Technical Specifications for High Precision HT Static Trivector Meters without DLMS Protocol & Suitability for Remote Metering for solar (bi-directional meter four quadrant) project.

1. SCOPE:

This specification covers high precision tri vectors static energy meters **(bidirectional meter four quadrant)** of accuracy class 0.2s for 66KV and above & 0.5s for Voltage Level 11kv to 33KV Voltage Level meters capable of performing functions of energy audit/ load survey and metering for tariff purposes. The meters shall be three phase four wire type for HT applications. The meter with 0.5s for 11kv to 33KV Voltage Level has 5Amp Secondary rating. The meter with 0.2s for 66KVand above Voltage Level has 1 Amp Secondary rating.

It is not the intent to specify completely herein all the details of the design and construction of meter. The meter shall, however, conform in all respects to high standards of engineering, design and workmanship. The meter shall be complete with all accessories, hardware, software and components necessary for their effective and trouble free operation.

The meter shall have to be procured from the original manufacturer, who is registered vendor of PGVCL or other subsidiaries of GUVNL. The meter shall be ISI marked the meter must comply this specification.

2. STANDARD APPLICABLE:

While drafting these specifications, reference has been made to following Indian and International Standard Specifications. In case, certain details are not covered in these specifications, the relevant latest Indian/International Standard shall be applicable.

IS 14697/ 1999	Specification of AC Static Watt hour meters, class 0.2s.
IEC 62053-22-2003	Specification for AC static Watt-hour Meters ,Class 0.2s.
IEC 1036	Static Energy Meters
IEC 62052-11	Electrically Metering equipment (AC)–General Requirement, Test & Test condition
IS 9000	Environmental testing
IS 8161 (Draft)	Impulse wave testing
IS 12346	Specification for testing equipment for AC energy meters.
IS 8686	w.r.t. High frequency disturbance testing
IS-15707	Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice
CBIP-325	CBIP guide on static energy meter specifications & testing
CEA Notification Dtd: 17/03/2006,04/06/2010, 26/11/2014	on standard for Operation of meters
Government of Gujarat Energy and Petrochemical department	G.R. NO. SLR-11-2015-2442-B DTD 13th August 2015

3. SUPPLY SYSTEM:

3.1 Solid neutral grounded H.V. and E.H.V. 3 phase, 4 wire 50 Hz. systems with CTPT (auxiliary transformers) connected.

3.2 Primary voltages : 11,22,33,66, 132 and 220KV
For 5 Amp it should programmed for 11 Kv & for 1 Amp it should programmed for 66 Kv & above

3.3 Secondary voltages: 110V or 110V/√3. PTs are normally Y-Y (star-star) connected having a secondary Y (star) point brought out and with or without earthed.

CTs are 1-phase, 3 nos with 6 wire connections to measure balanced and Unbalanced (either Delta or Star connected with floating star point or star point neutral grounded) loads from installation charging (i.e. No load) to 200 % of declared rated loads at all power factors.

4. SYSTEM VARIATIONS:

The electrical quantities are required to be measured with a fine degree of precision, monitor, display and store in non-volatile memory of high precision static demand and energy Tri-vector meters of 0.2S/0.5 class accuracy for energy audit, load survey and tariff metering purposes at the installation of HT consumers, conforming to latest standard applicable. These meters are required to function accurately within the specified limits of errors under the following conditions of voltage, frequency, current, temperature& climatic condition.

A. Electrical Quantities:

I Voltage

a)	Phase to phase with star connection(but Neutral either solidly grounded or floated)	110 volts + 20%- 30%
b)	Phase to star point having neutral point either solidly grounded or floated.	110/√3 volts + 20% -30%

II Currents:- 1 or 5 ampere normal (In) and 0.1% Ibto 200%Ib working

III Frequency: - 50 Hz. (+) 5% to (-) 5%

IV Power factor: - 0.0 Lag-Unity-0.0 Lead

B. Climatic Conditions:

Sr.No.	Particulars	Specified Requirements
1	MAX. Ambient Air Temperature	55 Deg. Centigrade
2	MAX. Ambient Air Temperature in closed Box	UP TO 65 Deg. Centigrade
3	Minimum Air Temperature	0 Deg. Centigrade
4	Average Daily Ambient Temperature	25 TO 35 Deg. Centigrade
5	MAX. Relative Humidity	100 %
6	MAX. Altitude above mean sea level	1000 METERS
7	Average Annual rain fall	700 TO 900 MM
8	MAX. Wind Pressure	200 /Sq. MM

5 GENERAL REQUIREMENT:

5.1 The meter should be housed in a safe, high grade, unbreakable, fire resistant, UV stabilized, virgin Polycarbonate casing of projection mounting type. The meter cover should be transparent, for easy reading of displayed parameters, and observation of operation indicators. The meter base shall not be transparent. The meter casing should not change shape color, size, and dimensions when subjected to 200 hrs on UV test as per ASTMD 53.

5.2 Meter shall have in built power supply unit & it should be micro control type instead of control transformer type to avoid magnetic influence.

5.3 RTC battery & the battery for display (in case of power failure) should be separate.

5.4 Diagnostic Features: RTC, RTC Battery, Non Volatile Memory (NVM).

5.5 Meter shall be capable of withstanding switching and transient surges of highest level so as to protect the internal meter circuit.

5.6 The facility for reading the meter in absence of power supply shall be provided. This facility shall be powering from a separate internal battery having minimum life of 10 years.

5.7 The registered parameters shall not be affected by loss of power. The display shall not be affected by electrical and magnetic disturbances. The meter shall make use of non-volatile memory capable of storing and retaining all the data required to be stores, without the help of any power source or battery backup and shall have a minimum retention time of 10- years under un-powered condition.

