NOTICE INVITING

EXPRESSION OF INTEREST

FOR

SELECTION OF VENDOR(S)

FOR SUPPLY, TESTING & COMMISSIONING

OF

100% REDUNDANT & HOT STANDBY PROCESSOR BASED ELECTRONIC RACKS FOR MONITORING SYSTEM OF POWER TRANSFORMERS.

Department Ref no.: CEE/EOI/5.3A/20-21/001

Revision:00

Date: 14.09.2020

1.0 Expression of Interest (EOI)

1.1 About Bharat Heavy Electricals Limited (BHEL)

BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing company of its kind in India engaged in the design, engineering, manufacture, construction, testing, commissioning of a wide range of products and systems for core sectors of the economy, viz. Power, Transmission, Industry, Transportation (Railways), Renewable Energy, Oil & Gas, Water and Defense with over 180 products offerings to meet the needs of these sectors. The Manufacturing Set Up, Power Sector Operations and Business Sectors establishment has pan India presence.For More details about the entire range of BHEL's products, Systems and operations, please visit www.bhel.com.

1.2 EOI: BHEL's Requirement

1.2.1 Background of System

The Monitoring System is a rugged, compact and cost effective On-line Monitoring System for power transformers.

It functions as a single interface for the complete monitoring needs. It provides alarm signals, supervision of the operating condition, estimation of remnant life of the transformer, Control of cooling banks and tap changer control is also incorporated. The system also provides state-of-art communication with IEC 61850 and MODBUS protocols for communication of the monitored parameters to the control room. The system is designed to meet the international standards for EMI / EMC, Dielectric insulation and high voltage Impulse withstand as well as atmospheric environmental and mechanical standards. The developed system is IEC 61850 compliant with the ability to communicate with the station computer.

The entire system consist of 2 units , first one is the data acquisition unit and other one is the processing & control unit. Each unit consists of an electronic rack namely IOD & CMS rack respectively . Each rack is provided with 2x100% processors in hot standby mode. In case of a failure of working processor in rack, the standby processor shall take over the operation automatically by bumpless transfer.

BHEL is seeking responses from reputed Original Equipment Manufacturer (OEM) of control electronic racks for supply, testing & commissioning of these control electronic racks.

1.2.2 Purpose of EOI

The intent of this Expression of Interest is to invite applications from interested organizations / companies who are willing to supply, test & commission 100% redundant and hot stand by processor based electronic racks.

The EOI process involves seeking willingness of interested parties and selecting one or more party(ies) amongst all who make an application in response to this EOI for developmental order for the below racks.

S.N	Item	Scope of partnership
1	IOD rack	supply ,testing & commissioning of IOD rack .Detailed scope to be finalised during tendering process
2	CMS Rack	supply ,testing & commissioning of CMS rack .Detailed scope to be finalised during tendering process

Interested organizations / companies/parties may submit their proposal for either Sl.no. 1 or 2 or both.

The chosen vendor(s) shall also be required to provide due support to BHEL for complete integration of the item(s) in the system as per the contract obligations to the customer.

1.2.3 INSTRUCTION TO APPLICANTS:

1 Reputed business entities may submit their application as per Annexure -1 , Annexure – 2 & Annexure 3 (along with supporting documents) by Post / e-mail so as to reach us within 30 days from the date of publishing of this EOI at the following address:

Sh. S.K.Biswas
Addition General Manager
Control Equipment Engineering
Switchgear Controlgear Rectifier Division.
Bharat Heavy Electricals Limited
Bhopal-462023

Email: sanjitbiswas@bhel.in / ankursaxena@bhel.in

Phone: +91 9425604669 / +91 9406903697

2 The details submitted by the Applicant(s) shall be complete in all respects and BHEL may seek clarifications/additional information as considered necessary. Such clarifications/additional information must be provided within 5 days of BHEL request.

3 The EOI process involves seeking willingness of interested parties and selecting one or more party(ies) amongst all who make an application in response to this EOI. The matrix scoring as per

annexure 3 will be done by BHEL to rank vendors and selecting one or more high score party(ies).

4 Any request for further information or clarification on the EOI document may be submitted to the above mentioned official within 07 days from date of issue of EOI.

5 Responses to EOI are to be submitted in English only. Supporting documents, as required, should also be in English language. In case of some documents being available in languages other than English, the Applicant shall necessarily provide duly authenticated translated version of the same in English.

6 Duly authorized representative of the Applicant(s) shall sign on each page of the document. Response to EOI should be prepared in such a way so as to provide a straight forward, concise description of Applicant's capabilities.

7 Notwithstanding anything contained in this EOI, BHEL reserves the right to accept or reject any Application and to annul the EOI Process in whole or part, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons thereof.

