

TECHNICAL SPECIFICATIONS FOR 0.2s ACCURACY CLASS AC STATIC TRIVECTOR ENERGY METERS, SUITABLE FOR INTER FACE ENERGY METER AND AVAILABILITY BASED TARIFF (ABT) METRING

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, 50Hz, static HT tri-vector CT/ VT operated meters, along with other associated equipments as per details given in this specification. The meters shall be used for commercial/ tariff metering for inter utility power flows/ bulk consumers as well for Availability Based Tariff (ABT) application.
- 1.2 The meter shall be compliant to **IS 15959** and its latest amendments. Meter shall have provision to configure 15 or 5 min time block in field with authenticated transaction.
- 1.3 The meter shall be supplied in 3-phase 4-wire mode. However, provision shall be there to configure the meter in 3-phase 3-wire mode, as & when required, through authenticated/secured commands.
- 1.4 The metering system shall be housed in rack with **draw out type with automatic CT shorting** feature so as to ease the testing/ replacement of meters without disturbing the system. The rack shall 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.
- 1.5 The meter shall have wide secondary current range support i.e. same meter shall be put up for 1A or 5A rating as per field availability of CT's. The meter shall support 200% Ibasic. Meter required to be commissioned at each substation shall be of 3 phase 4 wire.
- 1.6 The meters shall normally operate with the power drawn from DC auxiliary power supply (Range 110V to 220V DC) to reduce the Voltage Transformer (VT) burden. In addition, there shall be provision to operate the meter from the Voltage Transformer (VT) secondary circuit having a rated secondary line-to-line voltage of 110V, and current transformers (CTs) having a rated secondary current of 1 A or 5A. Any further transformers/ transactions/ transducers required for their functioning shall be in-built in the meters. Necessary isolation and/or suppression shall also be builtin, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyards. The reference frequency shall be 50Hz. Also, the meter shall have suitable of $\pm 15\%$ tolerance for DC supply.

The total burden imposed by a meter for measurement and operation shall be defined as per IS 14697. An automatic backup for continued operation of the meter's calendar-clock, and for retaining all data stored in its memory, shall be provided through a long-life battery, which shall be capable of supplying the required power for at least 2 years.
- 1.7 The meters shall fully comply with all stipulations in IS 14697 except those specifically modified by this specification. The reference ambient temperature shall be 27° C.
- 1.8 Each meter shall have a test output device (visual), as per clause 6.11 of IS 14697.1999, for checking the accuracy of active energy (Wh) measurement.

- 1.9 The three line-to-neutral voltage shall be continuously monitored and in case any of these falls below defined threshold (70% of Vref), meter shall have suitable indication on LED/ LCD.
- 1.10 The meter shall also have provision for low voltage event logging in meter memory in case of any phase voltage going below a defined threshold.
- 1.11 The time blocks in which a voltage failure occurs/persists shall also be recorded in the meter's memory with a symbol "*" If 3 Phase RMS voltage applied to the meter is in between 25% to 70% of Vref and if Voltage is less than 25% of Vref, meter should record Zero voltage symbol "Z".
- 1.12 Time Accuracy - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer's works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front (when VT supply has been connected), on demand. Meter shall have the intelligence to synchronize the time with SNTP over Ethernet port and also provision through a single click from the software itself while connecting the meter with local or remote server.
- 1.13 Limited time synchronization through meter communication port shall be possible at site. When an advance or retard command is given, twelve subsequent time blocks shall be contracted or elongated by five seconds each if meter configured for 5 min block and six subsequent time blocks shall be contracted or elongated by ten seconds each if meter configured for 15 min block.
All clock corrections shall be registered in the meter's memory and suitably shown on print out of collected data.

2.0 Constructional Features

- 2.1 The meters shall be supplied housed in compact and sturdy, metallic or molded cases of non-rusting construction and/or finish. The cases shall be designed for simple mounting on a plane, vertical surface such as a control/relay panel front. All terminals for CT and VT connections shall be arranged in a row along the meter's lower side. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CTs and VTs leads through stranded copper conductors of 2.5 sq. mm. size.
- 2.2 All meters of the same model shall be totally identical in all respects except for their unique identification codes. They shall also be properly sealed and tamper evident, with no possibility of any adjustment at site, except for transactions allowed in IS 15959.
- 2.3 The meters shall safely withstand, without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. The meter shall be capable of satisfactory operation in an indoor, non-air conditioned installation.
- 2.4 Either the meters shall have built-in facility (eg. test links in their terminals) for in-situ testing, or a separate test block shall be provided for each meter.
- 2.5 Proper sealing arrangement shall be provided in metering system and sealing arrangement should be suitable for application of Polycarbonate seals.