5.8 Meters should have internal Real Time Clock with backup life of minimum Ten (10) years for operation of time clock. The Real Time Clock shall be independent of line frequency variations.

6. CONSTRUCTIONAL REQUIREMENT:

6.1 Meter 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 shall be ensured.

A) Personal safety against electric shock
B) Personal safety against effects of excessive temperature
C) Protection against spread of fire
D) Protection against penetration of solid objects, dust and water

6.2 The meter shall conform to the degree of protection IP 51 of IS:12063/IEC:529 for protection against ingress of dust, moisture and vermin's.

6.3 The meter shall be designed and manufactured using SMT (Surface Mount Technology).

6.4 Meter's Top Cover, Meter Base, Terminal Block and Terminal Cover material should be polycarbonate and it should be fire, heat and ultra violet radiation resistant.

6.5 All parts of the meter should be resisted against mechanical stroke and shake during the transportation

6.6 Meter base and terminal block should be injection molded and should not be transparent.

6.7 Meter top cover and terminal cover should be injection molded in transparent natural color.

6.8 The top cover should be ultrasonically welded or break to open type arrangement

6.9 The meter cover and base shall be suitably shielded with metallic material so as to protect the meter from adverse effect of AC/DC, Permanent Abnormal external magnetic field. The meter shall meet the requirements of CBIP-325 with its latest amendment for immunity against continuous magnetic induction.

6.10 The terminal cover shall be extended open type & shall enclose terminal compartment except for the provision of conductor entry at the bottom for incoming & outgoing leads. The terminal block, the ETBC meter cover & meter base shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermic overload of live parts in contact with them. The terminal block shall be of high grade non-hygroscopic, fire retardant, low tracking fire resistant, reinforced poly-carbonate or equivalent high grade engineering plastic which shall form an extension of the meter case and shall have terminal holes and shall be of sufficient size to accommodate the insulated conductors & meeting the requirement.

6.11 The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors or copper reducer type terminal ends (thimbles).The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.

6.12 The terminal screws shall be of Nickle plated brass metal. The screws shall not have pointed end of threads.

6.13 Meter should not be prone to produce audible noise while in use.

6.14 The meter base shall be manufactured from high quality Polycarbonate material.

6.15 The thickness of casing, base & terminal cover shall be 2.0 mm +/-0.2mm.

6.16 Creepage and clearance shall be as per relevant standard.

6.17 All connection screws and washers should be tinned/nickel plated brass. The terminal screws shall not have pointed end at the bottom. All terminals will have two screws. The terminals shall be properly bound in the insulation.

6.18 The embossing/engraving/printing shall be provided on meter base, meter cover, terminal cover and terminal block as 'UV STABILIZED', and manufacturer's logo/ trade name.

6.19 Meter shall have three fixing holes, one at top &two at bottom. The top screw hole shall be provided on back of the meter so that screw head are not accessible after the meter is fixed. Lower holes shall be provided inside the terminal compartment so as to make them inaccessible to an unauthorized person after terminal cover is fixed.

6.20 The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

6.21 The polycarbonate material of only following manufacturers shall be used:-

A) GE PLASTICS LEXAN 943A FOR COVER AND TERMINAL COVER/ LEXAN 503R FOR BASE & TERMINAL BLOCK
B) BAYER GRADE CORRESPONDING TO ABOVE
C) DDW CHEMICALS -DO-
D) MITSUBISHI -DO-
E) TEJIN -DO-
F) DUPONT -DO-

The meter base shall be manufactured from high quality industrial grade material viz. Polycarbonate with 10 % glass filled which shall meet following properties to ensure higher reliability and long life of the meter base.

1) Meter base & cover and 2) terminal cover shall conform to the following :-

Sr. No	Test	10% Glass filled non-transparent material for meter base & terminal block	Transparent material for meter cover & terminal cover
1	UV ageing for 200 Hrs. as per ASTM : G53(CL No. 9.3)	4 Hours UV at 60° C, 4 Hours condensation at 50° C	4 Hours UV at 60° C, 4 Hours condensation at 50° C
2	Boiling water test(10 MIN)	No softening & whitening & No change in colour, shape, size & dimensions	No softening & whitening & No change in colour, shape, size & dimensions
3	Ball pressure test as per IEC--60695-10-2	125°C +/- 2°C	125°C +/- 2° C
4	Flammability Test (a) As per UL 94 or (b) As per IS 11731(Part-2) 1986	 VO FVO	 VO FVO
5	Glow wire test IS:11000(part 2/SEC-1) 1984 OR IEC PUB,60695-2-12	960 ±15° C (For terminal block)	650 ±10° C (For Terminal cover and meter case)
6	Heat deflection Temp.(HDT) HDT/Ae, 1.8MPa edge (100mm) As per ISO 75/Ae	132° C	125° C
7	Free Fall Test from 2 mtr height without assembly	No crack	No crack

6.22 PCB of meter should be of Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm. The latest technology such as hybrid microcircuit or application specific integrating circuit (ASIC) shall be used to ensure reliable performance. The mounting of components on the PCB shall be SMT (Surface Mounted Technology) Type. The electronic components used in the meter shall be of high quality from world renowned manufacturers and there shall be no drift in accuracy of the meter for at least up to Guarantee period.