8 BHEL reserves the right to verify all statements, information and documents submitted by the Applicant in response to the EOI. Any such verification or lack of such verification by BHEL shall not relieve the Applicant of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

9 The EOI process shall be governed by, and construed in accordance with, the laws of India and the Courts at New Delhi shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the EOI process.

10 All costs incurred for participation in the EOI shall be borne by the Applicant(s).

1.2.4 Pre-Qualifying Requirements (PQR):

PQR responses to be submitted as per Annexure-2. It is desired that the prospective partner/ respondent meet the pre-qualification requirement supported with relevant documents/ credentials/ certificates for further consideration:

1.2.5 Specification of IOD rack

IOD rack is part of data acquisition unit and is required to receive signals from the field.

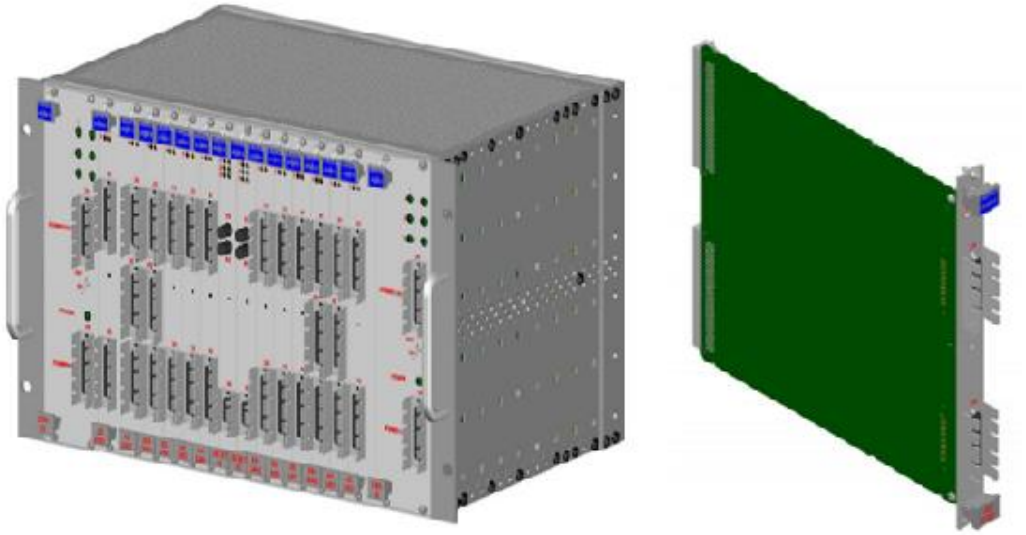


Fig1: Visualization of IOD rack & individual electronic card

1. It will have 2 sets cards (primary & secondary) housed in the same enclosure & operating on parallel redundancy in hot standby mode .
2. The complete IOD Rack comprises the following items:

Sl No.	Card Location in rack	Card Description	Function/Rating
1	A,B,C	Power supply card	Vin 230V AC $^{+-}$ 10% & 220 v DC $^{+-}$ 10%, Vout 24VDC,15VDC,-15VDC,5VDC
2	D	CT/PT card	3 channel power frequency current (Measure up to 2A AC current) and 3 channel power frequency voltage module(Measure up to 63.5 V AC voltage).
3	E	4-20mA Analog input card	16 Channel 4-20 ma current
4	F	Digital output card	20 channel Digital Output module (5A - 250V AC & 5A- 30V DC Rating Relay).
5	G	Digital input card	24 channel Digital Input module (24V - 150V DC Digital Logic, isolation of 1.5kV).
6	H	Digital input card	Same as sl no 5
7	I	Digital input card	Same as sl no 5
8	J	Bus coupler card	MODBUS TCP/IP protocol over Fiber optic cable
9	K	Bus coupler card	Same as sl no 8
10	L	Digital input card	Same as sl no 5
11	M	Digital input card	Same as sl no 5
12	N	Digital input card	Same as sl no 5

13	O	Digital output card	Same as sl no 4
14	P	4-20mA Analog input card	Same as sl no 3
15	Q	CT/PT card	Same as sl no 2
16	R,S,T	Power supply card	Same as sl no 1

3. Each set (primary & secondary) comprises of

a. 3 nos. 24 channel Digital Input module

b. 1 no. 20 channel Digital Output module.

c. 1 no. 16 channel 4-20 mA Analog Input module.
d 1 no. CT/PT card comprising of 3 channel power frequency current and 3 channel power frequency voltage module.

e. 1 no. Bus Coupler module.

4.The data will be communicated to remote processor with MODBUS over TCP/IP communication over fiber optic network.

5. Electronics Rack {19inch ,6U, 84HP}. Double EURO card supported.25 pin male Sub D connectors are to be used for external connections.

6. Type test Certification for compliance to International Standard for Electrical environment, Atmospheric Environment and EMI/EMC.