3.0 Measurement

- 3.1 The active energy (Wh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy as per class 0.2S of IS 14697. The principal unit of measured values shall be kilowatt-hour (kWh) or Megawatt-hour (MWh). The meter shall compute the **net active (Export-Import)** energy (Wh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to second decimal with plus sign if there is net Wh export and with a minus sign if there is net Wh import .
- 3.2 The Reactive energy (VARh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy of 0.5S as specified in IS 14697. The meter shall compute the **net Reactive (Export-Import)** energy (VARh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to second decimal with plus sign if there is net VARh export and with a minus sign if there is net VARh import. It shall also display on demand the net VARh sent out during the previous 5 min block.
- 3.3 The meter shall also integrate the reactive energy (VARh) algebraically into two separate registers, one for the period for which the average RMS voltage is above 103.0%, and the other for the period for which the average RMS voltage is below 97.0 %. The current reactive power (VAR), with a minus sign if negative, and cumulative reactive energy (VARh) readings of the two registers (>103% and <97%) shall be displayed on demand. The readings of the two registers at each midnight shall also be stored in the meter's memory. When reactive power is being sent out from substation bus bar, VAR display shall have a plus sign or no sign and VARh register shall move forward. When reactive power flow is in the reverse direction, VAR display shall have negative sign and VARh register shall move backward. Generally, the standard PT ratios are 220 kV /110 V, 400 kV /110 V and 765 kV / 110 V. However, at the time of commissioning the vendor may confirm the same from site and configure the meter accordingly to ensure correct recording of reactive energy. For Reactive High & Low recordings, PT secondary voltage shall be configured in the meter. Therefore it is required that the same shall be confirmed from the site.
- 3.4 Errors for different power factors shall be as defined in IS14697.
- 3.5 For reactive power (VAR) and reactive energy (VARh) measurements, IS14697 shall be complied with. The accuracy of measurement of reactive energy shall be as per class 0.5S.
- 3.6 No rounding off to the next higher last decimal shall be done for voltage and frequency displays. All 5 min Wh and VARh figures shall however be rounded off to the nearest last decimal.
- 3.7 The harmonics shall be filtered out while measuring Wh, V and VARh, and only fundamental frequency quantities shall be measured/computed.
- 3.8 Data security shall be ensured as per IS 15959 (three layers of security).

4.0 Data Communication Capability:

Each meter must have an optical port on its front for tapping all data stored in its memory through HHU. In addition to the above each meter shall also have following communication ports:

- 1) RS232
- 2) RS485
- 3) Ethernet
- 4) USB

The meter should be capable to communicate simultaneously on above ports all together at a time and communicate independently. The overall intention is to tap the data stored in the meter's

memories at a scheduled time from any of the above mentioned ports or any other means and transmit the same to a remote central computer using suitable means of communication.

Data collection from any local laptop/PC should be possible by installing data collection software. The meter shall be suitable for communication with external device like modem, DCU, etc. which shall be able to communicate with HES for local/remote data transfer.

For multi drop connection (Daisy chaining) networking, IN & OUT provision shall be there in RS 485 port. Also the RS485 and TCP / IP shall be configured as DLMS ICS and MODBUS protocol.

5.0 Display

The display of the meter shall indicate direct values (i.e. without having to apply any multiplying factor) of measured / computed parameters as per the meter configuration during commissioning. The display values shall accompany suitable legends, signs and OBIS code for identification. The meter shall have Graphical LCD with backlight for proper depicting of values in user friendly manner like values with unit, OBIS codes, negative signs, favourite page etc.

The energy register shall not take roll-over before 1500 hours of continuous operation with power equivalent to rated maximum current at reference voltage and unity power factor.

The meter shall be able to display the following parameters on demand & in Auto scroll mode, but the display of these parameters shall be programmable at site. There should be two push buttons for up & down scroll of display parameters.

- 1) Meter Serial No.
- 2) Real Time Clock – Date and Time
- 3) Net Active Energy (Export - Import)
- 4) Net Reactive Energy (Export - Import)
- 5) Energy Net Reactive High (i.e. when RMS Voltage >103% Vn)
- 6) Energy Net Reactive Low (i.e. when RMS Voltage <97% Vn)
- 7) Average frequency of the previous block
- 8) Net Active Energy (Export - Import) of the previous block
- 9) Net Reactive Energy (Export - Import) of the previous block
- 10) Three phase average % Voltage
- 11) Active Import
- 12) Active Export
- 13) Reactive Q1
- 14) Reactive Q2
- 15) Reactive Q3
- 16) Reactive Q4
- 17) Apparent while Active Import
- 18) Apparent while Active Export

The meter shall have the provision to display graphical representation of current & voltage vectors, both magnitude and angle, for each phases. In addition to that, there should a facility to configure the display parameters in favorite pages.

