

TECHNICAL SPECIFICATION OF LT AC THREE PHASE, FOUR WIRE,
40 - 200 AMPS ENERGY METER WITH IN-BUILT CT
(Composite Meter)

Rev No	Description	Prepared By	Approved & Reviewed By	Date
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1.0 SCOPE

This specification covers the design, engineering, manufacture, assembly, inspection, testing at manufacturers Works, dispatch and supply of LT AC Three Phase Four Wire 3 x 240 volt, 40 - 200 Amp fully static and AMR compatible Tri-Vector Energy Meter of accuracy class 1.0 category B, the complete meter unit i.e. meter, internal CTs shall be housed in the same enclosure.

The meter shall have provision in such a way that supply / service cable of consumer shall be directly passed through the meter for current measurement. Piercing screws shall be used in the meter for voltage connection

2.0 STANDARDS

Materials, equipment, and methods used in the manufacturing of above-mentioned equipment shall conform to the latest edition/ of following,

S No.	Standard Number	Title
2.0	Indian Electricity Act	IE Act 2003
2.1	CEA Metering Regulations	With latest amendments
2.2	CBIP Manual	Standardization of AC Static Electrical Energy Meters
2.3	IS- 13779: 1999	ac Static Transformer Operated Watt-hour and Var-hour Meters, Class 1 and 2
2.4	IS-15959 (Part 1): 2011	Data Exchange for Electricity Meter - Reading Tariff and Load Control - Companion Specification Part 1

3.0 FUNCTIONAL SPECIFICATION

Sr. No.	Function /Feature	Technical Requirements
3.1	Voltage Ratings	240 volt (P-N), 415 volt (P-P) +20% to -40% Vref. Meter shall stand continuously for any combination of phase and neutral wires
3.2	Current Ratings	40-200 amp with 120 % overload capacity
3.3	Starting current	0.2 % of Ib

Sr. No.	Function /Feature	Technical Requirements
3.4	Accuracy	Class 1.0 as per IS 13779:1999
3.5	Display	I. LCD (Six digits) with Height: 10 mm X 6 mm min. II. Pin Type connections with viewing angle min. 160 degrees
3.6	Power factor range	Zero lag –unity- zero leads
3.7	Measured parameters	I. Instantaneous parameters <ul style="list-style-type: none"> a. Voltage b. Current phases & Neutral channel c. Power factor d. Power in KW, KVA e. Frequency f. Neutral Current (IN) g. % THD in phase Voltage h. %THD in Phase Current II. Cumulative Energies <ul style="list-style-type: none"> a. Active energy KWh (Total and Fundamental separately) b. Apparent energy KVAh c. Reactive energy KVARh(Q₁,Q₂,Q₃ & Q₄) III. Maximum Demand <ul style="list-style-type: none"> a. KW and KVA b. Integration time 15/30 minutes (programmable) IV. Display parameters and tamper events shall be as per Annexure-1
3.8	Power Consumption	As per IS 13779 – 1999
3.9	Frequency	50 Hz with + / - 5% variation
3.10	Test Output Device	Flashing LED visible from the front for KWH and KVAH/KVARH
3.11	Load Survey data	Load survey for 60 power on days for 15/30 min integration: <ul style="list-style-type: none"> a. Active energy b. Reactive energy (Q₁,Q₂,Q₃ & Q₄) c. Apparent energy d. Average Voltage e. Average current f. Average Power factor

