidder shall provide the details in their bid.

- a. Bidder should provide Maintenance strategy of the product (Own & Sub-Vendor) being offered so as to schedule appropriate timeline for maintenance.

- **Maintenance Performance Requirement**

Purchaser envisaged that all offered equipment shall not require routine or planned maintenance. Therefore, no fans or moving parts shall be used in any of the system to avoid any need for maintenance. To ensure this, all the supplied equipment should be constructed to resist the entry of Dust, Water etc. A single technician shall be able to remove and replace for repair purposes, without special tools and test equipment, all equipment involved in the offered system. Restoration of equipment to full operational use shall be possible within 15 minutes (nominally) of repairs being completed. It should not be necessary to dismantle (remove multiple pieces of) the system in order to replace a module.

- **Service Life**

Purchaser prefers that the equipment shall be capable of complying with this standard, including performing its intended purpose, for a minimum of 10 years from the date of commissioning.

The supplier shall indicate the following:

- a. The date at which the product was released for sale.
- b. The anticipated date at which the product will be withdrawn from sale, but support will continue to be provided for Spares and Services.
- c. The anticipated date that product support will be withdrawn, i.e., spares and technical support will no longer be available.

- **Interchangeability**

All the parts/modules shall be interchangeable individually (e.g., DCUs/FPIs/modules shall be interchangeable individually). This is applicable for all the parts/module including Modems, Battery Chargers, battery supplied by the bidder under this contract.

Any such change or replacement shall not reduce the capability of the equipment to conform to the requirements of this specification.

- **Definitions**

The responsibility for maintenance of hardware and software will vary depending on the time during the Contract. So that the times for changes in responsibility can be determined, the following definitions shall be used:

Delivery – Delivery of any item shall be interpreted as receipt of the item at Purchaser's facility.

Commissioning – Commissioning of any item shall be interpreted as receipt of the item at Purchaser's facility, installation on-site, successful completion of the site tests, and correction of all variances from the tests.

- **Deliverable Hardware and Software Version**

The delivered Hardware and Software shall be the latest version being delivered by the manufacturer of the Hardware & Software six months prior to its delivery to Purchaser's facility. During delivery of the system, all the FRTU of a Bidder across the Tata Power DISCOMs network shall be upgraded to the latest version.

All hardware and software shall be of compatible versions. That is, the Bidder shall be responsible to ensure that all delivered hardware and software versions will inter-operate successfully. If it becomes necessary to upgrade some hardware or software to meet this requirement, the cost and time shall be borne by the Bidder. If it is necessary to revert to a previous version of any hardware or software to overcome incompatibilities among the hardware or software, the Bidder shall bear the cost and time of the "downgrade" and shall present a plan to correct the problems with the newer release. Such corrections shall also be at the Bidder's sole expense.

- **Warranty support**

- a. **Maintenance services** for the supplied Hardware, System and application Software up- gradation, Patch Management services including sub-vendor products during the Standard warranty period of 5 Years from the date of system handover after SAT, resolution of all punch point of SAT and trouble-free operation of the entire system for a period of one month.
- b. Bidder shall provide Software up-gradation (if any), Patch Management services including sub- vendor products for next 5 years over and above as mentioned in item a.

SLA will be prepared and adhered by Bidder, Sub-Vendor's of bidder for extending the Hardware, Software and Service support to Purchaser for the period mentioned above. To mitigate major failure like Complete system failure, FRTU system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability. Some of the salient points as example are documented below:

- a. Bidder shall report to site within 48 hours of receipt of reporting of the failure occurrence
- b. Bidder shall provide replacement of the faulty equipment within 7 days after confirmation of the fact that the equipment can't be repaired at site. Failure to this clause may have some penalty reference on Bidder.
- c. Bidder will mandatorily provide detailed analysis report of the faulty equipment within 30 days from the date of the site visit.

- d. Any spare Equipment replacement, testing and its commissioning to be done by bidder, with no cost implications to Purchaser. Any tools, equipment, Software or Hardware required for testing of the System (e.g., IEDs/FRTU/Communication Equipment) will be the responsibility of the Bidder, this includes all system supplied by bidder under this contract.
- e. Any up gradation in application software and hardware will be informed to Purchaser and necessary up gradation to be carried out by Bidder with no cost implications to Purchaser.

