

## **Technical specification for accuracy class “0.2S” AC static trivector energy meter with class “A” power quality measurement**

### **1.0 SCOPE**

- 1.1** This specification covers the design, engineering, manufacture, assembly, inspection and testing before supply and delivery at site/ FOR destination of class 0.2S accuracy along with this Class A conforming to latest edition of IEC 61000-4-30 HT tri-vector CT/ VT operated meter. The meters will be used for commercial/ tariff metering for inter utility power flows/ bulk consumers as well for Availability Based Tariff (ABT) application.

Meter will be suitable for power quality measurements, monitoring and recording as per latest international standards which will support high sampling rate of 1024 samples/ cycle, extensive data logging capabilities, big intuitive display and high end communication capabilities. It will have capabilities to capture, log and report PQ events, provide necessary data for analysis and assessment of power quality compliance to prevailing international standards.

- 1.2** The meter will have wide secondary current range support i.e. same meter will be put up for 1A or 5A rating as per field availability of CT's. The meter will support 200% I<sub>basic</sub>. The meter will supply in 3-phase 4-wire mode. However, provision will be there to configure the meter in 3-phase 3-wire type, as & when required, through authenticated/secured command.
- 1.3** The metering system will be housed in rack with draw out type feature capability for inserting the meter module. Current terminal connection must be automatically shorted when module is drawn out. The rack will have facility to accommodate either one or two individual 0.2s accuracy class meter modules for supporting the single and multiple points of installation practices respectively. The rack options will be available with 11 inch and 19 inch in size.
- 1.4** The meter will be self-powered. The meter will normally operate with the power drawn from the VT secondary circuits, without the need for any auxiliary power supply. However, there will be provision of functioning of the meter with the help of auxiliary supply, both AC & DC. The power supply in self powered condition will be from all the three phases of VT secondary, preferably equally, to ensure meter power supply when VT fuse(s) failures happen in one or two phases.
- 1.5** It is not the intent to specify completely herein all the details of the design and construction of material. The material will, however, conform in all respects to the best industry standards of engineering, design and workmanship and will be capable of performing for continuous commercial operation in a manner acceptable to the purchaser. The offered equipment will be complete in all respects including all components/ accessories for effective and trouble free operation according to the specifications. Such components will be deemed to be within the scope of this specification irrespective of whether those are specifically brought out or not.

### **2.0 APPLICABLE STANDARDS**

#### **2.1 STANDARDS**

The equipment will conform (for testing, performance and accuracy) in all respects the relevant Indian/ International metering standards with latest amendments thereof unless otherwise specified.

IEC 61000-4-30 edition 3	Electromagnetic compatibility (EMC)-Testing and measurement techniques-Power quality measurement methods
IEC 62586-1	Product and performance requirements for PQ instruments
IEC 62586-2	Functional tests and uncertainty requirements
IEEE 519-2014	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
EN 50160	Expected limits for the power quality parameters in a public distribution network.
IEC 61000-4-7	Measurement method and limits for harmonics and inter harmonics
IEC 61000-2-4	Limits for conducted disturbances for harmonics and inter harmonics
IEC 61000-3-8	Mains signaling voltage on the supply voltage for mains signaling frequencies over 3kHz
IEC61000-4-15	Flicker Measurement
IEC 62052-11	Electricity metering equipment (AC)-General requirements, tests and test conditions- Part 11: Metering equipment
IEC62053-22	Electricity metering equipment (AC) – Particular requirement – Static meters for active energy (class 0.2S and 0.5S)
IEC62053-24	Electricity metering equipment (AC) – Particular requirement Static meters for reactive energy (class 2 and 3)
IS 14697	AC static transformer operated Watt-hour and VAR-hour meters for class 0.2s and 0.5s
IS 15959	DLMS Indian Companion Standard – Category 'B' for Boundary/Bank/Ring/ABT Metering

### 3.0 CLIMATIC CONDITIONS

The meters to be supplied against this specification will be required to operate satisfactorily and continuously under the following tropical conditions of hot, humid, dusty, rust and fungus prone environment.

- i) Max. ambient air temperature : 55 °C
- ii) Min. ambient air temperature : (-) 5 °C
- iii) Average daily ambient air temp : 32 °C
- iv) Max. Relative Humidity : 95 %
- v) Max. Altitude above mean sea level : 2000 m
- vi) limit range of operating : (-)40°C to +70 °C
- vii) Storage temperature range : (-)40°C to +70°C
- viii) Operating temperature range : (-)20 to +60
- ix) Display operating temperature range : (-)10 to +60

### 4.0 PRINCIPAL PARAMETERS

The energy meter will be indoor type connected with the secondary side of outdoor current and voltage transformers and mounted in suitable panel/ cubicles.

S. No.	Item	Specification
1.	Type of Installation	Rack Type, Indoor installation
2.	VT secondary	HV 3x110V/ $\sqrt{3}$ V Phase to Neutral

		(3P4W) 3x110V V Phase to Neutral (3P3W) Variation -30% to +20%
3.	CT secondary	Ib: 1A, I <sub>max</sub> : 2A or Ib: 5A, I <sub>max</sub> : 10A (Site configurable)
4.	Power Supply	Self Powered Auxiliary AC/ DC Supply 60 to 230 V AC/DC, +/- 20%, 50/60 Hz
5.	System frequency	50 Hz +/- 5%

The meter would be suitable for working with above supply variations without damage and without degradation of its metrological characteristics.