Sr. No.	Function /Feature	Technical Requirements
3.11	Mid night data	30 powers on days: <ul style="list-style-type: none"> • Active energy • Reactive energy (Q₁, Q₂, Q₃ & Q₄) • Apparent energy
3.12	Billing data	Billing parameters shall be generated at the end of each billing cycle and stored in memory. 12 no's billing cycle parameters shall be remained in meter memory along with current cycle parameters and shall be available for reading as well as profile and or 'by entry' for selective access. Support for selective access shall be provided for billing parameters as per clause no 11.3 of IS 15959 (part 1). The current cycle billing parameters shall be readable as the values of the latest billing period, on demand. This shall be in addition to the last 12 billing period data which shall be available in the profile buffer.
3.13	MD Registration	I. 15-30 min sliding window method with 5 min subinterval for MD integration (Programmable for 15/30Min). At the end of every pre-defined integration period, new MD shall be stored as previous MD and store whichever is higher and the same shall be displayed. II. It should be possible to reset MD automatically on the defined date (or period) or through MRI or through communication. III. Manual MD reset knob should not be provided / shall be disabled.
3.14	Auto Reset of MD	Auto reset date for MD shall be 1st Day of month at 00.00 Hrs. and provision shall be made to change the same through communication. Meter shall store the Billing data at the time of MD reset Billing period reset mechanism shall be as per clause 10 of IS 15959 (Part 1)
3.15	TOD metering	Meter shall be capable doing TOD metering of Billing data in 6 time zones Default programming of the TOD in meters shall be as follow:

Sr. No.	Function /Feature	Technical Requirements			
			SL	Time Zones	1st Jan- 31st Dec
			1	0000-0600	T ₅
			2	0600-0900	T ₁
			3	0900-1200	T ₂
			4	1200-1800	T ₃
			5	1800-2200	T ₄
			6	2200-0000	T ₅
3.16	Tamper Events data	<p>Meter shall be able to log events in following compartments</p> <ul style="list-style-type: none"> a. Voltage Related Events b. Current Related Events c. Power Related Events d. Other Events e. Non-Roll Over Events f. Transaction related events g. Control Events <p>The above events to be stored on FIFO basis,</p> <ul style="list-style-type: none"> a. Threshold values shall be factory programmable. b. Selective access shall be provided as per clause 11.3 of IS 15959 (Part 1). c. For each occurrence event captured the cumulative tamper count shall be incremented. <p>Meter shall capture all the parameters mentioned in IS 15959 (Part 1) when event occurrence and restoration is logged.</p> <p>Defraud registers shall be provided for calculated energies and same shall be mapped with utility specific OBIS.</p>			
3.17	Power Quality Information	<p>Meter shall log last 50 events of</p> <ul style="list-style-type: none"> a. Power on/off b. Under Voltage <p>with date and time stamp and snap shots of</p> <ul style="list-style-type: none"> I. Cumulative Energies <ul style="list-style-type: none"> a. Active energy KWH b. Apparent energy KVAH 			

Sr. No.	Function /Feature	Technical Requirements
		<ul style="list-style-type: none"> c. Reactive energy KVARH II. Instantaneous parameters <ul style="list-style-type: none"> d. Voltages e. Current phases & Neutral channel f. Power factor g. Power in KW III. The above events to be stored with FIFO basis the settings of Under voltage will be decided by Utility
3.21	Programmable parameters	<p>Following parameters shall be programmable remotely and locally by CMRI via proper access writes. Every transaction shall be logged in non-volatile memory of the meter with date and time stamp. IS15959 (Part 2)</p> <ul style="list-style-type: none"> a) Real time clock, date, and time b) Demand integration period c) Unit for demand integration period and profile capture period shall be in seconds. The demand integration period shall be 1800 s (Default) and programmable to 900 s. The profile capture period shall be 1800 s (Default) and programmable to 900s or 3600 s. d) Profile capture period e) Single action schedule for billing dates f) Activity calendar for time zones g) kVAh Definition h) DLMS id (Device Physical Address) i) Display Configuration j) MD Reset <p>Programming of any of the parameters shall increment the 'Cumulative programmable count' value.</p>
3.22	Memory	Nonvolatile memory independent of battery backup, Data should be retained up to 10 years
3.23	Software & communication compatibility	<p>Meter should comply Indian companion of data exchange and tariff control specification IS 15959 (Part 1).</p> <p>Optical port with RS 232 compatible to transfer the data locally & physically</p>