6.23 DISPLAY MODULE:

A. The Display should be minimum 7 Digit LCD display with minimum character height of 10 mm.
B. The display shall be permanently green backlit LCD during power on condition.
C. The LCD shall be of STN (super twisted nematic type) constructing suitably for temperature withstand of 80^{o}C (storage) &65^{o}C (operation).
D. The LCD display should have a wide viewing angle of 120^{o} and up to one meter distance, for clear visibility of the display of the meter reading at distance. Large viewing area with large display icons is preferred.
E. When the meter is placed over at a constant temperature of 65 degree C for a period of 30 minutes, the character of LCD should not deform.
F. After keeping the meter at a constant temperature of 80 degree C for a period of 30 minutes and when restores at normal temperature, LCD display should work satisfactorily.
G. Dot- Matrix type LCD display is not acceptable.

7. CONNECTION DIAGRAM & TERMINAL MARKING:

The connection diagram of the meter shall be clearly shown in inside portion of the terminal cover & shall be of permanent nature. Meter terminals shall also be marked & these markings should appear in above diagram.

8. SEALING OF METER:

8.1 The construction of the meter shall be such as to be sealed independently and prevent unauthorized tampering. Meter should be sealed in such way to prevent unauthorized access. Any attempt for Opening the meter's main cover should not be possible unless by breaking the meter's case.
8.2 All the seals shall be provided on front side only. Rear side sealing arrangement shall not be accepted. The diameter of the sealing screw hole shall accommodate two seals, one by supplier and other by utility or separate holes shall be provided for both sealing.
8.3 At least two sealing screws of Nickel plated steel shall be provided (diagonally) for proper fixing of meter cover.
8.4 Appropriate sealing facility required on Meter terminal Cover, MD Reset Button &communication ports.
8.5 The supplier has to provide two polycarbonate seal having supplier's Logo and Serial No. both on Male and Female part on meter body.
8.6 The supplier has to provide two security seals on meter body. The security seals shall be as per ANNEXURE:A
8.7 The supplier must kept records of sealing done at their works.

9. MARKING OF METER & NAME PLATE OF THE METER

The meter terminal marking and mounting arrangement shall be as per Indian Standard/IEC.
The marking on every meter shall be in accordance with IS 14697/1999.

The meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked indelibly. The name plate marking shall not fade with lapse of time.

The basic marking on the meter nameplate shall be as under:

- Manufacturer's name and trade mark
- Type designation
- Number of phases and wires
- Serial number
- Month and Year of manufacture
- Reference voltage & PT ratio
- Rated Current & CT ratio
- Maximum rated Current
- Principal unit(s) of measurement
- Meter constant (Imp/kWh & KVarh)
- 'BIS' Mark (Applicable for Indian meter manufacturers only)
- Accuracy Class of meter for Active energy & Reactive energy
- Bar coding of Serial Number, month & year of manufacture, Meter Make
  Clear indication on Push Buttons i.e. for MD reset, Up /Down Scrolling, Battery Mode
- BIDIRECTIONAL METER

Meter Sr. no must be on name plate. Unique Alfa-numeric character be given to Meter, numeric part will appear on meter display and Alfa-numeric part will appear in BCS (MRI data) as well as on name plate.

There should be Clear indication on "MD Reset" Push Button, "Up- Scrolling" Push Button and "Down- Scrolling" Push Button so that they can distinguish from each other

10. Output Devices:

The meter shall have a test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator, must be visible from the front. Test output device shall be homogenous and be provided in the form of LED output device for kWh and kVArh measurement.

The relation between test outputs shall comply with the marking on the name plate or with the indication on display if so provided in addition to details on name plate I.e. pulse per kWh/KVARh

11. BROUGHT OUT ITEMS

The electronic components used in the meter shall be of high quality from world - renowned manufacturers and there shall be no drift in accuracy of the meter for at least up to Guarantee period. The make/grade and the range of the components should be from the following list.

Sr No	Component function	Requirement	Makes and Origin
1	Current	If the Meter is with current	Any Make of Origin Conforming to IS-

	Transformers	transformers as measuring elements.	2705 OR Relevant Standard.
2	Measurement or computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type along with the ASICs.	USA: Anolog Devices, Cyrus Logic, Atmel, Philips South Africa :SAMES Japan: NEC
3	Quartz Crystal		AVX, Vanlong, Advanced Crystaletc
4	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges.	USA: Atmel, National Semiconductors, Texas Instruments, Philips, ST, Japan : Hitachi
5	Display modules	a) The display modules should be well protected from the external UV radiations. b) The display visibility should be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for Viewing angle). c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display (PIN Type). D) It should be trans-reflective HTN or STN type industrial grade with extended temperature range.	Display TEK/KCE/RCL Display /Suzhou heng Xiamen instruments/ Veritronics/ Bona- fide/ JebonVIZ. Hongkong : Genda Singapore: Bonafied Technologies. Korea: Advantech China: Success Japan: Hitachi, Sony. TIANMA, Haijing, Holtek,
6	Communication Modules	Communication modules should be compatible for the optical port & RS232 port for communication with meter reading instruments ,computer and through remote metering	USA: National, Semiconductors HP, Optonica. Holland/ Korea: Phillips Japan: Hitachi Taiwan: Ligitek

7	Optical port	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily. The Optical Port should not be adversely affected by influence of electromagnetic field , Static discharge.	USA: National Semiconductors HP Agilent Holland/Koread: Phillips Japan: Hitachi Taiwan: Ligitek
8	Power supply	The power supply should be with the Capabilities as per the relevant standards. It should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections	SMPS Type or better
9	Electronic components	The active& passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	USA: National Semiconductors, Atmel, Philips, Taxas Instruments, Siemens WELWYN, VISHAY DRALORIC,YAGEO,KOA,R OHM,PHYCOMP,FAIRCHI LD,PHILIPS, VISHAY SEMICOND, TEXAS INSTRUMENT,EPCOS, OSRAM,INFINION,NATIONALSEMICOND etc. Japan: Toshiba , Hitachi, Oki, AVZ or Ricon Korea; Samsung
10	Mechanical parts	a) The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. b) The other mechanical components should be protected from rust, corrosion etc. by suitable plating/painting methods.	