## **5.0 TECHNICAL REQUIREMENTS**

### **5.1 POWER FACTOR RANGE**

The metering system will be suitable for full power factor range from zero (lagging) through unity to zero (leading). The meter will work as an active energy import and export meter along with reactive (lag and lead) meter. The energy measurement would be true four quadrant type.

### **5.2 ACCURACY**

Class of accuracy of the metering system will be 0.2S for energy measurement along with confirming to Class A as per IEC 61000-4-30 and IEC62586-2 (Edition 3). The accuracy would not drift with time.

### **5.3 POWER CONSUMPTION OF METER**

The meter must be capable to operate with the power drawn from the Auxiliary Power supply (AC/DC) instead of Station VT power supply.

### **5.4 STARTING CURRENT**

The meter would start registering the energy at 0.1% Ib and unity power factor.

### **5.5 MAXIMUM CURRENT**

The rated maximum current will be 200% of basic current (Ib) as per the configuration.

### **5.6 The meter will work accurately irrespective of phase sequence of the mains supply.**

### **5.7 GENERAL CONSTRUCTIONAL REQUIREMENTS**

Meters will be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However the following would be ensured:

- i) Personnel safety against electric shock
- ii) Personnel safety against effects of excessive temperature

- iii) Protection against spread of fire
- iv) Protection against penetration of solid objects, dust and water in normal working condition

All the materials and electronic power components used in the manufacturing of the meters will be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

All insulating materials used in the construction of meters will be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion will be effectively protected against corrosion by providing suitable protective coating.

The metering system when mounted in panel will conform to the degree of protection IP54 in the normal working condition for protection against ingress of dust and moisture.

## **5.8 SEALING**

Proper sealing arrangement will be provided as follows:

- i) 2 nos. sealing arrangement at back side of the meter.
- ii) 2 nos. sealing arrangement between meter and rack at front.
- iii) 2 nos. sealing, back terminals of product with terminal cover

The sealing arrangement would be suitable for application of Polycarbonate seals.

## **5.9 MARKING OF METER**

The marking on every meter will be in accordance with IEC. The basic marking on the meter name plate will be as follows:

- i) Manufacturer's name and trade mark
- ii) Serial Number
- iii) Year of manufacture
- iv) Type Designation
- v) Number of phases and wires
- vi) VT commissioning information
- vii) CT commissioning information
- viii) Reference frequency
- ix) Accuracy Class

Additionally, following information will also be available on name plate.

- i) Property Of "Purchaser name"
- ii) P.O. No. "Number"

**5.10** The connection diagram of the connecting 3P4W/3P3W meter will be depicted on meter. The meter terminals will be properly marked to identify voltage, Current, Auxiliary and communication ports.

**5.11** The meters will be suitable for being connected directly through its terminals to VT's having a rated secondary line- to- line voltage of 110 V, and to CTs having a rated secondary current of 1A or 5A. Any further transformers/ transducers required for their functioning will be in-built in the meters. Necessary isolation and/or suppression will also be built-in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyards.

**5.12** The active energy measurement will be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.2S for active energy. The meters will compute delta values of energies and store in the nonvolatile memory at each successive integration period block. The period would be configurable from 1 to 60 minutes. The instant parameter values will be configurable to store in nonvolatile memory as well at each successive integration period block. It will be configurable to select minimum/maximum/average/instant values to log for the instantaneous parameters.

**5.13** The meter will have Inputs/ Outputs pulsing pins availability. This will help in transferring the same Energy parameters being recorded inside the meters on pulse output as well for SCADA application at remote distance. 4 pulse pins will be fixed for output functionality and 4 pulse pins can be configured for input or output functionality. Potential free pulse output will withstands 6kV impulse.

**5.14** The meter will have Inputs/ Outputs pulsing pins availability. This will help in transferring the same Energy parameters being recorded inside the meters on pulse output as well for SCADA application at remote distance. Pulse output will be configurable for following power quality parameters and general parameters.

<b>Power quality parameters at output</b>	<b>General parameters at output</b>
High THD power	Energy pulse on channels
High harmonic voltage	End-of-SIP,DIP Pulse
High harmonic current	End-of-DIP pulse
Frequency healthy	Rate and MD register change
Phase wise Voltage THD (%)	Remote Control
Phase wise Current THD (%)	Average voltage healthy
Phase wise voltage healthy	All phase voltage healthy

## **6.0 POWER QUALITY AND ANOMALY DETECTION FEATURES**

**6.1 Power Quality Meter will be Class A conforming to IEC 61000-4-30 edition 3**

**6.2 The meter will have capability to detect and log power quality parameters as defined in IEC61000-4-30 as per the methods specified therein and as well complying with requirements of IEC 62586-2.**