7. Front connector Pin Out details & LED indications of electronic cards are as follows

a. Digital Input card

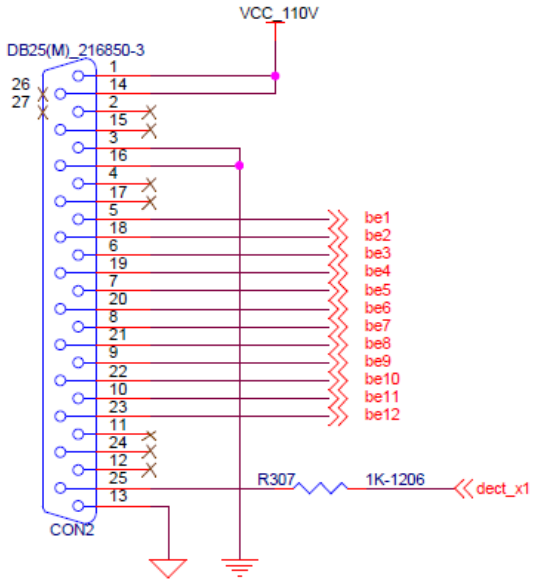
LED Indication details

Two types of LED at front plate give two different status of this card. Following is the detail of both LEDs.

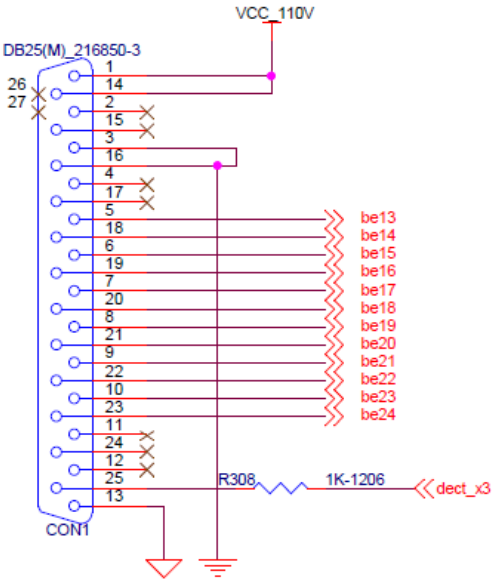
i. Green LED : Turn On on successful power supply connection

ii. Red LED : Turn On if any problem occur in the card

Front connectors pin out details



X1 CONNECTOR



X3 CONNECTOR

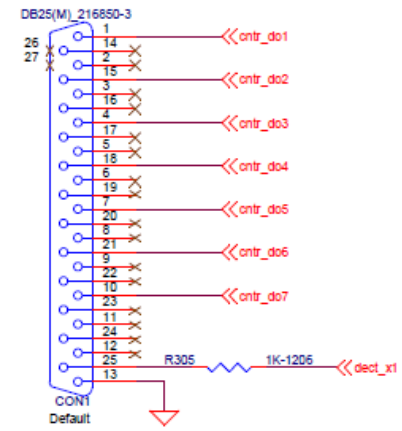
b. Digital Output card

LED Indication details

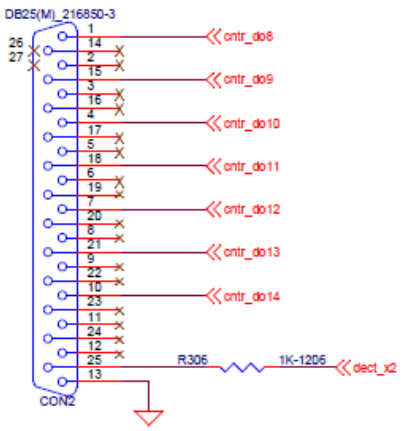
Two types of LED at front plate give two different status of this card. Following is the detail of both LEDs.

i. Green LED : Turn On on successful power supply connection
ii. Red LED : Turn On if any problem occur in the card

