

TECHNICAL SPECIFICATION FOR STATIC 3 PHASE 4 WIRE CT-PT OPERATED THREE VECTOR ENERGY METER

1. OBJECTIVE & SCOPE

This specification shall cover design, engineering, manufacture, assembly, inspection, testing at manufacturers works before dispatch, supply and delivery at destination any where in "state", Class 0.2s accuracy class static 3 phase-4 wire CT-PT operated three-vector energy meter. The meter shall be suitable for measurement of energy and power, demand requirement in an AC balanced/unbalanced system over a power factor range of zero lag to unity. These meters should have communication port to interface for remote meter reading.

2. SERVICE CONDITION

The meter shall be suitable for satisfactory continuous operation under the following tropical conditions:-

- a) Maximum ambient temperature : 50 °C
- b) Maximum ambient temperature in shade : 45 °C
- c) Relative Humidity : 10 to 95%
- d) Maximum annual rainfall : 1450 mm'
- e) Maximum wind pressure : 150 Kg/m. sq.
- f) Maximum altitude above mean sea level : 1000 meters
- g) Isoceraunic level : 50 days/year
- h) Seismic level (Horizontal acceleration) : 0.3g
- i) Moderately hot and humid tropical climate

3. APPLICABLE STANDARDS

The CT PT operated energy meter shall be of Accuracy Class 0.2s for active/ reactive / apparent energy and conform to relevant clauses of following standards or report: -

IS 14697: 1999	Specification for A.C Static Transformer operated Watt Hour & VAR – Hour meters, class 0.2s
IS: 15959	(for DLMS)
CBIP Technical Report No. 88 (Revised July 1996 and Amendments & Errata issued in April - 1999 and September '99)	Specification for A.C. Static Electrical Energy Meters.

Unless otherwise specified elsewhere in this specification the static meters shall conform to the latest version available of the standard as specified above.

4. GENERAL TECHNICAL REQUIREMENT

- 4.1 Application : 3 phase 4 wire
- 4.2 Rated Secondary Voltage : 63.5 Volts (Phase to Neutral)
- 4.3 Rated secondary Current (I Basic) : 5 Amps
- 4.4 Rated secondary Current (I Max) : 2 Ib
- 4.5 Rated Frequency : 50 Hz.
- 4.6 Accuracy class : 0.2 as per meter category
- 4.7 Power Factor : Unity to Zero (all power factor lag / or lead).

- 4.8** The meter shall start and continue to register on application of 0.1% of basic current at Unity P.F., as per relevant standards and shall work satisfactorily up to maximum continuous current of 2 times rated basic current with the following supply system variation:

Voltage: $V_{ref} +20\%$ to -30%
Frequency: 50 Hz $\pm 5\%$

- 4.9** Temperature: The standard reference temperature for performance shall be 27°C. The mean temperature co-efficient shall not exceed 0.03%.

5. INFLUENCE QUANTITIES

The meter should be designed and protected such that all external effects and influences shall not change its performance & shall work satisfactorily within guaranteed accuracy limits, as specified in IS 14697: 1999 / CBIP technical report – 88, under the presence of influence quantities.

6. CONSTRUCTION

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc, shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during storms/heavy rains/very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality. The meter should be sealed in such a way that the internal parts of the meter become inaccessible.

The meter should employ latest technology such as Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should be Surface Mounted Technology (SMT) type except some power supply related component. The electronic components used in the meter should be of high quality.

6.1 GENERAL MECHANICAL REQUIREMENTS

The construction of the meter shall be rigid & suitable to withstand shock & vibration involved in transportation & handling, as specified in CBIP technical report – 88. Meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially personal safety against electric shock, safety against effect of excessive temperature, protection against spread of fire, protection against penetration of solid objects, dust and water. The design of meter shall conform to IP51 class degree of protection against dust and moisture as per relevant standards.

6.2 TROPICAL TREATMENT

All parts, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions. Meters shall withstand solar radiation. The meters shall be suitably designed and treated for normal life & satisfactory operation under the hot and hazardous tropical climatic conditions as specified in clause no. 2. The meter shall work from -10°C to +55°C and RH 95% non-condensing type.