Sr. No.	Function /Feature	Technical Requirements
		<p>conforming to IEC 62056-21.</p> <ul style="list-style-type: none"> a) The Supplier shall supply Software required for CMRI (Analogic & Sands make). The software should be compatible to latest version of Microsoft Windows systems. The software should have polling feature with optional selection of parameters to be downloaded for AMR application. b) Necessary provision shall be made in the software for converting all the parameters available for new and old meters if supplied earlier. Copy of operation manual shall be supplied. c) Supplier shall provide support to designated system integrator to integrate meter with communication provider system. d) The manufacturer must provide software capable of downloading all the data stored in meter memory through window/ android operating system based handheld units (HHU) through optical port. e) HHU software should have option for selection of parameters to be downloaded from meter. f) Meter data consisting of all parameters and complete load survey for all parameters shall be read by HHU in minimum possible time (not more than 5 minutes). g) BCS and communication ports should support data transfer rate of 9600 bps (minimum). h) BCS shall have option of user defined report generation in format of Excel, Word and CSV, XML, PDF etc. BCS shall have capability to export data in ASCII, CSV and XML format at desired location so that the same could be integrated with our billing data for processing. All the data available in the meter shall be convertible to user defined ASCII, CSV and XML file format.
3.24	Climatic conditions	As per IS: 13779 for climatic conditions.
3.25	Calibration	Meters shall be calibrated at factory and modification in calibration shall not be possible at site by any means. Certified by manufacturer.
3.26	Communication interface	<p>Meter should have provision for interfacing external communication module (AMR) through isolated RS232 port in addition to the optical port. The preferable connector shall be of RJ 11 secured under terminal cover.</p> <p>Pin 1 : Rx (RS232 level)</p> <p>Pin 2: Tx (RS232 level)</p>

Sr. No.	Function /Feature	Technical Requirements
		Pin 3: GND Pin 4: DC +ve voltage
3.27	RTC	a. The meter shall have internal real time crystal clock to set date and time. b. Drift in time of this clock shall not be more than ± 5 minutes/ year at a reference temperature of 27°C. c. Meter RTC shall be corrected automatically by the system in synchronization to the network RTC.
3.28	Battery	Lithium-ion battery with guaranteed shelf life of 10 years and Capacity life of 15 years. Lithium thioyl Chloride battery will be Preferred. In case battery removal or total discharge same should not affect the working & memory of the meter.
3.29	Self-Diagnostic feature	Meter shall have self-diagnostic for the following a. Date and RTC. b. Battery. c. Nonvolatile memory. d. Display

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4.0 CONSTRUCTIONAL SPECIFICATIONS

Sr. No.	Parameters	Technical Requirements
4.1	Body of Meter	<ul style="list-style-type: none"> a) Top transparent and base opaque material polycarbonate of LEXAN 143A/943AA or equivalent grade. b) Front cover & base should be ultrasonically welded with IP54 grade enclosure. c) Top cover should be designed so as the internal components should not be visible. d) The meter shall be compact and reliable in design e.g. to transport and immune to vibration and shocks involved in transportation/ handling
4.2	Terminal Block	<p>The meter shall have provision in such a way that service cable of consumer shall be directly passed through the meter for measurement. Piercing screws shall be used in the meter for voltage connection.</p> <p>The meter shall be suitable to accommodate aluminum cable of 200A current carrying capacity. Piercing screw shall have the quality and capability to puncture the cable of 200 A capacity.</p> <p>The meter connection arrangement shall be such that so there is no need to remove insulation for connecting cable for current measurement.</p> <p>Design shall support thread through concept where connecting cable directly passed through the meter for measurement.</p> <p>As the cable directly passed through the meter, the offered meter shall not have provision for meter terminal connection as well as terminal block.</p> <p>The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation.</p> <p>Suitable Piercing teeth shall be provided for PT connection, connector shall have multiple teeth (minimum 5) such that in any case minimum 3 teeth shall pierce the insulation and the connection shall be firm.</p>
4.3	Terminal cover	Transparent terminal cover with provision of sealing through sealing screw.
4.4	Diagram of connections	Diagram of external connections to be shown on terminal cover
4.5	Marking on name plates	Meter should have clearly visible, indelible, and distinctly name plate marked in accordance with IS

Sr. No.	Parameters	Technical Requirements
4.6	Meter Sealing	Supplier shall affix one Buyer seal on side of Meter body as advised and record should be forwarded to Buyer.
4.7	Guarantee	10 Years.
4.8	Insulation	A meter shall withstand an insulation test of 4 KV and impulse test at 8 KV
4.9	Resistance of heat and fire	The terminal block and Meter case shall have safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them as per the relevant IS 13779.