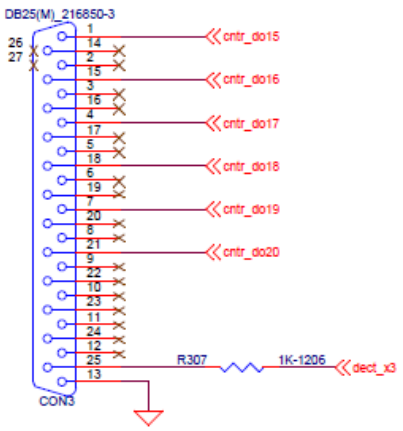
Front connectors pin out details



X1 CONNECTOR



X2 CONNECTOR



X3 CONNECTOR

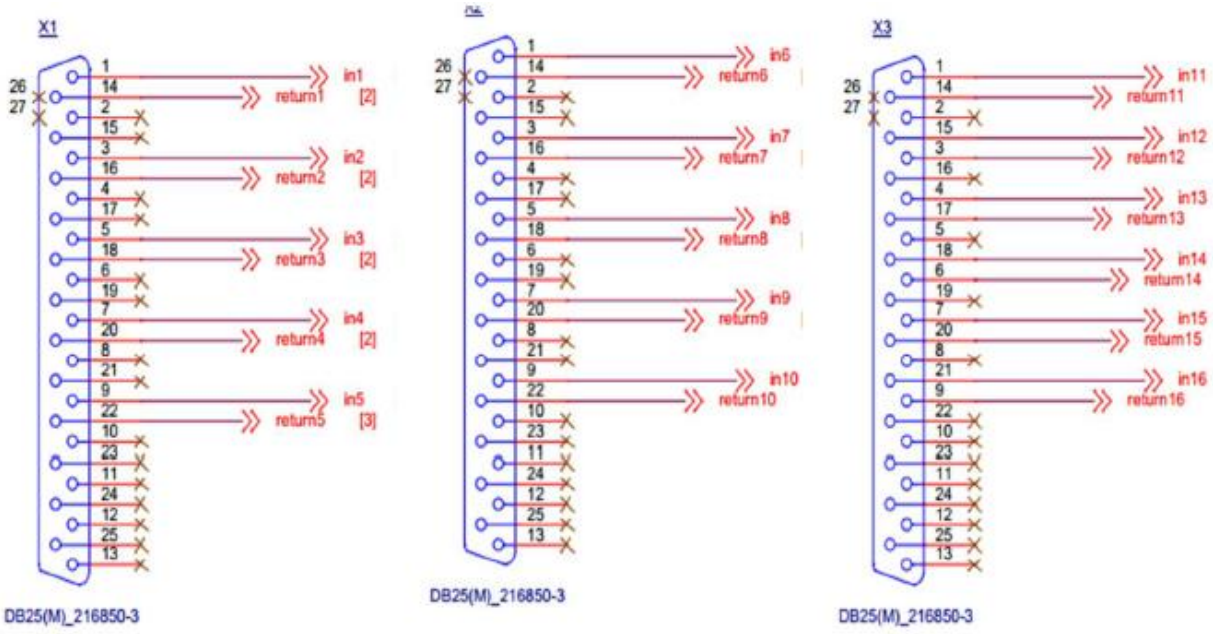
c. 4-20mA Analog Input card

LED Indication details

Two types of LED at front plate give two different status of this card. Following is the detail of both LEDs.

i. Green LED : Turn On on successful power supply connection
ii. Red LED : Turn On if any problem occur in the card

Front connectors pin out details



INPUT CONNECTOR

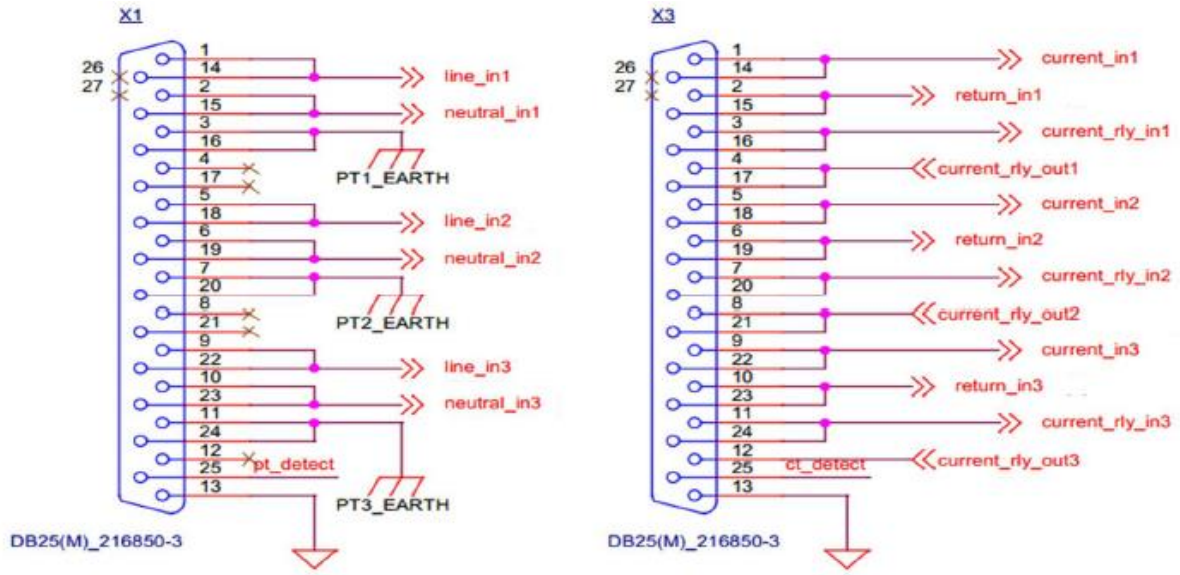
d. Voltage/Current (CT/PT) Input card

LED Indication details

Two types of LED at front plate give two different status of this card. Following is the detail of both LEDs.

i. Green LED : Turn On on successful power supply connection
ii. Red LED : Turn On if any problem occur in the card

Front connectors pin out details



e. Bus Coupler Card (BCRT)

LED Indication details

Green LED : Turn On on successful power supply connection

Red LED : Turn On if any problem occur in the card

Yellow LED : Left side : Turn on when Ethernet is Link up with IOD.