Bidder to note that Tri-Party agreement will be prepared for Bidder, Sub-Vendor to have protection against quitting of executing bidder and its alliances during commissioning, warranty and post warranty period as specified in this document.

- **Hardware Maintenance**

The project schedule shall include an allowance for hardware maintenance prior to the availability test. The Bidder will not be granted any relief for project delays caused by maintenance problems prior to the availability test.

- **Pre-Delivery Maintenance**

The Bidder shall have the responsibility for maintenance of all hardware prior to delivery to Purchaser's site. This maintenance may be performed by a maintenance contract with Original Equipment Manufacturers (OEMs) or other parties or by the Bidder staff using spare parts from the Bidder's stores or other sources.

- **Maintenance During Commissioning**

The Bidder shall have the responsibility for maintenance of all hardware after delivery and prior to commencement of the Warranty. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Bidder staff using spare parts from the Bidder's stores or other sources.

Failed equipment shall be replaced or repaired, and spares inventories (if any) replenished to their delivered level throughout the period of commissioning. Any spare parts found to be defective during initial delivery inspection or during this period shall be replaced within one week after notification. There shall be no charges to Purchaser for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by Purchaser.

- **Maintenance Under Warranty**

Maintenance during the warranty shall be in conformance with the terms of the warranty sections of this RFP.

During the warranty period, Purchaser's hardware maintenance responsibilities will include the following:

- a. Provision of trained staff, responsible for call-out when problems occur
- b. Providing local assistance to the Purchaser during problem resolutions

The Bidder's hardware maintenance responsibilities shall include the following:

- a. Providing maintenance of all equipment, including spare parts
- b. Providing materials and instruction for appropriate engineering changes for equipment
- c. Provision of technical guidance towards the resolution of all hardware problems for equipment.

When needed, the Bidder shall respond to requests for technical support within Two Hours, 24 hours a day, seven days a week.

Failed equipment shall be replaced or repaired, and spares inventories replenished to their delivered level throughout this period. Any spare parts found to be defective during initial delivery inspection or during the Warranty period shall be replaced within one week after notification. There shall be no charges to Purchaser for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by Purchaser.

The Bidder's technical support staff shall work with Purchaser's technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, Purchaser believes that the Bidder's technical support is not effectively

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resolving a problem, Purchaser may request that the Bidder's system expert or staff from the equipment's manufacturer be dispatched to Purchaser's facility. The Bidder's technical team shall be at Purchaser's facility within 48 hours of that request to provide hands-on support towards the problem resolution. Purchaser will not be responsible for any expenses connected to the technical support, including travel expenses.

The Resolution time for different complaints shall be as per the below matrix:

Category	Definition	Maximum Resolution Time
Severity 1 Urgent	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability	0-24 hrs.
Severity 2 Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost Non-availability of Manpower at site during working hours	0-48 hrs.
Severity 3 Minor	Any other system defect, failure, or unexpected operation Request for information, technical configuration assistance "how to" guidance, and enhancement requests.	0-72 hrs.

Failure by the Bidder to comply with the above-mentioned timelines, shall attract a penalty as per contractual LD clauses

- ***Hardware Minimum Support Period***

The Bidder shall guarantee the availability of spare parts and hardware maintenance support services for all System equipment for a minimum period of 10 years. Subsequent to this minimum support period, the Bidder shall provide to Purchaser a minimum of two year's advance notice of their intent to terminate such services.

- ***Upgrades, Patch Management & Modifications***

- Bidder shall continuously keep the Purchaser informed of all Software and Hardware upgrades as & when these are released.
- Bidder shall supply upgrades and patches of all installed software (both own and third party) for a period of ten years from the date of system acceptance without commercial implication.
- Bidder shall rectify all design defects and software bugs at no extra cost for a period of 10 years from the date of system acceptance.
- Bidder shall support the system totally for ten (10) years, even if no upgrades are implemented.
- Bidder shall provide lifetime support (10 years) for the system. To meet this requirement, Bidder shall refer with OEMs on the product's life cycle management and obsolescence. Bidder shall attach the product life cycle matrix for hardware and software offered under this RFP.
- The system referred to above includes Bidder's own as well as third party components.