11	Battery	Chargeable maintenance free guaranteed life of 10 years.	Varta, Tedirun, Sanyo or National, Panasonic, Renata
12	RTC& Micro controller.	The accuracy of RTC shall be as per relevant IEC/ IS standards.	USA: Philips, Dallas, ST, Xicor Atmel, Motorola, Microchip Japan: NEC or Oki.
13	PCB	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	A class vendor

Note: The make of components mentioned above are only indicative. The supplier can utilize better or equivalent make of components.

12. QUANTITIES TO BE MEASURED, DERIVED, MONITORED AND MEMORISED:

12.1 Sampling Rate & Derivation of Basic Measurable Quantity: The actual supply wave of related voltages and currents should be sampled out at the rate of minimum 3000 samples per second and should provide integrated values of each actual voltage and current cycle and angle between them. while deriving actual basic Active (cosine part measurable component) and Reactive (sine part measurable component) energies (with respect to relevant voltage wave and current wave) to assess actual contents of energies persisting / traversing, to have up to-date information for total energy even when highest order of Harmonics is present in supply wave.

12.2 Voltage for all three phase

12.3 Current for all three phase

12.4 Power Factor for all three phase

12.5 Frequency

12.6 TOD TIMINGS: The meter should have eight time zones, however it should be configured for following four zones.

1 – 07:00 to 11:00 Hrs + 18:00 to 22:00 Hrs – Peak Hr

2 – 22:00 to 06:00 Hrs - Night Hr.

3 – 11:00 to 18:00 Hrs + 06:00 to 07:00 Hrs. - Rest Hr.

4 – 19:00 to 6:00 Hrs. Non Solar Hr.

12.7 Date and Time

12.8 Total Cumulative Import Active Energy: Total Import active energy i.e, with highest order of harmonics.

12.9 Total Cumulative Export Active Energy: Total Export active energy i.e, with highest order of harmonics.

12.10 Reactive energy: Lag & Lead (Four Quadrant).

12.11 Total Cumulative Import Apparent Energy: Vectorial summation of Total Import Active Energy and Reactive Energy with Lead PF treated as Unity Power Factor

12.12 Total Cumulative Export Apparent Energy: Vectorial summation of Total Export Active Energy and Reactive Energy with Lead PF treated as Unity Power Factor

12.13 Maximum MD in (KW) &(KVA) for 15/30 minutes integration period for current billing period & last twelve billing period including TOD & it should be programmable.

12.14 Average Power factor: Derived from division of Total Import active Energy to Total Import Apparent Energy for current billing period & last twelve billing period.

12.15 Load survey data for following parameters for 45 power on days with integration of 15 /30 (e.g. 09:30 to 09:45) minute for 0.2s Meters and 62 power on days with integration of 15/ 30 Minutes (e.g. 09:30 to 10:00) for 0.5s Meters is required to be stored and shall be available in BCS & in Meter memory.

- Date and Time
- Average Voltage for all three phase (Power On time only)
- Average Current for all three phase (Power On time only)
- Total Import Active Energy (KWH) (Power On time only)
- Total Export Active Energy (KWH) (Power On time only)
- Total Reactive Energy (KVarh lag) (Power On time only)
- Total Import Apparent Energy (KVAH) (Power On time only)
- Total Export Apparent Energy (KVAH) (Power On time only)

BCS should have facility for generate load survey for average max. demand (KW & KVA) from load survey of Total Active Energy (KWH) & Total Apparent Energy (KVAH) (Power On time only).

12.16 **Configuration Details:**

The following Configuration Details is required to be stored and shall be available in BCS

RTC
TOD
MD INTEGRATION PERIOD
AUTO MD RESET DATE
PROGRAMMING ATTEMPT

Note: Meter shall have facility to change above parameter through authenticated pass ward. No hardware lock should be provided.

12.17 **Self Diagnostics:**

The following Self Diagnostics is required to be stored and shall be available in BCS

Real Time Clock (RTC) status
Nonvolatile Memory (NVM) status

12.18 **Parameters / information: - Must be kept recorded permanently**

I Meter - make and Sr. No.
II Prevailing integration period
III Automatic re setting date and time
IV Tariff time Zone.
V Meter CT and PT ratio.

12.19 The meter shall keep all recorded and memorized in its Non Volatile memory chip forever, so that in event of failure/damage of the meter the all recorded & memorized data should not be lost.

13. DISPLAY PARAMETERS:

The meter should have legible LCD with green backlit minimum 8 digit and automatic in cyclic order display. In case a single display is being used to display the values of various parameters in rotation, it should be possible to display contents of relevant memories continuously in a specified cyclic order.

Each of the physical quantities shall remain on the display screen for a time interval of Ten(10) seconds.

While displaying the memories, proper and adequate legible and understandable text identification of each of the quantities being displayed shall be made.

Sequence of the display parameter must be as per ANNEXURE B. Scrolling should be continuously without any interval between two cycle.

14. Maximum Demand Resister :

The meter should monitor demand during pre-specified integration period(15 /30 Minutes) and record/display the maximum registered value. The rising demand under the current integration period should be displayed along with elapsed time. The integration period shall be programmable (as may be required by the provisions of tariff schedule). The integration period option shall be available and it should be possible to select the period of integration by the user after duly authenticated through base computer service center/HES/CMRI only..