- Supply Frequency
- Magnitude of supply Voltage
- Magnitude of supply Current
- Flicker
- Voltage harmonics
- Current harmonics
- Voltage inter harmonics
- Current inter harmonics
- Over voltage deviation
- Under voltage deviation
- Voltage Unbalance
- Mains signaling voltage

**6.3 The meter will have feature to detect and log the occurrence and restoration of power quality events as defined in IEC61000-4-30 along with date and time of event.**

- Voltage Sag or Dip
- Voltage Swell
- Interruption
- Rapid voltage change

**6.4 The meter will store following power quality parameters (10 minute aggregated values) data for analysis and meter will store at least for 30 days.**

- THD Voltage (phase wise)
- Flicker
- Supply Frequency
- Voltage unbalances (u2)
- Voltage harmonics L1 (2 to 25th)
- Voltage harmonics L2 (2 to 25th)
- Voltage harmonics L3 (2 to 25th)
- Current harmonics L1 (2 to 25th)
- Current harmonics L2 (2 to 25th)
- Current harmonics L3 (2 to 25th)
- L1 Flicker (Pst)
- L2 Flicker (Pst)
- L3 Flicker (Pst)

**6.5 Waveform and RMS value capturing**

For analysis, the meter will have provision to log 10 cycle including pre and post waveforms with RMS value for following events:

- Voltage Sag or Dip
- Voltage Swell
- Interruption

Software will have provision of direction analysis of event as upstream and downstream

**6.6 Power quality compliance:**

Meter will have capability to log all the parameter required to generate compliance report as per EN50160 & IEEE 519(2014). Limits would be configurable using configuration tool and this stored data in the meter will be used to generate compliance report.

Meter will also support the data required to generate ITIC curve using software.

**6.7 Web server for remote display:**

Meter will have built in web server to enable viewing of basic Instantaneous parameters and cumulative energy registers data.

**6.8 The meter will have feature to detect and log the occurrence and restoration of anomalies along with date and time of event.**

Following configurable events will be provided in meter for which the persistence/restoration time can be configured through BCS:

- Over voltage
- Under voltage
- Current circuit open
- Current terminal shorting

- Reverse current direction (phase wise)
- Current missing (phase wise)
- Current unbalance
- Power fail
- Missing voltage (phase wise)
- Voltage unbalance
- Invalid Phase Association
- Invalid Voltage
- Feeder Supply Fail

Following quality parameter events will be provided for which % occurrence/restoration limit and time can be configured through BCS:

- Phase wise Voltage THD
- Phase wise Current THD

Last thousand (1000) events (occurrence + restoration), in total, will be stored in the meter memory on first in first out basis.

## 6.9 DISPLAY PARAMETERS

Meter display will be Intuitive, easy to use and understand. The meter will have support of following display parameters with graphical Color display:

- (1) Voltage (Phase wise)
- (2) Current (Phase wise)
- (3) Power (Phase wise)
- (4) Vector diagram
- (5) Voltage wave form (Phase wise)
- (6) Current wave form (Phase wise)
- (7) Voltage-Current wave form (Phase wise)
- (8) Voltage %THD (Phase wise)
- (9) Current %THD (Phase wise)
- (10) Current %TDD (Phase wise)
- (11) Voltage harmonic for 3<sup>rd</sup> order (phase wise)
- (12) Voltage harmonic for 5<sup>th</sup> order (phase wise)
- (13) Voltage harmonic for 7<sup>th</sup> order (phase wise)
- (14) Current harmonic for 3<sup>rd</sup> order (phase wise)
- (15) Current harmonic for 5<sup>th</sup> order (phase wise)
- (16) Current harmonic for 7<sup>th</sup> order (phase wise)
- (17) Instant voltage harmonic graphical trend up to 50<sup>th</sup> order (Phase wise)
- (18) Instant current harmonic graphical trend up to 50<sup>th</sup> order (Phase wise)
- (19) Flicker (phase wise)
- (20) % TDD current phase wise
- (21) K- factor
- (22) Voltage crest factor (Phase wise)
- (23) Current crest factor (Phase wise)
- (24) Voltage deviation (Under & Over)
- (25) Voltage unbalance (% value)
- (26) Current unbalance (% value)
- (27) Main Signaling voltage
- (28) Voltage sequence component
- (29) Current sequence component
- (30) Cumulative active energy import



- (31) Cumulative active energy export
- (32) Cumulative net active (Import – Export) energy
- (33) Cumulative reactive energy lag while active import
- (34) Cumulative reactive energy lead while active import
- (35) Cumulative reactive energy lag while active export
- (36) Cumulative reactive energy lead while active export
- (37) Cumulative apparent energy (while active import)
- (38) Cumulative apparent energy (while active export)
- (39) Cumulative Reactive High energy
- (40) Cumulative Reactive Low energy
- (41) Last block average of active import energy
- (42) Last block average of active export energy
- (43) Last block average of the net active (Import – Export) energy
- (44) Maximum demand apparent (while active import) for current month (0-24 hrs)
- (45) Maximum demand apparent (while active export) for current month (0-24 hrs)
- (46) Cumulative active import energy reading of predefined date and time for monthly billing purpose
- (47) Total event count
- (48) Present event status
- (49) Time of last restoration of event
- (50) Date of last restoration of event
- (51) Meter information
- (52) Configuration page for network setting