6.3 METER CASE

The housing of the meter shall be safe high-grade Engineering plastic or any other high quality insulating material and shall be very compact in design. All the insulation materials used in the construction of meter shall

be non-hygroscopic, non ageing & of tested quality, capable of withstanding resistant to heat & fire. The construction of the meter offered shall be such that it can be sealed independently and the cover cannot be removed with the use of a tool, without breaking the seal. The case of offered meters shall be so constructed that any non-permanent deformation shall not prevent the satisfactory operation of the meter.

6.4 TERMINALS -TERMINAL BLOCK

The base of the meter shall have a terminal block at the bottom made out of High grade Engineering plastic so as to facilitate bottom connection and houses solid nickel plated brass terminals having capability to carry maximum value of current.

The material of the terminal block shall be capable of passing the tests given in IS 14697: 1999/ CBIP technical report – 88.

The terminal holes in the insulating material shall be of sufficient size to accommodate the insulation of the conductors. The diameter of the terminal hole for current terminals shall not be less than 5.0 mm & shall be of adequate length in order to have proper grip of conductors / crimping pins with the help of two screws.

The terminal block shall satisfy all the conditions such as clearance & creepage distance between terminals & surrounding part of the meter as specified in relevant clause of IS 14697: 1999/ CBIP technical report - 88.

The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there shall have 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 minimised. Electrical connections shall be so designed that contact pressure shall not be transmitted through insulating material. For current circuits, the voltage shall be considered to be at the same potential as for the related voltage circuit.

6.5 TERMINAL BLOCK COVER

The terminals block cover for the energy meters shall be extended transparent type, which can be sealed independently of the meter cover. The terminals, their fixing screws and the insulated compartment housing them shall be enclosed by extended terminal cover in such a way that no part of meter or accessories at terminal block shall be accessible from the front of the meter.

The terminals shall not be accessible without removing the seal(s) of terminal cover when energy meter is mounted on the meter board.

6.6 WINDOW

The energy meter cover shall be made of high-grade engineering plastic with one window and shall be of transparent material and made such that it cannot be removed undamaged without breaking the meter cover.

6.7 QUALITY

Overall the quality of the meter should be good and the service life of the meter shall be more than the guarantee period. The material, components used for manufacturing the meter shall be of premium quality. The LCD display shall not fade with time and the display annunciators should be visible. Functionality of the meter shall not be affected by the harsh environmental conditions. Quality meters shall be given preference and the performance of previous installed meters shall be analysed before awarding the tender. Aesthetically, the meter shall be of premium quality.

7. COMMUNICATION PORT

a) LOCAL COMMUNICATION PORT

The energy meter shall have a galvanically isolated optical communication port located in front of the meter for data transfer to or from a DOS based hand held Data Collection Device.

b) REMOTE COMMUNICATION PORT

Meter shall have an additional communication port RS 485 (For multi drop connection) or RS 232 for periodic data transfer. **Meter shall operate on open DLMS protocol and will be individually addressable.**

Both ports shall support the default and minimum baud rate of 9600 bps.

8. DISPLAY OF MEASURED VALUE

The measured value(s) shall be displayed on seven segments, seven digit Liquid Crystal Display (LCD) display unit/register, having minimum character height of 10 mm.

The data should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under unpowered condition. Battery back-up memory will not be considered as NVM.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciators.

Meter shall have Scroll Lock facility to display any one desired parameter continuously from display parameters.

The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

The principle unit for the measured values shall be Wh/kWh/MWh for active energy, VArh/kVArh/MVArh for reactive energy & VAh/kVAh/MVAh for apparent energy. **The above active, reactive & apparent energy measurement value must be displayed both for import mode as well as export mode.** Bidder shall mention the scale in which the meter displays the energy values.

Required display list will be given at the time of order. However it will be in line with companion standard such as:

- Real Time
- Date
- Line currents
- Phase to Neutral Voltages
- Power Factor
- Frequency
- Active import- export power
- Reactive import – export power
- Cumulative tamper count
- Cumulative MD reset Count

- Cumulative active import energy
- Cumulative active export energy
- Cumulative apparent import energy
- Cumulative apparent export energy

The display list shall also confirm to SI. No.16 mentioned in this technical specification. Parameter value with relevant OBIS code should be made available on display.

9. ELECTROMAGNETIC COMPATIBILITY

The static energy meters shall conform to requirements listed in relevant standards and shall also be protected against radiated interference from either magnetic or radio-frequency source.