15. Maximum Demand Reset:

The meter should have the following maximum demand resetting arrangements:

- Automatic resetting at the specified date and time of every month which is 00.00 hours on 15th day or as specify by Discom. However, this should be programmable through BCS /CMRI with due authentication of protected password.
- Provision for Manual Resetting of the monthly Max Demand with adequate sealing arrangement shall be available
- After every reset (Auto & Manual both) MD reset count & cumulative maximum demand must be increased

16. Accuracy & VA Burden of various Circuits

16.1 **Accuracy**: Meters should be of **0.2s (1A) & 0.5S** (**5A**) Class of accuracy. Energy measurements by meter shall be tested in accordance with relevant clause of IEC 62053-22 and IS-14697 (1999. The tests and reference conditions under which tests shall be carried out shall be in accordance with respective clause no. of IEC-62053-22, along with tests and test conditions as envisaged under respective clause no of IEC 62053-22

16.2 VA Burdens of various circuits

VA burden shall not more than limit specified in relevant IS.
However, values to be specified by supplier as:

A : VA Burden Voltage circuit : Per Phase
B : VA Burden Current circuit : Per Phase

17. TAMPER FEATURES & TAMPER LOGIC

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Vibrations, Harmonic Distortion, Voltage/Frequency Fluctuations, and Electromagnetic High Frequency Fields etc. The meter shall be immune to abnormal voltage/frequency generating devices and shall record the occurrence and restoration of all tampers and related snapshots as per IS 15959:2011

A	Potential phase sequence	:	Meter should measure/monitor phase rotation and store all variable electrical quantities (active and reactive both) irrespective of rotation of potential phase sequence (i.e. either clockwise or anti-clockwise) accurately within the specified limits of errors.
B	Potentials/line voltage	:	1) Missing Potential (phase wise) As per Annexure C for tamper logics 2) Unbalancing of Voltage (non-phase wise) As per Annexure C for tamper logics 3) Low Voltage (non-phase wise) As per Annexure C for tamper logics 4) High Voltage (non-phase wise) As per Annexure C for tamper logics
C	Line currents	:	1) Current failure /CT Open (phase wise) As per Annexure C for tamper logics 2) Current unbalance (non-phase wise) As per Annexure C for tamper logics
D	Others	:	1) Influence of Permanent Magnet or AC/ DC Electromagnet As per Annexure C for tamper logics 2) Neutral Disturbance - HF& DC As per Annexure C for tamper logics
E	Top cover open	:	Meter shall registered “Top cover Open” event immediately & it should be logged & displayed permanently while opening top cover.
F	Indication for wrong connection	:	Meter should indicate wrong connections if made to Association respective phase pressure Coils and current coils (i.e. perfect current and potential phase association should be achieved).

G	Meter recording	:	Meter should be immune by application of remote induction device i.e. radiated spark through jammer circuit.
H	Power failure	:	

The meter shall be able to check wiring and shall flesh message for correct wiring as well as Wrong wiring. The meter Phase or Diagram through PC and MRI should also be possible.

Note:

I The meter must kept recorded all above events distinctly with type, identification and duration period in a roll over/rotational (i.e. FIFO) method and in NO case these tamper data shall be able to set "Zero".

II All tamper data shall not be to reset to ZERO. Minimum 400 events are required. i.e. 200 Occurrence +200 Restoration (i.e. FIFO or in rotational/roll over method).

III The Occurrence and Restoration of same tamper must be together with snap values.

IV Tamper data shall be available in compartments as under.

1) Voltage related : 75 nos
2) Current related : 75 nos
3) Others : 50 nos

V In addition of above minimum 20 nos power supply failure events should be separately available in BCS.

18. COMMUNICATION CAPABILITIES AND COMMUNICATION PORTS:

a. The meter should be capable to communicate with any make of CMRI, LAPTOP.
b. Meter should have communication facility for galvanically isolated optical port and RS 232 port. The meter manufacturer has to submit the pin configuration wiring diagram for this ports.
c. The communication baud rate of the meter is 9600 bps or more.
d. The Meter should be communicate through Modem (Modem can be GSM, GPRS or any other technology) to PGVCL software. For such remote communications, If meter has any authentication, put up by meter vendor, we require those Authentication / API for communication. Hence supplier shall share/extend the same required authentication/API (if put up by vendor) along with required technical support to PGVCL or its' authorized service provider.

19. BASE COMPUTER SOFTWARE (BCS):

The supplier has to provide licensed BCS for PGVCL Laboratory indicating the current version number of software. The BCS has the facility for reading and displaying following parameters. The BCS has user login and password for these. The BCS has facility to create multiple user ids with appropriate authority. The BCS has provision for user defined ASCII file generation. All the report should be exported to PDF, EXCEL etc. Meter should be capable to communicate to PGVCL software through any make of Modem (Modem can be GSM, GPRS or any other technology).

The BCS has following facilities:

19.1 Instantaneous Data:

The following Instantaneous data for Real Time is required to be stored and display whenever required:

Instantaneous AC Voltage (Phase to Neutral) –Phase wise
Instantaneous AC Current – Phase wise with +/- sign
Instantaneous Power Factor Phase wise
Instantaneous Three Phase Power Factor
Instantaneous Total Three Phase Active Power with +/- sign
Real Date and Time
Current Reading for Cumulative Total Import Active, Total Export Active Reactive (Lag) & Total Import Apparent Energy, Total Export Apparent Energy

All the display parameters as per the Annexure B preferably.

19.2 Billing Data or Energy:

The following Billing data for last 12 reset with TOD Zones is required to be stored and display whenever required:

Current cumulative Total Import Active Energy (KWH) Reading with date and time.
Current cumulative Total Export Active Energy (KWH) Reading with date and time.
(Total Cumulative as well as TOD Zone Wise)

Total cumulative Import Active Energy (KWH) Reading with date and time for twelve Last resets cumulative (Total Cumulative as well as TOD Zone Wise)

Total cumulative Export Active Energy (KWH) Reading with date and time for twelve Last resets cumulative (Total Cumulative as well as TOD Zone Wise)

Current cumulative Reactive Energy (Kvarh lag) Reading with date and time.
Cumulative Reactive Energy (Kvarh Lag) Reading with date and time for twelve last resets.