Right side : Continuous blink when Ethernet has active communication

Front connectors details

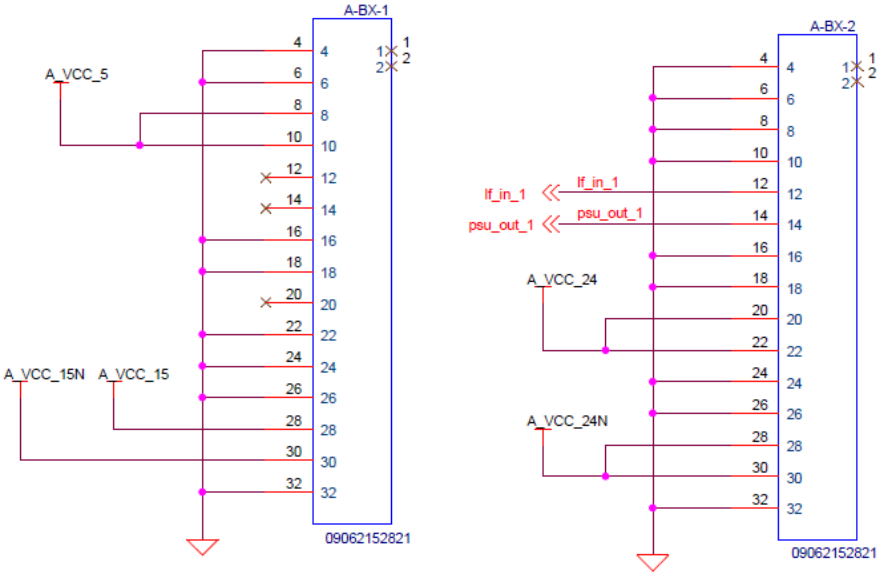
Fiber optic port, Ethernet port & RS232 connector.

f. Power supply card

The input to the card can be either 230V AC +25%/-20% and 172V to 268V DC. This card has multiple outputs which is connected to a common backplane through a press-fit type EURO connector at the end of the card. The outputs of the power supply are as follows:

Voltage	Current
24 V ± 2.5%	4 A
15 V ± 2.5%	1.5 A
-15 V ± 2.5%	1.5 A
5 V ± 1.5%	6 A

The above power supply card shall be provided by BHEL. The backplane euro connector pin out details is given below, which is to be incorporated by the vendor.



1.2.6 Specification of CMS rack

It is part of control & processing panel. CMS rack is high speed processor based system which collects field data from IOD rack on Fiber optic cable through Modbus protocol and stores into internal memory or transfers it to main SCADA system. There is 100% redundancy in CMS system, i) Primary & ii) Secondary. During operation if any issue in Primary side CMS or IOD then Primary CMS system switch it's role and Secondary CMS system takes total control and gets the data from IOD and send it to SCADA system accordingly.

CMS system will monitor all field digital input, 4-20mA sensor inputs, CT/PT input and also control the output connected to IOD.

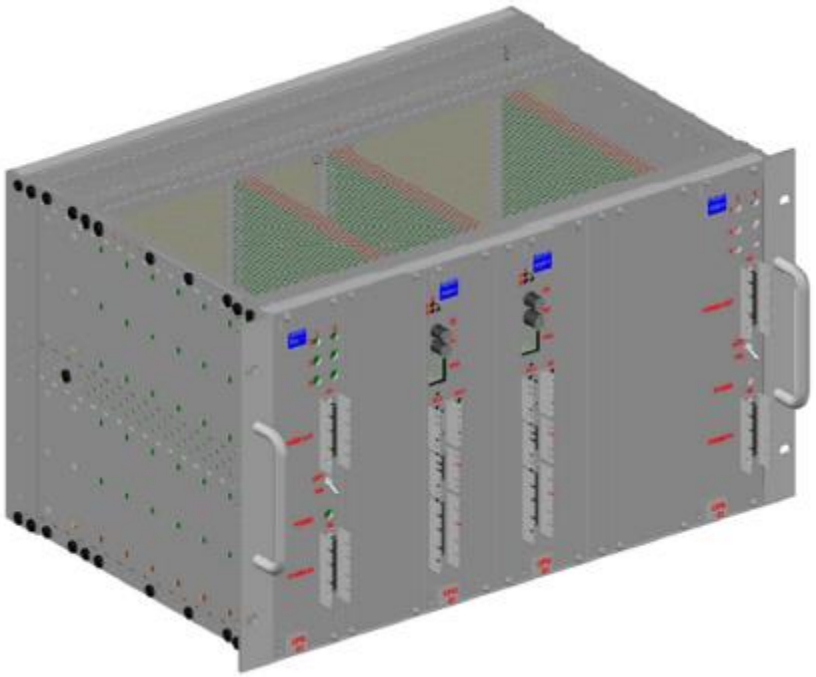


Fig 2: Visualization of CMS rack

Specifications of the CMS rack:

1. It will have 2 sets (primary & secondary) housed in the same enclosure & operating on parallel redundancy in hot standby mode

2. The complete CMS Rack comprises the following items:

Sl No.	Card Location in rack	Card Description	Function/Rating
1	A,B,C	Power supply card	Vin 230V AC $^{+-}$ 10% & 220 v DC $^{+-}$ 10%, Vout 24VDC,15VDC,-15VDC,5VDC
2	D,E,F	Ethernet switch and hub card	Ethernet switch and hub card of 6 channels each
2	G,H,I	Processor card CPU01	Single Board Computer with High speed processor, 40 Digital Inputs/Outputs, 6 serial ports and two Ethernet port. The application software is burnt onto a 16 GB mSATA Flash disk module mounted on the primary disk drive of the SBC module.
3	K,L,M	Processor card CPU01	Same as sl no 3

4	N,O,P	Ethernet switch and hub card	Same as sl no 2
5	R,S,T	Power supply card	Same as sl no 1

3. Each set (primary & secondary) comprises of

a. Processor card with baseboard.

b. Ethernet switch and hub card of 6 channels

4. Copper Ethernet Interface for communication with SCADA. Fiber Ethernet Interface for communication with IOD. RS-232/USB interface for PC & HMI interface.

5. Event logging, Historical data analysis, Transformer Life Estimation, channel and board level diagnostics.

6. 22inch HMI touch display with single board computer for interfacing with rack. HMI application displaying all the received data & event logs.

7. Electronics Rack {19inch ,6U, 84HP} . Double EURO card supported. 25 pin male Sub D connectors are to be used for external connections.

8. Type test Certification for compliance to International Standard for Electrical environment, Atmospheric Environment and EMI/EMC.

9.Pin out details of electronic cards are as follows

a. Processor card CPU01

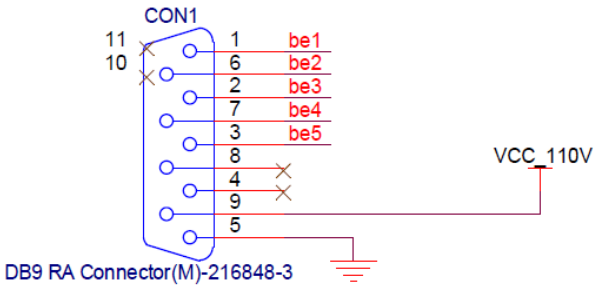
i. LED Indication Details

Color of LED Indication when turns on
Green Regular power on
Red Error in board
Yellow (Left) Fiber Ethernet link up
Yellow (Right) Fiber Ethernet link active

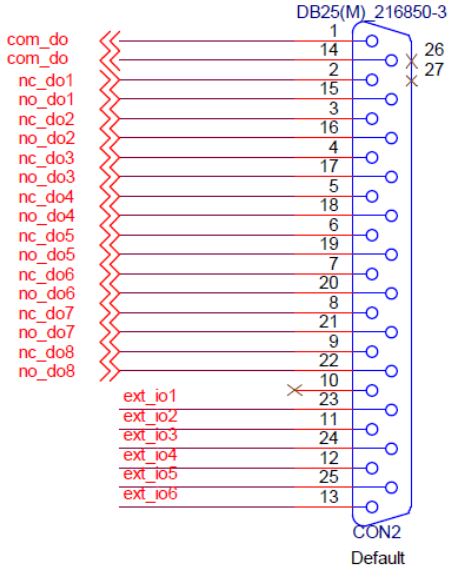
ii. . Front connectors details

a. Fiber optic port, 1no.
b. Ethernet port ,1no
c. USB port,1 no.
d. RS232 connector, 1 no.
e. Digital Input connector,1no.
f. Digital Output connector,1no.

iii. Front connector pin out details



DIGITAL INPUT CONNECTOR



DIGITAL OUTPUT CONNECTOR

b. Power supply card

Same as power supply card of IOD rack. It shall be provided by BHEL

Interested party(ies) are required to execute Non Disclosure Agreement with BHEL before receiving any further information against this EOI.BHEL shall provide guidelines for I/O module interface, logic for cooler and pump control, Layout for visualization in HMI and other details related with type testing & functional testing at the time of placement of order.