**6.10** Active and Apparent energies will also be made available by meter in separate energy registers as –

- i) Active energy Import total
- ii) Active energy Export total
- iii) Active energy Import fundamental
- iv) Active energy Export fundamental
- v) Active energy import total (phase wise)
- vi) Active energy export total (phase wise)
- vii) Net active energy
- viii) Apparent energy (while active import)
- ix) Apparent energy (while active export)

**6.11** The reactive energy will also be available in eight different registers as-

- i) Reactive import while active import
- ii) Reactive import while active export
- iii) Reactive export while active import
- iv) Reactive export while active export
- v) Reactive import
- vi) Reactive export
- vii) Reactive inductive
- viii) Reactive capacitive
- ix) Net reactive energy
- x) Net Reactive high and low
- xi) Reactive high import and export

**6.12** Meter will have provision to compute apparent energy based on lag only or lag+lead. The same will be configured at factory end.



- 6.13** For reactive power and reactive energy measurement, limits of errors all the four quadrants will be in accordance to IEC 62053-23 and IEC62053-24.
- 6.14** The metering system will normally operate with the power drawn through the auxiliary AC or DC supply. The metering system design would enable the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon their availability.
- 6.15** Meter will have a built-in calendar and clock, having an accuracy of <2 min/year or better. The calendar and clock will be correctly set at the manufacturer's works.
- 6.16 TOD (Time of day registers):** The meter will have TOD registers for below energies and MD values:
- i) Active energy Import total
  - ii) Active energy Export total
  - iii) Active energy Import fundamental
  - iv) Active energy Export fundamental
  - v) Apparent energy (while active import)
  - vi) Apparent energy (while active export)
  - vii) Reactive import while active import
  - viii) Reactive import while active export
  - ix) Reactive export while active import
  - x) Reactive export while active export
  - xi) Reactive import
  - xii) Reactive export
  - xiii) Reactive inductive
  - xiv) Reactive capacitive

Meter will have support of eight configurable demand registers. It will be possible to program number of TOD registers and TOD timings through suitable high level software/ MRI as an authenticated transaction.

- 6.17 Data loggers (Load survey):** Meter will have a non-volatile memory with **two individual loggers** to store the delta energy values, instantaneous parameter and power quality data values for each successive configurable integration period block. The integration period will be configurable for each logger. It can be configured for 1, 5, 10, 15, 20, 30 or 60 Minutes.

Minimum 60 days with 15 minute interval will have support in meter.

Selection of following parameters will have provision for logging:

- a) Energy parameters
- b) Voltage (Phase wise)
- c) Current(Phase wise)
- d) Phase voltage
- e) Line Voltage
- f) Frequency
- g) Power factor (Phase wise)
- h) Power factor (Phase wise)
- i) Phase angle (Phase wise)
- j) Voltage THD (Phase wise)
- k) Current THD (Phase wise)
- l) Power THD (Phase wise)

- m) Voltage harmonic up to 50<sup>th</sup> order (Phase wise)
- n) Current harmonic up to 50<sup>th</sup> order (Phase wise)
- o) Voltage inter- harmonic up to 50<sup>th</sup> order (Phase wise)
- p) Current inter- harmonic up to 50<sup>th</sup> order (Phase wise)

The instantaneous parameters can be configured for minimum/maximum/average or instant values for the configured integration period.

It will be possible to select either energy or demand view at Base Computer Software (BCS) end. The logger data will be available in the form of bar charts as well as in spreadsheets. The BCS will have the facility to give complete time synchronized load survey data both in numeric and graphic form.

**6.18 Daily snapshot parameters:** The meter will store the snapshot (or value) of following parameters at configured time for last 65 days:

- I. Cumulative active energy import
- II. Cumulative active energy export
- III. Cumulative net active (Import – Export) energy
- IV. Cumulative reactive energy lag while active import
- V. Cumulative reactive energy lead while active import
- VI. Cumulative reactive energy lag while active export
- VII. Cumulative reactive energy lead while active export
- VIII. Cumulative apparent energy (while active import)
- IX. Cumulative apparent energy (while active export)
- X. Cumulative Reactive High energy
- XI. Cumulative Reactive Low energy

The BCS will provide facility to configure the parameters and time.

**6.19 Data Communication Capability:** The metering system will have following communication ports for local/remote reading. All the communication channels will be capable of simultaneous and independent communication.

- IEC1107 optical port
- RS232 port (for remote communication or dedicated to Modem)
- RS485 port (would be configurable on DLMS/MODBUS)
- Ethernet port (DLMS TCP/MODBUS TCP)
- USB (micro B connector) for meter reading or configuration through Laptop or Tab device.

**6.20** Meter will support industry standard protocols IEC 61850 for data communication with base computer software, substation automation and monitoring systems. At least, Logical nodes will have support MMXU,MMTR,MHAI, MFLK and MSQI

**6.21** Meter will have a unique identification code i.e. serial number, which will be marked on name plate as well as in its memory. Further all meters of the same model will be totally identical in all respects except for their unique identification codes.