Current Total cumulative Import Apparent Energy (Kvah) Reading with date and time (Cumulative as well as TOD Zone Wise)

Current Total cumulative Export Apparent Energy (Kvah) Reading with date and time (Cumulative as well as TOD Zone Wise)

Cumulative Total cumulative Import Apparent Energy (Kvah) Reading with date and time for twelve last resets. (Cumulative as well as TOD Zone Wise)

Cumulative Total cumulative Export Apparent Energy (Kvah) Reading with date and time for twelve last resets. (Cumulative as well as TOD Zone Wise)

Current Maximum Demand in Import KW with date and time.
Maximum Demand in Import KW with date and time For last twelve resets.
(Cumulative as well as TOD Zone Wise)

Current Maximum Demand in Export KW with date and time.
Maximum Demand in Export KW with date and time For last twelve resets.
(Cumulative as well as TOD Zone Wise)

Current Maximum Demand in Import KVA with date and time.
Maximum Demand in Import KVA with date and time For last twelve resets.
(Cumulative as well as TOD Zone Wise)

Current Maximum Demand in Export KVA with date and time.
Maximum Demand in Export KVA with date and time For last twelve resets.
(Cumulative as well as TOD Zone Wise)

Average Power factor Since Last reset.
Average Power factor for Last twelve reset.

Note: TOD Zone wise Reactive Energy (Kvarh-Lag) shall be available at on Meter Display Mode-2

19.3 Load Survey Data:

The following load survey parameters data for 45 days (power on days only) with 15 / 30 (e.g. 09:30 to 09:45) minute for 0.2s Meters & for 62 days (power on days only) with 15/ 30(e.g. 09:30 to 09:45) minute for 0.5s Meters is required to be stored and displayed whenever required: The load survey should be in numeric tabular format and graphical format (Bar & Line graph). The software should show the parameters as per daily. However, in addition to daily view, weekly & monthly view is also preferable.

- Date and Time
- Average Voltage for all three phase (Power On time only)
- Average Current for all three phase (Power On time only)
- Total Import Active Energy (KWH) (Power On time only)
- Total Export Active Energy (KWH) (Power On time only)
- Total Reactive Energy (KVarh lag) (Power On time only)
- Total Import Apparent Energy (KVAH) (Power On time only)
- Total Export Apparent Energy (KVAH) (Power On time only)

Load Survey should be as per IS 15959 (2011)

BCS should have facility for generate load survey for average max. demand (KW & KVA) from load survey of Total Import Active Energy (KWH), Total Export Active Energy (KWH) & Total Import Apparent Energy (KVAH), Total Export Apparent Energy (KVAH) (Power On time only)

19.4 Tamper Information:

The Tamper Information data for all type of tampers (Clause-17) is required to be stored and displayed whenever required

The meter should record 400 such events (200 occurrence+ 200 Restoration. The tamper events shall be recorded in FIFO/Roll Over basis.

Snap Shots (numerical values) of voltage, current, power factor and energy (kWh) readings as well as the date and time of the occurrence and restoration of tamper events.

19.5 Configuration Details:

The following Configuration Details is required to be stored and displayed whenever required.

RTC
TOD
MD INTEGRATION PERIOD
AUTO MD RESET DATE
PROGRAMMING ATTEMPT

19.6 Self Diagnostics:

The following Self Diagnostics is required to be stored and displayed whenever required.

Real Time Clock (RTC) status
Nonvolatile Memory (NVM) status

19.7 All Data:

The above all data 19.1 to 19.6 is required to be stored and displayed whenever required with single selection.

19.8 BCS must have data collection facility through CMRI as well as Laptop**.**

20. PROGRAMMING:

20.1 Meter shall have capability to change the date and time (RTC), TOD Timings, and MD integration period (15/30/60 Minutes), Maximum Demand auto reset date and time, load survey parameter and interval timing.

20.2 The programming should be done through CMRI, LAPTOP and Remotely through Modem with authenticated passwords.

20.3 The meter shall be software calibrated at factory end and shall be supplied with certificate along with dispatch. However modification of calibration should not be possible at site. The meter should not have any form of mechanical adjustments such as trip pots potentiometer etc. for calibration. The meter shall be tested, calibrated and sealed at manufacturer's works

before dispatch. Further, no modification of calibration shall be possible at site by any means what so ever.

21. SUBMISSION OF METER AND TEST CERTIFICATE:

21.1 The consumer shall have to submit Meter and BCS Software to read the meter. Please note that the Meter submitted shall be tested at PGVCL NABL accredited laboratory for the following tests as per IS 14697/99/IEC1036, PGVCL specifications & CBIP technical report no 88. If the 'Meter' found failed in any of the test carried out, the 'Meter' of that consumer shall be considered 'Failed'.

21.2 The testing plan is as per ANNEXURE D

21.3 Meter will have to be submitted to PGVCL NABL accredited approved lab for testing of tests mentioned in specifications. In event of failure of the Meter during any of the tests, the Meter will be considered as "REJECTED". However, the decision of the PGVCL shall be final and binding to the consumer.

22. TYPE TEST CERTIFICATE:

The supplier shall have all type test certificates from the Govt. approved laboratory viz: CPRI, NPL, ERTL, ETDC& ERDA. For Indian supplier and for foreign supplier the certificate should be from recognized Govt. approved lab. of that respective country, as per IS No.14697 /1999 or IEC 62053:22 as the case may. Type test should not be older than 3 years. The supplier shall have also the type test certificate. AC/DC magnetic influence test & total energy test harmonics test as per CBIP 325 on the same rating of meter.