6.0 Marking of Meter

The basic marking on the metering module name plate shall be as follows:

- i) Manufacturer's name and trade mark

- ii) Serial Number
- iii) Year of manufacture
- iv) Meter Type
- v) Number of phases and wires
- vi) VT commissioning information
- vii) CT commissioning information
- viii) Reference frequency
- ix) Accuracy Class

7.0 Memory/Storage

- 7.1 Each meter shall have a non-volatile memory in which load survey, Midnight, Billing and MD data shall be automatically stored.

The survey integration period (SIP) shall be set as 5 minutes that shall be capable to change to other integration period (15 or 30 minutes) if required, through suitable high level software/ MRI as an authenticated transaction. Meter shall record following Load Survey parameters for 5 Minute blocks for secondary voltage and current rating (-/110V, -/1A or -/5A):

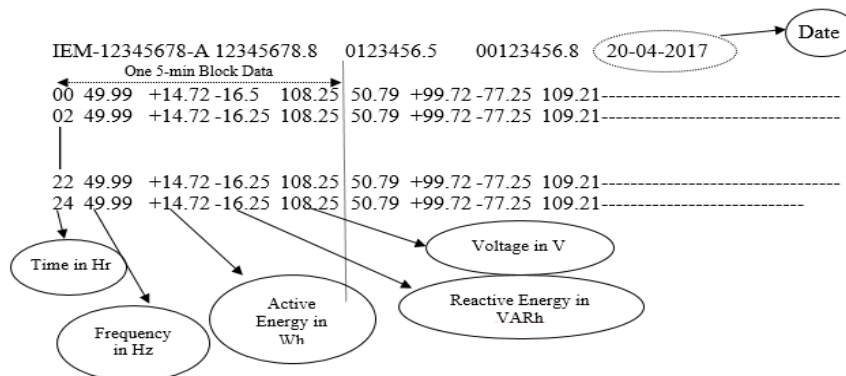
- i) Date and time blocks
- ii) Average frequency in Hertz up to third decimals
- iii) Net Active Energy (Export - Import) in Wh up to fourth decimal
- iv) Net Reactive Energy (Export - Import) in VARh up to fourth decimal
- v) Average RMS voltage
- vi) Flag star (*)/ (Z) mark

Meter shall record following cumulative parameters **at midnight in eight digits including one decimal** for secondary voltage and current rating (-/110V, -/1A or -/5A):

- i) Net Active Energy (Export - Import)
- ii) Net Reactive Energy (Export - Import)
- iii) Energy Net Reactive High (i.e. when RMS Voltage >103% Vn)
- iv) Energy Net Reactive Low (i.e. when RMS Voltage <97% Vn)

The meters shall store all the above listed data in their memories at least for a period of fifteen (15) days. The data older than storage capacity shall get erased automatically.

- 7.2 The below data shall be available in text file format exportable to Excel.



There are 4 values in one 5 min time block. The first row shall contain the meter data for 2 hours, i.e. 24 time blocks, 00 hrs to 02:00 hrs. Similarly the 2nd row shall contain the data for the next 2 hours and henceforth. The above data shall be available in text file format exportable to Excel.

Indication of time retard or advance to be provided without disturbing the proposed format. Each 5-min block data consists of **Frequency (in HZ)**, **Active energy (in Wh)**, **Reactive energy (in VARh)** and **Voltage (in V)**. All 5 minute Wh and VARh figures in required (.CSV/.NPC/ any other) output report shall be **rounded off up to third decimal**. Net Active and Reactive energy High Low to be in the order of **7+1 digits**.

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.

7.3 The meter shall have TOD registers for following parameters:

- i) Active energy import
- ii) Active energy Export
- iii) Apparent energy while active import
- iv) Apparent energy while active export

Maximum eight time of day registers including universal (0-24 hrs) register 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.

The meter shall continuously monitor and calculate the average demand for following parameters during the demand integration period set and the maximum, out of these shall be stored along with date and time when it occurred in the meter memory:

- i) Active energy import
- ii) Active energy Export
- iii) Apparent energy while active import
- iv) Apparent energy while active Export

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

Maximum Demand Reset: Following provisions shall be available for MD reset in meter:

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

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. Each meter shall store the following parameters corresponding to defined bill dates for up to last six (12) months:

- i) Active energy import
- ii) Active energy export
- iii) Apparent energy (while active import)
- iv) Apparent energy (while active export)
- v) Maximum demand Apparent (while active import)
- vi) Maximum demand Apparent (while active export)

Meter shall have provision to compute apparent energy based on lag only or lag+lead. The same shall be configured at factory end. The meters shall be compatible with ABT tariff as well as TOD tariff. The meter display should depict the total harmonic distortion (THD) of current and voltages up to 31st level of power quantity for providing the feature of supply monitoring to Utility.