**6.22** Meter will have a non-volatile memory in which the parameters as mentioned in this specification will be stored. The non-volatile memory will retain the data for a period not less than 10 years under un-powered condition; battery backup memory will not be treated as NVM.

**6.23** Meter will have the capability and facility to compensate for errors of external measurement transformers i.e. CT and VT:

- i. Linear compensation for measurement CT/VT errors (ratio and phase); there will be linear adjustment which will be applied across the complete measurement range of the transformer.
- ii. Non-linear compensation for measurement CT errors (ratio and phase) compensation; this will allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter.

## **7.0 Software package**

**7.1** Software would be support with a powerful multi-user web-based over intranet software package to configure and setup the power quality meter. In addition, the software would provide tools for analysing the measured data. Generally, the following capabilities would be maintained by the software packages:

- Retrieve recorded data automatically or schedule (if connected to meter)
- Measurement value lists (in tabulated format)
- Power quality incidents
- Sequence of events
- EN 50160 reports/Customized limits report
- IEEE 519 (2014) report
- Reliability indices (SAIDI, SAIFI and CAIDI)
- Real time aggregated data
- Historical data of aggregated values
- RMS and Waveform streaming
- Graphical dashboard (ITIC curve, DIP Classification, power quality indices)
- User management to access PQ data

## **8.0 TEST CERTIFICATES**

- Power quality compliance certificate as per IEC 61000-4-30 Ed. 3, IEC62586-2 (Class-A)
- Type test report (IS 14697)
- DLMS ICS compliance (IS 15959)

### **GURANTEED TECHNICAL PARTICULARS**

<b>S.N</b>	<b>Technical Specification Requirements</b>	<b>Bidder's Offer</b>
<b>1.</b>	Manufacturer's name & Country	
<b>2.</b>	Type of Meter	
<b>3.</b>	Name and model no. of offered product	
<b>4.</b>	Standards to which meter complies	
<b>5.</b>	Power quality Class	
<b>6.</b>	Accuracy class	
<b>7.</b>	Metrology indicator provided on meter and switching facility for	

	reactive & apparent energy	
8.	Voltage and frequency range	
9.	Maximum current	
10.	Variation of voltage at which system functions normally	
11.	Minimum Starting current	
12.	P.F. range	
13.	Power consumption per phase <ul style="list-style-type: none"> <li>• Voltage Circuit</li> <li>• Current Circuit</li> </ul>	
14.	AC and DC Auxiliary supply ratings for powering up the metering system	
15.	Sealing arrangement	
16.	Size (W x H x D) in mm Weight Mounting	
17.	Digital input/output	
18.	Communication ports i.e. Optical, USB, RS232, RS485 and Ethernet etc.	
19.	Communication protocol	□
20.	HTTP web server	
21.	Power quality report	
22.	10 minute aggregated data as per IEC 61000-4-30	
23.	Sampling rate	
24.	Data update rate	
25.	Time syncing options	
26.	Memory	
27.	Anti-alias filter provision	
28.	Power quality parameters: <ul style="list-style-type: none"> <li>• Supply Frequency</li> <li>• Magnitude of supply Voltage &amp; Current</li> <li>• Flicker</li> <li>• Voltage &amp; Current harmonics</li> <li>• Voltage &amp; Current interharmonics</li> <li>• Over &amp; Under voltage deviation</li> <li>• Voltage Unbalance</li> <li>• Mains signaling voltage</li> </ul>	
29.	Fixed power parameter logger:	

30.	Power quality displays <ul style="list-style-type: none"> <li>• Flicker</li> <li>• Voltage crest factor</li> <li>• TDD</li> <li>• K-factor</li> <li>• Crest factor</li> <li>• Current sequence component</li> <li>• Mains signaling voltage</li> <li>• PQ frequency</li> <li>• Voltage unbalance ratio</li> <li>• Current unbalance ratio</li> <li>• Voltage deviation</li> <li>• Voltage sequence component</li> <li>• Voltage harmonics</li> <li>• Current harmonics</li> <li>• THD</li> </ul>	
31.	<b>Trends (up to 50<sup>th</sup> order) on meter display</b>	
32.	Individual Harmonics (both Voltage and Current): Up to 50 <sup>th</sup> order	
33.	Two independent Loggers Configurable for interval 5, 15 and 30 Minutes.	
34.	Anomaly detection features	Meter will detect following system events: <ul style="list-style-type: none"> <li>• Over voltage</li> <li>• Under voltage</li> <li>• Current circuit open</li> <li>• Current terminal shorting</li> <li>• Reverse current direction (phase wise)</li> <li>• Current missing (phase wise)</li> <li>• Current unbalance</li> <li>• Power fail</li> <li>• Neutral Disturbance</li> <li>• Magnet Interference</li> <li>• Missing voltage (phase wise)</li> <li>• Voltage unbalance</li> <li>• Invalid Phase Association</li> <li>• Invalid Voltage</li> <li>• Feeder Supply Fail</li> </ul>
35.	IS15959 compliance and category	YES, Cat-B
36.	Energy parameters recorded in meter	
37.	ABT compatibility	
38.	TOD compatibility	
39.	MD Reset provisions: Auto or Manual	
40.	Demand integration period	
41.	Energy parameters for Loggers, Billing and Midnight	