23. ROUTINE TEST:

Meter shall undergo the routine tests as well as functional tests as per IS:14697/1999 . The consumer shall produce Test reports for the following tests,

AC High Voltage test
Insulation Resistance Test.
Starting current Test
No load Test.
Limits of error Test.

24. **BIS MARK**- The meter manufacturer should have valid BIS license for HT Meters for required rating. Meter must have ISI marking.

25. Meter manual and routine test report:

Test Results of Routine test carried out by meter manufacturer shall be attached with each meter.
Operation manual with blank reading sheet for readings in all three modes shall be attached with meter. Meter must get tested for routine test as per IS 14697 from PGVCL NABL accredited Laboratory.

ANNEXURE A

Security Seal

In addition to 2 Nos. of polycarbonate seals, further 2 Nos. of tamper proof void seals are to be provided on the Meter body in such a way that both the side covers shall be sealed by the tamper proof void seals. The tamper proof void seals to be provided on Meters shall be as per the following specification:

1. Size of the seal -- 3 x 1 inches.

2. The seal should be digitally printed on white VOID film having UV destructive inks printed with thermal resin ribbon technology.

3. The seal should be water proof and should withstand all the weather conditions. The seal should have adhesive of sufficient strength to avoid peeling off under extreme temperature and environmental conditions.

4. The seal should be sticker type seal and applied on both the side of the Meter which connects the body and the box.

5. If someone lifts the seal, "VOID" impression should be transferred on the meter and if this is applied back, "VOID" impression should be readable from the surface of the seal.

6. The disturbed portion of the seal should glow under UV light if the seal is disturbed from any part.

7. Barcodes of serial numbers should be printed on the seals and the barcodes should be readable with a barcode scanner.

8. The seals should have continuous variable serial numbers along with security codes of last three digits of serial numbers printed in black and the same serial numbers along with code of serial numbers shall also be printed in a vertical semi circular Shape which should be visible only under Ultra-violet (UV) light.

9. Two security cuts should be given on the seal on both the sides, and if someone tries to lift the seal it should tear off from the security cuts. The security cuts should be made with a computer controlled plotter which should put the security cuts on the same position on each seal.

10. The name of the supplier and supplier logo along with the security warning or any other information in any language as given by the company should be printed on the seal.

11. There should be a provision of incorporating officers' signature on the seal as given by the company.

12. If someone tries to remove the seal by allying heat, the printing should get disturbed and the shape of the seal should change if more heat is applied.

ANNEXURE B

MODEWISE LIST OF PARAMETERS TO BE DISPLAYED ON STATIC TVM

There should be Three Modes for displaying parameters.

MODE – 1

Mode-1 Should be displayed in auto mode as well as push button.
Up and Down facility is required for viewing display parameter.

Sequence	Name of Parameters
1.	Meter Sr. No.
2.	R-Phase Voltages
3.	Y-Phase Voltages
4.	B-Phase Voltages
5.	R-Phase Current (With Signed)
6.	Y-Phase Current (With Signed)
7.	B-Phase Current (With Signed)
8.	Frequency
9.	Voltage and current phase sequence
10.	Instantaneous PF (resultant of all the three phase) (With Signed)
11.	Instantaneous KW (Total of all the three phase) (With Signed)
12.	RTC – Date and Time.
13.	Rising demand in KVA with elapse time
14.	Total Cumulative Import KWH
15.	Total Cumulative Export KWH
16.	Cumm. Import KVARH (lag)
17.	Cumm. Export KVARH (lag)
18.	Total Cumulative Import KVAH
19.	Total Cumulative Export KVAH
20.	Total Cumulative Import KWH Time Zone 1 i.e Peak hours
21.	Total Cumulative Import KWH Time Zone 2 i.e Night hours
22.	Total Cumulative Import KWH Time Zone 3 i.e Remaining hours
23.	Total Cumulative Export KWH Time Zone 1 i.e Peak hours
24.	Total Cumulative Export KWH Time Zone 2 i.e Night hours
25.	Total Cumulative Export KWH Time Zone 3 i.e Remaining hours
26.	MD KVA for present billing period
27.	Present MD in Import KVA for Time Zone 1 i.e Peak Hours
28.	Present MD in Import KVA for Time Zone 2 i.e Night hours
29.	Present MD in Import KVA for Time Zone 3 i.e Remaining hours
30.	MD KVA for last billing period
31.	Billing MD in Import KVA for Time Zone 1 i.e Peak Hours
32.	Billing MD in Import KVA for Time Zone 2 i.e Night hours
33.	Billing MD in Import KVA for Time Zone 3 i.e Remaining hours
34.	Cumulative MD in Import KVA
35.	No. of Reset count
36.	No. of Total tamper count
37.	Cumulative Programming count
38.	Anomaly / circuit check in meter display
39.	Cumulative Reverse KWh
40.	Display check

Note :- Each parameter shall be displayed for 10 sec.

MODE – 2

Mode-2 is with Push Button Mode

1.	Average power factor for last billing period
2.	Instantaneous load in KVA
3.	Instantaneous load in KVAR
4.	Cumm ImportKVAH Time Zone 1 i.e Peak hours
5.	Cumm ImportKVAH Time Zone 2 i.e Night hours
6.	Cumm ImportKVAH Time Zone 3 i.e Remaining hours
7.	Cumm KVARH lag Time Zone 1 i.e Peak hours
8.	Cumm KVARH lag Time Zone 2 i.e Night hours
9.	Cumm KVARH lag Time Zone 3 i.e Remaining hours
10.	Present Max. Demand in Import Kw
11.	Last Reset date and time
12.	Total Voltage failure tamper count (Phase wise)
13.	Total Current failure tamper count (Phase wise)
14.	Total Voltage unbalance tamper count
15.	Total Current unbalance tamper count
16.	Total High Voltage count
17.	Total Low Voltage count
18.	Total neutral disturbance count
19.	Total magnet temper count

MODE – 3

Separate High Resolution registers for testing purpose.