- ***Database modification during Warranty Period***

All database modification major or minor is in the scope of the bidder, after the system handover and during the warranty period. The Scope covers FRTU configuration and necessary changes for control center communication. It is bidder's responsibility to provide resources as and when required by the purchaser for these changes and testing of the same as per the project and planned activity schedule. One of the examples of Configuration changes/modification are as mentioned below:

- Addition of Tags
- Addition/ Deletion of System/IEDs/Devices/SCADA enabled equipment/sensors

13.0 PACKING

Bidder shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit. The packing should be in such manner that during storage of relay and its components should not be damaged. **No**

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single use plastic to be used in packing material. Packing should be done with environment friendly recyclable materials.

14.0 TENDER SAMPLE

Bidders to submit one sample of FPI at TPCODL/TPNODL/TPSODL/TPWODL for verification of all desired features.

For communicable FPI- Bidders to provide all required equipment and demo of one communicable FPI unit data communication and integration testing and only successful bidder shall be qualified for further processing.

Commissioning of one unit of FPI in case of new vendor to be done.

If the Model is already supplied then tender sample is not required.

15.0 TRAINING

The bidder shall arrange to provide the operating training at TPCODL/TPNODL/TPSODL/TPWODL offices as and when required for better installation and usage of the product.

Video Manuals for configuration and troubleshooting of FPI, help in understanding the things in better way and skill enhancement.

16.0 QUALITY CONTROL

The bidder shall submit with the offer, assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's or its nominated representative engineer shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

To ensure proper functioning of relay the bidder shall provide onsite training of TPCODL/TPNODL/TPSODL/TPWODL teams as and when required. To ensure quality of installations bidder shall provide supervision support during impartation.

17.0 TESTING FACILITIES

Bidder shall have adequate in-house testing facilities for carrying out all routine tests, acceptance tests and special test as per this document and accordance to relevant International / Indian standards as mentioned.

18.0 MANUFACTURING ACTIVITIES

The successful bidder will have to submit (after placement of RC) technical compliance document and drawing of cable as per RC line items for getting approval before mass manufacturing.

Manufacturing mass quantity to start only after getting CAT-A approved drawings or as per intimation from TPCODL/TPNODL/TPSODL/TPWODL.

19.0 SPARES & ACCESSORIES

Bidder shall provide a list of recommended spares/tools with quantity and unit prices for 5 years of operation after commissioning. TP DISCOMs may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works.

TP DISCOMs may order additional spares at any time during the contract period at the rates stated in the Contract Document. Bidder shall ensure availability of recommended spares for 15 years from the date of commissioning.

Minimum 10% buffer stock should be maintained by the BA to avoid the shortage of spare part.

The communication cable for accessing controller from laptop to be provided by bidder as spare item.

Remote 1 No. required for 9 Nos of FPI

Hot-Stick 1 No. required for 20 Nos of FPI

RATE OF SPARE NEED TO BE DISCUSSED

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20.0 DRAWINGS & DOCUMENTS

Following drawings and documents shall be prepared based on TPCODL/TPNODL/TPSODL/TPWODL specifications and statutory requirements and shall be submitted with the bid:

- Completely filled in Technical compliance document for all clauses
- Any deviation sheet or No deviation
- General description of the equipment and all components including brochures.
- Experience List
- All set of Type test certificates & detailed reports
- Mounting drawing of PT & DCU unit at the time of evaluation.

Drawings / documents to be submitted for approval after the award of the contract are as under:

- Completely filled in Technical compliance document for all clauses
- General Arrangement drawing
- Type test reports if any pending.

All the documents & drawings shall be in English language.

After the receipt of the order, the successful bidder will be required to furnish all detailed drawings of components for TPCODL/TPNODL/TPSODL/TPWODL approval.

Instruction Manuals: Bidder shall furnish softcopies and one hard copy manuals of Relay (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to relay.

20.0 GENERAL TECHNICAL PARTICULARS

Bidder to submit compliance to all above clauses and sub-clauses and shall furnish all desired details as technical compliance document.