## **TECHNICAL SPECIFICATION OF PANEL FOR MOUNTING 0.2S ACCURACY CLASS AC STATIC TRIVECTOR ENERGY METERS**

### **Metering Panel:**

1. The Panel shall be suitable for mounting of maxim 8 nos. Energy Meter modules.
2. The panel shall be designed with two doors on the front side and one door on back side. On front side the upper door shall have a glass window. Using the upper door it shall be possible to have frequent access to meter reading only through display. Moreover the lower compartment that houses the 3P 4W Test Terminal Block shall be provided with additional sealing arrangement.
3. Panels shall be completely enclosed and shall be dust, moisture and vermin proof to meet the requirements of IP:54. The panels shall be free standing, floor mounting type and shall be of rigid, structural frames, enclosed completely, made with specially selected, smooth finished, CRCA sheet of thickness not less than 1.6 mm for front, sides, top & bottom portions and the doors. There shall be sufficient reinforcement to ensure level surfaces, resistance to vibration, and rigidity during transportation, installation and operation.
4. All doors shall be gasket all around, material selection and workmanship shall be such as to result in neat appearance both inside and outside, with no weld, rivets or bolt heads apparent from outside and with all exterior surfaces true and smooth.
5. Blanking plate should be required for cover the meter mounting location in case of less mounting of than 8 meters.
6. Colour of Metering panel will be as per IS 631 ( grey shed ) , Powder coating will be carried out on metallic surface. Base will be of black colour.
7. **Interior Lighting and Heating:**
  - a) Each Panel shall be provided with lighting fixture rated for 240V A.C. supply, controlled by panel door switch and fuse.
  - b) Each Panel shall be provided with 240V, 50Hz, 5 Amp 3 pin receptacle and switch.
8. **Earthing:**

Each panel shall be provided with earth strip of steel iron galvanized having size not less than 25x5mm securely fixed to (inside) base of panels. As several control panels are to be mounted adjoining each other, the earth bus shall be provision to connect earthing to adjoining panel. All metallic cases and other mounted equipments shall be connected to earth bus by copper wires of size not less than 2.5 sq.mm. The colour of insulation for earthing wires shall be Green.
9. **Panel internal wiring:**

All wiring shall be carried out with 660V grade single core multi strand flexible copper conductor wires with P.V.C. insulation and shall preferably be flame, vermin and rodent proof. The current carrying capacity of wire shall be adequate for the duty assigned to it and shall have sufficient flexibility to facilitate proper termination at any location. Colour coded wires (R,Y,B) shall be used for CT, VT Secondary connections having size not less than 2.5 sq.mm and auxiliary supply connection having size not less than 1.5 sq. mm.
10. **Test Terminal Block (TTB):**

The TTB shall be suitable for 3 phase 4 wire, back connected, and made of non inflammable plastic material for each meter. All terminals shall be clearly marked with identical numbers or letters to facilitate connection to external wiring.

# TECHNICAL SPECIFICATIONS FOR DIGITAL SUMMATION UNIT SUITABLE FOR BULK CONSUMER MULTI-FEEDER STANDARD SUMMATION METERING

**Detail specification of Standard Summation is as mentioned below:**

## **1.0 SCOPE**

- 1.1 This specification covers the design, engineering, manufacture, assembly, inspection and testing before supply and delivery at site/ FOR destination of digital summation unit, along with other associated equipments as per details given in this specification. The digital summation unit shall be used for commercial/ tariff metering for multi-feeder standard summation application at bulk consumer premises, in conjunction with compatible 0.2Saccuracy class AC static trivector feeder meters.
- 1.2 The summation unit and feeder meter module shall be an integrated part of standard 19" rack and this rack shall also have facility to accommodate either one summation unit and one feeder meter or two feeder modules and shall have capable to add feeder meters up to 7 feeder meters module.
- 1.3 These four 19" racks are accommodates in one summation metering panel with all hardware as details in panel specification. Number of feeder meters which vary two to seven as per site requirements. Purchaser will confirm about number of feeders summation as required.
- 1.4 It is not the intent to specify completely herein all the details of the design and construction of material. The material shall, however, conform in all respects to the best industry standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser. The offered equipment shall be complete in all respects including all components/ accessories for effective and trouble free operation according to the specifications. Such components shall be deemed to be within the scope of this specification irrespective of whether those are specifically brought out or not.
- 1.5 A dedicated digital summation unit shall be provided that shall be capable to collect the required energy parameters from the feeder meter modules and calculate concurrent apparent demand & summated energy parameters as per principle specified below. It shall have the provision to summate the readings of up to seven individual feeder meters in a typical installation.

## **2.0 GENERAL CONSTRUCTIONAL REQUIREMENTS**

The equipment shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However the following should be ensured:

- i) Personnel safety against electric shock
- ii) Personnel safety against effects of excessive temperature
- iii) Protection against spread of fire
- iv) Protection against penetration of solid objects, dust and water in normal working condition

All the materials and electronic power components used in the manufacture of the summation unit shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

The summation unit shall be designed with application specific integrated circuits. The electronic components shall be mounted on the printed circuit board using latest Surface Mount Technology (SMT).