Mode-3 is with Push Button Mode

Sequence	Name of Parameters
1.	High Resolution display for Import KWH**(12.345678)**
2.	High Resolution display for Export KWH**(12.345678)**
3.	High Resolution display for KVARH-Lag**(12.345678)**
4.	High Resolution display for KVARH-lead**(12.345678)**
5.	High Resolution display for KVAH**(12.345678)**

Note: -

1. In the meter display especially for the consumption of time zone, proper and adequate legible and understandable text shall be incorporate with the display..
2. Push button for up and dawn scroll should be provided and all buttons should clearly marked its function.
3. Any parameter can be locked for 15 Minutes, after that scrolling of auto mode will be start.

ANNEXURE C

Sr No	Type of Tamper	Requirement	Tamper Logics / Conditions & (Occurrence &Restoration) Persistence Time					
			Occurrence			Restoration		
			Voltage	Current	Persist Time	Voltage	Current	Persist Time
1	Voltage Failure	Phase wise	Vx< 40% of Vref irrespective to any other phase voltage	Ix > 10% of Ib	15 Minutes	Vx> 75% vref irrespective to any other phase voltage		5 **Minutes**
2	Current Failure	Phase wise	All voltages > 75 % of Vref.	Ir or Iy or Ib < 2% of actual max. current and any one phase has value > 10% Ib	15 Minutes		Ir or Iy or Ib > 2% of actual max. current and any one phase has value > 10% Ib	5 **Minutes**
3	Voltage Unbalance	-	(Vmax - Vmin) > 10% of max Voltage of 3 phase voltages and all voltages > 60% of Vref .	Ix > 10% of Ib For at least any one phase	15 Minutes	(Vmax-Vmin) <10% of max voltage of 3 phase voltages		5 **Minutes**
4	Current Unbalance	-	All voltages > 75 % of Vref.	(Diff. of Actual Max current & Actual Min current) > 30 % of Actual maximum current and all phase has value greater than 10% Ib	15 Minutes		(Diff. of Actual Max current & Actual Min current) < 30 % of Actual maximum current	5 **Minutes**
5	Magnetic Influence	-		When magnet influence start affecting the accuracy, meter should start recording at Imax Amp and in **Import Mode only**	1 Minute		When magnet influence stop affecting the accuracy, meter should start recording at actual load	1 Minute
6	Low Voltage	-	Vx> 40% of Vref&Vx< 75 % of Vref	Ix > 10% of Ib For at least any one phase	15 Minutes	Vx> 75 % of Vref		5 Minutes
7	High Voltage	-	Vx> 120% of Vref	Ix > 10% of Ib For at least any one phase	15 Minutes	Vx< 110% Vref		5 Minutes

Note: For tamper logics, following points shell be taken in consideration

1. During High Voltage & Low Voltage tampers, Voltage unbalance tamper shall not be logged.
2. During Voltage failure Tamper, Voltage Unbalance & Low Voltage tamper shall not be logged.
3. During current failure Tamper, Current Unbalance tampers shall not be logged.
4. During power failure duration, if any tampers persisting, those tampers shall not get recovered until it meets the logic for restoration and duration of respective tamper shall be from occurrence of that tamper irrespective of power failure duration.
5. For tamper events logging, snap shot data i.e. voltage, current, power factor, active energy register reading (Total Import Kwh & Total Export Kwh) & date & time should be corresponds to starting of occurrence and starting of restoration.
6. Snap shot of date and time should be available for occurrences and restorations of events.

ANNEXURE D

Inspection / Testing for Meter

1. Insulation resistance test as per IS 14697.
2. AC high voltage test method as per IS 14697:99 but shall be taken at 4 KV for one minute.
3. Test for limit of error as per IS 14697:99 with balance and unbalanced load and on active energy and reactive energy.
4. Interpretation of test results, if required.
5. Test for meter constant IS 14697:99.
6. Test of starting condition at 0.1 % of basic current as per IS 14697:99.
7. Test of no load condition as per IS 14697:99.
8. Test of repeatability of error as per IS:14697:99.
9. Test of power consumption as per IS 14697:99.
10. Test for total energy i.e. fundamental + harmonics as per CBIP 325 & PGVCL requirement.
11. Test for influence of quantities i.e .Voltage and frequency variation test and10% of 3rd harmonics, Reverse Phase Sequence, Voltage Unbalance as per IS 14697:99.
12. Test for influence of AC / DC& Permanent magnetic field as per CBIP 325 & PGVCL requirement.
13. Tamper condition tests with tamper logics as per Annexure C.
14. Test of Short time over current test as per IS 14697.
15. 35 KV Test as per Application of abnormal voltage/frequency :

    Meter should not be affected/or hanged by non standard equipment like jammer. The accuracy of the meter should not be affected with the application of abnormal voltage/frequency such as spark discharge of approximately 35KV in any of the following manner for total 10 minutes:

    i) On any of the phases and neutral terminal
    ii) On any connecting wires of the meter
    iii) Voltage discharge with 10 mm spark gap
    iv) At any place in load circuit
    v) Spark on meter body.

    "After the application of spark discharge meter should operate normally and meter should register the correct energy"
16. Verification of Display parameters and Functional requirement.