1.2.7 Mechanical details

The Electronics rack are to be designed with 6U PCB's with front accessibility for easy wiring and maintainability.25 pin male sub D connectors with coding plates are to be used in front plate of every card for external connection.

Suitable LED to be provided on front plate of every card indicating its healthiness, its connection to back plane of rack and error.

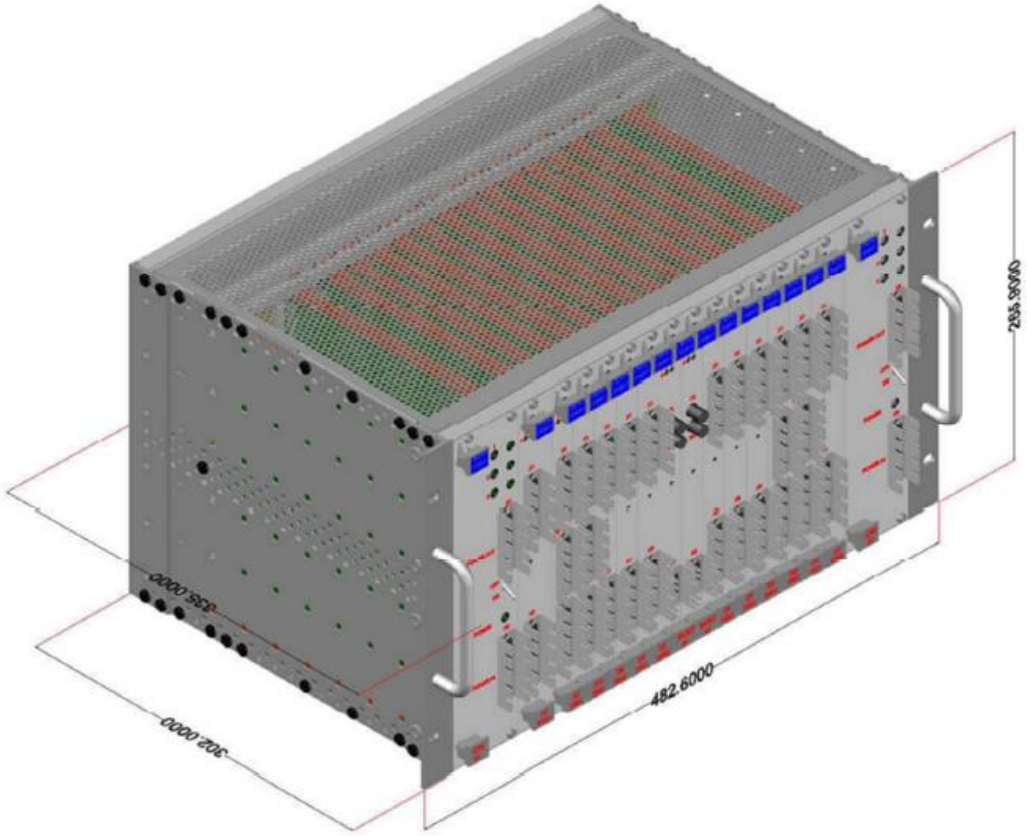


Fig3: Electronic rack outer dimension

1.2.8 Software requirement

Vendor to design and develop software for achieving following functionalities

1. The racks to have firmware for supporting 2x100% processors in hot standby mode. In case a failure of working processor, the standby processor shall take over the operation automatically by bumpless transfer.

2. IOD shall be a Modbus slave device and CMS rack will be a Modbus Master Device which will requests field information from IOD on fiber optic cable.I OD rack will receive Modbus command from CMS system for processing / to operate digital output.

3. Self-diagnostic system to be implemented on IOD & CMS for detection of any internal fault at card & signal level
4. CMS system can monitor healthiness of IOD system via Modbus protocol.

5. SNTP Client implementation in IOD for Time Synchronization.

6. Front panel Visualization and Configuration - Display of measured values, calculated values, Input and Output status, device status and configuration parameters etc. on the HMI display. HMI application (.net based) having pages dedicated for status of digital inputs and digital outputs, displaying real time data of AI,CT & PT channels,graphs,trend,self test mode, archival data ,settable ip, Events, Configuration, calculation of the hotspot temperature, ageing rate and life consumed (in Hrs.) of transformer.

7. Communication protocols implementation

a. MODBUS TCP / IP: For communication between IOD and CMS over Fiber optic network.

b. Serial : For communication with Local HMI and PC based HMI with CMS & IOD rack.

c. IEC 61850 Server Communication Protocol
All the relevant Logical Nodes are to be mapped in the device and can be retrieved by an IEC 61850Client. Buffered and Un-buffered Reports can be configured for the Data-Sets. File transfer is to be made available. SNTP Client to be configured in the device for time synchronization with a SNTP Server.
Primary & secondary processor of CMS rack to be operated on same ip address, Ethernet port of only master shall be active at a time for SCADA communication.