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5.0 Tamper & Anti-fraud features

The meter shall log minimum 200 tamper events, compartment wise division of each event.

The meter shall have total monthly tamper events & cumulative count on display & shall be available in BCS to convert the same in the export files.

The Meter shall not be affected by any remote-control device & shall continue recording energy under any one or combinations of the following conditions:

- 5.1 Phase sequence reversal: The meters shall work accurately irrespective of the phase sequence of the supply.
- 5.2 Detection of missing potential: In case someone intentionally takes out a potential lead, the date and time of such occurrence shall be recorded by the Meter. The restoration of normal supply shall also be similarly recorded. The threshold for the voltages should be programmable at factory level.
- 5.3 Recording under any two phases/wires: The meter should log the event with snap shots in case of any two phases/wires connected and the neutral is disconnected.
- 5.4 Reversal of C.C. (Current Coil) Polarity: Meter shall record the reversal of C.C. polarity with time and date, and the time of restoration. Meter shall however register the energy consumed correctly with anyone, two or all three-phase c.c. reversal.
- 5.5 C.C. Shorting: Meter shall record C.C. Terminal shorting with time and date and time of restoration. The threshold for the voltages should be programmable at factory level.
- 5.6 C.C Open: Meter shall log event Current coil open. The thresholds should be programmable at factory level.
- 5.7 Power On / Off: Meter shall detect power OFF (minimum power off period 1 minutes) if all three phase voltages are not present. This event shall be recorded at the time of each power OFF. At the same time power 'ON' event shall be recorded. This logging shall be available in Tamper details along with cumulative time of failure.
- 5.8 Abnormal Power Off (Occurrence/restoration): If meter micro detect power off whereas phase voltage is present than abnormal power will be recorded. Meter shall continue to record energy as per phase voltage and current.
- 5.9 Recording of Neutral disturbance: - Meter shall log all events when AC/DC current or voltage is injected in neutral circuit without disturbing the recording of energy.
- 5.10 Cover open tamper: Meter shall log the event of meter cover opening with date and time stamp under powered / not powered conditions.
- 5.11 External Magnetic tampers: Meter should log on the events of attempt of tampering by external magnetic field as mentioned in the CBIP Technical report no. 325 with latest amendments. The Meter shall record energy at maximum current (I_{max}) under the influence of abnormal external magnetic field irrespective of actual load, energy recorded in such case shall also be available in separate register. The Meter shall record as per actual load once the external abnormal magnetic

field is removed. In such conditions the Meter shall log the event for presence of abnormal external magnetic field and its restoration.

5.12 HV Spark (Occurrence/restoration)/Jammer: Meter with communication card should be immune or log the event in the case of application of ESD upto and including 35KV.

5.13 High Neutral Current: Meter shall log event of high neutral current if measured neutral current more than predefined threshold value.

5.14 Transaction Related Events logging.

- Real Time Clock- Date and Time
- Demand Integration Period
- Profile Capture Period
- Single Action schedule for billing date
- Activity calendar for time zones
- MD reset
- kWh Definition
- MD integration and sub interval length

5.15 Influence Parameters: Meter shall work within guaranteed accuracy as per IS 13779/ IEC62053-21/CBIP325 (most stringent standard to be followed) under and after influence of following: -

- a. Current Variation
- b. Ambient Temperature variation
- c. Voltage variation
- d. Frequency variation
- e. 10% third harmonic in current
- f. Reversed phase sequence
- g. Voltage unbalance
- h. Harmonic components in current and voltage circuit
- i. DC and even harmonics in AC current circuit
- j. Odd harmonics in AC current circuit.
- k. Sub harmonics in AC current circuit
- l. Continuous (DC) "stray" magnetic induction of 67mT +/- 5%.
- m. Continuous (DC) "abnormal" magnetic induction of 0.27T +/- 5%.
- n. Alternating (AC) "stray" magnetic induction of 0.5mT +/- 5%
- o. Alternating (AC) "abnormal" magnetic induction of 10mT.
- p. External magnetic field 0.5 T
- q. Electromagnetic HF fields
- r. Radio frequency interference
- s. DC immunity test