8.0 Anomaly Detection Features

The meter shall have features to detect and log the occurrence and restoration of following anomalies, along with date and time of event:

- i) Phase wise Missing Potential – The meter shall detect missing potential (1 or 2 phases) provided the line current is above a specified threshold. The voltage at that stage would be below a specified threshold.
- ii) Phase wise Current Circuit Reversal – The meter shall detect reversal of polarity provided the current terminals are reversed. This shall be recorded for 1 or 2 phase CT reversal.
- iii) Voltage Unbalance – The meter shall detect voltage unbalance if there is unbalance in voltages.
- iv) Current Unbalance – The meter shall detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks.
- v) CT Miss – The meter shall detect current miss if the current is below a defined threshold, provided the phase voltage is above a specified threshold.

Snapshots of phase wise voltage, phase wise active current and phase wise power factor shall be provided with above specified anomaly events.

Further, each meter module shall record the following events along with total duration:

- vi) Power On/Off – The meter shall detect power off if both the auxiliary supplies fail. The event shall be recorded on the next power up. At the same time power on event shall be recorded. No snapshot shall be logged with this event.
- vii) Feeder Supply Fail -This event shall be logged when feeder supply, i.e. all the voltages goes below certain threshold. No snapshot shall be logged with this event. This feature shall be available if meter powered up with auxiliary supply.

Following additional tampers should also be provided in the meter:

- a. Over voltage
- b. Under voltage
- c. Voltage sag (power quality)
- d. Voltage swell (power quality)
- e. Neutral disturbance
- f. Magnet detection

Minimum 500 events (occurrence + restoration) in total shall be stored in the meter memory on first in first out basis. Once one or more compartments have become full, the last anomaly event pertaining to the same compartment shall be entered and the earliest (first one) anomaly event should disappear. Thus, in this manner each succeeding anomaly event shall replace the earliest recorded event, compartment wise. Events of one compartment/ category should overwrite the events of their own compartment/ category only. In general persistence time of 5 min. for occurrence and restoration respectively need to be supported in meter.

The meter shall transaction (as performed in authenticated manner) of Time set, MD reset operation and tariff change. These events shall be logged in roll over mode.

9.0 Self Diagnostic Information

The meter shall be capable of performing complete self diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data in memory location all the time. The meter shall have indications for unsatisfactory/ nonfunctioning/ malfunctioning of the following:

- i) Non volatile memory
- ii) RTC battery

The above malfunctioning should be flagged in the meter memory and should be made available in meter reading data.

10.0 Type Test

The meters shall be fully type tested as per relevant standards IS 14697. The type test report of the meters shall be submitted by bidder along with the offer.

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.

GURANTEED TECHNICAL PARTICULARS

S. No.	Technical Specification Requirements	Bidder's Offer
1.	Manufacturer's name & Country	
2.	Type of Meter	
3.	Name and model no. of offered product	
4.	Standards to which meter complies	
5.	Accuracy class <ul style="list-style-type: none"> • Active energy measurement • Reactive energy measurement 	
6.	Metrology indicator provided on meter and switching facility for reactive & apparent energy	
7.	Variation of voltage at which system functions normally	
8.	Minimum Starting current	
9.	Maximum current	

10.	P.F. range	
11.	Power consumption per phase <ul style="list-style-type: none"> • Voltage Circuit • Current Circuit 	
12.	AC and DC Auxiliary supply ratings for powering up the metering system	
13.	Sealing arrangement	
14.	Energy parameters recorded in meter	
15.	ABT compatibility	
16.	TOD compatibility	
17.	MD Reset provisions <ul style="list-style-type: none"> • Auto • Manual 	
18.	Demand integration period	
19.	Load survey parameters recorded in meter	
20.	Billing parameters recorded in meter	
21.	Daily Midnight parameters recorded in meter	
22.	Communication Capability for <ul style="list-style-type: none"> • Local reading • On demand Remote reading 	
23.	Facility of external CT/ VT error compensation	
24.	Anomaly detection features	
25.	Self diagnostics features	
26.	Magnetic immunity	
27.	Maximum nos of communication ports i.e. Optical, USB, RS232, RS485 and Ethernet etc.	
28.	IS15959	