1.3. Willingness for Confidentiality Agreement

Supplier to confirm their willingness for confidentiality/non-disclosure agreement during tendering process. The terms and conditions of which shall be discussed and mutually agreed.

Annexure 1
Information to be submitted by Applicant

1. Name of the Company:

2. Legal status of the Company

3. Brief description of the Company including details of its business groups/subsidiaries/ affiliates:

4. Date of Incorporation:

5. Date of Commencement of Business:

6. Full address including Telephone nos. / Fax nos.:

   Registered Office:
   Head Office:
   Address for communication:
   Contact Details:
   Office Address in India, if any:

7. Documents to be enclosed:

   a) Technical Credentials – Relevant Product/System catalogues, Experience /Reference List, Copies of Customer Certificates, Engineering strengths, quality accreditations, etc.

   b) Financial Credentials – Copies of Audited Financial statements (Annual Reports) for last 3 years, Credit Rating, Market share (Domestic/International), Segmental Revenue in the applied category(ies).

   c) Other documents considered relevant to meet PQR and support evaluation criteria.

(Sign & Company Seal)
Authorized signatory

Annexure-2
Pre-Qualification Requirements

S.N.	Requirement	Applicant's Response
1	Applicant to have sufficient engineering/ design/manufacturing capabilities for design, development, manufacturing, & testing of proposed /similar scope of work in part or full. The applicant shall submit proof of its manufacturing facility, Acceptable documentary proof in this regard shall be 1) Quality certification of manufacturing facility (ISO cerification,etc) 2) Valid Certificate of Incorporation / Udyog Aadhar certificate / government approval of manufacturing facility. 3) Organisation chart of applicant indicating various functions like Design, production, Manufacturing, Testing, Quality & inspection.	
2	Applicant to confirm at least 2 orders have been executed by them in past 3 years involving latest state of art components in part or full as mentioned in the EOI. Applicant to submit copies of purchase order /contract along with invoice copies of such orders executed in past 3 years. Date of applicant invoices should be within 3 years from the date of closing of this EOI.	
3	Applicant to submit audited financial annual report (Balance Sheet and Profit & Loss account) for last three consecutive years (2016-17, 2017-18, 2018-19). Alternatively a certificate issued by a practicing Chartered Accountant or Cost Accountant (with membership number and Firm Registration Number), certifying the Annual Turnover & Net worth for last three consecutive years (2016-17, 2017-18, 2018-19) shall also be acceptable	

(Sign & Company Seal)
Authorized signatory

Annexure 3

Vendor Evaluation criteria

Note: Supporting documents to be provided by vendor against each parameter for assessment by BHEL.

Evaluation parameter Detailed	**Guidelines / Evaluation criteria for allotment of Marks**	**Detailed Evaluation Criteria (Individual Max Marks)**	**Max Marks**	**Vendor self assessed score**
Facilities Available/ Required relevant to BHEL requirement	A. Design/ Development tools B. Manufacturing /Processing/ Fabrication tools/ equipment C. Testing Tools/Equipment	A. Circuit simulator, FPGA development tools, software development environment incl. SDKs, IDEs (7) B. CAD tools, assembly tools, rework stations (7) C. Oscilloscopes, analyzers, protocol analyzers etc. (6)	20	
Expertise required in	A. Design & Development B. Manufacturing/ Processing/Fabrication C. Familiarity with applicable standards D. Documentation	A. Multilayer PCB design, FPGA based processing design, Embedded system design and programming (10) B. Prototype h/w module fabrication, assembly and testing. UL certification of PCB's. (3) C. Familiarity with EMI/EMC, Dielectric, Environment, vibration standards (1) D. Detailed documentation capability (1)	15	
Skills	A. Process skills B. Testing skills C. Modelling, Simulation & Analysis	A. Design of high speed h/w implemented through FPGAs, design of multilayer PCB, Development of device drivers, BSPs etc. (4) B. Capability to integrate firmware with high speed CPU boards, testing & debugging (3) **C.** Design conformance to EMI/EMC, dielectric, environmental and mechanical standards, MATLAB/ Circuit simulation and capability for rapid prototyping. (3)	10	

Prototype Manufacturing, Testing & Evaluation capabilities/facilities		A. Prototype manufacturing of multilayer board(5) B. PCB reworking capability (2) C. Multilayer PCB testing , Firmware debugging(3)	10	
Past Experience in specific category relevant to BHEL requirement		A. Past experience in designing of I/O hardware modules (5)	5	
Overall suitability of the vendor wrt relevance, timely execution capability, domain knowledge, skills, expertise etc. to deliver the nonstandard item/service		A. Capable of development of I/O hardware module (10) B. Capability to offer total design along with prototype(4) C. Timely execution capability based on delivery schedules of past purchase orders(4) D. After delivery support for debugging/ troubleshooting and system integration(2)	20	
TOTAL			80	