9.1 IMMUNITY TO ELECTROMAGNETIC DISTURBANCE

The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and meter shall work satisfactorily under these conditions as per relevant standards

NOTE: the disturbances to be considered are: -

- (a) Harmonics
- (b) Voltage dips and short interruptions
- (c) Conducted transients
- (d) D.C. and A.C. magnetic fields
- (e) Electromagnetic fields
- (f) Electrostatic discharges

9.2 RADIO INTERFERENCE SUPPRESSIONS

The meter shall not generate noise, which could interfere with other equipment, and meter shall work satisfactorily as per relevant standards

9.3 INFLUENCE OF HIGH MAGNETIC FIELD

The meters shall be provided appropriate magnetic shielding so that any external magnetic field (AC/DC electromagnet) as per CBIP Technical Report no. 88 (amendment Aug '99 & September '99) applied on meter would not affect the proper functioning of the meter and meter shall work satisfactorily as per relevant standards.

10. STARTING CURRENT

The meter shall start and continue to register at the current 0.1% of Ib.

11. RUNNING WITH NO LOAD

When the 115% of rated voltage is applied with no current flowing in the current circuit, the meters shall not register any energy and test output of the meter shall not be more than one pulse/count on "no load".

12. POWER CONSUMPTION

- 12.1 The active and apparent power consumption in each voltage circuit of the CT PT Operated meters at reference voltage; temperature and frequency shall not exceed 1W and 4 VA per phase respectively.
- 12.2 The apparent power consumption in each current circuit for the CT PT Operated meters at basic current, reference frequency and reference temperature shall not exceed 1.0 VA per phase.

13. CALIBRATION & TEST OUTPUT

All the meters shall be tested, calibrated and sealed at works before despatch. Further, no modification of calibration shall be possible at site by any means. However, it shall be possible to check the accuracy of energy measurement of the meter in the field by means of LED output on meter as well as through high-resolution display on Common meter reading instrument using suitable test equipment as per CBIP Report 111. Resolution of the test output shall be sufficient to enable the starting current test in less than 10 minutes.

14. CONNECTION DIAGRAM

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system, on inside portion of the terminal cover. The meter terminals shall also be marked and this marking should appear in the above diagram.

15. QUANTITIES TO BE MEASURED AND DISPLAY

The meter shall be able to provide the following data in line with Category 'B' type as per FINAL DOCUMENT - Indian Companion Specification.

- a) Instantaneous Parameters
- b) Block Profile / Load Survey data
- c) Parameters for billing.
- d) Abstract quantities
 - Name Plate Details
 - Programmable parameters
- e) Event Conditions.

The meter shall be able to measure and provide the parameters listed in the guideline document. The OBIS code for each parameter shall be as identified as per DLMS /COSEM protocol in line with Indian companion standard.

16. ABNORMALITY EVENTS DETECTION

Meter shall function properly under following common abnormal conditions:

1.Phase sequence reversal	The meter shall keep working accurately irrespective of the phase sequence of the supply.
2.External magnetic influence	The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) as per the values specified in CBIP Technical Report No.88 (with latest amendments) applied on the metering system shall not affect the proper functioning and recording of energy as per error limits prescribed by CBIP.
3.Current reversal / CT polarity reversal	The meter shall be capable of detecting and recording occurrence and restoration with date and time if the current is flowing in reverse direction in one or more phases.

Beside this the meter should have features to detect the occurrence and restoration of, at least, the following common abnormal events:

- a) Missing Potential: The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure (one phase or two phases). All potential missing cases shall be considered as power failure.
- b) Current imbalance: The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (30% or more for more than a defined persistence time).
- c) Power on/off: The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.
- d) Magnetic Influence - The Meter shall be capable of detecting and recording of presence of abnormal magnetic influence near the meter, if the magnetic influence affects the meter functionality.
- e) Phase wise current circuit reversal - meter shall detect reversal of polarity provided the current terminals are reversed.
- f) Voltage unbalance – Meter shall detect voltage unbalance if there is unbalance in voltages.

Meter shall keep records for the minimum last 200 events (occurrence + restoration) for above abnormal conditions. Each event shall be logged with date and time of occurrence/restoration with snapshot of voltage, current and active energy. It shall be possible to retrieve the abnormal event data locally using a hand held unit (HHU) through the meter's optical port & same can be viewed / analysed at base computer end in simple and easily understandable format.