21.0 SCHEDULE OF DEVIATIONS

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

Sl. No.	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Designation

Signature

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Annexture-1 - Inspection & Quality Test Plan

Sr. No.	Test	Method	Requirement
1	Insulation Resistance Test	IEC 60950-1, IEC 60255-27	Withstand & value >100MOhm
2	Electric Strength (2kV)	IEC 60950-1, IEC 60255-27	Withstand without any damage/flash.
3	Visual Checks	As per specs and approved documents.	Should meet requirements
4	Functional Test	As per approved documents and specification requirements	Should meet requirements
5	Other parts of package of communicable FPI	a) Modem – OEM Test reports b) PT– OEM Test report c) Controller/data collector – OEM Test report	As per relevant standards and approved drawings and technical parameters

Annexture-2 – Preferred Make List of Components

Sl. No.	Component	Preferred Make list
1	Modem	ABB Modem-ARG600 (4G) Robustel (Dynalog) Modem R2000L IPSec-VPN for Dynalog Modem and L2TP, open VPN for ABB Modem. Lantronix / Teltronics / XNet / Schneider/Nombus Equivalent
2	Battery Charger	Delta/Amara raja/Mass tech/Chloride /Schneider/Go Gate/ Equivalent
3	Battery Bank	Delta/Amara raja/Exide/Chloride /Leo/ Equivalent
4	MCB	Siemens / Schneider / Anchor / Havells/ Any reputed OEM
5	Lightening arrestor	Raychem, Oblem, Elpro
6	Potential Transformer	Narayan Powertech Pvt Ltd, Pragati Electrical

Annexure-3 – I/O List for FPI

S.N.	Alarm Description as on SCADA	SPI(Bit 0)	SPI(Bit 1)	Datatype	Type of info	Type of signal
1	1st Line Fault Current A Phase			36	Floating	ANALOGS
2	1st Line Fault Current B Phase			36	Floating	ANALOGS
3	1st Line Fault Current C Phase			36	Floating	ANALOGS
4	2nd Line Fault Current A Phase			36	Floating	ANALOGS
5	2nd Line Fault Current B Phase			36	Floating	ANALOGS
6	2nd Line Fault Current C Phase			36	Floating	ANALOGS
7	3rd Line Fault Current A Phase			36	Floating	ANALOGS
8	3rd Line Fault Current B Phase			36	Floating	ANALOGS
9	3rd Line Fault Current C Phase			36	Floating	ANALOGS
10	1st Line R Phase Current			36	Floating	ANALOGS
11	1st Line Y Phase Current			36	Floating	ANALOGS
12	1st Line B Phase Current			36	Floating	ANALOGS
13	2nd Line R Phase Current			36	Floating	ANALOGS
14	2nd Line Y Phase Current			36	Floating	ANALOGS
15	2nd Line B Phase Current			36	Floating	ANALOGS
16	3rd Line R Phase Current			36	Floating	ANALOGS
17	3rd Line Y Phase Current			36	Floating	ANALOGS
18	3rd Line B Phase Current			36	Floating	ANALOGS
19	1st Line A Phase Electric Field			36	Floating	ANALOGS
20	1st Line B Phase Electric Field			36	Floating	ANALOGS
21	1st Line C Phase Electric Field			36	Floating	ANALOGS
22	2nd Line A Phase Electric Field			36	Floating	ANALOGS
23	2nd Line B Phase Electric Field			36	Floating	ANALOGS
24	2nd Line C Phase Electric Field			36	Floating	ANALOGS
25	3rd Line A Phase Electric Field			36	Floating	ANALOGS
26	3rd Line B Phase Electric Field			36	Floating	ANALOGS
27	3rd Line C Phase Electric Field			36	Floating	ANALOGS
28	1st Line A PH Indicator battery volt Va			36	Floating	ANALOGS
29	1st Line B PH Indicator battery volt Vb			36	Floating	ANALOGS
30	1st Line C PH Indicator battery volt Vc			36	Floating	ANALOGS
31	2nd Line A PH Indicator battery volt Va			36	Floating	ANALOGS
32	2nd Line B PH Indicator battery volt Vb			36	Floating	ANALOGS
33	2nd Line C PH Indicator battery volt Vc			36	Floating	ANALOGS
34	3rd Line A PH Indicator battery volt Va			36	Floating	ANALOGS
35	3rd Line B PH Indicator battery volt Vb			36	Floating	ANALOGS