All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

### **3.0 SEALING**

One number sealing screw shall be provided on the front cover of summation module. The sealing arrangement should be suitable for application.

### **4.0 MARKING OF SUMMATION UNIT**

The basic marking on the name plate of summation unit shall be as follows:

- i) Manufacturer's name and trade mark
- ii) Serial Number
- iii) Year of manufacture

5.0 This summation unit shall process the data of feeder meters to provide the summated energy parameters as specified below:

- i) Summated active energy import total
- ii) Summated active energy export total
- iii) Summated active energy import fundamental
- iv) Summated active energy export fundamental
- v) Summated reactive energy lag while active import
- vi) Summated reactive energy lead while active import
- vii) Summated reactive energy lag while active export
- viii) Summated reactive energy lead while active export
- ix) Summated apparent energy (while active import)
- x) Summated apparent energy (while active export)

### **6.0 CONCURRENT APPARENT DEMAND/ ENERGY CALCULATION**

The Summation unit shall calculate the concurrent apparent demand from the incremental active and reactive energy readings of feeder meters. The apparent energy/ demand shall be calculated by vector (Pythagoras) addition of active energy and reactive energy readings of feeder metering modules.

The Concurrent demand shall be computed on the fixed time block principle. The block interval shall be set as 30 minutes that shall be capable to change to other integration period (5/15/ 60 minutes), if required, through suitable high level software as an authenticated transaction.

Summation unit shall provide the following apparent demand and energy parameters:

- i) Summated active import total
- ii) Summated active export total
- iii) Summated apparent energy (while active import)
- iv) Summated apparent energy (while active export)

7.0 The summation unit shall act as the master for all its feeder meters. It shall be possible to have a common MD reset operation, which shall be performed in the summation unit. During this common MD reset operation, MD of all the feeder meters and summation unit shall get reset concurrently. This shall ensure that all feeder meters and summation unit remain synchronized to each other. Further, it shall not be possible to perform individual MD reset operation in feeder meters.

8.0 Maximum Demand Reset: Following provisions shall be available for MD reset in summation unit –

- i) Auto billing at predefined date and time
- ii) Manual via MD reset button (optional)
- iii) Authenticated transaction through suitable high level software/ MRI (optional)

9.0 The summation unit shall also draw its operating power from the auxiliary power supply, in the same manner as feeder meters. There shall be two auxiliary supplies (60-240 V AC/DC) so that the summation system remains alive even if one or more feeder(s) is off. The system shall continue to work even if any one of the above auxiliary supply (AC/ DC) is present.

10.0 Summation module shall have a built-in calendar and clock, having an accuracy of one minute per month or better. The calendar and clock shall be correctly set at the manufacturer's works.

An automatic backup for continued operation of the calendar-clock shall be provided through a long life battery, which shall be capable of supplying the required power for at least two years under meter un-powered conditions. The summation module shall be supplied duly fitted with the batteries, which shall not require to be changed for at least ten years, as long as total supply interruption does not exceed two years.

- iv) The real time clock of the summation unit shall be used as the master clock for its feeder metering modules so that all the feeder meters remain time synchronized with summation unit. For time set, summation unit shall accept authenticated command through suitable high level software/ MRI (optional). Feeder meter time shall synchronize with summation unit and it shall not accept time set command through suitable high level software/ MRI (optional).

11.0 TOD (Time of day registers): The summation unit shall have TOD registers for active energy import and export, apparent energy import and export and apparent MD import and export. Maximum eight time of day registers can be defined. It shall be possible to program number of TOD registers and TOD timings through suitable high level software/ MRI as an authenticated transaction.

12.0 Individual display shall be used for viewing the display parameters of summation unit and feeder meters. Necessary means shall be provided for moving forward/ backward from one display to the other via soft key pad.

The display shall indicate direct values (i.e. without having to apply any multiplying factor) of computed parameters. It should be possible to easily identify the single or multiple displayed parameters through legends on the metering system display.

13.0 The summation unit shall display on demand the following parameters:

- i) Date
- ii) Time
- iii) Summated active energy import total
- iv) Summated active energy export total
- v) Summated active energy import fundamental
- vi) Summated active energy export fundamental
- vii) Summated reactive energy lag while active import
- viii) Summated reactive energy lead while active import
- ix) Summated reactive energy lag while active export
- x) Summated reactive energy lead while active export
- xi) Summated apparent energy (while active import)
- xii) Summated apparent energy (while active export)
- xiii) Summated maximum apparent demand (while active import)

- xiv) Summated maximum apparent demand (while active export)
- xv) MD reset count
- xvi) Date of Billing Action
- xvii) Cause of Billing
- xviii) History1- Summated active energy import energy total
- xix) History1- Summated active energy export energy total
- xx) History1- Summated apparent energy (while active import)
- xxi) History1- Summated apparent energy (while active export)
- xxii) History1- Concurrent Maximum demand for apparent energy (while active import) for current month (0-24 hrs)
- xxiii) History1- Concurrent Maximum demand for apparent energy (while active export) for current month (0-24 hrs)

14.0 Load Survey: Summation unit shall have a non-volatile memory in which the following shall be automatically stored for each successive 30 minute integration period block:

- i) Summated active import total
- ii) Summated active export total
- iii) Summated active import fundamental
- iv) Summated active export fundamental
- v) Summated apparent (while active import)
- vi) Summated apparent (while active export)

30 minute average of above parameters shall be available for last thirty five (35) days. It shall be possible to select either energy or demand view at Base Computer Software (BCS) end. The load survey data should be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete time synchronized load survey data both in numeric and graphic form.