The above shall be selectable and will be in line with final BIS document: Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification

17. LOAD SURVEY AND DAILY LOAD PROFILE

Refer final Companion Specification for the parameters, number of days and data set required for different categories.

Five parameters i.e. Power Factor, Voltage (Vr, Vy, Vb), Current (Lr, Ly, Lb), Demand (Import & Export) & Energy (Import & Export) shall be selectable from the list. For selected parameters, 45 days profile shall be maintained by meter with integration period of 15 minutes.

History data for 12 months should be provided in the meter.

These load survey and history data can be retrieved with the help of Meter Reading Instrument on local interrogation or remotely using the remote communication interface.

Daily load profile parameters are required in line with table 26 of final BIS companion standard. It will be maintained for listed parameters in table 26 for **45** days at 00.00 Hrs.

18. MD REGISTRATION

The meter shall continuously monitor and calculate maximum demand for each interval of time, which may be programmable as a block of **15 minutes**. At the end of every demand integration period the new calculated MD shall be compared with the previous MD and meter shall store whichever value is higher.

19. MD RESET

The meter shall have Auto MD reset facility (at the end of the month).

20. SELF DIAGNOSTIC FEATURE

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location at all time. The meter shall have indication for unsatisfactory/non-functioning/malfunctioning of the following:

- a) Time and date on meter display
- b) All display segments on meter display
- c) Real Time Clock (RTC) status in meter reading prints out at BCS end
- d) Non-volatile Memory (NVM) status in meter reading prints out at BCS end

21. OTHER SALIENT FEATURES OF METERS

- a) It should be possible to check the healthiness of phase voltages by phase indicator available on meter display.
- b) The meter shall have provision of reading in the absence of power through an external source. An inductive coupling arrangement shall be provided so that it should not be possible to damage the circuit of the meter by applying excess voltage directly in the meter. The meter should be powered up using an external battery pack only in absence of power supply to the meter to enable taking of meter readings through display.
- c) **Internal battery back up may be provided to display unit during power off period.**
- d) The meter should work accurately irrespective of phase sequence of the supply.

22. TEST AND TEST CONDITIONS

- **Acceptance test:** All acceptance tests as per relevant standards shall be carried out in the presence of utility representatives.
- **Routine Test:** All the routine tests as per CBIP Technical report - 88 shall be carried out and routine tests certificates shall be submitted for approval of purchaser.

23. SOFTWARE:

Latest BCS software relating to meter is required and also training may be provided to our executives for accurate analysis free of cost.

Software supporting to DLMS to be provided alongwith the meters for loading in the available CMRIs to facilitate proper meter reading.

GUARANTEED TECHNICAL PARTICULARS FOR 3 PHASE 4 WIRE CT PT OPERATED TRIVECTOR ENERGY METER FOR BOUNDARY/ABT METERING

Sl. No.	Item	Bidder's data
1	Type	
2	Application	
3	Rated Voltage	
4	Rated Current	
5	Frequency	
7	Minimum starting current in % of base current	
8	Power loss in potential circuit	
9	Power loss in current circuit	
10	Change in error due to	
	a. Variation in frequency	
	b. Variation in temperature	
	c. Variation in voltage	
11	Accuracy Class	
12	Total Weight of meter	
13	Details of case	
14	H.V. withstand	
16	Standard to which the meter confirm	
17	Type of Energy Registration Mechanism.	
18.	MD Reset Mechanism	
19	Insulation Test (Voltage 50Hz for 1Min)	
20.	Temperature co-efficient from 10% of rated load to 100 % rated load (5°C to 45°C)	
21.	Working range	
	Voltage	
	Current	
22.	Type of load (linear, non linear, balanced /unbalanced at any P.F.)	
23.	Display details	
	i. Display Cycle (descriptive In order of display)	
	ii. Period of display of each parameter	
	iii. Display scroll-lock facility	
	iv. Backlit LCD	
	v. OBIS code (given or not)	
24	Memory	
26	Power on in absence of mains	
27	Tamper data preservation capacity	
28	Load Survey	
a.	Parameter Logged	
b.	Logging interval	
c.	No. of days of Load Survey	
30	Capability for fraud Prevention & detection	
31	Sealing and Locking Arrangement	
32	Type of communication Local- Optical port	
	Additional Communication port	
33	Real Time Clock	