36	3rd Line C PH Indicator battery volt Vc			36	Floating	ANALOGS
37	1st Line A PH line temp Ta			36	Floating	ANALOGS
38	1st Line B PH line temp Tb			36	Floating	ANALOGS
39	1st Line C PH line temp Tc			36	Floating	ANALOGS
40	2nd Line A PH line temp Ta			36	Floating	ANALOGS
41	2nd Line B PH line temp Tb			36	Floating	ANALOGS
42	2nd Line C PH line temp Tc			36	Floating	ANALOGS
43	3rd Line A PH line temp Ta			36	Floating	ANALOGS
44	3rd Line B PH line temp Tb			36	Floating	ANALOGS
45	3rd Line C PH line temp Tc			36	Floating	ANALOGS
46	DCU battery voltage			36	Floating	ANALOGS
47	Charging Battery Volt			36	Floating	ANALOGS
48	DCU Status	Normal	Low	30	SPI	DIGITAL INPUT
49	DCU low battery alarm	Normal	Low	30	SPI	DIGITAL INPUT
50	1st Line A ph Indicator Comm Status	Normal	Fail	30	SPI	DIGITAL INPUT
51	1st Line A Ph Transient Short Circuit Fault	Normal	Operated	30	SPI	DIGITAL INPUT
52	1st Line A ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
53	1st Line A ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
54	1st Line A ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
55	1st Line A ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
56	1st Line A ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
57	1st Line A ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
58	1st Line A Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
59	2nd Line A ph Indicator Comm Status	Normal	Fail	30	SPI	DIGITAL INPUT
60	2nd Line A Ph Transient Short Circuit Fault	Normal	Operated	30	SPI	DIGITAL INPUT
61	2nd Line A ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
62	2nd Line A ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
63	2nd Line A ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
64	2nd Line A ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
65	2nd Line A ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
66	2nd Line A ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
67	2nd Line A Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
68	3rd Line A ph Indicator Comm Status	Normal	Fail	30	SPI	DIGITAL INPUT
69	3rd Line A Ph Transient Short Circuit Fault	Normal	Operated	30	SPI	DIGITAL INPUT

70	3rd Line A ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
71	3rd Line A ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
72	3rd Line A ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
73	3rd Line A ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
74	3rd Line A ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
75	3rd Line A ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
76	3rd Line A Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
77	1st Line B ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
78	1st Line B ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
79	1st Line B ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
80	1st Line B ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
81	1st Line B ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
82	1st Line B ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
83	1st Line B ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
84	1st Line B ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
85	1st Line B Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
86	2nd Line B ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
87	2nd Line B ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
88	2nd Line B ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
89	2nd Line B ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
90	2nd Line B ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
91	2nd Line B ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
92	2nd Line B ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
93	2nd Line B ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
94	2nd Line B Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
95	3rd Line B ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
96	3rd Line B ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
97	3rd Line B ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
98	3rd Line B ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
99	3rd Line B ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT

100	3rd Line B ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
101	3rd Line B ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
102	3rd Line B ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
103	3rd Line B Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
104	1st Line C ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
105	1st Line C ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
106	1st Line C ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
107	1st Line C ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
108	1st Line C ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
109	1st Line C ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
110	1st Line C ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
111	1st Line C ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
112	1st Line C Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
113	2nd Line C ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
114	2nd Line C ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
115	2nd Line C ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
116	2nd Line C ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
117	2nd Line C ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
118	2nd Line C ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
119	2nd Line C ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
120	2nd Line C ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT
121	2nd Line C Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
122	3rd Line C ph Indicator comm status	Normal	Fail	30	SPI	DIGITAL INPUT
123	3rd Line C ph transient short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
124	3rd Line C ph Permanent short circuit fault	Normal	Operated	30	SPI	DIGITAL INPUT
125	3rd Line C ph Earth fault	Normal	Operated	30	SPI	DIGITAL INPUT
126	3rd Line C ph Line Temp Overheat	Normal	Operated	30	SPI	DIGITAL INPUT
127	3rd Line C ph Current Overloaded	Normal	Operated	30	SPI	DIGITAL INPUT
128	3rd Line C ph Low Battery Alarm	Normal	Operated	30	SPI	DIGITAL INPUT
129	3rd Line C ph Voltage Presence	Dead	Live	30	SPI	DIGITAL INPUT

130	3rd Line C Ph Indicator Flag	Normal	Operated	30	SPI	DIGITAL INPUT
131	Door Status	Close	Open	30	SPI	DIGITAL INPUT
132	FPI Group Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
133	1st Line A Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
134	1st Line B Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
135	1st Line C Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
136	2nd Line A Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
137	2nd Line B Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
138	2nd Line C Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
139	3rd Line A Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
140	3rd Line B Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT
141	3rd Line C Phase FPI Reset	Operated	Normal	45	SPC	DIGITAL OUTPUT