15.0 Billing parameters: The predefined date and time for registering the billing parameters of shall be 00.00 hours of the first day of each calendar (billing) month. The summation unit shall store following parameters corresponding to defined bill dates for up to last 12 months:

- i) Summated active energy import total
- ii) Summated active energy export total
- iii) Summated active energy import fundamental
- iv) Summated active energy export fundamental
- v) Summated apparent energy (while active import)
- vi) Summated apparent energy (while active export)
- vii) Concurrent Maximum Demand Apparent (while active import)
- viii) Concurrent Maximum Demand Apparent (while active export)

16.0 Daily midnight parameters: The summation unit shall store following end day parameters for last thirty five (35) days:

- i) Summated active energy import total
- ii) Summated active energy export total
- iii) Summated active energy import fundamental
- iv) Summated active energy export fundamental

## 17.0 DATA COMMUNICATION CAPABILITY

The summation unit and feeder meter system should have a suitable communication ports following communication ports for local/remote reading. Simultaneous communication over all ports shall be available.

- i) IEC 1107 optical port
- ii) RS232 port (for remote communication or dedicated to Modem)
- iii) TCP/IP Ethernet (should be configurable on DLMS TCP/MODBUS TCP)
- iv) USB port

Meter reading instrument (MRI) shall be used for the purpose of local meter reading via this optical communication port and Pen drive for USB port. MRI shall serve as the interface between meters and PC loaded with Base Computer Software. It shall also be possible to download meter data via this port by connecting laptop computer directly. The overall intention is to have the local ports is to tap the data stored in meter once in a week/month and transmit the same to PC with BCS for view.

Easy integration with third party software over Ethernet, meter shall have support of **two clients** to access meter data over DLMS as well as MODBUS simultaneously.

18.0 The summation unit shall have a unique identification code i.e. serial number, which shall be marked on name plate as well as in its memory.

19.0 Each summation unit shall have a non volatile memory in which the parameters as mentioned in this specification shall be stored. The non volatile memory shall retain the data for a period not less than 10 years under un-powered condition; battery back up memory shall not be treated as NVM.

## 20.0 TRANSACTIONS

The summation unit shall record critical events (as performed in authenticated manner) of Time set, MD reset operation, Communication status with feeder meter and tariff change. These events shall be logged in roll over mode.

## **GURANTEED TECHNICAL PARTICULARS – STANDARD SUMMATIONUNIT**

S. No.	Technical Specification Requirements	Bidder's Offer
1.	Manufacturer's name & Country	
2.	Name and model no. of offered product	
3.	MD Reset provisions <ul style="list-style-type: none"> <li>a. Auto</li> <li>b. Manual</li> </ul>	
4.	Demand integration period	
5.	Method of concurrent apparent demand/ energy calculation	
6.	Load survey parameters recorded in summation unit	
7.	Billing parameters recorded in summation unit	
8.	Daily Midnight parameters recorded in summation unit	
9.	Communication Capability for <ul style="list-style-type: none"> <li>a. Local reading</li> <li>b. On demand Remote reading</li> </ul>	a.
10.	Communication ports	

**GURANTEED TECHNICAL PARTICULARS FOR SUMMATION METERING APPLICATION METER**

S. No.	Technical Specification Requirements	Bidder's Offer
1.	Manufacturer's name & Country	
2.	Type of Meter (3P4W or 3P3W)	
3.	Standards to which meter complies	
4.	Accuracy class	
5.	Summation parameters measured	
6.	P.F. range	
7.	Overload capacity	
8.	Variation of voltage at which system functions normally	I.
9.	Minimum starting current	
10.	MD Reset provisions	
11.	Reset count	
12.	No. of digit of display	
13.	Particular of readouts by MRI	
14.	Non Volatile memory retention time in absence of power	
15.	Memory capacity of metering module	
16.	Demand integration period.	
17.	Metrology indicator for each meter	
18.	Communication Capability on I. Local port II. Remote port	I.
19.	modem for reading over GSM/GPRS, its max speed and Transmission protocol	
20.	Transformer loss compensation	
21.	Rack auxiliary supplies	
22.	Load survey parameters	
23.	Power consumption per phase Voltage circuit Current circuit	
24.	Self-diagnostics features	
25.	Testing Facility with meter test terminal block	
26.	Type of port used for data download in meter	
27.	Sealing arrangement for meters,& test terminal blocks	1.
28.	Method use to display import & export data	
29.	Capacity on non-volatile memory of the meter	
30.	Immunity to external magnetic field	
31.	EMI/RFI generated by metering system	
32.	Tamper & Anomaly detection features	

**\* Due to continuous endeavor to improve the design the specifications are subject to change**