Accelerated Life Test (Aging): The meters should undergo accelerated life tests (powered, at extended temperatures – above and beyond the operating temperature range) to demonstrate its reliability and long service life. The test shall be carried out per IEC62059-41 methodology.

6.0 GENERAL REQUIREMENTS

- a) Meter serial number should be of at least 8 digits with alpha numeric digits.
- b) Size of the digit of the meter serial number should be minimum 5mm X 3mm.
- c) bar code should be printed next to / below / above the meter serial number.
- d) BIS registration mark (BIS mark)
- e) The supplier should seal meters with own seals with their logo and sr. no
- f) The internal potential links are not acceptable.
- g) Terminal cover should be fixed on Meter before dispatch.
- h) Meter Sr. Nos. to be printed in black on the name plate, instead of embossing.

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7.0 Annexure-1

- 7.1 The meter shall have only one LED i.e. Cal Pulse LED of RED color in front display of meter.

Display Parameter Sequence: Display list shall be finalized during detailed engineering in the event of order.

- i) Auto Mode (Default Display)
Cumulative Total KWh Import (Cumulative Total KWh Import to be displayed continuously without decimal)

Note: In case of occurrence of meter "Cover Open" tamper, the message "Cover Open" and Cumulative Total KWh shall be displayed in toggle mode (6 seconds).

7.2 On Demand Display

After using the pushbutton, the following parameters should be displayed.

- a) LCD Test
- b) Real time clock date and time
- c) Phase wise Voltage
- d) Phase wise Current
- e) Neutral Current
- f) Signed power factor
- g) Frequency, Hz
- h) Apparent power KVA
- i) Active power, kW
- j) Vectorial angles in numerals between V & I
- k) Cumulative energy, kWh- Import
- l) Cumulative Energy, KVAh (While Kwh Import)
- m) Reactive Energy kVAh (Lag)(while Kwh import)
- n) Reactive Energy kVAh (Lead)(while Kwh import)
- o) Maximum Demand, kW (Import)
- p) Maximum Demand, kVA (Import)
- q) Cumulative energy, kWh- Export
- r) Cumulative Energy, KVAh (While Kwh Export)
- s) Reactive Energy kVAh (Lag)(while Kwh Export)
- t) Reactive Energy kVAh (Lead)(while Kwh Export)
- u) Maximum Demand, kW (Export)
- v) Maximum Demand, kVA (Export)
- w) Cumulative power ON duration in min
- x) Cumulative tamper count
- y) Cumulative billing count
- z) Cumulative programming count
- aa) Load Limit Function Status
- bb) Load Limit value in kW
- cc) High Resolution Cumulative Total KWh (Import) for dial test.(00.0000 format)
- dd) High Resolution Cumulative Total KWh (Export) for dial test.(00.0000 format)

- ee) High Resolution Cumulative Total KVAh (Export) for dial test.(00.0000 format)
- ff) High Resolution Cumulative Total KVAh (Import) for dial test.(00.0000 format)
- gg) High Resolution Cumulative Total kVArh(Lag) for dial test.(00.0000 format)

Note:

- All TOD energies and TOD Maximum demands shall be displayed

The meter display should return to Default Display mode (mentioned above) if the 'push button' is not operated for more than 6 seconds

7.2 TOD timings: (for KWH,KVARH,KVAH, & MD in KW , KVA)

- a. 06.00 Hrs. to 09.00 Hrs.
- b. 09.00 Hrs. to 12.00 Hrs.
- c. 12.00 Hrs. to 18.00 Hrs.
- d. 18.00 Hrs. to 22.00 Hrs.
- e. 22.00 Hrs. to 06.00 Hrs.

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